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

BAKALÁŘSKÁ PRÁCE
BACHELOR´S THESIS

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Ing. FRANTIŠEK VAJKAY, PhD.

BRNO 2016

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FAKULTA STAVEBNÍ

Studijní program	B3607 Civil Engineering
Typ studijního programu	Bakalářský studijní program s výukou v anglickém jazyce a prezenční fromou studia
Studijní odbor	3608R001 Pozemní stavby
Pracovište	Ústav pozemního stavitelství

ZADÁNÍ BAKALÁŘSKÉ PRÁCE

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Název	Detached Family Residence
Vedoucí bakalářské práce	Ing.František Vajkay, Ph.D.
Datum zadáni bakalářské práce	30.11.2015
Datum odevzdání bakalářské práce	27.5.2016

V Brně dne 30.11.2015

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Vedoucí ústavu	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, konštrukčního 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, cíle práce, požadované výstupy)

*** Zadání VŠKP (BP)*** Zpracování projektové dokumentace (dále PD) pro provedení stavby stevbního objektu. Objekt je situován na vhodné stavební parcele. V rámci zpracování PD je nutné vyřešit rovněž širší vztahy, tj. zázemí objektu, venkovní parkovácí plochy, napojení objektu na stávající inženýrské sitě, technickou a dopravní infrastrukturu atp.
*** Cíle práce *** Vyřešení dispozice zadaného objektu s návrhem vhodné konštrukční soustavy a nosného systému stavby na základě zvolených materiálů a konštrukčních 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, bodou-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 bílem 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.

Struktura bakalářské/diplomové práce

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

ABSTRAKT

Bakalárska práca sa zaoberá architektonickými, stavebnými a technickými riešeniami dvojpodlažného rodinného domu (nepodpivničený). Objekt sa nachádza v obci Babice nad Svitavou, ktoré patria do katastrálneho územia Babice nad Svitavou. Číslo parcely na ktorej bude objekt zhotovený je 693. Rodinný dom je navrhnutý pre päť člennú rodinu. Konštrukcia je navrhnutá ako sendvičová skladba s nosným dreveným skeletom. Dom je navrhnutý tak aby minimálne zaťažoval životné prostredie pri výstavbe ale aj jeho nasledovnom užívaní.

KĽÚČOVÉ SLOVÁ

Drevený rám, sendvičová konštrukcia, priehradový nosník, šikmá strecha, dvojpodlažný, Babice nad Svitavou

ABSTRACT

The bachelor work is dealing with architectonical, construction and technical solution of the double floor family house (without basement). The object is located in Babice nad Svitavou. Babice nad Svitavou belongs to the cadastral region Babice nad Svitavou with the property number 693. Family house is designed for five member family. Construction is designed as a sandwich composition with load bearing, timber skeleton structure. The house is designed with regard to decrease the impact on an environment during the construction process as well as future usage.

KEY WORDS

Wooden skeleton, sandwich construction, truss, sloped roof, double floor, Babice nad Svitavou.

BIBLIOGRAFICKÁ CITÁCIA VŠKP

Jakub Čupec *Detached Family Residence.* Brno, 2016. 37 s., 91 s. příl. Bakalářská práce. Vysoké učení technické v Brně, Fakulta stavební, Ústav pozemního stavitelství. Vedoucí práce Ing. František Vajkay, Ph.D.

PREHLÁSENIE:

Čestne prehlasujem že som bakalársku prácu vypracoval samostatne a uviedol som všetky použité zdroje a informácie.

DECLARATION:

I honestly declare that this bachelor thesis was worked out by myself only and that I presented all of the used sources and information.

V Brne, dňa 16.5.2016

.....
podpis autora
Jakub Čupec

POĎAKOVANIE:

Týmto by som sa chcel poďakovať môjmu vedúcemu učiteľovi Ing Františkovi Vajkayovi za podporu, rady, dohľad a vedenie pri spracovaní bakalárskeho projektu. Ďalej by som sa chcel poďakovať mojim spolužiakom, ktorý mi podali pomocnú ruku vždy keď bolo treba. Veľká vďaka patrí aj mojim rodičom, ktorý mi umožnili študovať túto vysoký školu a počas života mi boli vždy veľkou oporou.

THANKS:

I would like to thank to my supervisor Ing František Vajkay for a great support, advices, and proper leading I have received from him during elaboration of the bachelor thesis. Special thanks go to my classmates. They were always helpful, when it was needed. Big thanks go to my patents as well. I would like to thank them for letting me study this university and for their unlimited support during my life time.

