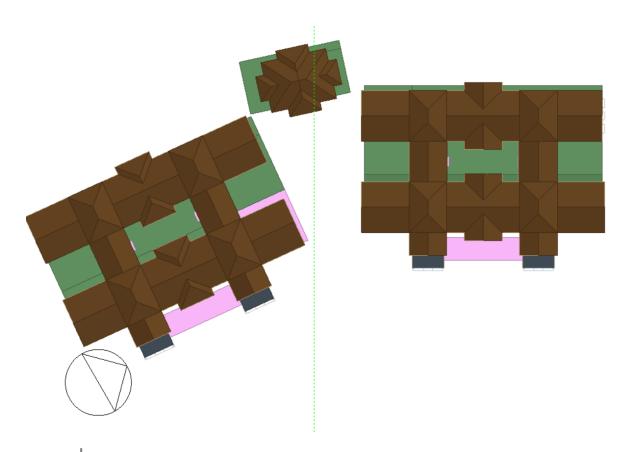
Institutional Energy Modelling for Green Building Certification



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



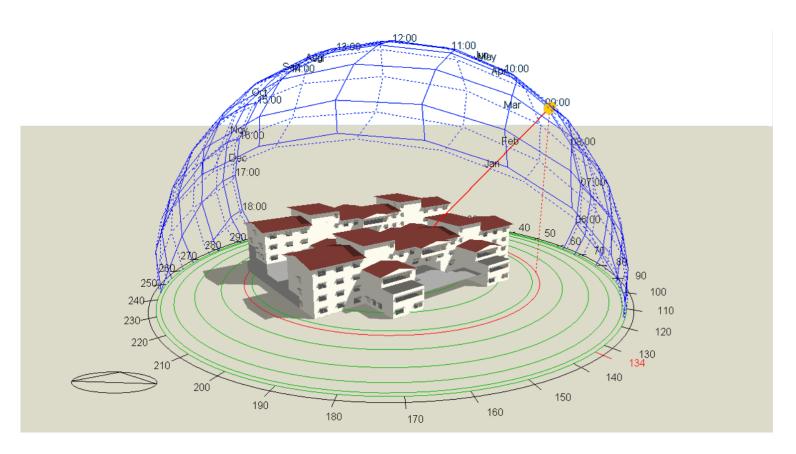


Summer: Operation

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

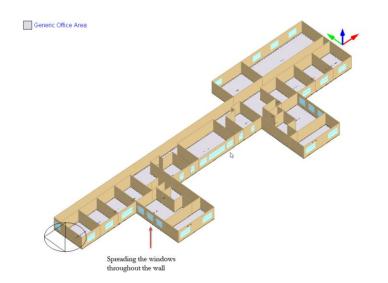
Operation		¥
Schedule definition	1-Follow occupancy	•
Free Aperture		¥
Opening position	2-Bottom	•
% Glazing area opens	21.5	
Discharge coefficient	0.6500	

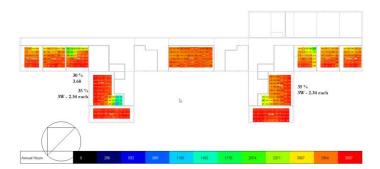


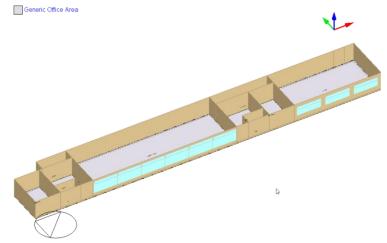
DAYLIGHTING ANALYSIS: sDA

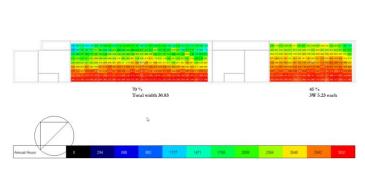
INTENT: Demonstrating that the mean DA requirements (300-500 lux) are met over the total living area for at least 50-80% of the total annual hours. Annual analysis hours – 800-1800 each day NOTE: The sDA analysis was performed for every space.

