Polski Komitet Narodowy Międzynarodowej Rady Ochrony Zabytków ICOMOS

FONDAZIONE ROMUALDO DEL BIANCO

SAPIENZA UNIVERSITÀ DI ROMA

POLITECHNIKA LUBELSKA

UNIVERSIDAD POLITÉCNICA MADRID

SAPERE AUDE VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

FONDAZIONE FLAMINIA RAVENNA

Sustainable Urban Rehabilitation in Europe

Historical building adaptation to modern function

Erasmus+

Sustainable Urban Rehabilitation in Europe

3rd Semester

Susana Mora Alonso-Muñoyerro
Ignacio Mora Moreno
David García García
Carolina Hernández Martínez
Camila Burgos Vargas

Historical building adaptation to modern function

3 ECTS

SH

Sustainable Heritage

EC

Elective Courses

Erasmus+

SURE
SUSTAINABLE URBAN REHABILITATION IN EUROPE

UNIVERSIDAD POLITÉCNICA DE MADRID

Sustainable Urban Rehabilitation in Europe

Historical building adaptation to modern function

3 ECTS

SH

Sustainable Heritage

EC

Elective Courses

01 Introduction to building adaptation
02 Typology: big to big & small to small adaptations
03 Typology: big to small & small to big adaptations
04 Programme: extensions
05 Programme: bubbles
06 Programme: other adaptations
07 Circulations: horizontal circulations
08 Circulations: vertical circulations
09 Enclosure: protective enclosure
10 Enclosure: lightweight roofs, façades and finishings
11 Systems: climatization
12 Systems: fire protection, water supply and evacuation
13 Illumination: natural lighting
14 Illumination: artificial lighting
15 Illumination: lighting systems

Sustainable
Urban
Rehabilitation in
Europe

Historical building adaptation to modern function

3 ECTS

LESSON 13: ILLUMINATION – NATURAL LIGHTING

Erasmus+

SURE
SUSTAINABLE URBAN REHABILITATION IN EUROPE

UNIVERSIDAD
POLITÉCNICA DE MADRID

ILLUMINATION

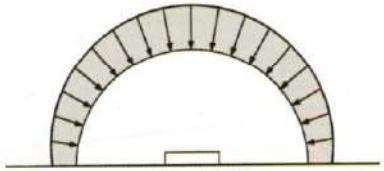
Natural illumination

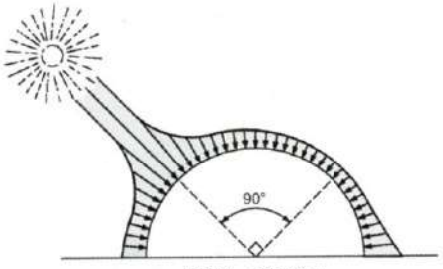
Castillo de la Luz, Nieto y Sobejano

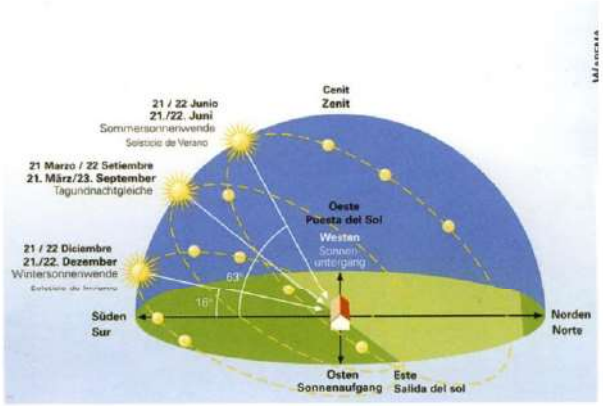
Artificial illumination

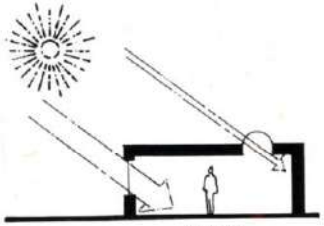
Koldinghus Castle

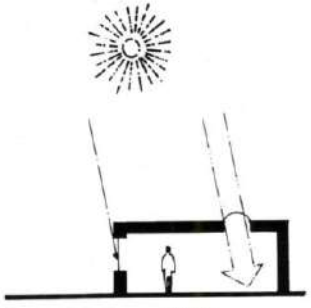
Zenithal light

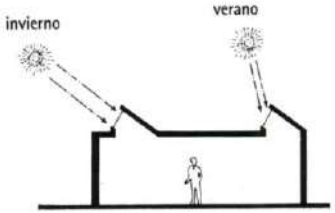








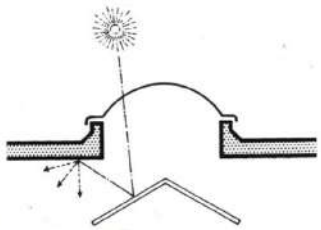




Basic criteria in Zenithal lighting

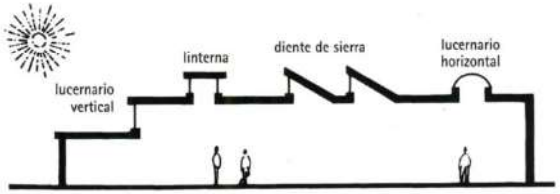
- Use zenithar lighting whenever possible. Use vertical locks and avoid skylights.
- Orient the elevators to the south if the thermal load of the building is significant.
- Orient them to the north if the thermal load is low.
- Arrange loaners to the east or west only if the orientations to the south or North are impossible.
- Use slats or screens to spread light, avoid glare and avoid the incidence of direct sunlight.

Reflected zenithal light

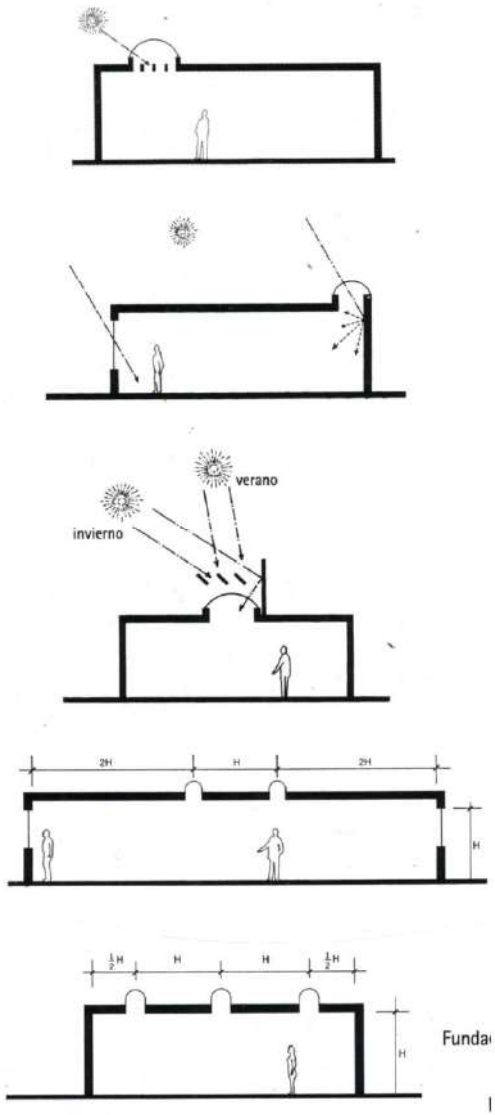


En el Kimbell Art Museum (Fort Worth, EE UU, 1972), Kahn utilizó luminarias de luz natural para difundir la luz y evitar el deslumbramiento directo.
A la izquierda, esquema de funcionamiento de un reflector bajo lucernario horizontal, que actúa como luminaria de luz natural.

