KNOWLEDGE SERIES

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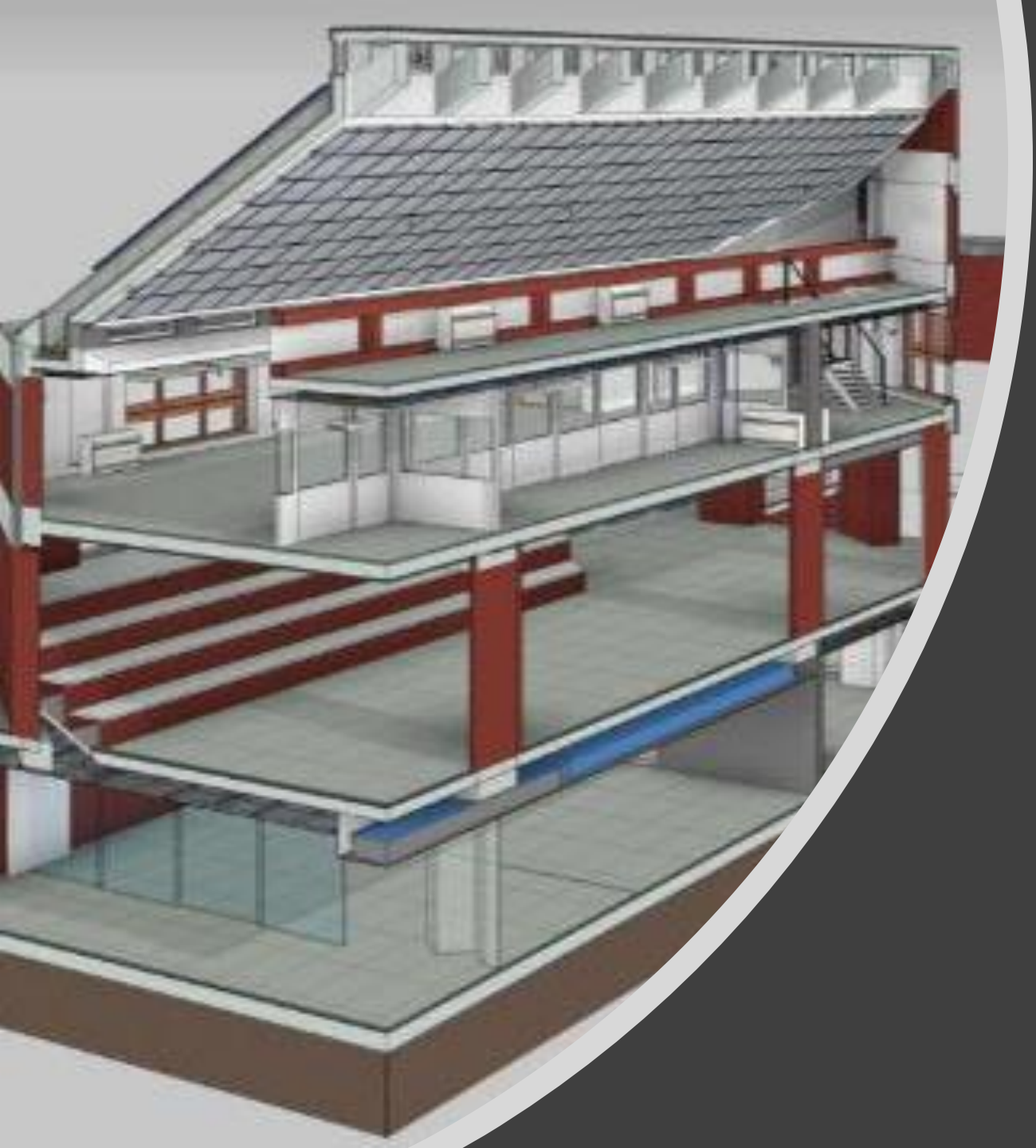


2nd August, 2019

DAYLIGHT TECHNOLOGIES

SESSION MODERATOR

DEEPA PAREKH
Sr. Project Manager
Environmental Design Solutions

SESSION MODERATOR

DEEPA PAREKH
Sr. Project Manager
Environmental Design Solutions

EXPERT SPEAKER

SEKHAR NORI
CEO, Skyshades Inc

Good daylighting is a key attribute of a high performance design

Daylighting technologies help harvest more daylight and also enhance the quality of daylight in the space.

Skyshade™

Daylighting for Energy Efficiency

11 YEARS OF EXPERIENCE EXPERTISE EXCELLENCE

Sekhar Nori

Founder & CEO

What is Daylighting?

Controlled use of Sunlight to meet requirements of Building illumination

What is Daylighting Design?

- Indirect & diffuse radiation to provide useful illumination
- Minimize direct sunlight & glare into work spaces
- Controlling electric lighting in accordance with daylight
- Reduce contrast in daylight between perimeter and interior areas

Standards

LEED Rating System	Grade Points
Energy Performance Optimization	18
Interior Lighting	2
Daylight & Views	4
Light pollution reduction	1

GRIHA Rating System	Grade Points
Energy Saving	4
Efficient Artificial Lighting	2
Daylight	6
Thermal Efficiency	2

ASHRAE Standards	Grade Points
Energy Performance Optimization	19
Lighting Control	1
Daylight & Views	2
Thermal Comfort	1

