

STEEL STRUCTURES FOR BUILDING IN CHINA

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JULY 6, 2012

LONDON

1. STEEL AND STEEL STRUCTURES IN CHINA

2. SOME PROJECTS OF STEEL STRUCTURES FOR HIGH-
RISE BUILDINGS IN CHINA

STEEL AND STEEL STRUCTURES IN CHINA

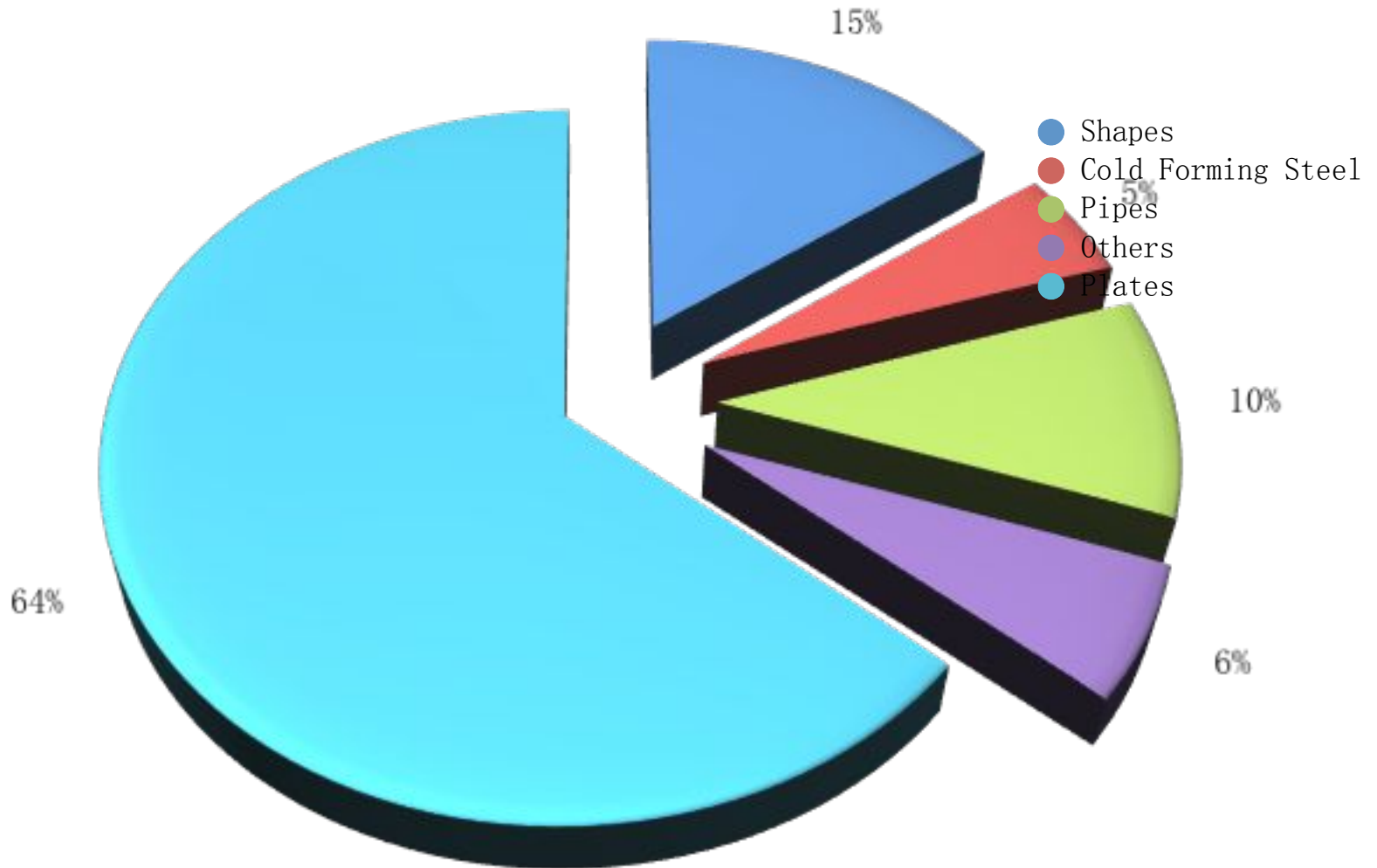
The products of raw steel are about 565 million tons in 2009, 626 million tons in 2010 and 683 million tons in 2011, the highest in the history.

There are more than 5,000 steel construction companies in China now.

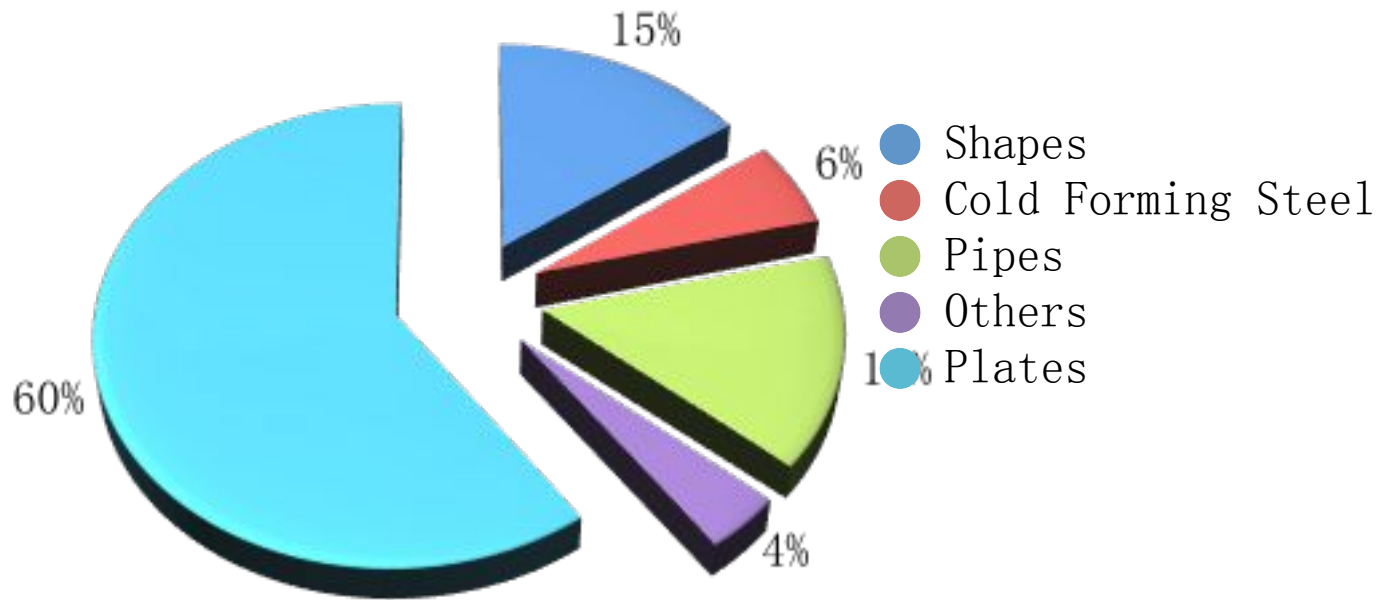
The products of steel structures are about 20 million tons in 2008 , 23 million tons in 2009 , 26 million tons in 2010 and 30 million tons in 2011.

The products of steel structures based on the data from 200 big qualified steel construction companies are about 12 million tons in 2009 , 13 million tons in 2010 and 15 million tons in 2011.

