VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

BRNO UNIVERSITY OF TECHNOLOGY

FAKULTA STAVEBNÍ

ÚSTAV POZEMNÍHO STAVITELSTVÍ

FACULTY OF CIVIL ENGINEERING

INSTITUTE OF BUILDING STRUCTURES

DETACHED FAMILY RESIDENCE

MAIN TEXT PART OF BACHELOR'S THESIS

BAKALÁŘSKÁ PRÁCE

BACHELOR'S THESIS

AUTOR PRÁCE DENISA PARTYKOVÁ

AUTHOR

VEDOUCÍ PRÁCE Ing. FRANTIŠEK VAJKAY, Ph.D.

SUPERVISOR

BRNO 2015

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Studijní program	B3607 Civil Engineering
Typ studijního programu	Bakalářský studijní program s výukou v anglickém jazyce a prezenční formou studia
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ZADÁNÍ BAKALÁŘSKÉ PRÁCE

Student	Denisa Partyková
Název	Detached Family Residence
Vedoucí bakalářské práce	Ing. František Vajkay, Ph.D.
Datum zadání bakalářské práce	30. 11. 2014
Datum odevzdání bakalářské práce	29. 5. 2015

V Brně dne 30. 11. 2014

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ fakulta stavební DĚKANÁT -29-

prof. Ing. Miloslav Novotný, CSc.	prof. Ing. Rostislav Drochytka, CSc., MBA
Vedoucí ústavu	Děkan Fakulty stavební VUT

Podklady a literatura

Studie dispozičního řešení stavby, katalogy a odborná literatura, Zákon č.183/2006 Sb., Zákon č. 350/2012, kterým se mění zákon č. 183/2006 Sb., Vyhláška č.499/2006 Sb.,Vyhl. č. 62/2013, kterou se mění vyhláška č. 499/2006 Sb.,Vyhláška č.268/2009 Sb., Vyhláška č.398/2009 Sb., platné ČSN, Směrnice děkana č. 19/2011 a dodatky.

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

Zadání VŠKP: Projektová dokumentace stavební části k provedení novostavby rodinného domu vedený pod názvem "Detached Family Residence".
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. 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 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 bakalářskou 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.

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).

.....

Ing. František Vajkay, Ph.D.
Vedoucí bakalářské práce

Abstrakt

Tato bakalářská práce se zabývá návrhem samostatně stojícího rodinného domu s projekční kanceláří. Dům se nachází na konkrétním pozemku katastrálního území města Brna, v Soběšicích v ulici Rozárka. Cílem práce bylo vytvoření objektu vyhovujícímu svým dispozičním řešením požadavkům čtyřčlenné rodiny a svým vzhledem zapadajícímu do okolní zástavby. Dům je navržen jako dvoupodlažní, nepodsklepený se sedlovou střechou. Obvodové zdivo nadzemních podlaží je postaveno z vápenopískových bloků zdícího systému SENDWIX. Na zateplení celého objektu byl použit kontaktní zateplovací systém. Strop nad prvním nadzemním podlažím je monolitický železobetonový. Nosnou konstrukci střešního pláště tvoří dřevěné vazníky. Součástí práce je také požární a tepelně-technické řešení.

Klíčová slova

Rodinný dům, monolitický železobetonový strop, dřevěná sedlová střecha, zdící systém SENDWIX.

Abstract

This Bachelor's Thesis deals with a design of detached family residence with planner's office. The house is situated on a specific plot of cadastral area of Brno city, in Soběšice in Rozárka Street. The aim was to create an object suitable for a four-member family by its disposition solution, and fitting the neighbouring buildings by its appearance. The designed house is two-storey, basementless with saddle roof. Peripheral walls of above-ground floors are built from lime-sand blocks of SENDWIX walling system. Contact insulation system was used for thermal insulation of the whole object. Ceiling above first above-ground floor is monolithic reinforced concrete. Load-bearing structure of a roof deck is made of wooden trusses. The work also includes fire safety and thermotechnical solution.

