BRNO UNIVERSITY OF TECHNOLOGY
FACULTY OF CIVIL ENGINEERING

Assignment Bachelor's Thesis

Department:	Institute of Building Structures
Student:	**Vedat Demirkiran**
Supervisor:	**Ing. Jan Müller, Ph.D.**
Academic year:	2023/24
Study programme:	B0732A260005 Civil Engineering
Field of study:	Building Construction

The Dean of the Faculty, in accordance with Act No. 111/1998 on universities and the Study and Examination Regula

Block of flats in Brno

Concise characteristic of the task:

Preparation of building documentation for construction purposes for a near-zero energy building, including preliminary studies / blueprint of internal layout with partial focus on positioning of bearing elements from chosen materials. It is to include building site topography and terrain works as a result of building positioning. The solved building is to have a partial or full scale basement. The BIM method will be applied in the design in accordance with the instructions of the supervisor.

Objectives and outputs Bachelor's Thesis:

Within the framework of the related assignments of the Bachelor's thesis in the specializations of civil engineering, metal and timber structures and concrete and masonry structures, in which the BIM method is applied, develop the design of a block of flats. Apply the scope of the BIM method according to the instructions of the thesis supervisor. Design layout and load-bearing structure of the building and siting of the building with respect to its surroundings. The extent of the project will comply with ordinance No. 499/2006 Coll. as amended: it will include reports and drawings defined in parts A, B, C and D, throughout the section D.1.1 and D.1.3 and to the partial extent of section D.1.2 of the ordinance, especially: site plans; excavations; foundations; floor plans; roofing; vertical sections; elevations; floor formwork plans or floor structure assemblies; at least five assembly details; documents specified in D.1.1.c), thermal and acoustic assessment of the building and specified structures, including confirmation of compliance with nearly-zero energy requirements. The project will also include following appendices: layout concepts including module scheme of load-bearing structures; concept drawings of heating; ventilation and domestic hot water systems; simplified structural design of foundations and specified load-bearing structures; 3D model of the building. The project might also include other specific parts requested by the supervisor.

The project will be structured in compliance with Dean’s directive no. 4/2019 as amended. The individual parts of the project will be delivered in A4-sized folders with a title block on the front page and a table of content inside. All parts of the project will be elaborated using word processing and CAD software. All drawings will include a title block. The text part will also include sections h) “Introduction”, i) “Text of the work” and j) “Conclusions”. The Text of the work will contain technical reports complying with ordinance no. 499/2006 Coll as amended. The reports and assessments in the project will list applied nearly-zero energy building requirements. The electronic version of the project will include a B1-sized poster with key information, schemes and 3D model of the designed building. All sources utilized in the project have to be properly cited in compliance with ČSN ISO 690 (e.g. using www.citace.com tool).

List of recommended literature and documents:

1) Směrnice děkana č. 1/2023 s dodatky a přílohami; (2) Stavební zákon č. 183/2006 Sb. v platném a účinném znění; (3) Vyhláška č. 499/2006 Sb. v platném a účinném znění; (4) Vyhláška č. 268/2009 Sb. v platném a účinném znění; (5) Vyhláška č. 398/2009 Sb.; (6) Platné normy ČSN, EN; (7) Katalogy stavebních materiálů, konstrukčních systémů, stavebních výrobků; (8) Odborná literatura; (9) Vlastní dispoziční řešení budovy, (10) Vlastní architektonický návrh budovy a (11) ČSN ISO 690.

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

In Brno, 29. 11. 2023

L. S.

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

Ing. Jan Müller, Ph.D.
project supervisor

prof. Ing. Rostislav Drochytka, CSc., MBA, dr. h. c.
Dean

ABSTRACT

This bachelor's thesis explores the architectural and functional aspects of a block of flats (multi-storey residential building) in Brno-Komín. The residential building comprises four floors, a underground floor which functions as a garage and a flat green roof. The primary objective of this project is to create a living space that accommodates the needs of 8 families. The project explores the use of suitable materials, construction techniques, and building systems to ensure durability, safety, and cost-effectiveness. Addition to that, BIM process is applied by exporting the models from Revit to Trimble by creating .ifc files. The materials used are implemented throughout the building to minimize energy consumption and reduce environmental impact.

