

DESCRIPTION OF PROJECTS



Studio Tecnico Majowiecki

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YAOUNDE – COSO NEW STADIUM

DESCRIPTION

The grand stands of the Stadium will be covered by a Tension Structure Roof composed by two inner tension rings (TR = Tension Ring) and a perimeter compression truss ring (CR = Compression Ring) connected with radial carrying and stabilizing cables.

The governing structural principle of the horizontal structure of the roof is that the equilibrium, geometry, static stiffness, dynamic stiffness, are obtained by an accurately planned and constructed distribution of forces in combination with an accurate geometry, in the components of the tension structure made by the cables, the connection nodes, the steel components and the perimeter compression truss ring as a whole integral system.

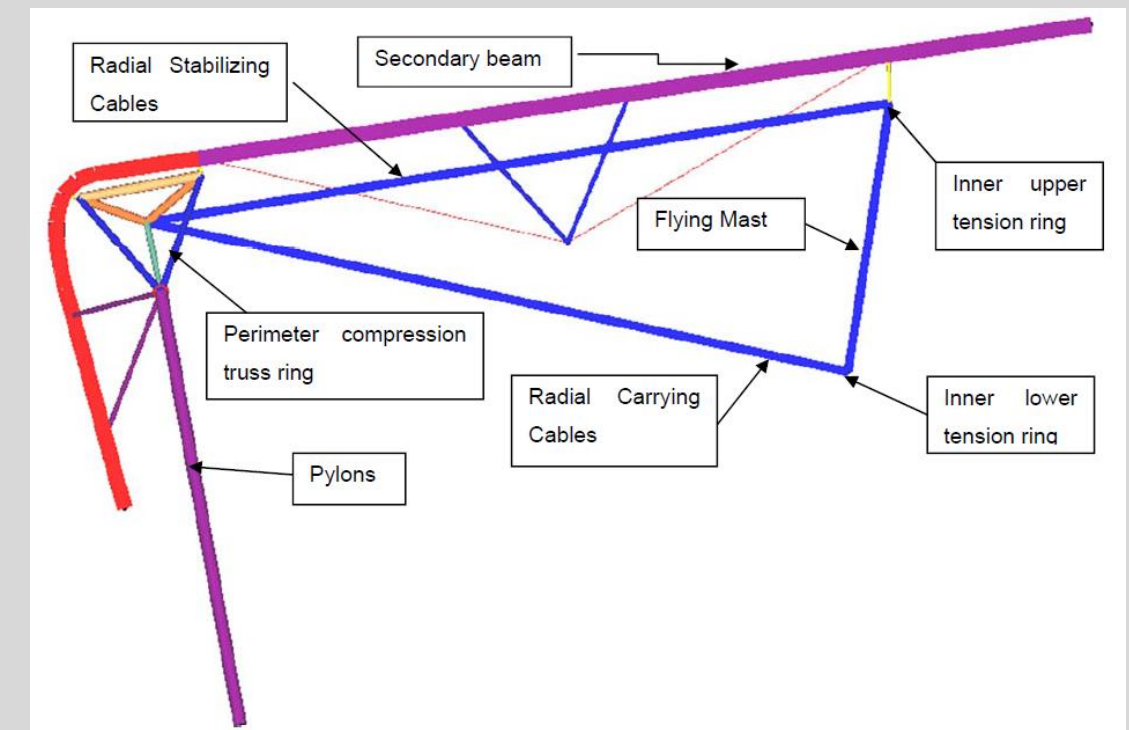
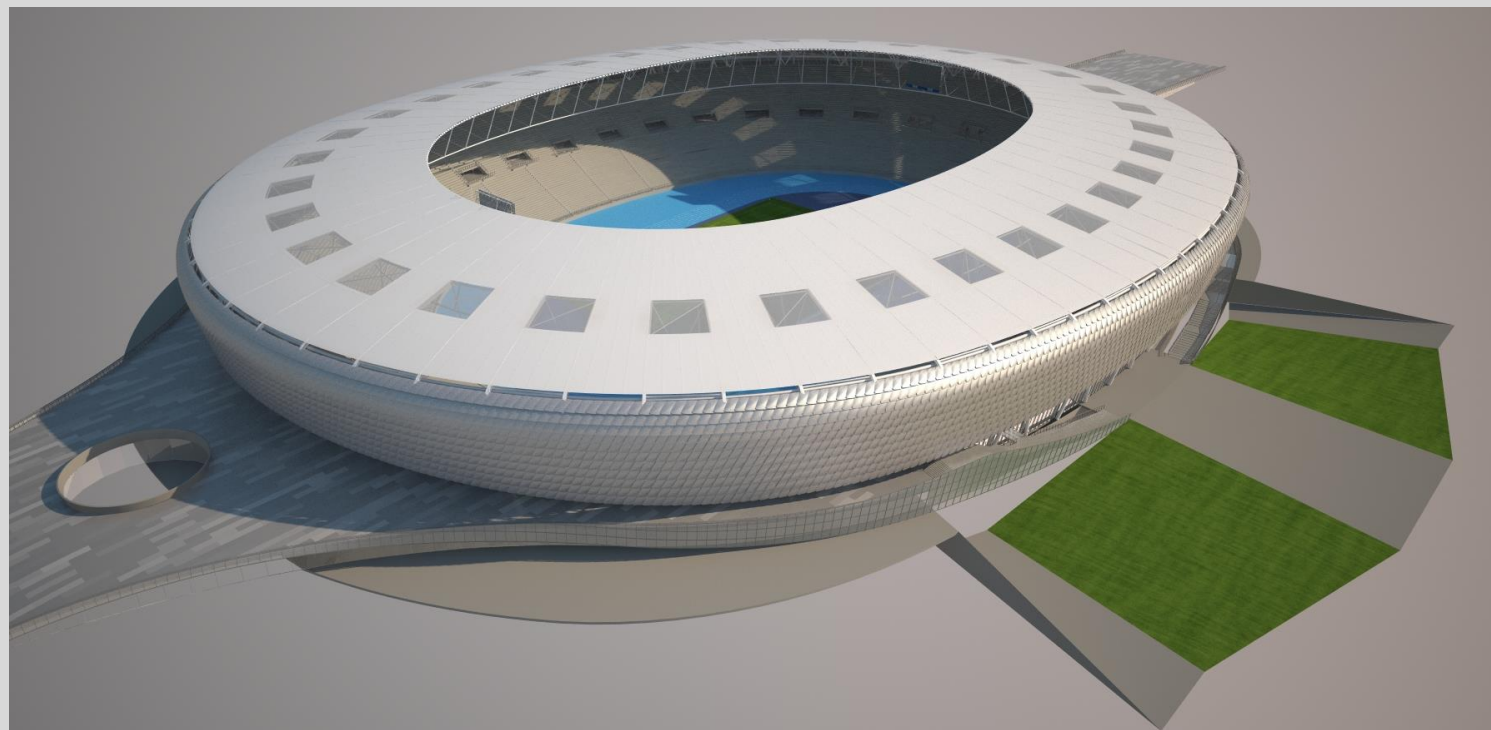
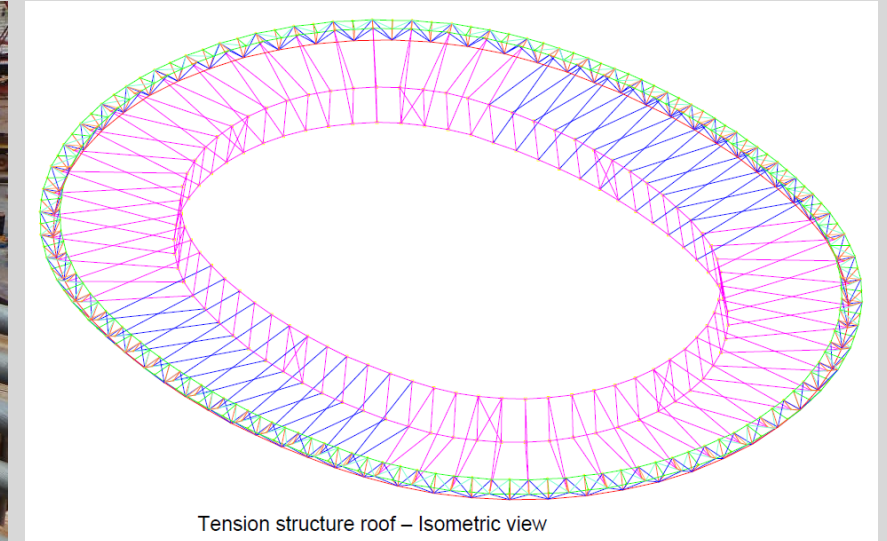
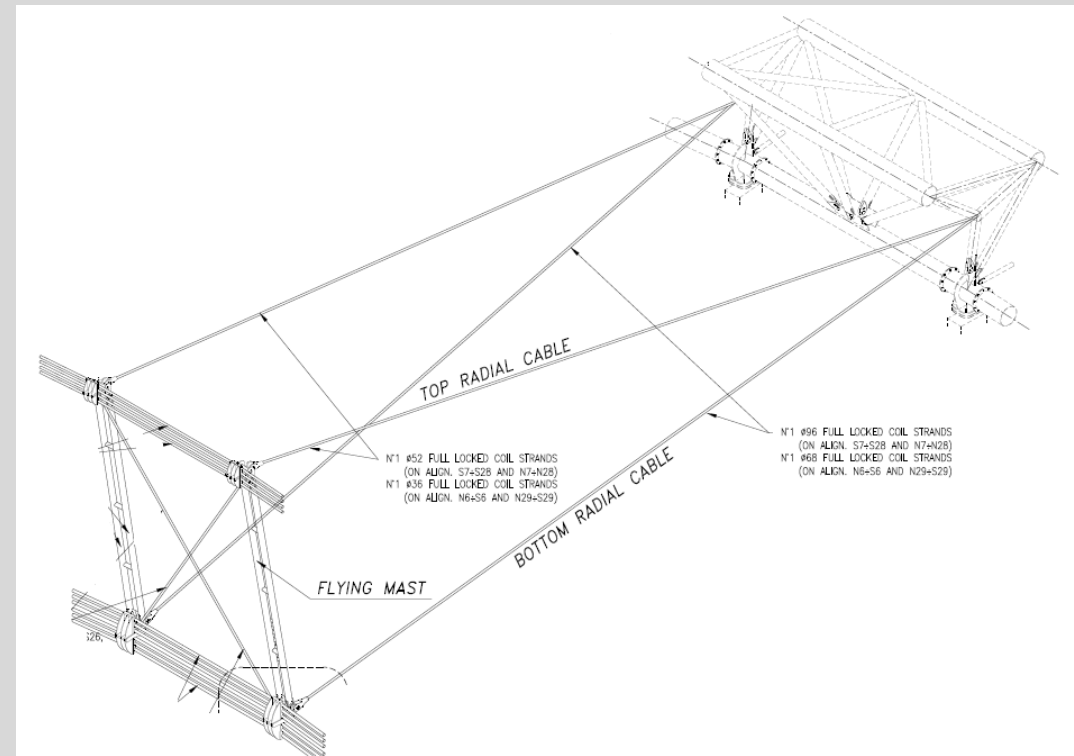
Compressed sub-vertical flying masts (made by 2 x CHS 298.5mm each one) connect top and lower cable groups of TR. The Tension Structure Roof has plan dimensions about 300 m x 245 m and an height of about 46 m above ground. Compressed sub-vertical flying masts (made by 2 x CHS 298.5mm each one) connect top and lower cable groups of TR.

Service provided: Preliminary, final and executive structural design

Client: Piccini Group

Year: 2017

Amount of works: € 50.000.000.



MILANO – UNIPOLSAI TOWER

DESCRIPTION

The tower has 23 floor for a total height of about 120m. The shape of the plant is elliptical with dimensions 52m x 31.3m, the surface of each floor is about 850sm. The structure is composed by an external diagrid connected every three floors: in the connection node there is an hanger that support the structure of the two floor below.

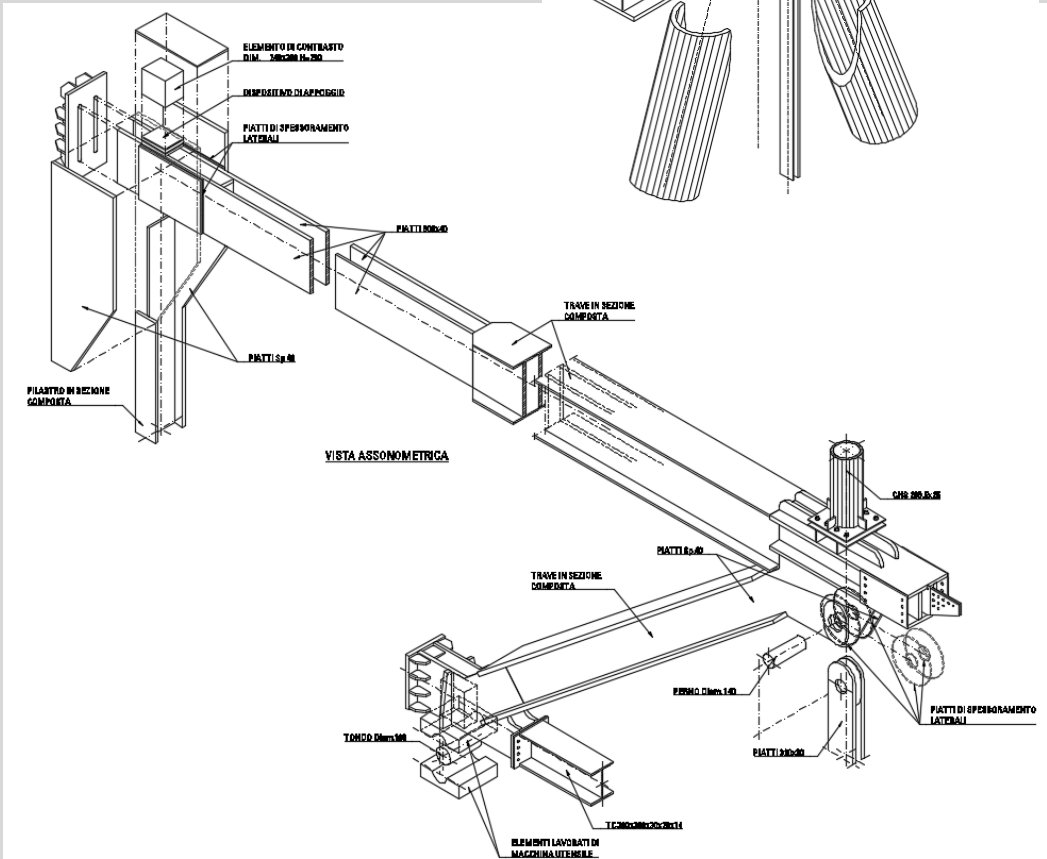
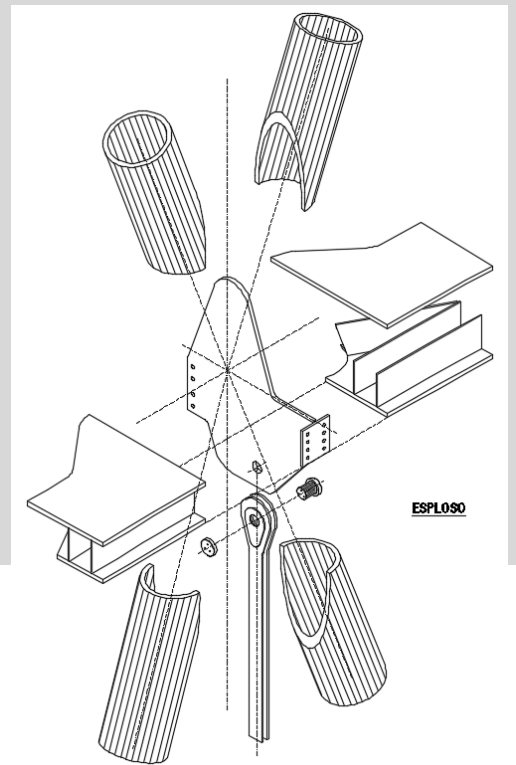
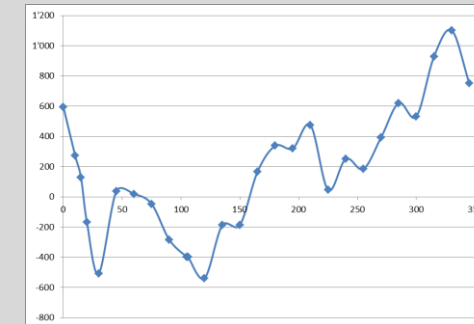
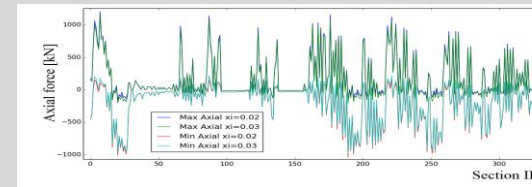
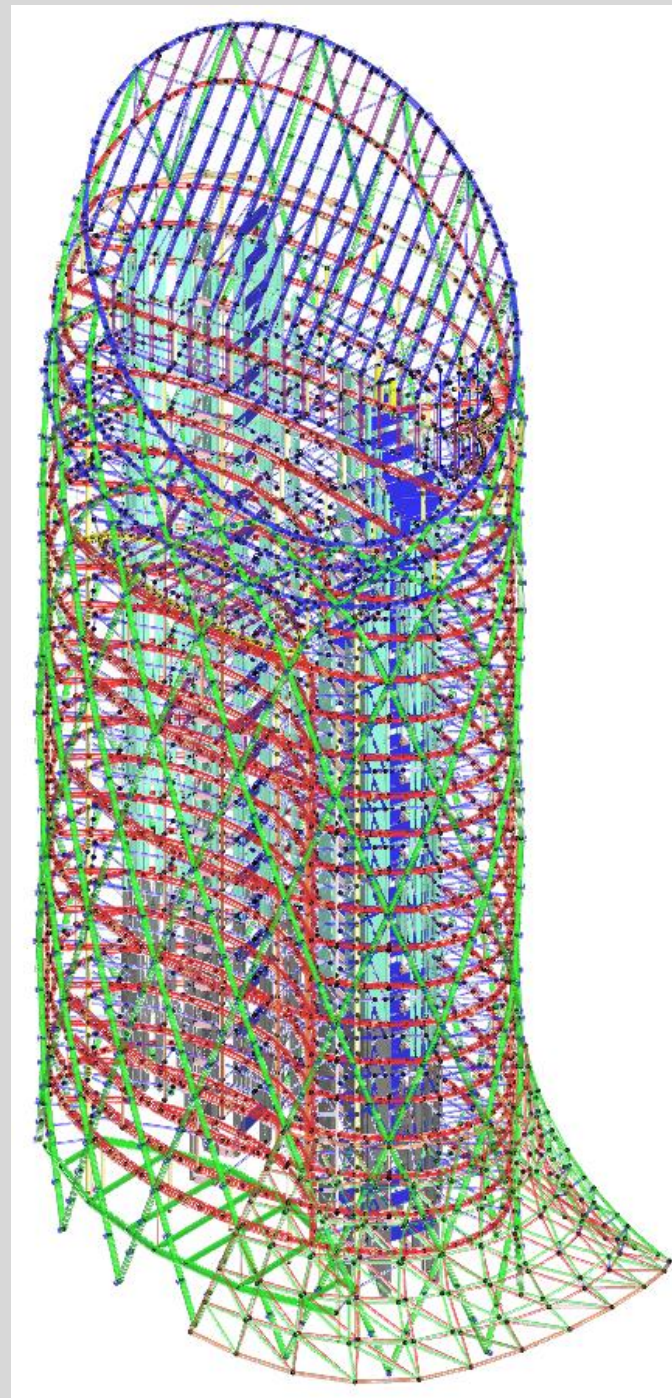
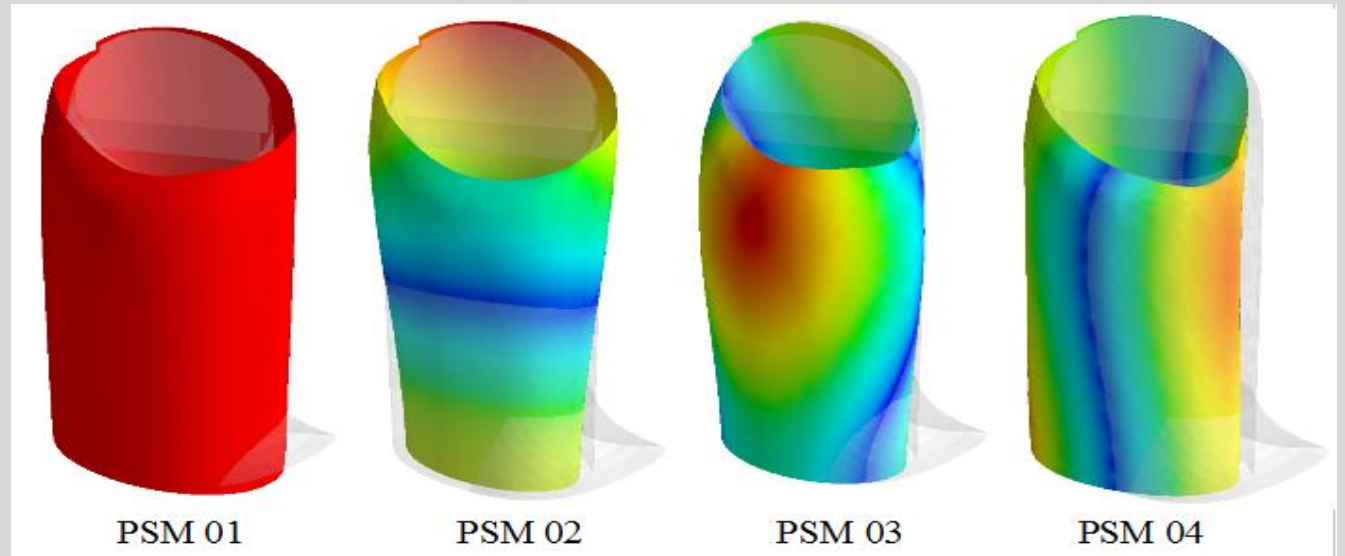
In the centre of the structure there are two concrete cores that contain the plants and give a contribution (together with the diagrid) to the horizontal stiffness of the tower.

Service provided: Preliminary, final and executive structural design

Client: UNIPOLSAI Insurance Company

Year: 2017

Amount of works: € 60.000.000.



BOLOGNA – PAVILIONS 29 E 30

DESCRIPTION

The designed structures are included inside the re-development intervention of North-Eastern area of exhibition neighborhood in Bologna. The new structural system can be subdivided into 4 main structures: Pavilion 29, Pavilion 30, Multifunctional building, the Mall.

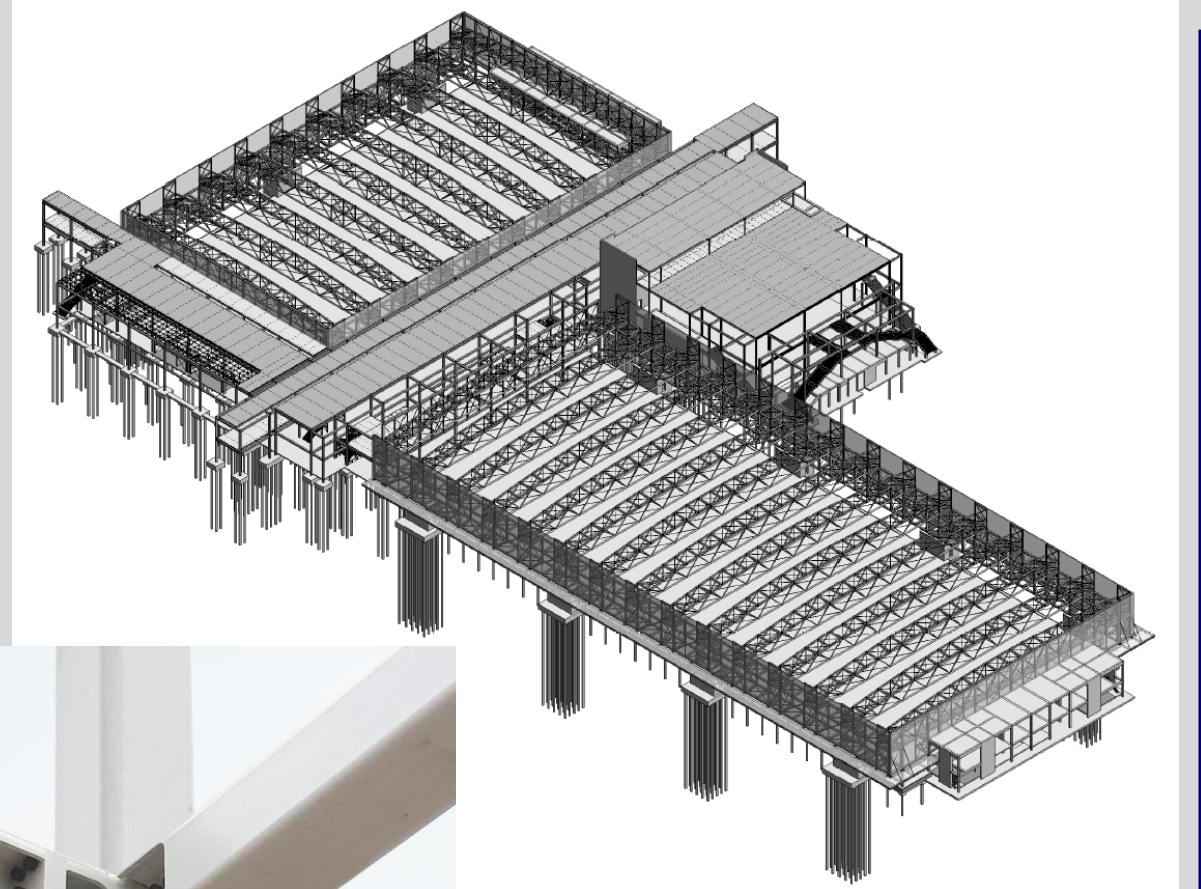
Pavilions 29 and 30 are one-storey buildings whose dimensions are respectively 68.80m x 112.50m e 81.20m x 173.00m; the first one is developed along North-South axis, while the second one lies on East-West direction. The Multifunctional building is the two-storey building in the North-East corner of the project, whose main purposes will be restaurant and meeting room (with a plant room on the roof). The "Mall" is a covered surface between pavilions and multifunctional building. Part of it should be composed by a pedestrian path at +6.20m level.

Service provided: Structural final design

Client: BOLOGNA Fiere

Year: 2017

Amount of works: € 30.000.000.



ATHENS – NEW AEK STADIUM

DESCRIPTION

The steel structures of the roof of AEK Stadium are composed by four Main Reticular Beams (MRBs or main trusses) parallel to the ground, suspended at the ends to the reinforced concrete Pylons.

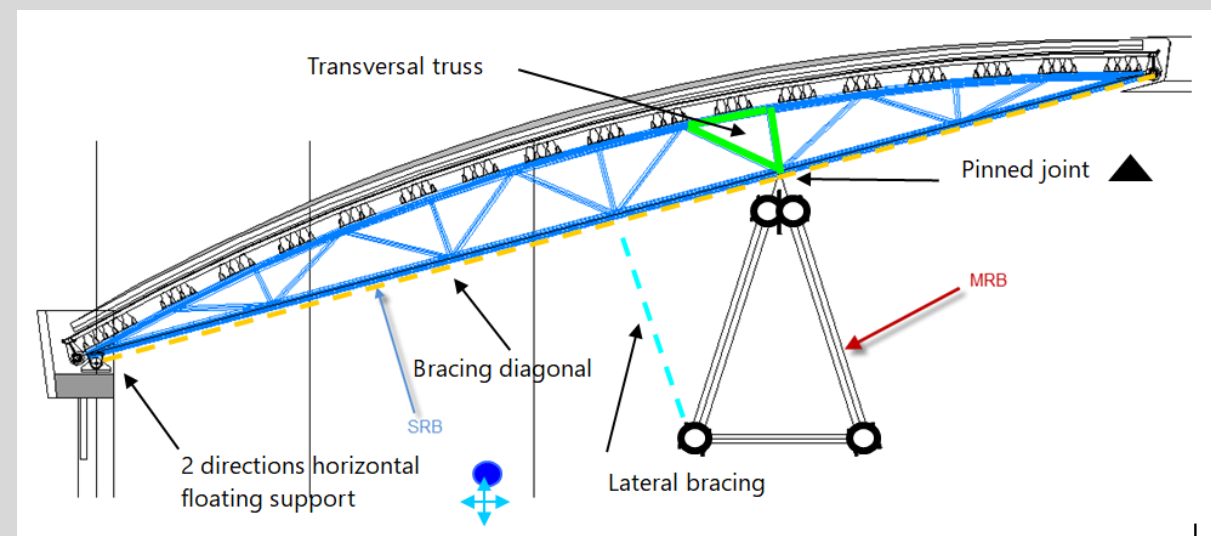
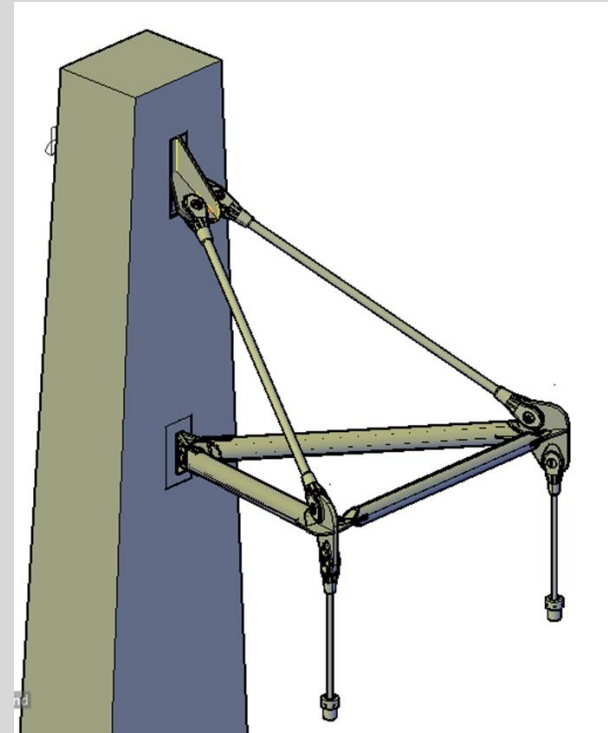
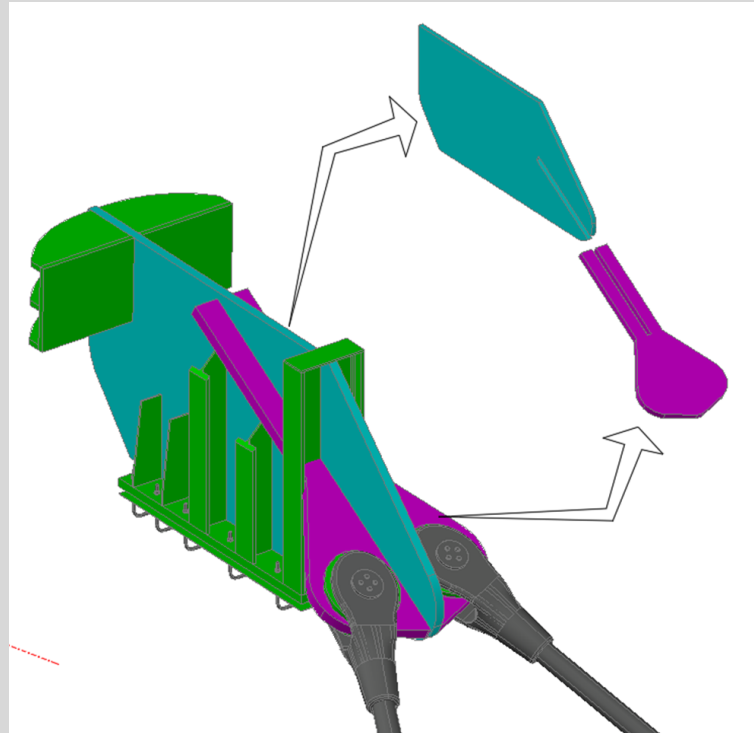
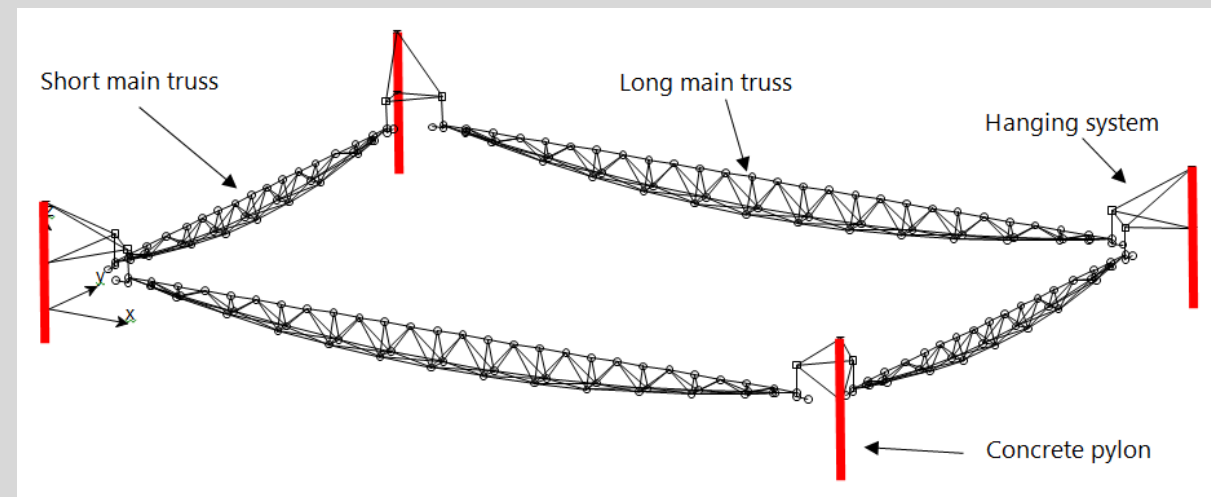
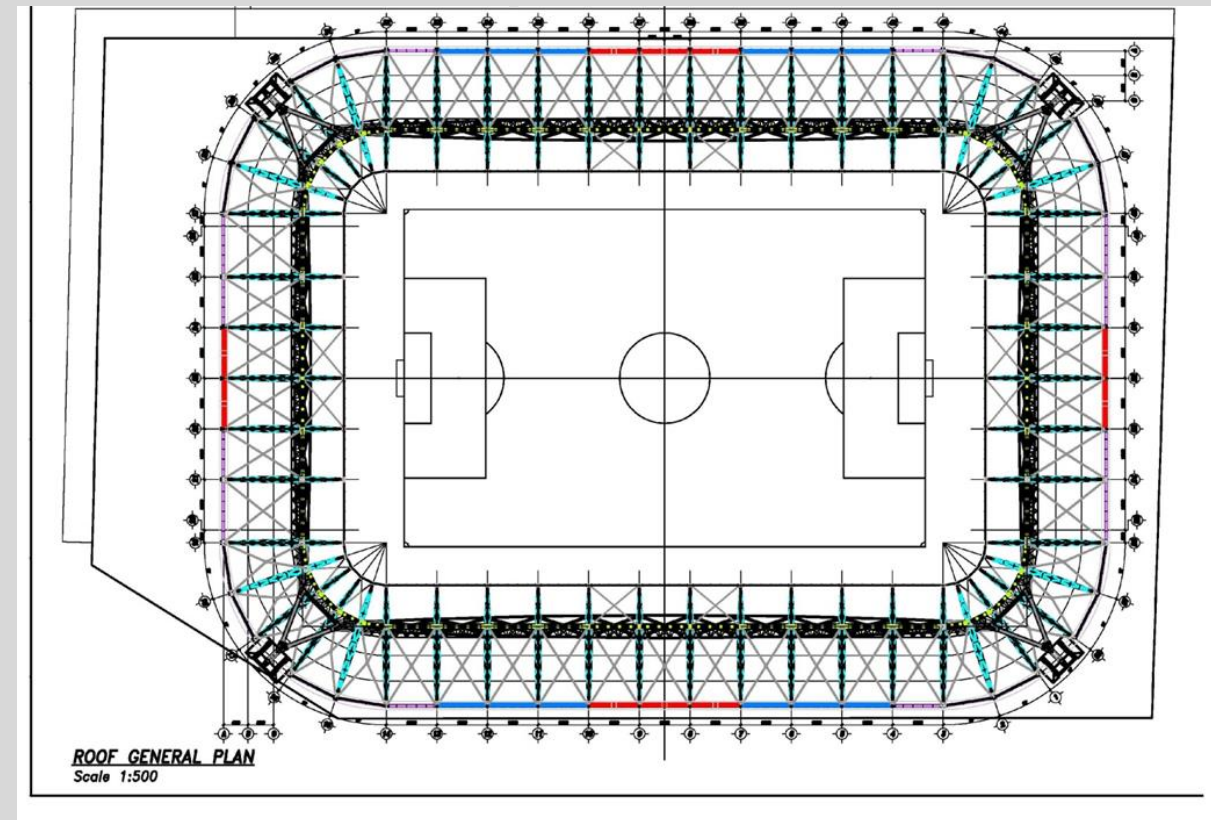
Main truss span is about 132m (long main trusses) and 86m (short main trusses) length. Cross section has triangular shape with one upper straight chord and two curved lower chords. Height at mid span is 6.0m and 4.0m (referred to chords center lines). Lower chords are braced by transverse and diagonal elements.

Service provided: Preliminary, final and executive structural design of the roof structures

Client: AEK Atene football club

Year: 2017

Amount of works: € 130.000.000.



PERTH – SWAN RIVER PEDESTRIAN BRIDGE

DESCRIPTION

The bridge is formed by three steel arches and three cable stayed steel decks. The geometry of the steel arches follow the free form shape designed by the architects. The total length of the bridge is about 400[m] with a central span of 144[m] and the two lateral of 84[m].

Each arch is formed by four legs, supported by concrete piers.

The first and last steel arches have approximately a 84m free span and 36m height above the water level. The central arch has a 144m free span and 75m height above the water level.