Keywords

Family house, monolithic reinforced concrete ceiling, wooden saddle roof, SENDWIX walling system.

Bibliografická citace VŠKP

Denisa Partyková *Rodinný dům.* Brno, 2015. 35 s., 110 s. příl. Bakalářská 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 Bachelor's Thesis independently and that I stated all used information sources.

Prohlášení:

Prohlašuji, že jsem bakalářskou práci zpracovala samostatně a že jsem uvedla všechny použité informační zdroje.

V Brně dne 28.5.2015

…….

podpis autora

Denisa Partyková

Thanks:

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

Poděkování:

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

V Brně dne 28.5.2015

…….

podpis autora

Denisa Partyková

CONTENT OF TEXT PART OF BACHELOR'S THESIS

1. INTRODUCTION

The Bachelor's Thesis is focused on elaboration of project documentation for detached family house with planner's office. The building is located in Brno-Soběšice, in Rozárka Street. The designed house is basementless, two-storey high, with saddle roof and is intended for dwelling of a four to five-member family.

The building stays on foundation strips from plain concrete. Both vertical load-bearing and non-load bearing structures are from lime-sand blocks of SENDWIX walling system. All peripheral walls are thermally insulated by contact insulation system Isover. Horizontal load-bearing structure above first floor is from monolithic reinforced concrete slabs. Saddle roof structure is made of wooden truss system with inclination of 18°.

Disposition of the house is done in accordance with valid regulations and standards. The design intention was to create a building which exterior appearance corresponds with surrounding buildings. Therefore, simple shape of the house, saddle roof and color selection conforms those criteria. The fire-safety and thermotechnical solutions are part of this work.

The aim was to create uniform design of a detached family residence with planner's office such, that it would satisfy all needs and requirements of future residents.

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A ACCOMPANYING REPORT

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SUPERVISOR

BRNO 2015

CONTENT

A ACCOMPANYING REPORT

A.1 Identification data

A.1.1 Data about the construction

Name of construction:	Detached Family Residence
Place of construction:	cadastral area Soběšice [751910], parcel number 45/2
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 Partyková
Address:	Kleštínek 21, 621 00 Brno

A.2 List of input data

The amount and type of input documents used for the preparation of design is decided by the Building Office.

A.3 Data about the area

The parcel with parcel number 45/2 is located in in Southern part of Brno and is determined for family house construction. There is no construction on the parcel. The plot is almost flat with very small vertical elevation with slope elevation to the South. The parcel has quadrilateral shape. The access road to the parcel 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.

Data about building plot

Parcel number:	45/2
Township:	Brno [582786]
Cadastral area:	Soběšice [751910]
LV number:	1481

Acreage:	797 m2
Parcel type:	Parcel of cadastre estate
Map sheet:	DKM
Determination of acreage:	from S-JTSK coordinates
Parcel type:	garden

Data about property rights‘ relationships

List of affected lands according to cadastral estate:

Parcel number: 47/3, township: Brno, cadastral area: Soběšice, parcel type: Parcel of cadastre estate, map sheet: DKM, acreage: 649 m2, parcel type: garden, owner: Procházka Michal Mgr.

Parcel number: 45/1, township: Brno, cadastral area: Soběšice, parcel type: Parcel of cadastre estate, map sheet: DKM, acreage: 953 m2, parcel type: garden, owner: Žáková Jindřiška

Parcel number: 43, township: Brno, cadastral area: Soběšice, parcel type: Parcel of cadastre estate, map sheet: DKM, acreage: 1605 m2, parcel type: garden, owner: Odstrčil Martin Ing.

Parcel number: 988/42, township: Brno, cadastral area: Soběšice, parcel type: Parcel of cadastre estate, map sheet: DKM, acreage: 344 m2, parcel type: garden, owner: Trejbal Josef Dipl.-Ing.

