REINFORCEMENT OF ROOF STRUCTURE OF OLD AND NEW HALL WITH SPATIAL STEEL STRUCTURE – BRIDGE

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Summary: *For the needs of expansion of the existing industrial complex and uninterrupted technological process of production, it was necessary to design a supporting spatial construction - bridge for the construction of the roof structure of the existing and newly constructed halls. The existing construction of the hall relies on the construction of the bridge to the left for the removal of facade columns. In addition to the existing hall on the right side of the bridge construction, a new hall of the roof ties range is added l = 43.0m. Instead of the main bearing pillars in the façade plane, the main lattice carriers-relays rely on a newly-designed spatial construction-bridge. Bridge steel structure is located between the old and the new hall and thus fully connects the unobstructed technological process in the complex of existing and new halls. In static terms, the spatial steel construction is a simple beam of different ranges () mounted over three fields, which are administratively mounted on the transversal roof hinges-carriers of the hall.The foundation of the bridges' construction is designed in the form of the foundation of the male at the end supports and at two places within the bridge. The mentioned complex of the hall is located near the city of Salzburg in Austria.*

Key words: *capture, shooting, steel construction, mounting attachments, bridge.*

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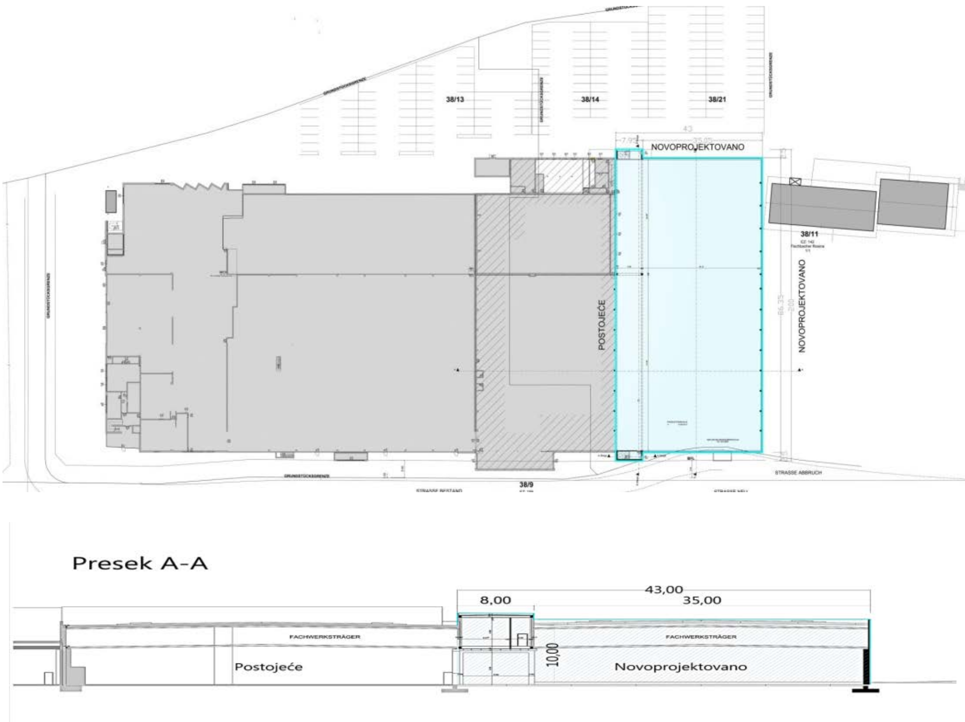
1. INTRODUCTION

For the needs for the expansion of the technological and production process, it was necessary to remove the complete facade liner from the sandwich panels with all the supporting structural elements of the existing hall.It was also necessary to complete and upgrade the new hall range L = 43.0m and length Σl = 85.0m. For this reason, it is necessary to project a spacious steel structure - bridge, which is placed in between the removed phase and the new hall. The bridge construction is in the form of three lattice carriers of unequal range lasphones () conditioned by technological process. The bridge girders are relying on concrete frames and foundations in two places in the hall and on the calcars. Picture no 1 shows the complex with the existing hall which removes the longitudinal facade plane to the new bridge construction, that is, the clock, is the basis of the existing and newly constructed halls with a cross-section.



