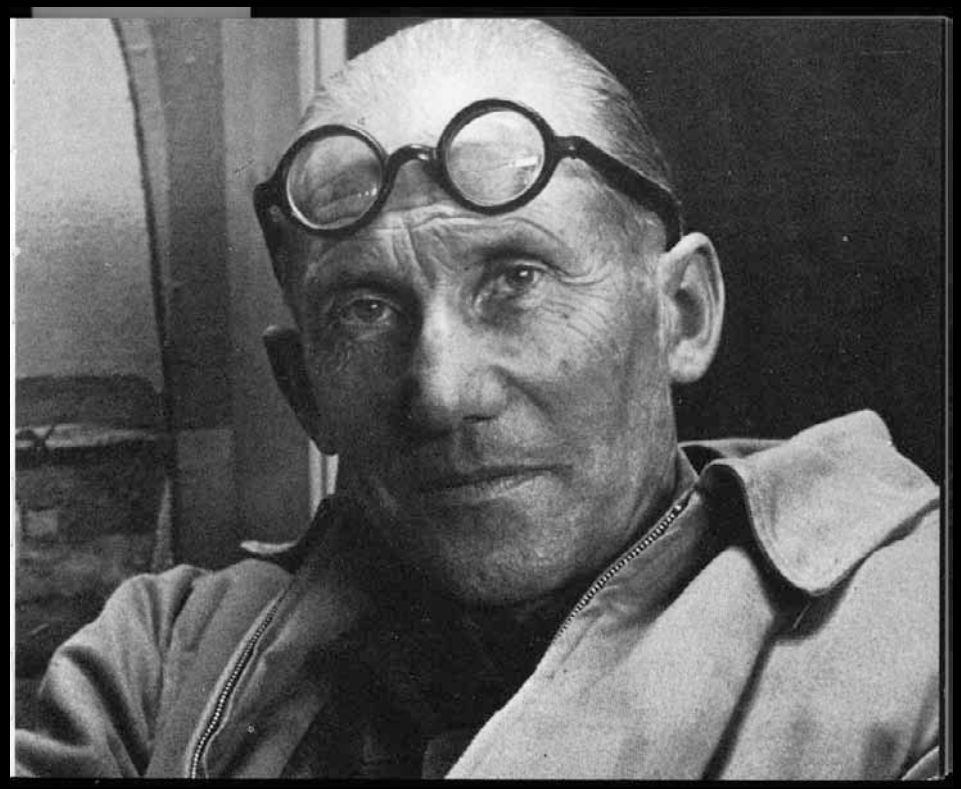
Chapel of Notre Dame du Haut in Ronchamp
and
Braga Stadium

Le Corbusier

Born as Charles Edouard Jeanneret on October 6, 1887 in La Chaux de Fonds, Switzerland. He studied at the La Chaux de Fonds Art School. His career spanned five decades and he made significant contributions to the Modernists or International Style. He has built works in North America, South America, Europe and Asia. He died on August 27, 1965 of a heart attack while swimming in the Mediterranean Sea in south France.



Major Works

1905 Villa Fallet, La Chaux de fonds, Switzerland
1912 Villa Jeanneret, Paris
1916 Villa Schwob, Paris
1923 Villa LaRoche, Paris
1924 Pavilion de L'Esprit Nouveau, Paris
1924 Quartiers Modernes Fruges, Pessac France
1926 Villa Cook, Boulogne-sue-Seine, France
1927 Villas at Weissenhof Estate, Stuttgart, Germany
1928 Villa Savoye, Poissy-sur-Seine, France
1929 Armee du Salut, Cite de Refuge, Paris
1930 Pavilion Suisse, Cite Universitaire, Paris
1931 Palace of the Soviets, Moscow, USSR
1933 Tsentrosoyuz, Moscow, USSR
1936 Palace of the Ministry of National Education and Public Health, Rio de Janerio
1938 The Cartesian Sky-scrapper.
1946 Duval Factory in Saint Die, France
1947-1952 Unite d'Habition, Marseille, France
1948 Curutchet House, La Plata, Argentina
1949 Usine Cluade et Duval, Saint Die-des-Vosges
1950 UN Headquarters, New York
1950-1954 Chapel Notre Dame du Haut, Ronchamp, France
1951 Cabanon Le Corbusier, Roquebrune-Cap-Martin
1951 Maisons Jaoul, Neuilly-sur-Seine, France
1952 Unite d'Habitation of Nantes-Reze, Nantes, France
1952-1959 Buildings in Chandigarh, India.
1905 Museum at Ahmedabad, India
1912 Unite d'Habitation of Briey en Foret, France
1957 National Museum of Western Art, Tokyo
1913 Masison du Bresil, Cite Universataire, Paris
1957-1960 Sainte Marie de la Tourette Lyon, France
1957 Unite Habitation of Berlin-Charlottenburg, Flatowallee 16, Berlin

Villa Savoye France 1928

Maison Domino

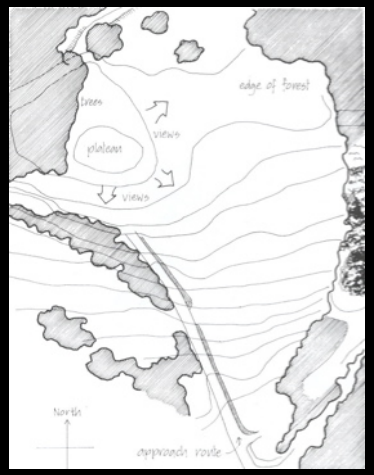
Notre Dame du Haut Ronchamp

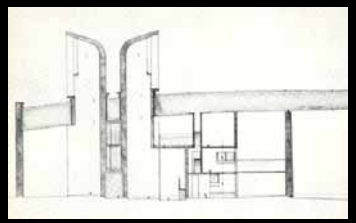
- Location: Ronchamp, France
- Date: 1955
- Building Type church
- Construction System: reinforced concrete
- Climate: temperate
- Context: rural, mountains
- Style: Expressionist Modern
- Notes: Soft-form composition, deep windows with colored glass (wall thickness 4' to 12')

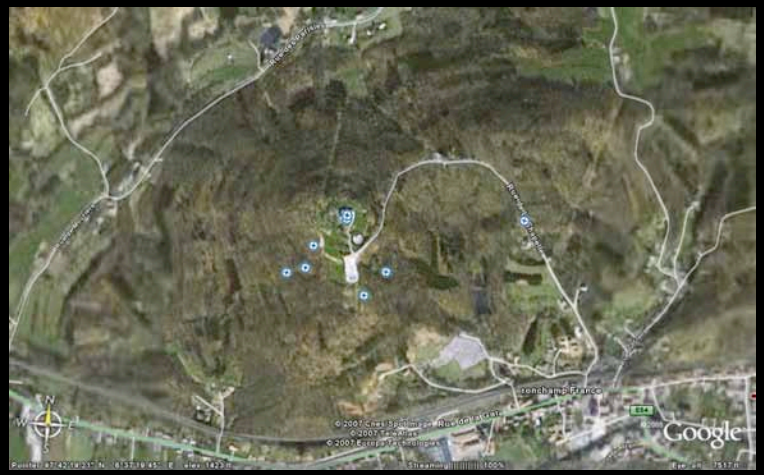
"Surrealism is a key to other late works of Le Corbusier, most notably the church at Ronchamp, France, of 1950-54... Notre-Dame-du-Haut was a more extreme statement of Le Corbusier's late style. Programmatically,...the church is simple—an oblong nave, two side entrances, an axial main altar, and three chapels beneath towers—as is its structure, with rough masonry walls faced with whitewashed Gunite (sprayed concrete) and a roof of contrasting beton brut. Formally and symbolically, however, this small building, which is sited atop a hillside with access from the south, is immensely powerful and complex."

SITE

- Approach route of the chapel is from the Southeast .
- Chapel is placed at the high point on an East West axis.
- Curved wall on the South wall directs visitors up and to the entrance.
- The Chapels act as periscopes which establish contact with the distant horizon.
- Entry zone has a primary reading because of its thickness and by extending its length beyond the southeast corner.
- The North and West walls are built of stone. The South wall has a reinforced concrete frame.
- The Southeast parabolic reflector, with it's outdoor alter, is meant to embrace the pilgrims when they come for a large open-air service.
- The site is high on a hill near Belfort in eastern France
- There had been a pilgrimage chapel on the site dedicated to the Virgin Mary, but it had been destroyed during the Second World War
- Warning against decadence, reformers within the Church looked to renew its spirit by embracing modern art and architecture as representative concepts
- By Le Corbusier's own admission, it was the site that provided an irresistible genius loci for the response, with the horizon visible on all four sides of the hill and its historical legacy for centuries as a place of worship.
- The Jura mountains in the distance and the hill itself, dominate the landscape.
- The nature of the site would result in an architectural ensemble that has many similarities with the Acropolis – starting from the ascent at the bottom of the hill to architectural and landscape events along the way, before finally terminating at the sanctus sanctorum itself – the chapel. You cannot see the building until you reach nearly the crest of the hill. From the top, magnificent vistas spread out in all

