

# DOCTA MANUS DRAWING STRUCTURES

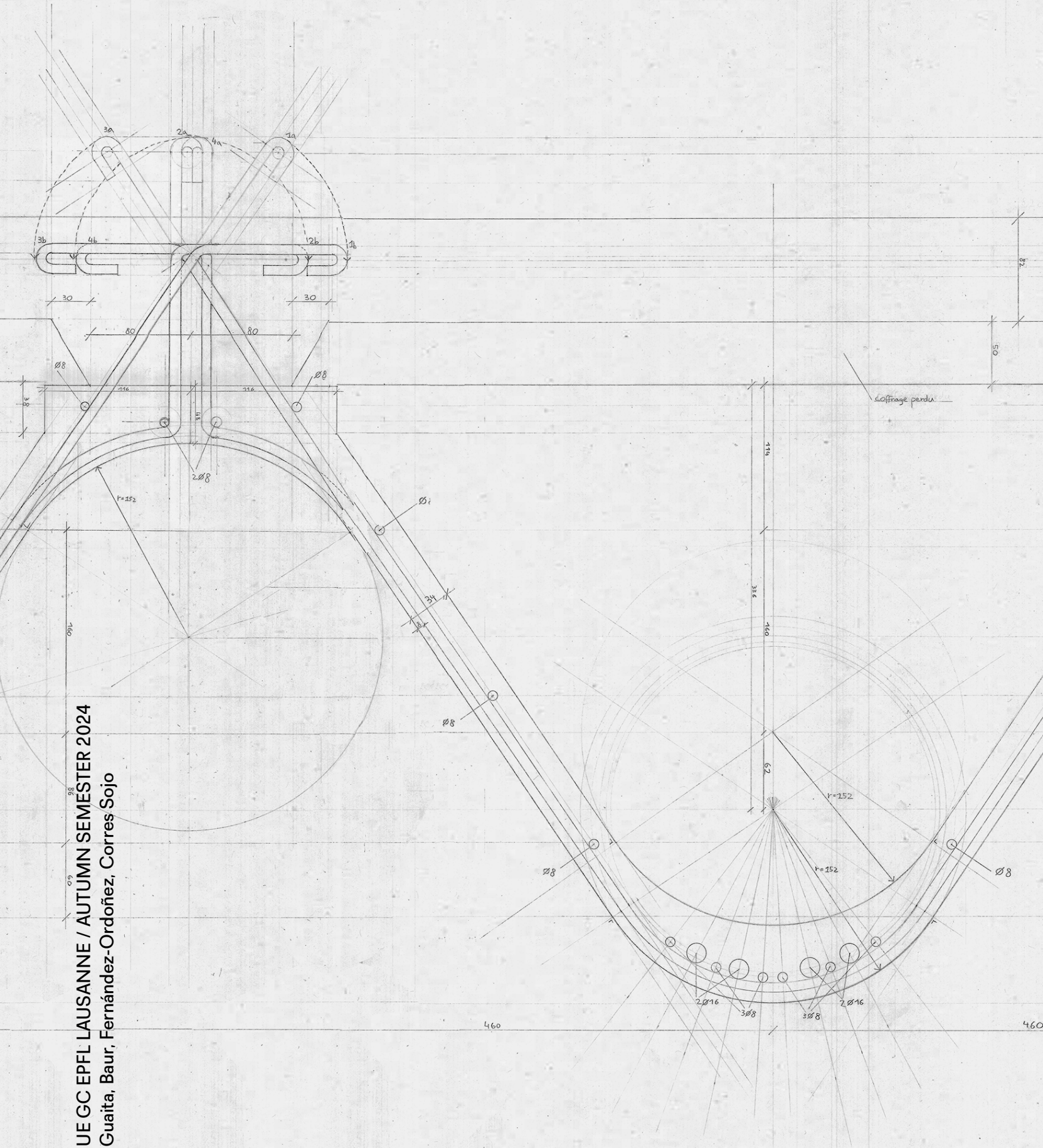


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Drawing constitutes a very powerful and critical tool of conceptual design. Drawing constructs thought, it acts as a communication interface between the work and the mind and between different disciplines; it is the most powerful language of communication in the working together between architects and engineers.

The UE Docta Manus – Drawing Structures will introduce the basic drawing techniques (sketch, plan, section, elevation, axonometry, perspective). Based on these techniques, we will further investigate analytical drawing methods capable of exploring structural concepts and their architectural solutions.

Through hand drawing we will analyse selected projects that embody an exemplary interplay of architecture and engineering, as e.g. the work of Mies van der Rohe, Jean Prouvé, Luigi Nervi, Robert Maillard or Eugène Freyssinet. Our main focus lies on the load bearing structure and its tectonic and spatial articulation as common intersection between architecture and engineering. Through analysis, students will enter into dialogue with construction in a direct way. They will get a sense for the adequacy of tools and refinements of solutions. We will investigate proportion, material innovation and tectonic articulation in relation to the structural idea and become aware of the importance of detail. Analysis will take apart and make transparent the parameters and dependencies of the design process and will open the work into a condition of possibility.

We will draw by hand, as this is the most direct and immediate way of becoming aware of technique in relation to intention (it forces to take decisions). Drawing by hand is a cognitive process

where the dynamic relation between doing and thinking is essential. That is why 'the more you draw, the more you see' and vice versa. The construction of points and lines on a sheet of paper will sensitize students to the notions of scale, size, proportion, transparency and composition. The learning hand will build up tacit knowledge.

It makes them aware of the importance of detail as a key moment of construction, as a mediator relating a structure to the perceiving subject.

This fifth publication shows a selection of 17 working drawings from an atelier of 22 students in civil engineering and architecture that took place during the autumn semester 2024 at EPFL. Each student analyzed one out of six selected projects of Pier Luigi Nervi, and projects of Eduardo Torroja, exploring adequate scales, drawing types and techniques to understand the project's structure and construction principles. The drawings thus include dimensioning and fabrication notes up to catalogue of elements, mounting principles and sequence. The careful construction of layers of information by hand builds up into tactile working drawings that embody the spatial and tectonic ideas as well as the construction process of a structure. These 'meta-drawings' allow the observing eye to survey from one detail to another in a synchronous manner while integrating all information into the mental construction.





The American philosopher John Dewey (1859-1952) was one of the first to spread the idea that the best way to learn to do something is simply to do it. You don't learn to ride a bike by listening to theoretical explanations over and over again, or even by watching others do it. We learn when we get on, fall off and get up again. Painters, writers, dancers, musicians... learn by painting, writing, dancing and playing their scores. In the case of the design of industrial objects, architecture, engineering and sculptures the first step is *drawing the idea* before built it. Everyone learns from their own mistakes and is eagerly involved in learning.

On the other hand, if we want to learn what others have done, the path is the same. The key to understanding the work of the great masters of the history of architecture and engineering is to draw it. We must do this by changing the scale of our gaze. First from a great distance to understand its insertion in the landscape or the city, and from up close to understand the small details of its structural and constructive design.

During the first half of the twentieth century Dewey was the most representative figure of progressive pedagogy in the United States. He applied this learning ideology with his students in the so-called *New School* founded in 1919 in New York.

*This is the hour for the experiment;  
and New York is the place, because it is the  
greatest social science laboratory in the  
world and of its own force attracts scholars  
and leaders in educational work.*

#### FOUNDING MANIFESTO

The *New School* housed very different study programs, including philosophy, literature, social sciences, art, economic, painting, history, music, social sciences, actors, theatre directors, literary creation, design, science, technology, town planning... As predicted in the manifesto of the *New School*, there were many relevant professors in its different programs. Among

them; John Dewey, Frank Lloyd Wright, Piet Mondrian, Woody Allen... As we know, *Learning by doing* was also the ideology of the famous Bauhaus School of Arts and Crafts, also founded in 1919 in Germany. Its first directors were Walter Gropius, Hannes Meyer and Mies van der Rohe.

In 1934 Eduardo Torroja founded in Madrid the Technical Institute of Construction that today bears his name. A revolutionary research center unlike any other in the world. It housed all the activities that produce progress, Research, Design-Built, Dissemination and Teaching. His international school was based not only on *Learning by doing*, but also on *Doing side by side – day by day*. Eduardo Torroja considered it important that all the professionals who carried out these different activities did so together, in the same workspace. Only in this way could they share, day by day, the progress of their works, their concerns and worries, and help each other to improve results. As at the Bauhaus and the New School of New York, at the Institute, very different professionals worked together: scientists, engineers, architects, chemists, physicists, furniture designers, painters, writers, graphic designers, historians...

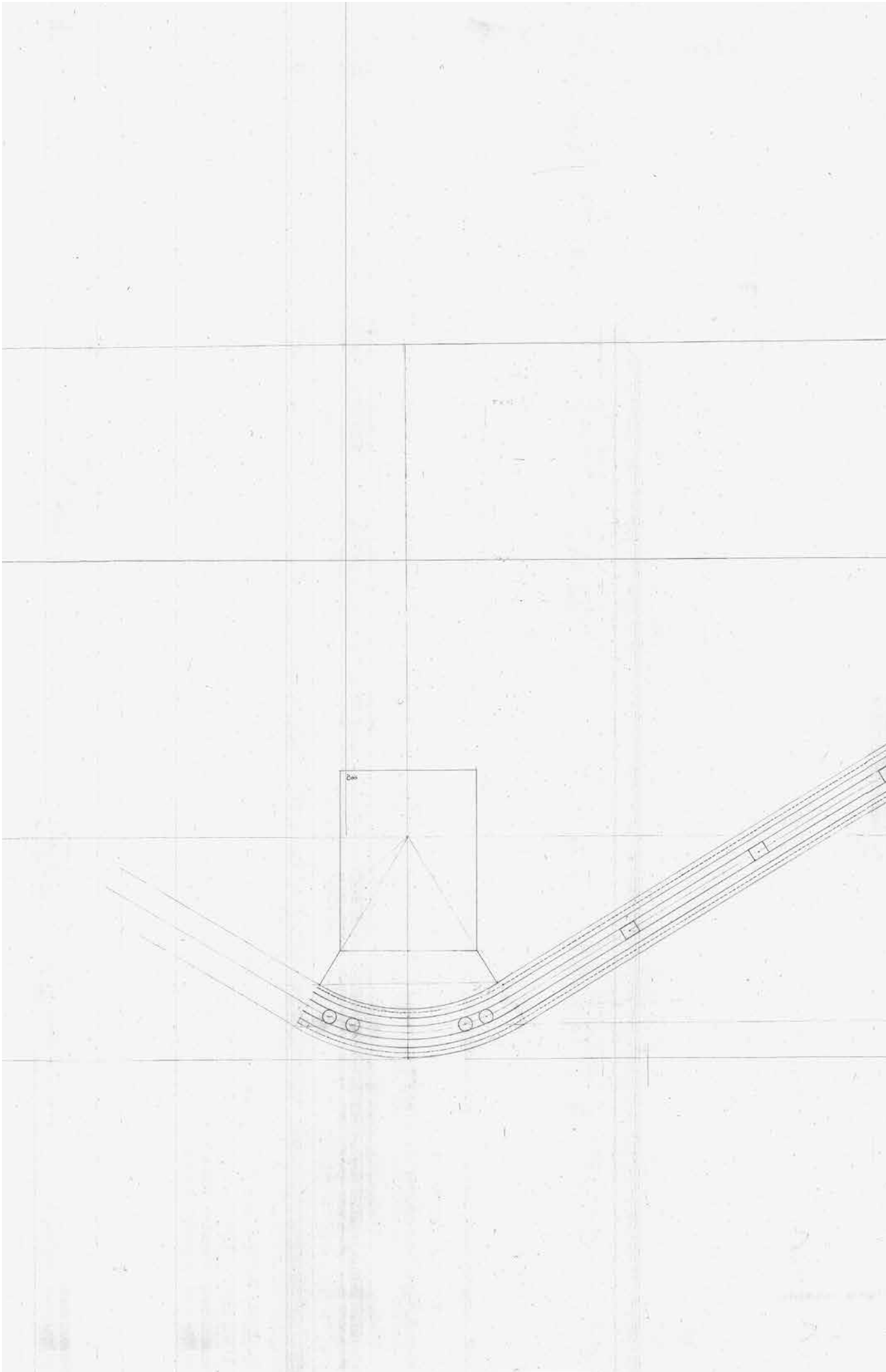
Eduardo Torroja also carried out his structural designs in his office at the Institute from 1953, the year in which he managed to inaugurate a new headquarters capable of housing all these activities in the same architectural space. A very special modern building which was admired by all the people who visit it as his friends Pier Luigi Nervi, Richard Neutra, Franco Levi, Jaroslav Polivka, David B. Steiman, Mario Salvadori... They and too many other were invited by Eduardo Torroja to participating in several activities of his Institute to disseminating and teach the progress of the design and built of the architecture, engineering and materials.

On the door of the Eduardo Torroja Institute you can read, in a single sentence, what this center stands for, *Técnicas Plures Opera Unica*.

