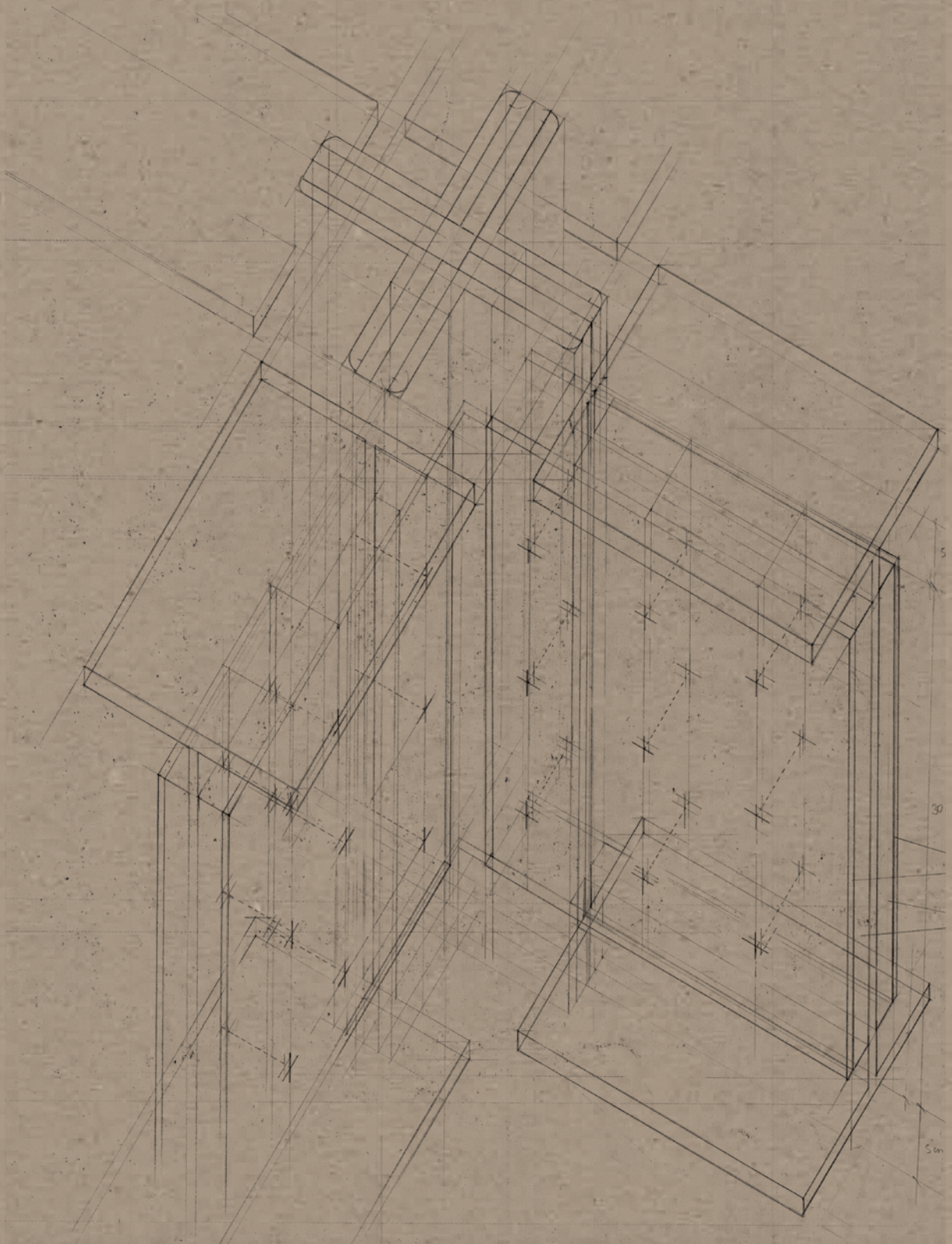


DOCTA MANUS DRAWING STRUCTURES



UE GC EPFL LAUSANNE / AUTUMN SEMESTER 2021
Guaïta, Baur, Fernández-Ordoñez, Corres Sojo

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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* introduces 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 decision-making).

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.

The construction of points and lines on a sheet of paper sensitizes students to the notions of scale, size, proportion, transparency and composition; 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 second publication shows a selection of 25 working drawings from an atelier of 35 students in civil engineering and architecture that took place during the autumn semester 2021 at EPFL. Each student analyzed one out of five selected projects of Mies van der Rohe, 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 a mental construction.

Mies and drawing in architecture education

In February 1965, as a 78-year-old Ludwig Mies van der Rohe was finishing the design and starting the construction of Berlin's Neue Nationalgalerie, he wrote an introduction for a publication on the decades of teaching of Walter Peterhans at the Illinois Institute of Technology.

Peterhans was well known to Mies, as he had been a part of the Bauhaus faculty¹ when he took over the Dessau institution in 1930. As Mies became the director of the Architecture Department of Chicago's IIT², he asked for Peterhans (together with Ludwig Hilberseimer) to be hired as faculty³ to assist him in transforming the teaching of the school. They started changing the curriculum from the first year, as Mies was "convinced that a beginner with proper training and guidance can become a good drawer in one year"⁴ and believed Peterhans was the man to provide this necessary first year foundation for a proper education in architecture. Mies' understanding evolved, as he understood the *good drawers* sometimes failed to be sensible to proportions, and asked Peterhans to develop a follow-up to the foundation for the students to improve their understanding of space, so that they could later apply this acquired sensibility to their designs in the studio. With the addition of the Visual Perception unit by Peterhans at the beginning of the second year⁵ the foundation of Mies' way of teaching architecture was established and remained largely unchanged as the IIT approach until recently, long after Mies, Peterhans and Hilberseimer departed.

Mies' view on drawing is to be found in one of the last texts of the appendix of his collection of writings — *The Artless Word* — a repository compiled by Fritz Neumeyer, who understood it to be the "key to his thought and to his architecture"⁶. What is somewhat remarkable, for someone stating this understanding of the role of drawing, is that it is the only direct reference that

Mies (or Neumeyer) make to it in the book. Browsing through his archive, drawing also appears as an instrument that Mies employs profusely, both in his teaching and his designs, albeit, apparently, one that he does not care to reflect much upon.

Reverse engineering Mies

"Reverse-engineering", the act of deducing a design process from a finished project, has a long tradition in the building arts and provides a solid base for the development of a critical gaze towards the built environment and a profound understanding of alternative strategies of design. It is a tradition that connects Alberti or Palladio with Le Corbusier or Mies when they all set out to produce modern takes on the design principles of Classical Antiquity. It is also what Mies and Peterhans made the IIT student do, in order to understand order, composition and proportions.

For the teaching studio that produced this publication the five buildings selected for the students to reverse-engineer are some of the masterpieces of Mies' career. They can be divided into two groups: a first, with the Barcelona Pavilion and the Tugendhat House, is a fully mature personal take on the heroic late 1920's of the Modern Movement, and a second, with the Farnsworth House, the Crown Hall and the Neue Nationalgalerie, at the full development of his post-war American period, with its refined industrial temple (proto)types for idealized representative buildings. An important distinction between the two groups is the clarity and precision of their tectonic strategy, much refined in the later examples, and the value given to structure as the main organizing element of spaces, also much clearer in the second of the phases. In the two early buildings, the chrome plated covering of the steel columns acts to reinforce their objectual value in the hierarchy of the building elements, as these structural elements were heroic totems in nature, displaying the prowess of a new way of

1. Peterhans was teaching Photography at the Bauhaus and had a fruitful practice as a photographer of close-up still-lives as a member of the *Neues Sehen* movement (that ran parallel to the *Neues Sachlichkeit*).
2. Shortly after Mies took over the Architecture department of the Armour Institute of Technology it was renamed Illinois Institute of Technology.
3. MIES VAN DER ROHE, Ludwig: "Peterhans's Seminar for Visual Training at the Architecture Department of IIT" wrote on the 5th of February 1965, in NEUMAYER, Fritz (tr. Mark Jarzombek) — *The Artless Word*, Mies van der Rohe on the Building Art, Cambridge, MA: The MIT Press, 1991, p. 334.
4. Id, Ibid
5. Id, Ibid, p. 335
6. Id, Ibid, Preface to the German Edition, p. IX.

7. An interesting reflection on the problems of CAD for design can be found in Richard Sennet's *The Craftsman*, where I first encountered the work of Sutherland at MIT.

building and a new way of understanding space and architecture. In the later buildings, no polish is necessary, as the construction system has been industrialized and became ubiquitous, and the structure is part of a perfectly coordinated system and can simply be painted black, as no doubt can be had as to the key role it plays in the building and organizing of large flexible open spaces.

The documents produced by this studio are a remarkable departure from the tide that engulfed architectural teaching in the past decades. With its obsessive focus on a rigid, intelligent approach to a precise way of looking at buildings, through large scale hand-made drawings and models, made and remade until the adequate intimacy is created with the logic of the design, this process creates the necessary time and space to glean the rules of design, as Mies and Peterhans tried to do at IIT.

Drawing as tradecraft, today

In January 1963, two years before Mies reflected upon the work of Peterhans at the IIT, Ivan Sutherland presented his PhD at MIT — *Sketchpad: a man-machine graphical communication system* — setting off the development of Computer Aided Design and with it, the rapid change of centuries of carefully refined drawing and design methods. The first interface to draw on Sketchpad was to sketch with a “light pen” directly on the screen, as one can do today in a tablet, with the software interpreting the input into vector space. That close connection to freehand drawing was gradually lost as CAD software favored absolute precision over a gradual, tentative approach to a solution, and the pen was replaced by the keyboard and a mouse, increasing the distance between brain, hand and design, hampering the ability to freely sketch and draft, arriving progressively at a more precise and detailed design solution⁷.

As CAD became the ubiquitous tool of design, another interesting problem emerged – that of the size of the support where one draws. When pencil on paper was the default, the size of the paper could be increased to fit the scale of a design (or the phase of that design that was being developed), but the usable drawing space in a laptop display is smaller than A4 and in a desktop display, smaller than A3. This limitation in the size of the drawing media takes the design practice back to times

when paper was scarce and expensive and produces all manners of perversion in the approach to the development of the design, from the miniaturization of the gaze, the misunderstanding of scale and the appearance of all sorts of blind spots on the design (i.e. its relation to the context or between the part and the whole).

Drawing conclusions

In drawings, a set of codes and uncountable untold stories lie, allowing us to read, interpret, learn, and imagine worlds beyond what mere words (or even some buildings) ever could. The practice is fading and the craft weening, as tools are turned into methods, with substantive loss of knowledge. In a world saturated by mass and personal media, the basic tools for the communication of ideas between building professionals are being progressively lost, as we find ourselves submerged in codes, references, tools, systems, and methods alien to the core nature and values of the profession. Drawing is drowning under the pressure of all this noise.

The 60's were fruitful in changes to architectural thinking. 1966 alone is famous for Aldo Rossi's *Architecture of the City* and Robert Venturi's *Complexity and Contradiction in Architecture*. As these publications garnered attention and became new keys to understanding the fabric of architecture and the city, the tectonic shift that CAD gradually introduced arguably caused a more severe transformation of the rules of design. One that is undervalued and barely discussed but is relentless in its upending of centuries of traditions and methods towards a future where the socio-cultural value of architecture slowly disappears and is replaced by its economic logic.

As the pen is mightier than the ... computer, there is hope that a sustained return to the questions that Mies and Peterhans were debating when reforming the IIT might improve the quality of our built environment. Sidelining tools over methods, and focusing on core questions of architectural design, namely within architecture schools, should result on a resurgence of drawing as the key for development, communication, and debate of ideas. One can only hope, as we are oppressed by the boring correct buildings produced by the complexities of today's building economy.

Why do architects draw? Pose the question to two architects, and you'll get three opinions. But what if, as in this class, you pose it to an engineer? Even better, to a student of engineering, who takes nothing for granted?

If we take nothing for granted, we must start from the basics. We're in the shady reading room of the Uffizi, holding these drawings—very gently—in our hands. But then things get tricky. Because for decades 1A^[Fig. 1] has been in

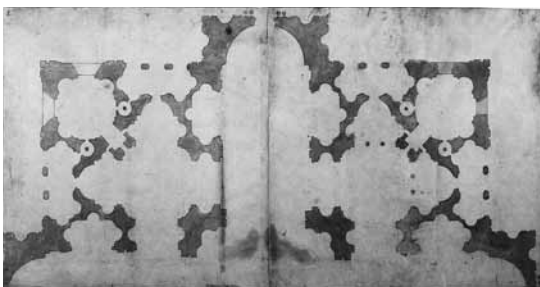


Fig. 1 Donato Bramante, plan of St. Peter's Basilica, Gabinetto Disegni e Stampe degli Uffizi, Florence, inv. 1A, 1505, 543 x 1103 mm

an enormous frame, under glass, too precious to be touched. Perhaps, if we're lucky, the curator will take us into the back.

There we find 1A is huge by sixteenth-century standards, over a meter long: two pieces of expensive parchment were stitched together to create it. It is carefully measured and inked; the masonry massing colored precisely in wash. At bottom, someone has printed "Bramante Arch:&Pit:". The frame covers the back of the sheet, but the curator may tell us it bears a scribbled note: "pianta di sto pietro di mano di bramante che no' ebbe effetto" ("plan of saint peters in bramante's hand that was not executed"). Thus we have author, building, and its

non-existence. And indeed, the engineers will note the slender central piers: how on earth would they hold up a dome like Saint Peter's? Letters from Bramante's time confirm they couldn't; what little he built cracked within decades and had to be demolished. But back to the drawing in front of us. It depicts, clearly, only part of a building. The bottom edge is neat, however; nothing has been removed. What did the rest of the design look like? Was it a mirror image, or a long nave to make a Roman cross? The latter is more sensible, liturgically speaking, but nothing about this plan is practical. Did Bramante know that? Did he make 1A as a luxury object in itself, to show Pope Julius the kind of beauty he could create for him?

A numbered drawing implies that there are others, and the helpful curator will also show us 2A^[Fig. 2].

