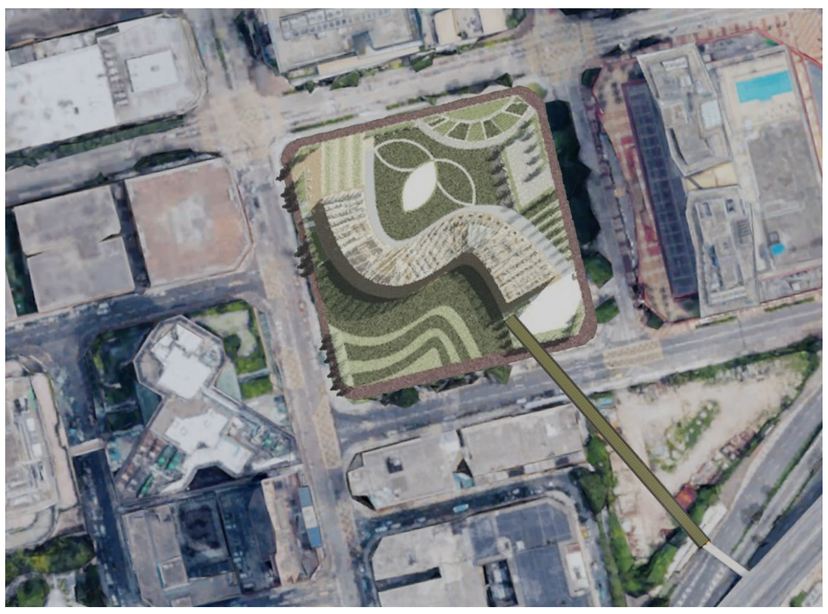
CIC BIM Competition 2021 – Zero Carbon Park by Bimify

Location Plan 1:2000



Design Concept:

The renovated design of the Zero Carbon Park enables a sustainable approach to cater for the social, environmental and developmental requirement expected by the clients, institutes, and the society. The enclosed space of the Zero Carbon Park integrates multiple passive design elements to minimise the energy consumption and waste generation meanwhile the spatial efficiency of the indoor areas is maximised to hold various facilities for multi-purpose uses. The outdoor area, in the other hand, focus on green coverage, rainwater collection and a spacious public space which could reserve as a highly flexible land area for future development or to host large-scale gatherings or similar activities.

Building Form:

With a low profile building envelop, the building alone could merge to the surrounding land profile and cause minimal visual obstruction to nearby pedestrians. The site moreover has a high green coverage where no facilities are built on-top, the visual perception of spaciousness by the pedestrians is thus amplified. The extensive use of wood materials on finishes and partitions would furthermore be an optimal combination of design that the whole site would have a strong resemblance to the nature. The bridge takes form of a warren-based space truss, being symmetrical on transverse and longitudinal axes. The structure protrudes in the centre and free up the 2 sides for photovoltaic and photochromatic panels.

Spatial Arrangement:

With the extensive use of glass throughout the building envelop, the ground floor of the proposed Zero Carbon Park will be comprising of indoor exhibition areas, which is clearly visible by the pedestrians even if they are located outside of the building. Such design encourages the general public to walk into the building, or delimiting the physical constraint preventing user in the outdoor area to view the artefacts placed indoor.

The top floor, adopted a column-less design with glass roof and wall panel, on the other hand would be office area. Workers would have sunlight as a natural source of light, while having a nice view over site to maintain a comfortable work environment.

Connectivity:

Vehicles are granted access into the site via the car park located on the Sheung Ut Road. Pedestrian could access into the site via any directions without any obstacles. The site is provided 2 elevators in case any disabled has to access into other floors of the building. Toilets specialised for the disabled are also provided as well. In the case of a fire accident, two excavation paths are established to evacuate all users on time.

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

Revit would be the main platform for the overall design including architectural, structural, and building services. Analysis of such design would be undertaken by various advanced engineering software including Autodesk SAP2000, Ecotech, and HAP. Autocad Naviswork would be used for rendering purposes which could generate a visually appealing view of the site, and Rhino would be used for the preliminary design and the generation of site surrounding.

BIM Collaboration approach:

In terms of the collaboration between BIM models, Revit would be the common platform which the separately-generated architectural, structural, and MEP design produced by each teammates can be combined into one single model in simple yet quick manner via the “link revit” function. Speaking of the internal demonstration and sharing of BIM materials, BIM 360 would be the convenient platform onto which each of the team members could upload and update their models.

MiC/ DfMA:

The most difficult component of the project, the roof glass panels, are constructed using the DfMA which each glass panel, each with an unique size and curvature, are manufactured in off-site factories, transported to the site via land transport, and installed directly onto the structural steel framework on site.

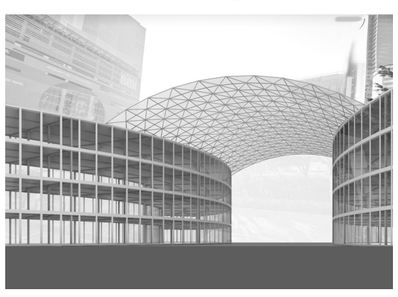
Constructability:

With the introduction of DfMa technology, the quality of members prefabricated thus would be greatly enhanced, and the total construction time would be decreased as well. On-site work procedures would be greatly reduced, together with a much lower risk of labour accident.

