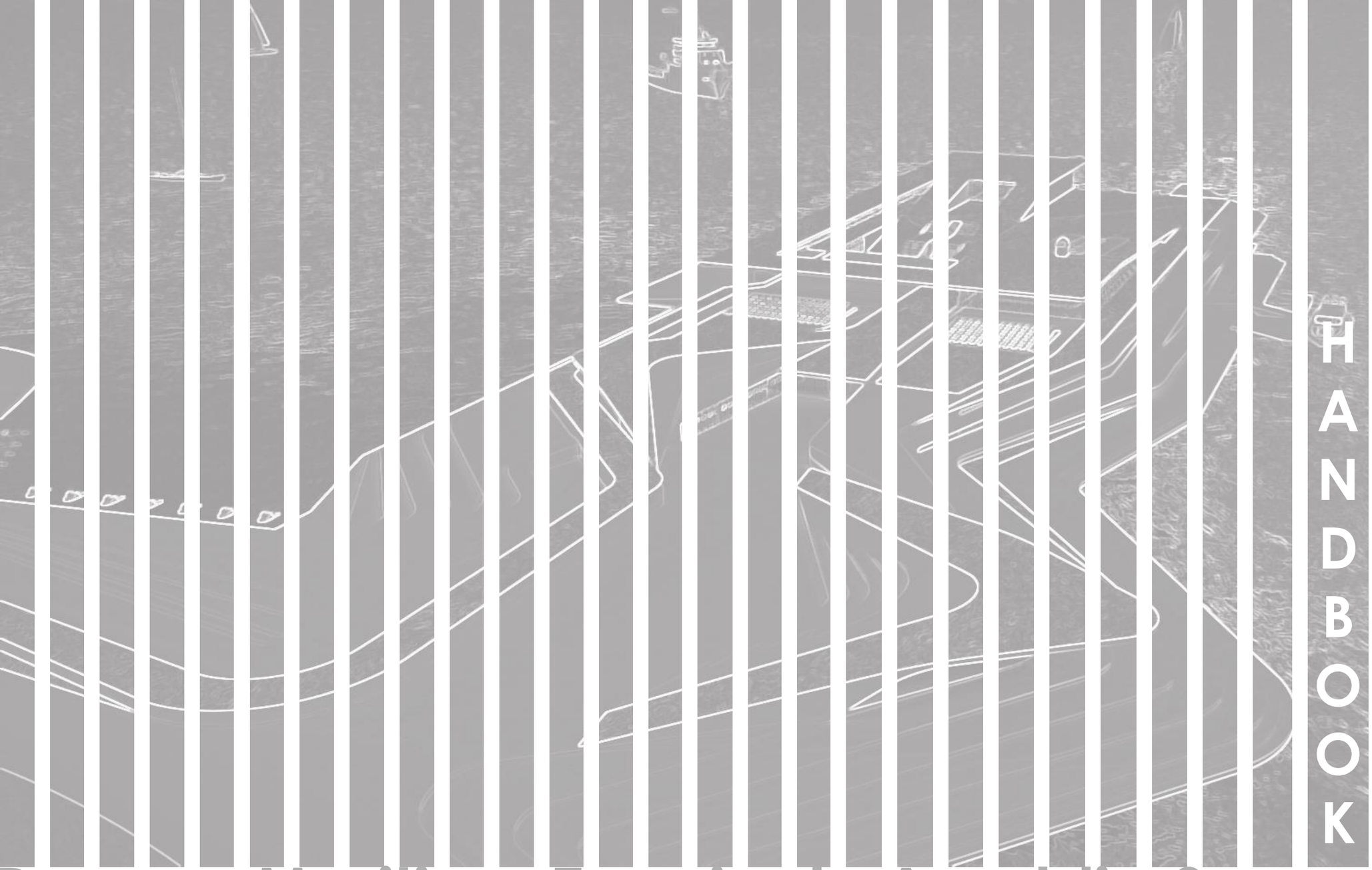

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HANDBOOK

Ramsar Maritime Terminal , A public Space

2023

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School of Architecture Urban Planning Construction Engineering

Building and Architectural Engineering

Ramsar Maritime Terminal , A public Space in a Moderate Costal Zone

PROJECT HANDBOOK

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2023

INTRODUCTION

Why Maritime Terminal ?

A large part of the southern shores of the Caspian Sea is under Iran's control. Unfortunately, due to the lack of proper management of these beaches, except for two small docks in the east and west of this large coastline, there is no marine terminal in this area, and in practice, no tourist and economic use of the Caspian Sea coasts is carried out on the border of Iran.

INTERNATIONAL

IRAN ABSENCE IN INTERNATIONAL MARITIME HAULAGE HUB

NO GLOBAL TRADE

NO INTERNATIONAL TOURIST

DEVELOPING A MARITIME TERMINAL

Caspian Sea developing a maritime haulage hub between Europe and Asia

By developing a marine terminal in this region and becoming a member of the Caspian Sea Transportation Hub, the possibility of international tourists and international trade will be provided, which will lead to the economic prosperity of the region, the exchange of different cultures, and the development of the lives of local people.

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With the development of a coastal terminal in this area, a sea passenger transportation route can be created with two other ports in the east and west of the province, which can reduce the heavy traffic load in the region during holidays.

This maritime terminal can also increase the number of tourists in the region, which increases the living standards of the local people. Also, by creating local markets and exhibitions in this terminal, in addition to transferring the local culture, it also improves the local people's economy.

NO INTRA-REGIONAL TOURIST

INCRESE OF TRAFFIC LOAD OF COSTAL CITIES

NO INTRA-REGIONAL MARITIME TRANSPORT

NATIONAL

NO LOCAL COASTAL PUBLIC SPACE
LACK OF BEACH ACTIVITES
REDUCTION OF SAFE COAST

UNORGANIZED COAST

Amirabad port

Anzali port

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Residents of neighboring coastal cities

Use of Domestic ferry

Benefits

Creating an inter-regional passenger line, attracting regional tourists, reducing the traffic load in coastal cities

Local of Ramsar city who wish to enjoy the port-side

Benefits

Create a landscape to enjoy the view of the sea
Creating a public space for social interactions
Walking line
Creating a beach cafe and restaurant
Creating local markets

3 key user groups with distinct needs

International Tourist

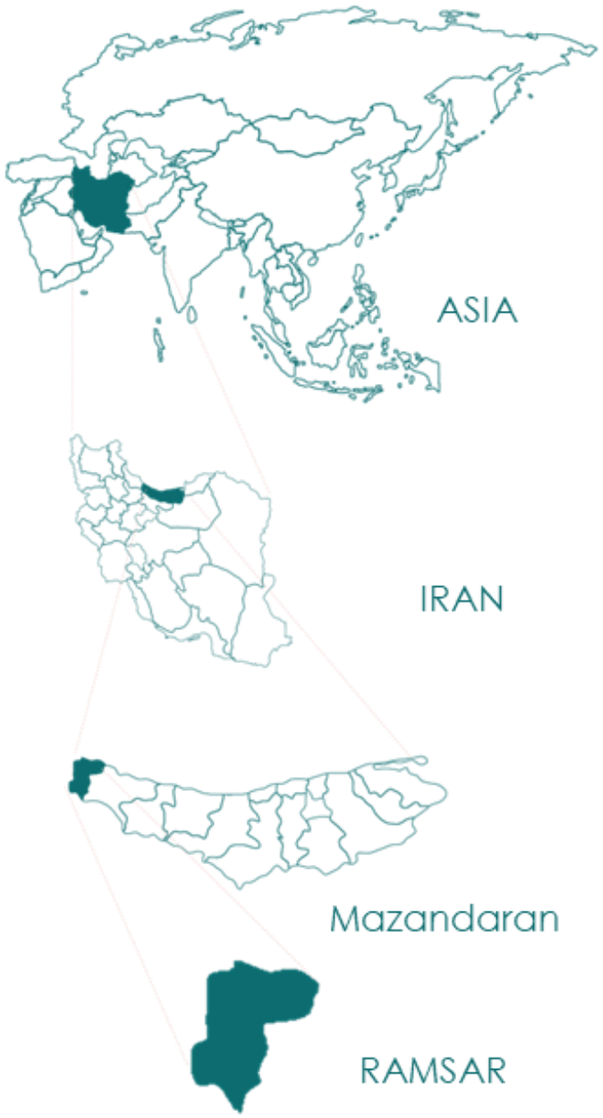
Use of international cruise liners

Benefits

Membership in the maritime haulage hub Maritime communication with the countries along the Caspian Sea
Increase in international tourists
Creating new global trade opportunities
cultural exchange

MARITIME TERMINAL TARGET USER IN RAMSAR

LOCATION



Ramsar lies on the coast of the Caspian Sea.
It is the westernmost county and city in Mazandaran. It borders the Caspian Sea to the north, Gilan province to the west, Qazvin Province to the south, and Tonekabon to the east.

CLIMATE

humid subtropical climate

Ramsar has a humid subtropical climate (Köppen: Cfa, Trewartha: Cf), with warm, humid summers and cool, damp winters. Northern Iran, as well as most portions of Iran, is separated by mountains. it is humid and green due to moisture from the Caspian sea.

TOURIST

Ramsar is a popular sea resort for Iranian tourists. The town also offers hot springs, the green forests of the Alborz Mountains, the vacation palace of the last Shah, and the Hotel Ramsar. Twenty-seven kilometres (17 mi) south of Ramsar and 2,700 metres (8,900 ft) above sea level in the Alborz mountains is Javaher Deh village, which is an important tourist attraction in Ramsar county.

WHY RAMSAR...

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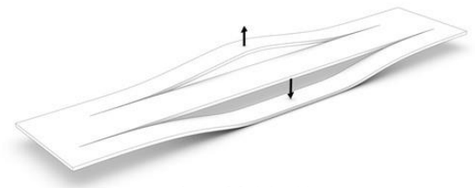
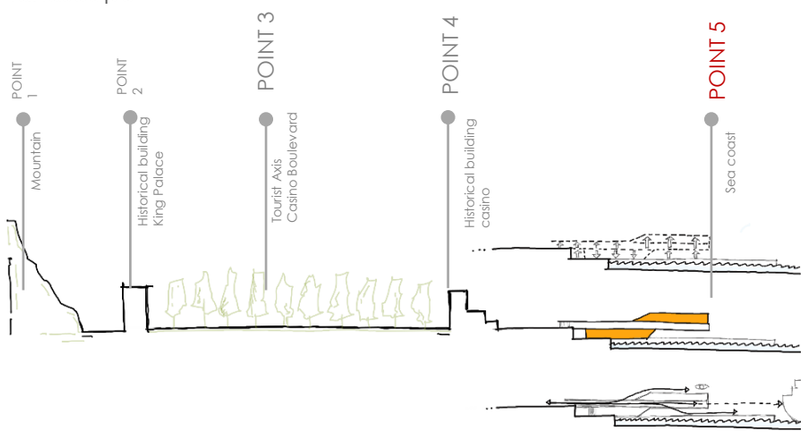
The new proposal is imagined as a piece of urban topography that has been lifted and split into a series of folded layers, in some places it is read as a piece of extruded groundscape. embedded with functions. In other places it hovers over the port-side, stretching out into the sea. In some respects in mirrors the range of experiences associated with the travelers it houses both mundane commuter facility and visionary landscape for journeys not yet taken. At its heart is an interest in how this mega structure supports its present function, how it could be adapted and how the fabric itself can be harnessed to support both itself and potentially its wider urban context.



series of folded layers

The terminal building will not be raised in respect of the historical context and preservation of the skyline and integration with the landscape.



Circulation Strategy:

The brief highlights three key user groups with distinct needs, the users of the domestic ferry and international cruise liners, those citizens of Ramsar who wish to enjoy the port-side. The building stacks these groups vertically: passengers for the ferries go below, visitors run above them, and urban citizens go on the roof. This fairly conventional diagram is then distorted which each group inhabits up and down creating a distorted topography that begins to connect different user groups.

Physical Program :

Project : Ramsar Maritime Terminal

Area : 18000 m2

Floor : 2 (1 below ground)

Maximum Height : 9.20 m

Maximum Length : 250 m

Program:
Maritime terminal for local, regional and international ferries and cruise liners from around the world.

The terminal includes:
Access Ramp , Entrance , Check in , Conveyor Belt-check in , Departure Hall , Conveyor Belt Arrival , Arrival lounge , Control Room , Ticketing , Information , Bar , Restaurant , WC , Offices , Passport control , Security , staff rest room .

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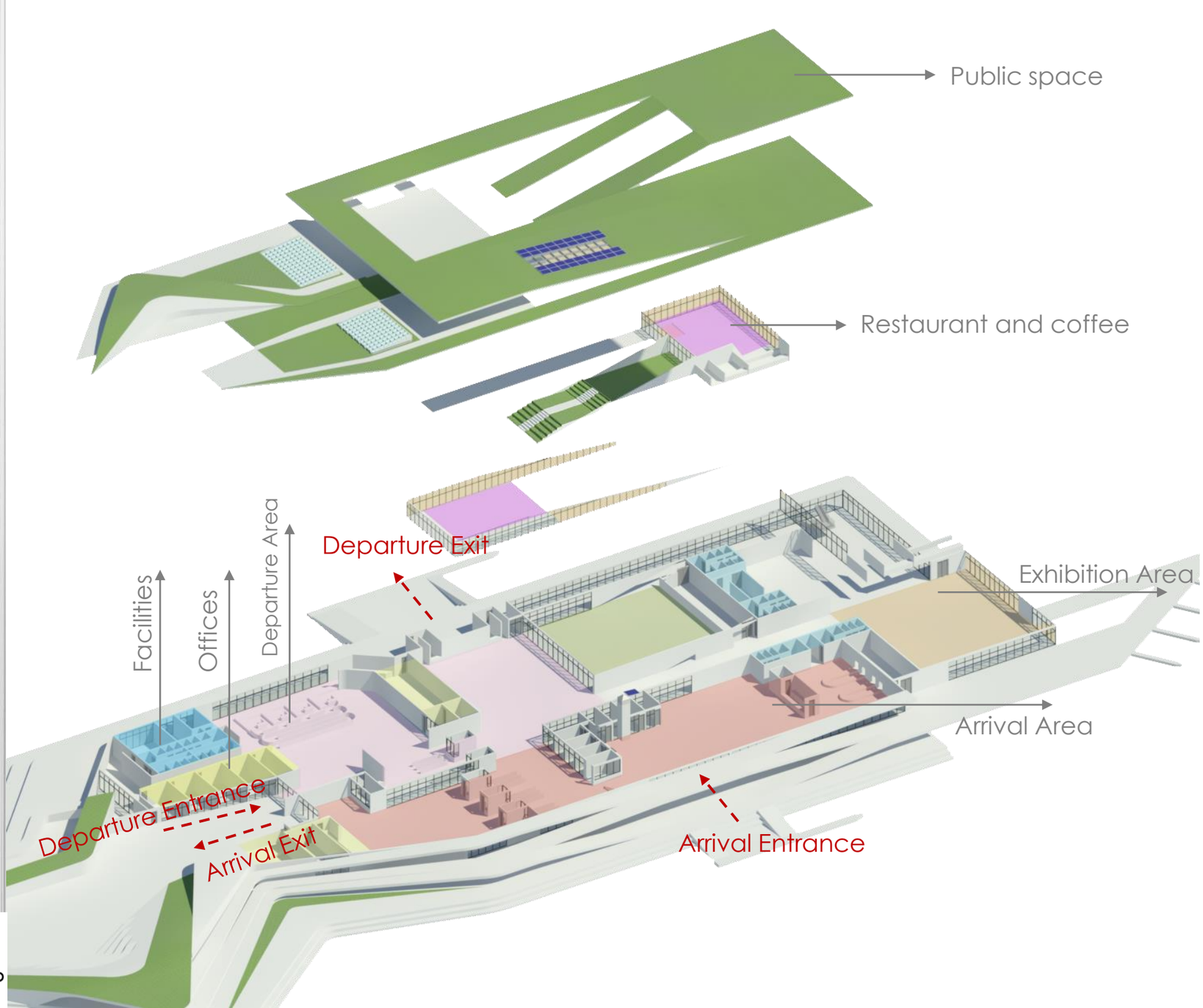

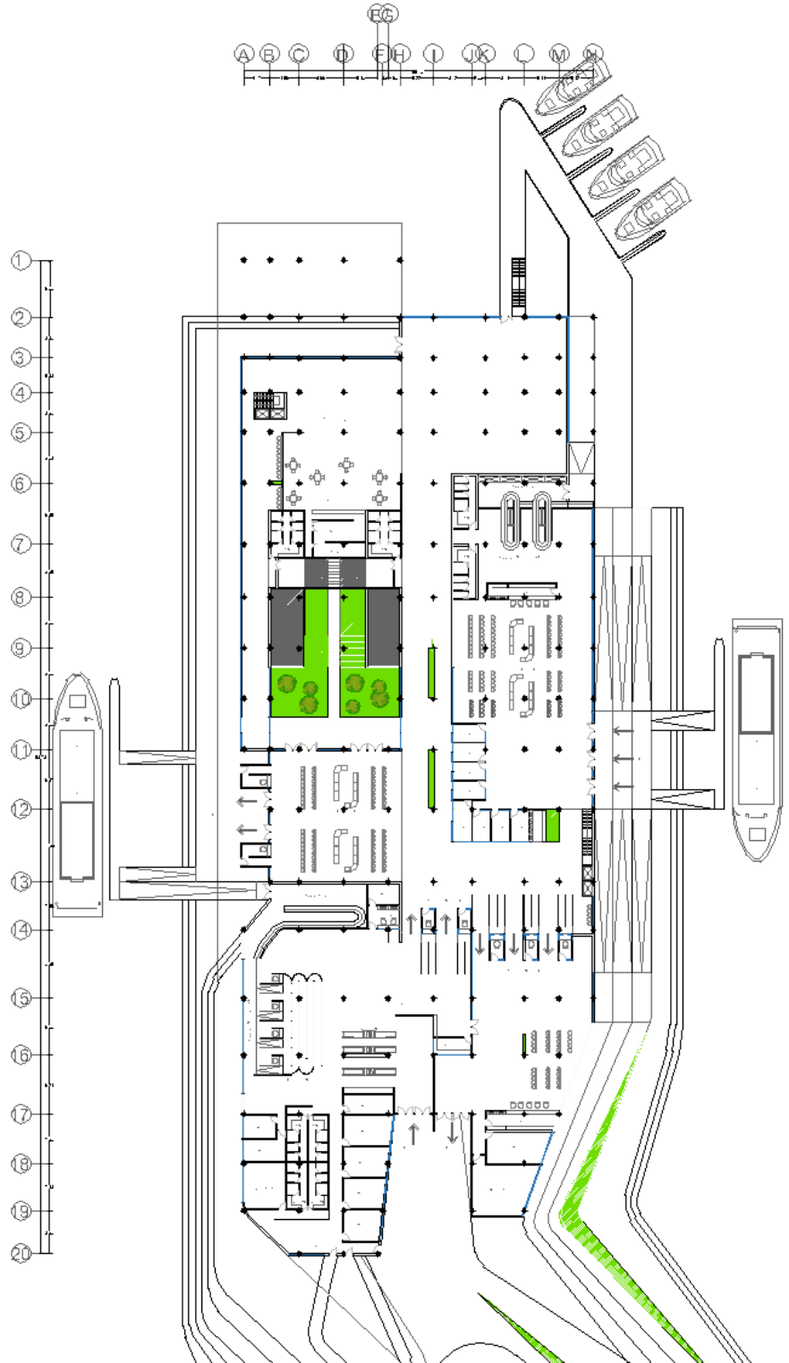

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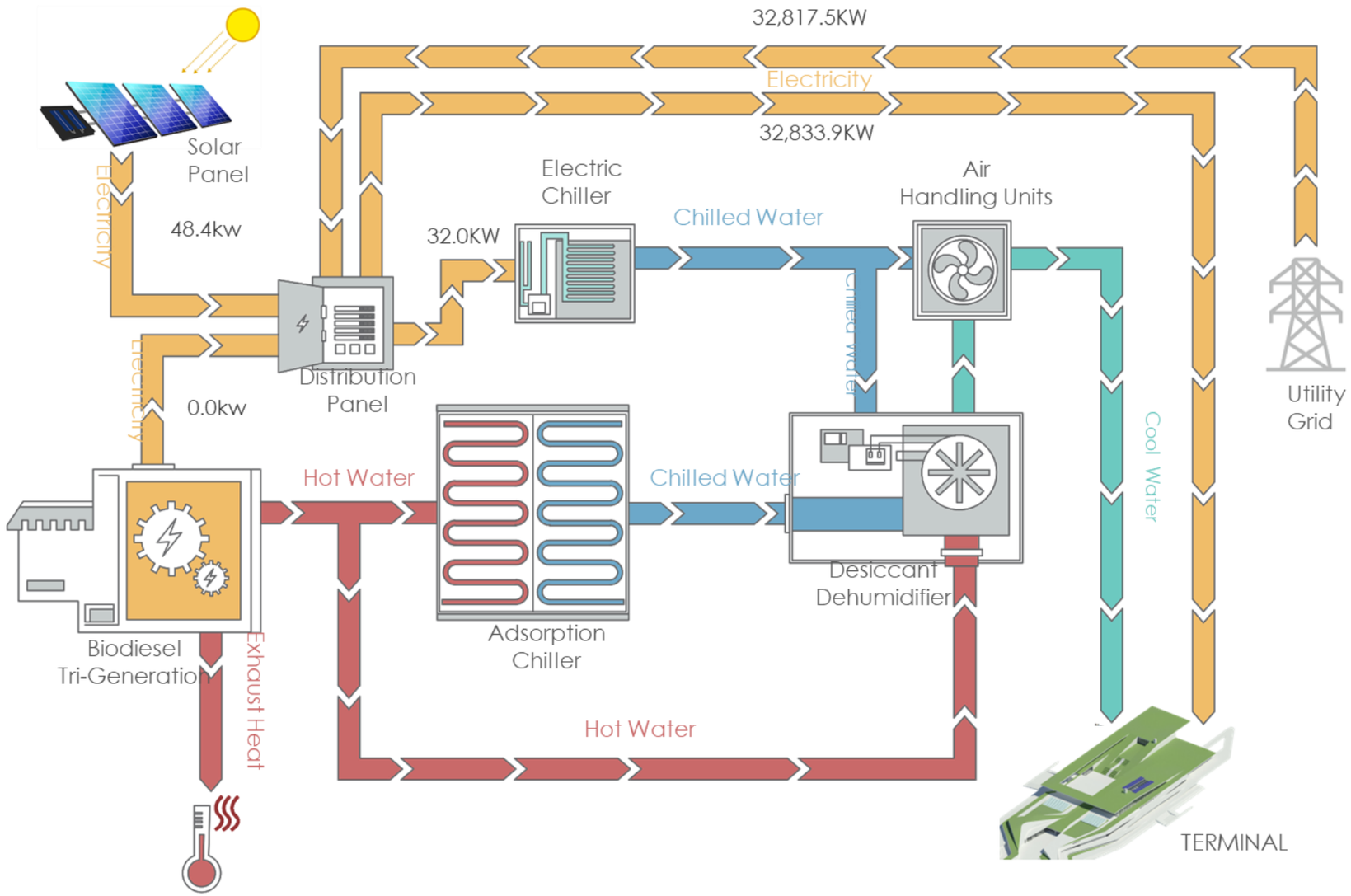
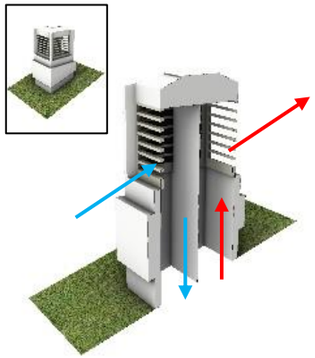
The Ramsar Maritime Terminal has its mission in carbon neutrality. That is, the building has net zero consumption of energy generated from fossil fuel. Passive design opportunities for reducing the reliance on mechanical systems were then explored. The most noticeable passive design features in the terminal are the maximal use of the natural ventilation and natural lighting and the optimal use of thermal insulation. The maximal use of the passive design measures leads to a reduction in energy needs by about 20%, compared to the benchmark of the Building Energy Code.

The electrical and mechanical systems of the highest efficiency (also referred to as active systems) were selected. Main examples are the floor cooling system combined with radiant cooling from the ceiling, high volume low speed ventilation fans, separate cooling and humidity removal systems, active skylights and light tubes. The adoption of those active systems lead to another 25% energy saving compared to the benchmark of the Building Energy Code.

Finally, the essential energy need is met through the on-site generation of electricity from the renewable sources. At the terminal, 60% of the energy need is met by the electricity generated from the solar panels. A tri-generation system provides another 110% of the energy needs, using waste cooking oil. As such, about 100 MWh/year surplus electricity is expected to be exported to the city grid, which is used to offset the embodied carbon over a period of 50 years.





