

“The complete workflow of B.I.M.”

***- Advancements in Digital Design &
Fabrication in Architecture***

David Fung

LECTURE 2 PART 1
HKPDA PARAMETRIC SEMINAR

April 14th, 7:00PM

SZU, Dept. of Arch.

David Fung

David Fung has over 19 years of architectural experience in Australia and Hong Kong since graduating from University 1993. After obtaining his HKIA and RAIA, and whilst working in Sydney Australia as an architect, David also completed his Master degree in Project Management. He has been at the frontier of the latest technological applications. He has been using Building Information Modelling technology for 14 years and applied this state-of-the-art technology into the building design, documentation and co-ordination, construction and Facility Management. David was the Vice President of Hong Kong Institute of Building Information Modelling (HKIBIM, formed 2008) promoting BIM in Hong Kong. He was a member of Hong Kong government's CAD Standard for Works Projects (CSWP) Working Committee, HKIA's I.T. Committee, HKIA's Board of Practices, and the past Chairman of the Autodesk's Industry Advisory Board. He teaches BIM technology in different universities in Hong Kong, China and overseas such as HKU, PolyU, HKUSPACE, Chu Hai College, Tianjin and Tsinghua University.



Information 建築資訊

Graphical 圖型性資訊

Plan 平面圖

Section 剖面圖

Elevation 立面圖

Area Diagrams 面積圖

Schematic Designs 方案圖

Building Plan 審批圖

Structural Plans 結構圖

E/M Drawings 機電圖

Schematics 機電示意圖

Details 大樣圖

Other Diagrams... 其他圖

Non-Graphical 非圖型性資訊

Area Schedule 面積表

Finishing Schedules 裝潢表

Door/Window/Louvre 門窗表

Beam/Column Schedule 樑柱

Equipment Schedule... 機器

Program 進度

Cost Estimate 造價表

Quantity Take Off 材料表

Bills of Quantities 物料清單

Variation Assessments 變更

Building Projects

Modelling

- Plan
- Section
- Elevation
- Area Diagrams
- Schematic Designs
- General Building Plan
- Structural Plans
- E/M Drawings
- Schematics
- Other Diagrams

BIM

Information

- Area Schedule
- Finishing Schedules
- Door/Window/Louvre Sch
- Beam/Column Schedule
- Equipment Schedule
- Program
- Cost Estimate
- Quantity Take Off
- Bills of Quantities
- Variations

Building Information Modeling

信息化建築模型

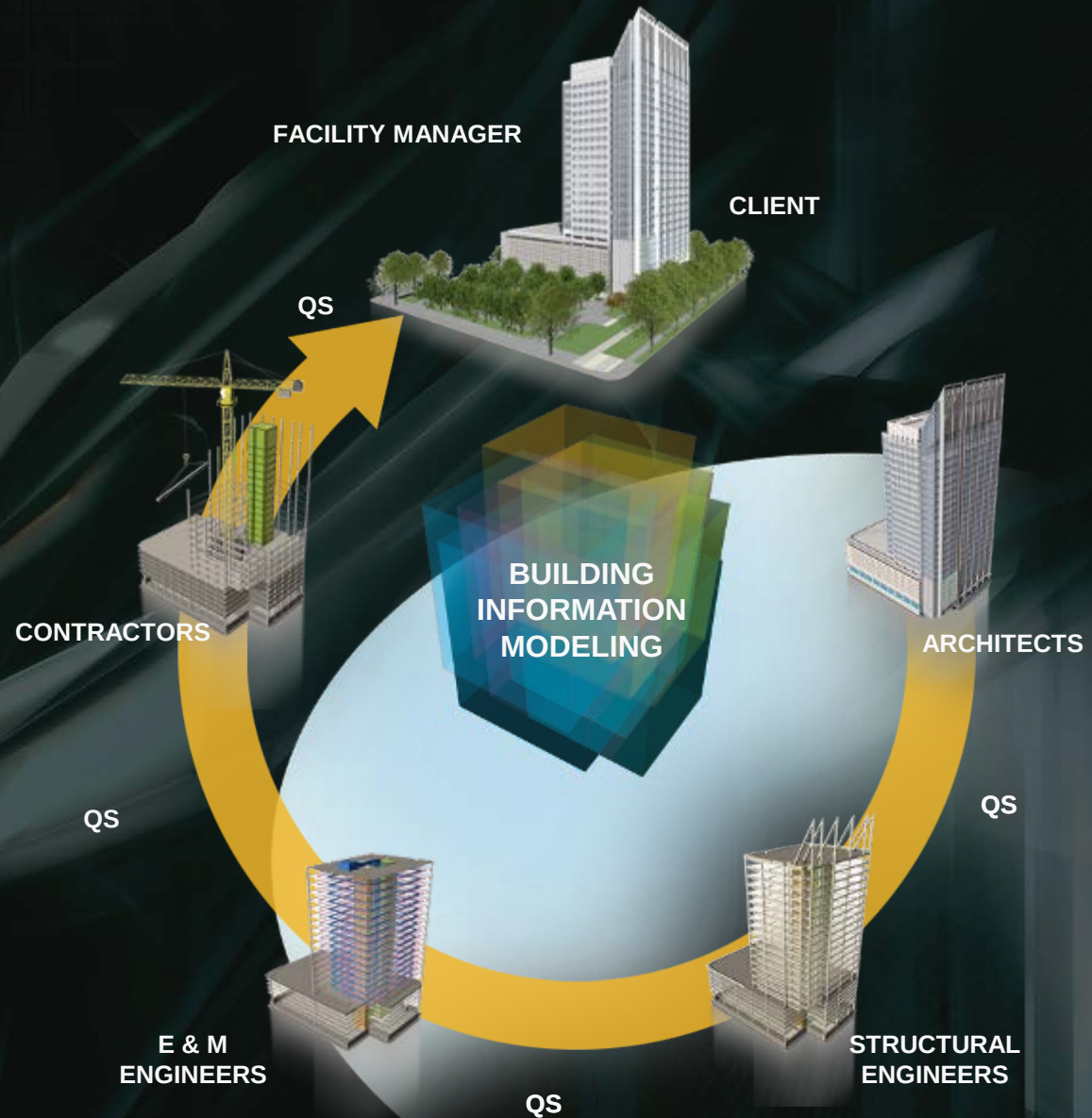
Graphical Data
(model)

+

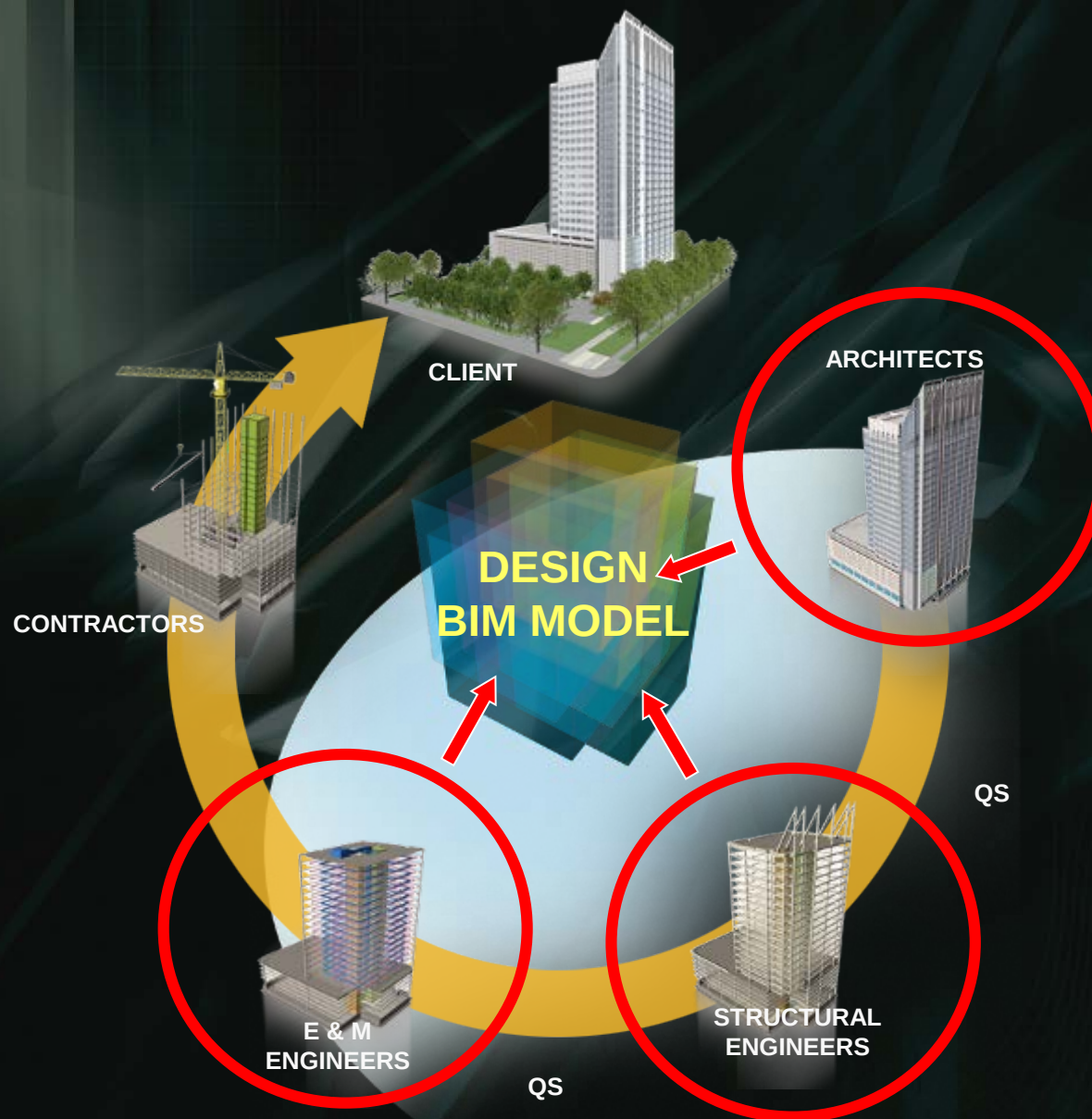
Non-Graphical
Data
(Information)

+

New workflow

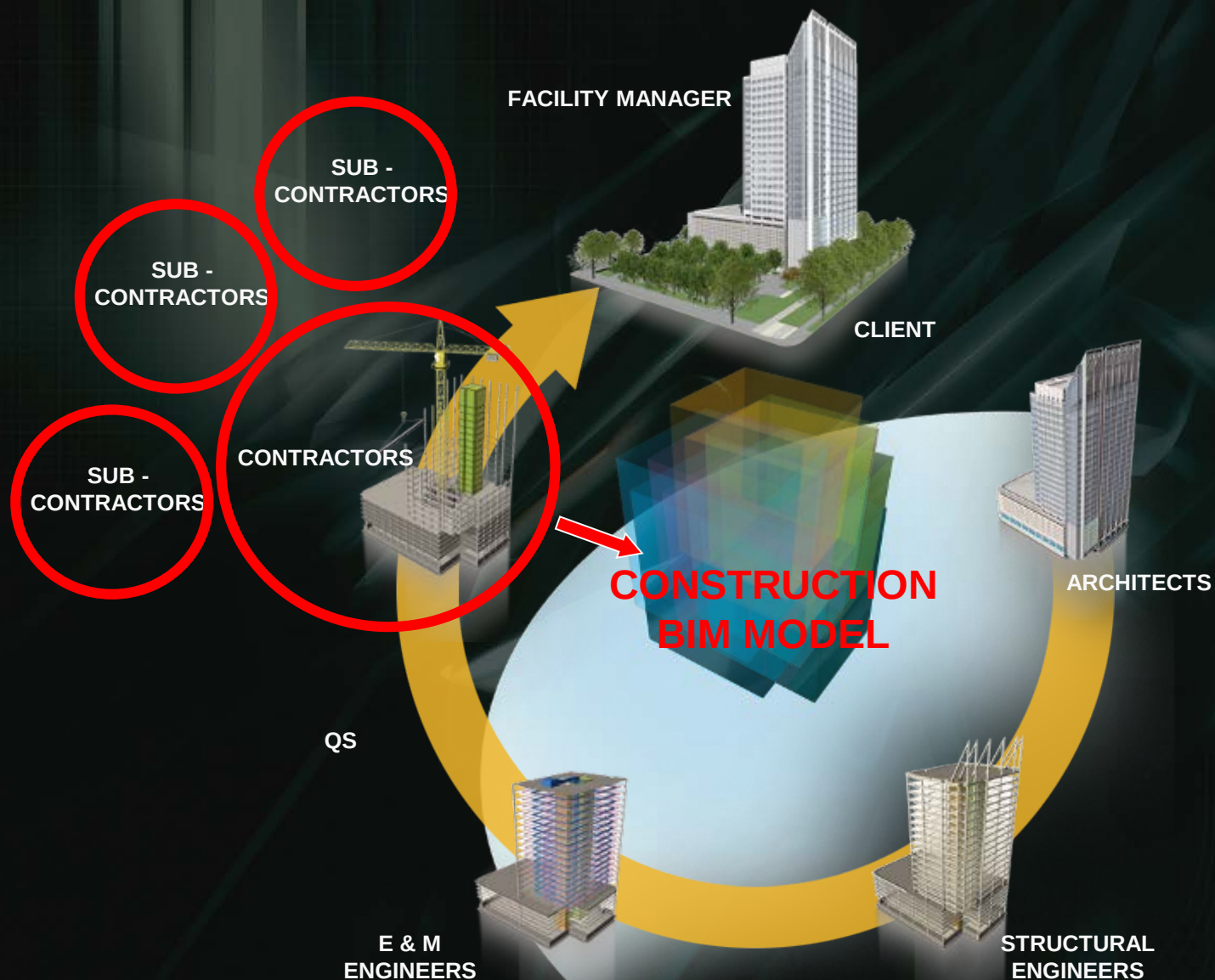


HOW BIM WORKS?



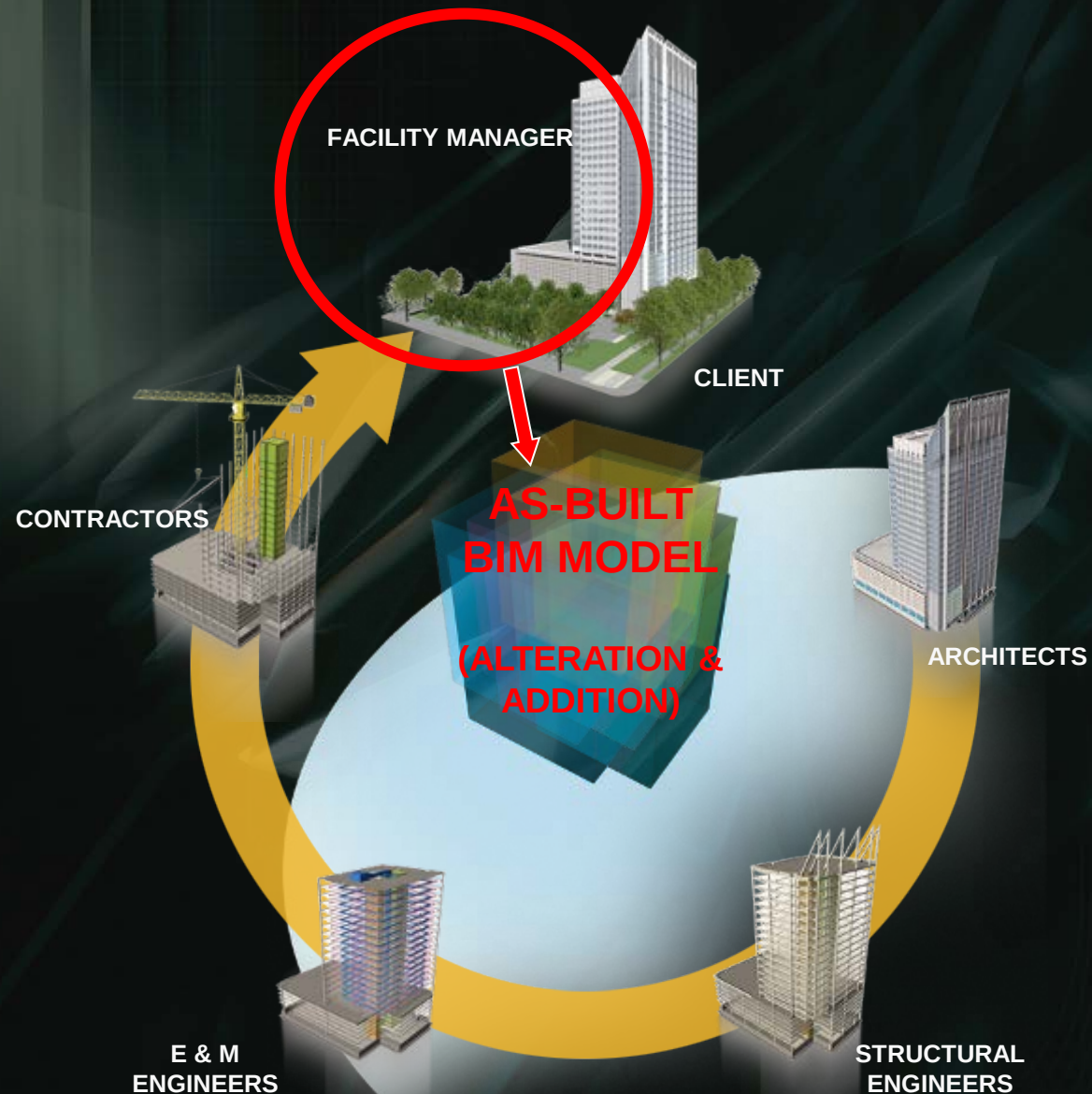


CONSTRUCTION BIM MODEL





AS BUILT BIM MODEL

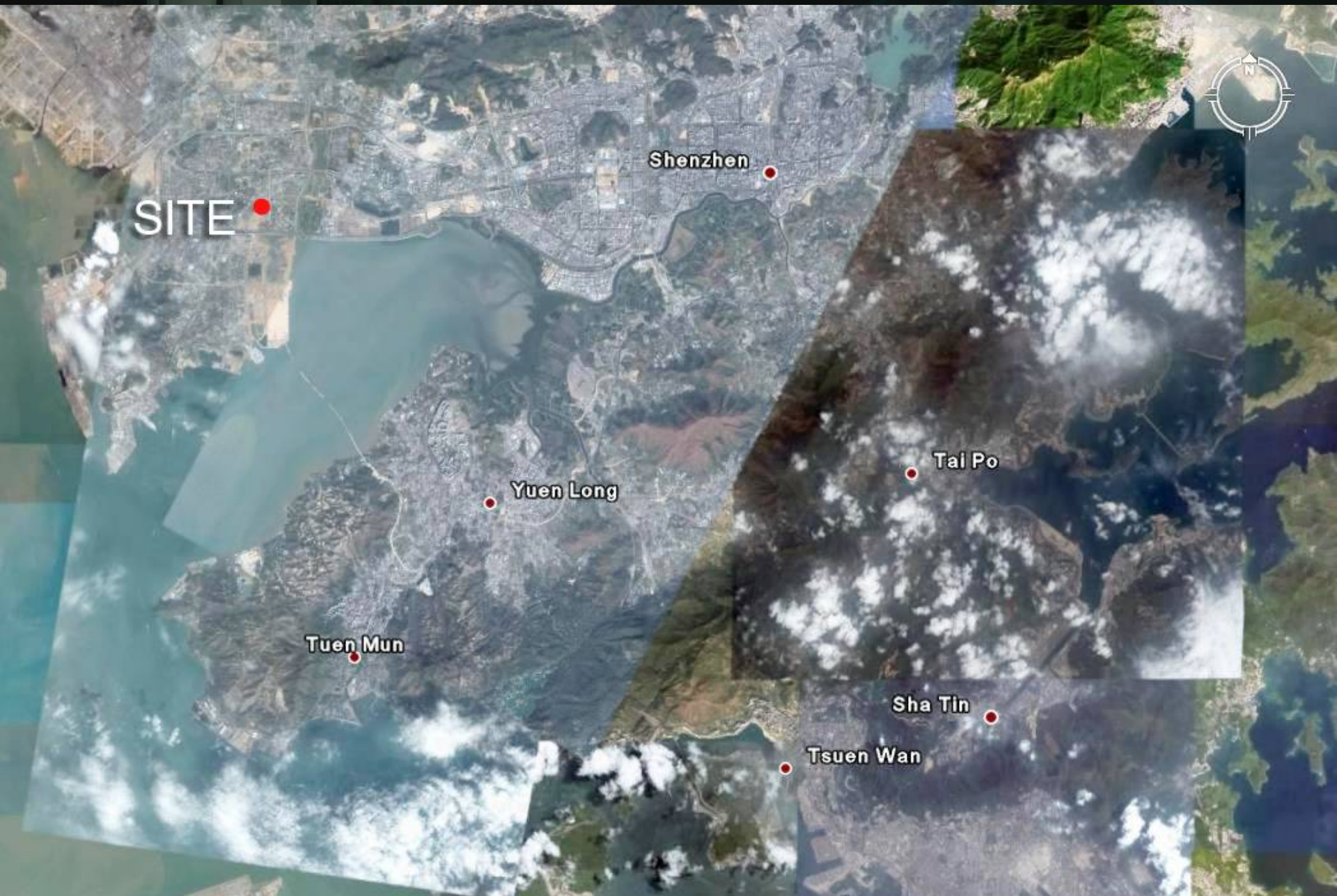


The Hong Kong Polytechnic University

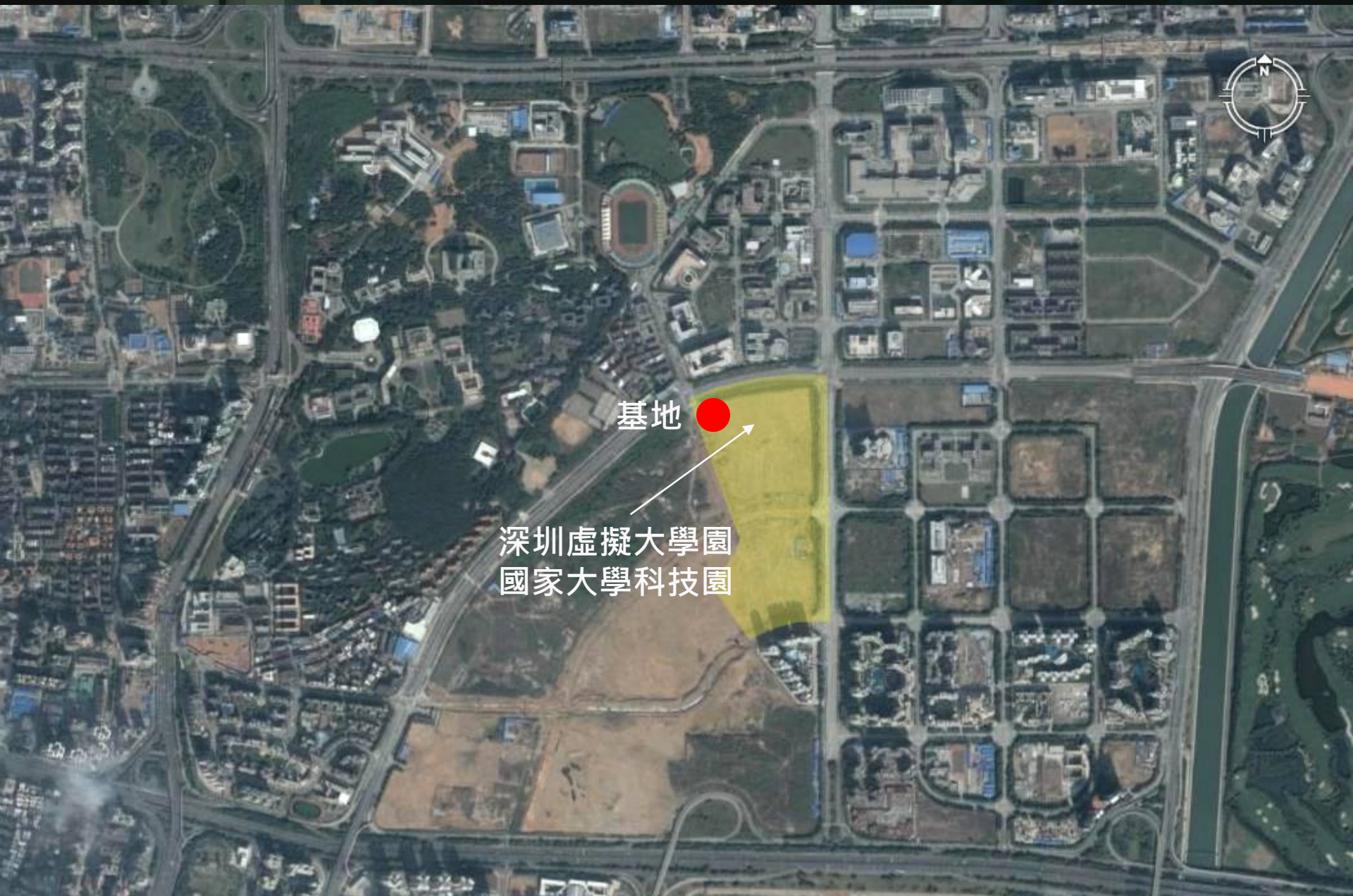
Campus in the Shenzhen Virtual University Science Park

Location	Shenzhen
Building Type	Institutional – Theatre, laboratories, classrooms, library, offices and administration
GFA	12,500 sq.m + 4,000 sq.m basement
Completion	End of 2009
Client	Hong Kong Polytechnic University
Architect	Aedas Ltd
Structural Engineer	Scott Wilson (Benaim (China) Ltd.)
E/M Engineer	JRP

LOCATION



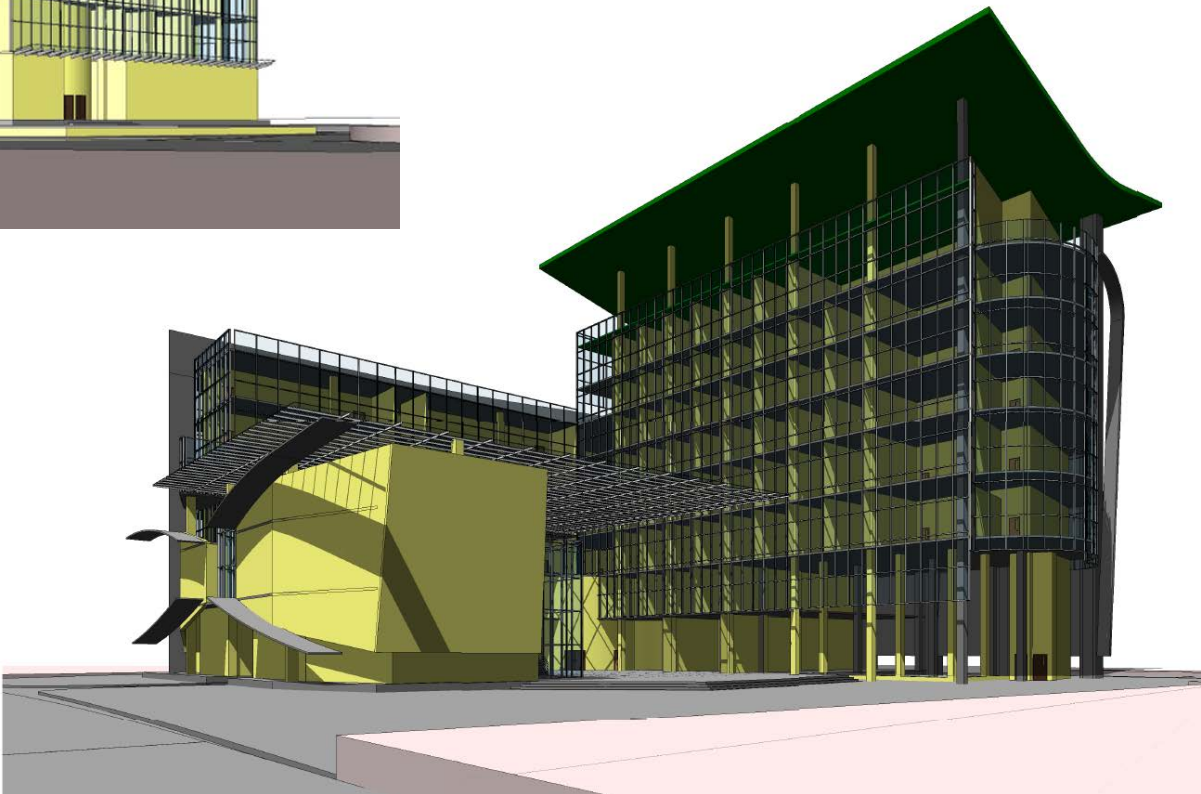
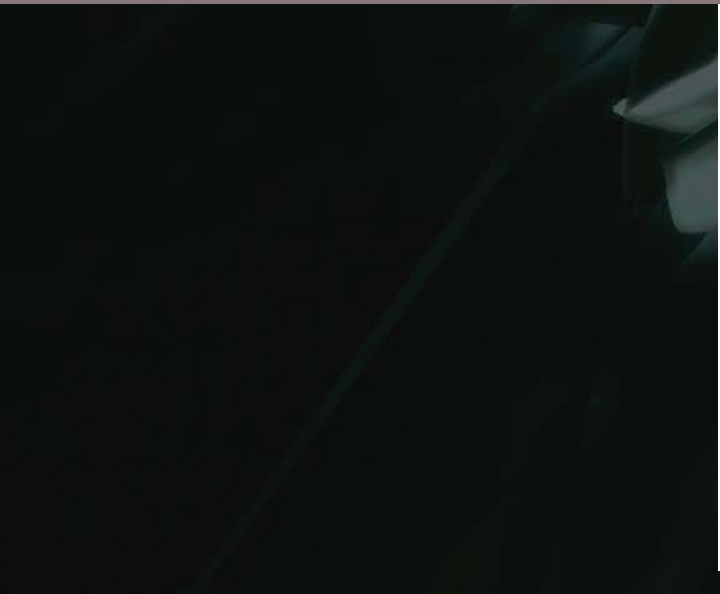
SITE



SITE



EARLY DESIGN IDEAS



DEVELOPING DESIGN IDEAS



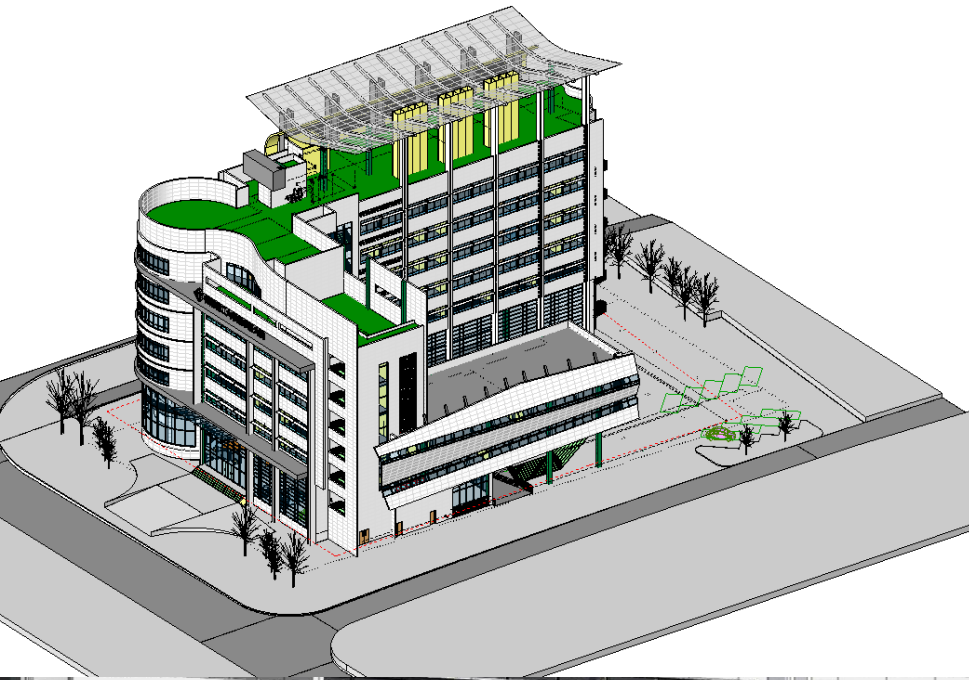
DEVELOPED DESIGN IDEAS



TESTING MASSING IN GOOGLE EARTH



PRESENTING DESIGN IDEAS

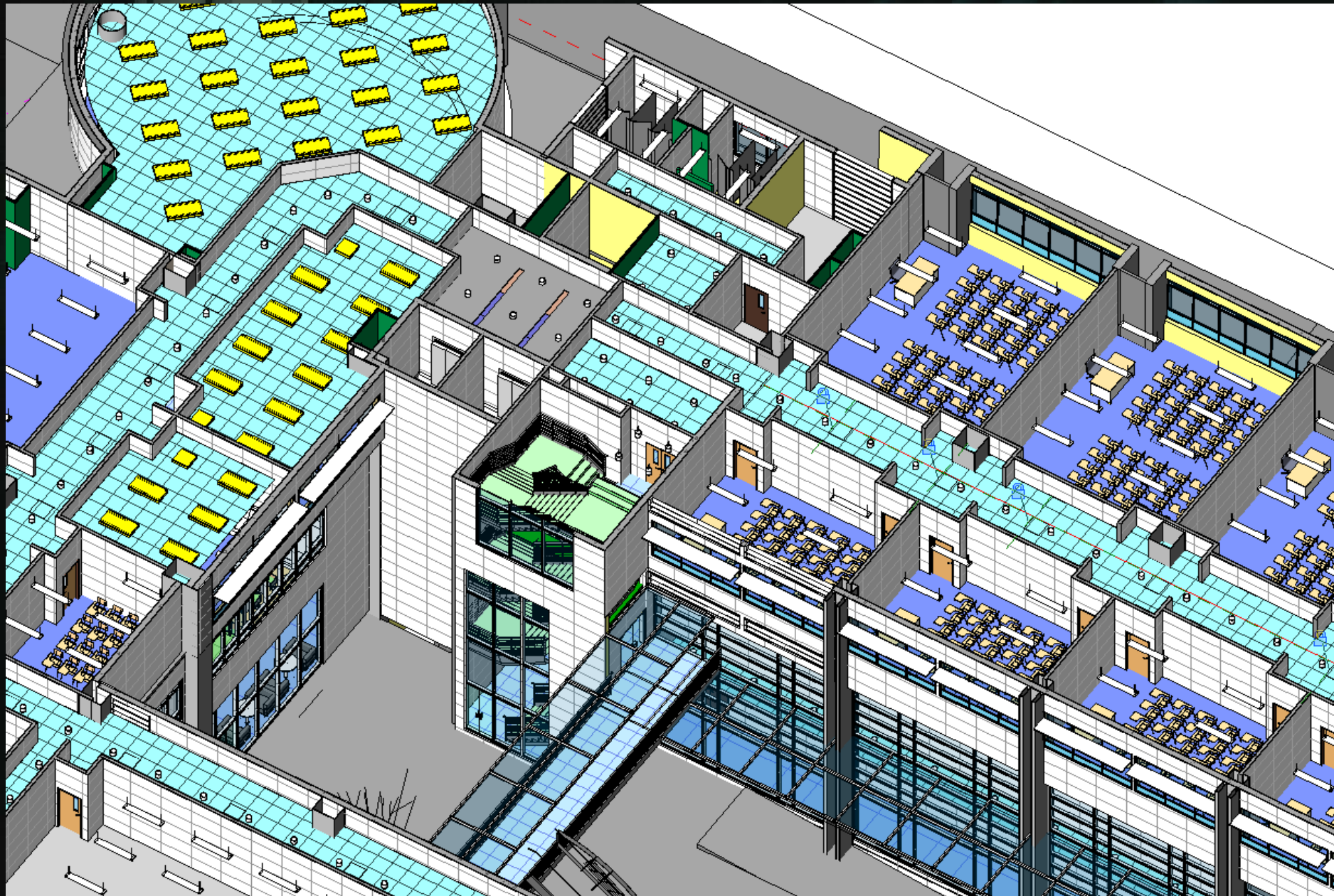


LIFT LOBBY
DESIGN CONCEPT

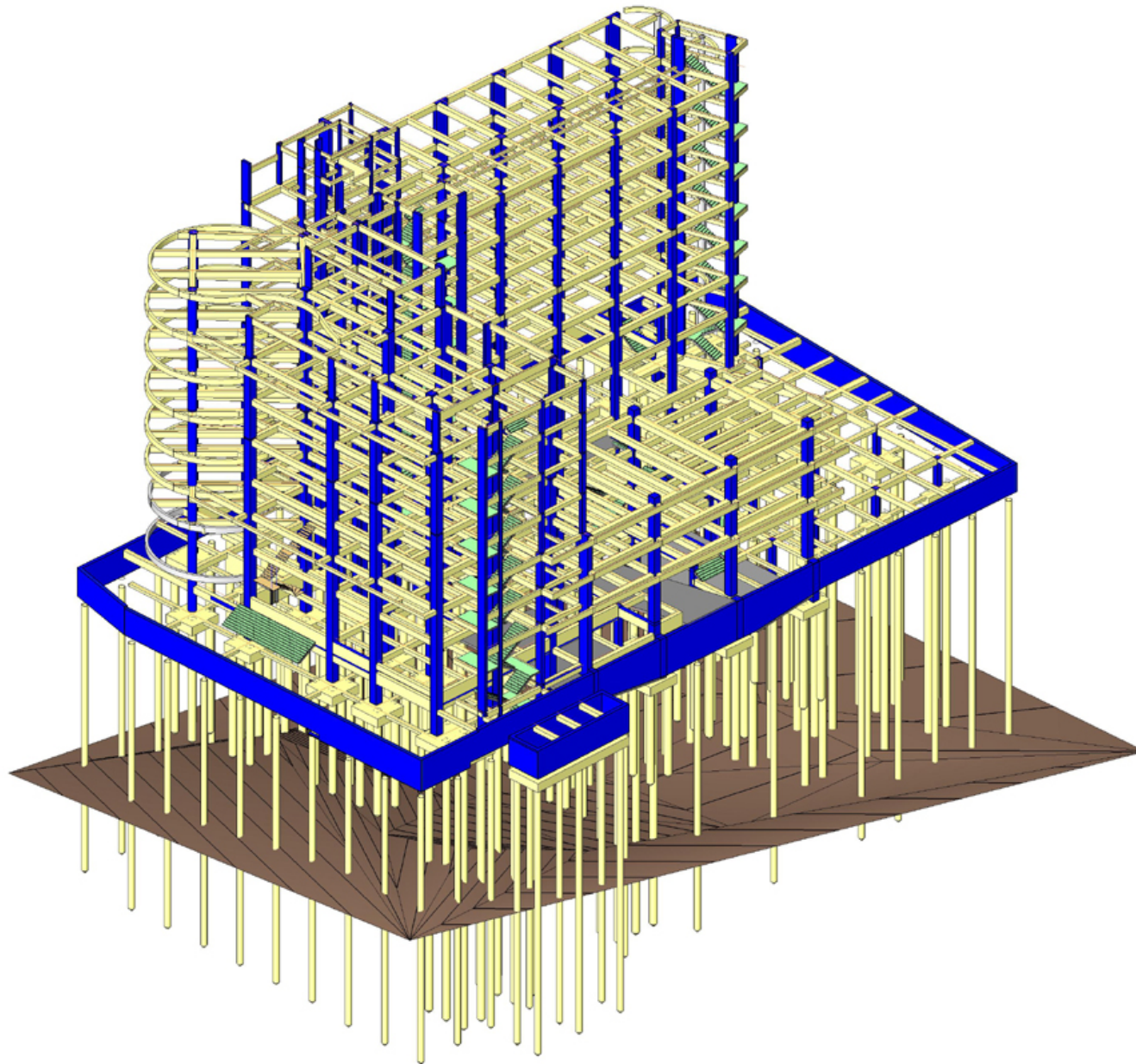
DETAILED DESIGN



ARCHITECTURAL CO-ORDINATION

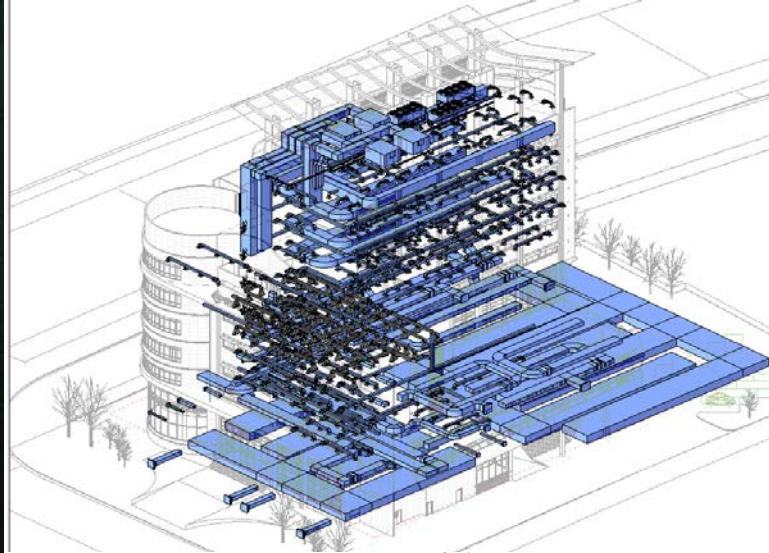


STRUCTURAL DESIGN MODEL

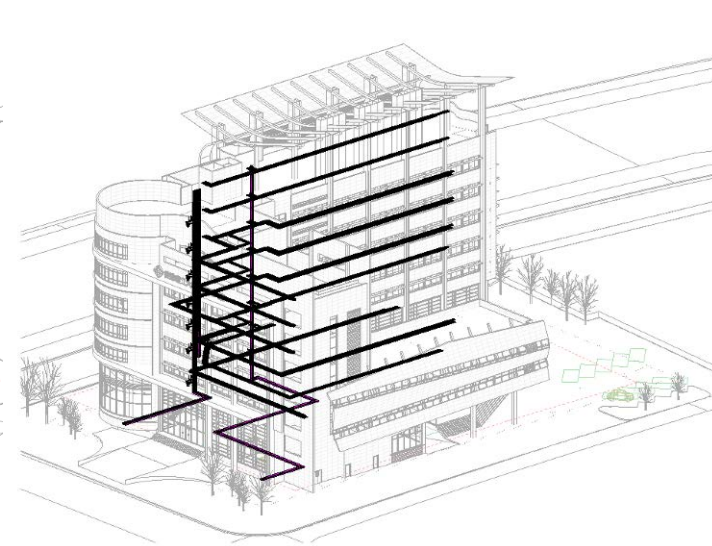
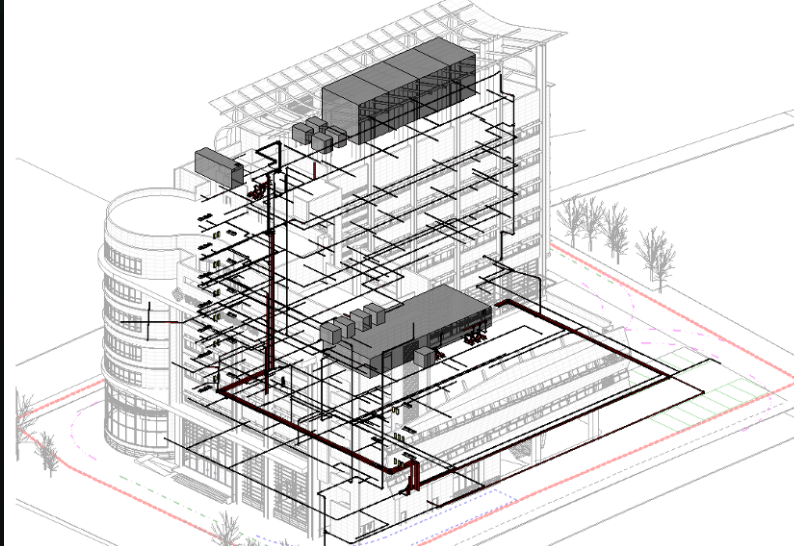
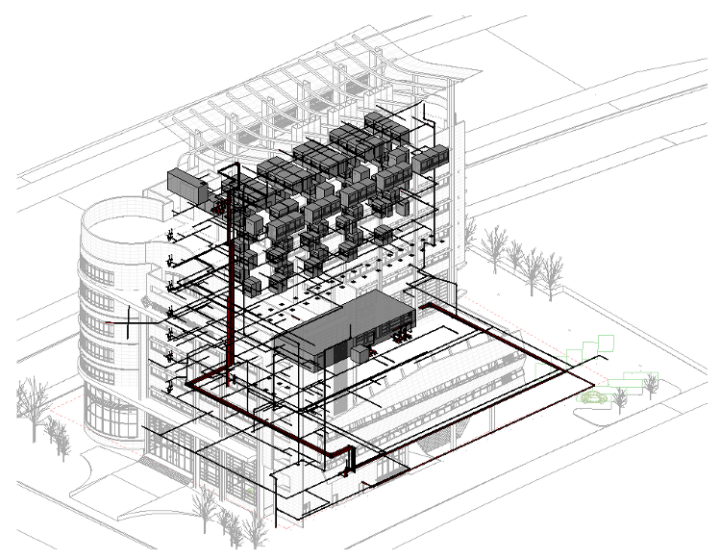


BUILDING SERVICES CO-ORDINATION

HVAC Installation



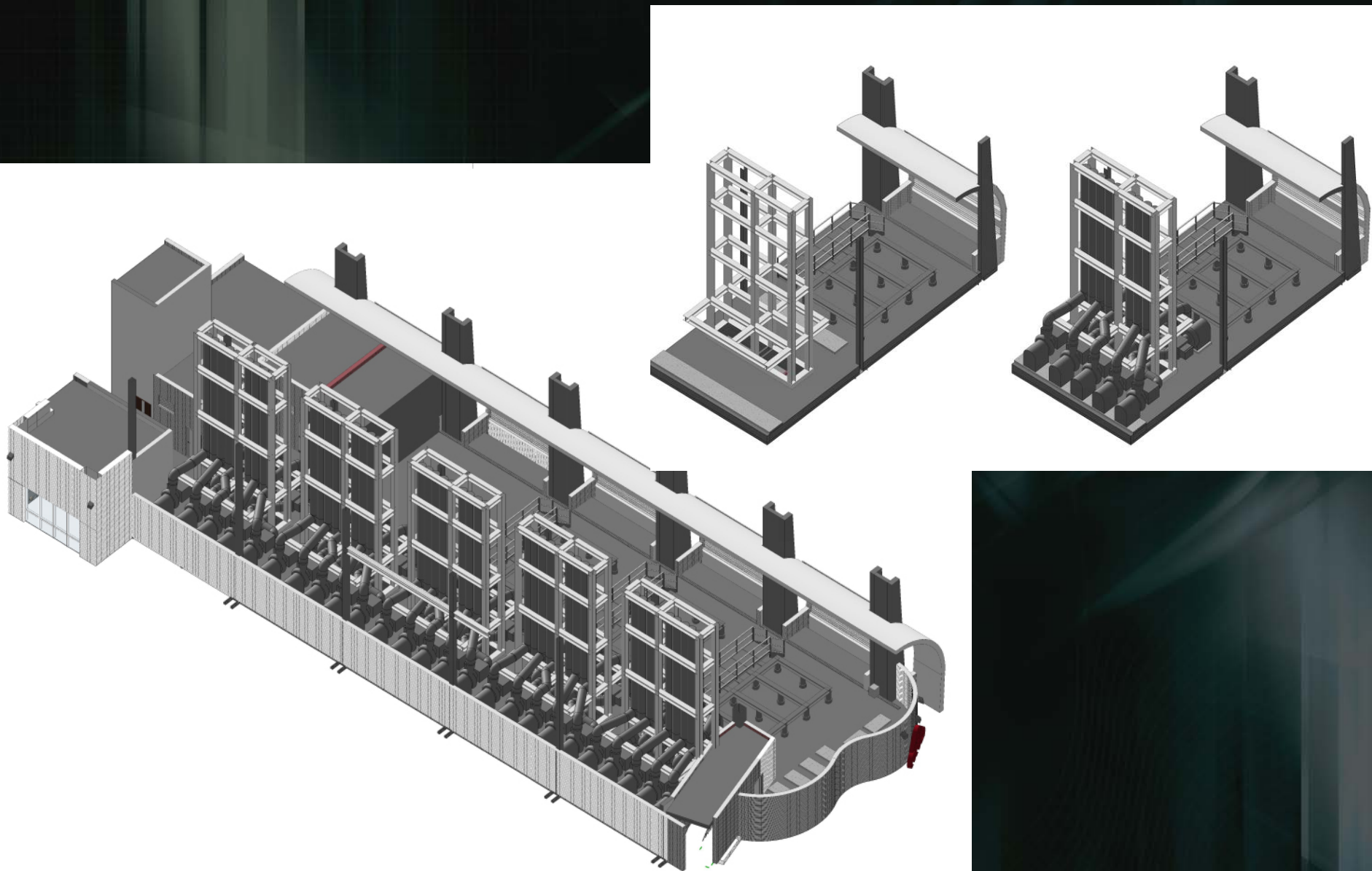
Fire Services Installation



P/D Installation

Electricity Installation

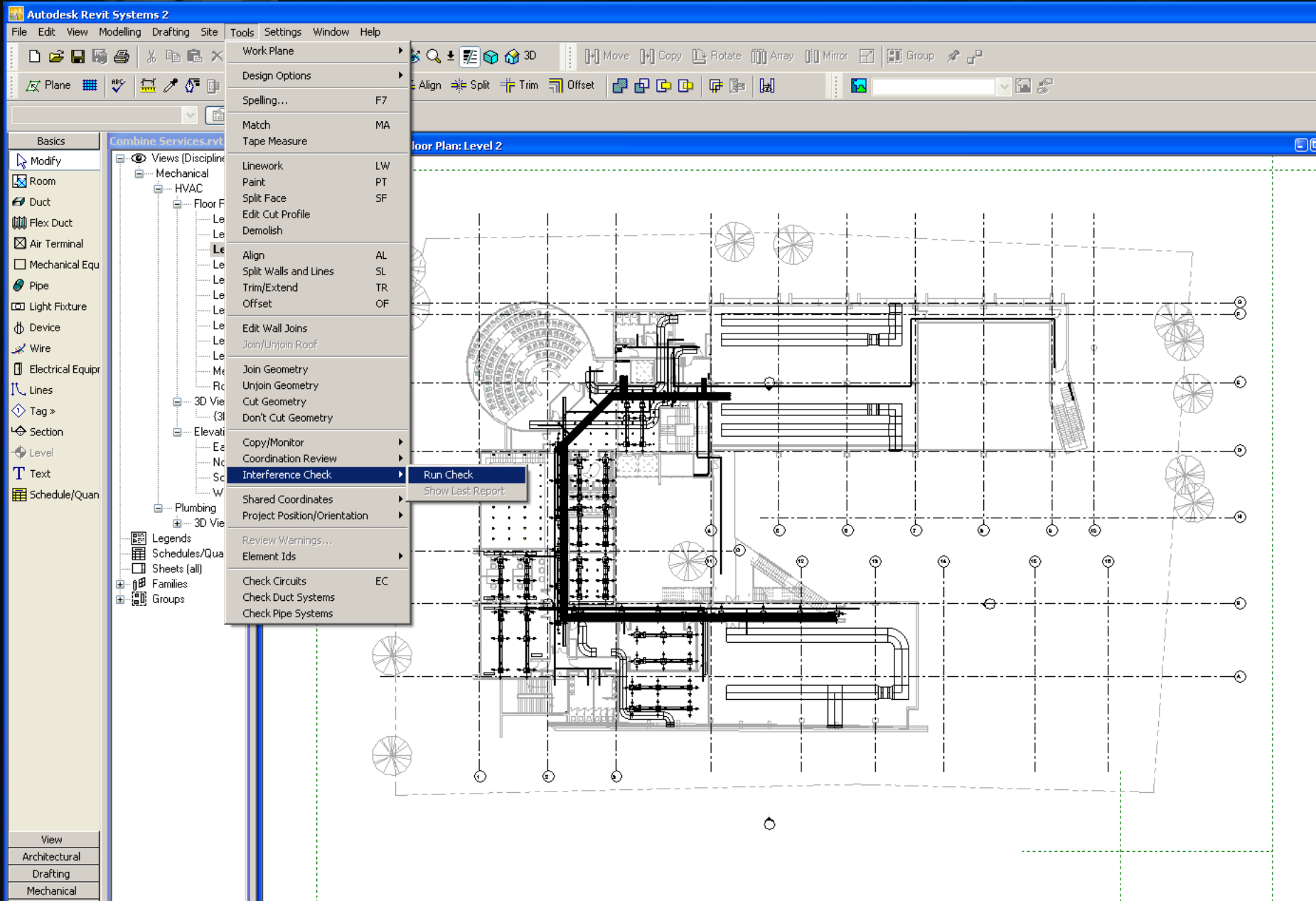
SPECIAL CO-ORDINATION - LABORATORIES



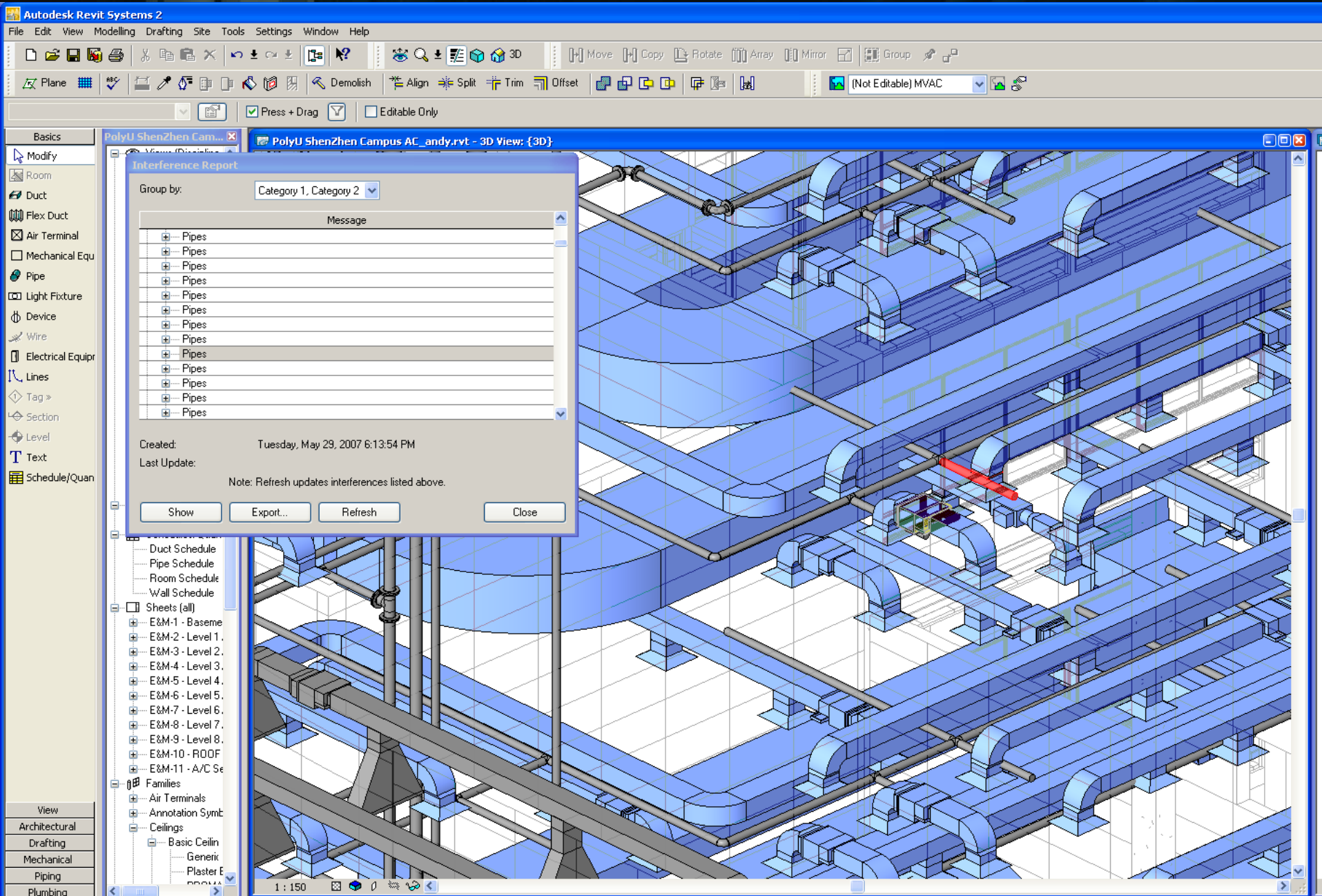
CO-ORDINATED DETAILED DESIGN



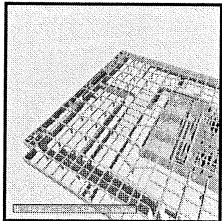
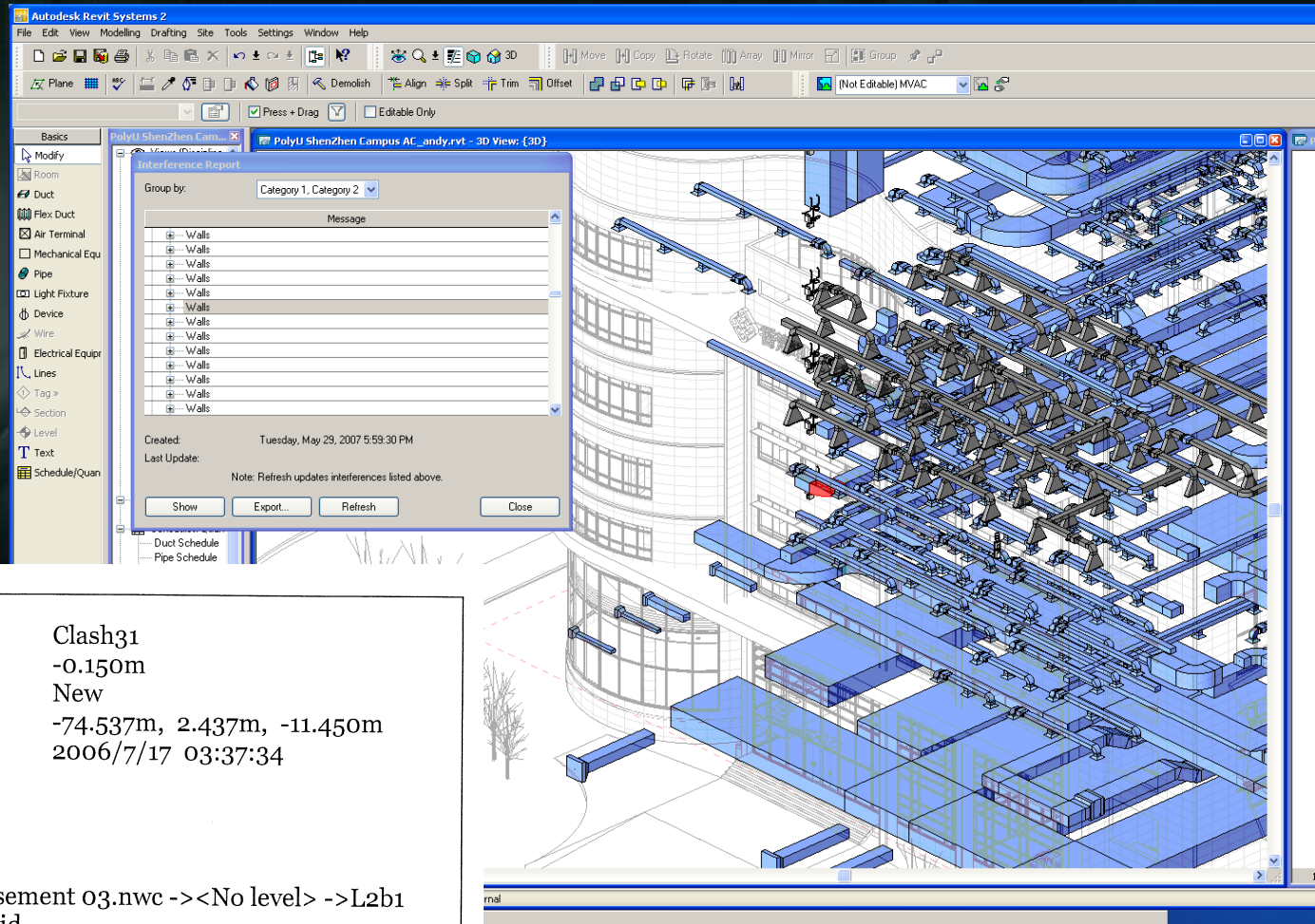
CLASH ANALYSIS



CLASH ANALYSIS



CLASH ANALYSIS REPORT



Name Clash31
 Distance -0.150m
 Status New
 Clash Point -74.537m, 2.437m, -11.450m
 Date Created 2006/7/17 03:37:34
 Approved By

Item 1

Path File ->File ->Basement 03.nwc -><No level> ->L2b1
 500 x 700 ->L2b1 500 x 700 ->Solid

Item 2

Entity Handle 2AD6
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 >Duct

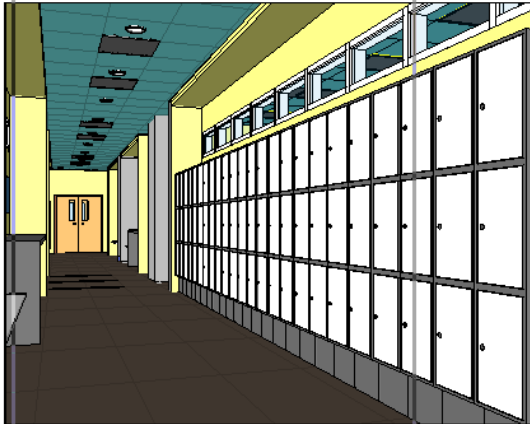
A 3D perspective view of a classroom layout. The room features a blue floor, yellow walls, and a whiteboard. A teacher's desk is positioned at the front, and rows of student desks are arranged in the main area. A blackboard is visible on the left wall, and a doorway is on the right.