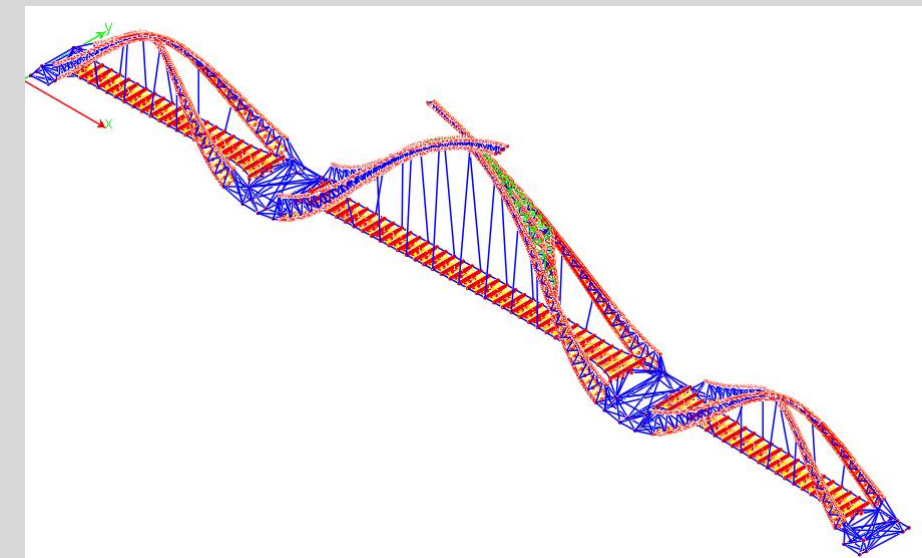
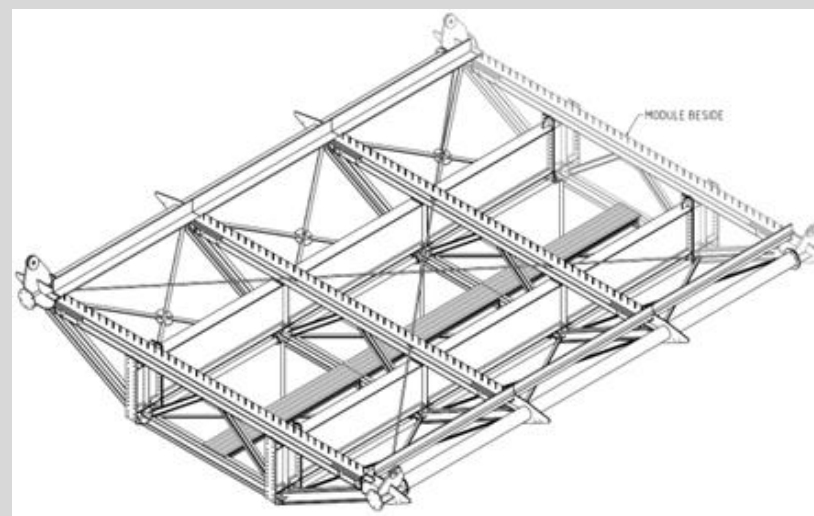
The main arches are connected at the top by a hinge joint that allow a rotation in the longitudinal plan but ensure a rigid connection in the transversal plan. In the apex of the main arches there are two cantilever part of the structure of about 25[m] length.

Service provided: Preliminary, final and executive structural design

Client: Rizzani De Eccher

Year: 2016

Amount of works: € 50.000.000.



FLORIANOPOLIS – PONTE HERCILIO LUZ

DESCRIPTION

The initial condition of the bridge, called “Start” condition, reproduces at the best the geometrical and load condition at the time of the surveys carried out, in May 2016, when the deck has been removed and only that main truss structure with transverse girders and main longitudinal purlins are present.

The numerical model has the scope to reproduce a structural system with the same geometry of the survey and with a distribution of forces in the elements in equilibrium with the loads applied.

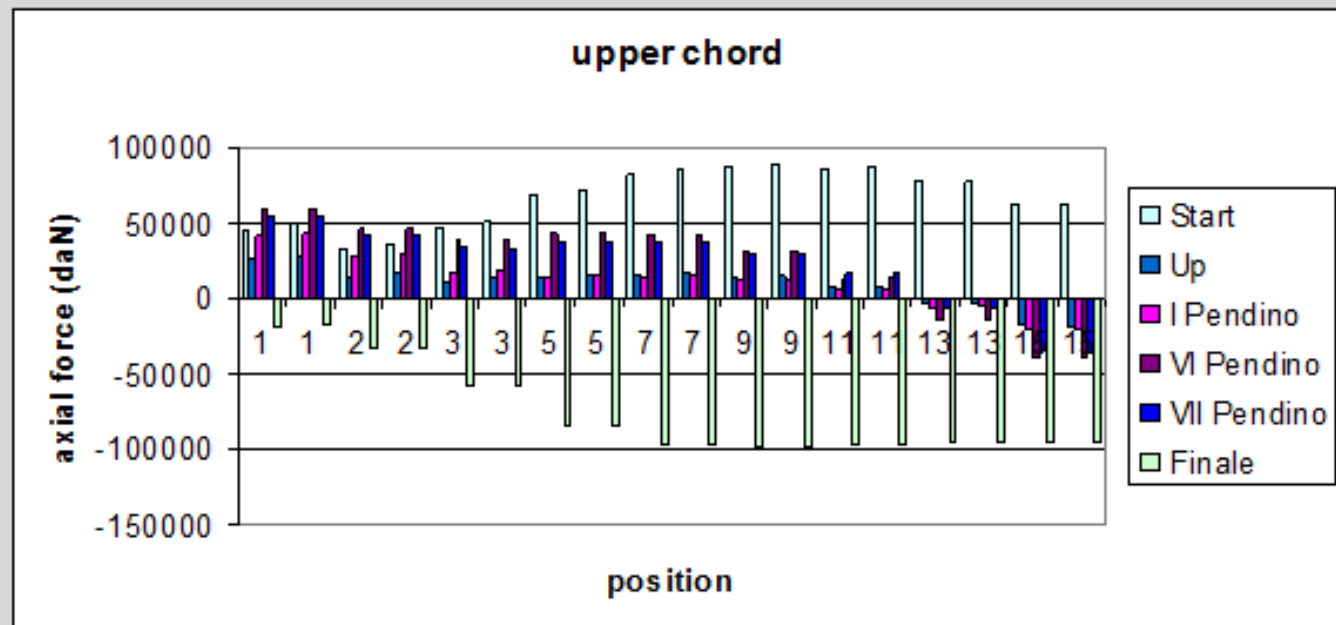
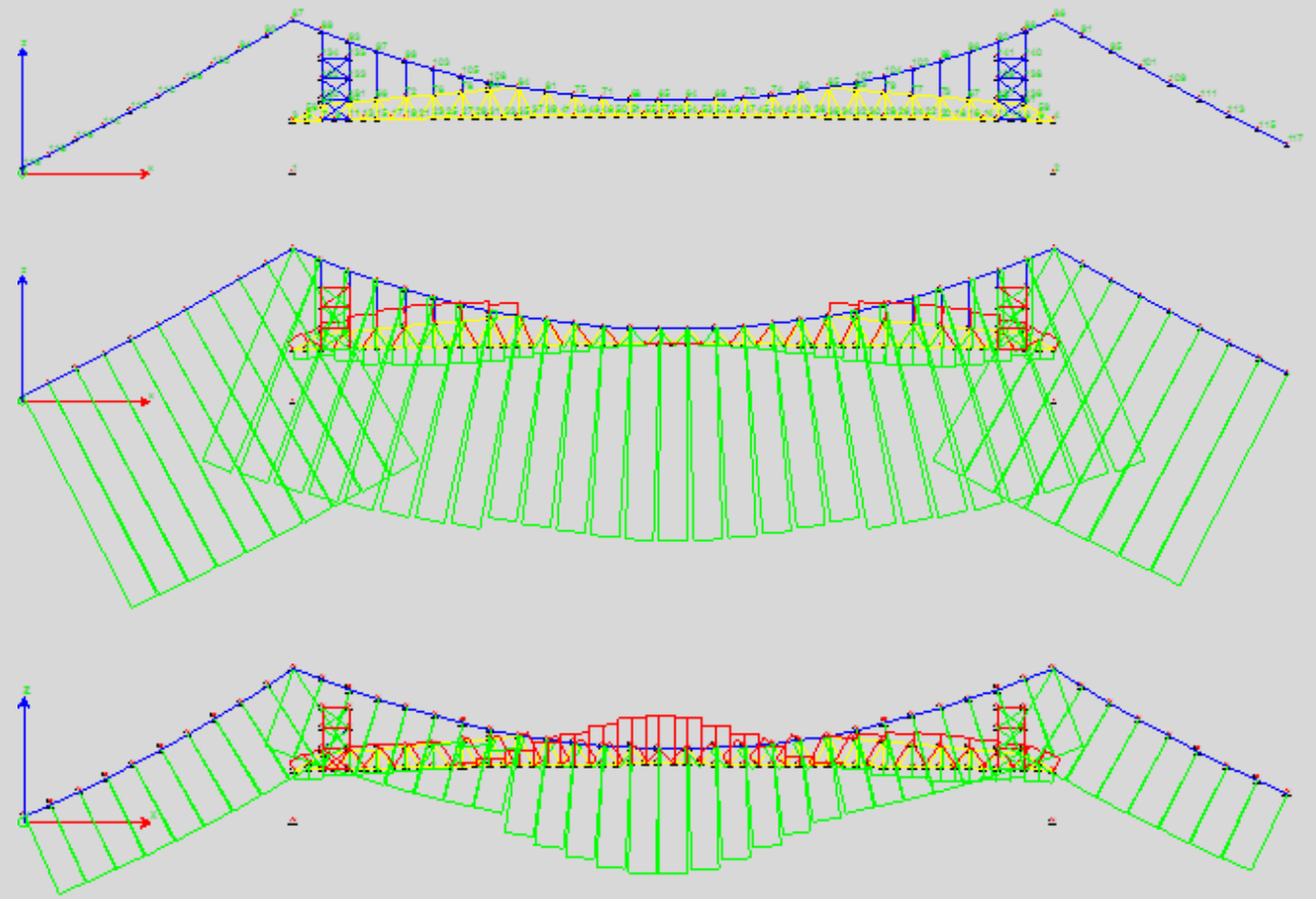
The model has been built by Studio Tecnico Majowiecki, using the program RETE that is a specific software dedicated to the form finding of the tension systems and structures, in combination with the program TENSO, that is a specific software dedicated to the non linear analyses of structures and tension structures with large displacements and redefinition of the geometry step by step.

Service provided: Executive structural design

Client: MMI

Year: 2016

Amount of works: € 30.000.000.



IRAQ – AS SAMAWAH STADIUM

DESCRIPTION

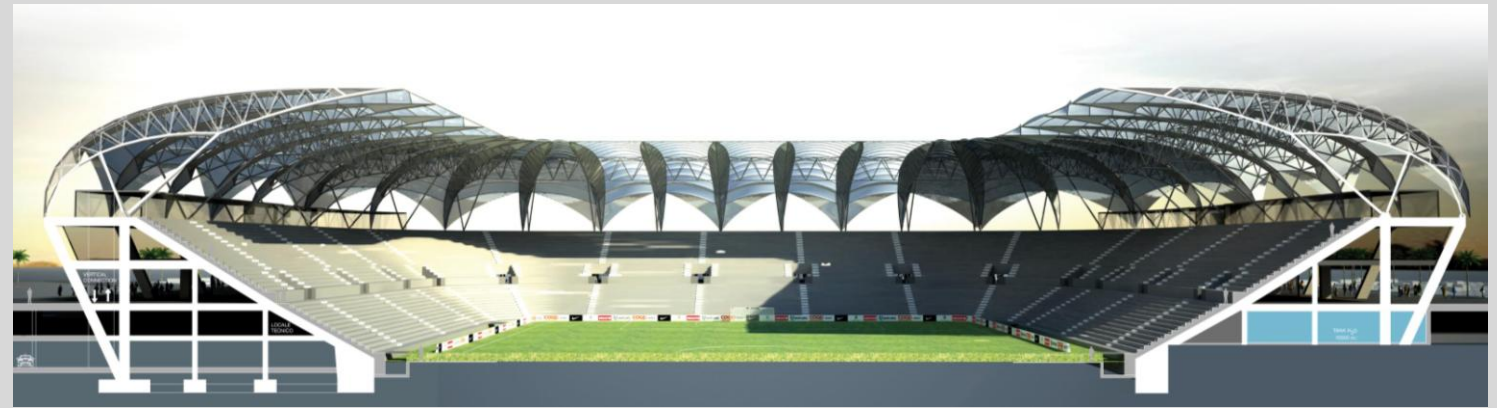
The project concerns a stadium of 20,000 spectators. The stands are made of reinforced concrete and with steel beams collaborating with the concrete slab. The cover is made with cantilever structures of metal profiles.

Service provided: Structural and architectural preliminary, final and executive design.

Client: T&T Costruzioni srl.

Year: 2013-2014

Amount of works: € 50.000.000.



MILANO – EXPO BRIDGES

DESCRIPTION

The EXPO bridges are inserted between two large arches that provide aesthetic continuity to the formal system of infrastructure constituted by the "Arch Bridge on the A4" - "Viaduct EXPO" - "Arch Bridge on the A8."

The viaduct consists of a continuous beam of 5 spans of equal dimensions.

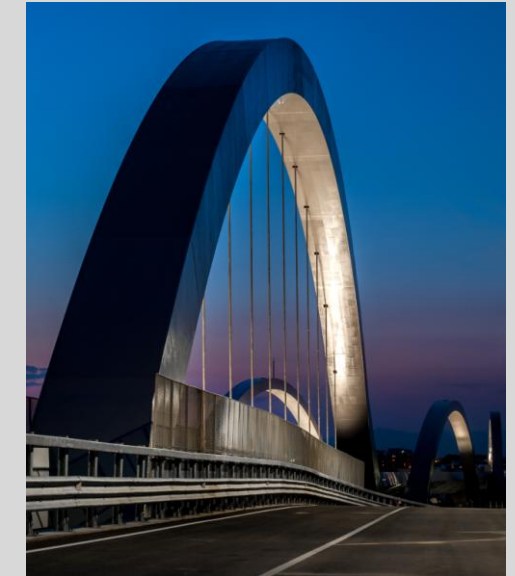
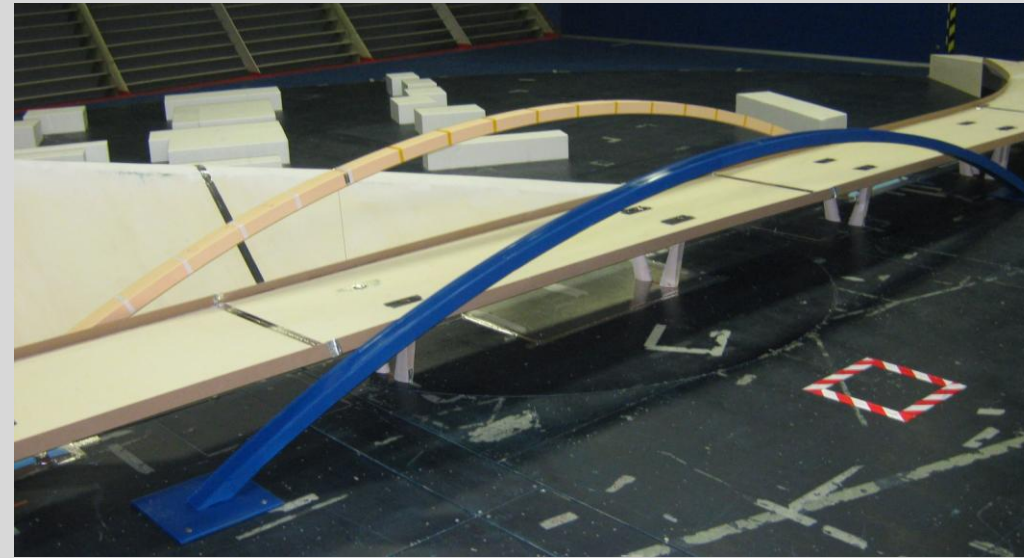
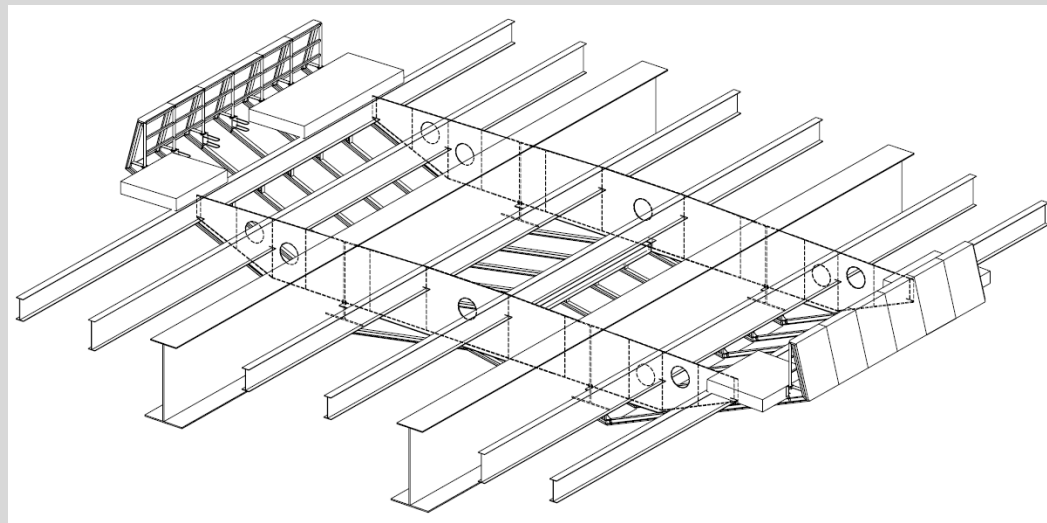
Service Provided: Executive Structural Design

Amount of works: € 13.000.000,00

Client: Politecnica

Year: 2012

Total span: 600m



MILANO – EXPO 2015 COVERAGE SYSTEM OF THE WALKWAYS

DESCRIPTION

The graphic images of the Masterplan Expo 2015 show for the coverage system of the walkways a light and simple structural system: the tent.

After a series of computer graphics simulations (rendering and 3D movies) it was decided to adopt the following structural solution:

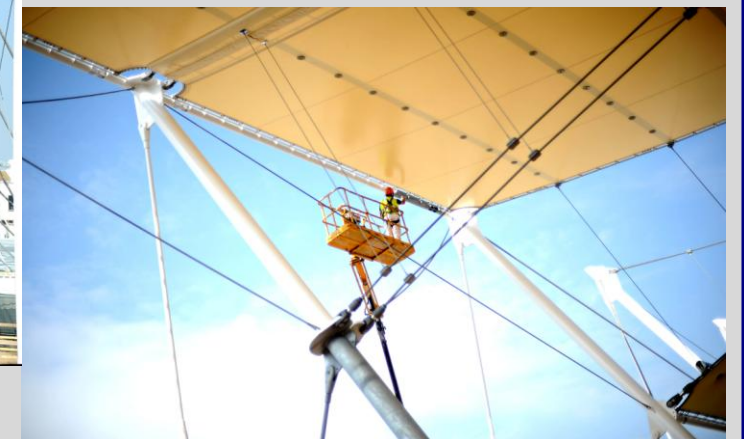
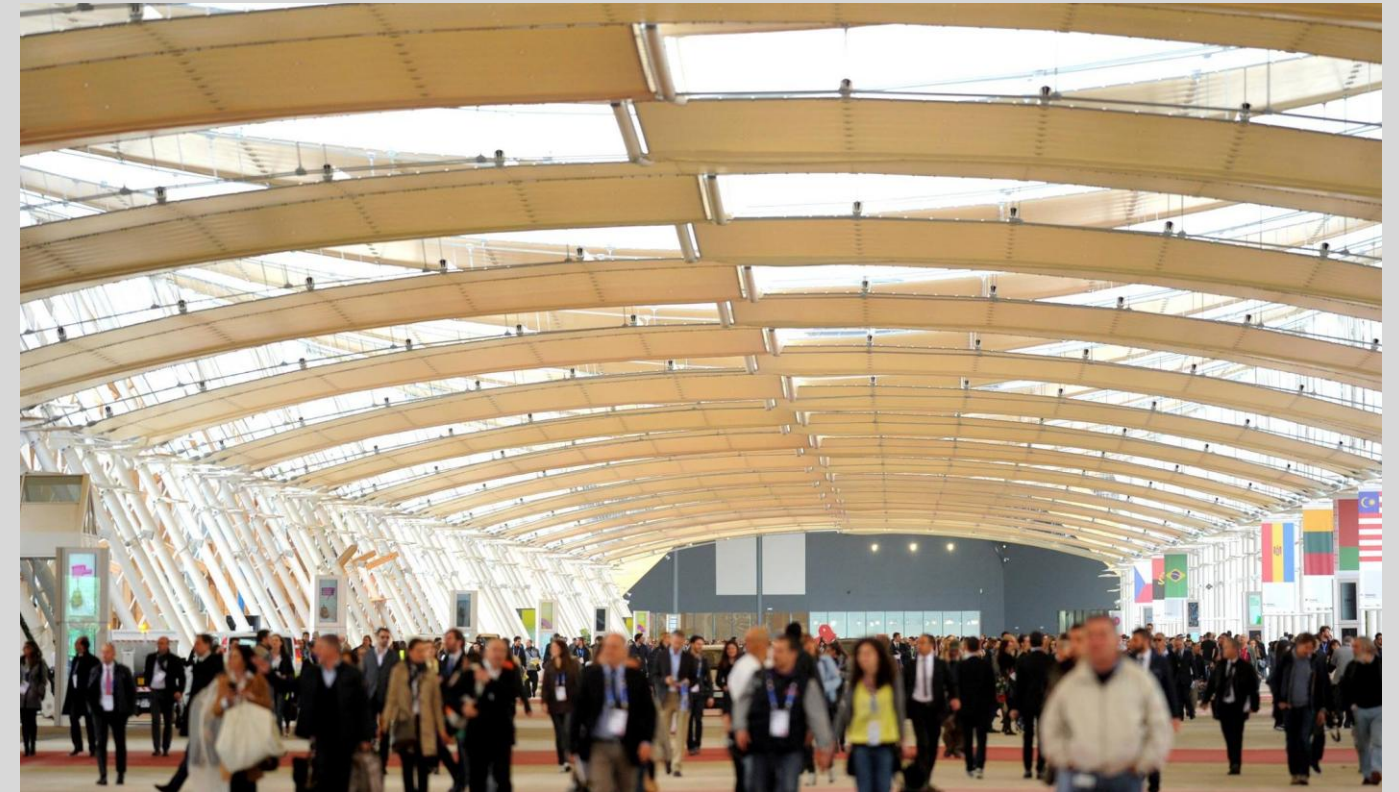
- Horizontal tension structural system made with ropes of opposing curvatures and vertical connections elements;
- Translucent and pre-stressed cover membrane stabilized with transversal tubes;
- Vertical anchoring and support structures realized with a reticular space frame;
- Foundational footing system and anchor foundation system made with a gravity system.

Service provided: Preliminary, final and working architectural-structural design

Client: Metropolitana Milanese S.p.a.

Year: 2012

Amount of works: € 22.000.000.



ROME – THE NEW PARKING OF HIGH SPEED STATION “TERMINI”

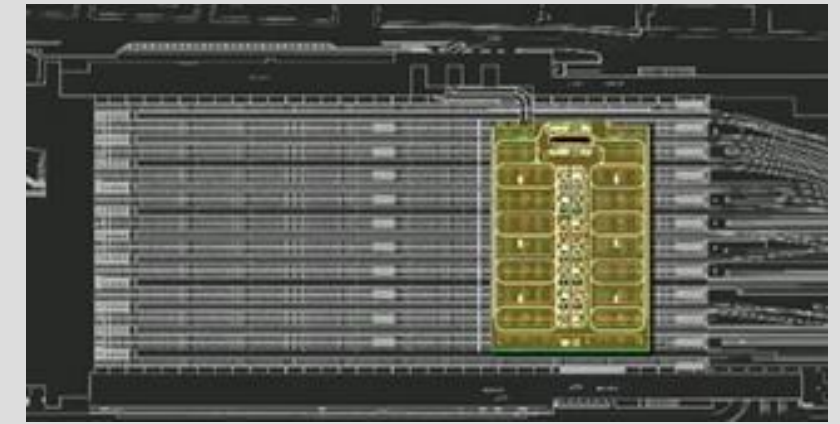
DESCRIPTION

Service provided: Executive Structural Design

Client: Italian Railways Organisation

Year: 2011

Amount of works: € 62.000.000



ROMA – EUR CONGRESS CENTRE

DESCRIPTION

With the architectural design of M. Fuksas the congress centre is a structure that can be synthesized in the joining of 3 simple elements: the Teca, formed by a system of steel portals to create a box-shaped space containing the Nuvola; the Nuvola is an irregular shaped volume, created by using tubular profiles, accessible from the Teca and containing a series of plankings and the Auditorium; the Lama is made of a regular steel frame and reinforced concrete nucleus, created to accommodate a hotel.

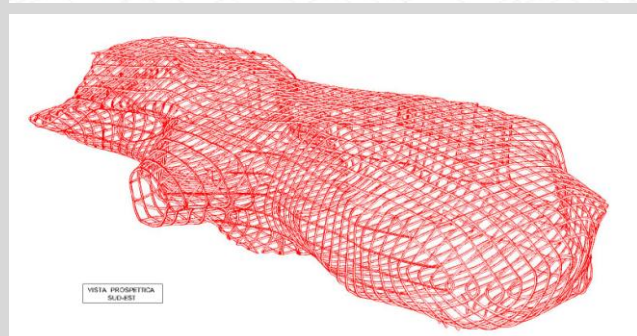
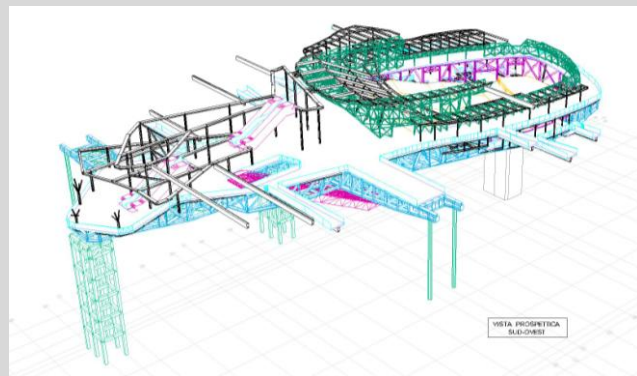
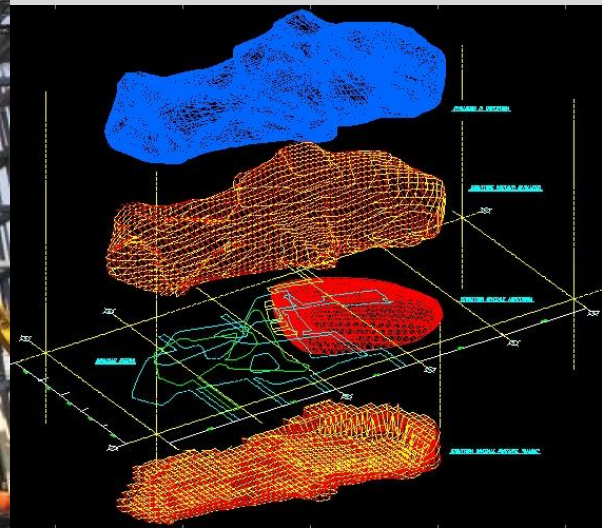
Service provided: Preliminary, final and executive structural design

Client: EUR S.p.a.

Year: 2008 - 2011

Surface: 16.000 m²

Amount of works: € 276.000.000



FIRENZE – NEW HIGH SPEED STATION

DESCRIPTION

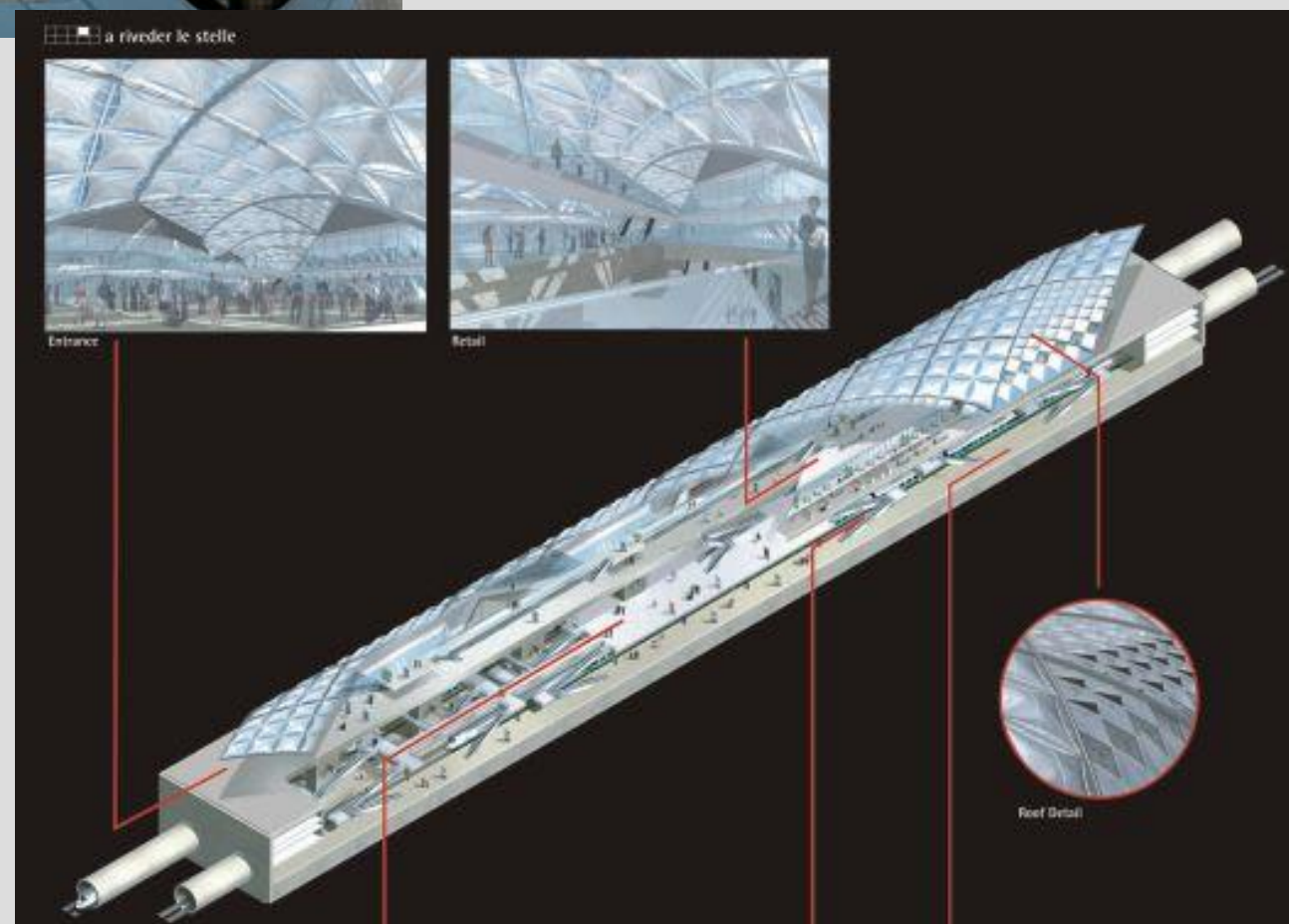
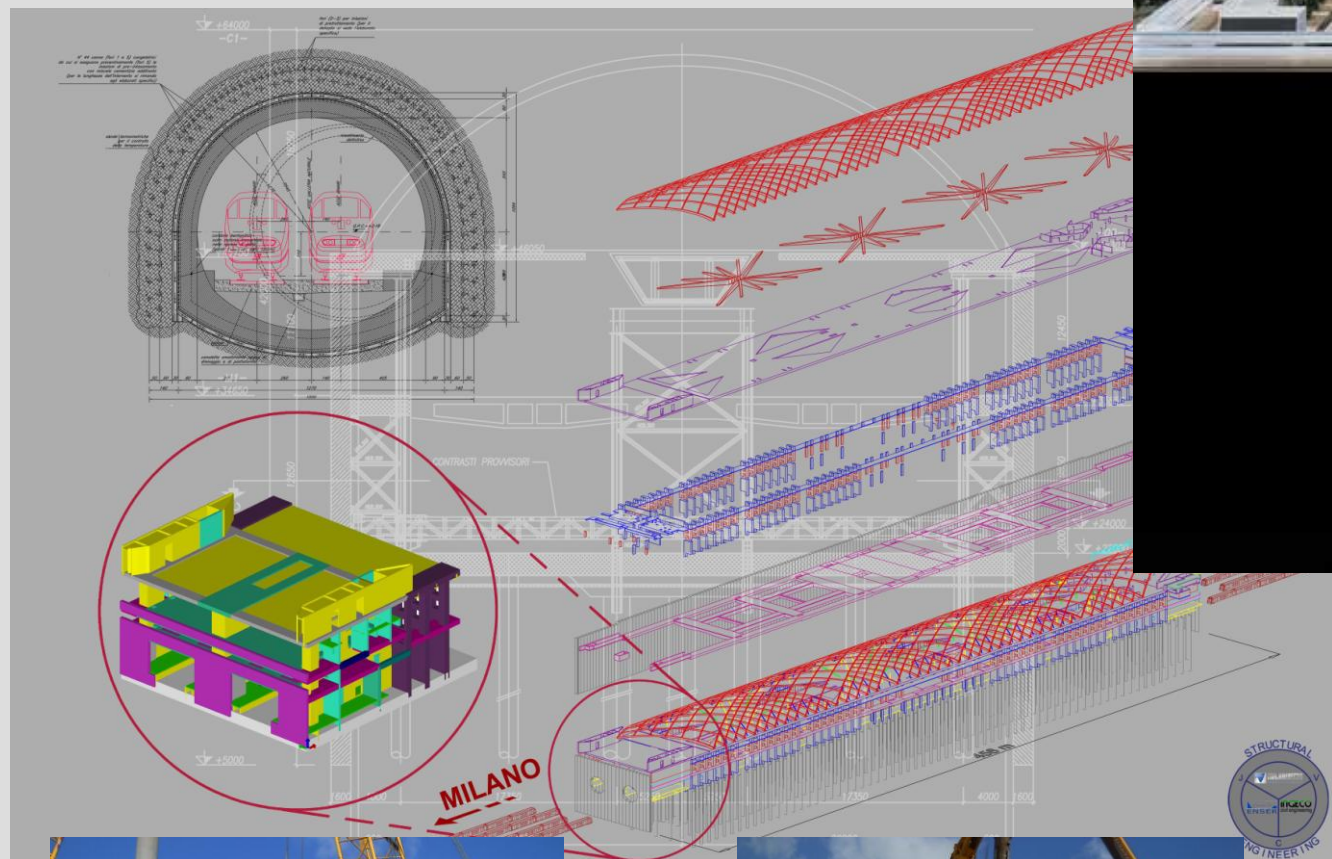
Final design is based on architectural design by Sir N. Foster and structural design by ARUP. The Station, 500x52 m, is underground for ≈25 m: final design has changed the construction technology from bottom-up to top-down. The part above ground - having two suspended levels - is realized with steel arches spanning 172 m. Among preparatory works an hydraulic underpass 150 m long has been designed, to be realized with the 'push-in' technique under rails.

Service provided: Structural working design

Client: Italferr

Year: 2008 - 2011

Amount of works: € 270.000.000 Euro



BOLOGNA – PEPOLI PALACE

DESCRIPTION

From a distribution point of view, the project development consisted in structuring the new rooms destined for temporary exhibitions and to bond them organically into an easy to use museum route. Inside the iron tower, the rooms destined to hold the temporary exhibitions and the other initiatives foreseen by the scientific project have been placed on five levels. The stairs and lift that access the museum route of Pepoli Palace, which will be restored and cleaned of all the additions that have followed over the years, are on the outside.

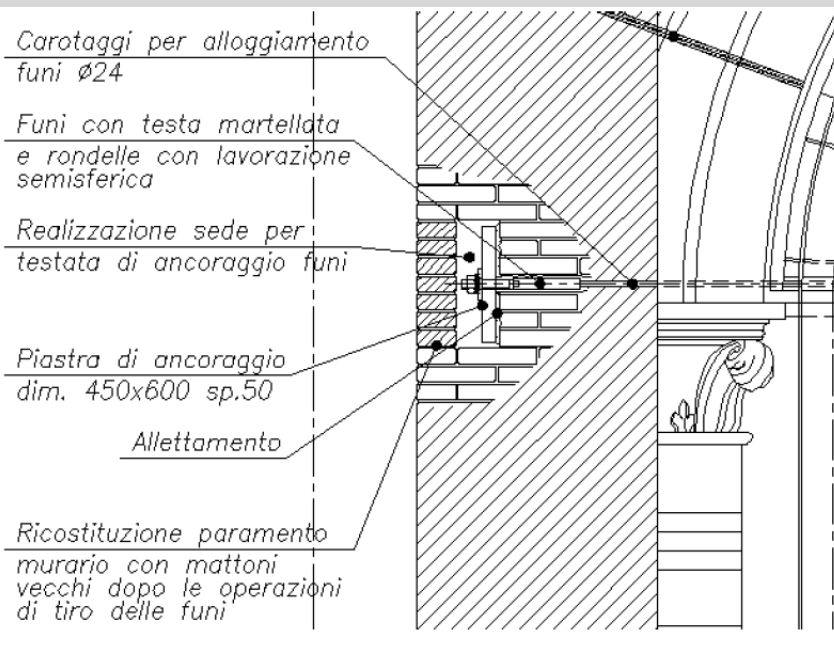
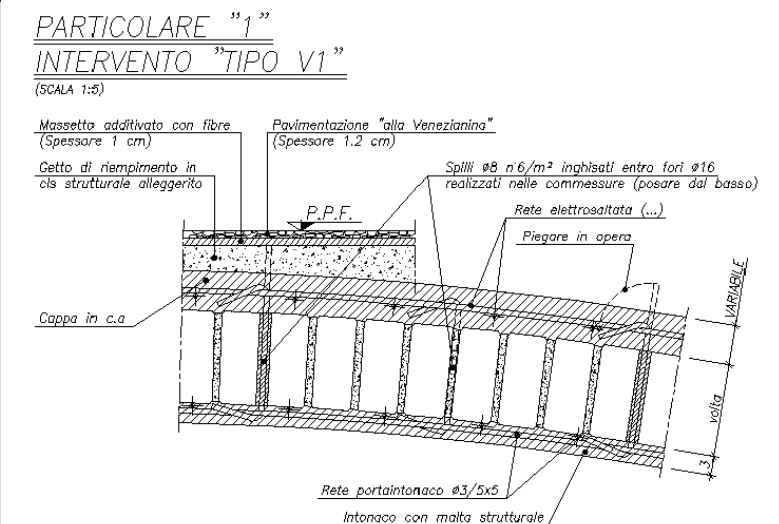
Service provided: Executive and working structural design and supervision

Client: Cassa di Risparmio foundation

Year: 2008 - 2011

Surface: 4671m²

Amount of works: € 17.000.000



TORINO – JUVENTUS NEW STADIUM

DESCRIPTION

The stands are constructed with reinforced concrete frames and reinforced concrete or steel step support beams. The groups of frames are made solid by extremely stiff plankings and by the continuity of the beam elements.