Technologies to harvest and enhance daylight

- **Top Lighting – Skylights, Lightpipes**
- **Side Lighting - Windows,**

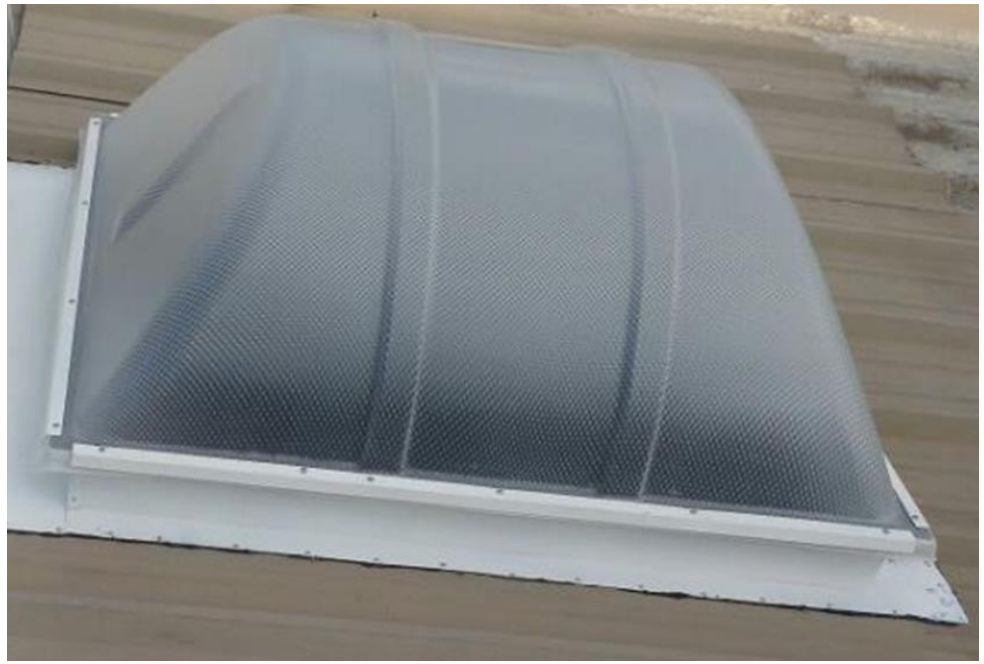
  Curtain Wall Glazing,

  Light Shelves

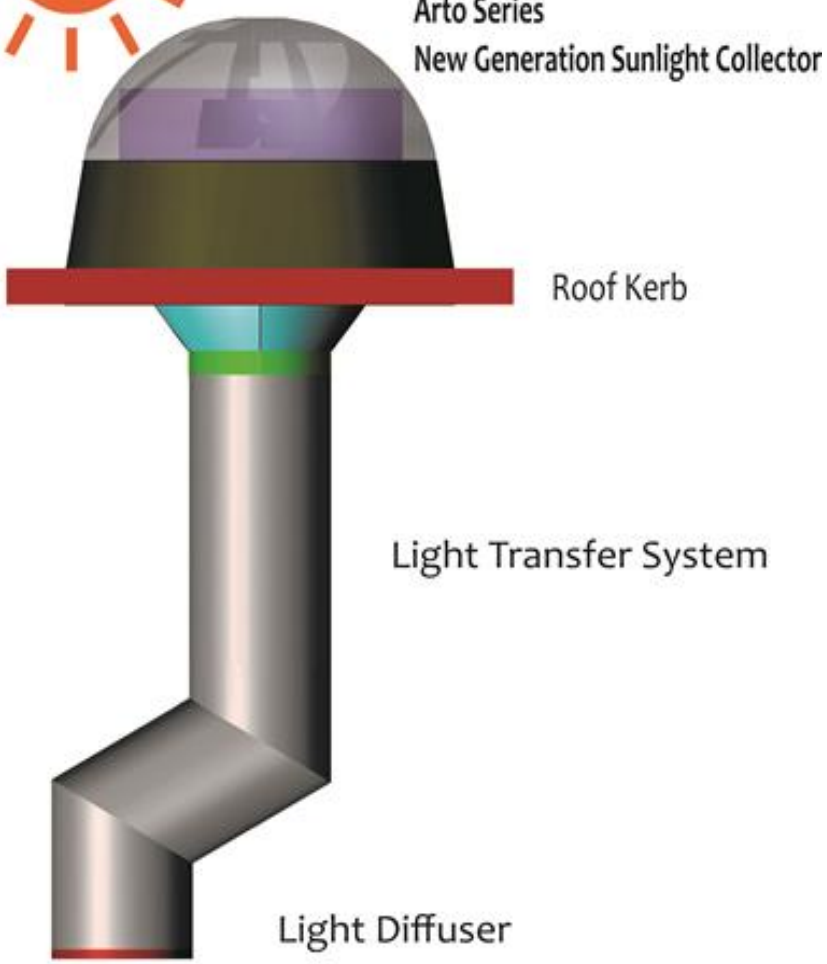
Daylighting Strategies

Top Lighting

Skylights



Lightpipes



Daylighting Strategies

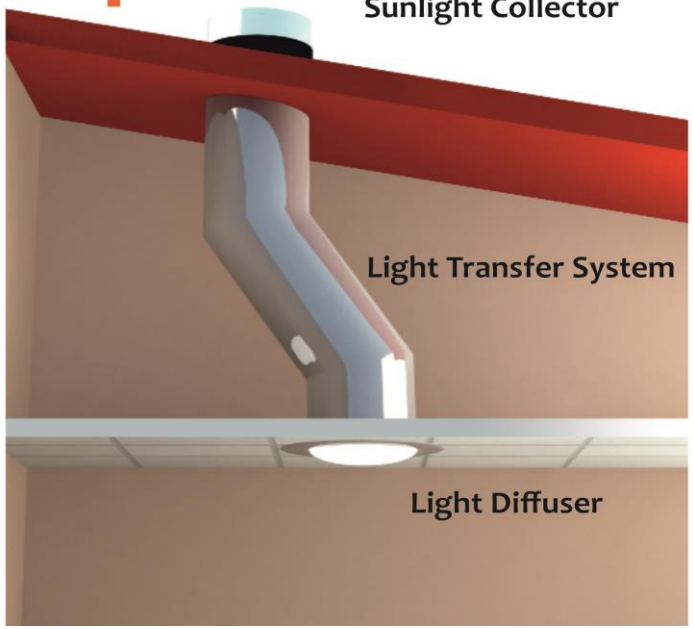
Side Lighting

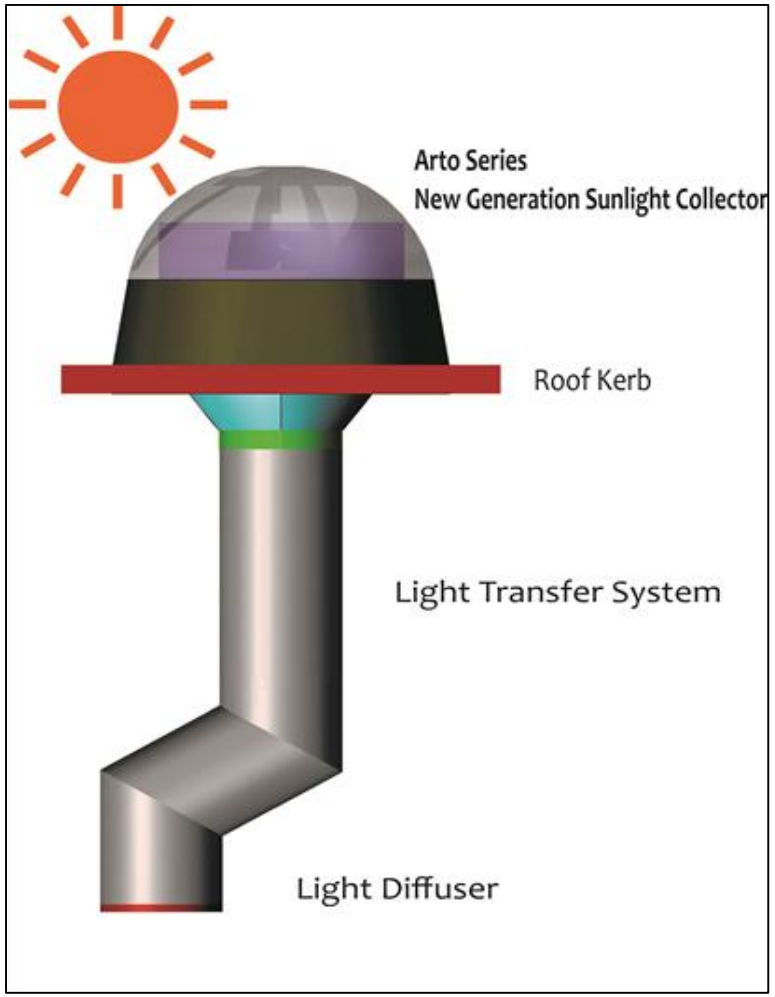
Window Daylight

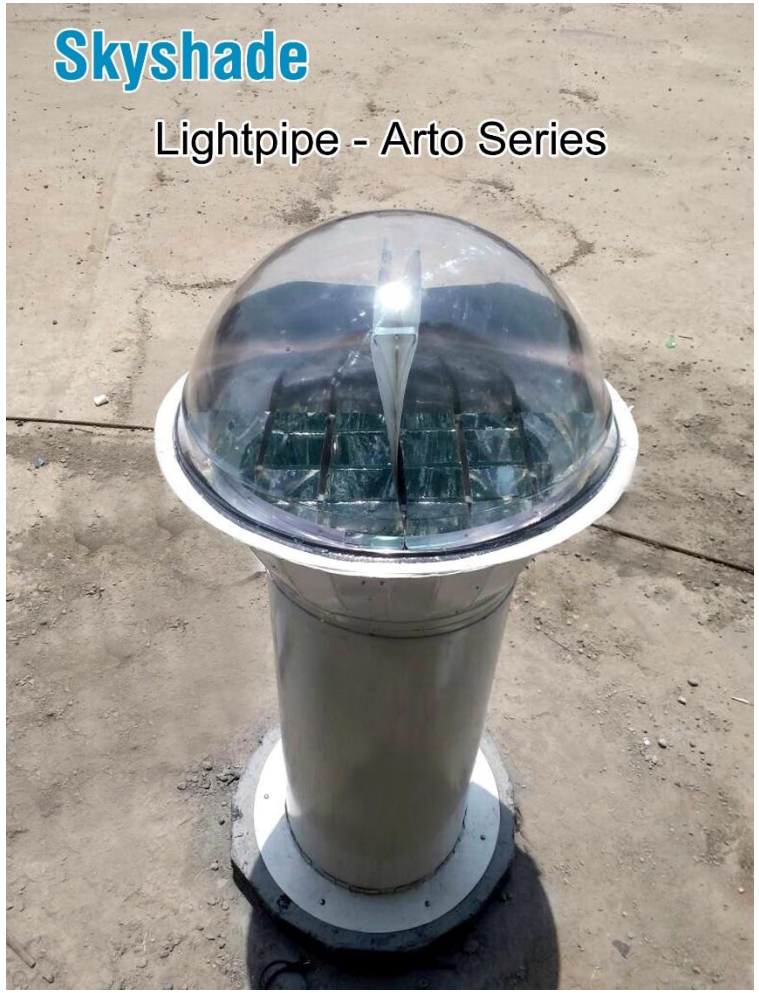
Light Shelves

Curtain wall glazing

LightPipe™
Solar Lighting System







Lightpipe Size (Diameter)	Lumen Output
300 mm	5,000 lumens
400 mm	9,000 lumens
530 mm	15,000 lumens
750 mm	24,000 lumens

Roof Mounted
Standard Series

Wall Mounted Daylighting System, Secunderabad Railway station


Rail Coach Factory, Rae Bareli

Amara Raja Batteries, Tirupati

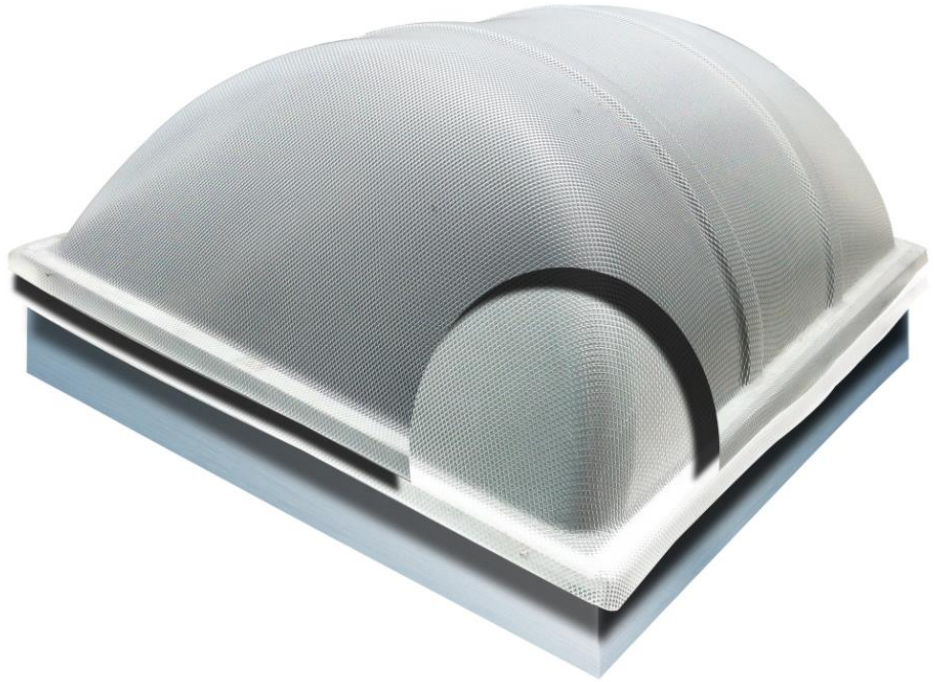
Railway Station, Bangalore


Aurobindo Pharma, Hyd

Chief Engineer Office, SCRly

NoriKool

Prismatic Skylight



Skyshade™ manufacturers prismatic Double Glazed/Triple Glazed Skylights.
It can replace Strip/Roof lights in Pre-engineered Metal Buildings.
The prismatic skylights are equipped with factory made Metal Kerbs.


Machine Facility Room
Before Installation
Light Output: 70-90 LUX
After Installation
Light Output: 1800-2100 LUX

Daylight Economics

Case Study

Daylight Economics:

For a manufacturing space/warehouse (Box Building)

- Area :- 2000 Sq.m
- Average height :- 12 m
- Location :- Hyderabad
- Daylighting system :- Norikool Double Glazed Prismatic Skylight (Aperture Area - 1.2 Sq.m.)
- Design illuminance :- 275 Lux