A 3D perspective view of a classroom layout. The room features a blue floor, yellow walls, and a white ceiling. There are two sets of double doors on the left wall. The seating area is filled with rows of light blue rectangular tables and grey chairs. A teacher's desk with a brown top and a black office chair is positioned at the front of the room. A long white counter or storage unit runs along the right wall. The room is enclosed by a grey wall on the right and a yellow wall on the back.

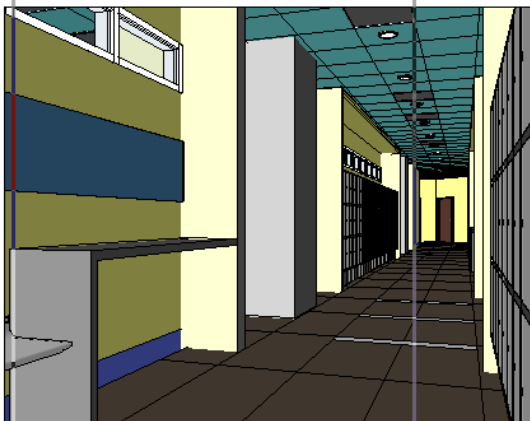
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Drawing Type		B.D. SUBMISSION	
B.D. Reference No.		GOVERNMENT REFERENCE NO.	
B.D. Revision No.		GOVERNMENT REFERENCE NO.	
Author's Sign			
AUTHORIZE PERSON TO SIGN AREA			
Notes			
Date	Description	Contract Code	Drawn
Originality	Issue	Drawn	App.
		APPROVED	
Structural Engineer			
B & M			
J. JORDA PRETORIO			
C & S			
利比 RLB Rider Levett Bucknall			
			
Client			
 THE HONG KONG POLYTECHNIC UNIVERSITY 香港理工大學			
Project 香港理工大学图书馆 中港基总			
Drawing 汇收入员培训室平面图 (高层三座) 1			
Drawing Number 00778		Revision 1 : 00	
Drawing Number 778 (342)		Date REV.	
Drawing Number 778 (342)		Date REV.	

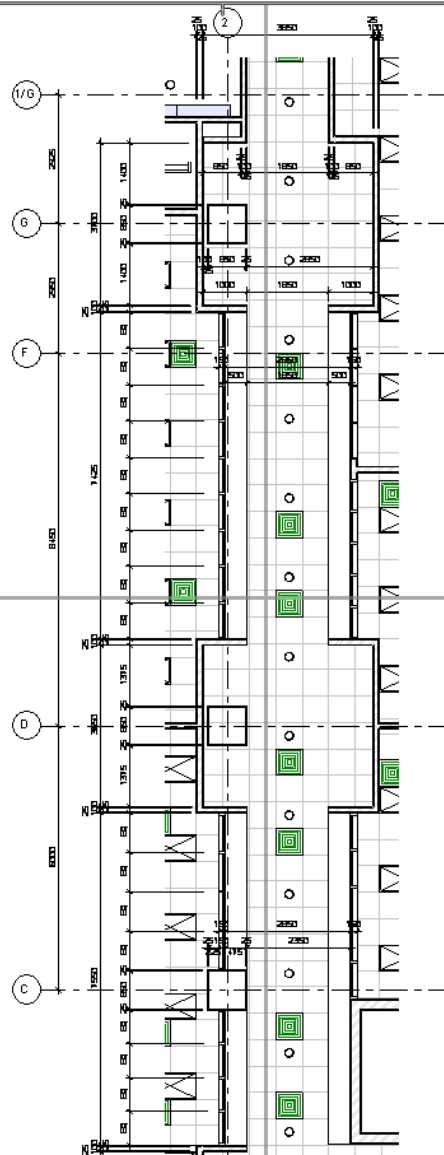
PRODUCTION OF CONSTRUCTION DRAWINGS



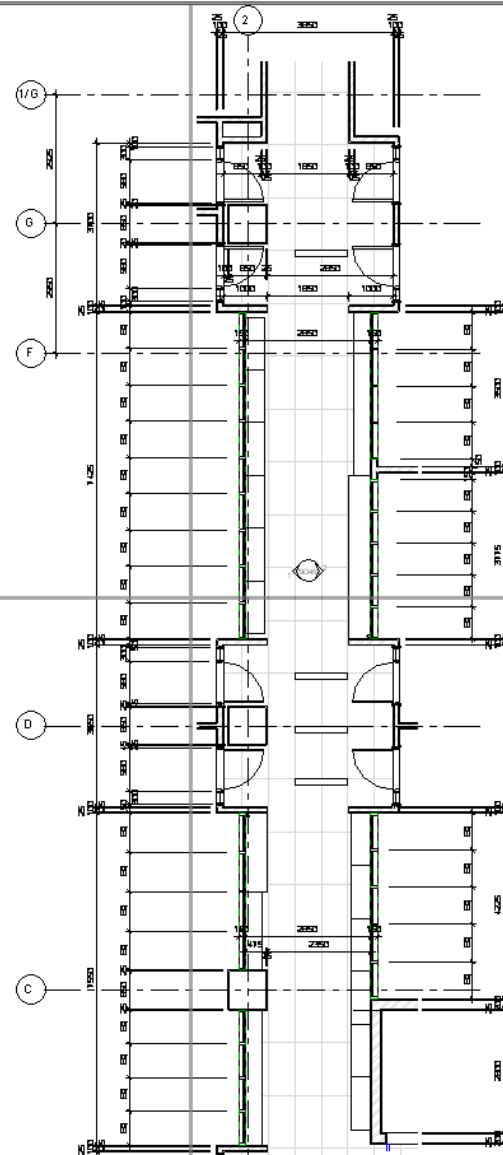
4 走廊立体示意图(低楼三至四层)2



2 走廊立体示意图(低楼三至四层)1



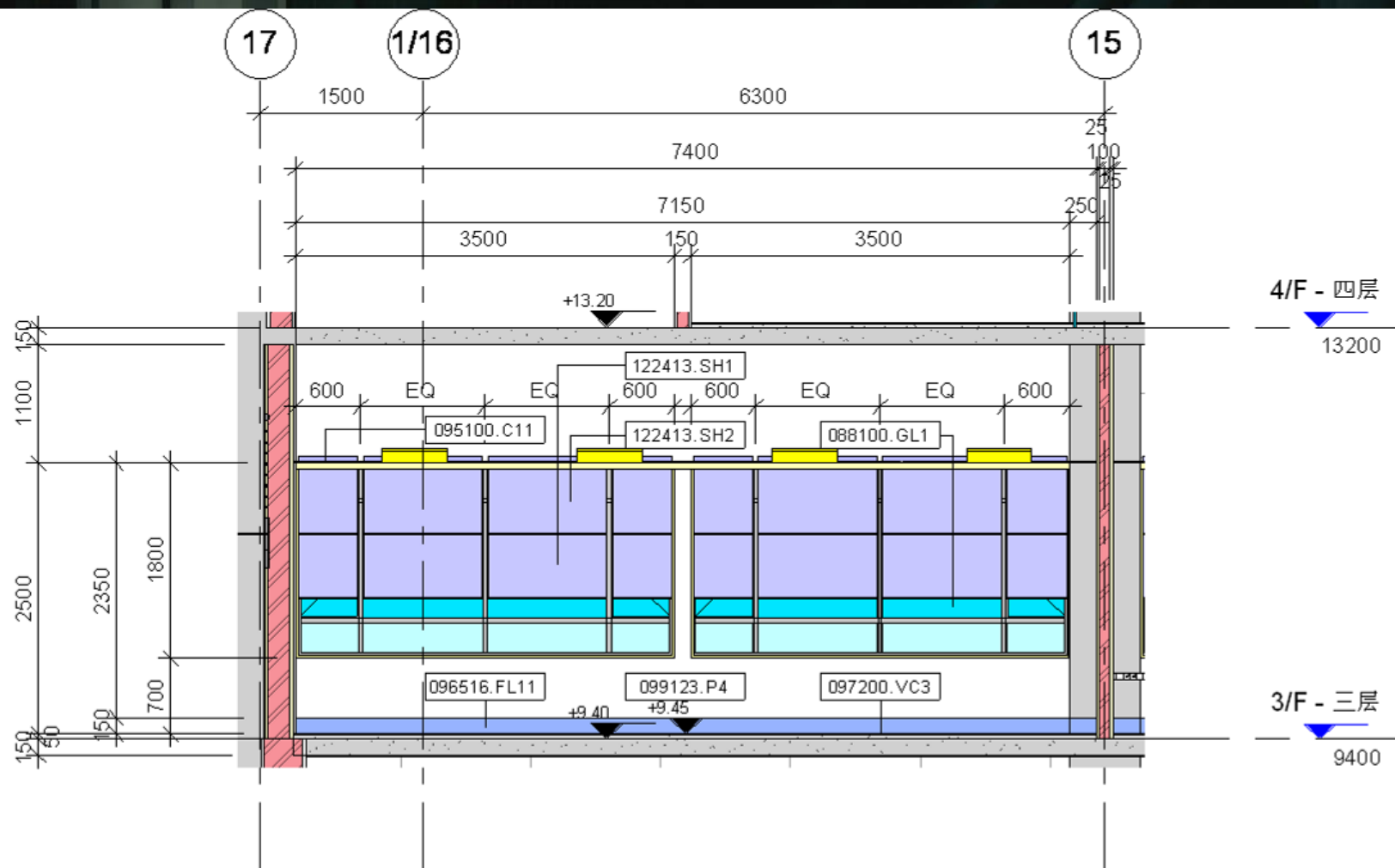
2 走廊天花平面图(低楼三至四层)
1:50



① 走廊平面图(低楼三至四层)
1:50

[illegible]

PRODUCTION OF DRAWINGS



2

行政人员培训室立面图(高楼三层)6

1:50

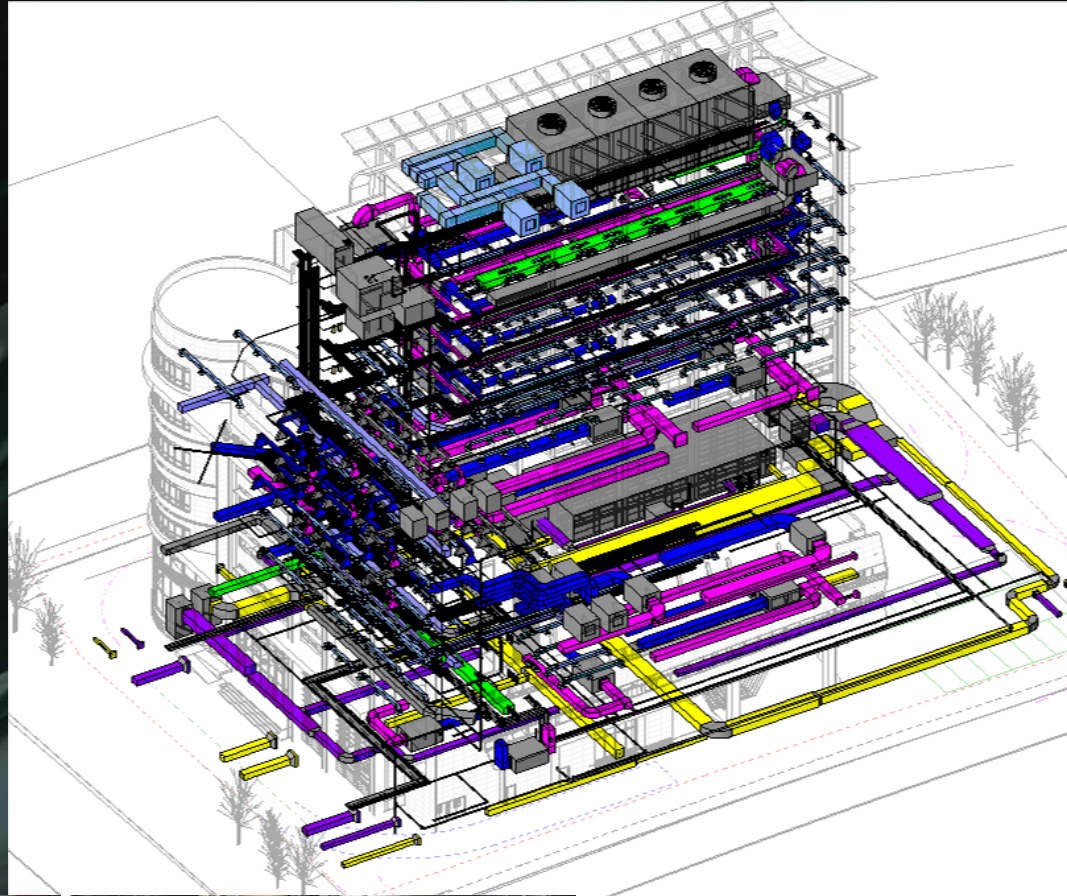
CONSTRUCTION



CONSTRUCTION



BUILDING SERVICES CONSTRUCTION



CONSTRUCTION







DEVELOPMENT



BIM 的運用範圍

1. **Design visualization** 型像化設計
2. **Drawing Productions** 製作圖件
3. **Services Co-ordination and Clash detection with other disciplines** 各專業協調
4. **Quantity taking and preparation of Tender Document** 投標文件
5. **Automated Statutory Submission** 自動化審批
6. **Scientific analysis of different environmental aspects** 科學性分析
7. **Supply Chain Integration with the manufacturing and production** 生產製造
8. **Complex Geometry** 複雜幾何形狀

Parametric Modelling

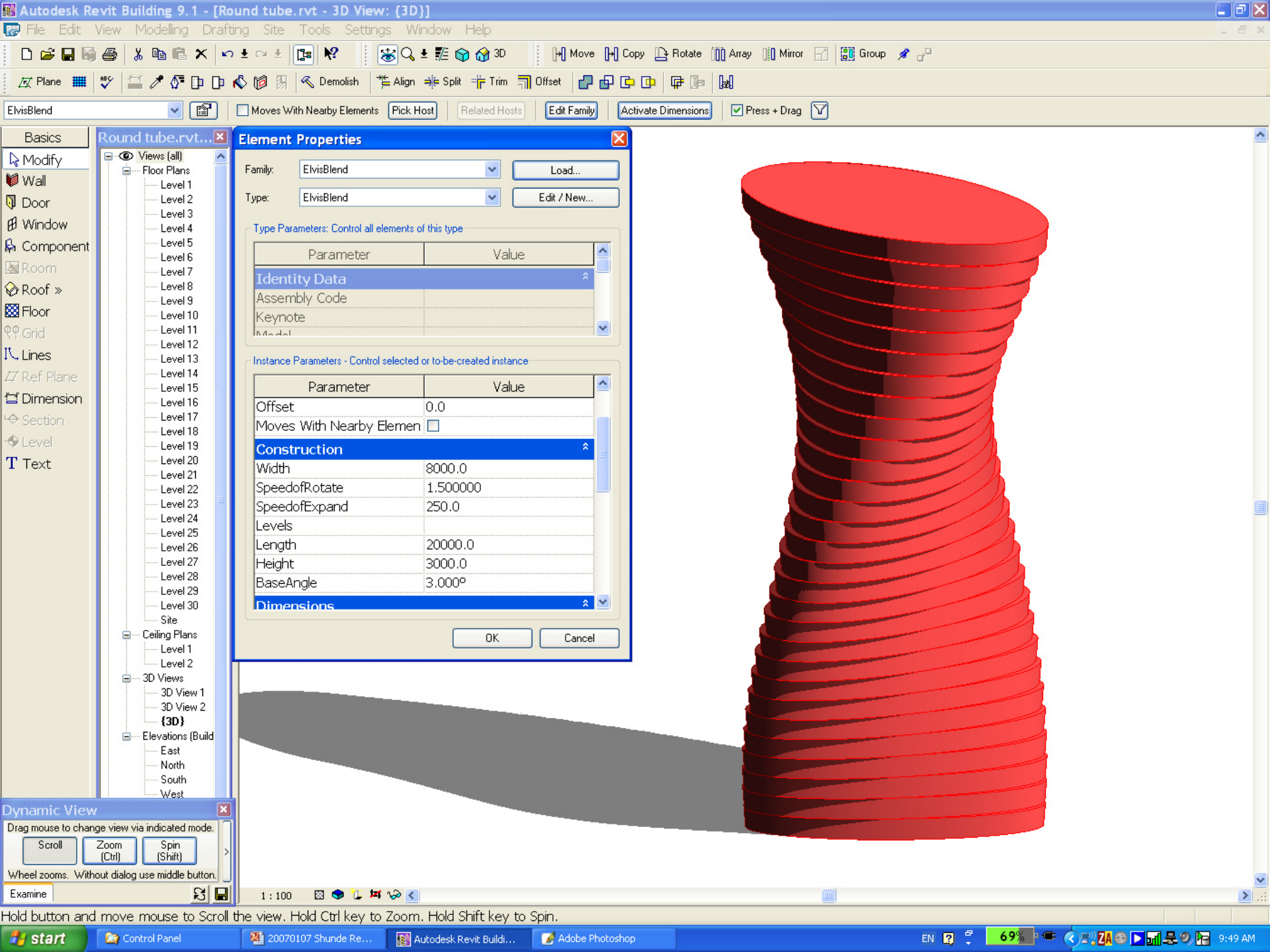
- Use parameters to drive the model
- Relates related to the approach taken in the **design process** than the software tools an architect uses.
- Creating and modifying these relationships is an important part of the design process. A parametric model is often defined by rules and constraints. Changing a rule or constraint, or modifying a part of the model itself, often has implications in the entire model.
- Why Changes? - **Responses** to environmental conditions such as sun and shadows, zoning criteria, views, and size (floor areas and program verification, façade surface areas, volume), aesthetics; or other requirements.

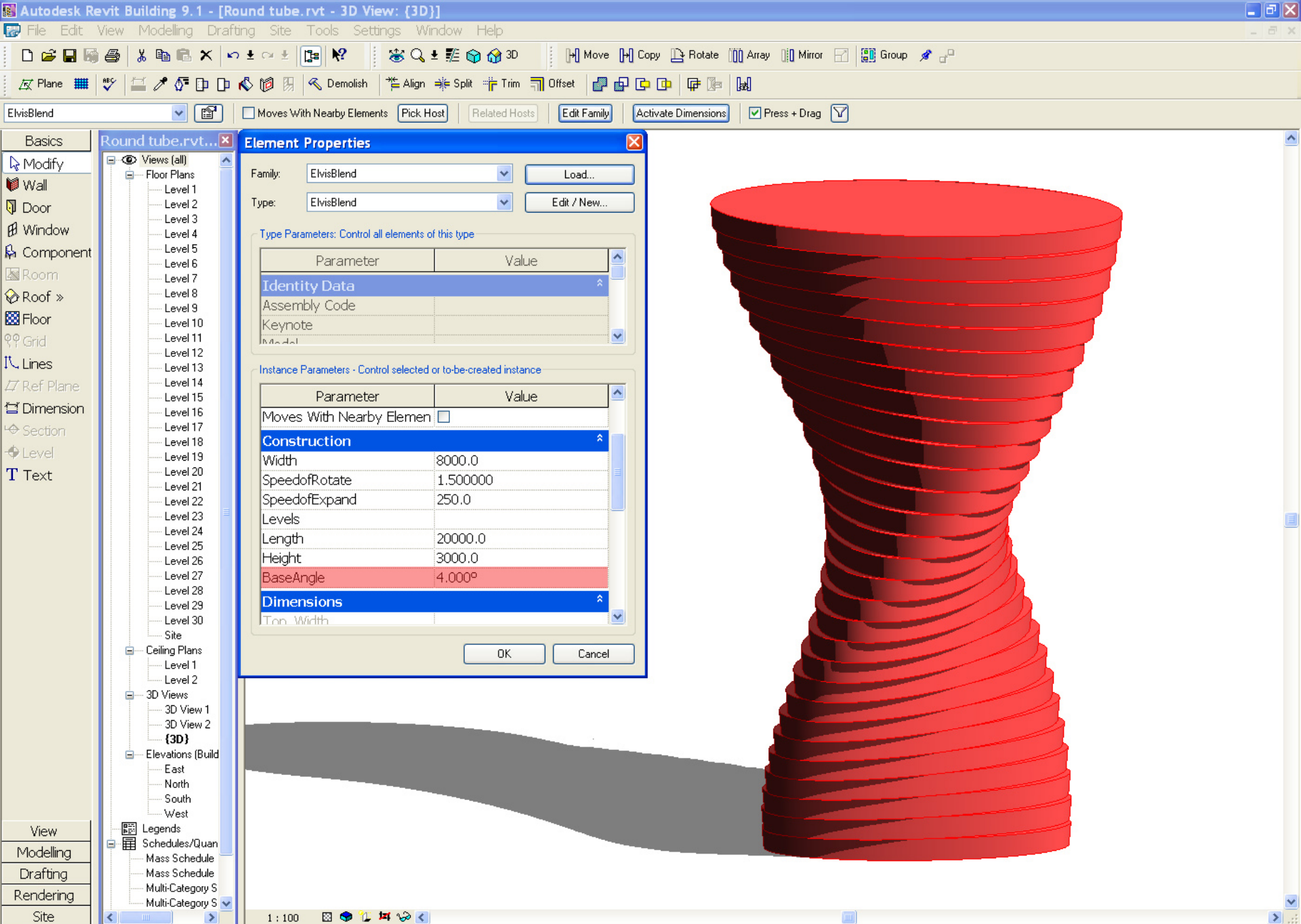
Parametric Modelling



“Design a Design Tool” - Thinking creatively and not being constrained by one’s own thinking or by a limiting set of tools is the key to innovative designs and design processes.







Click to select, TAB for alternates, CTRL adds, SHIFT unselects.



absolute world

BUILDING 2

AbsoluteWorld's two buildings, as envisioned by their creator, Yansong Ma. The buildings were designed to complement and enhance each other, each with its own unique personality, but created from the same architectural language.

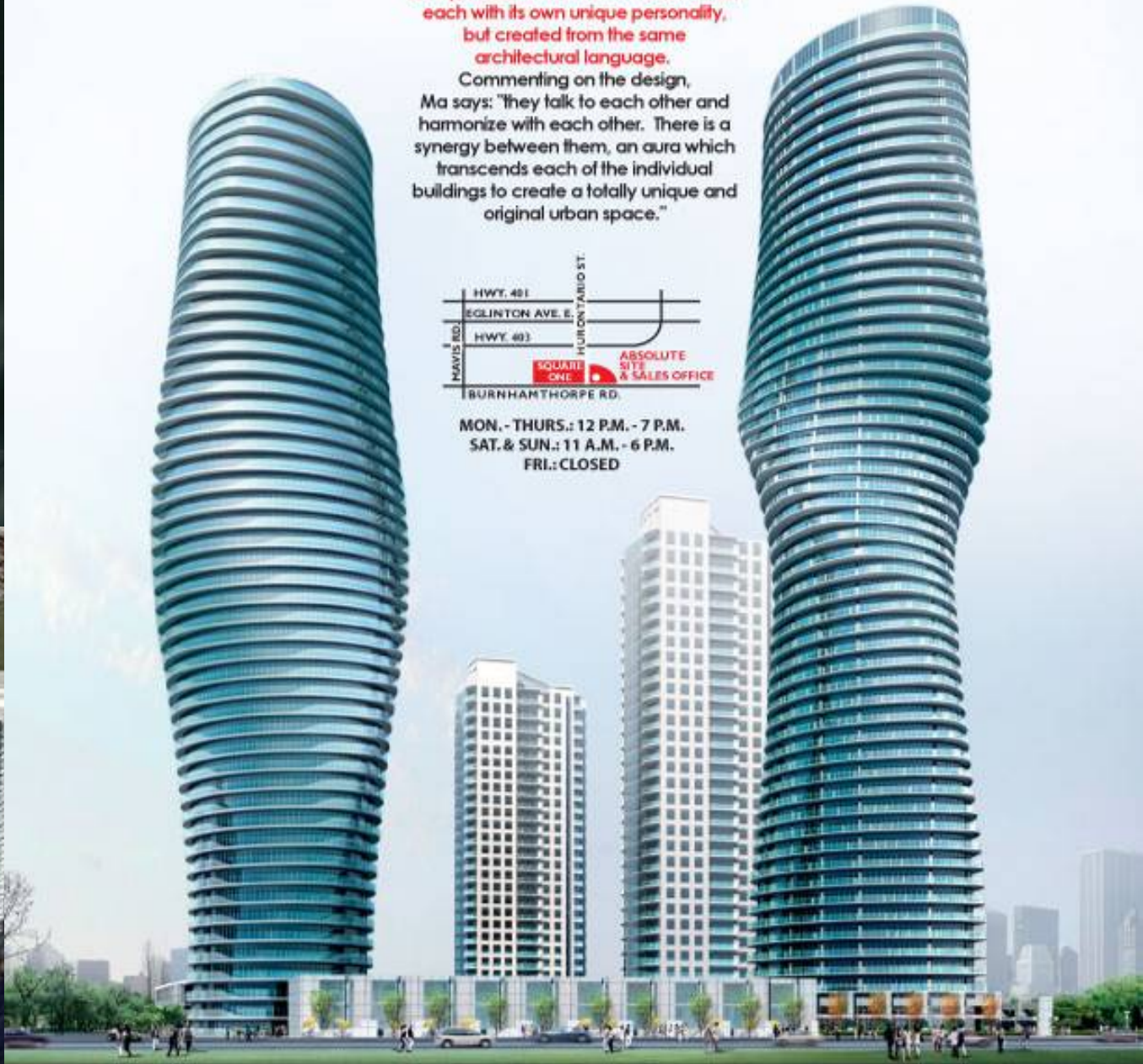
Commenting on the design, Ma says: "They talk to each other and harmonize with each other. There is a synergy between them, an aura which transcends each of the individual buildings to create a totally unique and original urban space."



MON. - THURS.: 12 P.M. - 7 P.M.
SAT. & SUN.: 11 A.M. - 6 P.M.
FRI.: CLOSED

absolute world

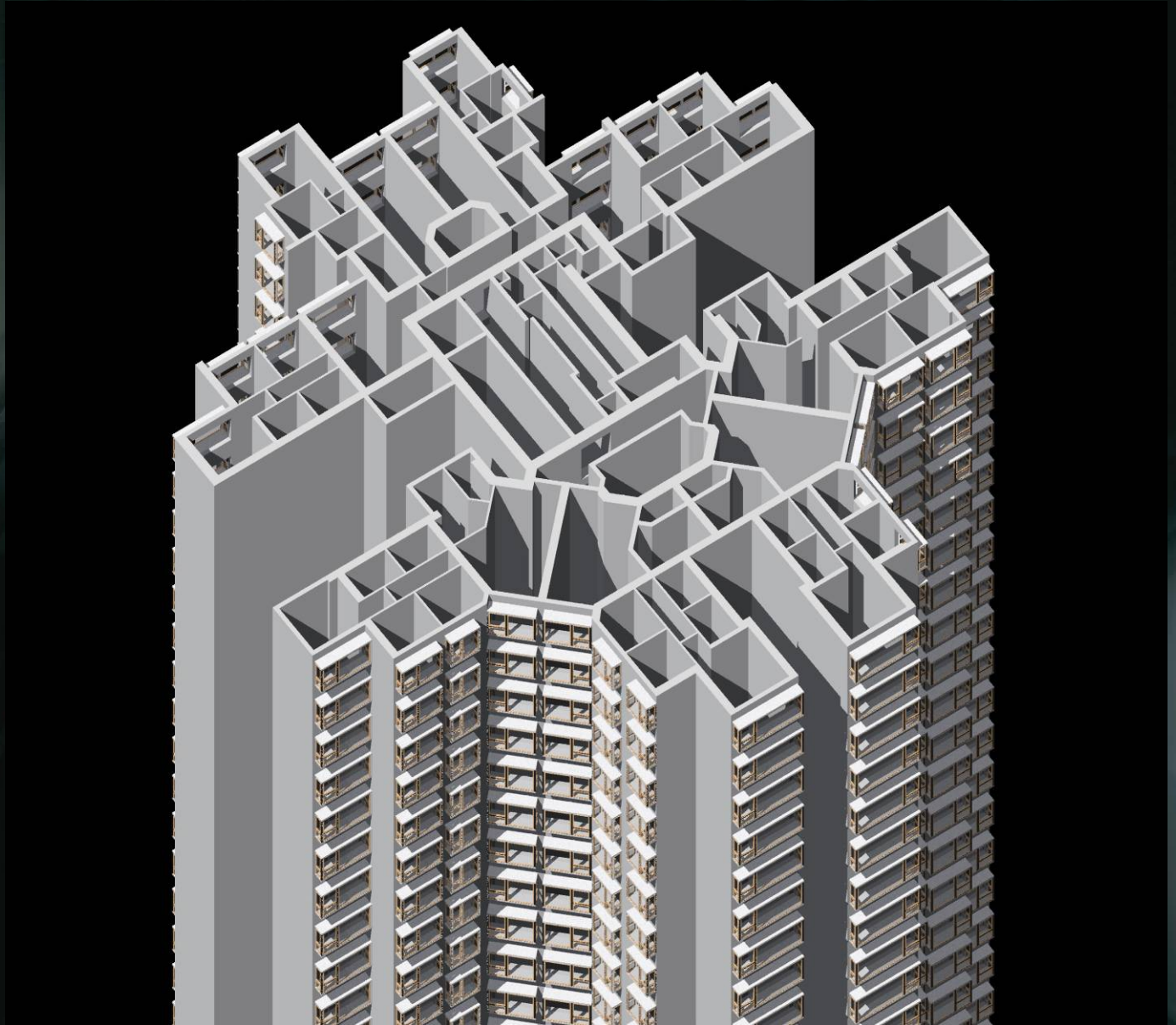
BUILDING 1

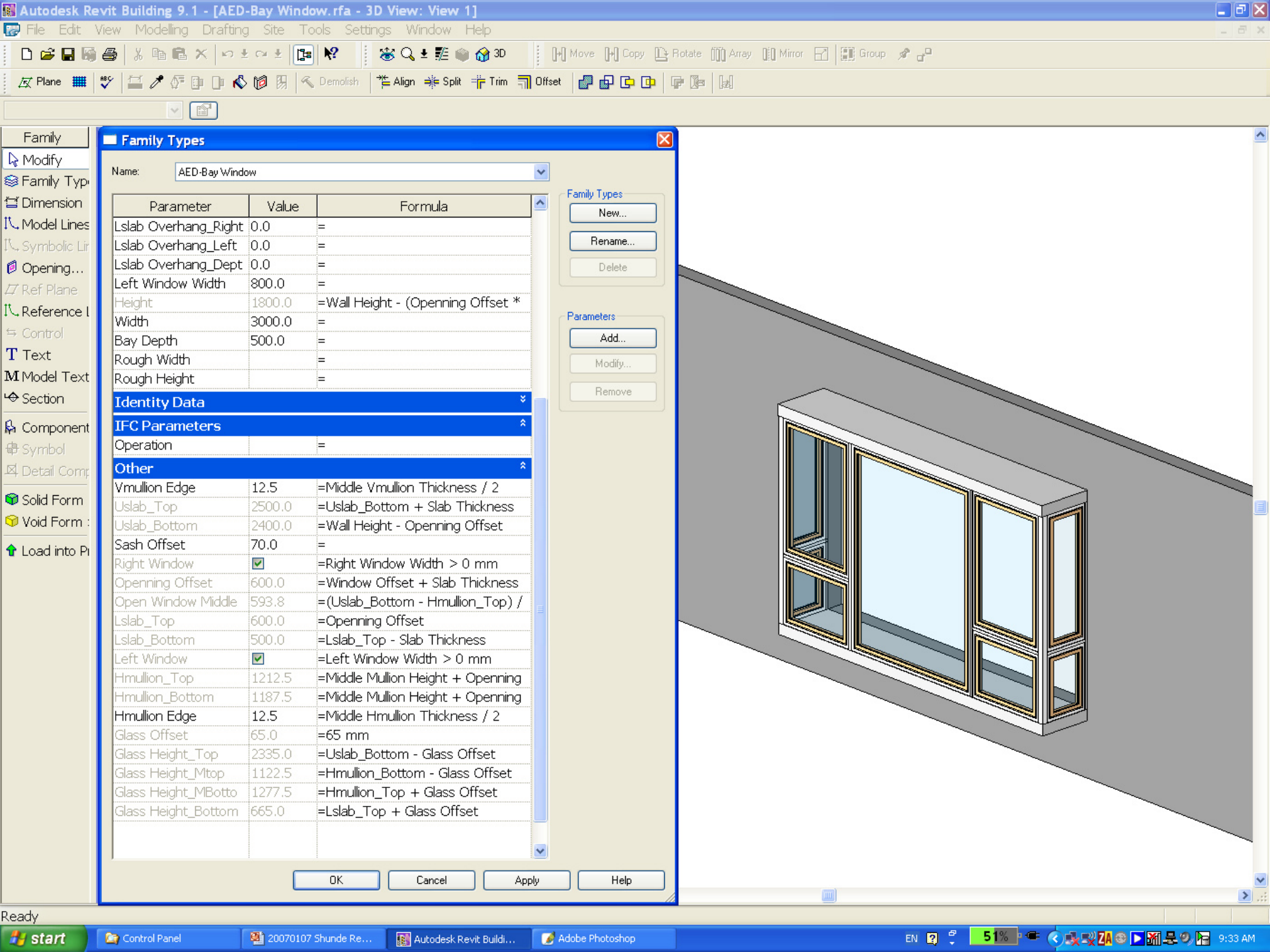




REPETITIONS vs VARIATIONS

PARAMETRIC MODELLING



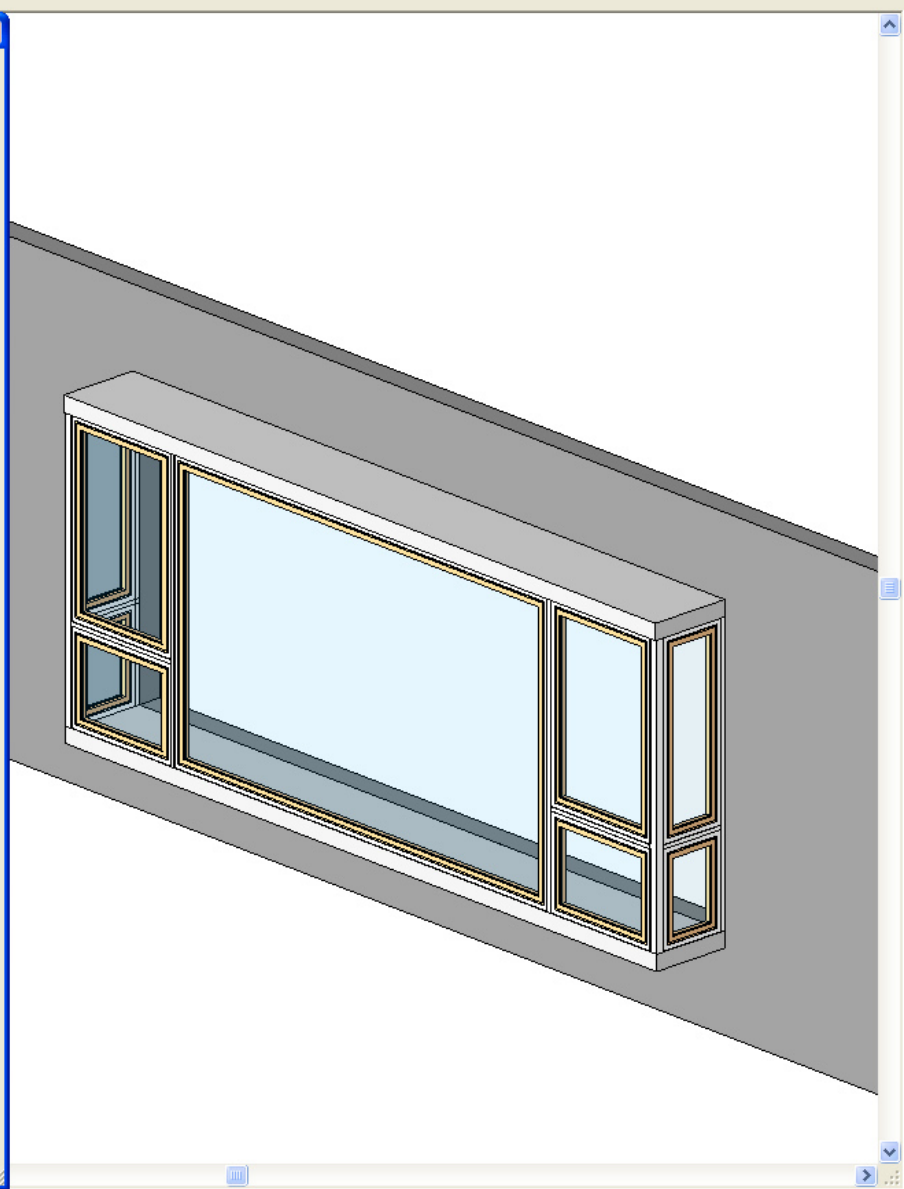


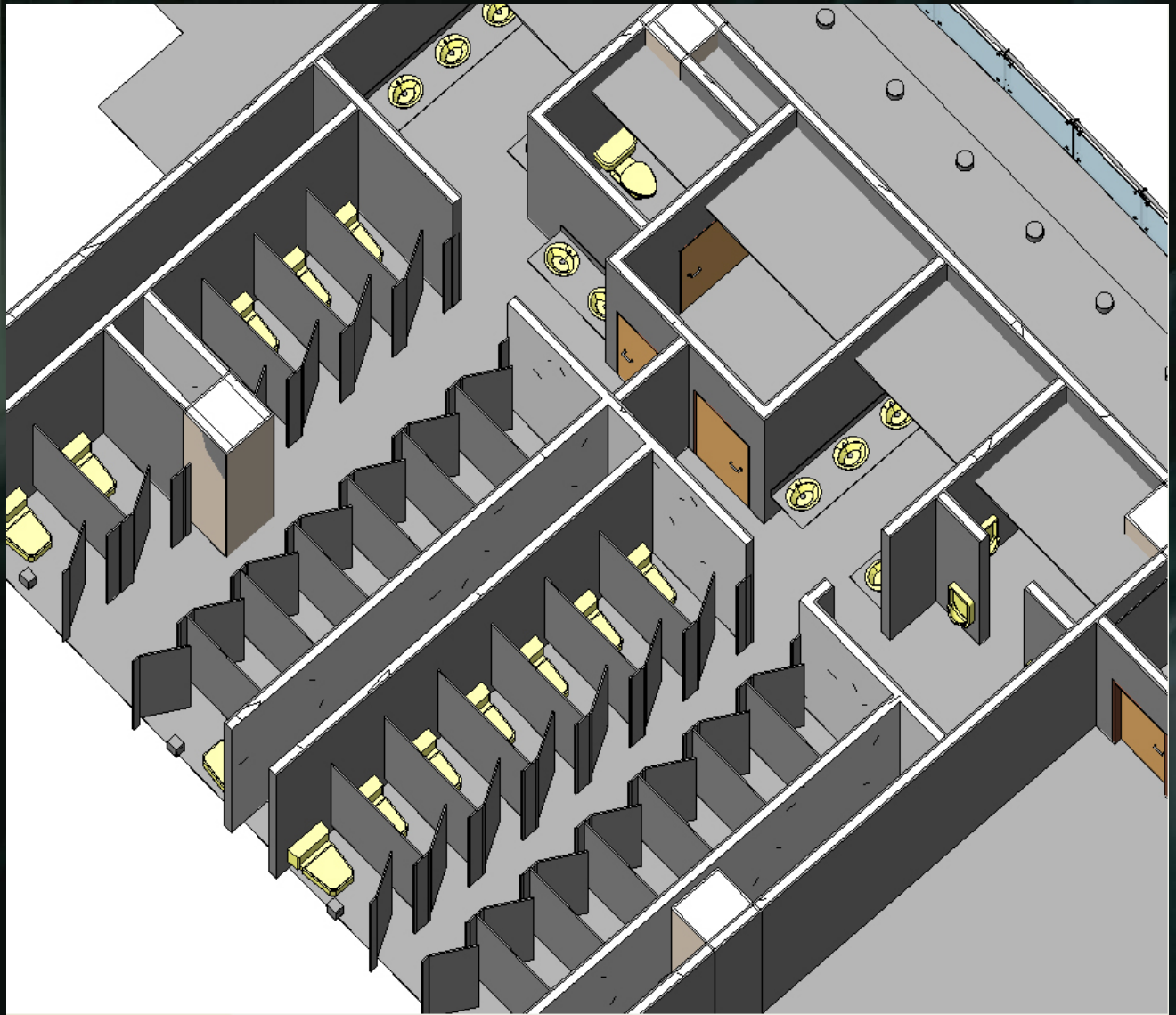
Family Types

Name: AED-Bay Window

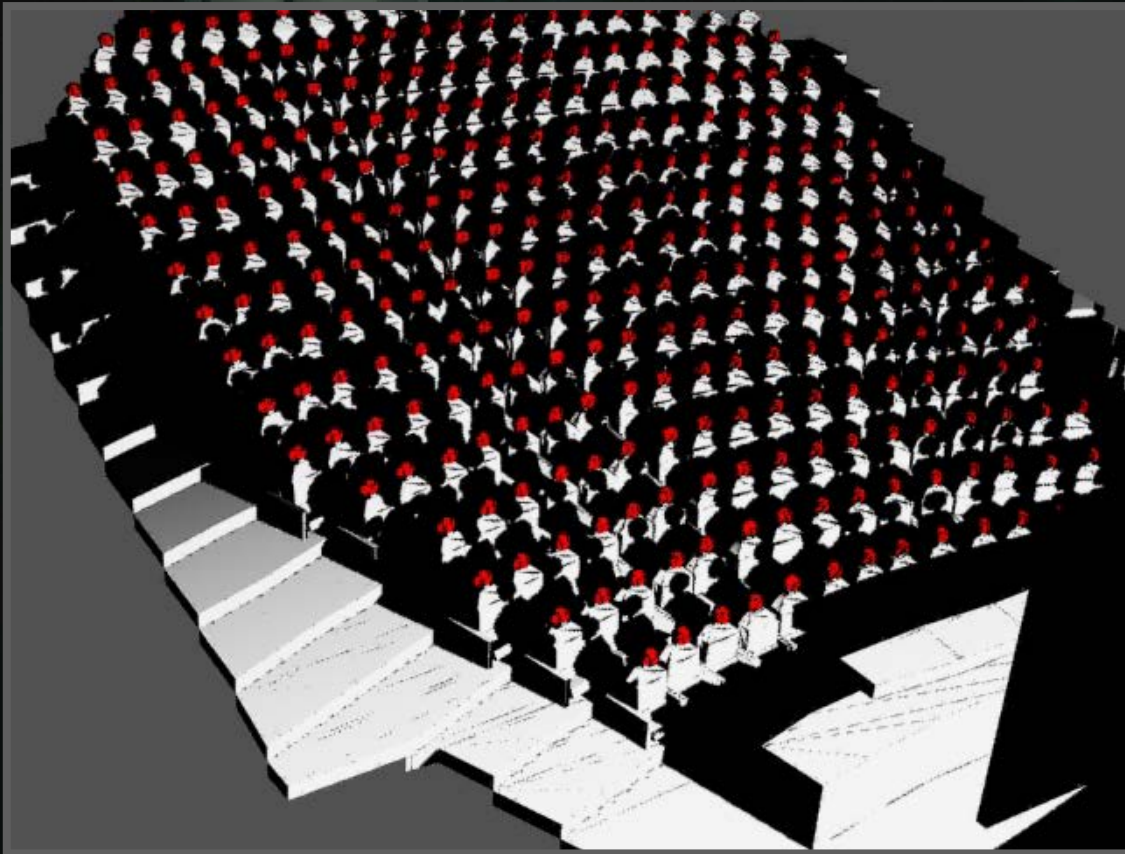
Parameter	Value	Formula
Lslab Overhang_Right	0.0	=
Lslab Overhang_Left	0.0	=
Lslab Overhang_Dept	0.0	=
Left Window Width	800.0	=
Height	1800.0	=Wall Height - (Opening Offset *
Width	4500.0	=
Bay Depth	500.0	=
Rough Width		=
Rough Height		=
Identity Data		
IFC Parameters		
Operation		=
Other		
Vmullion Edge	12.5	=Middle Vmullion Thickness / 2
Uslab_Top	2500.0	=Uslab_Bottom + Slab Thickness
Uslab_Bottom	2400.0	=Wall Height - Opening Offset
Sash Offset	70.0	=
Right Window	☒	=Right Window Width > 0 mm
Opening Offset	600.0	=Window Offset + Slab Thickness
Open Window Middle	593.8	=(Uslab_Bottom - Hmullion_Top) /
Lslab_Top	600.0	=Opening Offset
Lslab_Bottom	500.0	=Lslab_Top - Slab Thickness
Left Window	☒	=Left Window Width > 0 mm
Hmullion_Top	1212.5	=Middle Mullion Height + Opening
Hmullion_Bottom	1187.5	=Middle Mullion Height + Opening
Hmullion Edge	12.5	=Middle Hmullion Thickness / 2
Glass Offset	65.0	=65 mm
Glass Height_Top	2335.0	=Uslab_Bottom - Glass Offset
Glass Height_Mtop	1122.5	=Hmullion_Bottom - Glass Offset
Glass Height_MBotto	1277.5	=Hmullion_Top + Glass Offset
Glass Height_Bottom	665.0	=Lslab_Top + Glass Offset

OK Cancel Apply Help

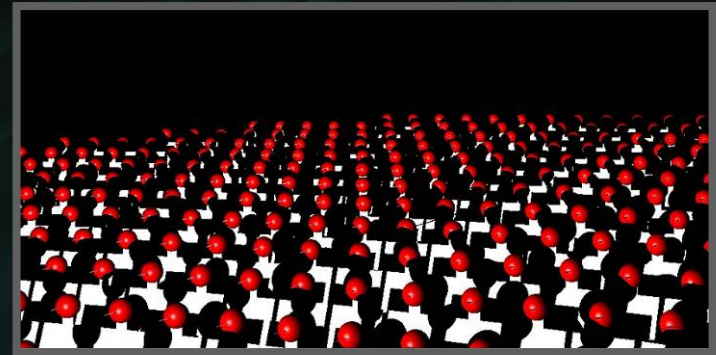




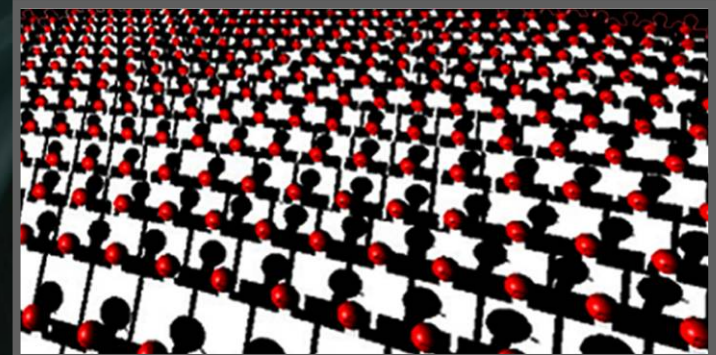
CREATIVE TOOLS



Radiating Light Method



Unsatisfactory sightlines



Satisfactory sightlines

SIGHTLINE STUDIES



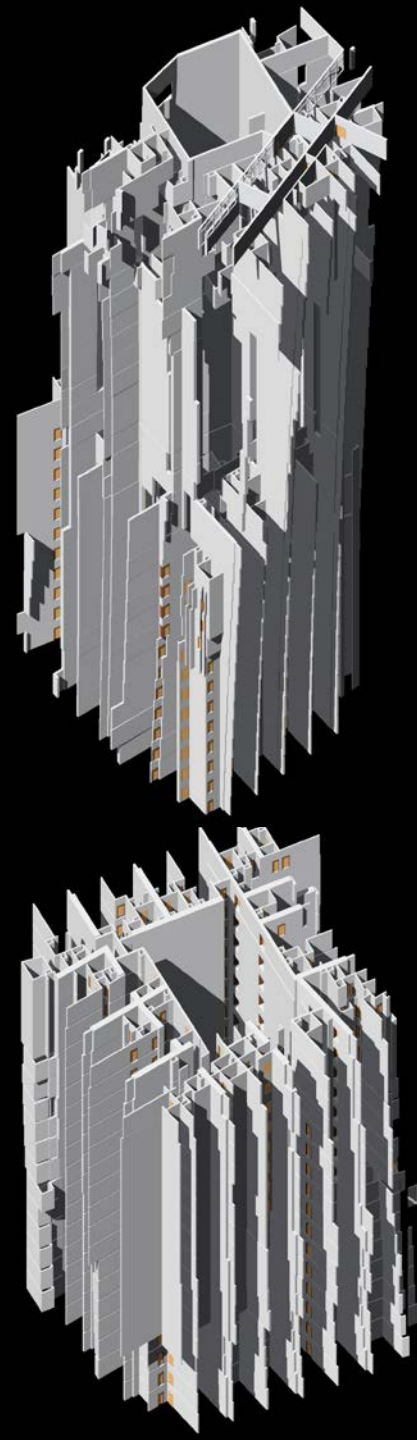


FAÇADE PANEL DESIGN

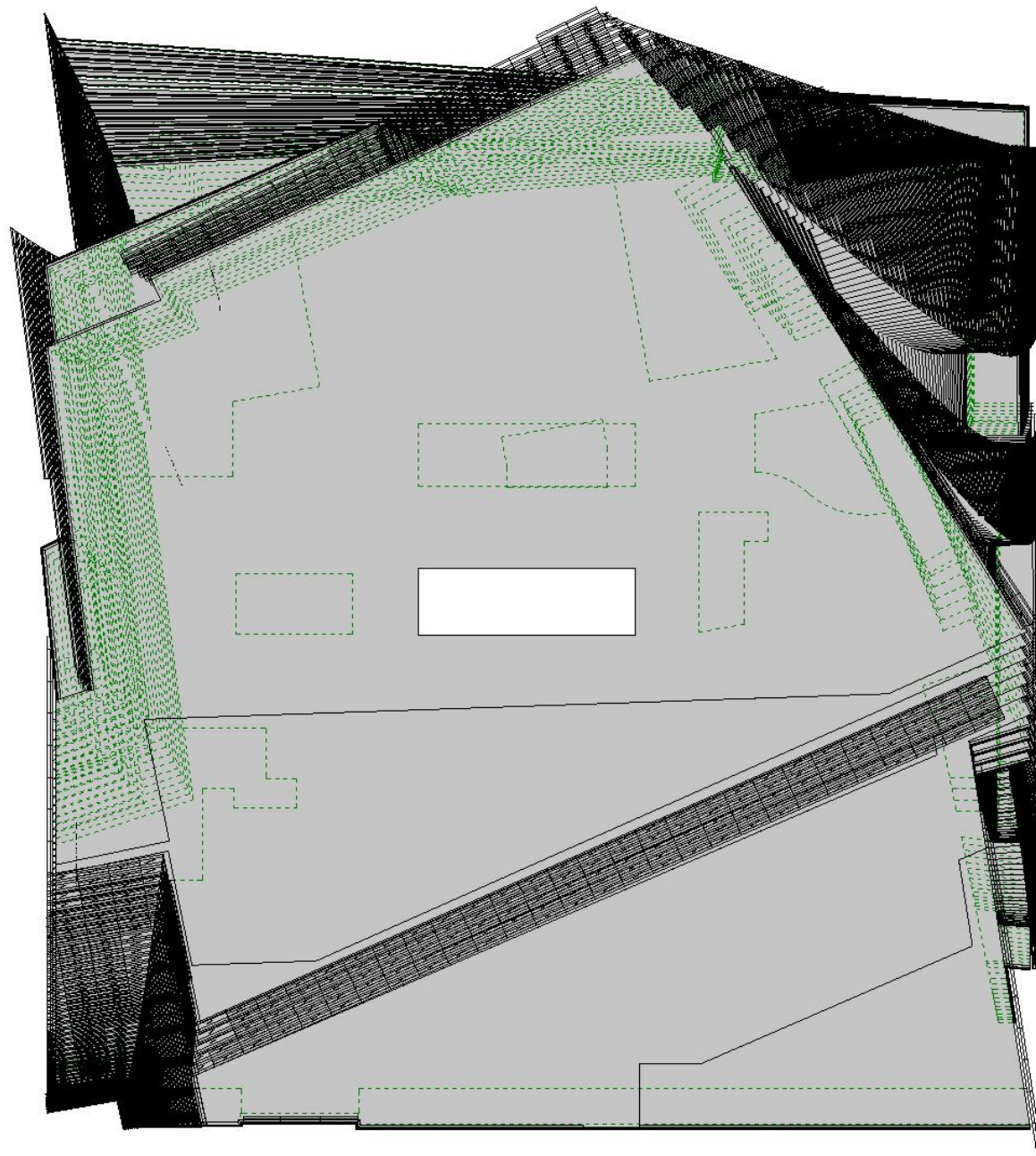
Program Residential Site Area 3,746 sqm
Floor Area 659,659 sqm Building Height 345 m