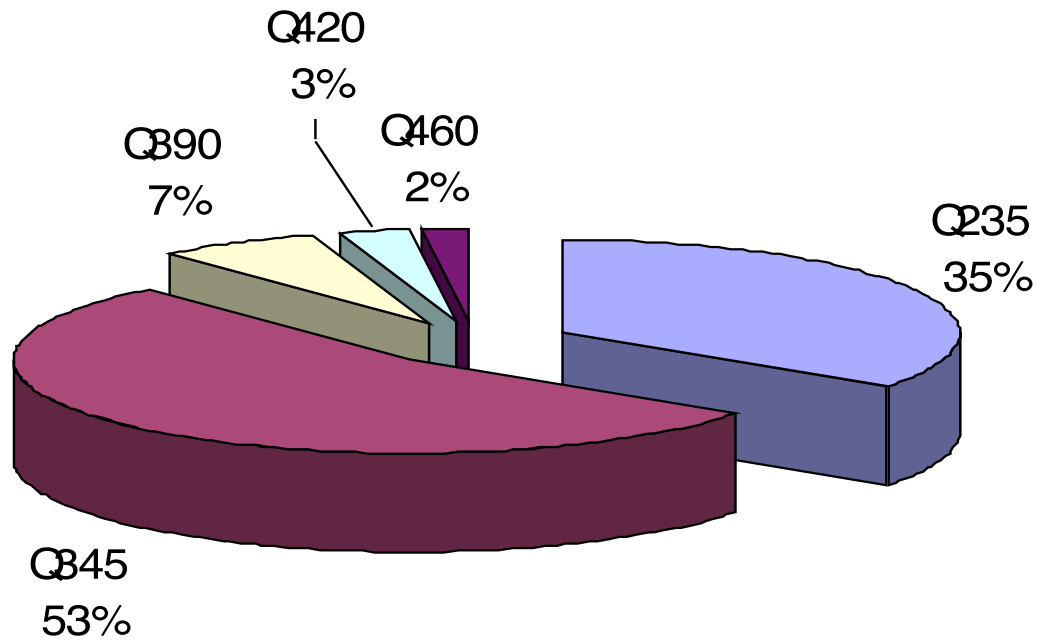
STEEL MATERIALS IN 2009



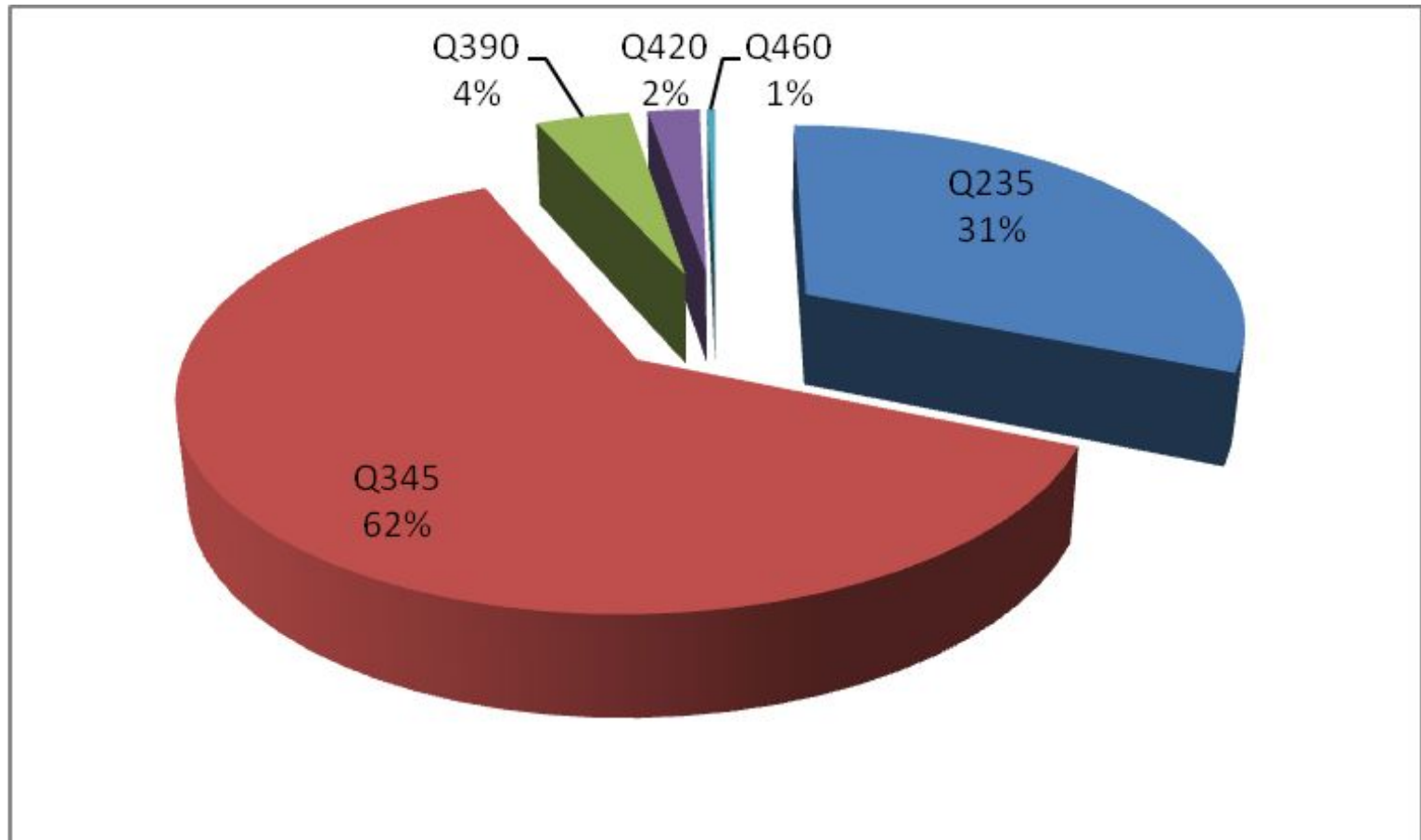
STEEL MATERIALS IN 2010



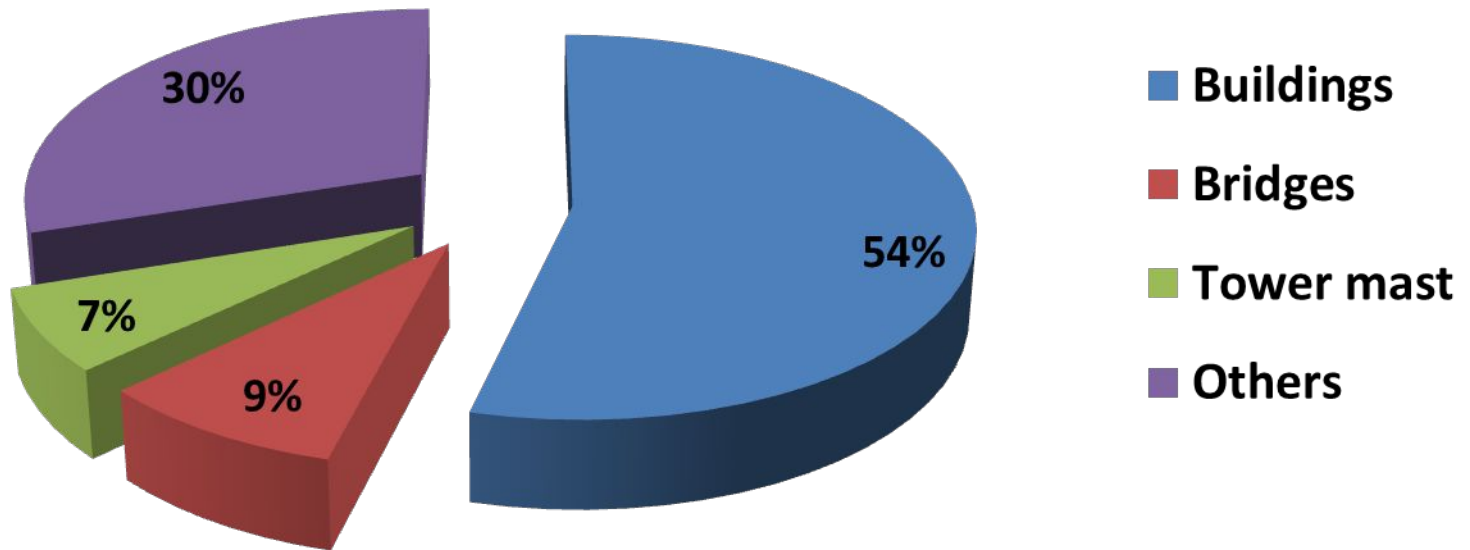
STEEL GRADE IN 2009



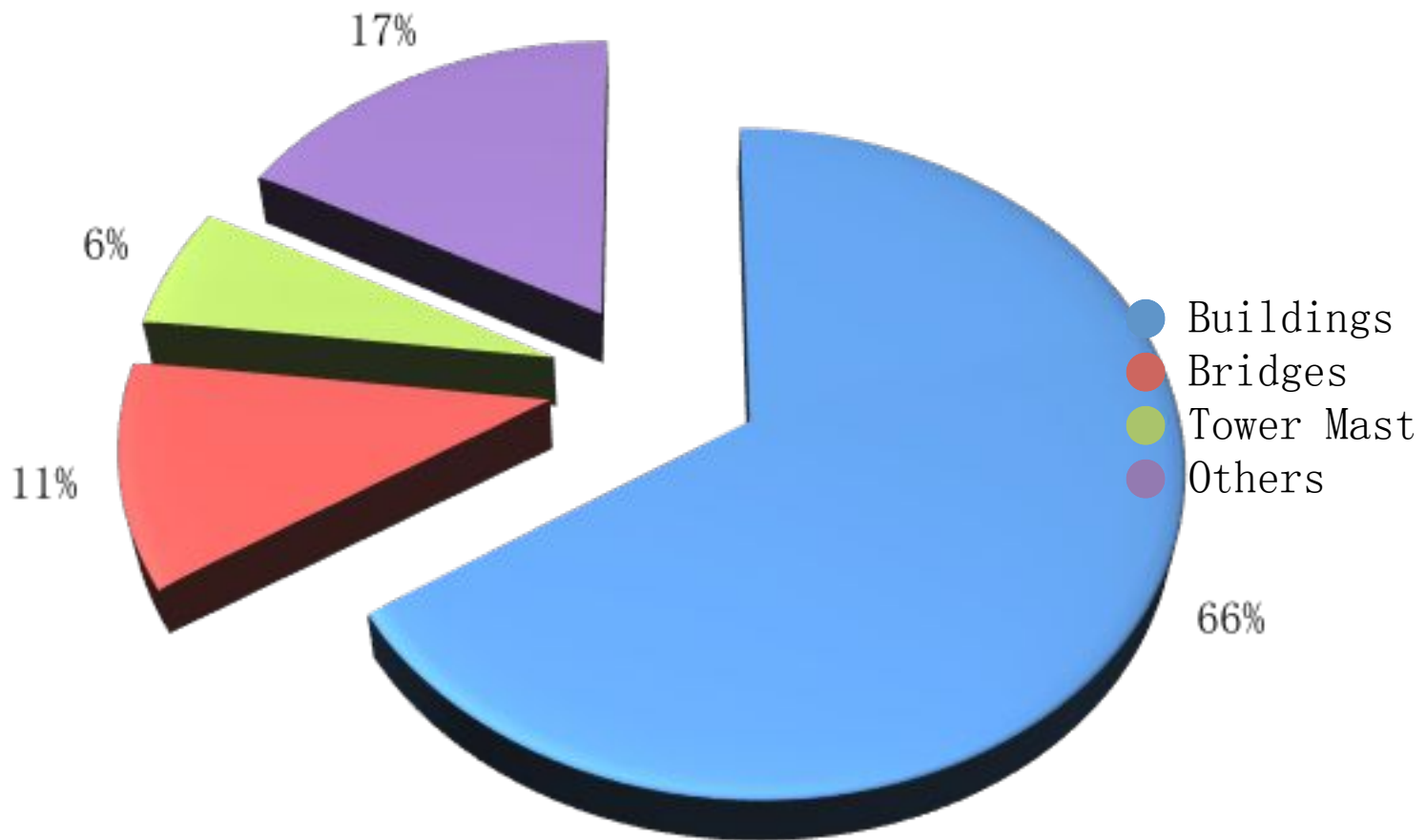
STEEL GRADE IN 2010



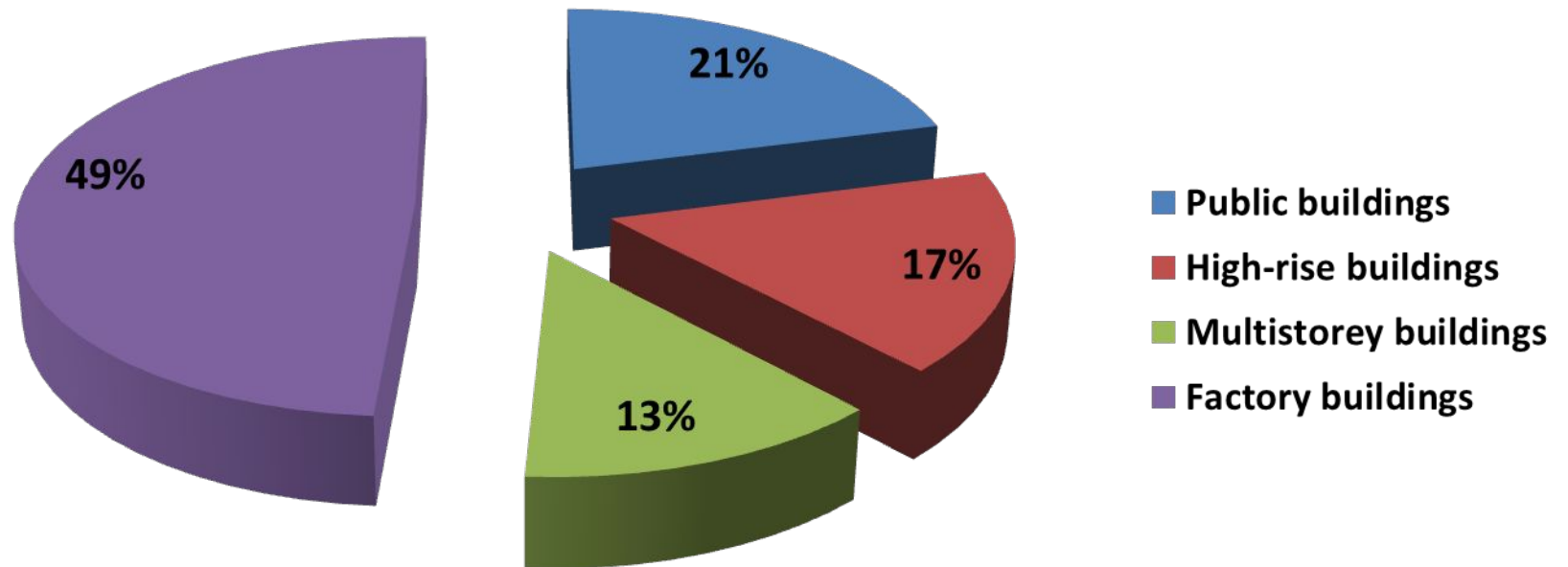
STRUCTURES IN 2009



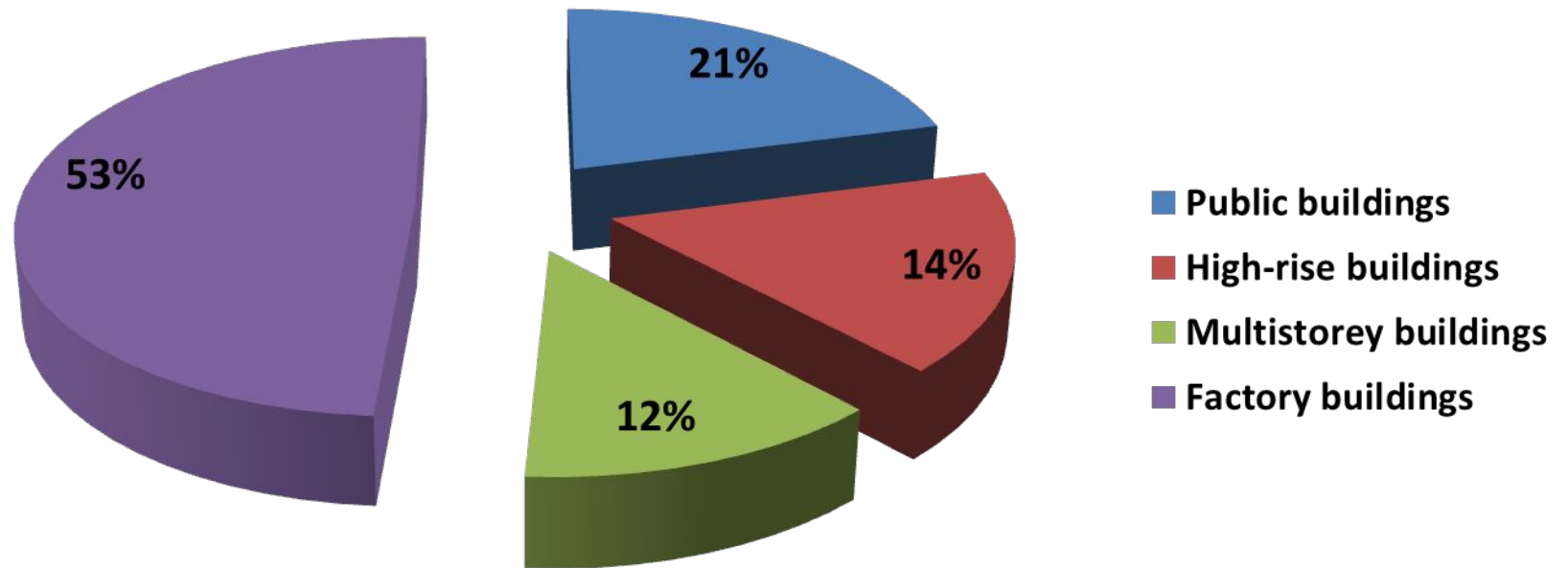
STRUCTURES IN 2010



BUILDING STRUCTURES IN 2009



BUILDING STRUCTURES IN 2010



HIGH STRENGTH LOW ALLOY STRUCTURAL STEELS

GB/T 1951-2008

CHEMICAL COMPOSITIONS

牌 号	质量等级	化学成分 ^{a,b} (质量分数)/%														
		C	Si	Mn	P	S	Nb	V	Ti	Cr	Ni	Cu	N	Mo	B	Als
		不大于													不小于	
Q345	A	≤0.20	≤0.50	≤1.70	0.035	0.035	0.07	0.15	0.20	0.30	0.50	0.30	0.012	0.10	—	—
	B				0.035	0.035										
	C				0.030	0.030										
	D	0.030			0.025											
	E	≤0.18			0.025	0.020										
Q390	A	≤0.20	≤0.50	≤1.70	0.035	0.035	0.07	0.20	0.20	0.30	0.50	0.30	0.015	0.10	—	—
	B				0.035	0.035										
	C				0.030	0.030										
	D				0.030	0.025										
	E				0.025	0.020										
Q420	A	≤0.20	≤0.50	≤1.70	0.035	0.035	0.07	0.20	0.20	0.30	0.80	0.30	0.015	0.20	—	—
	B				0.035	0.035										
	C				0.030	0.030										
	D				0.030	0.025										
	E				0.025	0.020										
Q460	C	≤0.20	≤0.60	≤1.80	0.030	0.030	0.11	0.20	0.20	0.30	0.80	0.55	0.015	0.20	0.004	0.015
	D				0.030	0.025										
	E				0.025	0.020										
Q500	C	≤0.18	≤0.60	≤1.80	0.030	0.030	0.11	0.12	0.20	0.60	0.80	0.55	0.015	0.20	0.004	0.015
	D				0.030	0.025										
	E				0.025	0.020										

CHEMICAL COMPOSITIONS

牌 号	质量等级	化学成分 ^a (质量分数)/%														
		C	Si	Mn	P	S	Nb	V	Ti	Cr	Ni	Cu	N	Mo	B	Als
		不大于														不小于
Q550	C				0.030	0.030										
	D	≤0.18	≤0.60	≤2.00	0.030	0.025	0.11	0.12	0.20	0.80	0.80	0.80	0.015	0.30	0.004	0.015
	E				0.035	0.020										
Q620	C				0.030	0.030										
	D	≤0.18	≤0.60	≤2.00	0.030	0.025	0.11	0.12	0.20	1.00	0.80	0.80	0.015	0.30	0.004	0.015
	E				0.025	0.020										
Q690	C				0.030	0.030										
	D	≤0.18	≤0.60	≤2.00	0.030	0.025	0.11	0.12	0.20	1.00	0.80	0.80	0.015	0.30	0.004	0.015
	E				0.025	0.020										

^a 型材及棒材 P,S 含量可提高 0.005%, 其中 A 级钢上限可为 0.045%。

^b 当细化晶粒元素组合加入时, $20(\text{Nb} + \text{V} + \text{Ti}) \leq 0.22\%$, $30(\text{Mo} + \text{Cr}) \leq 0.30\%$ 。

STRENGTHS

牌号	质量等级	拉伸试验 ^{a,b,c}																					
		以下公称厚度(直径,边长)下屈服强度(R_{eL})/								以下公称厚度(直径,边长)抗拉强度(R_m)/								断后伸长率(A)/%					
		MPa								MPa								公称厚度(直径,边长)					
		≤ 16 mm	>16 mm ~ 40 mm	>40 mm ~ 63 mm	>63 mm ~ 80 mm	>80 mm ~ 100 mm	>100 mm ~ 150 mm	>150 mm ~ 200 mm	>200 mm ~ 250 mm	>250 mm	≤ 40 mm	>40 mm ~ 63 mm	>63 mm ~ 80 mm	>80 mm ~ 100 mm	>100 mm ~ 150 mm	>150 mm ~ 250 mm	>250 mm	≤ 40 mm	>40 mm ~ 63 mm	>63 mm ~ 100 mm	>100 mm ~ 150 mm	>150 mm ~ 250 mm	>250 mm
Q500	C									610~	600~	590~	540~										
	D	≥ 500	≥ 480	≥ 470	≥ 450	≥ 440	—	—	—	—	610~ 770	600~ 760	590~ 750	540~ 730	—	—	—	≥ 17	≥ 17	≥ 17	—	—	—
	E																						
Q550	C									670~	620~	600~	590~										
	D	≥ 550	≥ 530	≥ 520	≥ 500	≥ 490	—	—	—	—	670~ 830	620~ 810	600~ 790	590~ 780	—	—	—	≥ 16	≥ 16	≥ 16	—	—	—
	E																						
Q620	C									710~	690~	670~											
	D	≥ 620	≥ 600	≥ 590	≥ 570	—	—	—	—	—	710~ 880	690~ 880	670~ 860	—	—	—	—	≥ 15	≥ 15	≥ 15	—	—	—
	E																						
Q690	C									770~	750~	730~											
	D	≥ 690	≥ 670	≥ 660	≥ 640	—	—	—	—	—	770~ 940	750~ 920	730~ 900	—	—	—	—	≥ 14	≥ 14	≥ 14	—	—	—
	E																						

^a 当屈服不明显时,可测量 $R_{p0.2}$ 代替下屈服强度。

^b 宽度不小于 600 mm 扁平材,拉伸试验取横向试样;宽度小于 600 mm 的扁平材、型材及棒材取纵向试样,断后伸长率最小值相应提高 1%(绝对值)。

^c 厚度 >250 mm~400 mm 的数值适用于扁平材。

NATIONAL STADIUM BEIJING,CHINA

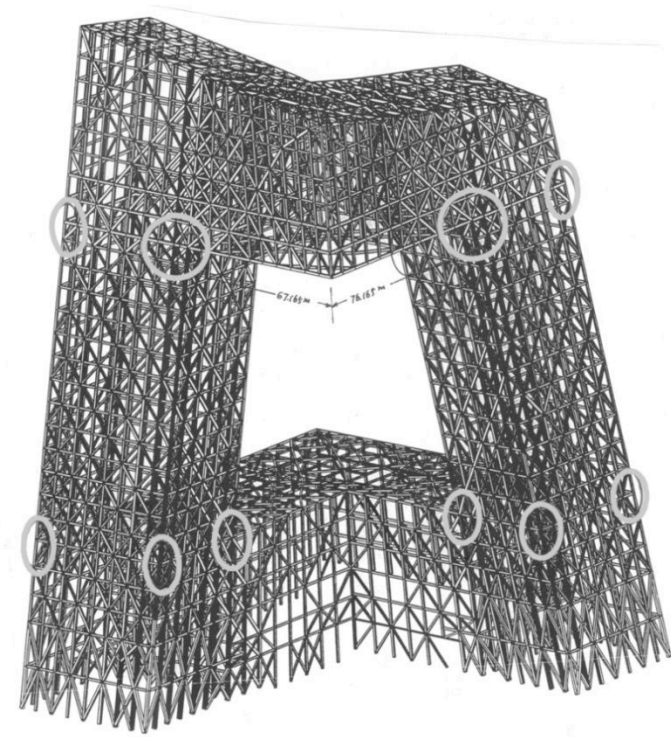
Steel:500 tons

Grade : Q460E/Z35



Steel : 2,363 TONS

Grade : Q460



CCTV NEW TOWER BEIJING, CHINA

Basic characteristics of HPS

Grade	f_y (MPa)				f_u (MPa)	d (%) ≥	f_y / f_u ≤	P %	S %
	Nominal thickness (mm)								
	≤16	>16~35	>35~50	>50-100					
Q460GJ	≥460	460~600	450~590	440~580	550~720	17	0.85	≤0.020	≤0.015
Q460	≥460	≥440	≥420	≥400	550~720	16		≤0.025	≤0.020

Benefits of high strength steels

- **Reduced materials, labor, and fabrication efforts.**
- **Reduced energy in fabrication and delivery.**
- **Increased usable floor areas in buildings.**
- **Significant reduction in total cost.**

**SOME PROJECTS OF STEEL
STRUCTURES FOR HIGH-RISE
BUILDINGS IN CHINA**

Steel buildings are often adopted in areas with weak foundation and high earthquake intensity in order to reduce the self-weight of the buildings.

For high-rise buildings over 300 m high, steel-concrete composite buildings are often adopted.

CCTV NEW TOWER

BEIJING, CHINA



CCTV NEW TOWER

234m High
53 Story
470,000 m²

Steel Materials:

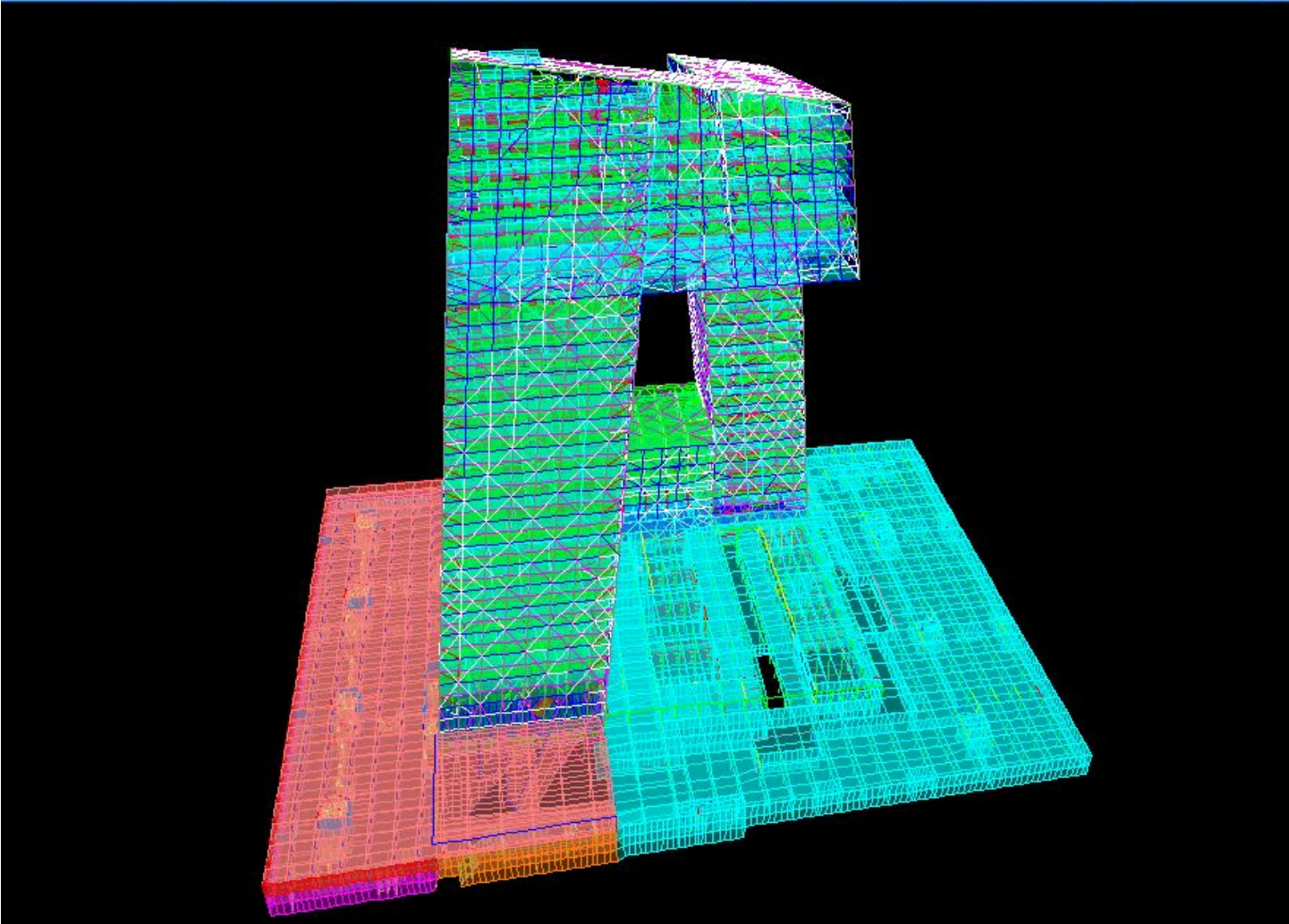
Q345GJC T_{max}=135mm

Q390D T_{max}=100mm

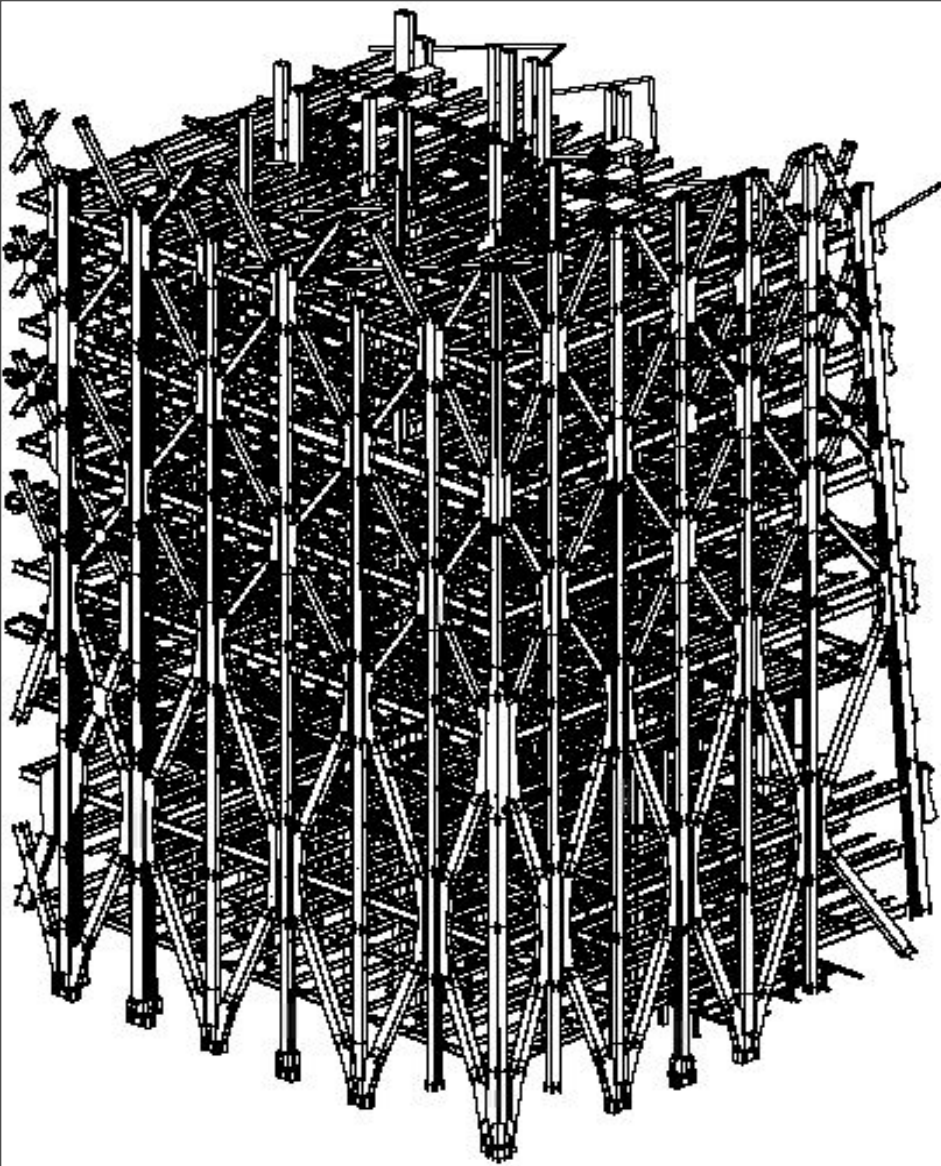
Q420D T_{max}=100mm

Q460E T_{max}=100mm

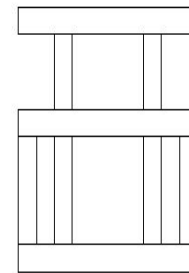
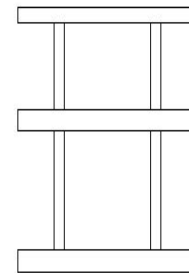
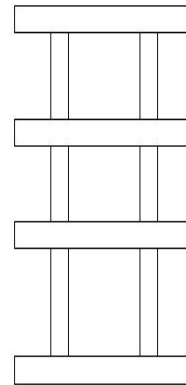
Total tonnage:124,000tons,where
Q420:3,326tons and Q460:2,363tons



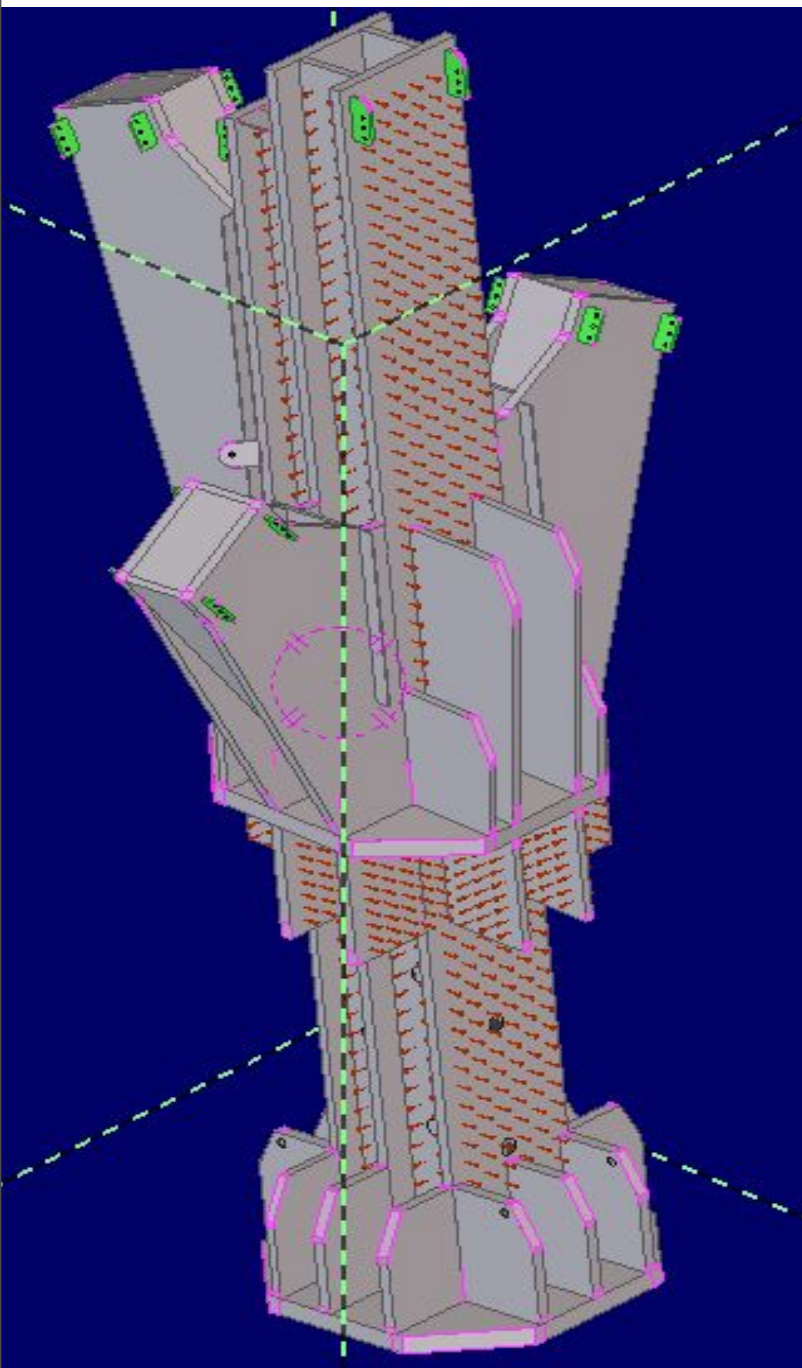
Frame structures



Frame structures



Sections of columns





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ACB-Old
4012447-1

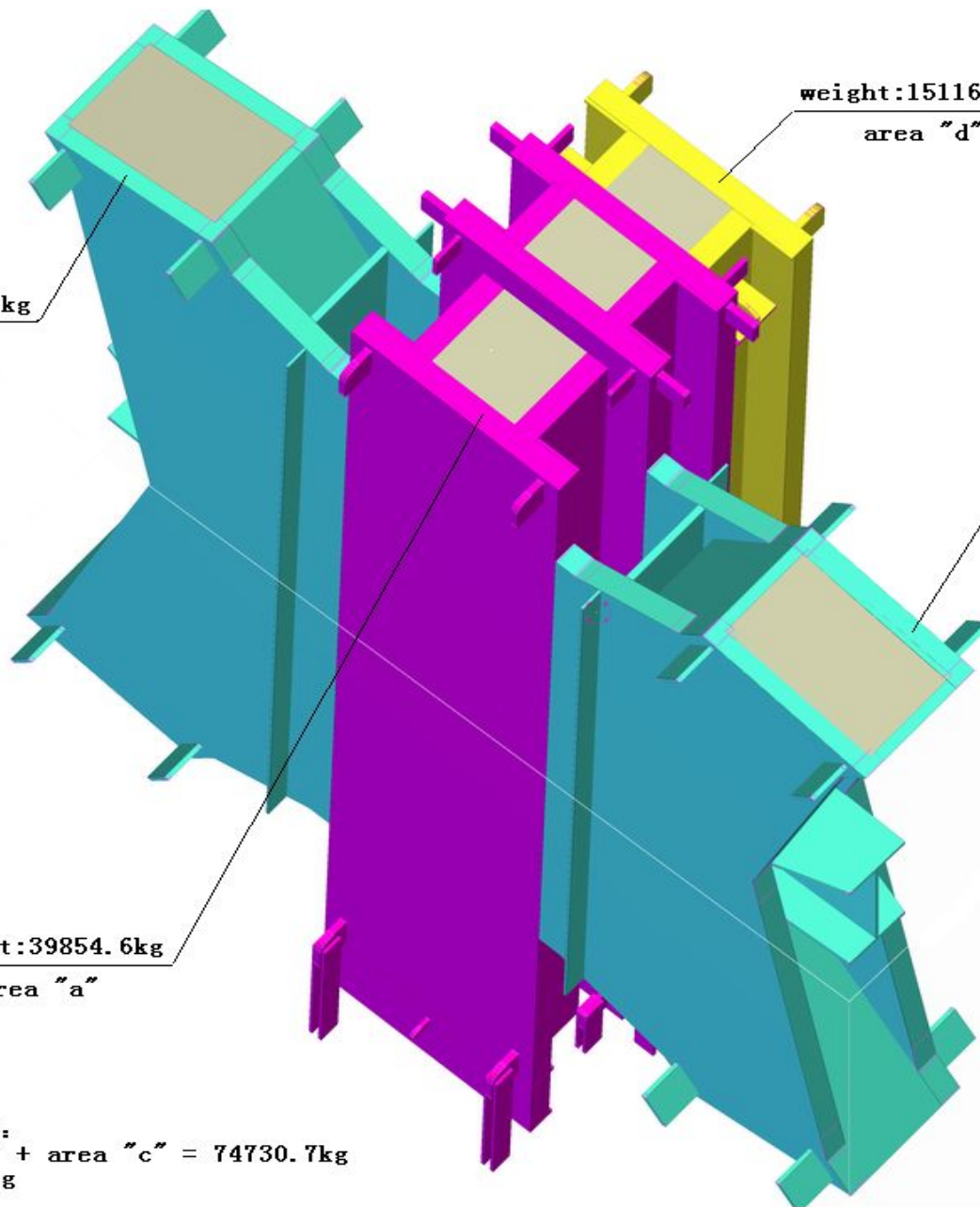
weight:18177.8kg
area "b"

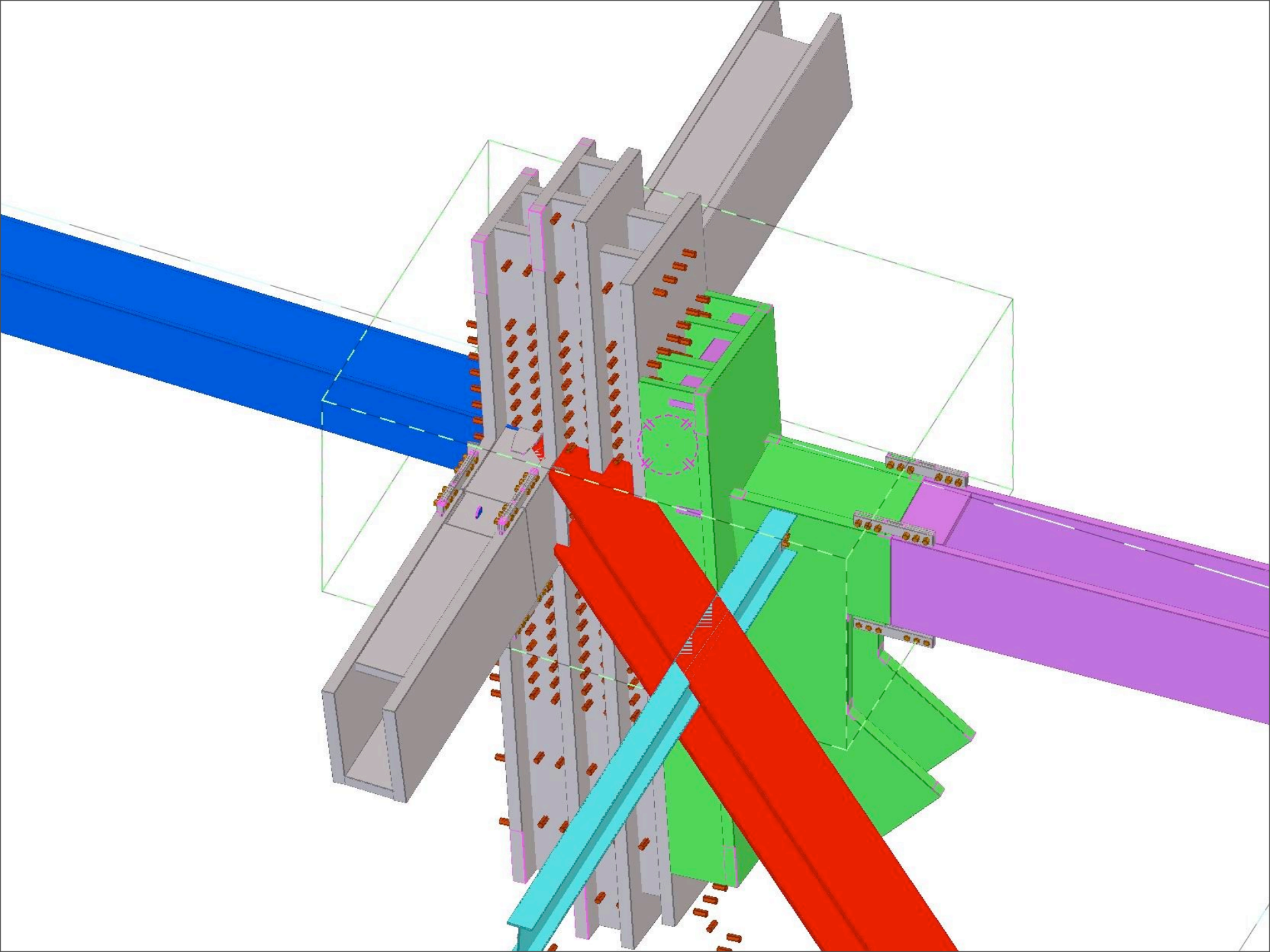
weight:15116.2kg
area "d"

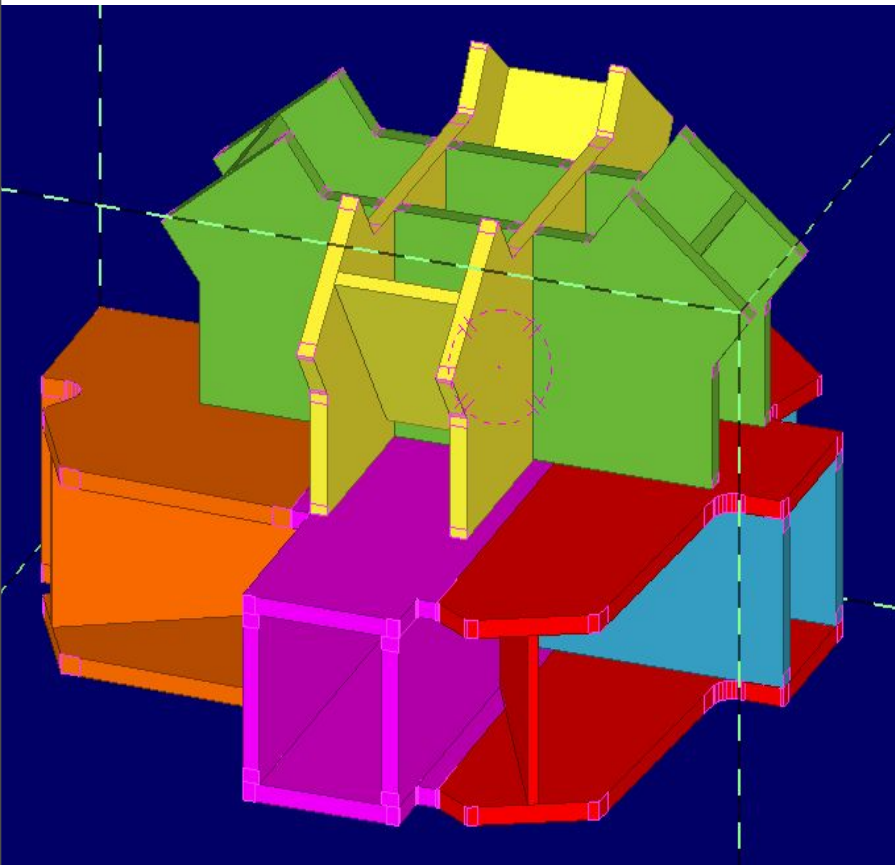
weight:16493.3kg
area "c"

weight:39854.6kg
area "a"

