



دانشگاه سمنان

تنظیم شرایط محلی

نور روز در معماری

مدرس: دکتر سعید مقیمی

پاییز ۱۳۹۹

Solutions for optimal

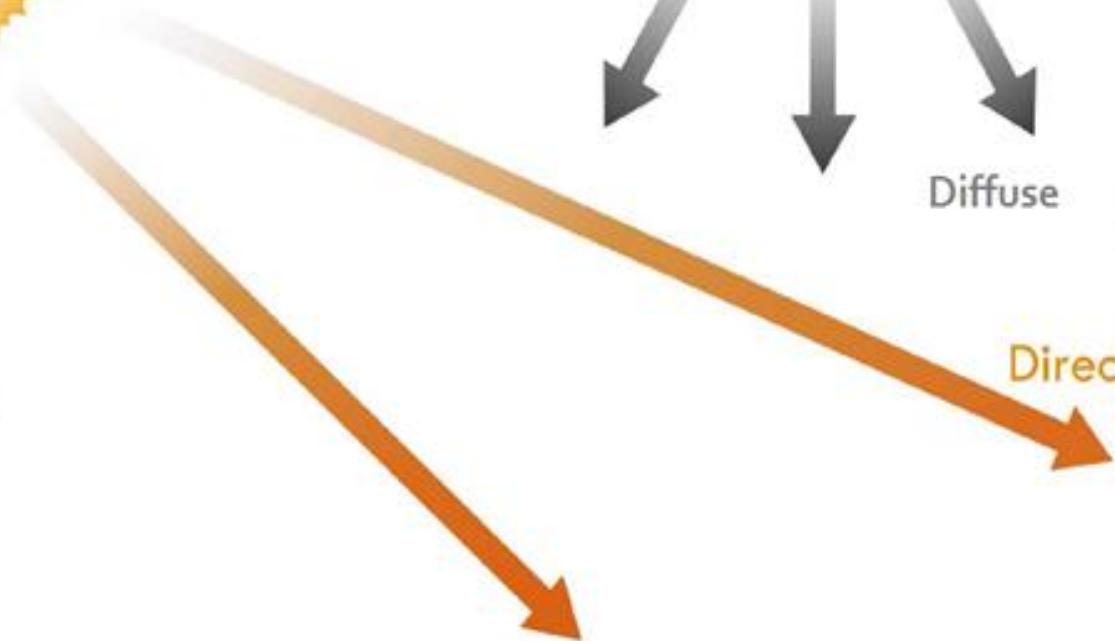
day lighting use

Daylight

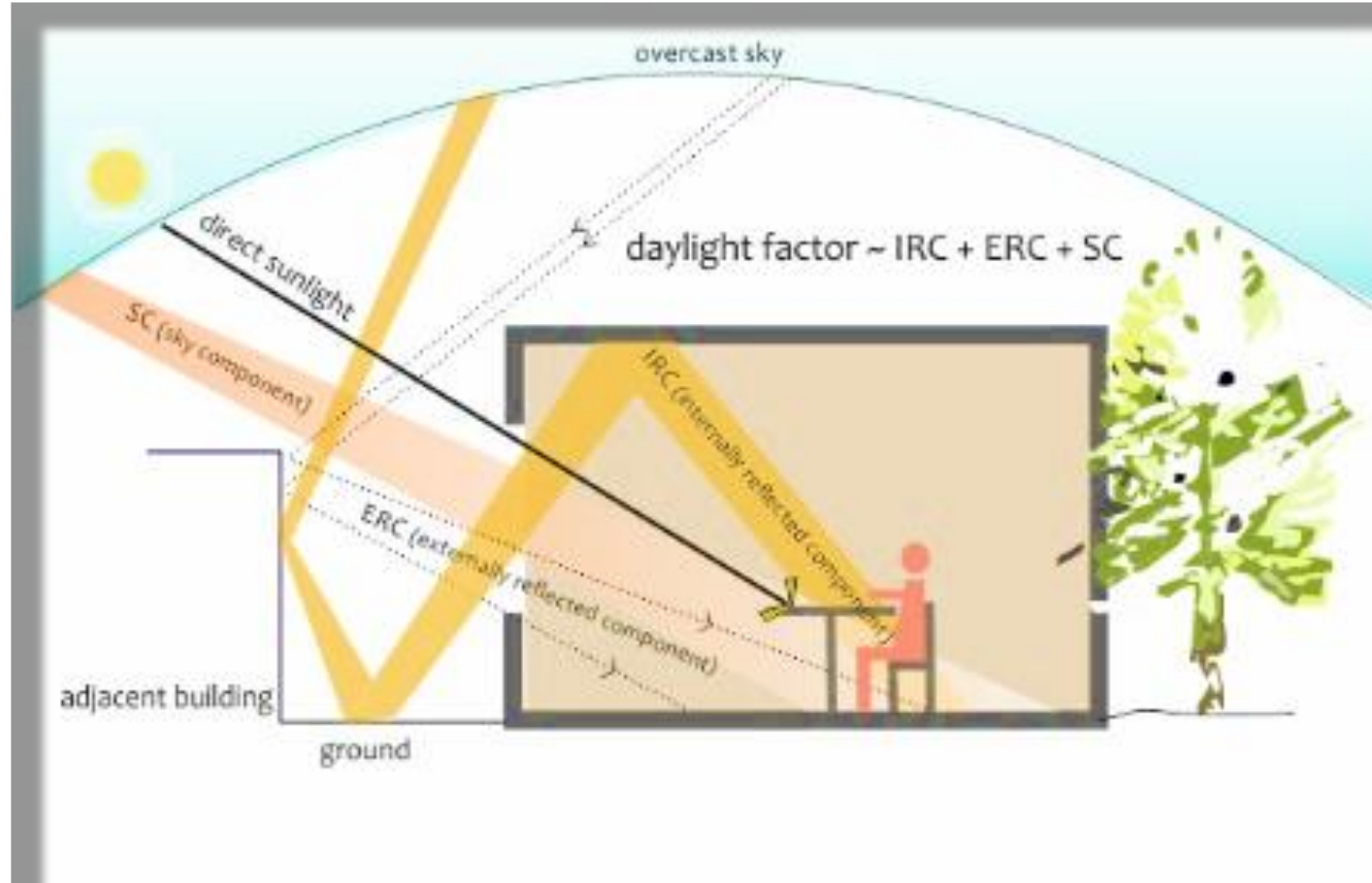
Daylight consists of direct and diffuse light. Direct light is radiation directly coming from the sun. Diffuse light is light that is scattered in the earth's atmosphere or reflected by objects. Direct light can be experienced as bright and uncomfortable, diffuse light as soft and cool.



