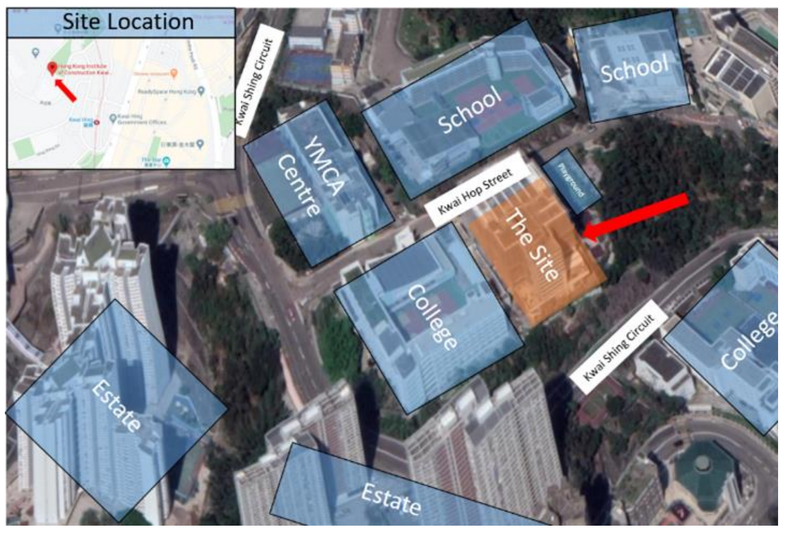
CIC BIM Competition 2020 – Formula of Gravity

Location Plan 1:2000



About the New Development of the Student Hostel

Design Concept: What is the design rational for the Building Design?

Shear wall system will be chosen as boxes and partitions are required to separate the rooms in dormitory building, which will be suitable for inserting shall walls. As the floor-by floor repetitive planning is often used in student accommodation and residential building, vertically continuous shear wall design will be adopted in this project.

Building Form: How does the building form relates to the surrounding site context?

Buildings surrounding the site, such as schools and the YMCA centre, are low rise buildings, which then across the roads there are the high rise residential buildings. Considering environmental aspect and based on nearby structures, building is designed to enhance comfortability, service and to cater the nearby environment.

Spatial Arrangement: How is the Dormitory Areas, Common Areas and Sports Facility being arranged?

All dormitory areas are assigned on 3/F - 10/F, where include one common area per floor. The 2/F consist of plant room and gym house. The study and meeting area are located on 1/F, with half of the floor occupied by a sport center of two floor high from ground floor. Serval common area and parking area are included on the ground floor.

Connectivity: What is the vehicular and pedestrian connectivity, accessibility and evacuation considerations?

The public and residents can enter our building through the bridge from down the hill or the ground level roads. Vehicles can be enter our site through the roads on the ground floor level.

BIM Uses in Design, Collaboration, Engineering, Analysis and Optimisation: What is the defined BIM uses in carrying out design, collaboration, engineering, analysis and optimisation?

3D coordination, 4D scheduling are the important BIM uses throughout the project, it helps find out conflicts and we will give solutions to minimise possible logical or structural problems in the design.

BIM Collaboration approach: What is the approach and BIM tools for design collaboration?

The Wind loads simulation in AutoDesk Robot Structural Analysis is used to simulate a wind flow around the structure, and generate wind loads automatically. Dynamo is used to used for scripting, which helps to ensure our project is well coordinated. Naviswork is used to detect clash. Civil 3D is used to analysis the soil condition for making foundation choice. Fuzor is used to simulate the construction process and spot potential flaws of the project. Enscape is used to render our revit project. AutoCad is used for preliminary drawing which is further developed through Revit.

Quality of Design: How BIM improve the quality of design?

With the support of BIM tools, accurate calculations and estimations have been taken out, with lack of constructional problems, BIM enhances the quality of design in terms of sufficient geometry information, data managements etc.

Sustainability: How are the considerations of sustainability aspect and passive building design being achieved?

Curtain walls (3-10/F) and glass structure (G/F) are adapted to maximise natural sunlight while sky garden (2/F), green walls and solar panels (roof) minimise direct sunlight from reaching the structure. These approaches enhance the energy efficiency of the building. Besides, wind turbines and solar panels are installed on the rooftop, so that some of the energy consumed by the building can be supported by renewable energy.

MiC/ DfMA: How is Design for Modular Integrated Construction or Manufacturing and Assembly being involved in the design considerations?

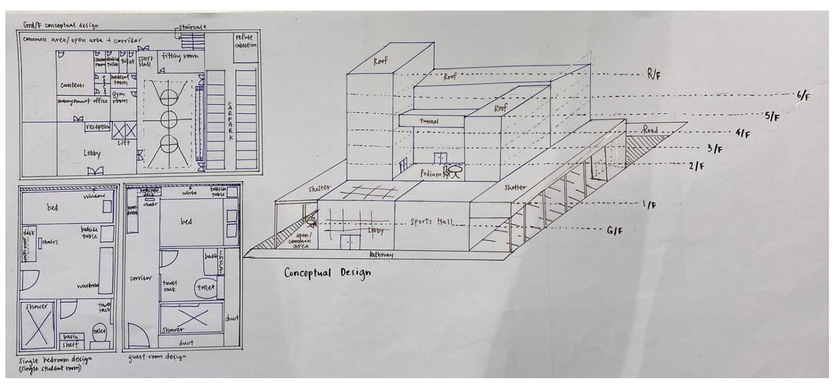
There are type of 9 Mic units forming the student rooms, for modular unit with a width larger than 2.5 metres is required to make special traffic arrangement. Temporary storage location or special traffic arrangement needs to be made for transportation of modular units with width larger than 2.5 meters. Therefore, night transportation will be arranged so as to fulfil the transportation law.

Constructability: Any innovative approach introduced for construction?

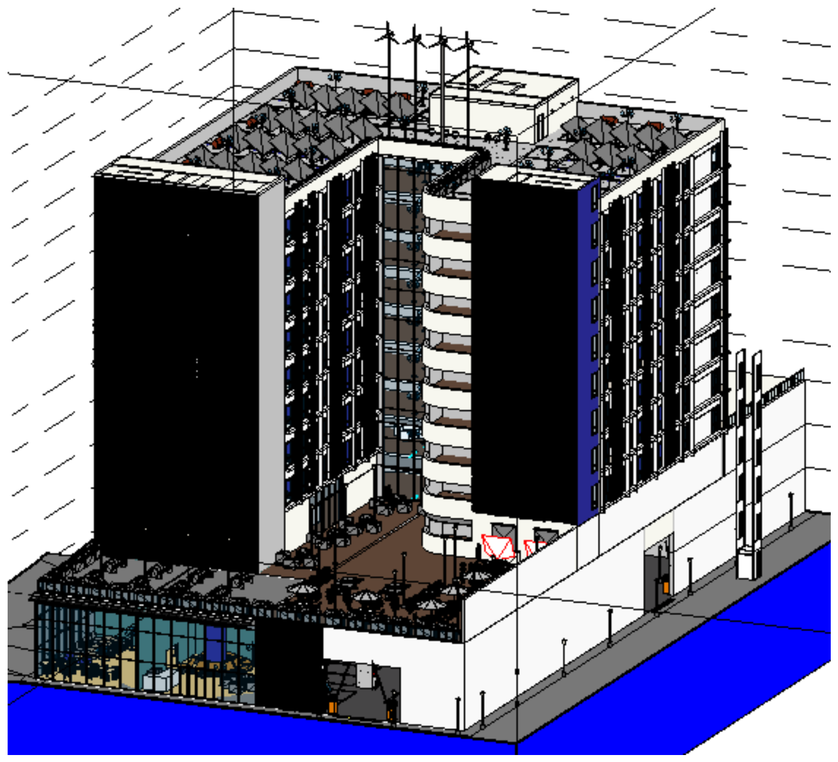
Sky Garden, high ceiling lobby and reception, outdoor movie area

Summary: How BIM influences the design, engineering and design collaboration?