Parcel number: 988/44, township: Brno, cadastral area: Soběšice, parcel type: Parcel of cadastre estate, map sheet: DKM, acreage: 138 m2, parcel type: other area, owner: Statutární město Brno

Ownership right to parcel number 45/2 is cadastral area of township Brno written in Cadastre estate. There are no restriction on ownership rights.

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 granodiotite, class 5 was determined.

Data about connection to traffic infrastructure

Along the Northern borders of the plot there is a service road for the access to the houses. To this road, the driveway from concrete tiles 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 the family house will be built.
- Rainwater and sewage will be taken to single underground sewage system located on parcels no. 988/42 and 988/44 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 of 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. Documentation abides mandatory standards ČSN, such as ČSN 73 4301 Residential buildings, ČSN 73 0540 Thermal technology of buildings, and hygienic regulations and requirements about health protection and healthy living conditions.

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 detached family house is a newly constructed structure. Its purpose is a dwelling for 4-5 member family, and a planner's office. There are no legal obstacles and the construction does not belong to any protected constructions. The access for disabled people is not necessary. The house is designed as low-energy house of class of energy performance B. The building shape is of two rectangles, one bigger – residential part, and one smaller – garage.

Build-up area: 327,26 m2

Enclosed space: 1106,5 m3

Demarcation of building plot: 797 m2

Maximal height above the terrain: 8,76 m

Number of residential units: 1

Number of parking places: 1 car in a garage, 2 cars outside

Construction process is not anyhow bound to other construction activity or measure. Construction period is approximately 10 months from the beginning of construction.

Understructure	7/2015
Connection of engineering networks	7/2015
Horizontal and vertical structures	10/2015
Internal networks, surface treatment, flooring	1/2015
Surface treatment, paving	3/2015
Building approval	5/2015

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 m^2, and about number of flats in residential and nonresidential buildings.

The final price is based on price index of average budget price in 2015. Price of one-flat family house is 5291 CZK/m^3 . Total volume of the building is V = 1106,5 m^3 .

Supposed implementation costs are therefore about 5 854 500 CZK. Final price may differ according to purchase price of individual material.

A.5 Division of the object into parts

The building is divided into 3 objects according to coordination situation.

Parts: Residential area, Non-residential area, Utility network.

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B SUMMARY TECHNICAL REPORT

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SUPERVISOR

BRNO 2015

CONTENT

B SUMMARY TECHNICAL REPORT

B.1 Description of the parcel

The parcel with parcel number 45/2 is located in in Southern part of Brno and is determined for family house construction. There is no construction on the parcel. The plot is almost flat with very small vertical elevation with slope elevation to the South. The parcel has quadrilateral shape. The access road to the parcel 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. On the the West, there is a neighbouring structure – newly built family house with mesh fence along border of the neighbouring plot. On the East and South there are gardens also dividing individual parcels by mesh fence. Across the road in the North, there is also newly built family house. The parcel is covered with grass and there are also small young trees, which may either stay there since they are on the periphery of the plot and therefore do not create obstacles, or may be cut. There are no undermined areas in given location.

Data about building plot

Parcel number:	45/2
Township:	Brno [582786]
Cadastral area:	Soběšice [751910]
LV* number:	1481
Acreage:	797 m2
Parcel type:	Parcel of cadastre estate
Map sheet:	DKM
Determination of acreage:	from S-JTSK coordinates
Parcel type:	garden

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.

B.2 General description of the building

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

The purpose of the object is to create pleasant, healthy and ecologically friendly place for living of a young family. It is possible to use this object for capacity of 5 people, ideally two adults and two to three children.