Results:-

Daylight Autonomy :- 9 Hrs

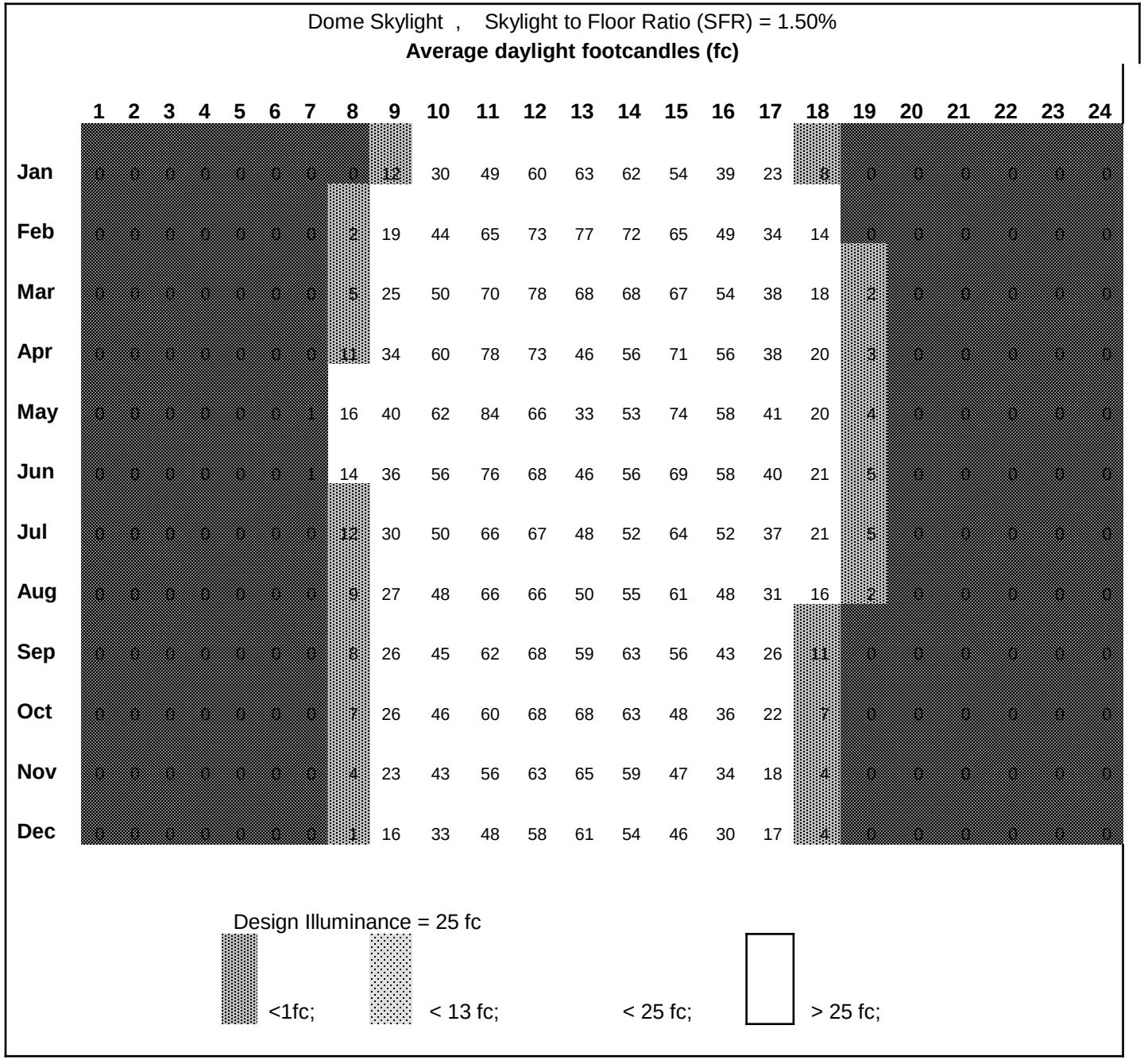
Average Daylighting Hours :- 10 Hrs

Uniformity Ratio :- 0.4 to 0.5

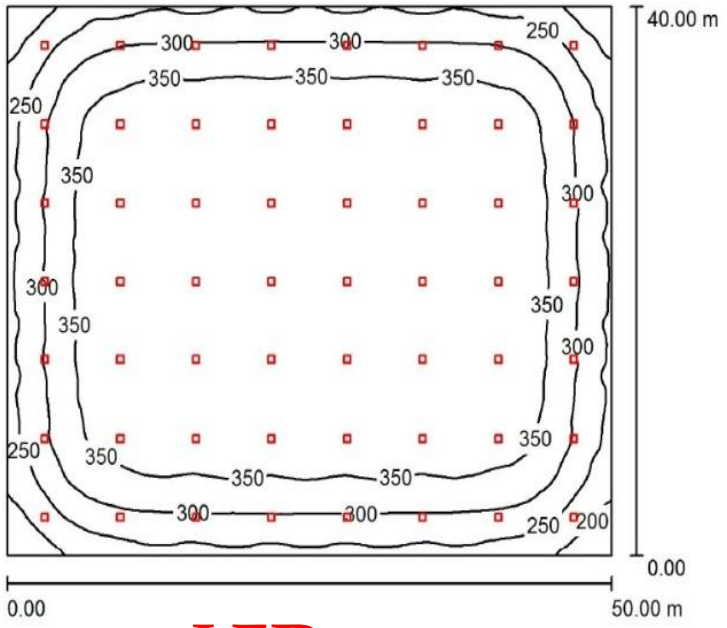
Skylight to Floor Area Ratio :- 0.015 (1.5 % of roof area)

Daylighting

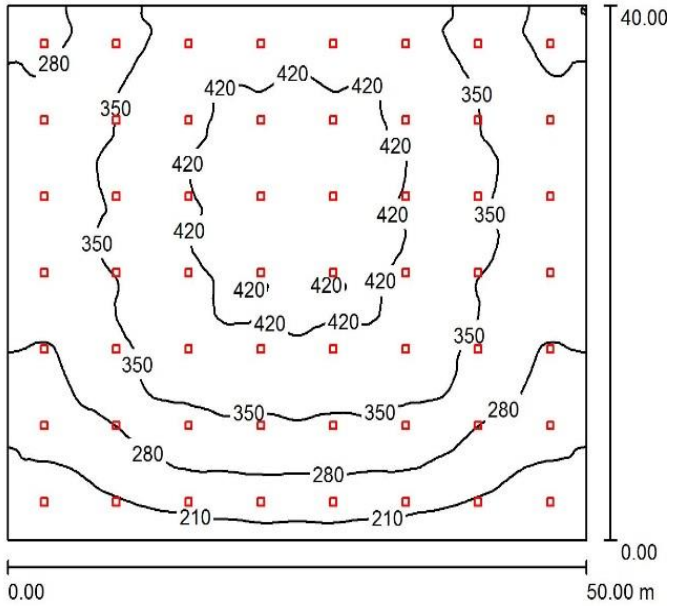
Simulation Output



ELECTRICAL LIGHTING SIMULATION



LED



METAL HALIDE

Type of light :- LED 150 Watts	Type of light :- METAL HALIDE 400 Watts
Total wattage required :-8.4 KW	Total wattage required :-22.4KW
Illuminance Uniformity :-0.450	Illuminance Uniformity :-0.441
Lighting Power Density:- 4.2 W/Sq.m	Lighting Power Density :-11.20 W/Sq.m
(OR)	(OR)
0.39 W/Sq.ft	1.04 W/Sq.ft

Compared to LED Lighting:- **ENERGY SAVING**

Daylighting Design Illuminance :- 250 - 300 Lux

Proposed Daylighting Product :- Norikool Double Glazed Prismatic Skylight (Aperture Area-1.2 Sq.m.).

Connected Electrical Lighting Load LED :- 8.4 Kw

Average Daylighting Hours :- 10 Hrs

Average Working per year :- 360 Days

Electricity Unit Cost :- @ Rs.9.0 / unit

Electricity Saving On Power Consumption:-

Energy Savings per Year :-8.4 Kw X 10 Hrs X 360 Days

30,240 Kwh/annum

@ Rs.9.0 per Kwh, Energy cost savings :- 30,240 X 9

Rs.2,72,160 / annum

Payback period:

Approx. 2 Years.

Note: 1. Add bulb replacement costs 2. Add cooling load reduction cost

CASE STUDY:

Installation of Solar Lightpipe at Modern Coach Factory Rae Bareli, Uttar Pradesh (India)

Project: Rail Coach Factory, Rae Bareli (RCF)

Installed Product	Lightpipe™
Model No	LPR-750
Building Name	Shell Fabrication, Paint, Wheel, Bogie
Building Area	1,14,735 Sq.m
Designed illuminance	250-300 Lux
Project Completion	31-08-2015
Project Cost	Rs.4,28,89,681
Energy Savings/Annum	21, 94,008 Kwh
Payback Period	28 months
Return on Investment/Annum (ROI)	40.98%

Payback Period Calculation

Following assumptions have been considered:

Daylighting Design illuminance: 250 - 300 LUX

Proposed Daylighting Product: Lightpipe Lighting

Power Density: 6.02 W/ m2

Building Area: 1,14,735 m2

Connected Electrical Lighting Load: 691.56 KW

Average Working Days / Year = 300

Electricity Unit Cost = Rs. 8.0 / Unit

(Reference Link : http://jan.moesen.nu/daylight-calculator/)

Total Cost Savings = Electricity Savings on power consumption

1. Electricity Savings on power consumption

Energy Savings per year = 731.336 Kwh x 10 Hours x 350 Days **= 21, 94,008 Kwh / Annum**

@ Rs. 7.0 per Kwh, Energy cost savings **= 21, 94,008 x 8 = Rs 1, 75, 52,064 / Annum**

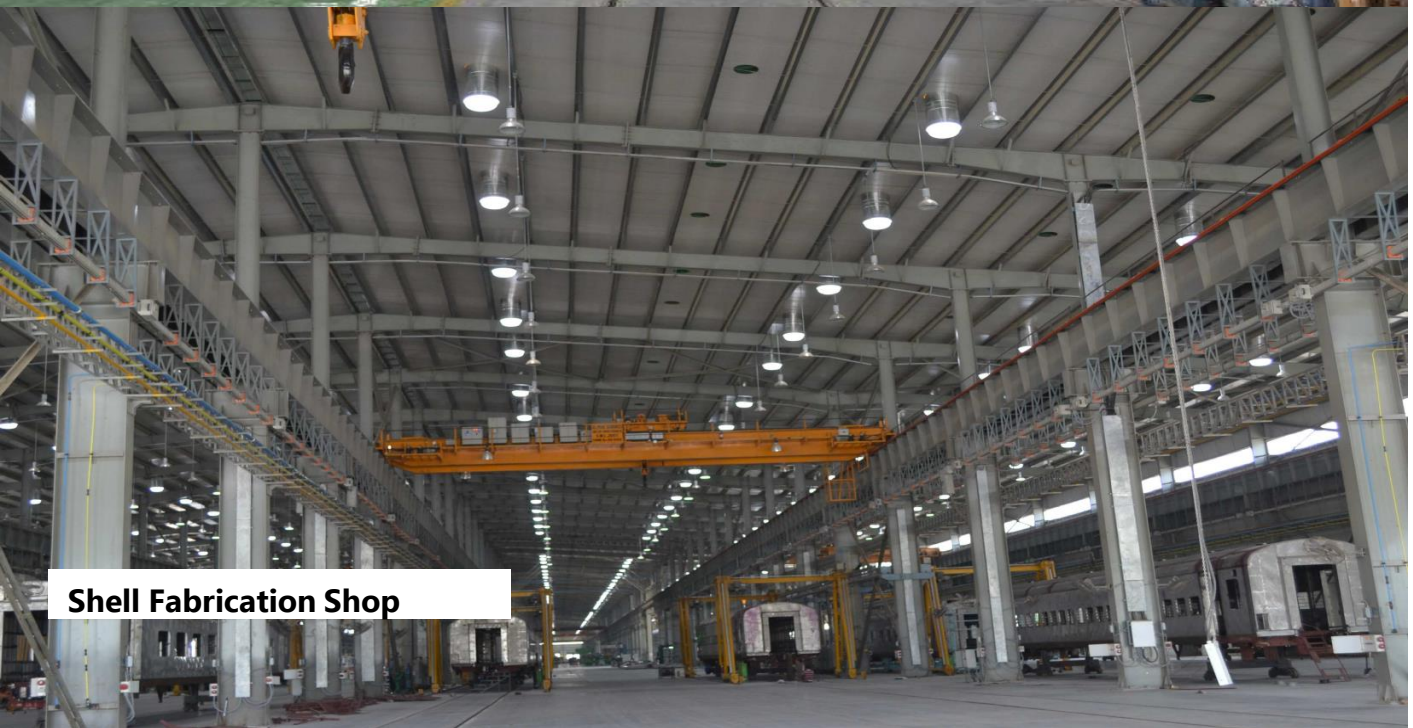
Total Cost Savings (X) = Rs.1, 75, 52,064 / Annum

Total Investment Cost (Y) = Rs 4, 28, 89,681 / Annum

Payback Period = Y/X = 4, 28, 89,681 / 1, 75, 52,064 = 2.4 Years (28 Months)

