CZECH TECHNICAL UNIVERSITY IN PRAGUE

FACULTY OF CIVIL ENGINEERING

DEPARTMENT OF CONCRETE AND MASONRY STRUCTURES

TECHNICAL REPORT

CONCRETE PART

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NAME OF PROJECT	RESIDENTIAL BUILDING IN PRAGUE
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Contents

1. GENERAL INFORMATION

Residential building in Letnany in Prague is designed. The building is located in the outer border area of Prague in a newly developed residential area. The residential building is designed economically and utilizing modern ways of design and construction. The project emphasizes on good quality. The project utilized orthogonal architecture to blend in with the surrounding. Czech and Euro codes were used during design.

2. BASIC INFORMATION

The residential building has 1 underground floor and 5 upper ground floors. The size of the building is different in underground level and in upper floors. Underground level is 47.0 m long and 20.6 m wide. Height above the ground is 17.05 m. Height under the ground is 2.02 m. Total height is 19.07 m. The underground floor is equipped with a garage, technical room, washing machine room, drying room, rooms for storages. 16 parking spaces are located outside the building. Drive in to the building is from south. There are 10 apartments first level, 11 apartments in second till fourth level and 6 floor in fifth floor. Apartment is of different dispositions from 1+kc to 4+kc. The building consists of 49 apartment units in total. All the apartments are properly lighted. Underground level is bigger than upper floor, there is jump in the slab in the structural system of underground level to achieve the difference in section of first level terraces and apartments. Another recces of building shape is in the fifth level when the fifth level is smaller than others. The roof areas of fourth floor is used as terraces for fifth floor apartments. Building is also equipped with balconies. Entrance to the garage is from the level of outside street. There is no ramp. Underground level floor is in the same height as surrounding street level. Entrance to the building is from the intermediate level of staircase. It is one staircase wing downstairs to the garage and one staircase wing up to the apartment areas. In the entrance area there is common residential building equipment such as cleaning room and staller room. Underground floor is used mainly for parking, there is also storage areas and technical room. The building is not designed specifically for use of disabled people. Disabled people will be in the building not permanently, only occasionally.

2.1. STANDARDS

Used codes

EN1992-1 – Concrete structures

2.2. SOFTWARE

-AutoCAD 2018

-MS Office

3. STRUCTURAL SYSTEM

The structural system of underground floor is a two-way flat slab with thickness of 250 mm. First floor is created by load bearing concrete walls in perpendicular direction of length of the building. Therefore the slab above underground level is also supported by walls of first level and those are supported by the columns of the underground level, which is used mainly for garage purposes. Therefore the assumption is made, that the slab above first level acts more in a one way fashion, than as plain two way slab. And the construction system can be characterized as combined with columns in UL and walls in upper structure.

Columns in the underground garage are 1000x250 mm.

Underground floor is bigger than the rest of the building, the reinforced concrete slab above underground level is used as a terrace of the apartments in first level. Due to different composition of terrace and regular apartment, there is a slab brake in the RC slab above underground level. First level to fourth level are almost similar in the perimeter of the building, there is few recesses and adding on the perimeter of the building. There is obvious advantage seen in the choice of structural load bearing reinforced concrete walls system. In a expansion of the floor further from the perimeter of the floor below and in a situation with the balcony cantilever from this expansion, structural solution without expanding load bearing walls would be difficult. Wall system is also much stiffer than skeleton system. Fifth floor is smaller than the rest with slab above fourth level used as a terrace, this time without slab brake, which would create unwelcome appearance in the apartments below. This recess of the fithf floor leads to thicker reinforced concrete slabs than in the regular floor to thickness of 250 mm.

There is an elevator shaft with doubled wall in the face of apartment. Double wall starts directly from foundation slab.

Underground level is all from reinforced concrete. Load bearing walls of first level are all from reinforced concrete. Load bearing walls of second level are from reinforced concrete in the case of creation the expansion of the perimeter of the building, otherwise are from masonry. Load bearing walls of third and fourth level are from masonry, there is no more expansion in these levels. Load bearing walls of fifth floor are from masonry. Standing sometimes not on other load bearing walls of the floor below but on the reinforced concrete slab of thickness of 250 mm with hidden beams in the place of walls of fifth floor.