Wind Catcher:

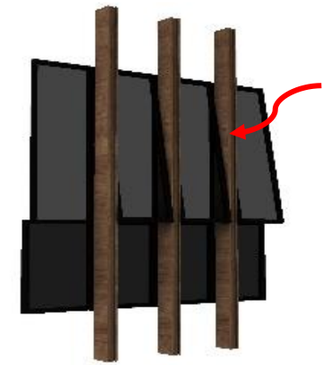
Local air speed

- Sensors
- Motorized dampers

Light Shelves:

Average lighting level

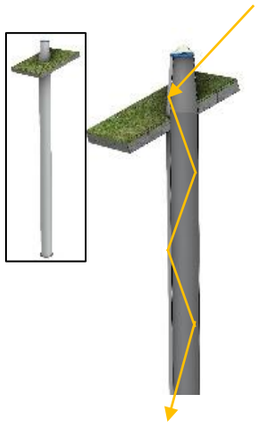
- 20 degrees angle
- System of mirrors
- Ceiling without projecting beams



External Shading:

Envelope heat gain

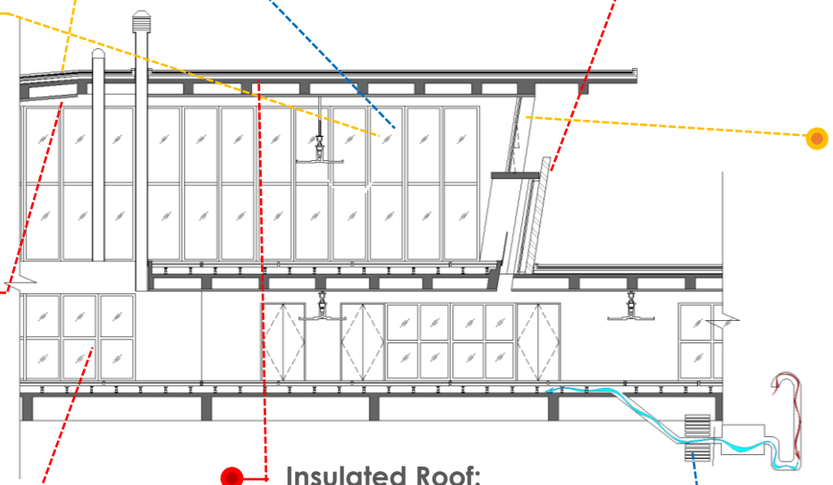
- Shade low-angled sun (North)
- Shade high-angled sun (South)



Light pipes:

Local lighting level

- Dome shape collects sunlight
- Highly reflective tube



Heat reflecting shade:

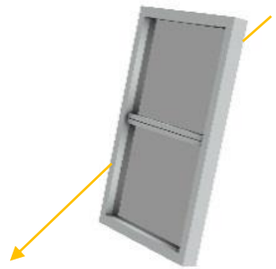
Envelope heat gain

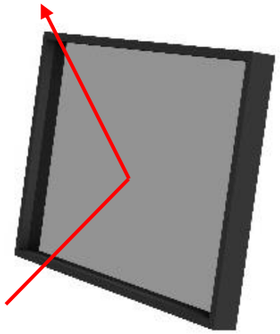
- Aluminum sheet
- Manually control

North Glazing:

Average lighting level

- VLT: 0.54
- Large area glazing wall





High Performance Glazing:

Envelope heat gain

- U value: 1.6 W/m^{2}K
- SC: 0.33

Insulated Roof:

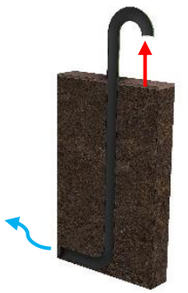
Envelope heat gain

- Cellular glass insulation
- 15% PV Panel
- 85% green roof

Earth Cooling Tube:

Air temperature

- 2 to 3m underground
- Tube diameter: 0.48m

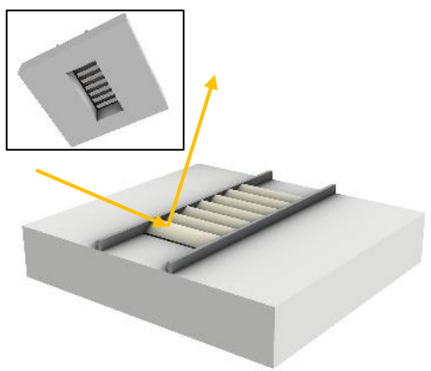


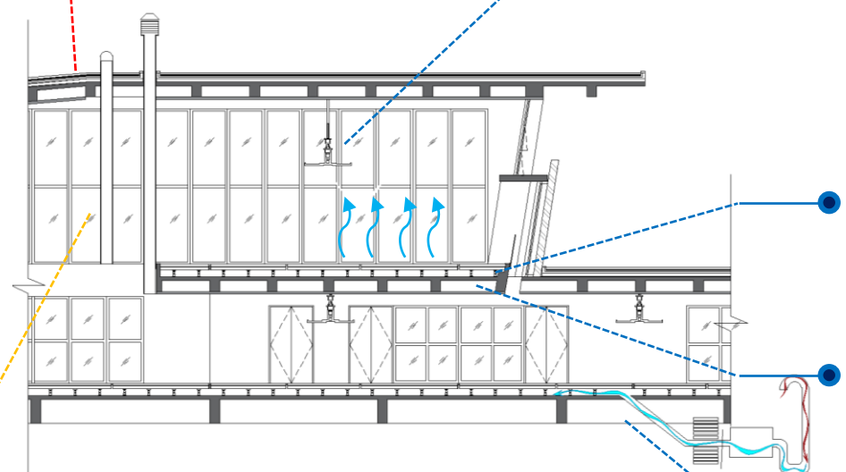
Solar control — Ventilation — Lighting

Active shaded Skylight:

Heat Gain

- Sensor detects sunlight angle
- Automatically shading control





High-Volume-Low-Speed Fans:

Cooling energy consumption

- Perceived temperature: -2˚C
- Diameter: 2.4m
- Airflow: 15,000 to 20,000 L/s

High Temperature Cooling System:

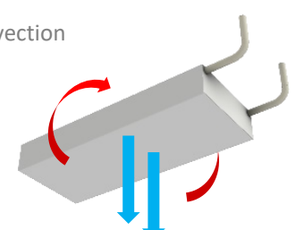
Cooling energy consumption

Underfloor Air Supply:

- Low speed airflow
- Cause natural convection

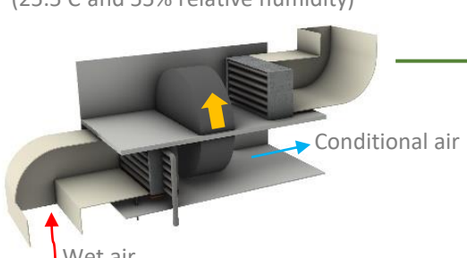
Chilled Beam:

- Radiant cooling



Desiccant dehumidification:

- Prevent overcooling (10 to 14 ˚C)
- Easier to achieve room condition (25.5˚C and 55% relative humidity)



Intelligent Lighting Management:

Lighting energy consumption

- Managed by a centralized system
- Manual override option

Solar control — Ventilation — Lighting

Passive system

01 North Glazing:

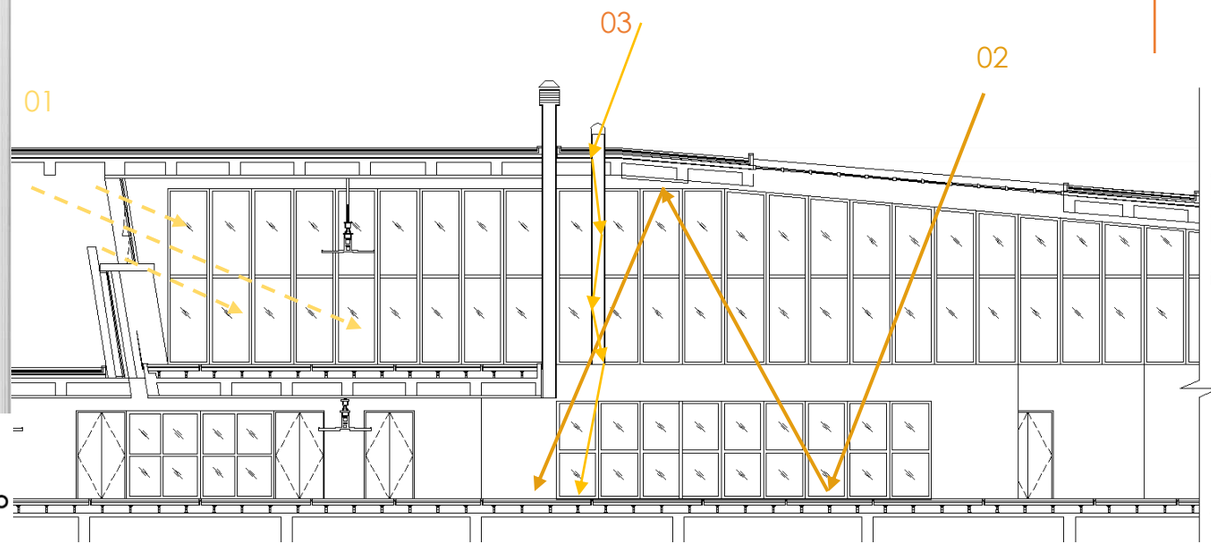
- Visual light transmittance: 0.54
- Tapered built form features large windows with additional head height and a partially glazed northwest glass wall.
- Northwest glass wall faces a relatively unobstructed sky but is sheltered from direct sunlight.

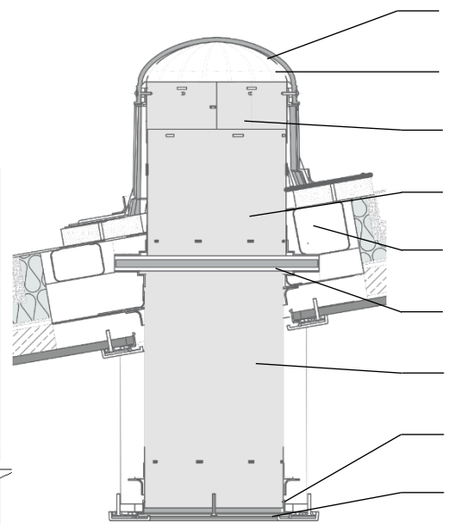
02 Light Shelves:

- Shading perimeter zones and distributing daylight to central zones.
- Ceiling without projecting beams to enhance internal light reflection.
- positioned at an angle of about 20 degrees to reflect light to the center of the building
- The light also bounces off the ceiling to the floor area.

03 Light Pipe:

- Dome shape collects sunlight
- Highly reflective tube surface
- Captures direct sunlight through a dome on the roof and deflects it through a highly reflective tube.
- Provides light throughout the day without glare or using electrical power.





Acrylic dome

VELUX SunCurve daylight directing device

Counter flashing assembly

Top collar

Curb & insulation provided by installer

Tape for tunnel joint

Tunnel

Cover to prevent vapor

Vapor barrier

Light pipe section profile detail

Light Shelves

Light pipes

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VENTILATION SYSTEM

High-Volume-Low-Speed Fans:

Perceived temperature: -2°C

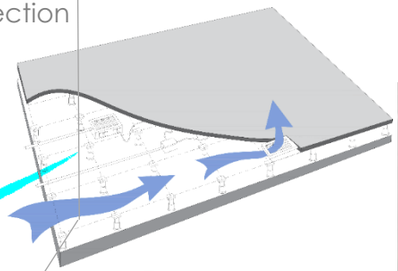
Diameter: 2.4m

Airflow: 15,000 to 20,000 L/s

Underfloor Air Supply:

Low speed airflow

Cause natural convection

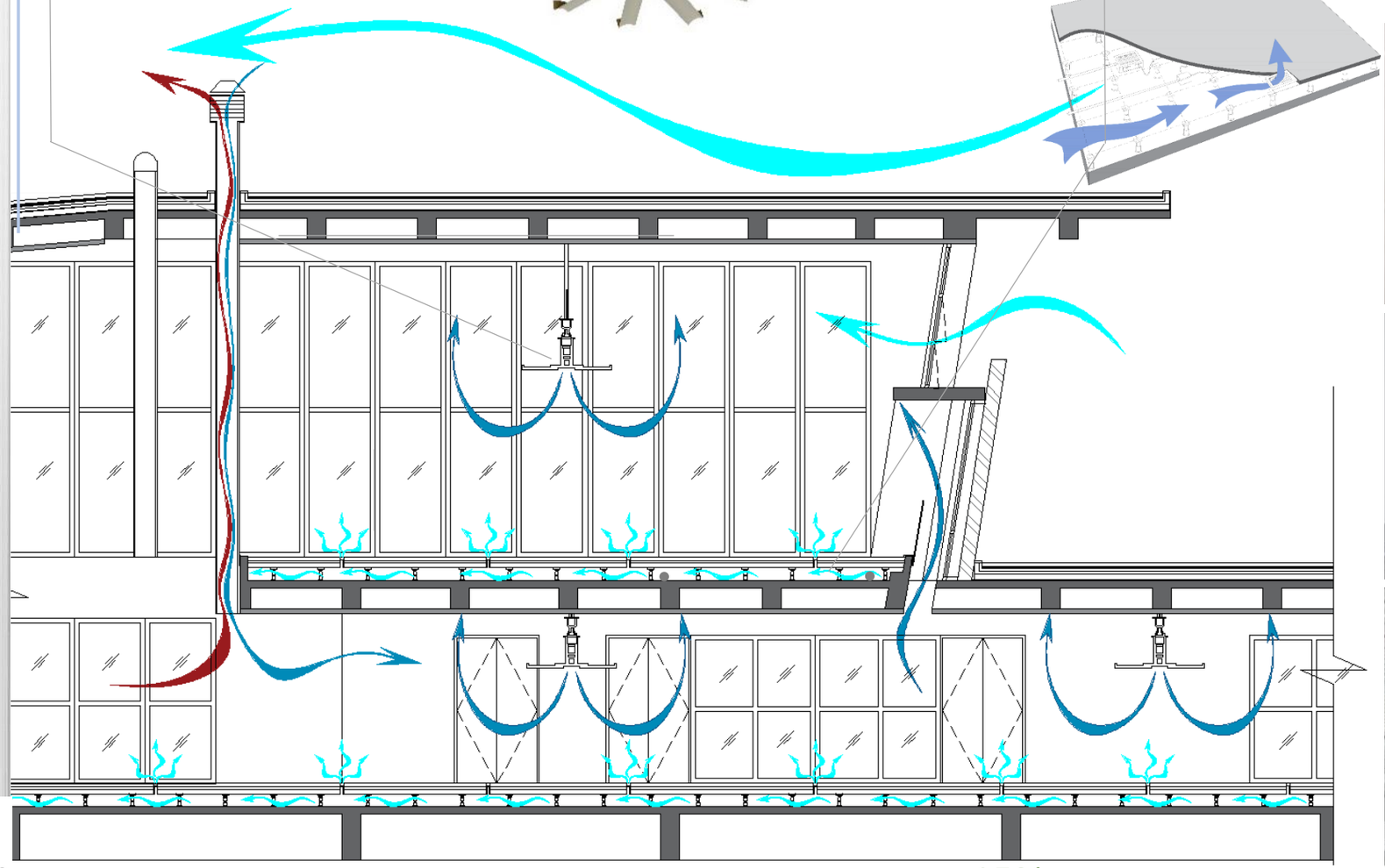


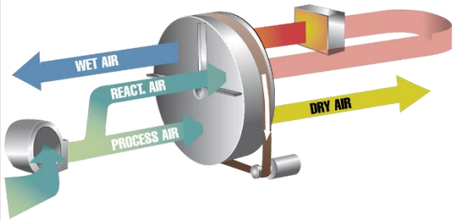
Desiccant dehumidification:

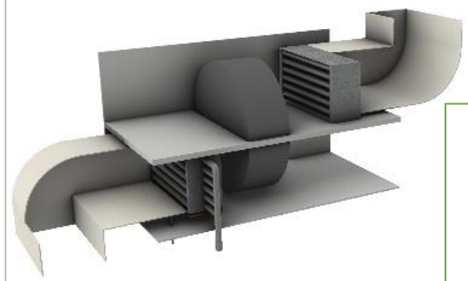
Prevent overcooling (10 to 14 °C)

Easier to achieve room condition (25.5°C and 55% relative humidity)

Wet air







Cooling energy consumption: -15%

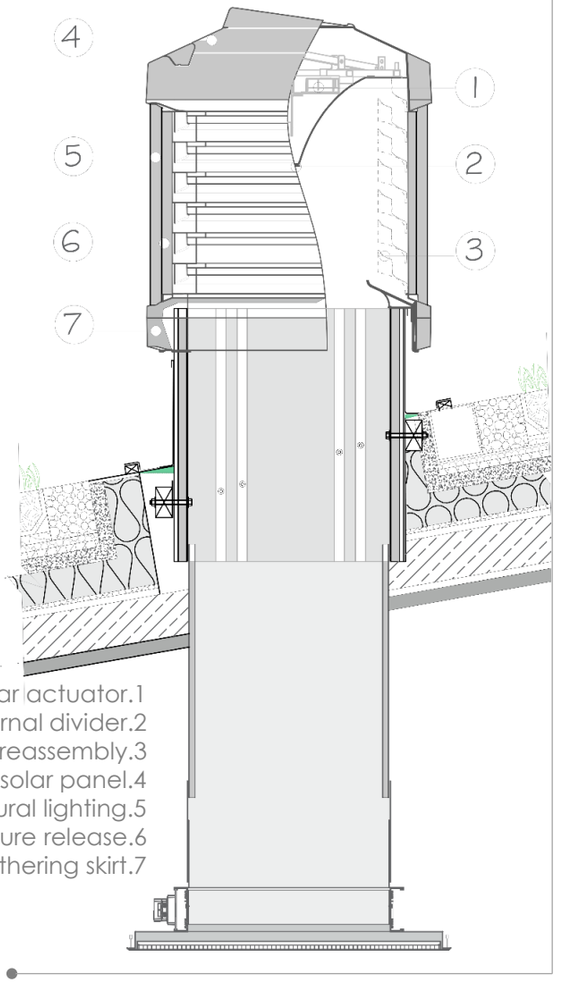
High temperature system

VENTILATION SYSTEM

WIND CATCHER

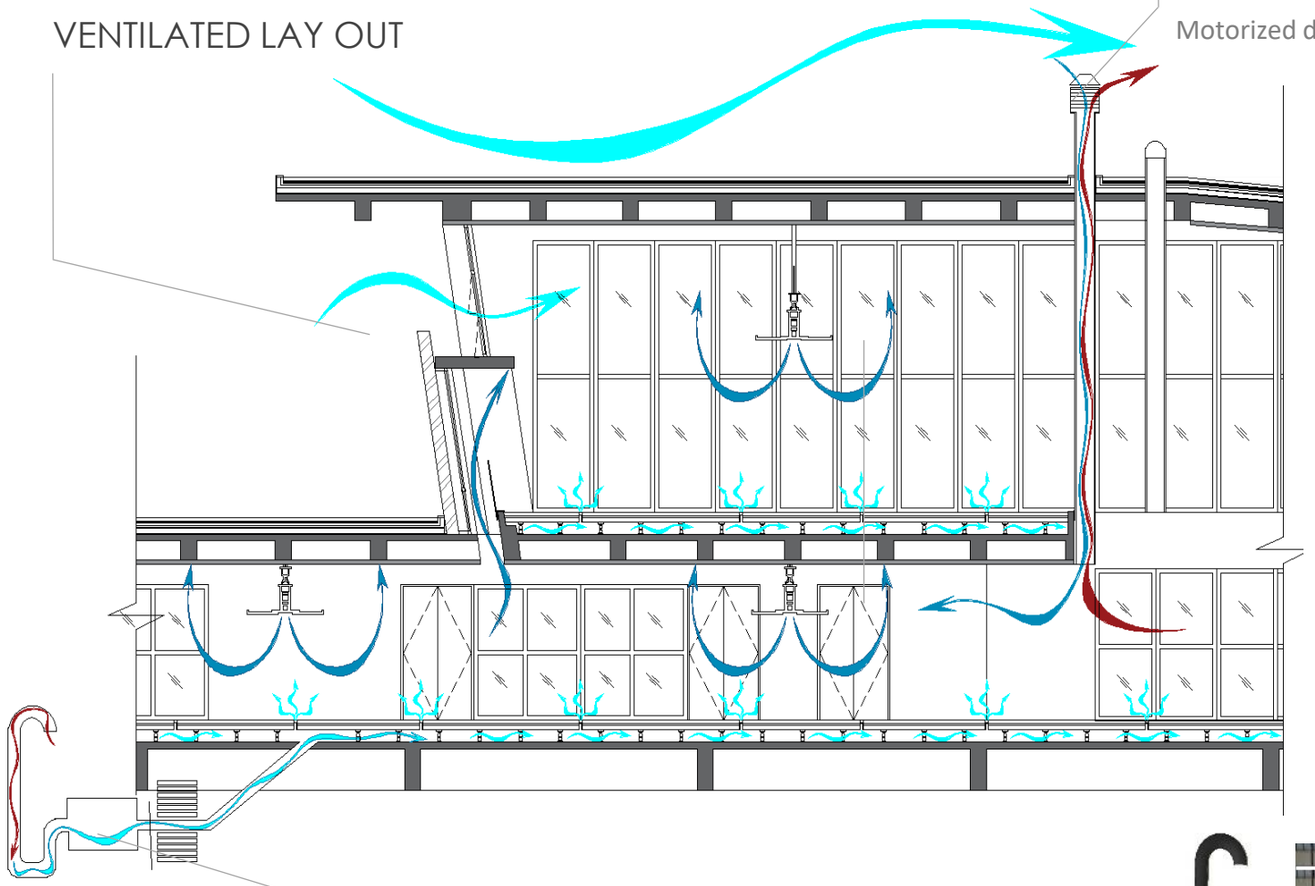
Sensors

Motorized dampers



Linear actuator.1
Internal divider.2
Active louvreassembly.3
Capping with integrated solar panel.4
White architectural lighting.5
Pressure release.6
Weathering skirt.7

VENTILATED LAY OUT



EARTH COOLING TUBE

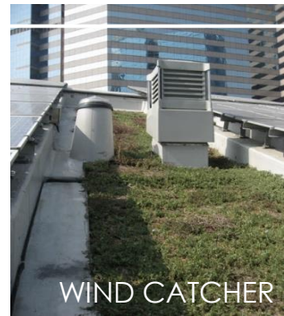
2 to 3m underground

Tube diameter: 0.48m


EARTH TUBE


VENTILATED LAY OUT


WIND CATCHER


WIND CATCHER

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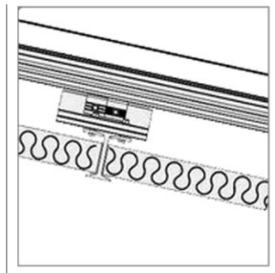
RENEWABLE SYSTEM

PHOTOVOLTAIC PANEL

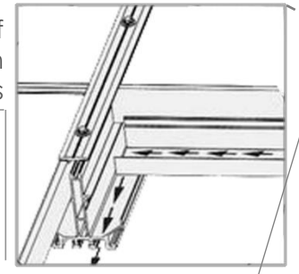
- •Polycrystalline Silicone PV panels are installed on terminals's inclined main roof.
- •Building Integrated Photovoltaics (BIPV) are used for the roof of the viewing deck.
- •Cylindrical CIGS are integrated in the Air-Tree installation to capture direct, diffused and reflected sunlight.

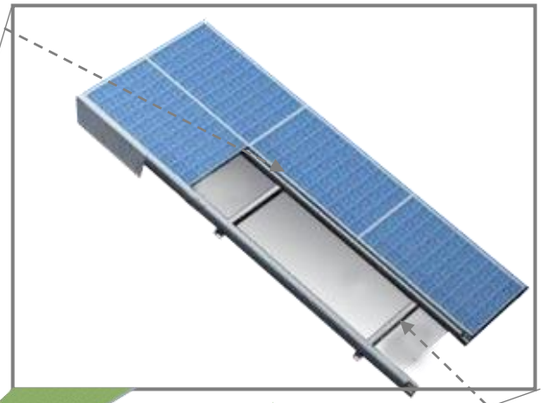


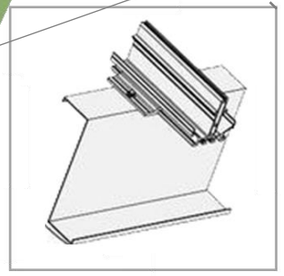
Insulation option

Provide the building with a performance upgrades and reduce energy consumption

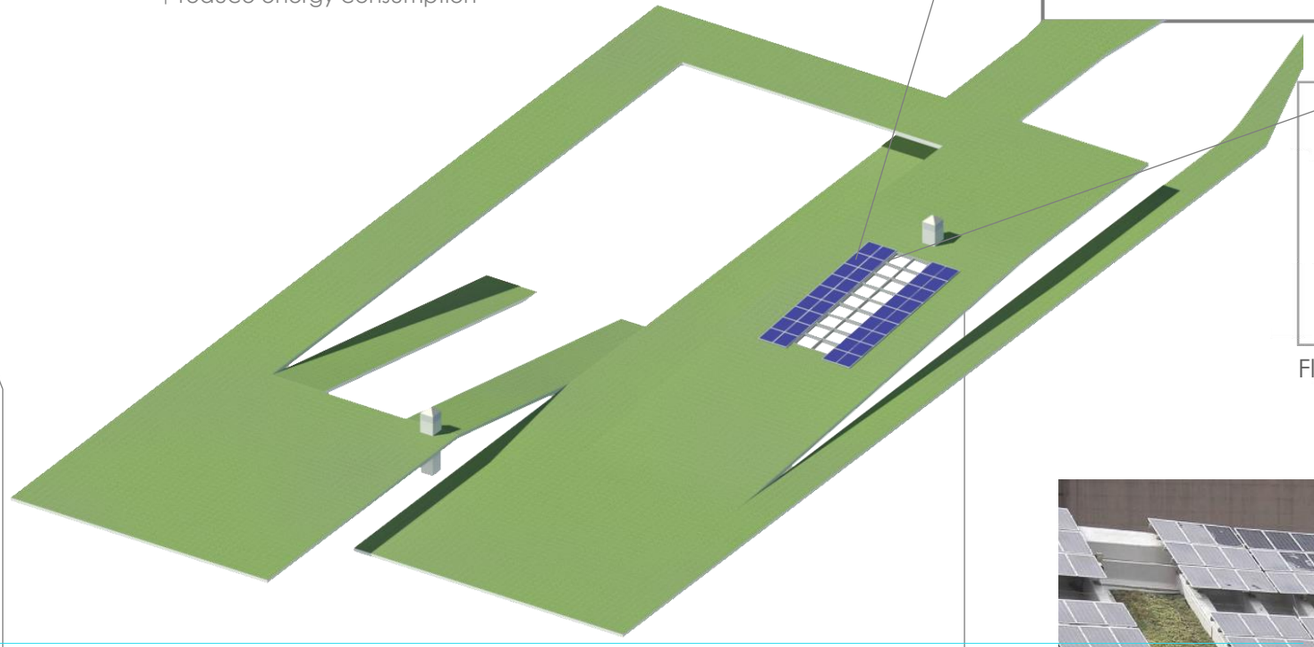
Weather – proof channel rail beneath PV modules

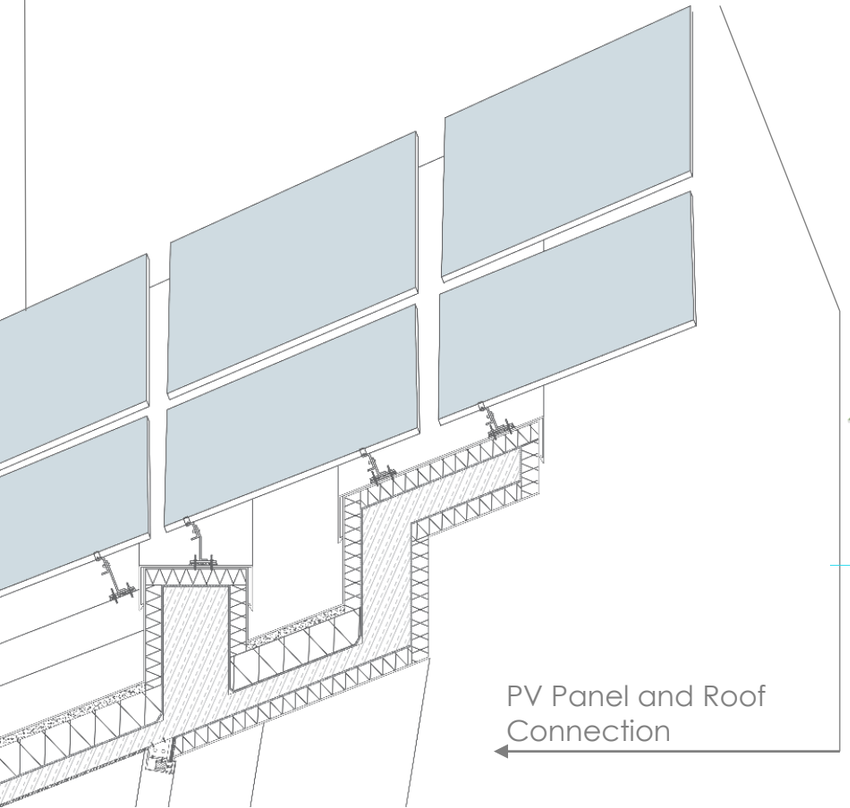






Flexibility in installation





PV Panel and Roof Connection

Building Integrated Photovoltaics (BIPV) are used for the roof of the viewing deck, where shading and daylighting are to be optimized.

