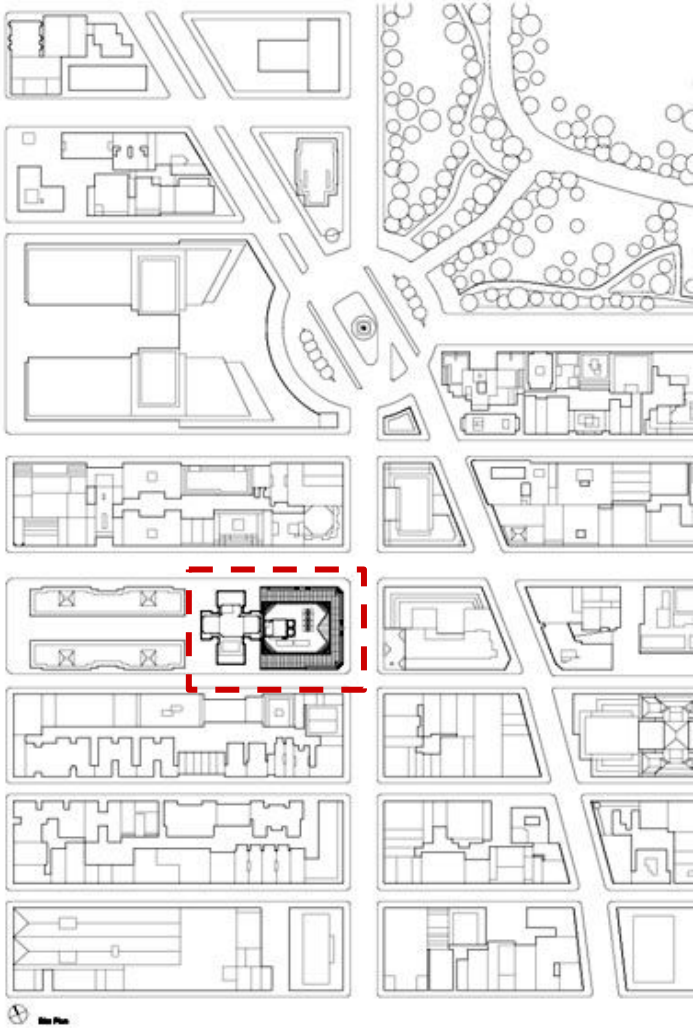
HEARST TOWER

ARCH 631 NICHOLS

jingtong liu
xinran liu
nathanielle sybico
jin tu
gaoyang ye



LOCATION

The Hearst Tower is located between *300 West 57th Street and 959 Eighth Avenue, near Columbus Circle, in Midtown Manhattan, New York City.*

The new addition is made up of ***856,000 ft^2***

Tower is **600 ft** tall and incorporates two underground levels.

The Hearst Tower became the **first** LEED Gold Skyscraper in New York City.

PROJECT TEAM

ARCHITECT Norman Foster

STRUCTURAL ENGINEER WSP Cantor Seinuk

CONSTRUCTION Turner Construction

FABRICATORS Cives Steel Fabrication and Mountain Enterprises

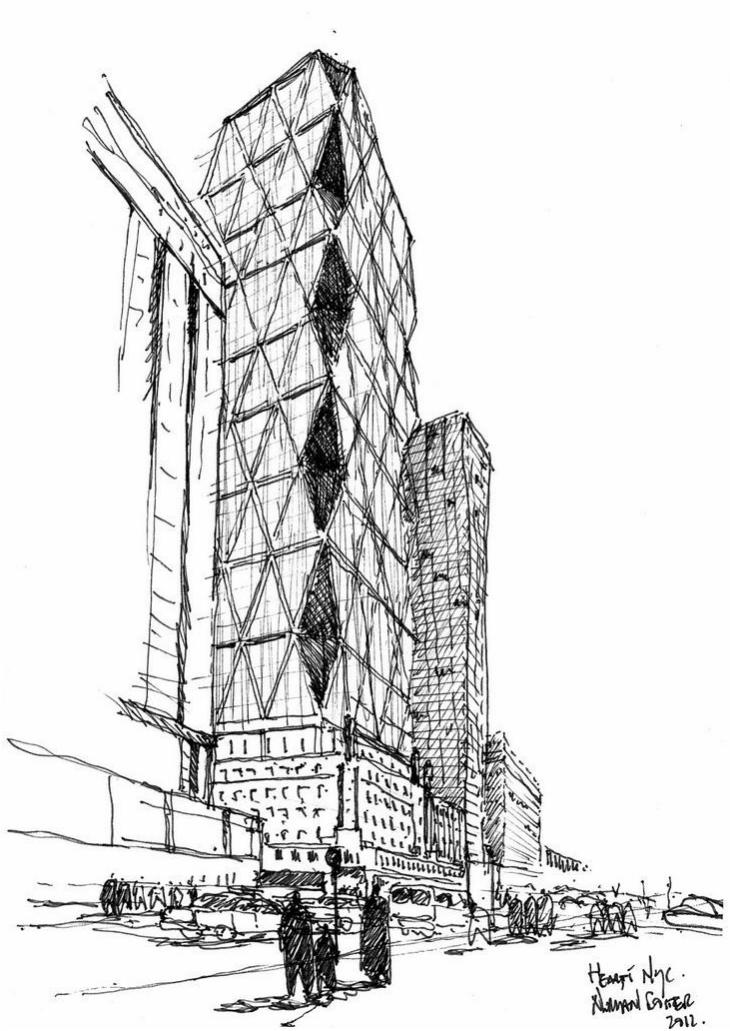
Foster + Partners is a British international studio for architecture and integrated design.

BACKGROUND

The original six-story structure was built in **1928** and was meant to be the base of a skyscraper expansion.

The Great Depression and then World War II **postponed** these expansion plans.

In **2001**, the Hearst Corporation decided to consolidate the offices it rents for nearly 2,000 employees in a new 46-story tower.



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DESIGN CONCEPT

Preserving New York's Heritage-- The Landmark Facade

An important design specification was the **preservation** of the existing landmark facade and its incorporation into the new tower design.

Hearst's original intention for this building was to provide a **high quality** work environment for his employees

The building truly celebrates the **marriage** of the old and new

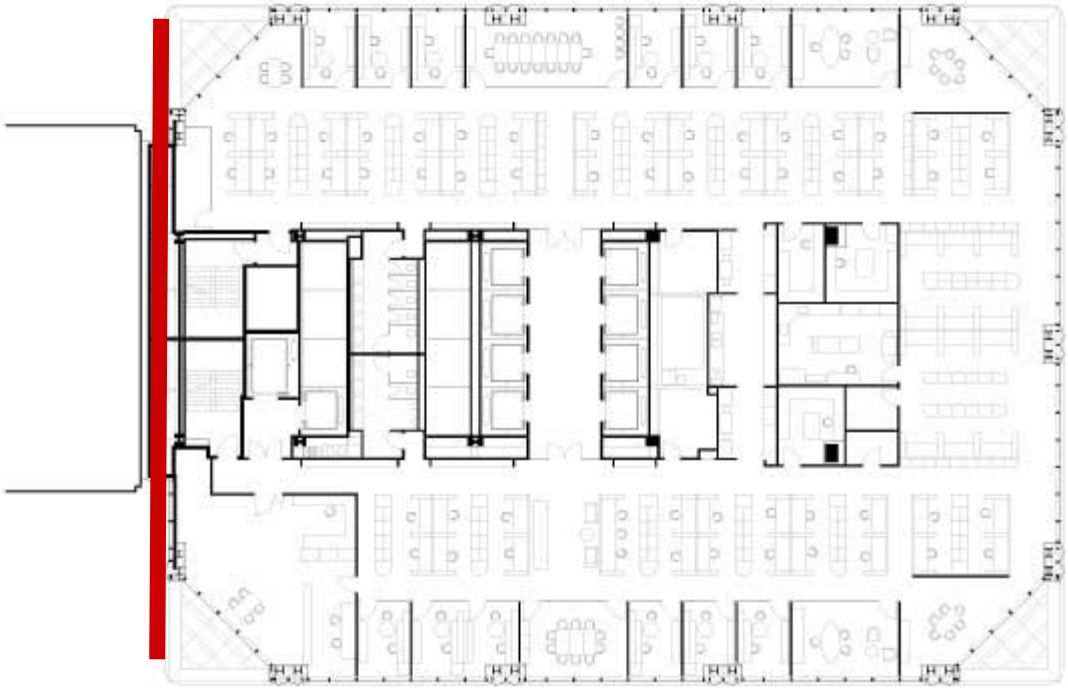
BUILDING LAYOUT

The original building an approximate footprint of **200 ft by 200 ft**

The tower has two distinct zones
1 the zone below 10th floor contains entrance at street level and lobby, cafeteria
2 auditorium at the 3rd floor with an approximately 80 ft high interior open space

The tower is connected to the existing landmark facade at the 7th level by the horizontal skylight system spanning approximately 40 ft

BUILDING LAYOUT



Three sides of the building face streets and views

The west side is against another building; so the core was shifted toward the western edge

The office zone starts at 110ft above street level from the 10th floor to the top of the building

Composite steel and concrete floors with 40 ft interior column free spans were utilized for open office planning

http://farm1.static.flickr.com

HISTORIC 1926
LANDMARK FACADE

The glass and steel addition sits atop a six-story cast stone base, which was designed by Joseph Urban in 1928.

