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Structure of the new Zagreb airport passenger terminal

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Professional paper

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Passenger terminal construction at Zagreb airport

The design solution presented by authors from the Faculty of Architecture and Faculty of Civil Engineering won the first prize award at the international competition organized by the Zagreb Airport. The structure and form of this solution are integrated through multidimensional approach in which individual factors – town planning, environmental aspects, architecture, structure, functionality, and traffic – are not given precedence one over another, but are rather evaluated as a whole made of equal parts. The principal airport building is covered with a fluid steel truss structure, which continuously expands into linear, tubular passenger piers on each side. The terminal building constitutes, together with proper regulation and development of surrounding space, a new dimension of development of the city of Zagreb, and its merger with Velika Gorica.

Key words:

airport, steel structure, truss, city of Zagreb, shaping

PStručni rad

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Konstrukcija novog putničkog terminala zagrebačkog aerodroma

Na međunarodnom natječaju koji je raspisala Zračna luka Zagreb pobijedilo je rješenje autora s Arhitektonskog i Građevinskog fakulteta Sveučilišta u Zagrebu. Konstrukcija i oblik rješenja zajedno su integrirani višedimenzionalnim pristupom u kojem niti jedan od čimbenika - urbanizam, ekologija, arhitektura, konstrukcija, funkcionalnost, promet - nije stavljen ispred ostalih. Glavna je zgrada aerodroma natkrivena čeličnom rešetkastom konstrukcijom fluidne forme koja se u kontinuitetu oblika proširuje u linearne, cjevaste izdanke uzdužnih putničkih komunikacija (eng. pier) sa svake strane. Zgrada terminala, zajedno s uređenim i izgrađenim okolnim prostorom, predstavlja novu liniju razvoja grada Zagreba i udruživanje s Velikom Goricom.

Ključne riječi:

aerodrom, čelična konstrukcija, rešetka, grad Zagreb, oblikovanje

Fachbericht

Branko Kincl, Velimir Neidhardt, Jure Radić, Anđelko Vlašić, Nijaz Mujkanović

Konstruktion des neuen Flughafenterminals des Zagreber Flughafens

Bei dem internationalen Wettbewerb, den der Flughafen Zagreb ausgeschrieben hat, hat das Projekt von Autoren von der Fakultät für Architektur und Bauwesen der Universität in Zagreb gewonnen. Das Hauptgebäude des Flughafens ist mit einer gitterförmigen, fluidartigen Stahlkonstruktion bedeckt, die sich auf jeder Seite in ihrer Fortsetzung in lineare, rohrförmige Ausläufer längsförmiger Piers erweitert. Das Terminalgebäude stellt, zusammen mit dem hergerichteten und ausgebauten umliegenden Raum, eine neue Linie der Entwicklung der Stadt Zagreb und einen Zusammenschluss mit der Stadt Velika Gorica dar.

Schlüsselwörter:

Flughafen, Stahlkonstruktion, Gitter, Stadt Zagreb, Entwurf

1. Urban relationship between the city and the airport

The conceptual design of the new Zagreb airport terminal has defined a new urban area that will emerge at the very crossing of two important Zagreb transport routes: one of these routes is the Zagreb symmetry axis stretching in the direction Upper Town – Zrinjevac – Freedom Bridge – Buzin, and the other one follows the line Heinzlova Street – Radnicka Street – Homeland Bridge. Both routes are connected by means of a high speed road and the Zagreb – Sisak national motorway (Figure 1). The north side of this triangle is the Zagreb bypass, also offering connections to motorways A1 and A3. Such concept of traffic connection has imposed establishment and development of the Airport City. The Airport City rises in the centre of the green belt 150m in width, starting at the east-side road and ending at the west side with a large sports and recreation park, which intersects with another, perpendicularly positioned sports and recreation zone. This second zone is a new urban facade of the central part of Velika Gorica. Outstanding new urban development zones, with trade, tourist and sports and recreation areas, are thus being formed. In this way, Velika Gorica will become a significant regional and economic factor in the expansion of the city of Zagreb. This link between Velika Gorica and the city of Zagreb will be further strengthened by the planned route of the future Zagreb Metro, which is to connect the Airport City and the Zagreb downtown area.

2. Creation of Green Concept

Despite being located in the suburb of Zagreb and Velika Gorica, the urban concept of the new Zagreb airport terminal envisages a space with a high level of urbanity, with significant representative parks and transport routes. New points of reference, focuses, avenues, linear and other parks, lake systems, recreation zones, walking oases, footways and green roofs, all join in the creation of this unique urban and architectural concept. The green concept can repeatedly be seen throughout the project, and especially within the new airport terminal, where green roofs constitute an important element of the architectural interior. Inside the terminal, and especially at the restaurant level, green areas occupy as many as 2200 square metres, thus influencing the microclimate in a natural way. Interior gardens stretch towards the exterior and allow the departing passengers to enjoy the green roof pathways. Domestic passengers can walk along the southwest side, and international passengers can use the northeast side. These ecological oases, along with the roof garden at the top visitor level, take up 4,700 square metres. The access terminal road, situated at +9.60m, is conceived in its southern part as a natural green zone. The terminal is connected with a spacious roof garden parking lot by means of three garden bridges. Further on, it is connected with a hotel, which is the central point of the Airport City.



