Case study no. 9

SPORTS HALL – ČESKÝ TĚŠÍN

1. General information

Date: September 2007
Price: 7 458 277 CZK, incl. VAT
Investor: private investor
Design studio: DELTA Třinec, s.r.o.
Location: Český Těšín, Street: Svojsíkova alej
Surrounding: Karviná district, Moravian-Silesian region
Materials used: concrete, timber, masonry material

2. Investment design

The principle aim and intention of the municipality is to provide better conditions for recreational and top level sports, to create good conditions for high-quality life in the town of Český Těšín.
The sports hall internal dimensions: 25,2 x 44,8 m, height in the highest point is 12,2 m, exploitable sports area is 968 m^2. The sports hall is intended for indoor games: badminton, basketball, indoor football, handball, indoor hockey, volleyball and tennis.

3. Bearing system

The object is founded on drilled piles on which foundation girders connected by transverse reinforced-concrete ribs are located.
External filing masonry and internal bearing walls are made of burnt shaped bricks POROTHERM P+D and Ytong shaped bricks.
Floor structure of the hall is projected to be from arch timber glue laminated trusses in dimensions 180/900, 160/900 mm and gable timber trusses 100/600 mm and with internal radius of 11 640 mm. Between the trusses purlins into BOVA straps are located.
Wind bracing of the roof level is provided by steel drawbars in two lateral fields and by timber bracings of 120/240 mm along the whole object. The roof of the hall is single-shelled with thermal insulation above the bonds. Asphalt roofing paper is used. Ceiling is covered by timber battening with spaces. Shields of the hall is designed as ventilated walls made of timber glued columns anchored on brick backing covered by plasterboards from internal and external sides.
Floor of the sports hall is universal cladding of thickness 4 – 6 mm, in nearby rooms the floor is made of ceramic tiles. In shield walls tipping glassy brightening areas are designed into plastic profiles.

4. Computational models used

Structure of the arch glued plain girded was modelled as a 3D frame structure. It was solved as a geometrically non-linear computational model in IDA NEXIS 32 programme.

5. Actions on structures

Single loads were calculated according to EC 1, according to its single parts for calculation of permanent load, snow loads and wind actions.

ČSN EN 1991-1-1 Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight and imposed loads for buildings
ČSN EN 1991-1-3 Eurocode 1: Actions on structures - Part 1-3: General actions – Snow loads
ČSN EN 1991-1-4 Eurocode 1: Actions on structures - Part 1-4: General actions – Wind actions.

ČSN EN 1995-1-1 norm was used for designing of the sports hall made of glue laminated timber connected by mechanical joining parts. The norm comprises principles and requirements related to safety and serviceability of structures and principles for designing and testing according to the theory of limit states.

