Group 1

Gentry, Tyler + Hochstein, Samantha + Pasillas, Anel + Smuda, Peter

Case Study :

- Santiago Calatrava's Satolas TGV Station
- Pier Luigi Nervi's Exhibition Building

Santiago Calatrava

Biography:

- Architect, artist, and engineer.
- Born on July 28, 1951, near Valencia, Spain.
- Electric Background.
- His family on both sides was engaged in the agricultural export business, which gave them an international outlook.

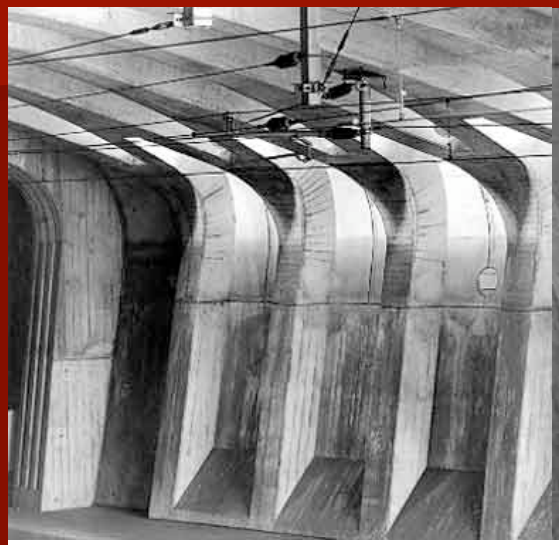
Calatrava Bio Cont'd

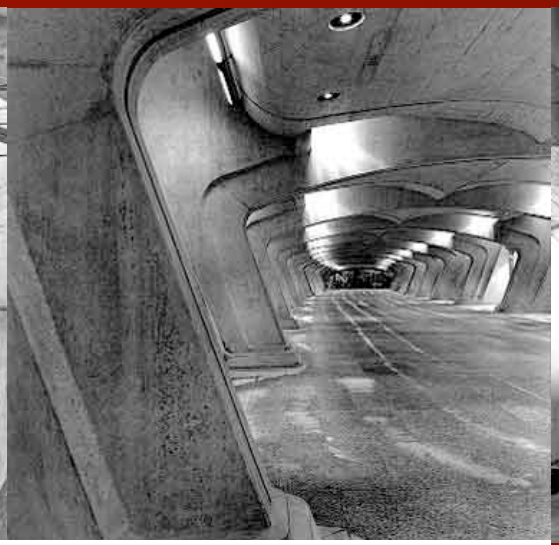
- Calatrava went to primary and secondary school in Valencia.
- At 8 years old, he attended the Arts and Crafts School, where he began his formal instruction in drawing and painting.
- At 13 years old, his family sent him to Paris as an exchange student.
- Later he traveled and studied in Switzerland.
- He enrolled in the Escuela Tecnica Superior de Arquitectura in Velencia, where he got a degree in architecture.
- Calatrava decided to pursue post-graduate studies in civil engineering. He enrolled in 1975 at the Federal Institute of Technology in Zurich.

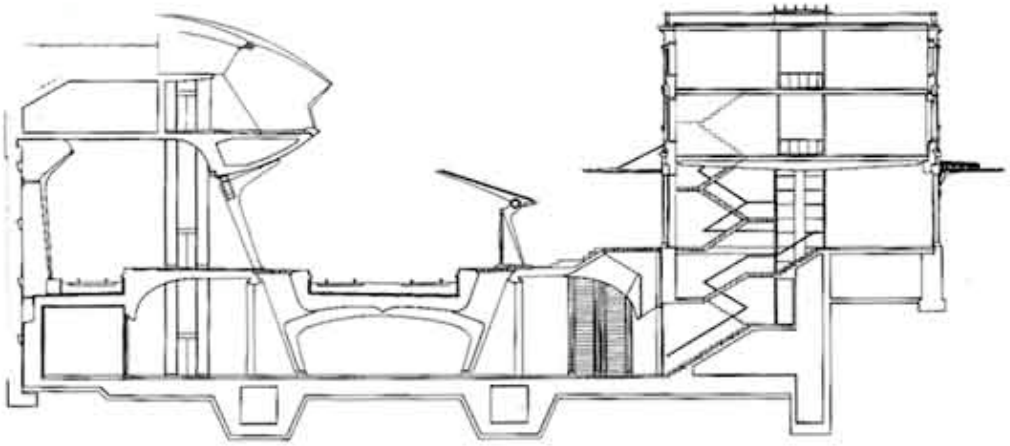
Calatrava Bio Cont'd

- Calatrava began working with small engineering commissions.
- He also began to enter competitions, feeling that this was his most likely way to obtain commissions.
- In 1983, he won his first competition for Stadelhofen Railway Station in Zurich.
- In 1984, Calatrava won another competition to design and build the Bach de Roda Bridge
- This was the beginning of the bridge projects that created his international reputation.

Calatrava Works Cont'd:



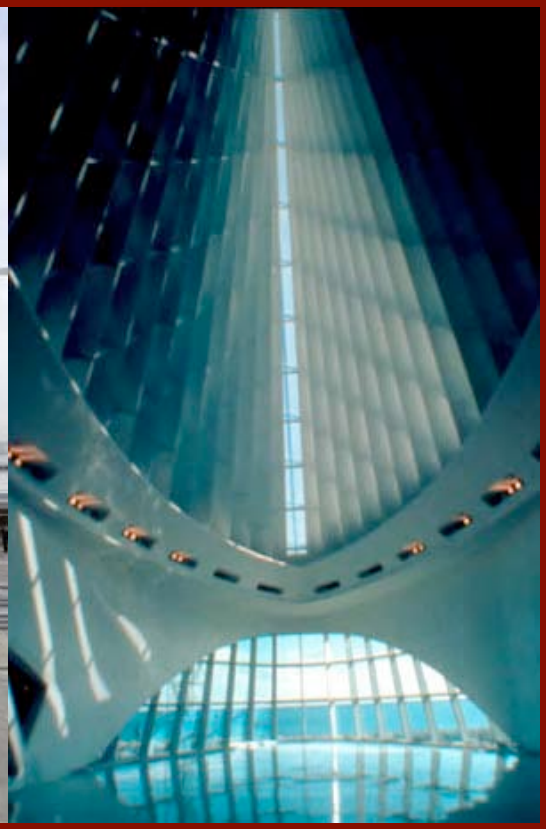




Stadelhofen Train Station. 1983-90. Section.

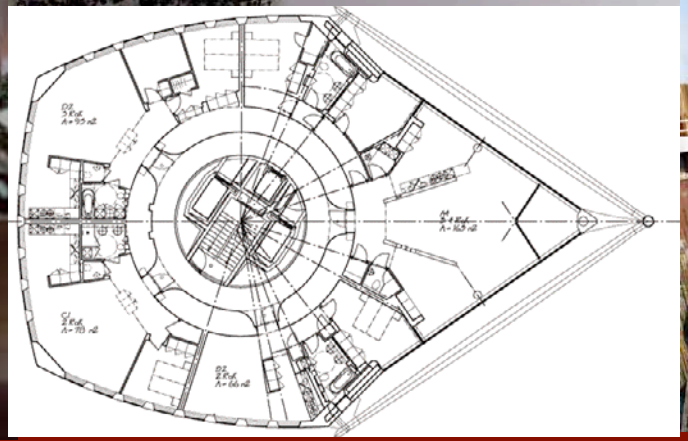
Stadelhofen Station

Calatrava Works:



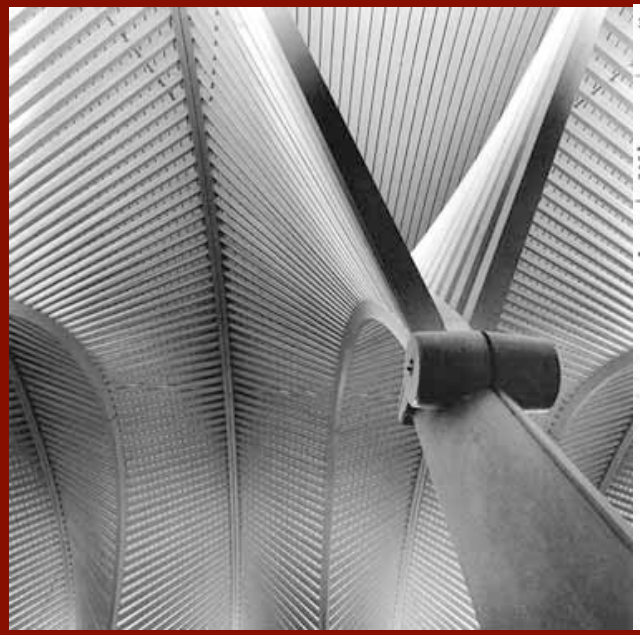
The Milwaukee Art Museum (addition), the Quadracci Pavilion, was Calatrava's first U.S. built building project.

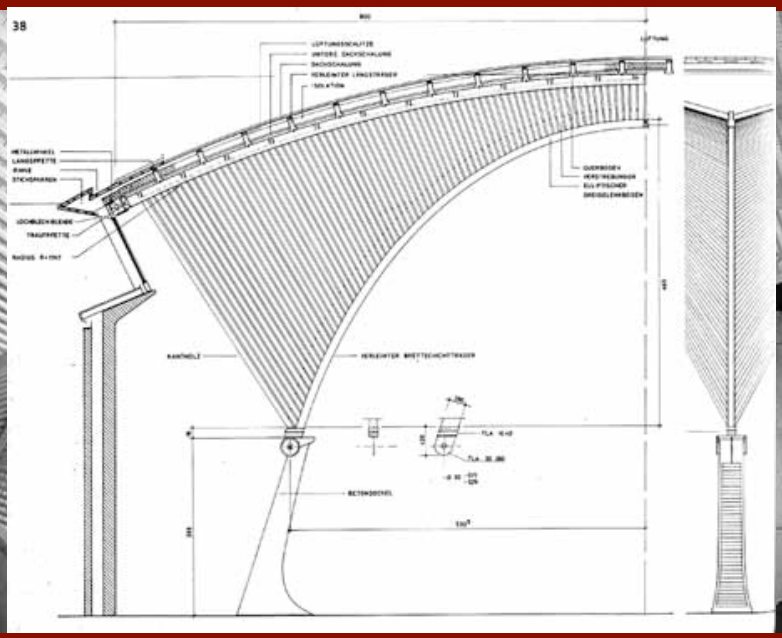
Calatrava Works Cont'd:

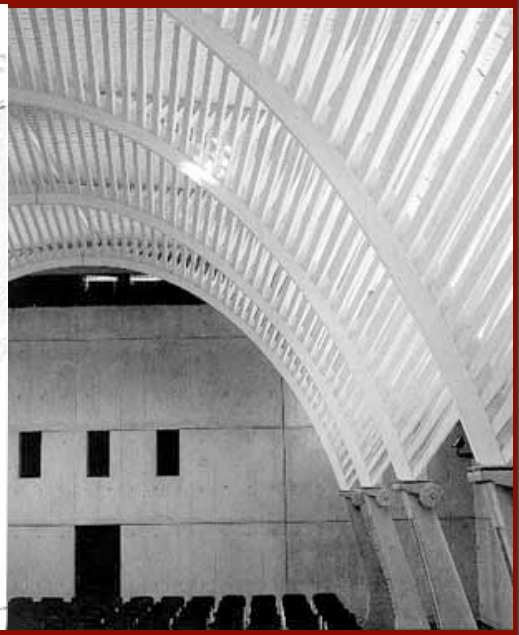


Turning Torso is a residential and commercial tower based on a sculpture that Calatrava made years ago. It is to be in Sweden.

