



# Centre Georges Pompidou

## A Structural Case Study

# Background

**Architect:** Renzo Piano, Richard Rogers and Gianfranco Franchini

**Location:** Paris, France

**Structural Engineer:** Arup

**Area:** Land area : 5 acres

**Floor Area :** 103,305m<sup>2</sup>

**Project Year:** 1971-1977



Created by Vonn Weisenberger  
from the Noun Project

# Concept

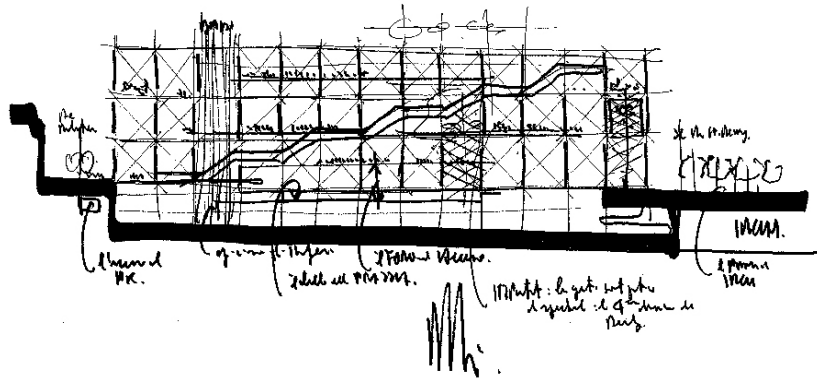
The initial intention was to create much more than a museum; rather, Renzo Piano and Richard Rogers sought to create a cultural icon. Their competition entry was the only to propose using half of the available land on-site.

Located in the building are an Industrial Creative Center, Public Library, Modern Art Museum, and Center for Music & Acoustic Research

The skeleton itself turns the building inside-out, color coding the different mechanical, circulatory and structural systems.

Rogers and Piano also intended

to be supported by columns.



# Building Layout



Background Image \_ <http://www.archdaily.com/tag/centre-pompidou>



# Color-Coded Systems

Large HVAC components = white

Circulatory elements (stairs and elevators) = red

Climate Control = blue

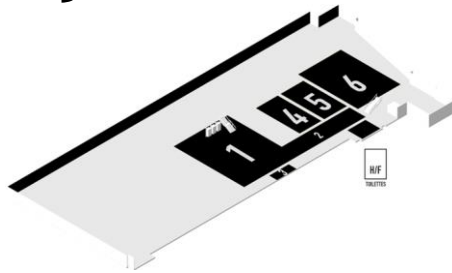
Plumbing = green

Electrical ele

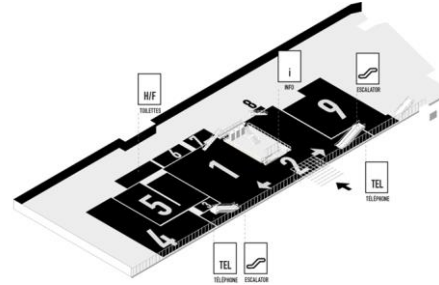


# Building Layout

1. Studio 13/16
2. Main Forum
3. Ticket Shows
4. Cinema 2
5. Small Exhibition Hall
6. Large Exhibition Hall



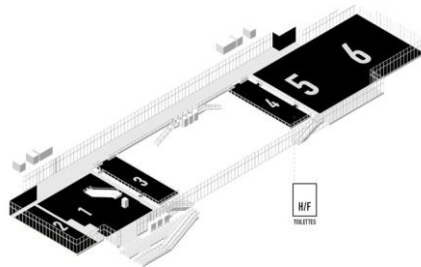
Basement -1



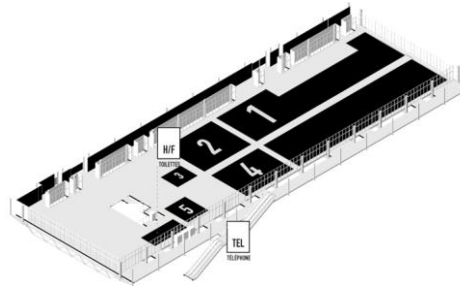
Basement 0

1. Reception and Information Desk
2. Forum
3. RMN Shop Pompidou Centre
4. Ticketing and Sales
5. Cloakrooms
6. Multimedia Guides Rentals
7. Library