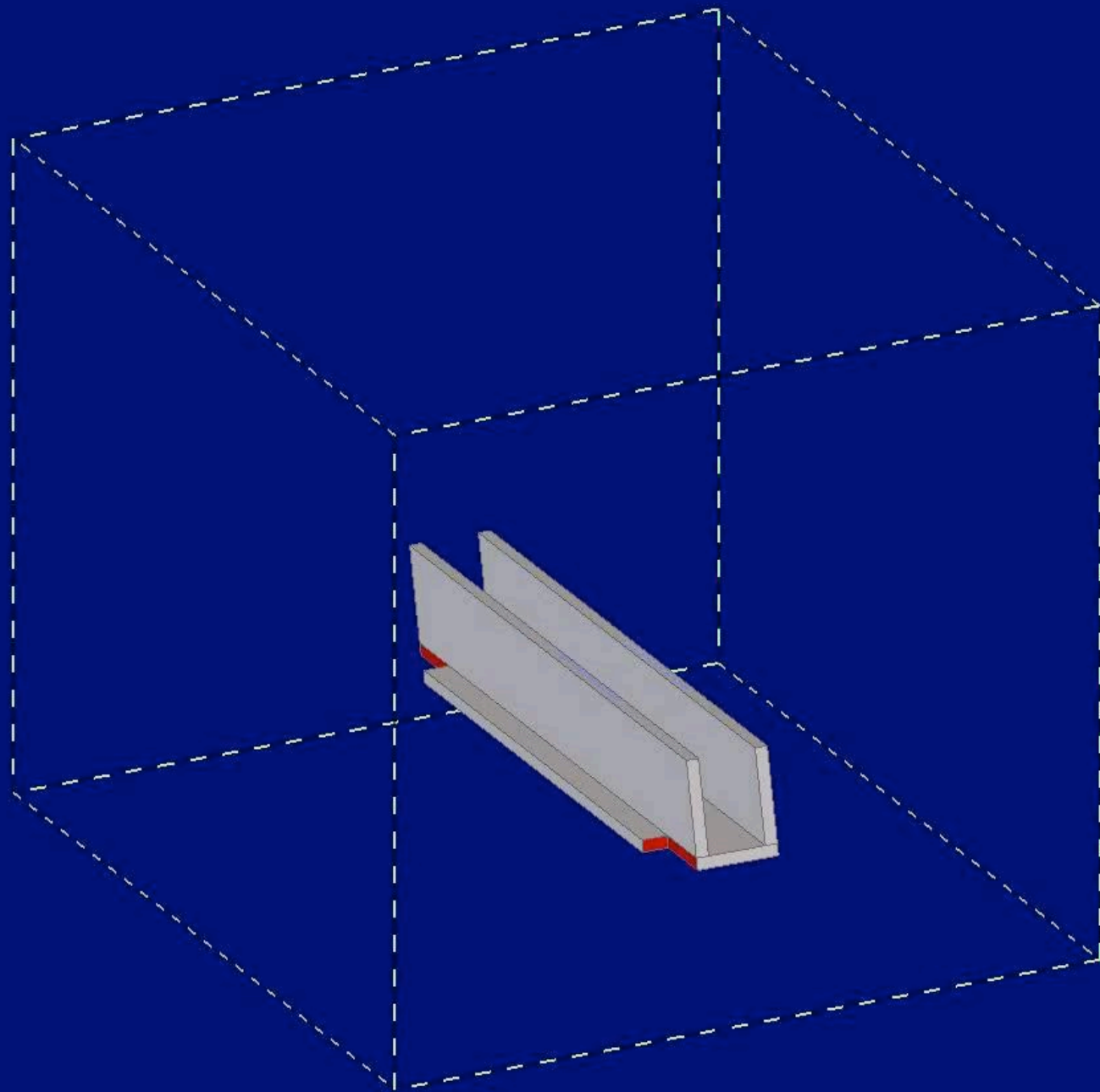
总重: 89846.9kg
起吊重量: 76600kg
分成两部分吊装分别为:
area "a" + area "b" + area "c" = 74730.7kg
area "d" = 15116.2kg







Connections for trusses at 37th-story

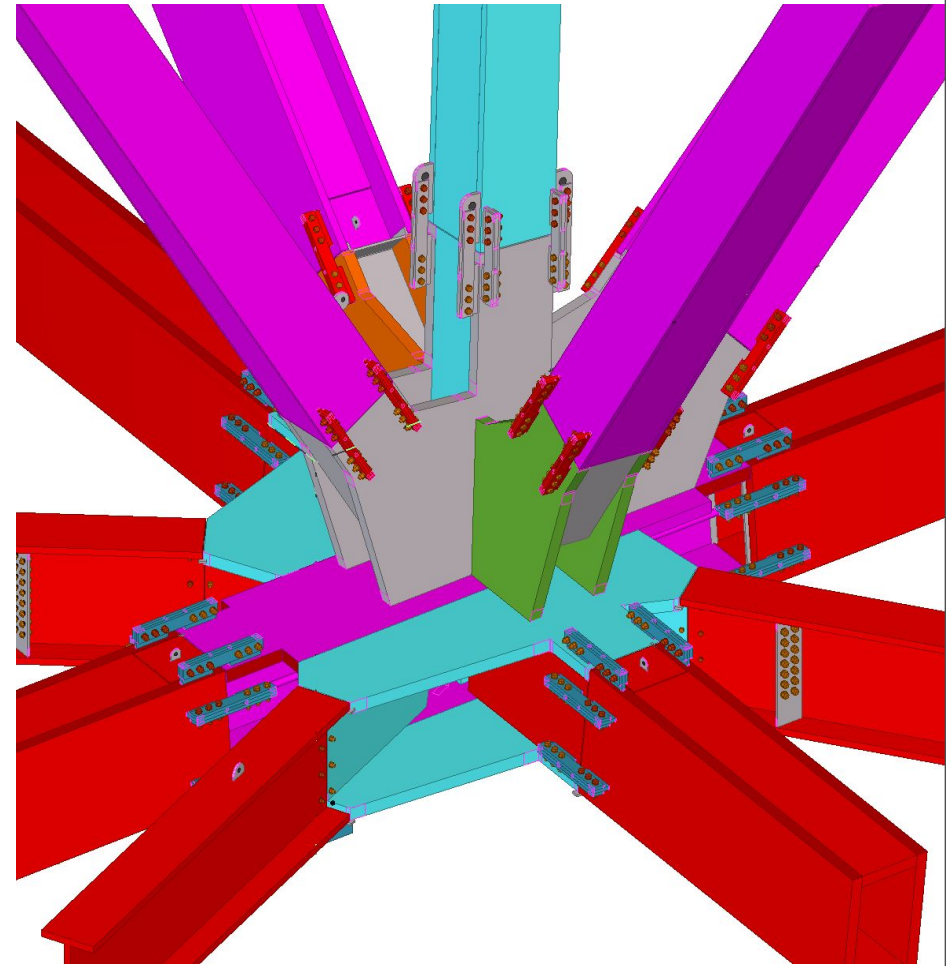
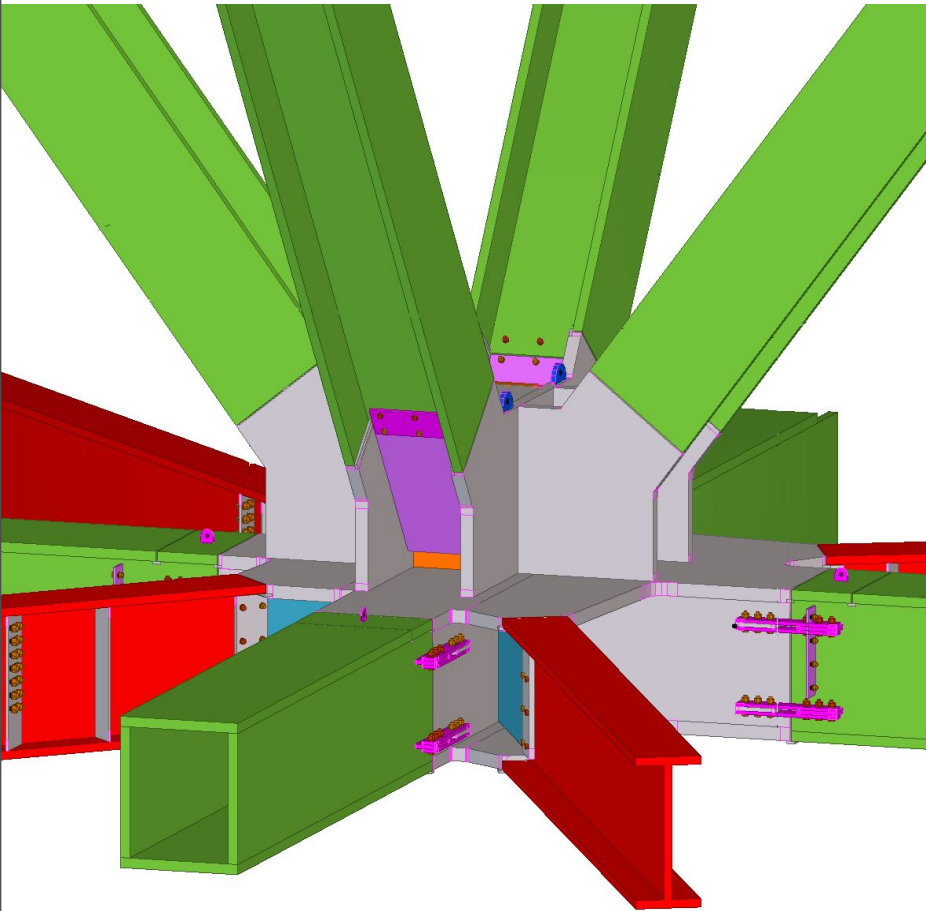




