

The Federal Reserve Bank of Minneapolis (Marquette Plaza)

ARCH 631

Case Study

Professor: Dr. Anne Nichols

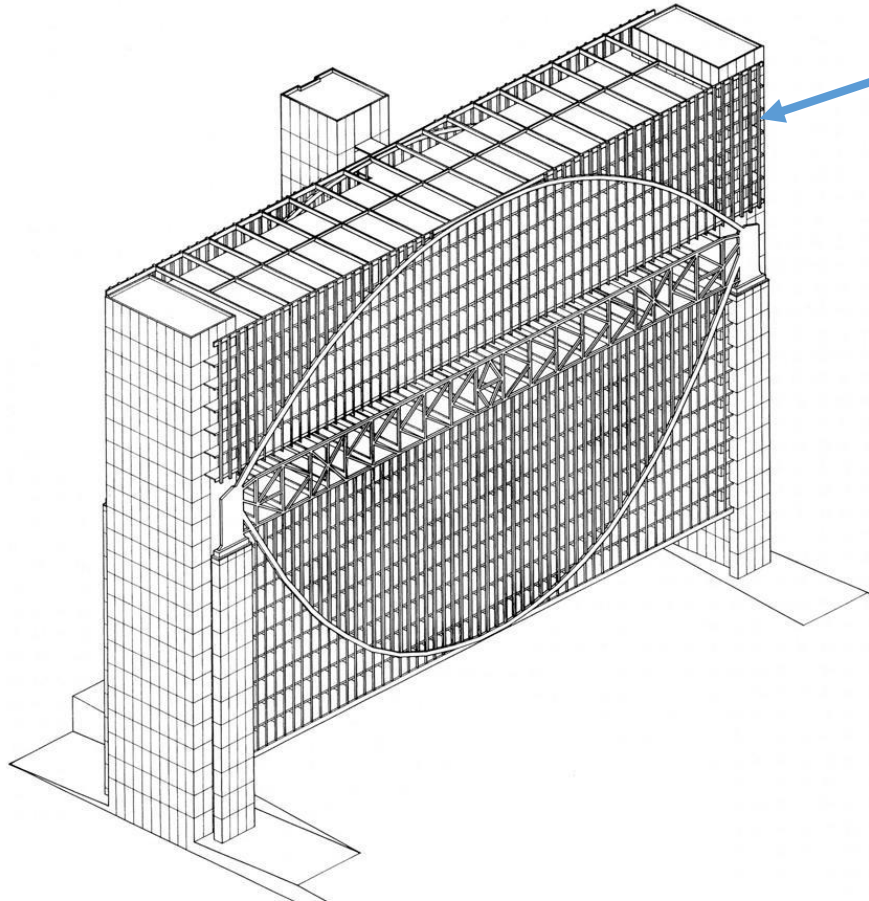
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Tianchen Nie

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Building Introduction

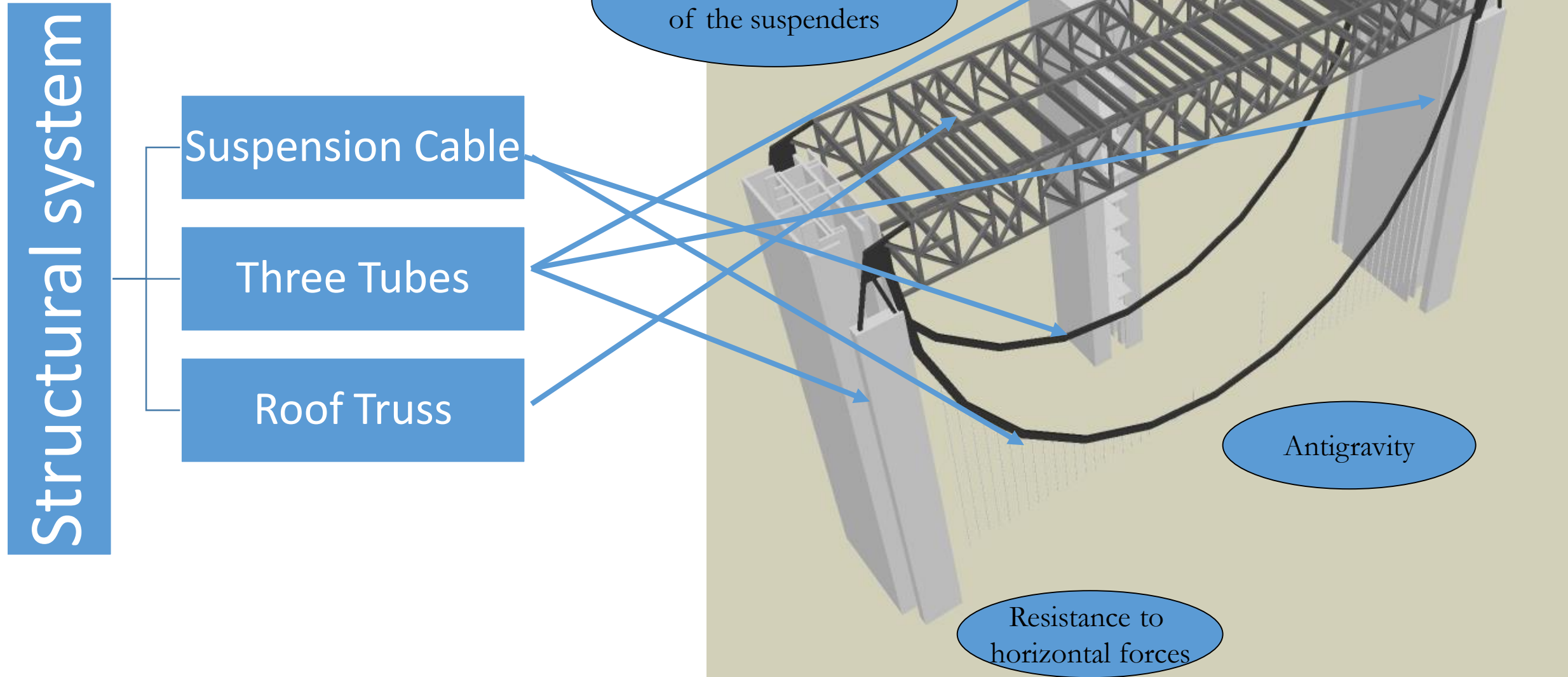
- A famous suspended building
- Architect: Gunnar Birkerts
- Functions: Offices, Management
- Future Extension



For future
construction
extension

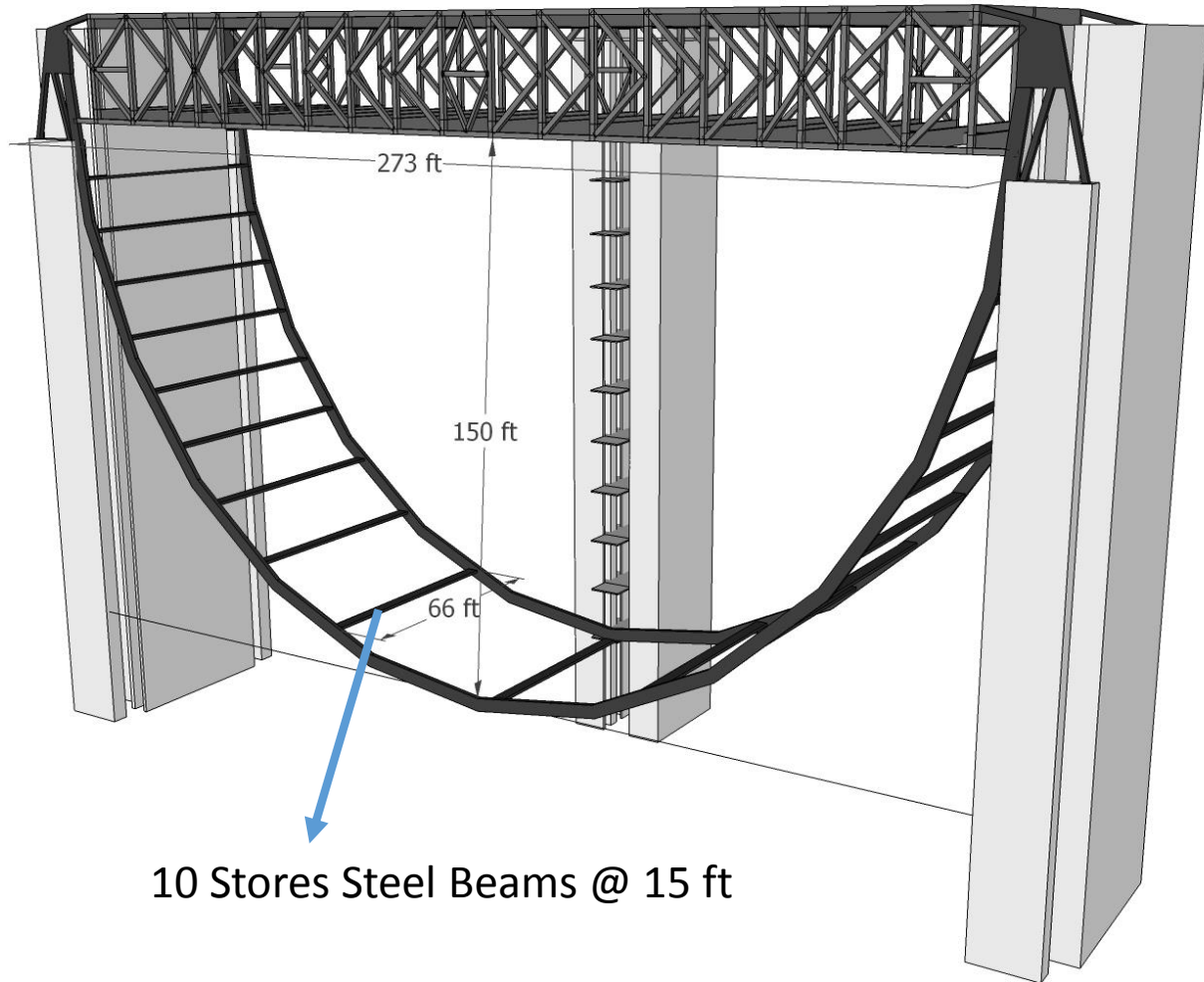


Building Main Structure

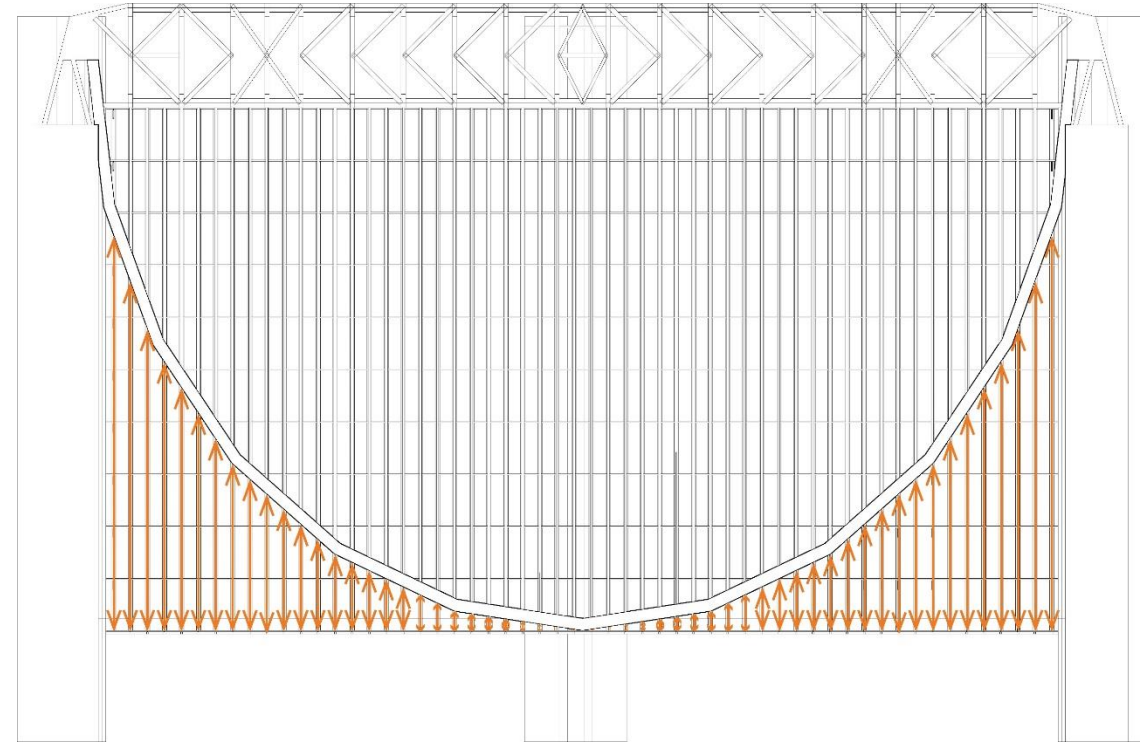


Suspension Cable

The cables are actually wide-flange steel sections of parabolic curvature to balance the distributed floor loads. And then, they transfer the loads to the tubes.

