

Rooflighting Only Works In Western Context “A Myth”

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Abstract- This paper talks about the generalised idea of rooflighting enhancing its cons with specific examples. The rooflighting guidelines are not yet firm with the tropical climate hence this paper does not discuss about the temperatures in particular. Traditionally, skylights have been a European concept, where natural light is a scarcity. India is a country full of natural light. With more than 300 bright sunny days a year, why would we need a skylight anyway? However, in the recent past, the design trends have changed. The living patterns have changed. More so, to accommodate the western style of architecture and living. Contemporary designs are more popular now even in India. So, why not fancy skylights? However, if we do not follow certain aspects of designing a proper skylight customised to the Indian climatic conditions, it might be a disaster and one might be living in an ‘oven’ practically. Choosing a proper design along with material that are more suitable for local conditions is the key while incorporating a skylight into your building. If you’re confused about the various terms ‘roof light,’ ‘skylight’ or ‘roof window,’ and what is best in your case, then don’t worry. You wouldn’t be the first person to be confused by it. The fact is, there is little or no difference between the meanings of the different terms. It has just happened that, over time, these different terms have become popular alternatives for what is essentially the same thing. On this website, you will see these different terms cropping up frequently. This is because different people use different terms to search when, really, they are searching for the same thing. Whether you call it roof light, skylight or roof window, the aim remains the same: maximise the natural light levels (and in the cases of non-fixed models – ventilation too) coming into a room or living space.

Keywords- Daylight, rooflight, window, western , ventilation, light , climate , glazing, scope, material.

I. INTRODUCTION

Rooflights now tend to refer to products fitted within a flat roof, or installed on a pitched roof that’s positioned out of plane with the level of the tiling i.e. standing out from the roof line more so than a roof window would. Another key difference between a rooflight and a skylight is that the former

can be installed within listed buildings where new window openings in walls are not permissible. That’s because rooflights do not need to alter the external aesthetics of a building in order to provide abundant levels of natural daylight to the interior.

Daylight is a vital natural resource that will significantly improve the environment within any building. Rooflights provide three times more light than the same area of vertical glazing. They can also provide a much more even distribution of light, particularly in larger structures. Where vertical glazing exists, the effective area for natural lighting will only be within 6m of the wall containing the window. These facts are well understood by most people involved in building design. However the huge potential of rooflights to provide exactly the amount, type and distribution of natural light required to meet any given specification is not always appreciated. Rooflights can help to provide natural light with qualities appropriate to the use of the building.

AIM

To study the scope of rooflighting.

OBJECTIVE

- To study rooflighting in different climates
- To study the material suitable for rooflighting.
- To study the designing of rooflighting.
- Different types of rooflighting.
- Where is the technique of daylighting suitable the most?

LIMITATION

- Details of rooflighting fixing
- Temperature ranges for rooflights

NEED

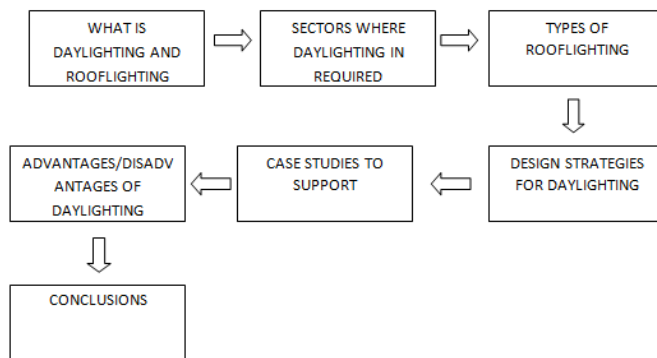
- Adds life and variability to a dull and small spaces
- Add high quality, dependable illumination for indoor spaces
- Color enhancement and high illumination

- Reduction on artificial light, proportional to cost.

WHY DIFFUSED LIGHT?

- Natural sunlight is too bright for comfort
- “Hot spots” of excessively bright non-difused light will cause thermal discomfort.