Calatrava Works Cont'd:



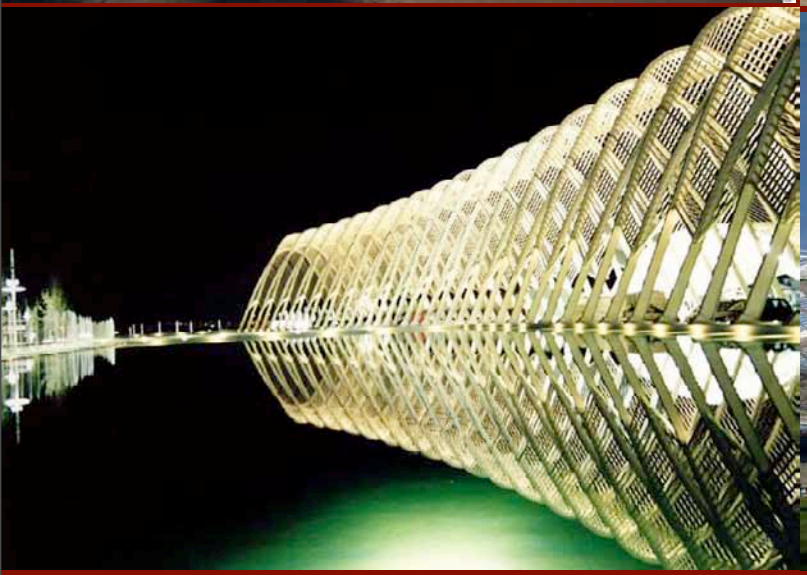




Wohlen High School

Calatrava Works Cont'd:

2004 Olympics, Athens, Greece.



Calatrava Works Cont'd:

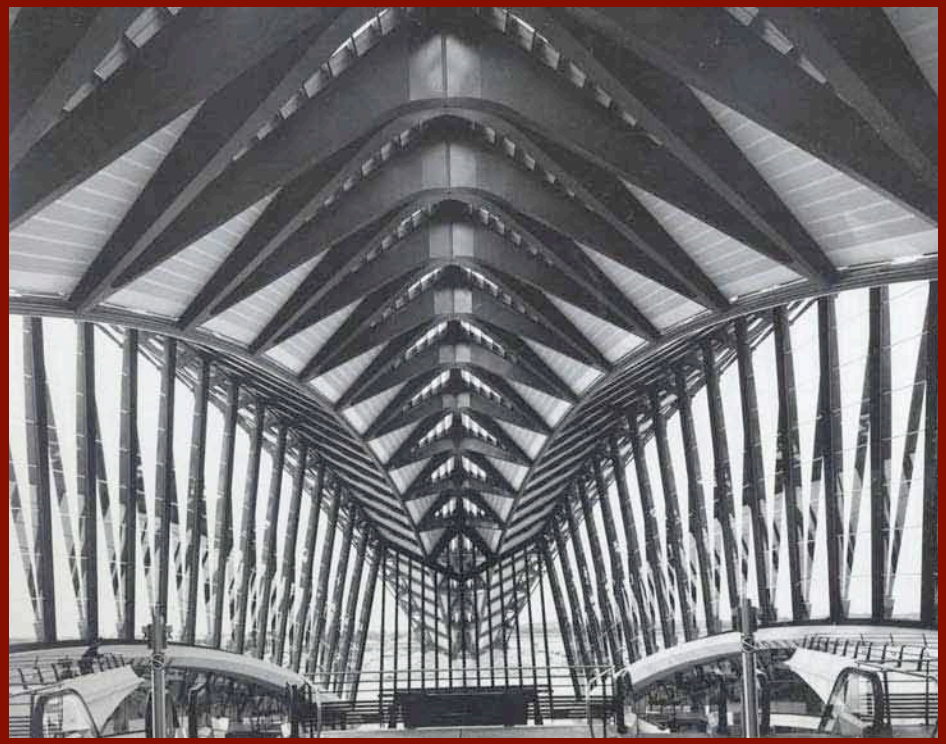
PATH Terminal

Satolas TGV Station

Satolas TGV Station

- **Location:** Lyons, France
- **Client:** French Railways (SNCF), Region Rhone Alpes, Lyons Chamber of Commerce and Industry (CCIL)
- **Architects:** Santiago Calatrava
- **Project Architects:** Alexis Bourrat, Sebastien Mamet
- **Project Team:** Dan Burr, David Long
- **Work Supervision:** Planitec DTX
- **Major Contractors:** E.I.-G.F.C.-M.S
  Eiffel; Berretta-Girardet-Instalux
  Leon Grosse
  G.T.M.
  Baudin-Chateauneuf
- **Project Design Date:** 1989
- **Project Completion Date:** 1994

Program



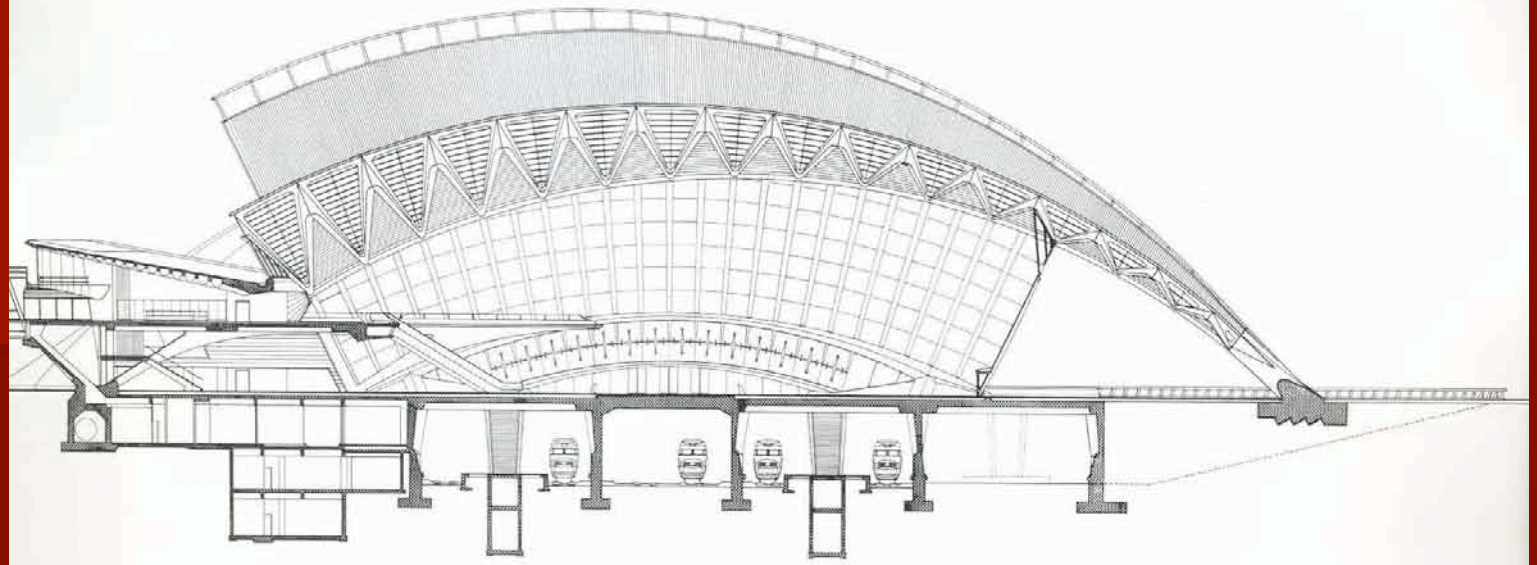
- Competition won by Calatrava.
- The competition brief stated that the clients sought an exciting symbolic structure to serve as a landmark, which would at the same time be pleasant to use.

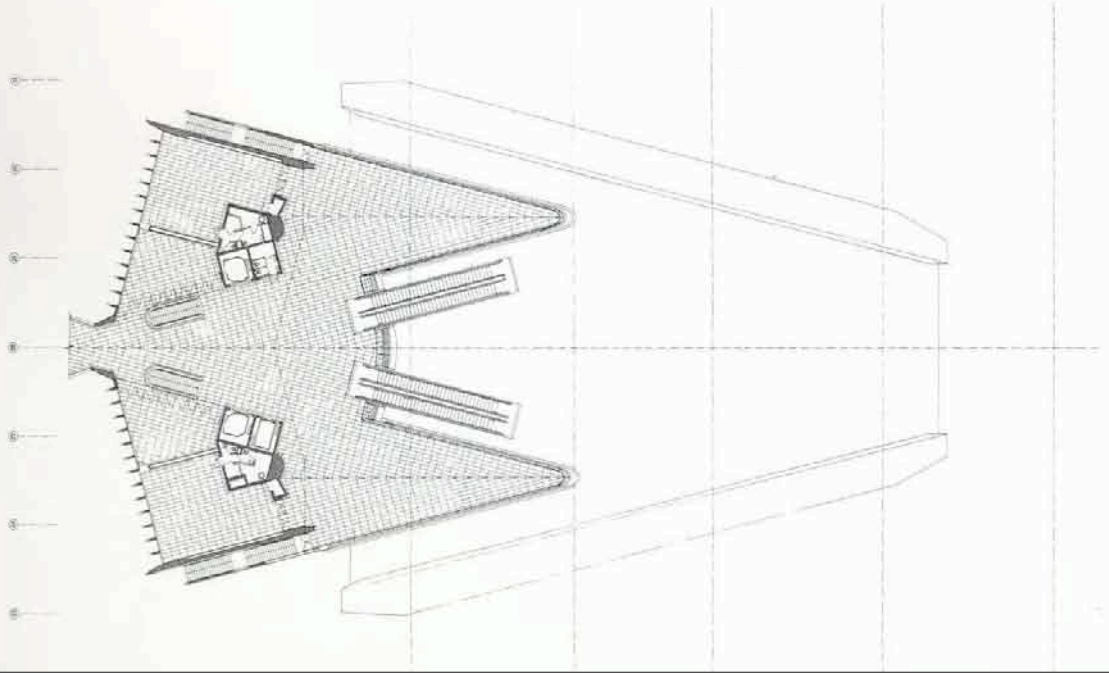
Program

- The station is made of 2 elements: the tunnel for the trains (built of reinforced concrete), and the large access and distribution hall resting on top of it (built with metallic structure)

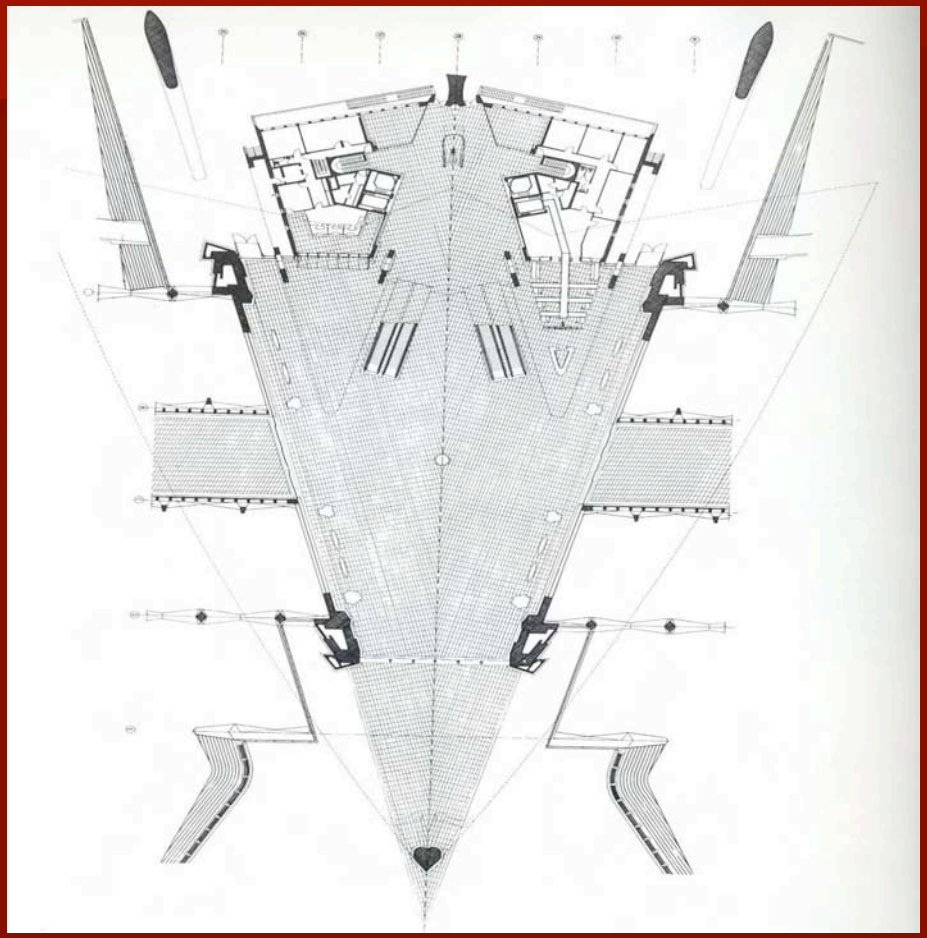
Program

- The station hall is placed symmetrically over the tracks.
- There is a 500 meter long covered train platform.
- The station hall is connected to the airport through a covered steel gallery.
- The bus and taxi terminals are on the west side of the station hall.