Diffuse



DIFFERENT ASPECTS OF DAYLIGHTING



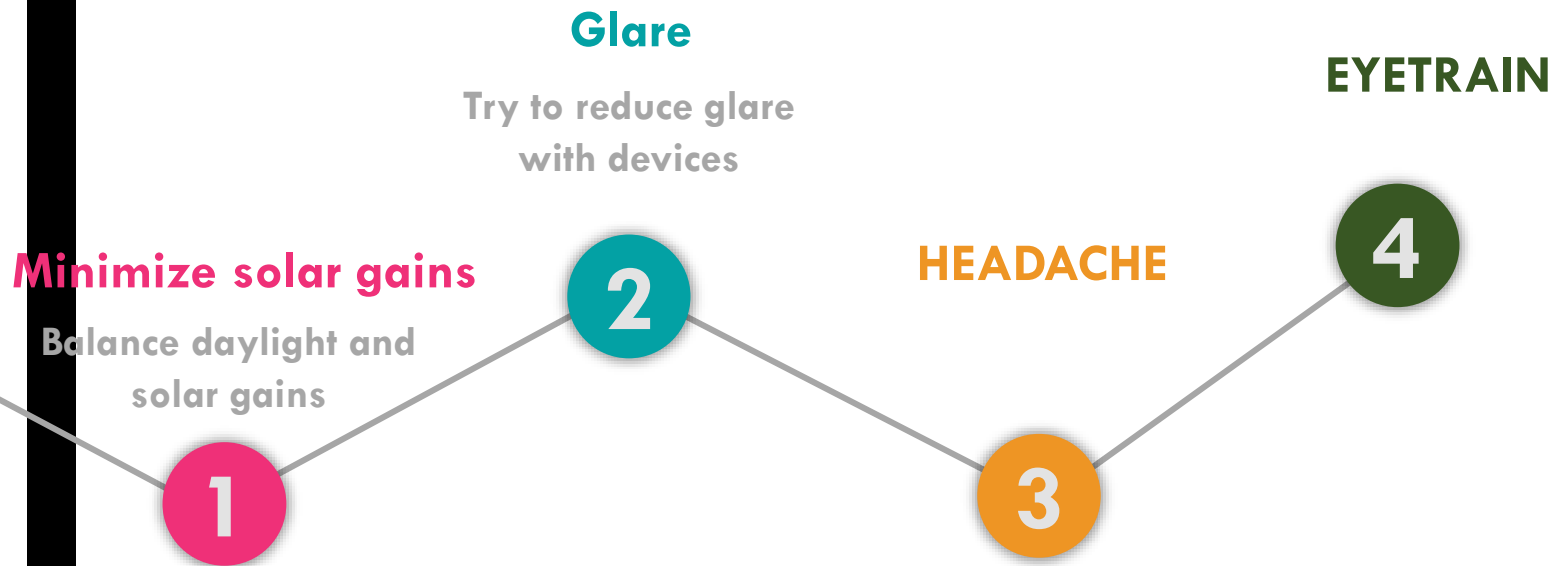
Daylight factor is used for determining daylight. It is equivalent to the sum of the diffused skylight (SC), internally reflected light (IRC) and externally reflected light (ERC). Quality and quantum of daylight entering a space can be controlled by modifying these three factors.

DAYLIGHT EFFECTS



Lighting control systems can reduce energy use from electricity by 20% or even up to 60% in certain conditions

PROBLEMS USING DAYLIGHT



کاربری	متوسط نور روز مناسب
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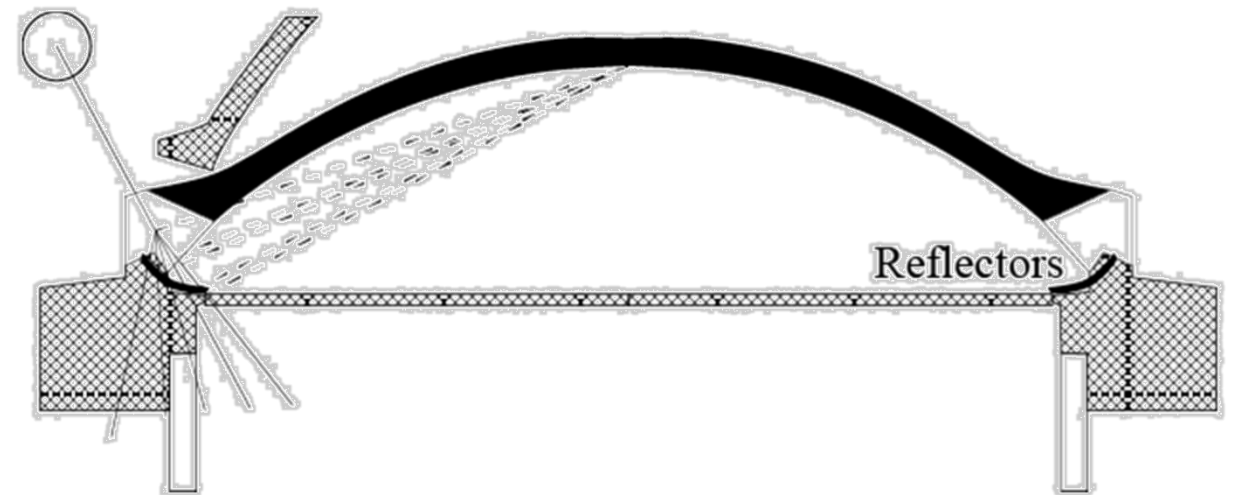
EFFECTIVE FACTORS IN DAYLIGHT



LATITUDE
LONGITUDE
ORIENTATION
BUILDING FORM
ANGLE OF RADIATION
TYPE OF SKY
WINDOW LOCATION
WINDOW DIMENSIONS

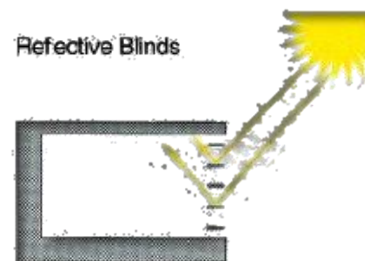
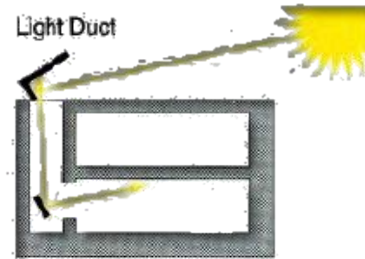
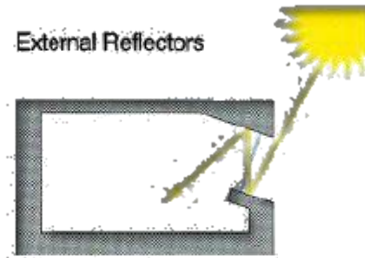
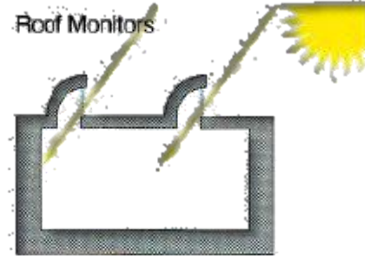
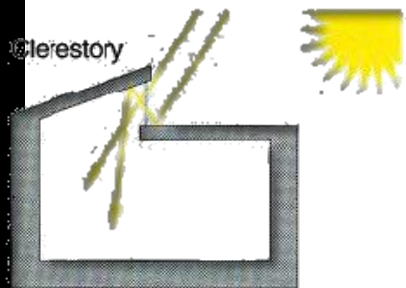
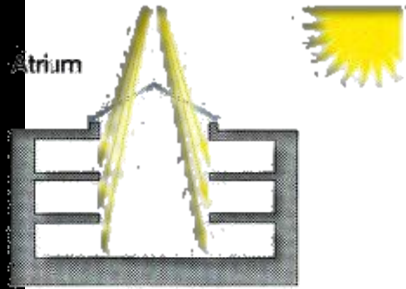
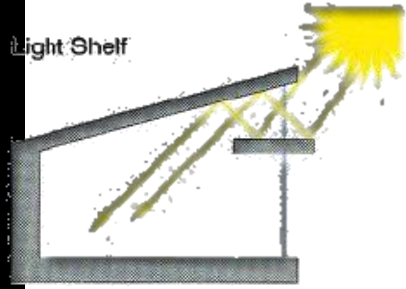
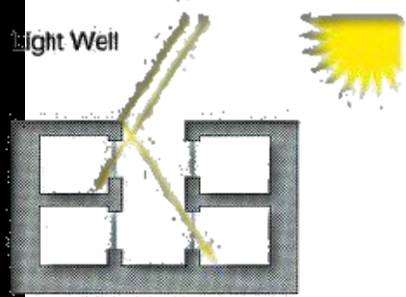


UESE DAYLIGHTING AT LAST


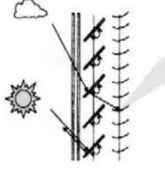
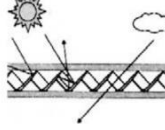
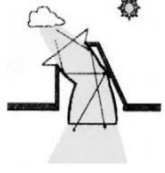
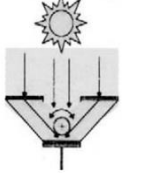
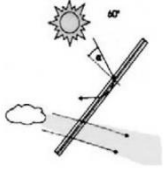


