



# The Evolution of Steel High-rise Towers in Asia

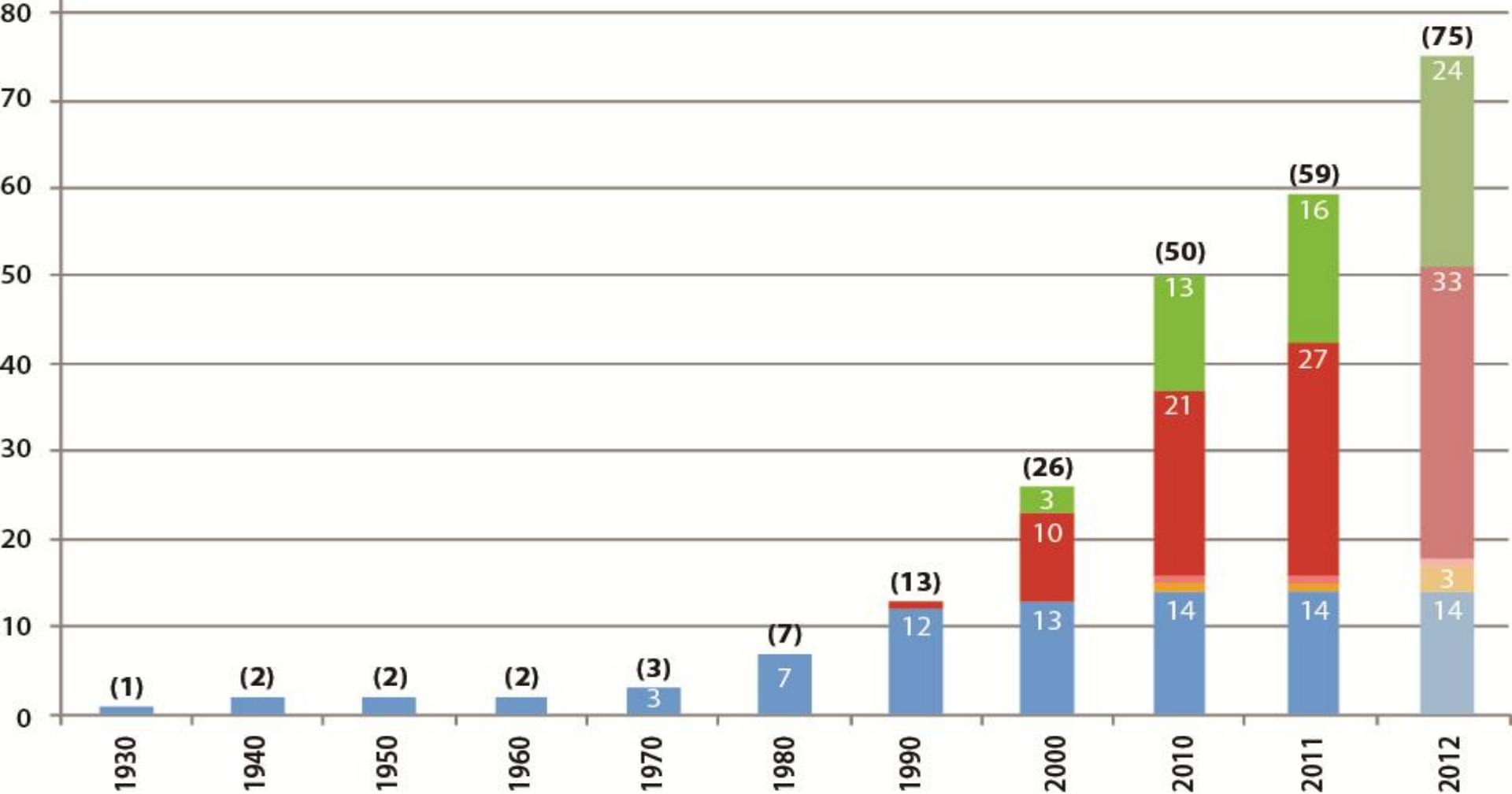
Craig Gibbons

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## Supertall buildings (300m+) by location





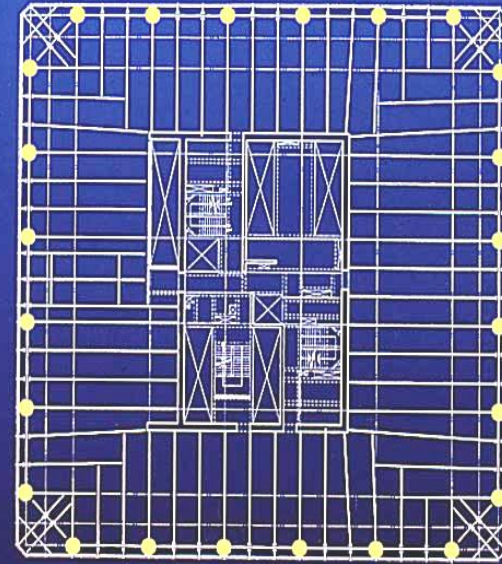




- 62 Storey, 290m tall
- Concrete Core
- Composite floor
- 3 levels of steel outriggers
- Steel Transfer structure

# Cheung Kong Center

- 24 Concrete Filled Tubes (CFT)
- 965 diameter (44/L to 58/L)
- 1220 diameter (24/L to 40/L)
- 1422 diameter (4/L to 22/L)



Level 32 - Plan  
Cheung Kong Center

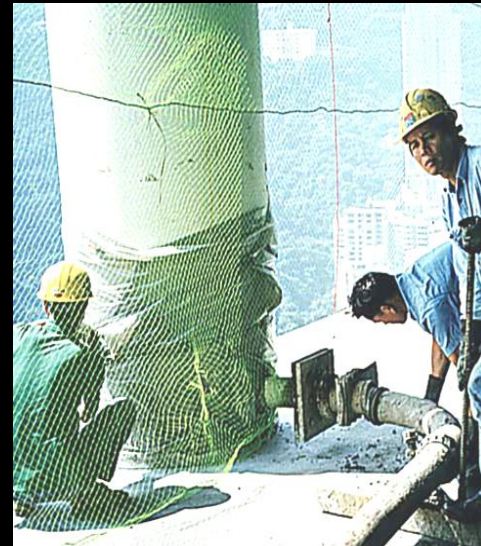
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# Cheung Kong Center



- No External Fire Protection
- D/t approx 70
- Retro pumping of Concrete
- Grade 60 self compacting concrete
- No formwork - improved crane efficiency







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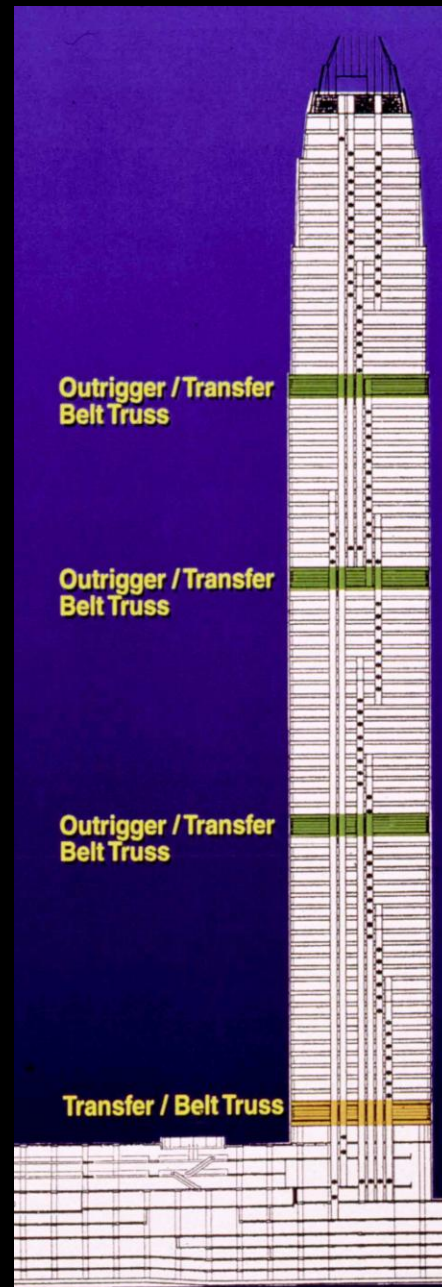