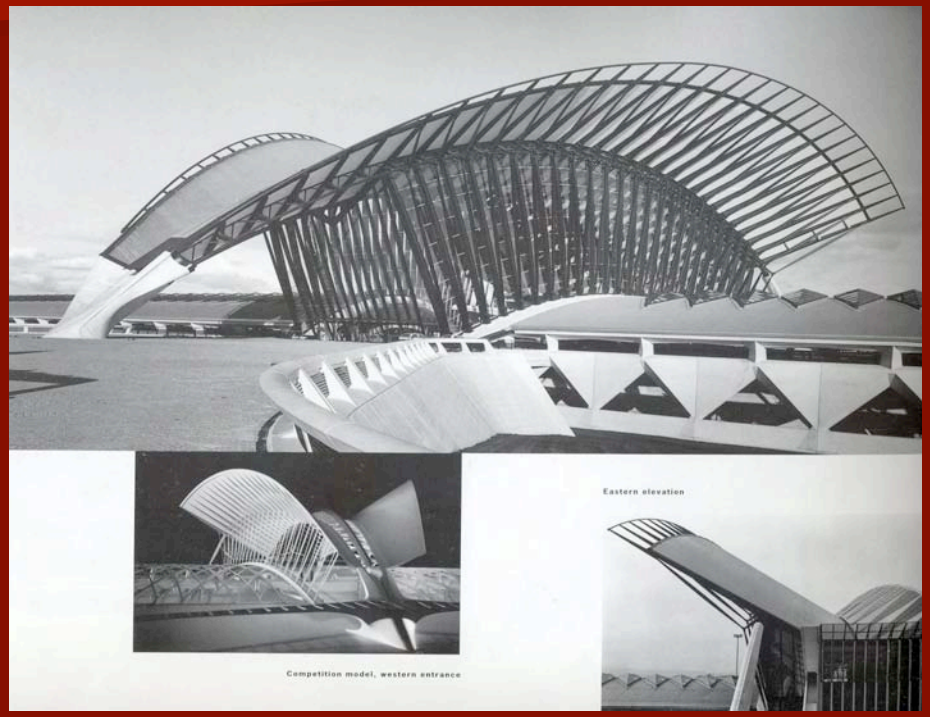


Program



- The station has 6 tracks.
- The center two pass through a caisson for nonstop trains which are traveling at full speed.

Site Context Consideration



- Lyon became connected by rail to the airport at Satolas
- Towns further away received a direct link to the airport through the high speed rail network.

Site Consideration

- They selected an expressive and easily grasped form, the image of which can be readily associated with the region when seen from both the ground and the air.
- It symbolizes the idea of flight and passage, the character of the mountain scape, and the notion of soaring.

Historical Context Consideration

- They felt that the existing architecture of the airport should be preserved and enhanced by the new building.
- Therefore, they framed the front of the building and conserved the symmetry of the complex as much as possible.

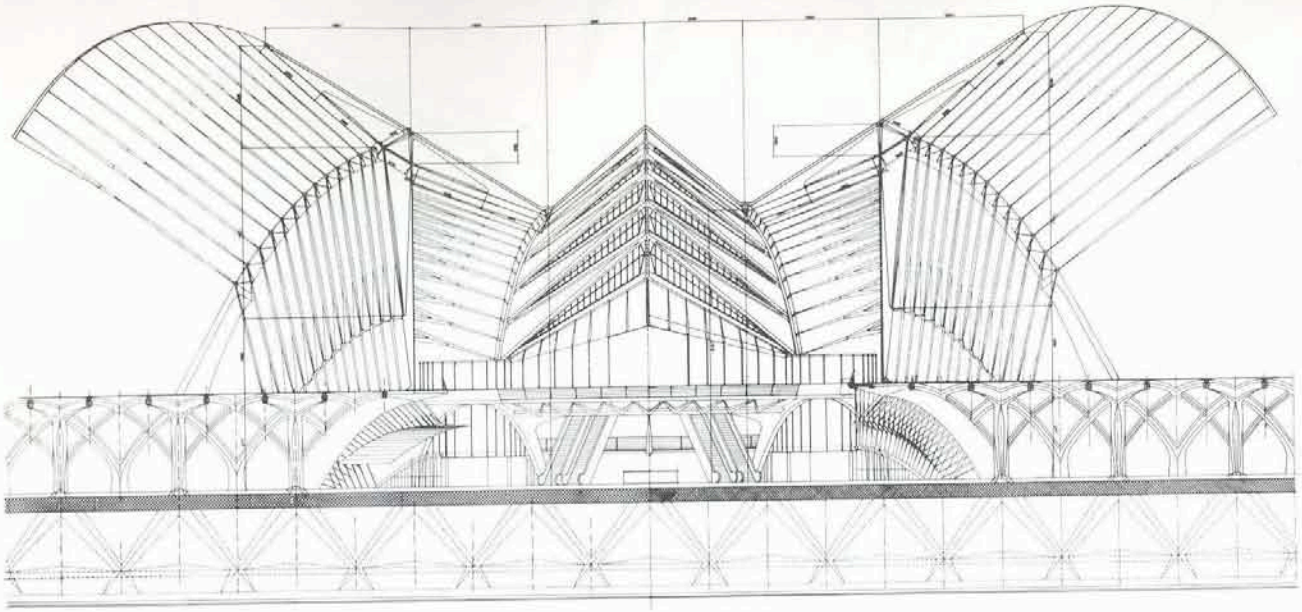
Esthetic Considerations

- The complex gives the idea of lightness although it uses heavy materials - steel and concrete.
- It was intended that passengers should not be in doubt that they are arriving at the airport.
- Therefore, the platform roofs were lowered to give an unobstructed view of the station against the background of the airport building, and the traffic access was arranged to approach the main building from the front to emphasize its appearance and function.

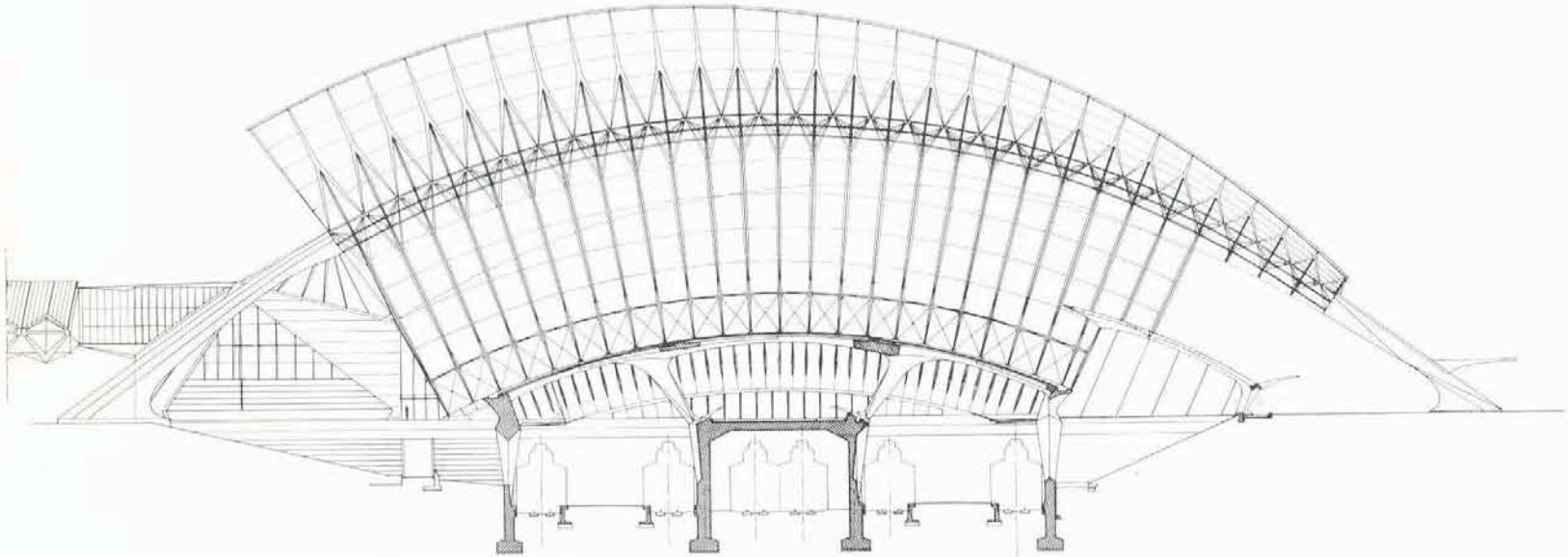

PORTE ALPES

Esthetic Considerations

- He dictated the kinds of movement that take place there: flow of trains, buses, cars, and pedestrians.
- There was a special stipulation related to movement: good passenger orientation.
- The size and directions of the volumes keep passengers oriented.
- The roof accomplishes this the best. It is complex, highly recognizable, identifiable, and memorable. The shape is to resemble the silhouette of a gigantic bird that "unfolds its wings longitudinally over the platforms" as if ready to



Early design, cross and longitudinal section of station hall

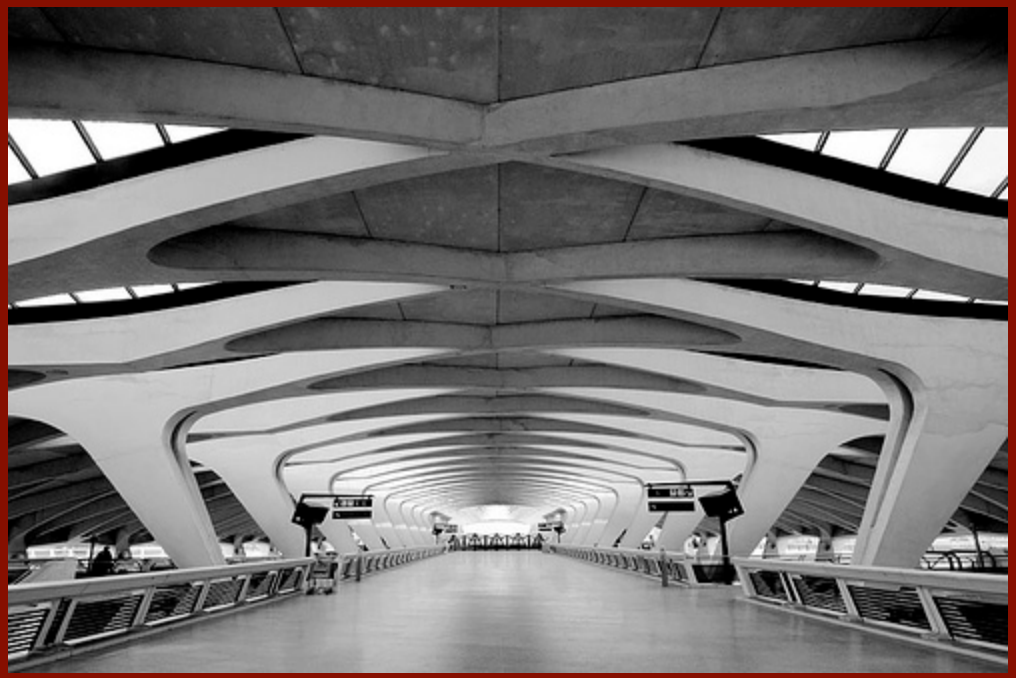


Structural Considerations

- The train tunnel is made up of a series of modular elements in reinforced concrete, cast on site with steel forms.
- The basic module is 9 meters long and refers to the length of one car of the train. The structure becomes more and more open as it nears the exterior.

