ES20821 - Digital Craftsmanship of a Half-Size Eiffel Tower Replica

Marty Collins

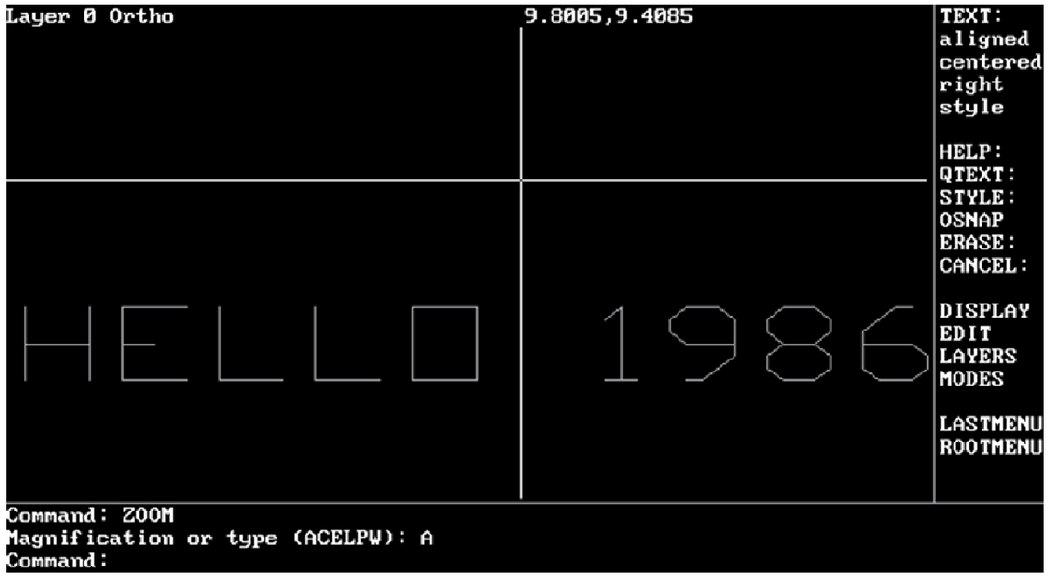
BIM Manager – Aurecon Thailand

About me

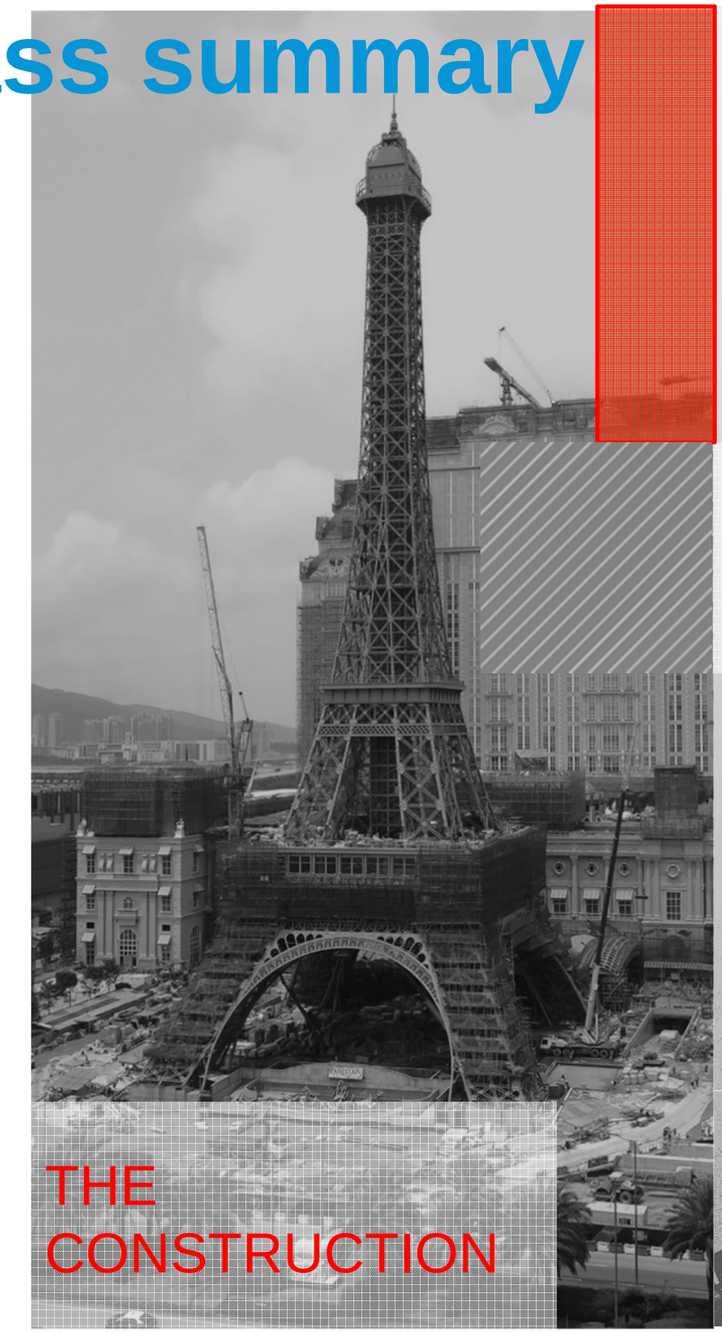
1985

2006

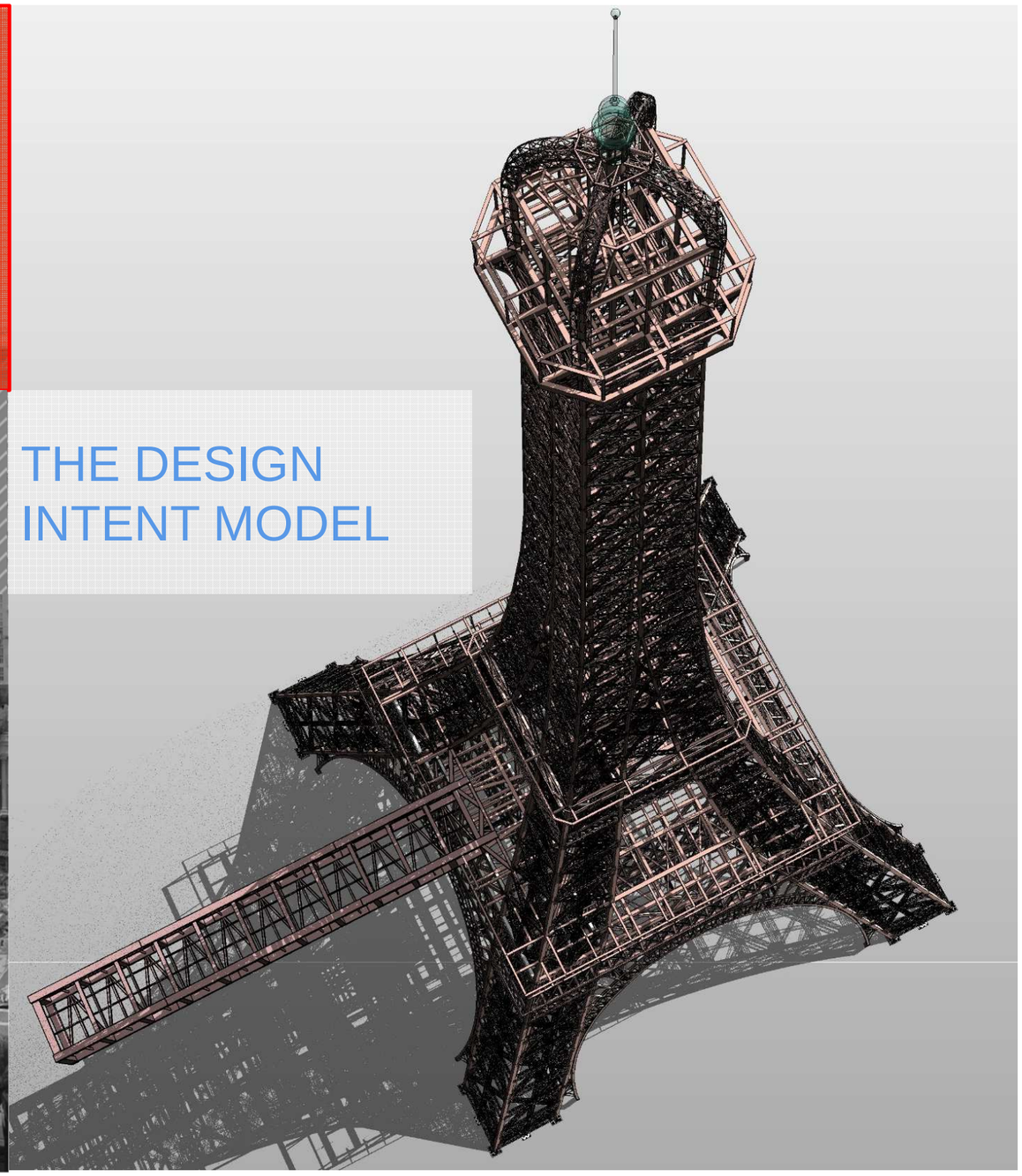
1986



Class summary



THE CONSTRUCTION



THE DESIGN INTENT MODEL

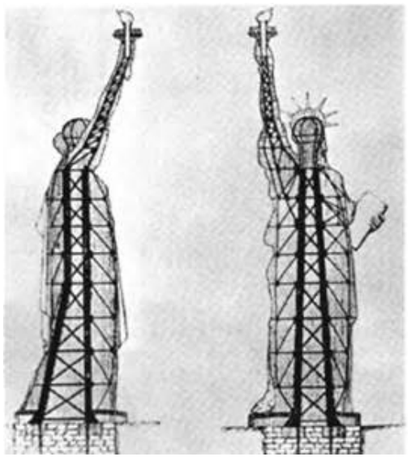
Key learning objectives

At the end of this class, you will be able to:

- Appreciate the power of Revit
- Learn how we pushed Revit to its limits
- Discover the process from model to site
- Along the way see some of the lessons learnt on the project

The Original

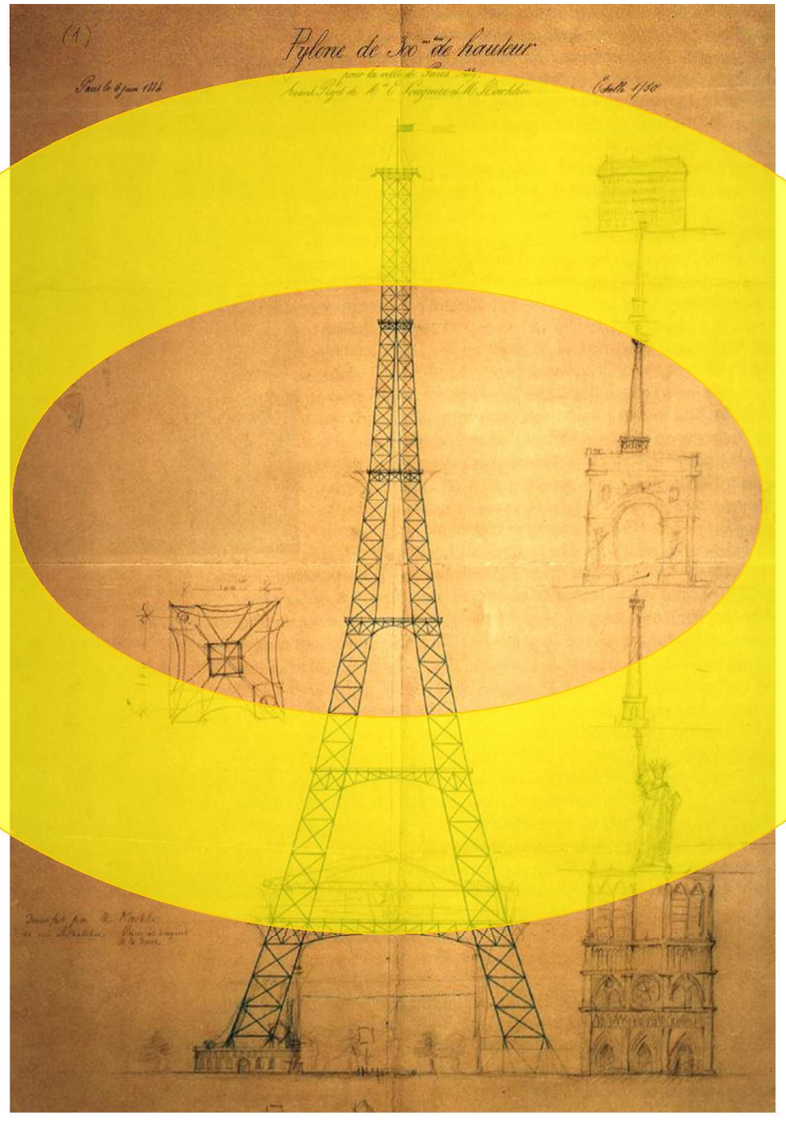
The Engineer - Gustave Eiffel



The Team

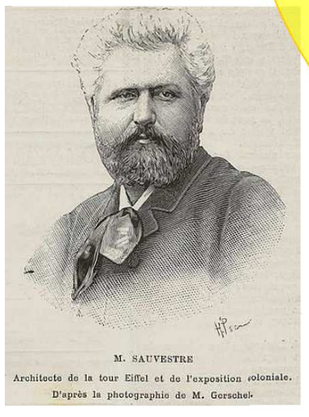
Maurice_koechlin

The Engineers



Émile_Nouguier

Latting Observatory

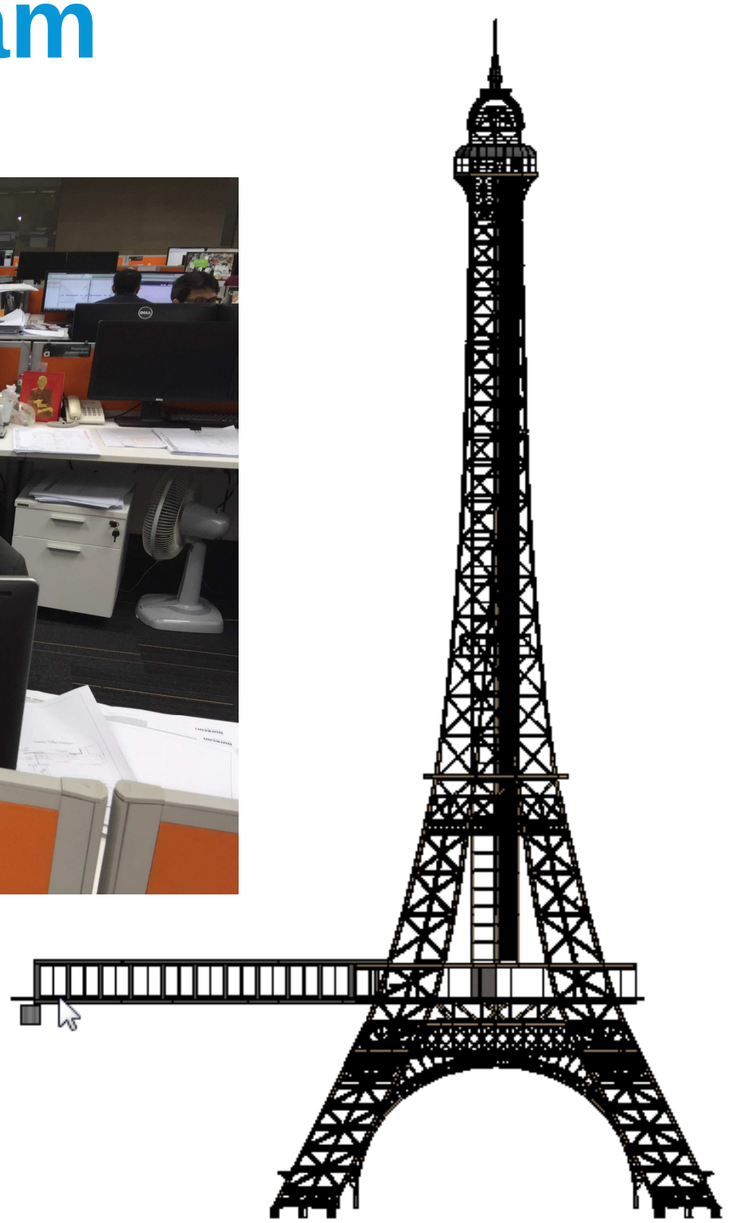


Stephen_Sauvestre

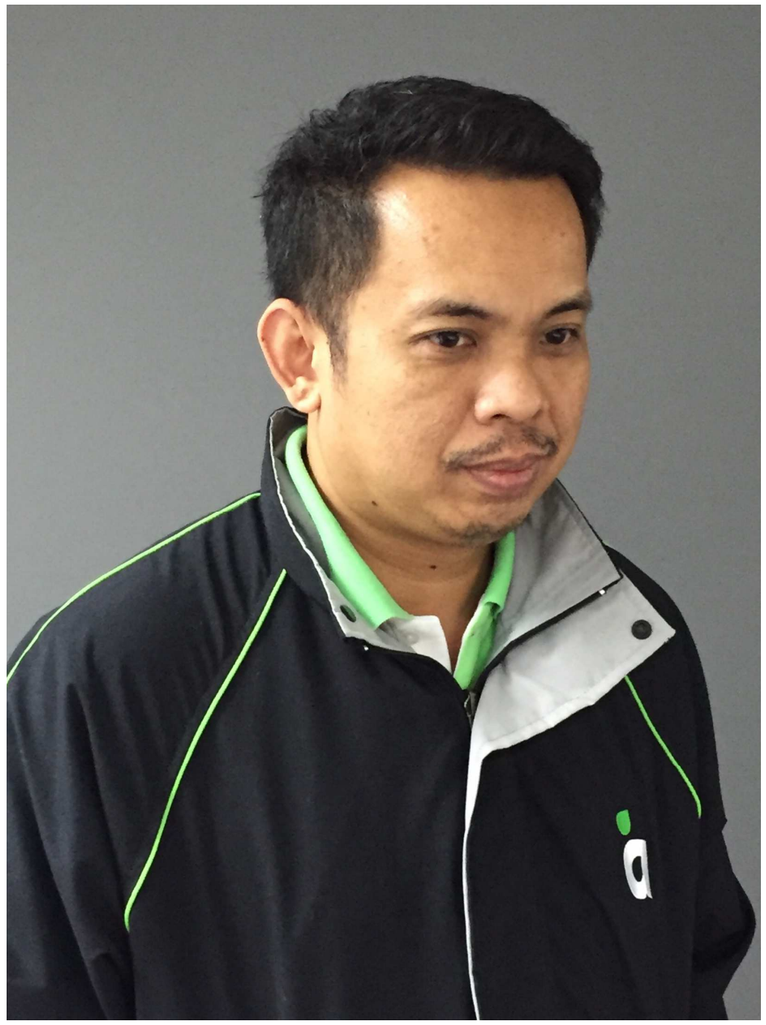
The Architect

Gustave Eiffel

The Bangkok Team



The Revit Modelers

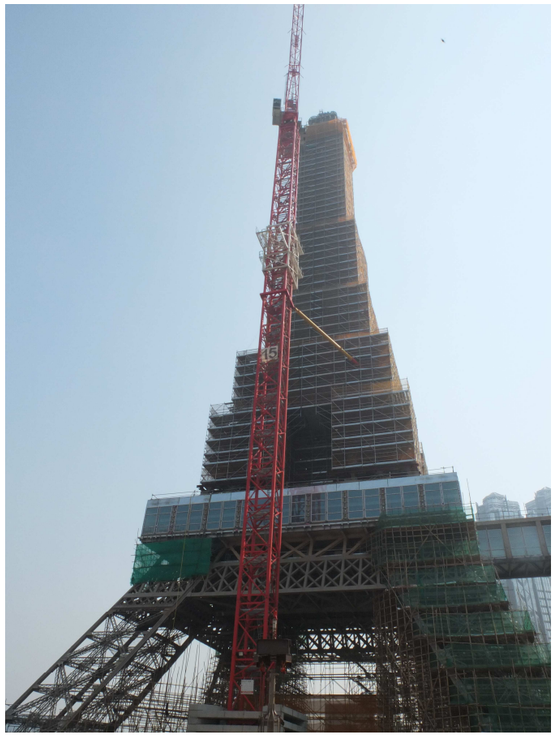


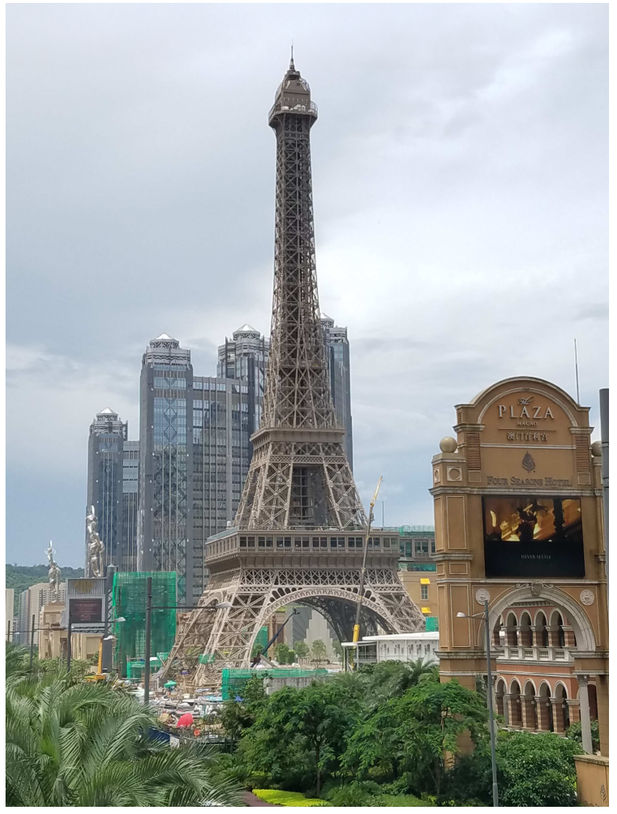
Noppadon Thanathornphiphat

The Construction

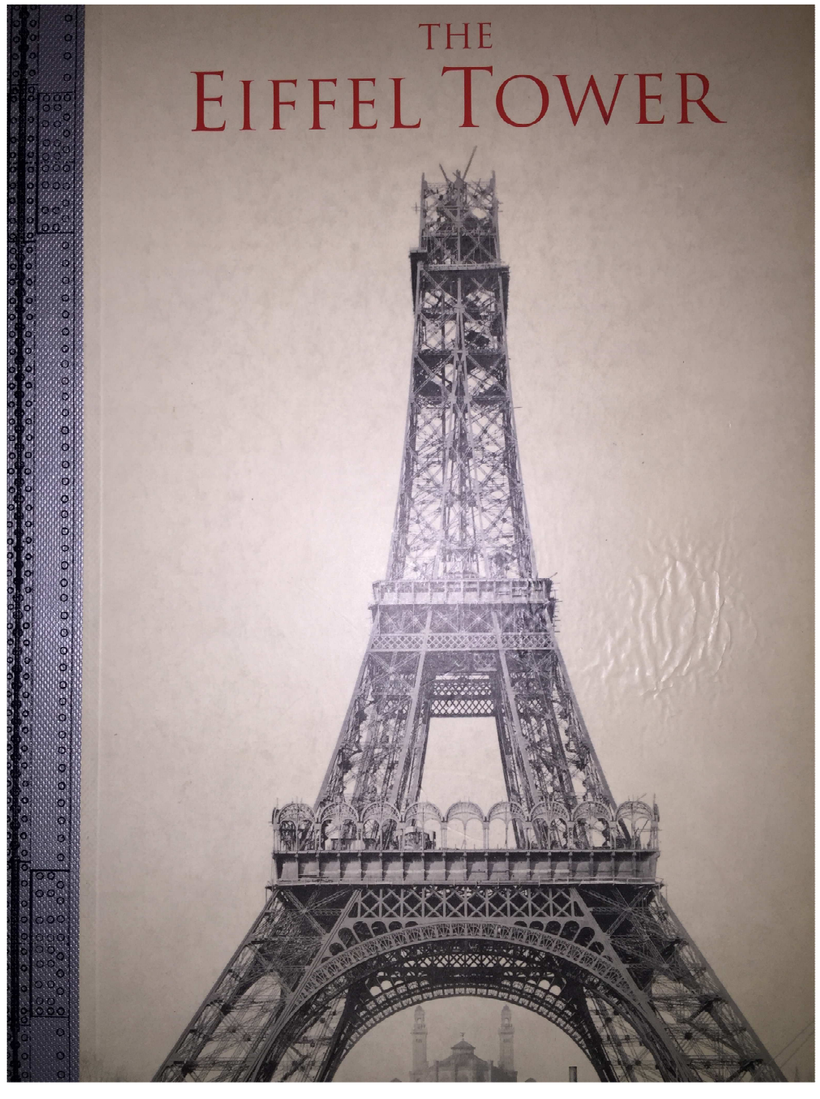
The Eiffel Tower - from April 1888 to May 1889