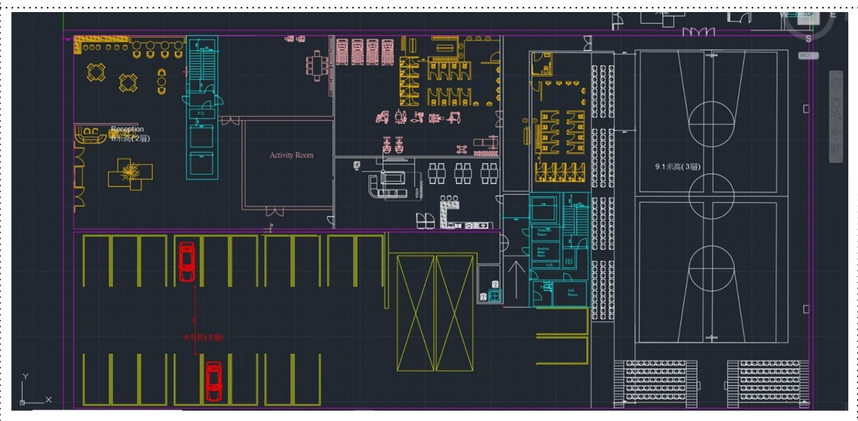
BIM facilitates the project efficiency, improves the accuracy of the details through real-time connection with teammates, robot simulation, loads analysis and calculation.

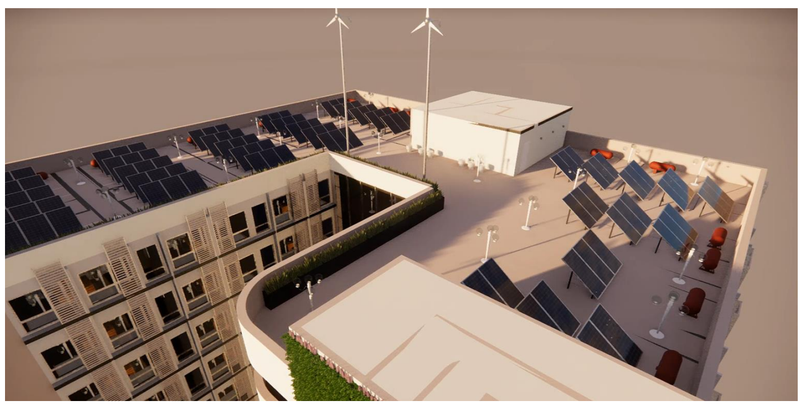


Conceptual Diagram: The concept of the building is a merge concepts of space, shape and comfortable living, which hence suits to the environment and provide practical uses.

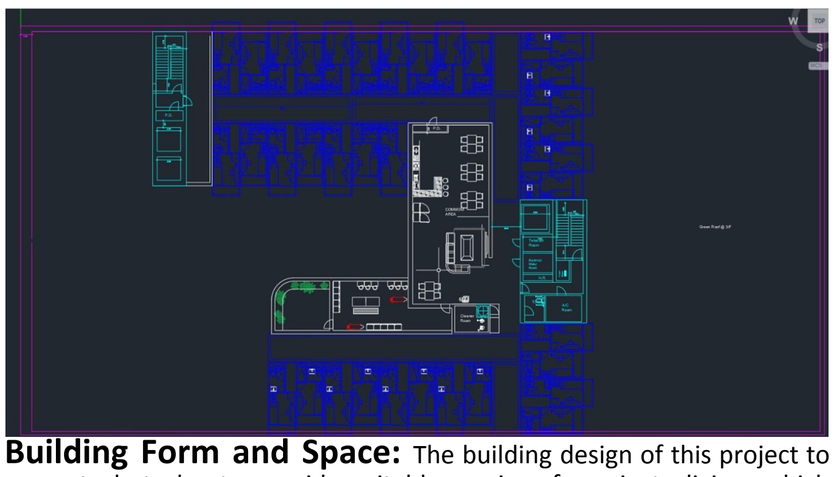


Overall Bird Eye view: The building, which suits the environment with similar building height and accordingly to the ground conditions, will be built at a irregular shape which fulfills spatial requirement and services, such as sports ground, gym room, single room, visitor's romm etc.

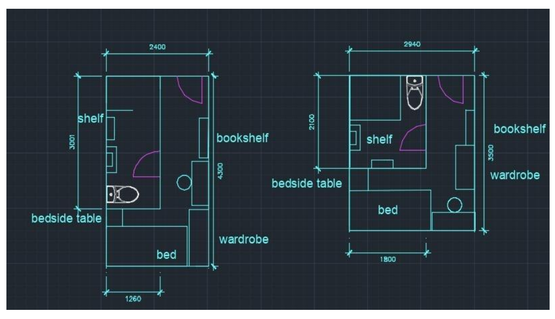


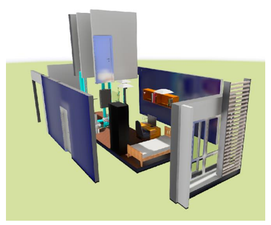


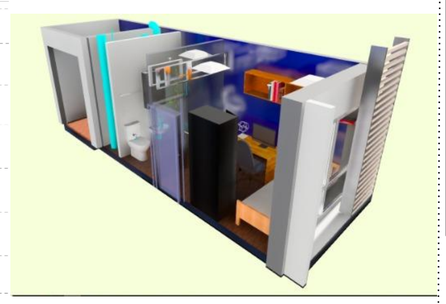
Solar panels & wind turbines on the roof floor



Building Form and Space: The building design of this project to separate but also to provide suitable services for private living, which fulfills both building requirements, personal space and public space.





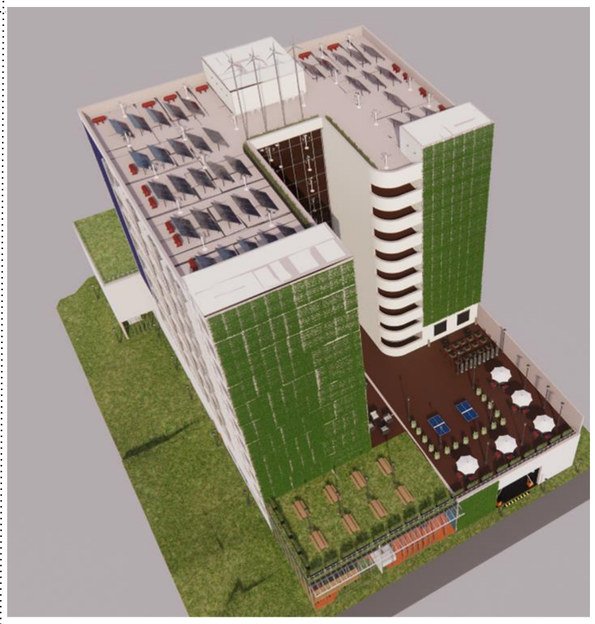


Quality: The use of BIM helps moderate development in stages of design, construct and imitation of the building design.