V Brne, dňa 16.5.2016

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podpis autora
Jakub Čupec

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INTRODUCTION

This bachelor project is dealing with project documentation for new family house in Babice nad Svitavou. The object is designed as double floor with no basement and sloped roof. The property on which the building is designed is trapezoidal shape with total area 881.55 m^2 and flat surface. The main road to the property and all engineering networks are located north from the property. The object is T shaped and designed as one generation house for the five member family. Main entrance to the object is situated to the north. Outside part of the house are terrace and compacted area for two cars, covered with wooden pergola. Vertical constructions are designed as sandwich structure. External load bearing walls are designed as timber skeleton filled by mineral wool Nobasil FKD-S th. 250 mm. The wall is closed with magnesium boards from exterior and plaster boards from interior. Total thickness of the external wall is 300 mm. Main interior wall is designed as timber frame filled by thermal insulation Nobasil FKD-S th. 250 mm and it is closed by plaster boards Rigips th. 12.5 mm. Total thickness of the wall is 290 mm. Additional load bearing walls are made of timber frame filled by thermal insulation Nobasil 160 mm and closed by Rigips 12.5 mm. Total thickness of the wall is 185 mm. The partition walls are also Rigips walls of thickness 80, 125 mm. Roof structure is designed as truss system covered with the metal sheets Blachotrapez Kingas. Insulation of the roof is designed above the ceiling of the second floor as the layers of Nobasil FKD-S in total thickness 280 mm. Ceiling is designed from wooden beams filled by thermal insulation Nobasil FKD-S th. 160 mm and covered by plaster boards Rigips 10 from the bottom and by double layer of OSB 15 from the top. Total thickness of the ceiling construction is 225 mm.

My goal was to create a modern house with practical disposition, for 5 member family, which can be constructed in a short period of time. This is achieved by easily assembled structures and reduction of wet processes during construction.

Project is designed according to valid Czech lows, regulations and technical norms.

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A - ACCOMPANYING REPORT

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A.1 IDENTIFICATION

A.1.1 INFORMATION ABOUT THE PROJECT

Name: Family house

Location: Babice nad Svitavou

A.1.2 INFORMATION ABOUT THE BUILDER

Name: Štefan Čupec

Address: Rozkvet 2072/154, 017 01 Považská Bystrica

Phone: +421 907 742 473

A.1.3 INFORMATION ABOUT THE DESIGNER

Name: Jakub Čupec

Address: Rozkvet 2072/154, 017 01 Považská Bystrica

Phone: +421 944 950 338

A.2 THE LIST OF INPUT DATA

For this project there have been used next documents: cadaster map of the area, landscape photos, map of the engineering networks.

A.3 INFORMATION ABOUT AREA

The project will be realized on the property which belongs to cadaster area of Babice nad Svitavou with parcel number 693. The property is trapezoidal shape with total area of 884.6 m2. There are no other buildings or structures on the property. Terrain is considered as flat with small surface roughness. The whole property is surrounded by other properties with parcel numbers of 692, 697, 695, 787, 694 and by the side road, which is considered as entrance road to a property, from the north side. The property doesn't belong to any of the following: flooding area, monument area, nature reservoir, special protected area or protected area of water supply. The drainage of the rain water on the property is solved by natural leak out. The whole property is covered by grass. The purpose of the project and the parcel is in accordance with

general requirements of an area usage and with general requirements on architectonical planning of the area. The building construction itself will touch the surrounding properties in some way. Numbers of touched properties: 691, 698, 697, 696, 695, 694, 787.

A.4 INFORMATION ABOUT THE PROJECT

The processed project is solving a new family house, in Babice nad Svitavou, which will be realized on a parcel number 693. The purpose of the project is to create a leaving for five member family. The family house is determined as a long term construction (with expected durability of 50 years). The project is not protected in any way, and it is not considered as cultural monument, meaning there are no legal obstacles for the construction. Family house is not designed for access of disabled people. For this project there is no need for requirement exceptions or facilitate solutions. The object is designed with consideration of energy consumption there for it is classified as low-energy building, class B. The time needed for construction realization is approximately 5 months. Estimated cost of the construction is 3 800 000 czk (140 000 €).