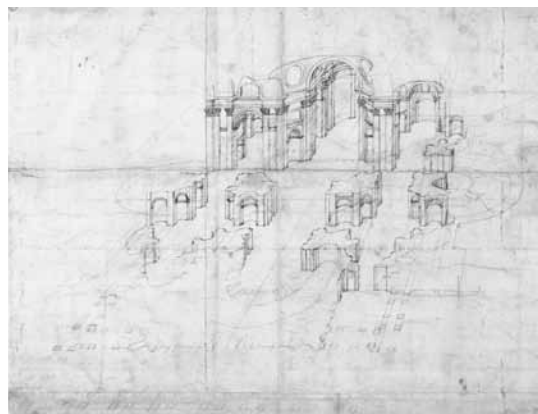


Fig. 2 Baldassarre Peruzzi, axonometry of St. Peter's Basilica, Gabinetto Disegni e Stampe degli Uffizi, Florence, inv. 2A, 1527-36, 538 x 677 mm

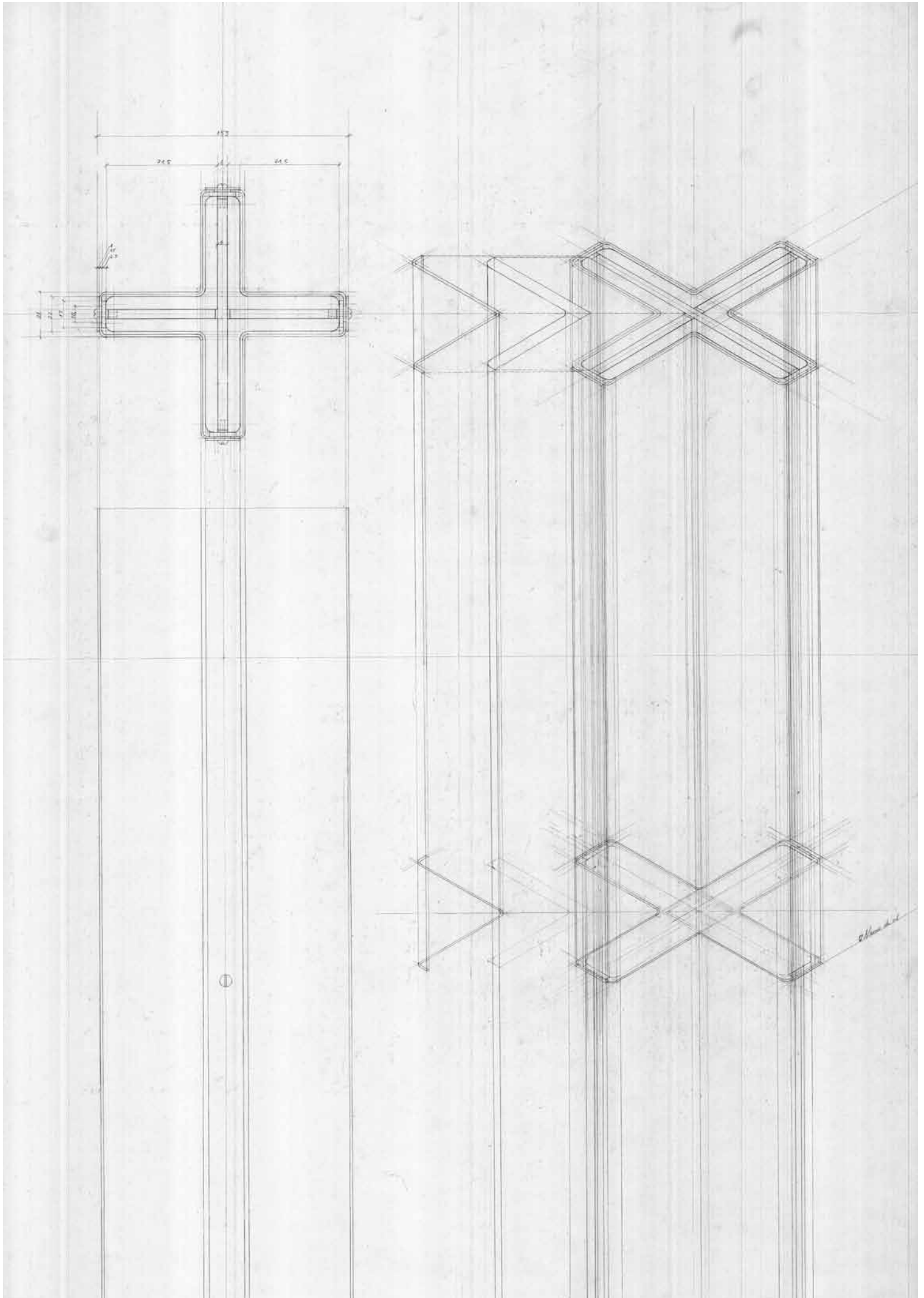
2A is not so big as 1A, although still not small: almost 70 cm across, and it too has been stitched together from multiple sheets, although now of paper. We can

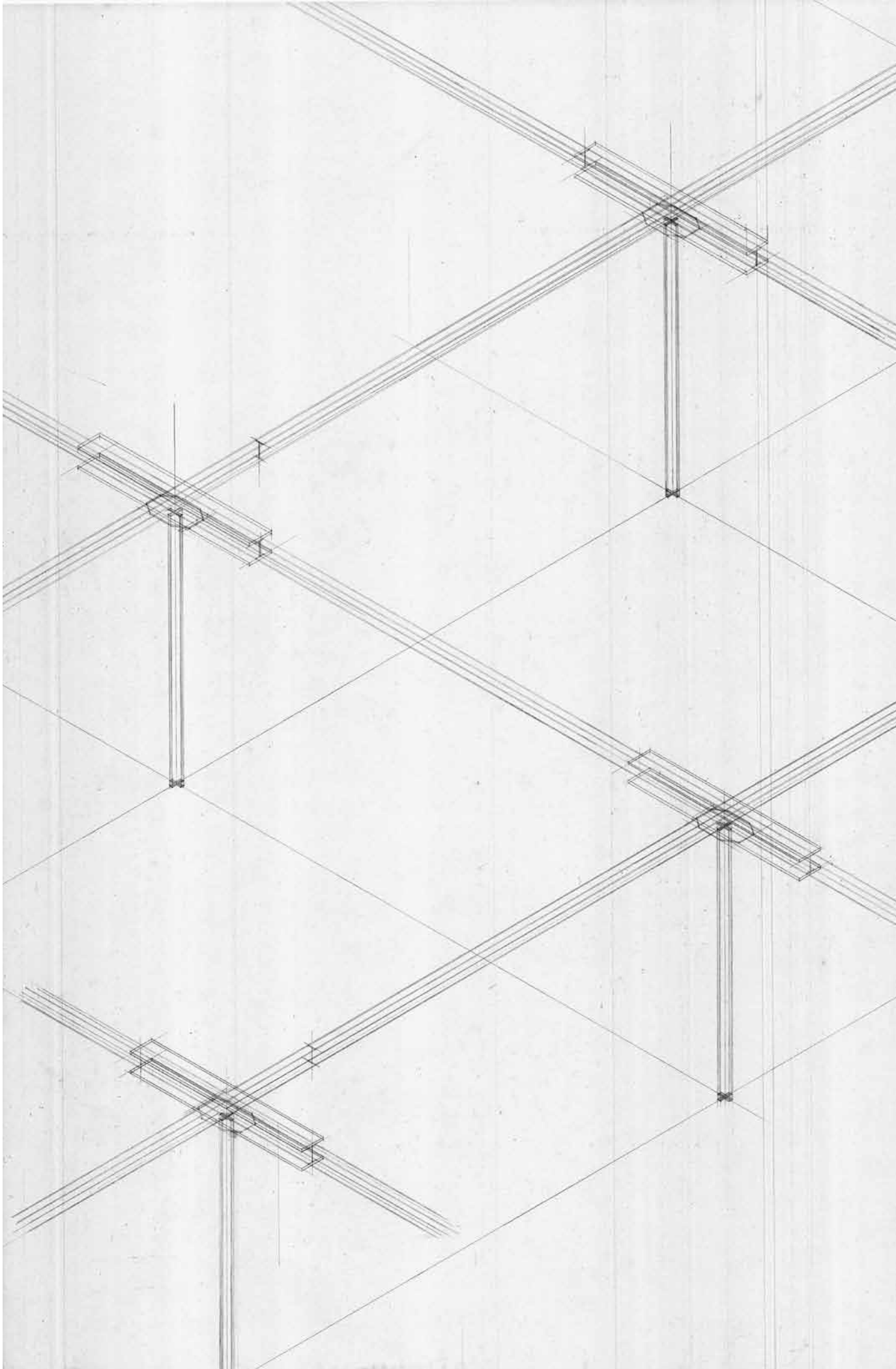
see it on an easel in the reading room, which is fortunate, considering its level of detail. The inked portions grab attention first: Saint Peter's rising from the middle of the page, higher in back and lower in front, so that few parts block the others behind. We may recognize an axonometric, which would make it the only such image in Italy for hundreds of years, but in fact a closer look reveals that the plan is actually a subtle bird's-eye perspective view. A student of engineering might comment on the excessive labor needed to make such a complex image, and ask, practical as ever: to what end? And why these parts only? Did it show what had been built already, or the effect of what was proposed? Here the central

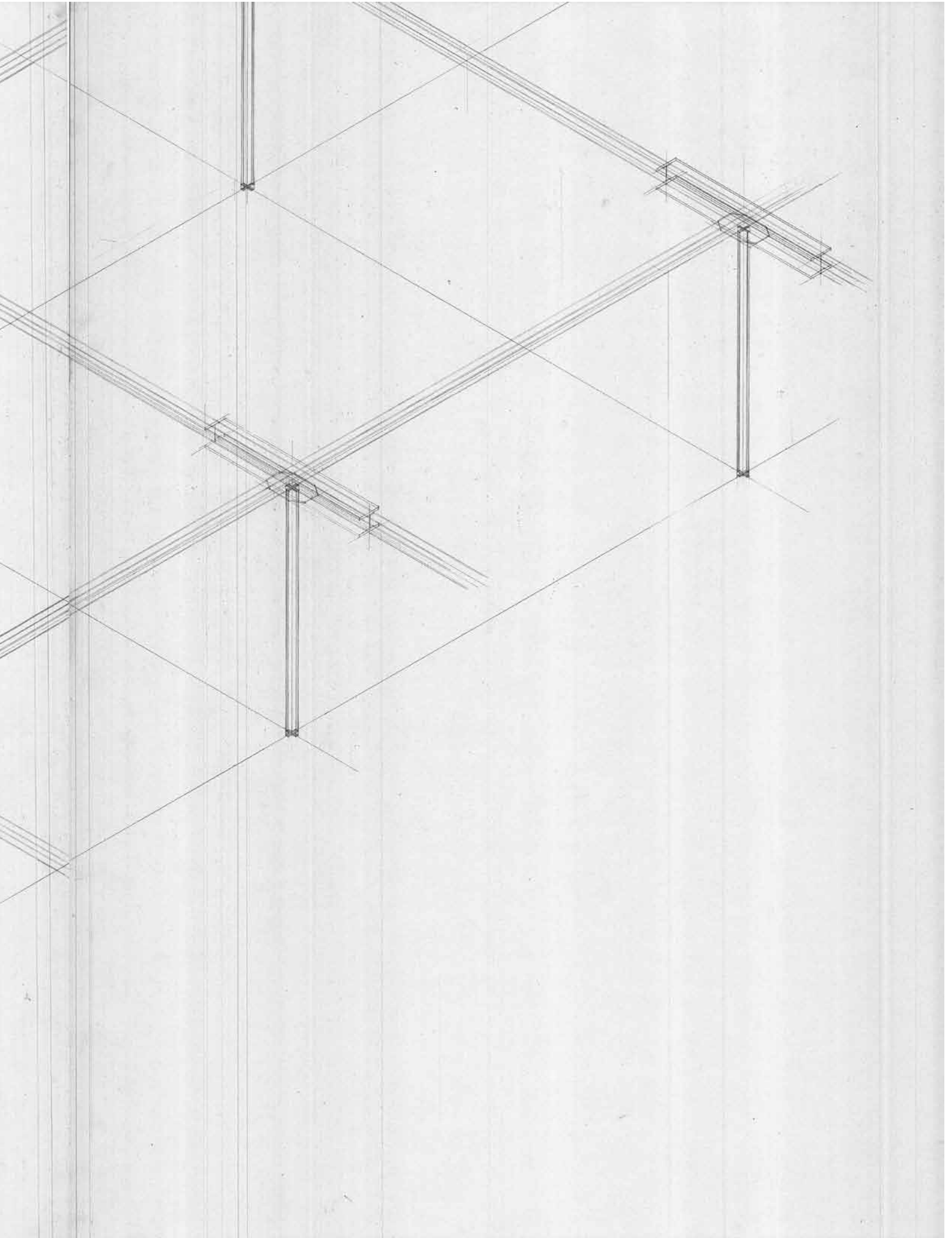
piers — those which had to hold up the big dome — are much thicker than in 1A, but the drawing miraculously manages to show them as sturdy but not overwhelming. Could that have been the goal, to convince that a building which would support itself could nevertheless be full of light? That might explain the near-obsessive attention to detail: like a contemporary architect's rendering, this is a picture designed to reassure, and to make visible what could not otherwise be seen.

To make visible the impossible: that, I think, is one reason we draw. But ask another architect, another engineer, another student—and bring back more opinions.

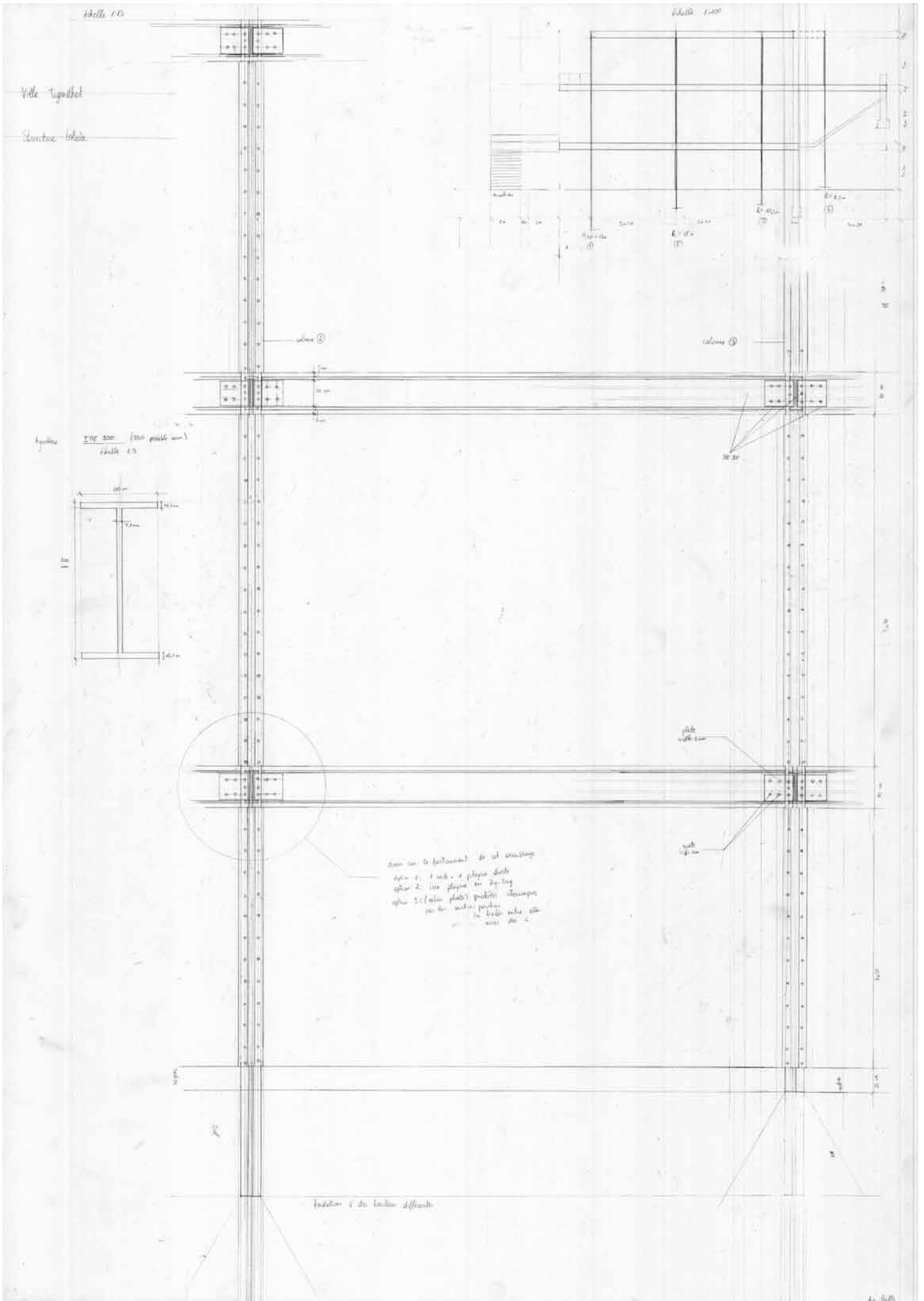
BARCELONA PAVILION,
BARCELONA, 1928-29 / 1983-86