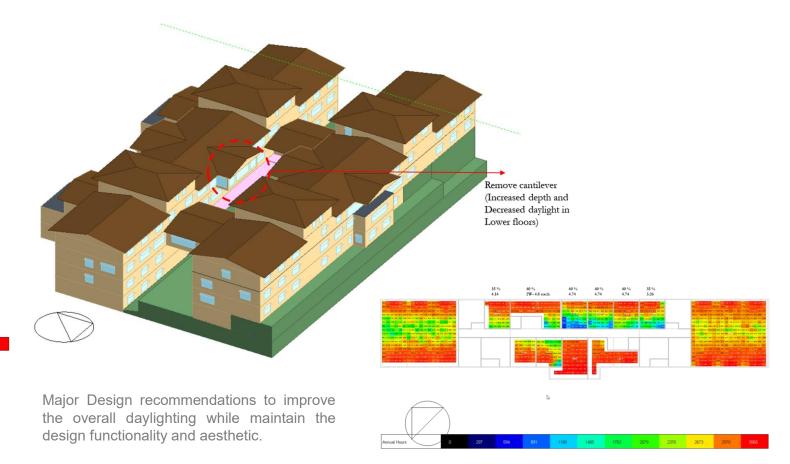
Improved DA Base case DA

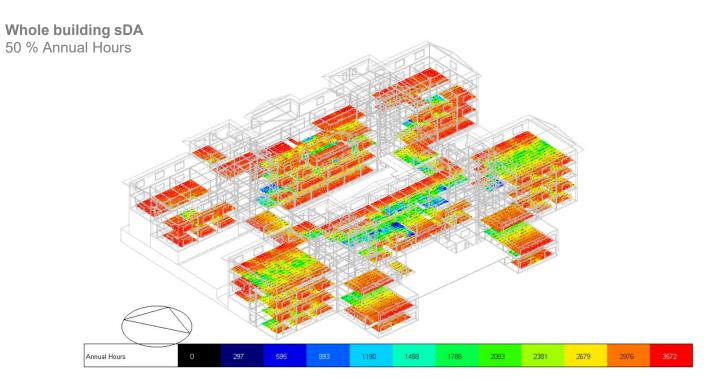






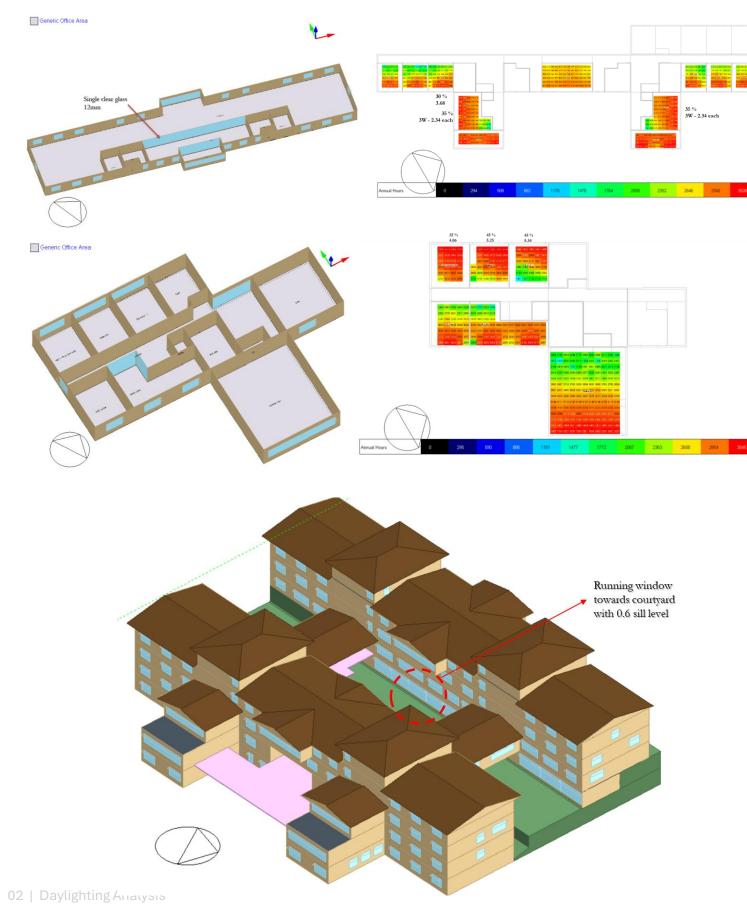


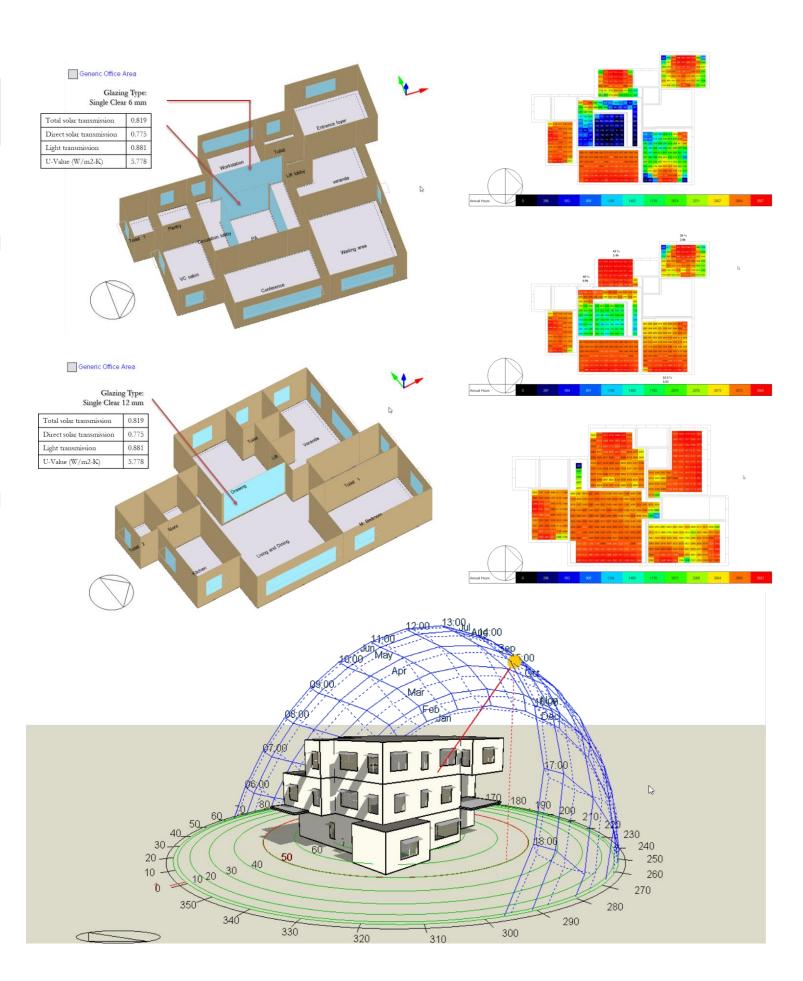




Total		6631.302	6422.733	36.362	6043.627	30.861	6033.711	30.742
T-1-1		6651.502	6422.793	96.562	6043.627	90.861	6035.711	90.742
TF_North	Library 1	203.578	203.578	100.000	198.552	97.531	198.552	97.531
TF_North	Library	60.592	60.592	100.000	60.592	100.000	48.989	80.851
FF_North West	Seminar rrom	176.488	173.028	98.039	164.953	93.464	152.264	86.275
FF_North West	HOD cabins	44.425	44.425	100.000	41.812	94.118	41.812	94.118
DIUCK	Zone	FIDUI AIEa (IIIZ)	SDA Alea in hange (IIIZ)	SDA Alea in nange (%)	ASE Alea in hange (IIIZ)	ASE Alea in hariye (%)	ODI Alea in hange (IIIZ)	ODI Alea in hange (%)