Slika 1. Osnova postojeće i nove hale sa poprečnim presekom nove konstrukcije mosta

By placing the steel grid structure of the bridge it is possible that the technological process is not interrupted in such a way that it is possible to bend the existing transverse roof tile of the hall, to dismantle the existing main pillars in the facade and rely on the short element of the lower belt of the new spacious construction of the bridge. The reliance of the crossover roof of the new hall was achieved by directly relying on the short element of the lower band on the right.

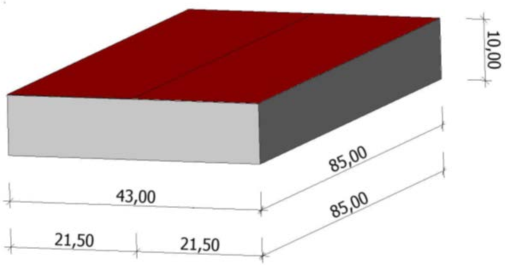
2. EXISTING CONSTRUCTION OF THE OBJECT

The existing structure of the hall complex is constructed as a steel construction, with a considerably large range of transverse roof ties (larger than 30.00m). Roof cover and facade linings are made of sandwich panel with thickness of 15.0cm. The main pillars of the hall were set at a distance of l = 5.95m, in the longitudinal walls with a height in the ridge of h = 10.0m.

3. NEWLY DESIGNED STEEL CONSTRUCTION

The main bearing spatial design of the bridge is designed as a spatial grid with parallel belts, of steel S335 quality, HEA profile. Connections in knots were made with nodal sheets. The resilient steel bridge structures and the concrete frame is realized through the bearing. In the load analysis, all relevant impacts for the conversion were taken, in everything as shown in the images and tables. No. 2 with the basic information about the new hall. Then loads of snow and wind are shown.

OBJECT -HALL - double-deck roof		
Altitude Hail Height	H=616.0m h=10,00 m	
Building width (width / length)	L_x=43,00 m	L_y=85,00 m

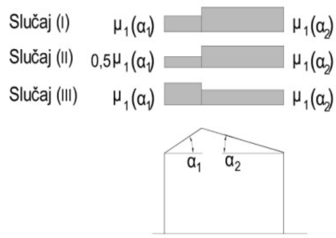


Pic. no. 2 - Dimensions of the new hall

WORK LOAD:
basic + additional load
(according to EN 1991-1-3: 2006 i EN 1991-1-4: 2011)

Snow load:	S = 2,77 Kn / m2
Basic wind speed:	vb = 24 m / s
Field category:	Category II
Basic pressure:	qb = 0.36 Kn / m2
Wind pressure:	qp = 0,76 Kn / m2
Wind pressure:	qp, 90 = 0.76 Kn / m2