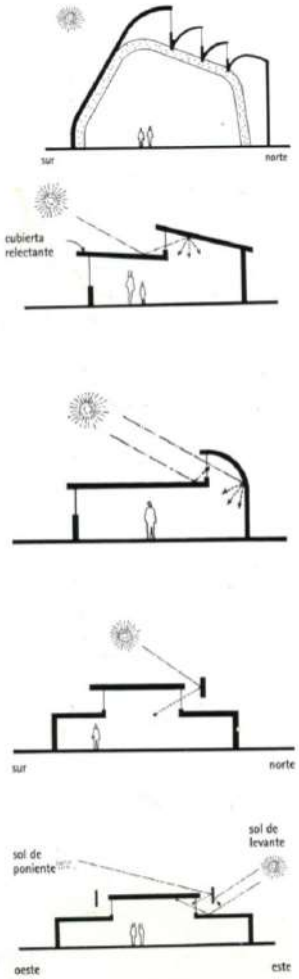
Los reflejos molestos son un problema habitual en cualquier fuente de luz cenital. Debajo, las manchas de luz solar directa producen contrastes excesivos entre distintos niveles de claridad .



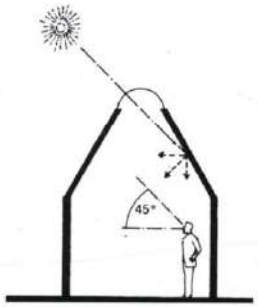
Direct and indirect zenithal light

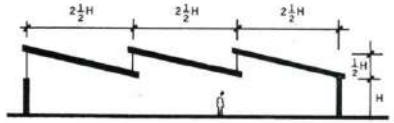


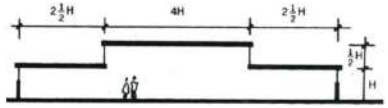
Skylights

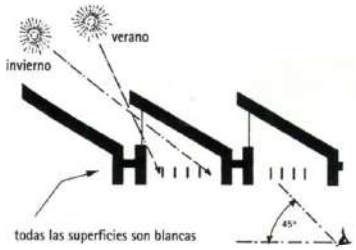

sur
norte
cubierta
relectante
sur
norte
sol de
levante
sol de
poniente
oeste
este

Skylight design

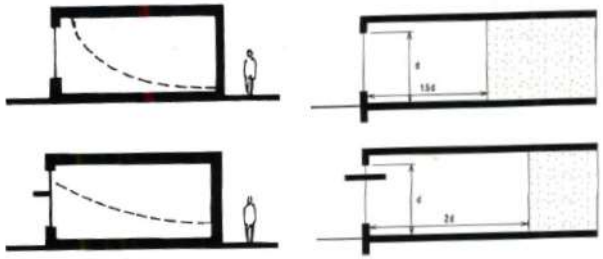




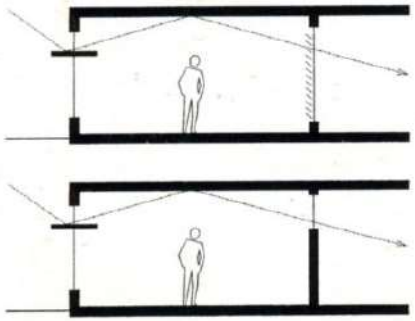




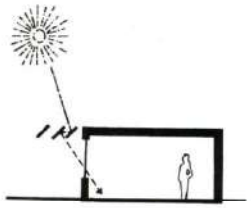
Façade lighting. Reflective window slabs

