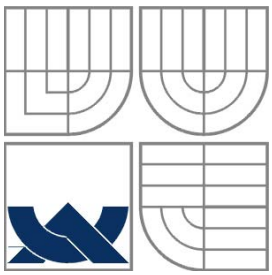

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INSTITUTE OF BUILDING STRUCTURES

LOW-ENERGY BLOCK OF APARTMENTS

LOW-ENERGY BLOCK OF APARTMENTS

DIPLOMOVÁ PRÁCE
DIPLOMA THESIS

AUTOR PRÁCE — Bc. MICHAL REITER
AUTHOR

VEDOUCÍ PRÁCE — doc. Ing. SEDLÁK JIŘÍ, CSc.
SUPERVISOR

BRNO 2015

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Studijní program	N3607 Civil Engineering
Typ studijního programu	Navazující magisterský studijní program s výukou v anglickém jazyce s prezenční formou studia
Studijní obor	3608T001 Pozemní stavby
Pracoviště	Ústav pozemního stavitelství

ZADÁNÍ DIPLOMOVÉ PRÁCE

Diplomant	Bc. Michal Reiter
Název	Low-energy block of apartments
Vedoucí diplomové práce	doc. Ing. Jiří Sedlák, CSc.
Datum zadání diplomové práce	31. 3. 2014
Datum odevzdání diplomové práce	16. 1. 2015

V Brně dne 31. 3. 2014

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

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

Podklady a literatura

Studie dispozičního řešení novostavby bytového domu v nízkoenergetickém standardu, katalogy a odborná literatura, Stavební zákon č. 183/2006 Sb., Zákon č. 350/2012 Sb., Vyhláška č. 499/2006 Sb., Vyhláška č. 62/2013 Sb., Vyhláška 268/2009 Sb., Vyhláška 398/2009 Sb., platné ČSN, směrnice děkana č. 19/2011 a dodatky.

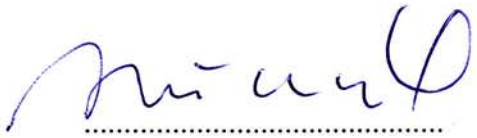
Zásady pro vypracování (zadání, cíle práce, požadované výstupy)

Zadání VŠKP: Projektová dokumentace stavební části k provedení novostavby bytového domu v nízkoenergetickém standardu.
Cíl práce: vyřešení dispozice pro daný účel, návrh vhodné konstrukční soustavy, nosného systému a vypracování výkresové dokumentace včetně textové části a příloh podle pokynů vedoucího práce. Textová i výkresová část bude zpracována s využitím výpočetní techniky. Výkresy budou opatřeny jednotným popisovým polem a k obhajobě budou předloženy složené do desek z tvrdého papíru potažených černým plátnem s předepsaným popisem se zlatým písmem. Dílčí složky formátu A4 budou opatřeny popisovým polem s uvedením seznamu příloh na vnitřní straně složky.
Požadované výstupy dle uvedené Směrnice:
Textová část VŠKP bude obsahovat kromě ostatních položek také položku h) Úvod (popis námětu na zadání VŠKP), položku i) Vlastní text práce (textová část projektové dokumentace dle vyhlášky č. 499/2006 Sb. ve znění vyhlášky 62/2013 Sb.) a položku j) Závěr (zhodnocení obsahu VŠKP, soulad se zadáním, změny oproti původní studii).
Příloha textové části VŠKP v případě, že diplomovou práci tvoří konstruktivní projekt, bude povinná a bude obsahovat výkresy pro provedení stavby (technická situace, základy, půdorysy řešených podlaží, konstrukce zastřešení, svislé řezy, pohledy, detaily, výkresy sestavy dílců popř. výkresy tvaru stropní konstrukce, specifikace, tabulky skladeb konstrukcí – rozsah určí vedoucí práce), zprávu požární bezpečnosti, energetické hodnocení budovy ENB, stavebně fyzikální posouzení stavebních konstrukcí včetně zadané specializované části. O zpracování specializované části bude rozhodnuto vedoucím DP v průběhu práce studenta na zadaném tématu.

Struktura bakalářské/diplomové práce

VŠKP vypracujte a rozčleňte podle dále uvedené struktury:

1. Textová část VŠKP zpracovaná podle Směrnice rektora "Úprava, odevzdávání, zveřejňování a uchovávání vysokoškolských kvalifikačních prací" a Směrnice děkana "Úprava, odevzdávání, zveřejňování a uchovávání vysokoškolských kvalifikačních prací na FAST VUT" (povinná součást VŠKP).
2. Přílohy textové části VŠKP zpracované podle Směrnice rektora "Úprava, odevzdávání, zveřejňování a uchovávání vysokoškolských kvalifikačních prací" a Směrnice děkana "Úprava, odevzdávání, zveřejňování a uchovávání vysokoškolských kvalifikačních prací na FAST VUT" (nepovinná součást VŠKP v případě, že přílohy nejsou součástí textové části VŠKP, ale textovou část doplňují).



doc. Ing. Jiří Sedlák, CSc.
Vedoucí diplomové práce

Abstrakt
Diplomová práce se zabývá vypracováním projektové dokumentace čtyřpodlažního nízkoenergetického bytového domu s plochou střechou ve stupni pro realizaci stavby. Jedná se o nepodsklepenou stavbu s hromadnou garáží v prvním nadzemním podlaží. Stavba je navržena s důrazem na celkovou energetickou úspornost, která je doložena podrobným energetickým výpočtem náročnosti budovy podle vyhlášky č.78/2013 Sb. a ČSN 73 0540-2.

Klíčová slova
nízkoenergetický bytový dům hromadná garáž vápenopískové zdivo monolitické stropní desky Olomouc stavební fyzika

Abstract
Diploma thesis is aimed on solution of project documentation design of a four-storey low-energy block of apartments with a flat roof in the degree of project realization. The object has a collective garage on first floor and no basement. The structure is designed with the emphasis on overall energy saving, which was documented by detailed calculation of the energy performance of the building under Decree No.78 / 2013 Coll. and ČSN 73 0540-2.

Keywords
low-energy block of apartments collective garage lime-sand masonry monolithic ceiling slabs Olomouc building physics energy efficient
…

Bibliografická citace VŠKP

Bc. Michal Reiter *Low-energy block of apartments.* Brno, 2015. 145 s., 152 s. příl. Diplomová práce. Vysoké učení technické v Brně, Fakulta stavební, Ústav pozemního stavitelství. Vedoucí práce doc. Ing. Jiří Sedlák, CSc.

Prohlášení:

Prohlašuji, že jsem diplomovou práci zpracoval(a) samostatně a že jsem uvedl(a) všechny použité informační zdroje.

V Brně dne 16.1.2015

.....

podpis autora
Bc. Michal Reiter

PROHLÁŠENÍ O SHODĚ LISTINNÉ A ELEKTRONICKÉ FORMY VŠKP

Prohlášení:

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

V Brně dne 16.1.2015

.....

podpis autora

Bc. Michal Reiter

Acknowledgements
I would like to express thanks to supervisor of my diploma thesis doc. Ing. Jiří Sedlák, CSc. for proper leading and supervision, patience and helpful advices during consultation.
Poděkování:
Tímto bych rád poděkoval vedoucímu mé diplomové práce doc. Ing. Jiřímu Sedlákovi, CSc. za jeho vlídné vedení, podporu a cenné připomínky při konzultacích.

INTRODUCTION:

This diploma thesis deals with design of new residential building in low-energy standard. Residential building is located in the southern part of a city Olomouc, at the cadastral area of Povel. The object has three residential floors, collective garage in the first floor and it is without basement. The building shape is rectangular with warm flat roof. Designed number of flats is 10.

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INSTITUTE OF BUILDING STRUCTURES

A - ACCOMPANYING REPORT

DIPLOMOVÁ PRÁCE
DIPLOMA THESIS

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AUTHOR

VEDOUCÍ PRÁCE — doc. Ing. SEDLÁK JIŘÍ, CSc.
SUPERVISOR

BRNO 2015

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A ACCOMPANYING REPORT

A.1 IDENTIFICATION

A.1.1 INFORMATION ABOUT CONSTRUCTION

Name of the structure:	LOW-ENERGY BLOCK OF APARTMENTS
Stage of the documentation:	Study and realisation project
Investor and landowner:	Pavel Kotěra
Address:	Slavonínská 482/22, Olomouc
Plot number:	88/3, k.ú. Olomouc - Povel

A.1.1 INFORMATION ABOUT APPLICANT

Investor and applicant:	Pavel Kotěra
Address:	Stupkova 22, 779 00 Olomouc, Czech Republic
Telephone number:	+420 728 26 99 88
E-mail address:	kotera@gmail.com

A.1.2 INFORMATION ABOUT DOCUMENTATION REALISER

Name:	Bc. Michal Reiter
Identification number:	123456789
Address:	Mošnerova 17, 77900 Olomouc, Czech Republic
Telephone number:	+420 728 878 889
E-mail address:	michal.reiter@seznam.cz

A.2 SOURCES

Cadastral maps: ČZÚK (http://geoportal.cuzk.cz)
Copy of regulatory plan
Report – radon in subsoil (Česká geologická služba - http://www.geology.cz)
Report – overview of geological risks (Česká geologická služba - http://www.geology.cz)
Geotechnical report

A.3 INFORMATION ABOUT BUILDING SITE

a) The object is located in a residential zone in a municipal part Olomouc-Povel in the southern part of Olomouc. The building plot number 88/3, (cadastral Olomouc-Povel) have area 1579 m^2. Entry to the building plot is located on the northern part from the street Slavonínská.
b) The project has been based on an architectural study and has been made in accordance with the urban regulatory plan of Olomouc.
c) The concerned area is not located in protected area or zone; it is not part of cultural or historical heritage and it is not located in floodplains.
d) The plot in most areas only slightly sloped, contains a number of grassy areas that allow infiltration of rainwater. Both sanitary waste water service pipe and rainwater drainage will be connected to the existing combined sewer main in the neighbouring road.
e) The building is in accordance with the common building development and territorial planning documentation.
f) General requirements for usage of the area will be satisfied.
g) Exceptions and reliever solutions are not known.
h) Related and conditional investments are not known.
i) The plot is situated in the city urban area of Olomouc. Purpose of the parcels is building of the low-energy blocks of apartments. At present time the plot is a free place prepared for the building up. Plot is in the ownership of the submitter. Parking of the personal vehicles of the residents will be solved from the part inside of the building and from the part on the parking places located in front of the building.

A.4 INFORMATION ABOUT CONSTRUCTION

a) The project is a new building.
b) The concerned building serves as a residential building.
c) Building is a permanent structure.
d) It is a new building; there is no historical or cultural value.
e) The building is designed in accordance with technical standards and legal regulations valid at the time of preparation of documentation.
f) Requirements and comments to the construction by the authorities concerned have been incorporated into the documentation for building permit proceedings.

g) There are not proposed any exceptions or reliever solutions.

h)

Gross floor area:	1st floor:	349,3 m^2
	2nd floor:	363,4 m^2
	3rd floor:	363,4 m^2
	4th floor:	363,4 m^2
	Total:	1439,5 m^2
Net internal area:	1st floor:	313,2 m^2
	2nd floor:	294,6 m^2
	3rd floor:	294,6 m^2
	4th floor:	294,2 m^2
	Total:	1196,6 m^2
Built-up area:	362 m^2	
Height of the attic:	+ 12,600 m = 264,800 m a.s.l.	
No. of dwellings:	10	
No. of persons:	24	
No. of garages:	7	
No. of parking places outside:	10	

i) Building will be connected to the following utility lines:

a. Combined building sewerage

b. Heat distribution

c. Power connection

d. Water supply

j) Basic information about construction process:

Term of beginning of the construction will be determined by the investor.

Expected time for realization: 12 months

k) Approximate cost of the construction: 12 000 000 CZK

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B - SUMMARY TECHNICAL REPORT

DIPLOMOVÁ PRÁCE
DIPLOMA THESIS

AUTOR PRÁCE — Bc. MICHAL REITER
AUTHOR

VEDOUCÍ PRÁCE — doc. Ing. SEDLÁK JIŘÍ, CSc.
SUPERVISOR

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B SUMMARY TECHNICAL REPORT

B.1 DESCRIPTION OF CONSTRUCTION SITE

a) The object is located in a residential zone in a municipal part Olomouc-Povel in the southern part of Olomouc. The building plot number 88/3, (cadastral Olomouc-Povel) have area 1579 m^2. Entry to the building plot is located on the northern part from the street Slavonínská.

b) There has been an expert evaluation on the geological state on the plot carried out. The foundation state is defined as simple. A specialized report on this problematic is a part of the project documentation.

c) The building is not located in a conservation area. Therefore, there was no need to carry out historical or archaeological surveys.

d) There is no threat of landslides or earthquakes in the building area. No special precautions related to mining need to be taken into account. The location is not flood area.

e) The building is located entirely within the building plot. During the construction process a building company must follow obligatory rules concerning the protection of the environment and neighbouring properties. Owners of neighbouring plots do not have any requirements or further comments regarding the construction process, building itself and its future use.

f),g) Before the start of the construction work, topsoil will be removed according to the documentation under the building. Original plants are self-seeded and there is no need for protection. There will be new vegetation planted according to situation drawings made by a garden architect. General requirements for usage of the area will be satisfied.

h) There are utility lines under neighbouring roads. The concerned authorities have permitted connections and they are solved in an attached situation drawing. Used utility lines are water supply, sewerage, electricity and gas supply. Both parking lots and garage entry will be connected to existing transport infrastructure according to situation drawing.

i) The construction works will be carried out in continuously in term (including technological breaks). There are no known additional investments yet.

B.2 OVERALL DESCRIPTION OF THE CONSTRUCTION

B.2.1 PURPOSE OF THE CONSTRUCTION, BASIC CAPACITY OF THE STRUCTURE

The project design solves a low-energy block of apartments.
The object serves for two various purposes - in the 1st floor there is a garage with 7 parking lots for the residents, the 2nd, 3rd and 4th floor serves as a residential area consisting of 10 flat units.

No. of flat units:	10
No. parking places in garage:	7
No. parking places outside:	10

B.2.2 OVERALL URBAN AND ARCHITECTURAL SOLUTIONS

Urban solution

The area is intended for construction of dwelling structures so the proposed structured suffices the requirements. The structure is aligned with the nearby public road situated on the northern border of the building plot so it matches the overall logical situation of nearby structures. The building respects the street line given by the surrounding objects. According to the visage of neighbouring houses the roof is designed as a flat warm roof (in 2% slope). Concerning the urban solution the building was designed not to exceed the height of the surrounding buildings.

Architectonic solution

Residential building is designed as a four-storey building without basement. Compact rectangular shape of the building follows basic energy efficient principles of design with the living areas opened to south to maximize solar gains in the winter. Summer season over heating protection is provided both with shading using balcony slabs and outside aluminium sun-blinds on the southern, eastern and western facade.

Parking is available on the first floor of building. The garage has together 7 parking spaces. Furthermore, the first floor contains of bicycle and baby stroller room. The other three floors are divided into individual dwelling units. Total number of dwelling units is 10. Dwelling units are accessible through the main stairwell with an elevator shaft. The main stairwell provides also security escape way in case of fire.

B.2.3 OVERALL SOLUTION OF PRODUCTION FACILITIES

There are no production facilities in object.

B.2.4 BAREER-FREE USE OF THE CONSTRUCTION

The object is accessible with all floors by the elevator, the parking garage included. All the apartments' entry doors, main, elevator and parking garage doors are at least 900 mm wide which comply with requirements given by standards and recommendations.

B.2.5 SAFETY DURING BUILDING USAGE

The utilization of the building must comply with general mandatory rules.

B.2.6 BASIC STRUCTURAL CHARACTERISTICS

The construction of the first floor is made from monolithic reinforced concrete columns in combination with reinforced concrete walls and monolithic reinforced concrete ceilings with visible girders.

The upper structure load-bearing walls are made from lime-sand blocks that are insulated by ETICS system. All the load-bearing walls are finished with reinforced concrete wreath which is a part of the ceiling system. The ceilings are monolithic from reinforced concrete. The internal non-load-bearing walls are of two types – lime-sand and plasterboard partitions. In bathrooms and toilets there is suspended plasterboard ceiling.

The roof is designed as warm flat roof construction; load-bearing structure is from monolithic reinforced concrete slabs.

The building is founded on foundation strips under the load-bearing walls and also under the columns to preserve equal settlement of the whole structure.

The building is designed in such way, that the intended load acting during construction and usage will not cause: collapse of the building or of its part; higher degree of unacceptable deformation; damage of other parts of the building or of technical facilities or of installed equipment as a result of major deformation of the structure; damage in case, when its range is disproportionate to its original cause. Mechanical resistance and stability of the structures designed by this project documentation has to be assessed in detail in its part concerned by statics and constructions.