KEYWORDS

Block of flats, green roof, BIM, masonry, Revit, Trimble

ABSTRAKT

Tato bakalářská práce zkoumá architektonické a funkční aspekty bytového domu (vícepodlažního bytového domu) v Brně-Komíně. Bytový dům má čtyři podlaží, podzemní podlaží sloužící jako garáž a plochou zelenou střechu. Primárním cílem tohoto projektu je vytvořit obytný prostor, který uspokojí potřeby 6 rodin. Projekt zkoumá použití vhodných materiálů, stavebních technik a stavebních systémů k zajištění odolnosti, bezpečnosti a hospodárnosti. Kromě toho je proces BIM aplikován exportem modelů z Revitu do Trimble vytvořením souborů .ifc. Použité materiály jsou implementovány v celé budově s cílem minimalizovat spotřebu energie a snížit dopad na životní prostředí.

KLÍČOVÁ SLOVA

Rodinný dům, zelená střecha, BIM, zdivo, Revit, Trimble.

BIBLIOGRAPHIC CITATION

DEMIRKIRAN, Vedat. Block of flats, Brno. Brno, 2024. Bachelor's Thesis. Brno University of Technology, Fakulta stavební, Ústav pozemního stavitelství. Supervisor Ing. Jan Müller, Ph.D.

DECLARATION OF AUTHORSHIP OF THE FINAL THESIS

I, Vedat Demirkiran, declare that this Bachelor's Thesis titled Block of flats, Brno 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, 24. 05. 2024

Vedat Demirkiran

author

Acknowledgement

I would like to sincerely thank my supervisor, Ing. Jan Müller, Ph.D. Your expertise, patience, and valuable insights have greatly improved this work. Your guidance and constructive feedback have been very important in shaping the quality of my research. From the start, your willingness to share your knowledge and provide helpful advice has been very beneficial. Your support and timely suggestions have made this project much easier to handle. Each of our discussions and your careful reviews have taught me a lot. Thank you, Dr. Müller, for your great support and dedication. Your help has had a big impact on my work and my academic journey.

Introduction

The goal of this thesis is to design a block of flats utilizing the Building Information Modeling (BIM) method, focusing on civil engineering specializations including metal and timber structures, as well as concrete and masonry structures. The project will be situated with respect to its surroundings and will aim to achieve a high standard of sustainability, energy efficiency, structural stability, and user comfort.

The specified objectives are as follows:

BIM Application: Develop the design of the block of flats using the BIM method, incorporating detailed modeling and documentation as per the supervisor's instructions.

Design Layout and Load-Bearing Structure: Create an efficient and functional layout along with a strong load-bearing structure that complies with structural and architectural standards.

Environmental Consideration: Ensure the building is sited appropriately, taking into account its surroundings and environmental impact.

Compliance with Ordinance No. 499/2006 Coll.: Include comprehensive reports and drawings in accordance with parts A, B, C, and D, specifically sections D.1.1, D.1.3, and partially D.1.2. This includes site plans, foundation plans, floor plans, roofing, vertical sections, elevations, floor formwork plans, assembly details, and more.

Energy Efficiency and Sustainability: Implement design strategies and technologies that ensure nearly-zero energy consumption. This includes external wall insulation, energy-efficient systems, and the use of renewable energy sources.

Technical Reports and Assessments: Conduct thermal and acoustic assessments to ensure the building meets the highest standards of thermal protection and noise control.

3D Modeling: Develop a detailed 3D model of the building to visualize and optimize the design.

Layout Concepts and Structural Design: Provide detailed layout concepts, including module schemes of load-bearing structures and simplified structural design of foundations and other critical structures.

Detailed Documentation: Prepare all necessary documentation, including site plans, excavation details, foundation plans, floor plans, roofing, vertical sections, elevations, floor formwork plans, assembly details, and compliance reports.

Electronic Submission and Poster Presentation: Include an electronic version of the project with an A1-sized poster displaying key information, schemes, and a 3D model of the building.

By achieving these objectives, this thesis aims to deliver a comprehensive and innovative design solution for a block of flats that integrates sustainable practices, functional layout, aesthetic appeal, and compliance with all necessary health, safety, and energy efficiency standards.

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VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

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FAKULTA STAVEBNÍ

INSTITUTE OF BUILDING STRUCTURES

ÚSTAV POZEMNÍHO STAVITELSTVÍ

BLOCK OF FLATS IN BRNO

BYTOVÝ DŮM, BRNO

1.Accompanying report

BACHELOR'S THESIS

BAKALÁŘSKÁ PRÁCE

AUTHOR — Vedat Demirkiran

AUTOR PRÁCE

SUPERVISOR — Ing. Jan Müller, Ph.D.