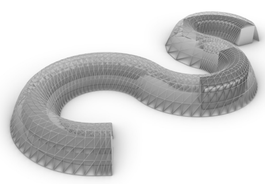
Summary:

Introduction of BIM technology into industrial practices could facilitates the generation of neat, clear, yet detailed design of architectural, structural, and MEP elements. The resultant floor plans generated would be much sophisticated and accurate than conventional approaches. The BIM technology moreover provides a wide range of analytical software to accurately simulate for example the effect of building to the surrounding environment, the structural stability of the building framework, and the discharge and the capacity of the MEP system. The BIM collaboration platform could moreover facilitate the viewing and sharing of BIM models between each team members, which significantly improves the convenience and the working efficiency of the

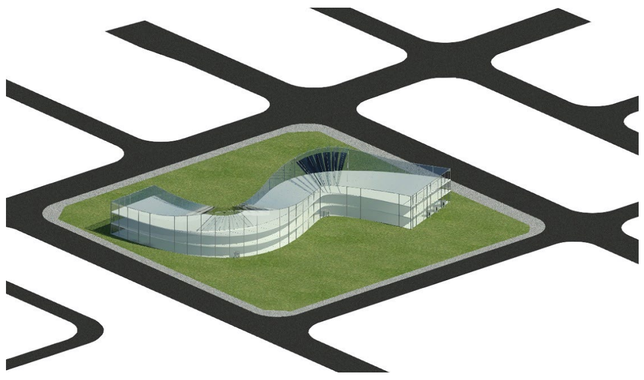
Conceptual Diagram: Design Considered for the New ZCP



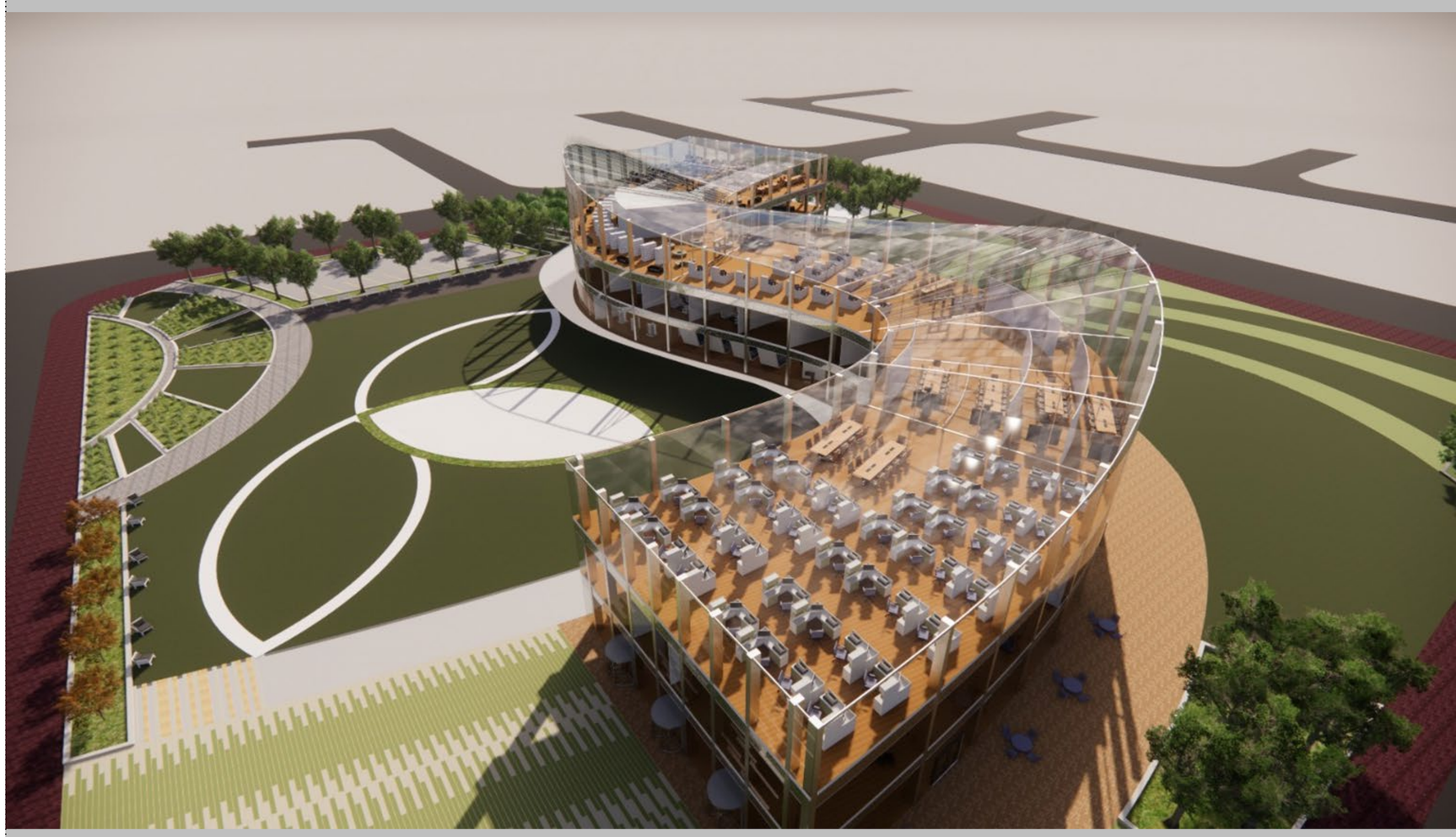
1st Design



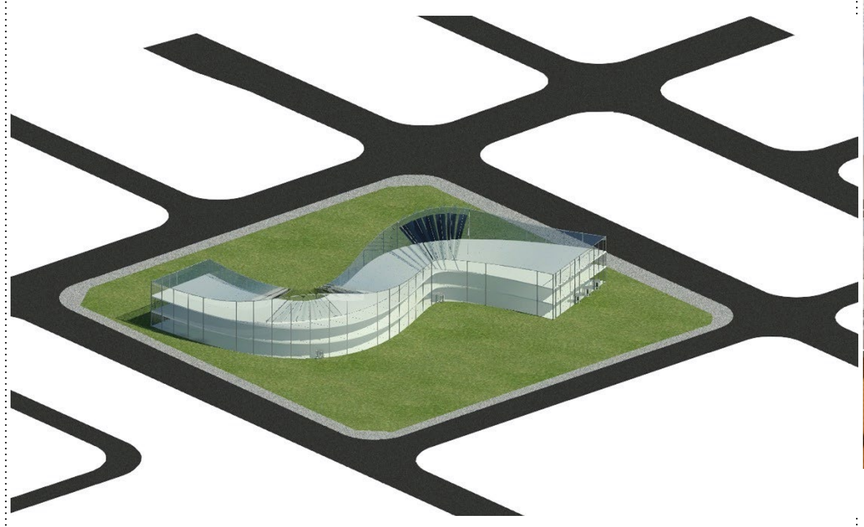
2nd Design



Final Design



Overall Bird Eye view: Located at the No. 8 Sheung Ut Road, Kowloon Bay, the redeveloped Zero Carbon Park is a low-profile, 3-storey high multi-purpose facility with a large area of green coverage and public space which has the capacity to host large-scale activities.

