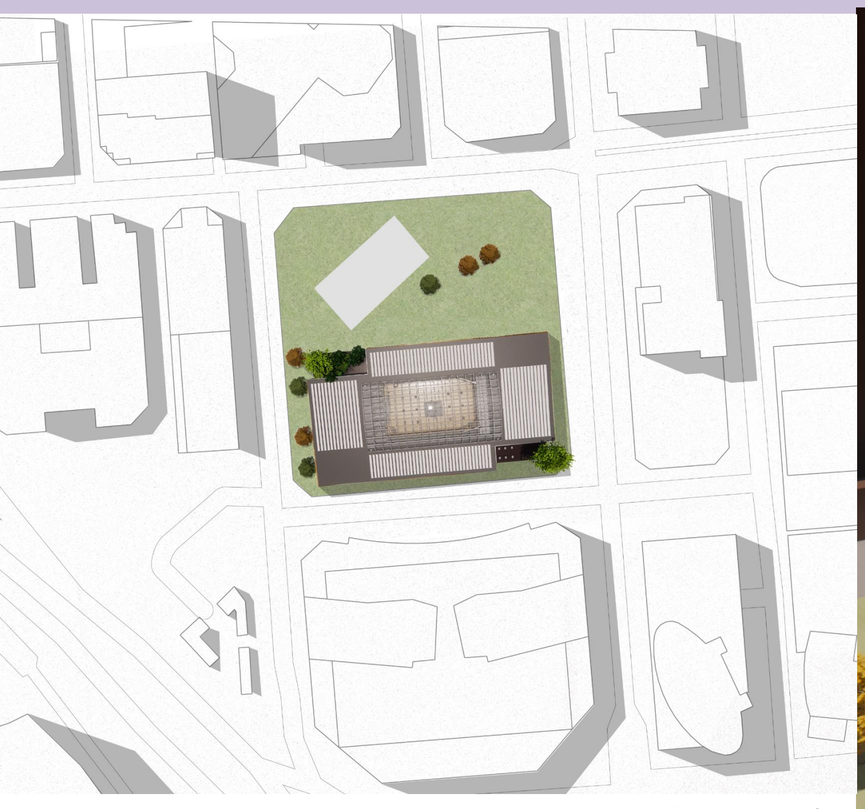
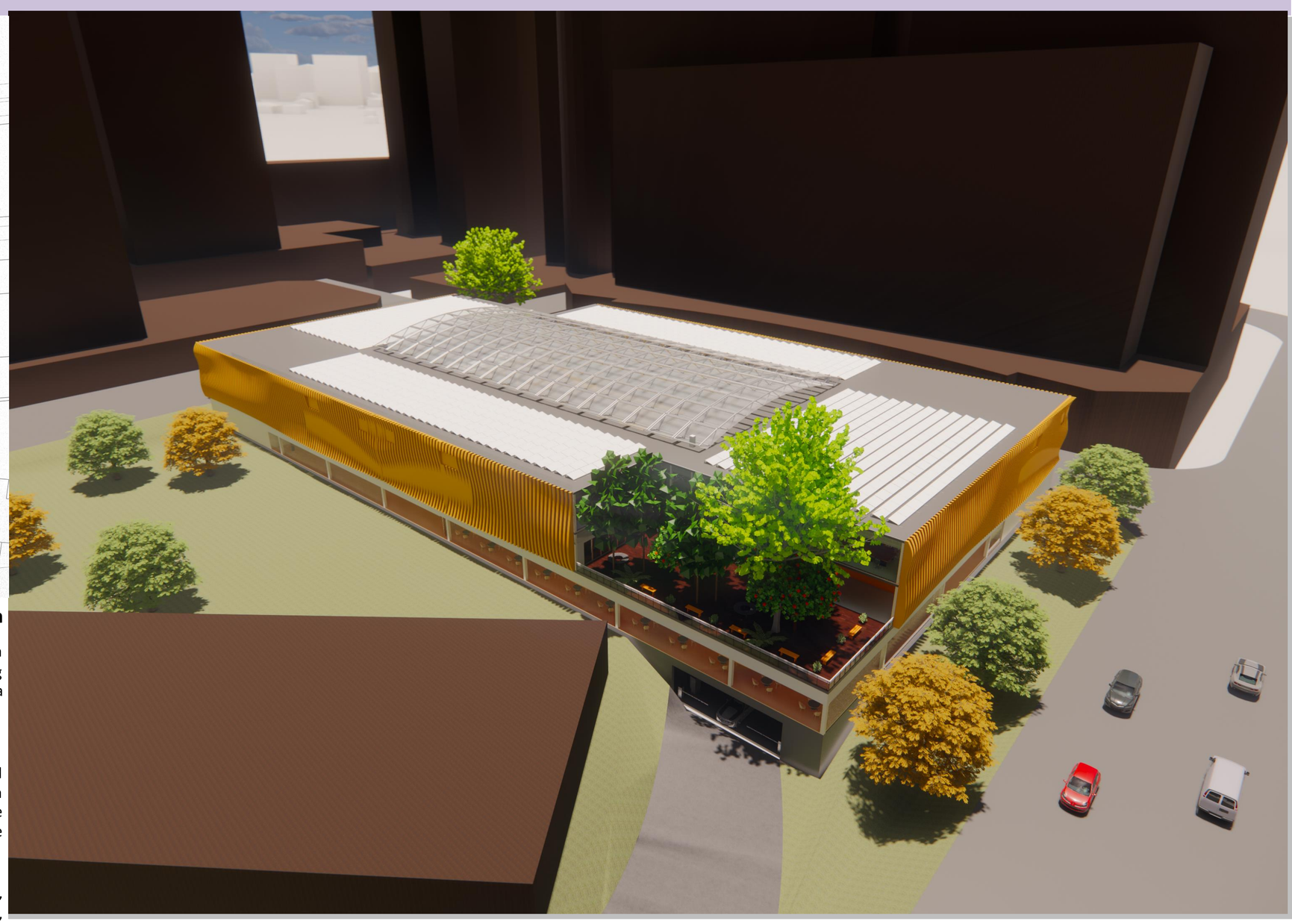
CIC BIM Competition 2021 – Submission Poster

Night Owl



Site Layout Plan



Overall Bird eye view

Design Concept: The design rational for the Building Design is to foster interaction between human and nature. To do so, we focus on testing the overall circulation of travelling through the building, applying different natural building materials and greening to create a harmonious space for human-nature coexistence.

Building Form:

To achieve the aim of interaction with nature and promotion of relaxation spaces, we divided the site into mainly two parts: the building itself and the community park for people's relaxation and gathering. A substrate form of rectangular volume is used in the design, together with the organic facade with multiple openings which effectively promote passive ventilation and receive of sunlight to the building.

Spatial Arrangement: Our building mainly divide in 4 areas – exhibition area, office area, service area and learning area. Exhibition area and learning areas are arranged in basement, G/F and 1/F for easy access of visitors. Office area is comparatively private and arranged on 2/F. While service areas like library and canteen are arranged on G/F.

Connectivity:

To create a flexible pedestrian connectivity, the building has four entrances, connecting to the surrounding streets and the park. For vehicular connectivity, while the landscape is excavated to create a path connected to the basement car park. Four centers are linked closely with similar interior design style. To strike a balance between every center's integrity and connectivity of the whole building, we allocated each zone to each floor so that the facilities of particular center can be grouped together spatially.

BIM Uses in Design, Collaboration, Engineering, Analysis and Optimisation:

Our design concept was firstly inspired by passive design and green engineering, thus we put much emphasis on creating an large atrium for stack ventilation. Once we confirm the brief ideas, a draft model was built on Revit construction template for confirming the dimension of MiC units and partition arrangement for required facilities. A BIM structural model was then built for loading analysis on **Robot** so that we could ensure proper span of beams and columns placement. Taking HVAC into account, a mechanical model was then created with system zoning to calculate the heating and cooling load analysis for every space via Autodesk Insight. Eventually. furniture and greenings were inserted to vitalize our ANZ hub, following by solar and illuminance analysis on **Insight**.

BIM Collaboration approach:

Due to COVID-19 pandemic, our face-to-face coordination was invariably hindered. Yet, an array of BIM platform for each of us to keep track on the latest amendment by every groupmate through channels like BIM 360 and openBIM. Such collaboration platforms enable us to gain a quick access of shared model without fully downloading the BIM files which require large storage on computers. Adding to it is that the function of "Link Revit'' stimulates our division of labor as it allows files to be combined or even immersed into one through "Bind Link" and "Ungroup" features, so that our whole group could simultaneously make progress on different floor design and various models.

Quality of Design:

Unlike AutoCad and Rhino, to name but a few, BIM is a all-rounded tool for massing, structural analysis, loading prediction, building services simulation, as well as interior design with great flexibility. One is easily allowed to view on 2D floor plans and 3D realistic views, enabling us to preview our design with rendered material graphics with high efficiency. Also the project browser in Autodesk Revit also categories the disciplines for various professionals, allowing engineers upon different realms to collaborate and coordinate in such organized platform.