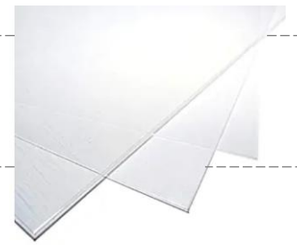
PV Panel

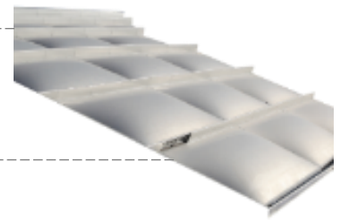
COMPARISON

Alternative materials for passive skylight

PV–ETFE cushion roof

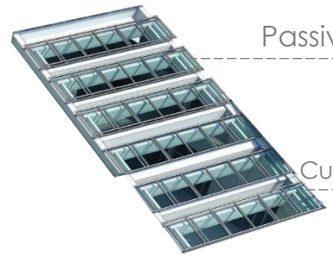
Different material





Passive skylight

Current system



	fiberglass	Polycarbonate	ETFE ethylene tetrafluoroethylene	glass
Durability :	Over 25 years	Over 20 years	Over 30 years	80 to100 years
Strength :	●●●●○	●●●●●	●●○○○	○○○○○
Light control:	●○○○○	●○○○○	●●●●●	●○○○○
Area to cover :	●●●○○	●●○○○	●●●●●	●●○○○
Installation: difficulties	●●○○○	●○○○○	●●●●●	●○○○○
Flexibility:	●○○○○	●○○○○	●●●●●	●○○○○
Environmental: friendly	○○○○○	●●○○○	●●●●●	●●●●○
energy efficiency:	Thermal Insulation 0.05 _1.2 w/m²□K	Thermal Insulation 2.4 w/m²□K, G VALUE 0.55	Thermal Insulation 5.6 _1.96 w/m²□K/G VALUE 0.48 _ 0.35	Thermal Insulation 5.2 _2.7 w/m²□KG VALUE 0.2 _ 0.7
FIRE :	500-700 degrees F	580°	low flammability (270C)	-
Cost :	$18,000 – $65,000 for installation and $375+ for maintance	$1.60 – $1.90 per pound	between $125 and $185 per square foot	$50-$75

SOLAR SYSTEM

Passive shaded Skylight:

01: Flashing

02: Water sealant

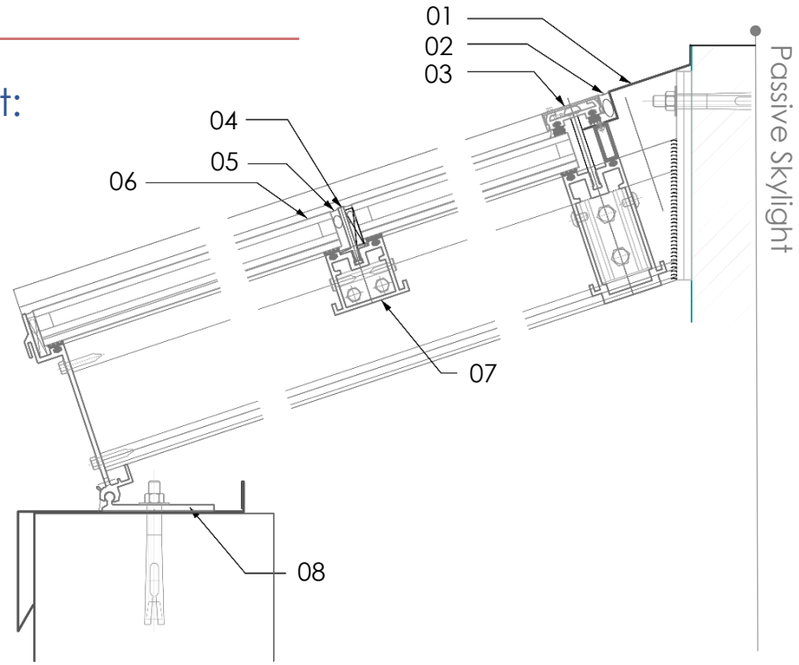
03: EXTR.ALUM. Retainer & snap-on cap

04: Extruded glass stop

05: Structure sealant glass

06: EXTR.ALUM. Crossrafter

07: Variable curb system



Passive Skylight

Active shaded Skylight:

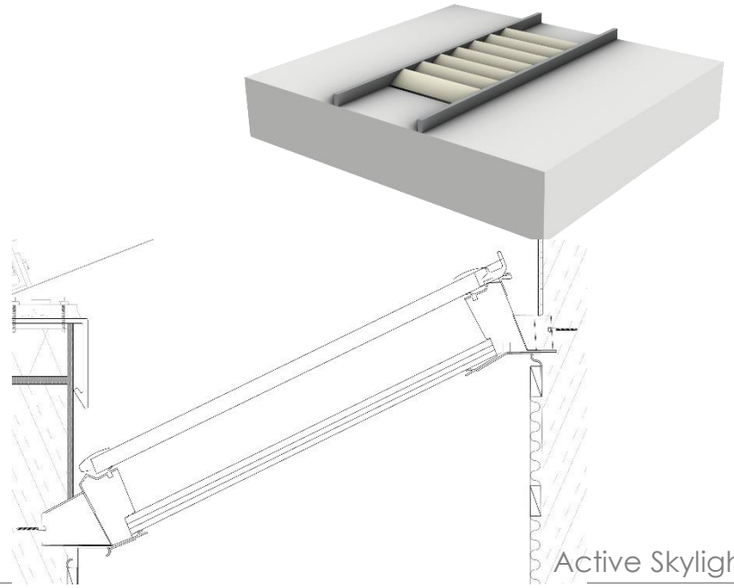
Sensor detects sunlight angle

Automatically shading control

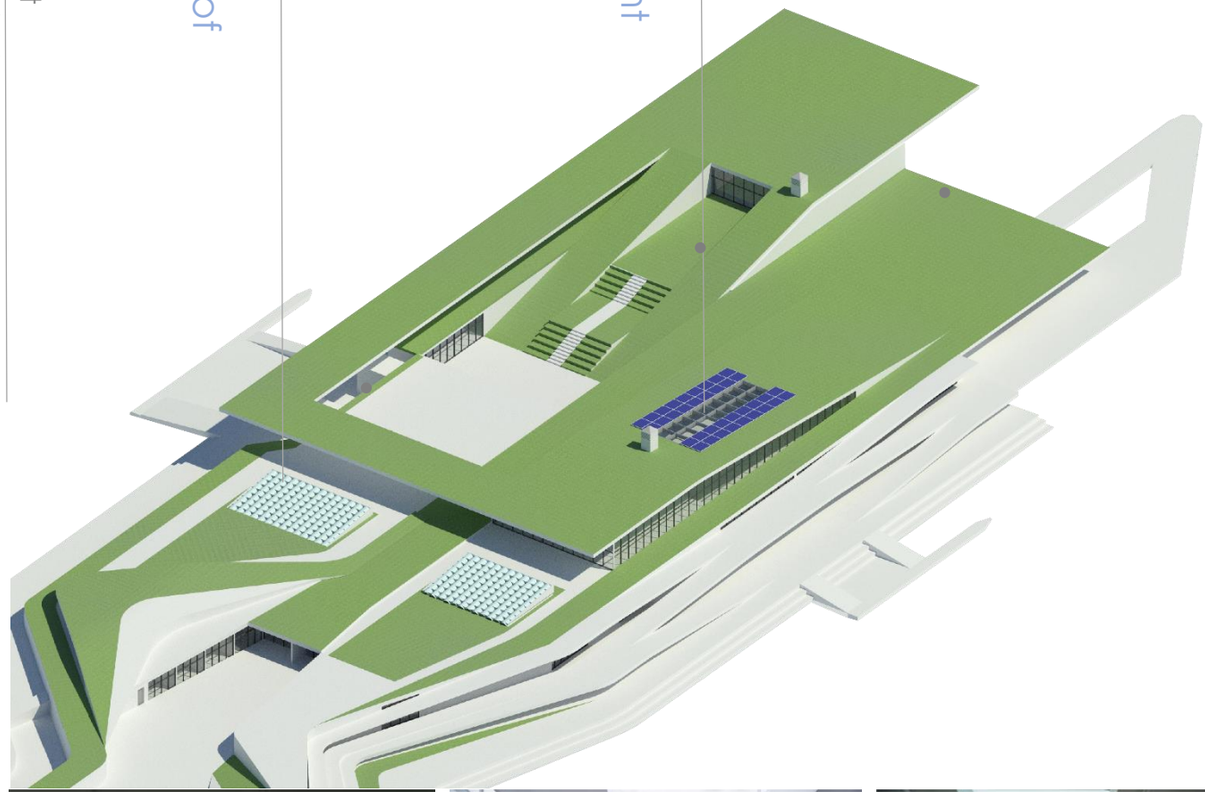
•Adjustable movable shading fins cut out direct sunlight at different solar angles.

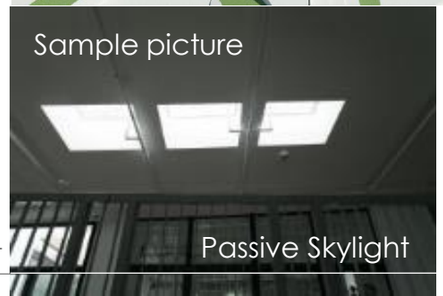
•Fins are controlled by computer software and sensors.

•Reflected light is diffused into the interior as needed.



Active Skylight





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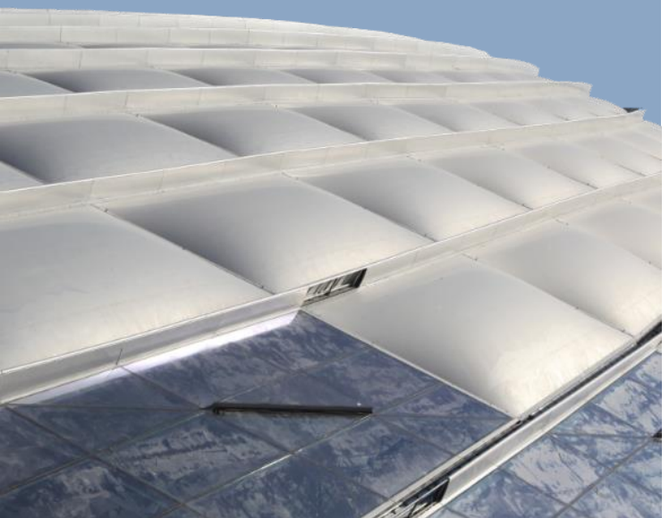
SOLUTION

PV–ETFE cushion roof



What is it

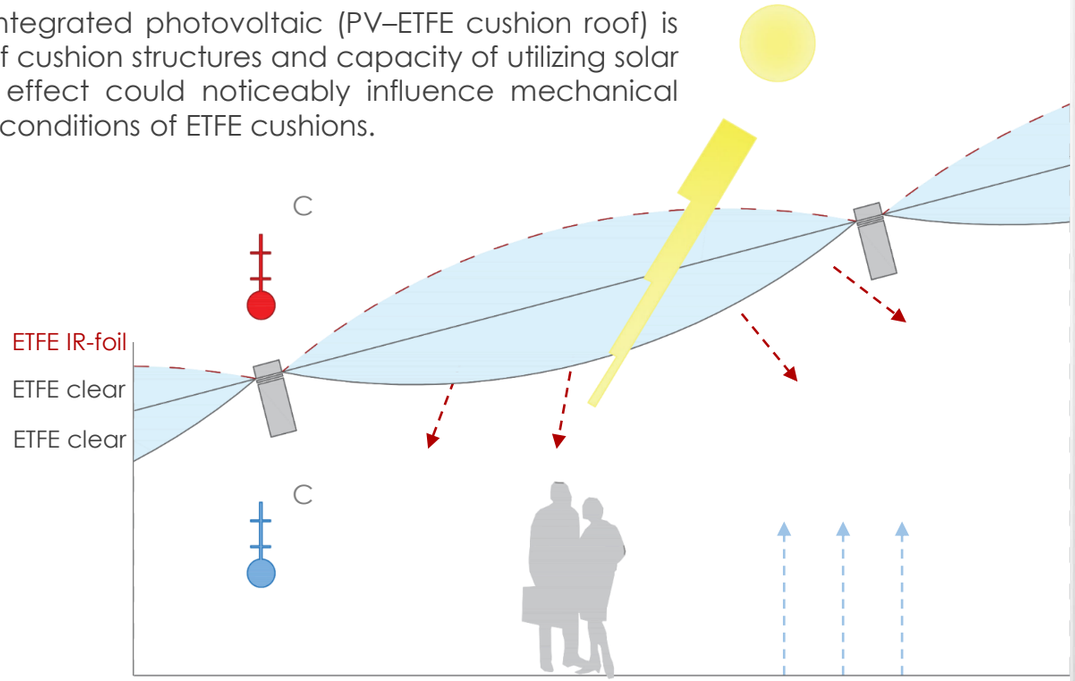
ETFE (ethylene tetrafluoroethylene) cushion roof integrated photovoltaic (PV–ETFE cushion roof) is an environment-friendly retrofit with advantages of cushion structures and capacity of utilizing solar energy. PV temperature due to photo thermal effect could noticeably influence mechanical properties of ETFE foils and temperature boundary conditions of ETFE cushions.

What does it do

Improvement of thermal protection for the summer case

Reduction of solar gain with min .T_{sol} and max T_{vis} (max . Selectivity)

Reduction of emissivity of lowest layer facing to the inside (reduced radiation of IR)



light transmission

ETFE has similar light transmission to glass, but at just 1% of the weight. approximate 85% light transmission, although multiple layers will lead to a small reduction.

energy consumption

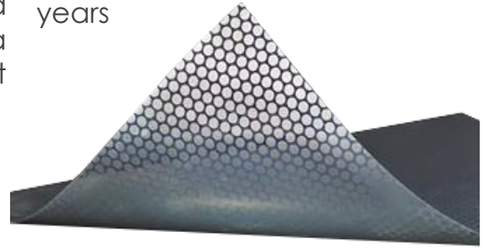
the film absorbs a large proportion of infra red light Transmitted.

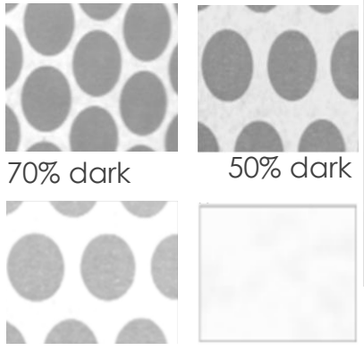
MATERIAL

Ethylene Tetrafluoroethylene (ETFE) is a fluorine-based plastic polymer that offers a creative and lightweight alternative to glass.

lifespan

With a lifespan of over 30 years





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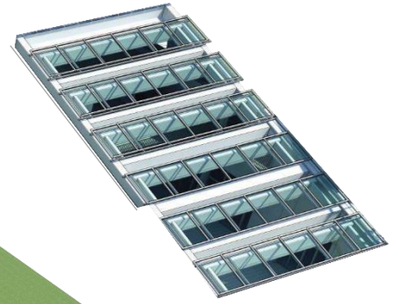


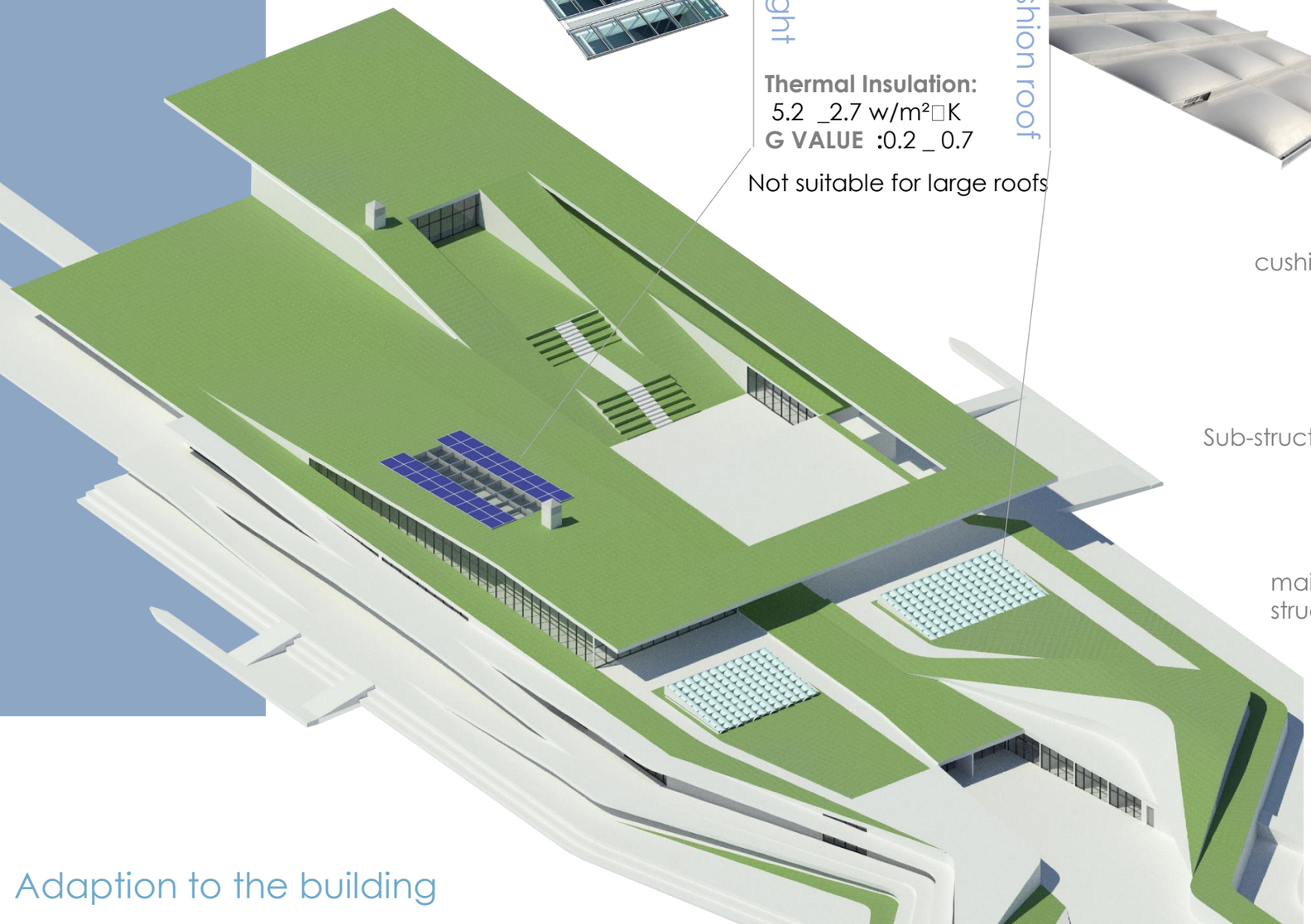
Passive Skylight

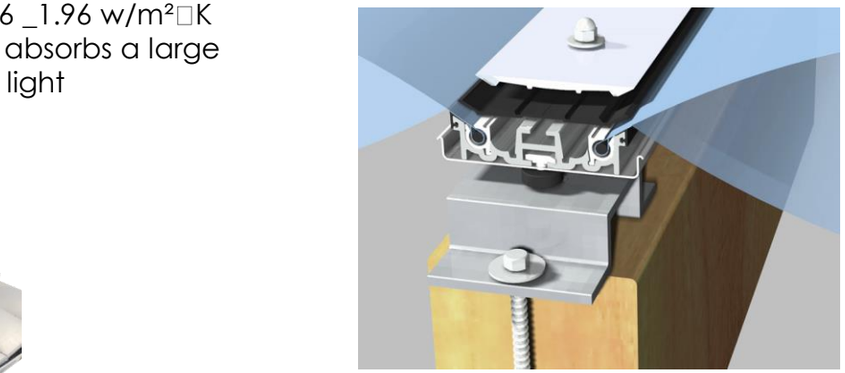
Thermal Insulation:
5.2 _2.7 w/m²□K
G VALUE :0.2 _ 0.7

Not suitable for large roofs

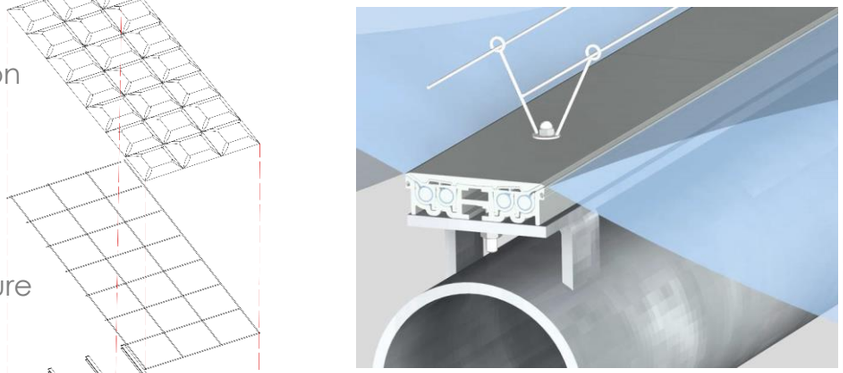
PV–ETFE cushion roof

Thermal Insulation : 5.6 _1.96 w/m²□K
energy consumption: absorbs a large proportion of infra red light
G VALUE : 0.48 _ 0.35
It covers large roofs

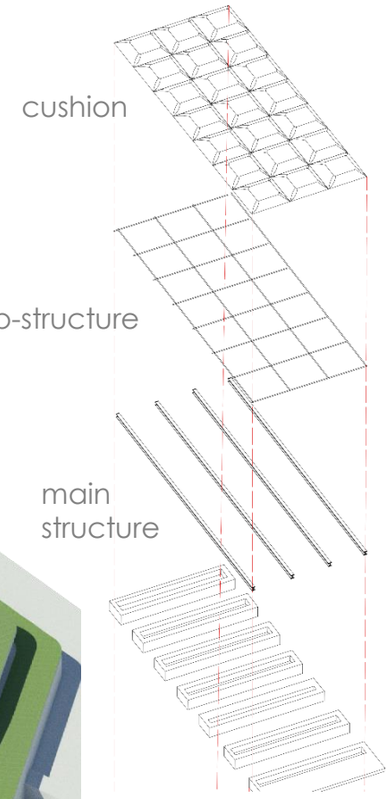


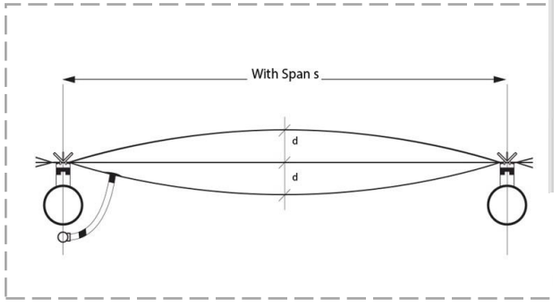


Waterproof profile system for multi-layered ETFE constructions

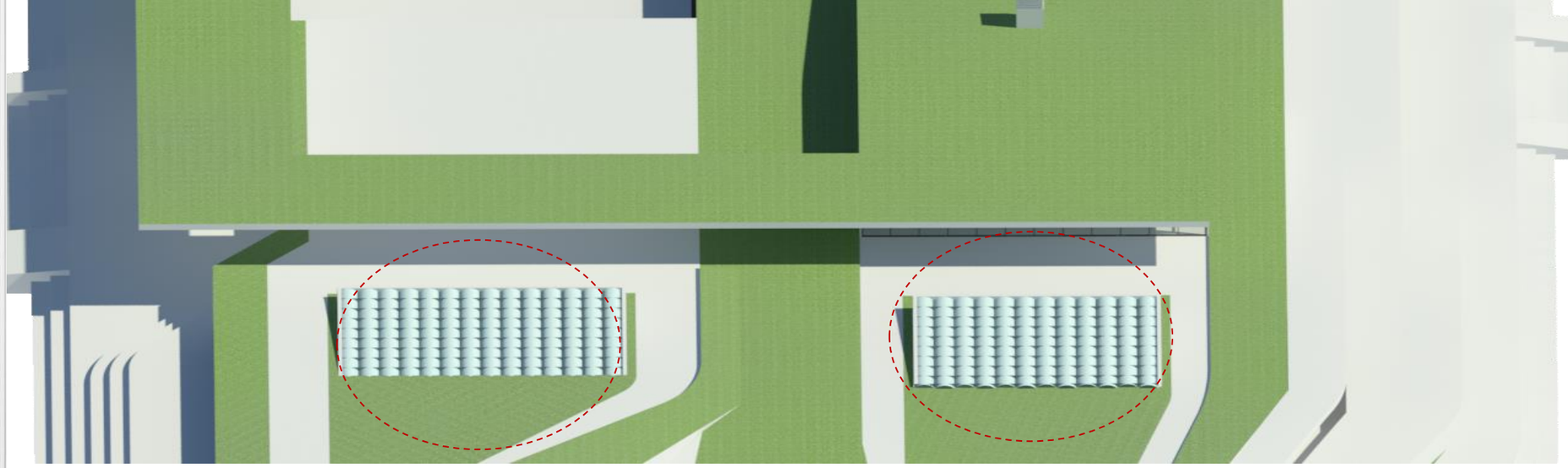


ETFE support system with drainage

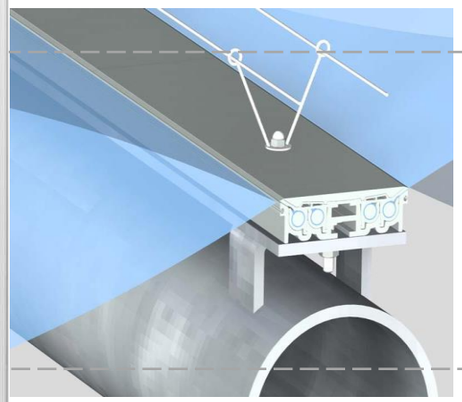




Adaption to the building



PV–ETFE cushion roof

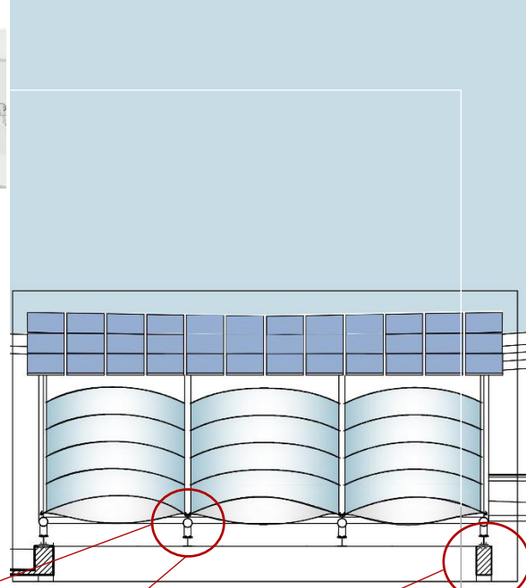


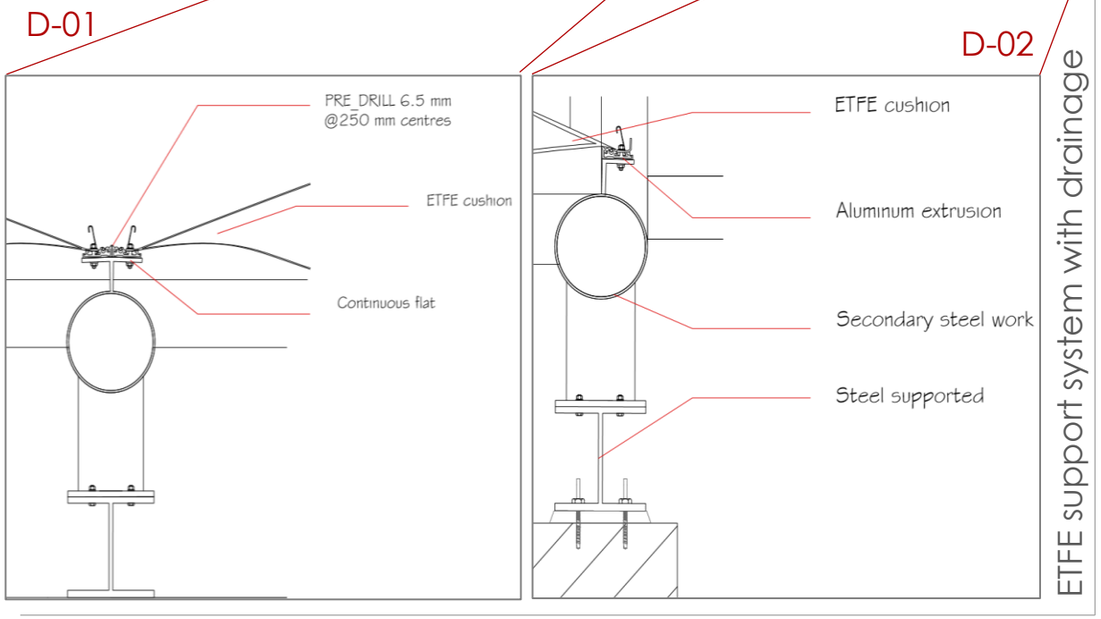
DRAINAGE SYSTEM

All ETFE structures are designed with curvature to ensure that rainwater does not 'pond' or collate on the top of the membrane . Rainwater will be channelled to the perimeter of the roof where it can be collected in the main gutter system.
Gutters are not supplied as standard within most ETFE installations but they can be incorporated if required.

CLEANING

ETFE Foil has a smooth surface. This smoothness reduces the amount of dirt retained on the ETFE foil surface and allows the rain to wash away the majority of bird droppings etc. ETFE foil cushions are cleaned externally every 2-3 years.
recommend they are cleaned every 5-10 years on the interior surface of the cushions.