Autocad: provide platform to form suitable designs and plots.

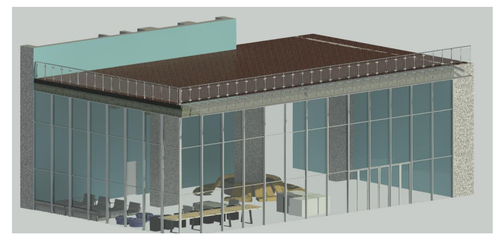
Revit: supports the build up of structures, engineering, and building services elements.

Fuzor: shows present the possible look of the building with the adopted building method(MIC)



G/F & 1/F:
Lobby and Reception with curtain wall

Living floors (3-10/F)
Common area with curtain walls



Sustainability: Sky Garden are built on the roof of the stadium as leisure area for residents. Curtain walls are also adopted to maximize natural lighting and reduce electrical demand. Renewable energy devices are also installed.

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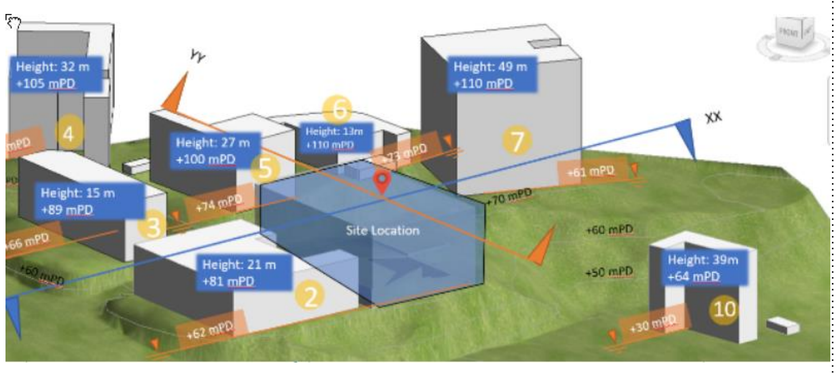
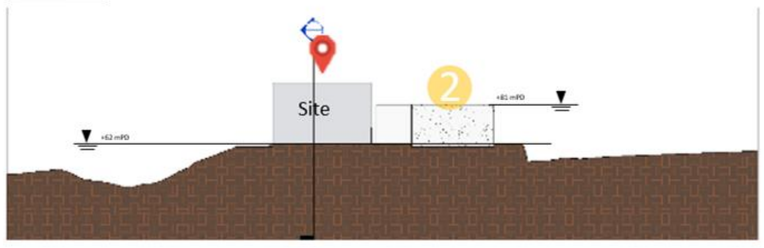
Site Layout Plan 1:1000

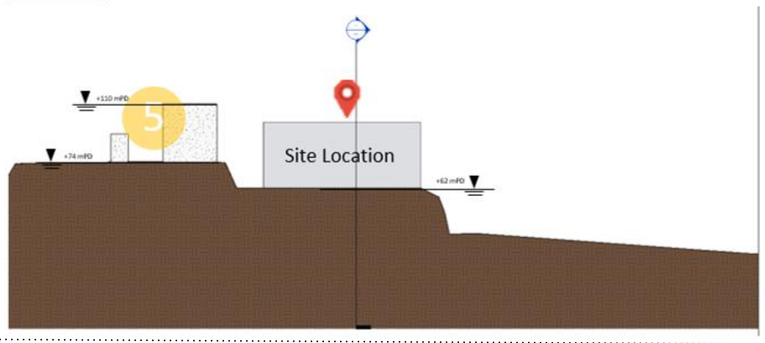


3D View showing the Height of each surrounded buildings

Section XX



Section YY



Adjoining Condition

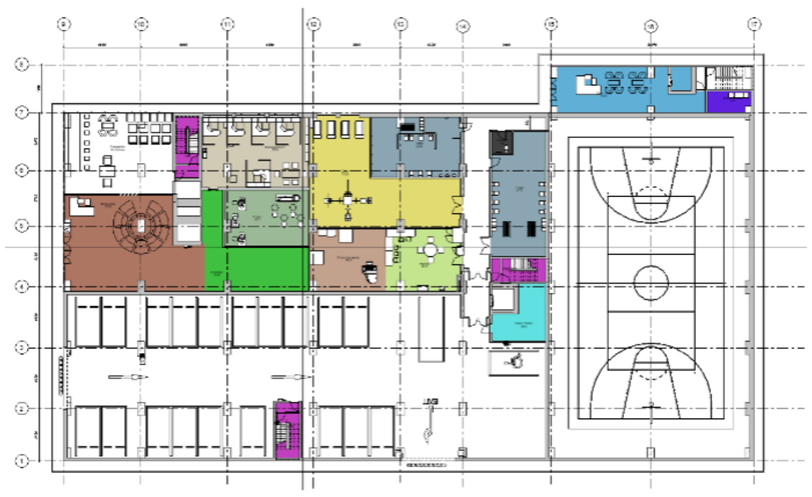
1. Kwai Hop Street Playground
2. TWGHs Chen Zao Men College
3. Chinese YMCA of Hong Kong New Territories Centre
4. The Methodist Lee Wai Lee College
5. Daughters of Mary Help of Christians Siu Ming Catholic Secondary School
6. Sahk B.m. Kotewall Memorial School
7. Salesians of Don Bosco Ng Siu Mui Secondary School
8. Kwai Chung Estate Chun Kwai House
9. S.K.H. Yan Laap Primary School
10. Sheng Kung Hui Lam Woo Memorial Secondary School
11. ELCHK Grace Lutheran Church
12. Fung Yat Social Service Complex
13. Kwai Hong Court East
14. Kwai Shing East Estate Shing Fung House and Shing Hei House
15. Basketball Court
16. Kwai Hong Court Shing Fu House
17. Kwai Shing East Comm. Complex

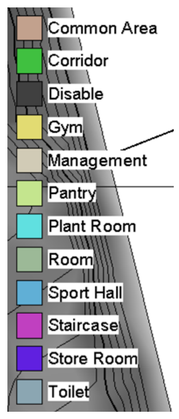
Computational Design:

The figure above shows that schools nearby are the major element which might be affected by the environmental impact caused by the construction activities.

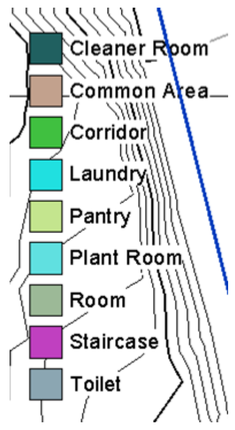
Among the above, the most affected element is undoubtedly the surrounded schools that next to our site, and the estates nearby.