EXISTING BUILDING COST $2 million

Only the facade of the existing building was saved and one bay of the original steel frame was kept in order to keep the limestone stable.

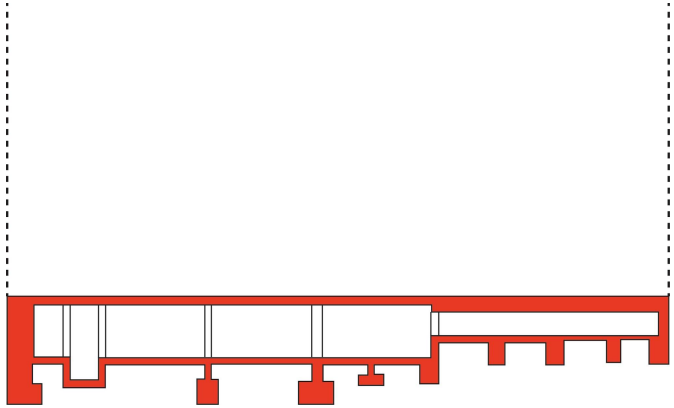
TOWER ADDITION COST $500 million

FOUNDATION

SOIL sharp drops in elevation of bedrock varied up to 30 feet

SPREAD FOOTING used on half the building on top of rock

CAISSONS used on the other half and embedded into rock



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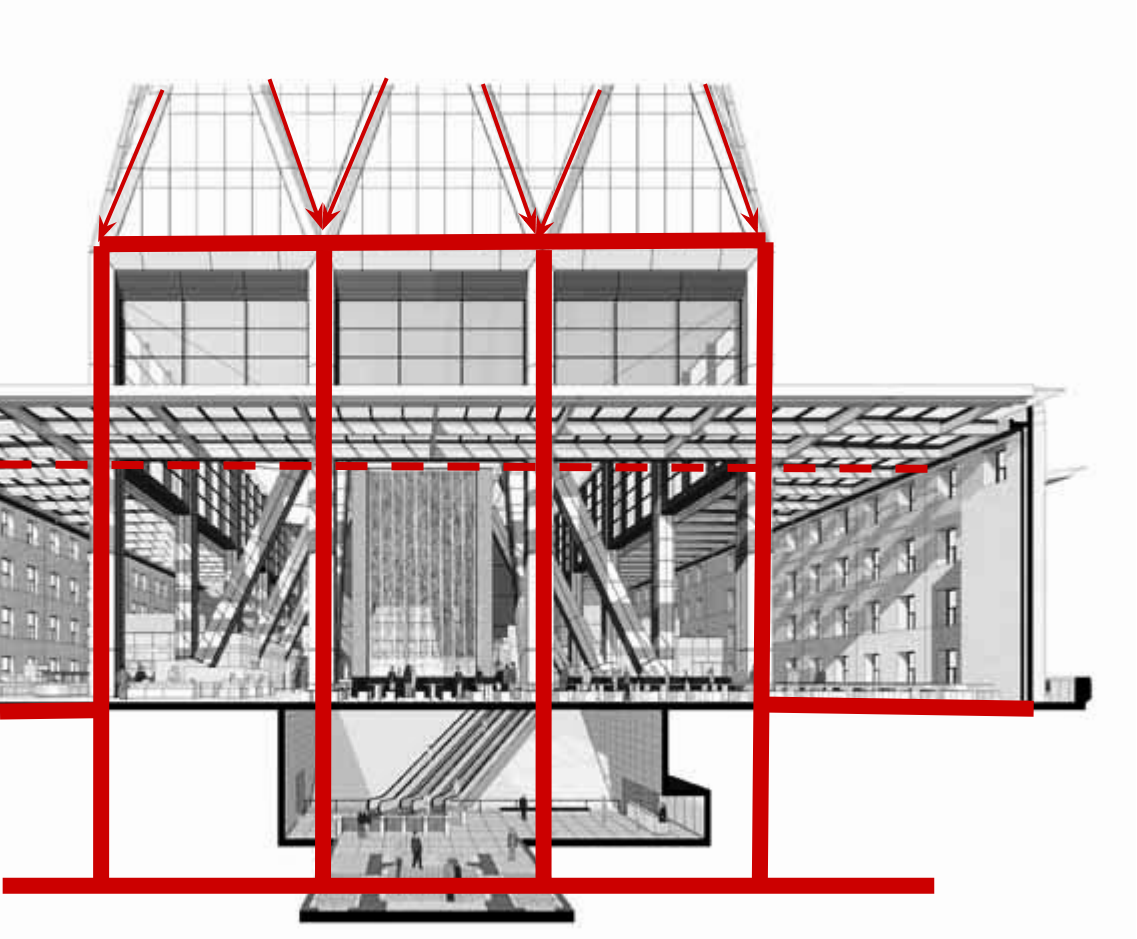


FIRST TO TENTH FLOOR
STRUCTURE

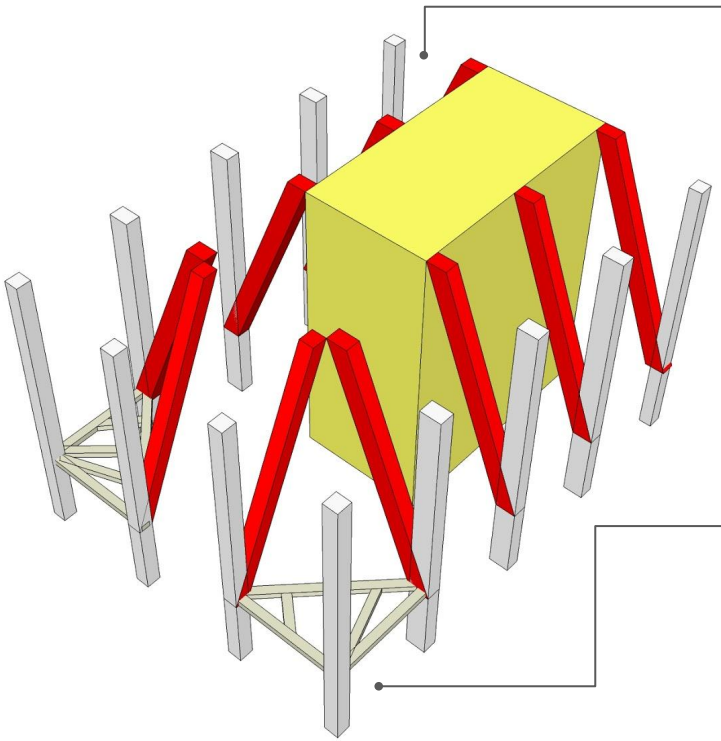
12 ***30-ton, 44-inch-square*** box mega columns assembled from 4-inch rolled steel plates

90-foot "mega-diagonals"

Grade 50 steel members were used throughout, with ***65 ksi elements***

A system of ***40-ton beams*** at the tenth floor, integrated with skylights, forms a ***diaphragm*** that braces the structure laterally and ties the old building to the new.

a shimmering pewter-like linen finish, ***5-millimeter stainless steel cladding*** wraps the exterior structural system, adding that same subtle shimmer to the streetscape and skyline.