2007 9 9



2007 9 9



Connections for trusses at 37th-story



2006 1 19



I#4: TVB0-25
1-159-471-1
A

2006 1 19



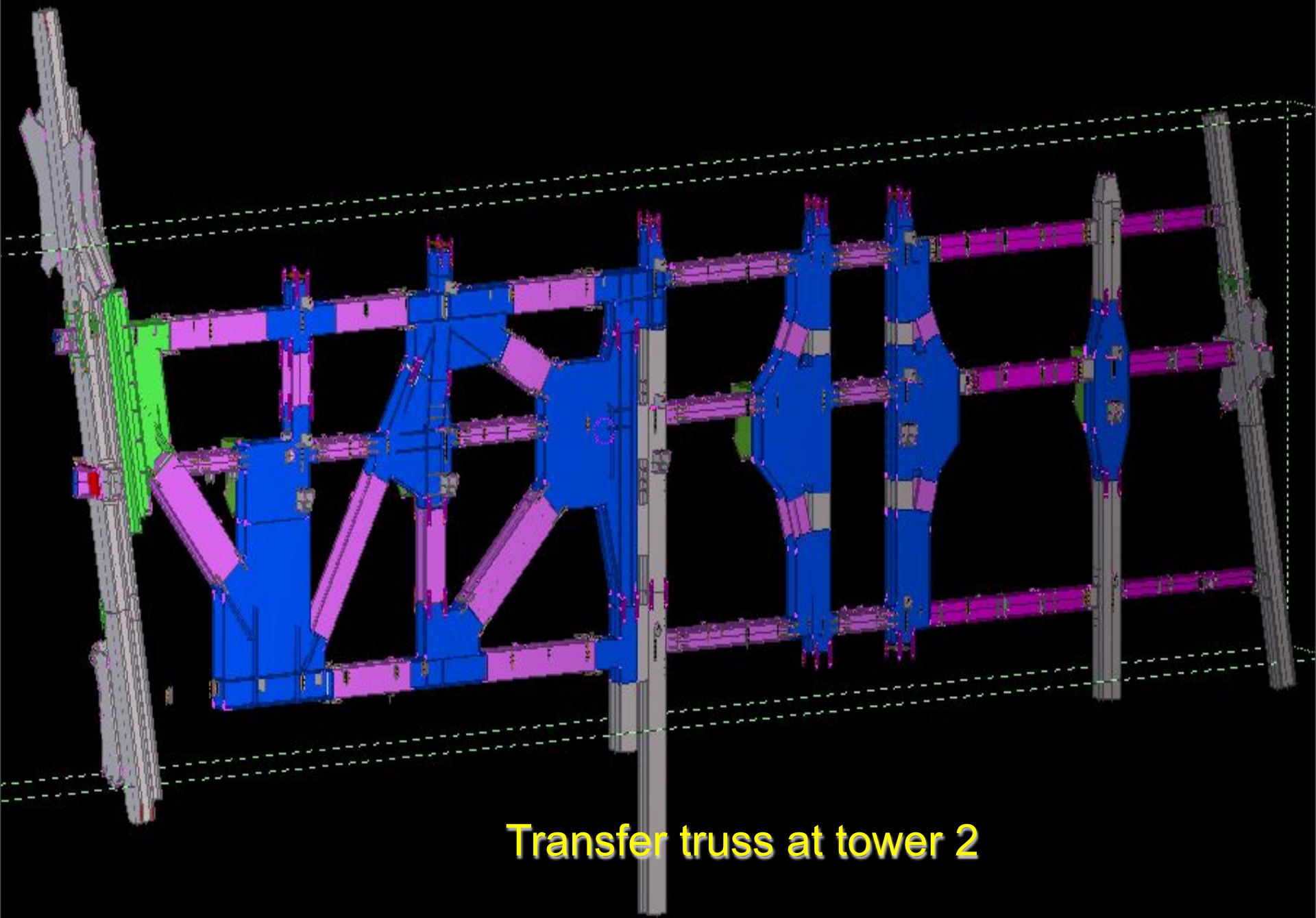
2005 9 29



2005 11 7



2006 6 13

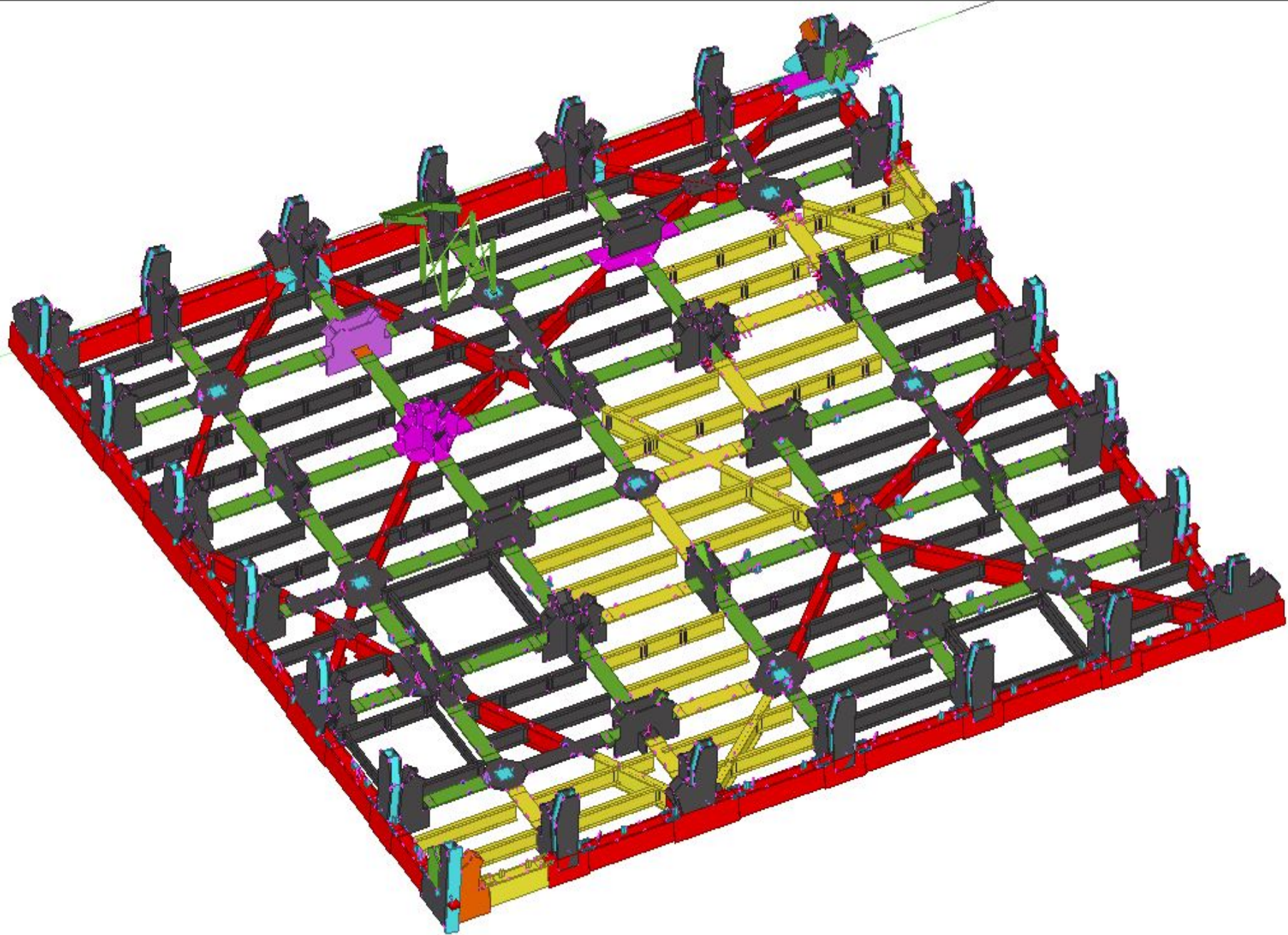


Transfer truss at tower 2

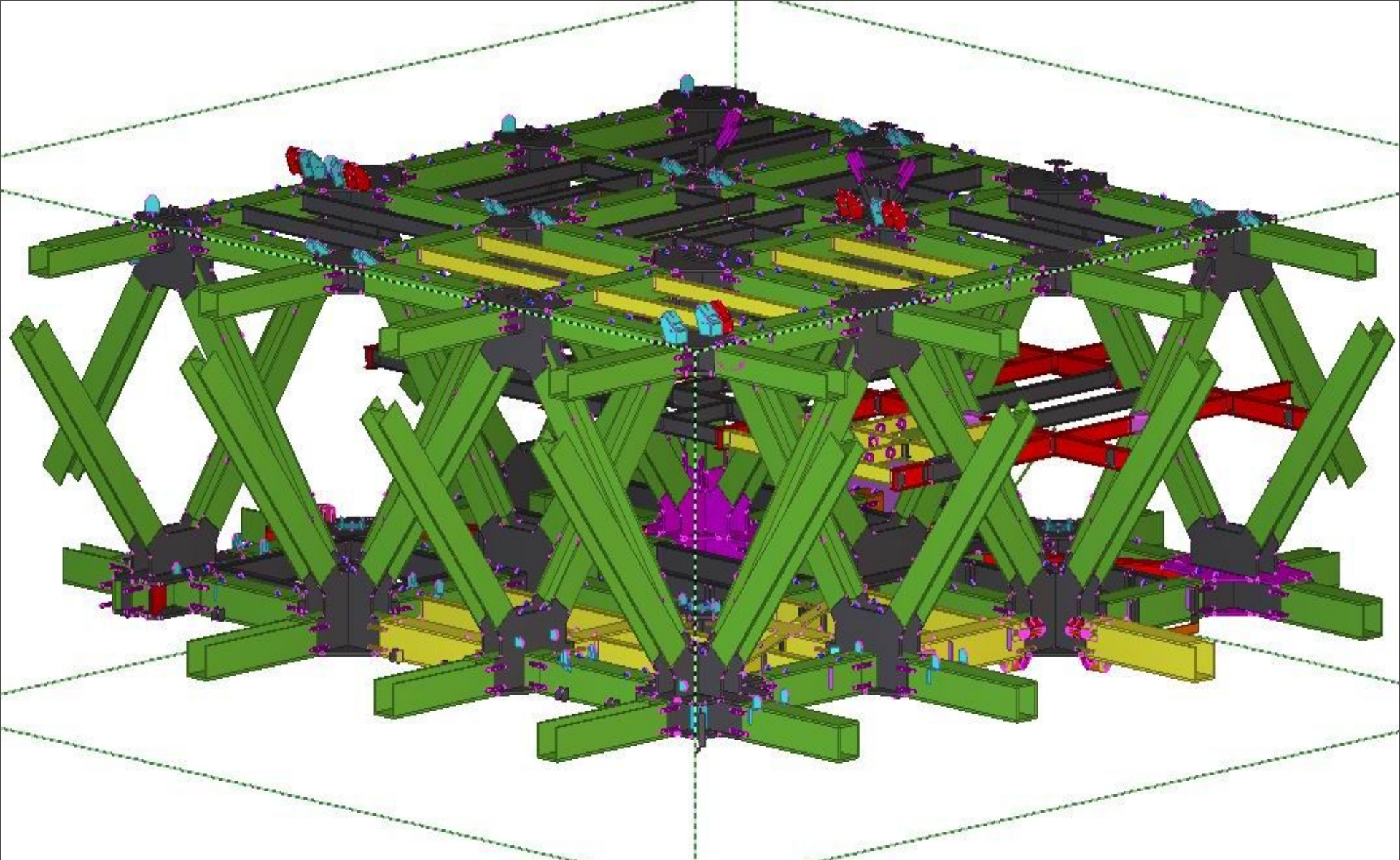


Pre-assembling of transfer truss



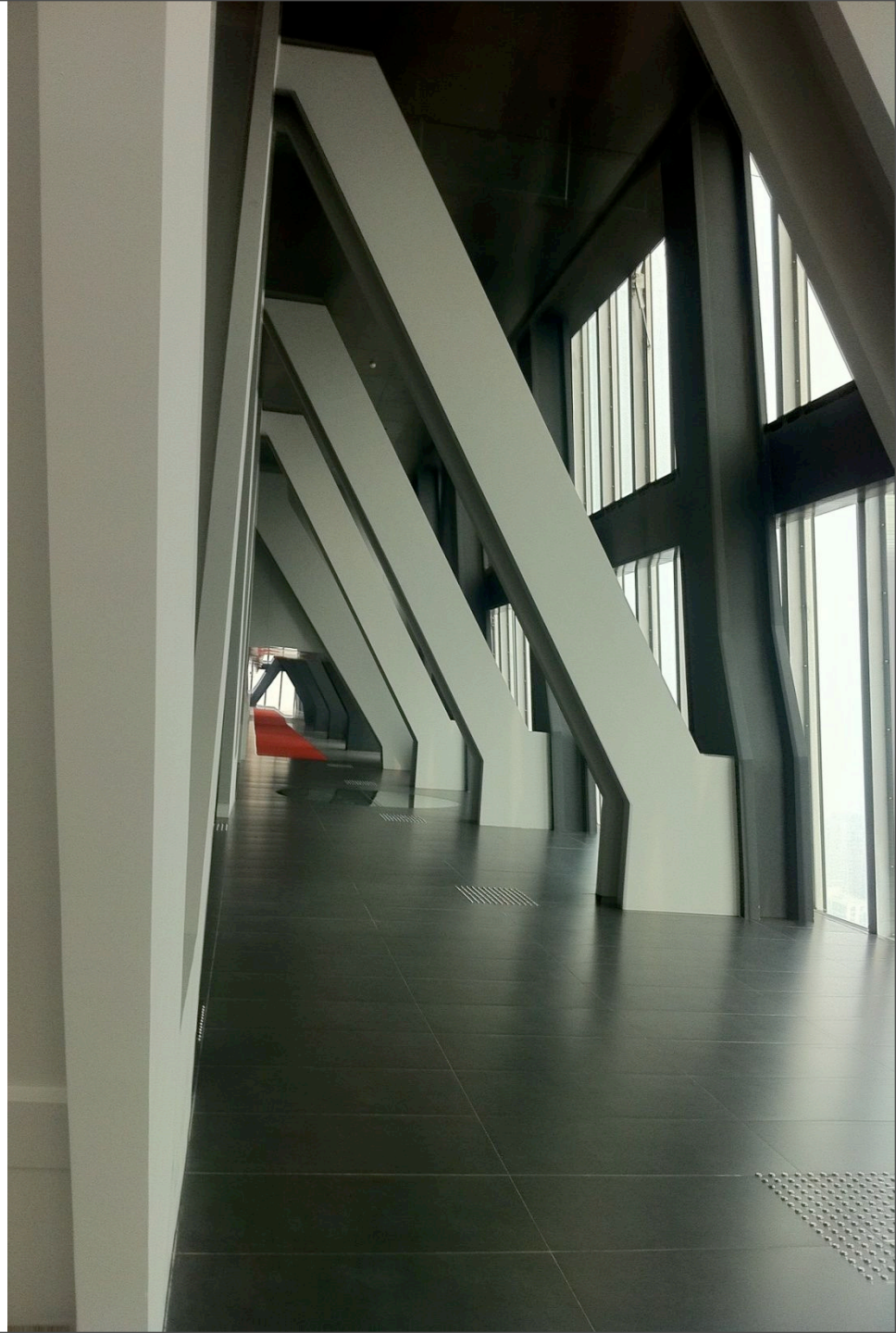


悬臂F37层X6区构件工厂拼装区域立体图



悬臂F37~F39层X6区桁架TR3、TR4相交示意图



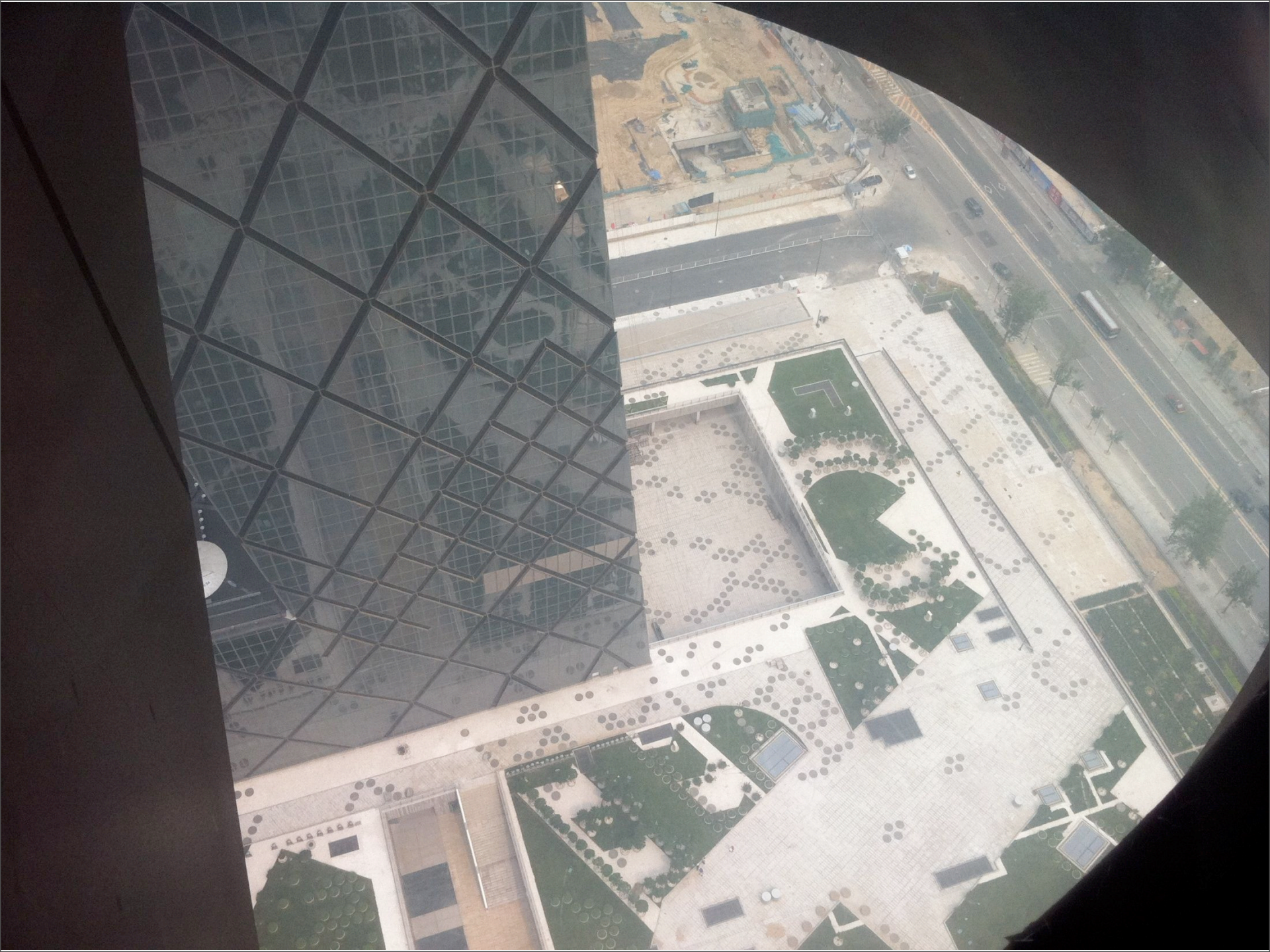


























17700-1-100111

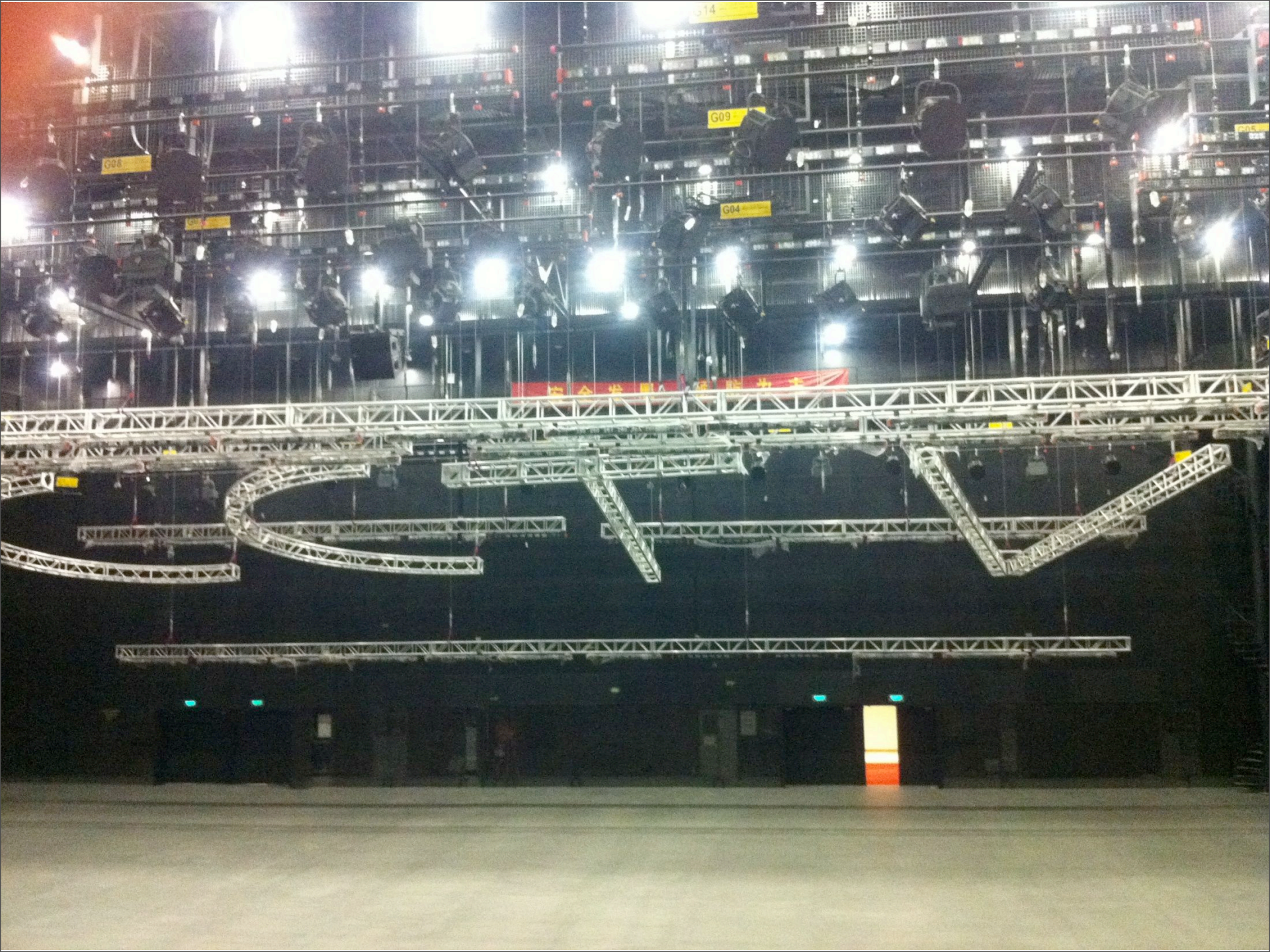


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中国中铁

















QX56
陆上豪华爱机

全区... 力争创全国双拥模范城

清华大学 继续教育

SHANGHAI WORLD FINANCIAL CENTER

492 m High

101 Story

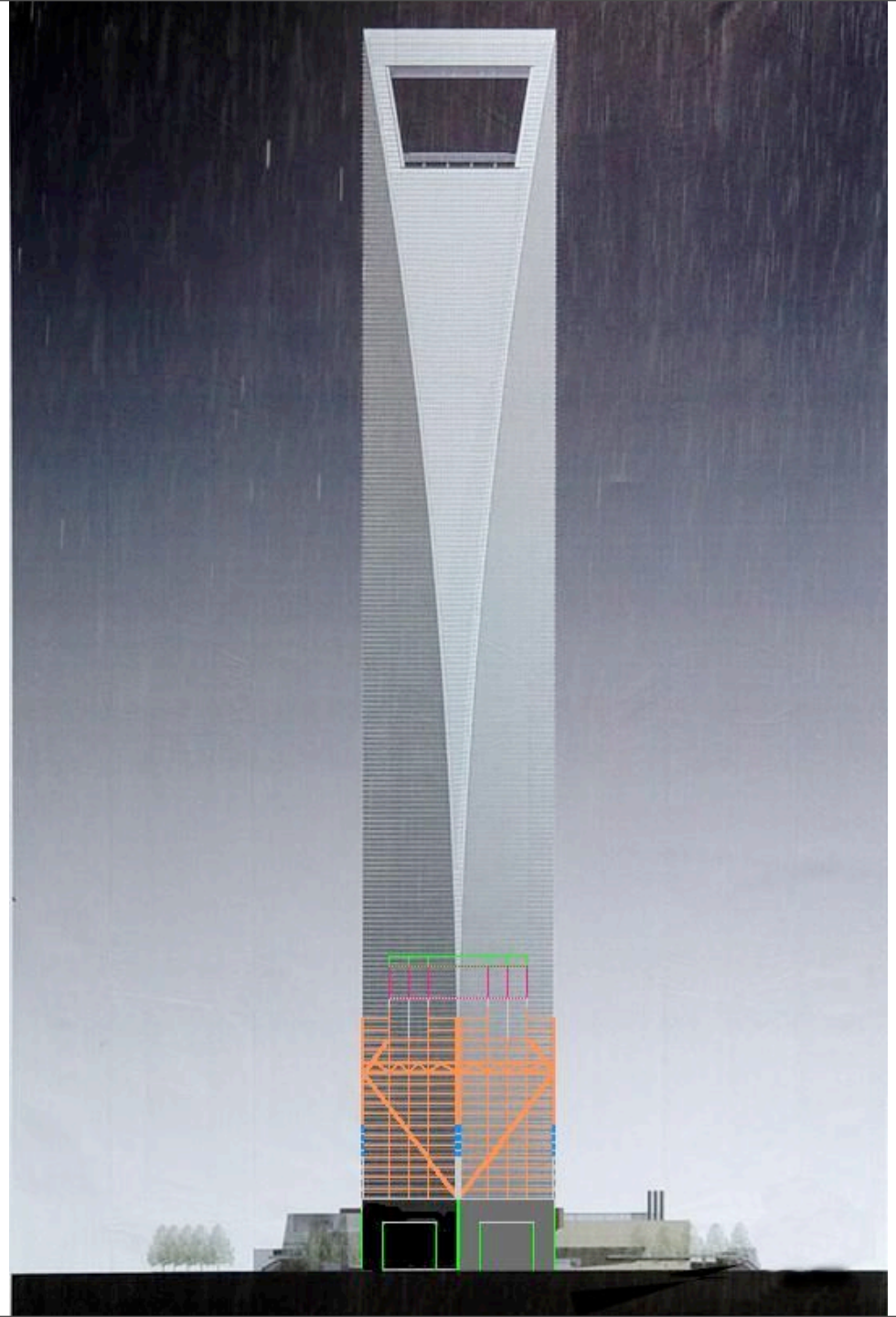
381,600 m²

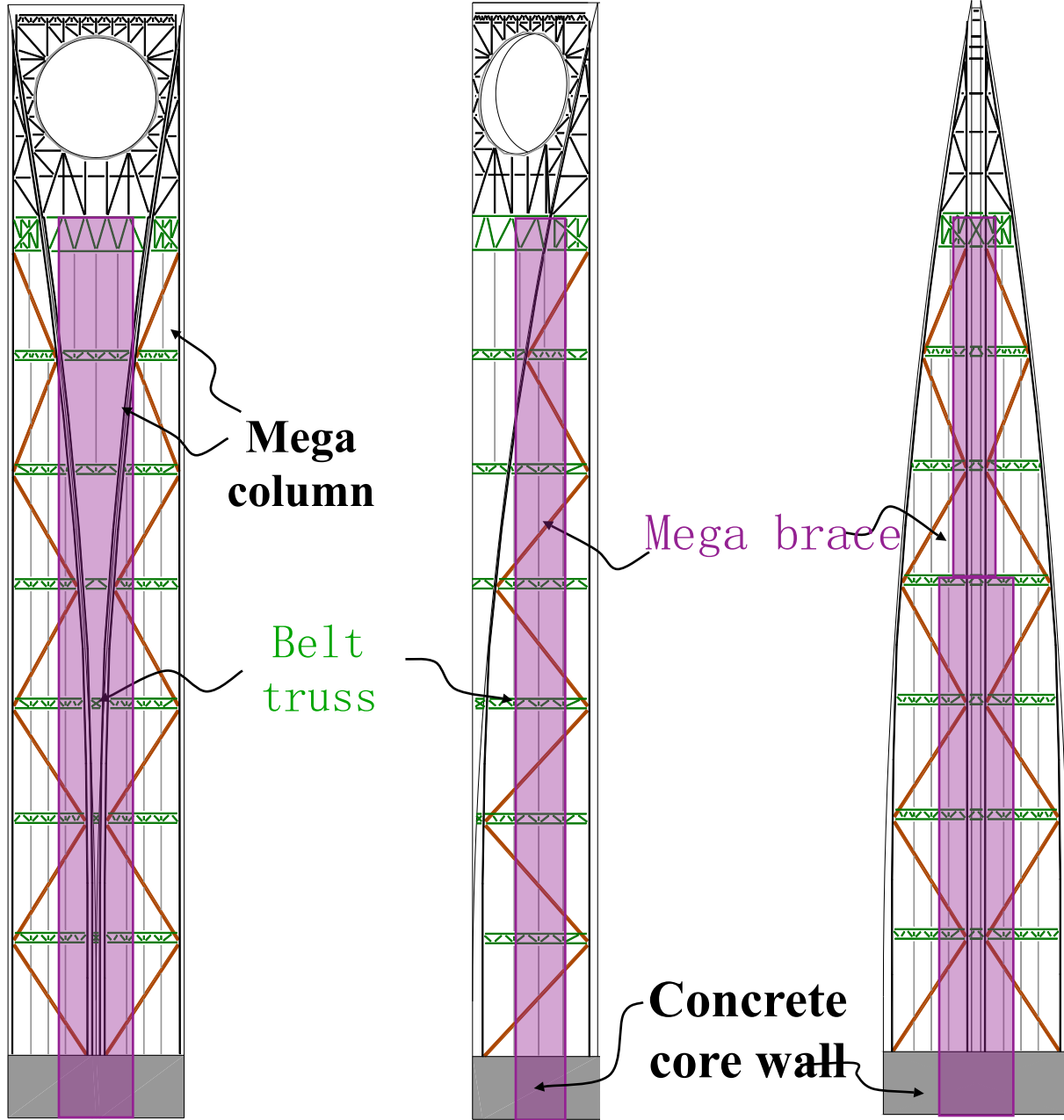
Steel 60,000 tons

Grade A572 Gr50

S460

SN490



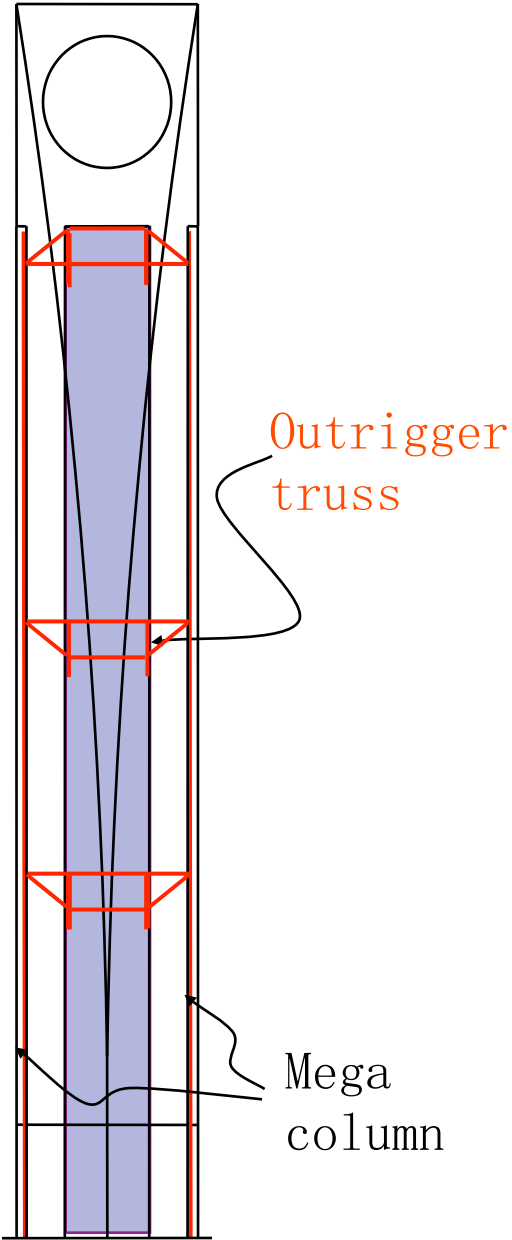


