



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 PART

BAKALÁŘSKÁ PRÁCE  
BACHELOR'S THESIS

AUTOR PRÁCE  
AUTHOR

RICHARD SASKO

VEDOUCÍ PRÁCE  
SUPERVISOR

Ing. FRANTIŠEK VAJKAY, Ph.D.

BRNO 2016



# VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ FAKULTA STAVEBNÍ

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<b>Pracoviště</b>	Ústav pozemního stavitelství

## ZADÁNÍ BAKALÁŘSKÉ PRÁCE

<b>Student</b>	Richard Sasko
<b>Název</b>	Detached Family Residence
<b>Vedoucí bakalářské práce</b>	Ing. František Vajkay, Ph.D.
<b>Datum zadání bakalářské práce</b>	30. 11. 2015
<b>Datum odevzdání bakalářské práce</b>	27. 5. 2016

V Brně dne 30. 11. 2015

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

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

## Podklady a literatura

(1) směrnice děkana č. 19/2011 s dodatkem 1 a přílohami 1, 2, 3 a 5; (2) studie dispozičního, konstrukčního a architektonického řešení stavby; (3) katalogy a odborná literatura; (4) Zákon o územním plánování a stavebním řádu (stavební zákon) č. 183/2006 Sb. ve znění zákona č. 350/2012 Sb.; (5) Vyhláška č. 499/2006 Sb. ve znění vyhlášky č. 62/2013 Sb.; (6) Vyhláška č. 268/2009 Sb.; (7) Vyhláška č. 398/2009 Sb.; (8) platné normy ČSN, EN, ISO včetně jejich změn a dodatků.

## Zásady pro vypracování

\*\*\* Zadání VŠKP (BP) \*\*\* Zpracování projektové dokumentace (dále PD) pro provedení stavby stavebního objektu. Objekt je situován na vhodné stavební parcele. V rámci zpracování PD je nutné vyřešit rovněž širší vztahy, tj. zázemí objektu, venkovní parkovací plochy, napojení objektu na stávající inženýrské sítě, technickou a dopravní infrastrukturu atp.

\*\*\* Cíle práce \*\*\* Vyřešení dispozice zadaného objektu s návrhem vhodné konstrukční soustavy a nosného systému stavby na základě zvolených materiálů a konstrukčních prvků. PD objektu bude rozdělena na textovou a přílohovou část. PD bude obsahovat výkresy situace, základů, půdorysů všech podlaží, konstrukce zastřešení, svislých řezů, technických pohledů, 5 detailů, výkresy sestavy dílců popř. výkresy tvaru stropní konstrukce, specifikace a výpisy skladeb konstrukcí. Součástí dokumentace bude i stavebně fyzikální posouzení objektu a vybraných detailů, požární zpráva a další specializované části, budou-li zadány vedoucím BP.

\*\*\* Požadované výstupy \*\*\* BP bude členěna v souladu se směrnicí děkana č. 19/2011 a jejím dodatkem a přílohami. Výkresová, textová a přílohová část PD bude vložena do složek s klopami formátu A4 opatřených popisovým polem a uvedením obsahu na vnitřní straně každé složky. Všechny části PD budou zpracovány na bílém papíru s využitím PC v textovém a grafickém CAD editoru. Výkresy budou opatřeny popisovým polem. Textová část bude obsahovat také položku 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". BP bude mít strukturu dle pokynu umístěném na [www.fce.vutbr.cz/PST/Studium](http://www.fce.vutbr.cz/PST/Studium).

## Struktura bakalářské/diplomové práce

VŠKP vypracujte a rozčleňte podle dále uvedené struktury:

1. Textová část VŠKP zpracovaná podle Směrnice rektora "Úprava, odevzdávání, zveřejňování a uchování vysokoškolských kvalifikačních prací" a Směrnice děkana "Úprava, odevzdávání, zveřejňování a uchování vysokoškolských kvalifikačních prací na FAST VUT" (povinná součást VŠKP).
2. Přílohy textové části VŠKP zpracované podle Směrnice rektora "Úprava, odevzdávání, zveřejňování a uchování vysokoškolských kvalifikačních prací" a Směrnice děkana "Úprava, odevzdávání, zveřejňování a uchování 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**

Moja bakalárska práca sa venuje návrhu samostatne stojaceho rodinného domu. Ide o všestranný dizajn projektovej dokumentácie, ktorej výsledkom je možná realizácia objektu, ktorý vyhovuje normám Českej republiky ako aj potrebám užívateľa.

Dom je navrhovaný ako dvoj-poschodová, nadzemná novostavba pre päť člennú rodinu. Technicky sa jedná o drevostavbu rámovej konštrukcie po príklade rodinných domov z USA, Kanady a Škandinávie, ktorá sa všeobecne označuje ako 2 by 4 (2x4) alebo Platform-Frame.

Základy tvorí obvodový základový pás a betónové patky. Strecha je plochá s uhlom 2°. Izoláciu tvorí minerálna vata a polystyrén.