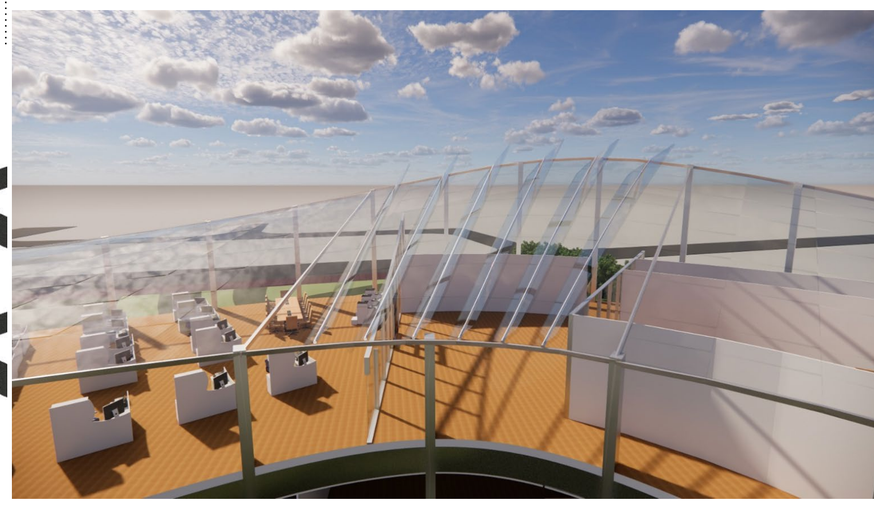


Building Form and Space:

With a low profile building envelop, the building alone could merge to the surrounding land profile and cause minimal visual obstruction to nearby pedestrians. The site moreover has a high green coverage where no facilities are built on-top, the visual perception of spaciousness by the pedestrians is thus amplified. The extensive use of wood materials on finishes and partitions would furthermore be an optimal combination of design that the whole site would have a strong resemblance to the nature.

Quality:

Thanks to the extensive collaboration granted by sophisticated BIM software, structural elements and mechanical devices could be accurately linked to the architectural model, further securing their parameters being in line with the overall layout to facilitate on-site installation as well as the maintenance work.



Natural Ventilation:

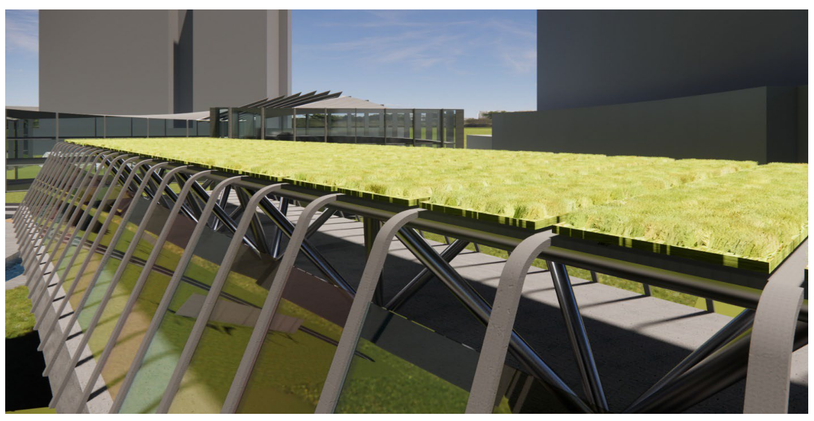
Automatic Vents are installed onto the rooftop of the building to provide natural ventilation for the building. These vents are closed in extremely hot or rainy days where the indoor areas would be cooled down by minimal air conditioning. During windy or shady days, vents would be opened to facilitate circulation of air. While cold air is discharged into the building via ducts located on the ground of each level, utilising the principle of hot air will be raised to upper strata of the atmosphere due to decrease in density, hot air would be expelled out of the building via the vents while colder air would be remained within the building. Lower energy would be required for air conditioning as a result.

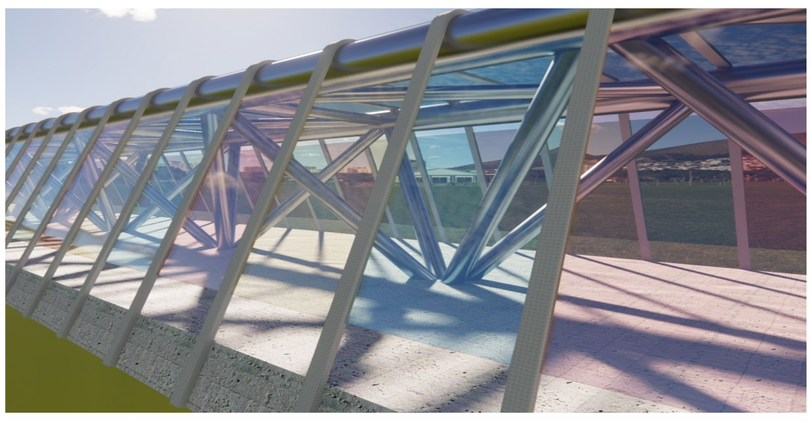
Semi-transparent Solar Panels:

All glass panels of the building would be installed semi-transparent solar panels to harvest solar energy during sunny days, while preserving a particular degree of light transmittance. Such recycled energy would be used to power particular electrical devices in the building.

Sustainability: As being increasingly advocated by modern building design practices, integration of sustainable elements to structures would be aesthetically and environmentally beneficial to the new ZCP.