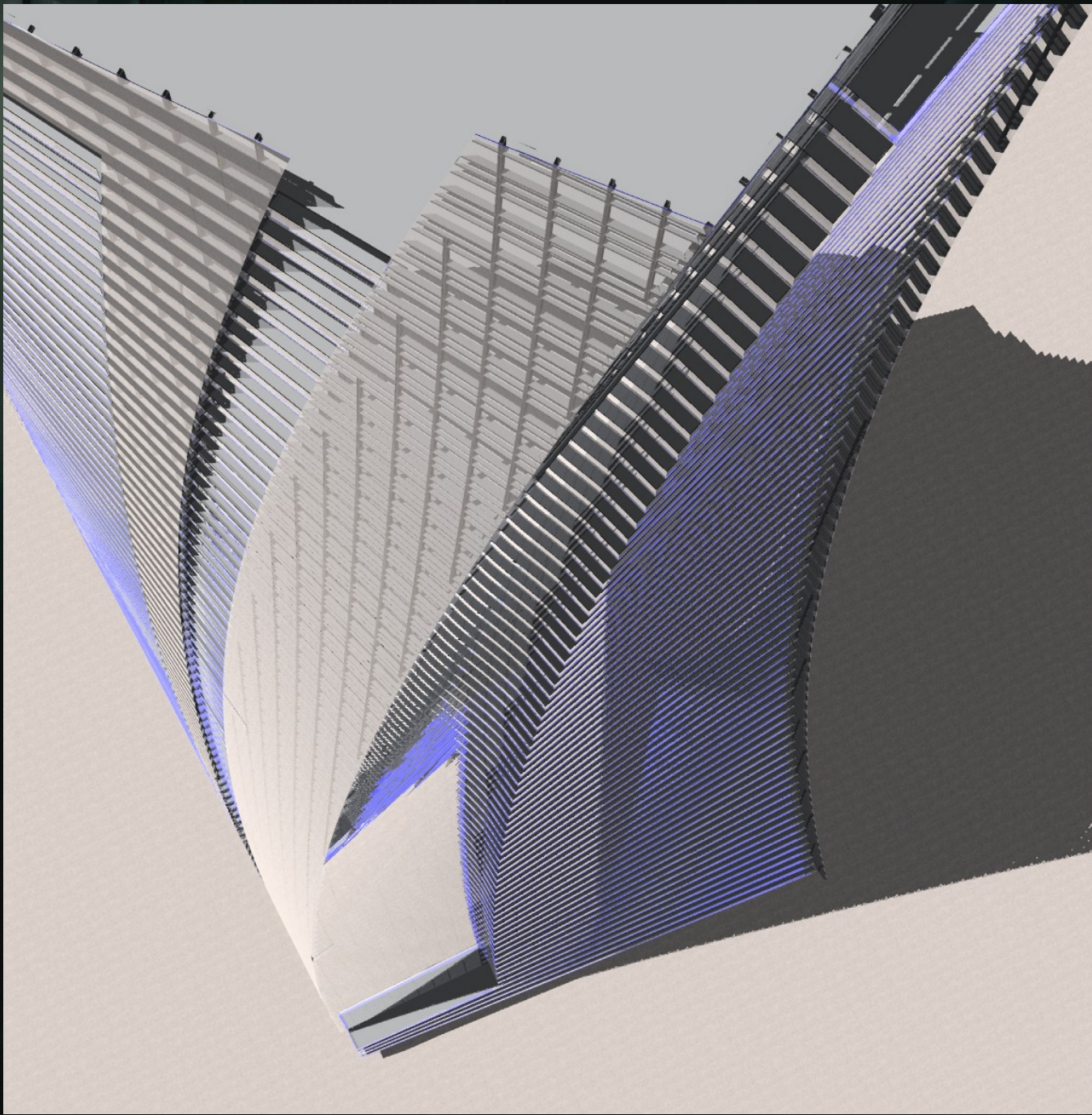


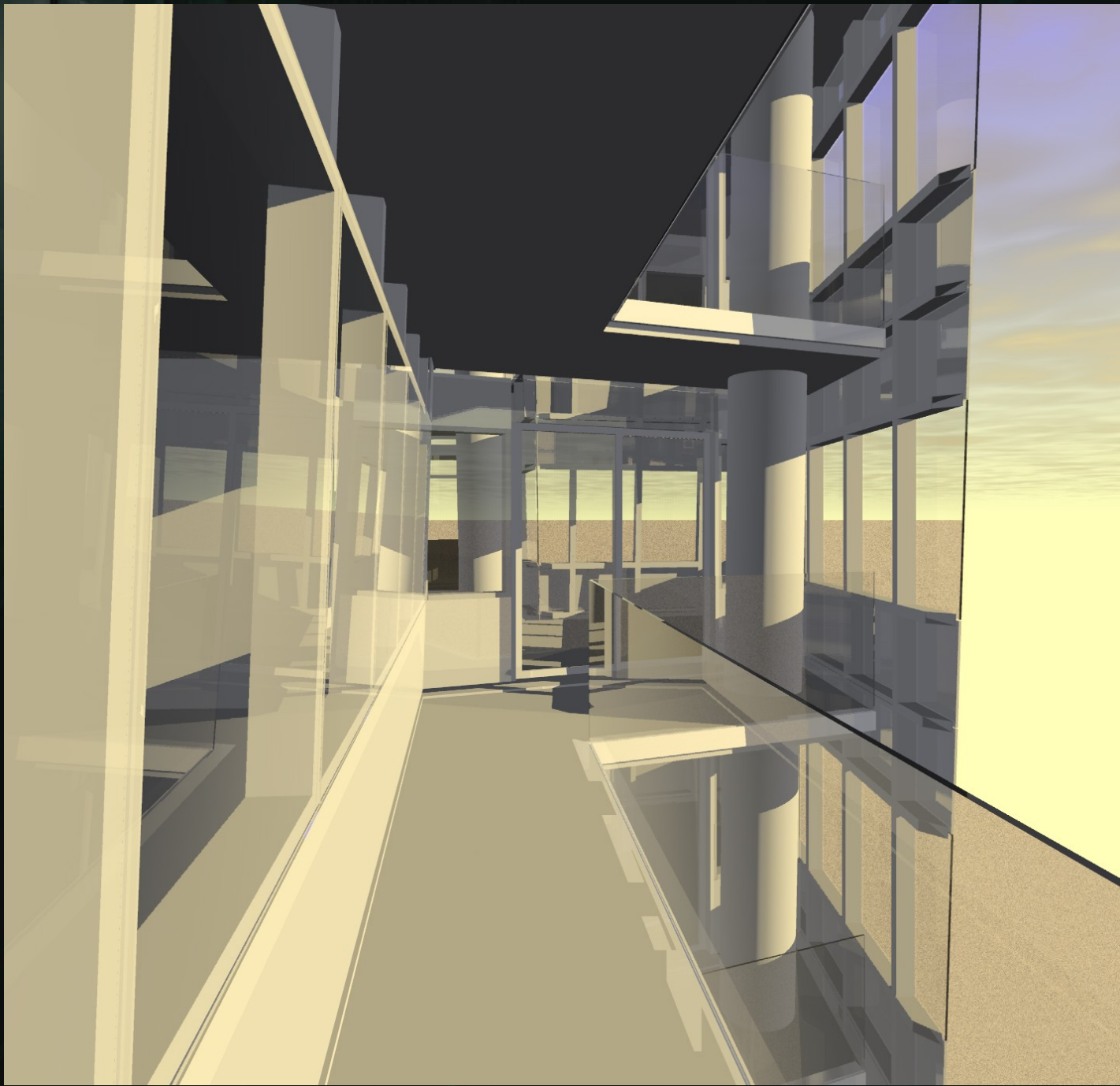
Dubai **Ocean Heights One**

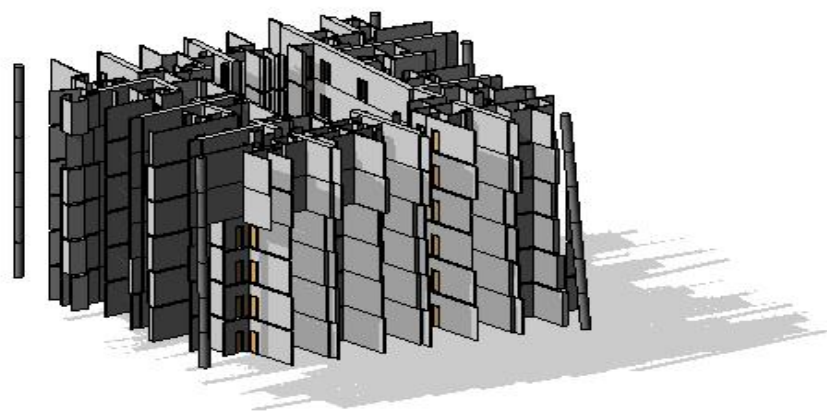


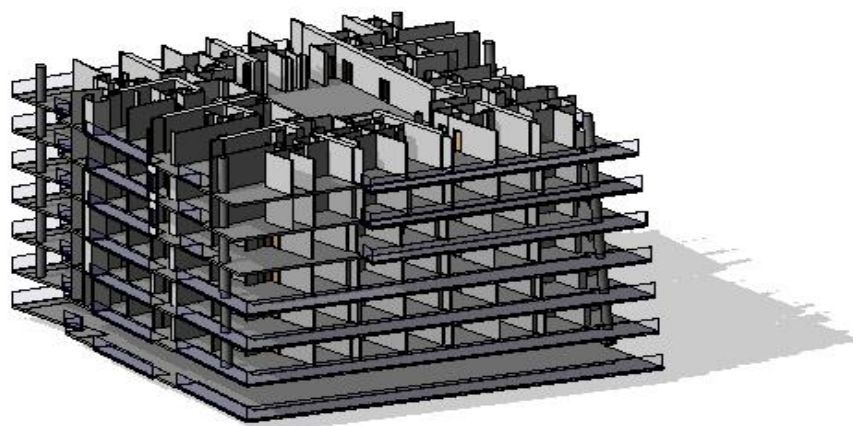
COMPLEX GEOMETRY









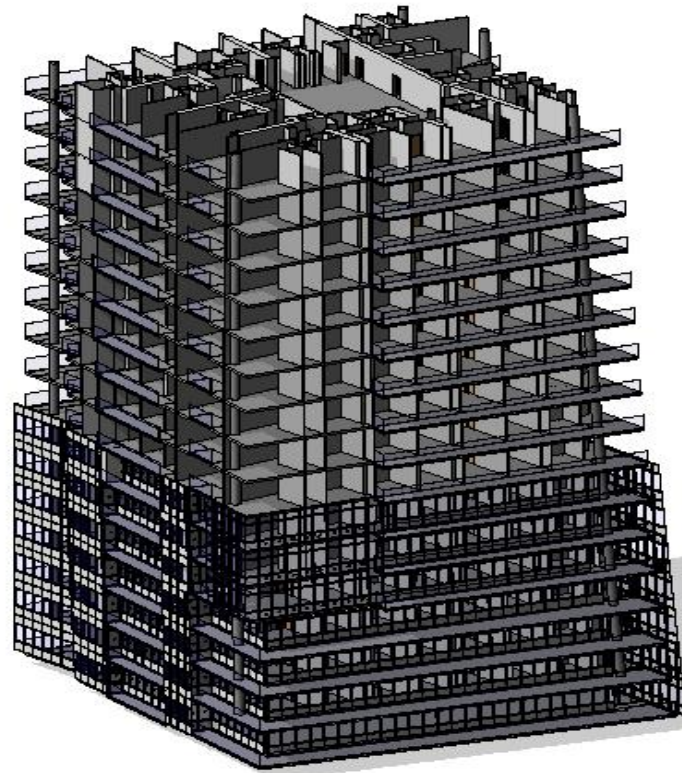










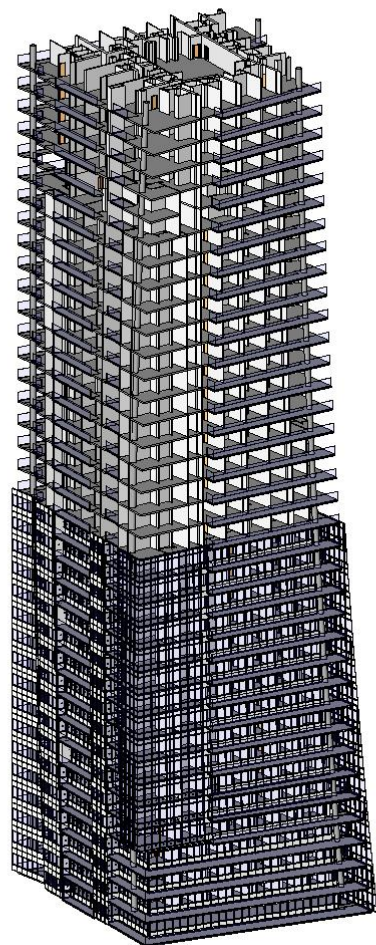


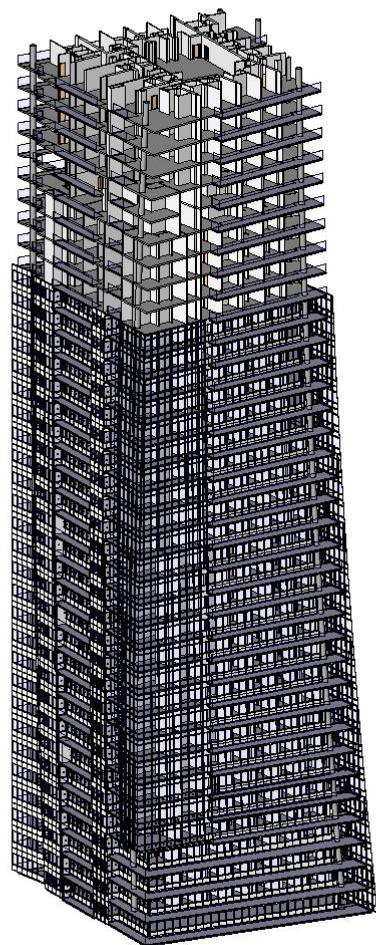


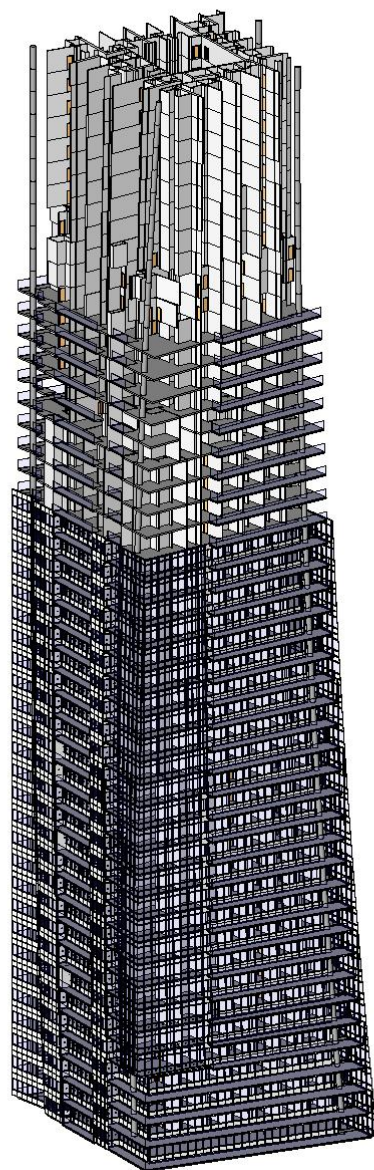


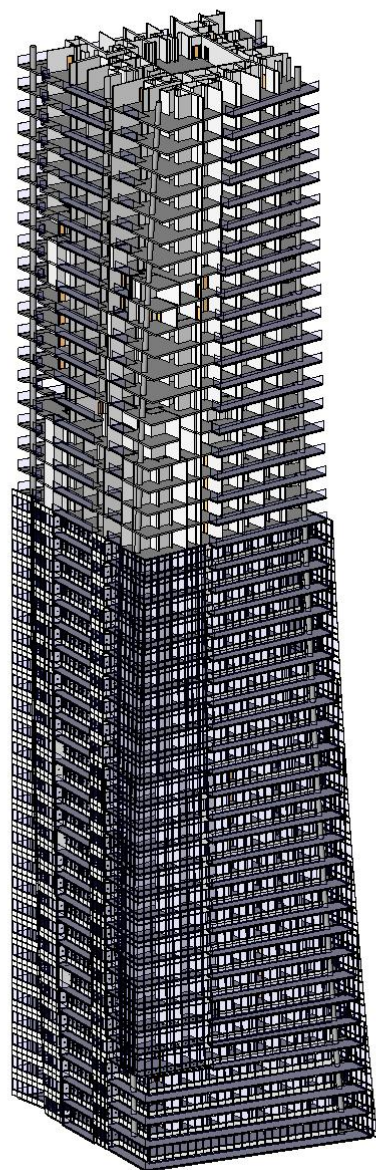


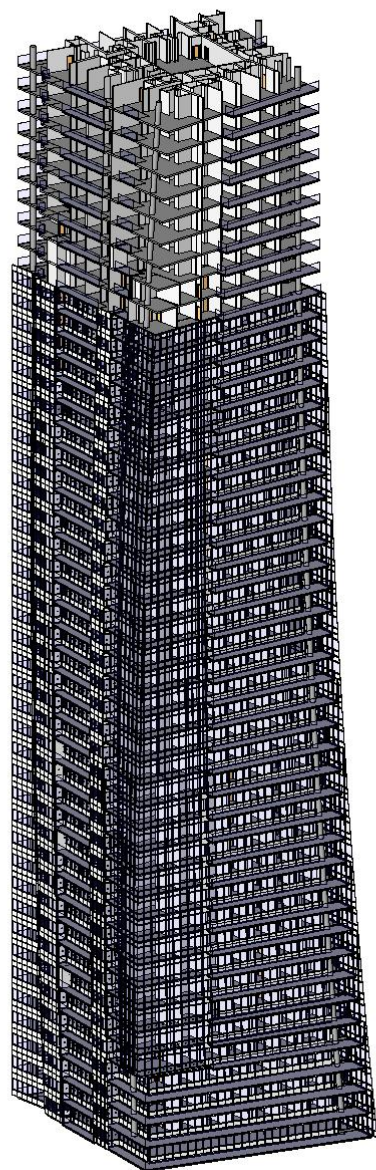


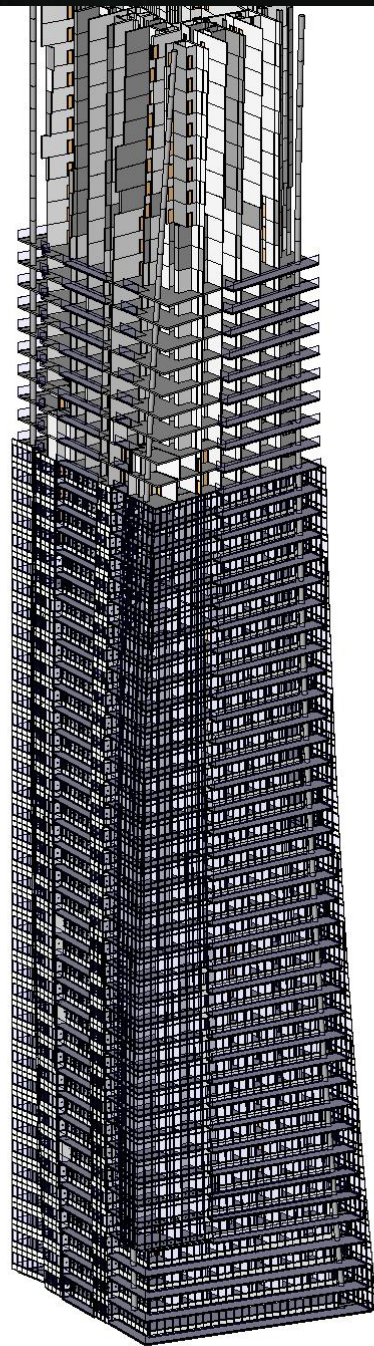


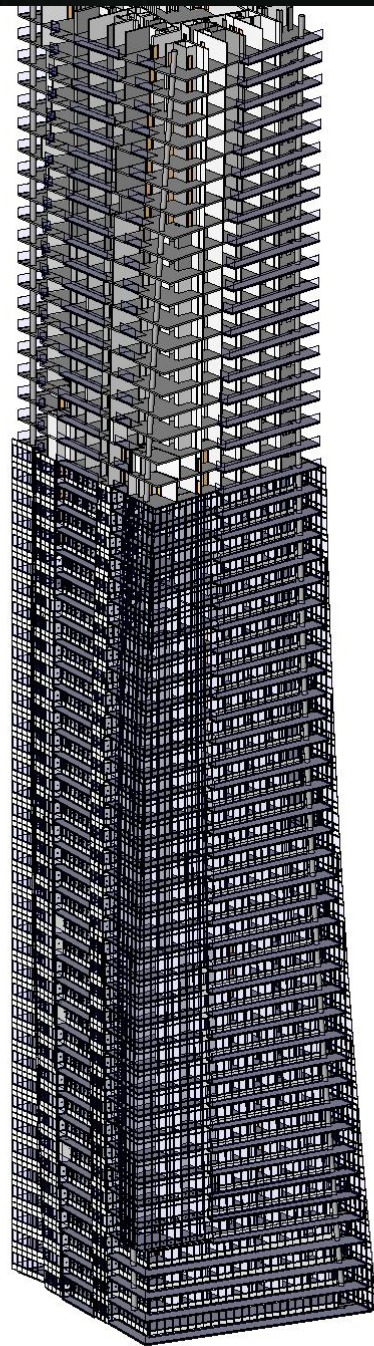


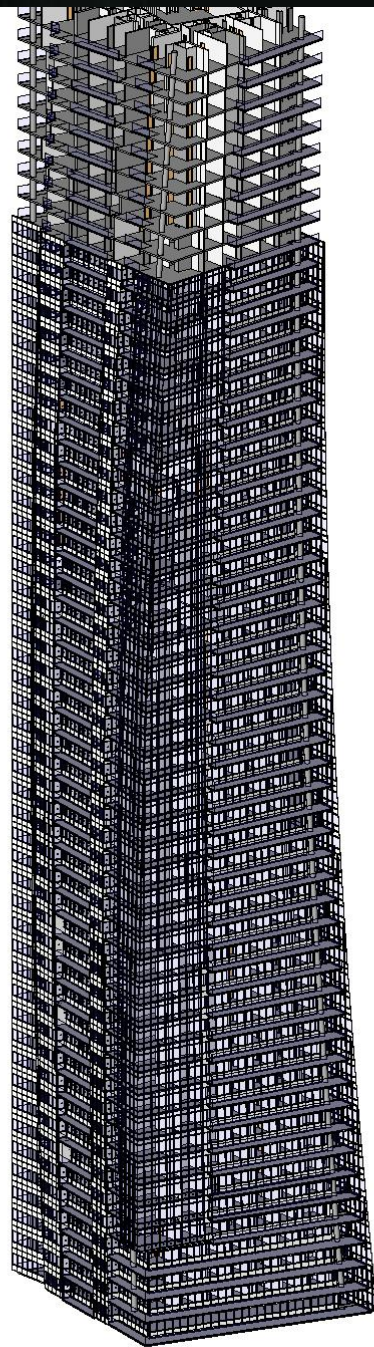
















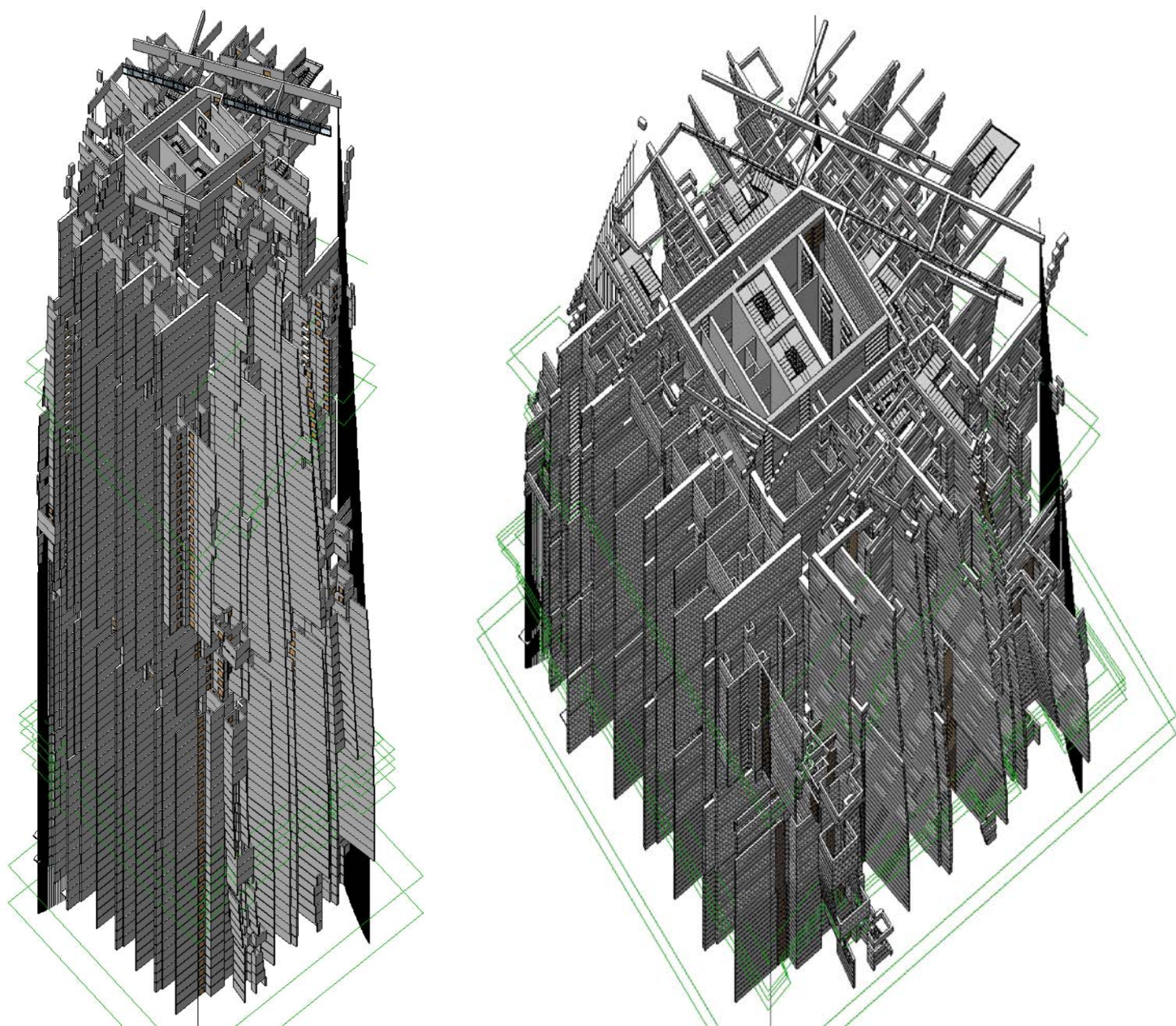




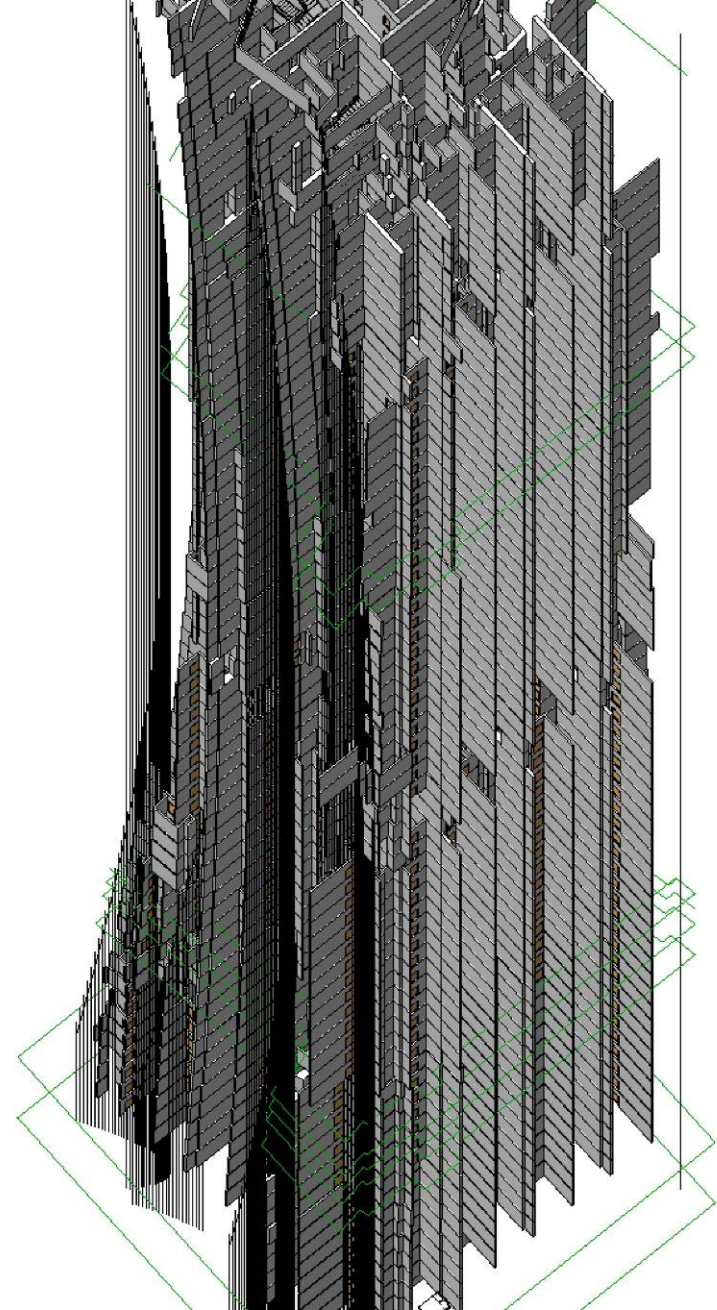
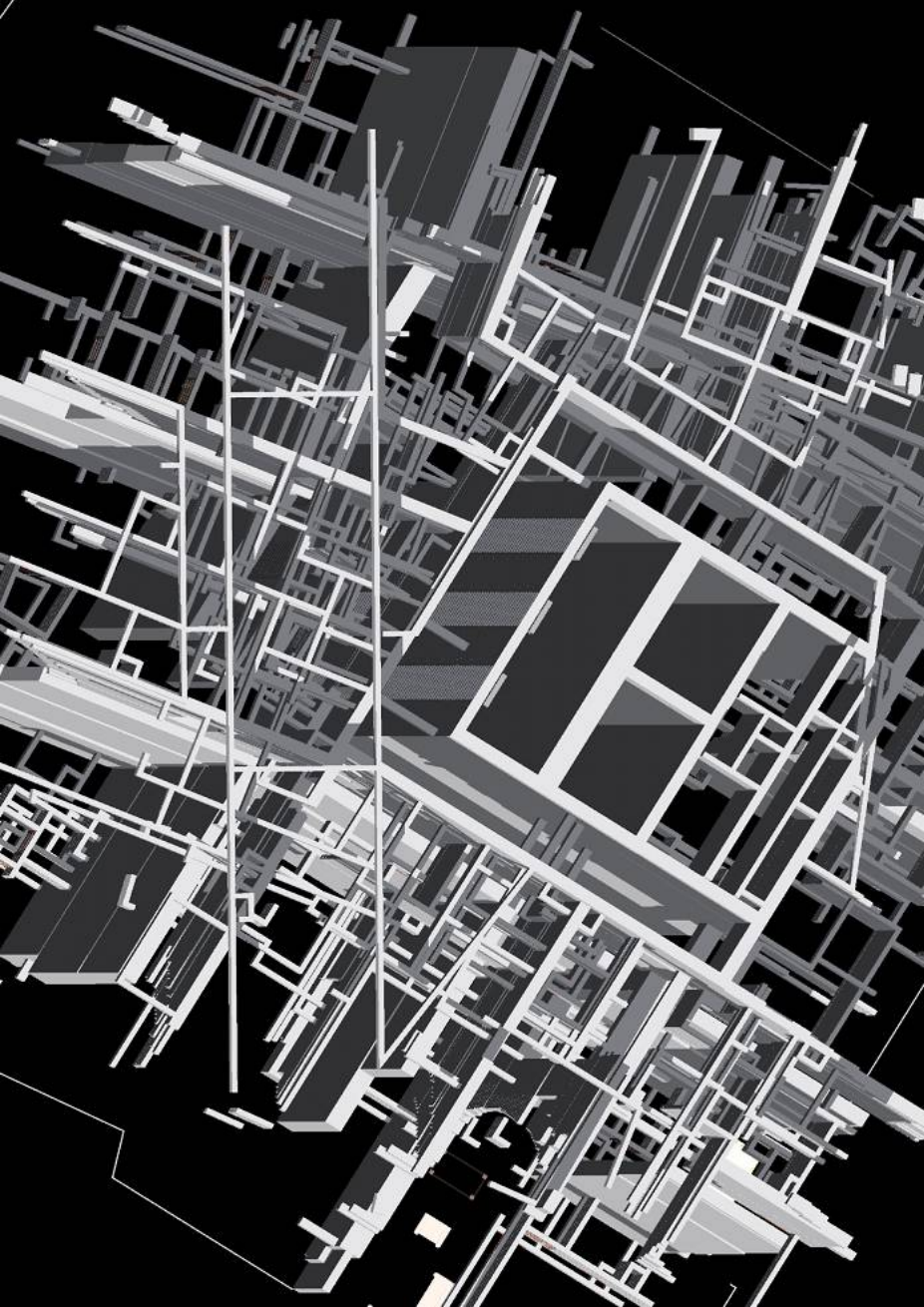




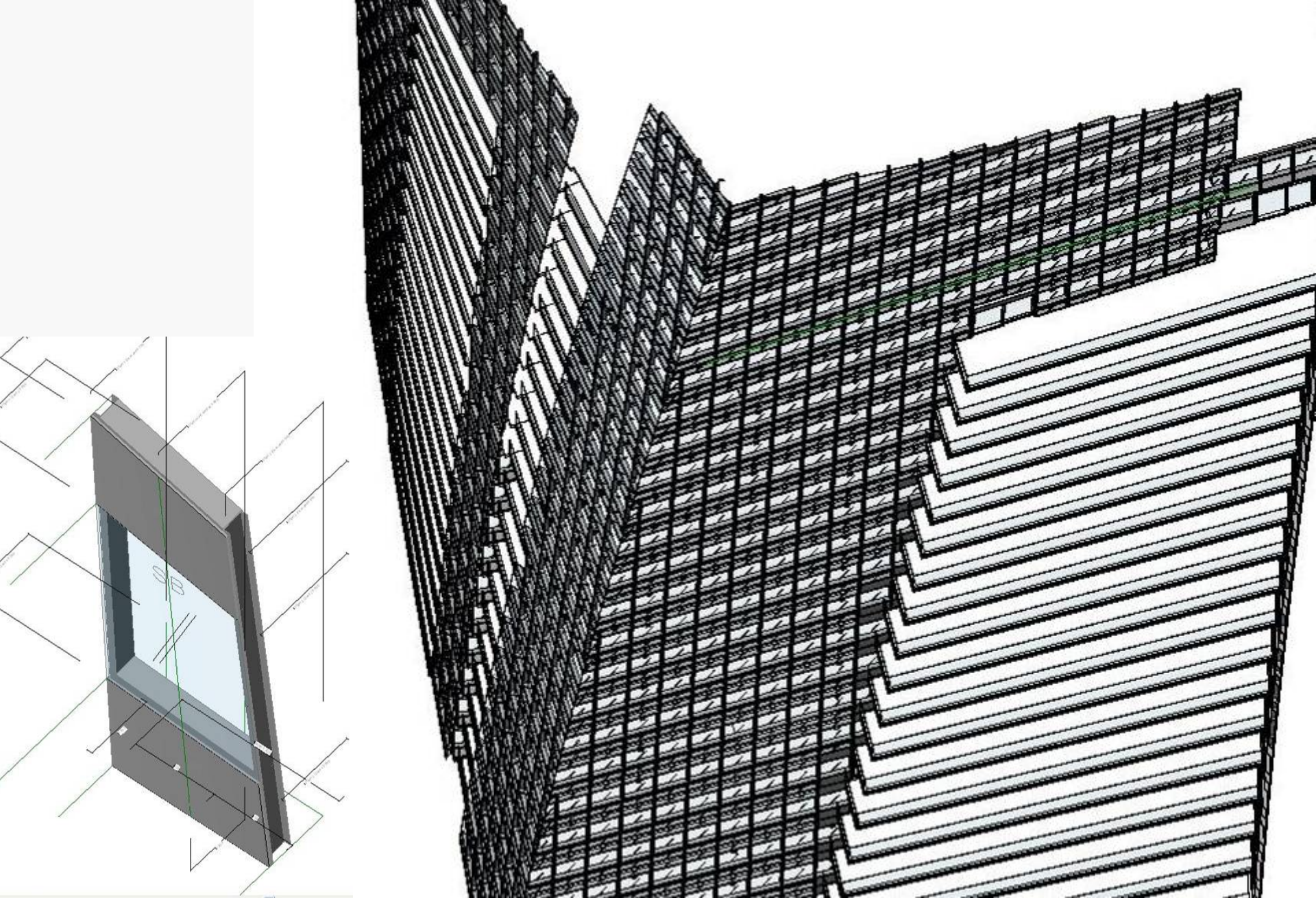




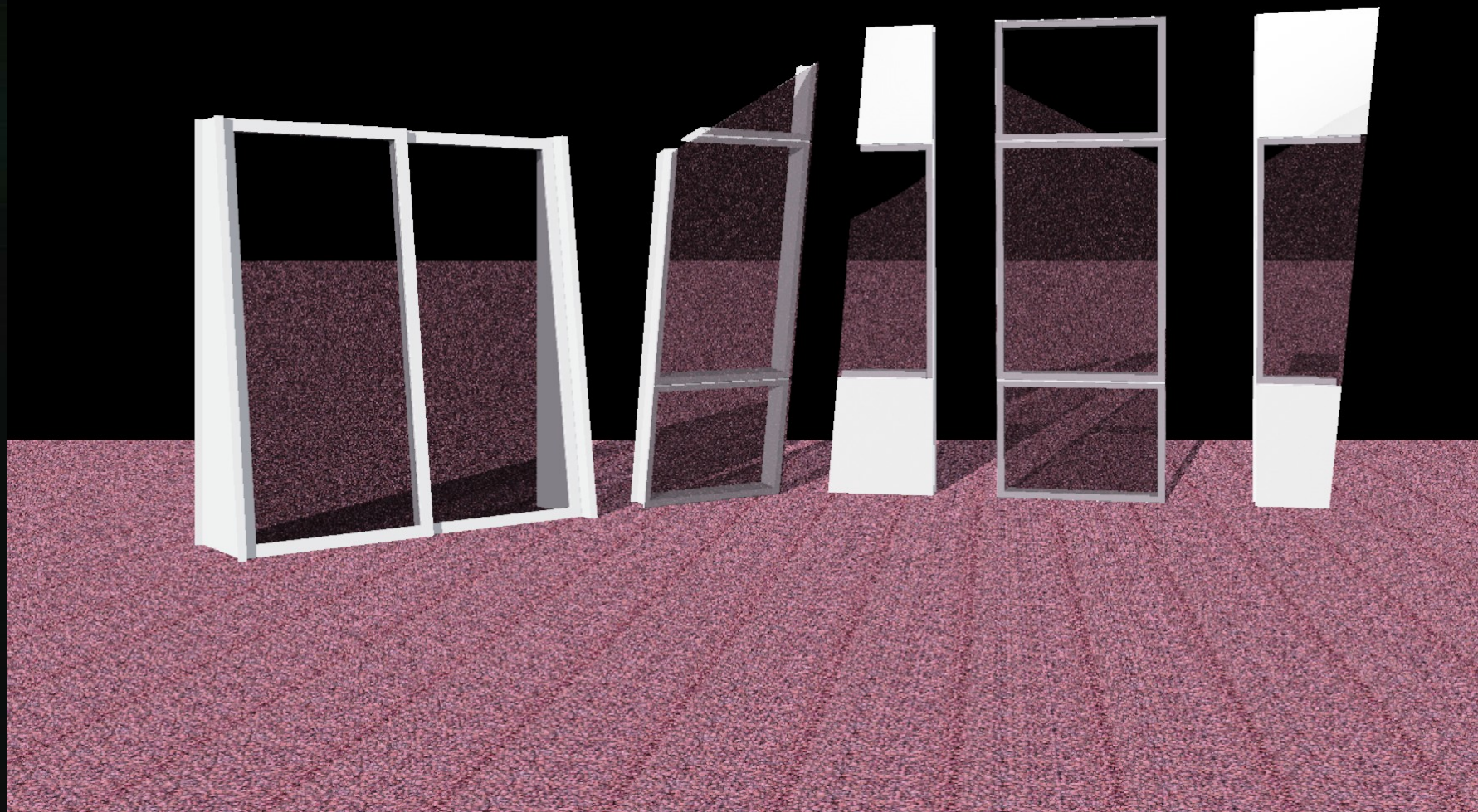
VERTICAL CO-ORDINATION



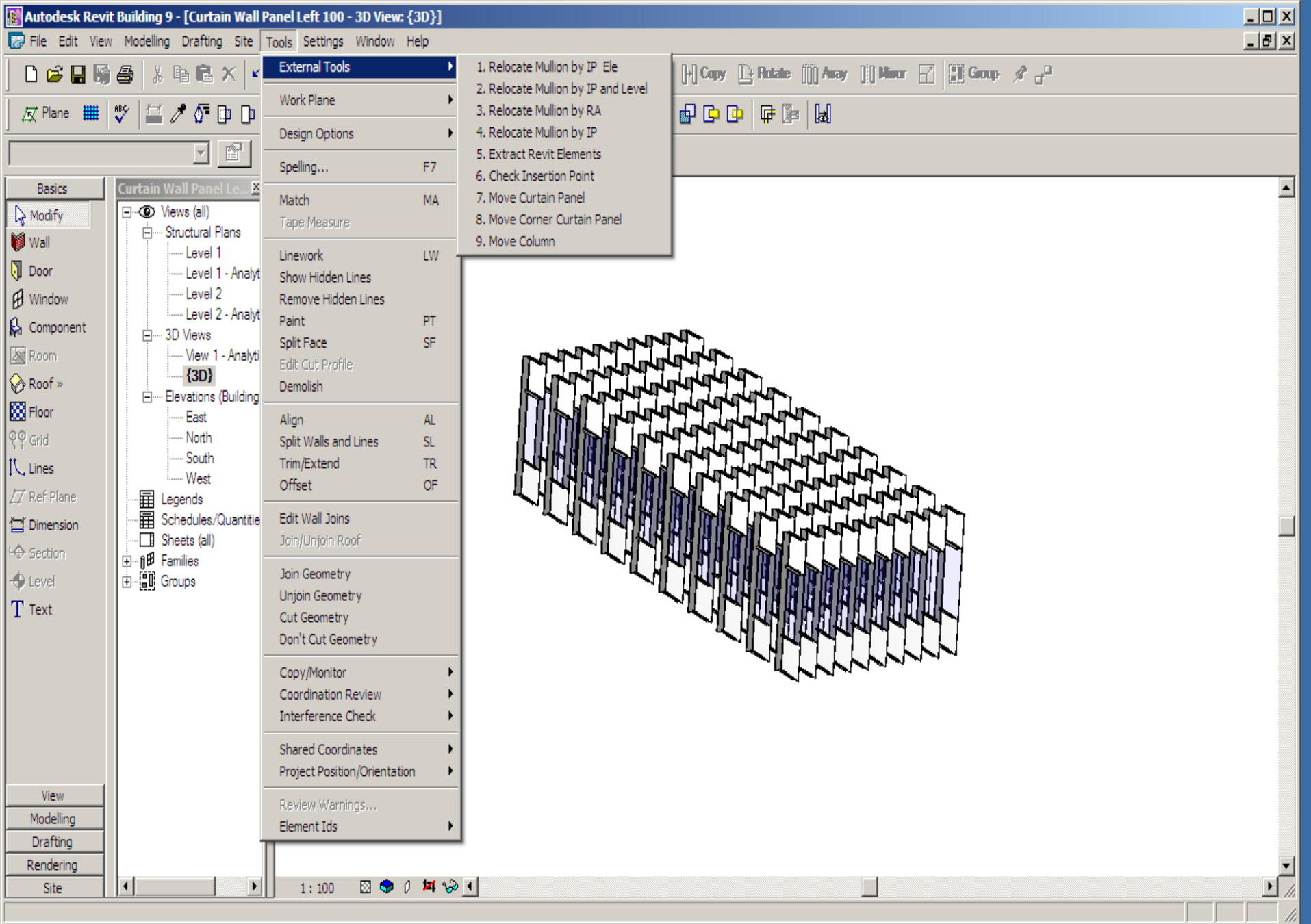
INTERNAL vs EXTERNAL

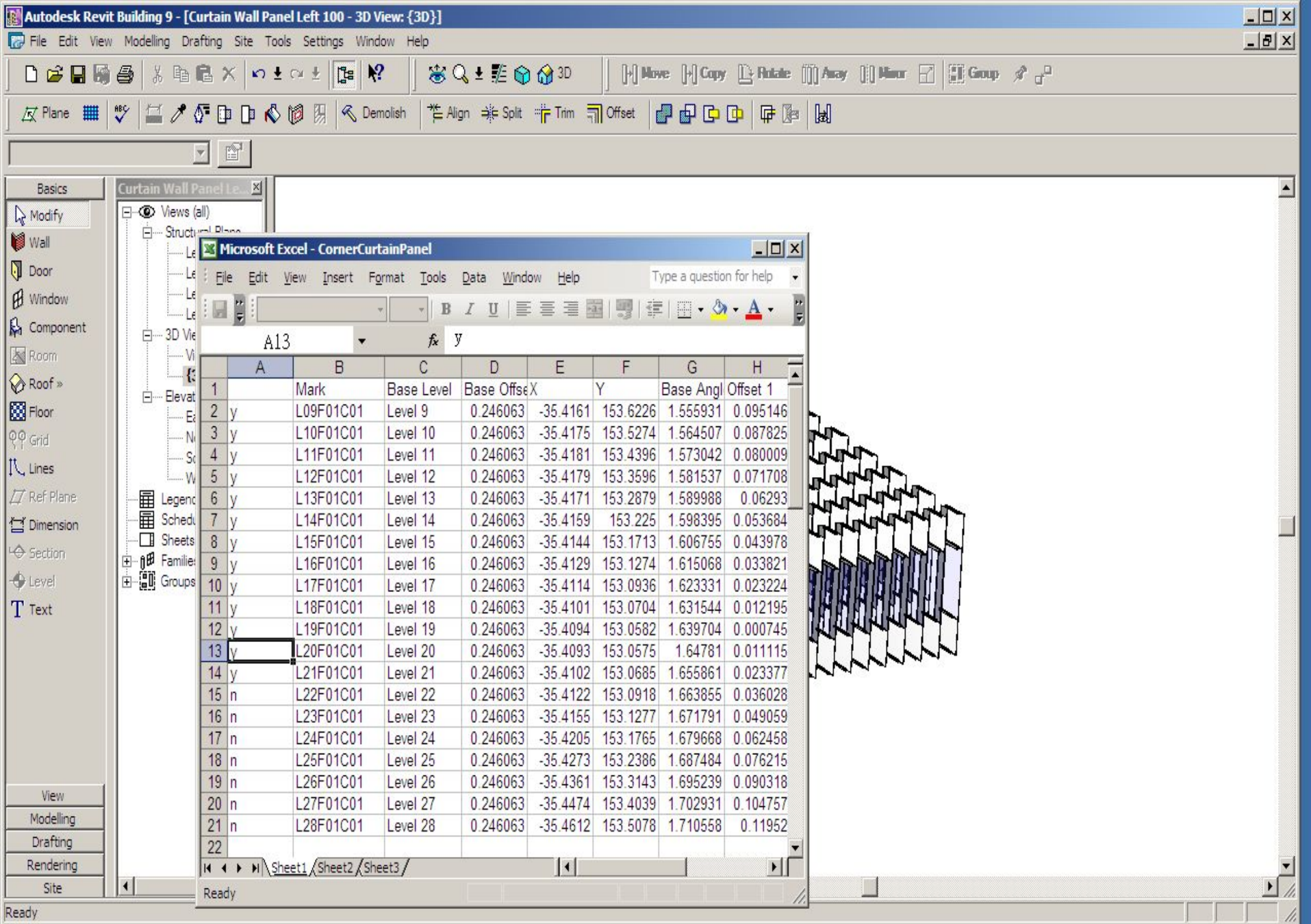


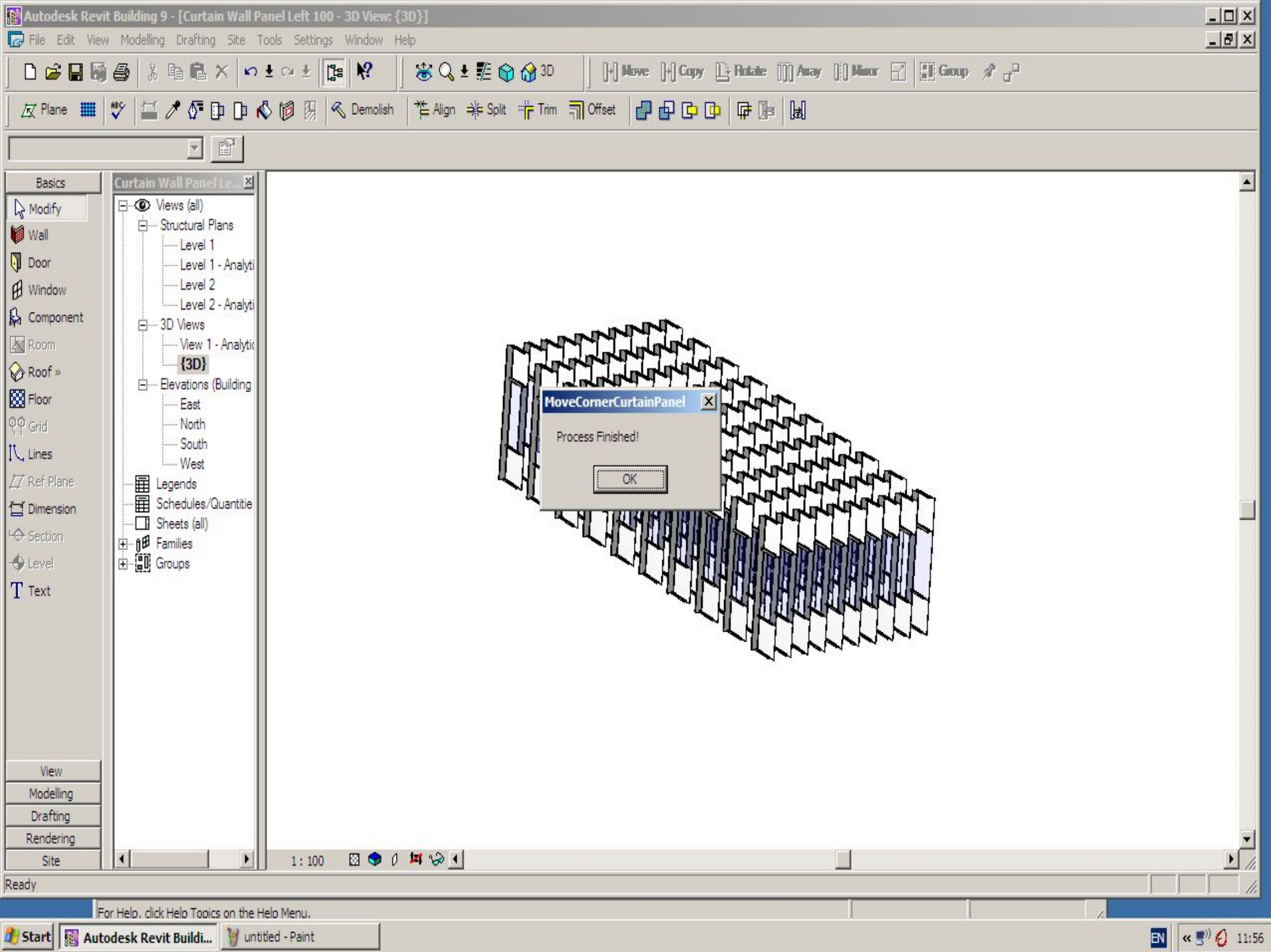
COMPLICATED CURTAIN WALL

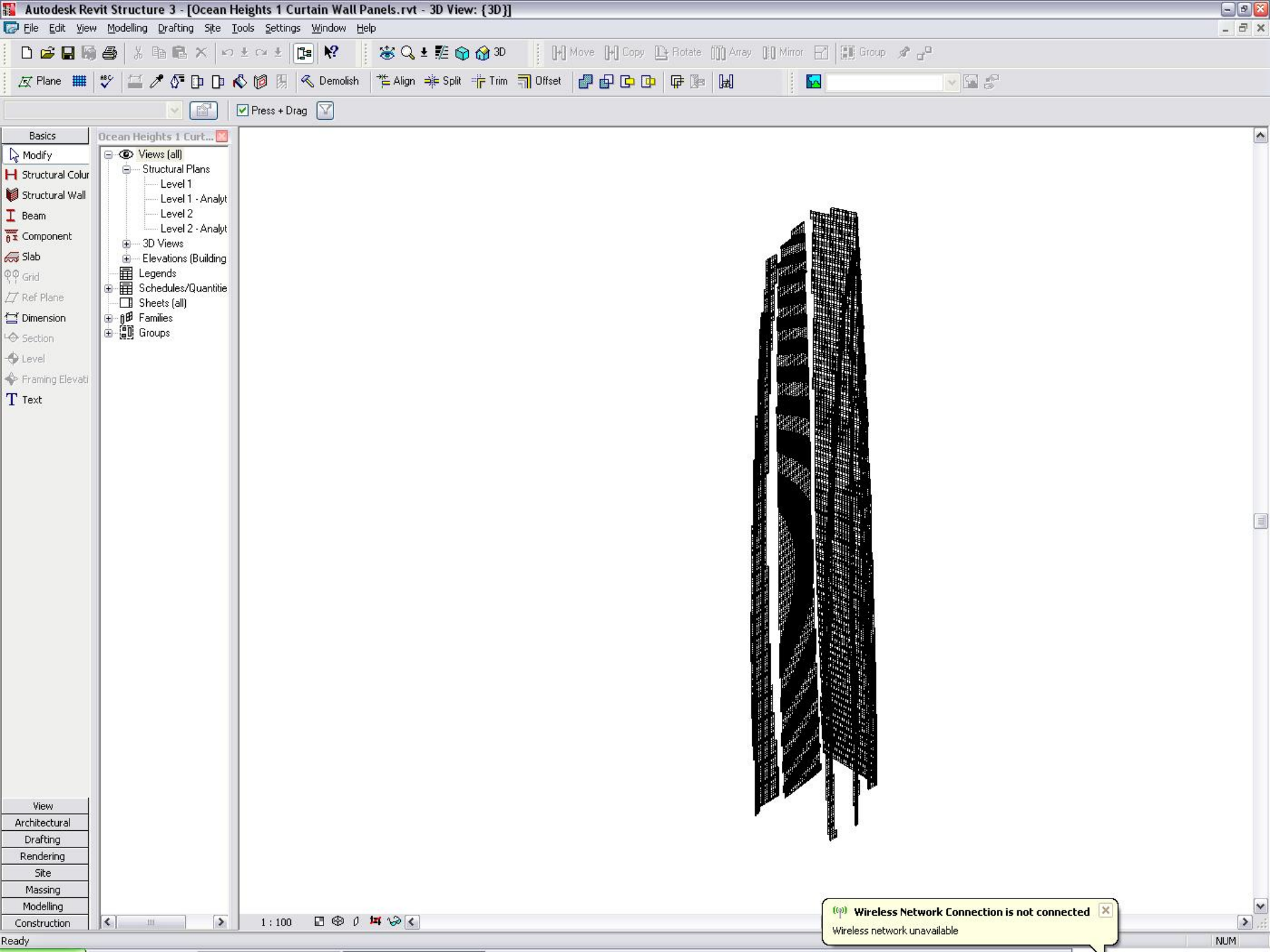


Ref Plane Dimension Section Level Framing Elevati Text 3D Views 3D View 1 3D View 2 3D View 3 3D View 4 3D View 5 3D View 6 Copy of 3D V View 1 - Ana (3D) Elevations (Build East North South West Sections (Building Section 1 Section 2 Section 3 Legends Schedules/Quan Multi-Category S Multi-Category S Sheets (all) Families Annotation Synt Ceilings Curtain Panels Curtain Systems Curtain Wall Mul Detail Items Doors Floors Furniture View Architectural Drafting Rendering Site Massing Modelling Construction	Level 20	Sliding Door	L71B05D12	Level 71	2550.00		0.00
	Level 30	Sliding Door	L71B05D15	Level 71	2550.00		0.00
	Level 40	Sliding Door	L72B01D02	Level 72	2400.00		0.00
	Level 50	Sliding Door	L72B02D02	Level 72	2500.00		0.00
	Level 60	Sliding Door	L72B04D01	Level 72	1800.00		0.00
	Level 65	Sliding Door	L72B05D03	Level 72	2550.00		0.00
	Level 70	Sliding Door	L72B05D05	Level 72	2550.00		0.00
	Level 75	Sliding Door	L72B05D08	Level 72	2550.00		0.00
		Sliding Door	L72B05D10	Level 72	2550.00		0.00
		Sliding Door	L72B05D12	Level 72	2550.00		0.00
		Sliding Door	L72B05D15	Level 72	2550.00		0.00
		Sliding Door	L73B01D02	Level 73	2400.00		0.00
		Sliding Door	L73B02D02	Level 73	2500.00		0.00
		Sliding Door	L73B04D01	Level 73	1700.00		0.00
		Sliding Door	L73B05D03	Level 73	2550.00		0.00
		Sliding Door	L73B05D05	Level 73	2550.00		0.00
		Sliding Door	L73B05D08	Level 73	2550.00		0.00
		Sliding Door	L73B05D10	Level 73	2550.00		0.00
		Sliding Door	L73B05D12	Level 73	2550.00		0.00
		Sliding Door	L73B05D15	Level 73	2550.00		0.00
		Sliding Door	L74B01D02	Level 74	2400.00		0.00
		Sliding Door	L74B02D02	Level 74	2500.00		0.00
		Sliding Door	L74B04D01	Level 74	1600.00		0.00
		Sliding Door	L74B05D03	Level 74	2550.00		0.00
		Sliding Door	L74B05D05	Level 74	2550.00		0.00
		Sliding Door	L74B05D08	Level 74	2550.00		0.00
		Sliding Door	L74B05D10	Level 74	2550.00		0.00
		Sliding Door	L74B05D12	Level 74	2550.00		0.00
		Sliding Door	L74B05D15	Level 74	2550.00		0.00
		Sliding Door	L75B01D02	Level 75	2400.00		0.00
		Sliding Door	L75B02D02	Level 75	2500.00		0.00
		Sliding Door	L76B01D02	Level 76	2400.00		0.00
		Sliding Door	L76B02D02	Level 76	2500.00		0.00
		Sliding Door	L77B01D02	Level 77	2400.00		0.00
		Sliding Door	L77B02D01	Level 77	2426.17		0.00
		Sliding Door	L78B01D02	Level 78	2400.00		0.00
		Sliding Door	L78B02D01	Level 78	2203.01		0.00
		Sliding Door	L79B01D02	Level 79	2400.00		0.00
		Sliding Door	L79B02D01	Level 79	1974.15		0.00
Sliding Door: 649							
Sliding Door to Replace CW Pan			L10F01N10	Level 10	1255.77		-123.24
Sliding Door to Replace CW Panel: 1							
Grand total: 9740							









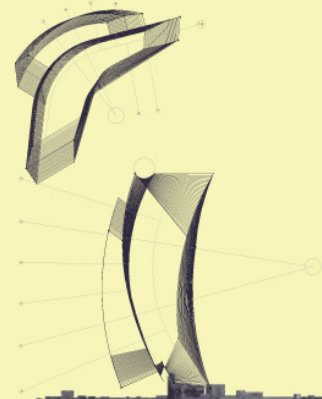
Abu Dhabi Dancing Towers

Located in the heart of Abu Dhabi, Dancing Towers was designed to appropriately fit its surrounding neighbors in scale.

The challenge was how to achieve this when the project was only 70,000 square meters and adjacent properties were relatively small, averaging 900 square-meter floor plates. Two slender towers as opposed to one singular tower was the first step, but the site itself was constrained, forcing a close proximity between the two buildings.