Objekt je situovaný v časti Brno Modrice.

### **Klíčová slova**

#rodinný dom #drevostavba #plochá strecha #rámova konštrukcia #minerálna vata  
#základová patka #C24 #625mm #two-by-four #2x4 #USA #Larry Haun  
#holzrahmenbau #crawl space

## **Abstract**

My thesis is dedicated to the proposal for a detached family residence. It is an universal design of project documentation, resulting in possible erection of building that meets the standards of the Czech Republic as well as needs of its user.

The house is designed as a two-storey, above-ground new work for five membered family. Technically, it is a wood frame construction based on family houses from the USA, Canada and Scandinavia, which is commonly known as 2 by 4 (2x4) or Platform-Frame.

Foundations consist of a peripheral strip foundation and concrete footing pads. The roof is considered as flat with an angle of 2°. Insulation is mineral wool and polystyrene.

The building is situated in the district Brno Modrice.

### **Keywords**

#family house #wood house #flat roof #frame construction #mineral wool #footing pad  
#C24 #625mm #two-by-four #2x4 #USA #Larry Haun #holzrahmenbau #crawl space

## **Bibliografická citace VŠKP**

Richard Sasko *Detached Family Residence*. Brno, 2016. 43 s., 269 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 zpracoval(a) samostatně a že jsem uvedl(a) všechny použité informační zdroje.

V Brně dne 27.5.2016

.....

podpis autora

Richard Sasko

## **Thanksgiving:**

This way I would like to thank everyone who helped me in their way to this personal masterpiece of mine. First of all, to my supervisor Mr. Ing. František Vajkay Ph.D., who has always shown me the right direction in solving technical problems.

Furthermore, to my designers, who enabled me to be where I am today.

To my personal Brno support, who stands out in the local crowd at first glance, she has always stood by me and helped me to overcome everything I faced last four years.

To all my kamaláskas and the God who led me on my way (Proverbs 24:5)

## **Poděkování:**

Týmto by som sa chcel poďakovať všetkým, ktorí mi svojím spôsobom pomohli k tomuto osobnému veľdielu. V prvom rade môjmu vedúcemu bakalárskej práce pánovi Ing. Františkovi Vajkayovi Ph.D., ktorý ma vždy naviedol tým správnym smerom pri riešení technických problémov.

Ďalej mojím projektantom, ktorí mi umožnili byť tam kde dnes som.

Mojej osobnej Brněnskej podpore, ktorá vyčnieva z tunajšieho davu už na prvý pohľad, stála vždy pri mne a pomohla mi prekonať všetko čomu som za 4 roky čelil.

Všetkým mojím kamaláskam ako aj Bohu, ktorý ma viedol na mojej ceste (Príslovia 24:5).

V Brně dne 27.5.2016

.....  
podpis autora

Richard Sasko

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# 1. Introduction

My thesis is dedicated to the proposal for a detached family residence. It is an universal design of project documentation, resulting in possible erection of building that meets the standards of the Czech Republic as well as needs of its user.

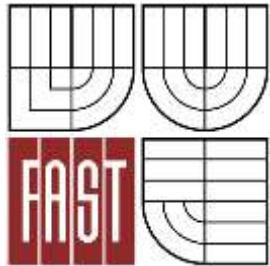
The house is designed as a two-storey, above-ground new work for five membered family. Technically, it is a wood frame construction based on family houses from the USA, Canada and Scandinavia, which is commonly known as 2 by 4 (2x4) or Platform-Frame.

Foundations consist of a peripheral strip foundation with concrete blocks and concrete footing pads under the house with crawl space. All walls are made of KVH timber studs of dimension 160x80 mm and reinforced by OSB boards from outer side. All walls are load-bearing. The roof is considered as flat with an angle of 2 °. Insulation is mineral wool and polystyrene.

The building is situated in the district Brno Modrice. It is placed in quiet location surrounded by family houses.



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## 2. OWN TEXT PART OF THE BACHELOR'S THESIS

A Accompanying report

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## **A.1.1 Own text part of the Bachelor's thesis**

### **A.1.1 Data about construction**

Construction: Detached Family Residence  
Location: Pančochy 930, 664 42 Modřice [583391], Czech Republic  
Cadastral area Modřice [697931], Popovice u Rajhradu  
Parcel number 2487/6

### **A.1.2 Data about the builder**

Builder: Richard Sasko and collective  
Address: Kounicova 46/48 C02-215 602 00 Brno,CZ

### **A.1.3 Data about the designer**

Designer: Richard Sasko  
Address: Kounicova 46/48 C02-215 602 00 Brno,CZ

## **A.2 List of input data**

- basic information about the resolutions or proceedings, based on which was the construction permitted (denotation of construction segment, name of authorised inspection, date of permission)

- basic information about the documentation or project documentation, based on which was the building designed

- additional background information:

- cadastral map of the lot and its further relations
- map of networks and infrastructures
- data about geodetic and altitude points of surrounding

## **A.3 Data about the area**

The parcel number 2487/6 is located in newly built area of municipality Modřice which is intended for family house building. It is already surrounded by family houses from two sides and is having ploughland from its back side.