1. BPI (reference room, dressing room for the visually impaired)
2. Cinema 1
3. Children's Gallery
4. Coffee, "Mezzanine"
5. Space 315
6. South Gallery



Floor 1

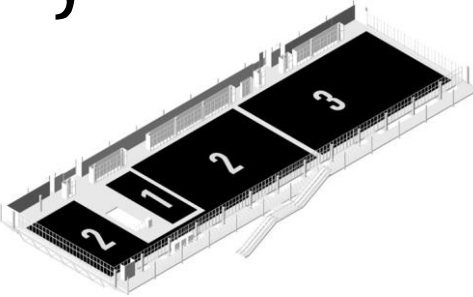


Floor 2

1. General Fund
2. Study Space
3. Television of the World
4. Press Room
5. Cafeteria

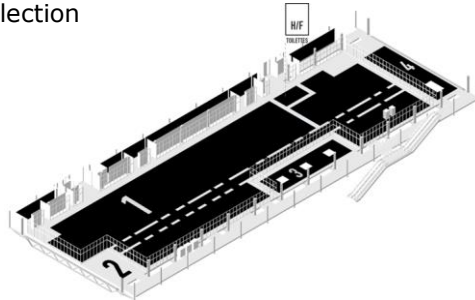
# Building Layout

1. Space Electrical Equipment
2. General Fund
3. Kandinsky Library and Graphic Design Studio

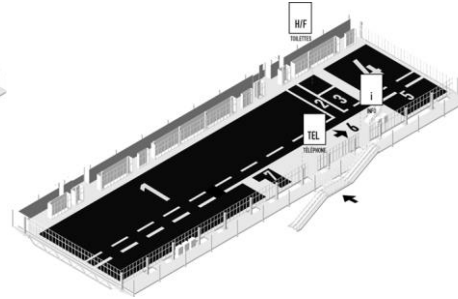


Floor 3

1. Museum, Modern Collection
2. North Terrace
3. West Terrace
4. South Terrace

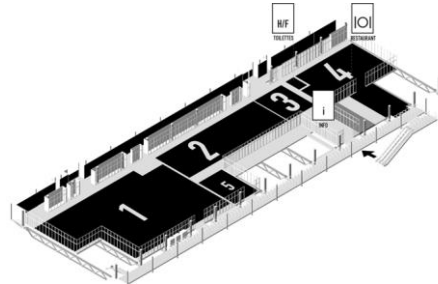


Floor 5



Floor 4

1. Museum, Contemporary Collection
2. New Media and Movie Space
3. Fair Visitors
4. Gallery Museum
5. Gallery of Graphic Arts
6. Shop
7. Bookstore



