TAYLOR'S UNIVERSITY
Wisdom · Integrity · Excellence

GREEN STRATEGIES FOR BUILDING DESIGN (ARC61804)

PASSIVE GREEN BUILDING CASE STUDIES

TUTOR : MR KHAIROOL

GROUP 8

0358281 TAN YUE TUNG
0358766 TEA HE YING
0349422 YEO XU WEN
0358757 SEE TOO CHENG KAI
0357052 YONG SHAN WEI
0369797 EUNICE LOW YONG ZHEN

CONTENTS

HERIOT-WATT UNIVERSITY

PUTRAJAYA, MALAYSIA

Heriot-Watt University Malaysia's campus, facing the picturesque **Putrajaya Lake**, integrates **innovative green strategies** with sustainable design. The "Green Continuum" concept features an **earth berm**, making the buildings appear naturally embedded in the landscape. The campus's **fast-track construction**, completed in time for the 2014 academic year, required careful planning, especially for its distinctive **curved and sloping roofs**.

Set within a dynamic **urban context**, surrounded by a mix of recreational areas, hotel, office building, industrial, residential zones, and abundant green land. The presence of **Putrajaya Lake** further enhances the site's scenic and vibrant environment.

ARCHITECTS
Hijjas Kasturi Associates

NO. OF FLOORS
from 3 to 6 storeys

TYPOLOGY
Academy Building

SITE AREA
37,460 sq m

YEAR OF COMPLETION
2014

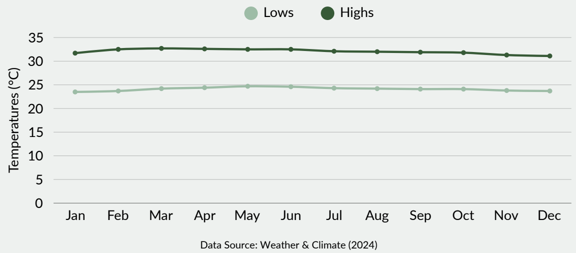
LOCATION
1, Jalan Venna P5/2, Precinct 5, Putrajaya, Malaysia

AWARDS / CERTIFICATIONS
2017 Green Building Index Rating
2018 The Edge Property Excellence Award

CLIMATE ANALYSIS

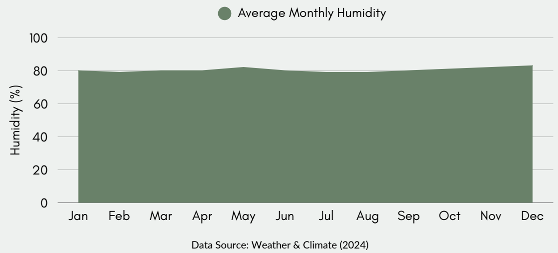
Putrajaya, Malaysia's administrative capital, has a **tropical rainforest climate** with **high humidity** and consistent **rainfall** year-round. Temperatures typically range from **23°C to 32°C**, occasionally exceeding **33°C** during the day. The city experiences **two monsoon seasons**: the Southwest Monsoon (May to September) brings drier conditions, while the Northeast Monsoon (November to March) brings heavy rain and thunderstorms. Despite the rainfall, Putrajaya enjoys **ample sunshine** throughout the year.

TEMPERATURE



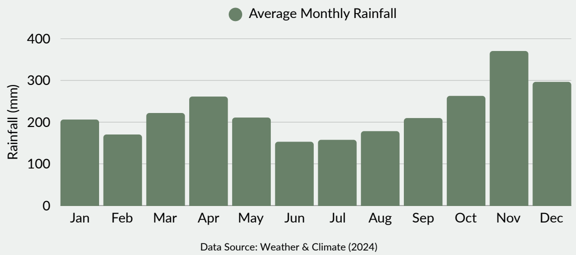
Average Yearly Temperature: 32.3°C
Hottest Month: March (32.7°C)
Coldest Month: September (31.3°C)

HUMIDITY



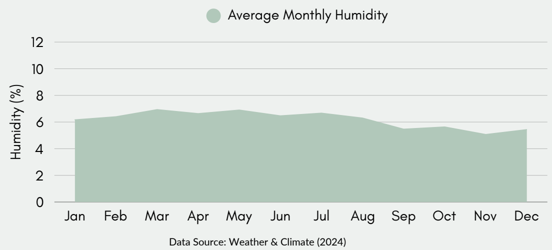
Average Yearly Humidity: 80.4%
Most Humid Month: December (83%)
Least Humid Month: February, July, August (79%)

RAINFALL



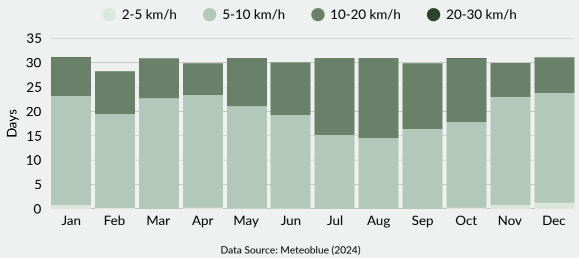
Average Yearly Rainfall: 2700mm
Wettest Month: November (370.5mm)
Driest Month: June (153mm)

DAYLIGHT



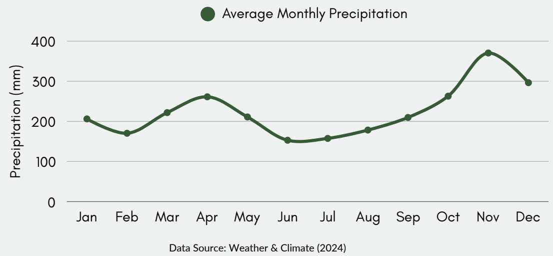
Average Yearly Daylight Hours: 6h
Sunniest Month: March (6.933h)
Least Sunny Month: November (5.067h)

WIND SPEED



Most Wind : October
Least Wind : February

PRECIPITATION



Average Yearly Precipitation: 2700mm
Wettest Month: November (3711mm)
Driest Month: June (153mm)

TRANSOCEÁNICA BUILDING SANTIAGO, CHILE

The Transoceánica Building by +arquitectos in Santiago, Chile, spans **14,000 square meters** as the headquarters for Transoceánica companies. Part of a masterplan by Krause Bohne Gmbh and developed with Bohne Ingenieure, it includes **three office levels**, **two underground parking levels**, and a **central hall** with open office wings and an independent **auditorium** and **dining area**. Located near Lo Castillo airfield, the project aims for **LEED Gold certification**, highlighting its commitment to sustainability.

Situated on a **sloped terrain**, the varying elevation of the site influences the building's layout. It is surrounded by clinic, airport, office buildings, residential areas, green land, and zones under construction, creating a **dynamic** and **evolving urban context**.

ARCHITECTS
+arquitectos

YEAR OF COMPLETION
2010

NO. OF FLOORS
3 levels of offices and 2 levels of underground parking

LOCATION
Sta. María 5888, 7660268 Vitacura, Santiago Metropolitan Region, Chile

TYPOLOGY
Office Building

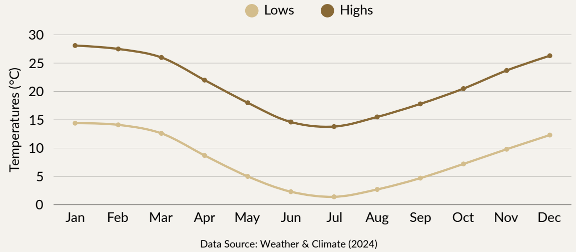
AWARDS / CERTIFICATIONS
LEED Gold Certification
Certificación de Edificio Sustentable (CES) - "Sobresaliente" Level

SITE AREA
14,000 sq m

CLIMATE ANALYSIS

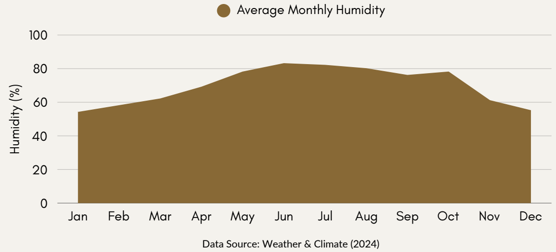
Santiago, the **capital of Chile**, lies between the Andes and the Chilean Coast Range. Founded in 1541, it is the country's cultural, political, and economic hub, offering vibrant urban life with easy access to both mountains and the coast. The city has a **Mediterranean climate** with hot, dry summers (December to February) and cool, wet winters (June to August). Summer temperatures can reach **35°C**, while winter lows can drop to **0°C**, with most rainfall occurring in winter. Santiago enjoys plenty of **sunshine year-round**.

TEMPERATURE



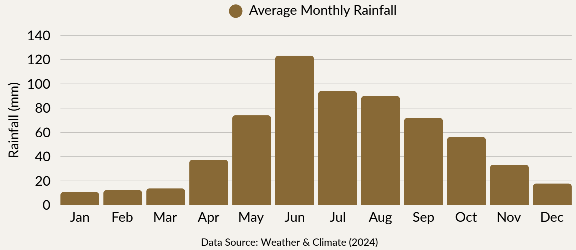
Average Yearly Temperature: 21.3°C
Hottest Month: January (28°C)
Coldest Month: July (14°C)

HUMIDITY



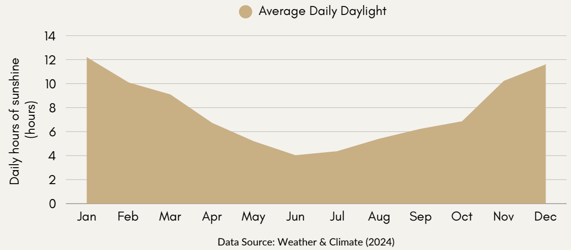
Average Yaerly Humidity: 69.6%
Most Humid Month: June (83%)
Least Humid Month: January (54%)

RAINFALL



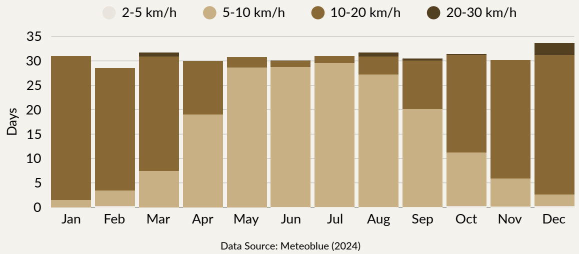
Average Yearly Rainfall: 635mm
Wettest Month: June (123mm)
Driest Month: January (11mm)

DAYLIGHT



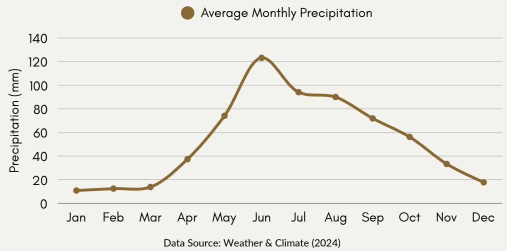
Average Yearly Daylight Hours: 7.64h
Sunniest Month: January (12.2h)
Least Sunny Month: June (4h)

WIND SPEED



Most Wind : March
Least Wind : February

PRECIPITATION



Average Yearly Precipitation: 634mm
Wettest Month: June (123.2mm)
Driest Month: January (10.8mm)

SITE PLANNING

LEGEND
RECREATIONAL | HOTEL | INDUSTRIAL | LAKE
OFFICE BUILDING | RESIDENTIAL | GREEN LAND


Marina Putrajaya


DoubleTree by Hilton Putrajaya Lakeside


Gas District Cooling (Putrajaya) - GDC Plant 3


Ministry of Higher Education (MOHE)

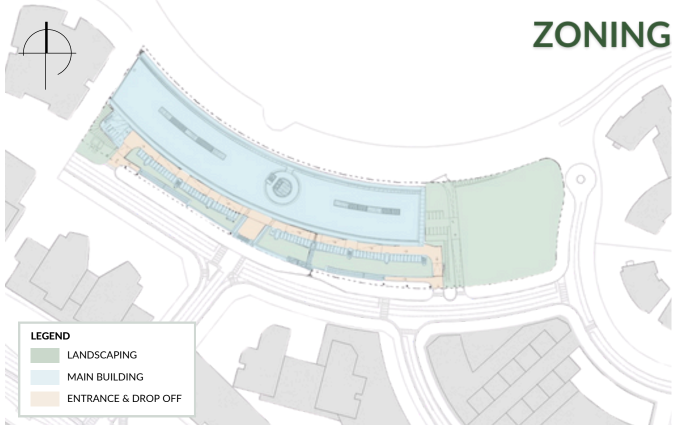

Putrajaya RC Park


Apartment 5R1, Presint 5

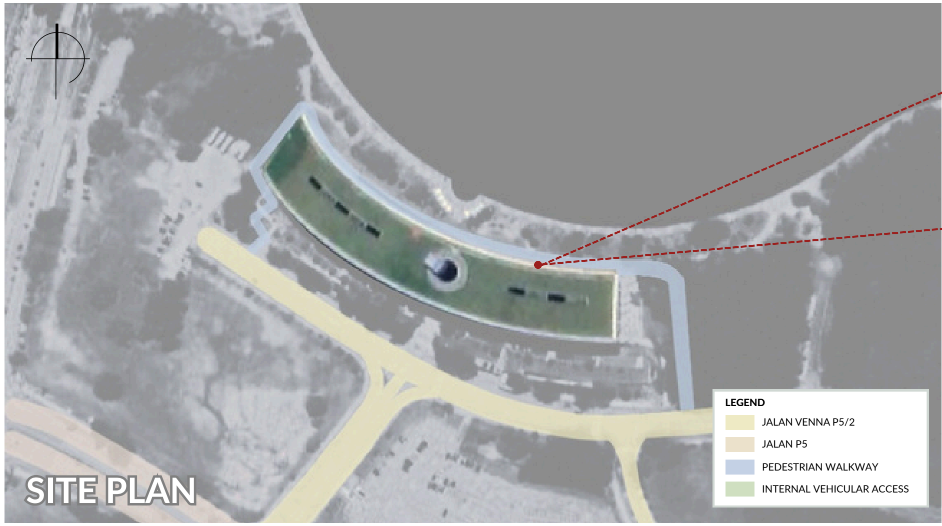

Green Land


Lake

ZONING



HERIOT-WATT UNIVERSITY
PUTRAJAYA, MALAYSIA



SITE PLAN

SETBACKS FROM THE STREET

LANDSCAPED BUFFER ZONE

*The image illustrates a **landscaped setback** at Heriot-Watt University, creating a natural **buffer** that enhances the building's aesthetics and **blends** it with the **surrounding environment**.*

ACCESSIBILITY


Jalan Venna P5/2

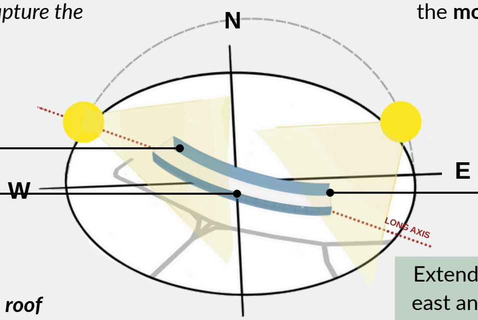

Jalan P5


Pedestrian Walkway


Internal Vehicular Access

*The building's **long axis** runs **north-south**, with main facades oriented to capture the most diffuse light.*

East & **west** facades receives **strong** low-angle **sunlight** in the **morning** and **afternoon**.



Horizontal surfaces** & **roof** receives the most sunlight during the **noon.

Extended **overhangs** shade east and west facades from **intense** sun, while north-south facades receive **soft**, **diffuse** light throughout the day.

BUILDING ORIENTATION

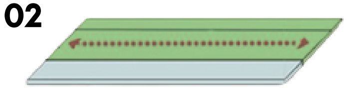
CONTEXTUAL FORM INTEGRATION

01

LANDSCAPE INTEGRATION

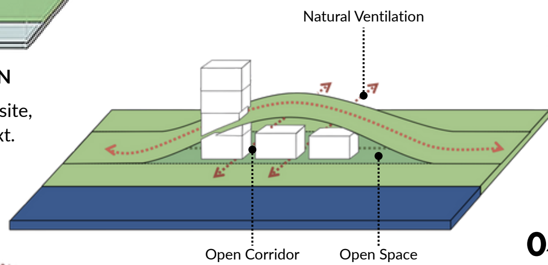
Begins with a **flat** natural site, reflecting the existing context.

02



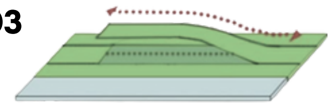
GREEN CONTINUUM

Connects parks, lake, and open spaces to unify **nature** and **built form**.