Figure 1. Position and traffic connection of the new Zagreb airport terminal and the Airport City

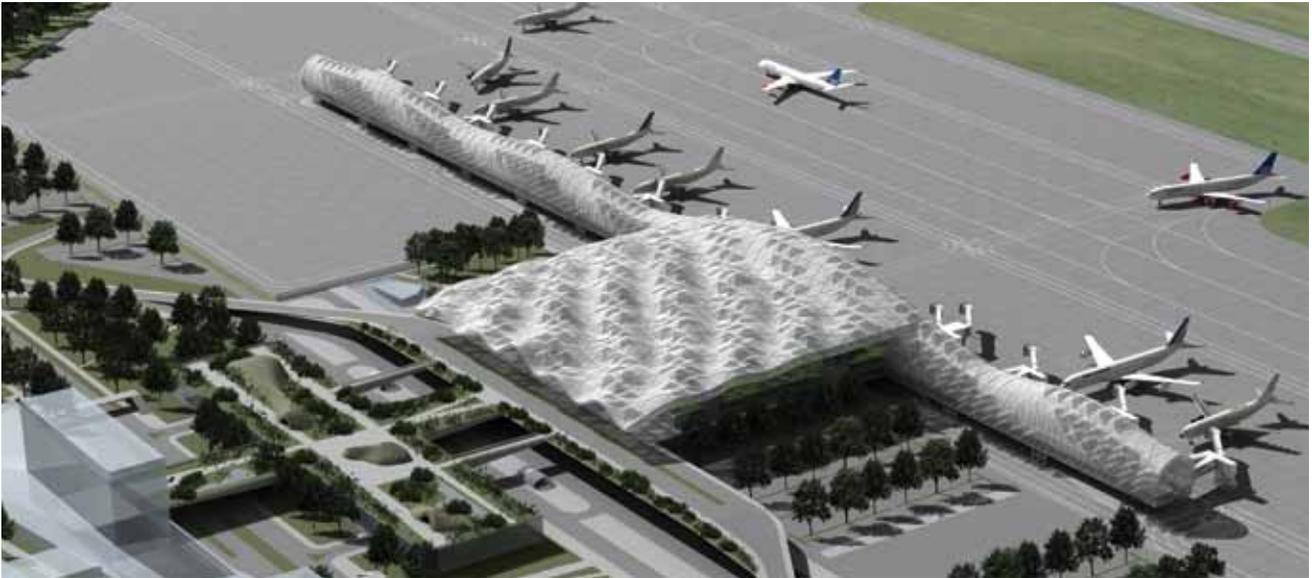


Figure 2. Levitating structure of terminal building

While waiting for the luggage, arriving passengers can enjoy the unique view of the nearby meditation pool surrounded by greenery and a sculptures park. Water surface is further connected to the system of artificial lakes which merge into a forest-like landscape. The greenery and the water surfaces harmonize the relationships between the physical structures and further enhance the entirety of the architectural-urban approach.

The new passenger terminal building is designed to withstand failure of all standard power sources. In such a case, the power supply comes from the accumulated reserves generated from solar energy. This solution is in compliance with the international agreement on reduction of carbon emissions: for Croatia this reduction is 5% with respect to 1991 levels, while the share of renewable power sources in the overall power production should amount to 20 percent by the year 2020. The environmental sustainability of this design solution is based on:

- ventilation of the facade and roof, principled on the double membrane envelope
- large area of the photo-voltage cells (8,500m²) for the environmentally friendly production of electricity
- trigeneration plants for synergetic production of electricity and preparation of warm and cold water
- collection, processing, purifying and managing of water from all parts of the complex, such as roofs, aprons, runways, sanitation facilities, etc.
- centralized control and management of all power and utility resources by means of the efficient management systems (EMS)
- selection of best technological solutions and usage of materials which contribute to quality and ecological sustainability

Utilization of large glass surfaces and transparent materials in the departure and arrival hall, as well as in the linear communication facility (pier), which results in abundant introduction of natural light and hence in considerable energy savings.