B.2.2 Urban and architectural solution

The terrain of Soběšice is sloping down to the South, which allows the sunlight to reach most parts of the house during whole year. This resulted in such a disposition of the house, that mostly used rooms are facing South. The first floor is divided into two parts – Northern and Southern. In the Northern part, there is separate entrance hall to the office, office space with small kitchen, toilet, entrance hall to the family house, hall, toilet and bathroom, staircase, technical room and garage. These are such areas that do not require big amount of sunlight. On the other side, the Southern part of the first floor requires enough sunlight. That is why living room, dining room and kitchen is placed there. The second floor is similarly divided. In the Northern part, there is staircase, hall, guest's room, parents' room with bathroom. The Southern part includes both children's rooms, closet (future kitchen), toilet and bathroom. The building itself is placed in the Norther part of the plot, such that there is enough space for parking of cars. The Southern part of the parcel is used as a garden.

The building shape is of two rectangles, one bigger – residental part, and one smaller – garage. The house has two above-ground floors and is without a basement. The load-bearing elements of saddle roof are from timber truss girders connected by gang nails. The utility network of the house is going to be connected to public utility network underneath the road.

The floor level of the first floor is defined as ±0,000 and refers to 372 m.a.s.l. There are two types of used surfaces of exterior facade – brick facing of brown-red color, acrylic white color. Windows are plastic VEKRA Classic of bright-brown color to the exterior. Entrance doors vekra Cidlina and garage doors VEKRA Elegant VA3 are of the same color as all windows. Saddle roof has roof cover Francouzská 12 of dark brown color. Detailed color choice is listed in relevant project documentation. Paving around the house is designed of concrete blocks BEST-ARCHIA and BEST-KORZO of caramel color.

B.2.3 Layout and operational solutions, production technology

The disposition of the house was designed for needs of the family. First floors is intended as common space, where the family can meet. On the other side, the second floor is supposed to a quiet zone for relaxation, studying and sleeping. Parents have one room and each child has its own, therefore it creates ideal balance between common and private spaces.

B.2.4 Barrier-free use of the building

The object was not designed as a barrier-free.

B.2.5 Safety during usage

There are no special requirements on safety during usage.

B.2.6 Basic technical description of the buildings

a) Foundations

The foundation strips are made of plain concrete of class C20/25 in the thickness of 500 mm, which is 860 mm below the flooring level ±0,000 (refers to 372 m.a.s.l.). The foundation slab is made of concrete reinforced by KARI net in thickness of 150 mm. The diameters of reinforcement are according to structural design.

b) Hydroinsulation

Hydroinsulations is done underneath the whole structure above foundation slab with the help of hydroinsulation strips GALSTEK 40 Special mineral and ELASTEK 40 Special mineral, and also along foundation strips to the height of 300 mm above flooring level. Hydroinsulation of terrace above garage, hydroinsulation strips GLASTEK 30 Sticker and ELASTEK 40 Special dekor were used. Diddusion permeable foil DEKTAN is used in saddle roof.

c) Vertical load-bearing structures

The peripheral load-bearing walls are made of lime-sand blocks SENDWIX 8DF-LD with dimensions 248x240x248 mm covered from the interior by 15 mm of core plaster and with different top layers in individual rooms. The exterior side has 160 or 80 mm of thermal insulation and two different top layers – on is white acrylic exterior paint, and second one is made of facing bricks of caramel color. The overall thickness of the peripheral wall varies from 374 mm to 454 mm. The internal load-bearing walls are also made of lime-sand blocks SENDWIX 8DF-LD with dimensions 248x240x248 mm and with 15 mm of core plaster from both sides. Top layers also vary as thicknesses do. The smallest thickness is 280 mm, and the biggest is 428 mm because of gypsum board substructure. Partitions are also from lime-sand blocks SENDWIX 4DF-LD with dimensions 248x115x248 mm. Its overall thickness is from 155 to 301 mm.

d) Horizontal load-bearing structures

Ceiling above first floor is constructed as monolithic reinforced concrete slab. The thickness of the slab structure is along the whole area the same – 200 mm. Concrete class and diameter of reinforcement is done according to static calculation. Ceiling above second floor is from timber trusses to which suspended KNAUF gypsum-board structure with thermal insulation of 200 m is fastened.

