Cast Study:

NTU Learning Hub South

CPG Consultants + Heatherwick Studio

NTU Learning Hub

Designer : Heatherwick Studio

Architect : CPG Consultants

location

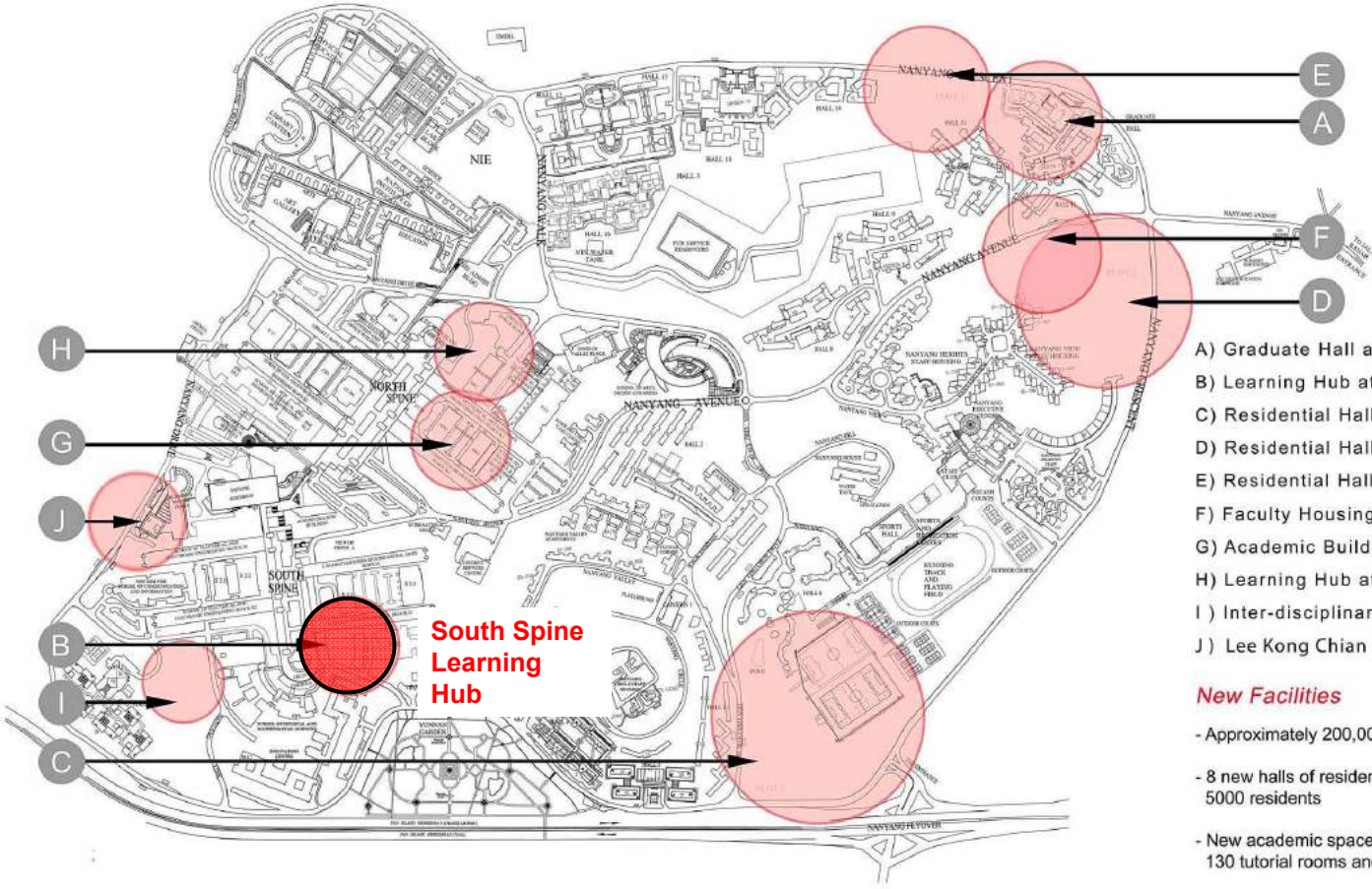
vision

NANYANG TECHNOLOGICAL UNIVERSITY

A VIBRANT UNIVER-CITY

NTU's Campus Master Plan will transform the varsity grounds into a mini city, pulsating with activities that bring together students, faculty and staff in cross-campus interactions.

Designed along sustainability principles, the new spaces will add to the lushness of the campus, incorporate eco-friendly features and create formal and informal spaces to connect the NTU community.



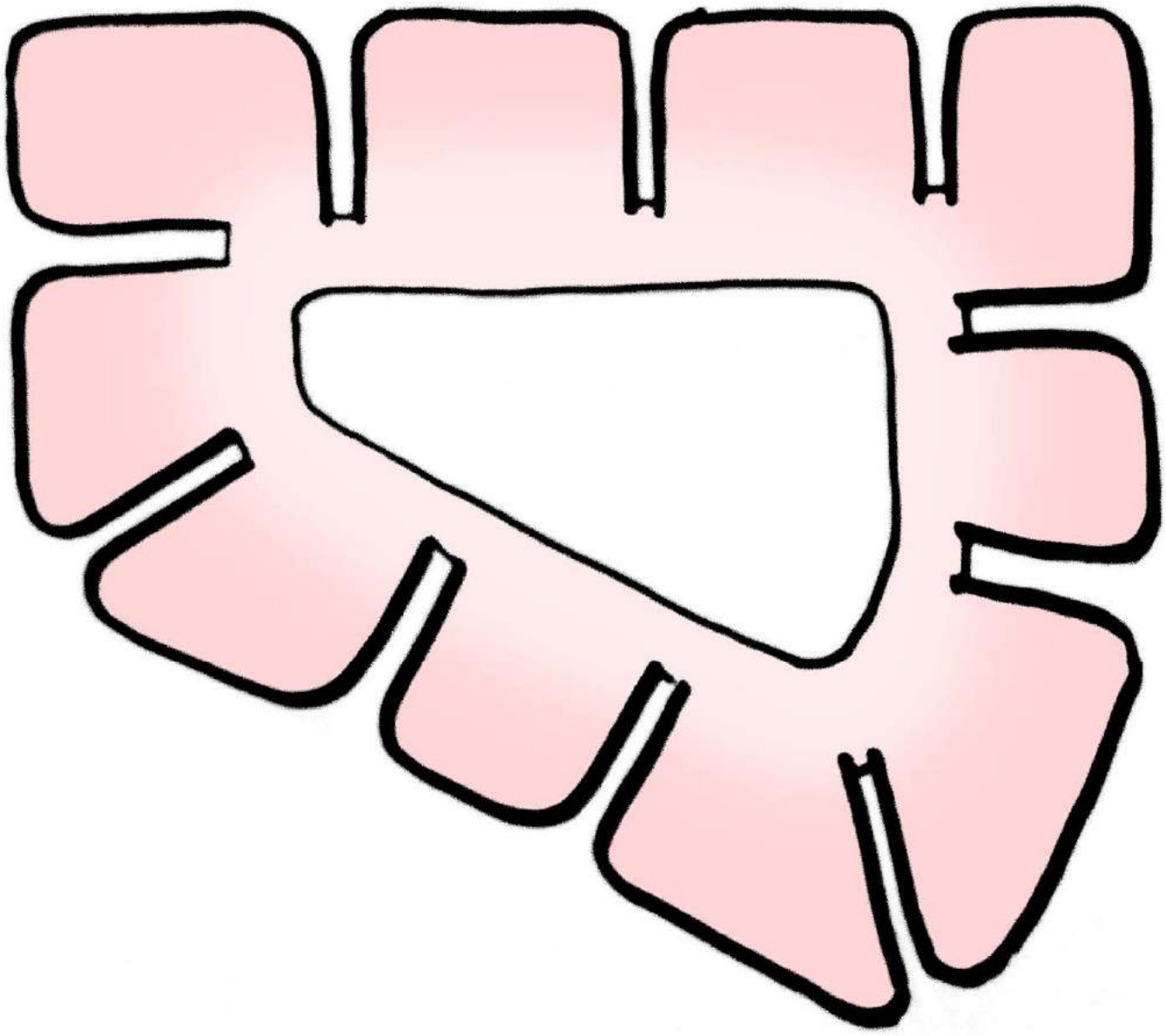
A) Graduate Hall at Nanyang Crescent
B) Learning Hub at South Spine
C) Residential Halls at Nanyang Drive
D) Residential Halls at Nanyang Avenue
E) Residential Halls at Nanyang Crescent
F) Faculty Housing at Nanyang Avenue
G) Academic Building at North Spine
H) Learning Hub at North Spine
I) Inter-disciplinary Research Building
J) Lee Kong Chian School of Medicine

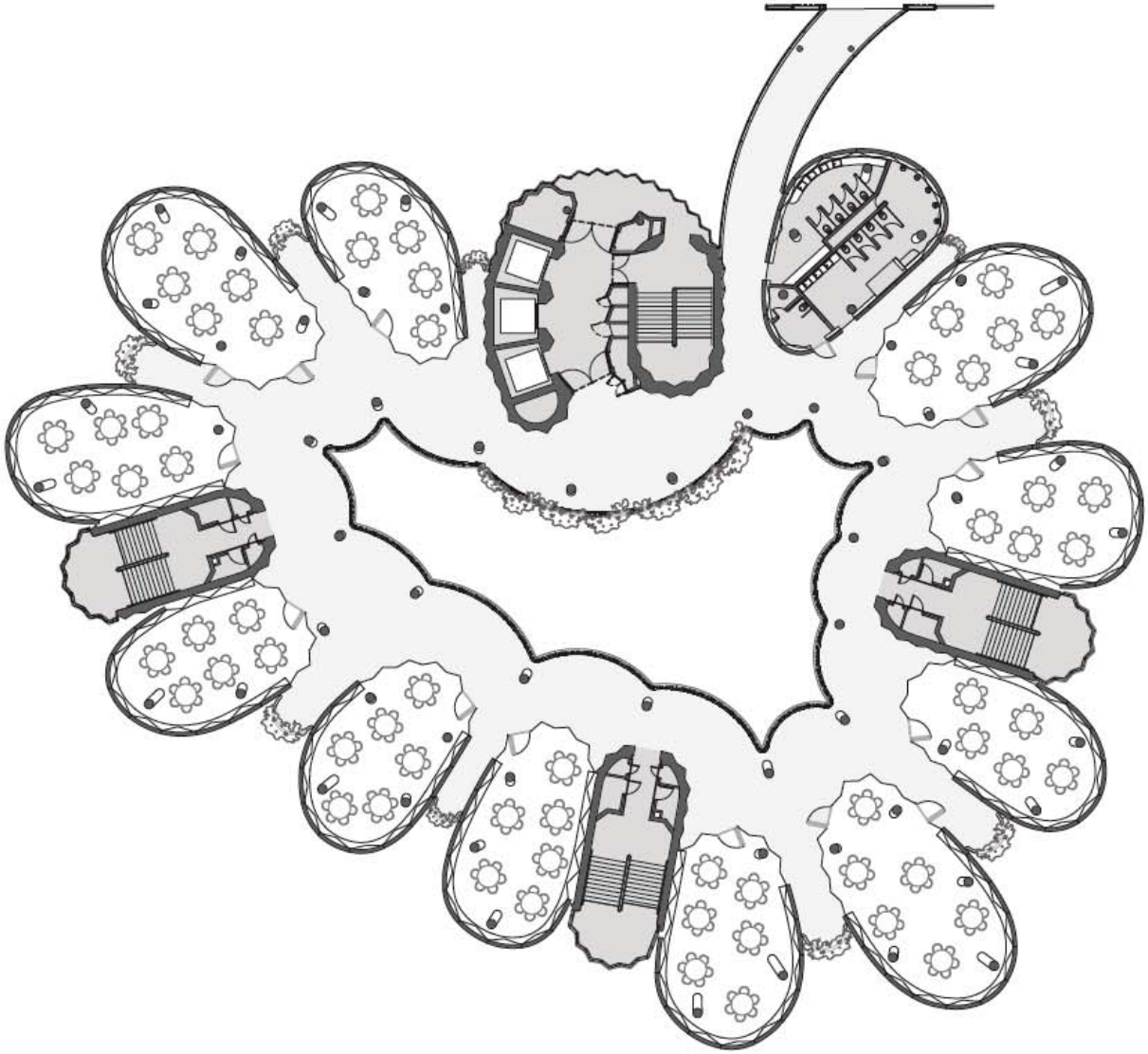
New Facilities

- Approximately 200,000 sqm of new space
- 8 new halls of residence for approximately 5000 residents
- New academic spaces including lecture theatre, 130 tutorial rooms and new library facilities
- 110 units of faculty housing
- Approximately 50,000 sqm of laboratory and research facilities

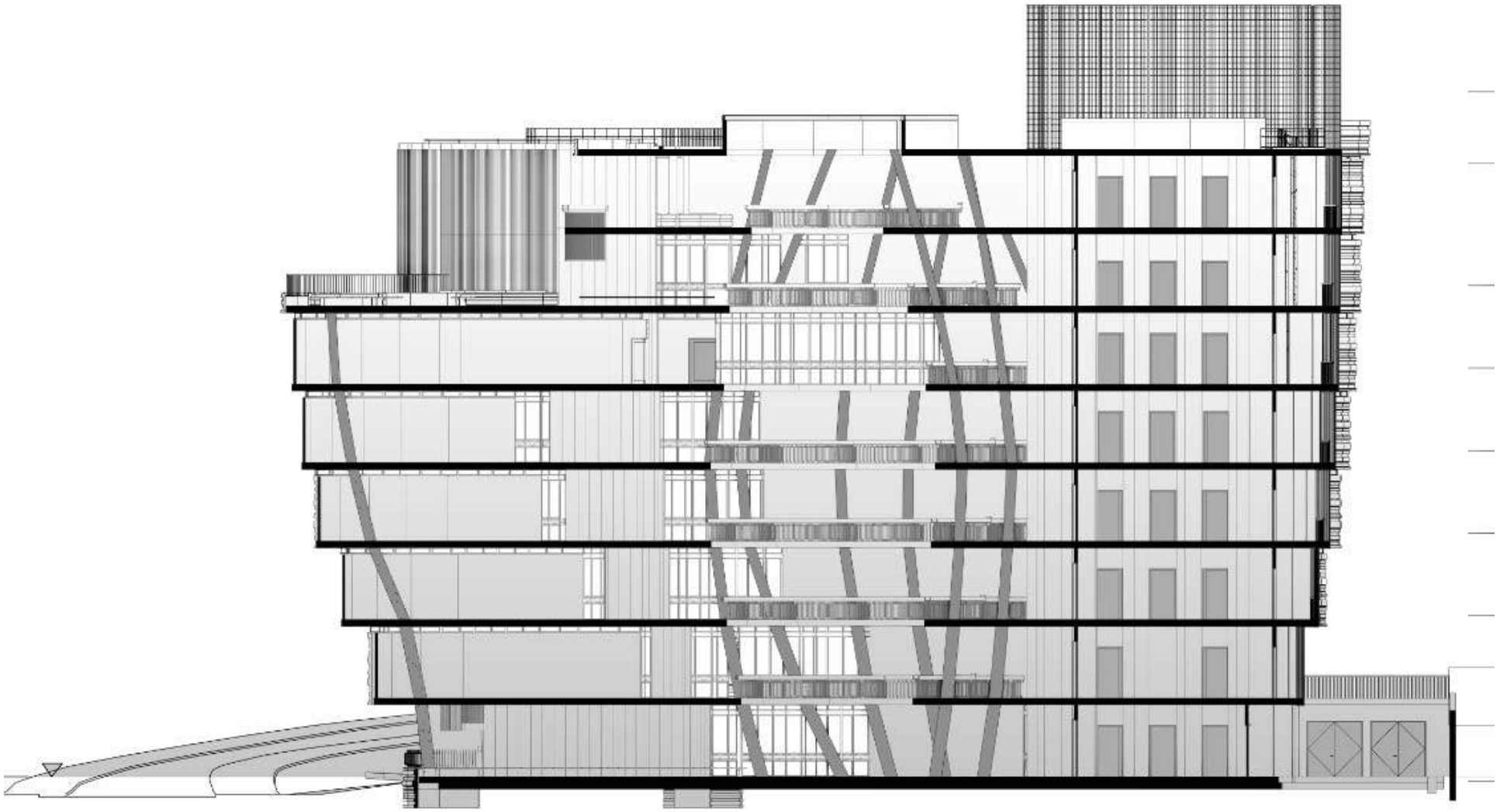
corridors

classrooms





0 1 2 3 4 5 10




DROP OFF POINT

BIM for NTU Learning Hub

- Submissions Process
- Construction Stage
- As-built model requested by Client for facilities management