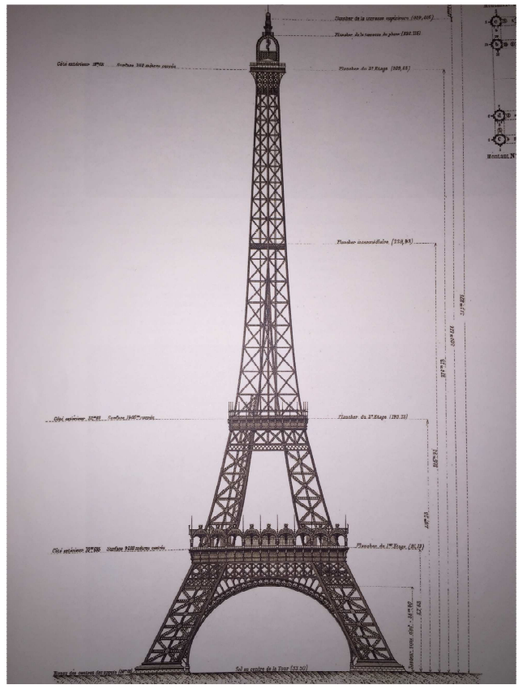
The Eiffel Tower - July 1888

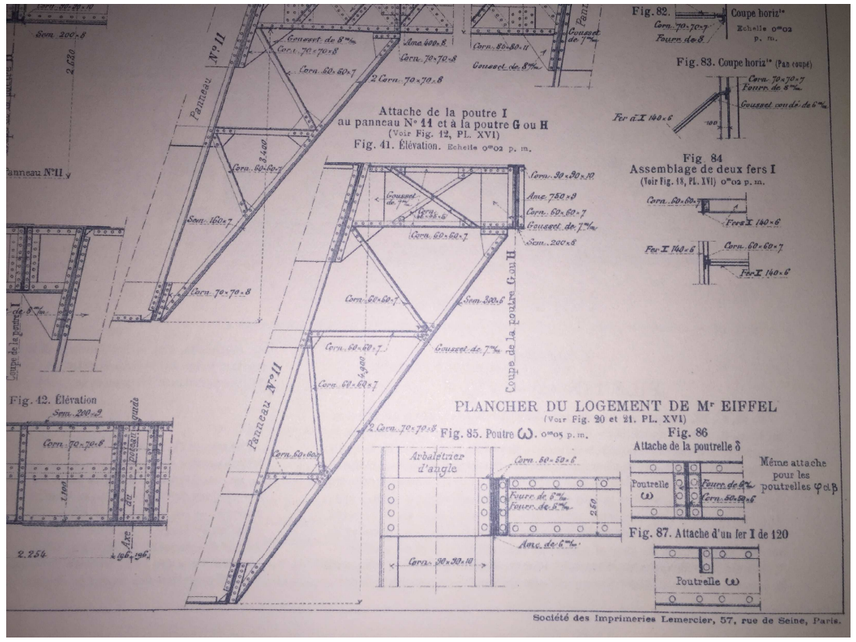


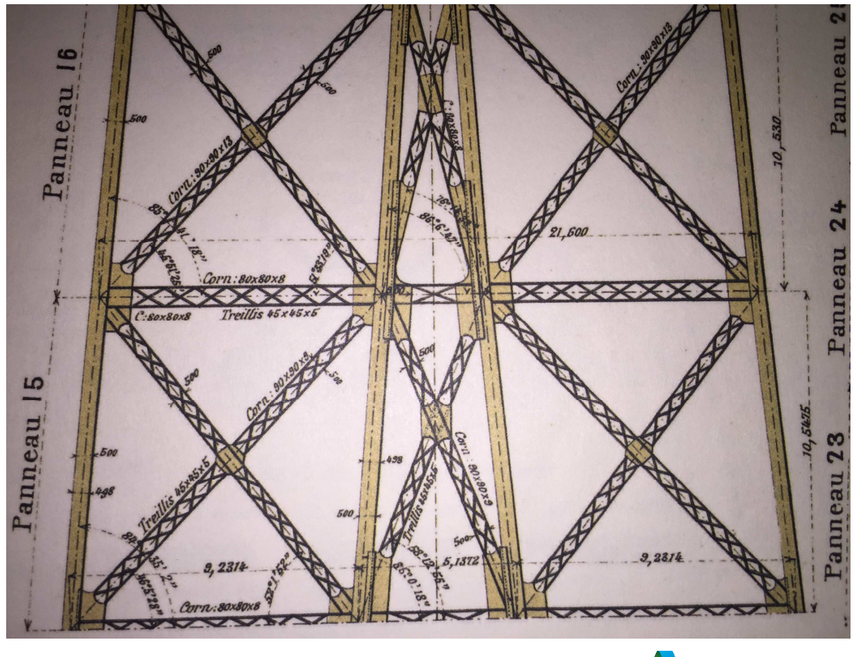


The Documentation

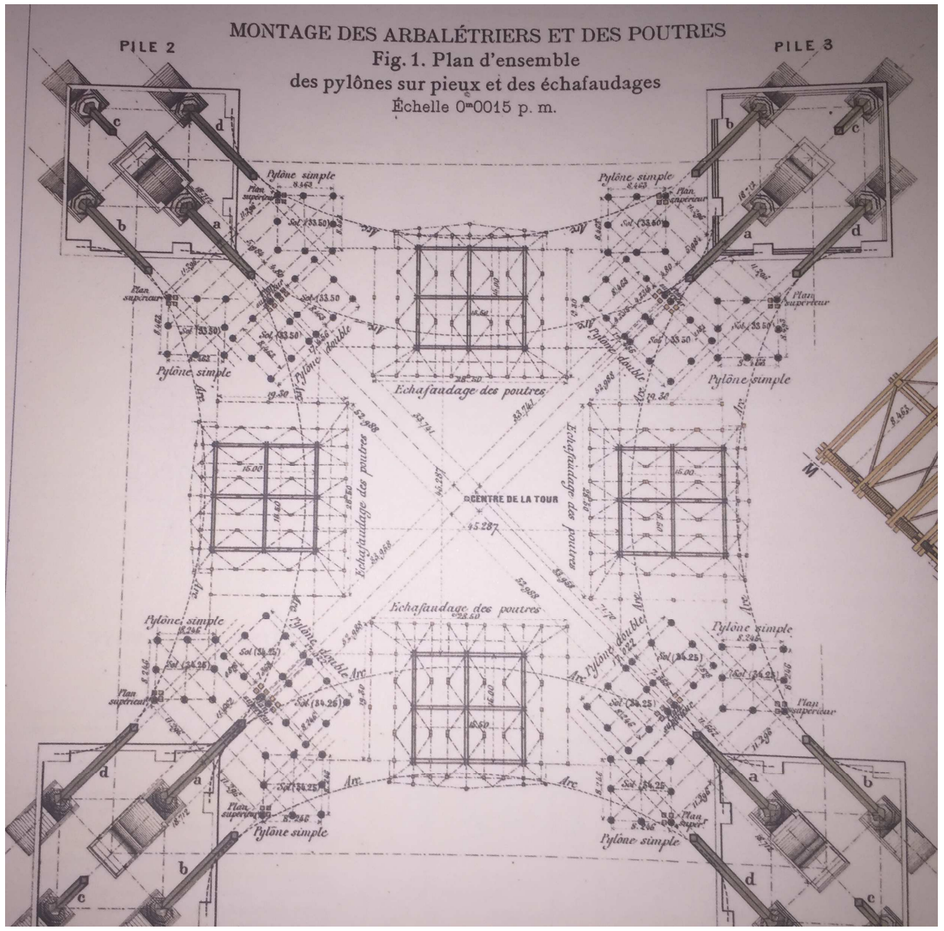


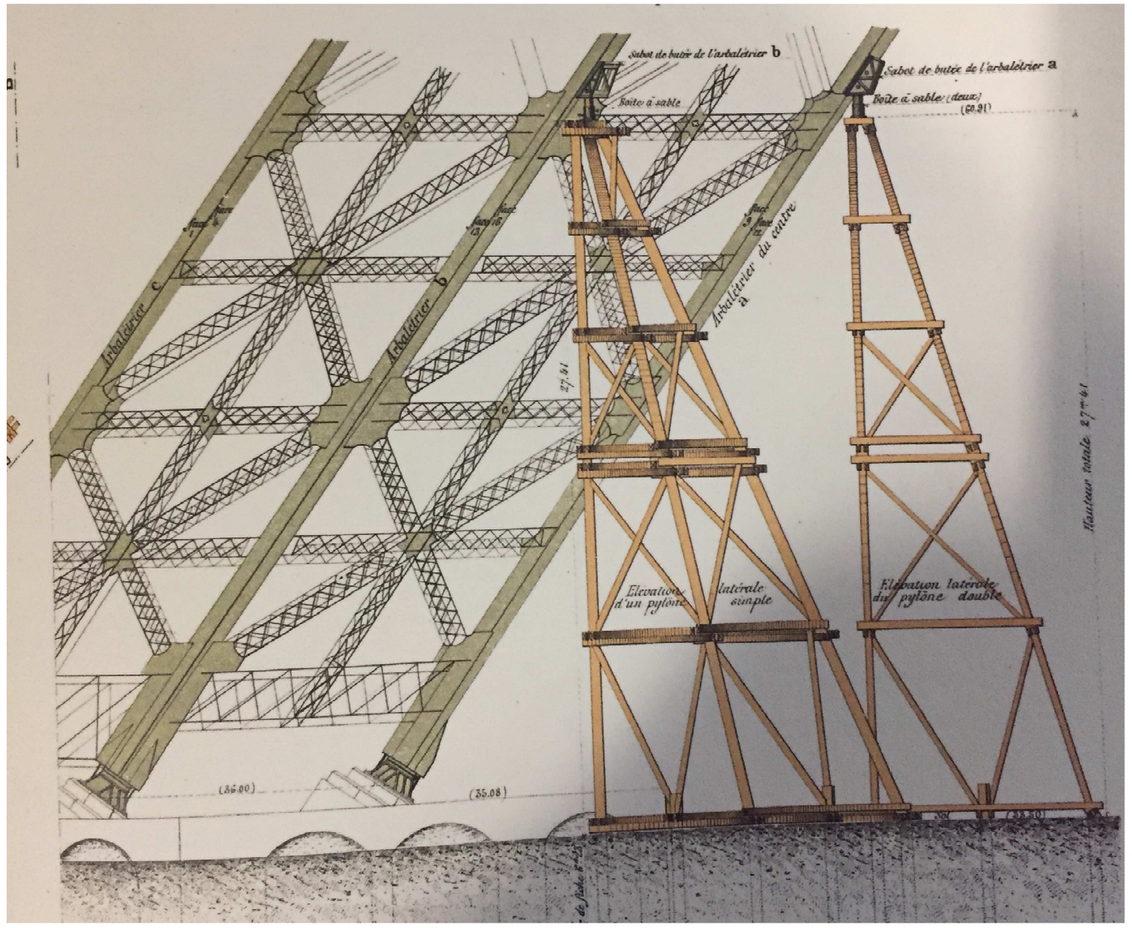




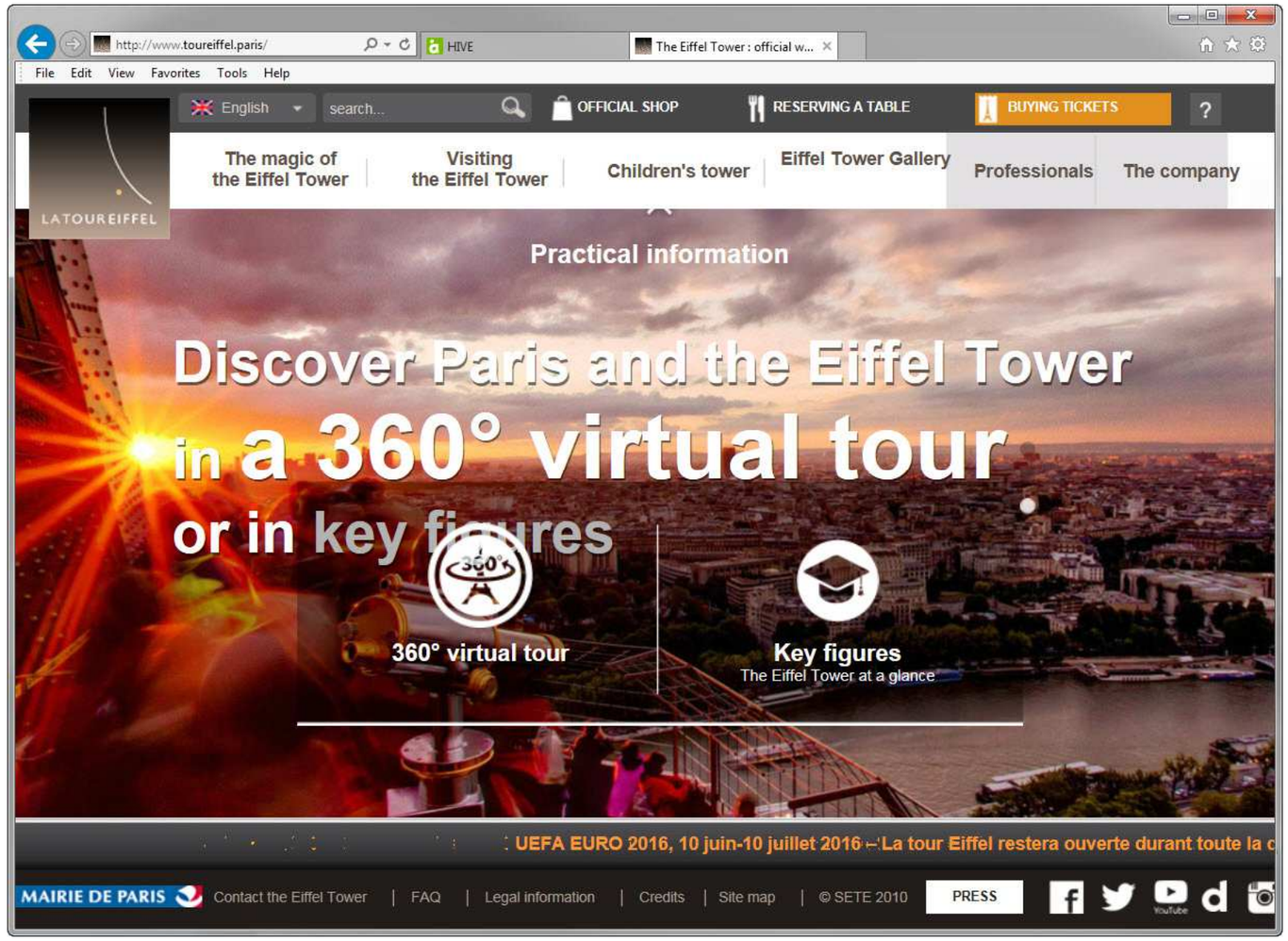


The Construction



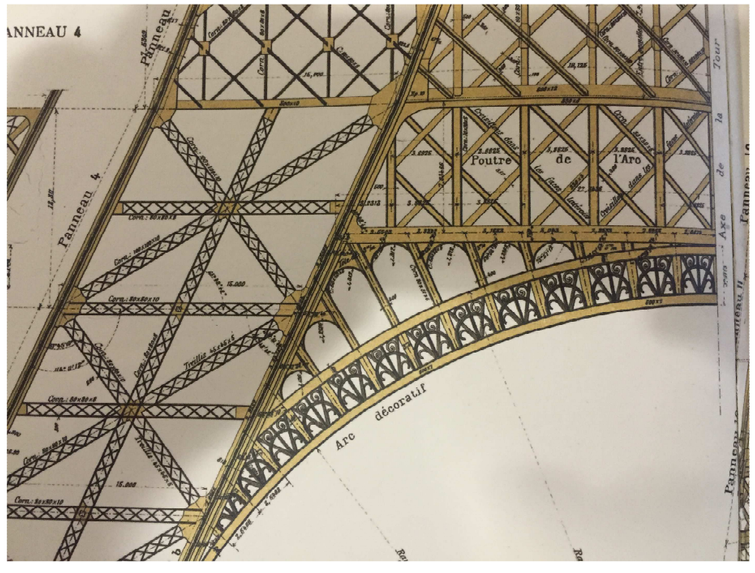


The Virtual Site Visit
http://www.toureiffel.paris

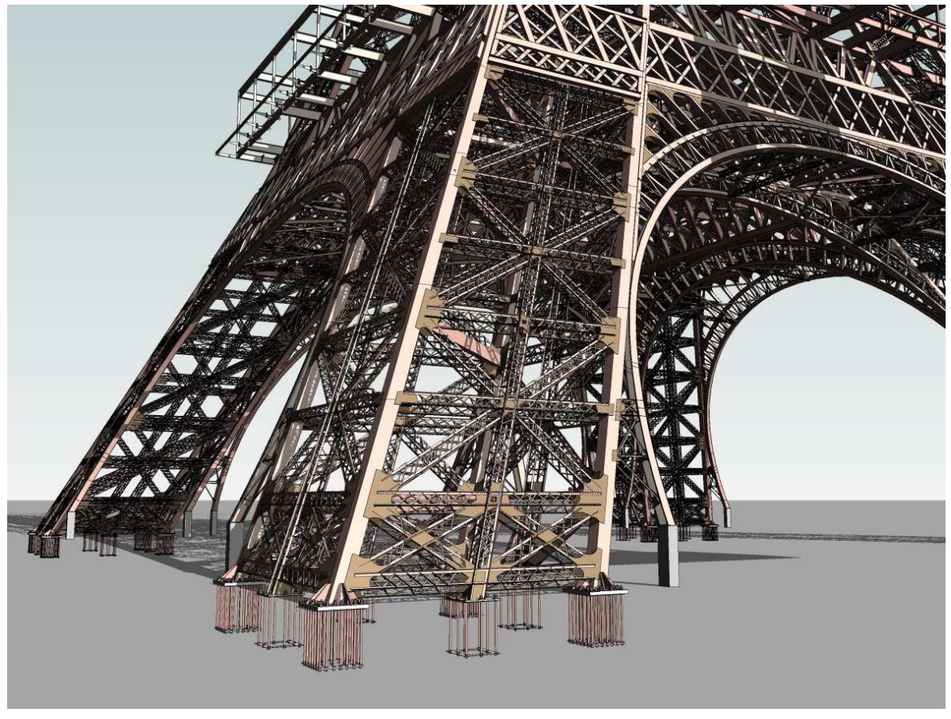


Virtual site visit

Website

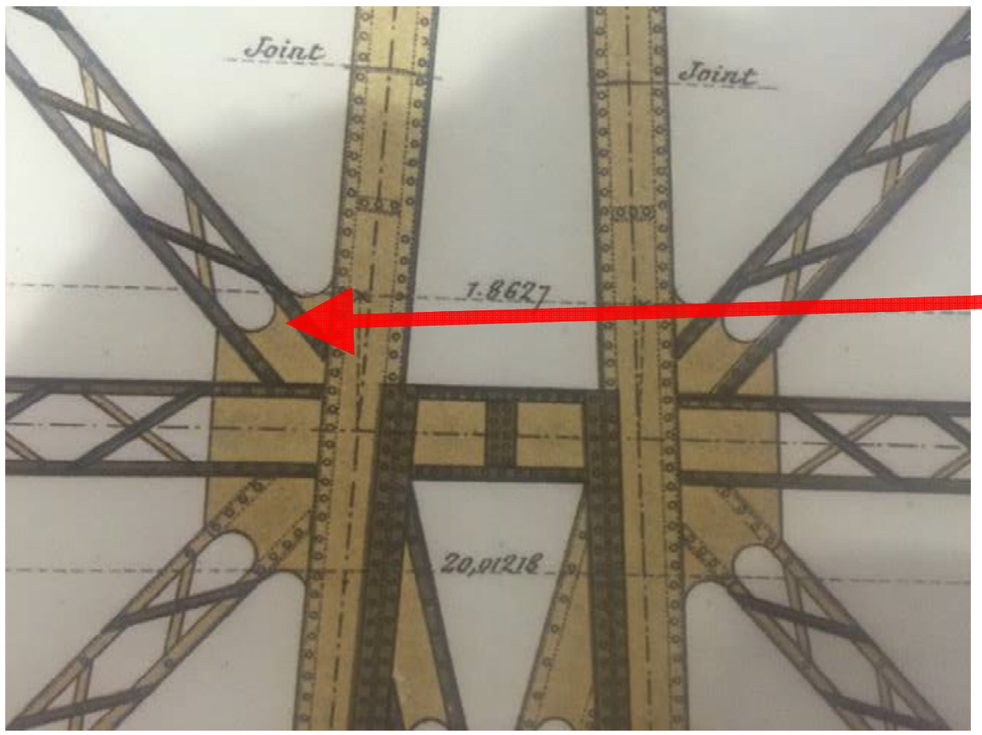


The Book



Our Model

Virtual site visit

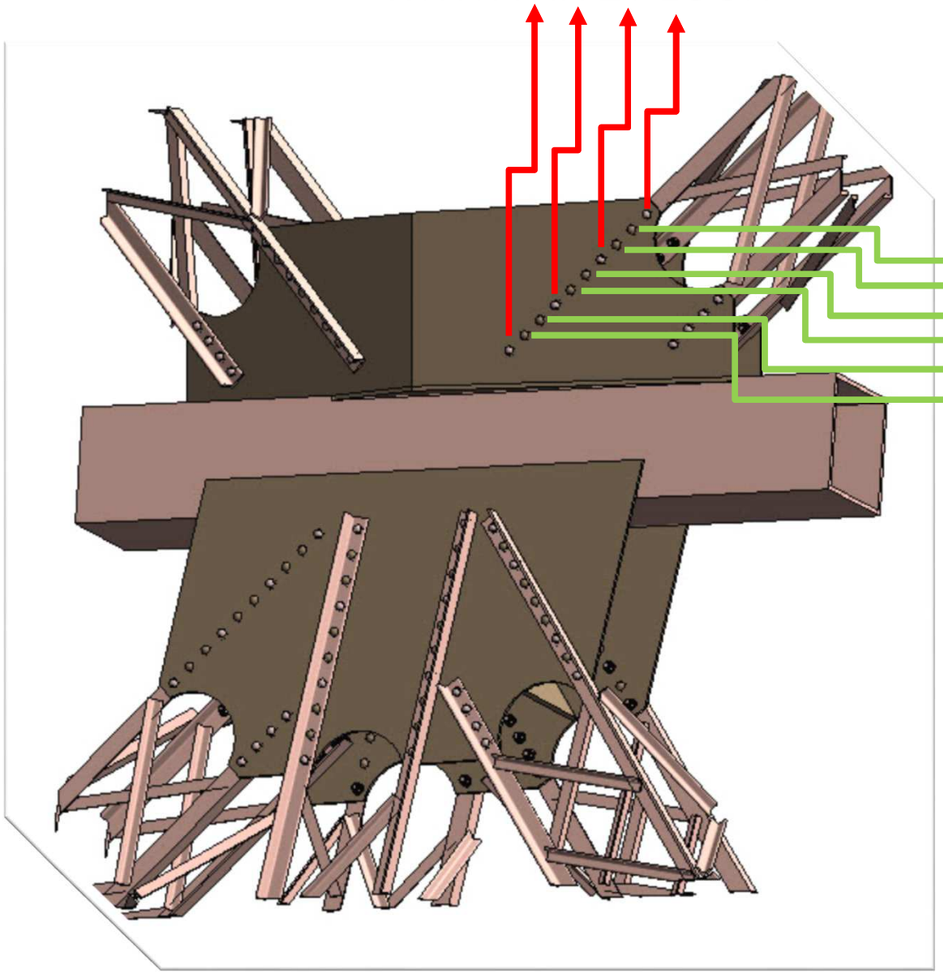


The Book

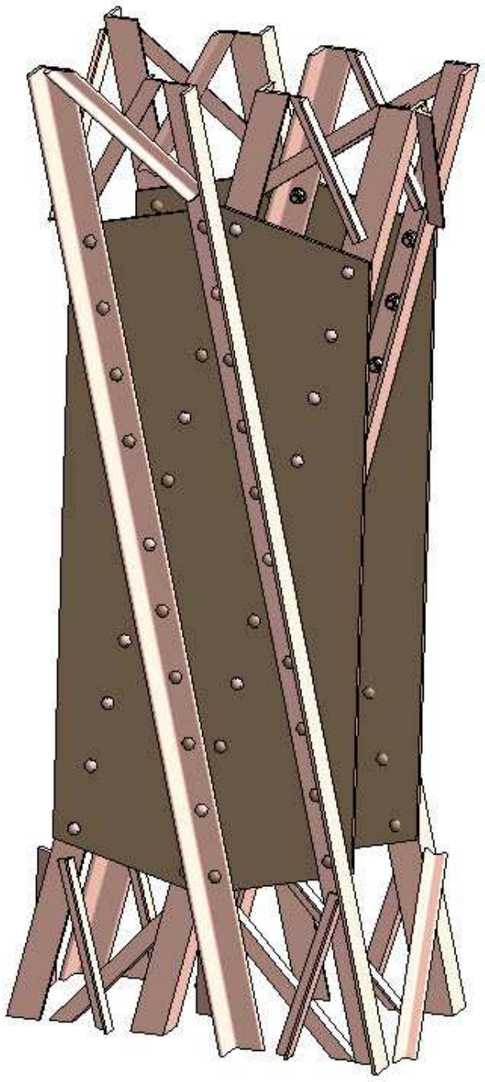
Website

Achieving the look

STRUCTURALLY REQUIRED BOLTS
WITH A RIVET LOOK

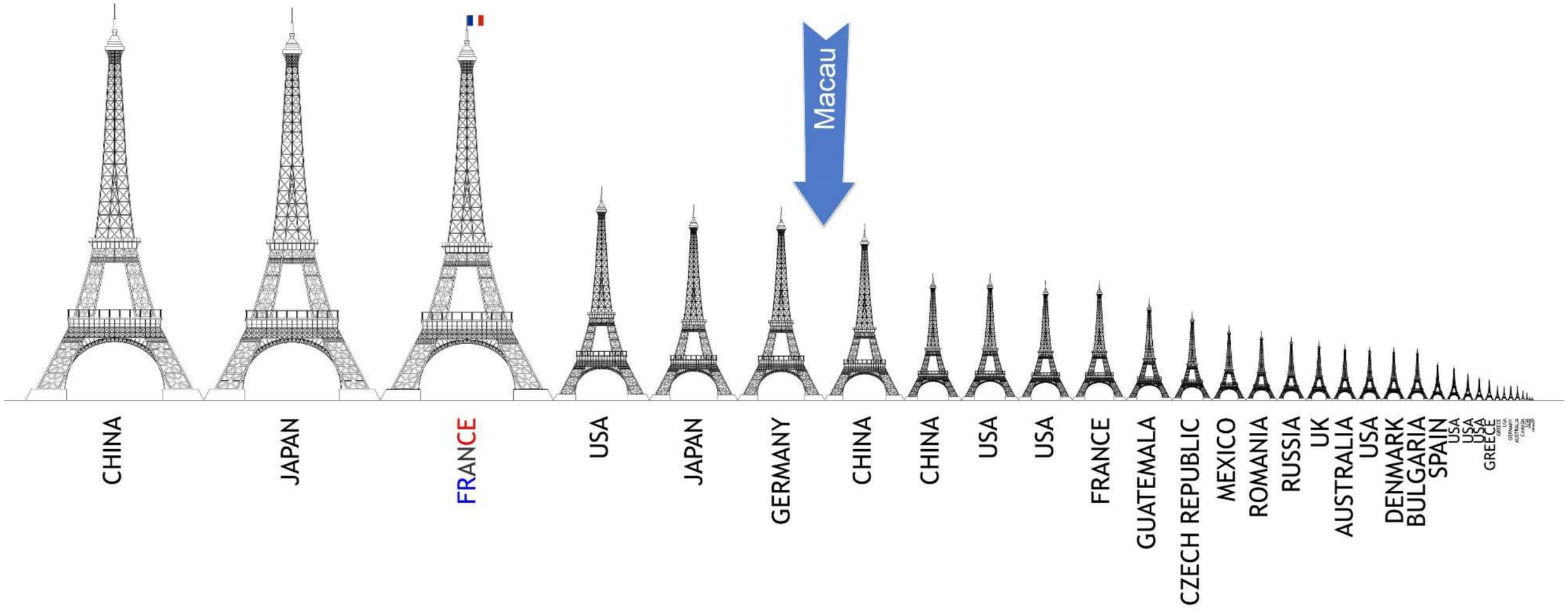


DUMMY REVITS WELDED
TO PLATE CONNECTIONS
TO ACHIEVE THE
DESIRED LOOK

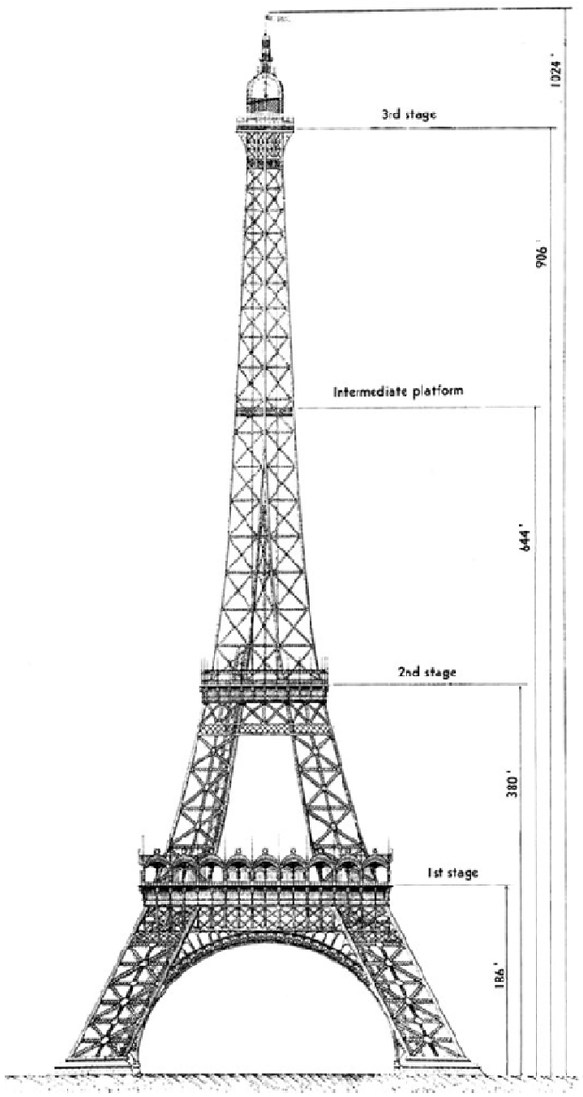


Eiffel Tower Replicas around the World

Relative sizes of Eiffel Tower replicas from around the world



The Comparison

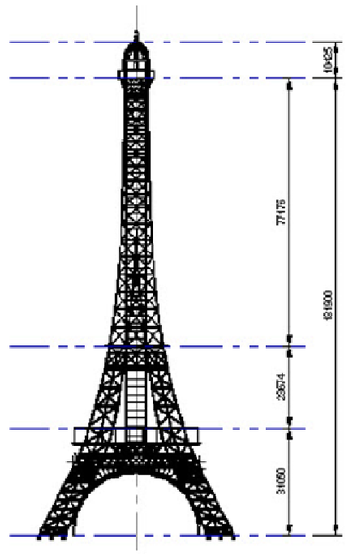


Original - Paris

Eiffel Tower
48% Scale Replica

Paris
*Construction started : **1887***
*Top floor Height : **273.000 m***

Macau
*Construction started : **2014***
*Top floor Height : **131.900m***



Replica - Macau

Decision time

Bentley
Prosteel

?????? X

REVIT

??????