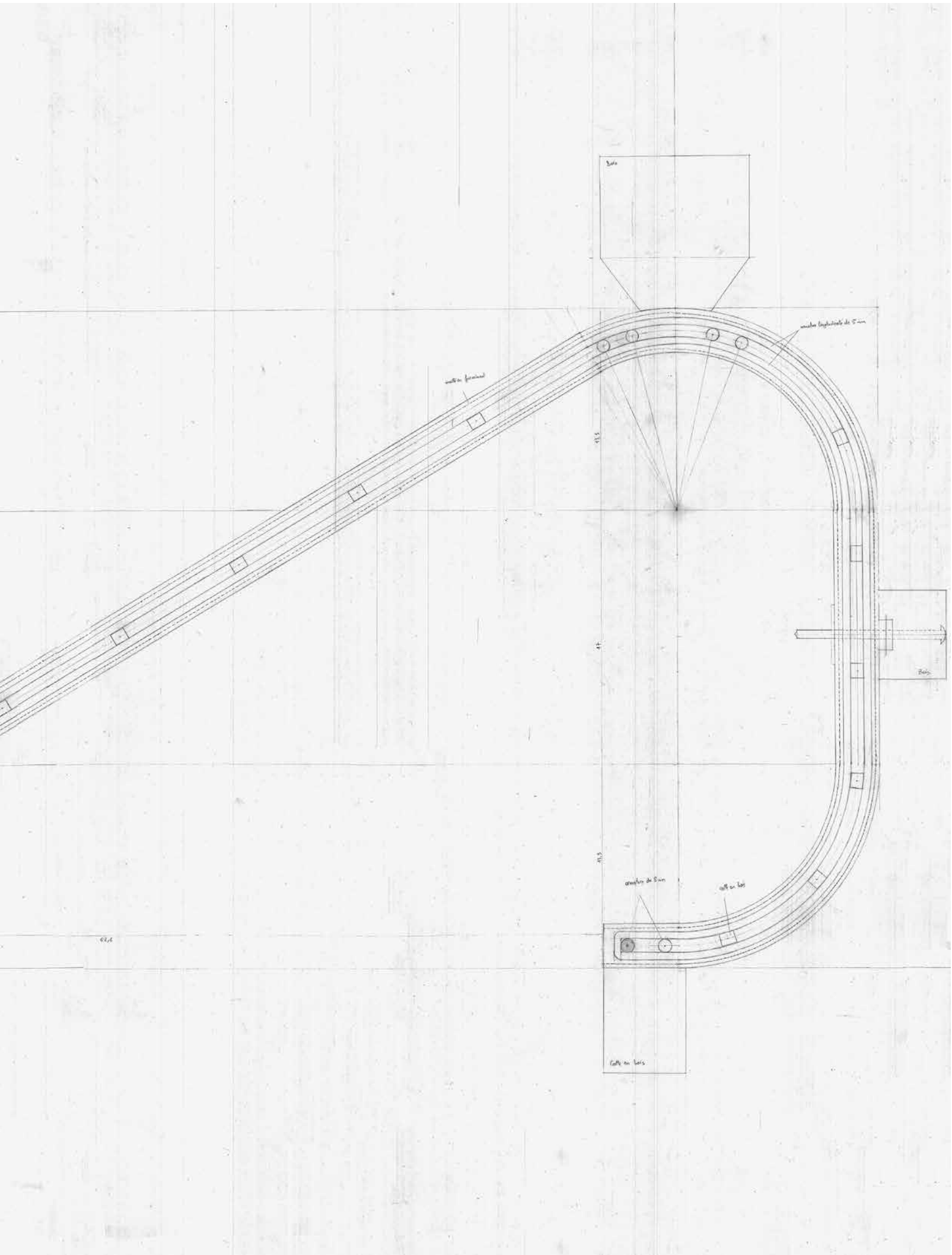


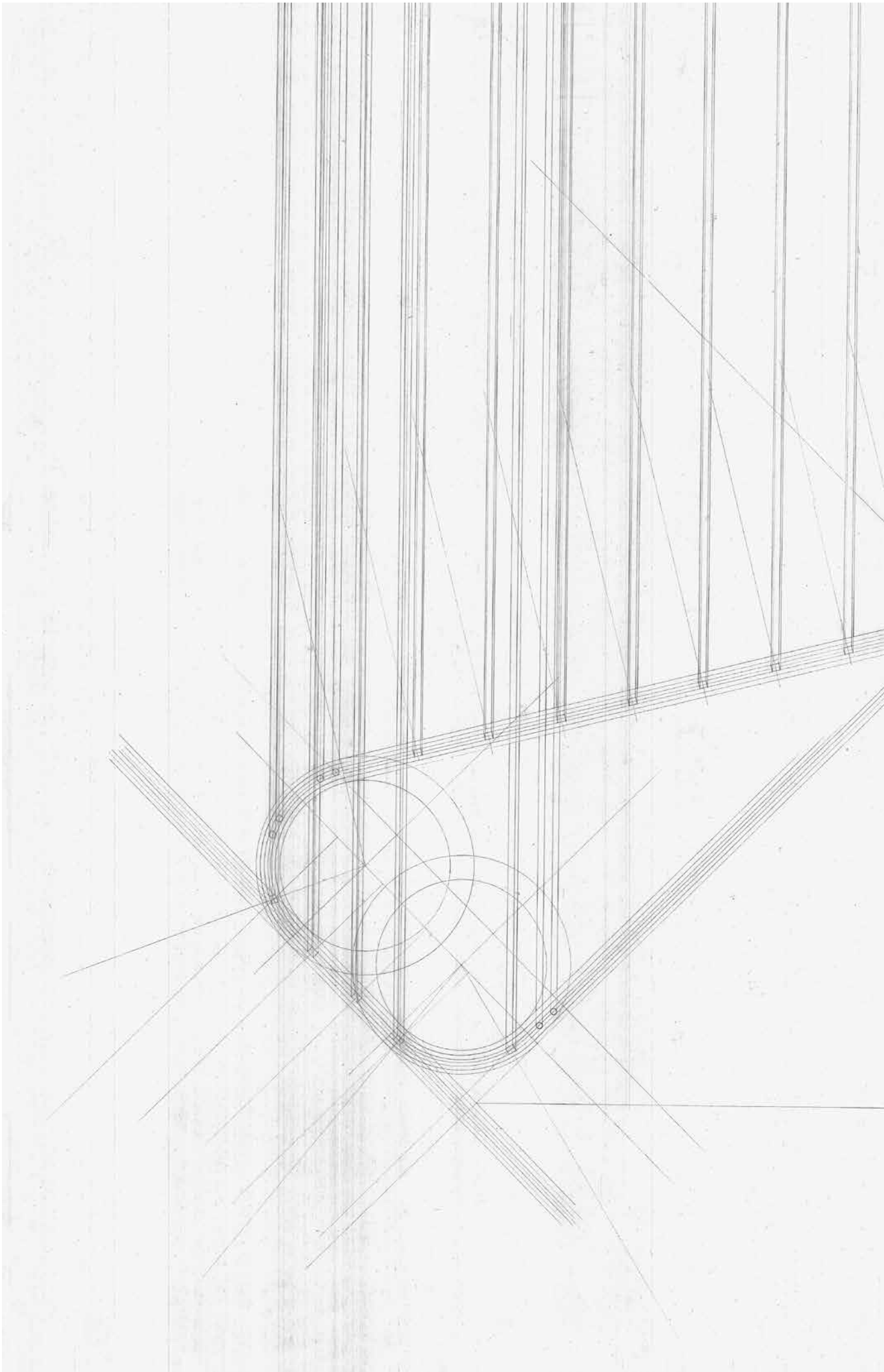
PIER LUIGI NERVI

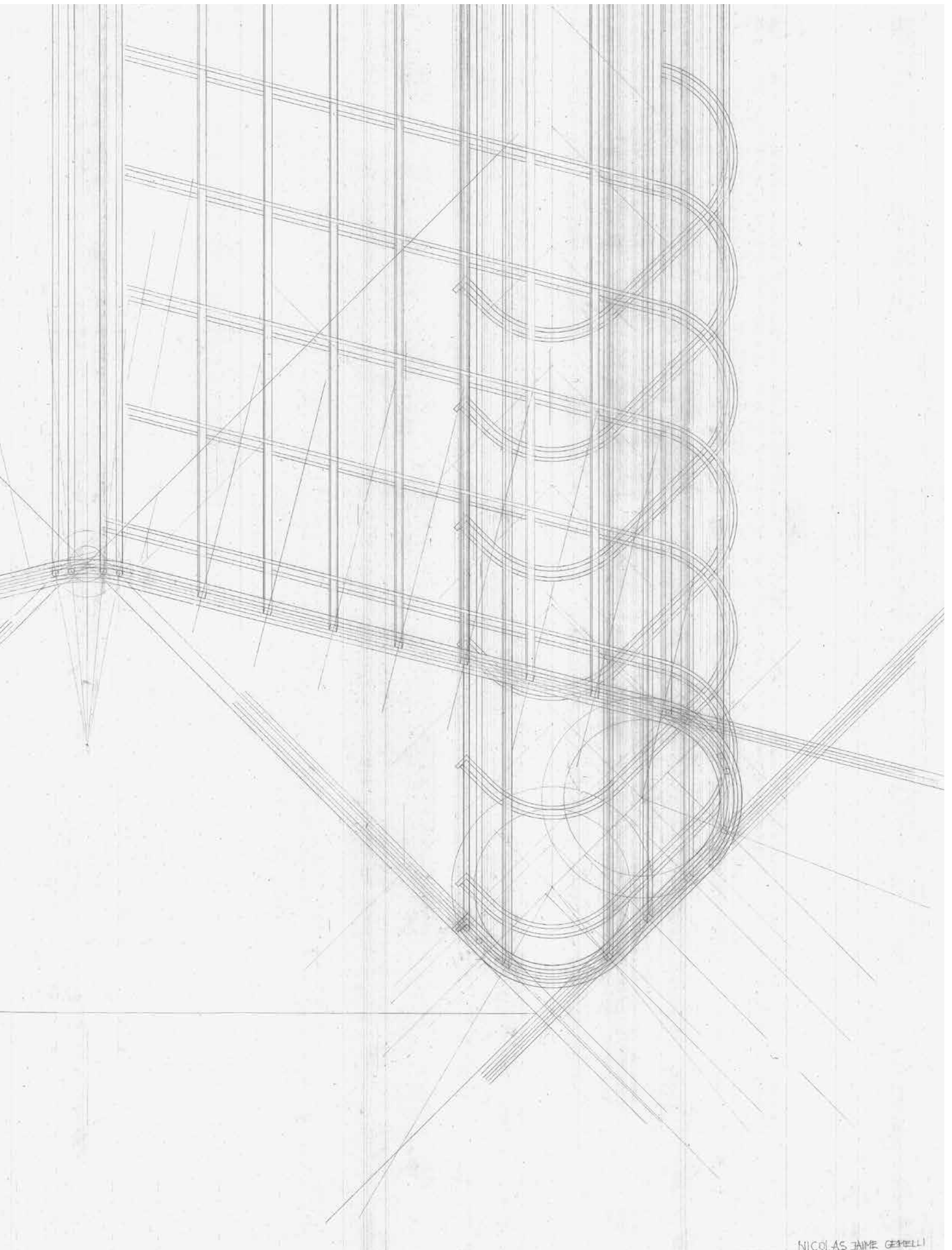
WORKSHOP HALL,  
ROME, 1945







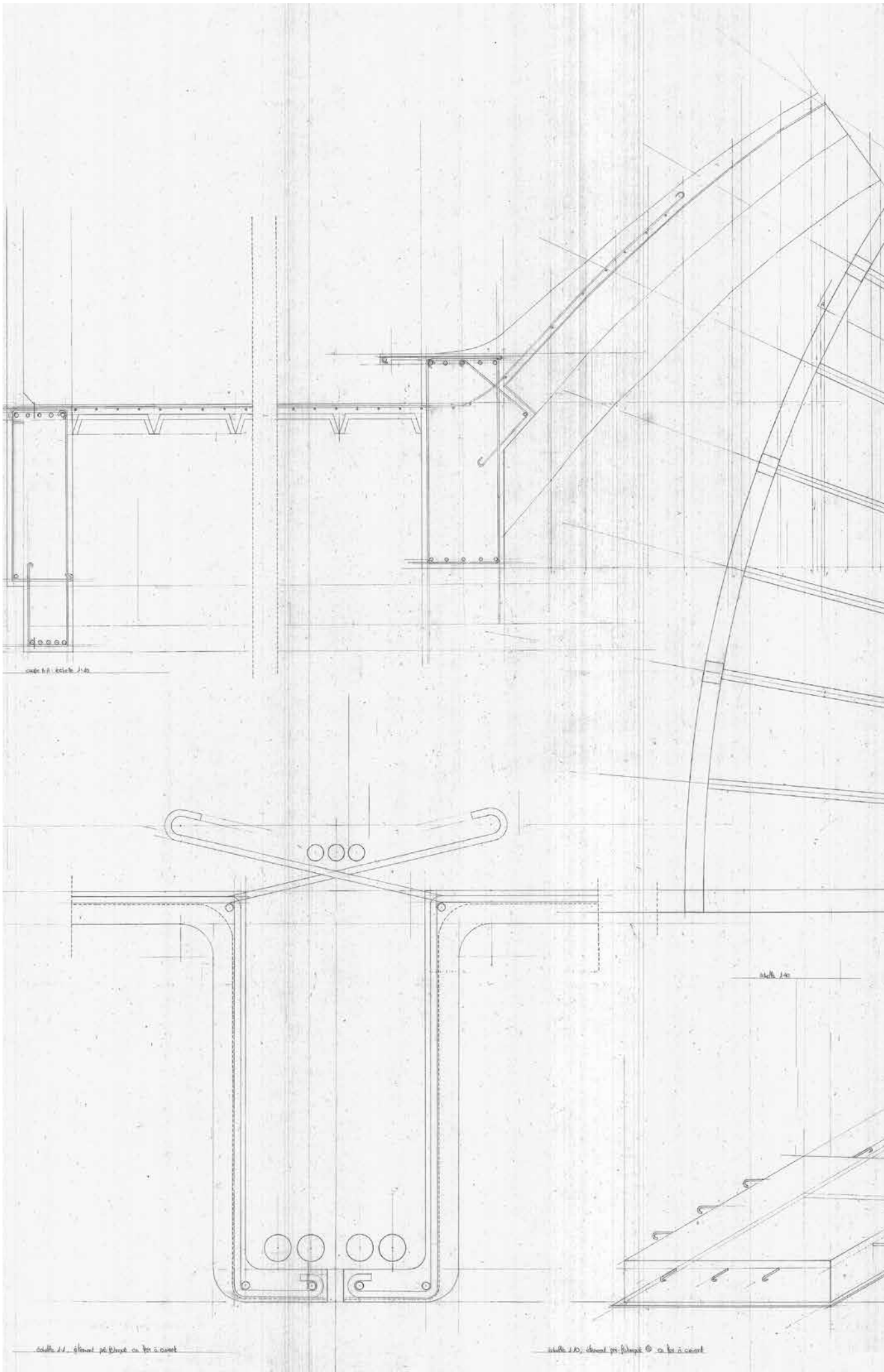


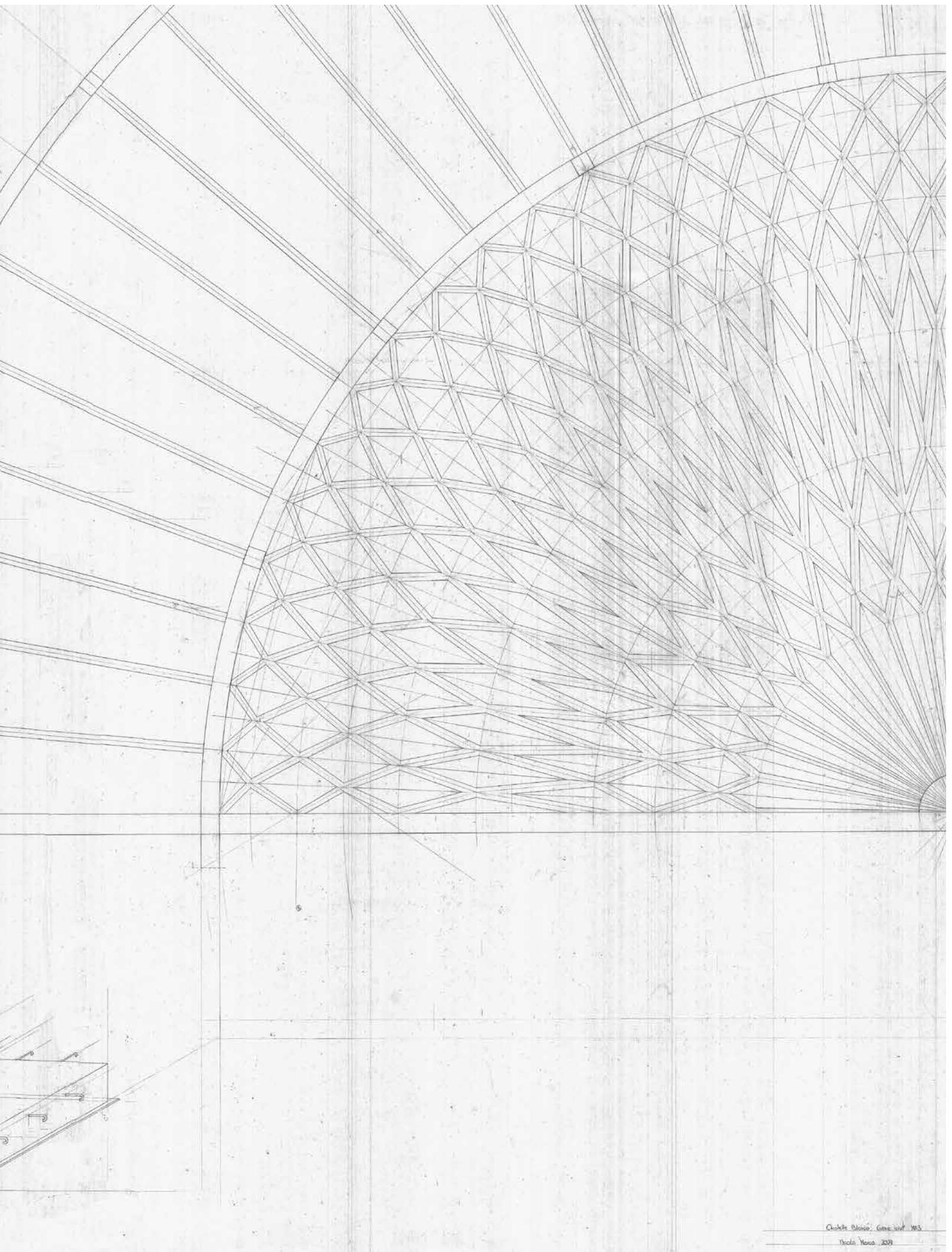




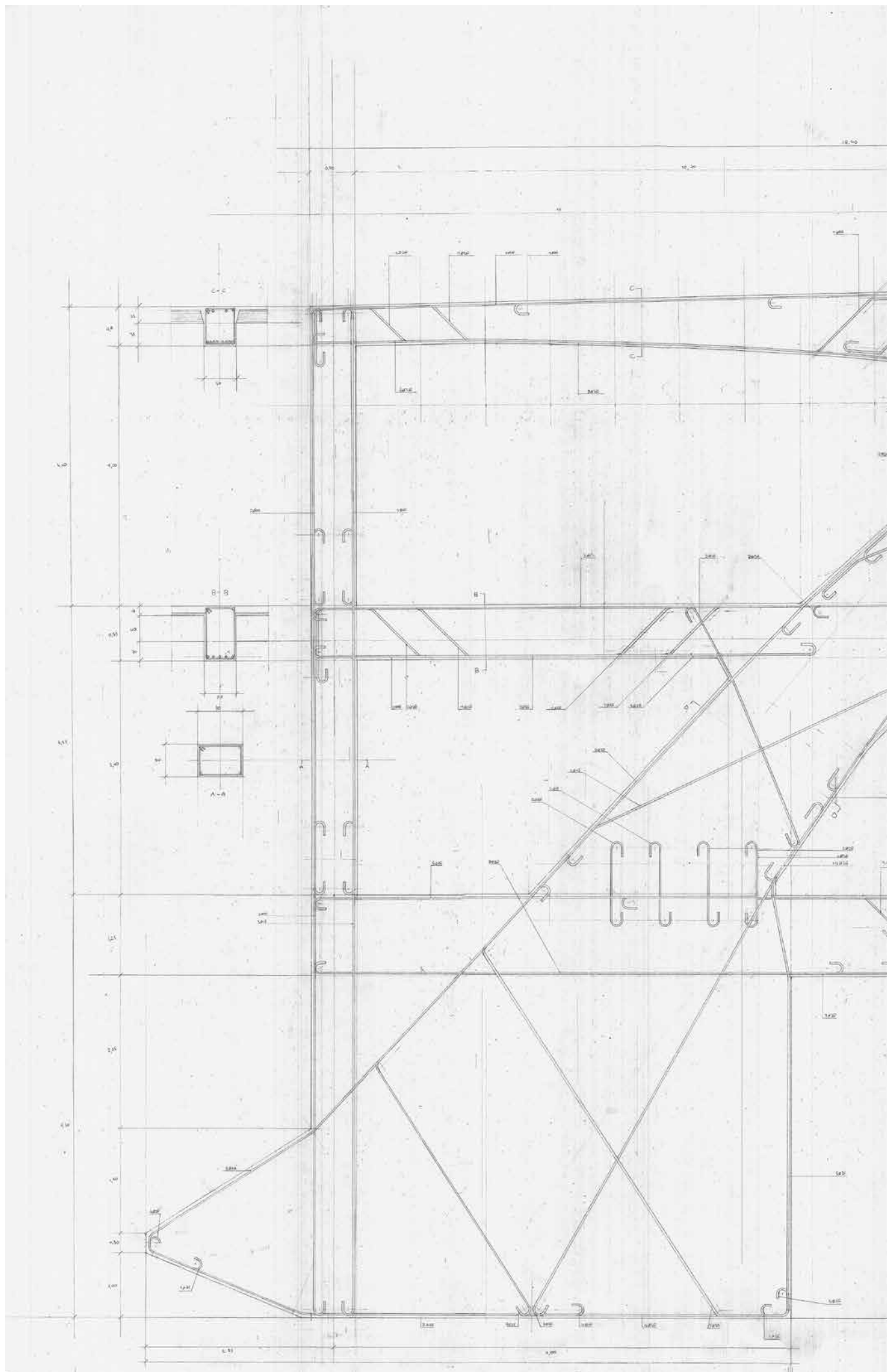