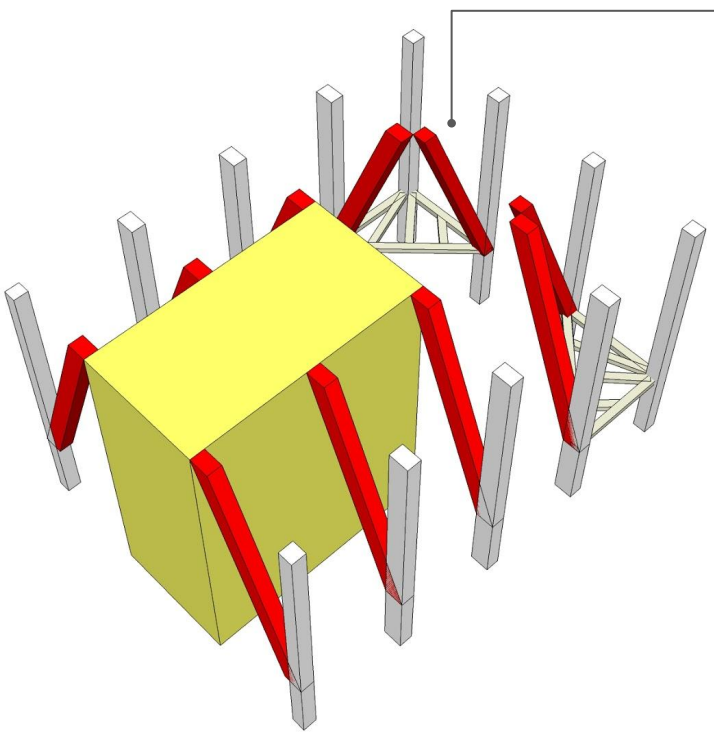


mega-columns

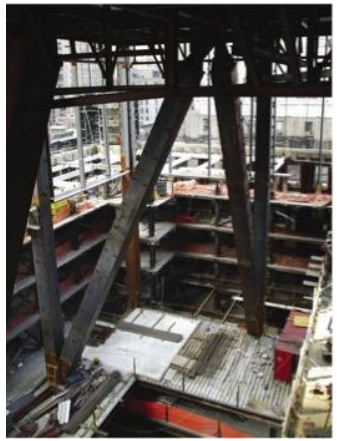
The 30-ton, 44-inch-square

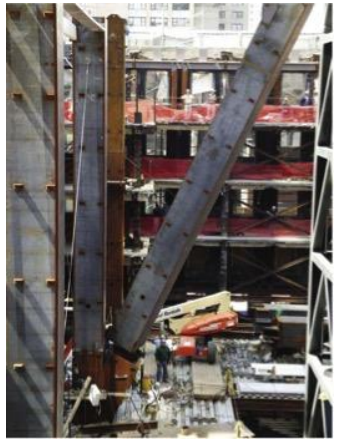
Web framing

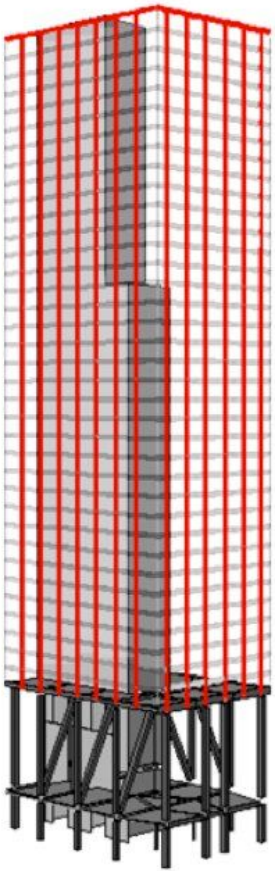
Beneath the atrium floor laterally braces the mega-columns



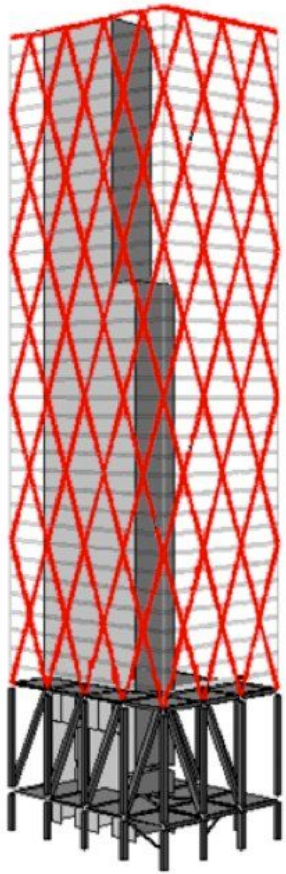
The *“mega-columns”* and similar *“mega-diagonals”* support the tower above a 7-story-high atrium.







20 x 20ft Moment Frame
10,756 tons



Complete Diagrid - more efficient
8,453 tons

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TENTH TO TOP FLOOR
STRUCTURE

FREE FORM

Since the west side of the building is close to another skyscraper, the service core was put at the west side. As a result, the eastern edge of the building couldn't be reinforced by a central core. In order to eliminate the structural disadvantage of this unsymmetrical form, the structures on the perimeter were designed as diagrid system. The diagrid structural system can provide sufficient support for the building facade to resist lateral forces.

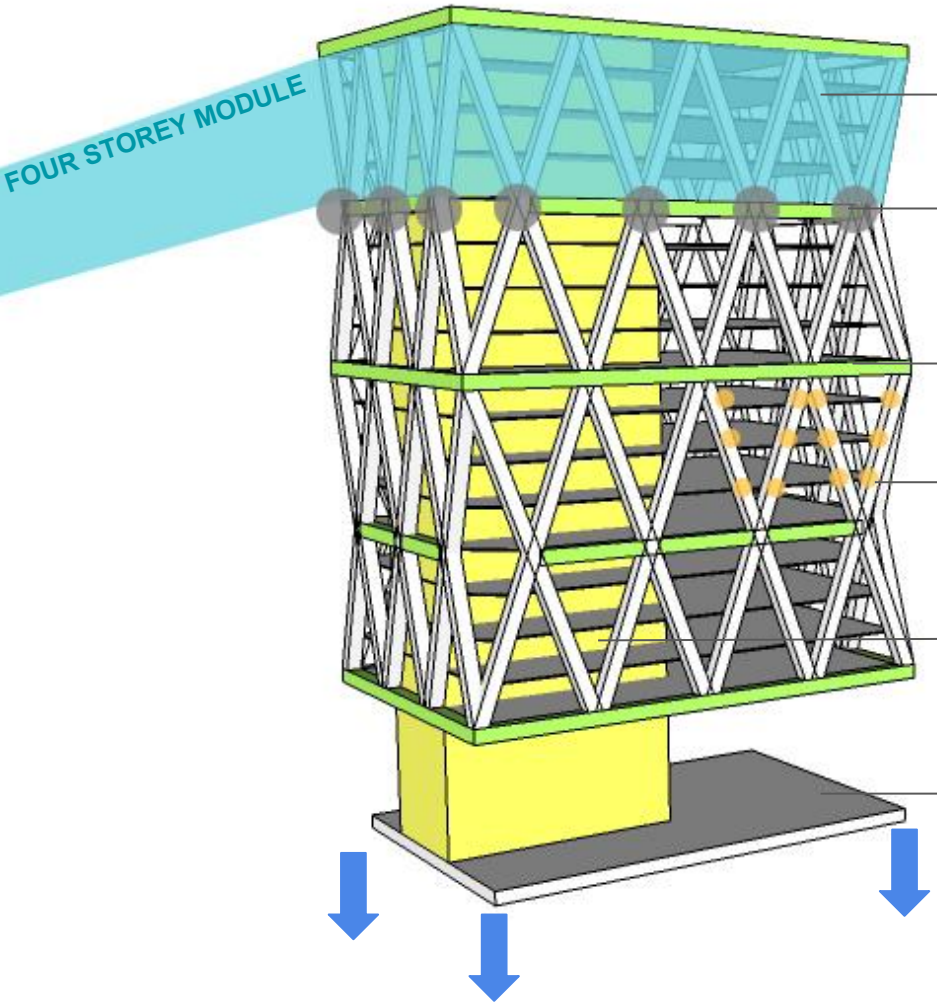
EFFICIENCY

Another reason for using a diagrid on the perimeter is that it is more efficient than the moment frame system. The complete diagrid system saved 20% of steel material.

REDUNDANCY

In order to prevent collapsing and to withstand extreme loading events, such as blasts, earthquakes, or unexpectedly large loads.