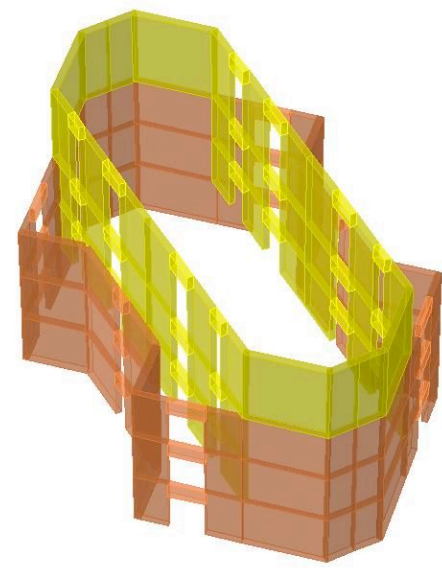
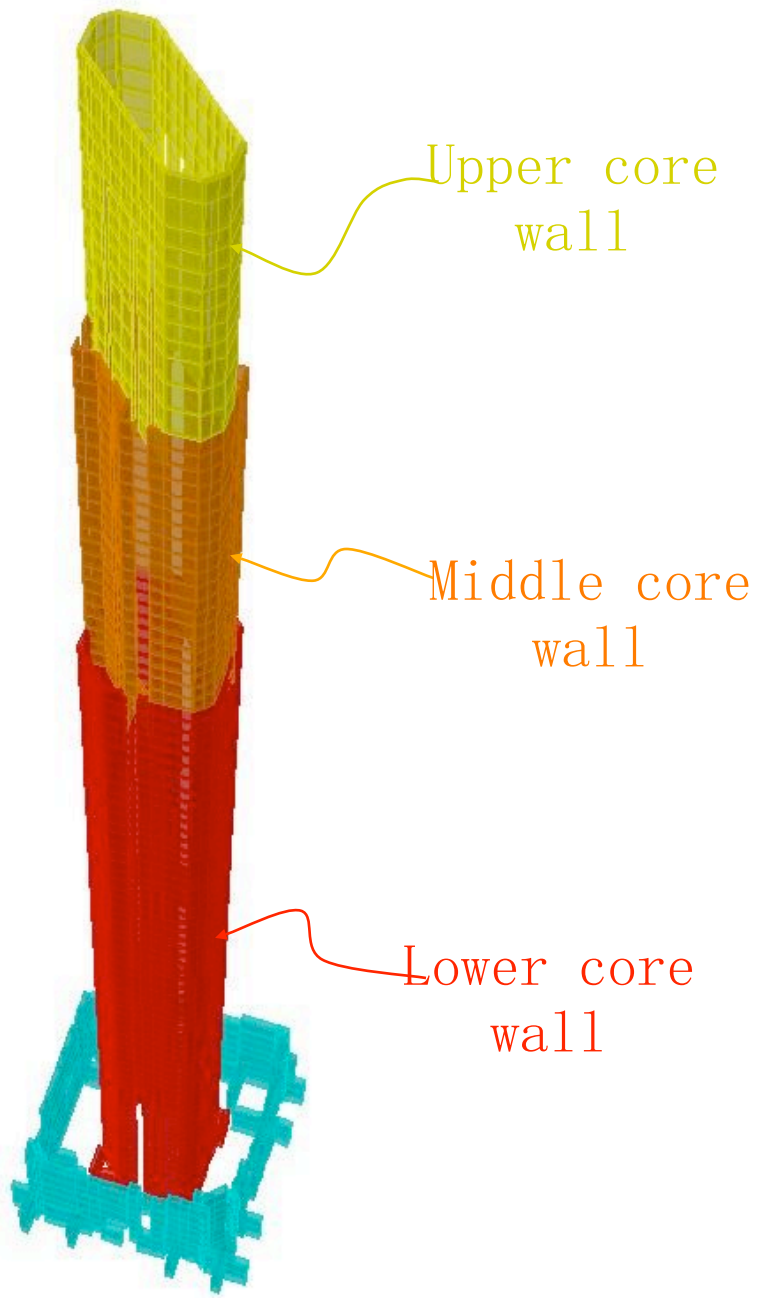
Mega column

Belt truss

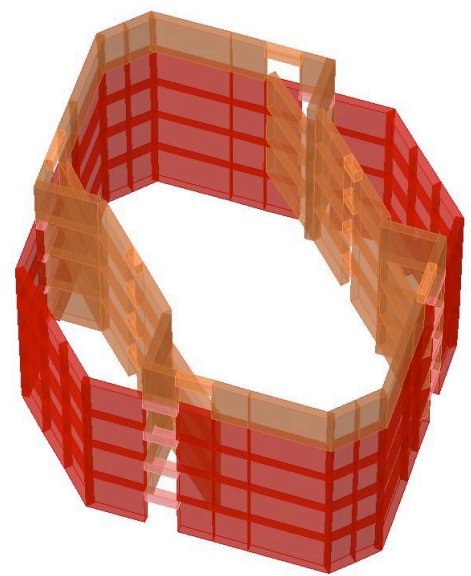
Mega brace

Concrete core wall

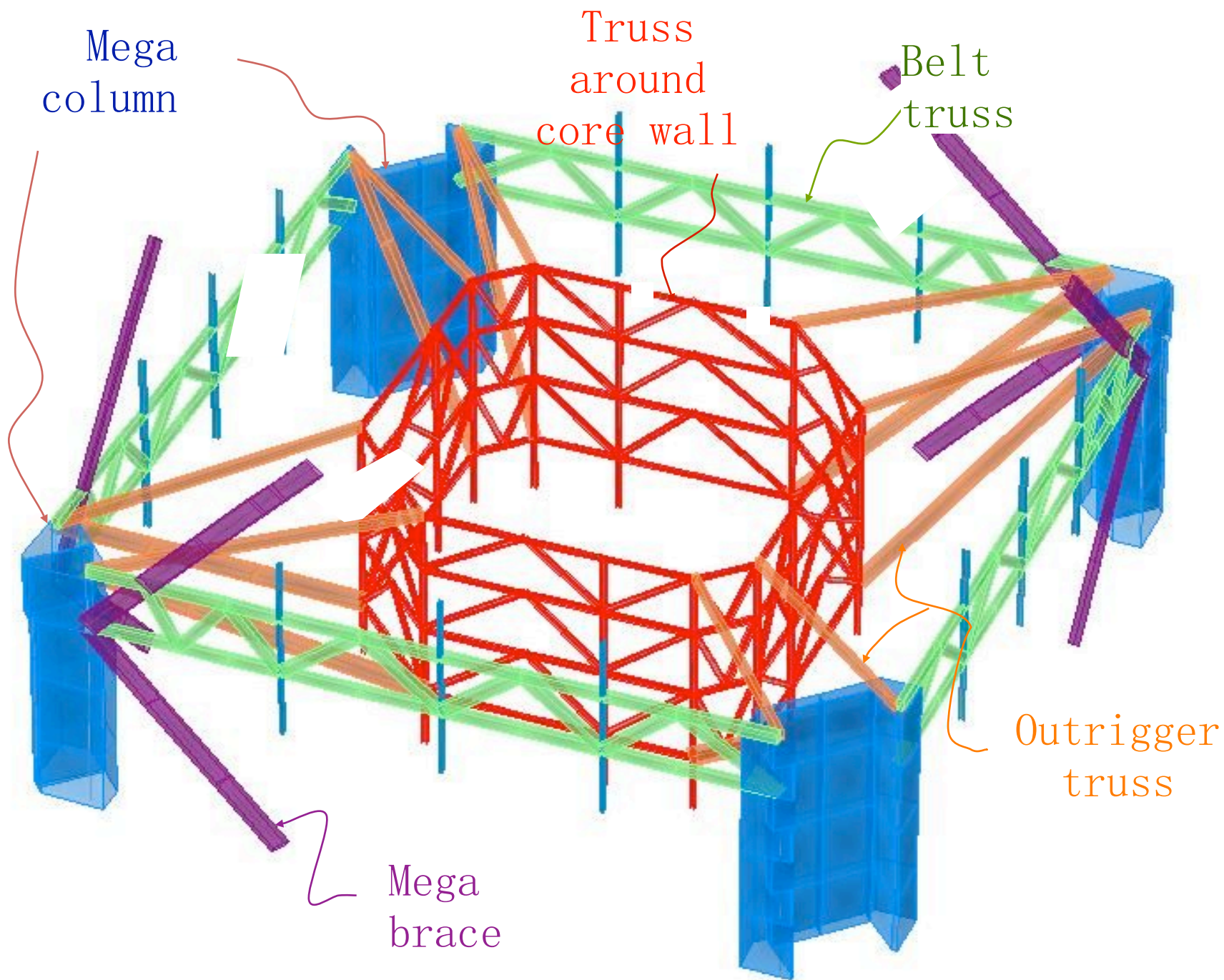


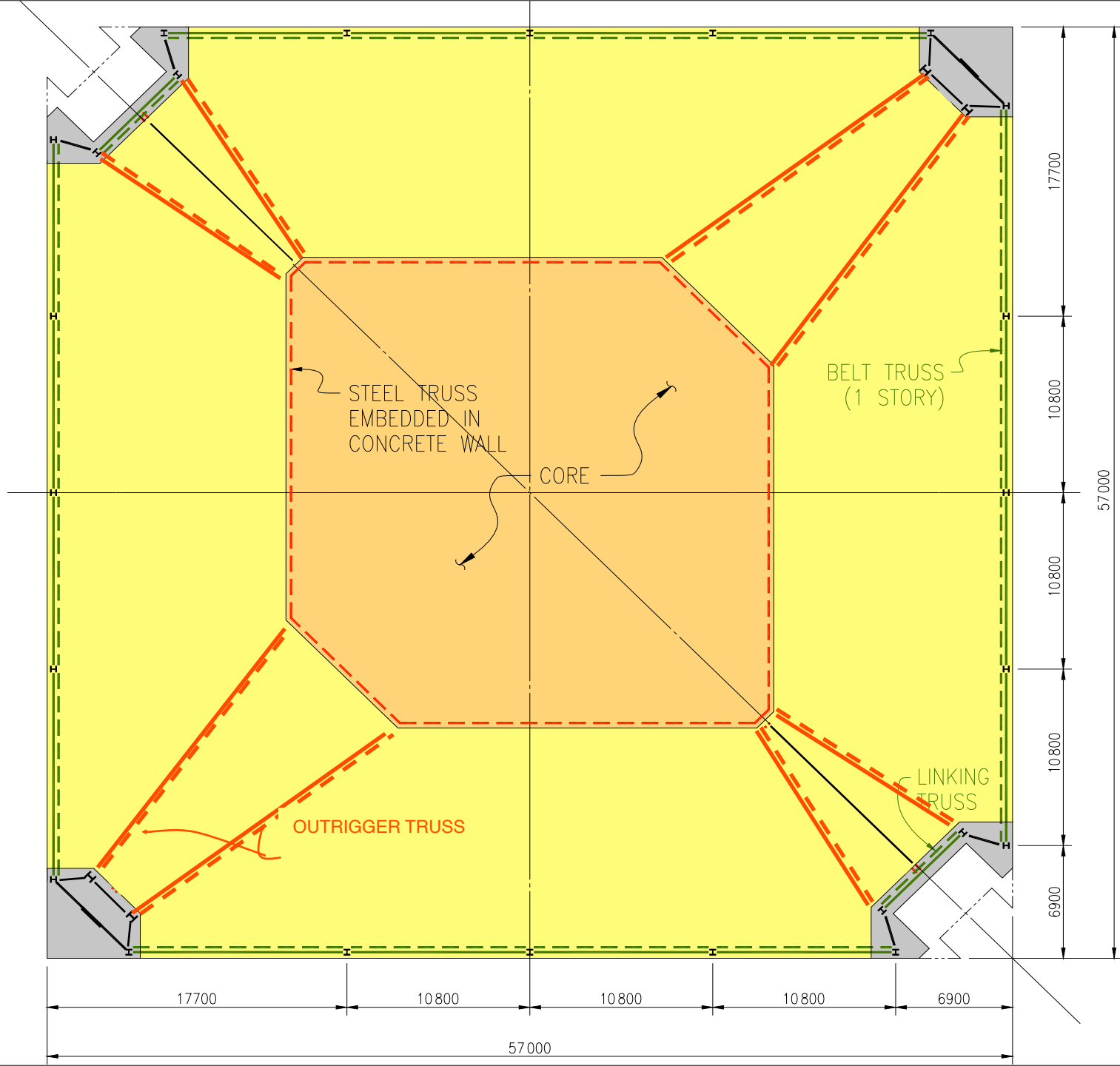


FL-76 to FL-79



FL-55 to FL-59





Outrigger
at FL-19

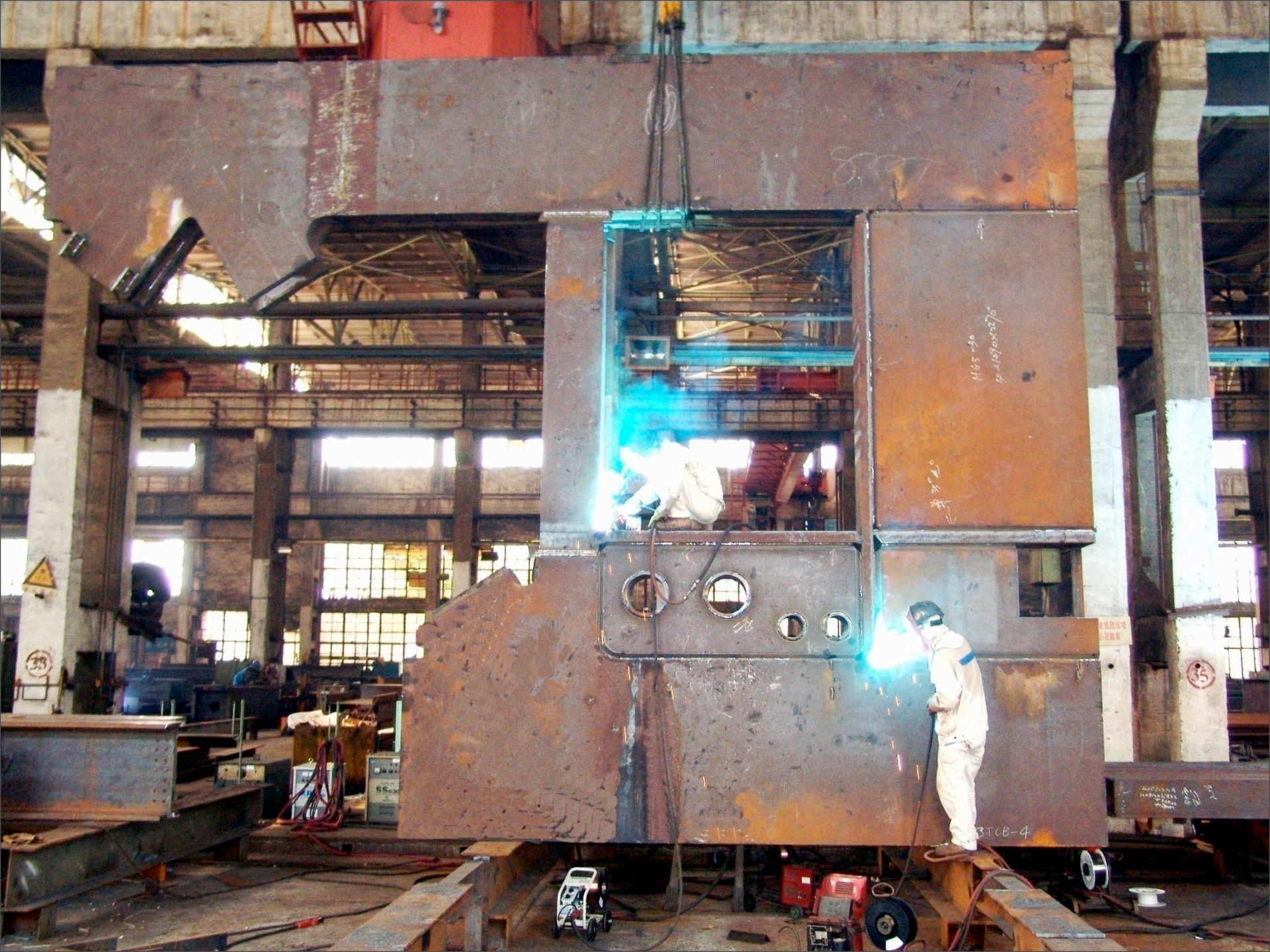


2006 1 19

安全生产 警钟长鸣

2006.06.23

2006.06.23



8.2.2

1165-90
30-1810x270

30-1810x270

3TCB-4



安全区域
禁止入内

1165-90
30-1810x270









2007 8 22











上海环球金融中心观光厅
Shanghai World Financial Center Observatory

世界最高观光厅

The World's Highest Observatory



100F

您所在的高度为 **474m**

▪ 吉尼斯世界纪录认证 海拔 **477.96m**

2009年上海环球金融中心观光厅荣获吉尼斯世界纪录“最高观光厅”称号。

▪ 世界高楼协会认证

2008年6月1日，上海环球金融中心通过世界高楼协会认证，在“最高使用楼层高度”和“最高屋顶高度”两项认证中获得“世界第一”的美誉。

▪ GUINNESS WORLD RECORDS™
CERTIFICATE

GUINNESS WORLD RECORDS™ awarded the Shanghai World Financial Center Observatory the title of the Highest Observation Deck in 2009.

