

Institutional Energy Modelling for Green Building Certification



Internship Project – Special Topic collaboration with Perkins and Will
Location – Sikkim, India
Software Used – DesignBuilder (Energy Plus), DialuxEvo, Ecotect

The project focused on achieving GRIHA certification (equivalent to LEED). Challenges with modelling and running simulations: Large scale geometry, heavily contoured site, façade – glazing and shading; required more adjustments since daylight metrics were not satisfied, changes in envelope to achieve thermal comfort as a natural ventilated building.

DAYLIGHT ANALYSIS: INPUT PARAMETERS

Glazing

General	
Name	4-10-4 mm
Description	
Source	
Category	Project
Region	INDIA
Colour	
Definition method	
Definition method	1-Material layers
Layers	
Number layers	2
Outermost pane	
Pane type	Generic Clear 4mm glass
Flip layer	
Window gas 1	
Window gas type	AIR 10MM
Innermost pane	
Pane type	Generic Clear 4mm glass
Flip layer	
Radiance Daylighting	

Calculated Values

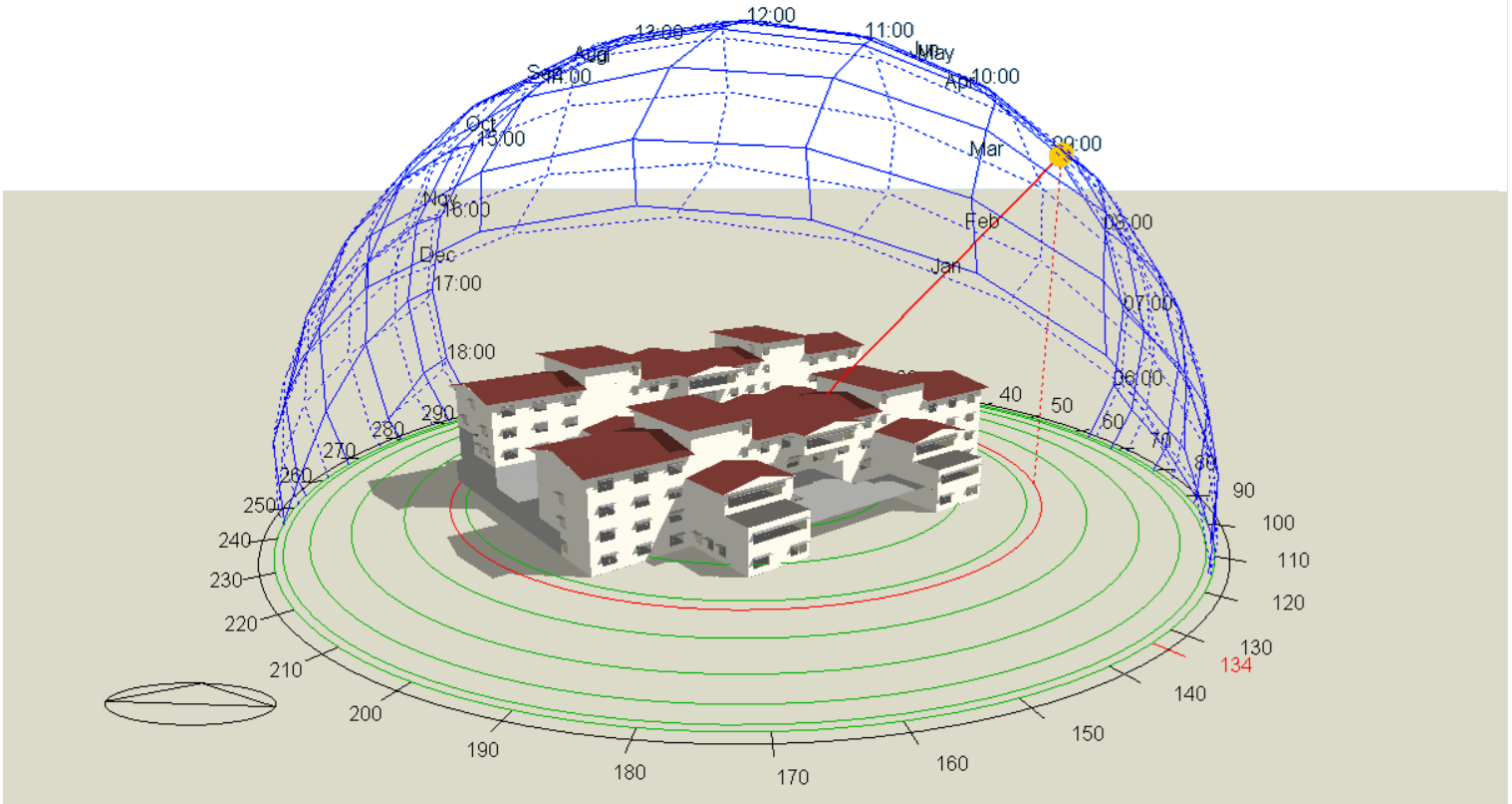
Total solar transmission (SHGC)	0.741
Direct solar transmission	0.67
Light transmission	0.801
U-value (ISO 10292/ EN 673) (W/m2-K)	2.964
U-Value (W/m2-K)	2.805