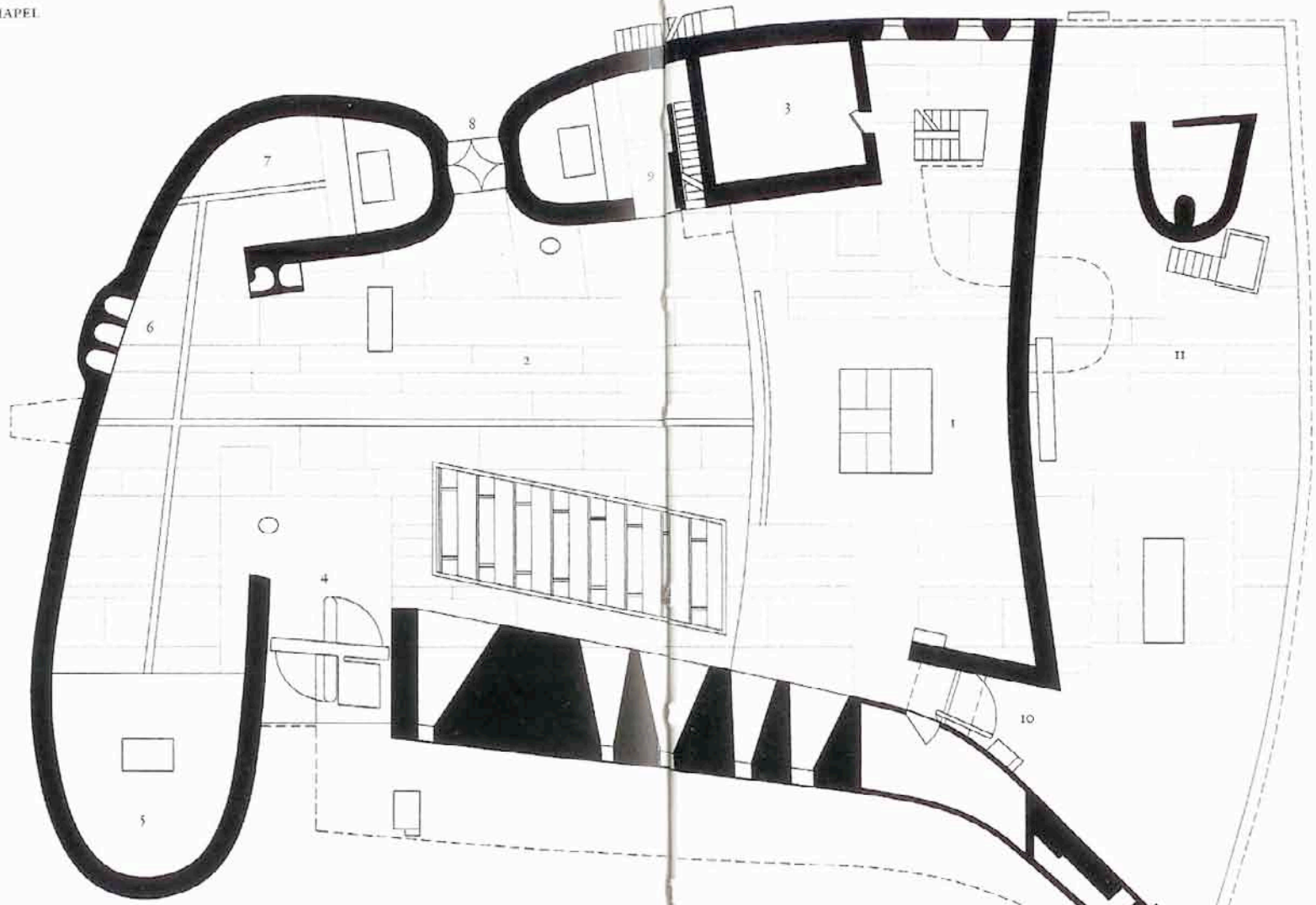






Floor Plan

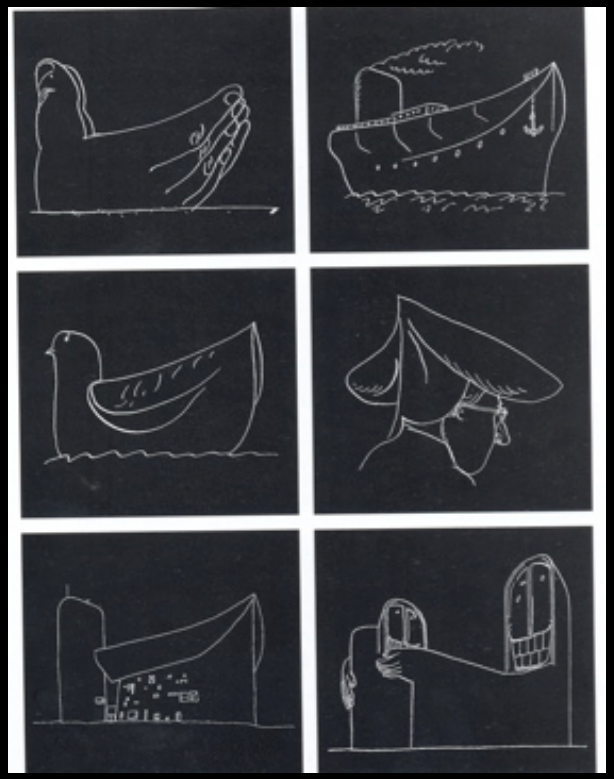
PLAN OF THE CHAPEL



1. ALTAR
2. CHOIR
3. SACRISTY
4. MAIN ENTRANCE
5. SOUTH SIDE CHAPEL
6. CONFESSIONALS
7. EAST SIDE CHAPEL
8. NORTH ENTRANCE
9. WEST SIDE CHAPEL
10. EAST ENTRANCE
11. EXTERIOR ALTAR & PULPIT

THEORIES

- Large Embrasures on south wall represent the Crow (Corvus), Libra Constellation
- The upper two tiers of the interior windows of the South wall as the Virgo constellation.
- That LC based his design off of praying hands, a ship, a bird, a nuns cowl.
- LC superimposed Ronchamp II over Ronchamp I.



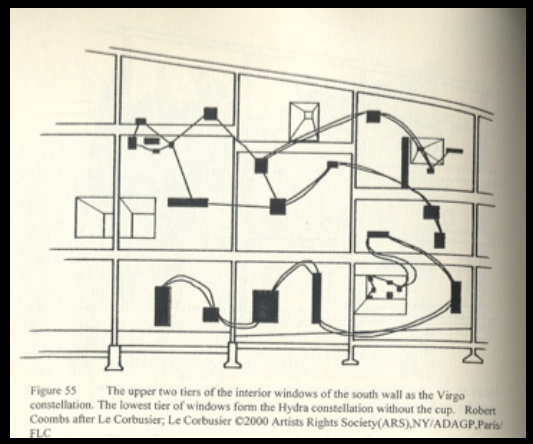


Figure 55 The upper two tiers of the interior windows of the south wall as the Virgo constellation. The lowest tier of windows form the Hydra constellation without the cup. Robert Coombs after Le Corbusier; Le Corbusier ©2000 Artists Rights Society(ARS),NY/ADAGP,Paris/FLC

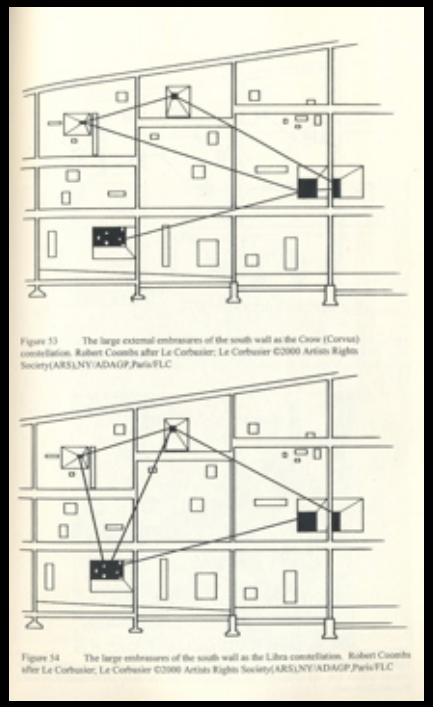
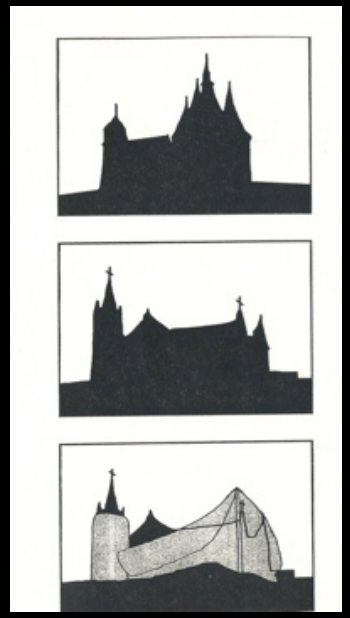


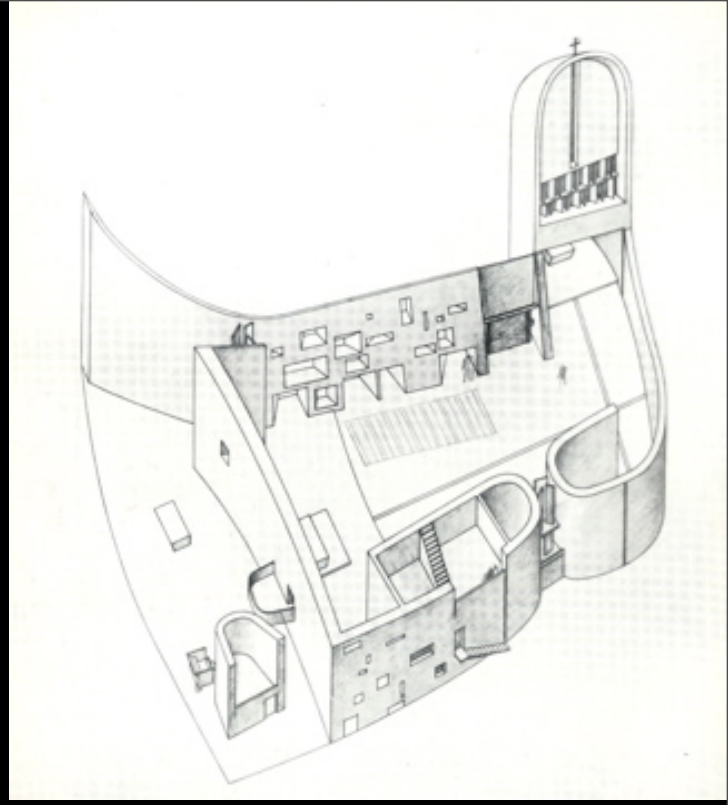
Figure 53 The large external embrasures of the south wall as the Crow (Corvus) constellation. Robert Coombs after Le Corbusier; Le Corbusier ©2000 Artists Rights Society(ARS),NY/ADAGP,Paris/FLC

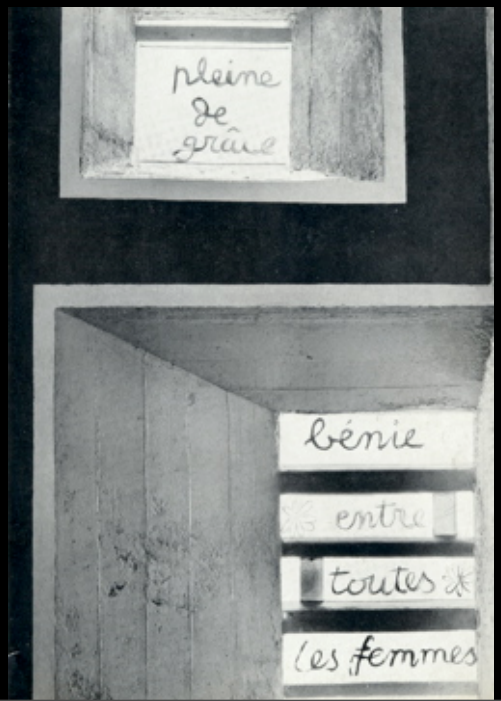
Figure 54 The large embrasures of the south wall as the Libra constellation. Robert Coombs after Le Corbusier; Le Corbusier ©2000 Artists Rights Society(ARS),NY/ADAGP,Paris/FLC