□ HAGIA SOPHIA MOSQUE

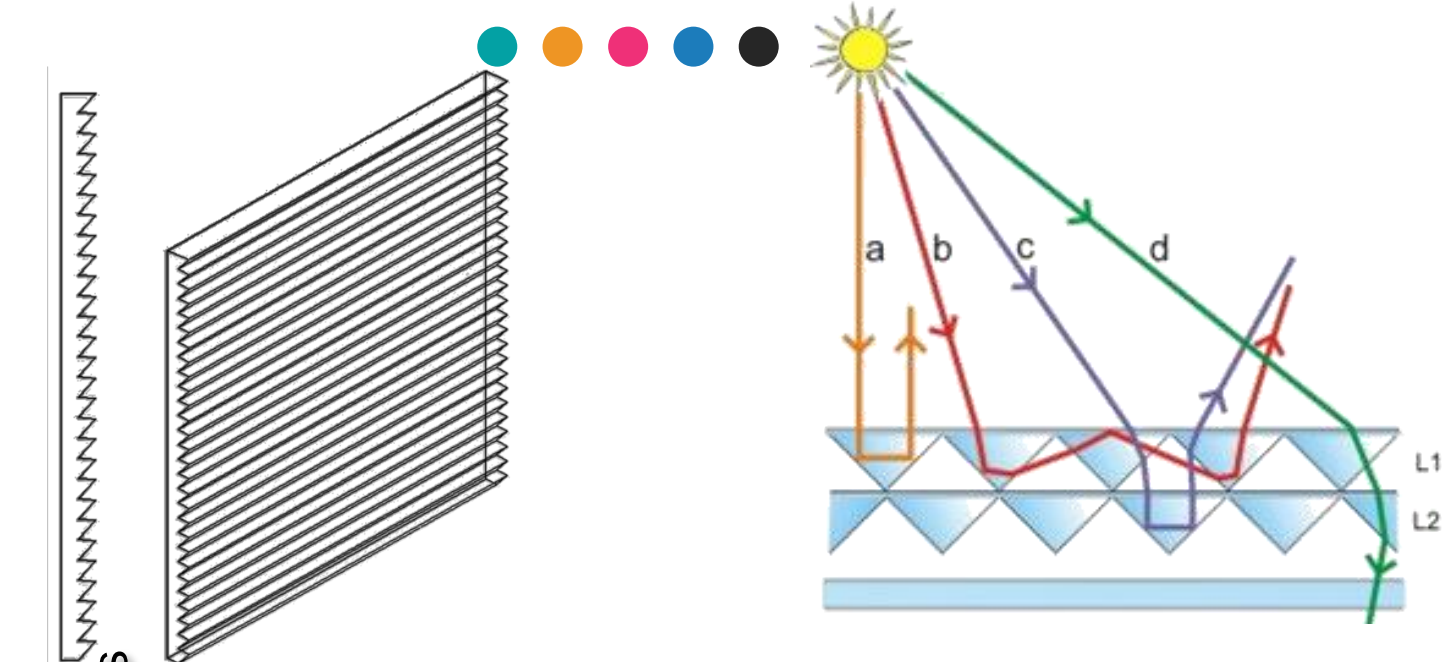
UESE DAYLIGHTING



Daylight can be delivered into a building with conventional techniques; windows, clerestories, etc. are common examples of side-lighting applications which have the disadvantage of only effectively illuminating areas that are located near them.

System	Climate	Attachment	Criteria for the choice of elements
Prismatic panels 	All climates	Vertical windows, skylights	<ul style="list-style-type: none"> - Glare protection (D) - View outside (D) - Saving potential (artificial lighting) - Need for tracking (D) - Available
Prisms and venetian blinds 	Temperate climates	Vertical windows	<ul style="list-style-type: none"> - Glare protection - Lightguiding into the depth of the room - Homogeneous illumination - Saving potential (artificial lighting) - Available
Sun protecting mirror elements 	Temperate climates	Skylights, glazed roofs	<ul style="list-style-type: none"> - Lightguiding into the depth of the room - Homogeneous illumination - Saving potential (artificial lighting) - Available
Anidolic zenithal opening 	Temperate climates	Skylights	<ul style="list-style-type: none"> - Glare protection - Homogeneous illumination - Saving potential (artificial lighting) - Testing
Directional selective shading system with concentrating HOE 	All climates	Vertical windows, skylights, glazed roofs	<ul style="list-style-type: none"> - Glare protection (D) - View outside - Saving potential (artificial lighting) - Need for tracking - Available
Transparent shading system with HOE based on total reflection (→ 4.2.3) 	Temperate climates	Vertical windows, skylights, glazed roofs	<ul style="list-style-type: none"> - Glare protection (D) - View outside - Homogeneous illumination - Saving potential (artificial lighting) - Need for tracking - Available

UESE DAYLIGHTING



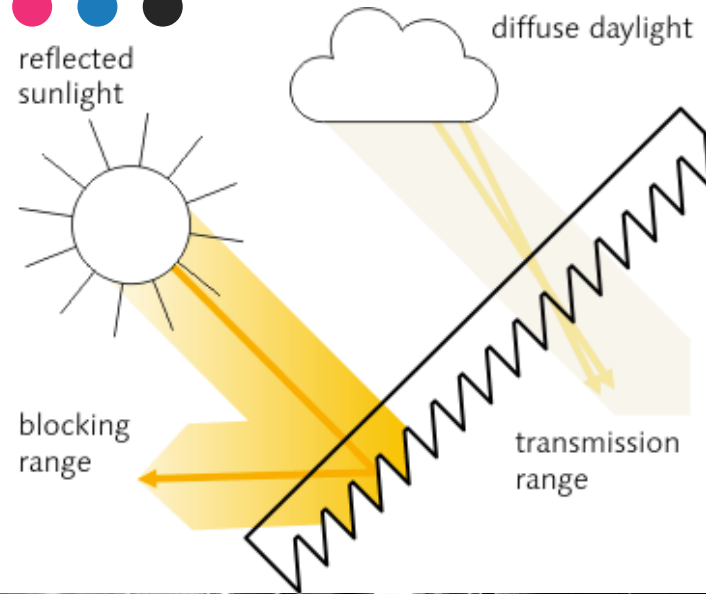
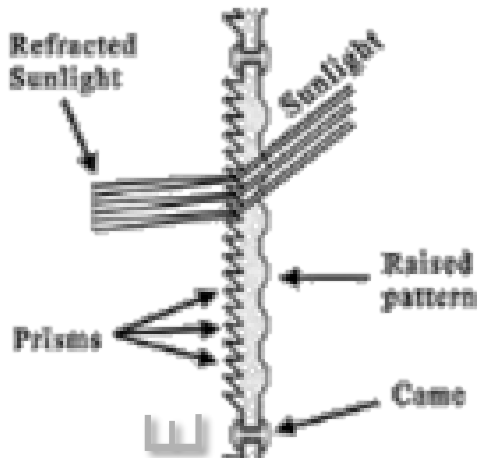
Prismatic panels
Prismatic panels
USE FOR ALL CLIMATES



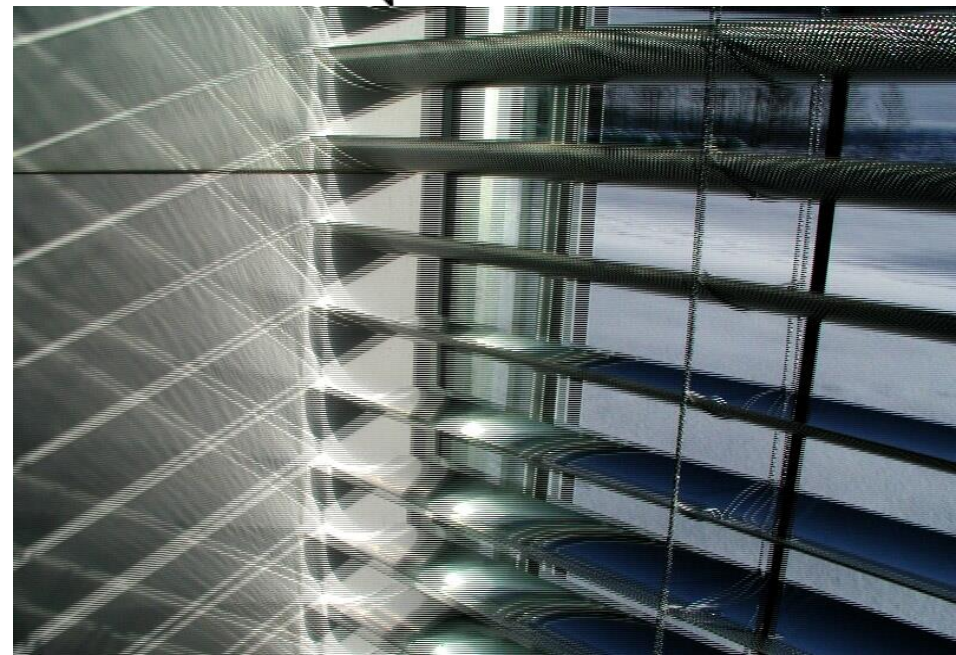
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UESE DAYLIGHTING