PIER LUIGI NERVI

EXHIBITION HALL B,  
TURIN, 1948







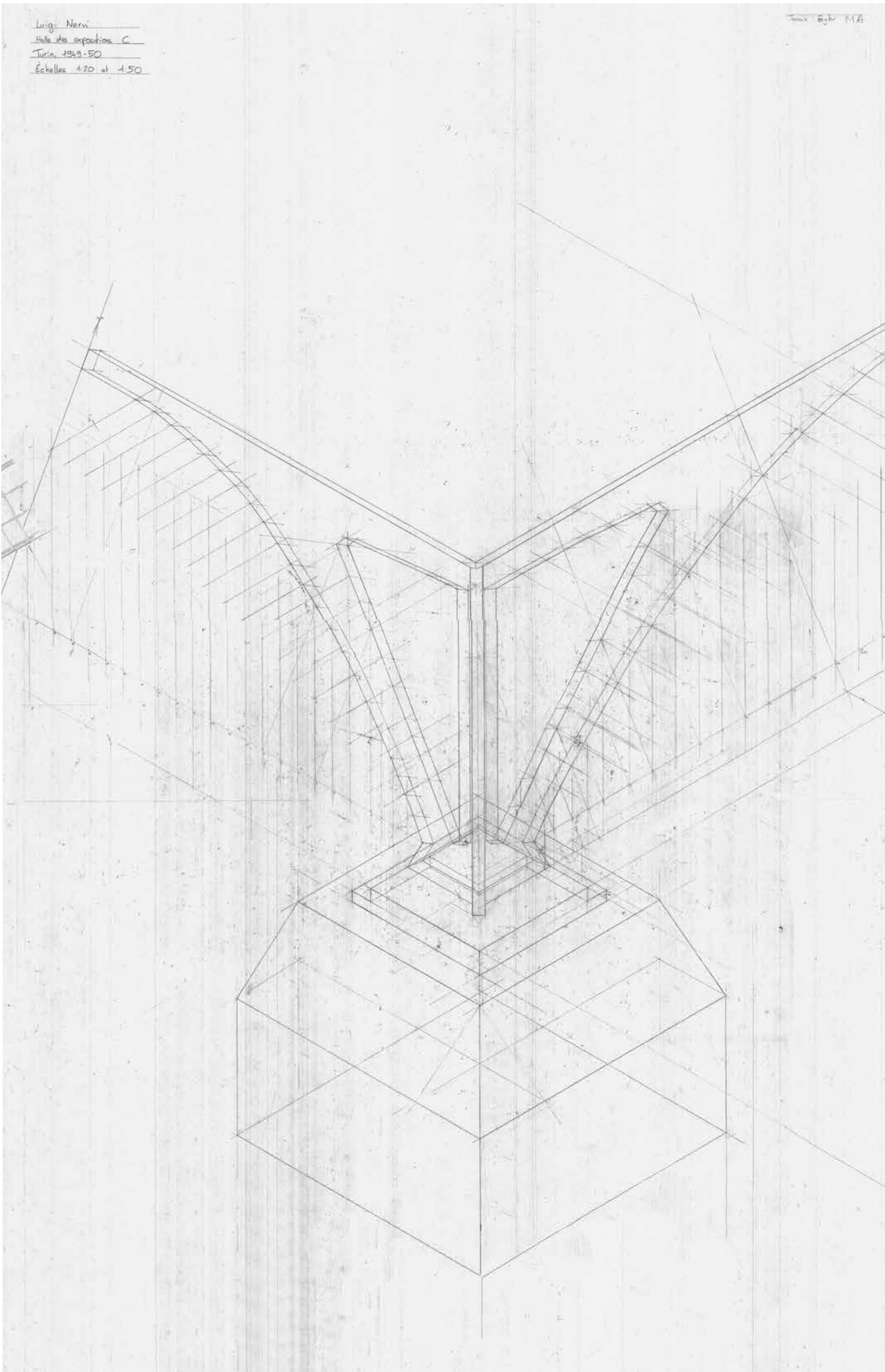


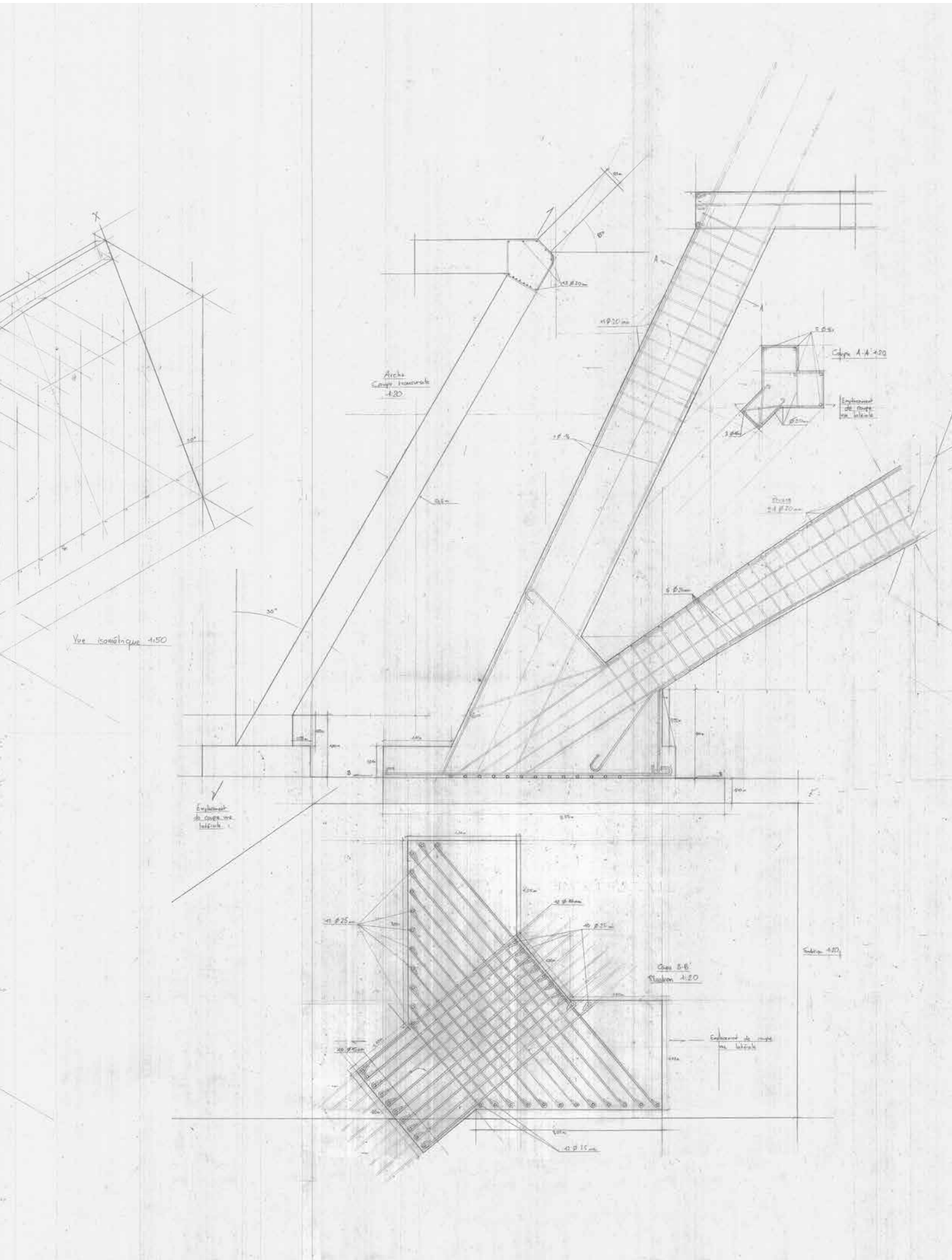




PIER LUIGI NERVI

EXHIBITION HALL C,  
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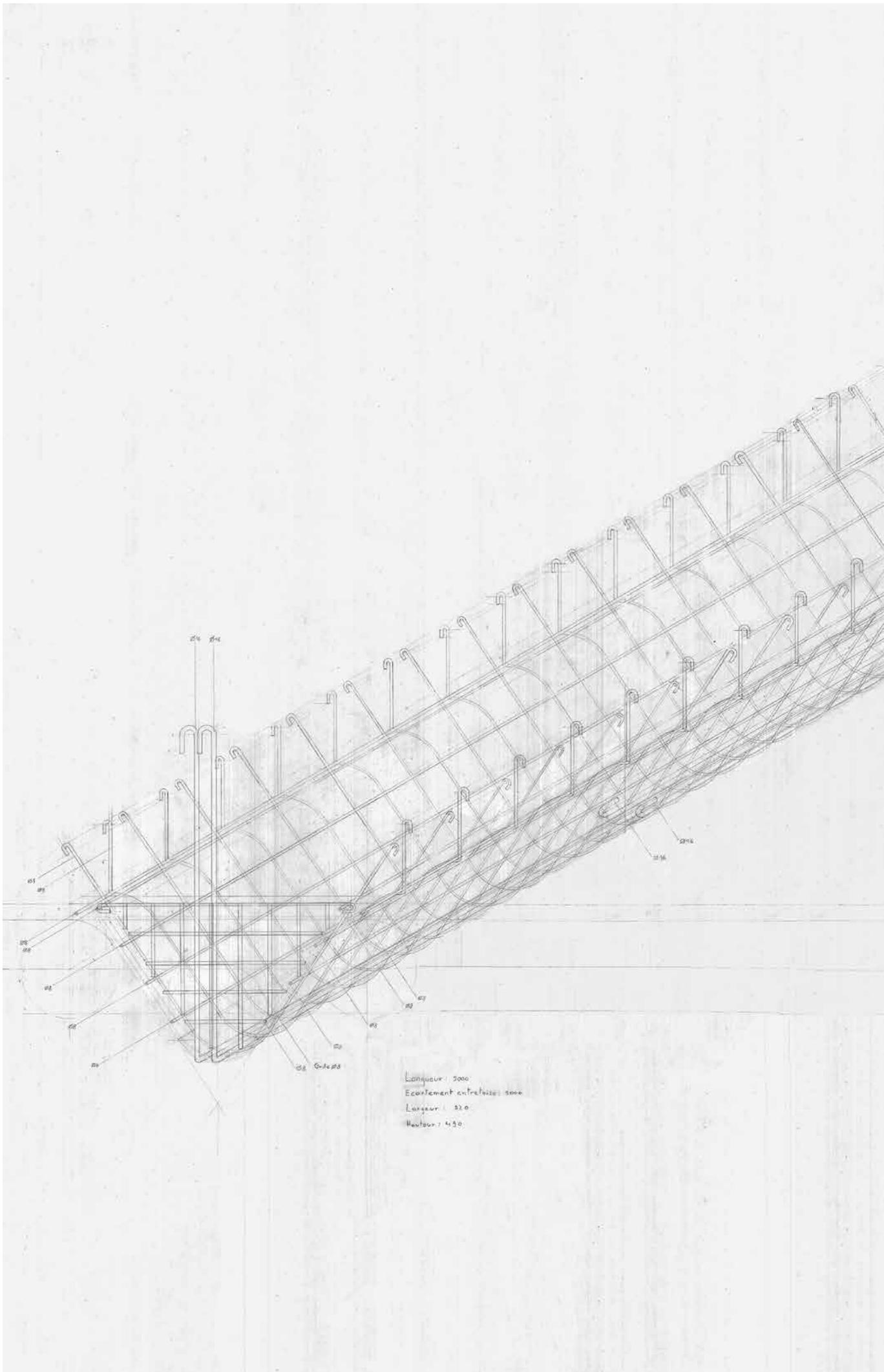