Zero Carbon Park by Bimify : Architectural Design





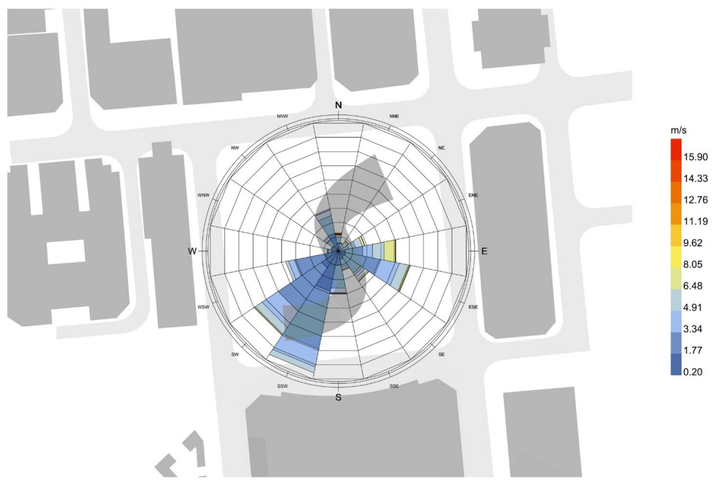
Perspective View:

Surrounded by a large area of green coverage and outdoor public spaces, the proposed Zero Carbon Park provides a source of energy and natural elements highly contrastive to the surrounding high-rise, densely developed urban terrain. Workers and the general public could freely explore the area during their leisure time and weekends, which serves the social role of the building. The integration between human structures and natural elements demonstrated by this building moreover addresses the possibility of sustainable engineering and should be practised by the modern construction industry.

Road Bridge

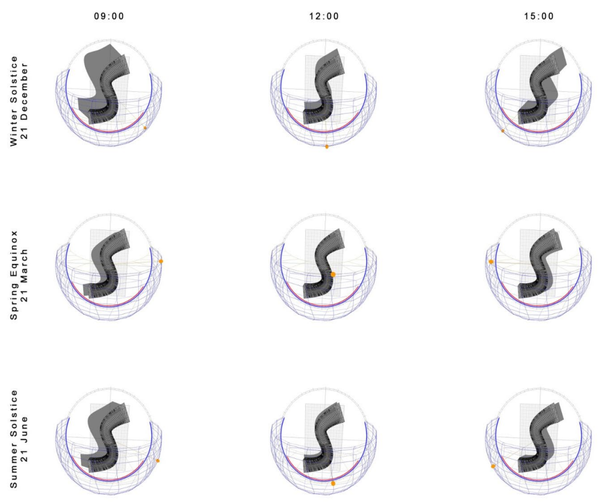
Human Comfort - Outdoor temp sensation - Heat Map (Summer)

Heat Map of Site and its Surrounding - Summer



Wind Speed (m/s)

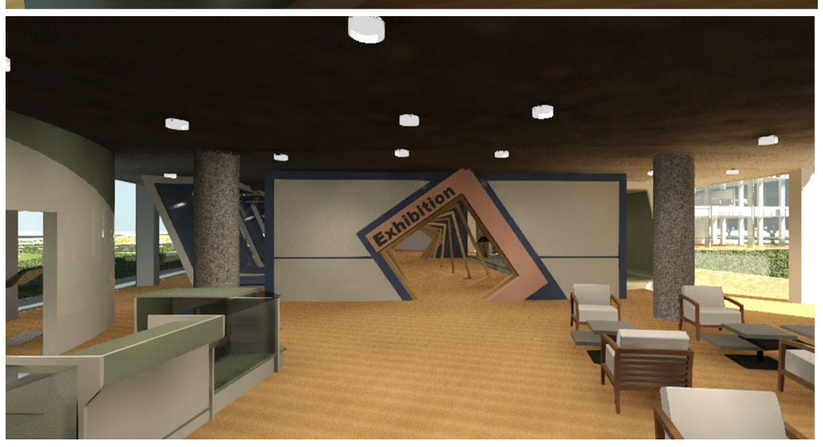
Wind Rose Diagram - Majority of Wind from SW