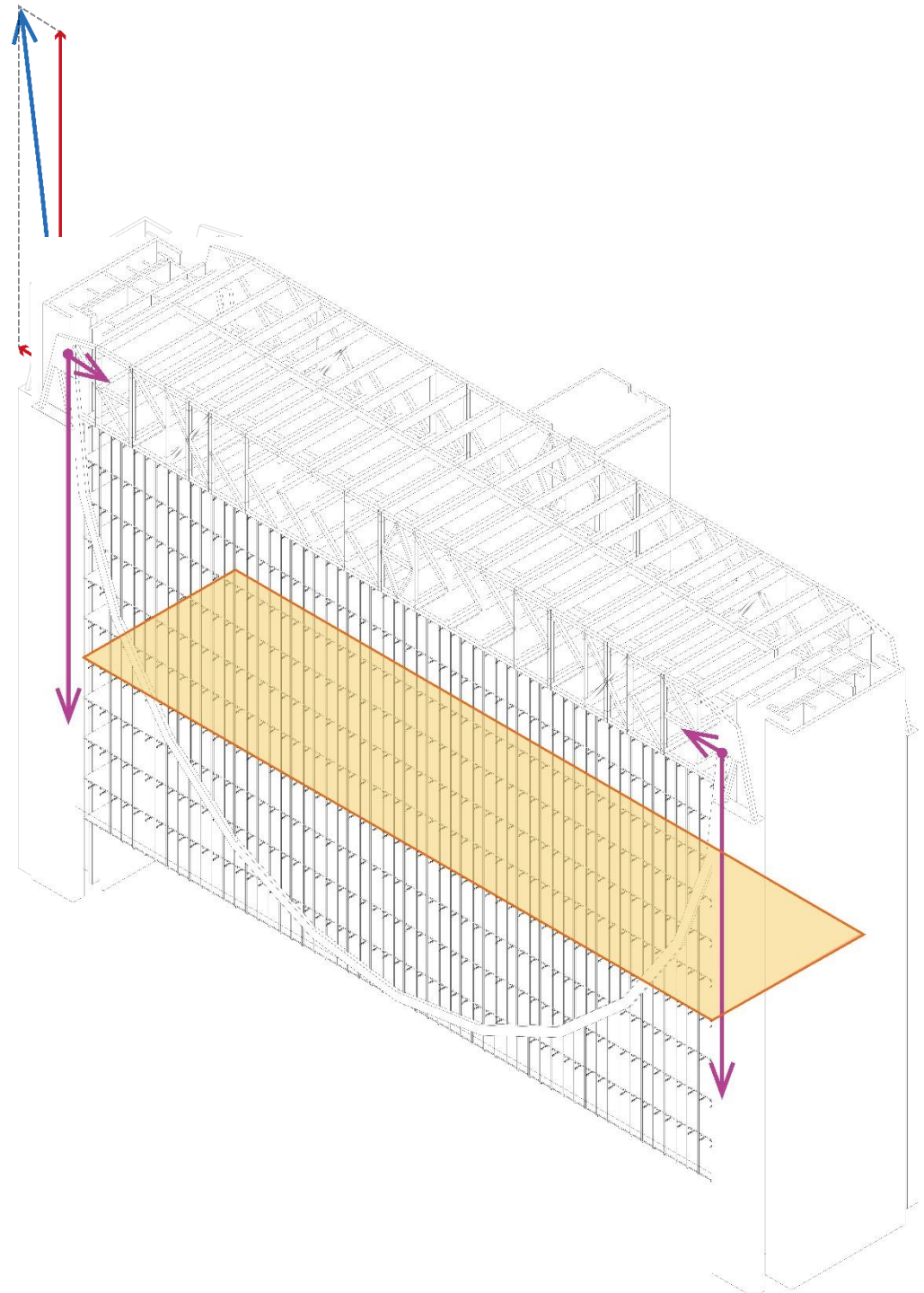


Compression steel column @4.8 ft



Tension steel column (boom) @4.8 ft

Vertical load tracing

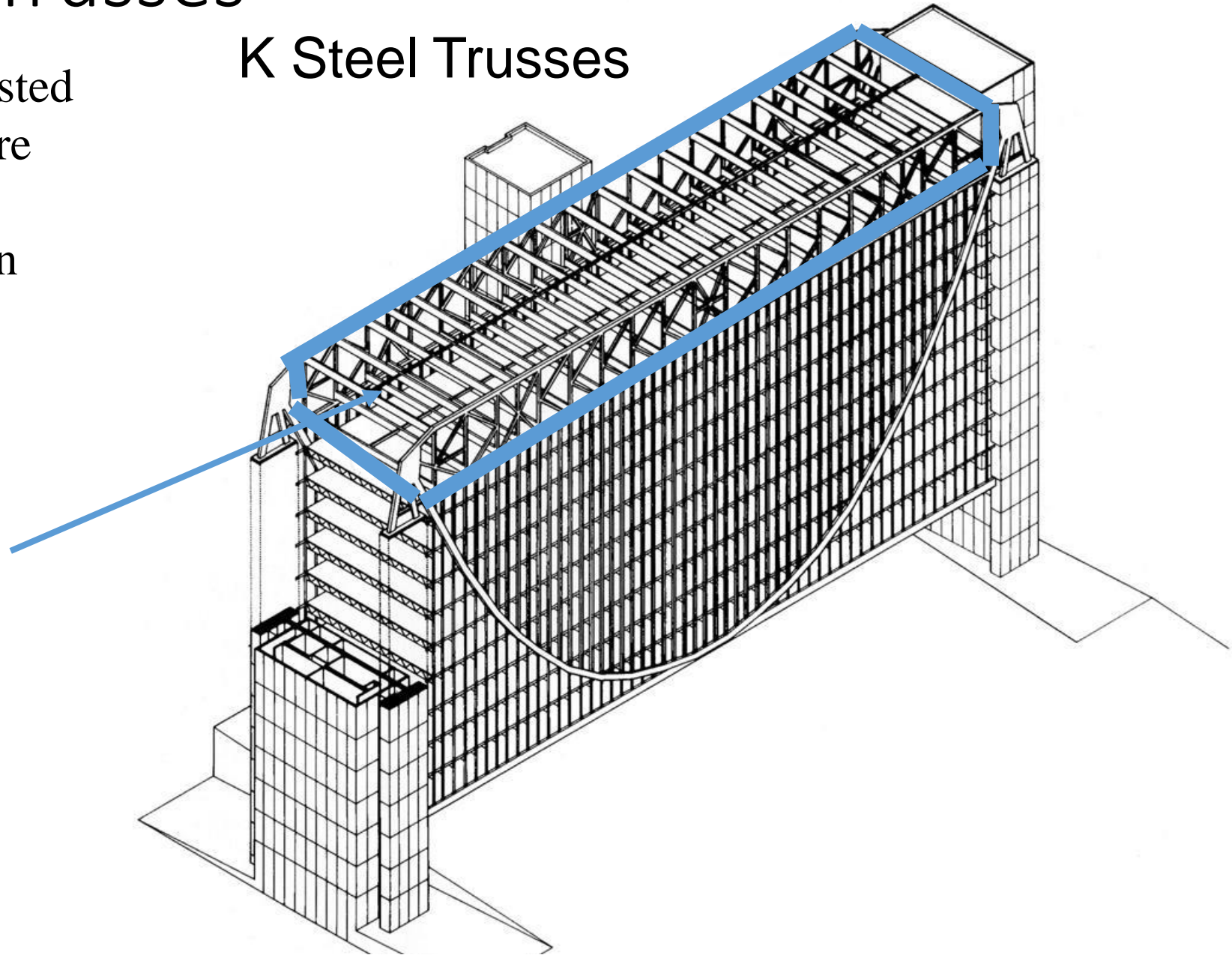


K Steel and Roof Trusses

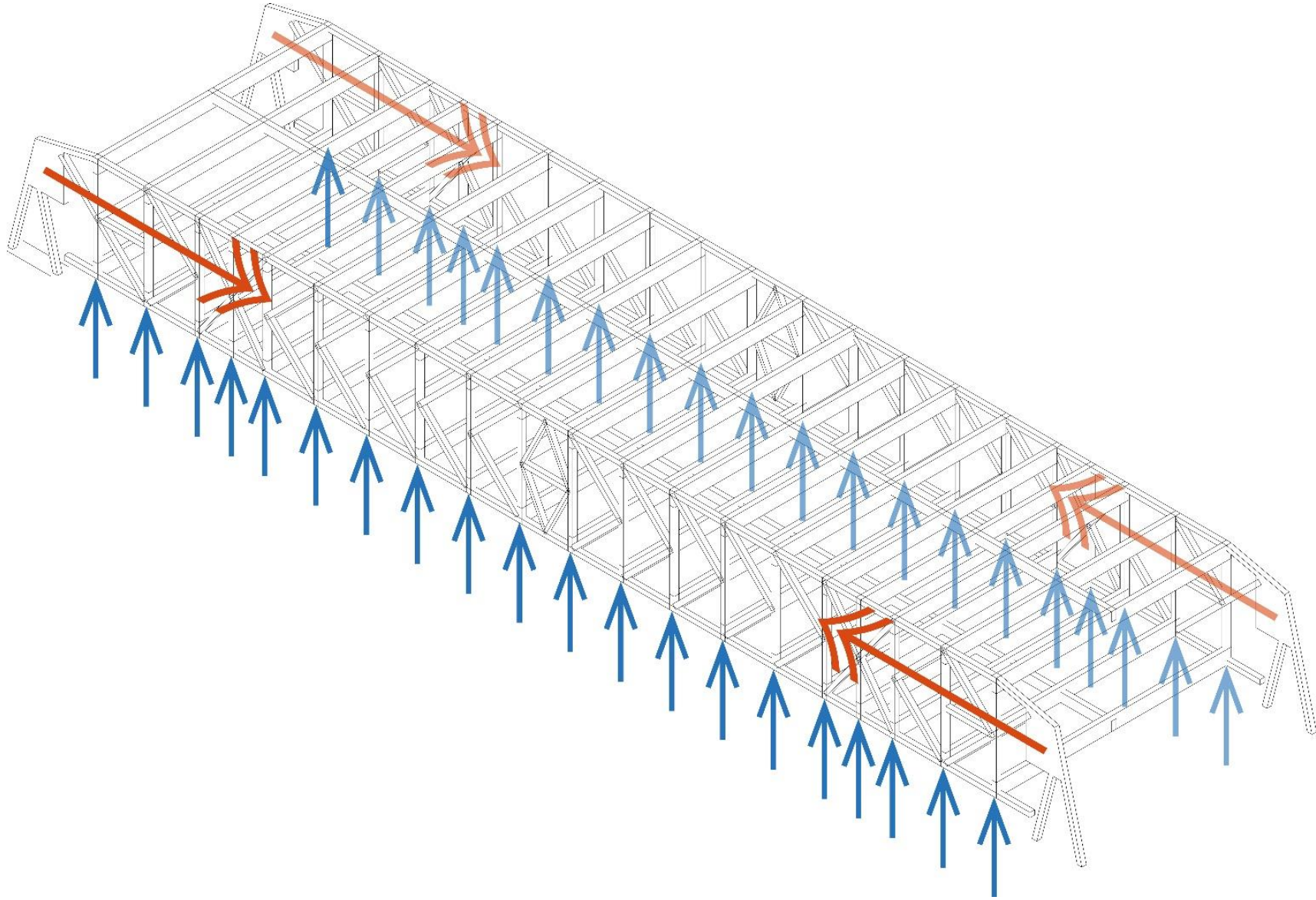
The K Steel Trusses are consisted as pressure bars. These bars are used to balance the horizontal force at the ends of suspension cable.

The lateral horizontal support and roof truss are used to strength the stability of the pressure bars, and resist the lateral load of the suspension cables.