Build-in area of house:	134.27 m^2
Total build-in area:	164.38 m^2
Total usable area:	207.31 m^2
Usable area of 1st floor:	120.51 m^2
Usable area of 2nd floor:	86.8 m^2
Number of housing units:	1HU
Number of users:	5
Number of bedrooms:	4

A.5 THE DIVISION OF THE OBJECT IN TO SEGMENTS AND TECHNICAL EQUIPMENT

The building object will be divided in to the following segments:

SO 01 – Family house

SO 02 – Compacted area

SO 03 – Parking pergola

SO 04 – Fence

SO 05 – Sewage connection

SO 06 – Water connection

SO 07 – Electricity connection

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B – SUMMARY TECHNINCAL REPORT

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B.1 DESCRIPTION OF THE PARCEL

The perimeter of the construction side is define by the border of the parcel in cadaster area of Babice nad Svitavou with specific number 693 – see attachment C.1 Situation of surrounding area. The main access to the construction side is secured by the side road located on the north from the property. Construction side is in ownership of the project Investor. There are existing objects on the surrounding parcels. Considering this fact there was no need to do the geological research and measuring of the radon activity. The foundation soil was classified according to previous measurement of the surrounding parcels. Parcel doesn't belong to any floating area, protected area or secured area. The new family house will not interrupt existing build-up area. Architectonically it fits in to the given environment. The modification of the parcels terrain will be minimal, so it will not have a radical impact on the environment. The object will not occupy any properties which are classified as forest, meadow or veldt. The new object will be connected on the existing public networks of the sewage pipeline, water supply pipeline and high voltage electricity cable. Connection of the electricity cables will be set on the north border of the property. Connection to the public water supply and public sewage system pipelines will be located under the side road. In the given area there are no known easements, time connections or conditional investments.

B.2 GENERAL DESCRIPTION OF THE OBJECT

B.2.1 THE PURPOSE OF THE OBJECT USAGE

The object will be used as a family house for living. The goal of this project is to create healthy and comfortable living conditions for the family consisting of five members. Object is designed as one generation house.

B.2.2 URBAN AND ARCHITECTONICAL SOLUTION

The object is located on the north-east part of the property. The reason was to create a short way to the access road and to create an open space on the south-west part of the property. This solution creates an enough space on south of the property for build in pool and garden sitting. West part of the property is created a huge space for the

garden. There is designed a place for parking a two cars in north-east corner. The boarder of the parcel will be fence by a reinforced concrete wall covered by decoration stone tiles. Height of the fence is approximately 2 m. The garden will be planted by grass and flowers. Compacted areas are created by concrete tiles.

The facade of the first floor of the family house is created by the facade plaster CEMIX NANOCEM R, fracture of 2 mm, color pure white. Second floor facade and facade of the entrance part of the first floor is created by oak facing in horizontal direction. Roof will be covered by black metal sheets of BLACHOTRAPEZ KINGAS. Domination of the house is a terrace with winter garden on the second floor. Winter garden is light wooden frame filled by windows. This construction creates an open space full of light. The railing of the terrace is created by attic of height 1 m. Surface of the attic is covered by horizontal oak facing from exterior. Next interesting part of the exterior is terrace on the first floor. This terrace is designed as an open space from three sides. Roof of this terrace is created by part of the second floor structure. Windows and doors are wooden euro window VEKRA oak, th. 94 mm. Windows on the second floor are French. The railing is designed from stainless steel J.A.P.

Particular views and visualization can be seen in part of the project called architectonical study.

B.2.3 OVERALL OPERATIONAL SOLUTION

The family house is double floor object without the basement. Roof is designed ass truss system sloped to the one side. Ground plan is T shaped.

There are nine rooms in the first floor. After entering the entrance hall, there is possibility to access the technical room on the left side or move to the main corridor. From the main corridor there is access almost to the all other rooms. On the right side there are doors leading to the kitchen, dining and living room. These three rooms are creating as an open space separated only by wall. On the left side of the main corridor there is an access to the WC and parents bedroom. Parent bedroom has its own bathroom. Staircase is located on the end of the corridor and leads to the second floor main corridor. From this corridor it is possible to access terrace with winter garden, all three kids bedroom and one bath room. The south bedroom has private wardrobe room and bathroom.

B.2.4 USAGE BY DISABLED PEOPLE

The object was not designed for usage by disabled people. This solution was not necessary for the users of this house. The leveling of the terrain differences between original terrain and entrance to the house is created by the height of 130 mm. Compacted area from public road is with no obstacles, and the small height differences are leveled by sloping of the surface, so it can be considerate as disabled access. The spacing of the rooms, corridors and width of the doors are not sufficient for disabled people.

B.2.5 SAFETY DURING USAGE

All equipments must be tested and regulated after assembling. There are no special safety requirements during the usage.

