Factsheet no. 9: Metis canopy, Otočac, Croatia

Figure 1. Relocated canopy – Otočac, Croatia

Project summary

Client:	Metis d.d., www.metis.hr
Architect:	URED OVLAŠTENOG ARHITEKTA, Slobodan Petrović, dipl.ing.arh.
Structural engineer:	STABILNOST d.o.o., Daniel Repac, dipl.ing.građ.
Duration:	~ 5 months

Project description

Metis d.o.o. is a waste management company with headquarters in Kukuljanovo. The company has five subsidiaries including the hub. Given the workload that was occurring at that time in the Lika-Senj County, it was necessary to expand the capacities. For that reason, a project to build a new facility in Otočac has started.

Figure 2. Original location – Pula, Croatia

Figure 3. New location - during construction– Otočac, Croatia

The construction of the new facility included the removal of the Metis canopy from Pula and reassembling it in Otočac. Below the canopy, an administrative building and underneath the elevation ± 0,00 the weighbridge was built independently of the canopy. The canopy was relocated in 2011 to a new location 266 km away. The existing double-pitched canopy was a steel structure with a trusses every 10.00 m with a span of 50.00 m. The condition of the steel structure was rusty, but without significant reduction of the steel profile section area. The steel grade was C 0.361, or in accordance with EN 10025 steel grade S235.

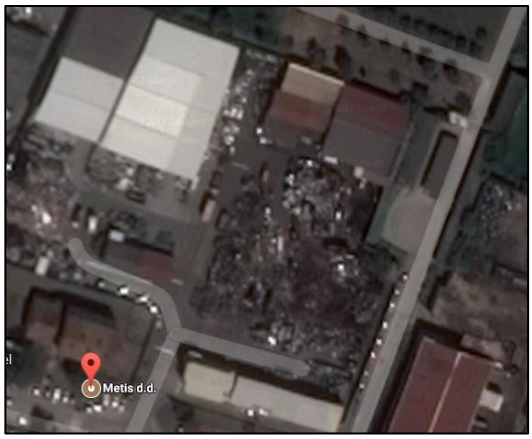

Figure 4. Original location – Valica 8, Pula

Figure 5. New location – Gornja Dubrava 57, Otočac

The main task of the structural engineer was to use the elements removed from the original structure as much as possible. Longitudinal arrangement of columns in plan is changed. Consequently, the spans of roof beams were also changed. The following arrangement was adopted: The columns in the central part of the canopy are located at span of 14 m. Left and right part of the canopy have the arrangement of columns at span of 6 m. According to adopted arrangement of columns, two main roof truss beams were constructed with the central column. New trusses with new columns are made of steel grade S355. Other roof truss beams are constructed with strengthened old structural elements.

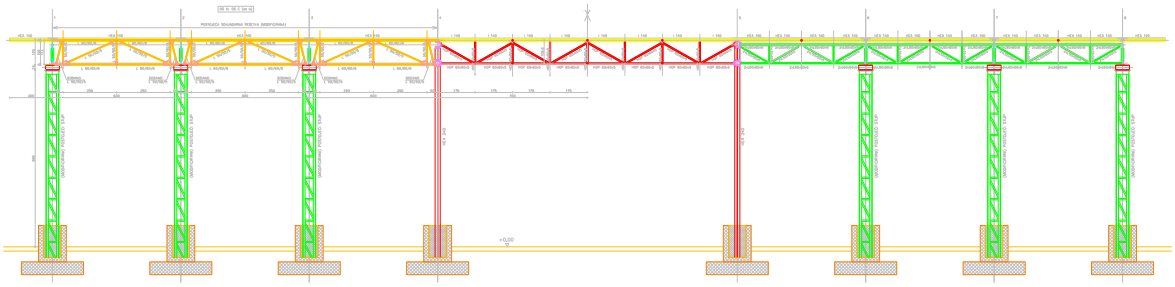

Figure 6. New positions of columns

Secondary existing beams supporting trapezoidal sheets are spaced at 1.00 m instead of 1.67 m adopted at old structure. Because of the uplift wind, all bottom cords of secondary trusses have been strengthened due to increased span to 14.00 m.