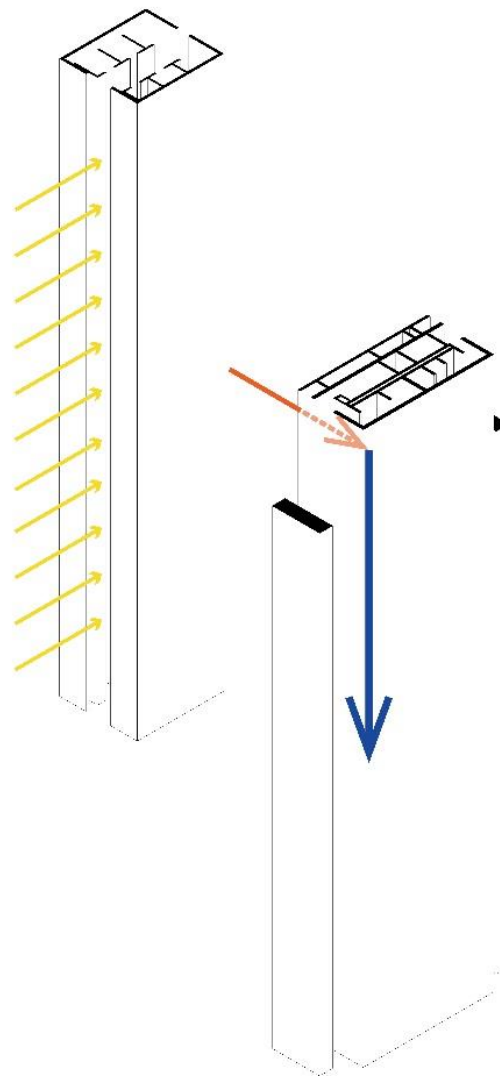
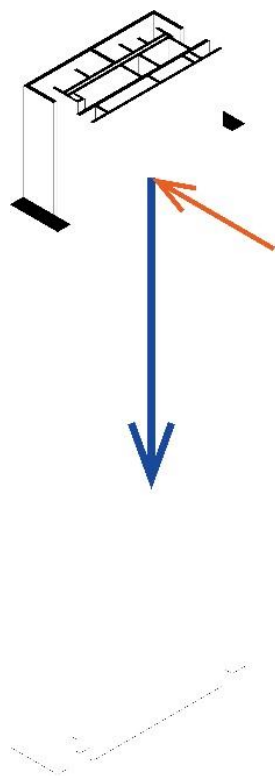
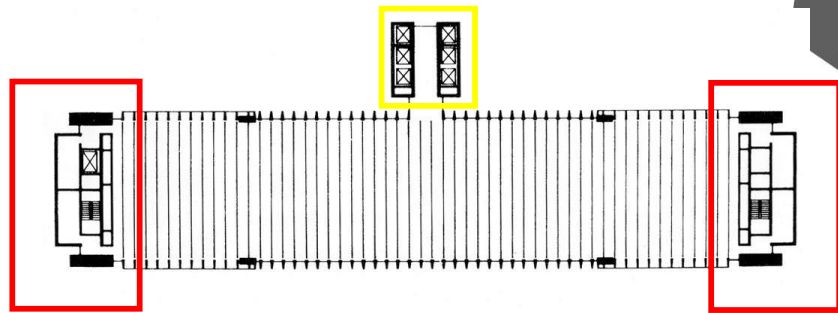
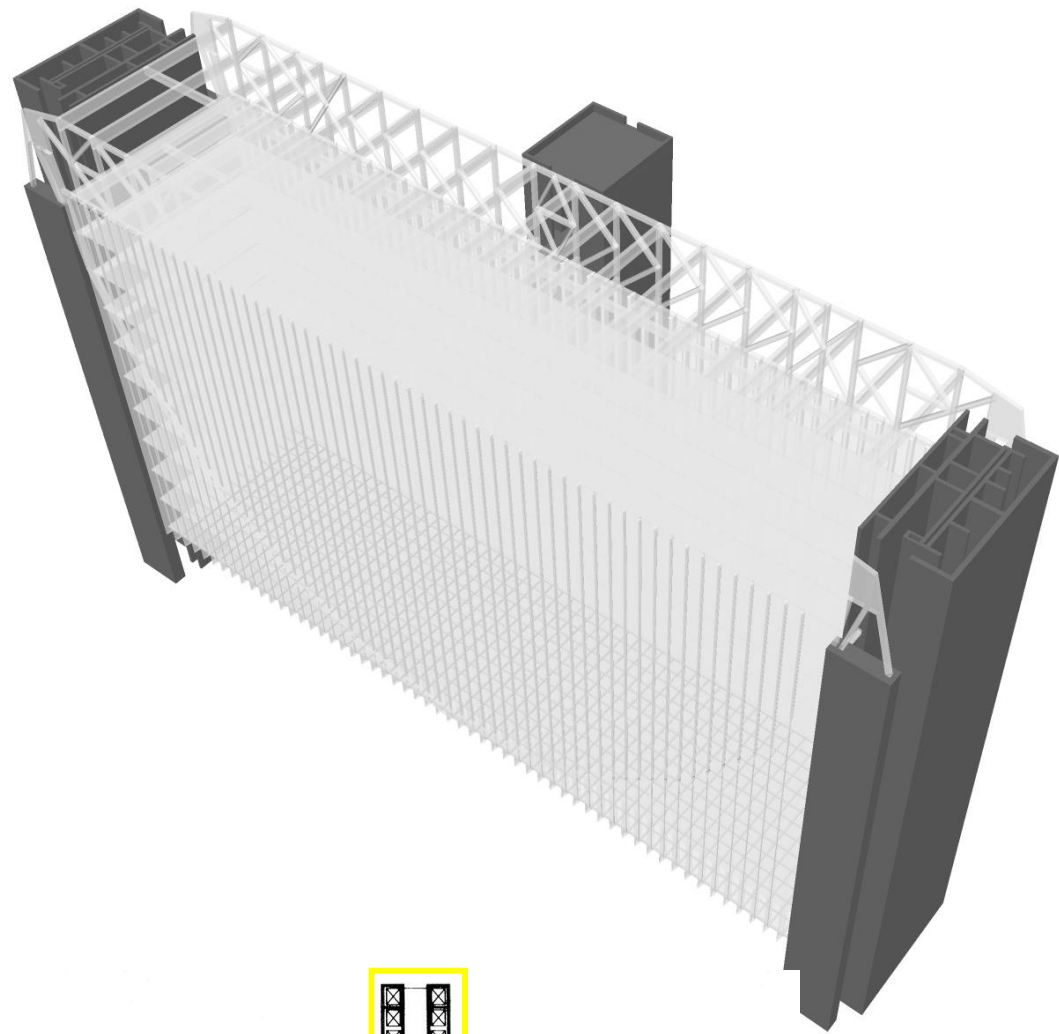
K Steel Trusses