3. Functionality, flexibility and shaping

The specific architectural form has been achieved through unique integration of esthetical and functional phenomena, and through attribution of a special symbolism and meaning. The terminal building roof features a dynamic wavy geometry; it opens and levitates above the terminal space, creating a free dynamics of the structural grid – a levitating roof – an iconic expression of the landscape. Such spacious harmony is also visible in the terminal interior through a series of different functionally conceived aesthetic attractions. The levitating roof provides for maximum exposure of the interior, and the broadest possible panoramic orientation towards the Medvednica Mountain landscape and city contours in the north, and the Airport City in the south. Fundamental principles of the design are based on the overall rationalization and transparency – with even distribution of functions and clear spatial axes – aimed at achieving a perfect model for passenger orientation. Some of the formal architectural characteristics, wavy roof in particular, transcend the usual spatial models, but are nevertheless not devoid of strict utilitarian role. The transparent glass floor in the mid departure hall allows passage of daylight to the lower luggage level. Four load bearing cores that assume all horizontal loads from the roof are also used as four sided information screens. The structure of the levitating roof (Figure 2) has been designed as a double membrane, with a large ventilated mid area that presents significant ecological advantages. By



Figure 3. A night view on the structure at terminal entrance

placing the roof openings on the sides and using powerful reversible jet propellers, a microclimate has been created within the double roof membrane, which can significantly decrease energy consumption inside the terminal building in winter and summer alike. The dynamic roof structure levitates above the interior of the terminal and grows upward and sideways where it forms linear sprout-like combinations. The faces of the hall are closed with simply formed, double glazed ventilated facades. A modular geometrical principle has been used for the division of glass surfaces, with 360 x 180 cm in the lower part of the building, and almost double that in the upper part of the building, near the connection with the levitating roof. This module derives from rational modular planning, and also from functional content of the new passenger terminal, where the contrast between simple geometry of the double glazed facade at the entrance, and the steel sinusoidal line of the levitating roof, can be observed.

The basic processes (primary functions) that take place inside the terminal include passenger services (departure, arrival) and passenger baggage processing facilities. Secondary functions of the terminal building facilitate standard movements, and increase the overall quality of the terminal. The functional organization of the building is arranged and distributed vertically through four levels. The flexibility of architectural form of the terminal is derived from two geometrical systems: the dynamic liner structure of spatial shoots, and the compact layout plan of the terminal building.

At the linear sprout (pier), the flexibility has been achieved with large spans which are covered with the roof envelope. The flexibility of the central terminal building has been achieved with a free layout plan that is covered by the roof envelope. All services and accompanying spaces (cores, installation ducts, and sanitary installations) are positioned on the sides. The central hall, with its free layout plan, allows for full flexibility of basic functional processes (passenger check-in, security checks, and passport checks) as related to expected changes in passenger flows and their capacities (domestic – international, Schengen – non-Schengen). The area of the central hall can be



Figure 4. Interior of the terminal at the connection between the main building and the pier

extended towards the northeast, depending on the change in capacities due to increase in traffic. The pier flexibility allows for its linear expansion in accordance with an increase in air traffic and in the number of air bridges. The parking apron area can be increased according to the dimensions of the pier and in keeping with the number of aprons planned.

The roof of the building is a steel truss measuring 155m x 165m in plan, and its upper and lower planes are formed of two transparent membranes, while the space in between them allows for the ventilated air changes, with significant savings in summer and winter. An additional effect of fluidity is achieved with variable height of the roof truss, following the principles of load carrying laws, so that its maximum height is in the zone of the supports, where the roof structure is concavely drained into tube-like columns. Such variable curvature of the lower and upper truss surface is most visible on the face of the building where the height of the truss is the lowest and the wavy form is most apparent. The first impression gained upon entering the building is therefore energetic, but it becomes more calming immediately after the entrance due to "the levitating state" implied by the roof that levitates above the volume of the interior (Figure 3). A special visual effect of the building, caused by interesting game of lights emanating from glass surfaces at night-time, is shown

in Figure 3. Glass surfaces emit the light to the exterior space at night time, while during daytime the daylight enters the building through these same glass surfaces.

The basic shape characterizing the upper and lower surfaces of the truss is a triangle measuring 8.05 m at two sides, and 7.2 m at the third side. These dimensions define the basic pattern of the building and the sprout piers. The wavy structure of the roof is gradually calming towards the airstrip side of the building, where it finally descends, rolling towards the ground and forming the face of the building. This is the place where the building is at its highest, and the levitation is again pronounced by protrusion towards the airstrip. The space is additionally enriched by an elevated restaurant in the central part, which gives a unique view of the airstrip and the entire terminal, and is sure to attract visitors thanks to such prominent position. The wavy face of the building continues at the sides where it turns into linear sprouts (Figure 4) – tube-like structures to the left and right of the building. These structures are divided into three horizontal levels, the top level for departures, the bottom level for arrivals, and the intermediate level for the transfer of passengers. The sprouts (piers) are 14m wide and variable in height, thus continuing

the set wavy form of the main building. The west pier is 353m long and the east is shorter, only 151m in length, allowing for subsequent extensions, depending on the rise in traffic.