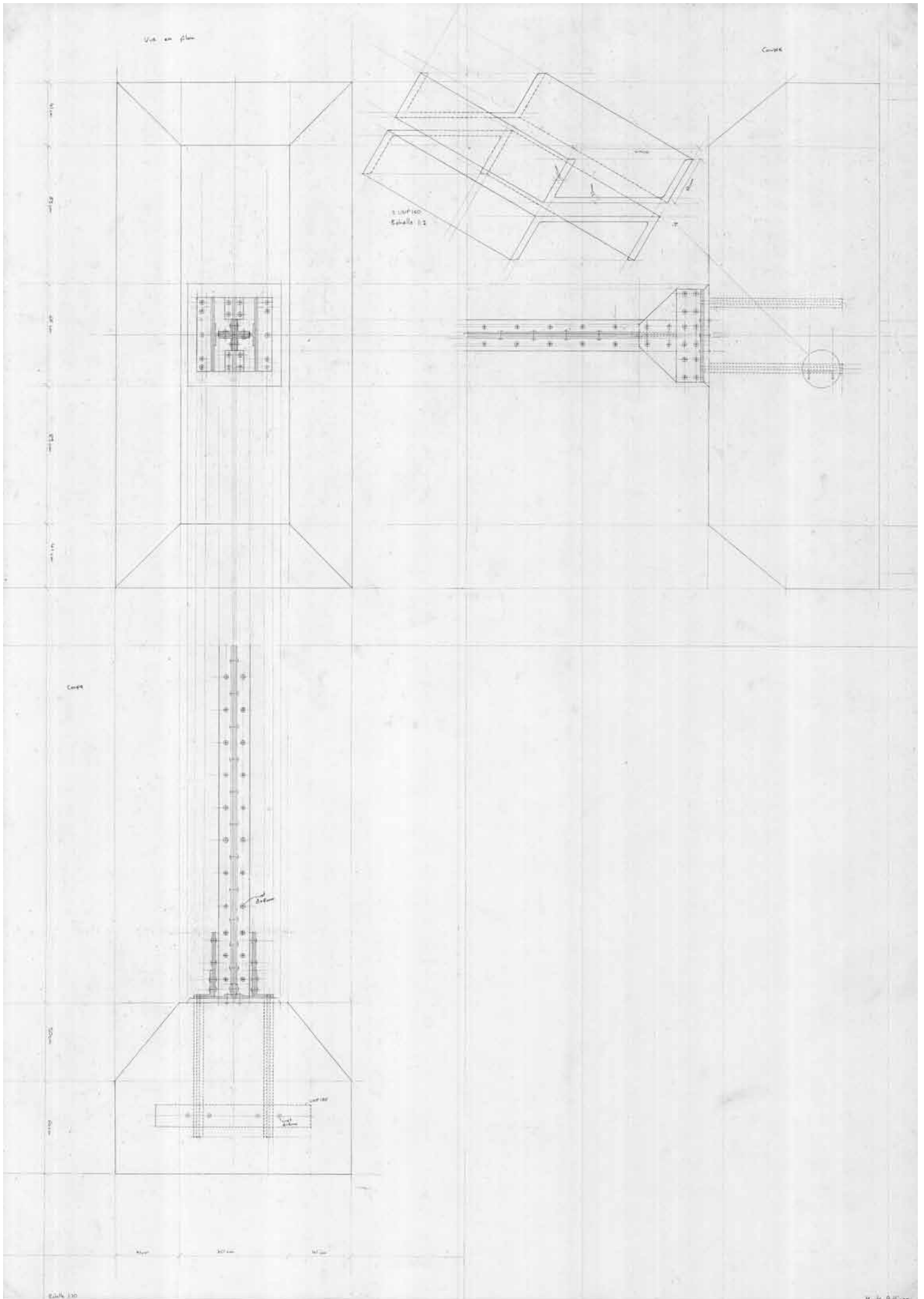


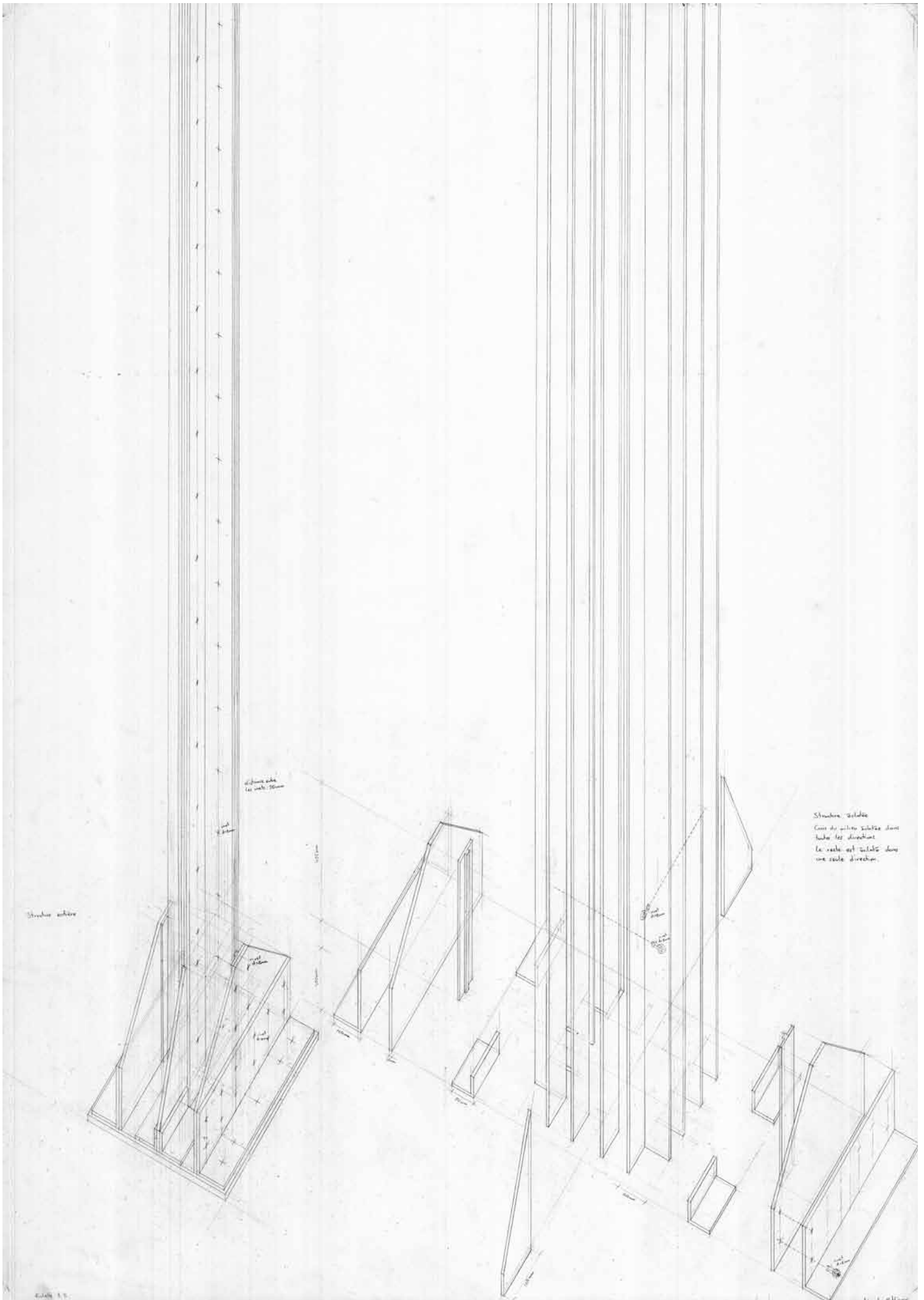


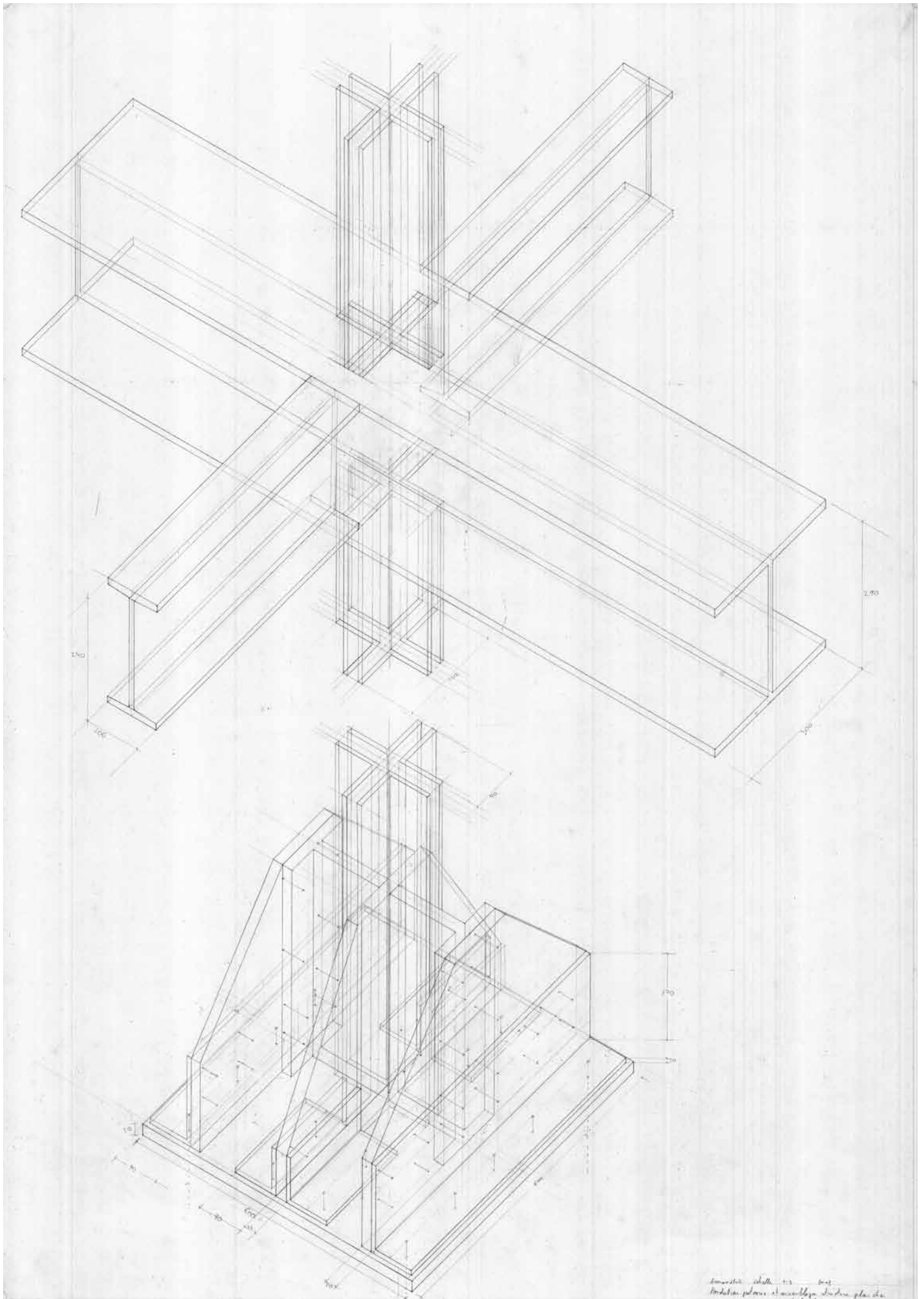


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BRNO, 1928-30

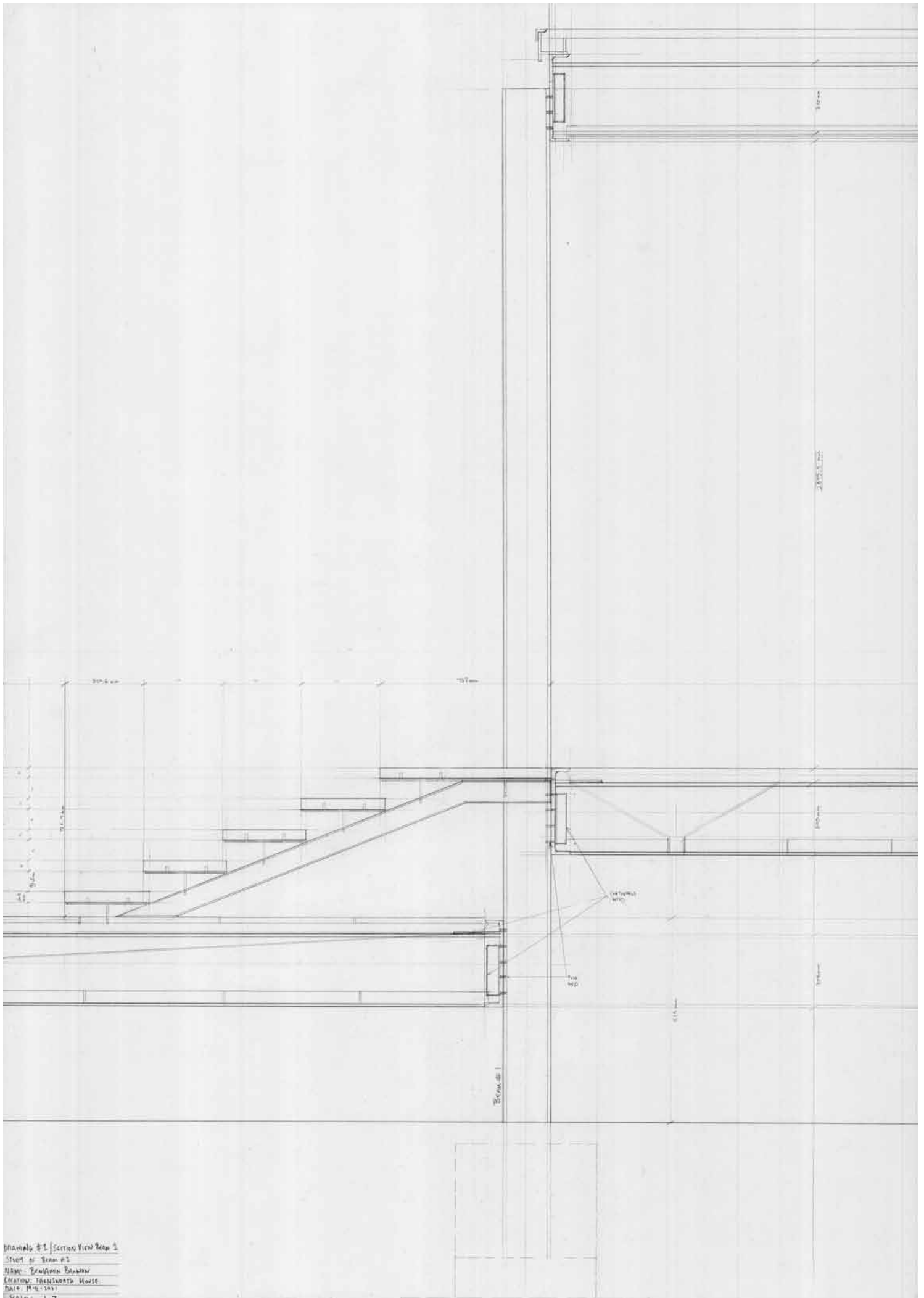