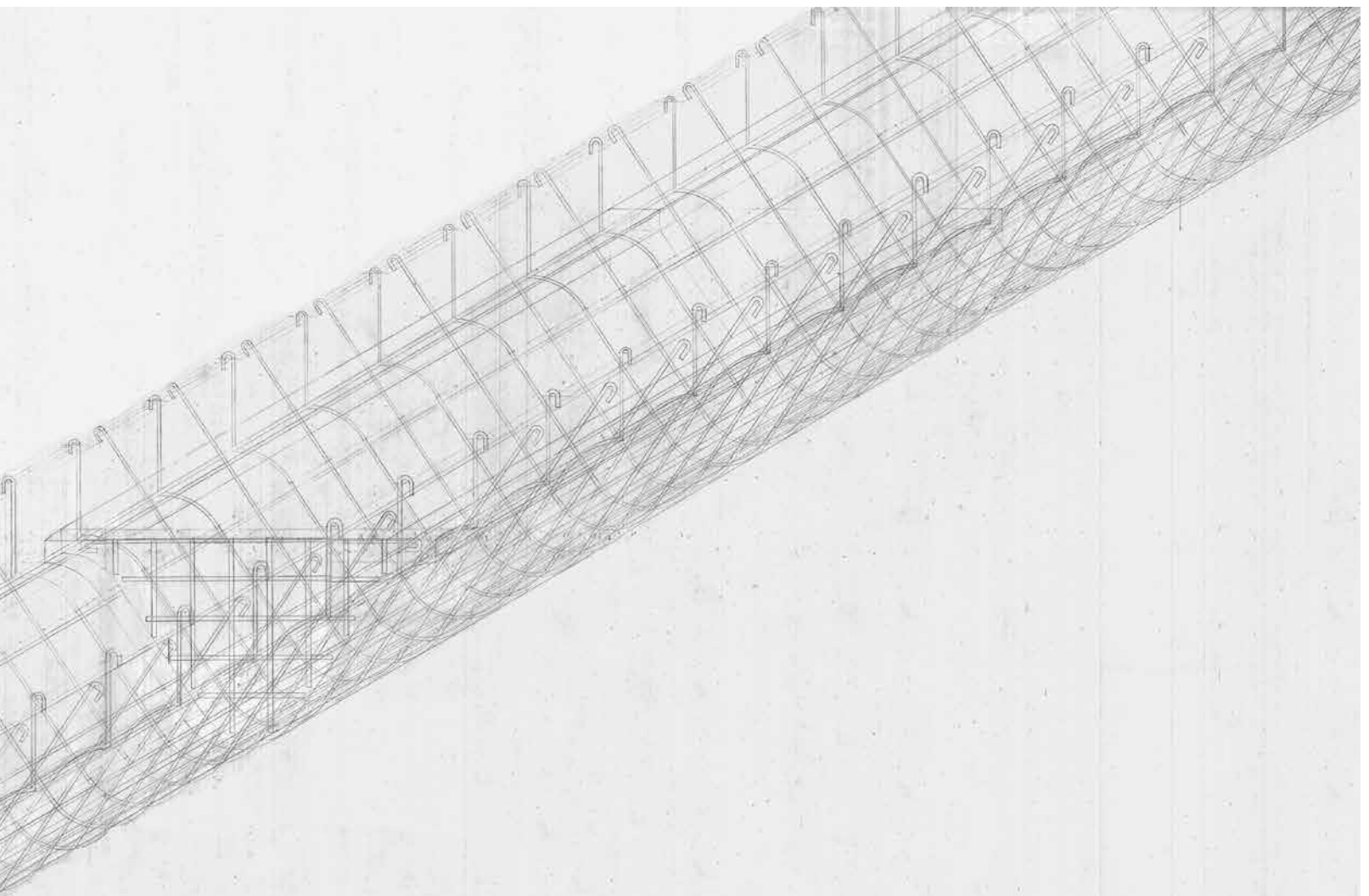




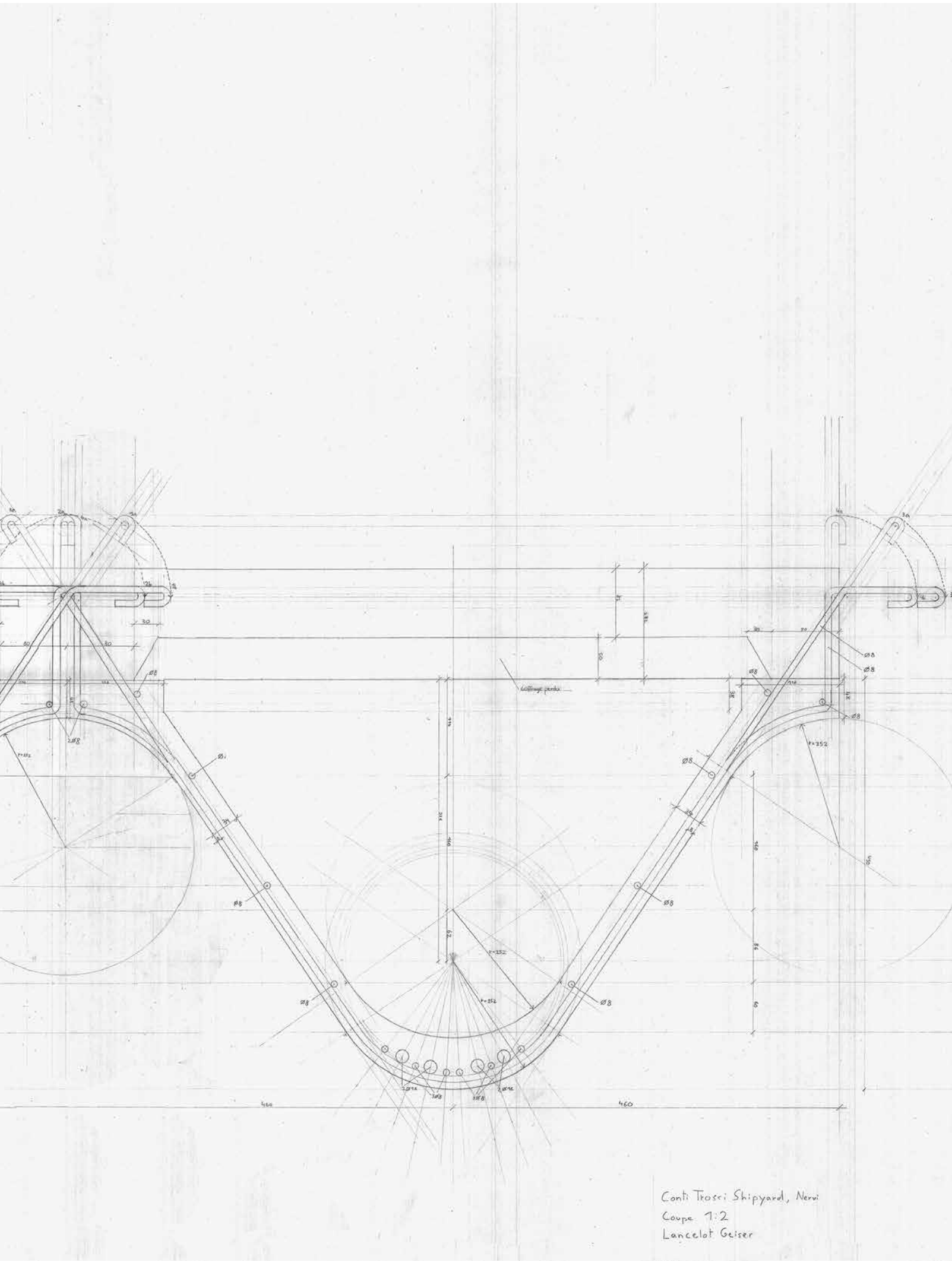
PIER LUIGI NERVI

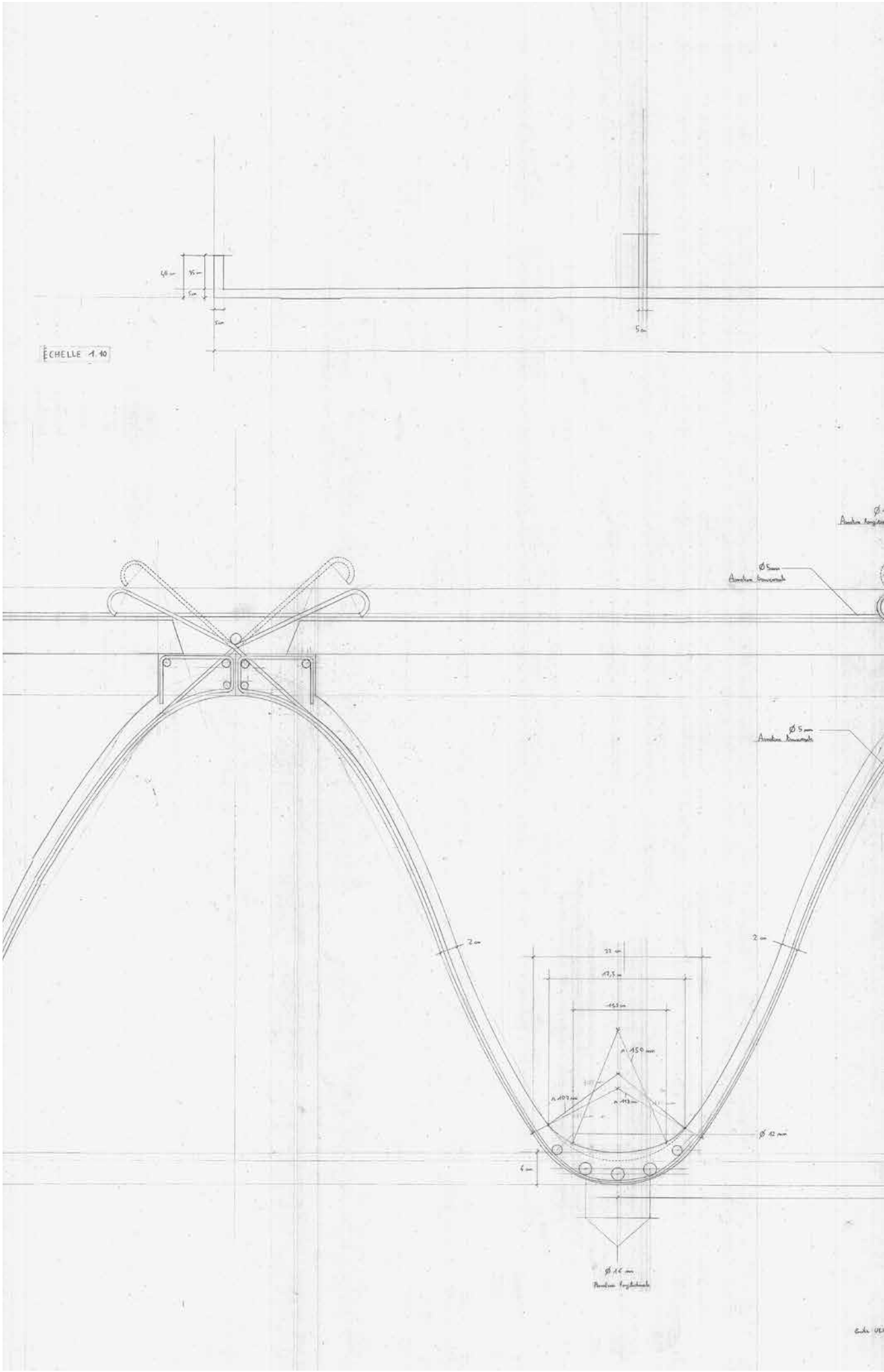
CONTI-TROSSI SHIPYARD,  
1947-48

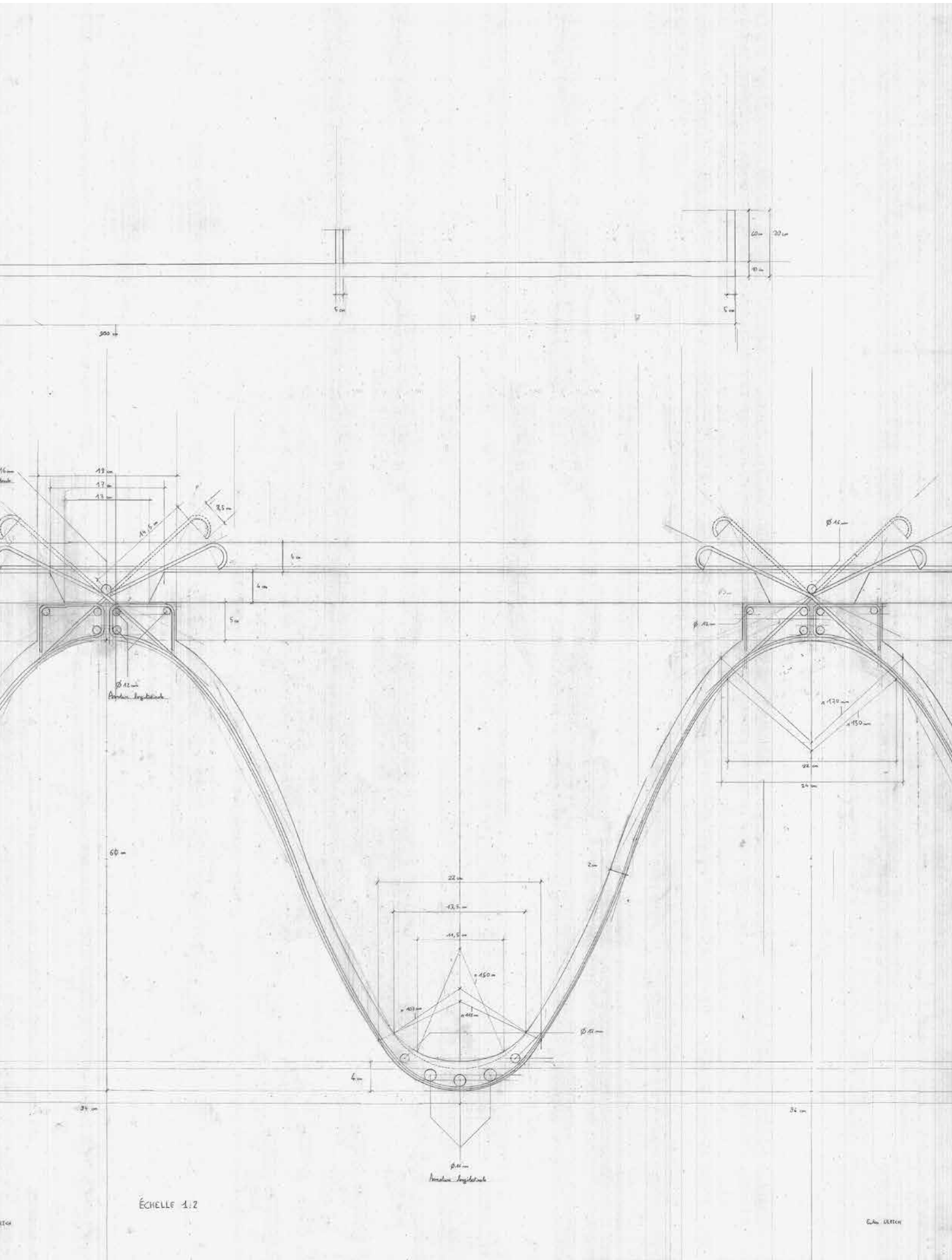






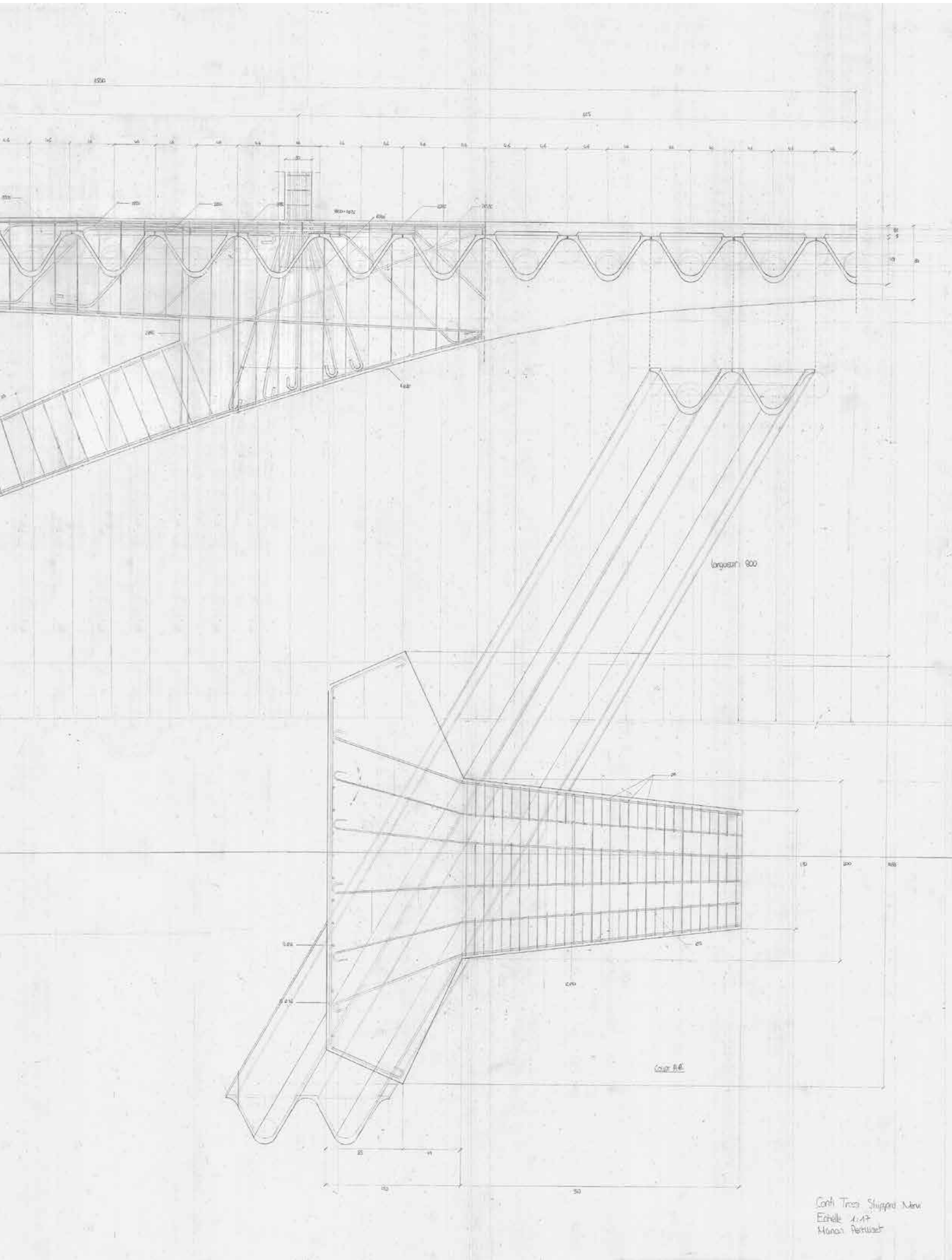


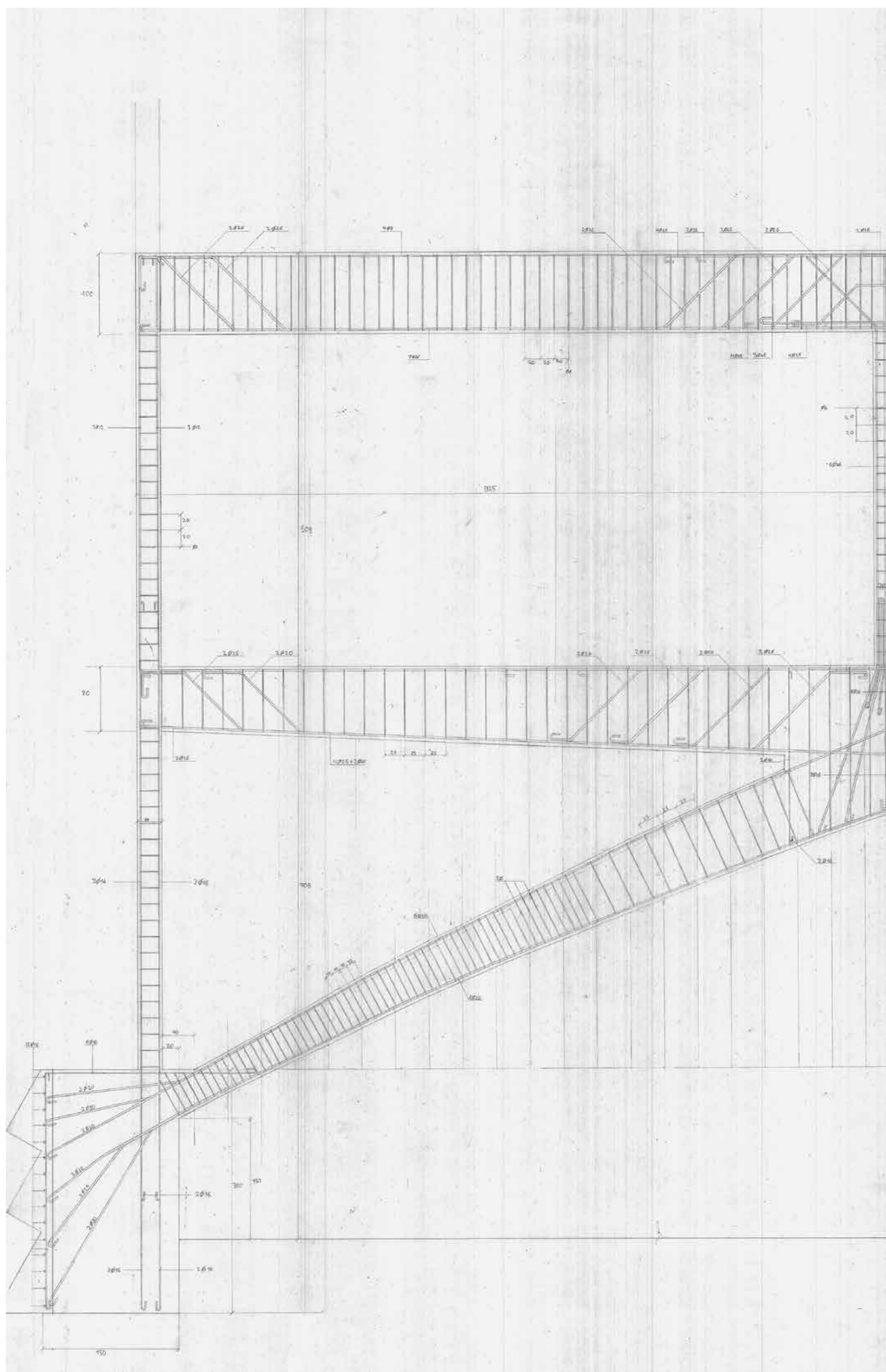