The basic functions of the airport are the departure, arrival and transfer of passengers. These functions are organized in vertical segments (Figures 5 and 6). All levels are connected to one another by escalators and elevators situated inside the cores. The departing level, which is the highest storey, can be accessed from outside roads using approach ramps inclined at 6 percent. This level is also connected by three foot bridges to the airport hotel and parking lot (Figures 2 and 5). The front of the departure level hosts two isles with check-in counters. Two counters for boarding pass, passport and security control are located further on, towards the departure points. The departing level continues outside of the main building and into the upper level of the piers. The departure level also hosts shops and snack bars. The central restaurant is placed above this level, and offers a good view of the departure zone. Yet another public area is situated above the restaurant, closest to steel structure of the roof, and people are likely to visit it to experience the fluid aesthetics of the roof. The highest point of the main building is reserved for the ellipsoid structure

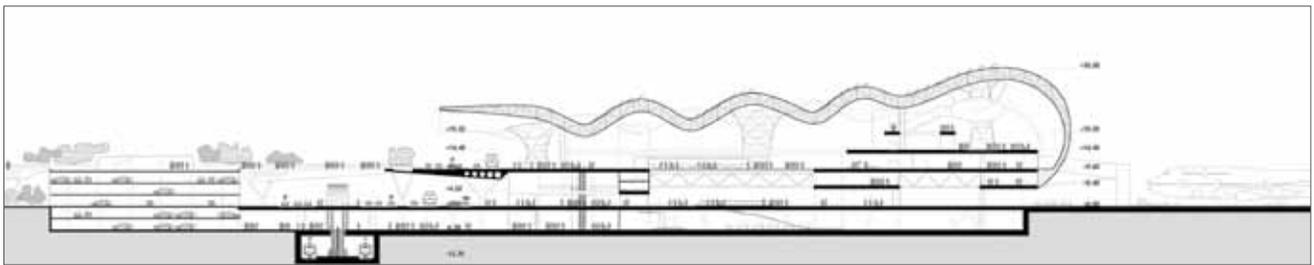


Figure 5. Structure and vertical functional arrangement of the terminal and nearby area

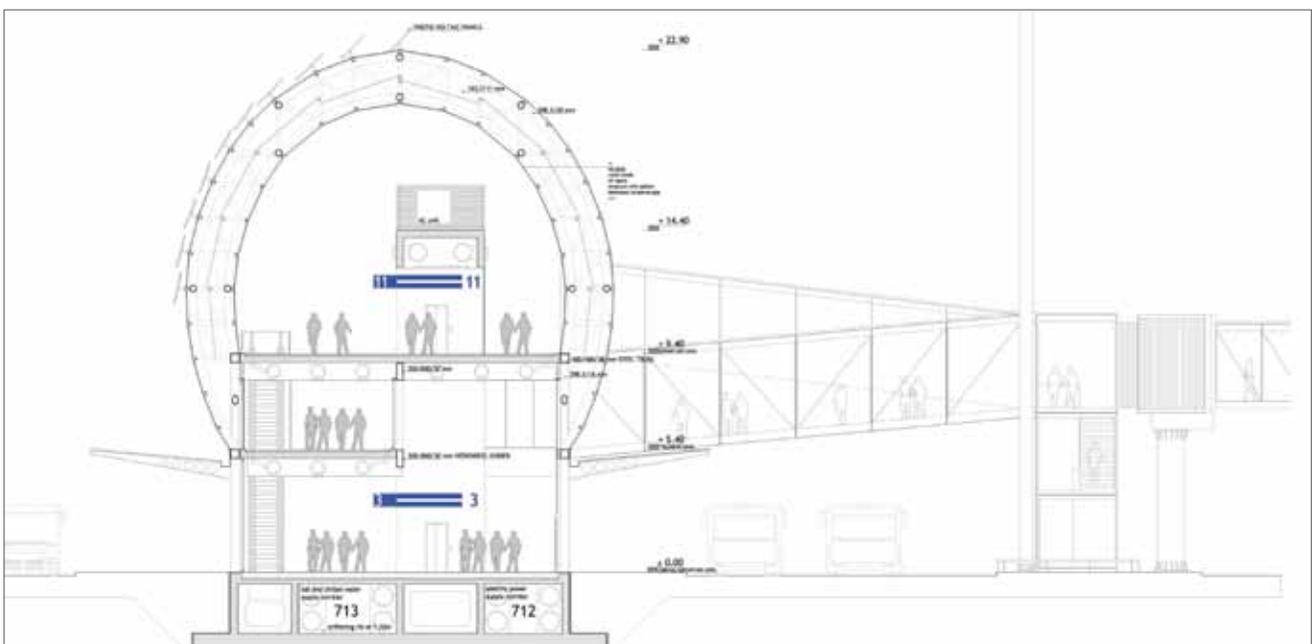


Figure 6. Cross section of the pier – structure and vertical functional arrangement

which hosts the operating and maintenance controls of the terminal. The departure level also allows people to access the walkways, green roofs and terraces that offer amazing views of the airport traffic and landscapes of the Zagreb, city with Medvednica Mountain in the background.