Perspective View: **The reception and common area on the ground floor adopted a curtain wall design to maximize natural lighting and minimize the need of artificial lighting. Besides, in order to increase the sense of space, G/F and 1/F combined to create a high ceiling.**

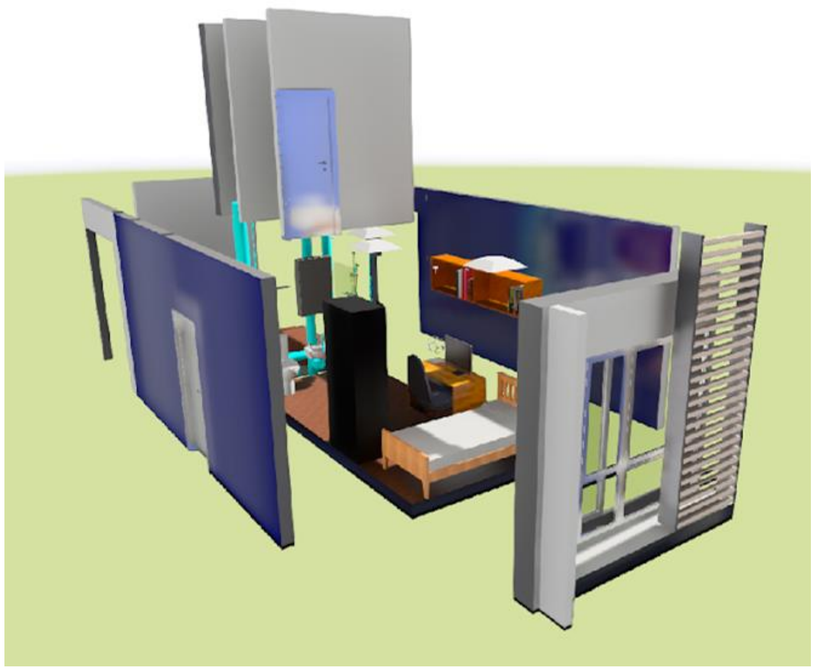




Ground Floor Plan 1:500



Typical Floor (3/F) Plan 1:500



Internal Perspective of student room 1:500

Overall Bird Eye view (Night View)

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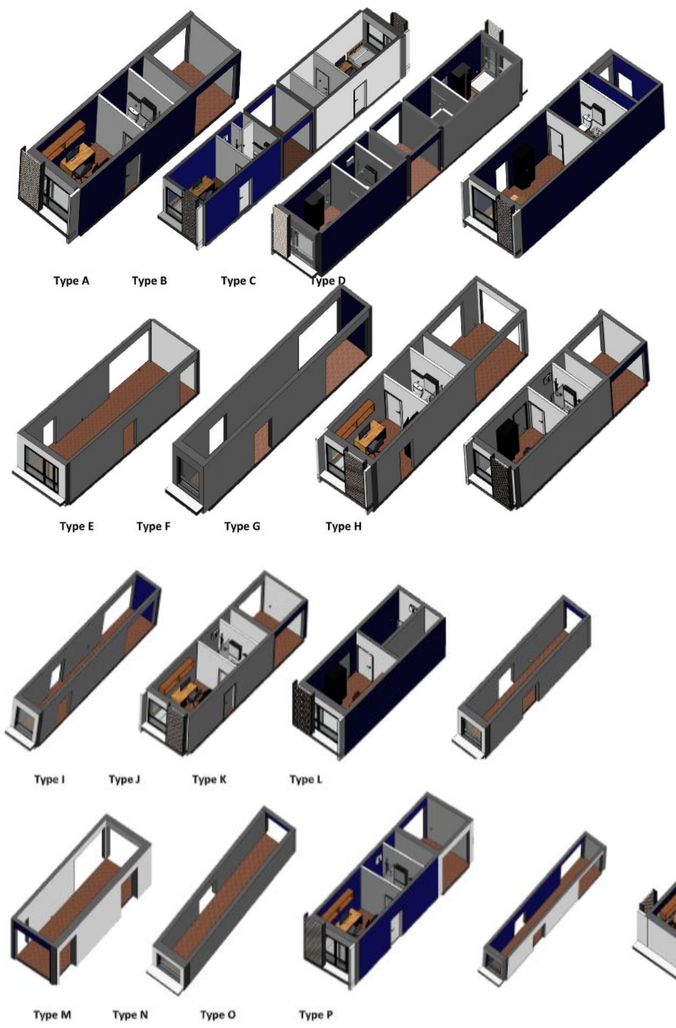
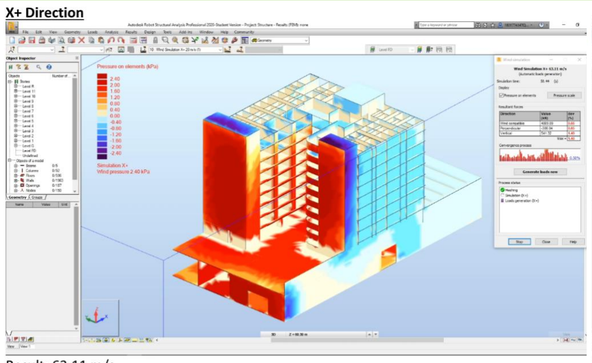


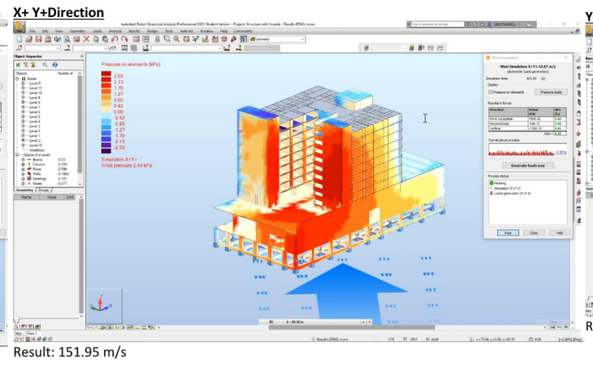
MiC/DfMA: There are type of 9 Mic units forming the student rooms, each of them will be constructed, furnished and installed with MEP in factory. Once the Mic units is delivered to the site, they will be joined together with connection joints.