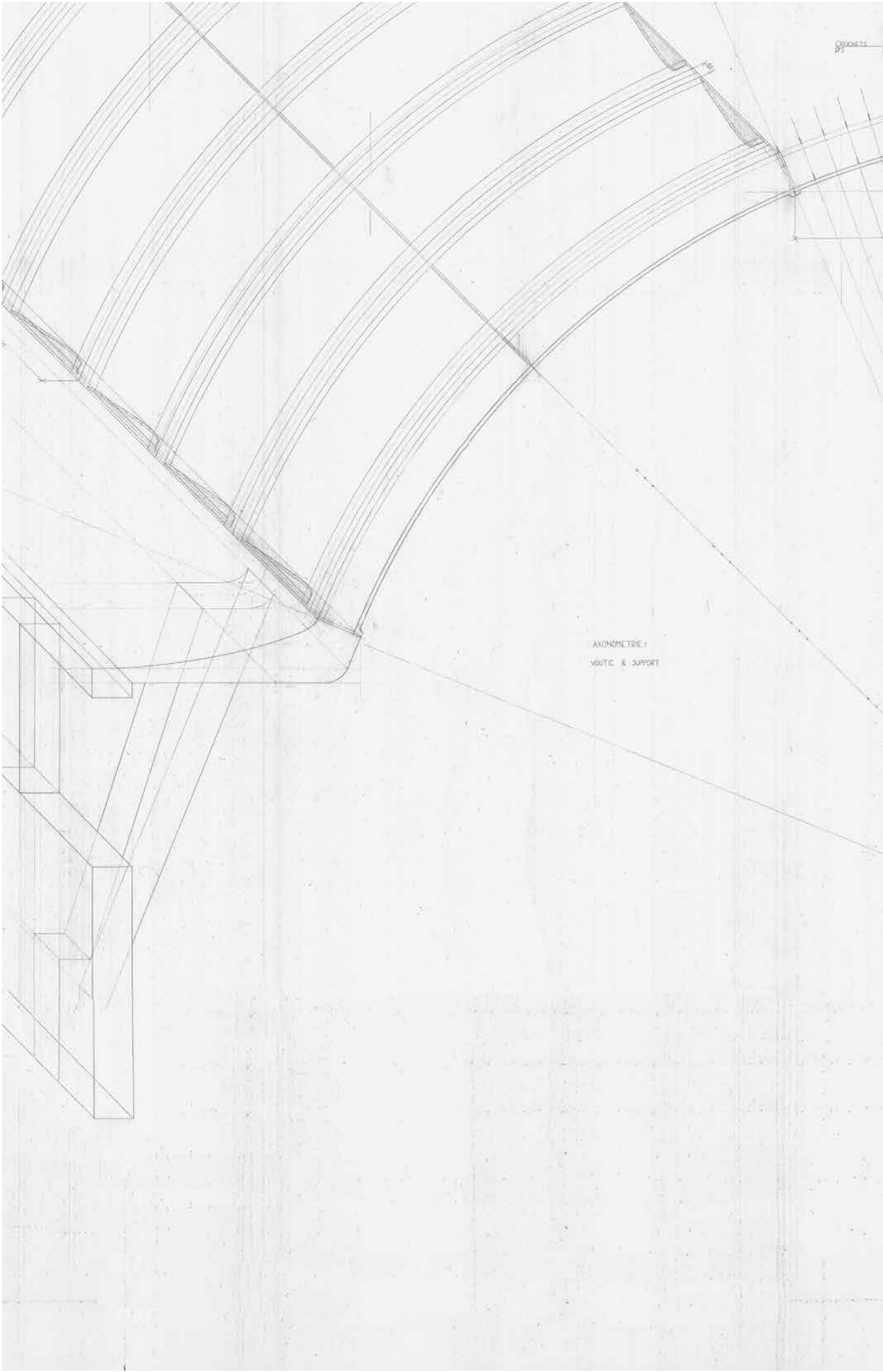


Conti Trossi Shipyard, Nemo  
Escale 1-20  
J. Ducrest



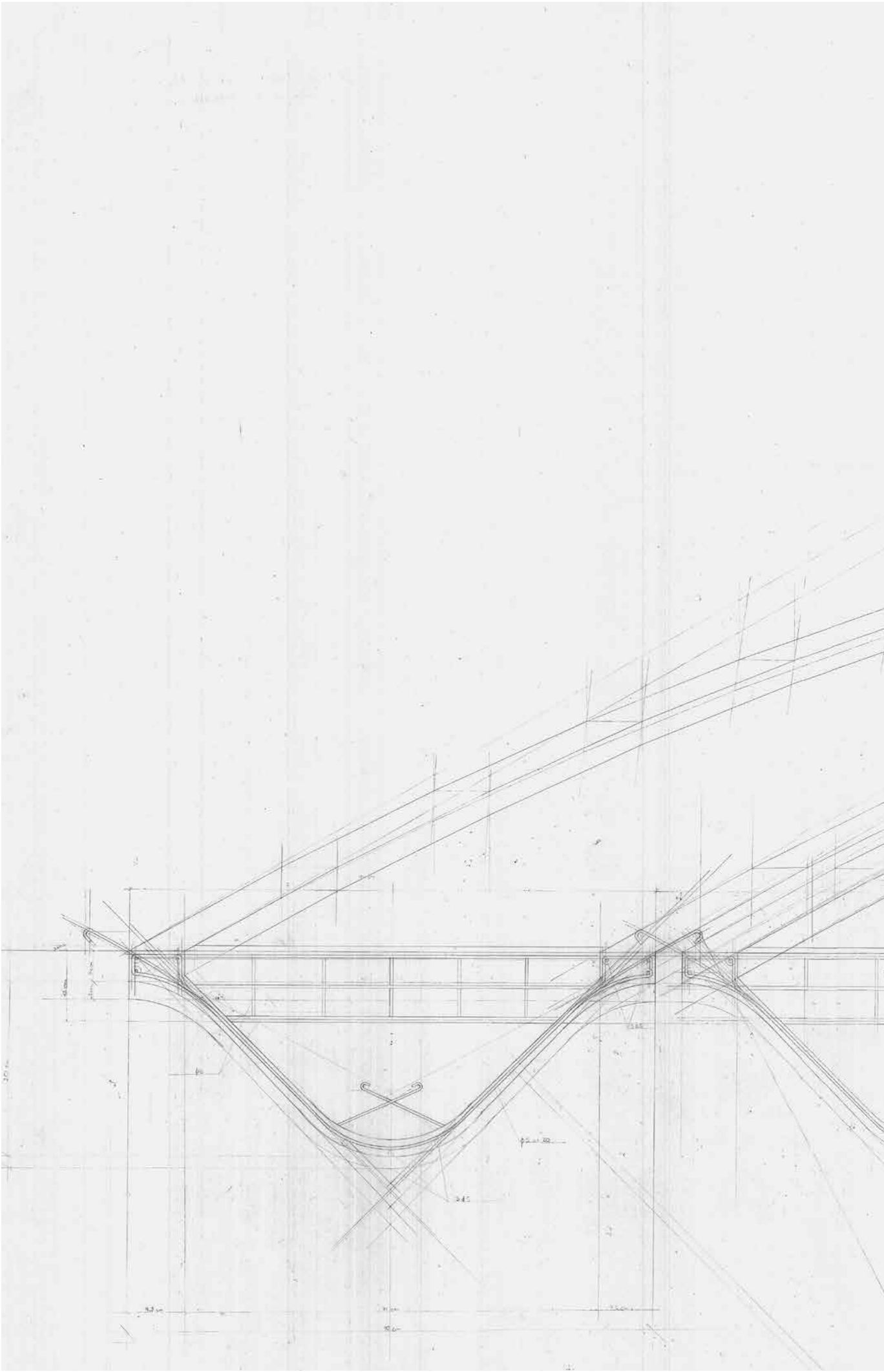
PIER LUIGI NERVI

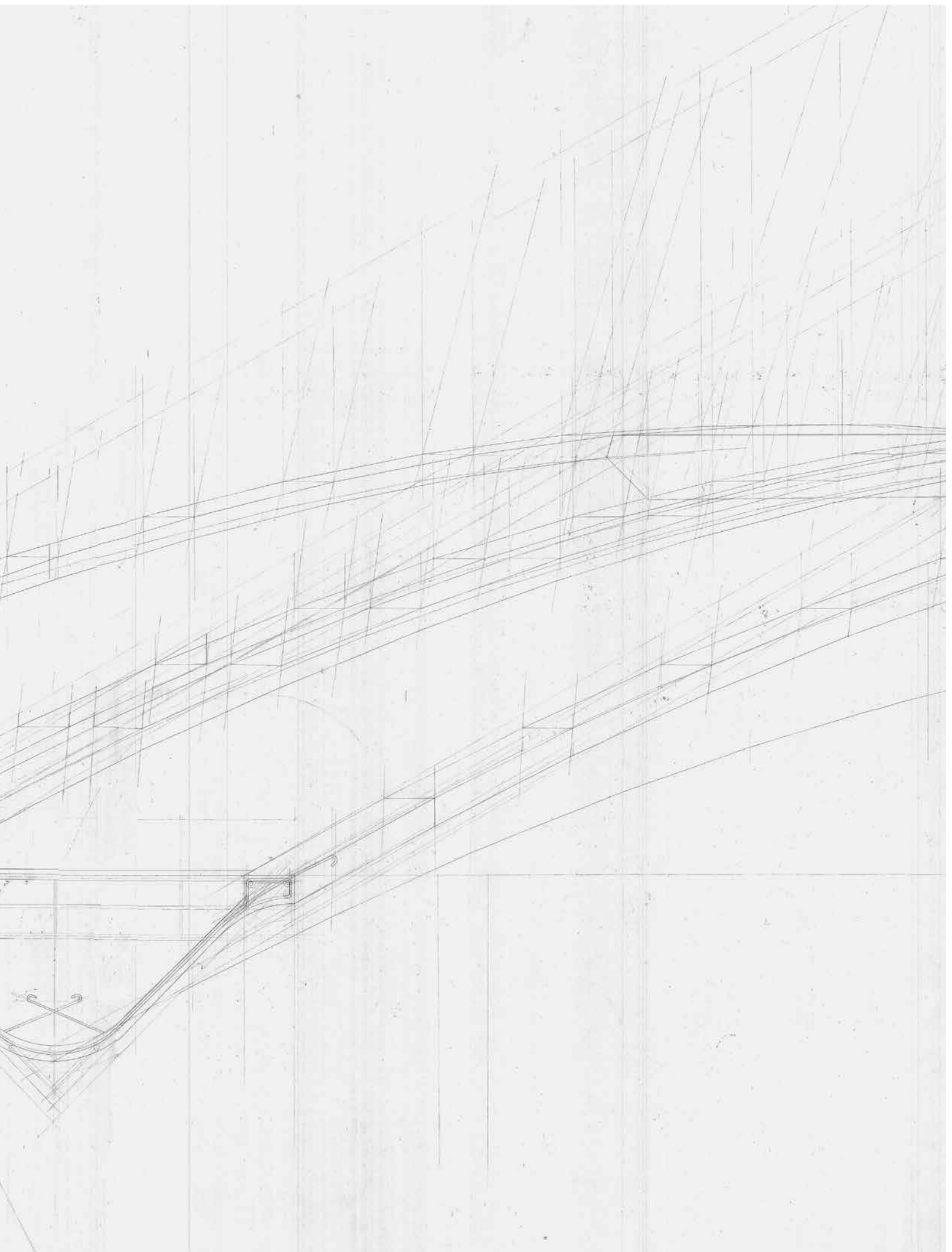
SWIMMING POOL,  
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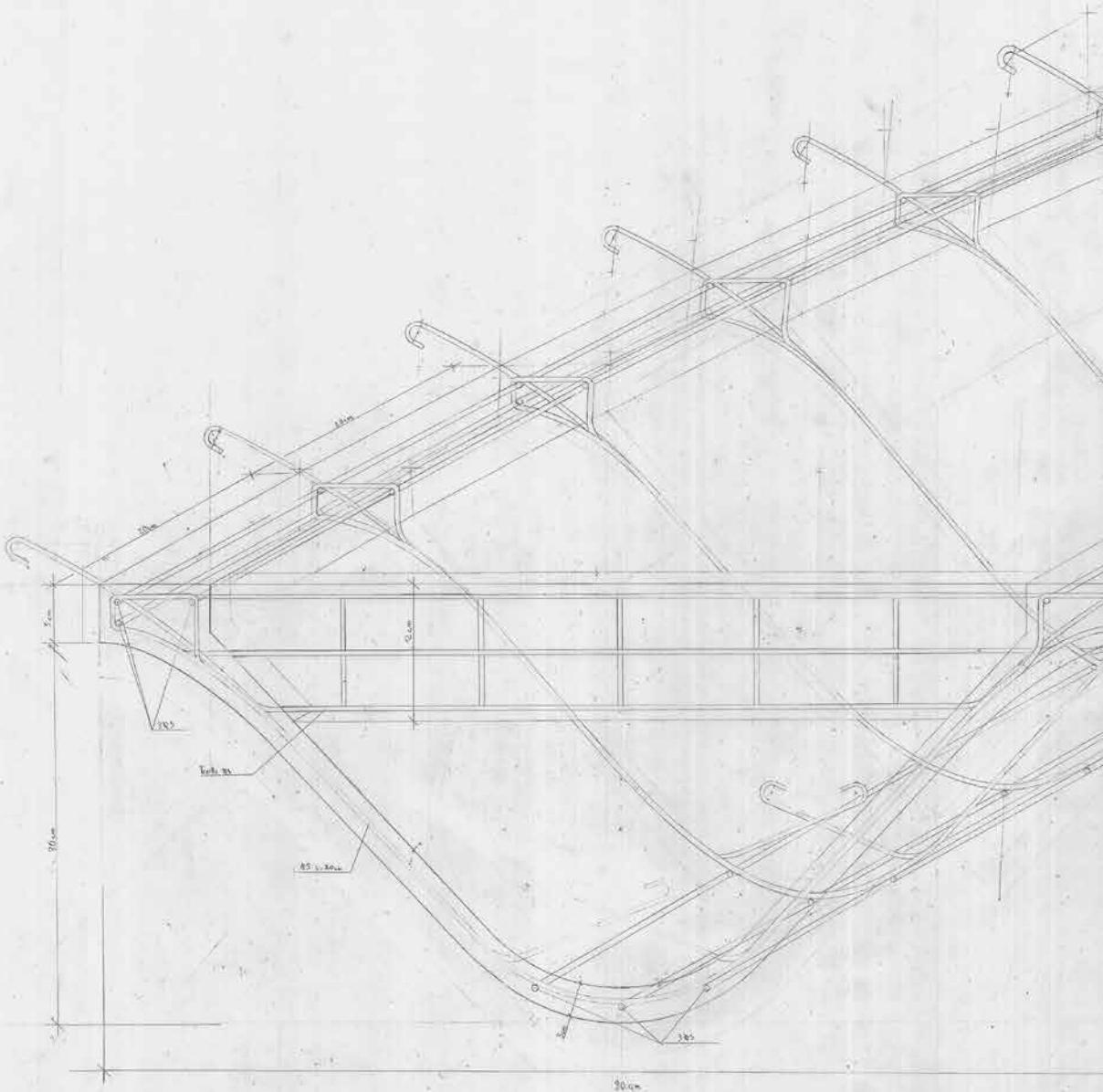