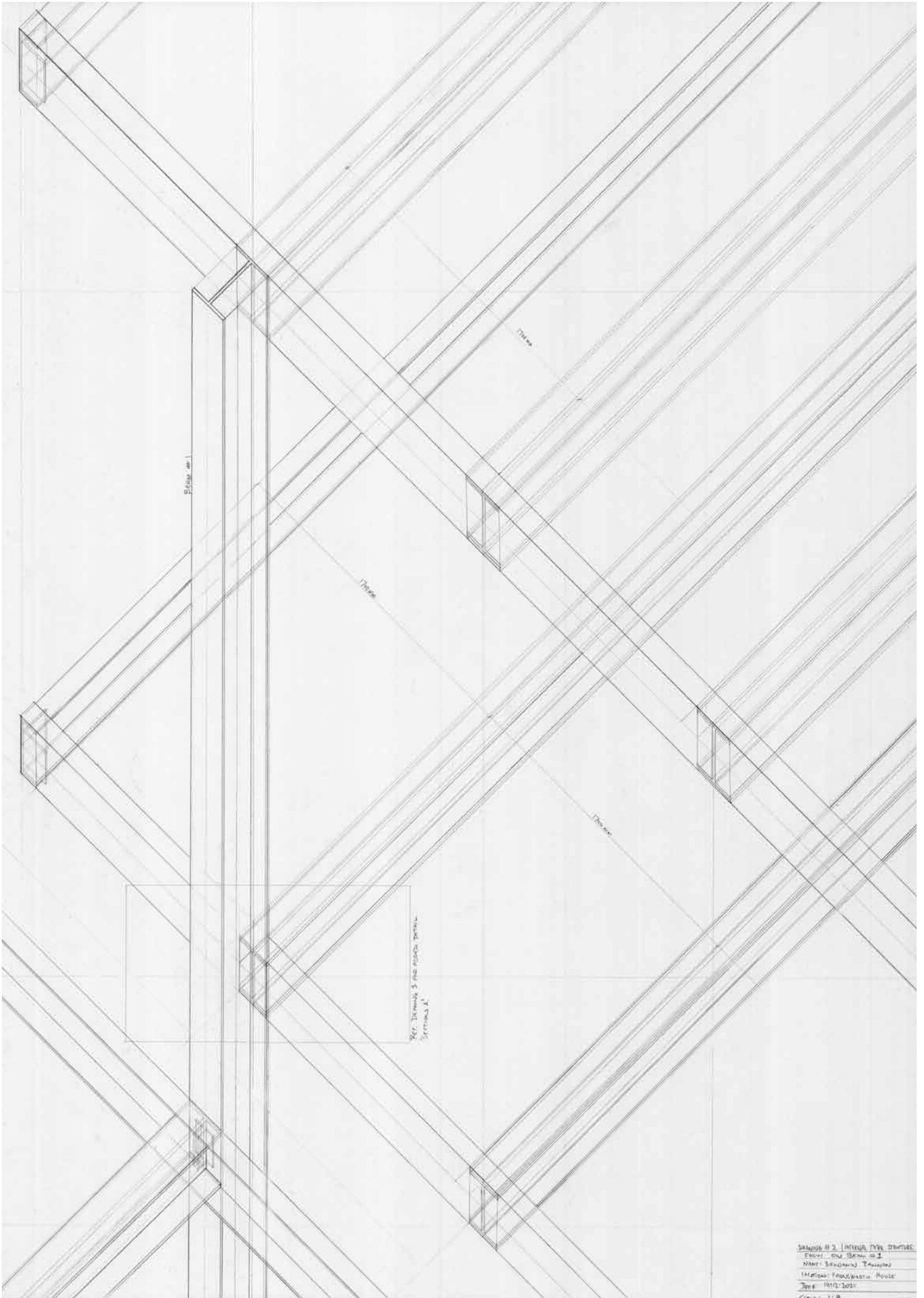


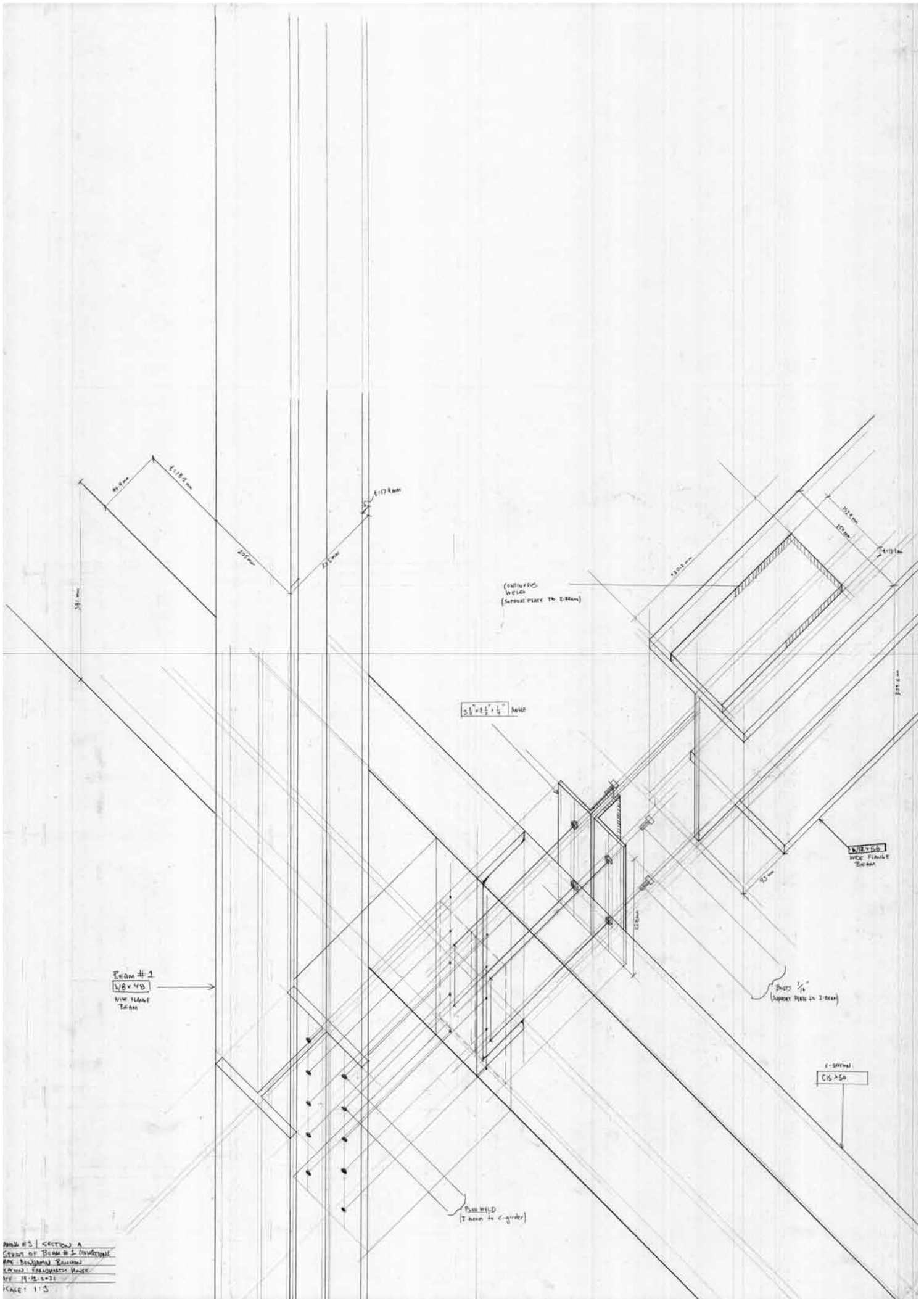


FARNSWORTH HOUSE,
PLANO, 1945-51

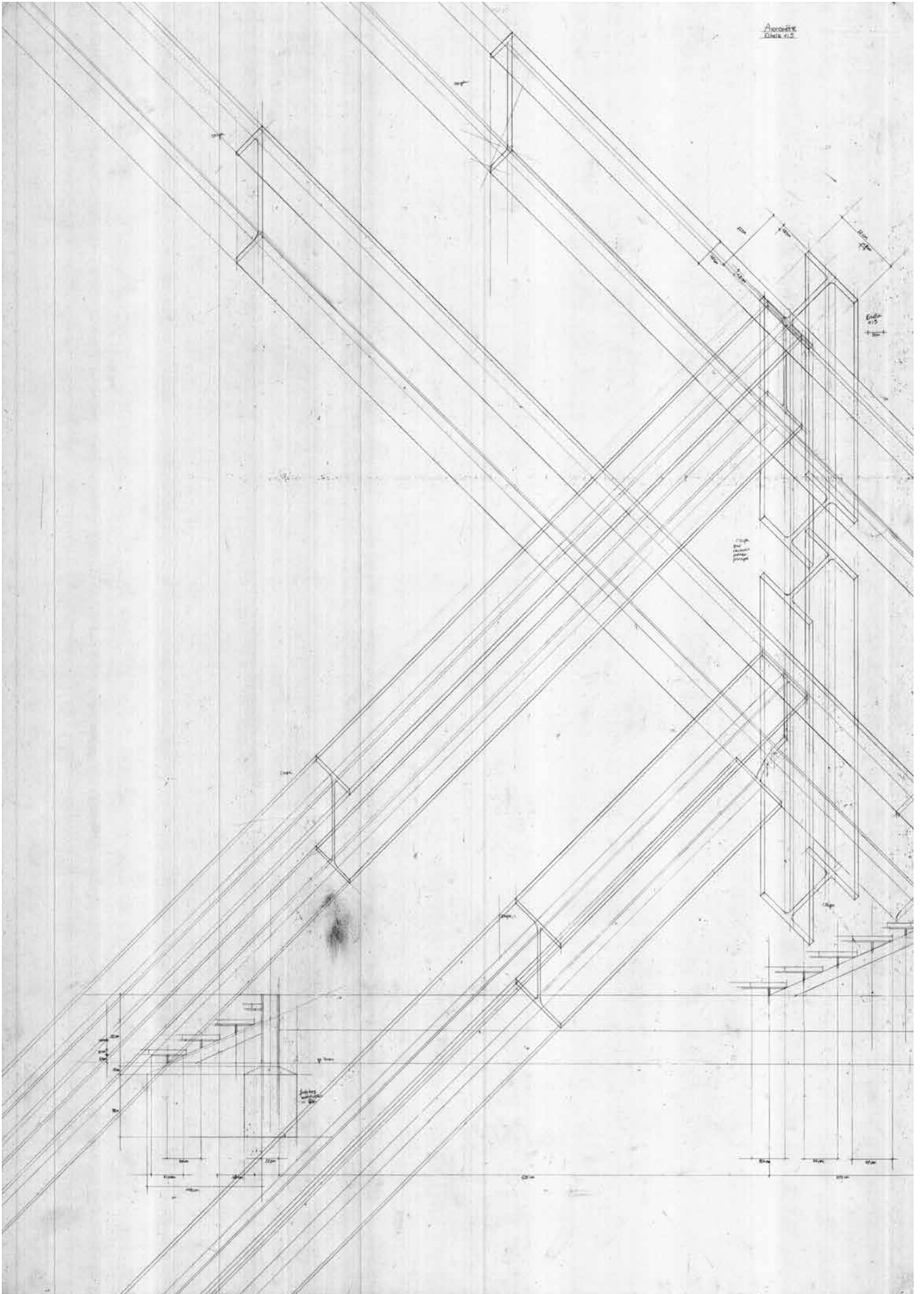


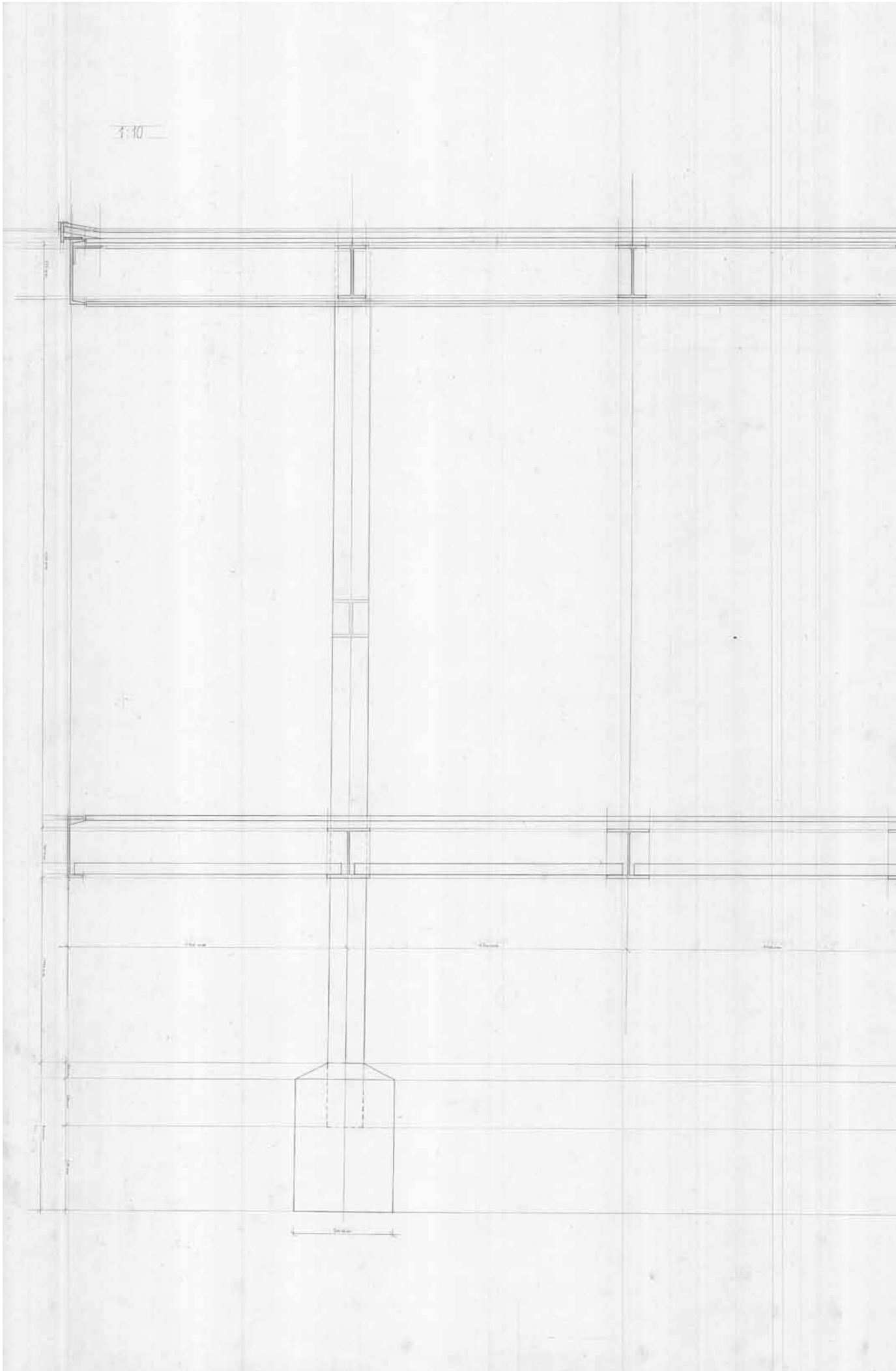