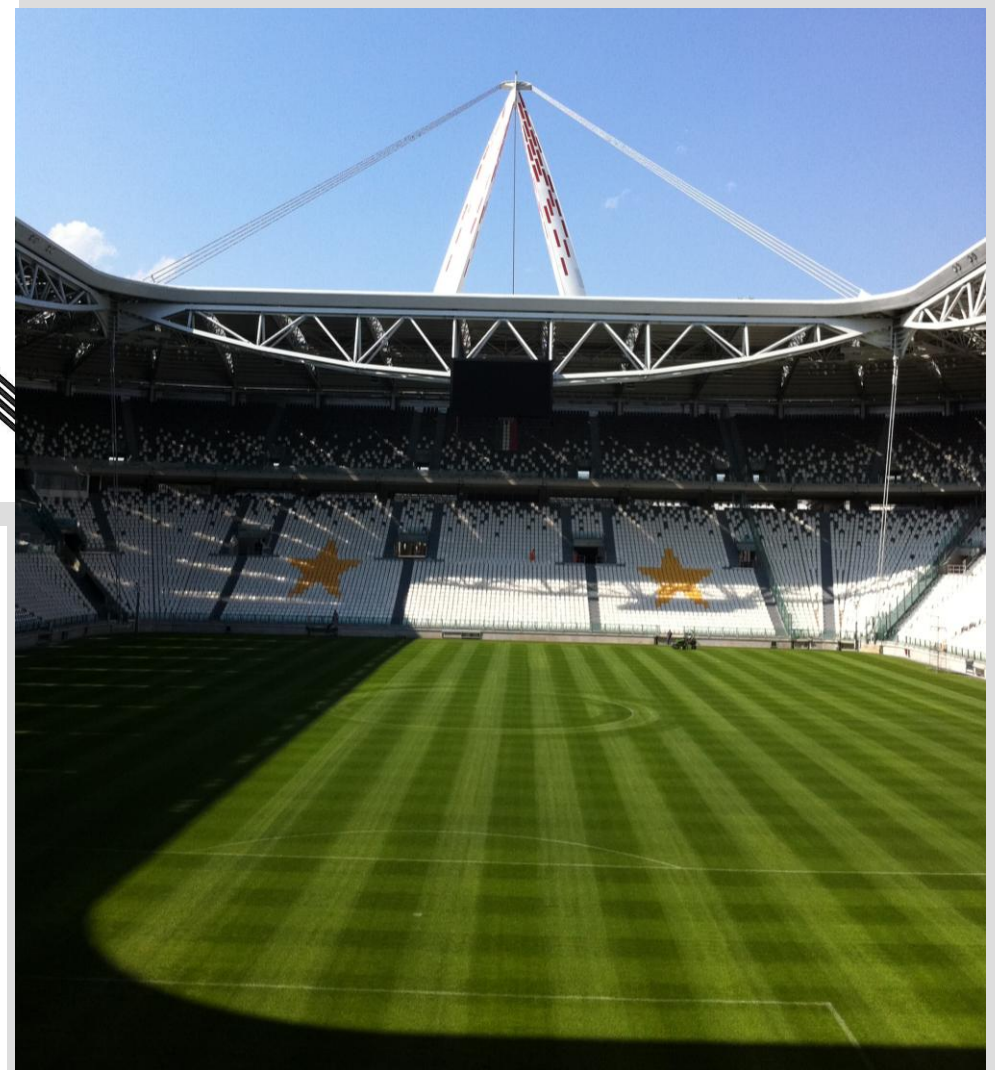
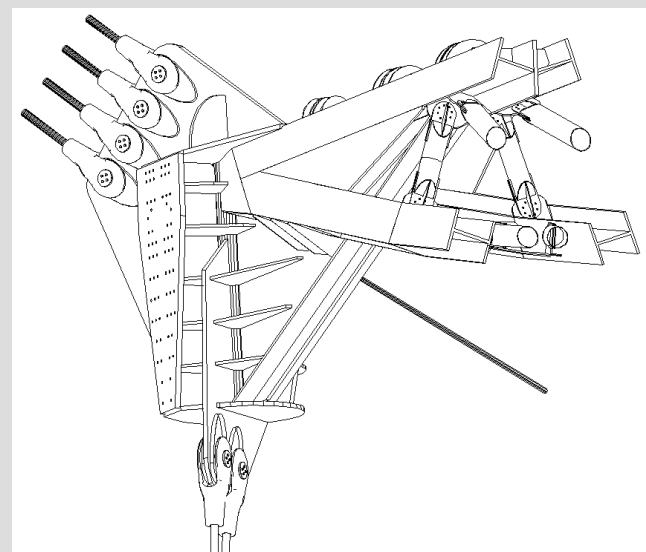
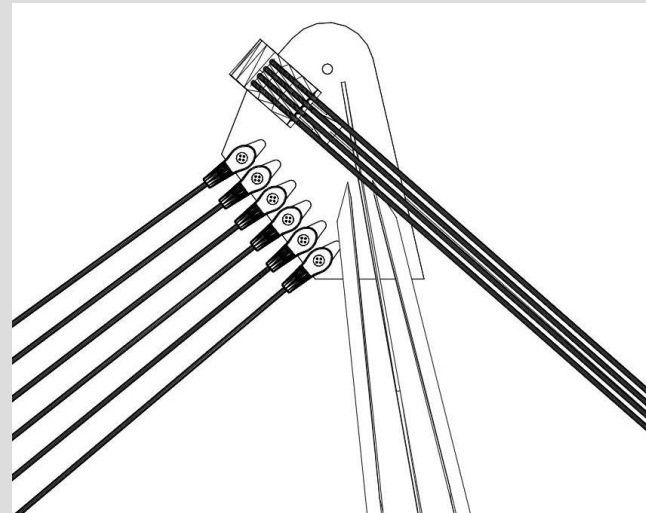
The hanging system with cables is formed by two pairs of trusses placed on the vertical of the 4 sides of the football pitch and supported in each one of the 4 vertex nodes, by a group of high resistant steel closed spiral cables (4 ϕ 105 vertex group). These groups of internal cables converge in pairs on the top of an upturned V trestle with a base of about 45 metres and height of about 84 metres and continue in a group of 6 ϕ 105 external cables that is anchored on the ground.

Service provided: Preliminary, final and executive structural design

Client: Juventus FC.

Year: 2008-2010

Amount of works: € 105.000.000.



PESARO – FOOTBRIDGE OVER THE RIVER FOGLIA

DESCRIPTION

The bridge with a span of about 100 metres, connects the two banks of the Foglia river, making a connection possible on the cycling-pedestrian path, between the areas of Tombaccia and Miralfiore. The conceptual choice is the one of a bridge with reticular planking, suspended by asymmetrical cables: this allows the crossing of the entire span without constructing supports in the riverbed and the effect of the wind is minimized by the reticular planking, keeping the structure light. The cables have been placed in a manner as to minimize the surface to be exported.

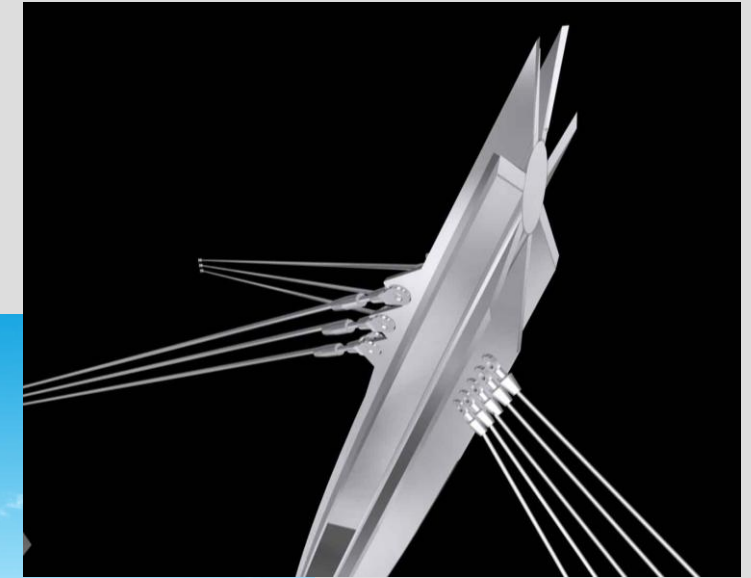
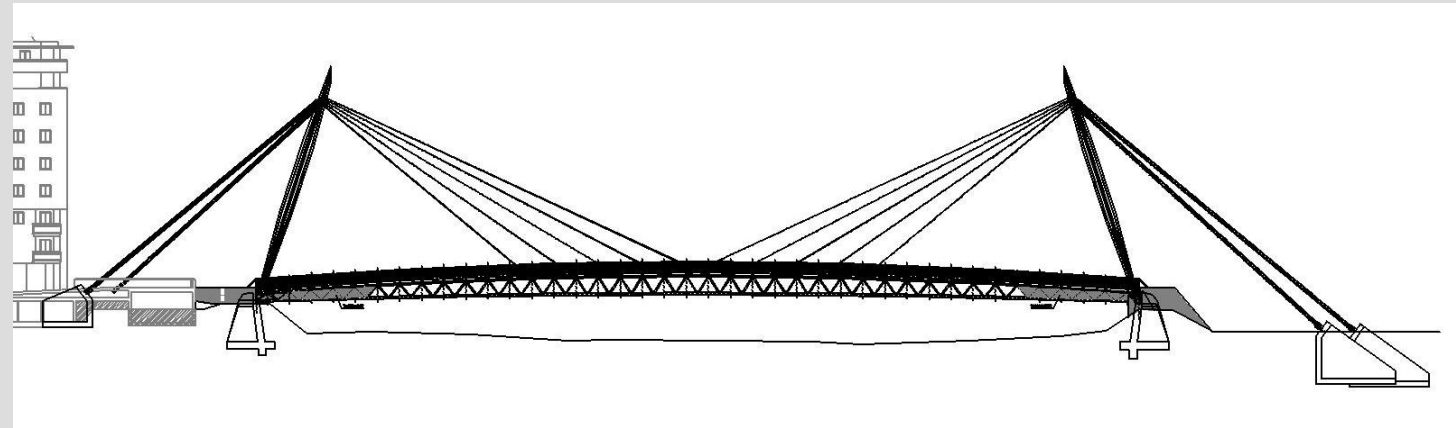
Service provided: Structural and architectural preliminary, final and executive design.

Client: Pesaro Municipality.

Year: 2008-2010

Span: Mt. 100

Amount of works: € 800.000 (categoria IXb).



MILANO – NEW EXHIBITION CENTRE

DESCRIPTION

The project of the International Conference Centre regards the conversion of the exhibition spaces used in the Milan City Fair (pavilions 5 and 6) in a space for the integrated conferences with the already existing adjacent Conference Centre.

The new Conference Centre will hold 18.000 people, with an auditorium, able to hold 1500 people and a conference hall for 4000 people. On the outside, the building will be covered with a reticular spatial structure (called “comet”) that supports pierced aluminium panels and bright strips powered by photovoltaic panels.

During the design, the problem of integrating the new structures with those existing was dealt with, keeping in mind the seismic action based on Italian standard DM 2008.

The plenary hall, auditorium and the comet have all been made with double layer reticular spatial structures, constrained to the existing reinforced concrete pavilions.

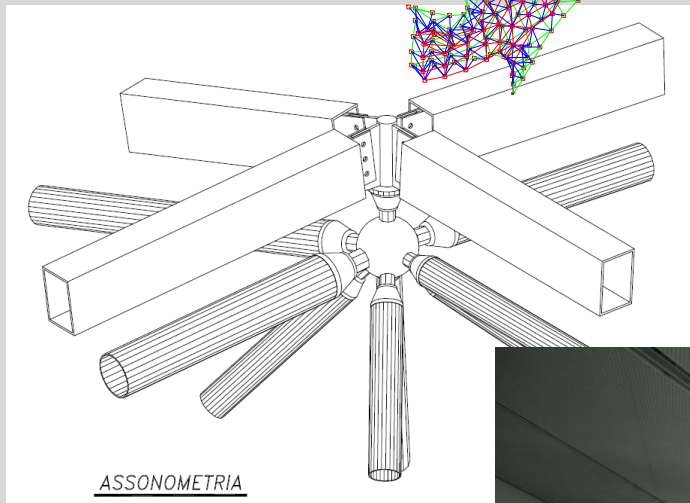
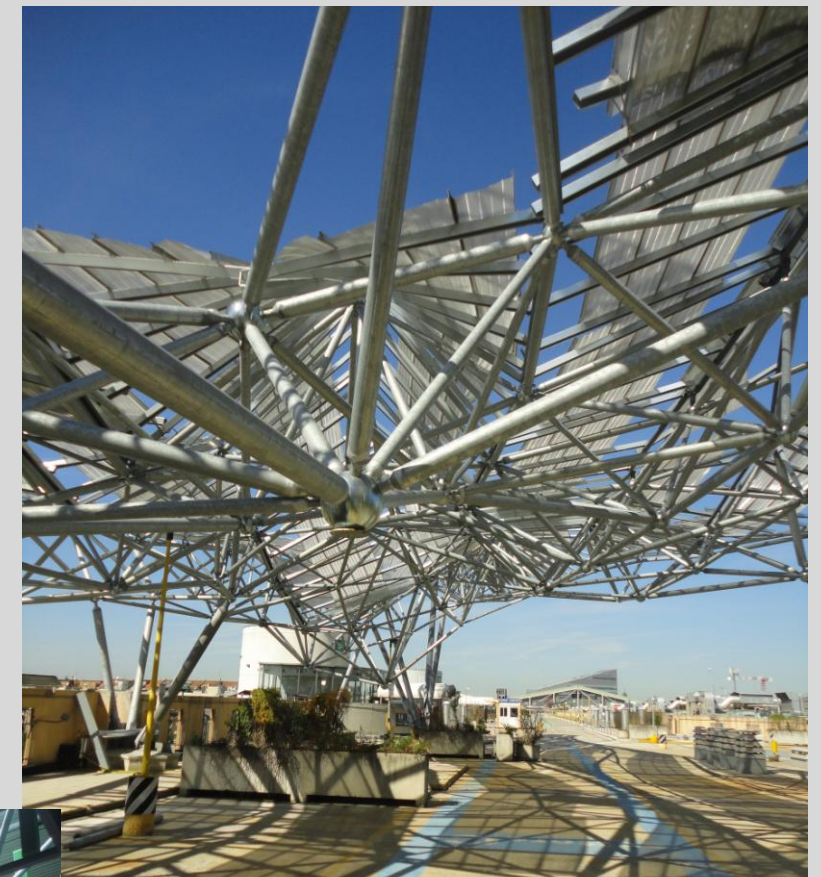
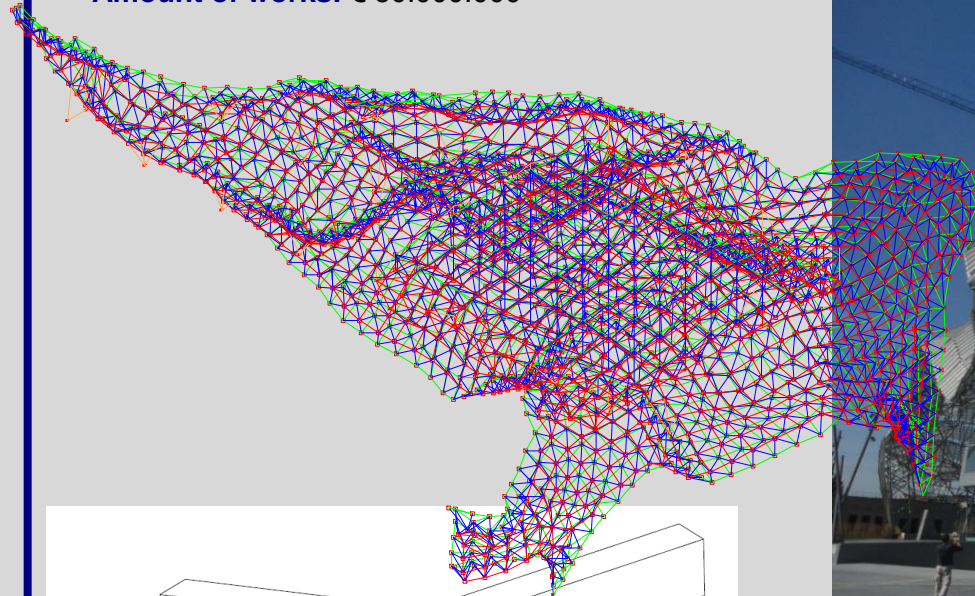
Accessory steel or reinforced concrete structures have been constructed with emergency stairs, exits, lifts and access ramps for cars and pedestrians.

Service provided: Executive Structural Design

Client: Ente Sistema Fiera Milano

Year: 2008 - 2010

Amount of works: € 50.000.000

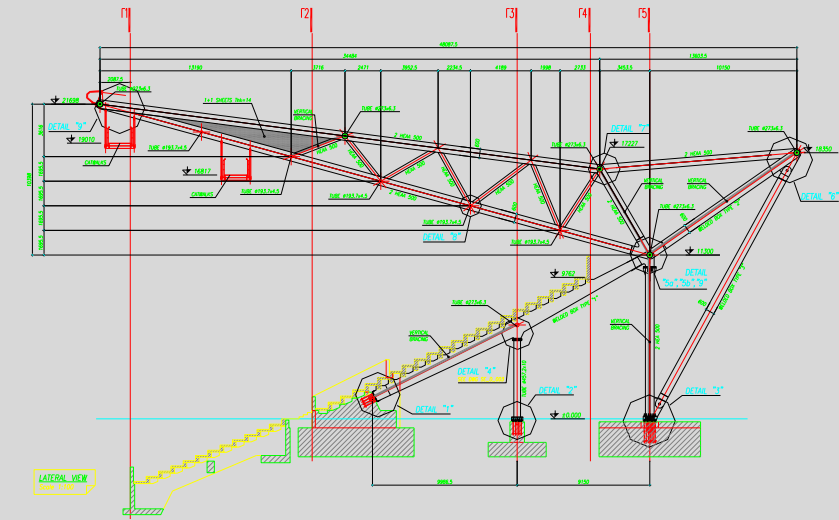
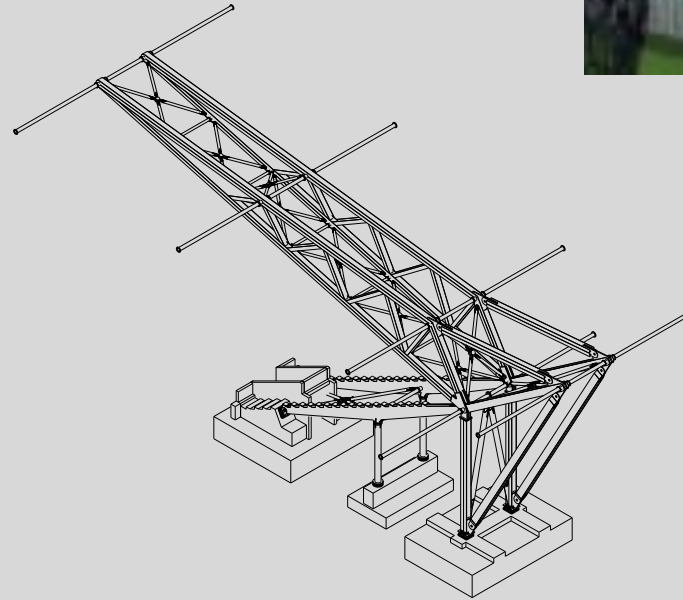


LARISA – NEW STADIUM

DESCRIPTION

Steel structures of Larisa stadium roof are formed by couples of plane-truss cantilevers. Distance between the plane-trusses is 4.7m and the step of couples is $(9.4m+4.7m) = 14.1m$. Each couple of main trusses is internal braced and is connected in the joints of lower layer by transversal posts and diagonals. Each North/South truss has a global length of about 24m and a cantilever length of about 13.5m. It has the internal support on a steel column (with transversal "X" bracing) and the external support on a concrete structure. The longitudinal distance between supports is about 7m. Concrete structure and the transversally braced columns give the necessary restraints to horizontal actions.

Year: 2009 - 2010
Service provided: Structural preliminary, final and executive design.
Client: Larisa FC.
Amount of works: € 41.000.000.



CLASSE - MUSEUM

DESCRIPTION

The conceptual design of the structural system adopted for the new archaeological museum of Classe is addressed to the partial recovery of the walled structure of the existing complex of the Sugar refinery and the reconstruction of the demolished parts by making a structure both of steel and reinforced concrete.

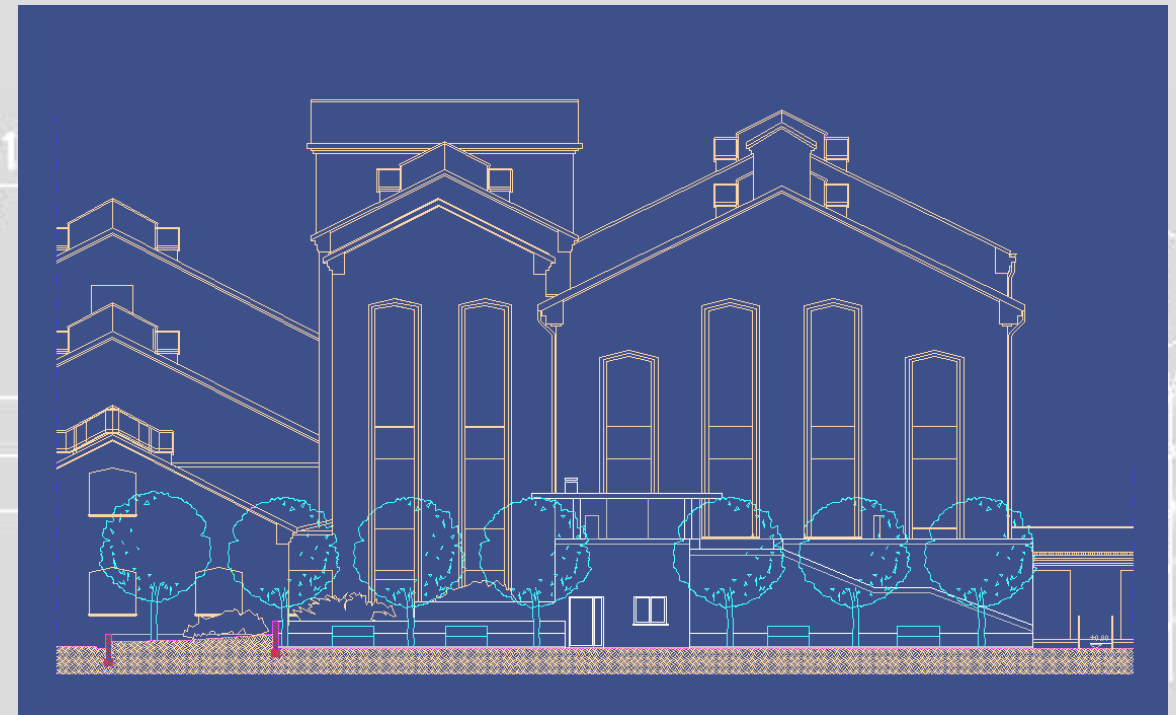
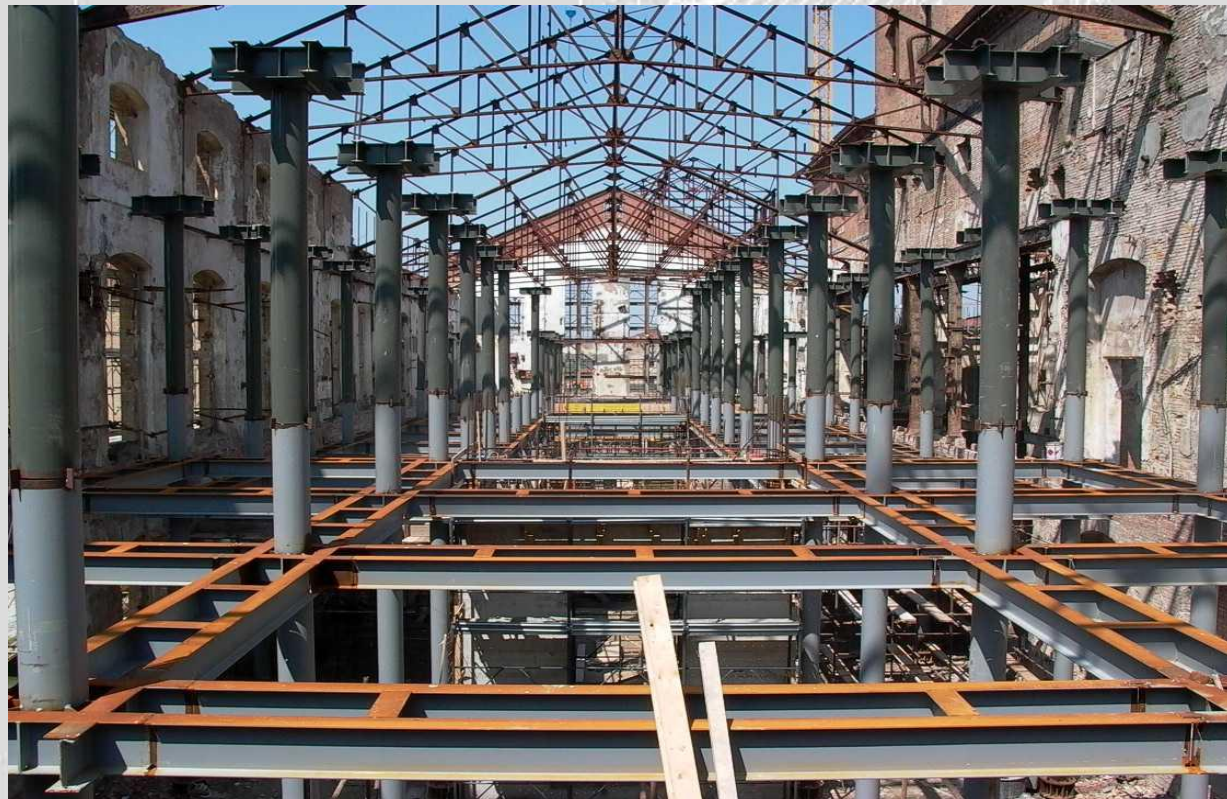
Service provided: Structural Design

Client: Ravenna City Council

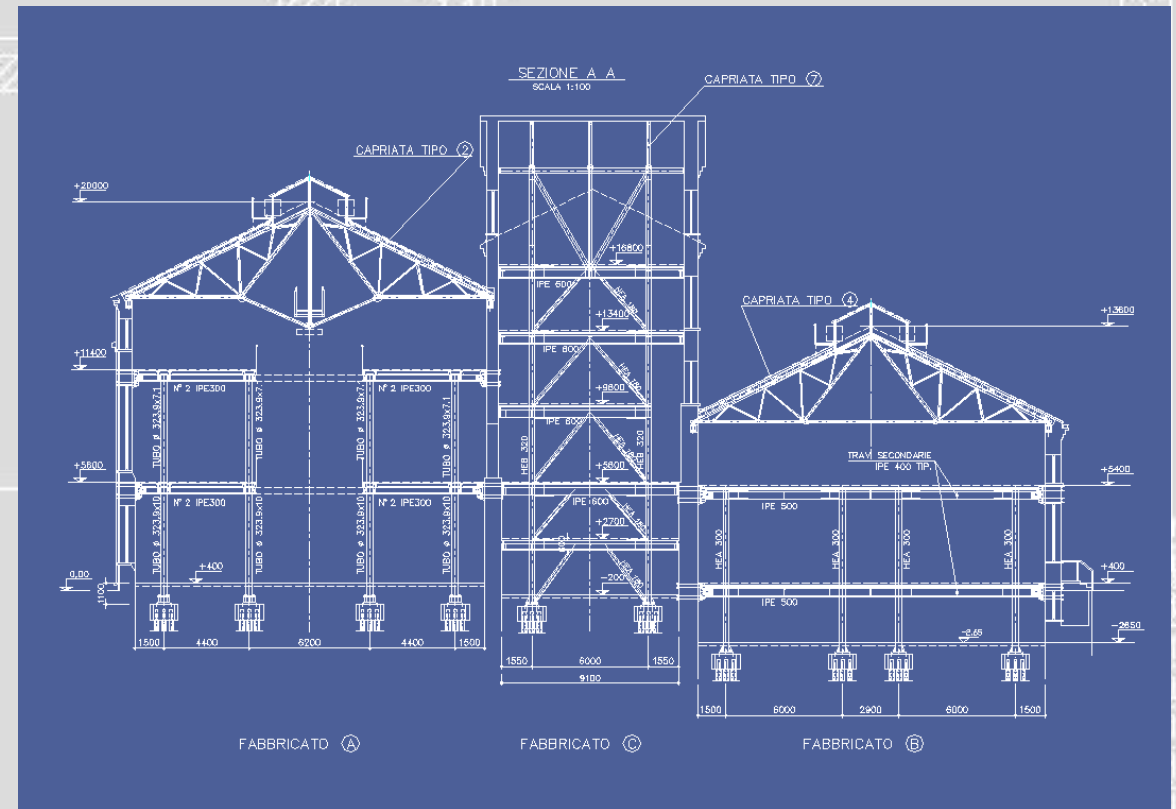
Year: 2010

Surface: 15.400 m²

Amount of works: € 19.108.905



PROSPETTO



SEZIONE

TORINO – SAN PAOLO TOWER

DESCRIPTION

The tower, whose construction will conclude in 2011, will have 39 floors and a height of 168 metres.

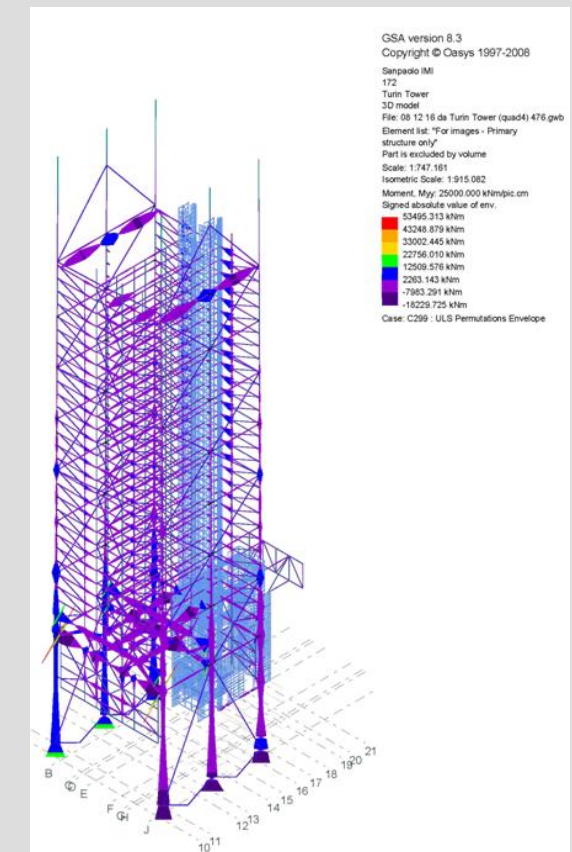
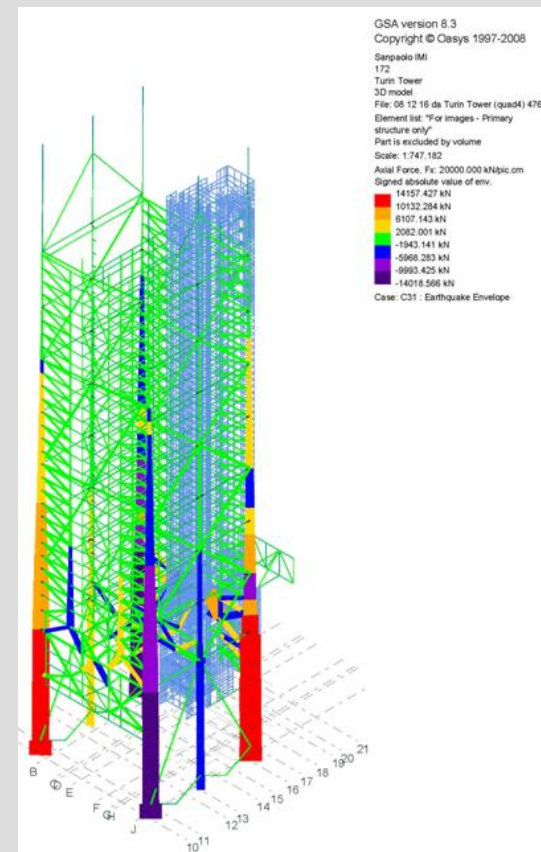
The tower has no air conditioning tools as it will be built according to bio-architecture principles with technological solutions able to reduce energy consumption by a third and it will be totally covered with glass and crystal.

The building will be situated in the area of the Porta Susa station; it will be constructed over an area of 7 thousand square metres. There will be a garden on the roof as on each floor. The offices will hold 3000 people and there will be an auditorium with seating for 500.

Service provided: Consulting to the structural design

Year: 2009

Amount of works: € 235.000.000



SASSUOLO – FOOTBRIDGE OVER THE RIVER SECCHIA

DESCRIPTION

The work in question is structured as a 5 span cable stayed bridge, 3 with spans of 40 metres and two of 20 metres, for a total of 160 metres, supported by 4 intermediate yards and by two extremity shoulders. The larger spans are supported, near the centre line, by 2 sets of cables, each afferent to one of the adjacent yards. The yards are planimetrically positioned, in an alternating manner (left-right) compared to the planking; that is, besides architecturally characterizing the work, they give more stiffness to the horizontal floor. The planking is supported by a reticular spatial structure, formed by a lower and two upper currents, as well as the connecting diagonal elements; the frameworks of the reticular are made of tubular metal elements. Above the mentioned reticular structure, secondary frameworks are positioned to support the planking – walkway.

Service provided: Structural and architectural preliminary, final and executive design.

Client: Provincial administration of Modena.

Year: 2007-2009

Span: Mt. 160

Amount of works: € 1.020.000 (category IXb).



CASALECCHIO – SECOND FOOTBRIDGE OVER THE RENO RIVER

DESCRIPTION

The new footbridge over the Reno river connects the two banks covering a span of 100 metres.

The architectural conception of the work is inspired by the shape of a swan, trying to imitate its lightness and elegance. With this aim, the steel structure has been optimized with various and innovative solutions so as to obtain the best possible ratio between weight and resistance, and consequently reducing the costs.

Service provided: Structural and architectural preliminary, final and executive design.

Client: Casalecchio di Reno (BO) Municipality

Year: 2009

Amount of works: € 750.000 (category IXb)



BOLOGNA – UNIPOL TOWER

DESCRIPTION

The project regards the redevelopment of a former industrial area, joining the circumferential road and a shopping centre, with the construction of an office tower, a hotel, a cinema multiplex and shopping and services area.

The construction of the following is foreseen:

- an office tower of over about 13,000 square metres, with 25 floors. It is about 120 metres high on a triangular layout, having about 520 square metres of useful surface on each floor with 5 internal lifts and a service lift, with a plant design integrated into the system of façades making each single floor independent;
- a Cinema Multiplex of about 7400 square metres with 14 film theatres that hold a total of 3100 people;
- a hotel of about 6000 square metres that develop in two bodies at different heights arranged around a central pivot;
- a grid, for about 2800 square metres of small business units, public establishments and services;
- about 2000 square metres of fitness centre,
- 30,000 square metres of parking space.

Service provided: Preliminary, final and executive structural design

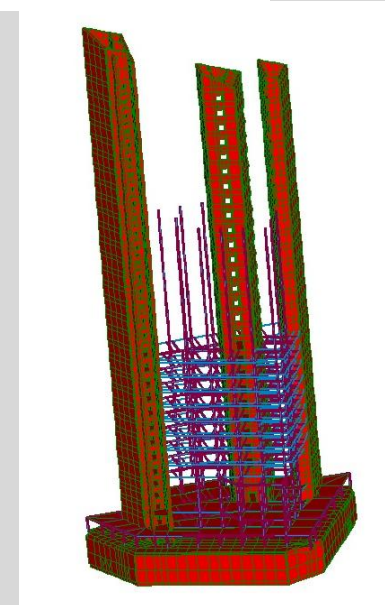
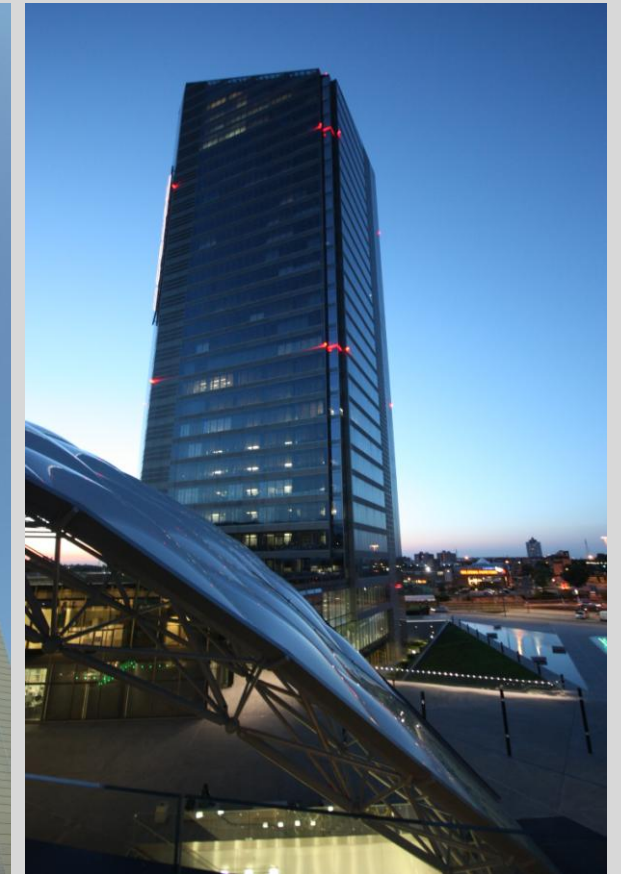
Client: Unifimm s.r.l.

Year: 2006 - 2009

Surface: M² 45.000

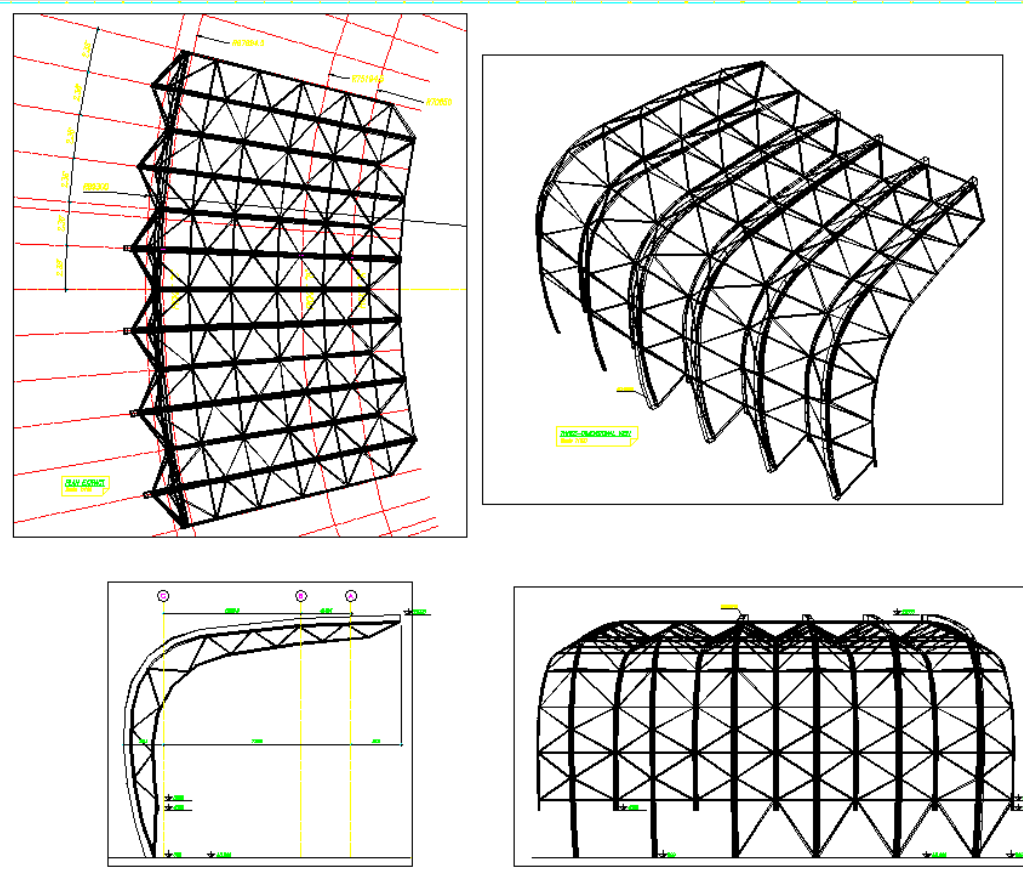
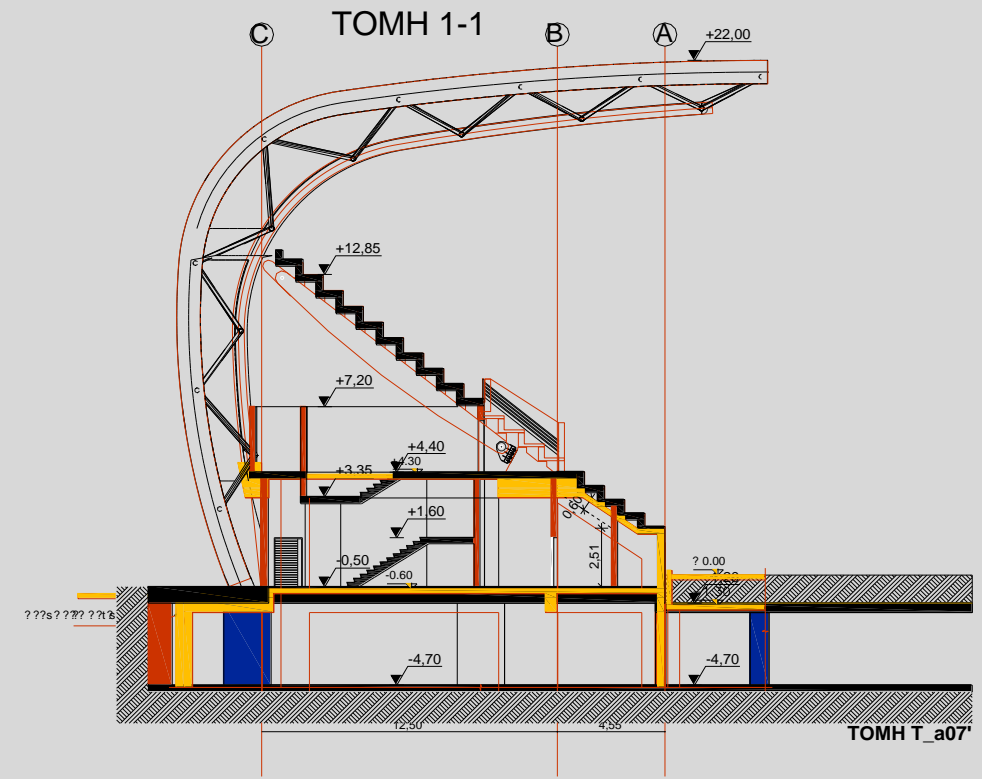
Height: M 130

Amount of works: € 62.000.000



ATHENS – PANIWNIOS NEW STADIUM

Service provided: Structural executive design
Year: 2009 - 2010



BOLOGNA – NEW MUNICIPALITY CENTRE

DESCRIPTION

The new building develops over a total surface of 33 thousand square metres and is located behind the central railway station, where there was once a wholesale fruit and vegetable market. With the creation of commercial and service spaces in the area (shops, offices, services and sports facilities), the intervention contributes to the redevelopment of the area that is reunited with the city by the reconstruction of the caesura formed by the railway track and the market wall.