This site constraint is intensified in achieving a viable connective retail podium between the commercial and residential towers, drop-offs to the lobbies and access to supporting functions. The buildings were placed deliberately to maximize the uses down below.

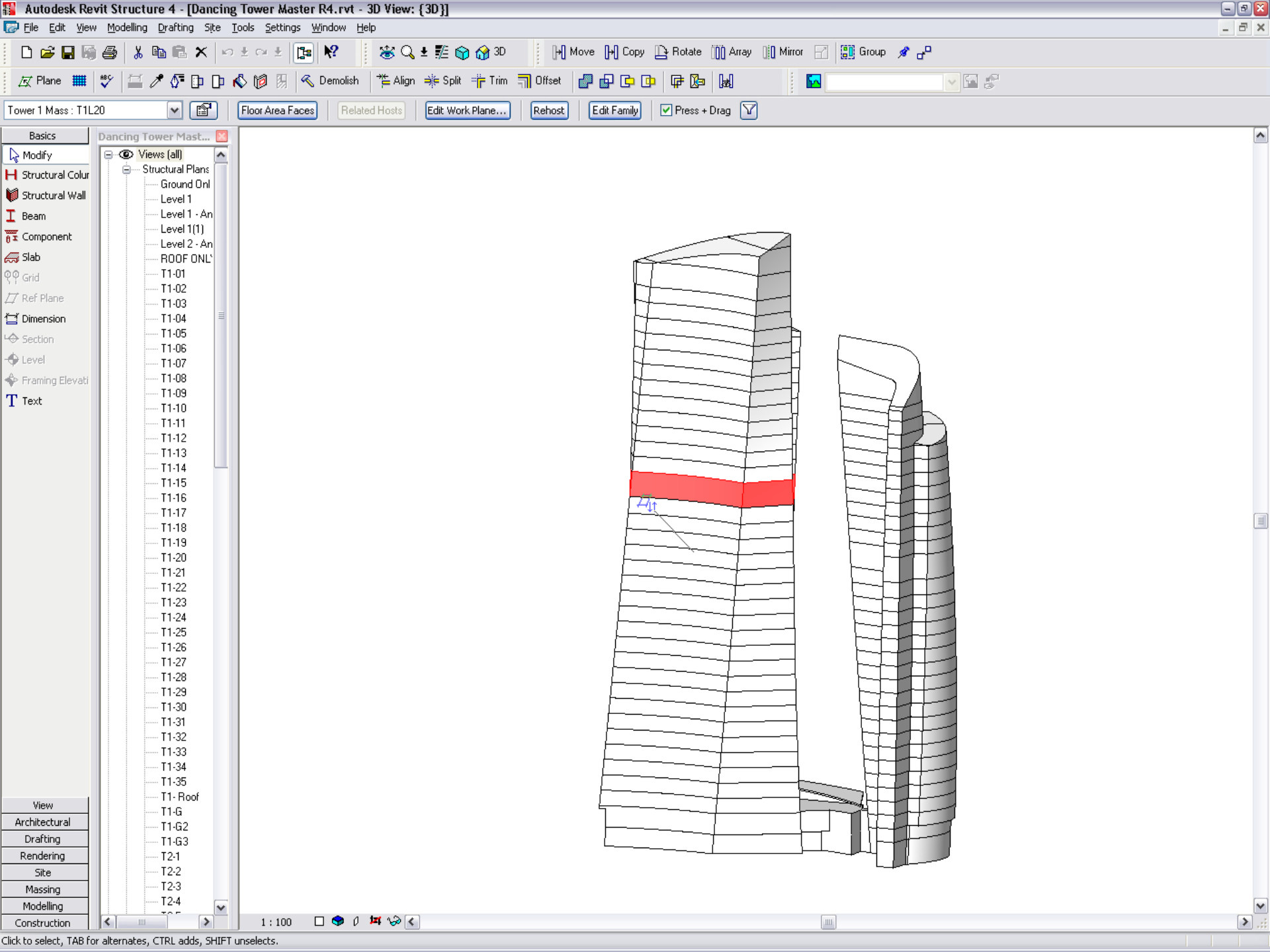
However, the two towers quickly lean, rotate, bend and warp to respond to each other, the adjacent sites and ultimately the view to the ocean at their horizon. These two figures fluidly respond to each other, dynamically engaged and flowing – and ultimately tied together in a passionate dance •

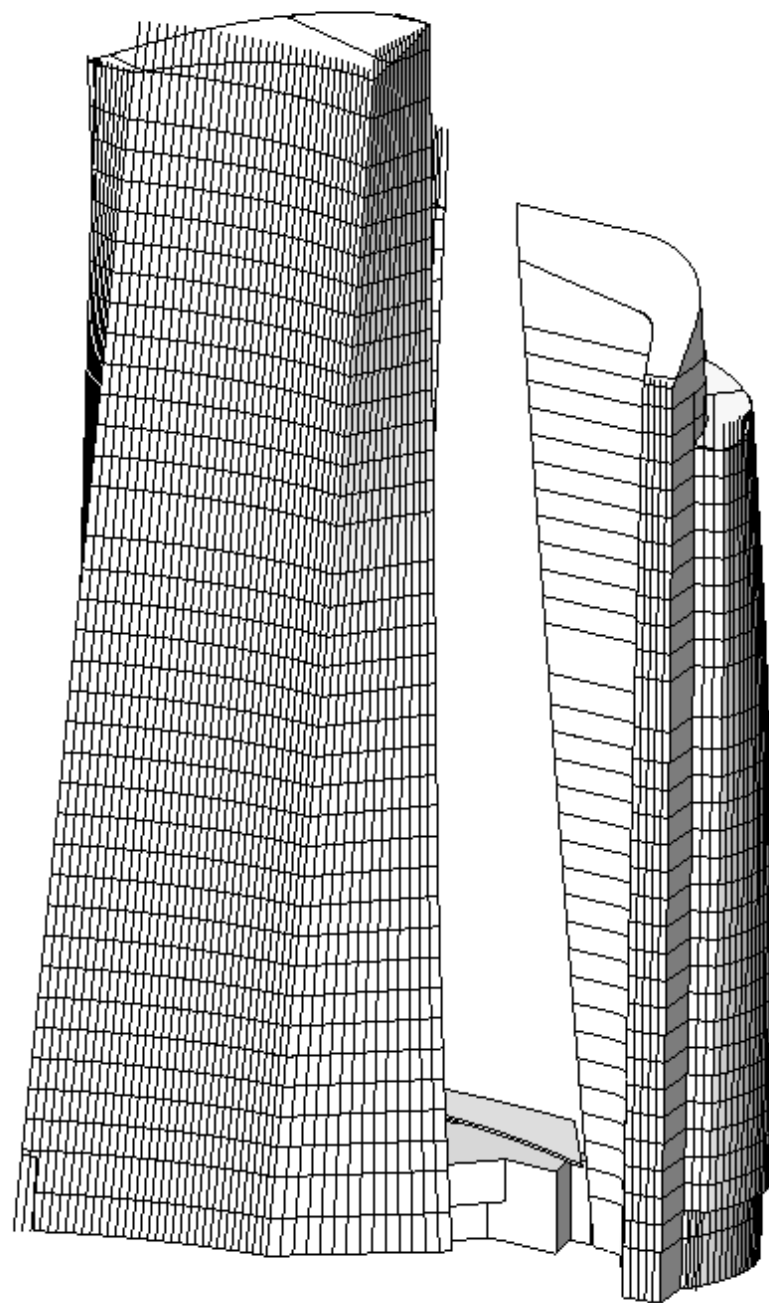


Program Mixed Use Site Area 4,160 sqm
Floor Area 44,235 sqm Building Height 160 m

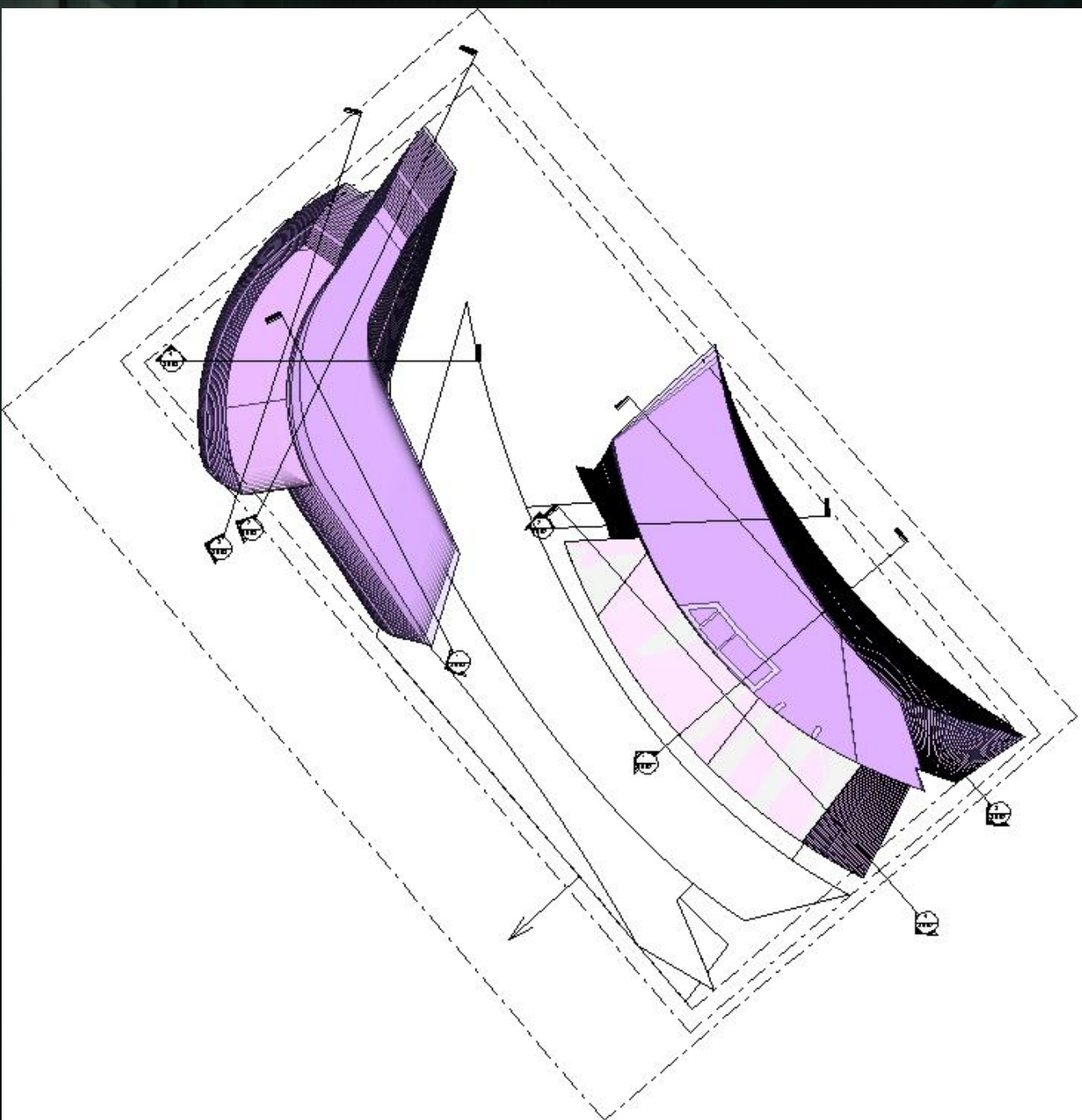


Abu Dhabi **Dancing Towers**







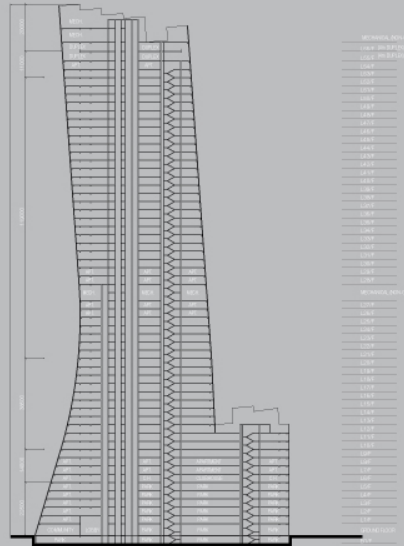


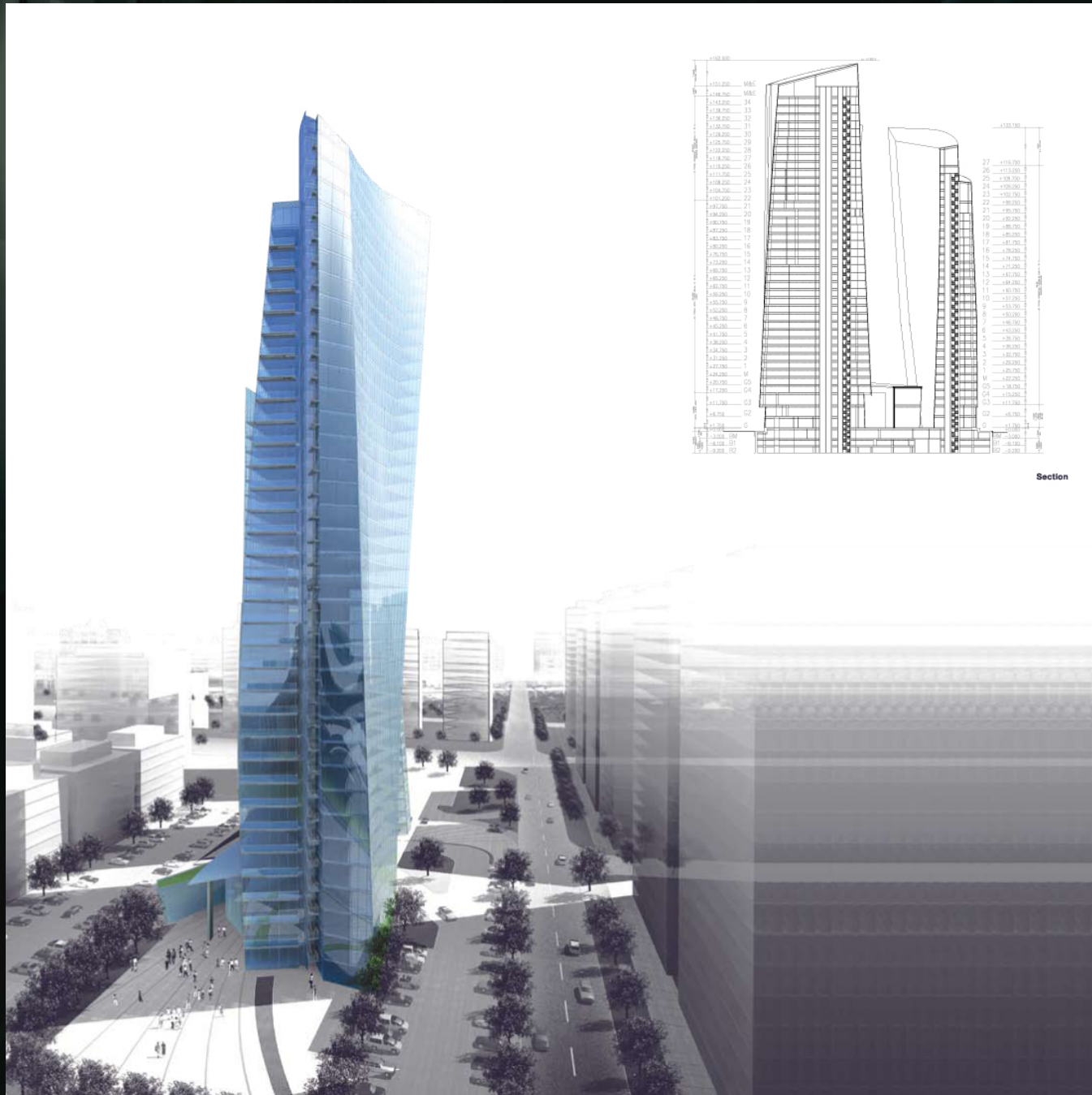
Program: Residential, Site Area 7,007 sqm
 Floor Area 90,206 sqm Building Height 225 m

Abu Dhabi Empire Tower

Empire Tower was challenged through a client request of not "pushing the limits" too far. The concern is that the residential project was located in the middle of a master plan filled with potential icons. The design standardizes the units to accommodate the client request but manipulates the section to develop a very dynamic solution, which holds its own amidst the visual clutter of its neighbors. This was deemed crucial to the financial viability of this project, which is dependent on pre-sales within a highly competitive market.

The design maximizes the tower's presence on the street, with vertical layers spreading out to the property lines. The building then bends back away from the street across from a large commercial tower, allowing for an enlarged view corridor between the central park of the community and the sea, one block away. The splayed vertical layers converge and rise up before bending forward together, as the 230-meter tower extends into the sky – maximizing its views between the park and the sea •





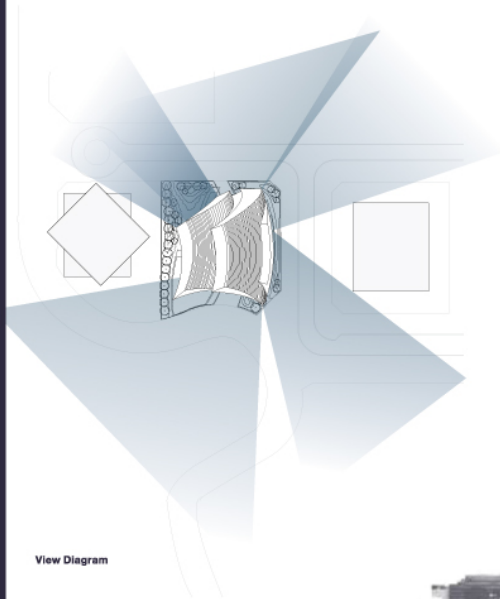
Section

Program Residential Site Area 3,443sqm
Floor Area 197,975 sqm Building Height 460 m

Dubai Ocean Heights Two

Ocean Heights Two is also located in Dubai Marina, UAE, along with its sister project, Ocean Heights One. At 460 meters in height and 105 floors, it will be the tallest tower in its vicinity. However, unlike its predecessor, the requirements for more modulated units up to the 60th floor, forced a different approach while intending to maintain the spirit of its sister.

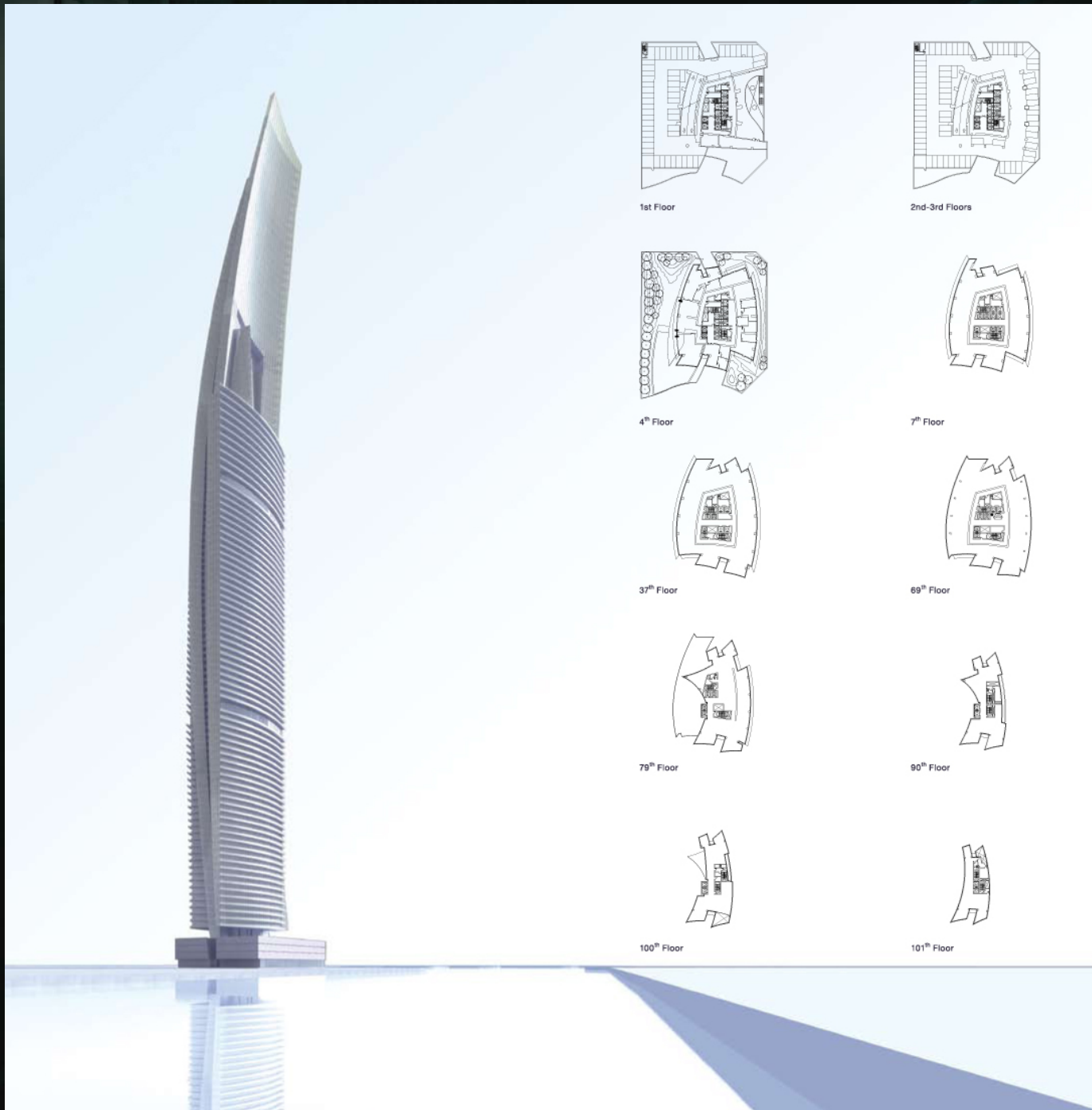
The first 60th floors of the tower are intended to be service apartments, which in order to be marketable, needed to have the majority of units standardized. The curved shape of the tower improves views past its densely located neighbors. The playfulness of this tower was concentrated into the two most visible faces, allowing units to bend up the tower in two blades. These blades were still modulated up to the 60th floor before the tight restrictions of unit area fluctuations become more relaxed. At this point, the modules drop off and the blades continue, tapering and bending into the sky ▪



View Diagram



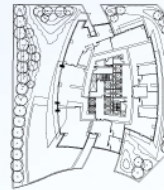
Dubai Ocean Heights Two



1st Floor



2nd-3rd Floors



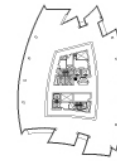
4th Floor



7th Floor



37th Floor



69th Floor



79th Floor



90th Floor



100th Floor

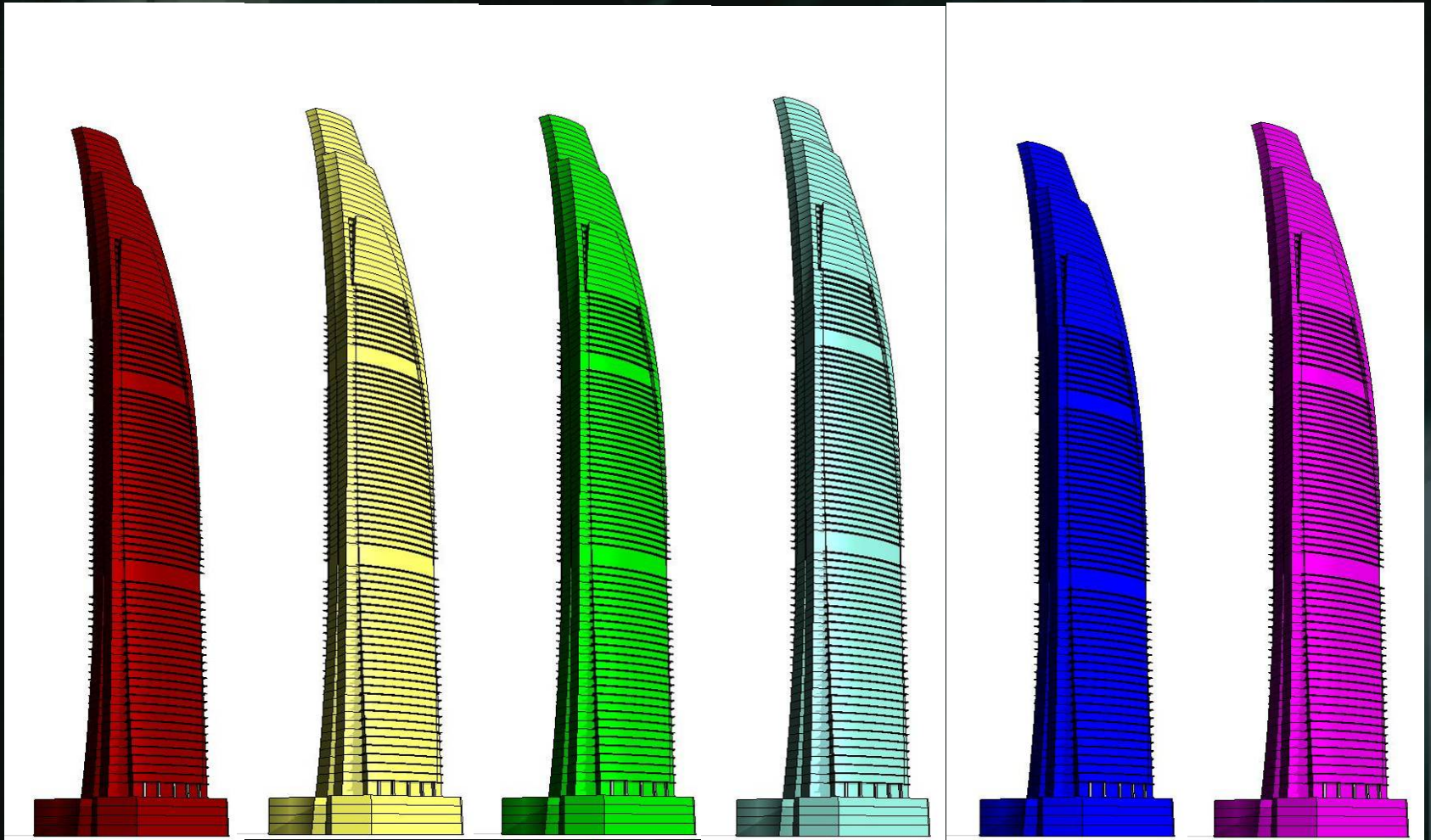


101th Floor

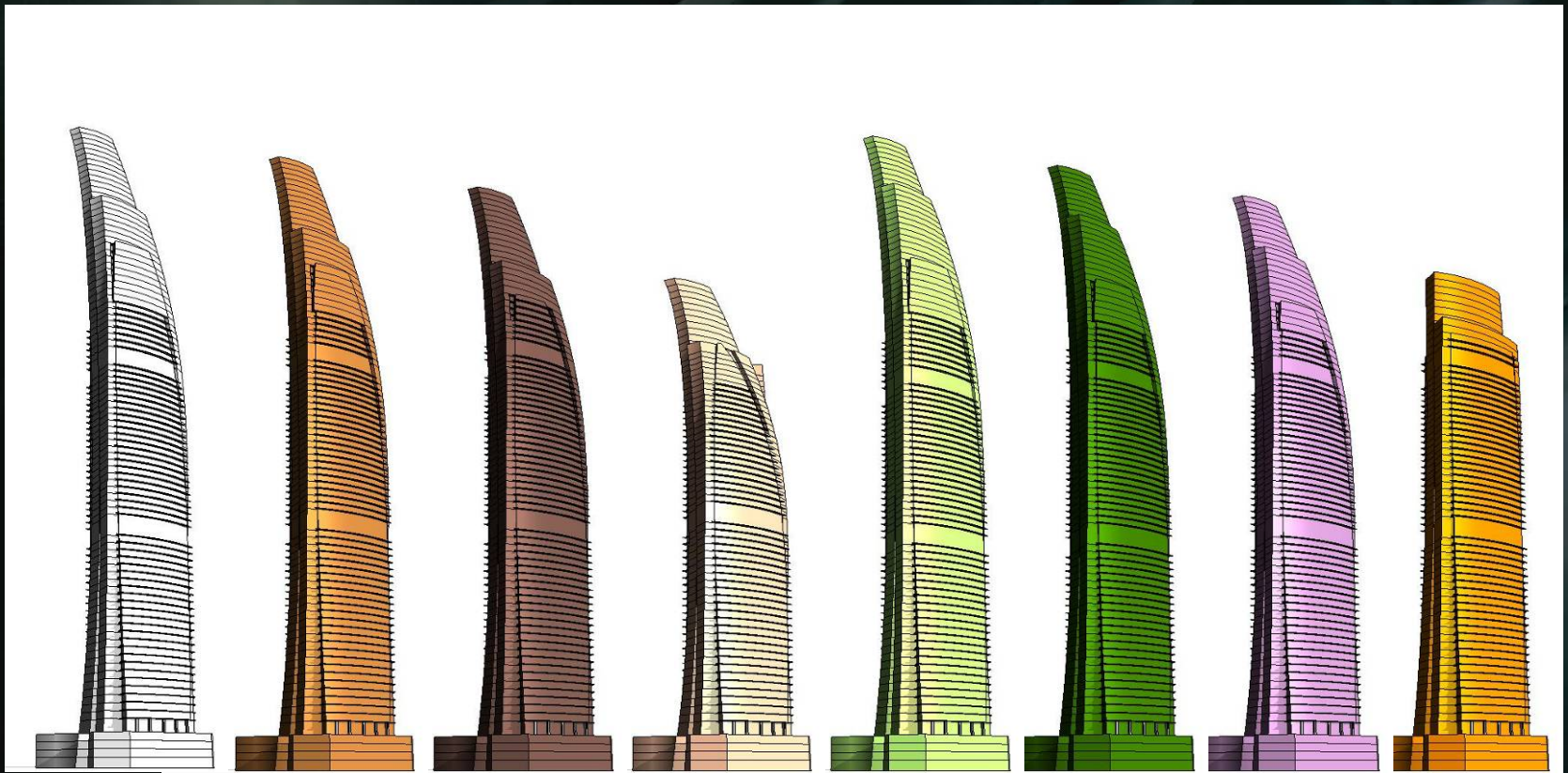
Ocean Heights II



Ocean Heights II – Options



Ocean Heights II – Options



Organic Architecture — 流線型建築

現代建築大師

Frank O. Gehry



Frank O. Gehry



Sketches of Frank Gehry
DG Bank Berlin, Germany
Photos from Sketches of Frank Gehry by Urban Gullikje / courtesy of Sony Pictures Classics Inc. © 2006 CTS Film Company

SONY PICTURES CLASSICS
©2006 SONY PICTURES ENTERTAINMENT INC.

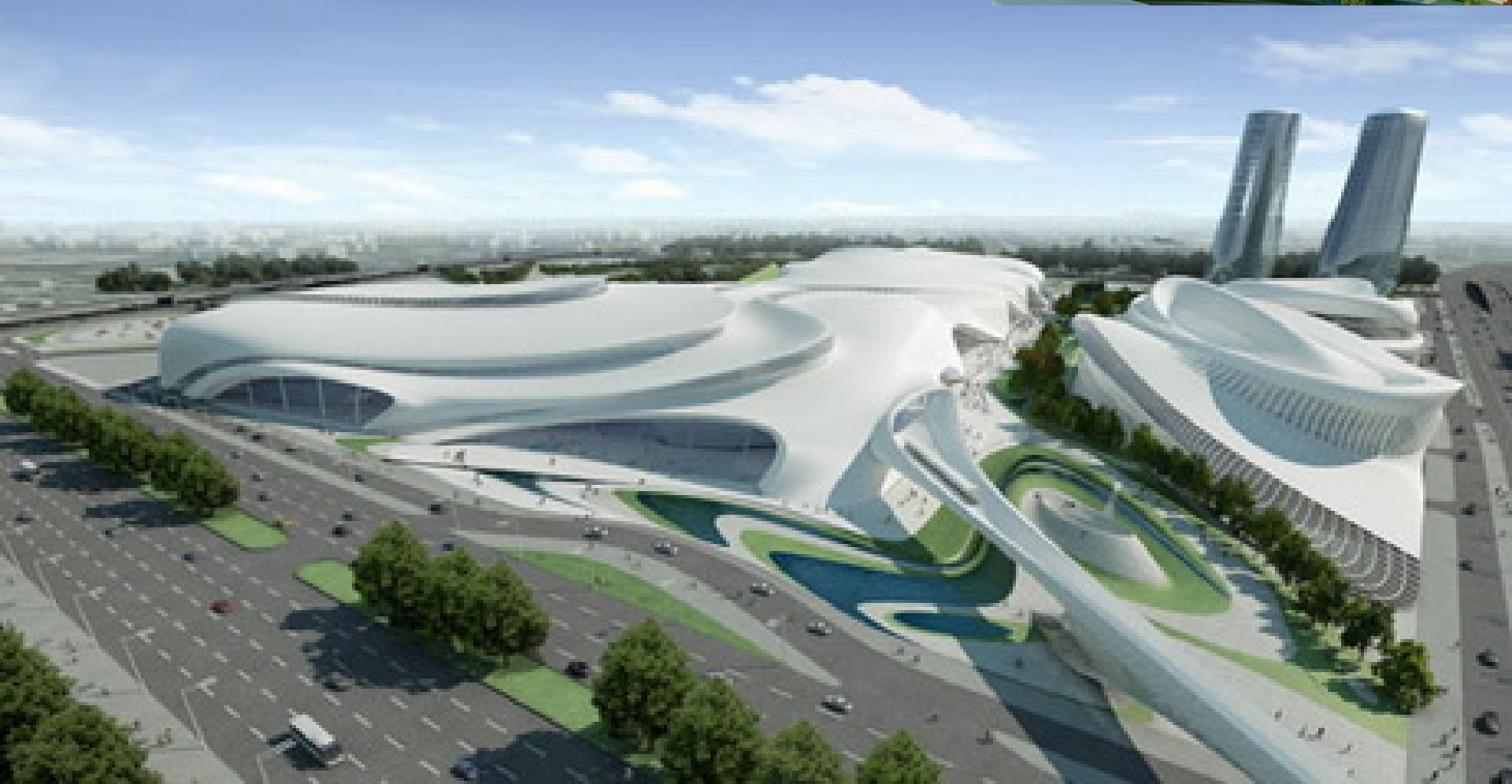
Frank O. Gehry



Santiago Calatrava



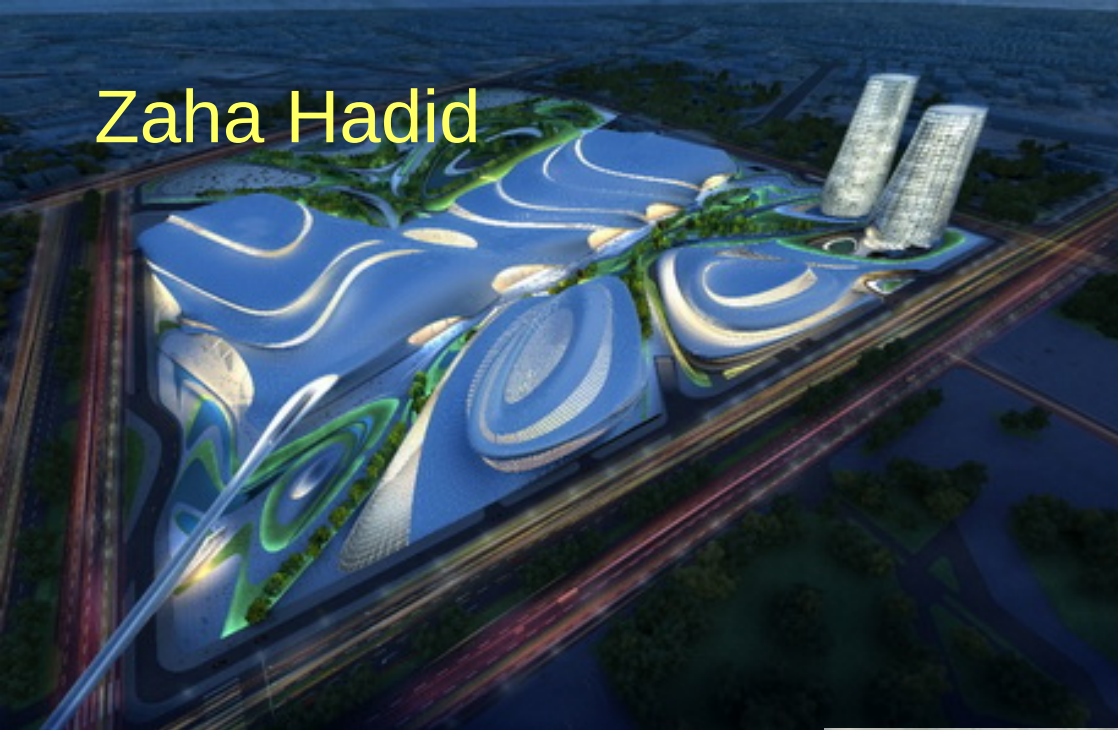
Zaha Hadid



Zaha Hadid



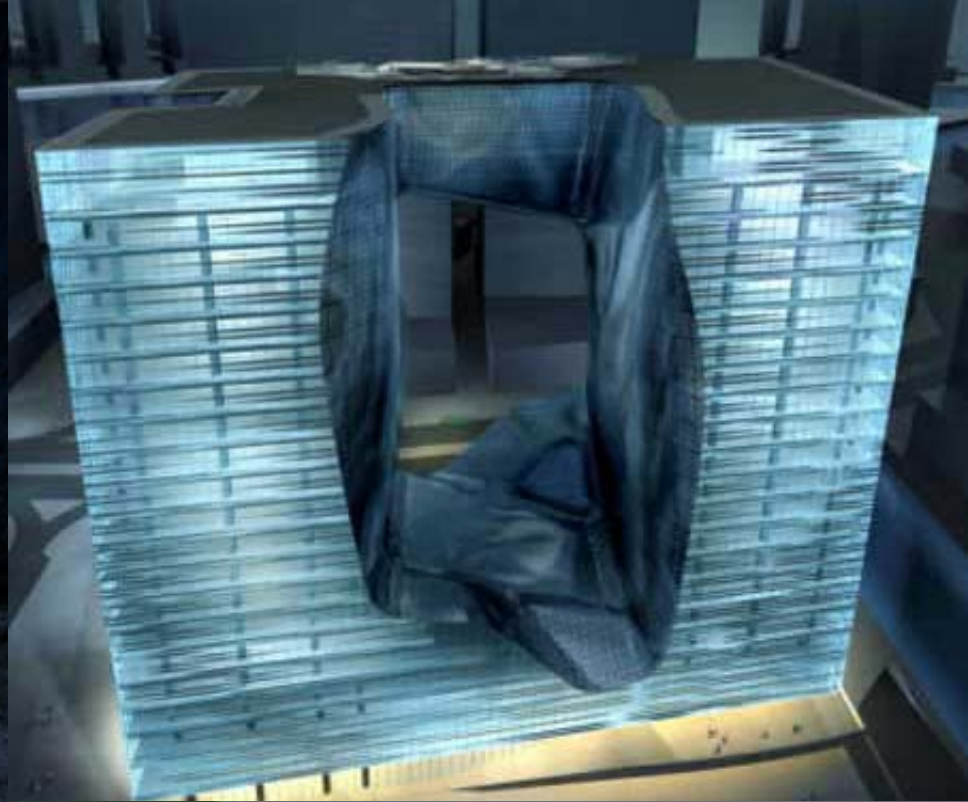
Zaha Hadid



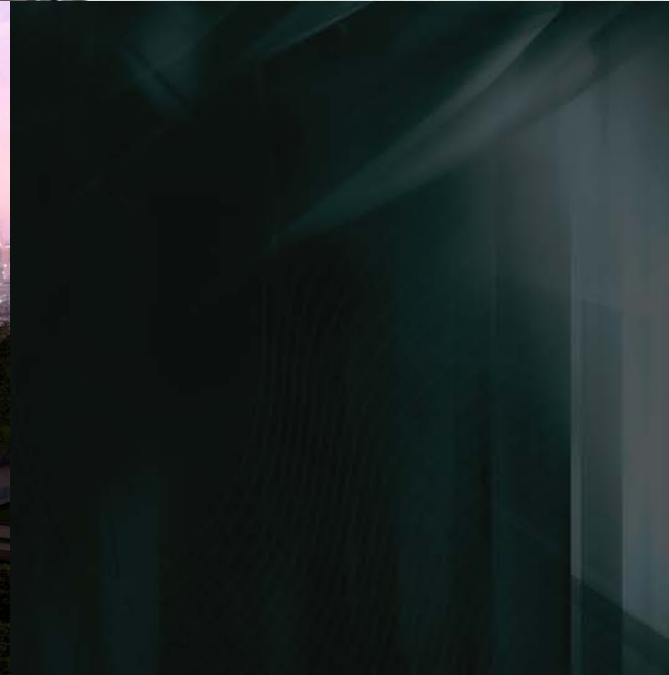
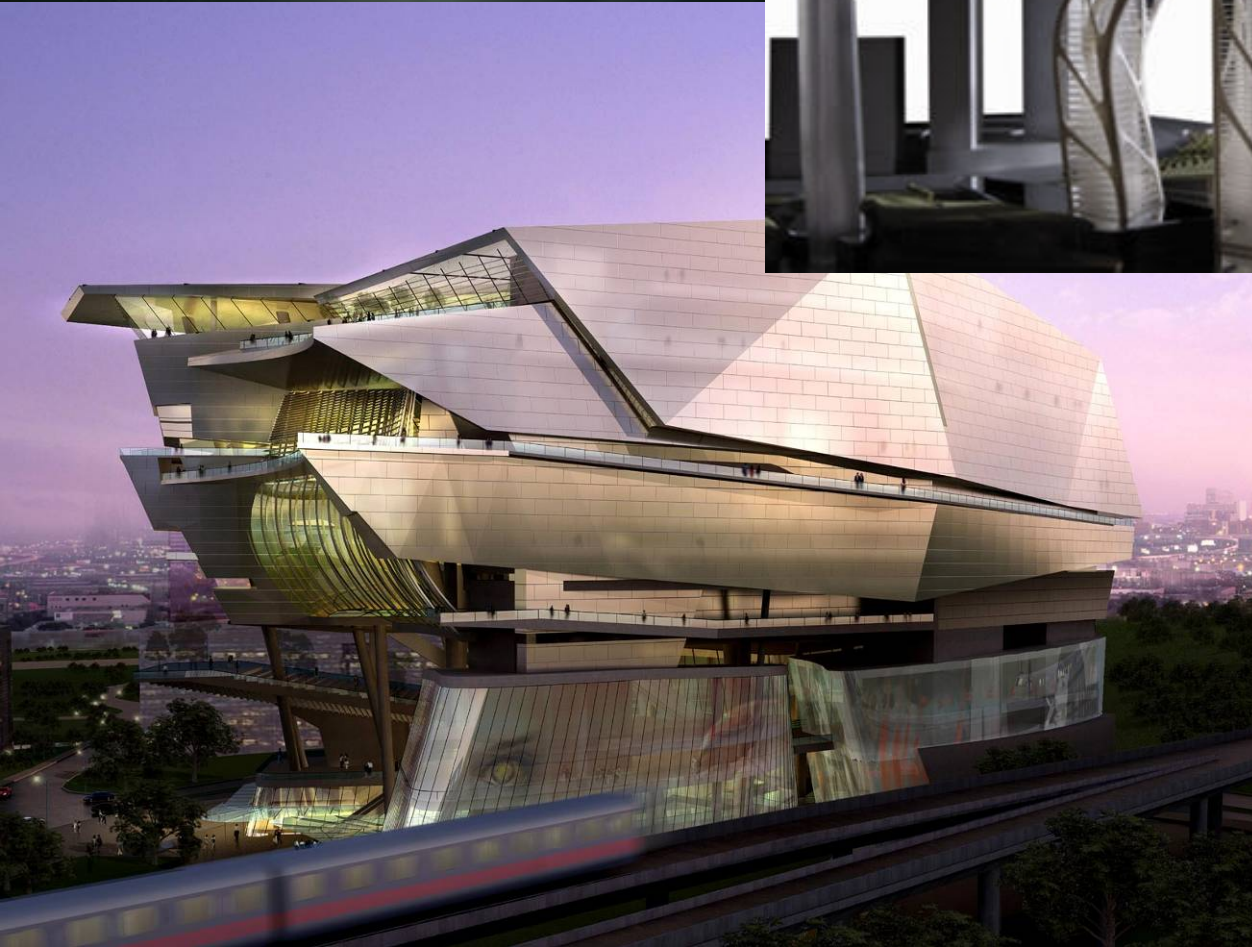
Zaha Hadid



Zaha Hadid



Aedas



Aedas

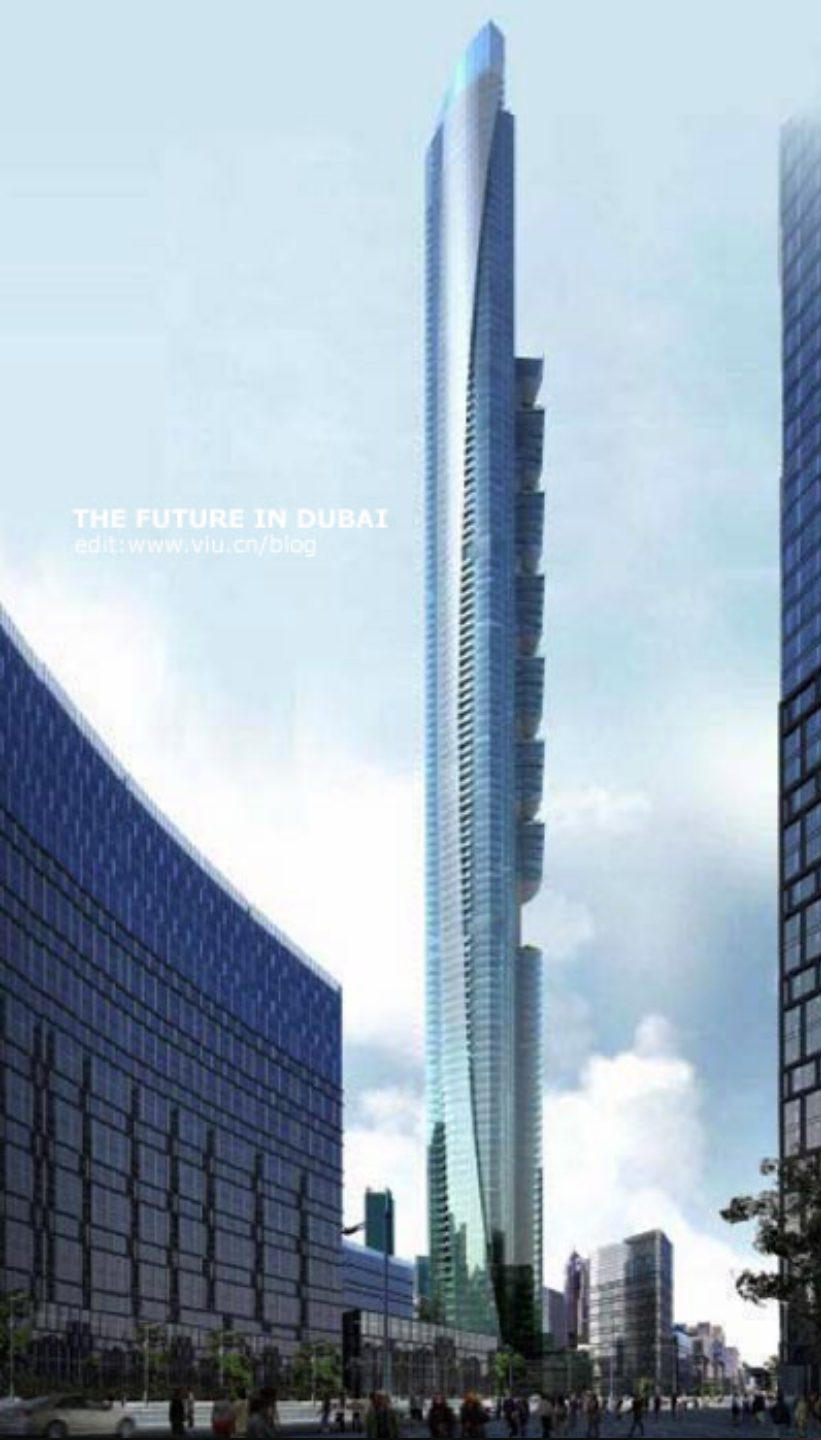


Aedas



Aedas

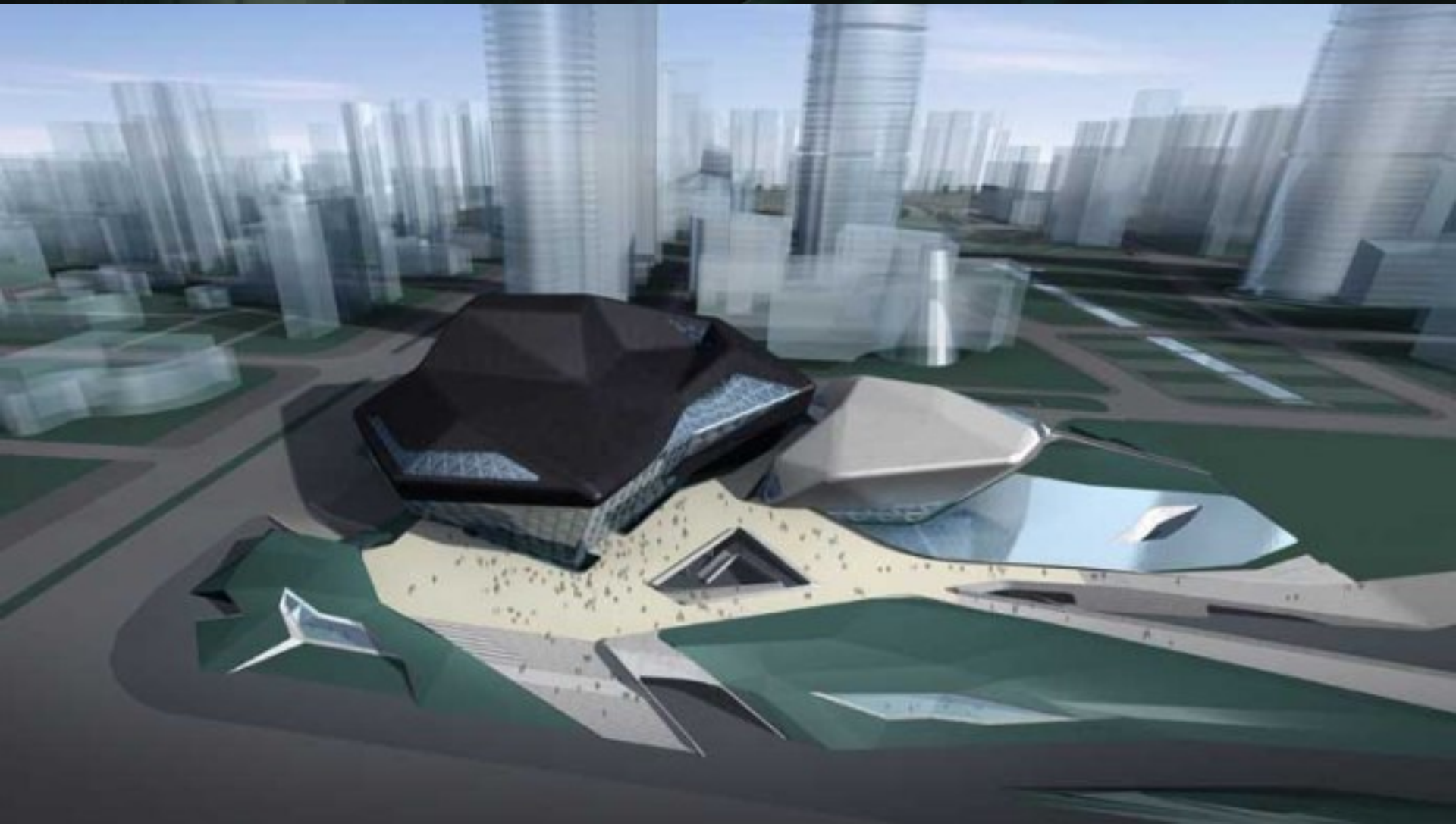
THE FUTURE IN DUBAI
edit: www.viu.cn/blog



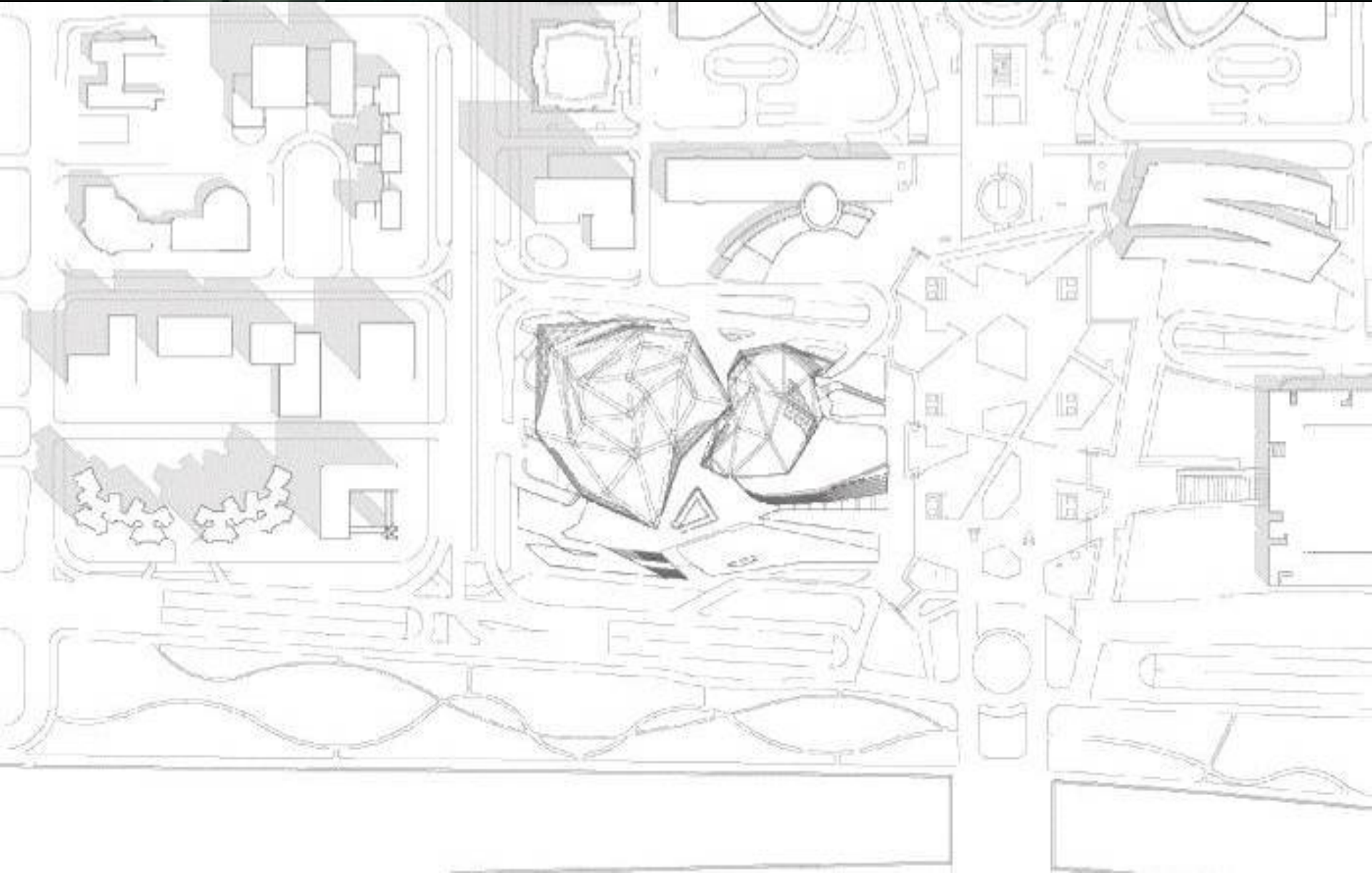
Zaha Hadid Guangzhou Opera House



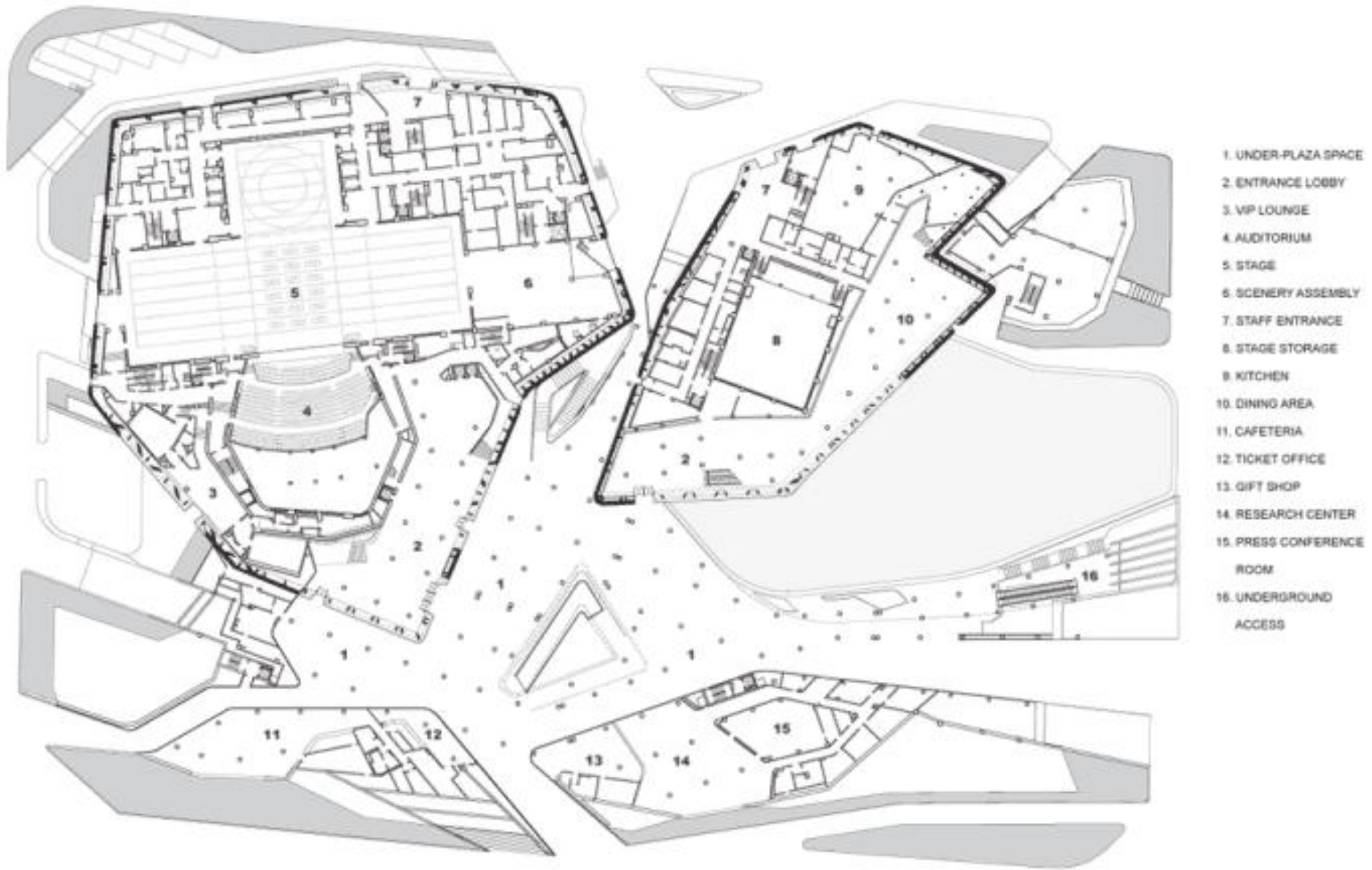
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Zaha Hadid Guangzhou Opera House