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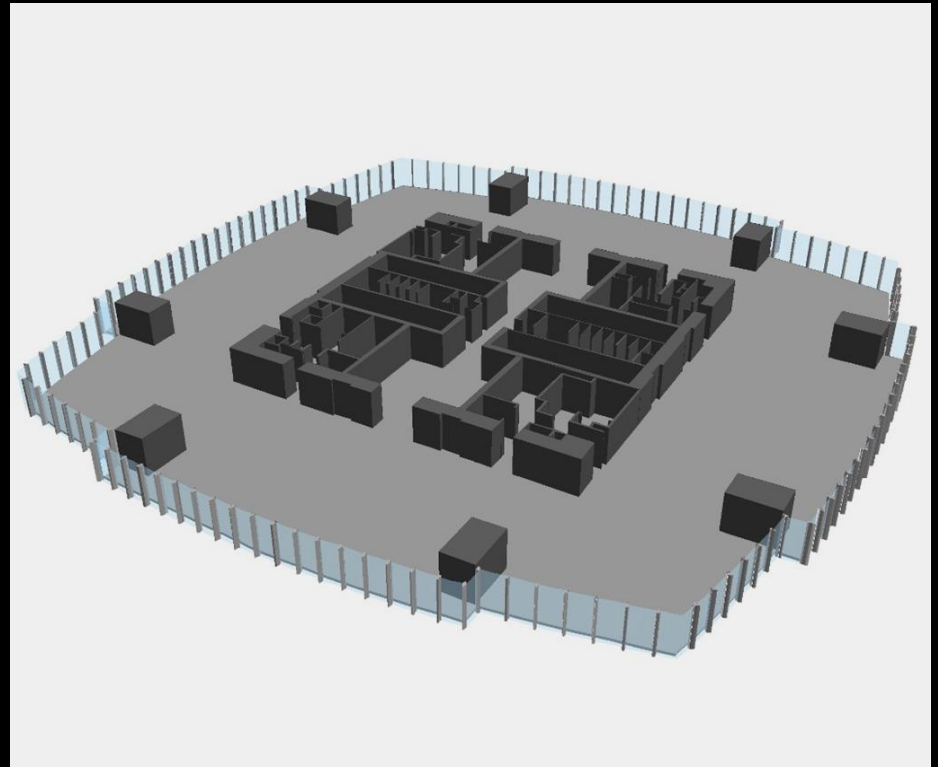
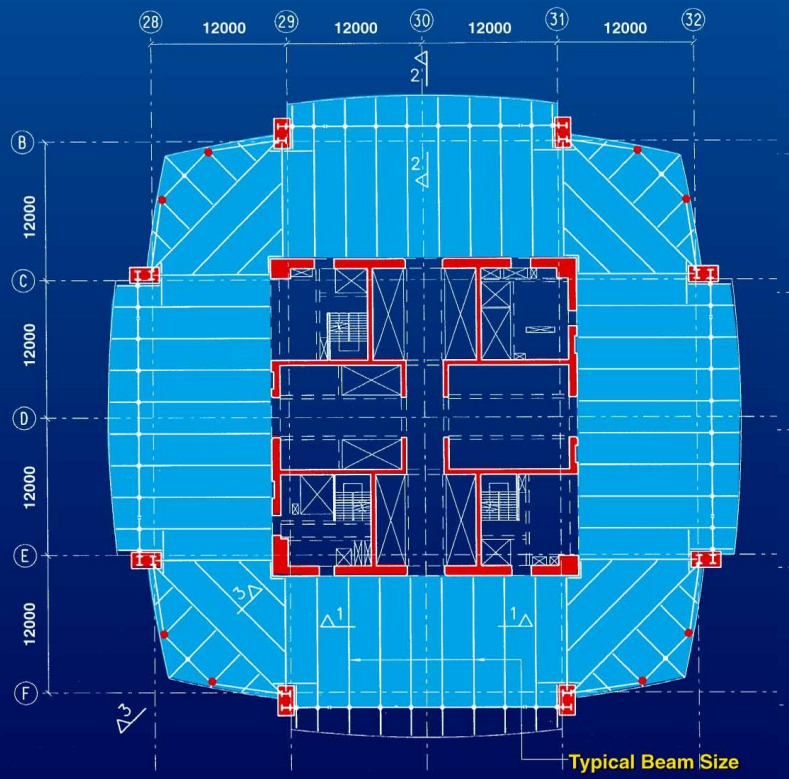




- Height – 420mPD (top of feature)
- 88 Storeys
- Concrete Core – Using 25% PFA
- Steel Outriggers at Three Levels
- Belt Truss at Four Levels
- Large Composite Megacolumns