The design concept is to divide a single mass into three distinct blocks destined for different uses. The three blocks of different heights – 12, 10 and 8 floors – are joined by a folding sunscreen roof, an entrance hall developed on four floors and a new sloping public area.

The most connoting element of the design is the large sunscreen roof that folds like a giant “origami”, placed on various buildings and overlooking a panoramic terrace. A real “sun screener”, the roof has the double function of protecting from the sun and giving a sense of architectural cohesion to the complex.

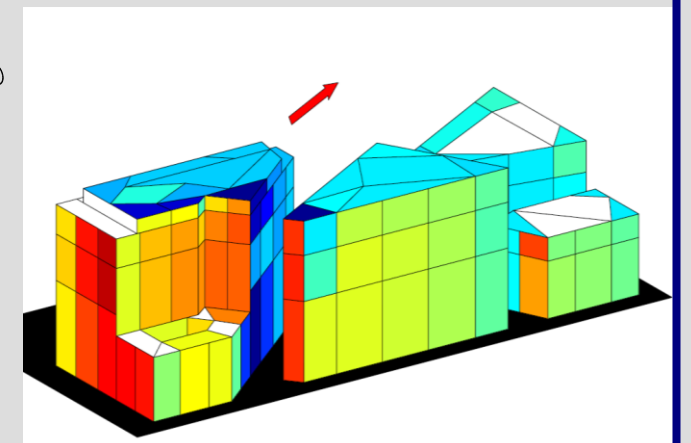
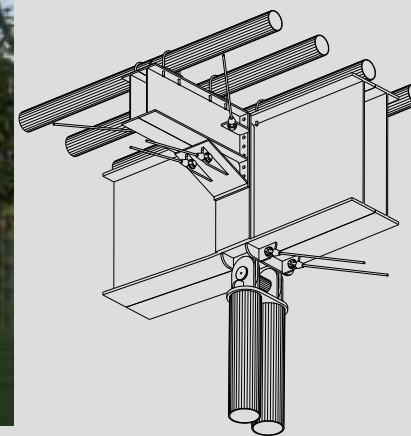
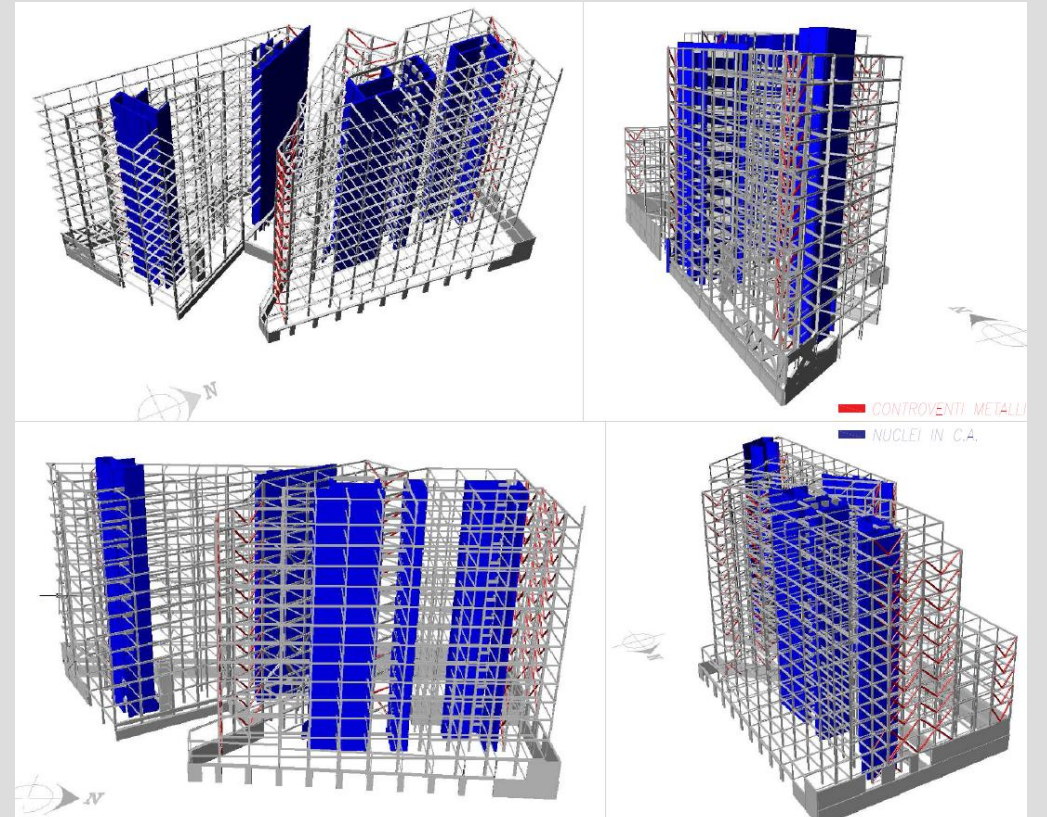
Service provided: Preliminary, final and executive structural design

Client: Bologna Municipality

Year: 2005 - 2008

Surface: M² 33.000

Amount of works: € 68.000.000



BOLOGNA – EXHIBITION HALL 14-15

DESCRIPTION

Pavilions 14-15 are situated north-west of the Bologna fair area, with the aim of making this area a comparable size to an average fair area (over 60,000 m²). They are directly connected to pavilions 19-20 and 16-18 to form a single large exhibition space.

The connection allows the use of space and facilities already present in pavilions 16-18: restaurant, multi-purpose area for offices and/or conferences. From a structural point of view pavilion 14-15 is configured with:

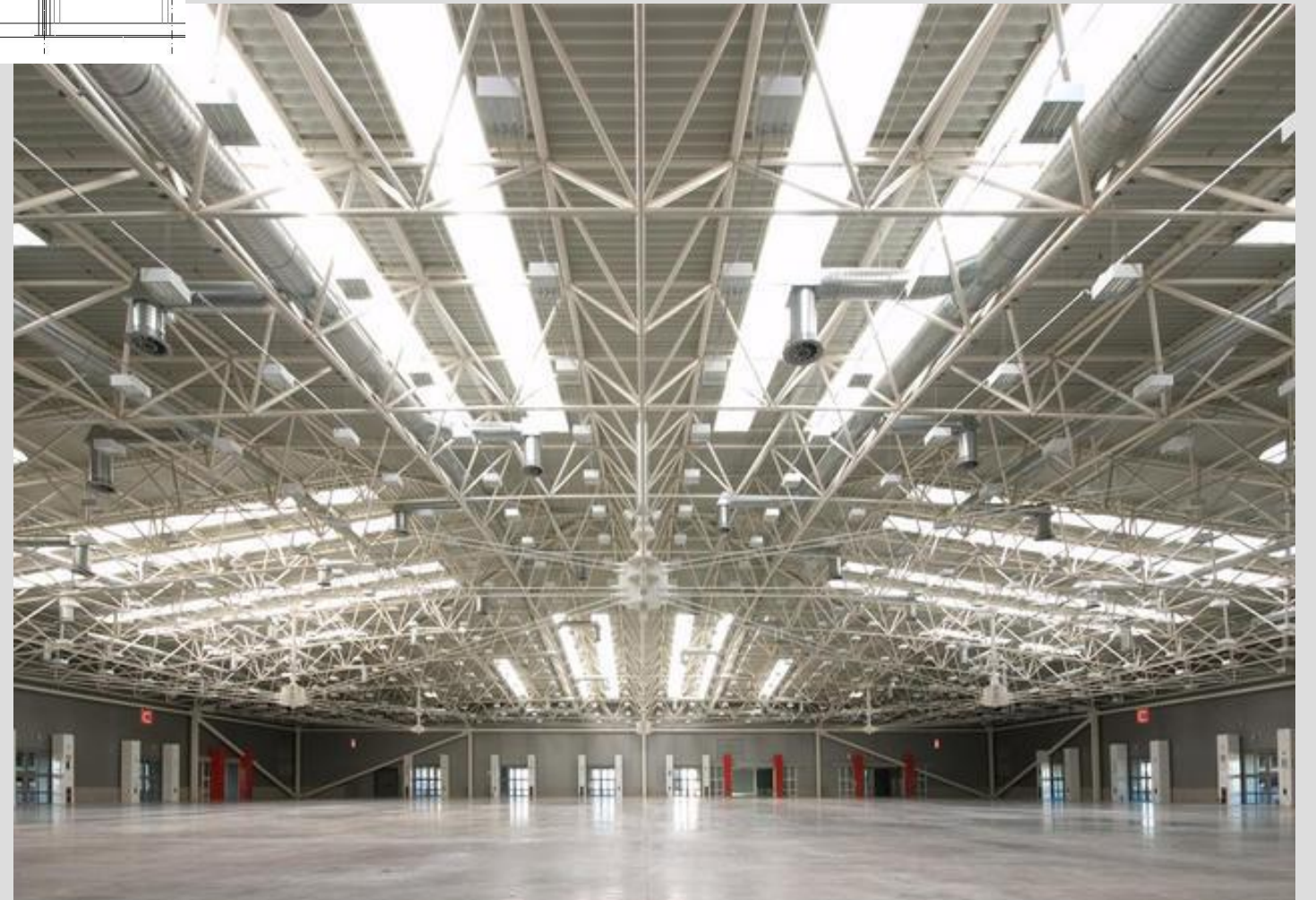
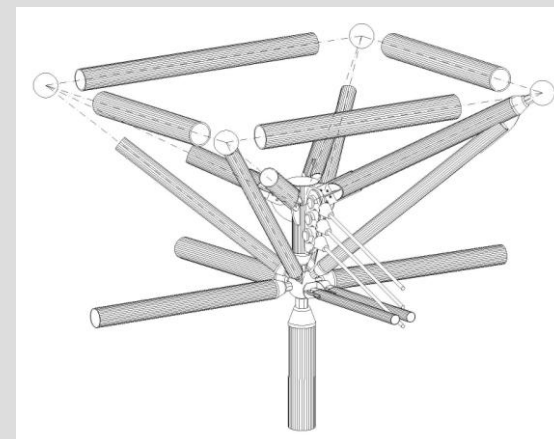
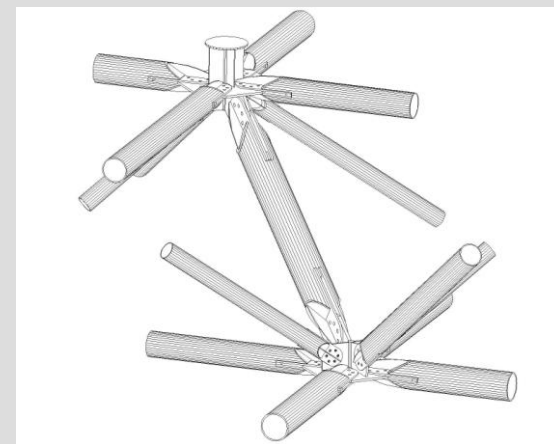
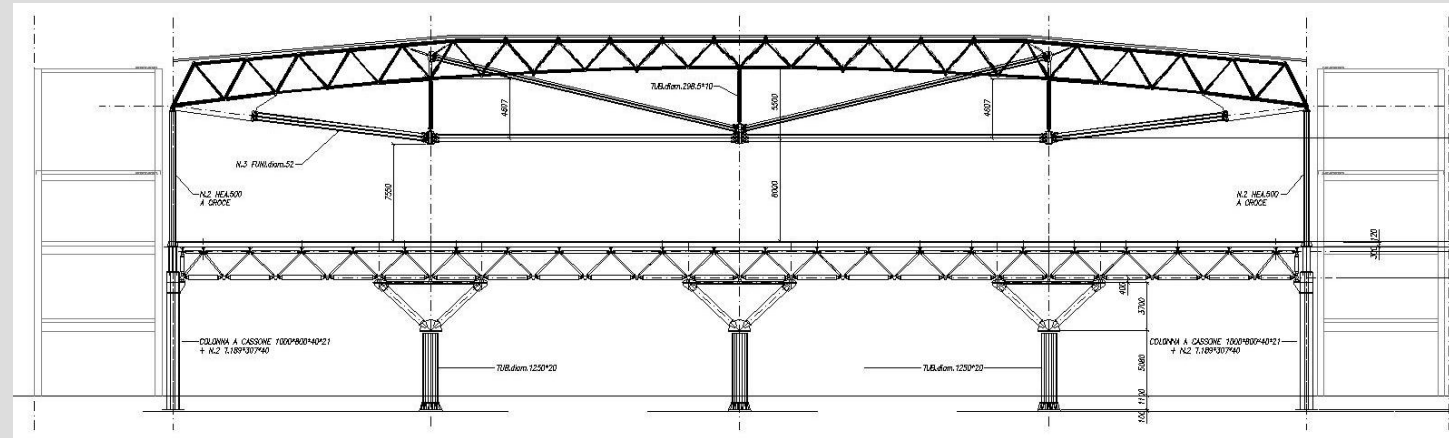
- 1) A central body with a near square layout (88.00 x 95.70 metres) and planking at a height of + 1200 metres. The roofing of the building is a reticular spatial reinforced with cables.
- 2) The south entrance.
- 3) The north entrance.
- 4) The connections to pavilions 19-20 and adjacent 16-18.

Service provided: Preliminary, final and executive structural design

Client: BolognaFiere S.p.A.

Year: 2006 - 2008

Amount of works: € 55.500.000



KORINTHOS – RAILWAY BRIDGE

DESCRIPTION

The bridge is part of the railway line that connects Korinthos to Patra and passes over the new road that also connects Korinthos to Patra. The bridge is composed of two spans of 45 metres and a central span of 170 metres. The central span is supported by two rectangular frames that have cables anchored to the top to support the planking. The 16.6 wide planking is stabilized by metal braces placed under the concrete floor. The bridge is seismically isolated both in a longitudinal and transversal direction by appropriate supporting apparatus and viscose dampers.

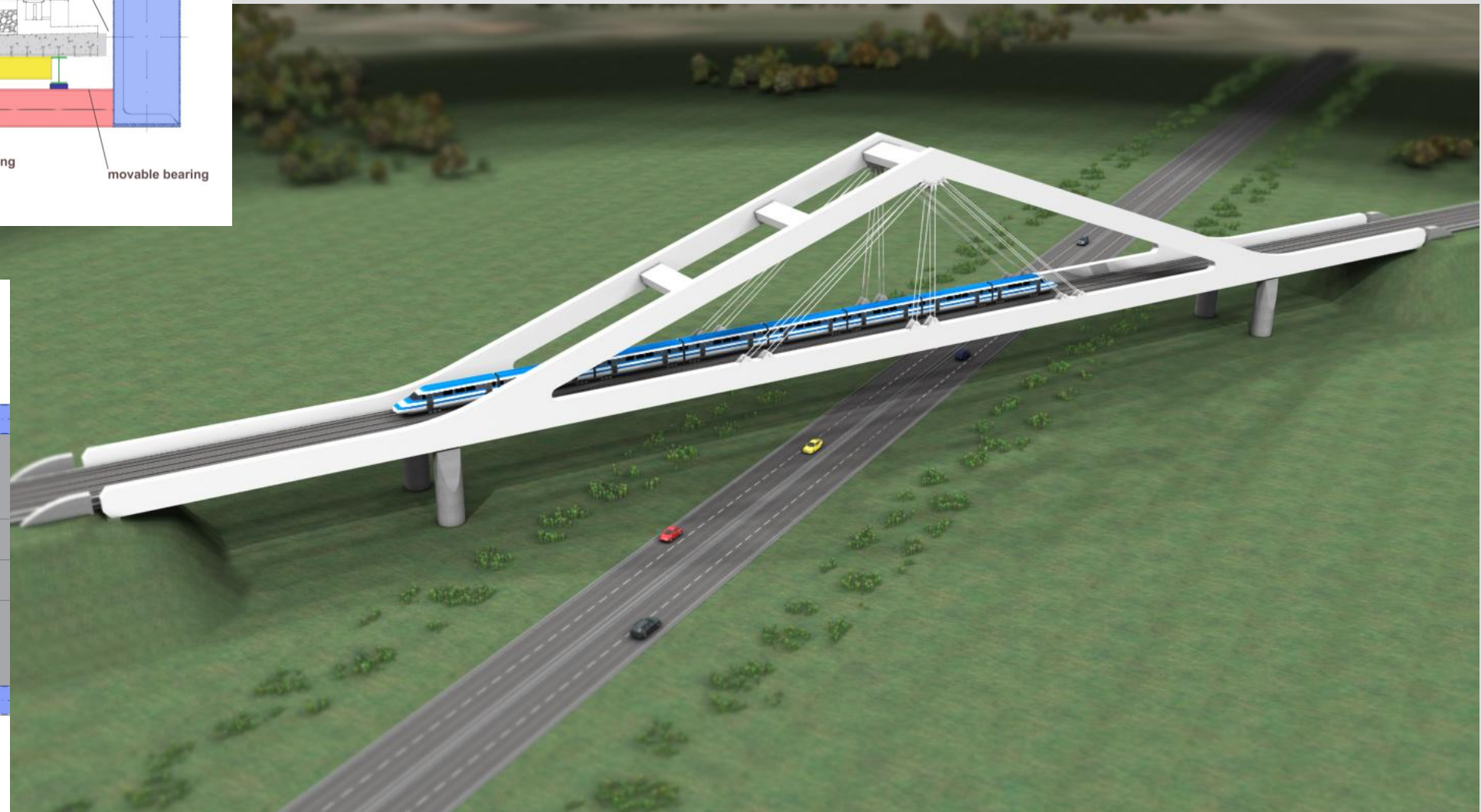
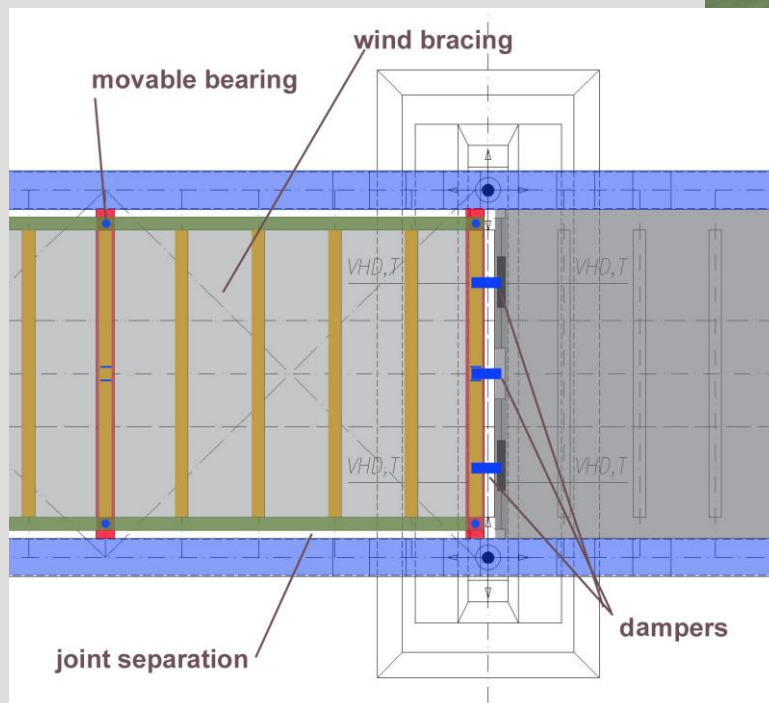
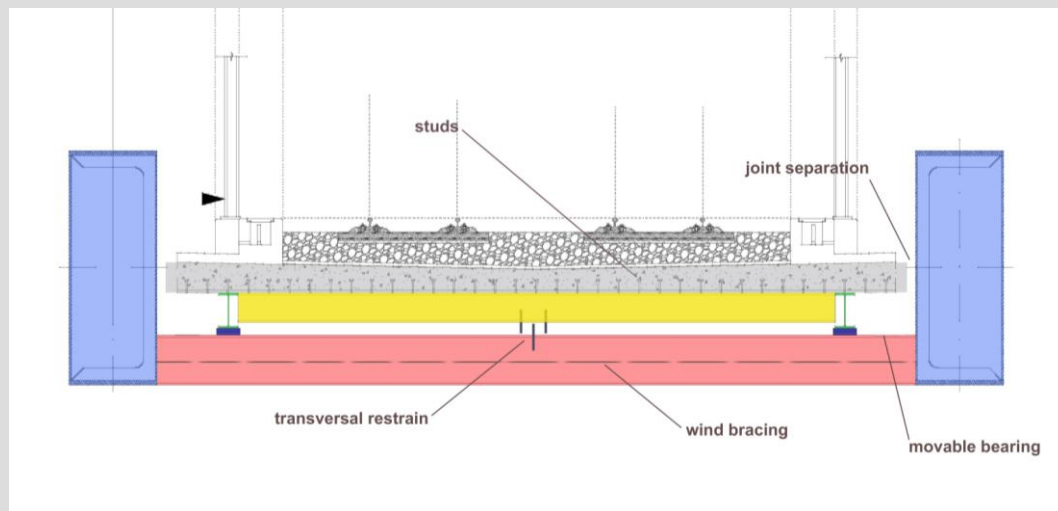
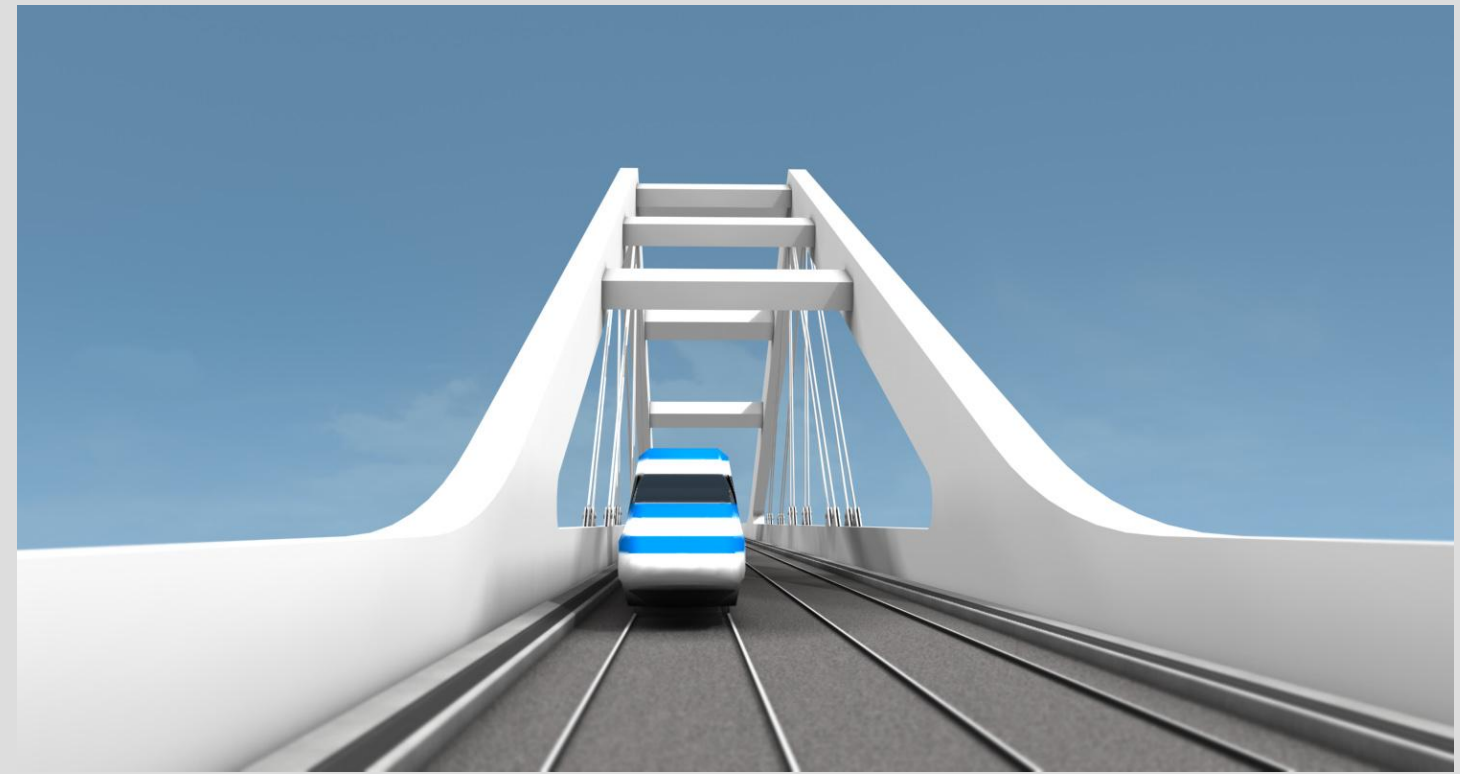
Service provided: Structural executive design.

Client: Hellenic Railways Organisation.

Year: 2007 - 2008

Span: Mt. 260

Amount of works: € 10.000.000 (category IXb).



JESOLO – AQUILEIA TOWER

DESCRIPTION

The design of the tower foresees the construction of 84 apartments on 22 floors and 73 metres high, as well as the ground floor (with double height) where there is the hall, some businesses and a cafeteria. The building develops on a symmetrical polygon layout, with lifts and stairs in the central nucleus.

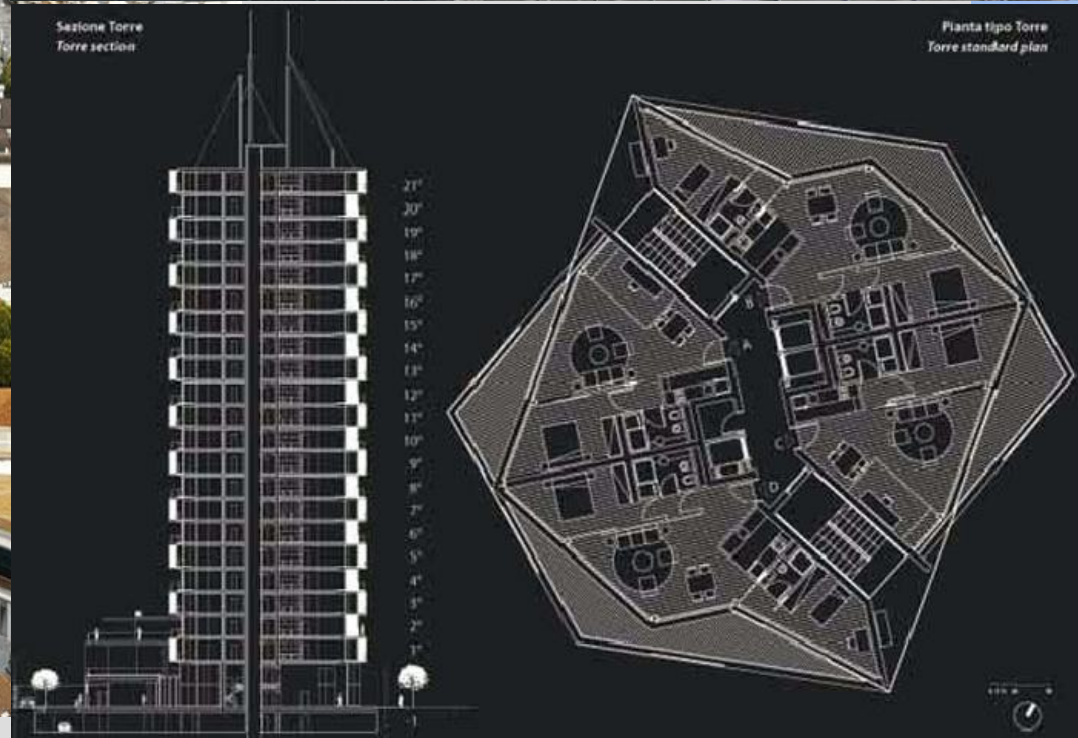
The structure of the façade is suspended by the roofing, consisting of a system of crossed “sails”, which when lit, become a point of orientation at night. A specially designed sliding intertwining mesh protects the terraces from the sun and provides a glimpse of the windows of the apartments, giving lightness to the Tower.

Client: Boldrin s.p.a.

Year: 2004 - 2009

Surface: M² 10.000

Amount of works: € 45.000.000



GENOVA – BRIDGE OVER THE POLCEVERA RIVER

DESCRIPTION

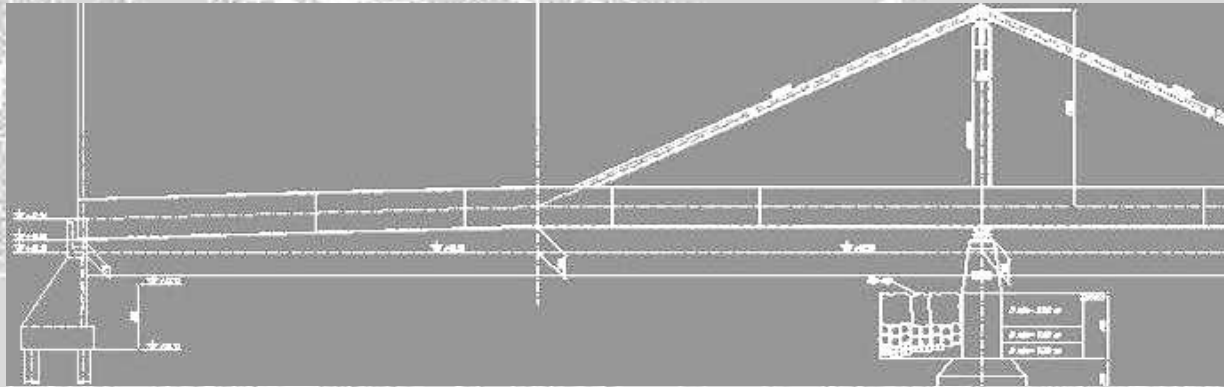
A road bridge with two spans of 50 + 50 metres of 1st category with two lanes. The structure is of cables with mixed steel-concrete planking. The beams, columns and stay beams are made of tubular section composed of S355 steel plates. The protection against corrosion is obtained by galvanizing and painting.

Service provided: Structural preliminary, final and executive design.

Client: Genova Municipality

Year: 2005 - 2007

Span: Mt. 110



BOLOGNA – FOOTBRIDGE OVER THE HIGHWAY A13

DESCRIPTION

Cycling-pedestrian footbridge over the Padova - Bologna motorway. An arch structure with eliminated pressure of a 100 metre span. The main structure is formed by a closed profile macro trestle composed of steel sheet; a radial system of cables supports the planking bringing the strain to just one point. The pressure originating from the struts is balanced by stay beams, positioned on the planking. The traction in the planking allows, with the opposing curvature, a stabilization for strong transverse winds.

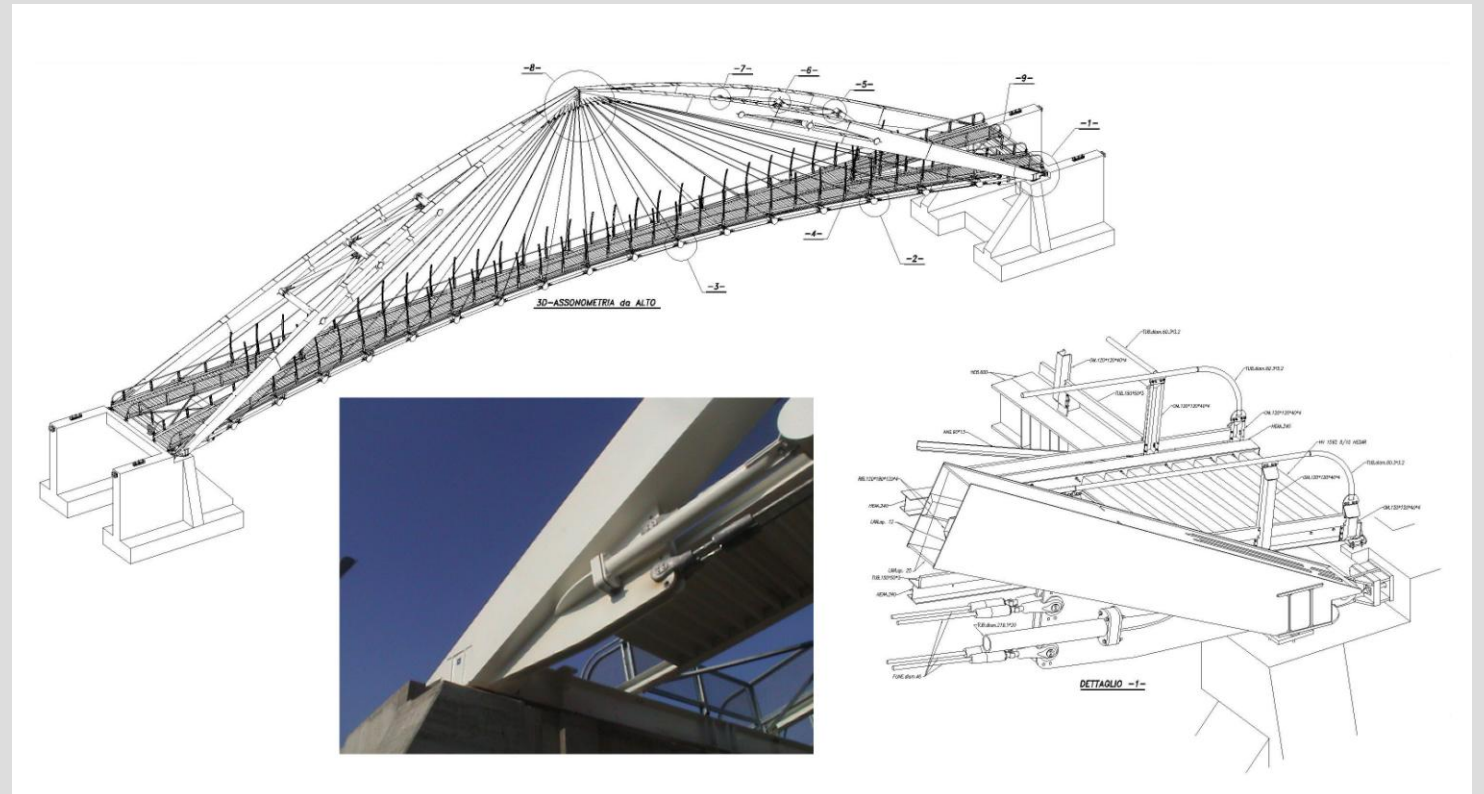
Service provided: Structural and architectural preliminary, final and executive design.

Client: Bologna municipality

Year: 2006 - 2009

Free span: M. 100

Amount of works: € 1.300.000



ADIGE – CABLE STAYED BRIDGE

DESCRIPTION

Motorway bridge with one 310 metre span and two lanes in each direction. The structure is with cables and mixed steel-concrete planking. The main trestles are made of reinforced concrete while the anchorage heads for the cables are made of steel.

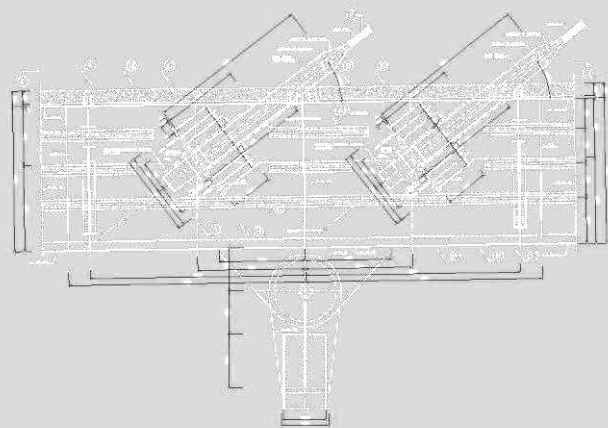
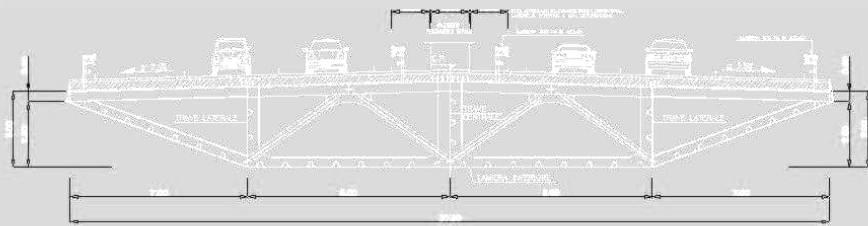
Service provided: Consulting for the service centre Tecnici RPA Engineering Consultants S.r.l.

Client: Società per Azioni Autostrada Brescia Verona Vicenza Padova

Year: 2006-2007

Amount of works: € 30.000.000 (IXb), € 25.000.000 (Ig)

Span: Mt. 310



ROMA – NEW EXHIBITION CENTER

DESCRIPTION

The roofing system of the footbridge is formed by a multi-span tension structure with variable pitch from 48 to 53.6 metres.

The suspended roofing is made from stainless steel sheets with 125 mm width and 15/10 mm thick arranged according to a catenary configuration and each separated by about 25 cm, so as to create a total transversal width of 10 metres. The sheets with their role of supporting cables have an arrow/span of about 10 %.

At the extrados of the steel sheets is a real waterproof covering, obtained from a polyester material covered by a layer of PDVF on both sides.

The stabilization of the covering and steel sheet is by steel tubes set on the roof covering and vertically anchored by pre-stressed cables, to the reinforced concrete floor below of 6 metres in height.