Summer: Operation

Operation	
Schedule definition	2-Custom schedule
Operation schedule	On 24/7
Free Aperture	
Opening position	2-Bottom
% Glazing area opens	21.5
Discharge coefficient	0.6500

Winter: Operation

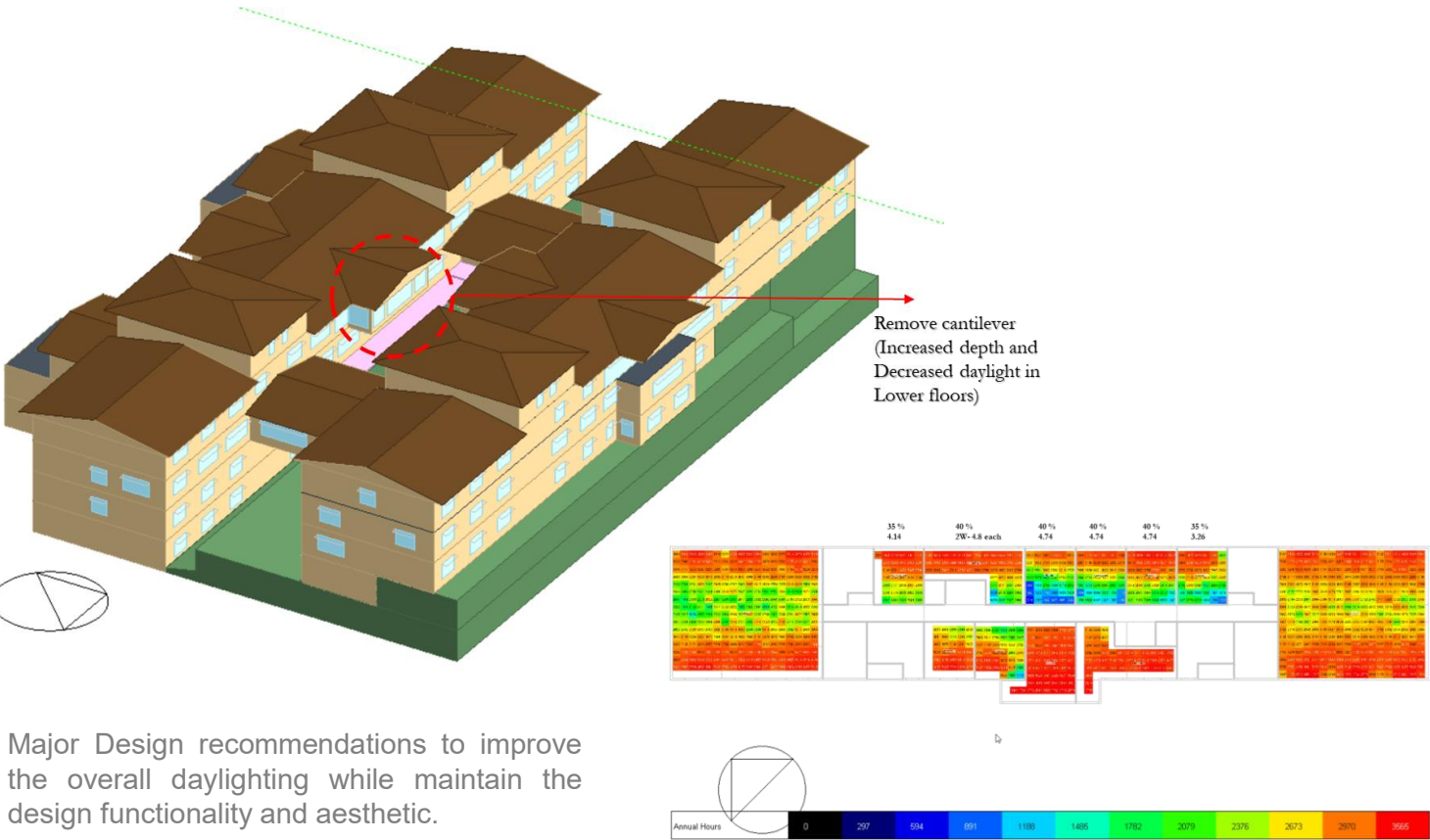