VEDOUCÍ PRÁCE

BRNO 2024

1.Accompanying Report

Identification of the building

Name of the building: Blocks of flats in Brno

Place of the building: Brno-Komin

Cadastral area: Komín [610585]

Parcel number: 2547/7

LV numbers: 5163

Aim of the object: Building for longterm living

Total area:876 m2

Built-up area:472.17 m2

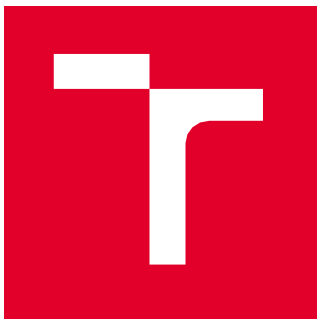
Number of flats:8

The proposed design entails a residential building comprising four above-ground floors and one basement floor as garage, intended to accommodate 28 individuals. In plan, the residential house takes on a rectangular shape, with the entrance situated in the northwestern part. Each flat between in the second floor will feature a balcony, flats in 1st, 3rd and 4th floors will have terrace and the roof will be designed as a green roof structure.

For the construction of the peripheral walls, Porotherm 30 P10 blocks will be utilized in the above-ground storeys, while the basement will be constructed using site cast reinforced concrete. Similarly, the internal load-bearing walls will be constructed using Porotherm 25 AKU Z P15 blocks in the above-ground storeys, while the basement will incorporate site cast reinforced concrete. As for non-load-bearing walls which are separating the rooms, Porotherm 11.5 Profi blocks will be utilized, whereas the walls between the living place and technical room will be Porotherm 19 AKU Profi.

To ensure adequate insulation, above the first floor, the facade of the building will be equipped with an External Thermal Insulation Composite System (ETICS), incorporating Expanded Polystyrene (EPS) as the insulating material. Since there is contact with the soil, the facade of the garage will be equipped with XPS. The

ceiling of the basement floor will be equipped with the Rockwool to ensure the needed thermal properties.



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2.Summary technical report

BACHELOR'S THESIS

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BRNO 2024

2.Summary Technical Report

2.1. Description of the Construction Site

a) **Characteristics of the Area and Building Plot**:

The proposed block of flats, situated in Brno-Komín, holds access from Houškova street, positioning it within a residential area. With a gentle slope ranging from approximately 326 to 334 meters above sea level, the site offers a favorable topography for construction. Surrounded by similar residential developments, the plot is earmarked for multi-storey residential buildings, aligning with the intended purpose of the project. Existing utility infrastructure, including communication, sewage, water supply, gas, and electricity lines, is readily available, facilitating construction and future occupancy.

b) **Compliance with Zoning Decision**:

The project adheres to the zoning decision, ensuring alignment with legal requirements and municipal regulations governing land use and development in the area.

c) **Compliance with Spatial Planning Documentation**:

The design and functionality of the proposed block of flats are in accordance with the spatial planning documentation established by the municipality of Brno. Complying with the city's spatial plan, which designates the area for multi-storey residential buildings, the project fulfills the intended use and development goals outlined in the planning framework.

d) **Decisions on Permitting Exemptions**:

No exemptions or deviations from general land use requirements have been sought or granted during the planning and documentation phase of the project.

e) **Incorporation of Concerned Authorities' Opinions**:

All requisite conditions and recommendations issued by relevant administrative authorities have been carefully considered, integrated, and addressed within the project documentation.

f) **Surveys and Analyses**:

While no specific surveys have been conducted for this project, valuable insights obtained from past construction endeavors in the vicinity have informed the planning and decision-making process.

g) **Protection of Territory under Legal Regulations**:

The site falls outside designated protective safety zones or other legally protected areas, reducing concerns related to additional regulatory requirements or restrictions.

i) **Impact of Construction on Surroundings and Environment**:

Environmental considerations have been paramount throughout the planning process to ensure minimal disruption to the surrounding ecosystem and community. The proposed block of flats is designed to harmonize with existing developments, preserving the aesthetic and functional integrity of the neighborhood.

j) **Requirements for Sanitation, Demolition, Felling of Trees**:

No significant vegetation removal or demolition activities are anticipated on-site, minimizing ecological impact, and preserving green spaces within the sector.

k) **Requirements for Land Occupation**:

Excavation works will be conducted as necessary for foundation and infrastructure installation, with careful attention paid to temporary land occupation and subsequent restoration during landscaping activities.

l) **Territorial Technical Conditions**:

New connections to essential utilities, including sewage, water supply, electricity, and gas pipelines, will be established to support the block of flats. Efforts will be made to ensure barrier-free access to the proposed building, promoting inclusivity and accessibility for all residents and visitors.

m) **Plots of Land in Real Estate Cadaster**:

The construction encompasses plots 2547/7 within the designated area identified in the real estate cadaster, ensuring accurate land parcel delineation and legal compliance.

n) **Creation of Protective or Safety Zones**:

No provisions for the creation of protective or safety zones on adjacent plots or roadways are required, as the project's scope and scale do not warrant additional protective measures beyond standard construction protocols.