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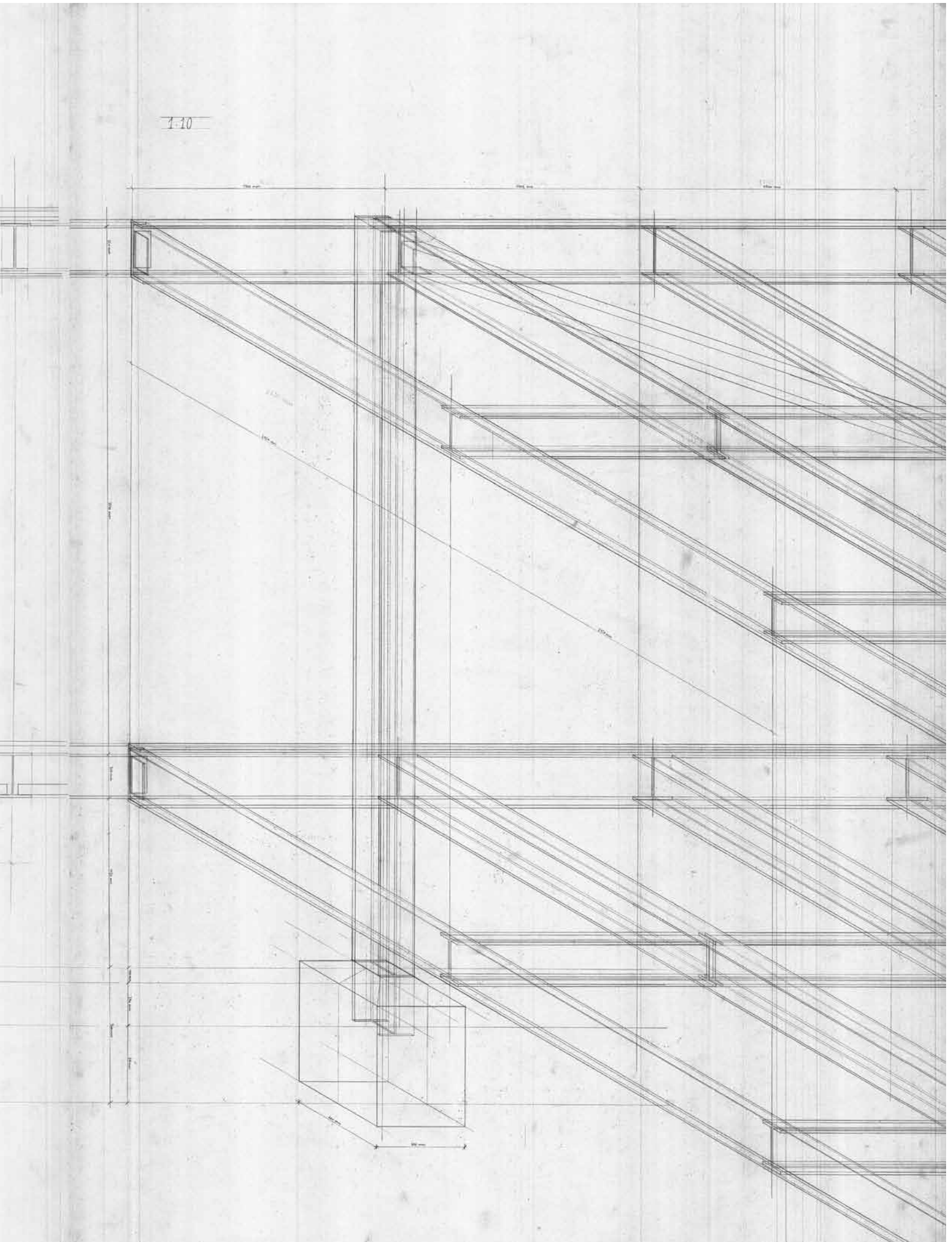




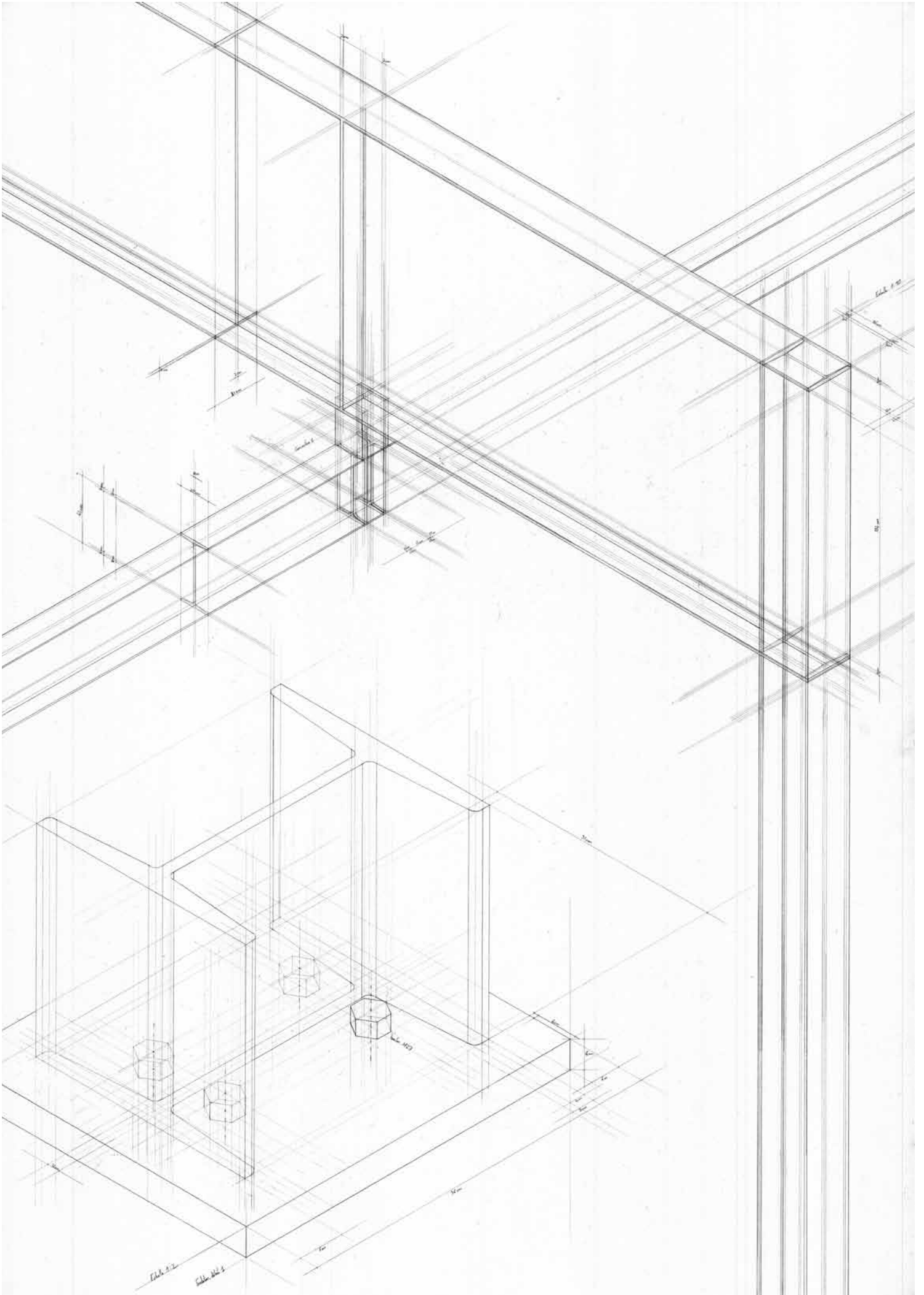
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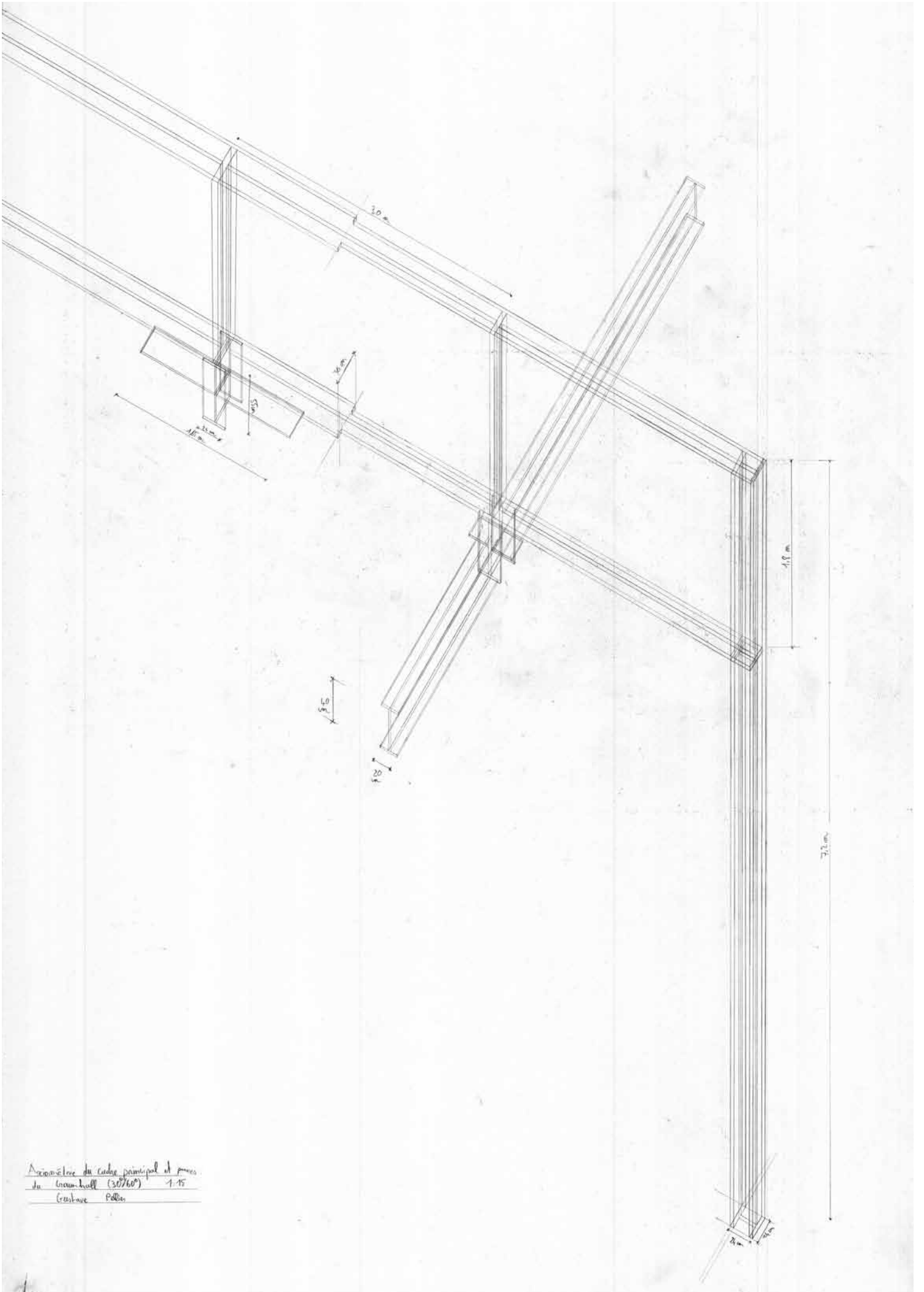