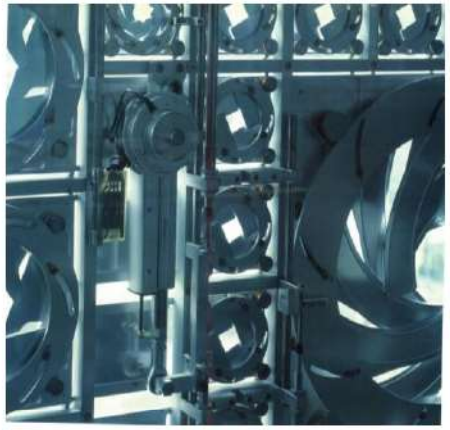


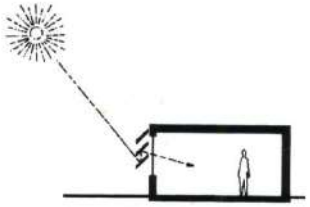
M. DE GUZMAN



Window light illumation



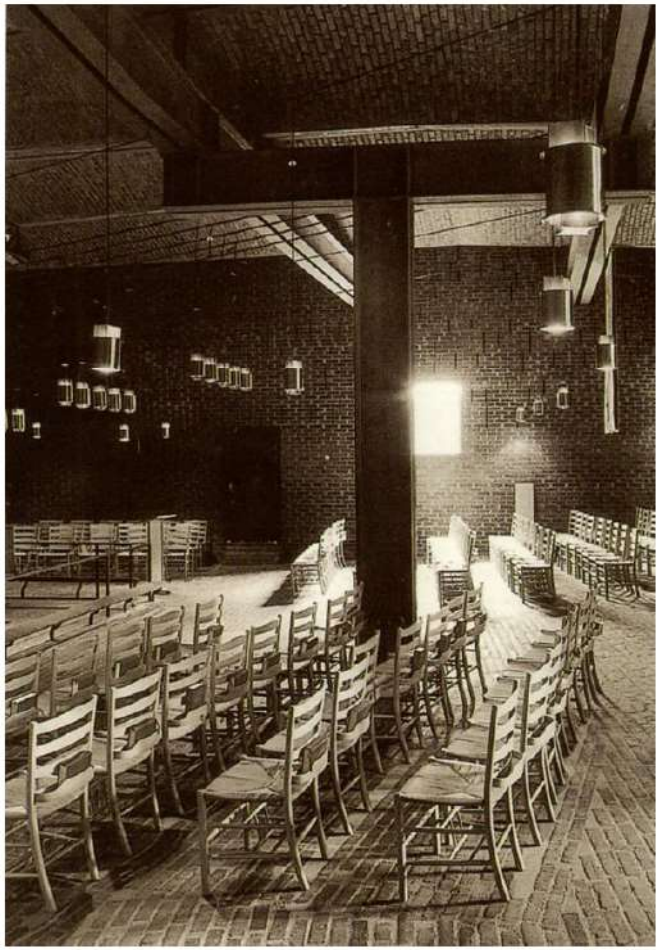


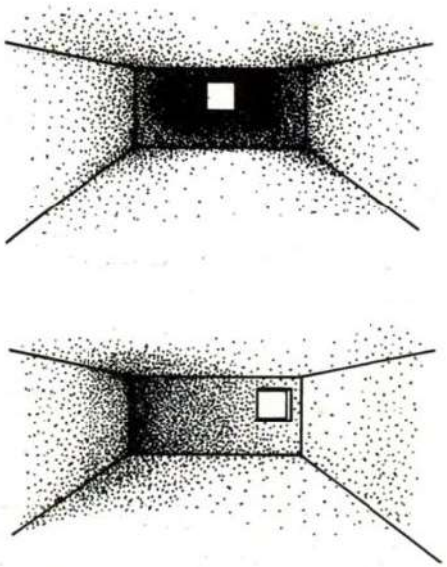


BASIC CRITERIA IN ILLUMINATION WITH WINDOWS

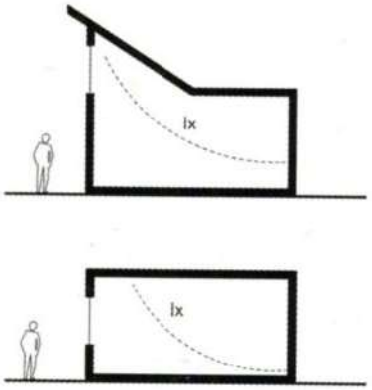
Design the shape of the building to maximize the illuminated areas. Use elongated plants or atriums. Maximize windows to the south if winter heating is required. Maximize windows to the north if winter heating is not required. Avoid windows to the east and west. Use horizontal reflector screens except on the north facade. Use separate windows for lighting and views. Place the windows for lighting in the upper part of the walls. Use venetian blinds or blinds to control the light. Use open floor distributions - avoid partitions - to maximize the penetration of light and views. Use glass interior partitions to share light. Use light colours on the outside to reflect light through windows and skylights. Use light colours inside to maximize the penetration and diffusion of light and minimize glare.

Window lighting glare

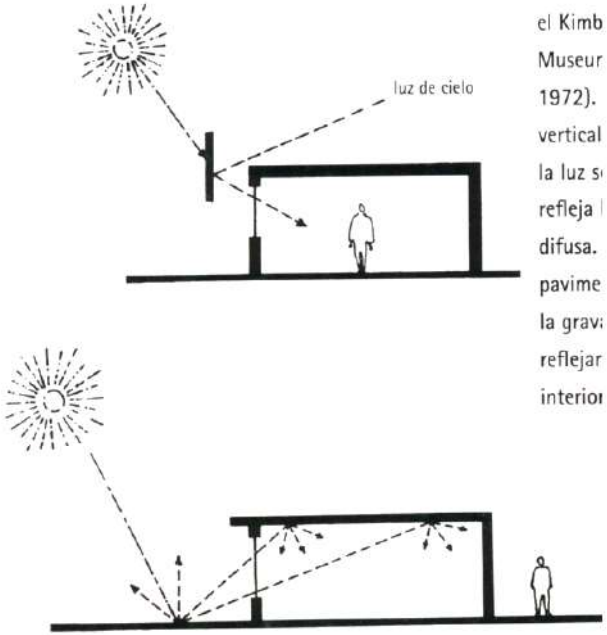




Window lighting. Window height

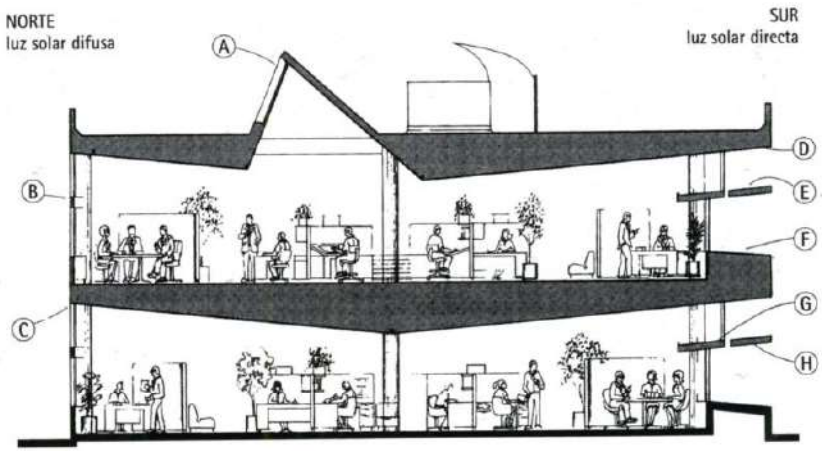


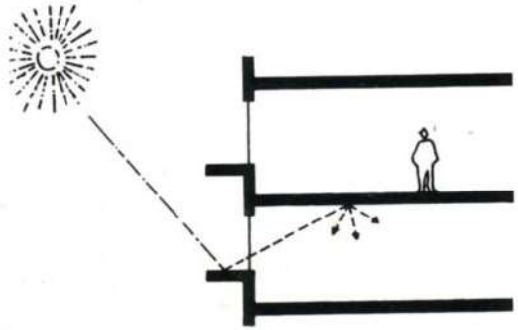
Window indirect lighting.



El empa
luz ante
el Kimb
Museur
1972).
vertical
la luz s
refleja
difusa.
pavime
la grav
reflejar
interior

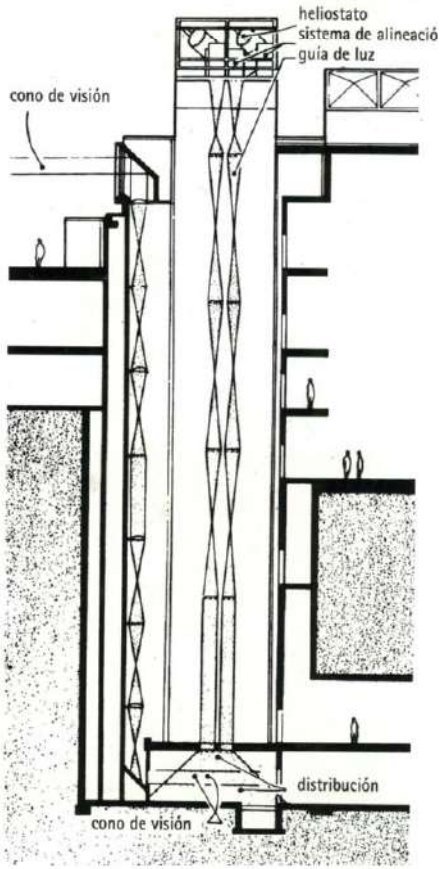
Reflective window sill



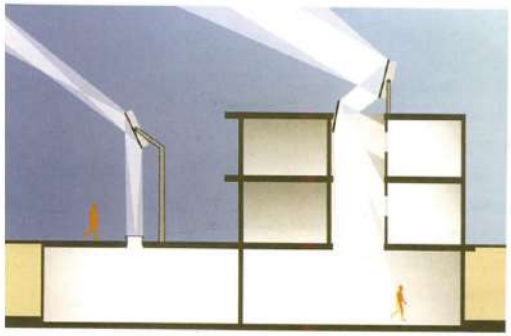


Los alféizares profundos pueden utilizarse como reflectores para enviar luz a la zonas alejadas del interior.