The tension structure spans are supported by a series of portals formed by metal tubular uprights having transversal inter-axis of about 12 metres.

The 1500 metre long structural system has longitudinal bracing portals with a progressive breakage short-circuiting function due to accidental causes.

Service provided: Structural preliminary, final and executive design design

Client: Lamaro Appalti

Year: 2005 - 2006

Surface: 12x1500m (roof); 80x160m (Exhibition halls)

Amount of works: € 131.000.000



ATHENS – PIREO PEDESTRIAN FOOTBRIDGE

DESCRIPTION

The span of the planking is 45.5 metres and the width is 6.4 metres. The planking is supported by a system of cables anchored to a variable section 25 metre high pylon and composed of box shaped steel profile. The pylon is across the planking without any type of constraint and is stabilized by two cables on the back. The lateral stabilization of the planking is ensured by two bracing frames that are part of the steps to access the footbridge.

Service provided: Structural executive design

Client: Authority of Pireo port.

Year: April 2006 – August 2006

Free span: Mt. 45,5

Amount if works: € 1.000.000 (category IXb).



ROME – NEW HIGH SPEED STATION “TIBURTINA”

DESCRIPTION

The main structure is formed by a reticular spatial with layout dimensions of 340 metres longitudinally and 52 metres transversally.

Corresponding with the longitudinal extremities the height of the reticular is gradually reduced from 3.6 metres to about 0 metres according to a double split profile.

The reticular finds support in 20 points: on columns standing out from the +9.00m height of the existing bridge structure, new columns standing out from the height of -4.50m or on the reinforced concrete elements of the stairs, lifts and service lift bodies.

The main reticular keeps 8 particular structures called “Suspended volumes” suspended by tubular hangers; they are composed of planking made of both steel and timber and a roofing of a steel tubular structure. Given the particular shape of the volumes, the roofing structure is connected vertically to the supporting hangers by a vertical regulation system that ensures, during mounting, the final correct position; the profiles of the roofing must then be fixed to the hangers so that no relative horizontal movements are made.

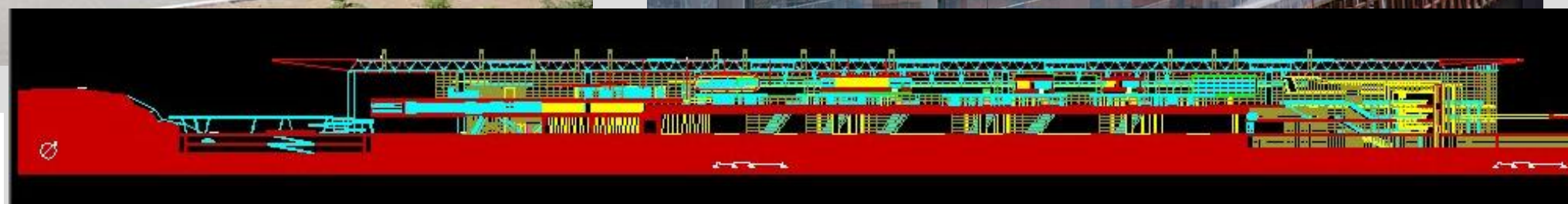
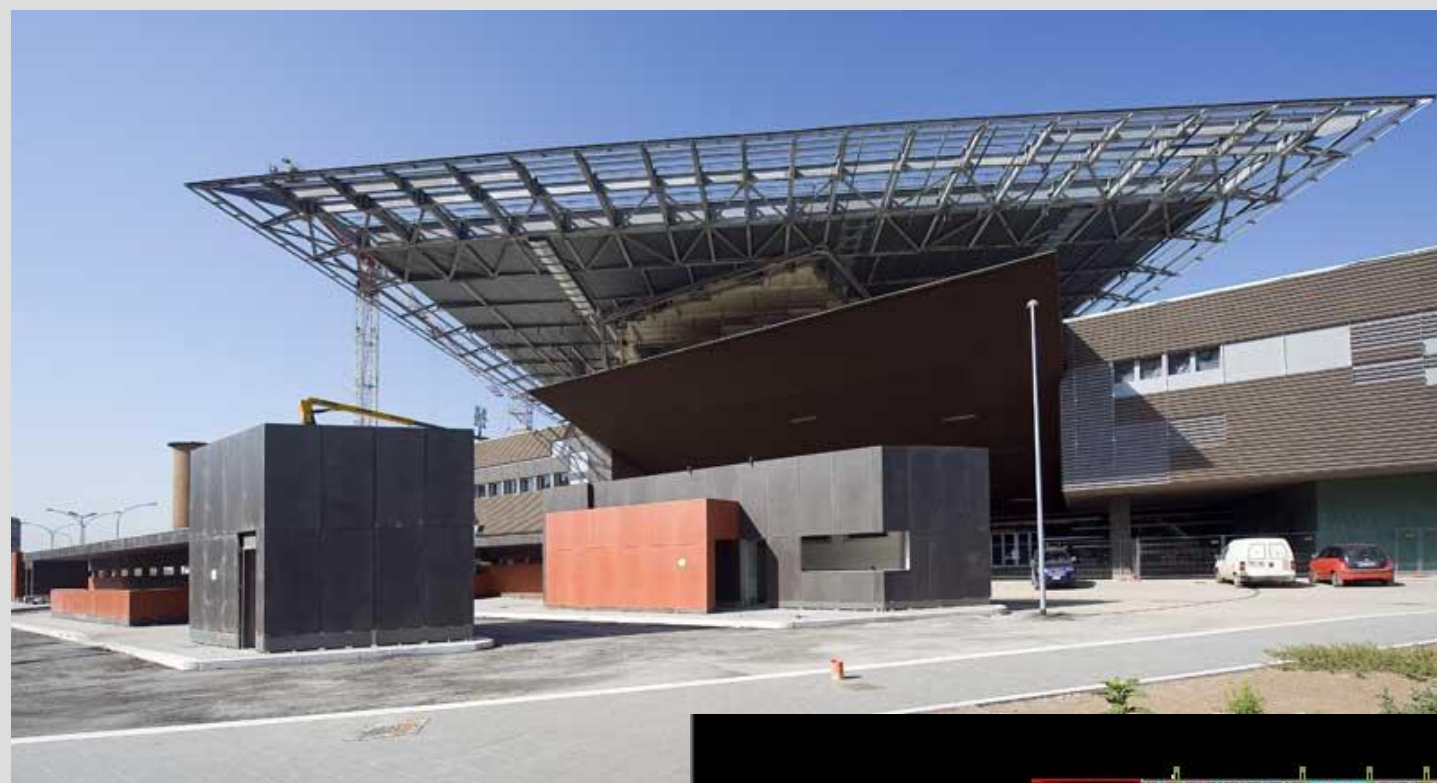
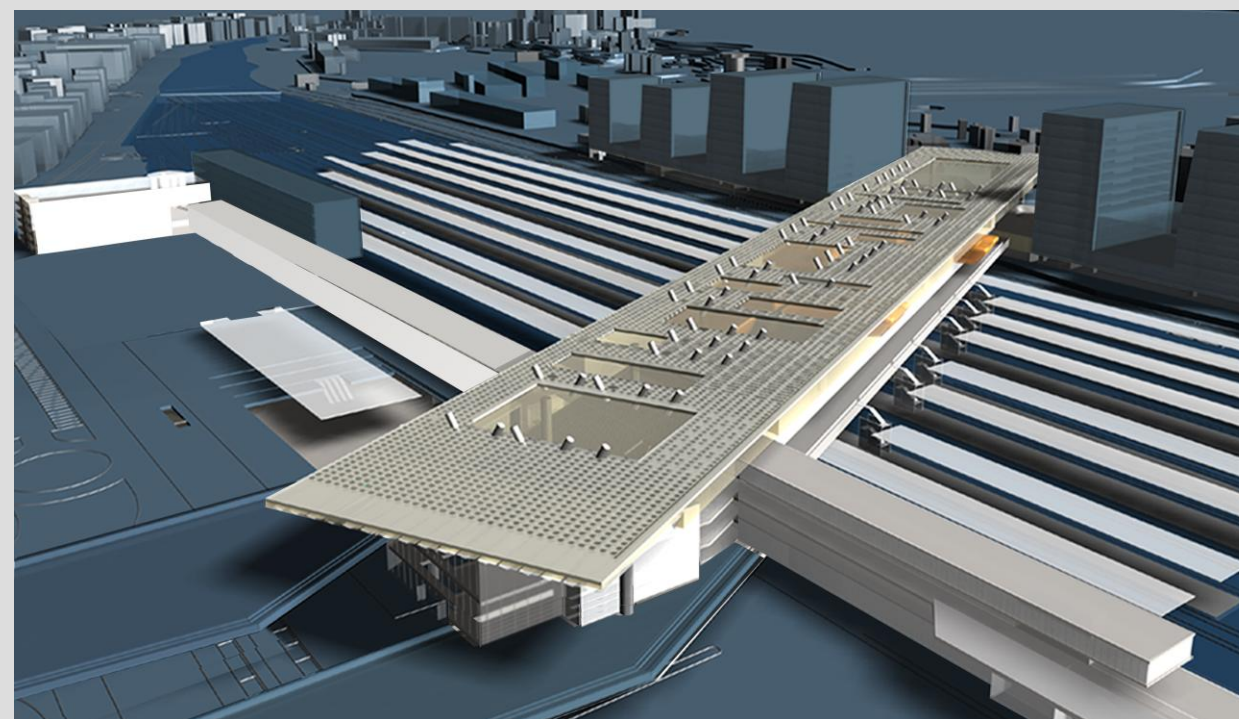
Service provided: Executive Structural Design

Client: Italian Railways Organisation

Year: 2005

Surface: 60.000 m²

Amount of works: € 158.000.000



BOLOGNA – CARMEN LONGO SWIMMINGPOOL

DESCRIPTION

The conceptual design was developed in order to optimize the design requirements and to comply with the existing architectural constraints. A typological solution was adopted of a retractable roof consisting of the following steel sub structures:

- a main support longitudinal beam;
- a system of transversal reinforced beams;
- a system of mobile and fixed panels for roofing.

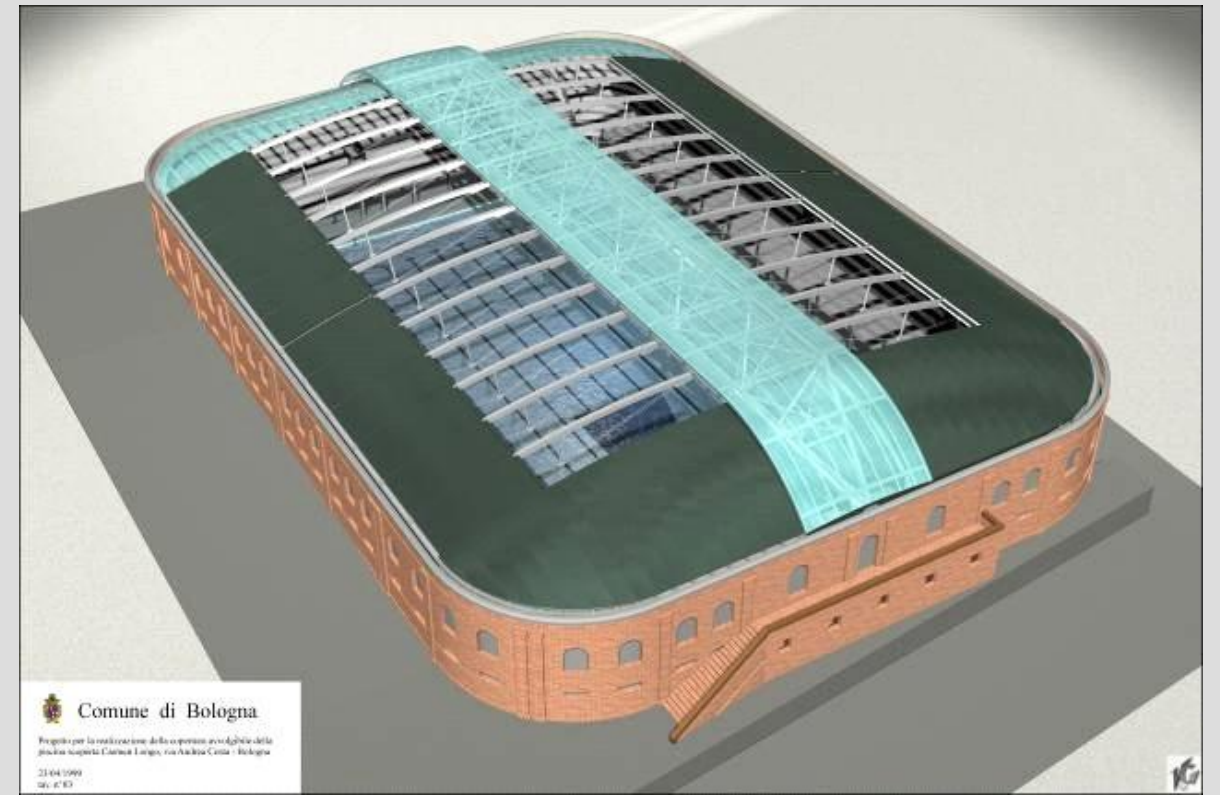
Service provided: Structural design

Client: Bologna City Council

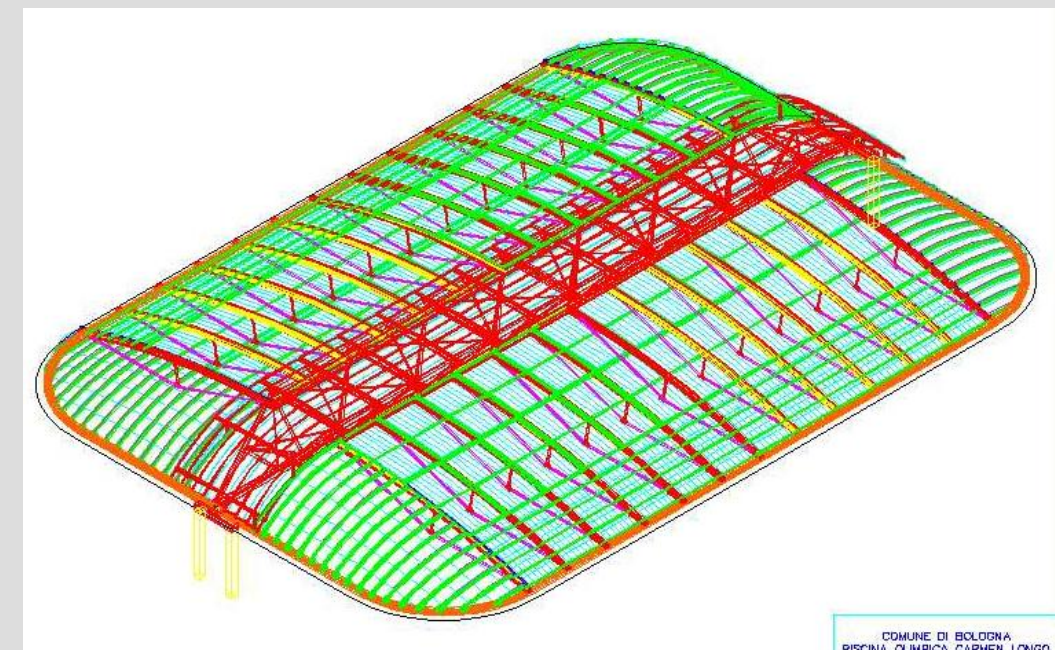
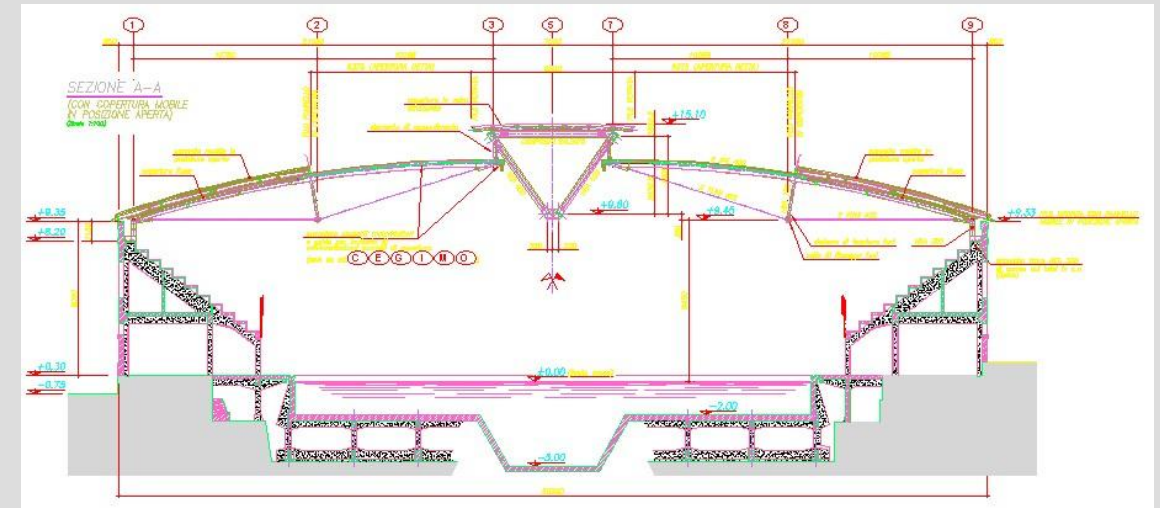
Year: 2003 - 2004

Surface: 3500 m²

Amount of works: € 4.650.000



Comune di Bologna
Progetto per la realizzazione della copertura avvolgibile della piscina olimpica Carmen Longo, via Anacleto Costa - Bologna
23/04/1999
vol. n° 83



COMUNE DI BOLOGNA
PISCINA OLIMPICA CARMEN LONGO

SWEDEN – BRIDGE OVER THE OXHALSSUNDET RIVER

DESCRIPTION

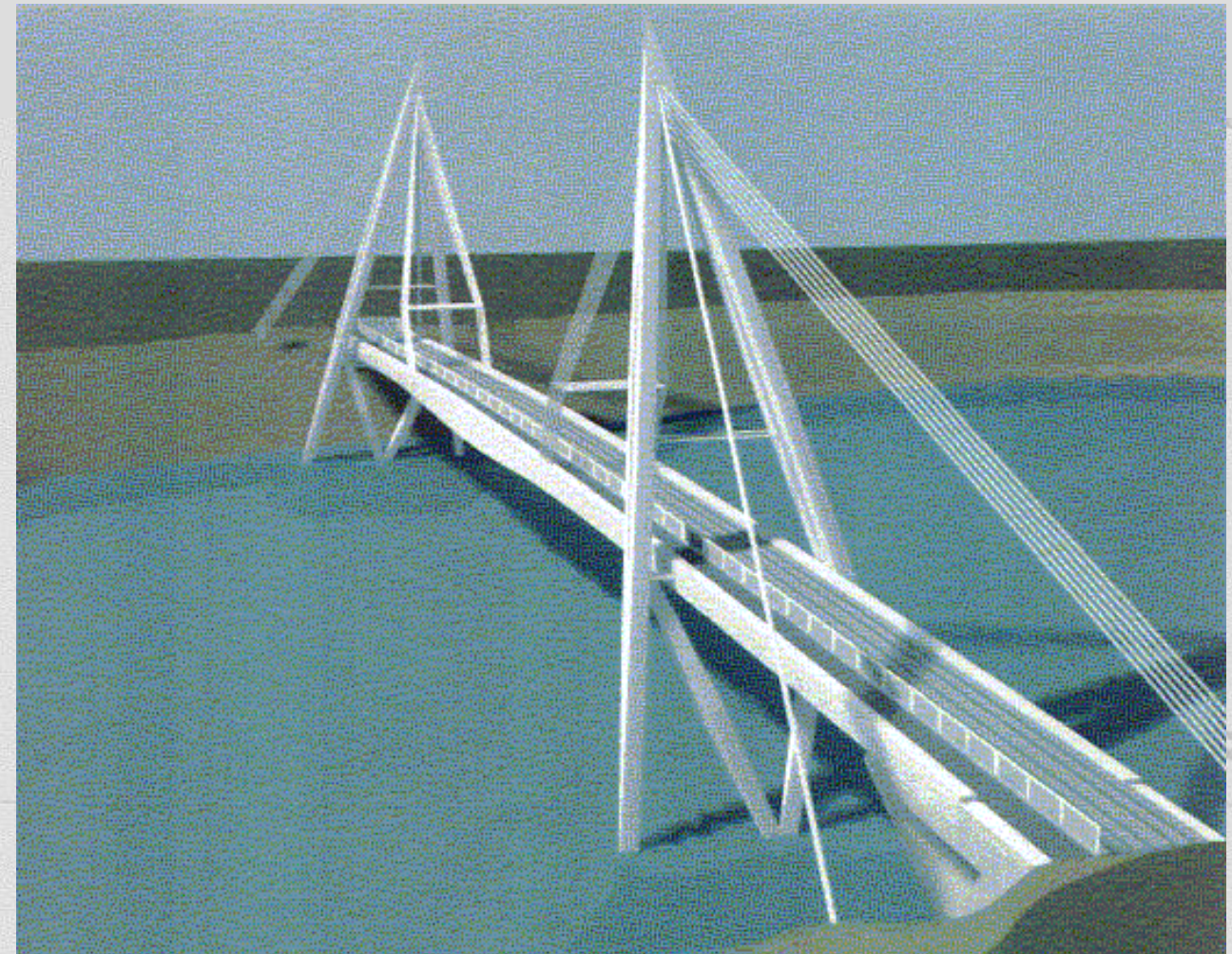
Railway and cycling-pedestrian bridge. Cable-stayed structure with inclined columns and high resistant closed steel spiral cables. The planking is essentially formed by two longitudinal beams composed of two box girders of S355 steel sheet of variable shapes.

Service provided: Structural design.

Client: Coop Costruzioni

Year: 2003 - 2004

Span: Mt. 110



RAVENNA – MOBILE BRIDGE OVER THE RIVER CANDIANO

DESCRIPTION

1st category mobile bridge with two lanes and external pavements; closed bridge span: not less than 50 metres; open bridge intrados = 2.40 – 3.00 metres a.s.l. (average variation for tide h=0 .60 metres; 1.20metres maximum) for small boat traffic; maximum dimension of the units that can sail in the stretch of the Candiano channel including the part between San Vitale and the city harbour.

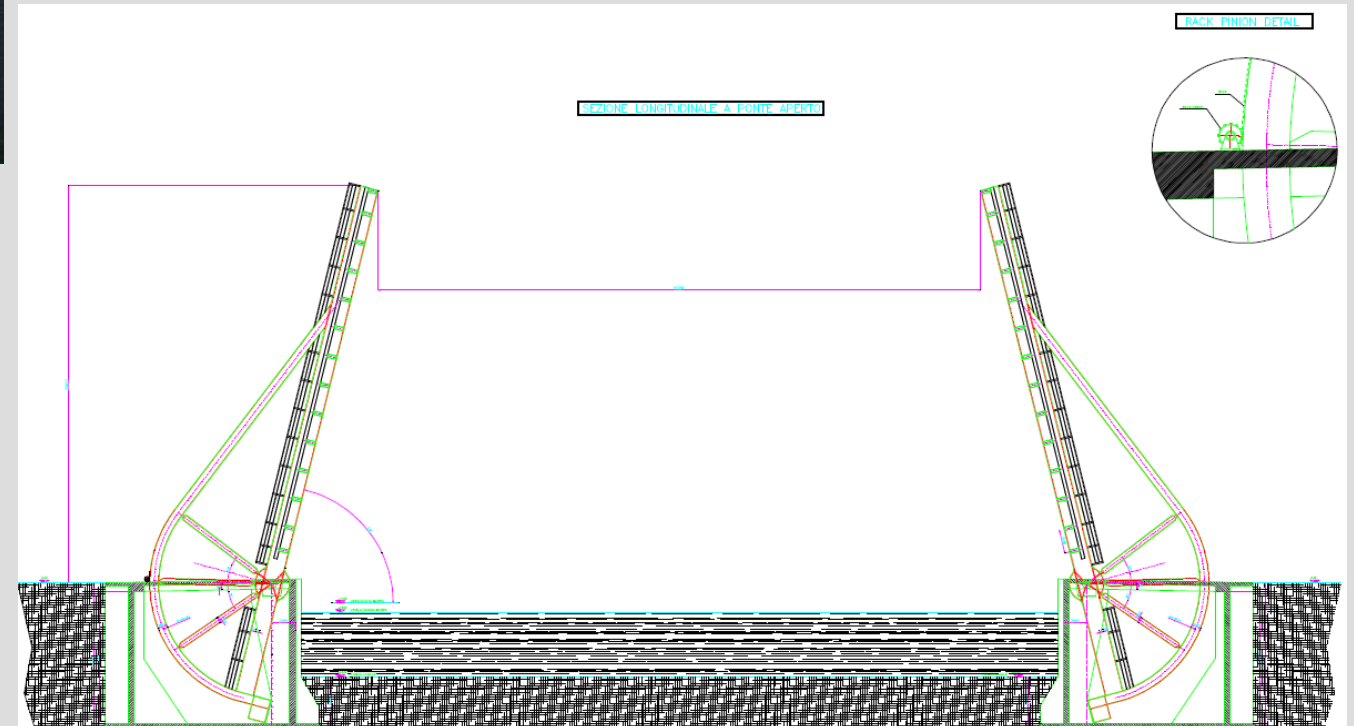
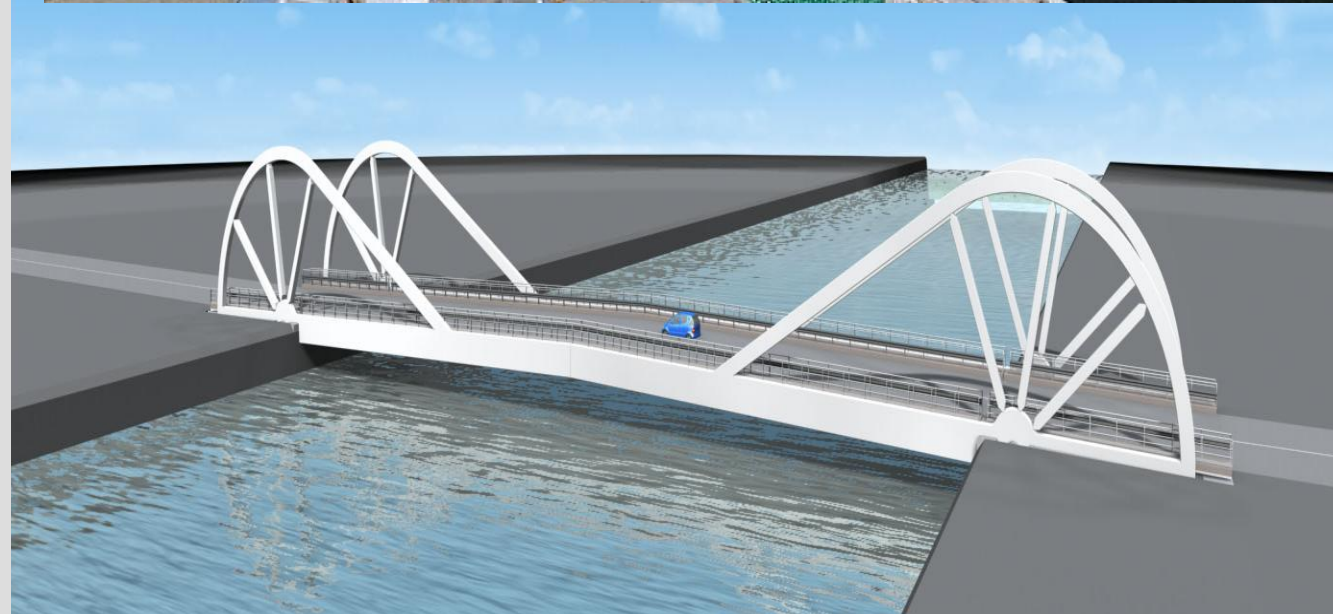
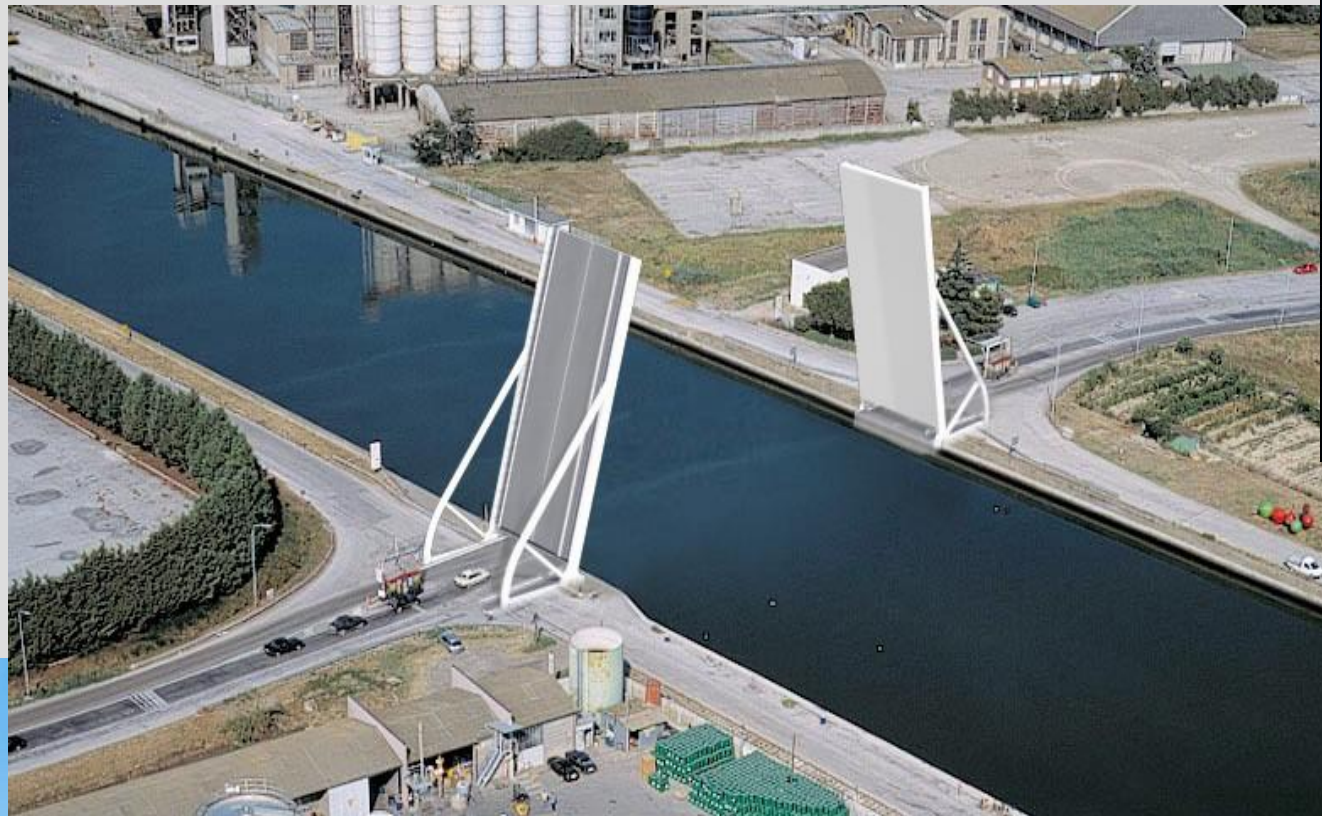
Service provided: Structural executive design

Client: Port authority

Year: 2003 - 2004

Span: Mt. 32.00

Amount of works: € 3.100.000



MODENA - STADIUM

DESCRIPTION

The structures are of tubular shaped metal pillars on which variable sectioned I curve beams are set, onto which are arranged the supporting seats for the prefabricated steps.

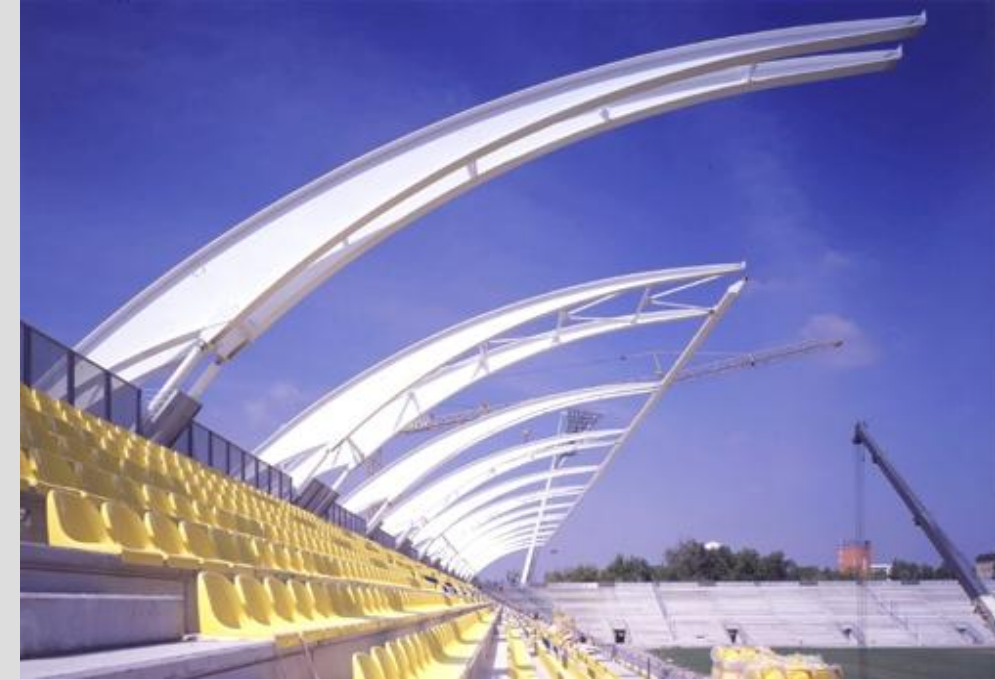
Sabre shaped beams that support the roof (by means of struts, tie beams and braces), these also made of welded plates to form an I curved section of a variable height are connected to the top lower beams. The roofing is constructed by connecting micro-perforated corrugated sheets, placed upside down on each other and secured by means of rivets along the ribs. A PTFE pre-stressed membrane to ensure the impermeability of the structure is positioned by means of timber spacers on top of the sheets.

Client: Modena Municipality

Year: 2004

Number of seats: 22.000

Amount of works: € 10.300.000,00



CASALECCHIO – FIRST FOOTBRIDGE OVER THE RENO RIVER

DESCRIPTION

A cycling-pedestrian footbridge with about 100 metre span. It is a suspended structure with supporting cables and opposing curvature stabilizers. The planking is supported by rope hangers with painted steel beams shaped as “gondolas”. The anchoring structure is formed by an A shaped trestle of steel tubes and tie beams of galvanized and painted spiral cables. The handrail and parapets are made of stainless steel cables.

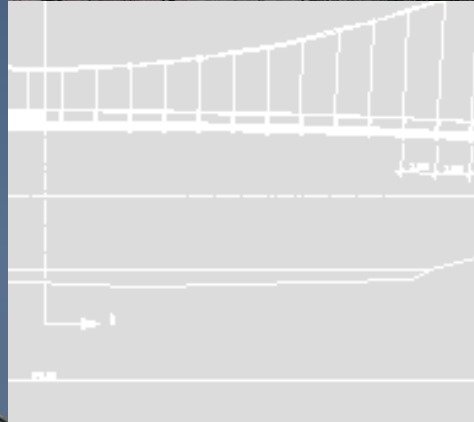
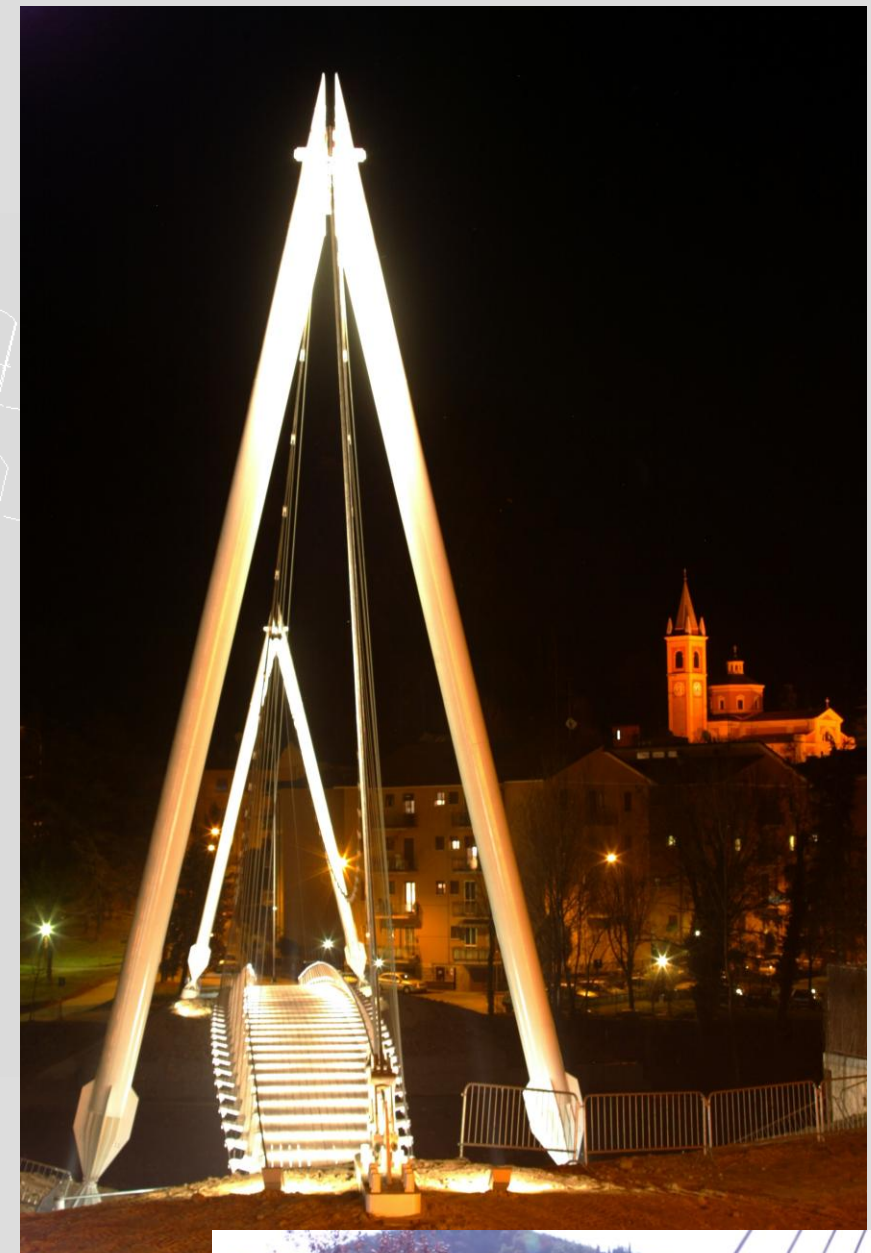
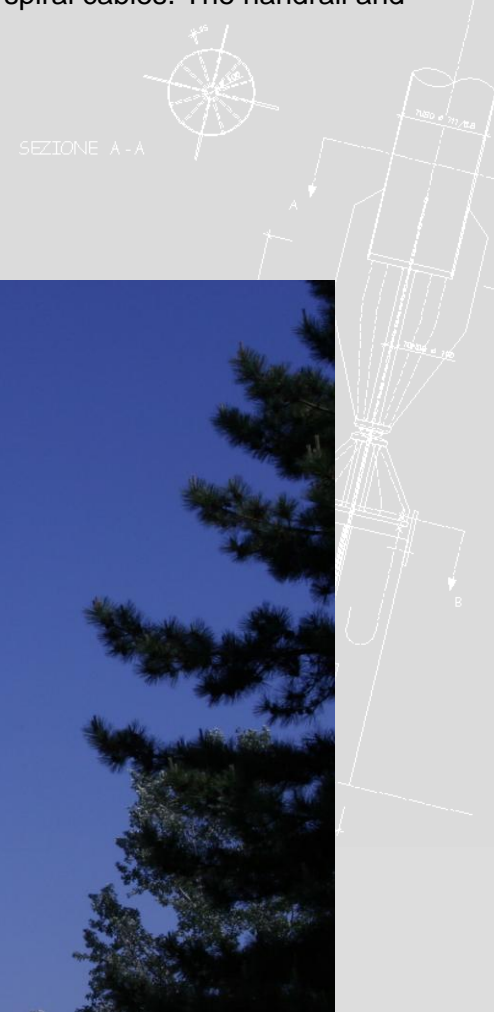
Service provided: Structural and architectural preliminary, final and executive design.