Building of the BIM model

- Design model in Rhino
- No easy transfer from Rhino to Revit
- Rhino – Autocad - Revit

Submissions Process

Planning Stage (URA)

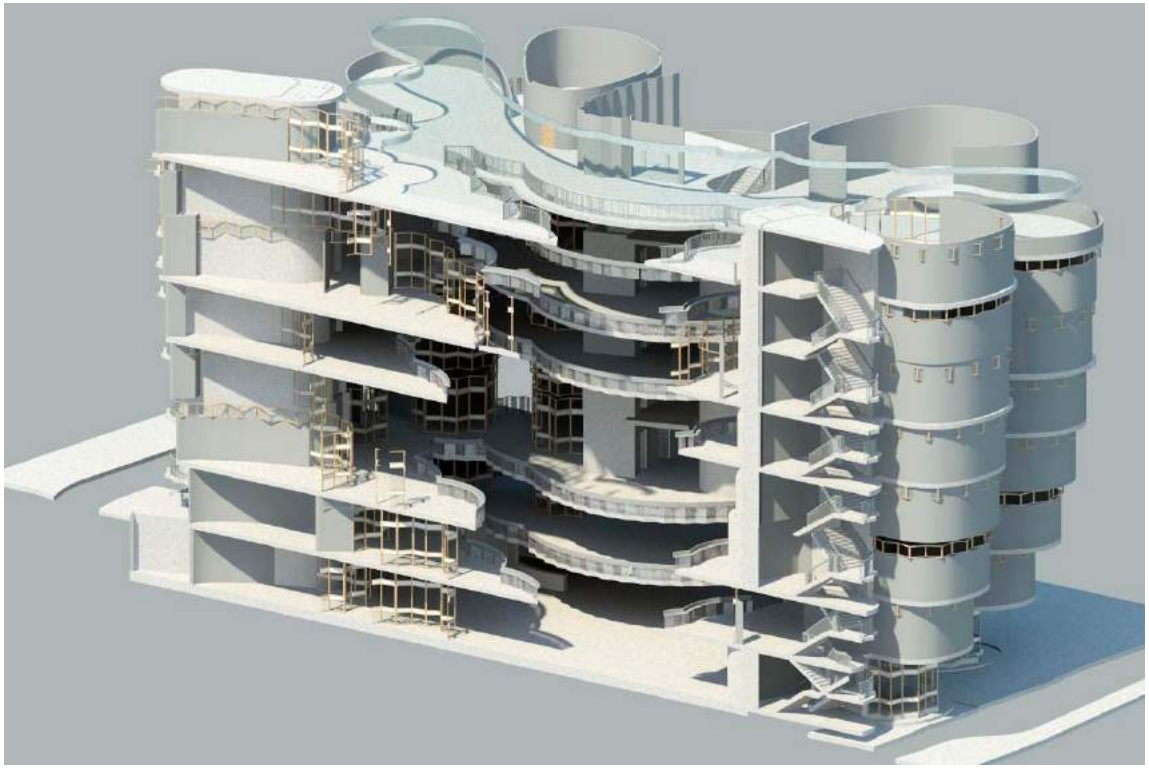
Fire Department (FSSD)

Building Control (BCA)

- Accessibility Provisions
- Buildability Score
- Green Mark

Building Control (BCA)

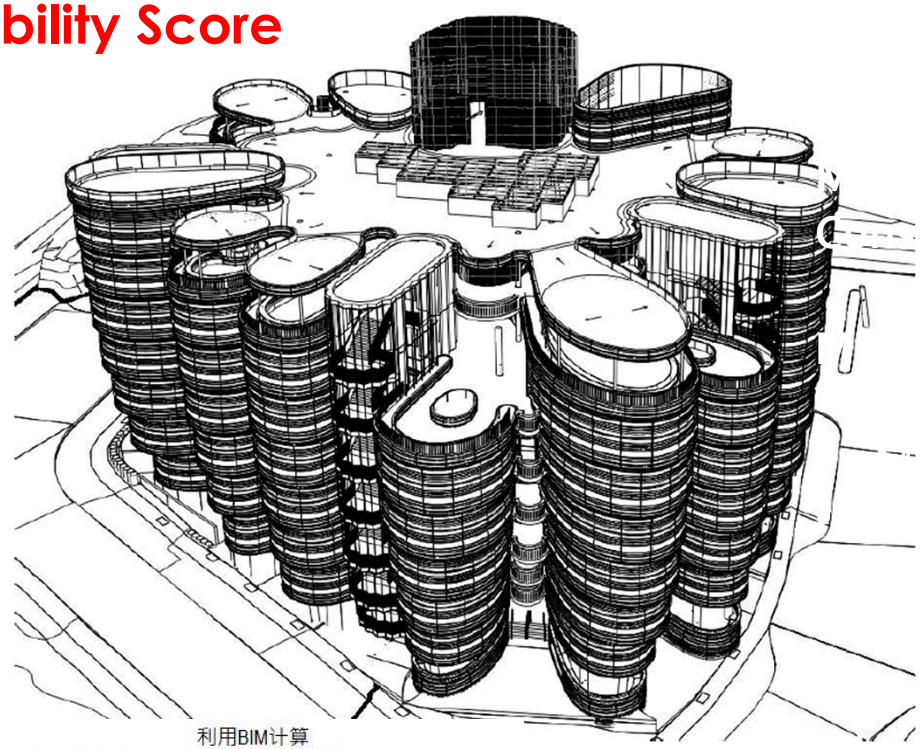
- **Accessibility Provisions and other building control requirements**

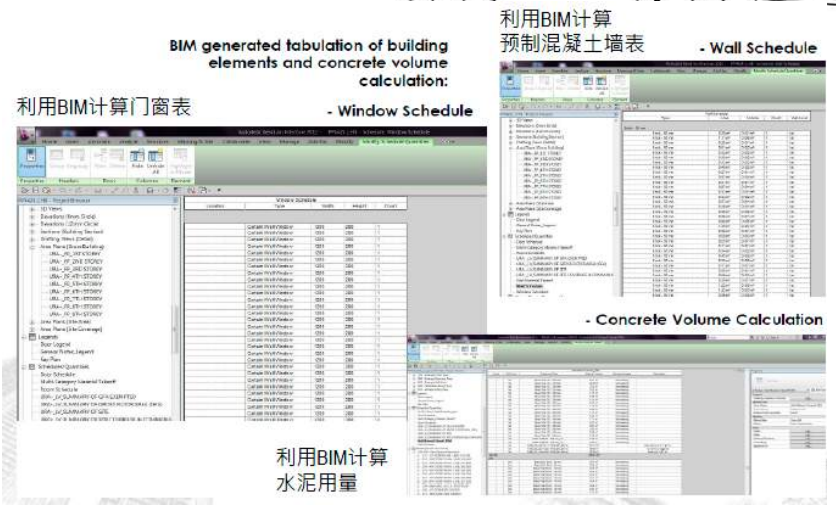


Handrail heights, spacing, widths of staircases, doorways, headroom, size of openings etc are checked

Building Control (BCA)

- **Buildability Score**





Mandated by Building and Construction Authority

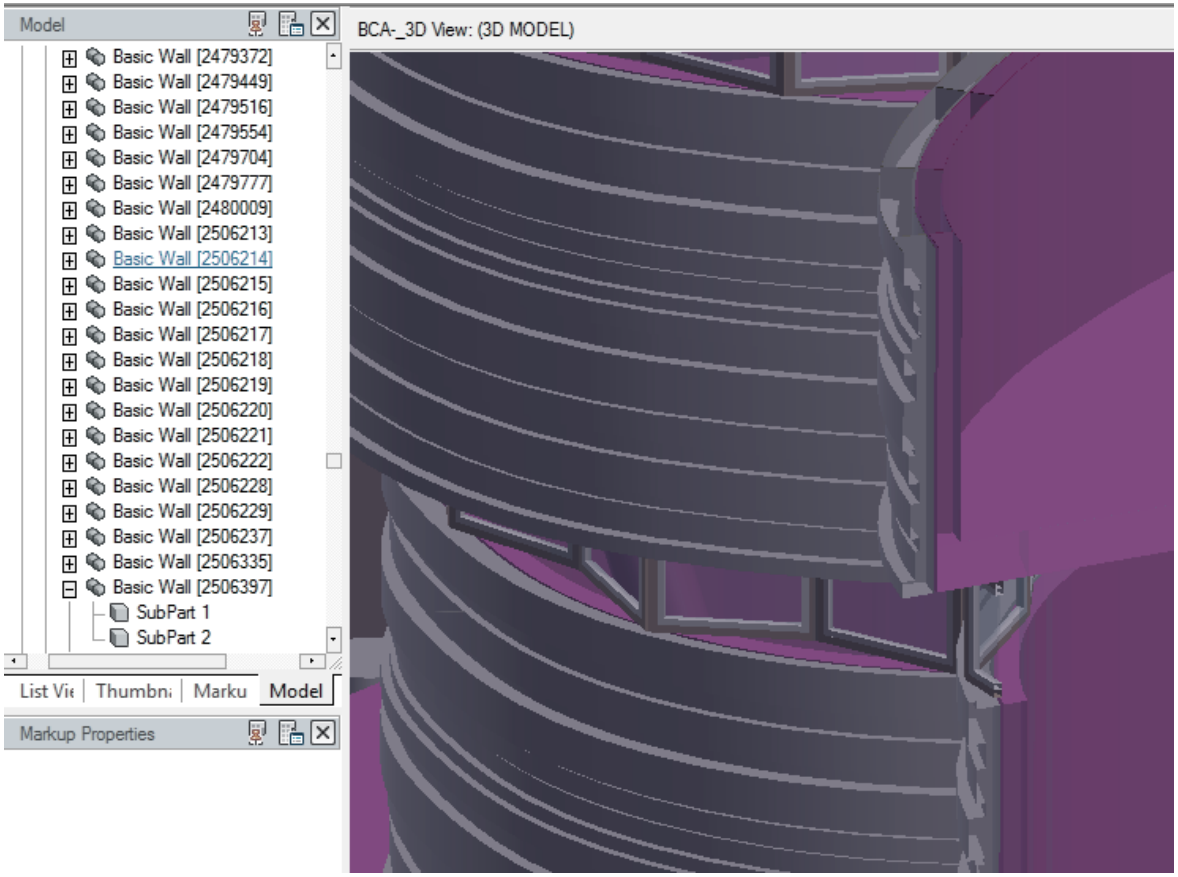
Methods of scoring:

- Standardisation
- Minimal transfer structures
- Minimal plastering/tiling/stone finishes
- Minimal brick walls

Minimum Requirement for this typology and size:
66 points

Building Control (BCA)

- **Buildability Score**



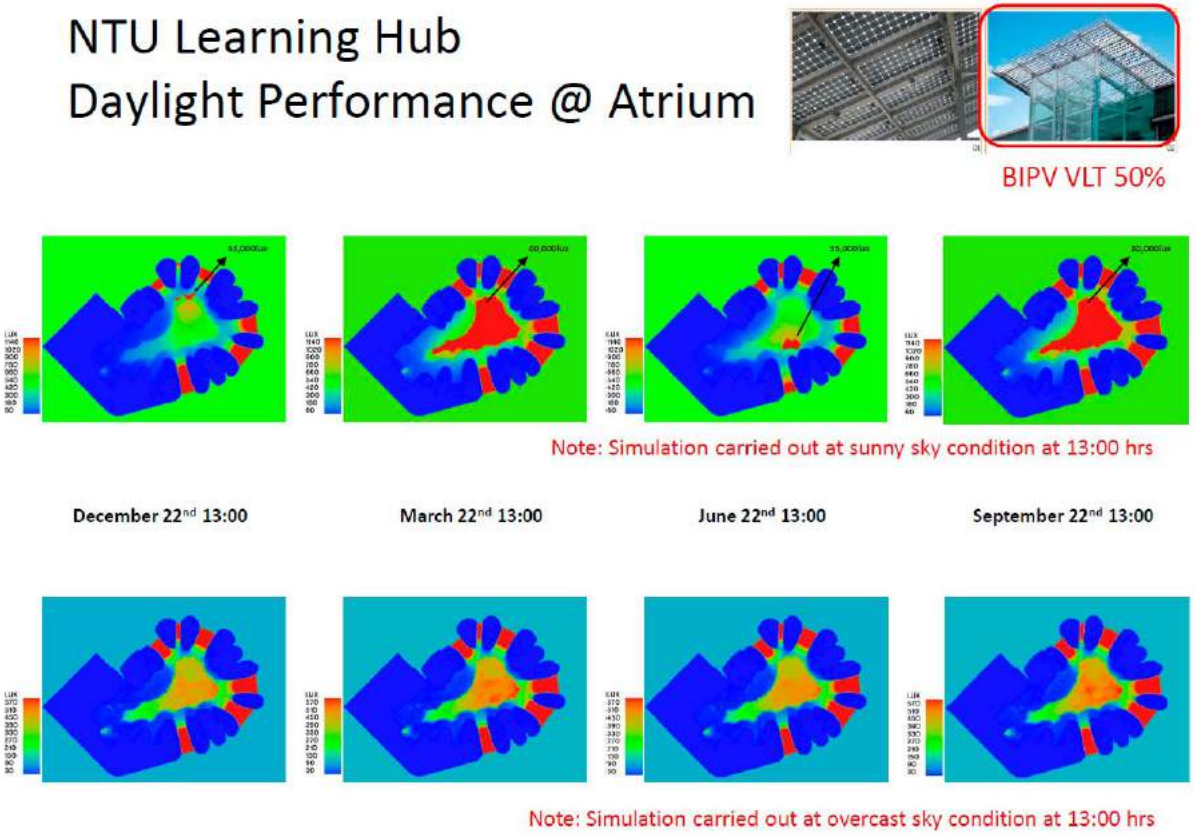
Submission method is using a form

BIM model is used to compute data using **eBDAS programme**

Length of walls, railing etc can be generated

Building Control (BCA)

