



# BRNO UNIVERSITY OF TECHNOLOGY

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

## FACULTY OF CIVIL ENGINEERING

FAKULTA STAVEBNÍ

## INSTITUTE OF BUILDING STRUCTURES

ÚSTAV POZEMNÍHO STAVITELSTVÍ

## DETACHED HOUSE

DETACHED HOUSE

## BACHELOR'S THESIS

BAKALÁŘSKÁ PRÁCE

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# Assignment Bachelor's Thesis

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Student: **Pavel Kukačka**  
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The Dean of the Faculty, in accordance with Act No. 111/1998 on universities and the Study and Examination Regulations of the BUT in Brno, assigns you the following topic Bachelor's Thesis:

## Detached House

### Concise characteristic of the task:

The task involves the creation of construction documents for a near zero-energy building, which has a full or partial basement. More specifically it handles about chosen parts of a complete documentation required by local regulations. The task also involves earlier phases of the design process, like „Schematic Design“ and „Design Development“. Therefore it contains the building layout, selection of materials, structural elements and system, and integration of the building into its surrounding including the terrain.

### Objectives and outputs Bachelor's Thesis:

The aims are to develop a building object, in case of which the structural system and bearing structures will be in compliance with the schematic design and choice of building material. The design is to incorporate the integration of the building in question to its surroundings including earthworks. As a final output it is necessary to present a construction documentation which fully abides Appendix 8 of Decree No. 131/2024 Coll., in its current and effective wording. Required parts of Appendix 8 of Decree 131/2024 Coll. are the following: A, B, C, selected sections of part D (specifically D.1, D.3 and D.4, as specified by the supervisor of the final university thesis). According to the aforementioned selection of sections the output is to include drawings like: Site plans, Floor plans, Vertical sections, Elevations, Roof drawings, drawing of foundations, drawing of excavations, assembly drawings or formwork drawings of all floor structures, and at least 5 detail drawings among others. The presented construction documentation is also required to include point i) of section D.1.3, which is assessment of the building object and selected technical details with respect to building physics, and other specialised components if assigned by the supervisor. From section D.1.2 the output is to encompass the design of the ventilation, heating, and domestic water supplies. Additionally, the documentation will include the schematic design as well as the preliminary designs of foundations and other bearing elements, and a spatial visualisation of the building, including a modular scheme. The output of the design will be an IFC

(Industry Foundation Classes) file, which implements international standards for the import and export of building objects and their properties.

The final thesis is to be organised in accordance with the Dean's Directive No. 1/2023, including its annexes. All parts of the documentation are to be processed using a text editor and at least one CAD software tool. All of the drawings are to include title block. The text document is to be organised to „Introduction“, „Main body“ and „Conclusion“. The „Main body“ should consist of Parts A (Cover report) and B (Summary technical report), followed by the technical reports from sections D.1.1 and D.1.2 of Construction documentation according to Appendix 8 of Decree 131/2024 Coll., in its current and effective form. The electronic version of the thesis will also to include a B1-size poster with details about the building and a graphical visualisation. All sources used in the preparation of the thesis must be properly cited according to ČSN ISO 690:2022 (for example using tools such as [www.citace.com](http://www.citace.com)). Data concerning owners of plots and buildings obtained from the Cadastre (Land registry) may not be included in the final thesis unless the owners have given explicit consent.

#### **List of recommended literature and documents:**

(1) Směrnice děkana č. 1/2023 s dodatky a přílohami; (2) Stavební zákon a jeho prováděcí vyhlášky v platném a účinném znění; (3) Platné normy ČSN, EN; (4) Katalogy stavebních materiálů, konstrukčních systémů, stavebních výrobků; (5) Odborná literatura; (6) Vlastní dispoziční a architektonické řešení budovy; (7) Vlastní architektonický návrh budovy a (8) ČSN ISO 690:2022.

Deadline for submission Bachelor's Thesis is determined by the schedule of the academic year.

In Brno, 8. 11. 2024

L. S.

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prof. Ing. Miloslav Novotný, CSc.  
head of department

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dean

## **ABSTRACT**

The bachelor's thesis deals with the design of a detached house intended for a family of four. The outcome of the thesis is a set of construction documents for the execution phase of the building. The proposed building has two above-ground floors and is partially basemented. The internal layout corresponds to a 4+kk configuration. The structural system is a combined wall system, made of autoclaved aerated concrete blocks. The ceiling structures are designed as monolithic reinforced concrete slabs, while the foundations consist of plain concrete foundation strips. The building is covered with a single-skin flat roof. The external walls are insulated using a certified thermal insulation system ETICS. The thesis also includes an Building Energy Performance Certificate (BEPC), a concept and schematic design of heating, domestic hot water preparation and ventilation, as well as building physics calculations.

## **KEYWORDS**

detached house, partial basement, flat roof, autoclaved aerated concrete masonry, foundation strips, BEPC

## **ABSTRAKT**

Bakalářská práce se zabývá návrhem rodinného domu pro čtyřčlennou rodinu. Výstupem je projektová dokumentace pro provádění stavby. Navržený objekt má dvě nadzemní podlažní a je částečně podsklepen. Dispoziční řešení odpovídá uspořádání 4+kk. Konstrukční systém je kombinovaný stěnový, tvořený pórobetonovými tvárnicemi. Stropní konstrukce jsou navrženy jako monolitické železobetonové, základové konstrukce tvoří základové pasy z prostého betonu. Objekt je zastřešen jednoplášťovou plochou střechou. Obvodové stěny jsou zatepleny certifikovaným kontaktním zateplovacím systémem ETICS. Součástí práce je také průkaz energetické náročnosti budovy (PENB), koncepce a schéma vytápění, ohřevu vody a větrání a výpočty stavební fyziky.

## **KLÍČOVÁ SLOVA**

rodinný dům, částečné podsklepení, plochá střecha, pórobetonové zdivo, základové pasy, PENB

## **BIBLIOGRAPHIC CITATION**

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## **DECLARATION OF AUTHORSHIP OF THE FINAL THESIS**

I, Pavel Kukačka, declare that this Bachelor's Thesis titled *Detached House* is my own work and the result of my own original research. I have clearly indicated the presence of quoted or paraphrased material and provided references for all source.

Brno, 16. 05. 2025

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Pavel Kukačka

author

## **Acknowledgements**

First and foremost, I would like to express my sincere gratitude to mr. Ing. František Vajkay, Ph.D. for his willingness, guidance, and valuable time throughout the course of this bachelor thesis. His support and insights have been truly appreciated and have significantly contributed to the development of this work.

I would also like to thank all those who have supported me during my studies and throughout the writing of this thesis.

Finally, my deepest thanks go to my family for their continuous encouragement, understanding, and unwavering support. Without them, this achievement would not have been possible.

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## INTRODUCTION

The bachelor's thesis deals with elaboration of a project documentation for a nearly-zero energy detached house, which is designed for a family of four members.

The detached house is located in a municipality Veselí nad Lužnicí in South Bohemian Region, Czech Republic. In this part of the municipality „Na Chmelnici“ is a built-up area for detached houses. The terrain conditions are almost flat. A main orientation of the building is towards the south side. An area of the parcel is 1109 m<sup>2</sup> and the house built-up area occupies less than 25% of the parcel area.

The detached house has two above-ground floors and a partial basement and a garage for one vehicle. The other parking spot for a vehicle is in front of the house. The roof structure is flat single-skin roof. The structural system of the house is combined wall structural system from autoclaved aerated concrete blocks. Ceiling slab structures are from monolithic reinforced concrete. The object is founded on foundation strips from plain concrete. The external walls are insulated using a certified ETICS system with expanded polystyrene boards.

The project documentation is organized into following sections: main text section, preparatory and study works, site plans, architectural building solution, building structural solution, fire safety solution, building physics.

## **A ACCOMPANYING REPORT**

### **A.1 IDENTIFICATION DATA**

#### **A.1.1 DATA ABOUT THE STRUCTURE**

**a) name of the structure:**

Detached house

**b) place of the structure:**

parcel number of the plot: 3227/68

municipality: Veselí nad Lužnicí

cadastral municipality: Veselí nad Lužnicí [780685]

**c) subject of the documentation – new construction or alteration of a completed building, permanent or temporary structure, purpose of use and function of the building:**

newly built structure

#### **A.1.2 DATA ABOUT THE BUILDER**

**a) given name, family name, and place of permanent residence (individual) or:**

Pavel Kukačka, Malé náměstí 7, 39181 Veselí nad Lužnicí

**b) name, or names and surname, identification number (if assigned), registered address (in the case of a self-employed natural person, if the project is related to their business activity), or:**

**c) business name or company name, identification number (if assigned), registered office (legal entity):**

#### **A.1.3 DATA ABOUT THE DESIGNER OF THE PROJECT DOCUMENTATION**

**a) first name(s) and surname, business name, identification number (if assigned), registered office (for a self-employed natural person), or business name or company name, identification number (if assigned), registered office (for a legal entity)**

First name, surname: Pavel Kukačka

Adress: Malé náměstí 7, 39181 Veselí nad Lužnicí

Mobile number: 234 200 100

Email: Pavel.Kuckacka@vut.cz

**b) first name(s) and surname of the chief designer, including the registration number under which they are listed in the register of authorized or registered persons maintained by the Czech Chamber of Architects or the Czech Chamber of Authorized Engineers and Technicians Engaged in Construction, with the specified field and, if applicable, specialization of their authorization,**

**c) first names and surnames of the designers of individual parts of the documentation, including the registration number under which they are listed in the register of authorized or registered persons maintained by the Czech Chamber of Architects or the Czech Chamber of Authorized Engineers and Technicians Engaged in Construction, with the specified field and, if applicable, specialization of their authorization,**

**d) first name(s) and surname of the authorized land surveyor, including the item number under which they are listed in the register of authorized land surveyors maintained by the Czech Chamber of Surveyors.**

#### **A.1.4 CONTRACTOR OF THE CONSTRUCTION (IF KNOWN)**

### **A.2 LIST OF INPUT DOCUMENTS**

Zoning plan of the municipality of Veselí nad Lužnicí

Legislative regulations valid at the time of preparing the documentation

Statement regarding the existence of utilities

Cadastral map

Geological map with coordinates

## **B SUMMARY TECHNICAL REPORT**

### **B.1 OVERALL DESCRIPTION OF THE SITE AND THE BUILDING**

#### **a) description and characteristics of the building and its use,**

The building is designed as a detached house intended for permanent residential use. It consists of three floors—two above-ground and one partially underground. The architectural and structural design is tailored to meet the requirements of comfortable, functional living for a standard family. The layout includes living spaces, bedroom, children's rooms, toilets, bathrooms, technical room and a garage. The house is designed with energy efficiency and modern comfort in mind, fully complying with applicable construction regulations and standards.