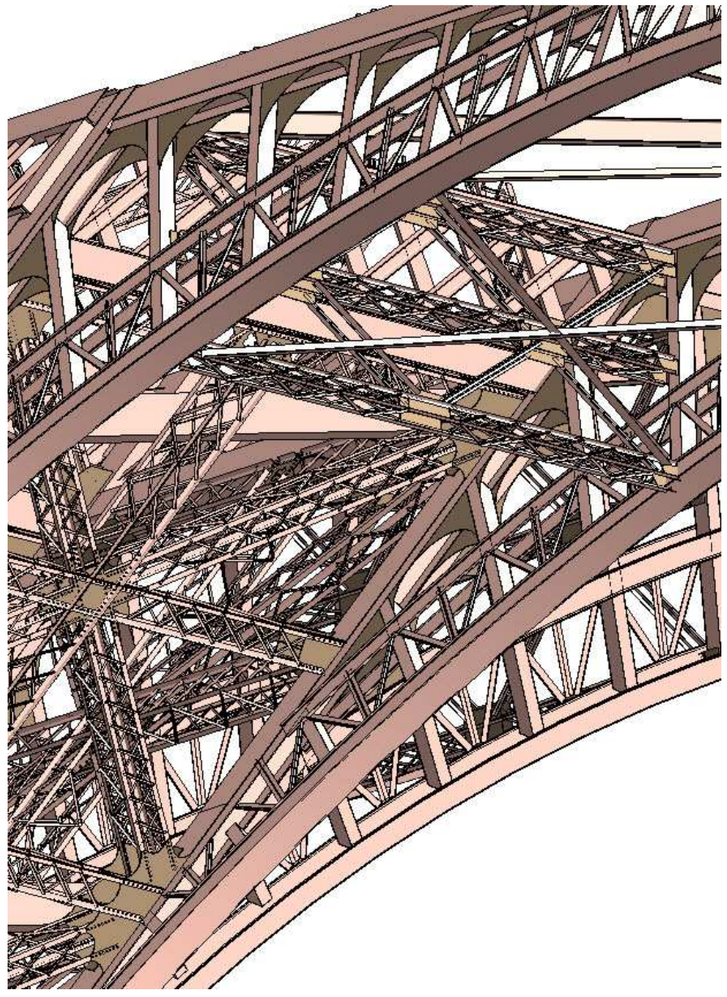
AUTODESK®
AUTOCAD® STRUCTURAL DETAILING

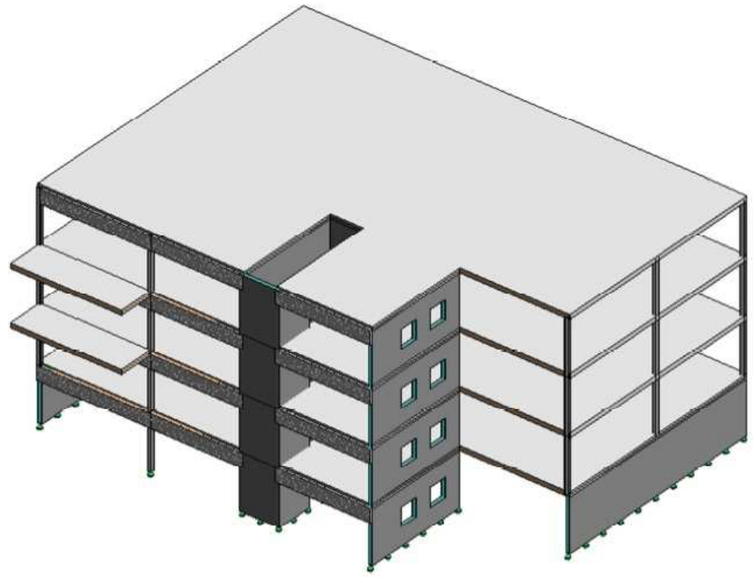
?????? X

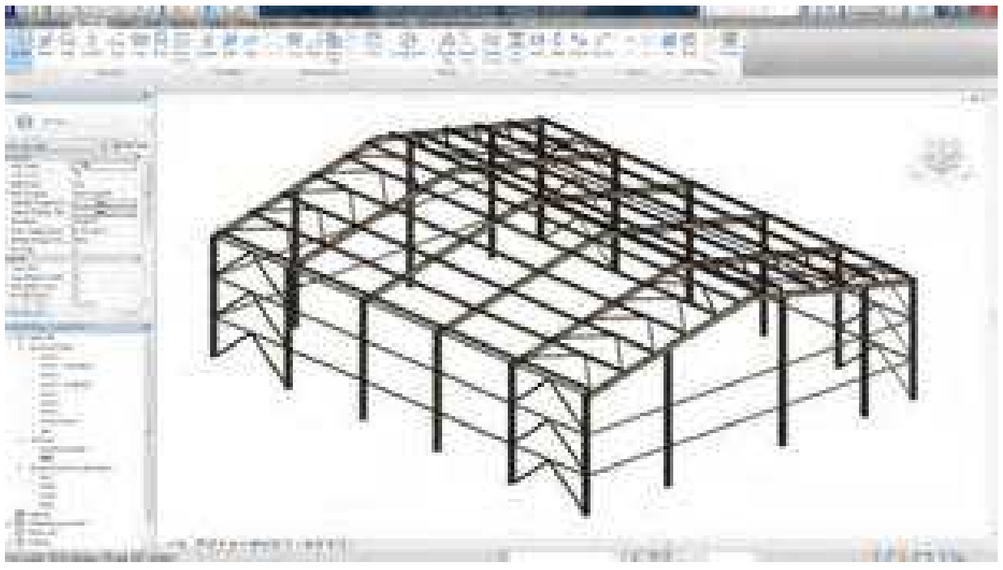
Tekla

?????? X

Decision time

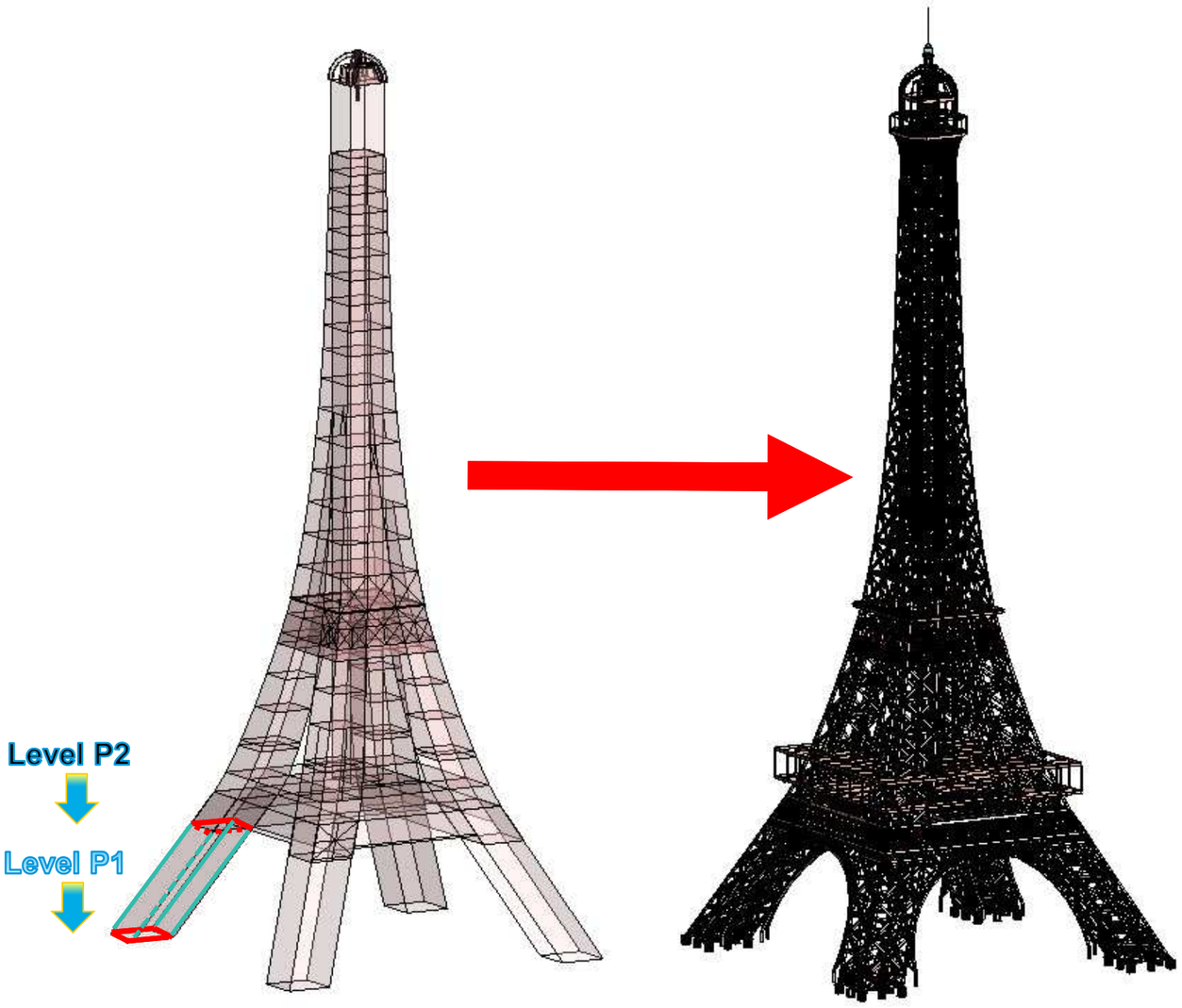


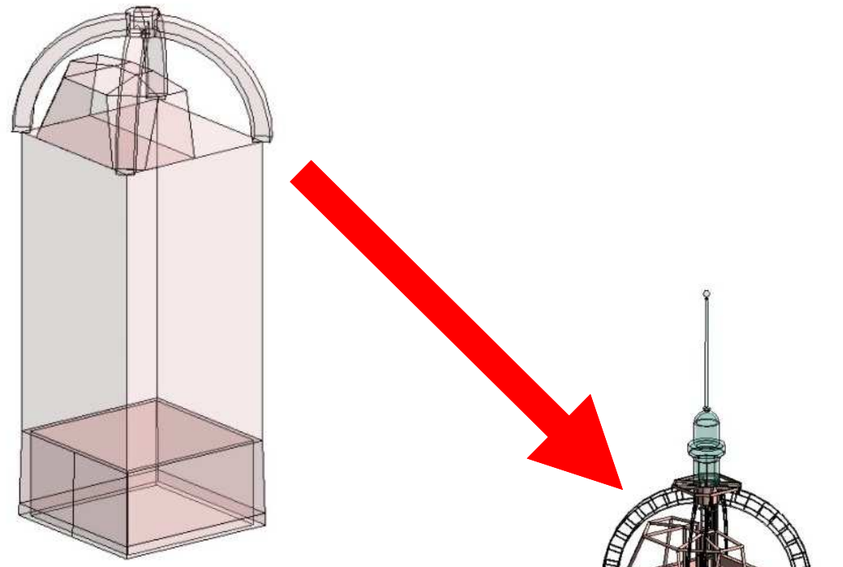


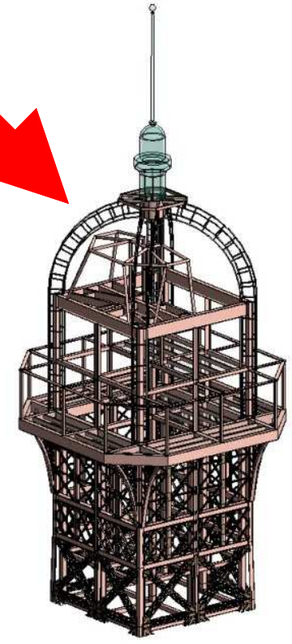


The starting point

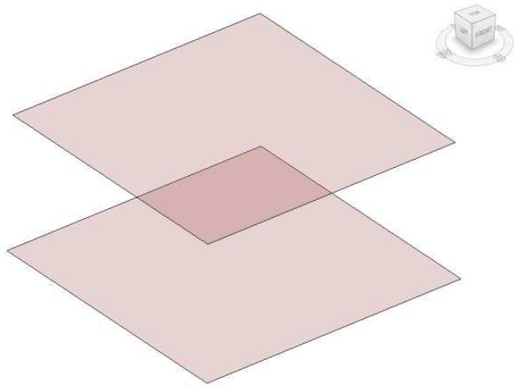
Massing for control center of columns and Lattice beams

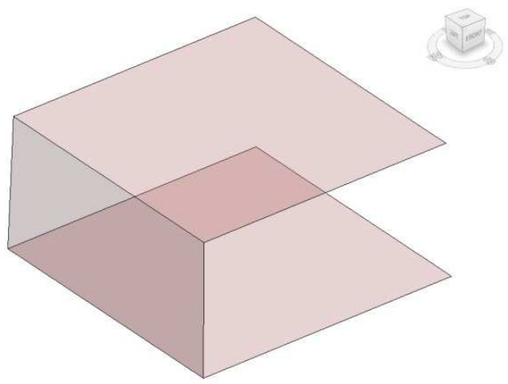






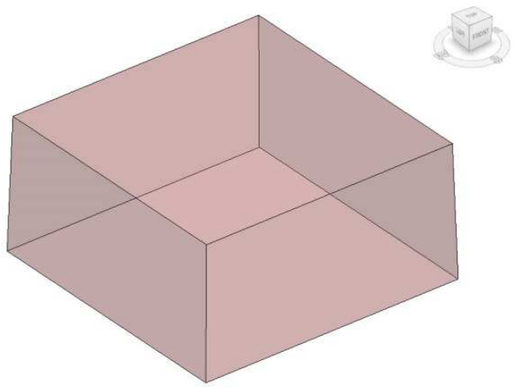
The mass model

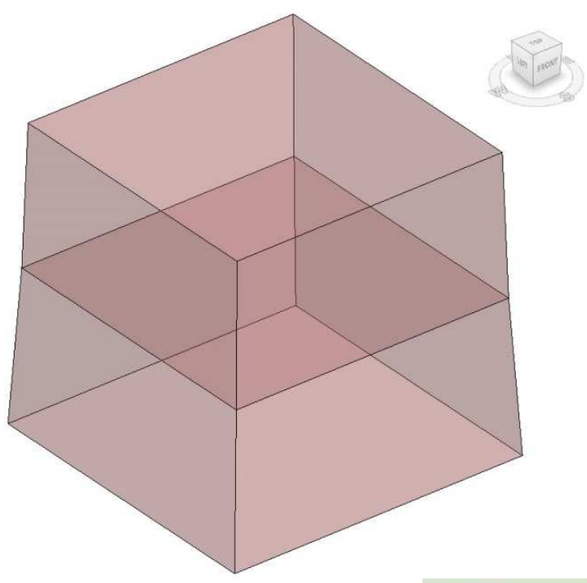


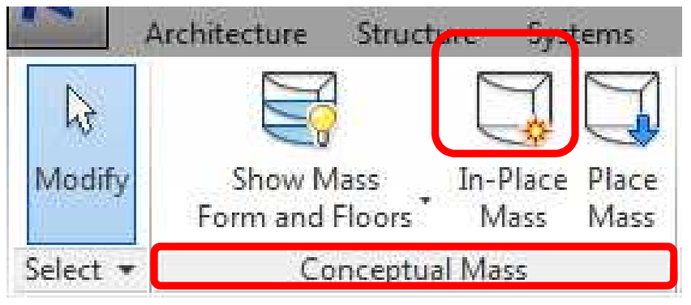


Mass Model

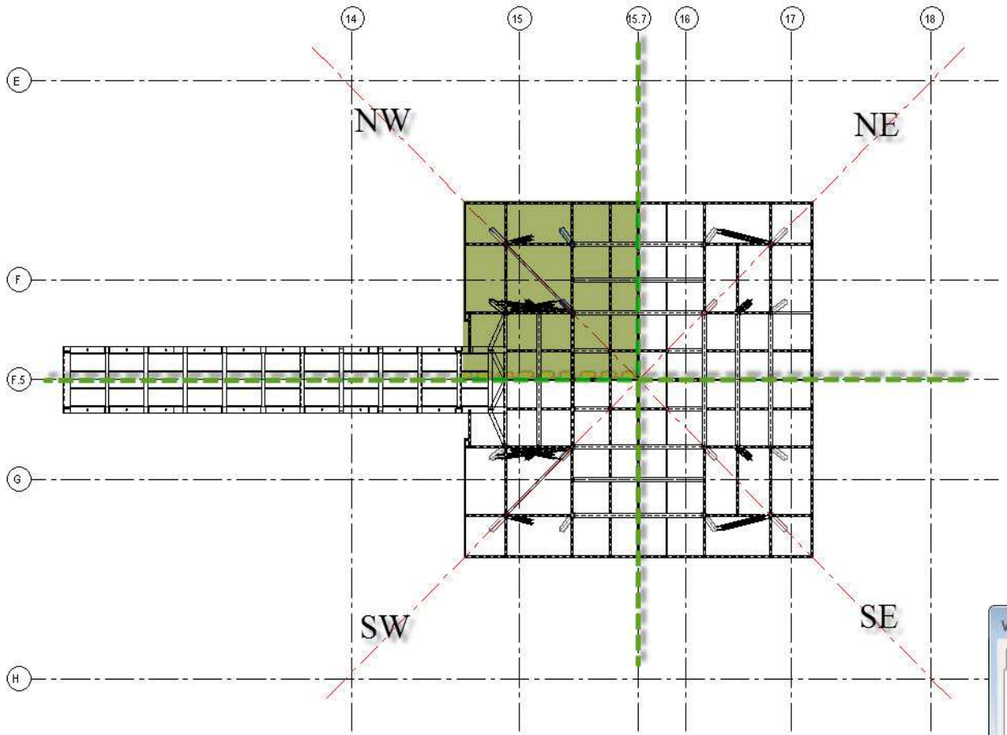
- *Start plane with Plan Level for Bottom and Top Plane*
- *Create Side Surface from top and Bottom Plane for Each Side*

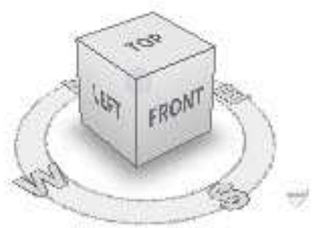


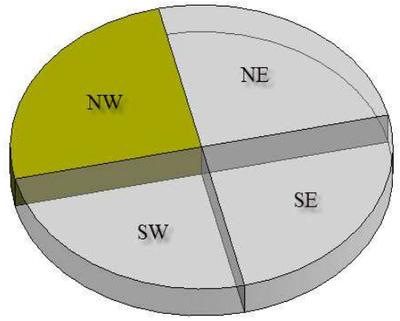


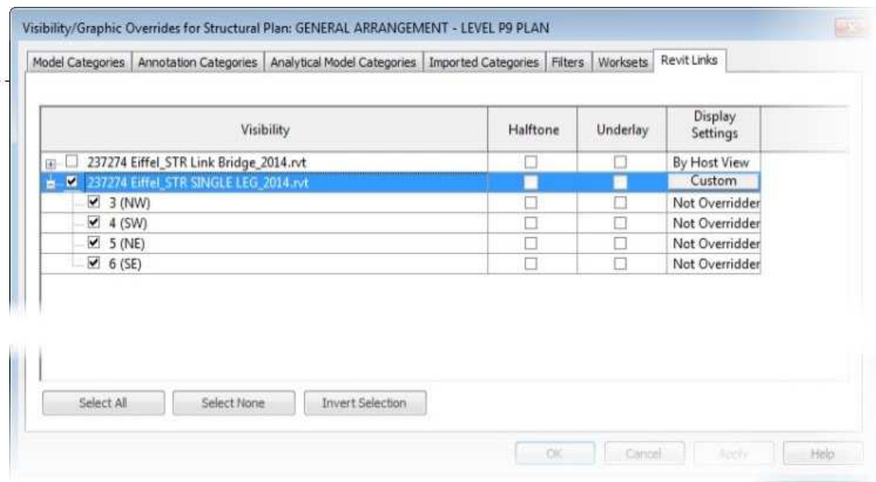


A time saving idea



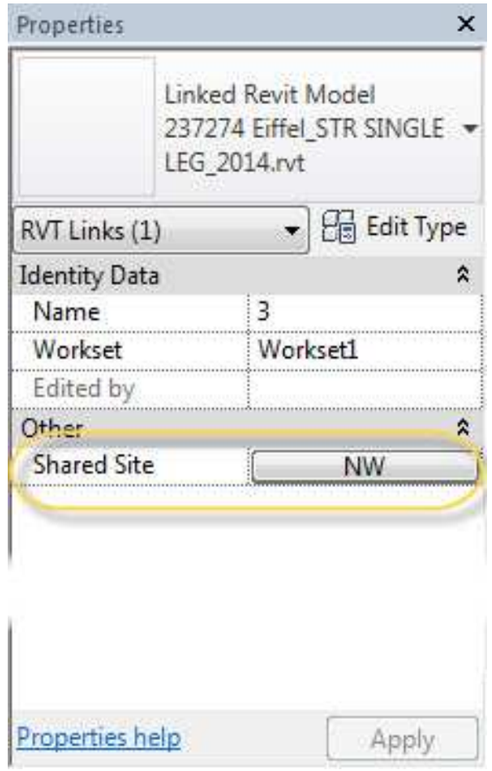






Model Part of Quarter

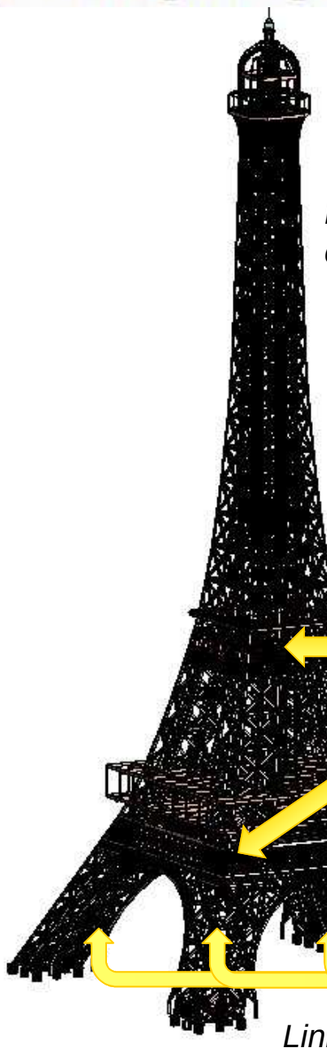
- *Create Link Model for Part of Quarter NW*
- *Import Link Model to Master Model*
- *Duplicate with Mirror and Setup Shared Site*



Model setup

What went where

237274 Eiffel_STR 2014_Central.rvt 325,220 KB

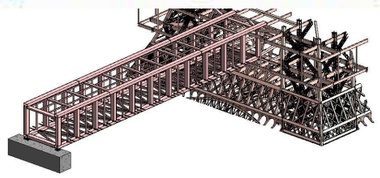


Everything documented out from central file.

Contractor, Consultant, Client, Government Departments

237274 Eiffel_STR stair.rvt 25,244 KB

237274 Eiffel_STR Link Bridge_2014.rvt 45,300 KB



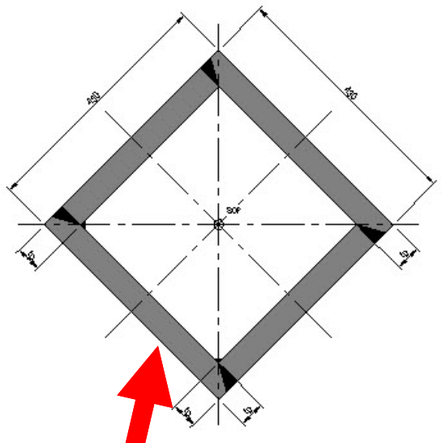
237274 Eiffel_STR SINGLE LEG_2014.rvt 335,716 KB

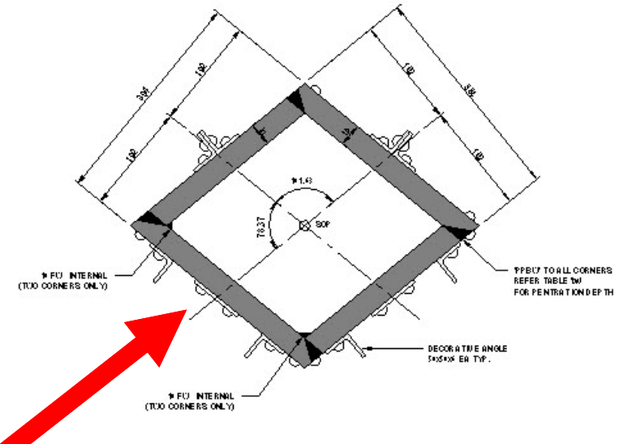
Linked in and put into each Quadrant

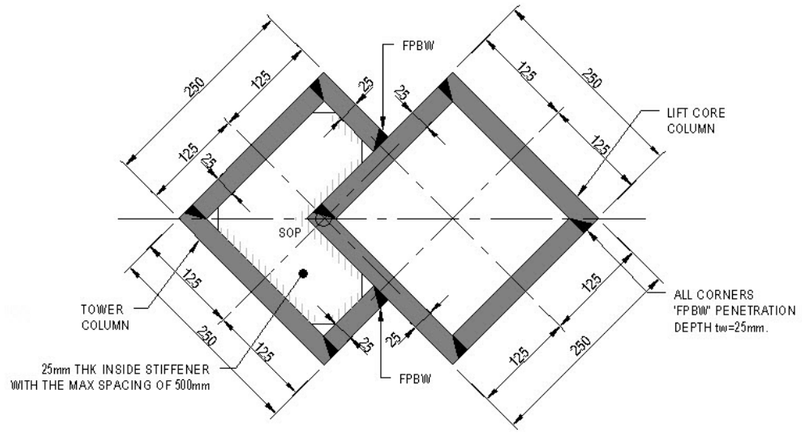
- *The central file contained all link files.*
- *What was not modelled in to link files was modelled in the central file, (infill structure between the single leg models)*
- *All the Documents were produced from the Central file.*

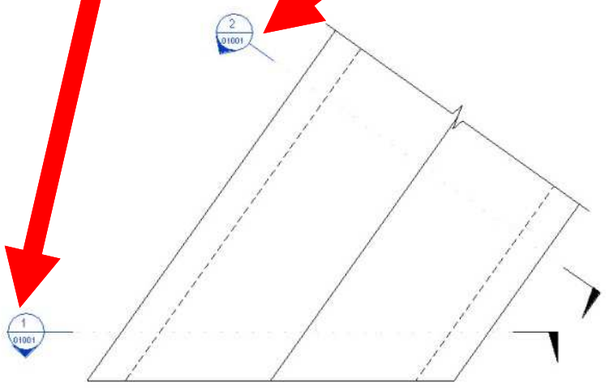
Some strange geometry

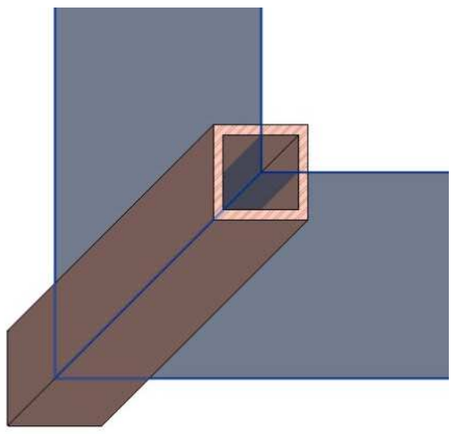
Custom Built-Up for Main Column

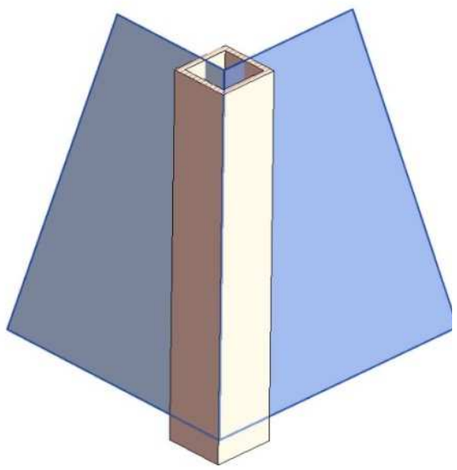


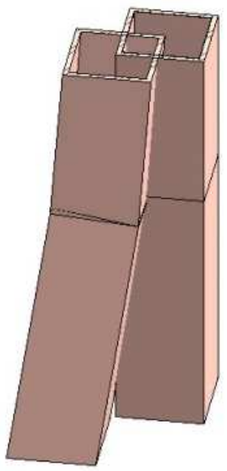




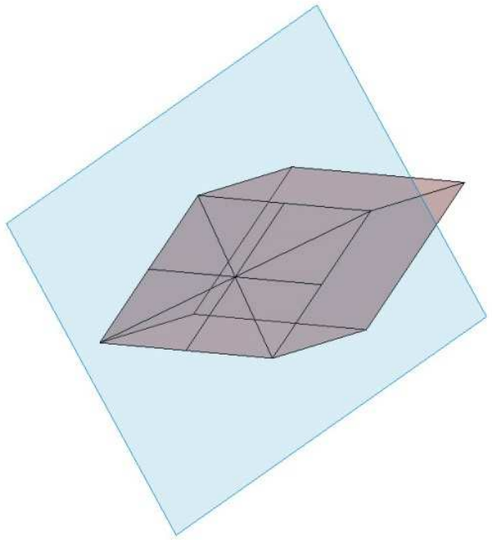


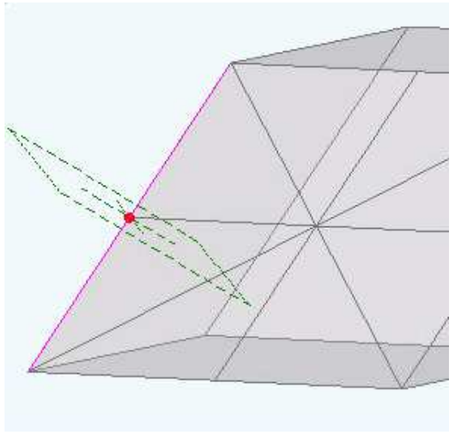


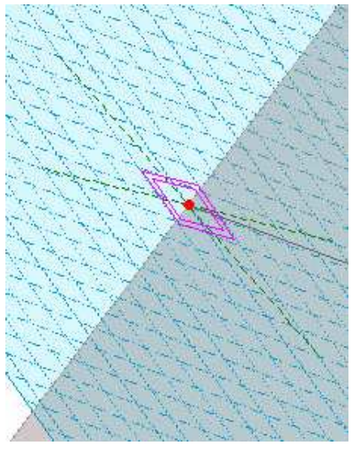




Column placement

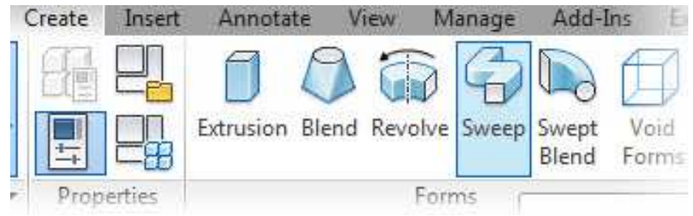


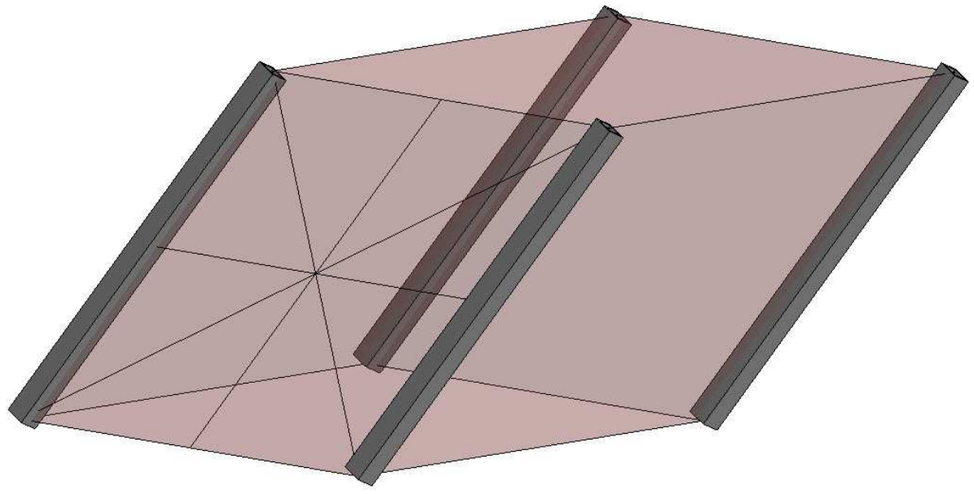




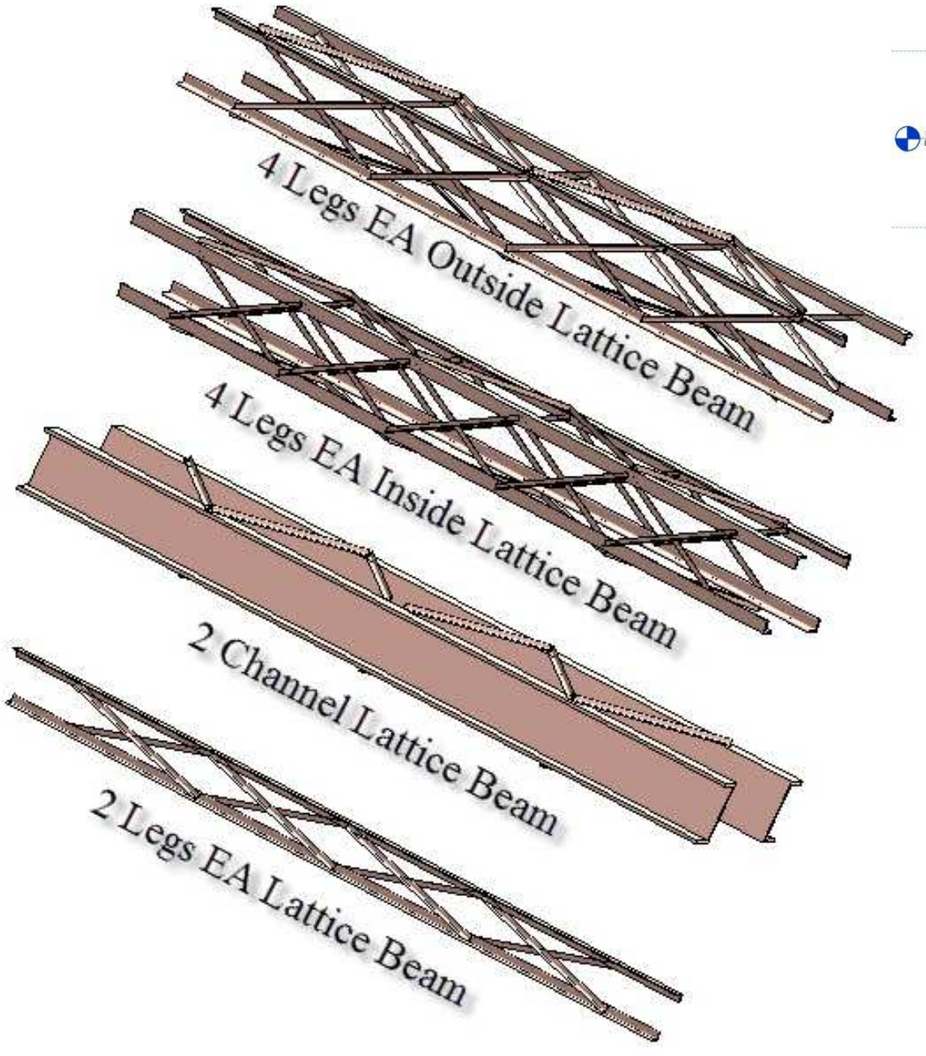
Custom Built-Up for Main Column

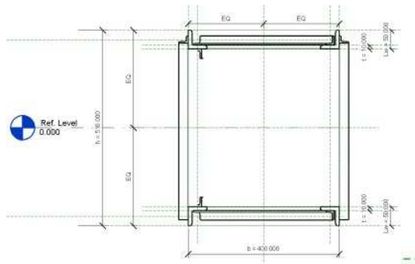
- *Create Main Column by*
  Component > Model in-Place > Sweep
- *Used Mass Model for Main Column Reference*