Sustainability:

Our model is designed for gaining and maximizing natural ventilation with four entrances at each direction on G/F and openings on every upper floors. Such design can minimize the cooling loads on HVAC system, hence saving more energy in the long run. Moreover, our design concept of having various size of atrium opening for every floor also favors the gain of daylight, so that the lower floor will not be easily covered by the upper one. The exterior parametric wood facades are designed to act as brise soleil for deflecting part of the sunlight while allowing some penetrate inside for passing lighting. Deciduous trees were also planted next to the building for sheltering sunlight in summer.

MiC/ DfMA:

Since the provided spatial arrangement of facilities are multiple of 25 in terms of floor area, so it is convenient to create a fundamental MiC unit with 25 meter square. Large areas can be created by connecting numbers of such MiC unit. This method of construction can simplify the working procedure on site with rebar mounted and mechanical equipment installed in each MiC box for further connection. Also, we can take MiC units for loading bearing, avoiding extra columns penetrating in rooms.

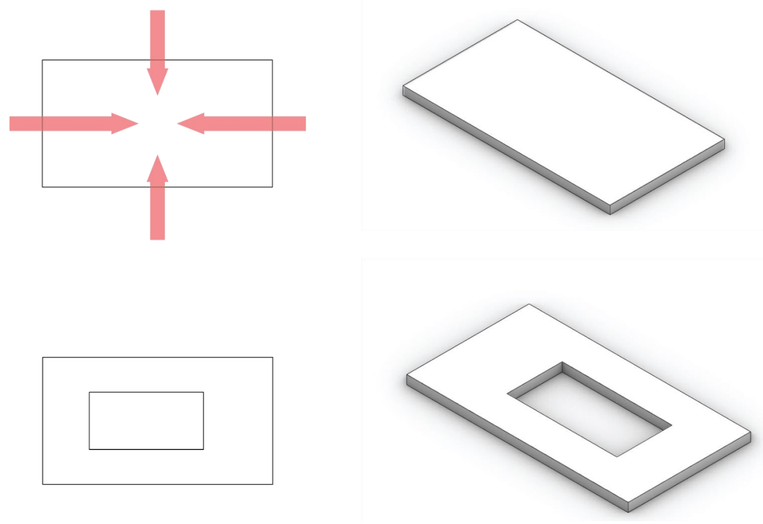
Constructability: Any innovative approach introduced for construction?

Many examples of utilizing MiC method for construction are usually for typical residential building or temporary office on construction site, in which those MiC units are having same inhouse design or furniture. Yet, in the case of ANZ Hub, spaces are serving for variety of purpose. To design it with a more open atmosphere, our MiC units were designed to be connectors of each others so as to build spacious capacities. Detailed furniture will not be pre-installed in MiC units to allow greater mobility.

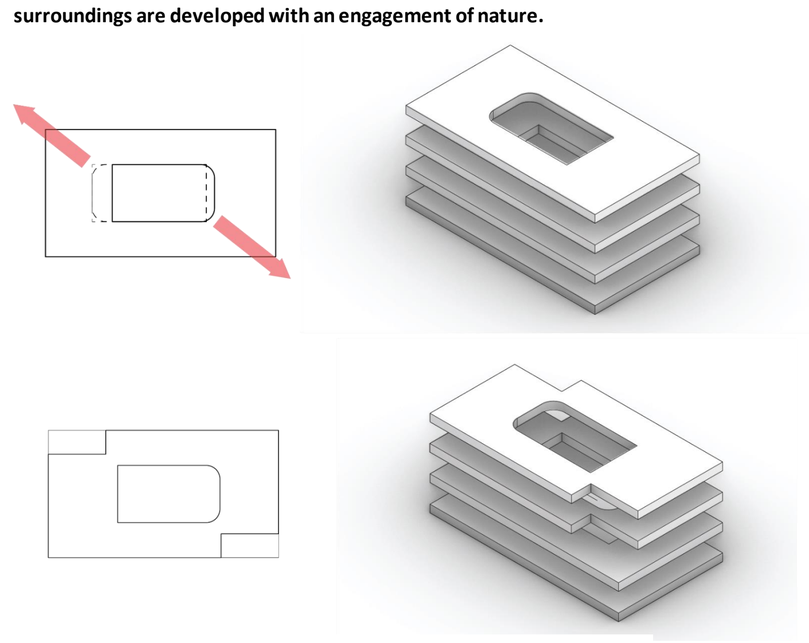
Summary:

BIM gives a holistic view for all stakeholders involved as it provides views with no angle constraints, which facilitates the evaluation of design and avoids crashes of pipework for engineers. The ease of modification and division of discipline also proves the essence and potential of BIM.

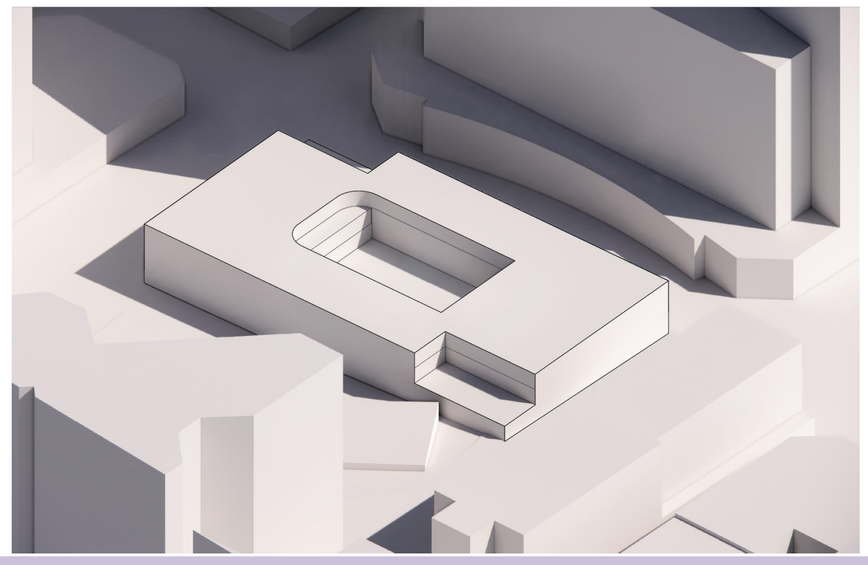
Centralized communal space – through entrances at four sides, visitors will be guided to the centre of building. Thus, an atrium is created to serve as communal space for gathering and relaxing under natural sunlight.

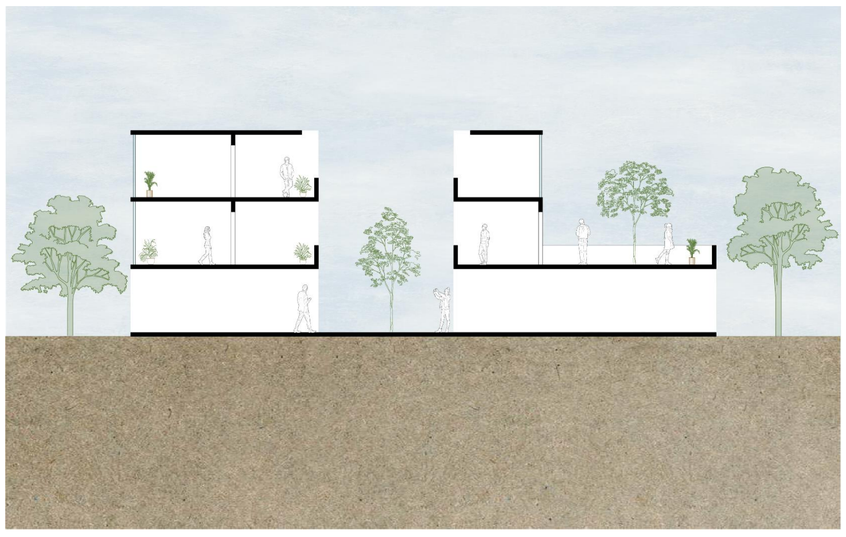


Visual connections with surroundings - Diagonal subtraction forms are created to expose the interior spaces, an inside-out dialogue of the building and the surroundings are developed with an engagement of nature.