B.2.6 BASIC CHARACTERISTIC OF THE OBJECT

Building solution

The internal disposition of the rooms is design with consideration of comfortable usage of the object. Design disposition is in accordance with valid norms requirements. All rooms are fulfilling the conditions of minimal spacing and clear height.

Construction and material solution

The object is build up on the foundation strips of height 1 000 mm under the peripheral load bearing walls and 500 mm under the internal load bearing walls. The horizontal part of the foundations is foundation plate. Under the foundation plate, there must be a layer of compacted gravel sub-base of thickness 200 mm and particle fraction of 16-32 mm. The foundation plate and strips is monolithic reinforced concrete structure. Strips are reinforced by still bars and foundation plate is reinforced by KARI grid. During the construction of the foundation, the dimensions and distances for piping openings must be kept. The grade of concrete and diameters of reinforcements is according to static design which is not part of this project.

The insulation against the ground water will be created by one layer of asphalt hydro-insulation BITUBITAHIT PE V60S30. This layer is applied on the top of the

foundation plate. The insulation is bended on the edges and covers the foundation strip in to the depth of 400 mm. For additional drainage is used studded film LITHOPLAST PERFOR. It is applied on the perimeter of the foundation strip in depth of 500 mm under the original terrain.

The basic structure of the external load bearing walls is timber skeleton. Skeleton is filled by thermal insulation NOBASIL FKS-S th. 190 mm (two layers 120 +70 mm). Exterior part of the wall is covered by magnesium board MEGAPAN th. 22 mm. Interior side is covered by layer of OSB board KRONOSPAN SUPERFINIS ECO th. 15 mm. and additional timber frame assembled on OSB boards, filled by thermal insulation NOBASIL FKD-S th. 60 mm. Frame is closed by plaster boards RIGIPS th. 12.5 mm. Internal load bearing walls are constructed with similar principles, except the top surface from each side is created by plaster board RIGIPS 12.5 mm see in attachment Architectural and structural solution.

Slab construction above the 1st GF is made of timber beams supported by load bearing walls. Additional slab support is created by distance beam. Space between the beams is filled by thermal insulation NOBASIL FKD-S th. 160 mm. From the bottom side the slab construction is closed by layer of OSB boards KRONOSPAN SUPERFINISH ECO th. 15 mm and layer of plaster boards RIGIPS th. 10 mm. From the top side the construction is closed by double layer of OSB boards KRONOSPAN SUPERFINISH ECO th. 30 mm (15 + 15 mm). Slab construction above the 2nd GF is creating a top part of the building envelope. Construction is designed as wooden frame attached to the roof truss system. There is a layer of thermal insulation NOBASIL FKD-S th. 50 mm applied in the frame. The construction is closed by plaster board RIGIPS th. 12.5 mm. Additional layer of thermal insulation NOBASIL FKD-S th. 250 mm is applied above the slab construction, between the roof truss system.

Staircase is created by timber arms, which holds the steps. Arms are anchored to the walls. Top of the staircase is anchored to the slab beam and bottom will stand freely on the floor structure.

The main load bearing roof structure is created by timber trusses anchored to the peripheral load bearing walls. There is a layer of Diffusion foil applied on the rafters. All trusses are stabilized by roof battens. The cover of the roof is designed as metal sheets BLACHOTRAPEZ KINGAS. The whole roof is sloped to the north side.

All exterior window and doors are euro windows VEKRA, oak texture, th. 94 mm, triple glassed. Interior door are designed with casing doorframes.

The basic terrace construction is similar to a 1st GF slab structure. The top part is extended by layer of sloped wedge STYROTRADE STYRO EPS th. 150 mm and layer of leveling concrete CEMIX LEVELA PROFI th. 30 mm.

Structure of the winter garden is designed as simple timber frame filled by windows and doors euro windows VEKRA, oak texture, th. 68 mm, double glassed.

B.2.7 BASIC CHARACTERISTICS OF BUILDING SERVICES

The new object has three bathrooms, one kitchen and one separated WC. All of the equipments of the new object will be connected to the public networks by new connections. Sewage water is connected to the public sewage network. Domestic water pipeline is connected to a network of public water supply. The object is connected to a public height voltage electricity cable. Main electricity box for the house is located in technical room. Rain water drainage is created by rain water down pipe and it is drain to the gravel pits. The heating source of the house will be pellet boiler approximately 25-W. The object will be heated by underfloor heating in the 1st GF and radiators in the 2nd GF. Preparation of hot domestic water will be secured by water storage heater which will be connected to the boiler. Boiler and hot water heater are located in technical room of the house. The whole object will be heated by solid fuel (pellets).