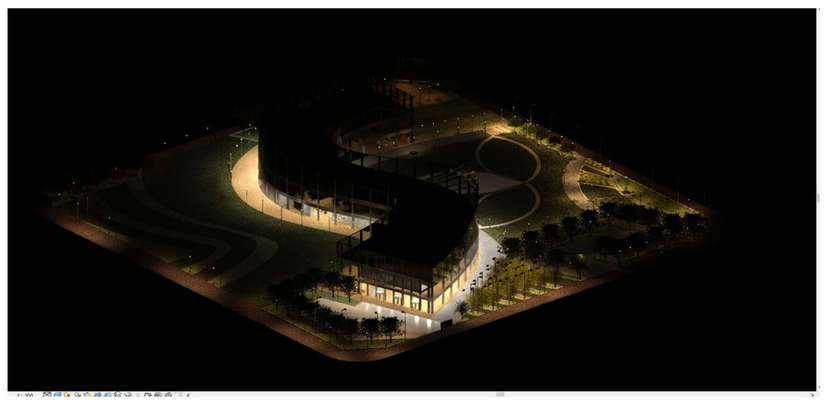
Shadow Analysis - Throughout a Year

Ground Floor Plan 1:500

1st Floor Plan 1:500



Internal Perspective 1:500

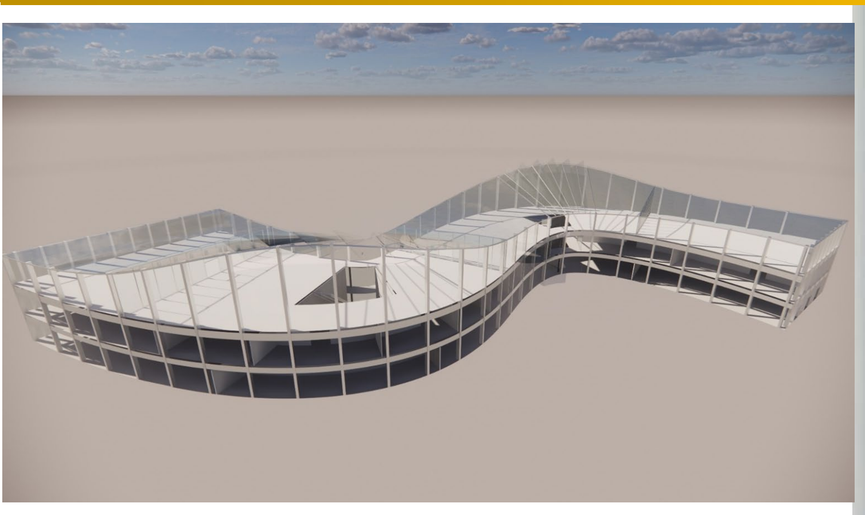


Overall Bird Eye view (Night View)

CIC BIM Competition 2021

BIM for Design Collaboration

Zero Carbon Park by Bimify : Structural Design



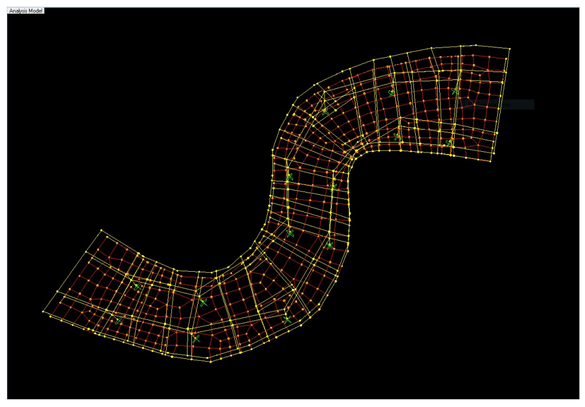
MiC/DfMA: The most difficult component of the project, the roof glass panels, are constructed using the DfMA which each glass panel, each with an unique size and curvature, are manufactured in off-site factories, transported to the site via land transport, and installed directly onto the structural steel framework on site.

Such introduction of DfMA technology into the project could greatly enhance the quality and the accuracy of glass panels, which the exposed risks of having defects or delays could be minimised. A better cost efficiency and much lower construction time would be anticipated.

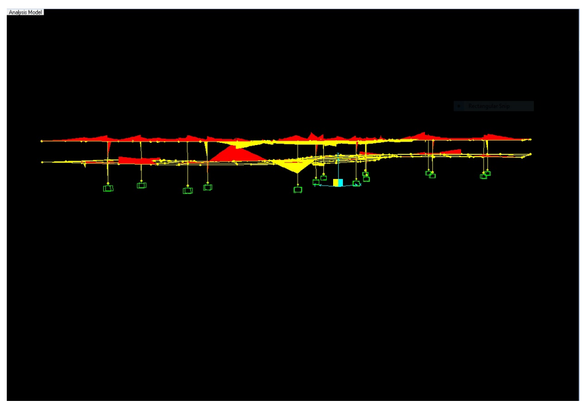
Internal View:

The structural layout of the building could be classified into two sections: Reinforced Concrete session and the Steel Portal Frame Section. The former comprises of a typical slab-beam-column load transfer path transferred by Reinforced Concrete component. whereas the latter is to support the glass panels on the rooftop. Such design enables minimised the number and diameter of column used in the G/F an the 1/F of the building, while permitting the existence of a column-less top floor to provide unobstructed scenery to the users.

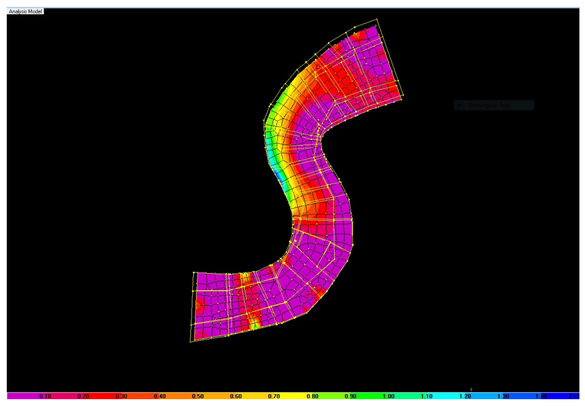
Steel Portal Frame is adopted to support all the loadings imposed onto the roof with the rationale of its low self-weight as well as its simplicity on the connection with the glass panels. Rectangular Hollow Steel Sections are used due to their neat appearance and high enough Modulus of Plasticiy and Bending Modulus. Steel members are designed to have welded connections.



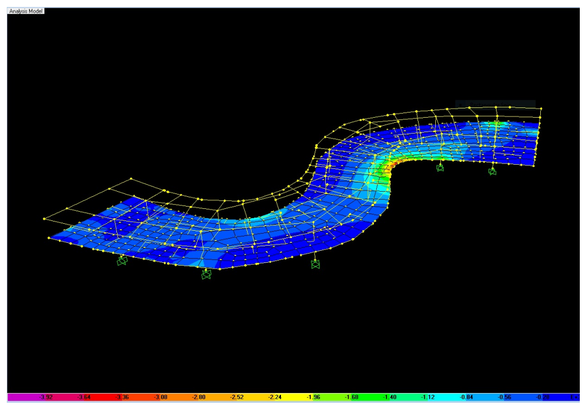
Structural Framework of the Building with the Finite Element Mesh