Client: Casalecchio di Reno (BO) Municipality

Year: 2002 - 2004

Free span: M. 100

Amount of works: € 620.000



BRAGA – STADIUM

DESCRIPTION

The geometry of the Stadium is made clear in the rigorous reinforced concrete structure of the two central stands. The body of the steps is cut by three circular section tunnels allowing people to cross. The roofing of the stands has been constructed by using two laminar slabs of reinforced concrete, with a 25 cm thickness, suspended simply by a cable system arranged transversally across the pitch. The 220 metres of roofing span is a unique example in the world, from a structural point of view. The executive project has been developed with extensive experimental research in wind tunnels.

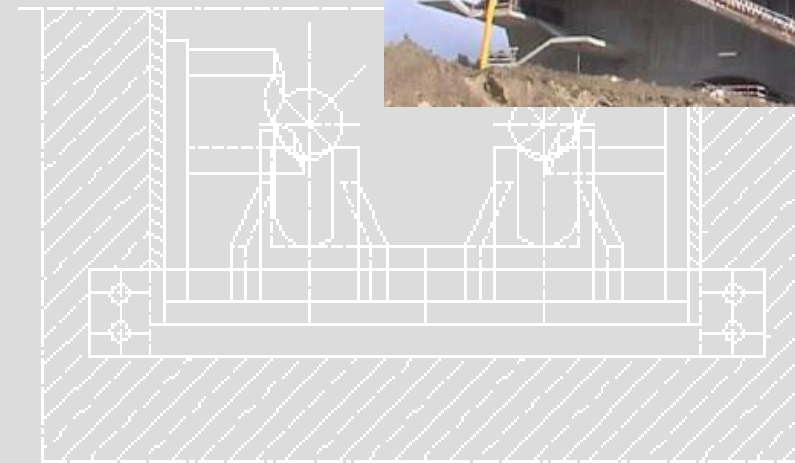
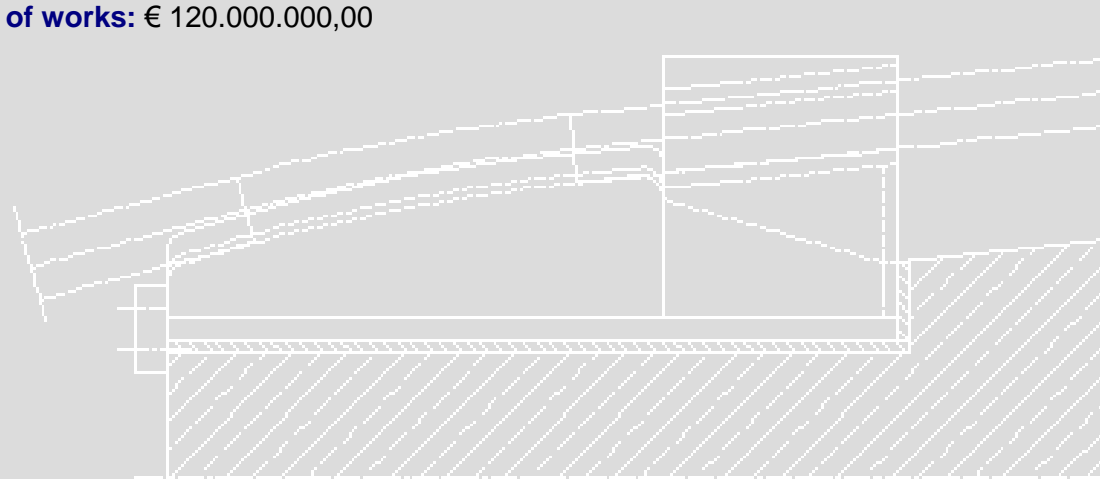
Service provided: Executive Structural design of the roof

Client: Soc. Soares da Costa

Year: 2003 - 2004

Roof span: 202 m

Amount of works: € 120.000.000,00



BOLOGNA - FOOTBRIDGE BETWEEN 21-24 FAIR PAVILLIONS

DESCRIPTION

The footbridge is placed between the 21-22 and 23-24 pavillions and has the following plant dimension: 88m (96m for the roof) in longitudinal way and 13.5m in transversal way. The structure is composed by a deck (+6.00m height) and by a roof (about +14.00m height).

Service provided: Executive Structural Design

Client: Finanziaria Bologna Metropolitana

Year: 2004

Free span: M. 24

Amount of works: € 3.955.912



ATHENS – OLYMPIAKOS FC STADIUM

DESCRIPTION

The steel structure is composed of a stand on the highest level and its global roofing system which is supported by a 6.44 metre Reinforced Concrete element that surrounds the entire stadium.

The steel structure is essentially constructed with the following components:

- Step support beams, spaced with 6 metre constant pitch
- Structure of main roofing, consisting of 14 large cantilevers arranged on the same vertical plane of the step support beams; each cantilever is formed by a spatial reticular macro and balanced by a vertical pillar that reaches the ground.
- Secondary roofing structure, consisting of rectangular section beams arranged radially.
- Roofing membrane, constructed with panels, composed of polyester and highly resistant PVDF, double curvature and pre-stressed.

Service provided: Executive Structural Design

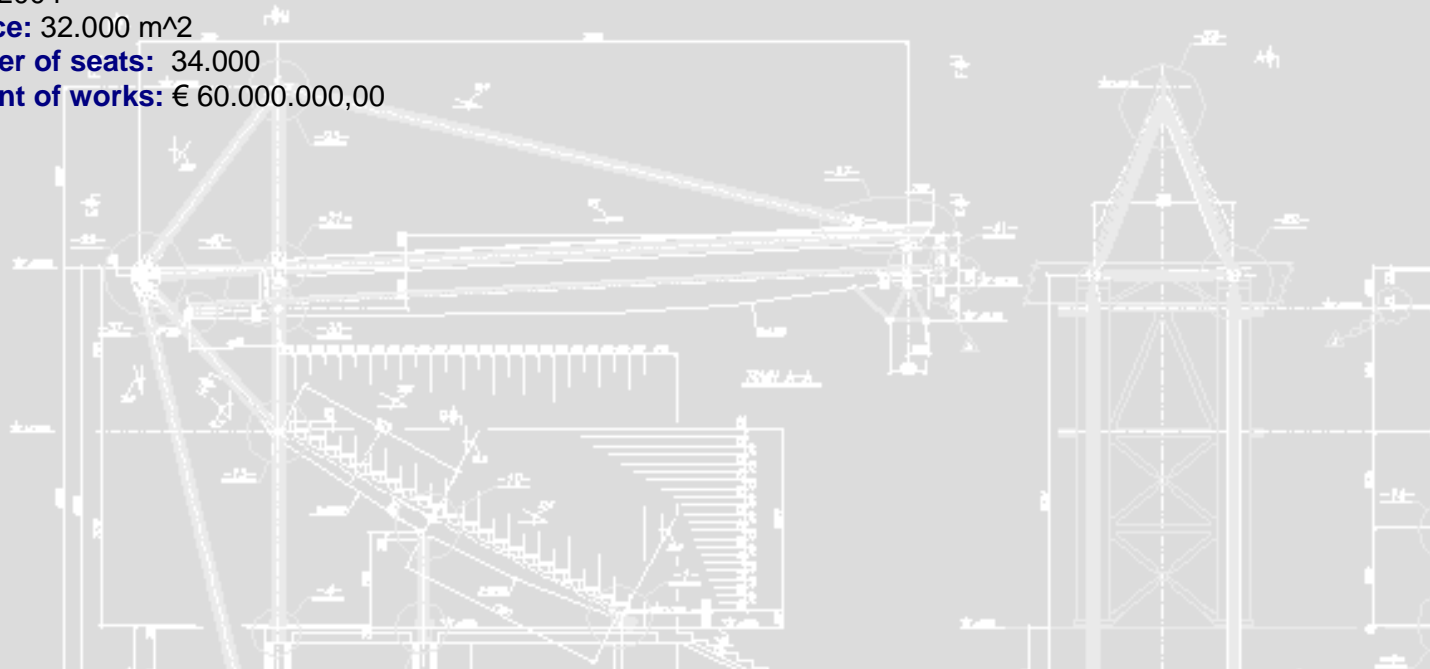
Client: Karaiskaki S.A.

Year: 2004

Surface: 32.000 m²

Number of seats: 34.000

Amount of works: € 60.000.000,00



TRIPOLI – CORINTHIA HOTEL

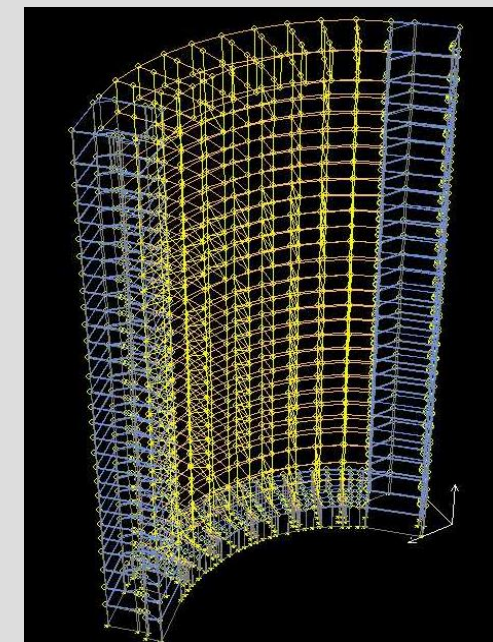
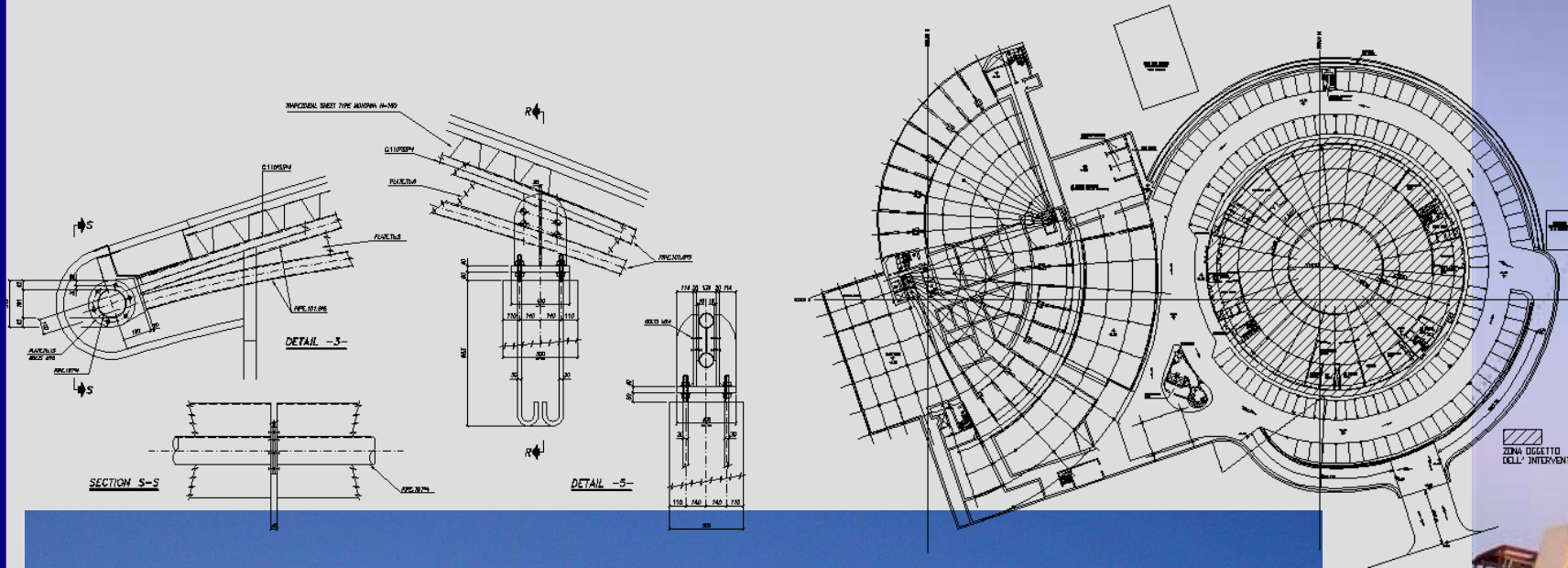
DESCRIPTION

The hotel is located on the Mediterranean coast of Tripoli, in the centre of the business area and near to the cultural centre of the city. The two towers of 100 and 70 metres are joined by a central body with a 40 metre span.

Service provided: Structural design

Year: 2003

Amount of works: € 125.000.000



BOLOGNA – EXHIBITION HALL 18

DESCRIPTION

The geometrical configuration of pavilion 18 in the layout is characterized by a central rectangular body (body C), with external dimensions of 100 metres according to the longitudinal axis (direction E-O) and 84 metres according to the transversal axis, in which body A is inserted (52m x 48m rectangular shape) on the east façade and body B (44m x 48m rectangular shape) corresponding with the north-west corner.

The structural-architectural project conception of central body C foresees the adoption of a main structural system formed by 4 statically independent spatial frameworks, arranged transversally at consistent 24 metre inter-axis.

The structural systems, thus formed, are all inter-connected in a longitudinal direction according to a Gerber type plan so as to be elastically and thermally correlated in order to minimize short-circuiting, the possible consequences of a structural collapse caused by unpredictable extreme accidental actions

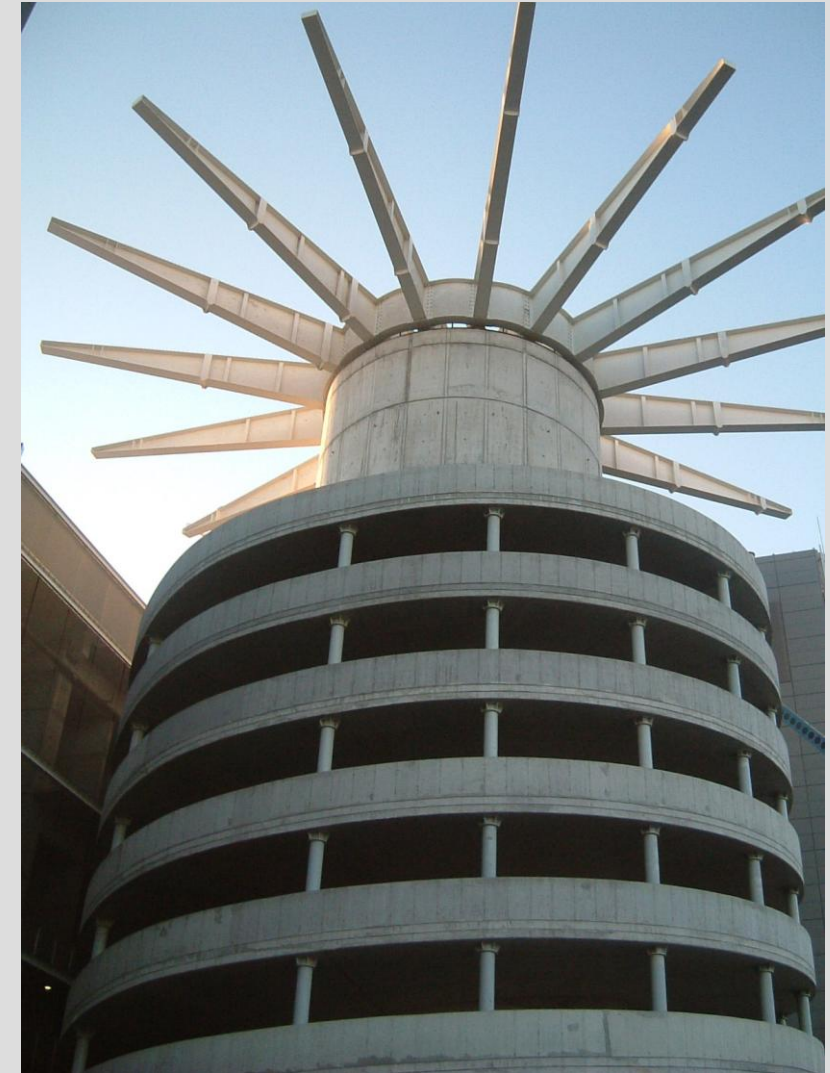
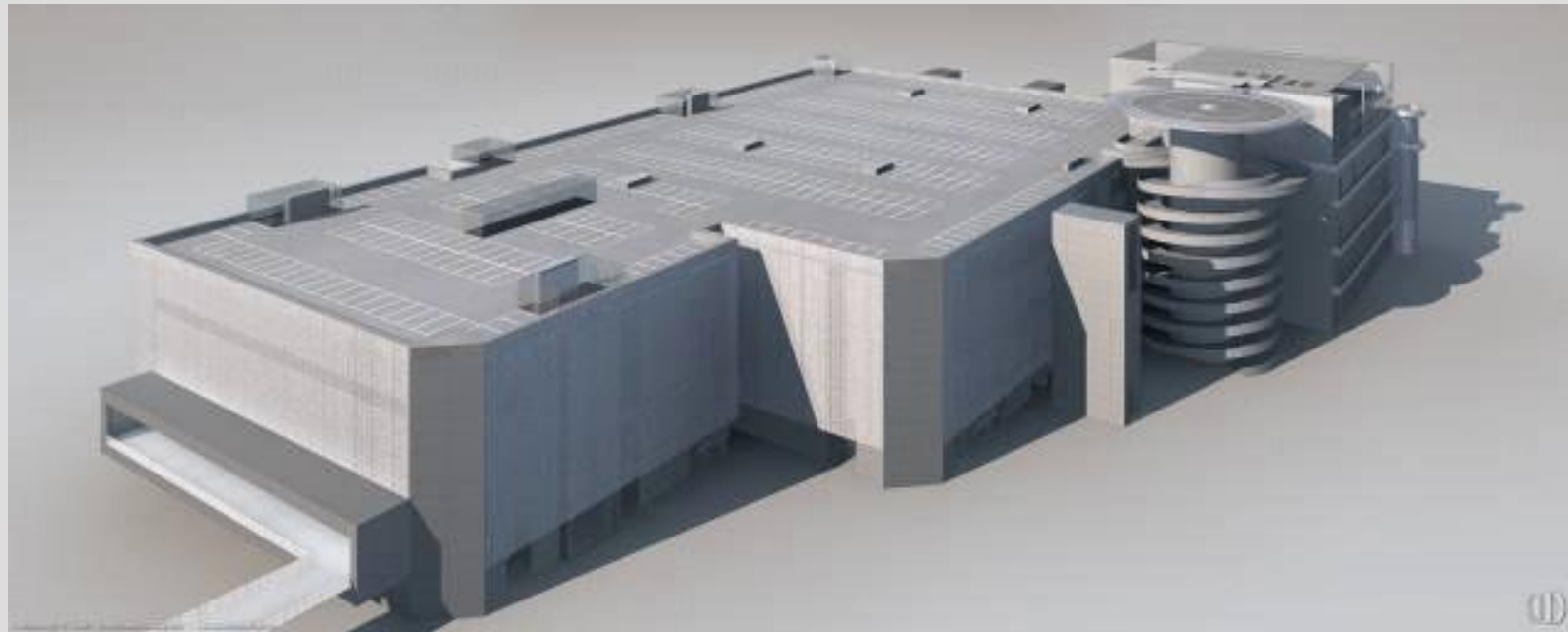
Service provided: Structural Design

Client: Bologna Fair

Year: 2003

Surface: 43.000 m²

Amount of works: € 41.316.552



MOSCA – WATERPARK

DESCRIPTION

The building is formed by two overlooking towers that are based at about +107.8 metres and at the top, reach about +279.8 metres, for a total height of 172 metres.

There is a single foundation for both towers and is made of a reinforced concrete cellular foundation, directly resting on the ground.

The elevation of the two towers is of reinforced concrete; the bracing action is accomplished by centres composed of parting walls, made integral to the other supporting elements (beams and pillars) from the floor slabs.

The central part that develops until the height of about +166.2 metres is made with steel columns filled with concrete, except for some portions of the planking in the part that overlooks the water park, made of a reticular spatial structure.

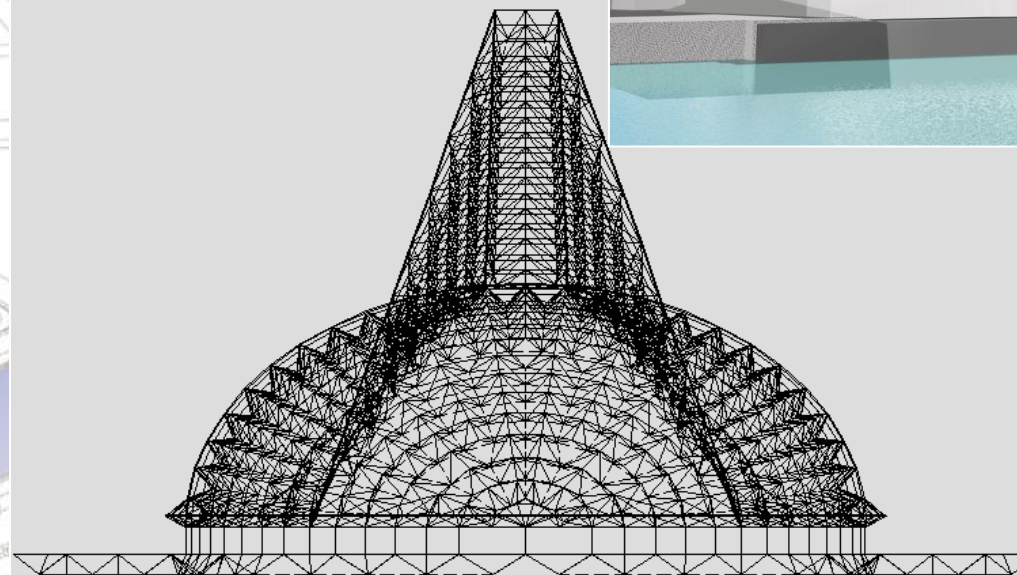
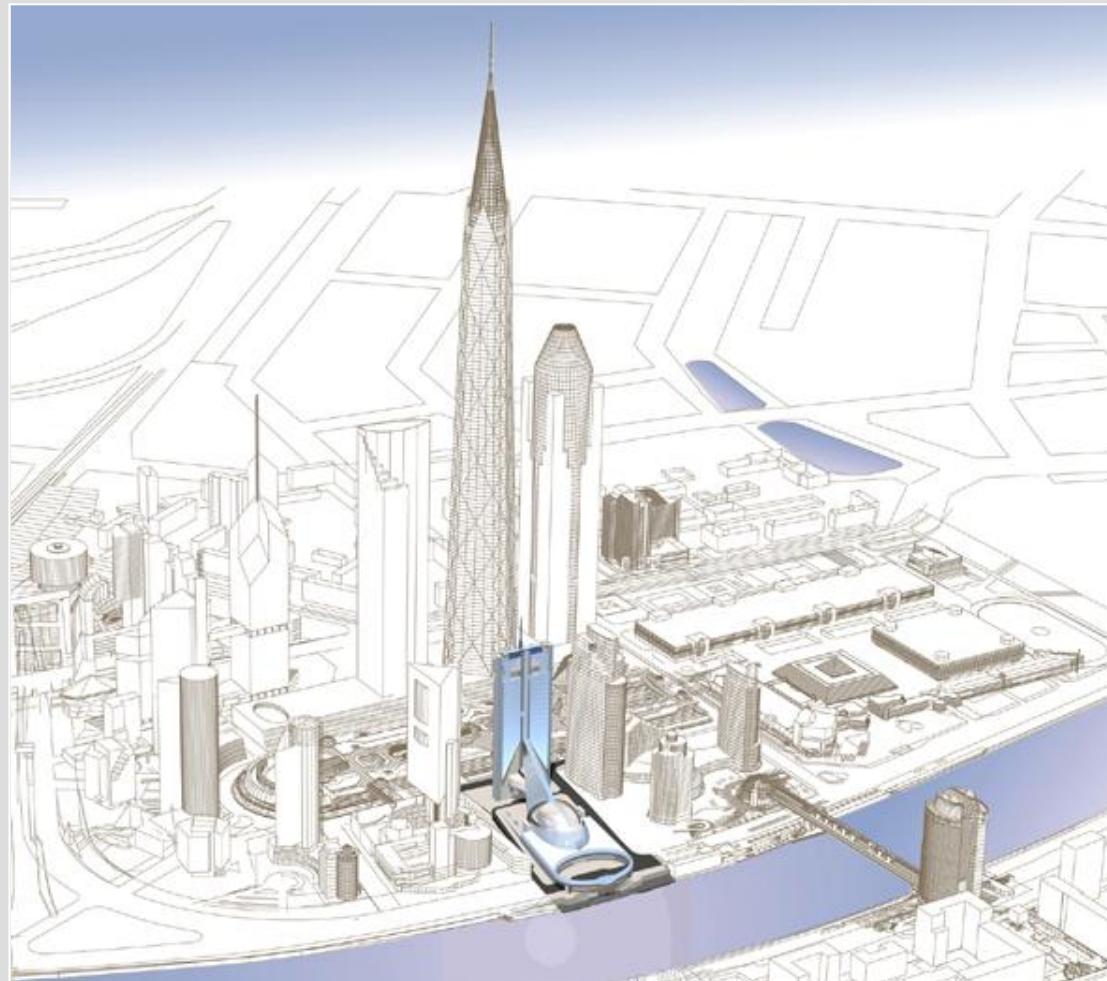
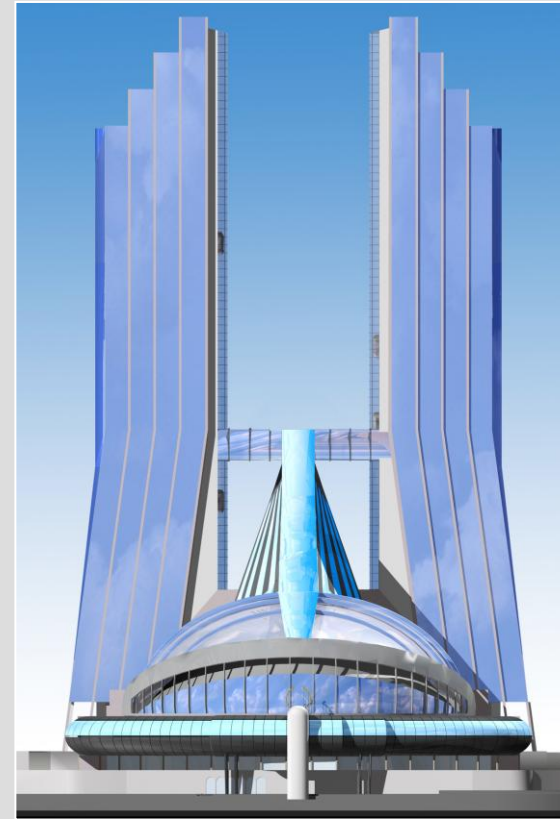
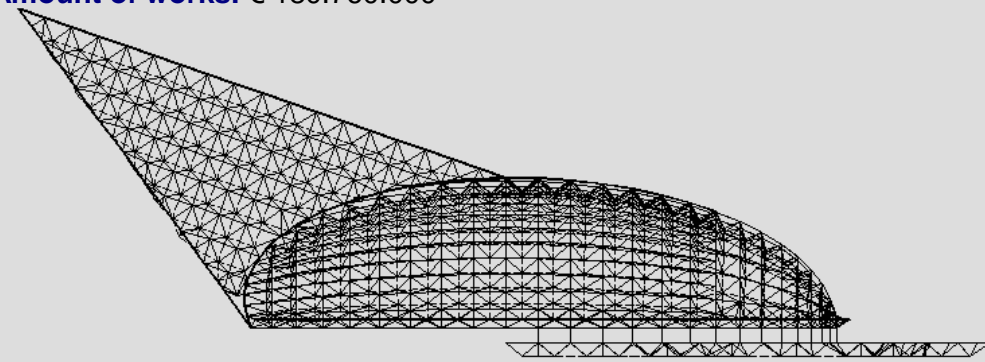
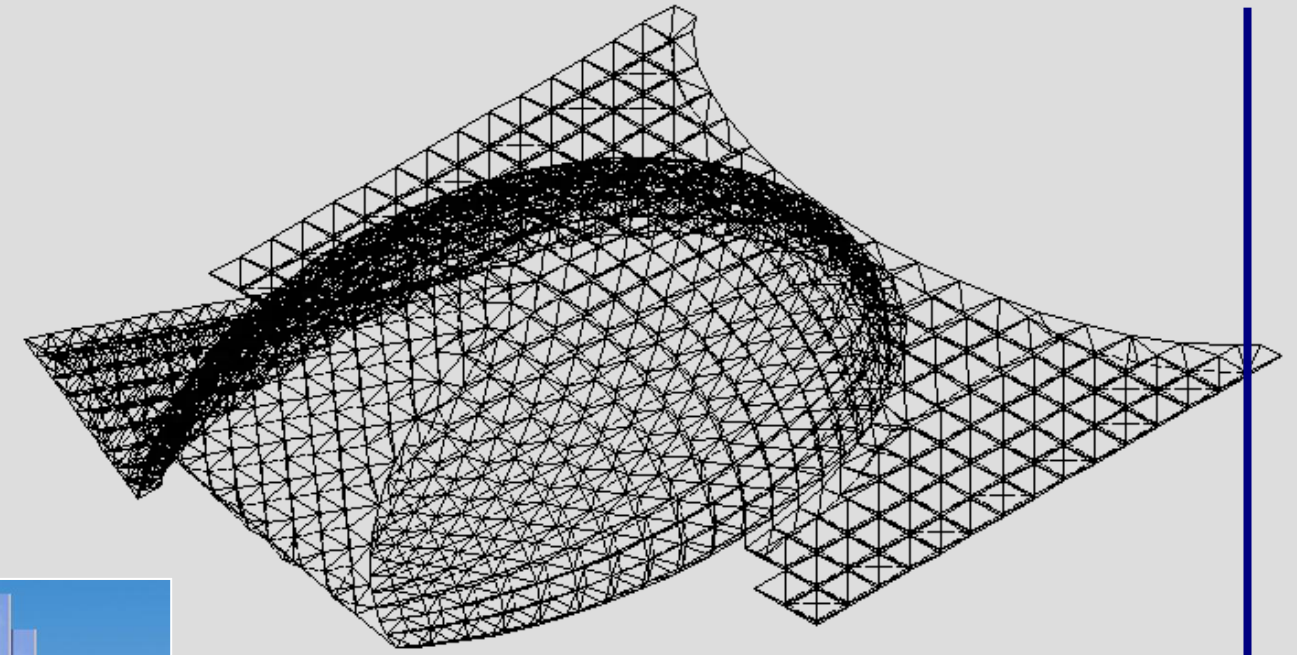
Between the heights of +189.47 and +200.72 metres, another three metal structured plankings are present, creating a “bridge” between the two towers: the connection of the “sail” of the roofing of the water park is foreseen under the first of these plankings, that here, joins in a horizontal direction.

Service provided: Structural Design

Client: Gazprom - Mosca

Year: 2001

Amount of works: € 180.760.000



ATHENS – HANGAR OLYMPIC AIRWAYS

DESCRIPTION

The parallel 300 metres, longitudinally oriented twin trusses, supported on three main transversal box girders, are positioned with a relative separation of 9115 metres. The trusses have a parabolic curved top flange, with a height varying from 3.5 metres at the ends to 12.5 metres at the centre, and a bottom horizontal flange (fig.3). The upper chord geometry facilitates rain drainage.

Two couples of twin trusses are then both connected, with vertical and horizontal braces, in order to finally obtain a self out of plane stabilizing spatial frame.

Five reticular spatial frames, forming the principal structural system (fig.4), are supported on transversal oriented frames formed by 4 box-section concrete columns and steel box-section continuous beams, with three spans of 27.5 metres each (85 metres long), positioned along the two lateral gable walls and the symmetrical axis of the Hangar.

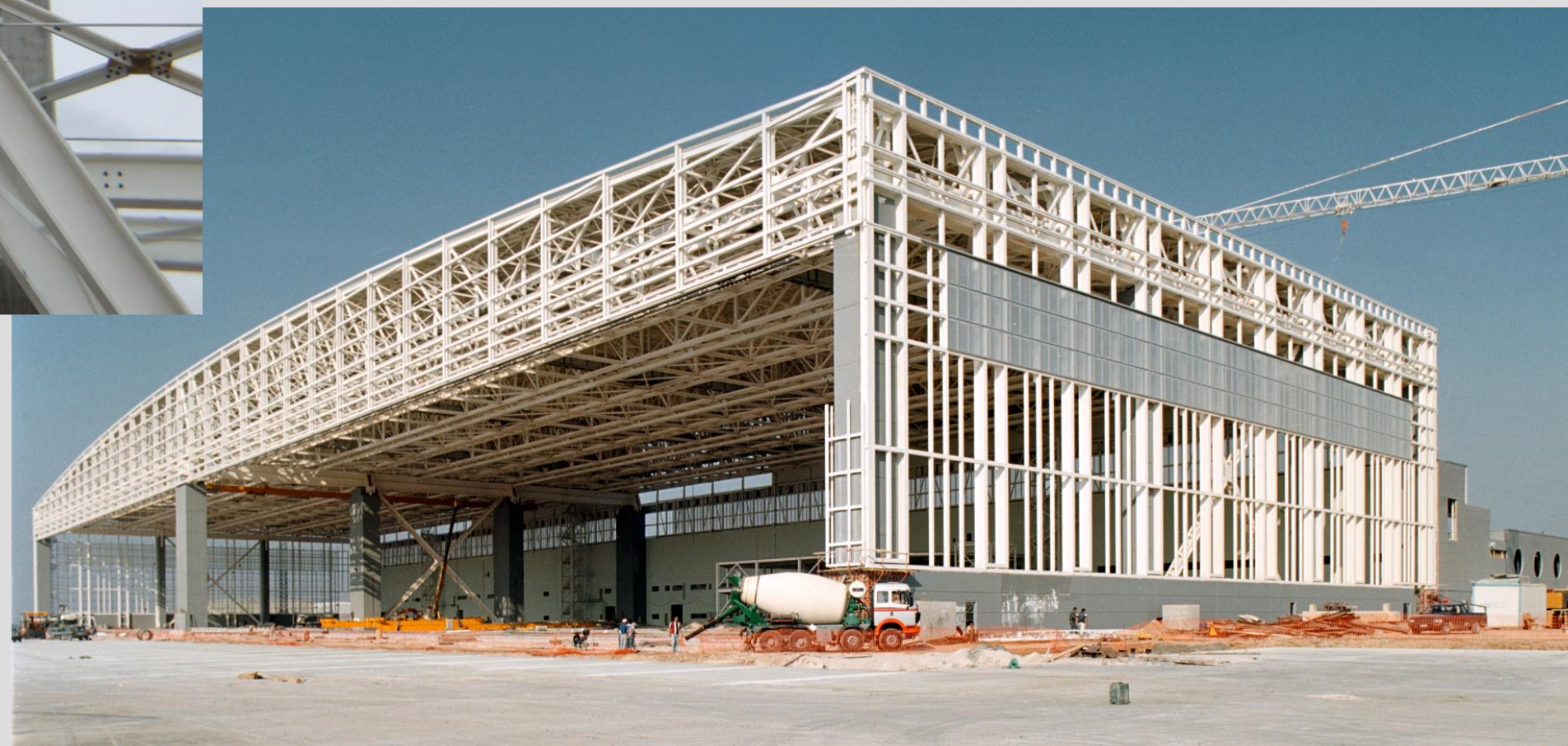
Service provided: Preliminary, final and executive structural design

Client: Tecnodomiki

Year: 2000

Surface: 25.000 m²

Amount of works: € 4.131.655,19



VENEZIA – MARCO POLO STADIUM

DESCRIPTION

A football stadium with mobile roofing. The structural system of this roof is essentially formed by:

- main longitudinal arches with considerable span make up the main supporting structure.
- lateral roofing of the stands which cover the stand areas of the external border and the longitudinal arch; the type adopted for this structure is of circular configuration reticular beams, arranged in a radial manner.
- Central roofing with fixed and mobile panels, made of two types of structure: one fixed and the other mobile (corresponding to the football pitch area which is equal to about 90 x 110 metres); the type foreseen for this structure is reticular spatial with hot rolled open profiles; the driving mechanism is of particular importance for the movement of the roofing.

Roof covering made of pre-stressed material membrane system.