K Steel and Roof Trusses

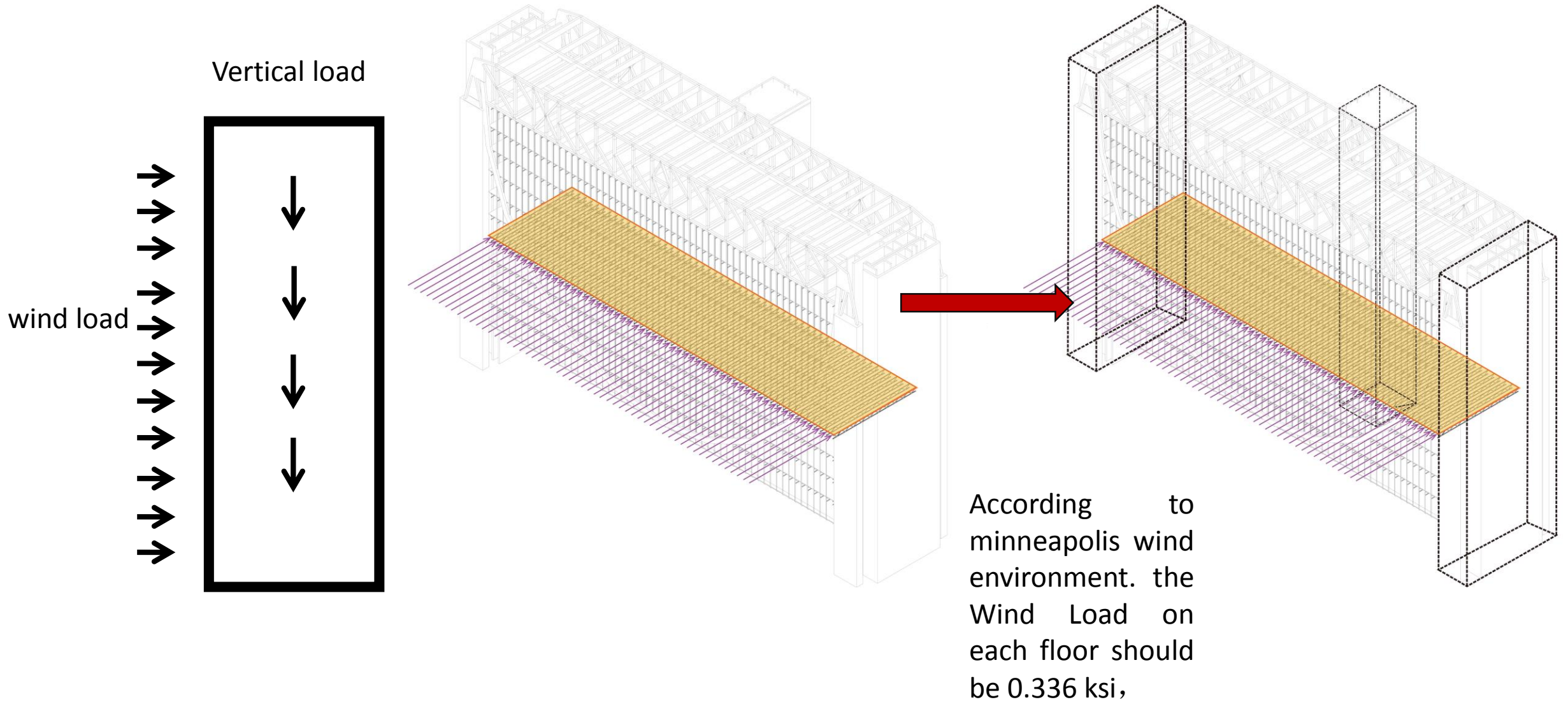


Tubes

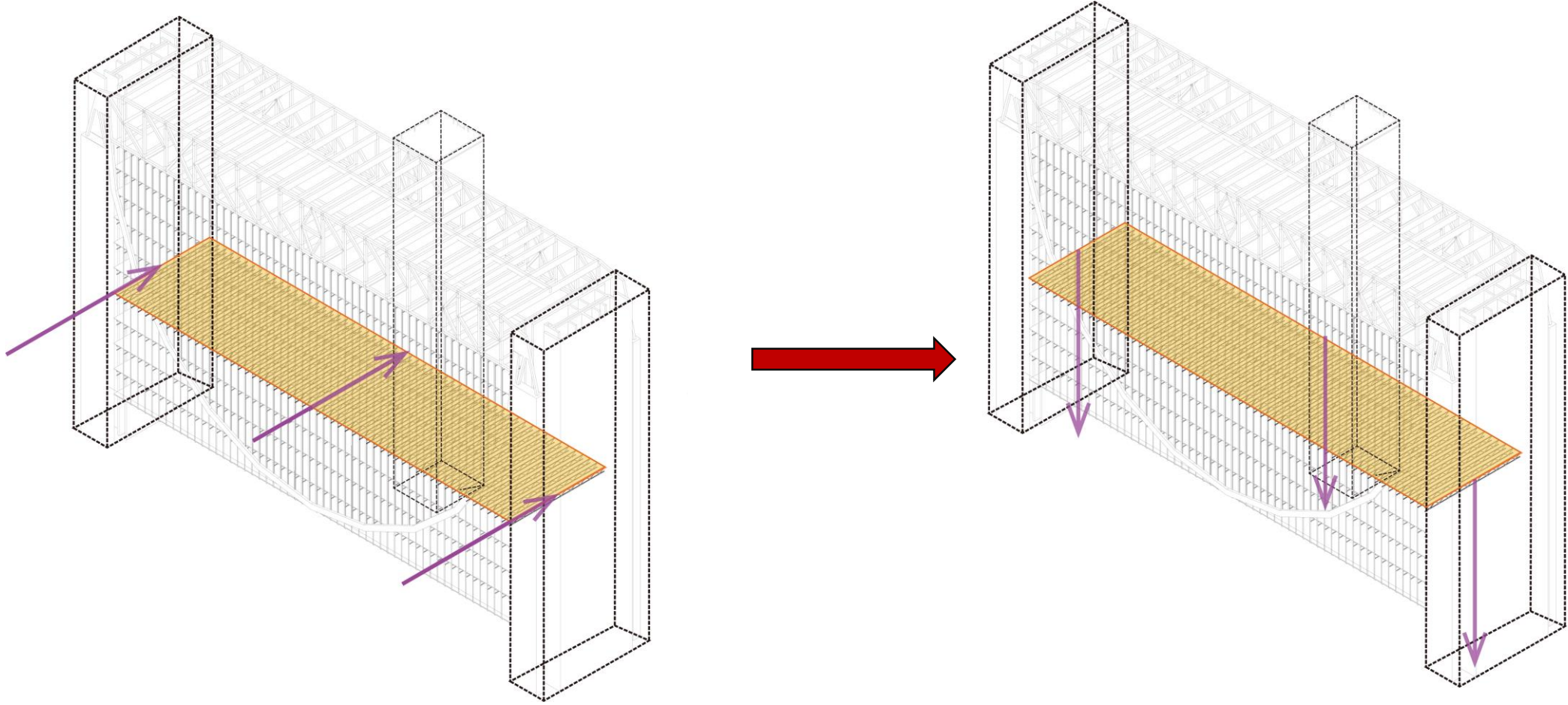


Tubes Force Diagram

Lateral Load



Lateral Load



Soil and Foundation

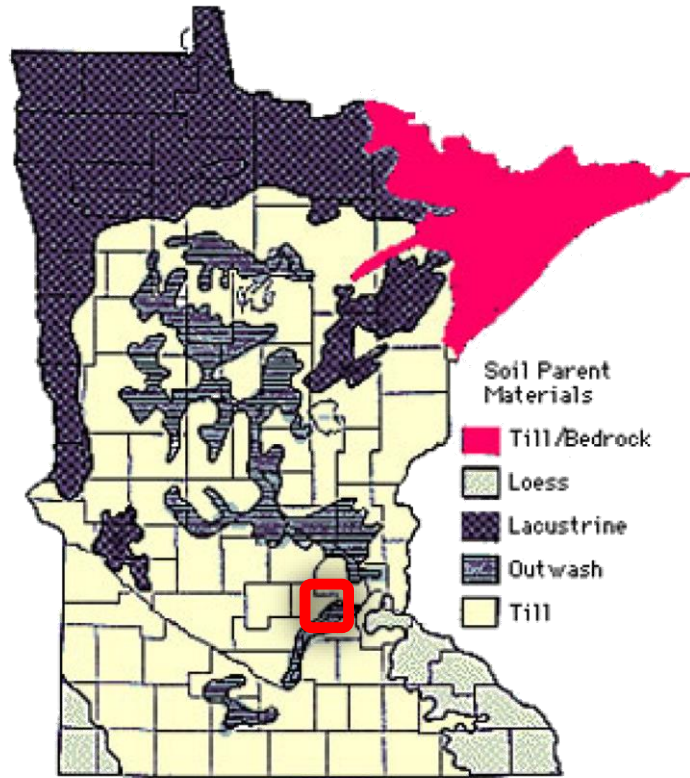
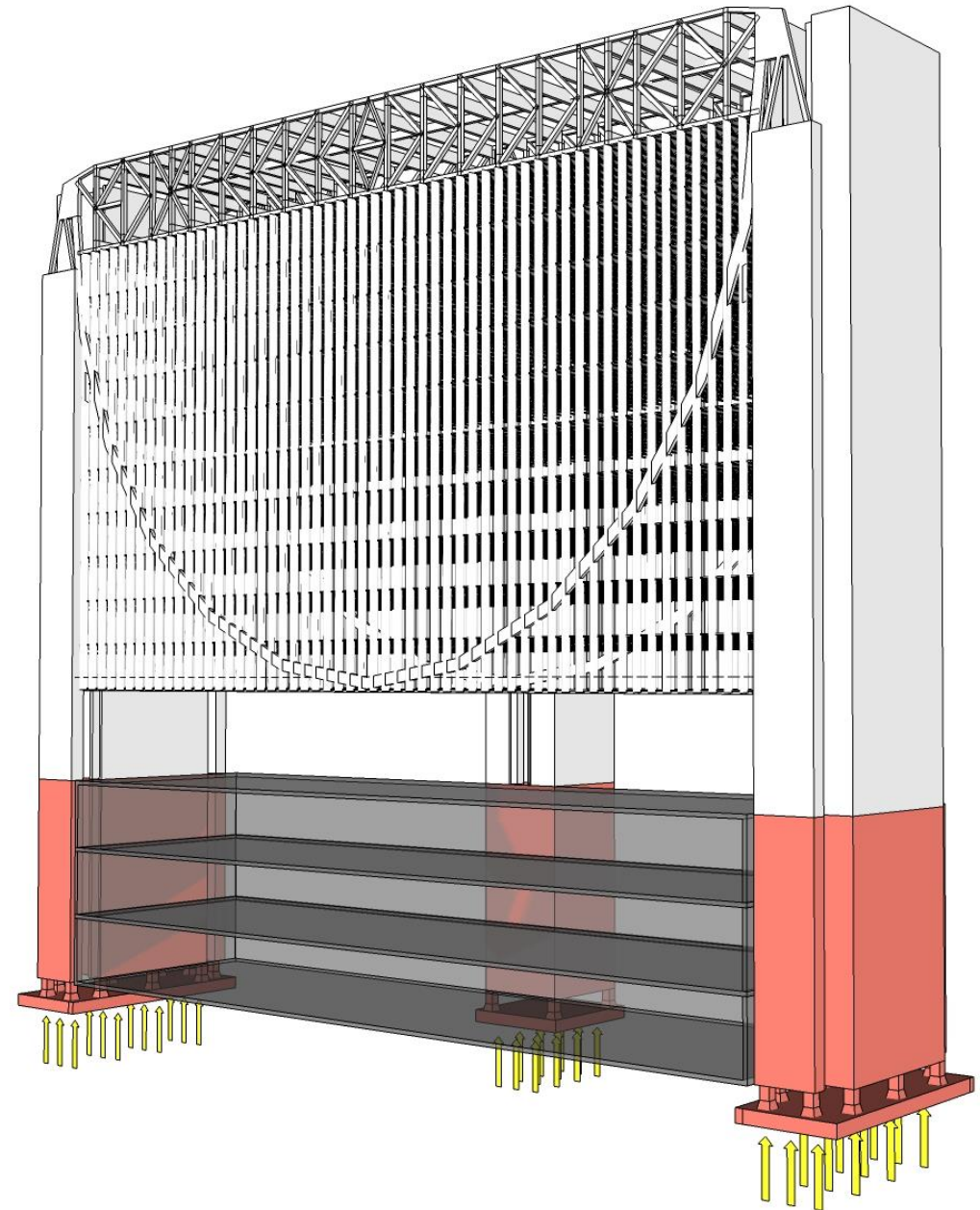


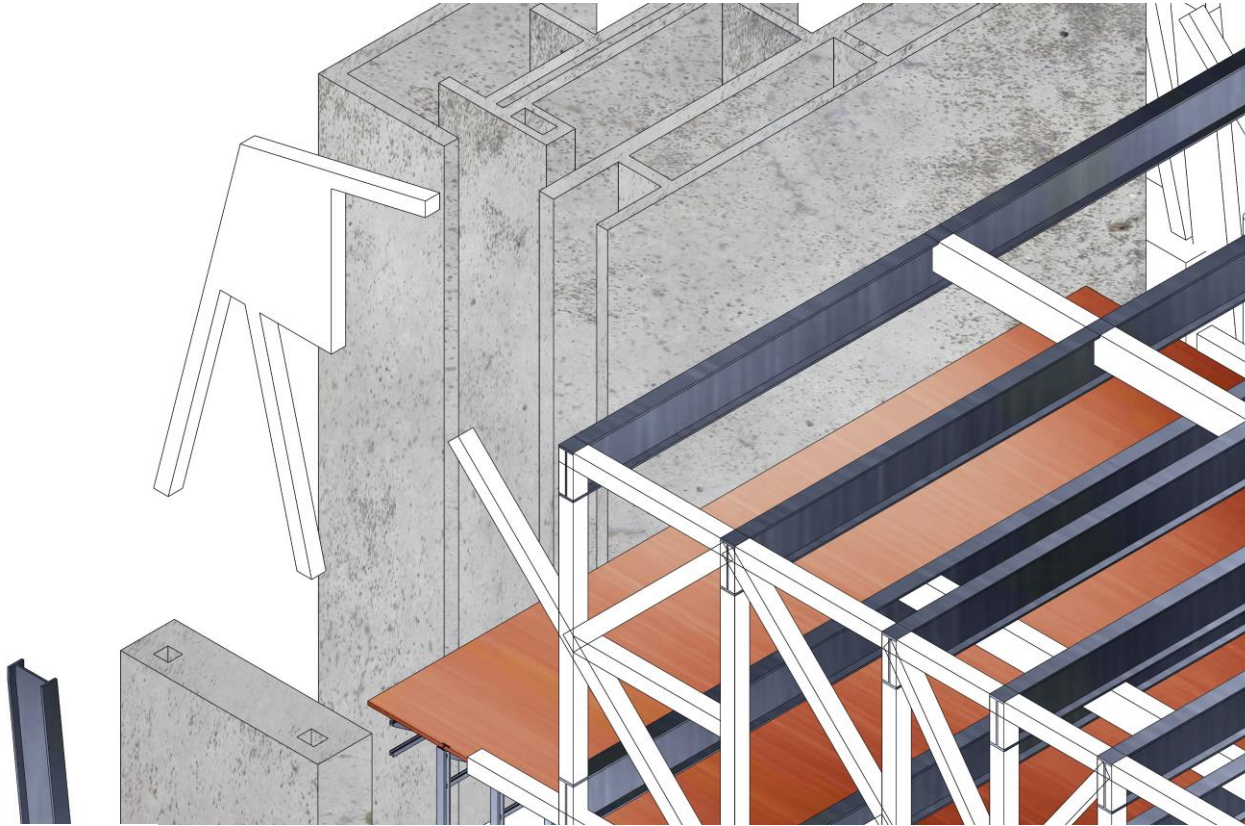
Figure 1. Parent materials





Soil: Till, which is often a good building foundation.

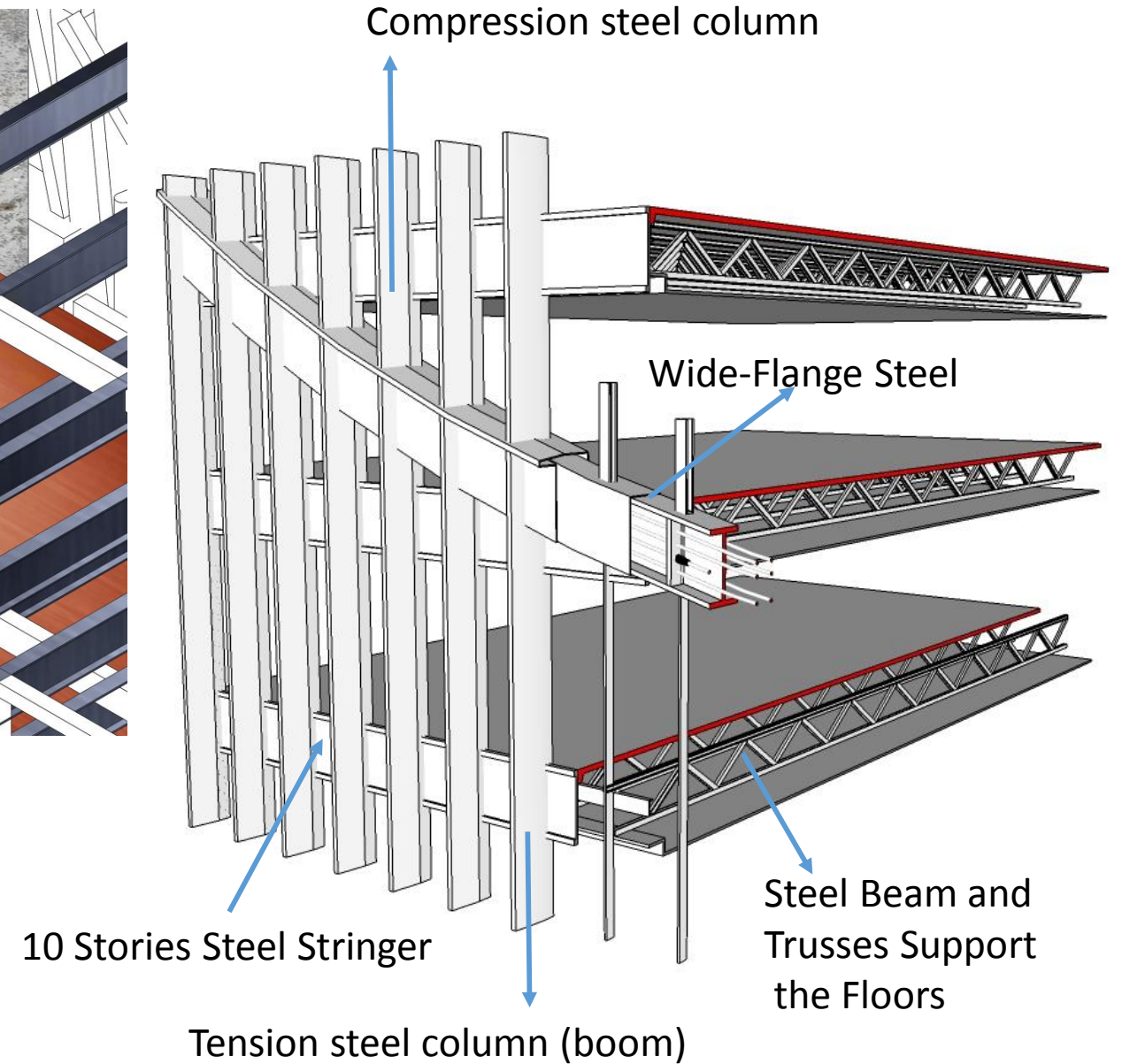


Shallow Foundation: Combined footing.