X+ Direction



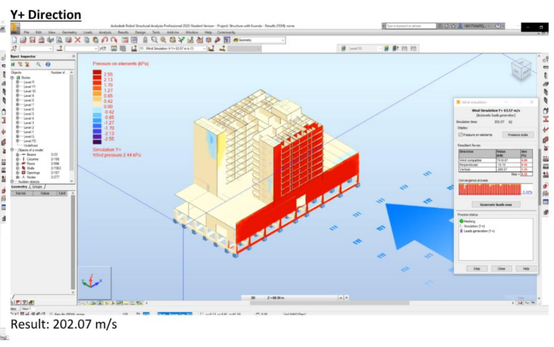
Result: 63.11 m/s

X+ Y+Direction



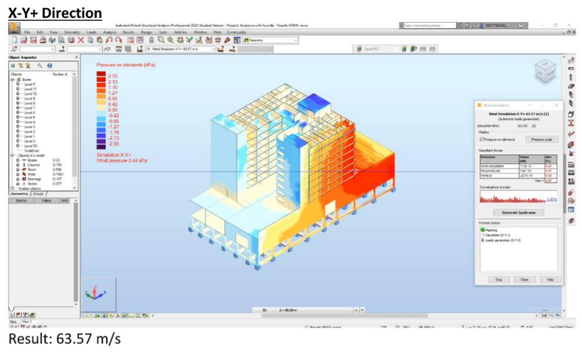
Result: 151.95 m/s

Y+ Direction



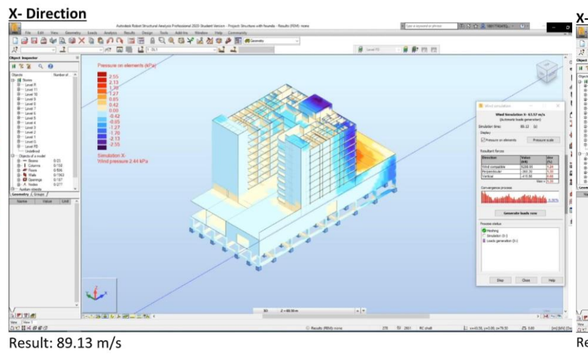
Result: 202.07 m/s

X-Y+ Direction



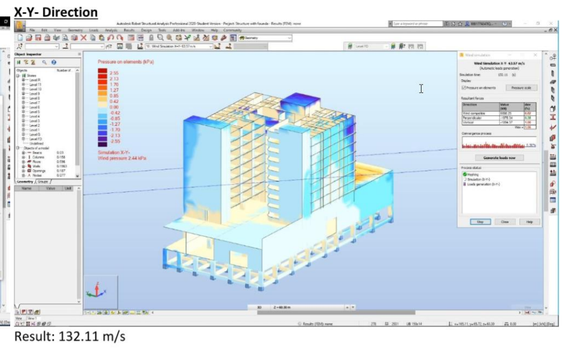
Result: 63.57 m/s

X- Direction



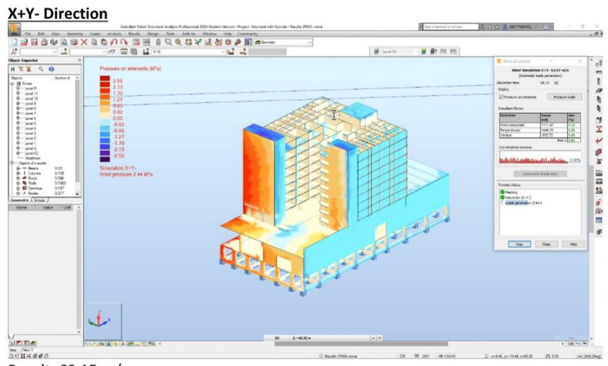
Result: 89.13 m/s

X-Y- Direction



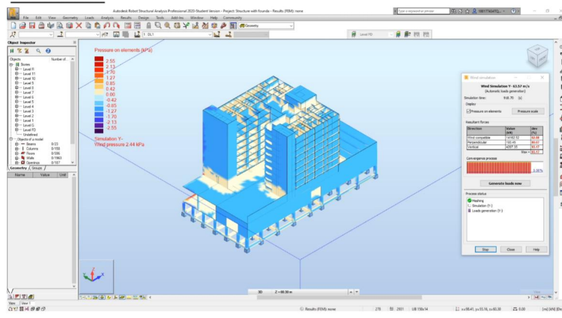
Result: 132.11 m/s

X+Y- Direction



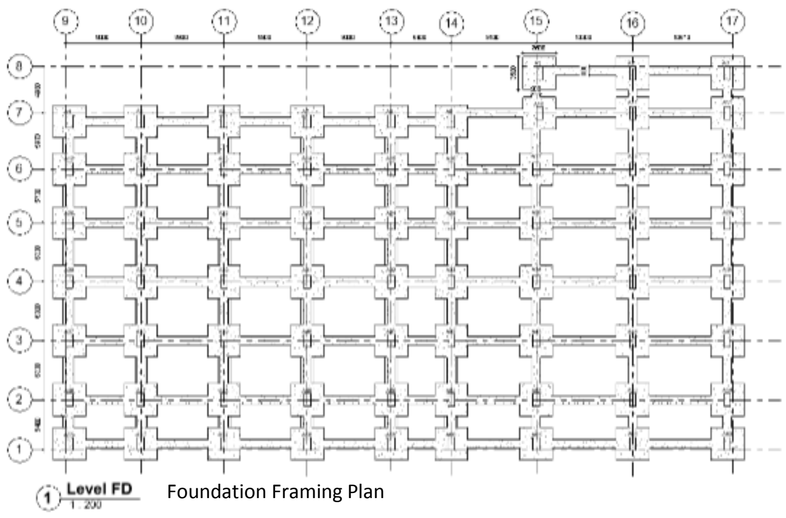
Result: 68.15 m/s

Y- Direction

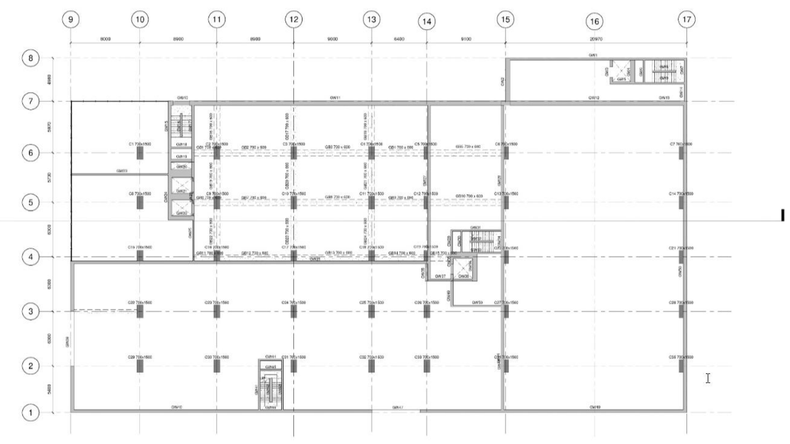


Result: 63.57 m/s

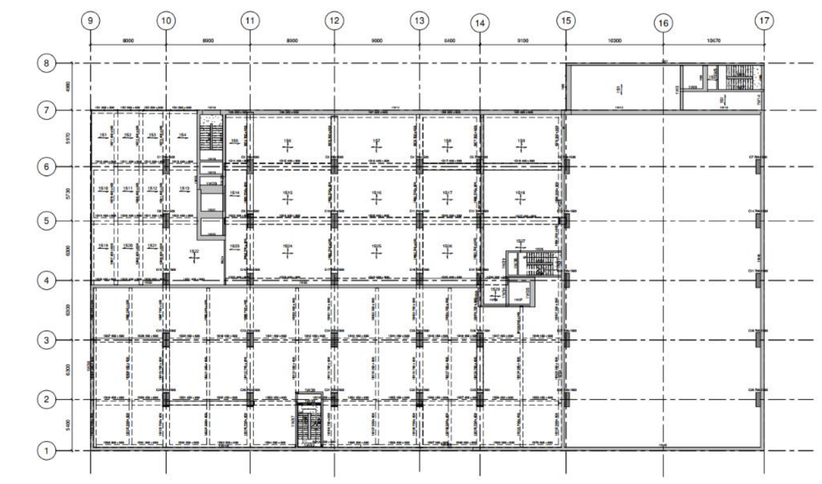
Perspective View: Wind loads around the structure are simulated by AutoDesk Robot Structural Analysis. The wind pressure obtained is 2.435kPa. The loads are analyzed in 8 directions, the coloured area represents different amount of wind pressure.