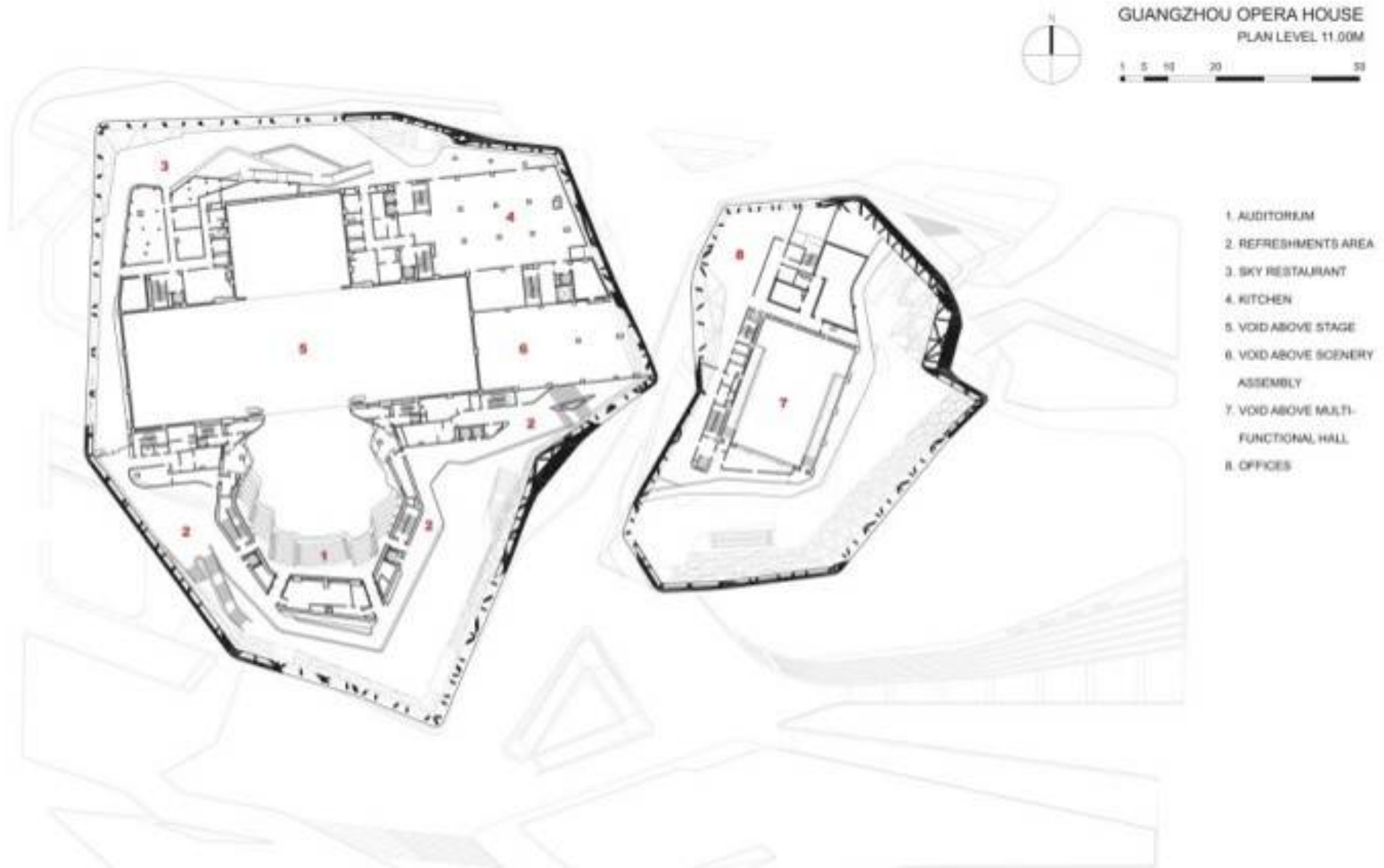
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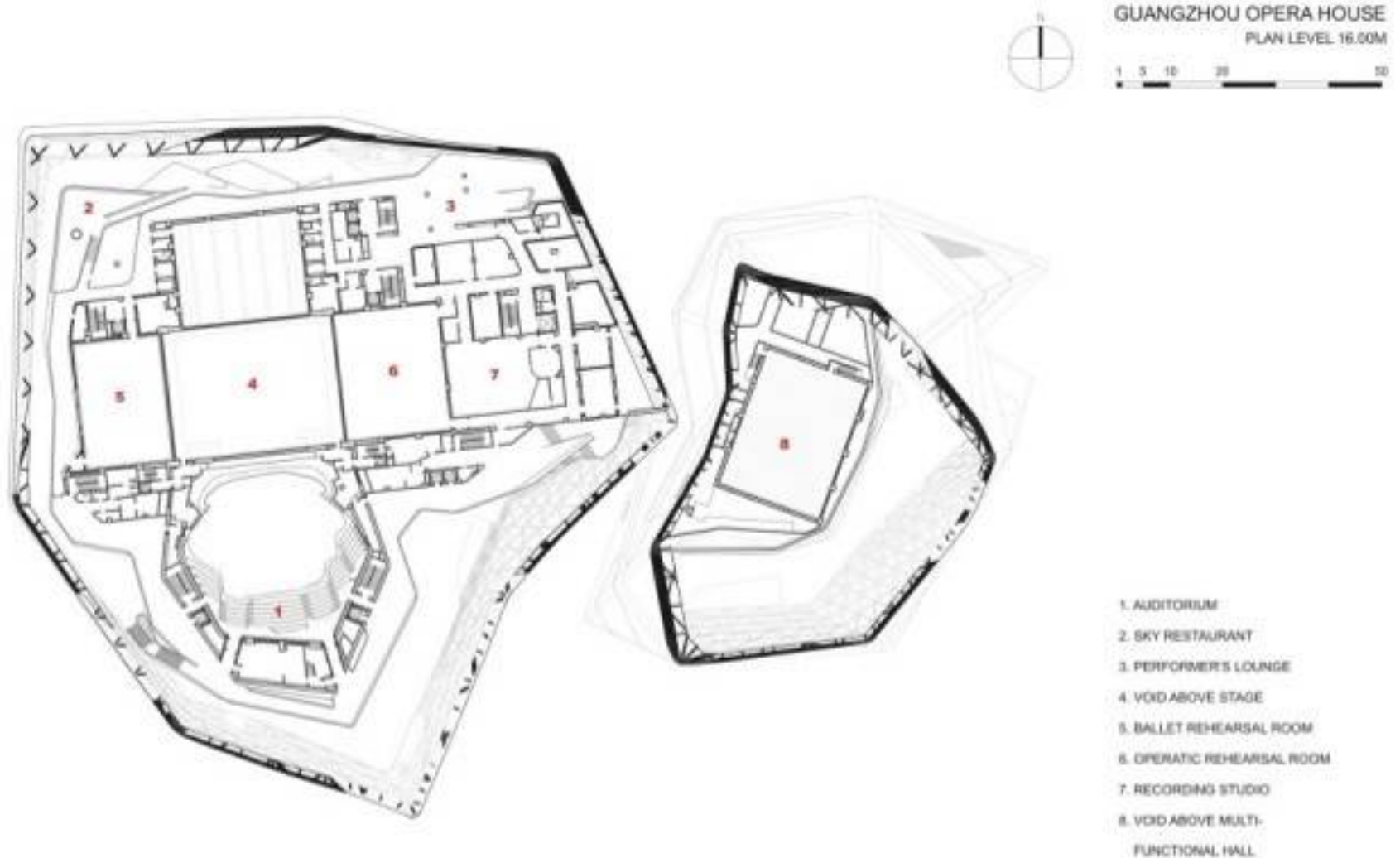
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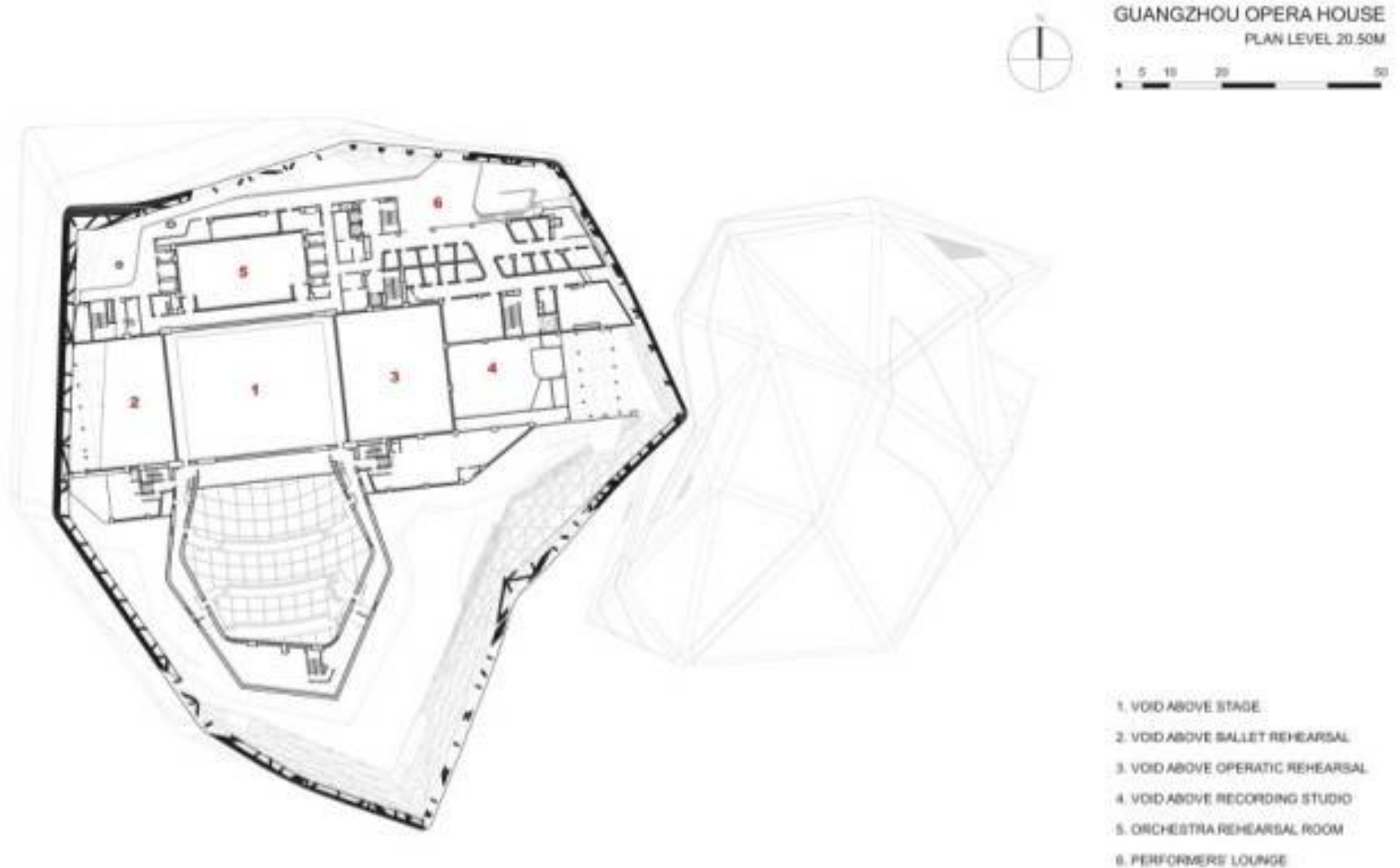
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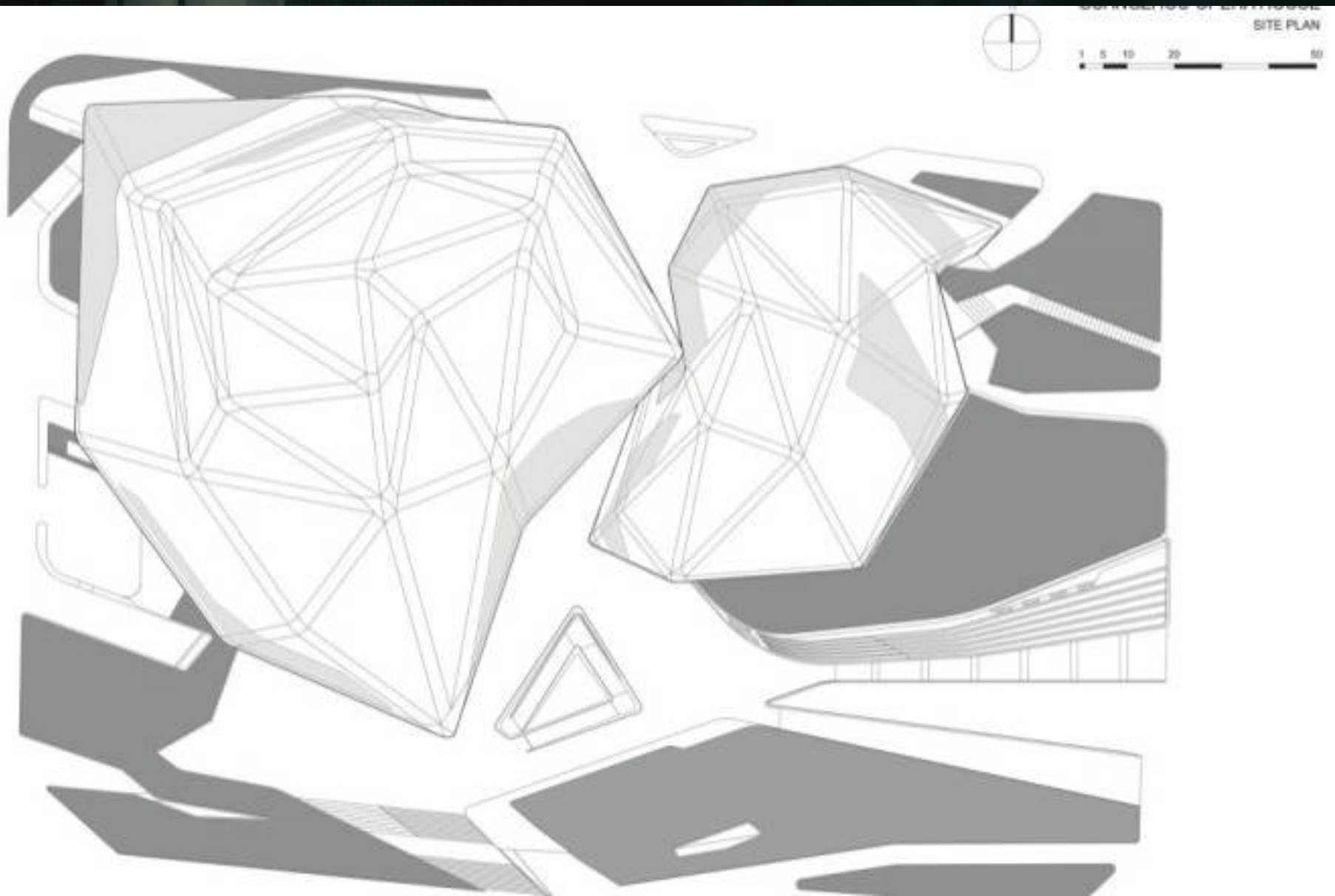
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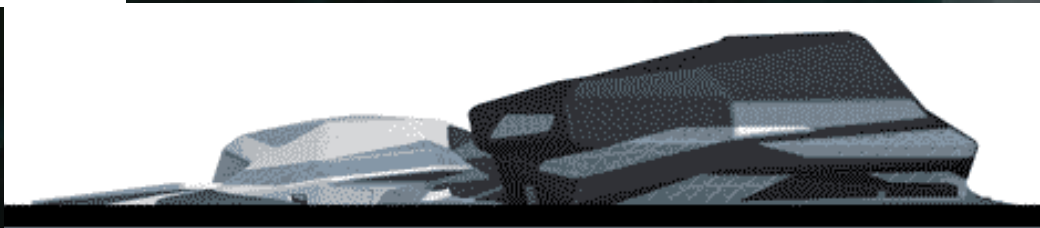
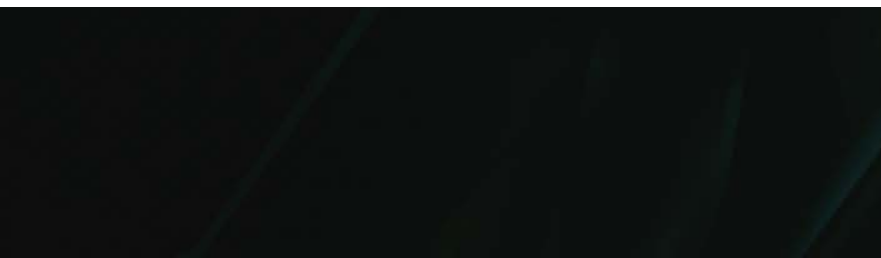
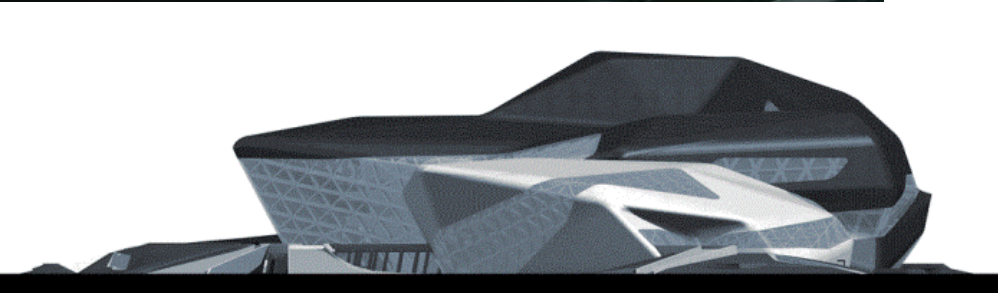
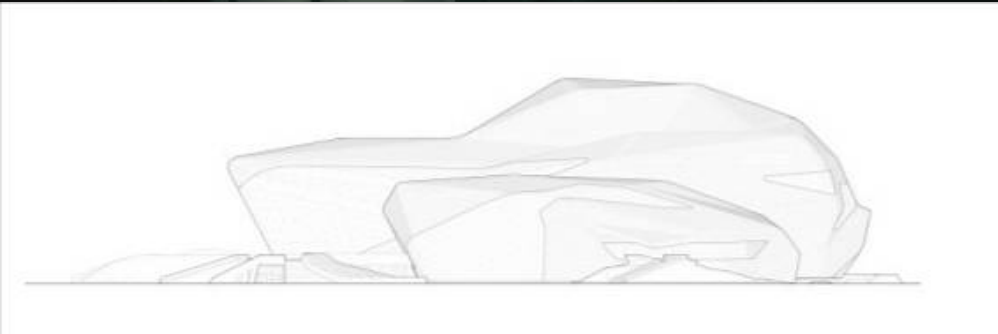
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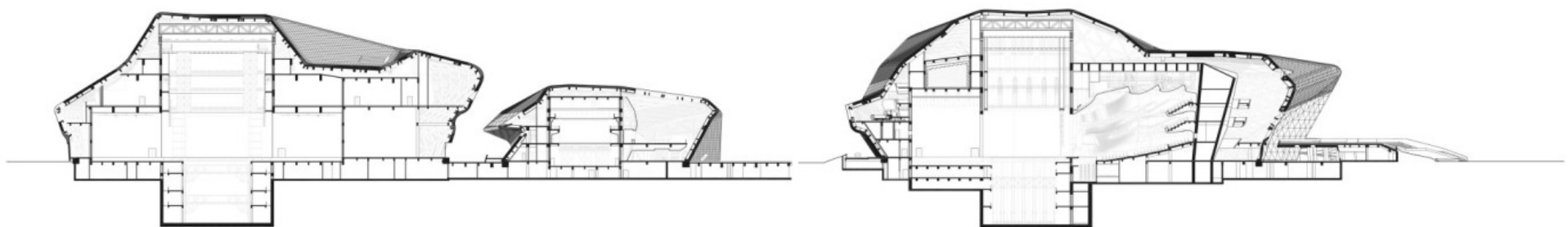
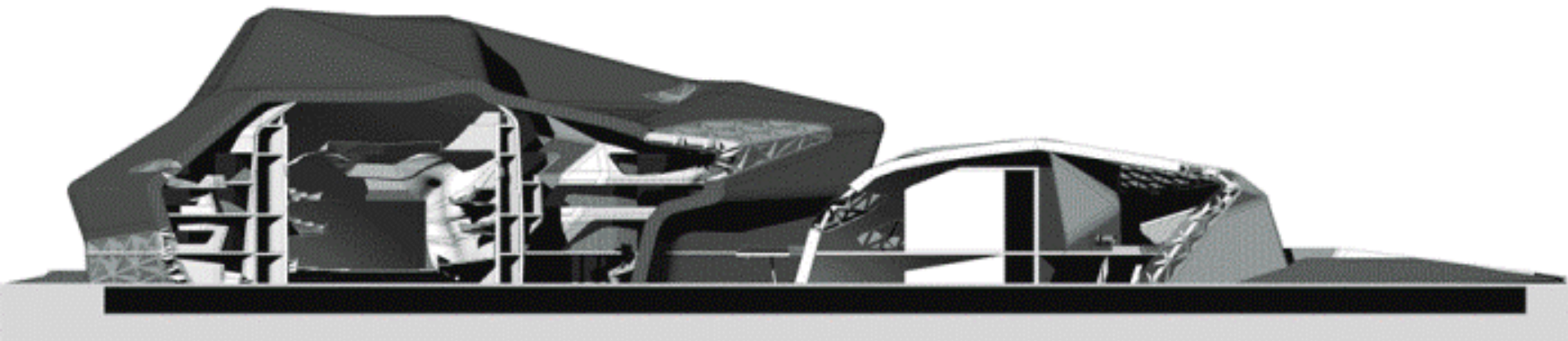


Zaha Hadid Guangzhou Opera House

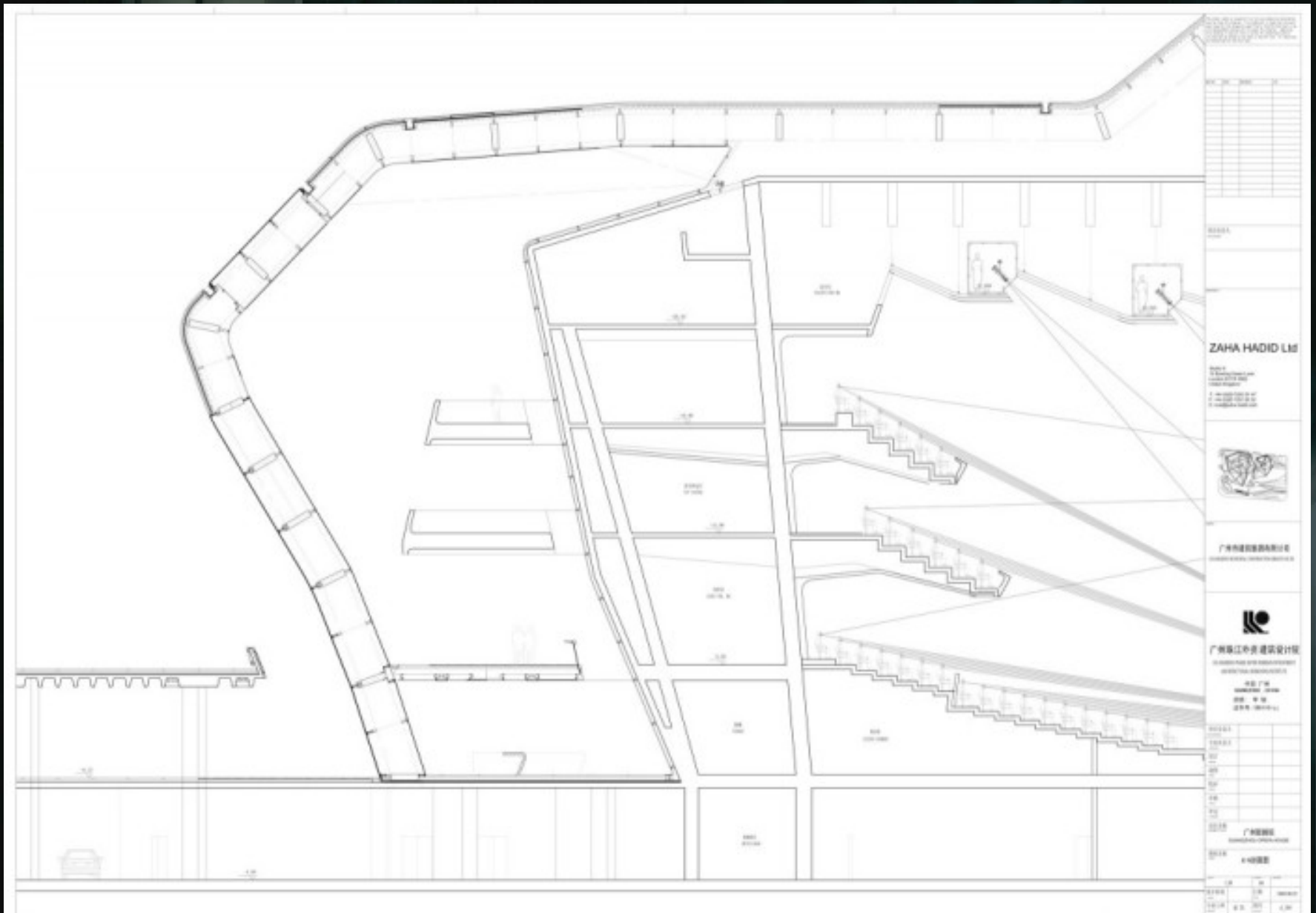


Zaha Hadid Guangzhou Opera House





Zaha Hadid Guangzhou Opera House



Zaha Hadid Guangzhou Opera House



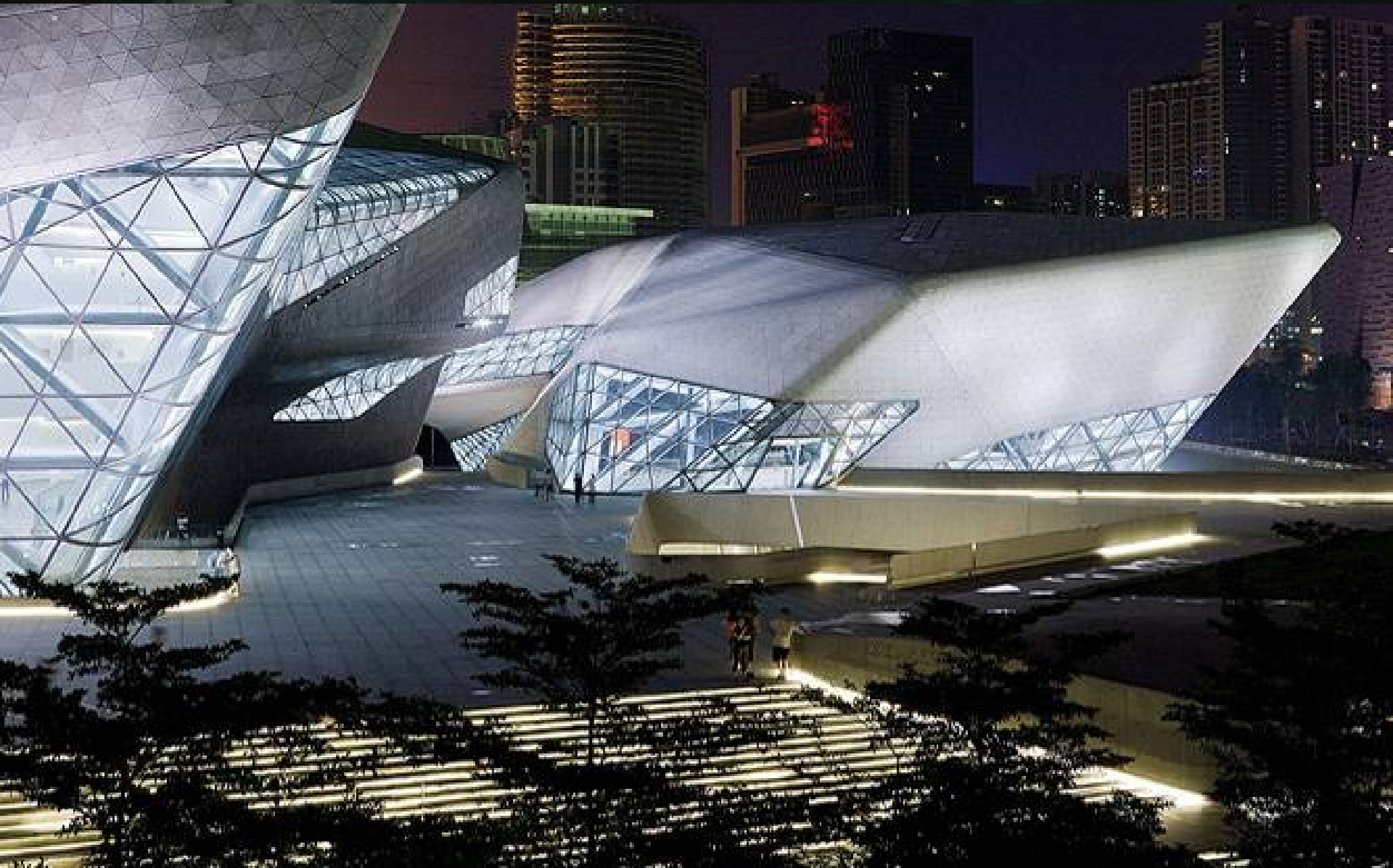
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Zaha Hadid Guangzhou Opera House



Zaha Hadid Guangzhou Opera House

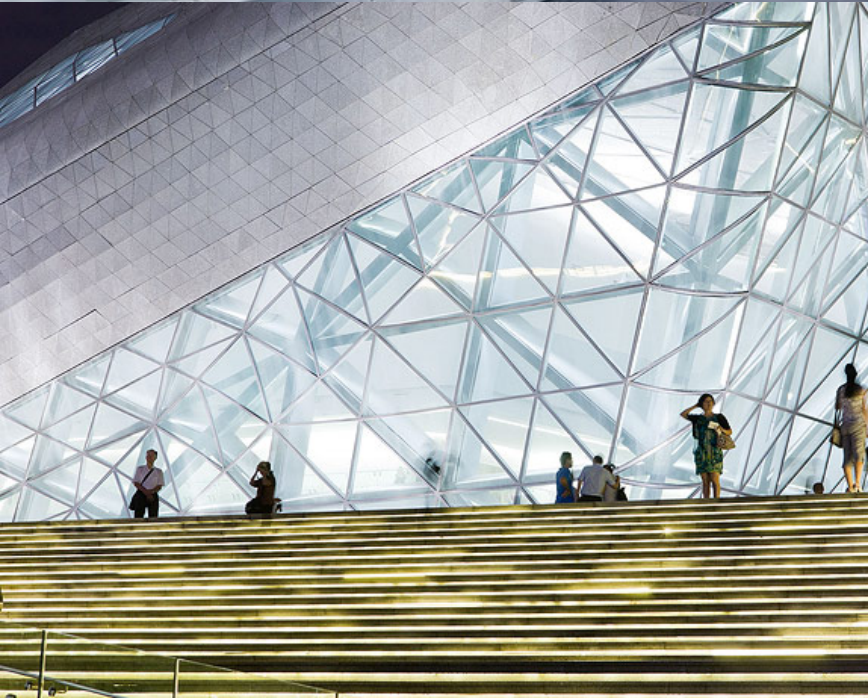


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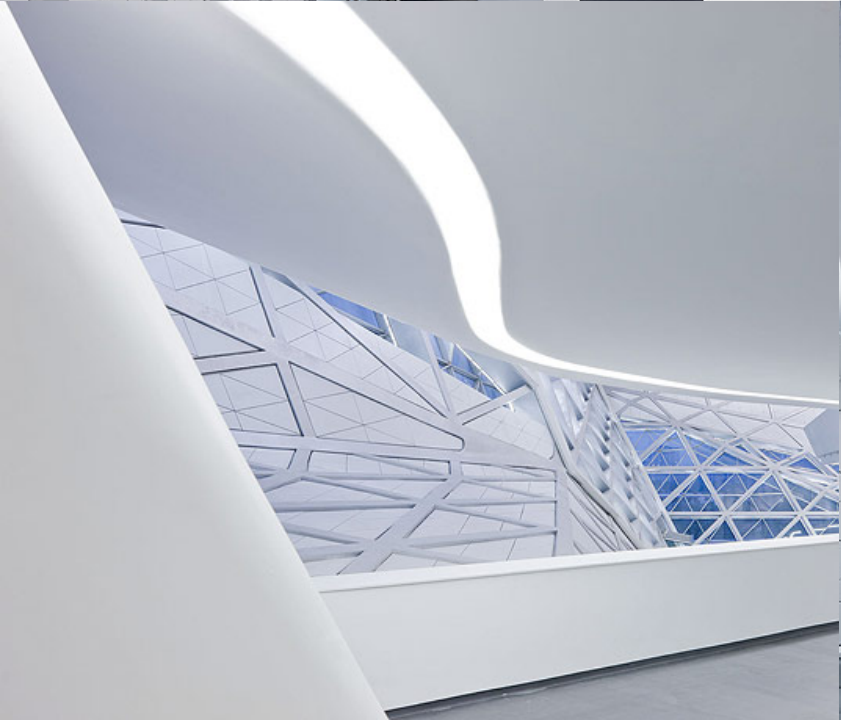


Zaha Hadid Guangzhou Opera House

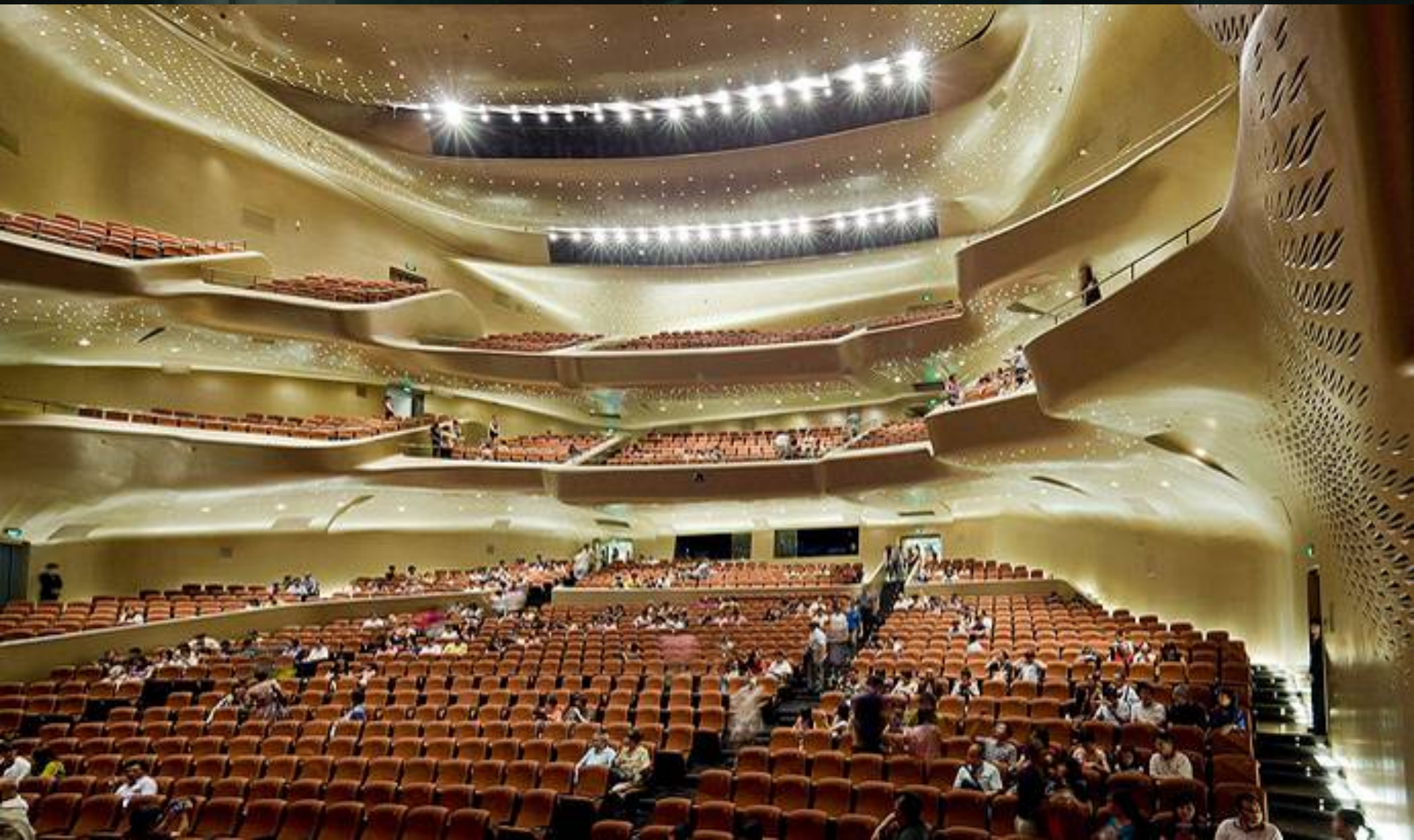














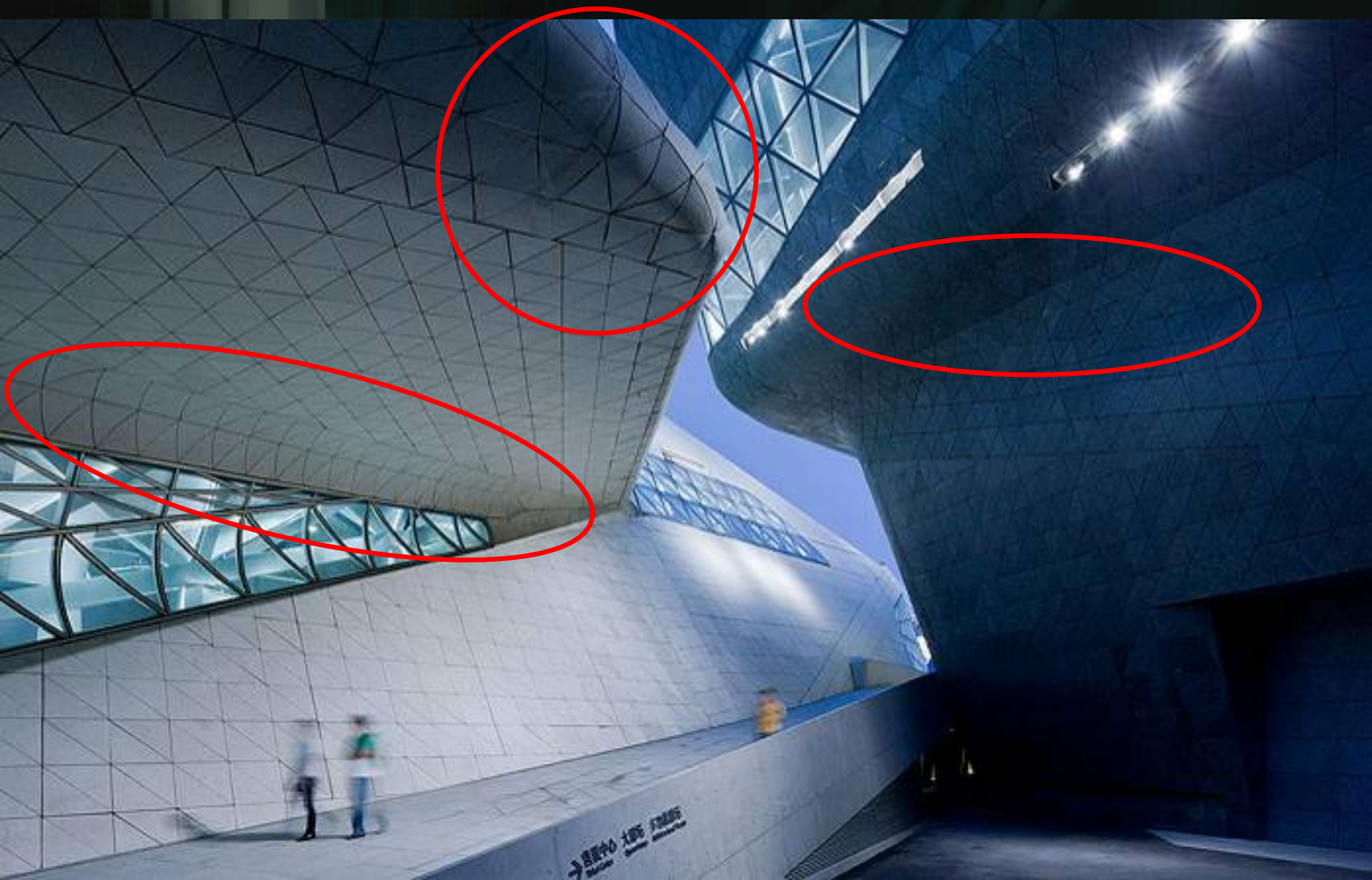


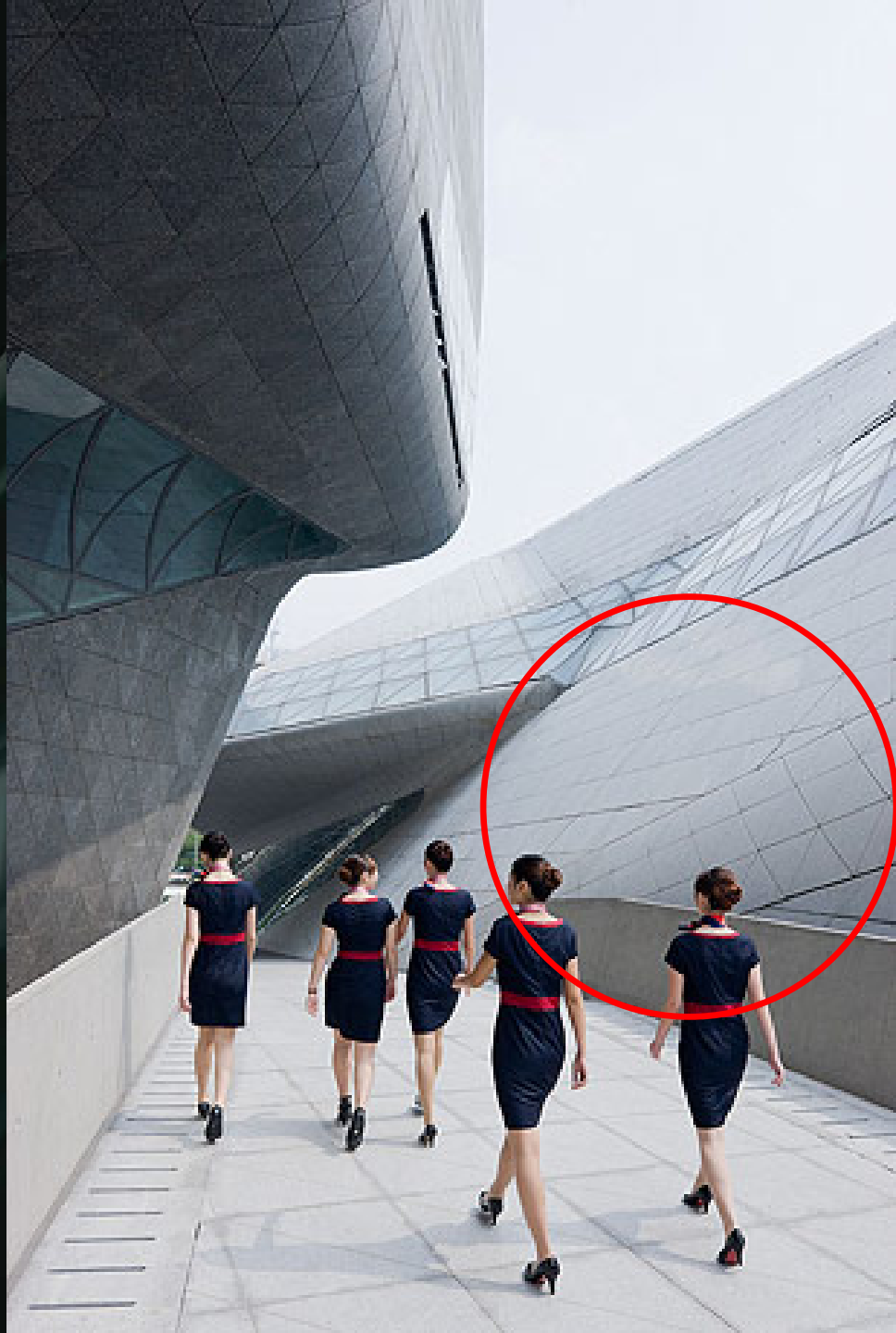


Excited? But wait.....



Zaha Hadid Guangzhou Opera House



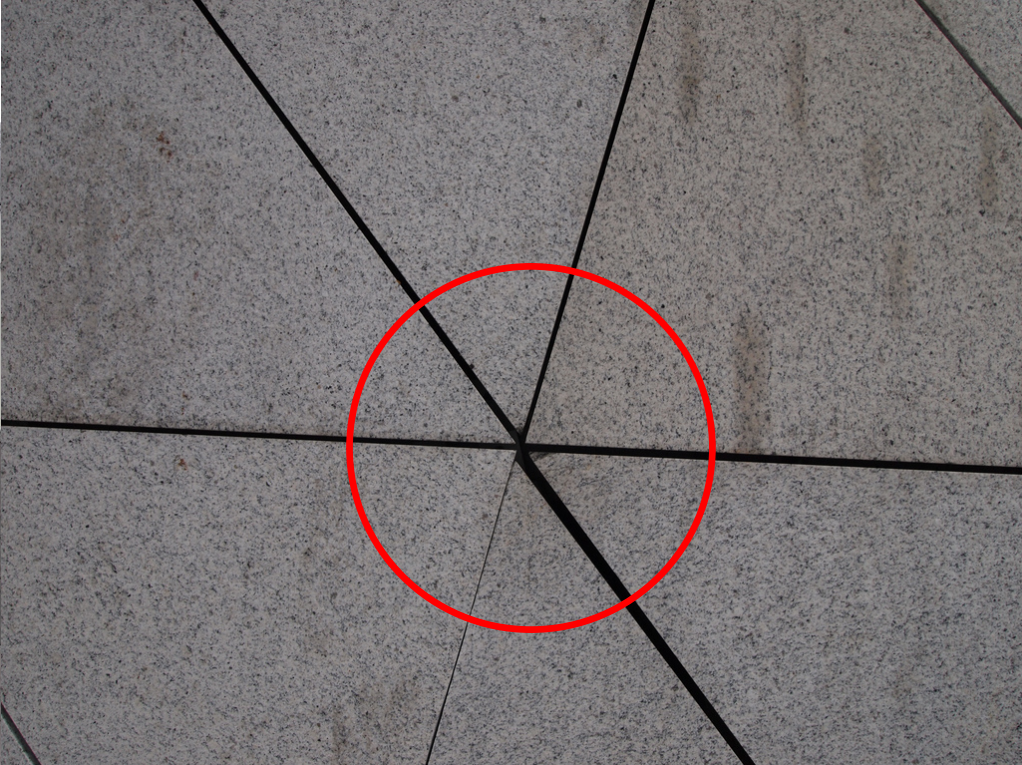
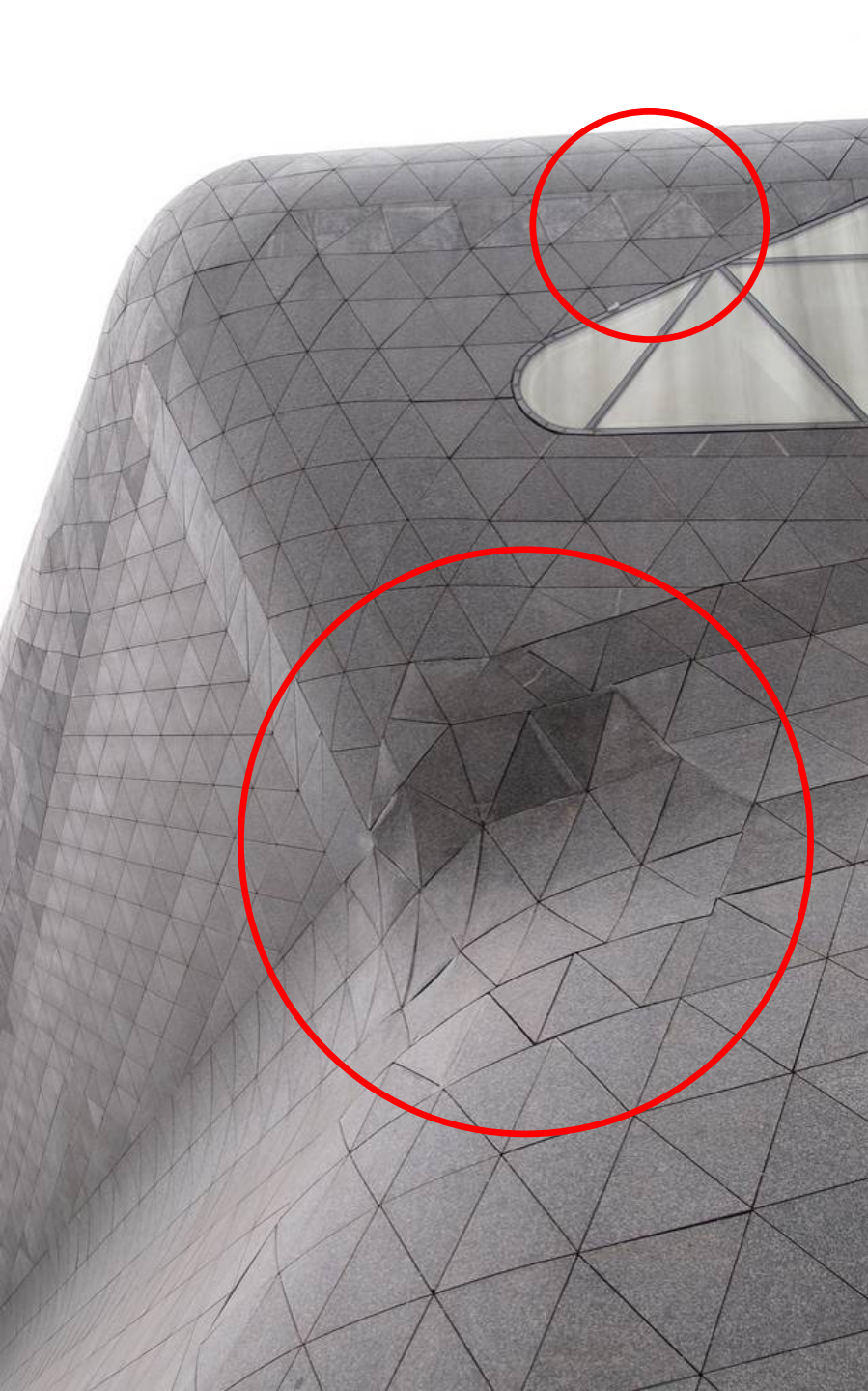


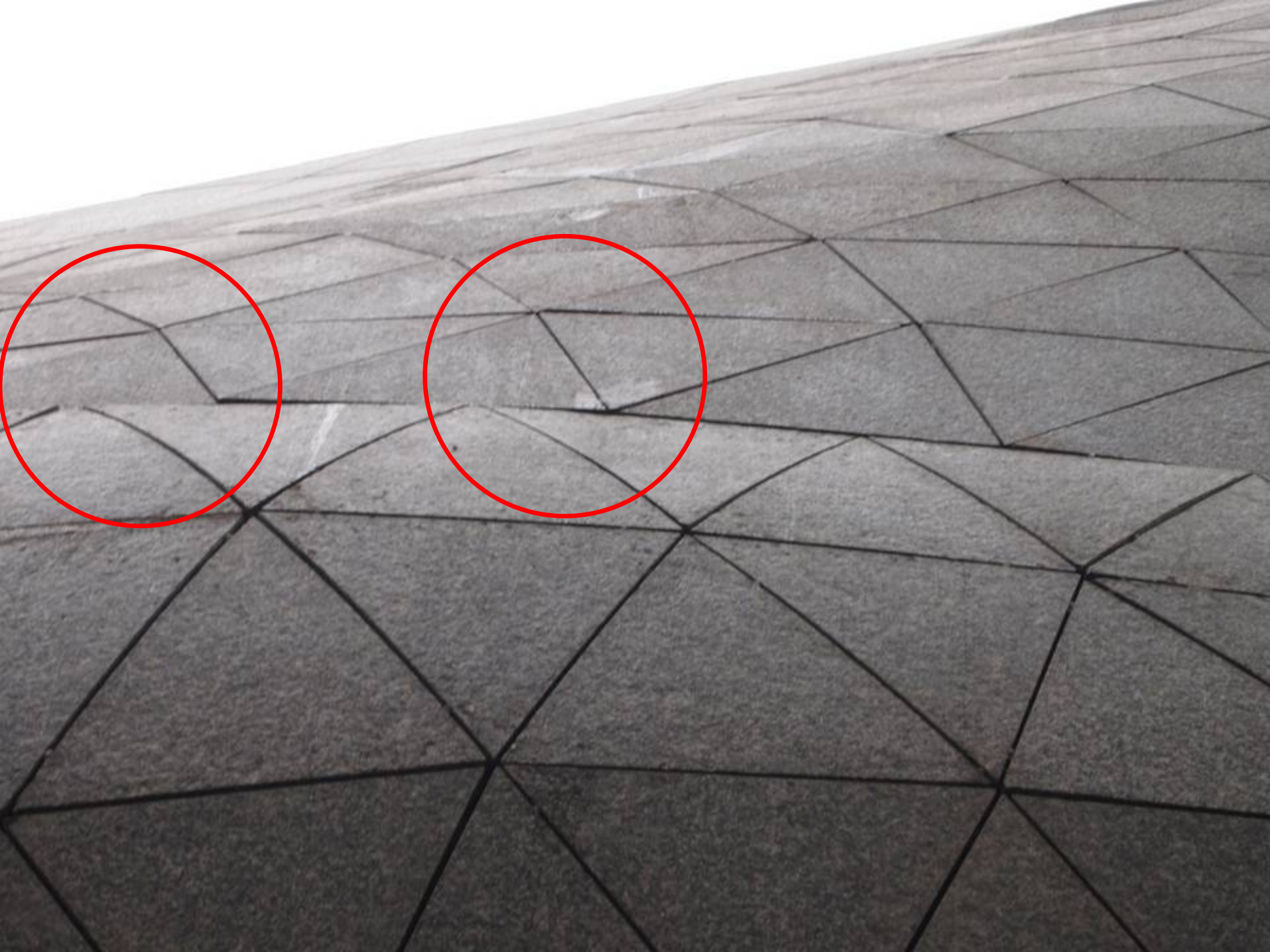




合景国际金融广场 International Finance Plaza







SCULPTURE

vs

ARCHITECTURE



Purely decorative, NO accommodation

Built by Sculptor (Designer)

Materials freedom of choice - malleable

Direct production

Changes as one thinks fit

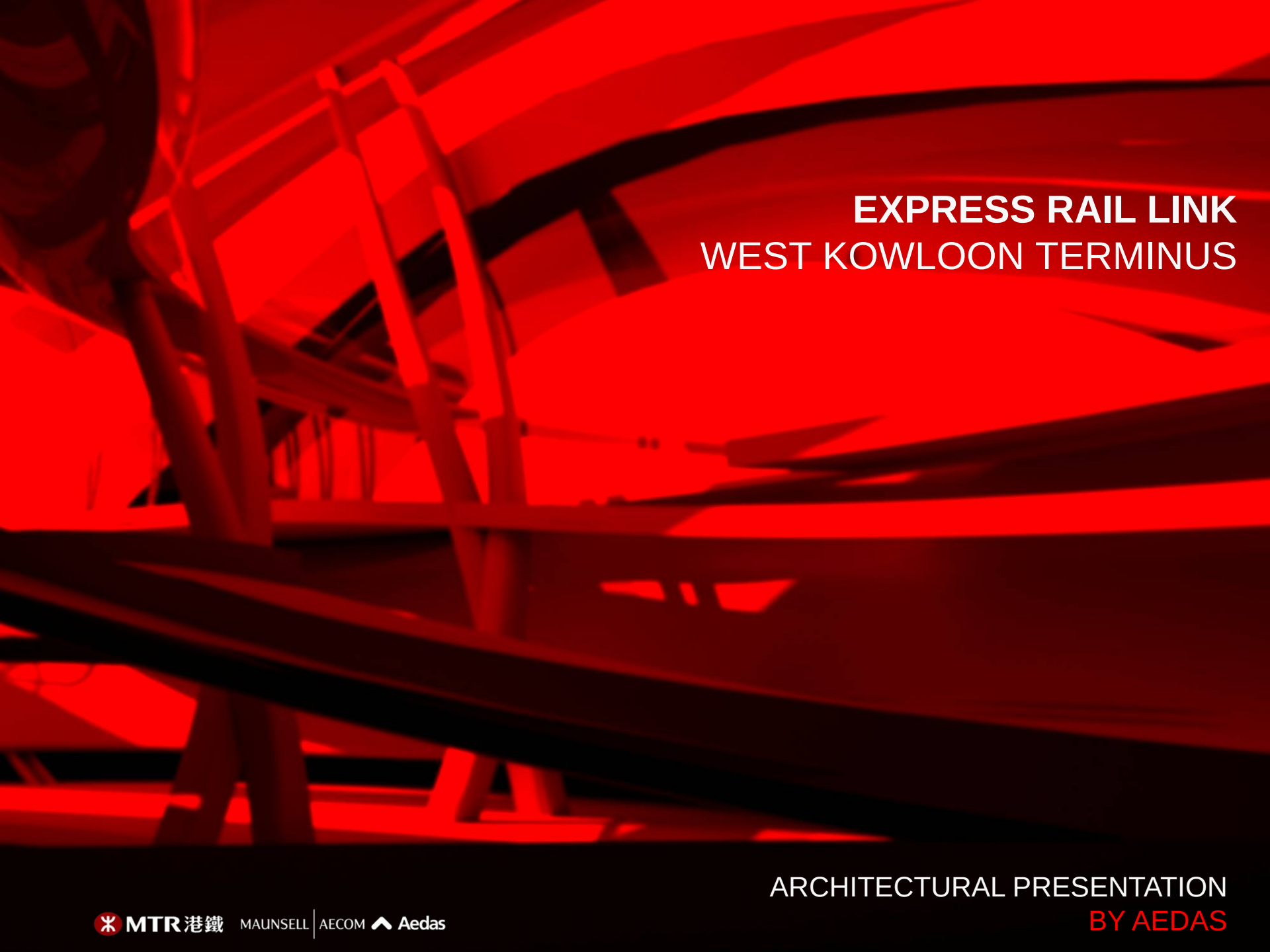
Accommodations - area, uses, clear height, travel distance constraints