B.2.7 BASIC CHARACTERISTICS OF TECHNICAL FACILITIES

There are no production facilities in the object. Therefore, there is a one technical room for the whole object. In the technical room there are condensing boilers for the heat and hot water production. The boilers are intended to burn natural gas. The gas supply will be provided through connection to the public low pressure gas network.

B.2.8 FIRE SAFETY

The fire safety of the building is described in detail in a special part of this project documentation – in the fire safety report.

B.2.9 ENERGY SOLUTION

The standards – the building is designed in accordance with act No. 406/2000 Coll., about energy management and ČSN 73 0540-2 Z1 (2012). Compositions of constructions in contact with exterior are fulfilling required U-values (thermal loss coefficient) given by the standard.
There has been made an Energy label, which categorized the building as a class B (Uem = 0,26 W/m^{2}K) – efficient building. The energy label is a part of this project documentation.

Constructions – ČSN 73 0540-2 Z1 (2012) has stated required and recommended U-values in W/m^{2}K for different types of constructions. Also it is necessary to pay attention to construction details and their execution on the construction site. If there are instructions from a producer, they must be followed. Specified compositions are a part of this project documentation.

Construction	Required (recommended) coef. of heat transfer U (W.m-2.K-1)	Coef. of heat transfer U (W.m-2.K-1)	Evaluation
External walls	0,30 (0,25)	0,150	Satisfied
Floor above the ground	0,45 (0,30)	0,291	Satisfied
Ceiling from heated area to non-heated area	0,60 (0,40)	0,230	Satisfied
Wall from heated area to non-heated area	0,60 (0,40)	0,358	Satisfied
Flat roof construction	0,24 (0,16)	0,155	Satisfied
Building foot	0,30 (0,25)	0,294	Satisfied
Windows	1,50 (1,2)	0,730	Satisfied
Doors	1,70 (1,2)	0,730	Satisfied

Windows - are made by producer Slavona, the type is HA110, which has thermal average loss coefficient UW = 0,73 W/m²K. It is made of wood with aluminium cover and it has insulating triple glazing. It can be tilted or turned to ensure suitable type of ventilation. Specifications and ironwork can be found in list of windows, which is a part of this project documentation.

Equipment - there are condensing boilers for the heat and hot water production. The boilers are intended to burn natural gas. The gas supply will be provided through connection to the public low pressure gas network.

There are no alternative energy-sources used in this building.

B.2.10 HYGIENIC REQUIREMENTS

The building satisfies requirements given by act No. 183/2006 Coll., Building Law and by public notice No. 268/2009 Coll., about technical requirements for buildings – especially part three. Further the building satisfies ČSN 73 4301 and other valid standards and regulations. The project documentation fulfils relevant rules both for interior of the building and exterior influences of the building.

Ventilation – in apartments it is designed as natural, using infiltration and ventilation by openings. The garage on the 1st floor has natural ventilation ensured by ventilation grids of the dimensions 400x600 mm. Vapour and fume produced in kitchen is cleaned by kitchen extractor hood. Ventilation of toilets and bathrooms is over-pressure.

Air conditioning – cooling is not designed. The perimeter walls have good accumulation capacity and the roof has sufficient thermal insulation, therefore there is satisfactory temperature stability during year.

Heating – in the technical room there are condensing boilers for the heat and hot water production. The boilers are intended to burn natural gas. The gas supply will be provided through connection to the public low pressure gas network.

Daylighting – openings was designed provide sufficient light to all habitable rooms. Every window in apartments including French windows will have a possibility of shading by external window blinds.

B.2.11 PROTECTION AGAINST NEGATIVE ENVIRONMENTAL EFFECTS

Radon protection - RC slab over the foundations and asphalt waterproofing layer serve together as a sufficient protection against radon leakage as well.
Noise protection - is in accordance with the type of building, the massive masonry walls and the composition of the roof structure ensures that there is a sufficient airborne sound insulation of the building.

As concerns spreading of sound within the building, constructions must be done according to rules and recommendations from the producers. All floor structures in or above habitable rooms must have a layer of acoustic (impact) insulation. Layers above this insulation must be separated from walls by a mineral wool strip. Also the monolithic RC stair flights are separated from the slabs by HALFEN HTT units for the impact noise insulation.

Piping has to be bedded flexibly in relation to constructions to interrupt sound spreading within the construction. It is forbidden to wall up the piping without foam insulation. Piping leading through a floor structure must be separated from both concrete screed and the load-bearing construction below – these two constructions must not touch in any case.

B.3 TECHNICAL INFRASTRUCTURE

The building's gas supply will be connected to the public low-pressure gas supply located under the Slavonínská street. Proper openings in foundations must be manufactured for the network penetration.

The building's electricity supply will be connected to the low voltage public electric network located under the Slavonínská street.

The building's water supply will be connected to water main is located under the Slavonínská street. The service pipe leads to water meter shaft placed on the plot.

The building's sewerage system connection will be to the combined sewer main located under the Slavonínská street (sewage and rainwater together).

The solution of the connection to the network is only preliminary and will be defined in specialized project.

B.4 TRAFFIC SOLUTION

The building's driveway to garage as well as the parking places will be connected to the public road along the northern border of the plot to the Slavonínská street.

B.5 VEGETATION AND LANDSCAPING

The terrain will be flattened before initiation of the construction. There are no major landscaping changes, which can influence neighbouring buildings or geology of the area. There will be new vegetation planted according to situation drawings made by a garden architect.

B.6 ENVIRONMENTAL INFLUENCES AND PROTECTION

Waste produced during the construction works and during the usage of the building is being treated in compliance to act No. 185/2001 Coll., Waste Act, and must be categorized according to public notice No. 381/2001 Coll., and handled according to public notice No. 383/2001 Coll.

The production of waste can be divided to:

- Waste produced during the construction works – this kind of construction does not presume production of dangerous waste, requiring special care during liquidation. However common waste will be produced, it will be liquidated according to act No. 185/2001 Coll. by an authorized company. Glass and steel will be recycled, wood will be burned.
- Waste produced during the usage of the building – the purpose of the building does not deduce risk of production of dangerous waste. Waste production will be solved as is standard for a residential building. Storage of municipal waste will be placed according to the situation drawing.

B.7 PROTECTION OF INHABITANTS

The building meets the requirements according to the standards. The building services machinery must be operated by educated person only. The revision and cleaning of roof inlets must be processed by educated person only.

B.8 BUILDING WORKS ORGANIZATION

The building site and workplace will be taken over 20th June, 2015 between the investor and the contractor. There will be made up a site diary involving information about taking over the building site. All building works are supervised by site manager or mandated foreman. He is also checking volumes of earthworks in given places. It's necessary to keep demanded dimensions of excavations and compactions. Before the building works, the area has to be fenced.
The construction company has their own machinery and they will be responsible for their operation. Machinery is operated only by assigned and trained personnel. Before the beginning of construction works operating personnel will have checked technical status of all used machinery. All of the earthworks and construction works are executed at the area of the building site; hence there is no need to provide additional safety precautions.

The temporary connections to the electricity and water supple will be created.
There will also be created a storage area, units for foremen and construction supervisor and mobile WC on the building site. The crane works will be done with mobile crane.

There will be one entrance for machinery from the Slavonínská street. All machinery has to be cleaned before leaving the construction site.

If possible all soil from earthworks will be used on the site; the rest will be taken to a specified place.

Common waste produced before and during the construction works:

Code	**Name of waste**	**Origin**
17 01	Concrete, bricks, ceramics	Building works
17 02	Wood, glass, plastics	Building works, Vegetation
17 03	Bitumen and tar	Building works
17 04	Metals	Building works
17 05	Soil and rocks	Earthworks
17 06	Insulation materials	Building works
17 08	Gypsum based materials	Building works
17 09	Other building materials	Building works
20 03	Other municipal waste	Site facilities

In the vicinity of the construction site there are no buildings which are used by disabled persons and this function will be influenced or impossible during the built up process.
There are no other special requirements for the construction works.

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FACULTY OF CIVIL ENGINEERING
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D1.1 - TECHNICAL REPORT

DIPLOMOVÁ PRÁCE
DIPLOMA THESIS

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SUPERVISOR

BRNO 2015

Content

1. ARCHITECTONICAL AND CONSTRUCTIONAL TECHNICAL SOLUTION

1.1 TECHNICAL REPORT

a) Purpose of the object

The project design solves a low-energy block of apartments.
The object serves for two various purposes - in the 1st floor there is a garage with 7 parking lots for the residents, the 2nd, 3rd and 4th floor serves as a residential area consisting of 10 flat units.

b) Architectural solution

Residential building is designed as a four-storey building without basement. Compact rectangular shape of the building follows basic energy efficient principles of design with the living areas opened to south to maximize solar gains in the winter. Summer season over heating protection is provided both with shading using balcony slabs and outside aluminium sun-blinds on the southern, eastern and western facade. According to the visage of neighbouring houses the roof is designed as a flat warm roof (in 2% slope).

Object appearance is designed in a way not to have negative influence on the architectonical and urban concept of other objects with respect to the locality. Urban integration of the object is in accordance with the planed built-up of the locality.

The building can be accessed through the main entrance door of the width 1000mm in the 1st floor which are located on the northern side of the building. The entry for the vehicles is provided through the garage door Hörman Rollmatic of the width 4000 mm.

Parking is available on the first floor of building and also on the designed parking spots (10) outside. The garage has 7 parking spots. Furthermore, the first floor contains of bicycle and baby stroller room. The other three floors are divided into individual dwelling units. Total number of dwelling units is 10.

Dwelling units are accessible through the main stairwell with an elevator shaft. The main stairwell provides also security escape way in case of fire.

Each dwelling unit is equipped with bathroom and kitchen and enough storage space as visible in the architectonic part of the project documentation. Dwelling units on the eastern and western part of the building have also balconies.

c) Building areas, orientation, daylight, capacity

According to the land registry the area of the parcel is 1579 m^2.

Gross floor area:	1st floor:	349,3 m^2
	2nd floor:	363,4 m^2
	3rd floor:	363,4 m^2
	4th floor:	363,4 m^2
	Total:	1439,5 m^2
Net internal area:	1st floor:	313,2 m^2
	2nd floor:	294,6 m^2
	3rd floor:	294,6 m^2
	4th floor:	294,2 m^2
	Total:	1196,6 m^2
Built-up area:	362 m^2	
Height of the attic:	+ 12,600 m = 264,800 m a.s.l.	
No. of dwellings:	10	
No. of persons:	24	
No. of garages:	7	
No. of parking places outside:	10	

Compact rectangular shape of the building follows basic energy efficient principles of design with the living areas opened to south to maximize solar gains in the winter. Summer season over heating protection is provided both with shading using balcony slabs and outside aluminium sun-blinds on the southern, eastern and western facade.
The northern side of the building serves mainly for the technical rooms and the stairwell.

In all living areas are designed sufficiently large windows that provide the necessary room lighting. Critical rooms are assessed in a separate report of building physics.

d) Technical solution

Residential building is designed as a four-storey building without basement.

The construction of the first floor is made from monolithic reinforced concrete columns in combination with reinforced concrete walls and monolithic reinforced concrete ceilings with visible girders.

The upper structure load-bearing walls are made from lime-sand blocks that are insulated by ETICS system. All the load-bearing walls are finished with reinforced concrete wreath which is a part of the ceiling system. The ceilings are monolithic from reinforced concrete. The internal non-load-bearing walls are of two types – lime-sand and plasterboard partitions. In bathrooms and toilets there is suspended plasterboard ceiling.

Balcony slabs are connected with the monolithic ceiling through SCHOCK ISOKORB KXT system with incorporated 120 mm of thermal insulation eliminating thermal bridging from the external environment.

The roof is designed as warm flat roof construction; load-bearing structure is from monolithic reinforced concrete slabs. Attic is monolithic from reinforced concrete connected with the ceiling structure through ISOKORB A system with incorporated 60 mm of thermal insulation eliminating thermal bridging from the external environment.

The building is founded on foundation strips under the load-bearing walls and also under the columns to preserve equal settlement of the whole structure.

Assumed life-time of the building is 70 – 90 years.

e) Thermal assessment of constructions and openings, Acoustic assessment

Thermal and acoustic assessment is done in a separate report.

f) Foundations and related surveys

There has been an expert evaluation on the geological state on the plot carried out. The foundation state is defined as simple. A specialized report on this problematic is a part of the project documentation.

The building is founded on foundation strips under the load-bearing walls and also under the columns to preserve equal settlement of the whole structure.

g) Influence of object and its usage on environment, principles of construction organisation

In the given locality there are no protection zones of gas or electricity. The locality is not in the protected area or in the area with the characteristics of the national park. During an operation of the structure no danger emissions are produced. Emissions from road transport and usage of all technical devices, equipment and installation are minimal in compare with existing traffic in the municipal area. Areas around the considered building will be mostly affected by the quality of the overall development of air pollution in the municipality, not by realisation and usage the new block of apartments.
The construction will not have any significant influence on the environment and the possible influences during the construction will be eliminated as much as possible by the following precautions: protection of the underground water quality; protection of the air against gaseous pollutions and or excessive dustiness; protection of the travel traces and the other areas in the vicinity of the building site against polluting – if such pollution will occur the supplier of the building construction will be obliged to immediate removal of the pollutants and compensate the damage if occurred; keep the site in order and respect health and safety precautions according to the valid public notices.

Nevertheless there are rules for environment protection during construction works which must be followed. Above all it means protection of ground water against pollution, especially by oil products; protection of adjacent areas and roads against pollution, all vehicles must be cleaned before leaving the building site and all the transported material must be treated to minimize its uncontrolled spreading or leaking; protection against dangerous gases and odours; protection from dust and protection from noise and vibrations. The contractor will proceed during the construction works in compliance with public notice No. 272/2011 Coll., about health protection against negative effects of noise and vibration. He will ensure the limits given by this public notice will not be exceeded. Also he will use tools and machinery in appropriate technical condition. Loud machines can be placed in cells or other suitable closed spaces if necessary.

According to §4, act No. 100/2001 Coll., about assessment of environmental impacts, it is not necessary to evaluate impacts of the object to environment. Waste produced during the construction works and during the usage of the building is being treated in compliance to act No. 185/2001 Coll., Waste Act, and must be categorized according to public notice No. 381/2001 Coll., and handled according to public notice No. 383/2001 Coll.

During the earth-works the topsoil will be stored on the given area on the parcels and the rest of the soil will be moved to the temporal repository or to the heap. During the construction the containers for the storage of the waste and rubble will be placed out of the public areas and the rubble will be continuously moved away to the heap of the rubble.

There will be forbidden polluting by the waste water, surface wash outs on the site, especially on the place that will be polluted by the oils or crude oil products (e.g. from leaking tank of the trucks or the working machines). The building is in accordance with the regulations for the protection against the harmful influences of the outer environment.

Building has no public demands on the fulfilling of the tasks for the protection of the people during the armed conflict. Building process will not affect any surrounding buildings. Health and safety precautions will be provided according to the law 309/2006 Coll. See further demands on health and safety precautions during the working process in Government regulation 61/2007 Coll. About health and safety precautions determination with changes 68/2010 Coll. and 93/2012 Coll.; which is focused on the work in the excavations, in heights, in the protective zones of the heavy machinery; work with the rotating and electric-driven tools and especially on the usage of the protective gear.

h) Traffic solution

The building's driveway to garage as well as the parking places will be connected to the public road along the northern border of the plot to the Slavonínská street. Throughout the period execution of construction works must be ensured the safety of pedestrians.

Transport solutions including the use of temporary traffic signs will be discussed in advance on Municipal Office of Olomouc and agreed by relevant road authority.

i) Protection of the building against harmful environmental effects

Radon and waterproofing

According to a preliminary report, the objects are located in an area with low radon index. In this case, there are no special requirements for the radon protection from this point of view.

Even though it is not demanded, increased protection against radon will be used – RC slab over the foundations and waterproofing layer made from SBS modified bitumenous felt with strengthening linen made from glass fibre (Glastek).

This layer has to be continuous with welded connections. It is also important to pay attention to the perfect watertight processing of penetrations for installations. For the low radon index, there are no other requirements for constructions or devices. Designed solution respects every generally technical demand.

A standard protection against ground water is done according to the site conditions. Aggressive ground water was not detected. The building is not located in an area with known seismic activity or undermining.

Fire protection

Fire protection is solved in separate fire report.

Noise protection

Is in accordance with the type of building, the massive masonry walls and the composition of the roof structure ensures that there is a sufficient airborne sound insulation of the building.

As concerns spreading of sound within the building, constructions must be done according to rules and recommendations from the producers. All floor structures in or above habitable rooms must have a layer of acoustic (impact) insulation. Layers above this insulation must be separated from walls by a mineral wool strip. Also the monolithic RC stair flights are separated from the slabs by HALFEN HTT units for the impact noise insulation.

Piping has to be bedded flexibly in relation to constructions to interrupt sound spreading within the construction. It is forbidden to wall up the piping without foam insulation. Piping leading through a floor structure must be separated from both concrete screed and the load-bearing construction below – these two constructions must not touch in any case.

j) General requirements for construction

All the technical demands on the construction process are respected by designed building solution.