Open corridors, open spaces, and natural ventilation work together to **improve airflow**, **reduce** heat, and **enhance comfort** and **public interaction**.

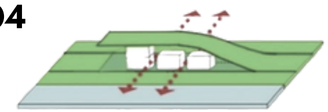
03



PEELING THE EARTH

Earth is **lifted** to form a **berm**, shaping a curved green roof.

04



REVEALED TREASURE

Buildings **emerge** naturally from the **landscape**, blending with nature.

SITE PLANNING

SITE CLIMATIC ANALYSIS

Tropical rainforest climate

High humidity, warm temperatures year-round (averaging 25–32°C)

High precipitation

Abundant rainfall with two distinct monsoon seasons.

Front facing lake

The front facing lake contributes to cooling of the building

Urban planning between Putrajaya and Kuala Lumpur

Factors	Kuala Lumpur	Putrajaya
Building Density	Very high (skyscrapers, narrow streets)	Low to medium (spread-out, planned layout)
Green Coverage	< 30% (limited parks)	> 50% (parks, wetlands, tree-lined roads)
Water Bodies	Few (mostly rivers covered by development)	Extensive (man-made lakes, wetlands)
Traffic & Pollution	Heavy (higher anthropogenic heat)	Moderate (controlled traffic flow)
Albedo (Surface Reflectivity)	Low (dark asphalt, concrete absorbs heat)	Higher (water bodies reflect sunlight)

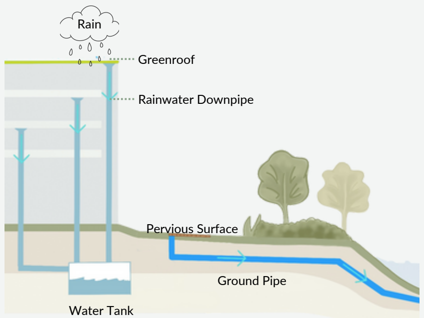
UHI Index comparison

UHI Parameter	Kuala Lumpur (KL)	Putrajaya
Daytime UHI Intensity	2–4°C warmer than rural	0.5–2°C warmer than rural
Nighttime UHI Intensity	4–7°C warmer	1–3°C warmer
Peak Surface Temp.	45–50°C (dense urban areas)	35–40°C
Annual Mean UHI	2.5–3.5°C	1.0–2.0°C

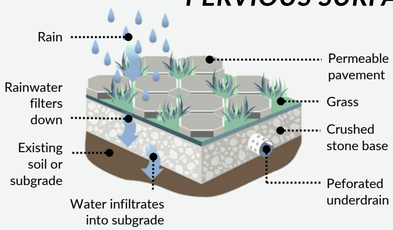
- KL's **higher UHI** results from dense concrete, limited greenery, and heat retention.
- Putrajaya's **lower UHI** benefits from planned vegetation, water bodies, and open spaces.

DRAINAGE

It uses green roofs, permeable pavements, and rainwater harvesting to **manage stormwater**, **reduce flooding**, and **improve water efficiency**.



PERVIOUS SURFACE



HWUM has mostly **green grass surface** around the campus while pairing with **pervious surfaces** that let **water pass through**, aiding drainage and reducing runoff.

01 Rainwater Falls on the Surface

02 Water Passes Through Surface Layer

03 Water Passes Through Surface Layer

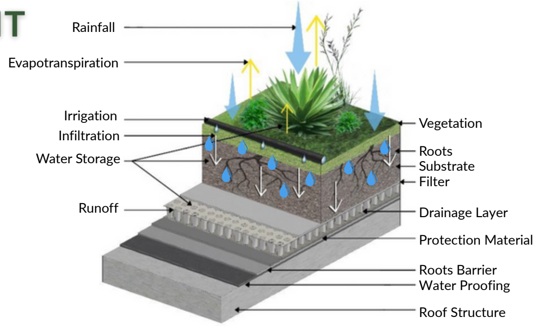
04 Water Infiltrates the Soil

05 Excess Water Drains Off

ACTIVE STORMWATER MANAGEMENT

GREEN ROOF

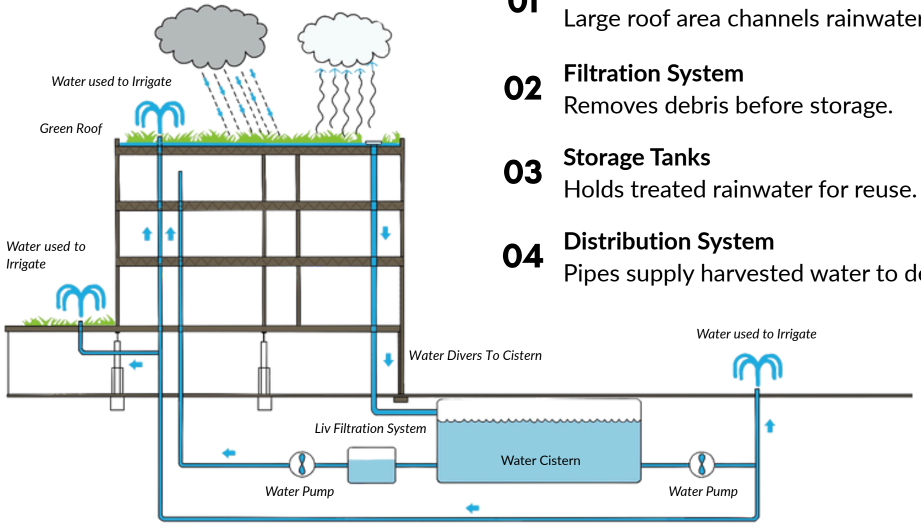
The green roof system effectively **manages rainwater** by absorbing, filtering, and storing it, while also incorporating **drainage** and **root protection layers**.



Waterproofing Layer

Low vapor diffusion helps **release moisture** from the roof membrane while **shielding** it from root intrusion, and also offers **resistance** to fire and radiant heat.

RAINWATER HARVESTING SYSTEM



01 Roof Collection Surface
Large roof area channels rainwater into gutters.

02 Filtration System
Removes debris before storage.

03 Storage Tanks
Holds treated rainwater for reuse.

04 Distribution System
Pipes supply harvested water to designated areas.

The smooth, **curved** design enables water to naturally **flow downward**, reducing the amount of additional water required by the irrigation system to nourish the plants.

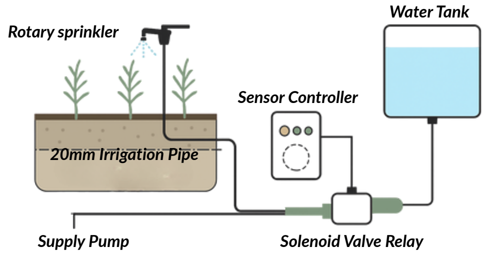
IRRIGATION SYSTEM

Controller Signal – The timer/controller sends an electric signal.

Valve Activation – Solenoid opens, allowing water flow.

Water Distribution – Pressurized water reaches sprinklers

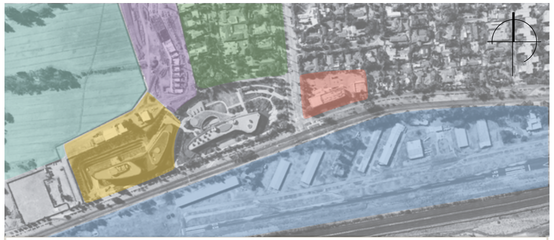
Valve Shutoff – Signal stops, solenoid closes, cutting water flow



HERIOT-WATT UNIVERSITY

PUTRAJAYA, MALAYSIA

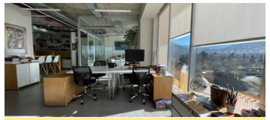
SITE PLANNING



Clinic IST Lo Curro


Municipal de Vitacura Airport

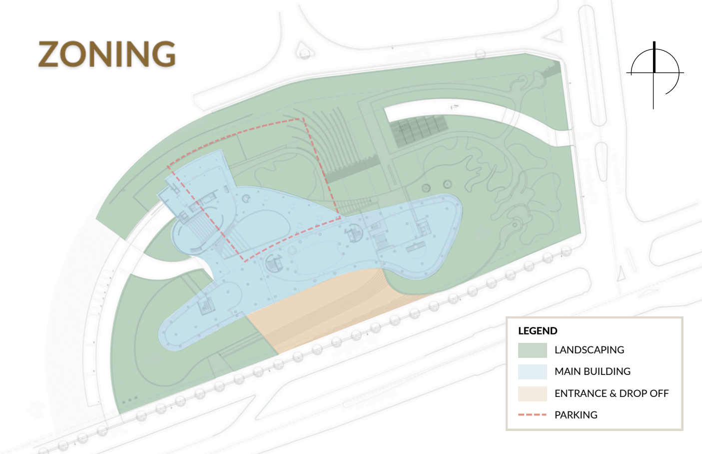

Under Construction

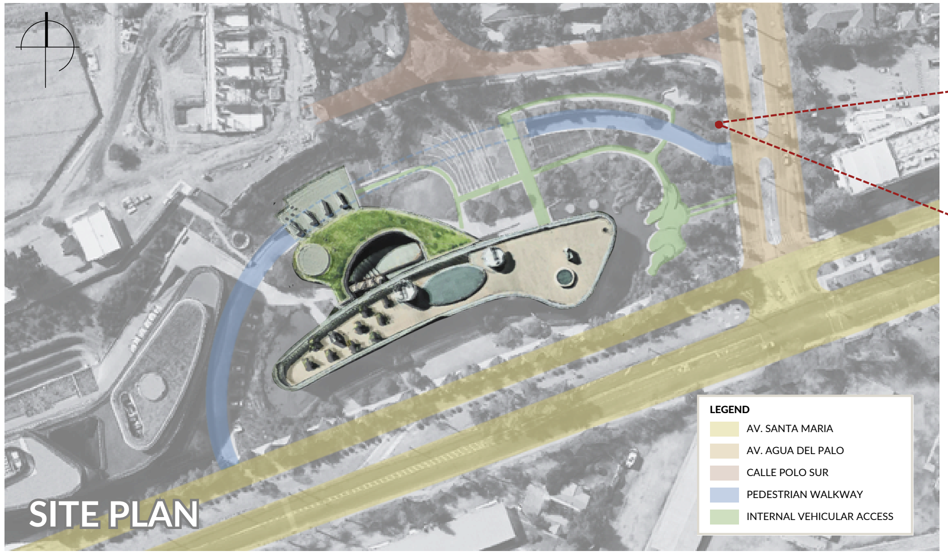

Kurantu Architecture


El Peumo


Green Land

ZONING





SITE PLAN

SETBACKS FROM THE STREET

LANDSCAPED BUFFER ZONE

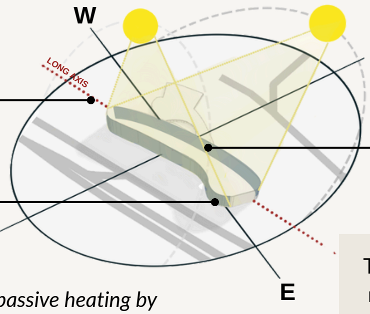
- *The setback creates a* ***green buffer*** *that* ***softens*** *the building's edge, enhances visual appeal, and improves the streetscape.*
- *This green edge contributes to* ***microclimate regulation****,* ***noise reduction****, and* ***biodiversity*** *in the urban environment.*

ACCESSIBILITY


AV. Santa Maria | AV. Agua Del Palo | Calle Polo Sur | Pedestrian Walkway | Internal Vehicular Access

The building's ***long axis*** *is aligned* ***east-west*** *to maximize solar access, ideal for Chile's* ***Southern Hemisphere*** *location.*

North-facing *facades receive* ***consistent sunlight****, especially in winter when the sun is lower.*

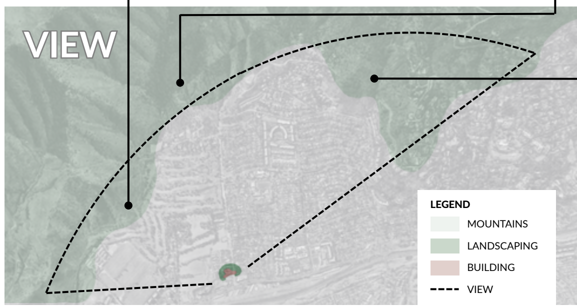


South-facing *facades support passive heating by admitting solar radiation during colder months.*

The building's facade is mainly oriented to the **north** and **south** sides, optimizing solar energy use year-round.

BUILDING ORIENTATION

Parquemet - Santiago Forest | *El Carbón Hill* | *Manquehuito Mountain*



By prioritising landscaping and plazas on the **north-northwest side**, the design takes full advantage of the scenic **mountain views** concentrated in that direction.

TRANSOCEÁNICA BUILDING
SANTIAGO, CHILE

SITE PLANNING

SITE CLIMATIC ANALYSIS

Hot, Dry Summer

In summer, temperatures can soar up to 35°C with minimal precipitation.

Cool, Wet Winter

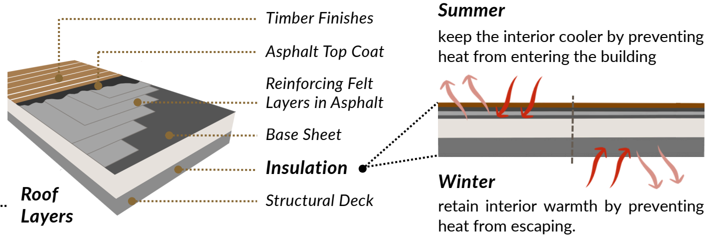
In winter, temperatures can drop to 0°C, accompanied by high rainfall and precipitation.

Sloped Terrain

Situated on sloped terrain, which poses a risk of soil erosion.

ROOF SYSTEM

ROOFING WITH INSULATION

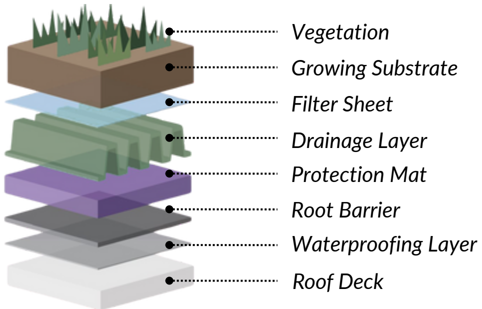


GREEN ROOF

The building features a green roof over its underground parking area, which serves multiple purposes:

a) Absorbing rainwater, reducing stormwater runoff.

b) Providing insulation, enhancing energy efficiency.

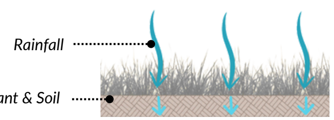


Green Roof Layers

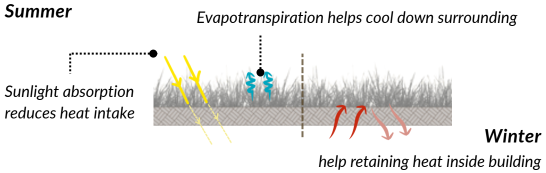
Prevents moisture entry, shields **insulation** and interiors, supports soil and vegetation loads, and resists roots for long-term **durability**.

ABSORBING RAINWATER

Soil and plants absorb and retain rainwater, temporarily storing it.



PROVIDING INSULATION

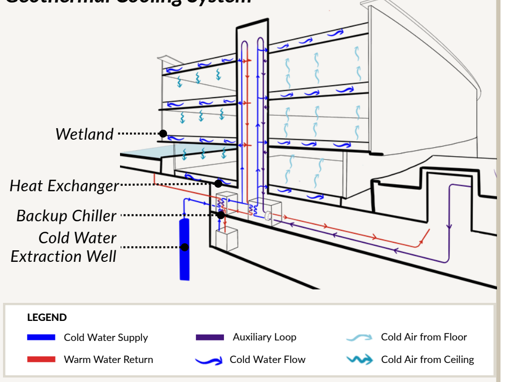


GEOTHERMAL COOLING

The building uses **12°C** water from a **75-meter-deep well** to pre-cool fresh air, reducing energy use and supporting summer comfort.