2.2. General Description of the Building

a) New Construction or Alteration:

The project documentation encapsulates the meticulous planning and design considerations for a groundbreaking new construction endeavor: a block of flats in Brno-Komín. With a vision for modern living and community integration, the project not only encompasses the creation of residential spaces but also includes strategic connections to transportation and technical infrastructure, ensuring seamless access and functionality within the urban fabric.

b) Purpose of Use:

At the heart of this development lies the commitment to serve the needs of the community comprehensively. The block of flats is predicted as a permanent fixture, providing multi-family housing for up to 28 individuals across eight distinct residential units.

c) Permanent or Temporary Construction:

In line with its enduring role within the community, the block of flats is designed as a permanent structure. Its architectural and structural elements are engineered for longevity, ensuring enduring comfort and functionality for generations to come.

d) Permitting Exemptions and Barrier-Free Design:

Stringent adherence to regulatory standards is a cornerstone of this project. The design meticulously aligns with Decree No. 268/2009 Coll. on technical requirements for buildings, with no exemptions sought or permitted. Furthermore, special attention is given to barrier-free design principles, as mandated by Decree No. 398/2009 Coll., ensuring equitable access for all residents, particularly for the healthcare facility component.

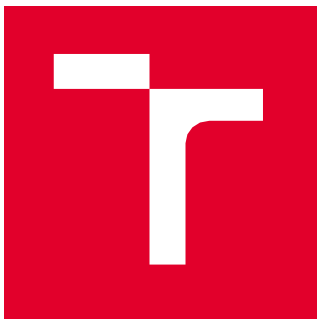
e) Compliance with Binding Opinions:

The project's commitment to regulatory compliance extends to the incorporation of all binding opinions from relevant authorities. These opinions, integral to ensuring safety, functionality, and legal conformity, are meticulously integrated into the project documentation, setting the stage for seamless execution during the construction phase.

f) Building Protection:

While the project stands as a testament to architectural innovation and community development, it does not necessitate additional protection measures

under prevailing legal regulations. This underscores the meticulous planning and design efforts undertaken to ensure structural integrity, safety, and compliance with all regulatory requirements.



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3.Technical report

BACHELOR'S THESIS

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AUTHOR — Vedat Demirkiran

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BRNO 2024

3.Technical Report

Identification of the building

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Place of the building: Brno-Komin

Cadastral area: Komín [610585]

Parcel number: 2547/7

LV numbers: 5163

Aim of the object: Building for longterm living

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Built-up area:472.17 m2

Number of flats:8

3.1. Architectural and Construction Solutions

a) Purpose of the Object:

The residential building, designed for long-term living, aims to accommodate 28 individuals while offering optimal comfort within the financial constraints of the investor.

b) Layout Solution:

The structure boasts a semi-rectangular design, extending across four stories plus an underground level. The first and second floors feature three flats each, while the third and fourth floors house one flat each, complete with a terrace. Each level is interconnected by a central staircase and elevator situated within a shared corridor.

On the first floor, accessible from the north, there is a flat comprising a corridor, a terrace, three bedrooms, two closets, a bathroom, a toilet, and a living room with an integrated kitchen. Additionally, this floor accommodates a technical room and a room for bikes and baby carriages, each with its separate entrance.

The second flat on this floor includes a corridor, a terrace, a bedroom, closets, a bathroom with a toilet, and a living room with a combined kitchen. The third flat features a corridor, a bathroom, a toilet, a living room with a kitchen, and a terrace.

Moving up to the second floor, there are two flats connected by a corridor, each boasting a balcony, three bedrooms, two closets, a bathroom, a toilet, and a living room with an integrated kitchen. Another flat on this floor offers a corridor, a bathroom, a toilet, a living room with a kitchen, and a balcony.

The third floor houses a flat with two corridors, four bedrooms, a bathroom, a toilet, and a spacious living room with a kitchen and a terrace.

Ascending to the fourth floor, there is a flat featuring a corridor, two bedrooms, a toilet, a bathroom, a terrace, and a kitchen with a living room. The roof floor is designed with a green-roof composition, while all terraces are constructed with Lindner concrete blocks suspended on pedestals. Beneath them, a sloped roof composition ensures efficient drainage of rainwater away from the building.

c) Barrier-Free Use of the Building:

Compliance with Decree No. 398/2009 Coll. ensures barrier-free access, with the main door level with the exterior pavement.

d) Architectural Material Solution:

The building boasts a rectangular shape, with a facade finished in white silicon-based plaster. The highest point of the attic is at +12.630m above the 1st floor level. Openings in the perimeter wall are fitted with wood-aluminum windows and doors and secured by lintels above. A flat green roof is present in the building. The area surrounding the building is consists of pavement.