2. BUILDING CONSTRUCTIONAL PART

1.2 TECHNICAL REPORT

a) Description of the construction part of the building, used products and materials

Foundations

The building is founded on foundation strips made of reinforced concrete (C 25/30, B500B) under the load-bearing walls and also under the columns to preserve equal settlement of the whole structure. The bottom surface of the foundation strips is placed in non-freezing depth of 1050mm below the level of modified terrain. Proper compacting and curing of concrete is essential. The intended degree of influence of the environment is XC2 for foundation strips.

Foundation strips are covered with reinforced concrete slab partially supported by the foundations and partially laying on compacted gravel layer of the fraction 16-32 mm.

All of the foundations must allow continuous attachment of reinforcement from RC walls forming the structural envelope and load-bearing part of parking garage in the 1st floor. There is processed only preliminary design of RC elements of foundations and further calculation must be carried out by the specialist on structural statics.

The further shape and arrangement of foundation is a content of particular drawing.

Proper openings in foundations must be manufactured for the networks penetrations. There must be precisely measured in-situ and prepared according to the media suppliers and project documentation.

Waterproofing of the structure is made from SBS modified bitumenous felt with strengthening linen made from glass fibre (Glastek). The concrete base for bitumenous felt must be prepared by special penetration under asphalt. Its welded in points to concrete slab.

Vertical structures

Arrangement and dimensions of all vertical constructions is defined in the drawing part of the project documentation.

Vertical load-bearing structures will be formed by RC external walls (C 25/30, XC4, B 500 B), internal walls (C 25/30, B 500 B) and columns (300 x 300 mm, C 25/30, B 500 B) in the first floor. The external walls will be provided from the height of + 2,200 m from the exterior side with a 200 mm of thermal insulation (EPS GreyWall λ_k=0,031 W/mK). Also the ceiling over the garage is provided with 100 mm of thermal insulation as well as all the girders - 50 mm of thermal insulation. These measures should keep the thermal bridges between the garage and apartment area at the minimum level.

Vertical external and internal load-bearing structures above the first floor are formed by lime-sand blocks SILKA S20-2000 8DF th.240 mm and laid no masonry mortar Silka of the thickness 2mm.

External walls are provided with ETICS system formed from 200 mm of thermal insulation (EPS GreyWall λk=0,031 W/mK). The precise composition of the system is defined in the list of compositions.

The elevator shaft going through all floors will be made from reinforced concrete (C20/25, B500B), th. 200mm.

Non-load-bearing partitions are from lime-sand partition blocks SILKA S20-2000 5DF th. 150 mm and NF th. 115 mm (shafts). Also there are installation plasterboards partitions - KNAUF W623 th. 100 mm and KNAUF W628 shaft partition th. 50 mm. Non-load-bearing partitions between flats are made from sound proof internal partition - KNAUF W115 double partition, th. 205 mm which comply with the requirement to walls between flats.

All the internal surfaces of the walls will be provided with lime-cement plaster of the thickness 12 mm and white colour coating.

Above all the opening in the internal walls will be lintels specified in the project documentation drawings and list of lintels. Lintels in load-bearing walls are half-prefabricated SENDWIX and prefabricated YTONG. There has to be carried out a static calculation for the reinforcement of SENDWIX lintels according the wide of the opening and loading.

All the load-bearing walls are finished with reinforced concrete wreath (C 25/30, B 500 B) 240x400mm which is a part of the monolithic ceiling system and also serves as a lintel for the openings in the external walls.

Roof

The roof is designed as warm flat roof from EPS 150 S thermal insulation in 220 mm thickness with inclination layer formed by wedges from EPS 70 S thermal insulation with various thicknesses from 20-200 mm.

The overall slope of the roof is 2%.

Waterproofing layer is made of PVC-P FOIL DEKLPLAN 76 th. 1,5 mm which is mechanically anchored and separated by textile layer from the EPS insulation.

As the vapour barrier serves SBS bitumenous strip GLASTEK 40 Special mineral, th. 4 mm welded in spots on the penetrated load-bearing RC slab.

Drainage of the roof is ensured with two roof inlets GULLYDEK PVC S, DN 100 mm (5,6 l/s); provided with leaf-catcher. There are also two security overflows DN 100 mm provided with grid and placed 30 mm above roof plane.

The access to the roof is provided by open-able skylight ESSERTOP 4000 ThermoPlan (U=0,83 W/m^{2}K)

Balconies

Balconies slabs are connected with the monolithic ceiling through SCHOCK ISOKORB KXT system with incorporated 120 mm of thermal insulation eliminating thermal bridging from the external environment. Railings are from steel profiles (40x40mm) with infill in form of the perforated steel sheets treated with Komaxit powder treatment. Top layer of balcony slab is made of frost-resistant ceramic tiles, sloping is provided by cement screed layer.

Staircase

Consist from three monolithic reinforced concrete flights (C 25/30, B 500 B) and two intermediate landings in each floor.

Because of different construction height of the 1st floor and upper floors, heights of the particular steps could not be calculated with same heights, but the final height was optimized to 160,00 mm between the 1st and the 2nd floor and 161,11 mm between the upper floors. The construction height between the 1st and the 2nd floor is 3200 mm (20 steps) and between the upper floors is 2900 mm (18 steps).

Requirements for minimum clearance and headroom height were satisfied.

The railing is made from aluminium tubes screwed into the RC elevator wall.

The connection of the individual flights to the landings is provided with HALFEN HTT impact sound insulation unit which will be incorporated into the formwork and reinforcement system during concreting. This precaution will avoid spreading of impact sound noise through the vertical and horizontal load-bearing system.

Attic is monolithic from reinforced concrete connected with the ceiling structure through ISOKORB A system with incorporated 60 mm of thermal insulation eliminating thermal bridging from the external environment.

Roof plane is provided with safety anchoring point acc. ČSN EN 795. Their position is specified on the roof layout drawing.

The roof inlets must be checked and cleaned twice a year. The revision and cleaning of roof inlets must be processed by educated person only.

Windows and doors

The windows and doors in the 1st floor have aluminium frame HEROAL W 72, double glazing and thermal loss coefficient U_W = 1,2 W/m^{2}K.

The windows and balcony doors in the rest of the building are made by producer Slavona, the type is HA110, which has average thermal loss coefficient U_W = 0,72 W/m^{2}K. Frame is made of wood with aluminium cover and it has insulating triple glazing. It can be tilted or turned to ensure suitable type of ventilation. Specifications and ironwork can be found in list of windows, which is a part of this project documentation. Mounting of windows can be seen in Detail of window sill and lintel. The main mounting element is “Ejot” fixing

point made from Compacfoam. It is necessary to use internal vapour barrier tape and external waterproofing tape according to detail drawing.

Elevator shaft and elevator

There is one elevator in the building in a concrete shaft with thickness 200 mm. Designed type of elevator is Schindler 3100, which is machine room-less traction elevator with frequency-controlled drive. The elevator door are wide 900 mm which is in comply with its non-barrier usage.

Tinsmith constructions

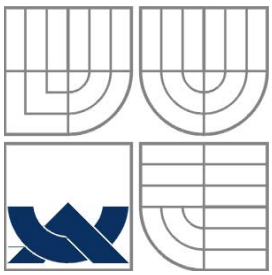
All tinsmith constructions, such as downspouts, eaves, flashings are made of TiZn of thickness 0,6 mm except of flashing of attic, which will be made from plastic-applied viplanyl.

Others

The driveway, entry pavement, garbage zone and parking in front of the building will be from concrete interlocking tiles in sand bed (fr. 0-0,4 mm) and compacted gravel layer (fr. 16-32 mm).

The dripping pavement will be made of ceramic tiles 500 x 500 x 50 mm into sand bed (fr. 0 -4 mm) and compacted gravel layer (fr. 16-32 mm) and secured with concrete curb 50 x 100 mm into concrete bed (C 16/20).

The particular details not solved in this PD will be solved by the supplier of the construction.



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INSTITUTE OF BUILDING STRUCTURES

E.1.1 – BASIC ASSESSMENT OF THE OBJECT FROM THE BUILDING PHYSICS POINT OF VIEW

PROCESSED AT INSTITUTE OF BUILDING STRUCTURES, FCE, BUT

DIPLOMOVÁ PRÁCE
DIPLOMA THESIS

AUTOR PRÁCE — Bc. MICHAL REITER
AUTHOR

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SUPERVISOR

BRNO 2015

1 Content

1 IDENTIFICATION OF THE BUILDING

Name of the structure:	LOW-ENERGY BLOCK OF APARTMENTS
Stage of the documentation:	Study and realisation project
Investor and landowner:	Pavel Kotěra
Address:	Slavonínská 482/22, Olomouc
Plot number:	88/3, k.ú. Olomouc - Povel

1.1 Purpose of the construction, basic capacity of the structure

The project design solves a low-energy block of apartments.
The object serves for two various purposes - in the 1st floor there is a garage with 7 parking lots for the residents, the 2nd, 3rd and 4th floor serves as a residential area consisting from 10 flat units.

No. of flat units:	10
No. parking places in garage:	7
No. parking places outside:	10

1.2 Basic structural characteristics

The construction of the first floor is made from monolithic reinforced concrete columns in combination with reinforced concrete walls and monolithic reinforced concrete ceiling with visible girders.

The upper structure load-bearing walls are made from lime-sand blocks that are insulated with ETICS system. All the load-bearing walls are finished with reinforced concrete wreath which is a part of the ceiling system. All ceilings are monolithic from reinforced concrete. The internal non-load-bearing walls are of two types – lime-sand and plasterboard partitions. In bathrooms and toilets there is a suspended plasterboard ceiling.

The roof is designed as warm flat roof construction; load-bearing structure is from monolithic reinforced concrete slabs.
The building is founded on foundation strips under the load-bearing walls and also under the columns to preserve equal settlement of the whole structure.

2 PURPOSE OF THE ASSESSMENT

The purpose of the assessment is on the basis of Decree no. 268/2009 Coll., about technical requirements to the structures in the version of Decree no.20/2012 validating if the given object and its structures meets:

· Thermal and technical requirements,
· Requirements in terms of energy savings,
· Sound insulation properties of structures,
· Protection against noise and vibration,
· Requirements of room acoustics,
· Requirements in terms of daylight,
· Requirements in terms of insolation,

in a way which ensures safe and hygienic state of structures and ensure the proper function of the object.

3 BACKGROUND DOCUMENTS

· Study of Master Thesis including text parts;
· Working versions of the project at the execution stage;
· Situation of wider relations;
· Urban and climatic conditions of the area;
· Internal and external boundary conditions;

4 USED LEGISLATION AND STANDARDS

1) Zákon č. 183/2006 Sb. o územním plánování a stavebním řádu (stavební zákon) ve znění pozdějších předpisů;
2) Zákon č. 406/2000 Sb. o hospodaření energií ve znění pozdějších předpisů;
3) Vyhláška č. 268/2009 Sb., o technických požadavcích na stavby ve znění vyhlášky č. 20/2012 Sb.;
4) Vyhláška č. 499/2006 Sb., o dokumentaci staveb ve znění pozdějších předpisů;
5) Vyhláška č. 78/2013 Sb. o energetické náročnosti budov;
6) Nařízení vlády č. 272/2011 Sb., o ochraně zdraví před nepříznivými účinky hluku a vibrací;
7) Nařízení vlády č. 361/2007 Sb., kterým se stanoví podmínky ochrany zdraví při práci ve znění pozdějších předpisů;
8) ČSN 73 0540-1:2005 Tepelná ochrana budov - Část 1: Terminologie;

9) ČSN 73 0540-2:2011 + Z1:2012 Tepelná ochrana budov - Část 2: Požadavky;
10) ČSN 73 0540-3:2005 Tepelná ochrana budov - Část 3: Návrhové hodnoty veličin;
11) ČSN 73 0540-4:2005 Tepelná ochrana budov - Část 4: Výpočtové metody;
12) ČSN 73 0532:2010 Akustika – Ochrana proti hluku v budovách a posuzování akustických vlastností stavebních výrobků – Požadavky;
13) ČSN 730525 - Akustika - Projektování v oboru prostorové akustiky - Všeobecné zásady
14) ČSN 73 4301:2004 + Z1:2005 + Z2/2009 Obytné budovy;
15) ČSN 73 0580-1:2007 + Z1:2011 Denní osvětlení budov – část 1: Základní požadavky;
16) ČSN 73 0580-2:2007 Denní osvětlení budov – část 2: Denní osvětlení obytných budov;
17) ČSN 73 0581:2009 Oslunění budov a venkovních prostor – Metoda stanovení hodnot.

5 ASSESSMENT IN TERMS OF ENERGY SAVING AND PROTECTION

5.1 Standard requirements

Lowest internal surface temperature of the structure:

Structures and their joints in the spaces with designed relative humidity of inner air $\varphi_I \leq 60$ % have in the winter time exhibit in all point such a surface temperature that temperature factor f_{Rsi} meets requirement:

$f_{Rsi} \geq f_{Rsi,N}$

where $f_{Rsi,N}$ is required value of the lowest temperature factor of inner surface from the equation:

$f_{Rsi,N} = f_{Rsi,cr}$

where

$f_{Rsi,cr}$ is critical temperature factor of inner space.

Heat transfer coefficient for single constructions:

Constructions of heated buildings have to have in spaces with designed relative humidity of inner air $\varphi_I \leq 60$ % heat transfer coefficient U in W/(m^2.K) such that meets condition:

$U \leq U_N$

where

U_N is required value of heat transfer coefficient in W/ (m^2.K).

Average heat transfer coefficient:

Average heat transfer coefficient U_{em} in W/ (m^2.K), buildings or heated spaces have to meet the condition:

$U_{em} \leq U_{em,N}$

where

$U_{em,N}$ is required value of average heat transfer coefficient in W/(m^2.K).

Linear and point thermal transmittance:

Linear and point thermal transmittance Ψ, in W/ (m.K) and χ in W/K of the thermal links between constructions have to meet condition:

$\Psi \leq \Psi_N$ $\chi \leq \chi_N$

where

Ψ_N is required value of linear thermal transmittance according the table 6 in ČSN 73 0540-2

χ_N is required value of point thermal transmittance according the table 6 in ČSN 73 0540-2.

Drop of contact floor temperature:

There are different floor classes from the drop of contact floor temperature point of view:

Floor class	Drop of contact floor temperature $\Delta\theta_{10,N}$ [°C]
I. Very warm	till 3,8 included
II. Warm	till 5,5 included
III. Less warm	till 6,9 included
IV. Cold	from 6,9

For the classification of the relevant category the condition of drop of contact floor temperature must be met:

$\Delta\theta_{10} \leq \Delta\theta_{10,N}$

where

$\Delta\theta_{10,N}$ is required value from the table above.

Condensed water vapour inside the construction:

For the building structure in which the condensed water vapour inside the structure M_c, in kg/ (m^2 ·a) could threaten its required function, cannot happen the condensation of the water vapour inside of the structure:

$M_c = 0$

For the building structure in which the condensed water vapour inside the structure is not threaten its function, its required restriction that annual amount of condensed water vapour inside the structure M_c, in kg / (m^2 · a) has to satisfy the condition:

$M_c \leq M_{c,N}$

For one layer roof, construction with built-in wooden elements, structure design with external heat insulation system or external cladding, respectively other peripheral structure with little diffusion through porous outer surface layers, the lower of the values:

$M_{c,N}$ = 0.10 kg / (m^2 · a) or 3% of surface weight of the material, for other structures it is the lower of values

$M_{c,N}$ = 0.50 kg / (m^2 · a) or 5% of surface weight of the material.

Annual balance of condensation and evaporation of water vapour inside the structure:

In building structure with allowed restricted condensation of water vapour inside of the structure in annual year balance of condensation and evaporation of the water vapour cannot be any leftover amount of the water vapour which would increase the humidity of the structure permanently. Annual amount of condensed water vapour inside the structure M_c, in kg / (m^2. a) have to be lower than annual amount of evaporated water vapour inside of structure M_{ev}, in kg/(m^2·a).

Air spreading through building and constructions:

Air permeability

There cannot be any unsealed joints in the perimeter constructions of the building. All the connections of the structures have to be permanently sealed.

Thermal stability of a room in winter season:

Its required that a critical room at the end of the time of cooling t showed drop of resulting temperature in the room in winter season $\Delta\theta_v(t)$ in °C, according equation:

$\Delta\theta_v(t) \leq \Delta\theta_{v,N}(t)$

where

$\Delta\theta_{v,N}(t)$ is required value of temperature drop in room in winter time, in °C, determined from table 11, ČSN 73 0540-3.

Thermal stability of a room in summer season:

Critical room has to show the highest day temperature of the air in the room in summer season $\theta_{ai,max,}$ in °C, according the equation:

$\theta_{ai,max} \leq \theta_{ai,max,N}$

where

$\theta_{ai,max,N}$ is required value of the highest day temperature in room in summer season, in °C, from the table 12, ČSN 73 0540-3.