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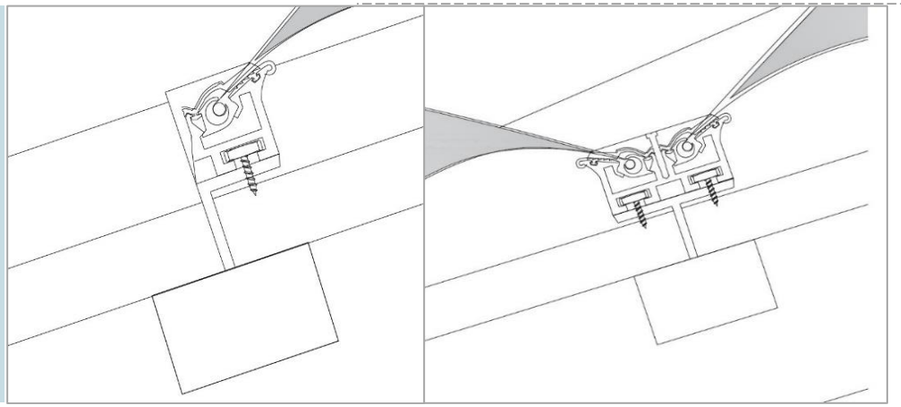
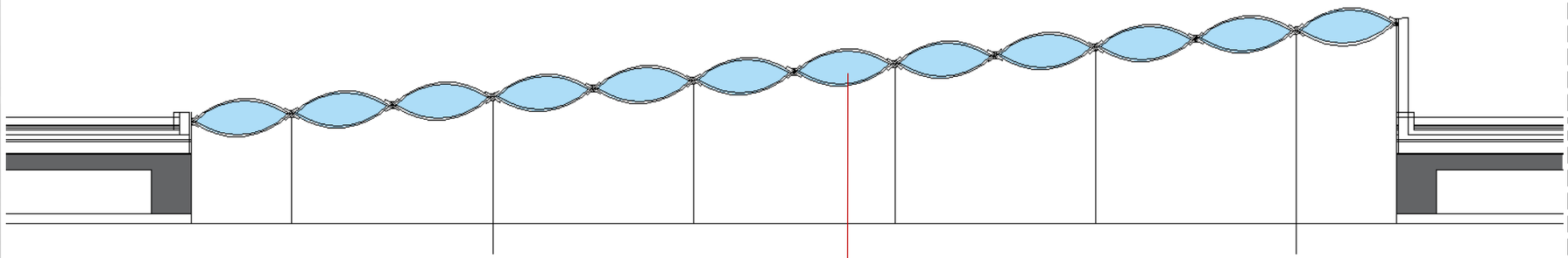
Waterproof profile system



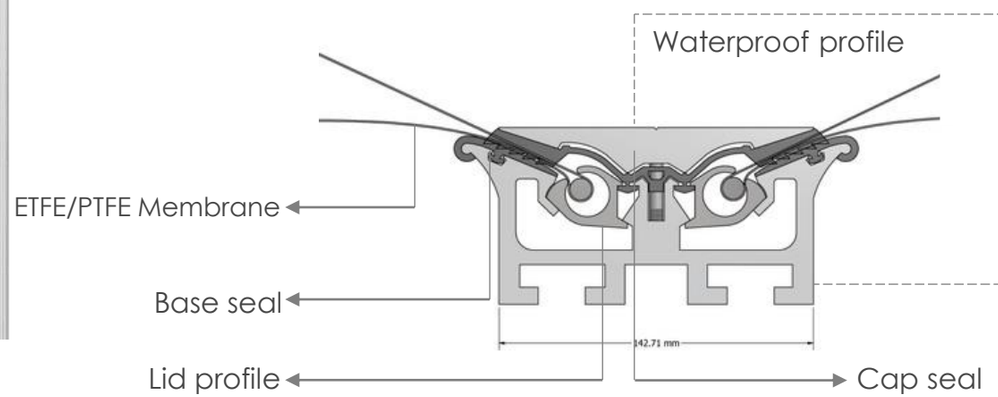
Roof section

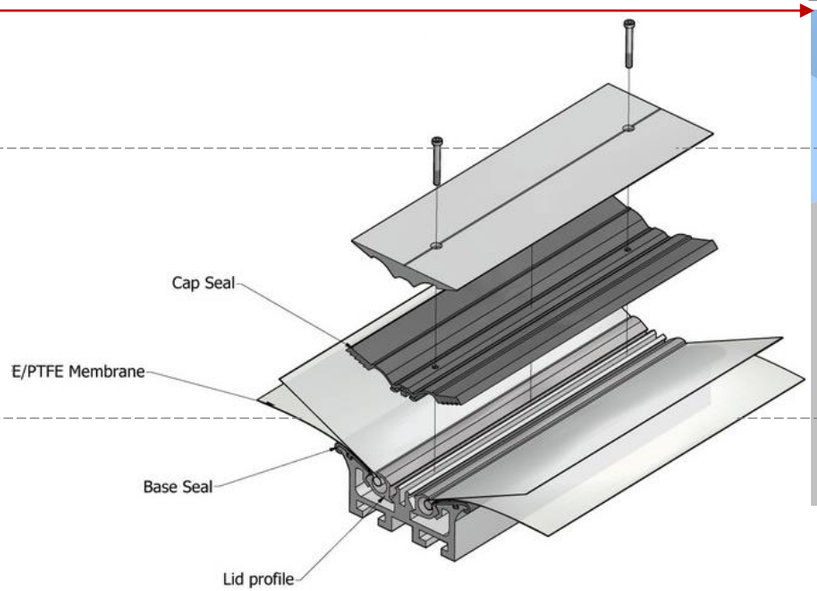


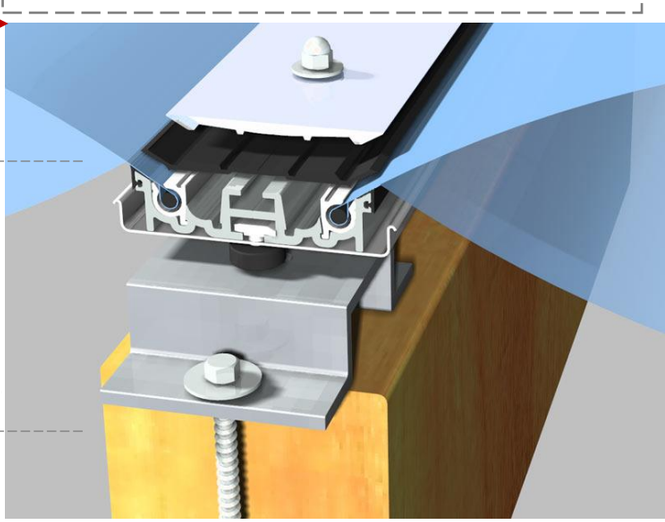
ENVIRONMENTAL

- The raw material associated with ETFE is a class II substance admitted under the Montréal treaty.
- no solvents are used in this water based procedure.
- The material is then extruded to varying thicknesses depending on application; a process which uses minimal energy.

ETFE can be recycled with ease, but due long life making the need for recycling small.







Waterproof profile system for multi-layered ETFE constructions

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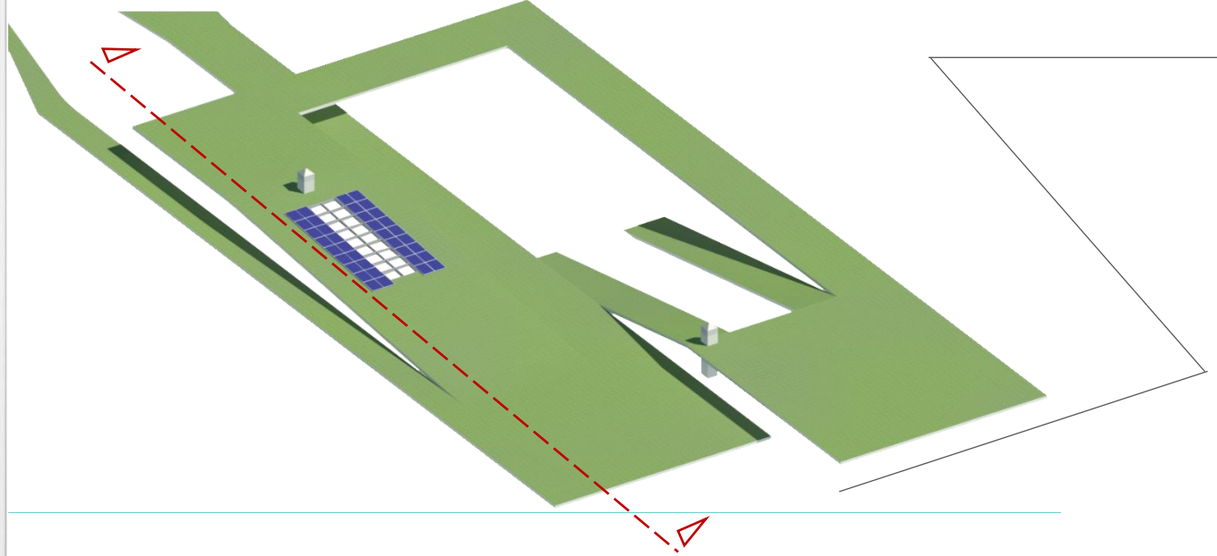
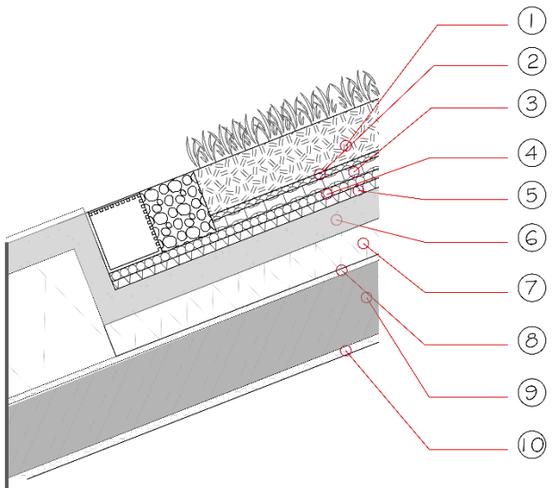
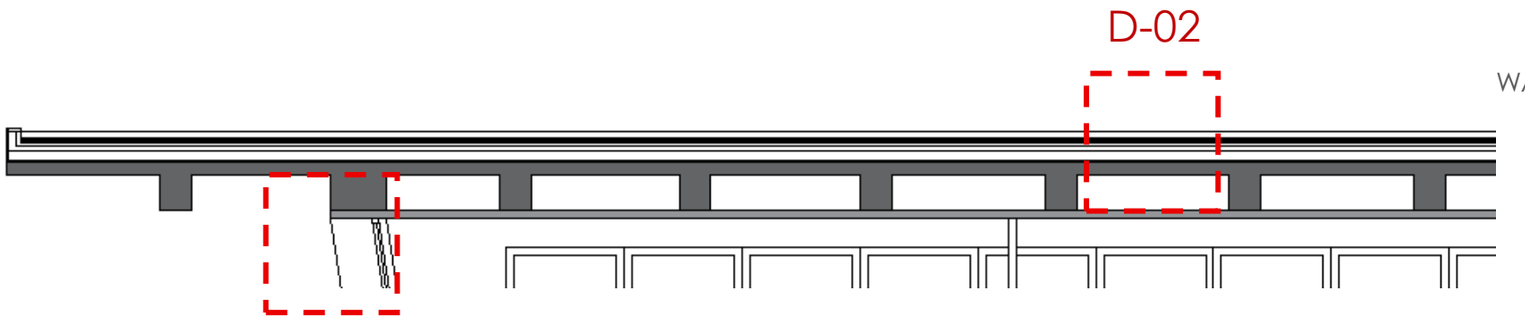
BLOW-UPS



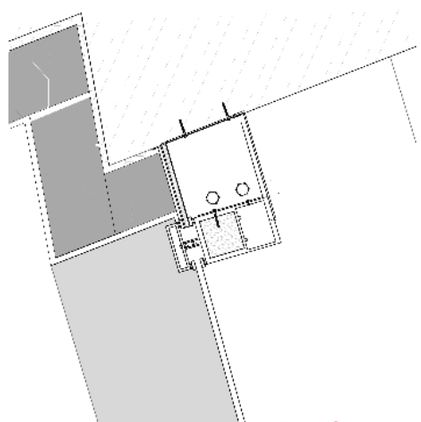


GROWTH SUBSTRATE.1
FILTER FABRIC.2
DRAINAGE LAYER.3
PROTECTED LAYER.4
ROT BARRIER.5
MOLTHIC CONCRETE.6
THERMAL INSULATION.7
WATERPROOF MEMBRANCE.8
RC ROOG.9
INSIDE FINISHING.10

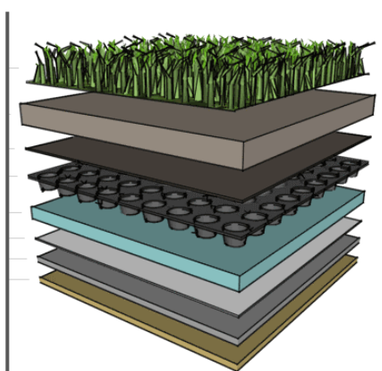
D-02



VERTICAL SECTION



D-01



Green roof	Thickness (cm)
Growth substrate	8
Filter fabric	1
Drainage layer	2
Protect layer	1.5
Root battier	1.5
Monolithic concrete	5
Thermal insulation	5.8
Waterproof membrane	1
RC roof	12
Inside finishing	1.5
Auxiliary	Position
Gravel	Left
Gutter	Left

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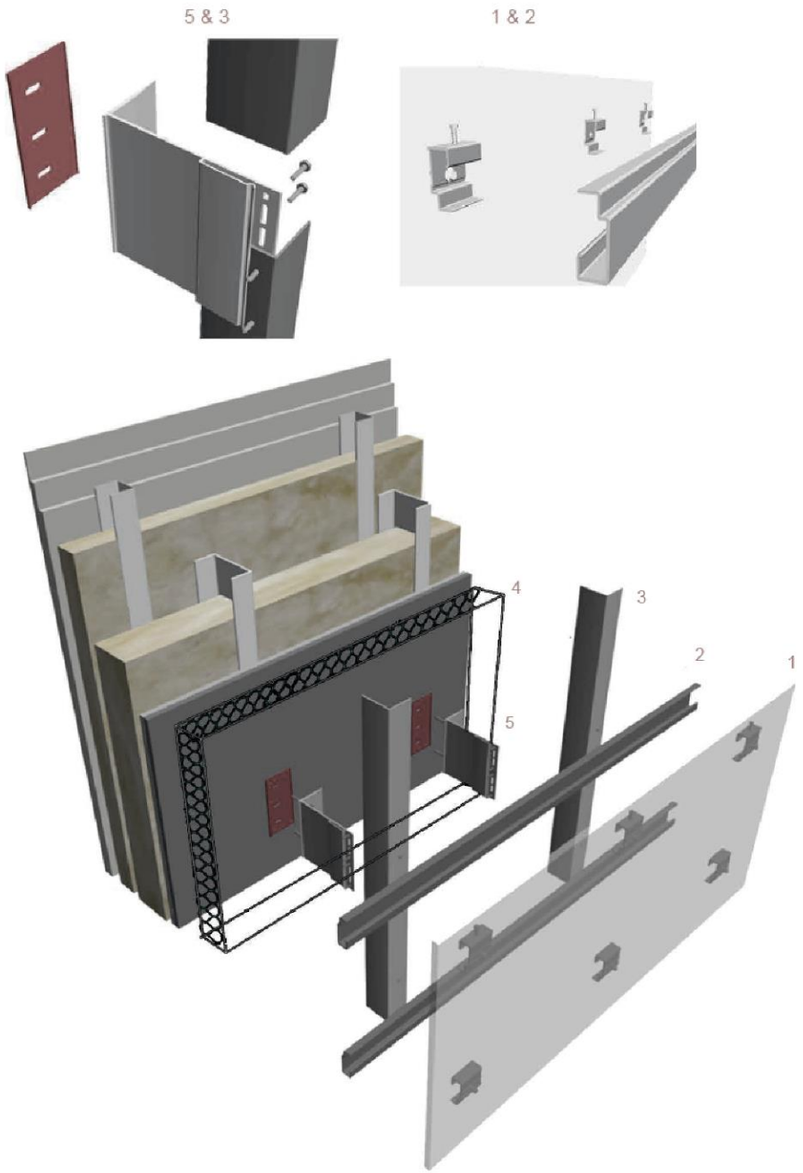
ENVELOPE DESIGN II

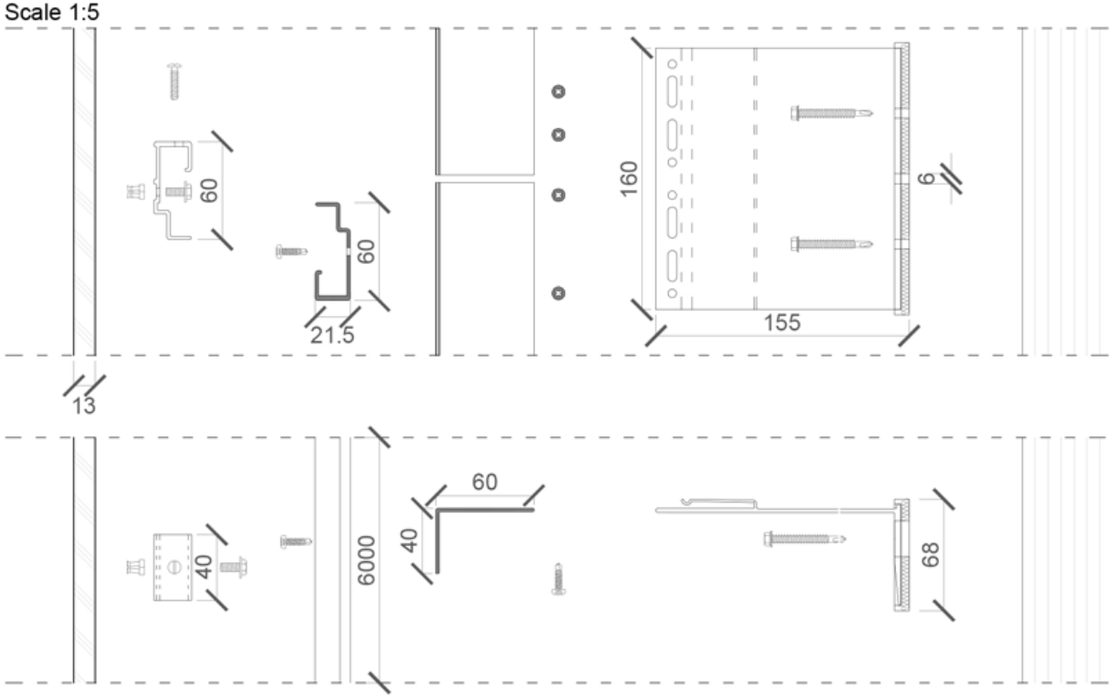
OPAQUE SYSTEM
GLAZING SYSTEM

Glassfibere reinforced concrete ,GFRC fixing details



1) Cladding, in glass fibre reinforced concrete (GFRC), tk. 1.3cm, dim. variable, "RIEDER, Fiber C Façade Panels"
Fixing elements anchored to GRC panel:
   - Undercut anchor and locking ratchet, in stainless steel, ø=7mm, "KEIL, KH AA"
   - Anchoring element, in aluminium alloy, h=6cm, w=4cm, "HILTI, MFT-H 200K"
   - Adjusting screw, in aluminium, L=2cm, ø=3.5mm "HILTI, MFT-JS"
2) Horizontal hanger profile, in aluminium alloy, tk. 2mm, w=2.15cm, h=6cm, "HILTI, MFT-HP 200". Fixed with self-drilling screw, "HILTI"
Ventilated cavity, tk. 4cm
Vertical L profile, in aluminium alloy, tk. 0.18cm, dim. 4x6cm, "HILTI, MFT-L". Fixed with self-drilling screw, in alluminium, "HILTI"
3) Thermal insulation layer, in stone wool boards, tk. 12cm, dim. 60x120 cm, λ=0,035 W/mK, class A1, "ROCKWOOL Rainscreen Duo"
   - Insulation fastener, in plastic, L=14.5cm, "HILTI HIF"
   - Glue layer, in cement-based fiber reinforced glue, tk. 0.3cm, "FASSA BORTOLO, A96"
4) L bracket with clamping spring, in aluminium alloy, tk. 0.25 cm, dim. 15.5x16cm, hole ø=6mm; with thermal separator in polypropylene, tk. 0.5cm, "HILTI, MFT-MFI L". Fixed with self drilling screws, in stainless steel, ø=5.5mm, "HILTI, S-MD 03 S"

Scale 1:5



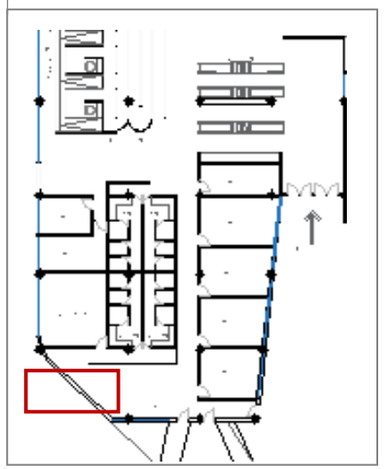
POLITECNICO MILANO 1863

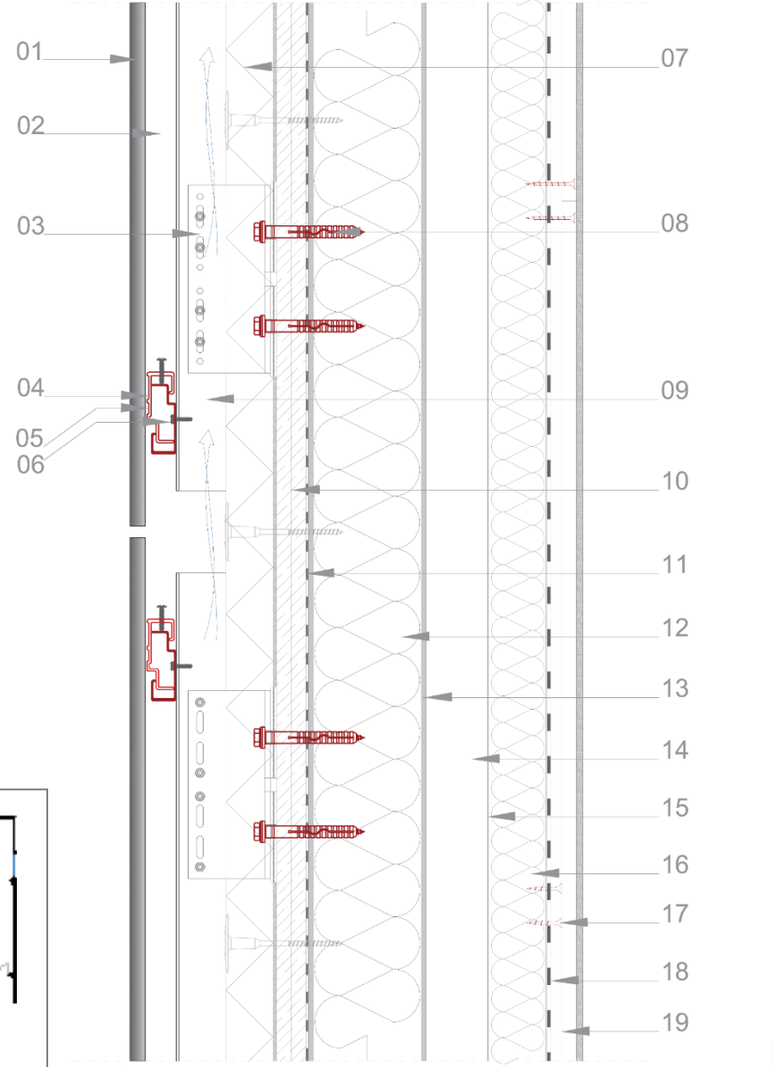
U=0.36 W/m2k
Main Ventilated façade in GFRC , insulated stud wall

COMPONENT SPECIFICATION

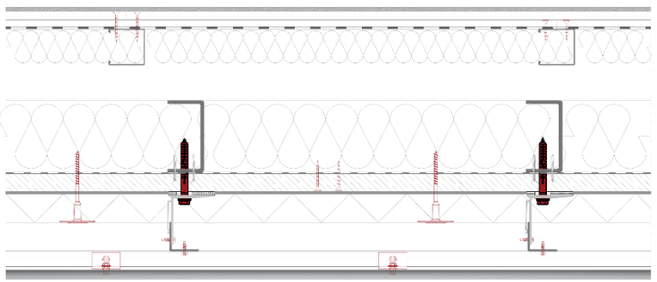
N.	Item	Material	Function	Dimensions (H/W/T) [mm]	Fixation	Note
01	Rain screen cladding	Glass reinforced concrete (GRC)	Protection / Finishing	1200/3100/13	Screwed	Euroclass A1
02	Ventilated cavity	-	ventilation	_/_/40	-	
03	L bracket	Aluminium alloy	connection	65/160/2.5	Screwed	
04	Anchoring element	Aluminium alloy	connection	_/_/_	Screwed	
05	Ratchet screw	Stainless steel	Fixing			
06	Adjusting screw	Aluminium	Fixing	Φ 3.5		
07	Thermal insulation layer	expanded polystyrene	Thermal insulation	_/_/40	Pressed	
08	Frame anchor	Plastic	Fixing	Φ 10		"HILTI,HRD-H"
09	Vertical L profile	Aluminium alloy	connection	40/40/18	Screwed	" HILTI , MFT-M "
10	Double stiffening layer	Fibercement panel	Stiffening	1200 /1200 /250	self tapping screws	"KNAUF – ACQUAPANEL"
11	Water barrier breathable layer	Fabric	Water insulation	_/_/0.2	Screwed	"KNAUF_ VITI AQUAPANEL MAXI SCREWS
12	Thermal and acoustic insulation layer	stone wool boards	Insulation	1200 /600 /100	Interlocked	"ROCKWOOL ACOUSTIC225 PLUS"
13	Metallic frame – C profile	Stainless steel	Supporting	50 /100 /4	Screwed	"MARCEGAGLIA"
14	Dead air space	-	Insulation	_/_/50	-	-
15	Metallic frame – C profile	Stainless steel	Supporting	_/_/8	Screwed	"KNAUF_PROFILE MONTANTE"
16	Thermal and acoustic insulation layer	stone wool boards	Insulation	_/_/100		"ROCKWOOL ACOUSTIC225 PLUS"
17	Self-drilling screw	Corrosion – resistant steel	Fixing	-	-	"AQUAPANEL MAXI SCREWS , TEKS "
18	Vapour barrier	aluminum	Vapour insulation	_/_/ 0.3	Screwed	
19	Finishing layer	Double gypsum board	Finishing	1200/ 3000 /12.5+12.5	Adhered	

