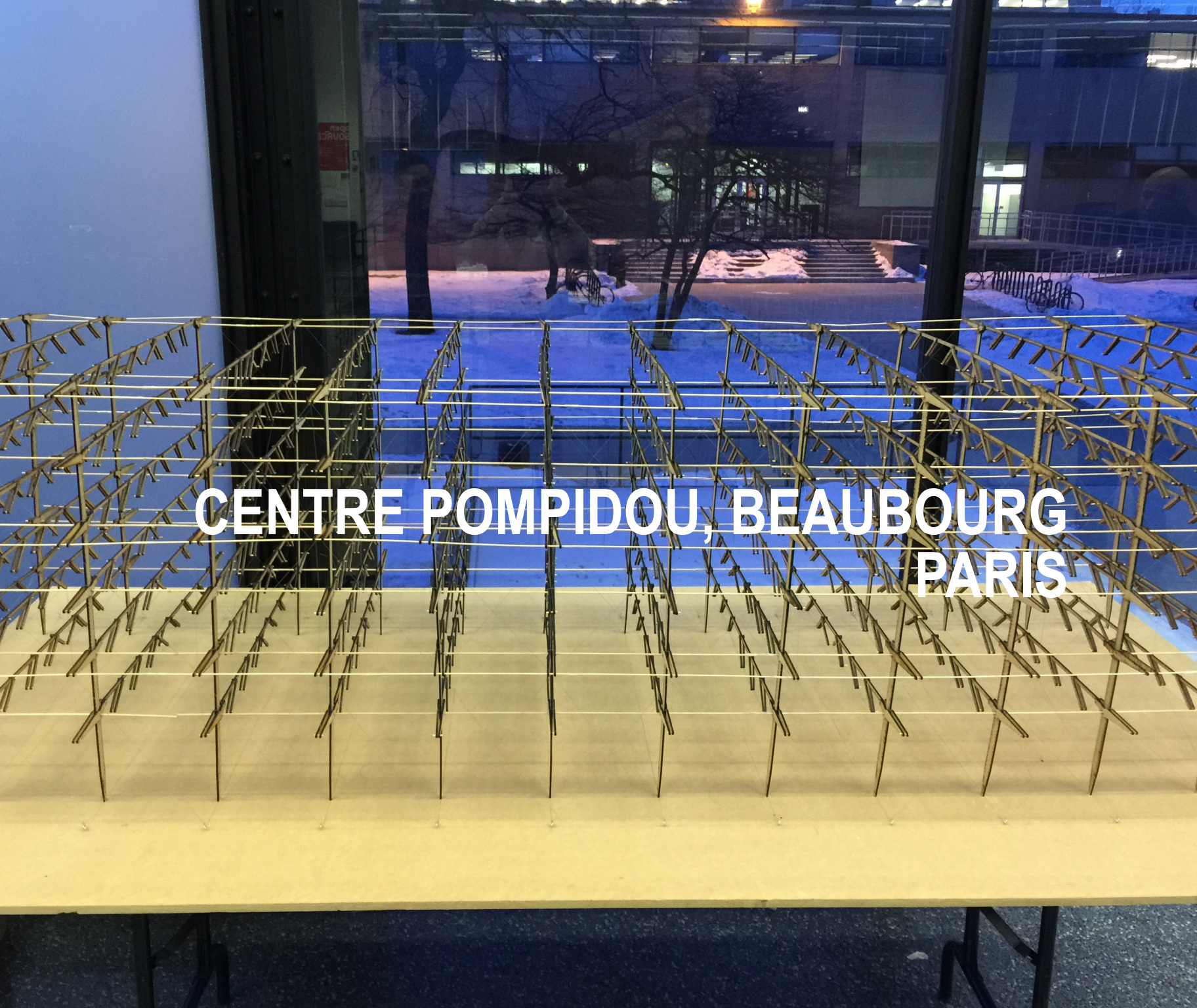

CENTRE POMPIDOU, BEAUBOURG
PARIS

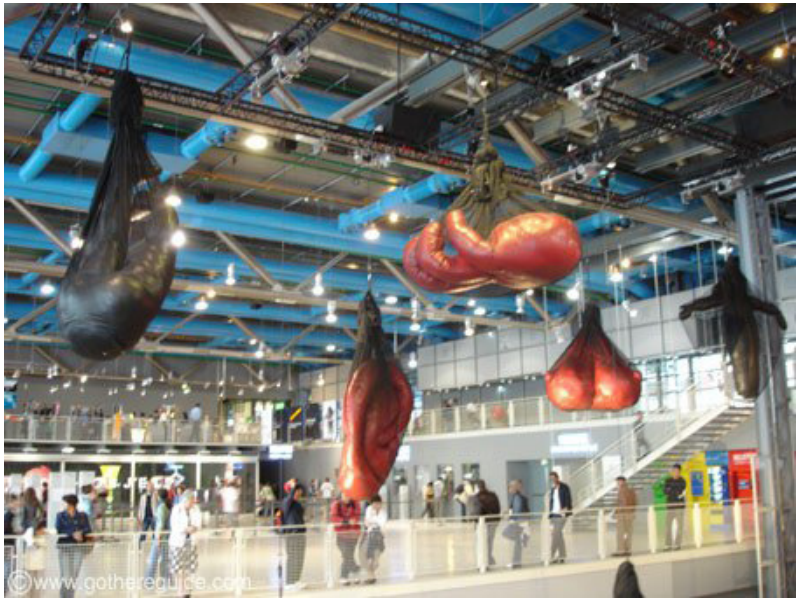
CENTRE POMPIDOU

Drew Gingrich
Woei Cherng Low
Amer Sassila
Jorge Serra

CENTRE POMPIDOU

Paris, Beaubourg. 1971.

Richard Rogers & Renzo Piano



The Pompidou Center, built in Paris between 1971 and 1977 by architects Richard Rogers and Renzo Piano and Structural Engineer Pete Rice, is often regarded as a turning point in architecture. We will discuss in this report the particularities of the building's structure and what makes is so innovative in terms of engineering and architecture.