#### **b) characteristics of the area and building plot, current land use and built-up status, position in relation to flood zones, mining areas, etc., and flood protection measures,**

The plot intended for the proposed construction, parcel no. 3227/68, is located within the built-up area of the town of Veselí nad Lužnicí, in the cadastral municipality Veselí nad Lužnicí. According to the valid zoning plan, the building plot is situated in an area designated for residential areas – in family houses. The surrounding buildings will consist residential structures. The proposed building is in accordance with the character of the area. The implementation of the proposed construction will also affect parcel no. 3227/35 (owned by the town of Veselí nad Lužnicí). This concerns the permanent installation of utility connections on this land. All utility connections will be laid at a minimum distance of 2,00 meters from neighboring plots. The terrain at the construction site is nearly flat. The future construction site is registered in the cadastral of real estate as arable land. There are no mature trees located on the site. The proposed detached house is designed with a standoff distance of 4,78 meters from the neighboring plot on the left-hand side. The building line of the house is more than 3,5 meters from the property boundary, as it has to be according to the zoning plan.

The building plot is not located within flood zone, in a mining area, or any other similarly hazardous areas.

#### **c) compliance of the construction documentation with the project approval, information on whether and in which parts of the documentation the conditions of binding opinions of the relevant authorities have been taken into account,**

The construction documentation for execution is in full compliance with the approved project and the valid zoning decision. No binding opinions from relevant authorities have been issued for this project. Therefore, no specific requirements from such authorities needed to be incorporated into the documentation.

#### **d) conclusions of follow-up or extended surveys; in the case of a modification of an existing building, information on its current condition,**

No follow-up or extended surveys were required for this construction project, as it concerns a new building. Therefore, no information on the current condition of an existing structure is applicable.

**e) existing protection of the area and the construction under other legal regulations, including the scope of restrictions and conditions for protection,**

The building plot is not located within any protected areas.

**f) impact of the construction on surrounding buildings and plots, protection of the surroundings, impact of the construction on runoff conditions in the area,**

The proposed construction will not have a negative impact on the surrounding buildings or neighbouring plots. All construction activities will be carried out with respect to the protection of the surrounding environment. During construction, appropriate measures will be taken to minimize noise, dust, and vibrations. Rainwater from the flat roof of the family house will be directed to a retention tank with a capacity of 7 m<sup>3</sup>, from where it will overflow into an infiltration boxes depth of 2.00 m. The infiltration boxes will be filled around with crushed aggregate and geotextile. All rainwater will be infiltrated on the property. These elements will be located on the eastern side of the plot, below ground level. The rainwater from the paved surfaces will be infiltrated on the plot to the ground.

**g) requirements for demolition, land remediation, and tree felling,**

The plot does not contain any structures that would require demolition or land remediation. The area affected by the construction does not include trees for felling.

**h) requirements for the maximum temporary and permanent occupation of agricultural land or land designated for forestry purposes,**

The affected plot is subject to protection under the agricultural land fund with Evaluated Soil-Ecological Unit (ESEU) 7.22.12 and protection class III.

**i) proposed and newly established protective and safety zones, scope of restrictions and protection conditions under other legal regulations, including a list of land parcels according to the cadastre of real estate on which the protective or safety zone will be established**

Protective zones will be established in connection with the construction of new utility network connections. The protective zone will be established on a parcel no. 3227/35, whose owner is municipality of Veselí nad Lužnicí according to cadastre of real estate

**j) proposed functions, parameters, and performance of the building – for example, basic dimensions, built-up area, floor area by function (residential units, services, administration, etc.), and enclosed volume**

|                                   |                    |
|-----------------------------------|--------------------|
| Built-up area of detached house:  | 166 m <sup>2</sup> |
| Enclosed space of detached house: | 723 m <sup>2</sup> |
| Utility area:                     | 239 m <sup>2</sup> |
| Area of paved surfaces:           | 91 m <sup>2</sup>  |
| Number of residential units:      | 1 RU, 4 + kk       |
| Number of above.ground floors:    | 2                  |
| Number of underground floors:     | 1                  |

**k) building balance – inputs, consumption, and outputs (materials, media, rainwater, energy, types and amounts of emissions, waste, etc.),**

Drinking water demand:

According to annex no. 12 of Decree No. 120/2011 Coll., the water demand for one resident is 35 m<sup>3</sup> per year. Detached house is designed for 4 members of family. Meaning:

nominal water consumption:  $35/365 = 0,096 \text{ m}^3/\text{member}/\text{day} = 96 \text{ l}/\text{member}/\text{day} = q$

number n of members: 4

Average daily water demand:  $Q_p = (n * q) = 4 * 0,096 = 0,4 \text{ m}^3/\text{day} = 400 \text{ l}/\text{day}$

Maximal daily water demand:  $Q_m = Q_p * k_d = 400 * 1,5 = 600 \text{ l}/\text{day}$

$k_d$  - daily irregularity coefficient

Maximal hourly water demand:  $Q_h = 1/24 * Q_p * k_d * k_h = 1/24 * 400 * 1,5 * 1,8 =$   
 $= 45 \text{ l}/\text{hour}$

$k_h$  - coefficient of hourly irregularity

Annual water demand:  $Q_r = Q_p * 365 = 0,4 * 365 = 146 \text{ m}^3/\text{year}$

Designed object is connected to foul water sewer, water supply system and electrical energy.

Heating and domestic hot water preparation of the object is done by monoblock heat pump air-water connected to uniTower, which is internal unit of the heat pump intended for preparation of DHW and heating. Outdoor heat pump unit is located on the north side of the object on a paved surface and indoor unit is located in the technical room in the basement. Performance of the heat pump is 12 kW.

Energy performance of the building was done by detailed calculation with help of DEK ENERGETIKA software. Into the calculation was included help of PV system. The results may be seen in a folder "Building physics". The detached house meets energy efficiency class A.

In accordance with requirements for rainwater management, all rainwater from roofs will be directed in retention tank and then to infiltration boxes and all rainwater from paved surfaces will be infiltrated on the owner's property. The retention tank is located on the east side of the plot and surplus of the rainwater will be partially utilized for irrigation of the garden.

All waste will be handled in accordance with the provisions of Act No. 541/2020 Coll., on Waste, and Decree No. 8/2021 Coll., on the Waste Catalogue and the Assessment of Waste Properties. The operation of the building will primarily generate municipal waste. A dedicated area for waste collection, including containers for separated waste, will be located in front of the house near the fencing of the main gate. Waste will be regularly collected by an authorized waste management company and transported to designated disposal or processing facilities. The majority of the sorted waste will be recycled and further utilized in territorial and technical conditions.

The detached house will be connected to the utility networks from the west side. It will be connected to the water supply system, foul water sewer connection and to the low-voltage electricity.

Waste produced during building operation:

| <u>Waste Code</u> | <u>Waste Type Description</u> | <u>Handling Method</u> |
|-------------------|-------------------------------|------------------------|
| 15 01 02          | Plastic packaging             | Recycling              |
| 20 01 01          | Paper                         | Recycling              |
| 20 01 02          | Glass                         | Recycling              |
| 20 01 39          | Plastics                      | Recycling              |
| 20 03 01          | Mixed municipal waste         | Landfill disposal      |

**l) requirements for the capacity of public networks of communication lines and electronic communication equipment of the public communication network,**

The low-voltage (LV) electrical connection will be made using an underground CYKY-J 4x10 cable from the existing LV supply point in the left corner of the plot with a main circuit breaker. This new connection is designated as BO 06.

**m) anticipated construction procedure according to the principles of construction site organization, material and time-related links of the construction, related (conditional or induced) investments,**

**1. Preparation and Site Preparation (Duration: 7 weeks)**

This phase includes site clearance, excavation, and the establishment of necessary infrastructure such as access roads.

**2. Foundation and Structural Work (Duration: 16 weeks)**

The foundation of the building will be laid, followed by the construction of the structural elements (walls, beams, and floors).

**3. Installation of Utilities and Systems (Duration: 12 weeks)**

Installation of plumbing, electrical wiring, heating systems, and other essential utilities.

**4. Finishing Work and Interior Construction (Duration: 22 weeks)**

The focus will be on completing interior spaces, including insulation, flooring, tiling, and painting.

**5. Final Inspections and Handover (Duration: 9 weeks)**

The final inspection will be performed, including necessary adjustments, and the building will be prepared for handover.

To sum it up, start of the construction is expected on 02/2025 and is expected to end 04/2026.

Given the scope and intended use of the proposed building, it has no material or time-related links to the surrounding area and does not involve any related investments.