- **Green Mark**



Sustainability rating based using points system

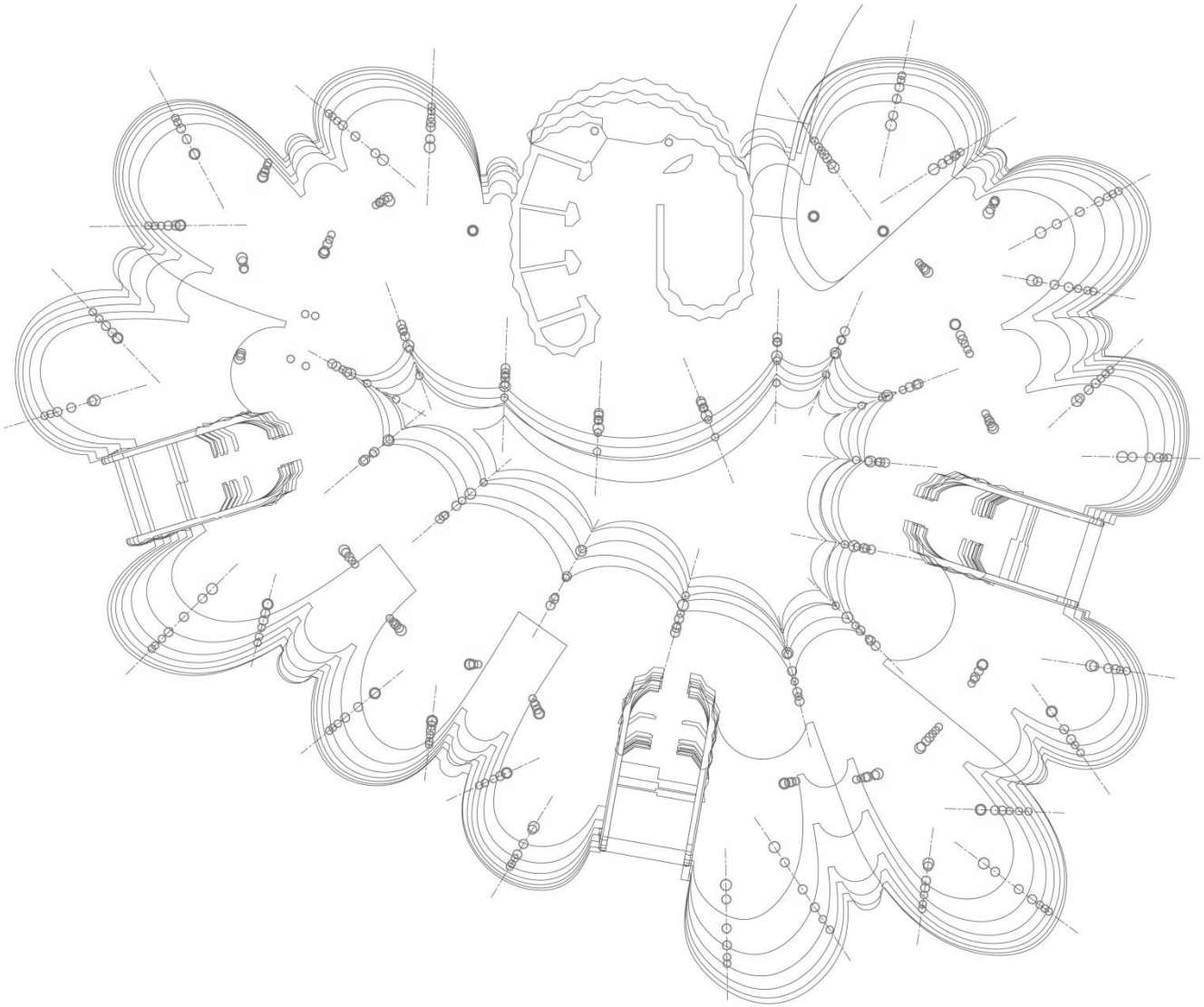
BIM model is used for computing data, eg air conditioned areas, volume of concrete used

Simplified models are built for simulation purposes

Green Mark award: PLATINUM

Construction

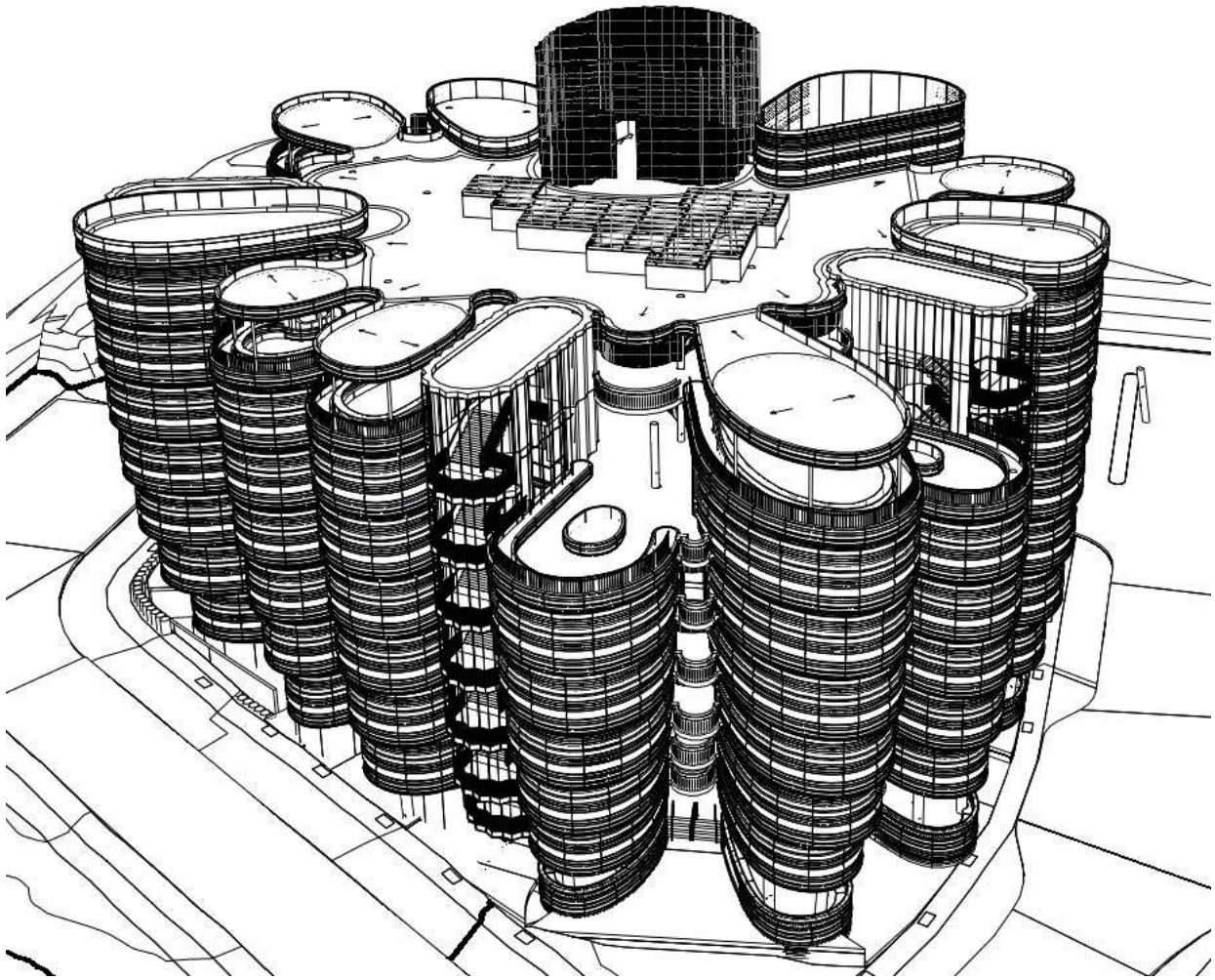
Modular Construction



Variation within Standardisation

Deviates from the common presumption that modular construction adopts the repeated use of completely identical elements.

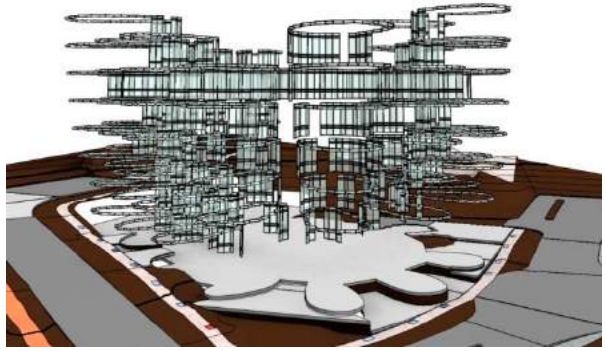
BIM Model – the components



model constructed in autodesk revit

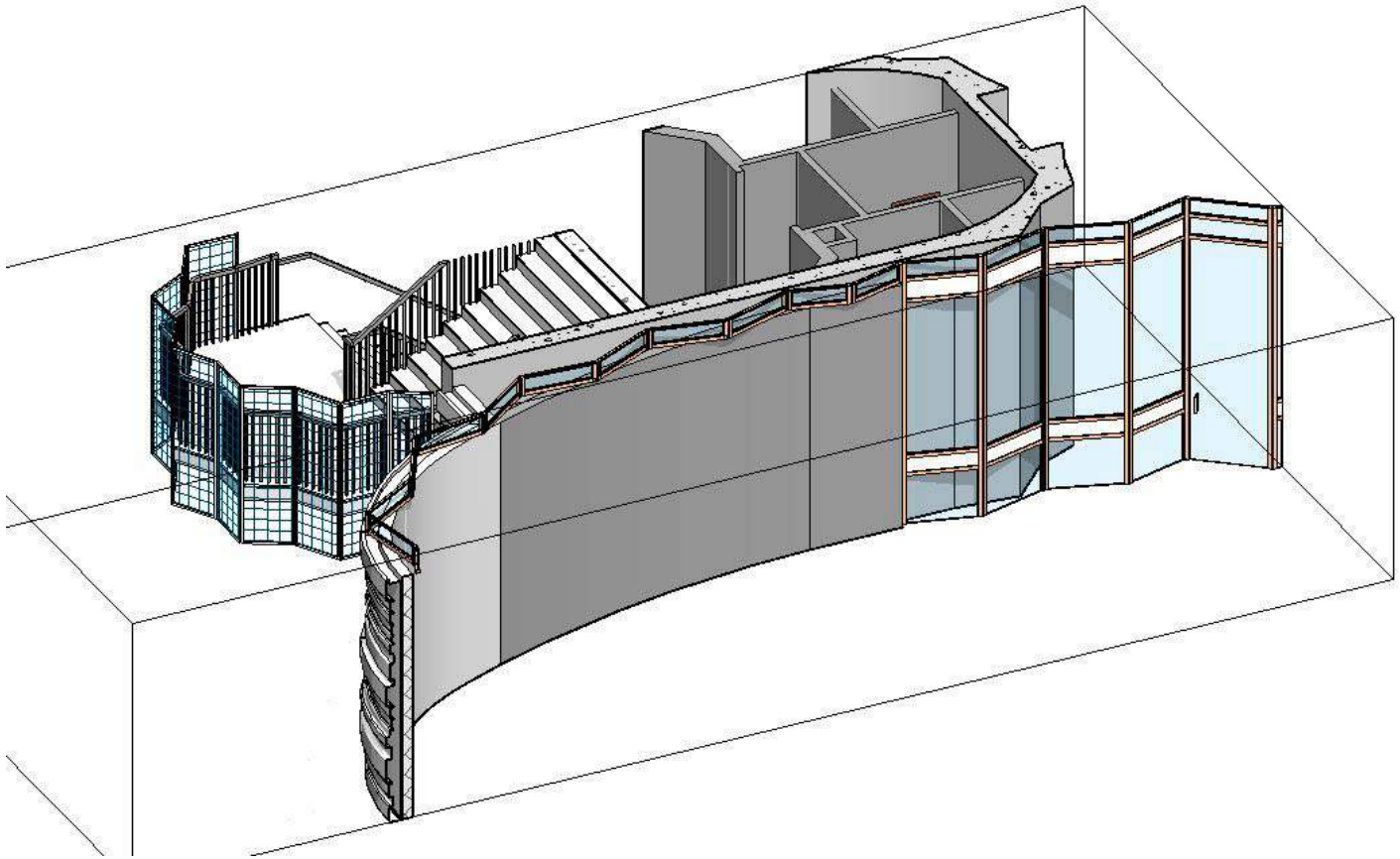
column and slab

cladding panels



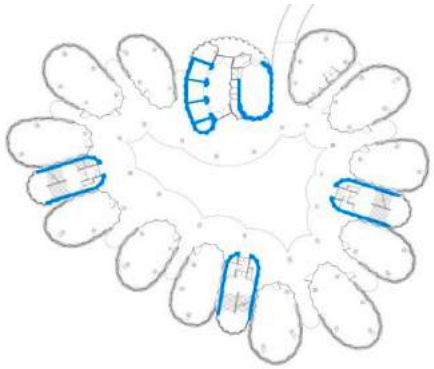
glazing

BIM

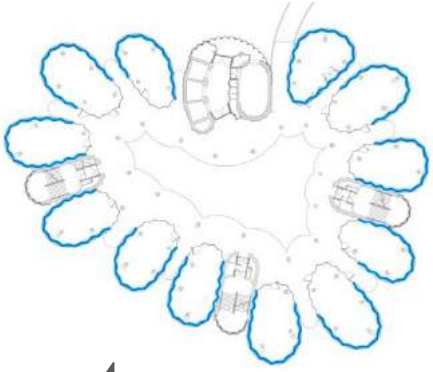


Wall layers and families for each component

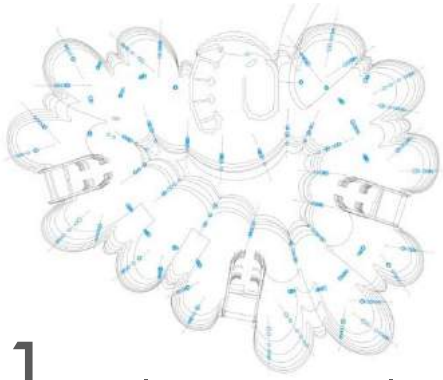
… the modular components



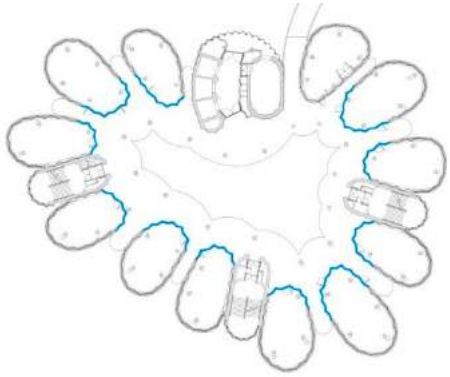
19 core wall panels



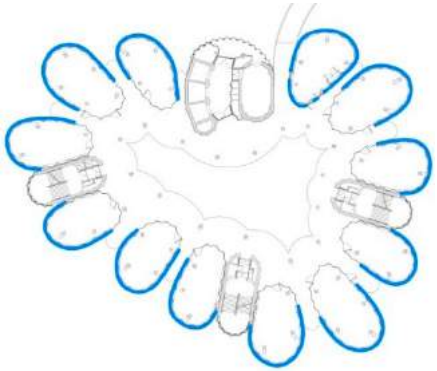
4 window units



11 column angles



1 glazing panel

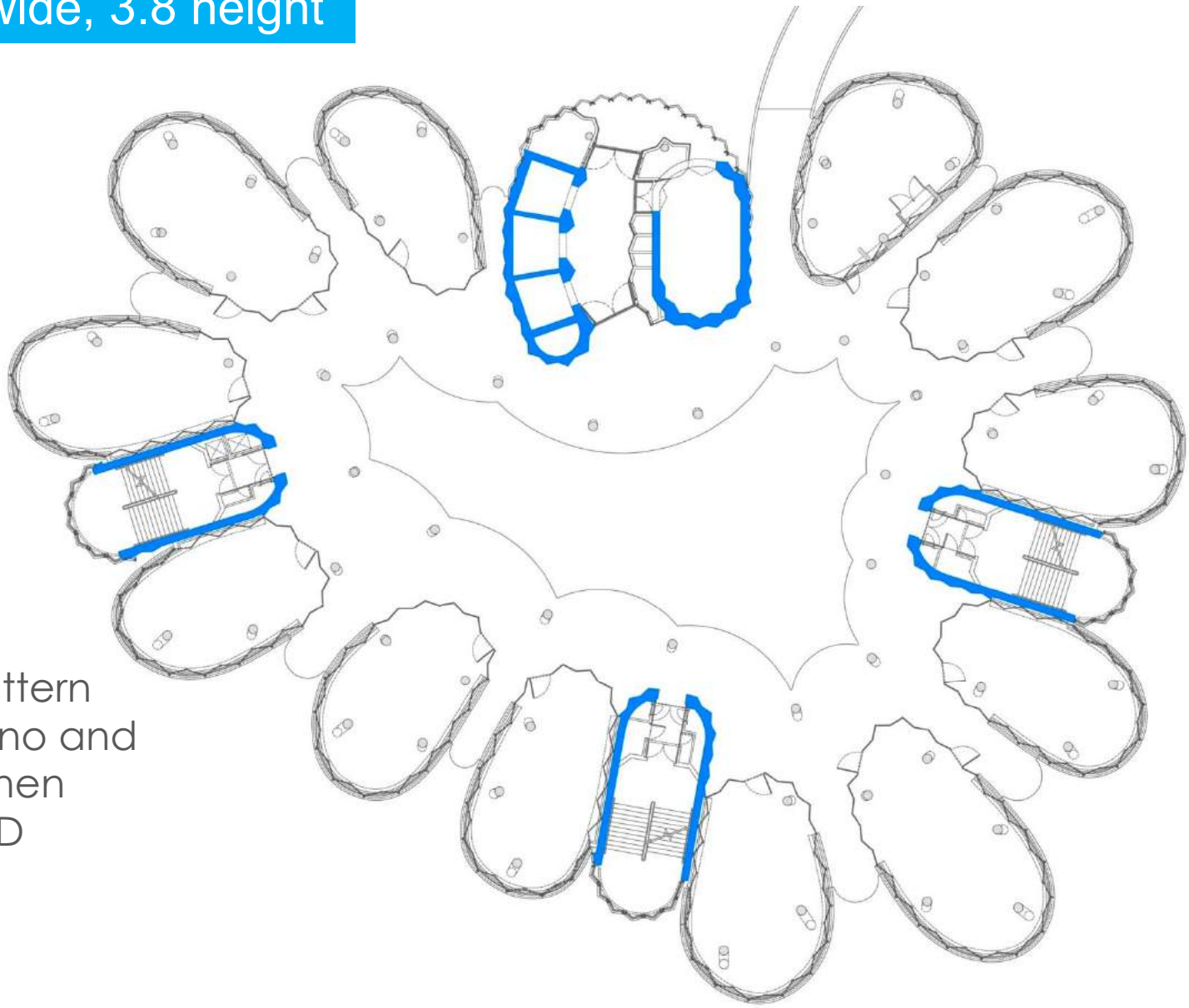


10 façade panel curvatures

modular components

core wall form liner panels

600 & 850mm wide, 3.8 height

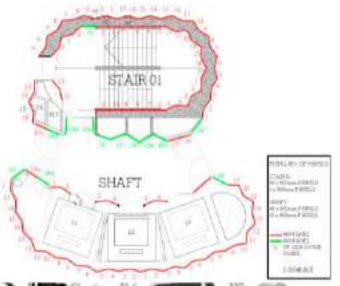


3D formliner pattern modeled in Rhino and Grasshopper, then converted to 3D Autocad to be fabricated