Return on Investment/Annum (ROI) = X/Y * 100 = 40.92 %

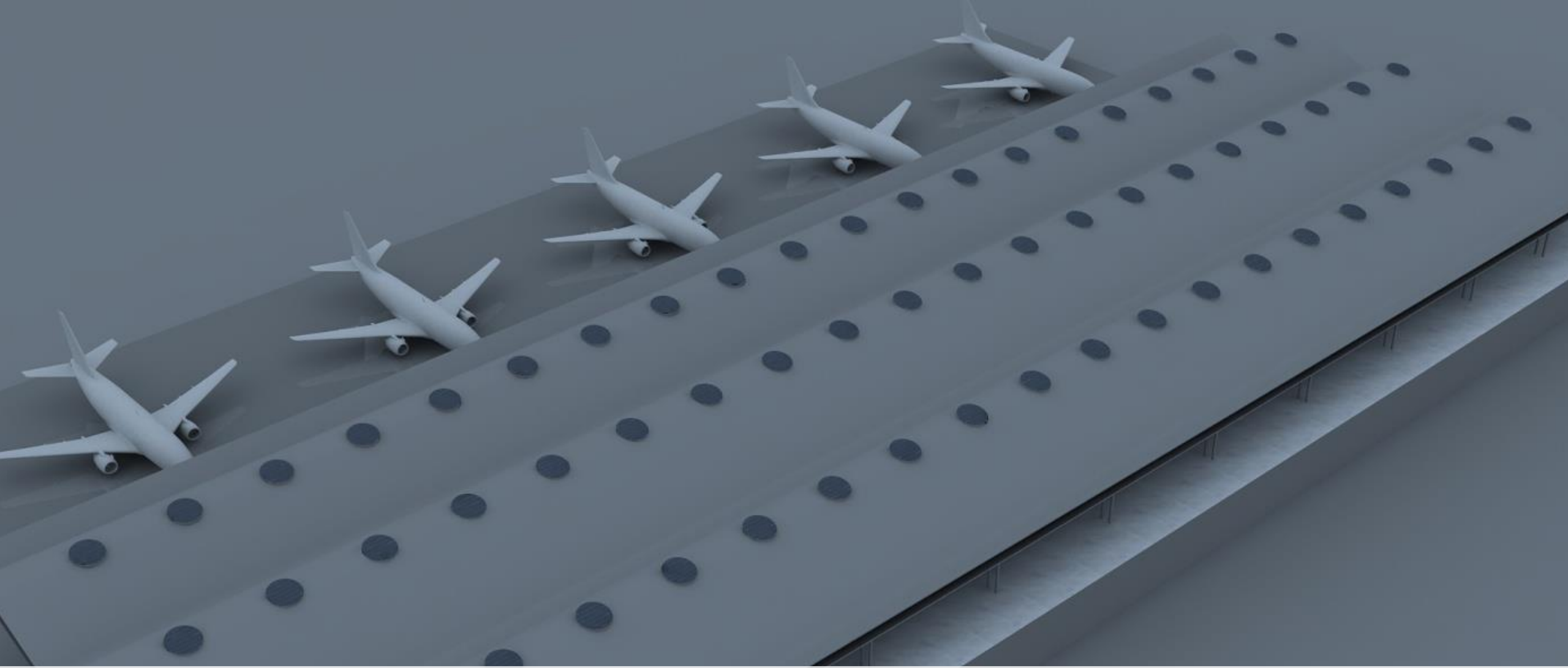
Bogie Shop



Shell Fabrication Shop

Paint Shop

Wheel Shop



CASE STUDY:

Daylighting for new Chennai International Terminal

The first airport in INDIA with exclusive Daylighting systems for harvesting Natural light.

Skyshade

Project Details - Chennai International Terminal Building

- Floor Area: 58,000 sq m.
- Roof Height: 30.0 m
- False Ceiling Height: 26.0 m

- Method of working: Active sunlight Tracking system collects sunlight and delivers through reflective ducts and light diffusers into the terminal building.
- Daylighting systems are equipped with daylight sensors for sensing daylight and through light controllers control building electric lighting depending on availability of ambient daylight.

- Number of systems:53


Skyshade


Quiz
Insert
Home
Delete
Ctrl

Side Lighting Strategies

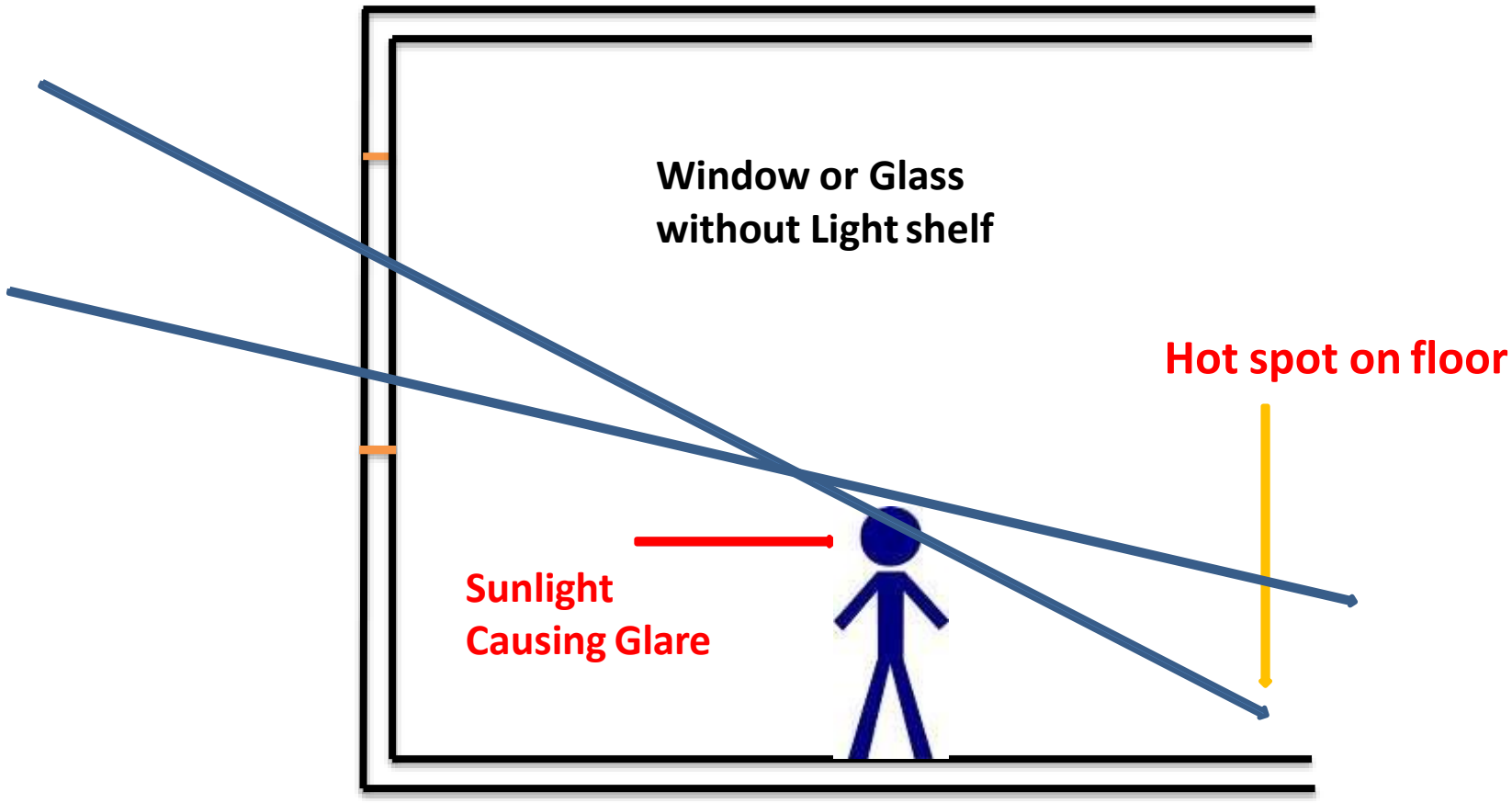
Window Daylight

Light Shelves

Curtain wall glazing

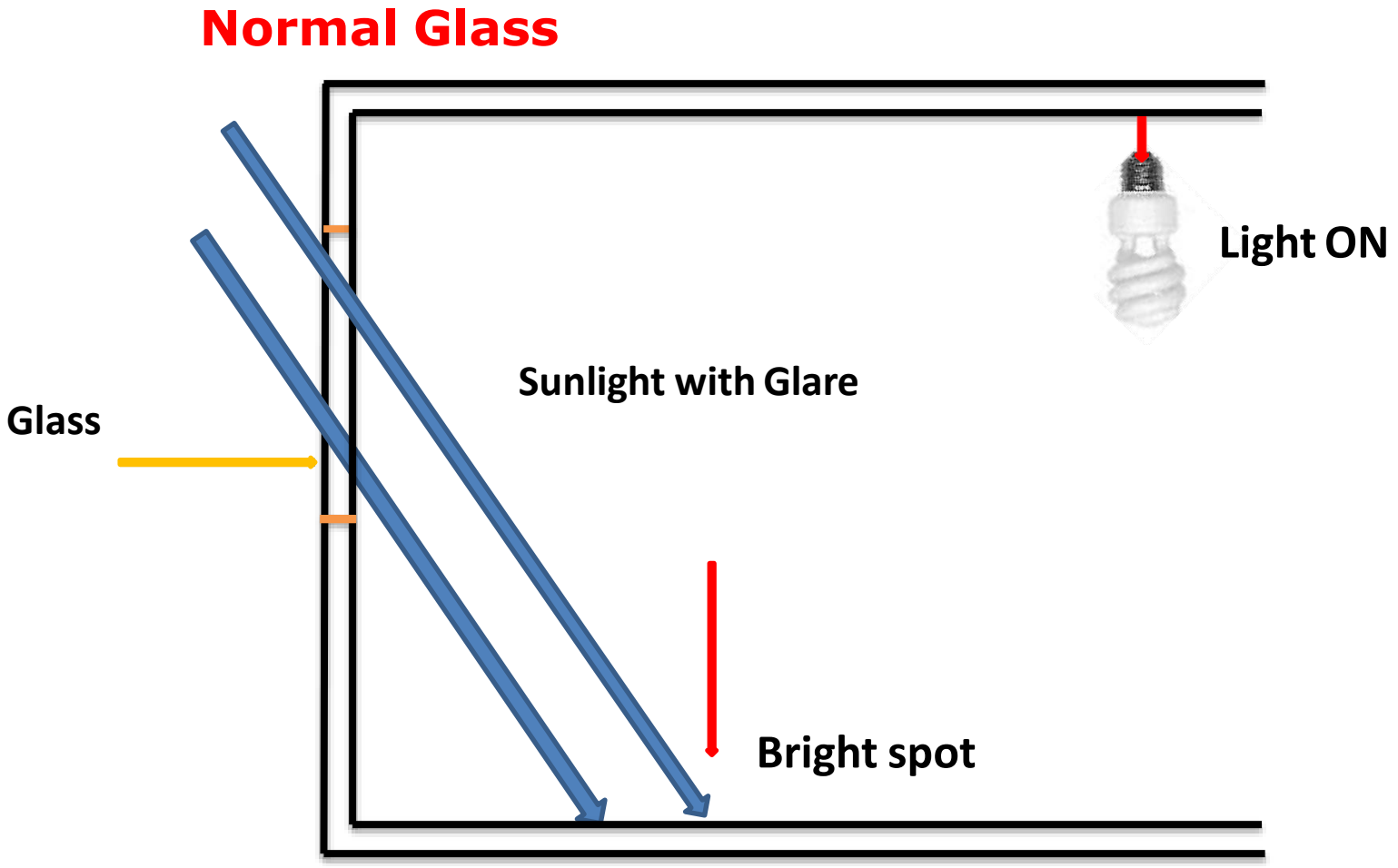
Limitation of Glass

Glass transmits solar radiation directly causing bright hot spots on floor close to windows or glazing. This causes glare.