- **01** *Cold Water Extraction*
- **02** *Water Enters Heat Exchanger*
- **03** *Distribution through Closed Loop*
- **04** *Indoor Cooling Effect*
- **05** *Warm Water Return*
- **06** *Auxiliary Cooling (if needed)*

Geothermal Cooling System

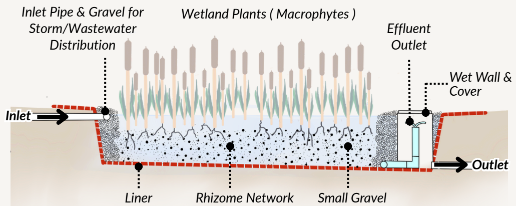


STORMWATER MANAGEMENT

ARTIFICIAL WETLAND LAGOON

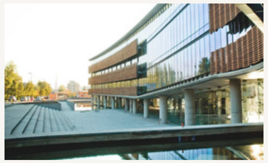
Surrounding the building is a park lagoon system, designed as an artificial wetland.

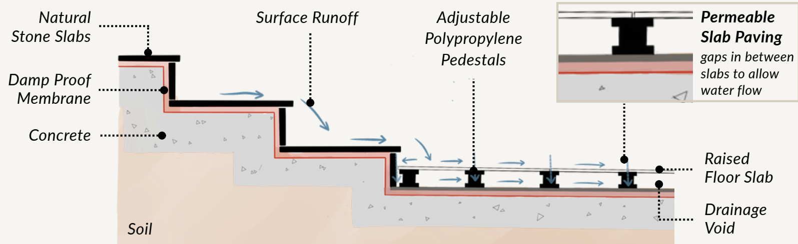
It collects and treats stormwater for irrigation, reducing potable water use



Wetland System

PERVIOUS SURFACES



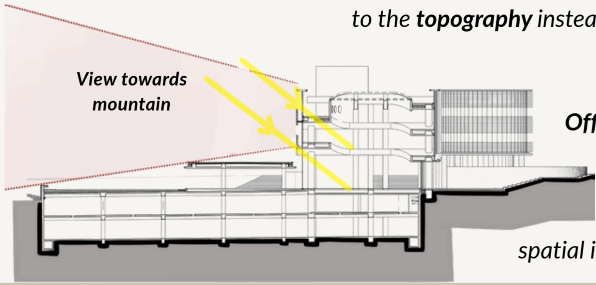


- Permeable paving materials enable **water infiltration**, **reducing** runoff and boosting groundwater recharge.
- Drainage voids **reduce runoff** and **flood risk** during heavy rain.

SLOPED SITE ADAPTATION

SPLIT-LEVEL DESIGN

*The building follows the **natural incline**, adapting to the **topography** instead of flattening the land.*



*The **stepped layout** reduces shadowing and provides broader sightlines and better daylight access.*

***Offset floor levels** respond to terrain changes, enhancing views, sunlight access, and spatial integration with the site.*

TRANSOCEÁNICA BUILDING SANTIAGO, CHILE

SITE PLANNING COMPARITIVE ANALYSIS

DIFFERENCES

HERIOT-WATT UNIVERSITY PUTRAJAYA, MALAYSIA

CLIMATIC CONDITION

Tropical Rainforest Climate

High humidity, warm temperatures year-round (averaging 25–32°C)

High Precipitation

Abundant rainfall with two distinct monsoon seasons.

Front facing lake

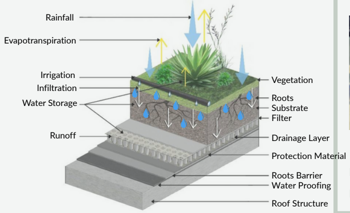
The **front facing lake** contributes to cooling of the building

HOT WITH HIGH PRECIPITATION ALL YEAR-ROUND

01 Active Stormwater Management

Green Roof

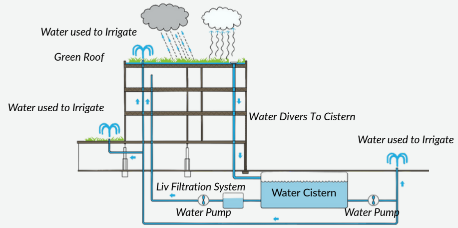
The green roof system effectively **manages rainwater** by absorbing, filtering, and storing it, while also incorporating **drainage** and **root protection layers**.



Waterproofing Layer

Low vapor diffusion releases moisture, blocks roots, and resists fire and radiant heat.

Rainwater Harvesting



01 Roof Collection Surface
Large roof area channels rainwater into gutters.

02 Filtration System
Removes debris before storage.

03 Storage Tanks
Holds treated rainwater for reuse.

04 Distribution System
Pipes supply harvested water to designated areas.

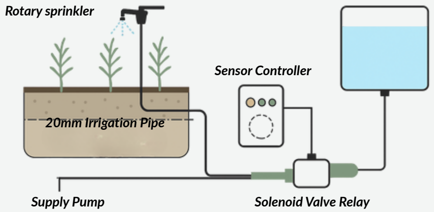
Irrigation System

Controller Signal – The timer/controller sends an electric signal.

Valve Activation – Solenoid opens, allowing water flow.

Water Distribution – Pressurized water reaches sprinklers

Valve Shutoff – Signal stops, solenoid closes, cutting water flow



02 Drainage

Pervious Surface

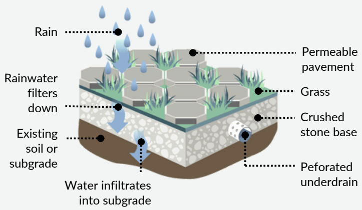
01 Rainwater Falls on the Surface

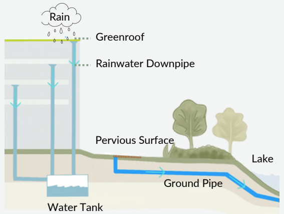
02 Water Passes Through Surface Layer

03 Water Passes Through Surface Layer

04 Water Infiltrates the Soil

05 Excess Water Drains Off





TRANSOCEÁNICA BUILDING SANTIAGO, CHILE

CLIMATIC CONDITION

Hot, Dry Summer

Temperatures up to **35 °C** with minimal precipitation.

Cool, Wet Winter

Temperatures can drop to **0°C** with **high rainfall** and **precipitation**.

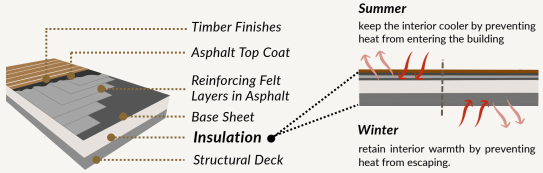
Sloped Terrain

Situated on **sloped terrain**, which poses a risk of soil erosion.

HOT, DRY SUMMERS

01 Roof System

Roofing with Insulation



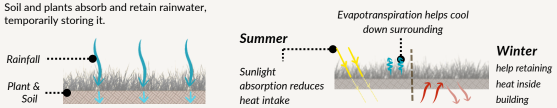
Green Roof

The green roof above the underground parking **absorbs rainwater** and **insulates** to boost energy efficiency.

Absorbing Rainwater

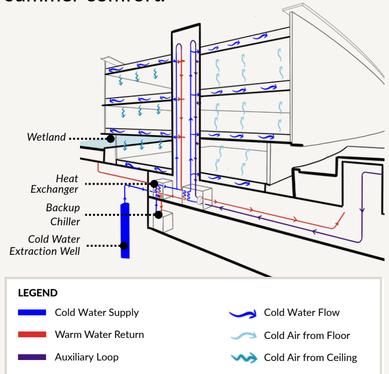
Soil and plants absorb and retain rainwater, temporarily storing it.

Providing Insulation



Geothermal Cooling

The building uses **12°C** water from a **75-meter-deep well** to pre-cool fresh air, reducing energy use and supporting summer comfort.

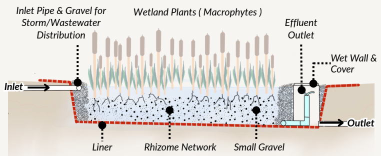


COOL, WET WINTERS

01 Stormwater Management

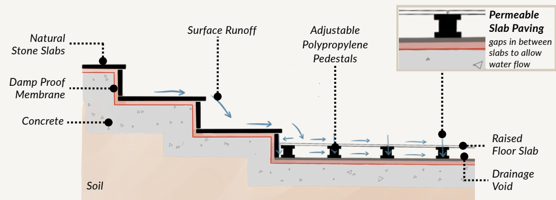
Artificial Wetland Lagoon

An artificial wetland surrounds the building, treating **stormwater** for **irrigation** and reducing potable water use.



Pervious Surface

- Permeable paving materials enable **water infiltration**, **reducing** runoff and boosting groundwater recharge.
- Drainage voids **reduce runoff** and **flood risk** during heavy rain.

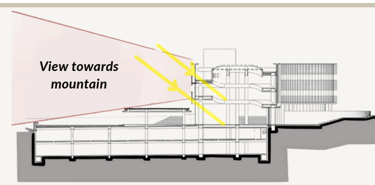


The building uses raised floor slabs with gaps, creating a permeable surface that allows water to flow through into the drainage void below.

SLOPED SITE ADAPTATION

Split-Level Design

The building adapts to the **natural incline** with **offset floors**, enhancing views, sunlight, and spatial integration while reducing shadowing and improving daylight access.



STRATEGIC LANDSCAPING

HERIOT-WATT UNIVERSITY

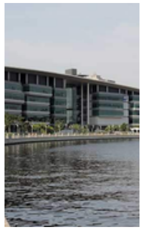
PUTRAJAYA, MALAYSIA

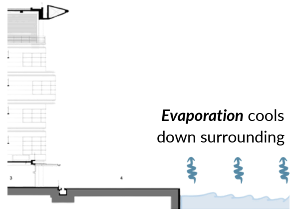
EXTERIOR LANDSCAPING

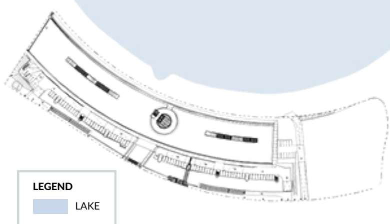
Heriot-Watt University Malaysia features a pioneering **300-meter-long**, **30-meter-wide** green roof, making it the first of its kind in Malaysia. The landscaping around the campus covers up to **95%** of the site area, **integrating** seamlessly with the surrounding **urban park** structure of Putrajaya.

Putrajaya Lake

Cools the building naturally, improves ventilation, enhances views, and supports flood control.







GREEN ROOF

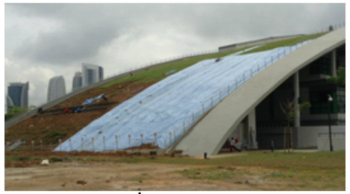
A green roof, covered with **vegetation**, enhances aesthetics, reduces heat, improves insulation, and promotes water conservation through rainwater collection.

TYPE OF GRASS

JAPANESE CARPET GRASS

Slow growth, low maintenance, and minimal trimming needs

GRASS MAINTENANCE



4 weeks

Grass maintenance keeps the green roof **healthy**, **prevents overgrowth**, and ensures **proper drainage** in Malaysia's tropical climate.

When have to maintenance?

- Once every 2 to 4 weeks
- Quarterly
- After heavy rain

Type Of Maintenance

- Trimming/Cutting
- Weeding
- Irrigation Check
- Drainage Maintenance
- Fertilizing (2-3 Month)
- Pest and Disease Monitoring
- Structural Inspection

TYPES OF VEGETATIONS

INTEGRATION OF NATIVE & DROUGHT TOLERANT VEGETATION

1

Height:
15000-25000mm
Shading Area:
8000-12000mm
Purpose:
Screens views, reduces noise, adds greenery.

2

Height:
10000-25000mm
Shading Area:
6000-10000mm
Purpose:
Gives seasonal shade, controls sunlight and runoff.

3

Height:
30000- 45000mm
Shading Area:
6000-8000mm
Purpose:
Provides shade, reduces heat, blocks wind and noise.

4

Height:
3000-4500mm
Shading Area:
2000-3500mm
Purpose:
Provides shade and helps block views

1

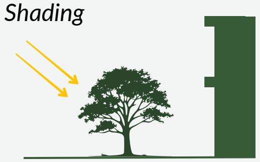
Height:
20000-30000mm
Shading Area:
12000-20000mm
(Very wide canopy)
Purpose:
Offers wide shade, cools open areas.

2

Height:
300-500mm
Shading Area:
300-500mm (Limited)
Purpose:
Valued for its healing properties

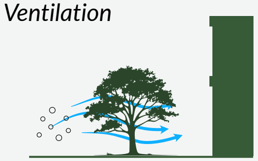
ENVIRONMENTAL BUFFER

Shading



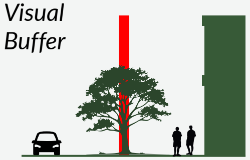
- Tall trees positioned near glazed facades **reduce solar heat gain**.
- Provides **shaded outdoor circulation paths** between building blocks.

Ventilation



- Vegetation acts as a **filter** for vehicle emissions from surrounding roads.
- **Traps airborne dust** and improves air quality near entrances and open areas.

Visual Buffer



- **Blocks** unwanted views (roads, parking)
- Adds **privacy** between spaces
- **Softens** building edges and enhances aesthetics

Noise Reduction

- Trees are planted **along the perimeter** facing main roads.
- Helps **absorb** and **block** traffic noise from entering academic spaces.

STRATEGIC LANDSCAPING

Up to **80%** of the site is covered by **hard** and **soft** landscaping, helping anchor the building to its context while offering **shade**, **better air quality**, and improved **ecological balance**.

GREEN ROOF OVER UNDERGROUND PARKING

The landscape **extends** over the underground parking, disguising infrastructure while creating a green, **walkable park**.

MAIN TYPES OF GRASSES & GROUNDCOVERS

Carex

Requiring minimal care over time

Festuca

Help regulate the temperature on the roof

Achillea

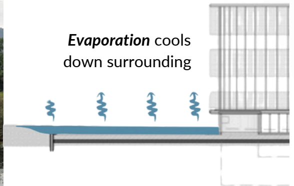
Offering seasonal interest & attracting pollinators

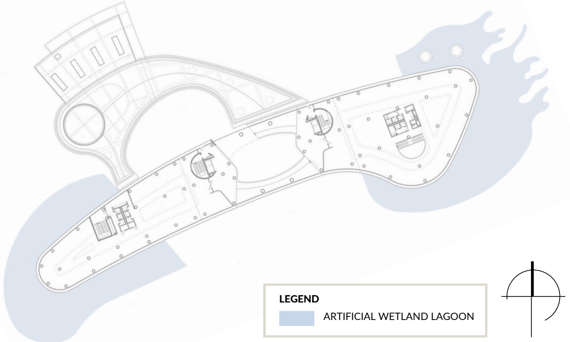
Creeping Juniper

Help with soil stabilization, preventing erosion

Artificial Wetland Lagoon

Helps manage **stormwater**, improve **water quality**, and support **biodiversity**, while enhancing the **landscape's beauty**.





TYPES OF VEGETATIONS

INTEGRATION OF NATIVE & DROUGHT TOLERANT VEGETATION

1

Height: *6000–8000mm*

Shading Area: *3000–4000mm (Moderate)*

Purpose: *Used in herbal teas for digestive health.*

2

Height: *2000–3000mm*

Shading Area: *1500–2500mm (Light)*

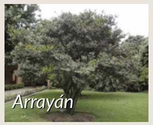
Purpose: *Antioxidant-rich berries used in cuisine.*

3

Height: *4000–7000mm*

Shading Area: *2000–3000mm (Light)*

Purpose: *Aids reforestation and provides edible fruits.*



4

Height: *6,000–9000mm*

Shading Area: *2000–3000mm (Moderate)*

Purpose: *Ornamental landscaping for striking bark.*

5

Height: *8000–12000mm*

Shading Area: *6000–7000mm (Dense)*

Purpose: *Used in traditional medicine for its aromatic leaves.*

1

Height: *7000–30000mm*

Shading Area: *4000–6000mm (Dense)*

Purpose: *Toxic but contributes to forest structure.*

2

Height: *20000mm*

Shading Area: *2000–4000mm (Moderate)*

Purpose: *Used in reforestation efforts.*

3

Height: *15000–20000mm*

Shading Area: *3000–5000 mm (Moderate)*

Purpose: *Used in soap and has medicinal properties.*

6

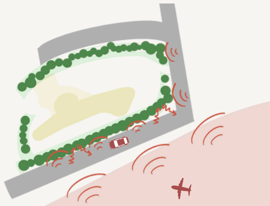
Height: *1500–2500mm*

Shading Area: *1000–2000mm (Light)*

Purpose: *Attracts pollinators like hummingbirds.*

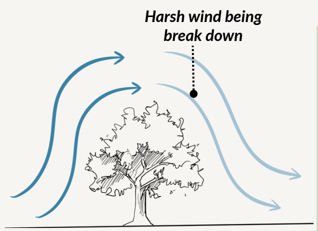
ENVIRONMENTAL BUFFER

These plants work synergistically to form a comprehensive **environmental buffer**, offering **protection** against various environmental factors.