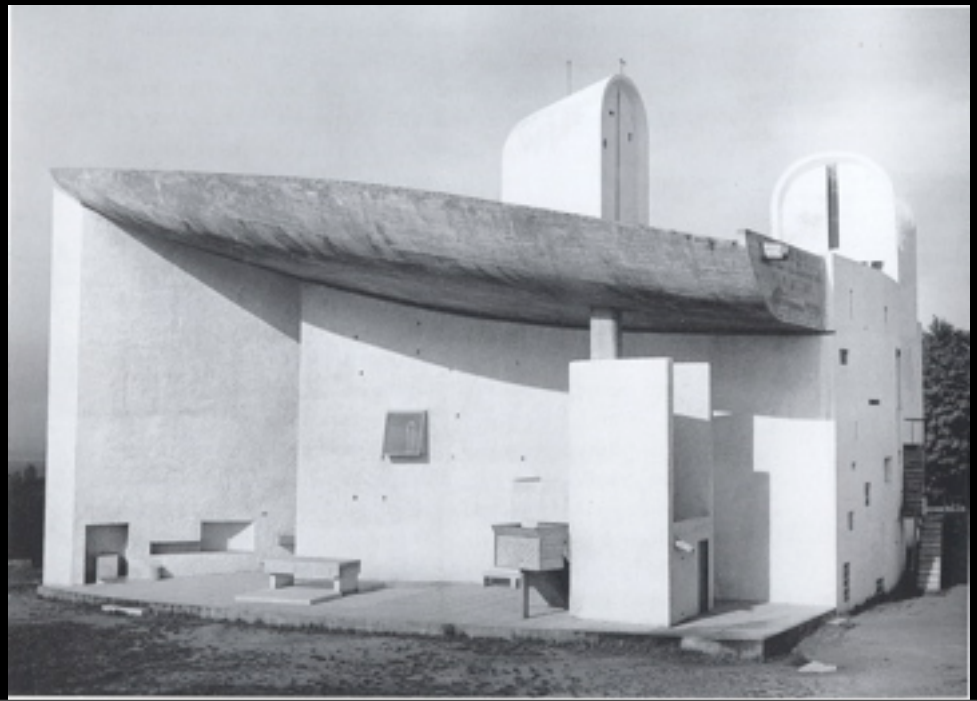


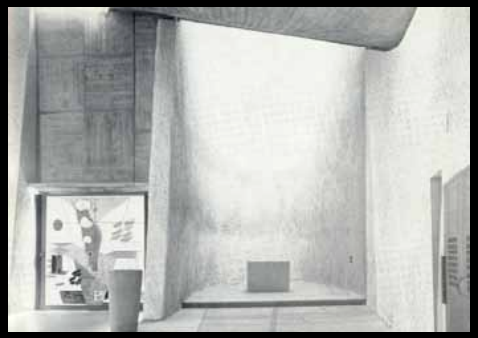
Overview

- Le Corbusier was given free reign to create a total work of art, the way he liked it
- North and West walls are concaved and closed, the South and East bend in to admit light and receive long distant views.
- Le Corbusier believed that the shape of the structure was acoustic, which emit and listen.
- The 3 hooded towers are tops lit chapels.
- Exterior walls are white pebble-dashed applied with a spray gun (stucco). Application applied on inside and outside, symbolizing outside becomes inside and inside becomes outside.
- Where the ceiling meets the towers on the interior, it slices into them: another reversal , since on the exterior the towers poke through the roof.
- To one end of the outdoor sanctuary, a single concrete pier holds up the corner of the roof in a hint at the actual construction.
- Gargoyle water spout meant to resemble the nostrils of the Taureaux, while the triangular prisms suggest some aquatic symbolism.
- Resembles some Expressionist architecture, but is not overstated.
- Window that contains opening phrases of “Hail Mary”

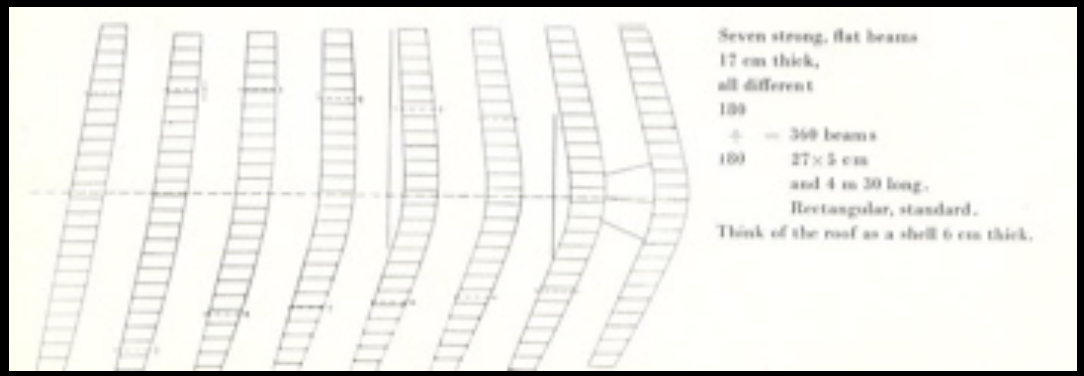




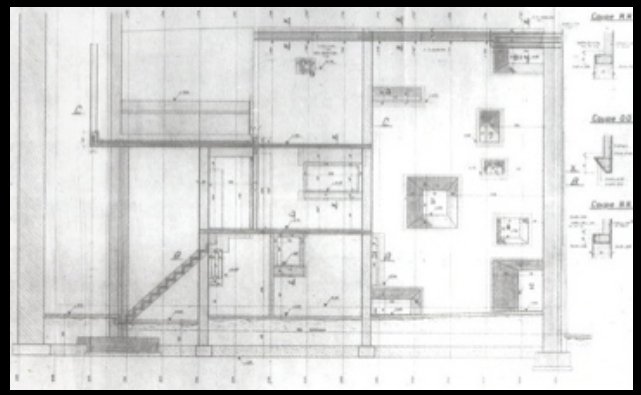


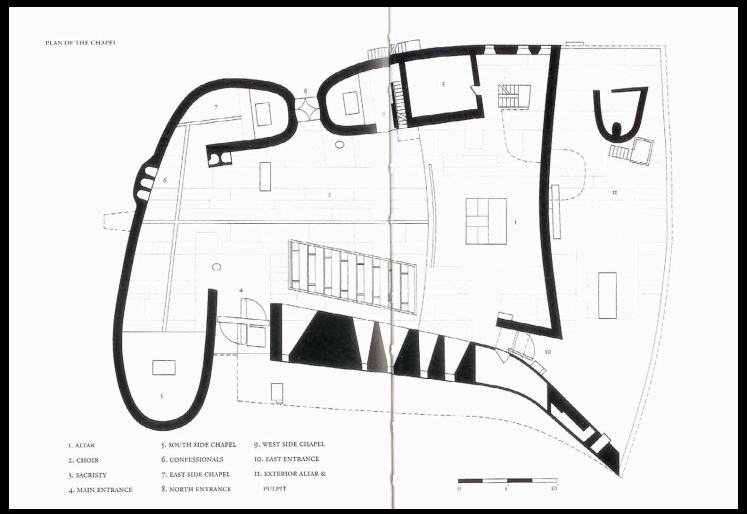


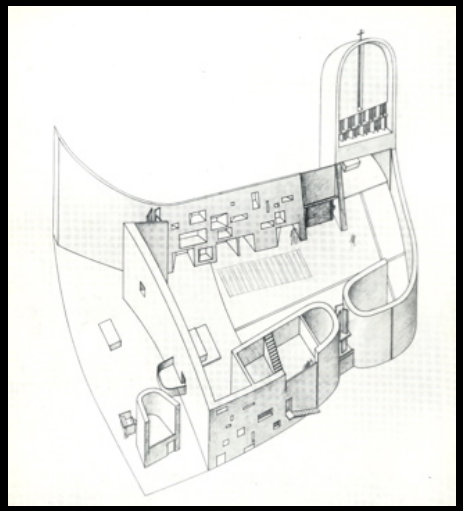
- The shell consists of two concrete membranes separated 6’11” is supported by struts. Made with “gunnite” by struts
- Walls are without buttress.
- The slope of the floor follows the natural slope of the hill, and slopes towards the alter.
- Floor consists of cement paving poured in place between battens, the design of which is dictated by the Modulor.
- Towers are stone masonry topped with cement domes
- Concrete roof is the shell (idea came from crab shell on beach when he was visiting Nivolas. He imagined its curved strength)
- Shell (roof) consists of 7 strong, flat beams 17cm thick, all different. roof is cast in place. Concrete shell is left rough, just as it came out of the formwork.
- The interior of one 1 of the 3 chapels is painted red
- Doors are made of sheet steel enameled in vivid colors at 760 degrees. This was the first time this technique was used in architecture. Door panels consist of open hand, star, pyramid, meandering river, rain, and clouds. Each door consists of eight panels. Pivoting door on center. Red and blue symbolize opposites
- Door opening to the East onto the platform is for open-air ceremonies.
- The chapel is oriented in a traditional manner with the alter to the East.

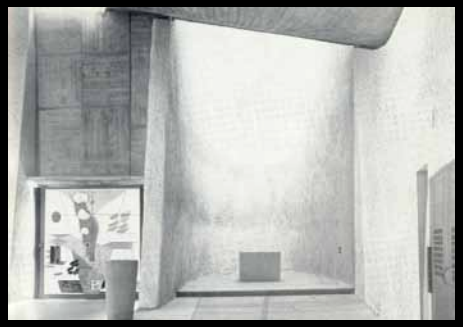


- Lies on walls made of the salvages stones
- Walls made of of reinforced concrete columns. The shell rests on these columns, but will not touch the wall.
- There is a 10cm horizontal crack the separates the two. In LC's words, "The shell has been put on walls which are absurdly but practically thick. Inside them however are reinforced concrete columns. The shell will rest on these columns but it will not touch the wall. A horizontal crack of light 10cm wide will amaze."
- The South wall is made up of vertical triangular reinforced concrete frames 16cm thick. Carry the immense shell of the roof.
- Why the building is considered by some to be post modern?? Because the building asks to be seen on its own terms. Concave and convex pieces are juxtaposed, fused, or separated to create a building unequalled in it's spatial mystery in the modern age. One has to go back to Borromini or even to the small Bath's at Hadrian's villa to find anything remotely comparable.
- Building is a basic cube layed out on grid proportioned by the Modular. Here, the rectangular volumes have been pushed inwards on 3 sides, distorted axially to the south as if by a twist of the rectangular structure, and released downward on the ground by a slight slope. Distortion gives opposition, grid versus curve
- Metaphorically, the walls and roof weigh down on the worshiper and force his mind in the direction
- Slope of the roof, grid on floor, and directional dark center line direction attention up to the cross.
- The Three small chapels, completely separated from the nave, afford simultaneous services.









http://www.youtube.com/watch?v=yvo5na4JuLQ

- 'Here we will build a monument dedicated to nature and we will make it our lives' purpose.'

- Le Corbusier's 'chapel of our lady of the height' is a pilgrimage chapel, though on most days more frequented by architectural pilgrims than the intended variety. Perched on a commanding hill above the village of Ronchamp, it is the latest of a long history of chapels on the site. Its

  predecessor was destroyed in fighting in the Second World War, though much of its stone is used in the walls of Le Corbusier's building..