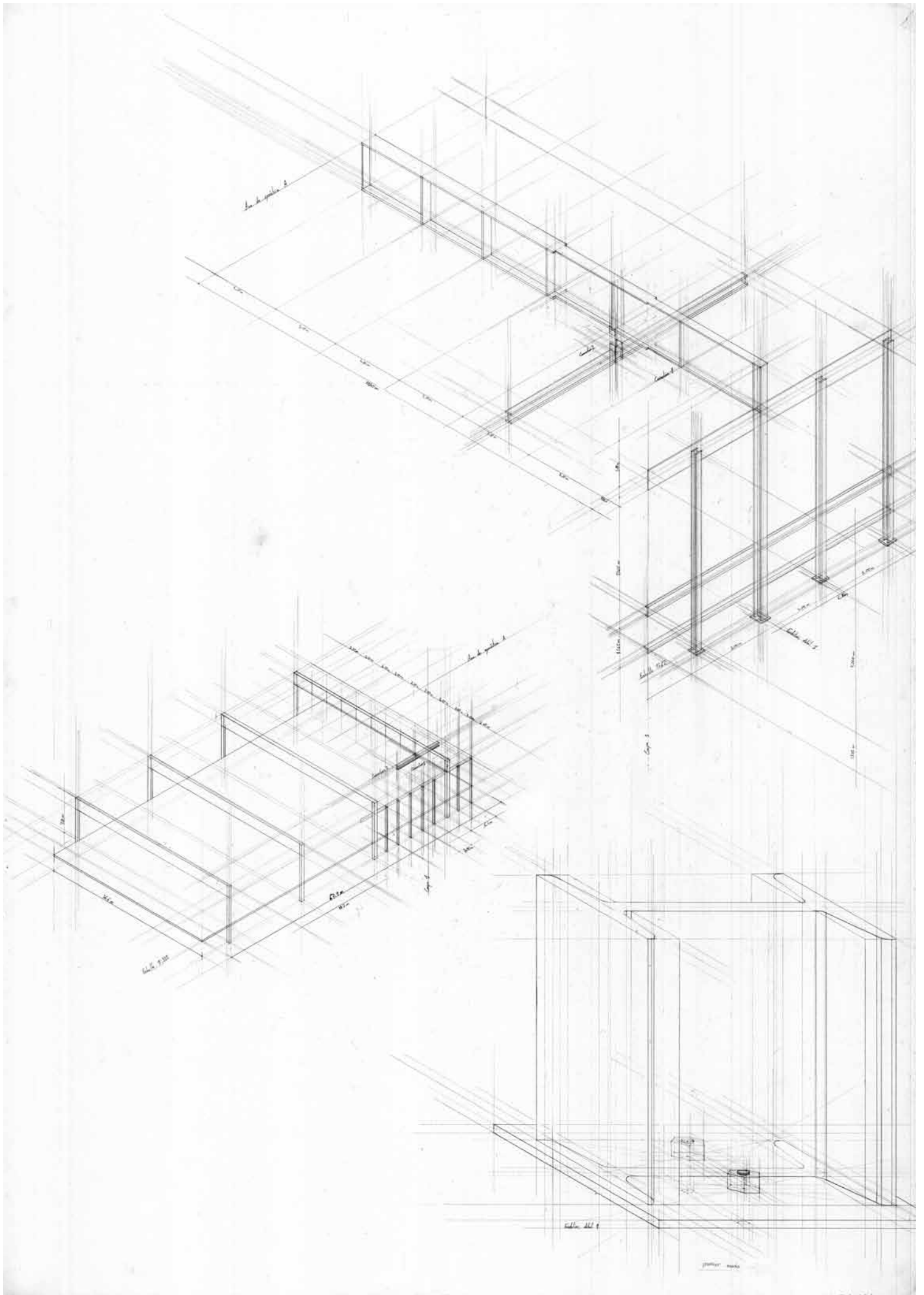


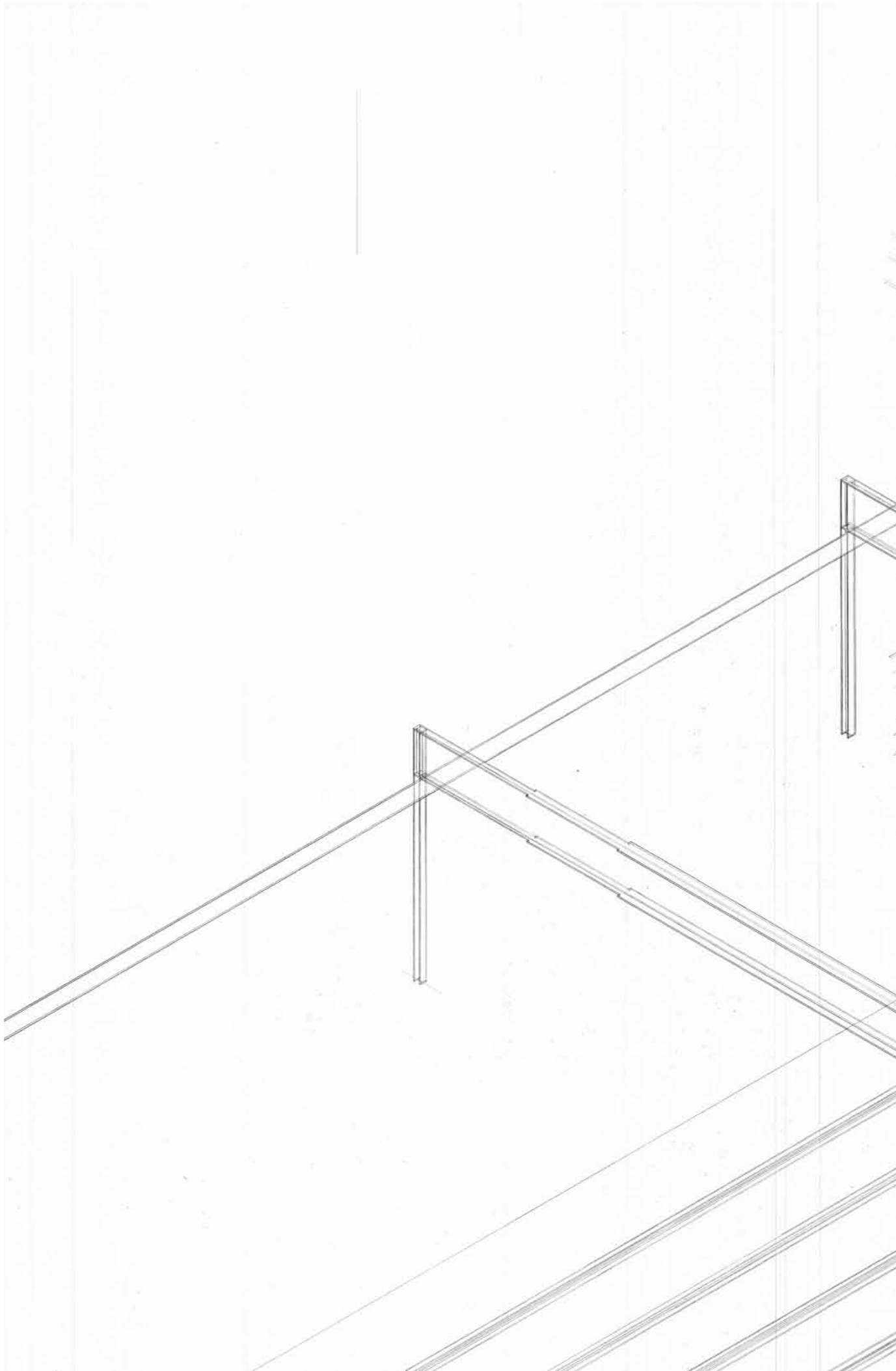
CROWN HALL,
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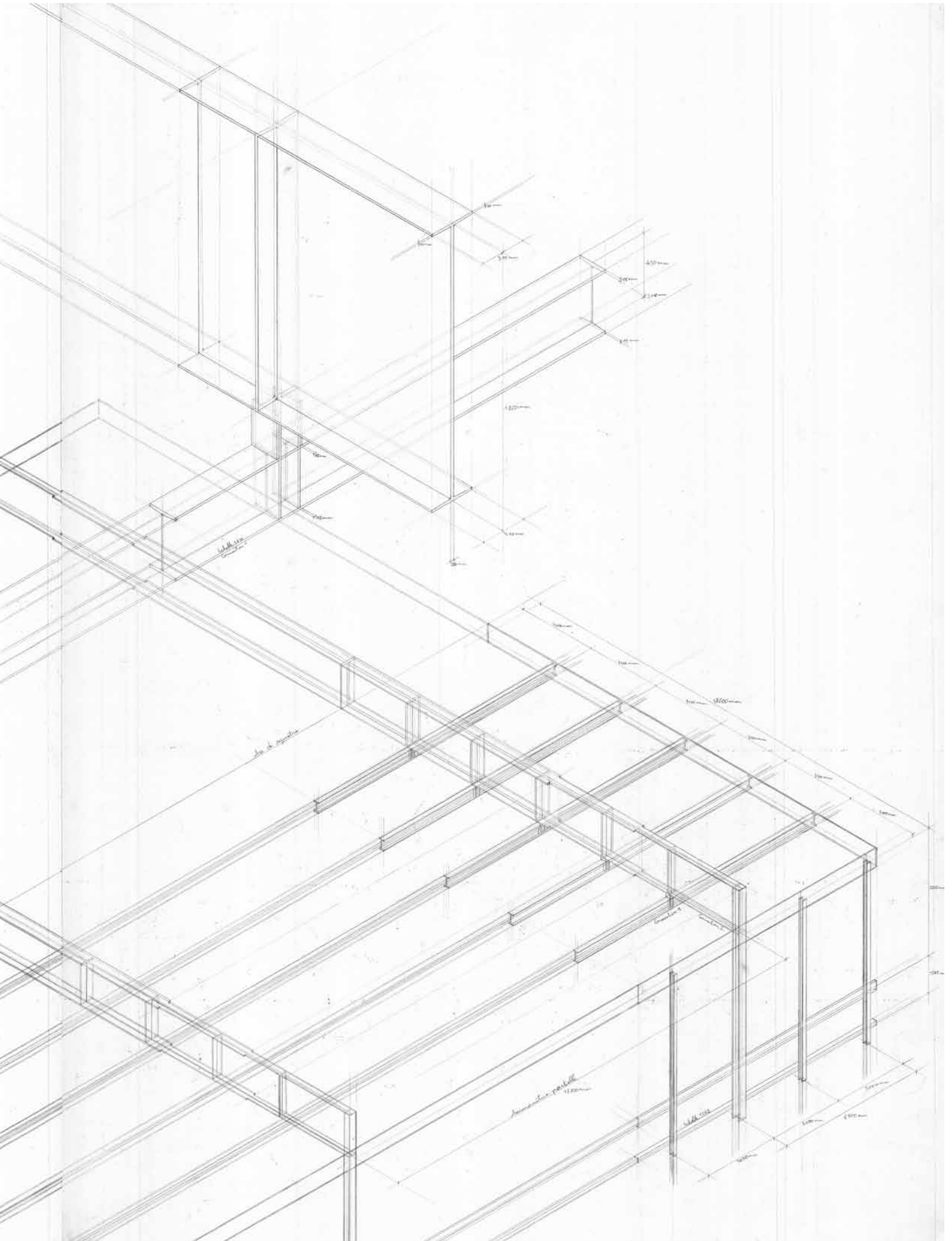