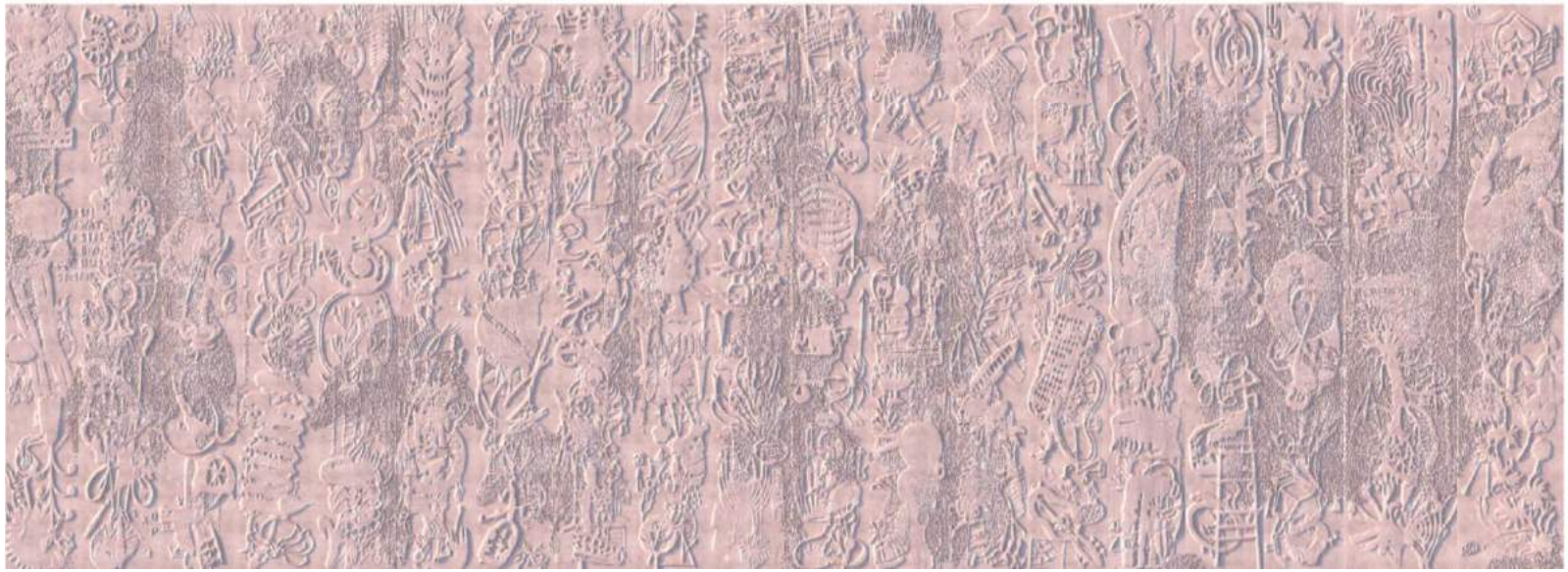
modular components

core wall form liner panels

600 & 850mm wide, 3.8 height



Heatherwick studio



modular components

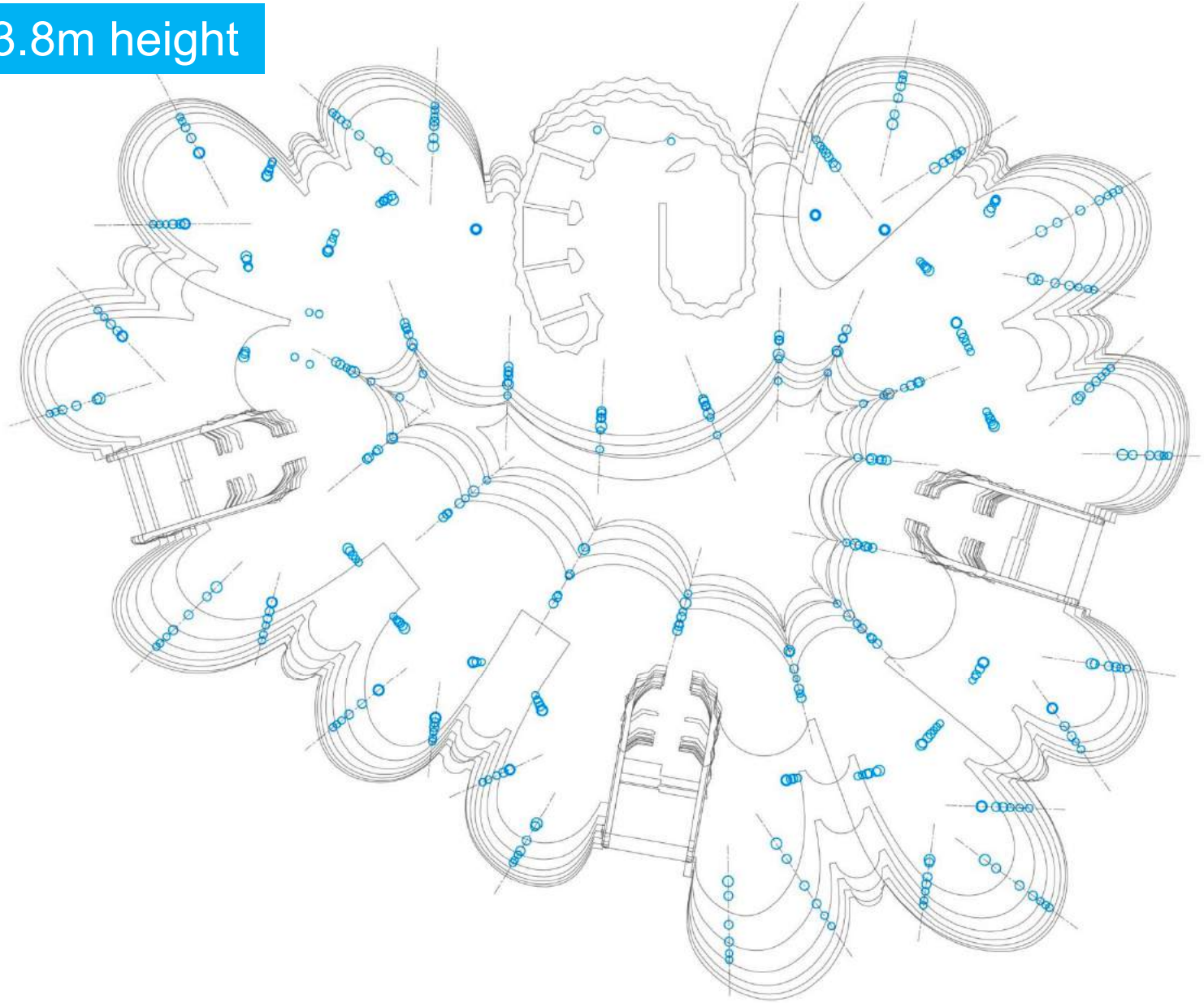
core wall form liner panels

600 & 850mm wide, 3.8 height

modular components

columns

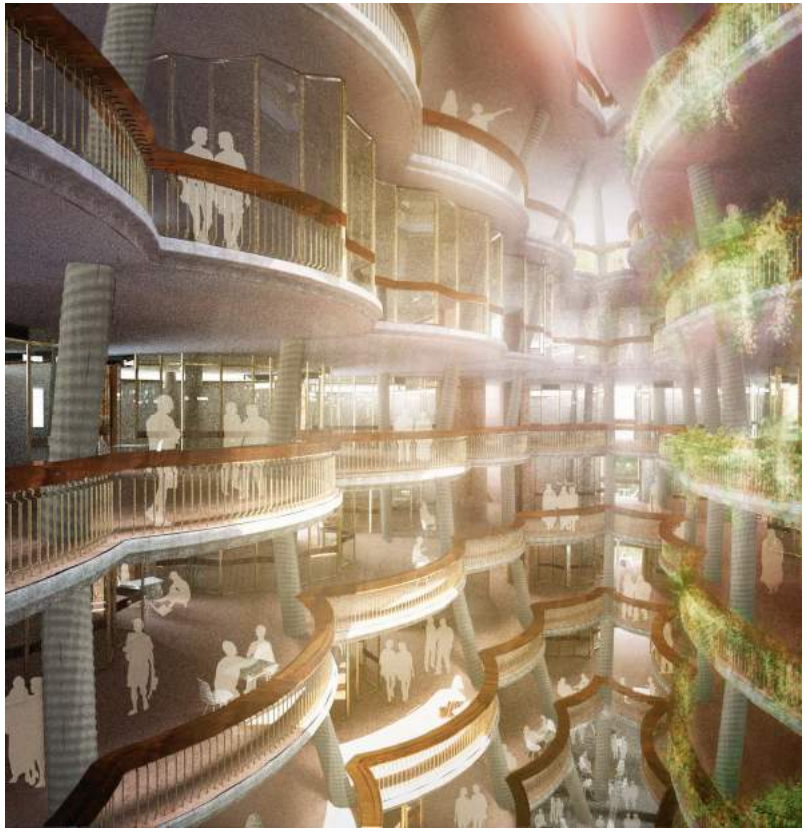
11 angles, 3.8m height



modular components

columns

11 angles , 3.8m height

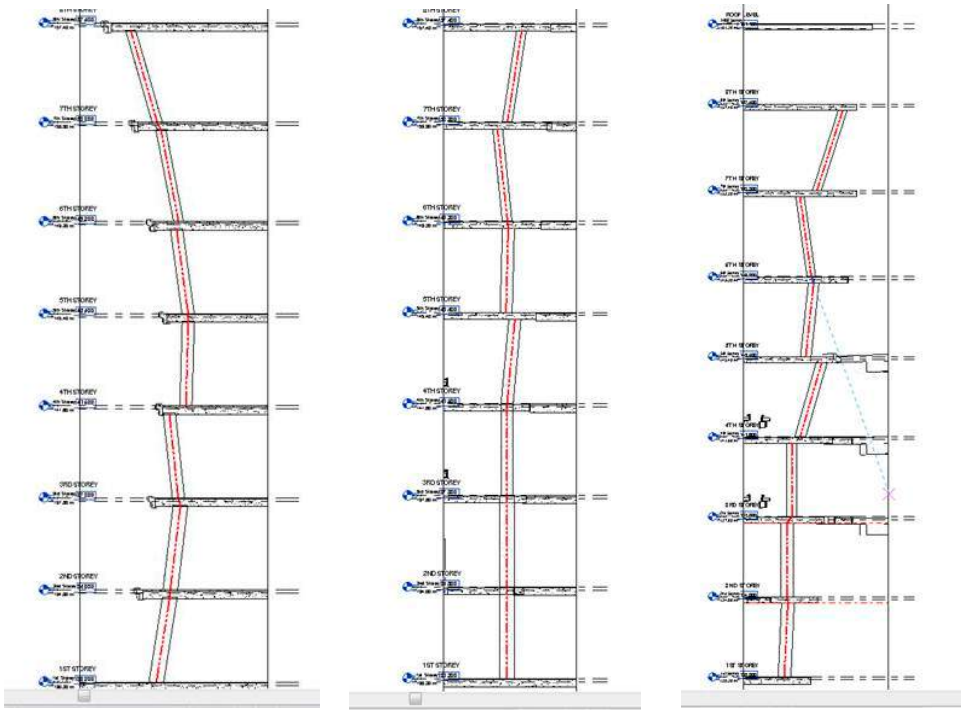


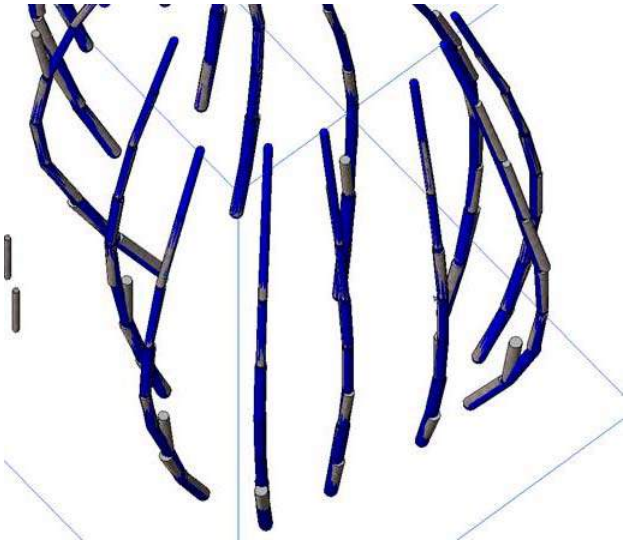
Heatherwick studio

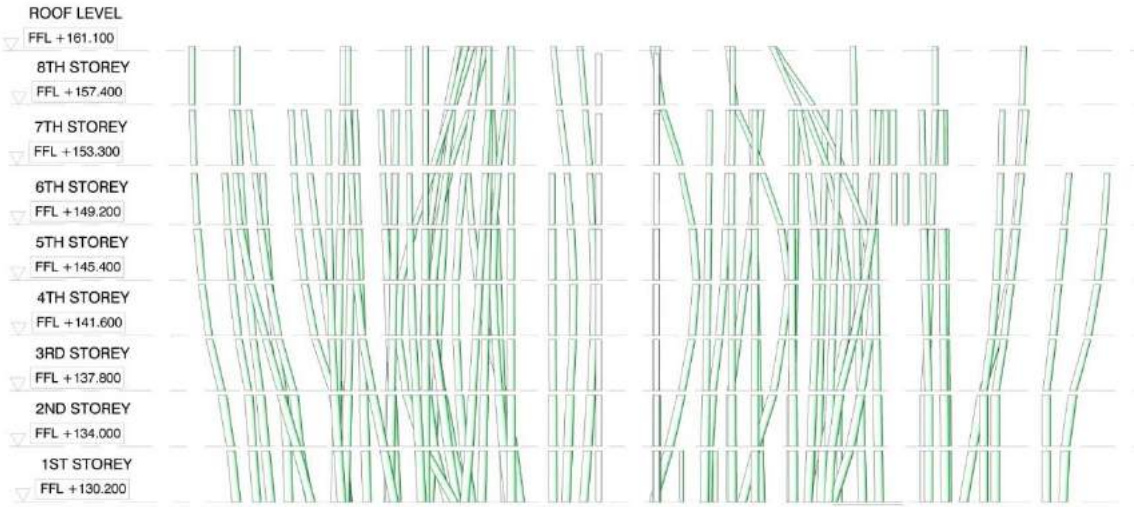
modular components

columns

11 angles , 3.8m height







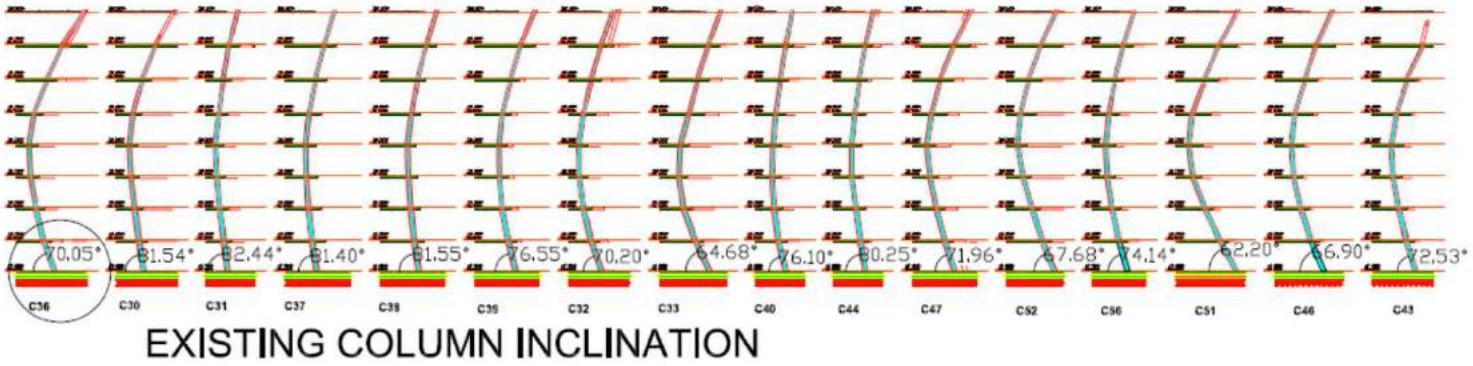
modular components

columns

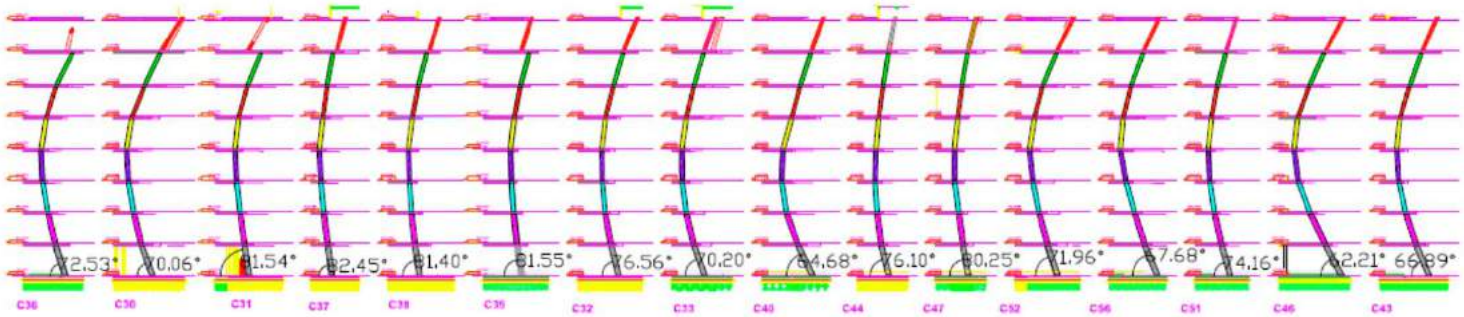
11 angles , 3.8m height

BIM used to check Contractor's model against design model

C32	APPROVED 22/7		C49	APPROVED
C33	APPROVED		C48	SEE COMMENT
C40	APPROVED 22/7		C29	APPROVED 18/7
C44	APPROVED		C28	APPROVED
C47	APPROVED		C35	APPROVED
C52	APPROVED 22/7		C19	APPROVED
C56	APPROVED		C20	APPROVED 18/7
C51	APPROVED		C18	APPROVED 18/7
C46	APPROVED		C5	APPROVED
C43	APPROVED		C12	APPROVED
C36	APPROVED		C13	DEPENDING
C30	APPROVED		C6	SEE COMMENT
C31	APPROVED 22/7		C7	APPROVED 22/7
C37	APPROVED 22/7		C22*	APPROVED 22/7
C38	APPROVED 22/7			