**n) requirements for early use of the building, duration in relation to completion and occupancy of the building,**

There are no requirements for early use of the building. The building will be put into use only after its full completion, final inspection, and issuance of the occupancy permit.

**o) list of results of surveying activities pursuant to other legal regulations, which are expected to be produced during the construction according to the project documentation of surveying results.**

Surveying results will include setting-out plans and geometric plans, which will be prepared and provided by a certified surveyor during the construction process. These documents will be used for the final building approval.

## **B.2 ARCHITECTURAL SOLUTION**

The land is located within the built-up area of the municipality of Veselí nad Lužnicí in the cadastral municipality of Veselí nad Lužnicí. The building will be located on land with parcel number 3227/68. The zoning plan allows the construction of detached houses. According to the zoning plan, this land is situated in Zone III, where detached houses with flat roofs, a maximum of two above-ground floors, and a basement are permitted. The maximum building coverage of the land is 25%. In case of this object the coverage is 23,17%. The proposed building complies with these regulations.

The exterior appearance of the family house is simple and will blend smoothly into the surrounding development. The building is primarily in the shape of an L, with a side ratio smaller than 2:1. The family house has two above-ground floors has a partial basement. The house is topped with a single-skin flat roof. Around the house, there are paved areas made of concrete blocks. The facade of the house is designed in white and will feature a rough texture. The base will have the same color scheme, made of mosaic plaster. The exterior of the building emphasizes the ring beam, which will be highlighted with gray render.

## **B.3 STRUCTURAL AND TECHNICAL SOLUTION**

### **B.3.1 OVERALL CONCEPT OF THE STRUCTURAL AND TECHNICAL SOLUTION**

The building is designed with a plain concrete strip foundation and load-bearing perimeter walls and internal load-bearing walls made of autoclaved aerated concrete th. 250 mm. The structure consists of three stories, with two above-ground stories and one underground story. The underground floor is partially basemented.. The roof structure is flat, designed as a single-skin covering with sufficient insulation to meet the necessary thermal and waterproofing standards. The roof is supported by load-bearing walls and reinforced concrete slab th. 250 mm, ensuring its stability. The horizontal load-bearing ceiling structures are from monolithic reinforced concrete th. 250 mm. The staircase is designed as two-flight from monolithic reinforced concrete th. 150 mm. The facade of the building will be finished with weather-resistant materials, including high-quality render with a rough surface.

### **B.3.2 PRINCIPLES OF SAFETY DURING THE USE OF THE BUILDING**

The building is designed in accordance with the valid technical regulations, specifically Decree No. 146/2024 Coll., on technical requirements for buildings, with an emphasis on safe use for all users throughout the building's lifecycle.

The layout of the building ensures safe and unhindered movement within all interior and exterior spaces. Stairs, corridors, and doorways are designed with sufficient dimensions and in accordance with ergonomic and safety standards. Floors and outdoor walking surfaces will be finished with non-slip materials to reduce the risk of falls.

The building includes proper lighting of common areas, especially staircases and entrances, to ensure safe orientation.

All technical installations (electrical, water) will be carried out in compliance with relevant norms, and fitted with safety elements such as circuit breakers, and protective grounding.

The building is also designed to ensure fire safety, with escape ways appropriately dimensioned and equipped, and materials selected according to fire resistance requirements.

These measures collectively ensure that the building is safe for everyday use by its residents and visitors, including children.

### **B.3.3 TECHNICAL DESCRIPTION OF THE BUILDING**

#### **a) description of the existing condition,**

The building is a new construction project; therefore, no existing structure is present on the plot. The land is currently undeveloped and has been used as a garden or green space. It is located within a built-up residential area and will be surrounded primarily by detached houses of the same manner. The plot is nearly flat, and there are no underground utilities or structures affecting the intended construction area. There are no existing buildings, hard surfaces, or mature vegetation that would require demolition or removal before the start of construction.

#### **b) description of the proposed structural and technical solution**

Structural system is combined wall structural system.

The foundation structures are designed as foundation strips from plain concrete of strength class C 20/25. The waterproofing of the underground structure consists of two modified bitumen membranes (SBS), which will be torch-applied across their entire surface to the sublayer.

Perimeter load-bearing wall in the basement is designed from concrete formwork blocks dims. 300×500×250 mm. The blocks will be filled with concrete C 20/25 and reinforced with a steel B500B. Modified bitumen SBS membranes will then be torch-applied onto it. The perimeter masonry will be insulated with 120 mm thick extruded polystyrene. A protective layer consisting of an 9 mm high PE profiled drainage film will be applied over the insulation.

Perimeter load-bearing masonry in the above-ground floors is designed as autoclaved aerated concrete blocks th. 250 mm and will be bricked on a thin-layer mortar. Internal load-bearing walls are as well as perimeter load-bearing masonry from autoclaved aerated concrete blocks th. 250 mm.

Partitions are from gypsumboard. The gypsumboard th. 12,5 mm is anchored from both sides to the steel grid structure th. 100 mm. Between children's room and bedroom in second above-ground floor, there are additionally two more gypsumboards th. 12,5 mm applied from both sides for better acoustic comfort.

Horizontal ceiling load-bearing structures are from monolithic reinforced concrete th. 250 mm designed from concrete C 25/30 XC1 and horizontal load-bearing roof structure is from concrete C 25/30 XC3 same thickness. All horizontal load-bearing structures are reinforced with steel B500B.

Staircase is designed as two-flight from monolithic reinforced concrete th. 150 mm. It will consist of concrete C 25/30 and reinforced with steel B500B. Half-landings are the same thickness and same material. They are monolithically connected.

Floors are done from concrete screed with a variable thickness and flooring is either from PVC or ceramic tiles. A detailed list of floor compositions, including room designations, is provided in the attachment – list of components.

Roof cover is single-skin flat roof. The slope of the roof is 3°. The sloping is done from slope wedges from expanded polystyrene with a variable thickness. Vapour-barrier is from SBS modified bitumen felt and roof cover is from softened polyvinyl chloride (PVC-P) reinforced with polyester fabric th. 1,5 mm placed on nonwoven geotextile from glass fibers.

Façade is insulated from certified ETICS system consisting of expanded polystyrene th. 200 mm. The surface finish is executed using a thin-layer exterior silicone render creating a rough surface of the façade.

The door and window fillings in the external walls are filled with plastic elements. They are equipped with insulating triple glazing. For detailed information see attachment – list of doors and windows.

### **B.3.4 PRINCIPLES OF FIRE SAFETY**

**a) characteristics and criteria for determining the building category according to the requirements of other legal regulations – building height, built-up area, number of floors, number of persons for whom the building is intended, or other parameters of the building, such as clear floor height or tunnel length, etc.,**

Maximal height of the building is +6,650 m with a built-up area of 166,17 m<sup>2</sup>. There are 2 above-ground floors and 1 underground floor. The building is intended for four persons. The clear height of the floor is 2,6 m.

The building according to decree No. 460/2021 Coll. falls into category I.

**b) criteria – usage class, presence of hazardous substances or other risk factors, declaration of the building as a cultural monument.**

Usage class is as first usage class because the first usage class includes a building or part of a building that does not contain a space intended for sleeping, a space intended for public access, or a space intended for persons whose evacuation in the event of a fire depends on assistance from others according to decree No. 460/2021 Coll.

There is no presence of hazardous substances or other risk factor, and the building is not declared as a cultural monument.

### **B.3.5 ENERGY EFFICIENCY AND THERMAL PROTECTION**

An Energy Performance Certificate (EPC) for the family house was prepared in accordance with Act No. 406/2000 Coll., on Energy Management, and Decree No. 222/2024 Coll., on the Energy Performance of Buildings.

The assessed building was classified in energy performance class A – very energy-efficient.

### **B.3.6 HYGIENIC REQUIREMENTS FOR BUILDINGS, REQUIREMENTS FOR WORKING AND COMMUNAL ENVIRONMENT**

#### **a) indoor environment – in particular parameters of the internal microclimate, shading, lighting, sunlight exposure, protection against noise and vibrations, etc.,**

The layout ensures suitable acoustic comfort, and all structural elements are designed to meet the sound insulation criteria as per ČSN 73 0532. Natural lighting and sunlight exposure are sufficient and comply with the requirements of ČSN 73 4301 and ČSN 73 0508. Artificial lighting is provided in rooms without direct access to daylight.

Shading of interior spaces is provided by external venetian aluminum blinds, which effectively regulate incoming sunlight and prevent overheating of the interior, especially during the summer months. This system contributes to thermal comfort, enhances visual conditions, and reduces the need for mechanical cooling, while maintaining the aesthetic appearance of the building.

#### **b) impact on the external environment – particularly noise, vibrations, shading,**

An outdoor unit of the air-to-water heat pump is installed outside the building. The selected model complies with applicable acoustic performance standards and is designed for quiet operation. It is also equipped with a night mode, which further reduces noise levels during evening and nighttime hours. The unit is positioned regarding surrounding buildings to ensure it does not negatively affect the acoustic comfort of the neighbouring environment and fully complies with hygiene and noise regulations.

It is a low-intensity residential structure that does not generate vibrations. No equipment or operations are planned that would produce disturbing environmental effects.

Due to the size and shape of the building, shading of neighbouring plots or buildings is minimal and within acceptable limits defined by applicable regulations. There are no planned structures behind the building and so the light exposure from the south side will not limit other buildings. The positioning and height of the structure have been designed with respect to the surrounding development to avoid any significant reduction of sunlight on adjacent properties.

#### **c) in the case of building modifications – impact of changes on the environment, particularly assessment of the temperature and humidity balance.**

As this is a new construction, no changes to an existing building are proposed. Therefore, there are no negative impacts on the temperature or humidity balance of the structure.