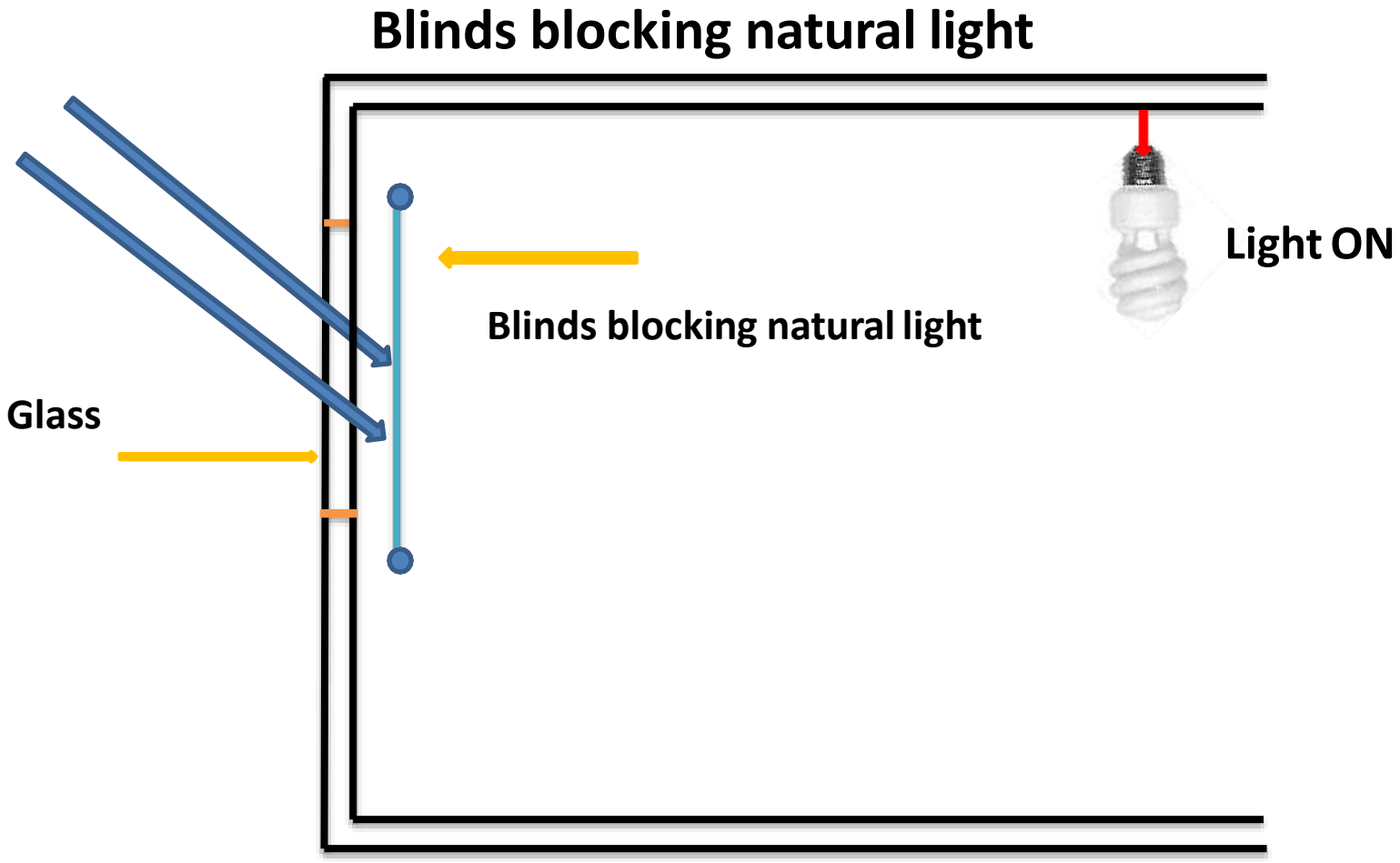
Limitation of Glass

Daylight availability reduces drastically as we move away from windows or glass. Deeper areas have relatively less daylight.



Limitation of Glass

Because of glare & hot, bright spots people use blinds on glazed fenestrations which blocks natural light.



The Solution: **Skyshelves™ DG**

- The Sunlight incident on glass is redirected at a lower angle to hit the ceiling inside the building.
- The redirected light hitting the ceiling reaches deeper into the building space.

Working of Skyshelves™ DG

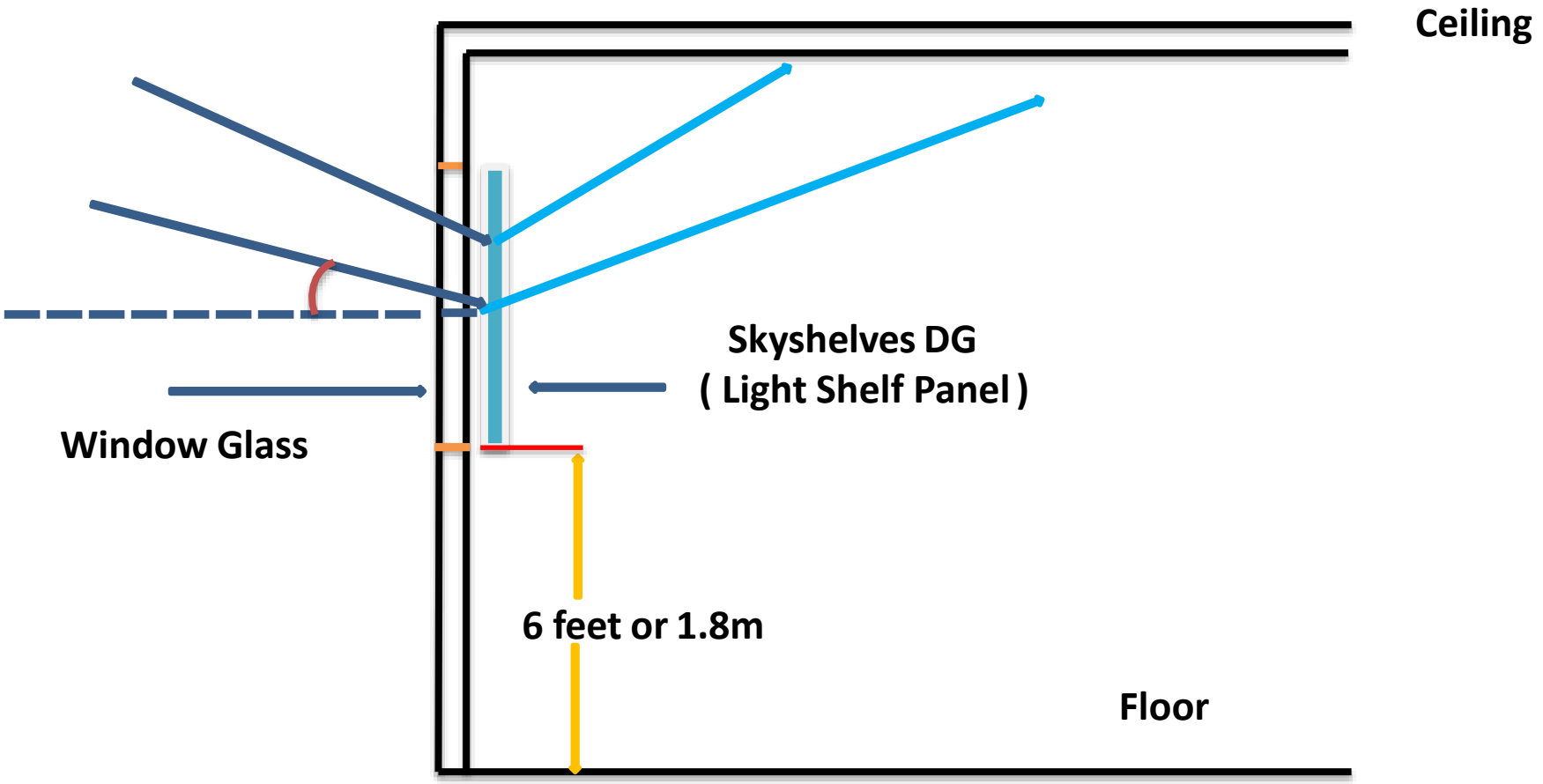
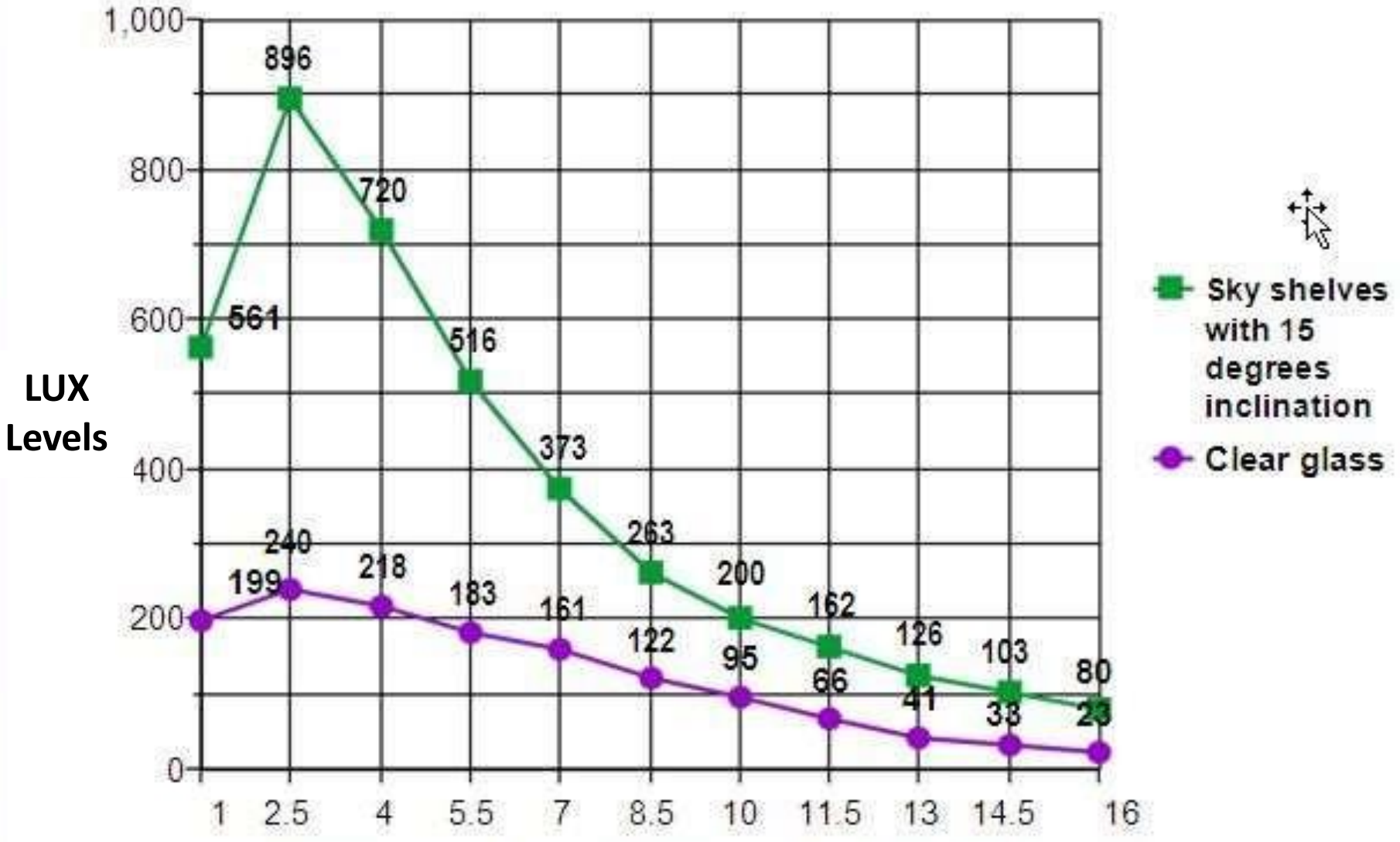
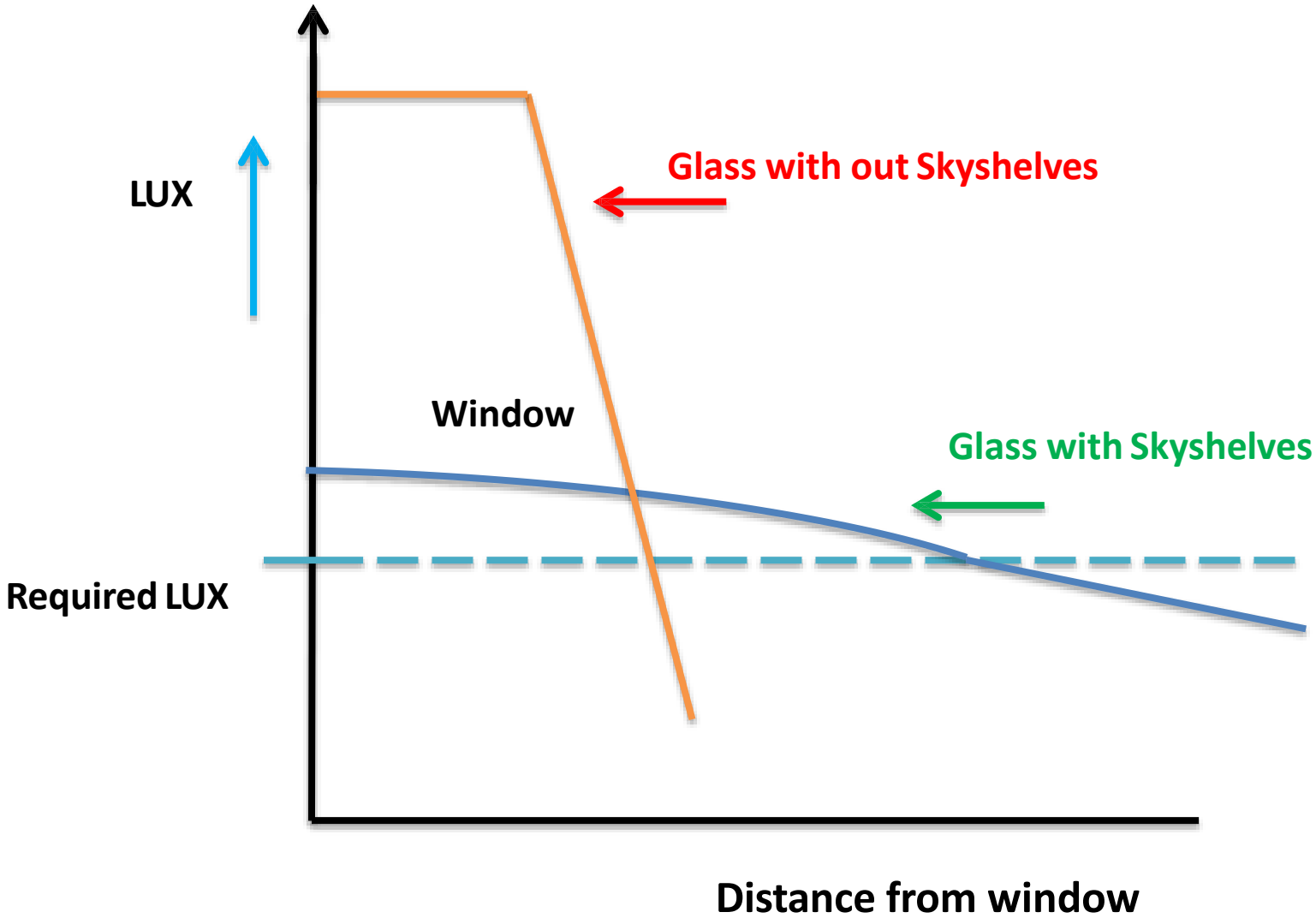