3.2. Building Construction Solutions

a) Construction solutions:

The building's foundation is a critical component of its structural integrity, providing the necessary support to withstand the loads imposed by the entire structure. It is meticulously designed with bearing footings aligned along a reinforced concrete wall, strategically positioned on the underground floor. This foundation design ensures stability and durability, anchoring the building firmly to the ground. Descending into the basement level, one encounters the strong

presence of monolithic reinforced concrete walls and partitions. These elements serve multiple functions, acting as load-bearing structures while also depicting various areas within the basement space. Their solid construction not only contributes to the overall strength of the building but also provides essential support for the floors above. Ascending through the floors, from the first to the fourth level, attention is drawn to the meticulous craftsmanship evident in the construction of exterior and load-bearing walls. These walls are meticulously erected using Porotherm 30 and Porotherm 25 blocks, carefully chosen for their superior strength and thermal insulation properties. By utilizing these high-quality building materials, the structure ensures both structural stability and energy efficiency, crucial considerations in modern construction practices. Moreover, partition walls are strategically integrated into the building's layout, defining individual spaces while maintaining structural integrity. These walls not only serve practical purposes by tracing rooms and areas but also contribute to the overall strength and stability of the structure. A defining feature of the building is its green flat roof, carefully engineered to provide both functional and aesthetic benefits. Crafted with a monolithic reinforced slab, this roofing system offers strong protection against the elements while also creating an inviting outdoor space. The incorporation of insulation materials within the roof structure enhances thermal performance, promoting energy efficiency and comfort within the building. Additionally, the implementation of the EPS ETICS system further elevates the building's insulation capabilities, ensuring optimal thermal comfort for its occupants throughout the year. In summary, the meticulous construction of the building's foundation, walls, and roofing system reflects a commitment to quality, durability, and sustainability. By utilizing innovative building materials and techniques, the structure not only meets the highest standards of construction but also prioritizes the comfort and well-being of its occupants.

b) Description of the Designed Structural System:

Masonry wall construction system.

c) Designed materials and main structural elements:

c.1) Earthworks

Before commencing with the earthworks, it is imperative to conduct a thorough assessment of the existing underground networks to ensure no interference or damage during excavation. Additionally, it is crucial to note the absence of groundwater in the vicinity of the excavation area, mitigating any potential adverse effects on the earthworks process. The initial step involves the removal of the topsoil layer, typically ranging between 200-300 mm in thickness.

This topsoil, once excavated, is carefully stored in a designated landfill area on the property, ensuring proper disposal and adherence to environmental regulations. Following the removal of the topsoil, precise measurements of the building's position and height are taken to guide the subsequent excavation process accurately. Excavations are then initiated using specialized machinery, allowing for efficient and controlled digging of the designated areas. Before proceeding with the concreting of the foundation strips, meticulous preparation and cleaning of the excavated areas are essential. This involves removing any debris, rocks, or other obstacles that may impede the construction process. Additionally, proper leveling of the excavation site is ensured to facilitate seamless installation of the foundation strips. Overall, adherence to these meticulous earthworks procedures is paramount to laying a solid foundation for the construction project, ensuring structural integrity and longevity in line with Czech construction standards and regulations.

c.2) Foundations

The solution is realized with foundation strips made of reinforced concrete C30/37 with B500B steel to a depth of 400 mm. Before concreting the foundations, penetrations will be left in the foundations in accordance with the requirements for engineering equipment and such. After the soil has been compacted in the space between the foundation strips, a base concrete slab of C30/37 thick concrete is created with reinforced mesh.

c.3) Waterproofing of the substructure

The waterproofing for the substructure will utilize modified S-type asphalt strips reinforced with a glass fabric insert. These strips will be applied by melting and welding them with a hot flame, ensuring a minimum overlap of 100 mm to maintain a strong seal. Prior to laying these asphalt strips, the concrete base will be treated with an asphalt penetrating coating to enhance adhesion and waterproofing effectiveness.

For the vertical edges, a single layer of the asphalt strip will be used. Before applying this strip, the surface will also be treated with an asphalt penetrating coating to ensure proper bonding and waterproofing. The vertical waterproofing will extend 200-300 mm above ground level to protect against soil contact and potential moisture infiltration. This elevation ensures that the waterproofing

remains effective even when the soil is in direct contact with the wall, preventing water from penetrating the structure.

c.4) Vertical load bearing structures and partitions

The vertical load-bearing perimeter structures are constructed using Porotherm 30 P10 masonry blocks, each measuring 247 x 249 x 300 mm. These blocks are assembled using a thin-layer masonry technique with 921 cement mortar glue, ensuring strong and precise bonding. On the exterior side of these perimeter walls, an external thermal insulation system will be applied. This system will utilize Isover Eps Greywall Plus boards, which are 140 mm thick, to provide effective insulation.

