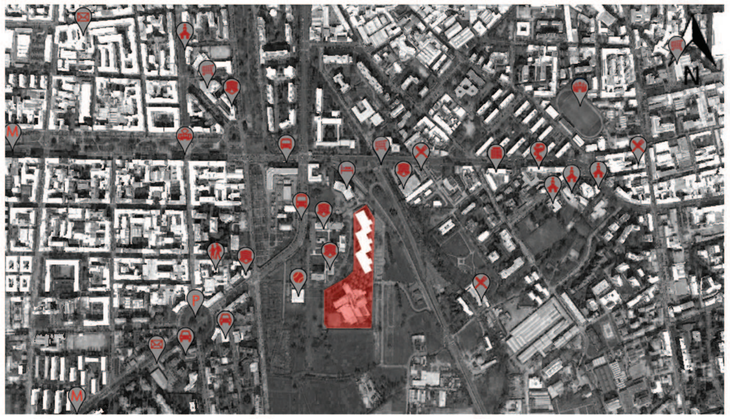
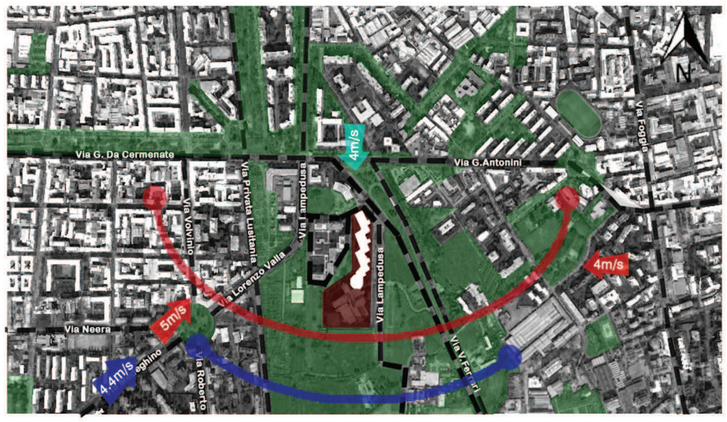
Lampedusa Office Building is surrounding by many transportation lines (Tram, Bus and Metro)and alot of facilities that help in making this area like Porta nuova district in the future like (Restaurants, Hotels, Green Areas, Supermarkets, Post office, School)



Buildings | Green Areas | Selected Area
Post Office | Office Building | Restaurant
School | Sports Center | Hotel
Church | Car services | Super Market
Bus station | Tram station | Metro station

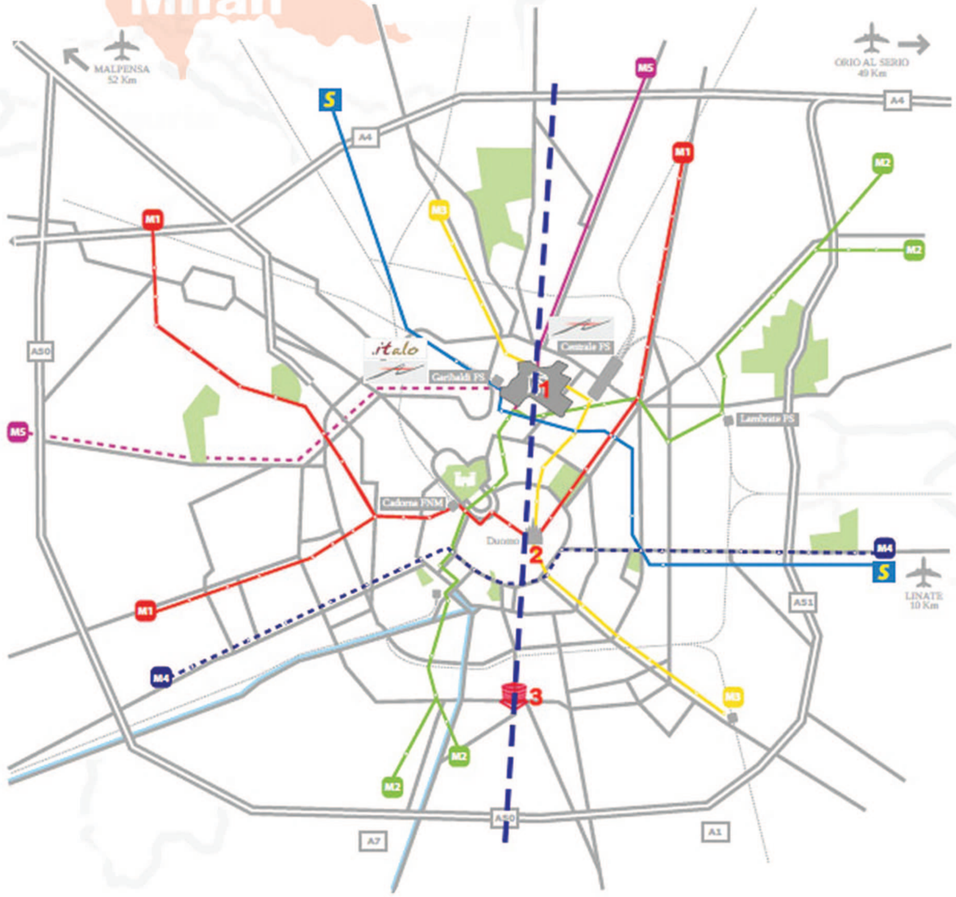


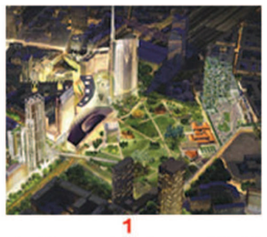
The Selected Area | Warm Wind | Winter Radiation
Green Areas | Cold Wind | Summer Radiation
Street | Spring Wind

The Map showing the Wind direction and speed around the selected area for the Lampedusa Office Building over the year as the Prevailing Wind are from (**West South West, South West, East South East and East**), and also showing the Summer Radiation and Winter Radiation