Fig.1

Graph showing LUX Levels with distance from Skyshelves ™Daylight Glazing



Glass with Light shelves



Skyshelves™ Light Shelf Panels

Skyshelves - Glass Windows application

When Sun is lower in Sky (Morning & Evening), Daylight can penetrate deep inside. Skyshelves allows this light pass. This daylight is not associated with heat.

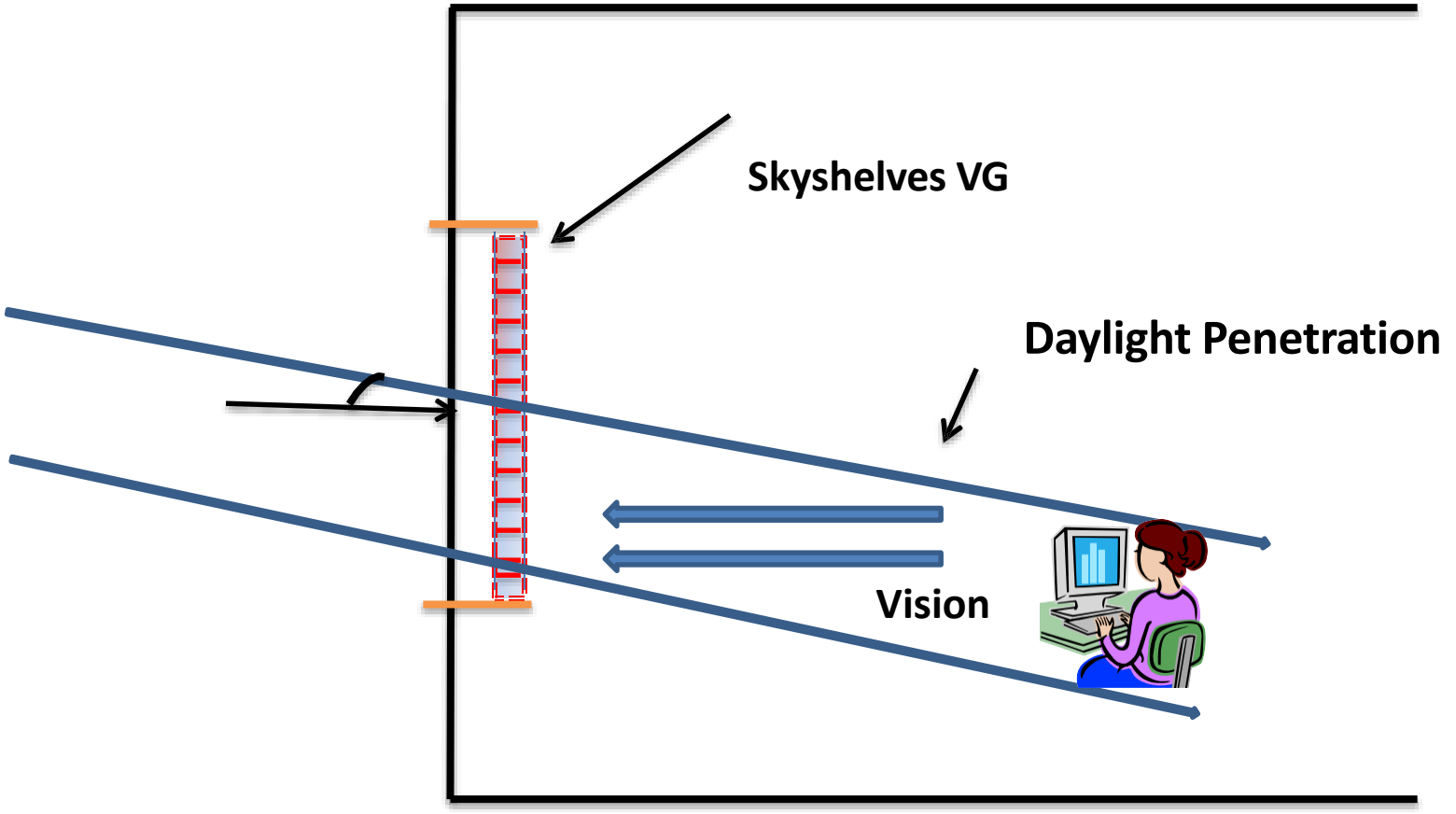


Fig.4 { Low angle Pass }


See the difference With Out and With Skyshelves
Bright Spots
Diffused light
No Bright Spots
Skyshade™

Working of Skyshelves™ VG: When Sun goes higher in Sky (Higher elevation angle), the solar energy intensity increases. Skyshelves blocks this radiation by rejecting it.