The plot is in altitude 226 m H.a.s.l and levelled. There is already existing road from the street along the northern edge of parcel with width of 6.7 m.

Given plot is not located in any historical reserve, reserve of special protection or flood zone.

### **Data about the parcel**

Parcel number: 2487/6

Municipality: Modřice [583391]

Cadastral area: Modřice [697931], Popovice u Rajhradu

Number LV: 2371

Acreage: 1041 m<sup>2</sup>

Type of parcel: Parcel of cadastral estate

Map sheet: DKM

Determination of acreage: from coordinates S-JTSK

Type of parcel: ploughland

### **List of affected plots according to cadastral estate:**

- Parcel number: 2485/31, Parcel type: Public road
- Parcel number: 2487/4, Parcel type: Garden
- Parcel number: 2487/7, Parcel type: Garden
- Parcel number: 369/78, Parcel type: Ploughland

### **Data about the soil**

Lot is located in loess soils as can be visible in map. Close geological survey shown there are two groups of soils with their specific geotechnical qualities which are labelled as geotechnical types (GT):

GT1 - Aeolian sediments F6

GT2 - Fluvial sediments F4

Generally speaking, soil type can be specified as class F4 CS (Fluvial sandy clay).

### **Data about the traffic connection**

Parcel is connected to already existing road which will be jointing the lot with public road. Additional driveway and paths will be built to connect house with existing roads on its parcel border.

### **Data about the existing utility networks**

Parcel is not connected to any utility network and all connections have to be built. From public street, there is possibility of connection to AC medium voltage, sewerage, rain

sewerage, drinking water and medium pressure gas. The house does not need connection to pressure gas. All the others are being brought to parcel as situation drawing shows.

Electrometer will be located on border of parcel covered in masonry for visual purposes.

### **Data about fulfilment of regulation plan, zoning permission or land use planning according to § 104 article 1 of Building Law**

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

### **Data about compliance of general requirements for construction**

Fulfilled requirements of project documentation:

- Building Law 186/2006 Coll. and Notice no. 137/1998 Coll. about general requirements for construction
- Notice no.502/2006 Coll. about change of notice about general technical requirements for construction
- 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 fulfilment of requirements of concerned authorities**

All documentations fulfil the requirements of concerned authorities.

## **A.4 Data about the construction**

The object is new work. The building is designed as two-storey family house. Construction is wooden frame house with one main entrance and two side entrances. Main entrance is located from side facing public road and the rest is facing to backyard of house.

The house is designed with a purpose of usage of the nuclear family of 4 to 5 members. It is placed in quiet location surrounded by family houses.

It is founded on side wall made of concrete block standing on foundation strip and concrete pads under the house with crawl space. Construction is made as wooden frame house 2x4 from KVH timber studs of dimension 160x80 mm and reinforced by OSB boards from outer side. Insulation is situated inside of construction among the studs

(Isover UNI 16) as well as on outer side of OBS board (Isover UNI 8). All walls are load-bearing. The building does not belong to any protected construction. Its energy protocol shows, the building belongs to category A.

Information regarding compliance with technical requirements ensuring barrier-free usage:

Building meets all general technical requirements for construction work in accordance with Decree 268/2009 Coll., on technical requirements for construction.

The build-up area:	268.22 m <sup>2</sup>
Enclosed space:	772.78 m <sup>2</sup>
Acreage:	1041 m <sup>2</sup>
Maximal height above the terrain:	7 760 mm
Number of residential units:	1
Number of parking places:	2 in garage, one outside

Construction process:

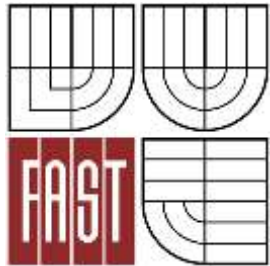
- Foundations	4/2017
- Connection of engineering networks	4/2017
- Horizontal and vertical structures	5/2017
- Internal surfaces, flooring	6/2017
- Surface treatment, pavement	6/2017
- Building approval	7/2017

## **A.5 Division of the object into zones**

House is divided into 7 zones. The basic ones are common, quiet, hygienic and communication. There are as well the additional zones for technical room, garage and storage.



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## 2. OWN TEXT PART OF THE BACHELOR'S THESIS

B Summary technical report

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## **B.1 Description of the parcel**

The parcel number 2487/6 is located in newly built area of municipality Modřice in the street of Pančochy which is intended for family house building. It is already surrounded by family houses from two sides and from back side there is an agricultural field and little forest. It is in the ending of street what ensures low vehicle occurrence. The plot is in altitude 226 m H.a.s.l and levelled. There is already existing road from the street along the northern edge of parcel with width of 6.7 m.

Given plot is not located in any historical reserve, reserve of special protection or flood zone.

Parcel is covered in grass and separated from its neighbouring parcels by fences which are not under investor's ownership.