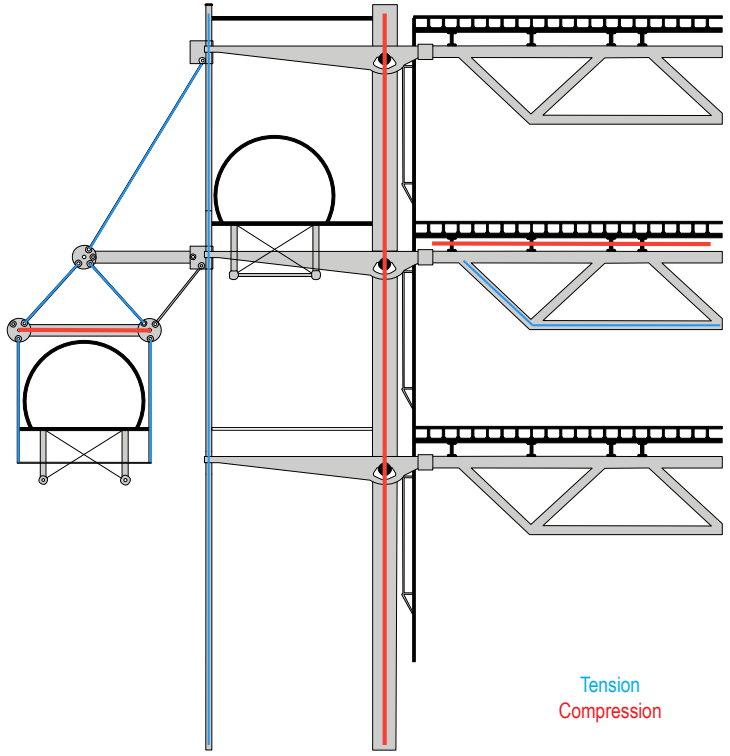
Being a cultural center, the architects wanted to maximize the open space on the inside of the building. And allow for modularity without being constrained by structure or obstacles. The structure was therefore placed on the outside of the building with elements spanning its entire width to create a completely open space on the inside, devoid of any obstacles. The process seems relatively simpler than it actually is, and several clever ideas were employed that helped to achieve this.

