Case study no. 5

APARTMENT HOUSES CHÝNĚ

1. General Information

Period of construction:	2006 – 2007
Price:	7,4 million CZK
Investor:	OXES, s.r.o. Praha 2, Španělská 742/6, PSČ 120 00
Project:	Jindřich Sporek, Valašské Klobouky, Cyrilometodějská 301, PSČ 766 01
Construction company:	RD Rýmařov, s.r.o. Rýmařov, 8. května 1191/45, PSČ 795 01
Location:	Chýně
Materials used:	Timberwork (timber, mineral and glass fiber insulation, gypsum wood-fiber board, gypsum plasterboard, concrete roofing, ceramics, contact thermo facade …)

2. Investment design

It is a locality construction of 32 timber-based multistoried detached and terrace houses. The delivery is turn-key including groundwork, house connections, ground completion and fencing.

Pic. 1 Apartment houses in Chýně

3. Bearing system

The timber-based houses are made of platform frame. The carrying bars of the vertical construction have a profile of 120 x120 mm and are located in a module distance of 600 mm. Gypsum wood-fiber boards are used for static sheathing. The horizontal construction is made of beams with a dimension 60 x 240 mm, closed with DTD 22 mm. The roof construction is a purlin system. Moreover, it is made of wooden beams for a maximum snow load of up to 1,5 kNm^{-2} in agreement with the static calculations. The house can be situated to the elevation above sea-level up to 600 m. The overlap of

the saddle roof is approximately 600 mm on the eaves and gable side. The roof covering is made of concrete roof tiles.

4. Computational models used

The program IDA NEXIS is used for the computation of the building static.

5. Actions on structures

The individual structural parts are made in the factory as a platform frame. The dimension of the vertical structural parts is the whole story height with a length up to 11 000 mm. The horizontal structures are made in form of ceiling elements with the maximum dimension of 2 400 x 12 000 mm. The roof purlin construction is completely prepared in the factory in the form of individual machined members. The production documentation is run by means of the graphic program Cadwork.

6. Project documentation, plans, drawings

The apartment houses in Chýně are designed for detached and terrace house-buildings. The houses are built on slab–on-ground foundation bases. They have two stories above ground and an attic. The apartments are designed as houses with six or ten flats. The dimensions of the ground plan of the house are 16, 96 x 10, 63 m. Characteristics of the building are shown in Fig.1:

Ground plan size	16,96 x 10, 63 m
Number of above-ground stories	3
Number of dwelling units	6 (10)
Type of roof construction	purlin system 38°
Construction of external walls	framework
Thermal resistance for external walls	R = 4,195 m ^{2}K W^{-1}
Coefficient of thermal transmittance for external walls	U = 0,229W m $^{-2}$K^{-1}
External wall fire resistance	REI 90, REW 60
External wall airbone sound insulation	R w 44 dB
Impact sound insulation for ceiling with covering	L´$_{n,w}$ = 52 dB
Airbone sound insulation for flat to flat walls	R´ $_{w}$ = 59 dB

Fig. 1

6.1. Structure of single components

External wall and gable from exterior:
- Stopper with stiffening network 3 mm
- Facade polystyrene 60 mm
- Gypsum wood-fiber board 15 mm
- frame construction with mineral insulation 120 mm
- Moisture stop
- Gypsum wood-fiber board 12,5 mm
- Gypsum plasterboard 12,5 mm
- Structural wallpaper
- Interior paint

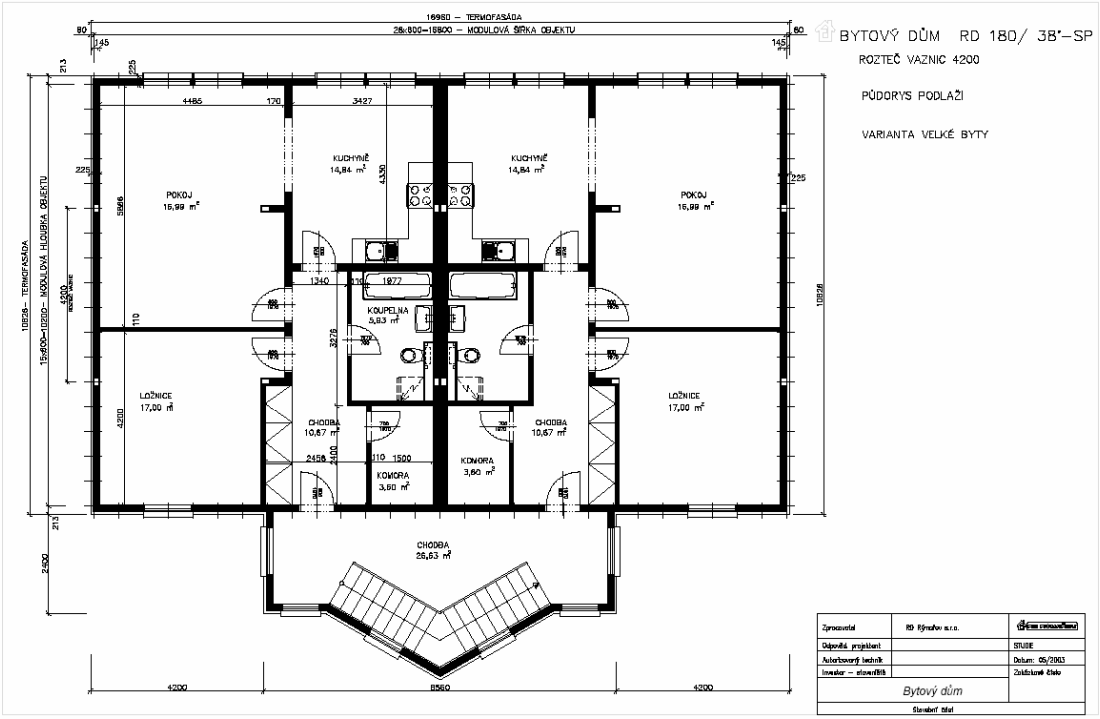
Ceiling structure top down:
- Floor covering (carpet, tiles)
- Anhydrite compound 45 mm
- Sound insulation layer of mineral wool
- Ceiling covering DTD 22 mm
- Ceiling beams 60 x 240 mm with min. insulation 120 mm
- spread lathing 30 x 60 mm
- 2 x gypsum plasterboard GKF 12, 5 mm