PLAN LAYOUT





VERTICAL SECTION

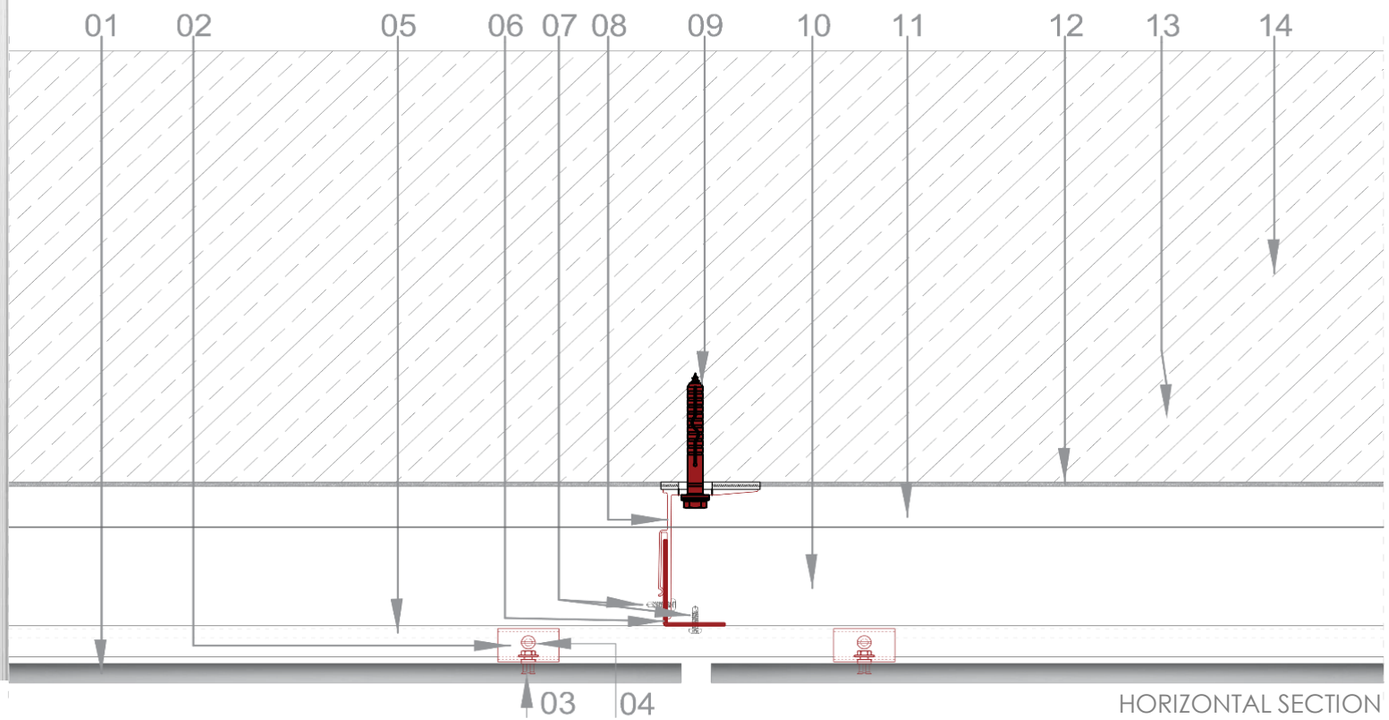


HORIZONTAL SECTION

POLITECNICO MILANO 1863

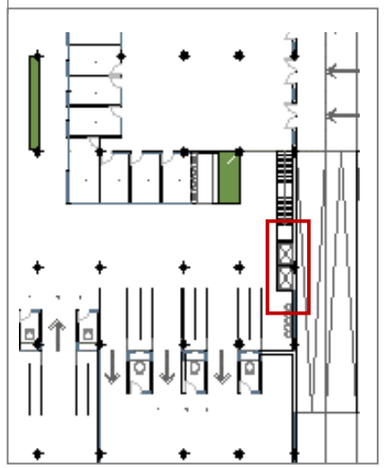
U=1.60 W/m2k
Ventilated façade in GFRC ,Load- bearing

N.	Item	Material	Function	Dimensions (H/W/T) [mm]	Fixation	Note
01	Rain screen cladding	Glass reinforced concrete (GRC)	Protection / Finishing	1200/3100/13	Screwed	Euroclass A1
02	Anchoring element	Aluminium alloy	connection	_/_/_	Screwed	
03	Ratchet screw	Stainless steel	Fixing			
04	Adjusting screw	Aluminium	Fixing	Φ 3.5		
05	Horizontal hanger profile	Aluminium	supporting	60/40/2	Screwed	
06	Vertical L profile	Aluminium alloy	connection	60/40/20	Screwed	" HILTI , MFT-M "
07	Self-drilling screw	Corrosion – resistant steel	Fixing	-	-	"AQUAPANEL MAXI SCREWS , TEKS "
08	L bracket	Aluminium alloy	connection	95/80/2.5	Screwed	
09	Frame anchor	Plastic	Fixing	Φ 10		"HILTI,HRD-H"
10	Ventilated cavity	-	ventilation	_/_/35	-	-
11	Thermal insulation layer	expanded polystyrene	Thermal insulation	_/_/50	Adhered	-
12	gluing layer	cement based elastic adhesive	Connection	_/_/3	Adhered	-
13	Insulation fastened	EPS board	Insulation	_/_/_	Adhered	-
14	Structural layer	Reinforced concrete	Supporting	_/_/300	Air-dried	-

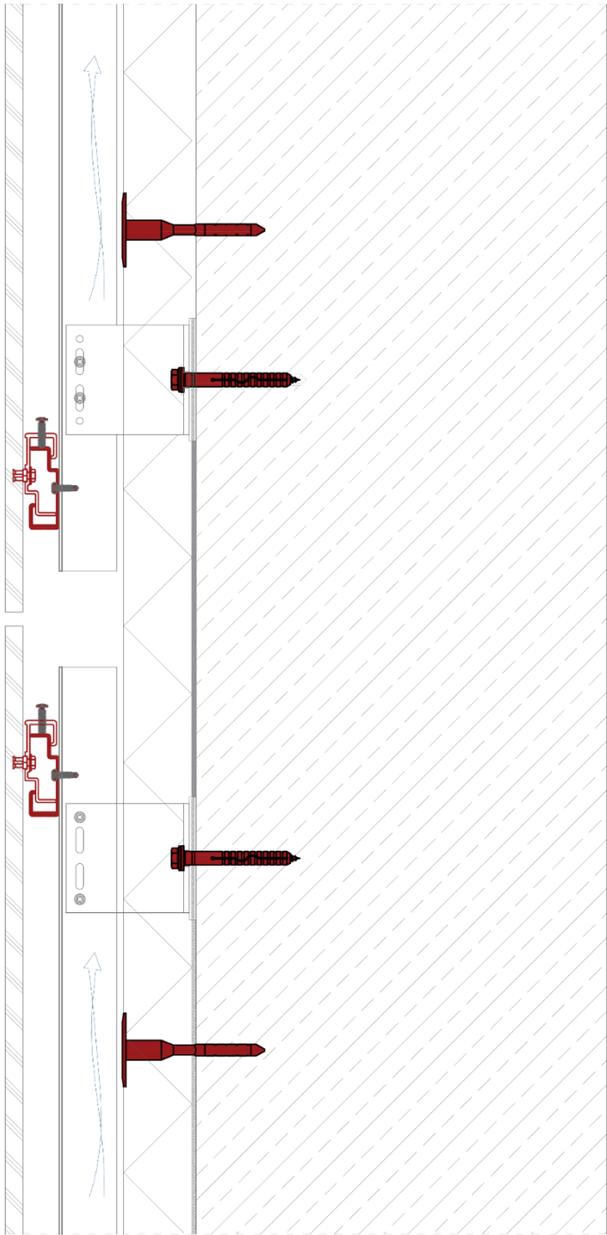


HORIZONTAL SECTION

PLAN LAYOUT



VERTICAL SECTION



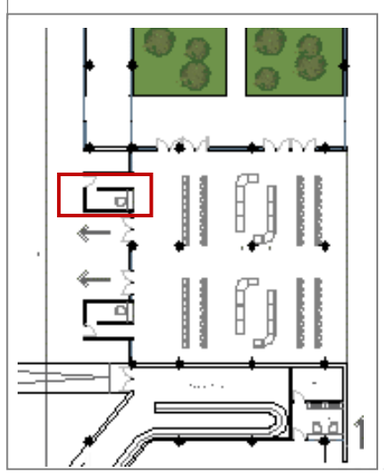
POLITECNICO MILANO 1863

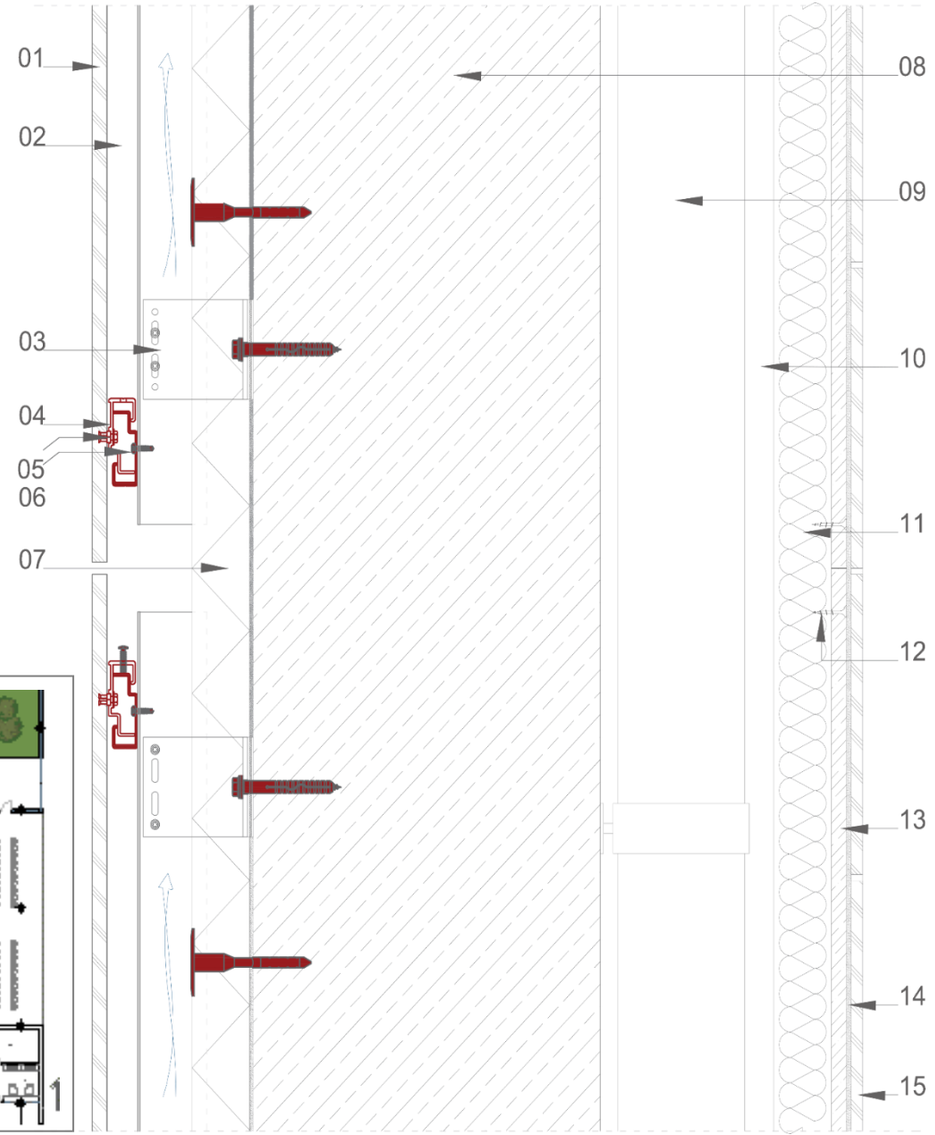
U=0.36 W/m2k
Ventilated façade in GFRC , Load- bearing , insulated with services cavity

COMPONENT SPECIFICATION

N	Item	Material	Function	Dimensions (H/W/T) [mm]	Fixation	Note
01	Rain screen cladding	Glass reinforced concrete (GRC)	Protection / Finishing	1200/3100/13	Screwed	Euroclass A1
02	Ventilated cavity	-	ventilation	_/_/35	-	-
03	L bracket	Aluminium alloy	connection	95/80/2.5	Screwed	
04	Anchoring element	Aluminium alloy	connection	_/_/_	Screwed	
05	Ratchet screw	Stainless steel	Fixing			
06	Adjusting screw	Aluminium	Fixing	Φ 3.5		
07	Thermal insulation layer	expanded polystyrene	Thermal insulation	_/_/40	Pressed	
08	Structural layer	Reinforced concrete	Supporting	_/_/300	Air-dried	-
09	Hydraulic services cavity	-	Hydraulic services	_/_/140	-	-
10	Metallic frame – C profile	Stainless steel	Supporting	50 /100 /4	Screwed	"MARCEGAGLIA"
11	Thermal and acoustic insulation layer	stone wool boards	Insulation	_/_/50		"ROCKWOOL ACOUSTIC225 PLUS"
12	Self-drilling screw	Corrosion – resistant steel	Fixing	-	-	"AQUAPANEL MAXI SCREWS , TEKS "
13	Infill and water repellent layer	Reinforced cement board	Infill	1200/900/12.5	Adhered	-
14	gluing layer	cement based elastic adhesive	Connection	_/_/4	Adhered	-
15	Tiling layer	Porcelain stoneware tiles	Finishing	60 /240 /10	Adhered	-

PLAN LAYOUT



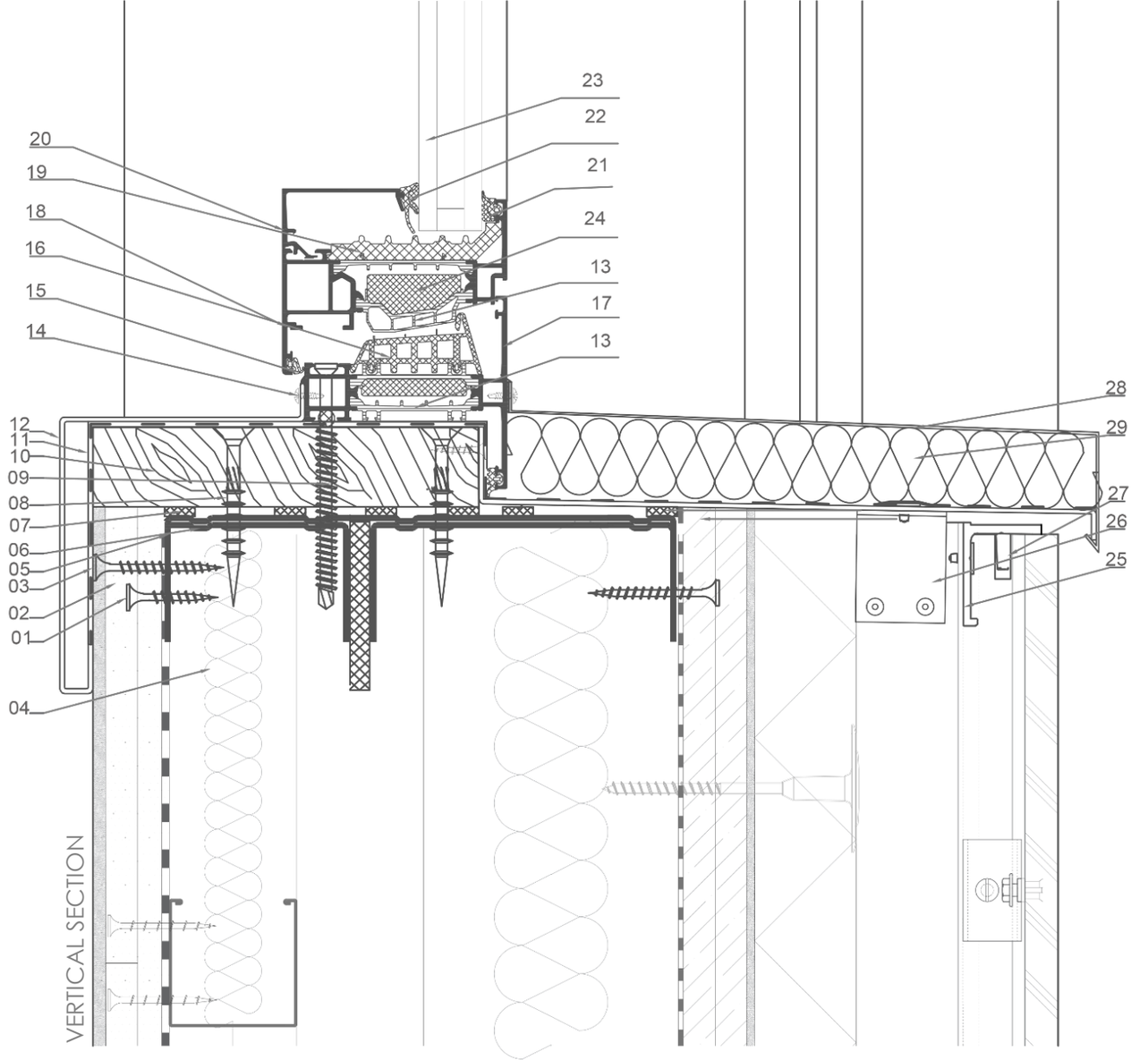


VERTICAL SECTION

POLITECNICO MILANO 1863

COMPONENT SPECIFICATION

N.	Item	Material	Function	Dimensions (H/W/T) [mm]	Fixation	Note
01	Self-drilling screw	galvanized steel	Fixing			Fischer
02	Plasterboard		Finishing	1200 / 3500 / 15	Self-drilling screws	Knauf
03	Self-drilling screws					Fischer
04	Mineral wool	wool	Insulation	1000 / 600 / 50	Framed	Rockwool
05	U profile	Galvanized steel	Framing	70 / 60 / 0,6	Self-drilling screw	Knauf
06	C profile	Galvanized steel	Framing	150/ 60 / 0,6	Self-drilling screws	Knauf
07	Acoustic insulation		Adhesive	- / 14 / 4	Adhesive	Knauf
08	Self-drilling screws		Fixing			Hilti
09	Window frame screw	galvanized steel	Fixing			Fischer
10	stud	Timber	Framing	1000 / 170 / 30	Self-drilling screws	
11	Impermeable membrane		Water tightness		Self-adhering	Knauf
12	carter	Aluminum	Finishing	0,65	Self-drilling screws	
13	Thermal cut	polyamide	Interlocking	1	Interlocking	
14	Self-drilling screw	galvanized steel				Fischer
15	Internal gasket	EPDM	Sealing		Interlocking	
16	Central gasket	EPDM	Insulation		Interlocking	
17	Window fixed frame	aluminum	Framing		Self-drilling screws	
18	Window movable frame	aluminum	Framing		Hinged	
19	Polymeric foam		Insulation		Interlocking	
20	Panelocker	aluminum	Framing		Interlocking	
21	External pane gasket	EPDM	Sealing		Interlocking	
22	Internal pane gasket	EPDM	Sealing		Interlocking	
23	Double glazed insulating unit	glass	Glazing	1000 / 1650 / 8-4	Interlocking	
24	Insulation listel	styro foam	Insulation		Interlocking	
25	L profile	Aluminum	Framing	46 / 36 /4	Rivetted	Aliva
26	L bracket	Aluminum	Connection	50 / 50 / 2	Rivetted	Aliva
27	Dowel	aluminum	Connection			Aliva
28	Mineral wool		Insulation	1000 / 600 / 40	Supported	Rockwool
29	carter	Aluminum	Finishing (external sill)	1	Self-drilling screws	



Opaque wall and window connection

POLITECNICO MILANO 1863

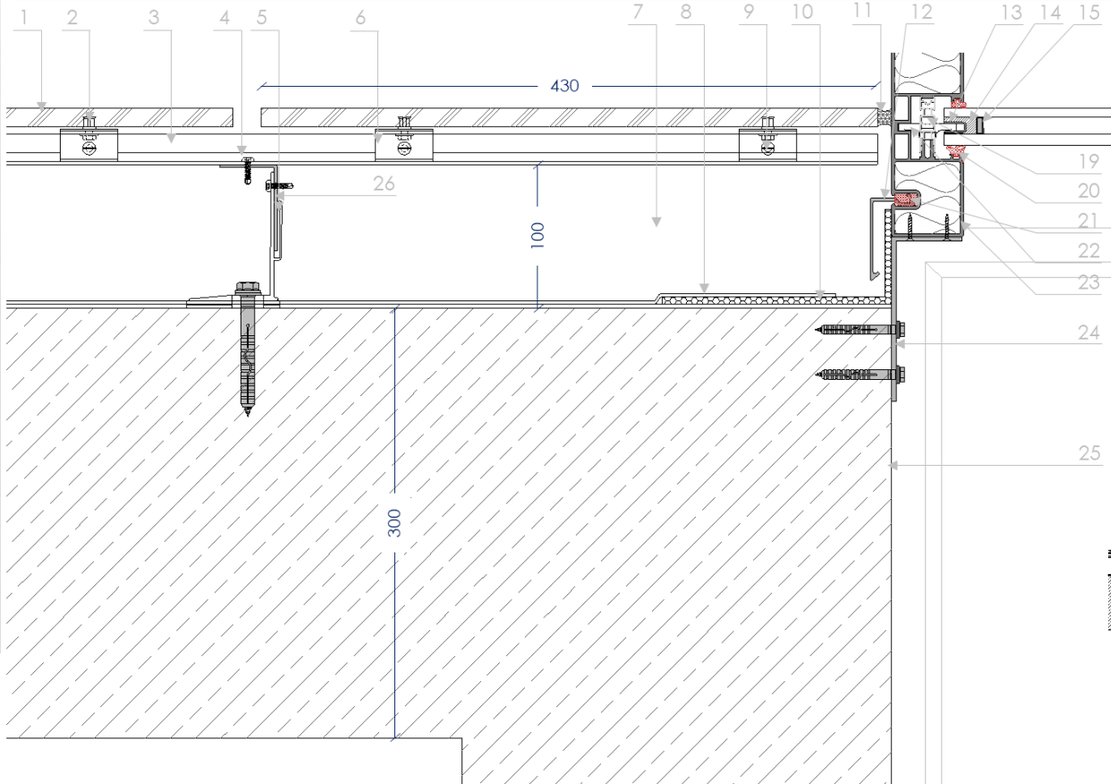
CURTAIN WALL DETAIL

CURTAIN WALL AND OPAQUE WALL CONNECTION - HORIZONTAL

N.	Item	Material	Function	Dimensions (H/W/T) [mm]	Fixation
01	Rain screen cladding	Glass reinforced concrete	Protecting	3100/1200/13	Screwed
02	Undercut anchor	Stainless steel	Fixing	-	Screwed
03	Hanger profile	Aluminum alloy	supporting	60/40/3.5	Screwed
04	Self-driilling screw	Aluminum alloy	Fixing	-	-
05	L barket with clampspring.	Aluminum alloy	Supporting	-	Screwed
06	Anchoring element	-	Fixing	-	Screwed
07	Ventilated cavity	Air	Ventilation	- / - /45	-
08	Emergency membrane	rubber, elastomer, polyethylene	Waterproof	- / - /2	Adhered
09	Adjusting screw	Aluminum alloy	Fixing	3.5 Φ 30	-
10	Waterproof membrane	rubber, elastomer, polyethylene	Water tightness	- / - /5	Adhered
11	Sealant	Vulcanized Rubber	Connection	-	Adhered

COMPONENT SPECIFICATION

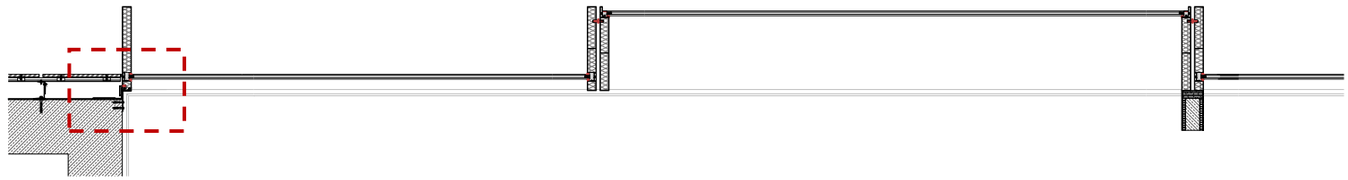
N.	Item	Material	Function	Dimensions (H/W/T) [mm]	Fixation
12	Cover	Steel sheet	Covering	-	Interlocked
13	Glass compound edge	Aluminum	Holding frames	15.5/7.3/0.9	Interlocked
14	Sealant	Vulcanized Rubber	Glazing	-	Adhered
15	Glazing spacer	Aluminum profile filled with silica gel Bulk and surrounded with Butyl Rubber	Glazing assembly	1750/12/5	Pressed
16	External glass	Heat-strengthened safety glass	Glazing	1825/1473+2973/6	Interlocked
17	Cavity	Argon	Glazing	1825/1473+2973/12	Interlocked
18	Internal glass	Thermal-insulating glass with low-emittance coatings	Glazing	1825/1473+2973/8	Interlocked
19	Thermal break	Polyamide 6.6 with 26% glass fiber	Thermal insulation	-	Interlocked
20	Gasket	Black EPDM rubber	Sealing	-	Interlocked
21	Junction	Silicon	Fixing	-	Interlocked
22	SG holder	Aluminum	Framing	-	Interlocked
23	Mullion	Aluminum	Galzing	-	Hanged
24	L profile	Steel	Fixed	-	Screwed
25	Infilled layer	Concrete	Elevating	-	Air-dried
26	Collared plastic anchor	plastic	Fixing	-	Screwed



