LoGing, d.o.o., Novo mesto

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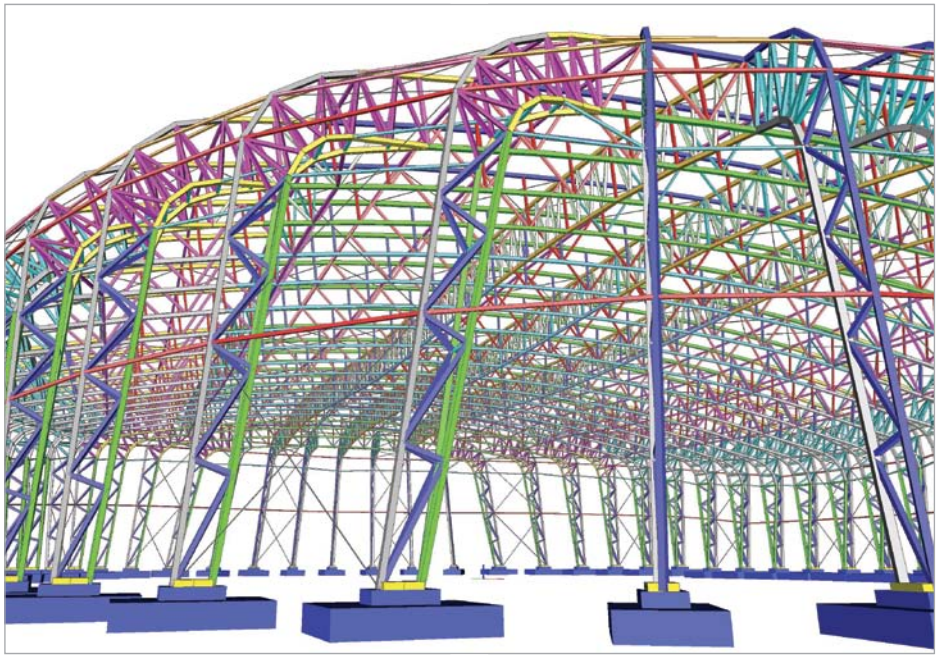
Personal information
Matjaž Žabkar, Born in 1979 Novo mesto, Slovenia.

- 1997-2002 Diploma of Civil Engineering at the University of Ljubljana; Speciality "Steel structures"
- 2002-2007: working on Architectural and Civil Structure projects.
- 2008: certified engineer at the Slovenian Chamber of Engineers IZS.
- Since 2007: working on planning and optimisation of steel and membrane structures, foundation and other concrete structures.

Company information
The company is developing, manufacturing and erecting: business and manufacturing facilities, storage halls, functional constructions, sports facilities and mobile halls.

The company cooperates with many Slovenian and foreign partners for developing new products and improving existing programmes and services.



Software: Scia Engineer

Velodrome Roof, Multifunctional Sports Arena - Novo mesto, Slovenia

The purpose of the project is modernisation of a velodrome and expanding the functionality of the existing structure of only one sports event to several types of sports.

The History
The existing structure was built in 1996 for the purpose of the Junior World Championship Cycling. After the championship the structure was more or less unusable and was left to decay. To preserve the refurbished track it is necessary to build a roof cover over the facility.

Architectural design
The oval shape of the track dictates the shape of the structure and allows the architect to use a natural saddle form for the roof. The outer form also allows the usage of a pressurized membrane cover.

Technical data
The structure consists of twenty-one cross frames as planar truss girders with spatial truss columns on both ends. The span of the cross frames varies from 49.7 m to 88.2 m. The main truss girders are 3.2 m high and curved just as the shape of the roof. On each end the truss girder passes into a spatial column which measures 1.6 m at the top and 1.2 m at the base. The cross width of the columns measures 2.4 m.
In the longitudinal direction there are three main planar truss frames with a span of 116.6 m. On each side of the main frames there are also two rows of stability girders and stability beams in between. Both primary frames and secondary longitudinal girders consist of segments placed between cross frames to form the spatial structure.

On the front and back side there are three additional planar truss columns which are also curved in both directions at the top to form the complete outer form of the building.

For the stability of the structure there are some beams around the whole circumference forming some kind of ring and diagonal bracings in eight fields between cross frames and in two fields at each front end.
The whole structure will be fabricated with the use of rectangular hollow sections except the diagonal bracings, which are of solid round bars. The steel grade used for the manufacturing of the structure sections is S275 according to EN standards. The same grade of steel will also be used for all the joints where each of the joints will be specially designed to fulfil the erecting at the construction site.

A block of concrete foundation is used under all the columns of the structure. All the foundations will be connected with concrete beams around the whole perimeter of the building. Normal grade concrete is expected to be used for concrete casting.

Software and model
Scia Engineer 2010 was chosen for 3D Modelling and also for the calculation. The whole steel structure was designed with the modeller after the general idea of the architectural design. All the main frames are designed as trusses and all other elements as beams or bracings. Some hinges and nonlinearities are also used to assure correct results as in natural behaviour.

The new feature for block foundation modelling was also used with the application of elastic soil underneath. The Wind and Snow generator was used on cross frames to accommodate exact loading. Some additional distributed loads were also used to represent all other load influences. Temperature load was also applied.

Calculation steps
The design and optimisation of the steel structure was done according to the second order theory and the EC3 standard. The block foundations were designed automatically with consideration of the built in EC7 standard. Earthquake calculation was also done with consideration of the built-in EC8 standard and use of modified design spectrums. Both linear and nonlinear stability calculation was done according to the Newton-Raphson theory to assure sufficient stability of the structure.

Presentation
The Scia document reporting tool was used for the presentation. Each frame was presented separately with all important results. All other results were also exported for revision.

Velodrome Roof, Multifunctional Sports Arena

Novo mesto, Slovenia

Project information

Owner	Dipl.-Ing. Matjaž Žabkar
Architect	Marjan Zupanc, u.d.i.a.
Engineering Office	LoGing, d.o.o. Slovenia
Construction Period	From December 2011 to December 2013
Location	Novo mesto, Slovenia

Short project description

The main goal of the project is to cover an existing outdoor 250 m long velodrome track with a steel structure and membrane covering and turning the facility into a Multifunctional Sports Arena with the ability of organizing sports events including athletics. The main structure measures ~117.8 m in length and ~92.6 m in width. The tallest point of the structure measures ~23.2 m above ground. The structure consists of truss frames in both directions with additional stability beams and diagonal bracings.