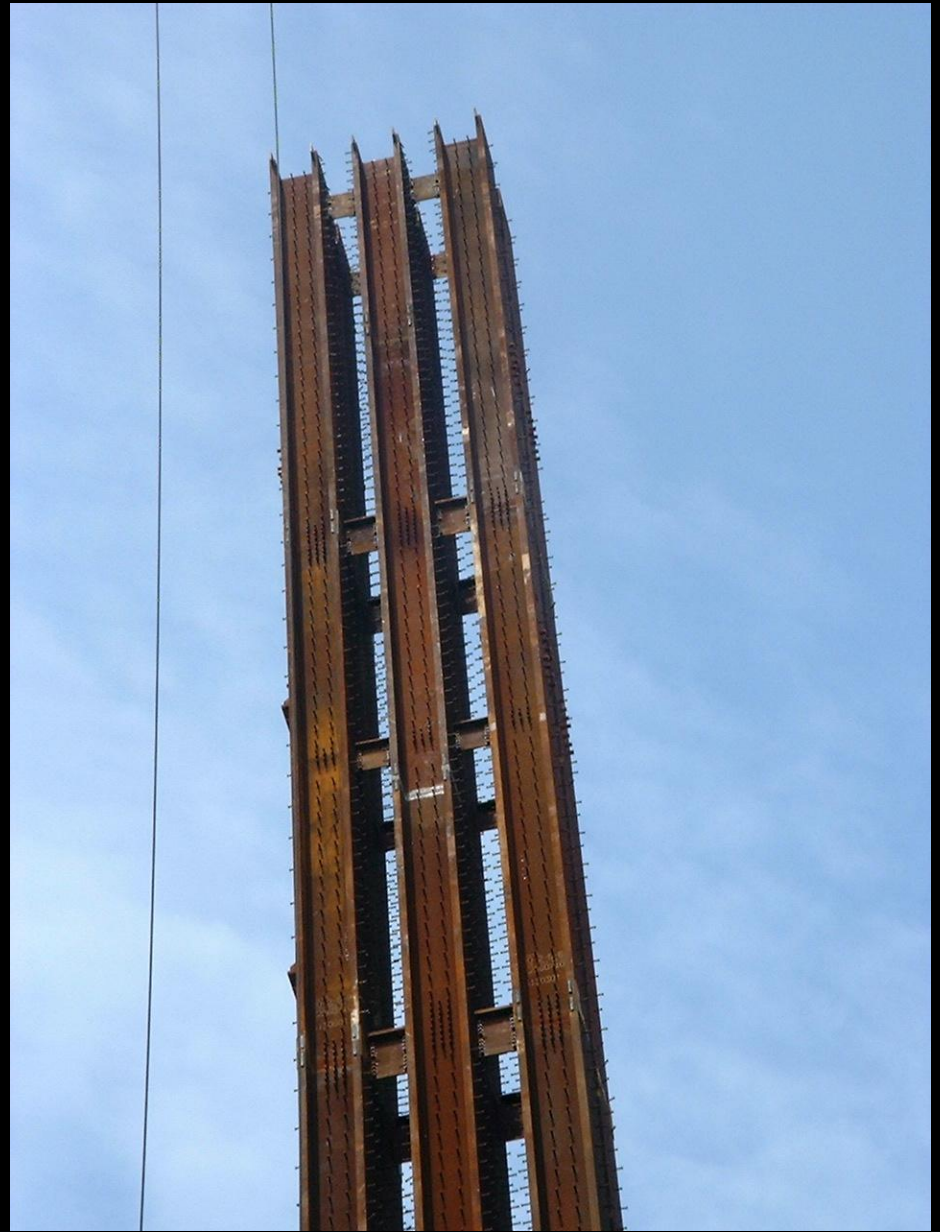






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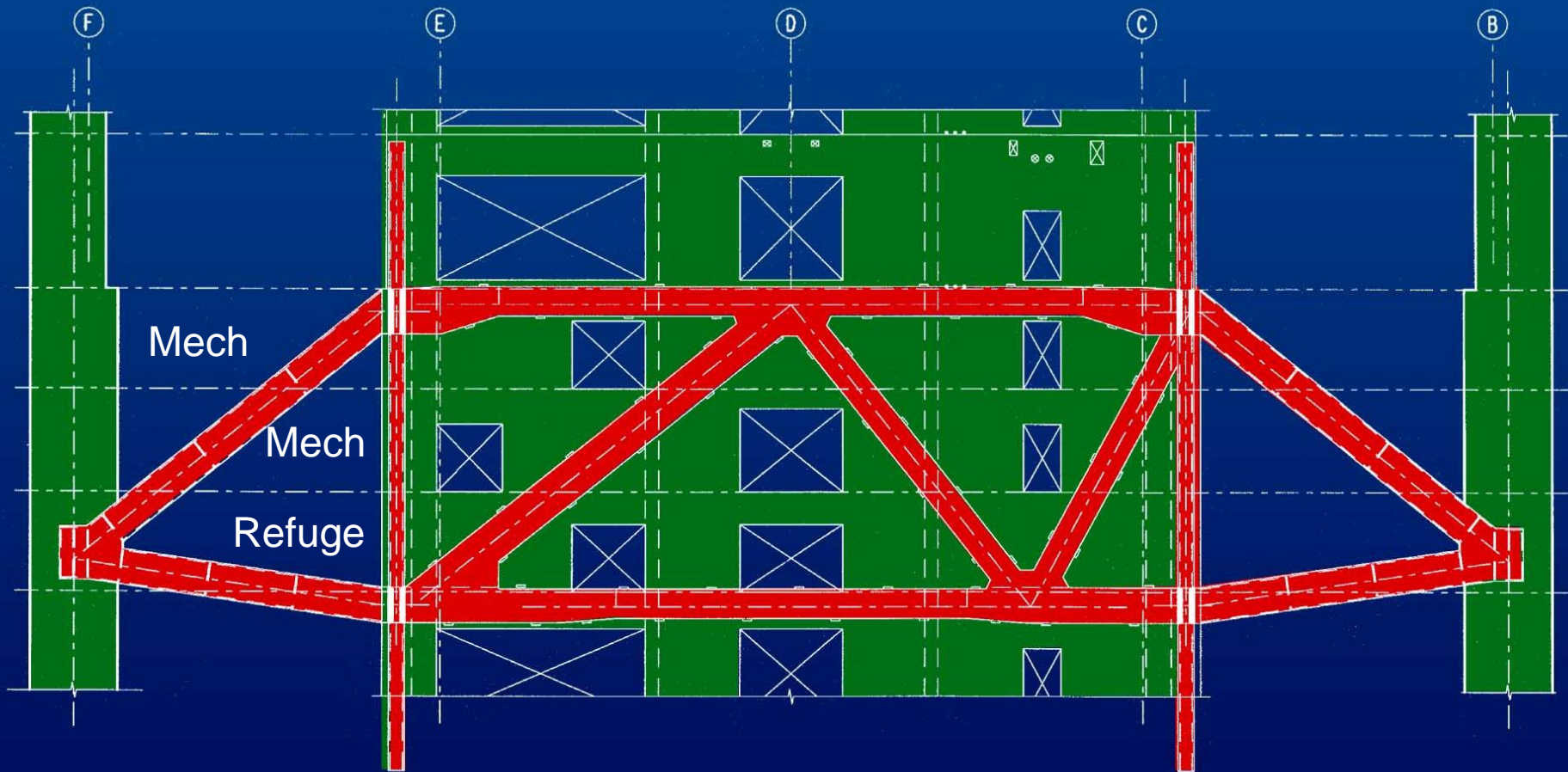




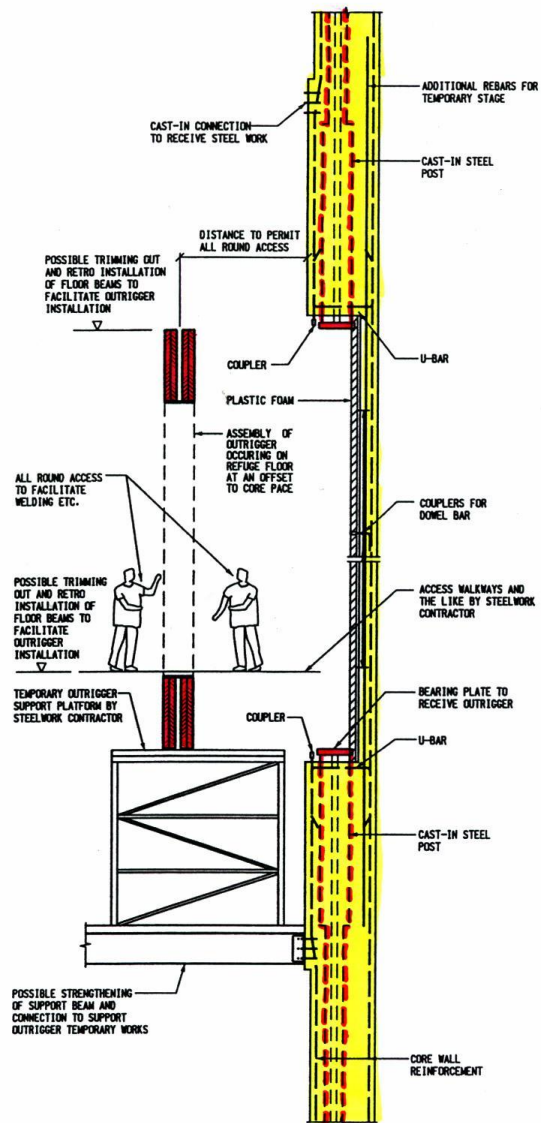
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# Outrigger Construction