Lampedusa Office Building is located in Milan,
"at latitude 45°26'04.42" N and longitude 9°11'26.49" E"

And it is the extended Line Axis for:
"Duomo Cathedral"
"Porta Nuova BusinessDistrict"



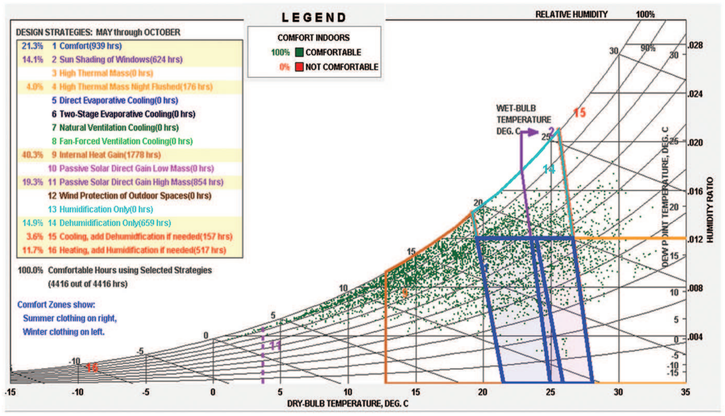


1
Porta Nuova Business District

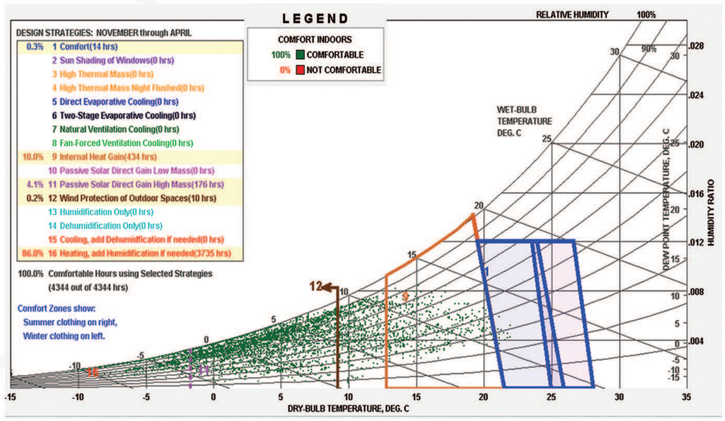
2
Duomo (Milan city center

3
Lampedusa Office Building

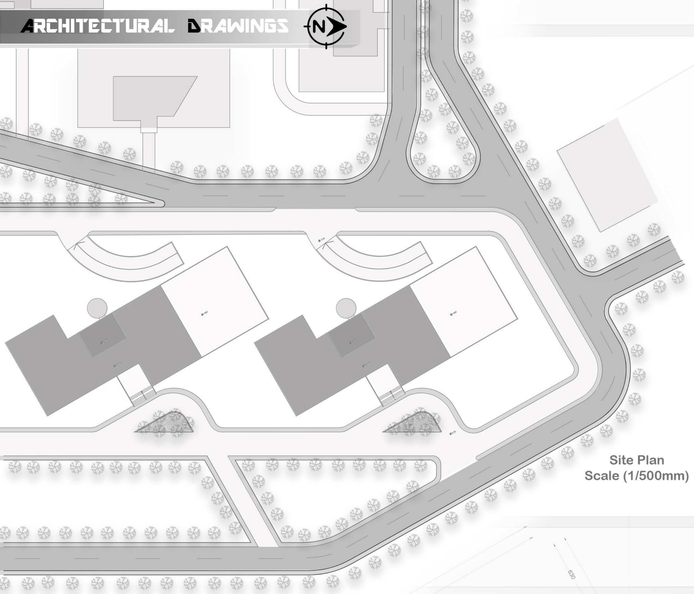
PSYCHROMETRIC Chart for the Building
Showing the Building Climate during
"Summer Season"



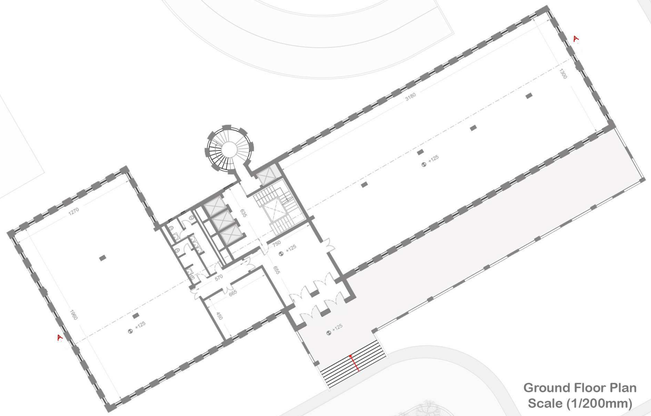
PSYCHROMETRIC Chart for the Building
Showing the Building Climate during
"Winter Season"



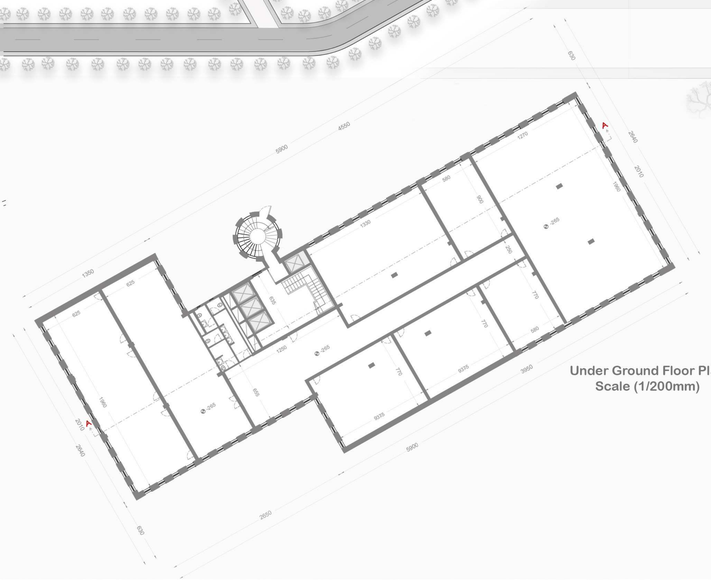
ARCHITECTURAL DRAWINGS



Site Plan
Scale (1/500mm)