Bending Moment Diagram on the Structural Slabs

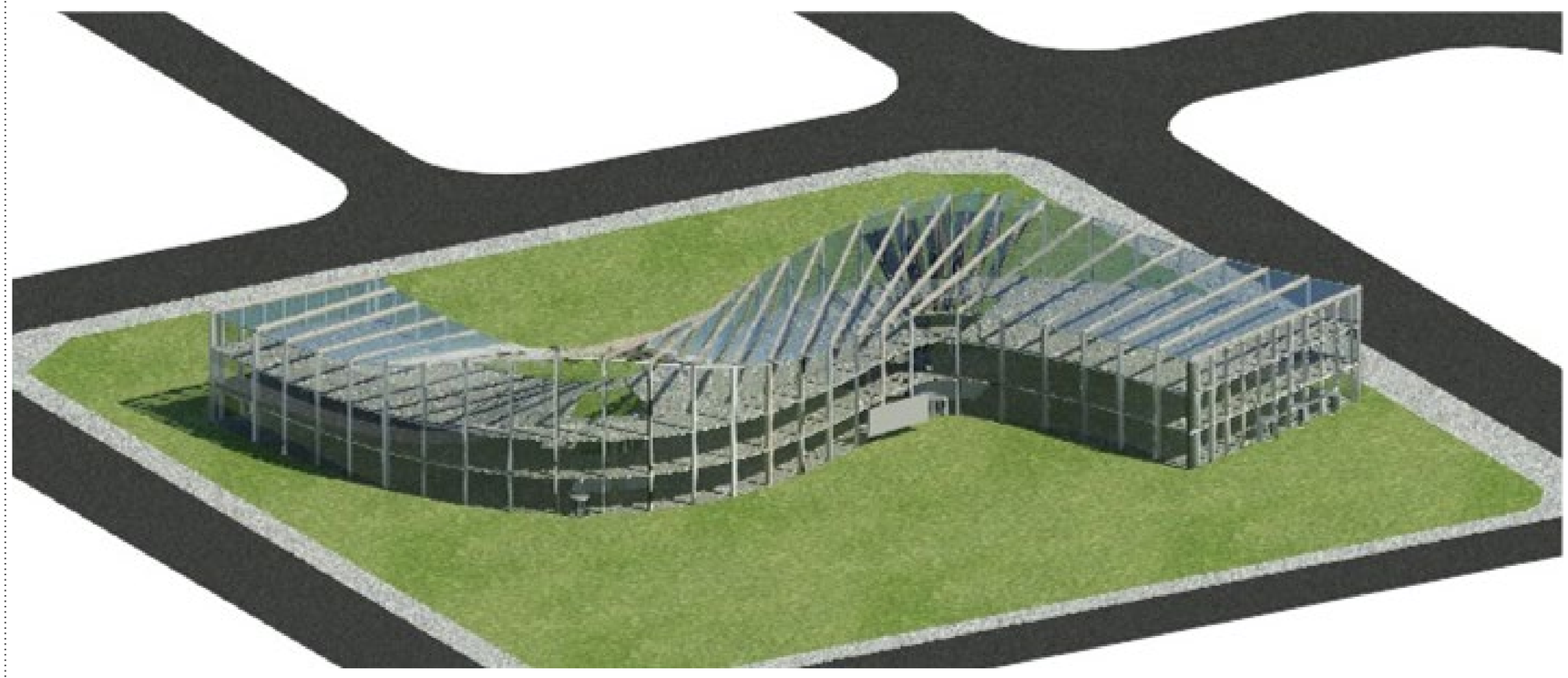


Maximum (Positive Critical) Stresses Distribution on Slab

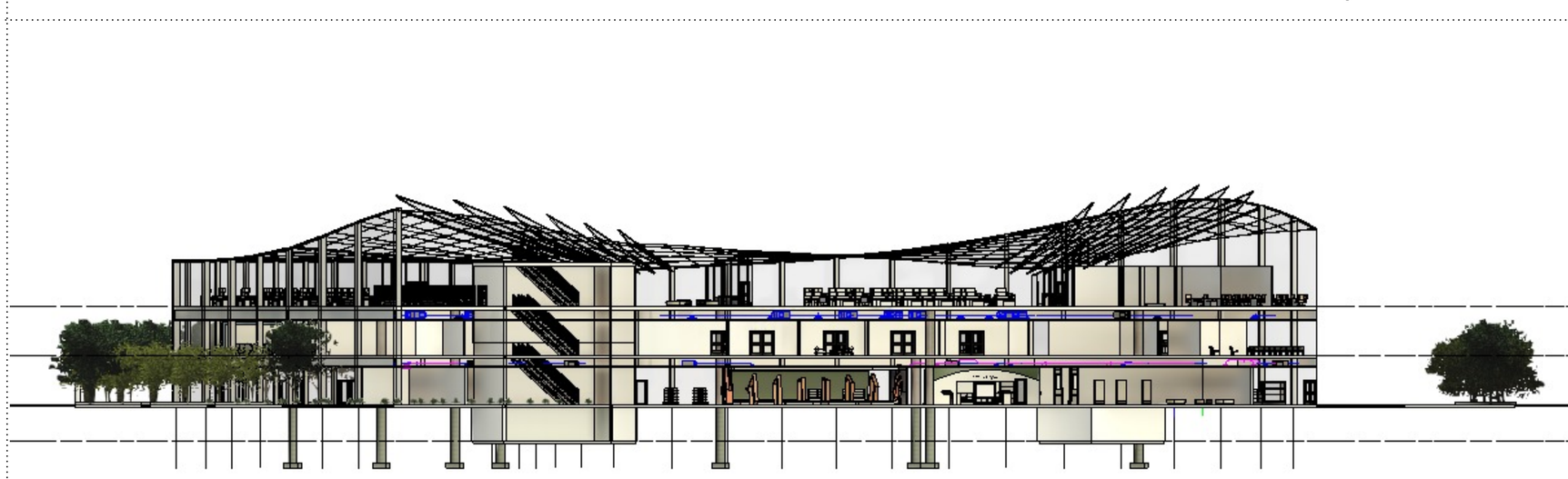


Minimum (Negative Critical) Stresses Distribution on Slab

Computational Design

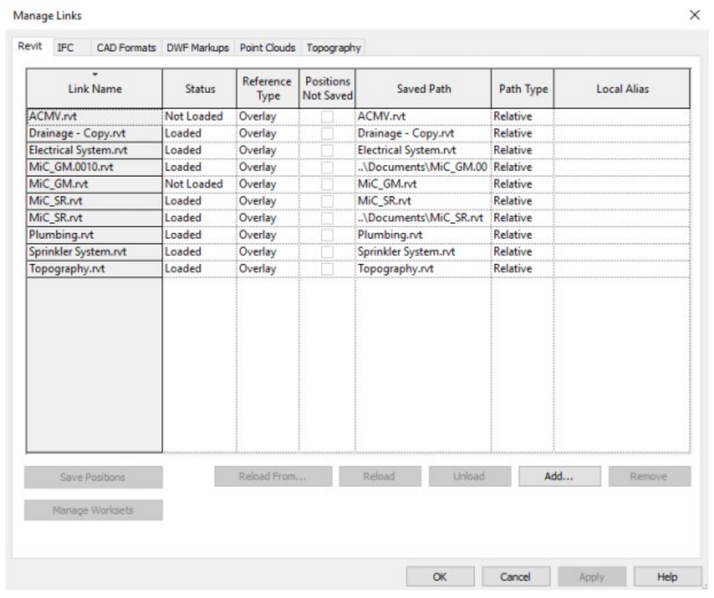


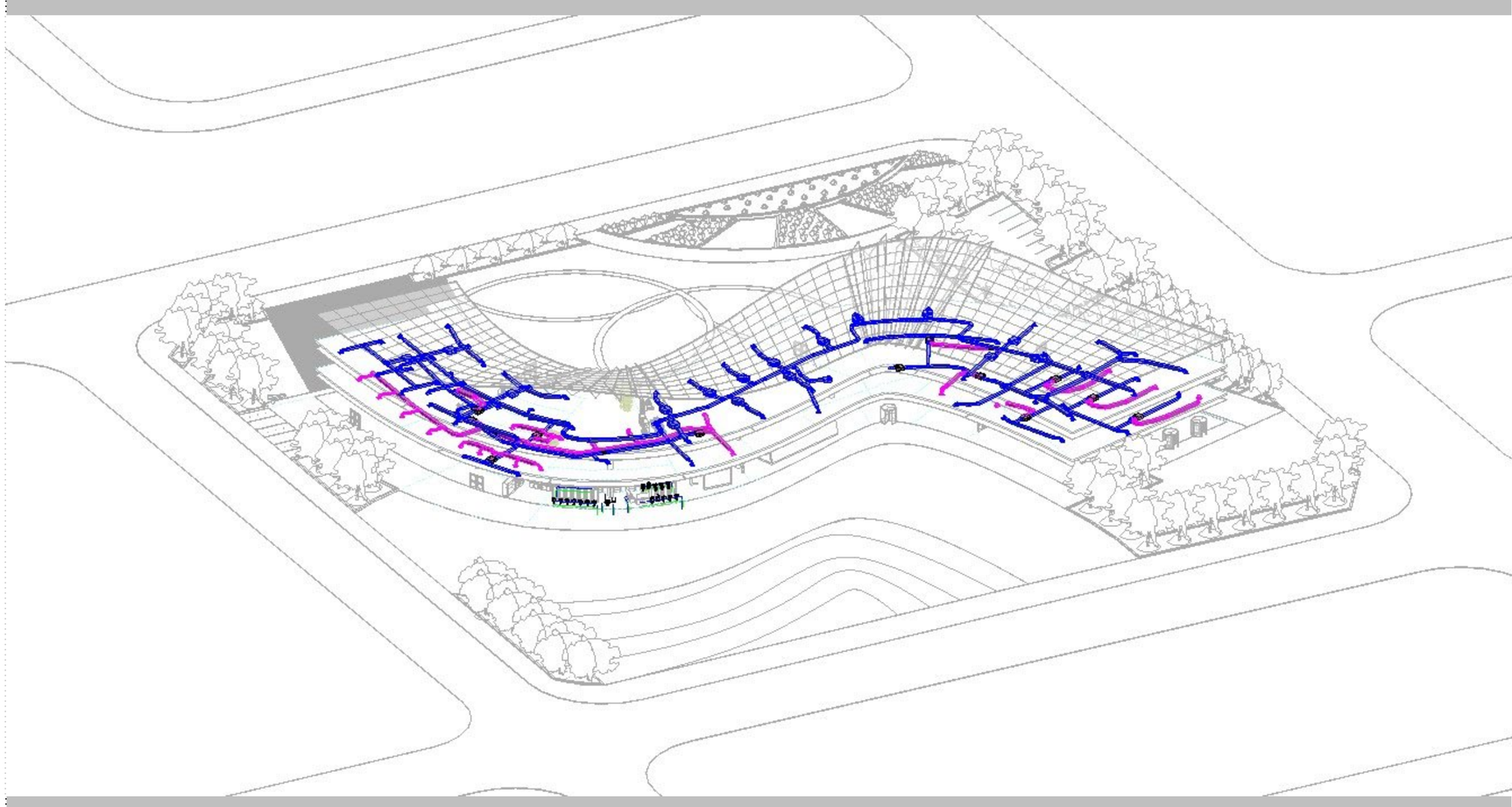
Perspective View 1:500



Sectional Perspective 1:500

Zero Carbon Park by Bimify : MEP Design