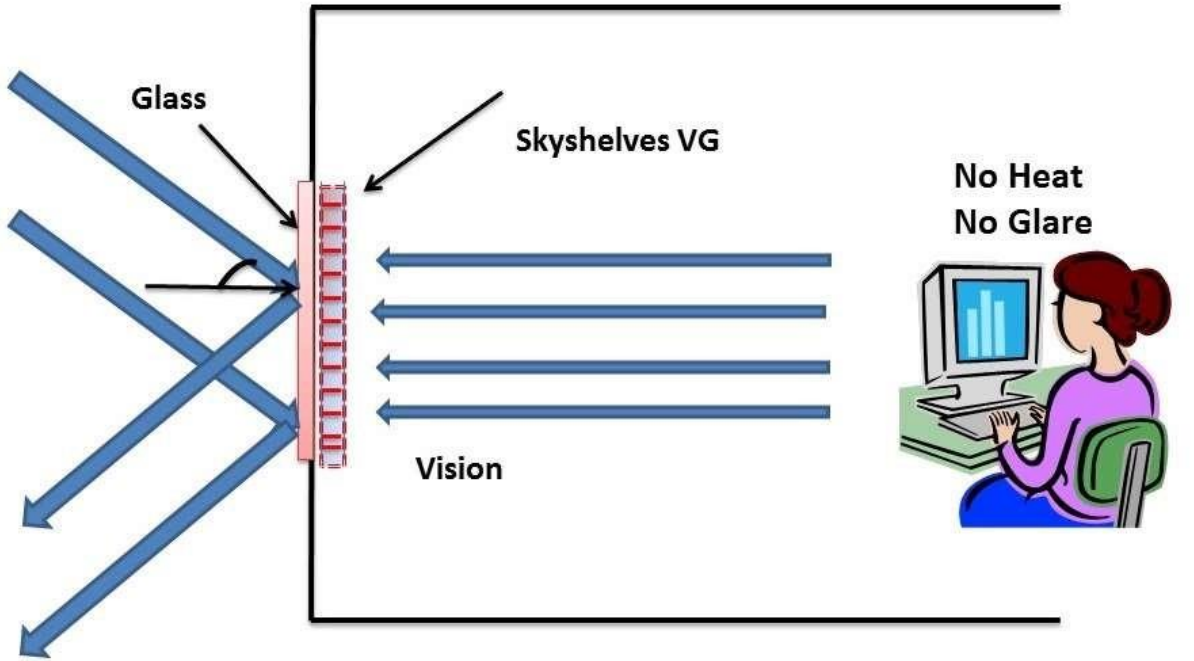
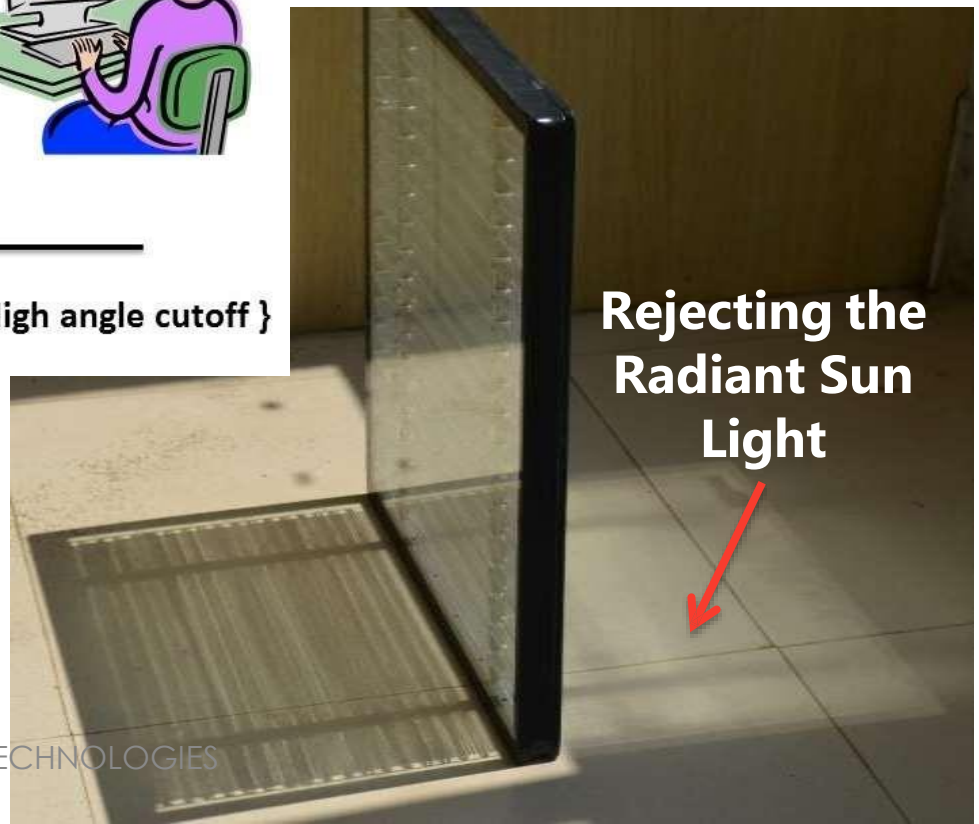


Fig.3 { High angle cutoff }



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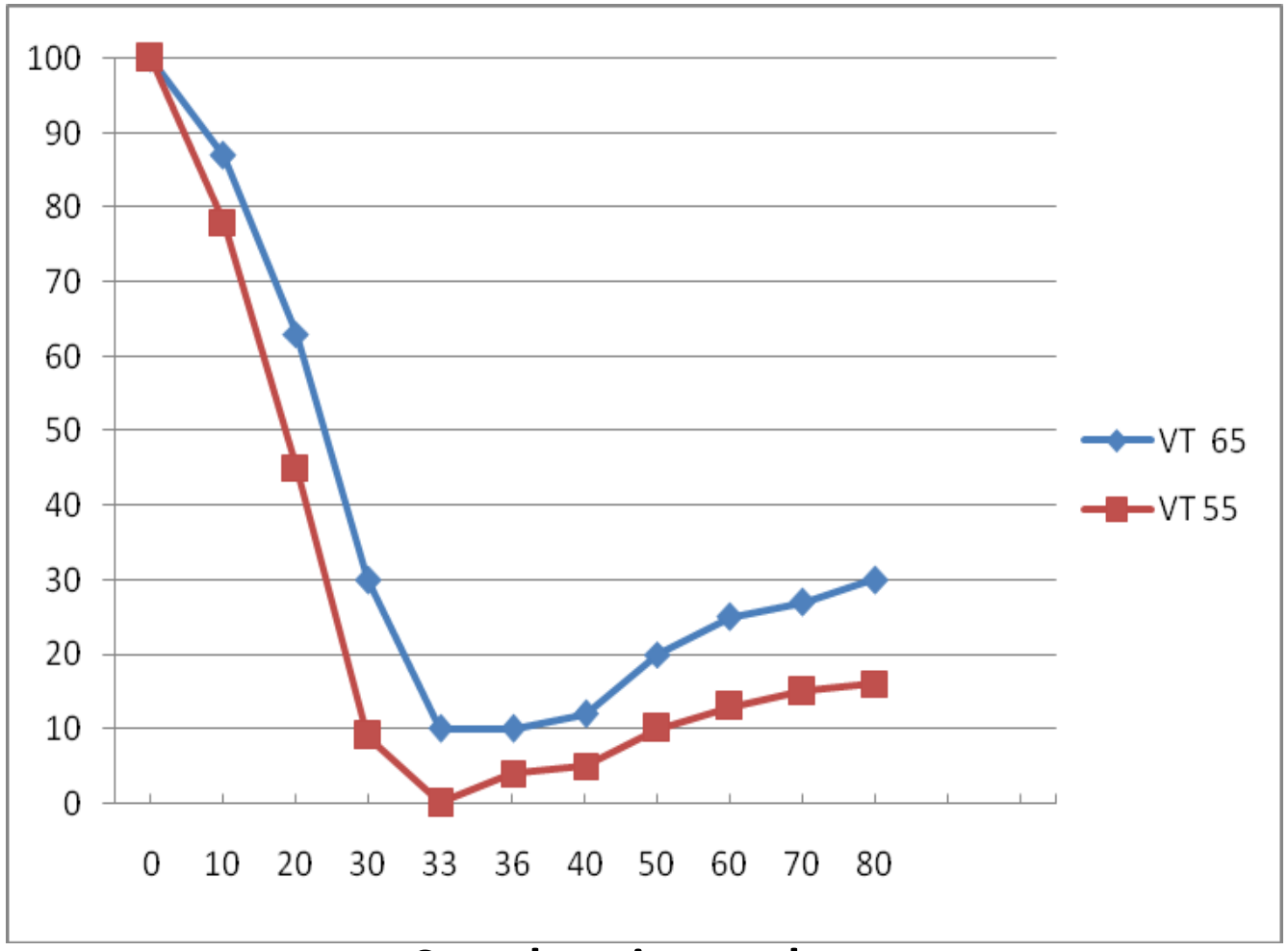
Skyshelves™ VG
Managing Light + Heat from Glass

Graph showing Light transmission with sun elevation **angle** for two panels of vision transmission 65% and 55%.

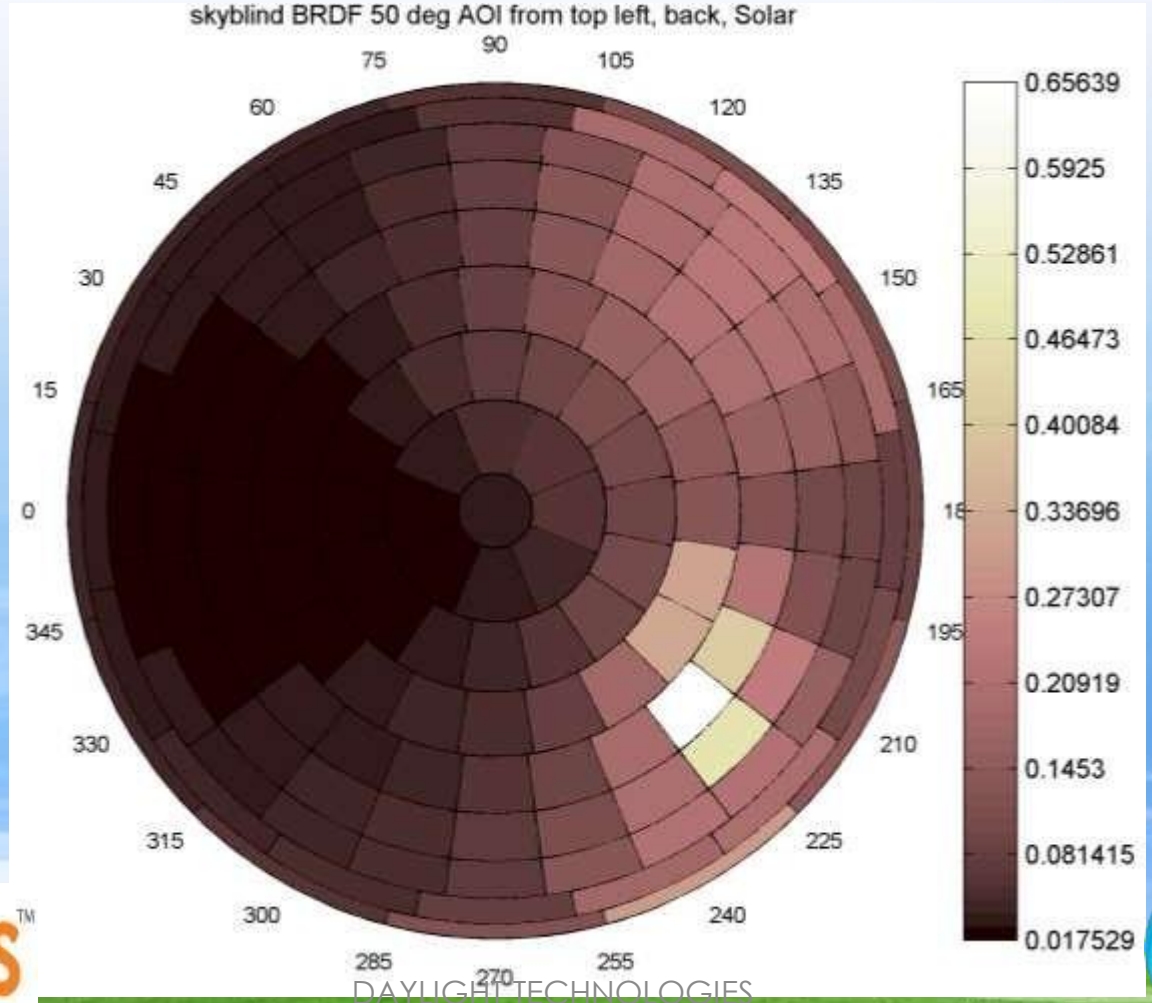


V.T- Vision Transmission

L.T- Light Transmission

Light Characterization:

Skyshelves light transmission & distribution properties are characterized to help in Building glazing simulation. (CEPT, India-LBNL, USA) has successfully done this under LBERD programme.