Floor 6

1. Gallery 1
2. Gallery 2
3. -
4. Restaurant, "The George"
5. Bookstore

# Materials

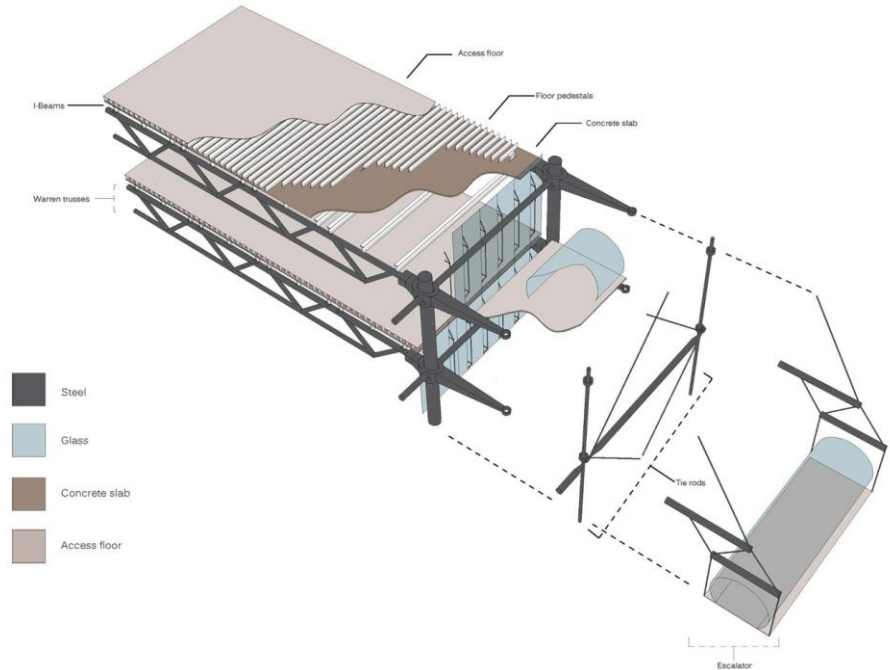
Hollow steel columns

Hollow steel/solid steel welded trusses

Steel gerberettes

Composite decking

Concrete basement/foundation





# Foundation and Soil

Most of France can be considered a zone of brown forest soil

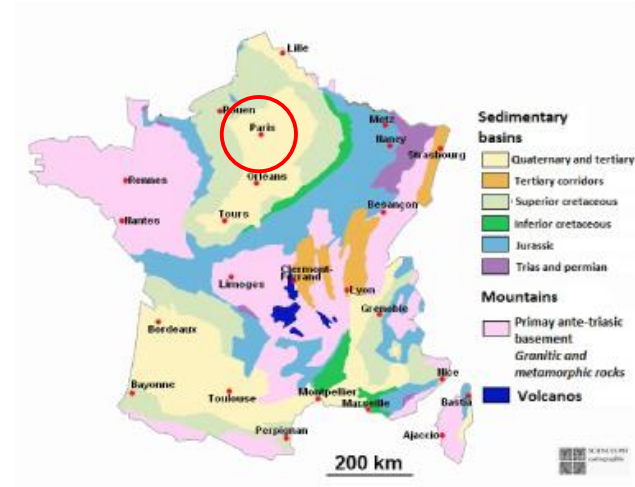
Paris itself sits in a sedimentary basin of Quaternary and Tertiary soils

These soils have a bearing capacity of 5,000-6,000 lb/ft<sup>2</sup>

These soils aren't bad for building

Did not cause issues during construction

The foundation lays 3 stories below the entire building and the courtyard in front of it



<https://www.britannica.com/place/France/The-Rhine-system#ref468824>

<http://www.fao.org/ag/AGp/agpc/doc/Counprof/France/france.htm>

[http://www.concretenetwork.com/concrete/footing\\_fundamentals/why\\_soils\\_matter.htm](http://www.concretenetwork.com/concrete/footing_fundamentals/why_soils_matter.htm)

<https://www.youtube.com/watch?v=SgHjHWbx7pw&feature=youtu.be>

# Foundation and Soil

Below grade the structure is all concrete. A one-way parking garage consumes the footprint of the site.

The concrete below picks up the loads from the steel columns.



# Seismic Considerations

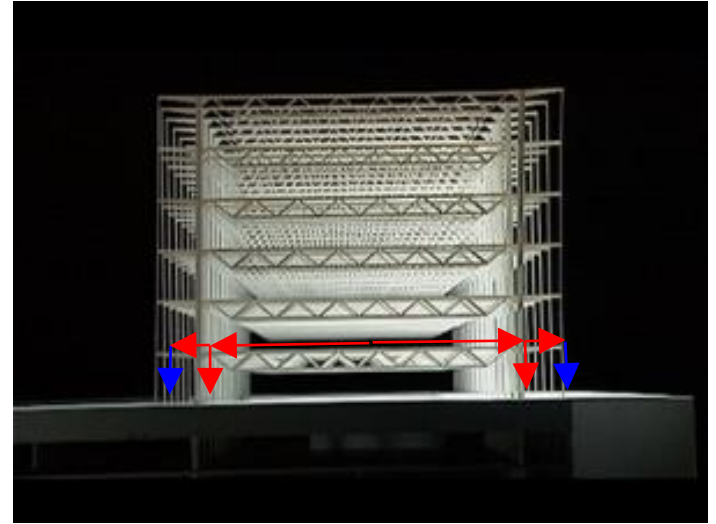
The site lies in the least severe seismic zone in France.