For the internal load-bearing walls, Porotherm 25 AKU P15 masonry blocks are used. These blocks have dimensions of 330 x 249 x 250 mm and are also bonded with 921 cement mortar glue. This method ensures robust and durable internal walls, contributing to the overall structural integrity and sound insulation of the building.

c.5) Lintels

The translations refer to the use of the same Porotherm profiles in areas below the ceiling structure, maintaining consistency in the masonry materials throughout the building. For the lintels above internal openings, prefabricated Porotherm lintels are utilized, providing ready-made solutions that integrate seamlessly with the masonry blocks.

In the basement, however, the lintels for the garage doors are constructed differently. These are made from monolithic reinforced concrete, which is cast in place to provide the necessary strength and support for the larger openings, ensuring durability and stability in areas subjected to higher loads.

c.6) Ceiling construction

The ceiling structures are made of C30/37 reinforced concrete. In the third and fourth floors there are beams which are supporting the load-bearing capacity of the structure.

c.7) Stair construction

The staircase is a stringer type. It is made of precast concrete which is mechanically anchored to the flooring structure and the ceiling structure on the second floor. The staircase is 1100 mm wide, the step height is 173mm and the width is 260mm, the number of steps is 17 for each floor.

c.8) Flat roof

The building features a flat roof constructed with a traditional layering system. The supporting structure is composed of a reinforced concrete slab and beams, ensuring the roof's stability and strength. Initially, the concrete surface is treated with a penetrating asphalt coating, which is then covered with a vapor barrier made from a modified S-type asphalt strip reinforced with a glass fabric insert. This barrier is fused to the asphalt coating, ensuring a secure and effective seal.

Next, slope wedges are installed at the corners to facilitate proper drainage. On top of these wedges, a layer of thermal insulation made from 200 mm thick EPS stone wool Isover Intense is placed, providing excellent thermal efficiency. This insulation layer is then covered with a waterproofing system consisting of two layers of modified asphalt, each 4 mm thick. The individual strips of asphalt are welded together using hot air, and the joints are sealed with a special grout to ensure watertightness. This waterproofing layer is both mechanically anchored and melted into place, as it supports a green roof above it.

The roof drainage system includes two-stage TOPWET roof drains equipped with inspection chambers, ensuring efficient water removal. Additionally, safety overflows are installed to prevent water accumulation in case one of the drains fails. Safety anchor points are also present on the roof to protect individuals from falls while performing maintenance or other tasks. It is crucial that all components of the roof are installed and maintained according to the manufacturer's instructions, relevant regulations, standards, and project documentation to ensure the roof's integrity and safety.

c.9) Interior finish

The masonry walls and ceilings are finished with a 10 mm thick layer of lime-gypsum plaster. This plaster is applied to create a smooth and even surface. Once the plaster is in place, the surfaces of the walls, including the front walls, are thoroughly sanded to achieve a fine finish.

After sanding, all surfaces are treated with a penetrating primer to enhance adhesion and durability. Following the primer, a silicate coating is applied in two layers, providing a robust and long-lasting finish that protects the surfaces and enhances their appearance.

c.10) Floors

The leveling layer for the floors is made of cement screed, providing a smooth and even base. The floors are insulated with a single layer of EPS Isover Rigifloor

4000 thermal insulation, which is 40 mm thick. To prevent stress and accommodate movement, a 10 mm thick expansion tape is used to separate the floors from vertical structures.

The tread layer, which is the topmost layer people walk on, is finished with either ceramic tiles or laminate flooring, depending on the area. In the corners of the rooms, skirting boards are installed to cover the joint between the walls and the floor, giving a neat finish. Additionally, thresholds are used at transitions between laminate flooring and ceramic tiles to ensure a smooth and secure transition between different flooring types.

d) Building Physics

The building is designed to meet the requirements in terms of building physics. Building physics is dealt with in a separate part of this project documentation in Appendix No. 6.

e) Fire safety solution principles

The building is designed to meet fire protection requirements. The fire safety solution is part of this project documentation in Appendix No. 5.

f) Verification of the quality of materials used and construction

Only materials specified in the project documentation and approved by the main designer will be used for the construction. Additionally, all materials must have a valid certified declaration of properties to ensure their quality and compliance with standards. The overall construction quality will be regularly inspected according to agreed schedules by the designer, the investor's technical supervision, and the builder. All construction work must be carried out by qualified and trained professionals in their respective fields, ensuring that the work is performed to the highest standards and in accordance with their expertise.

g) Description of non-traditional technological procedures and special requirements for the construction and quality of the designed products

During construction, the technological procedures outlined by the designer will be strictly adhered to. This includes paying special attention to specific details such as the installation of windows and the construction of parapet walls. Following these detailed guidelines ensures that the construction meets the design specifications and maintains high standards of quality and accuracy.

h) Determination of the required inspections of covered constructions and possible inspection measurements and tests, if they are beyond the scope of the mandatory tests established by the relevant regulations and standards:

Inspections beyond the range of mandatory inspections are not required.