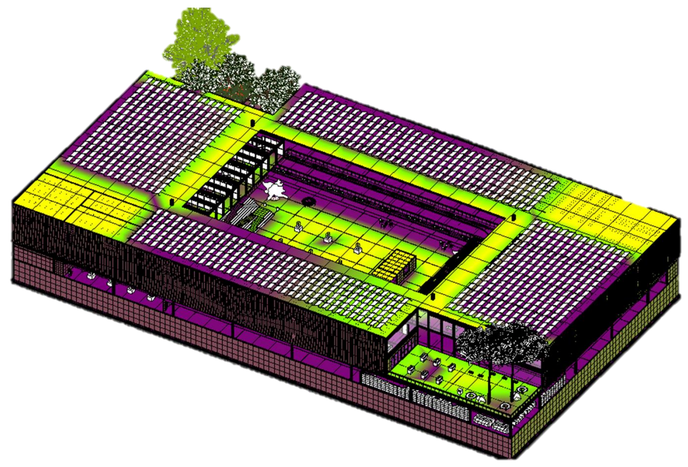
Pocket spaces – Inside-out relationship



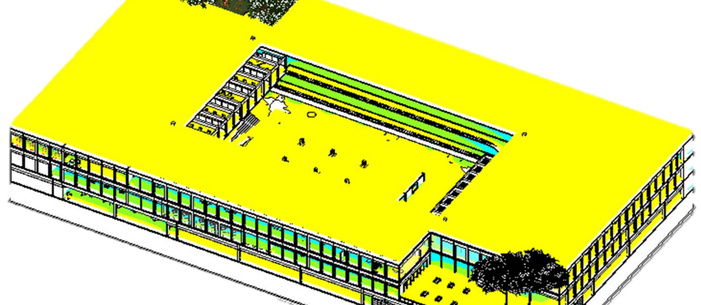


Conceptual diagram of design development

A connection between urban and nature are developed in our design, to enables visitors to embrace the beauty of nature and cultivate a sense of sustainability. Interaction between human and nature is created visually and physically.



Solar diagram



Light diagram

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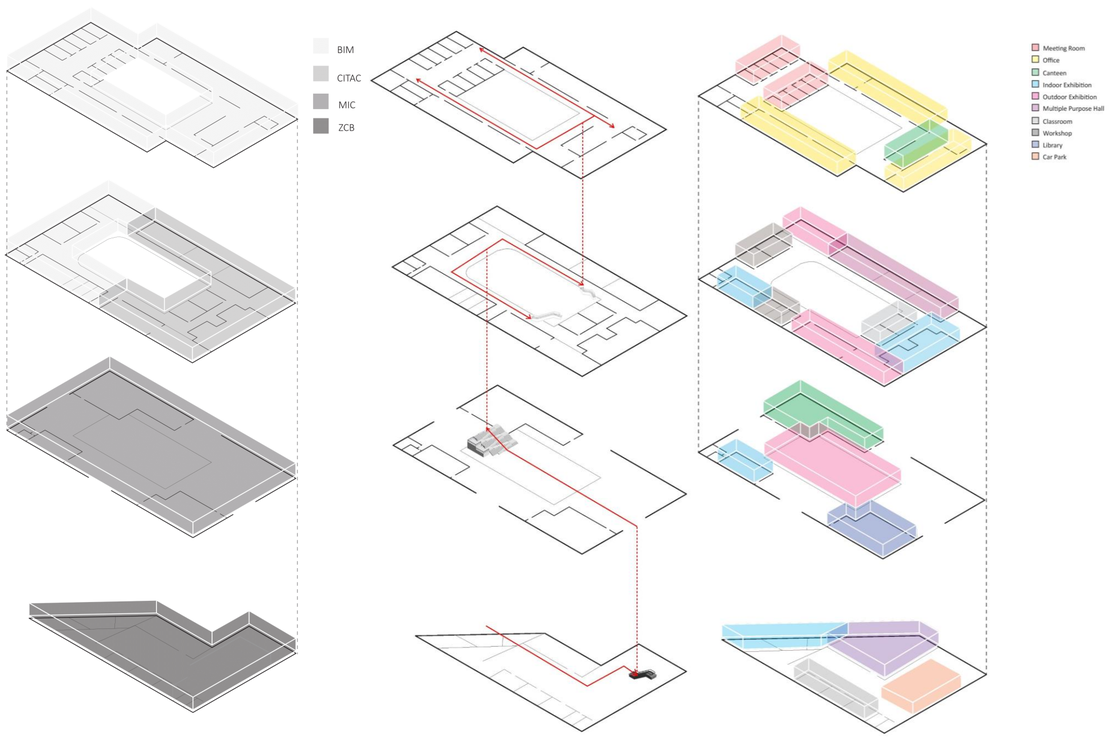
Site Layout Plan