▪ CTBUH CERTIFICATE

▪ CTBUH The Council on Tall Buildings and Urban Habitat
On June 1st 2008, CTBUH awarded the Shanghai World Financial Center the title World's Tallest Building in the categories of "highest occupied floor" and "height to top of roof".











Shanghai Tower

632m high

574,000m²

120 story



Steel 100,000 tons
Grade Q345-Q460
Tmax=130mm

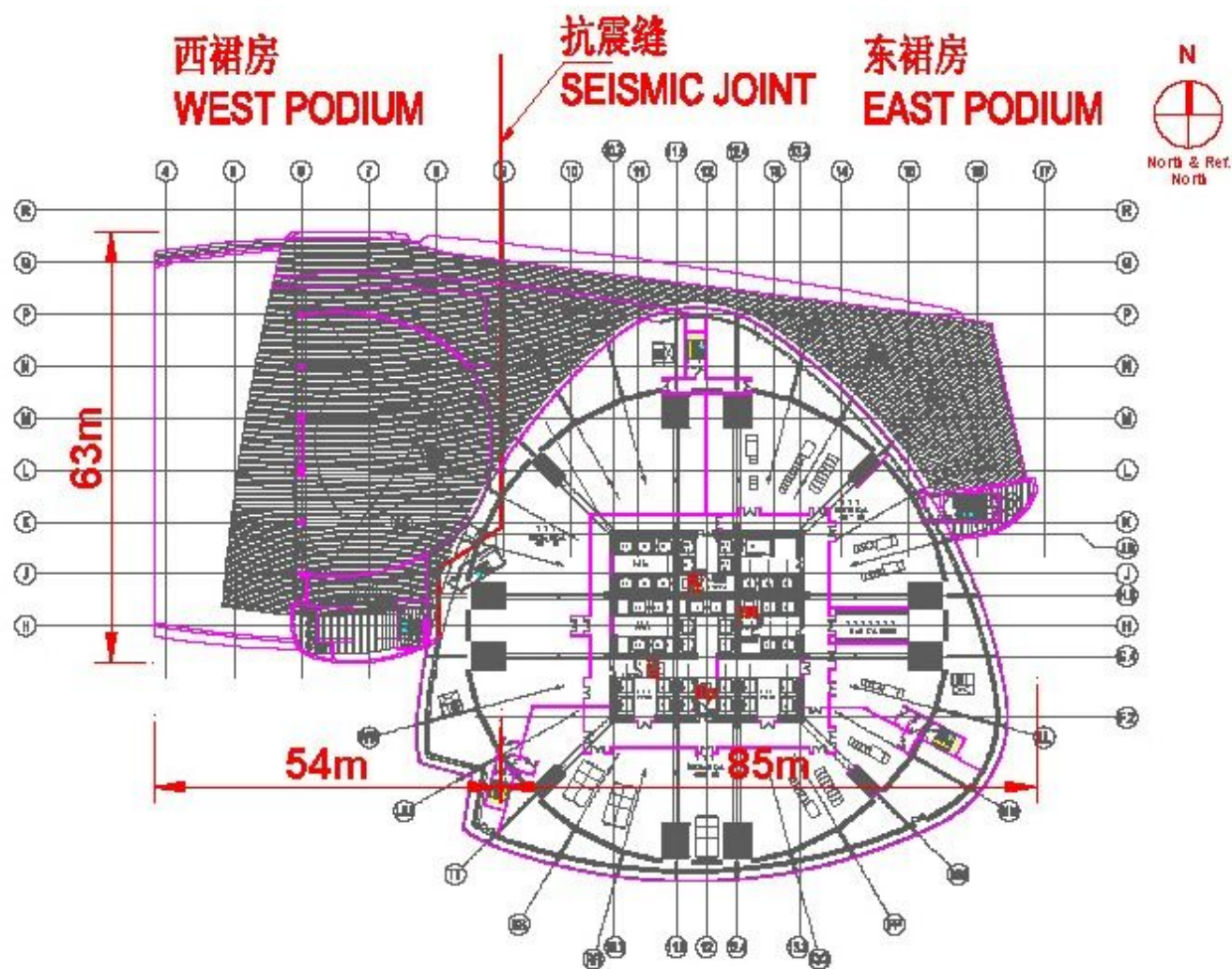
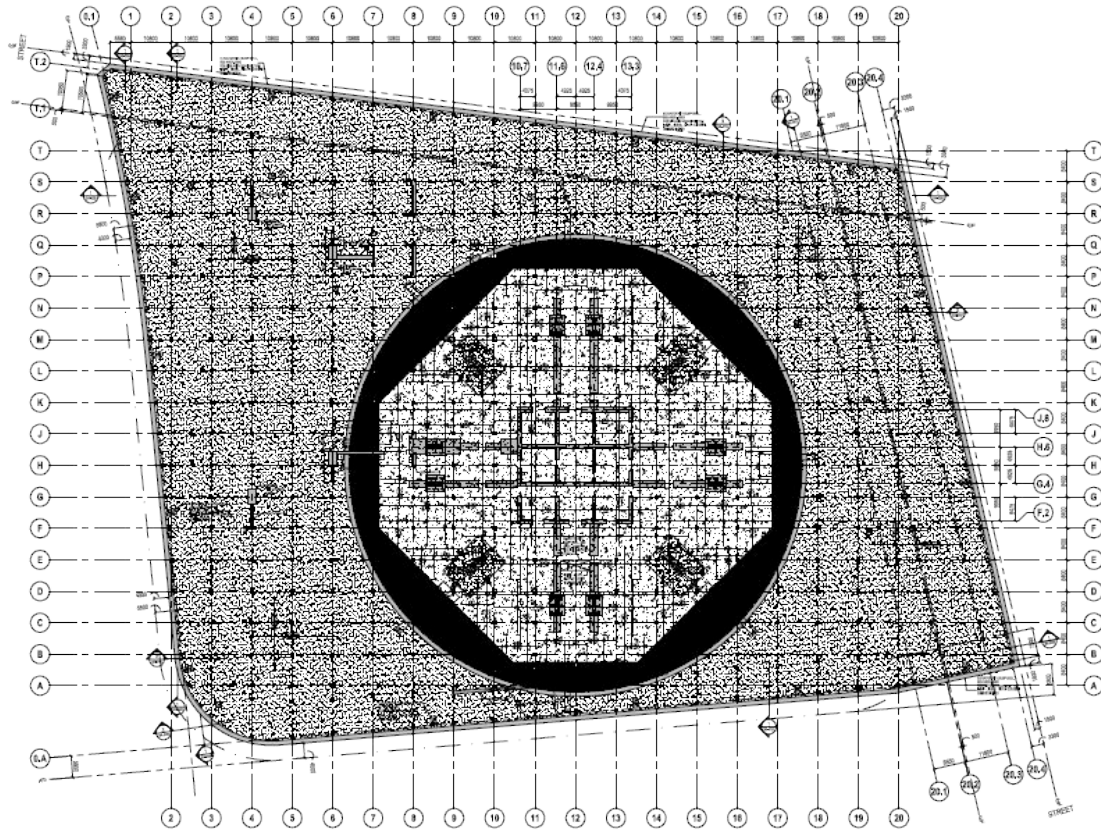
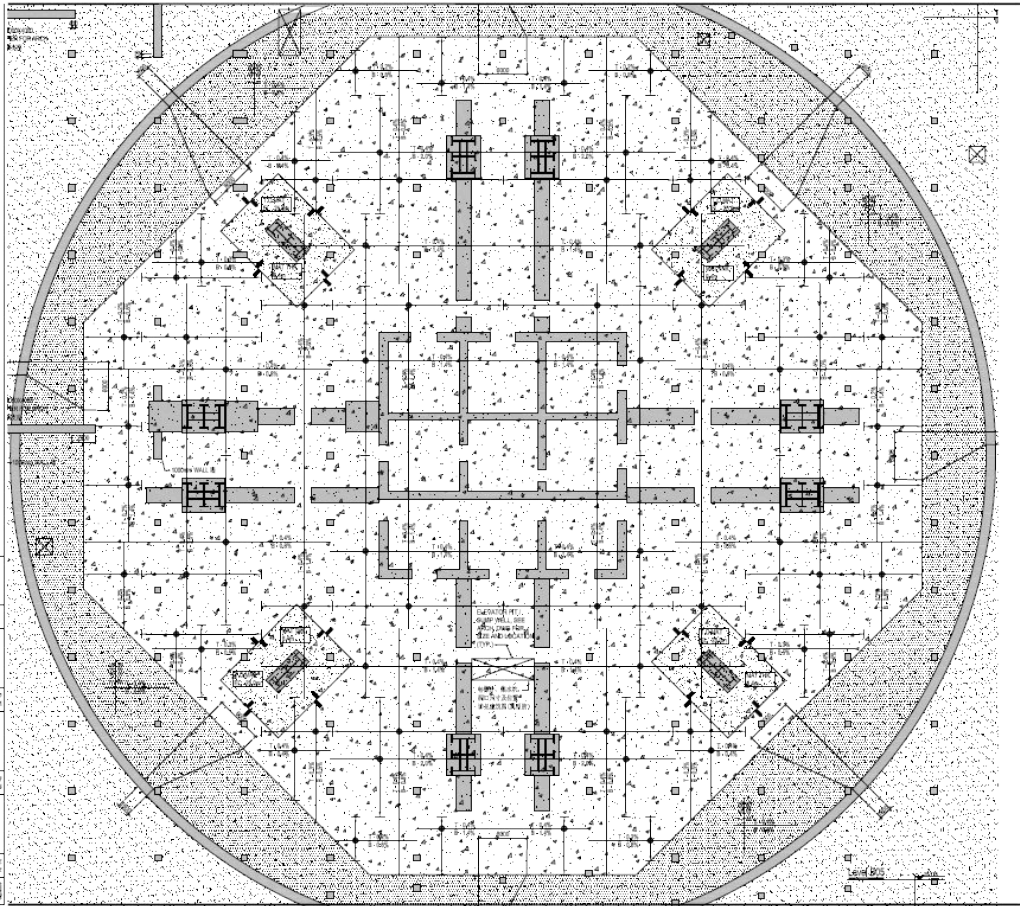


图1.1.3 裙房平面位置图

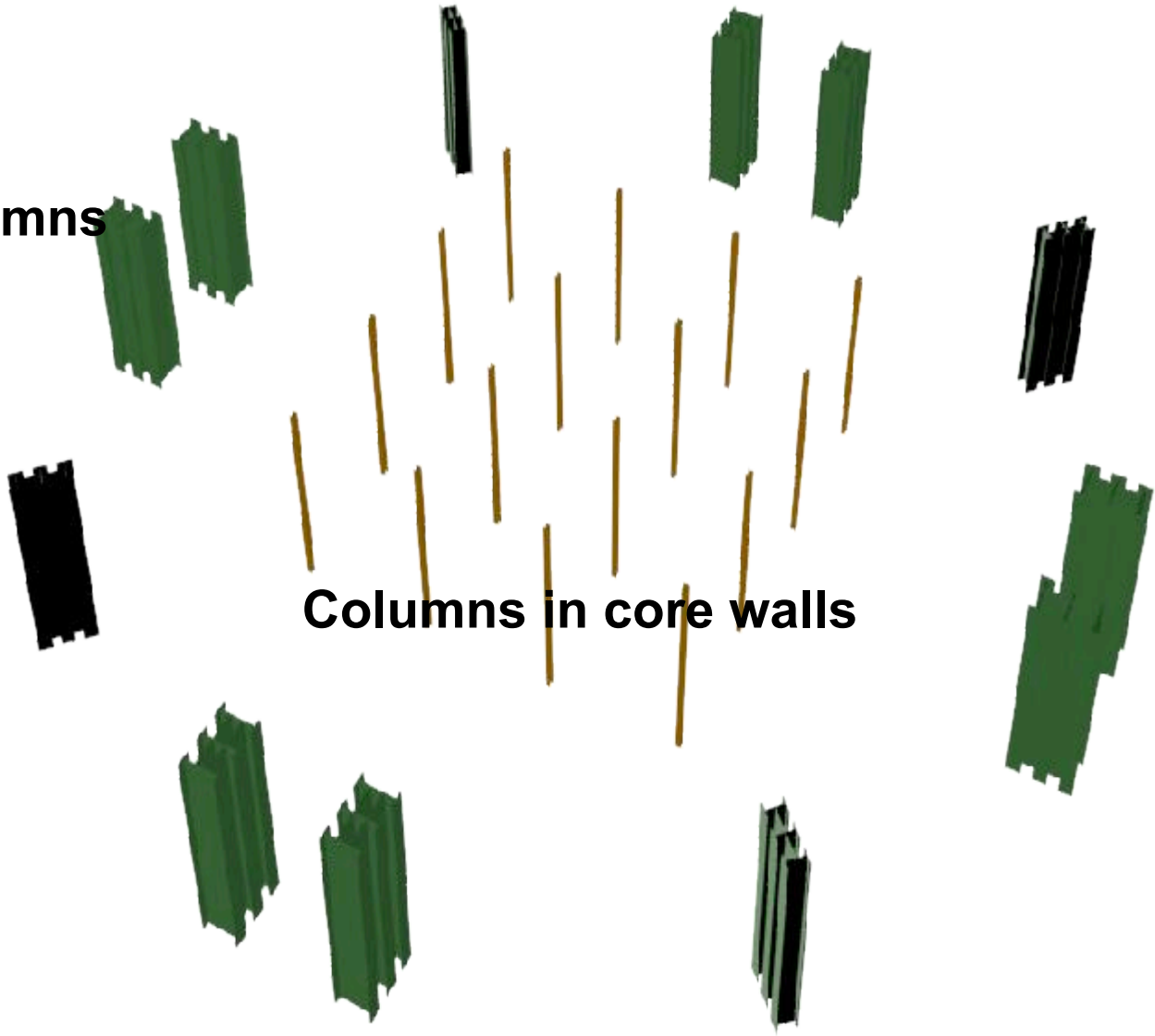
Layout



Plane

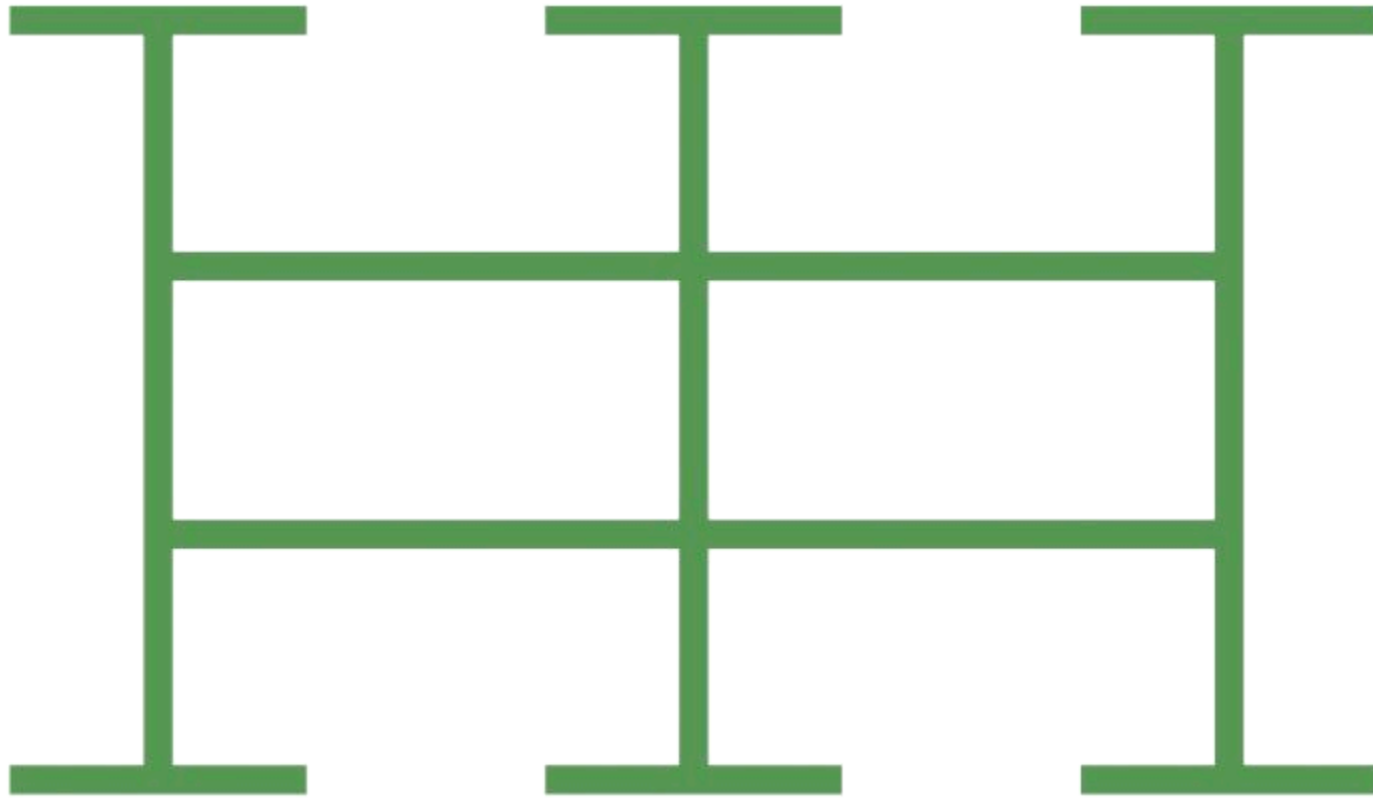


Mega columns



Columns in core walls

SECTION OF EIGHT MEGA COLUMNS



4.1mX3.0 m t=100mm

SECTION OF FOUR MEGA COLUMNS



4.25mX1.4m

t=50mm

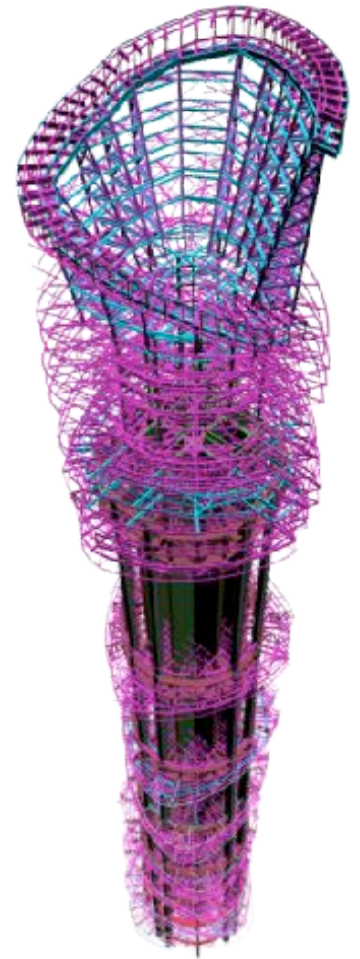
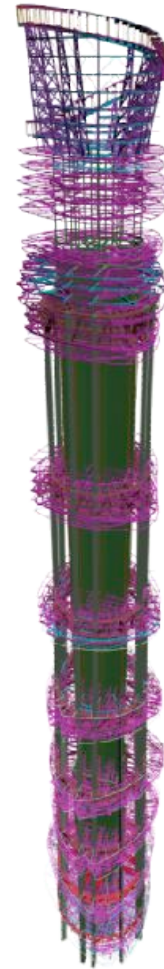
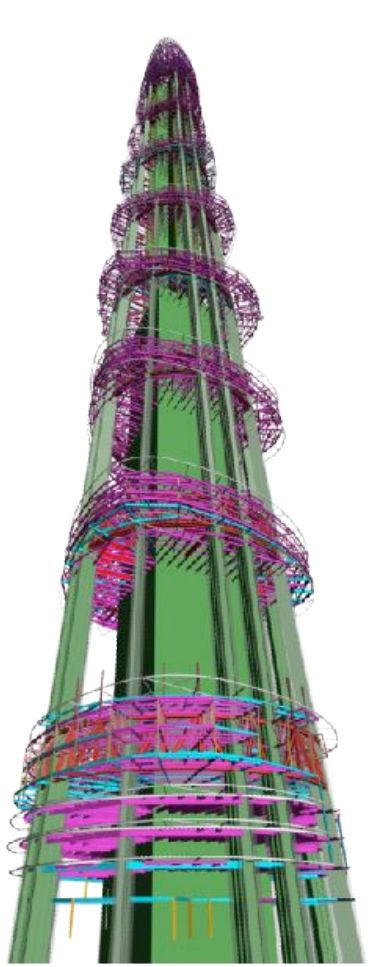