B.2.8 FIRE SAFETY

For fire safety solution of the family house see attachment D.1.3

B.2.9 FUNDAMENTALS OF THE ENERGY USAGE

New object is design in accordance with valid legislation. The constructions of roof, floor, terrace and peripheral walls are design in the way to fulfill requirements of heat transfer losses. The object is classified as low-energy house in class B. The design does not include any other alternative forms of energy.

B.2.10 HYGIENIC AND WORKING REQUIREMENTS, REQUIREMENTS ON COMMUNAL ENVIRONMENT

Ventilation system of the object is natural, secured by doors and windows. For this purpose, the window can be set to the ventilation stage. Heating is secured by the pellet boiler. Interior electricity is used for lightning and usage of home electric equipments. Communal waste during the usage will be transported to the waste site by garbage collection. In the designed object, there are no special installations of the equipments causing extra noise or vibration, which can interrupt surrounding environment.

B.2.11 PROTECTION OF THE BUILDING AGAINST NEGATIVE EFFECTS FROM THE SURROUNDING ENVIRONMENT

Protection against the radon penetration from the soil is secured by complex system of insulation on the bottom part of the construction. Protection against the external noises and vibrations is secured by the object construction, which fulfills the criteria about absorbing of noise and vibration. No other protections are needed.

B.3 CONNECTION TO THE INFRASTRUCTURE

There are three main connections to the public networks. Connection of the sewage (SO 05) to the public sewage system is 32 m long. Connection of the domestic water supply (SO 06) is 7.5 m long with main water shaft 0.5 m behind the border of the parcel. Electricity network of the object (SO 07) is connected to the public high voltage cable. Main electric box is placed on the border of the parcel. Main electric box for the object network is placed in technical room.

B.4 TRANSPORTATION SOLUTION

Main access to the property is secured from the public road on the north part of the property. Slip road for the cars is created by compact area, which connects public road with the property. The pathway leading between the public road and north border of the parcel can by also used for access. Cars will be parked on compacted area created

for this purpose. This area will be also used for the movements of the people on property. For detail look see attachment C.2 Detail situation of house settings.

B.5 VEGETATION AND TERRAIN SOLUTION

There are 5 bigger threes and few small bushes on the parcel. All of them will be cut out and stored on the property for later use by Investor. Roots from the trees must be rip out. A 300 mm layer of the top soil should be removed in the area of the new object. This soil will be stored and latter used for leveling of the terrain roughness. There should be compacted areas according to the attachments C2 Detail situation of house settings. The non compacted part of the property will be leveled by stored soil and grassed on the end of the construction work. The closer solutions of the vegetation and landscape architecture will be prepared additionally by garden architect, as it was requested by investor.

B.6 DESCRIPTION OF THE ENVIRONMENTAL IMPACT OF THE BUILDING

The new object does not have any negative impact on the environment. The waste during the construction will be liquidated with accordance to a valid lows and regulations about waste management. During the usage of the object, there will be only sewage waste and regular home trash. Sewage waste will be led away by sewage piping to the public sewage system. Home trash will be taken away by garbage collection and transported to the waste site. The materials used for constructions are mostly natural, so the family house will affect the environment in minimal range.

B.7 PROTECTION OF INHABITANCE

The primary purpose of the object is not for protection of the inhabitance. The building solution of the object fulfills all the necessary requirements for easy escape during the danger.

B.8 THE PRINCIPLES OF ORGANIZATION DURING THE CONSTRUCTION

Before the construction works begins, it is necessary to build a water supply connection for cleaning and other processes connected with construction and electricity connection for powering the working equipments. The construction materials must be secured in advance to prevent the suspension of the works on construction. The construction site will be naturally drained by leaking out to the soil. Connection of the construction site to public road will be created by compacted area. This connection will secure easy access for the supplies. Construction site is located in build up area so it is necessary to separate it by a fence of the min. height 1.8 m around the site. It is also necessary to prevent the entry of unauthorized people. The vehicles leaving the construction site and entering the public road must be cleaned to prevent the pollution of the public road. Ground work will be realized according to needed range for construction of the foundation. It is expected to take away a 300 mm of top soil in the area of construction. The top soil and the soil from foundation pit will be stored on the construction site and used latter for terrain leveling. The dry toilet (TOY TOY type) for the workers must be secured. Construction waste will be handled according to the valid lows and regulations about waste managing. On a request of the investor, the wooden waste will be stored on construction site for future purposes. The safety and health protection requirements must be fulfilled in all ways. All workers will be equipped by the safety and protective equipments (helmets, glows, safety shoes, high vests). The workers must be trained to use particular working tools. The regular movement of the vehicles and inhabitance on the public road and public pathway can not be limited by construction works.