Outside

Inside

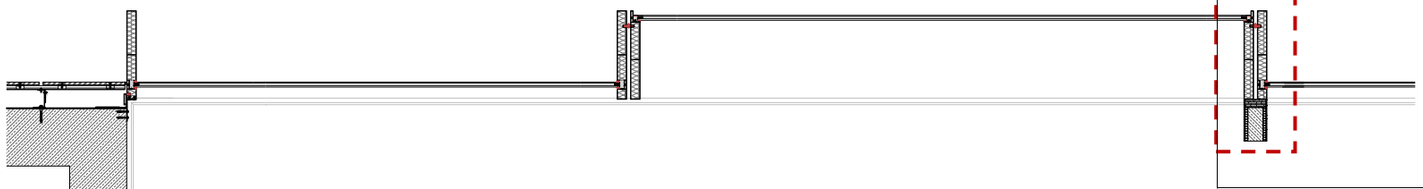
HORIZONTAL SECTION

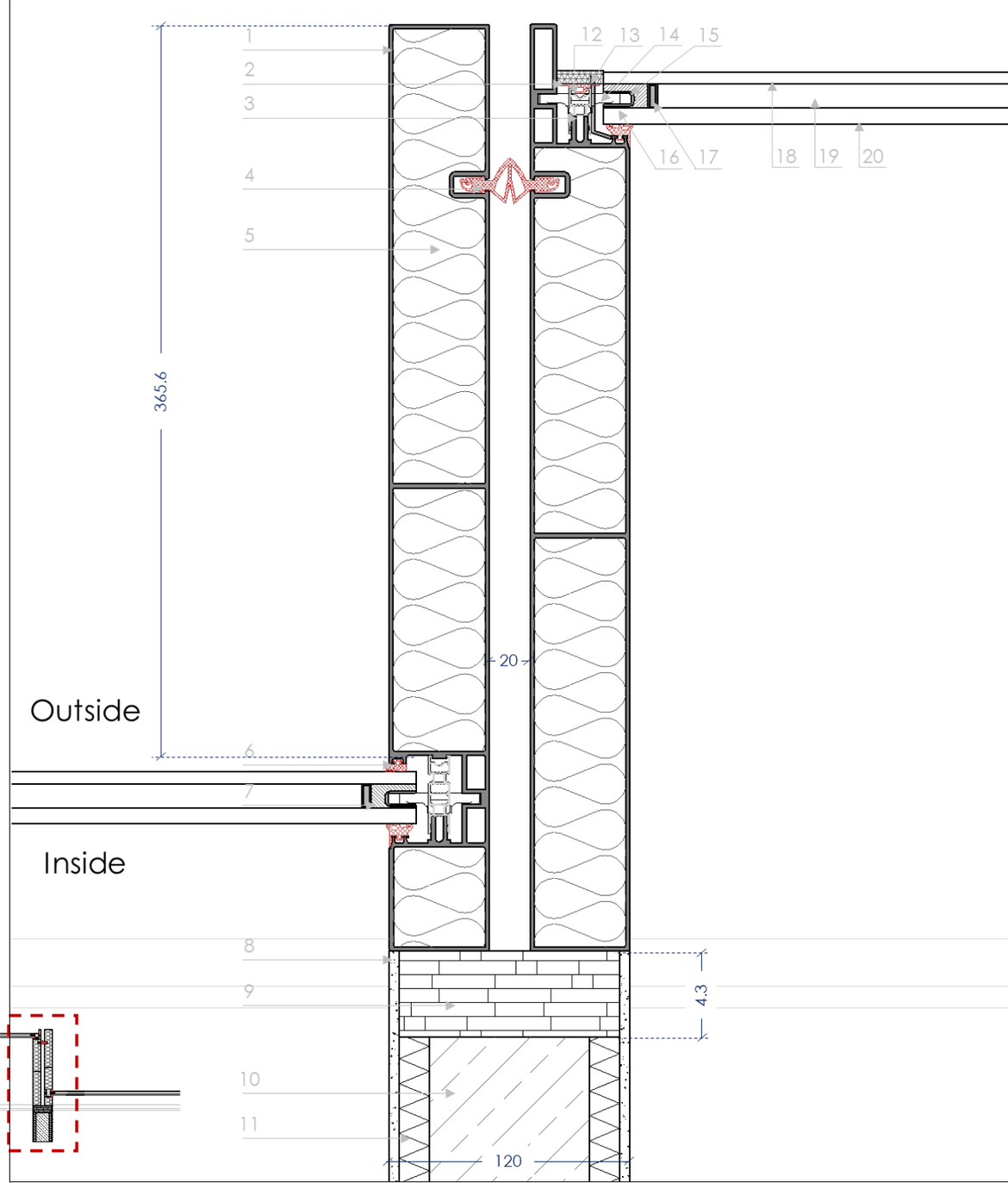


POLITECNICO MILANO 1863

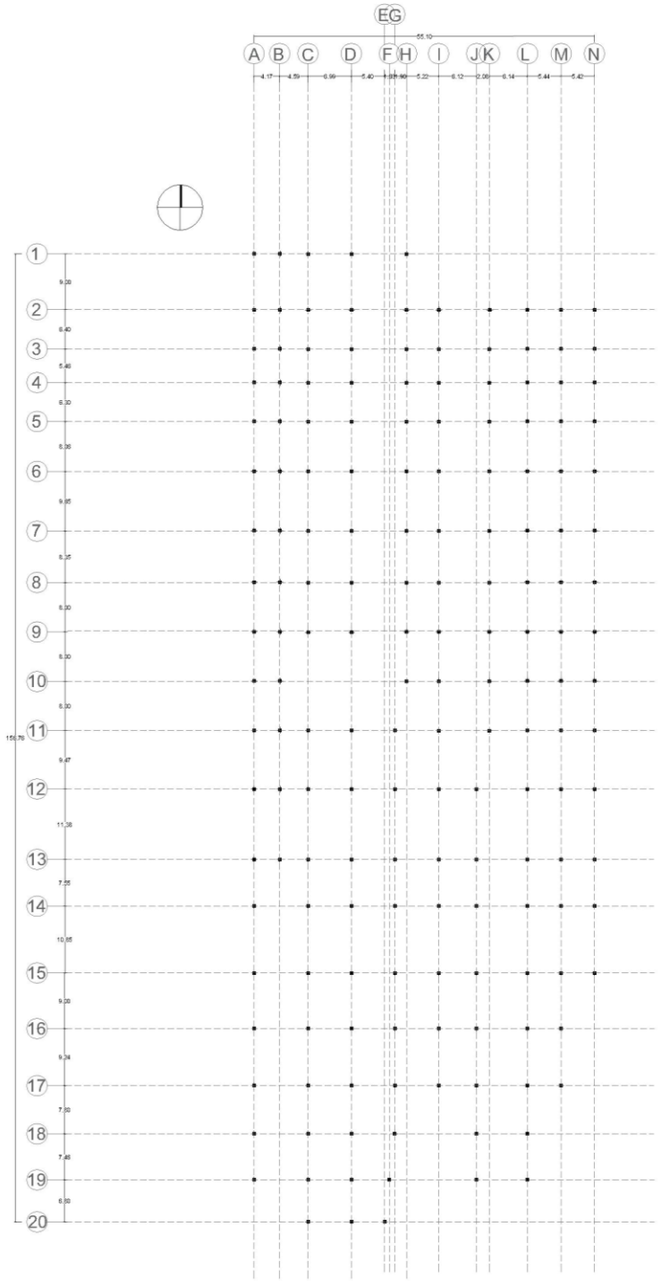
COMPONENT SPECIFICATION

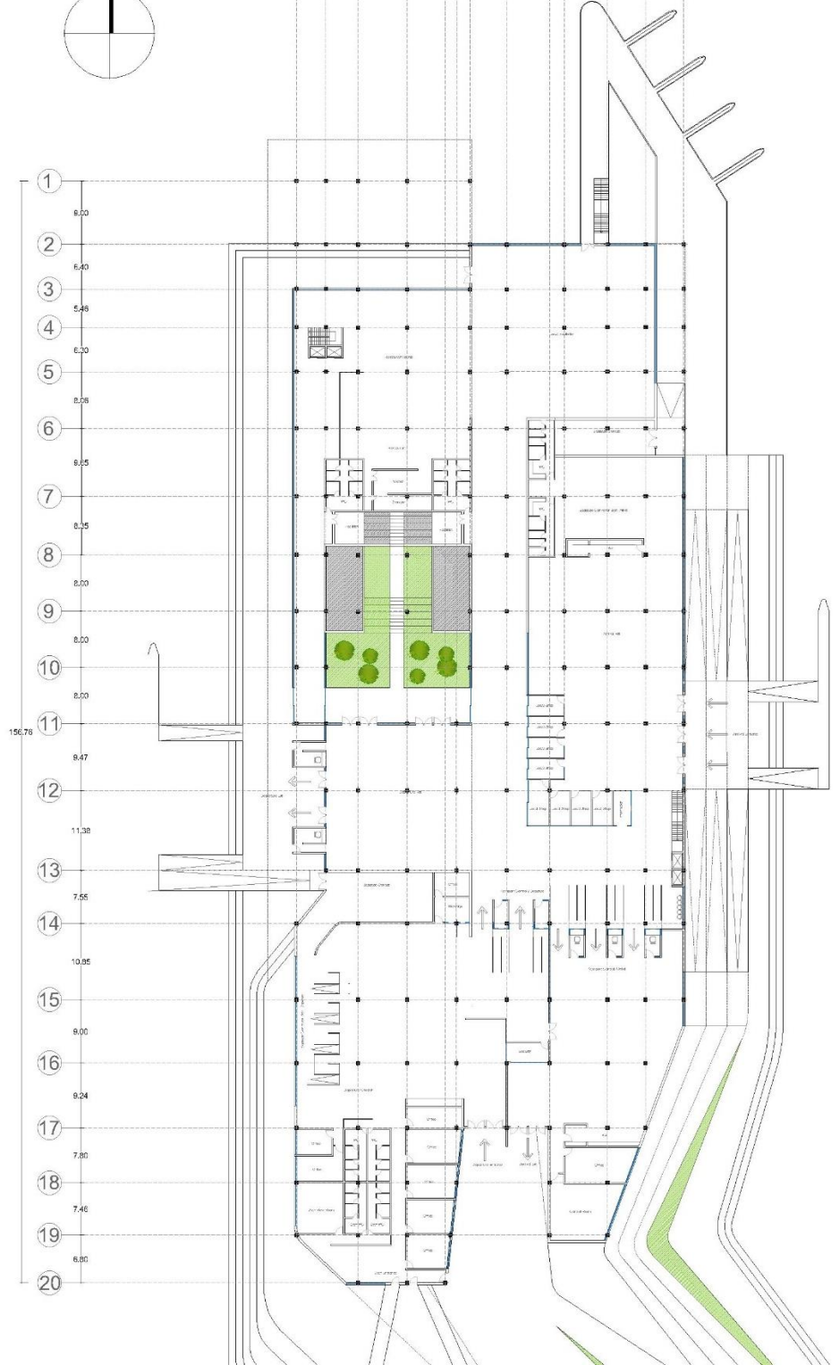
N.	Item	Material	Function	Dimensions (H/W/T) [mm]	Fixation
01	Mullion	Aluminum	Galzing	-	Hanged
02	Spacer	"Forex" material (rigid PVC foam sheet)	Framing	- /23/6.9	Pressed
03	Thermal break	Polyamide 6.6 with 26% glass fiber	Thermal insulation	-	Interlocked
04	Gasket (infilled)	Black EPDM rubber	Infilling spaces	-	Interlocked
05	Thermal insulation	Glass wool	Thermal insulation	- /250/50	Interlocked
06	Gasket	Black EPDM rubber	Sealing	-	Interlocked
07	Sealant	Vulcanized Rubber	Glazing	-	Adhered
08	Wall finishing	Mortar	Protection	- / - /10	Air-dried
09	Fire insulation	Gypsum plasterboard	Fire insulation	-	Pressed
10	Interior wall	Concrete	Separating	- / - /100	Air-dried
11	Acoustic insulation	Batts	Soundproofing	- / - /30	Pressed
12	Gasket	Black EPDM rubber	Connection	-	Interlocked
13	Glazing supporter	Aluminum	Framing	-	Pressed
14	SG holder	Aluminum	Framing	-	Interlocked
15	Glass compound edge	Aluminum	Holding frames	15.5/7.3/0.9	Interlocked
16	Adhesive tape	Backing	Fixing glasses	13/ - /1	Interlocked
17	Glazing spacer	Aluminum profile filled with silica gel Bulk and surrounded with Butyl Rubber	Glazing assembly	1750/12/5	Pressed
18	External glass	Heat-strengthened safety glass	Glazing	1825/1473+2973/6	Interlocked
19	Cavity	Argon	Glazing	1825/1473+2973/12	Interlocked
20	Internal glass	Thermal-insulating glass with low-emittance coatings	Glazing	1825/1473+2973/8	Interlocked





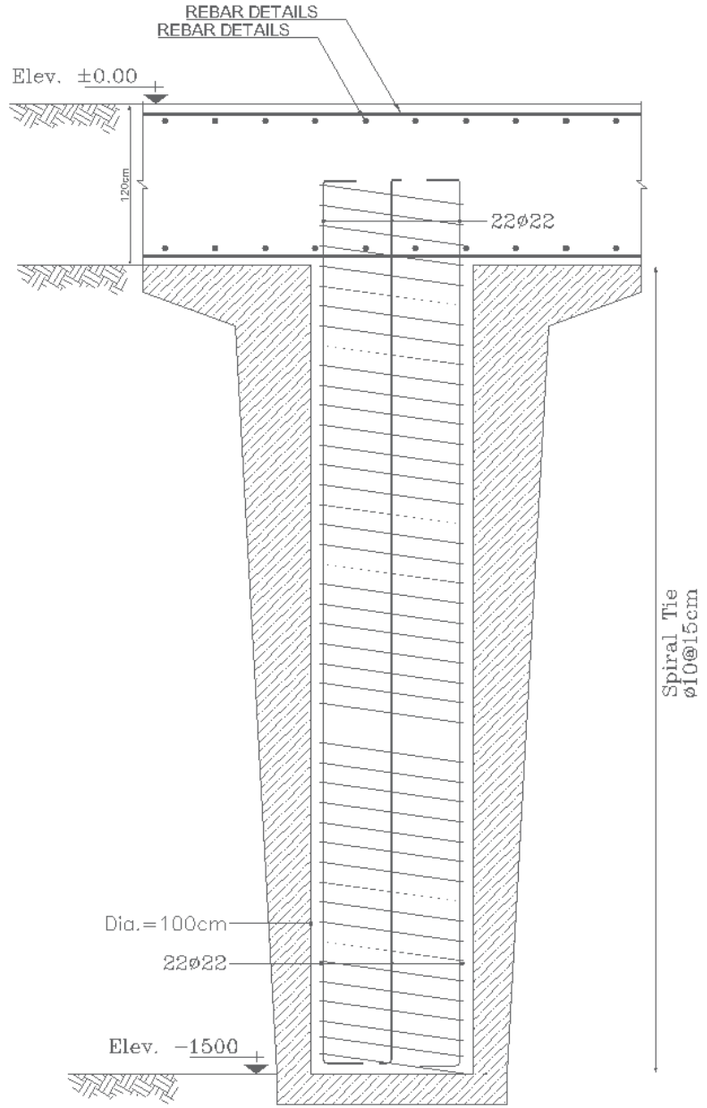
STRUCTURAL LAYOUT

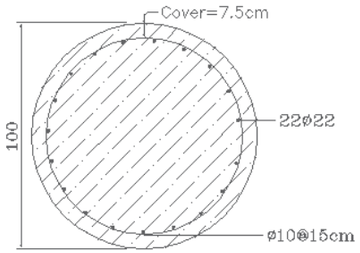




STRUCTURAL PLAN

POLITECNICO MILANO 1863





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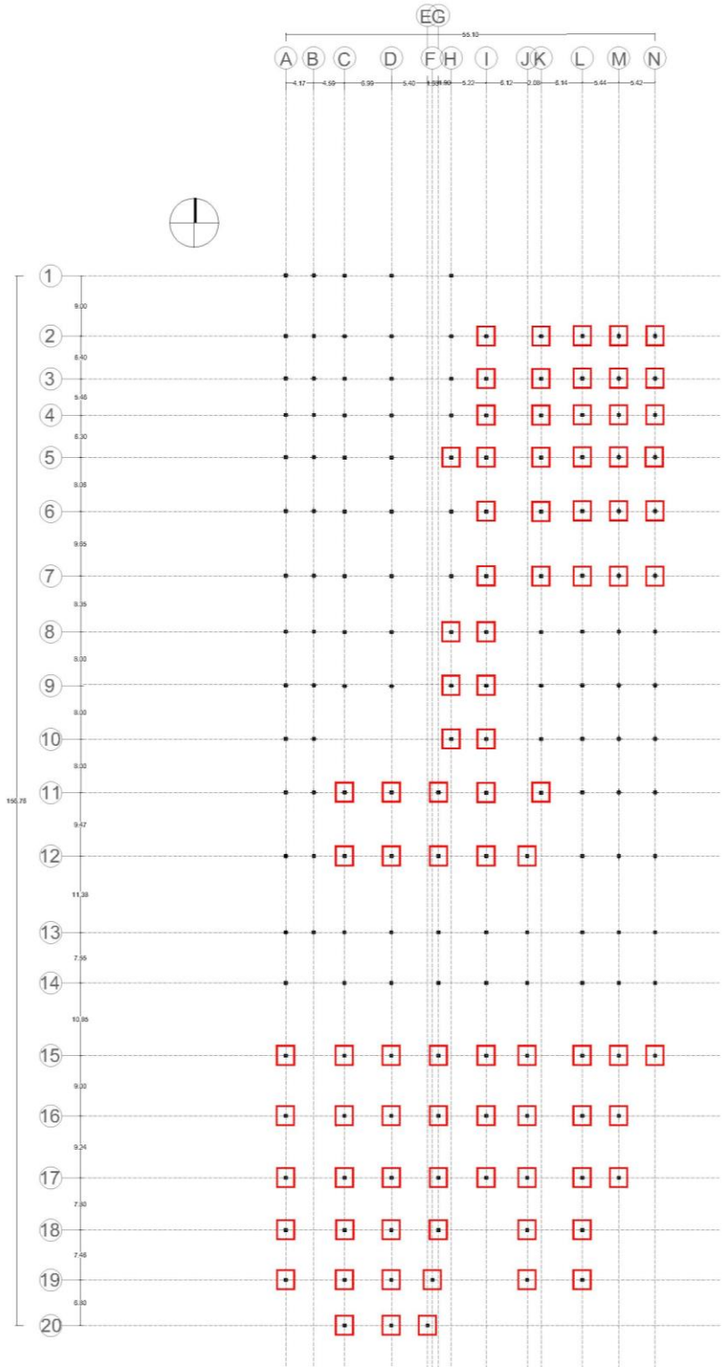
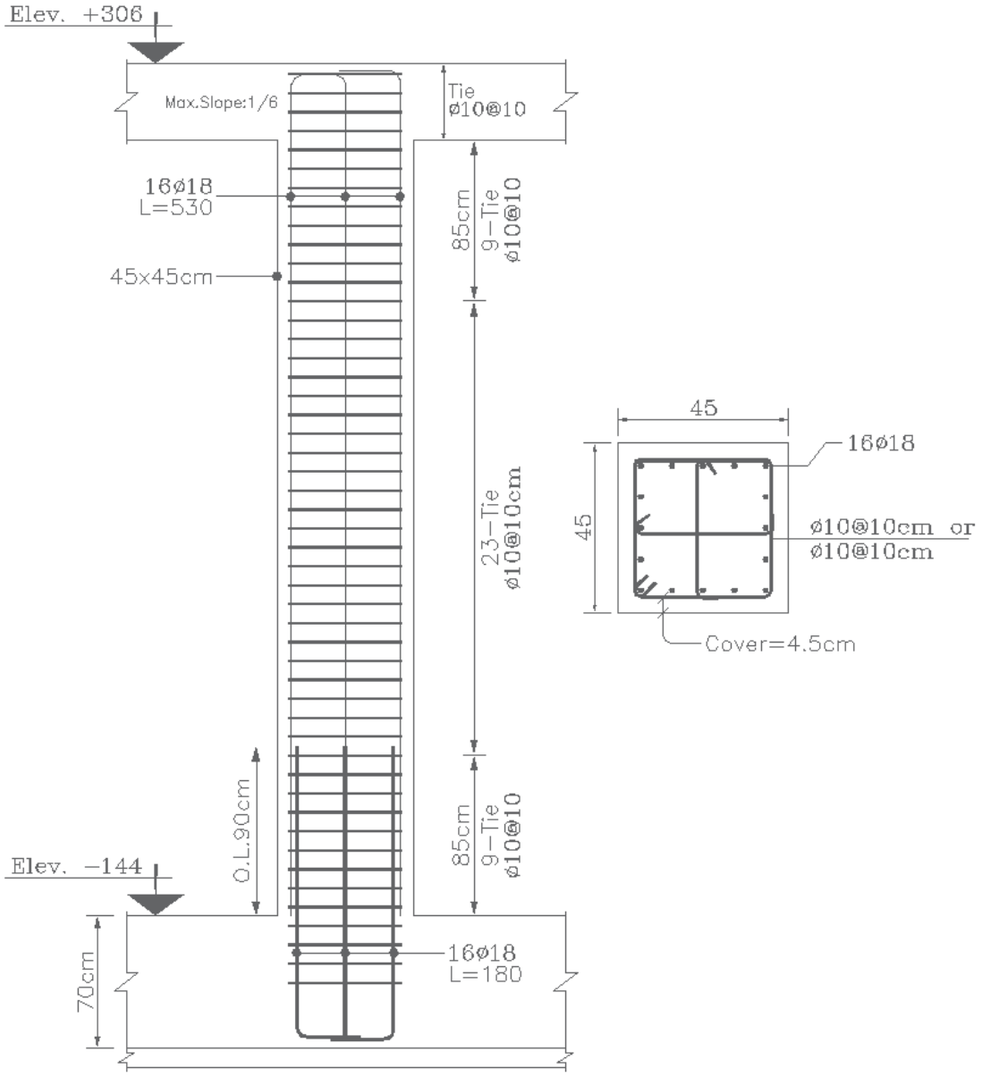
Sec.Sc. 1:14

COLUMN TYPE DETAIL



COLUMN C1 POSITION



COLUMN C1

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C1

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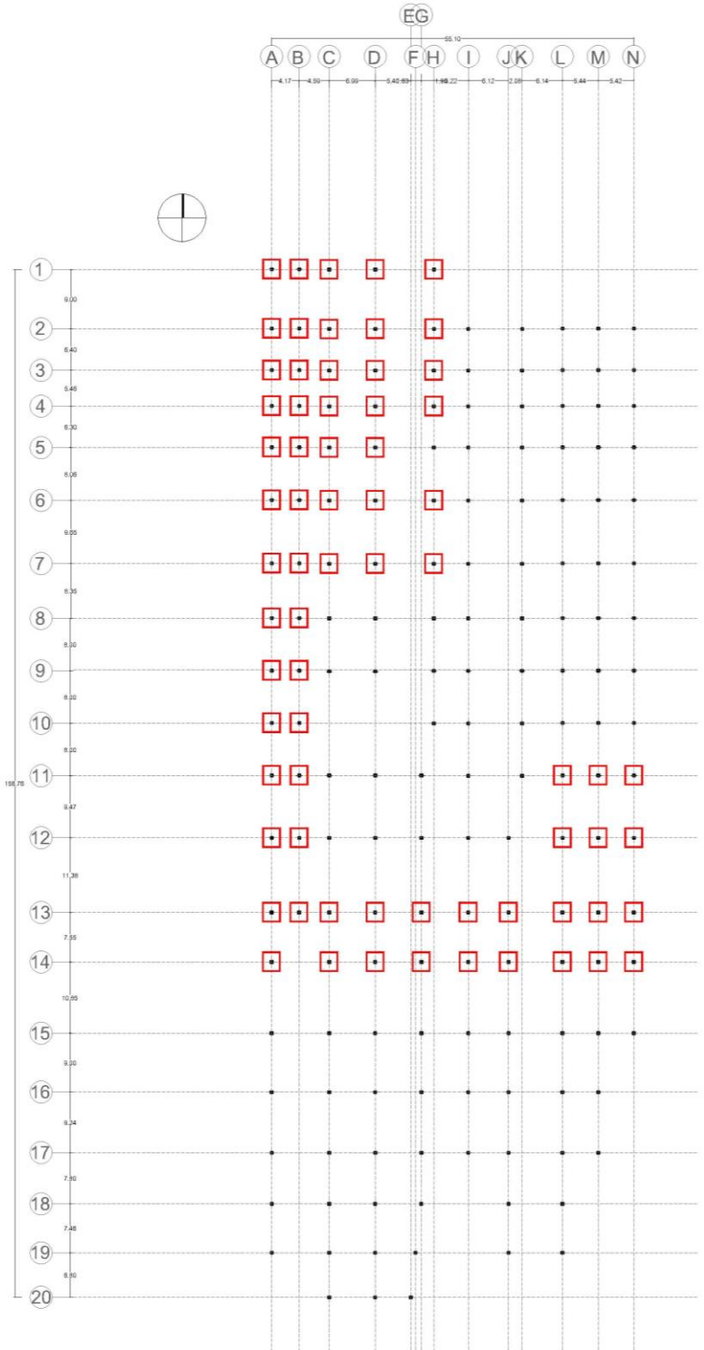

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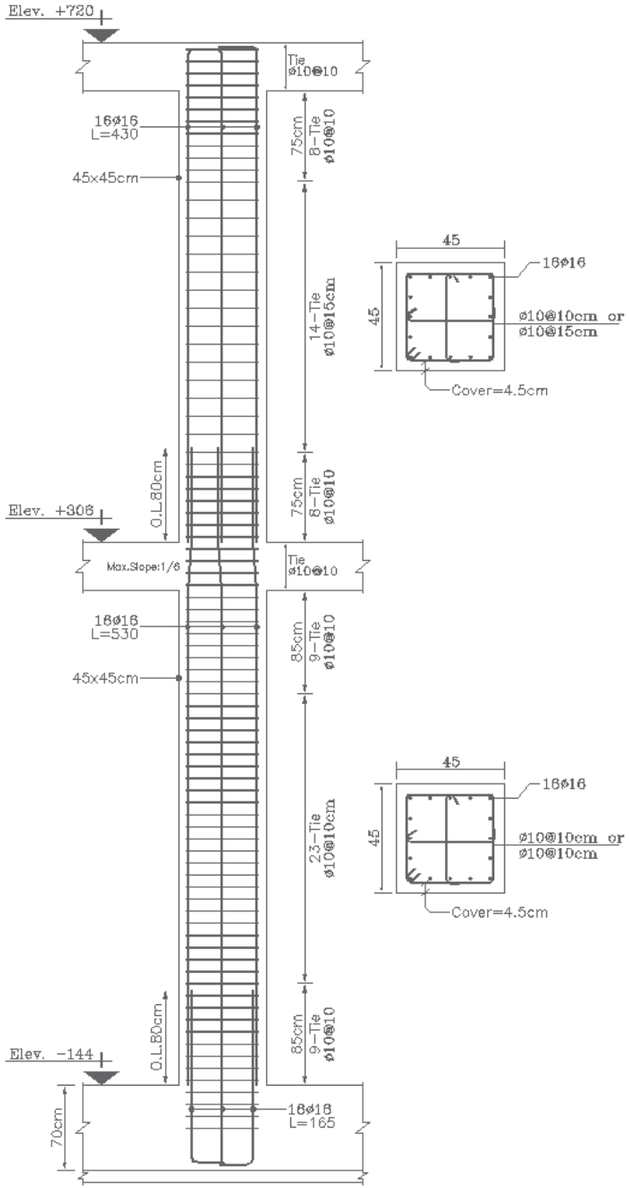

COLUMN C2

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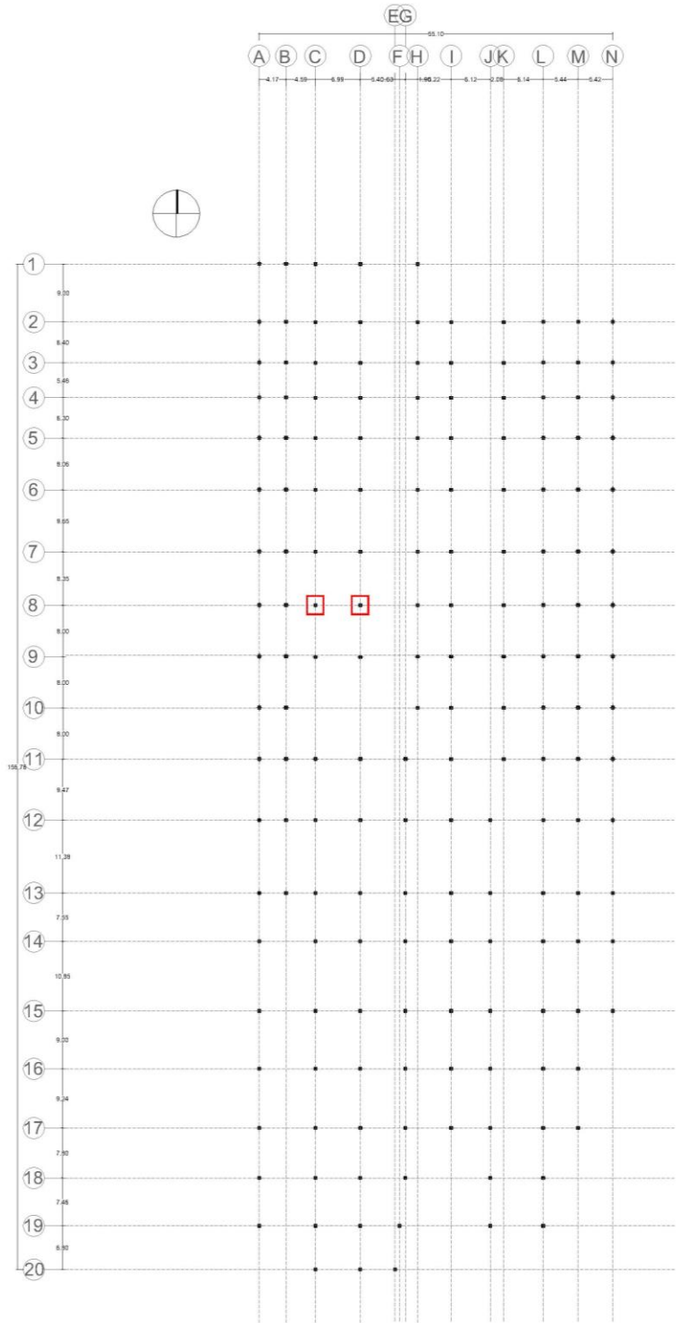
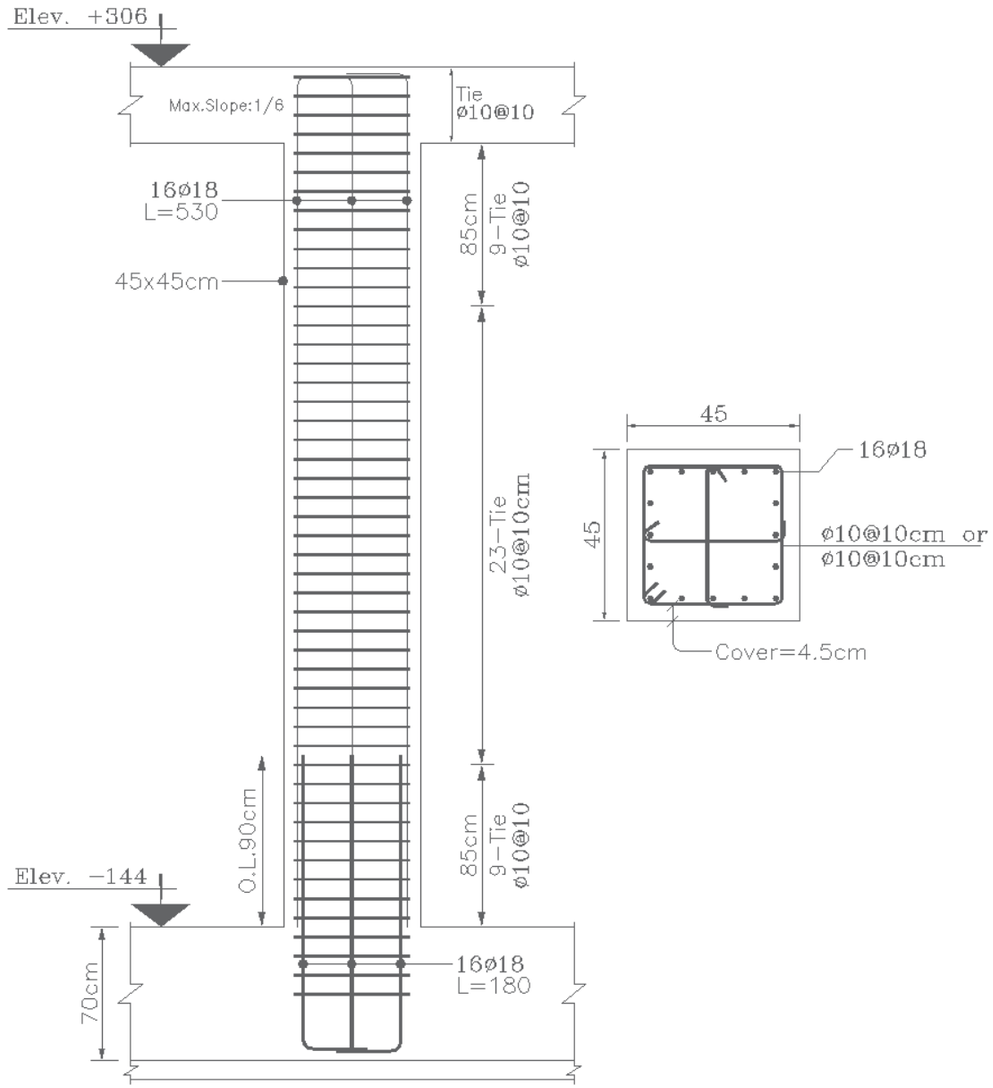
V.Scale 1:40
Sec.Sc. 1:20