# Main Structural System

The overall vision was to create a large building that appeared to be inside out. This required that the building, from the facade in, be uninterrupted by columns, walls, stairs etc. In order to satisfy this requirement the architects and the engineers had to get creative.

The building uses a repetitive steel bay system, repeated 6 times vertically, with high floor to ceiling heights to create space for the deep beams it takes to span the entire building width.

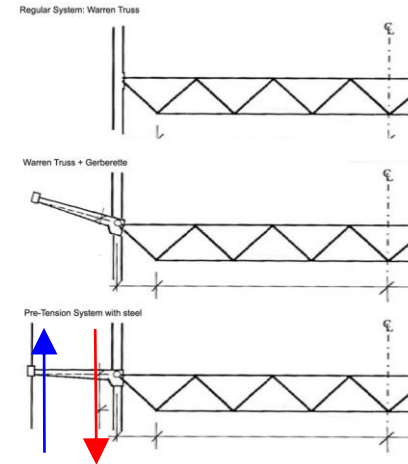
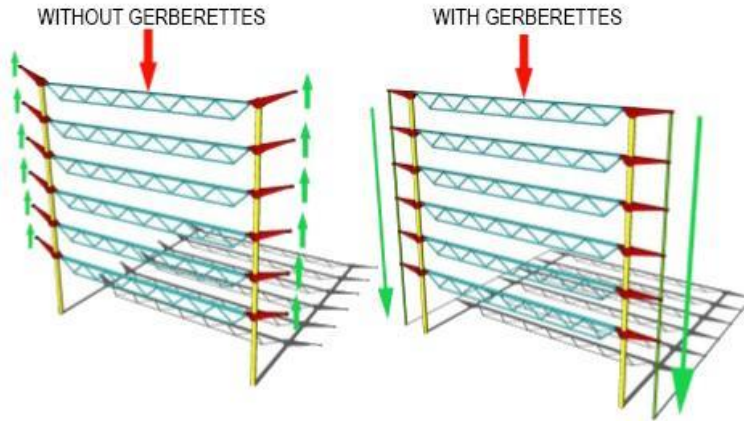


[http://boutique.arte.tv/f301-architectures\\_centre\\_georges\\_pompidou](http://boutique.arte.tv/f301-architectures_centre_georges_pompidou)

# Main Structural System

Each of the 13 bays consists of a truss, supported by columns on both sides. To stabilize each bay on both sides, gerberettes were used. Gerberettes are small cantilevered pivoting beams that allow the tie rods and the columns to share the vertical load. Where the gerberette meets the column is now the fulcrum point of the cantilever, causing the tie rods to be in tension while the column stays in compression.

Each of the 13 bays span 44.8 meters, uninterrupted.