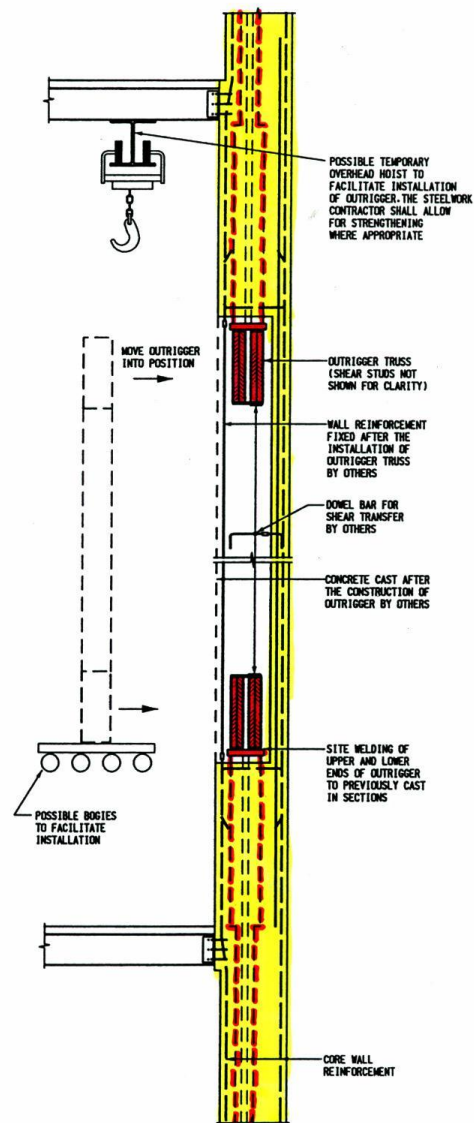






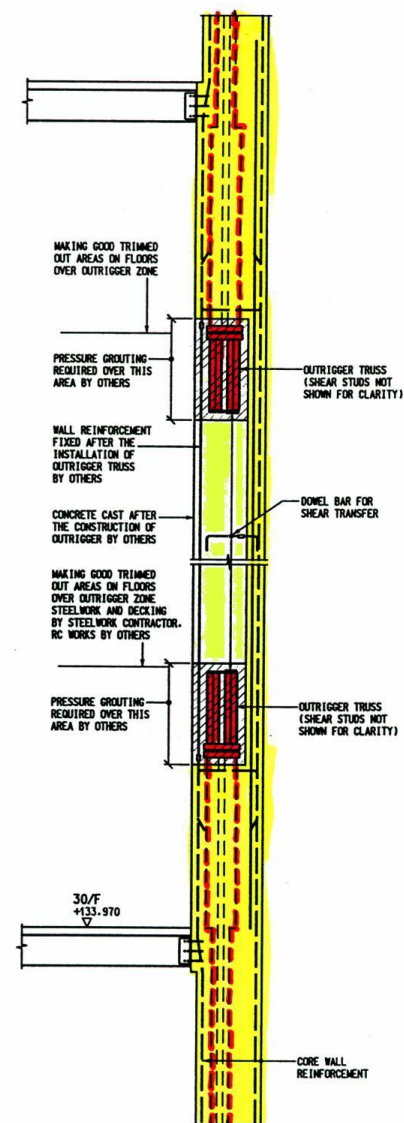
SECTION 1  
1:50 367

STAGE 1 - CONSTRUCTION OF TEMPORARY WALL AND CAST-IN STEEL BEARING POST



SECTION 1  
1:50 367

STAGE 2 - INSTALLATION OF OUTRIGGER TRUSS



SECTION 1  
1:50 367

STAGE 3 - CONCRETING OF THE BOX OUT CORE WALL





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CCTV Headquarter, Beijing – OMA



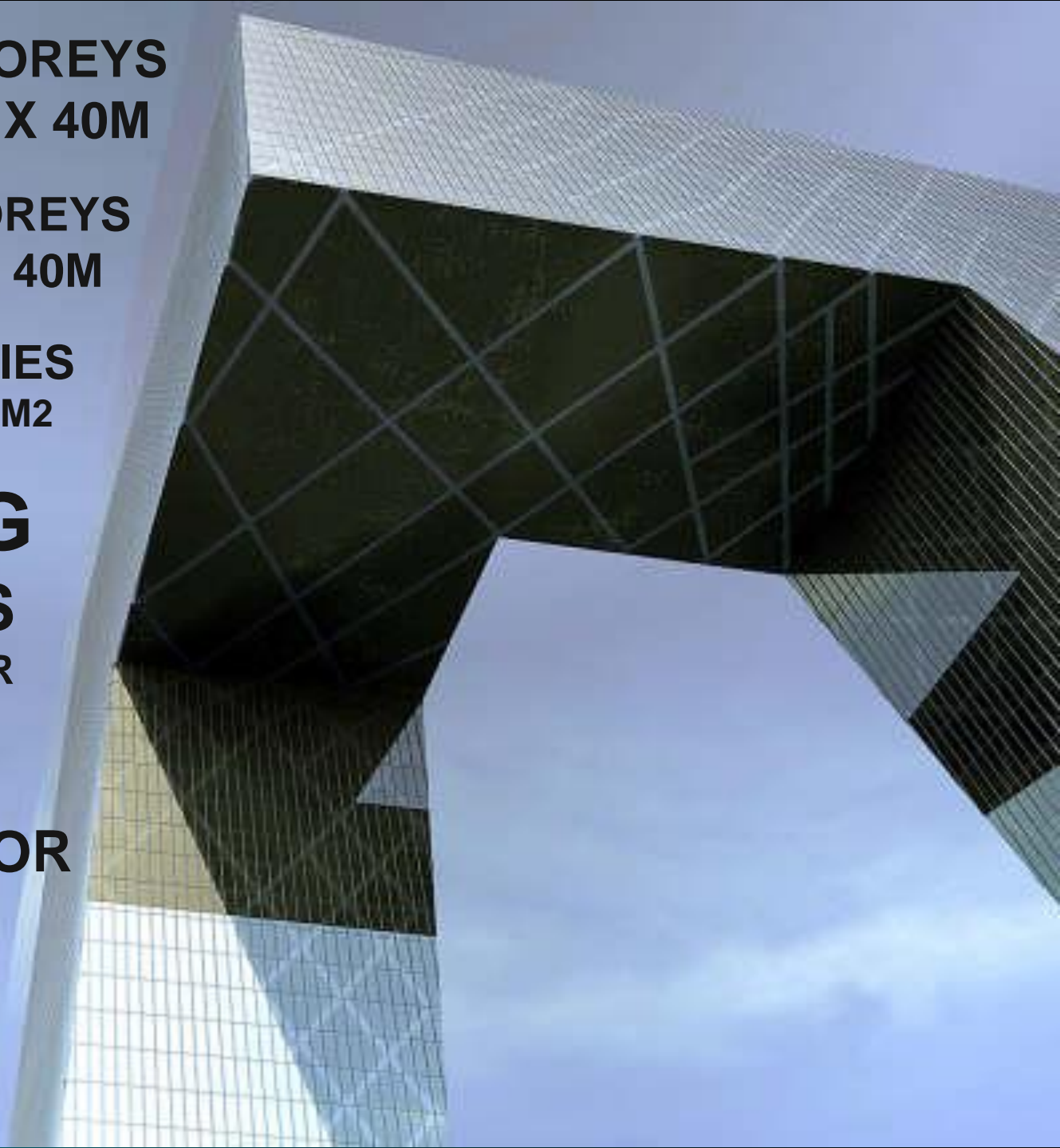
**TOWER 1 // 51 STOREYS  
234M TALL // 60M X 40M**