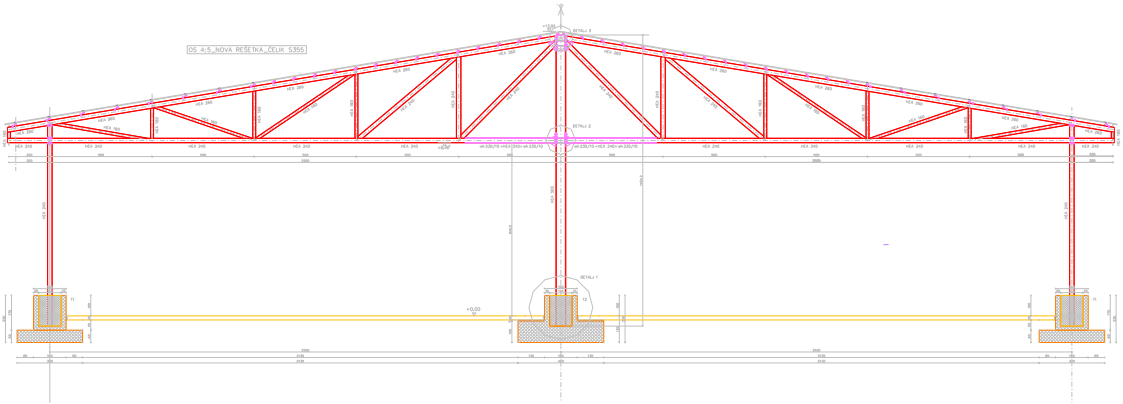

Figure 7. New steel trusses and columns

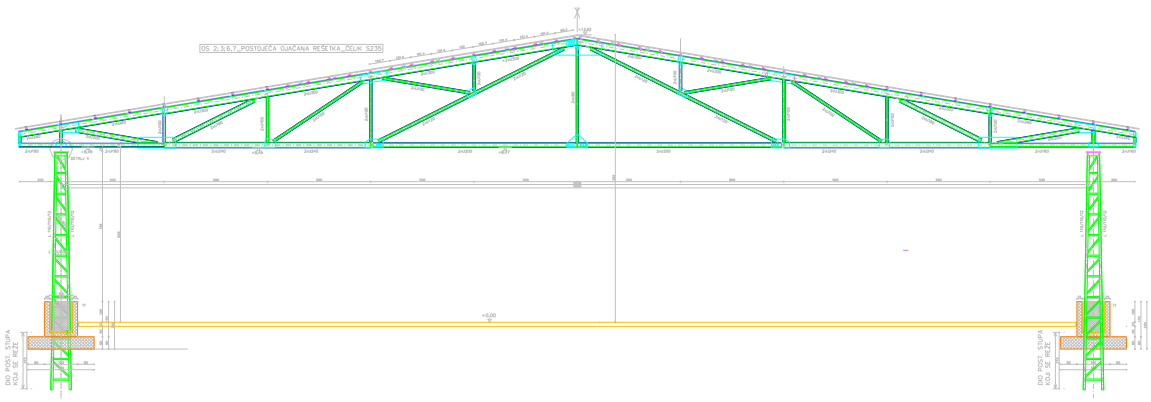

Figure 8. Strengthened existing steel trusses with modified columns

Design process

The investor didn't acquire the project documentation so it wasn't known on what loads the structure was dimensioned. Structural analysis, dimensioning, and drawings were made for a new location without the ability to compare them to the original one. The program used for the structural analysis is *Radimpex Tower*.