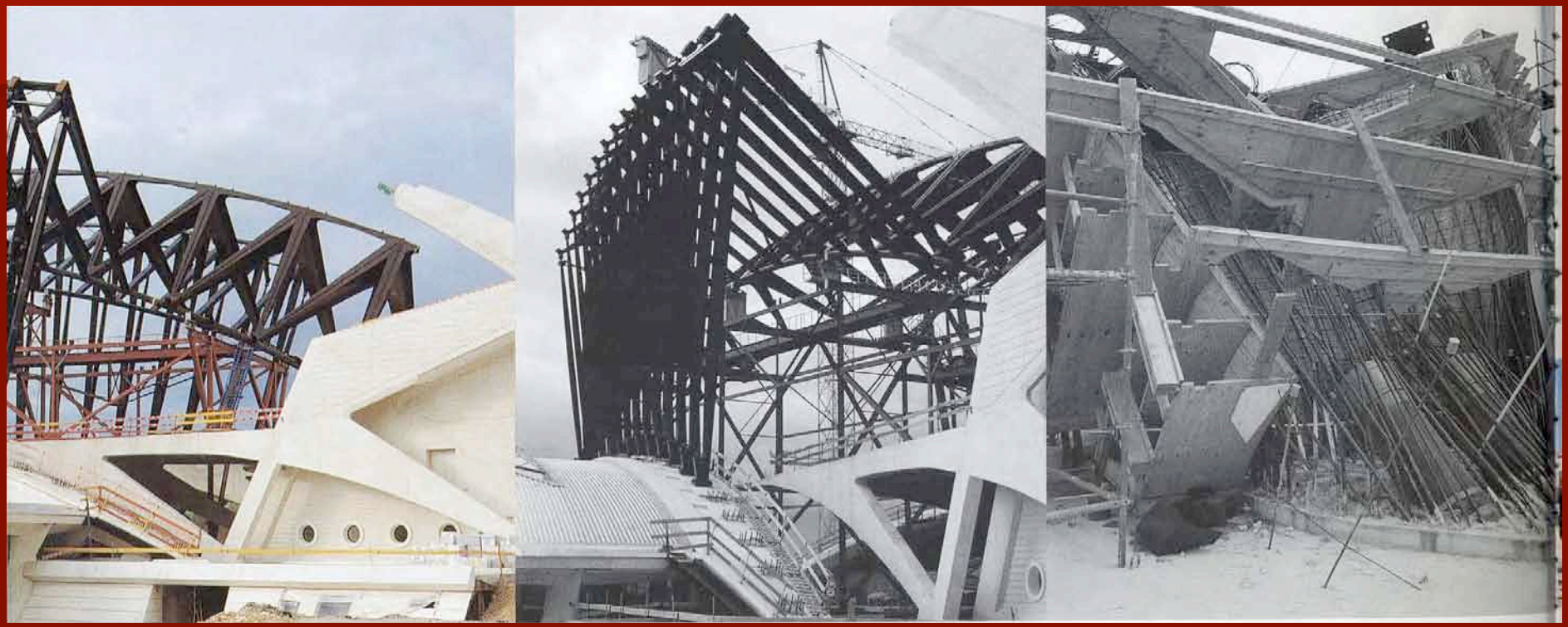
Structural Considerations

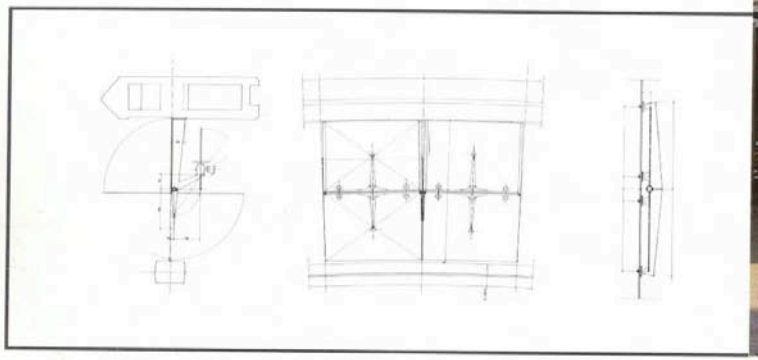
- The support structure for the platform roof is assembled out of inverted “V” like concrete elements.
- This 53 meter wide web-like concrete nave is glazed above the areas of passenger movement.



Structural Considerations

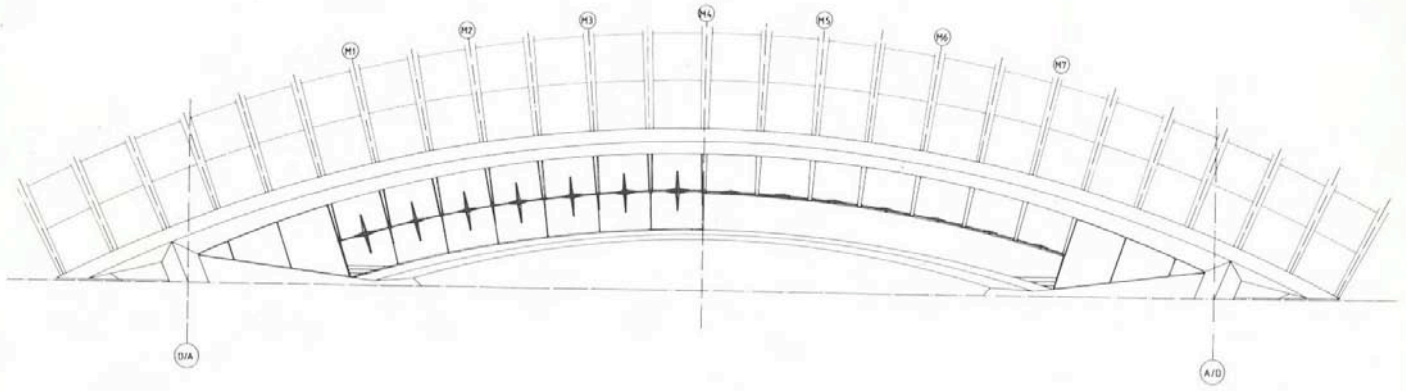
- The station hall roof is supported by 2 steel arched.
- Two more steel arched beams follow the line of the middle ribs of the roof.
- All 4 curved beams span 100 meters, supported by one concrete abutment in the west.
- The glazed screens rest on large concrete arches spanning the width of the station while smaller arches below from portals to the station walkways.
- The space between these arches is fitted with glass sheets which can be rotated for ventilation purposes.



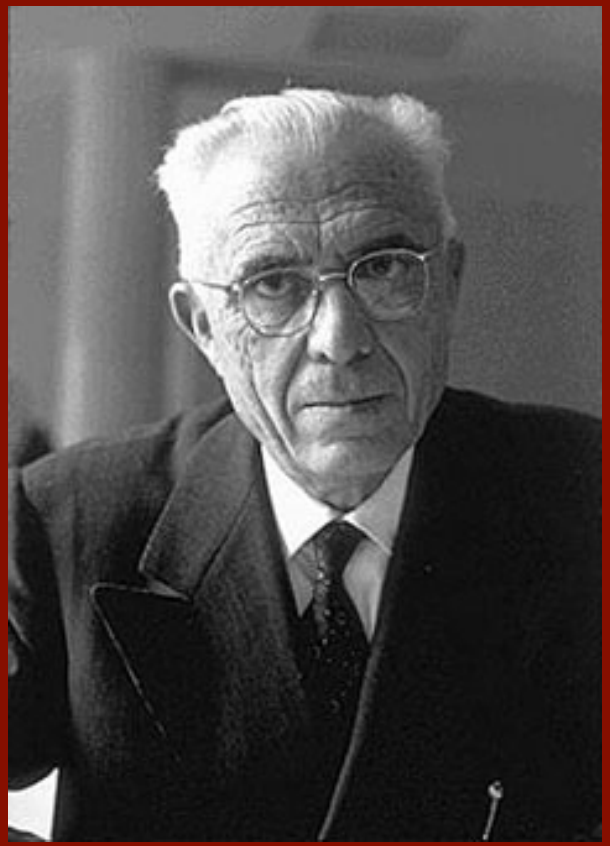


Function, ventilation windows
between concrete arches

Concrete portal arches and platform access



Pier Luigi Nervi



Biography:

- Architect, builder, and engineer.
- Born on June 21, 1891, in Sondrio, Italy, in the Alps. Died in 1979.
- Son of a postmaster.
- He graduated from the School of Civil Engineering in Bologna in 1913
- In 1923 Nervi started his own firm in Rome.

Nervi Bio Cont'd:

- Nervi's first all-concrete building was a small cinema in Naples, this was in 1927.
- In 1929, he designed the Municipal Stadium in Florence. The grandstand roof cantilevered 55 feet, the exterior stairs were cantilevered spirals, and this stadium established his reputation.
- 1932 – He formed a new firm – Nervi + Bartoli
- 1936 – that company developed a series of airplane hangars which were reinforced concrete.
- 1946 – Nervi began lecturing on architectural engineering at Rome University.

Nervi Bio Cont'd:

- Quote: "Be yourself! Achieve what you want through initiative and effort!"
- After graduation he joined the Society for Concrete Construction.
- During World War I, he was part of the Italian Army in the Corps of Engineering.
- He designed and created a boat hull out of reinforced concrete as a promotion for the Italian government.

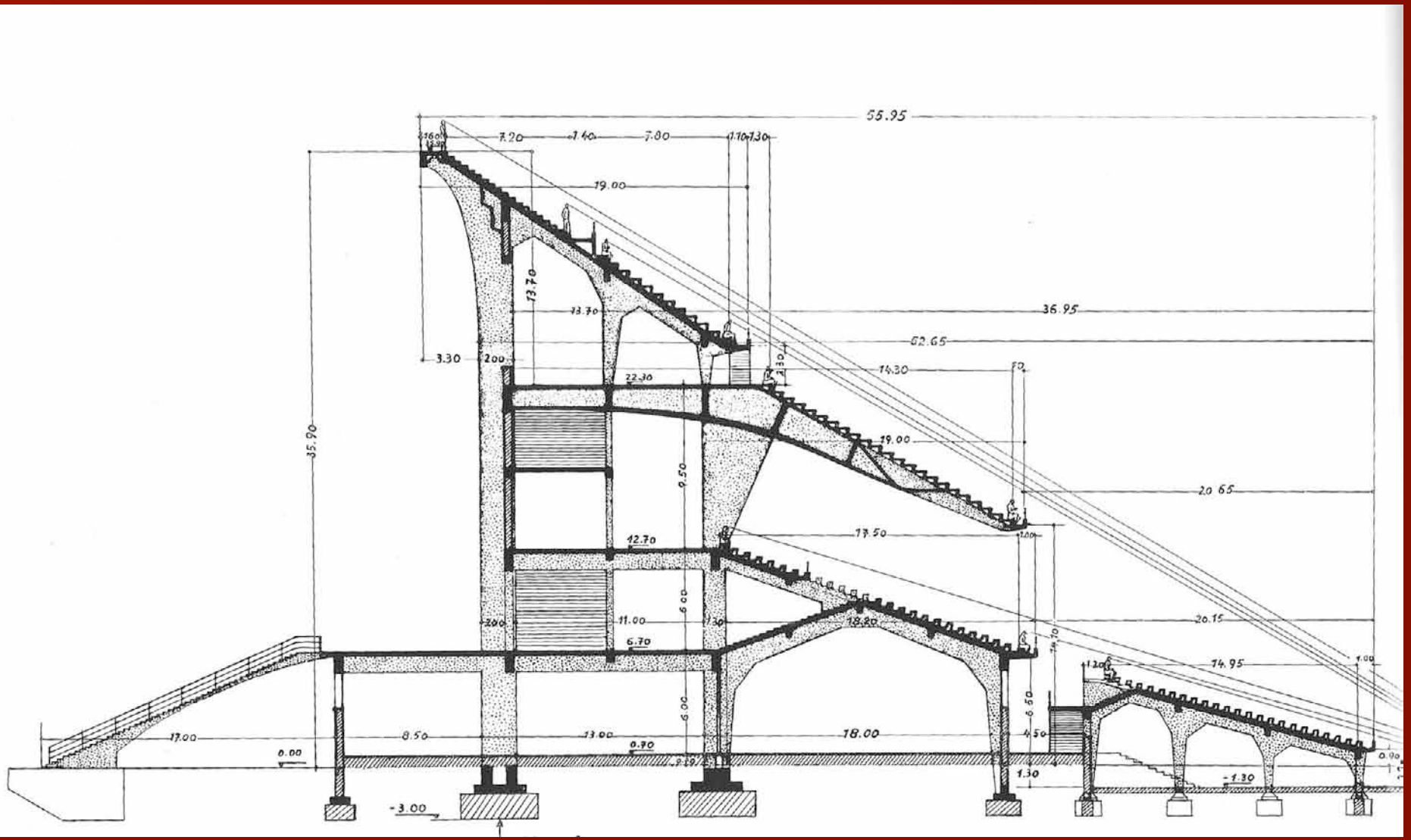
Nervi Works:

Other works by Pier Luigi Nervi:

Stadio Artemio Franchi in Florence (1931)
UNESCO HQ in Paris (1950)
Palazzetto dello sport in Rome (1958)
Olympic Stadium in Rome (1960)
Palazzo del Lavoro in Turin (1961)
George Washington Bus Station in New York City (1963)
Tour de la Bourse in Montreal (19640
Field House at Darmouth College
Thompson Arena at Darmouth College
Cathedral of Saint Marty of the Assumption in San Francisco, CA (1967)
Good Hope Centre in Cape Town (1976)
Norfolk scope in Norfolk, VA (1973)