The transfer level is the primary level for all arriving passengers. The passengers are then separated. The ones that have ended their journey are routed to the lower level where they can claim their luggage and go through customs controls. The in-transit passengers are given all necessary information at the transfer level, and are then routed to the top departure level. The transfer level can also be utilized as departure level in cases when multiple level planes with large number of passengers are boarded.

The arrival level is divided into sections for domestic and international flights. The arrival level is accessed by escalators from the transfer level, or directly from buses coming from the airstrips. After coming to the arrival level, passengers are routed to a wide area where they claim their luggage. International passengers are then routed further to the customs control area. Finally all passengers arrive to the great exit hall where they can choose their further transportation – buses or taxis. The passengers with personal cars, or the ones that choose light rail public transport, move one level lower using the escalators, so as to access the parking lot or the future metro station.

The lowest, basement level, is reserved for luggage processing. The main section of the luggage level is used for manipulation, automatic sorting, control and delivery. The luggage arrives to this level from check-in counters from the departure level through vertical transport blocks. The luggage is delivered to and from the airplanes by towing carts along the 6,5% inclined ramps. The terminal has road and rail traffic connections to the city of Zagreb. The connection with the eastern Velika Gorica bypass is achieved via the new Platana Avenue and, more to the south and parallel to this avenue, via the Oaks Avenue. A free 150m wide band reserved for the future Airport City is situated between these two avenues. The Airport City is destined for business, tourist and commercial occupancies (Figure 1). This would be the location of congress centres, hotels, shopping malls, and offices. The light rail (tram) would arrive to the terminal from the main Zagreb railway station over the Homeland Bridge, and the future metro line could provide a direct shortest connection with the centre of Zagreb. All road approaches to the terminal are regulated with roundabouts (traffic circles) providing connection to the above mentioned avenues. The vertical disposition of such approaches is arranged in such a way to accommodate the departure (+9,6m) and arrival (+/-0,0m) levels. The parking and garage space is located between the Platana Avenue and the terminal complex. It is connected with the departure level via bridges.



Figure 7. Terminal building layout (departure level)

4. Structure

It can be concluded from the above mentioned analysis that all load bearing structures have been devised so as to enable proper architectural shaping and functional utilization of space and energy. Nevertheless, they can in no way be regarded as inferior. On the contrary, a successful shaping results from the rationality and transparency of the load transfer path, from the roof to the foundations. Hence steel was chosen as the primary building material as it is characterized by superior architectural value and high bearing capacity. When developing the conceptual design of the roof structure, relevant literature dealing with similar steel-made spatial truss structures was consulted [2, 3, 4, 5].

4.1. Terminal building and roof

The load bearing structure of the terminal is a multi-level hybrid structure. The total height, from the foundation level to the roof top, amounts to 42,5 m. The load bearing structure has been fully harmonized with the functions of each building level. From the standpoint of functionality, the following levels can be identified:

- elevation -6,0m: service level, top of the foundation slab;
- elevation +/-0,0m: arrival level;
- elevation +5,4m: transfer level;
- elevation +9,4m: departure level (Figure 7);
- elevation +14,4m: waiting and resting area (vista points, restaurants, shops);
- elevation +19,2m: public walkways, vista point;
- elevation +25,0m: control level for airport services.

Terminal building foundations are composed of a concrete slab 133,0 m in width (transverse direction perpendicular to the pier) and 144,0m in length (longitudinal direction, parallel to the pier). Communication buildings (metro station, garages, footways, bridges, car access roads) are will be built in continuation of the building towards the airport city. The foundation slab is 1.0 m thick, with its bottom surface at the level of -7.0 m, as measured from the airstrip level (+/-0,0m). The top of the foundation slab (level: -6.0 m) is reserved for service areas (luggage and other airport services). The +0.0 m level is reserved for the arrival zone. This level is supported by the concrete grillage deck. Vertical loads are assumed by concrete walls of four concrete cores and concrete

columns measuring 0,8m x 0,8m. The columns are spaced at 7,2m x 14,4m intervals. Four vertical concrete cores, derived from three walls, ensure horizontal stiffness of the levels. The dimensions of individual core walls are 7,2 m. The cores are symmetrically positioned in the corners of the building. Floor structures for the levels +5,4m and 9,6m are formed of a hybrid system. In the middle area of the building at the transfer level, the floor of both levels will be made of transparent glass panels. The load bearing structures of these panels are steel trusses 43.2 m in span, spaced at 14,4 m intervals. These trusses are 4.2 m in height. The flanges of the trusses are of box section, 800 mm in width, and 400 mm in height. The wall thickness is up to 60 mm. The diagonals are of V form, made of rolled HE700 sections, or similar welded sections. In order to ensure an undisturbed communication of buses taking passengers to and from the planes at the level of +/-0.0 m, columns can not be realized at the front section of the terminal (access corridor). This section is therefore supported by two side steel trusses 21,6m in span, spaced at 14.4 m from one another. These trusses are 4.2 m in height, and the flange surfaces are at the levels of +5.4 m and +9.6 m. The flanges are of box section and they measure 600 x 400 x 40 mm. Diagonals are of rolled HE500 sections, or similar welded sections. The floors are concrete slabs combined with parts of transparent (glass) plates. In the remaining part of the levels +5.4 m and +9.6 m, the floor structure is made of concrete slabs, which are supported by concrete grillages, columns and cores. The load bearing structure at the public walkway and vista point (level: 19.2 m) is a hybrid structure made of steel, concrete and glass (walking panels). The previously described load-bearing structures of the building are explicitly defined by their function. They are distinguished by the requirement imposing the use of glass walking panels. This requirement is met by the use of steel structures in some parts, including level-high steel trusses.