Prismatic Tile

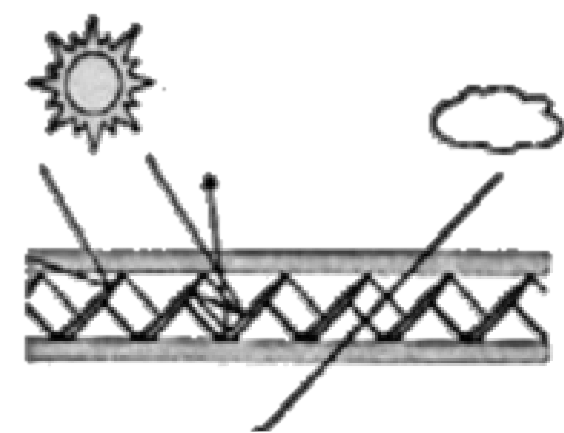


Prismatic panels
Prismatic panels
USE FOR TEMPERATE
CLIMATES



System	Climate	Attachment	Criteria for the choice of elements
Prismatic panels	All climates	Vertical windows, skylights	<ul style="list-style-type: none"> - Glare protection (D) - View outside (D) - Saving potential (artificial lighting) - Need for tracking (D) - Available
Prisms and venetian blinds	Temperate climates	Vertical windows	<ul style="list-style-type: none"> - Glare protection - Lightguiding into the depth of the room - Homogeneous illumination - Saving potential (artificial lighting) - Available
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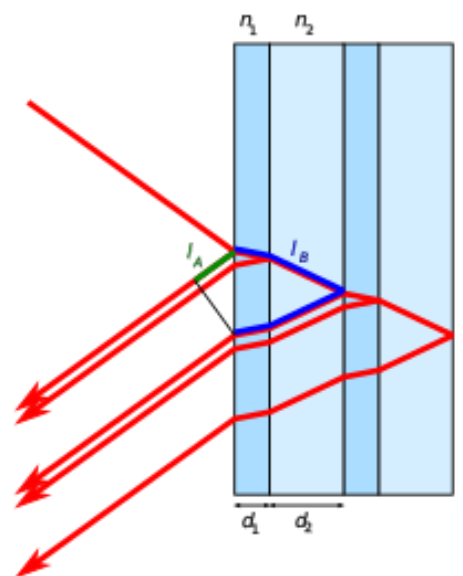
UESE DAYLIGHTING



Sun protecting Mirror elements

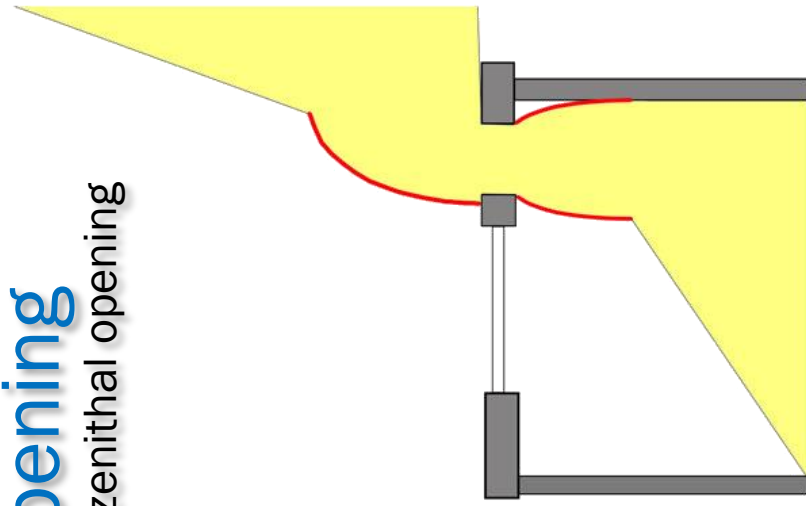
Sun protecting Mirror elements

USE FOR TEMPERATE CLIMATES



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Prismatic panels	All climates	Vertical windows, skylights	<ul style="list-style-type: none"> - Glare protection (D) - View outside (D) - Saving potential (artificial lighting) - Need for tracking (D) - Available
Prisms and venetian blinds	Temperate climates	Vertical windows	<ul style="list-style-type: none"> - Glare protection - Lightguiding into the depth of the room - Homogeneous illumination - Saving potential (artificial lighting) - Available
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UESE DAYLIGHTING



Anidolic zenithal opening



USE FOR TEMPERATE CLIMATES

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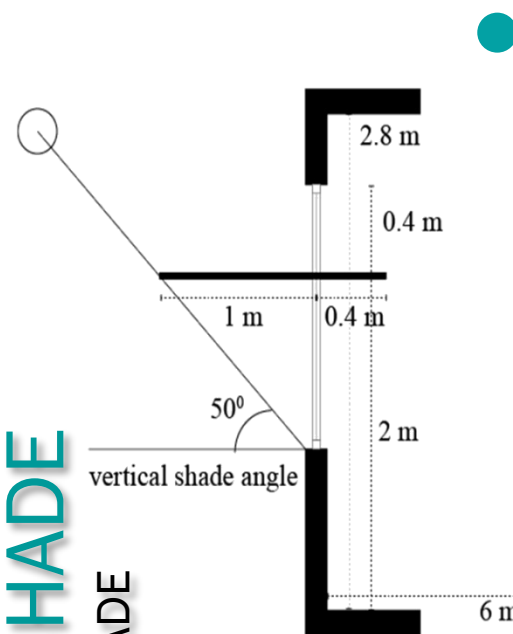
UESE DAYLIGHTING



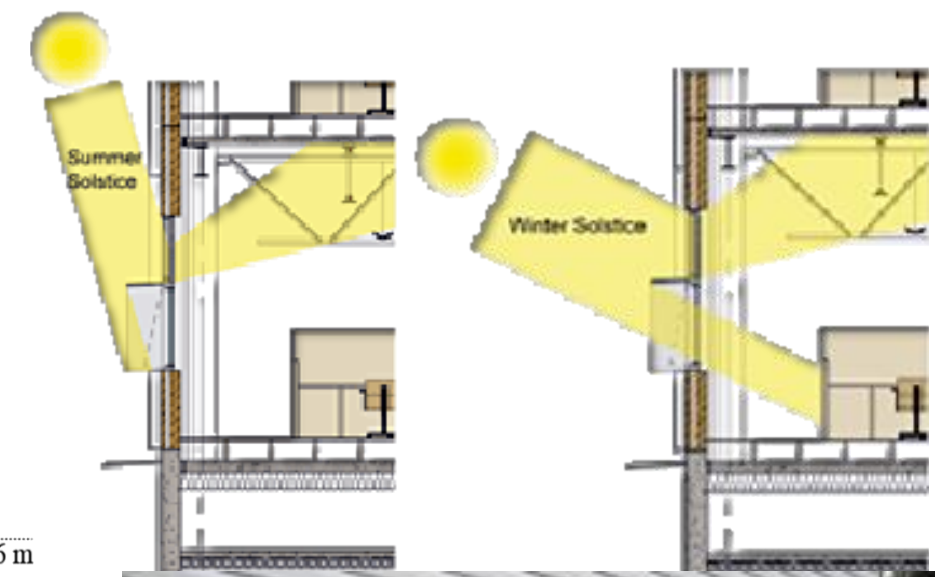
Directional Selective shading
 Directional Selective shading
 USE FOR TALL CLIMATES