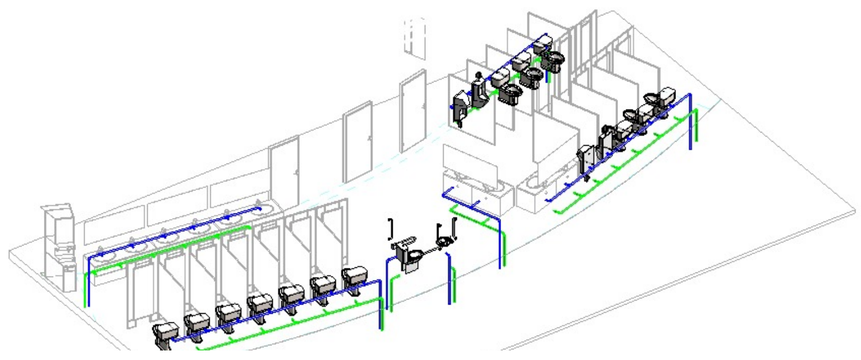


Design Coordination:

Being one of the most popular BIM software, Revit accepts modelling files imported from other BIM software which would greatly facilities division of work and a working environment. Communication between participants from different discipline, namely architects, structural engineers, MEPs, and surveyors, would be greatly enhanced. Productivity would be significantly improved.