DAYLIGHTING ANALYSIS: sDA

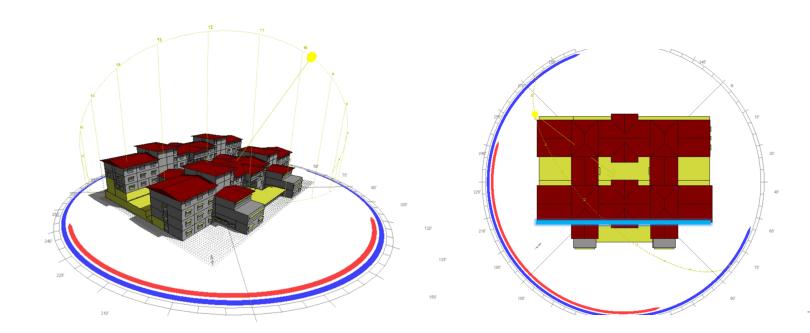




DAYLIGHTING ANALYSIS: SHADING ANALYSIS

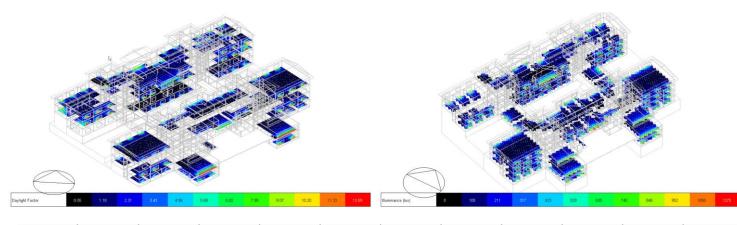
INTENT: Conduct solar path analysis for windows of AC as well as non-AC spaces, to ensure that the window is completely shaded for the duration between 10:00 am on 1st April to 15:00 on 30th September. Additionally, adequate daylight factors are achieved in more than 25% of the total living area.

NOTE: The shading analysis was performed for every window.



Whole building Daylight Factor Analysis

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

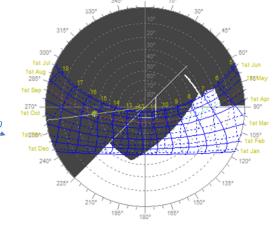


Block	Zone	Floor Area (m2)	Floor Area within	Floor Area within	Average Daylight	Minimum Daylight	Maximum Daylight	Uniformity ratio (M	Uniformity ratio (M	Min Illuminance (l	Max Illuminance (l
LBS_Conn	Workshop/labora	183.483	15.506	8.451	1.095	0.517	5.520	0.472	0.094	51.72	552.51
LBS_Conn	Classroom 3	45.707	11.795	25.806	1.891	0.788	5.696	0.417	0.138	78.94	570.53
LBS_Conn	Staff 2	8.965	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00
LBS_Conn LBN_FF	Computer room 1 office	103.519 60.924	58.229 60.924	56.250 100.000	3.188 5.552	1.282 2.995	10.621 10.847		0.121 0.276	128.32 299.92	1062.97 1086.19
LBN_FOF	Building manager	43.949	16.561	37.681	1.855	0.180	6.755	0.097	0.027	18.01	676.16
Total		6964.710	1994.193	28.633	1.828	0.000	12.695	0.000	0.000	0.00	1270.24



Extreme Left

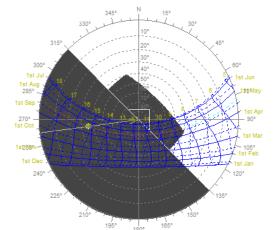
- Window shaded between 10:00 am on 1st April to 15:00 on 30th September
- Type: Horizontal shade
- Window: 2700 x 2000mm
- Shade Dimensions: 800mm depth
- Recommended projection Factor: 0.42