In Brno, May 2024

Vedat Demirkiran

4. CONCLUSION

Throughout my Bachelor's thesis journey, I've been busy in the world of civil engineering, focusing particularly on the concrete and masonry structures, all the while employing the Building Information Modeling (BIM) method. Under the guidance of my thesis supervisor, I embarked on the challenging task of conceptualizing and designing a block of flats, paying keen attention to the complex details of the BIM methodology.

My exploration into architectural design has been thorough and methodical, with a primary emphasis on crafting the layout and load-bearing structure of the building while considering its integration within the surrounding landscape. The project's expansive scope aligns closely with ordinance No. 499/2006 Coll., ensuring strict adherence to regulatory standards and requirements.

Key components of the project include accurate site plans, detailed foundation designs, comprehensive floor plans, roofing structures, detailed vertical sections, precise elevations, and thorough assembly details, among others. Moreover, thermal and acoustic assessments have been conducted to ensure compliance with nearly-zero energy requirements, underscoring the project's commitment to sustainability and energy efficiency.

In addition, the electronic version of the project features a visually appealing A1-sized poster showcasing key information, detailed schemes, and an immersive 3D model, thereby enhancing accessibility and visual representation. Throughout the project, I've been diligent in adhering to proper citation protocols outlined in ČSN ISO 690.

In summary, this thesis has been an enriching experience, providing me with invaluable insights into architectural design and engineering. It has equipped me with practical skills in project management, critical thinking, and problem-solving, paving the way for meaningful contributions to the development of residential and healthcare spaces that prioritize energy efficiency, user comfort, and regulatory compliance.

5.LIST OF SOURCES USED

The valid legislation, i.e., decrees and standards, were used to process the assessment of the project.

Act No. 183/2006 Coll. on spatial planning and building regulations (Building Act)

Act No. 406/2000 Coll. on energy management (amended by Act No. 3/2020 Coll.)

Decree No. 499/2006 Coll. on documentation of buildings (amended by Decree No. 62/2013 Coll., No. 405/2017 Coll.)

Decree No. 268/2009 Coll. on technical requirements for buildings (amended by Decree No. 20/2012 Coll., No. 323/2017 Coll.)

Decree No. 78/2013 Coll. on the energy efficiency of buildings (amended by Decree No. 230/2015 Coll.)

Government Regulation No. 272/2011 Coll. on health protection against the adverse effects of noise and vibrations, as amended

ČSN 73 0540-1:2005 Thermal protection of buildings – Part 1: Terminology

ČSN 73 0540-2:2011 + Z1:2012 Thermal protection of buildings – Part 2: Requirements

ČSN 73 0540-3:2005 Thermal protection of buildings – Part 3: Design values of quantities

ČSN 73 0540-4:2005 Thermal protection of buildings – Part 4: Calculation methods

ČSN EN ISO 10077-1:2019 Thermal behavior of windows, doors, and shutters - Calculation of the heat transfer coefficient - Part 1: General

ČSN EN ISO 10077-2:2019 Thermal behavior of windows, doors, and shutters - Calculation of the heat transfer coefficient - Part 2: Calculation method for frames

ČSN 73 0532:2010 Acoustics – Noise protection in buildings and related acoustic properties of building products – Requirements

ČSN EN ISO 717-1:2013 Acoustics – Evaluation of sound insulation of building structures and in buildings – Part 1: Air sound insulation

ČSN EN ISO 717-2:2013 Acoustics – Evaluation of sound insulation of building structures and in buildings – Part 2: Impact sound insulation

ČSN EN ISO 12354-1:2018 Building acoustics - Calculation of the acoustic properties of buildings from the properties of building elements - Part 1: Air sound insulation between rooms

ČSN EN ISO 12354-2:2018 Building acoustics - Calculation of the acoustic properties of buildings from the properties of building elements - Part 2: Impact sound insulation between rooms

ČSN EN ISO 12354-6:2004 Building acoustics - Calculation of the acoustic properties of buildings from the properties of building elements - Part 6: Sound absorption in closed spaces

ČSN 73 0525:1998 Acoustics – Design in the field of spatial acoustics – General principles