e) Roof

Roof is from timber truss system of MITEK distributor that also provides transport to construction site of individual parts, that at then fastened together by gang nails and by brackets and screws fastened to vertical structures. Slope of the saddle roof is 18° and as roof cover, ceramic roof tile Francouzská 12 of dark brown color was proposed.

f) Thermal insulation

Thermal insulation of floor of the first floor is in residental part of the house ISOVER EPS 70S - 140 mm thick, in garage ISOVER PEIMER 120 – 120 mm thick, and in laundry room ISOVER 70S – 120 mm thick. Thermal insulation of ceiling structure

between fisrt and second floor is done by ISOVER EPS T-N - 50 mm. Ceiling above second floor is insulated by 200 mm of UNIROL-PLUS 200. Flat roof above garage is insulated by 50 mm of ISOVER EPS 70S and 0-90 mm of Sloping wedge ISOVER SD. Thermal insulation of peripheral walls is from ISOVER EPS 100F with 160 mm in residental part, and 80 mm in non-residental part of the house.

g) Windows and doors

Plastic double-glazing windows VEKRA Classic were designed. Two entrance doors are plastic VEKRA Cidlina and two side entrance doors are also plastic VEKRA Dolomit. Plastic garage doors VEKRA Elegant VA3 are in the same design as main entrance doors. All above-mentioned windows and doors are in the same bright-brown color.

B.2.7 Technical and technological equipment

There are three bathrooms, three separated toilets, laundry room, one small kitchenette in an office and one kitchen. In the first floor, two toilets and a kitchenette have common installation shaft, that continues straight to the second floor, where there is parents‘ bathroom with a toilet, which pipes are connected to the common shaft. Second shaft is in the bathroom of the first floor and connects pipes from the bathroom and a toilet of the second floor. Sewerage of kitchen is partially lead individually and then is connected with sewerage from both shafts. Sewerage of garage is connected to one from laundry room. Drinking water, low voltage power lines and sewerage pipes go through foundation strips to desired places. There are four regular washbasins, three small washbasins, two kitchen sinks, two showers, one bathtub, four toilets, one washing machine and one dishwasher.

B.2.8 Fire safety solution

For more information, see annex Fire 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

Ventilation of the house is ensured by natural ventilation via windows and doors, also forced ventilation in toilet rooms and kitchen hood is designed. Gas condensed boiler Vaillant VU 246/5-3 EcoTEC Plus provides heating and hot domestic water. Heating can be also ensured by fireplace on wood.

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

The object is protected against penetration of radon by hydroinsulation of 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 20 m long. There is also water meter shaft.
- Two sewerage connections are totally 32 m long, with sewer inspection shafts.
- Low voltage power lines are 6,7 m long with main house box electrometer
- Low pressure gas pipes are about 19 m 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 newly constructed service road. There are no sidewalks or bike routes. The parcel is easily accessible.

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 along the fence.

B.6 Description of the effects of construction on 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 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 a family house 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 maily used for washing or treation of concrete and power lines will be used for powering of building equipment. Drainage of the construction site is natural during building process. There is no need to construct new access road. No demolition is necessary. The waste from the constrcution works will be sorted, 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.

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ
BRNO UNIVERSITY OF TECHNOLOGY

FAKULTA STAVEBNÍ
ÚSTAV POZEMNÍHO STAVITELSTVÍ

FACULTY OF CIVIL ENGINEERING
INSTITUTE OF BUILDING STRUCTURES

DETACHED FAMILY RESIDENCE

MAIN TEXT PART OF BACHELOR'S THESIS

TECHNICAL REPORT

BAKALÁŘSKÁ PRÁCE
BACHELOR'S THESIS

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CONTENT

D1.1 TECHNICAL REPORT

1. SOLUTION OF THE CONSTRUCTION

1.1 Architectonic solution

Investor's intention is to build family house with one residental unit and an office space.