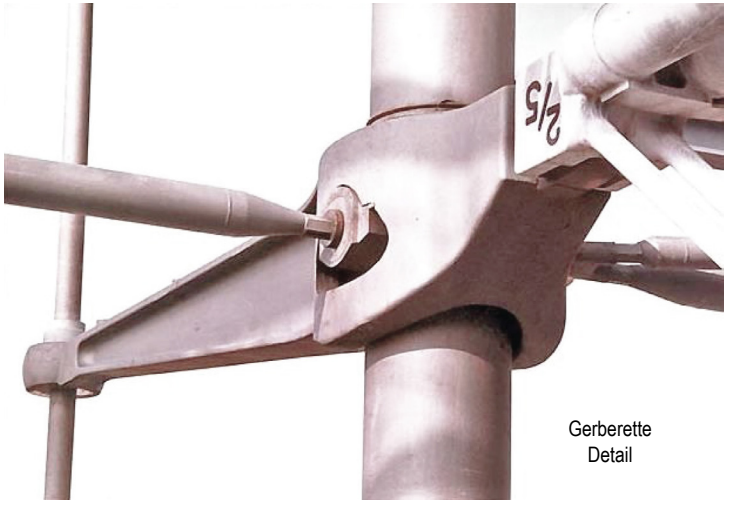
A close collaboration between the architects and engineers fostered a very good balance for the conception of this building, and is a key strategy for the success it became. Not only did it result in an amazing piece of architecture, it is also a feat of engineering, with revolutionary ideas and conception that make the Pompidou Center a true hallmark of good architecture.

Spanning & Support System

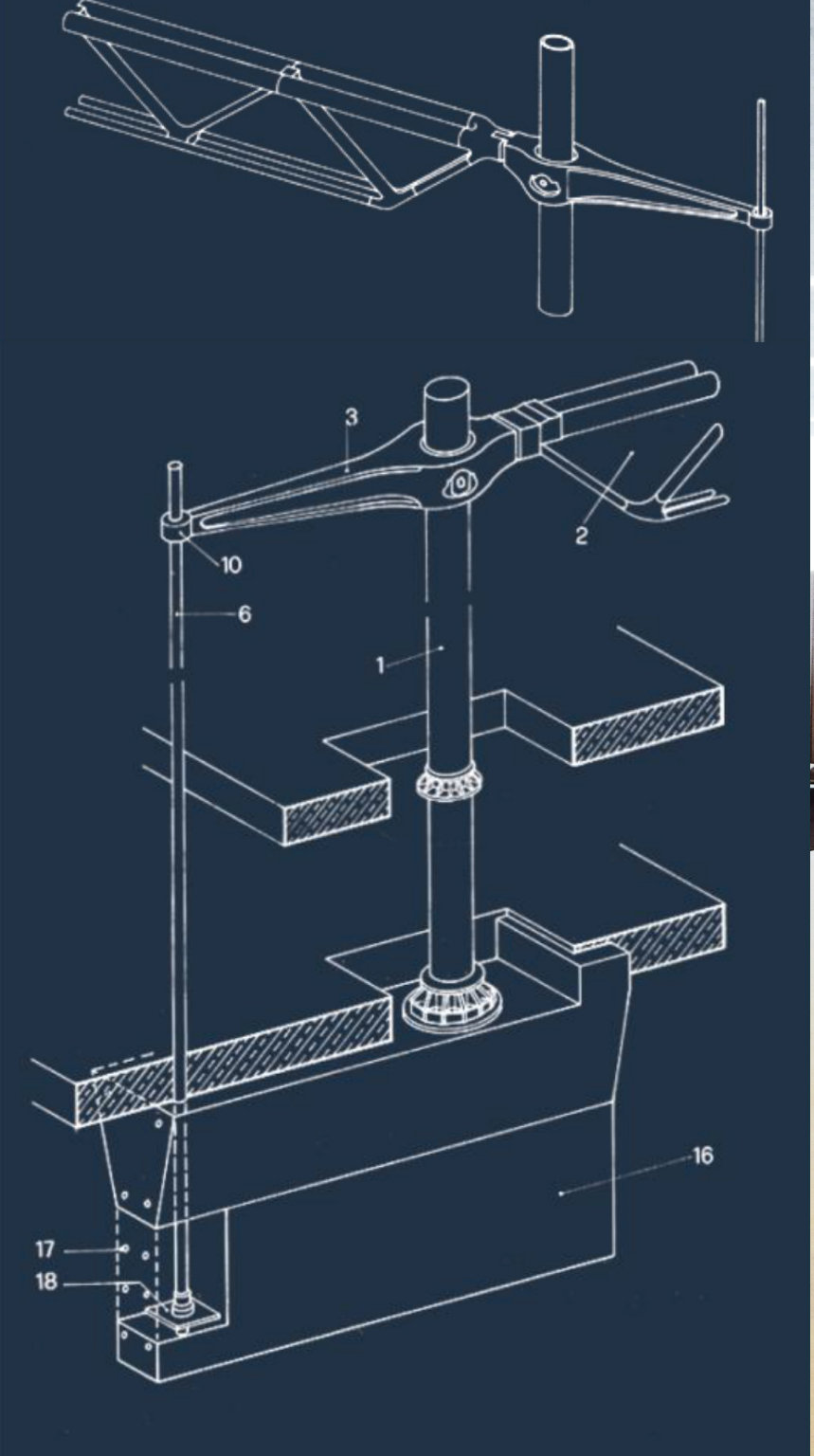
To achieve the spanning of the entire width of the building – 157 feet, the architects used enormous trusses resting on gerberettes. The truss elements keep an aspect ratio very close to 20:1, the limit for bending elements. The gerberette system is what allows for such an impressive span, all the while keeping the envelope of the building relatively light.