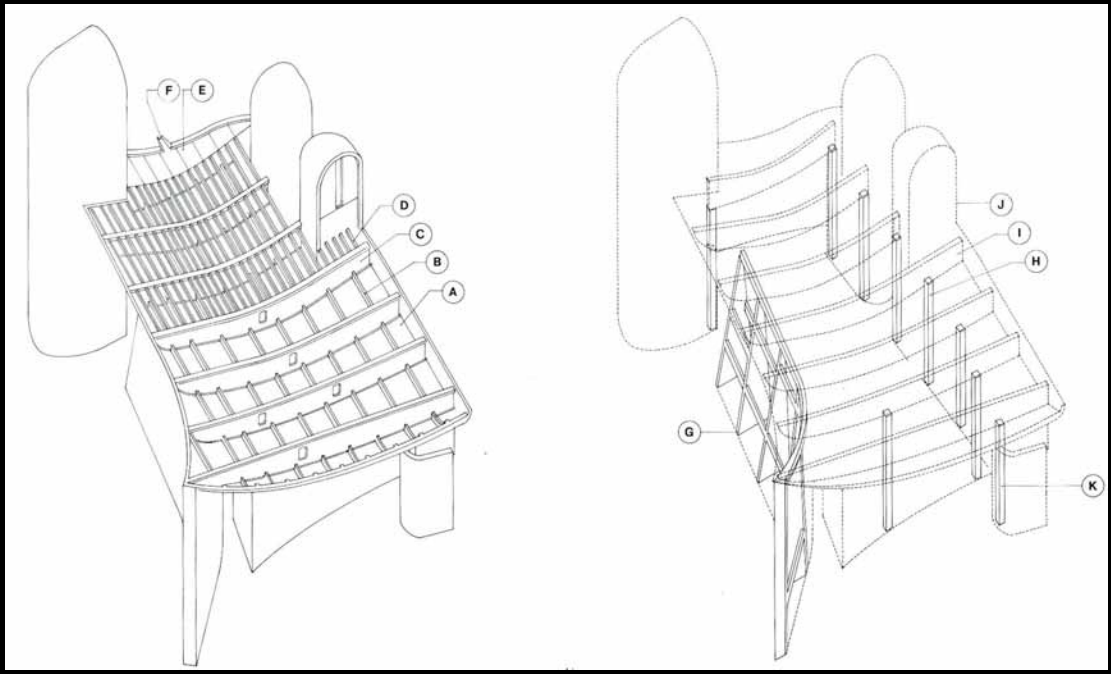
- The heaviness of the walls and roof is misleading. In Le Corbusier's words,

The interior of the chapel is modest, with plain pews down the south side only. The walls curve, the roof curves, and even the floor curves down towards the altar, following the shape of the hill. Above the plain altar, the east wall is punctuated by several pinhole-windows and by a single substantial window with the Madonna and Child in silhouette; through the window this image also serves the outside altar used during pilgrimages.

- '[The] south wall provokes astonishment. Vertical triganular frames of reinforced concrete 16cm thick varying, at the base, from a width of 3m70 to 1m40 to 50cm at the top, carrying the immense, spreading shell of the roof; the rest, the bays, embrasures and splays which break up the interior wall (and scarcely puncture the facade) is a membrane of concrete 4cm thick sprayed on to expanded metal by cement gun.'

- The complex shapes at Ronchamp start from a theme of acoustic parabolas, playing a practical role on the east wall to reflect the sound from the outside altar for the pilgrims gathered on the hill. Simple, geometric shapes from Le Corbusier's earlier buildings have given way to more subtle, fractal, 'natural' shapes here, leading to the description of Ronchamp as the first Post-Modern building.

Structure



- The structure is made mostly of concrete and is comparatively small, enclosed by thick walls, with the upturned roof supported on columns embedded within the walls, like a sail billowing in the windy currents on the hill top.
- The main part of the structure consists of two concrete membranes separated by a space of 6'11", forming a shell which constitutes the roof of the building. This roof, both insulating and watertight, is supported by short struts, which form part of a vertical surface of concrete covered with a concrete spray gun (gunnite) and which, in addition, brace the walls of old Vosges stone provided by the former chapel which was destroyed by the bombings.
- These walls which are without buttresses follow, in plan, the curvilinear forms calculated to provide stability to this rough masonry. The floor of the chapel follows the natural slope of the hill down towards the altar. Certain parts, in particular those upon which the interior and exterior altars rest, are of beautiful white stone from Bourgogne, as are the altars themselves. The towers are constructed of stone masonry and are capped by cement domes. The vertical elements of the chapel are surfaced with mortar sprayed on with a cement gun and then white-washed - both on the interior and exterior. The concrete shell of the roof is left rough, just as it comes from the formwork. Watertightness is effected by a built-up roofing with an exterior cladding of aluminum. The interior the walls are white; the ceiling grey; the bench of African wood created by Savina; the communion bench is of cast iron made by the foundries of the Lure.
- The billowing roof of concrete was planned to slope toward the back, where a fountain of abstract forms is placed on the ground. When it rains, the water comes pouring off the roof and down onto the raised, slanted concrete structures, creating a dramatic but natural fountain.

Structure (Roof Framing)

A. 6 cm concrete shell.

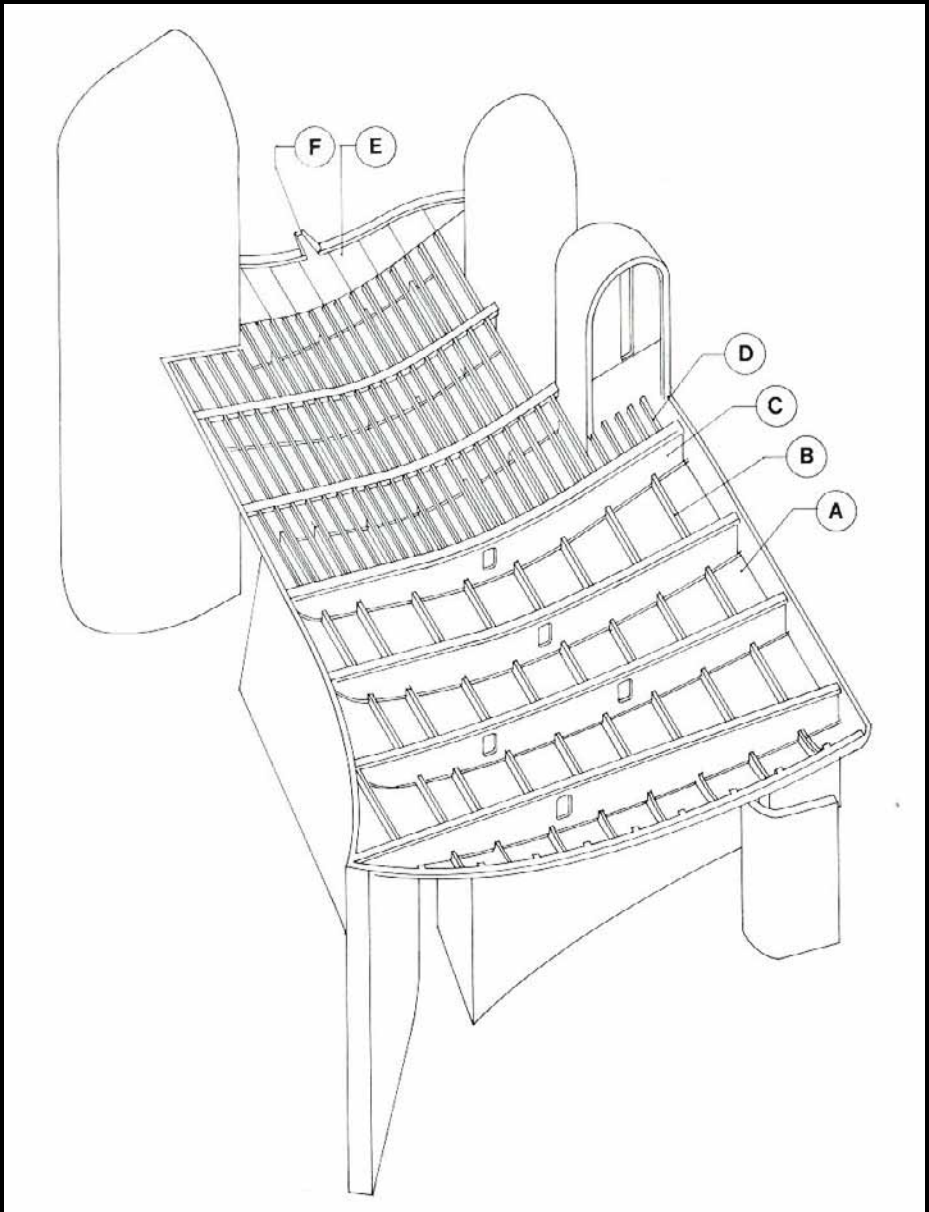
B. 10 x 30 cm cast in place lower beams.

C. 17 cm thick girders.

D. 5 x 27 cm pre cast upper roof beams.

E. Roof deck 4 cm thick.

F. Scupper for rainwater drainage.



Structure (Roof Supports)

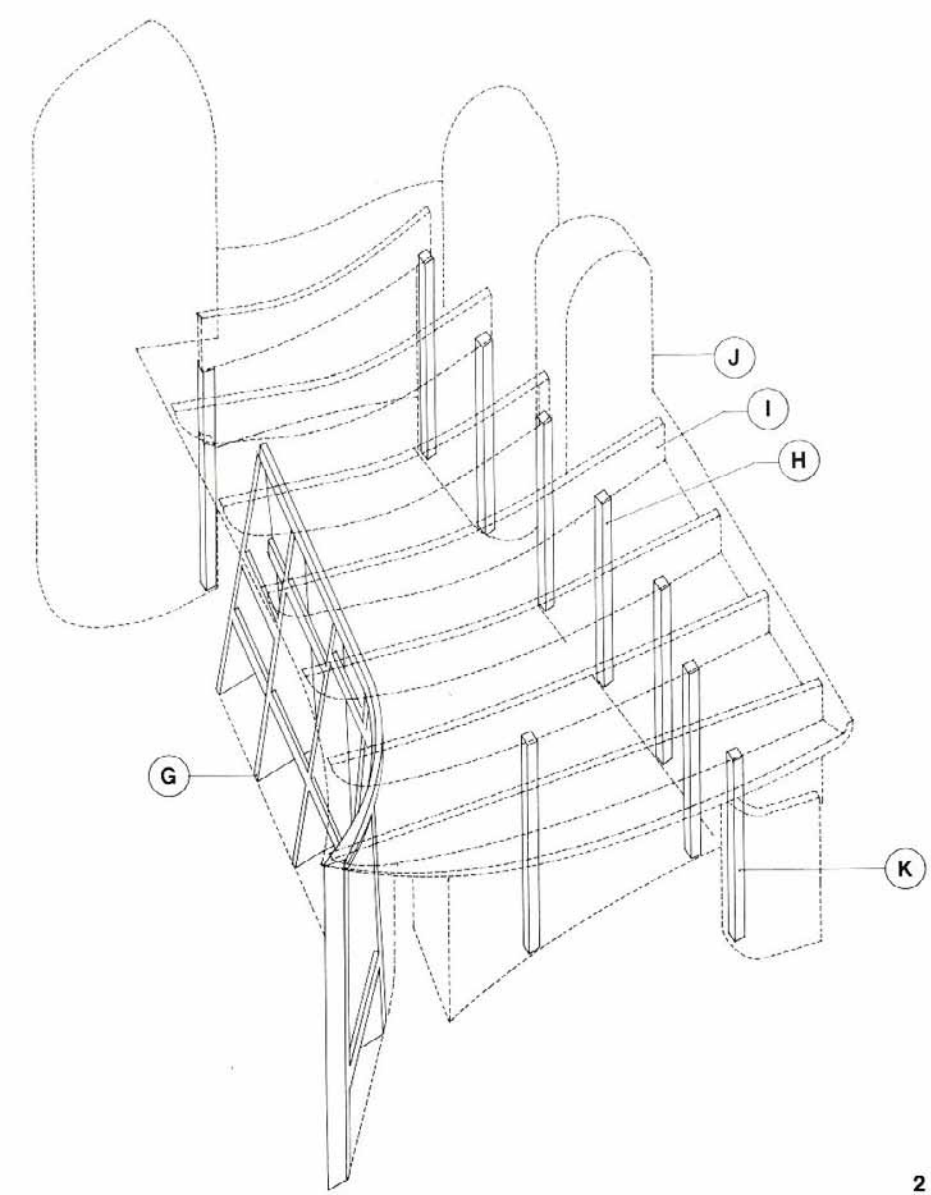
G. 15 cm concrete pylons and 40 x 15 cm beams.