Built by Workers (Not Designer)

Large size, material built up by sticks, sheets

Drawings – form of communications

Record of Changes => \$ and Time



EXPRESS RAIL LINK WEST KOWLOON TERMINUS

ARCHITECTURAL PRESENTATION
BY AEDAS

TERMINUS STATION



CONTEXT



FROM / TO
GUANGZHOU

SITE

WEST KOWLOON

TSIM SHA TSUI

VICTORIA
HARBOUR

HONG KONG
ISLAND SKYLINE



CONTEXT

PTI

KOWLOON STATION
(AIRPORT EXPRESS)

SITE

FUTURE
AUSTIN
STATION
(MTR)



TERMINUS STATION



CONVERGING FORCES

RAIL TO CHINA

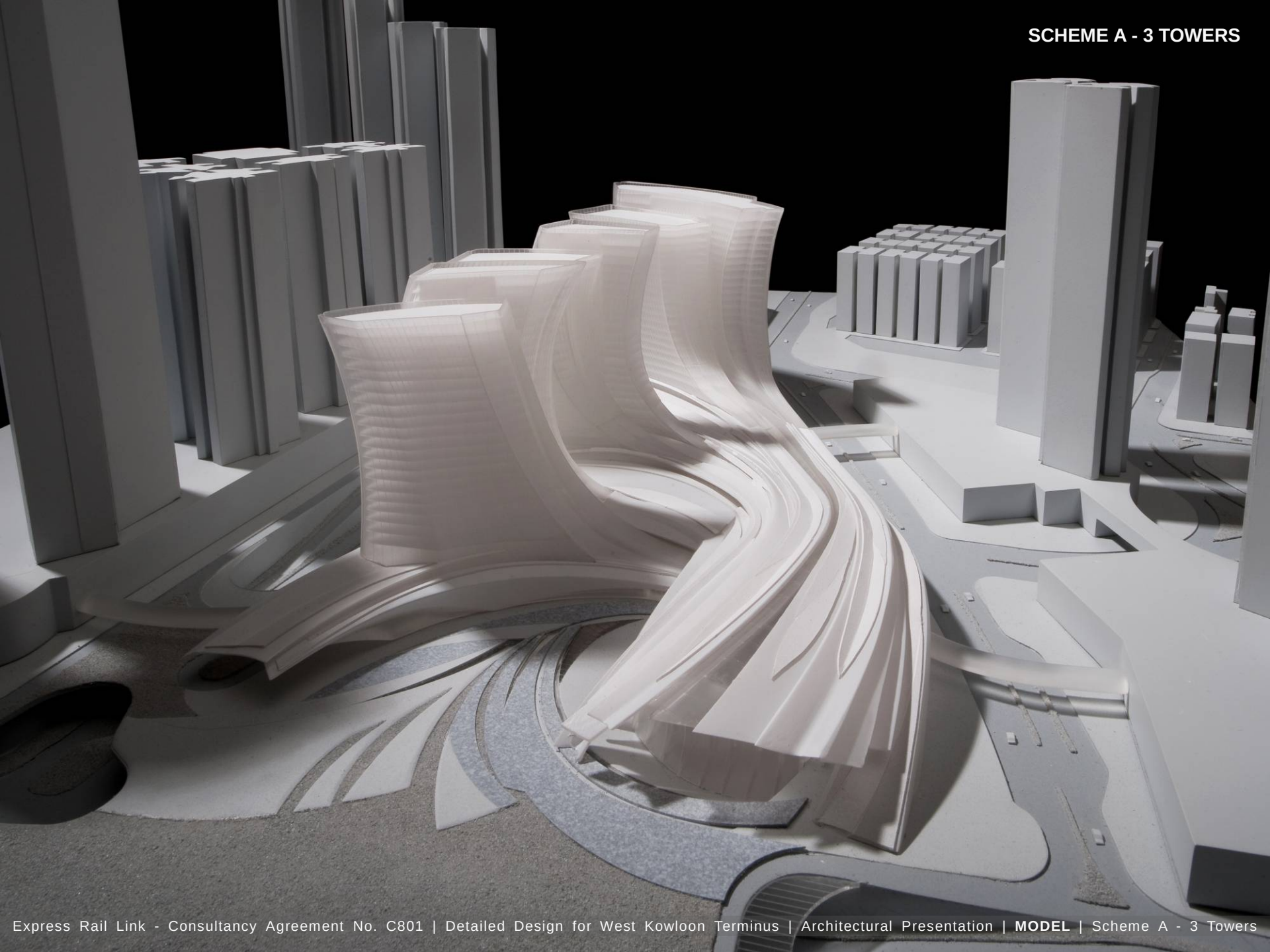
SCHEME A - 3 TOWERS

WIND

VEHICULAR
CIRCULATION

PEDESTRIAN
CONNECTIONS

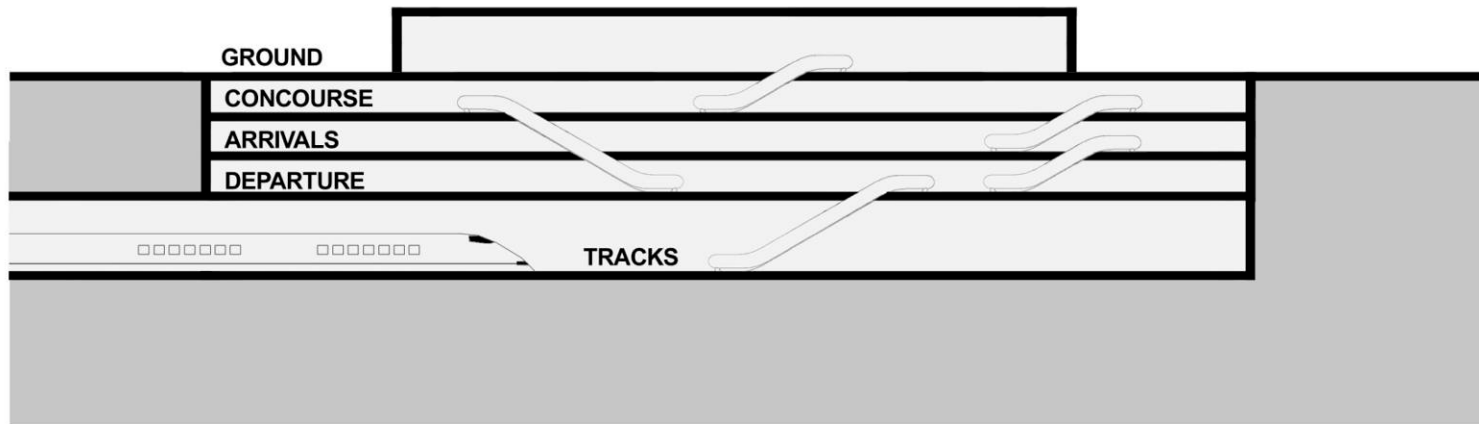
PEDESTRIAN
CONNECTION
TO WKCD



HOLISTIC

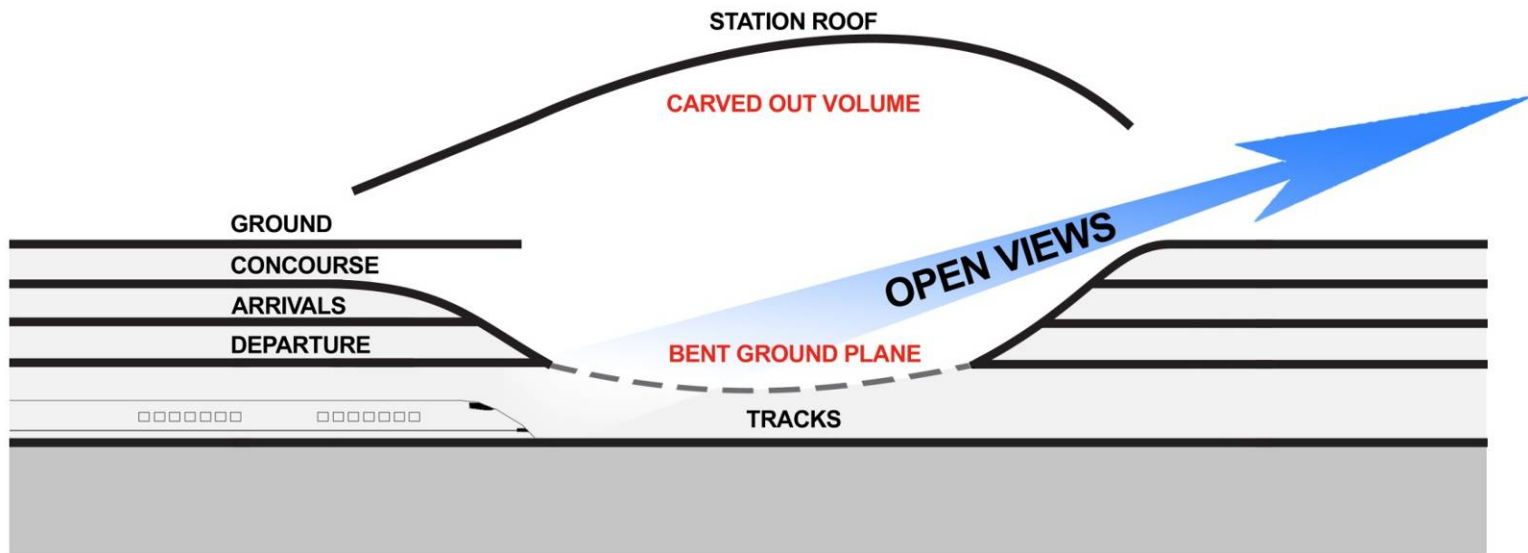


SCHEME A



TRADITIONAL UNDERGROUND STATION

Perceptually No Awareness of Surrounding Environment



PROPOSED UNDERGROUND STATION

Awareness of Surrounding Environment

DESIGN A "BELOW GROUND STATION"
TO NOT FEEL "BELOW GROUND"

• IMMEDIATE SENSE OF ARRIVING INTO HONG KONG



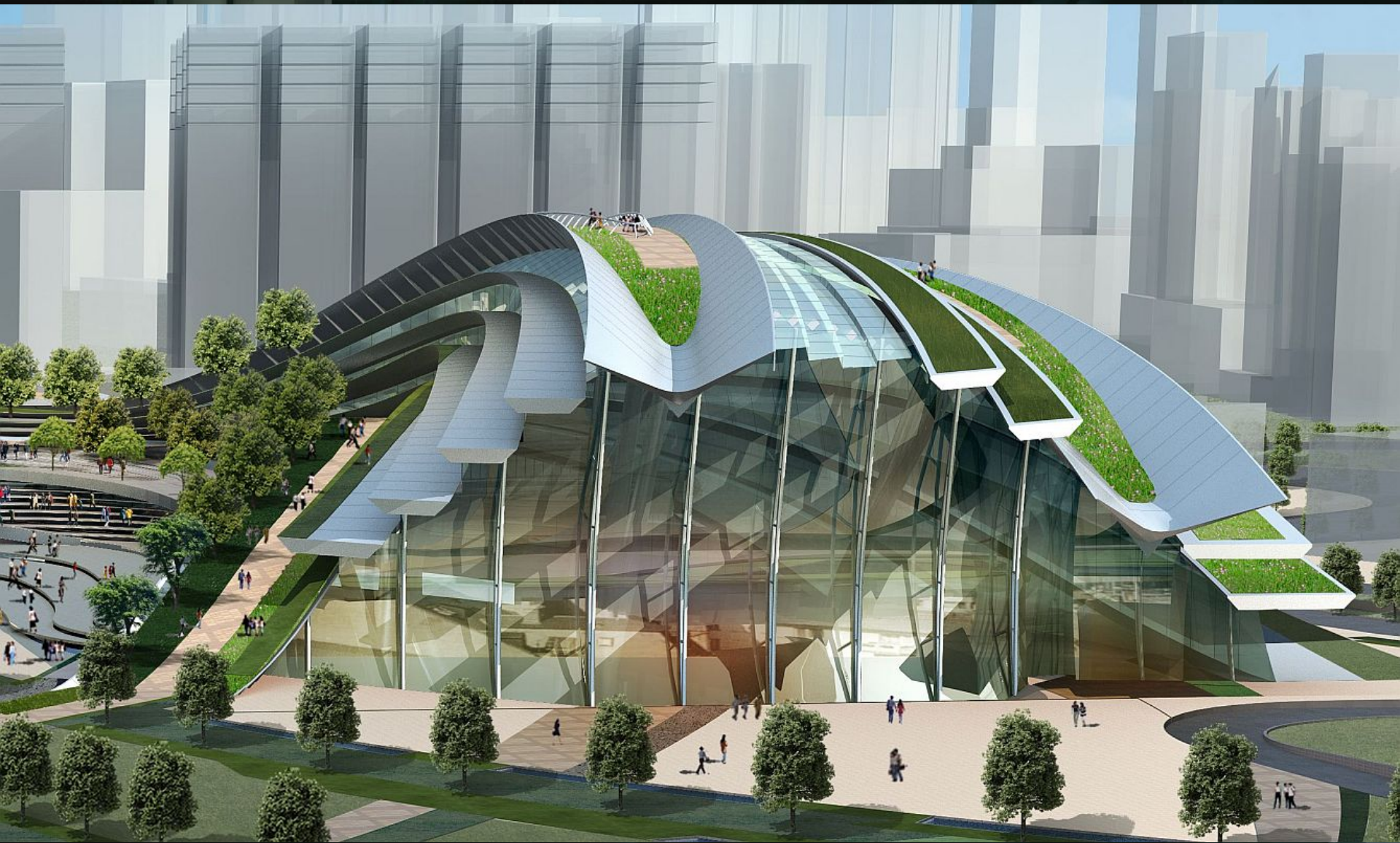
INTEGRATED

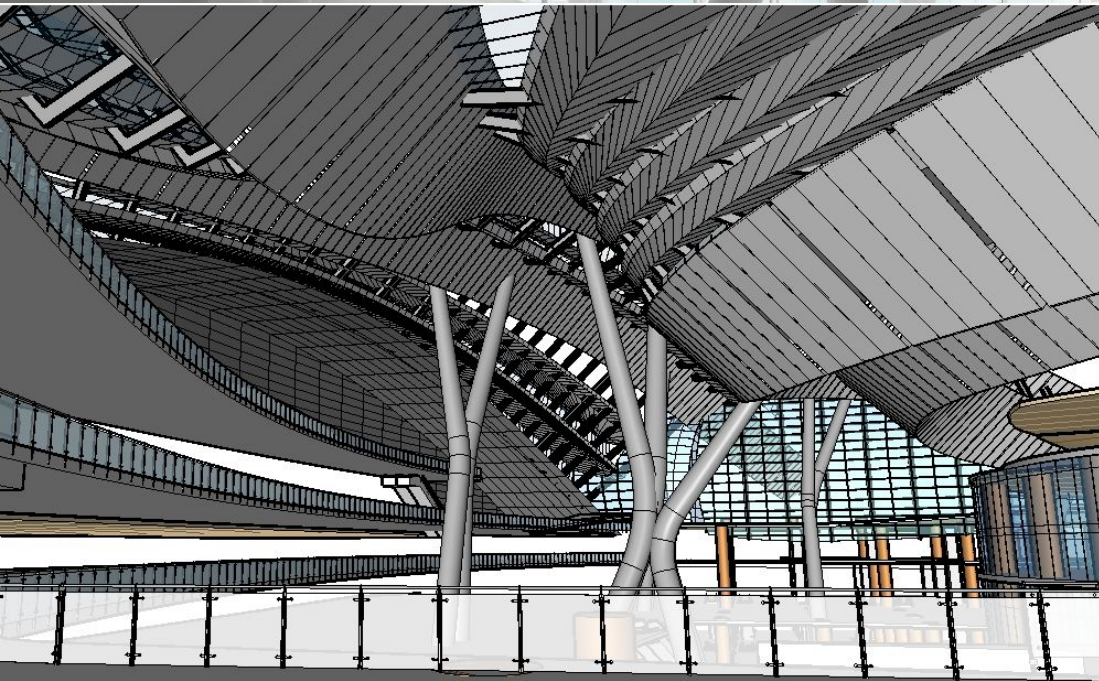
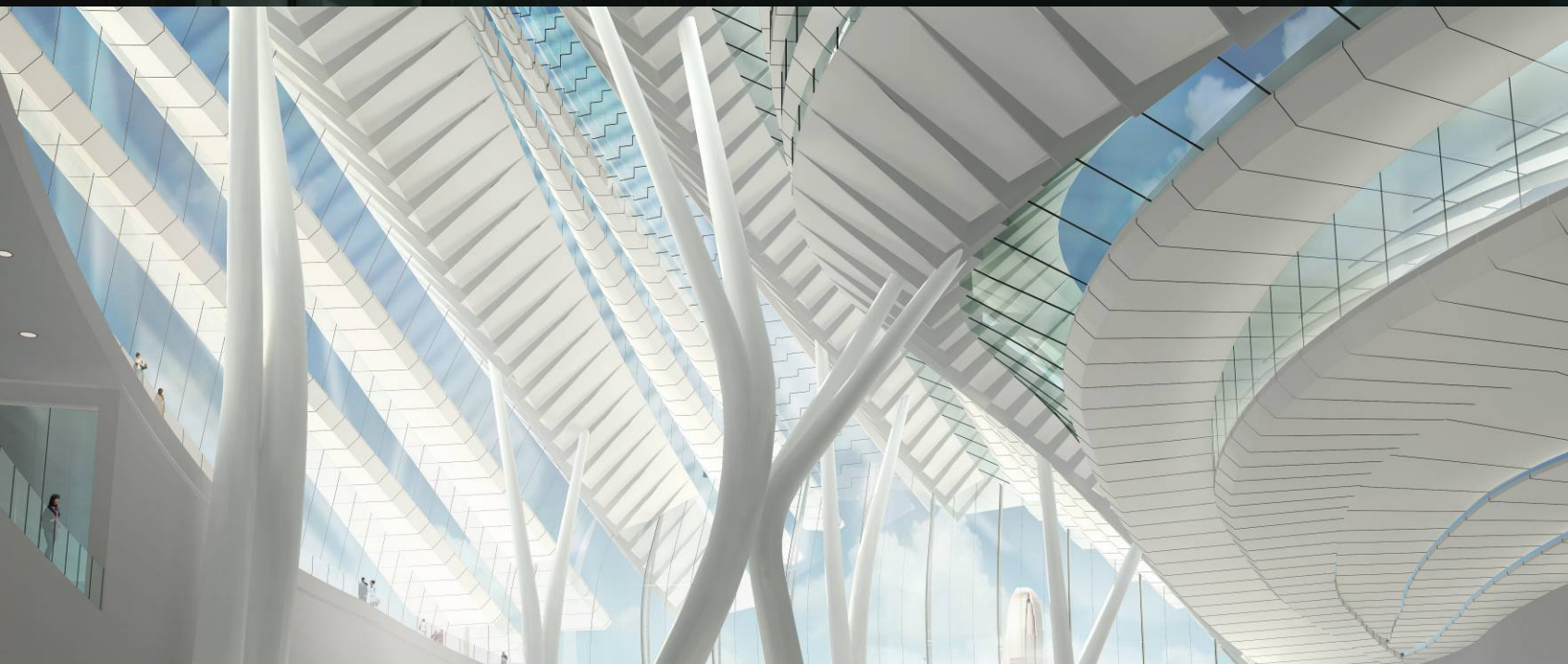


VIEW TOWARDS CITY

- Sustainable
- Public Interaction









DESIGN

RHINO



PANELIZATION

GRASSHOPPER



EXPORT

DATABASE

REVIT API



IMPORT

RATIONALIZATION

REVIT API



BIM RECREATION

REVIT



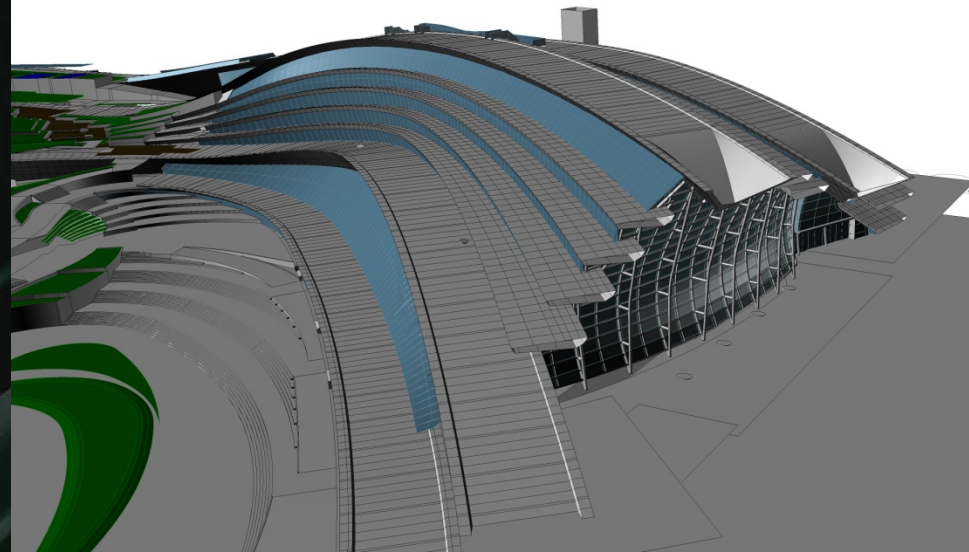
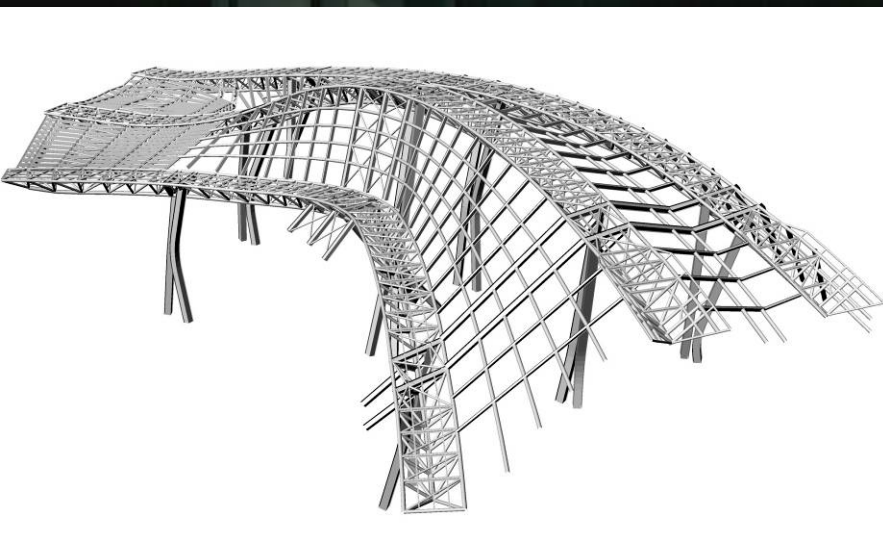
DOCUMENTATION

REVIT



TENDER

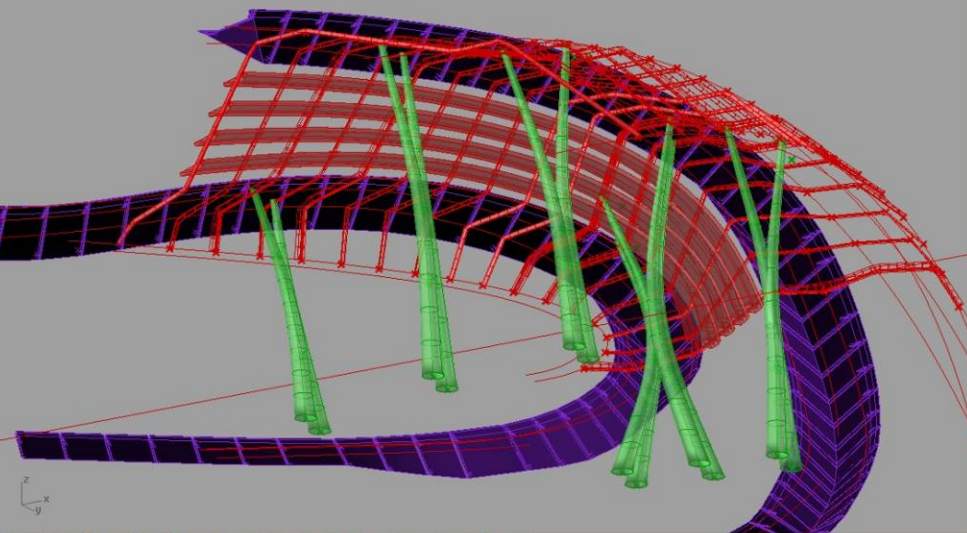
MANUF/CONSTRUCTION



COLUMN HEAD STUDY - Rhinoceros [Commercial] - [Perspective]

File View Curve Surface Solid Mesh Dimension Transform Tools Analyze Render Help
 Hide
 Invert
 Instances, 111 hatches, 452 points, 1924 curves, 117 polysurfaces, 126 surfaces, 36 text added to selection.
 Hide

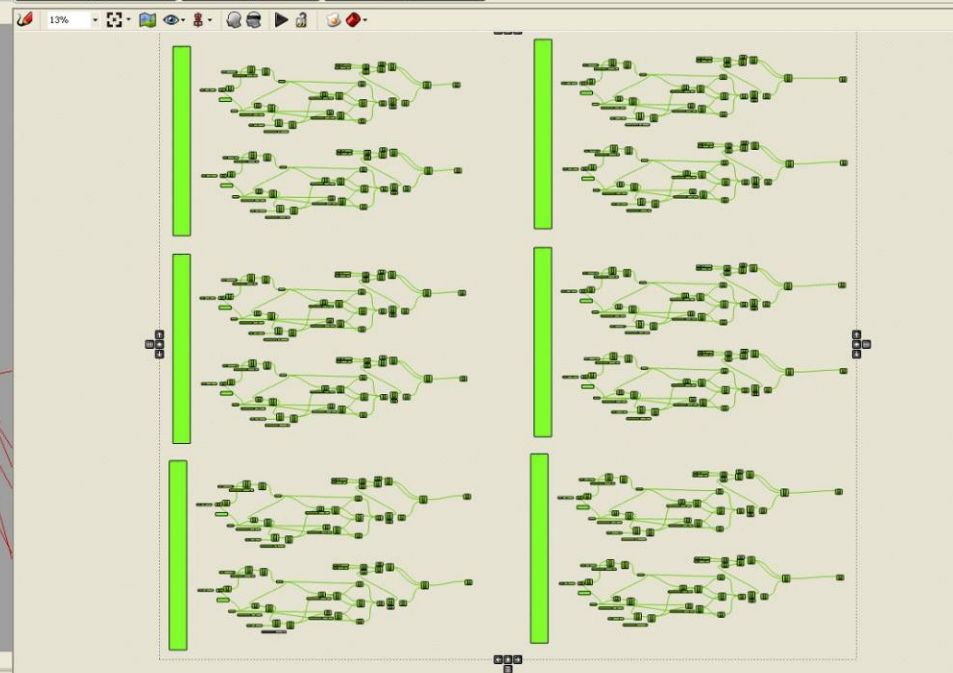
Perspective

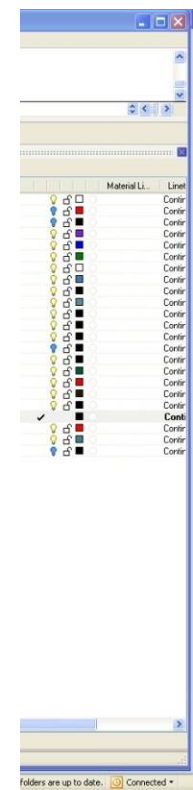
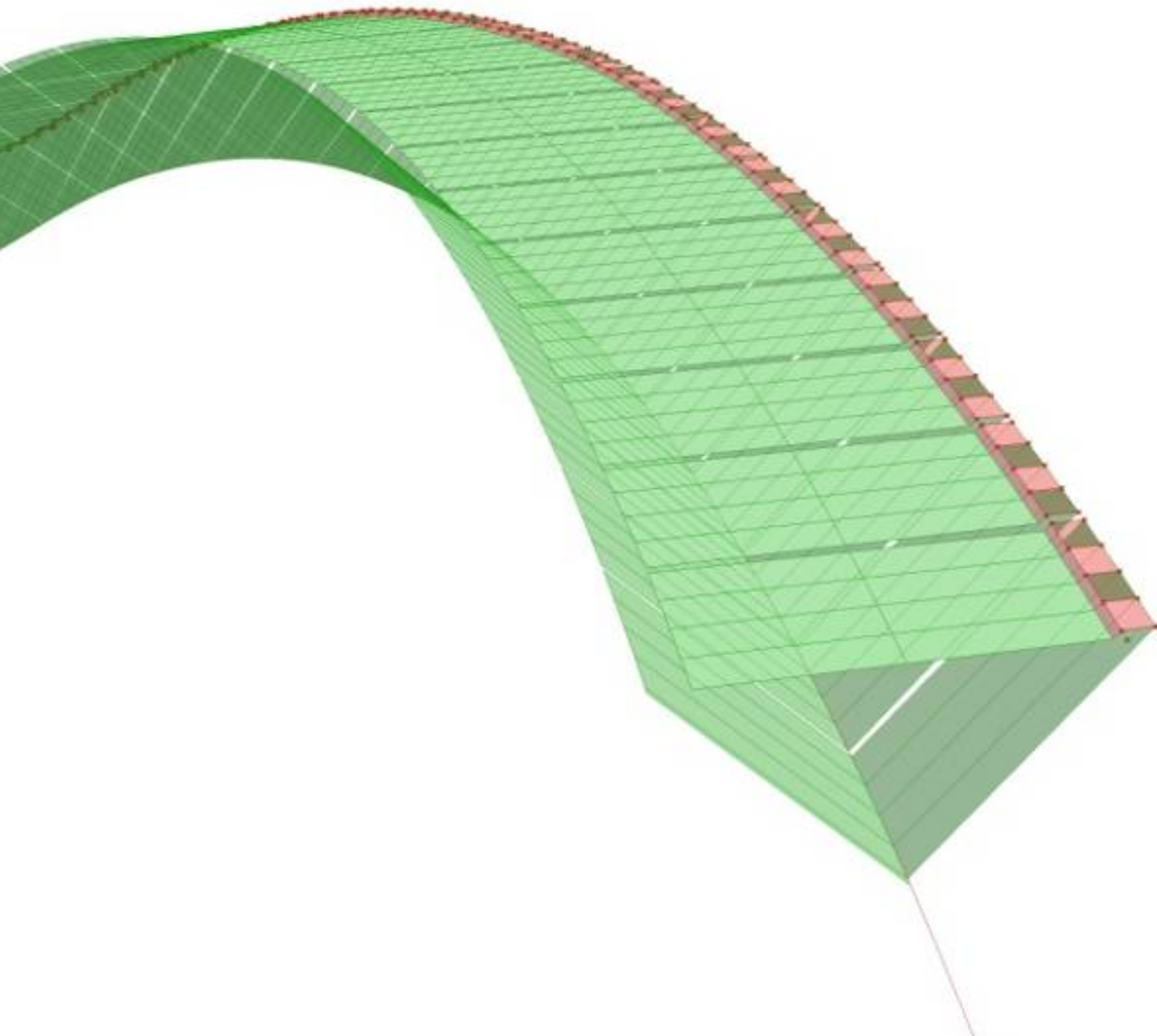


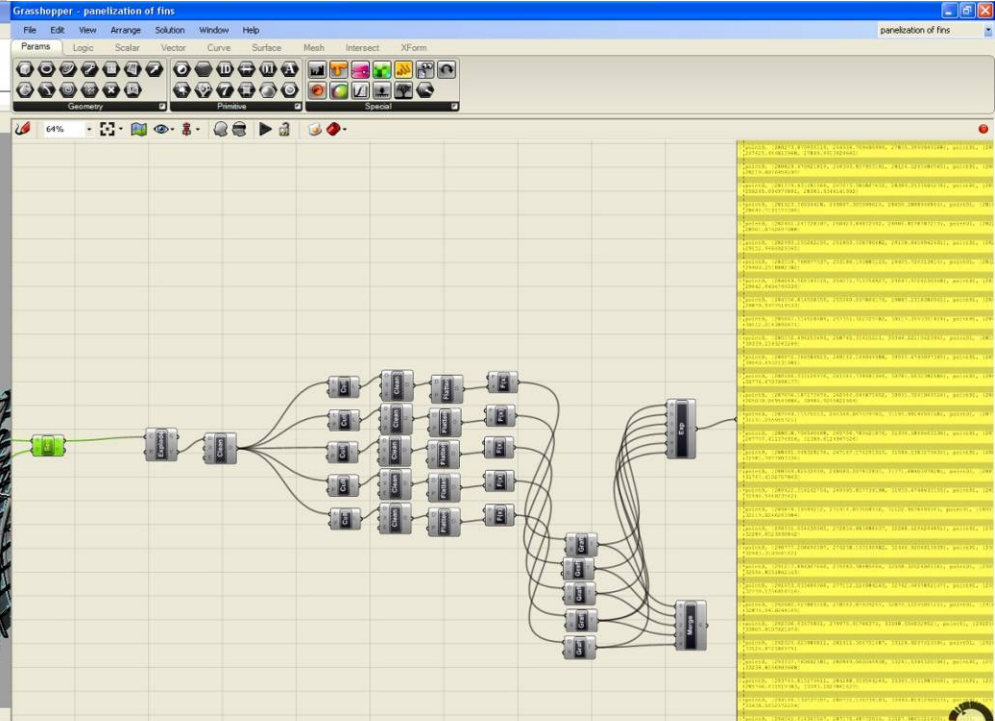
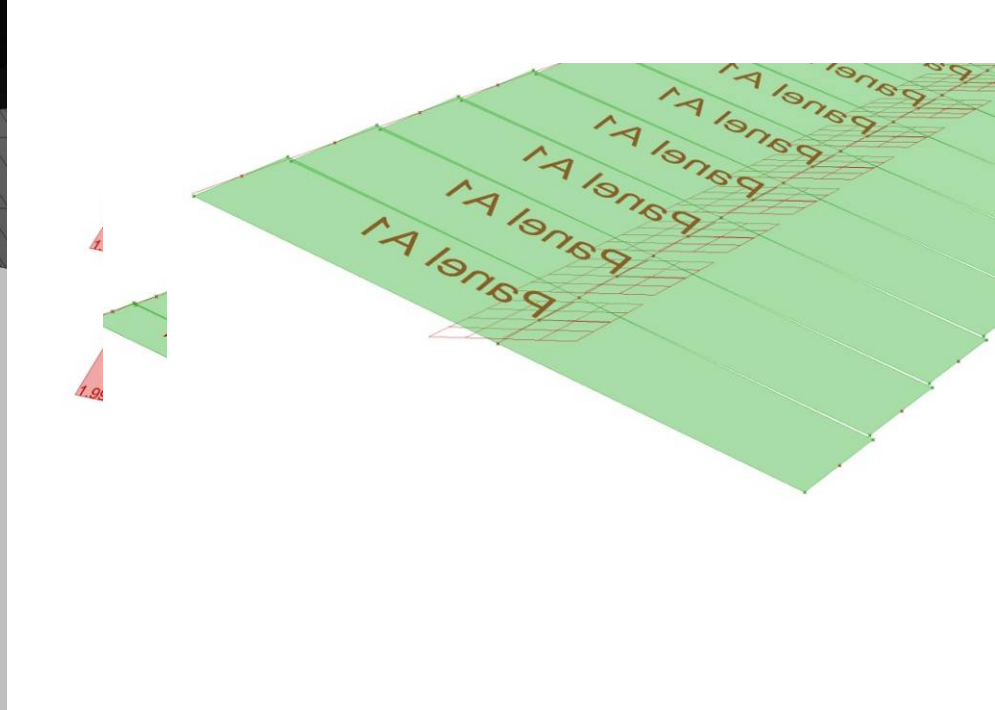
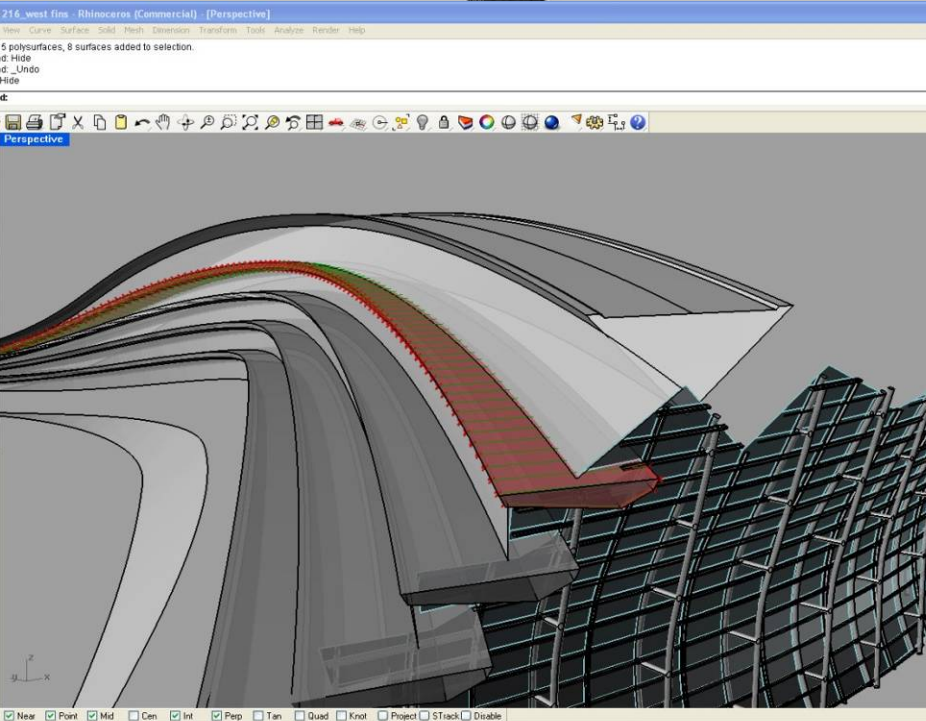
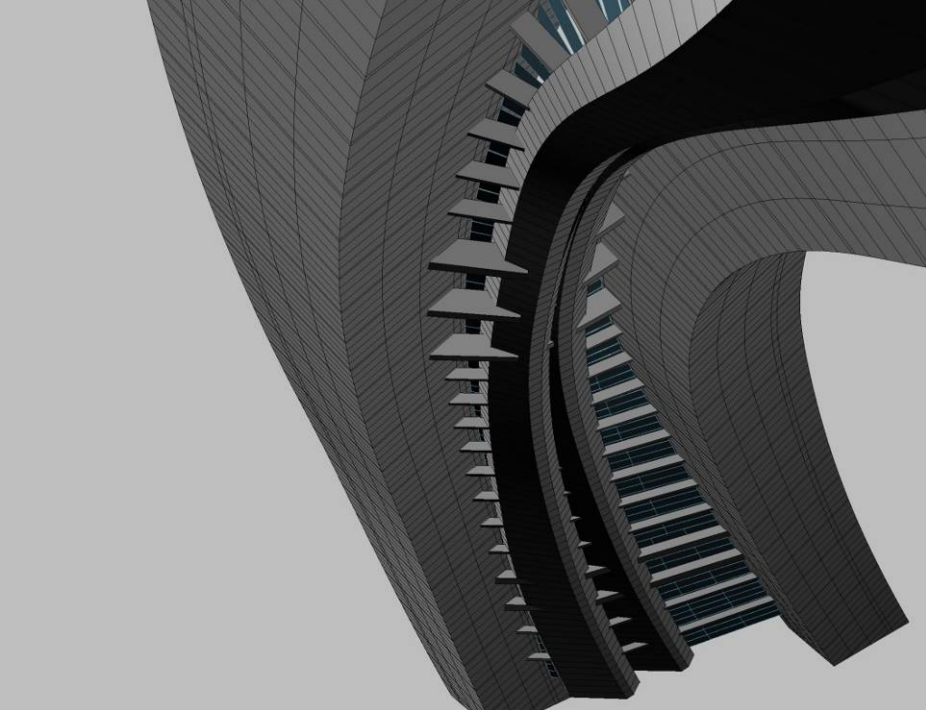
356.991 y 191.236 z 0.000 0.000 Layer 12 Snap Ortho Planar Osnap Record History

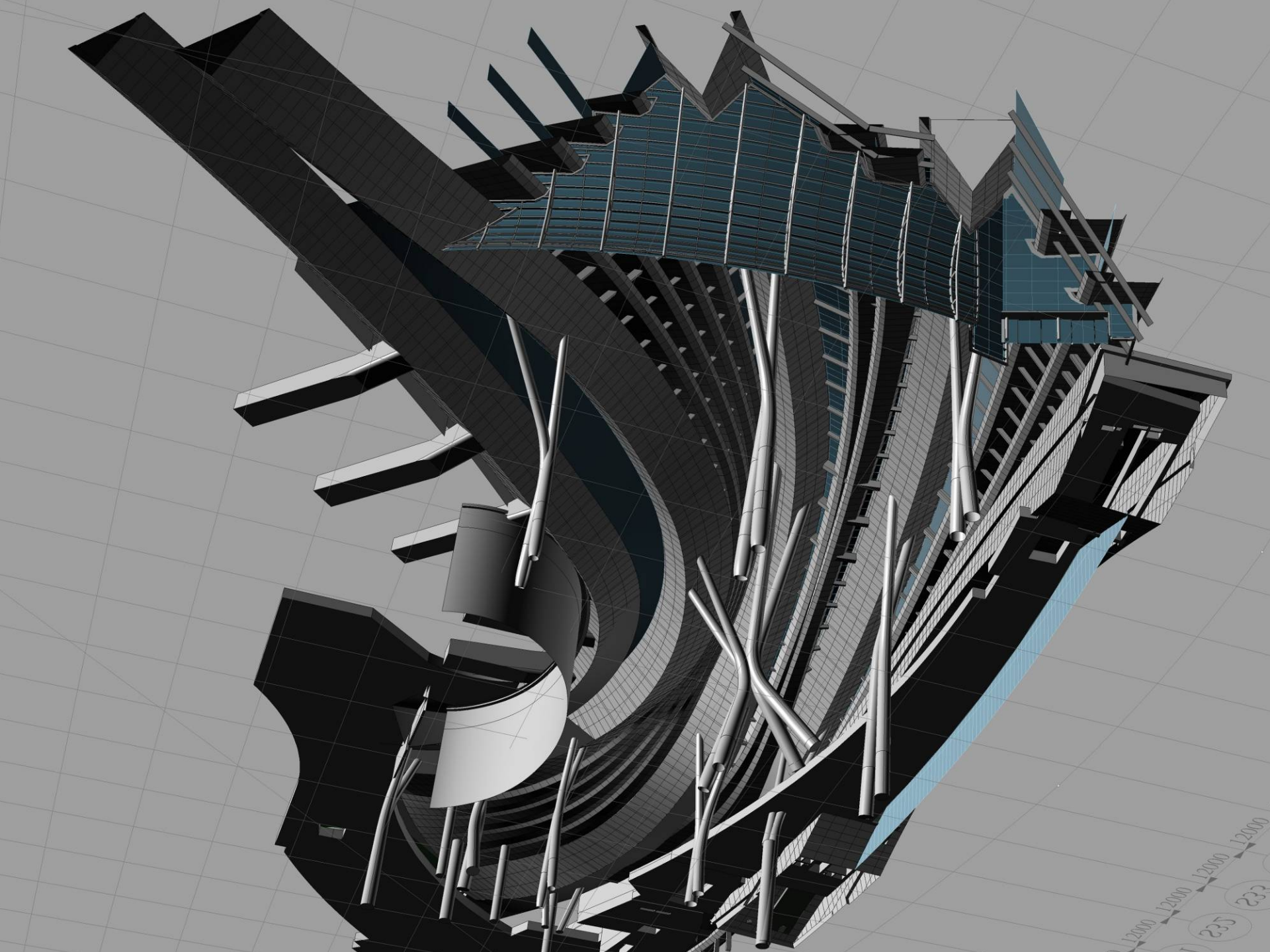
Grasshopper - column head with secondary structure until eastern arch

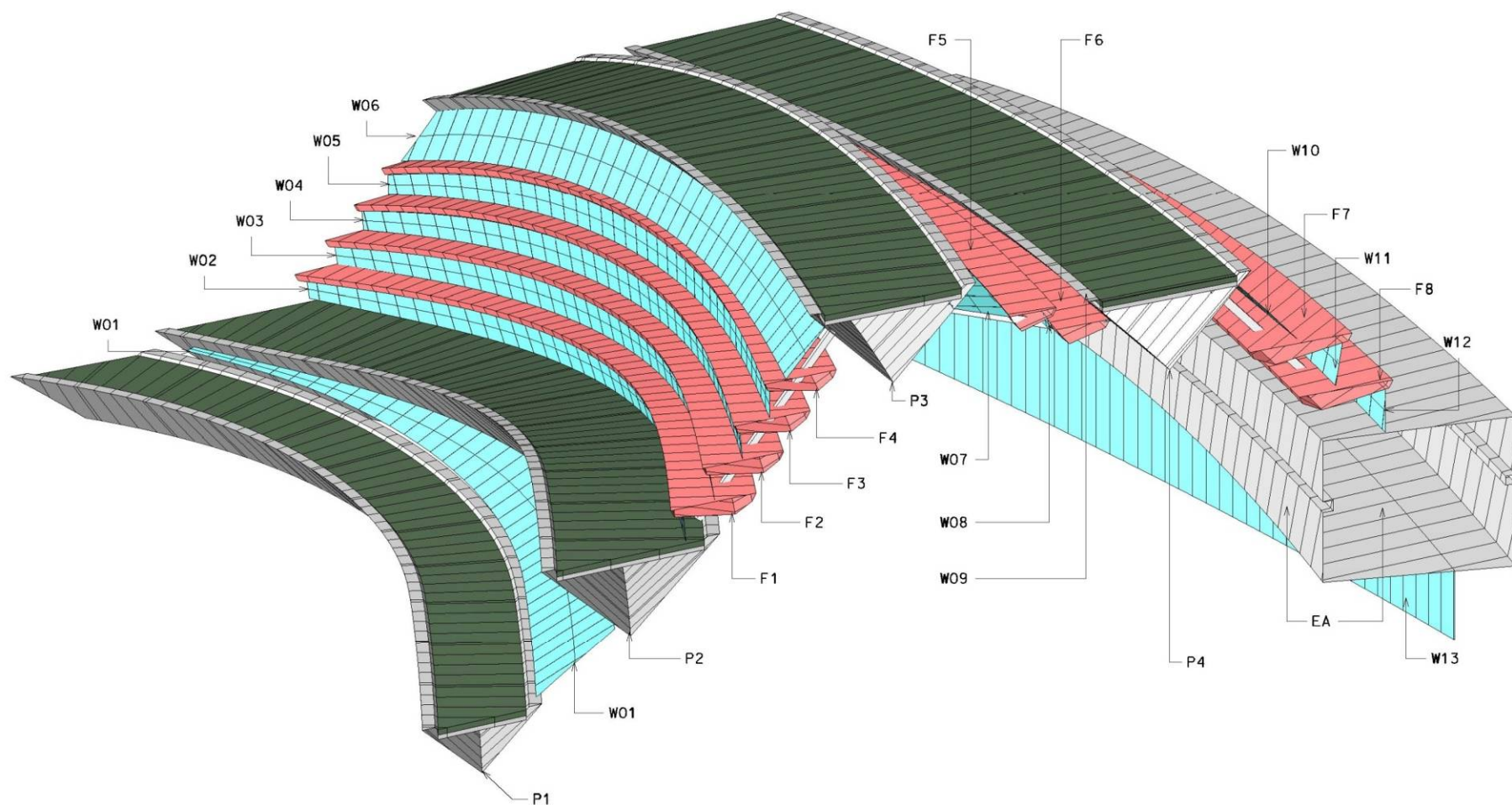
File Edit View Arrange Solution Window Help
 Params Logic Scalar Vector Curve Surface Mesh Intersect XForm
 Geometry Primitive Special

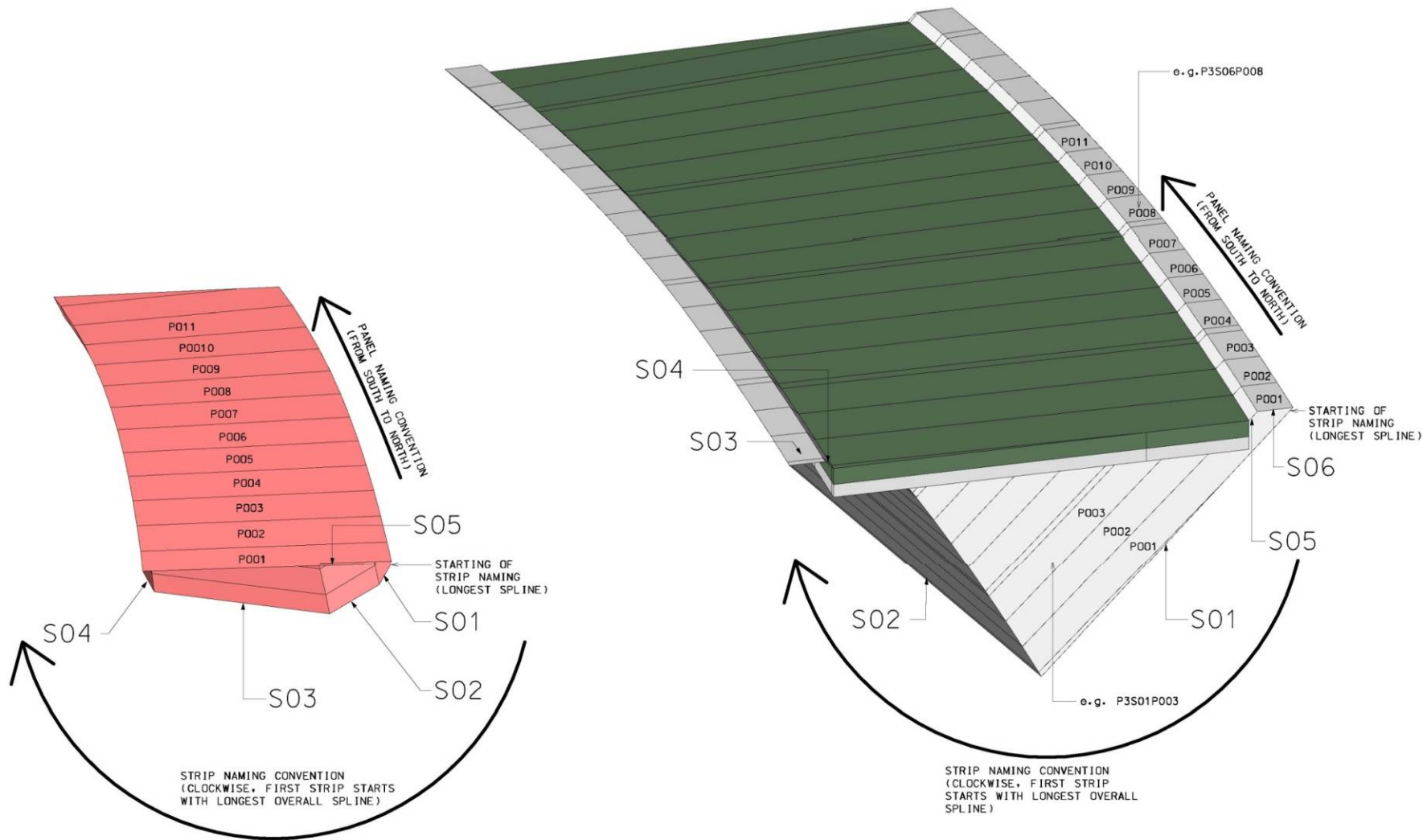












Nomenclature - Fin Cladding

② e.g. F1

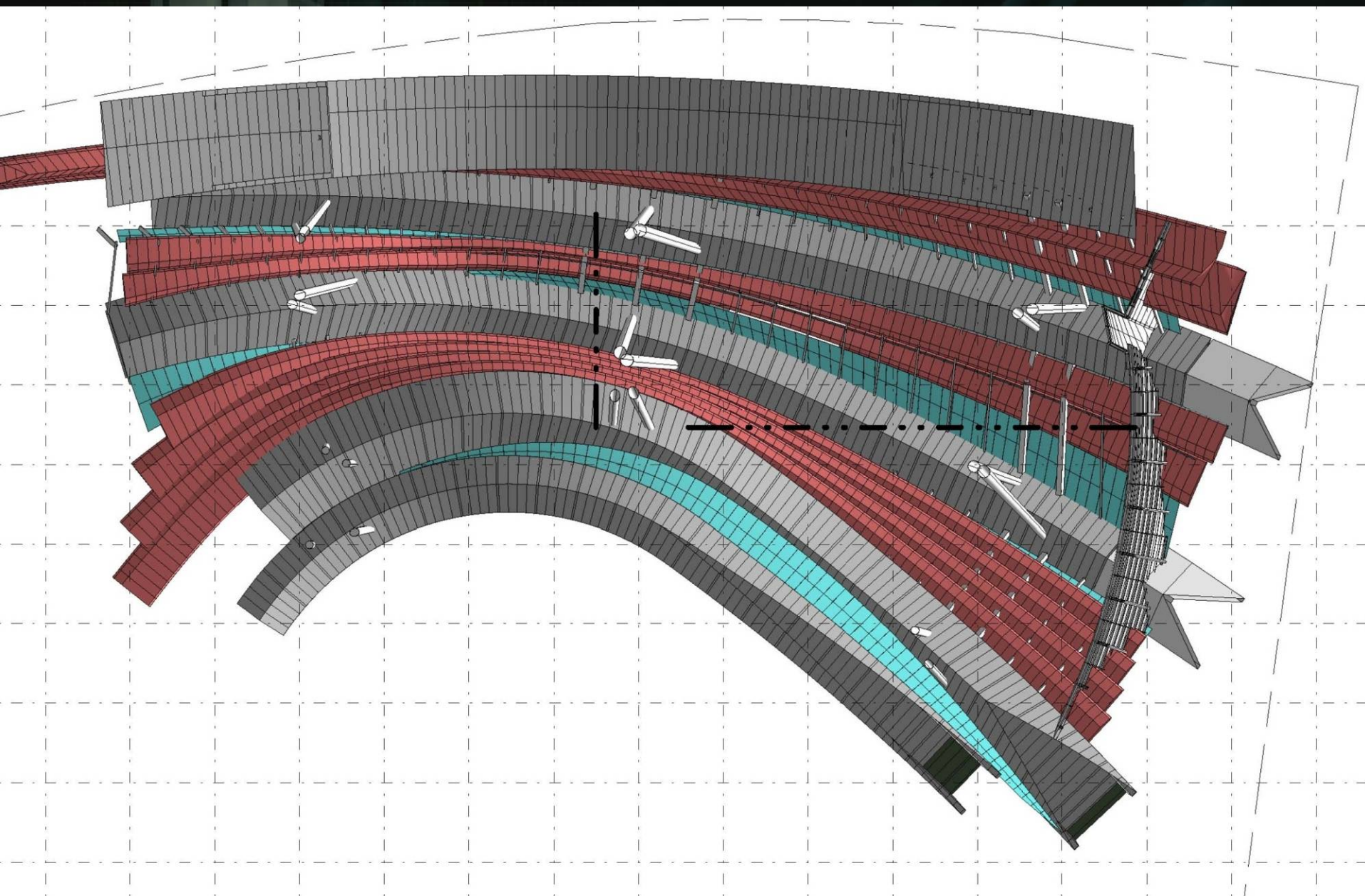
NAMING CONVENTION:
ELEMENT / STRIP(S) / PANEL(P)
E.G. F1 / SXX / PXXX
F1S03P078