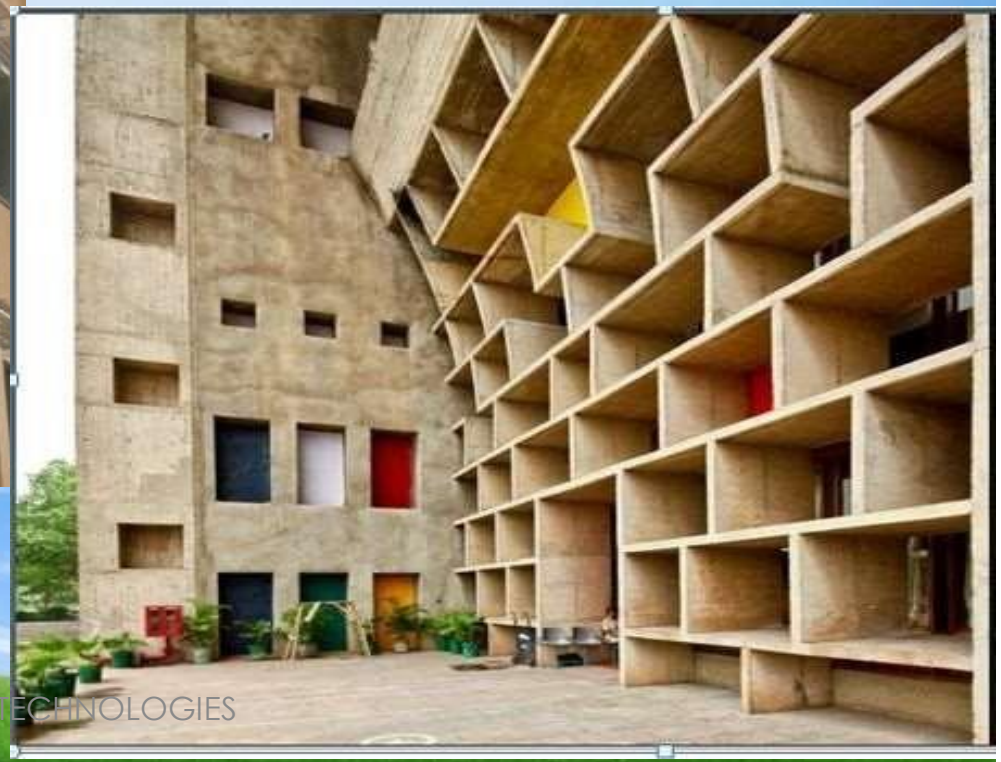


Skyshelves Thermal Imaging Report – South face Glazing

- Double Glazed Clear Glass Temperature is 40°C.
- Skyshelves VG Temperature is 33°C. Temperature Difference is 7°C
- Thus, helps in reducing heat gain and air conditioning loads

Skyshade™

Use of external shades to cut down the direct transmission of solar radiation is unnecessary with use of Skyshelves



Skyshelves™

Office application

Integrating daylight with controls

Why Daylighting need to Integrate with Electric lighting?

- **Daylight flux is not constant through the day**
- **Improves energy efficiency by maximum use of Daylight over 9-11 hours per day**

Integration Strategies- Top Lighting

Open loop method:

The lighting sensor views the Daylight directly and does not see the area lit by electric lighting.

Features:

- **Large open areas**
- **One sensor is good enough to control large area**
- **Manufacturing spaces, Big box retailers, Warehouses**

Day 360™ Hybrid Lighting Energy Monitoring System

Lightpipe ™/Norikool ™

RS–485 Comm

RS–485 Comm

Lighting Controller

Control Panel

Cloud Based Lighting Energy monitoring system

Hybrid Lighting system

Internet over cat5cale/Wi-fi/Gprs

Daylighting

Electrical Light-T5/Dimmable LEDs

Skyshade™

Methods of Daylight & Electric light integration

Top Lighting:

- **For a given building & climatic zone and illuminance, Daylighting analysis done**

DAYLIGHTING ANALYSIS

Product:-Skylight

Dome Skylight Effective Aperture = 1.07%, Skylight to Floor Ratio (SFR) = 1.77%

Average daylight footcandles (fc)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	0	0	0	0	0	0	0	0	9	32	60	74	77	71	61	47	31	13	0	0	0	0	0	0
Feb	0	0	0	0	0	0	0	0	13	40	72	86	90	82	72	56	38	19	2	0	0	0	0	0
Mar	0	0	0	0	0	0	0	2	24	57	85	101	88	78	82	65	47	25	5	0	0	0	0	0
Apr	0	0	0	0	0	0	0	8	35	67	90	92	58	57	77	69	47	25	7	0	0	0	0	0
May	0	0	0	0	0	0	0	12	37	65	84	84	52	53	75	67	49	25	7	0	0	0	0	0
Jun	0	0	0	0	0	0	0	9	30	46	63	68	60	58	63	56	37	22	8	0	0	0	0	0
Jul	0	0	0	0	0	0	0	6	22	41	53	62	58	56	56	49	37	22	8	0	0	0	0	0
Aug	0	0	0	0	0	0	0	4	22	41	56	60	60	53	54	46	37	19	6	0	0	0	0	0
Sep	0	0	0	0	0	0	0	4	23	44	61	69	65	62	54	40	26	13	1	0	0	0	0	0
Oct	0	0	0	0	0	0	0	2	19	42	61	76	77	69	55	39	20	6	0	0	0	0	0	0
Nov	0	0	0	0	0	0	0	1	18	42	65	71	73	66	56	38	22	5	0	0	0	0	0	0
Dec	0	0	0	0	0	0	0	0	12	36	57	70	73	65	54	37	24	6	0	0	0	0	0	0

Design Illuminance = 30 fc

< 1 fc; < 15 fc; < 30 fc; > 30 fc;

NOTE: 1 Foot-Candle = 10.764 Lux

Sky lighting System Description	
Skylight unit size (ft^2)	12.9
Number of Skylights	80
Total Skylight Area (ft^2)	1,033
Skylight to Floor Ratio (SFR)	1.8 %
Floor Area per Skylight	730(ft^2)
Building Area	5,426.9172 Sq.m / 58,394 Sq.ft
Average Illuminance	250 - 300 Lux
Climate Location	Pune

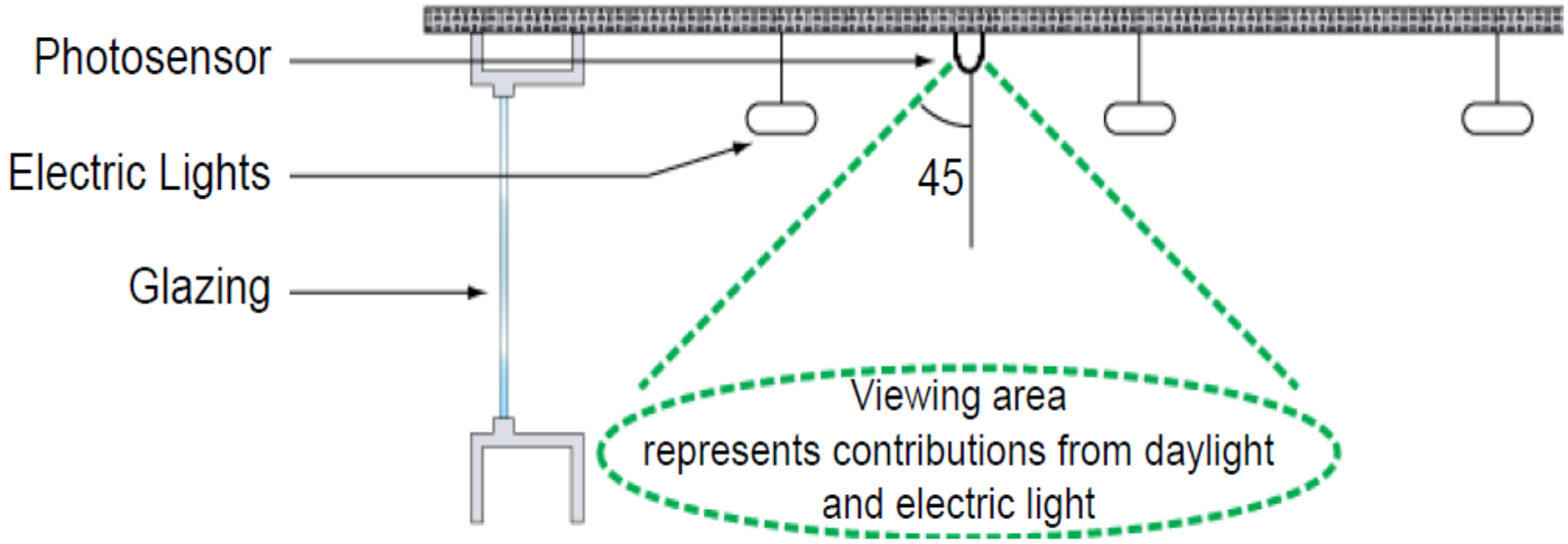
Integration Strategies- Side Lighting

Closed Loop Sensor:

The light sensor is exposed to area lit by electrical light & Daylight.

Features:

- **Require one photo sensor in every space/zone**
- **Offices, Cabins, Schools etc.**



The hybrid daylighting system has potential to generate huge energy savings and will payback its capital cost.

Energy savings are 70-80% for buildings operating 10-12 hours a day.

Energy savings are 40-45% for buildings operating 24 hours a day.

Thank You

- SKYSHADE DAYLIGHTS PVT LTD
- info@skyshadedaylights.com
- 04-040204022/33

Winner of *5 National awards* for Product innovation in Daylighting


Any
Questions


END OF
WEBINAR..

NZEBs Case Studies

Case studies of energy efficient and net zero energy with a focus on India, provide important insights to the feasibility of the concept.

Considering the concept is still in its nascent stage in India, it is very useful to study how architects and building owners have gone about setting net-zero and energy efficiency goals in the selected buildings. Moreover, the selected case studies are in various stages of design and implementation, with some already in the measurement & verification stage, enabling the demonstration of different aspects of net-zero implementation. This section contains the details of operational NZEBs, and will be updated periodically as more NZEBs emerge on the horizon.

The focus of the case studies is on the energy efficiency measures that have been implemented in the projects, the range of energy performance indices (EPI) the

NZEBs in India

international case studies

detailed case studies

nalanda university [PACE-D pilot]

8th August, 2019

@ 4 PM

High Performance Glazing Technologies

Presentation by

Venugopal,

Saint Gobain Glass Academy

NZEB Tours

Plant 13 Annexe, Mumbai
9th August

CARBSE at CEPT, Ahmedabad
24th August

NZEB International Conference

15-16 October, Delhi

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NZEBs Case Studies

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