H. Reinforced concrete column inside wall.

I. Girder bearing on column.

J. Masonry walls.

K. The only exposed column.



Section

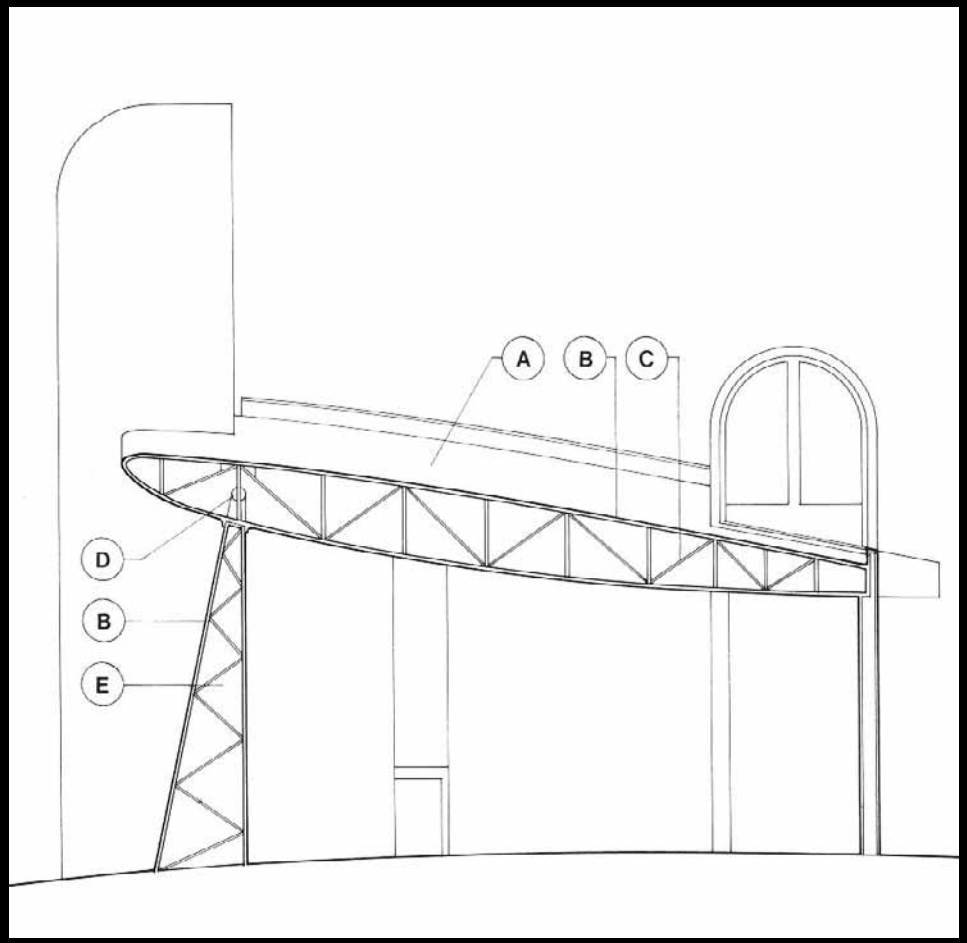
A. Aluminum roof covering.

B. 4 – 5 cm cement gunite covering.

C. Metal framework of parallel trusses.

D. Rotating joint.

E. Trussed pylon.



Details (window)

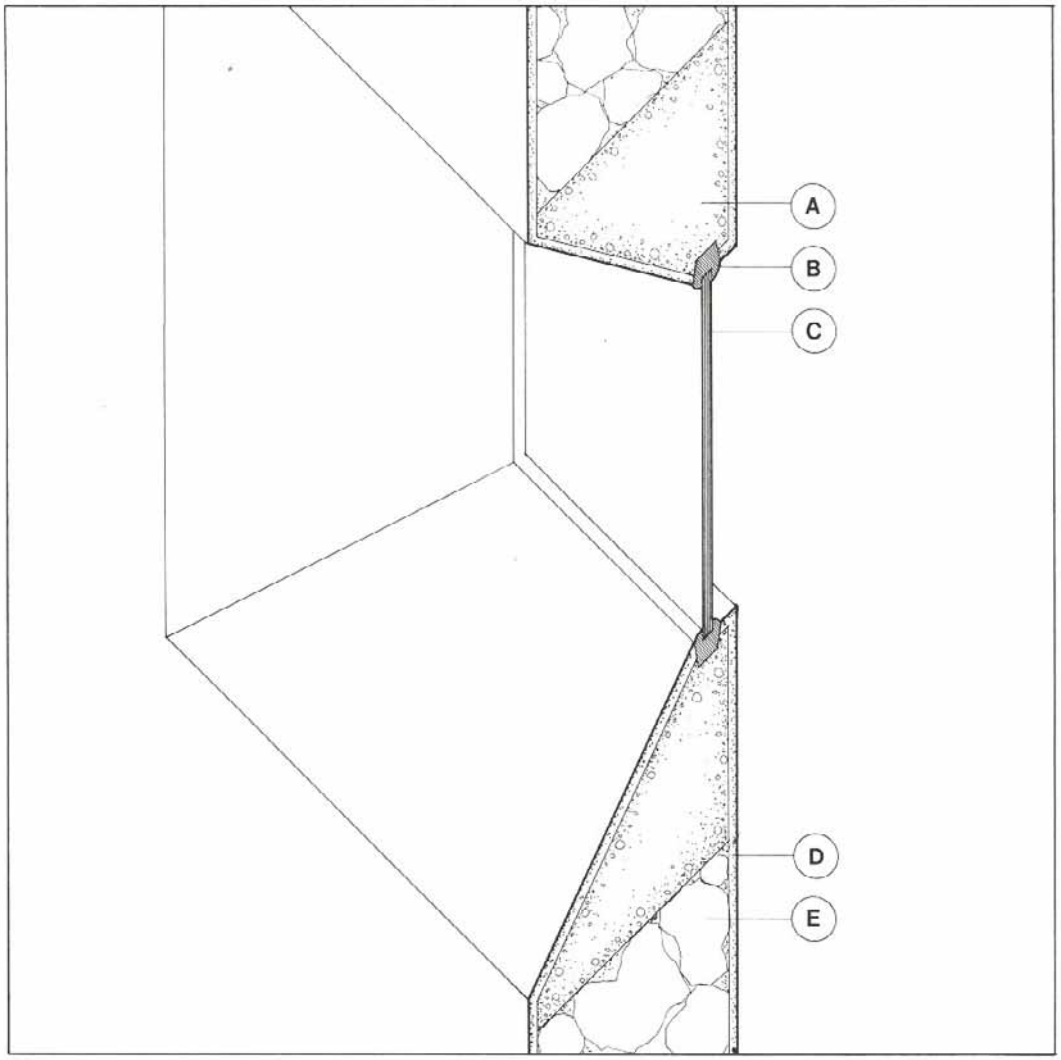
A. Precast concrete window frame.

B. Lead glazing compound.

C. Glass.

D. Plaster on wire mesh covering precast concrete and stone.

E. Rubble wall.



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Details (wall section at main door)

A. Truss section.

B. 15/10 mm enameled sheet metal panels.

C. Typical truss cord, 2 30x20x4 mm angles.

D. 2 30x20x4 mm face angles.

E. Horizontal truss members from 30x20x4 mm angles.

F. Joint with mastic fasteners and lead washers.

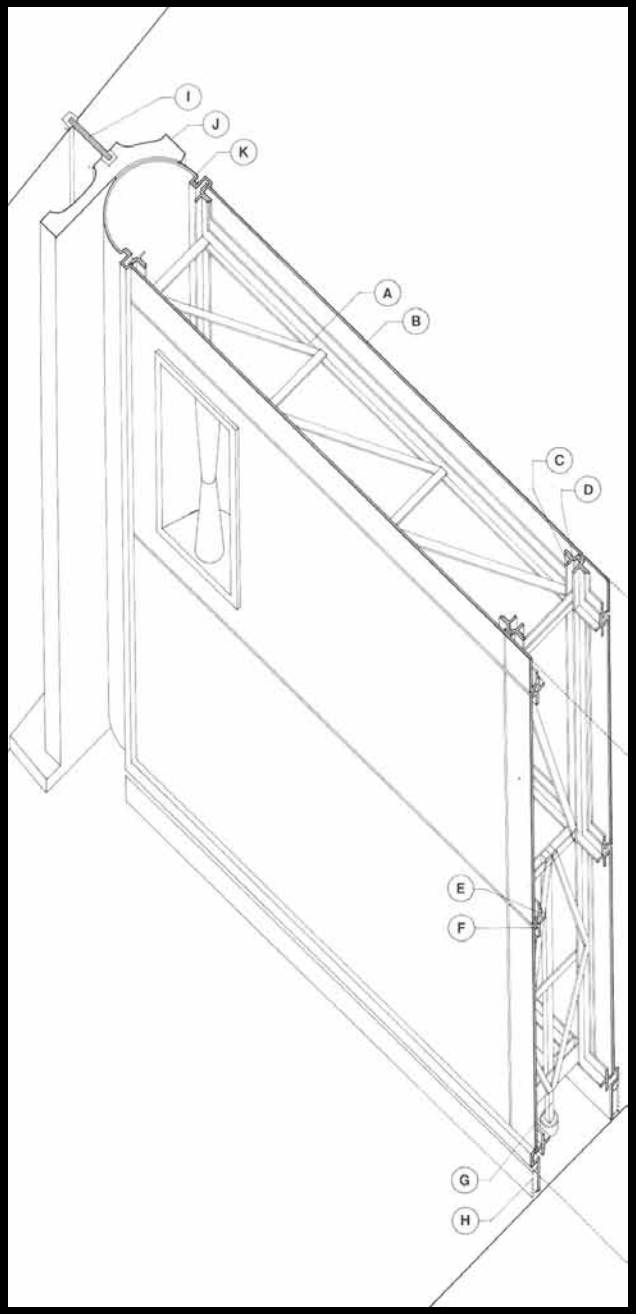
G. Pivot,

H. Base trim panel.

I. Frameless glass.

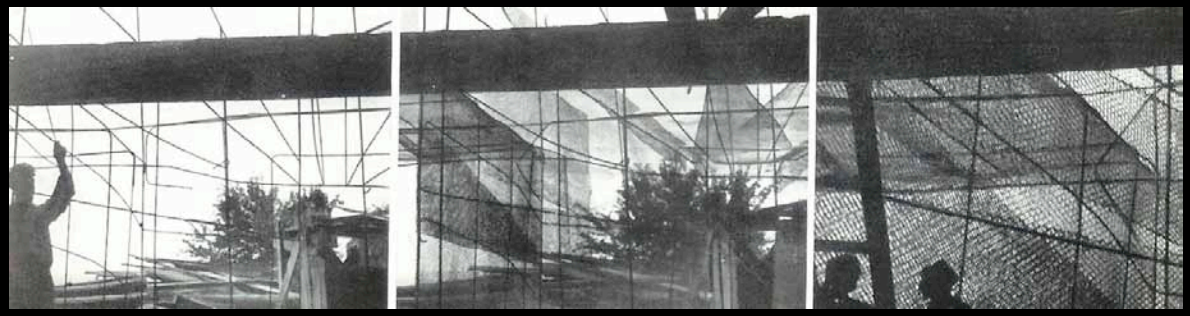
J. Concrete frame.