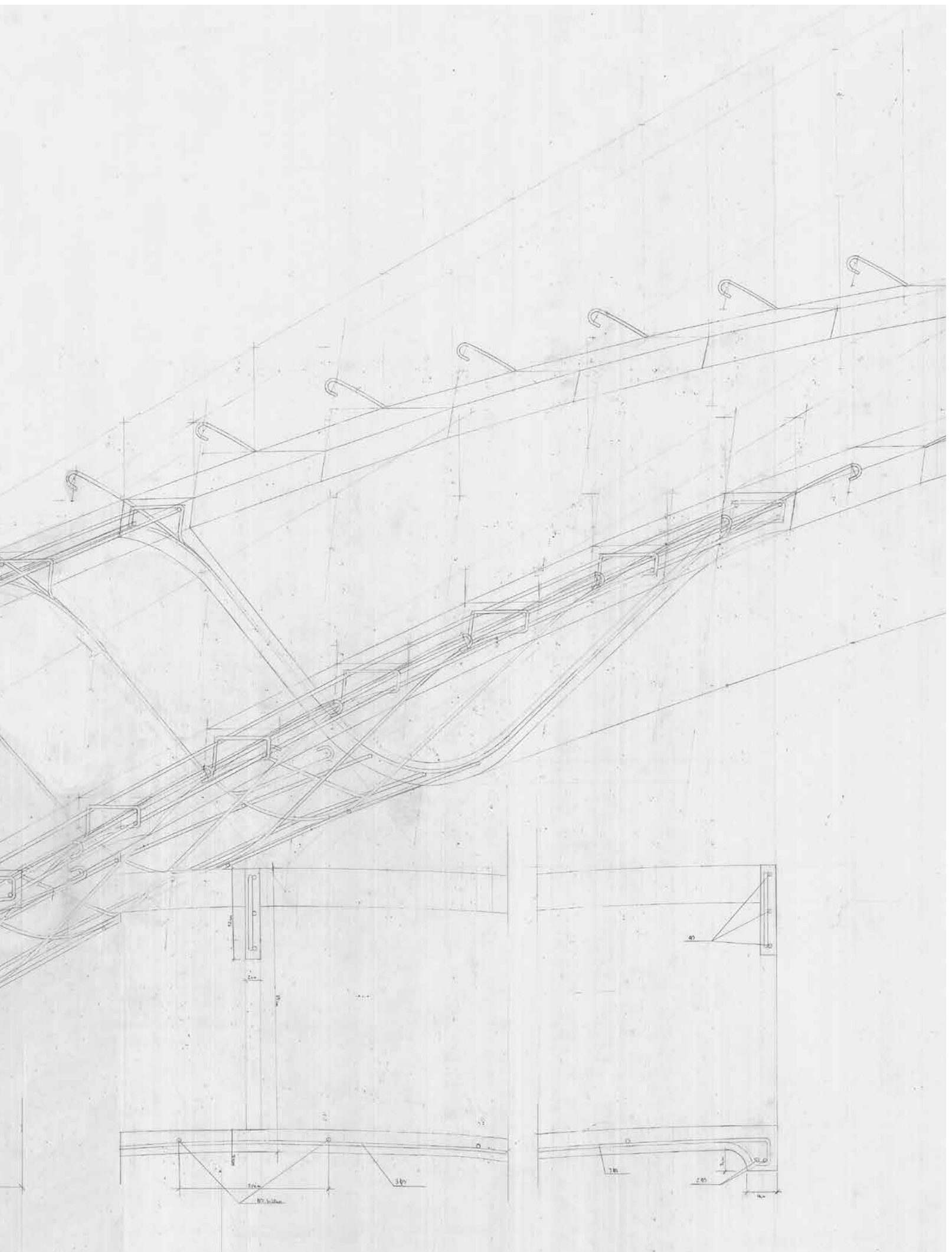






Emery Arnaud  
Prison de la caserne aux Libres (Paris)  
Axeometrie de l'ensemble de la salle  
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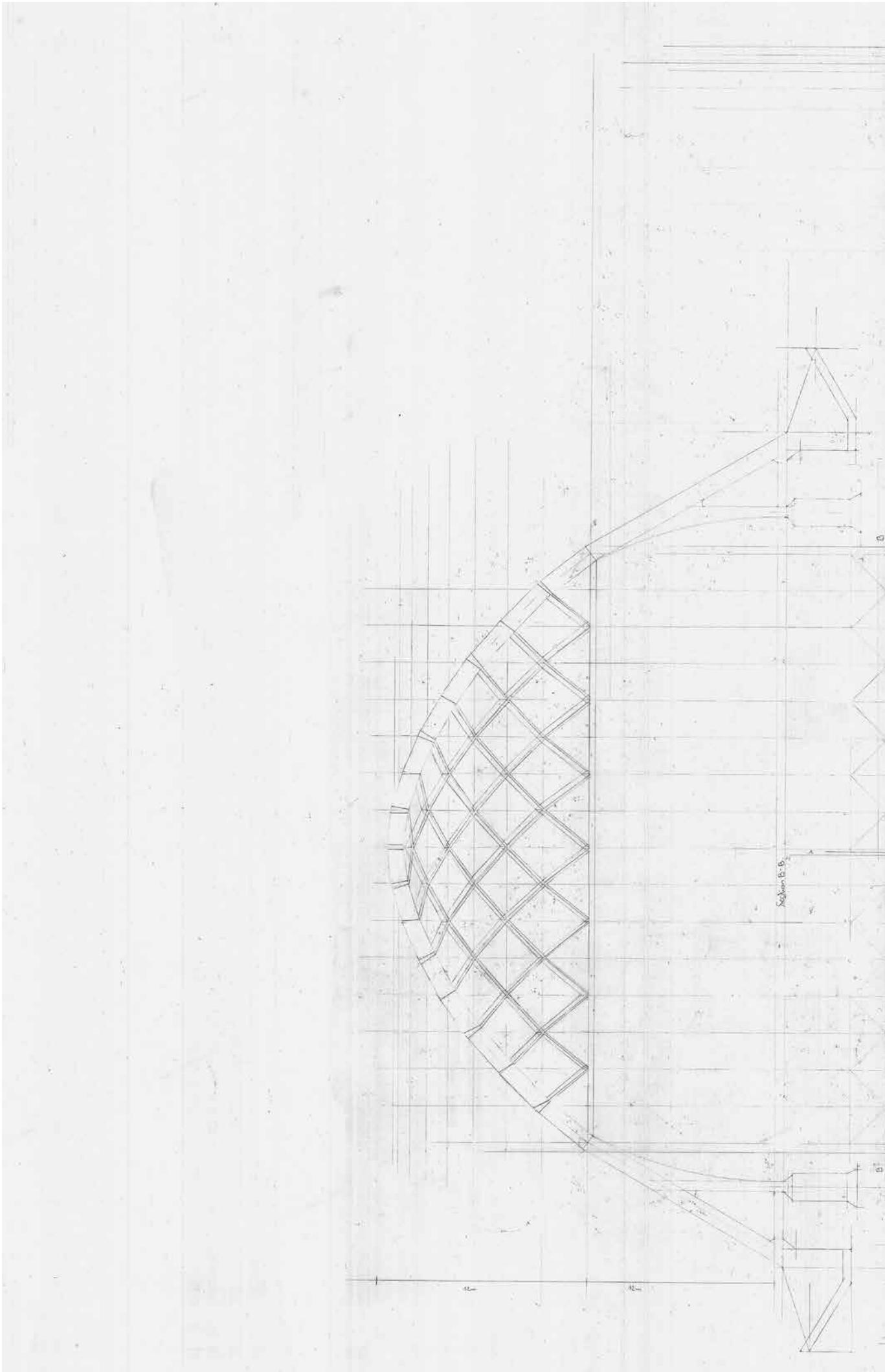