C2



COLUMN C3 POSITION



COLUMN C3

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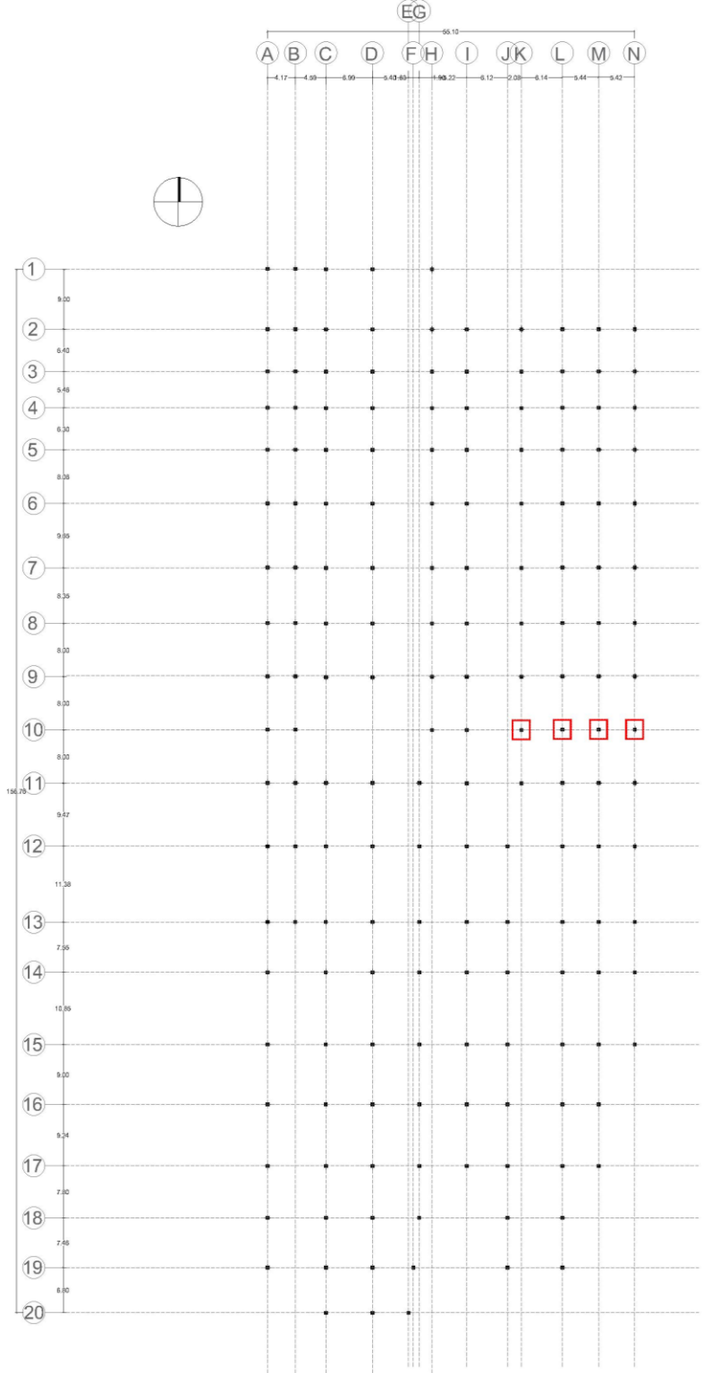
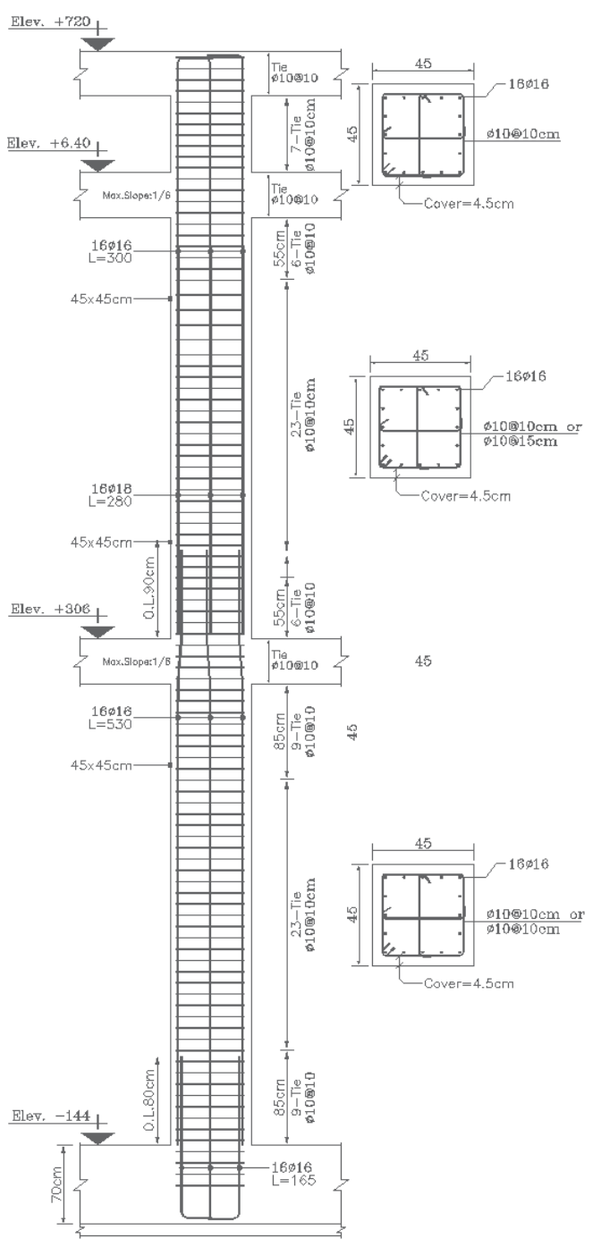
C3

COLUMN TYPE DETAIL



COLUMN C3 POSITION



■ COLUMN C4

Number=1

H.Scale 1:25
V.Scale 1:40
Sec.Sc. 1:20

C4

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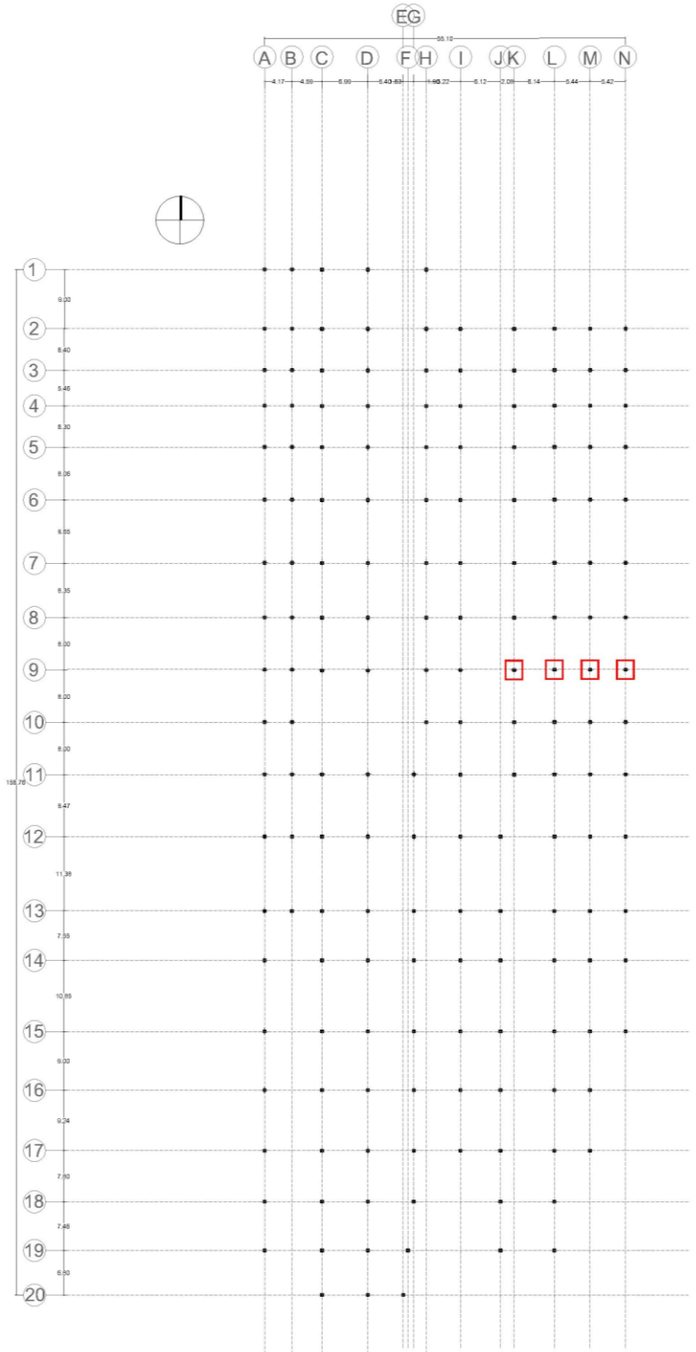
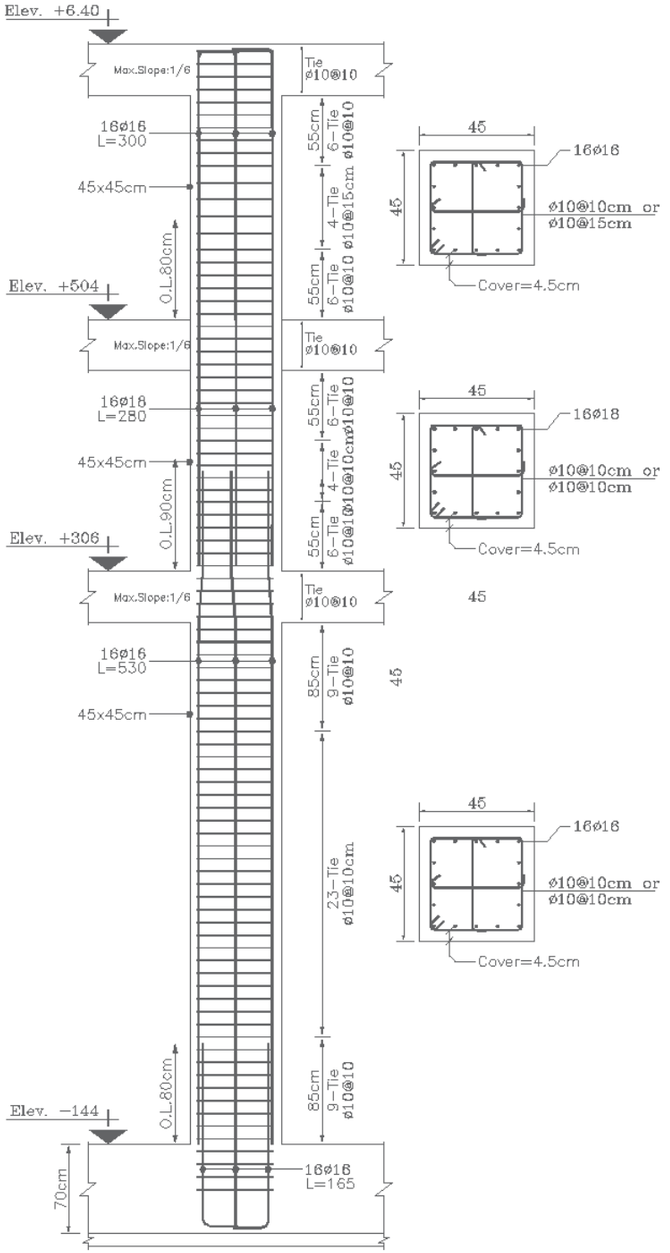
MILANO 1863



COLUMN C3 POSITION



COLUMN C5

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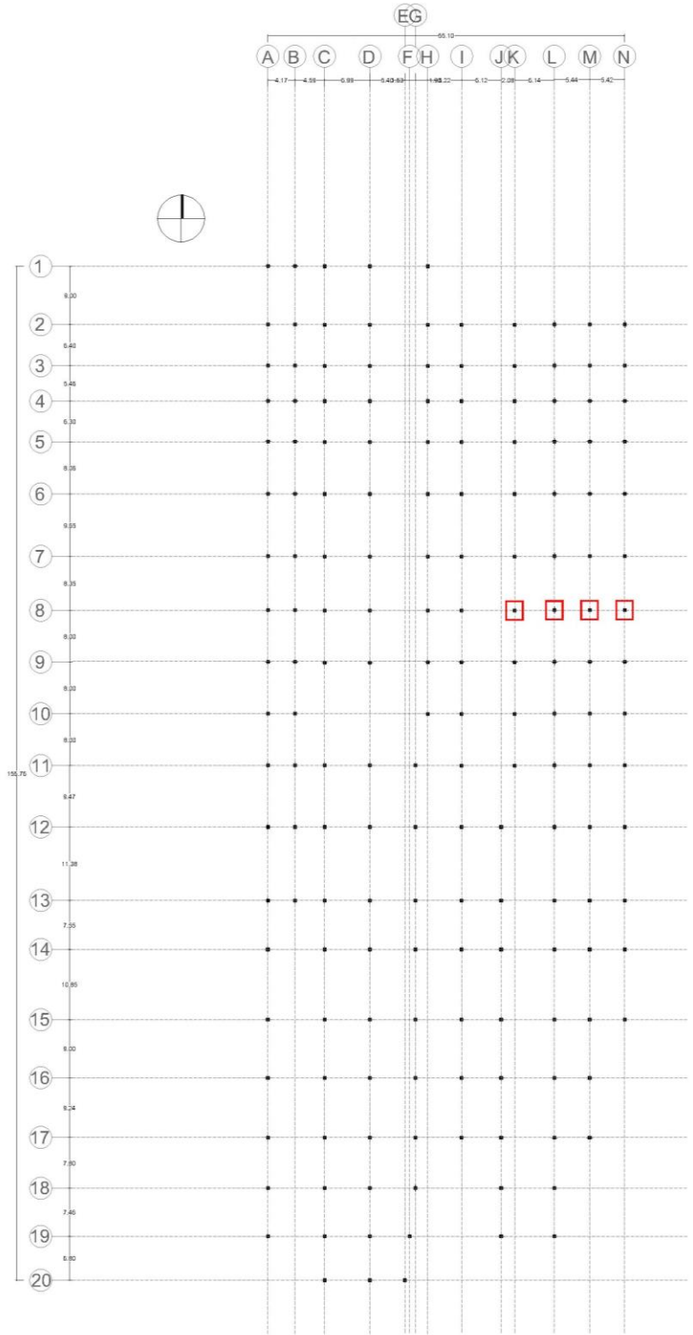
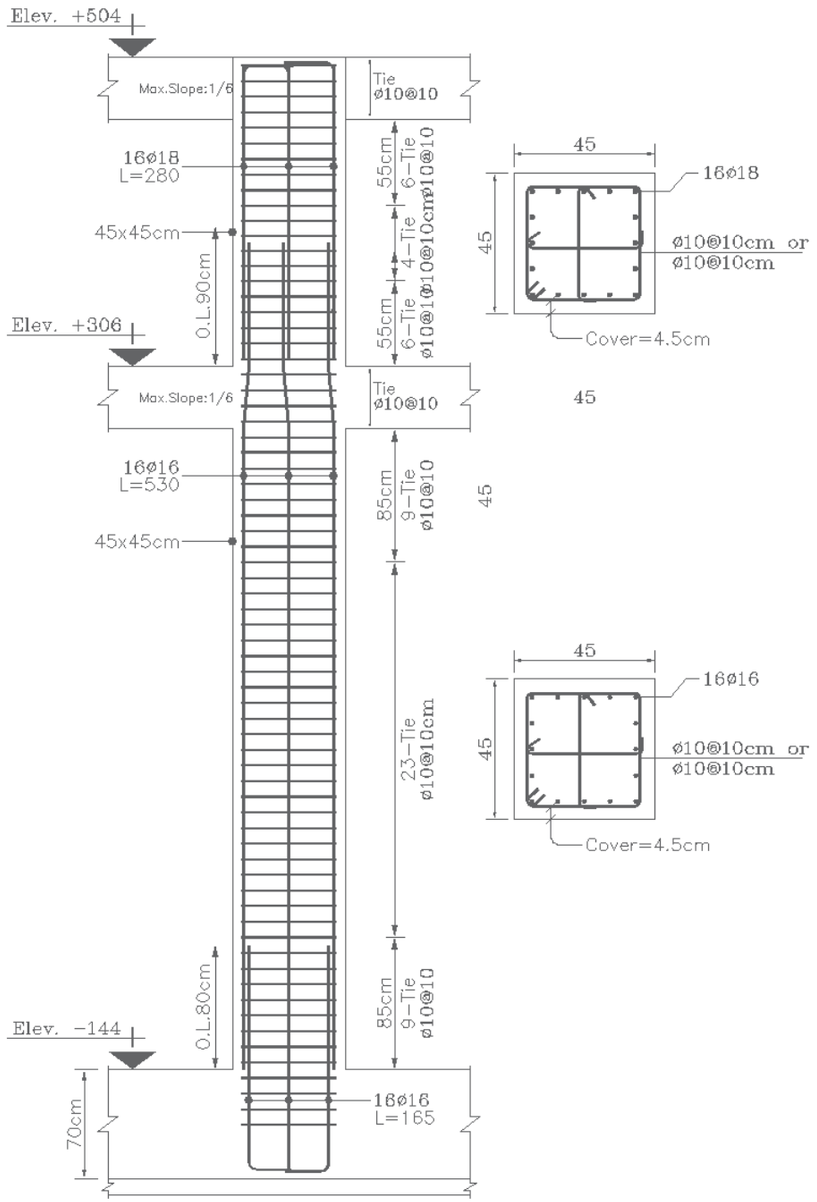
V.Scale 1:40
Sec.Sc. 1:20

C5

POLITECNICO MILANO 1863



COLUMN C3 POSITION



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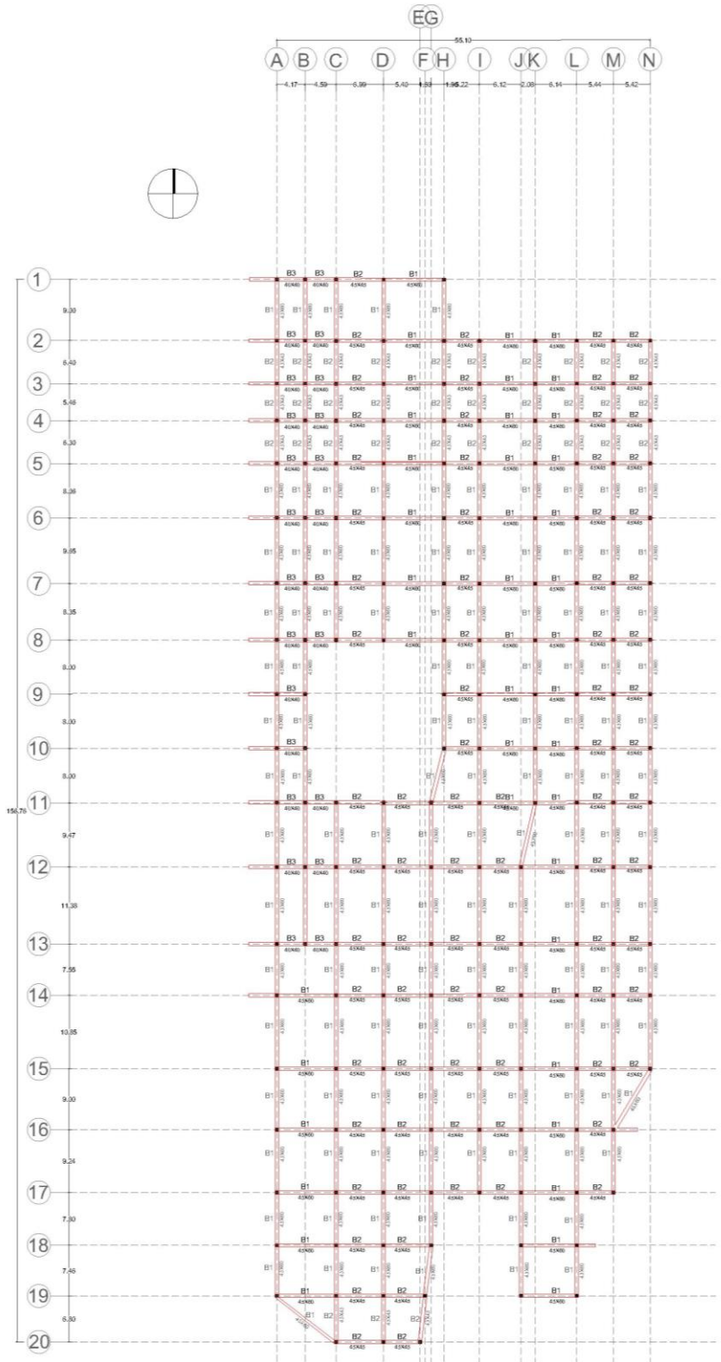
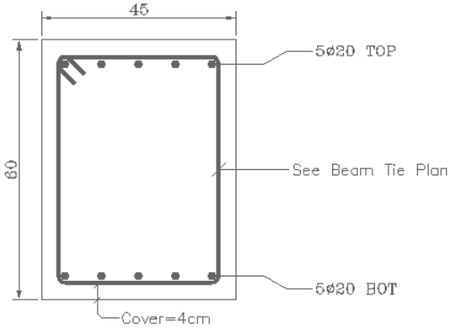
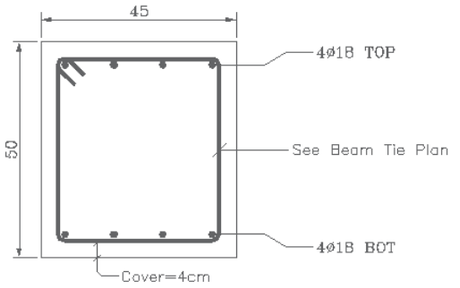
C6

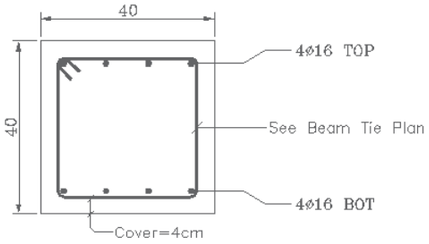




■ BEAM SECTION B1



■ BEAM SECTION B2

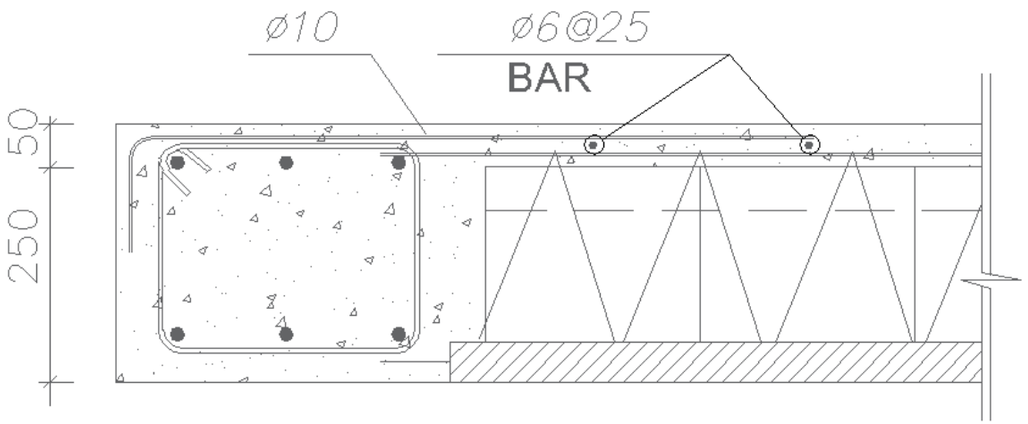


■ BEAM SECTION B3

Rebars Overlap Length Table (cm)

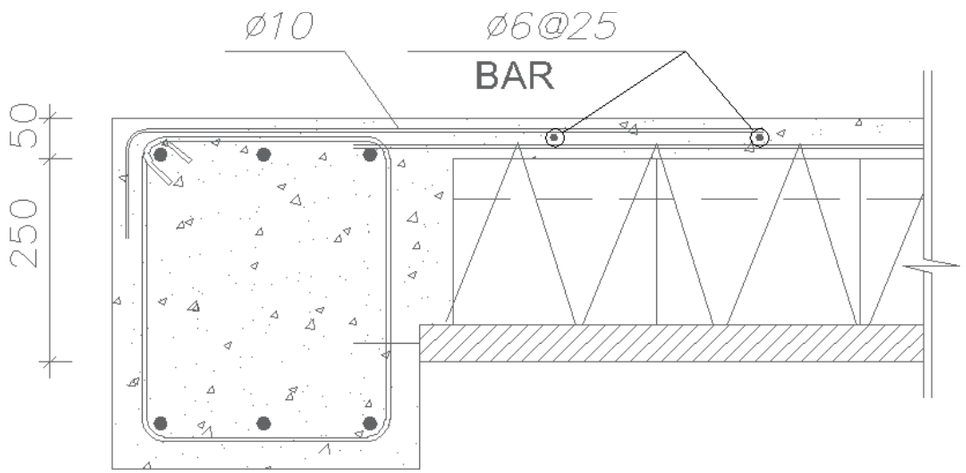
According to Rebar Position, Rebar Size and Properties of (F'c=260 Kg/cm?, Fy=4000 Kg/cm?)