Light wells



Iluminación natural de espacios subterráneos dirigida mediante espejos y lentes. Donde se requiere iluminación, un elemento difusor intercepta el haz y dispersa la luz. Edificio de Ingeniería Civil de la Universidad de Minnesota, Minneapolis, EE UU, 1983. Más del 95% del edificio está construido bajo tierra.



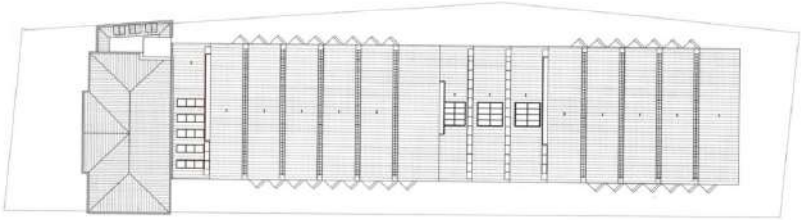
SUMMARY OF THE BASIC IDEAS

- Until the middle of the twentieth century, all buildings were illuminated with natural lighting.
- Natural lighting is still adequate because people need and enjoy
- so the qualities of natural lighting and because it saves energy for a sustainable future by reducing electricity consumption.
- It is a very abundant resource. On a cloudy day, the lighting on the deck is approximately thirty times higher than what is required inside, and in a sunny day is about 160 times greater.
- Natural lighting projects should distribute light uniformly in the space throughout the day.
- The lighting with south orientation is the best because it is warm, abundant, easy to control and adequate to the stations (maximum in winter and minimum in summer).
- Lighting from the north is the second best because it is constant and cold.
- It is necessary to avoid whenever possible to illuminate from the east and the west due to the glare of the lower solar angles and overheating in summer.
- Although all light is transformed into heat, artificial light sources heat the building more than natural light.
- During the summer, natural light alone is enough to supply the required lighting levels. In winter, natural light should be captured as much as possible.
- Use selective glass to achieve cold natural lighting in the east and west facades. When heating is not desired in winter, use selective glass to archive natural cold lighting, even on the south facade.
- Use artificial lighting as a complement to the natural one. Use controls with photocells to automatically adjust or turn off the lights when there is enough natural light;