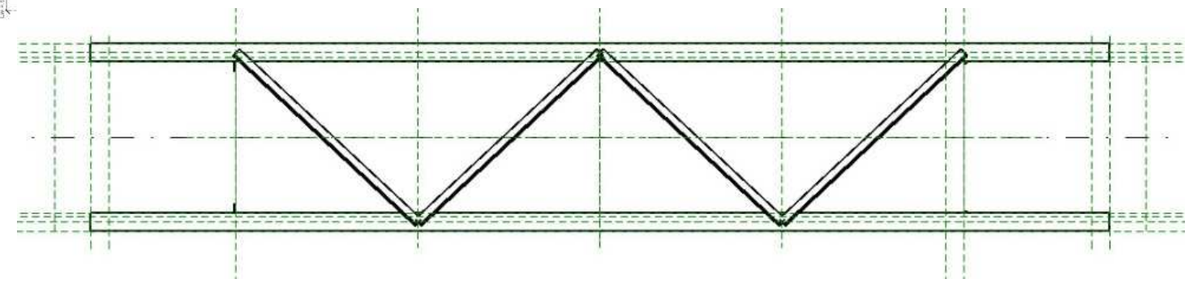
Lattice placement

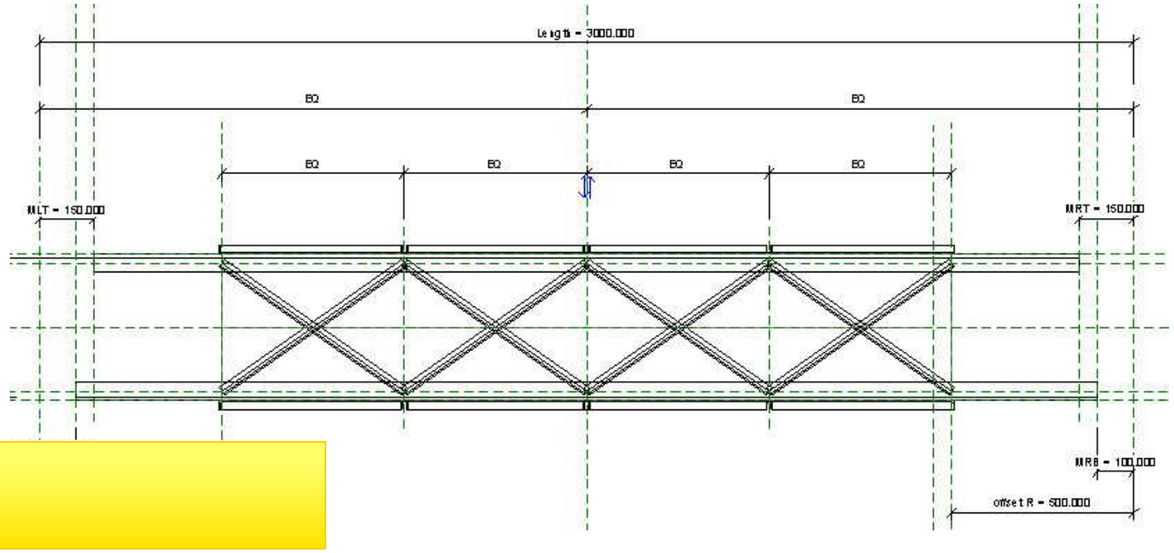




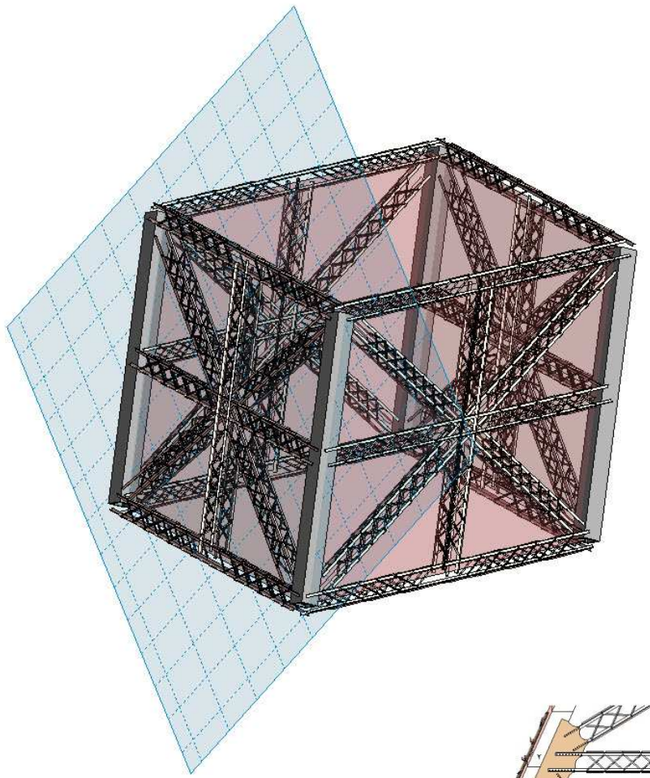
Lattice Framing Beam

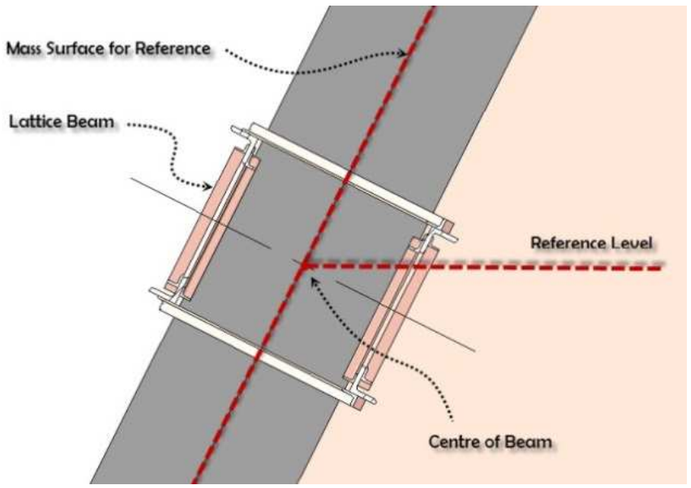
- *Create Family by Structure Framing*
- *Set Work Plane to Mass surface for Framing Reference*