Ground Floor Plan
Scale (1/200mm)

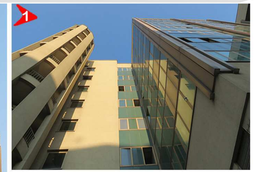


Under Ground Floor Plan
Scale (1/200mm)

First Floor Plan
(First Level :Seventh Level)
Scale (1/200mm)

Several Shots for The Existing Building

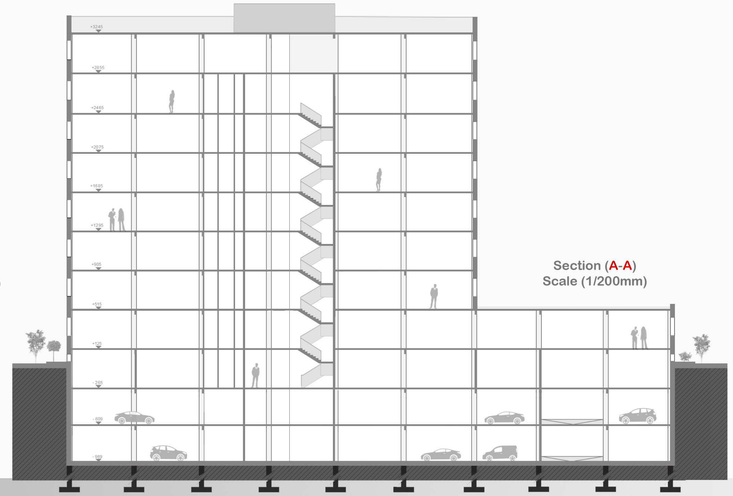
View (3)



View (1)

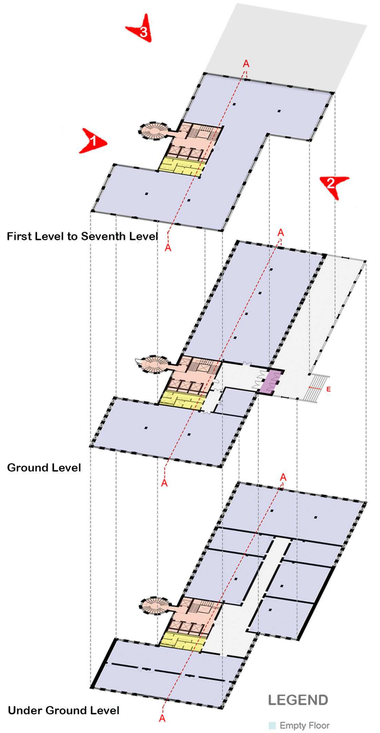
View (2)

Several 3D Shots for the Existing Office Building , showing the Facades with its materials cladding and showing also, the service stairs

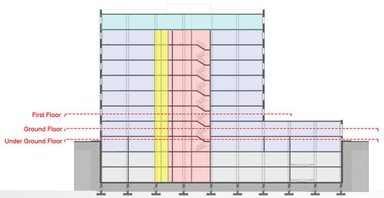


Section (A-A)
Scale (1/200mm)

"Key Plans"



"Key Section (A-A)"



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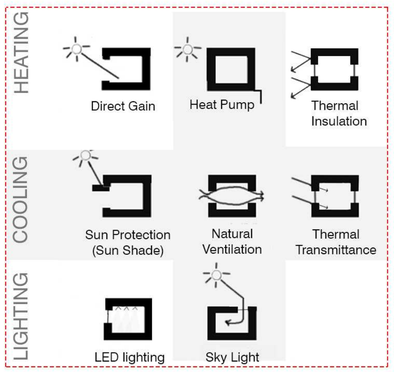
Double Degree Masters Project
"Achieving Thermal Comfort in Existing Buildings using Passive Cooling Techniques"
"Case Study of Retrofitting an Existing Office Building"

Supervisor : Professor | ALESSANDRO ROGORA
Student : ISHAK ENGY

LAMPEDUSA OFFICE BUILDING "Milan, Italy"

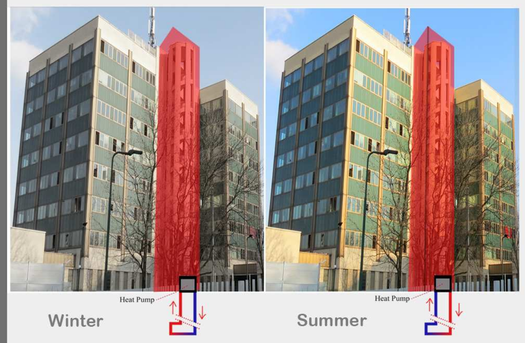
Existing Building
Scale (1/200 mm) , (1/500mm)

GENERAL Energy STRATEGY



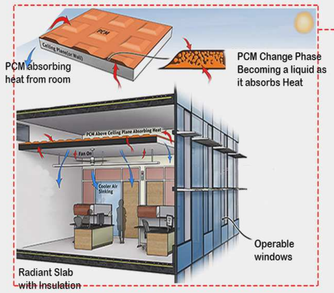
Heating

Heat Pump System"Decreasing Energy Consumption"



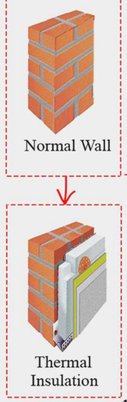
Heat Pump will be connected to the solar chimney in the building, as in Winter convert the cold air to warm air and in the Summer convert warm air to cold air, and this system decrease the Energy Consumption

PCM "Phase Change Material" "Thermal Comfort"
(in Ceiling)