Service provided: Structural Design

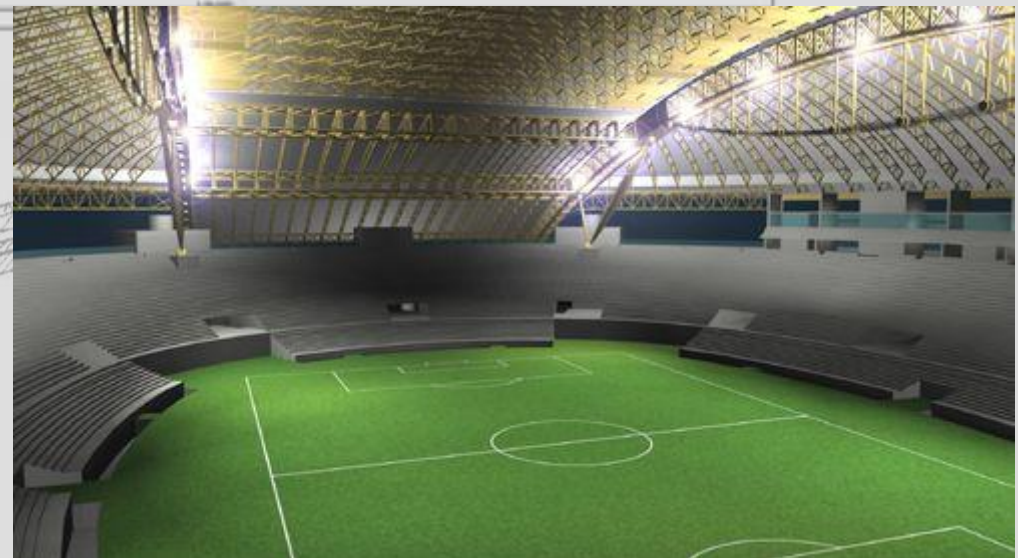
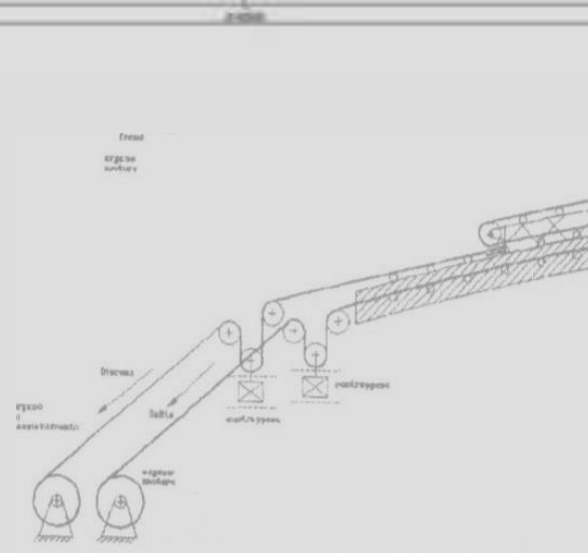
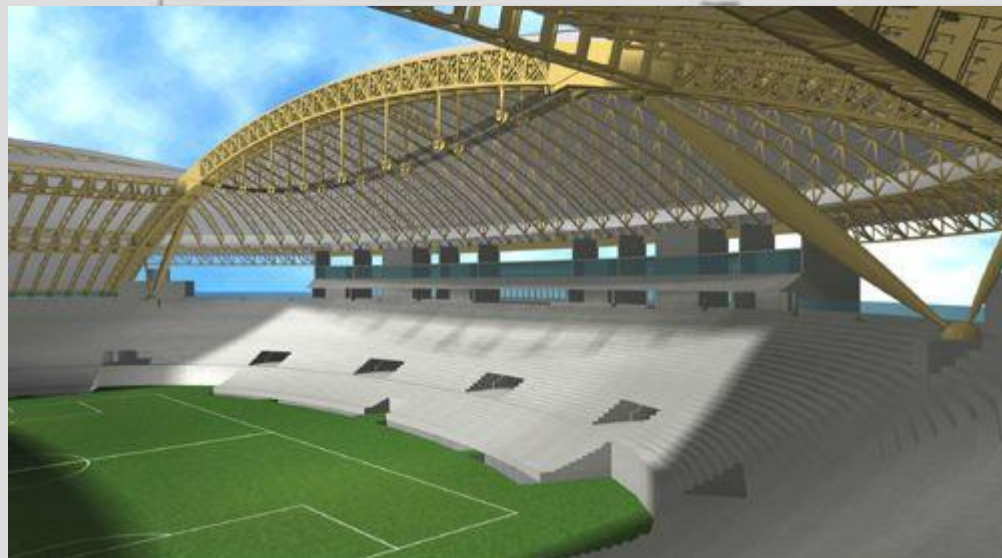
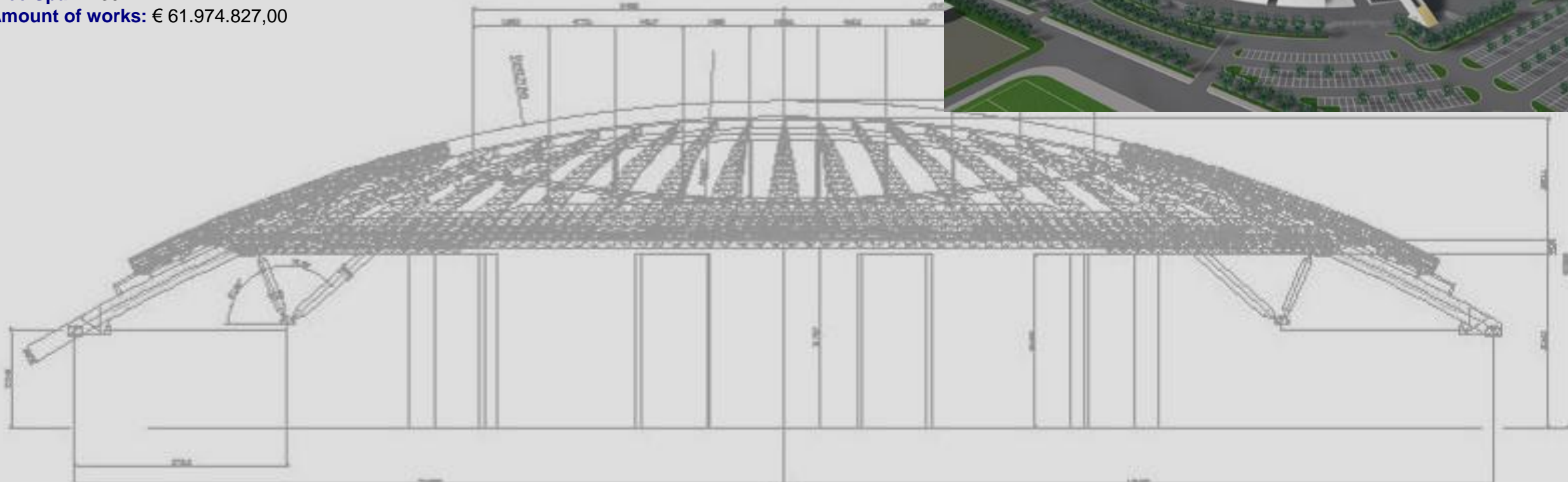
Client: Mazzi S.p.a.

Year: 1999

Roof Surface: 42.000 mq

Free Span: 230 m

Amount of works: € 61.974.827,00



TREVISO – RACES CENTER

DESCRIPTION

The maximum dimensions of the building are 125 metres in length, 64.40 metres in width and about 17 metres in height above ground.

The main supporting system is formed by two variable section tubular profile trestles, that are spaced to form a pressure eliminated three hinged arch.

The trestles are supported from the vertex by a highly resistant cable tie beam and a reticular spatial suspended beam.

The secondary reinforced beams are connected to the external reinforced concrete structures and rest on the extrados of the longitudinal reticular beam; they are arranged transversally with 6 metre inter-axis and have a span of about 30 metres.

The roofing rests on the perimeter of the reinforced concrete transversal frames, spaced with the same inter-axis of the secondary beams.

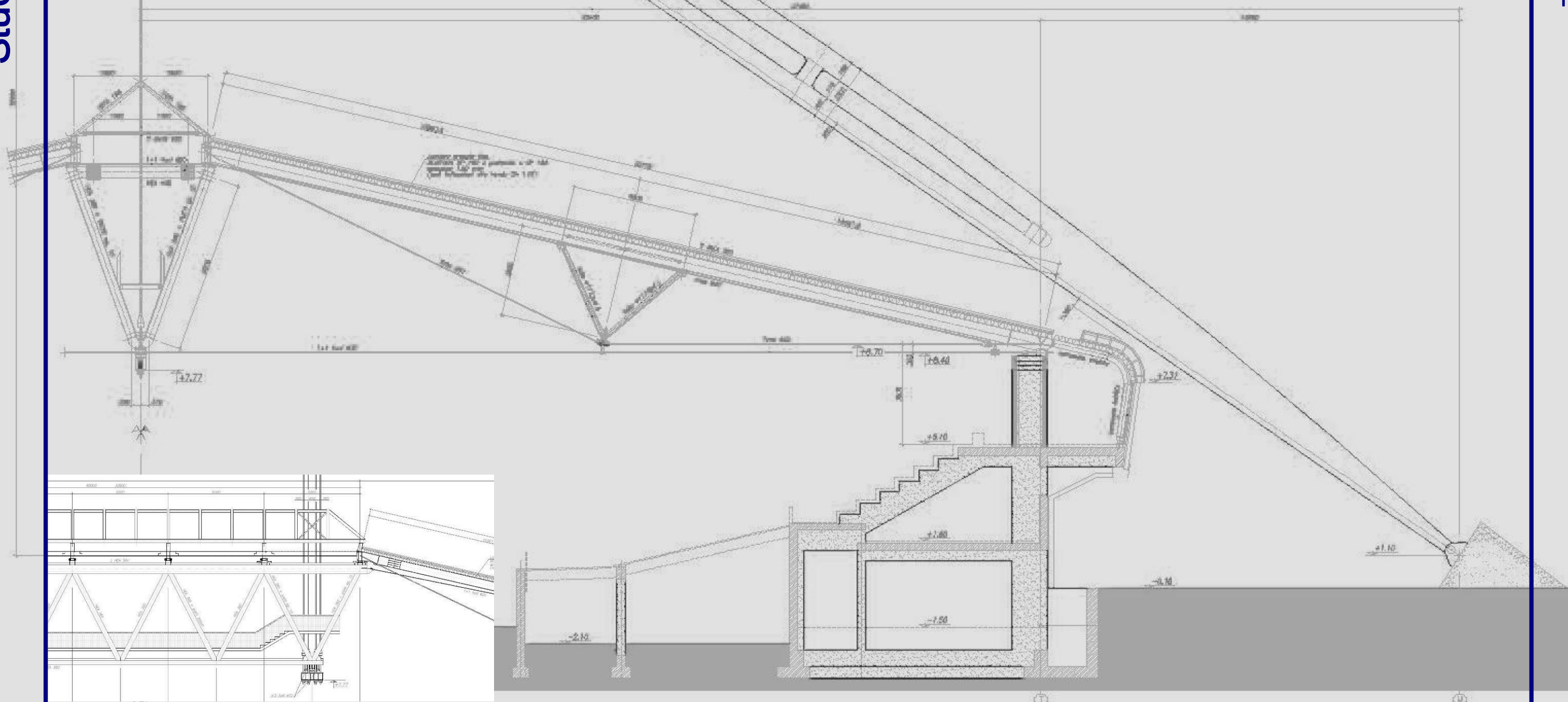
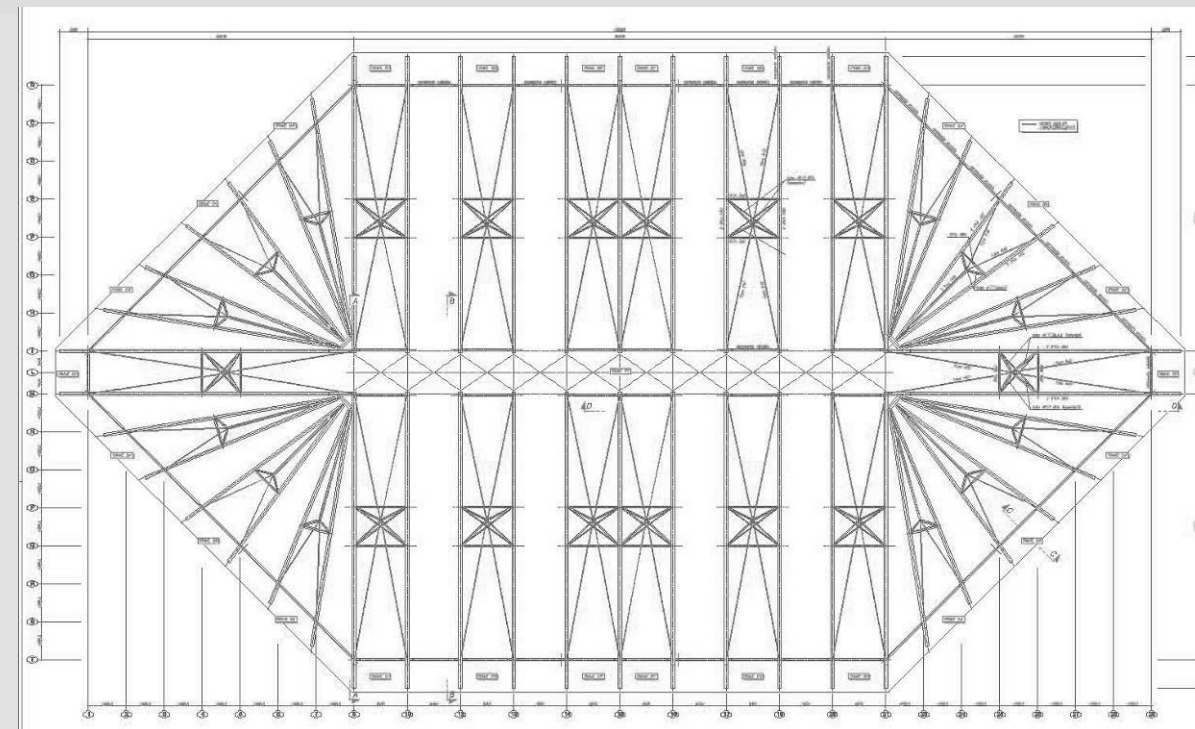
Service Provided: Executive Structural Design

Client: CONI

Year: 1999

Surface: 8.000 m²

Amount of works: € 10.330.000,00



OHITA – STADIUM (JAPAN)

DESCRIPTION

The project foresees an innovative mobile roofing. Unlike the conventional movement systems used for converting large sports areas, the Ohita roofing has been designed to have multi-purpose uses; as football stadiums are essentially “open” and rarely used closed (only in cases of bad weather conditions) the design foresees the use of the roofing also in an “open” position for social and exhibition events.

The main structures are made of two 300 metre long arches positioned over the rectilinear stands. The fixed part of the roofing is obtained by using transversal beams, placed between the arches and the structures of the stands.

The middle area, which can be opened, has a span of about 110 metres and is made of spatial beams , covered by PTFE membrane.

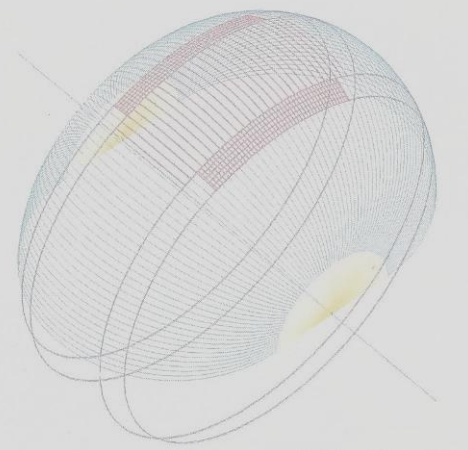
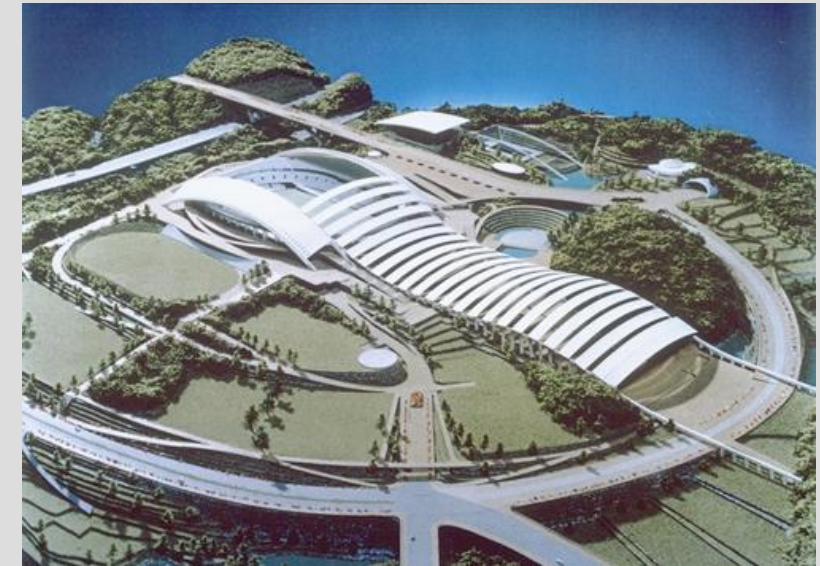
The movement system is rack and pinion and has appropriate locking devices.

Service provided: Structural Design for Tender (2° position)

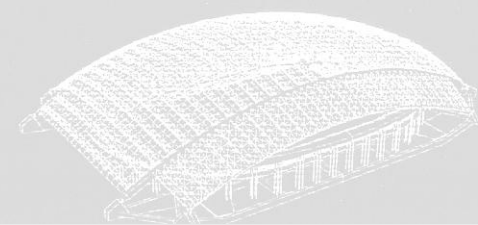
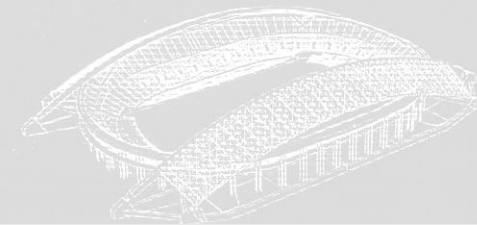
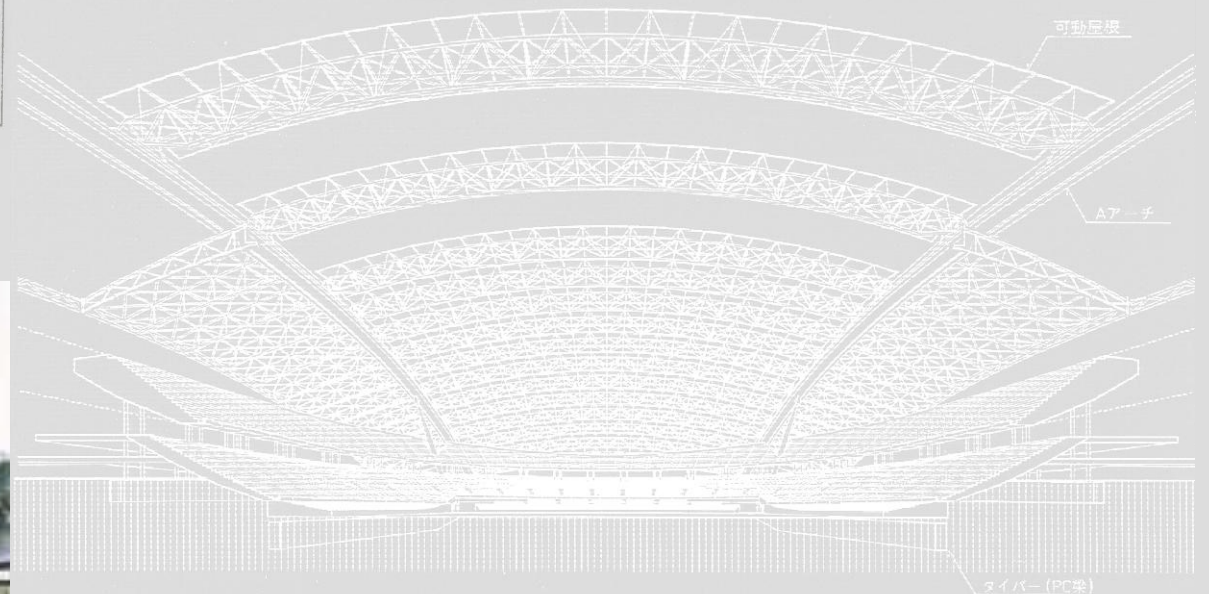
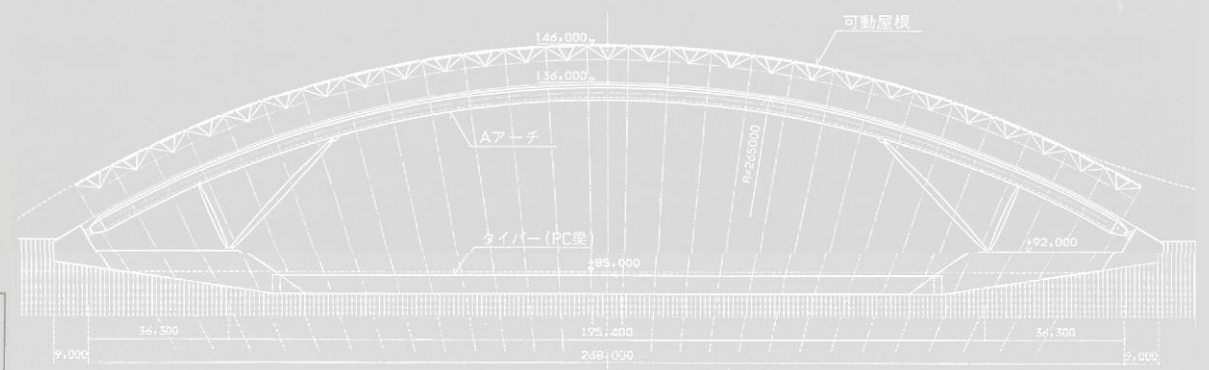
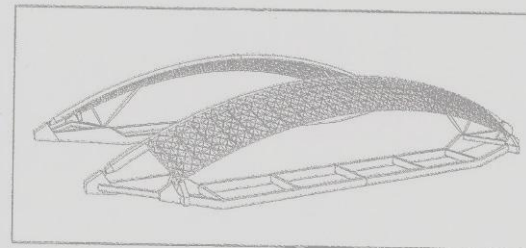
Client: Kajima Corporation Ohita Giappone

Year: 1998

Amount of works: € 119.334.218,00



Onion Shape Geometry



PESARO – SPORTS HALL

DESCRIPTION

A multi-purpose complex that besides sporting events, is used for concerts and musical events, due to its excellently enhanced sound features.

In the conceptual design of the structure, the following synthetic decisions were made:

- use of a strong longitudinal structural system, comprising a spatial reticular arch, hinged to the imposts, and pressure eliminated by using a tie beam of pre-stressed reinforced concrete;
 - use of two lateral substructures formed by arched beams, placed transversally with consistent inter-axis, with fixed support at the base (corresponding with the reinforced concrete structure) and sliding support, positioned in correspondence to the extrados of the main arch;
 - use of a bracing and lateral stabilizing system made of pre-stressed galvanized spiral cables;
- use of a mixed ventilated roofing system of pre-painted corrugated sheets and polyester membrane and double Tedlar curvature with high pre-stressing.

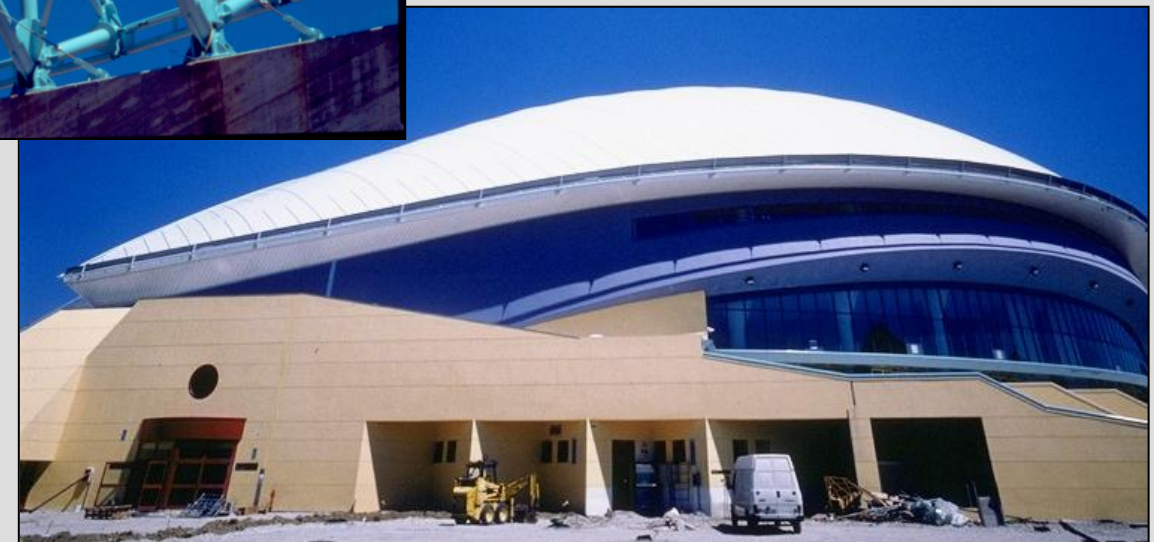
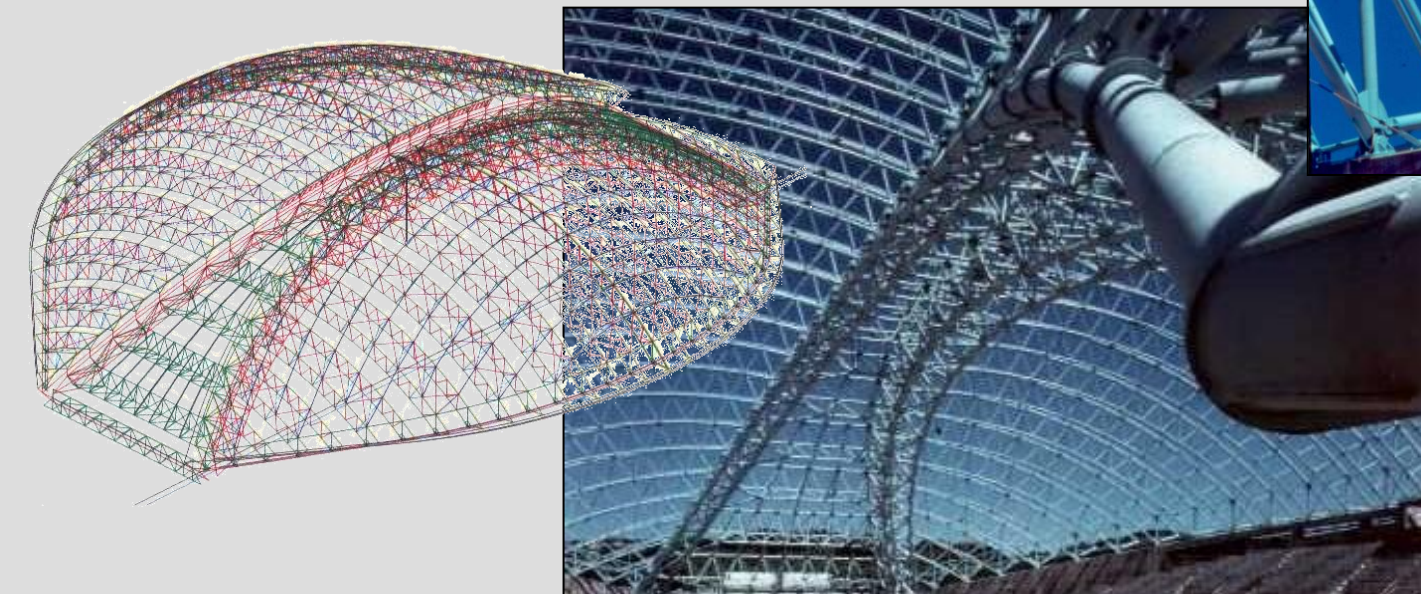
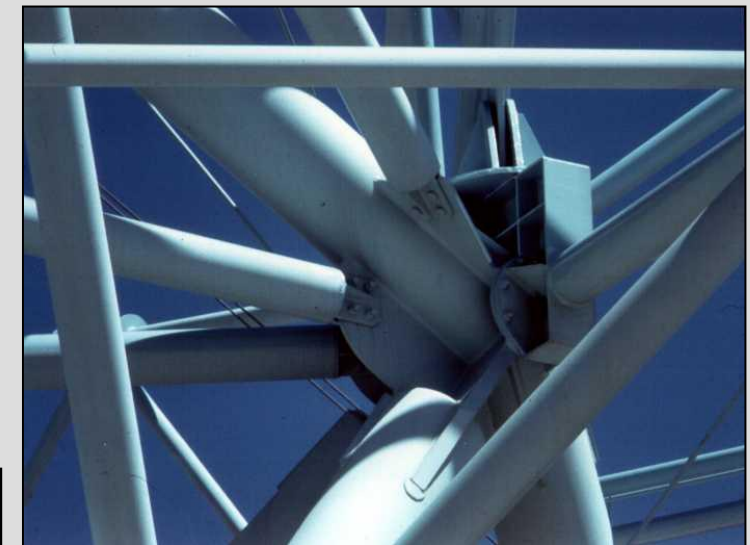
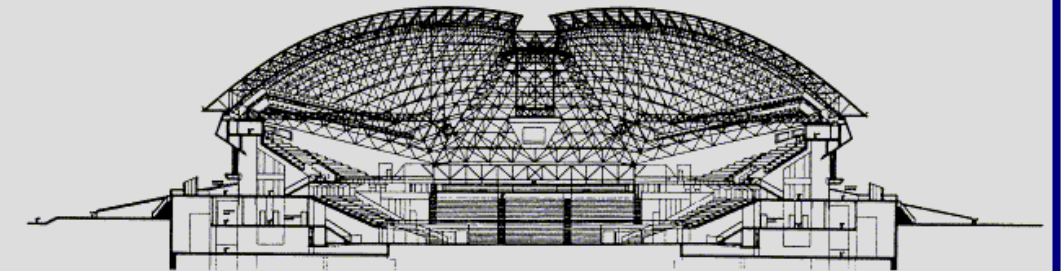
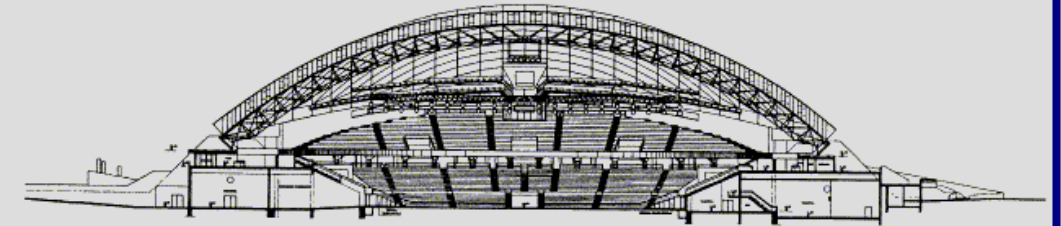
Service provided: Preliminary, final and executive structural design.

Client: Pesaro Municipality

Year: 1997

Surface: 36.645 m²

Amount of works: € 22.207.646



LIVORNO – SPORTS HALL

DESCRIPTION

The main roofing structure is formed by 24 meridian arches, arranged with radial symmetry at consistent inter-axis with 15° central angle, and by six parallel arches arranged about every 8° azimuth. The average roofing surface is similar to a spherical radius of about 70 metres and a 29 metre arrow vertex.

At 14 metres from the 0.00 reference height, a ring of pre-stressed cables formed by 3 high strength steel spiral cables with 42 mm diameter is disposed. The arches that are set directly on the foundations are blocked by cylindrical hinges made from metal. The covering of the vault is made of a composite system of corrugated sheets of galvanized and pre-painted steel, dimensioned in a manner as to pass directly over the spans (without using secondary structures) between the arches by more than 12 metres.

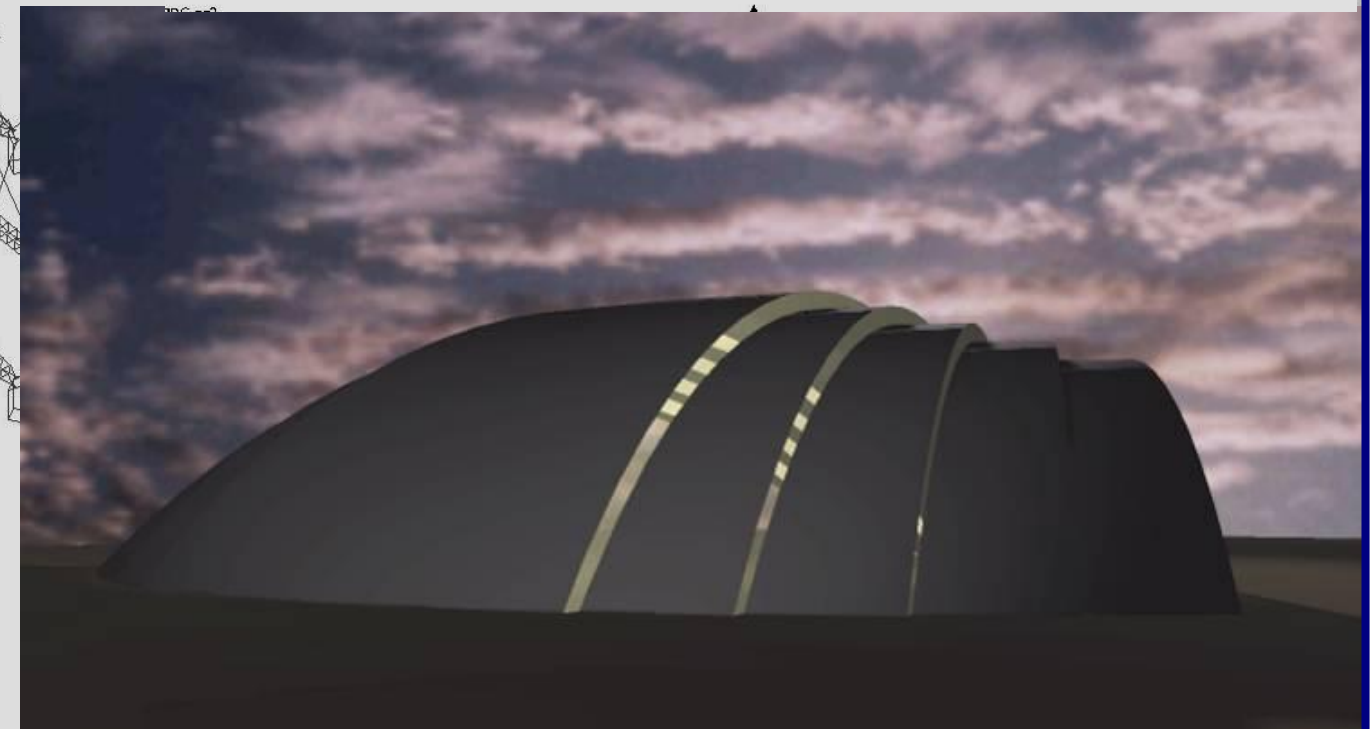
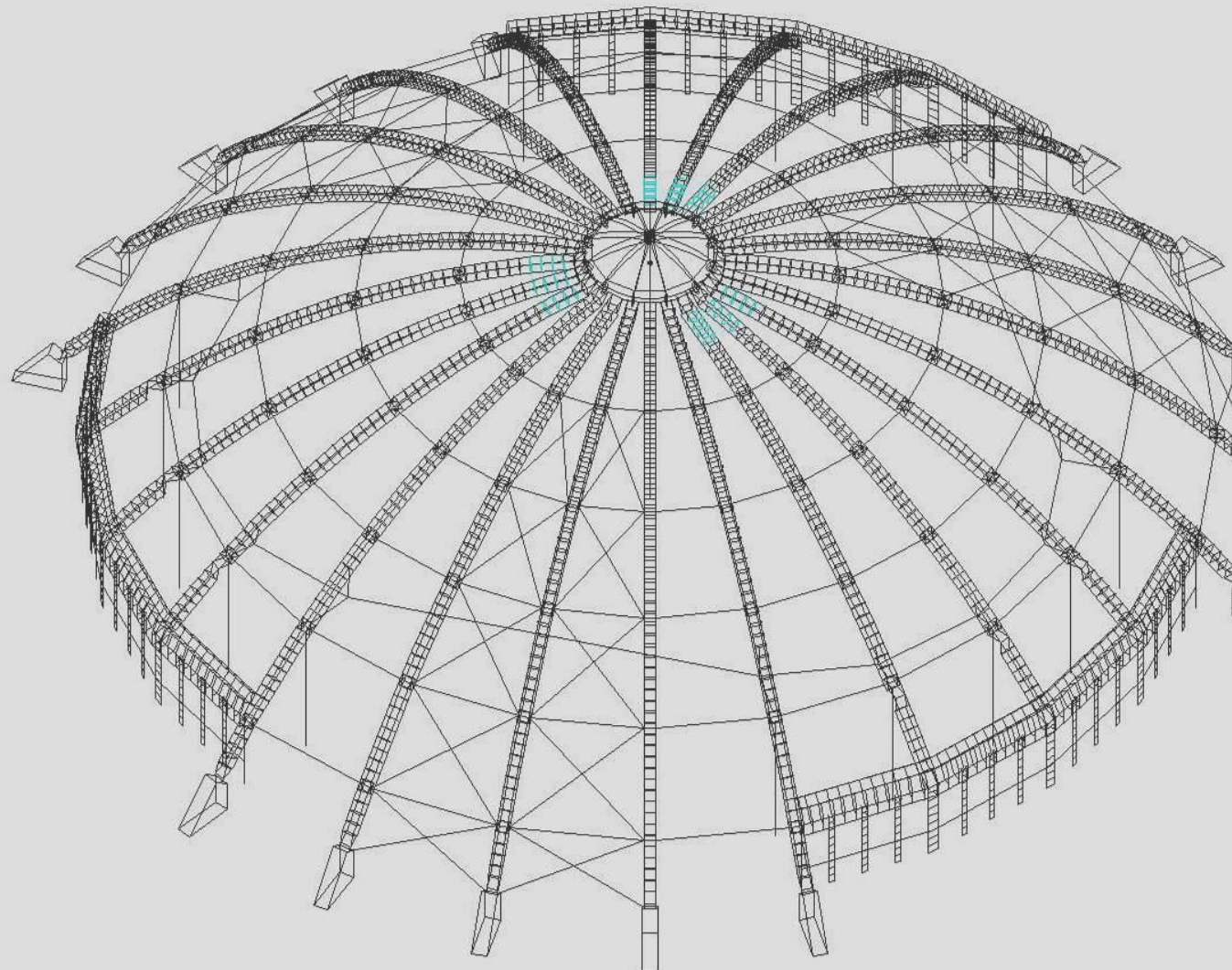
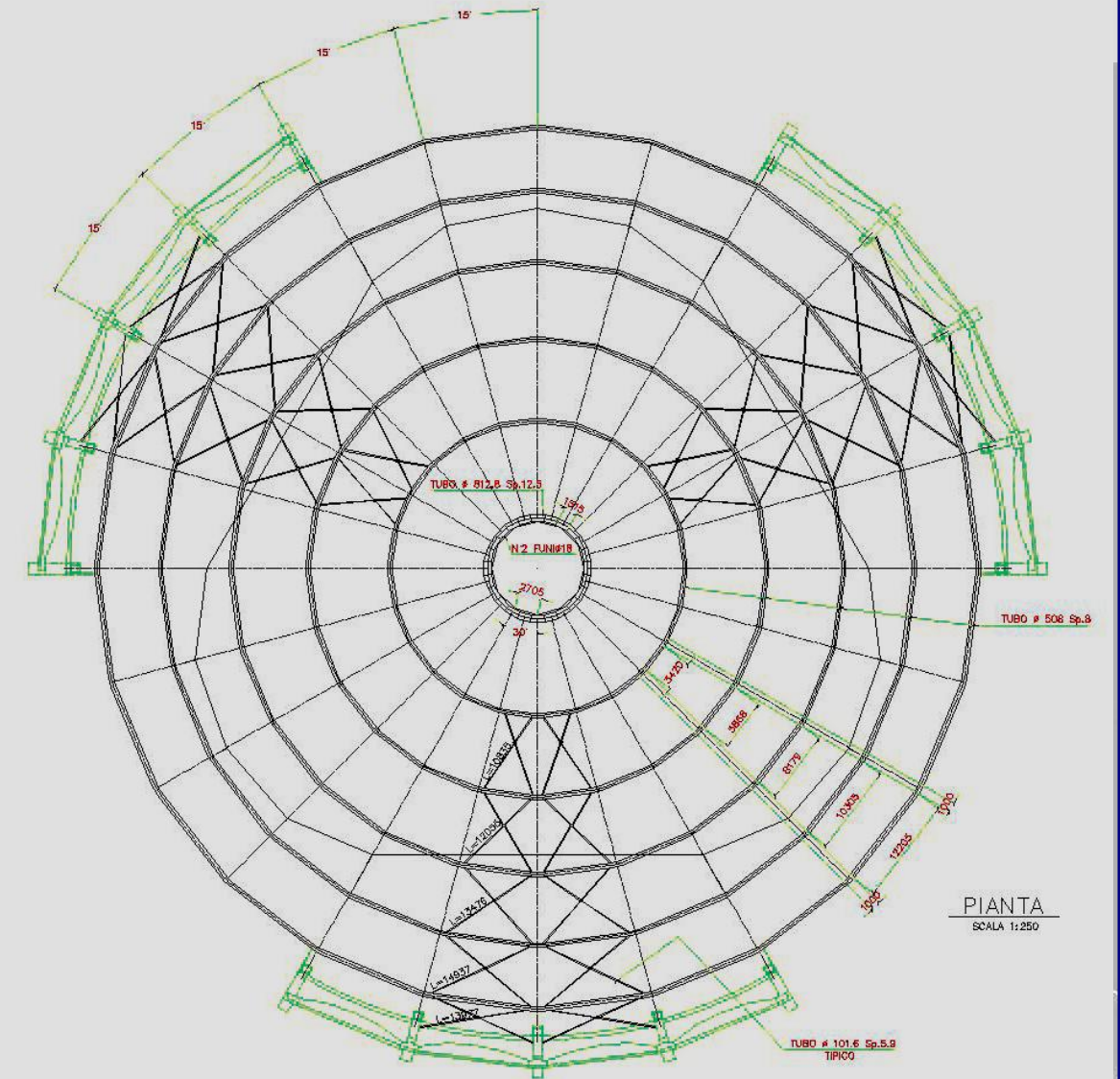
Service provided: Structural preliminary, final and executive design.