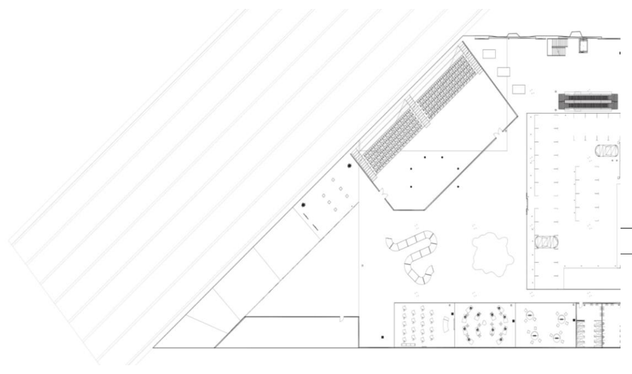
Internal Perspective



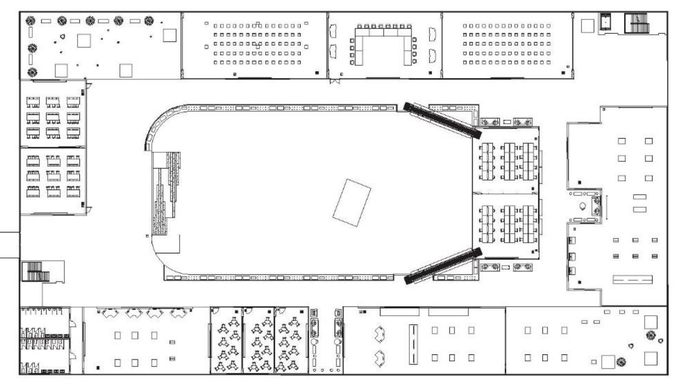
Zoning diagram

Circulation diagram

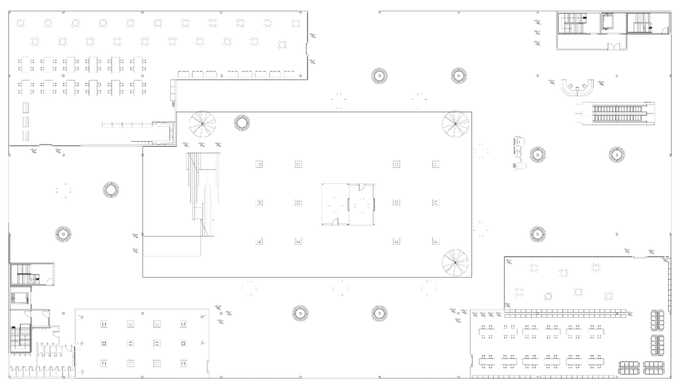
Programe diagram



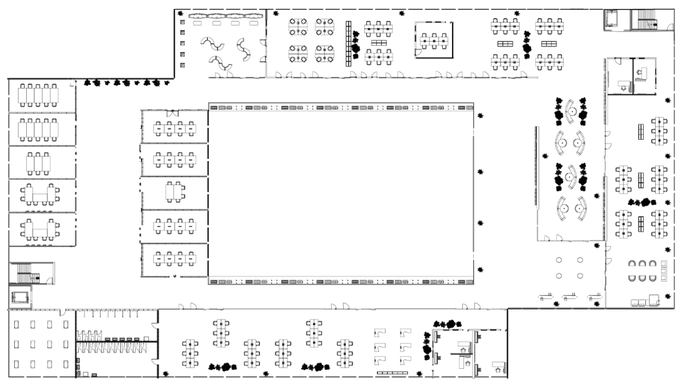
Basement Floor Plan



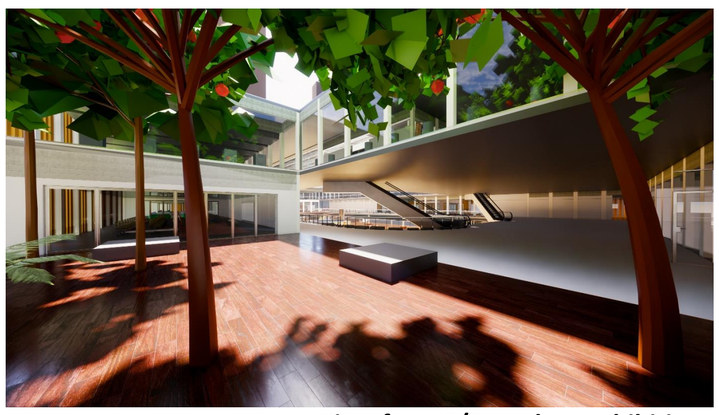
First Floor Plan



Ground Floor Plan

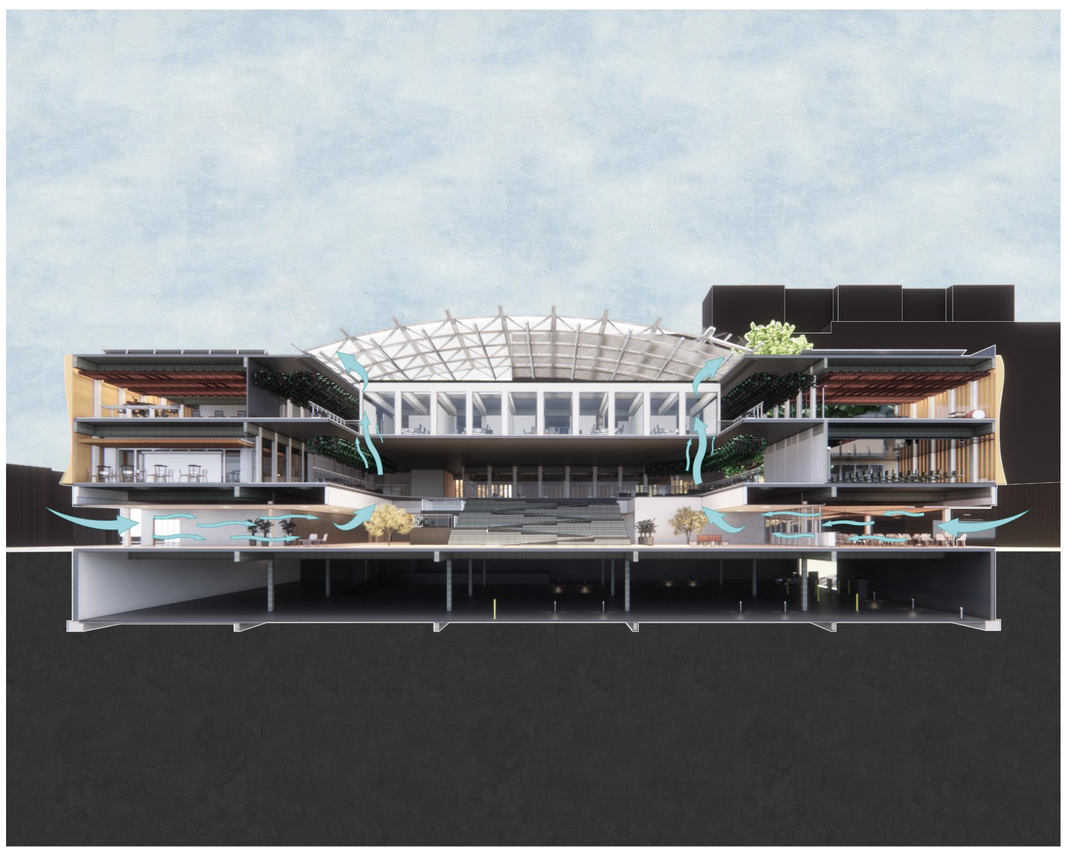


Second Floor Plan



View from 1/F outdoor exhibition

View from G/F



Sectional Perspective (Ventilation)

View from basement

Overall Bird Eye view (Night View)

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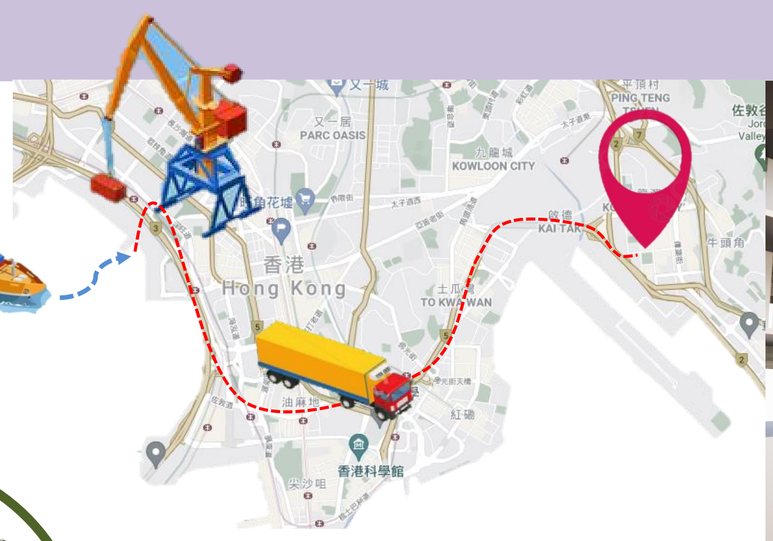
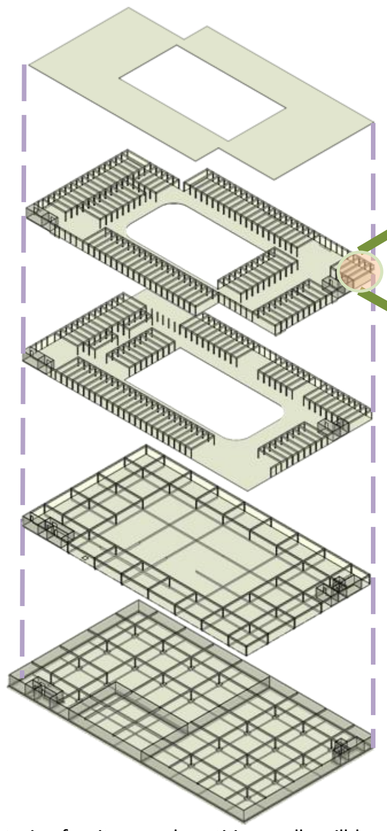
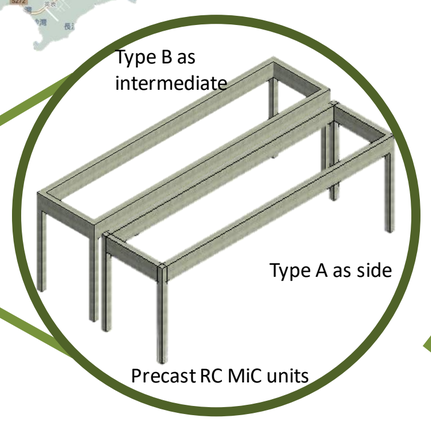
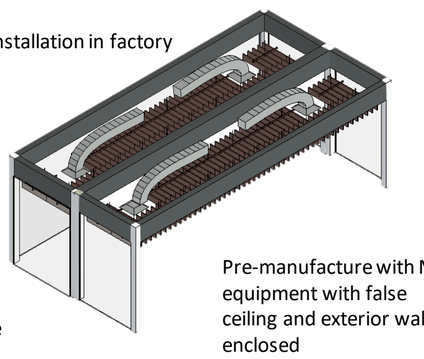
Logistic Diagram:
MiC factory in Chu Hai to Yuen Fat Wharf, then deliver to ZCP



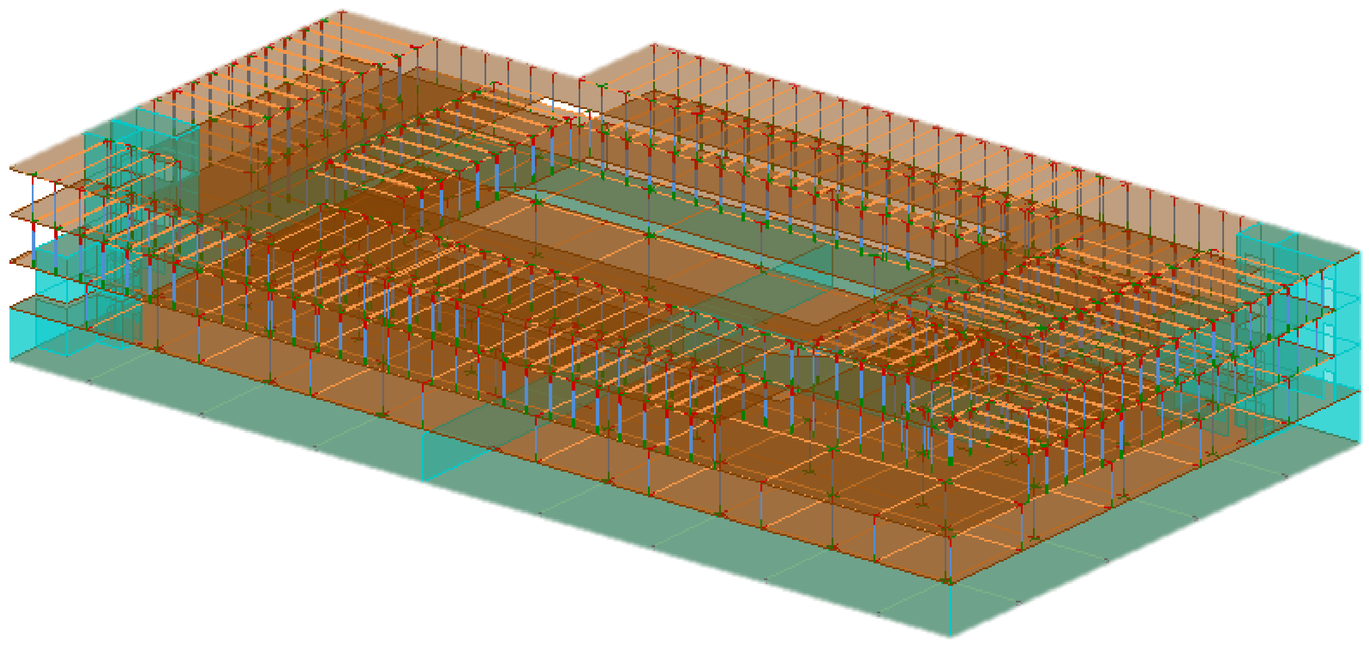






Pre-manufacture with MEP equipment with false ceiling and exterior walls enclosed

Interior furniture and partition walls will be arranged after the erection of MiC boxes for greater inhouse flexibility and spaciousness.