Diagrid system diagram



PERIMETER DIAGONAL STRUCTURE
DIAGONAL MEMBER ELIMINATE VERTICAL COLUMN

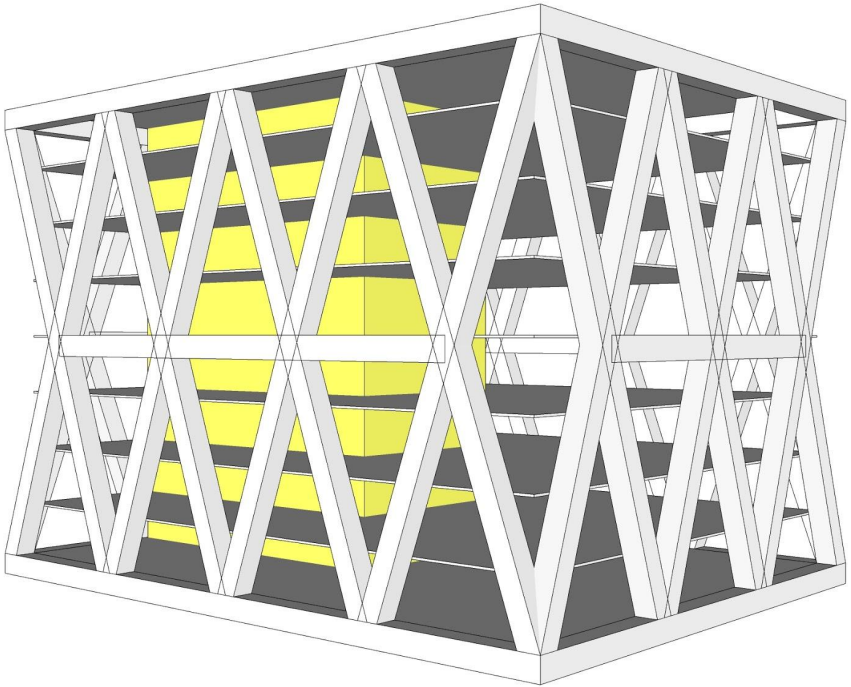
NODE
INTERSECTION NODE FOR DIAGONAL AND RING

RING BEAM
TO CONNECT DIAGONAL AND EDGE BEAM

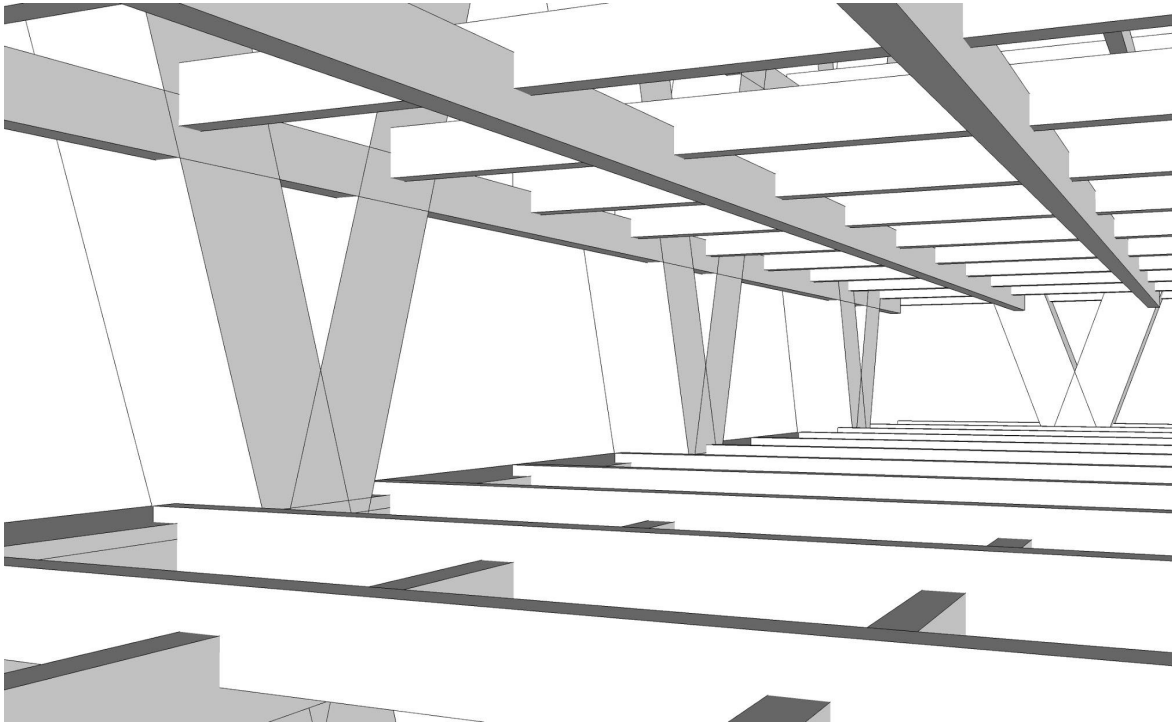
FLOOR SLAB
CONNECT DIAGONAL TO REACH STABILITY

SERVICE CORE
VERTICAL CORE RESIST GRAVITY LOAD

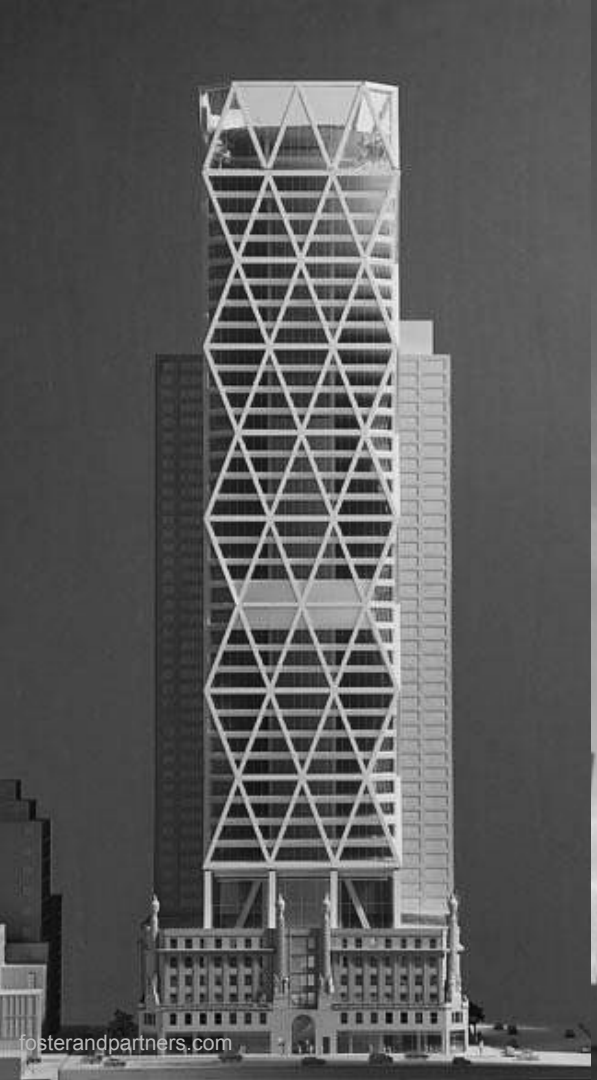
GROUND
CONCENTRATED LOAD DISTRIBUTION



In the diagrid-framed system, the gravity and lateral loads are distributed through the sloped column and spandrel beam members as axial tension or compression.



The system allows broad interior spans of more than 40 feet between columns.



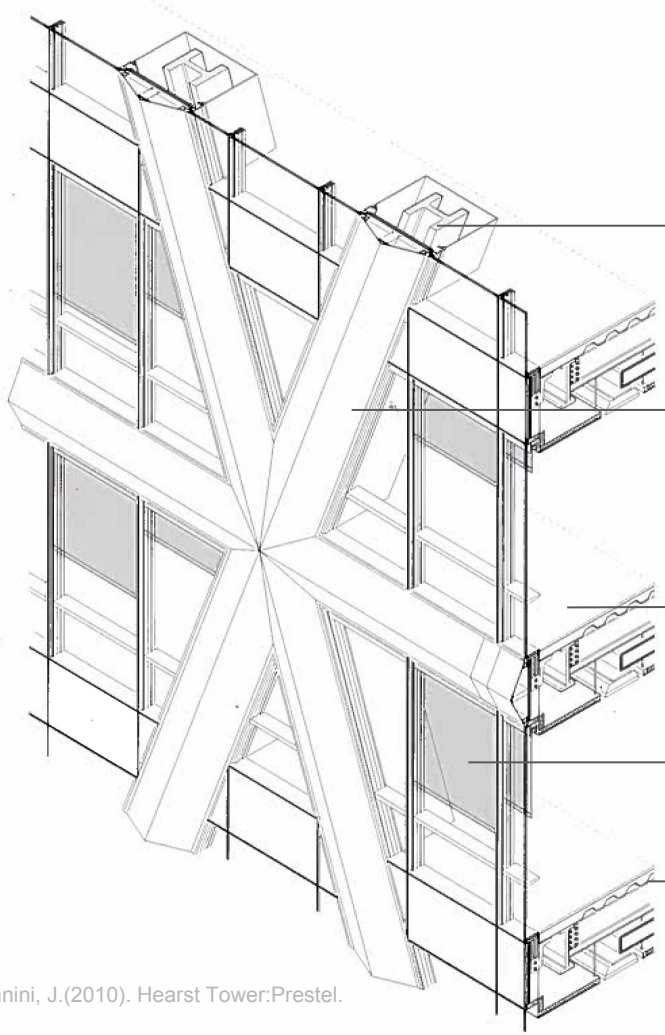
CONNECTION

STRUCTURE

three basic types of nodes

“bird’s mouths” in order to avoid large cantilevered floor plates between the corner nodes

CONNECTION DETAIL



12” wide flange rolled steels sections (Universal sections)

Heavy duty stainless steel sheets

Concrete topper on composite floor decking

Glass

Steel decking

Foster, N.,& Giovannini, J.(2010). Hearst Tower:Prestel.