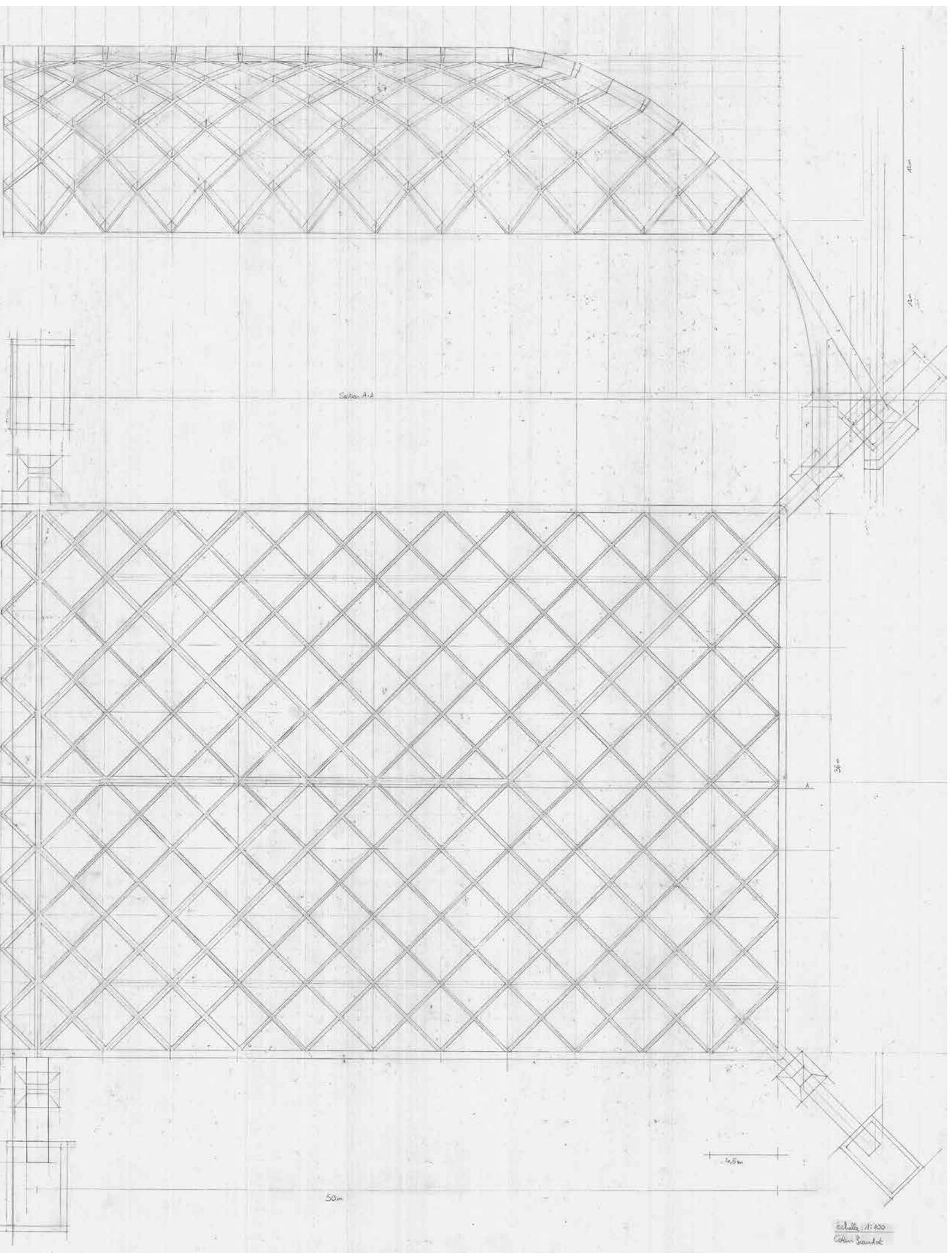


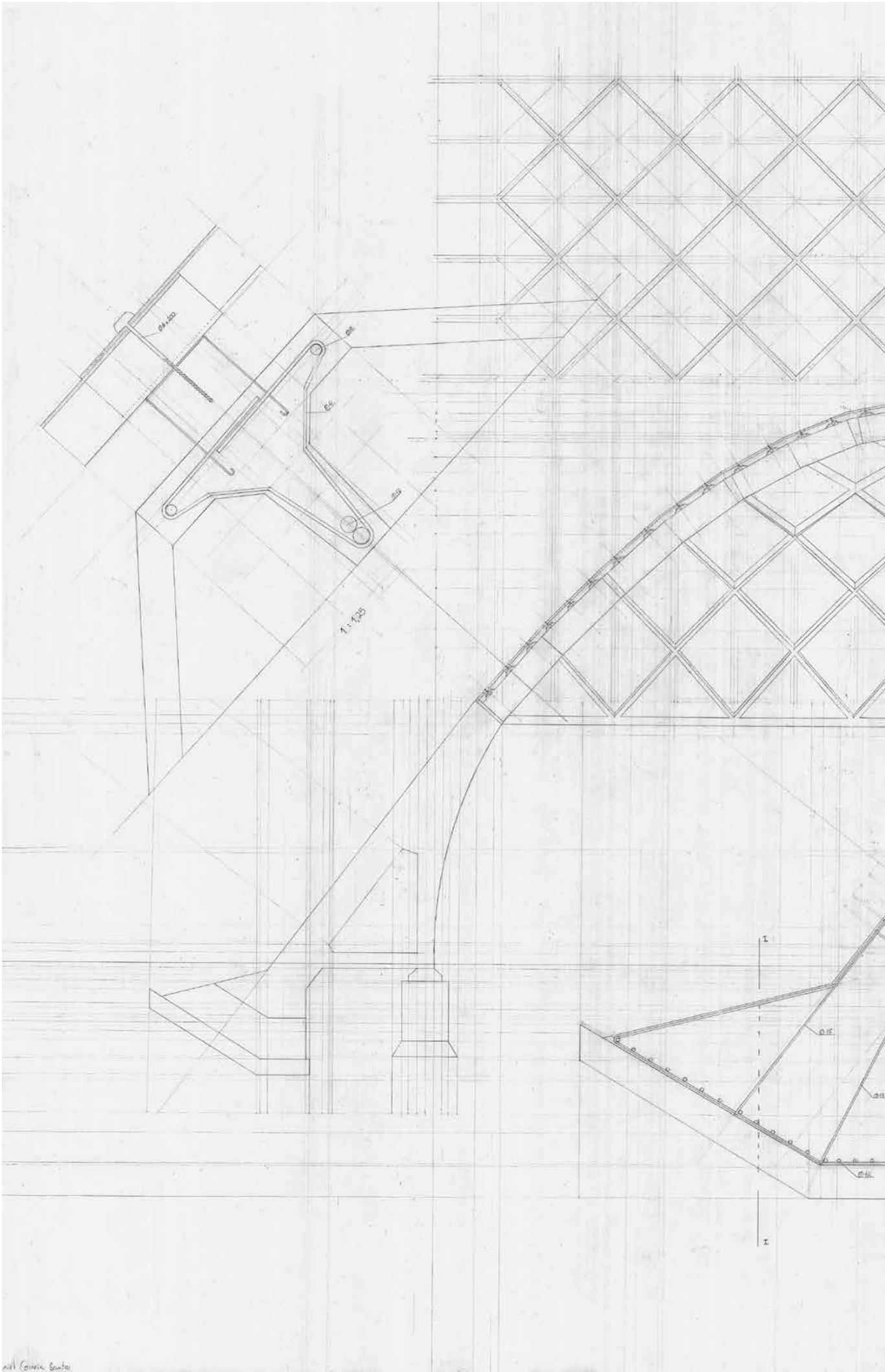
PIER LUIGI NERVI

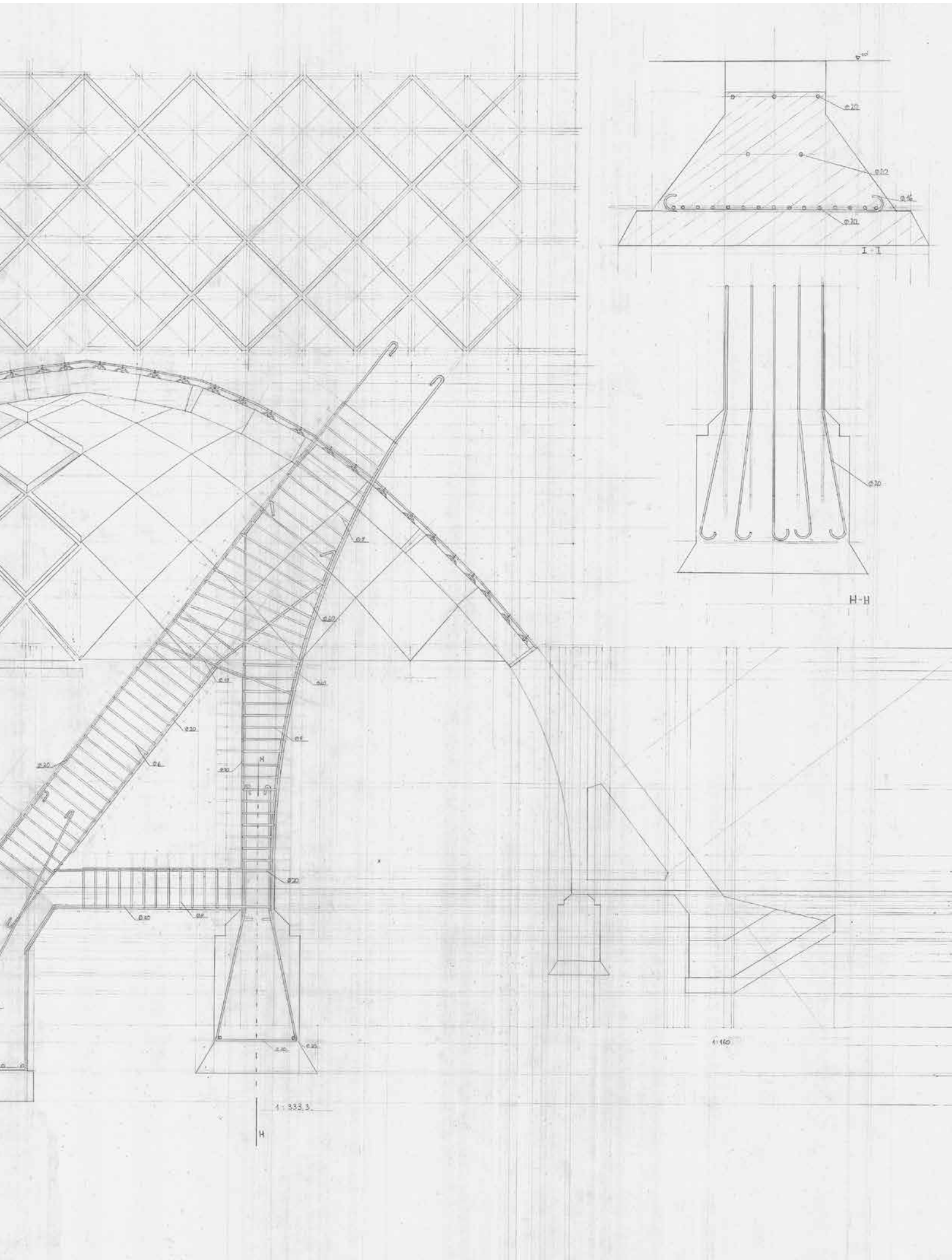
HANGARS ORVIETO  
ORVIETO, 1935







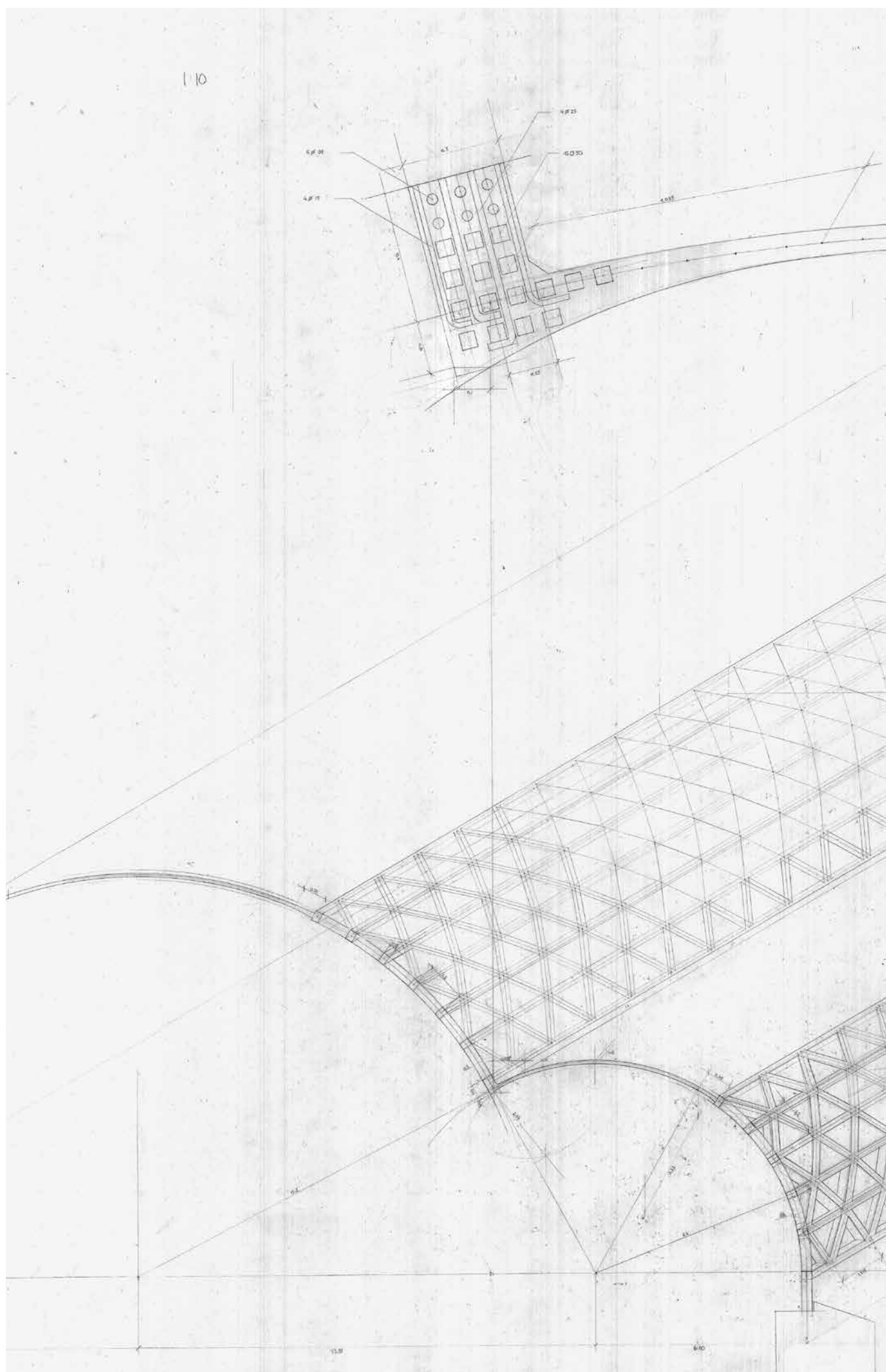


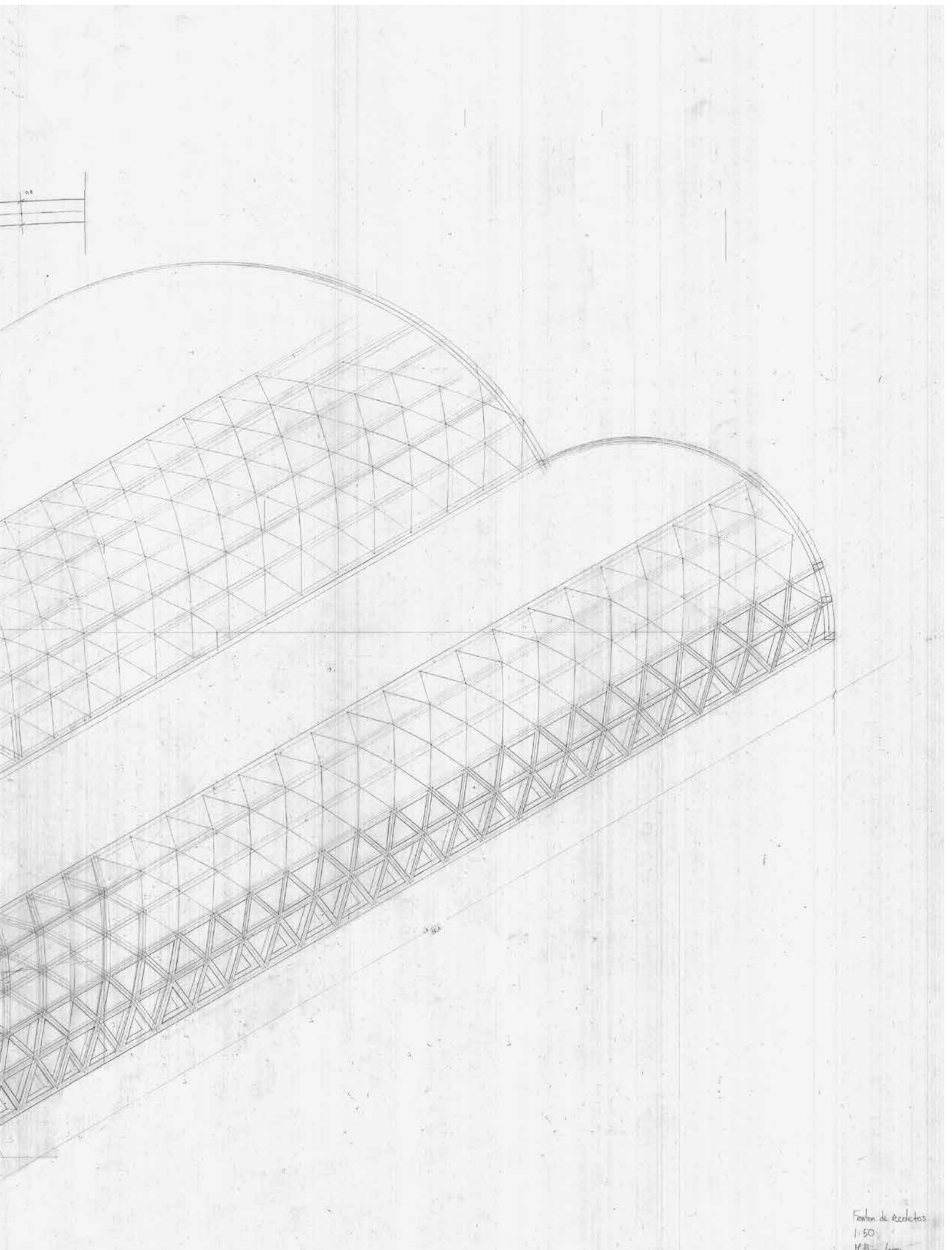




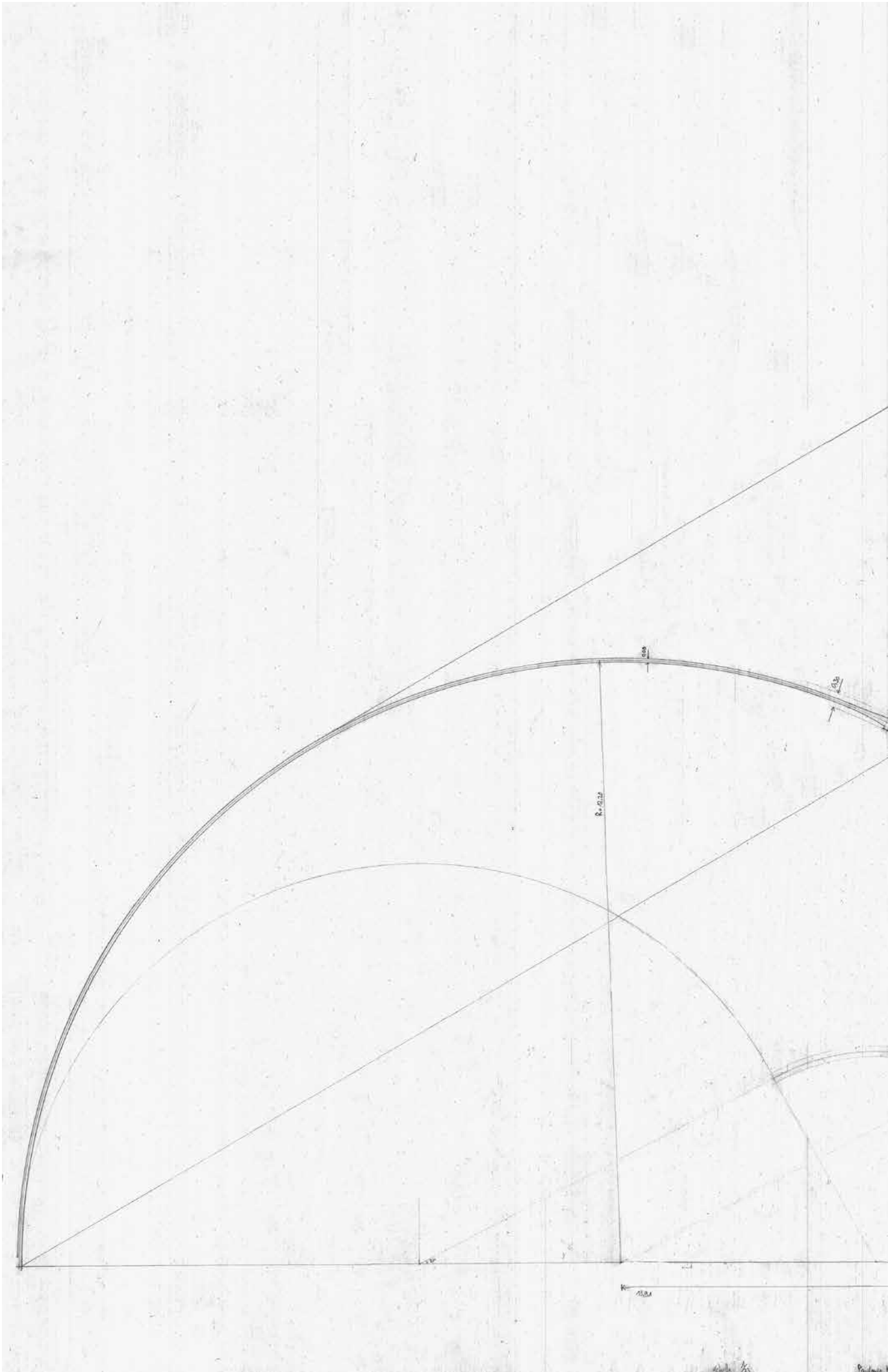
EDUARDO TORROJA

FRONTÓN RECOLETOS  
MADRID, 1935

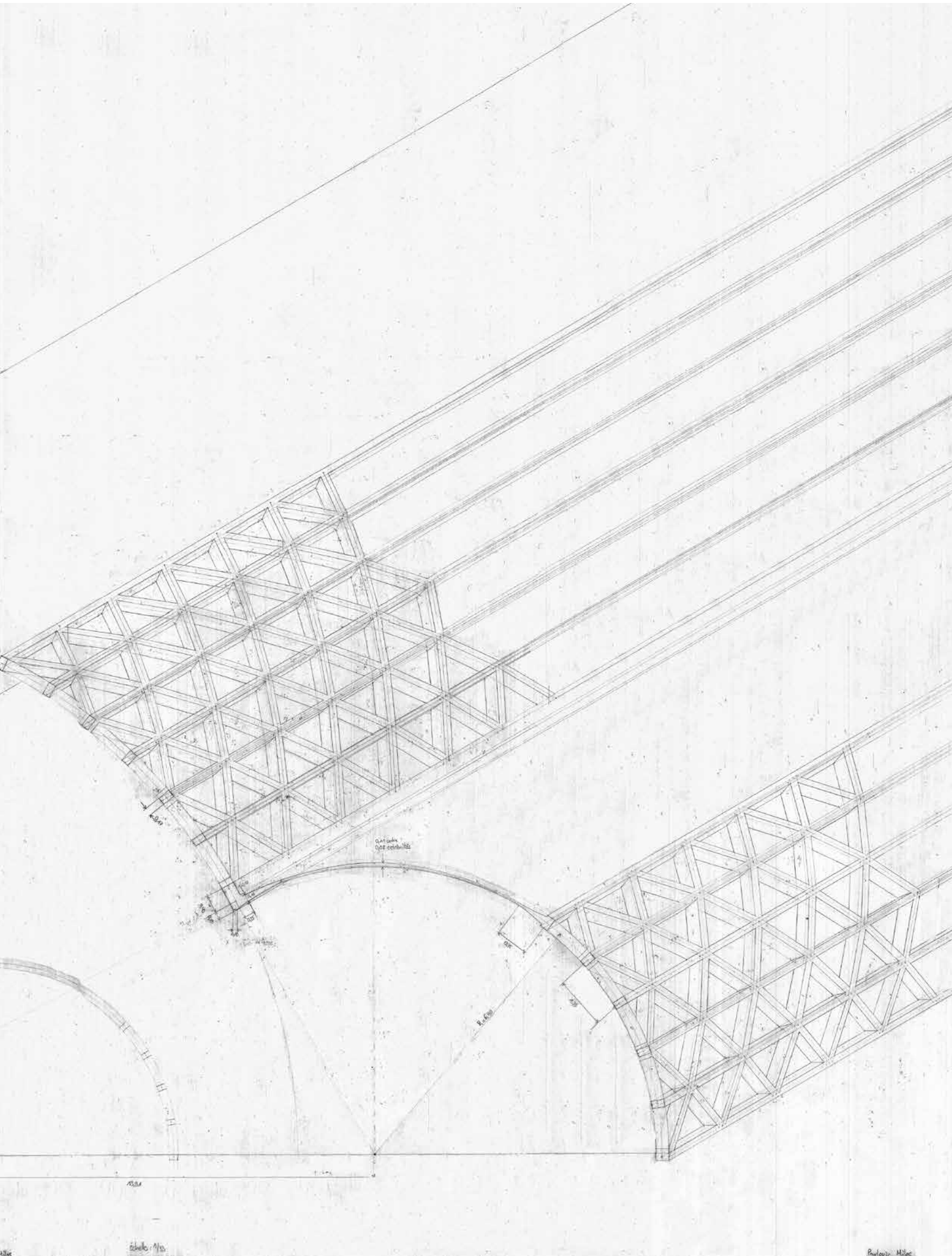












#### ACKNOWLEDGMENTS

This Teaching Unit has received financial support from the Section of Civil Engineering. The lectures are very appreciative of the support received and would like to thank Dr. Pascal Turberg for his constant support, time and personal involvement.

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#### GRAPHIC DESIGN

Studio Otamendi, Brussels

#### PRINT & BINDING

Neoprint, Morges