System	Climate	Attachment	Criteria for the choice of elements
Light guiding shade	Hot climates, sunny skies	Vertical windows above eyeheight	<ul style="list-style-type: none"> - Glare protection - View outside - Lightguiding into the depth of the room (D) - Homogeneous illumination (D) - Saving potential (artificial lighting) (D) - Available
Louvers and blinds	All climates	Vertical windows	<ul style="list-style-type: none"> - Glare protection - Lightguiding into the depth of the room - Homogeneous illumination - Need for tracking - Available
Lightshelf for redirection of sunlight	All climates	Vertical windows	<ul style="list-style-type: none"> - View outside (D) - Lightguiding into the depth of the room - Homogeneous illumination - Saving potential (artificial lighting) - Available
Glazing with reflecting profiles (Okasolar)	Temperate climates	Vertical windows, skylights	<ul style="list-style-type: none"> - View outside (D) - Glare protection (D) - Lightguiding into the depth of the room (D) - Homogeneous illumination (D) - Variable solar heat gain coefficient - Available
Skylight with Laser Cut Panels	Hot climates, sunny skies, low latitudes	Skylights	<ul style="list-style-type: none"> - Lightguiding into the depth of the room - Homogeneous illumination - Saving potential (artificial lighting) - Available
Turnable lamellas	Temperate climates	Vertical windows, skylights	<ul style="list-style-type: none"> - Glare protection (D) - Lightguiding into the depth of the room - Homogeneous illumination - Saving potential (artificial lighting) - Need for tracking - Available

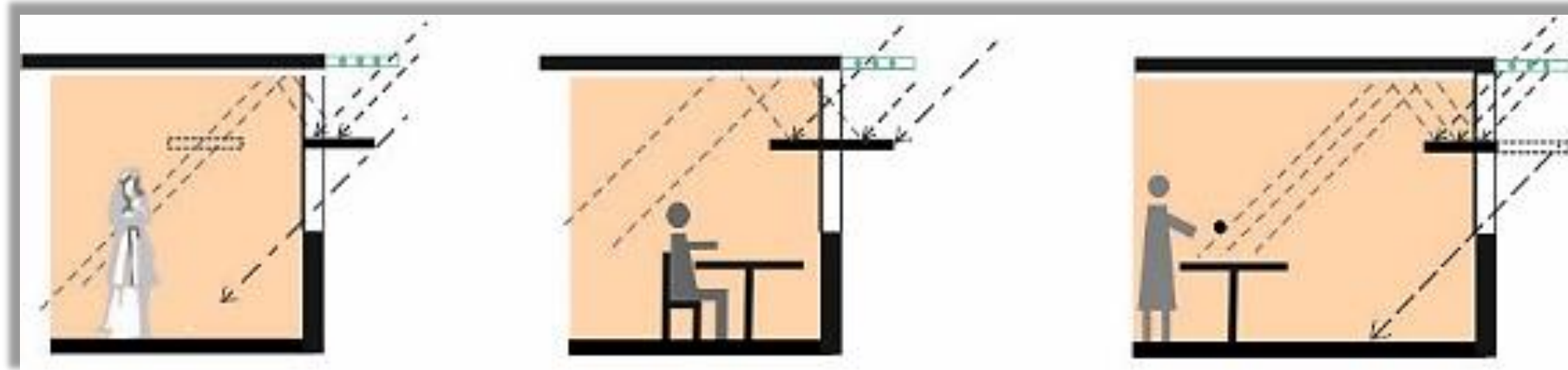
UESE DAYLIGHTING



LIGHT GUIDING SHADE
 LIGHT GUIDING SHADE
USE FOR HOT CLIMATES



UESE DAYLIGHTING



External light shelves allow diffused light penetration and shade.

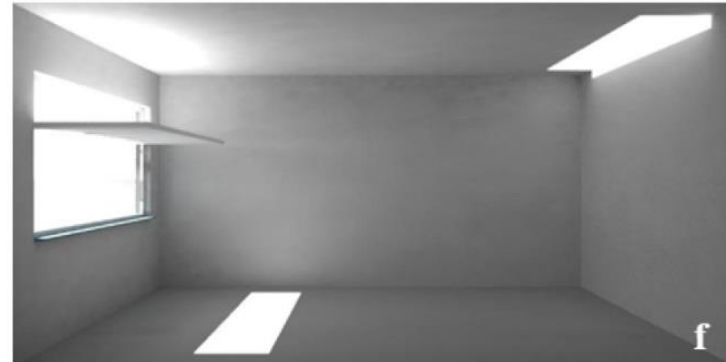
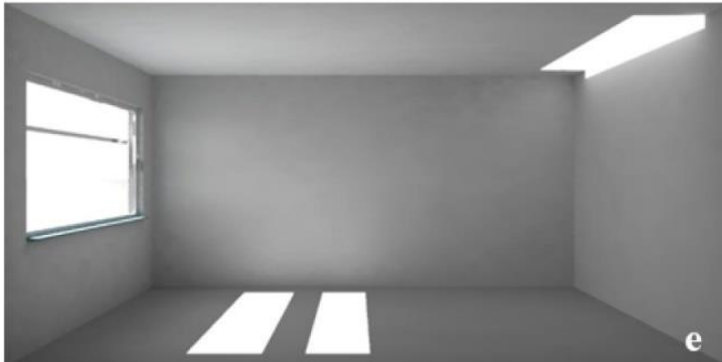
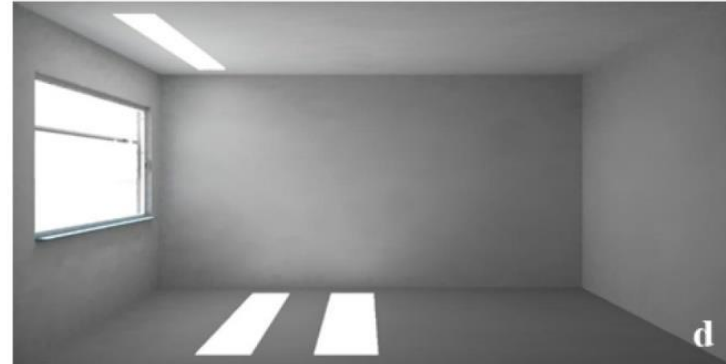
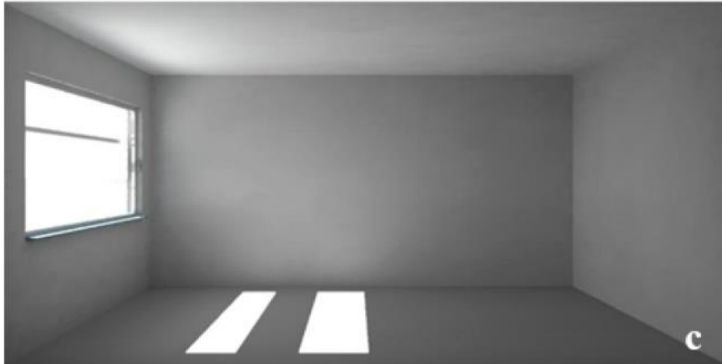
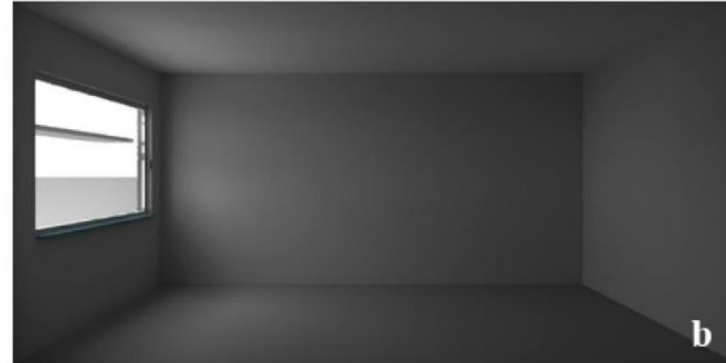
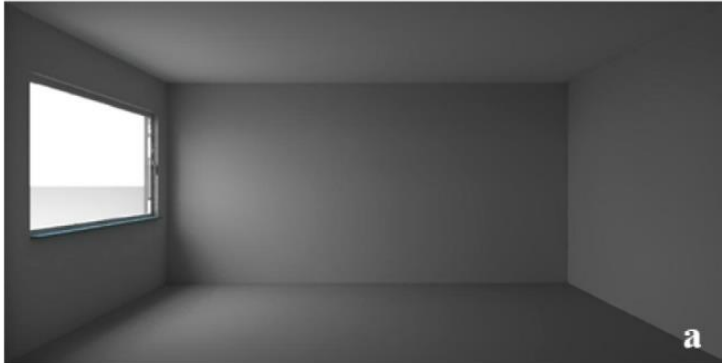
External /internal light shelves allow deeper diffused light penetration and shade.