A few of Nervi's projects…


POPOLARI
L 4
POPOLARI
L 4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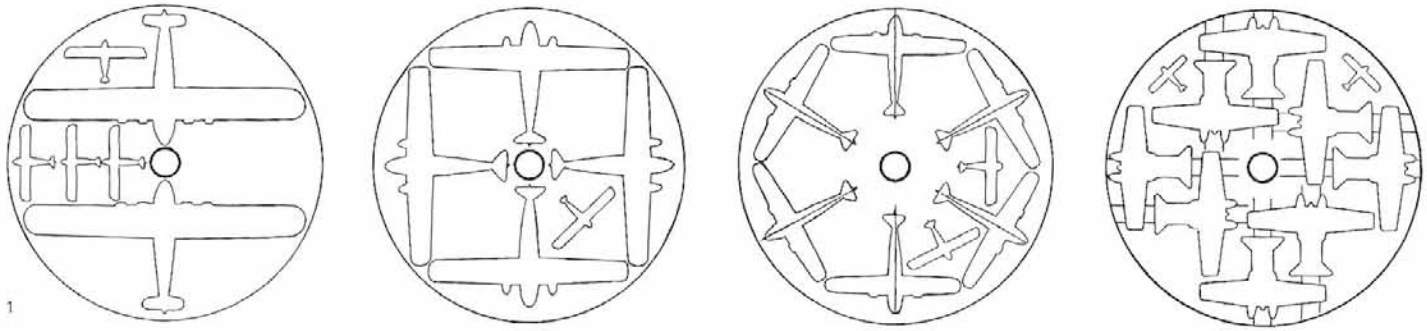

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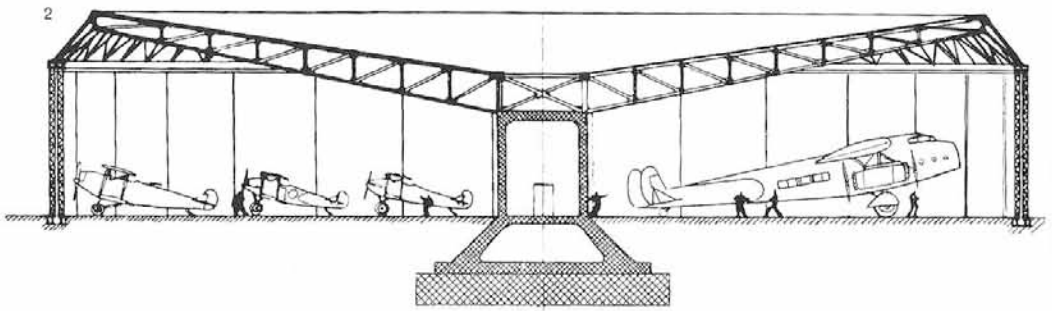

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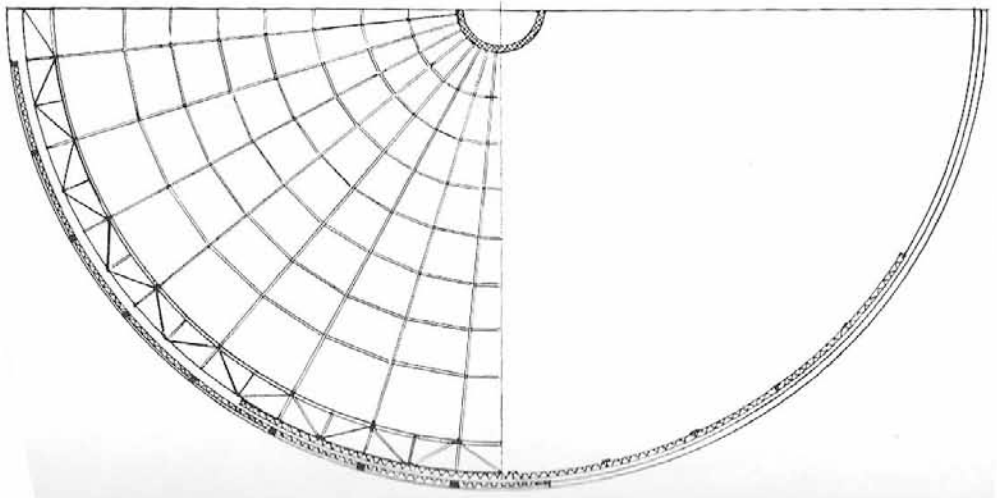