**TOWER 2 // 44 STOREYS  
210M TALL // 52M X 40M**

**PODIUM // 10 STORIES  
LARGEST STUDIO 2000M<sup>2</sup>**

**OVERHANG  
9-15 STOREYS  
75M MAX CANTILEVER  
SOFFIT AT +162M**

**457,000m<sup>2</sup> FLOOR  
AREA**

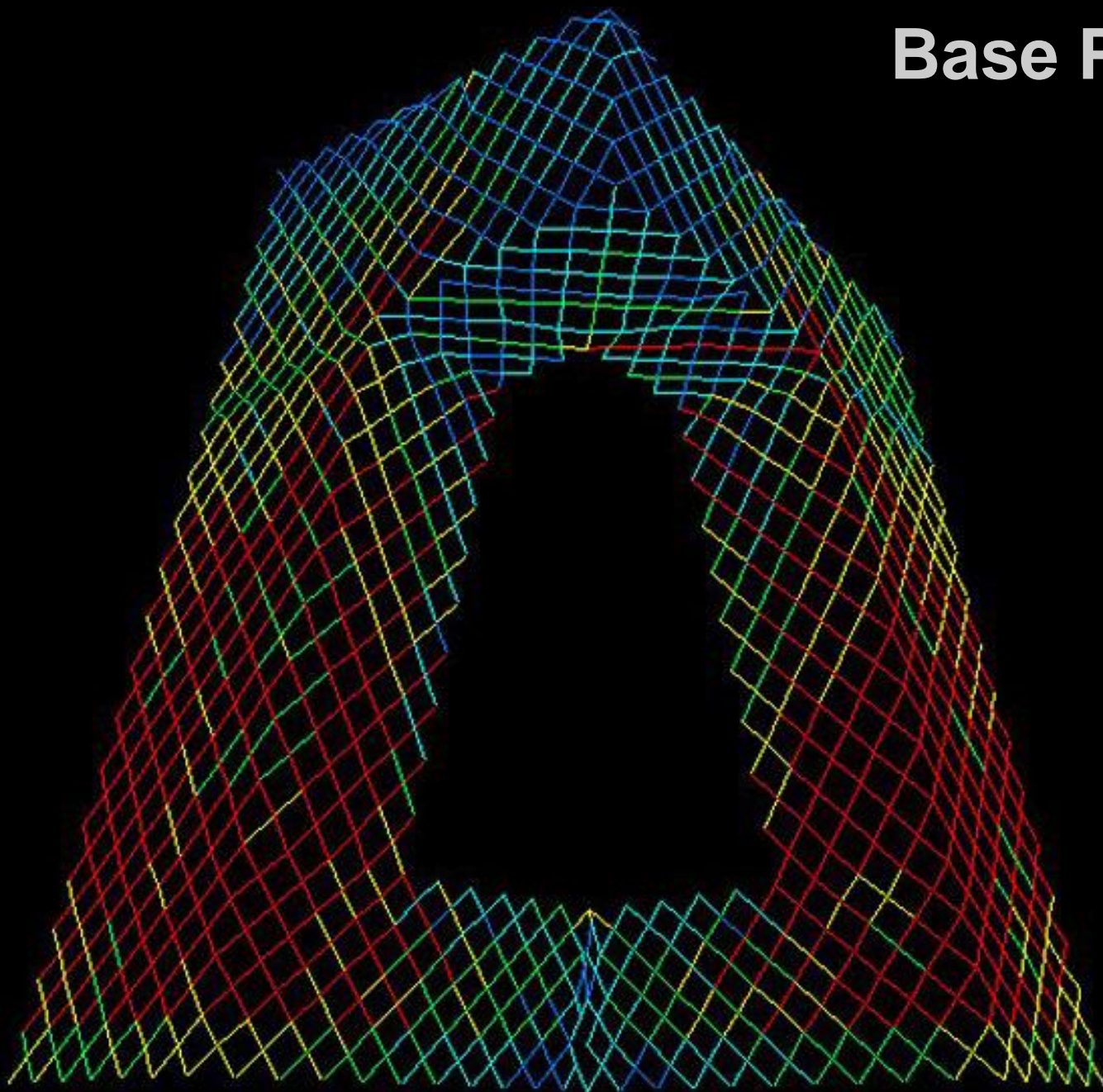






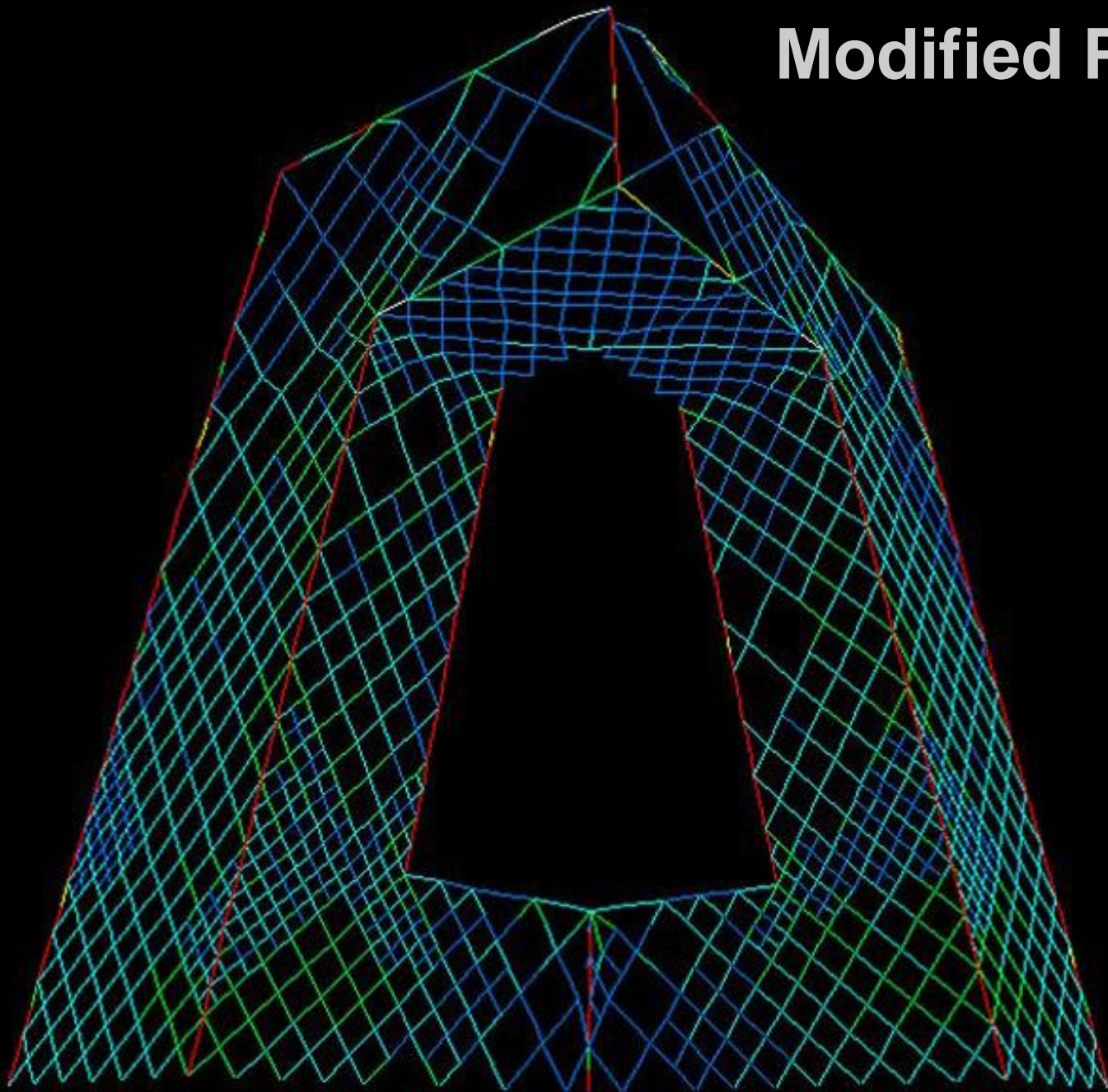


# Base Pattern





# Modified Pattern



0.00

0.50

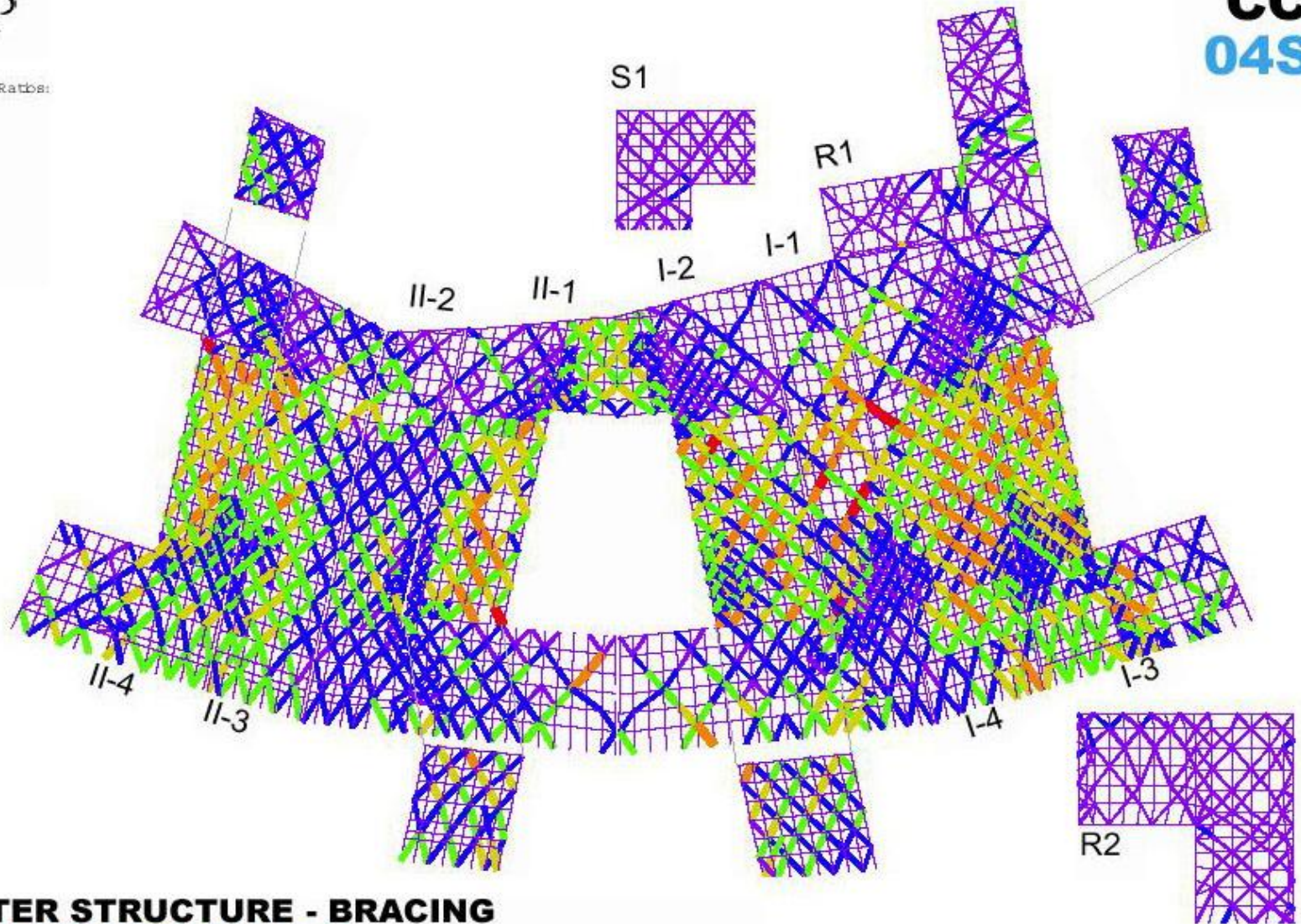
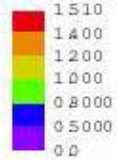
1.00