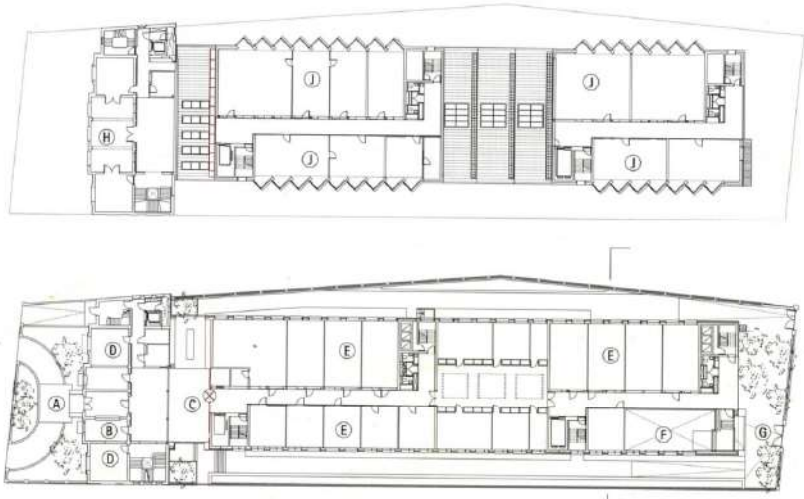
Natural illumination

Rijksmuseum's restauration workshop building

Cruz y Ortiz Architects

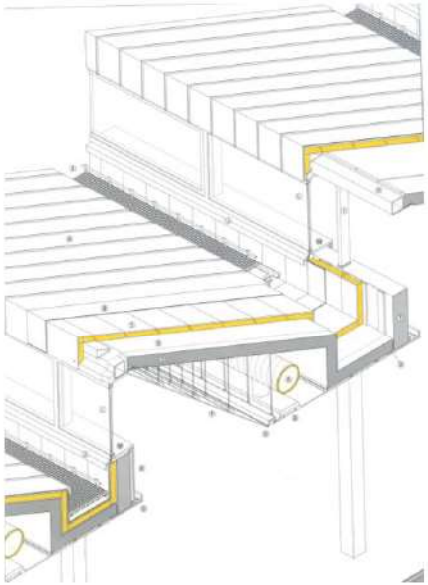


Planta de cubiertas



Planta baja

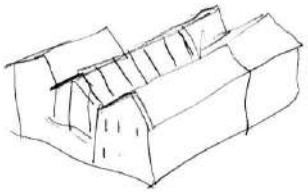
ILLUMINATION - ARTIFICIAL LIGHTING

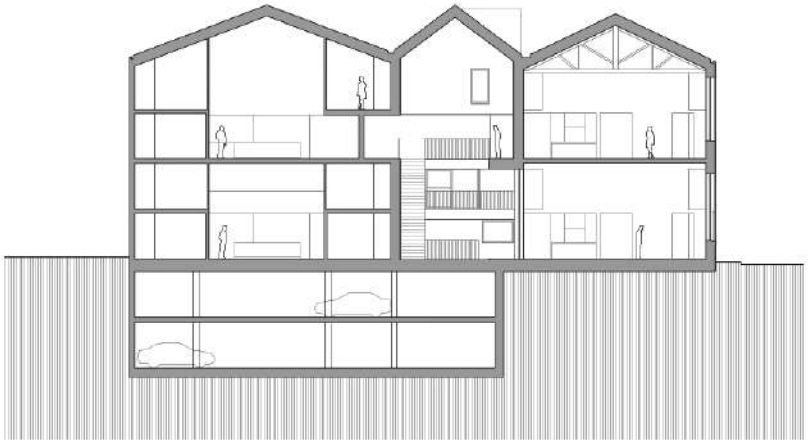


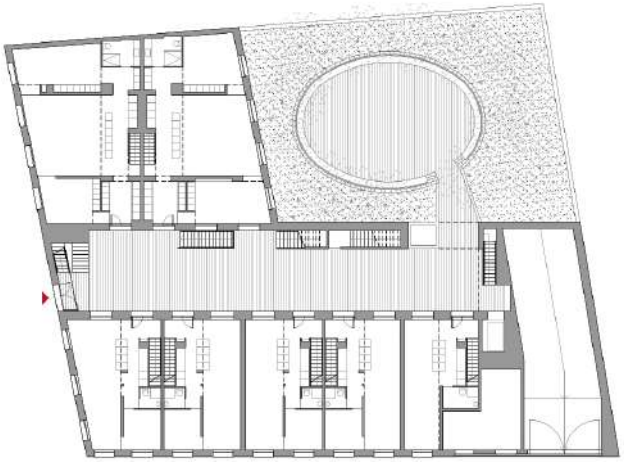
Natural illumination

Homes at the Tort Can Planell factory in Sabadell, Barcelona

Cruz y Ortiz Architects







Sección transversal

Lofts en Fábrica Tort Can Planell, Sabadell

Cruz y Ortiz arquitectos

0 1 2 5

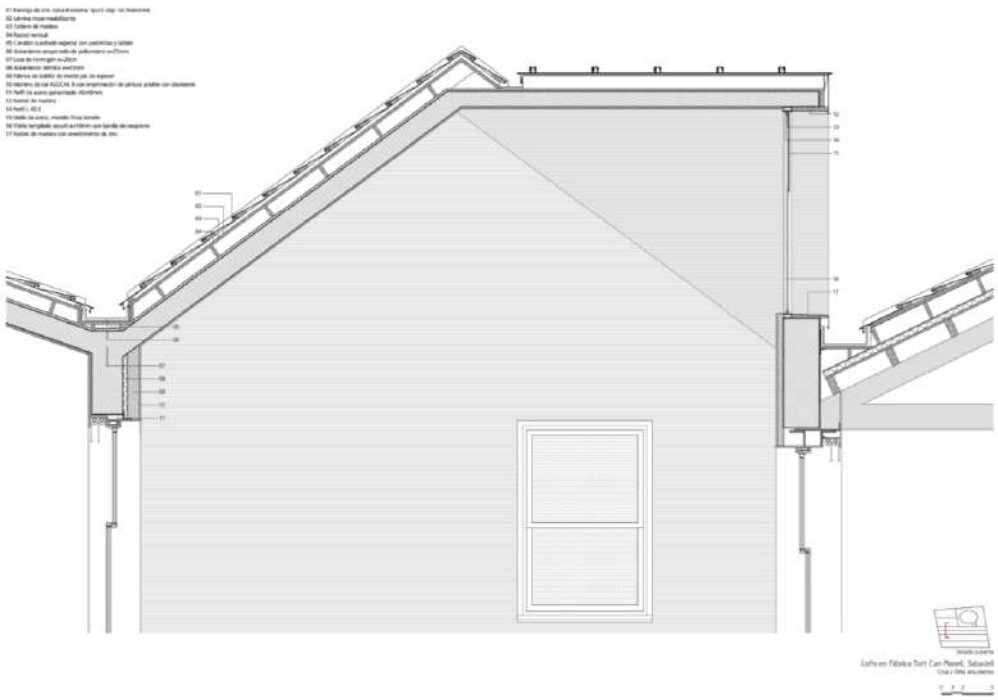