K. Metal end panel.



Construction

Below are some pictures of the Chapel while under construction in the early 1950's. The roof is a concrete shell that lies on walls made of salvaged stones. Seven precast concrete girders 17 cm thick support the roof.



How the Physical Characteristics Enhance the Religious Function:

- **Simplicity-** The chapel appears completely organic both in form and in materials. Notre Dame Du Haut lacks any obvious attempts at accentuating geometry. The materials are left in the raw and allowed to age naturally. The simplicity of form gives the chapel the feel of sculpture.

- Lack of ornate detail allows the building to completely exist as a religious space without any distractions to pilgrims and worshippers. Lacking mass-produced materials the structure is pure and simple exemplifying the desired way of life for those who came to the chapel.

- **Oblong Nave-** The word nave was derived from the nave of a ship. Le Corbusier created a nave for the chapel that appeared similar to the nave of a ship. This line of thinking brings us back to simplicity. Le Corbusier was breaking down all the elements of the structure to the basic forms and intentions so as not to distract from the true function of the building as a religious space.

- **Beton Brut Roof-** The roof is dark brown contrasting greatly with the whitewashed walls, constructed with two reinforced concrete membranes. The roof softly curves upward toward the sky. There is a small gap between the walls and the roof making it appear to be floating above the rest of the chapel. From the interior of the building one can see a line of light entering the structure through this gap. It is said that the smooth curve of the roof is symbolic of praying hands.

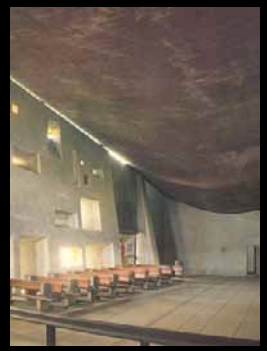
- **South Facing Wall of Windows-** This wall is also known as the `wall of light'. The windows vary in size and are placed in no certain pattern in the wall. Even though the walls are thick and heavy the interior is filled with a surprising degree of light thanks to these windows. The windows contain elements of stained glass adding color to the otherwise achromatic structure. The windows also enhance the steep slope of the wall.

  Light has been a long time symbol of religion. Gothic Architecture took this concept to the extreme considering light one of the most important elements of any religious structure. Light gives the space an ethereal quality.

- **Exterior Alter-** The hill on which Notre Dame Du Haut is located has been a site for pilgrimages since the thirteenth century C.E. The alter on the exterior of the chapel is a place where these weary travelers can come and worship. During important pilgrimage days, such as feast days, the outdoor chapel can house every visitor. The exterior alter is one of three chapels located beneath three towers. The main chapel can only hold up to 50 people. The small main chapel allows for more personal prayer.

- **Sculpture of the Virgin Mary-** This wooden sculpture is placed in a high niche. Le Corbusier was raised protestant so he therefore researched the Catholic religion before beginning to design the building. While learning about the religion he noticed a reoccurring mother and child relationship. He placed the sculpture up high so that the Virgin Mary could look over her children. The Virgin Mary can be seen from both the interior and exterior of the chapel. This way she can look over

  both alters.

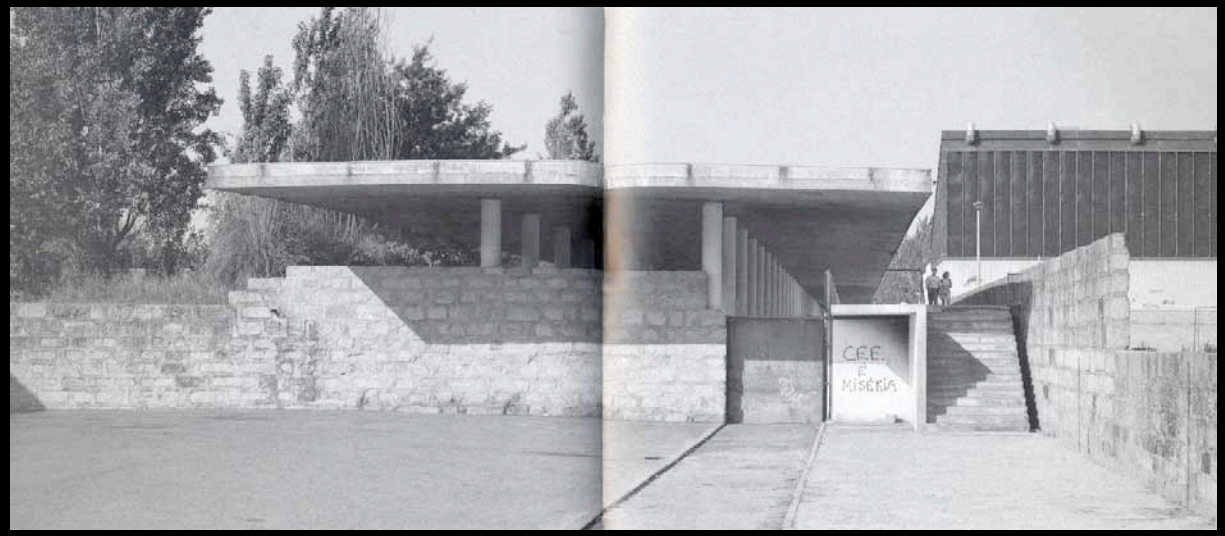


Braga Stadium

Eduardo Souto de Moura

Souto de Moura: Influences

Mies van der Rohe's Barcelona Pavilion



Cultural Center in Braga

Braga Stadium

Braga Stadium: Building Information

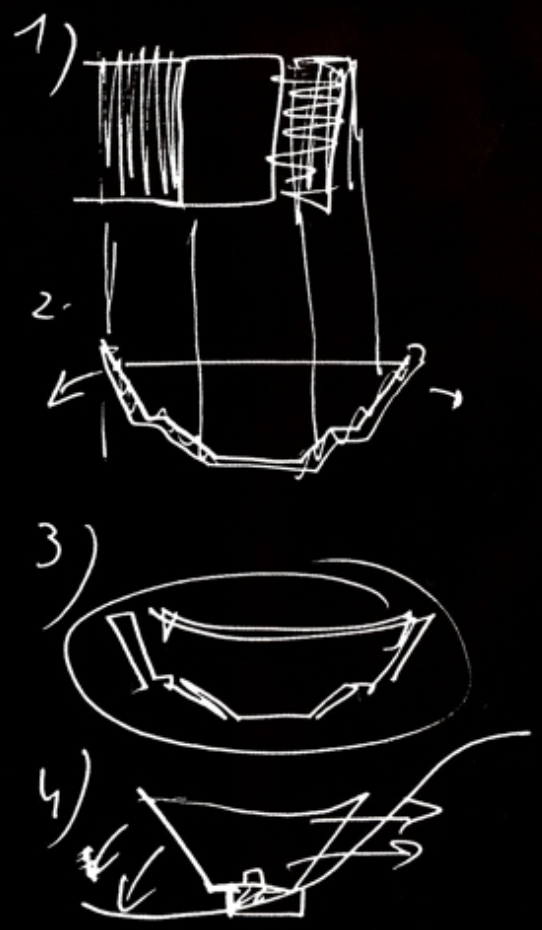
Client Câmara Municipal de Braga
Architect: Eduardo Souto de Moura
Collaborators: Carlo Nozza, Ricardo Meri, Enrique Penichet, Atsushi Hoshina, Diego Setien, Carmo Correia, Luísa Rosas
Landscape Design: Daniel Monteiro
Structural consultant: AFA Associados
Electrical consultants: Rodrigues Gomes & Associados
Mechanical consultants: Rodrigues Gomes & Associados
Consultants: Arup Associates London (General Stadium Advice)
General contractor: Soares da Costa/Assoc/Ace
Design: 2000
Construction start: January 2002
Completion: 2004

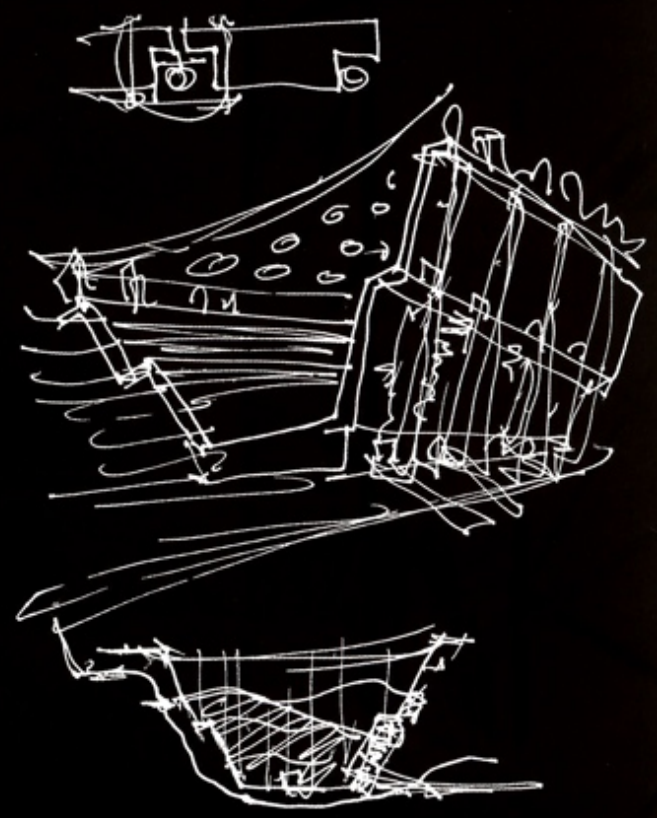
Steel (t):	15,000
Concrete (cubic meters):	90,000
Total Cost (USD):	75,000,000