METHODOLOGY



II. SECTORS WHERE DAYLIGHTING IS REQUIRED

1. INSTITUTIONAL

In the education sector Research demonstrates a clear correlation between classrooms with good natural light and improved student performance and even attendance. This is because in natural light children concentrate better so are more focused and less easily distracted. Some studies suggest that health is also enhanced helping to explain the improved attendance.

2. HEALTHCARE SECTOR

Seasonal Affective Disorder, a clinically diagnosed condition in which the lack of sunlight in winter makes people feel ill. Natural light helps people to feel better but it can also aid the healing process. In hospitals, studies have proven that the recovery rate of patients is accelerated where levels of natural light are increased.

3. PUBLIC

Public Buildings and transport facilities. As a free, natural resource, daylight not only improves the environment in large public spaces: it helps to control energy costs and improves safety levels for building occupants.

4. IN DOMESTIC PROPERTIES

and leisure facilities People like bright naturally lit environments, evidenced by the huge popularity of domestic conservatories and sunrooms. It is therefore logical that in their leisure time people prefer facilities enjoying high levels of daylight. Many sporting and recreational facilities have been designed to maximize natural daylight in recognition of this.

5. IN COMMERCIAL AND RETAIL ENVIRONMENTS

Daylight improves concentration so that working environments, be they factories or offices with natural light, tend to achieve increased productivity. Research into retail environments suggests that in many situations sales tend to be better in naturally lit locations; colours are more vivid and true, making goods appear attractive and encouraging customers to spend more time in these areas, leading retail organizations include large areas of rooflights in specifications for all new build projects to ensure a high percentage of evenly distributed natural light within the interior.

III. TYPES OF DAYLIGHT

Rooflights are not only the most effective way of allowing natural light into a building; they can also determine the type and amount of light entering the building.

DIRECT LIGHT

As the name suggests light passes through the rooflight without any disruption or interference, entering the structure as a straight beam. It therefore gives strong light in a given area but less general light in the surrounding area. It is useful where strong light is required in an area for close detailed work such as painting, or in situations where a very natural environment is desired, or the designer wants people in the building to see the sky through the roof. Direct light will result in shadows and glare on sunnier days. Polycarbonate, PVC and glass in clear and most tinted options provide direct light.

DIFFUSED LIGHT

As the light passes through the rooflight it is scattered giving a much more even distribution of light into the structure below. It is useful when the requirement is for ambient lighting over a large area with minimal shadows. Most industrial, commercial and sporting facilities prefer diffused light for these qualities. GRP in all forms, solid and multi-wall polycarbonate, PVC, and glass in patterned and opal tinted forms all provide diffused light.

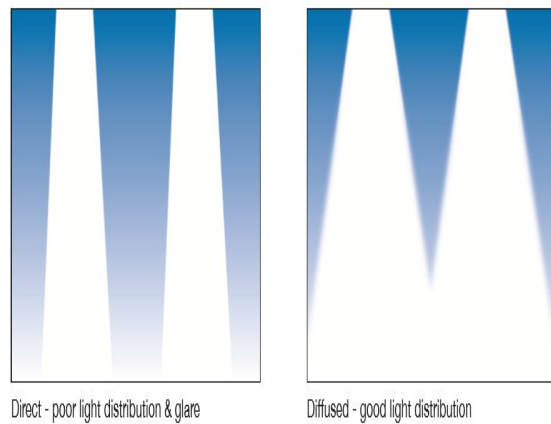


Fig. 1- Direct and diffused light

IV. TYPES OF ROOFLIGHTING

There are many types of skylights depending upon the materials, type of use, types of roof and room type. Some types of skylights are discussed below.

1. Fixed skylight
2. Ventilated skylight
3. Tubular skylight
4. Custom skylight
5. Pyramid skylight
6. Dome acrylic skylight
7. Barrel vault skylight

- Fixed skylight

The most popular type of skylights are fixed skylights. These type of skylights doesn't open for air ventilation. They are completely sealed to the roof. Fixed skylights are very similar to ventilating skylights overall. The biggest difference is simply that they don't provide ventilation. If you don't necessarily need ventilation in the room where you want to add some lighting, then looking into a fixed skylight would be smart. There are those who prefer the fixed skylight option simply because these are perfect for installing in hard to reach areas.