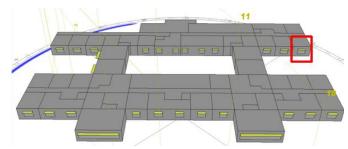




Connecting Bridge

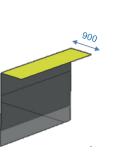
- Window shaded between 10:00 am on 1st April to 15:00 on 30th September
- Type: Horizontal Shade
- Window: 2700 x 2000mm
- Shade Dimensions: 600mm depth
- Recommended projection Factor: 0.3

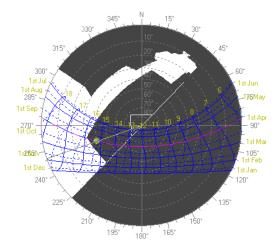




First Floor Extreme Right

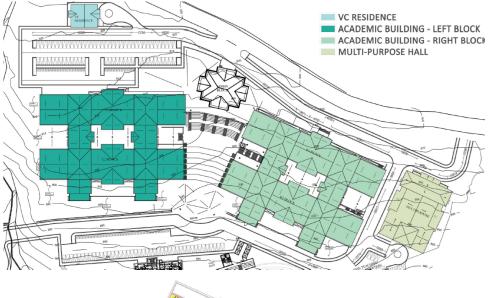
- Window shaded between 10:00 am on 1st April to 15:00 on 30th September
- Type: Horizontal Shade
- Window: 2700 x 2000mm
- Shade Dimensions: 900mm depth
- Recommended projection Factor: 0.45





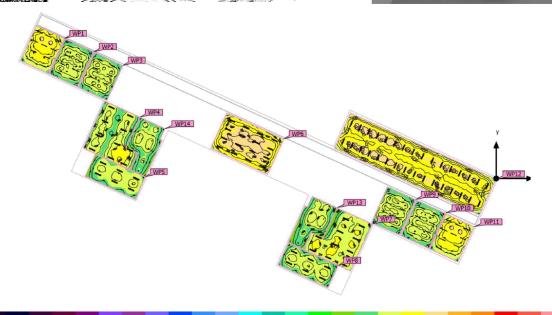
DAYLIGHTING ANALYSIS: ARTIFICIAL LIGHTING

INTENT: Artificial Lighting analysis, compliance and recommendations



Building Name	Total Lighting Load	Lux Level as per NBC 2005 Achieved	Uniformity of 0.4 Achieved
VC Residence	1108 W	✓	~
Multi-Purpose Hall	14,003 W	✓	~
Academic Building – Right Block	36,730 W	~	~
Academic Building – Left Block	34,428 W	~	~