Braga Stadium: Site

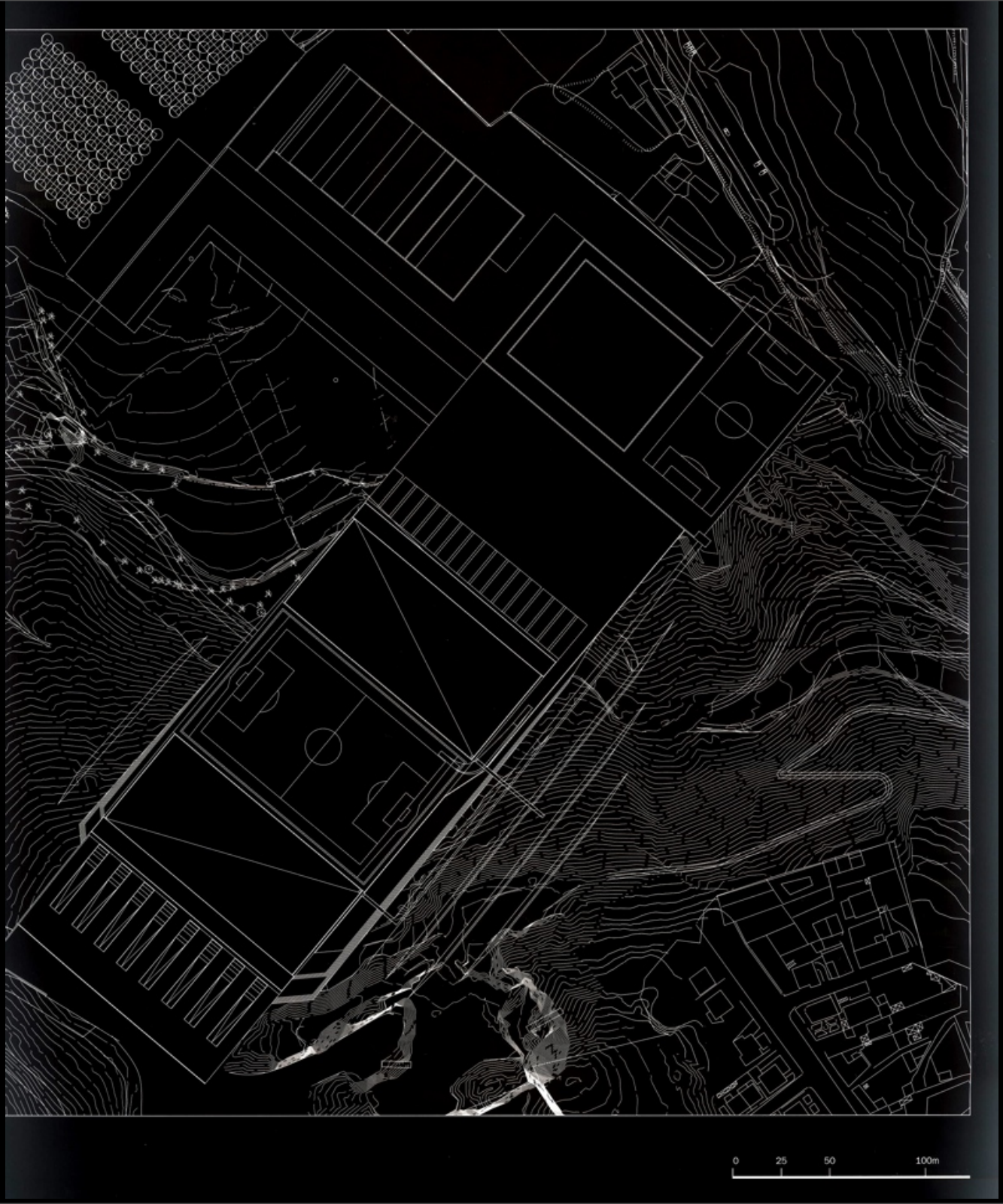
Braga Stadium: Site

Braga Stadium: Sketches

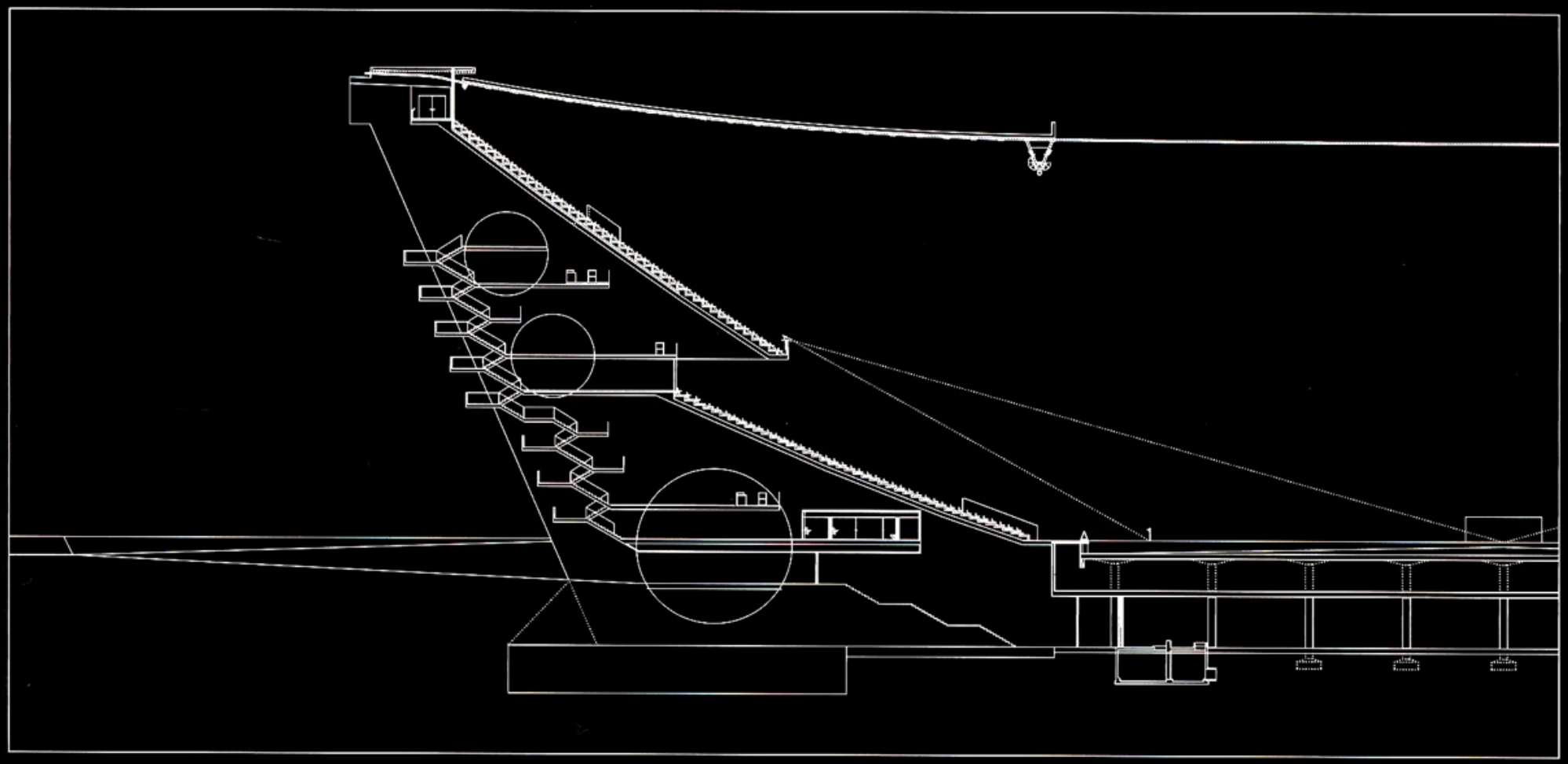




Braga Stadium: Plan

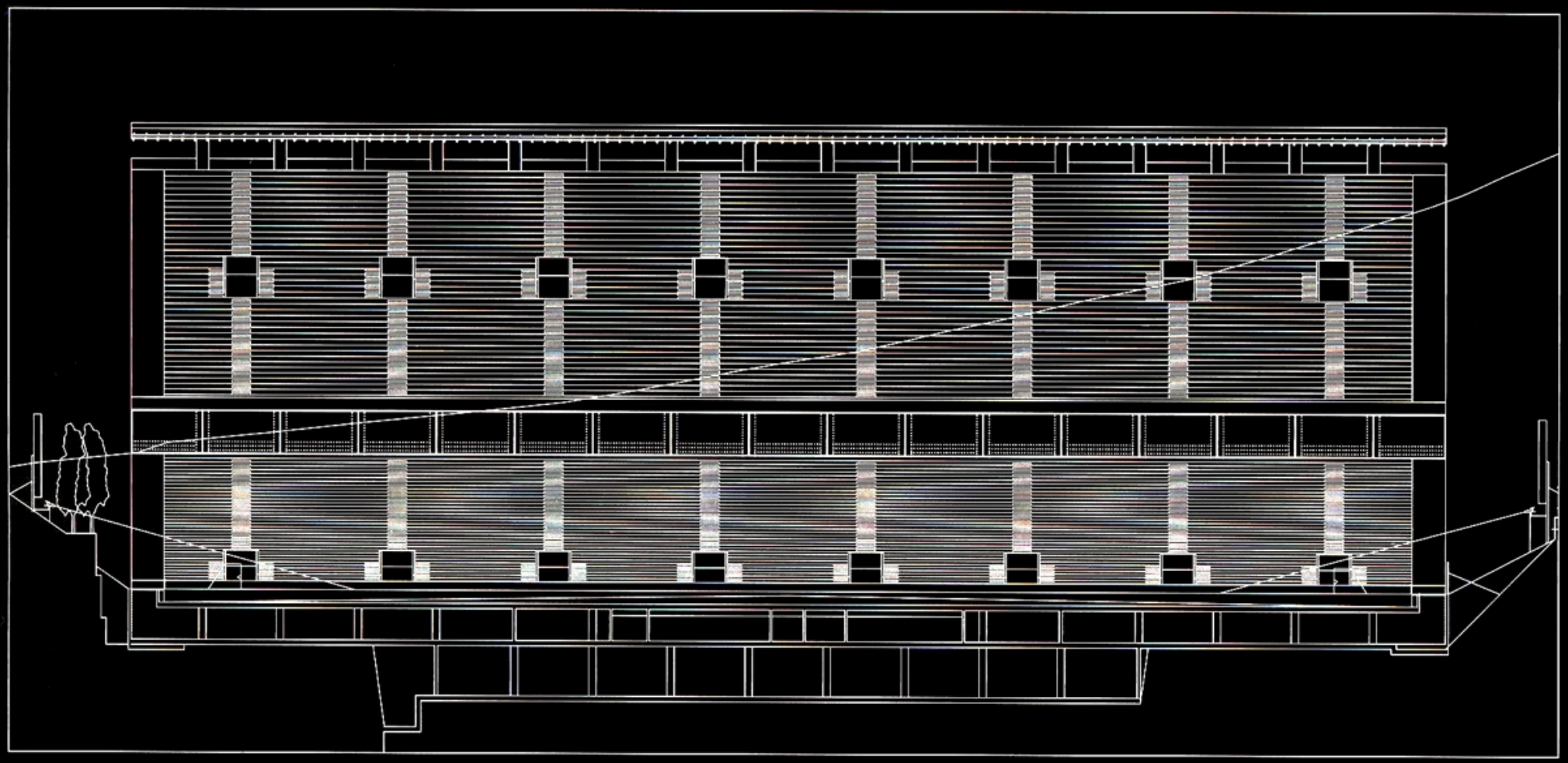


Braga Stadium: Section

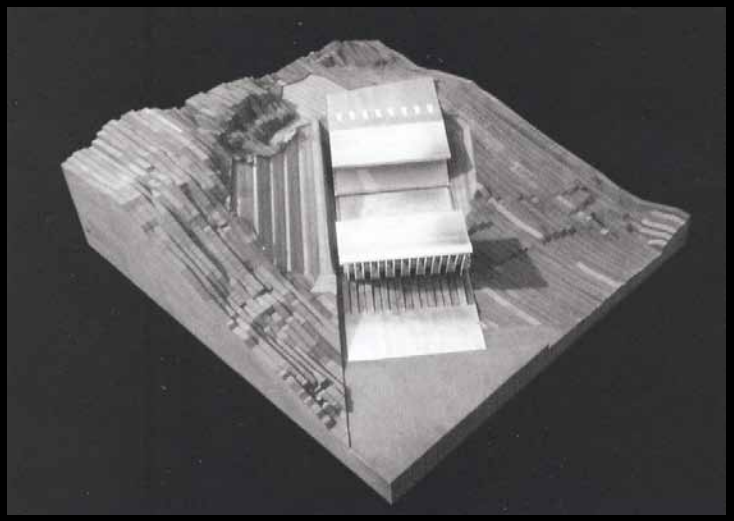


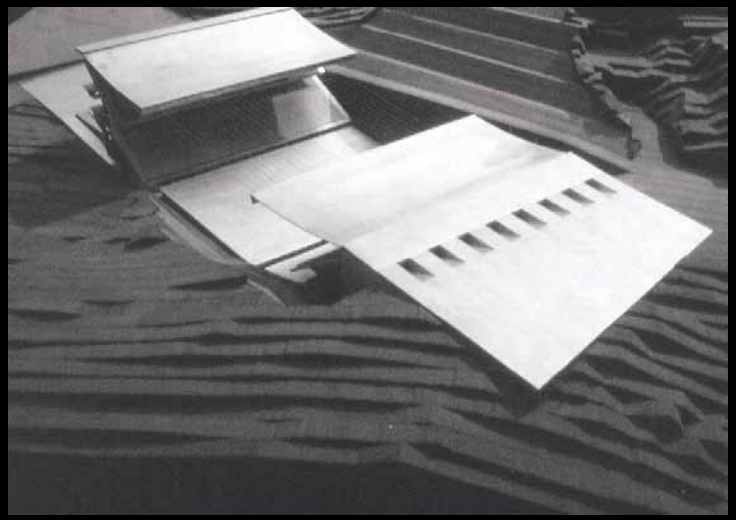
Braga Stadium: Section

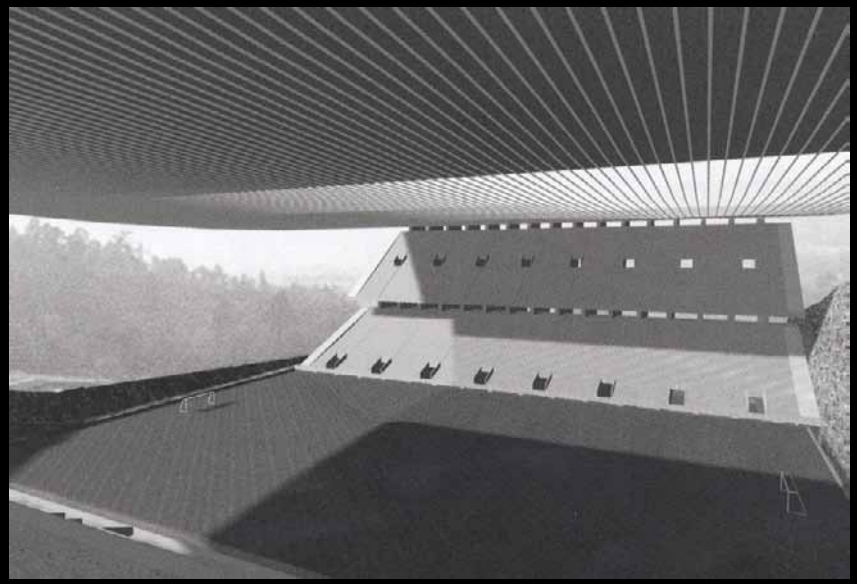