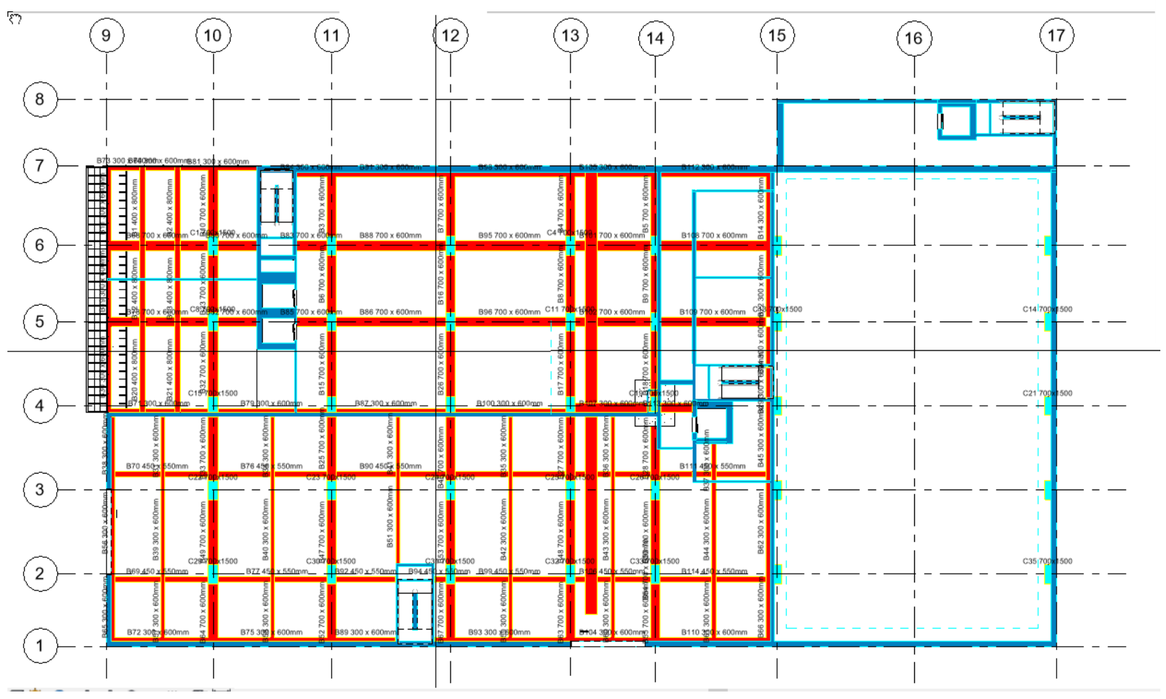
1 Level FD 1:200 Foundation Framing Plan



1 Level G Framing Plan 1:150



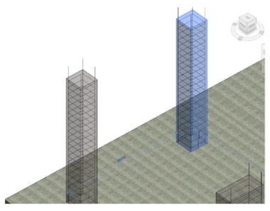
1 Level 1 Framing Plan 1:150



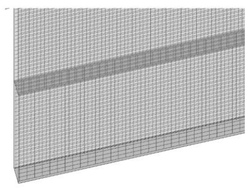
Computational Design :
The shear, bending moment, deflection diagrama are obtained through DT beam.

Internal Perspective of Ceiling Plan (G/F) 1:200

Framing Plan (3-10/F) 1:500

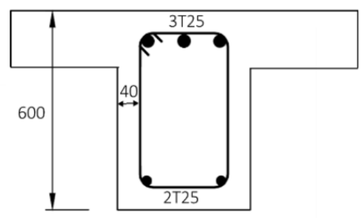


Revit Column Details – GC10



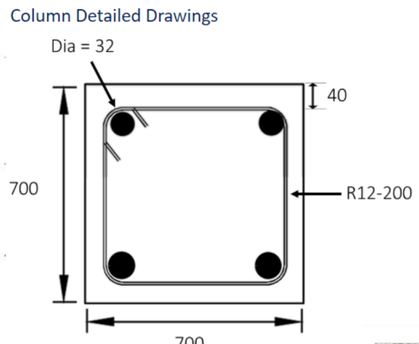
Revit Slab Details – 1S14

Beam Detailed Drawings

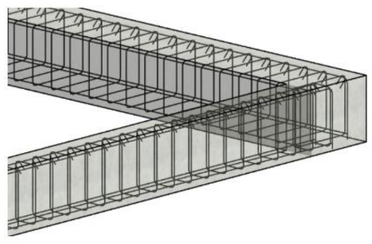


Beam Details – GC10

Column Detailed Drawings

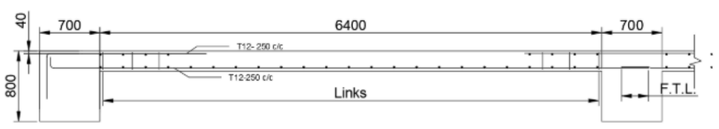


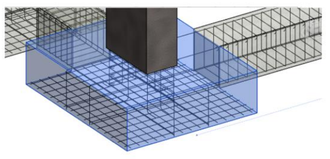
Column Details – GC10



Revit Beam Details – GC10

Slab Detailed Drawings





Revit Footing Details – A10

Computational Design : Dynamo is used to ensure the correct coordinate of the element. By running the scripting, the element will be placed at the exact correct coordinate to make sure that the Module in Revit is precise.

Detail drawings

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BIM for Design Collaboration

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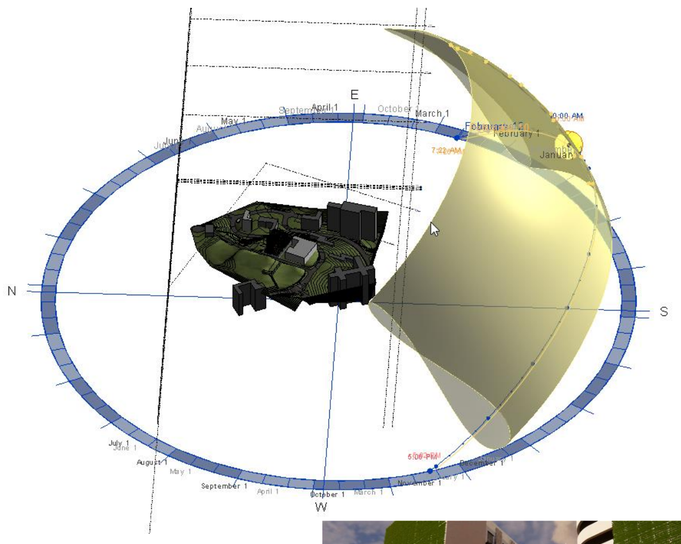
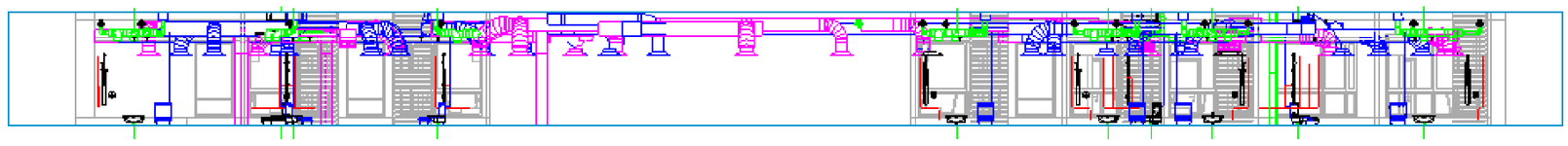
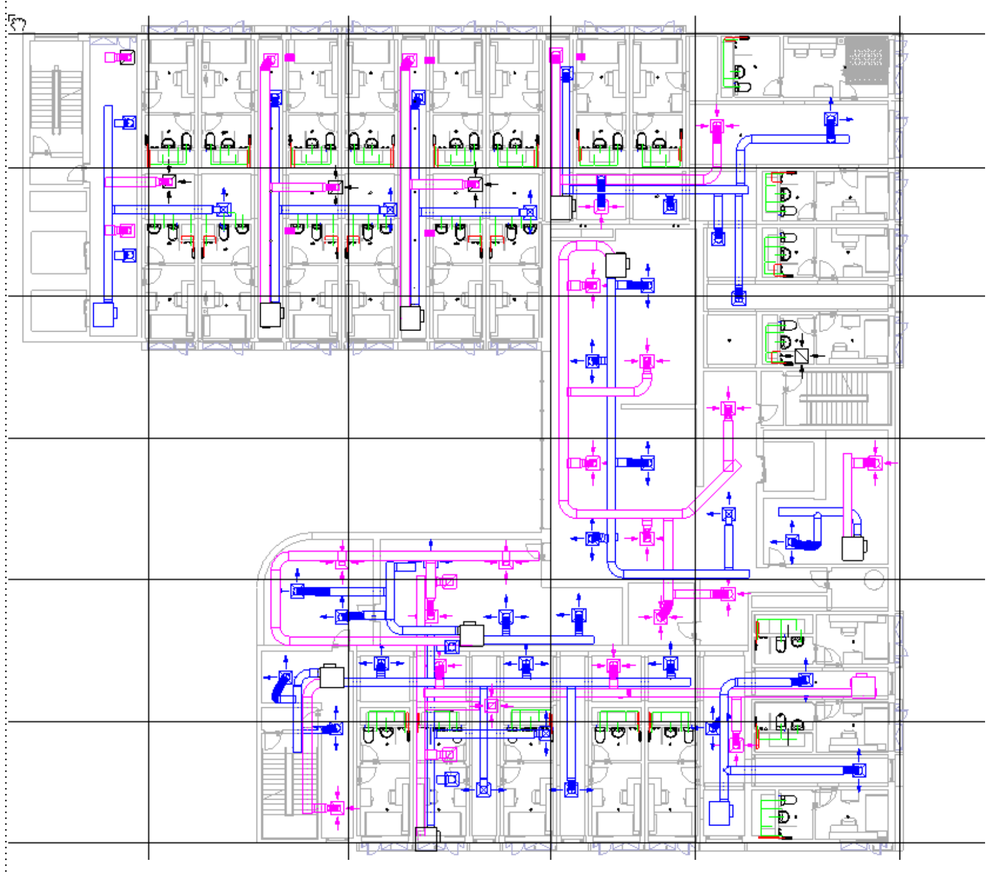