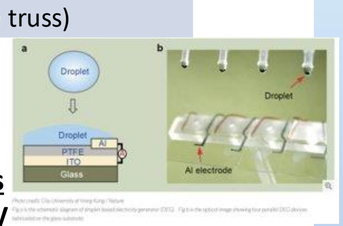


Perspective View: **As most facilities on G/F and Basement are spacious for public uses, these two floors will be constructed by the mean of In-situ construction. MiC strategy of construction will mainly be deployed on 1/F and 2/F with numerous units connecting together, creating spaces for designated facilities. Floors will be built by in-situ RC method, also serve as the slab and ceiling of MiC units' spaces.**

Fulfilling BEAM PLUS requirements

Domain	BEAM PLUS REQUIREMENTS FULFILLMENT
Sustainable site	Site coverage of greenery of at least 20% of the site
Water Use	Voluntary Water Efficiency Labelling Scheme (WELS) on plumbing fixtures and water consuming appliances
Prefabrication	Precast RC components, MIC modules, precast rebar
HVAC Load Reduction	Space truss with photovoltaic Glass for sunshading
Daylight	External glass facade with wooden strips to let light penetrate in
Ventilation	Stack ventilation by openings in ground floor and space truss
Suitainable Material	Timber(ceiling, flooring, facade), Aluminium (space truss)

Energy generative systems



Generating electricity from raindrops

- **A water droplet can generate 140V power** (City University of Hong Kong, 2020)
- Applied to the **roof for utilizing rainfall**

Roof vent wind turbine

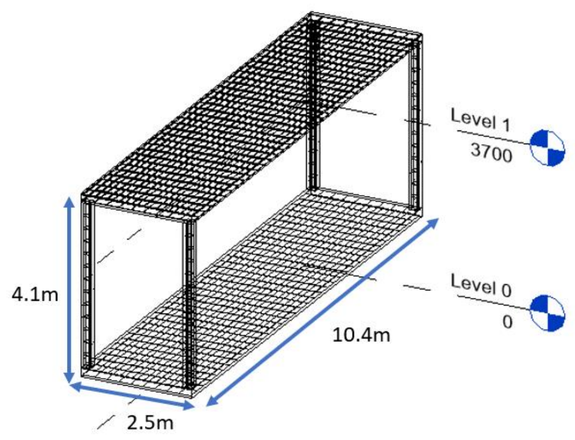
Roof ventilator would begin to generate a voltage of 0.2 - 0.3 volt at wind speed of 0.5 meters per second.

Wind energy → **electricity**

High-volume-low-speed fans

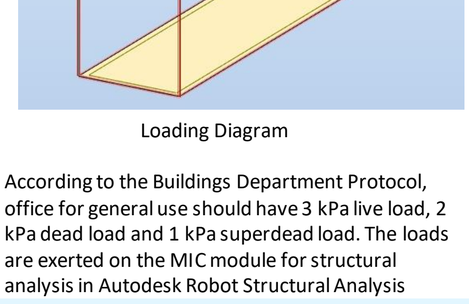
Increased air movement from ceiling fans
- cost-effectively
- Increase occupant comfort
- Reduce cooling load

(Counting the upper and lower slabs)



Analytical Model of MiC unit with rebar

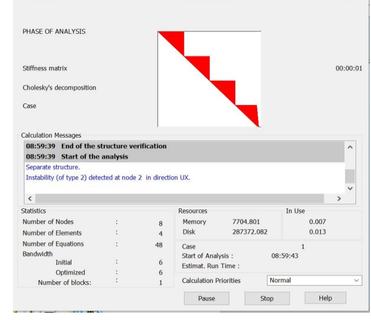
In loading analysis on the MiC unit, the upper and lower slabs were also included in simulation. The MIC Modules are mainly designed for indoor exhibition and office space. The floor-to-ceiling height is 3.7m, as some space is reserved for building services installation.

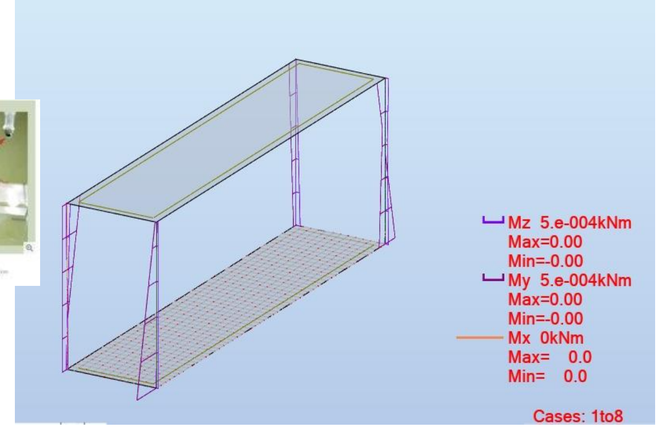


Loading Diagram

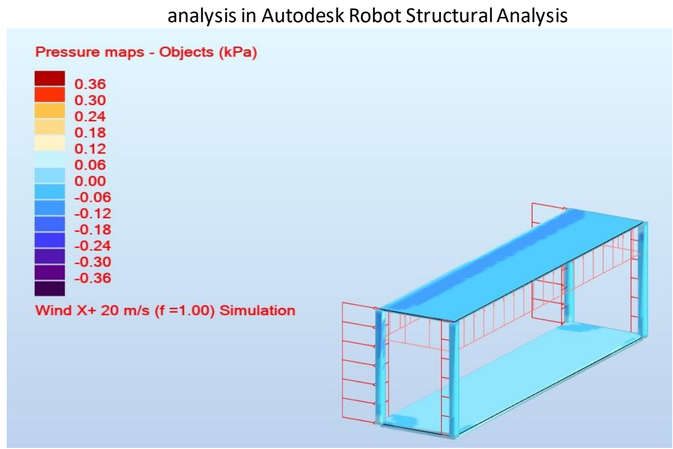
According to the Buildings Department Protocol, office for general use should have 3 kPa live load, 2 kPa dead load and 1 kPa superdead load. The loads are exerted on the MIC module for structural analysis in Autodesk Robot Structural Analysis

Autodesk Robot Structural Analysis



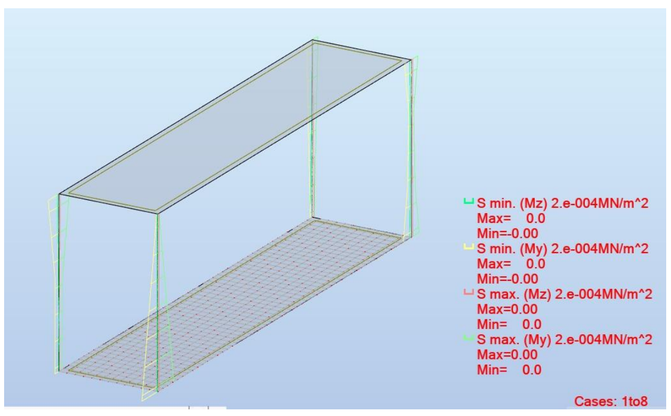


Moment Diagram on MiC Unit

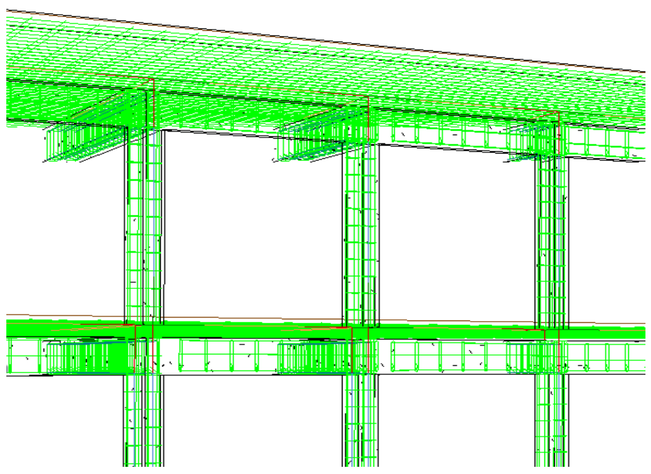


Wind Pressure Diagram on MiC Unit

By plugging the Revit model to **Autodesk Robot Structural Analysis**, structural performance of the MIC module can be obtained. The above analyses are for moments, bending stresses and wind pressure.