Nomenclature - V Cladding

① e.g. P3

NAMING CONVENTION:
ELEMENT / STRIP(S) / PANEL(P)
E.G. P3 / SXX / PXXX
P3S17P123





	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		P01x### lengt	P01y### lengt	P01z### lengt	P02x### lengt	P02y### lengt	P02z### lengt	P03x### lengt	P03y### lengt	P03z### lengt	P04x### lengt	P04y### lengt	P04z### lengt	Panel Type###tot
2	P3S06P001	149572.632	43124.1138	30997.4089	150034.096	44497.0923	31201.1007	151479.165	44220.6936	29756.4955	151017.994	42846.0425	29553.4116	P3S06P001
3	P3S06P002	150034.096	44497.0923	31201.1007	150490.205	45872.5015	31400.2904	151935	45597.7674	29955.086	151479.165	44220.6936	29756.4955	P3S06P002
4	P3S06P003	150490.205	45872.5015	31400.2904	150940.93	47250.3052	31594.9821	152385.473	46977.2334	30149.1841	151935	45597.7674	29955.086	P3S06P003
5	P3S06P004	150940.93	47250.3052	31594.9821	151386.267	48630.4698	31785.1616	152830.57	48359.0618	30338.7828	152385.473	46977.2334	30149.1841	P3S06P004
6	P3S06P005	151386.267	48630.4698	31785.1616	151474.689	48906.7825	31822.6539	152918.944	48635.7079	30376.1616	152830.57	48359.0618	30338.7828	P3S06P005
7	P3S06P006	151474.689	48906.7825	31822.6539	151913.575	50289.7323	32007.3872	153357.585	50020.3276	30560.3477	152918.944	48635.7079	30376.1616	P3S06P006
8	P3S06P007	151913.575	50289.7323	32007.3872	152347.08	51674.9657	32187.576	153790.836	51407.2369	30740.0246	153357.585	50020.3276	30560.3477	P3S06P007
9	P3S06P008	152347.08	51674.9657	32187.576	152775.147	53062.4739	32363.2813	154218.667	52796.4316	30915.2314	153790.836	51407.2369	30740.0246	P3S06P008
10	P3S06P009	152775.147	53062.4739	32363.2813	153197.744	54452.3272	32534.6167	154641.09	54188.0429	31086.0665	154218.667	52796.4316	30915.2314	P3S06P009
11	P3S06P010	153197.744	54452.3272	32534.6167	153281.603	54730.5766	32568.3694	154724.924	54466.654	31119.7184	154641.09	54188.0429	31086.0665	P3S06P010
12	P3S06P011	153281.603	54730.5766	32568.3694	153697.624	56123.188	32734.5715	155140.841	55861.1282	31285.4274	154724.924	54466.654	31119.7184	P3S06P011
13	P3S06P012	153697.624	56123.188	32734.5715	154108.128	57517.7498	32896.4211	155551.199	57257.4509	31446.8027	155140.841	55861.1282	31285.4274	P3S06P012
14	P3S06P013	154108.128	57517.7498	32896.4211	154513.02	58914.0007	33053.6684	155955.863	58655.1793	31603.5689	155551.199	57257.4509	31446.8027	P3S06P013
15	P3S06P014	154513.02	58914.0007	33053.6684	154912.275	60311.9726	33206.0604	156354.833	60054.3601	31755.4605	155955.863	58655.1793	31603.5689	P3S06P014
16	P3S06P015	154912.275	60311.9726	33206.0604	154991.455	60591.8003	33235.9403	156433.956	60334.4167	31785.2395	156354.833	60054.3601	31755.4605	P3S06P015
17	P3S06P016	154991.455	60591.8003	33235.9403	155384.039	61992.164	33382.3144	156826.258	61735.9125	31931.1206	156433.956	60334.4167	31785.2395	P3S06P016
18	P3S06P017	155384.039	61992.164	33382.3144	155771.104	63394.5402	33523.6095	157213.036	63139.4019	32071.9532	156826.258	61735.9125	31931.1206	P3S06P017
19	P3S06P018	155771.104	63394.5402	33523.6095	156152.641	64799.0536	33659.8994	157594.329	64545.1147	32207.8035	157213.036	63139.4019	32071.9532	P3S06


```

        {
            case 'x':
                p[index].x = System.Convert.ToDouble(para.AsValueString());
                break;
            case 'y':
                p[index].y = System.Convert.ToDouble(para.AsValueString());
                break;
            case 'z':
                p[index].z = System.Convert.ToDouble(para.AsValueString());
                break;
            default:
                MessageBox.Show("Wrong format of parameter name");
                break;
        }
    }
}

CladdingPanel cl = new CladdingPanel(p, PanelCounter); // new panel created from list of points.
double Area_m2 = cl.PanelArea / 1000000; // division by 1000000 to get area in m2 from mm2

//current family type parameter is updated with value of Area_m2 ;
document.BeginTransaction();
if( symbol.ParametersMap["Area"].Set(Area_m2) == false )
{
    MessageBox.Show("Wrong parameter type");
}
document.EndTransaction();

ArrayOfPanels.Add(cl); // new panel inserted into the array of panels

output += cl.UniqueNumber + "          " + Area_m2 + " " + cl.T_edge[0] + " " + cl.T_edge[1] + " " + cl.T_edge[2] + " " + cl.T_edge[3]

// creating panel objects in space
document.BeginTransaction();
FamilyInstance instance = document.Create.NewFamilyInstance(location, symbol, StructuralType.NonStructural);
document.EndTransaction();
}
//MessageBox.Show(output);

```



```

    {
        if
        (
            Math.Abs(nextPanel.G_edge[0] - G_edge[0]) <= tolerance
            &&
            Math.Abs(nextPanel.G_edge[1] - G_edge[1]) <= tolerance
            &&
            Math.Abs(nextPanel.G_edge[2] - G_edge[2]) <= tolerance
            &&
            Math.Abs(nextPanel.G_edge[3] - G_edge[3]) <= tolerance
            &&
            Math.Abs(nextPanel.G_diagonal_1 - G_diagonal_1) <= tolerance * Math.Sqrt(2)
        )
        { return true; }
        else
        { return false; }
    }

}

#endregion

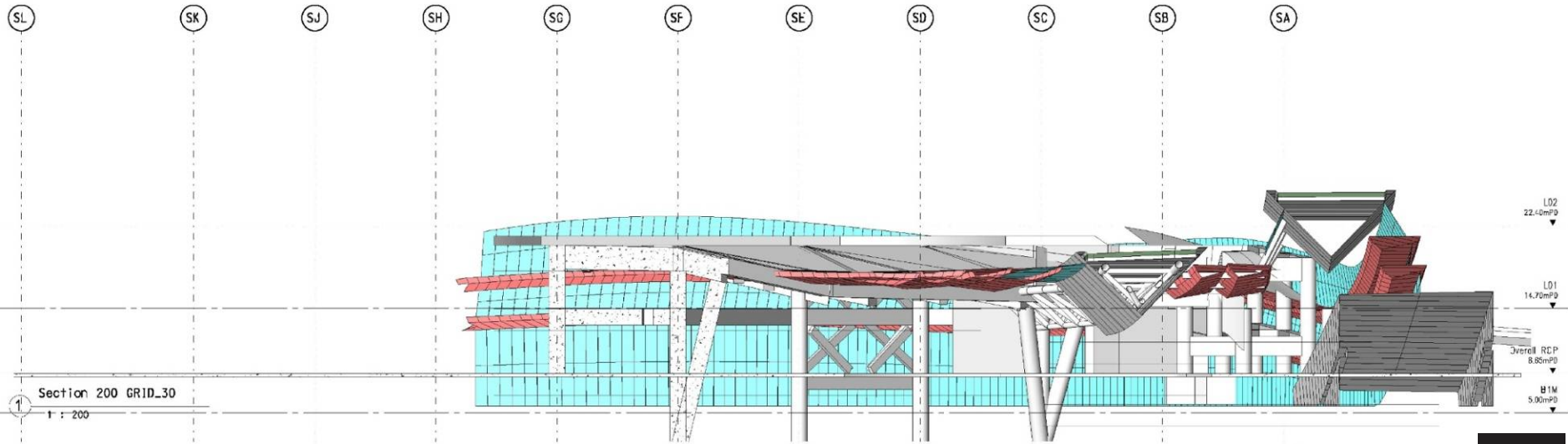
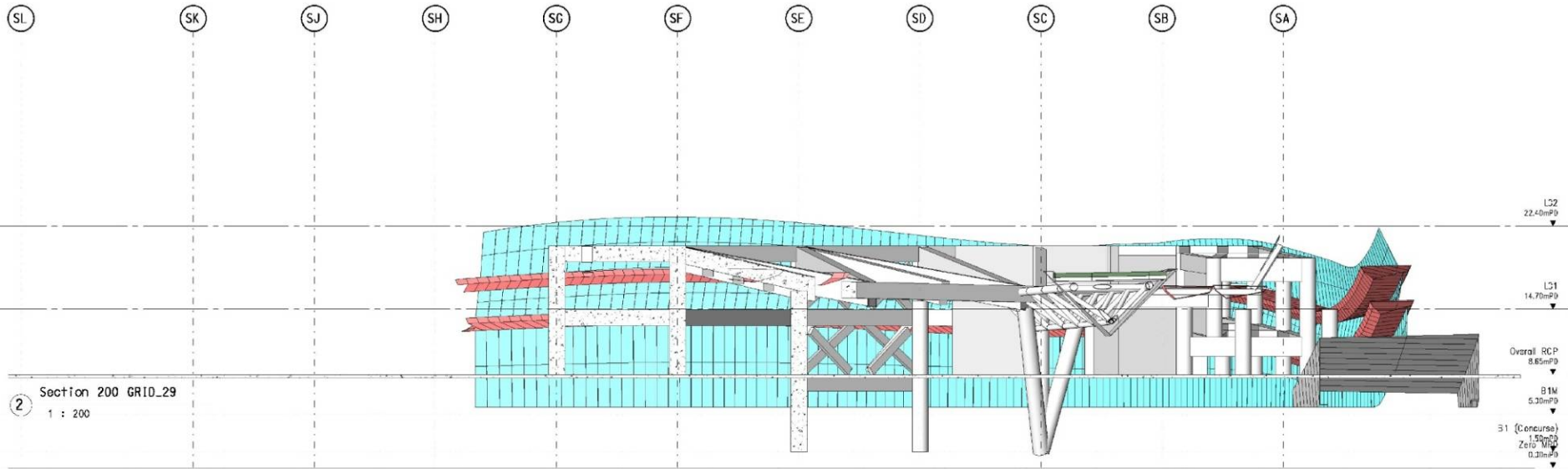
public class Group
{
    public int GroupNumber;
    public double[] Edge; //array of lengths of groups's edges.
    public double Diagonal; //length of group's diagonal.
    public double Area; //area of a grouped panel;
}

double toFeet(double value) //conversion of linear sizes for family instances
{
    return value * FACTOR_MMtoFT;
}

double toSqFeet(double value) //conversion of areal sizes for family instances
{

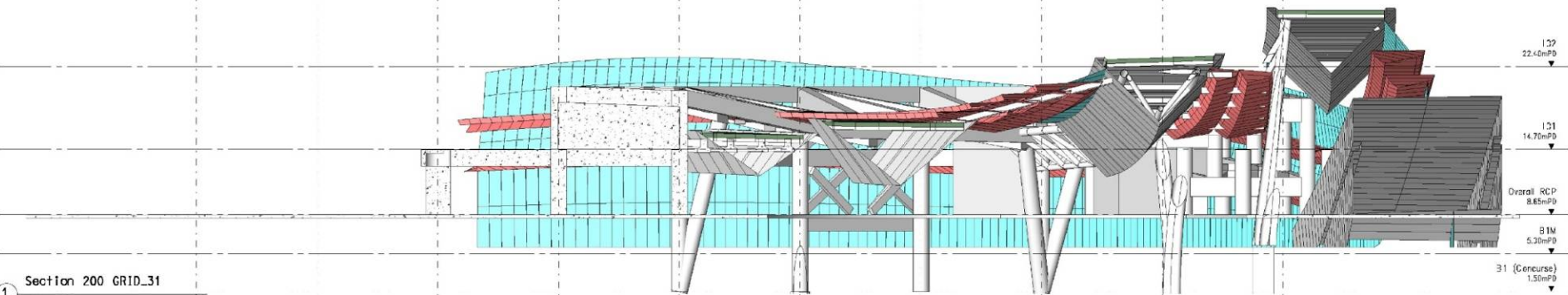
```

CONTEXT

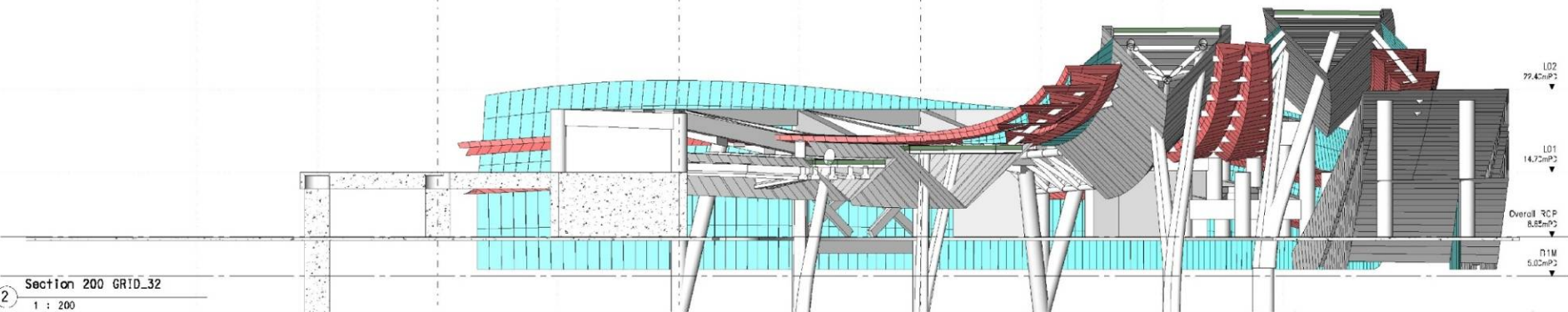


TERMINUS STATION

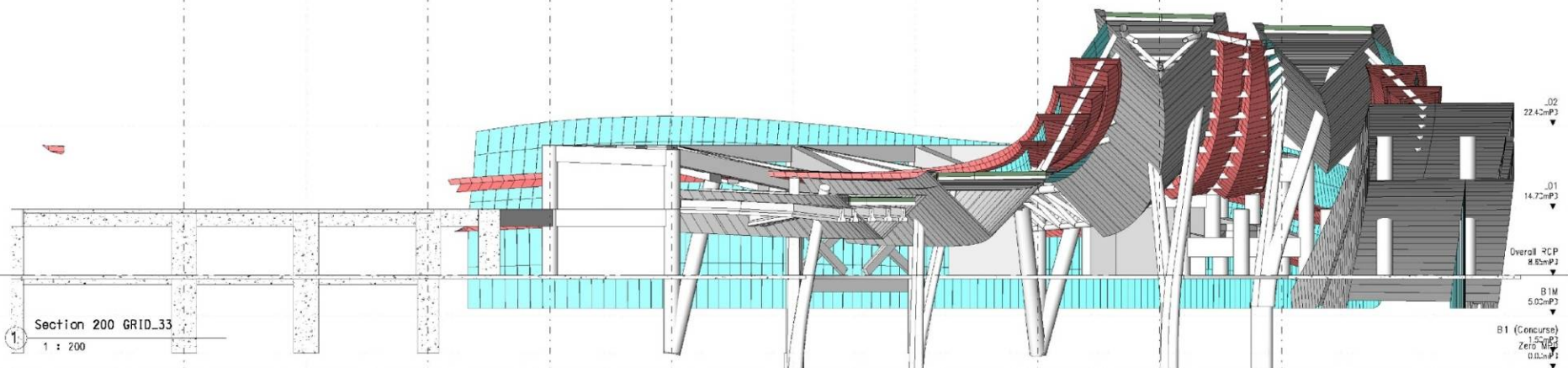
SK SJ SH SG SF SE SD SC SB SA



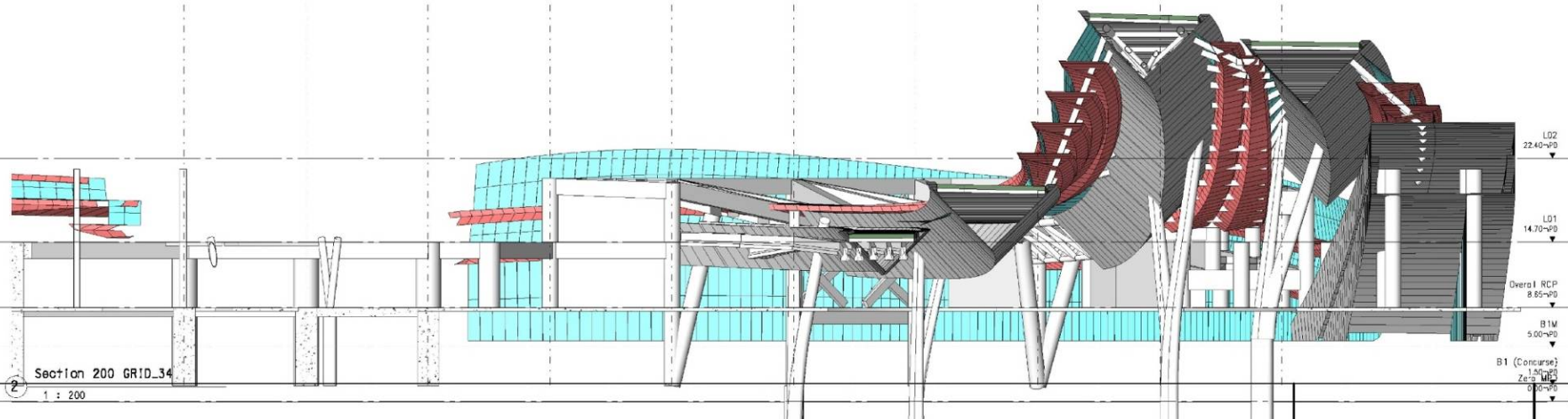
SK SJ SH SG SF SE SD SC SB SA

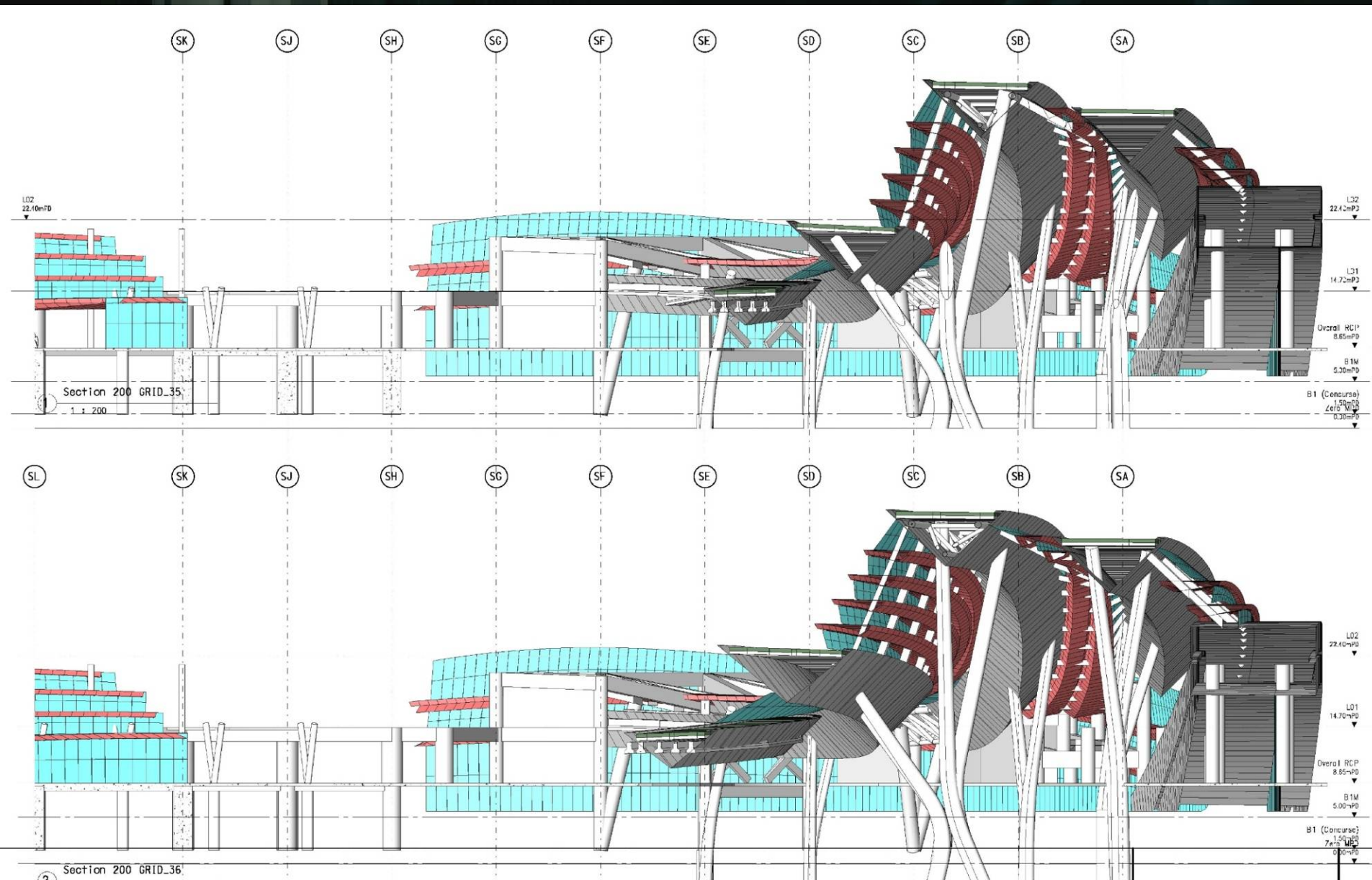


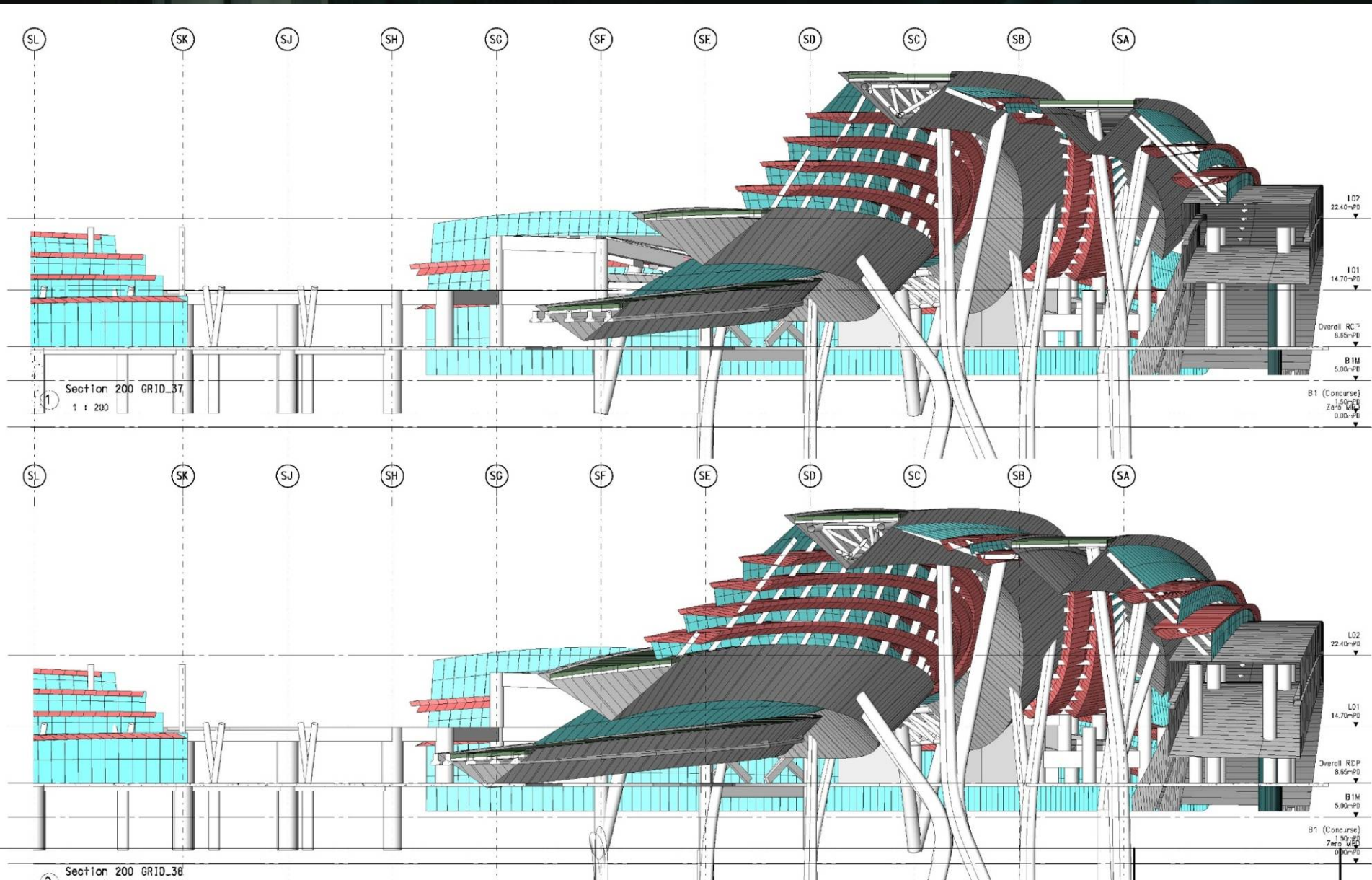
SK SJ SH SG SF SE SD SC SB SA

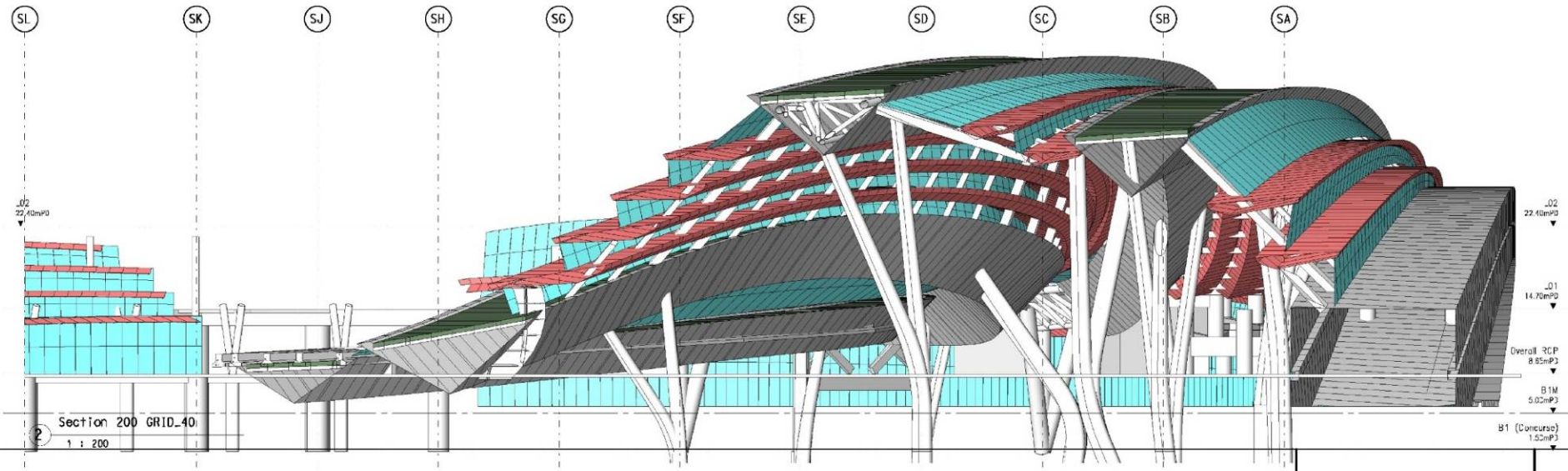
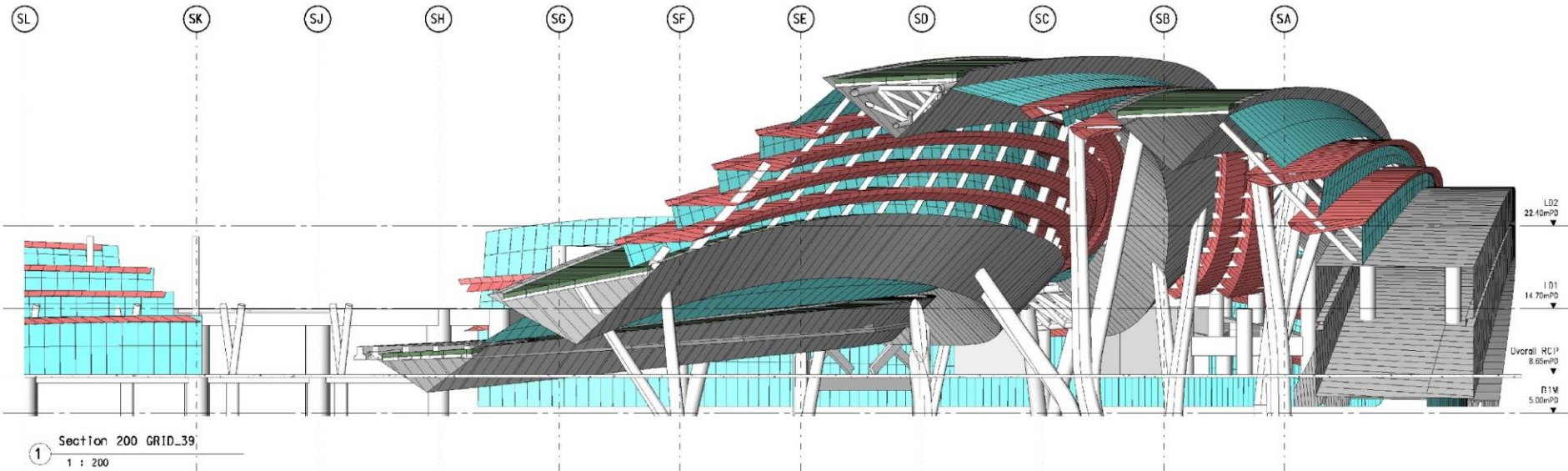


SK SJ SH SG SF SE SD SC SB SA

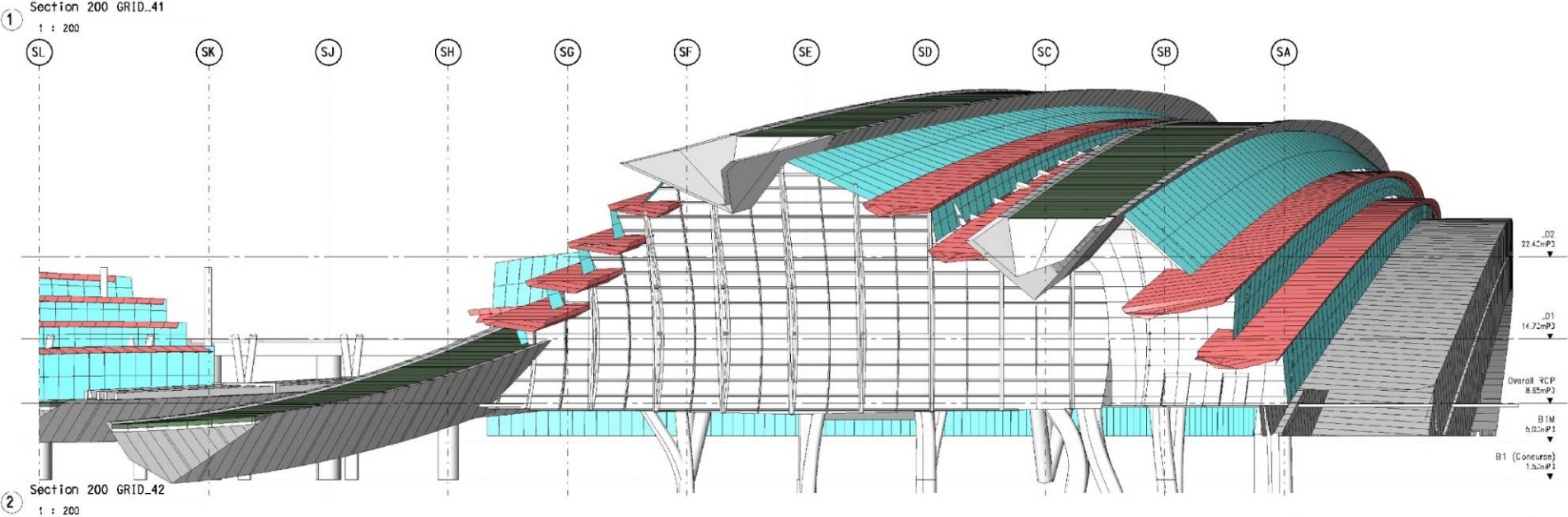
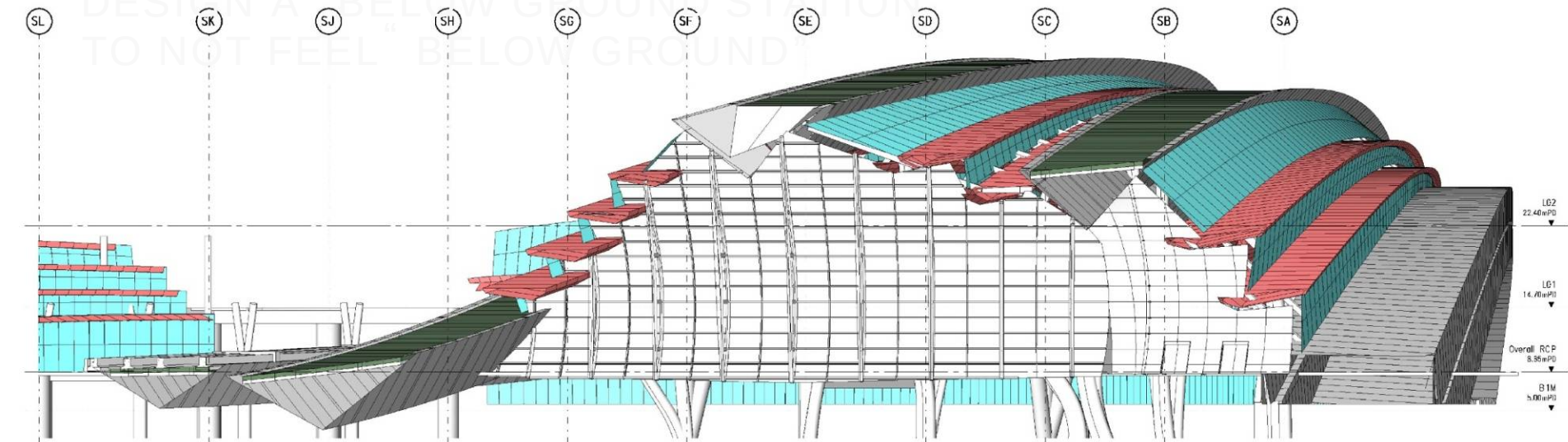


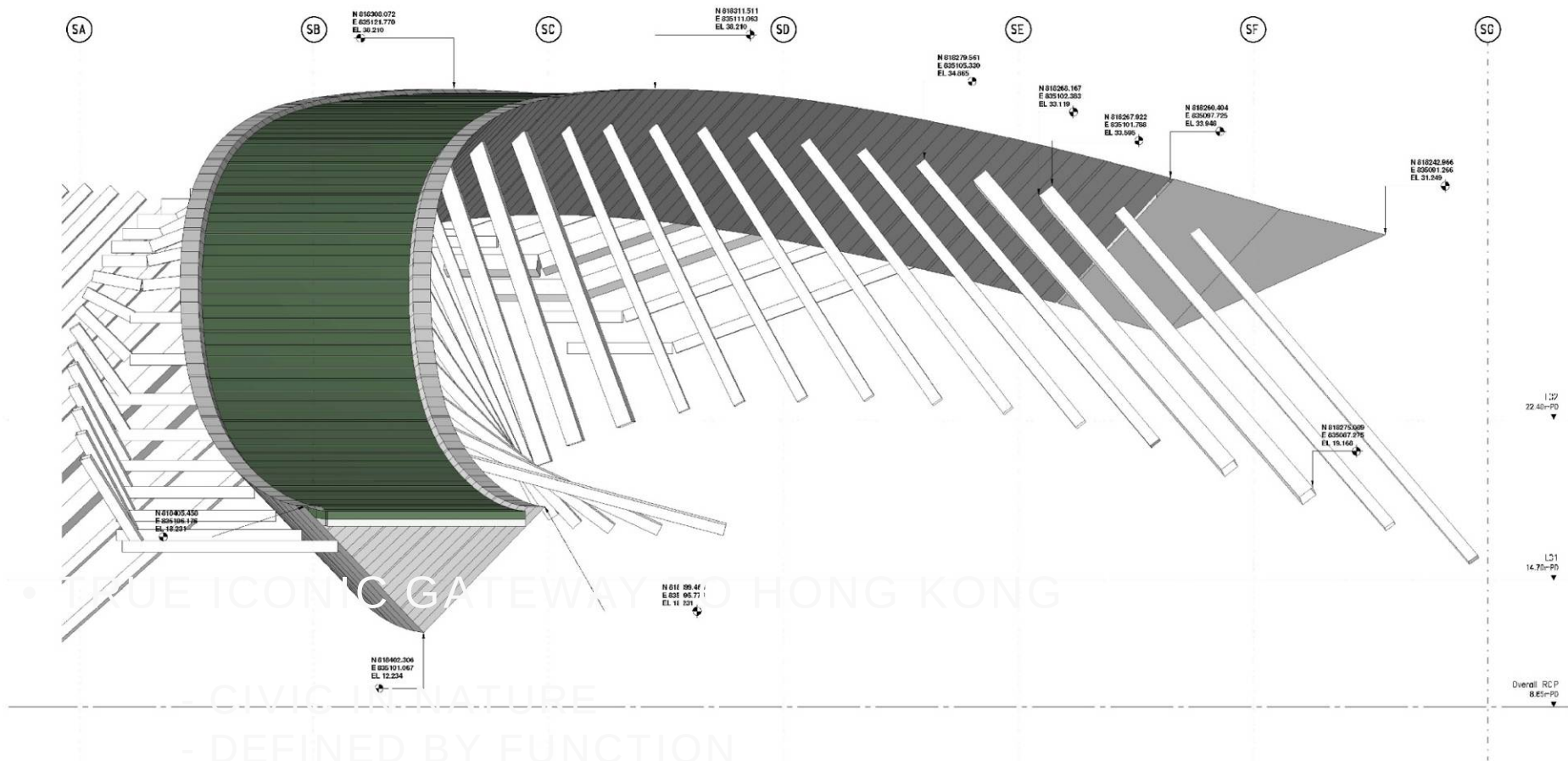






DESIGN A "BELOW GROUND STATION" TO NOT FEEL "BELOW GROUND"



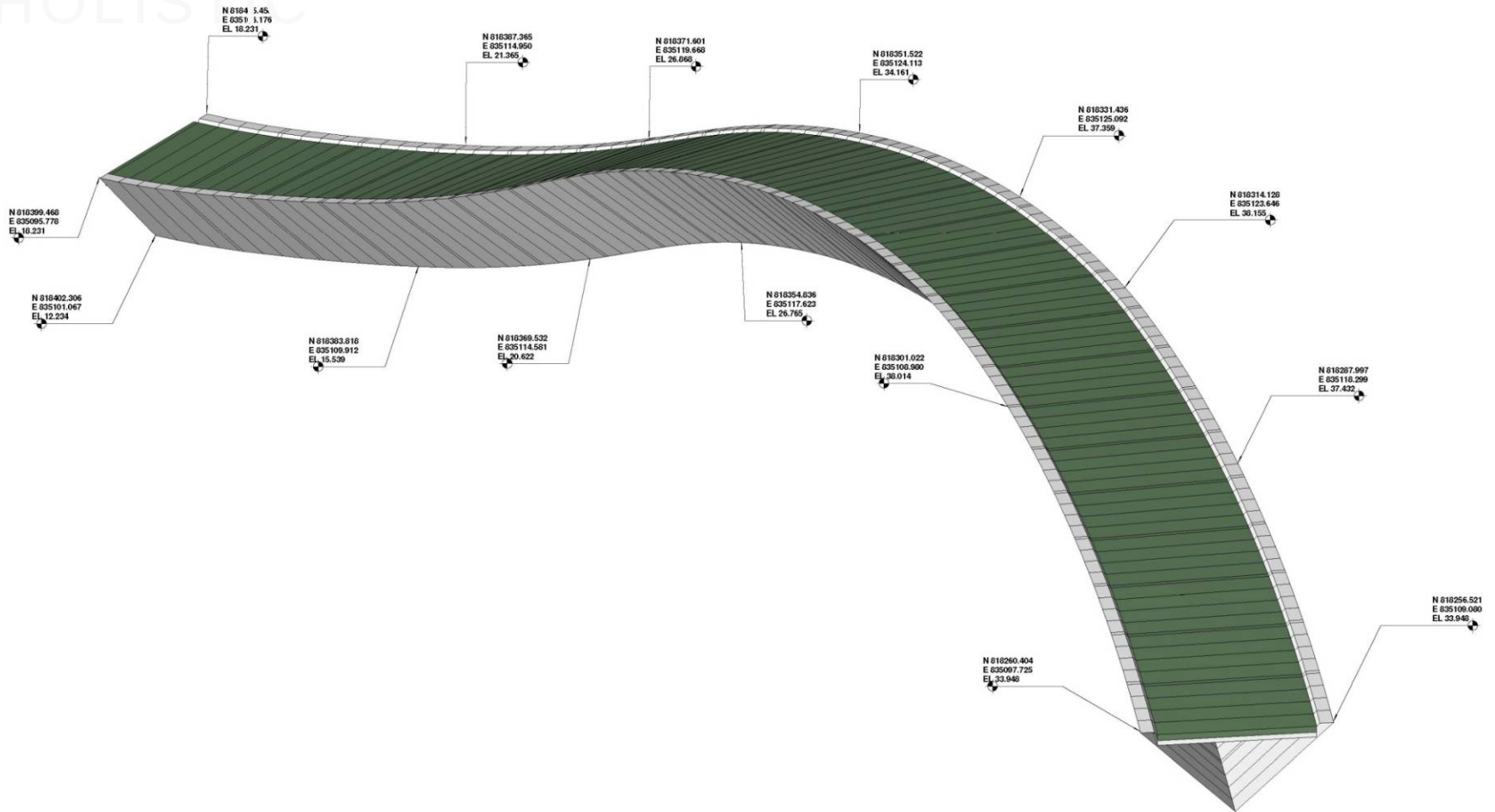


Component Elevation P3 North

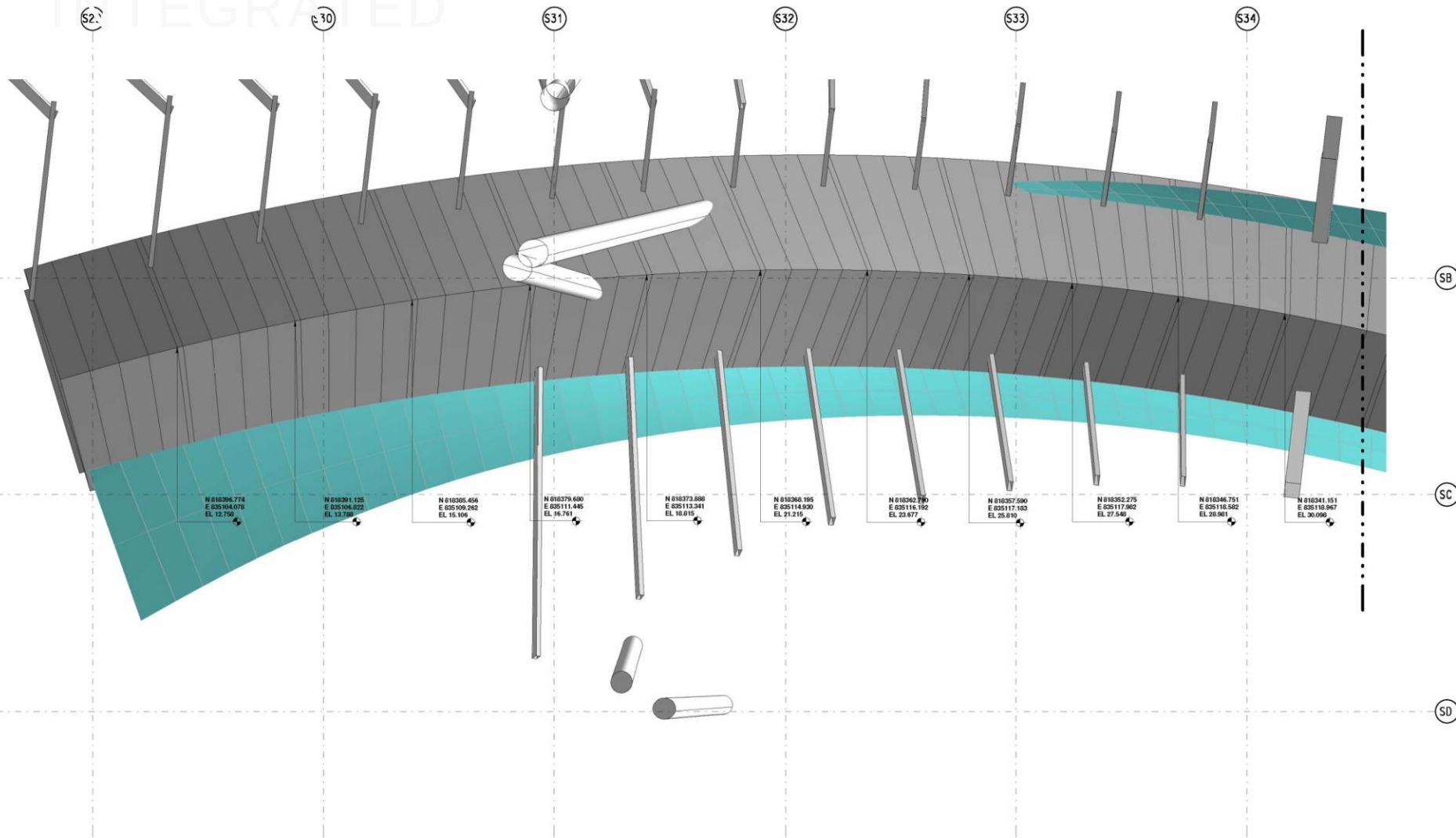
1 : 100

- EXCEEDING EXPECTATIONS

HOLISTIC



INTEGRATED



LEFT_Component RCP P3

1 : 100

ARRIVING or DEPARTING...

Panel P3S03P082

Group AL 36
Edge 1 1391 mm
Edge 2 839 mm
Edge 3 1398 mm
Edge 4 839 mm
Diagonal 1628 mm
Area 1.197 m²

Panel P3S03P081

Group AL 33
Edge 1 1358 mm
Edge 2 839 mm
Edge 3 1366 mm
Edge 4 839 mm
Diagonal 1600 mm
Area 1.169 m²

Panel P3S03P080

Group AL 34
Edge 1 267 mm
Edge 2 824 mm
Edge 3 269 mm
Edge 4 824 mm
Diagonal 867 mm
Area 0.234 m²

Panel P3S03P079

Group AL 33
Edge 1 1358 mm
Edge 2 839 mm
Edge 3 1366 mm
Edge 4 839 mm
Diagonal 1600 mm
Area 1.169 m²

Panel P3S03P078

Group AL 33
Edge 1 1358 mm
Edge 2 839 mm
Edge 3 1366 mm
Edge 4 839 mm
Diagonal 1600 mm
Area 1.169 m²

Panel P3S03P077

Group AL 33
Edge 1 1358 mm
Edge 2 839 mm
Edge 3 1366 mm
Edge 4 839 mm
Diagonal 1600 mm
Area 1.169 m²

Panel P3S04P082

Group AL 43
Edge 1 1378 mm
Edge 2 276 mm
Edge 3 1378 mm
Edge 4 276 mm
Diagonal 1405 mm
Area 0.400 m²

Panel P3S04P081

Group AL 40
Edge 1 1347 mm
Edge 2 276 mm
Edge 3 1354 mm
Edge 4 276 mm
Diagonal 1379 mm
Area 0.392 m²

Panel P3S04P080

Group AL 41
Edge 1 265 mm
Edge 2 271 mm
Edge 3 266 mm
Edge 4 271 mm
Diagonal 381 mm
Area 0.078 m²

Panel P3S04P079

Group AL 40
Edge 1 1347 mm
Edge 2 276 mm
Edge 3 1354 mm
Edge 4 276 mm
Diagonal 1379 mm
Area 0.392 m²

Panel P3S04P078

Group AL 40
Edge 1 1347 mm
Edge 2 276 mm
Edge 3 1354 mm
Edge 4 276 mm
Diagonal 1379 mm
Area 0.392 m²

Panel P3S04P077

Group AL 40
Edge 1 1347 mm
Edge 2 276 mm
Edge 3 1354 mm
Edge 4 276 mm
Diagonal 1379 mm
Area 0.392 m²

Panel P3S02P082

Group AL 30
Edge 1 1412 mm
Edge 2 8443 mm
Edge 3 1400 mm
Edge 4 8443 mm
Diagonal 8559 mm
Area 11.992 m²

Panel P3S02P081

Group AL 29
Edge 1 1400 mm
Edge 2 8443 mm
Edge 3 1367 mm
Edge 4 8443 mm
Diagonal 8551 mm
Area 11.801 m²

Panel P3S02P080

Group AL 23
Edge 1 272 mm
Edge 2 8298 mm
Edge 3 272 mm
Edge 4 8298 mm
Diagonal 8296 mm
Area 2.361 m²

Panel P3S02P079

Group AL 29
Edge 1 1400 mm
Edge 2 8443 mm
Edge 3 1367 mm
Edge 4 8443 mm
Diagonal 8551 mm
Area 11.801 m²

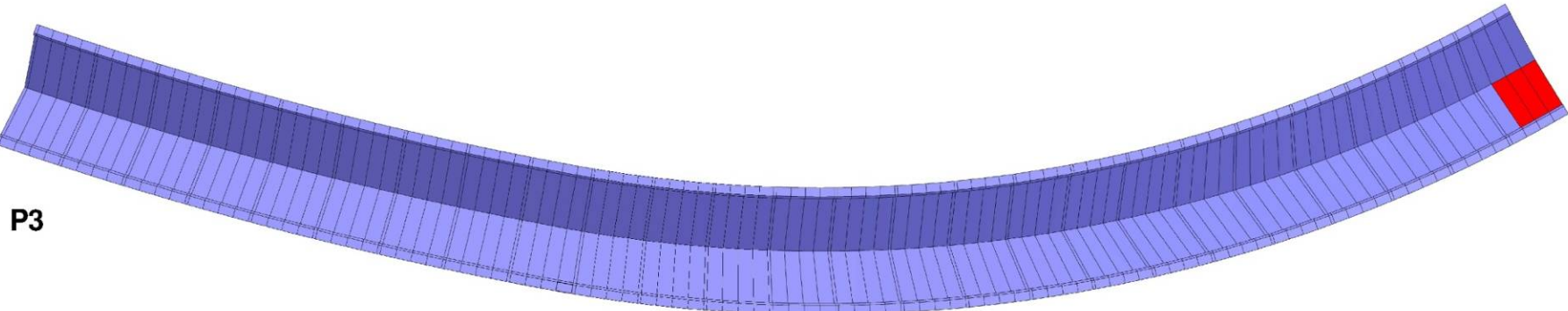
Panel P3S02P078

Group AL 29
Edge 1 1400 mm
Edge 2 8443 mm
Edge 3 1367 mm
Edge 4 8443 mm
Diagonal 8551 mm
Area 11.801 m²

Panel P3S02P077

Group AL 29
Edge 1 1400 mm
Edge 2 8443 mm
Edge 3 1367 mm
Edge 4 8443 mm
Diagonal 8551 mm
Area 11.801 m²

P3



Schedule of panels																								
Panel	Point 1				Point 2				Point 3				Point 4				Center of weight				Edges			
	P01 x	P01 y	P01 z		P02 x	P02 y	P02 z		P03 x	P03 y	P03 z		P04 x	P04 y	P04 z		C x	C y	C z		Edge 1	Edge 2	Edge 3	Edge 4
P3S01P001	8351061129	8184055541	18298	835101017	818402394	12231	835106871	818404239	18290	835101802	818401012	12299	835103955	818403297	15262	1493	8448	1583	8448	8585	13.111 m²	AL 1		
P3S01P002	835106871	818404239	18290	835101802	818401012	12299	835107598	818402931	18391	835102588	818399625	12410	835104710	818401952	15347	1493	8448	1583	8448	8585	13.111 m²	AL 1		
P3S01P003	835107598	818402931	18391	835102588	818399625	12410	835108310	818401617	18528	835103312	818398241	12560	835105447	818400604	15472	1493	8448	1583	8448	8585	13.111 m²	AL 1		
AL 1.3																					35.335 m²			
P3S01P004	835108310	818401617	18528	835103312	818398241	12560	835109007	818400300	18696	835104033	818396862	12745	835106166	818399255	15633	1493	8448	1559	8448	8583	13.010 m²	AL 2		
AL 2.1																					13.010 m²			
P3S01P005	835109007	818400300	18696	835104033	818396862	12745	835109144	818400036	18736	835104175	818396588	12786	835106560	818398446	15741	294	8313	305	8313	8318	2.594 m²	AL 3		
P3S01P010	835111765	818394722	19674	835106783	818391211	13770	835111890	818394544	19728	835109506	818390943	13826	835109336	818392833	16760	294	8313	305	8313	8318	2.594 m²	AL 3		
P3S01P015	835114256	818398075	20334	835109228	818385543	15084	835114368	818388805	21001	835109337	818395271	15154	835111797	818387174	18043	294	8313	305	8313	8318	2.594 m²	AL 3		
P3S01P020	835116476	818383392	22499	835111414	818379769	16734	835116575	818383121	22582	835111511	818379492	16822	835113994	818381444	19659	294	8313	305	8313	8318	2.594 m²	AL 3		
P3S01P025	835118417	818377721	24432	835113315	818373975	16781	835118503	818377451	24534	835113398	818373701	16888	835115908	818375712	21659	294	8313	305	8313	8318	2.594 m²	AL 3		
P3S01P030	835120084	818372092	26716	835114909	818368280	21178	835120157	818371825	26832	835114977	818368015	21297	835117532	818370053	24068	294	8313	305	8313	8318	2.594 m²	AL 3		
AL 3.6																					15.564 m²			
P3S01P038	835109144	818400036	18736	835104175	818396588	12786	835109622	818398714	18942	835104883	818395227	13005	835107001	818397641	16867	1493	8448	1534	8448	8581	12.901 m²	AL 4		
P3S01P018	835115454	818386100	21710	835110405	818382531	15899	835115973	818384746	22094	835110918	818381150	16305	835113167	818383632	19002	1493	8448	1534	8448	8581	12.901 m²	AL 4		
P3S01P019	835115973	818384746	22094	835110918	818381150	16305	835116476	818383392	22499	835114144	818379769	16734	835113995	818386264	19408	1493	8448	1534	8448	8581	12.901 m²	AL 4		
P3S01P021	835116575	818383121	22582	835111511	818379492	16822	835117059	818381769	23013	835111987	818378111	17278	835114283	818380623	19924	1493	8448	1534	8448	8581	12.901 m²	AL 4		
P3S01P022	835117059	818381769	23013	835111987	818378111	17278	835117528	818380417	23465	835112447	818376730	17757	835114755	818379257	20378	1493	8448	1534	8448	8581	12.901 m²	AL 4		
P3S01P023	835117528	818380417	23465	835112447	818376730	17757	835117980	818379088	23938	835112890	818375351	18258	835115211	818377891	20855	1493	8448	1534	8448	8581	12.901 m²	AL 4		
P3S01P024	835117980	818379088	23938	835112890	818375351	18258	835118417	818377721	24432	835113315	818373975	16781	835115550	818376629	21353	1493	8448	1534	8448	8581	12.901 m²	AL 4		
P3S01P026	835118503	818377451	24534	835113398	818373701	16888	835118921	818376718	25052	835113802	818372392	19436	835116156	818374398	21978	1493	8448	1534	8448	8581	12.901 m²	AL 4		
AL 4.8																					103.208 m²			
P3S01P007	835109822	818386714	18942	835104883	818395227	13005	835110485	818397388	19170	835105522	818393885	13245	835107673	818396303	16000	1493	8445	1507	8445	8578	12.786 m²	AL 5		
P3S01P008	835110485	818397388	19170	835105522	818393885	13245	835111332	818396057	19414	835109161	818392551	13500	835106325	818394070	10332	1493	8445	1507	8445	8578	12.786 m²	AL 5		
P3S01P009	835111332	818396057	19414	835109161	818392551	13500	835111765	818394722	19674	835106783	818391211	13770	835109960	818393635	10590	1493	8445	1507	8445	8578	12.786 m²	AL 5		
P3S01P011	835111890	818394544	19728	835109506	818385543	15084	835112504	818393115	20006	835107510	818386599	14716	835108702	818382028	10319	1493	8445	1507	8445	8578	12.786 m²	AL 5		
P3S01P012	835112504	818393115	20006	835107510	818386599	14716	835113103	818391771	20300	835108097	818388252	14422	835110304	818390654	17211	1493	8445	1507	8445	8578	12.786 m²	AL 5		
P3S01P013	835113103	818391771	20300	835108097	818388252	14422	835113688	818390425	20609	835108670	818386600	14745	835110890	818398357	17519	1493	8445	1507	8445	8578	12.786 m²	AL 5		
P3S01P014	835113688	818390425	20609	835108670	818386600	14745	835114256	818389075	20934	835109228	818385543	15084	835111450	818387968	17943	1493	8445	1507	8445	8578	12.786 m²	AL 5		
P3S01P016	835114368	818388805	21001	835109337	818385271	15154	835114919	818387453	21346	835109678	818383806	15516	835112126	818386359	18254	1493	8445	1507	8445	8578	12.786 m²	AL 5		
P3S01P017	835114919	818387453	21346	835109678	818383806	15516	835115454	818386100	21710	835110405	818382531	15899	835112654	818384998	18818	1493	8445	1507	8445	8578	12.786 m²	AL 5		
P3S01P027	835118921	818376106	25052	835113802	818372392	19436	835119324	818373428	26145	835114189	818370671	20002	835116559	818373544	22520	1493	8445	1507	8445	8578	12.786 m²	AL 5		
P3S01P028	835119324	818373428	26145	835114189	818370671	20002	835119711	818373428	26145	835114589	818368618	20585	835116948	818372196	23081	1493	8445	1507	8445	8578	12.786 m²	AL 5		
P3S01P029	835119711	818373428	26145	835114589	818368618	20585	835120084	818372092	26716	835114909	818368280	21178	835117316	818370855	23656	1493	8445	1507	8445	8578	12.786 m²	AL 5		
AL 5.12																					153.439 m²			
P3S01P031	835120157	818371825	26832	835114977	818368015	21297	835120513	818370490	27416	835115304	818366697	21896	835117738	818369257	24360	1493	8445	1477	8445	8574	12.661 m²	AL 6		
AL 6.1																					12.661 m²			

Remark: An above table is a portion extracted for presentation purpose from the full schedule of panels included in the BIM model.