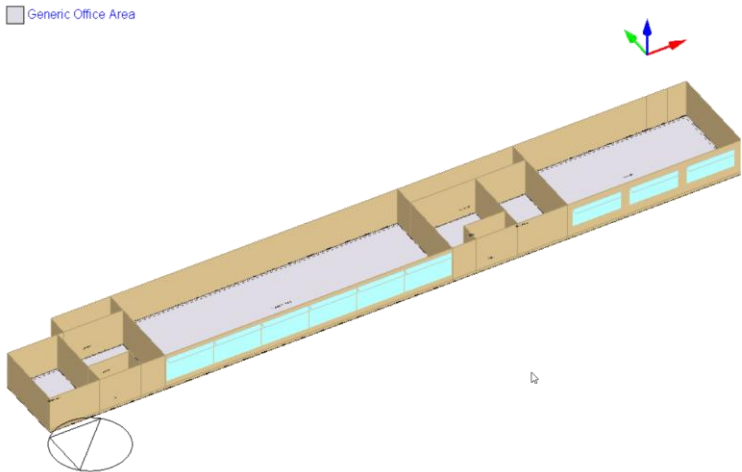
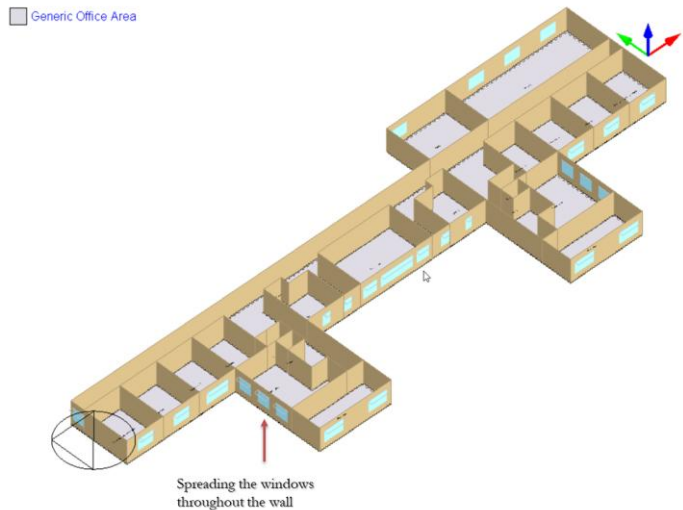
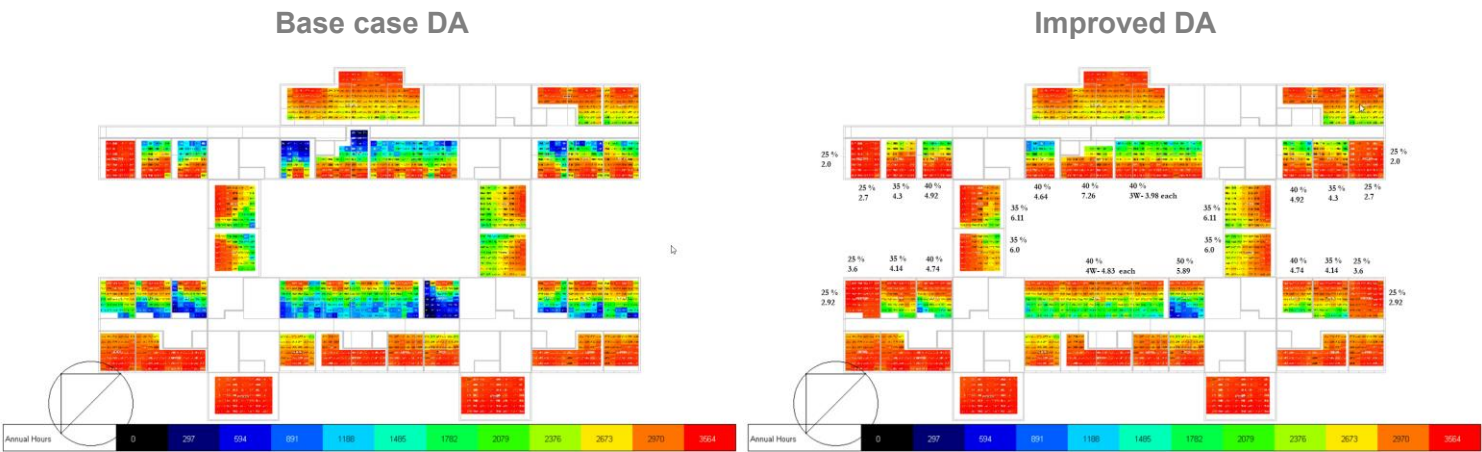
Operation	
Schedule definition	1-Follow occupancy
Free Aperture	
Opening position	2-Bottom
% Glazing area opens	21.5
Discharge coefficient	0.6500