Planta baja

Lofts en Fábrica Tort Can Planell, Sabadell

Cruz y Ortiz arquitectos

0 1 2 5

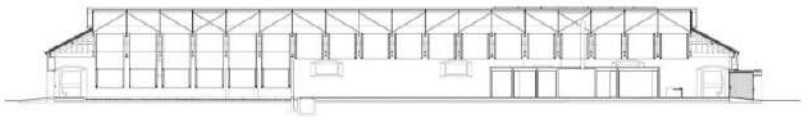
ILLUMINATION - ARTIFICIAL LIGHTING

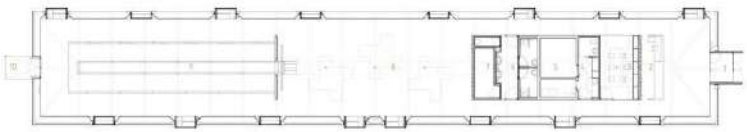


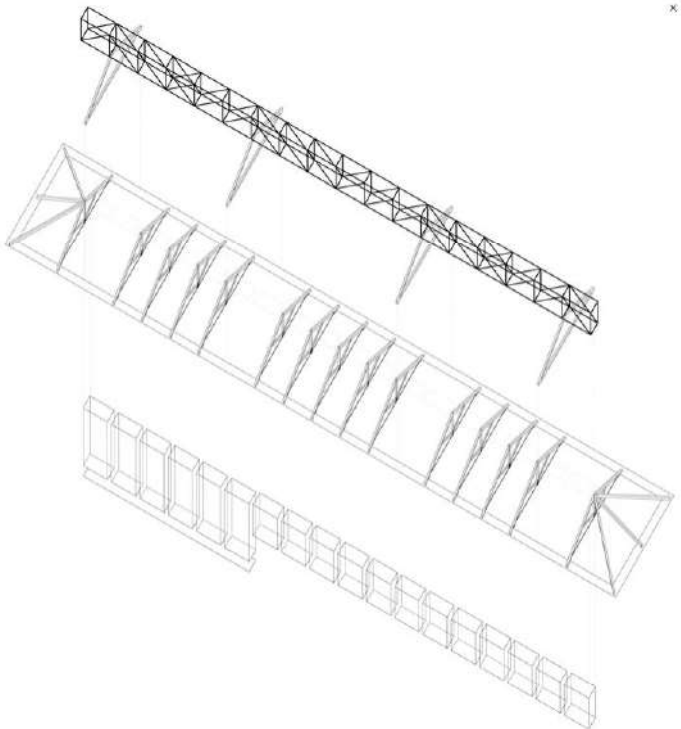
Natural illumination

Water Museum in Palencia, Spain

MID studio

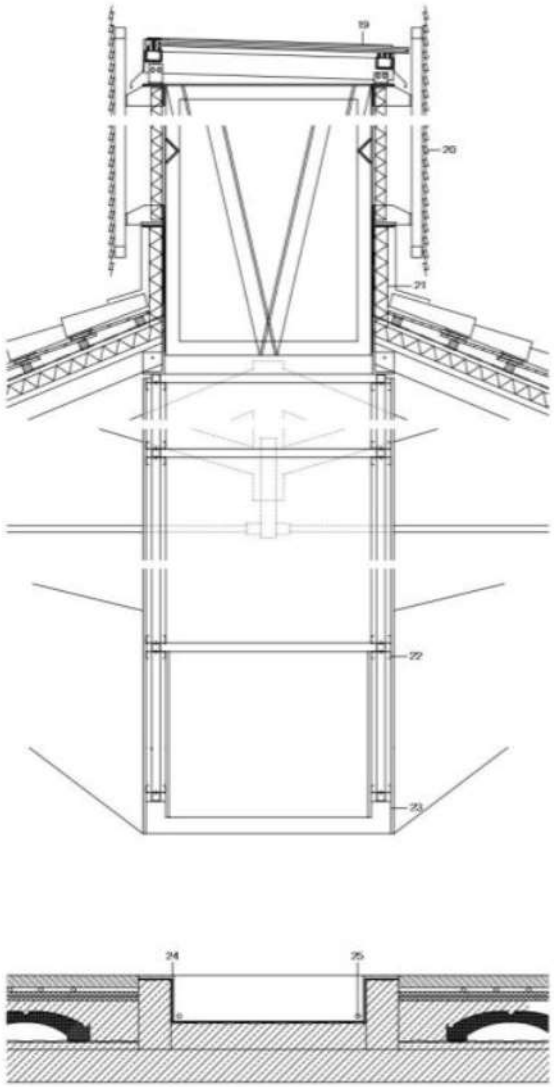


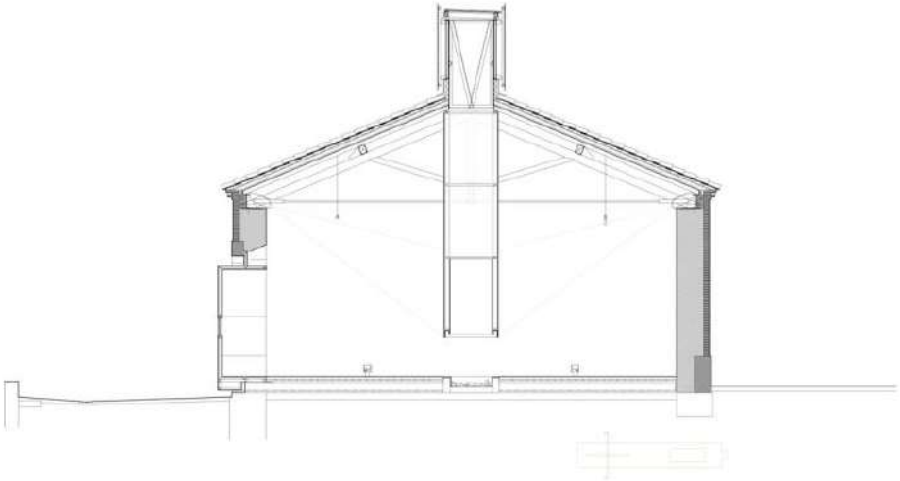




http://arqa.com/arquitectura/museo-del-agua-en-palencia-espana.html

ILLUMINATION - ARTIFICIAL LIGHTING

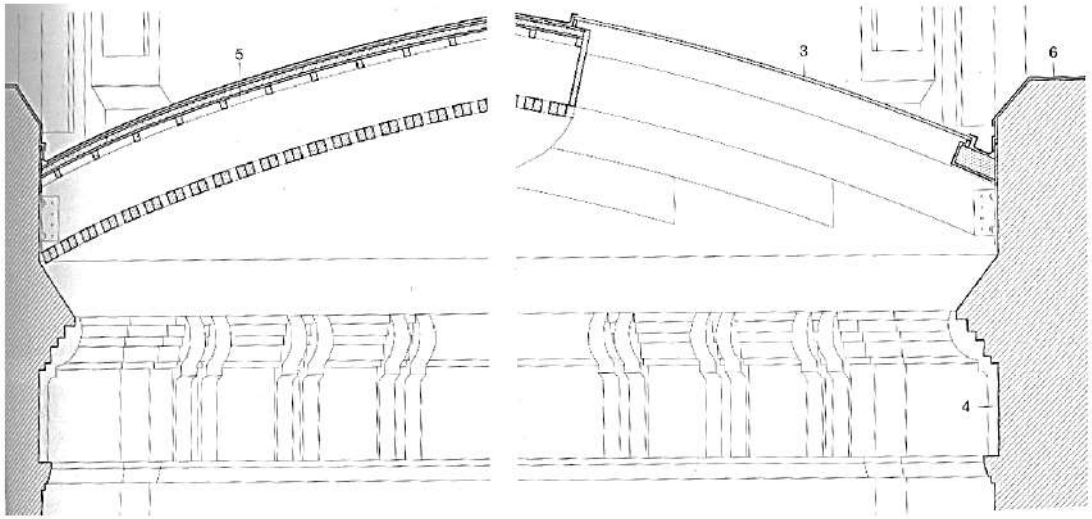




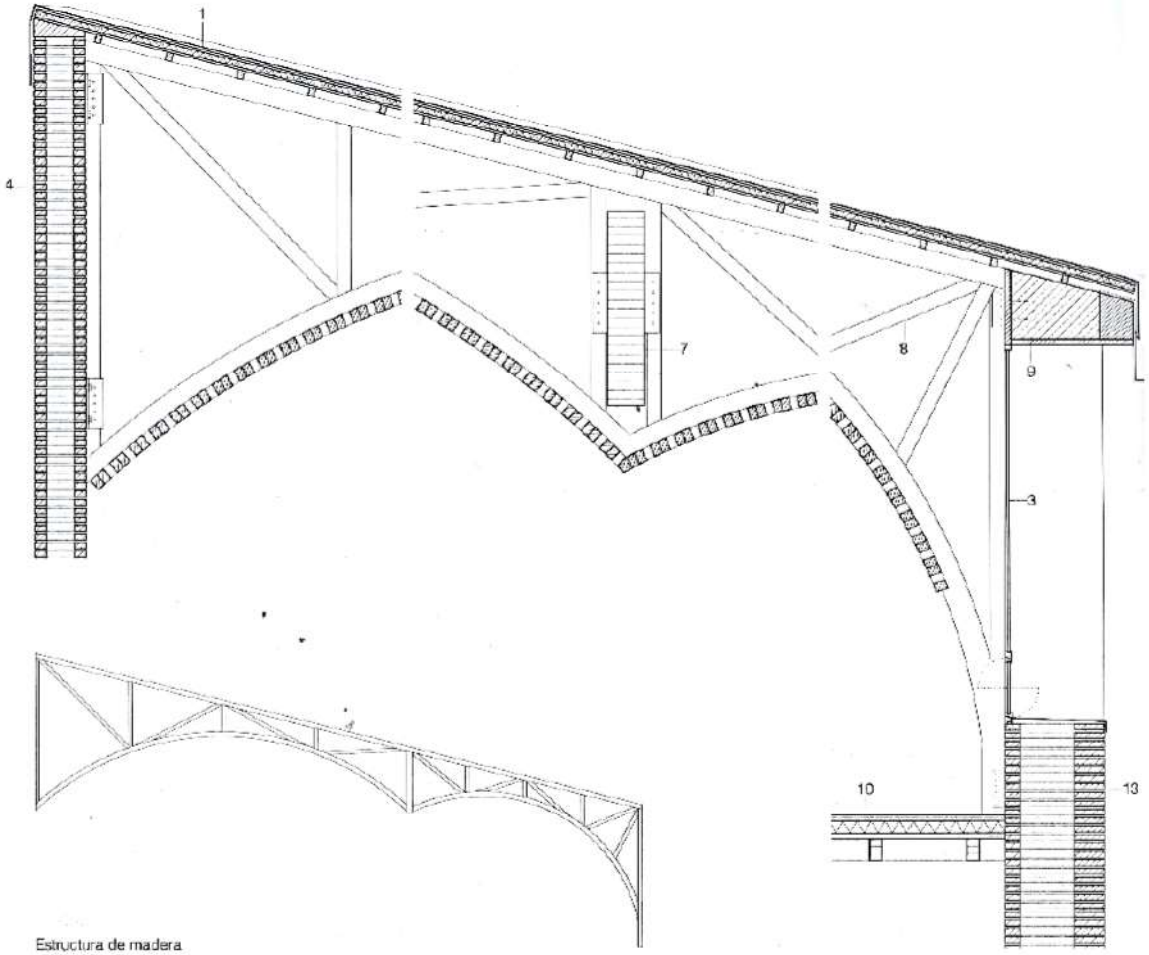