Braga Stadium: Section



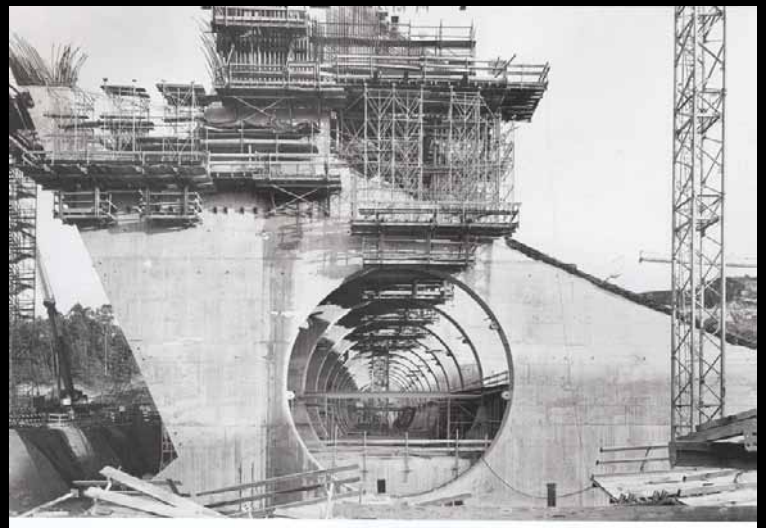
Braga Stadium: Models

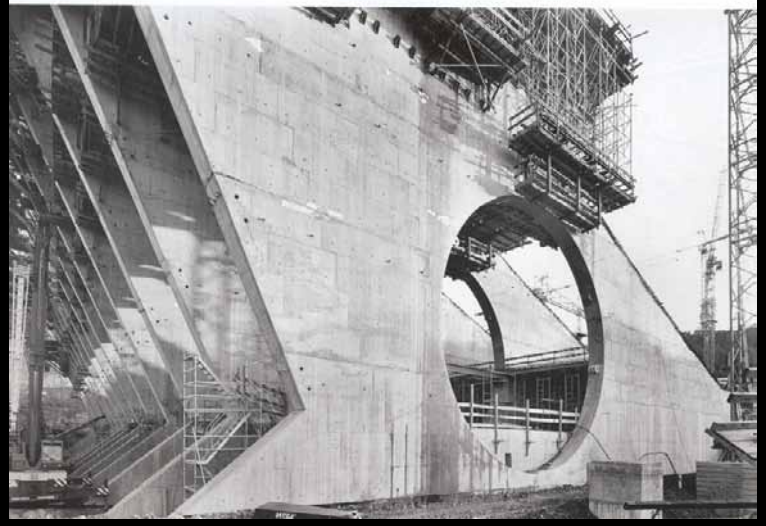






Braga Stadium: Construction





Braga Stadium: Construction

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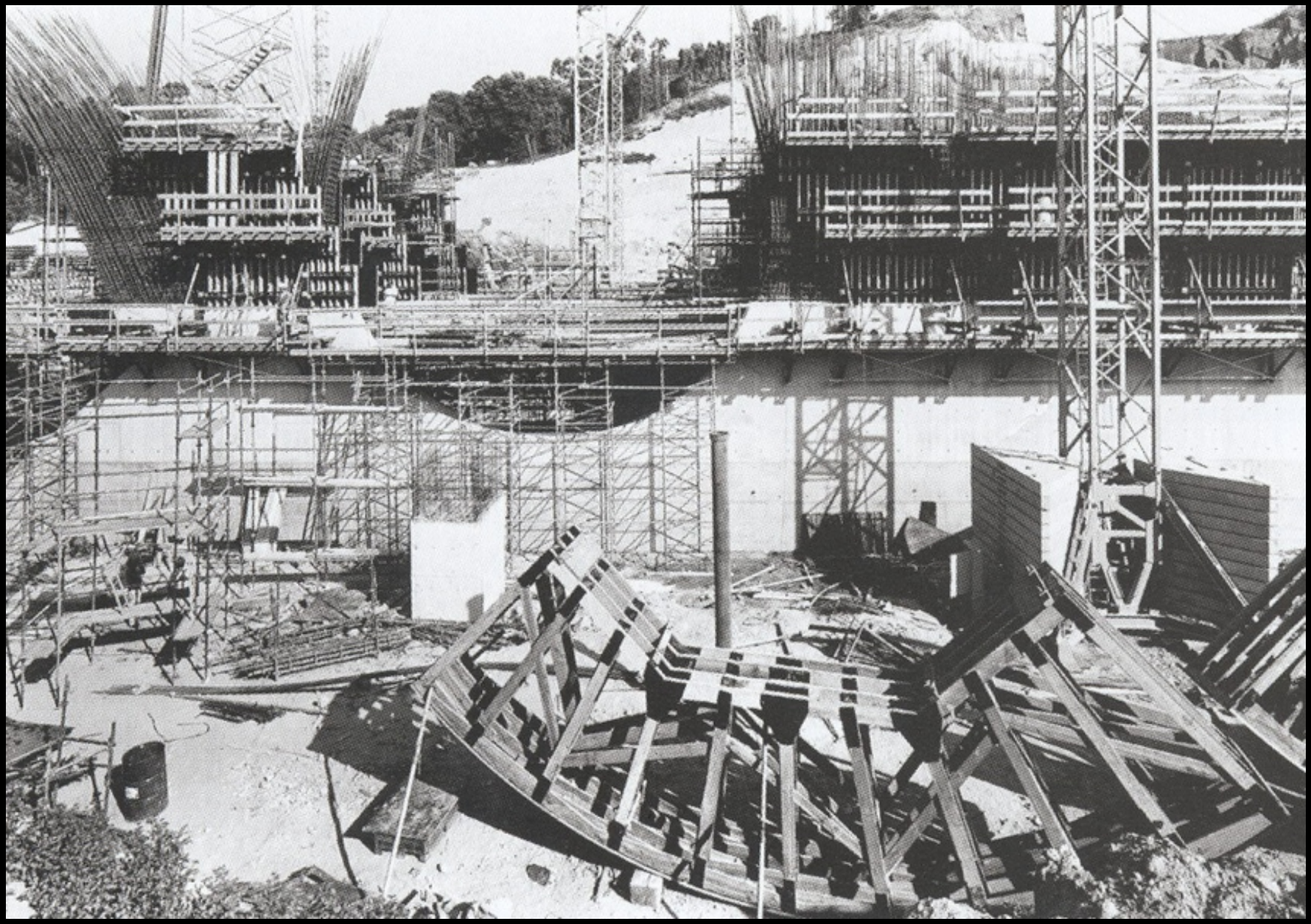

Braga Stadium: Aqueduct

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