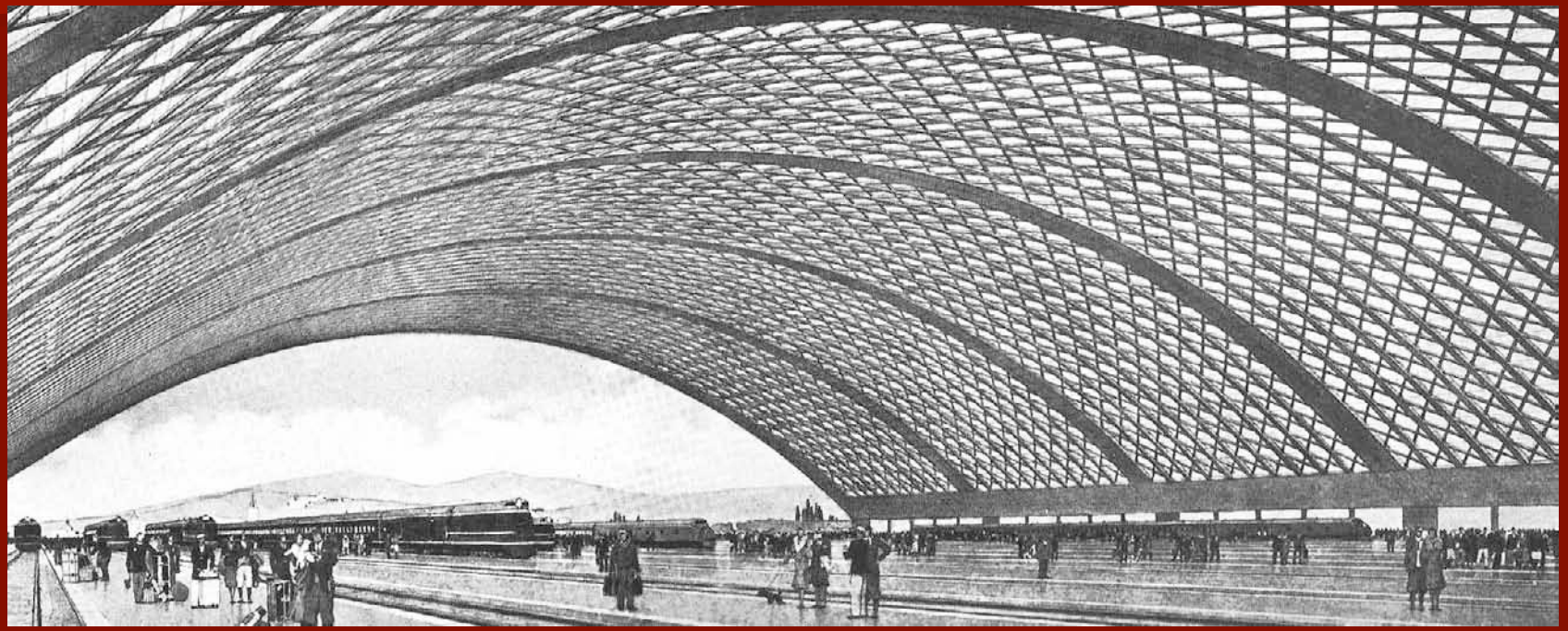

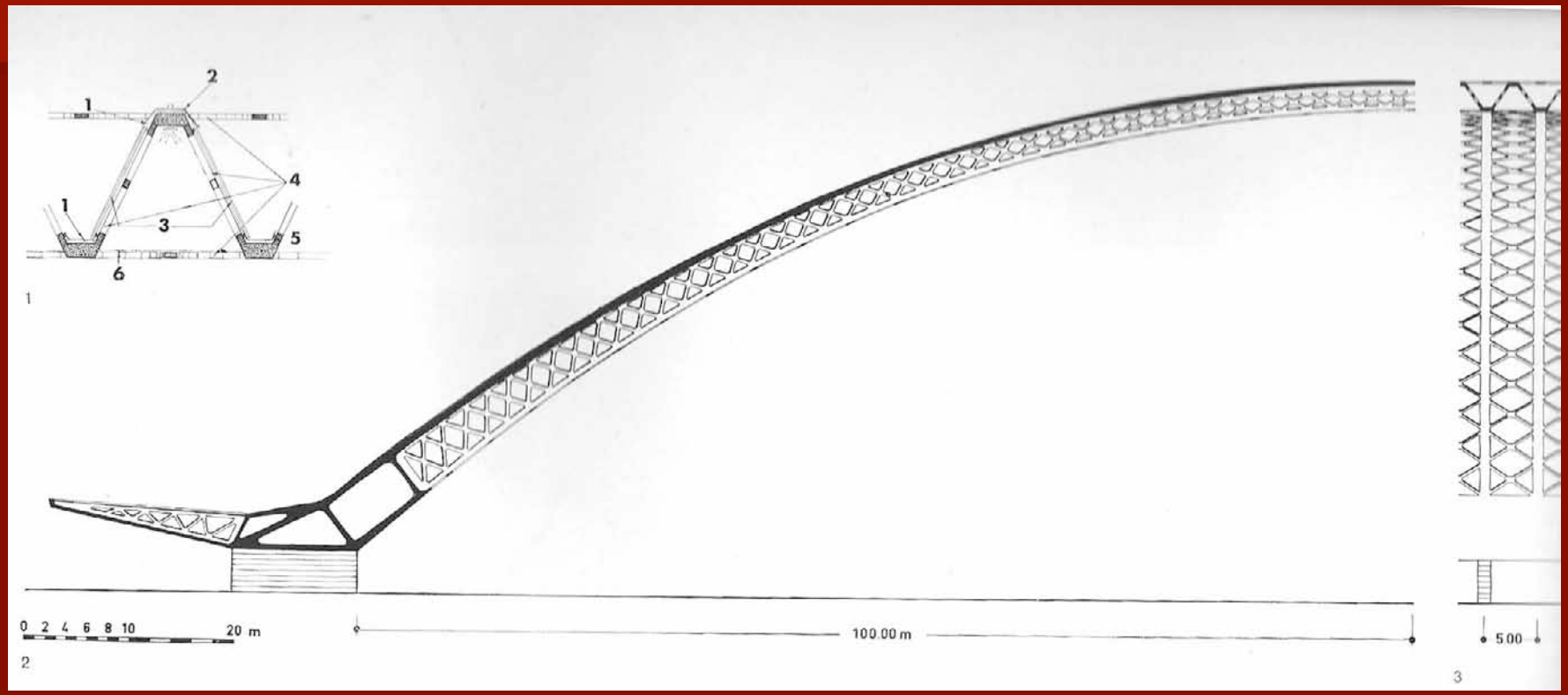
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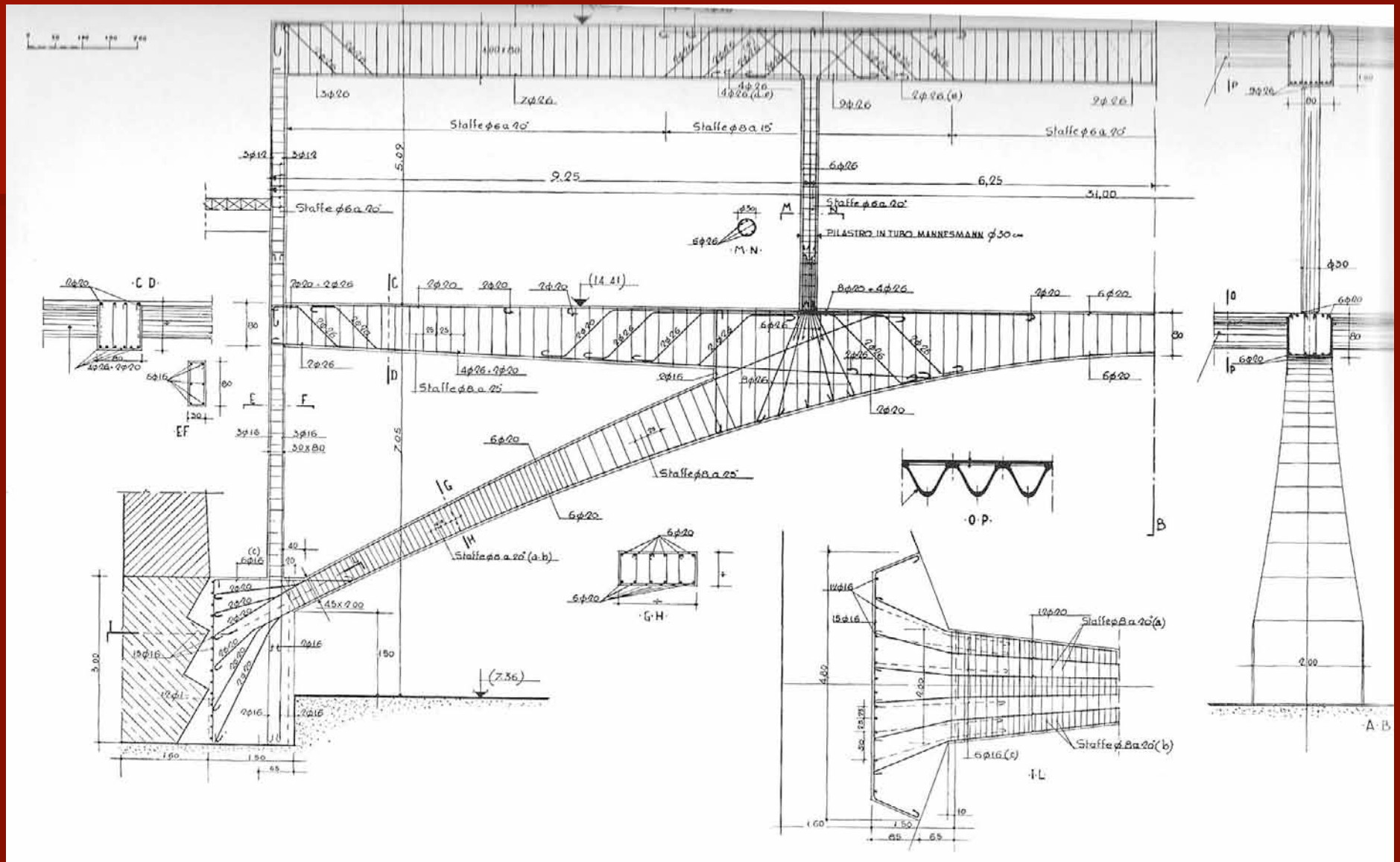
PILASTRO IN TUBO MANNESMANN ϕ30 cm
Staffe ϕ6 a 20
Staffe ϕ8 a 15
Staffe ϕ8 a 25
Staffe ϕ8 a 20 (a-b)
Staffe ϕ8 a 20 (a)
Staffe ϕ8 a 20 (b)
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(14.41)
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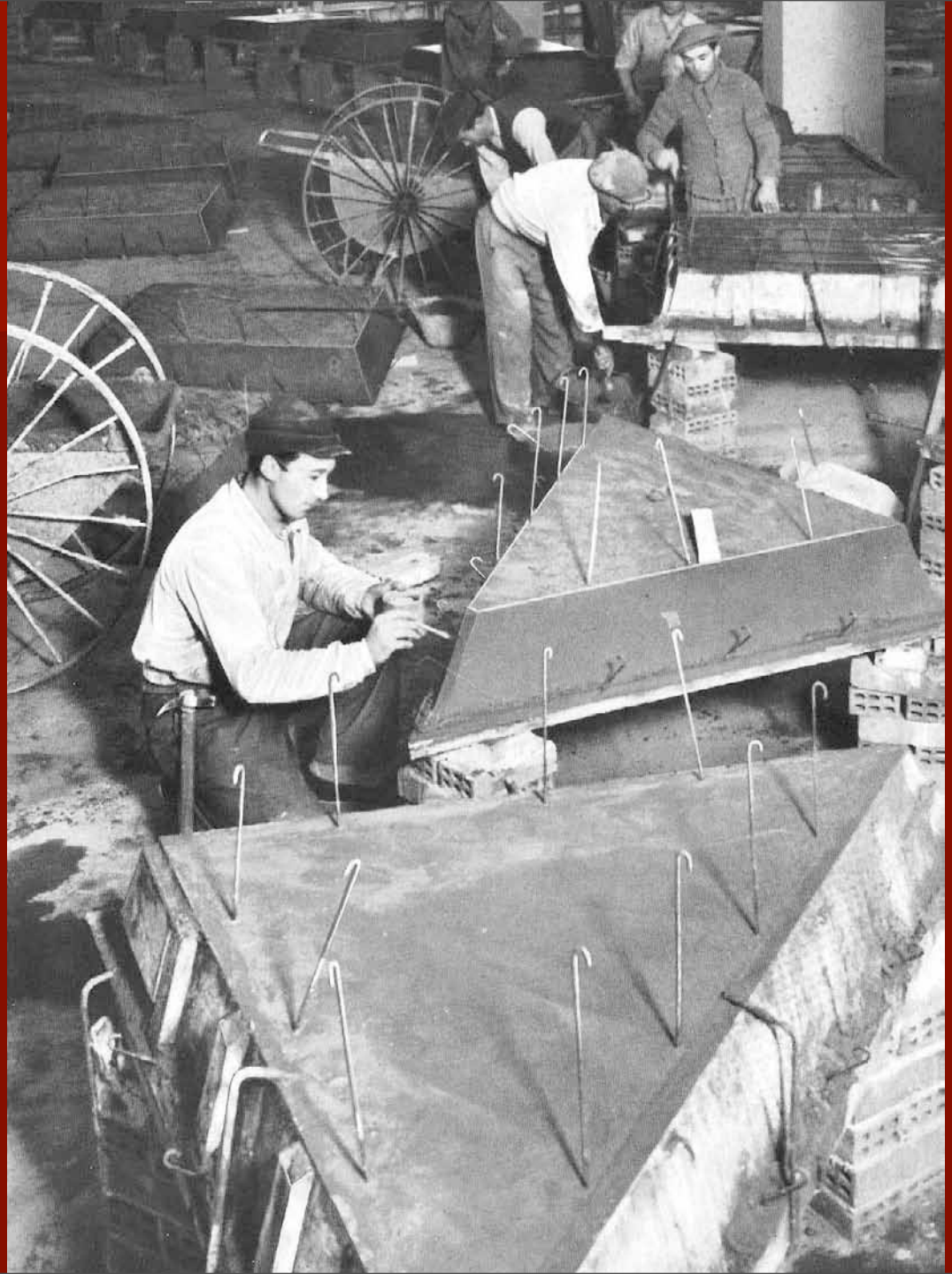