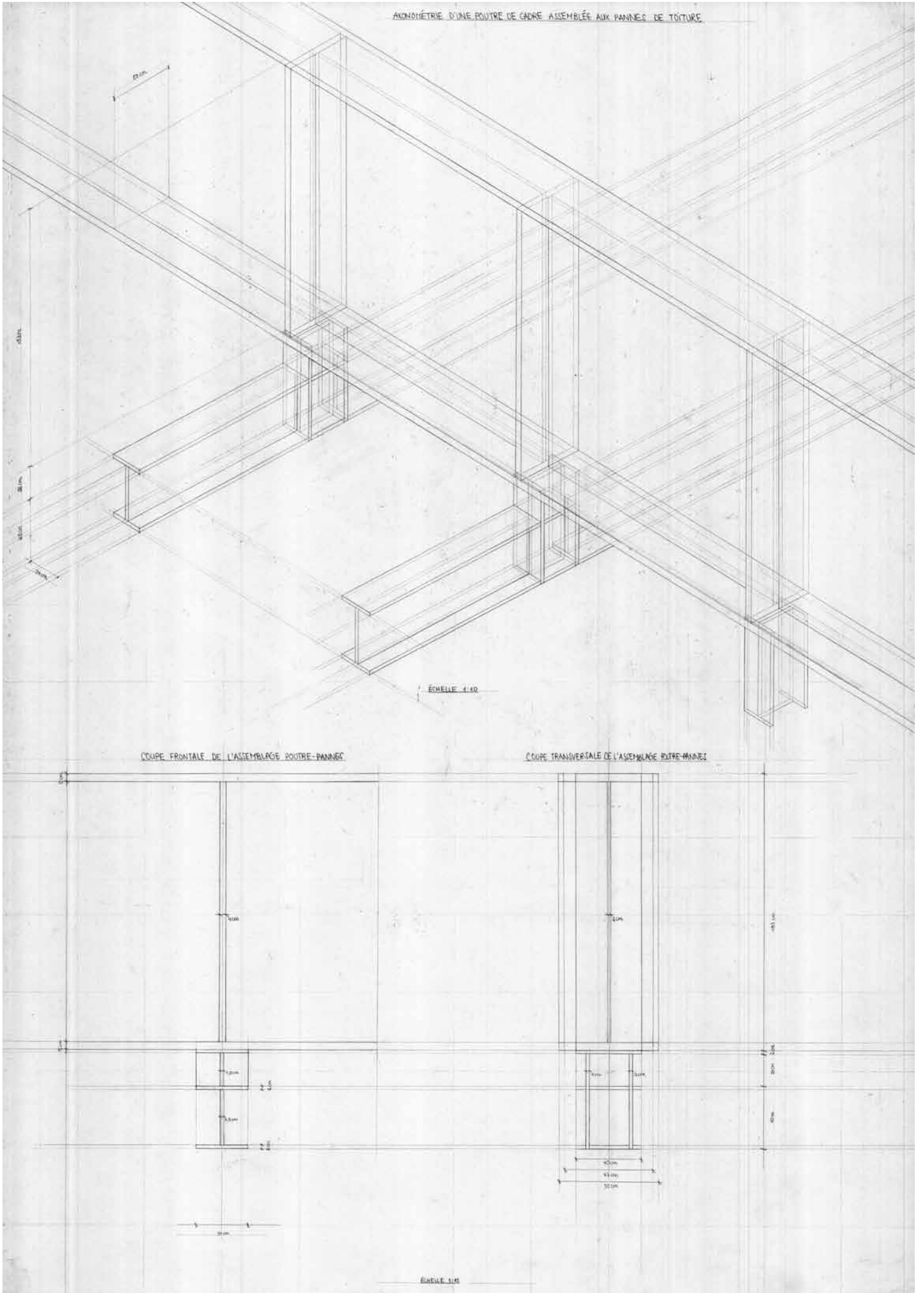


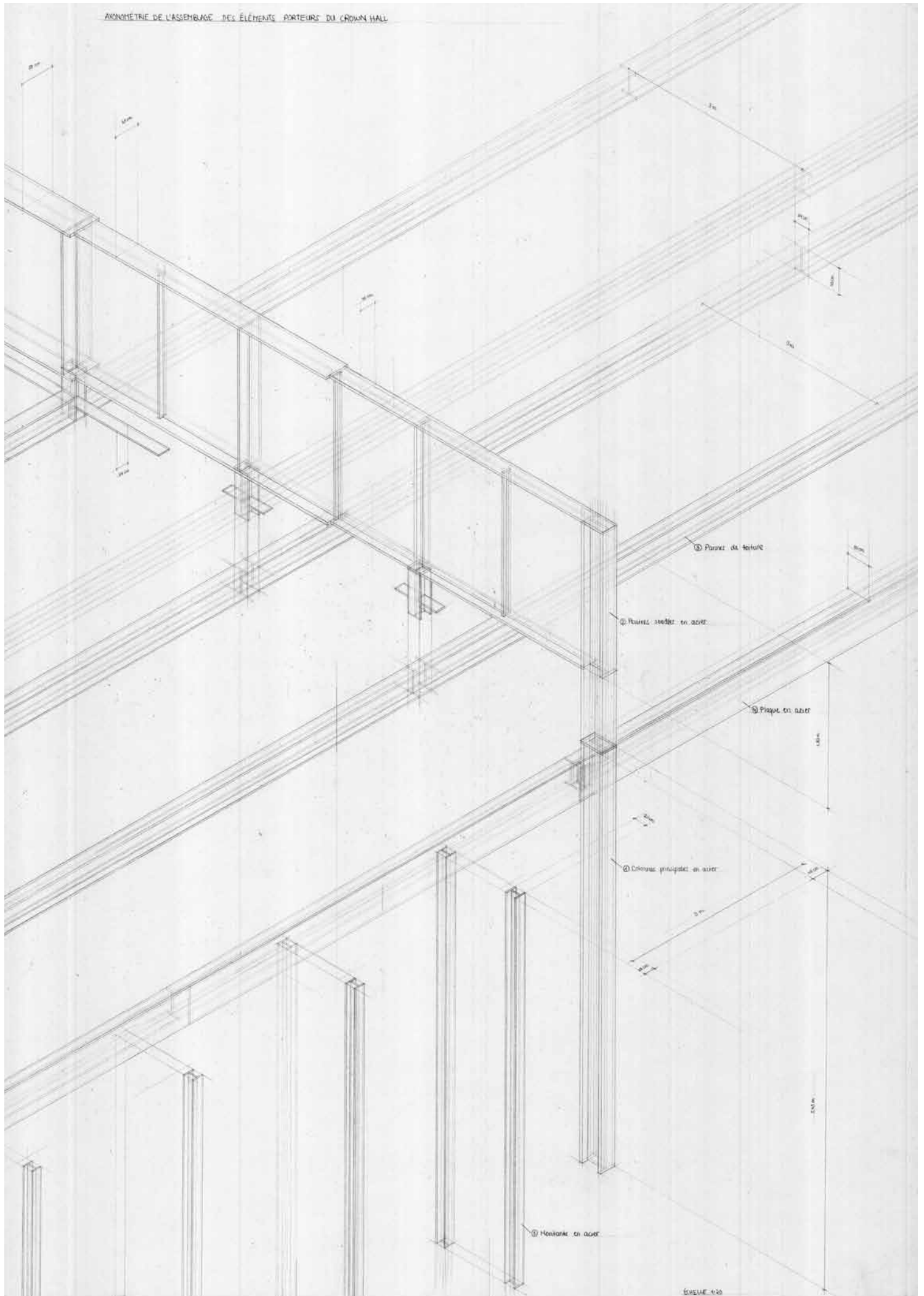
Ascension des cadres principal et poutres
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Gustave Pellier