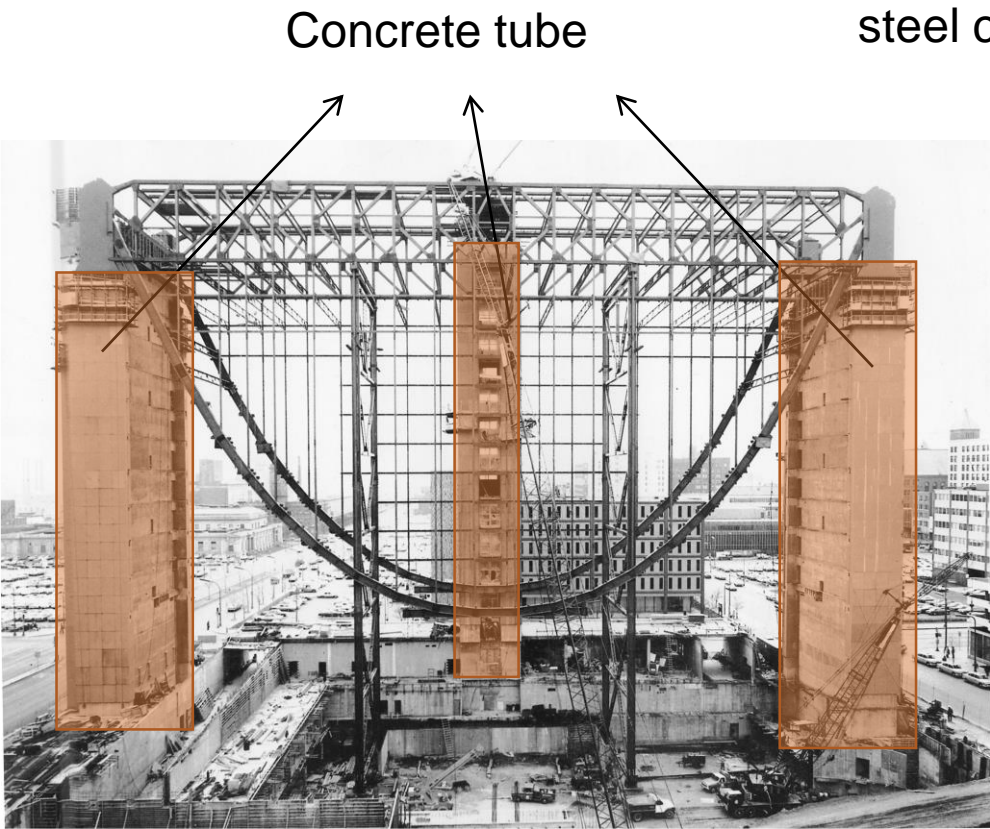
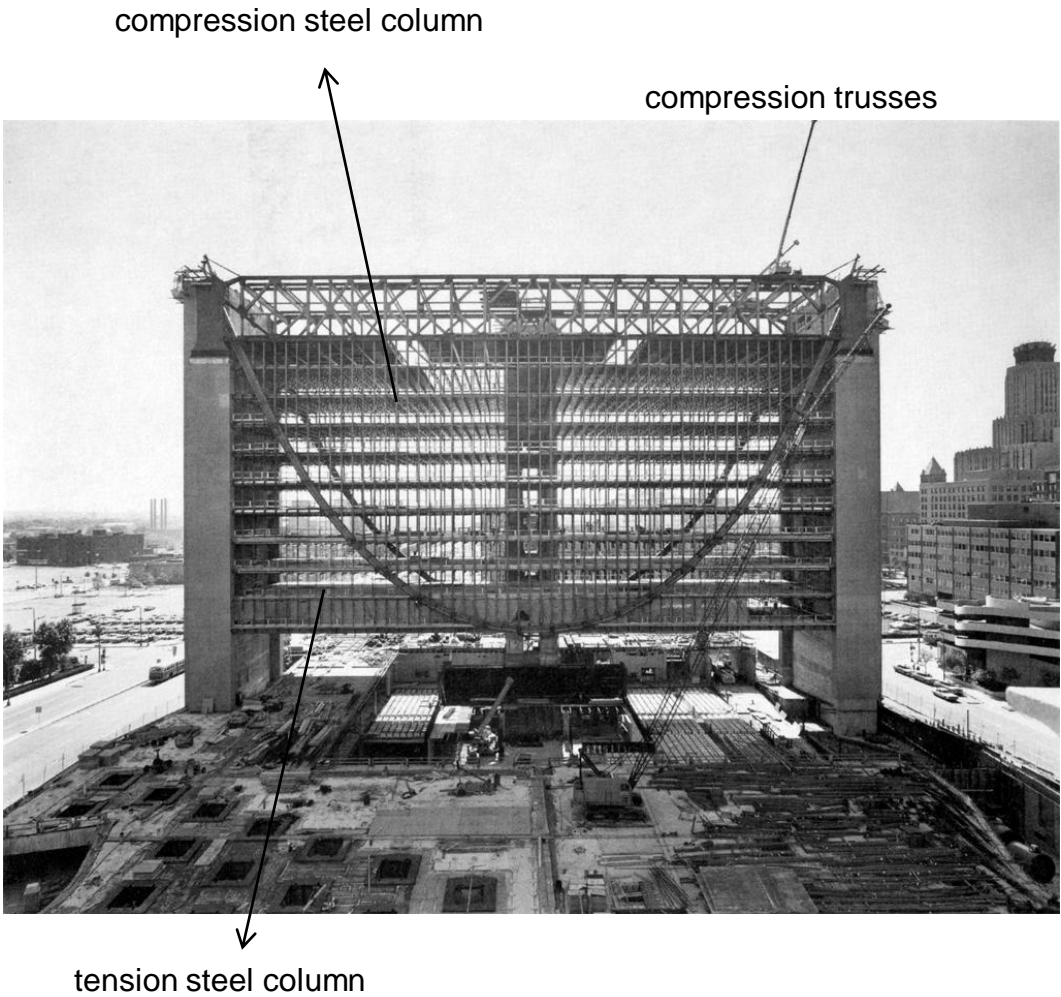
Connection



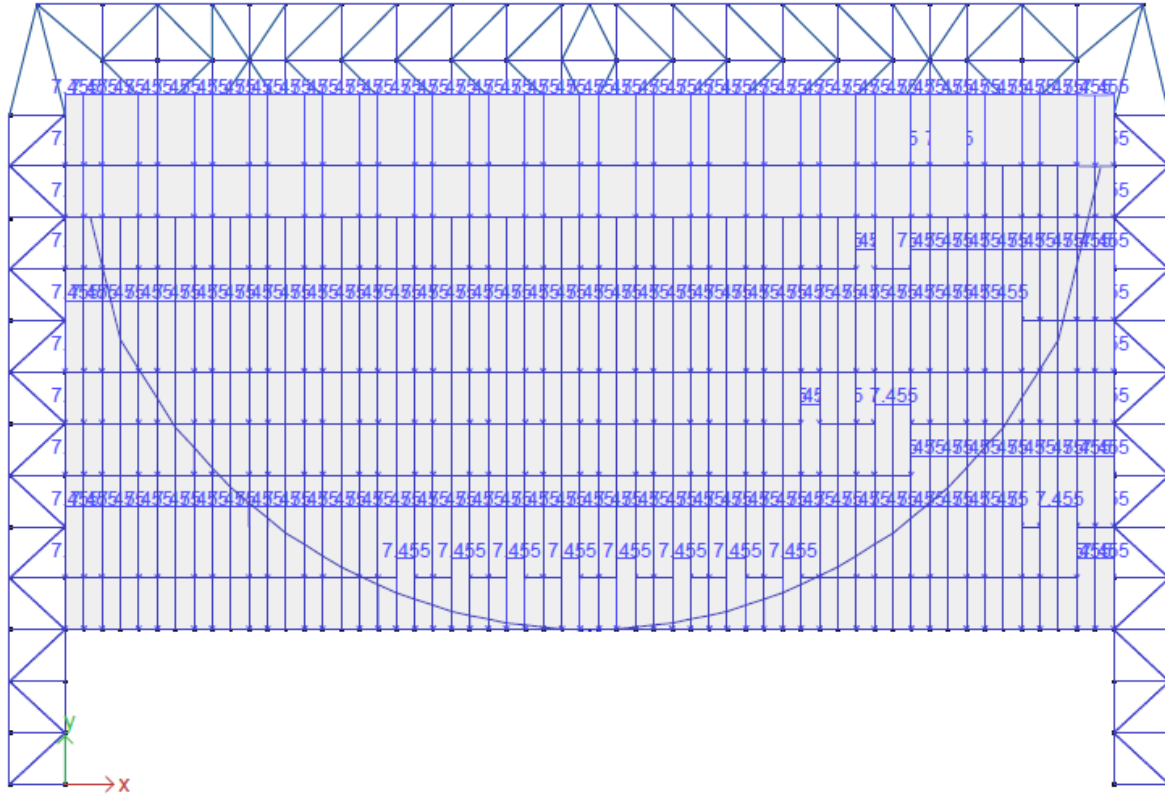
-  Concrete plate
-  Wide flange
-  Reinforced concrete
-  K steel trusses