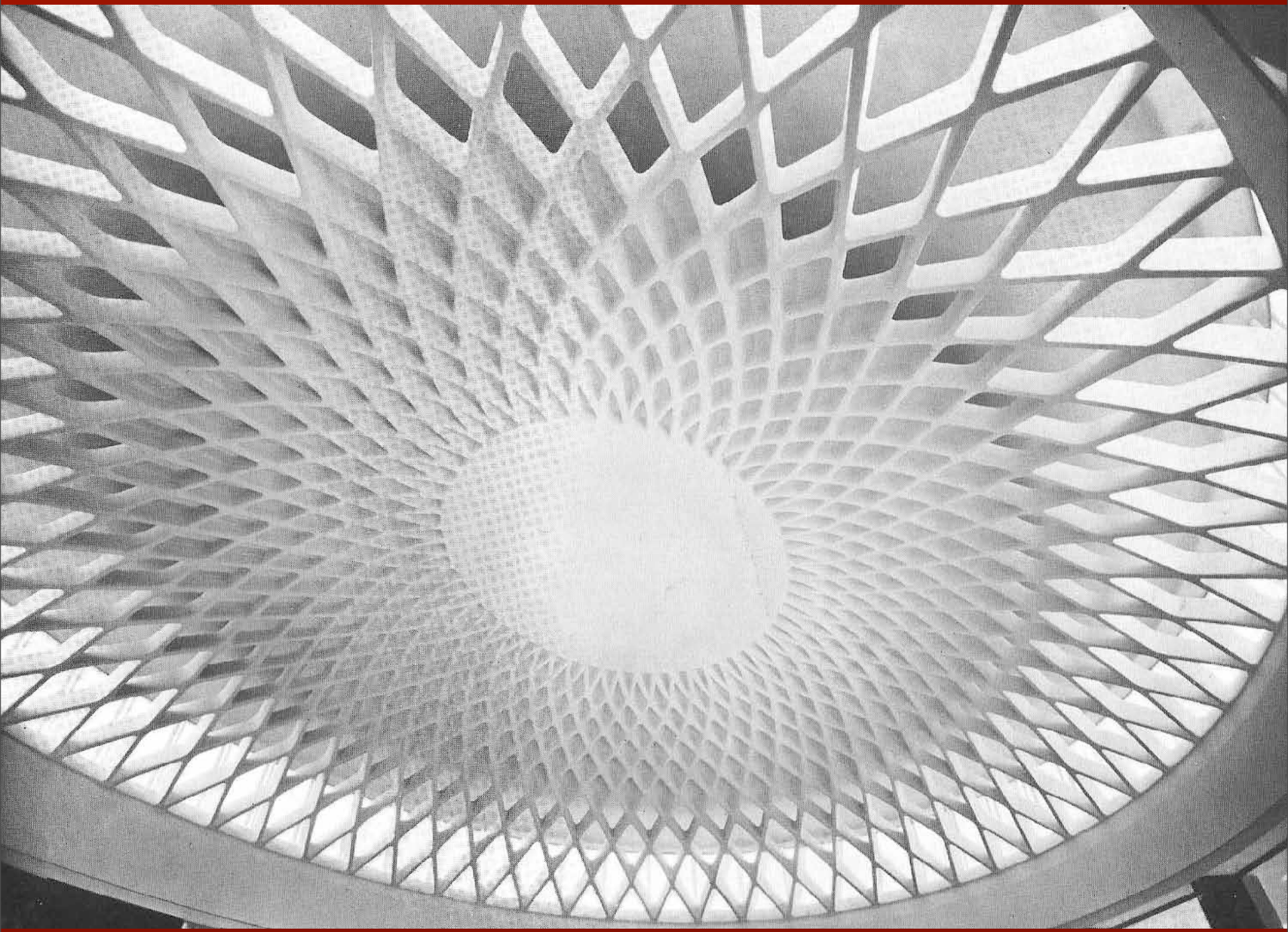

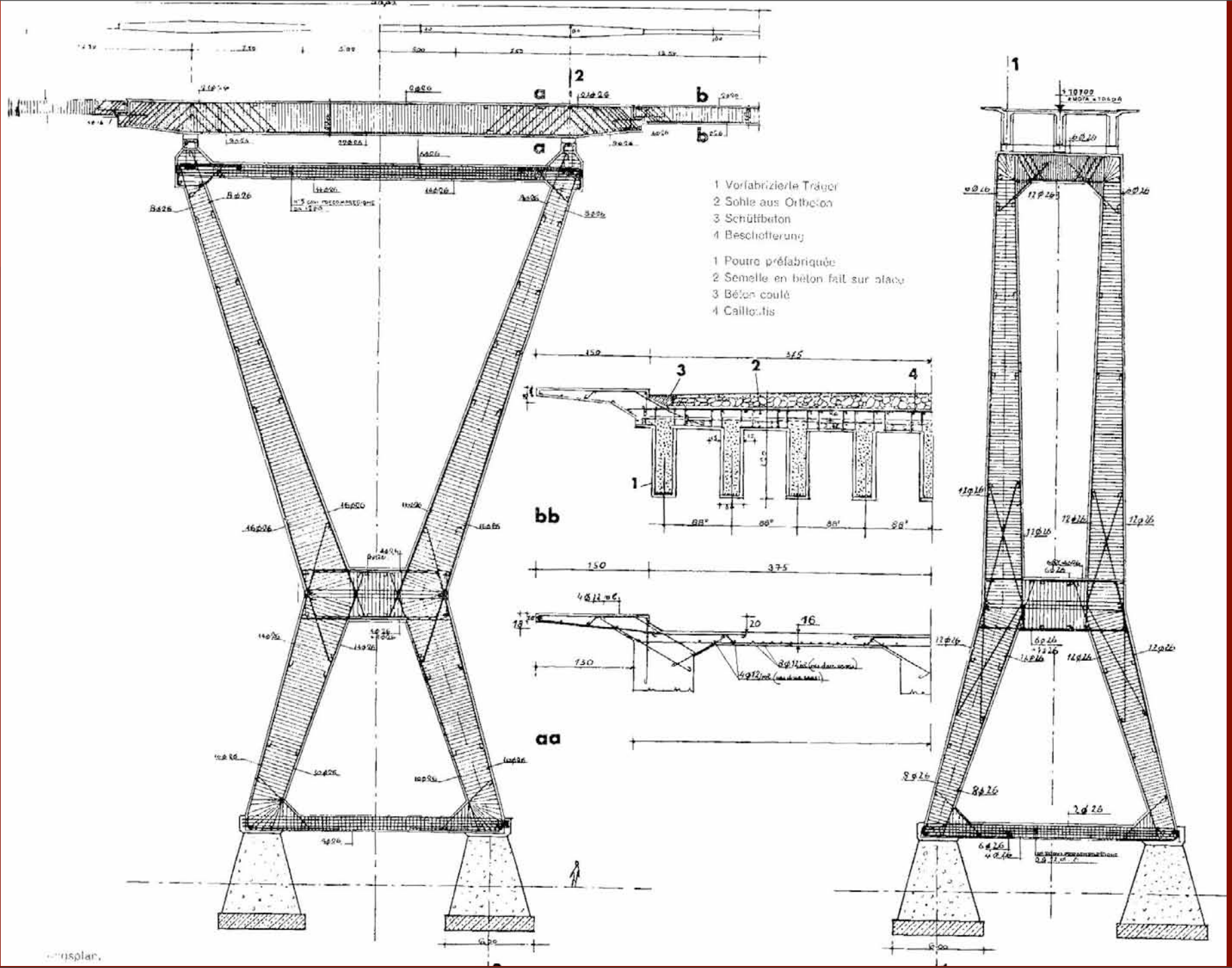
1 Vorfabrizierte Träger
2 Sohle aus Ortbeton
3 Schüttbeton
4 Beschotterung
1 Poutre préfabriquée
2 Semelle en béton fait sur place
3 Béton coulé
4 Caillouttis
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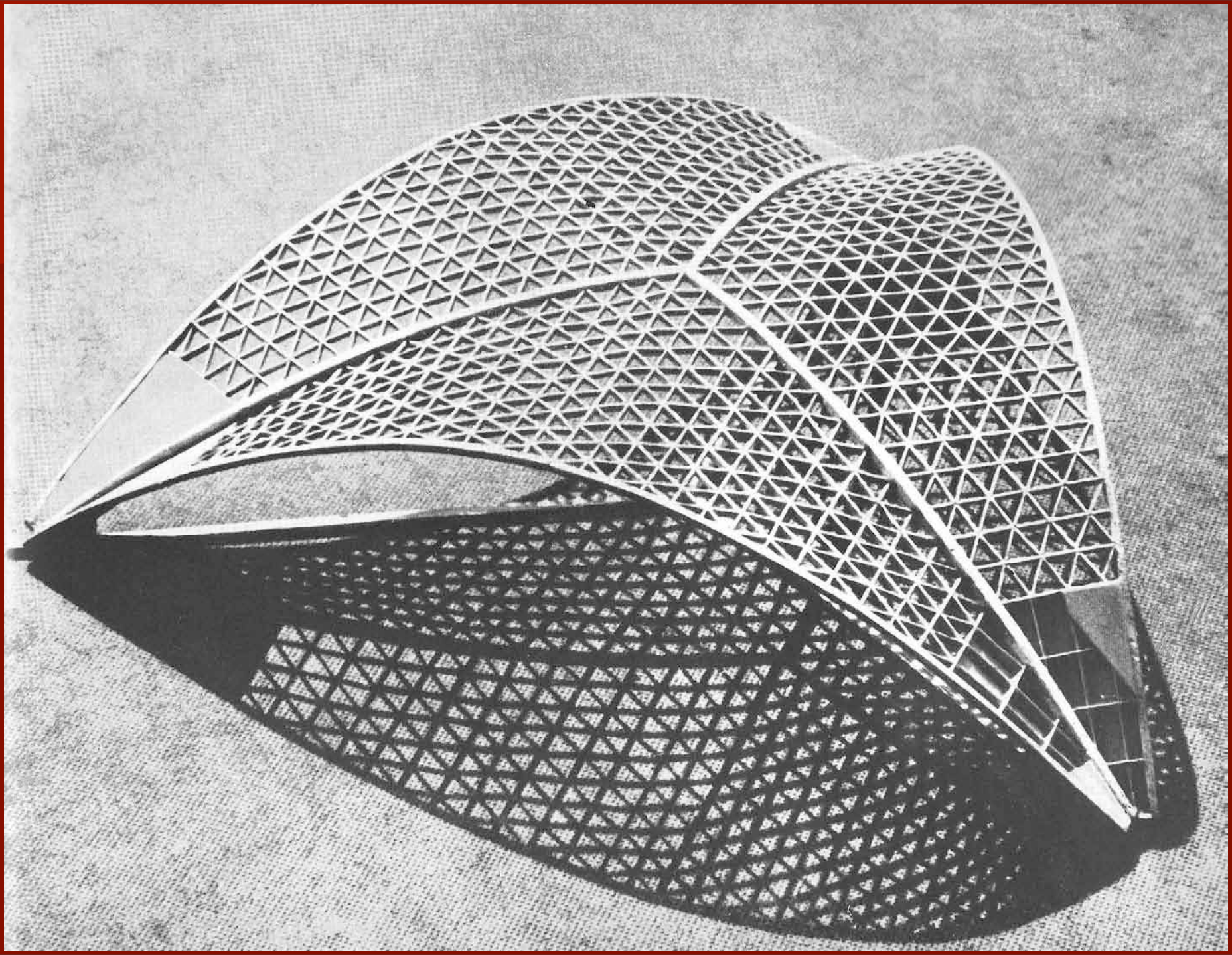


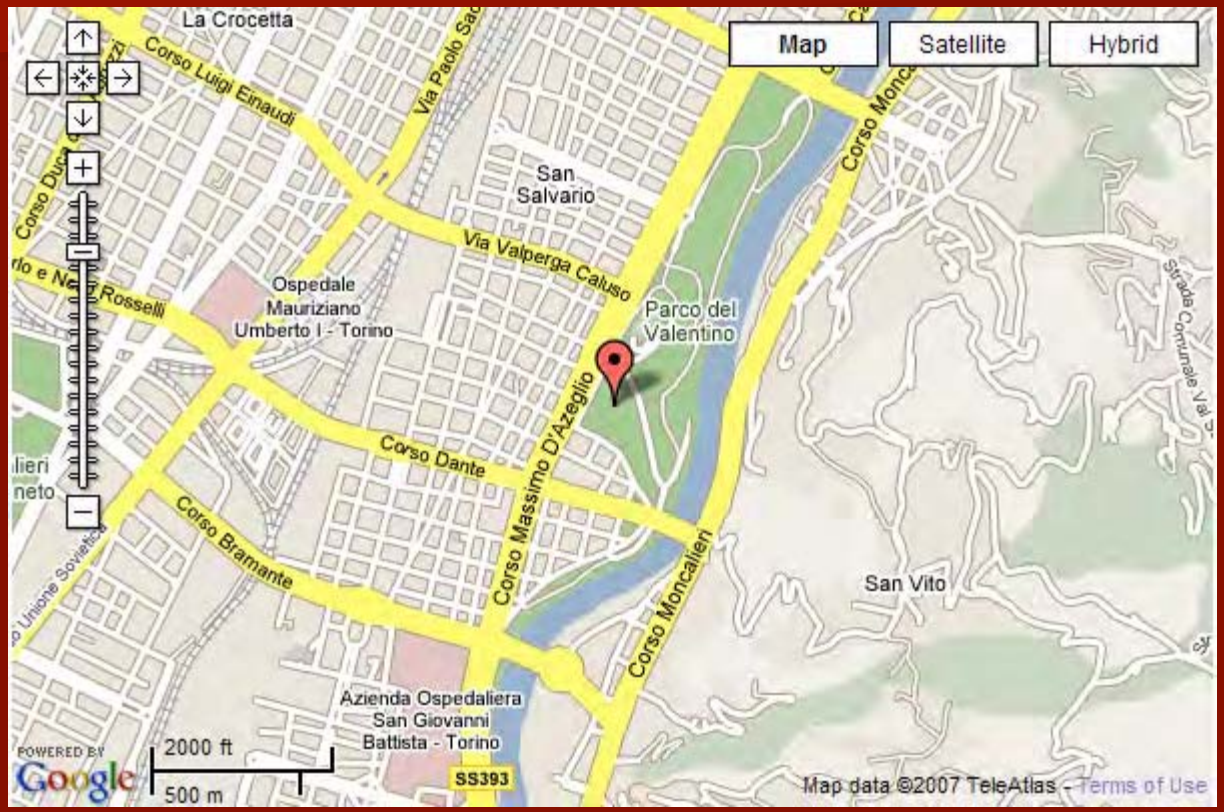
Exhibition Building

"...two of my most interesting projects, the hangars built of pre-cast elements and the roof for the Turin Exhibition Halls, would have been impossible without a simultaneous invention of the structural method. They would have looked completely different if they had been built on the same principle but in a conventional technique."

— Pier Luigi Nervi from the Introduction of Jürgen Joedicke. The Works of Pier Luigi Nervi. pVII.

Exhibition Building

- **Location:** Turin, Italy
- **Building Type:** Exhibition Hall
- **Construction System:** Long Span Reinforced Concrete
- **Context:** Urban
- **Style:** Modern
- **Architect** Pier Luigi Nervi
- **Engineer** Pier Luigi Nervi
- **Contractor** Pier Luigi Nervi
- **Climate:** Mediterranean
- **Project Design Date:** 1948
- **Project Completion Date:** 1949