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C – TECHNICAL REPORT

BAKALÁŘSKÁ PRÁCE
BACHELOR´S THESIS

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BRNO 2016

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C.1 GENERAL INFORMATION ABOUT THE OBJECT

Name of the building:	Family house
Location of the building:	Babice nad Svitavou
Investor:	Štefan Čupec, Rozkvet 2072/154, 017 01 Pov. Bystrica
Build-in area:	134.27 m^2
Usable area:	207.31 m^2
Total height:	6.9 m
No. of floors:	2 floors

C.2 EARTHWORKS

The construction area is flat surface so it is not necessary to flatten the surface before construction works begins. It will be necessary to remove the trees and bushes from the property. It is also required to remove the top soil in to the depth of 300 mm. It will be removed only from the area of actual object and with offset of 1 m. This soil will be stored on the construction site, preferably in south-east corner of the property. It is important to set the timber benches on each corner of the object with offset of 1 m for easy access of excavation machines. The benches must be set in to the correct height according to the project zero. The height and level of the benches must be properly measured. After setting the benches in to the correct positions it is possible to start excavation of the pits. Excavation will be processed according to the attachment D.1.2.01 Ground floor of the foundations. Foundation pit will be offset about 400 mm to each side according to the drawings of foundation strips. This approach secure easy access for carpenters to make a formwork for foundation strips. The minimal depth of the pit must be 1350 mm from project zero. After the foundation pit is ready, it must be properly measured more times before the concrete work begins. The excavated soil from the foundation pits will be taken and moved next the removed top soil. The excavated soil will be used for leveling the terrain roughness on the end of the construction work.

C.3 FOUNDATIONS

Construction of the foundation will begin after the foundation pits are ready and properly measured. The form work for foundation strips must be constructed by skillful workers. Total depth of the form work should be 1 000 mm. Top of the form work will be in height -350 mm from the project zero. After the form work is ready the reinforcement will be set inside and properly tied. When the reinforcement is ready, there will be one last proper check of the form work as well as reinforcement bars before purring the concrete mix. Concrete will be purred in to the formwork by mixer and subsequently vibrated. There must be a 6 days technological break before the form work is taken down. During this time the concrete structure must be kept in wet conditions. After the form work is taken down there must be another 10 days tech. break before the foundation work continues. An empty space around the foundation strips from the interior side will be filled by soil. The level of the soil inside the construction must be adjusted to the height of -550 mm from the project zero. This area will be covered by the layer of geotextile. After the geotextile is properly applied the interior foundation pit will be filled by gravel of fraction 16-32. A layer of gravel must be properly compacted. The total height of compacted layer will be 200 mm and the top level will be at the same height as the top level of foundation strip (-350 mm from project zero). After this process the form work for foundation plate will be prepared as well as the reinforcement for the plate. Reinforcement will be created by KARI grid and properly tied. There will be an additional metal anchors connected to Kari grid for attaching the wall structure in to the foundation. One last check of the form work and reinforcement will take place, before purring the concrete mixture. Mixture will be purred to the form work by concrete mixer and properly vibrated and leveled. There must be six days technological break before the form work is taken down and another 10 days before the construction works can continue. During this time the foundation plate must be kept in wet conditions. The positions and dimensions of the reinforcement will be according to the static design which is not part of this project.

C.4 VERTICAL LOAD BEARING STRUCTURES

For the main vertical load bearing structure is used a timber skeleton. Main parts of the skeleton are timber balk (190 x 200 mm) and timber column (120 x 190 mm). First row of timber balks is laid on the foundation plate according to a position of load bearing walls and will be anchored with prepared metal anchors attached to the foundation. The layer of hydro-insulation is applied under the balks. The main timber columns are then attached to the bulks and braced. Second row of the timber bulks is used on to top of the columns. Purpose of this row is tied the construction. After this procedure the horizontal load bearing structure will be constructed. The vertical load bearing construction of the 2nd floor is constructed the same way. This structure will be filled by mineral wool of th. 190 mm. Covering layer will be created by the magnesium boards from the exterior and OSB boards from the interior side. Additional timber frame will be attached to the peripheral wall from the interior side. This structure will be also filled by mineral wool and covered by plaster boards. Interior load bearing structures are cover by plaster boards from both sides. The insulation properties of the peripheral wall is secured by the layer of diffusive foil applied under the magnesium boards and water vapur barrier layer applied under the plaster boards. For details of the load bearing walls see attachments in section Architectural and structural solutions.