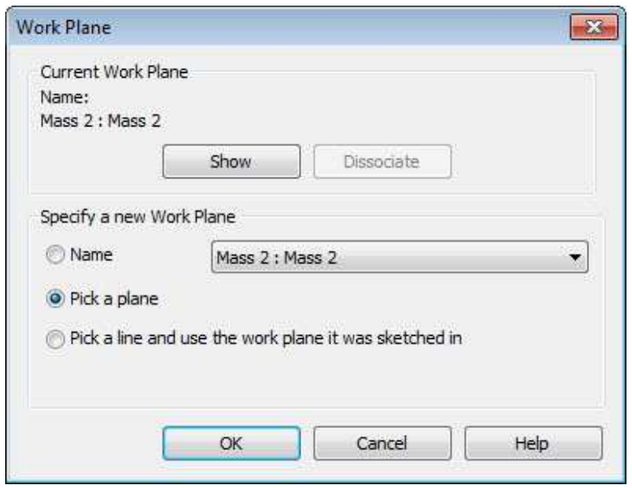
Lattice placement

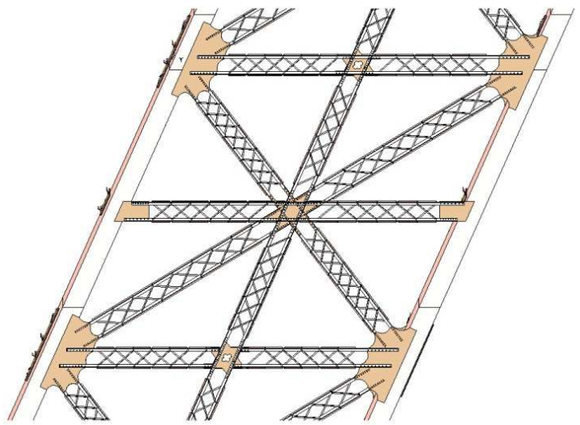


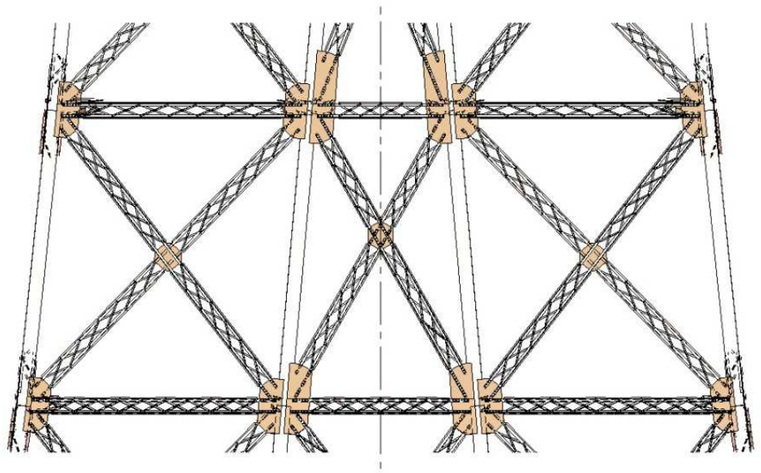


Lattice Framing Beam

- *Set Work Plane to Mass surface for Framing Reference*



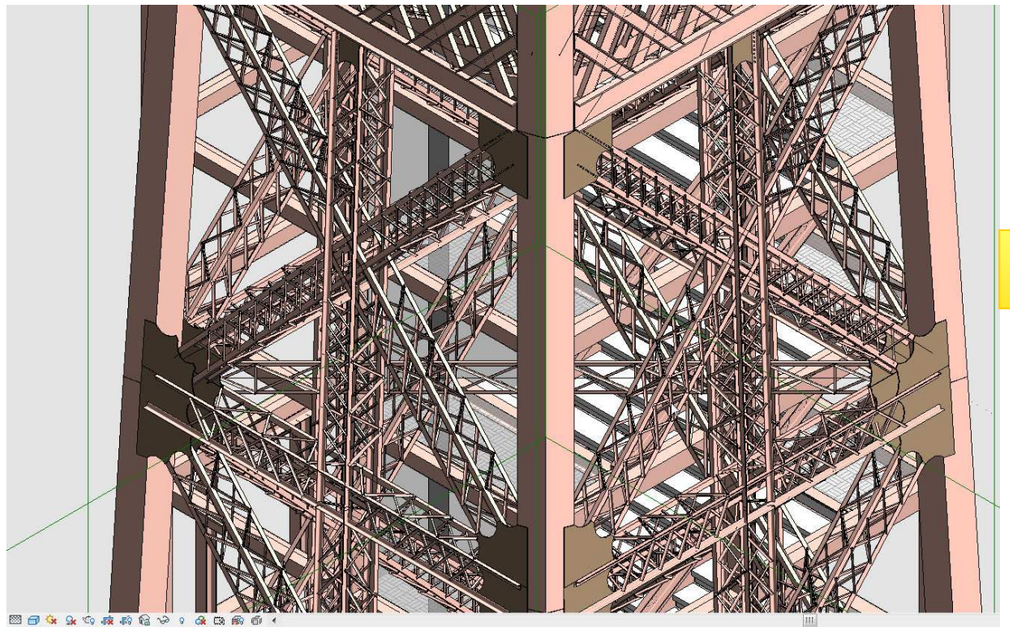




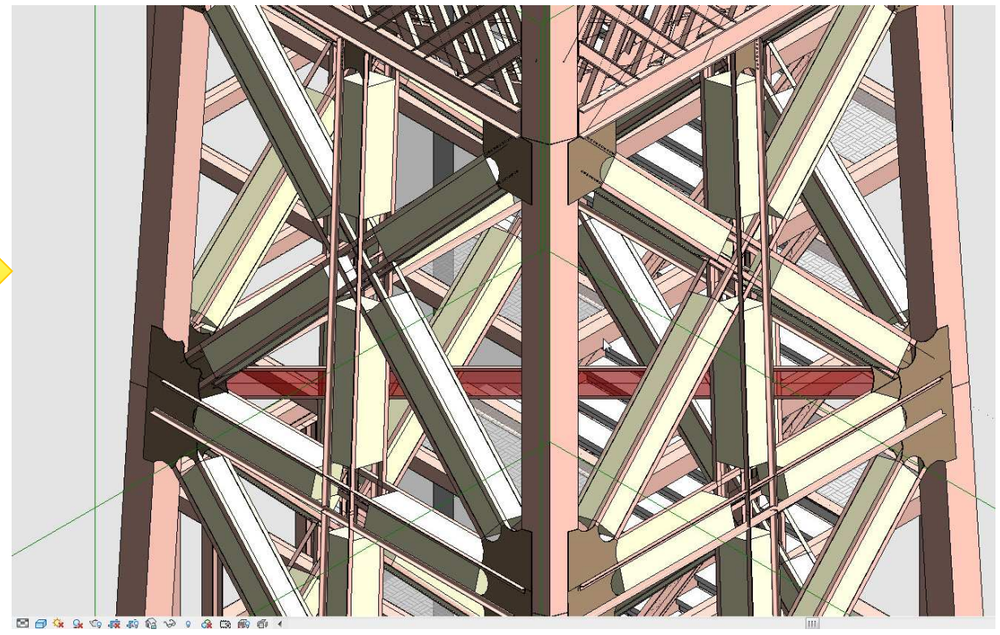
A time saving Concept

Lattice Framing Beam

- *Visibility settings while modelling*



Model shown in fine for Presentation

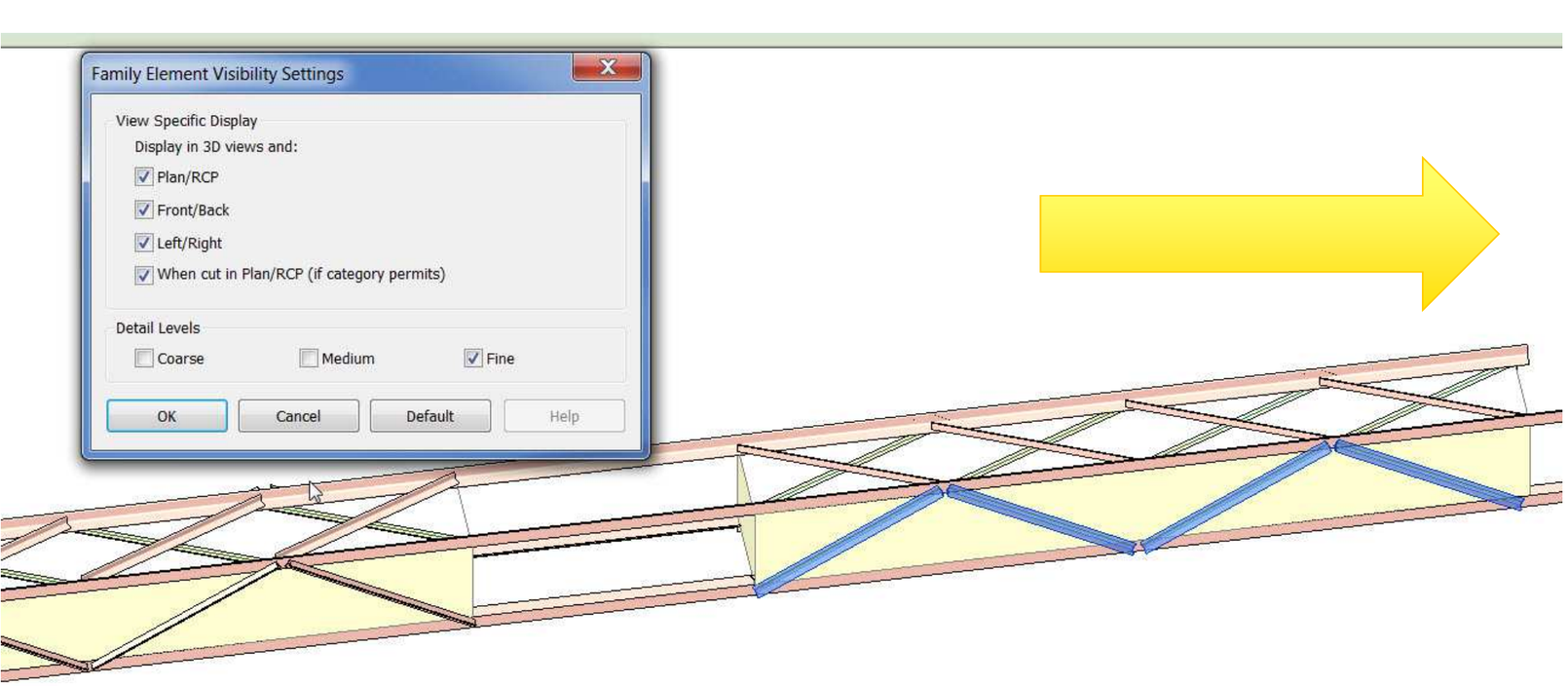


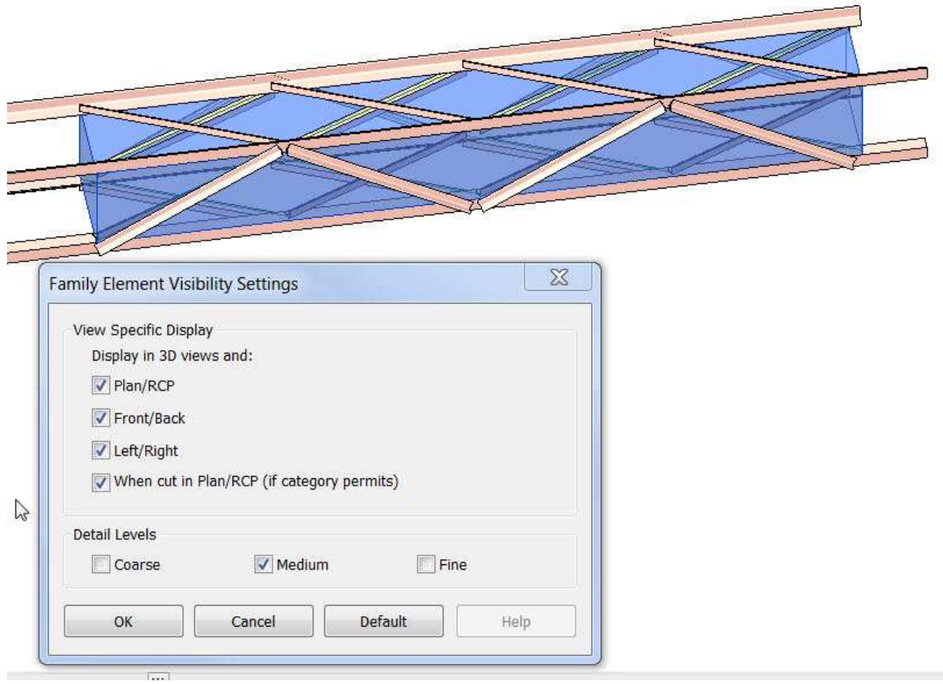
Model shown in medium while modelling

A time saving Concept

Lattice Framing Beam

- *Family Manipulation*





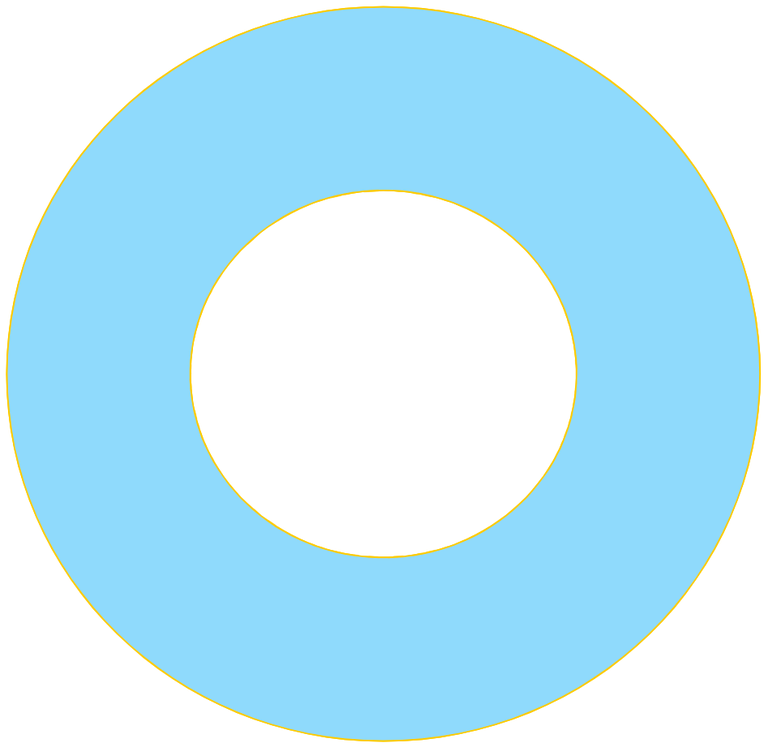
Model shown in fine for Presentation

Model shown in medium while modelling

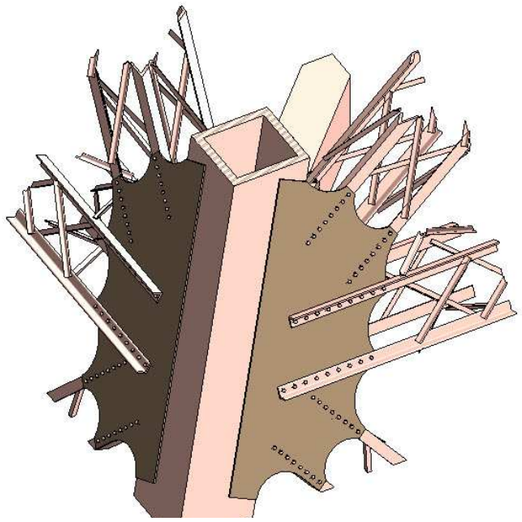
A time saving Concept

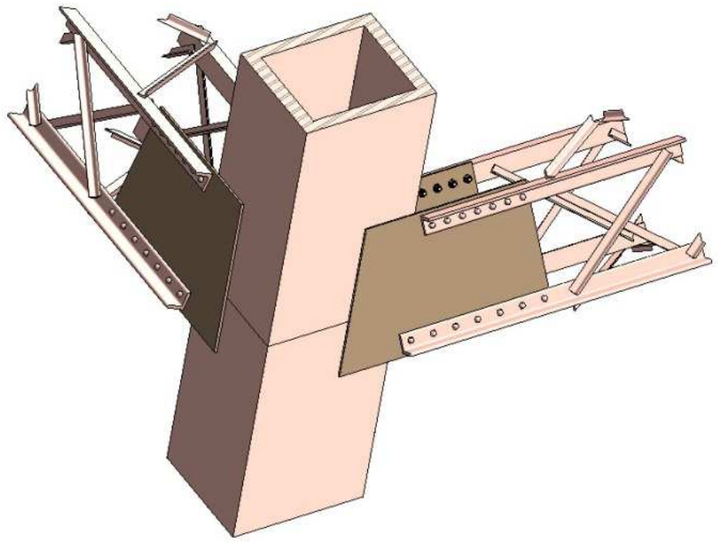
Lattice Framing Beam

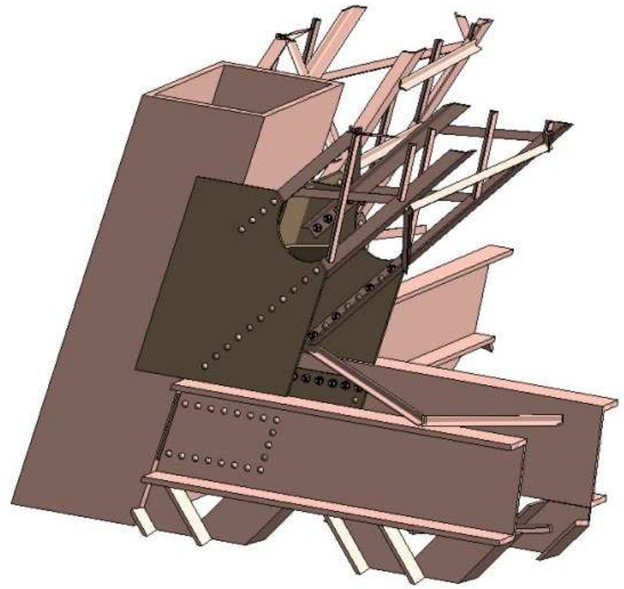
- *The dreaded DONUT*

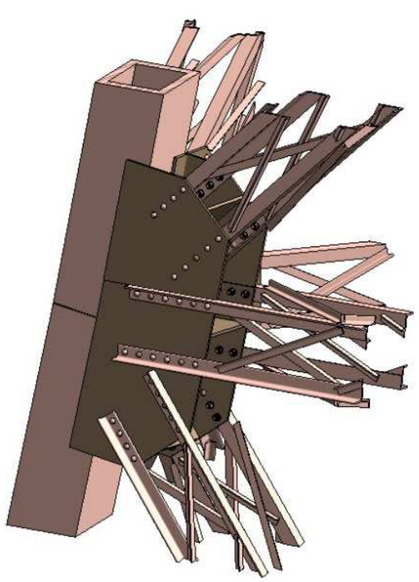


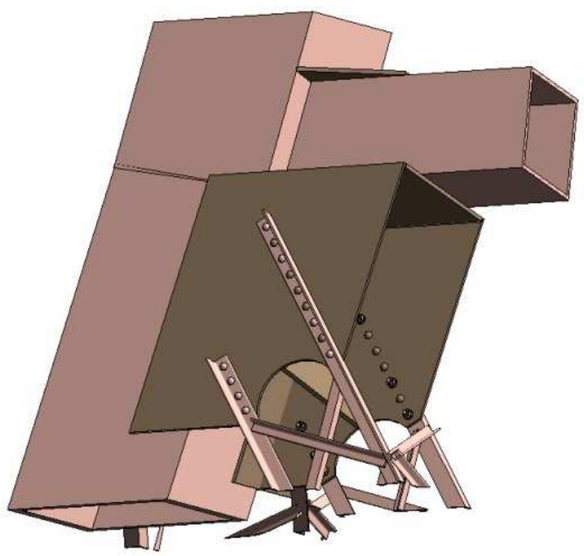
Connection plates

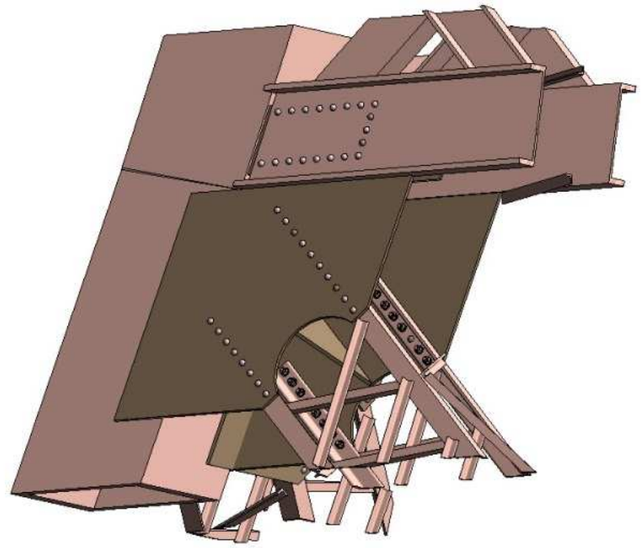




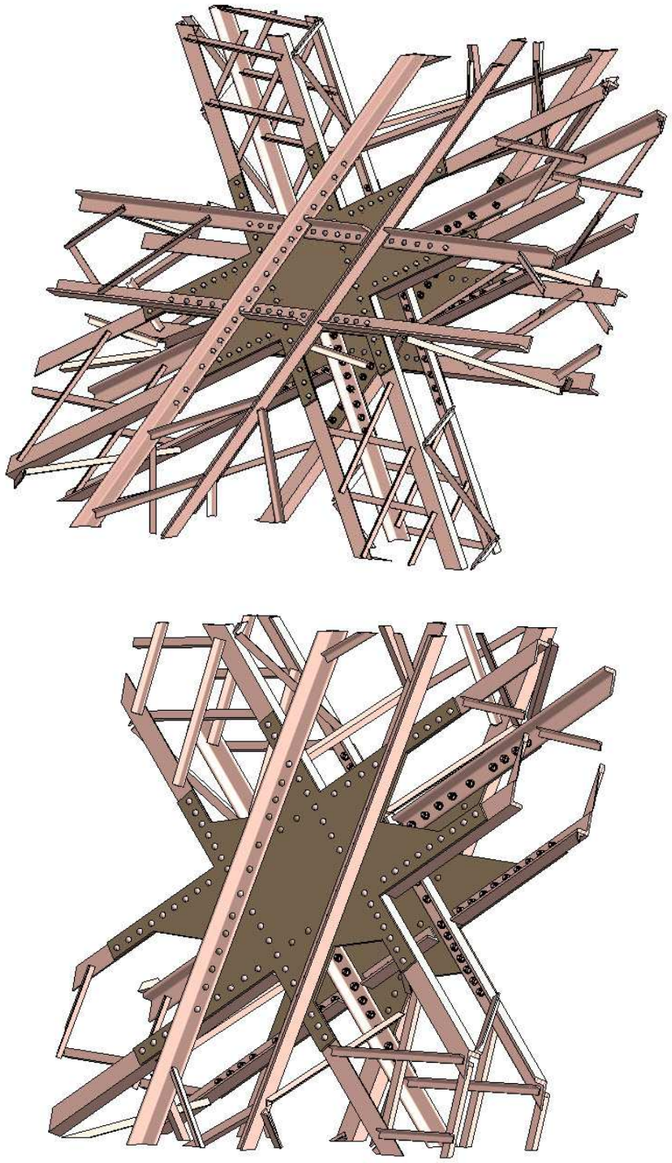


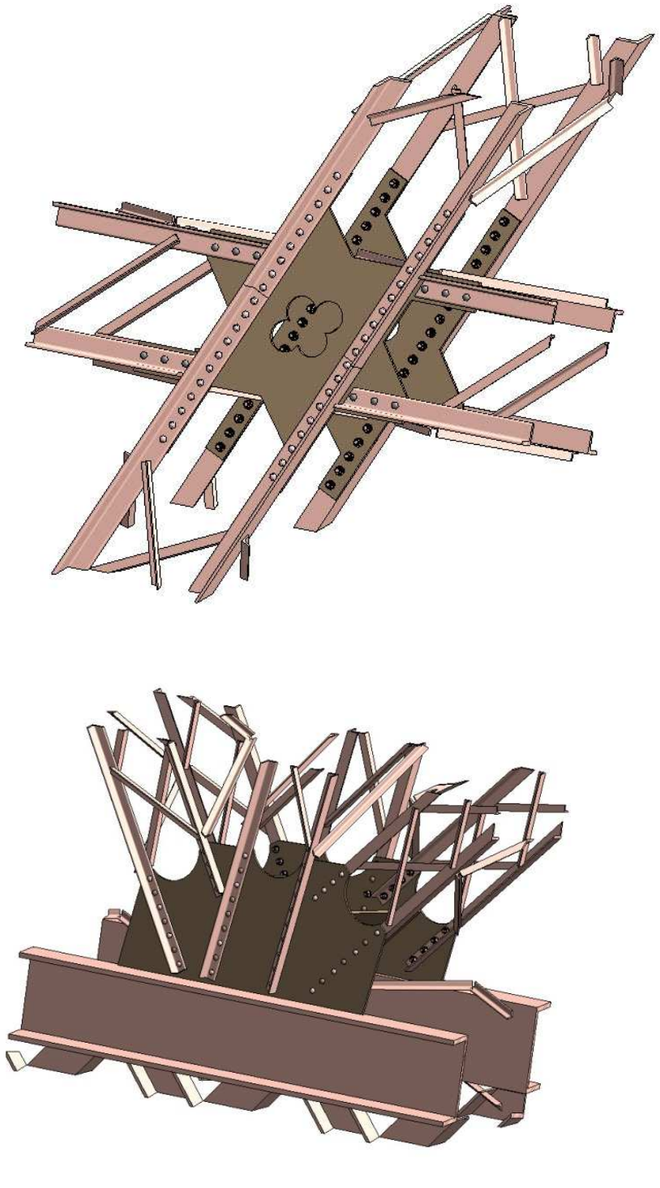


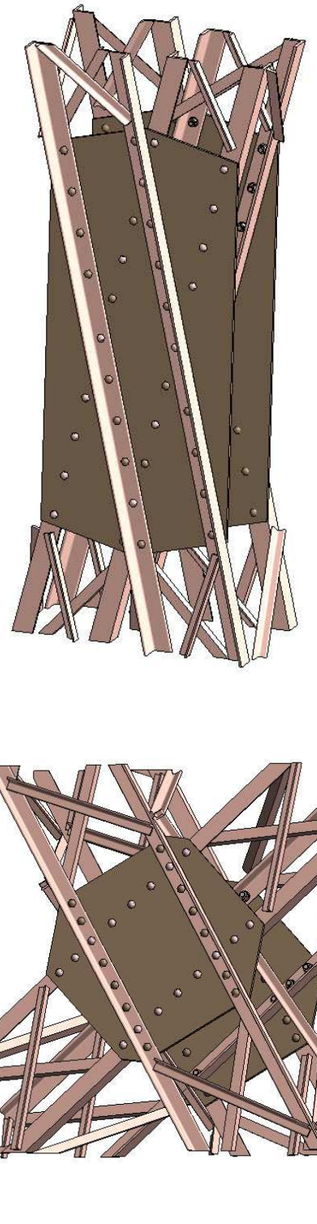




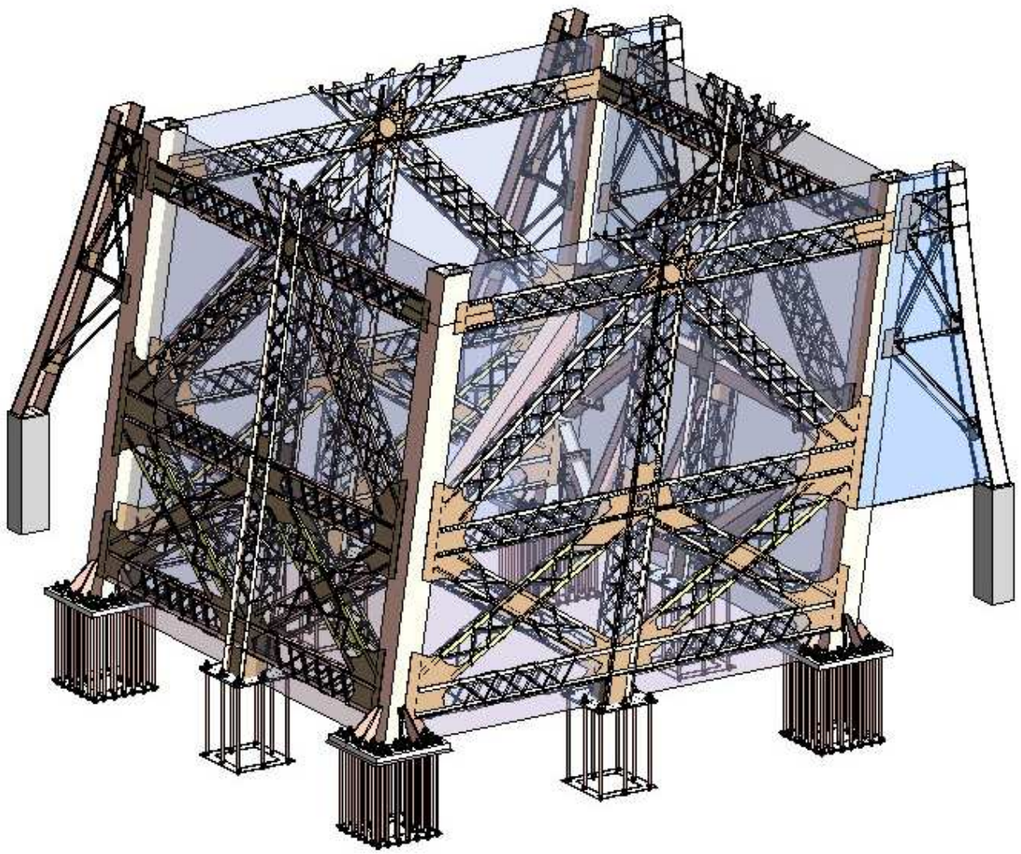
Connection plates





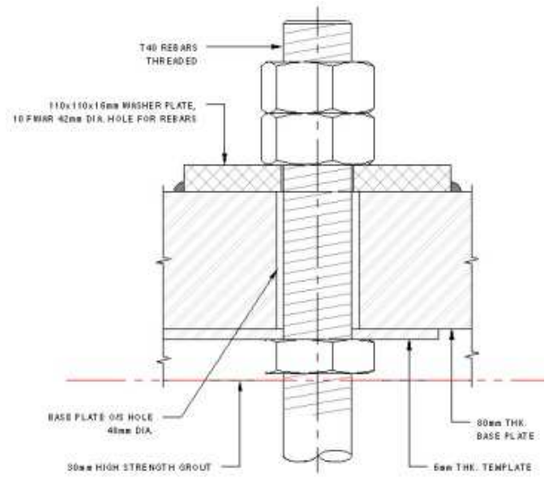


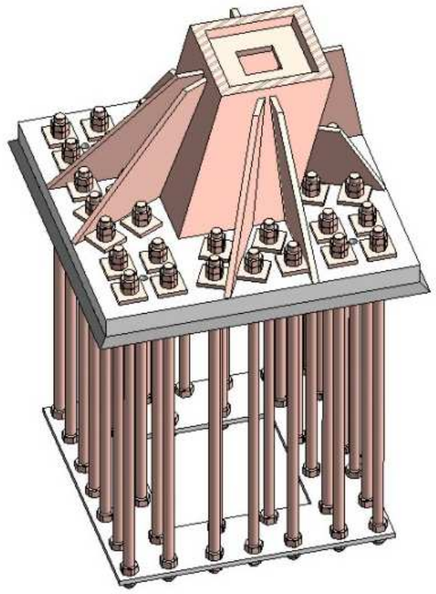
Model overview

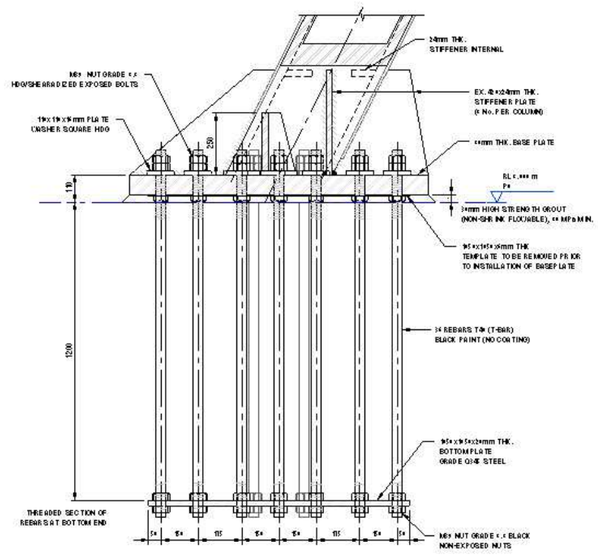


Corner Column Base Plate

- *1200 x 1200 x 80mm THK. Steel Base Plate*
- *36No. Rebars T40 , 1200mm Embedment with Threaded End and Washer & Nuts*