The parcel with parcel number 45/2 is located in in Southern part of Brno and is determined for family house construction. There is no construction on the parcel. The plot is almost flat with very small vertical elevation with slope elevation to the South. The house is designed as detached, with two above-ground floors, basementless. The building shape is of two rectangles, one bigger – residental part with dimensions 11,82x12,82 m, and one smaller – garage with dimensions 9,66x4,66 m. In the Norther part of the plot, there will be paved area for parking of two cars. All unhardened areas will be grasses and planted with trees and bushes. The building is placed in the Northern part of the plot. Minimal standoff distances from the neighbouring plots and buildings are respected. The family house does not overshadow neighbouring parcels and architectural solution does not disturb surrounding buildings.

1.2 Art solution

The overall look of the house is created mainly by saddle roof above residental part with inclination of 18°. The roof tiles are of dark-brown color. The top layer of façade is from acrylic white color and combination with brick facing of brown-red color.

1.3 Material solution

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

1.4 Disposition and operational solutions

The disposition of the house was designed for needs of the family. First floors is intended as common space, where the family can meet. On the other side, the second floor is supposed to a quiet zone for relaxation, studying and sleeping. Parents have one room and each child has its own, therefore it creates ideal balance between common and private spaces.

Build-up area: 327,26 m2

Enclosed space: 1106,5 m3

Demarcation of building plot: 797 m2

Maximal height above the terrain: 8,76 m

Number of residential units: 1

Number of parking places: 1 car in a garage, 2 cars outside

2. BARRIER-FREE USE OF THE BUILDING

The object was not intended to be used by people with reduced mobility and for this reason it is not designed as a barrier-free house. The design is in accordance with §2 of Decree no. 398/2009 Coll., about general technical requirements ensuring barrier-free usage of buildings. During construction of puplicly accessible areas, Decree no. 389/2009 Coll, about general technical requirements ensuring barrier-free usage of buildings, will be taken into account. Connection of the access road to public road, no height differences bigger then 20 mm will be created.

3. STRUCTURAL AND CONSTRUCTION-TECHNICAL SOLUTION

a) Earthworks

Prior the beginning of construction works, the object will be marked out. There will be distinctly marked elevation point from which any appropriate height can be determined. Earthworks begin with topsoil overburden in thickness of 300 mm. This soil will be tored in a stockpile of maximal height of 1,5 m, located in the Southern part of the parcel. Subsequently, excavation of foundations and for utility networks is going to be done. Excavation of last 100 mm will be done manually just before the start of concreting of foundation structures, to prevent wetting of foundation base. During excavation, the foundation base needs to be protected against mechanical damage and against unfavourable climatic conditions.

b) Foundations

The foundation strips are made of plain concrete of class C20/25 in the thickness of 500 mm, which is 860 mm below the flooring level ±0,000 (refers to 372 m.a.s.l.). The foundation slab is made of concrete reinforced by KARI net in thickness of 150 mm. The diameters of reinforcement are according to structural design.

c) Hydroinsulation

Hydroinsulations is done underneath the whole structure above foundation slab with the help of hydroinsulation strips GALSTEK 40 Special mineral and ELASTEK 40 Special mineral, and also along foundation strips to the height of 300 mm above flooring level. Hydroinsulation of terrace above garage, hydroinsulation strips GLASTEK 30 Sticker and ELASTEK 40 Special dekor were used. Diddusion permeable foil DEKTAN is used in saddle roof.