C.5 HORIZONTAL LOAD BEARING STRUCTURES

This construction has only one horizontal load bearing structure. Slab above the 1st GF. The main load bearing part of the slab is created by timber beams (100 x 160 mm). Beams are attached to the load bearing walls by the metal L shaped anchors. To obtain enough rigidity of this structure, there will be additional distance beams placed in between the main beams. This solution will make the structure even more rigid. After the main load bearing structure is ready it can be closed by the OSB boards from the bottom, filled by mineral wool and from the top closed by double layer of OSB boards. There are two openings in the slab structure. One is for chimney and second for staircase. For details of the structure see attachment D.1.2.02 Building and construction solutions.

C.6 ROOF STRUCTURE

The main part of the roof structure is construction of timber truss system. Trusses must be attached to the load bearing walls of the 2nd GF. For attachment are used metal L shaped anchors. The top part of the roof structure is covered by water vapor barrier. Roof batten will be nailed perpendicular to the roof trusses. Battens are used as a bracing of the truss system and they will be also used for attaching the metal sheets (roof cover). Additional timber frame will be attached to the roof structure from the bottom. This will give the roof structure more rigidity and it is also used for screwing the plaster boards. The 50 mm thick layer of mineral wool will be applied in between the additional timber frame and another 230 mm thick layer in between the truss system. The opening for the chimney must be kept. The whole structure is sloped to the one side. For details of the structure see attachment D.1.2.03 in Building and construction solutions.

C.7 PARTITION WALLS

Partition walls are created by timber structure. On the 1st GF the structure will be attached to the leveling concrete on the floor, using screws with mechanical anchors to the load bearing walls and slab beams by using screws. On the 2nd GF the structure is attached to the slab construction at the bottom, to the load bearing walls and to the roof trusses. There will be used an additional distance beams (70 x 50 mm) at the places where the partition walls are not perpendicular to the slab beams and roof trusses. This distance beams will be connected to the slab beams and roof trusses. Subsequently the partition wall structure will be screwed to prepared beams. All partition walls are filled by the mineral wool according the width and closed by plaster boards from each side.

C.8 FLOOR ABOUT THE FOUNDATION

Foundation plate will be covered by the layer of asphalt hydro-insulation. Insulation will be melted down to the plate and the connections must be properly welded. After this layer, the layer of thermal insulation (mineral wool) can be applied. The whole surface must be properly covered. After mineral wool there will be one more layer of thermal insulation (EPS). The connections from the bottom insulations must be

overlapped by the second layer of insulation. This layer is also used for attaching the underfloor heating pipelines. The pipelines must be laid before application of leveling concrete. After all piping is ready and checked (pressure check), the floor can be purred by leveling concrete. When the floor structure is finished, there must be a 2 days technological break.

C.9 STAIRCASE

Staircase is designed as wooden custom made structure in U shape. According design the staircase will have 16 steps and one lending. Structure of the staircase will be constructed by external company and assembled on construction site. Openings for the staircase must be kept during the construction works on 1st GF slab.

C.10 WINDOWS AND DOORS

The windows and exteriors doors are designed as euro windows and doors VEKRA NATURA, oak, th. 94 mm with triple glassed. The assembling of the windows and external doors is very important for the overall thermal looses. Because of this fact this process will be realized by manufacturer.

C.11 CHIMNEY

There will be only one chimney in the object. Chimney is designed as three layer system STADREKO. The composition of the chimney will be created by the manufacturer. The whole composition will be delivered to the construction side by the manufacturer and subsequently assembled according to manufacturers assembling procedure.

C.12 TERRACE FLOOR

The slab structure above 1st GF is used as a base for terrace floor. There will be one layer of the OSB boards attached on slab beams. Then the extra thermal insulation will be applied. The flat insulation from EPS th. 150 mm will be used in the place of winter garden. The rest of the terrace is sloped by EPS wedges, which creates drainage

of the terrace. After all insulation is ready the 30 mm layer of leveling concrete can be applied. For these purpose there will be a small form work assembled in the area of the stair to the terrace. For the Sloping and more details see attachments part Architectural and structural solutions.