The gerberettes have a pin connection to the columns, and the trusses rest on them from the inside. The columns are then in turn fixed to the ground. By doing so, the architects & engineers reduced the span the trusses actually have to cross, and therefore their size. But the gerberette element being pinned to the column, it will rotate with the different forces acting on it. To account for these reactions, the gerberettes are linked by an exposed steel structure that takes back the force in tension. Tension being the most efficient force, it allows for a very light external structure. This could have been done with a fixed connection between the gerberettes and the columns, but doing so would have resulted in much thicker members, it would have been harder and more expensive to build, and overall resulting in a much heavier looking building with less openings and a more imposing aspect.

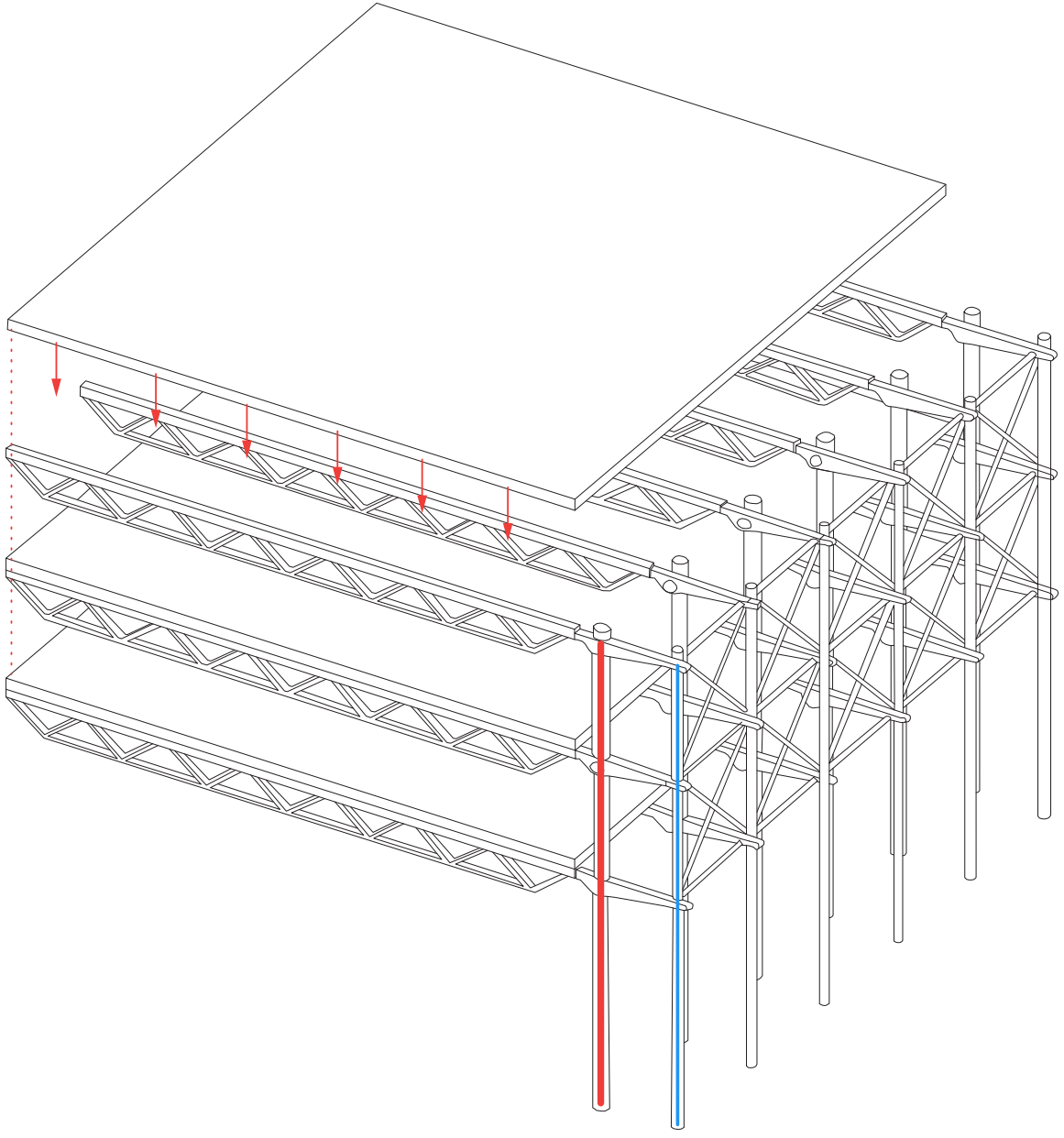




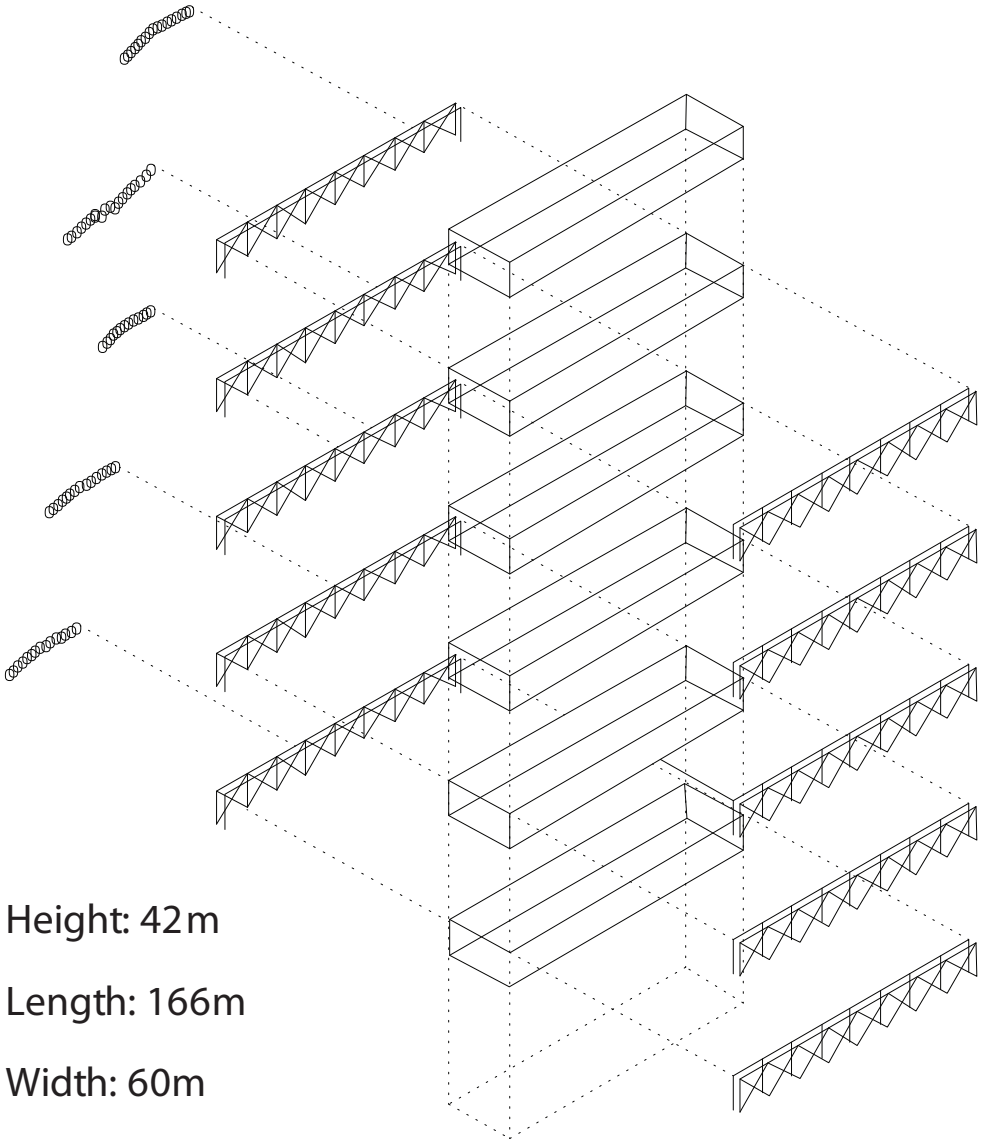
Gerberette Detail



Clear view of the exterior structure with the gerberettes and the fixed tension cables.