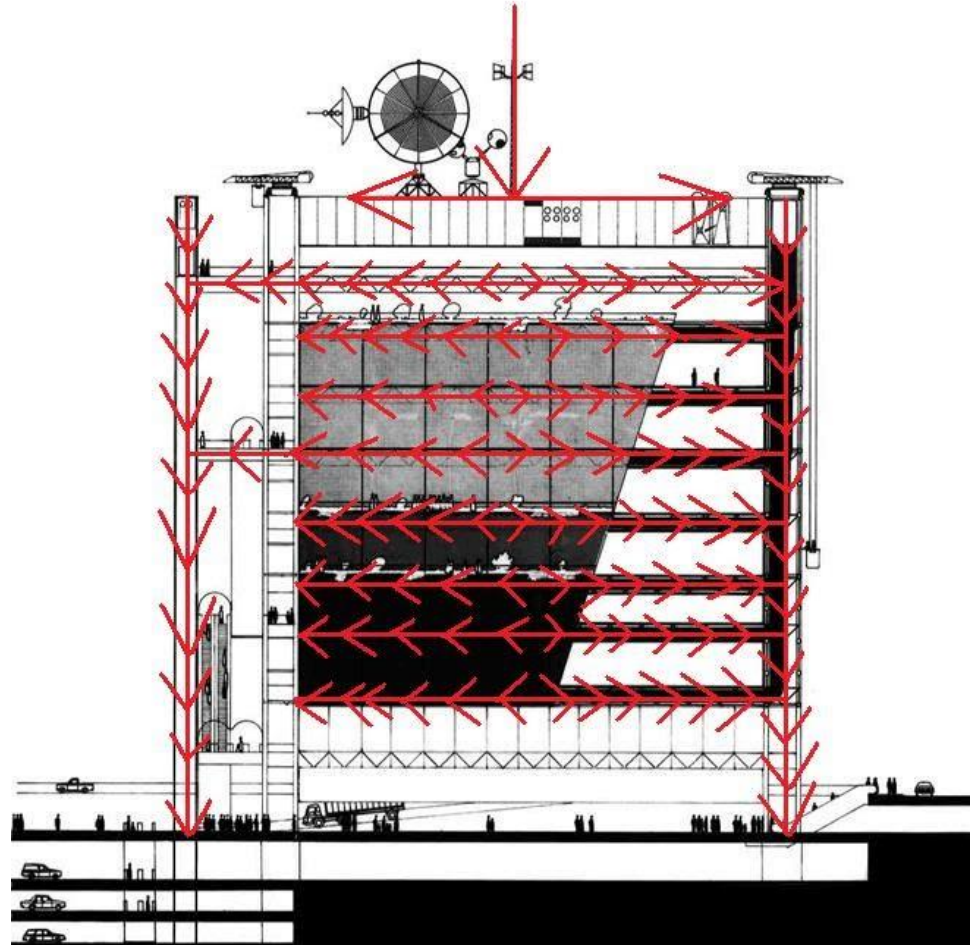


<http://totoro-georgesompidou.blogspot.com/>



# Load Transfer Diagram

Trusses transfer the gravity load to columns through the large gerberette pinned connections. However, the pinned connection with simply the truss, gerberette and column is inherently unstable. As a result, an additional tie rod is attached from the end of the gerberettes to the ground.



# Gerberettes

These cantilevered arms connect to the steel columns


Each one gerberette weighs 9.6 tons

Ensures that the load from the 6 floors is transferred down to the foundation and into the load bearing columns

Prevents from a bending moment

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<http://www.tboake.com/SSEF1/pompidou.shtml>

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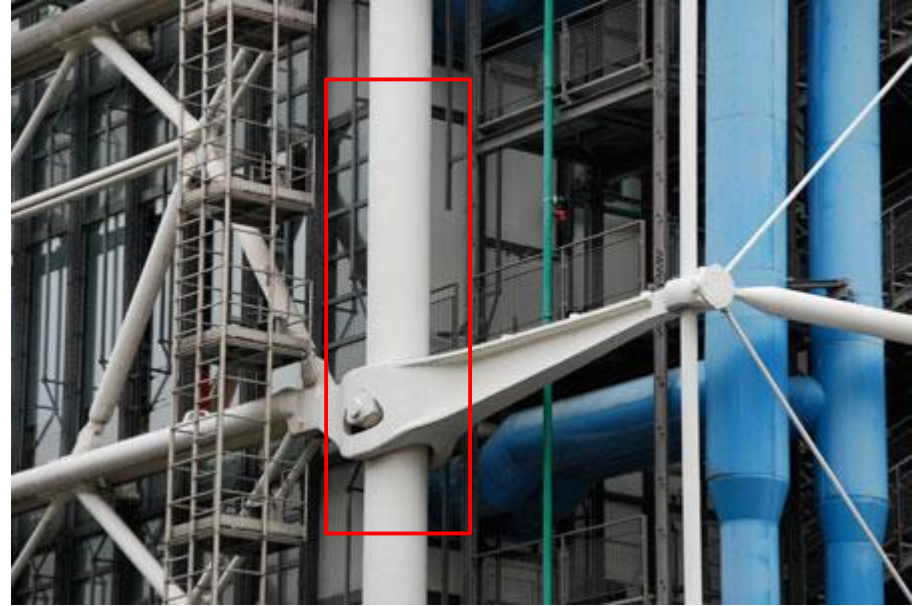
# Columns