EXISTING COLUMN INCLINATION

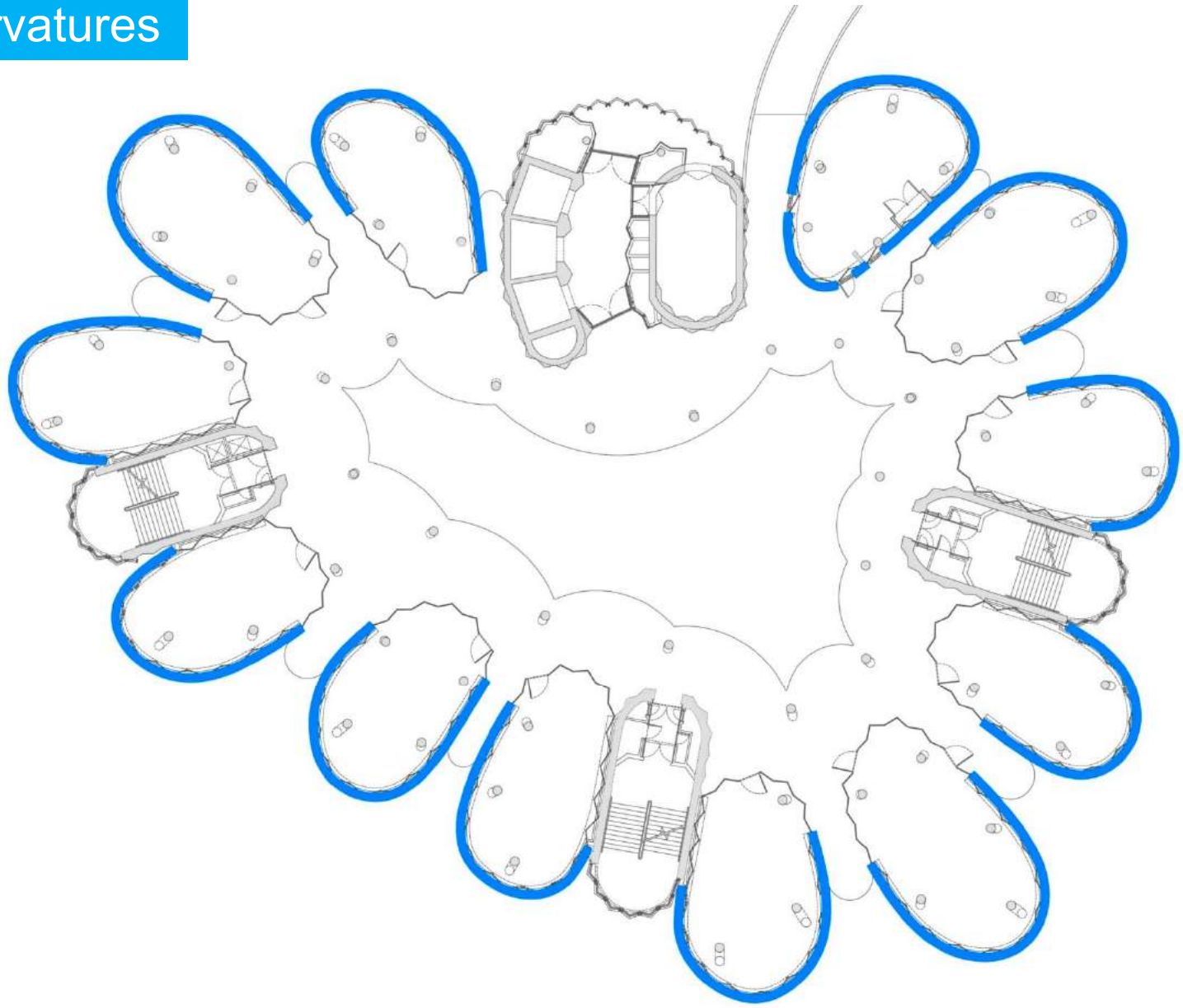


CONTRACTORS PROPOSAL

modular components

façade panels

2m width, 10 curvatures



modular components

façade panels

2m width, 10 curvatures

modular components

façade panels

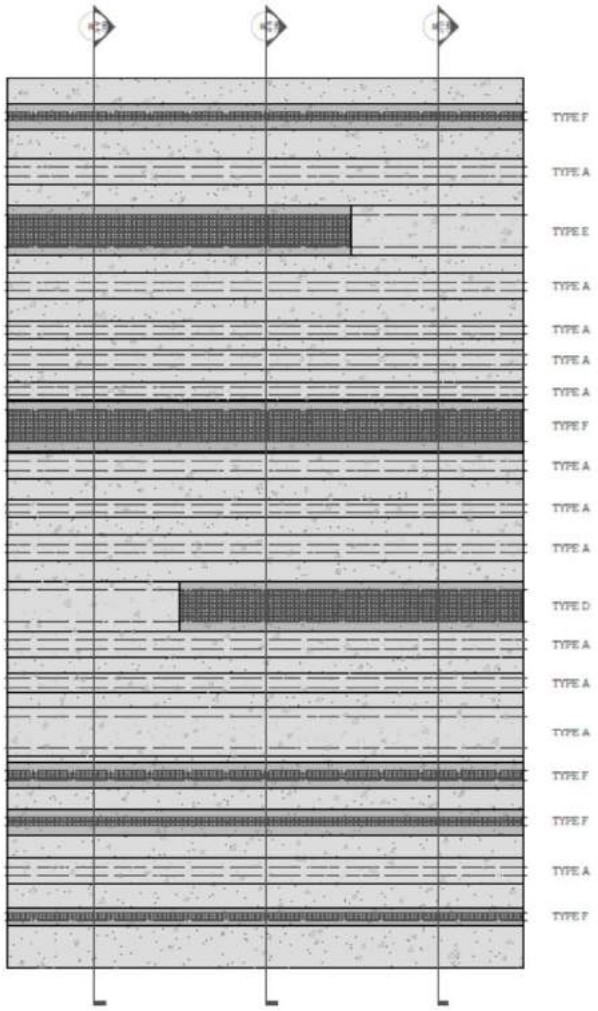
2m width, 10 curvatures

Due to the geometry of the panels, it was not possible at the time to model the panels as ‘walls’, as such they were modeled as objects which could not have much data attached to them

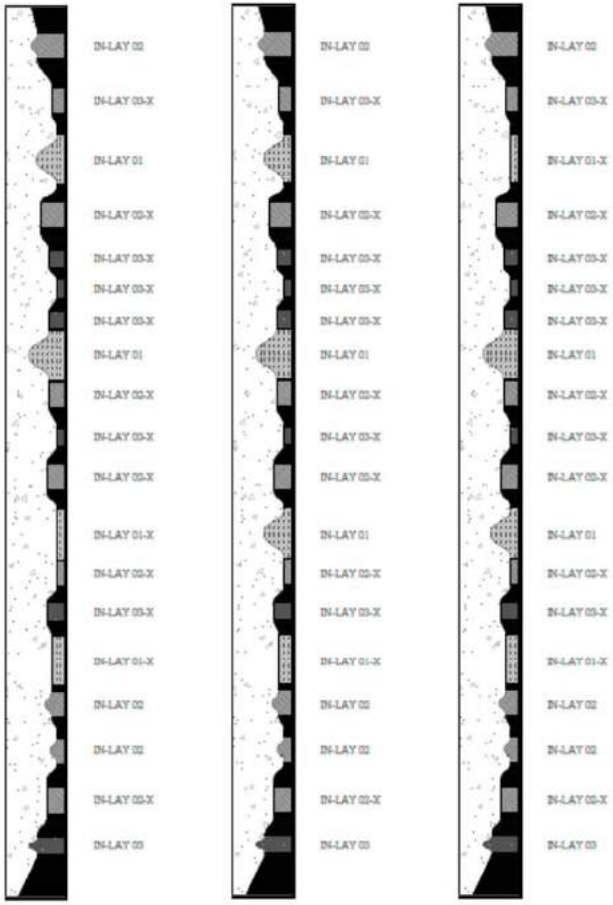
modular components

façade panels

2m width, 10 curvatures



PANEL
666-HS-XX-XX-DR-A-BS-1400



PANEL
SECTION A-A'

PANEL
SECTION B-B'

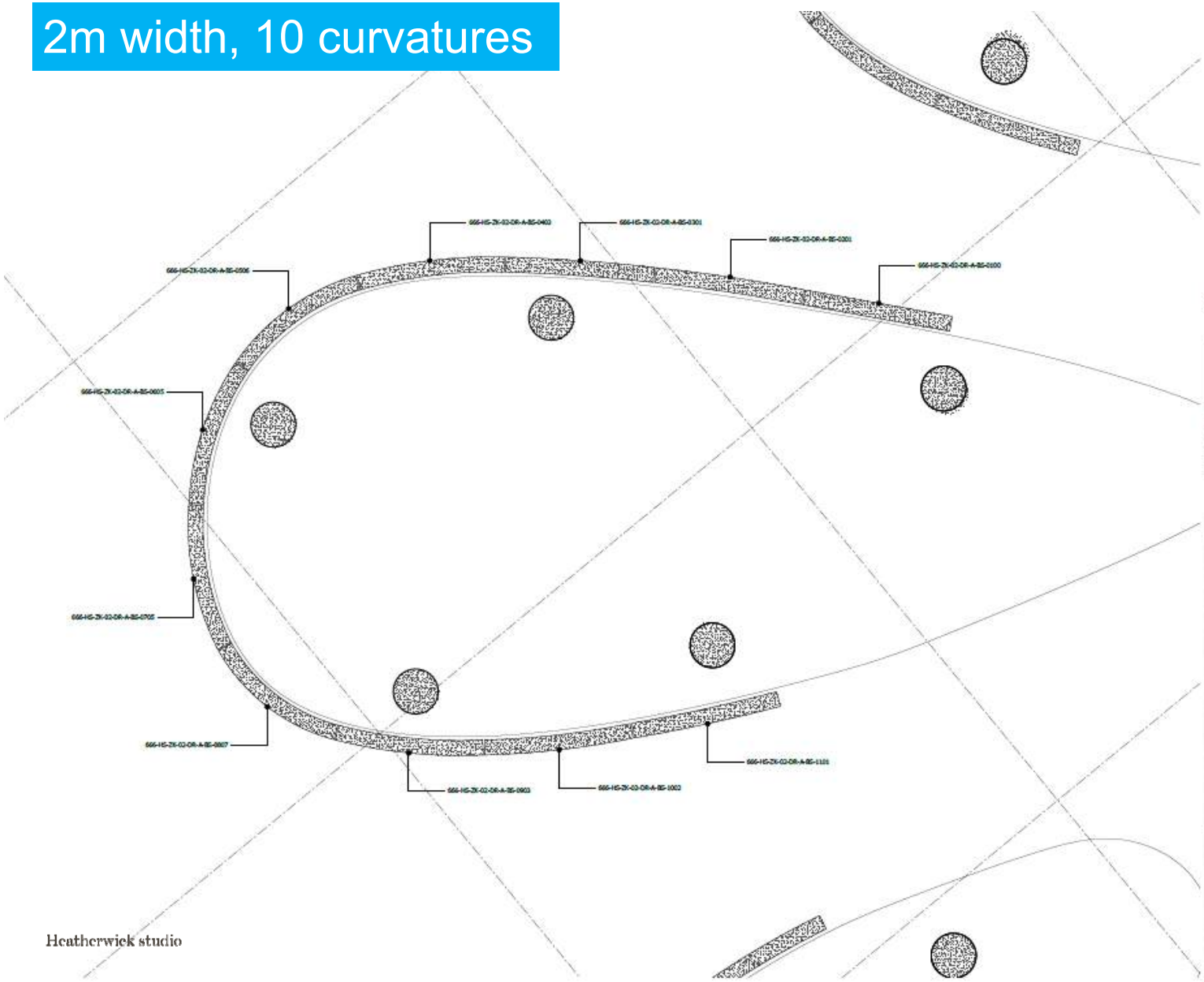
PANEL
SECTION C-C'

Heatherwick studio

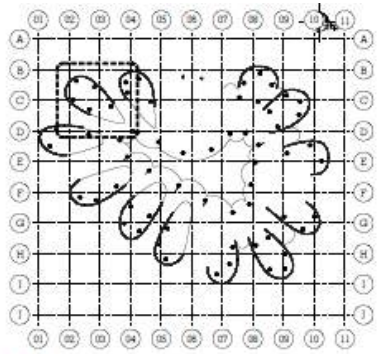
modular components

façade panels

2m width, 10 curvatures



Heatherwick studio



KEY PLAN

666-HS-ZK-02-DR-A-BS-XX-XX

POD K | LEVEL | PANEL NO. | CURVE TYPE

NOTES

- Do not scale this drawing work to figured dimension only.
- All Dimensions are in Millimeters unless otherwise stated.
- All Dimensions to be checked on site prior to commencement of the works
- Heatherwick Studio shall be notified in writing of any discrepancies requesting verification on how to proceed.