Tension
Compression



Height: 42m

Length: 166m

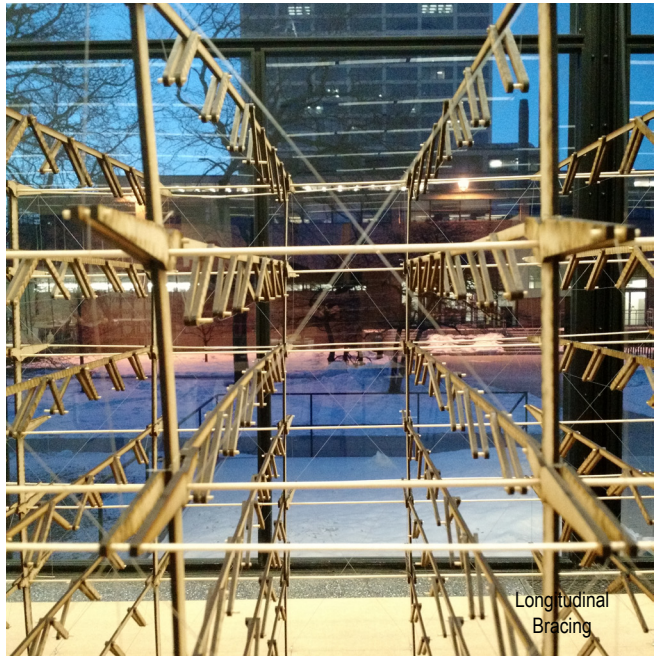
Width: 60m

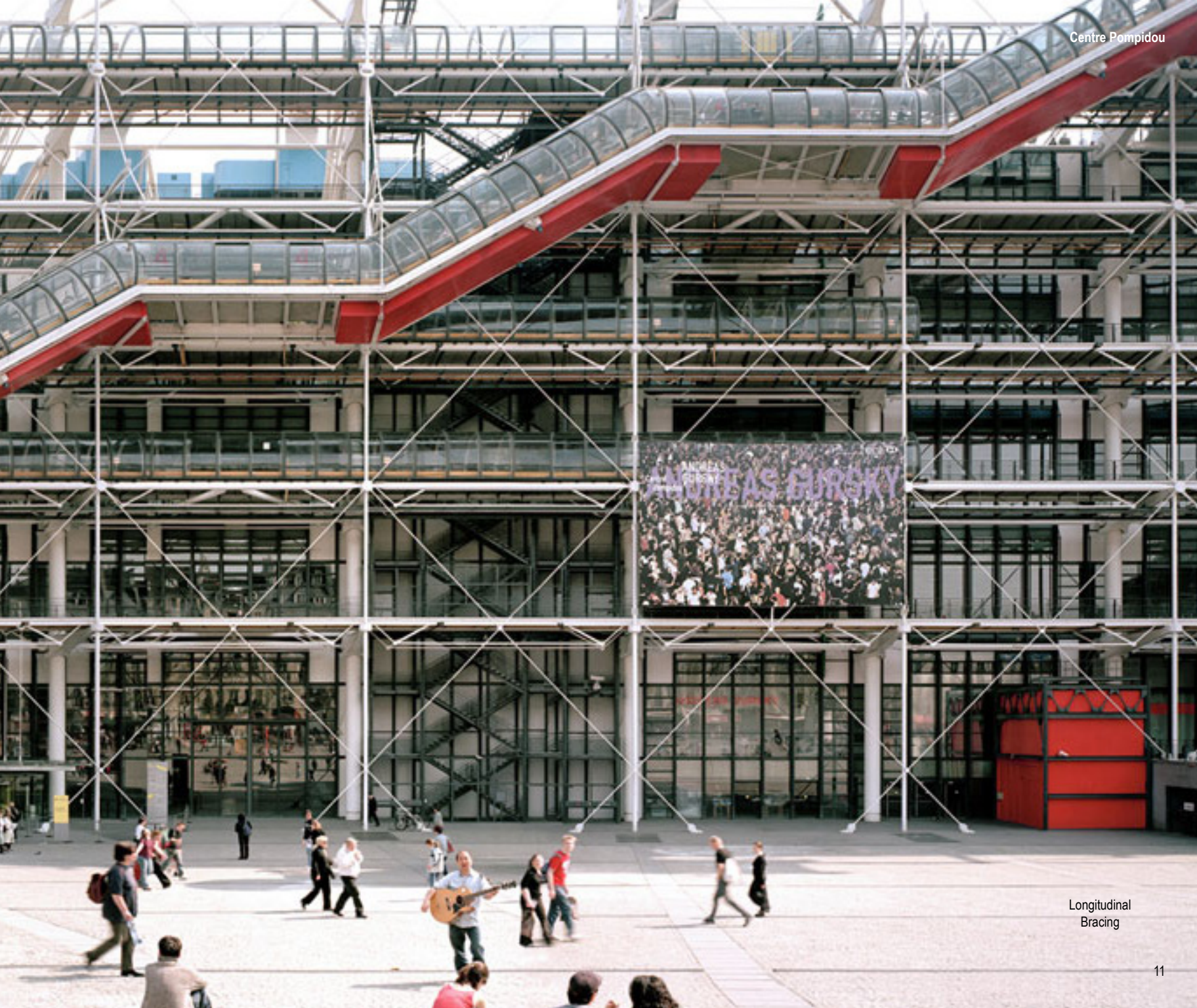
Centre Pompidou

Bracing System

The bracing of the building is also taken to the facade, with steel cables cross-bracing the building. The longitudinal bracing is incorporated to the gerberette system, and eventually fixed to the ground, while the transversal bracing is done directly connected to the end trusses of the building.

These different arrangements create a completely open building on the inside, free of any structure or obstacle, with almost every force being taken in tension by the outside steel superstructure. This is something that had realistically never been done in architecture before and a true revolutionary approach to structural engineering in architecture.





Longitudinal
Bracing

Model Construction

While very systematic, the model needed to deflect and each component had to be assembled separately and tested for reactions. The trusses were each assembled by elements to allow for an acceptable deflection. In total, 84 trusses were built and assembled separately, with close to 1200 separate compression chords, they were then tied together with string, simulating the tension steel cable, to allow for movement.

The trusses were then pin connected to the gerberettes, which in turn were pin connected to the columns. Temporary bracing and support had to be built before the final string bracing was assembled. Without the tension cables, the gerberettes thrust upwards under the weight of the trusses. Once the tension cables are in place, the model is still very unstable because it isn't braced, neither longitudinally neither transversely. Temporary bracing was put in place in the middle section of the model while everything was attached.

Putting the final bracing together was the crucial part as it strengthened the whole model together. And while the separate parts seem delicate - and they are, once everything is braced, it feels much more solid and strong.

The separate parts having all been prepared in advance, putting the model together in itself was fairly quick, what took up most of the time was preparing, testing and building the different elements.