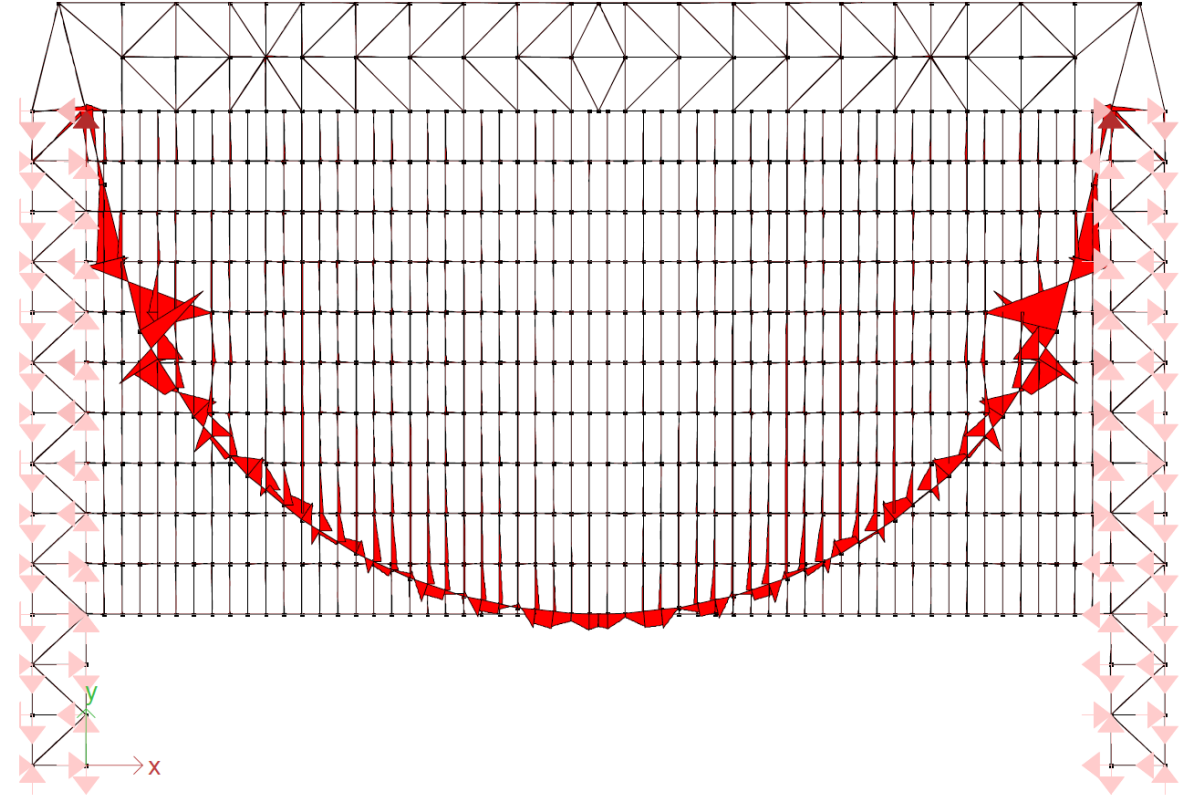
Material



Multiframe – Vertical Load

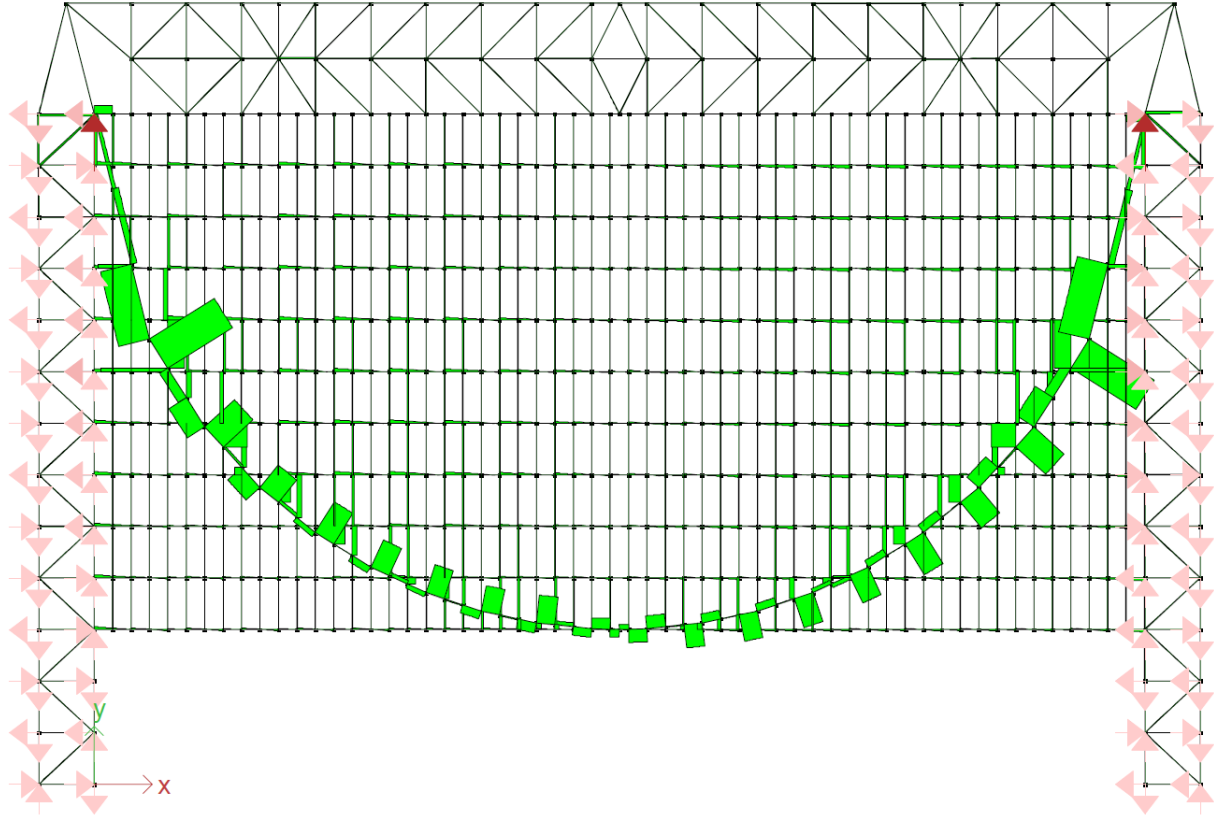


Vertical Loads

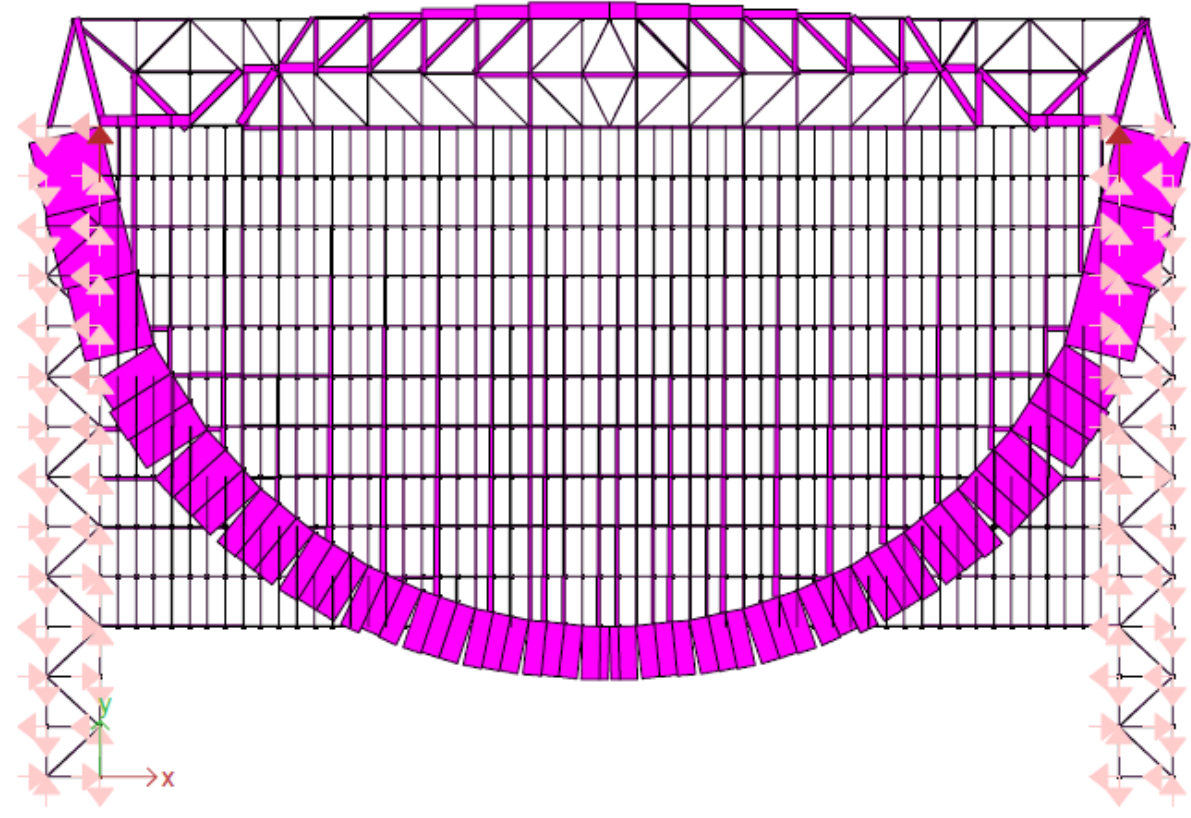


Moment

Multiframe – Vertical Load