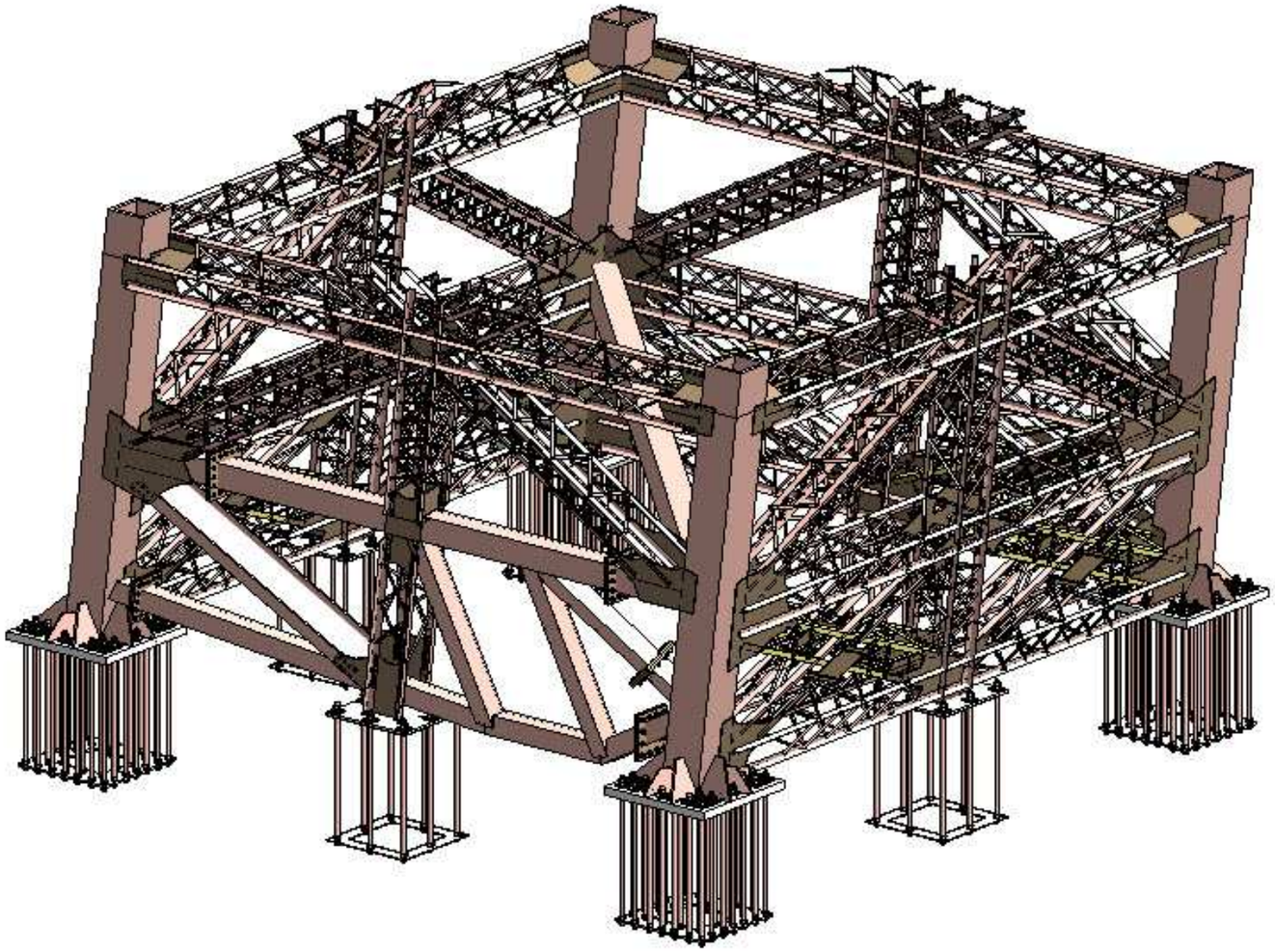




Model overview

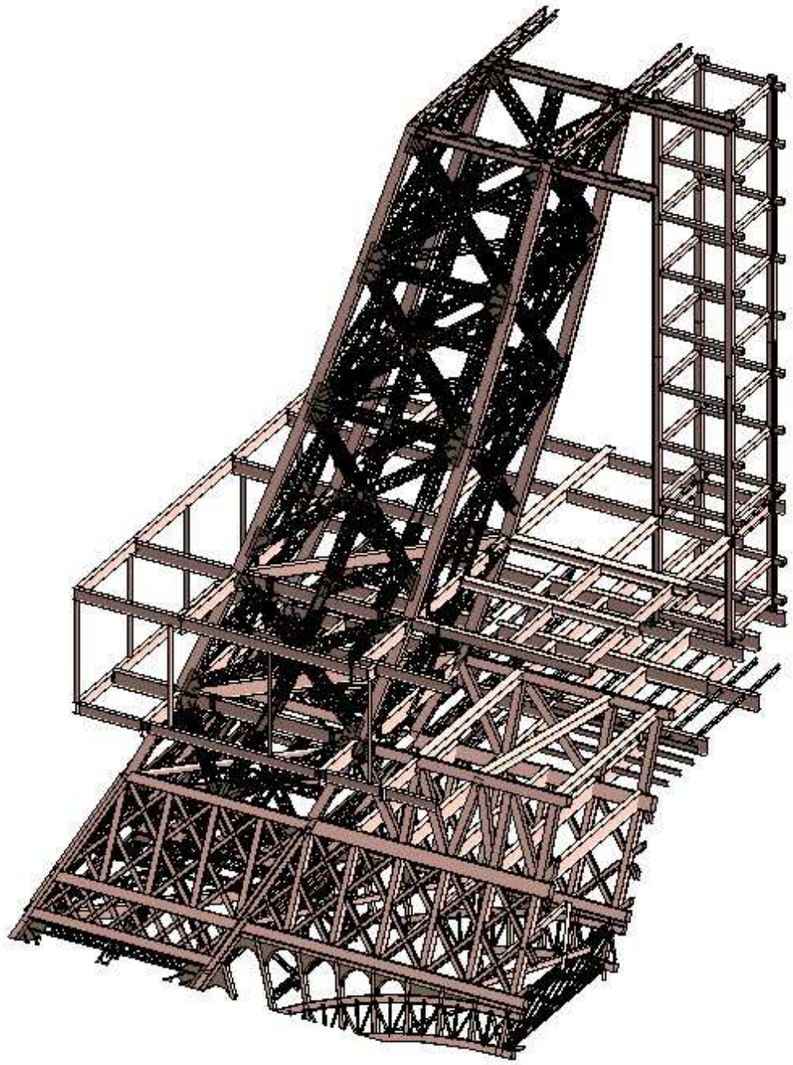
Area 1A – Level P0 – Level P4

Single Leg Model

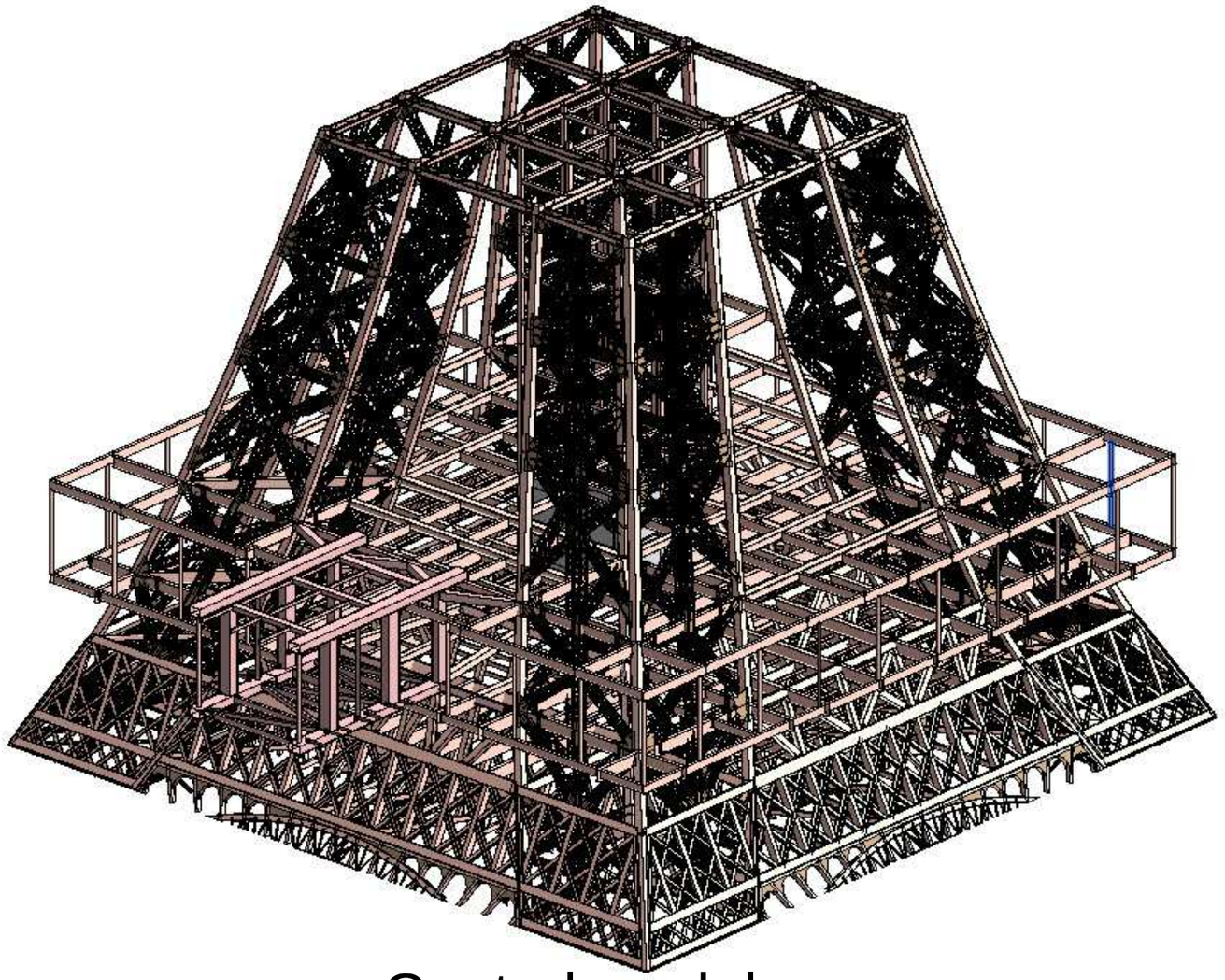


Model overview

Area 1A – Level P0 – Level P4



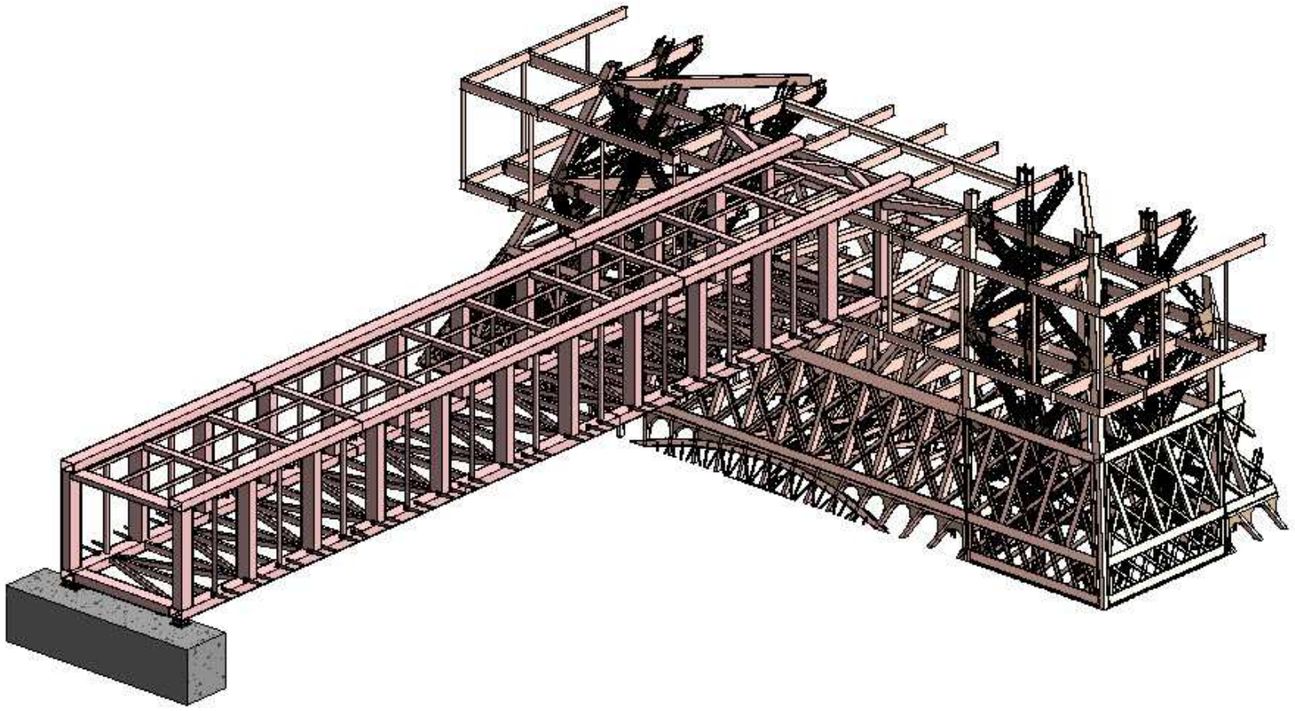
Single Leg Model

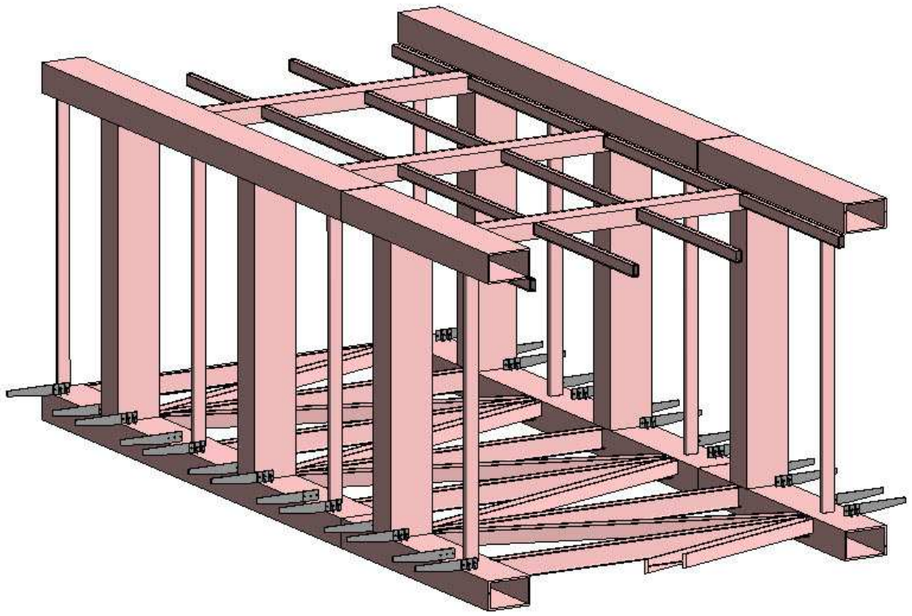


Central model

Model overview

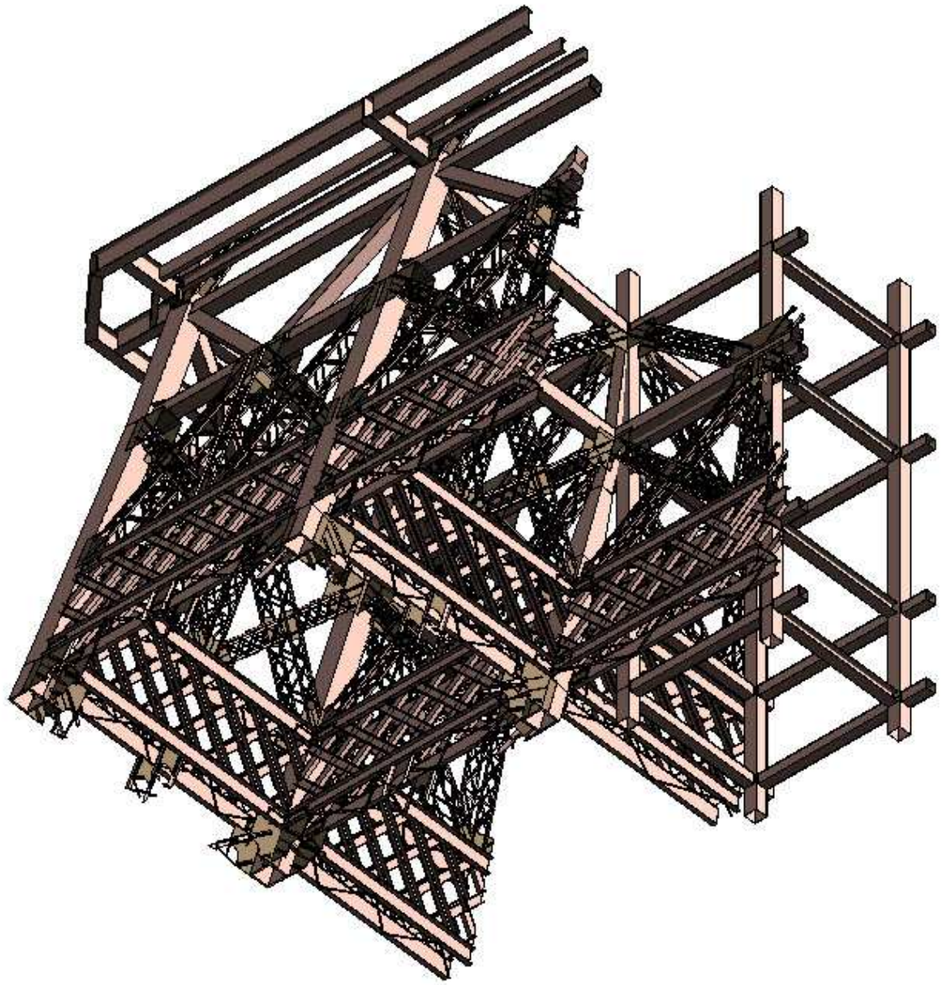
Area 1C – Link Bridge at Level P6



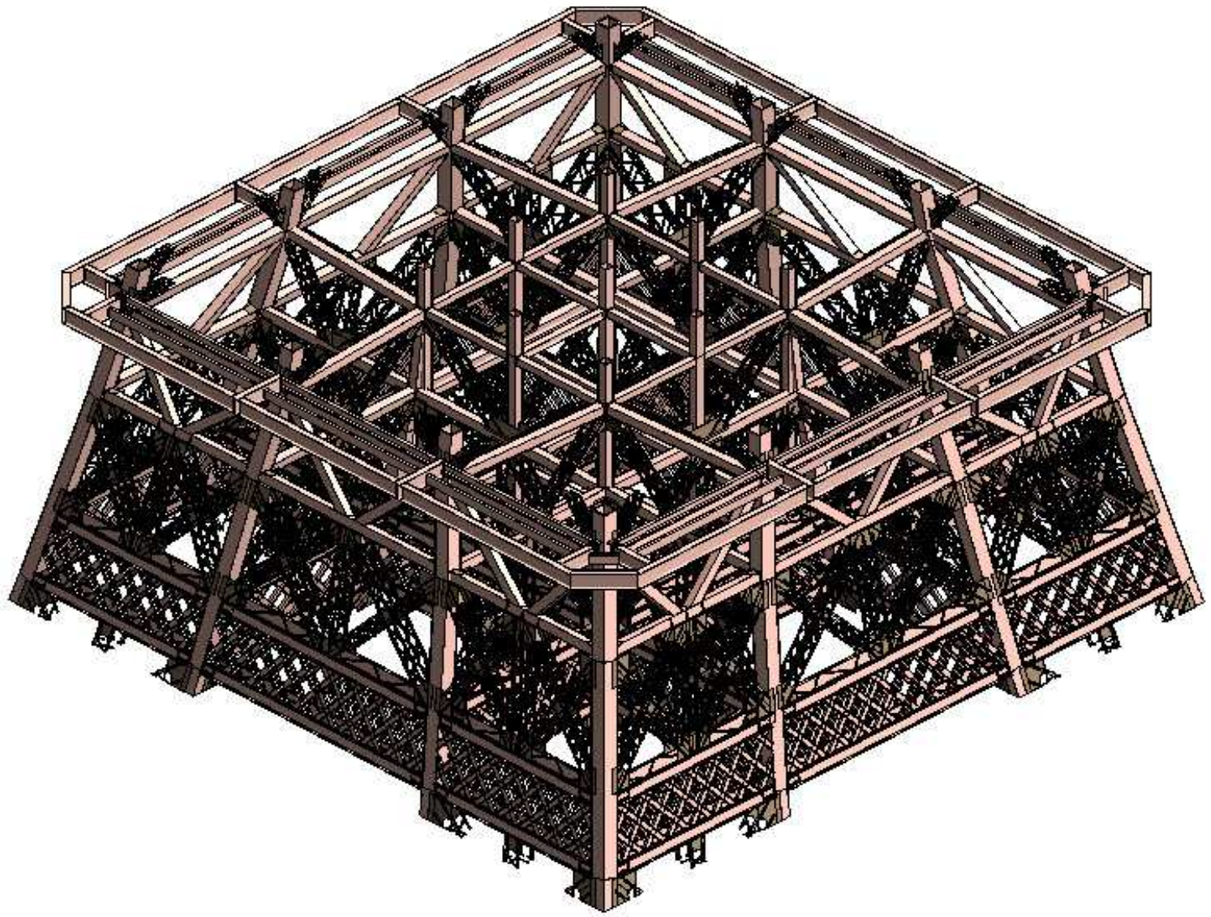


Model overview

Area 2 – Level P10 – Level P12



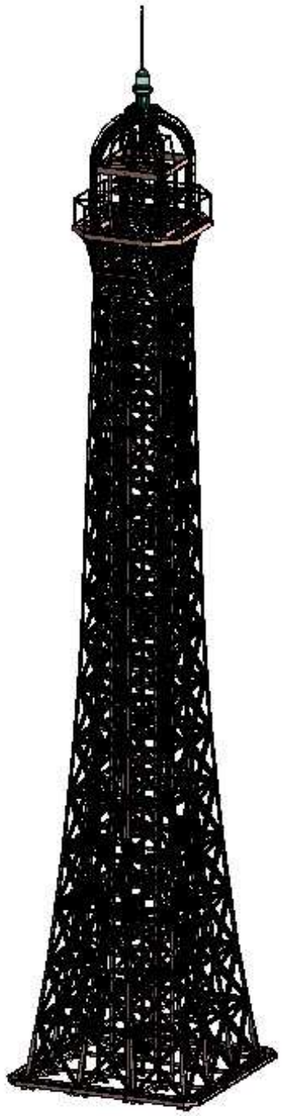
Single Leg Model

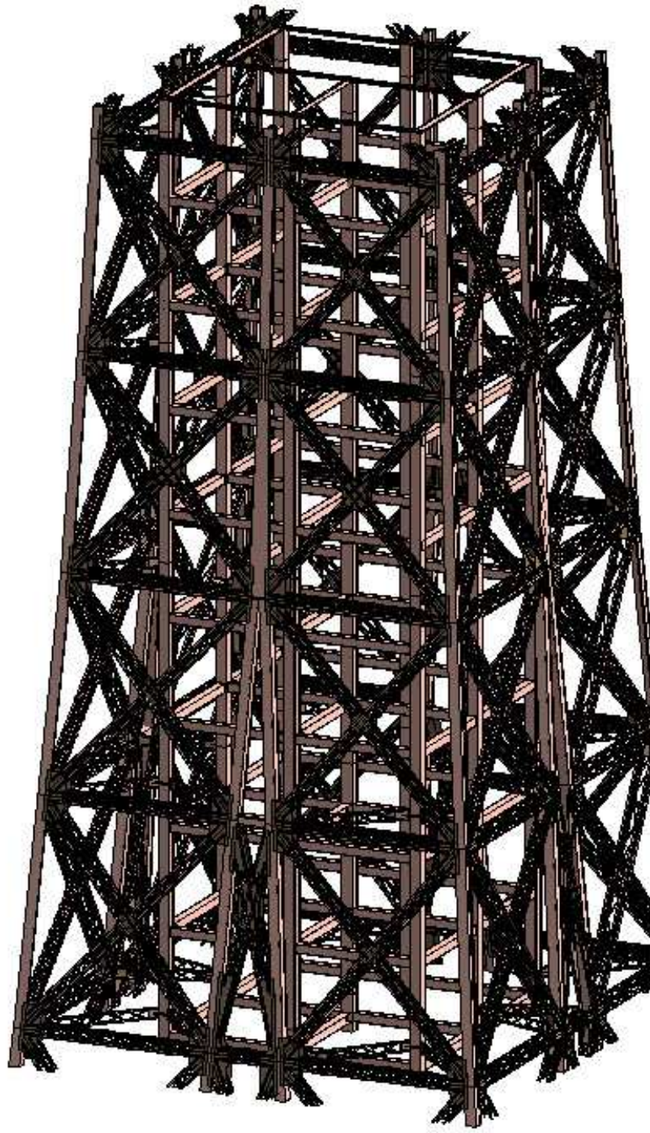


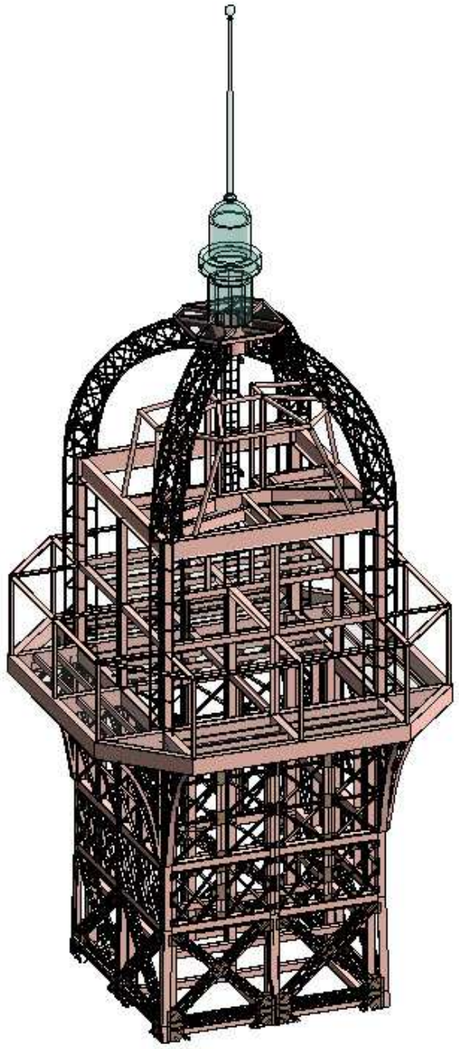
Central model

Model overview

Area 3 – Level P13 – Top

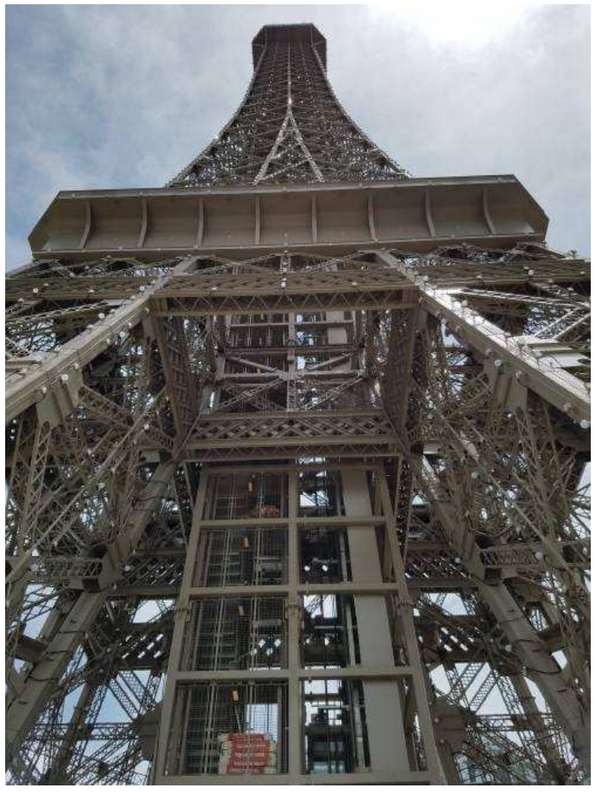


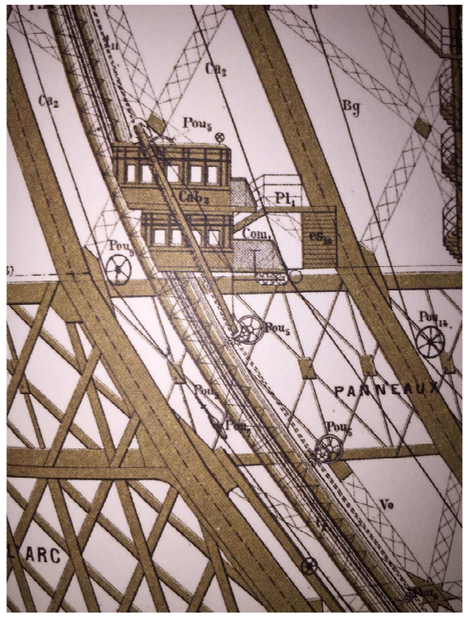


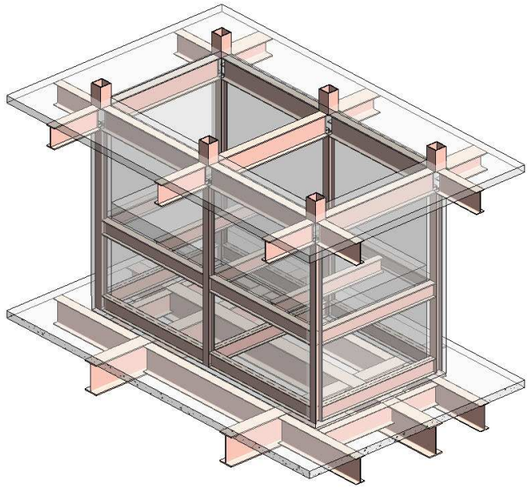


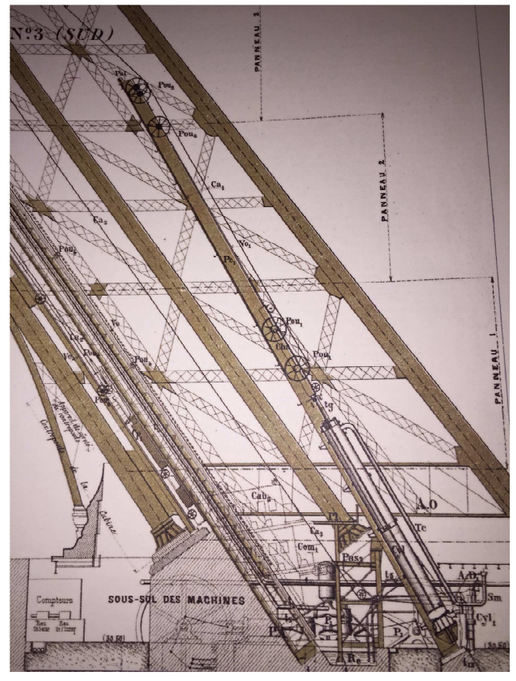
Model overview

Lift Pit – Level P6



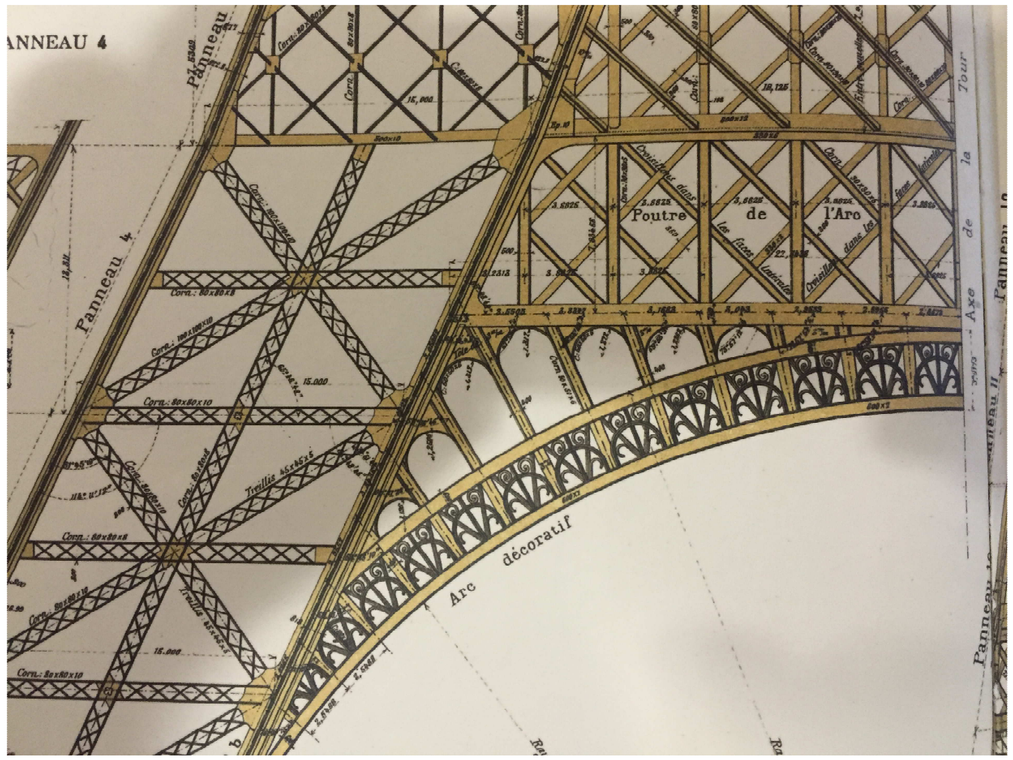




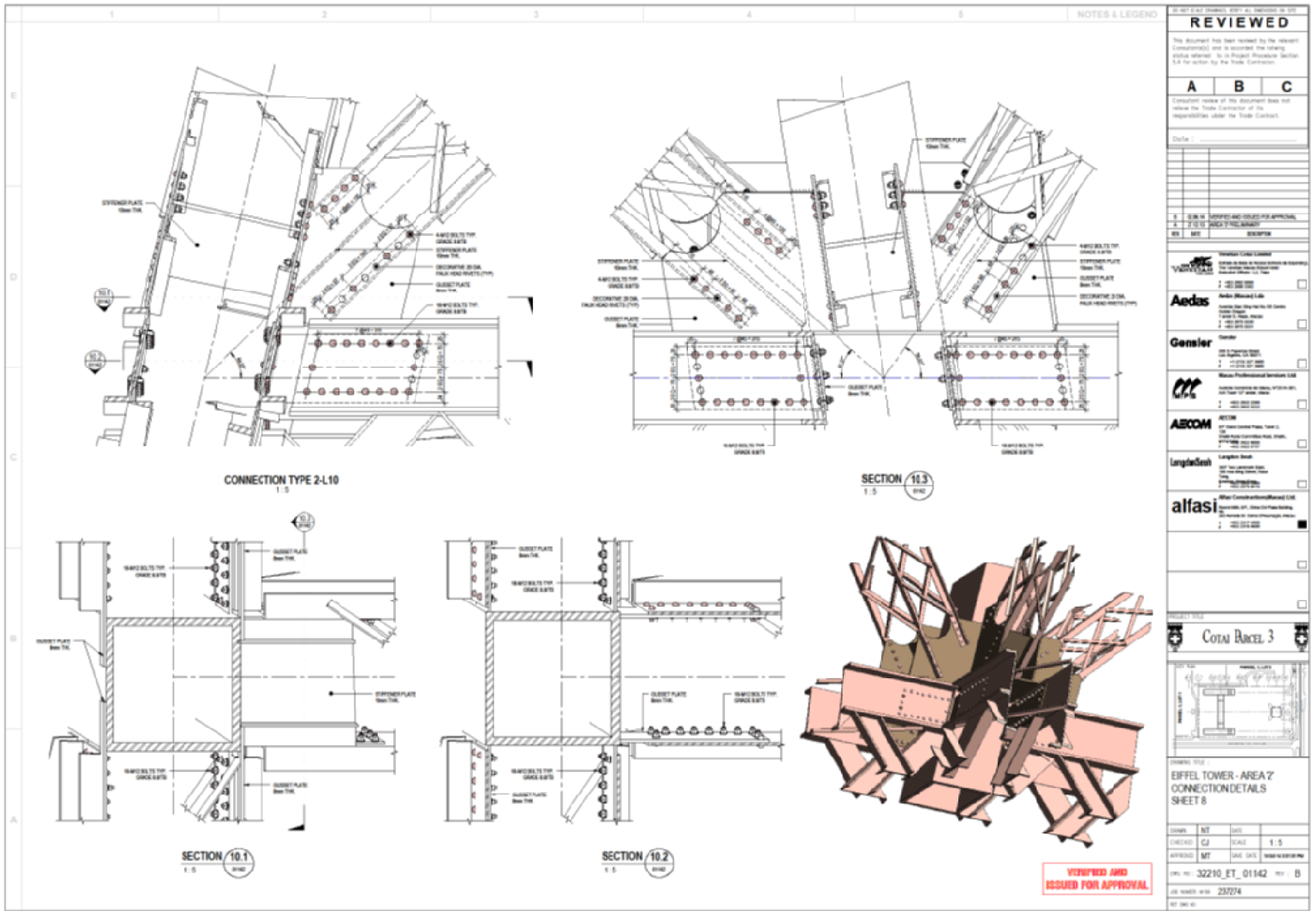


Model overview

Decorative Arch



Documentation



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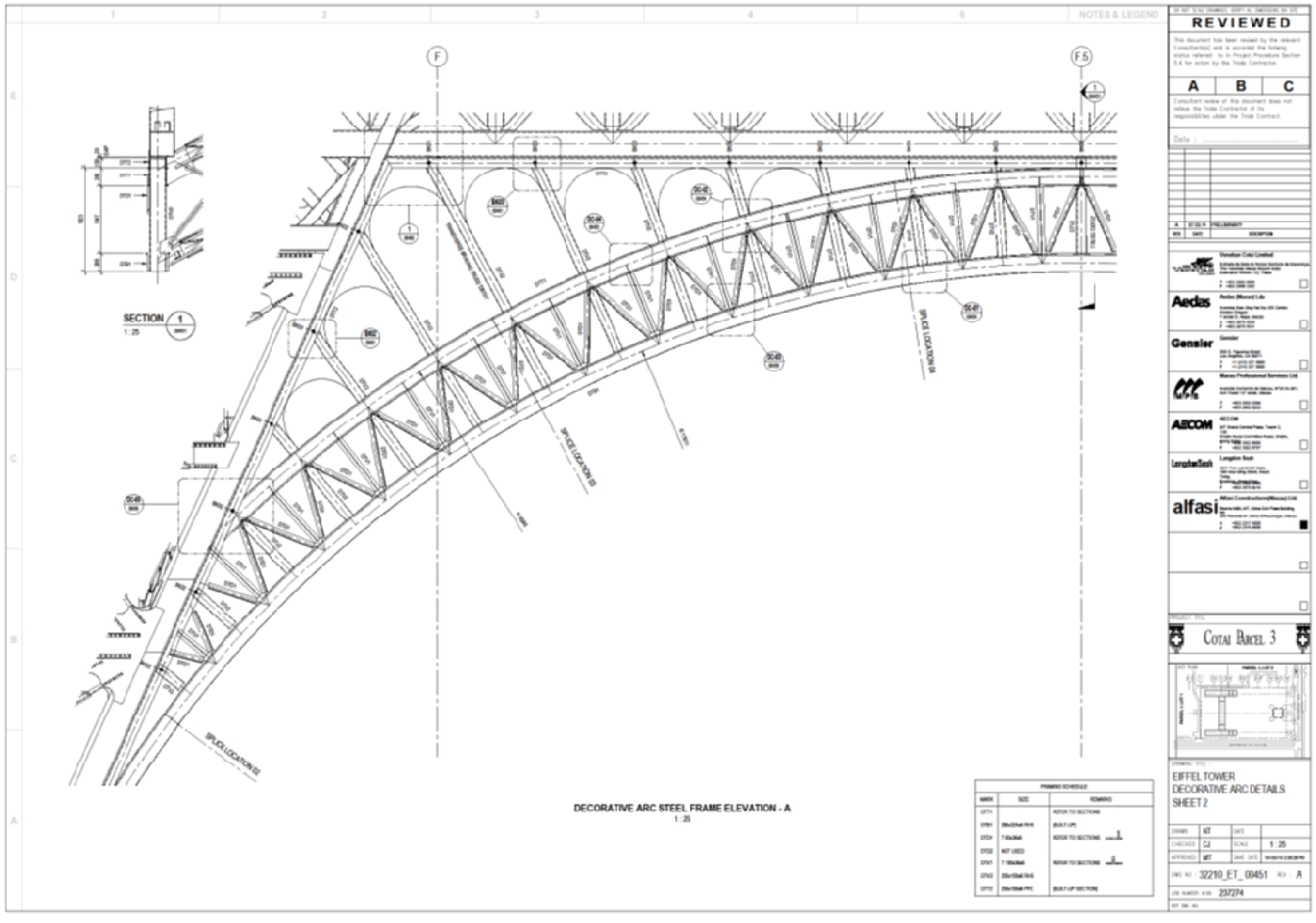
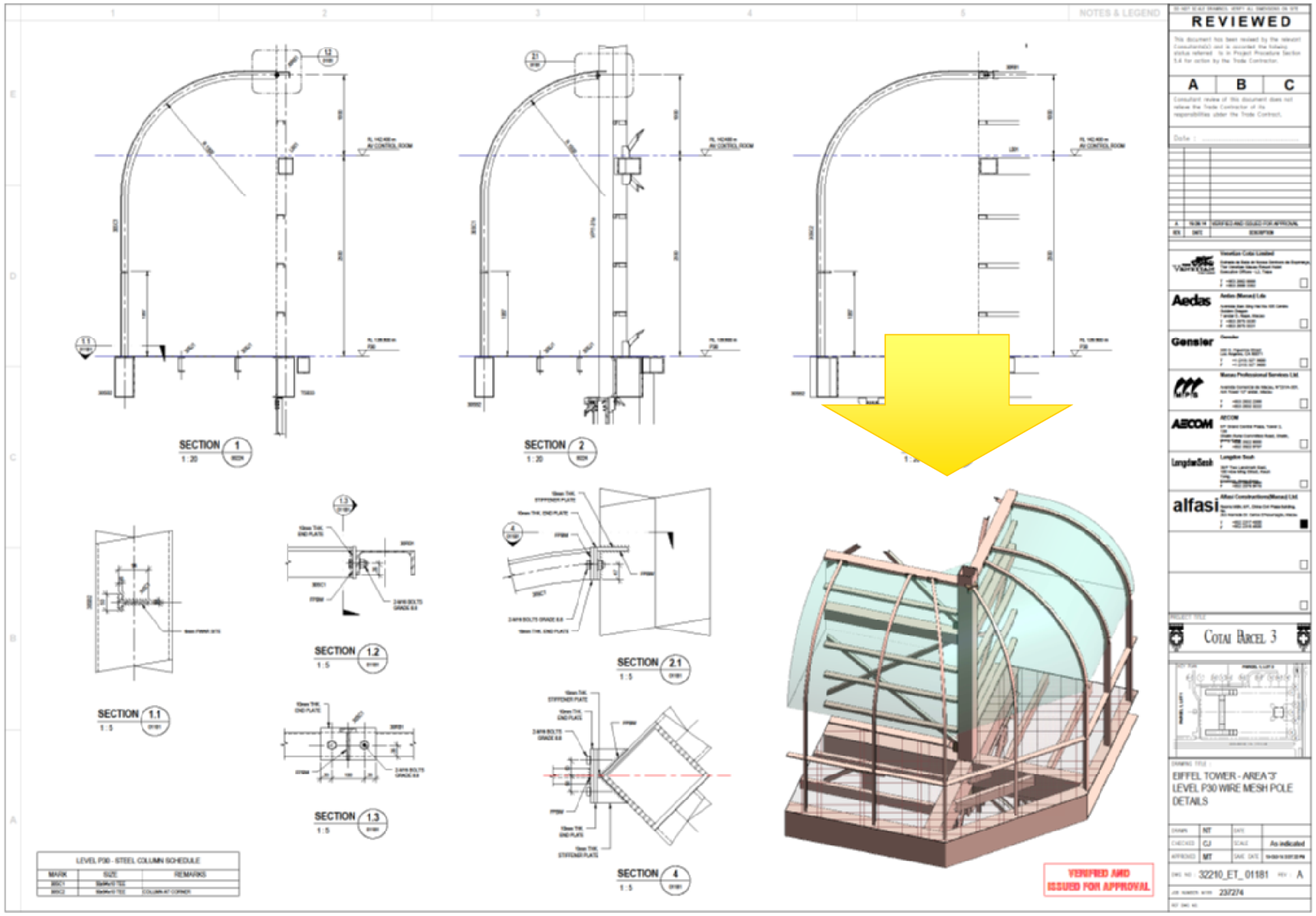
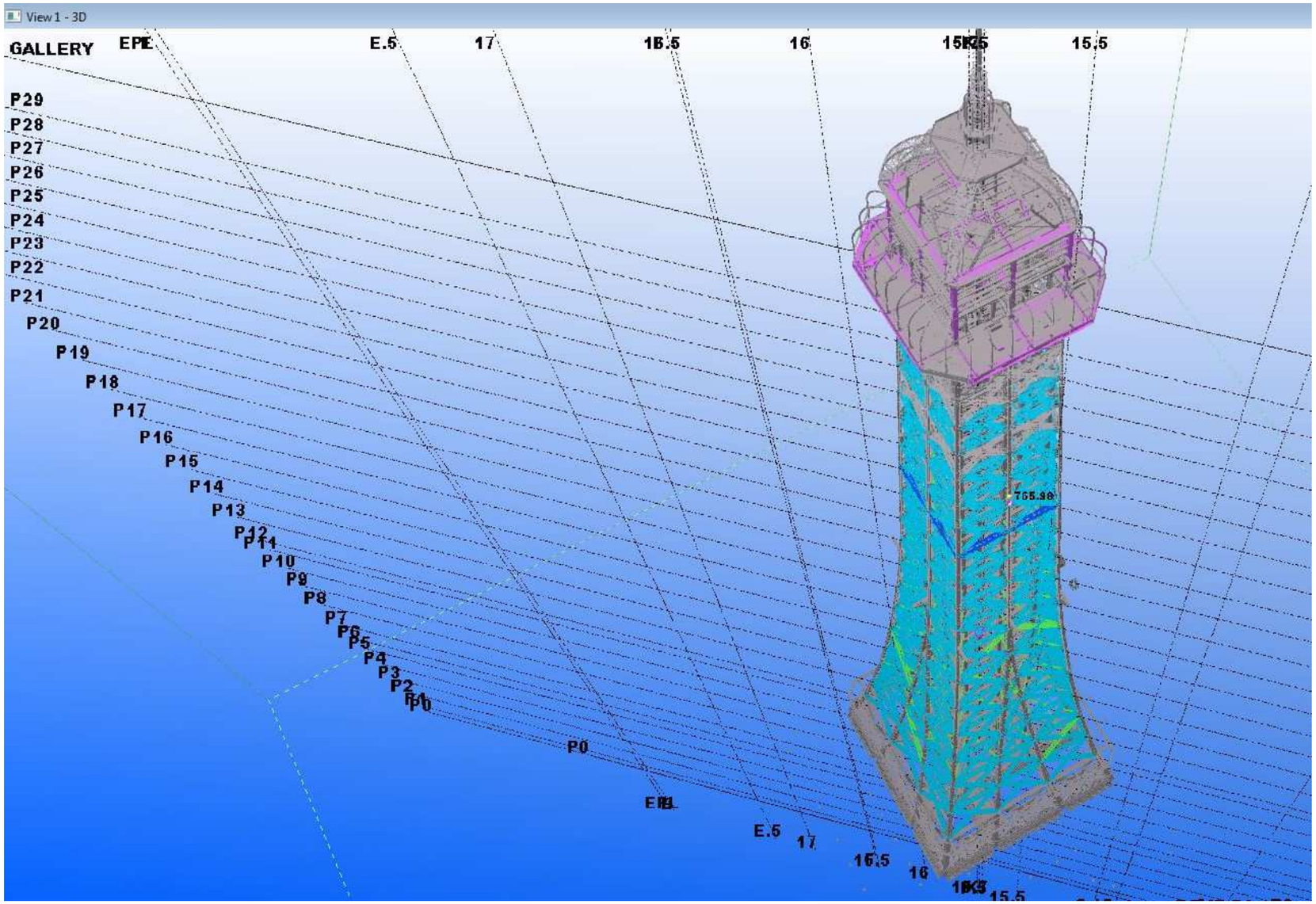