Should any future modifications be made, they will be assessed individually to ensure that the thermal and moisture performance of the building envelope remains in accordance with the applicable standards (ČSN 73 0540) and that no risk of condensation or structural damage arises.

### **B.3.7 PROTECTION OF THE BUILDING AGAINST NEGATIVE EFFECTS OF THE EXTERNAL ENVIRONMENT**

The building plot has been classified as having a low radon index. To prevent the possible infiltration of radon from the subsoil into the living spaces, 2 layers of SBS modified bitumen

felt have been proposed as a radon protection barrier. This radon-proof membrane must be installed continuously across the entire surface of the ground-contact structure, including beneath load-bearing walls.

A corrosion survey and stray current monitoring have not been carried out. Stray currents are not expected to occur within this residential development.

The building does not include any equipment that would pose a risk of technical seismicity.

Aggressive or pressurized groundwater does not pose a threat to the building, as such conditions are not present in the area according to available geological and hydrogeological data. The construction site is located in a region with a standard groundwater level and no occurrence of chemically aggressive components in the subsoil.

There are no significant sources of noise in the vicinity of the building. The structure is designed to withstand harmful effects caused by noise and vibrations.

The building is not exposed to other negative influences such as occurrence of methane, seismic activity, or undermining.

No modifications to the existing structural system are currently planned, as this is a new construction. However, in the event of any future changes to the building's layout or structure, a detailed assessment of the thermal and moisture performance of the affected building elements will be carried out to ensure compliance with relevant standards (e.g. ČSN 73 0540).

## **B.4 CONNECTION TO TECHNICAL INFRASTRUCTURE**

**a) connection points to existing technical infrastructure and relocations of technical infrastructure, crossings with technical and transport infrastructure and parallel alignments in cases where the building is located within a protection zone of technical or transport infrastructure, or where safety may be at risk,**

The building will be connected to newly constructed utility network connections. The connection to the existing technical infrastructure is described and illustrated in annex C.3 – Coordination Site Plan.

In the case of crossing or running parallel with underground utilities, the contractor shall follow the conditions stated in the official statement issued by the respective utility provider. Excavation within protection zones of underground utilities must be performed manually.

No utility relocations are required for this project.

The contractor is required to pre-excavate and verify the position of all underground utilities that intersect with the route of the newly constructed pipeline. If necessary, the pipeline gradient shall be adjusted locally to achieve the required clearance based on the actual vertical position of the existing utility lines.

**b) capacities, dimensions, lengths.**

The water supply connection is dimensioned with a HDPE DN 32 pipeline and is capable of supplying the required domestic water demand for a family house. Length is 3,1 m. Designated as BO 04.

The foul water connection is designed with a DN 150 pipe and a sufficient slope to ensure reliable gravity drainage to the public sewer system. Length is 4,1 m. Designated as BO 05.

The electrical connection is made with a CYKY-J 4×10 cable and protected by a 3×25 A main circuit breaker. Designated as BO 06

The rainwater from the flat roof of the family house will be directed to a retention tank with a capacity of 7 m<sup>3</sup>, from where it will overflow into an infiltration boxes depth of 2.00 m. Designated as BO 03.

## **B.5 TRANSPORT SOLUTION**

### **a) description of the transport solution, including access for fire and rescue services,**

The building is accessible from an existing local public road on the south side of the plot, which provides reliable vehicular access to the property. a driveway leads from the road directly to the garage and a designated outdoor parking space located on a paved area in front of the house.

The building is adjacent to a two-way paved road with a width of 5,5 m, which is greater than 3 m. The main entrance to the building is located 12,8 m away from the road, which is less than 50 m, as per Article 12.2.1 of ČSN 73 0802. The situation complies with the requirements. The building has a fire height of 3.0 m, and no access areas are required for buildings with a fire height up to 12 m, as stated in Article 12.4.4 of ČSN 73 0802. No access area is required. Internal or external intervention routes are not required in accordance with Article 12.5.1 and Article 12.6.2 of ČSN 73 0802.

### **b) connection to transport infrastructure, including connection to existing sidewalks and pedestrian areas,**

The building is connected to the existing transport infrastructure via a driveway leading from the adjacent public road. The connection is designed to allow safe and smooth access for passenger vehicles to the garage and parking area located on the plot.

Pedestrian access is provided by a paved walkway, which connects the main entrance of the building to the existing sidewalk and other walkable surfaces in the area.

### **c) parking (static transport), including designated parking spaces and energy sources for alternative propulsion systems**

One parking space is provided in the garage of the family house for one passenger vehicle, and one additional parking space is located on a paved area made of concrete paving within the property boundaries in front of the house.

|                                                   |                              |
|---------------------------------------------------|------------------------------|
| group:                                            | residential                  |
| purpose of the building:                          | residential use              |
| functional unit:                                  | floor area [m <sup>2</sup> ] |
| number of functional units per one parking space: | 120                          |
| floor area:                                       | 257,7 m <sup>2</sup>         |
| Calculation:                                      |                              |

257,7/120 = 2,1 -> 2 parking spaces

**d) description of accessibility and barrier-free use, including the impact on accessibility in terms of serious spatial, technical, or construction-related constraints, or other public interests**

The new family house is not intended for barrier-free use.

There are no serious spatial or technical constraints nor any public interest concerns that would negatively impact access to the building. all external connections and accesses are designed to be safe, logical, and in line with applicable standards.

## **B.6 LANDSCAPING AND RELATED TERRAIN ADJUSTMENTS**

**a) description and parameters of terrain adjustments,**

The building is designed in a nearly flat area. The topsoil will be stripped in th. 200 mm, and excavation work will be carried out for the foundation structures. Terrain modifications will involve sloping and shaping the terrain to be connected to surrounding top terrain. Surplus of soil will be used on the site for sloping and modifications and soil that will not be used will be transported to a landfill.

**b) vegetation elements,**

Vegetation will consist mainly of grass lawns, decorative shrubs, and optionally small trees or garden beds.

**c) biotechnical measures.**

Not part of the bachelor's thesis.

## **B.7 DESCRIPTION OF THE ENVIRONMENTAL IMPACTS OF THE BUILDING AND ENVIRONMENTAL PROTECTION MEASURES**

**a) impact on the environment and measures to minimize negative effects – particularly nature and landscape, Natura 2000, mitigation of undesirable outdoor lighting effects, presence of asbestos, noise, vibrations, water, waste, soil, impact on climate and air,**

The proposed construction will have no negative impact on the environment. the building is located outside any protected natural areas, landscape zones, or natura 2000 sites, and will not affect any valuable habitats or species.

No asbestos-containing materials will be used in the construction. the building is designed to produce minimal noise and vibrations both during and after construction. the outdoor unit of the heat pump is compliant with acoustic regulations and operates in low-noise night mode.

During construction, standard measures will be taken to reduce dust and noise, and work will be organized to minimize disruption to the surroundings. any waste produced will be sorted and removed by authorized companies in accordance with local regulations.

**b) method of addressing the conditions of the binding opinion from the environmental impact assessment (EIA), if applicable.**

The construction project is of small scale (detached house) and does not fall under the obligation for environmental impact assessment (EIA) according to act no. 100/2001 coll., on environmental impact assessment.

No binding opinion has been issued in connection with the EIA process, and therefore no conditions from such an opinion had to be incorporated into the project documentation.

## **B.8 OVERALL WATER MANAGEMENT SOLUTION**

### **a) water supply – connection to the source,**

The building will be supplied with drinking water via a connection to the public water supply system. The water connection will be implemented through a newly constructed water pipeline leading from the existing public water supply located in the adjacent road.

The internal water distribution system is designed to meet the needs of a standard single-family household and is in accordance with applicable technical regulations and hygiene standards. The connection includes a water meter shaft installed on the plot in a location approved by the utility provider. The distance of the water meter shaft from the plot boundary is 2 meters. From there will be connected and lead into the object.

### **b) wastewater – management and disposal,**

Foul water from the building will be discharged into the public foul water sewer system via a newly constructed gravity connection. the internal sewer system is designed to safely and hygienically remove all domestic wastewater from toilets, bathroom, kitchen, and other interior spaces. From the building it will lead into revision shaft at the plot's boundary. Foul water from a basement will be pumped into the main branch of the foul water sewer.

### **c) rainwater – utilization and management.**

Rainwater from the roof and paved surfaces will be collected and managed entirely on the investor's property. the system includes a retention tank with a volume of 7 m<sup>3</sup> which will store rainwater for garden irrigation. Rainwater from paved surfaces will be infiltrated on the owner's plot into the subsoil.

Excess rainwater from the retention tank will be directed into an underground infiltration boxes, there are 8 of them in underground.

## **B.9 PRINCIPLES OF CONSTRUCTION SITE ORGANIZATION**

### **a) demand and consumption of key utilities and materials, and their provision,**

During construction, there will be a temporary demand for electricity, water, and key building materials. Electricity will be supplied via a temporary connection from the public grid or nearby source, primarily for powering construction machinery, tools, and lighting. Water for construction activities such as concrete mixing and cleaning will be provided through a new water connection or delivered by cistern if needed.

### **b) site drainage,**

Natural surface runoff will be directed away from the building area using temporary shallow ditches or terrain shaping.

If necessary, temporary drainage elements such as trenches or collection pits will be created to capture rainwater during the construction phase. These will be regularly monitored and maintained to prevent waterlogging or erosion.

**c) connection of the construction site to existing transport and technical infrastructure, site entry and access during construction, including access routes if applicable,**

The construction site will be connected to the existing local road network, which provides reliable access for construction machinery, material deliveries, and personnel. Entry and exit to the site will be organized via the existing access point from the adjacent public road. A temporary paved or stabilized access route will be created within the plot to ensure safe movement of vehicles and reduce dust and soil dispersion.