Internal light shelves allow deeper light penetration and solar access. light shelves can be added inside to increase daylight penetration.



Side lighting is the most common method of allowing daylight into the building. Glare from direct sunlight can be prevented by using light shelves. These shelves redirect the light rays toward the ceilings which in turn reflect uniform, indirect light.

UESE DAYLIGHTING



Various interior radiance renderings of a south oriented room with dimensions $4 \times 6 \times 3$ m and a window to floor ratio equal to 20% equipped with:

(a) No light shelf, under overcast sky;

(b) Perfectly diffuse external horizontal light shelf with 0.5 m depth (reflectance 0.8), under overcast sky;

(c) Perfectly diffuse external horizontal light shelf with 0.5 m depth, under clear sky conditions, sun's elevation 37.8° ;

(d) Like; (c) but with mirror external horizontal light shelf;

(e) Similar to; (d) with the external inclined upwards by 15° ;

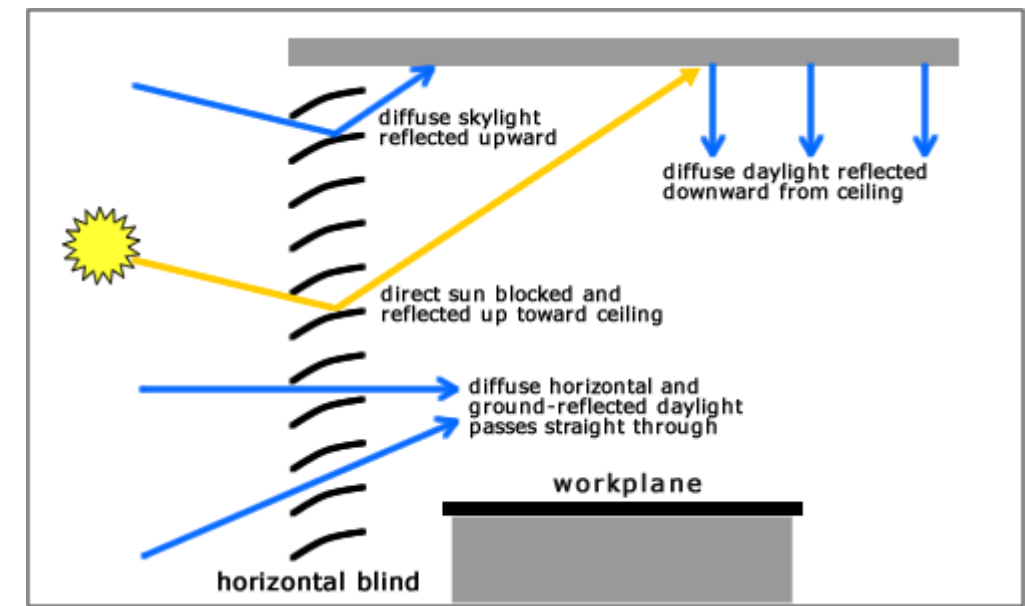
(f) Similar to; (e) with a perfectly diffuse internal light shelf (depth 1.2 m)

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Turnable lamellas	Temperate climates	Vertical windows, skylights	<ul style="list-style-type: none"> - Glare protection (D) - Lightguiding into the depth of the room - Homogeneous illumination - Saving potential (artificial lighting) - Need for tracking - Available