CONNECTION
STRUCTURE

Prefabricated node

The nodes are basically symmetrical as well as repetitious

An innovative two-point crane pick

Combination of standard and oversized holes to help with site erection

Complex nodes bolted into six different 12-inch, H-column-type diagrid elements

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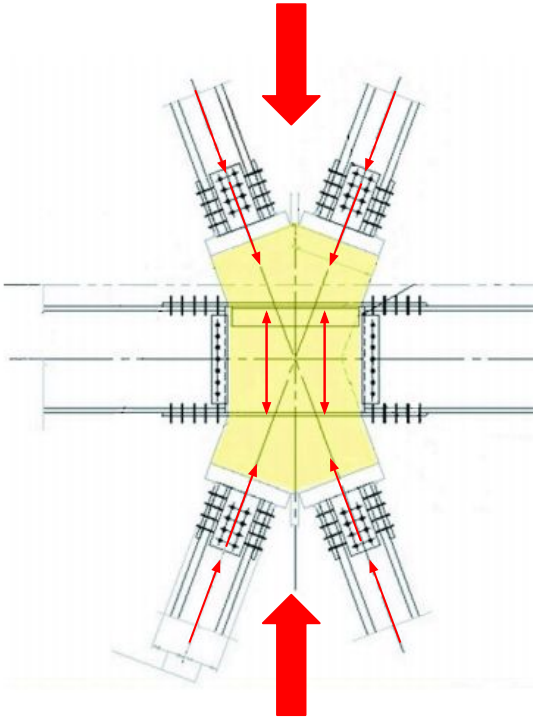
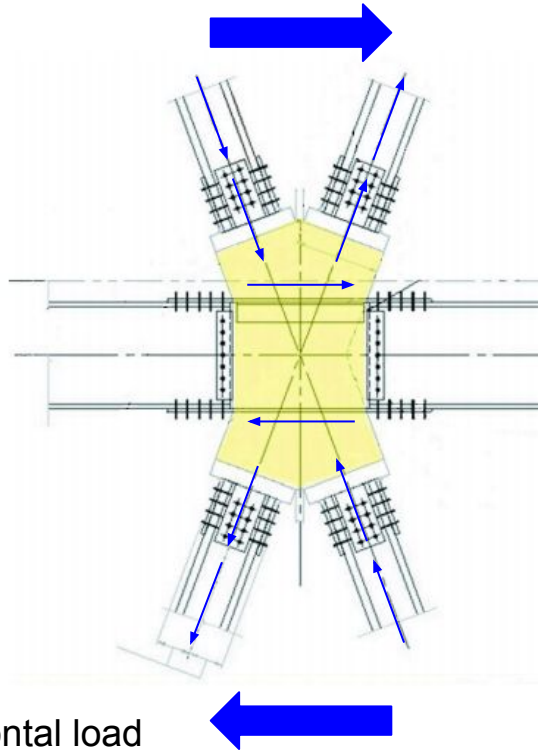
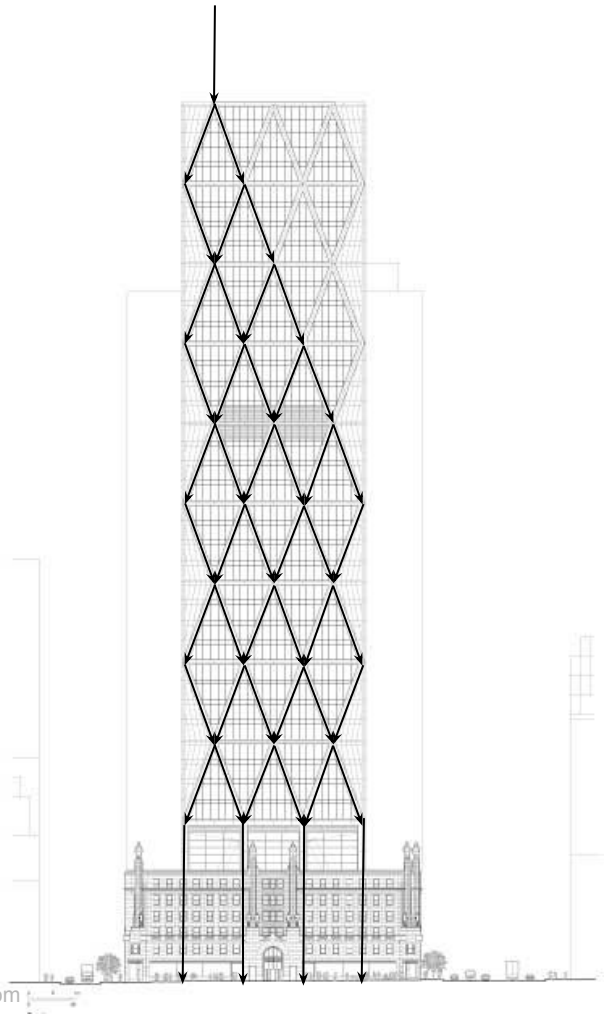
Load path at node



Under vertical load



Under horizontal load

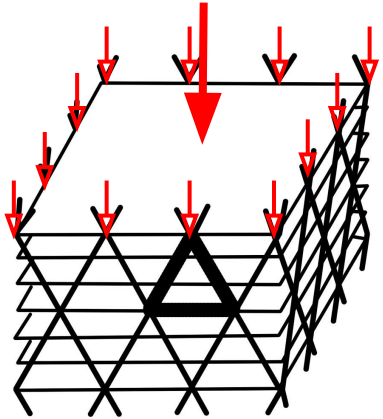


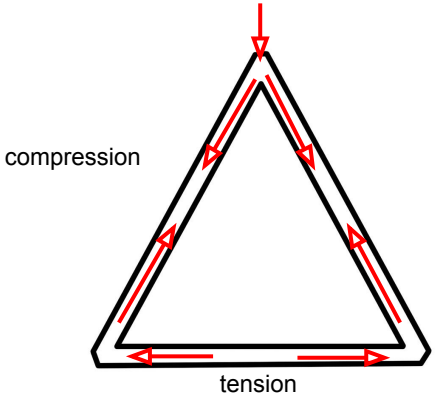
LOAD TRACING

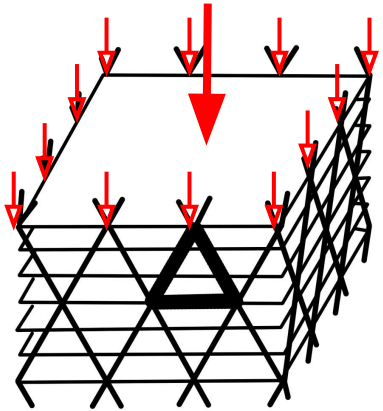
GRAVITY

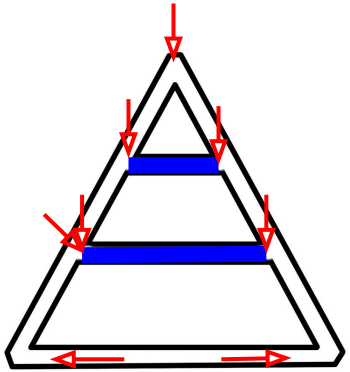
The gravity and vertical load from the building will distribute toward the apex of the diagonal structure. The forces will be divided into the other diagonal members and transfer into the bottom section.

The diagrid creates a highly efficient tube structure by being composed of a network of *triangulated trusses* which interconnect all four faces of the tower. The diagrid system is inherently highly redundant by providing a structural network allowing *multiple load paths*.