There are no known protective and safety zones extending into the construction parcel.

There are no obstacles or cuts in ground, lot is in good conditions and does not need any additional earthworks besides of foundation pits digging.

### **Data about the parcel**

Parcel number: 2487/6

Municipality: Modřice [583391]

Cadastral area: Modřice [697931], Popovice u Rajhradu

Number LV: 2371

Acreage: 1041 m<sup>2</sup>

Type of parcel: Parcel of cadastral estate

Map sheet: DKM

Determination of acreage: from coordinates S-JTSK

Type of parcel: ploughland

### **Data about the soil**

Lot is located in loess soils as can be visible in map. Close geological survey shown there are two groups of soils with their specific geotechnical qualities which are labelled as geotechnical types (GT):

GT1 - Aeolian sediments F6

GT2 - Fluvial sediments F4

Generally speaking, soil type can be specified as class F4 CS (Fluvial sandy clay).

## **B.2 General description of the building**

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

The detached family residence is designed with a purpose of usage of the nuclear family of 4 to 5 members. It is placed in quiet location surrounded by family houses. Construction is resulting in the building that meets the standards of the Czech Republic as well as needs of its user. The house is designed as a two-storey, above-ground new work.

#### **B.2.1.1 Urban and architectural solution**

Parcel borders with an agricultural field and little forest on the South end of it. That offers undisturbed view into green areas. Total area of house with its land is 870.5 meters squared. It is two-storey building with a typical disposition of rooms. Its ground floor is suited for day life while the first floor composes of quiet and relaxation areas.

The house is accessible either by main door which leads to anteroom, or from garage. That is made for 2 cars and doors connect via storage room to anteroom or through the corridor to the kitchen area with middle island kitchen desk and also little morning breakfast table in the corner. From the kitchen there is door to the back garden. It also connects to TV room and meeting room/library. Next to the meeting room there is hallway with the staircase upstairs and also with the enter to dining room which is last piece of the circle that forms a common area of the house allocated around the staircase and due to doors in form of openings it gives more spacious feeling. On ground floor you can find also guest room with its own bathroom, technical room with space for washing machine what gives this house potential for being also two-generation house ,while everything needed for living can be found on ground floor.

Using the staircase you can get to the first floor which consists of 3 separated bedrooms for children and main bedroom for parents. Main bedroom is located on other side from children rooms and is separated either by staircase or storage room what gives calm and quiet environment for both sides. If you know what I mean. Main bedroom is also equipped by its own little bathroom and enter to the terrace. You can find the relaxation area with grill and sitting. It is oriented to the North ,what is caused by garage which is

allocated under the terrace and is connected to the main road. However it gives an opportunity to have main garden area behind the house with a view into the fields oriented to South. Terrace connects whole Northern part of the house and is accessible from parents bedroom, one child bedroom and from main bathroom furnished with bathtub and steam sauna/shower. 2 of 3 children bedrooms are on the back side of the house with orientation to garden and South what makes them ideal for relaxation.

The floor level of ground floor stated as 0.000 refers to 226 H.m.a.s.l.

External façade consists of two different material implementations of wood. Most of the façade is covered in wooden shingles (shakes) with its natural look and without protective coating. Smaller part is formed by wooden planks of vertical direction painted in white. Vertical direction of façade was chosen for its better water offtake and less complicated manufacturing methods.

Windows and external doors of brand Slovaktual were picked to blend into the colour composition of white and brown where all windows are white and doors are toned into white and brown colours.

### **B.2.1.2 Layout and operational solutions, production technology**

The detached family house is two-storey building with a typical disposition of rooms. Its ground floor is suited for day life while the first floor composes of quiet and relaxation areas. Main bedroom is located on other side from children rooms and is separated either by staircase or storage room what gives calm and quiet environment for both sides.

### **B.2.1.3 Barrier-free usage of the building**

The building was not designed as a barrier-free.

### **B.2.1.4 Safety during usage**

The building is designed and must be built so that there is no risk in its usage. Balustrades and handrails of stairs and terrace are designed to satisfy minimal height of 900 mm. All materials have to be certified and safe. Bathroom and terrace floors have to be equipped with anti-skid ceramic tiles.

### **B.2.1.5 Basic technical description of the building**

-Foundations:

Foundations consist of a peripheral strip foundation of width 500 mm and depth 700 mm with concrete blocks wall on its top and concrete footing pads under the house of dimension 600x600 mm. Both types of foundations are designed to reach relative depth of -1.737 m to reach frost resistant depth. Pads enable the possibility of crawl space under the house which ensures easier maintenance of construction.

-Waterproofing:

Waterproofing is ensured by Penefol 750- black , that can be used as well as anti-radon layer. On roof is the waterproofing ensured by Elastodek 40 special dekor which contains PE layer. Additional waterproofing is used for example on foundations where profiled studden film is used from inner side to ensure better water-tightness. For better conditions are as well used water vapour membrane on interior side and diffusion foil on the outside. As water vapour membrane is used Isover vario KM duplex UV and for diffusion foil was used Jutadach 135.