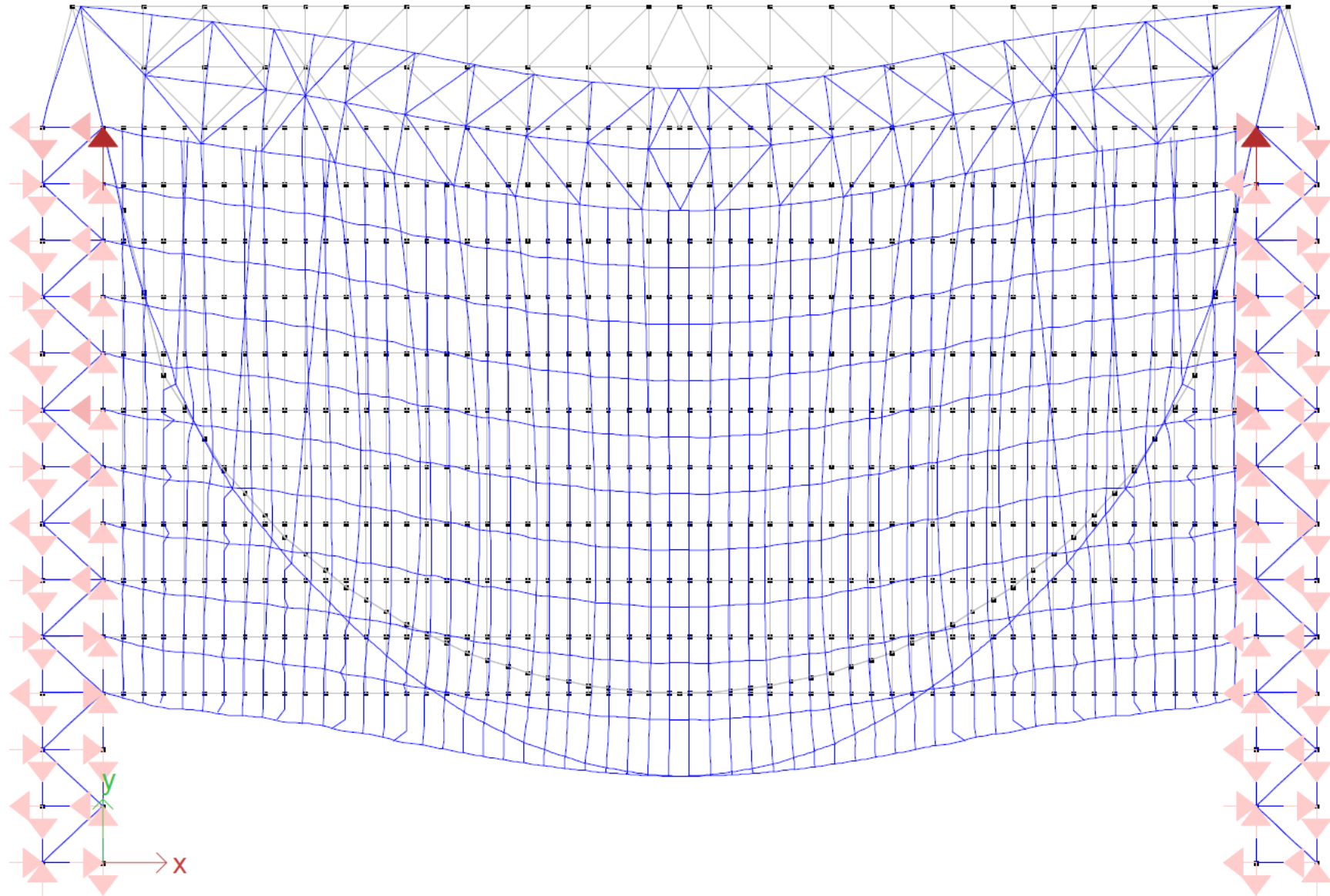


Shear



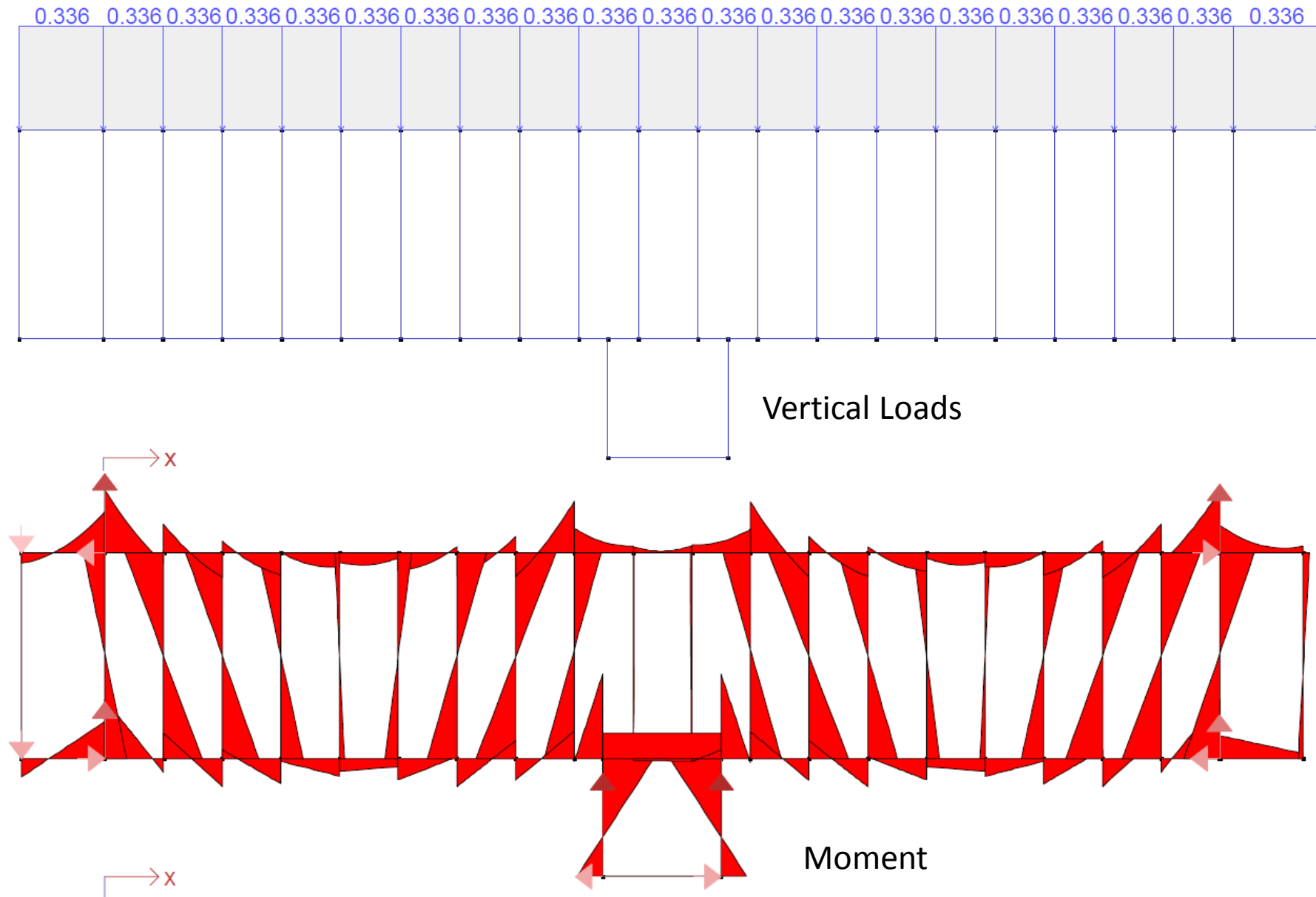
Axial Forces

Multiframe – Vertical Load

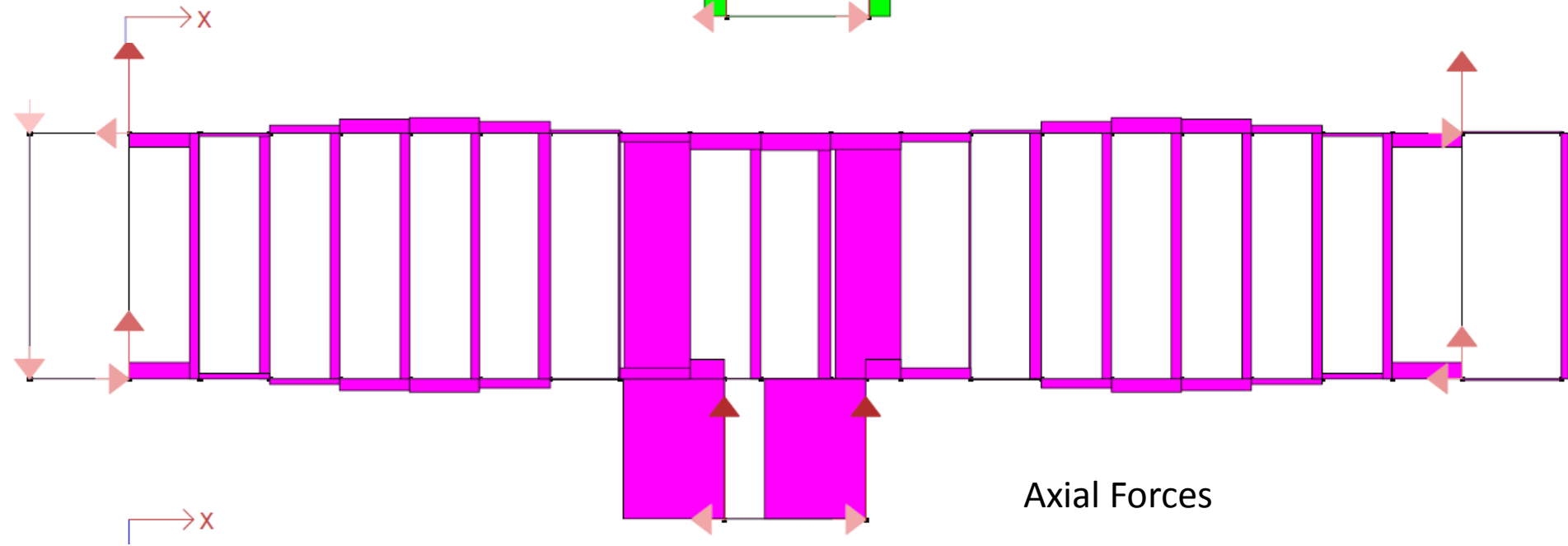
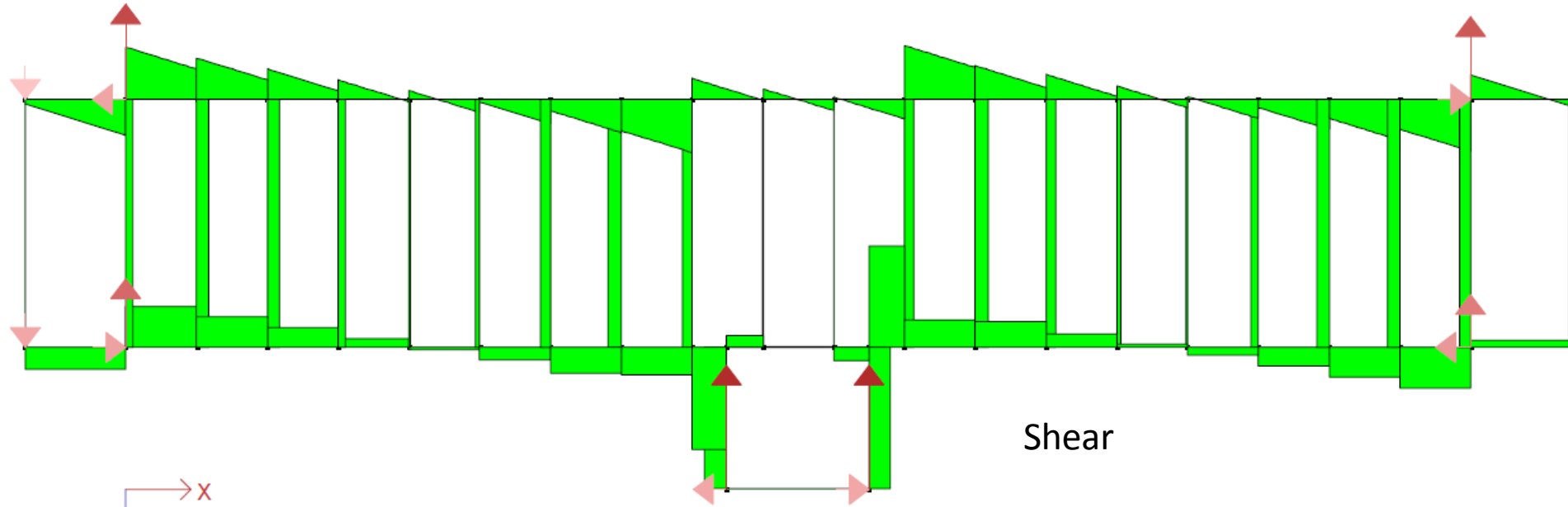