Stress Diagram on MiC Unit



Slab
Two-way slab with T12 reabr

Column
T16 rebar (with T12 links with 300mm spacing)

Beam
T16 rebar (with T12 stirrups with 300mm spacing

Sectional Perspective 1:500

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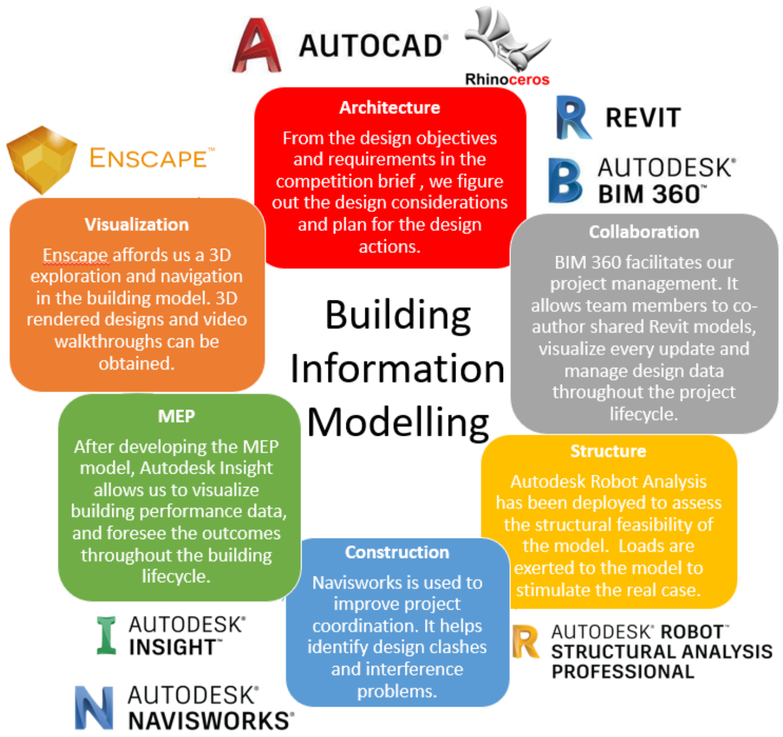
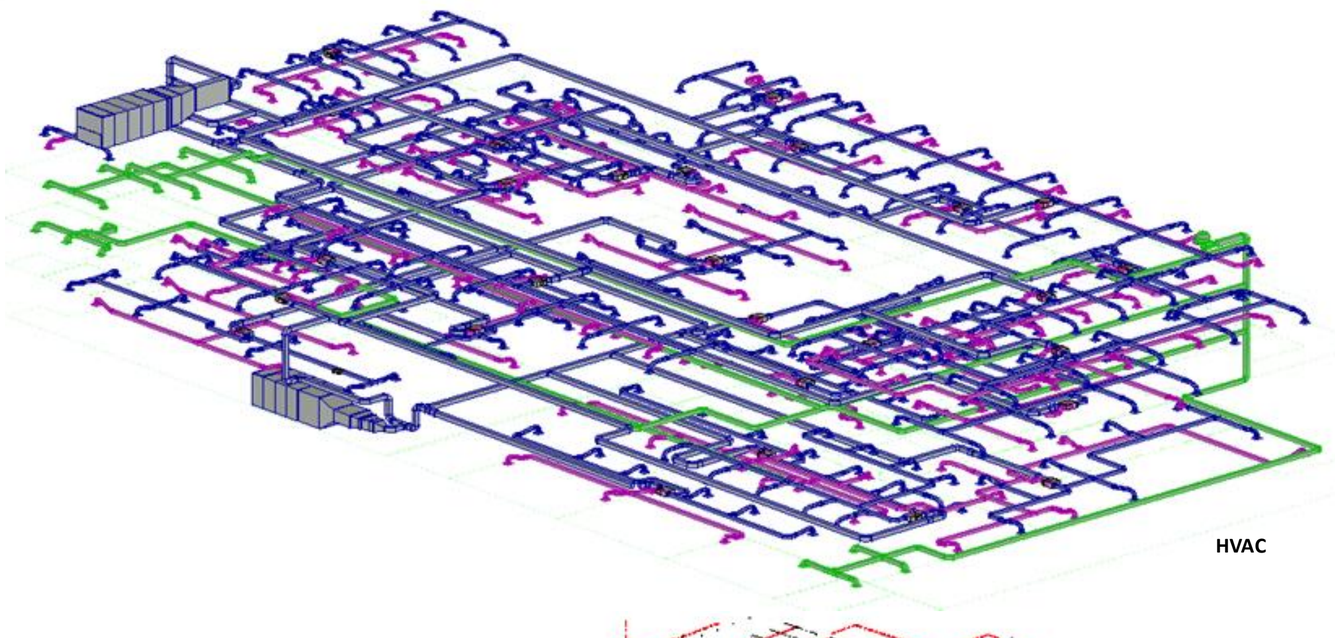
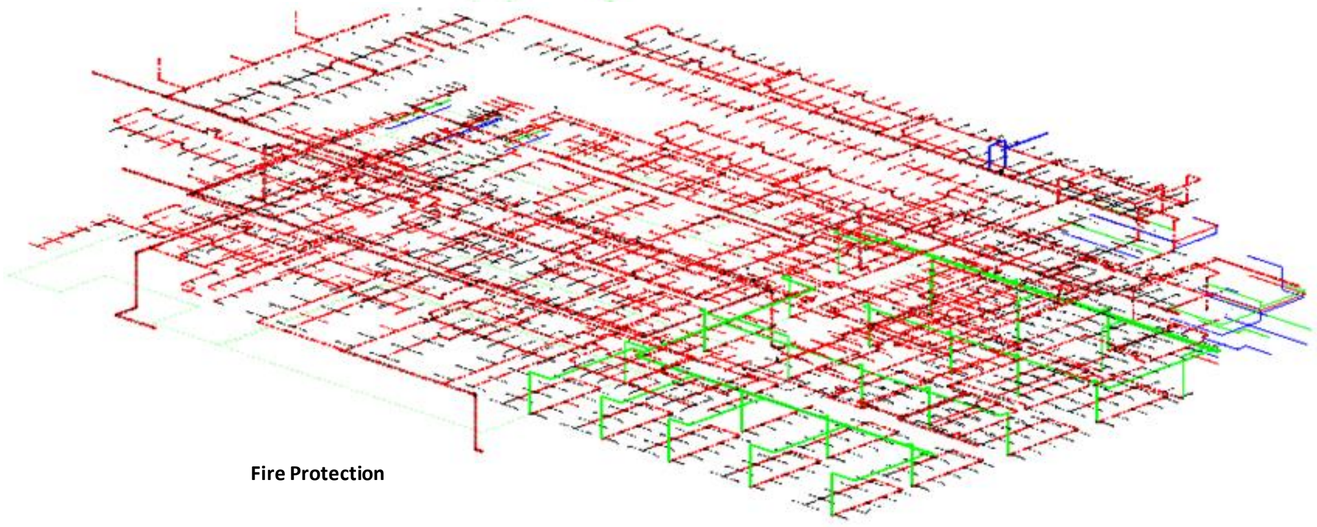