d) Vertical load-bearing structures

The peripheral load-bearing walls are made of lime-sand blocks SENDWIX 8DF-LD with dimensions 248x240x248 mm covered from the interior by 15 mm of core plaster and with different top layers in individual rooms. The exterior side has 160 or 80 mm of thermal insulation and two different top layers – on is white acrylic exterior paint, and second one is made of facing bricks of caramel color. The overall thickness of the peripheral wall varies from 374 mm to 454 mm. The internal load-bearing walls are also

made of lime-sand blocks SENDWIX 8DF-LD with dimensions 248x240x248 mm and with 15 mm of core plaster from both sides. Top layers also vary as thicknesses do. The smallest thickness is 280 mm, and the biggest is 428 mm because of gypsum board substructure. Partitions are also from lime-sand blocks SENDWIX 4DF-LD with dimensions 248x115x248 mm. Its overall thickness is from 155 to 301 mm.

e) Horizontal load-bearing structures

Ceiling above first floor is constructed as monolithic reinforced concrete slab. The thickness of the slab structure is along the whole area the same – 200 mm. Concrete class and diameter of reinforcement is done according to static calculation. Ceiling above second floor is from timber trusses to which suspended KNAUF gypsum-board structure with thermal insulation of 200 m is fastened.

f) Roof

Roof is from timber truss system of MITEK distributor that also provides transport to construction site of individual parts, that at then fastened together by gang nails and by brackets and screws fastened to vertical structures. Slope of the saddle roof is 18° and as roof cover, ceramic roof tile Francouzská 12 of dark brown color was proposed.

g) Thermal insulation

Thermal insulation of floor of the first floor is in residental part of the house ISOVER EPS 70S - 140 mm thick, in garage ISOVER PEIMER 120 – 120 mm thick, and in laundry room ISOVER 70S – 120 mm thick. Thermal insulation of ceiling structure between fisrt and second floor is done by ISOVER EPS T-N - 50 mm. Ceiling above second floor is insulated by 200 mm of UNIROL-PLUS 200. Flat roof above garage is insulated by 50 mm of ISOVER EPS 70S and 0-90 mm of Sloping wedge ISOVER SD. Thermal insulation of peripheral walls is from ISOVER EPS 100F with 160 mm in residental part, and 80 mm in non-residental part of the house.

h) Windows and doors

Plastic double-glazing windows VEKRA Classic were designed. Two entrance doors are plastic VEKRA Cidlina and two side entrance doors are also plastic VEKRA Dolomit. Plastic garage doors VEKRA Elegant VA3 are in the same design as main entrance doors. All above-mentioned windows and doors are in the same bright-brown color. For more information, see List of Openings in Annex D.

i) Floor

There are two different types of floor finishes – ceramic tiles and laminated floor. Thermal insulation of floor structures (see part g) Thermal insulation). As bearing layer of floor, self-leveling anhydride screed 25, CEMIX in various thicknesses, depending on the thickness of top layer, is used. Top layers differ depending on the type of the room. For more information, see Compositions is Annex D.

j) Staircase

Interior staircase is designed as turned wooden with width of 1142,5 mm. There are 17 steps and the staircase has U-shape without any landing. The height of one step is

182,353 and the depth is 290 mm. Railing is in the height of 1000 mm. For more information, see Staircase calculation in Annex D.

k) Chimney

There are two chimneys necessary in the house. On is for fireplace on wood made of HELUZ IZOSTAT system with outer dimensions 430x430mm, and the second one is for gas boiler.

l) Ventilation

Ventilation of the house is ensured by natural ventilation via windows and doors, also forced ventilation in toilet rooms and kitchen hood is designed.

4. BUILDING PHYSICS

See 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 Thermal technical assessment of the building, according to which the building is assessed as B class – very economical. Building also meets all fire-safety regulations and decrees. Fire danger area doesn not extend to surrounding properties. The result of my work is a complete design of a detached family house that respects the architectonic solutions of neighbouring buildings.