Before entering public roads, vehicles will be cleaned if necessary to comply with the requirements of Act No. 361/2000 Coll., on Road Traffic.

Pedestrian and vehicular access will be maintained for authorized workers and suppliers throughout the entire construction period. The access route will be clearly marked and secured, with appropriate signage and safety measures to ensure safe operation within the site boundaries.

**d) modifications for accessibility and barrier-free use – site fencing in relation to pedestrian areas, excavation safety, access to plots and buildings, bypass routes for persons with reduced mobility or orientation, including temporary crossings and crossing points, replacement of occupied designated parking spaces and pedestrian routes,**

During the construction phase, the site will be safely fenced and secured with respect to surrounding walkable and public areas. The fencing will not obstruct existing public pedestrian routes, and if necessary, temporary adjustments or marked bypass paths will be created to ensure safe and continuous movement for all individuals. Barrier-free access is not a case.

When working on slopes steeper than 1:1 and at heights greater than 3 meters, it is necessary to implement measures to prevent slipping of personnel or sliding of materials. Vertical side walls of manually excavated trenches must be secured with shoring when the excavation depth exceeds 1.3 m in built-up areas and 1.5 m in undeveloped areas. If there is a risk of collapse, shoring must be used even at shallower depths. The protection of persons will be ensured in accordance with Government Regulation No. 591/2006 Coll., on minimum occupational health and safety requirements at construction sites.

**e) impact of construction on surrounding buildings and plots, including measures to reduce negative effects,**

The construction will be carried out regarding minimizing any impact on neighbouring buildings and land. All works will be organized to avoid damage, excessive noise, dust, or vibration affecting the surroundings.

**f) protection of the surroundings of the construction site from negative impacts of the construction process**

The site will be fenced off and clearly marked, preventing unauthorized access and ensuring safety for the public. During construction, measures will be taken to reduce dust and limit noise, especially during earthworks and material deliveries.

All construction machinery and transport vehicles will use the designated access route, and cleaning of wheels will be performed before leaving the site to prevent pollution of public roads. Construction work will take place within standard working hours to avoid disturbing the surrounding area.

**g) requirements for demolitions, land remediation, and tree felling,**

The plot does not contain any structures that would require demolition or land remediation. The area affected by the construction does not include tree felling.

**h) maximum temporary and permanent land occupation for the construction site,**

During construction, there will be a temporary land occupation to carry out the connection of the paved area to the existing local road.

**i) waste and secondary material production during construction – quantities, types and categories of waste and materials, waste prevention and sorting for reuse, including measures against contamination and methods of disposal,**

All waste will be handled in accordance with Act No. 541/2020 Coll., on Waste, and Decree No. 8/2021 Coll., on the Waste Catalogue and Waste Assessment. Waste will be sorted on site into separate categories to facilitate reuse, recycling, or proper disposal.

| Code     | Type of Waste / Material          | Handling / Category |
|----------|-----------------------------------|---------------------|
| 15 01 01 | Paper                             | Recycling           |
| 15 01 02 | Plastic packaging                 | Recycling           |
| 15 01 04 | Metal packaging                   | Recycling           |
| 17       | Construction and demolition waste | Recycling           |
| 17 01 01 | Concrete                          | Recycling           |
| 17 01 02 | Bricks                            | Recycling           |

| Code        | Type of Waste / Material                                                               | Handling / Category |
|-------------|----------------------------------------------------------------------------------------|---------------------|
| 17 03<br>01 | Asphalt mixtures                                                                       | Hazardous waste     |
| 17 04<br>05 | Iron and steel                                                                         | Recycling           |
| 08 01<br>11 | Waste paints and varnishes containing organic solvents or other hazardous substances   | Hazardous waste     |
| 08 04<br>09 | Waste adhesives and sealants containing organic solvents or other hazardous substances | Hazardous waste     |

**j) earthworks balance, requirements for soil import or stockpiling,**

The construction involves standard earthworks associated with the excavation of foundation structures and terrain adjustments around the building. Based on the estimated excavation volumes, which is around 475 m<sup>3</sup> and planned backfilling, most of the excavated soil will be reused directly on-site for backfilling around the foundations and for landscaping purposes.

**k) environmental protection during construction – presence of hazardous substances, contamination prevention, measures to reduce environmental impacts during construction, including dust and noise control, asbestos handling, and tree protection,**

During construction, no hazardous substances such as asbestos or toxic chemicals will be used or stored on site. All materials used will be selected and handled in accordance with applicable environmental and safety regulations.

To prevent contamination of building materials, soil, and surroundings, materials will be stored in designated, protected areas on the site, away from water sources and vegetation. Handling of fuels, paints, and adhesives will be carried out with care,

Dust control will include regular watering of access routes and earthwork areas, especially in dry or windy weather. Construction traffic will use the designated access road only, and wheel washing will be performed before vehicles leave the site to avoid dirtying of public roads.

All construction activities will be carried out with the aim of minimizing environmental impact and in compliance with current environmental and construction legislation.

**l) fire safety and principles of health and safety at the construction site,**

During construction, all activities will be carried out in accordance with applicable legislation on occupational health and safety and fire protection, especially in line with Government Regulation No. 591/2006 Coll., on minimum health and safety requirements at temporary and mobile construction sites.

**m) detour and alternative routes – requirements and implementation,**

The construction of the building will not interfere with public roads, sidewalks, or transportation infrastructure to an extent that would require permanent or large-scale detours. Therefore, no official detour or replacement routes are planned.

**n) special conditions and requirements for construction execution, site organization, and work procedures, resulting especially from the type of construction work, protective or safety zones, site characteristics, execution during operation, and measures against external environmental effects during construction,**

There are no extraordinary conditions on the construction site that would significantly limit or complicate the execution of the works. The building is being constructed on a private plot in a flat, undeveloped area, outside of any protective or safety zones.

However, specific attention must be paid to:

Maintaining a safe distance from existing underground utility networks during excavation and connection works, in accordance with ČSN 73 6005.

Performing excavation work manually in protection zones or near known underground utilities, following the instructions of the respective utility providers.

Dust and noise mitigation, especially during earthworks and material handling, by using water spraying and scheduling work during standard daytime hours.

Ensuring proper site drainage during construction with help of localized infiltration.

**o) proposal of construction phases for the purpose of conducting control inspections**

These phases are proposed as follows:

Preparation phase – site setup, removal of topsoil.

Earthworks and foundations.

Structural framework – construction of vertical and horizontal load-bearing structures etc.

Roof construction and completion of building envelope.

Rough-in installations and internal partitions.

Façade and internal finishes.

Completion and final site works

## **D. DOCUMENTATION OF OBJECTS**

### **D.1 ARCHITECTURAL BUILDING SOLUTION**

#### **D.1.1 REQUIREMENTS FOR BUILDING STRUCTURES**

##### **a) description of the initial reference materials and description of minor deviations from the previous stage of documentation,**

The design is based on the following initial reference materials:

Valid zoning and planning documentation of the municipality.

Surveying data and cadastral map information.

Geological and hydrogeological surveys, if available.

Utility network statements from the respective operators.

Current legislation and technical standards (ČSN, EN, legal regulations).

Requirements and intentions of the client/investor.

No deviations from earlier project stages are present for a purpose of bachelor's thesis, as this documentation serves as the starting point for the project implementation.

##### **b) list of source documents used for processing, reference materials, list of applicable legal regulations and standards (norm values), including date of issue,**

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Act no. 283/2021 Coll., Building Act (new), as amended

Decree no. 460/2021 Coll., on the categorization of buildings in terms of fire safety and civil protection

Decree no. 146/2024 coll., on construction requirements

Act no. 541/2020 Coll., on waste

Decree no. 23/2008 Coll., on technical requirements for fire safety of buildings, as amended

Act no. 133/1985 Coll., on fire protection, as amended

Act no. 201/2012 Coll., on air protection, as amended

Decree no. 264/2020 Coll., on the energy performance of buildings, as amended

Government regulation no. 272/2011 Coll., on the protection of health from adverse effects of noise and vibrations, as amended

Government regulation no. 591/2006 Coll., on detailed minimum requirements for occupational safety and health at construction sites, as amended

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ČSN 73 0540-3. Thermal Protection of Buildings – Part 3: Design Values of Quantities. Prague: Czech Standards Institute, 2005.

ČSN 73 0540-4. Thermal Protection of Buildings – Part 4: Calculation Methods. Prague: Czech Standards Institute, 2005.

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### **c) requirements for the building (function) – purpose, description, and basic parameters**

The detached house is free standing object with 2 above-ground floors and a 1 partial basement. The detached house is designed for four family members. The layout of the building is 4+kk with equipment. The house is intended for long-term housing.

Built-up area of detached house: 166 m<sup>2</sup>

|                                   |                    |
|-----------------------------------|--------------------|
| Enclosed space of detached house: | 723 m <sup>2</sup> |
| Utility area:                     | 239 m <sup>2</sup> |
| Area of paved surfaces:           | 91 m <sup>2</sup>  |
| Number of residential units:      | 1 RU, 4 + kk       |
| Number of above-ground floors:    | 2                  |
| Number of underground floors:     | 1                  |
| Number of users:                  | 4                  |

#### **d) requirements for architectural, aesthetic, material, spatial, and structural design,**

The building should feature a simple and modern architectural expression that harmonizes with the surrounding residential structures. Proportions, facade composition, and window placement must ensure visual balance and respect local style.

Durable and quality materials are required, especially for the façade, roof covering, and structural components. Preference is given to materials with good thermal and acoustic properties, low maintenance demands, and long service life. The requirements for the material selection is either wooden cladding or rough pasty render on the building envelope. Another selection may be façade from either natural or artificial stone.