C.13 WINTER GARDEN

Winter garden structure is simple timber frame with roof rafters. The frame will be filled by the euro window VEKTRA NATURA oak, th. 68 mm with double glassed. Roof of the winter garden will be assembled the same way as the house roof. For details of the construction see attachments D.1.1.02 in architectural – structural solutions and attachment D.1.2.03 in Building construction solution.

C.14 CONCRETE SUPPORTING STRUCTURE

This construction will go on together with constructing of vertical load bearing walls. Main purpose of this structure is to create a load bearing support of 2nd floor. Columns are made of concrete blocks which are progressively lei one on the other. The reinforcement bars must be placed inside the blocks. After each four blocks the structure will be filled by concrete mixture and vibrated. After the columns are ready, the form work for the beams will be placed on the top of the column. Ready-made reinforcement structures will be placed inside the form work and subsequently filled by concrete mix. There must be 16 days technological break before the construction can be used. For more detail see attachments D.1.1.01 in Architectural – structural solutions. The placement of the reinforcement bars mast be done according to a static design, which is not part of this project.

CONCLUSION

The goal of this bachelor thesis was to create an architectural study and project documentation, fire safety report and thermal evaluation for realization of family house. During this work, it was necessary to solve some detail parts of the structure, to make the construction work easier and more efficient. There were not any significant changes on the project comparing to the architectural study. The main intention of this project was to create and construction which can be realized in short period of time. This goal was achieved by designing of the main construction as assembled sandwich. Because of this fact most of the wet processes were eliminated. The other intention, also very important, was to create a house which looks modern and trendy in visual aspect. This criterion was fulfilled by creating an interesting facade separated to the plaster part and part with oak facing. Another refreshing visual part of the project is terrace on 2nd GF with winter garden.

During the elaboration of given bachelor work, I obtained a lot of new knowledge and information about the materials trends, construction systems and architectonical solution of the buildings. I strongly believe, that all the things I have learned during the project will bring me a great help in my future carrier.

LIST OF USED SOURCES

STANDARDS

ČSN 73 0540 – Tepelná ochrana budov

ČSN 73 4301 – Obytné budovy

ČSN 73 0532 – Akustika, ochrana proti hluku v budových

ČSN 73 0580 – Denní osvětlení budovy

ČSN 73 0802 – Požární bezpečnost staveb – Požadavky na požární odolnost stavebních konstrukcí

LEGISLATIONS

Vyhláška 499/2006 Sb., o dokumentaci staveb

Vyhláška 246/2001 Sb., o požární prevenci

Vyhláška 246/2001 Sb., o požární prevenci

Vyhláška č. 501/2006 Sb., o obecných požadavcích na výstavbu

Zákon č. 183/2006 Sb., o územním plánování Vyhláska 23/2008 Sb., o technických podmínkách požární ochrany staveb

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www.blachotrapez.eu/sk

www.stadreko.sk

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www.mapy.geology.cz

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USED SOFTWARE

AutoCAD 2010

ArchiCAD 18

Microsoft Office 2007

LIST OF ABBREVIATIONS

mm – millimeter

m – meter

th. – thickness

No. – number

GF – ground floor

ČSN – česká štátna norma

HU – housing units

LIST OF ATTACHMENT

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3) SUMMARY TECHNICAL REPORT
4) TECHNICAL REPORT

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8) D.1.1.08 – LIST OF LOAD BEARING WALL STRUCTURES ON 1ST GF

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10) D.1.1.10 – LIST OF STRUCTURES COMPOSITION
11) D.1.1.11 – LIST OF CARPENTERY WORK
12) D.1.1.12 – DETAIL A
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FOLDER D.1.2 – BUILDING CONSTRUCTION SOLUTIONS

1) D.1.2.01 – DRAWING OF FOUNDATION
2) D.1.2.02 – CEILLING CONSTRUCTION LAYOUT
3) D.1.2.03 – ROOF TRUSS SYSTEM CONSTRUCTION LAYOUT
4) D.1.2.04 – ROOF DRAINAGE

FOLDER D.1.3 – FIRE SAFETY

1) D.1.3.01 – FIRE SAFETY REPORT
2) D.1.3.02 – SITUATION OF FIRE HAZARD

FOLDER E – THERMAL EVALUATION, GEOTECHNICAL REPORT AND CALULATION OF STAIRS

1) E.1 – THERMAL EVALUATION OF BUILDING ENVELOPE
2) E.2 – GEOTECHNICAL REPORT
3) E.3 – CALCULATION OF STAIRS