UESE DAYLIGHTING

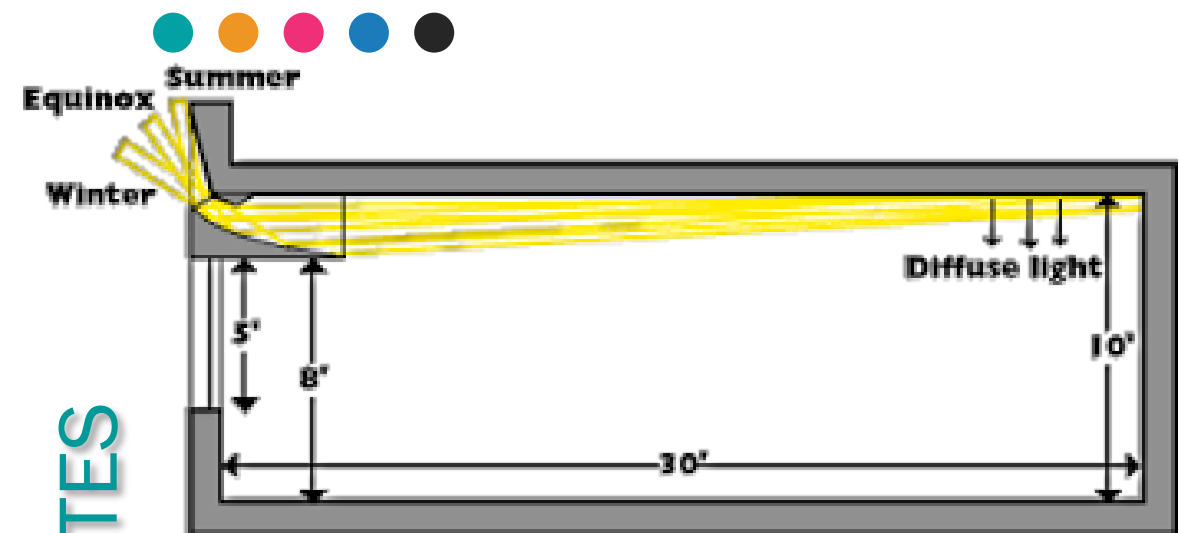


LOUVERS AND BLINDS LOUVERS AND BLINDS USE FOR ALL CLIMATES

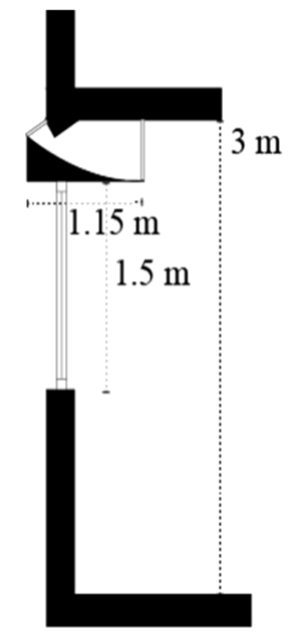


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UESE DAYLIGHTING



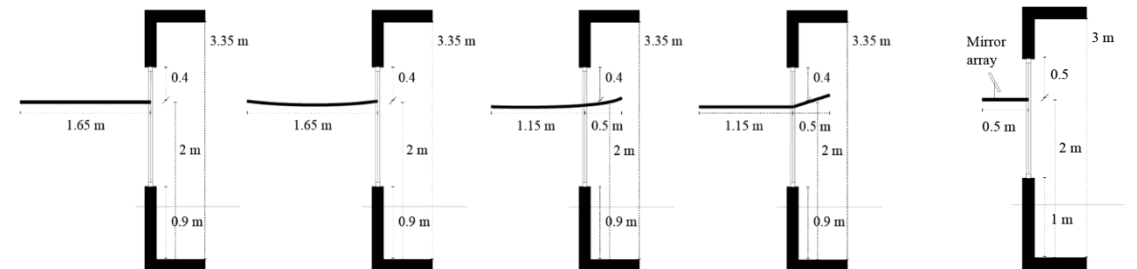
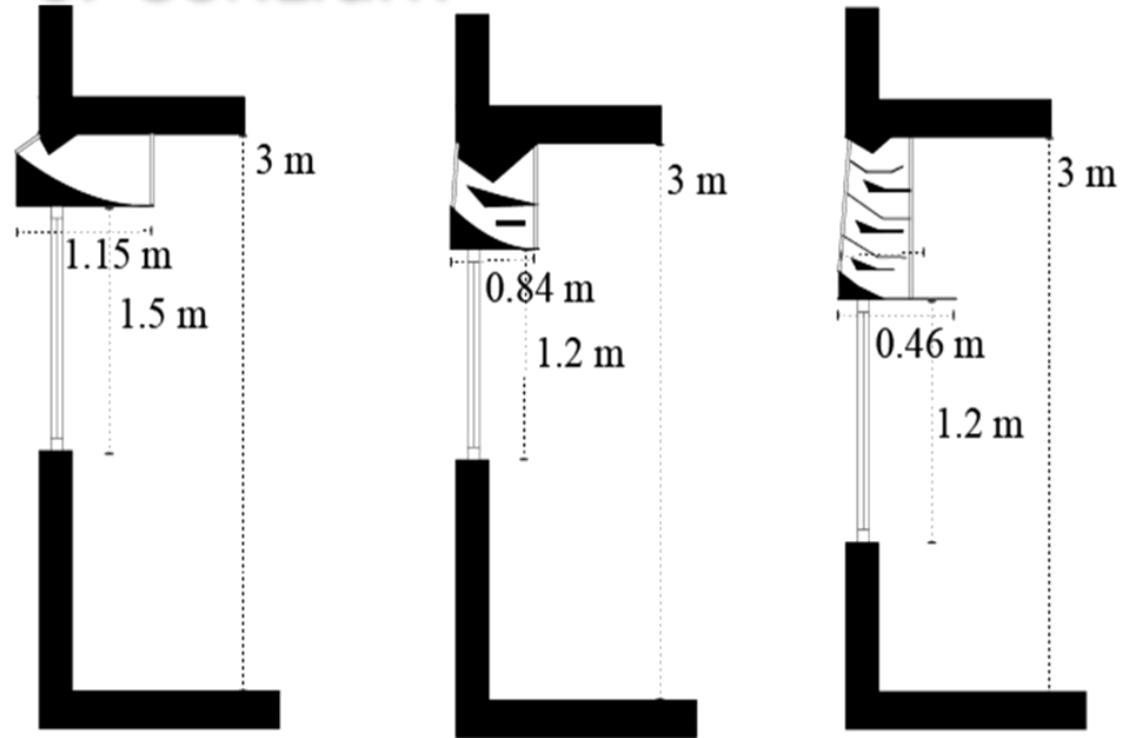
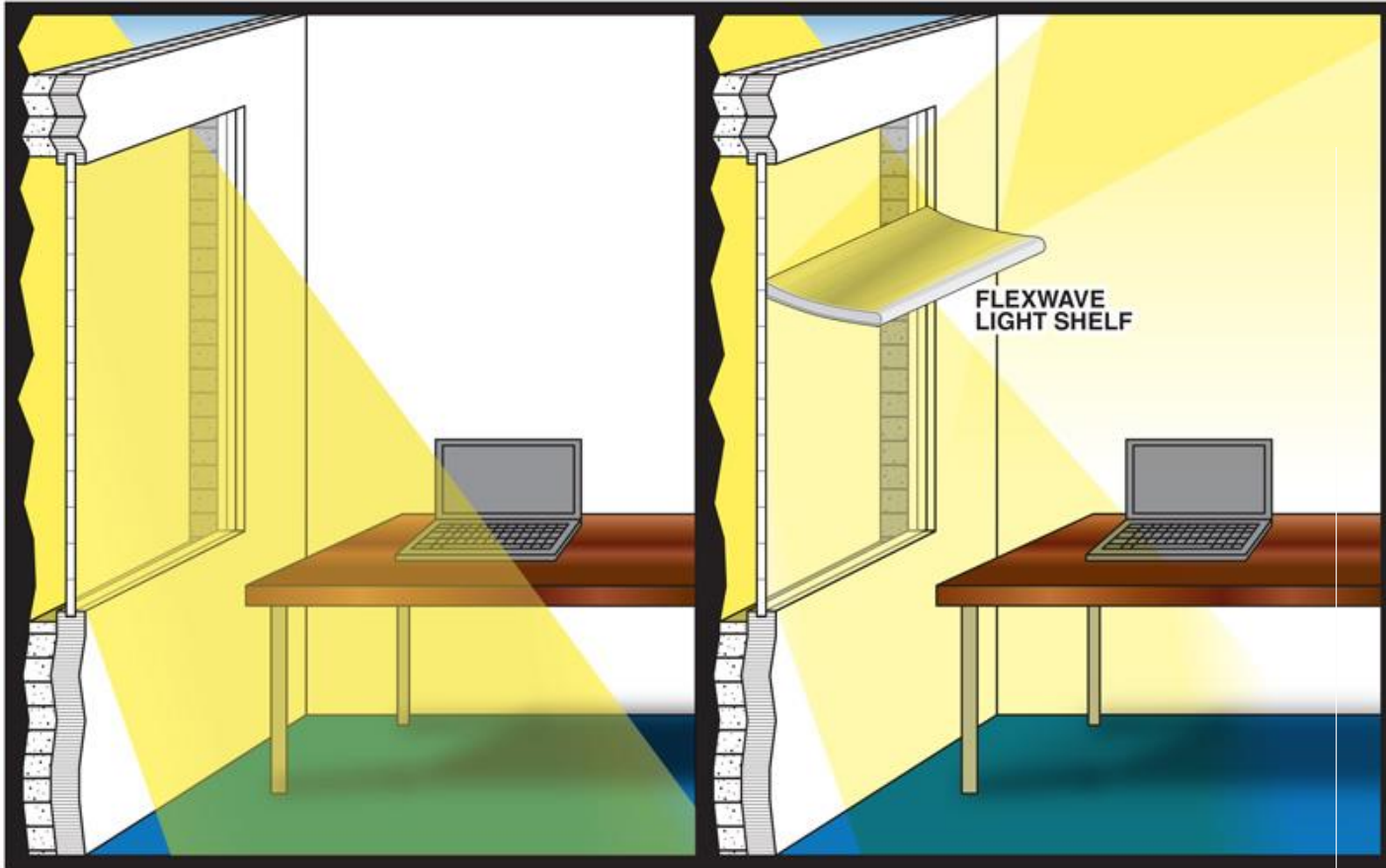
LIGHTSHELF FOR
 RESIRECTIO OF SUNLIGHT
 LIGHTSELF
 USE FOR ALL CLIMATES