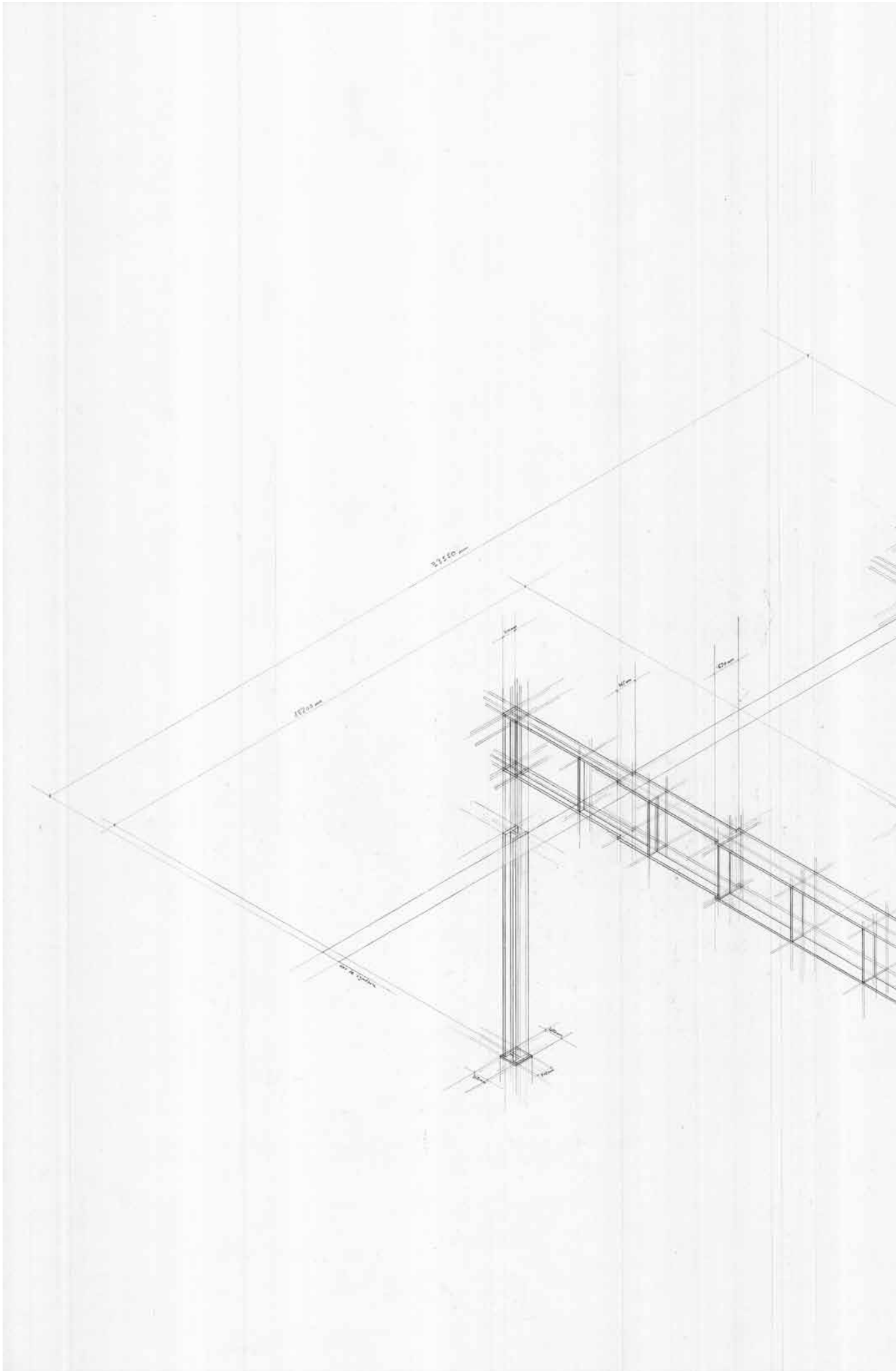


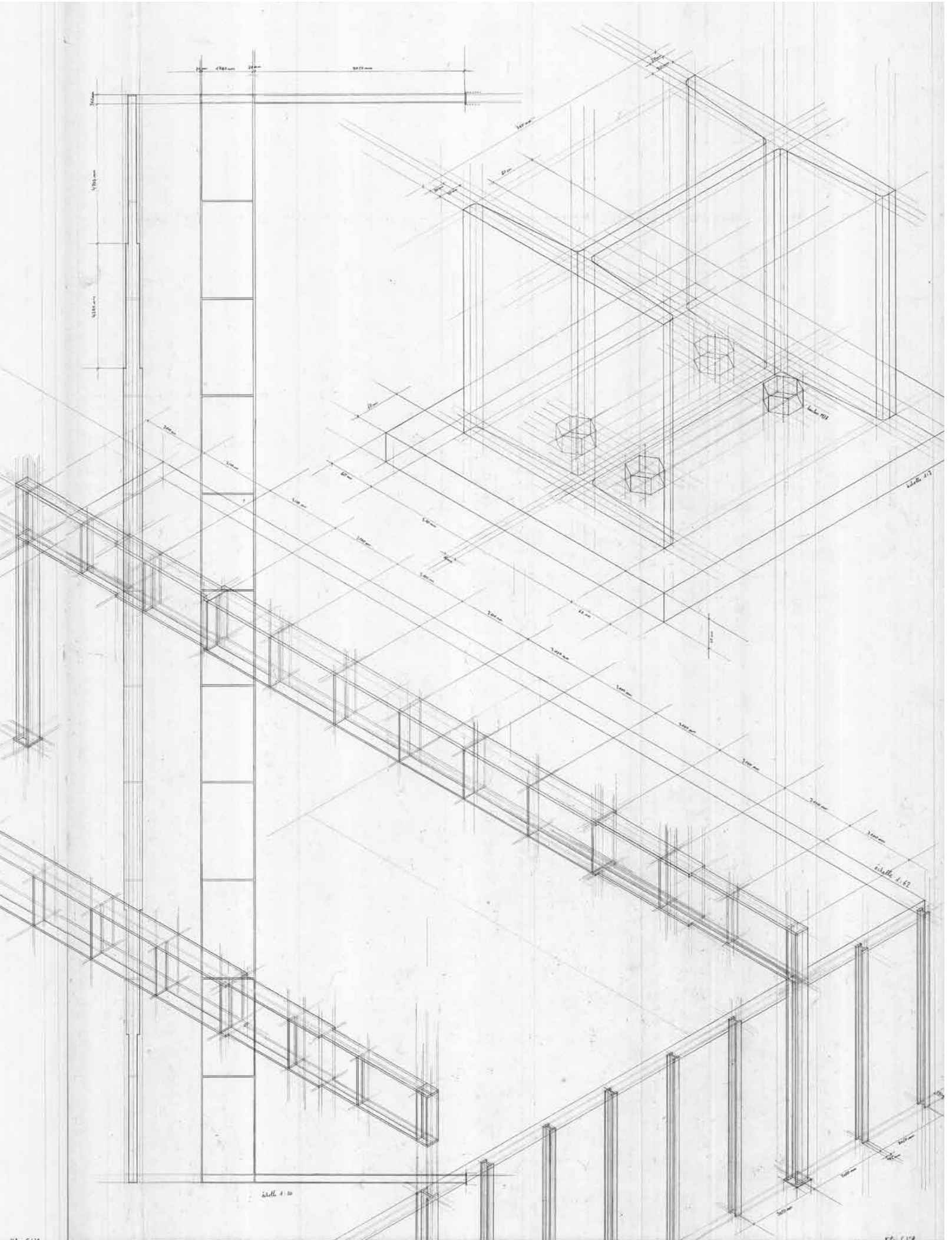




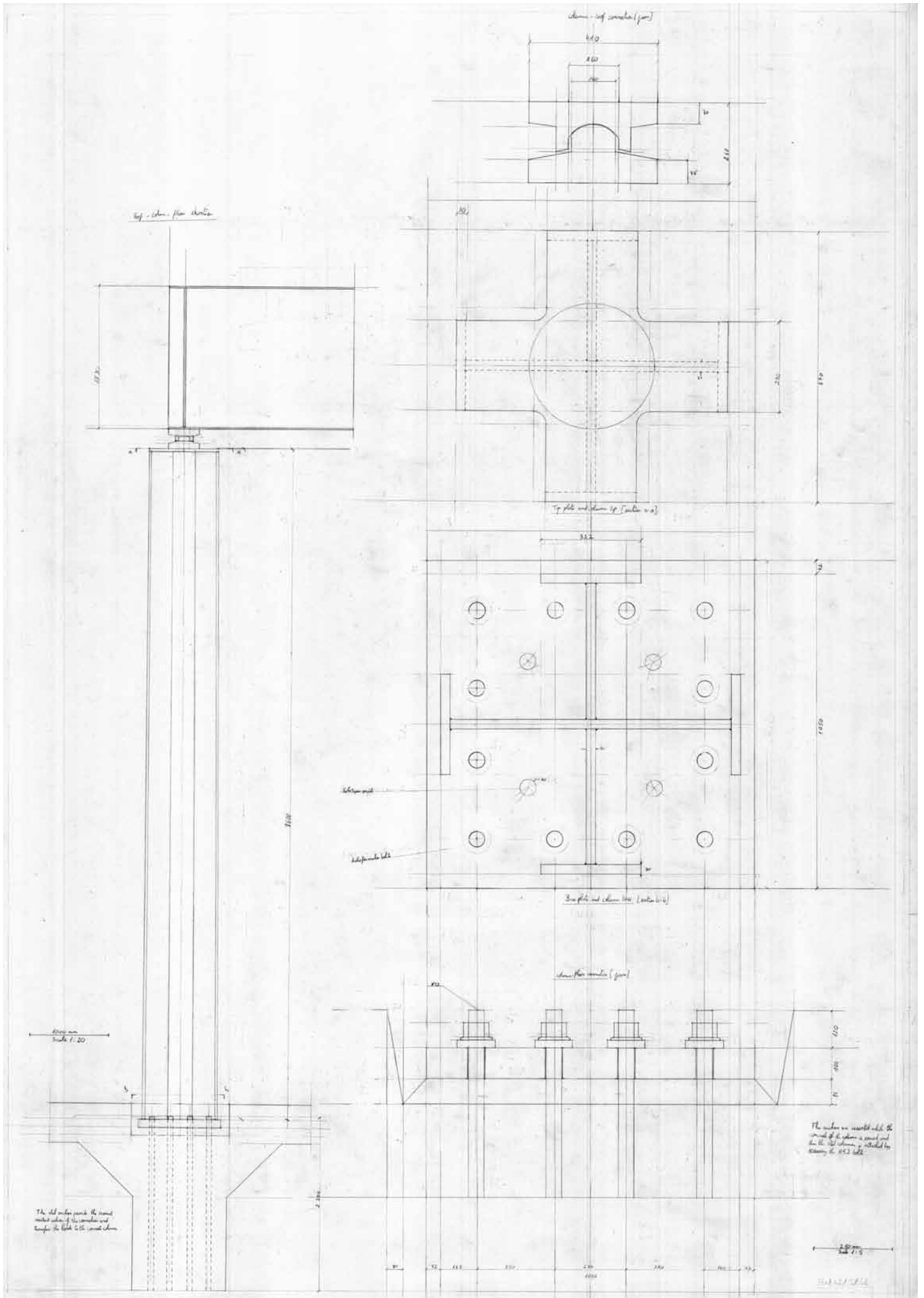


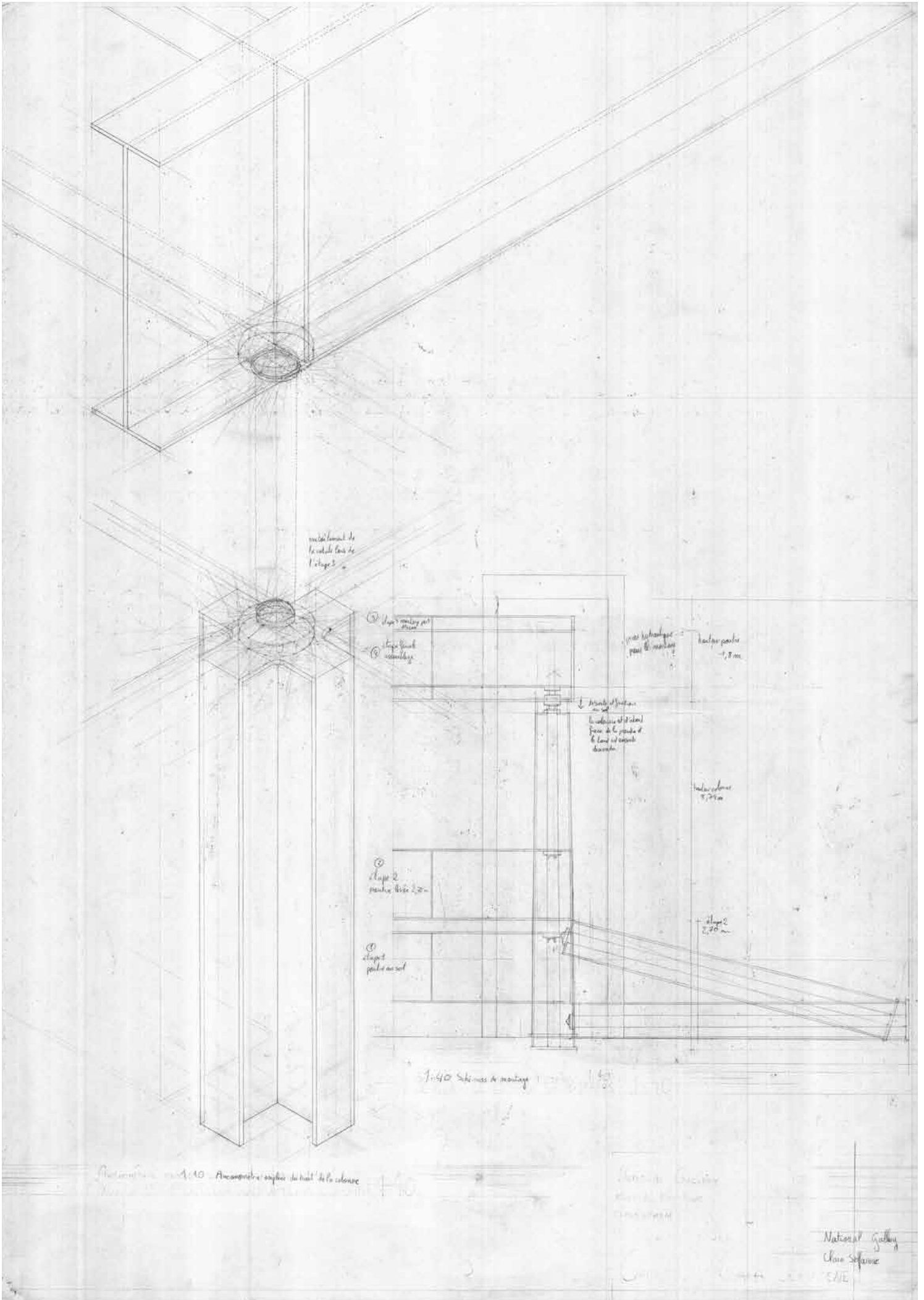


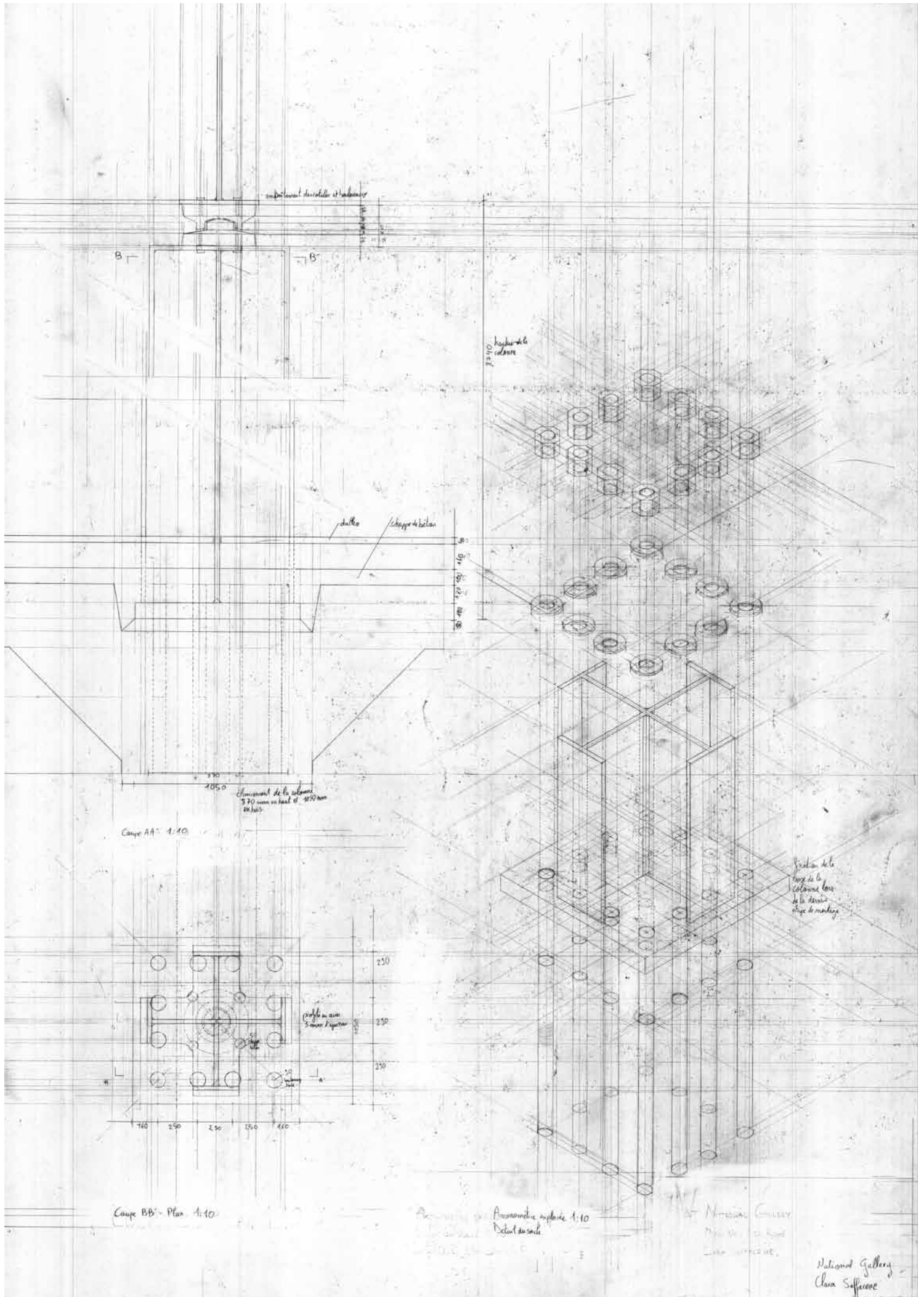


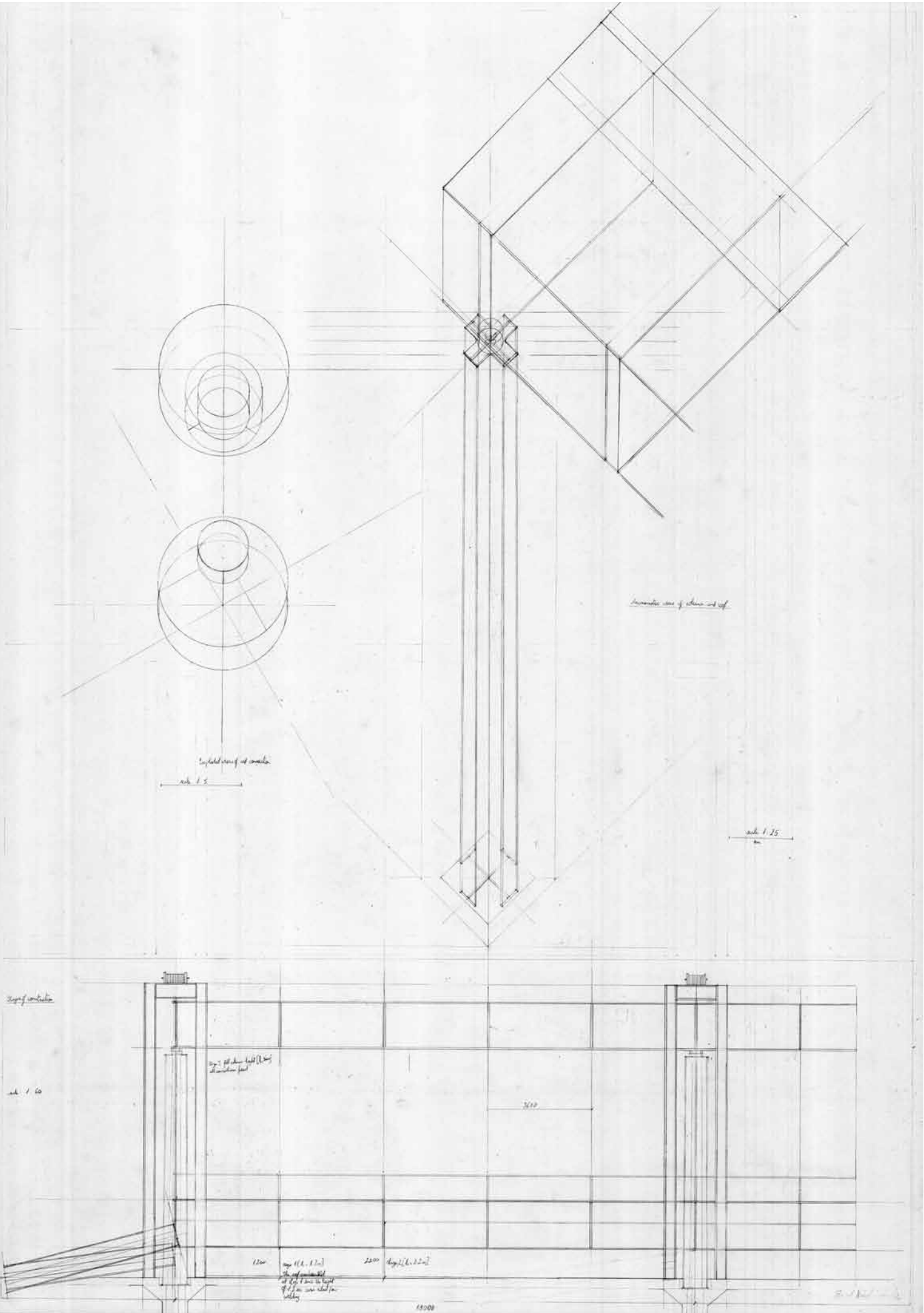


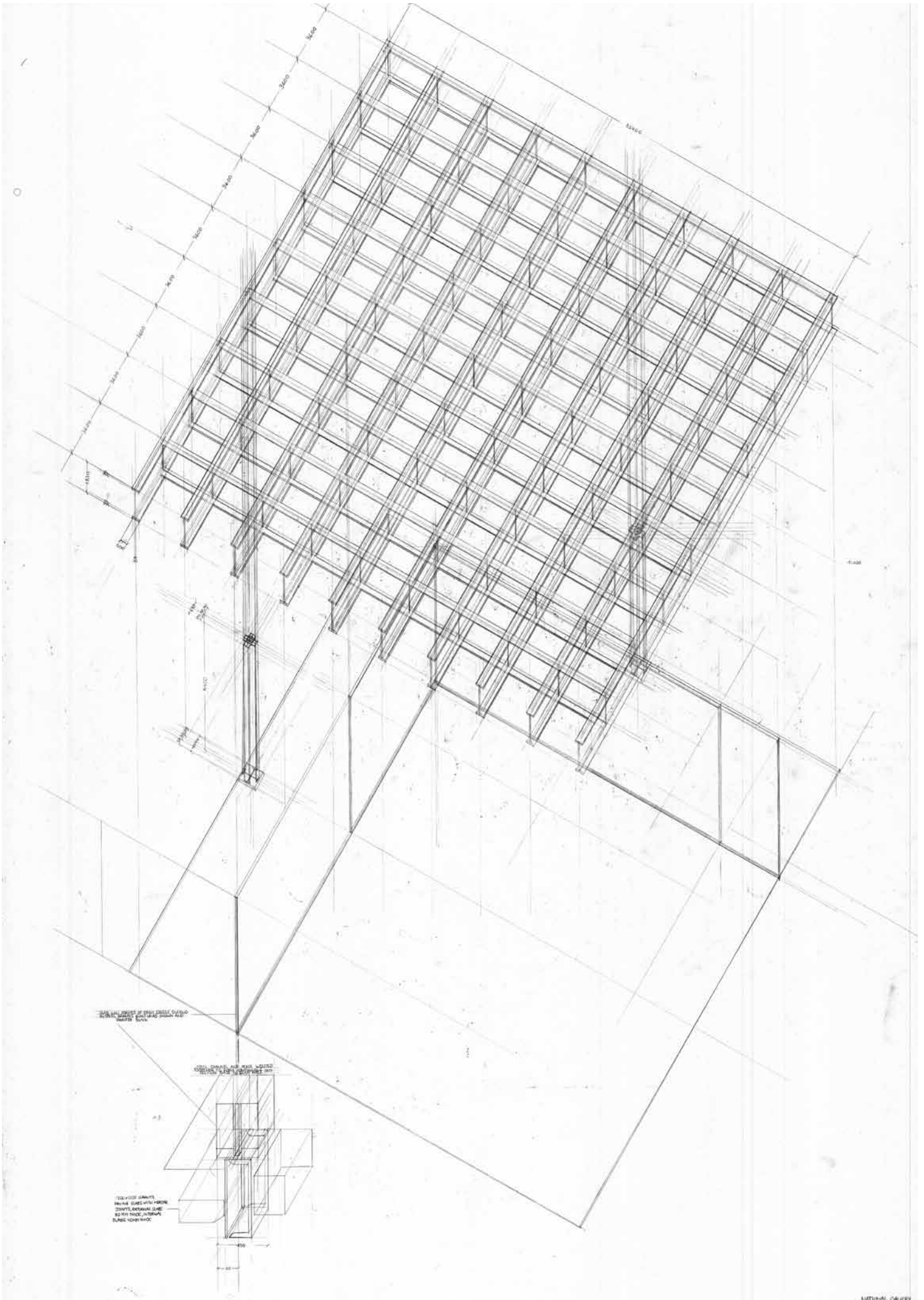
NATIONAL GALLERY,
BERLIN, 1962-68











DOCTA MANUS
DRAWING STRUCTURES

UE GC – EPFL

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GRAPHIC DESIGN
Studio Otamendi, Brussels

PRINT & BINDING
Neoprint, Morges

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ACKNOWLEDGEMENTS

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