Fixed skylights are used at low lit areas like stairwell and attics. 90% of the materials used in this is glass. The frame of the skylight is made up of aluminum or timber or steel.



Fig. 2- Fixed Rooflight

- Ventilated Skylight

Ventilated skylight is a multi-purpose type of skylight. It does the work of ventilating of light and air. These types of skylights are well suited for kitchen and bathrooms, so that it can remove excess of moisture and keep constant flow of fresh air in the building, while illuminating the place.

This skylight can be controlled manually or automatically or even remote controlled. While rain starts it closes automatically and so on. Due to constant flow of air in the building the need of electrical equipment's like AC are not required. People like to choose the ventilating skylights because of the ventilation that they can provide. These lights are often installed in bathrooms, kitchens, and washrooms because these are the rooms most in need of ventilation. The excess moisture in these areas needs a place to escape and the ventilating skylight is a perfect solution. You'll love the way that this new feature will look in your home and it has many practical benefits as well.

The only problem with ventilating skylights is that not everyone will have the room to install one. One of the reasons why people may have to shy away from this style is that it simply takes up a significant amount of space on your ceiling. It isn't impractical for most people, though. In most cases, you should be able to make use of this type of a skylight, as long as your house isn't really small.



Fig. 3-Ventilated Rooflight

- Tubular Rooflight

The new type of rooflights in the market are tubular skylight or tube skylight. When the roof space required for fixed and ventilated skylight is not available or very small roof space is available for skylight, this type of skylights is preferred.

Tubular skylight consists of a small tube shaped pipe of diameter around 10-15 inches covered with a spherical dome on the top. This dome collects the light and transmits the light to tube. The tube is made up of silver finished mirror type quality, so that the light transfers completely without any loss of light. This skylight illuminates the rooms evenly. This can be used for specific lighting of objects like living walls or aquariums.



Fig. 4-Tubular Rooflight

- Pyramid Rooflight

This name of the skylight is given depending on the shape of pyramid. This pyramid shaped rooflight has one horizontal purlins. It can be made of any size depending upon the requirement of use. This type of skylight is usually preferred for lobbies, entry spaces and other large spaces. The seal between the glass and purlins is to be properly made as the chances of leak are high. This skylight can be 20 ft. wide and the length may vary as per requirements.



Fig. 5- Pyramid rooflight

- Dome Acrylic Rooflight

These dome shaped skylights are made up of strong and flexible plastics. The shape is in the form of dome as the sunlight is evenly spread rather than direct rays penetrating in the room. If the sun light is not directly coming in the rooflight even in small light, this rooflight lights up the room. Mostly this rooflight comes in two layers for protection and insulation. This rooflights may also be used to advantage in building entrance foyers or spotlight attractive features such as sculptures, murals, paintings, planters etc.



Fig. 6-Dome acrylic rooflight

- Barrel vault rooflight

This type of rooflight is frequently used in non residential buildings. This cannot be used in the residential buildings as the area of the rooflight is more, privacy aspects are very less. In this type complete or more than 80% of the area is covered by rooflight. This type of rooflight is preferred usually in passageways, canopies, parking shelters, mall arcades, medical and educational institutions and industrial complexes.



Fig. 7- Barrel vault rooflight

V. DESIGN STRATEGIES FOR DAYLIGHTING

- OPTIMIZE URBAN DESIGN AND BUILDING ORIENTATION:

The large scale design for daylight starts with urban planning. Create districts and buildings in a form that people receive daylight as their source of light and heat as well as views where and when they want it. This strategy is of course dependent on the specific climate and location. A careful design of a building height forms the basis for avoiding excessive shading from nearby buildings or from different building wings. The next factor is the orientation of the architecture to maximize exposure, for example a south direction for the northern hemisphere. In addition northern exposure should be optimized for indirect diffuse lighting. Finally, enlarge as much as possible the perimeter footprint in order to maximize the daylight for interior spaces. For harvesting daylight, long and narrow building forms work better; atriums offer additional possibilities.