5.2 Technical data of the building in terms the energy saving and heat protection

Geometric characteristics of the building:

Volume of building V – outer volume of the heated zone, does not include balcony, attics and foundations	3305,869 m^3
Total area A – sum of outer surfaces of cooled structures	1561,708 m^2
Area/Volume factor of building	0,472
Prevailing inside temperature during heating season	+20 °C
Design relative humidity of inner air	φ_{Hi} = 55%
Outside design temperature in winter period (Olomouc)	-15°C
Design relative humidity of outer air	φ_{He} = 84%

Constructions of the building envelope	**Area A (m2)**
External walls	638,263
Floor above the ground	42,320
Ceiling from heated area to non-heated area	303,170
Wall from heated area to non-heated area	32,480
Flat roof construction	345,350
Windows	196,750
Doors	3,375
Total	**1561,708**

Characteristics of assessed constructions, including openings:

Openings:

Aluminium-wood windows Slavona 110 HA and entrance doors

With triple glassing λ_d = 0,73 w/mK

External wall composition

COMPOSITION NAME	MARK	Function	Prouduct	Propherties	Notes	Thickess (mm)
EXTERNAL MASONRY WALL WITH ETICS	C1	COATING	WEBER.DECO MAL	Dispersion, whiteness 90%		-
		STUCCO PLASTER	WEBER.DUR ŠTUK IN	Lime, MVJ 310		2
		INTERNAL PLASTER	WEBER.DUR KLASIK KRU	Lime-cement, MVC650		10
		PRIMER	WEBER.PODKLAD A			-
		LOAD-BEARING STRUCTURE	LIME-SAND BLOCK SILKA, 8DF	On construction adhesive 2 mm		240
		PRIMER	WEBER.PODKLAD A			-
		ADHESIVE	WEBER.TMEL 700			3
		THERMAL INSULATION	EPS Grey 150	λD=0,031W/mK		200
		ADHESIVE	WEBER.TMEL 700	Provided with glass-fibre reinforcement		4
		EXTERNAL PLASTER	WEBER.PAS SILIKÁT			2

Flat roof composition

WARM ROOF	C10	COATING	WEBER.DECO MAL	Dispersion, whiteness 90%		-
		STUCCO PLASTER	WEBER.DUR ŠTUK IN	Lime, MVJ 310		2
		INTERNAL PLASTER	WEBER.DUR KLASIK KRU	Lime-cement, MVC650		10
		PRIMER	WEBER.PODKLAD A			-
		LOAD-BEARING STRUCTURE	RC SLAB	C 25/30, B 500 B		200
		ASPHALT PENETRATION	DEKPRIMER	0,3-0,4 kg/m2		-
		VAPOR BARRIER	GLASTEK 40 SP. MINERAL	Welded in spots to RC slab		4
		SEPARATION	FILTEK 300			-
		SLOPING LAYER	EPS 70 S in 2% slope	λD=0,036W/mK		20-200
		THRMAL INSULATION	EPS 150 S in 2% slope	λD=0,036W/mK		220
		SEPARATION	FILTEK 300			-
		WATER-PROOFING	PVC-P FOIL DEKLPLAN 76	Mech. anchored to the RC slab		1,5

Floors compositions

COMPOSITION NAME	MARK	Function	Prouduct	Propherties	Notes	Thickess (mm)
FLOOR ON THE GROUND - CERAMIC TILES	F1	FLOOR FINISH	CERAMIC TILES			10
		ADHESIVE	WEBER FOR KLASIK			5
		LEVELLING LAYER	CEMEX AnhyLEVEL 30	Compress. strength > 20 Mpa, Volume mass - 2100-2200 kg/m^3, Grain max 4 mm		35
		SEPARATION	PE FOIL			-
		THERMAL INSULATION	EPS Grey 150	λD=0,031W/mK		100
		SEPARATION	GEOTEXTILE FILTEK 300			-
		WATERPROOFING LAYER	GLASTEK 40 SPECIAL MINERAL	Welded on foundation slab		4
		ASPHALT PENETRATION	DEKPRIMER	0,3-0,4 kg/m2		-
		LOAD-BEARING LAYER	RC SLAB	C 25/30, reinforcement mesh (KARI) 150 x 150		200
		COMPACTED UNDERLAY	COMPACTED GRAVEL	Fraction 16-32 mm		150

FLOOR IN 2nd FLOOR - CERAMIC TILES	F3	FLOOR FINISH	CERAMIC TILES			10
		ADHESIVE	WEBER FOR KLASIK			5
		SECURITY WATERPROOFING	WEBER AKRYZOL		Bathrooms only	-
		LEVELLING LAYER	CEMEX AnhyLEVEL 30	Compress. strength > 20 Mpa, Volume mass - 2100-2200 kg/m^3, Grain max 4 mm		35
		SEPARATION	PE FOIL			
		ACOUSTIC INSULATION	ISOVER TDPT			50
		LOAD-BEARING LAYER	RC SLAB	C 25/30, B 500 B		200
		PRIMER	WEBER.PODKLAD A			-
		ADHESIVE	WEBER.TMEL 700			4
		THERMAL INSULATION	ISOVER NF 333	λD=0,041W/mK		100
		ADHESIVE	WEBER.TMEL 700	Provided with glass-fibre reinforcement		4
		PLASTER	WEBER.PAS SILIKÁT	Silicate plaster, grain max. 2 mm		2

FLOOR IN 2nd FLOOR - WOODEN FINISH	F5	FLOOR FINISH	WOODEN PARQUETS	Interlocking		13
		ADHESIVE	ELASTIC GLUE STAUF SMP-930			2
		LEVELLING LAYER	CEMEX AnhyLEVEL 30	Compress. strength > 20 Mpa, Volume mass - 2100-2200 kg/m^3, Grain max 4 mm		35
		SEPARATION	PE FOIL			
		ACOUSTIC INSULATION	ISOVER TDPT			50
		LOAD-BEARING LAYER	RC SLAB	C 25/30, B 500 B		200
		PRIMER	WEBER.PODKLAD A			-
		ADHESIVE	WEBER.TMEL 700			4
		THERMAL INSULATION	ISOVER NF 333	λD=0,041W/mK		100
		ADHESIVE	WEBER.TMEL 700	Provided with glass-fibre reinforcement		4
		PLASTER	WEBER.PAS SILIKÁT	Silicate plaster, grain max. 2 mm		2

Attic composition

ATTIC	C11	WATER-PROOFING	PVC-P FOIL DEKLPLAN 76	Mech. anchored to the RC slab		1,5
		SEPARATION	FILTEK 300			-
		LOAD-BEARING STRUCTURE	RC ATTIC	Connected by ISOKORB A system		160
		PRIMER	WEBER.PODKLAD A			-
		ADHESIVE	WEBER.TMEL 700			3
		THERMAL INSULATION	EPS Grey 150	λD=0,031W/mK		200
		ADHESIVE	WEBER.TMEL 700	Provided with glass-fibre reinforcement		4
		EXTERNAL PLASTER	WEBER.PAS SILIKÁT			2

5.3 Information about fulfilment of the requirements in standards

5.3.1 Heat propagation through the structure and building envelope

Minimal internal surface temperature of the structure and temperature factor:

There were evaluated all the structures of the building envelope (in software Teplo) including the two construction details - attic and joint with wall in garage (in soft. Area)

Type of construction	Minimal internal surface temperature $T_{si,p}$	Required $f_{,Rsi,N} = f_{,Rsi,cr}$	Calculated temperature factor $f_{,Rsi,p}$	Evaluation
External wall	19,67 °C (T_i=20°C)	0,749	0,963	**Satisfied**
Flat roof	19,64 °C (T_i=20°C)	0,749	0,962	**Satisfied**
Floor on the ground	15,23 °C (T_i=15°C)	0,208	0,930	**Satisfied**
Floor to unheated space - ceramic tiles	23,87 °C (bathroom T_i=24°C)	0,828	0,944	**Satisfied**
Floor to unheated space - wooden parquets	20,11 °C (T_i=20°C)	0,435	0,944	**Satisfied**
Wall to unheated space	15,06 °C (T_i=15°C)	0,208	0,915	**Satisfied**
Building foot	13,08 °C (T_i=15°C)	0,719	0,929	**Satisfied**
Detail of attic	17,93 °C (T_i=20 °C)	0,744	0,941	**Satisfied**
Detail of ceiling joint with wall in garage	16,53°C (T_i=20 °C)	0,744	0,901	**Satisfied**

Heat transfer coefficient for single constructions:

Construction	Required (recommended) coef. of heat transfer U (W.m-2.K-1)	Coef. of heat transfer U (W.m-2.K-1)	Evaluation
External walls	0,30 (0,25)	0,150	Satisfied
Floor above the ground	0,45 (0,30)	0,291	Satisfied
Ceiling from heated area to non-heated area	0,60 (0,40)	0,230	Satisfied
Wall from heated area to non-heated area	0,60 (0,40)	0,358	Satisfied
Flat roof construction	0,24 (0,16)	0,155	Satisfied
Building foot	0,30 (0,25)	0,294	Satisfied
Windows	1,50 (1,2)	0,730	Satisfied
Doors	1,70 (1,2)	0,730	Satisfied

Drop of contact floor temperature:

Type of construction	Requirement	Designed $\Delta\theta_{10}$	Evaluation
Floor on the ground (corridor)	Cold floor $\Delta\theta_{10,N}$=from 6,9°C	9,47°C	**Satisfied**
Floor to unheated space - ceramic tiles (bathroom)	Less warm floor $\Delta\theta_{10,N}$= 6,9°C	4,77°C	**Satisfied**
Floor to unheated space - wooden parquets (living room)	Warm floor $\Delta\theta_{10,N}$=5,5°C	4,42°C	**Satisfied**

5.3.2 Moisture propagation through the structure

External wall

Requirements:

1. Condensation of water vapour cannot endanger the function of structure.

2. The annual amount of condensate must be lower than the annual evaporation capacity.

3. The annual amount of condensate M_c should be less than 0.1 kg/m².year, or 3-6% of surface weight material (lower value).

Limit for max. amount of condensate derived from min. surface weight material in the condensing zone is as follows: 0.204 kg / m^2 year (material: EPS GreyWall).
Furthermore, the limit will be used for max. condensate volume: 0.100 kg / m^2 year

Calculated values:
In the construction is occurred condensation at the outdoor design temperature.
The annual quantity of condensed water vapour $M_{c,a}$ = 0.0016 kg / m^2 year
The annual quantity of evaporable water vapour $M_{ev,a}$ = 2.7016 kg / m^2 year

Evaluation
1. Condensation of water vapour is not endangering the function of structure.
2. $M_{c,a} < M_{ev,a}$ Requirement is met.
3. $M_{c,a} < M_{c,N}$ Requirement is met.

Flat roof

Requirements:
1. Condensation of water vapour cannot endanger the function of structure.
2. The annual amount of condensate must be lower than the annual evaporation capacity.
3. The annual amount of condensate M_c should be less than 0.1 kg/m^2.year, or 3-6% of surface weight material (lower value).

Limit for max. amount of condensate derived from min. basis weight material in the condensing zone is as follows: 0.009 kg / m2 year (material: Filtek 300).
Furthermore, the limit will be used for max. condensate volume: 0.009 kg / m^2 year.

Calculated values:
In the construction is occurred condensation at the outdoor design temperature.
The annual quantity of condensed water vapour $M_{c,a}$ = 0.0064 kg / m^2 year
The annual quantity of evaporable water vapour $M_{ev,a}$ = 0.0626 kg / m^2 year

Evaluation
1. Condensation of water vapour is not endangering the function of structure.
2. $M_{c,a} < M_{ev,a}$ Requirement is met.
3. $M_{c,a} < M_{c,N}$ Requirement is met.

Floor on ground

Requirements:

We do not apply any requirements to floor on the ground from the condensation point of view.

Floor to unheated space-ceramic tiles

1. Condensation of water vapour cannot endanger the function of structure.
2. The annual amount of condensate must be lower than the annual evaporation capacity.
3. The annual amount of condensate M_c should be less than 0.1 kg/m^2.year, or 3-6% of surface weight material (lower value).

Calculated values:

In the construction is not occurred any condensation at the outdoor design temperature.

Evaluation

Requirements are met.

Floor to unheated space-wooden parquets

1. Condensation of water vapour cannot endanger the function of structure.
2. The annual amount of condensate must be lower than the annual evaporation capacity.
3. The annual amount of condensate M_c should be less than 0.1 kg/m^2.year, or 3-6% of surface weight material (lower value).

Calculated values:

In the construction is not occurred any condensation at the outdoor design temperature.

Evaluation

Requirements are met.

Wall to unheated space

1. Condensation of water vapour cannot endanger the function of structure.
2. The annual amount of condensate must be lower than the annual evaporation capacity.
3. The annual amount of condensate M_c should be less than 0.1 kg/m^2.year, or 3-6% of surface weight material (lower value).

Calculated values:

In the construction is not occurred any condensation at the outdoor design temperature.

Evaluation

Requirements are met.

Building foot

1. Condensation of water vapour cannot endanger the function of structure.
2. The annual amount of condensate must be lower than the annual evaporation capacity.
3. The annual amount of condensate M_c should be less than 0.1 kg/m^2.year, or 3-6% of surface weight material (lower value).

Calculated values:

In the construction is not occurred any condensation at the outdoor design temperature.

Evaluation

Requirements are met.

5.3.3 Thermal stability of a room

The room number 424 is considered to be the most critical room in the building from the thermal stability in winter season and also from the thermal stability in summer season. It is mainly due its location in the corner of the building, it has large windows to south and east and it lies under the roof in the 4th floor.

Evaluation of thermal stability of a room 424 in summer season:

The requirement for the maximum daily air temperature in summer season (art. 8.2 ČSN 730540-2) respectively to thermal stability of a room in summer season (Section 4, paragraph 1, point a6) of Decree)

Requirement: $T_{ai,\,max,\,N}$ = 27.00 C

Calculated value: $T_{ai,\,max}$ = 24.29 C

$T_{ai,\,max} < T_{ai,\,max,\,N}$ **... requirement is met.**

Evaluation of thermal stability of a room 424 in winter season:

The requirement for the maximum daily air temperature in summer season (art. 8.2 ČSN 730540-2) respectively to thermal stability of a room in summer season (Section 4, paragraph 1, point a6) of Decree)

Requirement:	Delta $T_{r,N}$ (tau) = 3,00 C
Calculated value:	Delta T_r (4,00) = 1,76 C
	Delta T_r (8,00) = 2,29 C
	Delta T_r (12,00) = 2,76 C
	Delta T_r (16,00) = 3,20 C
	Delta T_r (20,00) = 3,61 C
	Delta T_r (24,00) = 4,01 C
	Delta T_r (28,00) = 4,39 C
	Delta T_r (32,00) = 4,76 C
	Delta T_r (36,00) = 5,12 C
	Delta T_r (40,00) = 5,48 C
	Delta T_r (44,00) = 5,82 C
	Delta T_r (48,00) = 6,16 C

Evaluation:

Delta T_r (14,00) < Delta $T_{r,N}$ ... **requirement is met** for maximum time of the heating break 14,00 h.

For longer heating break the requirement will not be fulfilled.

5.4 Requirements to other professions and for coordination with the construction part

The building has sufficient thermal stability in summer season mainly because the design is counting with the cantilever balcony slabs which will serve as a shading mean in the summer season. Also there will be necessary to mount the external aluminium blinds which are incorporated into the ETICS facade before the execution of the thermal insulation of the building. All the specifications can be found in the detail of window lintel and the detail of balcony slab connection.

5.5 Calculation of energy use in the building

After the calculation Energy Label of Building Envelope and comparison with the reference building, it was evaluated that the building is in the category **B - energy saving**.

The calculated average heat transfer coefficient of building envelope of the object is
U_{em} = 0, 26 W/ (m²·K)
The calculated recommended average heat transfer coefficient of building envelope is
$U_{em,rec}$ = 0, 38 W/(m²·K)
The calculated required average heat transfer coefficient of building envelope is
$U_{em,N}$ = 0, 50 W/(m²·K)

The requirement for construction energy characteristics of the building is fulfilled.

6 ASSESSMENT IN TERMS OF ACOUSTICS AND VIBRATION

6.1 Standard requirements

Urban acoustics:
Hygienic limits of noise in the protected inner space of buildings:

Hygienic limit of the maximum sound pressure level down for noise propagating from sources inside the building is sum of the basic maximum sound level L_{Amax} equal to 40 dB and a correction regards to species protected interior space, and day and night time.

Hygienic limit in the protected interior of the building - living rooms
Correction for the time of stay:
- between 6.00 and 22.00 hour..... 0 dB
- between 22.00 and 6.00 hour.....-10 dB

Acoustics of building structures:
Requirements to sound insulation properties between rooms:

Weighted single number rating of airborne sound insulation between rooms in buildings designed by weighting pursuant to ČSN EN ISO 717-1 from octave values of the variables measured in accordance with ČSN EN ISO 140-4, must not exceed the maximum permissible limits laid down in Tables.