Rebar Size	ø10	ø12	ø14	ø16	ø18	ø20	ø22	ø25	ø28	ø32
Beam Top	65	80	90	105	115	160	175	195	220	250
Beam Bottom	50	60	70	80	90	120	135	150	170	195
Column-Wall	50	60	70	80	90	120	135	150	170	195



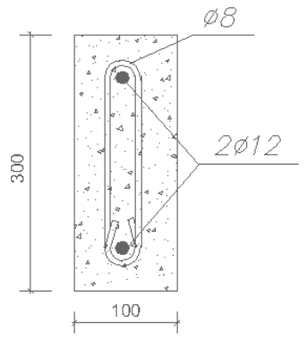
SECONDARY BEAM TO PRIMARY BEAM CONNECTION

unit = mm



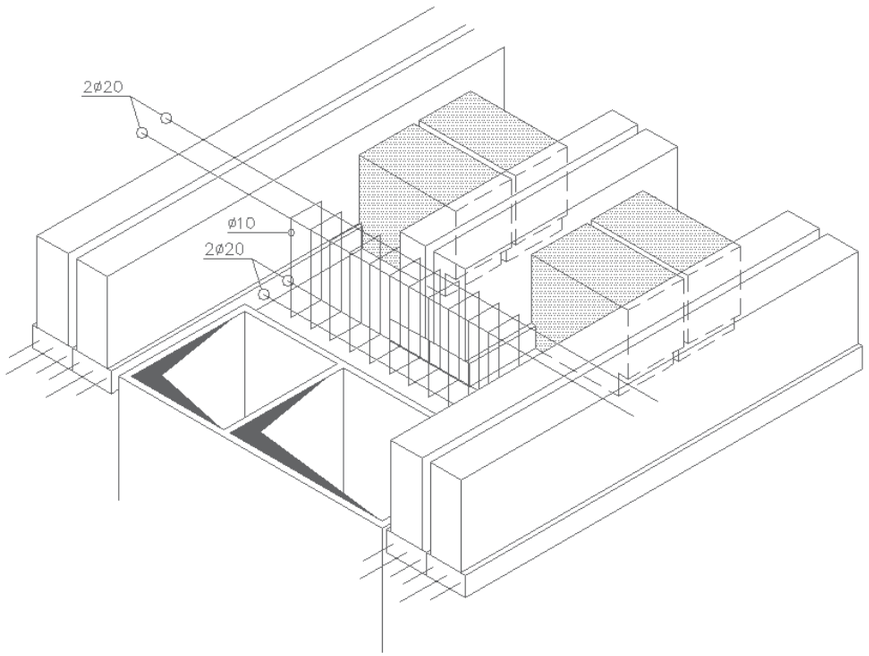
SECONDARY BEAM TO PRIMARY BEAM CONNECTION

unit = mm

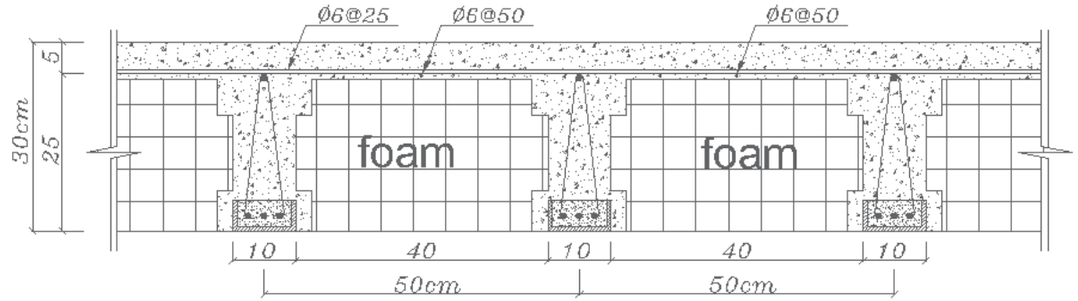


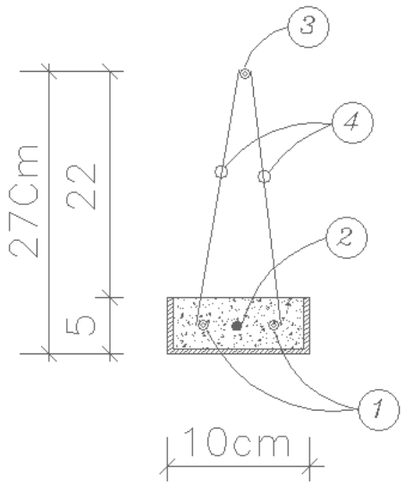
TIE–BEAM SECTION

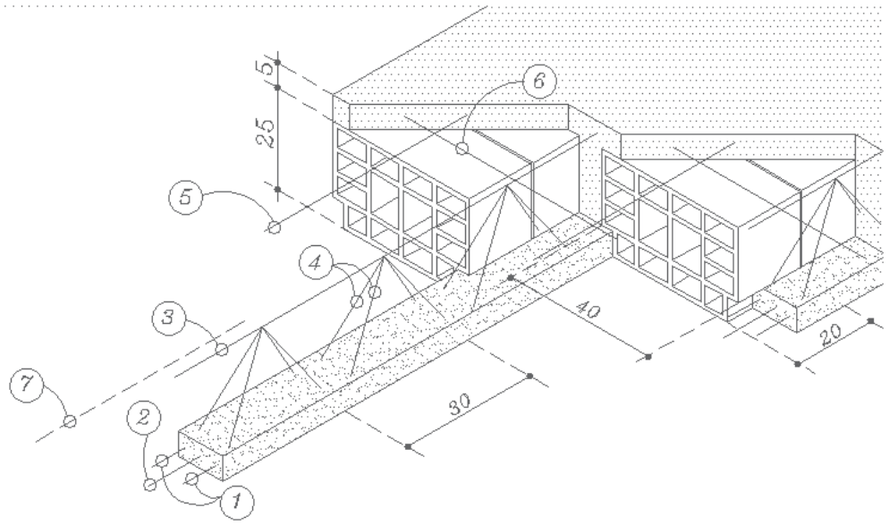
unit = mm



Details of connecting the secondary beam at the opening

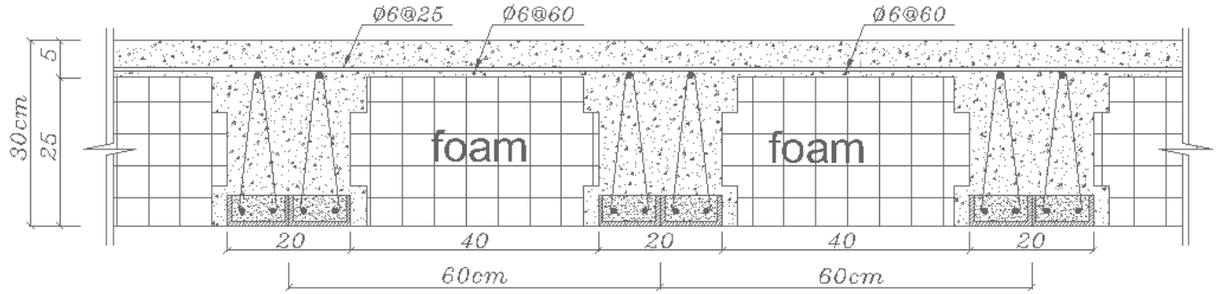


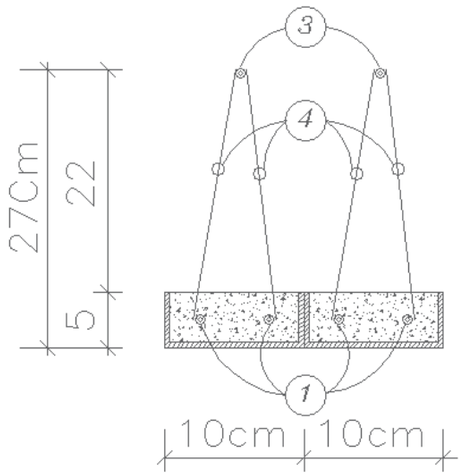


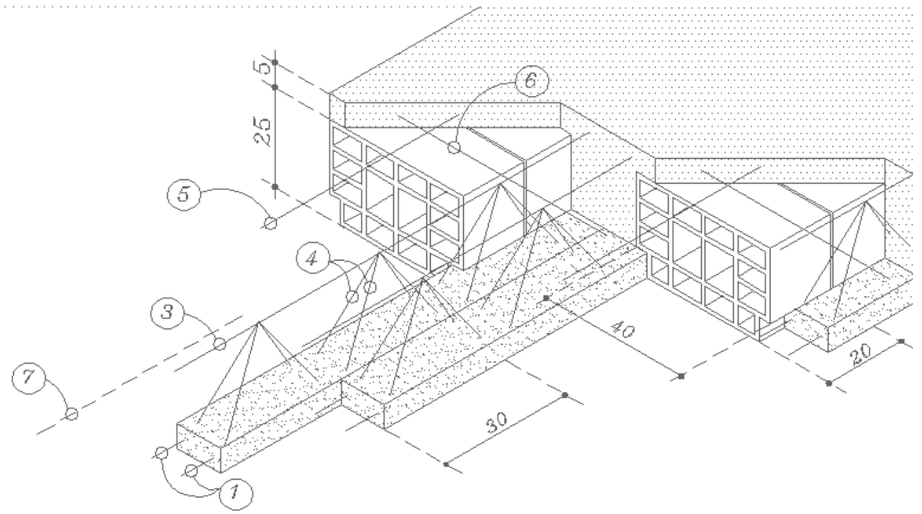


Details of the roof with secondary beam - foam (single)

Span length $L\ (cm)$	TYPE	1	2		3	4	5	6	7	
		Main Steel	Reinforcing steel	Reinforcing steel Length $Cm.$	upper steel	Diagonal shear steel	Thermal steel along the beam direction	Thermal steel Perpendicular to the direction of the beam	Negative steel	Negative steel Length $Cm.$
$L<400cm$	J1	2ø10	1ø8	L=300	ø10	ø8	ø6@50	ø6@25	ø12	L=100
$400<L<500$	J2	2ø12	1ø10	L=350	ø10	ø8	ø6@50	ø6@25	ø12	L=100
$500<L<600$	J3	2ø16	1ø10	L=400	ø10	ø8	ø6@50	ø6@25	ø14	L=110
$600<L<700$	J4	2(2ø14)	2(1ø12)	L=450	ø12	ø8	ø6@50	ø6@25	ø14	L=120
$700<L<800$	J5	2(2ø16)	2(1ø12)	L=500	ø12	ø8	ø6@50	ø6@25	ø14	L=120



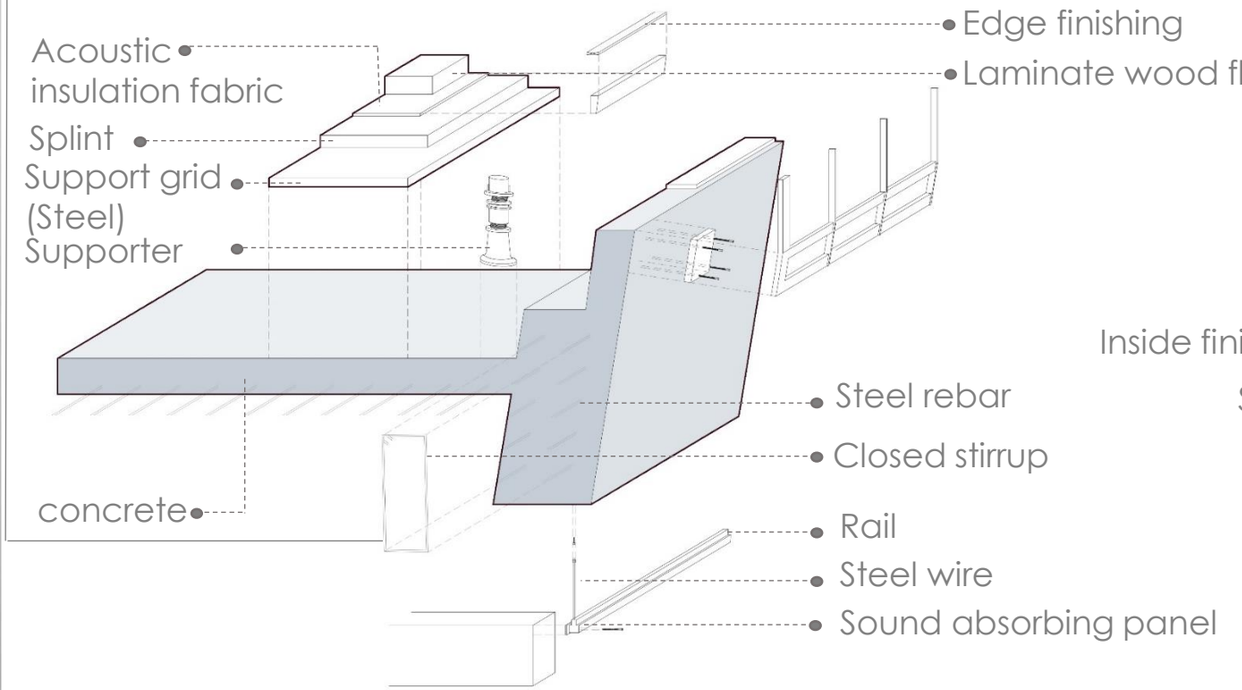


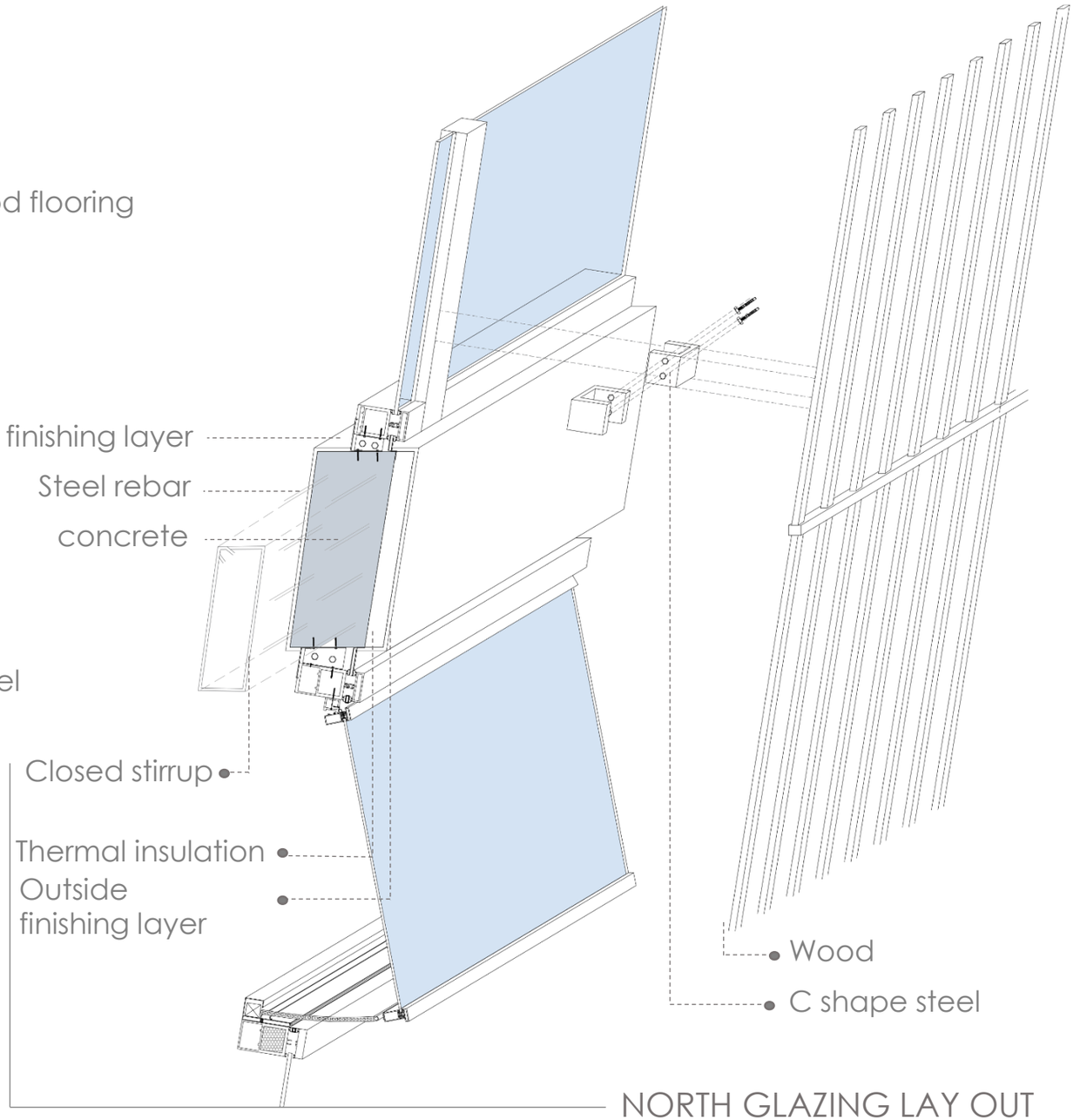


Details of the roof with secondary beam - foam (Double)

Span length L (cm)	TYPE	1	2		3	4	5	6	7	
		Main Steel	Reinforcing steel	Reinforcing steel Length Cm.	upper steel	Diagonal shear steel	Thermal steel along the beam direction	Thermal steel Perpendicular to the direction of the beam	Negative steel	Negative steel Length Cm.
L<400cm	J1	2ø10	1ø8	L=300	ø10	ø8	ø6@50	ø6@25	ø12	L=100
400<L<500	J2	2ø12	1ø10	L=350	ø10	ø8	ø6@50	ø6@25	ø12	L=100
500<L<600	J3	2ø16	1ø10	L=400	ø10	ø8	ø6@50	ø6@25	ø14	L=110
600<L<700	J4	2(2ø14)	2(1ø12)	L=450	ø12	ø8	ø6@50	ø6@25	ø14	L=120
700<L<800	J5	2(2ø16)	2(1ø12)	L=500	ø12	ø8	ø6@50	ø6@25	ø14	L=120

REINFORCED CONCRETE SLAB LAYOUT

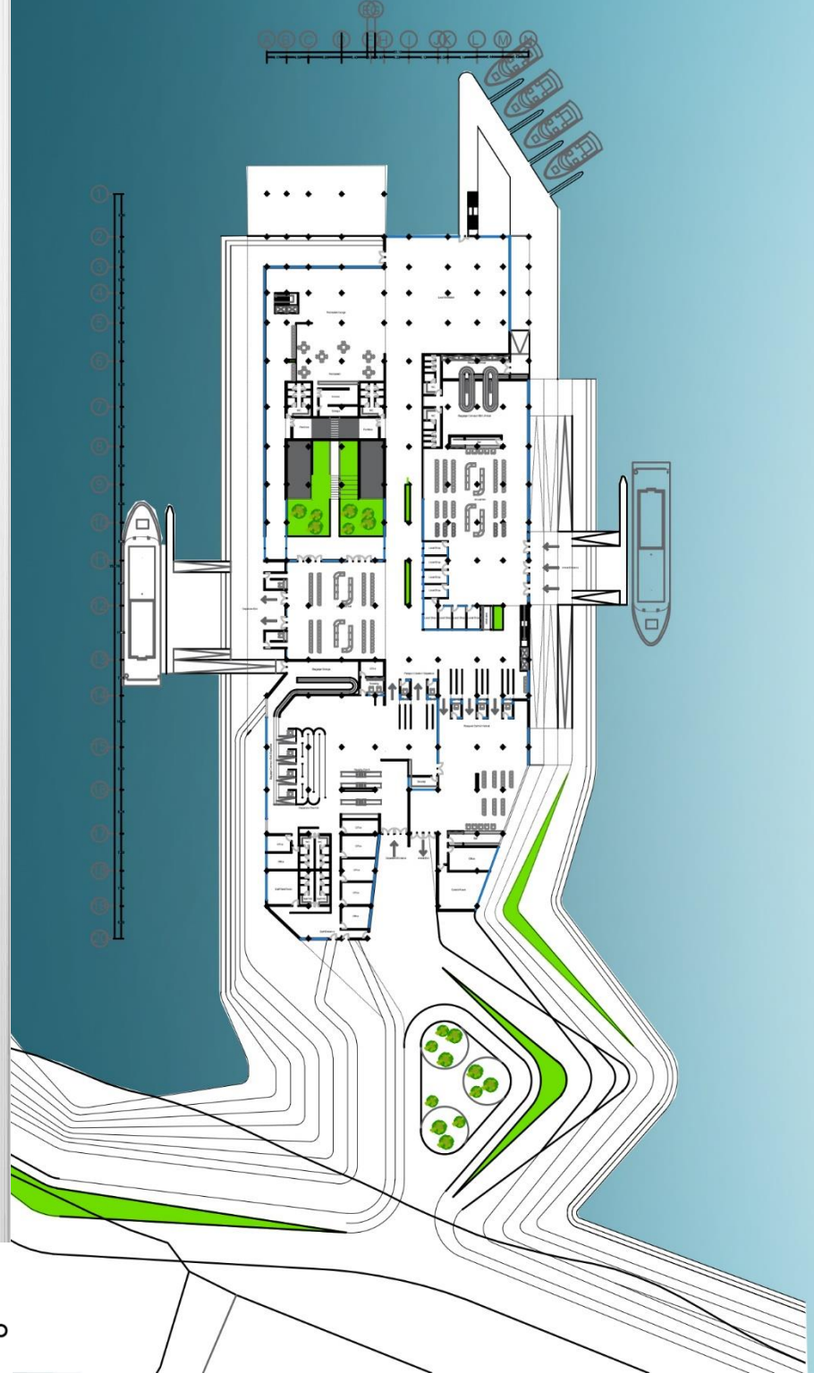




NORTH GLAZING LAY OUT

POLITECNICO MILANO 1863

PLAN

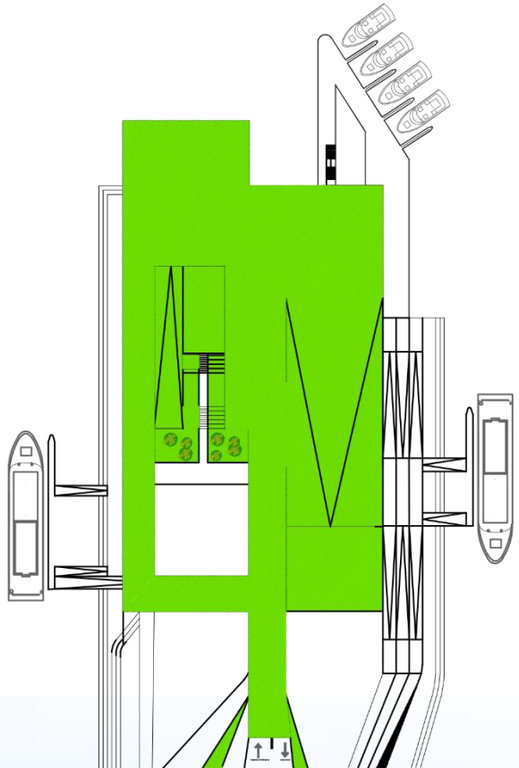


LEVEL 1

POLITECNICO
MILANO 1863

LEVEL 2

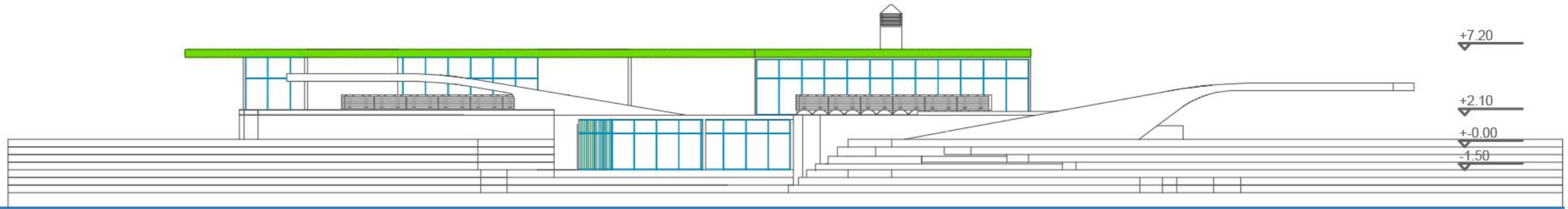
ROOF



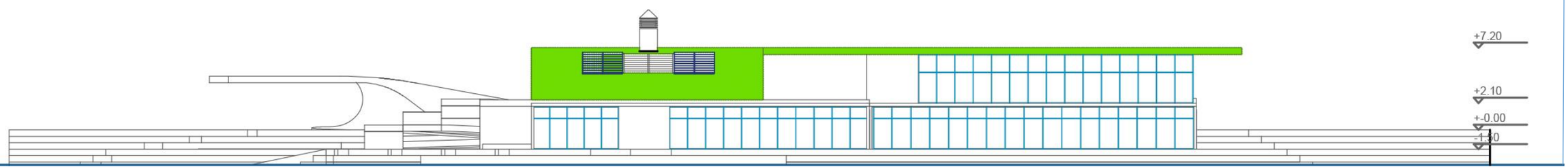
ROOF VIEW

EAST ELEVATION

SECTION & ELEVATION

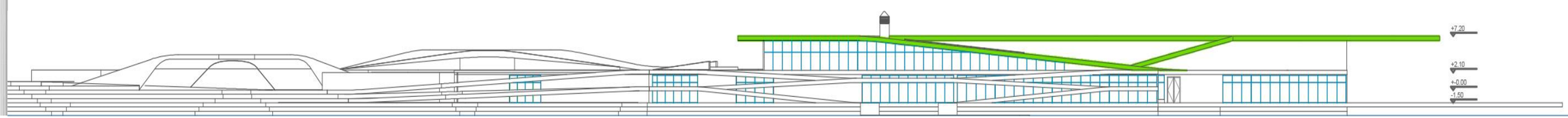


NORTH ELEVATION

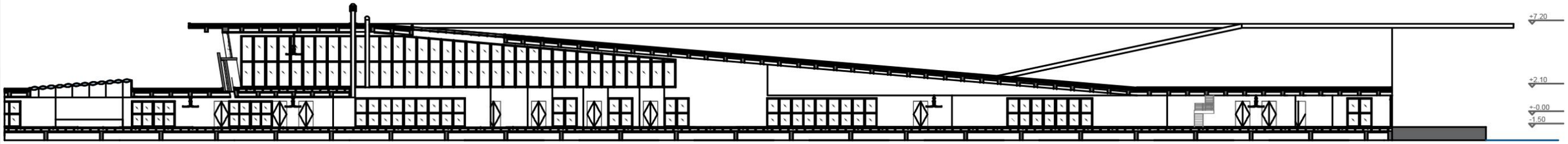


SOUTH ELEVATION

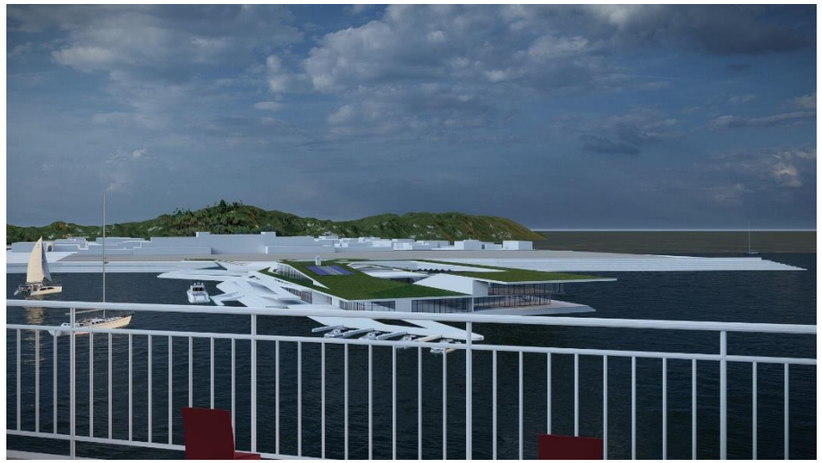
WEST ELEVATION



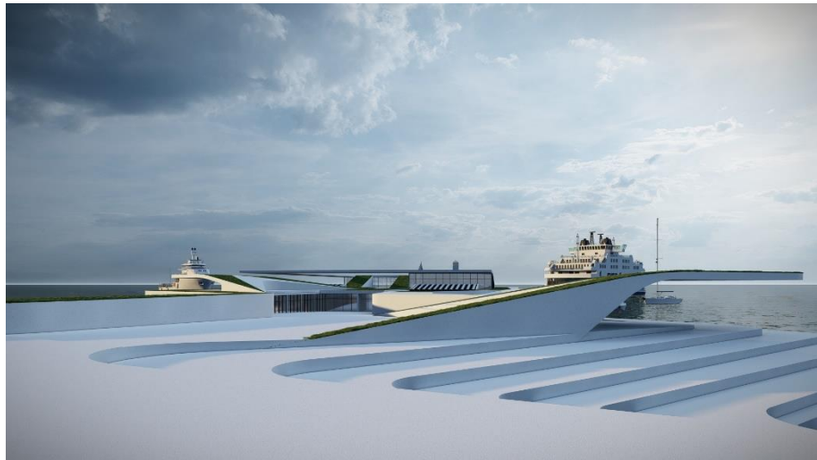
EAST ELEVATION



A-A SECTION





THANK YOU