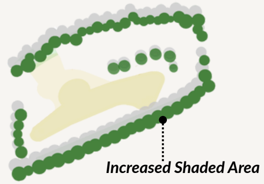
Noise Reduction

Dense foliage **scatters** sound waves, helping **reduce noise** from **traffic** and nearby **airports**.



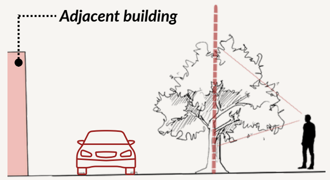
Windbreaks

Reduce wind speed, creating a **shield** that protects the surrounding area from **harsh winds**.



Shade & Temperature Regulation

Dense canopies and broad leaves **block sunlight**, reducing sun exposure and cooling the surrounding area.



Privacy Screening

Block sightlines from residential, roads, or public spaces, enhancing **privacy** without the need for artificial barriers.

TRANSOCEÁNICA BUILDING SANTIAGO, CHILE

STRATEGIC LANDSCAPING COMPARITIVE ANALYSIS

SIMILARITY

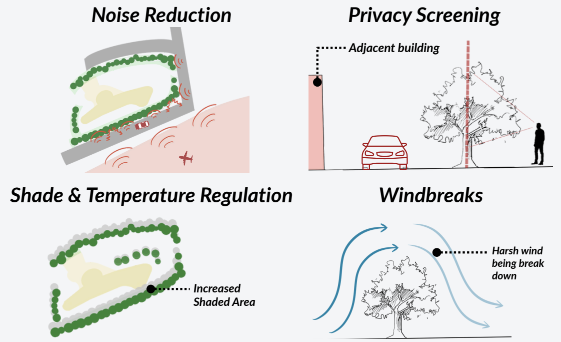
SURROUNDING LANSCAPING

Despite different plant palettes, both buildings use trees with **large canopies**, **dense foliage**, and **strong root systems** to blend with their surroundings and improve comfort and environmental quality.

Heriot-Watt University

Transoceánica Building

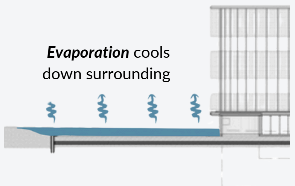
Both projects use **native**, **climate-adapted** landscaping to provide key environmental buffer functions.

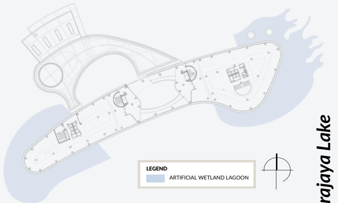


WATER FEATURES

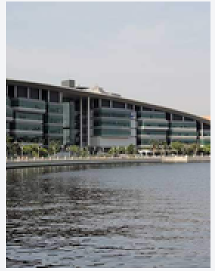
Both buildings use water features -**Putrajaya Lake** and an artificial wetland lagoon, not only for **flood control** and **biodiversity**, but also to enhance **cooling** through natural **evaporation**.

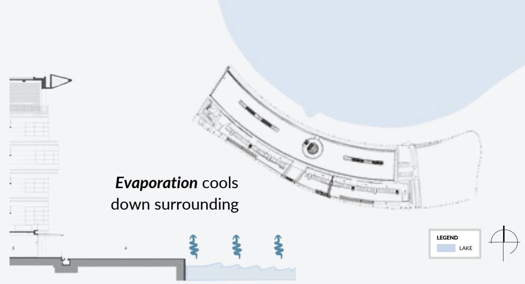
Artificial Wetland Lagoon





Putrajaya Lake





DIFFERENCES

HERIOT-WATT UNIVERSITY PUTRAJAYA, MALAYSIA

GREEN ROOF FUNCTION

Heriot-Watt University features a landmark 300m by 30m green roof, the first of its kind in Malaysia, designed as a key part of its sustainable strategy to **enhance aesthetics**, **reduce heat**, **improve insulation**, and **support water conservation** through rainwater collection.

GRASS TYPE

The green roof is planted with **Japanese Carpet Grass**, a groundcover species selected for its adaptability to Malaysia's tropical climate and its functional advantages for rooftop landscaping.

GRASS MAINTENANCE

Grass maintenance keeps the green roof **healthy**, **prevents overgrowth**, and ensures **proper drainage** in Malaysia's tropical climate.

TRANSOCEÁNICA BUILDING SANTIAGO, CHILE

GREEN ROOF FUNCTION

The green roof is built above an underground parking area, cleverly **disguising infrastructure** and transforming it into a **walkable, park-like space**.

GRASS TYPE

The building uses a diverse mix of **native** and **adaptive** grasses and groundcovers, carefully selected for their resilience in a **Mediterranean** climate and their functional roles in roof stabilization, temperature regulation, aesthetics, and biodiversity support.

Carex

*Requiring **minimal care** over time*

Festuca

*Help regulate the **temperature** on the roof*

Achillea

*Offering seasonal **interest** & attracting **pollinators***

Creeping Juniper

*Help with **soil stabilization**, preventing erosion*

FACADE DESIGN

GREEN ROOF

REDUCES URBAN HEAT ISLAND EFFECT

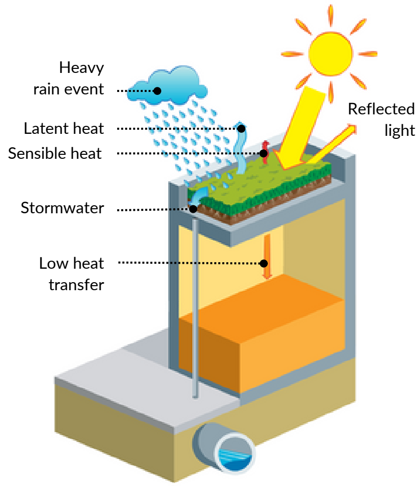
- Cools air via plant **evapotranspiration**
- **Reflects less heat** than concrete/asphalt
- **Lowers surface temps** by up to 30°C vs. bare roofs

NATURAL THERMAL INSULATION

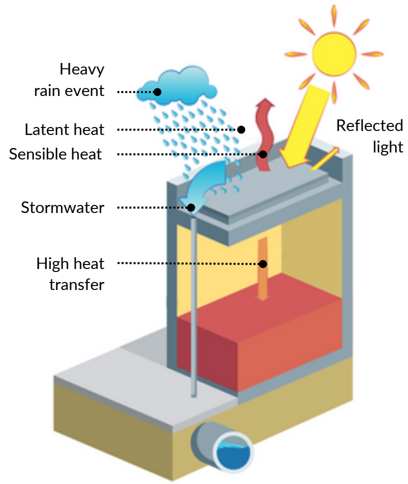
- **Reduces** heat absorption by **reflecting** sunlight
- **Stabilizes** indoor temps, **lowering** them by 3–7°C in tropical climates

RAINWATER HARVESTING

- Rainwater harvesting for irrigation systems and water saving uses



GREEN ROOF



STANDARD CONCRETE ROOF

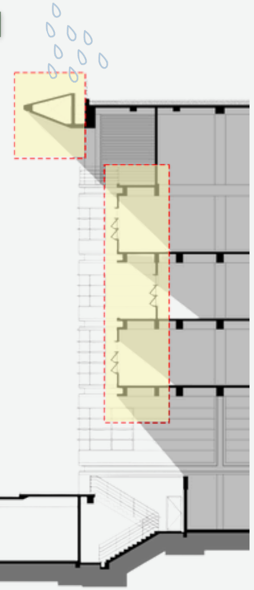
MASSING AND FORM

OVERHANG ROOF

- **Shades windows** – reduces heat and glare
- **Lets airflow** – keeps ventilation open even in rain
- **Protects walls** – less weather damage over time

OFFSET FLOORS

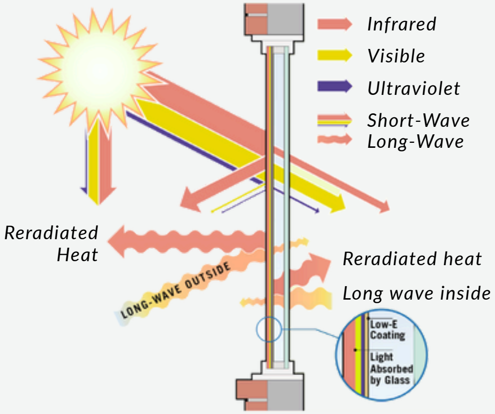
- **Self-shading –** Upper floors shade lower ones, reducing direct heat gain.
- **Airflow boost –** Gaps between floors promote natural cross-ventilation.

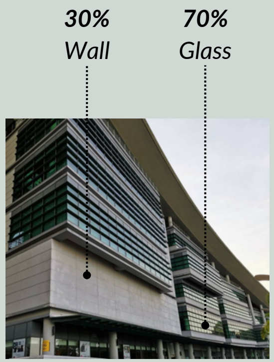


WINDOWS

LOW-E GLASS

- Blocks 60-70% of heat
- Lowers cooling demand
- Reduces glare
- Curtains are added where excess light is not optimal (eg. library)



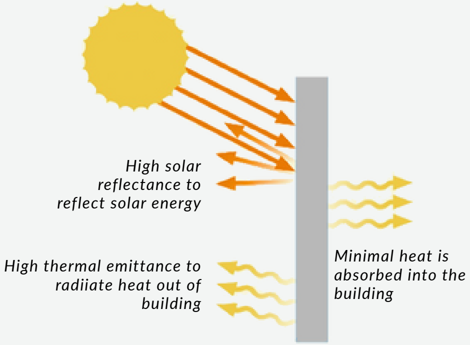


70% window-to-wall ratio maximizes natural light with a glass-dominated facade.

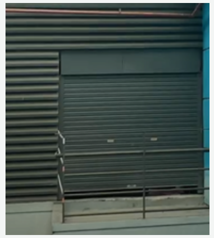
WALLS

LIGHT COLORED FINISHES

- **High SRI**: Reflects solar heat, reducing heat absorption.
- **Lowers cooling loads** and energy use.
- **High LRV**: Enhances natural daylight indoors.

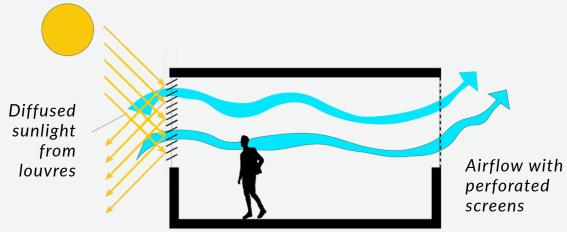


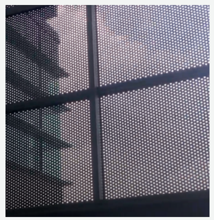
SCREENS AND LOUVRES



ALUMINIUM LOUVRES

- Allows **airflow** for HVAC/ducting systems.
- **Shields** M&E equipment from rain/debris.
- Permits maintenance while maintaining aesthetics.





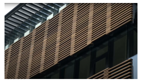
PERFORATED SCREENS

- Diffuses light, reduces glare.
- Allow **ventilation** for thermal comfort
- Modern, decorative touch to facade

FACADE DESIGN

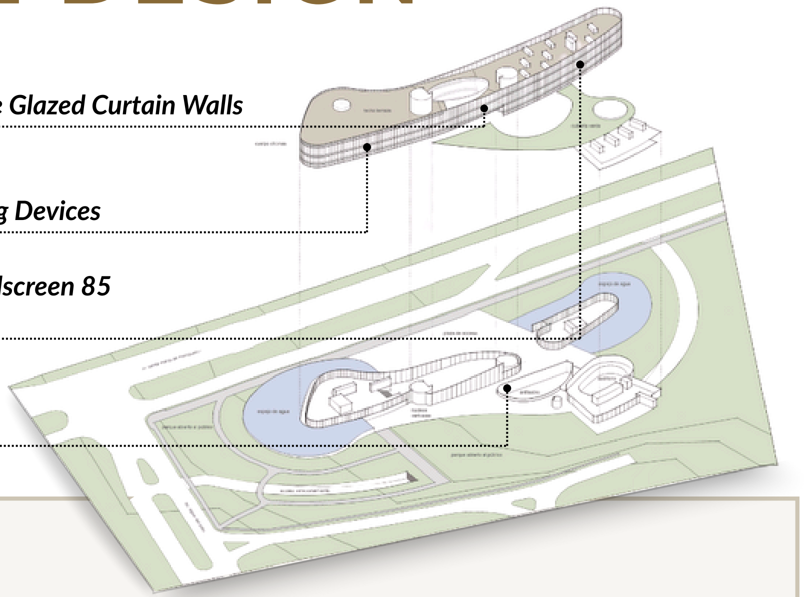
High - Performance Glazed Curtain Walls

Automated Shading Devices



Quiebravista Woodscreen 85 by Hunter Douglas

Vertical Louvers

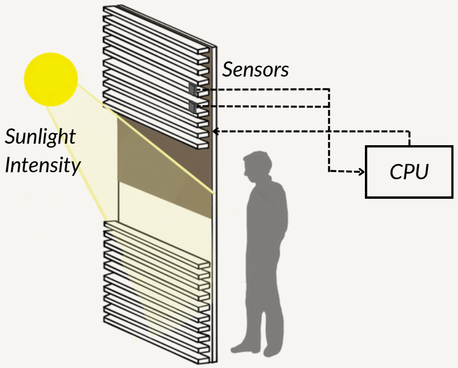


AUTOMATED SHADING DEVICES

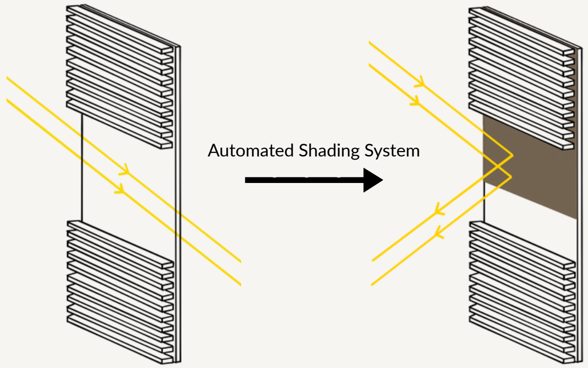
No Shading System

Shaded with Automated Awnings

- Automated external awnings respond dynamically to **solar intensity**.
- **Reduce glare** and overheating on sun-exposed facades.
- Enable **effective daylight** harvesting without visual or thermal discomfort.
- Fixed and automated shading ensures **consistent interior comfort**.

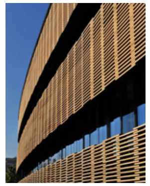


Sensors **detect** sunlight intensity and angle, **sending data** to the CPU, which **adjusts** the louvers to let in or block light as needed.



External awnings **automatically** adjust their position based on the intensity and angle of incoming sunlight, **controlling** the amount of light entering the building.

QUIEBRAVISTA WOODSCREEN 85 BY HUNTER DOUGLAS



A prominent feature of the facade is the Quiebravista Woodscreen 85, a **sun-shading** system comprising **horizontal** wooden slats mounted on aluminum support structures.

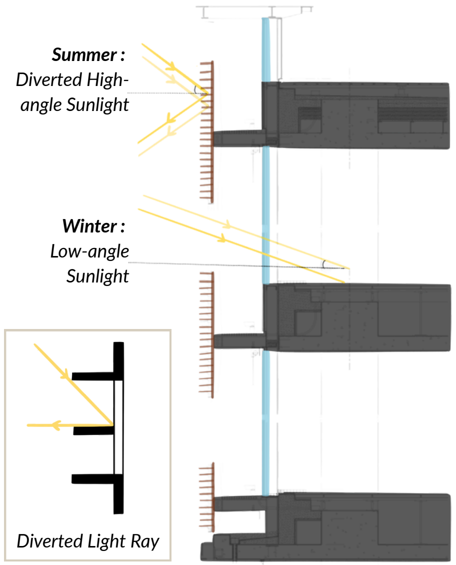
SUMMER

Block **high-angle** sunlight in **summer**, reducing heat gain while allowing natural light, maintaining thermal comfort, and minimizing cooling needs.

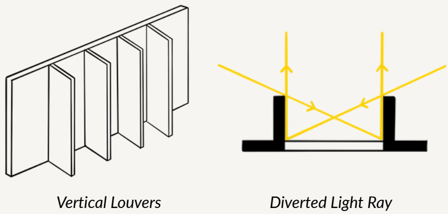
WINTER

Allow **more sunlight** to enter the building at **low angles** for passive heating, enhancing energy efficiency in **winter**.