Client: Livorno Municipality

Year: 1997

Surface: 11.500 m²

Amount of works: € 5.690.000,00



PISA – BRACING SYSTEM OF THE TOWER

DESCRIPTION

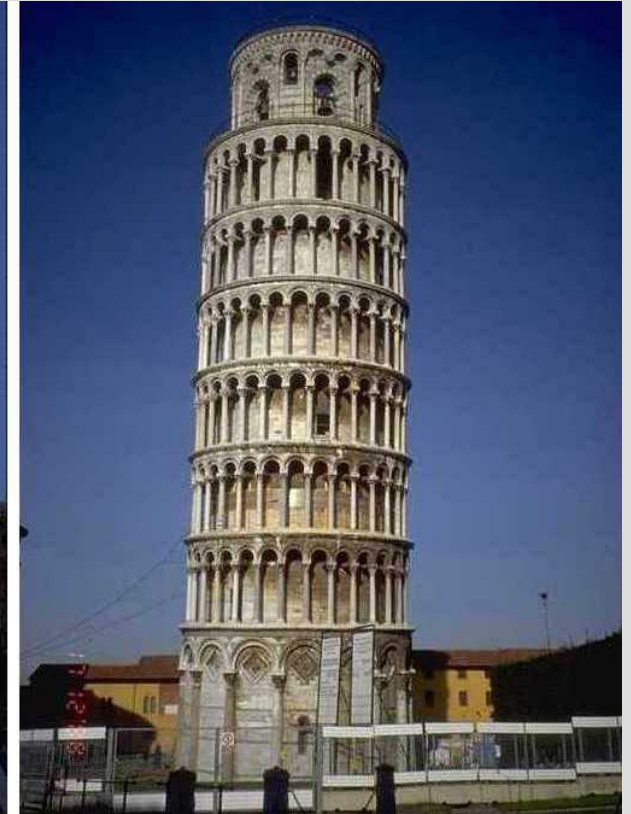
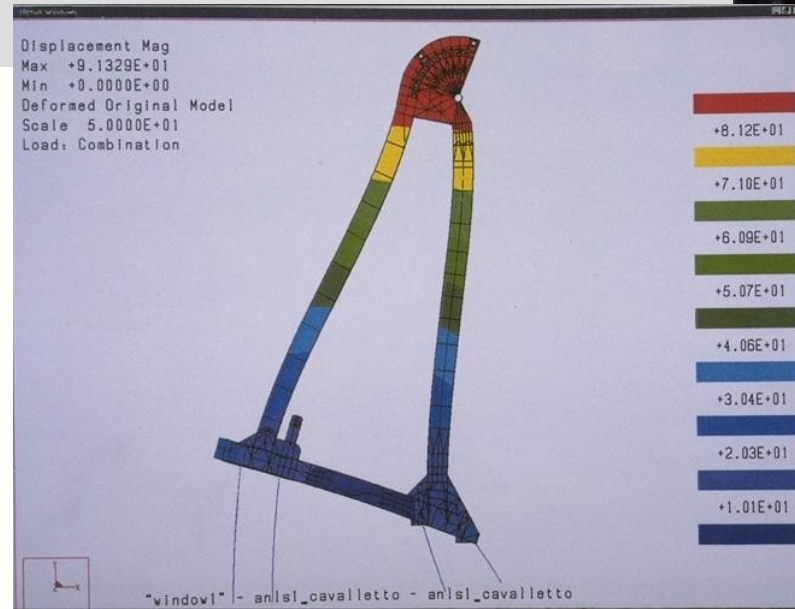
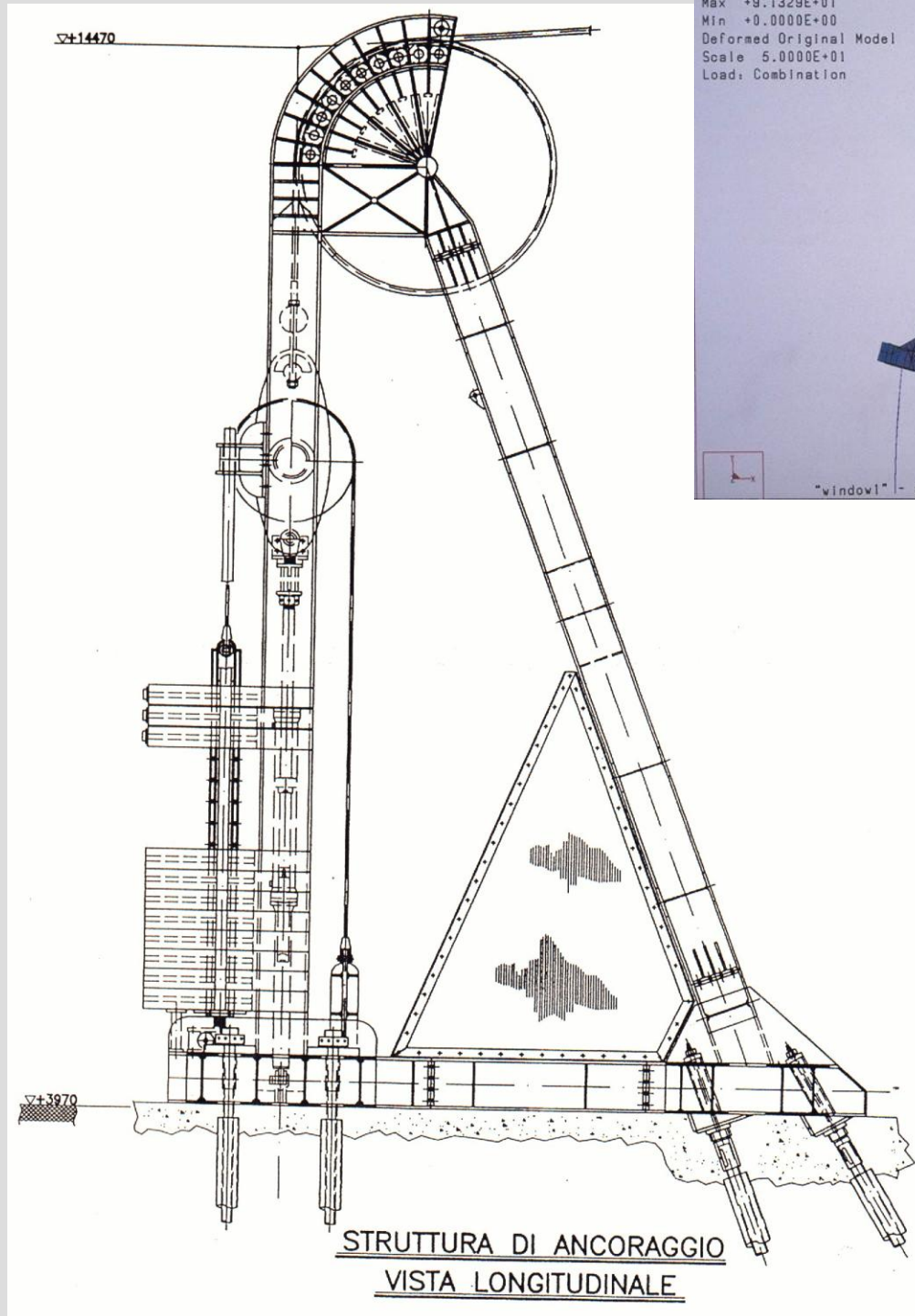
The work was carried out by the committee responsible for the consolidation and restoration work on the Tower of Pisa. The stays consist of high resistance steel cables, configured in accordance with the counter-curve tensile structure layout. The stays are able to transmit a maximum effort of 1600 kN to the Tower, generated by a drawing system made up of lead weights and oil-pneumatic drivers, which are nitrogen compensated to guarantee constant effort. The effort of the stays is transmitted to the tower using the nucleus of the tower itself as a return seat of 6+6 cables which divide up the drawing force reaching very modest contact pressure values with the masonry surface.

Service provided: Structural preliminary, final and executive design

Client: Consorzio di progettazione della torre di Pisa

Year: 1996

Amount of works: € 1.810.000



SALONICCO – OLYMPIC COMPLEX THERMIS

DESCRIPTION

The main structural systems of the complex are:

- The roofing system of the main Sport Hall
- The roofing system of the Training Hall
- The mobile flooring

The main structure is formed by a system of steel cables, which divide the construction in two symmetrical parts, giving a uniform and dynamic style to the whole building. The two sub-structures are formed by large concrete anchorage blocks and a group of reticular cable beams. The transversal beams are supported externally by cement structures, while on the inside they hang from the central tension structure by a special pendulum. The structural system of the roof is formed by a longitudinal pre-tensioned cable frame system; a system of pre-tensioned beams and a system of longitudinal system of sheet roofing.

The roofing system of the Training Hall is formed by a double layer steel structure supported by a cable system.

The flooring, made mobile by hydraulic jacks, can assume a double vertical displacement, to meet the different needs of the public of the various disciplines.

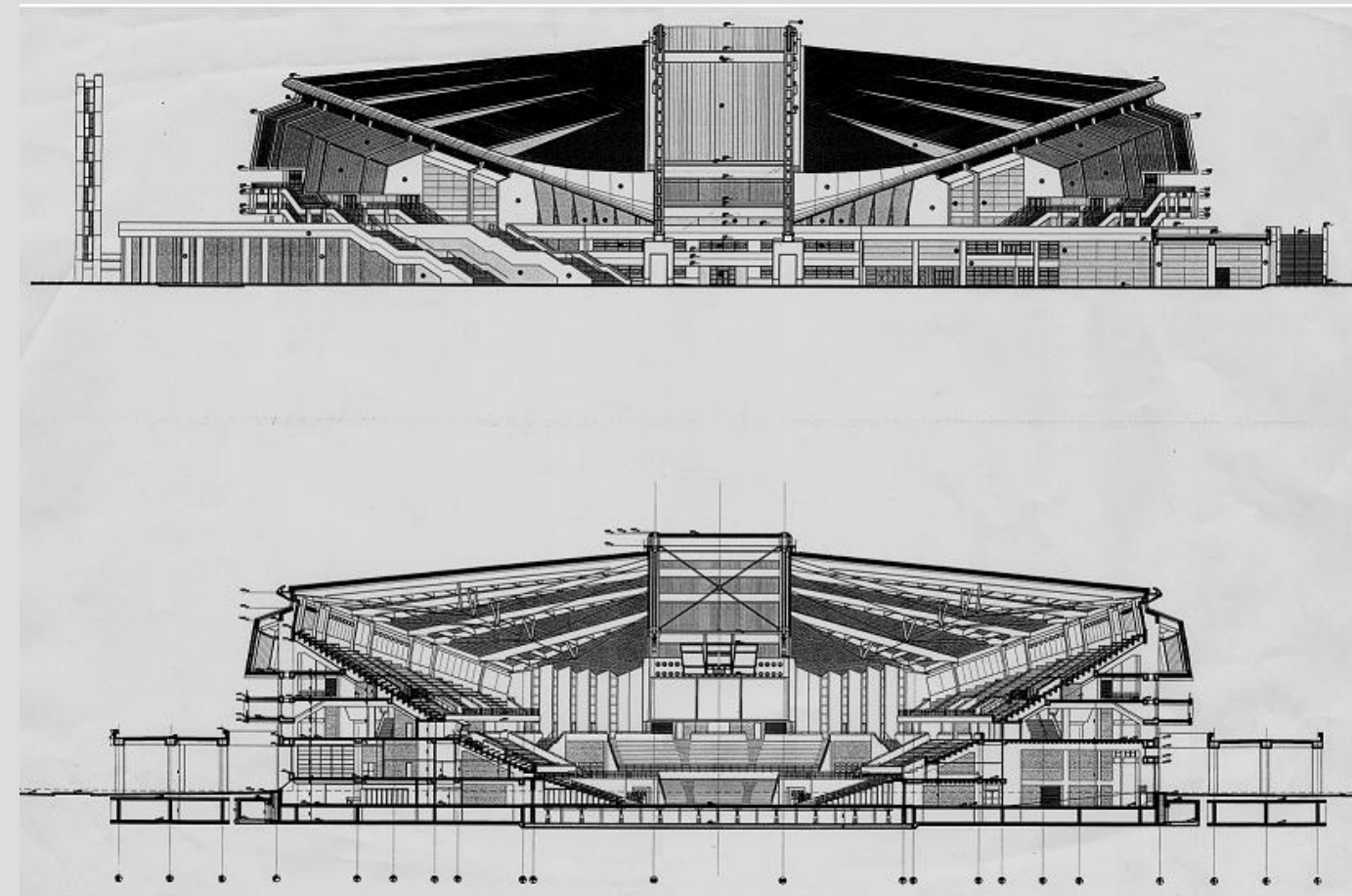
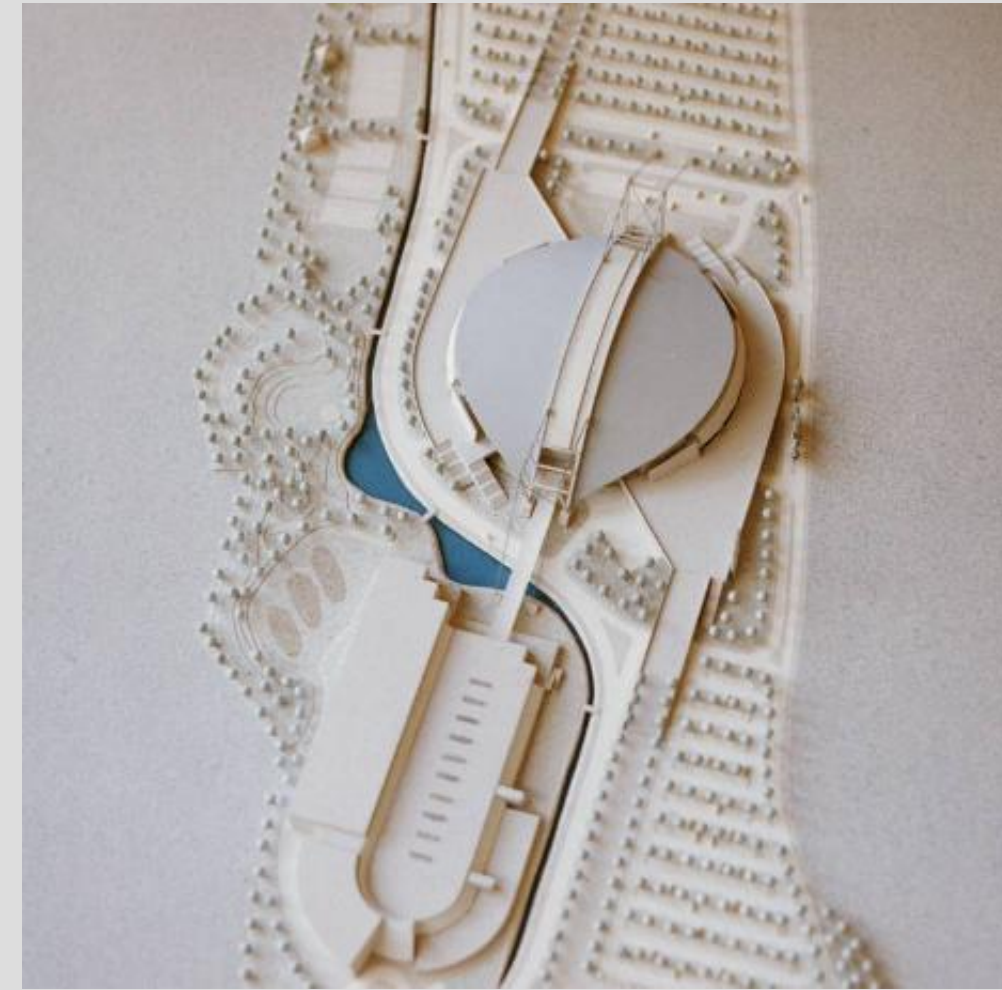
Service provided: Structural design.

Client: g.g.a.

Year: 1995

Surface: 35.000 m²

Amount of works: € 129.120.000,00



BOLOGNA – EXHIBITION HALL 20

DESCRIPTION

Pavilion P20 has 2 exhibition floors with 24x24m inferior mesh and 64m span of beams in the roofing. The reinforced beams are arranged transversally to the longitudinal axis and are on the top of the column-towers at a height of 21.45 metres. They are formed by box shaped beams, that form the upper current, obtained by coupling (according to the weak axis of the section) HEAA 900 profiles of Fe 510 C steel (S355 according to EC3) and reinforced, in the vertical floor, with 6 galvanized spiral cables of 42 mm in diameter of high resistant steel ($f_u > 1600$ MPa). The spacing uprights are made with HEAA 280 profiles of Fe 510 C steel, placed in the flat beam in a V configuration.

The beams placed in this manner have 65 metre spacing between the supports and a centre height, as the spacing between the axis of the upper and lower current, equal to about 10% of the span. The distance between the uprights is 24 metres.

The spatial conduct of the reinforced beam is reached by coupling the two flat beams at a relative distance of 8 metres, by an out of plane connection, created in correspondence of the upper current and the V shaped uprights.

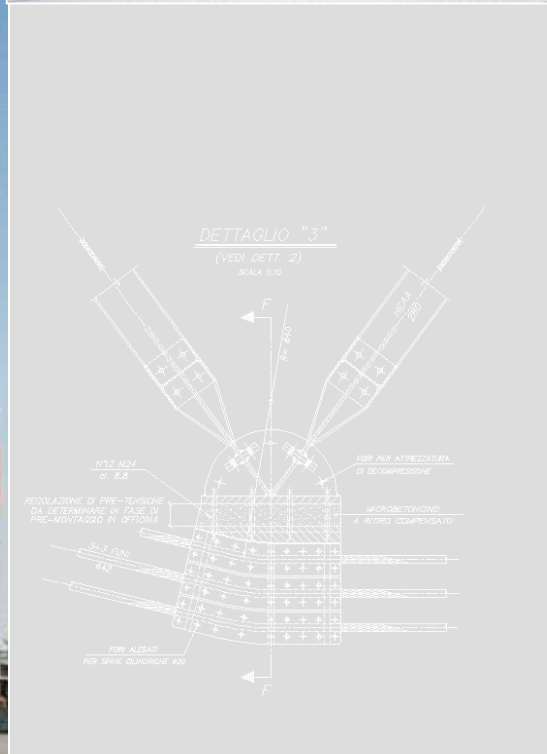
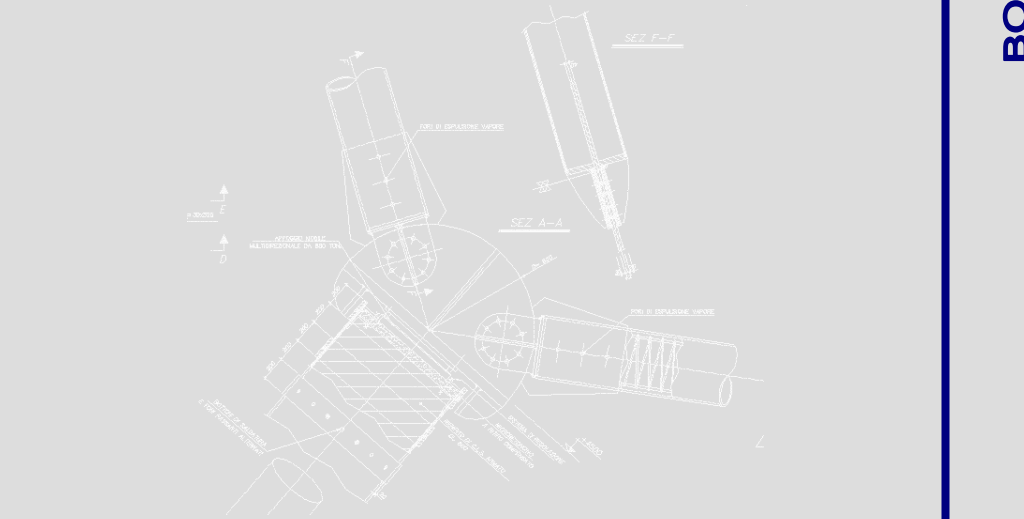
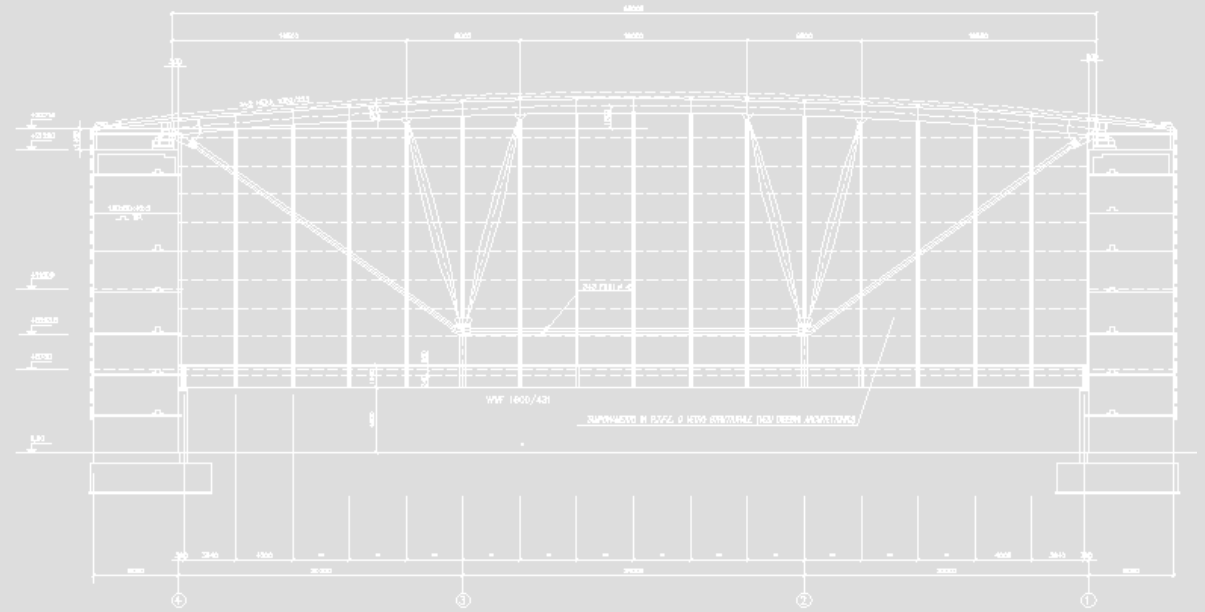
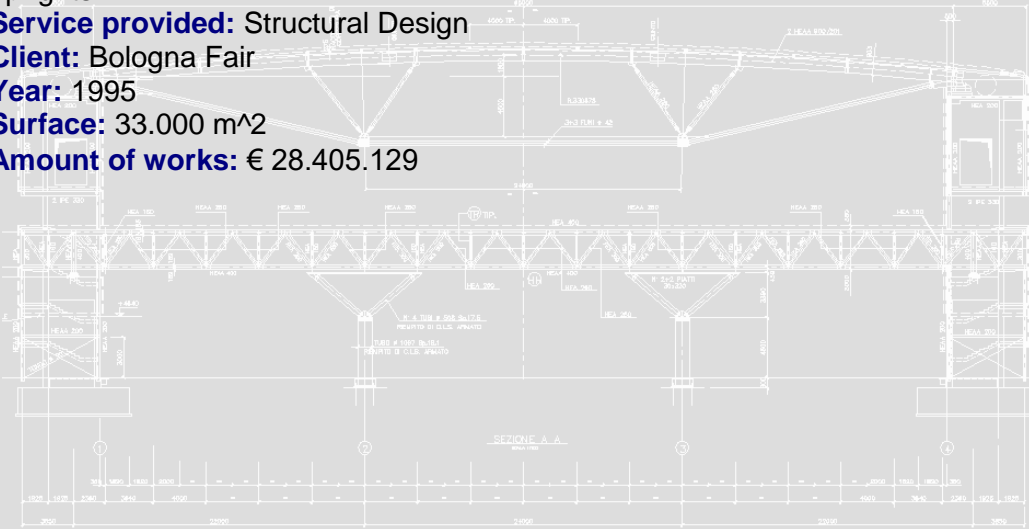
Service provided: Structural Design

Client: Bologna Fair

Year: 1995

Surface: 33.000 m²

Amount of works: € 28.405.129



RAVENNA –SPORTS HALL “PALA DE ANDRE”

DESCRIPTION

The sports hall has predominantly horizontal development and the central area is bordered by a main building with two floors in which have placed all the services. The shape of the dome allows to increase the space available for the spectators. Inside the building there are the tracks used for the movement of the stands that can be brought out and placed next to an ice rink: This technical solution makes the multi-purpose sports hall.

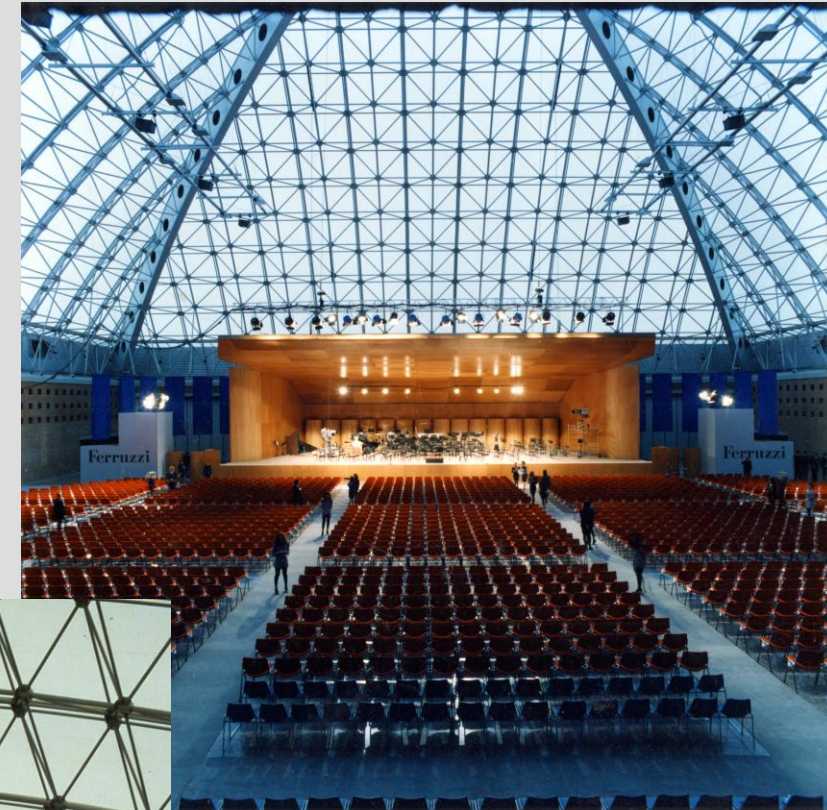
Service provided: Structural executive design

Client: Ferruzzi S.p.a.

Year: 1991

Roof Surface: 5.400 mq

Amount of works: € 3.620.000,00



TORINO – DELLE ALPI STADIUM

DESCRIPTION

The Stadio delle Alpi in Turin has an elliptical plan, three orders of stands disposed along the major sides of the stadium leaving two openings on the centerline of the curves.

The roof panels are supported by columns anchored to the ground and joined with a ring of six steel cables. The coverage of the curves consists in a Teflon membrane and a steel cable structure.

The cover system adopted for the construction of the new stadium in Turin is essentially made of:

- a plane radial tensile structure
- a inner cable ring of contrast
- two hyperbolic cable networks
- A cable-stayed anchorage system
- A gravity foundation system

Service provided: Structural Design

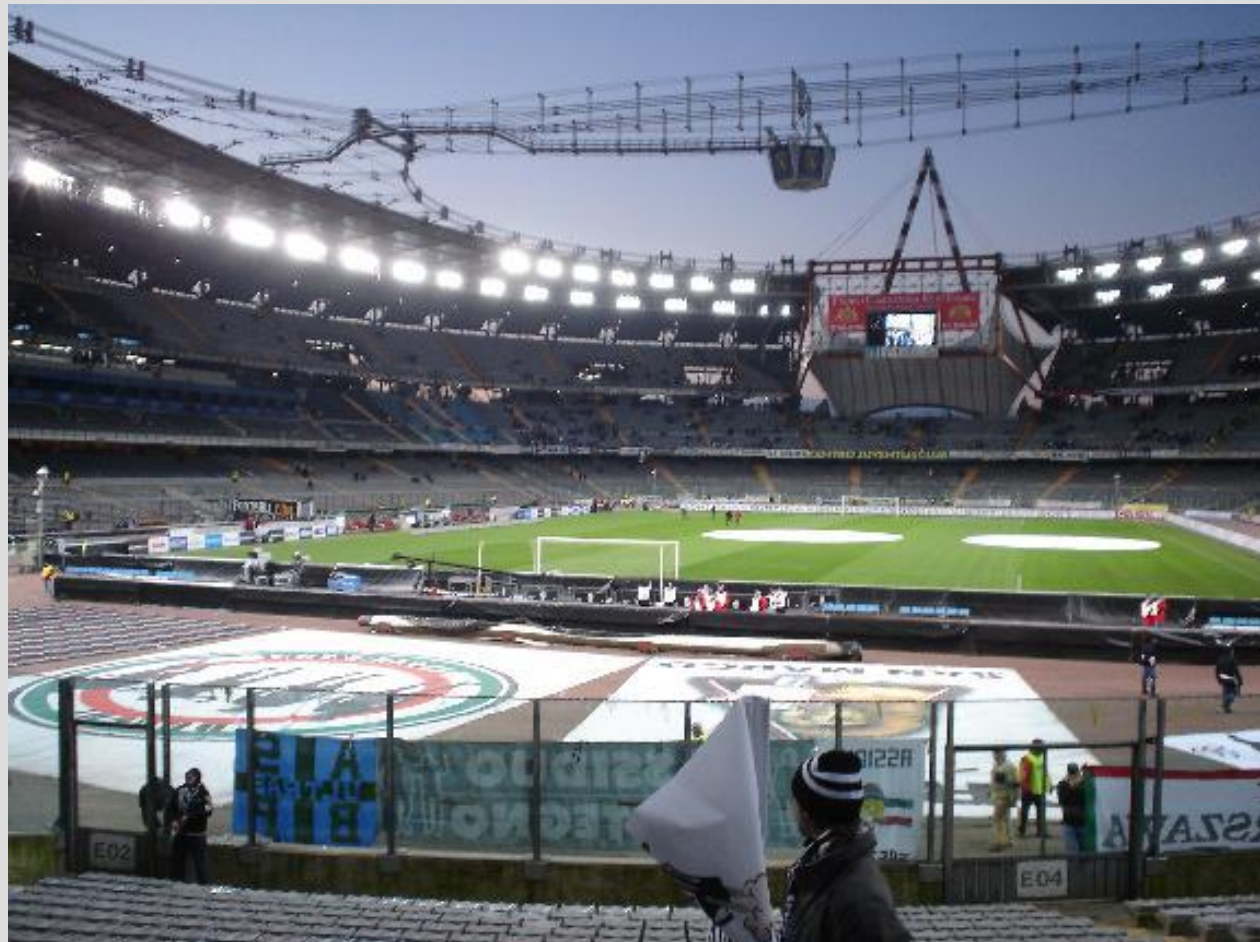
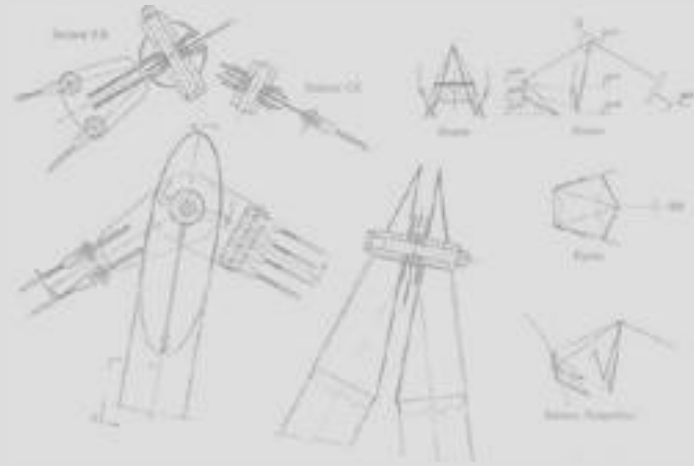
Client: ACQUA MARCIA S.p.a.

Year: 1990

Roof Surface: 40.000 m²

Number of seats: 77.000

Amount of works: € 65.000.000,00



ROMA – OLYMPIC STADIUM

DESCRIPTION

The tension structured system used for the roofing of the Olympic Stadium in Rome is formed by a system of 88 flat tension structures with supporting/stabilizing cables and vertical hangers, arranged radially with a maximum distance of 12 metres. The external cables are anchored by adjustable devices, that correspond to the nodes of a ring-shaped reticular spatial structure; inside they are connected to a tensioned inside ring.

Depending on the state of stress and deformation, the flat tension structures have been sized differently and joined in two groups. The arrangement of a secondary support of the roof covering is joined to the radial arrangement of the flat tension structures. The beams are made of a reticular frame and are suspended at the level of the stabilizing cables and secured by a simple support. The roof covering, supported and connected to the extrados of the parallel tubular secondary beams, is formed by a glass fibre membrane, coated with con P.T.F.E.

Service provided: Structural Design

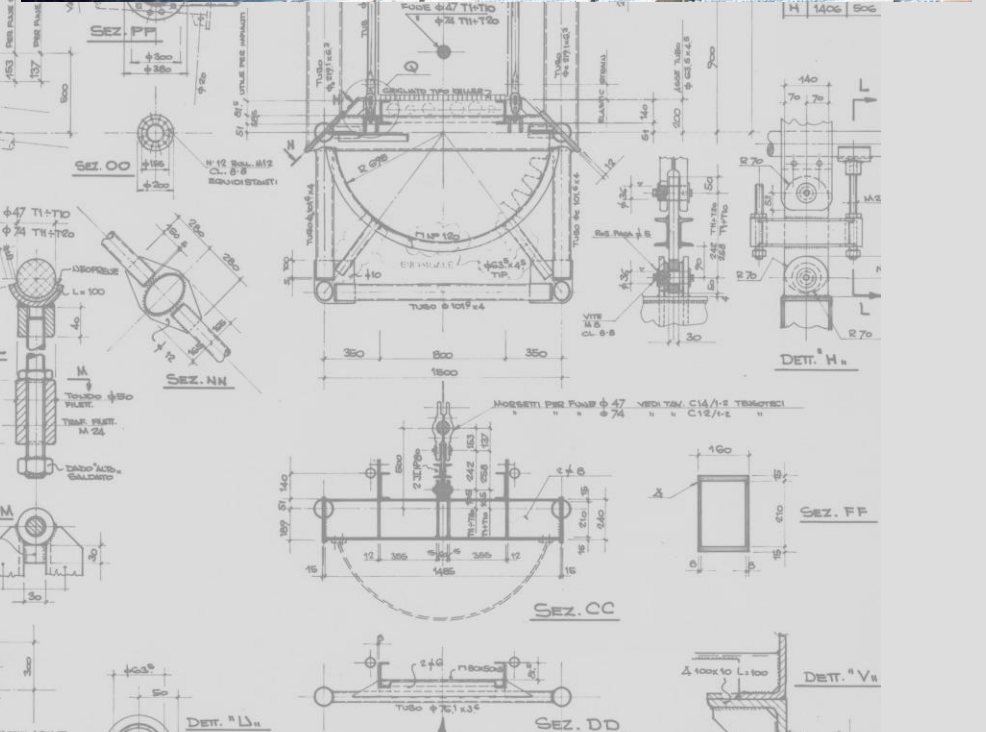
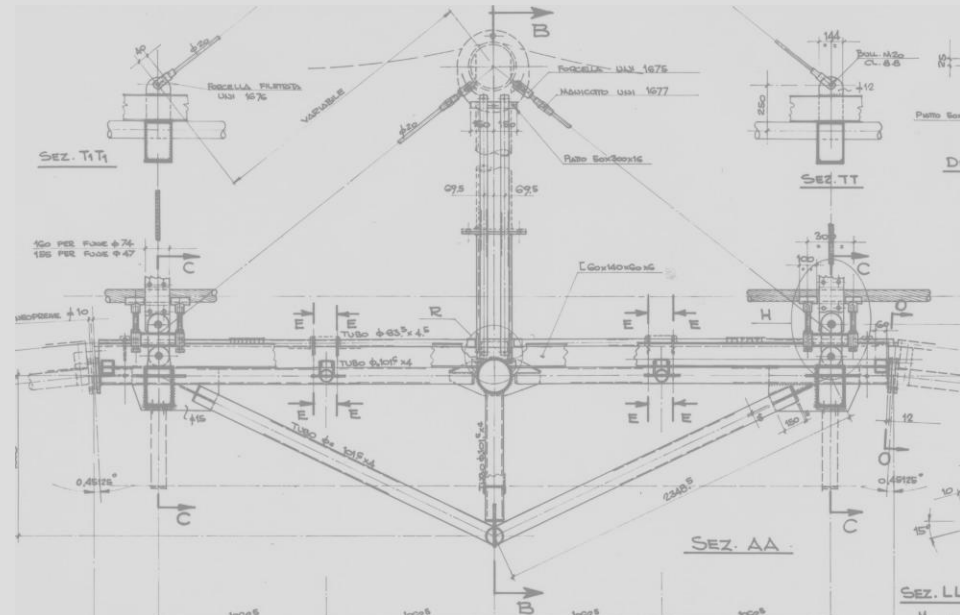
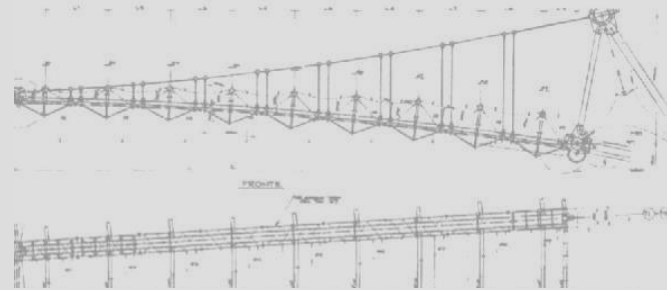
Client: CONI - Roma

Year: 1990

Roof Surface: 50.000 m²

Number of seats: 85.000

Amount of works: € 80.000.000,00



ATHENS – SPORTS HALL

DESCRIPTION

The circular building has a diameter of about 114m. The roofing is composed of a double curvature tension structure, network cables having in plan, a 4x4 metre grid.

The cable structure, or the suspended roofing, consists of an orthogonal mesh network, whose saddle surface has a total negative curvature with shape similar to a hyperbolic paraboloid. The cables that support the 77 mm high corrugated steel roof covering, are anchored to a box section ring bordered structure made of pre-stressed concrete.

The ring is, in its turn, supported by 32 trestles made of pre-stressed concrete.

The sports complex has been designed for a capacity of about 15,000 spectators.

In plan it has the shape of an inverted truncated cone, whose geometry derives from the solution adopted to solve the problem of the visibility of the spectators.

Service provided: Structural design of the roof

Client: Athletics General Secretariat

Year: 1983 - 1987

Dimensions: Seats 15.000, Parking 5.000 m²

Amount of works: € 3.000.000