安全生产 100/32

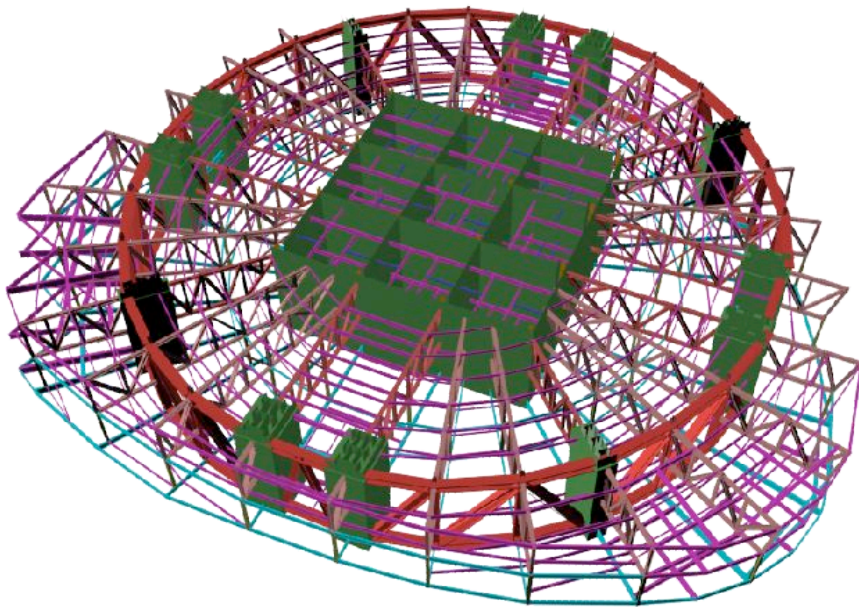
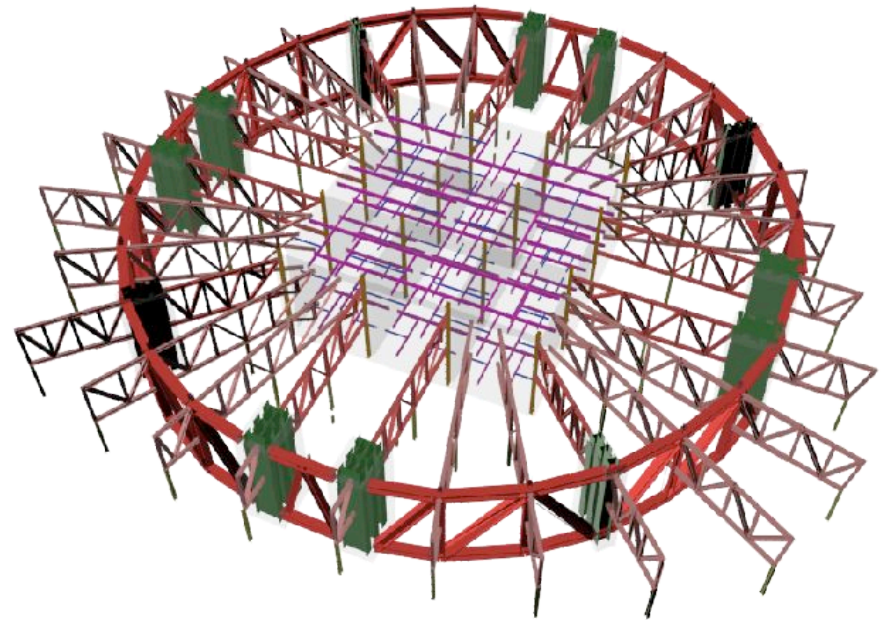


PX6-8

105

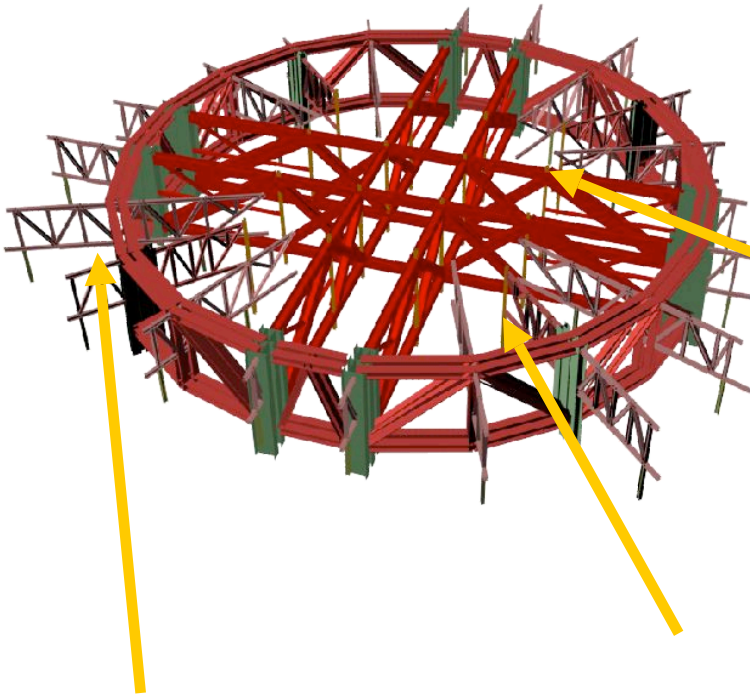


Main trusses at FL-8



Floor beams at FL-8

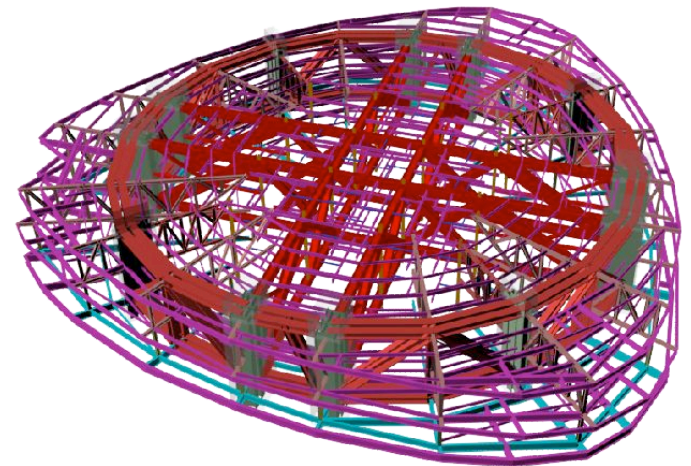
FL-22



Floor trusses

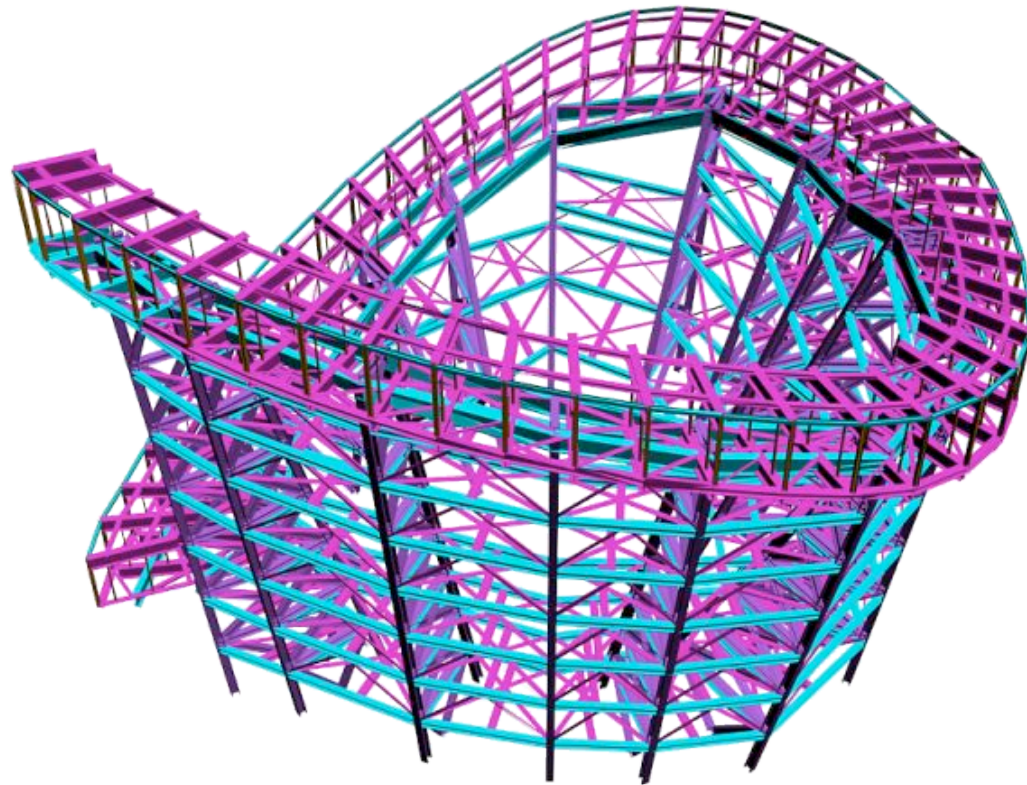
Belt trusses

Outrigger trusses

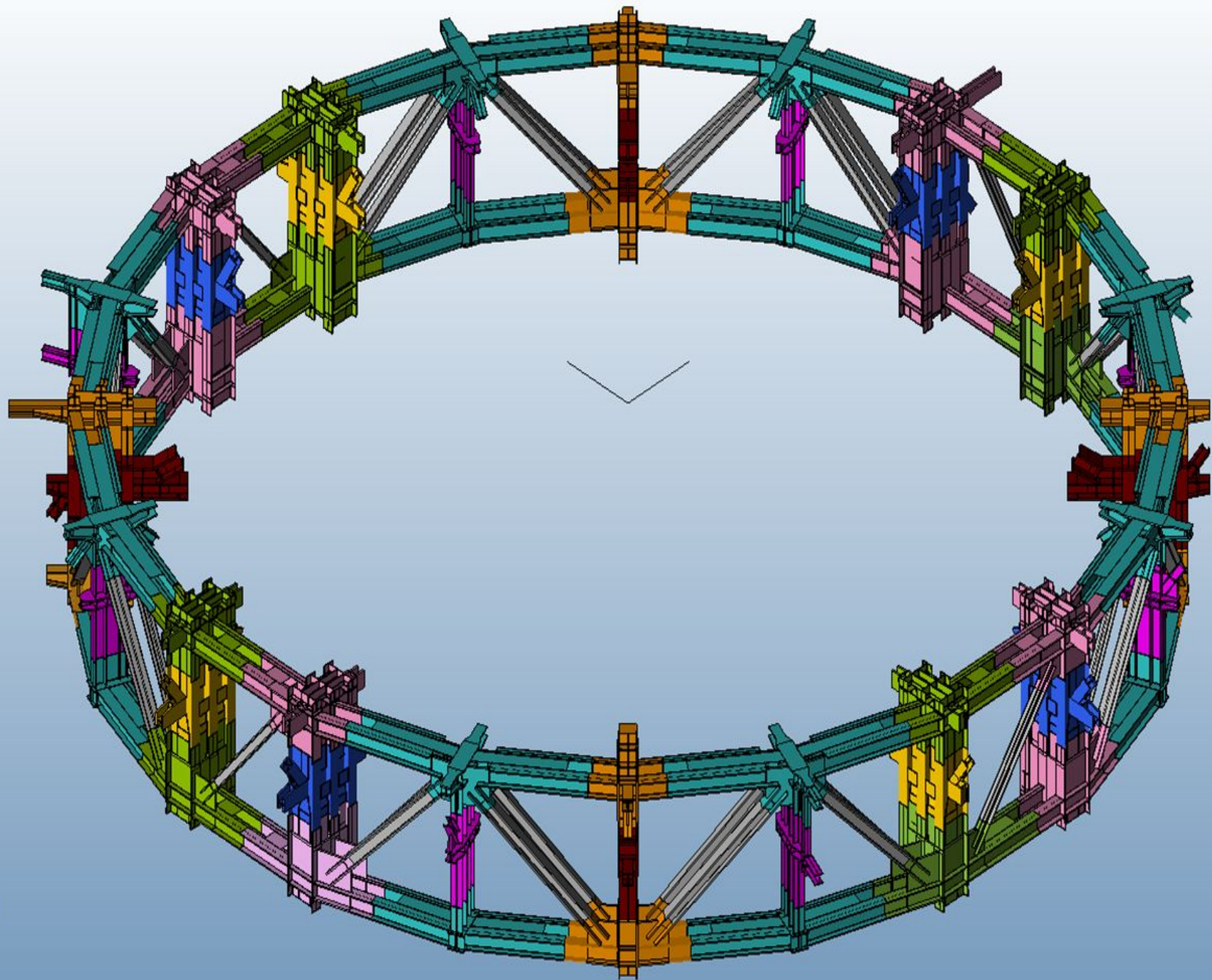


Floor beams

Roof steel structure

















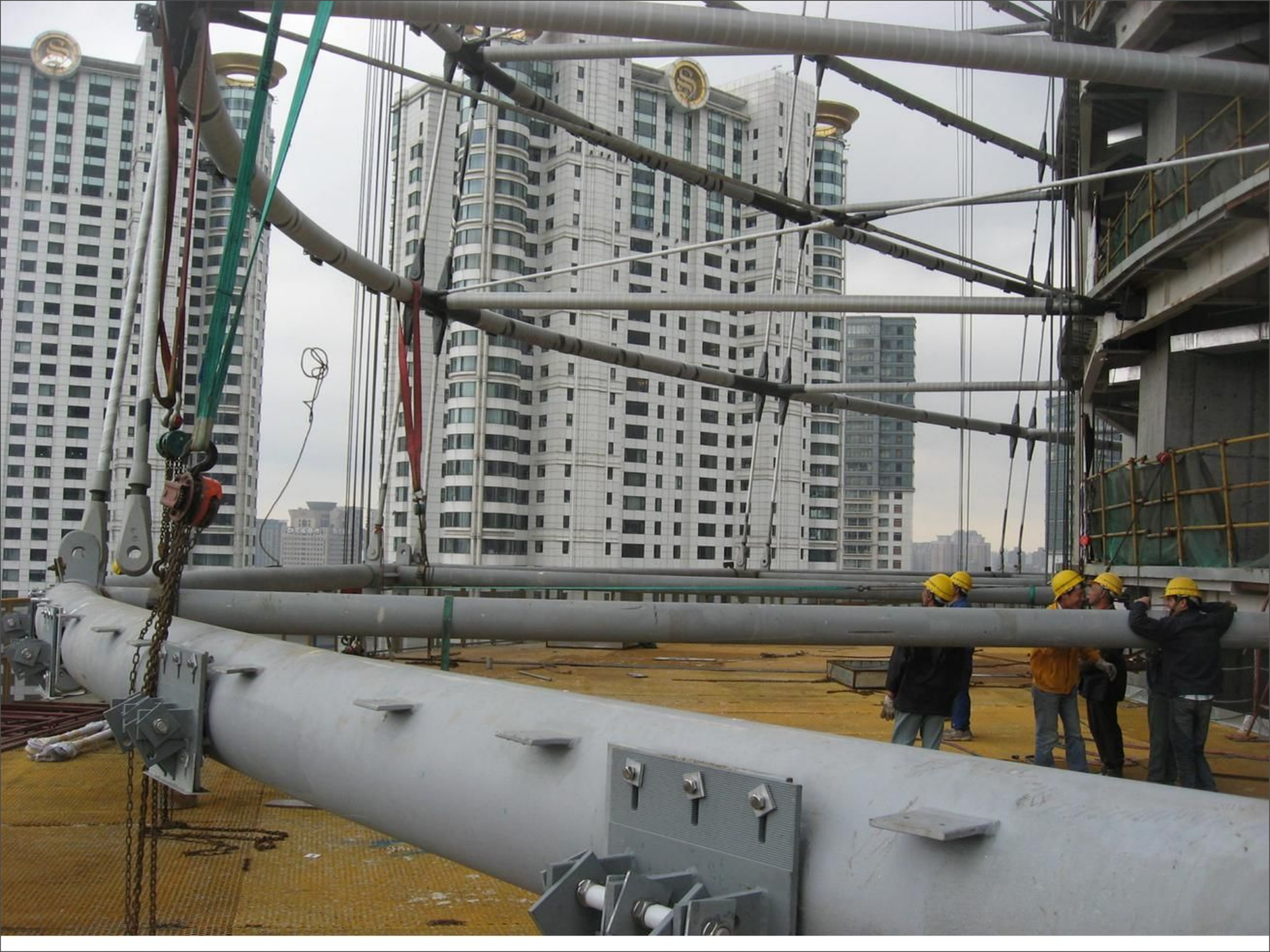
冠達爾鋼結構

GB/T 700
GB/T 8163
Q345B

















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谢 谢

Thank You