Properties	Index	Article Name	Pieces	Efficacy (Im/W)	Luminous flux (lm)	CCT (K)	Wattage (W)	Mounting Height	Uo	Ē	Compliant	
									(Target)	(Target)		
Working plane (ASS. ASSIS PROF OFFICE)		SP780 H LED25S-4000 PSU W5L112							0.62	463 lx		
Perpendicular illuminance (adaptive)	WP1	OD WH	10	125	2500	4000	20	3.25 m	(≥ 0.40)	(300 lx ≥ 750 lx)	Yes	
Height: 0.800 m, Wall zone: 0.000 m	L								ļ			
Working plane (CLASSROOM)		SP780 H LED25S-4000 PSU W5I 112		1		ŀ			0.68	373 lx	l	
Perpendicular illuminance (adaptive)	WP2	OD WH	8	125	2500	4000	20	3.25 m	(≥ 0.40)	(200 lx ≥ 500 lx)	Yes	
Height: 0.800 m, Wall zone: 0.000 m				أسسا		<u> </u>			<u> </u>	<u> </u>		
Working plane (CLASSROOM)		SP780 H LED25S-4000 PSU W5I 112							0.65	375 lx		
Perpendicular illuminance (adaptive)	WP3	OD WH	8	125	2500	4000	20	3.25 m	(≥ 0.40)	(200 lx ≥ 500 lx)	Yes	
Height: 0.800 m, Wall zone: 0.000 m						<u> </u>			i			
Working plane (ADMIN OFFICE)		SP680X2 LED39S 4000 PSU WH							0.72	380 lx		
Perpendicular illuminance (adaptive)	WP4	1120 S1	10	100	3900	4000	38	3.25 m	(≥ 0.40)	(300 lx ≥ 750 lx)	Yes	
Height: 0.800 m, Wall zone: 0.000 m									,,	,,		
Working plane (HOD CABIN)		SP680P LED34S 4000 PSD WH L120							0.57	351 lx		
Perpendicular illuminance (adaptive)	WP5	WP5	S1	6	100	3400	4000	32	3.25 m	(≥ 0.40)	(300 lx ≥ 750 lx)	Yes
Height: 0.800 m, Wall zone: 0.000 m		31								ļ		
Working plane (SEMINAR HALL)		SP680P LED34S 4000 PSD WH L120							0.66	548 lx		
Perpendicular illuminance (adaptive)	WP6	\$1	16	100	3400	4000	32	3.25 m	(≥ 0.40)	(300 lx ≥ 750 lx)	Yes	
Height: 0.800 m, Wall zone: 0.000 m												
Working plane (ADMIN OFFICE)		SP680X2 LED39S 4000 PSU WH							0.46	401 lx		
Perpendicular illuminance (adaptive)	WP7 L120 S1	10	100	100 3900	00 4000	38	3.25 m	(≥ 0.40)	(300 lx ≥ 750 lx)	Yes		
Height: 0.800 m, Wall zone: 0.000 m		E120 31							<u> </u>			
Working plane (HOD CABIN)		SP680P LED34S 4000 PSD WH L120		i i		İ	1 1		0.66	353 lx	İ	
Perpendicular illuminance (adaptive)	WP8	S1	6	100	3400	4000	32	3.25 m	(≥ 0.40)	(300 lx ≥ 750 lx)	Yes	
Height: 0.800 m, Wall zone: 0.000 m		51									1	

THERMAL COMFORT ANAYLYSIS

Input envelope parameters

Inner surface		¥
Convective heat transfer coefficient (W/m2-K)	4.460	
Radiative heat transfer coefficient (W/m2-K)	5.540	
Surface resistance (m2-K/W)	0.100	
Outer surface		¥
Convective heat transfer coefficient (W/m2-K)	19.870	
Radiative heat transfer coefficient (W/m2-K)	5.130	
Surface resistance (m2-K/W)	0.040	
No Bridging		×
U-Value surface to surface (W/m2-K)	3.798	
R-Value (m2-K/W)	0.403	
U-Value (W/m2-K)	2.480	
With Bridging (BS EN ISO 6946)		*
Thickness (m)	0.2120	
Km - Internal heat capacity (KJ/m2-K)	200.0000	
Upper resistance limit (m2-K/W)	0.403	
Lower resistance limit (m2-K/W)	0.403	
U-Value surface to surface (W/m2-K)	3.798	
	0.403	
R-Value (m2-K/M)		



U-Value (W/m2-K)

3.666

Ode indice

Int (Direct Concess)

Internalises

Radiative heat transfer coefficient (W/m2-K)

PITCHED ROOF - U-Value: 3.66 W/m2-K

U-Value (W/m2-K)
With Bridging (BS EN ISC



FLAT ROOF - U-Value: 2.480 W/m2-K



INTERNAL PARTITION - U-Value: 2.096 W/m2-K

INTERNAL FLOOR - U-Value: 2.314 W/m2-K

CASE 1 – BRICK WALL - U-Value: 1.909 W/m2-K

CASE 2 - AAC WALL - U-Value: 0.421 W/m2-K

Operative Temperature