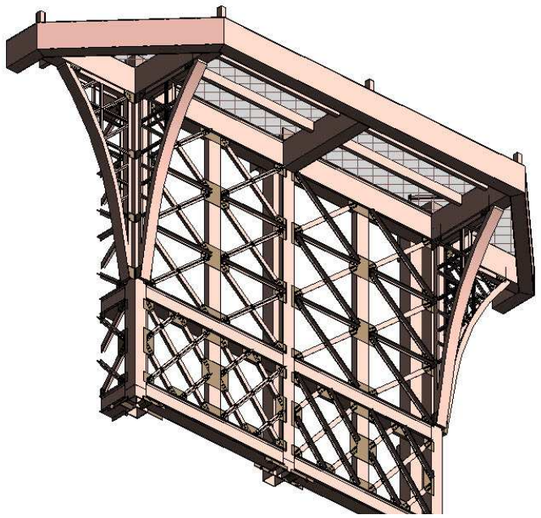
Documentation

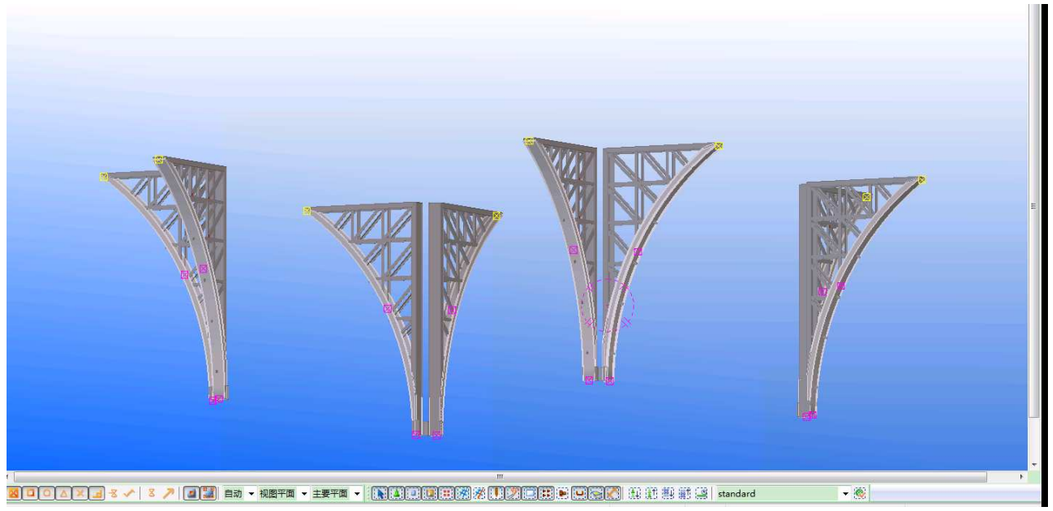


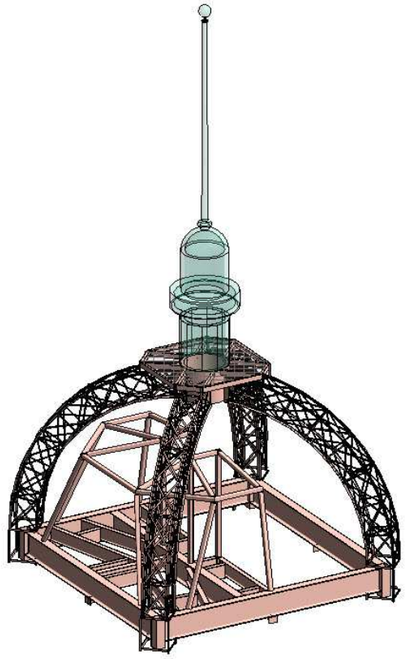
Design intent model to the factory

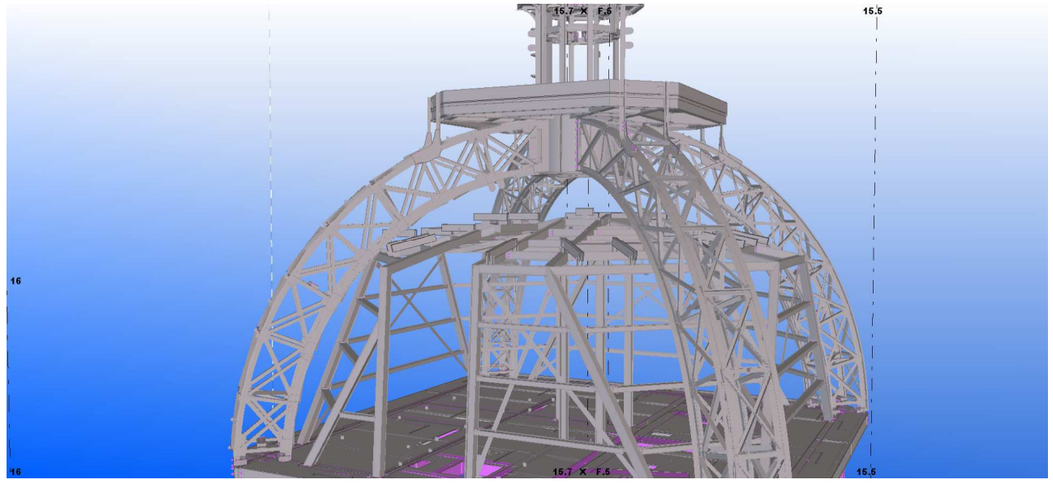


Design intent model to the factory

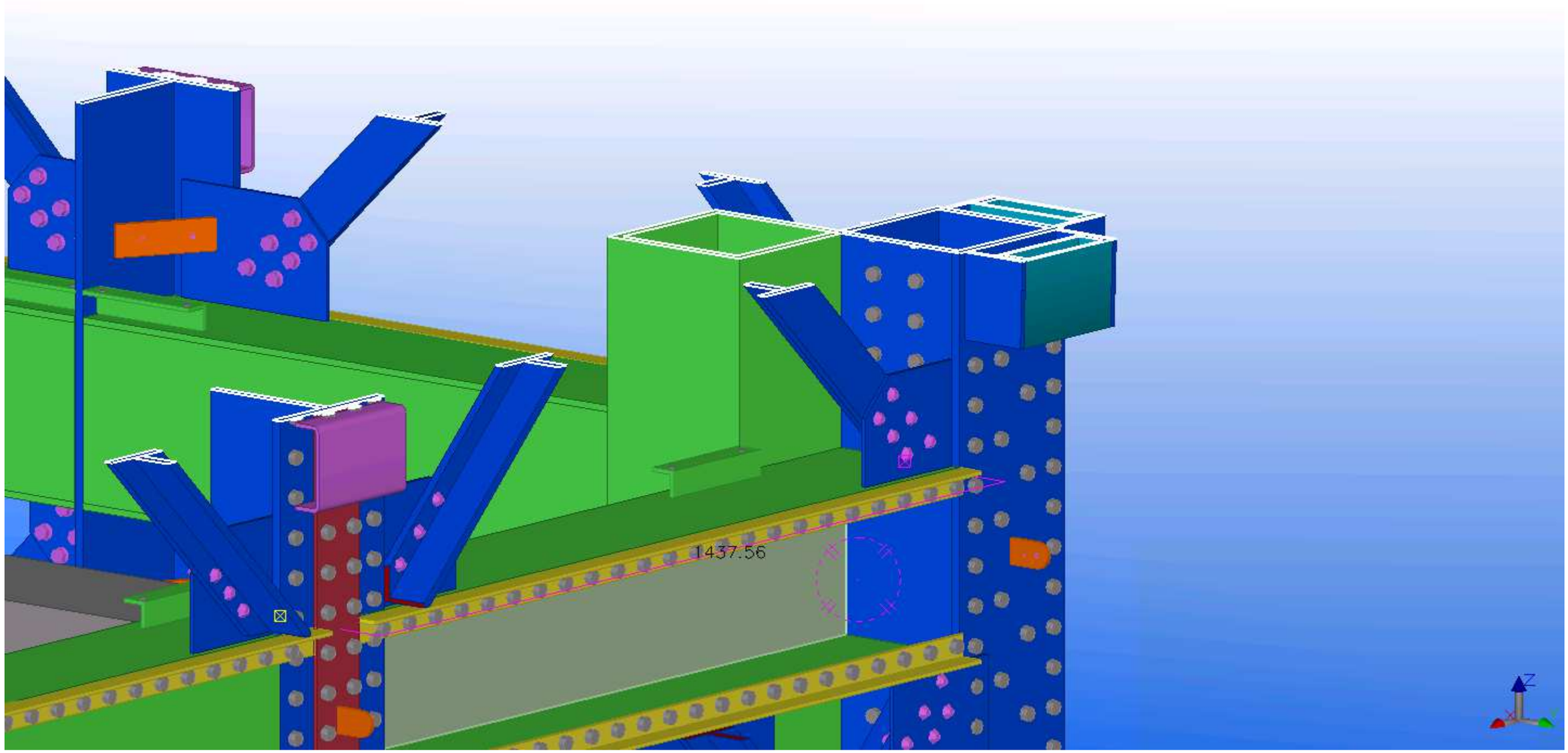




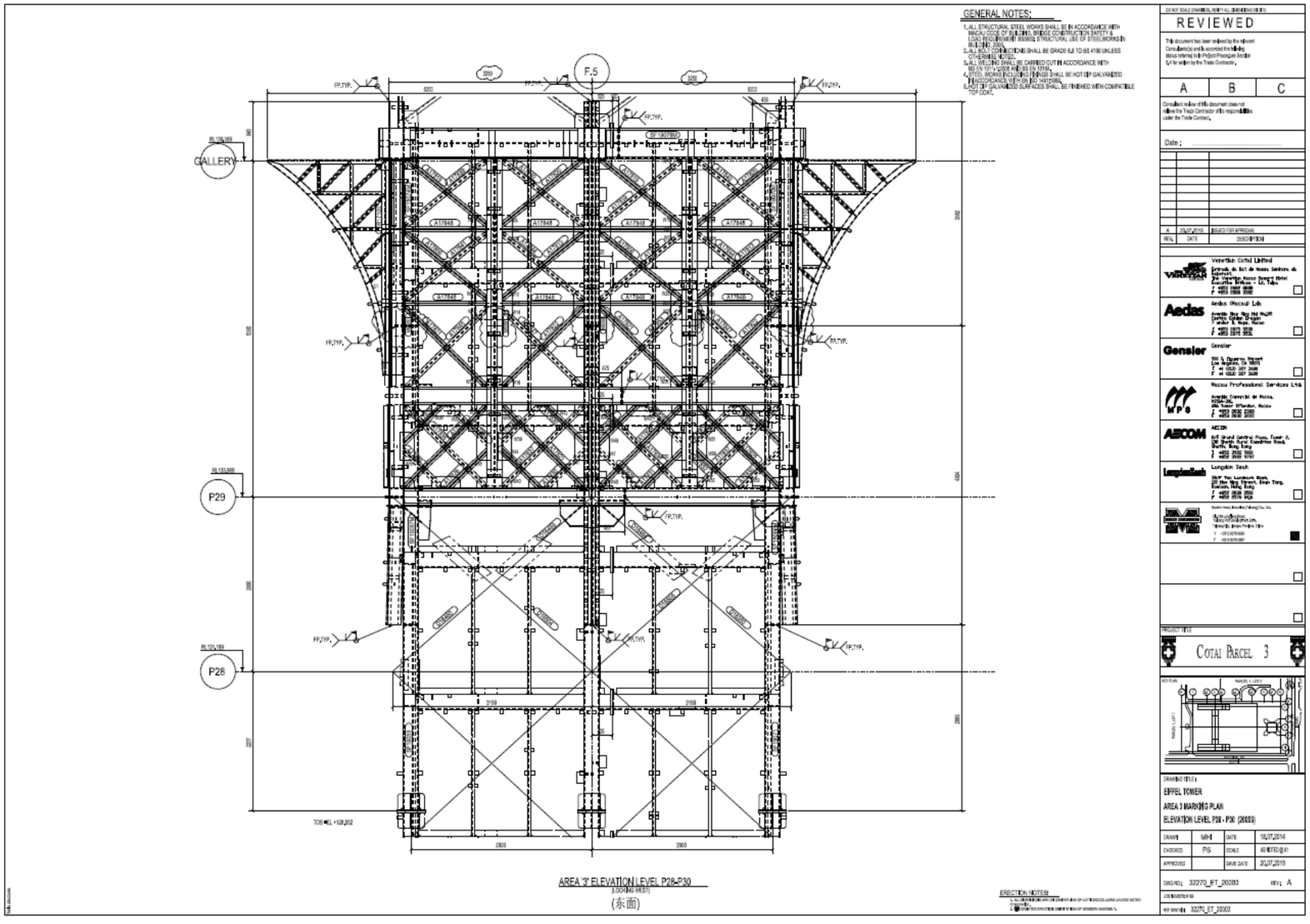




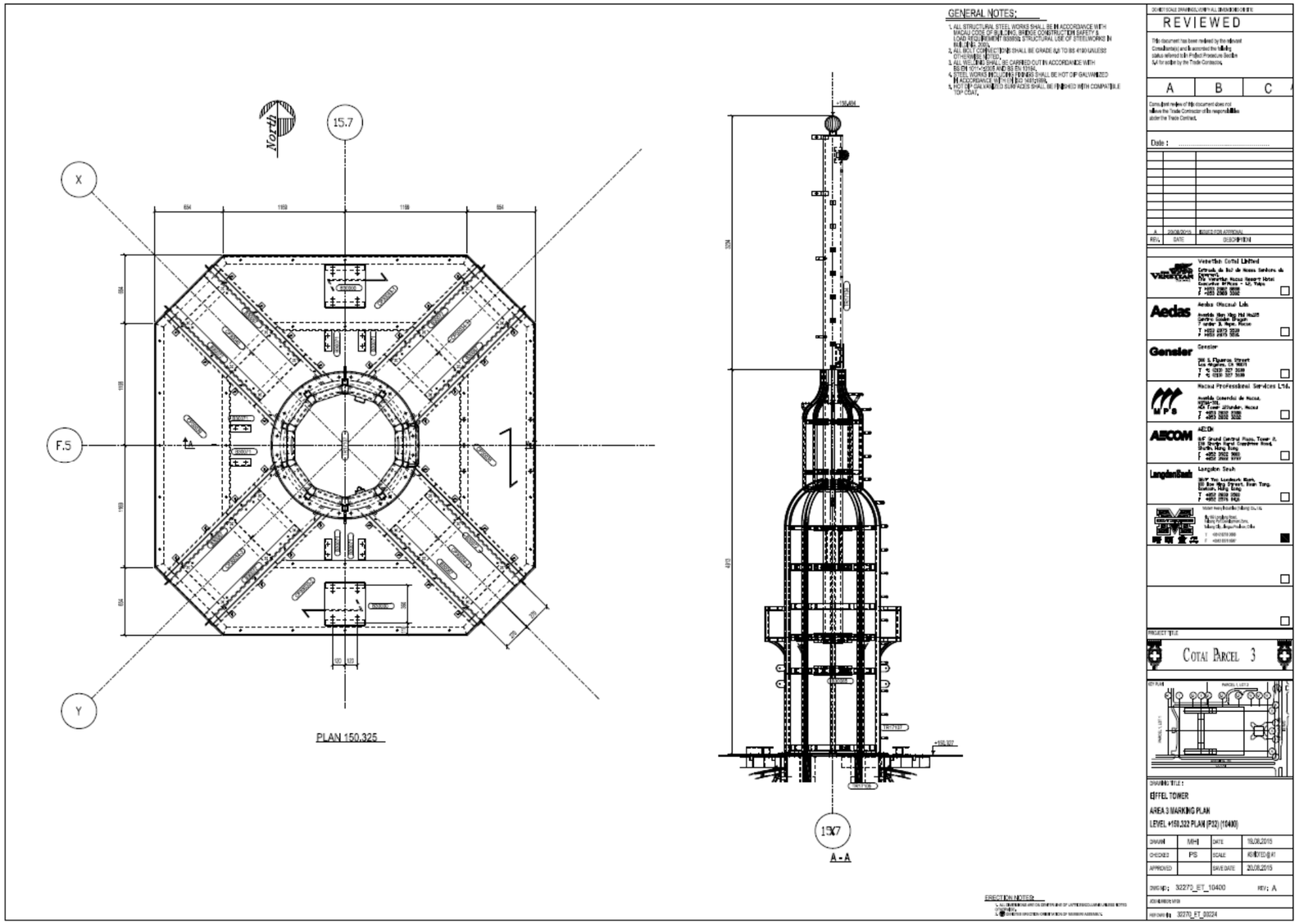
Design intent model to the factory



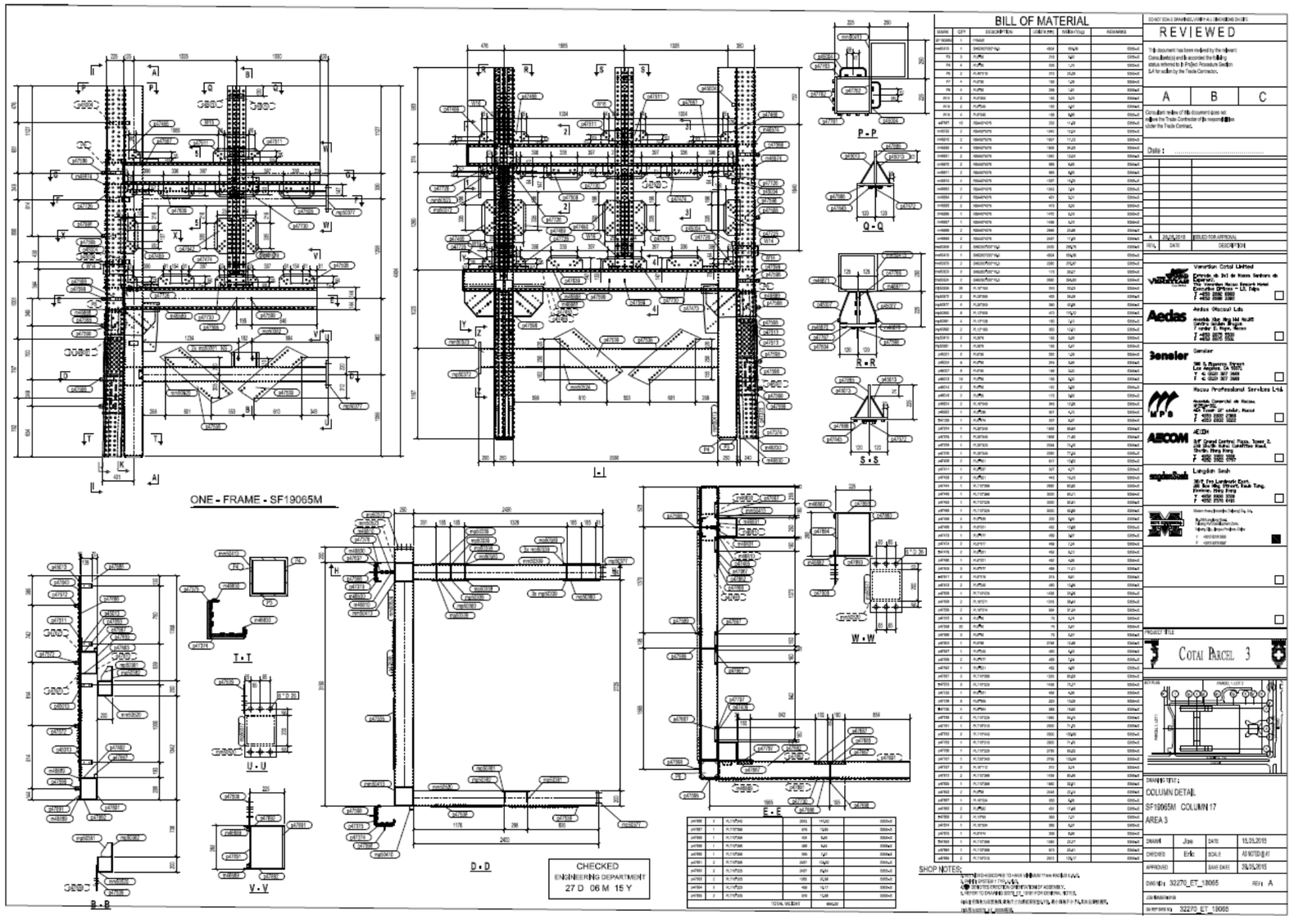
Shop drawing examples



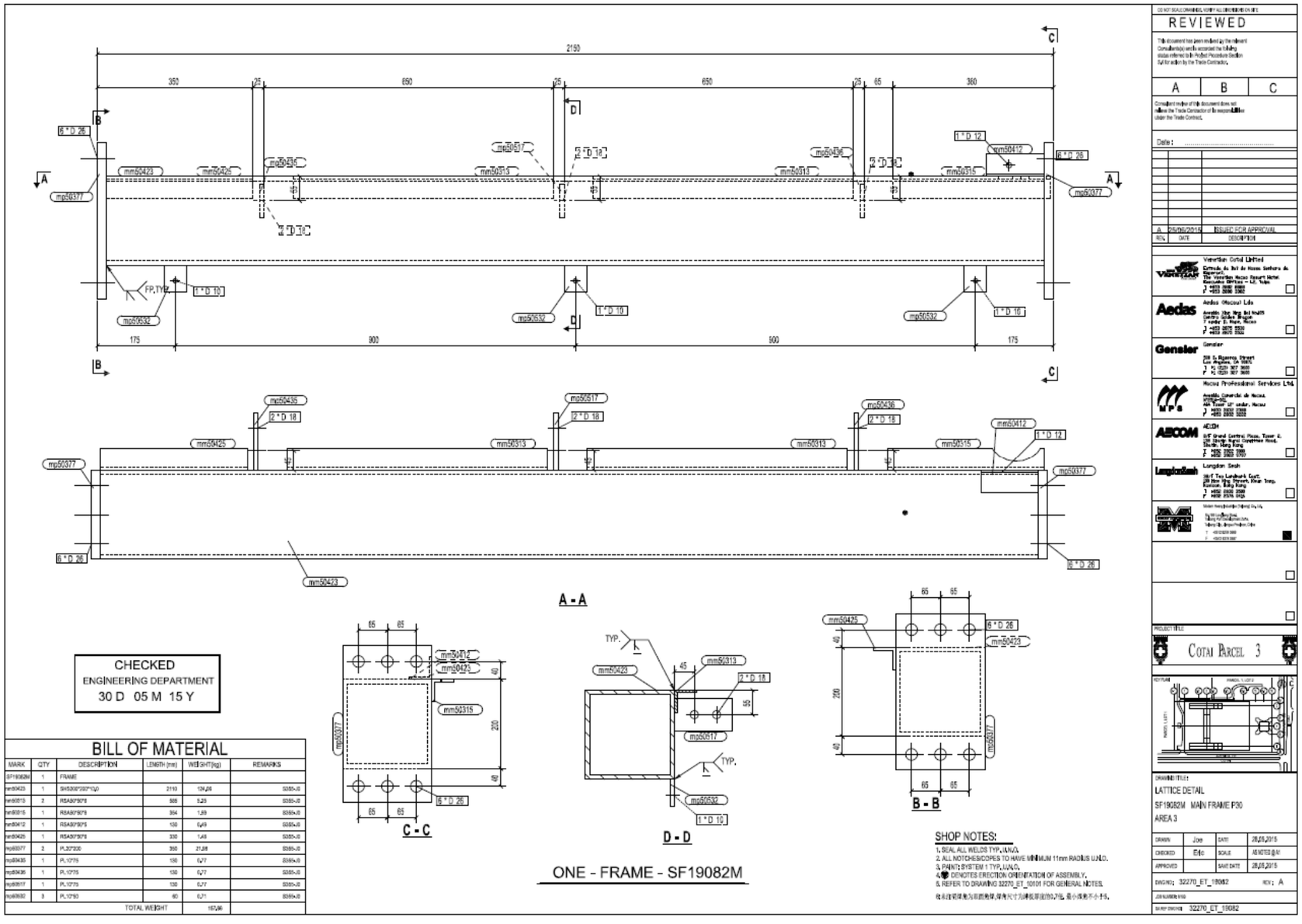
Shop drawing examples



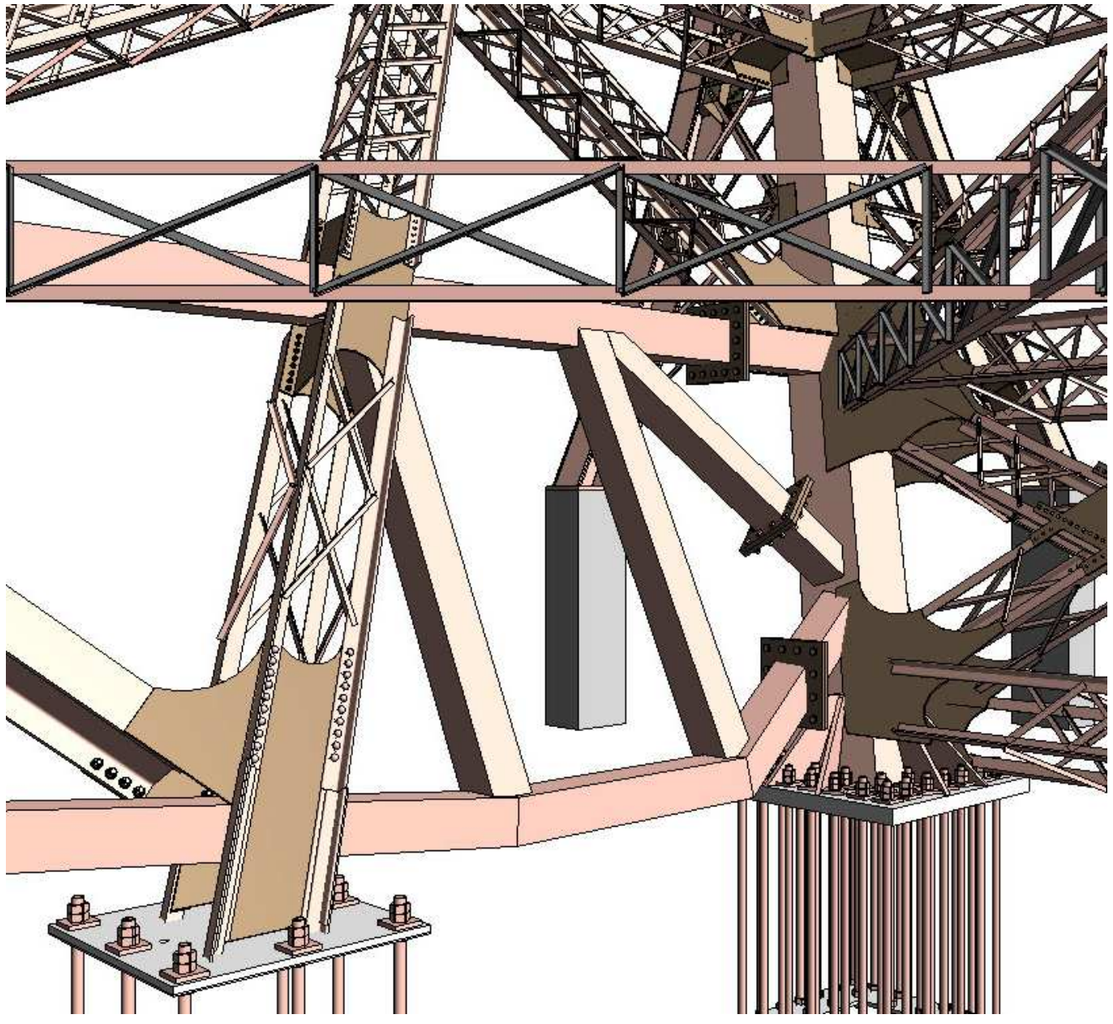
Shop drawing examples



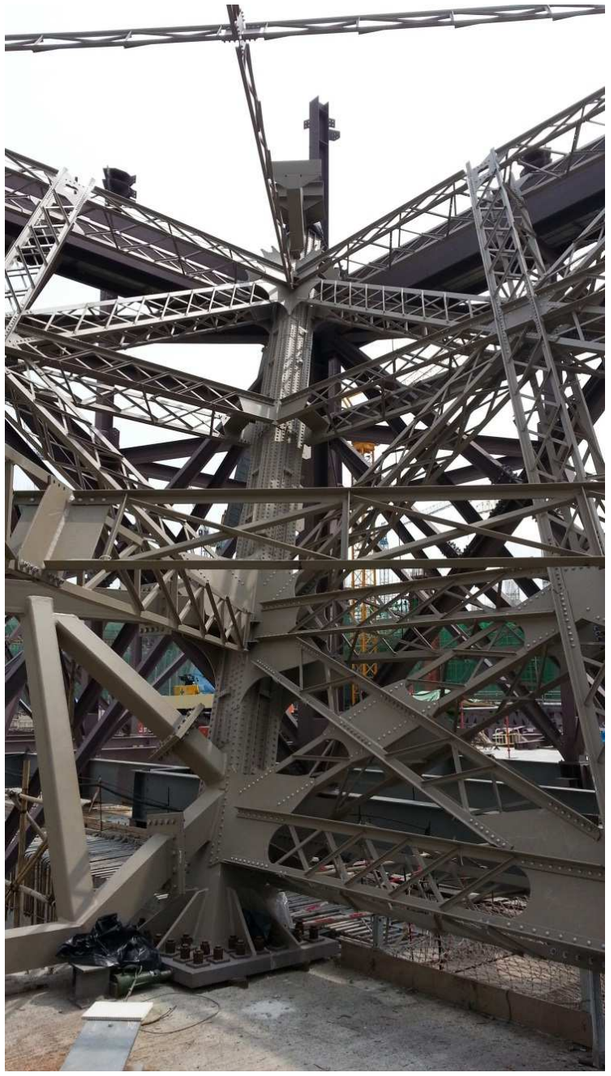
Shop drawing examples

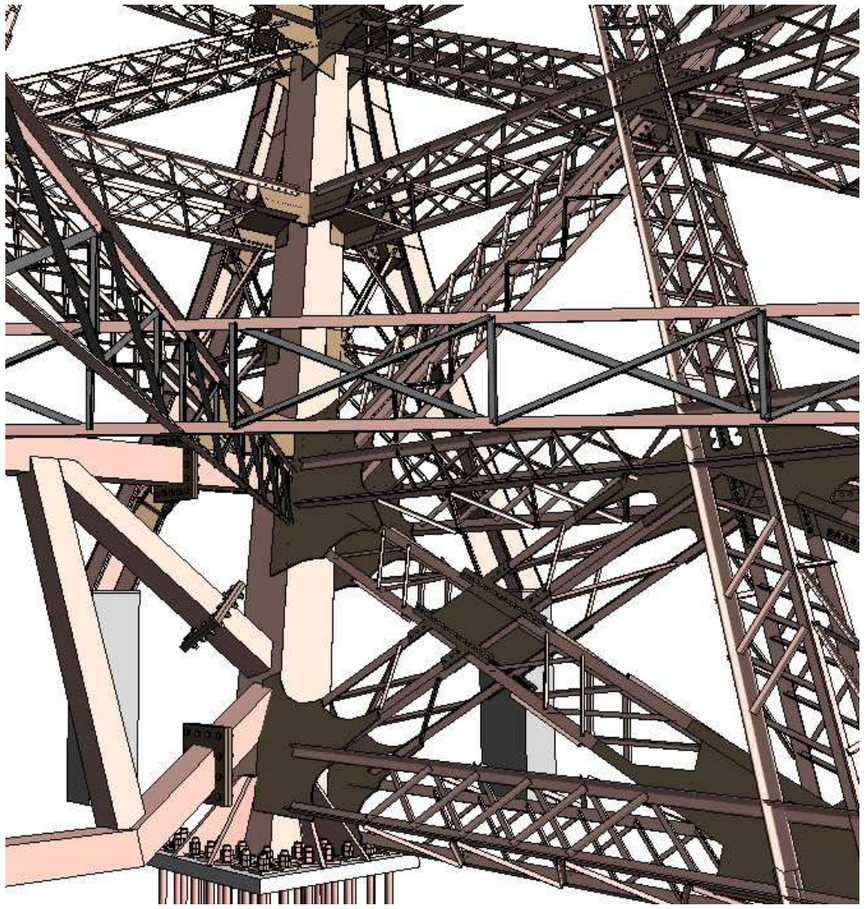


From model to site



From model to site