PCMs can be used in several ways, such as **Thermal energy storage** whereby heats, or **Coolness**, that can be stored from one process or period and used later, also very useful in providing **Thermal barriers or insulation**

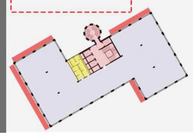
Thermal Insulation



Reduce the heat transfer between objects in thermal contact or in range of radiative influence, it can be achieved with specially engineered methods or processes, as well as with suitable materials

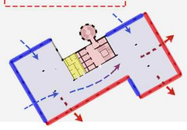
Cooling

Vertical Sunshades"Sun Protection"
[South West & South East]



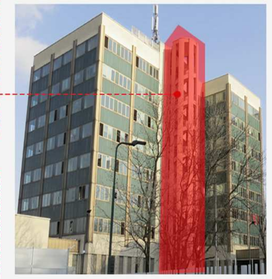
Use louvers in stade of solid overhang for more diffuse light while still shading

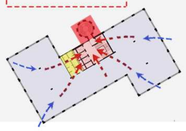
Operable Windows "Cross Ventilation"
"Inlet openings(South West & South East)"
"Outlet openings(North West & North East)"



To make air movement inside the building as "**Cross Ventilation**" to enhance the Natural ventilation

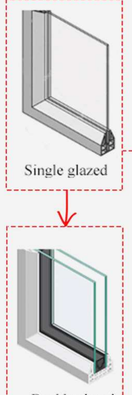
Solar Chimeny"Stack Ventilation"
[South West]

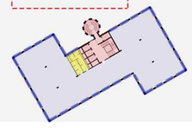




Postive pressure pushes air out of windows, seams and cracks on the upper levels as Negative pressure on lowels levels encourages infiltration of cold outdoor air through openings

Double Glass
"Reduction Heat Loss"
[All Facades]



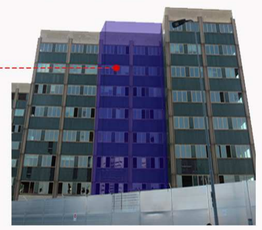


Using Double glass as it's"U-value" is lower than Single glass

Lighting

SkyLight
[Nouth East]

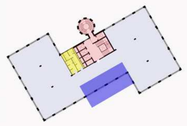
Credit Agricole Headquartes
(Parma, Italy)



IGuzzini Headquartes
(Recanati, Italy)

HOK's London Office
(London, UK)

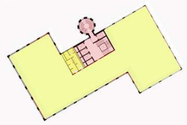
Federal Center South Building
(Seattle, USA)



Filtrating the air inside the building, Making a natural atmosphere to enhance the the inspiration of the employees and Feeling Comfortable during the working hours

LED Lighting System
"Reduce Energy Consumption"

	standard incandescent	CFL compact fluorescent lamp	LED
watts >>	60	18	10
lumens >>	840	825	800
life (years) >>	0.9	9.1	22.8
estimated annual energy cost* >>	$7.23	$5.18	$1.56
initial cost per bulb >>	$2.00	$8.00	$12.00



Using the LED lighting system as this system has life spa
n more than any other system, it is the lowest cost and decrease the Energy Consumption for the Building

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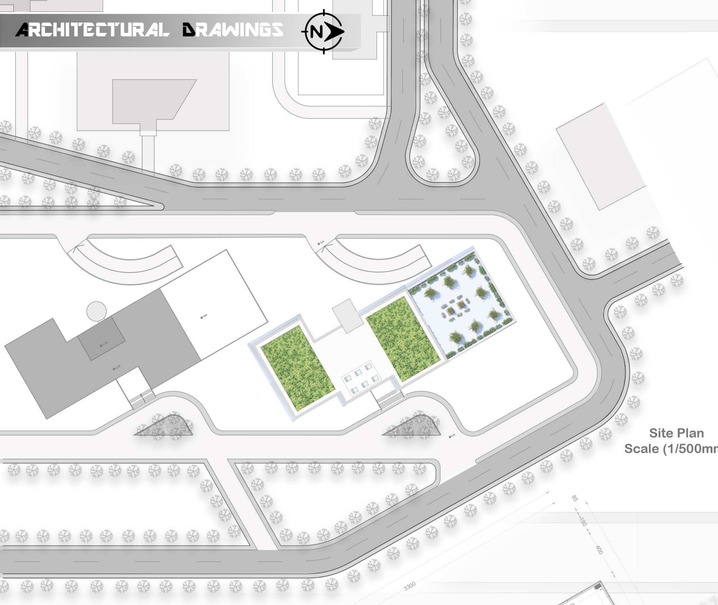
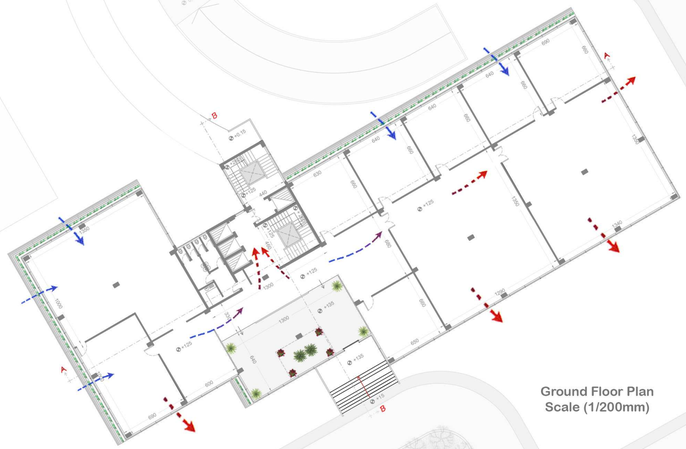
LAMPEDUSA OFFICE BUILDING "Milan, Italy"