The Column grid creates 13 identical bays

The interior of these bays are free of any columns

Each column starts at 85mm at the bottom and tapers to 40mm at the top

These columns are also filled with water for fire prevention



# Lateral Resisting System



Circular, bolted members are used to connect the steel tension members which form the lateral stabilizing system. A plate is then fastened to the outside in order to conceal the bolted connection.



For the walkway support, a donut-shaped steel plate is used. The circular shape provides ample surface for a bolted connection from multiple angles. However, cotter pins secure the bolts rather than nuts in this lateral stabilizing element.



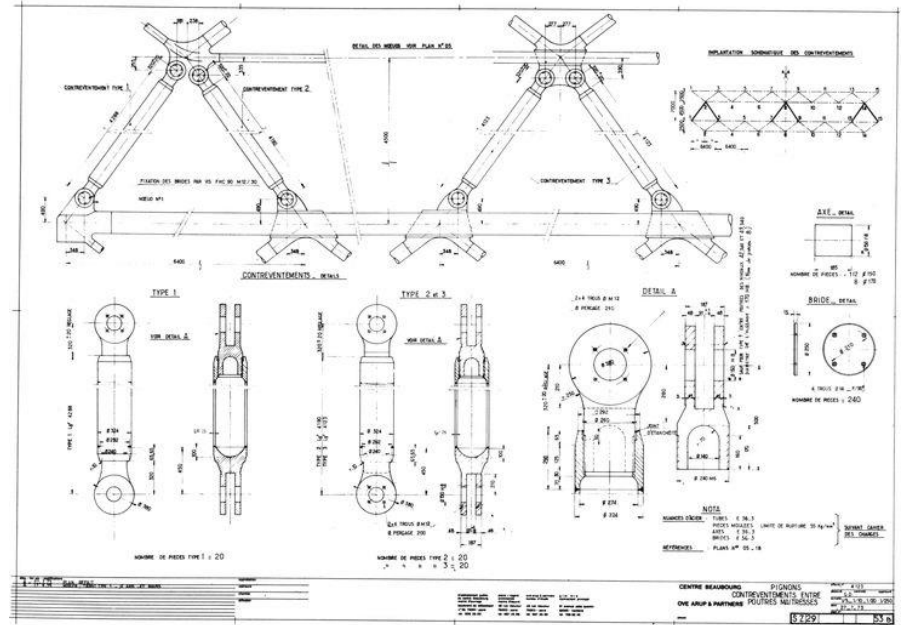
This detail shows some of the struts that attach the underside of the truss to the floor below. Here a pin connection is used at the end of a hollow structural member. The truss itself is comprised of smaller round members (some solid and some hollow) that have been fully welded for clean looking detailing.