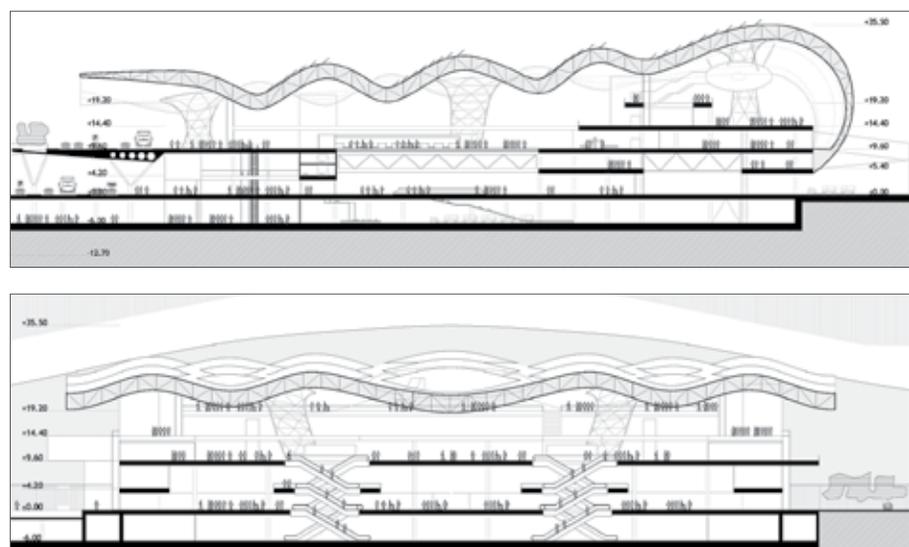


Figure 8. Transverse (up) and longitudinal (down) cross sections of the building

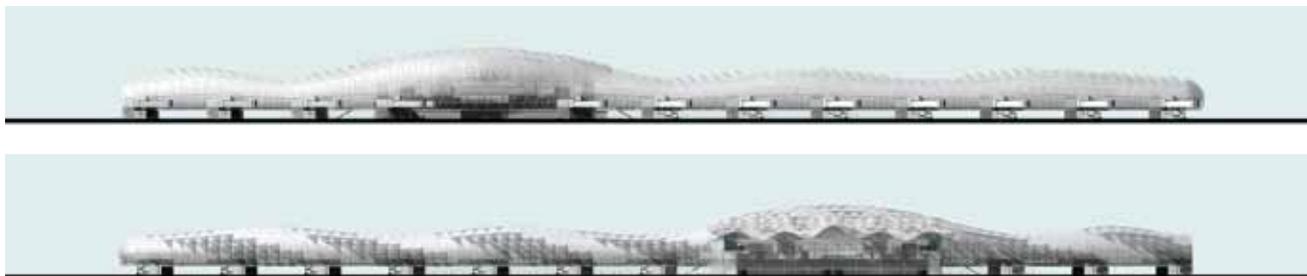


Figure 9. North (up) and south (down) views on the terminal



Figure 10. North view (from the airstrip) of the terminal building and the pier

The roof structure of the terminal building is an integral architectural-structural solution. It is distinguished by the fact that the basic visual impression of a complex building is achieved by its load bearing structure. The volume of the structure was formed and defined using the latest software resources. In the iterative process aimed at defining an optimum volume, the shape and size of individual elements were varied (number of the waves, ratios of the highest to lowest points, column positions...). After these iterations and comparison of individual solutions, the final design solution of the roof was adopted.

The roof is a steel truss that integrates the roof surface with the side of the building facing the airstrip. This side is oriented towards the north, i.e. towards the city of Zagreb. The total plan view dimensions of the terminal roof are: 165.0 m across the pier, and 155.0 m along the pier. The highest point of the roof is at 35.5 m (Figure 8). The north and south views on the terminal are shown in Figure 9. The north view of the building from the airstrip is shown in Figure 10.

The roof shell is a steel truss 3.0 m in nominal height. This

height increases in the proximity of tube-shaped columns. The top and bottom surfaces of the shell are triangular structures, with the top and bottom surface members coinciding in plan. The plan view distance between the triangle intersections is 7.2 m, which is the base module of the building. Truss diagonals are V shaped.