-Vertical load-bearing structures:

The peripheral and internal walls are based on same materials. Base forms KVH timber studs of dimensions 160x80 that form basic frame and are reinforced by OSB boards.

In case of peripheral walls, OSB boards are used only from outer side. Space among the studs is filled by insulation Isover Uni 16. Internal side is covered by gypsum boards Knauf. From exterior side of OSB is additional insulation from Isover Uni 8 connected by insulation anchors Topkraft ATK and screws Topkraft TO. Insulation layer is placed among timber laths 25x80 mm which are needed for external cladding anchorage. Cladding is formed by timber contra-laths 20x50 mm and construction is closed by either timber shingles 200x100x20 mm or timber planks 200x20 mm.

Internal walls are formed by KVH studs filled by Isover Uni 16 and covered by OSB board and gypsum boards from both sides.

-Horizontal load-bearing structures:

Ceilings and floors are based on same principle of usage of timber joists 200x40 mm filled by insulation Isover Uni. Additional layer for floors is formed by underfloor heating from Isover and top layer of laminate flooring or ceramic tiles.

Ceilings have additional gypsum boards.

Detailed composition can be visible in Section drawings (folder n.3) and details (folder n.4).

-Roof structure:

Roof is considered as flat roof with its slope of 2°. Top layer forms double layer of water proofing layer Elastodek 40 Special dekor. Insulation of roof is ensured by ceiling insulation Isover Uni, double layer of roof insulation Styrodur 3000 and slope wedge layer from Isover ESP 200.

Load bearing construction is formed by ceiling joists KVH 40x200 mm and OSB boards on top.

Detailed composition can be visible in Section drawings (folder n.3) and details (folder n.4).

-Thermal insulation:

Thermal insulation is formed mainly by mineral wool Isover Uni 8,16 or 20 as described in upper paragraphs, by Isover EPS in case of roof and Styrodur 3000 in case of roof and foundations.

-Windows and doors

Windows and doors are supplied by company Slovaktual. Windows are Slovaktual Pasiv OL with their heat transfer coefficient value of  $U_w = 0.8 \text{ W/m}^2 \cdot \text{K}$ . External doors are Slovaktual Heroal 72 with their heat transfer coefficient value of  $U_D = 1.2 \text{ W/m}^2 \cdot \text{K}$ .

Details can be seen in List of elements (folder n. 4)

-Technical and technological equipment:

There are three separate bathrooms, three separate toilets, washing machine and dryer in technical room and kitchen equipment.

Piping for sewerage, drinking water and electricity enter crawl space through its own passages in concrete block wall that can be seen in drawing of foundations in folder 4. Size of passages is set according to necessary dimensions of piping.

Installation shafts for drinking water and sewerage interrupt the concrete block wall on Eastern side of foundations and are marked as P2 and P3. Electricity interrupts the concrete block wall on Northern side of foundations and is marked as P1. Rooms 1.11, 1.12, 2.07 and 2.08 have common installation shafts. Rooms 1.07 and 2.04 lead partially separately and they then connect to first mentioned piping.

There are three double sinks, two single sinks, two toilets, three bathtubs, two separate showers, one combined with steam room, dishwasher, refrigerator, washing machine and dryer.

#### **B.2.1.6 Fire safety solution**

The fire safety report deals with family residence for 5 people of group OB1.

House consists of one fire compartment. N1.1/N2, grade of fire safety GFS II

Escape ways comply requirements (900 > 800 mm).

Access road comply requirements (6.7m > 3.0m).

Fire extinguishers are installed in each floor (Room 1.07, 2.03).

Smoke detectors are installed in every floor (Room 1.08, 2.01).

It can be seen from drawing that the fire hazardous area interfere with neighbouring borders. Written permission agreement with neighbour needed to be signed.

Building meets required conditions given by ČSN

#### **B.2.1.7 Principles of energy management**

The protocol for the thermal evaluation of the building envelope sets that building fulfils all requirements given by standards and is classified as building class A. (folder n.6).

### **B.2.1.8 Hygienic, working and communal requirements**

Ventilation of the house is secured by natural ventilation via windows and doors. Bathrooms and toilets are ventilated by ventilators. Kitchen island is equipped by kitchen hood Bedrooms are equipped with HVAC unit.

Heating is supported by underfloor heating and additional heating can be reimbursed by HVAC unit.

### **B.2.1.9 Principles of protection of building against negative effects of environment**

The house is protected against radon by crawl space of clear width 518 mm as well as by anti-radon layer Penefol 750- black.

There is no special requirement for noise protection. Protection against noise is ensured by thick layer of mineral wool insulation that is satisfying.

## **B.3 Connection to infrastructure**

From public road, there is possibility of connection to AC medium voltage, sewerage, rain sewerage, drinking water and medium pressure gas. The house does not need connection to pressure gas. All the others are being brought to parcel as situation drawing shows (folder n. 2).