Environmental Studeis

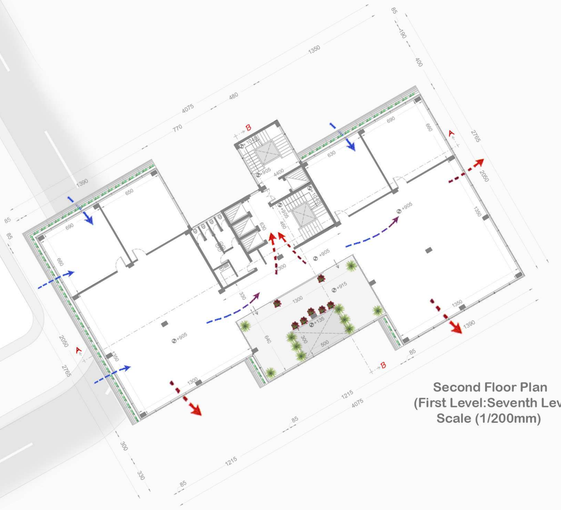
ARCHITECTURAL DRAWINGS



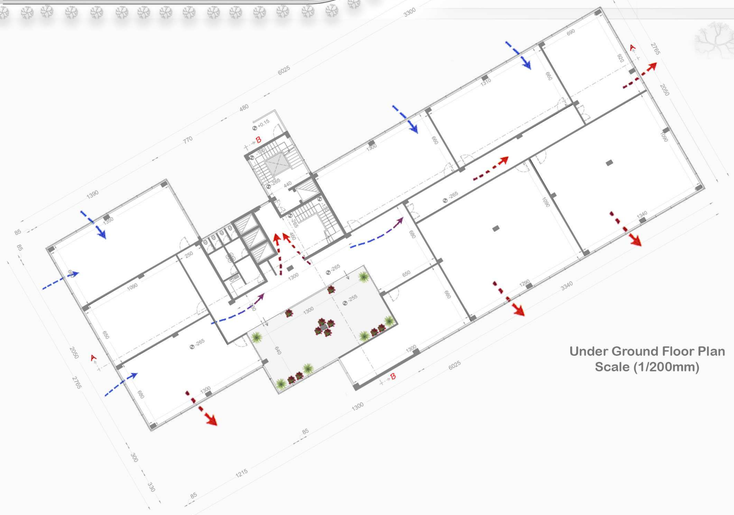
Site Plan
Scale (1/500mm)



Ground Floor Plan
Scale (1/200mm)



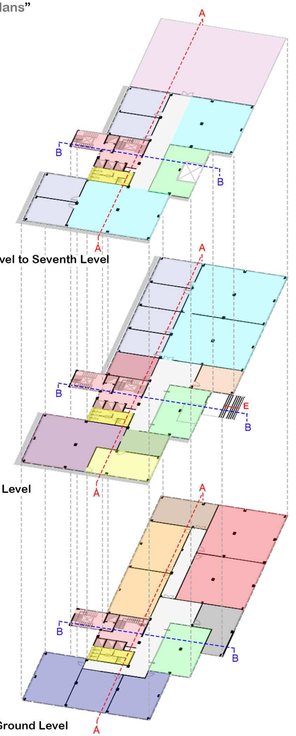
Second Floor Plan
(First Level:Seventh Level)
Scale (1/200mm)



Under Ground Floor Plan
Scale (1/200mm)

First Floor Plan
Scale (1/200mm)

"Key Plans"



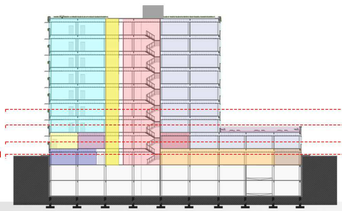
The Terrace(Open space) for employees to have more Natural Atmosphere inside the building

The Atrium inside the building as it will be the Rest Area for employees (for coffee and taking a break), and also for Direct Light

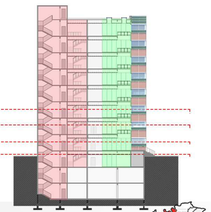
LEGEND

- Atrium
- Vertical Circulation
- Toilets
- Corridor
- Directors Offices
- Open Offices
- Open Terrace
- Services
- Security
- Secretary
- Manager Office
- Meeting Room
- Computers Lab
- Technician Office
- Conference Room
- Storage
- Archive Offices
- Parking

"Key Section (A-A)"



"Key Section (B-B)"



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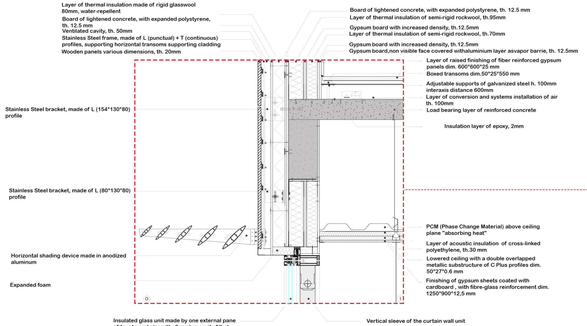
LAMPEDUSA OFFICE BUILDING "Milan, Italy"

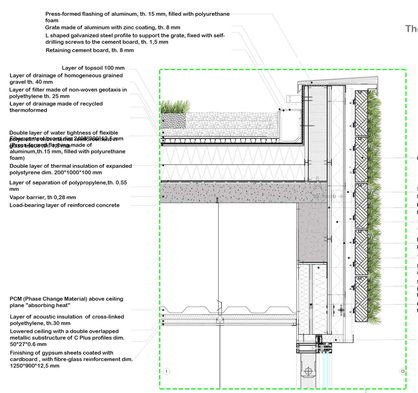
Proposal Design Building
"Floor Plans Drawings"
Scale (1/200 mm) , (1/500mm)

The Horizontal Sunshades in the (South East & South West) Facades



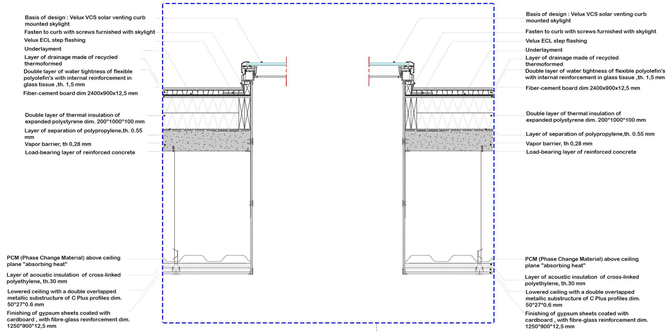
The Horizontal Sunshades Detail
Scale (1/10mm)