2.00

3.00

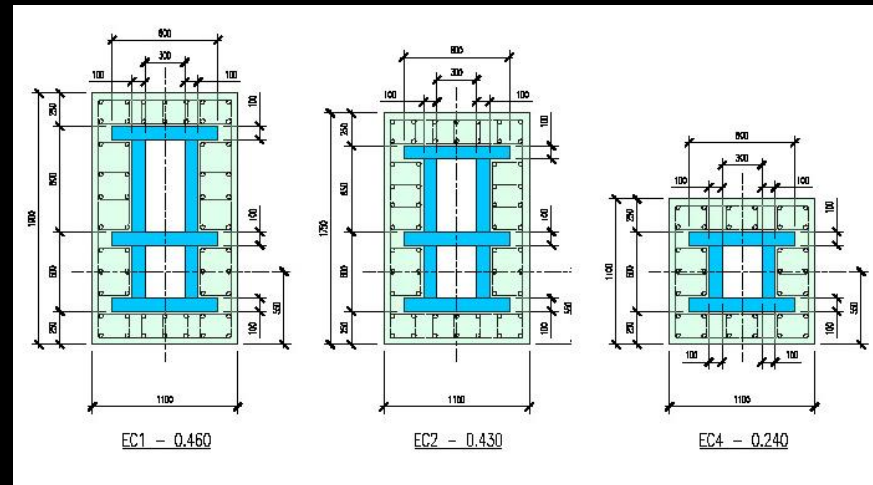
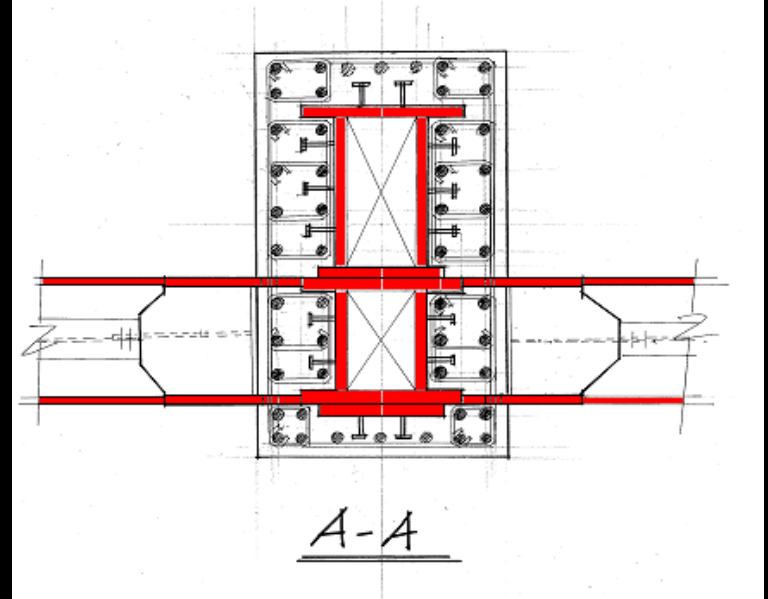
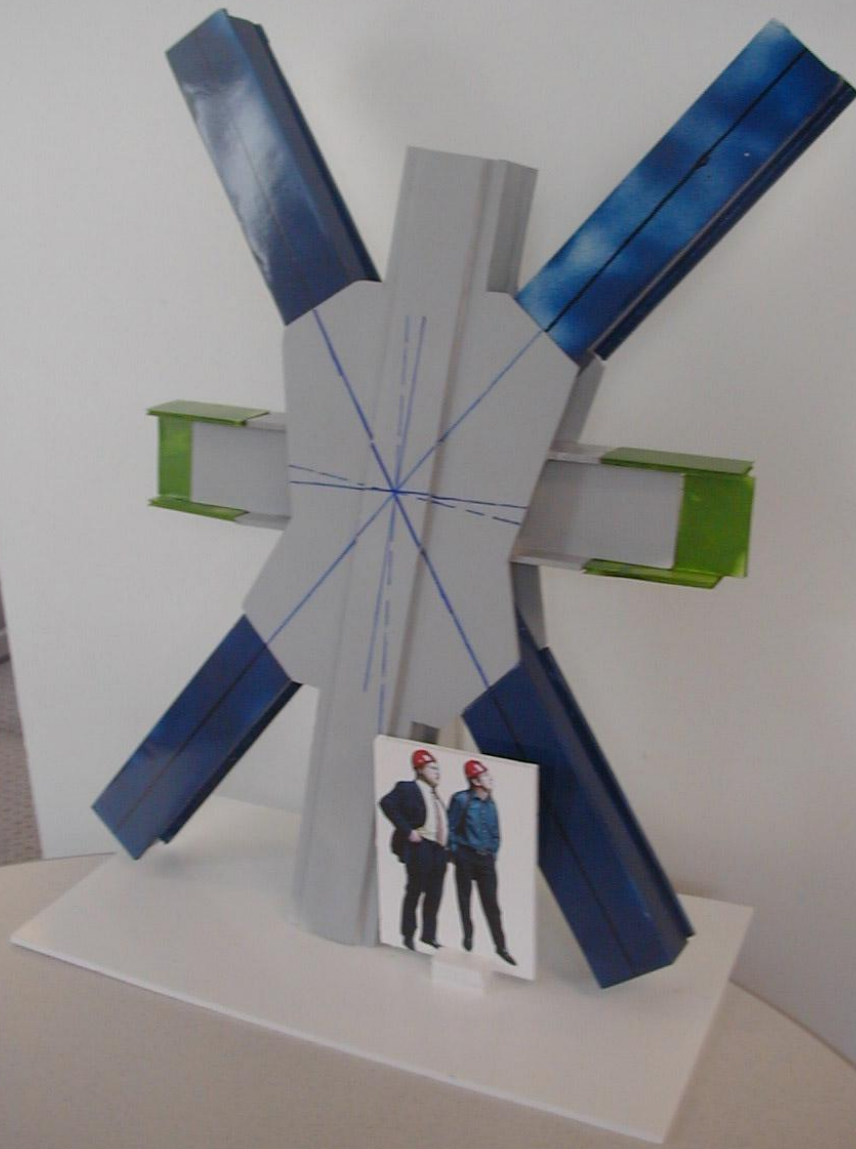


Dem and Capacity Ratios:



**PERIMETER STRUCTURE - BRACING**  
**DEMAND/CAPACITY RATIOS**  
**SEISMIC LEVEL 2 EVENT**







# Code Compliance

	Non-compliance
<b>Overall</b>	
Height (260m for braced tube)	✓
Multi-Tower	X
Tower Linkage	X
<b>Planar Irregularities</b>	
Torsional Irregularity	X
Re-entrant Corners	X
Diaphragm Discontinuity	✓
<b>Vertical Irregularities</b>	
Soft Storey	X
Weak Storey	X
Discontinuity in Vertical Lateral-load-resisting Element	X











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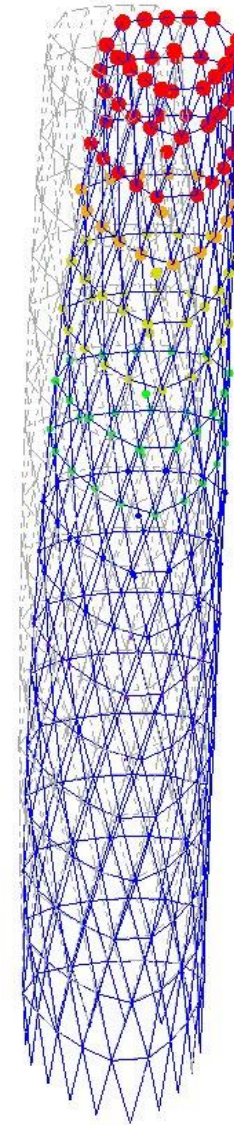