Vertical loads are transferred from the roof onto six steel truss columns shaped like double funnels or trumpets, joined in the middle where their diameter is the smallest. They are also inclined for additional impression. Their shape is defined iteratively, without mathematical logic. The smallest column diameter is 7,2m. Column truss members are supported at level +9.6 m by the floor structure. Members of the columns are steel tubes, measuring approximately 406.4 x 20 mm. In addition to the six above mentioned columns, the roof structure is also supported by four concrete cores. The cores are positioned along the edges of the building, and they stretch all the way to the foundation slab. The front side of the building (the airstrip facade) merges with side piers and is supported by the longitudinal level-high steel truss of the pier

at the level +5.4 m. The horizontal stability of the building roof is obtained with a hybrid system consisting of six trumpet columns, four concrete cores, and the concrete structure of the building which is connected to the roof structure with a truss at the level of +5.4 m.

4.2. Access corridor – pier

The pier volume solution is fully integrated with the solution for the entire terminal building. The functional areas of the pier at levels +5,4m and +9,8m are covered with a load-bearing steel structure. The entire pier structure is raised on steel columns and concrete cores (staircases), so that the level +/- 0,0m is free for traffic.

The load-bearing steel structure of the pier roof encompasses two pier levels, and so the roof and the faces are merged. The pier width is 14,4m. The length of the piers together with the terminal building is 670,0m. The height of the pier structure is variable and ranges from +20.2 m to +24.7 m in the pier area, while reaching up to +35.5 m in the building area.

The pier structure is formed of arch truss girders, inclined and interweaved in plan view. Each arch, viewed from above, is a hypotenuse of a triangle with sides measuring 7.2 m (along the pier) and 14.4 m (across the pier). The construction height of the truss arch is 1,30m. Flange members are steel tubes approximately Φ 298,5 x 20mm, and the diagonals are steel tubes approximately Φ 193,7 x 11mm. The arches are supported on the sides by the level-high pier trusses, with the lower flange at +5.4 m and the upper flange +9.8 m. Each arch of upper flange is connected to the lower flange of the support truss, and the lower flange of the arch is connected to the upper flange of the support truss (Figure 6).

Side trusses measure 28.8 m in span, with the construction height of 4.2 m (height of a level). They are made of steel box flanges measuring 400 x 400 mm and V shaped tube diagonals measuring approximately Φ 298,5 x 16 mm.

The concrete floor slab is 25cm thick, and it is laterally supported by truss flanges. The connection is achieved with bearing plates # 100 x 200 mm, and dowels Φ 22 x 200 mm.

The above mentioned structure assumes all vertical (truss) and horizontal (concrete floor slab) loads. Vertical loads are transferred from side trusses onto steel truss columns, placed in the same areas as the concrete cores. The transfer of horizontal loads to foundations is realized via concrete cores, spaced at 28.8 m.

4.3. Structural analysis

A preliminary structural analysis of the roof was made in the scope of conceptual design for the terminal building. The analysis was made using the finite element roof shell model, suitable for vertical loads only. The shell was supported at points representing individual column tubes, and at concrete core positions. The largest shell span is 57.5 m. The calculation