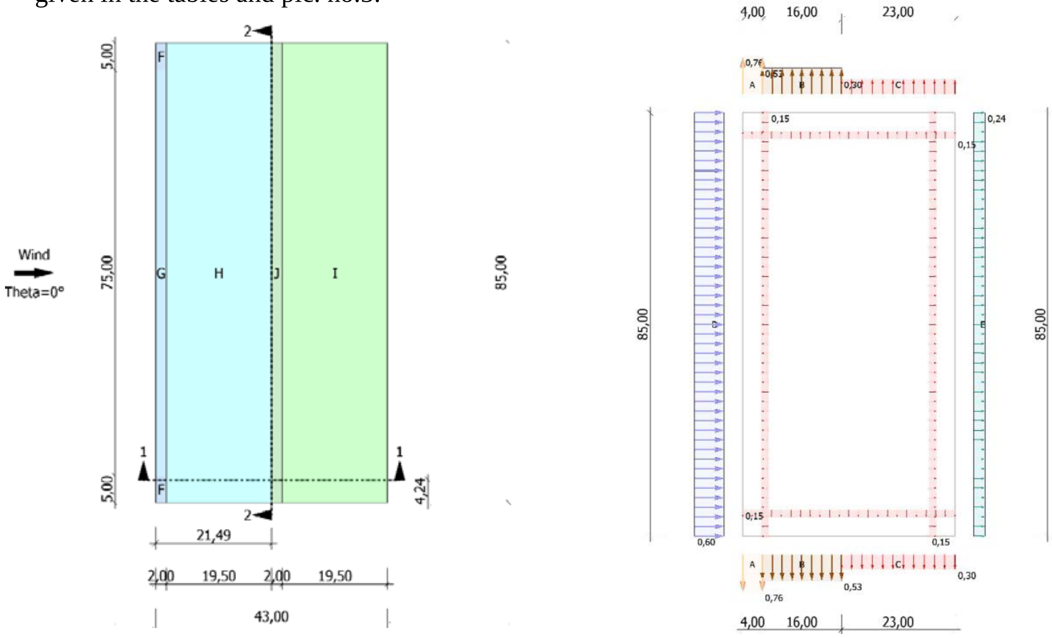
Table no. 1 Snow load



the angle of inclination of the roof α	$0° \leq \alpha \leq 30°$	$30° < \alpha < 60°$	$\alpha \geq 60°$
μ_1	0,8	0,8(60- α)/30	0,0
μ_2	0,8+0,8 α/30	1,6	--

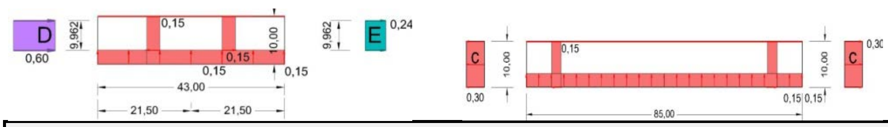
e		e/10			e/4		
20		2			5		
Pressureh (m)	q (kN/m^2)	Cpe,10	Cpe,1	Cpe,x	We,10	We,1	We,x
A	0,76	-1,00	-1,25		0,76	-0,95	
B	0,76	-0,70	-0,88		-0,53	-0,66	
C	0,76	-0,40	-0,50		-0,30	-0,38	
D	0,76	0,80	1,00		0,60	0,76	
E	0,76	-0,31	-0,39		-0,24	-0,29	
Coefficient of external pressure		Cpe,10	Cpe,1	Cpe,x	We,10	We,1	We,x
F		-1,80	-2,50		-1,36	-1,89	
G		-1,20	-2,00		-0,91	-1,51	
H		-0,70	-1,20		-0,53	-0,91	
J		0,20	0,20		0,15	0,15	
		-0,20	-0,20		-0,15	-0,15	
I		0,20	0,20		0,15	0,15	
		-0,20	-0,20		-0,15	-0,15	

The influence of the wind on the new hall building according to EN-1991-1-4: 205, it is given in the tables and pic. no.3.



Picture no.3- Wind effects affecting the hall

e	e/5	lA	lB	lC	h/d	e/d	h/b	d/b
20,00	4,00	4,00	16,00	23,00	0,23	0,47		



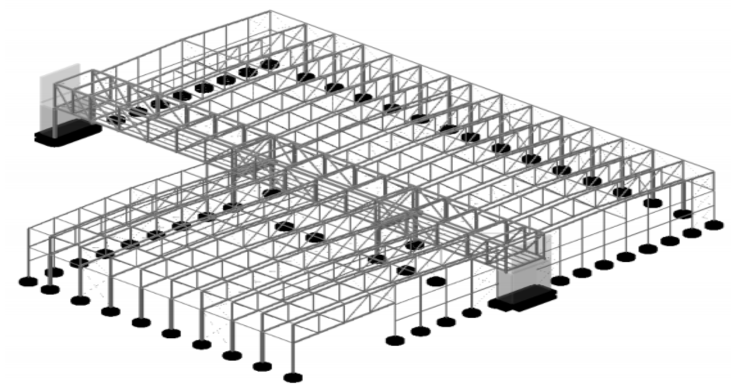
Θ	μ	Cp,e	Cp,i	Wi (kN/m²)
0	0,67		0,20	0,15
			-0,30	-0,23