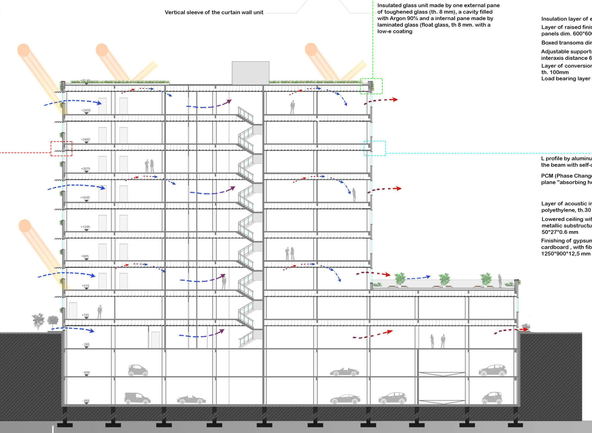
The Green Roof Detail
Scale (1/10mm)



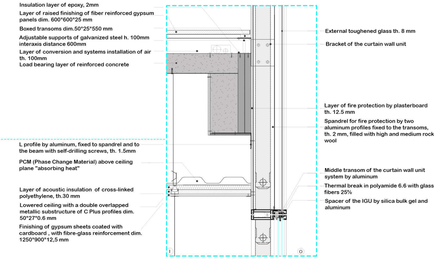
The Green Roof and the Skylight on the Roof of the Building

The Skylight Detail
Scale (1/10mm)



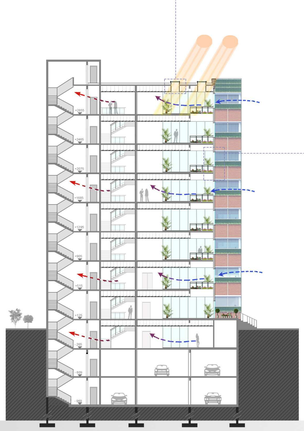


Section (A-A)
Scale (1/200mm)

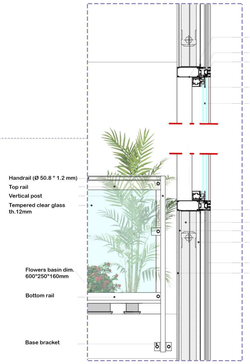


The Curtain Wall Detail
Scale (1/10mm)

The Curtain Wall Facade and the View of the Atrium that inside the Building

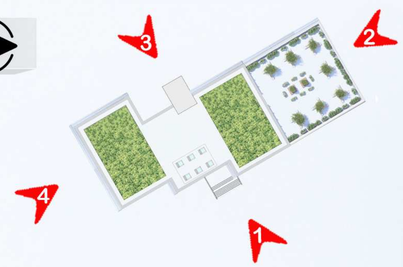


Section (B-B)
Scale (1/200mm)



The Operable Window Detail
Scale (1/10mm)

Lampedusa Office Building Facades



1 The North East Facade

2 The North West Facade

3 The South West Facade

4 The South East Facade

Interior Shots

The Rest & Green area and its connection with the Vertical services

The Rest & Green area with the Atrium and Natural light

The Entrance of the Office Building with the Atrium and The Green Area

The offices (Open Work Space) inside the Building with The Natural light

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LAMPEDUSA OFFICE BUILDING "Milan, Italy"

Proposal Design Building
"Facades" & "Interior Shots"
Scale (1/200 mm)

The Overview for the Proposed Office Building with Surrounded Site

The Intervention of Renovate a Service Stairs to work as **Solar Chimeny** in the **South West** Facade

The Intervention of Adding **Atrium** with **Skylight** in the **North East** Facade

The Intervention of Renovate the Empty Terrace to be as **Vegetation Terrace** that surrounded by **North East & North West & South West** Facades

The Intervention of Renovate the Empty Corridor to be as a **Part of the Ground Floor** in the **North East** Facade

The **3D** Section Plan for The Ground Floor

Thermal Transmittance and Thermal Bridges Calculations by using "Simulation Programes Softwares"

By using ASHRAE chart, the Dew Point Temperature is (9.5°C)

Operable Windows

Type
Operable Window
"AWS 114"
from Schüco

The Used Materials

ELEMENT	MATERIAL	THERMAL CONDUCTIVITY (W/mK)
Frame Detail	Aluminium Anodized	λ= 160
Gaskets	EPDM	λ= 0.25
Glazing	Laminated Glass Thermal Glass Float Glass	λ= 0.75 λ= 1 λ= 1
Spacer	Polysulphide Butyl Rubber Silica Gel Bulk Aluminium Anodized	λ= 0.4 λ= 0.24 λ= 0.13 λ= 160
Insulation	Polyamide 6.6 with 25% Glass Fibre	λ= 0.3
Insulation Fixing	Polyurethane Foam	λ= 0.05
Gasket Inserted	Silicon Foam	λ= 0.17
Sub Frame	PVC(rigid)	λ= 0.17
Fake Frame	Galvanized Steel	λ= 0.2
Sealant	Silicon	λ= 0.35
Insulation Panel		λ= 0.035

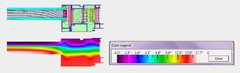
Vertical Section

Infrared Diagram shows that the inner temperature is between green and red colors and its higher than the Dew point

Frame + Glass		Frame + Insulation Panel	
Total Length		Projected (X)	
FRAME	EDGE	FRAME	EDGE
U 1.48	1.22	U 1.51	0.77
b 0.17	0.23	b 0.18	0.11
L_f [m]	Ψ		
0.518	0.123		

The calculations of (U. Value) for Frame and Edge

Horizontal Section (Transparent Part)