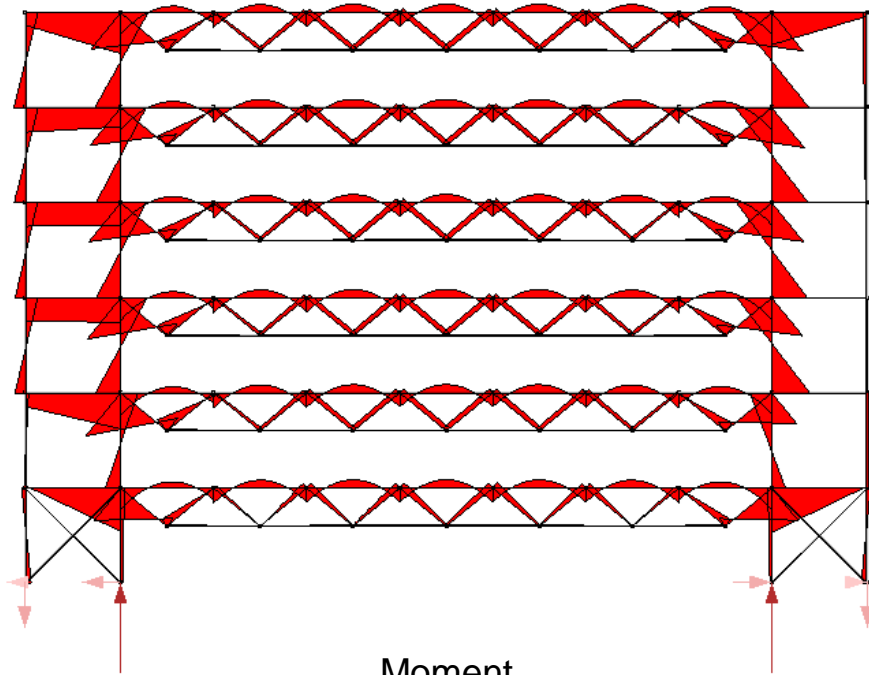
# Lateral Resisting System

These connections are for the truss that is used for the lateral bracing

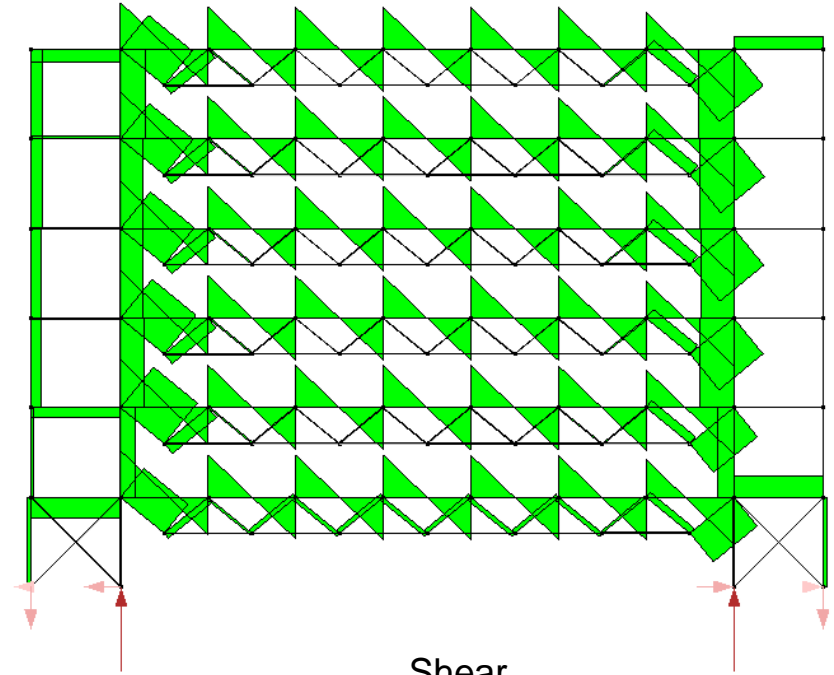
Most everything is made from hollow steel tubes