Requirements to sound insulation properties of the external walls and their parts:

Airborne sound insulation cladding of buildings must meet the minimum required values, which are for evaluation of external claddings set out in Table 2 convenient single variables, weighted sound insulation R'_{w}, $R'45_{, w}$, $R'_{tr, s, w}$ or $R'_{rt,s ,w}$, and for assessing the protection of the room from outdoor noise levels weighted difference $D_{nT, w}$, $D_{LS, 2m, nT, w}$, $D_{TR, 2m, nT, w}$ dependence on outside noise, expressed equivalent weighted sound pressure level $L_{Aeq, 2m}$. Interpolation is allowed. Those single-digit weighted values are determined by the method specified in ČSN EN ISO 717-1 of the variables in the third octave frequency bands defined in ČSN EN ISO 140-5.

Room acoustics:

Requirements for room acoustics - shape and volume solution, reverberation time:
There are no requirements for room acoustics for the residential buildings and flats.

Requirements on the reverberation time of rooms according to the CSN 73 0525-27
There are no requirements on the reverberation time of rooms for the residential buildings and flats.

6.2 Technical data of the building in terms of acoustics and vibration

Structure	R_w	$L_{n,w}$	k	R'_w	$L'_{n,w}$	Note
Internal load-bearing wall between flats lime-sand brick 240mm	55	-	3	52	-	producer
Internal plasterboard double partition wall between flats 205mm	60	-	4	55	-	producer
Internal partition wall between rooms 150mm	49	-	3	46	-	producer
RC Ceiling (200mm) with 50mm of acoustic insulation between the flats	57	53	2	55	55	calculated
RC Ceiling (200mm) with 50mm of acoustic insulation and 100mm thermal ins. between garage and flats	-	59	2	-	57	calculated
Windows	35	-	5	30	-	producer
External wall lime-sand brick 240mm	55	-	3	52	-	producer

Roof -RC Ceiling 200mm + thermal ins. 220mm	58	-	2	56	-	calculated

Sources of noise and vibration in the building (elevators, air handling units, etc.)

In the building there is only the elevator which could be the potential source of noise and vibration; there are not any other technical devices which can cause noise or vibration.

6.3 Evaluation of individual areas

Requirements to sound insulation properties between rooms and flats:

Placing of the construction	Sign	Required	Design	Result
Flat-flat- lime-sand brick 240mm	R´w	52	52	**satisfies**
Flat-flat-double partition wall 205mm	R´w	52	55	**satisfies**
Corridor-flat-lime-sand brick 240mm	R´w	52	52	**satisfies**
Room-room-partition wall 150mm	R´w	42	46	**satisfies**
Flat-flat RC Ceiling 200mm + ac. insulation 50mm	R´w	52	55	**satisfies**
	L´n,w	58	55	**satisfies**
Garage-flat RC Ceiling 200mm + ac. insul. 50mm +therm. insulation 100 mm	R´w	57	57	**satisfies**
	L´n,w	-	-	-

Sources of noise and vibration in the building (elevators, air handling units, etc.)

The elevator shaft walls are separated from the all other walls by the staircase which is going around the shaft. The walls of the flats are not neighbouring with the walls of the elevator shaft.

Sound insulation properties of external building structure

There are no sources of the increased noise or load in the vicinity of the object.

Hygienic limit of the maximum sound pressure level down for noise propagating from sources inside the building is sum of the basic maximum sound level L_{Amax} equal to 40 dB and a correction regards to species protected interior space, and day and night time.

Hygienic limit in the protected interior of the building - living rooms

Correction for the time of stay:

- between 6.00 and 22.00 hour..... 0 dB
- between 22.00 and 6.00 hour.....-10 dB

Day time ……..$L_{Aeq,T}$ = 40 + 0 = 40 dB

Night time …… ……$L_{Aeq,T}$ = 40 - 10 = 30 dB

→ The required sound insulation of the building envelope R'_w = 30 dB

The designed sound insulation R'_w for external wall is R'_w = 52 dB →**satisfies**

The designed sound insulation R'_w for windows is R'_w = 30 dB →**satisfies**

The designed sound insulation R'_w for roof is R'_w = 56 dB →**satisfies**

7 ASSESSMENT IN TERMS OF LIGHTING AND INSOLATION

7.1 Standards requirements

Ministry for Regional Development Decree No. 137/1998 Coll. The general technical requirements for construction:

§ 24 **Insolation**

(1)Insolated must be all habitable rooms which require that by them nature.

There must be ensured visual comfort and protection from glare, especially in residential rooms intended for accurate operation.

(2) All dwellings must be insolated. The apartment is insolated, if the sum of the floor areas of its insolated habitable rooms is equal to at least one third of the sum of the floor areas of all habitable rooms. In assessing the insolation we based on normative values.

The level of daylight in the living areas is assessed under the provisions of art. 2.2 CSN 73 0580-2 as follows:

All dwellings must be designed so that they have the sunlight. The apartment is insolated, if the sum of the floor areas of its insolated habitable rooms is equal to at least one third of the sum of the floor areas of all habitable rooms .

Habitable room is considered to be insolated, if are fulfilled following conditions:

a) A top plan angle of the sun line with the main plane of the window opening must be at least 25 ° (main line plane is a straight line which is the intersection of this plane with the horizontal plane).

b) Direct sunlight for a specified period must penetrate into the room window opening or openings covered transparent material , whose total area calculated from structural dimensions is at least equal to one tenth of the floor area of the room, the smallest dimension of lighting compositional hole must be at least 900 mm width of windows placed in an inclined roof plane can be smaller, but at least 700 mm.

c) Solar radiation for a set period must strike the critical point in the plane of the inner glazing at a height of 300 mm above the center of the bottom edge of the illumination aperture but less than 1200 mm above the floor level of the room under consideration.

d) The height of the sun above the horizon must be at least 5 °.

e) Neglecting the clouds there must be on 1 March insolation period of at least 90 minutes. It is recommended to comply a period of insolation at least 90 minutes also on 21 June. The required time for the day insolation March 1 can be replaced balance, when , the total time of insolation held from February 10 to March 21, including 3600 minutes (this is 40 days with a mean insolation 90 minutes).

The level of day lighting in habitable rooms acc. Čsn 73 0580-2:
There must be in two control points in half of the room depth but not far then 3m from window, distant 2m from inner walls surfaces, value of a daylight coefficient at least 0,7 % and average value from these two points at least 0,9 %. If the windows are in two touching walls, it satisfy, if this requirement is fulfil at least at one pair of both control points.

7.2 Technical data of the building in terms of lighting and insolation

There are no high structures in the vicinity of the object.
All the main living areas are orientated to south, east and west and all the habitable rooms are provided with sufficient openings for the daylight spreading.

The windows in the object have triple clear glassing and this property is included in all the calculations.

On the southwest side of the building there is in the distance of 12m another object of the top height of 7m, but according the calculations and insolation charts in the annex, this object is not a problem from the insolation or lighting point of view.

7.3 Evaluation of individual areas

7.3.1 Evaluation of sufficient insolation time at the residential buildings and habitable rooms

Because there is another building object in the vicinity of the evaluated building, there was done evaluation of insulation time for the critical flat number 2.1. on the 2nd floor in the western part of the house.
As it can be seen from the insolation situation in the annex. The adjoining building object has no influence on the insulation of the critical flat number 2.1.
The flat will satisfied and there will be fulfilled all the requirements to insolation of 180 minutes.

7.3.2 Evaluation of the operation of the building according to requirements on day lighting by class visual activities

There are no requirements on day lighting by class visual activities in the concerned residential building.
There must be hold only the level of day lighting in habitable rooms acc. Čsn 73 0580-2 in terms of the control points.
There was made an evaluation of the daylight coefficient for the critical room 212. As can be seen from the scheme of the critical room 212 with written daylight coefficients in prescribed two control points, the requirement to value of a daylight coefficient at least 0,7 % and average value from these two points at least 0,9 %.
The calculated value for the critical room 212 of the daylight coefficient is 0, 9% and 0,9% and the requirement is met. The requirement is fulfilled also for all habitable rooms in the building.

7.3.3 Evaluation of the influence on shading of proposed building to the environment according to the daily requirements on lighting by category territory

With consideration of location of the neighbouring object (south-west) from the evaluated building) we can say that evaluated building has no influence on shading to the environment according to the daily requirements on lighting by territory category. There are no other objects which can be shaded by the object.

8 IDENTIFICATION OF THE DOCUMENTATION PROCESSOR

Date : 14.1.2015
Name : Bc. Michal Reiter
Signature :

9 Annexes

As supporting documents were used drawings and reports from the folder D – Documentation of structures.

All the supplementary protocols and calculations from the software Building Physics Svoboda can be found in the Folder E. Including the Energy Label of Building Envelope and Protocol to the Energy Performance Certificate of the building.

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ
BRNO UNIVERSITY OF TECHNOLOGY

FAKULTA STAVEBNÍ
ÚSTAV POZEMNÍHO STAVITELSTVÍ

FACULTY OF CIVIL ENGINEERING
INSTITUTE OF BUILDING STRUCTURES

E.1.2 – STATEMENT OF ENERGY EFFICIENCY

DIPLOMOVÁ PRÁCE
DIPLOMA THESIS

AUTOR PRÁCE — Bc. MICHAL REITER
AUTHOR

VEDOUCÍ PRÁCE — doc. Ing. SEDLÁK JIŘÍ, CSc.
SUPERVISOR

BRNO 2015

Protokol k průkazu energetické náročnosti budovy

Účel zpracování průkazu

☒ Nová budova	☐ Budova užívaná orgánem veřejné moci
☐ Prodej budovy nebo její části	☐ Pronájem budovy nebo její části
☐ Větší změna dokončené budovy	
☐ Jiný účel zpracování:	

Základní informace o hodnocené budově

Identifikační údaje budovy	
Adresa budovy (místo, ulice, popisné číslo, PSČ)	Slavonínská 482/22, 77900 Olomouc
Katastrální území:	Olomouc - Povel
Parcelní číslo:	88/3
Datum uvedení budovy do provozu (nebo předpokládané datum uvedení do provozu):	1.7.2015
Vlastník nebo stavebník:	Pavel Kotěra
Adresa:	Stupkova 22, 77900 Olomouc
IČ:	
Tel./e-mail:	kotera@gmail.com

Typ budovy		
☐ Rodinný dům	☒ Bytový dům	☐ Budova pro ubytování a stravování
☐ Administrativní budova	☐ Budova pro zdravotnictví	☐ Budova pro vzdělávání
☐ Budova pro sport	☐ Budova pro obchodní účely	☐ Budova pro kulturu
☐ Jiný druhy budovy:		

Geometrické charakteristiky budovy		
Parametr	jednotky	hodnota
Objem budovy V (objem částí budovy s upravovaným vnitřním prostředím vymezený vnějšími povrchy konstrukcí obálky budovy)	[m^3]	3305,9
Celková plocha obálky budovy A (součet vnějších ploch konstrukcí ohraničujících objem budovy V)	[m^2]	1566,0
Objemový faktor tvaru budovy A/V	[m^2/m^3]	0,47
Celková energeticky vztažná plocha budovy A_c	[m^2]	1558,2

Druhy energie (energonositele) užívané v budově	
☐ Hnědé uhlí	☐ Černé uhlí
☐ Topný olej	☐ Propan-butan/LPG
☐ Kusové dřevo, dřevní štěpka	☐ Dřevěné peletky
☒ Zemní plyn	☒ Elektřina
☐ Soustava zásobování tepelnou energií (dálkové teplo): *podíl OZE:* ☐ *do 50 % včetně,* ☐ *nad 50 do 80 %,* ☐ *nad 80 %,*	
☐ Energie okolního prostředí (např. sluneční energie): *účel:* ☐ *na vytápění,* ☐ *pro přípravu teplé vody,* ☐ *na výrobu elektrické energie,*	
☐ Jiná paliva nebo jiný typ zásobování:	

Druhy energie dodávané mimo budovu		
☐ Elektřina	☐ Teplo	☒ Žádné

Informace o stavebních prvcích a konstrukcích a technických systémech

A) stavební prvky a konstrukce

a.1) požadavky na součinitel prostupu tepla

Konstrukce obálky budovy	Plocha A_j	Součinitel prostupu tepla			Činitel tepl. redukce b_j	Měrná ztráta prostupem tepla $H_{T,j}$
		Vypočtená hodnota U_j	Referenční hodnota $U_{N,rc,j}$	Splněno		
	[m^2]	[W/(m2.K)]	[W/(m2.K)]	[ano/ne]	[-]	[W/K]
Obvodová stěna	642,54	0,15	0,25	ano	1,00	97,0
Střecha	345,35	0,16	0,16	ano	1,00	53,5
Podlaha	377,97	0,25	0,3	ano	0,92	85,9
Otvorová výplň	200,13	0,73	1,2	ano	1,00	146,1
Tepelné vazby						31,3
Celkem	**1 566,0**	**x**	**x**	**x**	**x**	**413,9**

Poznámka: Hodnocení splnění požadavku je vyžadováno jen u větší změny dokončené budovy a při jiné, než větší změně dokončené budovy v případě plnění požadavku na energetickou náročnost budovy podle § 6 odst. 2 písm. c).

a.2) požadavky na průměrný součinitel prostupu tepla

Zóna	Převažující návrhová vnitřní teplota $\Theta_{im,j}$	Objem zóny V_j	Referenční hodnota průměrného součinitele prostupu tepla zóny $U_{em,R,j}$	Součin $V_j \cdot U_{em,R,j}$
	[°C]	[m^3]	[W/(m^2.K)]	[W.m/K]
LOW-ENERGY BLOCK OF APARTMENTS	20,0	3 305,9	0,41	1 355,42
Celkem	**x**	**3 305,9**	**x**	**1 355,42**

Budova	Průměrný součinitel prostupu tepla budovy		
	Vypočtená hodnota U_{em} ($U_{em} = H_T/A$)	Referenční hodnota $U_{em,R}$ ($U_{em,R} = \Sigma(V_j \cdot U_{em,R,j})/V$)	Splněno
	[W/(m^2K)]	[W/(m^2K)]	[ano/ne]
Budova jako celek	0,26	0,41	ano

Poznámka: Hodnocení splnění požadavku je vyžadováno u nové budovy, budovy s téměř nulovou spotřebou energie a u větší změny dokončené budovy v případě plnění požadavku na energetickou náročnost budovy podle § 6 odst. 2 písm. a) a písm.b).

B) technické systémy

b.1.a) vytápění

Hodnocená budova/zóna	Typ zdroje	Energo-nositel	Pokrytí dílčí potřeby energie na vytá-pění	Jmeno-vitý tepelný výkon	Účinnost výroby energie zdrojem tepla[2)]		Účinnost distribu-ce energie na vytápění	Účinnost sdílení energie na vytápění
					$\eta_{H,gen}$	COP	$\eta_{H,dis}$	$\eta_{H,em}$
	[-]	[-]	[%]	[kW]	[%]	[-]	[%]	[%]
Referenční budova	x[1)]	x	x	x	80	--	85	80
Hodnocená budova/zóna:								
LOW-ENERGY BLOCK OF APARTMENTS	Gas condensing boiler	zemní plyn	100,0		98		87	88

Poznámka: [1)] symbol **x** znamená, že není nastaven požadavek na referenční hodnotu
[2)] v případě soustavy zásobování tepelnou energií se nevyplňuje

b.1.b) požadavky na účinnost technického systému k vytápění

Hodnocená budova/zóna	Typ zdroje	Účinnost výroby energie zdrojem tepla $\eta_{H,gen}$ nebo $COP_{H,gen}$	Účinnost výroby energie referenčního zdroje tepla $\eta_{H,gen,rq}$ nebo $COP_{H,gen}$	Požadavek splněn
	[-]	[%]	[%]	[ano/ne]

Poznámka: Hodnocení splnění požadavku je vyžadováno jen u větší změny dokončené budovy a při jiné, než větší změně dokončené budovy v případě plnění požadavku na energetickou náročnost budovy podle § 6 odst. 2 písm. c).

b.2.a) chlazení

Hodnocená budova/zóna	Typ systému chlazení	Energo-nositel	Pokrytí dílčí potřeby energie na chlaze-ní	Jmeno-vitý chladící výkon	Chladi-cí faktor zdroje chladu $EER_{C,gen}$	Účinnost distri-buce energie na chlazení $\eta_{C,dis}$	Účinnost sdílení energie na chlazení $\eta_{C,em}$
	[-]	[-]	[%]	[kW]	[-]	[%]	[%]
Referenční budova	x	x	x	x			
Hodnocená budova/zóna:							

b.2.b) požadavky na účinnost technického systému k chlazení

Hodnocená budova/zóna	Typ systému chlazení	Chladící faktor zdroje chladu $EER_{C,gen}$	Chladící faktor referenčního zdroje chladu $EER_{C,gen}$	Požadavek splněn
	[-]	[-]	[-]	[ano/ne]