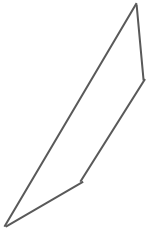


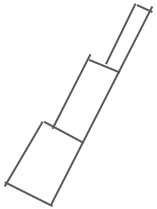


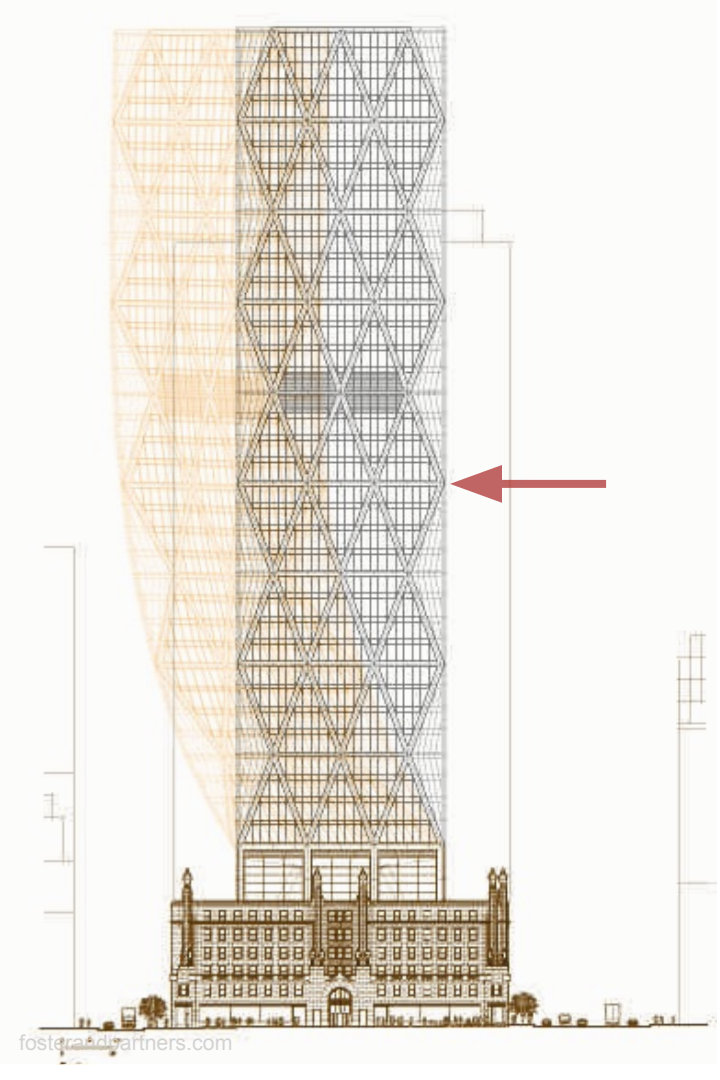
Considerations would affect the design of diagrid system and selection of module:

- geometry of the building
- occurrence of eccentric loading
- structural efficiency
- floor-to-floor height
- requirements for fenestration pattern and window sizes
- selection of AESS or concealed steel structure

75 degree or 105 degree slope with 8 storeys each module is the most efficient selection.


moment

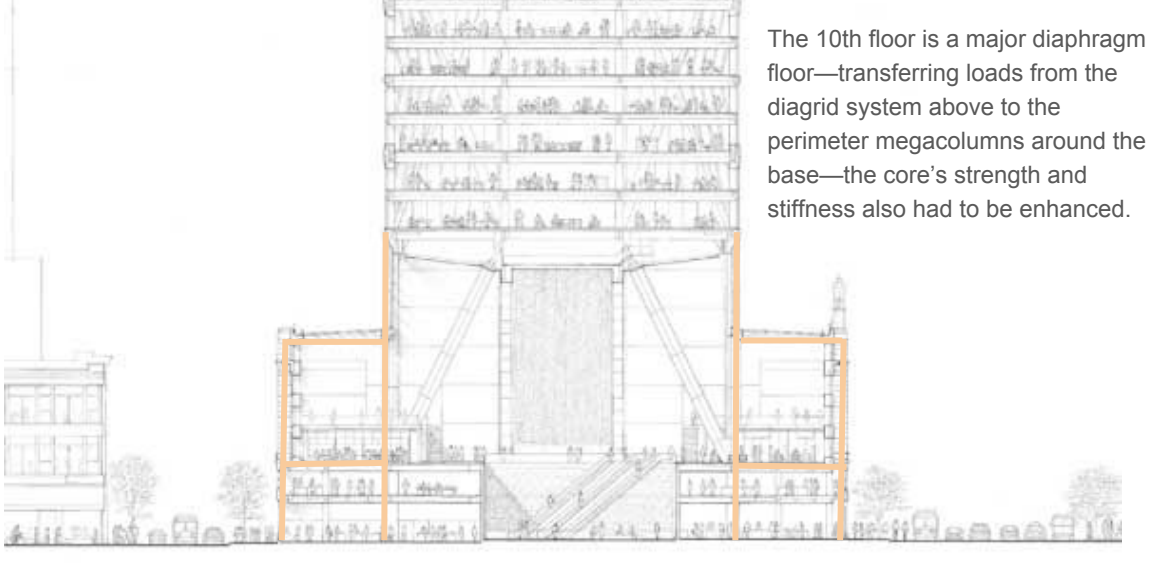

shear



LOAD TRACING

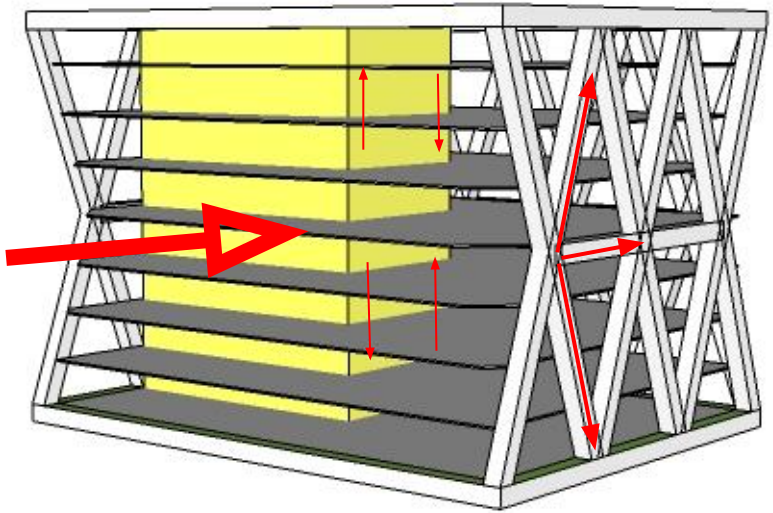
LATERAL

In the diagrid system, the columns and diagonals and bracings are all one.”



The 10th floor is a major diaphragm floor—transferring loads from the diagrid system above to the perimeter megacolumns around the base—the core’s strength and stiffness also had to be enhanced.

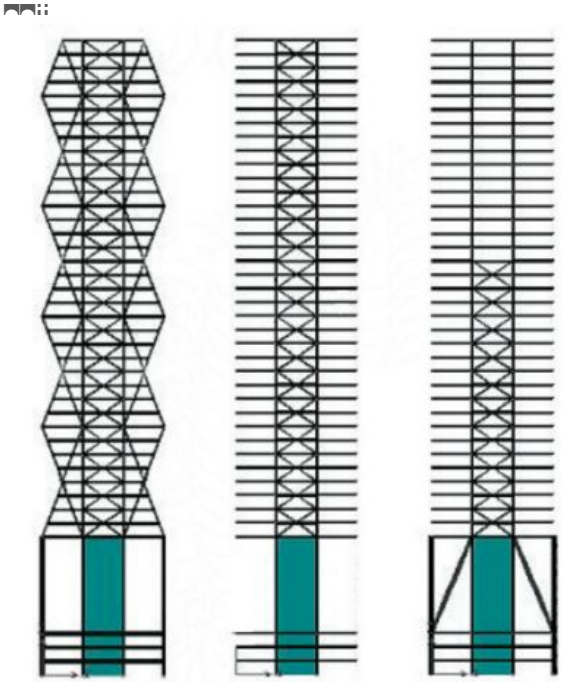
A typical seismic-force-resisting system needs to be able to provide sufficient *ductility* and *energy dissipation* characteristics. This is required to prevent collapse while undergoing inelastic frame deformations.

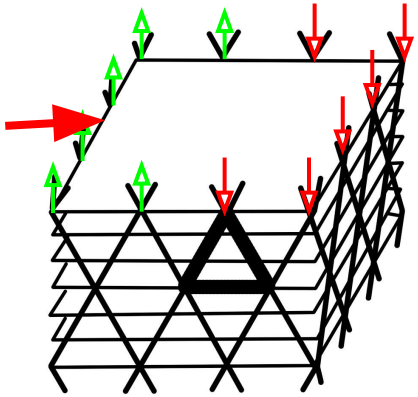


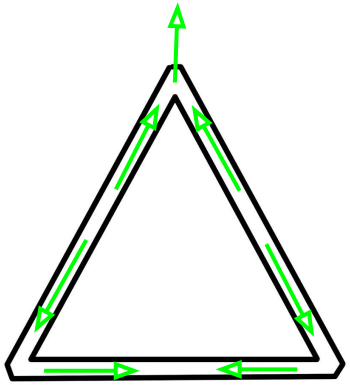
A dual system was designed to resist seismic forces in the Hearst Tower. The steel perimeter diagrid system is constructed with a reinforced concrete core and the core is considered to act as a ductile member.