DAYLIGHTING ANALYSIS: sDA

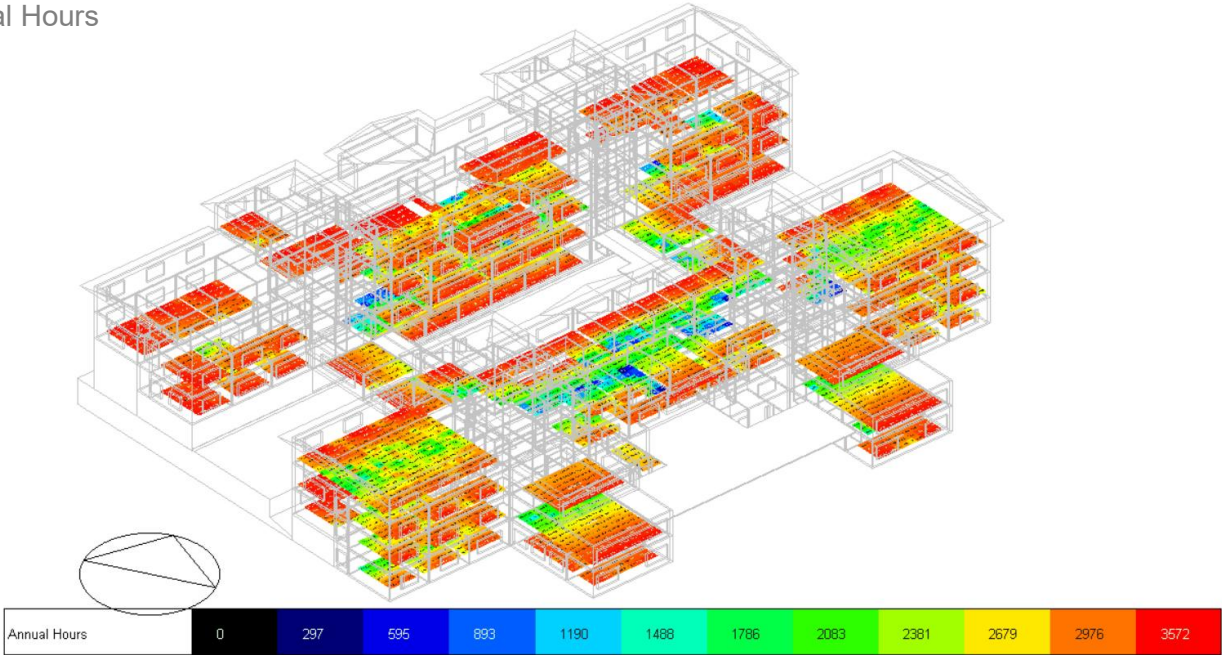
INTENT: Demonstrating that the mean DA requirements (300-500 lux) are met over the total living area for at least 50-80% of the total annual hours. Annual analysis hours – 800-1800 each day