Load bearing walls around elevator creating communication area are from reinforced concrete from bottom to the top.

4. MATERIALS

Concrete :

Reinforced concrete columns underground level

C35/45 - XC2, XD1 - dmax=22mm - Cl<2% - S4

Reinforced concrete perimeter walls underground level

C30/37 – XC4, XD1,XA1 - dmax=22mm - Cl<2% - S4

Reinforced concrete walls (communication areas) underground level

C30/37 - XC2, XD1 - dmax=22mm - Cl<2% - S4

Reinforced concrete walls (communication areas) upper levels

C30/37 – XC1 - dmax=22mm - Cl<2% - S4

Reinforced concrete slabs

C30/37 – XC1 - dmax=22mm - Cl<2% - S4

Reinforced concrete foundations

C25/30 - XC3, XA1 - dmax=22mm - Cl<2% - S4

Reinforced concrete of precast staircase elements

C30/37 – XC1 - dmax=22mm - Cl<2% - S4

Reinforced concrete piles

C25/30 - XC3, XA1 - dmax=22mm - Cl<2% - S4

Steel :

Reinforcing bars B500B

Masonry :

POROTHERM 25 AKU SYM P15, M10 250 mm

POROTHERM 19 AKU SYM P10, M10 250 mm

POROTHERM 17,5 P+D P8, M2,5 – PARTITIONS 175 mm

POROTHERM 11,5 P+D P10, M2,5 – PARTITIONS 115 mm

5. LOADS

(see the structural analysis)

The load generated from two way slab underground – General floor composition is 7,1 KN/m2

The load generated from one way slab general floor composition is 7,1 KN/m2

The load generated from one way slab roof composition is 7,2 KN/m2

Live load for floor for residential building is 1.5 KN/m2

Live load for roof for residential buildings (maintenance) is 0.75 KN/m2

Snow load =0.7 KN/m2

Live load on staircase = 3,0 kN/m2

Wind load: the building is located in Prague, it is 16 m height, vk = 25 m/s – horizontal load from wind is than estimated to 1,0 kN/m2

6. FOUNDATION

Building is founded on combination of piles and foundation slab. It is estimated that 70% of load will be carried by piles and 30% of load is carried by the foundation slab. Soil below underground level is clay. The load will be transferred by piles mainly by skin friction.

7. BALCONIES

Balconies are solved as cantilevered elements of span of 1600 mm. To eliminate thermal bridge, the iso beams elements are used. Element with negative moment capacity and also with shear force capacity has to be used.

8. STIFFNESS OF THE BUILDING

Load bearing reinforced concrete walls structural system is stiff enough to resist any kind of horizontal force (mainly wind) acted on the structure.

9. STAIRS

Staircase is solved as monolithic landings and intermediate landings with precast staircase flights. Intermediate landings are concreted using rebar connection system (for example stabox).This system works on a base of eliminating construction joint due to difference of elevation of intermediate landing in the surrounding walls. Rebar connection element is firstly placed on the walls rebars into the formwork, the wall is concreted. Afterwards the cover of rebar connection element is taken of and the rebars are opened. Now the workers can make a formwork for intermediate landing and concreated it afterwards.

10. ANCHORAGE ELEMENTS

The building is equipped with a variety of steel elements (for example railings), which has to be anchored to the concrete structure. To this purpose the chemical anchorage will be mainly used.

11. LIST OF ATTACHMENTS

-Structural calculation

-RC slab calculation

-RC column calculation

-Balcony calculation

-Staircase flight calculation

12. LIST OF DRAWINGS

1) FIRST LEVEL FORMWORK
2) FOUNDATION SLAB FORMWORK
3) STAIRCASE REINFORCEMENT DRAWING
4) STRUCTURAL SYSTEMS 1
5) STRUCTURAL SYSTEMS 2