Panel P3S02P002
 Group AL 14
 Edge 1 1583 mm
 Edge 2 8445 mm
 Edge 3 1367 mm
 Edge 4 8445 mm
 Diagonal 8568 mm
 Area 12.573 m²

N 818401012
 E 835101802
 EL 12299

N 818404239
 E 835106871
 EL 18290

Panel P3S01P002
 Group AL 1
 Edge 1 1493 mm
 Edge 2 8446 mm
 Edge 3 1583 mm
 Edge 4 8446 mm
 Diagonal 8585 mm
 Area 13.111 m²

Panel P3S01P009
 Group AL 5
 Edge 1 1493 mm
 Edge 2 8445 mm
 Edge 3 1507 mm
 Edge 4 8445 mm
 Diagonal 8578 mm
 Area 12.786 m²

P3

N 818398670
E 835109844
EL 18950

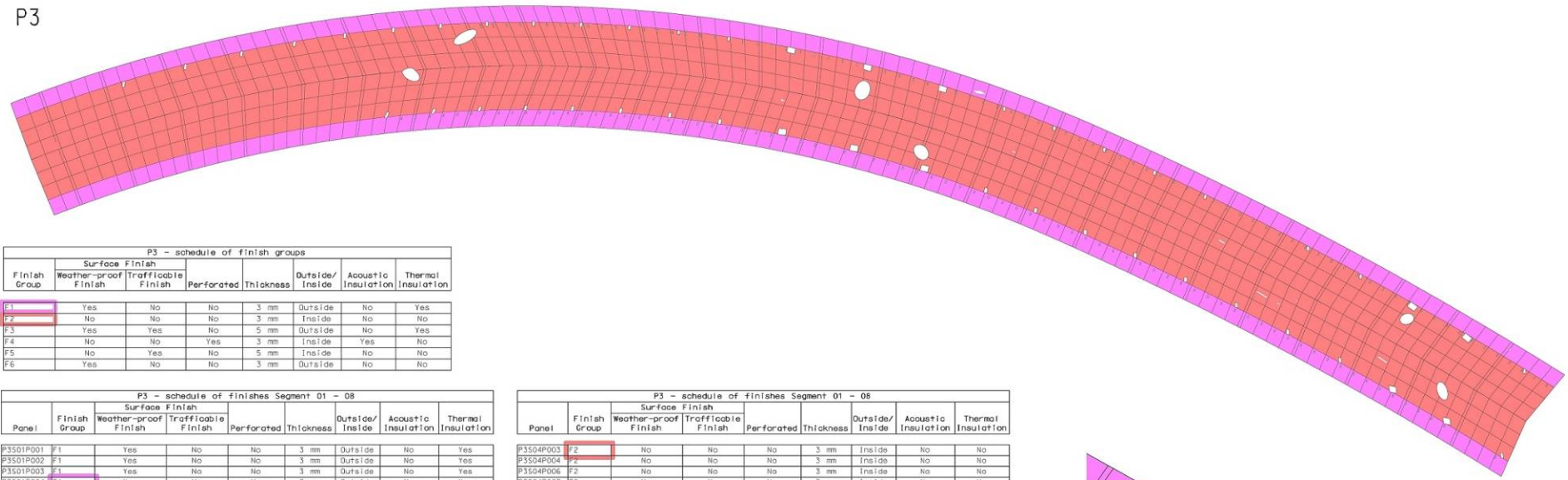
N 818405541
E 835106129
EL 18228

N 818402394
E 835101017
EL 12231

N 818398353
E 835096414
EL 18290

Schedule of panel groups									
Group Name	Number of panels	Edge 1	Edge 2	Edge 3	Edge 4	Diagonal	Panel area	Group Area	
AL 1	3	1493	8446	1593	8446	8595	13.111 m ²	39.333 m ²	
AL 2	1	1493	8446	1599	8446	8583	13.010 m ²	13.010 m ²	
AL 3	6	284	8313	305	8313	8318	2.594 m ²	15.564 m ²	
AL 4	9	1493	8448	1534	8446	8581	12.901 m ²	103.208 m ²	
AL 5	12	1493	8445	1507	8445	8578	12.786 m ²	153.433 m ²	
AL 6	1	1493	8445	1477	8445	8574	12.661 m ²	12.661 m ²	
AL 7	32	1493	8444	1452	8444	8572	12.554 m ²	401.734 m ²	
AL 8	5	1493	8444	1424	8444	8569	12.436 m ²	62.180 m ²	
AL 9	13	1493	8444	1398	8444	8567	12.325 m ²	160.227 m ²	
AL 10	13	284	8303	272	8302	8307	2.453 m ²	80.933 m ²	
AL 11	25	1493	8443	1399	8443	8564	12.199 m ²	304.979 m ²	
AL 12	3	1493	8443	1354	8443	8562	12.139 m ²	60.676 m ²	
AL 13	3	1493	8443	1338	8443	8560	12.069 m ²	36.208 m ²	
AL 14	3	1583	8445	1367	8445	8568	12.673 m ²	37.718 m ²	
AL 15	1	1559	8445	1368	8445	8560	12.479 m ²	12.479 m ²	
AL 16	6	1533	8445	1389	8445	8556	12.372 m ²	98.979 m ²	
AL 17	3	1513	8445	1374	8445	8547	12.311 m ²	36.932 m ²	
AL 18	1	1497	8446	1385	8445	8536	12.290 m ²	12.290 m ²	
AL 19	1	1477	8445	1387	8445	8534	12.209 m ²	12.209 m ²	
AL 20	1	1452	8445	1387	8445	8531	12.102 m ²	12.102 m ²	
AL 21	1	1424	8445	1387	8445	8529	11.984 m ²	11.984 m ²	
AL 22	1	1388	8444	1386	8444	8527	11.871 m ²	11.871 m ²	
AL 23	11	272	8298	272	8298	8296	2.361 m ²	25.974 m ²	
AL 24	6	1569	8444	1385	8444	8524	11.742 m ²	70.452 m ²	
AL 25	7	1254	8444	1384	8444	8524	11.674 m ²	81.718 m ²	
AL 26	3	1338	8443	1381	8443	8524	11.595 m ²	34.788 m ²	
AL 27	6	1362	8442	1389	8442	8539	11.648 m ²	93.185 m ²	
AL 28	3	1380	8442	1367	8442	8543	11.714 m ²	35.143 m ²	
AL 29	10	1400	8443	1367	8443	8551	11.801 m ²	118.005 m ²	
AL 30	1	1412	8443	1400	8443	8559	11.992 m ²	11.992 m ²	
AL 31	10	1427	8444	1431	8444	8564	12.187 m ²	121.867 m ²	
AL 32	24	1440	8444	1453	8444	8568	12.334 m ²	296.014 m ²	
AL 33	62	1358	839	1366	839	1607	1.169 m ²	66.791 m ²	
AL 34	16	267	824	269	824	867	0.294 m ²	3.748 m ²	
AL 35	13	1372	839	1379	839	1611	1.181 m ²	15.348 m ²	
AL 36	1	1391	839	1398	839	1628	1.197 m ²	1.197 m ²	
AL 37	31	1422	839	1426	839	1653	1.222 m ²	37.880 m ²	
AL 38	3	1444	839	1447	839	1671	1.240 m ²	3.720 m ²	
AL 39	34	284	825	285	825	873	0.248 m ²	8.448 m ²	
AL 40	54	1347	276	1354	276	1379	0.392 m ²	21.163 m ²	
AL 41	24	265	271	266	271	361	0.078 m ²	1.883 m ²	
AL 42	11	1361	276	1366	276	1396	0.396 m ²	4.353 m ²	
AL 43	1	1378	276	1378	276	1405	0.400 m ²	0.400 m ²	
AL 44	32	1406	276	1408	276	1432	0.408 m ²	13.052 m ²	
AL 45	2	1426	276	1425	276	1452	0.414 m ²	0.827 m ²	
AL 46	26	261	271	261	271	390	0.083 m ²	2.154 m ²	
AL 47	100	1456	276	1453	276	1481	0.422 m ²	42.209 m ²	
AL 48	100	1474	839	1483	839	1700	1.269 m ²	126.892 m ²	
Grand total: 750								2923.908 m ²	

P3

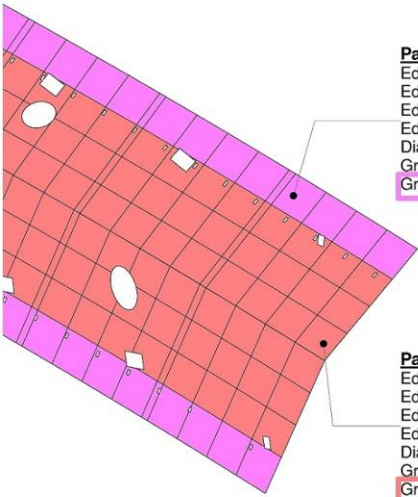


P3 - schedule of finish groups							
Finish Group	Surface Finish		Perforated	Thickness	Outside/ Inside	Acoustic Insulation	Thermal Insulation
	Weather-proof Finish	Trafficable Finish					
F1	Yes	No	No	3 mm	Outside	No	Yes
F2	No	No	No	3 mm	Inside	No	No
F3	Yes	No	No	5 mm	Outside	No	Yes
F4	No	No	Yes	3 mm	Inside	Yes	No
F5	No	Yes	No	5 mm	Inside	No	No
F6	Yes	No	No	3 mm	Outside	No	No

P3 - schedule of finishes Segment 01 - 08								
Panel	Finish Group	Surface Finish		Perforated	Thickness	Outside/ Inside	Acoustic Insulation	Thermal Insulation
		Weather-proof Finish	Trafficable Finish					
P3501P001	F1	Yes	No	No	3 mm	Outside	No	Yes
P3501P002	F1	Yes	No	No	3 mm	Outside	No	Yes
P3501P003	F1	Yes	No	No	3 mm	Outside	No	Yes
P3501P004	F1	Yes	No	No	3 mm	Outside	No	Yes
P3501P005	F1	Yes	No	No	3 mm	Outside	No	Yes
P3501P006	F1	Yes	No	No	3 mm	Outside	No	Yes
P3501P007	F1	Yes	No	No	3 mm	Outside	No	Yes
P3501P008	F1	Yes	No	No	3 mm	Outside	No	Yes
P3508P001	F1	Yes	No	No	3 mm	Outside	No	Yes
P3508P002	F1	Yes	No	No	3 mm	Outside	No	Yes
P3508P003	F1	Yes	No	No	3 mm	Outside	No	Yes
P3508P004	F1	Yes	No	No	3 mm	Outside	No	Yes
P3508P005	F1	Yes	No	No	3 mm	Outside	No	Yes
P3508P006	F1	Yes	No	No	3 mm	Outside	No	Yes
P3508P007	F1	Yes	No	No	3 mm	Outside	No	Yes
P3508P008	F1	Yes	No	No	3 mm	Outside	No	Yes
F 1: 17								
P3502P001	F2	No	No	No	3 mm	Inside	No	No
P3502P002	F2	No	No	No	3 mm	Inside	No	No
P3502P003	F2	No	No	No	3 mm	Inside	No	No
P3502P004	F2	No	No	No	3 mm	Inside	No	No
P3502P005	F2	No	No	No	3 mm	Inside	No	No
P3502P006	F2	No	No	No	3 mm	Inside	No	No
P3502P007	F2	No	No	No	3 mm	Inside	No	No
P3502P008	F2	No	No	No	3 mm	Inside	No	No
P3502P009	F2	No	No	No	3 mm	Inside	No	No
P3503P001	F2	No	No	No	3 mm	Inside	No	No
P3503P002	F2	No	No	No	3 mm	Inside	No	No
P3503P003	F2	No	No	No	3 mm	Inside	No	No
P3503P004	F2	No	No	No	3 mm	Inside	No	No
P3503P005	F2	No	No	No	3 mm	Inside	No	No
P3503P006	F2	No	No	No	3 mm	Inside	No	No
P3503P007	F2	No	No	No	3 mm	Inside	No	No
P3503P008	F2	No	No	No	3 mm	Inside	No	No
P3503P009	F2	No	No	No	3 mm	Inside	No	No
P3504P001	F2	No	No	No	3 mm	Inside	No	No
P3504P002	F2	No	No	No	3 mm	Inside	No	No

P3 - schedule of finishes Segment 01 - 08								
Panel	Finish Group	Surface Finish		Perforated	Thickness	Outside/ Inside	Acoustic Insulation	Thermal Insulation
		Weather-proof Finish	Trafficable Finish					
P3504P003	F2	No	No	No	3 mm	Inside	No	No
P3504P004	F2	No	No	No	3 mm	Inside	No	No
P3504P006	F2	No	No	No	3 mm	Inside	No	No
P3504P007	F2	No	No	No	3 mm	Inside	No	No
P3504P008	F2	No	No	No	3 mm	Inside	No	No
P3504P009	F2	No	No	No	3 mm	Inside	No	No
F 2: 25								
P3505P005	F2	No	No	No	3 mm	Inside	No	No
P3504P005	F2	No	No	No	3 mm	Inside	No	No
P3505P001	F2	No	No	No	3 mm	Inside	No	No
P3505P002	F2	No	No	No	3 mm	Inside	No	No
P3505P003	F2	No	No	No	3 mm	Inside	No	No
P3505P004	F2	No	No	No	3 mm	Inside	No	No
P3505P005	F2	No	No	No	3 mm	Inside	No	No
P3505P006	F2	No	No	No	3 mm	Inside	No	No
P3505P007	F2	No	No	No	3 mm	Inside	No	No
P3505P008	F2	No	No	No	3 mm	Inside	No	No
P3505P009	F2	No	No	No	3 mm	Inside	No	No
P3506P001	F2	No	No	No	3 mm	Inside	No	No
P3506P002	F2	No	No	No	3 mm	Inside	No	No
P3506P003	F2	No	No	No	3 mm	Inside	No	No
P3506P004	F2	No	No	No	3 mm	Inside	No	No
P3506P005	F2	No	No	No	3 mm	Inside	No	No
P3506P006	F2	No	No	No	3 mm	Inside	No	No
P3506P007	F2	No	No	No	3 mm	Inside	No	No
P3506P008	F2	No	No	No	3 mm	Inside	No	No
P3506P009	F2	No	No	No	3 mm	Inside	No	No
P3507P001	F2	No	No	No	3 mm	Inside	No	No
P3507P002	F2	No	No	No	3 mm	Inside	No	No
P3507P003	F2	No	No	No	3 mm	Inside	No	No
P3507P004	F2	No	No	No	3 mm	Inside	No	No
P3507P005	F2	No	No	No	3 mm	Inside	No	No
P3507P006	F2	No	No	No	3 mm	Inside	No	No
P3507P007	F2	No	No	No	3 mm	Inside	No	No
P3507P008	F2	No	No	No	3 mm	Inside	No	No
P3507P009	F2	No	No	No	3 mm	Inside	No	No
F 6: 29								

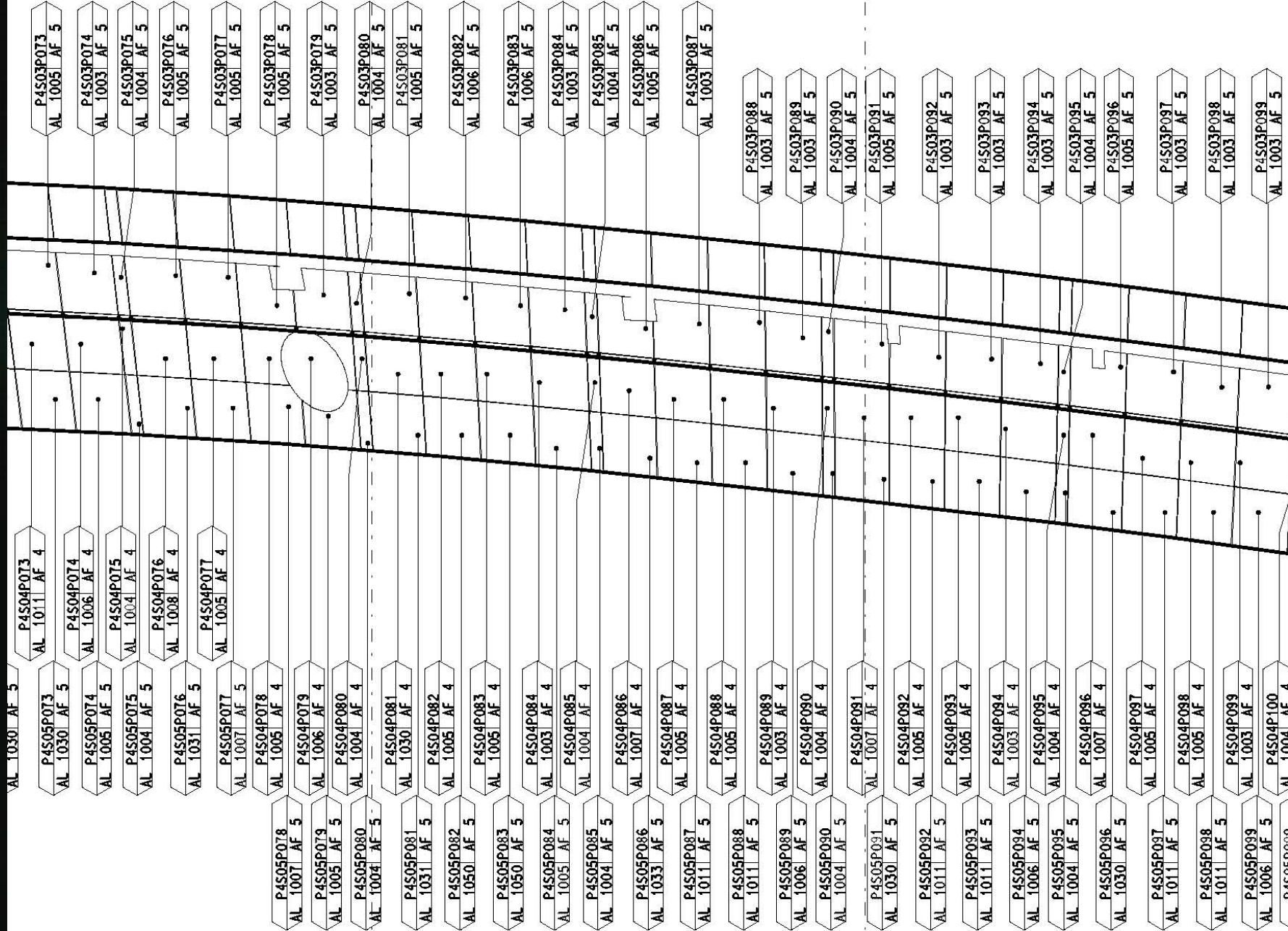
Remark: An above is a portion extracted for presentation purpose the full schedule of panels included in the BIM model.



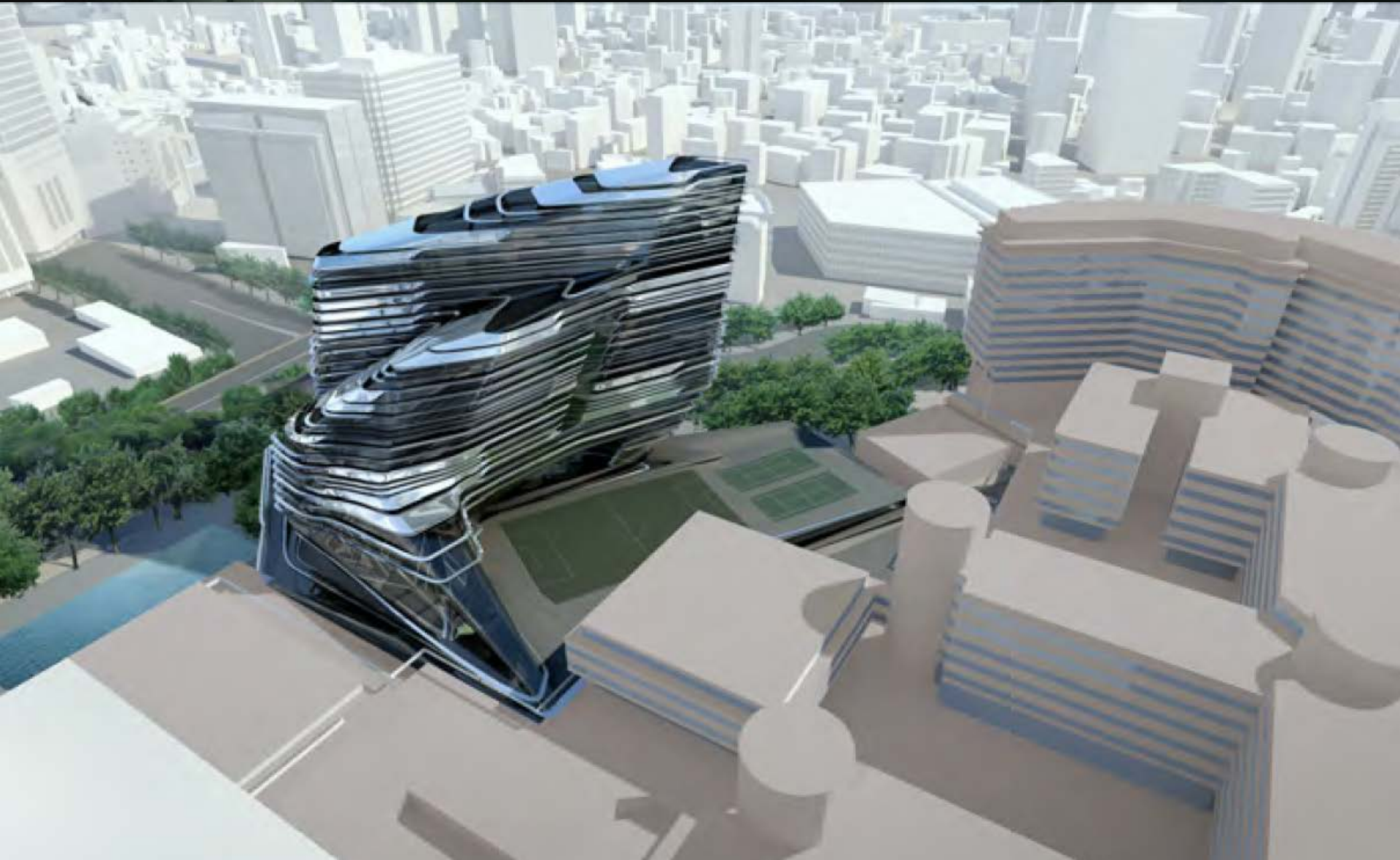
Panel P3S01P004
Edge 1 1488 mm
Edge 2 2279 mm
Edge 3 1476 mm
Edge 4 2279 mm
Diagonal 2720 mm
Group(Size) A 1
Group(Finish)... F 1

Panel P3S04P001
Edge 1 1460 mm
Edge 2 2042 mm
Edge 3 1445 mm
Edge 4 2042 mm
Diagonal 2508 mm
Group(Size) A 13
Group(Finish)... F 2





HONG KONG POLYTECHNIC UNIVERSITY



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The Real Estate Cash Flow-25 years



**Building Entire Life-Cycle Management
(3D Information Technology and Platform)**

❑ Setting realistic expectations of BIM from the facility maintenance operation team's perspectives.



Virtual Asset



Physical Asset

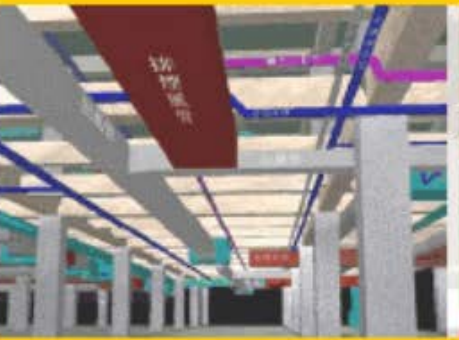


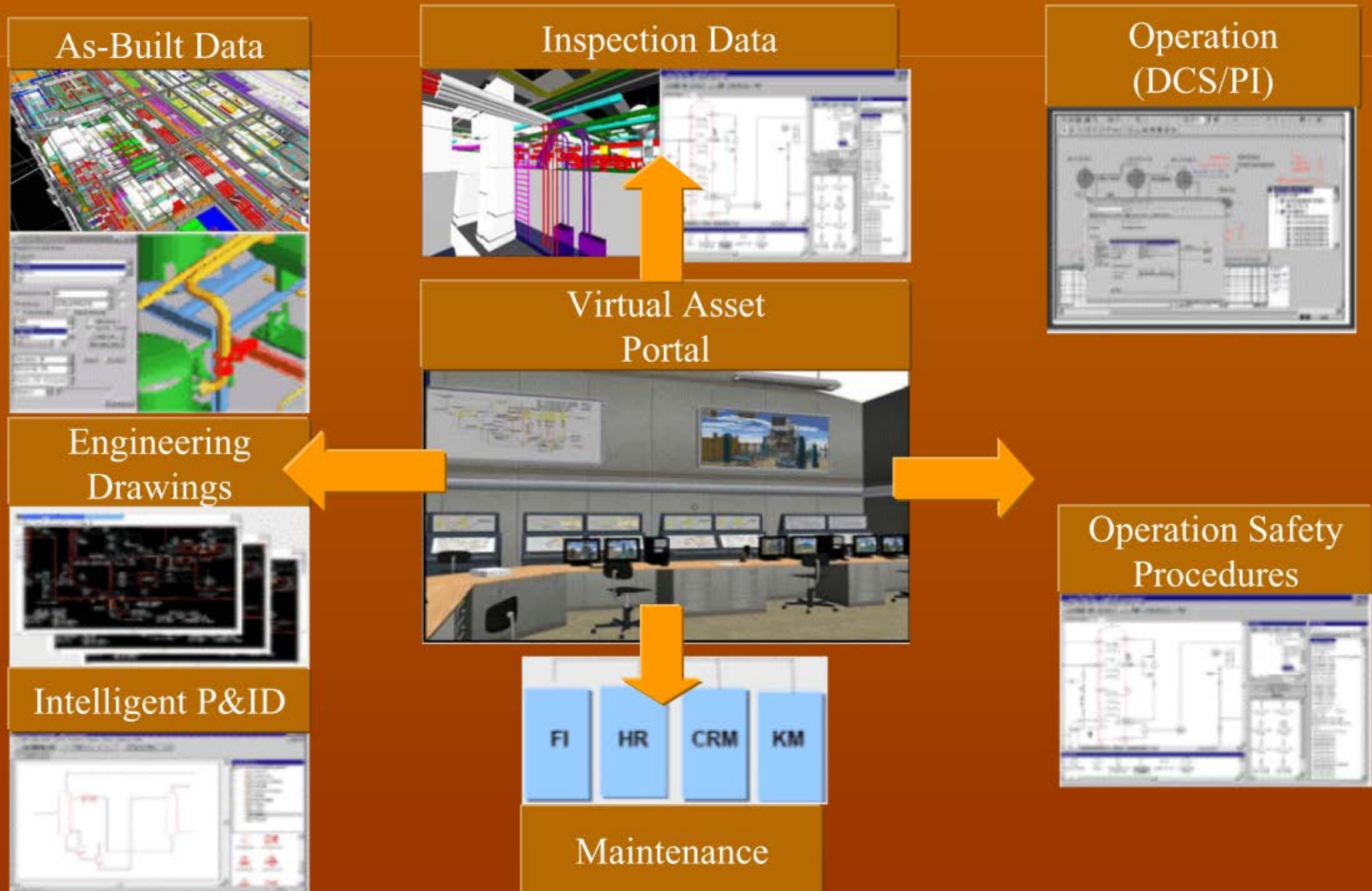
Physical Asset



Virtual Asset

As-built BIM Field Checking





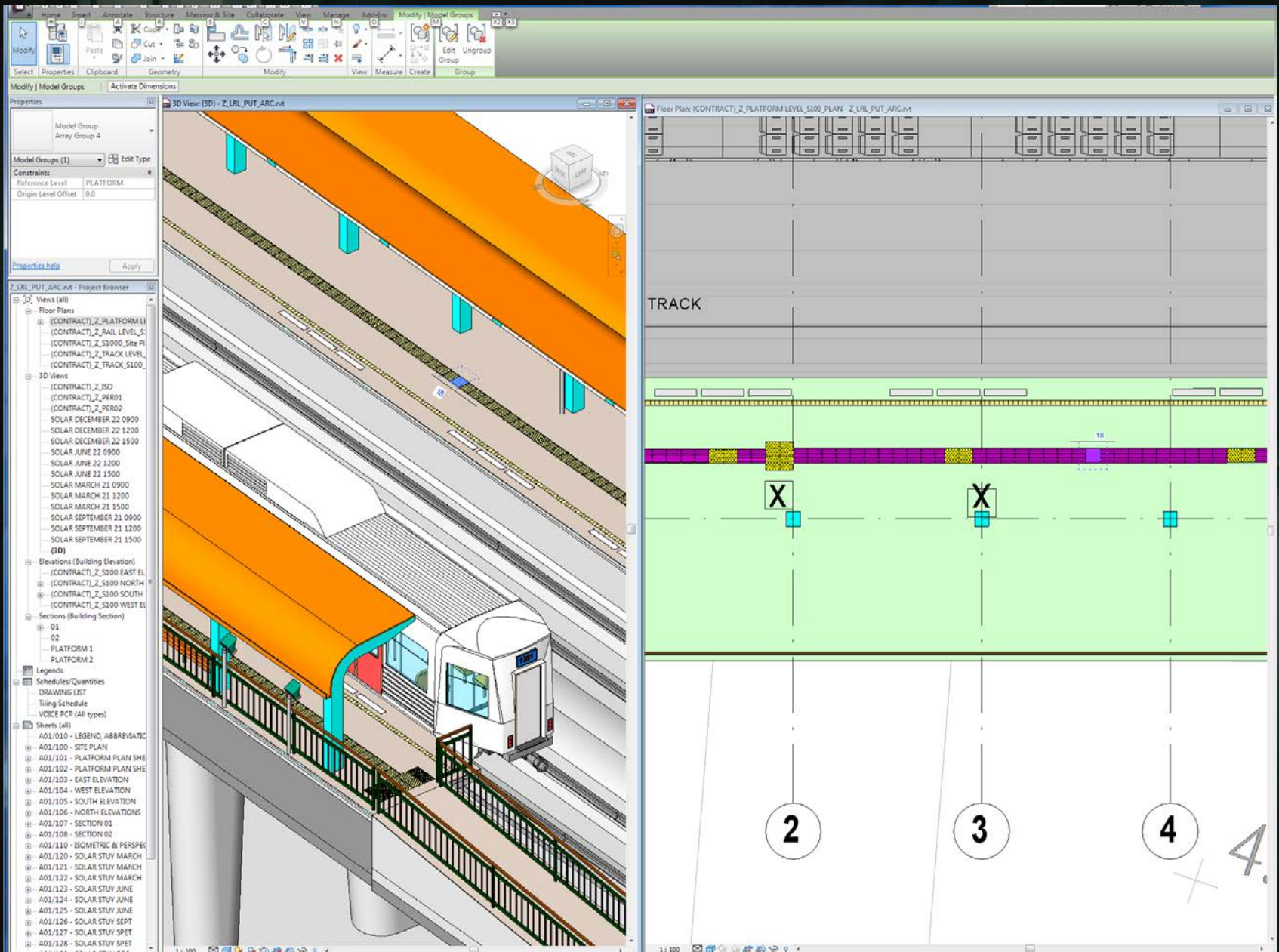
FACILITY MANAGEMENT

ROOM DATA SHEET

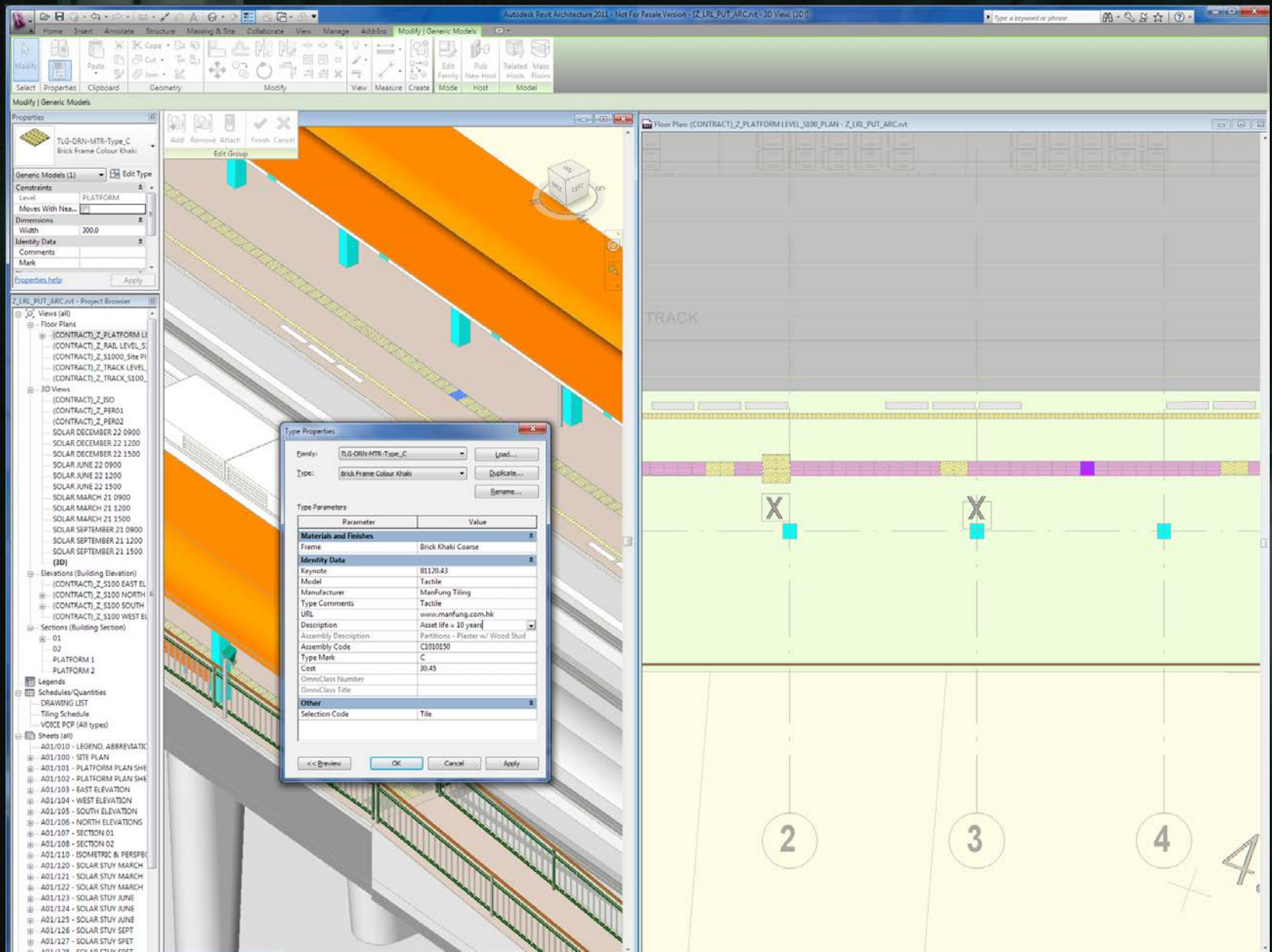
Room No. 3.3 - Cleaners' Room									
Function	A room for storage of small volume of cleansing materials, tools and short stay of cleaners								
Size	15 - 20 m ²								
Occupants	3-5 persons								
Location	Non-public area								
Fire Rating	# In accordance with Fire Safety Standard for KTL/TWL/ISL Stations - S/ARC/PD/005								
Security Level	Low								
Finish	Floor	Skirting			Wall		Ceiling		
	Vitrified ceramic tiles, 150x150x8, on c/s screed - "Pilkington Dorset, colour Dark Grey" or equal approved; on liquid-applied waterproof membrane - "Lacticrete 9235 with fabric reinforcement" or equal approved	Coved ceramic tiles, 150x150x8, on c/s backing - "Pilkington Dorset, colour Dark Grey" or equal approved; on liquid-applied waterproof membrane - "Lacticrete 9235 with fabric reinforcement" or equal approved			Glazed ceramic tiles, 150x150x6.5, on c/s backing - "Pilkington Architectural Colours, colour Vellum White" or equal approved; Durable paint on c/s render above 2100 high - "Alphadecor, colour 9010 White" or equal approved		Durable paint on fairface concrete - "Alphadecor, colour 9010 White" or equal approved		
Door Set	Size	Fire Rating	Acting	Frame	Inside Finish	Outside Finish	Air Resistance	Others	
	900 x 2100 mm	# (see above)	Swing In 90°	Painted/ S/S *	Painted/ S/S *	Painted/ S/S *	N/A	Durable kickplate to u/s of push plate	
Ironmongery	Lock Set	Security Level	Access Card		Remote Control	Inside Handle	Outside Handle	Accessories	
	Night Latch	Low	No	No	No	Lever handle on back plate	Pull handle on back plate	Door closer, door stop	
Signage	Door Plate (supply by Ops)								
Environment	Temperature	Ventilation	Humidity			Acoustic		Thermal	
	24 °C A/C	N/A	50% ± 10%			NC 50		---	
Lighting	Normal Illuminance	Emergency Illuminance	Type			Diffusers		Source	
	300 Lux	10 Lux	Fluorescent, surface mounted			---		Direct	
Fire	Detection		Suppression			Extinguisher		Smoke Extraction	
	Smoke Detectors		N/A			Relocate existing		---	
Plumbing & Drainage	Water Supply					Drainage			
	Yes					Yes + Floor drain			
E & M, C & C	Equipment		Socket Type			Socket No. / Location		Communications	
	PABX (no outside call feature)		RJ11 provided by in-house C&C			1 / At 1440mm AFFL		Telephone wire to MTRC distribution box	
	General		Twin 13A			2 / Skirting level		---	
Fixtures & Furniture	Slop sink connect to foul drainage, storage cabinets, lockers, vacuum cleaner, table and chair.								
Others	---								

* Dependent on location - stainless steel door to be used when facing public areas.
- painted doors to be used when facing BoH areas.

AS BUILT BIM MODEL DEMONSTRATION



AS BUILT BIM MODEL



AS BUILT BIM MODEL

Select Build Model Circulation Opening Datum Room & Area Work Plane

Properties

Sheet: LEGEND, ABBREVI... Edit Type

Graphics

Visibility/Graphi... Edit...

Scale

Text

C&R No.

Figure No. Prefix Z/LRI/PUT/M...

Sheet Name 2nd...

Identity Data

Properties help Apply

Z_LRI_PUT_ARC.rvt - Project Browser

- Views (all)
 - Floor Plans
 - (CONTRACT)_Z_PLATFORM LE
 - (CONTRACT)_Z_RAIL LEVEL_S
 - (CONTRACT)_Z_S1000_Site Pl
 - (CONTRACT)_Z_TRACK LEVEL
 - (CONTRACT)_Z_TRACK_S100...
 - 3D Views
 - (CONTRACT)_Z_ISO
 - (CONTRACT)_Z_PER01
 - (CONTRACT)_Z_PER02
 - SOLAR DECEMBER 22 0900
 - SOLAR DECEMBER 22 1200
 - SOLAR DECEMBER 22 1500
 - SOLAR JUNE 22 0900
 - SOLAR JUNE 22 1200
 - SOLAR JUNE 22 1500
 - SOLAR MARCH 21 0900
 - SOLAR MARCH 21 1200
 - SOLAR MARCH 21 1500
 - SOLAR SEPTEMBER 21 0900
 - SOLAR SEPTEMBER 21 1200
 - SOLAR SEPTEMBER 21 1500
 - (3D)
 - Elevations (Building Elevation)
 - (CONTRACT)_Z_S100 EAST EL
 - (CONTRACT)_Z_S100 NORTH
 - (CONTRACT)_Z_S100 SOUTH
 - (CONTRACT)_Z_S100 WEST EL
 - Sections (Building Section)
 - 01
 - 02
 - PLATFORM 1
 - PLATFORM 2
 - Legends
 - Schedules/Quantities
 - DRAWING LIST
 - Tiling Schedule
 - VOICE PCP (All types)
 - Sheets (all)
 - A01/010 - LEGEND, ABBREVIAT
 - A01/100 - SITE PLAN
 - A01/101 - PLATFORM PLAN SHE

DRAWING LIST

DRAWING	DRAWING TITLE	REVISION	SHEET IS SHE DATE
A01/010	LEGEND, ABBREVIATION, DRAWING LIST		07/23/10
A01/100	SITE PLAN		07/22/10
A01/101	PLATFORM PLAN SHEET 1 OF 2		07/22/10
A01/102	PLATFORM PLAN SHEET 2 OF 2		07/20/10
A01/103	EAST ELEVATION		08/25/10
A01/104	WEST ELEVATION		07/22/10
A01/105	SOUTH ELEVATION		07/23/10
A01/106	NORTH ELEVATIONS		07/23/10
A01/107	SECTION 01		07/23/10
A01/108	SECTION 02		07/20/10
A01/110	ISOMETRIC & PERSPECTIVES		07/23/10
A01/120	SOLAR STUDY MARCH		07/23/10
A01/121	SOLAR STUDY MARCH		08/26/10
A01/122	SOLAR STUDY MARCH		08/26/10
A01/123	SOLAR STUDY JUNE		08/26/10
A01/124	SOLAR STUDY JUNE		08/26/10
A01/125	SOLAR STUDY JUNE		08/26/10
A01/126	SOLAR STUDY SEPT		08/26/10
A01/127	SOLAR STUDY SEPT		08/26/10
A01/128	SOLAR STUDY SEPT		08/26/10
A01/129	SOLAR STUDY DEC		08/26/10
A01/130	SOLAR STUDY DEC		08/26/10
A01/131	SOLAR STUDY DEC		08/26/10
A01/132	SECTIONS		10/20/10

Tiling Schedule

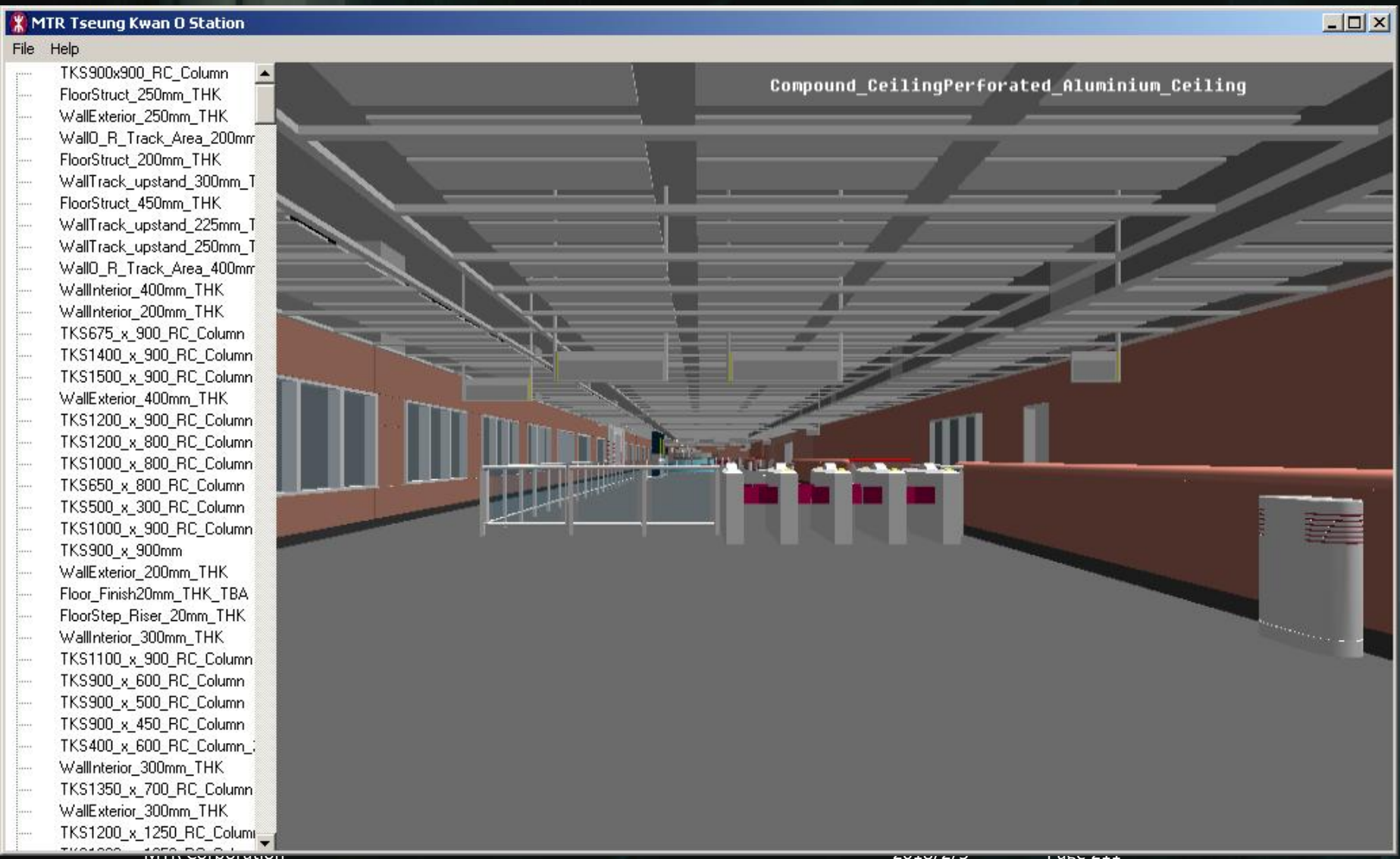
Family	Level	Type	Type Mark	Keystone	Count
GEM_MTR_Floor Care Mark Based_DimGray	PLATFORM	GEM_MTR_Floor Care Mark Based_DimGray			12
GEM_MTR_Floor Security Line Based_Yellow	PLATFORM				2
TLG-DRN-MTR-Type_A		Brick Frame Colour Khaki	A		36
TLG-DRN-MTR-Type_B		Brick Frame Colour Khaki	B		194
TLG-DRN-MTR-Type_C	PLATFORM		C		240

VOICE PCP (All types)

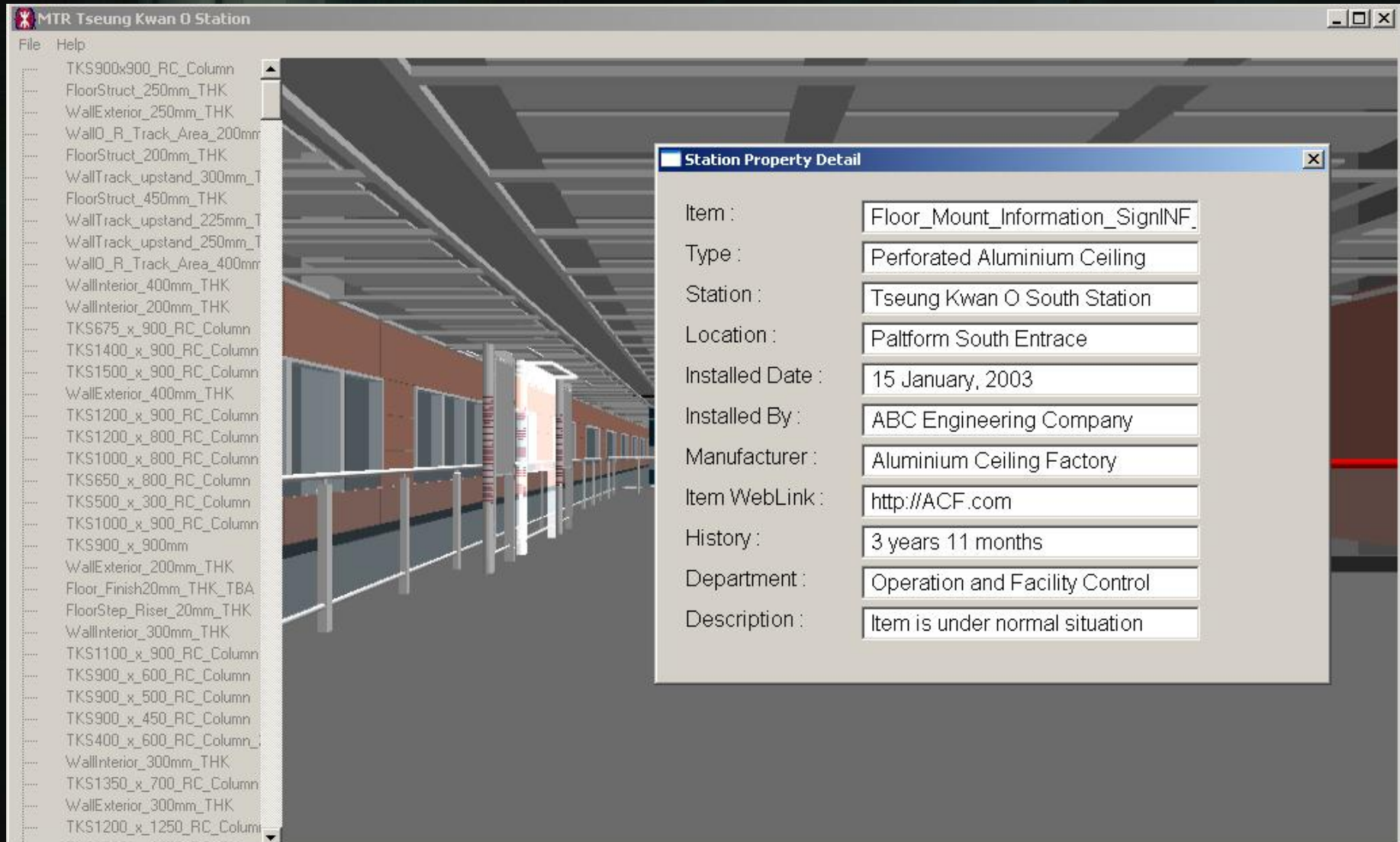
Family	Mark	Type Mark
ELF-ARC-MTR-PCP	xxxx	E
ELF-ARC-MTR-PCP	xxxx	E
ELF-ARC-MTR-PCP	xxxx	E
ELF-ARC-MTR-PCP-Ext_Voice	xxxx	E
ELF-ARC-MTR-PCP-Ext_Voice	xxxx	E
ELF-ARC-MTR-PCP	xxxx	X
ELF-ARC-MTR-PCP	xxxx	X
ELF-ARC-MTR-PCP	xxxx	X
ELF-ARC-MTR-PCP	xxxx	X
ELF-ARC-MTR-PCP	xxxx	X
ELF-ARC-MTR-PCP	xxxx	X
ELF-ARC-MTR-PCP-Ext_Voice	xxxx	X
ELF-ARC-MTR-PCP-Ext_Voice	xxxx	X
ELF-ARC-MTR-PCP-Ext_Voice	xxxx	X
ELF-ARC-MTR-PCP-Ext_Voice	xxxx	X
ELF-ARC-MTR-PCP-Ext_Voice	xxxx	X
ELF-ARC-MTR-PCP-Ext_Voice	xxxx	X
Grand total:	15	

A14 1530141				
A	J	K	L	
1	Id	FamilyName	TypeName	TypeMark Co
2	7848	Model Text	600mm Arial	
3	1148899	Model Text	200mm - wood	
4	1148901	Model Text	300mm - black	
5	1148904	Model Text	50mm - steel	
6	1193027	GEM_MTR_Floor Care Mark Based_DimGray	GEM_MTR_Floor Care Mark Based_DimGray	
7	1194842	GEM_MTR_Floor Security Line Based_Yellow	Security Line_MTR_Floor Based_Yellow	
8	1206709	GEM_MTR_Floor Security Line Based_Yellow	Security Line_MTR_Floor Based_Yellow W39600mm	
9	1282975	GEM_MTR_Floor Security Line Based_Yellow	Security Line_MTR_Floor Based_Yellow W39500mm	
10	1528388	TLG-DRN-MTR-Type_A	Brick Frame Colour Khaki	A
11	1528390	TLG-DRN-MTR-Type_A	Brick Frame Colour DimGray	
12	1529337	TLG-DRN-MTR-Type_B	Brick Frame Colour Khaki	B
13	1529335	TLG-DRN-MTR-Type_B	Brick Frame Colour DimGray	
14	1530141	TLG-DRN-MTR-Type_C	Brick Frame Colour Khaki	C
15	1530143	TLG-DRN-MTR-Type_C	Brick Frame Colour DimGray	
16	1532279	TLG-DRN-MTR-Type_C	Brick Frame Colour Khaki W200mm	C
17	1606926	TRN-TRN-MTR-LRL-Headstock	TRN-TRN-MTR-LRL-Headstock	
18	1618524	TRN-TRN-MTR-LRL-Coach	TRN-TRN-MTR-LRL-Coach	
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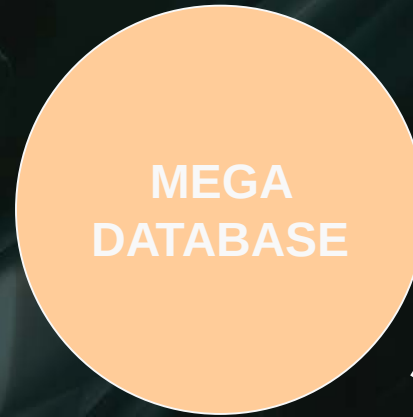
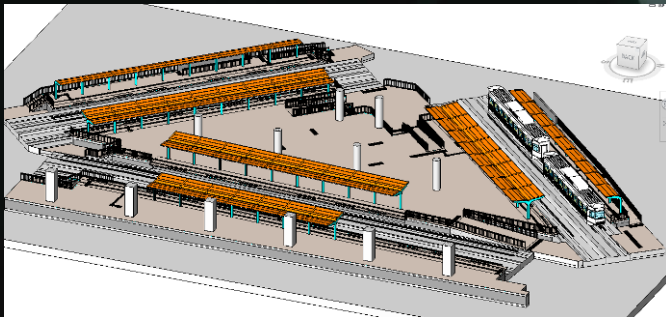
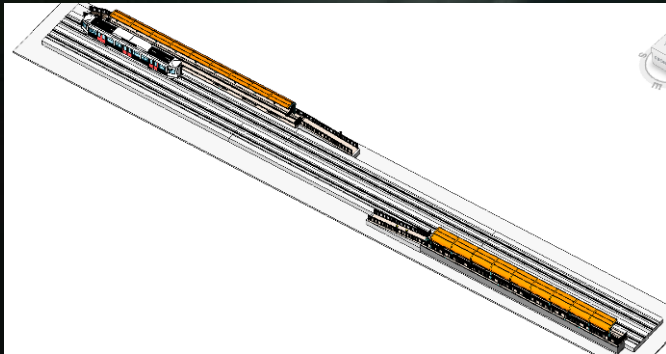
BIM FACILITY MANGEMENT



BIM FACILITY MANGEMENT



FACILITY MANAGEMENT ACROSS PROJECTS



APPLICATION



APPLICATION



APPLICATION

E.G.
REPLACEMENT PROGRAM



“十二五”建筑业信息化发展纲要

（一）总体目标

“十二五”期间，基本实现建筑企业信息系统的普及应用，加快建筑信息模型（BIM）、基于网络的协同工作等新技术在工程中的应用，推动信息化标准建设，促进具有自主知识产权软件的产业化，形成一批信息技术应用达到国际先进水平的建筑企业。

住房和城乡建设部 10/5/2011

<http://www.c-bm.com/news/2011/5-19/B16543600.shtml>

BEYOND BIM

VTT TECHNICAL RESEARCH CENTRE OF FINLAND

Building & Construction



ARScaleModel



ARWebCam



ARPhone



ARonPDA



Google Earth
"on Earth"



AROnSite



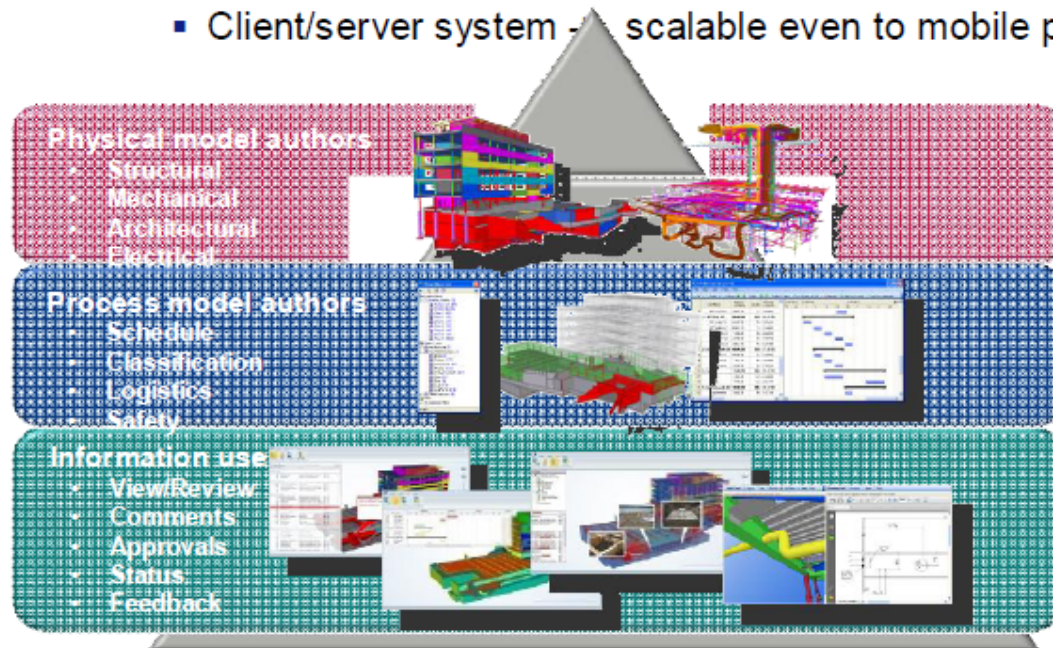
3D Model placed on a
Google Earth...



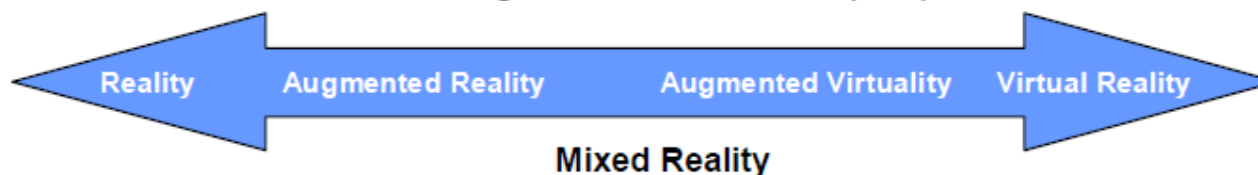
Project "AR4BC"

Augmented Reality for Building and Construction

- Compare project plans (4D BIM) with situation on site
- Provide real time mobile feedback from site to BIM system
- Client/server system - scalable even to mobile phones



Building Information Models (BIM)





Hardware + BIM + CLOUD + AR

Hardware + BIM + CLOUD + AR

The background is a dark, moody composition. It features large, fluid, and somewhat crystalline shapes that resemble liquid or smoke in motion, rendered in shades of deep teal and black. These organic forms are overlaid on a subtle, light-colored grid pattern that covers the entire frame. The lighting is dramatic, with highlights catching the edges of the flowing shapes, creating a sense of depth and movement.

THANK YOU