NOTE: The sDA analysis was performed for every space.



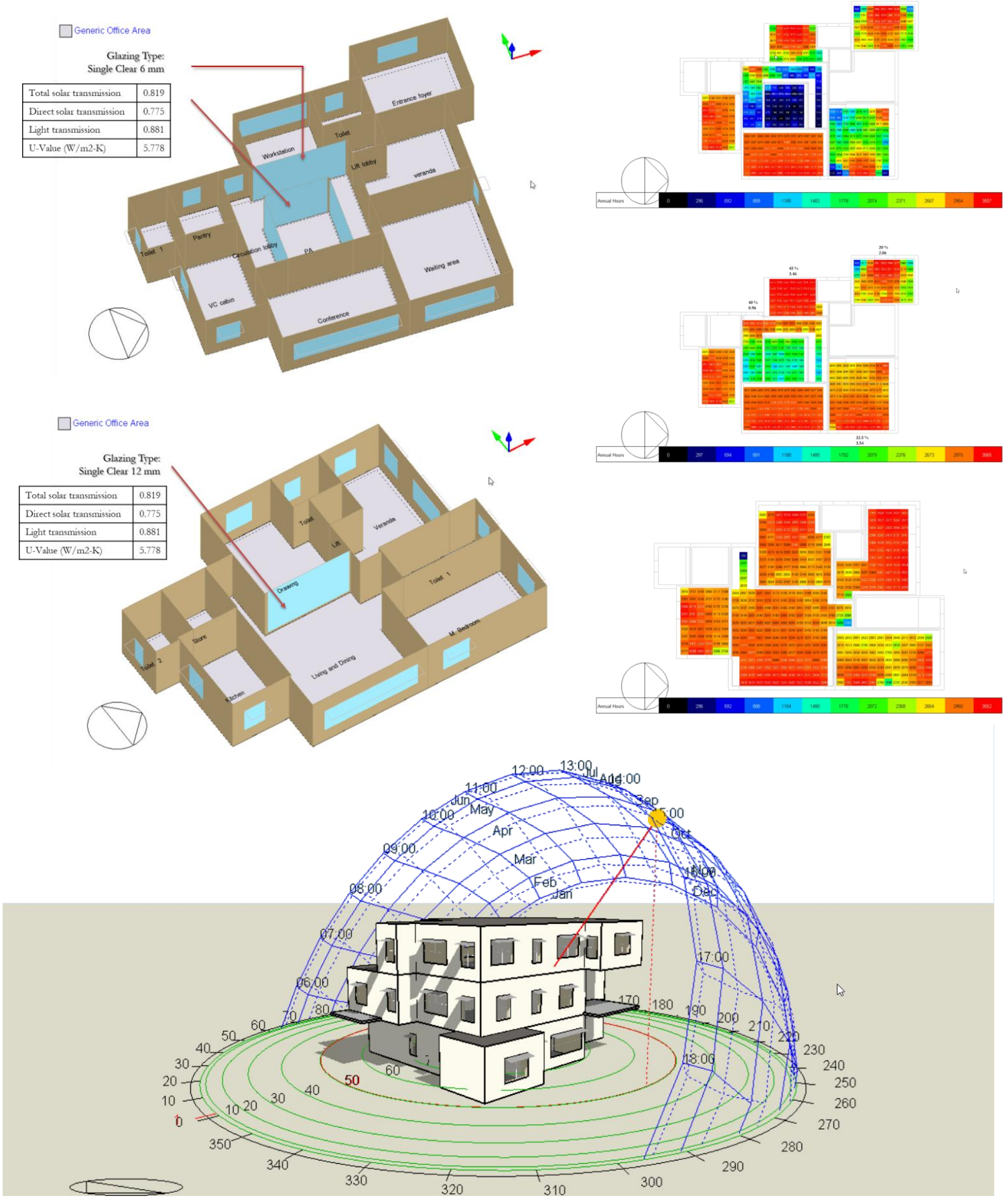
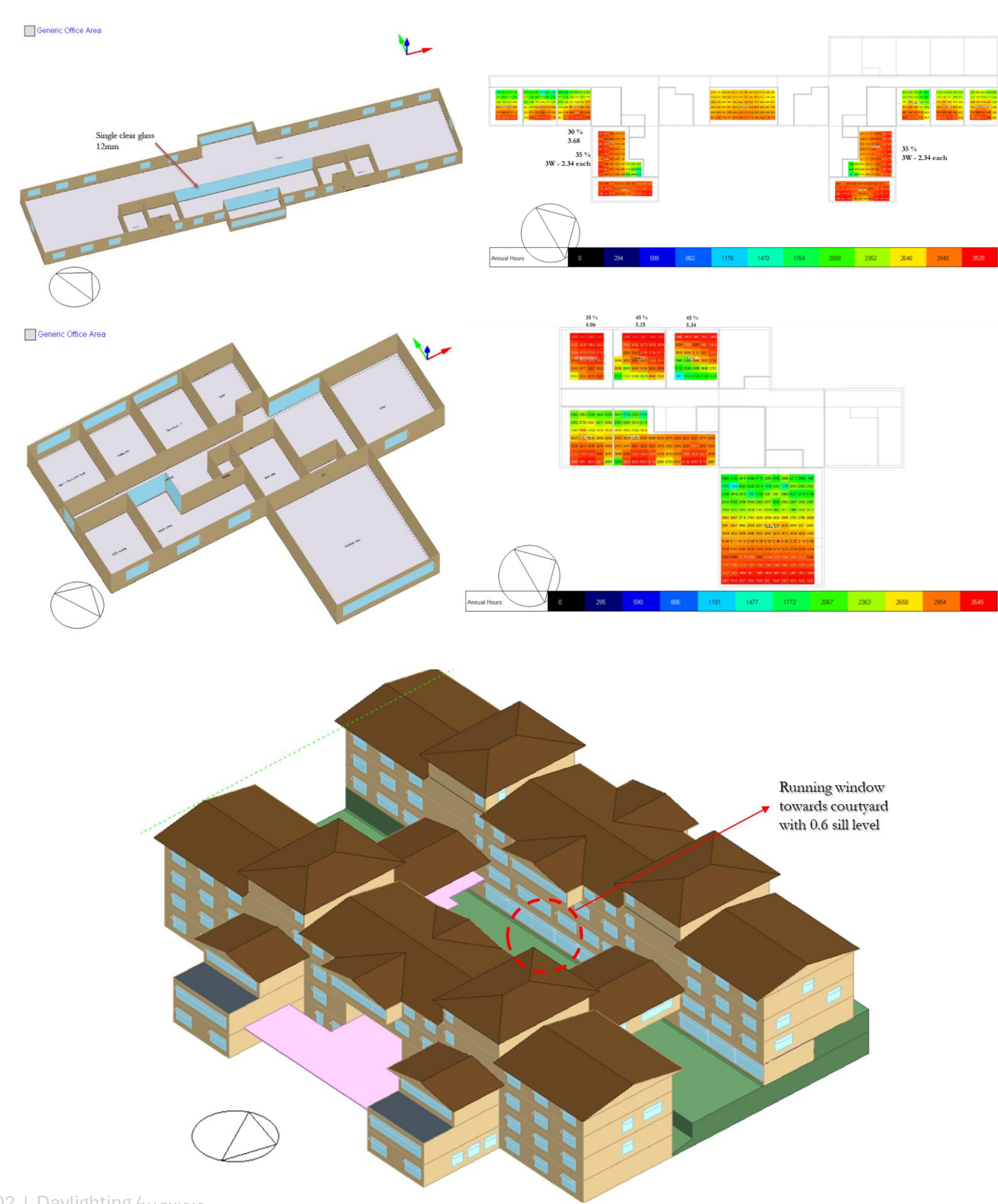
Major Design recommendations to improve the overall daylighting while maintain the design functionality and aesthetic.