Piping for sewerage, drinking water and electricity enter crawl space through its own passages in concrete block wall that can be seen in drawing of foundations in folder 4. Size of passages is set according to necessary dimensions of piping.

List of connections:

- Sewerage connection, approximate length 29 m, own sewer inspection shaft Ø 600mm
- Rain sewerage connection, approximate length 22 m, own rain water storage tank 4.5 m<sup>3</sup>, own dry well
- Drinking water connection, approximate length 29 m, own water meter shaft Ø 700mm
- AC medium voltage connection, approximate length 23 m, own main house box with electrometer

Electrometer will be located on border of parcel covered in masonry for visual purposes.



## **B.4 Traffic solution**

Parcel is connected to already existing road which will be jointing the lot with public road. Additional driveway and paths will be built to connect house with existing roads on its parcel border. Access road from public street is 6.7 m wide.

## **B.5 Vegetation and terrain solution**

Parcel will be covered in grass and trees will be added to separate house from the street and neighbouring plots.

## **B.6 Description of the effects of construction on the environment and its protection**

All used materials satisfy hygienic standards for emissions and foreign substances. In surrounding of construction are not any historical trees or endangered species locations. There is no area of protected bird colony from Natura 2000.

Construction has no negative effect on the environment.

## **B.7 Protection of population**

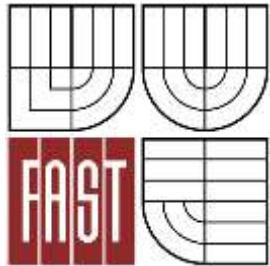
The building meets all conditions of regulatory plan in accordance to Decree n. 280/2002 Coll., preparation and execution of the tasks of civil protection.

## **B.8 Principles of construction organization**

- For erection is needed electricity connection from the beginning to supply equipment.
- Drainage is not planned ahead. In case of need, water pump will be used.
- Demolition of any obstacles is not necessary.
- All waste materials will be recycled by builder of user.
- Dry toilet is needed to be brought to the site.
- Working safety is necessary to be followed. Hardhats, glasses and protective footwear is mandatory.



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BRNO UNIVERSITY OF TECHNOLOGY



FAKULTA STAVEBNÍ  
ÚSTAV POZEMNÍHO STAVITELSTVÍ

FACULTY OF CIVIL ENGINEERING  
INSTITUTE OF BUILDING STRUCTURES

DETACHED FAMILY RESIDENCE

## 2. OWN TEXT PART OF THE BACHELOR'S THESIS

D.1.1 Technical report

BAKALÁŘSKÁ PRÁCE  
BACHELOR'S THESIS

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BRNO 2016

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## **D.1.1 Technical report**

### **1 Solution of construction**

#### **1.1 Architectonic solution**

The detached family residence is designed with a purpose of usage of the nuclear family of 4 to 5 members. It is placed in quiet location surrounded by family houses. Construction is resulting in the building that meets the standards of the Czech Republic as well as needs of its user. The house is designed as a two-storey, above-ground new work.

Parcel borders with an agricultural field and little forest on the South end of it. That offers undisturbed view into green areas. Total area of house with its land is 870.5 meters squared. It is two-storey building with a typical disposition of rooms. Its ground floor is suited for day life while the first floor composes of quiet and relaxation areas.

#### **1.2 Art solution**

External façade consists of two different material implementations of wood. Most of the façade is covered in wooden shingles (shakes) with its natural look and without protective coating. Smaller part is formed by wooden planks of vertical direction painted in white. Vertical direction of façade was chosen for its better water offtake and less complicated manufacturing methods.

Windows and external doors of brand Slovaktual were picked to blend into the colour composition of white and brown where all windows are white and doors are toned into white and brown colours.

#### **1.3 Material solution**

It is a wood frame construction based on family houses from the USA, Canada and Scandinavia, which is commonly known as 2 by 4 (2x4) or Platform-Frame. Construction is made of KVH timber studs of dimension 160x80 mm and reinforced by OSB boards from outer side. Insulation is situated inside of construction among the studs (Isover UNI 16) as well as on outer side of OBS board (Isover UNI 8).

## **1.4 Disposition and operational solutions**

It is two-storey building with a typical disposition of rooms. Its ground floor is suited for day life while the first floor composes of quiet and relaxation areas.

The build-up area:	268.22 m <sup>2</sup>
Enclosed space:	772.78 m <sup>2</sup>
Acreage:	1041 m <sup>2</sup>
Maximal height above the terrain:	7 760 mm
Number of residential units:	1
Number of parking places:	2 in garage, one outside

## **2. Barrier-free usage of the building**

Information regarding compliance with technical requirements ensuring barrier-free usage:

Building meets all general technical requirements for construction work in accordance with Decree 268/2009 Coll., on technical requirements for construction.

The object was not designed as a barrier-free.