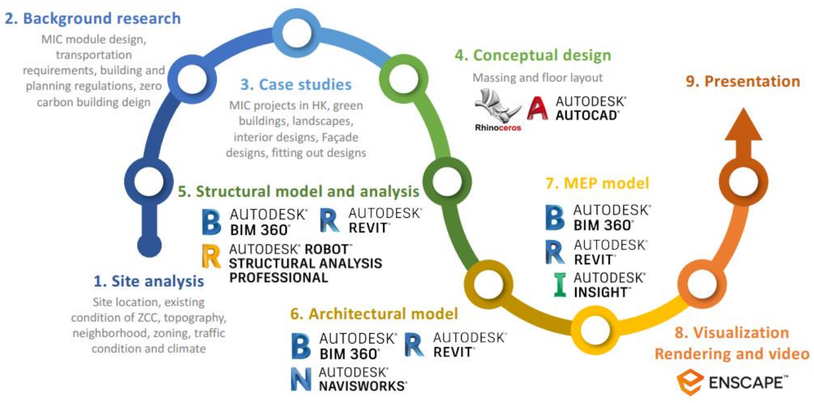
HVAC

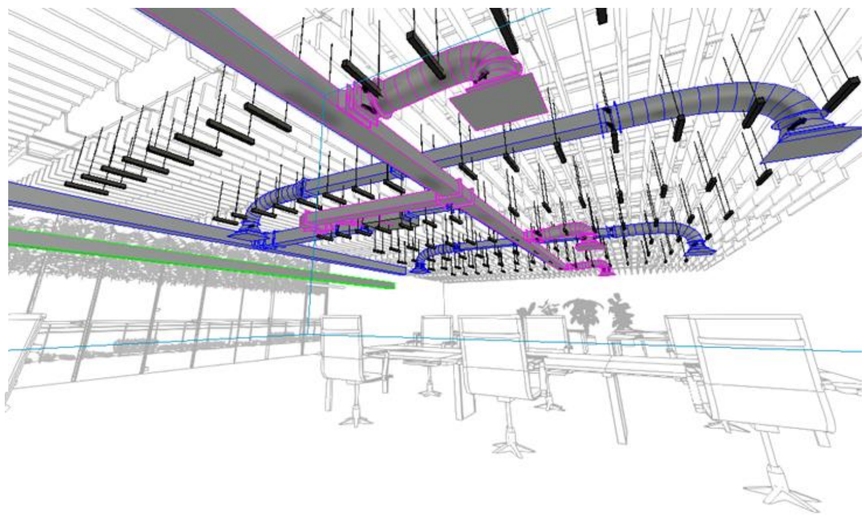


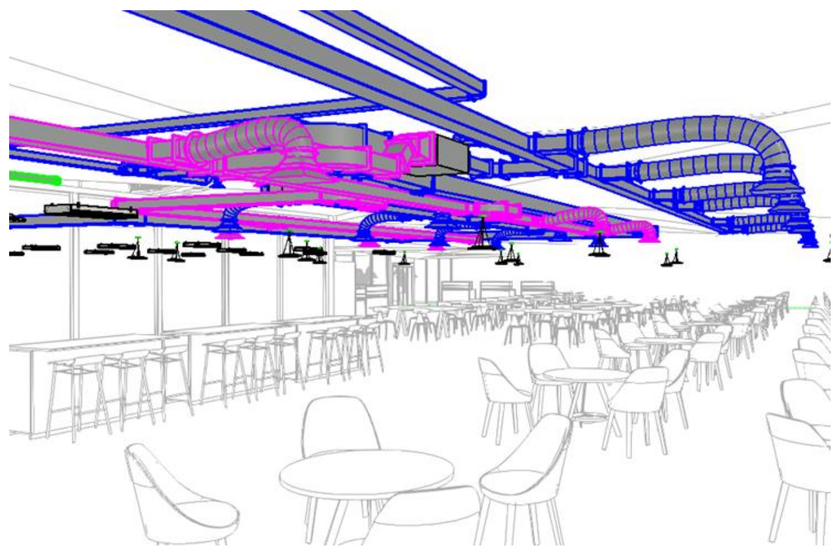
Fire Protection

Design Coordination: Different softwares are deployed for the BIM model. In the conceptual design development stage, Autocad and Rhino are used to sketch out the floor plans and massing diagrams. Autodesk Revit is then used to build up the BIM model. With the architectural, structural and MEP model built up in Revit, we used InSight to test out the lighting with solar analysis.

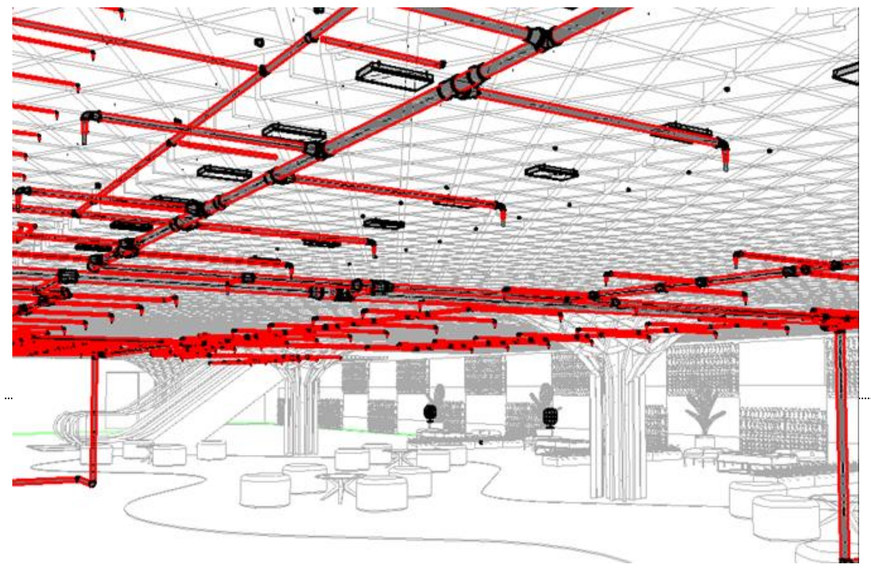
Perspective View: The above HVAC system shows the duct network throughout the ANZ hub with the air exchange from supply to return terminal connected to VAVs and AHUs. The circulation network of Fire Protection and Sanitary Plumbing systems were also shown.







Project Team Collaboration: Worked as a team, a common data sharing platform is important for us to coordinate and update our designs. Thanks to BIM 360, our team has a centralized location for accessing the project files and disturbing questions. It keeps every member on the same pace, which enhances our work efficiency.