Project Summary

Location and Weather	
Project	Project Name
Address	
Calculation Time	Sunday, May 31, 2020 10:24 PM
Report Type	Standard
Latitude	42.21°
Longitude	-71.03°
Summer Dry Bulb	93 °F
Summer Wet Bulb	78 °F
Winter Dry Bulb	6 °F
Mean Daily Range	20 °F

Design Coordination: **The sun path, shadow trace and the weather of the site can be stimulated by revit.**

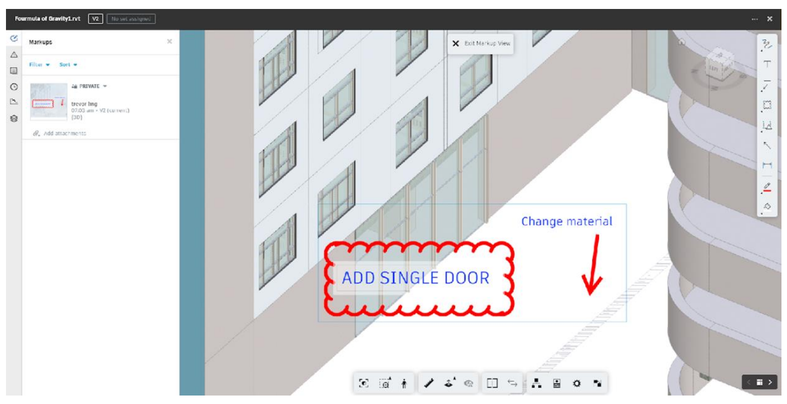


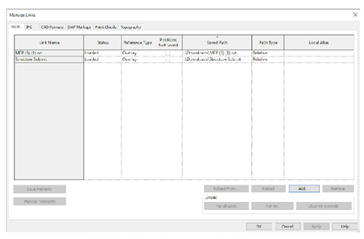


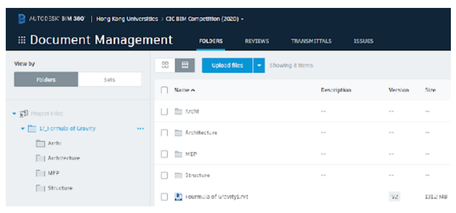
Internal Perspective of Typical Floor (3/F) 1:500

Perspective View: **The plumbing and ventilation system are shown above. The plumbing system are independent in each room for easy installation of the MiC units. Central HVAC will supply fresh air to the common area of the building, while split AC will be used in student rooms.**

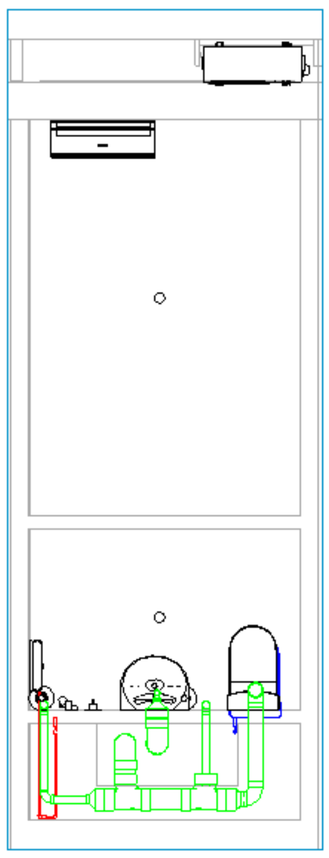
AUTODESK® BIM 360™



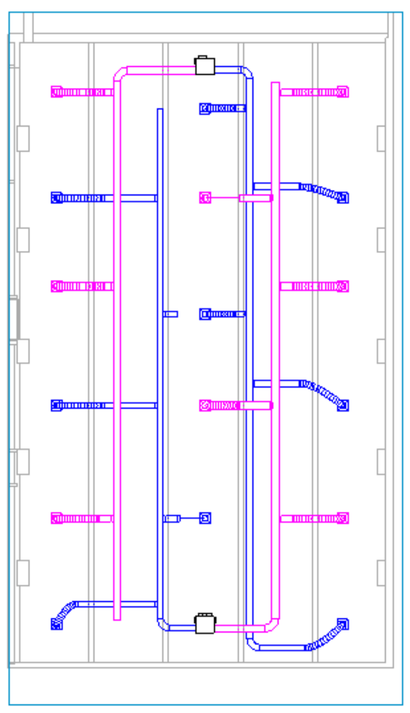




Project Team Collaboration: **BIM 360 is used to share files among group mates in real-time.**

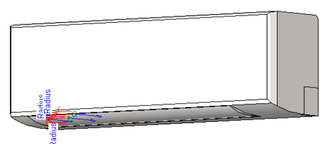


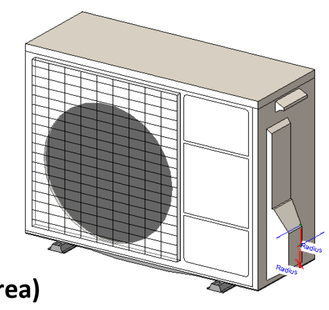
Internal Perspective of Typical Student Room



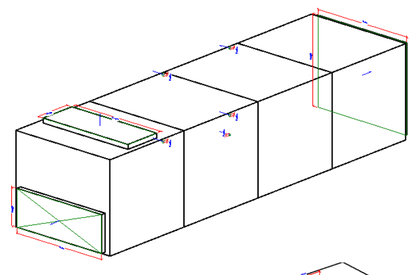
Internal Perspective of the Stadium

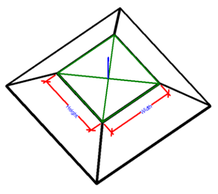
Split Air-Conditioning (Student's Room)