Natural illumination

Pías de Lavapiés Cultural Center

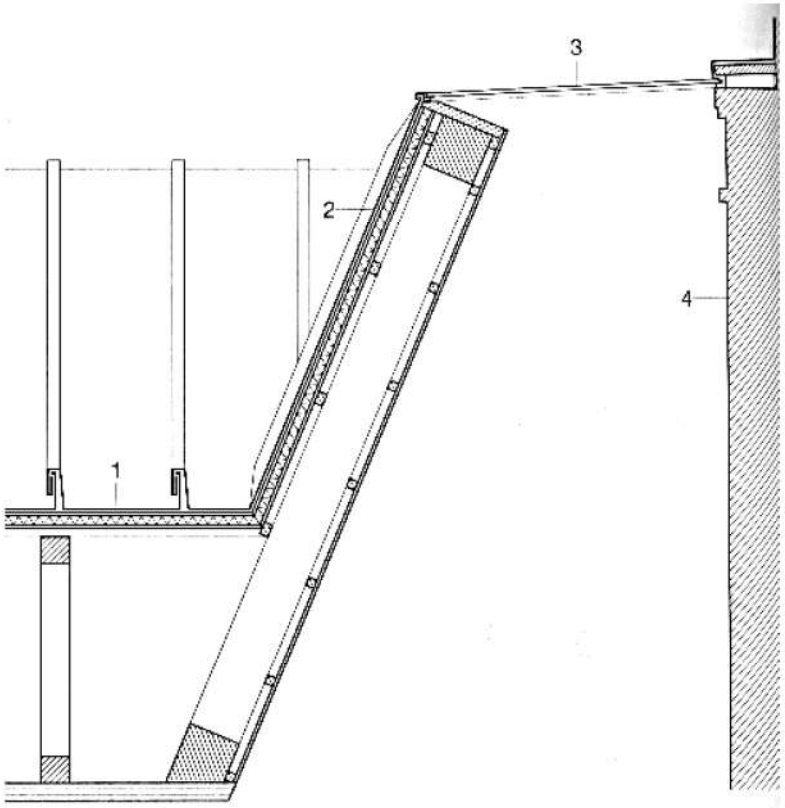
Linazasoro & Sánchez Architects



ILLUMINATION - ARTIFICIAL LIGHTING



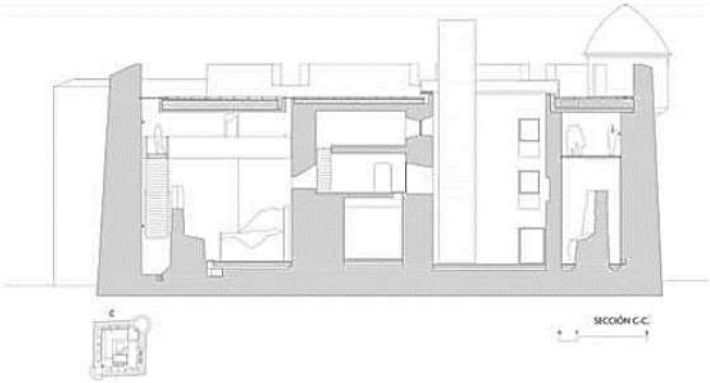
ILLUMINATION - ARTIFICIAL LIGHTING

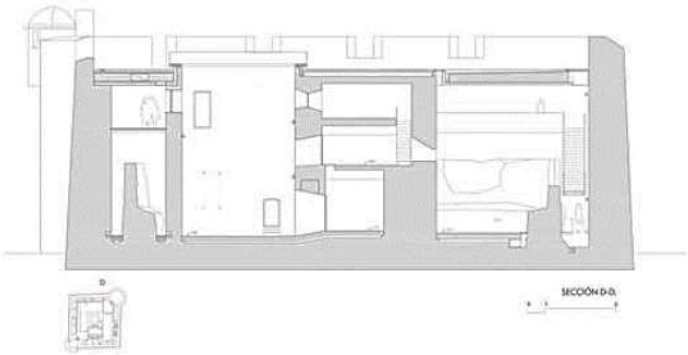


Natural illumination

Castillo de La Luz Museum
Las Palmas of Gran Canaria / Spain / 2013

Nieto y Sobejando Arquitects

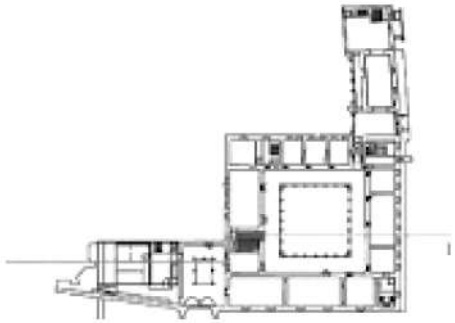


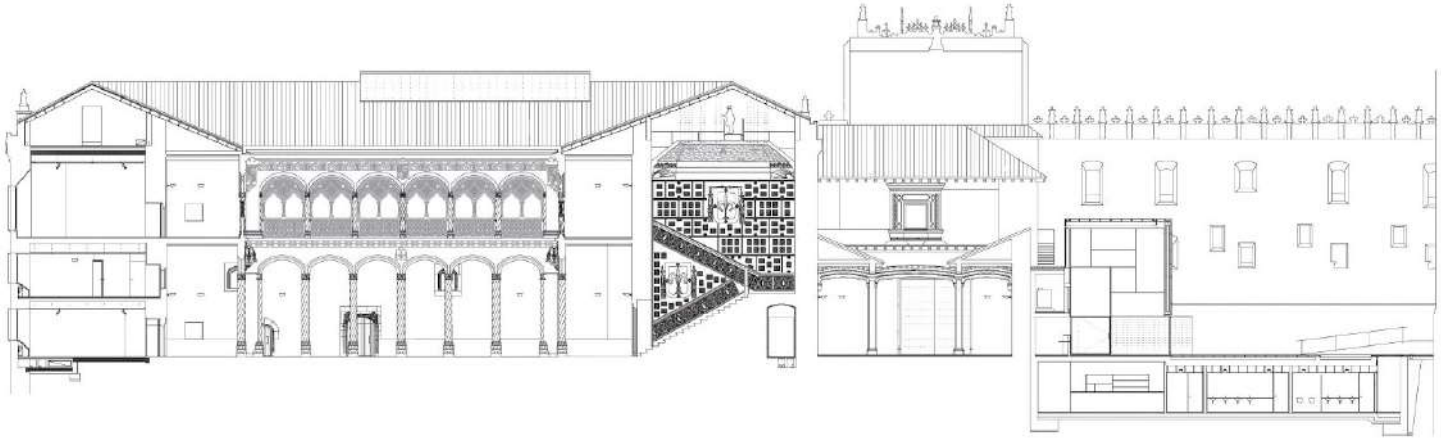


Natural illumination

Ampliación del Museo Nacional de Escultura. Antiguo Colegio de San Gregorio

Nieto Sobejano Arquitectos.