Whole building sDA
50 % Annual Hours



Block	Zone	Floor Area (m2)	sDA Area in Range (m2)	sDA Area in Range (%)	ASE Area in Range (m2)	ASE Area in Range (%)	UDI Area in Range (m2)	UDI Area in Range (%)
FF_North West	HOD cabins	44.425	44.425	100.000	41.812	94.118	41.812	94.118
FF_North West	Seminar room	176.488	173.028	98.039	164.953	93.464	152.264	86.275
TF_North	Library	60.592	60.592	100.000	60.592	100.000	48.989	80.851
TF_North	Library 1	203.578	203.578	100.000	198.552	97.531	198.552	97.531
Total		6651.502	6422.793	96.562	6043.627	90.861	6035.711	90.742

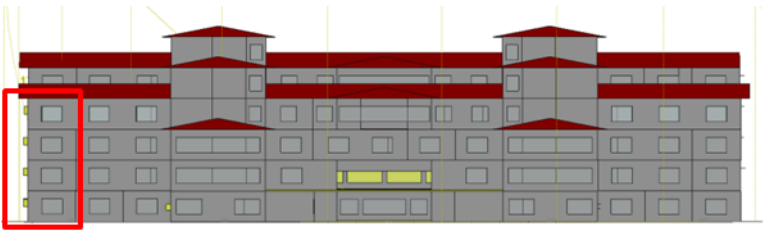
DAYLIGHTING ANALYSIS: sDA



DAYLIGHTING ANALYSIS: SHADING ANALYSIS

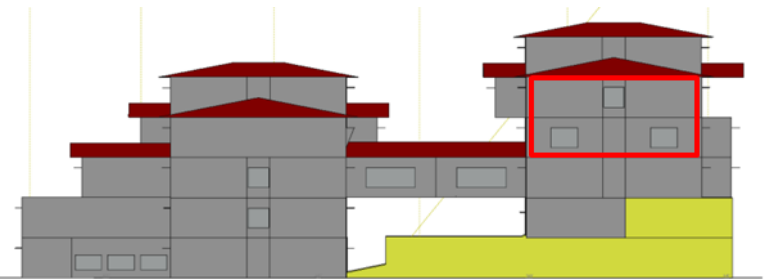
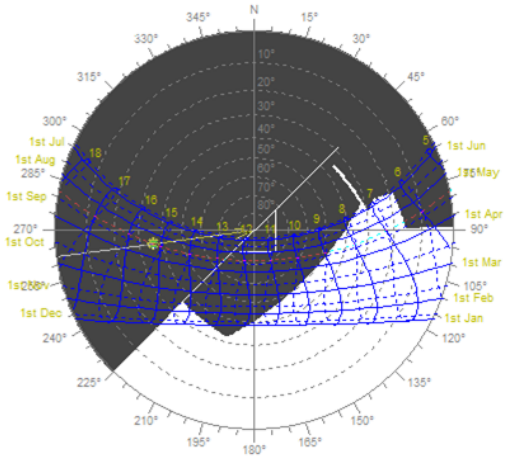
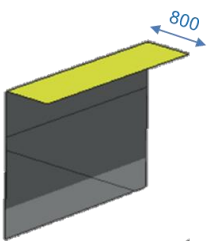
INTENT: Conduct solar path analysis for windows of AC as well as non-AC spaces, to ensure that the window is completely shaded for the duration between 10:00 am on 1st April to 15:00 on 30th September. Additionally, adequate daylight factors are achieved in more than 25% of the total living area.

NOTE: The shading analysis was performed for every window.



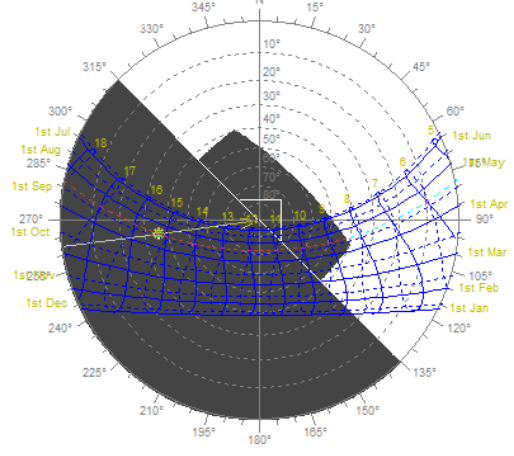
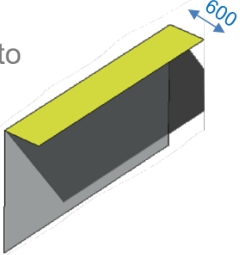
Extreme Left

- Window shaded between 10:00 am on 1st April to 15:00 on 30th September
- Type: Horizontal shade
- Window: 2700 x 2000mm
- Shade Dimensions: 800mm depth
- Recommended projection Factor: 0.42



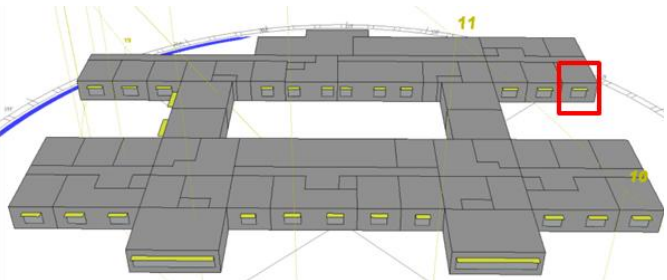
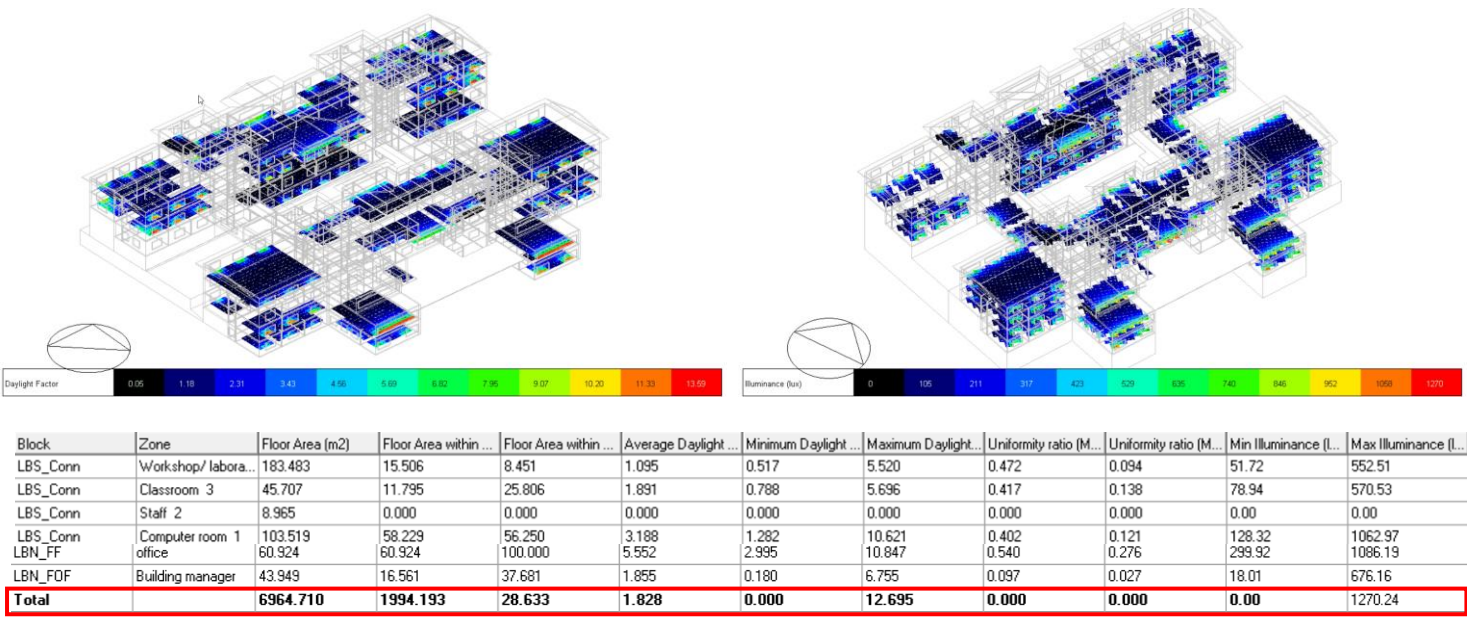
Connecting Bridge