TOWER K

	LEVEL							
PANEL NUMBER	L01	L02	L03	L04	L05	L06	L07	L08	L09
1		C00	C00	C00	C00	C00	C00	C01	
2		C01	C00	C00	C00	C00	C00	C02	
3		C01	C02	C01	C02	C02	C00	C03	
4		C03	C04	C03	C04	C03	C02	C04	
5		C06	C05	C05	C05	C04	C03	C05	
6		C05	C05	C05	C05	C05	C04	C04	
7		C05	C05	C05	C04	C04	C05	C04	
8		C07	C06	C05	C05	C04	C04	C04	
9		C03	C03	C04	C04	C04	C04	C03	
10		C02	C02	C02	C02	C03	C04	C03	
11		C01	C01	C02	C02		C03	C02	
12			C01	C01	C01		C02	C01	
13							C02	C00	
14							C01	C01	
15							C01		
15									
16									
17									
18									
19									
20									

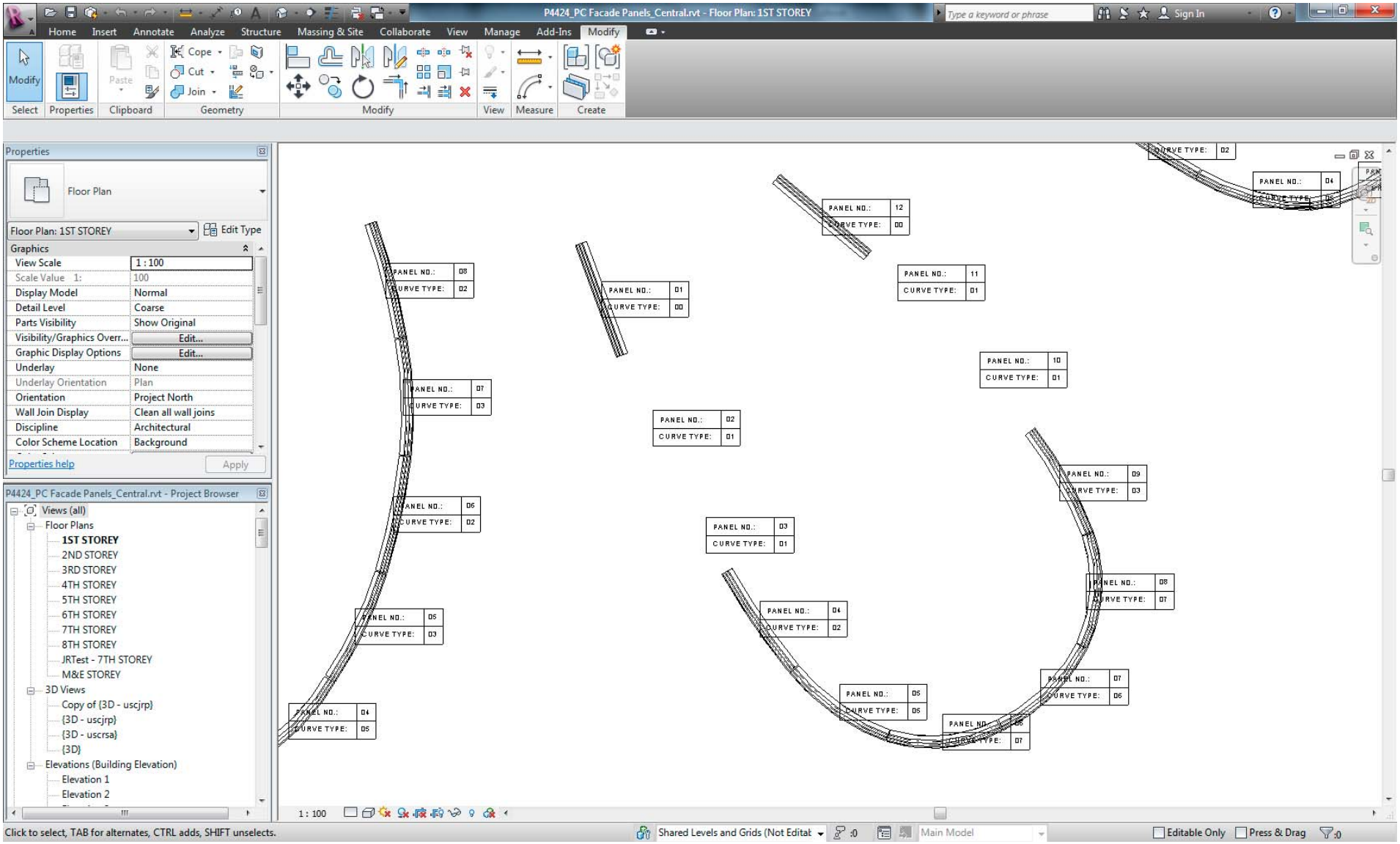
CURVE TYPE	L01	L02	L03	L04	L05	L06	L07	L08	L09
C00 INFINATE	0	1	2	2	2	2	3	1	
C01 R-23000mm	0	3	2	2	1	0	2	3	
C02 R-11570mm	0	1	2	2	3	1	3	2	
C03 R-6760mm	0	2	1	1	0	2	2	3	
C04 R-4770mm	0	0	1	1	3	4	4	4	
C05 R-3690mm	0	2	3	4	3	1	1	1	
C06 R-3000mm	0	1	1	0	0	0	0	0	
C07 R-2530mm	0	1	0	0	0	0	0	0	
C08 R-2180mm	0	0	0	0	0	0	0	0	
C09 R-1710mm	0	0	0	0	0	0	0	0	
TOTAL	0	11	12	12	12	10	15	1	