The transverse rails of bridge rail grids are located at the distance of the transverse roof ties so that after removing the main pillars, the roof grate supports are supported in the nodes on the cantilever portions. The demolition of existing pillars was carried out by supporting the roof ties support with a heavy scaffold. Prior to the dismantling of the facade columns, the reconnaissance and materialization of the points of the geodetic micro network of the object was performed. The geometry and internal accuracy of the network is such that it provides the possibility of detecting the expected intensity of the deformation of the structure by measuring from the point of the network. Using total high accuracy stations, geodetic recording of the spatial geometry of the resting points of the transverse grid connector was performed. The subject measurements were used in order to obtain the zero state of the geometry of the existing construction, and as such was the reference measurement in relation to which the degree of deformation in the execution phase was controlled. The installation of the bridge spatial construction is carried out according to the works on the foundations and reinforced concrete frames, on which it relies. Bridge construction is mounted on movable and immovable bearings. By relying on the existing roof ties on the bridge consoles, the dismantling of the heavy scaffold is carried out, and then by geodetic measurements of the characteristic points, from the existing network of the building, on the construction itself, the geometry is controlled, that is, comparing with the zero state, the data on the intensity and nature of the deformation are obtained. the clamping stages, the mounting of the roof roof ties on the right side of the bridge construction is carried out. The necessary interconnections and stiffening are made, and roof covering and cladding and porcelain facade are sandwich panels.Mounting cross-linked roof ties on the right side of the bridge construction. The necessary interconnections and stiffening are made, and roof covering and cladding and porcelain facade with sandwich panels.

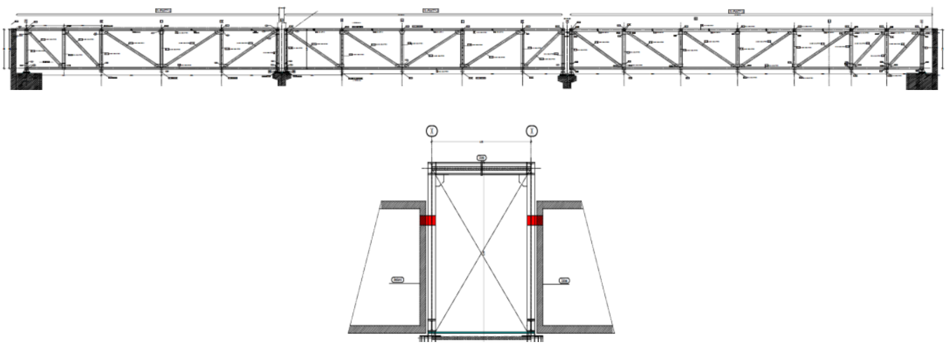
4. ESTIMATION OF NEWLY DESIGNED CONSTRUCTION

The calculation of newly constructed structures for adaptation - reconstruction of existing facilities includes the analysis of all parameters that need to be determined in order to obtain the relevant load for the dimensioning: :determination of the existing constructive system of objects (visual overview with recording geometry of supporting structural elements and all necessary measures and dimensions),

- analysis of existing technical documentation,
- testing the quality of the built-in materials in the construction,
- preparation of geomechanical study and determination of dimensions of basic construction,
- analysis of geodetic observations of the reper on the existing hall,
- analysis of the technological project in the function of establishing new constructive elements of the construction,
- the construction of the expansion of the new hall complex,
- analysis of the load and dimensioning of the existing construction of the hall and the newly constructed hall with a spatial bridge for the undertaking, was carried out in The Tower program and the spatial model are shown in Pic. 5, and in Pic. 6 there is a longitudinal cross-section through the newly designed structure - the bridge for the construction of old and new hall.



Pic. 5. Spatial view of the construction of the existing hall, the bridge for the bidding and the new halls



Pic. 6. Cross-section and longitudinal cross-section through bridges

The stiffness of the roof flat level is provided by transverse roof joints, and the stiffness of the base and the longitudinal walls of the new hall is carried out by vertical hinges in the said planes. In this way, the spatial stiffness of the new projected hall has been provided. Lighting of the hall is carried out with light strips in the roof level. The Mosotian construction makes it possible to use two levels for employees' offices because of its dimensions. Steel construction is made of steel S355, with nozzle sheets thickness d = 25-30mm. Explanation of points and vertices are from the HEA carrier and the diagonal of the warmed-up 2U carriers. The links of the banding rods are realized through welded sheets made by welding, while the filling rods are bonded to the nodal sheets with high-strength screws of the strength class 10.9. Pic. 7 shows the basis of the foundation of the substructure of the building.