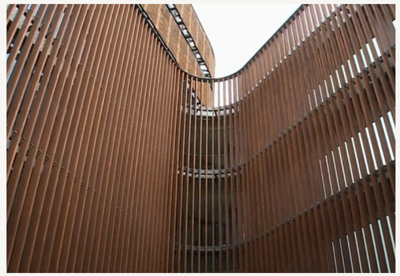
Offers **privacy** by blocking outside views while maintaining clear interior views of the surroundings.

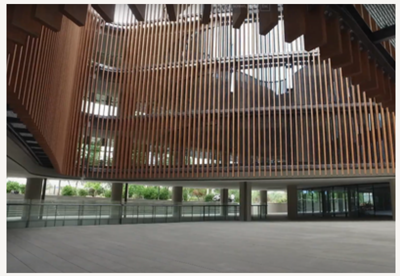


VERTICAL LOUVERS



- Diffuse sunlight, reduce glare, and evenly **spread natural light** across the room.
- **Reduce glare** by filtering incoming sunlight, making the interior spaces more comfortable, especially during hot periods.





TRANSOCEÁNICA BUILDING

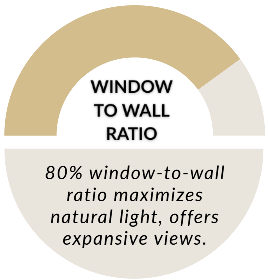
SANTIAGO, CHILE

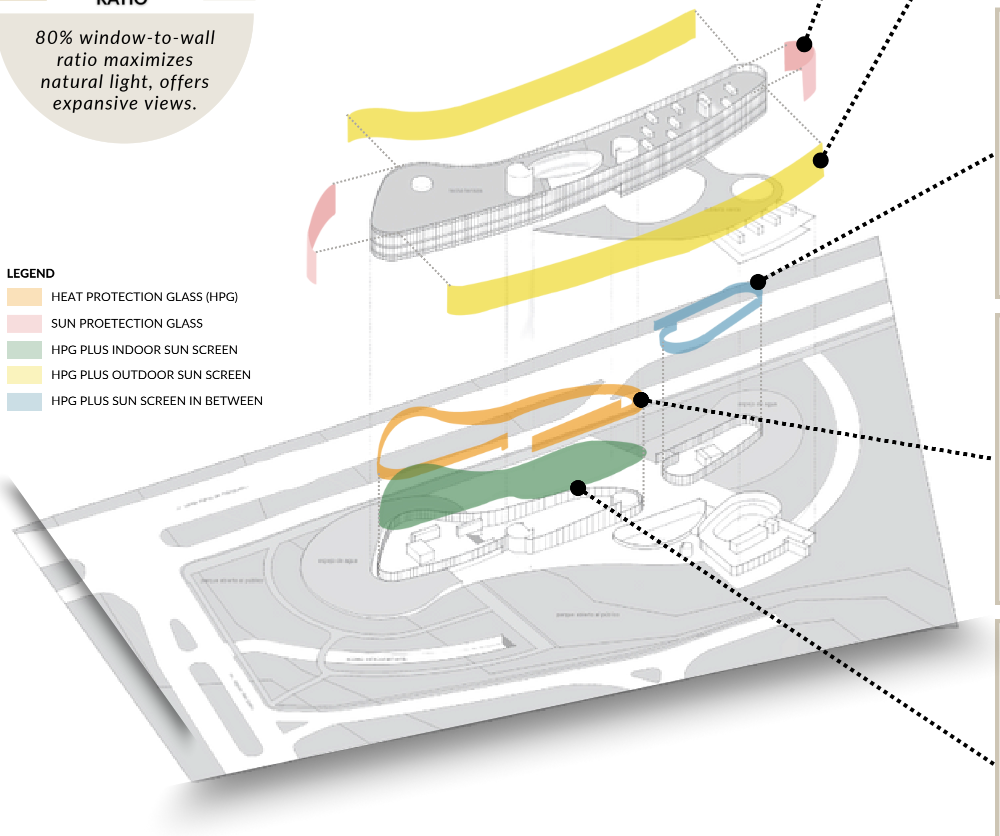
FACADE DESIGN

HIGH - PERFORMANCE GLAZED CURTAIN WALLS

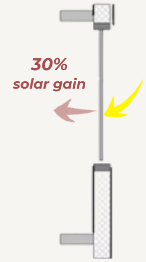
SOLAR PROTECTIONS AND THERMAL INSULATION

Extensive glass facades are equipped with **high-performance glazing** that **allows** visible light to enter while **filtering out** excess heat and UV radiation. This **improves** visual comfort and daylight quality while **reducing** the cooling load.



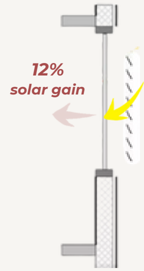


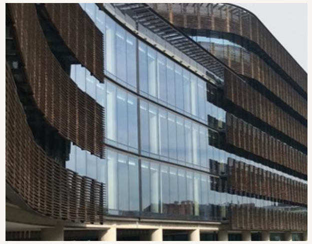
**5 types of glazed glass are used to control and optimize solar gain in different areas.*



SUN PROTECTION GLASS

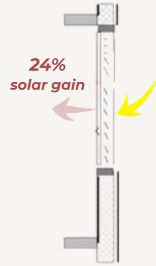
- Better at limiting heat gain.
- Used on facades with high solar exposure, like east or west.

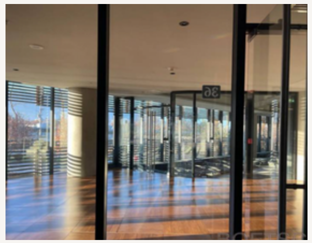




HPG PLUS OUTDOOR SUN SCREEN

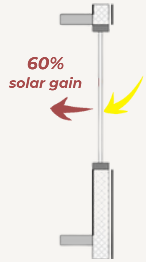
- Highly effective in blocking heat before it enters the building.
- Used in sun-exposed facades (north during winter, east-southeast in summer).





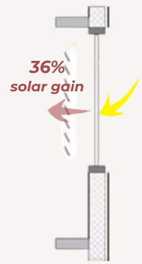
HPG PLUS SUN SCREEN IN BETWEEN

- Balanced solution.
- Used in areas with moderate solar exposure



HEAT PROTECTION GLASS (HPG)

- Basic protection but still allows significant heat entry.
- Likely used sparingly or in shaded areas.



HPG PLUS INDOOR SUN SCREEN

- Moderate performance.
- Effective for interior-controlled spaces, but less efficient than outdoor solutions.

FACADE DESIGN COMPARATIVE ANALYSIS

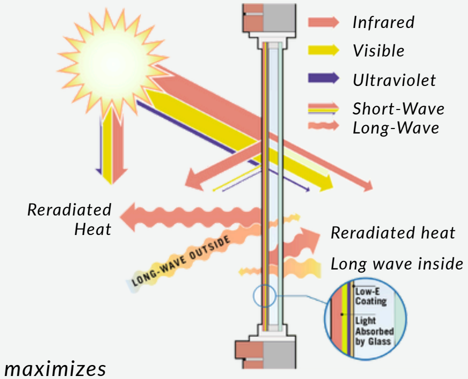
DIFFERENCES

HERIOT-WATT UNIVERSITY PUTRAJAYA, MALAYSIA

GLASS FACADE

01 Low-E Glass

Blocks **60–70%** of heat, reduces glare and cooling demand, with curtains added where light needs limiting.



02 Window-to-Wall Ratio

70%

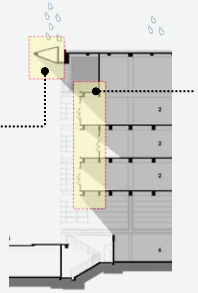
70% window-to-wall ratio maximizes natural light with a glass-dominated facade.

SHADING SYSTEMS

01 Massing & form

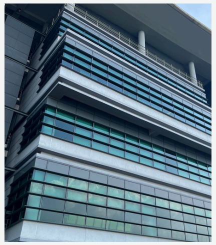
Overhang Roof

Shades windows to cut heat and glare, allows airflow even in rain, and shields walls from weather damage.



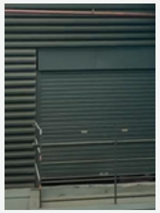
Offset Floors

Self-shading upper floors reduce heat gain, while floor gaps enhance natural cross-ventilation.

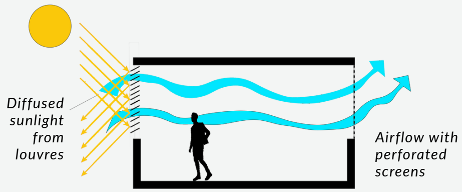


02 Screens & Louvers

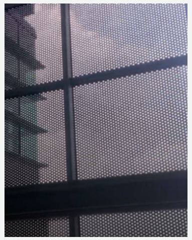
Perforated Screens

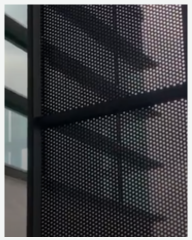


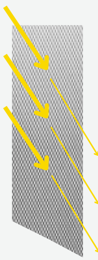
- Diffuses light, reduces glare.
- Allow **ventilation** for thermal comfort
- modern, decorative touch to facade



Aluminium Louvers





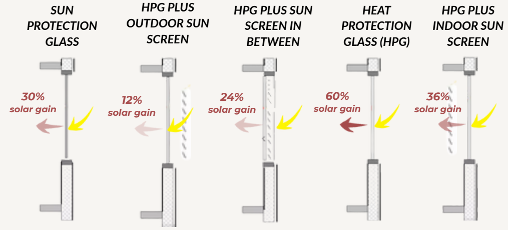


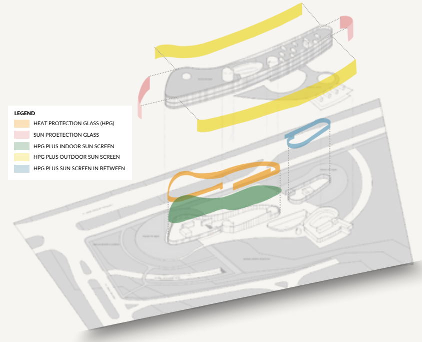
- Allows airflow for **HVAC/ducting** systems.
- Shields **M&E** equipment from rain/debris.
- Permits maintenance while maintaining aesthetics.

TRANSOCEÁNICA BUILDING SANTIAGO, CHILE

GLASS FACADE

01 High-Performance Glazed Curtain Walls





02 Window-to-Wall Ratio

80%

80% window-to-wall ratio maximizes natural light, offers expansive views.

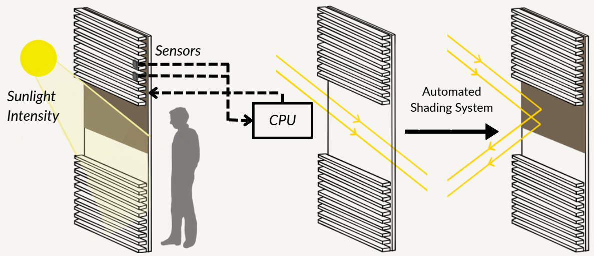
High-performance glazing **admits** light while **filtering** heat and UV, enhancing comfort and reducing cooling load.

SHADING SYSTEMS

01 Screens & Louvers

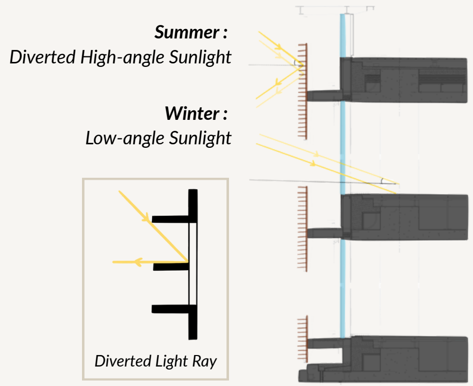
Automated Shading Devices

Adjust based on **sunlight intensity** and **angle**, allowing for more precise control of light entry and optimizing performance for both summer and winter.



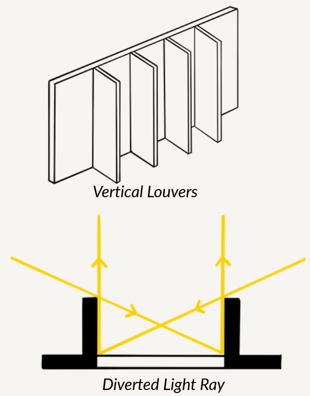
Quiebravista Woodscreen 85 by Hunter Douglas

The Quiebravista Woodscreen 85 features **horizontal wooden slats** on aluminum supports for sun shading.



Vertical Louvers

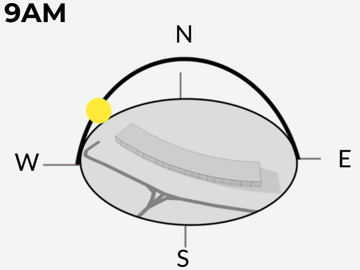
Diffuses sunlight to reduce glare and evenly distribute natural light, enhancing comfort in hot periods.



DAYLIGHTING

(Taken by 20 June 2024)

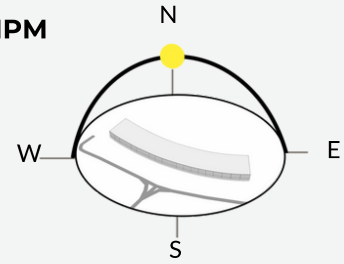
9AM



Azimuth: 92.07°, Altitude: 41.03°

Higher **eastern** sun intensifies light, shortening shadows sharply.

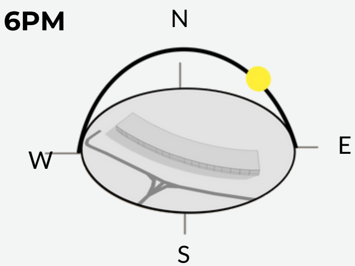
1PM



Azimuth: -65.39° , Altitude: 69.86°

Zenith sun creates **minimal shadows**, maxing solar gain on south faces.

6PM



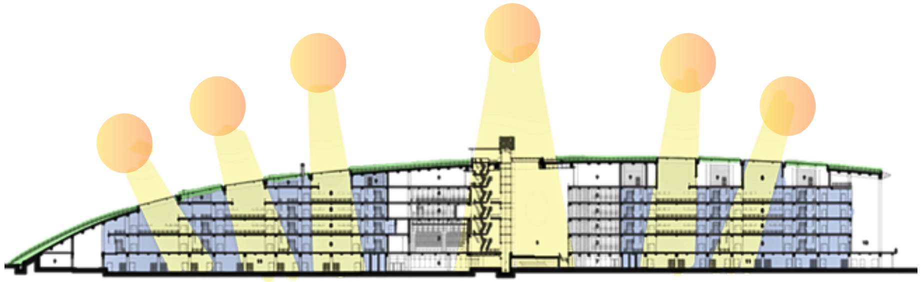
Azimuth: -77.80°, Altitude: 2.53°

Sunset stretches shadows **east**, lights west facades.

*The rising sun **shortens shadows**; noon brings **minimal shadows** and peak solar gain; sunset stretches shadows **east** while warming west facades.*

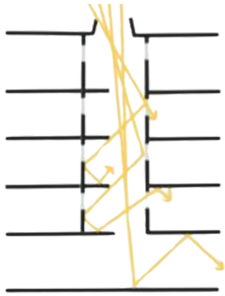
SKYLIGHT

- Allow **natural sunlight** into interior spaces and atrium
- **Reduce** reliance on **artificial** lighting during the day
- **Lower** overall **energy** consumption
- **Enhance interior** illumination and ambience



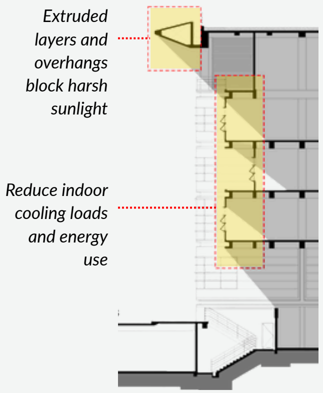
LIGHT WELL

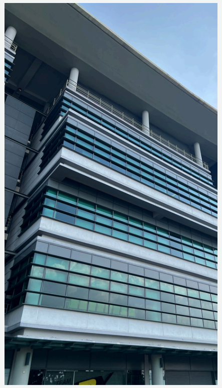
- Skylight functions as an optical gateway, **directing** daylight into the light well
- Reflective surfaces within the shaft amplify and **disperse** light vertically
- Glazing selectively **transmits** visible light for optimal illumination



- Well geometry (height and reflectance) **controls** daylight penetration depth
- Combined system **enhances daylight delivery** more effectively than individual components

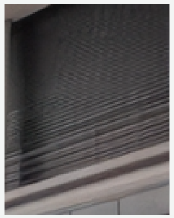
SHADING WITH MASSING

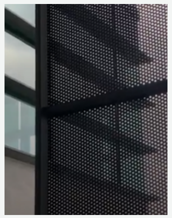


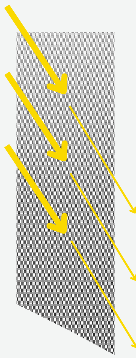


SCREENS AND PARTITIONS

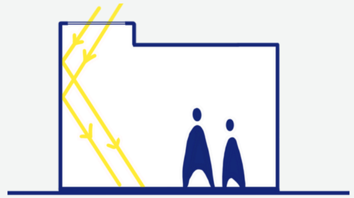
- **Block** direct sunlight to **reduce** heat gain
- Allow **natural ventilation**
- Conceal M&E equipment for a cleaner, streamlined look.