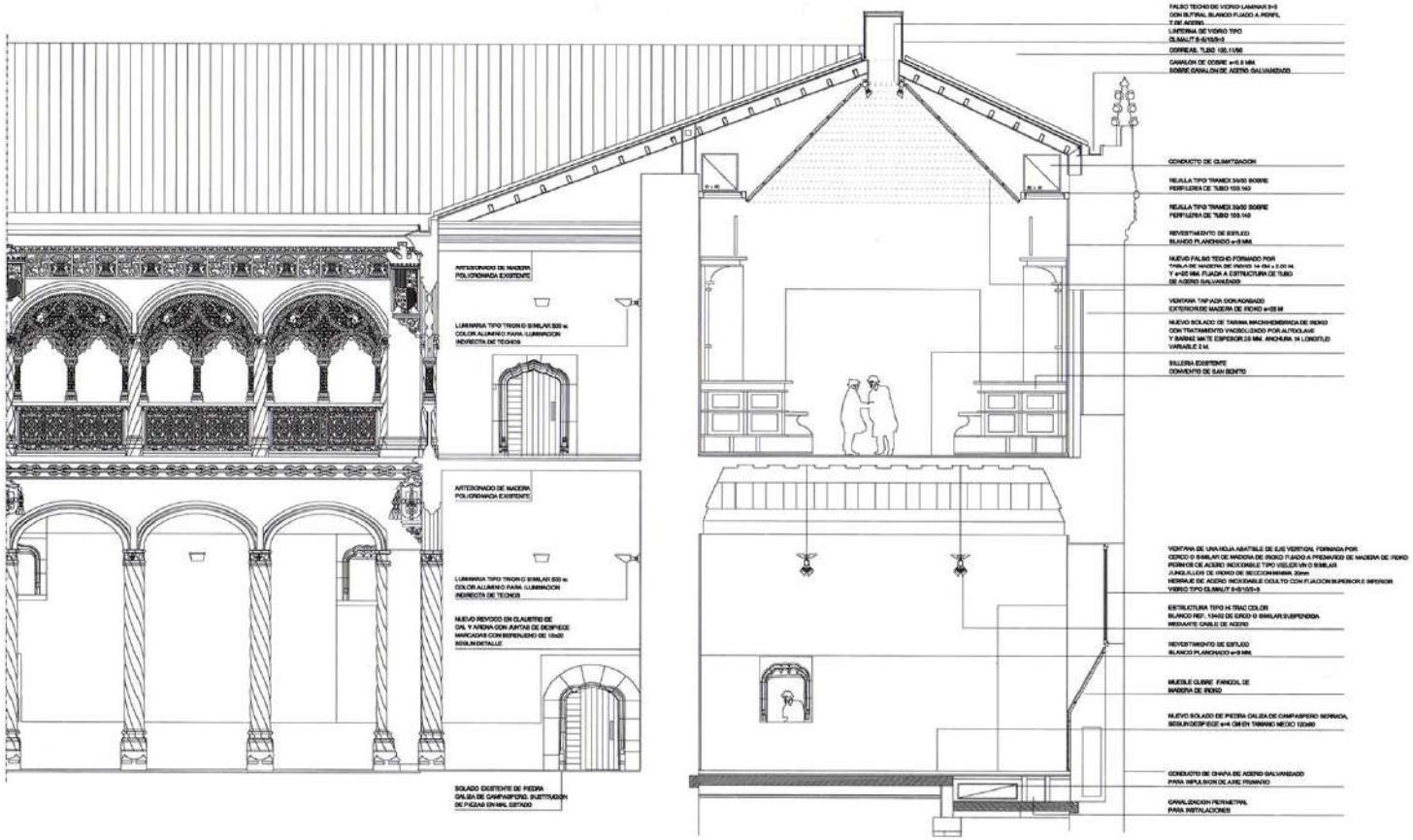




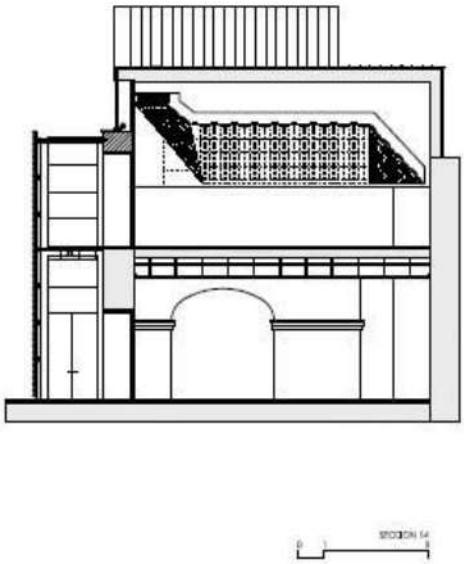
http://www.ondiseno.com/proyecto.php?id=1055

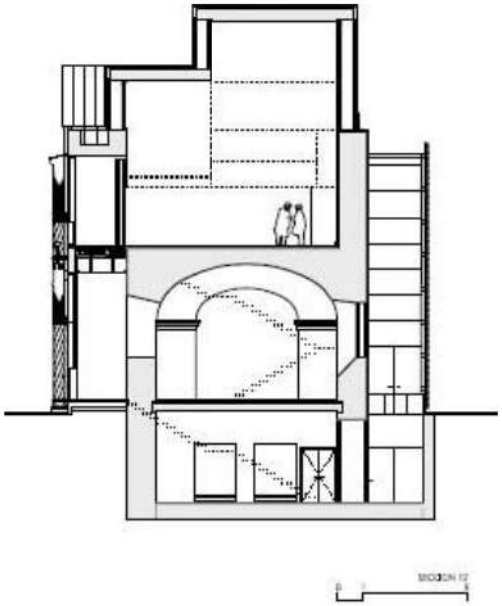
http://lostonsite.com/2010/04/01/museo-escultura-valladolic

ILLUMINATION - ARTIFICIAL LIGHTING



ILLUMINATION - ARTIFICIAL LIGHTING





Project "SURE - Sustainable Urban Rehabilitation in Europe"
implemented in frames of Erasmus+ Programme
Key Action 2: Strategic Partnership Projects
Agreement n° 2016-1-PL01-KA203-026232

This publication has been funded within support from the European Commission.

Free copy.

Co-funded by the
Erasmus+ Programme
of the European Union