- Window shaded between 10:00 am on 1st April to 15:00 on 30th September
- Type: Horizontal Shade
- Window: 2700 x 2000mm
- Shade Dimensions: 600mm depth
- Recommended projection Factor: 0.3



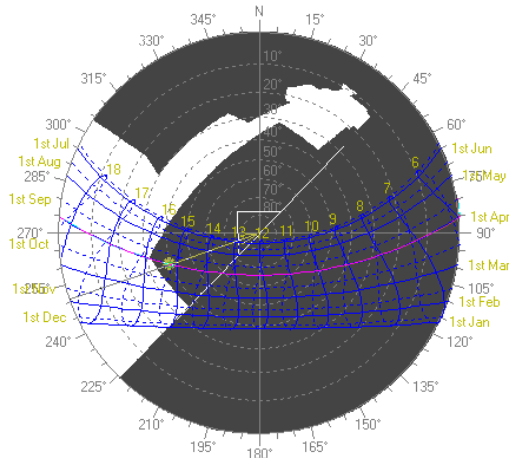
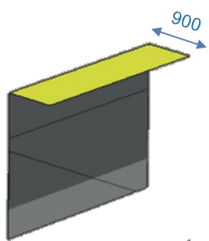
Whole building Daylight Factor Analysis

28.63% of the living areas are meeting adequate level of daylight (daylighting factors)