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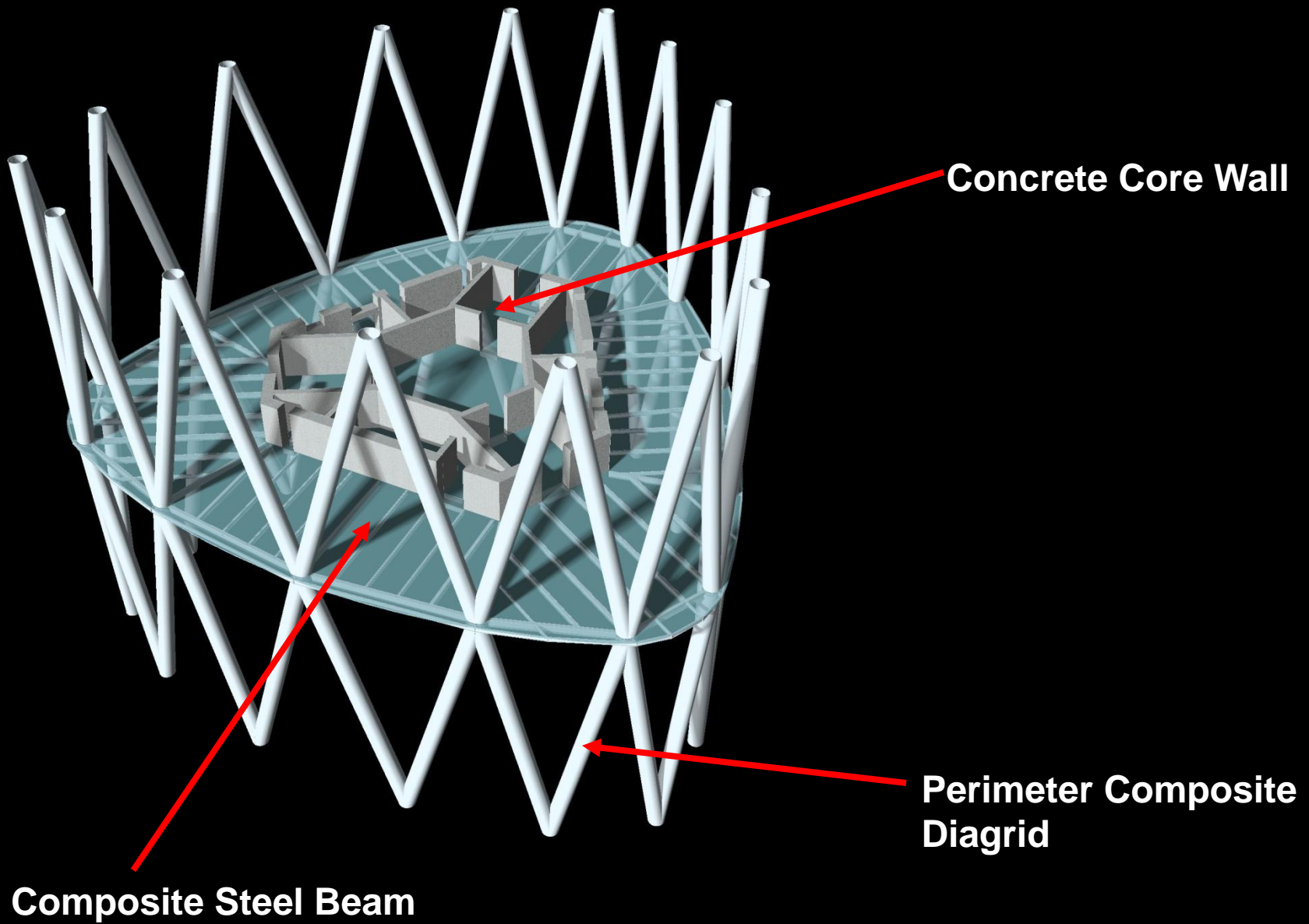


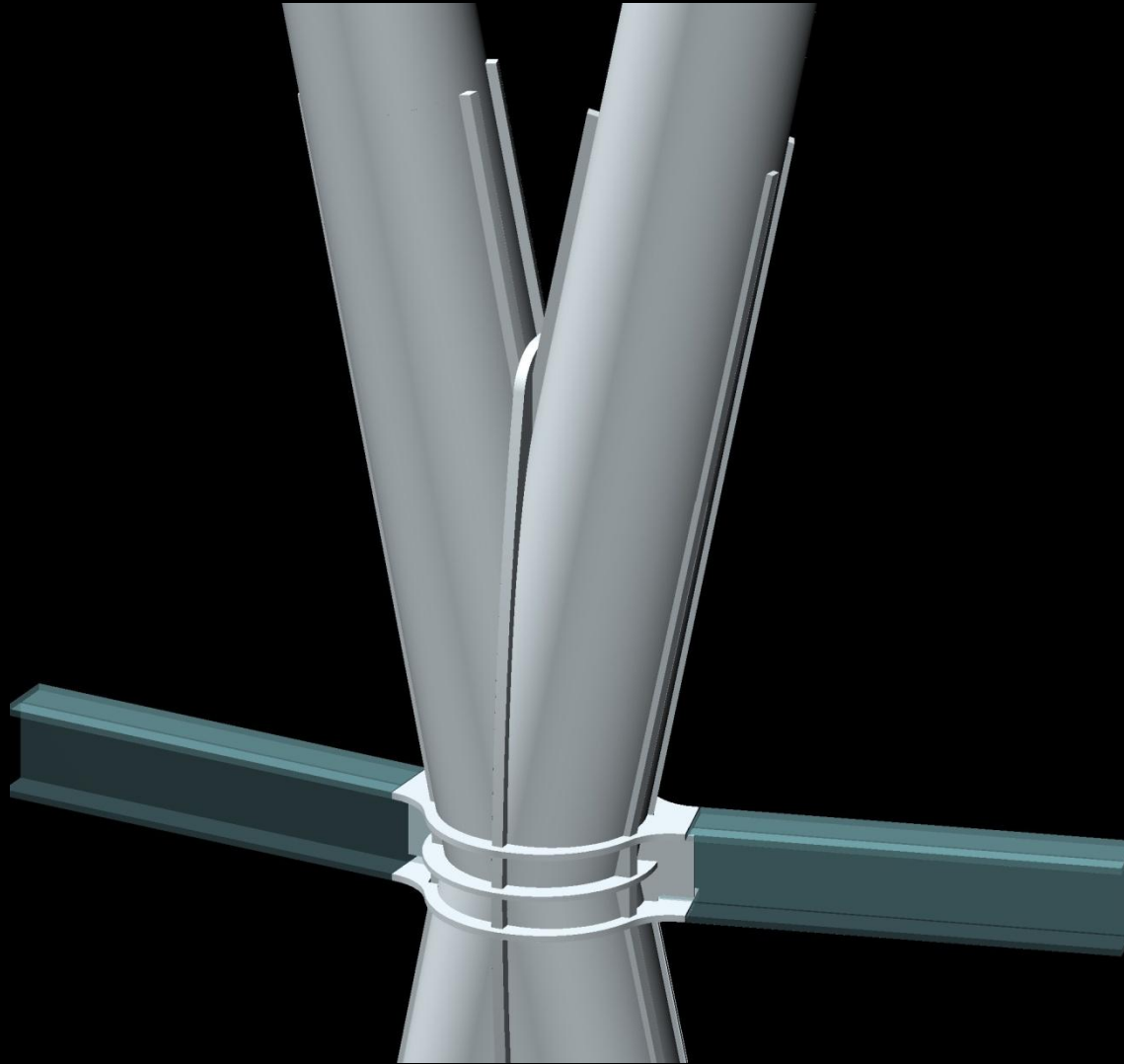




Element list: not 1 to 1 24  
Scale: 1:1656.  
Deformation magnification: 25.00  
Translation, Ux: 2500. mm/pic.cm  
781 mm  
670 mm  
560 mm  
449 mm  
338 mm  
228 mm  
117 mm  
7 mm  
Case: A1 : "Wind X"  
Case: L1 : "Wind X"



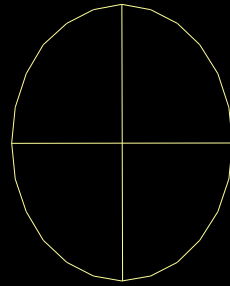








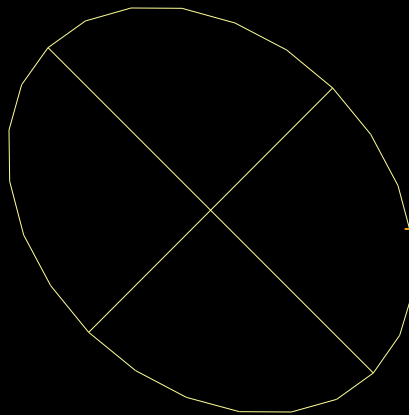
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40.5m x 54m



20.65m x ~27.5m



60m x 80m