The internal layout must provide functional zoning between living, service, and technical areas. Rooms must meet standard dimensions, lighting, and ventilation requirements in accordance with applicable regulations. According to the zoning regulations, the building must start 3,5 m from neighbour's plot boundary. The height of the object must be as common 2 above-ground floors houses, thus surrounding buildings are do not shade each other and have similar height parameters.

The structural system must ensure mechanical resistance and stability, fire safety, and thermal performance of the building. The chosen system should also allow for the integration of building services and support energy efficiency targets. The structural system should be selected and provided for minimal costs and maintenance requirements.

#### **e) climatic conditions – especially design parameters of outdoor air (winter, summer),**

The project considers local climatic conditions based on the applicable standards and decrees. The closest city for selection of meteorological data is Tábor. The design outdoor air parameters used for thermal calculations are as follows:

Winter design temperature: -17 °C

Internal design temperature (cooling): +20°C

Average annual outdoor temperature: approx. +8°C

Relative humidity in summer: approx. 75 %

Snow area: II. snow area

Wind area: II. wind area

Seismic area: N/A

Wind load and snow load according to ČSN EN 1991-1-4 and ČSN EN 1991-1-3

Seismic load according to ČSN EN 1998-1

These parameters are used for the design of heating, cooling, ventilation, and building envelope performance.

**f) requirements for building physics,**

Thermal protection – ensuring sufficient thermal insulation of the building envelope in accordance with Decree no. 264/2020 Coll. and ČSN 73 0540. The structure must meet the limits for heat transfer coefficients (U-values) and the overall energy performance of the building.

Protection against moisture – the design must prevent the accumulation of moisture in structures and surface condensation, especially in areas with higher humidity (e.g. bathrooms, basements).

Daylighting and sunlight access – all habitable rooms must be provided with sufficient daylight and must comply with ČSN EN 17037 and ČSN 73 0580. Proper sun exposure is ensured for residential spaces.

Acoustic protection – the building must meet standards for airborne and impact sound insulation, particularly between individual rooms and between the building and adjacent structures. Design and materials follow ČSN 73 0532.

All components of the building envelope must be designed in accordance with standard calculation procedures and simulation tools to ensure proper comfort and indoor environmental quality.

**g) building or facility balance (number of persons, units, inputs and outputs, thermal losses or gains, etc.),**

Functional units: 1 residential unit

Total utility floor area: 239 m<sup>2</sup>

Total energy reference area of the building: 288,7 m<sup>2</sup>

Net floor area of the zone: 245,9 m<sup>2</sup>

Number of floors: 3 (2 above ground, 1 basement)

Estimated daily water consumption: 400 liters

Annual energy demand (for heating and DHW): 8,89 kWh/year, preliminary calculation was made. Can be found in Attachment no.4 - Average heat transmission coefficient.

Energy source: heat pump air–water

Heat losses: calculated according to ČSN EN ISO 13790 and national methodology

Heat gains: considered from solar radiation and internal sources (people, appliances)

Wastewater discharge: into public sewer system

Rainwater handling: infiltration system on the owner's plot or into the soil

Solid waste: sorted municipal waste

Everything about heat gains and losses can be found in Attachment no.6 - Building energy performance certificate.

**i) design service life of the building, key structural elements and systems, requirements for inspections and maintenance affecting service life, required quality of materials and workmanship,**

The design service life of the building is assumed to be 50 years.

The project does not specify the service life of individual components or technologies separately.

All construction works and materials must meet the required quality standards as specified in the project documentation. Proper execution, material selection, and basic maintenance will ensure the intended durability and functionality of the structure throughout its service life.

**j) requirements for non-standard construction methods and special requirements for the execution and quality of the proposed structures,**

The project does not require the use of non-standard construction technologies. All construction processes are based on commonly used and proven building methods in accordance with current technical standards and regulations.

There are no special execution requirements beyond standard quality control procedures. All load-bearing and non-load-bearing structures must be executed with professional workmanship, using materials with declared and certified properties, as specified in the design documentation.

**k) environmental protection requirements,**

The construction and operation of the building must respect the principles of environmental protection in accordance with Act no. 17/1992 Coll., on environmental protection.

Key environmental requirements include:

Minimizing construction waste and ensuring its proper sorting and disposal in line with Act no. 541/2020 Coll., on waste

Reducing dust, noise, and vibration emissions during construction

Preventing soil and groundwater contamination through safe material handling and storage

Efficient use of natural resources, including water and energy

Rainwater management through retention and infiltration systems on-site

Use of environmentally friendly materials with low environmental impact and certified origin where possible

Ensuring that no protected natural habitats or species are affected by the construction activities

The building is not located in area Natura 2000.

**l) requirements based on binding opinions of relevant authorities,**

As of the date of project documentation preparation, no binding opinions or decisions from relevant authorities have been issued that would impose specific additional requirements on the construction.

Should any binding opinions be issued during the permitting process, their conditions will be respected and incorporated into the implementation documentation and construction process accordingly.

**m) specification of geometric and qualitative properties of building elements, structures, and construction products (thermal insulation, acoustic insulation, lighting, strength, etc.),**

All structural elements and construction products used in the building must meet the required geometric dimensions and qualitative parameters as specified in the project documentation and in accordance with applicable Czech and European standards.

Thermal insulation:

All relevant data with U parameters, dimensions etc. are specified in either LIST OF COMPOSITIONS or in Attachment no.5 - Thermal technical assessment of the structures.

Acoustic insulation:

All relevant data with  $R_w$  parameters are specified in Attachment no.1 - Acoustics assessment.

Lighting properties:

All habitable rooms comply with daylight requirements according to ČSN EN 17037 and ČSN 73 0580. Sufficient window-to-floor ratio and direct sunlight exposure

Structural strength:

All load-bearing structures are designed according to Eurocodes and verified by static calculations by a chambered structural engineer.

**n) modifications and adjustments to the building, demolition, deconstruction, dismantling, impacts on the surroundings, preventive and protective measures when handling asbestos and other hazardous waste and substances, estimate of reusable materials, etc.,**

No demolition or deconstruction of existing buildings is planned within the scope of this project. The construction involves a new building on a vacant plot. No usage or handling of asbestos is done. In the future, any modifications, dismantling, or potential demolition must be carried out in accordance with applicable legal and technical regulations

**o) external environment and sources (inputs) for the building (categories, capacities, conditions and limitations – especially protection against radon penetration from subsoil, stray currents and corrosion, technical and natural seismicity, aggressive and pressurized groundwater, humidity, noise, and other effects such as undermining, gases – especially methane, etc.),**

The building is situated in an area with standard environmental conditions. Based on available geological and environmental data, the following apply:

Radon protection:

The plot is classified with a low radon index. Nevertheless, radon-proof insulation 2x SBS bitumen felt is incorporated in the floor slab to prevent gas infiltration.

Stray currents and corrosion:

No stray current monitoring was required. The building is not located near railway infrastructure or high-voltage systems, and is not expected to be affected by electrochemical corrosion.

Seismicity:

The area is located in a low seismic risk zone. No special seismic design measures are necessary. According to seismic map, no value of seismic load is specified.

Groundwater and moisture:

No aggressive or pressurized groundwater is present. Standard waterproofing and moisture protection measures are applied in the foundation structures.

Noise:

The site is not exposed to significant noise sources. The building envelope is designed to provide sufficient airborne and impact sound insulation in compliance with ČSN 73 0532.

Other risks:

The site is not located in a mining or undermined area, nor is there any recorded presence of methane or other hazardous gases.

**p) requirements for protection against noise and vibrations from the operation of the building or facility,**

The operation of the building does not produce excessive noise or vibrations. It is a residential structure intended for standard domestic use, without any noise-generating equipment beyond the typical household appliances and technical installations like heat pump which is located outside in the northern side of the object. The heat pump has will not disturb neighbours or occupants of the object itself, additionally it has a night mode which operates in silent mode.

Building structures (floors, partitions) are designed to achieve adequate airborne and impact sound insulation in accordance with ČSN 73 0532.

**q) fire safety solution requirements,**

The fire safety of the building is ensured in accordance with applicable Czech legislation, especially Decree no. 23/2008 Coll., on technical fire protection requirements, and the Czech standard ČSN 73 0802 – Fire safety of buildings – non-industrial structures.

The building is classified in category OB1, designed for residential use with a maximum of utility floor area 600 m<sup>2</sup>, three residential units and maximal 3 above-ground floors and 1 underground floor and without areas intended for public gatherings or sleeping requiring assistance during evacuation.

The load-bearing structure is designed to achieve the required fire resistance rating in accordance with the fire safety solution.

Non-combustible or flame-retardant materials are used where required like on the roof.

The building is equipped with non protected escape way with minimal width of the route 900 mm and minimal width of door is 800 mm.

Technical systems, such as smoke alarms or fire extinguishers, are implemented and designed according to standard.

Fire compartment is designed in accordance with applicable fire protection standards.

The fire safety solution is elaborated in the dedicated D.4.01 FIRE SAFETY REPORT, which is an integral part of the project documentation.

#### **r) requirements for construction products.**

Only materials with proven quality and certified origin may be used during the construction. Installation must follow the manufacturer's instructions and comply with relevant standards and regulations.

## **D.1.2 BUILDING STRUCTURES REQUIREMENTS SOLUTION**

### **a) general layout, technical and safety parameters,**

The layout of the family house is designed on a parcel no. 3227/68 in municipality Veselí nad Lužnicí. The house is in contrast with a zoning plan and obey any regulation plan requirements. The object is standing on a nearly flat surface. The house layout is 4+kk with accessories and is intended for four family members. Safe access to all rooms is ensured, with proper escape ways, and the building is accessible for emergency services.