Map
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Hybrid
La Crocetta
Corso Luigi Einaudi
Via Paolo Sacchi
San Salvario
Via Valperga Caluso
Corso Monca
Ospedale Mauriziano Umberto I - Torino
Parco del Valentino
Corso Massimo D'Azeglio
Corso Dante
Corso Bramante
Corso Moncalieri
San Vito
Azienda Ospedaliera San Giovanni Battista - Torino
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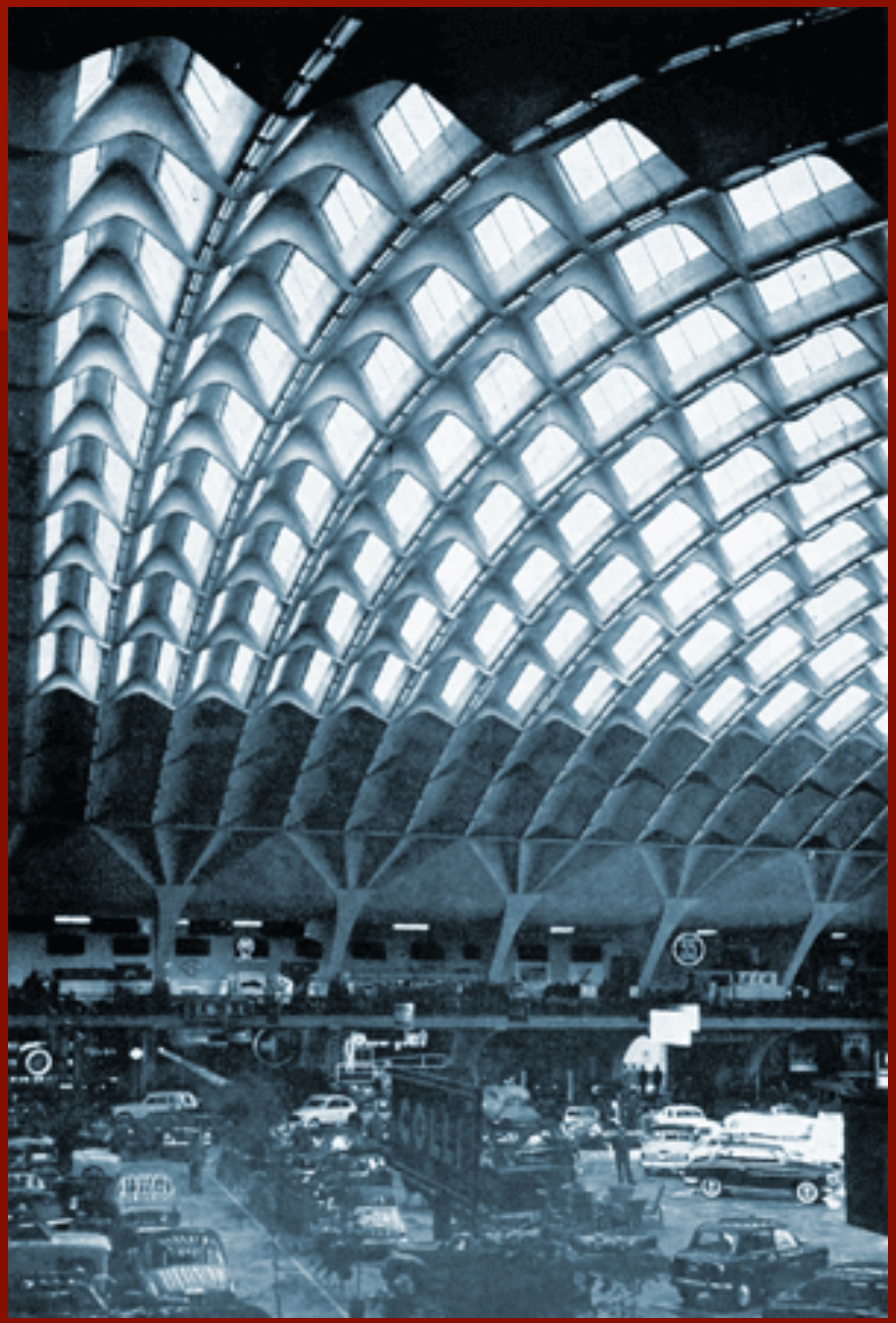
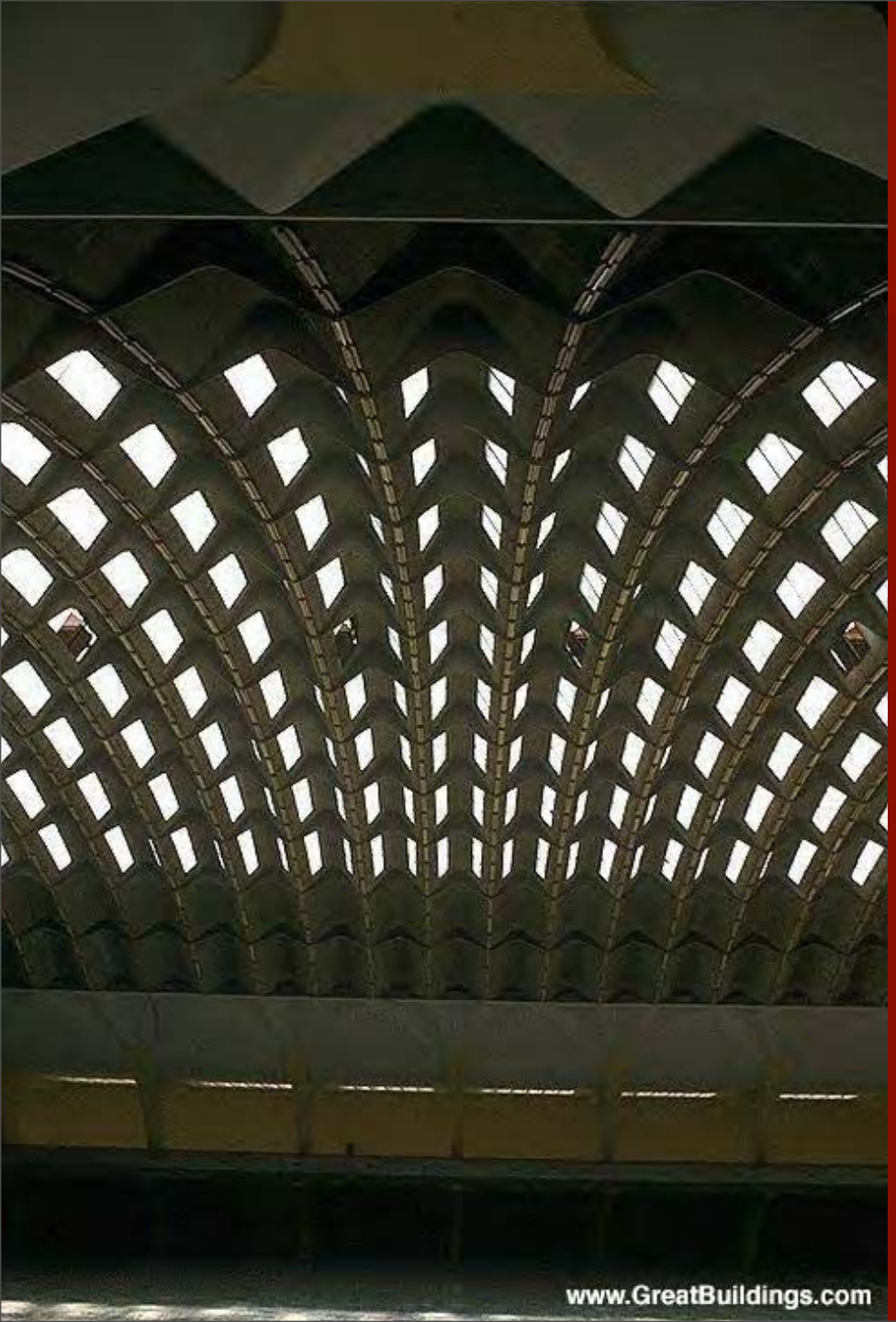
Imagery © 2007 DigitalGlobe - Terms of Use




www.GreatBuildings.com

Exhibition Cont'd

- **Details:** "The hall is rectangular and covers an area of 240 feet x 309 feet. On one of the two shorter sides is a semi-circular apse. Windows are arranged in the corrugation of the prefabricated roof elements."
- "A semi-circular apse 132 feet in diameter adjoins the main hall which is 240 feet long. Its roof consists of corrugated pre-cast units. The half-dome roof of the apse is also constructed with prefabricated elements."
- "The vaulted construction of the hall consists of prefabricated elements which spring from in situ concrete abutments."
- "The units are of "ferro-cement" and have a length of approximately 15 feet and a width of 8 feet 3 inches. The thickness of the curved precast parts is less than 2 inches. This small thickness is achieved only by the increased rigidity through the corrugation and the transverse webs at either end. The individual units are joined by in situ concrete."
- — Jürgen Joedicke. The Works of Pier Luigi Nervi. p59-62.



- Ferroconcrete, also called reinforced concrete, was used with the Exhibition Building.
- The material is fireproof, earthquake safe, and does not rust.
- Ferroconcrete is commonly used with sculptures, homes, buildings, boats, and can even be used to repair existing concrete structures.
- A good ferroconcrete mix is made by:
- 5 or 6 shovels sand, 1 shovel masonry cement, 1/2 shovel Portland cement, as you are mixing with a hoe add water until the mix is loose enough to work easily. Then one handful of fiber-mesh fiber is added and mixed together once again.

Concrete Studies

As mentioned earlier, ferroconcrete is used for sculptures in addition to buildings. This bench was created in a similar fashion to the Exhibition building, but on a much smaller scale. These two photos show the rebar and wire mesh which will give the concrete its form.

Conc. Studies Cont'd

- The first coat of cement is applied and is pushed by hand through the mesh to ensure that the mix gets on both sides of the frame.
  It is important to keep the ferroconcrete out of the sun and moist. Water should be sprayed lightly with water every few hours to assist with the curing process.

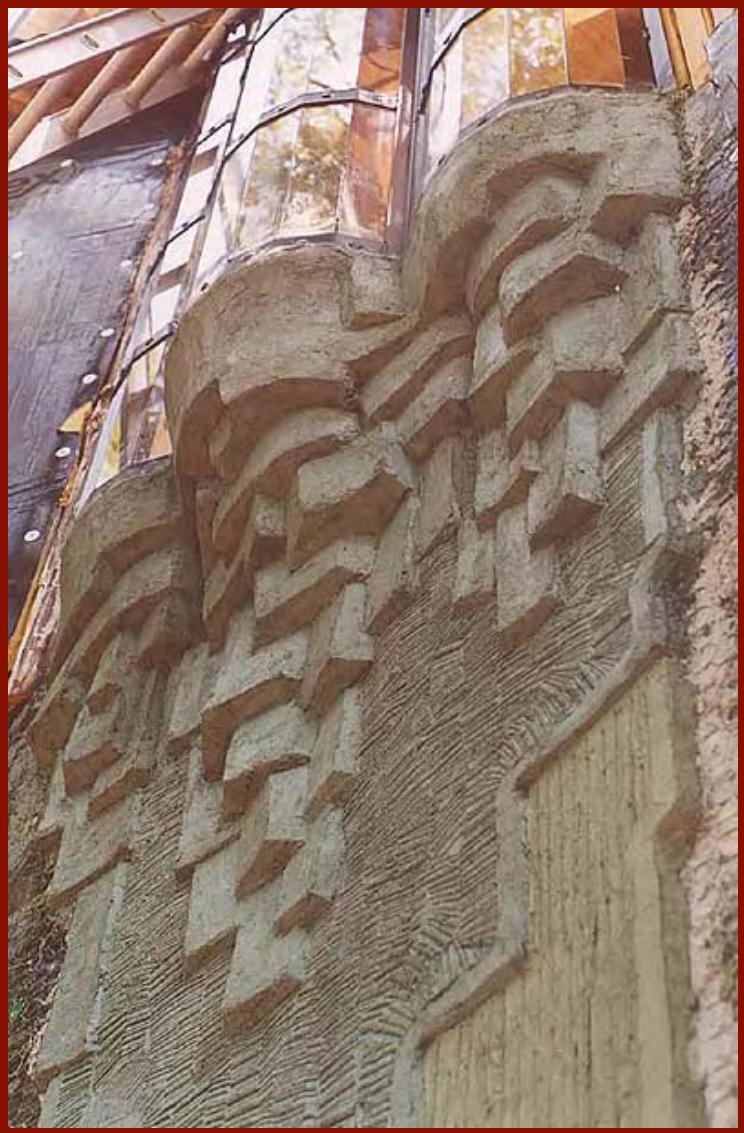
Conc. Studies Cont'd

- The next day a second coat can be applied. In this case a color layer was applied by dragging a dried paintbrush across the surface.

Conc. Studies Cont'd

- The final product after painting and final touchups. It is said to be quite comfortable considering that it is made out of concrete.

Conc. Studies Cont'd



Resources:

- http://web.mit.edu/newsoffice/2005/arts-calatrava.jpg
- http://www.smu.edu/newsinfo/releases/
- http://www.nndb.com/people/743/000031650/calatravar-MED.jpg
- http://www.calatrava.com/
- http://www.calatrava.info/
- http://www.galinsky.com/buildings/lyonairport/index.htm
- http://www.arcspace.com/architects/calatrava/Lyon-Satolas/
- http://www.lyon.aeroport.fr/index.php?module=cms&desc=default&action=get&id=2004070210264257&selectedMenu=0
- Blaser, Werner. Santiago Calatrava. Berlin: Birkhauser Verlag, 1990.
- Sharp, Dennis. Santiago Calatrava. London: Academy Editions, 1996.
- Tzonis, Alexander. Movement, Structure, and the Work of Santiago Calatrava. Berlin: Birkhauser Verlag, 1995.
- Zardini, Mirko. Santiago Calatrava: Secret Sketchbook. New York: The Monacelli Press, Inc, 1995.
- www.greatbuildings.com/architects/**Pier_Luigi_Nervi**.html
- www.unpi.com/**nervi**.html
- www.great**buildings**.com/**buildings/Exhibition_Building-Turin**.html
- Nervi, Pier Luigi. The works of Pier Luigi Nervi. New York, F.A. Praeger, 1957.
- Louis de Malave, Florita Z. Work and life of Pier Luigi Nervi, architect. Monticello, III : Vance Bibliographies, 1984.
- Huxtable, Ada Louise. Pier Luigi Nervi, New York, G. Braziller, 1960.
- http://www.bookrags.com/biography/pier-luigi-nervi/
- http://www.eugenesargent.com/bench1.htm
- http://www.greatbuildings.com
- Nervi, Pier Luigi. Pier Luigi Nervi – Bauten und projekte. Copyright 1957 by Verlag Gerd Hatje, Stuttgart. USA: Frederick A Praeger, New York.
- http://www.greatbuildings.com/buildings/Exhibition_Building-Turin.html - Exhibition Building