## **3. Structural and construction-technical solution**

-Foundations:

Foundations consist of a peripheral strip foundation of width 500 mm and depth 700 mm with concrete blocks wall on its top and concrete footing pads under the house of dimension 600x600 mm. Both types of foundations are designed to reach relative depth of -1.737 m to reach frost resistant depth. Pads enable the possibility of crawl space under the house which ensures easier maintenance of construction.

-Waterproofing:

Waterproofing is ensured by Penefol 750- black , that can be used as well as anti-radon layer. On roof is the waterproofing ensured by Elastodek 40 special dekor which contains PE layer. Additional waterproofing is used for example on foundations where profiled studden film is used from inner side to ensure better water-tightness. For better conditions are as well used water vapour membrane on interior side and diffusion foil

on the outside. As water vapour membrane is used Isover vario KM duplex UV and for diffusion foil was used Jutadach 135.

-Vertical load-bearing structures:

The peripheral and internal walls are based on same materials. Base forms KVH timber studs of dimensions 160x80 that form basic frame and are reinforced by OSB boards.

In case of peripheral walls, OSB boards are used only from outer side. Space among the studs is filled by insulation Isover Uni 16. Internal side is covered by gypsum boards Knauf. From exterior side of OSB is additional insulation from Isover Uni 8 connected by insulation anchors Topkraft ATK and screws Topkraft TO. Insulation layer is placed among timber laths 25x80 mm which are needed for external cladding anchorage. Cladding is formed by timber contra-laths 20x50 mm and construction is closed by either timber shingles 200x100x20 mm or timber planks 200x20 mm.

Internal walls are formed by KVH studs filled by Isover Uni 16 and covered by OSB board and gypsum boards from both sides.

-Horizontal load-bearing structures:

Ceilings and floors are based on same principle of usage of timber joists 200x40 mm filled by insulation Isover Uni. Additional layer for floors is formed by underfloor heating from Isover and top layer of laminate flooring or ceramic tiles.

Ceilings have additional gypsum boards.

Detailed composition can be visible in Section drawings (folder n.3) and details (folder n.4).

-Roof structure:

Roof is considered as flat roof with its slope of 2°. Top layer forms double layer of water proofing layer Elastodek 40 Special dekor. Insulation of roof is ensured by ceiling insulation Isover Uni, double layer of roof insulation Styrodur 3000 and slope wedge layer from Isover ESP 200.

Load bearing construction is formed by ceiling joists KVH 40x200 mm and OSB boards on top.

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-Thermal insulation:

Thermal insulation is formed mainly by mineral wool Isover Uni 8,16 or 20 as described in upper paragraphs, by Isover EPS in case of roof and Styrodur 3000 in case of roof and foundations.

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Windows and doors are supplied by company Slovaktual. Windows are Slovaktual Pasiv OL with their heat transfer coefficient value of  $U_W = 0.8 \text{ W/m}^2 \cdot \text{K}$ . External doors are Slovaktual Heroal 72 with their heat transfer coefficient value of  $U_D = 1.2 \text{ W/m}^2 \cdot \text{K}$ .

Details can be seen in List of elements (folder n. 4).

-Floors:

Two basic types of top layer are used in interior. Laminate flooring or ceramic tiles. External terrace on level of ground floor is simply made of timber planks and terrace in first floor is covered by ceramic tiles.

-Stairs:

Staircase flight is made of spruce timber. Stringers are made of three planks 50x400 mm. Designed width of stairs is 1200 mm. Number of stairs is 17. Calculated width of tread is 242 mm which is in limits, height is 172 mm that is in limits as well. Slope is  $35.4^\circ$  due to limitations of timber and space of hallway. With slope of  $35.4^\circ$ , staircase is classified as steep stairs.

Details can be seen in Calculation of staircase (folder n. 7).

-Technical and technological equipment:

There are three separate bathrooms, three separate toilets, washing machine and dryer in technical room and kitchen equipment.

Piping for sewerage, drinking water and electricity enter crawl space through its own passages in concrete block wall that can be seen in drawing of foundations in folder 4. Size of passages is set according to necessary dimensions of piping.

Installation shafts for drinking water and sewerage interrupt the concrete block wall on Eastern side of foundations and are marked as P2 and P3. Electricity interrupts the concrete block wall on Northern side of foundations and is marked as P1. Rooms 1.11, 1.12, 2.07 and 2.08 have common installation shafts. Rooms 1.07 and 2.04 lead partially separately and they then connect to first mentioned piping.

There are three double sinks, two single sinks, two toilets, three bathtubs, two separate showers, one combined with steam room, dishwasher, refrigerator, washing machine and dryer.

- Chimney

House is equipped by chimney from company Schiedel, model Schiedel Absolut.

-Ventilation

Ventilation of the house is secured by natural ventilation via windows and doors. Bathrooms and toilets are ventilated by ventilators. Kitchen island is equipped by kitchen hood Bedrooms are equipped with HVAC unit.

#### **4. Building physics**

The protocol for the thermal evaluation of the building envelope sets that building fulfils all requirements given by standards and is classified as building class A.

Details can be seen in Building physics (folder n. 6).