The internal bearing walls have a bearing construction of wooden beams. The covering is made of gypsum wood-fibre boards and gypsum plasterboards. The interior space of the framework is filled with mineral felt. The total thickness of one internal bearing wall including covering with gypsum plasterboards 2 x 12,5 mm is approximately 170 mm.

The dividing bars are a framework construction with a gypsum wood-fibre board and a gypsum plasterboard covering. The interior of the framework is filled with mineral felt – thickness approximately 60 mm. Dividing bars are used with a total thickness of approximately 110, 157, 170 mm. Installation walls are used according to the constructional requirements – thickness approximately 87 – 219 mm.

Stairs between the floors are made of metal, in accordance with the project documentation without risers. To make the loft accessible (loft above the attic), RD houses are equipped with a trap door.

Pic.2 - The ground plan



Pic. 2

7. Assembly

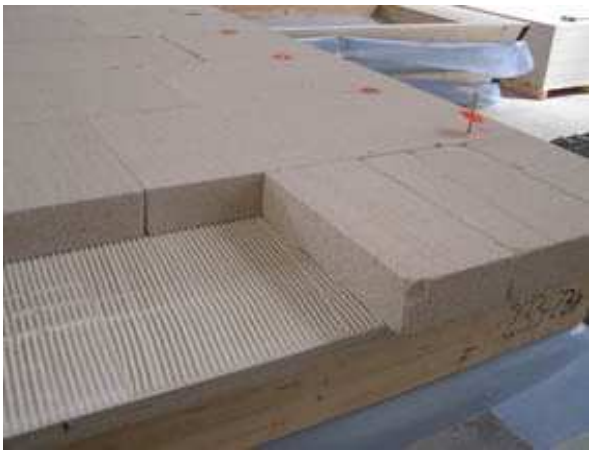
The vertical construction parts of the first storey are brought down on the prepared concrete foundation base by crane (walls and bars) and fixed with the help of anchors and expansion screws. The cross-connection of the parts is done through screws and drywall screws. The ceiling elements are laid on the balanced walls and **mutually** connected with screws. The whole ceiling board is fixed

with spiral nails to the walls. Beam riders are fixed on the ceiling on which the external walls of the second above ground storey are put. Bars and carrying walls are put into the object. The cross-connection is similar to the assembly of the first above ground storey, the same is for the assembly of the roof including the beam riders of the attic floor. The external walls of the attic floor and the bottom part of the gable are put on the beams. In between the walls and the external walls of the attic floor inclined walls are assembled. After the settlement of the purlin roof spars are fixed with the help of the BMF profiles, spiral nails and stepped nails. Roof and gable lower ceilings, diffuse folio, contra rods, roof rods and roof cover are settled on the roof spar. The external thermo façade is finished in the areas, where due to assembly reasons the production could not be finished and the visual plaster is extended. At the same time the interior is completed. The electricity is distributed. The central heating, the inner canalization, gas and sanitary conveniences are finished. Further, the floor construction is laid. The interior facing of the wall is completed with plasterboard and the gypsum plasterboard lower

ceilings are assembled. The walls and the ceilings are affixed with a structural wall paper and white paint. The floor coverings, paving and facings are laid, heaters, lights, blinds, fixtures and fittings for bathrooms, toilets and the kitchen are assembled. The entrance doors for each flat and interior doors without door steps with doorframes are assembled.

8. Interesting construction details

The requirement of the investor to increase the fire resistance of the gable wall of the apartment houses to REI 90 was fulfilled by implementing a MULTIPOR board 600x390x80 into the construction. The MULTIPOR boards were glued to the gable wall directly in the fabric and integrated into the areas of the connecting parts after the assembly.



Pic. 3 Glueing of Multipor

Pic. 4 Gable wall with Multipor

9. Protection from weather effects

The building parts are produced and loaded in protected tempered spaces. At the construction site trailers are transported under the protecting cover. The assembly is carried out directly form the transporters without an in-process store. In case of bad weather and stopped work, the object in the process of construction is protected with a cover. The assembly of building shells is done in a short time if possible and is finished with the roof covering and the completion of the thermo façade including the surface works.

10. Economical and ecological aspects

The use of wood for the construction of apartment houses in terms of the economy and environment is very useful. It is a matter of the most significant natural material. It is a resource, which positive aspects are especially good effects on the atmosphere, fragrance, regulated humidity, increased sense of warmth and emerging physical building characteristics. In consequence of current requirements of long-term sustainable growth, wood as a building material gains new perspectives. The fact, that wood as building material is prioritized has many reasons:

- its harvesting amount is increasing in the Czech Republic
- its use for the building of houses has historical roots in the Czech Republic
- the energy intensity of the harvesting of wood, its processing into the object and the disposal of the object after the termination of its lifetime is three to five times lower as materials like concrete, brick etc.
- the whole object from the floor to the roof covering can be built out of wood
- a wood construction of the whole object is represented by less than 2 % in the Czech Republic.

The wood can therefore be used to build family houses, apartment houses and in future even whole building blocks.

Instructions and case study no. 5 were prepared by Ing. Miroslav Jindrák.