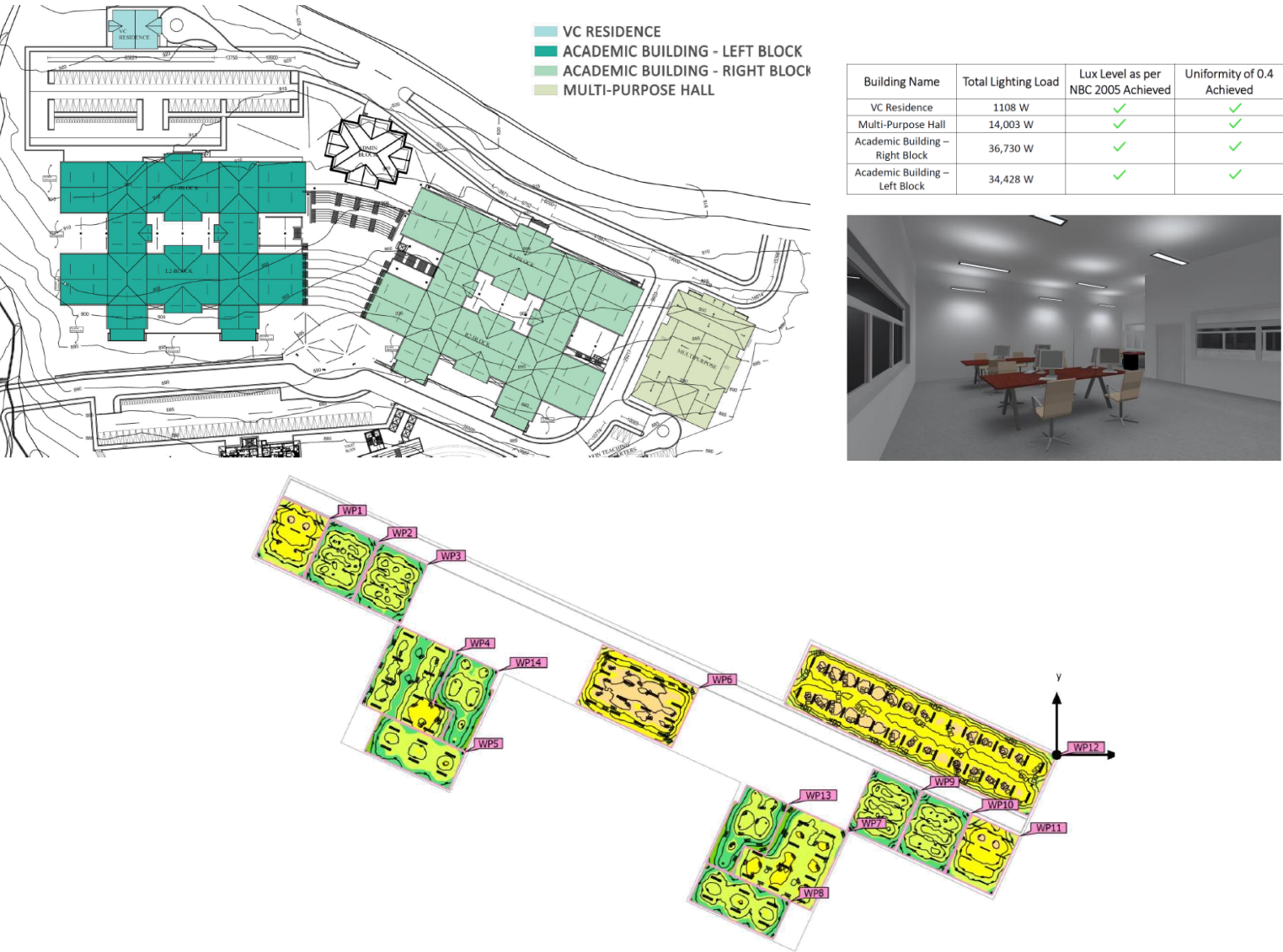
First Floor _ Extreme Right

- Window shaded between 10:00 am on 1st April to 15:00 on 30th September
- Type: Horizontal Shade
- Window: 2700 x 2000mm
- Shade Dimensions: 900mm depth
- Recommended projection Factor: 0.45



DAYLIGHTING ANALYSIS: ARTIFICIAL LIGHTING

INTENT: Artificial Lighting analysis, compliance and recommendations



Properties	Index	Article Name	Pieces	Efficacy (lm/W)	Luminous flux (lm)	CCT (K)	Wattage (W)	Mounting Height	U _o	Ē	Compliant
Working plane (ASS. ASSIS PROF OFFICE) Perpendicular illuminance (adaptive) Height: 0.800 m, Wall zone: 0.000 m	WP1	SP780 H LED255-4000 PSU W5L112 OD WH	10	125	2500	4000	20	3.25 m	(Target) 0.62 (≥ 0.40)	(Target) 463 lx (300 lx ≥ 750 lx)	Yes
Working plane (CLASSROOM) Perpendicular illuminance (adaptive) Height: 0.800 m, Wall zone: 0.000 m	WP2	SP780 H LED255-4000 PSU W5L112 OD WH	8	125	2500	4000	20	3.25 m	0.68 (≥ 0.40)	373 lx (200 lx ≥ 500 lx)	Yes
Working plane (CLASSROOM) Perpendicular illuminance (adaptive) Height: 0.800 m, Wall zone: 0.000 m	WP3	SP780 H LED255-4000 PSU W5L112 OD WH	8	125	2500	4000	20	3.25 m	0.65 (≥ 0.40)	375 lx (200 lx ≥ 500 lx)	Yes
Working plane (ADMIN OFFICE) Perpendicular illuminance (adaptive) Height: 0.800 m, Wall zone: 0.000 m	WP4	SP680X2 LED395 4000 PSU WH L120 S1	10	100	3900	4000	38	3.25 m	0.72 (≥ 0.40)	380 lx (300 lx ≥ 750 lx)	Yes
Working plane (HOD CABIN) Perpendicular illuminance (adaptive) Height: 0.800 m, Wall zone: 0.000 m	WP5	SP680P LED345 4000 PSD WH L120 S1	6	100	3400	4000	32	3.25 m	0.57 (≥ 0.40)	351 lx (300 lx ≥ 750 lx)	Yes
Working plane (SEMINAR HALL) Perpendicular illuminance (adaptive) Height: 0.800 m, Wall zone: 0.000 m	WP6	SP680P LED345 4000 PSD WH L120 S1	16	100	3400	4000	32	3.25 m	0.66 (≥ 0.40)	548 lx (300 lx ≥ 750 lx)	Yes
Working plane (ADMIN OFFICE) Perpendicular illuminance (adaptive) Height: 0.800 m, Wall zone: 0.000 m	WP7	SP680X2 LED395 4000 PSU WH L120 S1	10	100	3900	4000	38	3.25 m	0.46 (≥ 0.40)	401 lx (300 lx ≥ 750 lx)	Yes
Working plane (HOD CABIN) Perpendicular illuminance (adaptive) Height: 0.800 m, Wall zone: 0.000 m	WP8	SP680P LED345 4000 PSD WH L120 S1	6	100	3400	4000	32	3.25 m	0.66 (≥ 0.40)	353 lx (300 lx ≥ 750 lx)	Yes

THERMAL COMFORT ANALAYSIS

Input envelope parameters