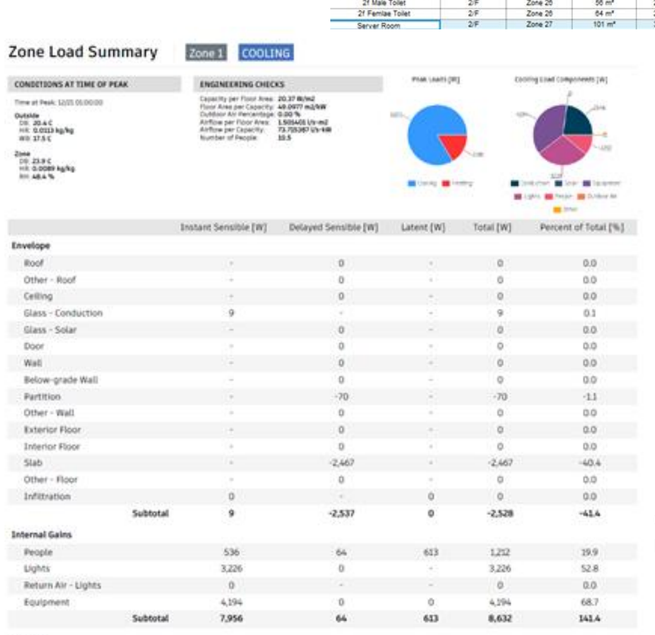


Cooling Load Analysis

Supply Airflow Schedule for Zones

<Space Schedule>

A	B	C	D	E	F
Name	Level	Zone	Area	Volume	Actual Supply Airflow
ZCB Indoor Exhibition 2	Basement Finish Sl	Zone 1	98 m²	392.85 m³	274.0 L/s
Basement Male Washroom	Basement Finish Sl	Zone 2	40 m²	161.50 m³	0.0 L/s
Basement Female Washroom	Basement Finish Sl	Zone 2	40 m²	161.33 m³	0.0 L/s
ZCB Classroom 1	Basement Finish Sl	Zone 2	99 m²	394.74 m³	470.0 L/s
ZCB Classroom 2	Basement Finish Sl	Zone 2	99 m²	394.58 m³	470.0 L/s
ZCB Classroom 3	Basement Finish Sl	Zone 2	99 m²	391.44 m³	470.0 L/s
ZCB Indoor Exhibition 1	Basement Finish Sl	Zone 1	99 m²	396.10 m³	274.0 L/s
ZCB Indoor Exhibition 3	Basement Finish Sl	Zone 1	101 m²	403.31 m³	274.0 L/s
ZCB MPH	Basement Finish Sl	Zone 3	602 m²	2179.94 m³	1410.0 L/s
ZCB Public Space	Basement Finish Sl	Zone 4	1662 m²	6626.23 m³	3710.0 L/s
Parking	Basement Finish Sl	Zone 6	2372 m²	9356.20 m³	1173.0 L/s
Canteen	G/F Finishing slab	Zone 7	717 m²	2210.29 m³	3015.0 L/s
Library	G/F Finishing slab	Zone 8	516 m²	1320.30 m³	1840.0 L/s
MC indoor exhibition	G/F Finishing slab	Zone 9	200 m²	523.76 m³	728.0 L/s
G/F female toilet	G/F Finishing slab	Default	26 m²	55.64 m³	0.0 L/s
G/F male toilet	G/F Finishing slab	Default	26 m²	54.82 m³	0.0 L/s
CITAC MPH 1	1/F Finishing Slab	Zone 11	229 m²	601.28 m³	840.0 L/s
CITAC MPH 2	1/F Finishing Slab	Zone 12	179 m²	470.19 m³	660.0 L/s
CITAC I/P3	1/F Finishing Slab	Zone 13	205 m²	540.20 m³	750.0 L/s
CITAC Indoor Exhibition	1/F Finishing Slab	Zone 14	415 m²	1091.41 m³	1520.0 L/s
CITAC WorkShop 1	1/F Finishing Slab	Zone 15	50 m²	131.29 m³	180.0 L/s
CITAC WorkShop 2	1/F Finishing Slab	Zone 15	49 m²	128.62 m³	180.0 L/s
CITAC WorkShop 3	1/F Finishing Slab	Zone 15	49 m²	129.67 m³	180.0 L/s
1f Female Toilet	1/F Finishing Slab	Zone 16	67 m²	176.58 m³	0.0 L/s
1f Male Toilet	1/F Finishing Slab	Zone 16	58 m²	151.23 m³	0.0 L/s
BIM Classroom 1	1/F Finishing Slab	Zone 17	104 m²	272.89 m³	400.0 L/s
BIM Classroom 2	1/F Finishing Slab	Zone 17	103 m²	270.35 m³	400.0 L/s
CITAC Classroom 1	1/F Finishing Slab	Zone 18	101 m²	265.20 m³	372.0 L/s
CITAC Classroom 2	1/F Finishing Slab	Zone 18	100 m²	264.24 m³	372.0 L/s
BIM Meetng Room 1	2/F	Zone 19	52 m²	141.63 m³	190.0 L/s
Bim Meeting Room 2	2/F	Zone 19	50 m²	134.42 m³	190.0 L/s
BIM Meeting Room 3	2/F	Zone 19	50 m²	134.21 m³	190.0 L/s
BIM Board Room 1	2/F	Zone 19	50 m²	135.04 m³	190.0 L/s
BM Board Room 2	2/F	Zone 19	51 m²	137.08 m³	190.0 L/s
BIM Meeting Room 4	2/F	Zone 20	49 m²	132.94 m³	190.0 L/s
BIM Meeting Room 5	2/F	Zone 20	50 m²	133.72 m³	190.0 L/s
BIM Meeting Room 6	2/F	Zone 20	51 m²	136.63 m³	190.0 L/s
BIM Meeting Room 7	2/F	Zone 20	50 m²	134.75 m³	190.0 L/s
BIM Meeting Room 8	2/F	Zone 20	49 m²	132.00 m³	190.0 L/s
BIM office 3	2/F	Zone 21	430 m²	1160.77 m³	2620.0 L/s
BIM Staff Canteen	2/F	Zone 23	242 m²	652.21 m³	1088.0 L/s
BIM Office 2	2/F	Zone 22	385 m²	1040.80 m³	1723.0 L/s
BIM Office 1	2/F	Zone 24	484 m²	1307.56 m³	1918.0 L/s
BIM Office Lounge	2/F	Zone 24	142 m²	382.17 m³	540.0 L/s
BIM Office 3 (Head Room)	2/F	Zone 25	80 m²	297.78 m³	470.0 L/s
BIM Office 2 (Head Room)	2/F	Zone 22	38 m²	99.61 m³	137.0 L/s
BIM Office (Head Room 2)	2/F	Zone 24	29 m²	75.09 m³	0.0 L/s
2f Male Toilet	2/F	Zone 26	56 m²	207.22 m³	0.0 L/s
2f Female Toilet	2/F	Zone 26	64 m²	236.20 m³	0.0 L/s
Server Room	2/F	Zone 27	101 m²	373.70 m³	520.0 L/s



Zone Load Summary — Zone 1 — COOLING

CONDITIONS AT TIME OF PEAK

Time at Peak: 12/21 01:00:00

Outside
DB: 20.4 C
HR: 0.0113 kg/kg
WB: 17.5 C

Zone
DB: 23.9 C
HR: 0.0089 kg/kg
RH: 48.4 %

ENGINEERING CHECKS

Capacity per Floor Area: 20.37 W/m2
Floor Area per Capacity: 49.0977 m2/kW
Outdoor Air Percentage: 0.00 %
Airflow per Floor Area: 1.503405 l/s-m2
Airflow per Capacity: 73.705367 l/s-kW
Number of People: 10.5

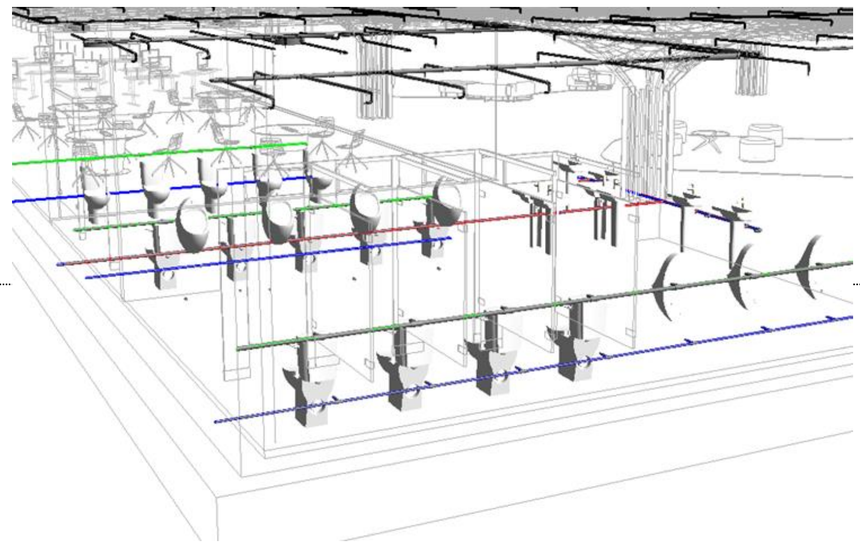
Peak Loads [W]

Cooling Load Components [W]

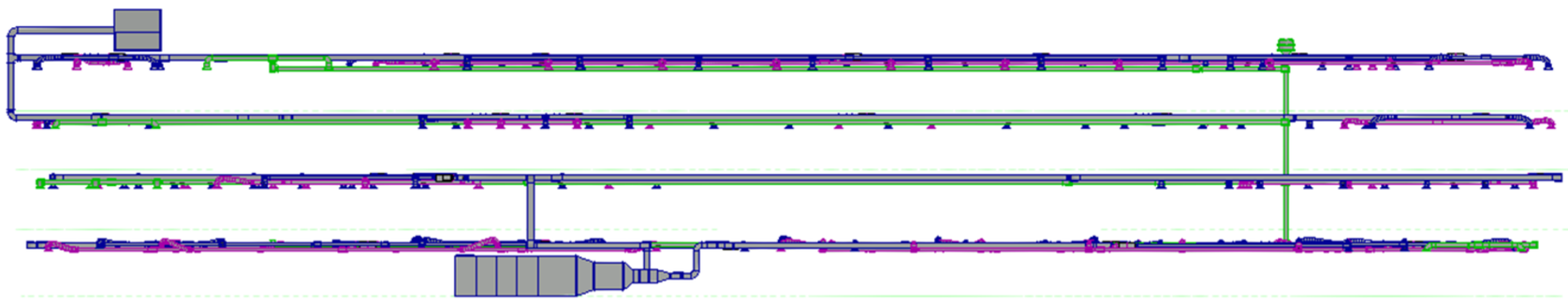
	Instant Sensible [W]	Delayed Sensible [W]	Latent [W]	Total [W]	Percent of Total [%]
Envelope					
Roof	-	0	-	0	0.0
Other - Roof	-	0	-	0	0.0
Ceiling	-	0	-	0	0.0
Glass - Conduction	9	-	-	9	0.1
Glass - Solar	-	0	-	0	0.0
Door	-	0	-	0	0.0
Wall	-	0	-	0	0.0
Below-grade Wall	-	0	-	0	0.0
Partition	-	-70	-	-70	-1.1
Other - Wall	-	0	-	0	0.0
Exterior Floor	-	0	-	0	0.0
Interior Floor	-	0	-	0	0.0
Slab	-	-2,467	-	-2,467	-40.4
Other - Floor	-	0	-	0	0.0
Infiltration	0	-	0	0	0.0
Subtotal	**9**	**-2,537**	**0**	**-2,528**	**-41.4**
Internal Gains					
People	536	64	613	1,252	19.9
Lights	3,226	0	-	3,226	52.8
Return Air - Lights	0	-	-	0	0.0
Equipment	4,194	0	0	4,194	68.7
Subtotal	**7,956**	**64**	**613**	**8,632**	**141.4**
Systems					

Cooling and Heating Load Report

Computational Design : By conducting an energy model analysis on Revit, HVAC system has taken heating and cooling load into account for calculating the desired supply airflow and distribution of terminals.



Internal view: Air exchange rate has been taken into consideration in our design, especially for canteens and toilets.
Sprinkler system was applied for the coverage of the whole building internal area, which provide a water supply protection from fire incidents.
Adequate supply of water pressure and flowrate were integrated in the system, such that the applied 15mm pendant sprinklers are able to preform a 2m radial coverage.



Section Front View : One AHU placed in the basement serves the fresh air supply for Basement and G/F, while another AHU on the roof connects to the VAVs and air terminals on 1/F and 2/F. The separated operation of AHUs can reduce cooling loading on equipment and ensure HVAC sustainability. Exhaust duct (Green in color) were connected to ventilate air from W.C. out of the roof with the installation of a centrifugal fan on the roof.

CIC BIM Competition 2021

BIM for Design Collaboration