### **3. Conclusion**

My thesis was dedicated to the proposal for a detached family residence. The result is complete project documentation that meets standards of the Czech Republic as well as needs of its user.

The house was designed in accordance with fundamental rules of wood frame housing using the simplest methods and materials. Building is classified as A class.

The project documentation was based on assignment of final work and gradually worked out from segment of architectonic study and disposition of the detached family residence through situations, architectonic solution of elevations and sections, building construction solution containing foundations, slabs, frame constructions and details to



calculations of foundations, fire safety, stairs, building envelope and last but not least this vast technical report.

All issues on its way were consulted and corrected the best possible way while zigzagging between legislations and desired outcome.

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<http://www.diynetwork.com/how-to/rooms-and-spaces/walls-and-ceilings/plan-and-prep-before-building-a-non-bearing-stud-wall>

<http://www.diynetwork.com/how-to/rooms-and-spaces/floors/all-about-wood-floor-framing-and-construction>

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<http://www.diynetwork.com/how-to/rooms-and-spaces/floors/all-about-joist-and-concrete-floor-structures>

<http://pioneersettler.com/how-to-build-a-tiny-house/>

## 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 network	jednotné trigonometrická síť katastrální = uniform trigonometric cadastral network	
VŠKP	vysokoškolská kvalifikační práce = university qualification work	minminimal
n.	number	
par	paragraph	
KVC	structural beam	
OSB	oriented strand board	
mm	milimeter	
m	meter	
th.	thickness	
SC	scale	

## **6. List of annexes**

### **FOLDER n. 1 - Architectonic Study and Disposition**

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D.1.2.11 Detail D - External wall vertical	SC 1:5
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E.1.1 / N. 6 Calculation of heat transfer coefficient	
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### **FOLDER n. 7 - Additional Calculations**

F.1.1 / 7.1 Calculation of Stairs	
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G.1.2 Floor construction

G.1.3 Foundations construction

G.1.4 Studs construction ground floor

G.1.5 Studs frame construction

G.1.6 External look



# **PROHLÁŠENÍ O SHODĚ LISTINNÉ A ELEKTRONICKÉ FORMY VŠKP**

## **DECLARATION OF CONFORMITY OF DOCUMENTARY AND ELECTRONIC FORM OF THESIS**

### **Statement:**

I declare that the electronic form of the submitted thesis is the same as the submission of a physical form.

### **Prohlášení:**

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

V Brně dne 25.5.2016

.....  
podpis autora  
Richard Sasko



VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

FAKULTA STAVEBNÍ

## POPISNÝ SOUBOR ZÁVĚREČNÉ PRÁCE

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<b>Název práce</b>	Detached Family Residence
<b>Název práce v anglickém jazyce</b>	Samostatně stojící rodinný dům
<b>Typ práce</b>	Bakalářská práce
<b>Přidělovaný titul</b>	Bc.
<b>Jazyk práce</b>	Čeština
<b>Datový formát elektronické verze</b>	
<b>Anotace práce</b>	<p>Moja bakalárska práca sa venuje návrhu samostatne stojaceho rodinného domu. Ide o všestranný dizajn projektovej dokumentácie, ktorej výsledkom je možná realizácia objektu, ktorý vyhovuje normám Českej republiky ako aj potrebám užívateľa.</p> <p>Dom je navrhovaný ako dvoj-poschodová, nadzemná novostavba pre päť člennú rodinu. Technicky sa jedná o drevostavbu rámovej konštrukcie po príklade rodinných domov z USA, Kanady a Škandinávie, ktorá sa všeobecne označuje ako 2 by 4 (2x4) alebo Platform-Frame.</p> <p>Základy tvorí obvodový základový pás a betónové patky. Strecha je plochá s uhlom 2°. Izoláciu tvorí minerálna vata a polystyrén.</p> <p>Objekt je situovaný v časti Brno Modrice.</p>

**Anotace práce v anglickém jazyce** My thesis is dedicated to the proposal for a detached family residence. It is an universal design of project documentation, resulting in possible erection of building that meets the standards of the Czech Republic as well as needs of its user.

The house is designed as a two-storey, above-ground new work for five membered family. Technically, it is a wood frame construction based on family houses from the USA, Canada and Scandinavia, which is commonly known as 2 by 4 (2x4) or Platform-Frame.

Foundations consists of a peripheral strip foundation and concrete footing pads. The roof is considered as flat with an angle of 2 °.

Insulation is mineral wool and polystyrene.

The building is situated in the district Brno Modrice.

**Klíčová slova** #rodinný dom #drevostavba #plochá strecha #rámová konštrukcia #minerálna vata #základová patka #C24 #625mm #two-by-four #2x4 #USA #Larry Haun #holzrahmenbau #crawl space

**Klíčová slova v anglickém jazyce** #family house #wood house #flat roof #frame construction #mineral wool #footing pad #C24 #625mm #two-by-four #2x4 #USA #Larry Haun #holzrahmenbau #crawl space