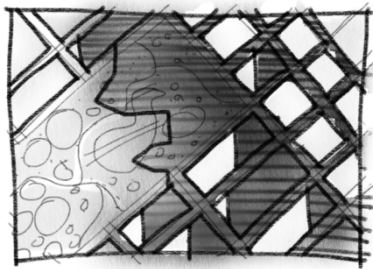


Fig. 7- Optimize urban design and building Orientation

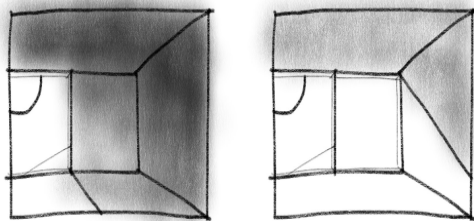


Fig. 8- Size of the Glazing

• **THE PERFECT SIZE, FORM AND GLAZING TREATMENT FOR WINDOWS:**

Analyse your climate regarding the four forms of daylight for each façade - including the roof:

1. Direct sun,
2. Indirect sun due to reflection from other buildings,
3. Direct cloudy sky and
4. Indirect cloudy sky, which is reflected on the ground.

In the northern hemisphere, the south windows should not be oversized and they need protection against direct

sunlight to avoid glare and heat. In contrast, the cool north facades mainly receive diffuse light and require window treatments with low heat losses.

• **SHADING FOR VISUAL COMFORT AND COOLING**

The intense rays of sunlight are critical for visual and thermal comfort. Therefore block the direct sunlight for workplaces and provide screens for glaring sources like neighbouring glass facades, which reflect the sunlight. In summer daylight could easily lead to overheating in buildings with large glass façades. This results in higher energy consumption for cooling. For that reason shading is essential to control thermal comfort. Take a tree to reduce glare and heat in the summer and let the rays of sunlight warm up your building in the winter when the leaves have fallen. For technical solutions, prefer exterior shading elements, which are much more effective than interior, because they keep the heat directly out of the building. In addition, plan movable shading elements for the daily and seasonal changes and let sensors and control systems help you optimize shading for visual comfort and cooling.

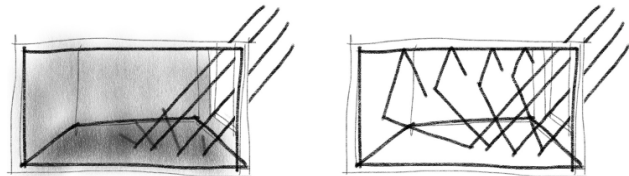


Fig. 9- Shading for visual comfort and cooling

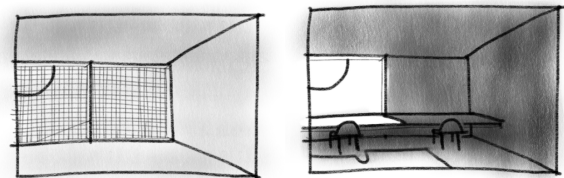


Fig. 10- Working with bright interiors

• **WORK WITH BRIGHT INTERIORS**

Design your interior surfaces with high reflectance to increase the daylight level in the depth of the space. Be careful with shiny and very bright surfaces that could cause glare. Therefore use matte light colours to improve the visual comfort. For a bright room impression, keep away from dark surfaces, especially on the back wall.

• **MOVE TASK AREAS CLOSE TO WINDOWS**

Detect functions that would benefit the most from daylight in relation to the time of occupation. Offer

workplaces access to daylight and keep service rooms in the core of the building. Make sure that furniture does not block the daylight. You could even provide daylight to corridors by using translucent partition wall.

VI. CASE STUDIES

INDIAN HABITAT CENTRE, NEW DELHI

LOCATION : LODHI ROAD, NEW DELHI

ARCHITECT : JOSEPH ALLEN STIEN

Climate : COMPOSITE

Summers are very hot, winters are very cold.