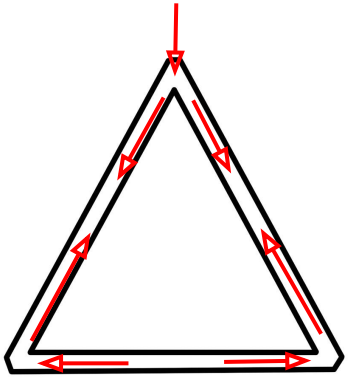
The core consists of a steel frame system above level 10.

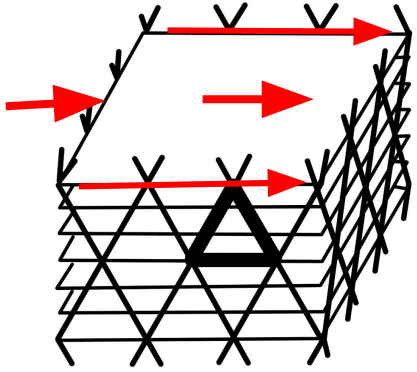
The diagrid acts like trusses on the four sides of facade.

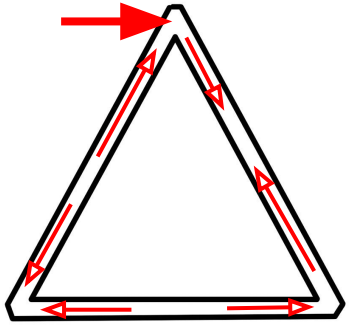






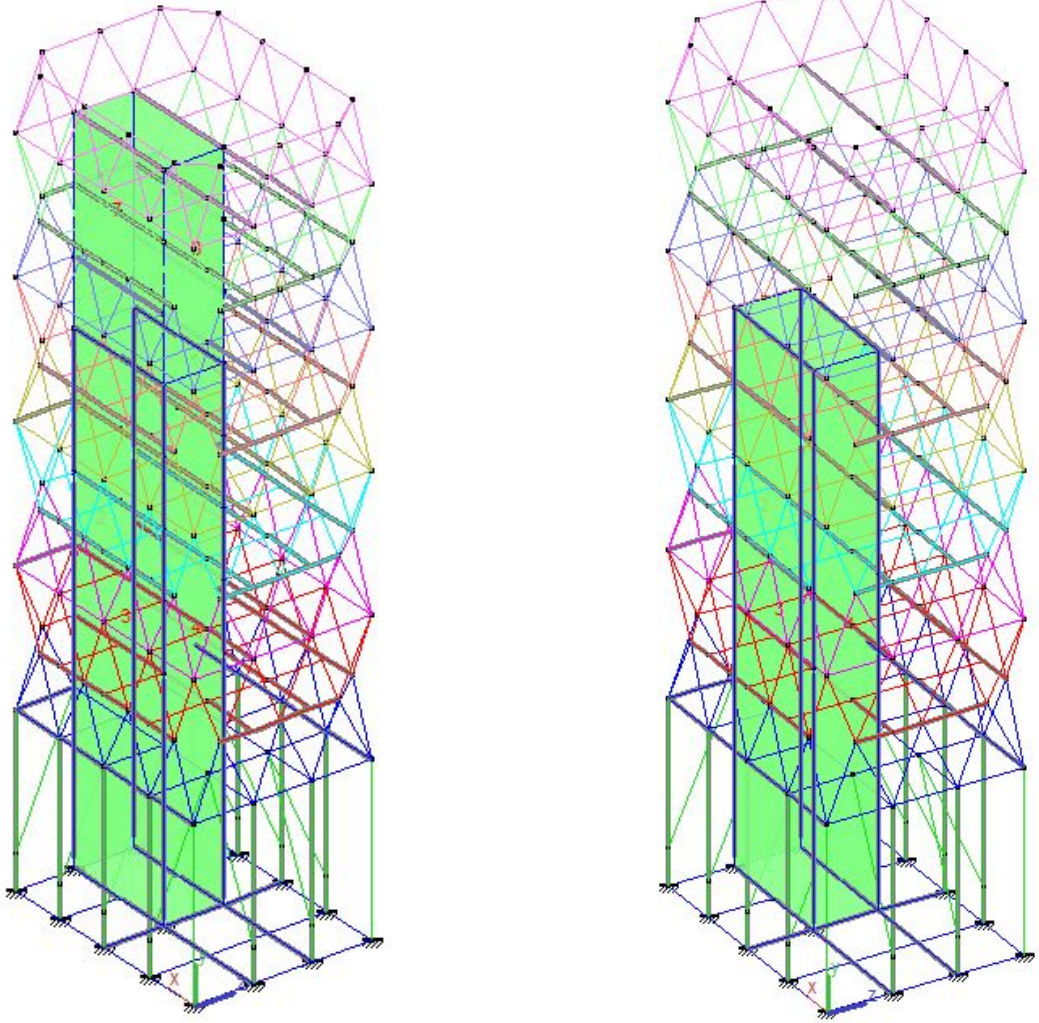


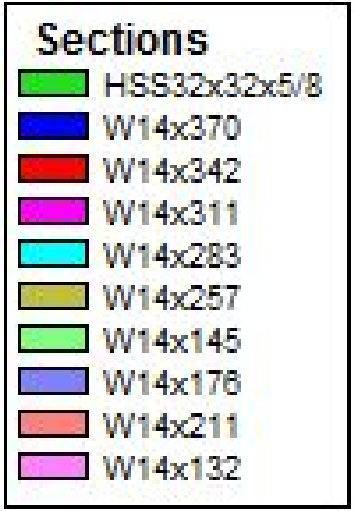




effect of overturning moment

effect of shear force

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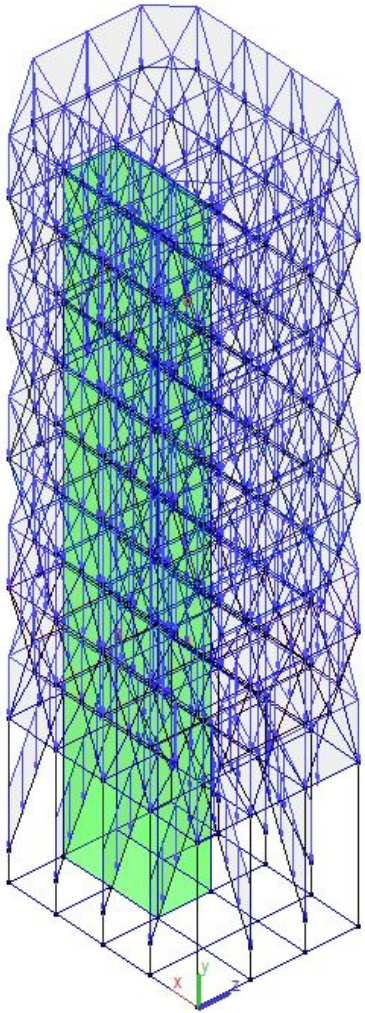
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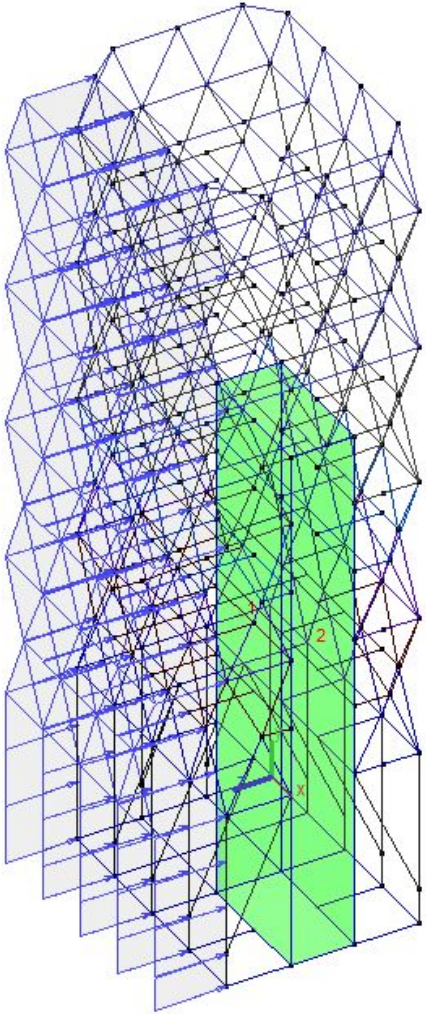
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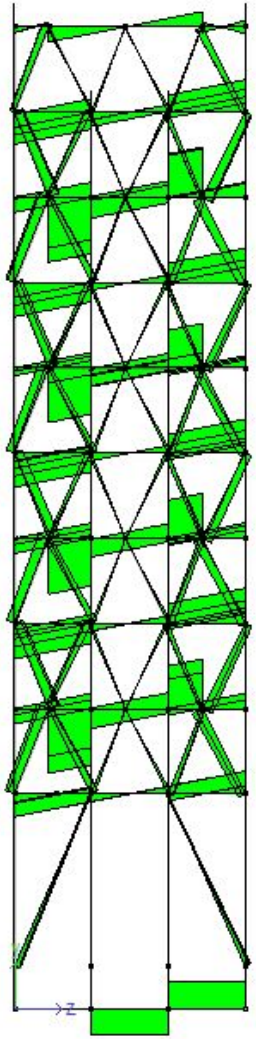