Poznámka: Hodnocení splnění požadavku je vyžadováno jen u větší změny dokončené budovy a při jiné, než větší změně dokončené budovy v případě plnění požadavku na energetickou náročnost budovy podle § 6 odst. 2 písm. c).

b.3) větrání

Hodnocená budova/zóna	Typ větracího systému	Energo-nositel	Tepelný výkon	Chladí-cí výkon	Pokrytí dílčí potřeby energie na větrání	Jmen. elektr. příkon systému větrání	Jmen. objem. průtok větracího vzduchu	Měrný příkon ventilátoru nuceného větrání SFP_{ahu}
	[-]	[-]	[kW]	[kW]	[%]	[kW]	[m^3/hod]	[W.s/m^3]
Referenční budova	x	x	x	x	x	x	x	
Hodnocená budova/zóna:								
LOW-ENERGY BLOCK OF APARTMENTS	přirozené větrání							

b.4) úprava vlhkosti vzduchu

Hodnocená budova/zóna	Typ systému vlhčení	Energo-nositel	Jmenovitý elektrický příkon	Jmenovitý tepelný výkon	Pokrytí dílčí dodané energie na úpravu vlhkosti	Účinnost zdroje úpravy vlhkosti systému vlhčení $\eta_{RH+,gen}$
	[-]	[-]	[kW]	[kW]	[%]	[%]
Referenční budova	x	x	x	x	x	
Hodnocená budova/zóna:						

Hodnocená budova/zóna	Typ systému odvlhčení	Energo-nositel	Jmen. elektr. příkon	Jmen. tepelný výkon	Pokrytí dílčí potřeby energie na úpravu odvlhčení	Jmen. chladící výkon	Účinnost zdroje úpravy vlhkosti systému odvlhčení $\eta_{RH-,gen}$
	[-]	[-]	[kW]	[kW]	[%]	[kW]	[%]
Referenční budova	x	x	x	x	x	x	
Hodnocená budova/zóna:							

b.5.a) příprava teplé vody (TV)

Hodnocená budova/zóna	Systém přípravy TV v budově	Energo-nositel	Pokrytí dílčí potřeby energie na přípravu teplé vody	Jmen. příkon pro ohřev TV	Objem zásob-níku TV	Účinnost zdroje tepla pro přípravu teplé vody[1)]		Měrná tepelná ztráta zásobní-ku teplé vody	Měrná tepelná ztráta rozvodů teplé vody
						$\eta_{W,gen}$	COP	$Q_{W,st}$	$Q_{W,dis}$
	[-]	[-]	[%]	[kW]	[litry]	[%]	[-]	[Wh/l.d]	[Wh/m.d]
Referenční budova	x	x	x	x	x	85	--	5,0	150,0
Hodnocená budova/zóna:									
LOW-ENERGY BLOCK OF APARTMENTS	Gas condensing boiler	zemní plyn	100,0		1000	98		7,0	100,8

Poznámka: [1)] v případě soustavy zásobování tepelnou energií se nevyplňuje

b.5.b) požadavky na účinnost technického systému k přípravě teplé vody

Hodnocená budova/zóna	Typ systému k přípravě teplé vody	Účinnost zdroje tepla pro přípravu teplé vody $\eta_{W,gen}$ nebo $COP_{W,gen}$	Účinnost referenčního zdroje tepla pro přípravu teplé vody $\eta_{W,gen,rq}$ nebo $COP_{W,gen}$	Požadavek splněn
	[-]	[%]	[%]	[ano/ne]

Poznámka: Hodnocení splnění požadavku je vyžadováno jen u větší změny dokončené budovy a při jiné, než větší změně dokončené budovy v případě plnění požadavku na energetickou náročnost budovy podle § 6 odst. 2 písm. c).

b.6) osvětlení

Hodnocená budova/zóna	Typ osvětlovací soustavy	Pokrytí dílčí potřeby energie na osvětlení	Celkový elektrický příkon osvětlení budovy	Průměrný měrný příkon pro osvětlení vztažený k osvětlenosti zóny $p_{L,lx}$
	[-]	[%]	[kW]	[W/(m^2.lx)]
Referenční budova	**x**	**x**	**x**	0,05
Hodnocená budova/zóna:				
LOW-ENERGY BLOCK OF APARTMENTS		100	3,5	0,05

Energetická náročnost hodnocené budovy

a) seznam uvažovaných zón a dílčí dodané energie v budově

Hodnocená budova/zóna	Vytápění EP_H	Chlazení EP_C	Nucené větrání EP_F		Příprava teplé vody EP_W	Osvětlení EP_L	Výroba z OZE nebo kombinované výroby elektřiny a tepla	
			Bez úpravy vlhčení	S úpravou vlhčením			Pro budovu	Pro budovu i dodávku mimo budovu
LOW-ENERGY BLOCK OF APARTMENTS	☒	☐	☐	☐	☒	☒	☐	☐

b) dílčí dodané energie

ř.			Vytápění		Chlazení		Větrání		Úprava vlhkosti vzduchu		Příprava teplé vody		Osvětlení	
			Ref. budova	Hod. budova	Ref. budova	Hod. budova	Ref. budova	Hod. budova	Ref. budova	Hod. budova	Ref. budova	Hod. budova	Ref. budova	Hod. budova
(1)	Potřeba energie	[MWh/rok]	61,318	34,684			x	x			14,240	14,240	x	x
(2)	Vypočtená spotřeba energie	[MWh/rok]	112,717	46,227							26,629	21,643	9,884	9,884
(3)	Pomocná energie	[MWh/rok]	0,243	0,230							0,372	0,372		
(4)	Dílčí dodaná energie (ř.4)=(ř.2)+(ř.3)	[MWh/rok]	112,961	46,457							27,002	22,015	9,884	9,884
(5)	Měrná dílčí dodaná energie na celkovou energeticky vztažnou plochu (ř.4) / m^2	[kWh/(m2.rok)]	72	30							17	14	6	6

c) výrobna energie umístěná v budově, na budově nebo na pomocných objektech

Typ výroby	Využitelnost vyrobené energie	Vyrobená energie	Faktor celkové primární energie	Faktor neobnov. primární energie	Celková primární energie	Neobnov. primární energie
jednotky		[MWh/rok]	[-]	[-]	[MWh/rok]	[MWh/rok]
Kogenerační jednotka EP_{CHP} - teplo	Budova					
	Dodávka mimo budovu					
Kogenerační jednotka EP_{CHP} - elektřina	Budova					
	Dodávka mimo budovu					
Fotovoltaické panely EP_{PV} - elektřina	Budova					
	Dodávka mimo budovu					
Solární termické systémy $Q_{H,sc,sys}$ - teplo	Budova					
	Dodávka mimo budovu					
Jiné	Budova					
	Dodávka mimo budovu					

d) rozdělení dílčích dodaných energií, celkové primární energie a neobnovitelné primární energie podle energonositelů

Energonositel	Dílčí vypočtená spotřeba energie / Pomocná energie	Faktor celkové primární energie	Faktor neobnovi-telné primární energie	Celková primární energie	Neobnovi-telná primární energie
	[MWh/rok]	[-]	[-]	[MWh/rok]	[MWh/rok]
zemní plyn	67,870	1,1	1,1	74,657	74,657
elektřina ze sítě	10,487	3,2	3,0	33,558	31,461
Celkem	**78,357**	**x**	**x**	**108,215**	**106,117**

e) požadavek na celkovou dodanou energii

(6)	Referenční budova	[MWh/rok]	149,847	Splněno (ano/ne)	ano
(7)	Hodnocená budova		78,357		
(8)	Referenční budova	[kWh/m^2.rok]	96		
(9)	Hodnocená budova		50		

f) požadavek na neobnovitelnou primární energii

(10)	Referenční budova	[MWh/rok]	166,303	Splněno (ano/ne)	ano
(11)	Hodnocená budova		106,117		
(12)	Referenční budova (ř.10 / m^2)	[kWh/m^2.rok]	107		
(13)	Hodnocená budova (ř.11 / m^2)		68		

g) primární energie hodnocené budovy

(14)	Celková primární energie	[MWh/rok]	108,215
(15)	Obnovitelná primární energie (ř.14 - ř.11)	[MWh/rok]	2,098
(16)	Využití obnovitelných zdrojů energie z hlediska primární energie (ř.15 / ř.14 x 100)	[%]	1,9

h) hodnoty pro vytvoření hranic klasifikačních tříd

Horní hranici třídy C odpovídají	Celková dodaná energie	[MWh/rok]	149,847
	Neobnovitelná primární energie	[MWh/rok]	166,303
	Průměrný součinitel prostupu tepla budovy	[W/m^2.K]	0,41
	Dílčí dodané energie: vytápění	[MWh/rok]	112,961
	chlazení	[MWh/rok]	
	větrání	[MWh/rok]	
	úprava vlhkosti vzduchu	[MWh/rok]	
	příprava teplé vody	[MWh/rok]	27,002
	osvětlení	[MWh/rok]	9,884

Tabulka h) obsahuje hodnoty, které se použijí pro vytvoření hranic klasifikačních tříd podle přílohy č. 2.

Analýza technické, ekonomické a ekologické proveditelnosti alternativních systémů dodávek energie u nových budov a u větší změny dokončených budov

Alternativní systémy	Posouzení proveditelnosti			
	Místní systémy dodávky energie využívající energii z OZE	**Kombinovaná výroba elektřiny a tepla**	**Soustava zásobování tepelnou energií**	**Tepelné čerpadlo**
Technická proveditelnost				
Ekonomická proveditelnost				
Ekologická proveditelnost				
Doporučení k realizaci a zdůvodnění				
Datum vypracování analýzy				
Zpracovatel analýzy				

Energetický posudek	Povinnost vypracovat energetický posudek	
	Energetický posudek je součástí analýzy	
	Datum vypracování energetického posudku	
	Zpracovatel energetického posudku	

Doporučená technicky a ekonomicky vhodná opatření pro snížení energetické náročnosti budovy

Popis opatření		Předpokládaný průměrný součinitel prostupu tepla	Předpokládaná dodaná energie	Předpokládaná neobnovitelná primární energie	Předpokládaná úspora celkové dodané energie	Předpokládaná úspora neobnovitelné primární energie
		[W/(m^2.K)]	[MWh/rok]	[MWh/rok]	[MWh/rok]	[MWh/rok]
Stavební prvky a konstrukce budovy:						
			x	x		
Technické systémy budovy:						
vytápění:		x		x		
chlazení:		x		x		
větrání:		x		x		
úprava vlhkosti vzduchu:		x		x		
příprava teplé vody:		x		x		
osvětlení:		x		x		
Obsluha a provoz systémů budovy:						
		x	x	x		
Ostatní - uveďte jaké:						
		x	x	x		
Celkem		x				

Opatření	Posouzení vhodnosti opatření			
	Stavební prvky a konstrukce budovy	Technické systémy budovy	Obsluha a provoz systémů budovy	Ostatní - uvést jaké:
Technická vhodnost				
Funkční vhodnost				
Ekonomická vhodnost				
Doporučení k realizaci a zdůvodnění				
Datum vypracování doporučených opatření				
Zpracovatel analýzy				

Energetický posudek	Energetický posudek je součástí analýzy	
	Datum vypracování energetického posudku	
	Zpracovatel energetického posudku	

Závěrečné hodnocení energetického specialisty

Nová budova nebo budova s téměř nulovou spotřebou energie	
• Splňuje požadavek podle § 6 odst. 1	Ano
• Třída energetické náročnosti budovy pro celkovou dodanou energii	B
Větší změna dokončené budovy nebo jiná změna dokončené budovy	
• Splňuje požadavek podle § 6 odst. 2 písm. a)	
• Splňuje požadavek podle § 6 odst. 2 písm. b)	
• Splňuje požadavek podle § 6 odst. 2 písm. c)	
• Plnění požadavků na energetickou náročnost budovy se nevyžaduje	
• Třída energetické náročnosti budovy pro celkovou dodanou energii	
Budova užívaná orgánem veřejné moci	
• Třída energetické náročnosti budovy pro celkovou dodanou energii	
Prodej nebo pronájem budovy nebo její části	
• Třída energetické náročnosti budovy pro celkovou dodanou energii	
Jiný účel zpracování průkazu	
• Třída energetické náročnosti budovy pro celkovou dodanou energii	

Identifikační údaje energetického specialisty, který zpracoval průkaz

Jméno a příjmení	Bc. Michal Reiter
Číslo oprávnění MPO	
Podpis energetického specialisty	

Datum vypracování průkazu

Datum vypracování průkazu	14.1.2015

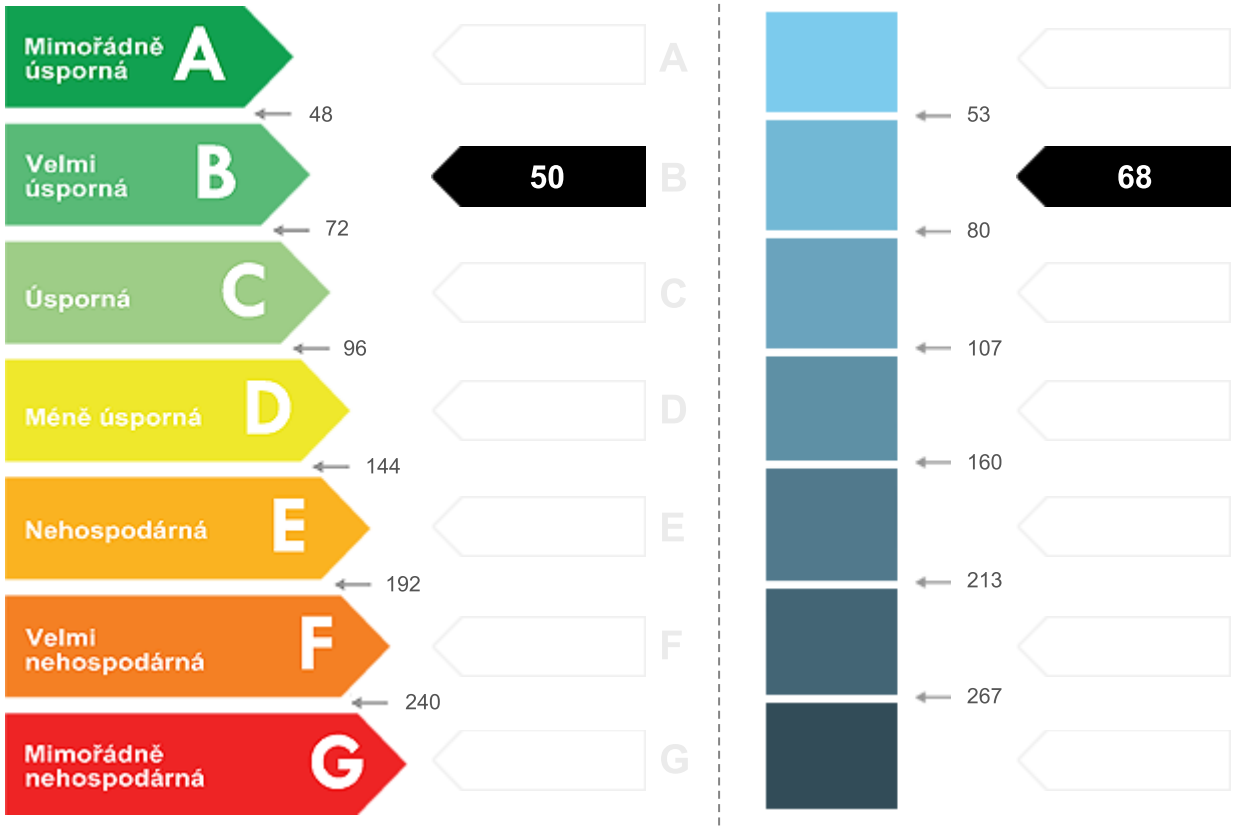
PRŮKAZ ENERGETICKÉ NÁROČNOSTI BUDOVY

vydaný podle zákona č. 406/2000 Sb., o hospodaření energií, a vyhlášky č. 78/2013 Sb., o energetické náročnosti budov

Ulice, číslo:	Slavonínská 482/22
PSČ, místo:	77900 Olomouc
Typ budovy:	Bytový dům
Plocha obálky budovy:	**1566,0 m²**
Objemový faktor tvaru A/V:	**0,47 m²/m³**
Energeticky vztažná plocha:	**1558,2 m²**

ENERGETICKÁ NÁROČNOST BUDOVY

Celková dodaná energie (Energie na vstupu do budovy)	**Neobnovitelná primární energie** (Vliv provozu budovy na životní prostředí)
Měrné hodnoty kWh/(m²·rok)	



Hodnoty pro celou budovu MWh/rok	**78,357**	**106,117**

DOPORUČENÁ OPATŘENÍ

Opatření pro	Stanovena
Vnější stěny:	☐
Okna a dveře:	☐
Střechu:	☐
Podlahu:	☐
Vytápění:	☐
Chlazení/klimatizaci:	☐
Větrání:	☐
Přípravu teplé vody:	☐
Osvětlení:	☐
Jiné:	☐