6. Project documentation, plans, and drawings

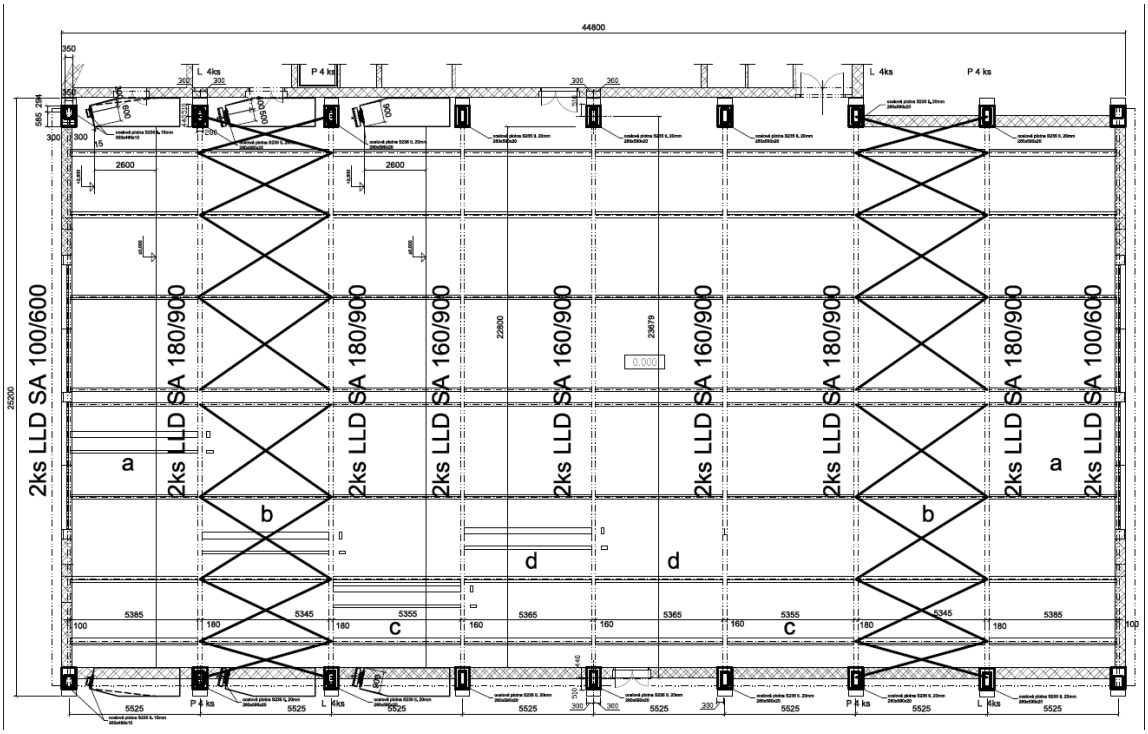

Fig. 1 Floor plan of the sports hall

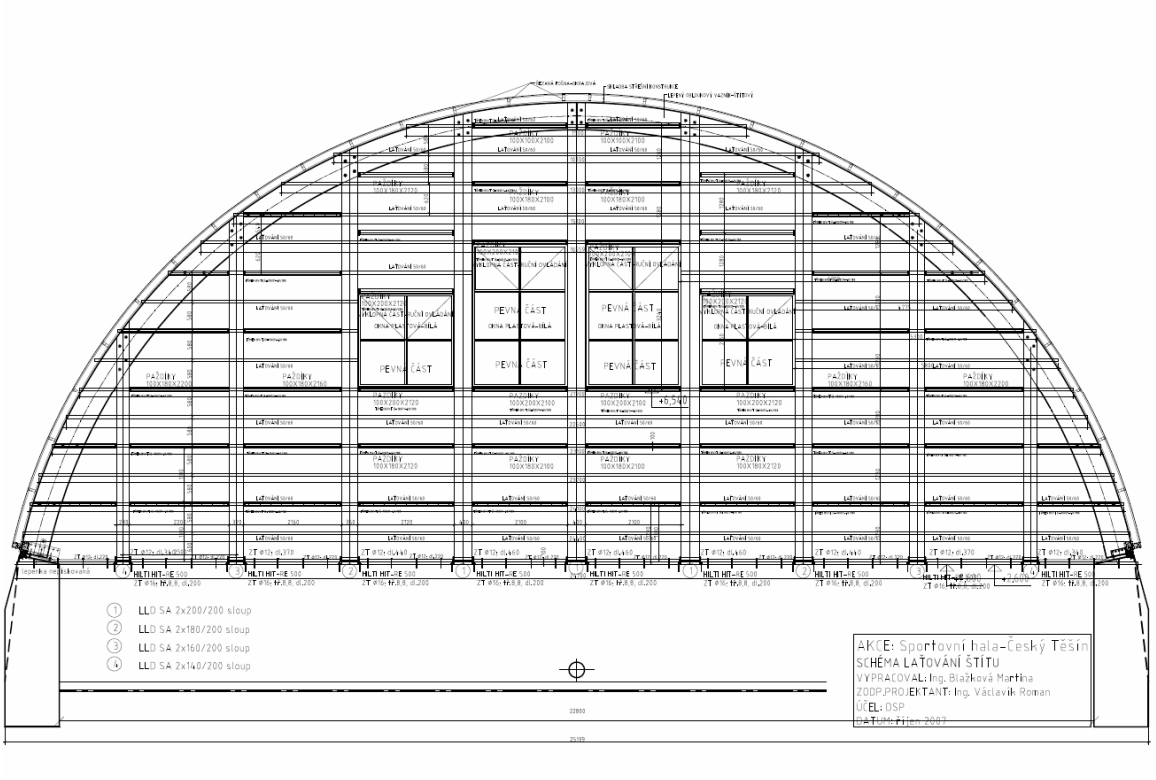

Fig. 2 Cross section of the shield wall

7. Erection

Fig. 3 Setting of the purlins into BOVA straps between glue laminated arches

Fig. 4 Arch truss frames with oblong bracing and steel drawbars

Fig. 5 Gradual roofing of the soffite

Fig. 6 View at timber battening with spaces

Fig. 7 Roofed sports hall with external filling masonry

Fig. 8 Shield wall

8. Interesting construction details

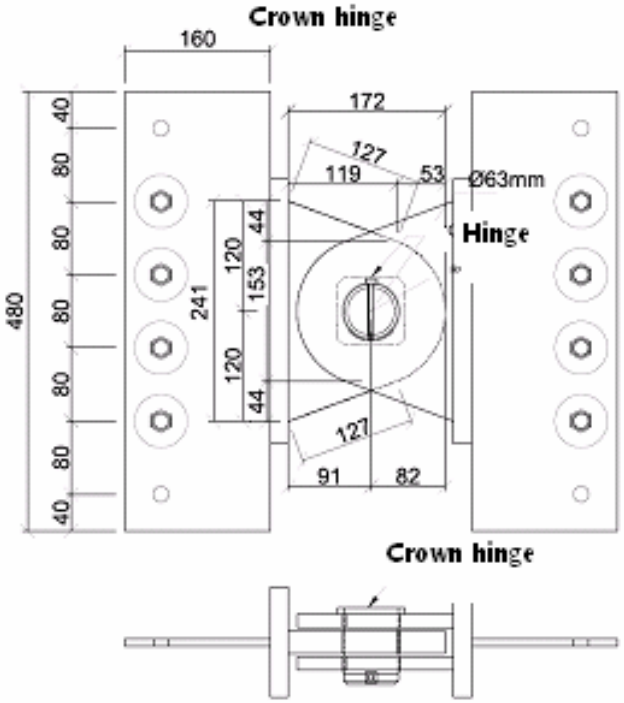

Fig. 9 Apical joint of arch truss frames

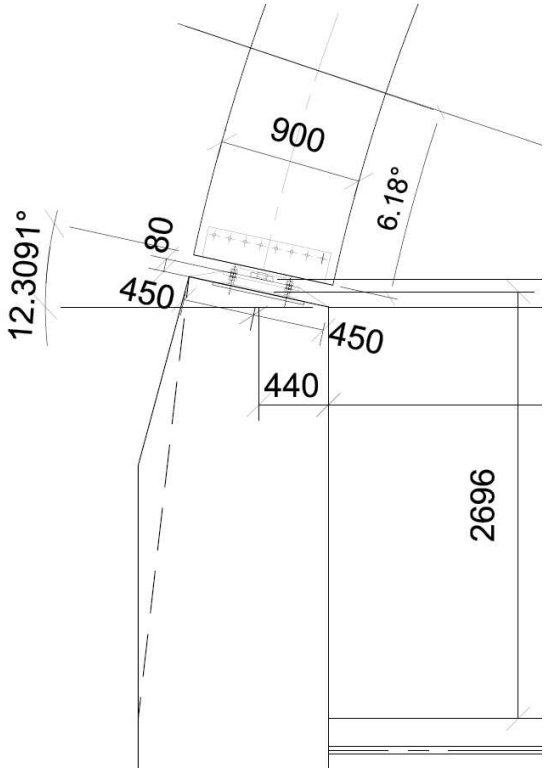

Fig. 10 Detail of the foot base of the arch timber truss with foundation structure

9. Protection from weather effects

Roof covering is single layered and it is designed by building-structural measures which assure that timber will be protected and ventilated. The edge of the roofing is provided with slots to provide air flow into the structures. Timber structures are located the way they are constantly exposed to free air flow. There was an edge created which should prevent leakage of rain water and condensation of air humidity.

10. Economical and ecological aspects

Towards the indisputable economic effect of the structure is necessary to be added a very positive economic circumstance. The sports facilities for non-organized public, which should be on the first place in the conception of priorities of investment building of physical training facilities in all towns, are not unprofitable and after relatively short time of returnability of invested resources it is possible to count on even economically profitable operation.
The main ecological aspect of the constructions is the use of the glued timber itself as the main bearing structural material. In the area where steel variants of structural roofing have been used on the past and present is the variant from glue timber energetically less demanding from the aspect of acquiring and operation.
Materials used in the construction process are characterized by lifetime span, minimal requirements on maintenance and treatment.

Instructions and case study no. 9 were prepared by Antonín Lokaj.