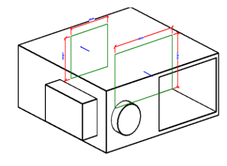




Central Air-Conditioning (Common Area)







Mechanical Return Air 174

System Information	
System Classification	Return Air
System Type	Return Air
System Name	Mechanical Return Air 174
Abbreviation	

Total Pressure Loss Calculations by Sections

Section	Element	Flow	Size	Velocity	Velocity Pressure	Length	Loss Coefficient	Friction	Diameter	Total Pressure Loss	Section Pressure Loss
1	Fittings	235.0 L/s	-	0.0 m/s	4.1 Pa	-	0.18731	-	-	0.8 Pa	14.8 Pa
	Air Terminal	235.0 L/s	-	-	-	-	-	-	-	14.0 Pa	
2	Duct	235.0 L/s	-	1.9 m/s	-	850.76 mm	-	0.12 Pa/m	400	0.1 Pa	0.2 Pa
	Fittings	235.0 L/s	-	1.9 m/s	2.1 Pa	-	0.067585	-	-	0.1 Pa	
3	Duct	235.0 L/s	400x350	1.7 m/s	-	1000 mm	-	0.10 Pa/m	-	0.1 Pa	0.1 Pa
	Fittings	235.0 L/s	-	1.7 m/s	1.7 Pa	-	0	-	-	0.0 Pa	

Critical Path : 1-2-3 ; Total Pressure Loss : 15.1 Pa

Detail Information of Straight Segment by Sections

Section	Element ID	Flow	Size	Velocity	Velocity Pressure	Length	Pressure Loss	Total Pressure Loss
2	1208209	235.0 L/s	400	1.9 m/s	2.1 Pa	850.76 mm	0.1 Pa	0.1 Pa
3	1208208	235.0 L/s	400x350	1.7 m/s	1.7 Pa	1000 mm	0.1 Pa	0.1 Pa

Fitting and Accessory Loss Coefficient Summary by Sections

Section	Element ID	Loss Method	ASHRAE Table	Loss Coefficient	Pressure Loss	Total Pressure Loss
1	1208212	Coefficient from ASHRAE Table	EB4-3	0.18731	0.8 Pa	0.8 Pa
2	1208211	Coefficient from ASHRAE Table	ED4-2	0.067585	0.1 Pa	0.1 Pa
	1208212	Coefficient from ASHRAE Table	EB4-3	0	0.0 Pa	
3	1208211	Coefficient from ASHRAE Table	ED4-2	0	0.0 Pa	0.0 Pa

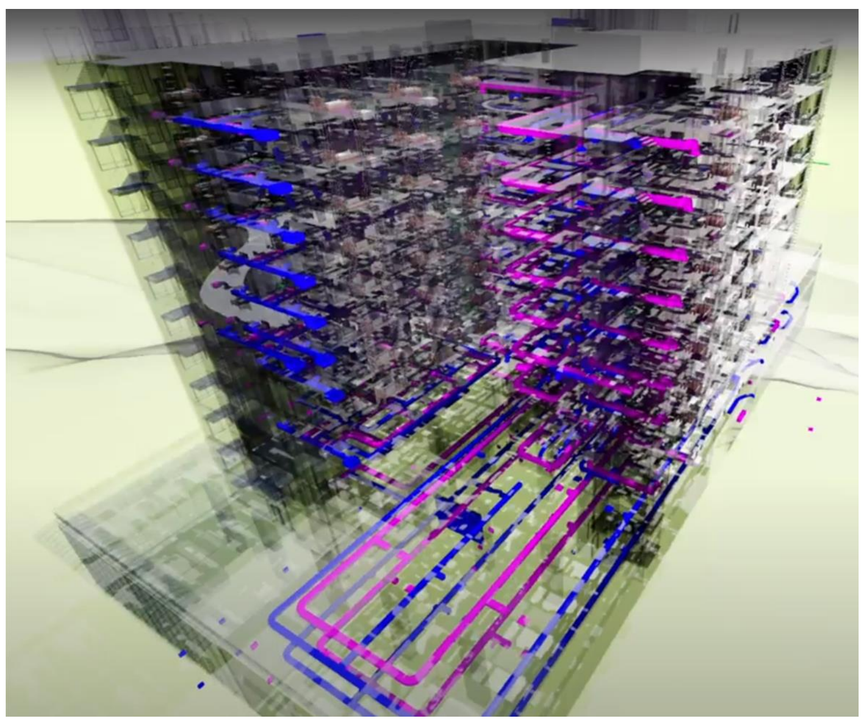
Project Summary

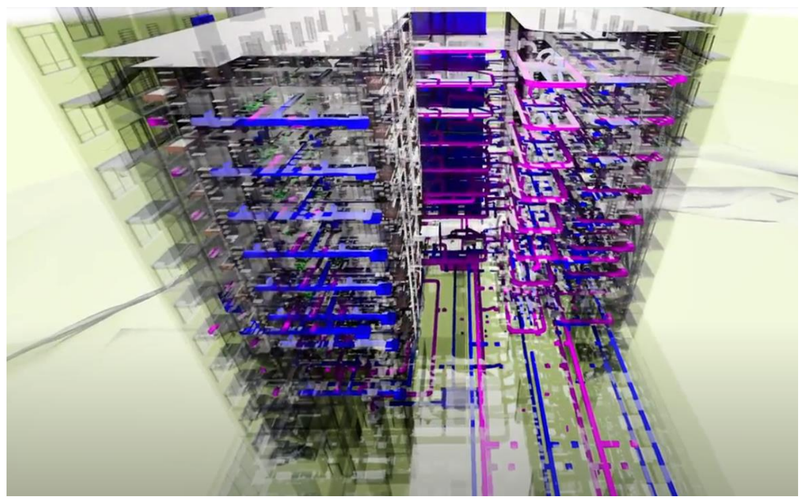
Location and Weather	
Project	Project Name
Address	
Calculation Time	Sunday, May 31, 2020 10:24 PM
Report Type	Standard
Latitude	42.21°
Longitude	-71.03°
Summer Dry Bulb	93 °F
Summer Wet Bulb	78 °F
Winter Dry Bulb	6 °F
Mean Daily Range	20 °F

Building Summary

Inputs	
Building Type	Office
Area (SF)	2,357
Volume (CF)	23,572.15
Calculated Results	
Peak Cooling Total Load (Btu/h)	**82,090.0**
Peak Cooling Month and Hour	July 2:00 PM
Peak Cooling Sensible Load (Btu/h)	74,217.0
Peak Cooling Latent Load (Btu/h)	7,873.0
Maximum Cooling Capacity (Btu/h)	82,090.0
Peak Cooling Airflow (CFM)	3,309
Peak Heating Load (Btu/h)	**71,651.0**
Peak Heating Airflow (CFM)	1,941
Checksums	
Cooling Load Density (Btu/(h·ft²))	34.82
Cooling Flow Density (CFM/SF)	1.40
Cooling Flow / Load (CFM/ton)	483.74
Cooling Area / Load (SF/ton)	344.58
Heating Load Density (Btu/(h·ft²))	30.40
Heating Flow Density (CFM/SF)	0.82

Computational Design : **Duct and pipes pressure loss analysis was conducted to ensure the air velocity are sufficient for good air ventilation. Heat and cooling loads are also calculated.**





Sectional Perspective of the plumbing system 1:500

CIC BIM Competition 2020
BIM for Design Collaboration