Infrared Diagram shows that the inner temperature is between green and red colors and its higher than the Dew point

Frame + Glass		Frame + Insulation Panel	
Total Length		Projected (X)	
FRAME	EDGE	FRAME	EDGE
U 1.4	1.1	U 1.4	0.75
b 0.12	0.2	b 0.1	0.2
L_f [m]	Ψ		
0.477	0.111		

The calculations of (U. Value) for Frame and Edge

Horizontal Section (Opaque Part)

The Tilted Angle of the Lamellas has been changed along the simulations:

"U-value, the Solar Factor and the Solar Heat gain decrease with the closing of the Lamellas"

So, the best solution is **, Lamellas with a 45° angle** Since as this solution is the best one to guarantee Thermal Performance of the Window and Daylight standard for the Office Building along the whole year

The Final Results of (U-value calculations)

$$U_W = \frac{U_{glass}A_{glass} + U_{frame}A_{frame} + \sum_i \Psi_i l_i}{A_{TOT}}$$

- Uglass = 0,9 W/m2K (from data sheet)
- Uframe = 1 W/m2K (from data sheet)
- Ψi = linear thermal transmittance.
- ATOT = total area of the window, obtained as sum of the area of all the element of the window
- UW = total thermal transmittance of the window

A_{TOT}	U_G	A_F	U_F	L_G	Ψ_G	L_F	Ψ_F	A_{TOT}	U_W	$U_{WDesign}$
m^2	W/(m²K)	m^2	W/(m²K)	m	W/(mK)	m	W/(mK)	m^2	W/(m²K)	W/(m²K)
0.98	0.9	0.62	1	3.4	0.11	1.54	0.13	1.6	1.14	1.4

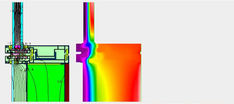
The **Uw= 1,14 W/m2K which is < 1,4** the limit assigned by UNI EN 13830:2015, so the unit of the window verified the standard limit values
Inner Temperature higher than the Dew point, **so there is no condensation the Window**

Curtain Wall

Type
Double Glazing Curtain Wall
"USC 65"
from Schüco

ELEMENT	MATERIAL	THERMAL CONDUCTIVITY (W/mK)
Frame Detail	Aluminium Anodized	λ= 160
Sealant	Silicon	λ= 0.35
Gaskets	EPDM	λ= 0.25
Glazing	Glass Toughened	λ= 1
Insulation	Polyamide 6.6 with 25% glass fibre	λ= 0.3
Spandrel Insulation	Rock Wool	λ= 0.038
Fireinthwool		λ=0.285
Spacer	Polysulphide Butyl Rubber Silica Gel Bulk Aluminium Anodized	λ= 0.4 λ= 0.24 λ= 0.13 λ= 160
Slab	Gypsum Board Aluminium Foiured	λ= 0.2 λ= 160
Roof Joint	Gravel Polyethylene HD Polyethylene LD Polypropylene Polylactic Insulation Fiber Cement Concrete Galvanized Plate Steel Polyurethane Foam Polyurethane Foam Sprayed	λ= 0.7 λ= 0.5 λ= 0.33 λ= 0.22 λ= 0.18 λ= 0.031 λ= 0.6 λ= 0.85 λ= 62 λ= 17 λ= 0.05 λ= 0.024

Vertical Section



Infrared Diagram shows that the inner temperature is between green and red colors and its higher than the Dew point

Frame + Glass		Frame + Insulation Panel	
Total Length		Projected (Y)	
FRAME	EDGE	FRAME	EDGE
U 1.75	1.57	U 5.7	0.88
b 0.22	0.36	b 0.07	0.30
L_f [m]	Ψ		
0.943	0.46		

The calculations of (U. Value) for Frame and Edge

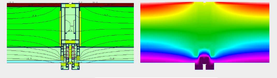
Horizontal Section (Transparent Part)

Infrared Diagram shows that the inner temperature is between green and red colors and its higher than the Dew point

Frame + Glass		Frame + Insulation Panel	
Total Length		Projected (X)	
FRAME	EDGE	FRAME	EDGE
U 0.83	1.54	U 2.86	0.86
b 0.47	0.55	b 0.05	0.46
L_f [m]	Ψ		
0.944	0.398		

The calculations of (U. Value) for Frame and Edge

Horizontal Section (Opaque Part)



Infrared Diagram shows that the inner temperature is between green and red colors and its higher than the Dew point

Frame + Insulation Panel		Frame + Glass	
Projected (X)		Total Length	
FRAME	EDGE	FRAME	EDGE
U 3.61	1.15	U 3.5	2.9
b 0.54	0.53	b 0.06	0.50
L_f [m]	Ψ		
1.251	-0.788		

The calculations of (U. Value) for Frame and Edge

The Final Results of (U-value calculations)

$$U_{cw} = \frac{A_g U_g + A_f U_f + A_{sp} U_{sp} + A_i U_i + L_{sg}\Psi_{sg} + L_{ss}\Psi_{ss} + L_{sg}\Psi_{sg} + L_f\Psi_g}{A_{cw}}$$

The following data that already exist in the data sheet and the results from THERM, are used to calculate the overall thermal transmittance of the unitized unit:

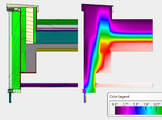
Area	U-value
m^2	W/m²K
A_g = 3.2	Ug= 1
A_f = 1.16	Uf= 5.041
A_{sp} = 0.23	Usp=3.93
A_i = 0.17	Ui=3.93
A_{cw} = 4.76	

	Glazing	Spandrel	(Glass- Spandrel)
Length (m)	Lsg = 2.57	Lsp = 0.93 m	Lg = 1.25 m
Linear Thermal Transmittance (W/mk)	Ψsg = 1.16	Ψsp = - 0.76	Ψfg = 0.46

The **Ucw= 1,184148 W/m2K which is < 1,4** the limit assigned by UNI EN 13830:2015, so the unit of the curtain wall verified the standard limit values
Inner Temperature higher than the Dew point, **so there is no condensation the Curtain Wall**

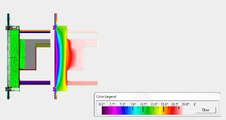
The Connections

Roof Joint



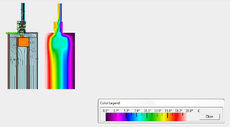
The inner temperatures are in between green and red on the infrared diagram. Lower temperature on the interior side in the green region is equal to **10.5 °C which is > 9.5 °C**, so no condensation occurs

Slab Joint



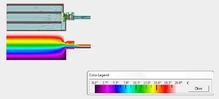
The inner temperature values are in between green and red on the infrared diagram. Lower temperature on the interior side in the green region is equal to **11.5 °C which is > 9.5 °C**, so no condensation occurs.