### **b) description of the architectural, aesthetic, material, structural, and technological design, including relevant parameters of the building or structure,**

The layout of the family house is simple and will blend smoothly into the surrounding development. The building is primarily in the shape of an L, with a side ratio smaller than 2:1. The family house has two above-ground floors has a partial basement. The basement includes a technical room, hallway, staircase, and a separate WC. The first floor features a garage for one car, a study, staircase, entrance hall, hallway, living room with a kitchen, and a separate WC with a shower, which will be partially used. The second floor consists of a hallway, two children's rooms, a bedroom, and a bathroom. In front of the house, a parking space for one vehicle is proposed on a paved surface. On the east side of the building, a terrace is planned, accessible from the kitchen. The house layout is 4+kk with accessories and is intended for four family members. The structural system of the object is combined wall structural system from load-bearing autoclaved aerated concrete blocks. Perimeter walls is from autoclaved aerated concrete blocks too. Horizontal load-bearing structures are from monolithic reinforced concrete. Foundation strips are from plain concrete. The detached house roofing is single-skin flat roof. Thermal insulation is from certified composition ETICS.

### **c) earthworks – excavation of pits and trenches, description and solution,**

Topsoil will be stripped in th. 200 mm and stored on site for reuse in final landscaping. Excavated soil will be temporarily stockpiled in a designated on-site depot. Any excess earth not suitable for reuse will be removed to an authorized landfill.

Excavation of the foundation trenches around the perimeter will be done according to the Excavation drawing. The whole excavation works are divided into main and submain figures. First of all, the main foundation pit will be excavated and sloped in adequate slope so that excavator can access the bottom of the foundation pit. The south side of the excavation are intended to this reason. Sloping around the foundation pit is 1:1. Once this is done, excavations will take place on the upper side so trenches for foundation strips are done. The depth of the foundation strips is in non-freezing depth. Temporary shoring must be installed to prevent collapse of trenches. Voids after excavations will be filled with added gravel sand soil.

Excavation works will be carried out in accordance with applicable safety regulations. Prior to excavation near existing utilities, all underground infrastructure must be located and marked. Excavations must be properly protected against frost and the infiltration of rainwater.

### **d) excavation support,**

In case of loose or unstable soil, sloped sides or stepped benches will be formed to ensure stability. However, there is no depth more than 3,0 m, so benches are not really needed. Before concreting of foundation trenches it needs to be stabilized with help of temporary wooden shoring. Stored material at the surrounding distance must be at least 0,5 m from the trenches.

### **e) foundation design – concept, calculation, and description including results of subsoil investigation,**

The building is founded on foundation strips made of plain concrete, designed based on the results of the geotechnical investigation and the expected load distribution of the structure. This will be verified by chambered structural engineer. However, preliminary calculation was done and can be found in Attachment – Preliminary calculations. The result of subsoil investigation found that there is gravel sand soil coarse grained with a capacity of 275 kPa. The foundation depth is designed to reach below the frost line, in this case it is 1,6 m below adjacent terrain. No risk of underground water was found.

The foundation strips are from plain concrete C20/25. The width is 500, 700 or 900 mm, depending on applied load from above storeys. Formwork blocks made of concrete, dims. 300 x 500 x 250 mm are above the foundation strips around the perimeter. They will be filled with horizontal and vertical reinforcement diameter 12 mm. To ensure the stability of the building due to the partial basement, stepped foundations are designed on both sides. From the foundation joint of the basement the stepped foundations are made to keep angle of 45 degrees. The void between stepped foundation strips and the perimeter wall of the first above ground floor is filled with the same formwork concrete blocks.

Gravel sand backfill fraction 0-32 mm in th. 200 mm is compacted 0,15 MPa and is below the concrete oversite which thickness is 150 mm. It is done from plain concrete C20/25 and steel reinforcement mesh 6/100/100 are added. The overlap of reinforcement must be respected so that 2 rows of eyes of the mesh overlap.

Before concreting, it is necessary to prepare openings for utility installations, and a grounding belt FeZn must be installed along the perimeter of the foundation strips, with an outlet positioned above the terrain toward lightning protection system.

**f) structural and constructional solution and technical characteristics of the building – description of the building by its structural elements including quality and execution requirements; vertical and horizontal load-bearing structures, stairs, roof, partitions, window and door openings, external and roof cladding, floors, ceilings, insulation, surface finishes, etc.,**

Structural system is combined wall structural system.

The foundation structures are designed as foundation strips from plain concrete of strength class C 20/25. The width of the strip is varying across the perimeter. It is either 500, 700 or 900 mm. It is all concreted in the non-freezing depth.

Perimeter load-bearing wall in the basement is designed from concrete formwork blocks dims. 300×500×250 mm. The blocks will be filled with concrete C 20/25 and reinforced with a horizontal and vertical reinforcement bars diameter 12 mm. Modified bitumen SBS membranes will then be torch-applied onto it. The perimeter masonry in basement will be insulated with 120 mm thick extruded polystyrene. A protective layer consisting of a 9 mm high PE profiled drainage film will be applied over the insulation.

Perimeter load-bearing masonry in the above-ground floors is designed as autoclaved aerated concrete blocks th. 250 mm and will be bricked on a thin-layer mortar. Internal load-bearing walls are as well as perimeter load-bearing masonry from autoclaved aerated concrete blocks th. 250 mm. Both will be laid on thin-layer mortar M5. First blocks as founding blocks will be used from autoclaved aerated concrete.

Partitions are from gypsumboard. The gypsumboard th. 12,5 mm is anchored from both sides to the steel grid structure from R-CW (vertical) and R-UW (horizontal) and th. 100 mm. The quality of the putty applied on a gypsumboard is Q2. Between children's room and bedroom in second above-ground floor, there are additionally two more gypsumboards th. 12,5 mm applied from both sides for better acoustic comfort.

Horizontal ceiling load-bearing structures are from monolithic reinforced concrete th. 250 mm designed from concrete C 25/30 XC1 and horizontal load-bearing roof structure is from concrete C 25/30 XC3 same thickness. All horizontal load-bearing structures are reinforced with steel B500B according to static calculations.

Staircase is designed as two-flight from monolithic reinforced concrete th. 150 mm. It will consist of concrete C 25/30 and reinforced with steel B500B. Half-landings are the same thickness and same material. They are monolithically connected.

Floors are done from concrete screed with a variable thickness and flooring is either from PVC or ceramic tiles. PVC flooring is in all habitable rooms and also in a study room. In every room except of garage and basement is EPS system roll for laying of radiant heating. The system roll consists of aluminium film. All around the perimeter will be dilatation belt from polystyrene to allow thermal movement of the subfloor. A detailed list of floor compositions are provided in the attachment – list of components.

Roof cover is from PVC-P waterproofing film. It is anchored to a sublayer from expanded polystyrene. First layer is th. 200 mm and second sloping layer is from expanded polystyrene wedges th. 50 – 200 mm. Slope of the roof is 3%. Between the PVC-P waterproofing film and

sloping layer is nonwoven geotextile from glass fibres. Vapour-barrier is from SBS modified bitumen felt. For more information see LIST OF COMPOSITIONS.

Thermal insulation of the building is from certified ETICS system from expanded polystyrene façade boards th. 200 mm. The insulation in the plinth area is from extruded polystyrene th. 180 mm. Thermal insulation of the basement is from extruded polystyrene too with th. 120 mm.

Insulation against radon and moisture is done with 2 SBS modified bitumen felts applied on a penetration asphalt emulsion. Reinforcement layer is made of glass fabric, upper surface finished with fine-grained mineral granules, lower surface covered with combustible PE foil. The waterproofing layer must be installed in full contact to prevent the penetration of moisture and radon into the interior spaces of the new building.

The external openings are fitted with plastic frames glazed with thermal insulating triple-glazing. The internal door openings will be filled with veneered door which are put in a door frame.

Surface finishes in the interior in the contact with autoclaved aerated concrete blocks are trowelled. The one-component trowel layer is 5 mm thick and fiberglass fabric is inserted into it. The finish is done from interior paint. Partitions are puttied and then painted with an interior white paint. For detailed compositions see LIST OF COMPOSITIONS.

**g) solution for non-standard construction methods and special requirements for the execution and quality of the proposed structures,**

The project does not involve the use of non-standard or unconventional construction methods. All construction works are designed using traditional and proven building techniques, in accordance with applicable Czech and European standards.

**h) in case of demolition works – demolition design and building protection – structural assessment and stability evaluation, work procedures, demolition technical conditions, measures for handling asbestos, hazardous waste and substances, deconstruction, dismantling, selective waste sorting for further reuse, etc.,**

No demolition or deconstruction works are planned as part of this project.  
The construction involves a new building on a vacant site.

**i) in case of building modifications – description of the current state of the building, impacts of changes on structural elements and the environment (especially assessment of the thermal and moisture balance),**

This project concerns the construction of a new building; therefore, no modifications to an existing structure are carried out.

**j) structural system of the building or structure – description, application of the existing load-bearing system survey for the design of building modifications,**

The project involves the construction of a new building; therefore, there is no existing load-bearing system to be surveyed or modified. If modifications to an existing structure were planned, a survey of the current load-bearing system would be required. This survey would be used to evaluate the impacts of proposed changes on structural stability, load transfer paths, and overall safety, and the structural design would be adapted accordingly.

#### **k) description of the building physics solution,**

##### Thermal protection:

All external structures (walls, roof, floors) are insulated to meet or exceed the requirements of decree No. 264/2020 Coll. and the relevant standards (ČSN 73 0540 series). The building achieves a high level of thermal insulation with U-values complying with low-energy building standards. Calculations to be seen are assessment of 2D critical details, average heat transmission coefficient and thermal technical assessment of the structures. Calculation may be seen in folder BUILDING PHYSICS.