FACADE PANEL SCHEDULE TOWER K

modular components

façade panels

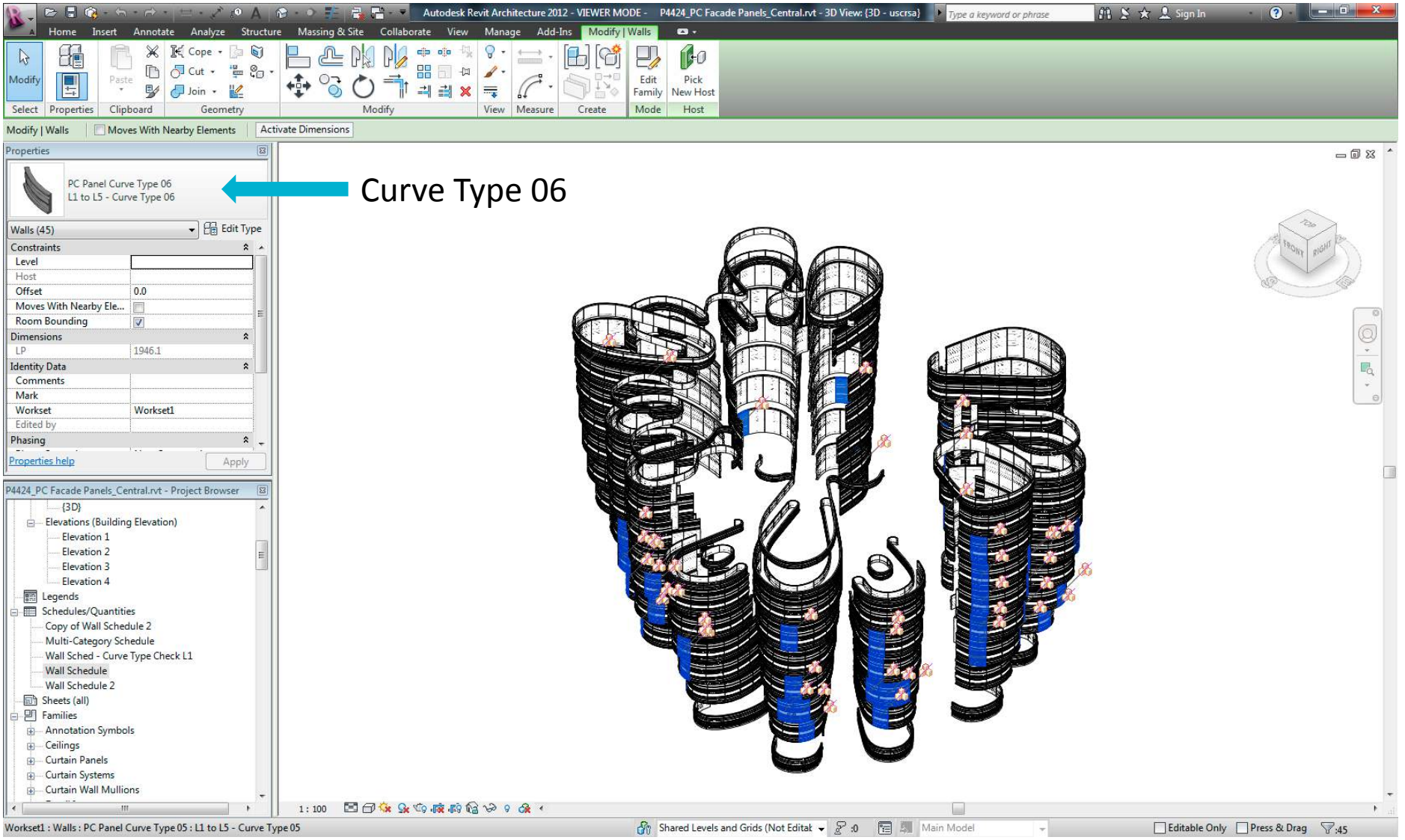
2m width, 10 curvatures



modular components

façade panels

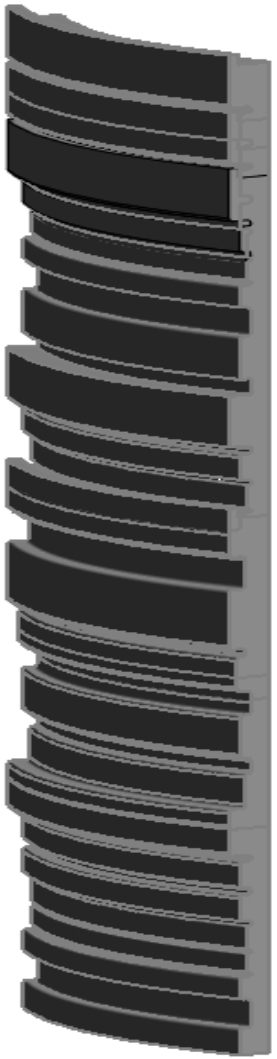
2m width, 10 curvatures

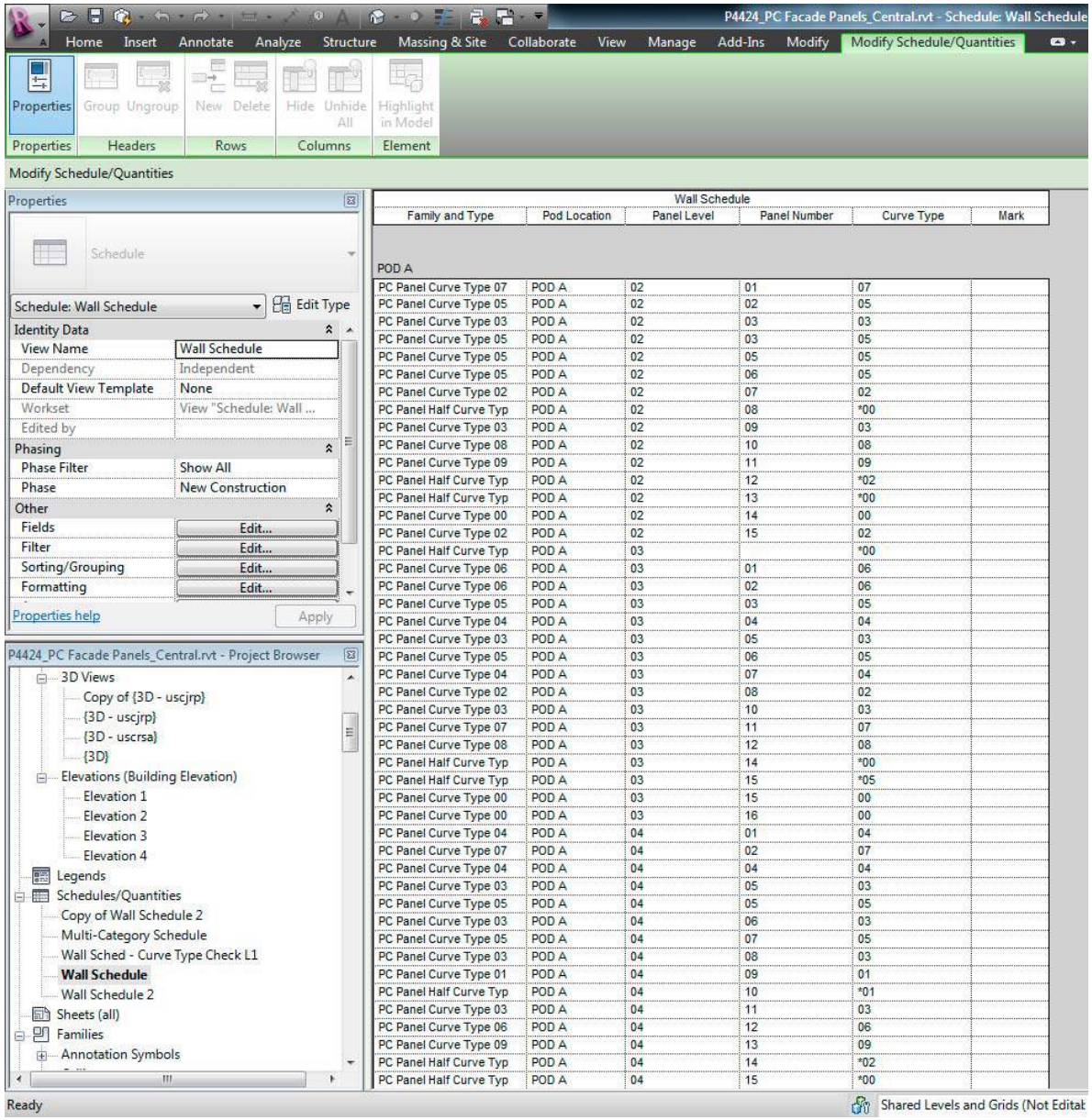


modular components

façade panels

2m width, 10 curvatures



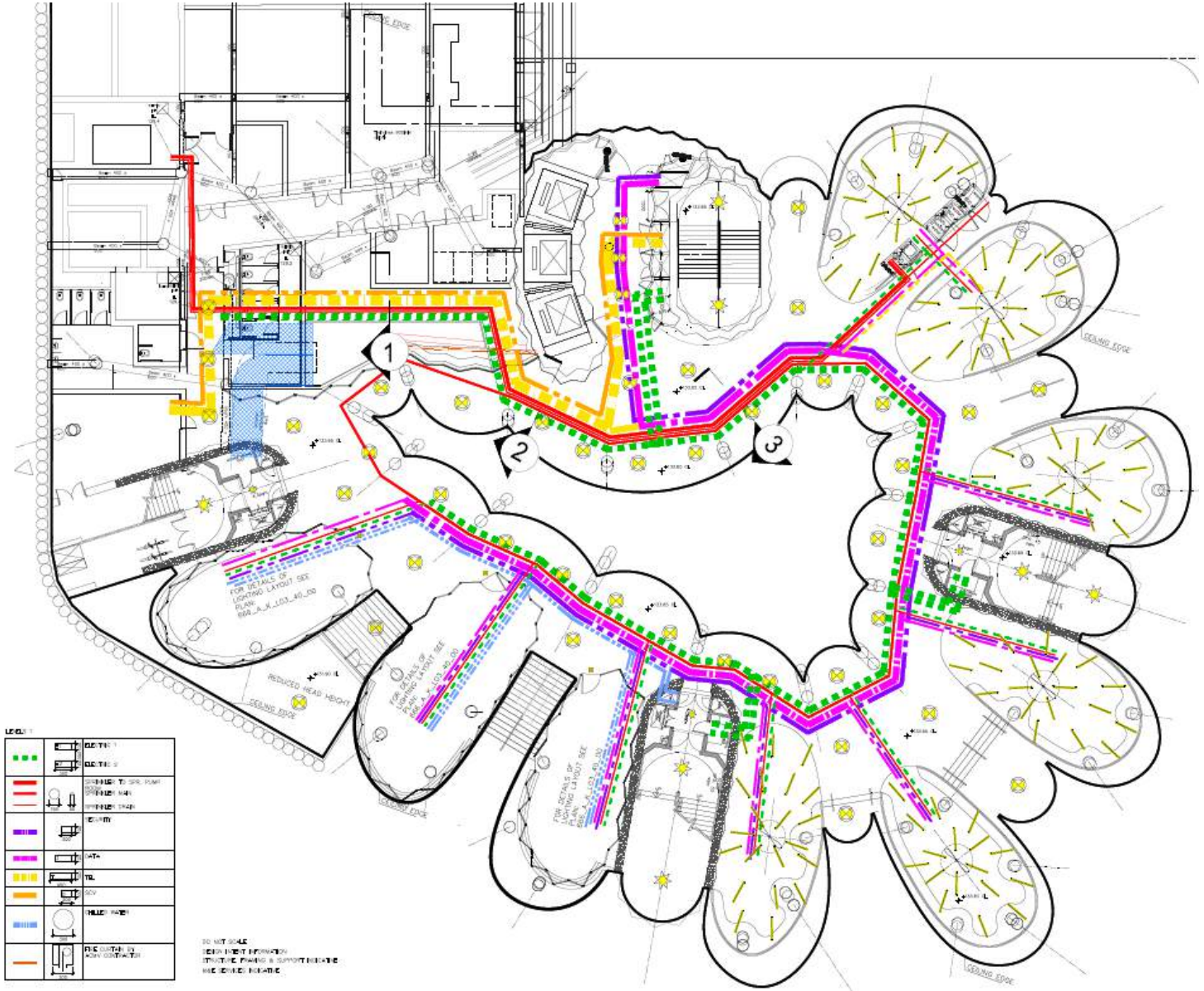


modular components

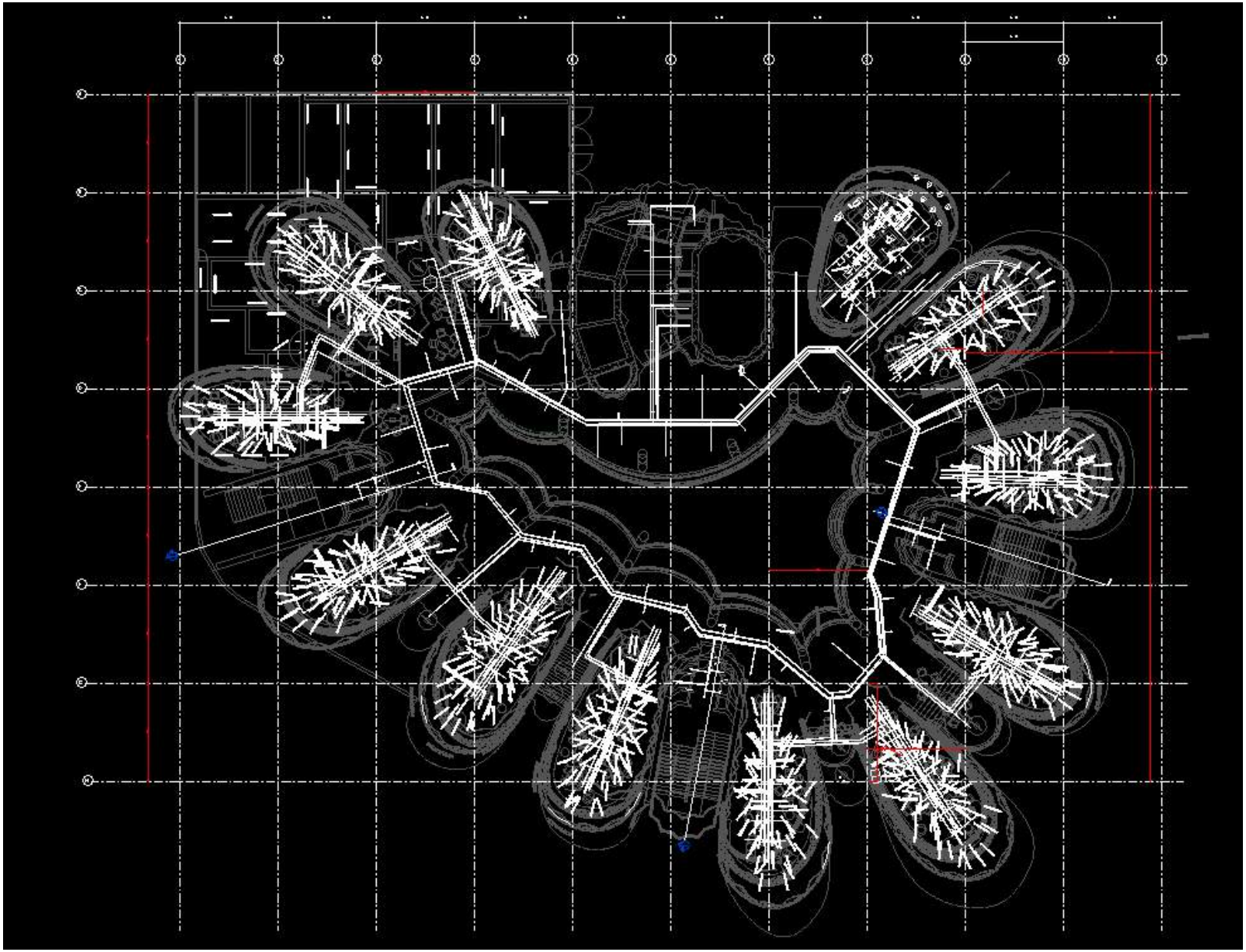
façade panels

2m, 10 curvatures

Ceiling Plan: from design to construction



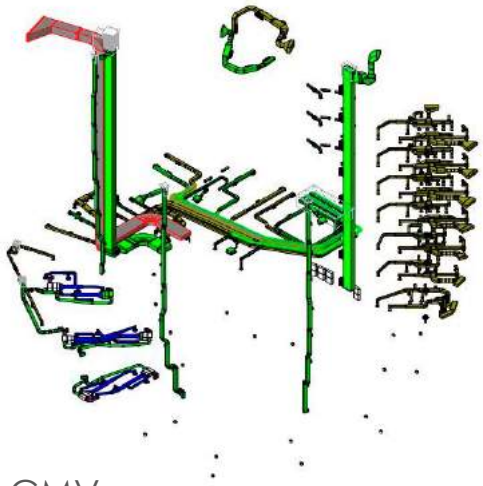
MEP Coordination



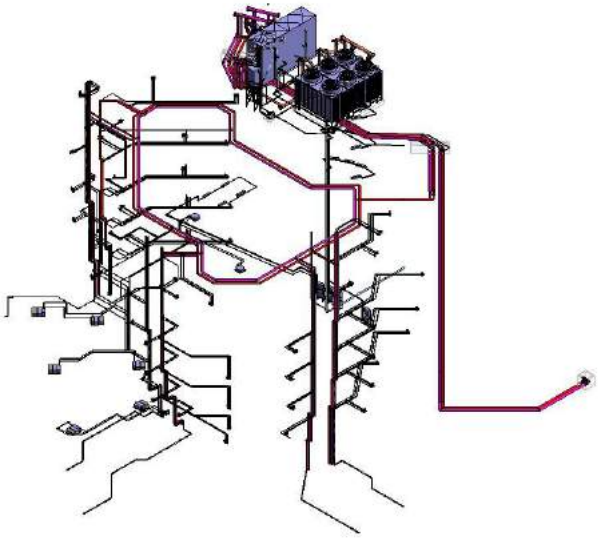
MEP Coordination

checking for interference

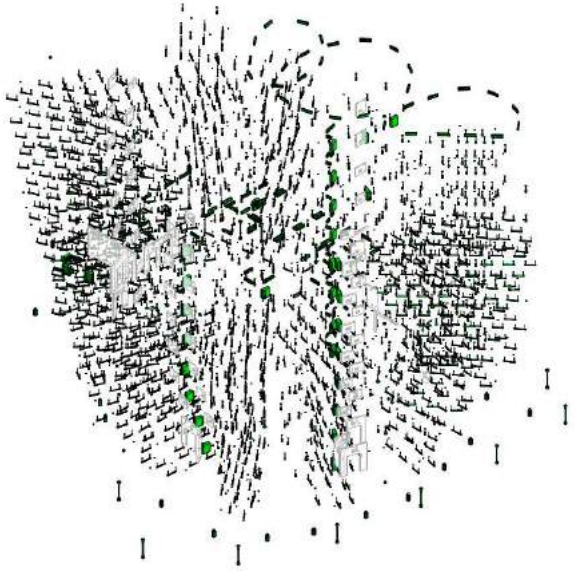
MEP As-Built



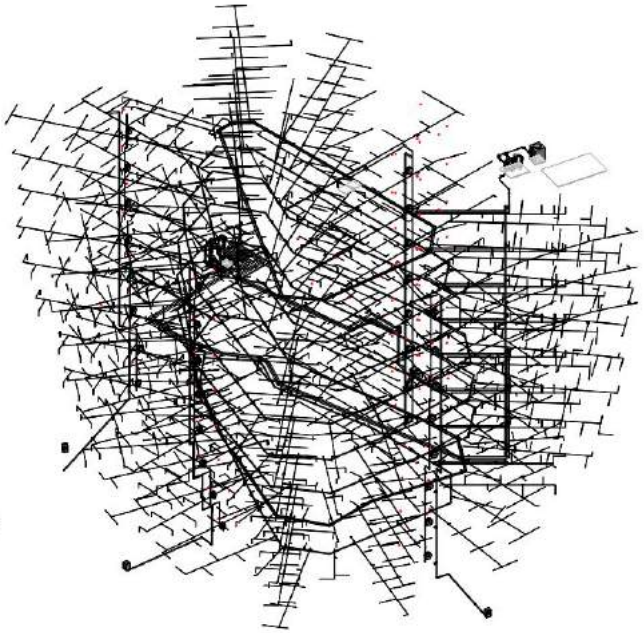
ACMV



Chilled water system

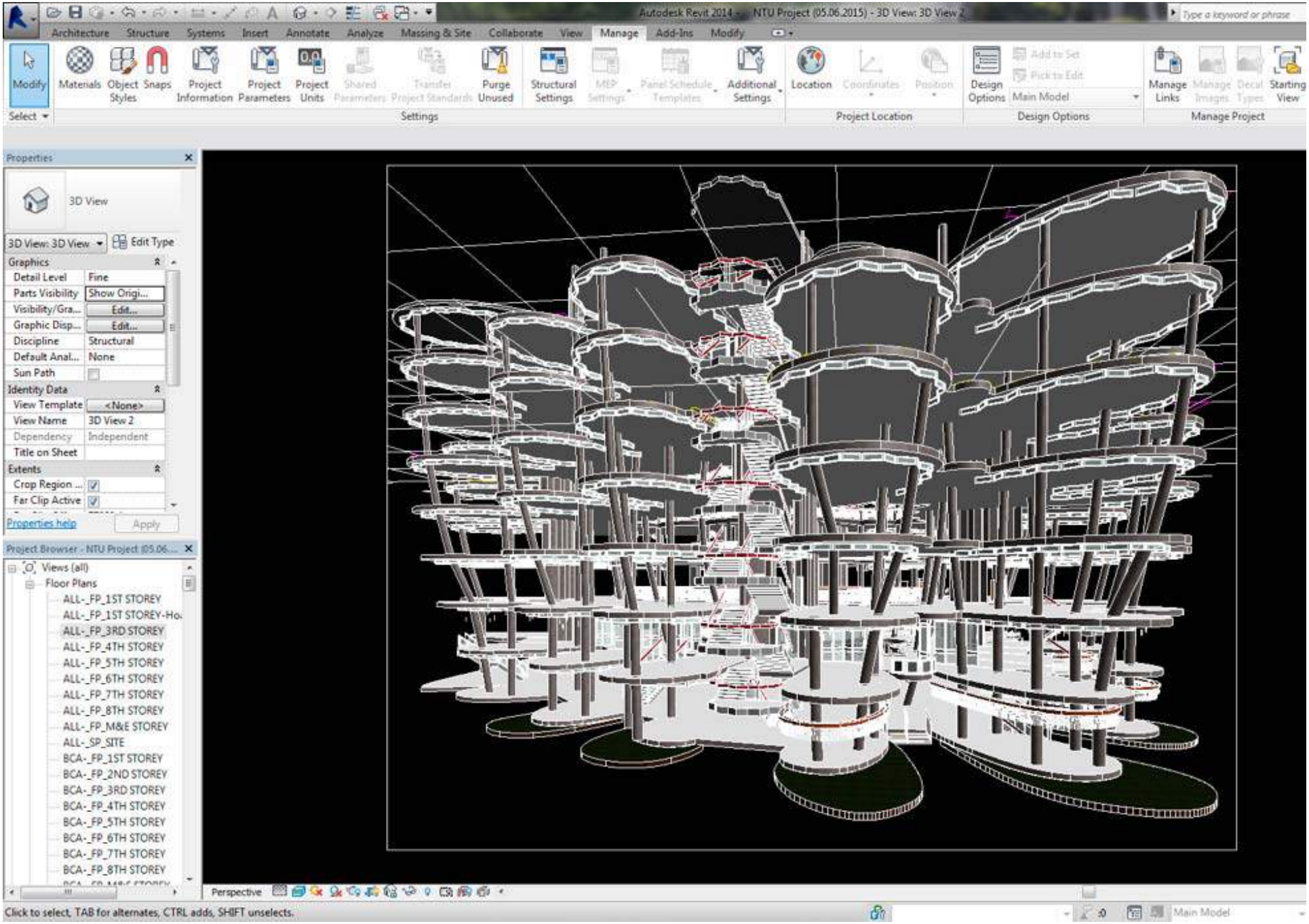


Electrical



Fire Safety Installation

As- Builts


Autodesk Revit 2014 - NTU Project (05.06.2015) - 3D View: 3D View 2
Type a keyword or phrase
Architecture Structure Systems Insert Annotate Analyze Massing & Site Collaborate View Manage Add-Ins Modify
Modify Materials Object Styles Snaps Project Information Project Parameters Project Units Shared Parameters Transfer Project Standards Purge Unused Structural Settings MEP Settings Panel Schedule Templates Additional Settings Location Coordinates Position Design Options Add to Set Pick to Edit Main Model Manage Links Manage Images Decal Types Starting View
Select
Settings
Project Location
Design Options
Manage Project
Properties
3D View
3D View: 3D View
Edit Type
Graphics
Detail Level Fine