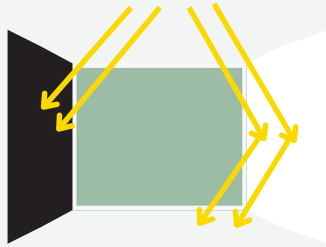




LIGHT COLORED FLAT WALLS

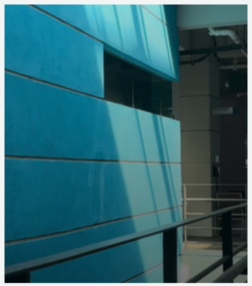


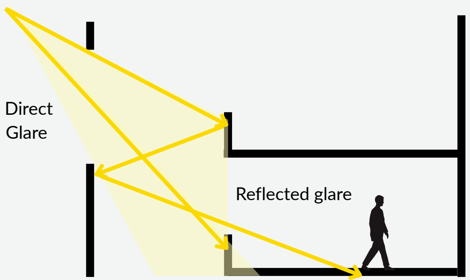
- Light-colored paint **increases** surface reflectance (high LRV)
- Amplifies **ambient light distribution** in interiors
- Surfaces with **LRV >70%** bounce sunlight **deeper** into spaces
- **Minimizes** need for **artificial lighting** while ensuring visual comfort



HIGH WINDOWS

- Capture **low-angle** sunlight near the ceiling
- Distribute natural light **deeper** into interior spaces
- **Enhance daylighting** while **minimizing glare**





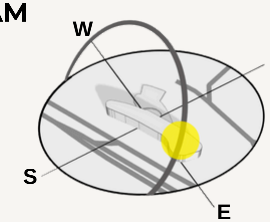
HERIOT-WATT UNIVERSITY

PUTRAJAYA, MALAYSIA

DAYLIGHTING

SUMMER (Taken by 21 Dec 2024)

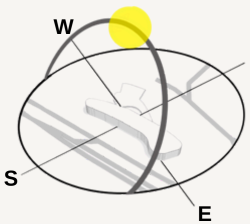
9AM



Azimuth: 84.66°, Altitude: 53.65°

Strong sunlight from the **east-southeast**; shadows are shorter.

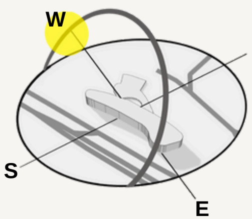
1PM



Azimuth: -65.39° , Altitude: 69.86°

Overhead sun; minimal shadows, strong exposure on roofs.

6PM



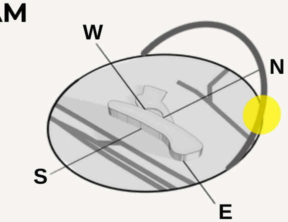
Azimuth: -112.33°, Altitude: 8.90°

Evening light on **south-south western** facades with long shadows to the east.

*In summer, sunlight moves from **southeast** to **southwest**, with strong **overhead** exposure on roofs and south facades.*

WINTER (Taken by 20 June 2024)

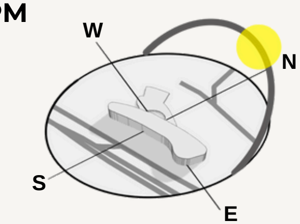
9AM



Azimuth: 40.18°, Altitude: 21.05°

Low-angle light from the **east-northeast**; long shadows casted.

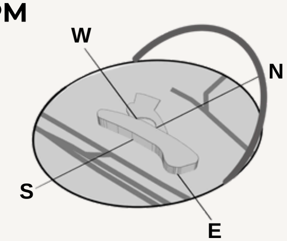
1PM



Azimuth: -20.22°, Altitude: 30.36°

Midday sun at **low altitude** on the **north**; soft light, moderate shadows.

6PM



Azimuth: -72.04°, Altitude: -15.77°

The sun is well **below the horizon**-nighttime conditions. **No sunlight** is present.

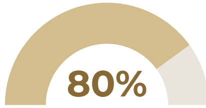
*In winter, **low-angle** sunlight from the **northeast** to **north** casts long shadows and softly lighten north facades.*

USAGE OF GLASS FACADE

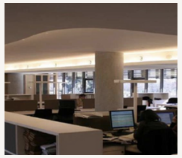
*Original **full glass** facade designed to maximize natural light.*

***Shading** added to block direct sunlight, reduce heat, and improve comfort while keeping daylight.*

80% of the facade is **glass**, mainly on the north and south sides, to **maximize** winter sunlight and natural lighting.

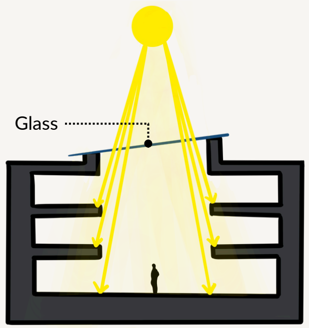


OPEN LAYOUT



- *Fewer interior walls / partitions*
- *Reduces shadowed or dark zone*
- *Maximises daylight penetration*
- *Enhances visual comfort and spatial connection*

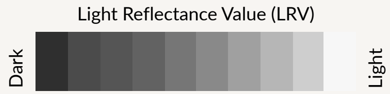
CENTRAL ATRIUM



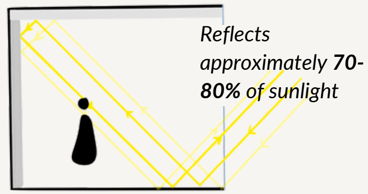
*The building has **two** main wings connected by a **central atrium** that acts as a **light well**, bringing daylight into the core.*

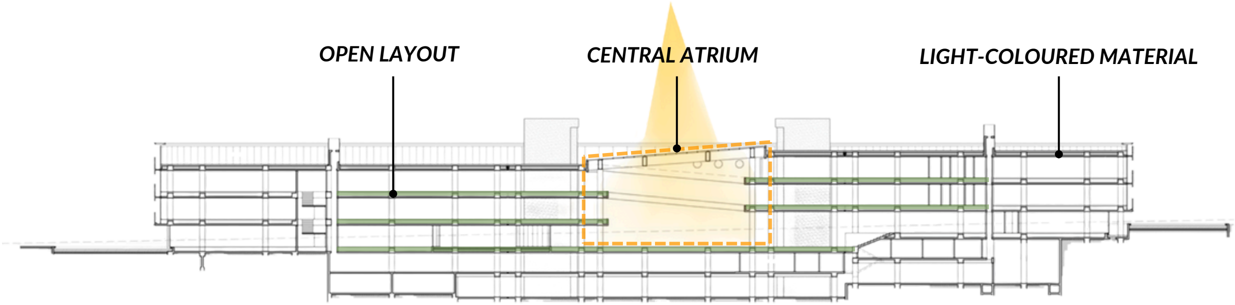
- **Reduces** the need for artificial lighting
- **Enhances** spatial quality with visual links between floors

LIGHT COLOURED MATERIALS



Light grey and white have **high LRV**, so they **reflect** more sunlight and help **reduce** heat absorption indoors.





TRANSOCEÁNICA BUILDING SANTIAGO, CHILE

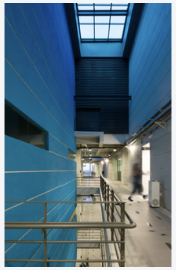
DAYLIGHTING COMPARITIVE ANALYSIS

SIMILARITY

MATERIAL REFLECTANCE

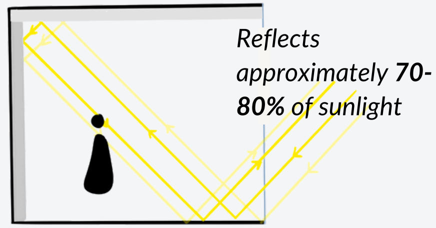
01 Light-Colored Materials

Both buildings utilize **light-colored materials** to enhance **natural light distribution** within the interior, minimizing the need for artificial lighting and **reducing indoor heat** absorption.



Light Reflectance Value (LRV)

Blue and light grey have **high LRV**, so they **reflect** more sunlight and help **reduce** heat absorption indoors.



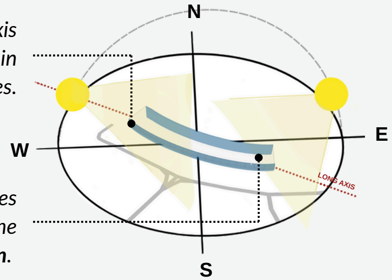
DIFFERENCES

HERIOT-WATT UNIVERSITY PUTRAJAYA, MALAYSIA

TROPICAL CLIMATE ADAPTATION

*The building's **north-south** axis **maximizes** diffuse light on main facades.*

__East__ & __west__ facades receives __strong__ low-angle __sunlight__ in the __morning__ and __afternoon__.

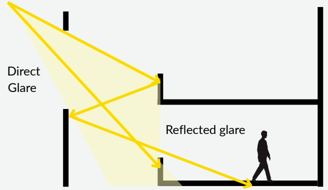


Designed to handle the **tropical** climate, it focuses in capturing **diffuse light** on the main **north-south** facade, avoiding **direct sunlight** on the **east-west** facade.

DAYLIGHTING MECHANISM

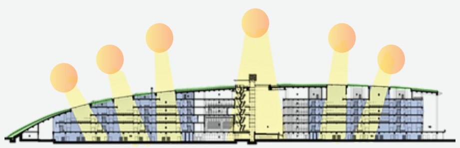
01 High Windows

Captures low-angle sunlight near the ceiling to distribute light deeper inside while minimizing glare.



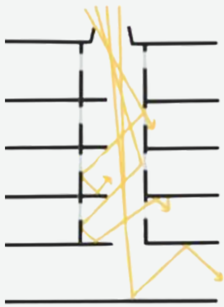
02 Skylight

Brings natural sunlight into interiors and the atrium, reducing daytime reliance on artificial lighting.



03 Lightwells

The skylight channels daylight into the light well, where reflective surfaces and selective glazing enhance and distribute illumination.



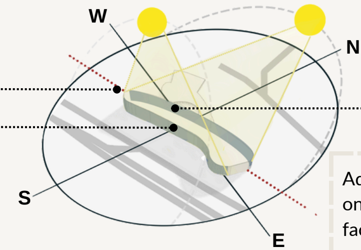
Well geometry (height and reflectance) **controls** light depth, while the combined system **improves daylight delivery** beyond individual components.

TRANSOCEÁNICA BUILDING SANTIAGO, CHILE

TEMPERATE CLIMATIC ADAPTATION

*The building's **long axis** runs north-south to maximize solar access*

__South-facing__ facades support passive heating by admitting solar radiation during colder months.

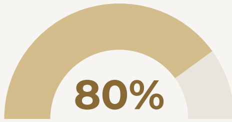


__North-facing__ facades receive __consistent sunlight__, especially in winter when the sun is lower.

Adapts to the temperate climate, it focuses on **capturing direct light** on north-south facade to optimise solar energy.

DAYLIGHTING MECHANISM

01 Extensive Use of Glass Facade



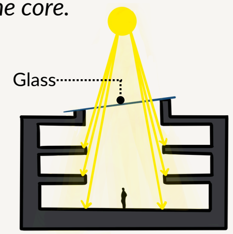
80% of the facade is **glass**, mainly on the north and south sides, to **maximize** winter sunlight and natural lighting.

*Original **full glass** facade designed to maximize natural light.*

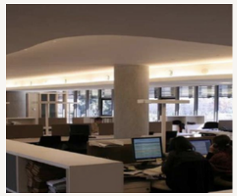
__Shading__ added to block direct sunlight, reduce heat, and improve comfort while keeping daylight.

02 Central Atrium

The building has __two__ main wings connected by a __central atrium__ that acts as a __light well__, bringing daylight into the core.



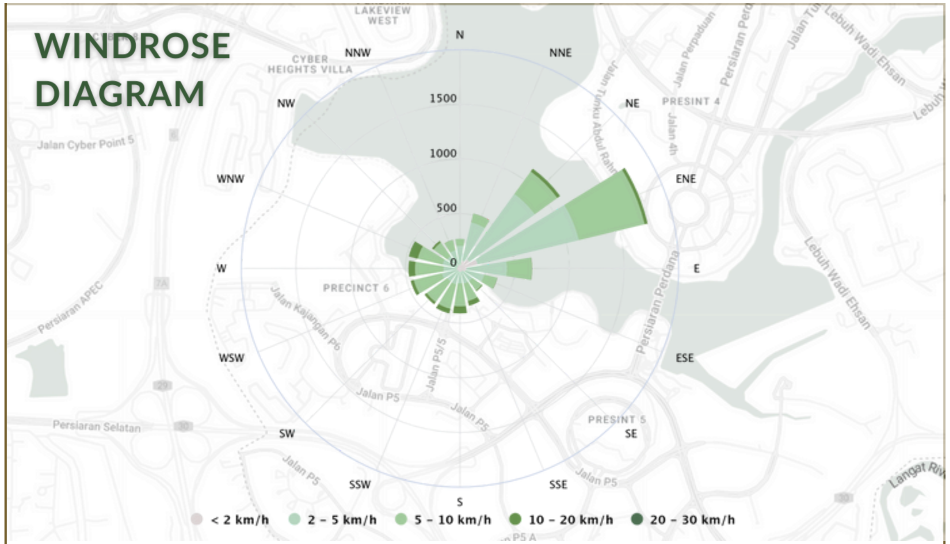
03 Open Plan



Fewer interior walls **reduce dark zones**, maximize daylight, and enhance visual comfort and spatial flow.