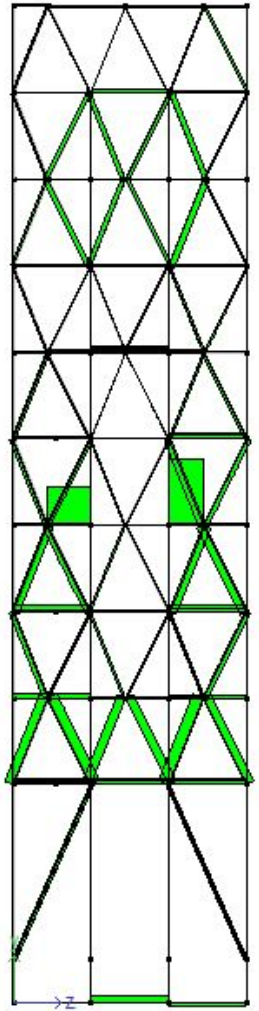

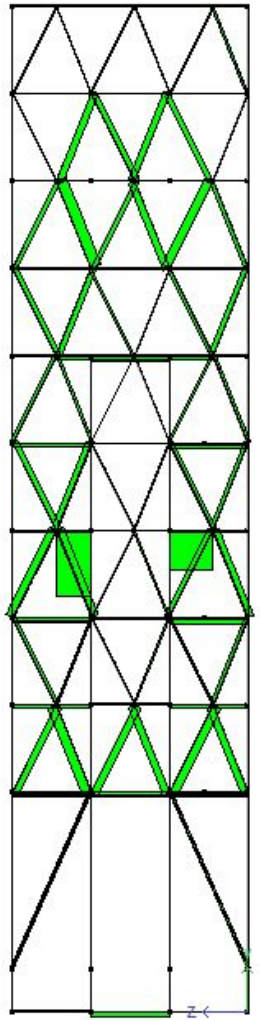

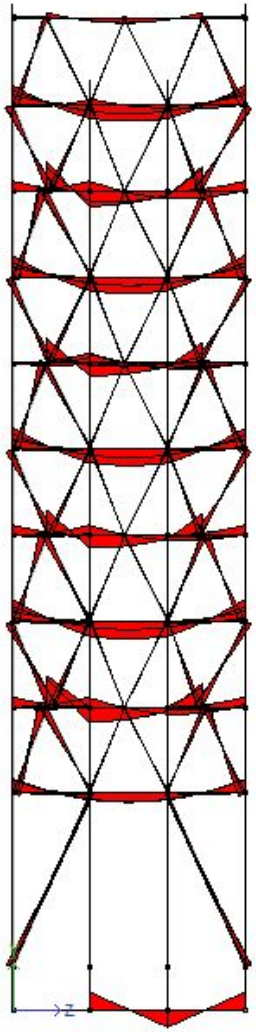

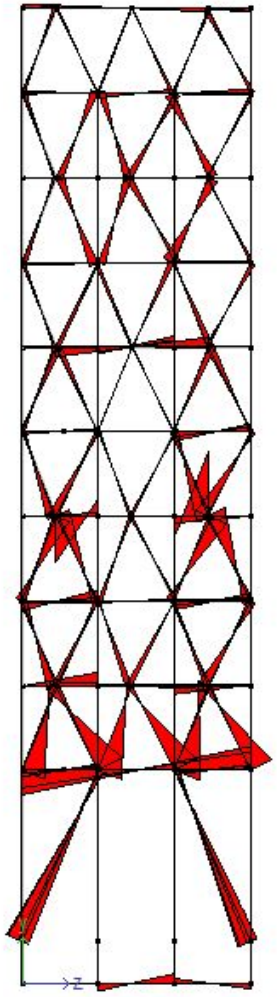

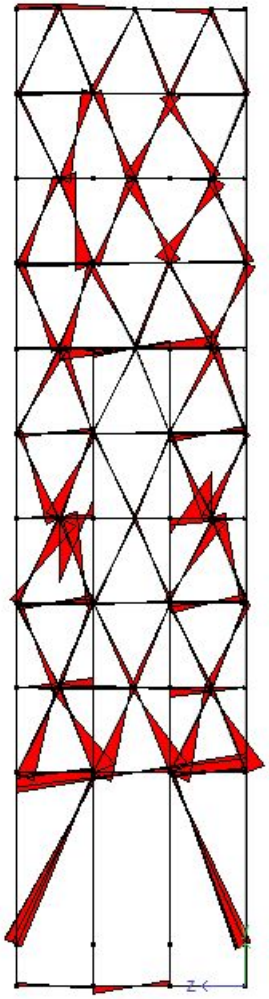

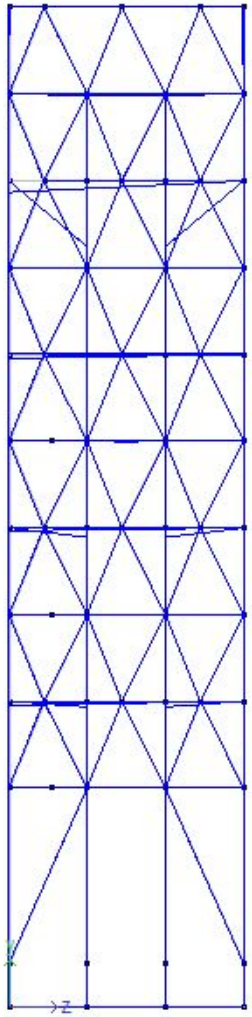

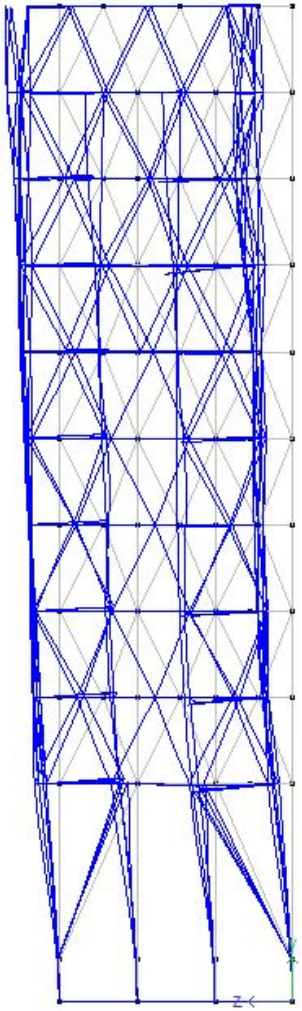

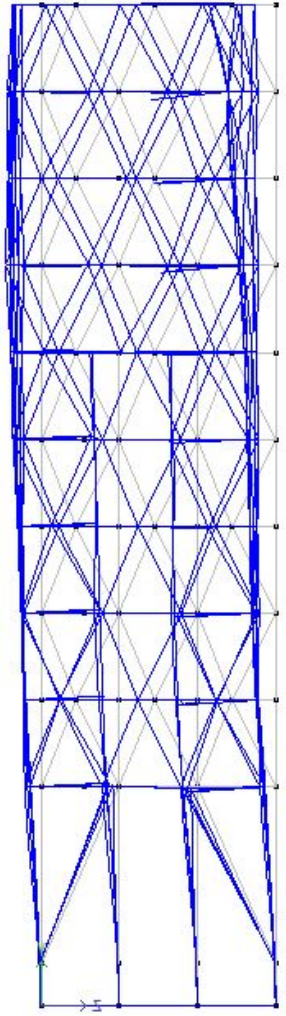

SOURCES

(Hearst Tower (Manhattan)- Wikipedia, the free encyclopedia)

("Flashback: Hearst Tower / Foster and Partners" 03 Feb 2012. ArchDaily. Accessed 29 Nov 2015. <http://www.archdaily.com/204701/flashback-hearst-tower-foster-and-partners/>)

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