Deflection

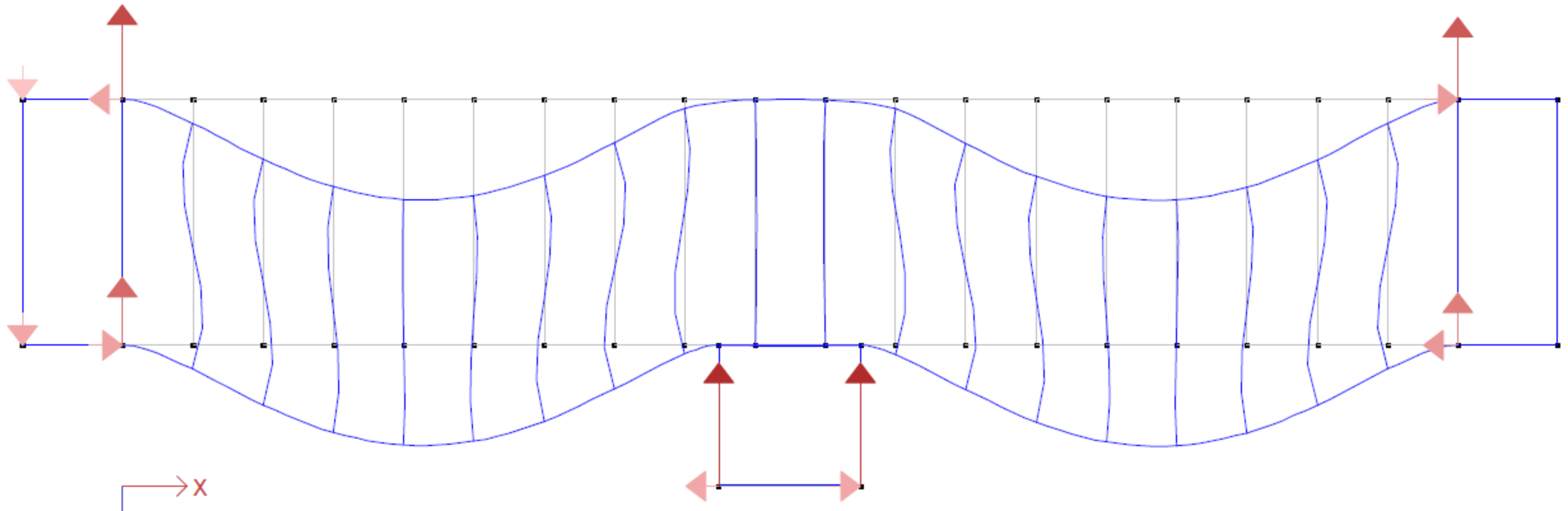
Multiframe – Lateral Load



Multiframe – Lateral Load

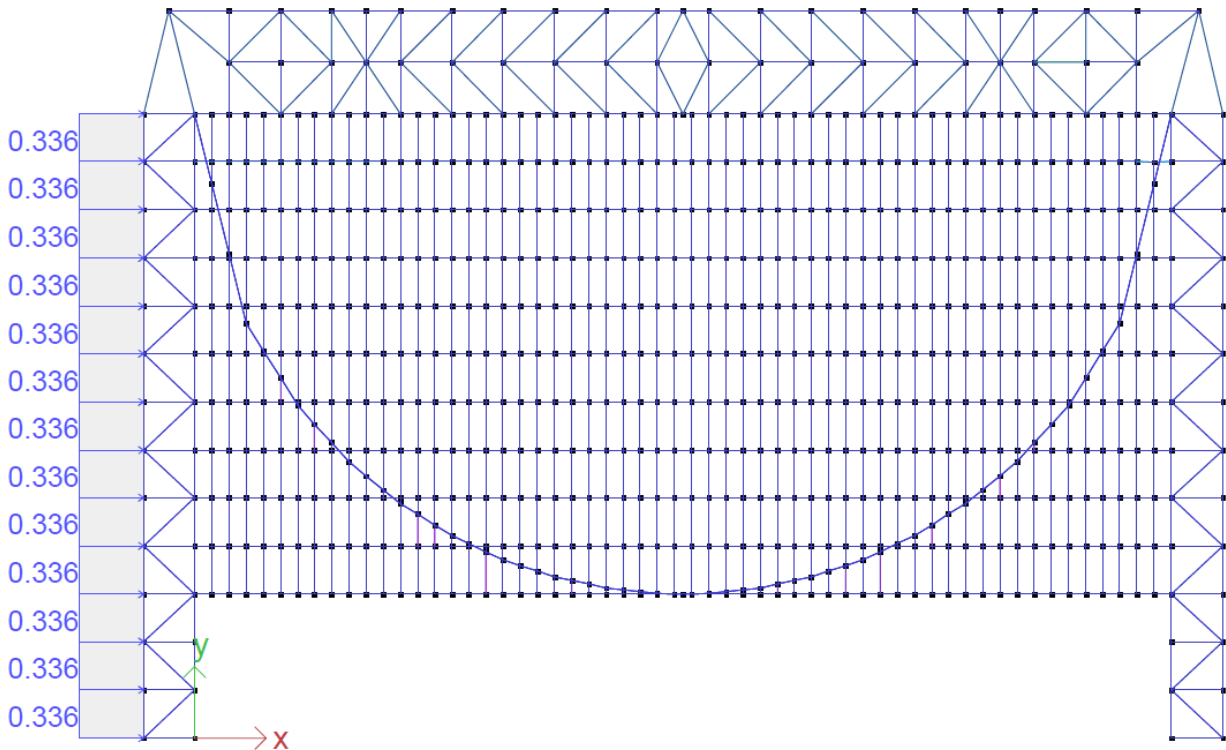


Multiframe – Lateral Load

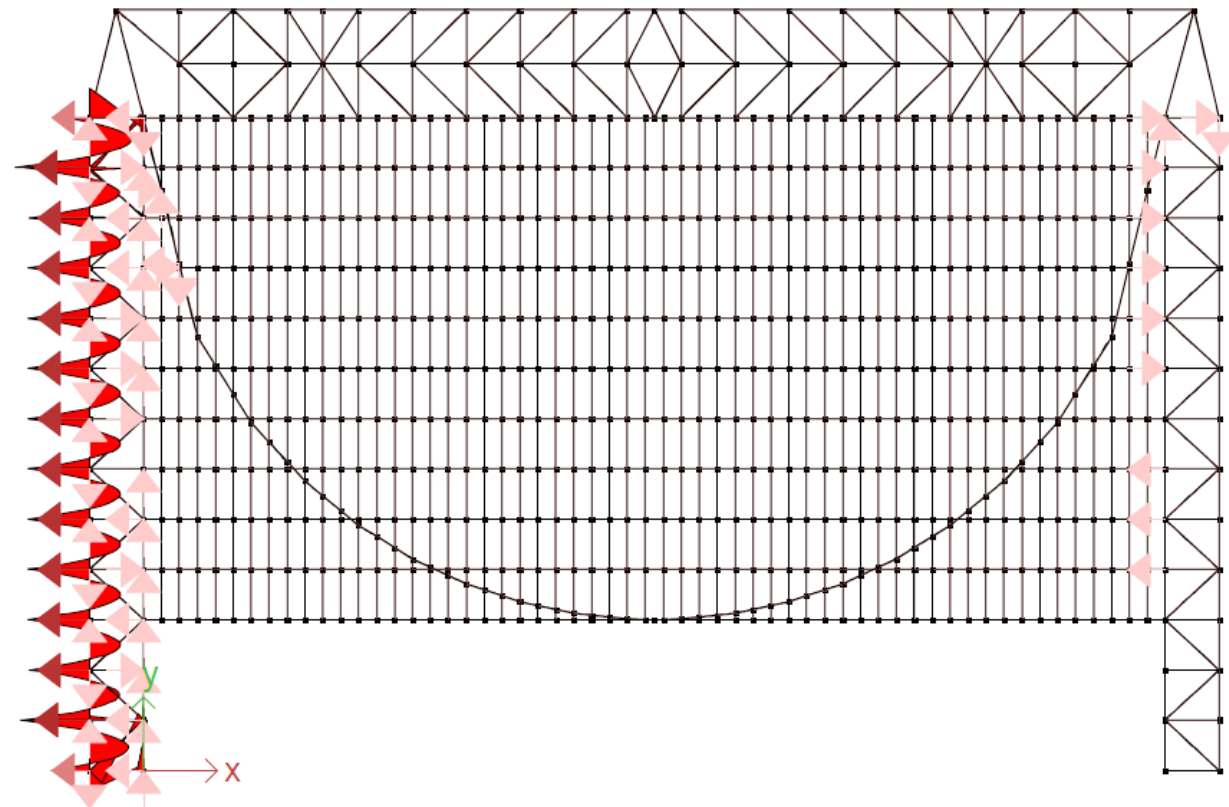


Deflection

Multiframe – Lateral Load

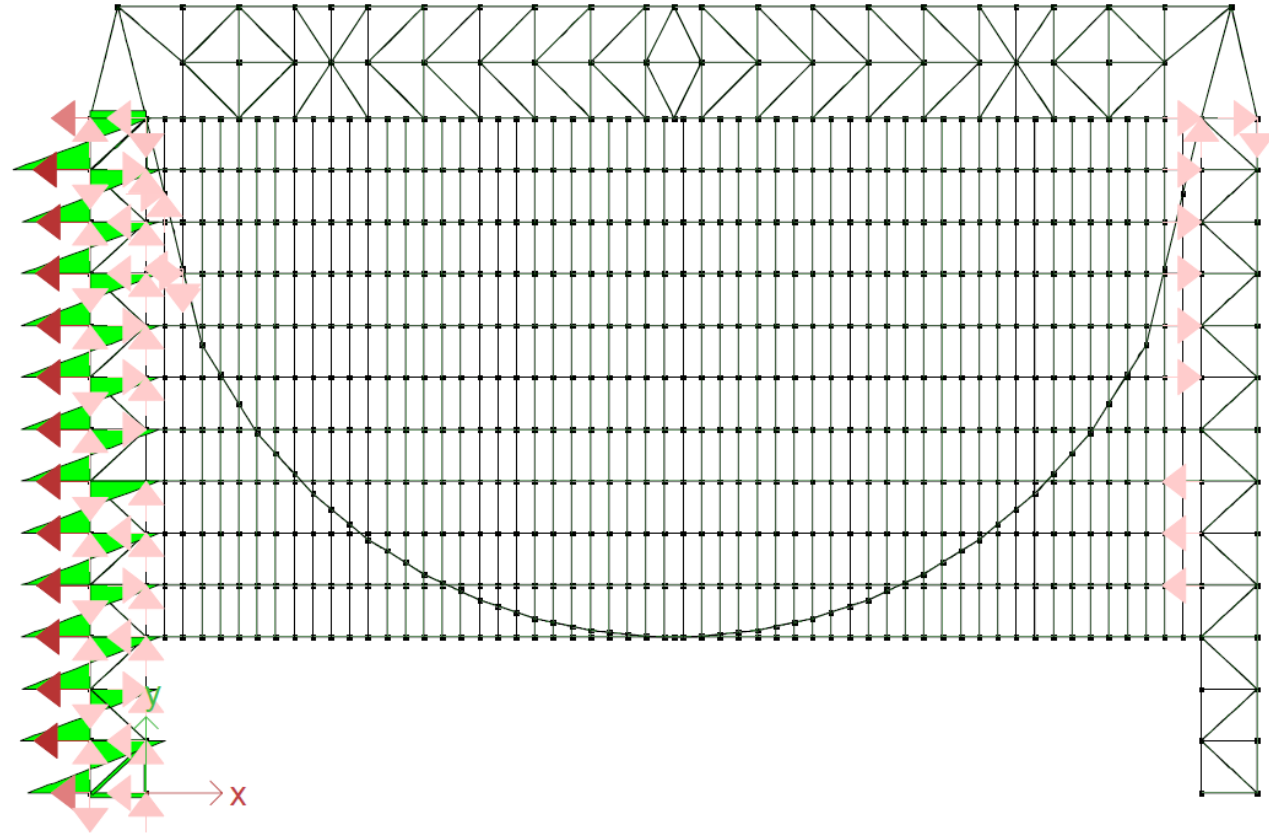


Vertical Loads

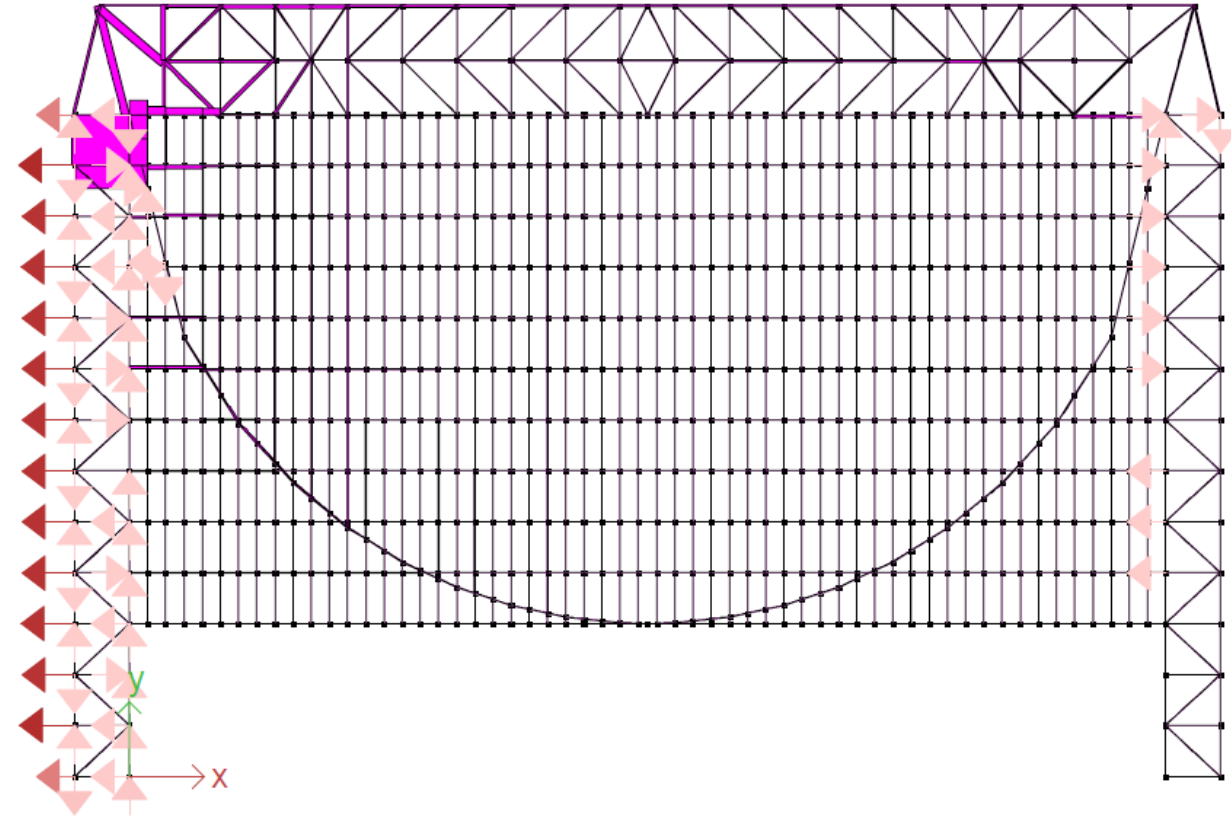


Moment

Multiframe – Lateral Load

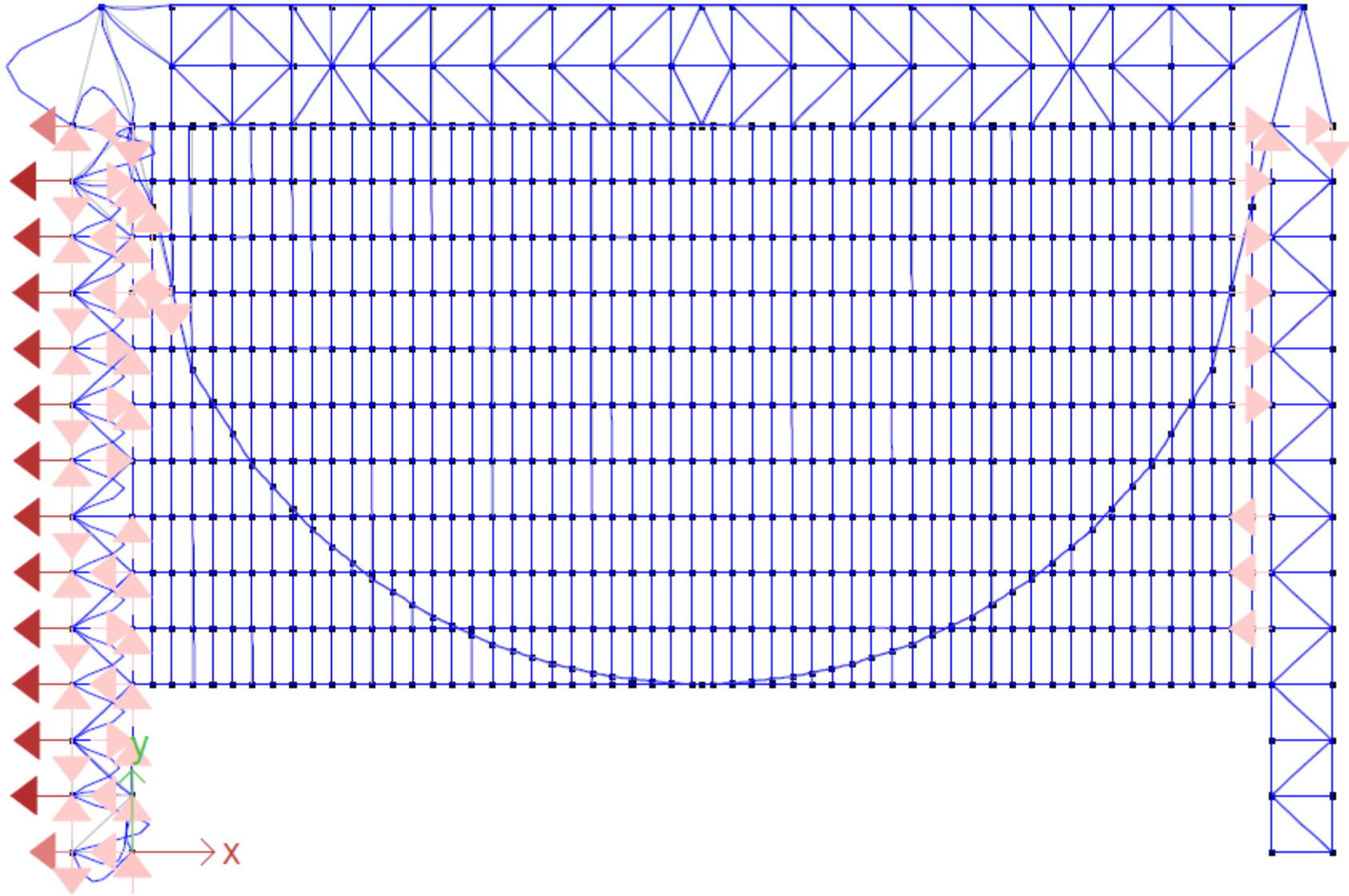


Shear



Axial Forces

Multiframe – Lateral Load



Deflection

Conclusion

The suspension structure systems of the Federal Reserve Bank of Minneapolis is used to open the ground square for the public. Thus, this building can be viewed as the one of the engineering experiment in suspension structure. After carefully studying, the bridge structure that applied in architecture structure design has some advantages and disadvantages.

For advantages: The suspension structure can save steel material. What's more, because the floor did not need the additional columns to support the vertical load, it can create large space for office without inside column. Most importantly, the bridge design in first two floors will not block the public square and the landscape.

Disadvantages: This building is not good at resist lateral load. The long side of the building gained a lot of wind load, but it could not resist wind load by itself. It need transfer the wind load into the third tube that behind the building to resist overturning.

Thank you!

Questions?