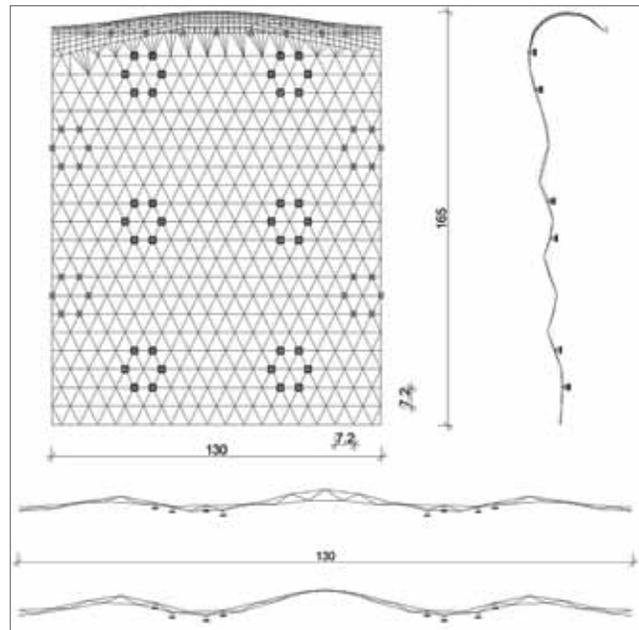


Figure 11. Roof truss shell model

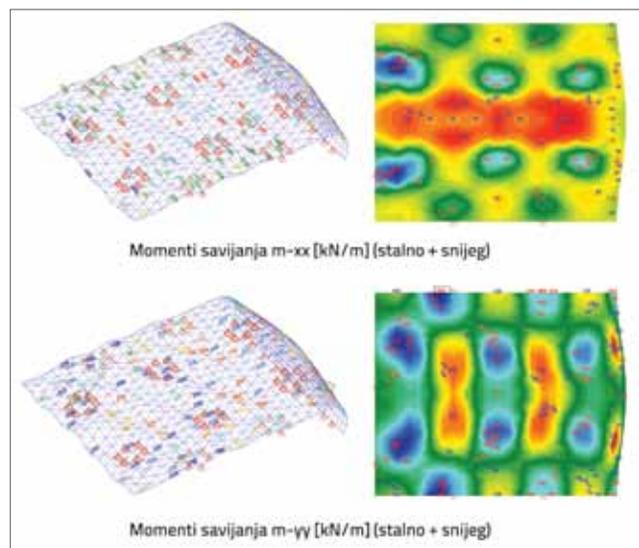


Figure 12. Structural analysis results for preliminary design of the roof

model is shown in Figure 11, and partial results are given in Figure 12.

The largest shell moments are: $\min M_{yy} = -400,0$ kNm/m i $\min M_{xx} = -410,0$ kNm/m. If these moments are converted into truss member forces, the largest truss force would be 1.658,0 kN $\sim N_{E,d}$. The limit force for the tube truss element of section Φ 219,1x16,0 mm, with the buckling length of 8.04 m, is $N_{R,d} = 1.218,0$ kN. Truss members have been chosen as tubes Φ 219,1x16,0 mm, with the possibility of stronger sections around support areas. These dimensions were generally accepted in preliminary calculations.

A more detailed calculation was made later on, using the model with real truss elements, which include both flanges, verticals

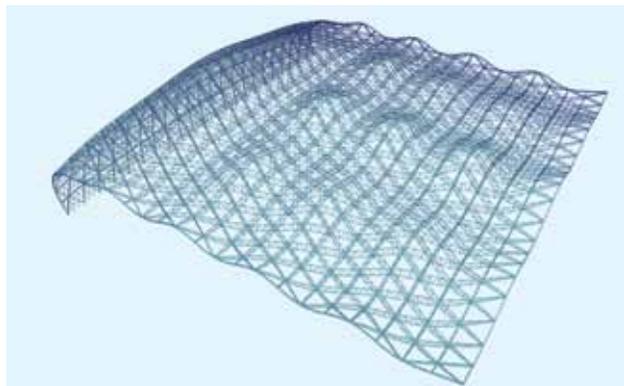


Figure 13. Spatial truss model of the main building steel roof

and diagonals (Figure 13). The calculation software Sofistik was used in the analysis. The truss member dimensioning was conducted according to ultimate limit states which include relevant combinations of the following loads: self-weight of the main truss (70 kg/m²), additional permanent load (secondary steel structure, roofing and equipment – approximately 75 kg/m²), snow (with characteristic value of 1,2 kN/m²), wind (reference speed of 22 m/s), temperature (+17 °C, -15 °C), and earthquake (acceleration 0,21g, importance factor 1,3). During the dimensioning of the elements, critical buckling lengths were determined for all major truss member types, and thus the critical buckling force. Dimensions of the members were optimized, and so some member thicknesses were reduced and some increased. Tube diameters were also increased for some members (around the supports). Flange truss members ranged from Φ 219.1 x 8.8 mm to Φ 273.0 x 28.0 mm. Diagonals and verticals ranged from Φ 139.7 x 6.3 mm to Φ 152.4 x 14.2 mm. Deflections were checked for serviceability limit state. Relevant deflections derive from rare combination of loads, and the maximum deflection is about 7cm in the middle of the span.

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According to calculations for wind and earthquake (horizontal loads), the total wind load to be distributed among the concrete cores is about 6.890.0 kN, and the total earthquake force acting on the steel roof structure (without the concrete and steel floor structures) ranges from 1.700 kN to 2.700 kN per core (depending on core position in plan view). Vertical stabilization elements were not calculated but, considering the number and disposition of the supports, it can be concluded that the structure is capable of withstanding such actions within acceptable deformation limits.

5. Conclusion

Building professions manufacture products that retain their functionality over an extended period of time. This is why buildings are mirror images of the time of their construction, and they are in a way a sum of the technical and social culture of the area in which they are created. Such an achievement leaves a mark in space and time, and represents the spirit of people who have built and used such creations.

The most advanced and state-of-the-art knowledge in urban planning and architecture was used in the creation and development of conceptual design for the airport terminal (and the surrounding airport space).

Technical means implemented for achieving the goal of forming man-made structures are among the most valuable advancements of our time. Choosing and employing leading parameters for form finding, along with the completeness and precision of software generated solutions, reflect the contemporary interaction potential between artistic creation and the techniques and flexibility found in engineering profession. Thus, during development of conceptual design for the facility presented in this paper, an optimum use was made of symbiosis of two affiliated professions – architecture and civil engineering.