Vertical Connection between Window and Wall



The inner temperature values are in between green and red on the infrared diagram. Lower temperature on the interior side in the green region is equal to **10.3 °C which is > 9.5 °C**, so no condensation occurs.

Horizontal Connection between Window and Wall



The inner temperature values are in between green and red on the infrared diagram. Lower temperature on the interior side in the green region is equal to **10.3 °C which is > 9.5 °C**, so no condensation occurs.

LBNL Window — simulation programme software

Sun Shading Devices

(Sun Shading Device)
"Large Louvre Blades ALB - passive" from Schüco

Simulink — simulation programme software

Thermal Energy Storage [PCM]

(PCM product) **"ANDOR-O-BP/58 " from ebtextiles**

Comparing between two cases during occupation period as following:

(Discomfort Time Percentage Index **DTP**, Weighted Discomfort Index **I.D.**, Mean Indoor Air Temperature **M.T.**, Deviation standard and Maximum Indoor Air Temperature **MAX.T.**)

City	Ventilation System	DTP (%)	I.D. [°C*]	M. T. [°C]	Dev. St. [°C]	Max T. [°C]
Milano	NVS	22	149	26.4	2.0	31.0
	NVS+PCMsystem	11	33	25.4	1.9	29.7

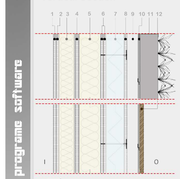
The difference between the two cases is appreciable in all the considered parameters:

Mean Indoor Air Temperature is around a 1°C
DTP reduce to 11%
That means **"The Peak Cooling Loads are Reduced for using PCM"**

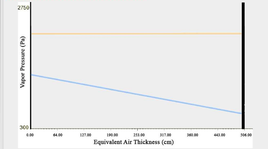
ISOLPARMA — simulation programme software

Ventilated Wall

Vertical Section



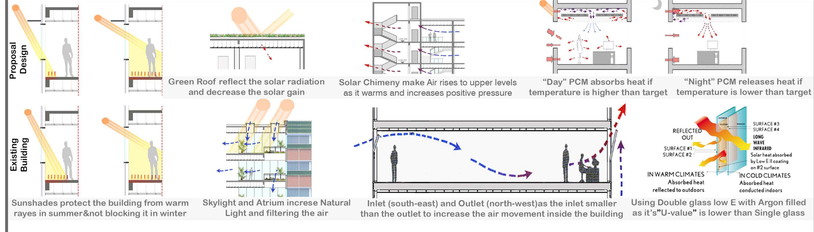
	Layer
1	Gypsum board + aluminium layer (vapour barrier), th. 12.5 mm
2	Gypsum board, th. 12.5 mm
3	Thermal insulation made by rockwool, th. 70 mm
4	Gypsum board, th. 12.5 mm
5	Thermal insulation made by semirigid rockwool, th. 05 mm
6	Double board of lightened concrete, with expanded polystyrene, th. 12.5 mm
7	Thermal insulation made of rigid rockwool, th. 80 mm
8	Board of lightened concrete, with expanded polystyrene, th. 12.5 mm
9	Ventilated cavity, th. 50 mm
10	Frame
11	Cladding: green wall panels (th. 80 mm)
12	Cladding: wooden panels (th. 20 mm)

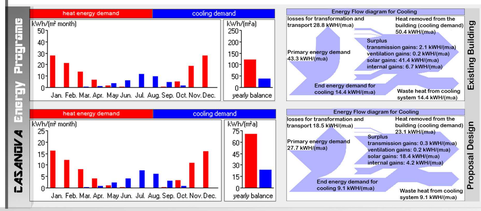


The graph shows :
X-axis there's the Equivalent Air Thickness (**cm**),
Y-axis the Vapor Pressure (**Pa**)
The Orange line is the Saturation Pressure profile, while the Blue one is the Partial Pressure profile
"Since the Partial Pressure is always smaller than the Saturation Pressure, there's no condensation"

CASANOVA Energy Programe — Existing Building / Proposal Design

The Summary OF The Study





(The Existing Office Building):
Heating Energy Demand **125 kWh/ (m2a)**
Cooling Energy Demand **40 kWh/ (m2a)**

As a result of the above Interventions (The New Proposal):
Heating Energy Demand **70 kWh/ (m2a)**
Cooling Energy Demand **22 kWh/ (m2a)**
So, **Heat Energy Demand and Cooling Energy Demand will be decreased inside the Office Building more than half and also, the Total Energy Consumption decreased more than "40%"per year**

Politecnico di Milano
Alexandria University
SCHOOL OF ARCHITECTURE URBAN PLANNING CONSTRUCTION ENGINEERING
SCHOOL OF GREEN INNOVATION AND ENTREPRENEURSHIP

Double Degree Masters Project
"Achieving Thermal Comfort in Existing Buildings using Passive Cooling Techniques "
"Case Study of Retrofitting an Existing Office Building"

Supervisor : Professor| ALESSANDRO ROGORA
Student : ISHAK ENGY

LAMPEDUSA OFFICE BUILDING " Milan, Italy "

Proposal Design Building
"Energy Performance"