4. LIST OF USED SOURCES

Related standards and laws

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 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 budových
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
Vyhláska 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

KM BETA, available at: www.kmbeta.cz
TONDACH, available at: www.tondach.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
GUTTA, available at: www.guttashop.cz
STAVBA HROU, available at: www.stavbahrou.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
K.M.K.DESIGN, available at: www.kmkdesign.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 sítě 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

6. LIST OF ANNEXES

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	S.2 Architectonic study of the 2nd floor, option 1	S 1:100
	S.3 Structural study of the 1st floor, option 1	S 1:100
	S.4 Structural study of the 2nd floor, option 1	S 1:100
	S.5 Architectonic study of the 1st floor, option 2	S 1:100
	S.6 Architectonic study of the 2nd floor, option 2	S 1:100
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	S.9 Section A-A‘	S 1:100
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Visualization		

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File no. 6 – BUILDING PHYSICS

D.1.6 Building physics

Annex 1:	D.1.6.01 Situation	S 1:500
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	D.1.6.05 Section B-B‘	S 1:100

Annex 2:

Calculation of heat transfer coefficient of structures

Calculation of heat transfer coefficient in windows and doors

Calculation of airborne and impact sound insulation

Calculation of temperature factor and surface temperature

Calculation of temperature factor and surface temperature in corners

Protocol of energy label of building envelope

Annex 3

Composition of structures for calculation

Annex 4

Calculation with AREA software

File no. 7 – OTHER CALCULATIONS

Calculation of foundations

Calculation of a staircase

PROHLÁŠENÍ O SHODĚ LISTINNÉ A ELEKTRONICKÉ FORMY VŠKP

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

V Brně dne 28.5.2015

- -

titul jméno a příjmení studenta

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ
FAKULTA STAVEBNÍ

POPISNÝ SOUBOR ZÁVĚREČNÉ PRÁCE

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Studijní obor	3608R001 Pozemní stavby
Studijní program	B3607 Civil Engineering
Název práce	Rodinný dům
Název práce v anglickém jazyce	Detached Family Residence
Typ práce	Bakalářská práce
Přidělovaný titul	Bc.
Jazyk práce	Čeština
Datový formát elektronické verze	
Anotace práce	Tato bakalářská práce se zabývá návrhem samostatně stojícího rodinného domu s projekční kanceláří. Dům se nachází na konkrétním pozemku katastrálního území města Brna, v Soběšicích v ulici Rozárka. Cílem práce bylo vytvoření objektu vyhovujícímu svým dispozičním řešením požadavkům čtyřčlenné rodiny a svým vzhledem zapadajícímu do okolní zástavby. Dům je navržen jako dvoupodlažní, nepodsklepený se sedlovou střechou. Obvodové zdivo nadzemních podlaží je postaveno z vápenopískových bloků zdícího systému SENDWIX. Na zateplení celého objektu byl použit kontaktní zateplovací systém. Strop nad prvním nadzemním podlažím je monolitický železobetonový. Nosnou konstrukci střešního pláště tvoří dřevěné vazníky. Součástí práce je také požární a tepelně-technické řešení.
Anotace práce v anglickém jazyce	This Bachelor's Thesis deals with a design of detached family residence with planner's office. The house is situated on a specific plot of cadastral area of Brno city, in Soběšice in Rozárka Street. The aim was to create an

object suitable for a four-member family by its disposition solution, and fitting the neighbouring buildings by its appearance. The designed house is two-storey, basementless with saddle roof. Peripheral walls of above-ground floors are built from lime-sand blocks of SENDWIX walling system. Contact insulation system was used for thermal insulation of the whole object. Ceiling above first above-ground floor is monolithic reinforced concrete. Load-bearing structure of a roof deck is made of wooden trusses. The work also includes fire safety and thermotechnical solution.

Klíčová slova Rodinný dům, monolitický železobetonový strop, dřevěná sedlová střecha, zdící systém SENDWIX.

Klíčová slova v anglickém jazyce Family house, monolithic reinforced concrete ceiling, wooden saddle roof, SENDWIX walling system.