Popis opatření je v protokolu průkazu a vyhodnocení jejich dopadu na enegetickou náročnost je znázorněno šipkou Doporučení

PODÍL ENERGONOSITELŮ NA DODANÉ ENERGII

Hodnoty pro celou budovu
MWh/rok

Elektřina ze sítě: 10,5
Zemní plyn: 67,9

UKAZATELE ENERGETICKÉ NÁROČNOSTI BUDOVY

	Obálka budovy	Vytápění	Chlazení	Větrání	Úprava vlhkosti	Teplá voda	Osvětlení
	U_{em} W/(m²·K)	Dílčí dodané energie			Měrné hodnoty	kWh/(m²·rok)	
Mimořádně úsporná A	0,26	30					
B							
C						14	6
D							
E							
F							
G							
Mimořádně nehospodárná							
Hodnoty pro celou budovu MWh/rok		46,46				22,02	9,88

Zpracovatel: Bc. Michal Reiter
Kontakt: Mošnerova 17
77900 Olomouc

Osvědčení č.:
Vyhotoveno dne: 14.1.2015
Podpis:

VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ
BRNO UNIVERSITY OF TECHNOLOGY

FAKULTA STAVEBNÍ
ÚSTAV POZEMNÍHO STAVITELSTVÍ

FACULTY OF CIVIL ENGINEERING
INSTITUTE OF BUILDING STRUCTURES

E.1.3 – ENERGY LABEL

DIPLOMOVÁ PRÁCE
DIPLOMA THESIS

AUTOR PRÁCE — Bc. MICHAL REITER
AUTHOR

VEDOUCÍ PRÁCE — doc. Ing. SEDLÁK JIŘÍ, CSc.
SUPERVISOR

BRNO 2015

Protokol k energetickému štítku obálky budovy

Identifikační údaje

Druh stavby	Bytový dům
Adresa (místo, ulice, číslo, PSČ)	Slavonínská 482/22, 77900 Olomouc
Katastrální území a katastrální číslo	Olomouc - Povel, č. kat. 88/3
Provozovatel, popř. budoucí provozovatel	Pavel Kotěra
Vlastník nebo společenství vlastníků, popř. stavebník	Pavel Kotěra
Adresa	Stupkova 22, 77900 Olomouc
Telefon/E-mail	

Charakteristika budovy

Objem budovy ***V*** - vnější objem vytápěné zóny budovy, nezahrnuje lodžie, římsy, atiky a základy	3305,9 m^3
Celková plocha ***A*** - součet vnějších ploch ochlazovaných kontrukcí ohraničujících objem budovy	1566,0 m^2
Objemový faktor tvaru budovy ***A / V***	0,47 m^2/m^3
Typ budovy	nová obytná
Převažující vnitřní teplota v otopném období Θ_{im}	20,0 °C
Venkovní návrhová teplota v zimním období Θ_e	-15,0 °C

Charakteristika energeticky významných údajů ochlazovaných konstrukcí

Ochlazovaná konstrukce	Plocha A_i [m^2]	Součinitel (činitel) prostupu tepla U_i ($\Sigma\Psi_k.l_k + \Sigma\chi_j$) [W/($m^2$·K)]	Požadovaný (doporučený) součinitel prostupu tepla U_N (U_{rec}) [W/(m^2·K)]	Činitel teplotní redukce b_i [-]	Měrná ztráta konstrukce prostupem tepla $H_{Ti} = A_i . U_i . b_i$ [W/K]
Slavonínská 482/22, 77900	642,5	0,15	Olomo (88/3)	1,00	97,0
1.7.2015	345,4	0,16	Pavel (Stupko)	1,00	53,5
	378,0	0,25	kotera (0,4)	0,92	85,9
Otvorová výplň	200,1	0,73	1,50 (1,2)	1,00	146,1
Tepelné vazby			( )		31,3
Celkem	**1 566,0**				**413,9**

Konstrukce splňují požadavky na součinitele prostupu tepla podle ČSN 73 0540-2.

Stanovení prostupu tepla obálky budovy

Měrná ztráta prostupem tepla H_T	W/K	413,9
Průměrný součinitel prostupu tepla $U_{em} = H_T / A$	**W/(m²·K)**	**0,26**
Požadavek ČSN 730540-2 byl stanoven:	na základě hodnoty Uem,N,20 a působících teplot	
Výchozí požadavek na průměrný součinitel prostupu tepla podle čl. 5.3.4 v ČSN 730540-2 pro rozmezí Θ_{im} od 18 do 22 °C $U_{em,N,20}$	W/(m²·K)	0,51
Doporučený součinitel prostupu tepla $U_{em,rec}$	W/(m²·K)	0,38
Požadovaný součinitel prostupu tepla $U_{em,N}$	**W/(m²·K)**	**0,50**

Požadavek na stavebně energetickou vlastnost budovy je splněn.

Klasifikační třídy prostupu tepla obálky hodnocené budovy

Hranice klasifikačních tříd	Veličina	Jednotka	Hodnota
A - B	$0,5 \cdot U_{em,N}$	W/(m².K)	**0,25**
B - C	$0,75 \cdot U_{em,N}$	W/(m².K)	**0,38**
C - D	$U_{em,N}$	W/(m².K)	**0,50**
D - E	$1,5 \cdot U_{em,N}$	W/(m².K)	**0,75**
E - F	$2,0 \cdot U_{em,N}$	W/(m².K)	**1,00**
F - G	$2,5 \cdot U_{em,N}$	W/(m².K)	**1,25**

Klasifikace: B - úsporná

Datum vystavení energetického štítku obálky budovy: 14.1.2015

Zpracovatel energetického štítku obálky budovy: Michal Reiter

IČ:

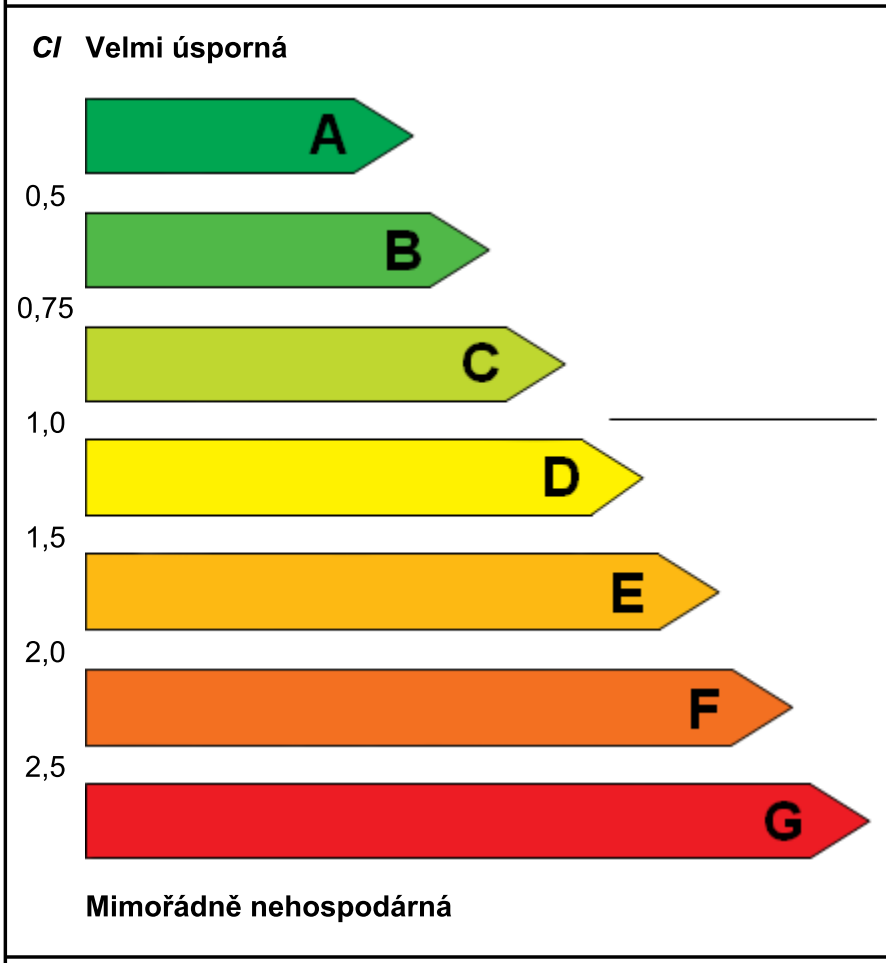
Zpracoval: Michal Reiter

Podpis: .....

Tento protokol a stavebně energetický štítek obálky budovy odpovídá směrnici evropského parlamentu a rady č. 2002/91/ES a prEN 15217. Byl vypracován v souladu s ČSN 73 0540-2 a podle projektové dokumentace stavby dodané objednatelem.

ENERGETICKÝ ŠTÍTEK OBÁLKY BUDOVY

Bytový dům Slavonínská 482/22, 77900 Olomouc	**Hodnocení obálky budovy**	
Celková podlahová plocha A_c = 1 558,2 m²	**stávající**	**doporučení**



KLASIFIKACE

Průměrný součinitel prostupu tepla obálky budovy U_{em} ve W/(m²·K) $U_{em} = H_T / A$	0,26	
Požadovaná hodnota průměrného součinitele prostupu tepla obálky budovy podle ČSN 73 0540-2 $U_{em,N}$ ve W/(m²·K)	0,50	

Klasifikační ukazatele *CI* a jim odpovídající hodnoty U_{em}

CI	0,50	0,75	1,00	1,50	2,00	2,50
U_{em}	0,25	0,38	0,50	0,75	1,00	1,25

Platnost štítku do:	Datum vystavení štítku: 14.1.2015
Štítek vypracoval(a):	Bc. Michal Reiter

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E.2.1 - GEOTECHNICAL AND RADON SURVEY

DIPLOMOVÁ PRÁCE
DIPLOMA THESIS

AUTOR PRÁCE — Bc. MICHAL REITER
AUTHOR

VEDOUCÍ PRÁCE — doc. Ing. SEDLÁK JIŘÍ, CSc.
SUPERVISOR

BRNO 2015

1. Identification data

Name of the document:

Geological report of foundation conditions of Low-energy block of apartments in the street Slavonínská

INFORMATION ABOUT CONSTRUCTION	
Name of the structure:	LOW-ENERGY BLOCK OF APARTMENTS
Stage of the documentation:	Study and realisation project
Investor and landowner:	Pavel Kotěra
Address:	Slavonínská 482/22, Olomouc
Plot number:	88/3, k.ú. Olomouc - Povel
INFORMATION ABOUT APPLICANT	
Investor and applicant:	Pavel Kotěra
Address:	Stupkova 22, 779 00 Olomouc, Czech Republic
Telephone number:	+420 728 26 99 88
E-mail address:	kotera@gmail.com
INFORMATION ABOUT DOCUMENTATION REALISER	
Name:	Bc. Michal Reiter
Identification number:	123456789
Address:	Mošnerova 17, 77900 Olomouc, Czech Republic
Telephone number:	+420 728 878 889
E-mail address:	michal.reiter@seznam.cz

2. Overview of geological conditions

Studied area belongs to the province of Západní Karpaty, system of Vněkarpatské sníženiny, subsystem of Západní Vněkarpatské sníženiny Hornomoravského úvalu, subsystem Prostějovské pahorkatiny.

Geologically interested area belongs to Neocene-lake cycle-Pliocene. It is freshwater series of sands and clays, which surface was measured in the depth of 0,7-1,5 m under the surface of nowadays area. At a depth of 3 m passes fine-grained soil in layers of

sandy and gravelly soils. Formation of gravel appears to be moderately laid down. The layers are aquifers. Gravel can be classified into soil class G3. The thickness of the layer ranges from 0,6 to 1,6 m. The geological bedrock was encountered at a depth of 4,2 to 5,2 m below ground level.

3. Geotechnical properties of the soils

Pliocene sediments 0,7-1,5 m
Sandy clay F3
Hard consistency
Total adhesion c_u = 60-70kPa
Total angle of inner friction Φ_u = 12-15
Effective adhesion c_{eff} = 20-28 kPa
Effective angle of inner friction Φ_{eff} = 24-129°

Argillaceous soil sandy (sandy soil)
Bulk weight r_n = 2110 kg.m^{-3}
Total adhesion c_u = 0,1 MPa
Total angle of inner friction Φ_u = 0°
Effective adhesion c_{eff} = 0,01 Mpa
Effective angle of inner friction Φ_{eff} = 20°

4. Engineering geological evaluation

Foundation proportions can be classified as simple.
The designed structure (low-energy block of apartments) is not foundation demanding. During the designing foundations of the modest buildings in simple bottom proportions we proceed according to the first geotechnical category that means we use the table bearing value
R_{dt} = 450 kPa (Sandy clay F3 of hard consistency)

1.Správní údaje	
název obce	Olomouc
kód obce	500496
název části obce	Povel
kód části obce	413852
2. Údaje o geologickém podloží	
horninový typ části obce podle geologických map 1 : 50 000	hlína, písek, štěrk
horninový typ části obce podle geologické mapy ČR 1 : 500 000	jíly, vápnité jíly ("tégl"), podřízeně písky, štěrky a řasové vápence
3. Údaje o radonovém indexu geologického podloží	
radonový index geologického podloží (1 – nízký, 2 – střední,3 – vysoký)	1
4. Údaje o radonu v ovzduší ve stavbách	
průměr výsledků měření objemové aktivity radonu v ovzduší ve stavbách (jednotka Bq.m-3)	165,4
pravděpodobnost překročení směrné hodnoty objemové aktivity radonu v ovzduší ve stavbách (200 Bq.m-3). Rozmezí pravděpodobnosti je 0 – nejnižší až 1 - nejvyšší.	0,23
5. Údaj o dávkovém příkonu gama záření hornin	
průměrný dávkový příkon gama záření hornin podle radiometrické mapy ČR 1 : 500 000. Rozsah hodnot v ČR je od 5 do 210 nGy.h-1.	55
6. Regionální údaje o radonu v ovzduší ve stavbách	
průměrná objemová aktivita radonu v ovzduší ve stavbách podle mapy geologického podloží v měřítku 1 : 500 000 (jednotka Bq.m-3)	144,5
průměr maxim objemové aktivity radonu v ovzduší ve stavbách podle mapy geologického podloží v měřítku 1 : 500 000 (jednotka Bq.m-3)	178
7. Regionální údaje o radonu v geologickém podloží	
průměr objemové aktivity radonu v geologickém podloží (jednotka kBq.m-3). Výpočet je proveden z radonové databáze ČGS.	19,6
průměr maxim objemové aktivity radonu v geologickém podloží (jednotka kBq.m-3). Výpočet je proveden z radonové databáze ČGS.	37,7

Aplikace přináší statisticky zpracované informace o radonovém riziku pro administrativní jednotky. Základem jsou databáze měření radonu v podloží a dávkového příkonu záření gama hornin (Česká geologická služba) a měření radonu v objektech (Státní úřad pro jadernou bezpečnost a Státní ústav radiační ochrany, v.v.i.), které byly zpracovány v rámci Radonového programu ČR. Podrobnější informace získáte na webových stránkách, uvedených ve vstupním okně aplikace. Lokalizace obcí a jejich částí, včetně městských částí, a topografický podklad byly pro účely této aplikace poskytnuty Českým statistickým úřadem a Českým úřadem zeměměřickým a katastrálním (bod 1).

Komplexní radonová informace je navázána na centroidy obcí a jejich částí (vztažné body pro jednoznačnou globální lokalizaci polygonu). Geologické podloží centroidu (bod 2) je uvedeno podle map v měřítku 1 : 50 000 (s kvartérním pokryvem) a 1 : 500 000 (hlubší podloží pod kvartérním pokryvem). K centroidu je vztažen i radonový index podloží (bod 3). Průměrná objemová aktivita radonu v ovzduší ve stavbách (bod 4) je aritmetickým průměrem všech měření, provedených v dané obci. Pokud je nulová, znamená to, že v obci nebyl radon v ovzduší ve stavbách měřen. V tomto případě je možno využít regionální údaje (bod 6). Pravděpodobnost překročení směrné hodnoty objemové aktivity radonu v ovzduší ve stavbách je vypočtena na základě korelací objemové aktivity radonu v podloží, ve stavbách a dávkového příkonu záření gama hornin. Regionální údaje o radonu ve stavbách a v podloží (body 6 a 7) jsou výsledkem statistického zpracování všech lokalizovaných dat pro vyšší geologické celky (horninové typy) na území ČR v měřítku 1 : 500 000.