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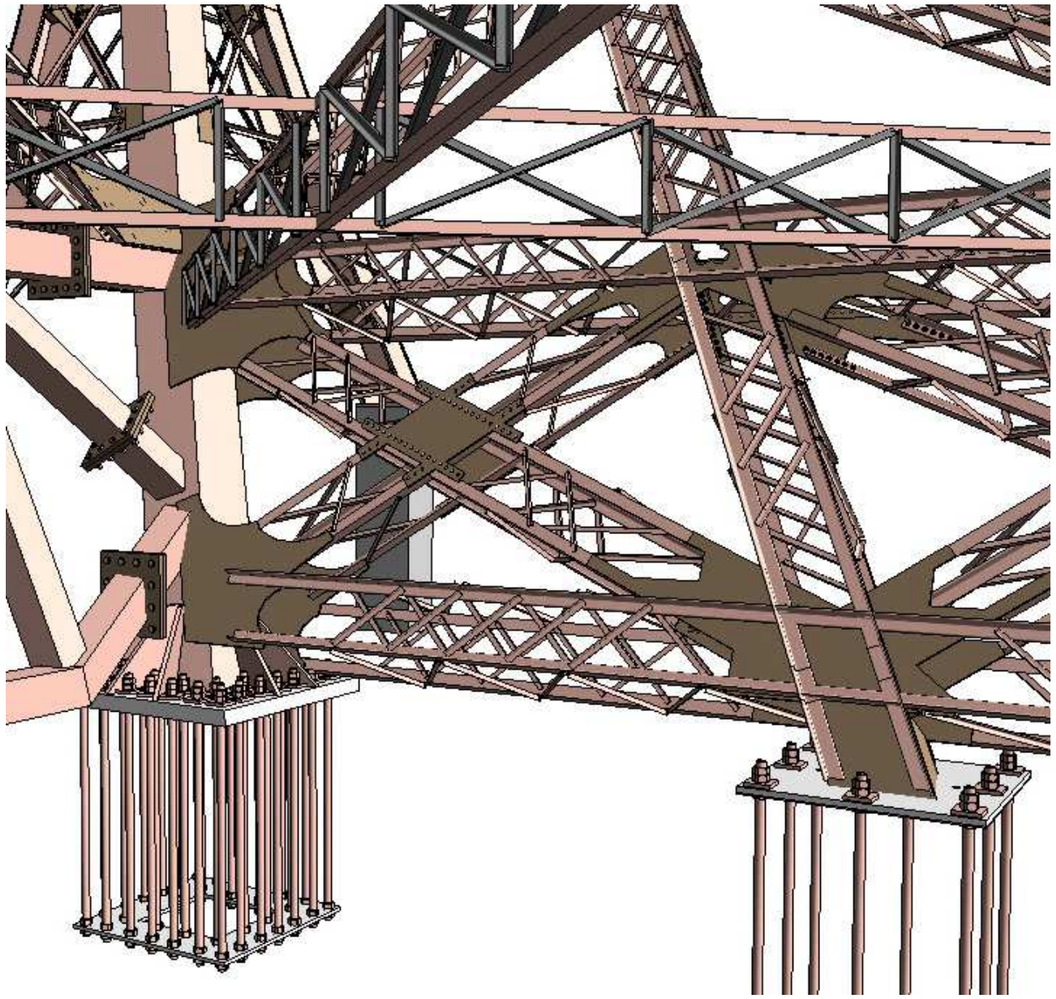
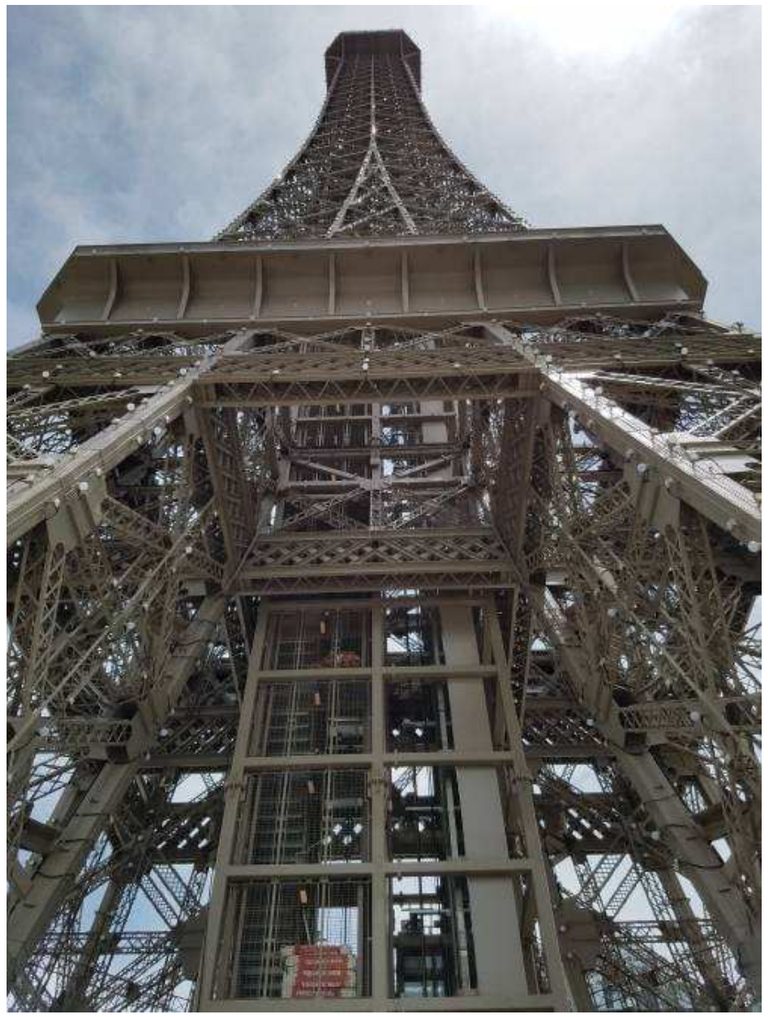


And here is the finished product



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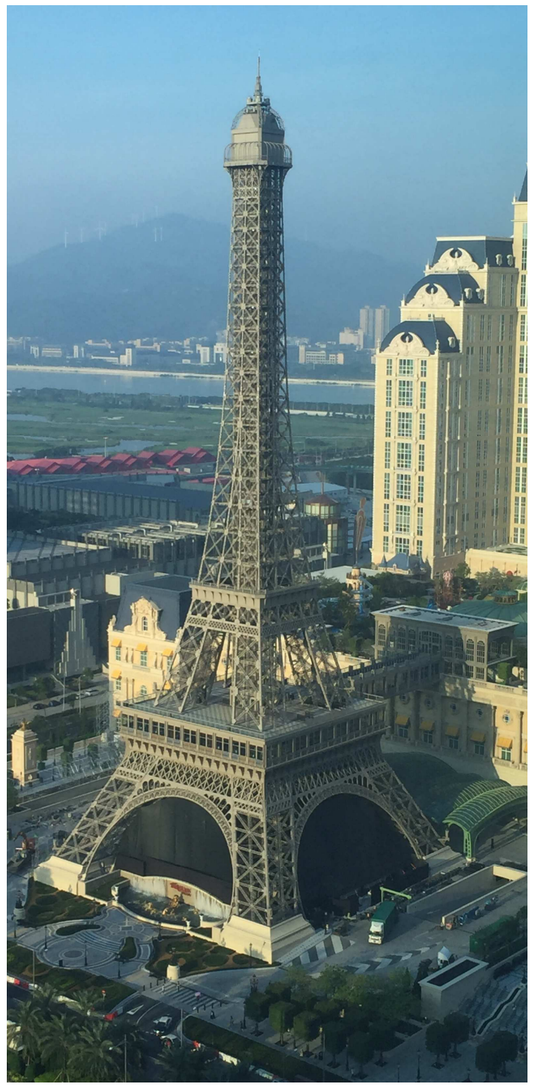
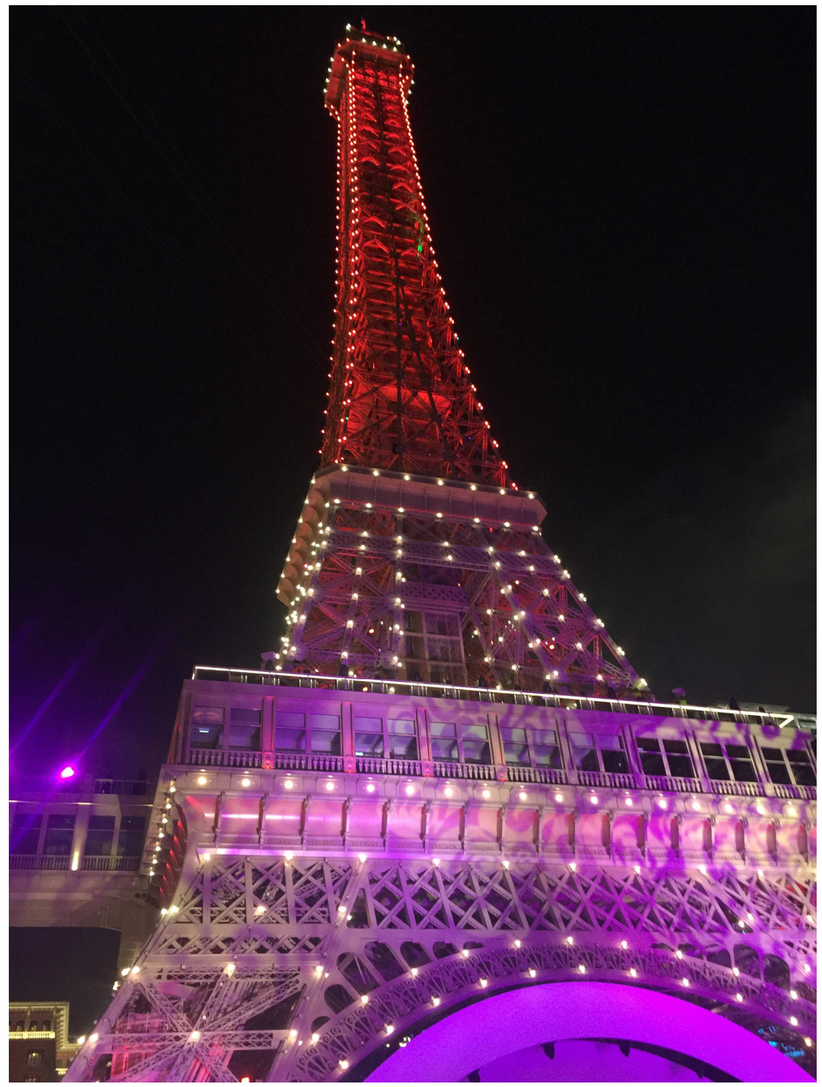
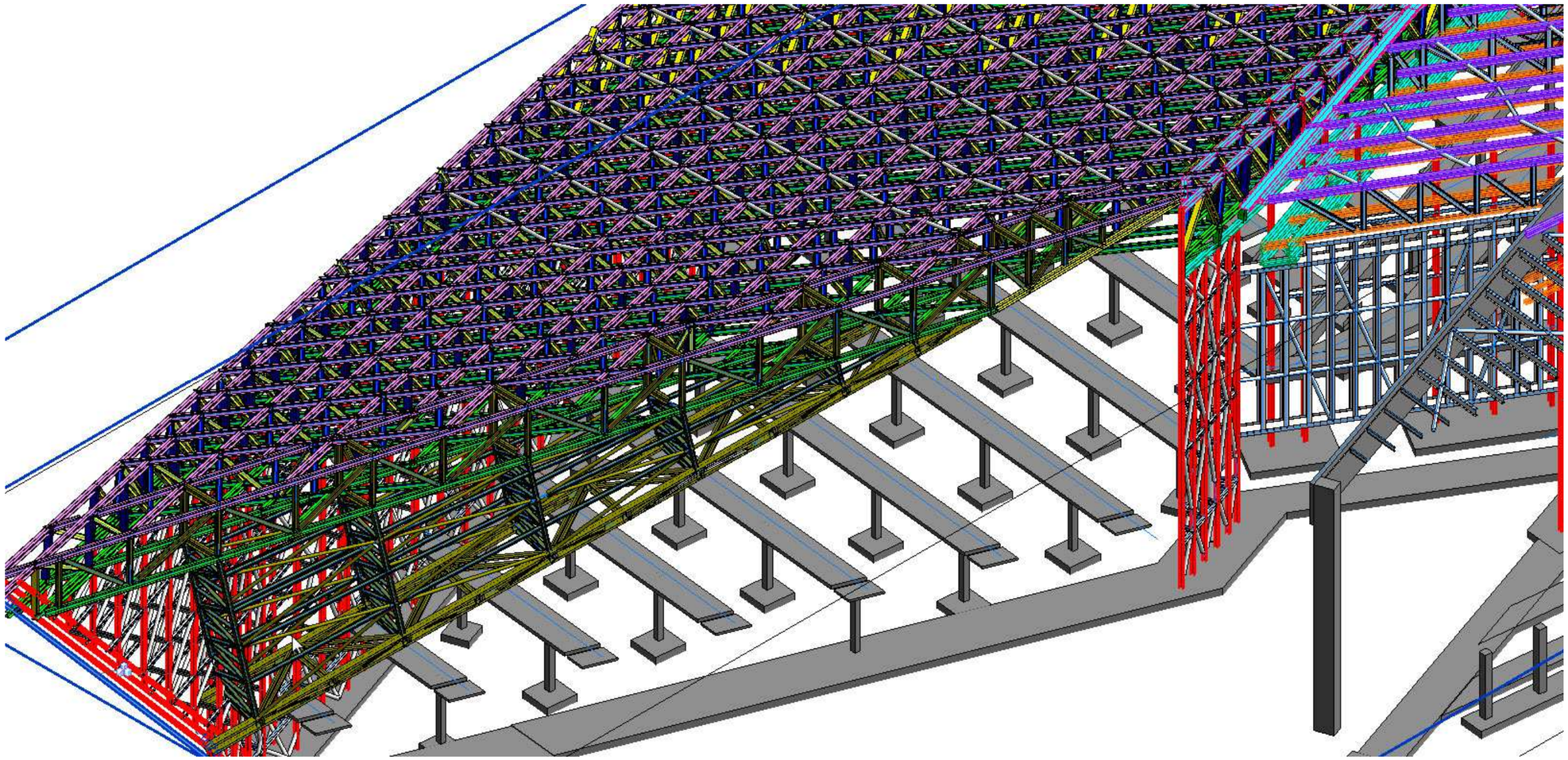




What we have done since



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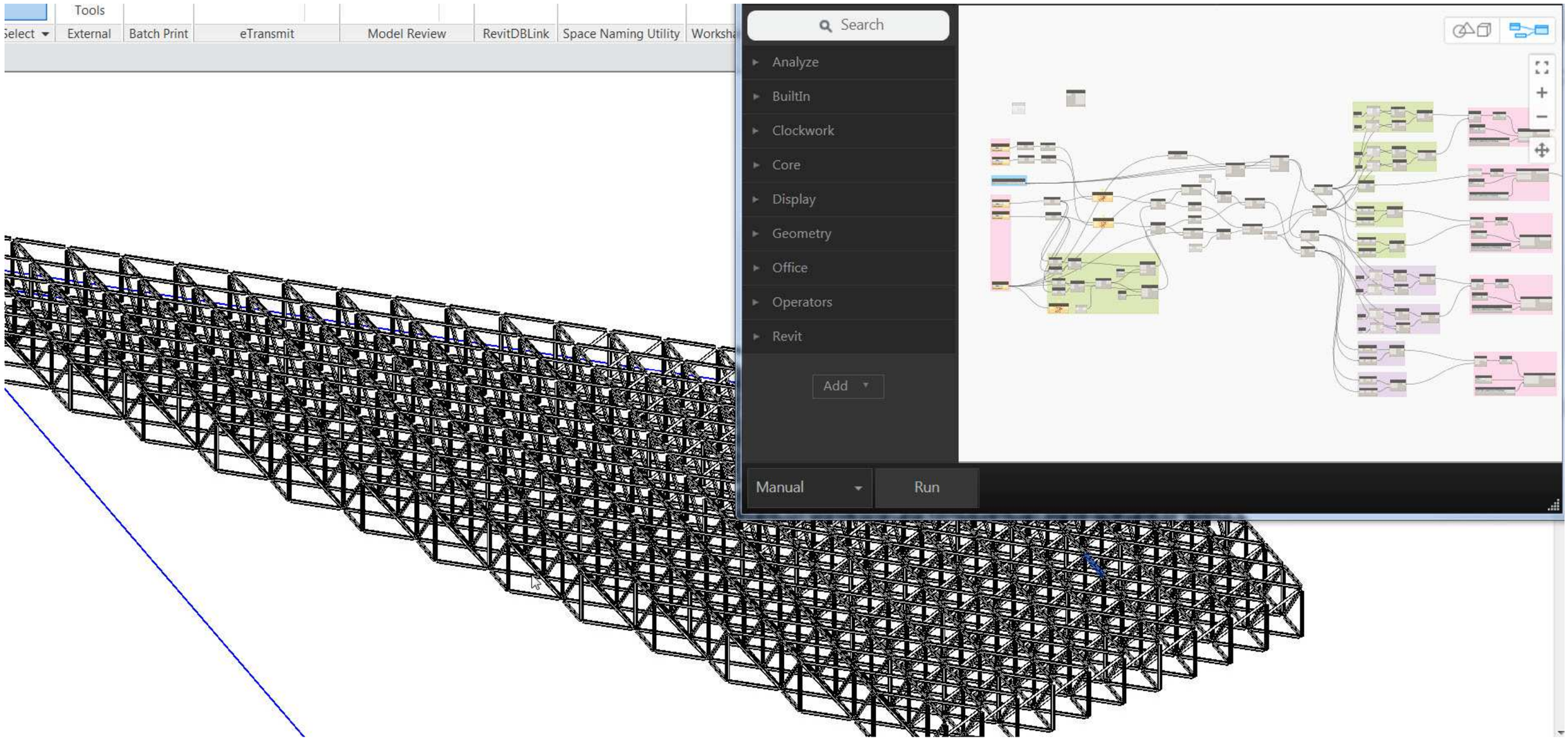
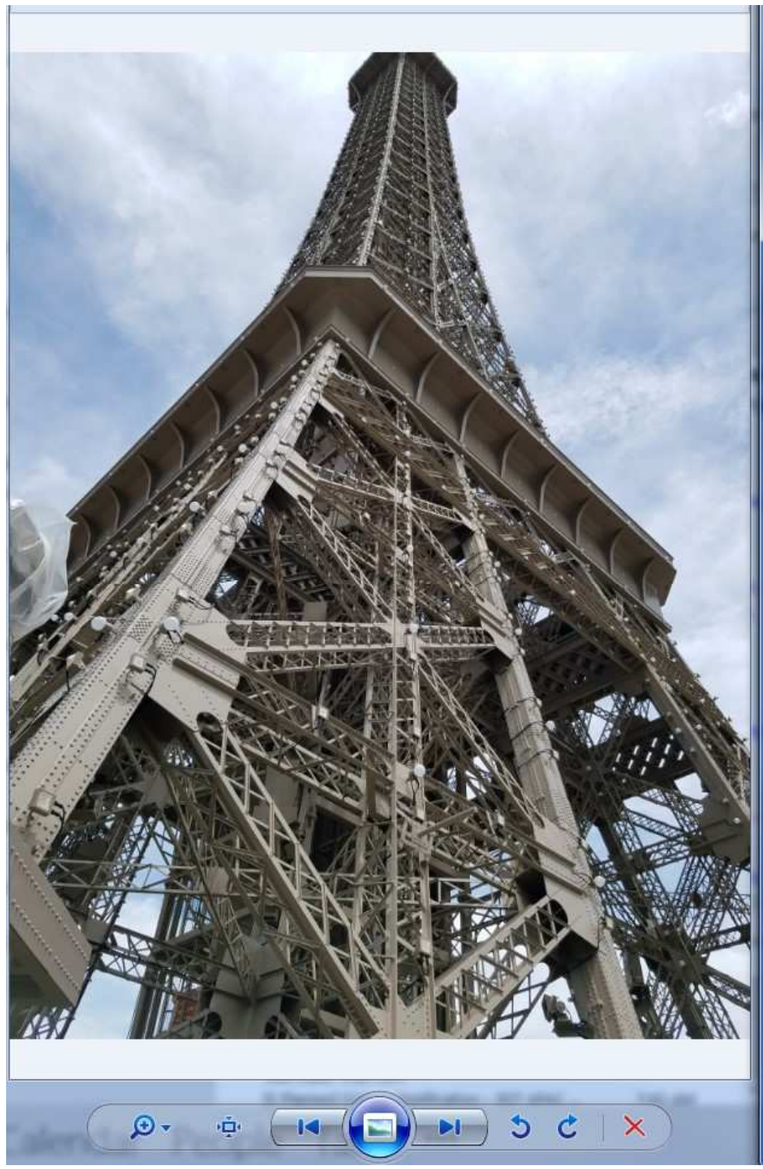
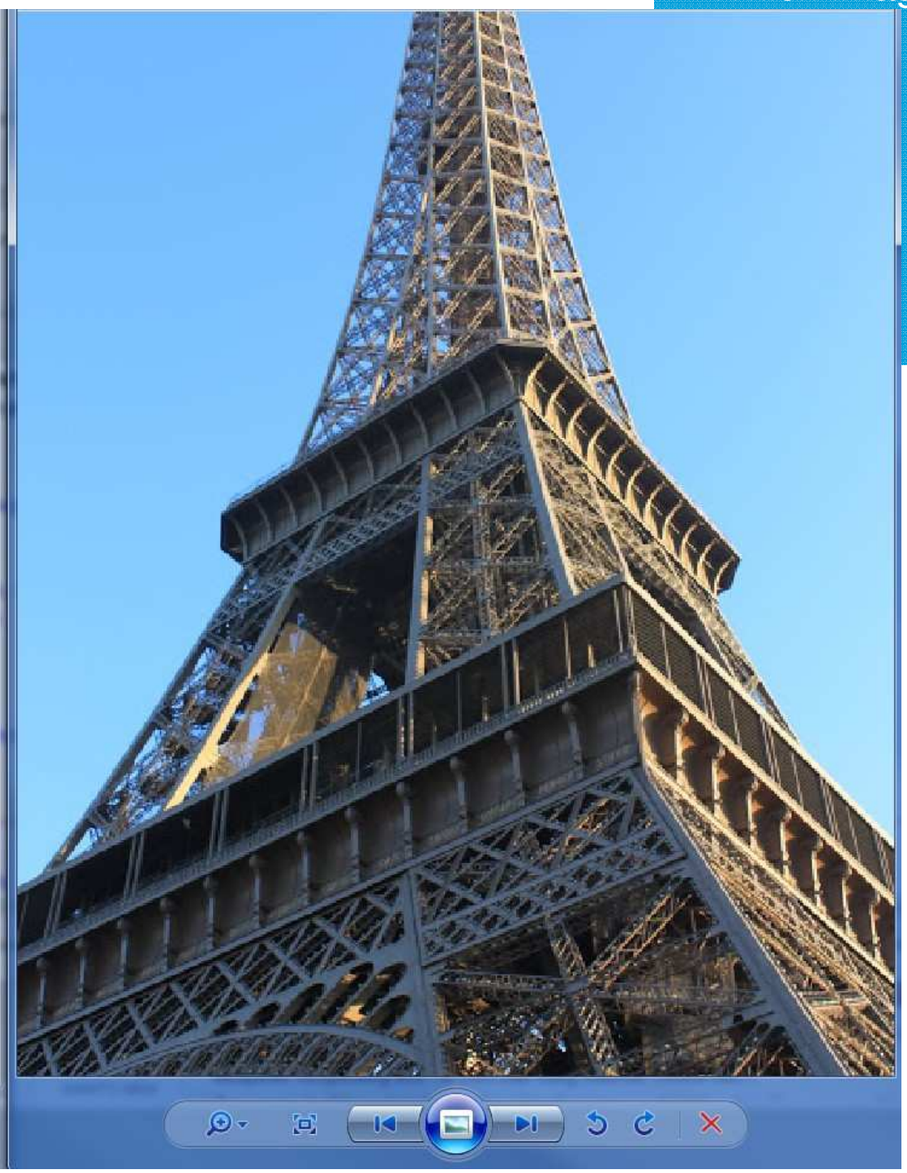


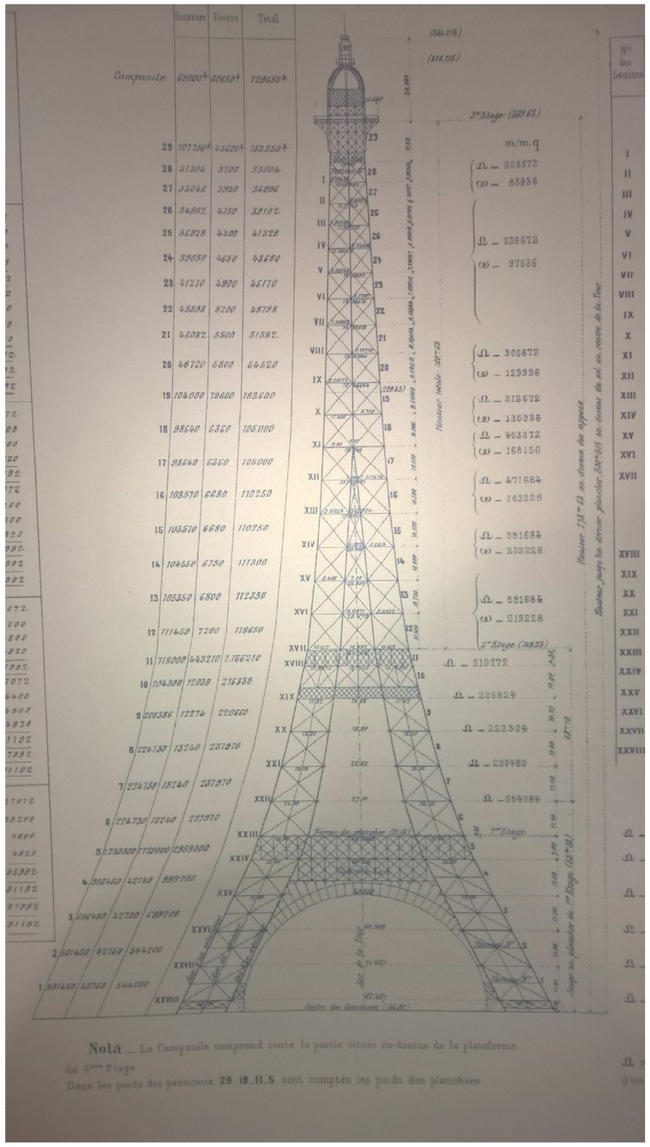
A little bit of fun

Which image is the Replica





A final comment



What we did in 2013-2015 using all the technology we had today

Just proves that Gustave Eiffel was a true GENIUS

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