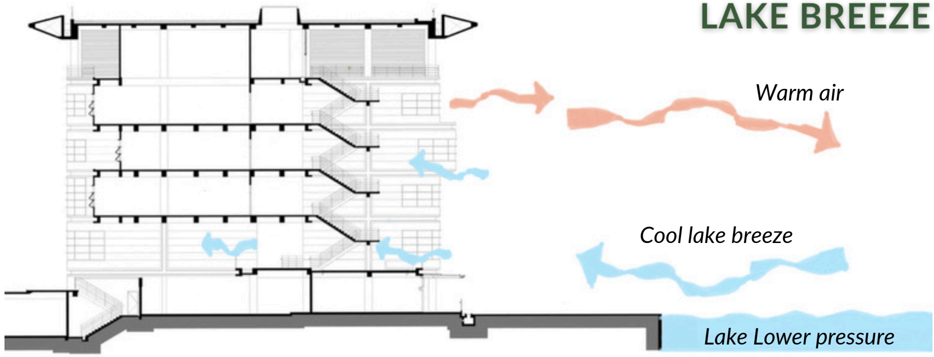
VENTILATION

WINDROSE DIAGRAM



- **Two monsoon seasons** shape wind patterns:
- **Northeast Monsoon** (Dec–Mar): Winds from **NE**
- **Southwest Monsoon** (Jun–Sep): Winds from **SW**
- Dominant wind direction: NE, with secondary SW flows
- Wind speed: Mainly **5–20 km/h** (light to moderate)
- Occasional gusts: **20–30 km/h** during seasonal shifts

LAKE BREEZE

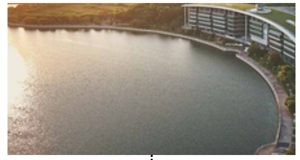


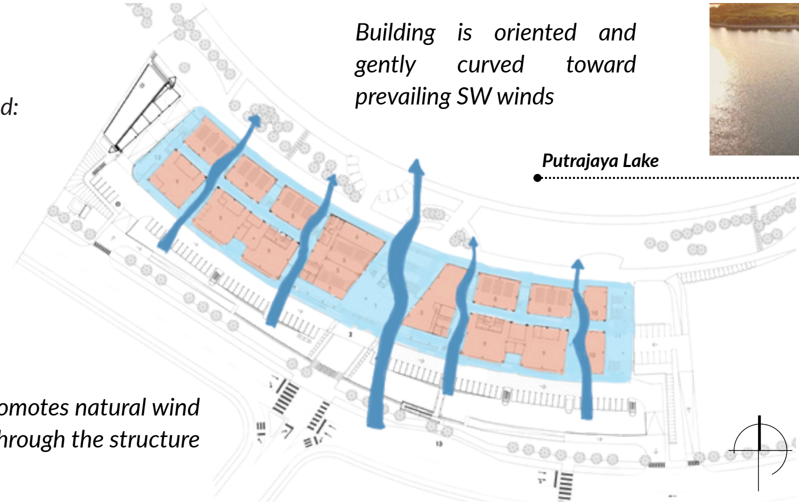
- HWUM uses **lake-cooled air** and **stack ventilation** for passive cooling by day
- **Cool air** enters through **lower openings**; **warm air** exits via **high-level vents**
- **Thermal stack effect** and voids sustain continuous airflow
- Indoor temperatures drop by **3–5°C** without mechanical cooling
- The lake acts as a **heat sink** and **fresh-air source**, integrating landscape and architecture sustainably

CROSS VENTILATION

Typical wind speed: ~5 km/h

Building is oriented and gently curved toward prevailing SW winds

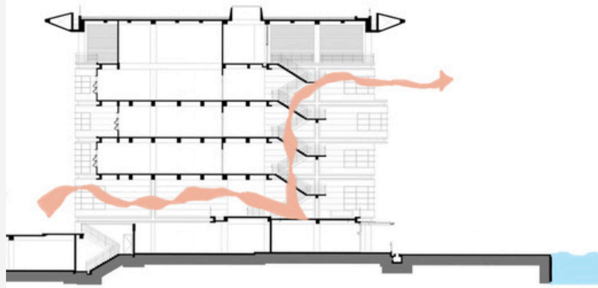




Design promotes natural wind flow through the structure

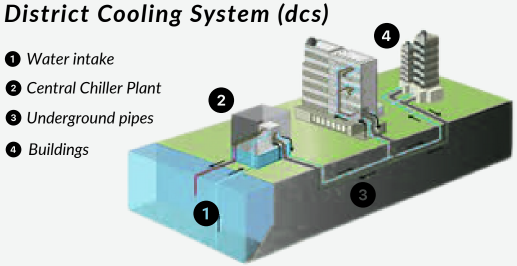
STACK VENTILATION

- Vertical voids **expel warm air**, **pulling** in **cool air** from shaded courtyards
- Open staircases, perforated landings, and angled baffles **improve** cross-ventilation
- Achieves **6–12** air changes per hour
- Lowers indoor temperature by **3–5°C**



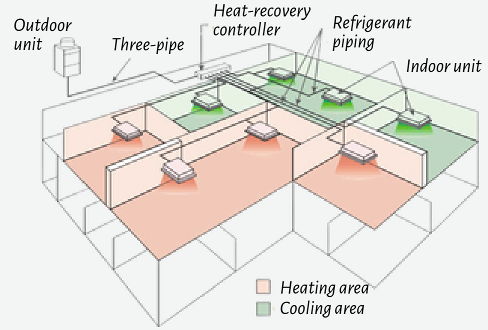
ACTIVE APPROACH

District Cooling System (dcs)



- District Cooling System **supplies chilled water** from a central plant to multiple buildings
- Provides **efficient air conditioning** through **underground piping**
- Offers **energy savings**, lower operational costs, and **reduced environmental impact**

Variable refrigerant flow (VRF)



- **VRF system**: Adjusts **refrigerant flow** for zoned heating/cooling and energy efficiency
- **Heat recovery unit: Reuses waste heat** from cooling to warm other areas via heat exchange

HERIOT-WATT UNIVERSITY

PUTRAJAYA, MALAYSIA

VENTILATION

TRANSOCEÁNICA BUILDING
SANTIAGO, CHILE

WINDROSE DIAGRAM

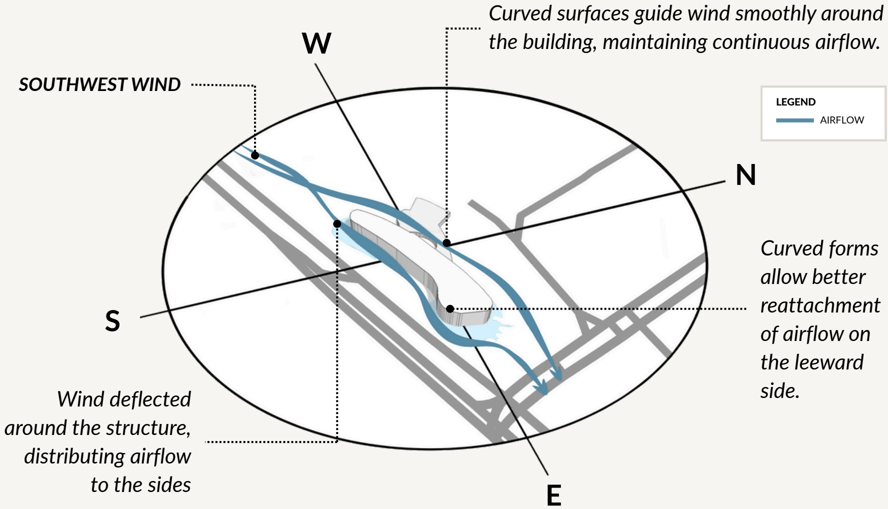
The **dominant** winds come from the **west** (W) and **southwest** (SW), with speeds mainly ranging from **5-10 km/h**, and occasional gusts from west-southwest (WSW) reaching **10-20 km/h**.

CURVED FORM

The curved form influences wind behavior around the building, contributing to improved environmental performance.

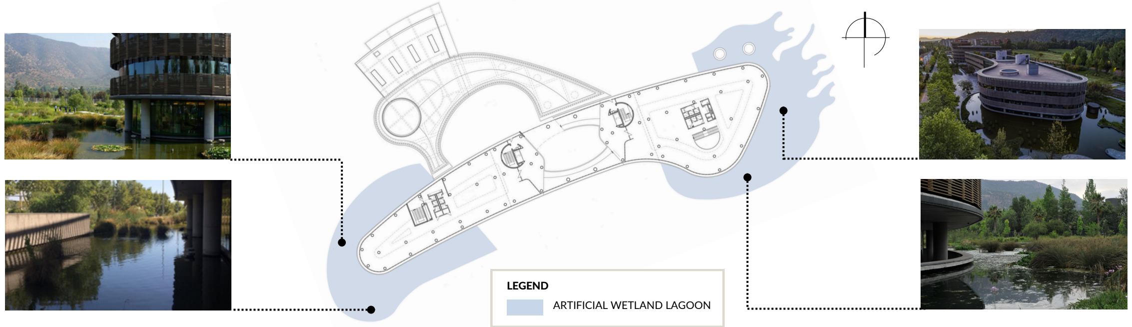
- **Enhance** the natural flow of air, **improving** ventilation and cooling.
- Helps **minimise** wind resistance, allowing for **smoother** airflow around the structure.

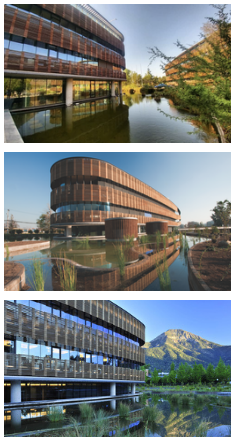
AIRFLOW MECHANISM



ARTIFICIAL WETLAND LAGOON FOR MICROCLIMATE COOLING

The building is **surrounded** by an artificial wetland lagoon, seamlessly **integrated** into the **landscape**.



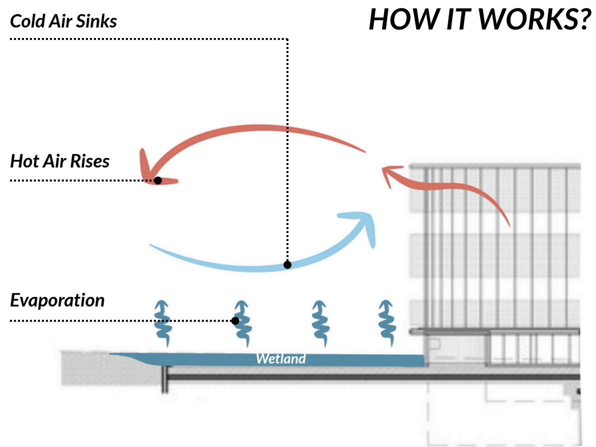


HOW IT WORKS?

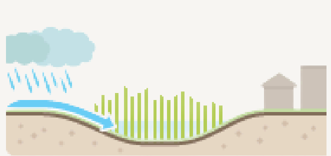
***Enhances** natural ventilation with **cooler air** near inlets.*

***Reduces** urban heat island effect and adds aesthetic and **ecological value**.*

*Passively **cools** the surrounding air through **evaporation** and **regulates** the local microclimate.*

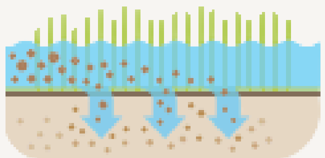


BENEFITS OF WETLANDS



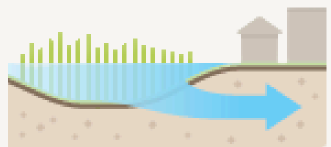
Flood & Erosion Control

Wetlands **hold rainwater** from heavy storms, **prevent** flooding, and **slow** soil erosion by **reducing** water speed.



Clean Water

Wetlands help **clean water** passing through them before it reaches rivers and the ocean.



Water Supply

Wetlands **store water** after rainfall, **replenishing** underground sources and reservoirs.

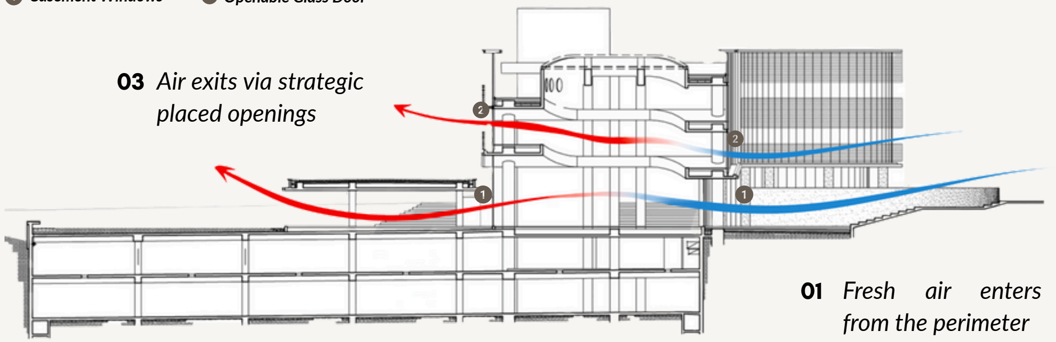
VENTILATION

CROSS VENTILATION

The building layout facilitates natural cross ventilation through its **open-plan** floor plates and **operable windows**, promoting consistent **air circulation** and **reducing** reliance on mechanical cooling systems during milder weather.

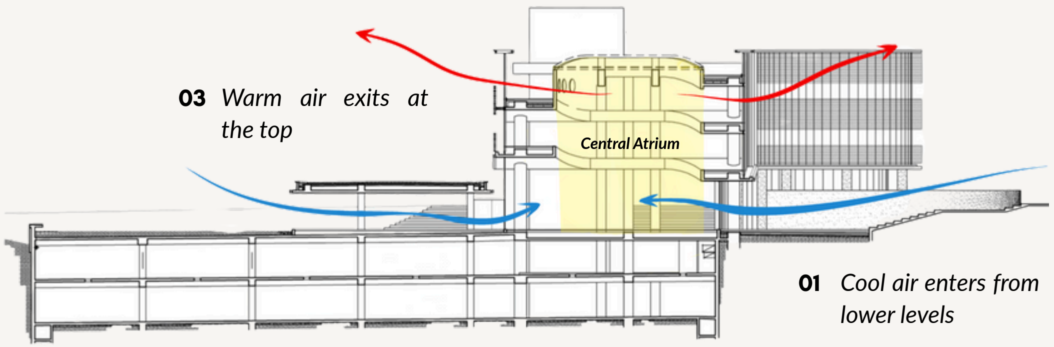

1 *Casement Windows*

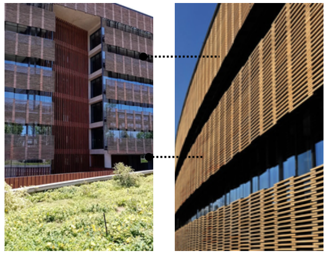

2 *Openable Glass Door*



STACKED VENTILATION

A **full-height central atrium** functions as a **vertical thermal shaft**, drawing in **natural light** while enhancing **natural ventilation** by utilising **temperature** and **pressure** differences between its base and top—thereby reducing reliance on mechanical systems.

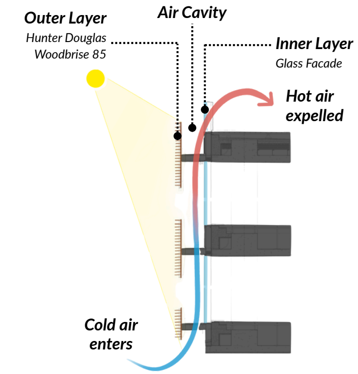




DOUBLE SKIN FACADE

- The glass facades are **paired** with **external wooden louvers** (Hunter Douglas Woodbrise 85), which also helps in **reduce** solar heat gain.
- The double skin facade uses **natural** airflow - driven by **solar heating** and the **stack effect** to continuously **draw** in cool air and **expel** hot air.

AIRFLOW MECHANISM



01 *Cool air enters from the bottom*

02 *Air fills in the cavity*

03 *Sun heats up air in cavity*

04 *Air warms up, becomes lighter, and starts to rise (stack effect)*

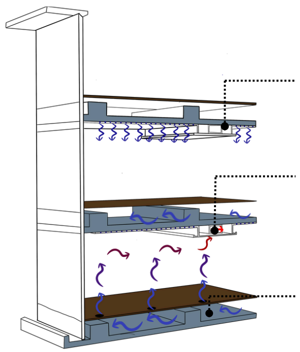
05 *Rising warm air pulls more cool air in from the bottom*

06 *Hot air exits through top vents*

Ventilating the cavity **cools** the inner glass, **prevents** heat buildup, and **reduces** indoor heat gain, thereby lowering cooling loads and enhancing **natural ventilation** for sustainable building performance.

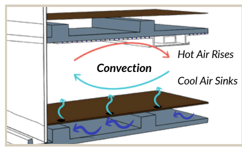
GEOTHERMAL COOLING

The geothermal system uses **12°C** well water to pre-cool fresh air, reducing energy use and supporting passive cooling



Ceiling Slab Area

Cold water run through ceiling and absorb the heat rises from the room – ***Radiant Cooling***



Natural Convection

Water running through slabs, cooling down floor surfaces in which it absorb internal heat via radiation.

Circulating Cool Water

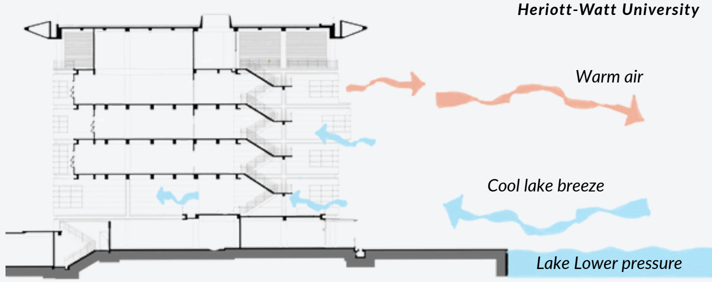
Air is cooled by contact with the geothermally tempered slab or air channels, creating an upward natural convection current.

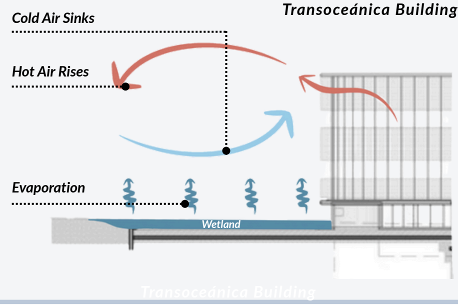
VENTILATION COMPARITIVE ANALYSIS

SIMILARITY

WATER INTEGRATION

Both buildings integrate **water features** as part of their natural cooling strategies, utilizing surrounding **water sources** to enhance **cooling** and regulate the indoor climate through **evaporative** processes.