Building type: Recreational / mixed use

The complex is built on an area of **9 acres** with a super built up area of **97,000 sq.mt.** and can be accessed through three sides, segregating vehicular and pedestrian movement. The courtyard being green, creates an image of a tropical rainforest with a constant airy flow through spaces. Use of Shading devices reflect back 70% of the summer heat. It is designed as a space frame structure with **Blue Reflectors** that can be aligned providing shade during summer and allows winter sun to enter. Sunlight streams into the complex creating beautiful patterns on the textured surface with the time of the day.

INFERENCE

- Even in scorching heat of Delhi, the courtyard doesn't feel hot at all. Functional in both summer and winter. Shading device reflect back 70% heat in summer.



Fig. 11- Indian Habitat Centre, New Delhi

CEPT UNIVERSITY, AHMEDABAD



Fig. 12- CEPT University, Ahmedabad

SCHOOL OF PLANNING AND ARCHITECTURE, CEPT

LOCATION: AHMEDABAD, GUJARAT

ARCHITECT: B.V DOSHI

CLIMATE: HOT AND DRY

BUILDING TYPE: INSTITUTIONAL

Site is on the western fringe of Ahmedabad, where hot dusty winds might roll in from the not too distant desert. The studios needed north light and it made sense to exclude the hot afternoon sun by presenting blank walls to the west. If openings were cut deeply enough they could catch the south-west wind without letting in glare. The building is oriented along the E-W axis with openings on N and S. Studios are designed keeping in mind the climatic needs and comfort of its users.

INFERENCE-

- Requirement is quite reflected being an Institutional building . Also proves to be a source of ventilation.

VII. ADVANTAGES AND DISADVANTAGES

ADVANTAGES-

- 1) They provide more natural ventilation of both air and light.
- 2) It improves the aesthetical appearance of the building.
- 3) It minimizes the need of artificial lightning in the room.
- 4) It provides a healthy dose of Vitamin D, as the sunlight enters directly into the room.
- 5) It maintains the temperature balance in the room by constantly replacing the hot air by fresh and cool air by the ventilated skylight.
- 6) Thus reducing the use of Air Coolers and reduces the emission of greenhouse gases.

- 7) The eco-friendly addition of natural lighting means that skylights can also increase the resale value of a home.
- 8) Use of tinted glasses reduces the glare effect and evenly distribute the light in the building.

DISADVANTAGES-

- 1) The major disadvantage of the skylight is that the amount of light and heat cannot be controlled that comes through the skylights.
- 2) In summer days, due to more heat coming through the skylights, need of artificial cooling of room is required.
- 3) In winter days, due to heavy snow fall the temperature inside the room decreases due to the skylight.
- 4) Accumulation of dust in the skylights, which needs to be cleaned regularly.
- 5) As the placement of the skylight is in the roof, cleaning of the skylight becomes a hectic job.
- 6) The installation cost and maintenance of the skylight is more when compared to normal windows.
- 7) Due to the improper sealing of skylights, leakage is the major problem faced in the homes.

VIII. CONCLUSION

India is a country full of natural light. With more than 300 bright sunny days a year, why would we need a skylight anyway?

The living patterns have changed. More so, to accommodate the western style of architecture and living. Contemporary designs are more popular now even in India. So, why not fancy skylights. Choosing a proper design along with material that are more suitable for local conditions is the key while incorporating a skylight into your building.

IMPORTANCE OF GLASS SELECTION In case of an all fixed skylight, one needs to make sure to use a low E laminated safety glass, that would bring in a minimum possible amount of heat without affecting the incoming light much. The best option would be to have skylights that open. Depending on the design, size, space availability, etc. these could be manually or electrically operated. This could work fantastically if other openings within the vertical walls below the skylight are designed appropriately. An open skylight above and open windows below would create a natural air draft. Let's not stick to the idea of not using much roof lighting techniques in India, and spread our wings towards the use of inhabiting daylight in correct manner.

Thus by understanding its proper application, enhances the spaces and creates a comfortable zone without any mechanical devices or with minimum use. While

designing the buildings, both Architects and Civil engineers should take care of adequate daylight inside the building, improve the productivity levels and keep the indoor in comfortable conditions in a natural way contributing towards energy conservation and sustainable architecture.

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