UESE DAYLIGHTING



LIGHTSHELF FOR RESIRECTIO OF SUNLIGHT



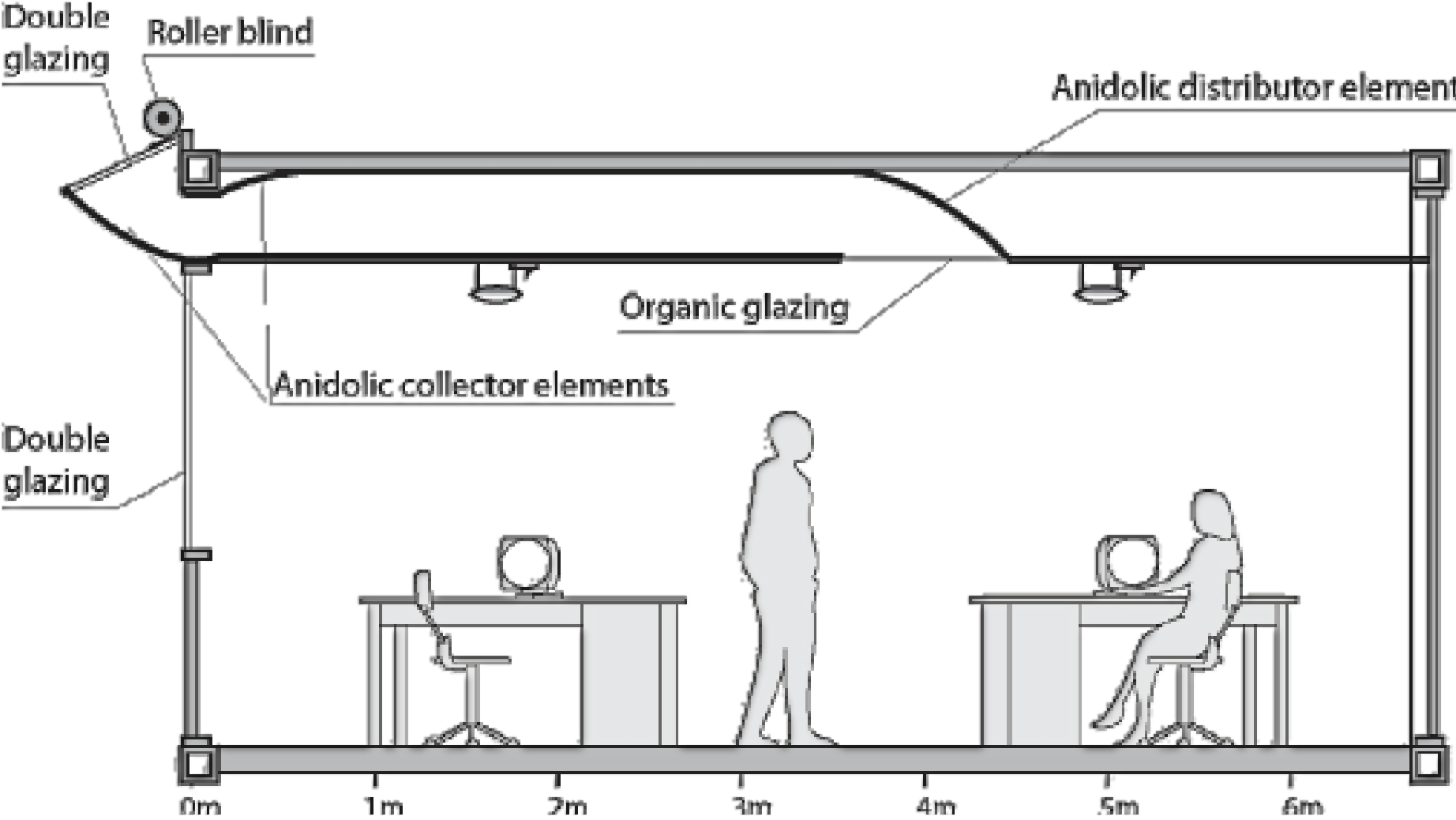
UESE DAYLIGHTING



Anidolic ceiling

USE FOR ALL CLIMATES

0m 1m 2m 3m 4m 5m 6m



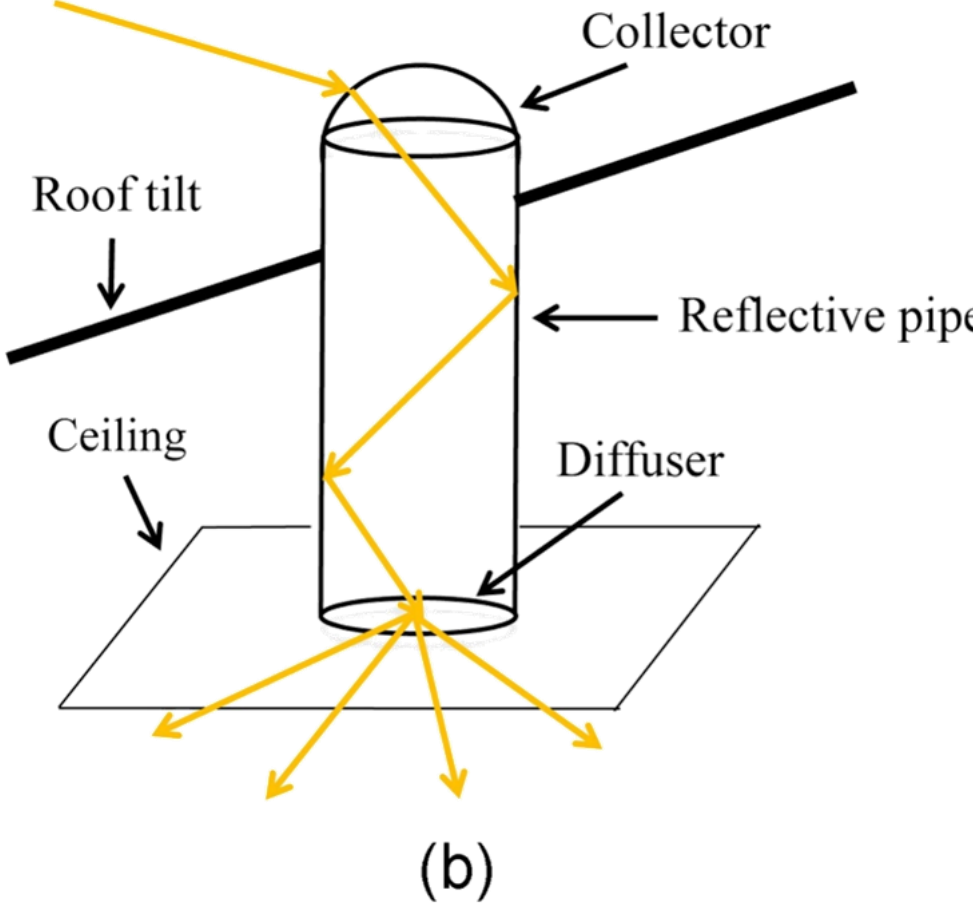
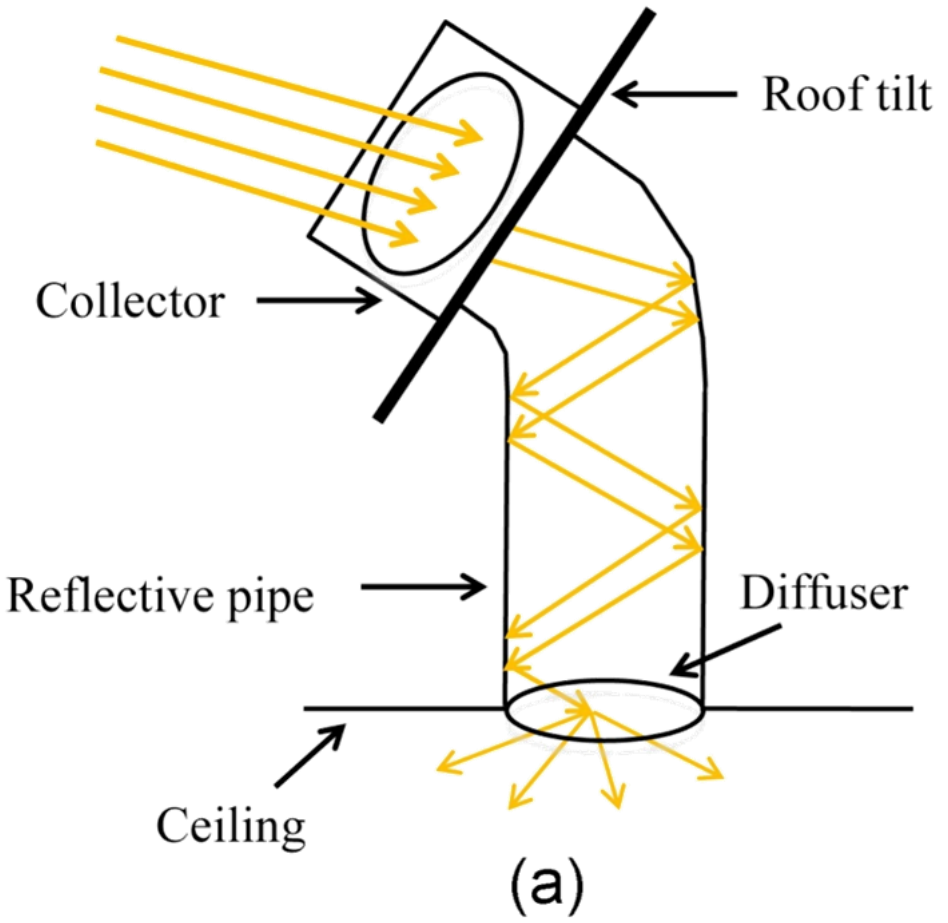
UESE DAYLIGHTING



LIGHT PIPE

LIGHT PIPE

USE FOR ALL CLIMATES



UESE DAYLIGHTING



LIGHT PIPE

LIGHT PIPE

USE FOR ALL CLIMATES

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USE FOR ALL CLIMATES

UESE DAYLIGHTING



LIGHT PIPE

LIGHT PIPE

USE FOR ALL CLIMATES

UESE DAYLIGHTING



Light transport systems