Perspective View: The above shows the Plumbing and Drainage System (in pink) and the Air Conditioning and Mechanical Ventilation System of the designed building. The outdoor area would be collecting the rainwater precipitated on the site and, after purification, would be partially recirculated into the Plumbing and Drainage System. The HVAC system is provide, yet at minimal degree to reduce energy consumption, from the lower floor. Air with higher temperature would be raised and expelled from the roof due to convection. As such, lower water and energy consumption could be achieved.

Layout of Washroom inside the ZCP Building



Plumbing and Drainage System for the Washroom

Internal Perspective 1:500

Architect

Rhinoceros

Autodesk Ecotect

Common Platform

AUTODESK REVIT

AUTODESK BIM 360

StruE

SAP2000

MEP

CHAP

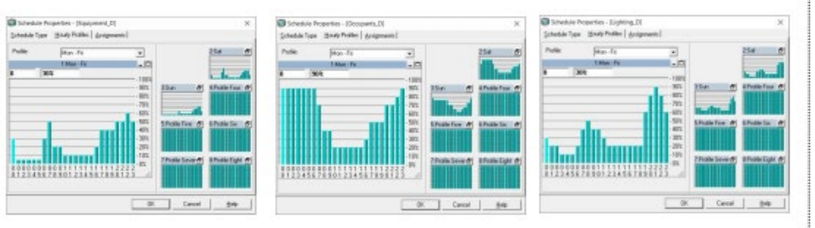
Visualisation and Rendering

ENSCAPE

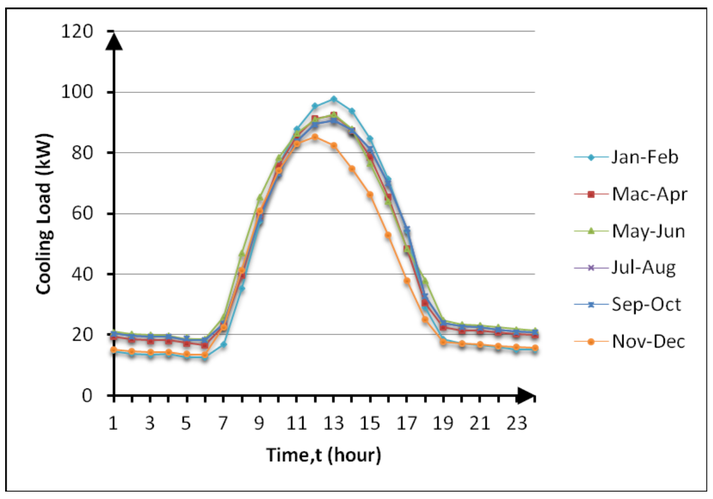
AUTODESK NAVISWORKS

Fuzor™

Project Team Collaboration

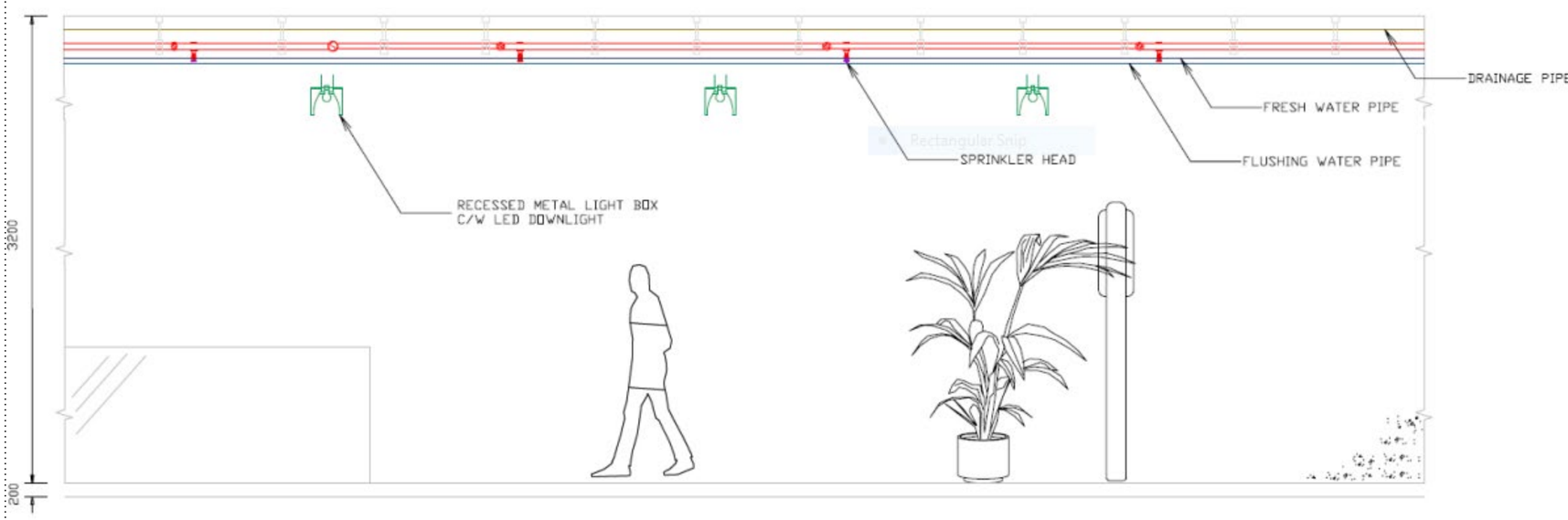


Electricity Consumption Rates



Cooling Load Profile

Computational Design



Sectional Perspective for MEP devices in Exhibition Area 1:500