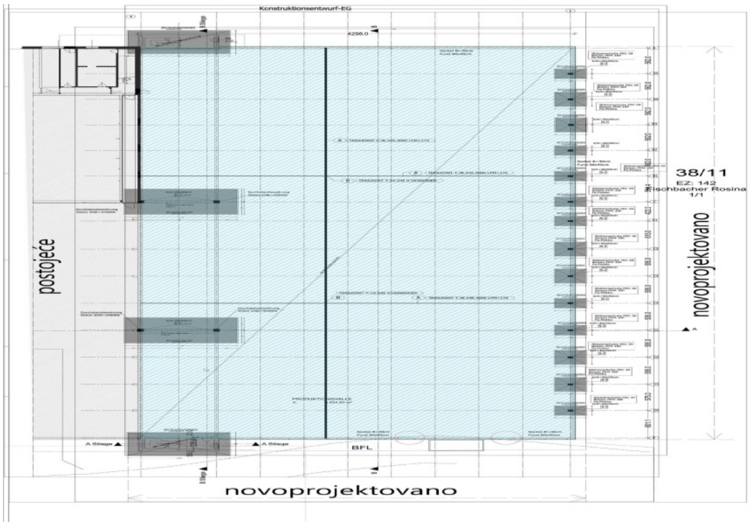


Figure 7 Disposes of the foundations of a new hall and a new bridge for the construction of the construction

The preparation of the steel construction surfaces was carried out according to the provisions of the Ordinance on the Protection of Steel Structures from Corrosion to EN. PPZ protection of the steel construction includes the application of fire protection coatings in the form of appropriate coatings that guarantee the prescribed time, consisting of the basic anti corrosion primer, then the in tumescent coating and finally the final coating (expanding fire protection coating system) is applied.

5. CONCLUSION

In the case of extension-expansion of existing facilities, the existing condition, constructions, newly designed structure, as well as the connection method must be analyzed into one whole in order to smoothly implement the production technological procedure. In this particular case, it was necessary to remove the main pillars in the longitudinal wall of the existing hall. Reactions from existing roof ties were transferred to a new spatial construction-bridge in axis 1, and the reactions from the newly constructed halls (roof cross-linkers) were based on the new bridge construction in axis 2. This enabled the smooth production of the technological process in the complex of the hall. New bridge structures are three free beams of different ranges.

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PODUHVATANJE KROVNE KONSTRUKCIJE STARE I NOVE HALE PROSTORNOM ČELIČNOM KONSTRUKCIJOM – MOSTOM

Rezime: *Za potrebe proširenja postojećeg industrijskog kompleksa i nesmetanog tehnološkog procesa proizvodnje, bilo je potrebno projektovati noseću prostornu konstrukciju – most za poduhvatanje krovne konstrukcije postojeće i novoprojektovane hale. Postojeća konstrukcija hale se oslanja na konstrukciju mosta sa leve strane zbog uklanjanja fasadnih stubova. Uz postojeću halu sa desne strane mostovske konstrukcije se dodaje nova hala raspona krovni vezača l=43.0m. Umesto glavnih nosećih stubova u fasadnoj ravni, glavni rešetkasti nosači –vezači se oslanjaju na novoprojektovanu prostornu konstrukciju-most. Mostovska čelična konstrukcija se nalazi između stare i nove hale i tako u potpunosti povezuje nesmetani tehnološki proces u kompleksu postojećih i nove hale. U statičkom smislu prostorna čelična konstrukcija je prosta greda različitih raspona(*$l_1 = 25.25, l_2 = 28.22, l_3 = 36.60m$*) postavljena preko tri polja upravno na poprečne krovne vezače-nosače hala. Temeljenje oslonaca mostovske konstrukcije je projektovano u vidu temelja samaca na krajnjim osloncima i na dva mesta unutar mosta. Navedeni kompleks hala se nalazi blizini grada Salczburga u Austriji.*

Ključne reči: *poduhvatanje, snimanje, čelična konstrukcija, montažni nastavci, most.*