# Multiframe Analysis

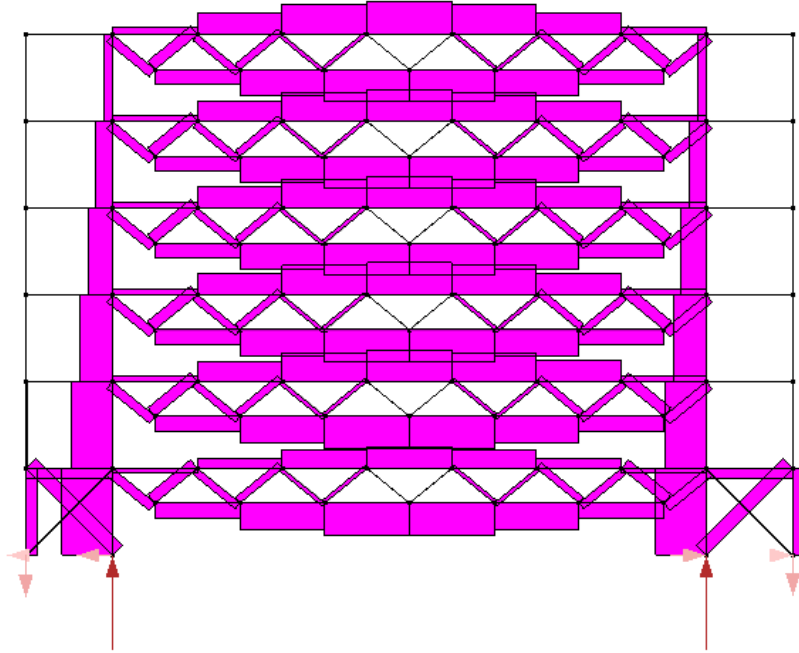


Moment

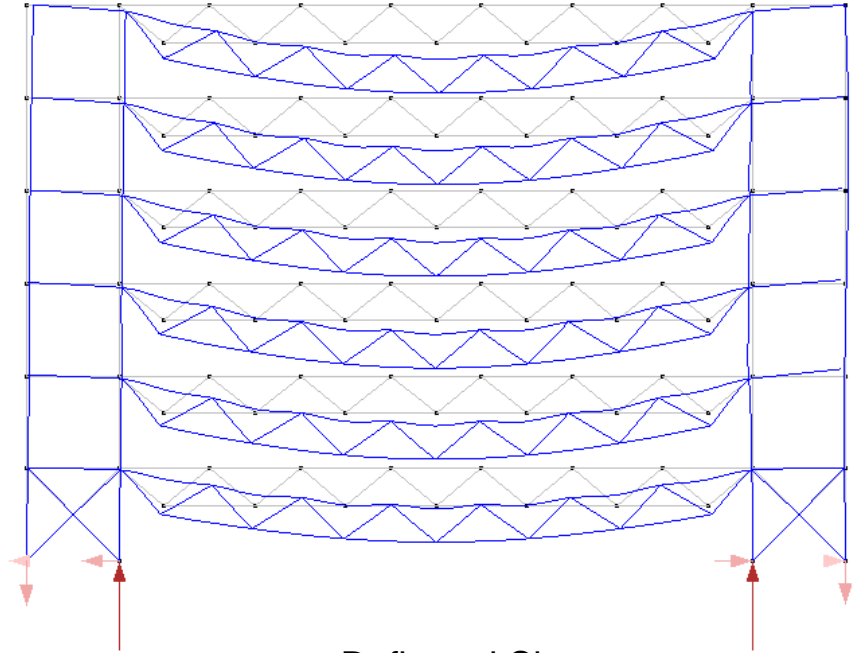


Shear

# Multiframe Analysis



Axial Loading



Deflected Shape

# Citations

<http://contemporaryartparis.perso.sfr.fr/centrepompidou.jpg>

<http://www.aviewoncities.com/img/paris/kvefr4023s.jpg>

[https://www.centrepompidou.fr/fr/Media/Plan-du-batiment/\(niv\)/m1](https://www.centrepompidou.fr/fr/Media/Plan-du-batiment/(niv)/m1)

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[http://www.tampagov.net/sites/default/files/construction-services/files/Risk\\_Category\\_Designations\\_1604.5.pdf](http://www.tampagov.net/sites/default/files/construction-services/files/Risk_Category_Designations_1604.5.pdf)