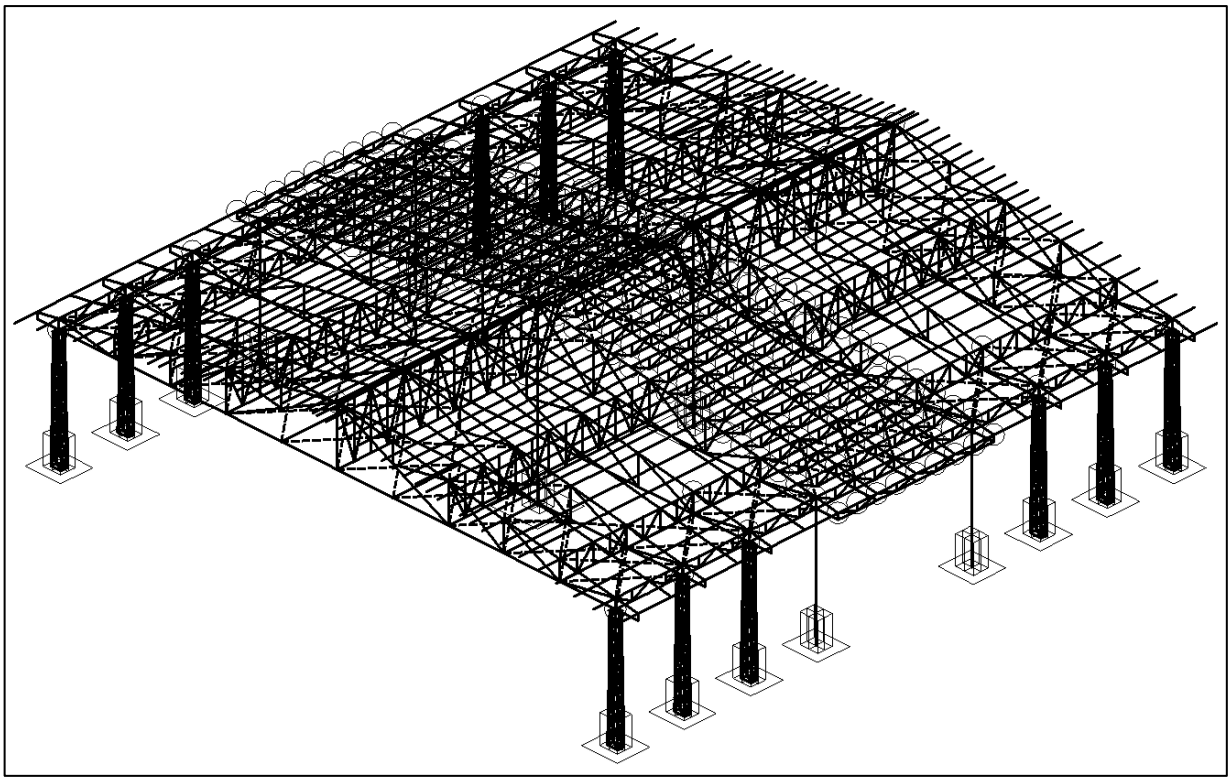

Figure 7. 3D model in Tower

The differences in structural analysis and dimensioning between two locations can be shown with the characteristic value of snow load and the fundamental value of the basic wind velocity.

Table 1. Snow and wind data

Location	Altitude	Characteristic value of snow load s_k	The fundamental value of the basic wind velocity $v_{b,0}$
Pula	7 m a.s.l.	0,50 kN/m^2	25 m/s
Otočac	457 m a.s.l.	1,25 kN/m^2	30 m/s

Problems caused by the usage of existing steel profile sections

The main problem was to remove the rust and to perform the prescribed protection of the steel profile sections. A particular problem was the removal of the rust between the angle and "U" profile sections. The protection is prescribed after proper cleaning with paint for rusty metal.

All the profile sections of the existing trusses are strengthened by welding the plates. On the other positions, the re-installed profile sections did not satisfy stability requirements so strengthening with additional plates were necessary.

Figure 8. Rust on the trusses

Figure 9. Details

The end of the existing columns with welded steel plates is placed into concrete foundations. The project envisages anchoring these columns, as well as the new ones, in reinforced concrete pockets.

Top of the column

Bottom of the column

Figure 10. Removed columns

Particular attention is paid to the fixing of aluminium trapezoidal sheets because of the uplift wind pressure of 2,00 kN/m^2 on the edges of the structure.

Figure 11. View of relocated canopy