ČSN EN 17037:2019 Daylighting of buildings

ČSN 73 0580-1:2007 Daylighting of buildings – Part 1: Basic requirements as amended Z3:2019

ČSN 73 0580-2:2007 Daylighting of buildings – Part 2: Daylighting of residential buildings, as amended Z1:2019

Law and other regulation:

Law No. 320/2015 CL., about the FRC in the Czech Republic

Law No. 133/1985 CL, fire protection law in amendments

Regulation No. 23/2008 CL, technical requirements of fire safety of buildings in amendment No. 268/2011 CL., about technical conditions of fire safety of buildings

Regulation about fire prevention

Regulation No. 246/2001 CL, determines requirements fire safety and performance of state fire supervision – regulation about fire prevention (about the determination of the conditions of fire safety and the performance of state fire supervision)

Reg. No. 268/2009 CL., about technical requirements of constructions

Reg. 499/2006 CL about building documentation – fire safety solution of building

Standards CSN:

ČSN 73 0810 – FPB –General requirements

ČSN 73 0802 – FPB – Non-industrial buildings

ČSN 73 0818 – FPB – Person surface rate in buildings

ČSN 73 0835 – FPB – Buildings for sanitary maters and social care

ČSN 73 0872 – FPB – Protection of buildings to extension of fire by air distributing equipment (standard for ventilation)

ČSN 73 0873 – FPB – Equipment for fire-water supply

ČSN 73 0821, ed. 21 – FPB – Fire resistance of engineering structures

ČSN 73 4200 – Chimneys – General requirements

ČSN 73 4201 – Chimneys and flues

ČSN 06 1008 – Fire safety of thermal equipment

ČSN 01 3495 – Construction drawings in fire safety of buildings

Other sources

Zoufal and coll.: Values of structure's fire resistance according to the EC technical data sheets

Lectures from last years.

Internet sources

KM Beta - český výrobce pro hrubou stavbu | KM Beta

TZB-info - Stavebnictví. Úspory energií. Technická zařízení budov.

ISOVER - Jistota v izolacích | Isover

Fasády, omítky, stěrky, zateplení, podlahy, hydroizolace - Cz.Weber

Porotherm – masonry, wienerberger

Systems for drainage of flat roofs – TOPWET

ČÚZK

DEKSOFT

BimTech Tools

6. LIST OF ABBREVIATIONS AND SYMBOLS USED

approx.	Approximately
cm	Centimeter
Coll.	Collocation
ČSN	Czech technical standard
ČSN EN	Adopted European standard
EPS	Expanded polystyrene
XPS	Extruded polystyrene
ETICS	External Thermal Insulation Composite System
FC	Fire compartment
km	Kilometer
m	Meter
max	Maximal
min	Minimal
mm	Millimeter
No.	Number
Pcs.	Pieces
PE	Polyethylene
RC	Reinforced concrete
S-JTSK	System of a unified cadastral trigonometric network
Th.	Thickness
MGC	main gas closure
EK	electrical box
RS	revision shaft
RB	rainwater infiltration box

7. List of Annexes

FOLDER NO. 1 – PREPARATORY AND STUDY WORKS

1.01 STUDY OF UNDERGROUND FLOOR

1.02 STUDY OF FIRST FLOOR

1.03 STUDY OF SECOND FLOOR

1.04 STUDY OF THIRD FLOOR

1.05 STUDY OF FOURTH FLOOR

FOLDER NO. 2 – C SITUATION DRAWINGS

C.1 CADASTRAL SITUATION DRAWING

C.2 COORDINATION SITUATION DRAWING

FOLDER NO.3 – D.1.1 ARCHITECTURAL STRUCTURAL SOLUTION

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D.1.02 FIRST GROUND FLOOR PLAN

D.1.03 SECOND GROUND FLOOR PLAN

D.1.04 THIRD GROUND FLOOR PLAN

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D.1.06 EAST VIEW

D.1.07 WEST VIEW

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FOLDER NO.4 – D.1.2 BUIDLING CONSTRUCTION SOLUTION

D.1.2.01 FOUNDATION PLAN

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D.1.2.03 FLOOR SLAB ABOVE THE FIRST FLOOR

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D.1.2.07 ROOF PLAN

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D.1.2.11 DETAIL 2

D.1.2.12 DETAIL 3

FOLDER NO.5 – D.1.3 FIRE SAFETY SOLUTION

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D.1.3.06 SITE PLAN

5.01 FIRE SAFETY REPORT

FOLDER NO.6 – BUILDING PHYSICS

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6.03 - A3 DAYLIGHTING AND SUN EXPOSURE ASSESSMENT