##### Daylighting and sunlight access:

All habitable rooms are provided with sufficient daylight and solar exposure in compliance with ČSN EN 17037 and ČSN 73 0580. Window openings are sized to ensure the required daylight factors. Calculation may be seen in folder BUILDING PHYSICS.

##### Acoustic protection:

The building's walls, ceilings, and partitions are designed to meet airborne sound insulation and impact sound insulation requirements according to ČSN 73 0532. The building object is not in danger by surrounding noise either from roads, train transport etc. Calculation may be seen in folder BUILDING PHYSICS.

##### Energy performance:

The building achieves an energy performance class A – very efficient as per the Building energy performance certificate. Heating and hot water are provided by an energy-saving air-to-water heat pump. Calculation may be seen in folder BUILDING PHYSICS.

#### **l) proof of compliance with limits (especially energy, material, and transport capacity, waste management) in relation to technical infrastructure – description and technical conditions,**

The building's energy demand for heating, domestic hot water, and appliances is within the capacity of the existing low-voltage electrical network. The main electrical connection (230/400 V) is dimensioned with a main circuit breaker of 3 × 25 A, sufficient for the building's operational needs.

Construction materials are standard, commonly available, and the project does not impose any excessive demand on raw material supplies. Material usage is optimized to minimize waste.

Waste generated during operation (mainly municipal waste, including separated recyclables) will be disposed of via the municipal waste collection system. Construction waste will be sorted and managed according to Act no. 541/2020 Coll., on waste, with preference for recycling and recovery.

The building is accessed via an existing local road (Class IV), which has sufficient capacity for construction logistics as well as for regular use after completion. The driveway from the object's plot is connected to this existing plot. Parking for residents and visitors is provided within the building's own plot or usage of public parking spaces on this local road, also parking spaces for persons with disabilities are there.

**m) description of the solution for hygiene requirements and protection against noise and vibrations during operation,**

The indoor environment is designed to provide adequate ventilation, natural daylight, and thermal comfort in accordance with Act no. 258/2000 Coll., on the protection of public health, and related standards.

The building envelope and internal partitions are designed to achieve the required airborne and impact sound insulation in compliance with ČSN 73 0532.

Technical equipment (such as the heat pump) meets strict acoustic performance requirements and operates in night mode to minimize noise emissions.

No significant vibration sources are present, and the construction minimizes the risk of vibration transmission.

Ventilation of the building is designed as forced ventilation, and every room will be sufficiently ventilated. The forced ventilation unit is placed in a basement, from there the pipeline is went through all the building.

The project ensures a healthy, comfortable, and quiet environment for building users, with minimal impact on the surrounding environment during normal operation.

**n) description of the protection of the building against negative effects of the external environment, especially against floods, technical and natural seismicity, aggressive and pressurized groundwater, moisture, noise, and other effects – impact of undermining, gases (especially methane), etc.,**

The building plot is located outside flood-prone areas. No special flood protection measures are required.

The area has no classification of seismic zones. Therefore, seismic activities are not expected.

No aggressive or pressurized groundwater is present. The building foundations are waterproofed with radon-proof and moisture-proof bitumen felts to prevent moisture ingress into the structure.

The building is situated away from major noise sources. The design ensures sufficient sound insulation of external walls, windows, and partitions in accordance with ČSN 73 0532.

The site is not located in an undermined area, nor is there any known presence of methane or other hazardous gases.

**o) description of the fire protection solution (e.g., fire resistance and protection of building structures, fire seals) in relation to the fire safety documentation,**

The fire protection of the building is designed in accordance with the requirements specified in the Fire Safety Report and can be found in FOLDER NO.5 - D.4 FIRE SAFETY SOLUTION. The building complies with the requirements of ČSN 73 0802 ed. 2:10/2020 – fire safety of buildings – non-industrial structures and ČSN 73 0833:02/2020 – fire safety of buildings – Residential and Accommodation Buildings.

**p) coordination of multiple professions (building works, fire safety design, plumbing, natural gas, heavy current electrical systems, electronic communications, HVAC, coatings, insulation, measurement and control systems, etc.),**

The project ensures full coordination between all involved disciplines to guarantee smooth implementation of construction works and the proper functioning of the completed building.

Plumbing systems (water supply, sewerage) are integrated without interfering with structural elements or fire protection measures.

Natural gas installation is not applicable in this project.

Heavy current electrical systems (power supply, lighting) and electronic communication networks (low-current systems) are planned to prevent conflicts in space, particularly in shafts and technical rooms.

HVAC systems (ventilation and heating) are designed with respect to fire separation requirements and crossings.

Building works are aligned with fire safety requirements, ensuring proper design and not interfering with other professions.

**q) other calculations,**

Other calculations may be found in FOLDER – STUDY AND PREPARATION WORKS.

**r) inspections during construction and inspections of covered structures, additional control measurements and tests beyond the mandatory inspections according to technological regulations and standards,**

During the construction process, all works will be subject to regular inspections to ensure compliance with the project documentation, applicable standards, and technological regulations. All inspections and tests must be properly documented, and any deviations must be addressed before further construction work continues.

**s) determination of the design service life of the building, structures, and equipment; requirements for inspections and maintenance affecting the service life; solution of quality requirements for products and workmanship,**

The design service life of the building is set at 50 years, in accordance with standard practice for residential structures and in compliance with relevant technical regulations.

Technical systems (heating, plumbing, electrical installations, ventilation or pv system) typically have a shorter service life 15–30 years and will require periodic maintenance and eventual replacement during the building's lifetime.

**t) specification of products and their required characteristics (properties or performance and their parameters),**

Joinery, locksmith, tinsmith and additional elements may be seen in FOLDER NO.3 - D.1.3 ARCHITECTURAL BUILDING SOLUTION.

**u) bill of quantities.**

Is not part of this bachelor's thesis.

## **CONCLUSION**

The aim of this bachelor thesis was to develop construction documentation for the execution of a nearly-zero energy building. All relevant legal regulations and technical standards, including currently valid decrees related to construction activities, were taken into account during the design process. The resulting documentation includes the architectural building solution and building structural solution, fire safety solution, and the conceptual design of heating, domestic hot water preparation, and ventilation. Assessment of building physics—specifically thermal performance, acoustics, and daylighting—are also included.

Throughout the preparation of this thesis, I applied knowledge and skills acquired during my studies, while also gaining a significant amount of new experience and understanding through the design process itself. This work provided me with valuable insight into the development of complete construction documentation and contributed meaningfully to my professional growth in the field of building construction.

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Act no. 541/2020 Coll., on waste

Decree no. 23/2008 Coll., on technical requirements for fire safety of buildings, as amended

Act no. 133/1985 Coll., on fire protection, as amended

Act no. 201/2012 Coll., on air protection, as amended

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## **Softwares**

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DEKSOFT

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Adobe Acrobat

### **Master's theses**

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HUSÁROVÁ, Barbora. Municipal centre in Nivnice. Brno, 2024. Master's Thesis. Brno University of Technology, Fakulta stavební, Ústav pozemního stavitelství. Supervisor Ing. Jan Müller, Ph.D.

### **Bachelor's theses**

ČECH, Patrik. Rodinný dům Pohořelice. Brno, 2024. Bakalářská práce. Vysoké učení technické v Brně, Fakulta stavební, Ústav pozemního stavitelství. Vedoucí prof. Ing. Miloslav Novotný, CSc.

## LIST OF ABBREVIATIONS AND SYMBOLS

|          |                                                  |
|----------|--------------------------------------------------|
| FGL      | formation ground level                           |
| IGL      | initial ground level                             |
| BO       | building object                                  |
| c.m.     | cadastral municipality                           |
| th.      | thickness                                        |
| l.       | length                                           |
| DPS      | dokumentace pro provedení stavby                 |
| m.a.s.l. | metres above sea level                           |
| FC       | fire compartment                                 |
| NON-PEW  | non protected escape way                         |
| FE       | fire extinguisher                                |
| RS       | revision shaft                                   |
| ELE      | electric meter distribution board                |
| WMS      | water meter shaft                                |
| INF      | infiltration box                                 |
| SMW      | sorted municipal waste                           |
| RC       | reinforced concrete                              |
| EPS      | expanded polystyrene                             |
| XPS      | extruded polystyrene                             |
| PE       | polyethylene                                     |
| PU       | polyurethane                                     |
| RT       | retention tank                                   |
| PVC      | polyvinylchloride                                |
| DN       | diameter nominal                                 |
| LV       | low voltage                                      |
| ČSN      | Czech technical standard                         |
| Coll.    | collection of laws                               |
| S – JTSK | systém jednotné trigonometrické sítě katastrální |
| A        | area                                             |
| C        | concrete grade sign                              |
| B        | steel grade sign                                 |

|           |                                        |
|-----------|----------------------------------------|
| Pa        | pascal                                 |
| MPa       | megapascal                             |
| t         | ton                                    |
| kN        | kilonewton                             |
| m         | meter                                  |
| mm        | millimetre                             |
| dB        | decibel                                |
| Lp        | sound pressure level                   |
| Rw        | laboratory airborne sound insulation   |
| R         | thermal resistance of the structure    |
| U         | heat transmission coefficient          |
| Ug        | thermal transmittance of glazing       |
| Uw        | thermal transmittance of a frame       |
| HT        | specific heat loss by transmission     |
| Uem       | average heat transmission coefficient  |
| fRsi      | temperature factor of internal surface |
| $\lambda$ | coefficient of thermal conductivity    |

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