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Dependency Independent
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Crop Region ...
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Properties help
Apply
Project Browser - NTU Project (05.06....
Views (all)
Floor Plans
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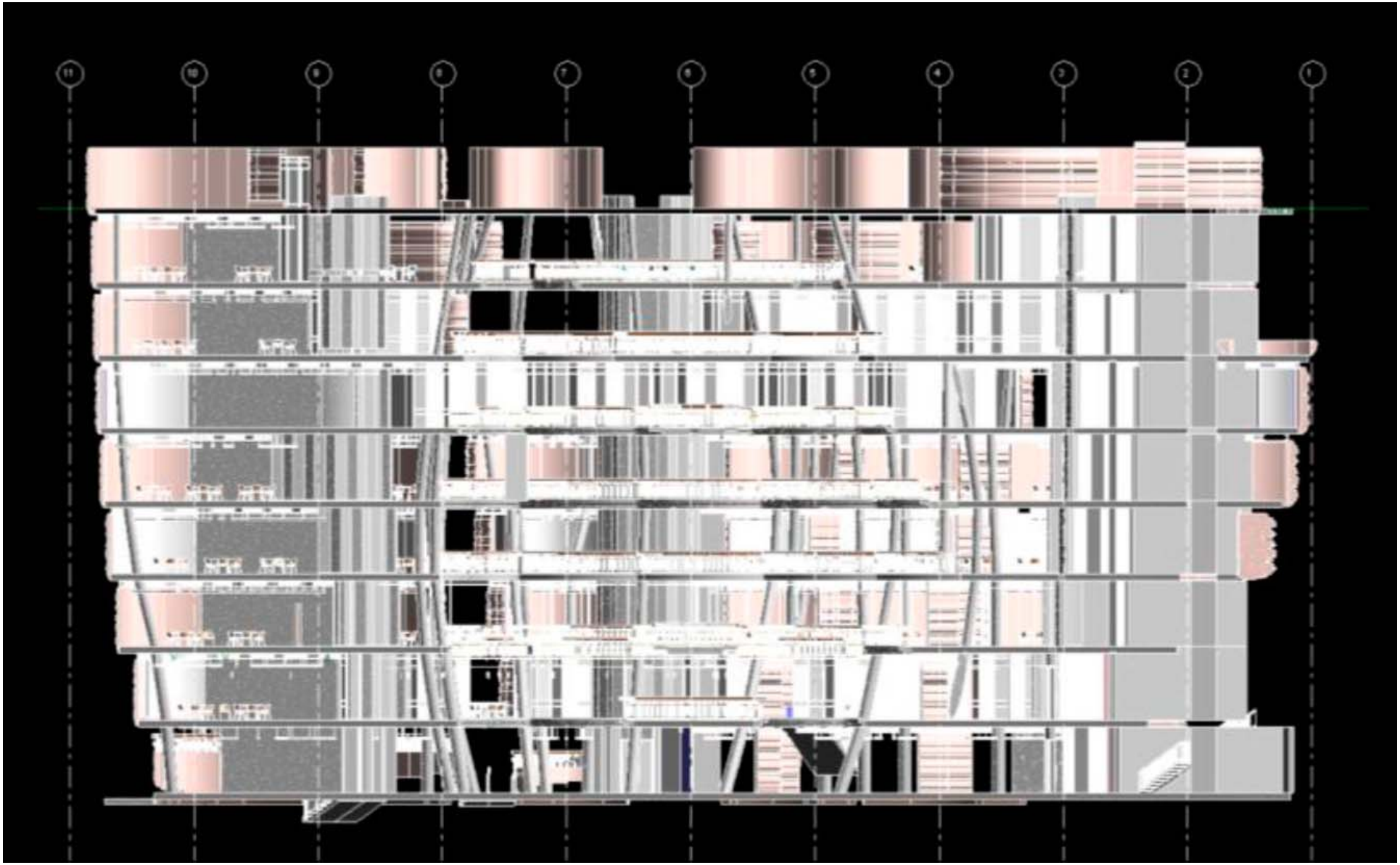
Perspective
Click to select, TAB for alternates, CTRL adds, SHIFT unselects.
Main Model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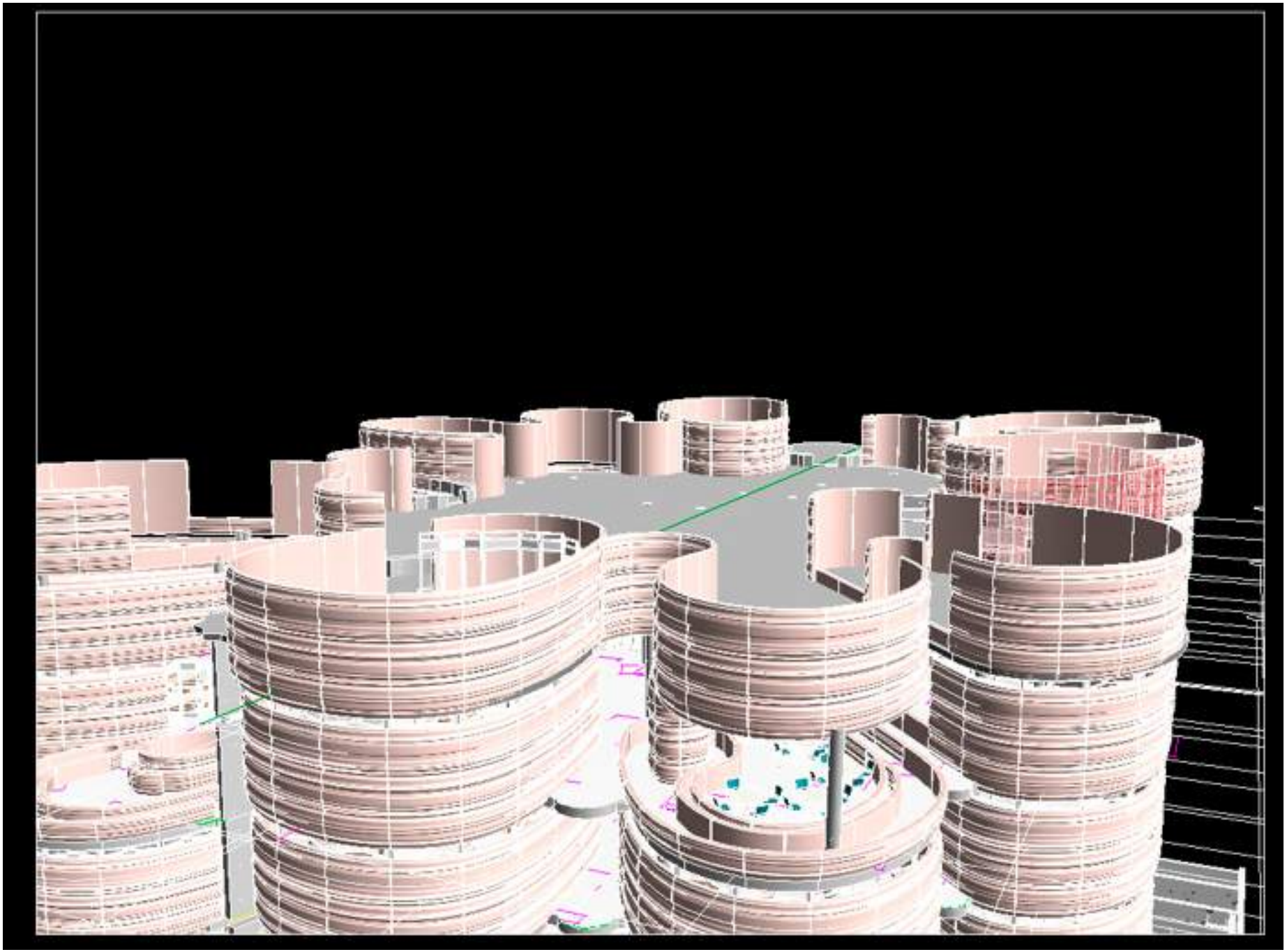

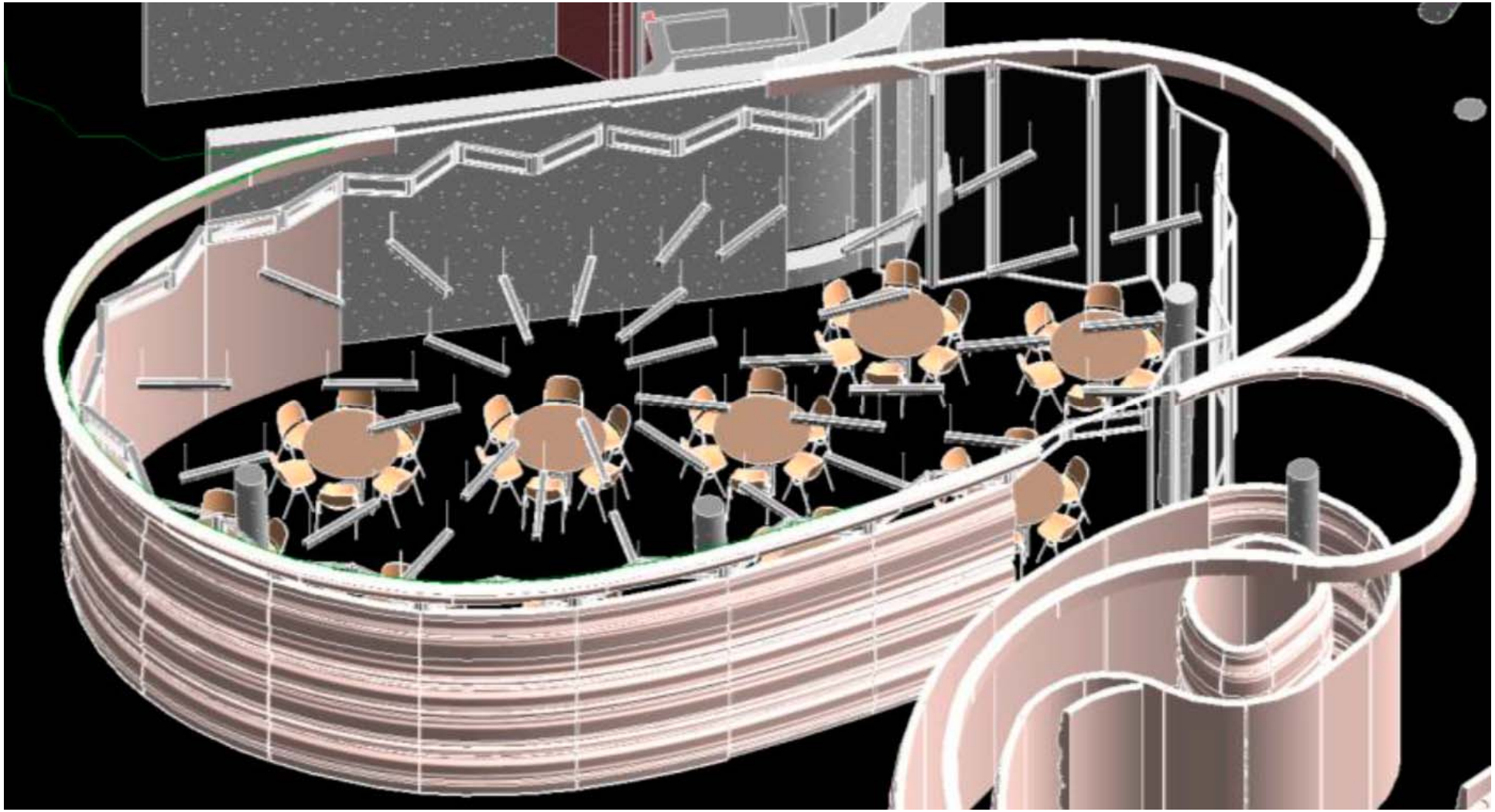

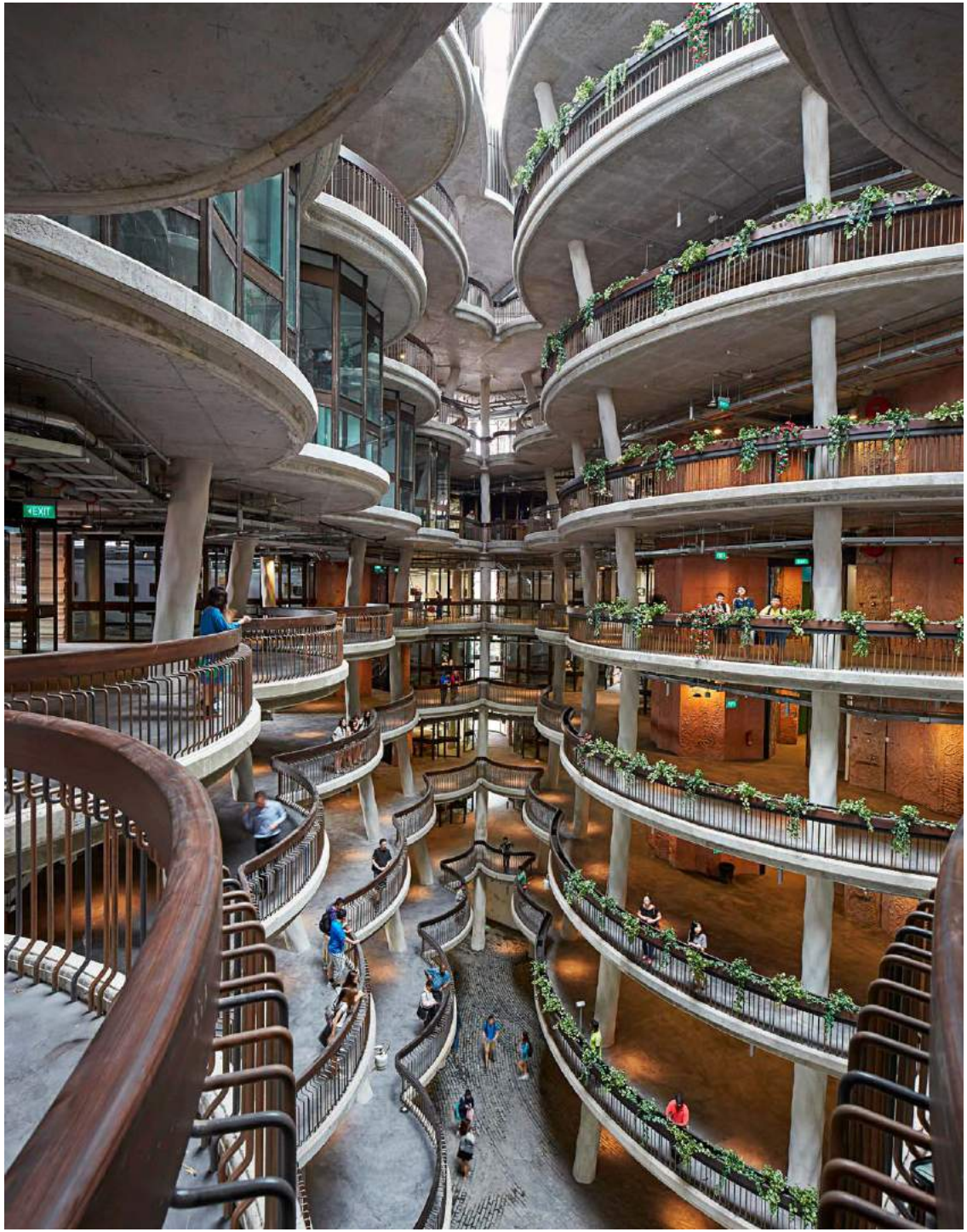
EXIT

Team

CLIENT
Nanyang Technological University

CONSULTANTS

Architect	: CPG Consultants
Design Consultant	: Heatherwick Studio, London, UK
Civil/ Structural Engineer	: TYL International
Structural Concept	: Arup London
Mechanical/Electrical Engineer	: Bescon Consulting Engineers
Quantity Surveyors	: Davis Langdon KPK
Green Mark Consultant	: CPGreen
Fire Safety Engineer	: LKH Fire Engineering
Acoustic Consultants	: CCW Consultants
Landscape Consultants	: Perfect Sense
Lighting Consultants	: L'Observatoire International, New York, USA
Induction Unit Specialist	: TCS Engineering

CONTRACTORS

Main Contractor	: Newcon Builders
Piling Contractor	: KH Foges
Services Diversion Contractor	: Supersonic
Minor Sewer Contractor	: Goh & Foong
Lift Contractor	: XJ Elevators

SPECIALIST SUPPLIERS

Form Liner Supplier	: Eng Lee Engineering
Façade Panel Supplier	: LWC Alliance

PROFESSIONAL PHOTOGRAPHY
Hufton & Crow

CPG

CONSULTANTS