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F.1 – TECHNICAL REPORT

DIPLOMOVÁ PRÁCE
DIPLOMA THESIS

AUTOR PRÁCE — Bc. MICHAL REITER
AUTHOR

VEDOUCÍ PRÁCE — doc. Ing. SEDLÁK JIŘÍ, CSc.
SUPERVISOR

BRNO 2015

Content

A. BACKGROUND DOCUMENTS

1. Project documentation

2. Czech National Standards

- ČSN 730810 – Fire protection of buildings, General requirements
- ČSN 730833 – Fire protection of buildings, Residential buildings
- ČSN 730873 – Fire protection of buildings, Water supply for fire systems
- ČSN 01 3495 – Building drawings - Fire protection drawings

3. Regulations

- No. 23/2008 Coll., about technical conditions for fire safety of buildings
- No. 268/2011 Coll., about technical requirements for buildings
- No. 246/2001 Coll., about assessment of conditions for fire safety

B. BRIEF DESCRIPTION OF BUILDING

1. Layout
    a. General information – Project documentation solves construction of new low-energy block of apartments. It is designed as a four storey building without basement.
    b. Floors – The object has four floors. Parking is available on the first floor of building. On the other three floors are situated residential apartments.
    c. Area, floor area – Total built up area of the building is 362 m^2, gross floor area is in the table below.

FLOOR	1ST FLOOR	2ND FLOOR	3RD FLOOR	4TH FLOOR	TOTAL
AREA [m^2]	322	307	307	307	1243

2. Constructions
    a. Roof - mechanically anchored warm flat roof construction, main water-proofing layer is made from PVC-P foil and sloping is made from thermal insulation wedges
    b. Vertical load-bearing constructions - consist of reinforced concrete walls in the 1st floor and lime-sand blocks masonry SILKA. The external walls are provided with ETICS thermal insulation.
    c. Vertical non load-bearing constructions - lime-sand blocks masonry partitions SILKA and plasterboards partitions Knauf.
    d. Horizontal constructions - are formed with RC monolithic continuous slabs. Ceilings are plastered by lime-cement plaster.
    e. Thermal insulation – There is thermal EPS polystyrene insulation inside the facade system and also on the roof. Thermal insulation of the floor on the ground under the insulated part of the building is made from EPS.
    f. Staircase – Construction of concrete staircase is monolithic.
    g. Elevator shaft - Construction of elevator shaft is made from monolithic reinforced concrete with thickness of 200 mm. It passes through all floors

in the place of protected escape way but it is placed only in the place of fire sector of protected escape way so that it does not have to be separate fire sector.

3. Purpose of the object – The object serves as a block of residential apartments – in the first floor there is also parking garage.
4. Location description – The object is situated in urban area of Olomouc. The distances between the neighbouring objects are sufficient and fulfilling standards. Terrain is almost flat, without any difficult conditions.

C. FIRE CHARACTERISTICS, DIVISION INTO FIRE SECTORS

1. Fire safety of building is assessed according to ČSN 73 0833 and other contextual standards.
2. Designed residential building according to ČSN 73 0833 - Fire protection of building - Buildings for dwelling and lodging, is classified as a building OB2.
3. Fire height of the building is h = 9,00 m.
4. Construction system is DP1 (non-flammable)
5. Whole object is divided into fire sectors:
    a. Dwelling units – N2.01, N2.03, N3.01, N3.03, N4.01, N4.04 (97,05 m2), N2.02, N3.02 (71,06 m2), N4.02, N4.03 (40,45 m2)
    b. Service room - N4.05 (6,50 m2)
    c. Cleaning room - N2.04 (6,50 m2)
    d. Storage room - N3.04 (6,50 m2)
    e. Protected escape way E1.01/E2.01/E3.01/E4.01 (75,23 m2)
    f. Garage G1.01 (272,91m2)
    g. Bicycle storage G1.02 (12,18m2)

D. FIRE RISK, DEGREE OF FIRE SAFETY, SIZE OF FIRE SECTORS

Fire sector N2.04, N3.04

Assumed as closets and other spaces for storage of household objects.
pv = 40 kg/m2
Degree of fire safety II.

Fire sector N4.05

pn = 15 kg/m2
ps = 5 kg/m2
p = pn + ps = 20 kg/m2
a = 1,1
b = 1
c = 1
pv = p * a * b * c
pv = 20 * 1,1 * 1 *1
pv = 22 kg/m2

Degree of fire safety II.

Fire sector N2.01-3, N3.01-3, N4.01-4

According to ČSN 73 0833, category of buildings OB2 - 5.1.2 In case of dwelling units we can determine the total fire load pv = 45 kg/m2 without any further calculations.
Degree of fire safety II

Fire sector E1.01/E2.01/E3.01/E4.01

Degree of fire safety of protected escape way is determined according to the lowest DFS of surrounding fire sectors - degree of fire safety in this case is II.

Fire sector G1.01

We evaluate fire safety of garage according to ČSN 73 0804 - Fire protection of building - Industrial buildings, enclosure I. Fire safety of garages.
- If in the standards are any other requirements each garage is separate fire sector
- Garage is reviewed like as collective built in garage
- Limit number of parking spaces by tab. I.2 for group 1 - the object with non-combustible construction system 135 parking spaces. This is a closed garage - with x = 0.25
- The garage will be marked - no entry for vehicles to gaseous fuel, garages are not equipped with gas detectors and effective ventilation
- For built-in garages where a surface area is bigger than 250 m2 there must not be stored fuel

According to enclosure B of ČSN 73 0802, table B.1 we can determine the total fire load pv=15 kg/m2 without any further calculations.
Degree of fire safety:
$\tau_e \cdot k_8$, where
τ_e - equivalent fire duration, according to enclosure G of ČSN 73 0804, table G.1
$\tau_e = 15$ min
k_8 - safety coefficient,
$k_8 = (k_5 \cdot k_6)/2,4 = (2 \cdot 1)/2,4 = 0,833$
$\tau_e \cdot k_8 = 15 \cdot 0,833 = 12,5$
Degree of fire safety I

Fire sector G1.02
According to ČSN 73 0833, category of buildings OB2 - 5.1.4 In case of bicycle rooms and baby strollers we can determine the total fire load pv = 15 kg/m2.
Degree of fire safety I

E. EVALUATION OF CONSTRUCTION FIRE RESISTANCE

Fire sectors N2.01, N2.02, N2.03, N3.01, N3.02, N3.03, N4.01, N4.02, N4.03, N4.04

Material	Demand – ČSN 730802	Actual value
External load-bearing wall Lime-sand blocks th. 240 mm	REW 30	REW 180 DP1
Internal load-bearing wall Lime-sand blocks th. 240 mm	REI 30	REI 180 DP1
Internal fire-resistant partition Plaster boards partition 2x Knauf white 12,5 mm	EI 30	EI 60 DP1
Ceilings monolithic RC slabs	REI 30	REI 30 DP1
Fire door	EIS 15 D3	EIS 15 D3

Fire sectors N2.03, N3.03, N4.04

Material	Demand – ČSN 730802	Actual value
External load-bearing wall Lime-sand blocks th. 240 mm	REW 30	REW 180 DP1
Internal load-bearing wall Lime-sand blocks th. 240 mm	REI 30	REI 180 DP1
Internal non-loadbearing wall Lime-sand blocks th. 150 mm	EI 30	EI 130 DP1
Ceilings monolithic RC slabs	REI 30	REI 30 DP1
Fire door	EIS 15 D3	EIS 15 D3

Fire sector E1.01/E2.01/E3.01/E4.01

Material	Demand – ČSN 730802	Actual value
External load-bearing wall Lime-sand blocks th. 240 mm 2-4th floor	REW 30	REW 180 DP1
Internal load-bearing wall Lime-sand blocks th. 240 mm 2-4th floor	REI 30	REI 180 DP1
Internal RC walls	REI 30	REI 30 DP1
Ceilings monolithic RC slabs	REI 30	REI 30 DP1
Fire door	EIS 15 D3	EIS 15 D3

Fire sector G1.01

Material	Demand – ČSN 730802	Actual value
External RC walls	REW 15	REW 30 DP1
Internal RC walls	REI 15	REI 30 DP1
Ceilings monolithic RC slabs	REI 15	REI 30 DP1
Fire door	EIS 15 D3	EIS 15 D3

Fire sector G1.02

Material	Demand – ČSN 730802	Actual value
External RC walls	REW 30	REW 30 DP1
Internal non-loadbearing wall Lime-sand blocks th. 150 mm	EI 30	EI 130 DP1
Ceilings monolithic RC slabs	REI 30	REI 30 DP1
Fire door	EIS 15 D3	EIS 15 D3

F. EVALUATION OF MATERIAL PROPERTIES

1. Plasterboards – reaction to fire – class A2
2. Reinforced concrete – reaction to fire – class A1
3. Lime-sand masonry – reaction to fire – class A1
4. EPS – reaction to fire – class B

G. EVACUATION - ESCAPE WAYS

Escape from the building is provided by a protected escape way of type A, consisting of the staircase from 4th floor to the 1st floor and out into the open space before the building.

Each floor consists of two open-able windows, of the total area 2m^2 min. is 2m^2 → satisfies.

The ultimate length of protected escape way of type A is 120 m. Assumed length of protected escape way is 44 m → satisfies.

According to the ČSN 73 0833, category of buildings OB2 - 5.3.6 we consider sufficient escape way for evacuation of people with width 1,1 m and door opening with width 0,9 m. Doors that are on the escape ways have to ensure fast and easy passing, the entrance door to the building may open inside, min. width of door - 0,9m → satisfies.
The escape way has width 1250 mm. The smallest possible value is 1,5 x one escape strip (1,5 *550) = 1100 mm. 1250 > 1100 mm therefore the escape way satisfies.

Evacuation from the fire sector of parking spaces will be through unprotected escape way of parking spaces to protected escape way or it can be use other escape way from parking spaces directly to open space with help of garage door. Unprotected escape is consider to be suitable when its length is up to 45 m of places to escape in two directions and length I s up to 30 m with one direction of escape.
Evacuation from the fire sector of bicycle room will be through unprotected escape way of garage sector to protected escape way. Maximal allowed length is 20 m, actual length of unprotected escape way is 10m → satisfies.

H. FIRE HAZARDOUS AREA

Fire hazardous area is calculated according to ČSN 730802, appendix F. The results are defined in the situation plan.

sector	fire load (kg/m^2)	area S_p			area S_{po}	% open	safe distance (m)
		length l (m)	height h_u (m)	S_p (m^2)			
northern facade							
E	15	4,0	1,0	4,00	2	50	**1,2**
N2.01	40	7,5	1,5	11,25	6	53	**4,2**
N2.03	40	7,5	1,5	11,25	6	53	**4,2**
N3.01	40	7,5	1,5	11,25	6	53	**4,2**
N3.03	40	7,5	1,5	11,25	6	53	**4,2**
N4.01	40	7,5	1,5	11,25	6	53	**4,2**
N4.04	40	7,5	1,5	11,25	6	53	**4,2**
N4.05	40	1,0	1,0	1,00	1	100	**4,7**
southern facade							
N2.01	40	7,5	2,4	18,00	10,05	56	**4,2**
N2.02	40	8,75	2,4	21,00	13,65	65	**5,2**
N2.03	40	7,5	2,4	18,00	10,05	56	**4,2**
N3.01	40	7,5	2,4	18,00	10,05	56	**4,2**
N3.02	40	8,75	2,4	21,00	13,65	65	**5,2**
N3.03	40	7,5	2,4	18,00	10,05	56	**4,2**
N4.01	40	7,5	2,4	18,00	10,05	56	**4,2**
N4.02	40	4	2,4	9,60	6,83	71	**3,6**
N4.03	40	4	2,4	9,60	6,83	71	**3,6**
N4.04	40	7,5	2,4	18,00	10,05	56	**4,2**
western facade							
N2.01	40	8,5	1,5	12,75	8,25	65	**4,7**
N3.01	40	8,5	1,5	12,75	8,25	65	**4,7**
N4.01	40	8,5	1,5	12,75	8,25	65	**4,7**
eastern facade							
N2.02	40	8,5	1,5	12,75	8,25	65	**4,7**
N3.02	40	8,5	1,5	12,75	8,25	65	**4,7**
N4.04	40	8,5	1,5	12,75	8,25	65	**4,7**

I. WATER FOR EXTINGUISHING

External fire water supply
The need of external fire water supply will be provided with existing fire water network within nearby communication (underground hydrants).

Internal fire water supply
Acc. ČSN 73 0873 hose systems connected to internal water supply must be installed. They must be permanently pressurized. The system must be controllable by one person and installed 1,2 m above floor height at each floor (4). Further information is defined in ČSN EN 671-1 standard.

J. EMERGENCY ROUTES

According to the 12.2.1 ČSN 73 0802 the access roads to the building can be placed at least 20 m from all building entrances where the fire intervention is assumed. According to the 12.2.2 ČSN 73 0802 the access road is considered to be at least single-lane road with minimal width 3 m. For design of roads is valid the ČSN 73 6110 or ČSN 73 6110 and for design of road construction is valid ČSN 73 6114. According to the 12.2.3 ČSN 73 0802 in case of new building it is recommended to widen the road in the place of hydrants so that it helps during the fire intervention. Maximal distance of access road from the building is 50 m. Road is approximately in 6,5 m distance from the building.

K. FIRE EXTINGUISHERS

According to the ČSN 73 0833, category of buildings OB2 and enclosure 4 of Public note 23/2008 sb. two powder extinguishers (6kg) will be place inside a garage, and one powder extinguisher type 21A (6kg) will be placed in bicycle room. Also there will be one powder extinguisher placed in each dwelling unit.
Its positioning will be in accordance with Public note 246/2001Sb.

L. TECHNICAL EQUIPMENTS

a) Ventilation – overall ventilation in the building is covered with natural ventilation through windows. Other forced ventilation is defined in the project documentation.
b) Heating – the heating is provided with condensing boiler situated in the service room.
c) Electric installations – will be installed acc. to latest standards regarding this problematic. The atmospheric electricity protection will be provided with external lightning protection.

M. SPECIAL REQUIREMENTS FOR CONSTRUCTIONS

The hydrant boxes must be installed in a predrilled cavity in the masonry.

N. FIRE SAFETY DEVICES

According to the Public notice 23/20008Sb. each dwelling unit has to be equipped by autonomous fire and smoke detector and autonomous signalization. The garage is designed mainly for habitants of building so that an installation of announce system is not needed.

O. SAFETY SIGNS

Movable fire extinguisher and main electric switch will be signed according to the ČSN ISO 3864, ČSN 010813 and government regulation NV 11/2002 Coll. warning protection signs and tables.

P. CONCLUSION

The solved structure will suffice all fire safety requirements while keeping all prescribed constructions and solutions.
If a change in the overall design should take place then the necessary adjustments of the fire safety evaluation must be processed.

CONCLUSION:

The main aim of diploma thesis is to design new residential building which will comply with the national standards and will be in low-energy standard. The results of calculations are in accordance with valid standards and building is energy saving of the B category.
Compositions of constructions satisfy all requirements as thermal properties of building, load bearing capacity, strength, fire protection and building acoustics requirements.

SOURCES:

Legislation:

Act. No. 183/2006 Coll., Building Act

Public Notice 499/2006 Coll., about structure documentation, change 62/2013 Coll.

Public Notice 268/2009 Coll., about technical requirements for constructuon

Public Notice 398/2009 Coll., about general technical requirements ensuring barrier-free use of buildings

Regulation No. 23/2008 Coll., about technical conditions for fire protection of buildings

Regulation No. 268/2011 Coll., about which change regulation No. 23/2008 Coll.

Regulation No. 246/2011 Coll., about Ministry of Interior determine fire safety conditions and state fire supervision (Regulation about fire prevention)

Standards:

ČSN 73 4301 Residential buildings

ČSN 01 3411 Large scale maps – Drawings and marks

ČSN 01 3420 Construction drawings – Presentation of general arrangement drawings

ČSN 01 3495 Building drawings – Fire protection drawings

ČSN 73 0540 Thermal protection of buildings

ČSN 73 0525: 1998 Acoustics – Acoustical design of rooms - General principles

ČSN 73 0532: 2010 Acoustics – Protection against noise in buildings and evaluation of acoustic properties of building elements – Requirements

ČSN 73 4130 Stairways and sliding ramps – Basic requirements.

ČSN EN ISO 6946 Building components and building elements – Thermal resistence and thermal transmittance – Calculation method

ČSN 73 4301: 2004 Residential buildings

ČSN 1991-1-1 Eurocode 1: Actions on structures

ČSN 73 0804 Fire protection of building - Industrial buildings

ČSN 73 0802 Fire protection of building - Non-industrial buildings

ČSN 73 0810 Fire protection of building - General requirements

ČSN 73 0818 Fire protection of building - Person/surface rate in buildings

ČSN 73 0833 Fire protection of building - Buildings for dwelling and lodging

ČSN 73 0873 Fire protection of building - Equipment for fire water supply

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LIST OF ABBREVIATIONS AND SYMBOLS

No. – number

Coll. – collection

th. – thickness [mm], [m]

Rdt – bearing capacity of soil [MPa]

λ – thermal conductivity [W/m·K]

R – thermal resistence [m2·K/W)]

HT – total heat transmission losses [W/K]

Uem,N – mean required coefficient of heat transfer [W/(m2·K)]

Uem,rec – mean recommended coefficient of heat transfer [W/(m2·K)]

CI – class index

pv – calculated fire load [kg · m^2]

BPV – height systeme used in Czech Republic