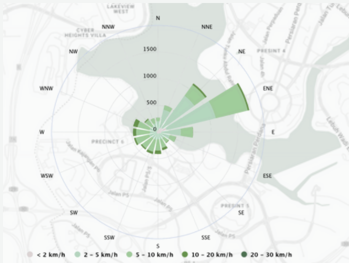


DIFFERENCES

HERIOT-WATT UNIVERSITY PUTRAJAYA, MALAYSIA

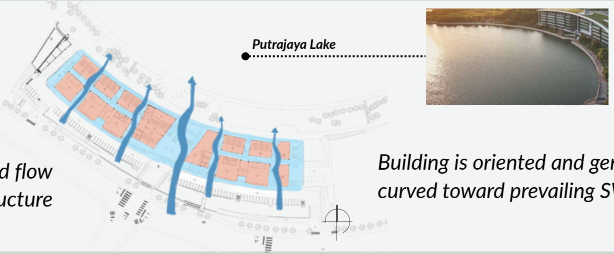
WIND PATTERN

Putrajaya has two monsoon seasons: the Northeast Monsoon (Dec–Mar) with winds from the **NE**, and the Southwest Monsoon (Jun–Sep) with winds from the **SW**. Winds typically range from 5–20 km/h, with occasional gusts up to 30 km/h during seasonal shifts.



CROSS VENTILATION

Typical wind speed: ~5 km/h

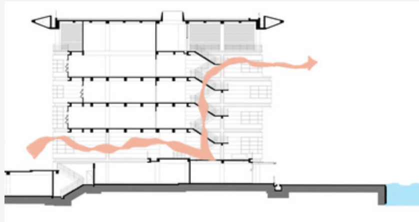


Design promotes natural wind flow through the structure

Building is oriented and gently curved toward prevailing SW winds

STACKED VENTILATION

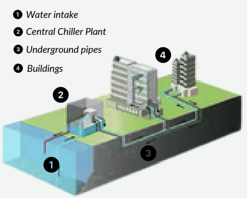
Vertical voids expel warm air, pulling in **cool air** from courtyards, while **open staircases** and **perforated landings** improve cross-ventilation, reducing indoor temperatures by 3–5°C with 6–12 air changes per hour.



ACTIVE VENTILATION

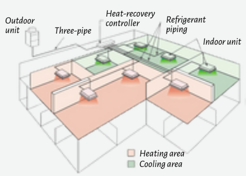
01 District Cooling System (dcs)

Supplies **chilled water** efficiently, cutting energy use and environmental impact.



02 Variable refrigerant flow (VRF)

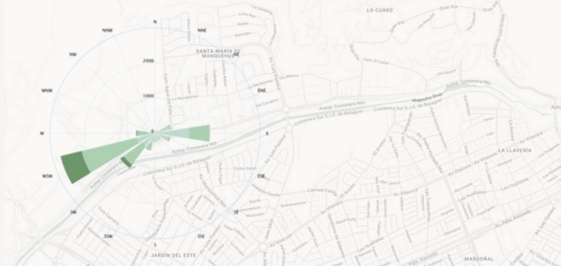
Adjusts **refrigerant flow** for zoned heating/cooling and energy efficience



TRANSOCEÁNICA BUILDING SANTIAGO, CHILE

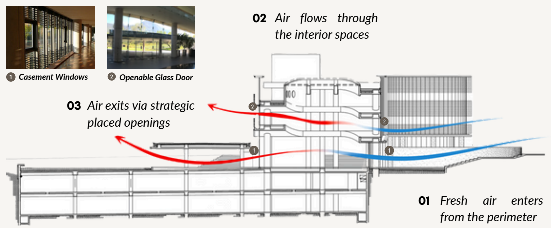
WIND PATTERN

The **dominant** winds come from the **west** (W) and **southwest** (SW), with speeds mainly ranging from **5-10 km/h**, and occasional gusts from west-southwest (WSW) reaching **10-20 km/h**.



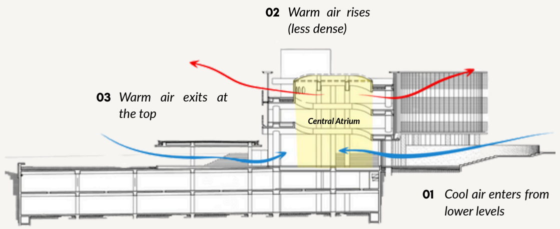
CROSS VENTILATION

The building's **open-plan layout** and **operable windows** enable natural cross ventilation, ensuring steady air circulation and reducing reliance on mechanical cooling during moderate weather conditions.



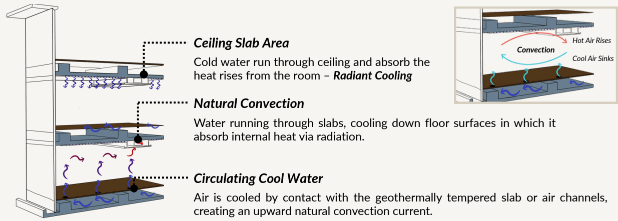
STACKED VENTILATION

A **full-height atrium** acts as a thermal shaft, drawing **light** and enhancing **ventilation** through natural temperature and pressure differences, reducing mechanical cooling needs.



ACTIVE VENTILATION

The geothermal system uses **12°C** well water to pre-cool fresh air, reducing energy use and supporting passive cooling



HERIOT-WATT UNIVERSITY

PUTRAJAYA, MALAYSIA

The campus embraces its tropical rainforest climate by incorporating a large green roof that aids in heat reduction and utilizes rainwater harvesting systems. The design promotes natural ventilation through open corridors, the integration of permeable surfaces, and strategic shading, reducing reliance on mechanical cooling. Its landscape, featuring native plantings, not only enhances the aesthetic appeal but also improves the microclimate and encourages biodiversity. Additionally, the nearby Putrajaya Lake plays a vital role in cooling the building.

SITE PLANNING

The site benefits from a carefully considered orientation that takes advantage of natural light while minimizing direct sunlight on the east and west facades. This helps reduce heat gain and cooling demand. The campus is integrated into the surrounding parkland, with a strong emphasis on green spaces and permeable surfaces that support water infiltration. The proximity to Putrajaya Lake is strategically utilized for passive cooling and stormwater management. The green roof and earth berms help control water runoff, reduce flooding risks, and support water conservation.

Sustainable Site Planning Characteristics

01 GREEN ROOF *02* PERVIOUS SURFACE *03* RAINWATER HARVESTING SYSTEM *04* IRRIGATION SYSTEM

STRATEGIC LANDSCAPING

The landscaping is designed to enhance biodiversity and create a seamless connection between the building and the surrounding green parkland. Native plants are incorporated to reduce maintenance and promote environmental harmony. Trees along the perimeter of the campus not only provide shade and reduce heat but also offer noise reduction, improving the overall comfort of outdoor spaces. The landscaping also plays a crucial role in cooling the building, utilizing plant evapotranspiration and shaded areas.

FACADE DESIGN

The facades are designed to maximize daylight while reducing heat gain through the use of shading overhangs, extended facades, and low-E glazing. The orientation ensures that the building captures soft, diffuse light, and the large windows allow natural light to penetrate deep into the interior spaces. The materials used for the facade also promote energy efficiency by minimizing heat absorption and promoting passive cooling strategies.

01 GREEN ROOF *02* OVERHANG ROOF *03* OFFSET FLOORS *04* LIGHT COLORED WALLS *05* PERFORATED SCREENS *06* ALUMINIUM LOUVRES *07* LOW-E GLASS

DAYLIGHT

The design optimizes daylighting by using its long-axis orientation to capture natural light without overexposing spaces to direct sunlight. The extended overhangs on the facades help diffuse the light entering the building, reducing glare and enhancing visual comfort. The green roof and shading strategies contribute to controlling light levels inside, reducing the need for artificial lighting.

01 SKYLIGHT *02* LIGHT WELL *03* SCREENS & PARTITIONS *04* LIGHT COLORED FLAT WALLS *05* SHADING WITH MASSING *06* HIGH WINDOWS

VENTILATION

Natural ventilation is prioritised throughout the building. The open layout and orientation allow for optimal airflow through the building, reducing the reliance on mechanical cooling systems. The integration of the nearby Putrajaya Lake further supports natural ventilation, ensuring that fresh, cool air enters the building while warm air is expelled. This design ensures a comfortable and energy-efficient indoor climate.

01 CROSS VENTILATION *02* STACK VENTILATION *03* LAKE BREEZE *04* DISTRICT COOLING SYSTEM *05* CARIABLE REFRIGERANT FLOW (RVF)

TRANSOCEÁNICA BUILDING

SANTIAGO, CHILE

Located in a Mediterranean climate, this building adapts to the sloped terrain with a layout that enhances natural ventilation. It integrates a green roof to manage stormwater and utilizes geothermal cooling to improve energy efficiency. The building also employs automated shading systems and extensive glazing to optimize natural light while minimizing heat gain. The surrounding artificial wetland lagoon supports water management, reduces flooding, and enhances the overall sustainability of the building.

SITE PLANNING

The Transoceánica Building in Santiago is strategically located on sloped terrain, taking advantage of the natural topography for its layout. The building orientation maximizes natural light while considering the prevailing wind patterns, contributing to passive cooling and energy efficiency. The site planning also includes an artificial wetland lagoon, which plays a key role in stormwater management by absorbing excess water and reducing runoff. The landscaping design reduces soil erosion risks and helps regulate the local microclimate through the use of permeable surfaces and native plants that are adapted to the dry Mediterranean climate.

01 GREEN ROOF *02* ROOFING WITH INSULATION *03* ARTIFICIAL WETLAND LAGOON *04* PERVIOUS SURFACES *05* GEOTHERMAL COOLING *06* SPLIT-LEVEL DESIGN

STRATEGIC LANDSCAPING

The landscaping surrounding the Transoceánica Building is designed to mitigate the impact of the environment and create a balanced relationship between the built and natural forms. The use of native and drought-tolerant plants helps conserve water and provides a habitat for local wildlife. The artificial wetland not only contributes to stormwater management but also enhances the site's ecological value, helping filter and clean water before it enters larger water systems.

FACADE DESIGN

The facade design emphasizes both energy efficiency and aesthetics. Extensive use of glass allows for maximum daylight penetration, while automated shading devices, such as wooden slats, protect against excessive solar heat gain. The high-performance glazing ensures that the building maintains a comfortable interior climate by blocking harmful UV rays while allowing natural light. These measures minimize the need for artificial lighting and reduce cooling loads.

01 HIGH - PERFORMANCE GLAZED CURTAIN WALLS *02* AUTOMATED SHADING DEVICES *03* QUIEBRAVISTA WOODSCREEN 85 BY HUNTER DOUGLAS *04* VERTICAL LOUVERS

DAYLIGHT

The building's design maximizes daylighting, particularly through its north and south facades. The use of light wells, skylights, and a central atrium allows daylight to penetrate the interior, minimizing the need for artificial lighting. The orientation and shading systems ensure that the building captures low-angle sunlight in the winter and reduces glare during the summer months.

01 USAGE OF GLASS FACADE *02* CENTRAL ATRIUM *03* OPEN LAYOUT *04* LIGHT COLOURED MATERIALS

VENTILATION

The building's open-plan layout facilitates cross-ventilation, while stack ventilation is used in the central atrium to expel warm air and draw in cooler air. The geothermal cooling system helps pre-cool incoming fresh air, reducing reliance on mechanical cooling and improving energy efficiency. The integration of the artificial wetland and the surrounding landscape also supports the building's ventilation by enhancing airflow and cooling the surrounding environment.

01 CROSS VENTILATION *02* STACKED VENTILATION *03* GEOTHERMAL COOLING *04* DOUBLE SKIN FACADE

REFERENCES

- HERIOT-WATT UNIVERSITY MALAYSIA @ Precinct 5, PUTRAJAYA Green Roof Campus. (n.d.). https://www.klccprojeks.com.my/wp-content/uploads/2021/01/HWU-PACK.pdf
- Abuseif, M. (2023). Exploring Influencing Factors and Innovative Solutions for Sustainable Water Management on Green Roofs: A Systematic Quantitative Review. Architecture, 3(2), 294–327. https://doi.org/10.3390/architecture3020017
- Woolsey, R. (2025, May 2). Permeable Pavement 101. ColonialSWCD. https://www.colonialswcd.org/post/permeable-pavement-101
- Jobs-Amst. (2021, October 6). What Are Waterproofing Membranes, the Types, and Applications? JOBS Group. https://jobs-amst.com/blog/what-are-waterproofing-membranes-the-types-and-applications/.
- NParks | Syzygium grande. (n.d.). Www.nparks.gov.sg. https://www.nparks.gov.sg/florafaunaweb/flora/3/1/3160
- (2021). Nparks.gov.sg. https://www.nparks.gov.sg/florafaunaweb/flora/3/1/3181
- (2020). Nparks.gov.sg. https://www.nparks.gov.sg/florafaunaweb/flora/3/1/3106
- Wikipedia Contributors. (2025, February 23). Hopea odorata. Wikipedia; Wikimedia Foundation.
- Wikipedia Contributors. (2019, December 3). Aloe vera. Wikipedia; Wikimedia Foundation. https://en.wikipedia.org/wiki/Aloe_vera
- Wikipedia Contributors. (2019, July 15). Moringa oleifera. Wikipedia; Wikimedia Foundation. https://en.wikipedia.org/wiki/Moringa_oleifera
- Heriot Watt University. (2018). Architizer. https://architizer.com/projects/heriot-watt-university/
- Oficina Para venta y arriendo — Santa María 5888 Vitacura Región Metropolitana Chile | Chile | Colliers. (2025). Colliers.com. https://www.colliers.com/es-cl/propiedades/ventaarriendo-oficinas-habilitadas-en-vitacura/chl-santa-mar%C3%ADa-5888-vitacura-regi%C3%B3n-metropolitana-chile/chl11002026
- Alex Brahm & Marcelo Leturia "Edificio Transoceánica." (2011, January 14). SlideShare; Slideshare. https://www.slideshare.net/slideshow/alex-brahm-marcelo-leturia-edificio-transocenica/6568598
- Edificio Transoceánica. (2017). Simetrika. https://simetrika.cl/edificio-transoceanica/
- Alex Brahm & Marcelo Leturia "Edificio Transoceánica." (2011, January 14). SlideShare; Slideshare. https://www.slideshare.net/slideshow/alex-brahm-marcelo-leturia-edificio-transocenica/6568598
- Nuñez, A. (2025). EDIFICIO TRANSOCÉANICO - ANALISIS. Scribd. https://www.scribd.com/document/455589473/EDIFICIO-TRANSOCEANICO-ANALISIS
- Edificio transoceanica. (2011, January 12). SlideShare; Slideshare. https://www.slideshare.net/slideshow/edificio-transoceanica/6535667
- EDIFICIO TRANSOCEÁNICA. (n.d.). Retrieved June 8, 2025, from https://arquitecturaysustentabilidadutem.com/wp-content/uploads/2017/09/acond.pdf
- transo - Bing. (2017). Bing. https://www.bing.com/search?qs=HS&pq=transo&sk=CSYN1MT10SC1CT1AS1&sc=18-6&q=transo
- The Transoceánica office building in Santiago, Chile. (2013). E ColibriuM, 36–37. https://www.airah.org.au/Common/Uploaded%20files/Archive/Ecolibrium/2013/Eco-August-13-004.pdf
- Transoceanica Vitacura - Chile | Buzon World Patio layers. (2025, March 18). Buzon. https://www.buzon-world.com/realisations/transoceanica/
- PB-series terrasdragers voor particuliere terrassen | Buzon. (2025, March 3). Buzon. https://www.buzon-world.com/be-NL/producten/tegeldragers/pb-series/
- Transoceánica Building / +arquitectos. (2013, September 3). ArchDaily. https://www.archdaily.com/422189/transoceanica-building-arquitectos
- Project - TRANSOCEANICA BUILDING. (2019). Hunterdouglas.asia. https://ap.hunterdouglas.asia/cb/project/transoceanica-building
- World Weather & Climate Information. (2020). World Weather & Climate Information. https://www.weather-and-climate.com/
- meteoblue - weather close to you. (2019). Meteoblue.com. https://www.meteoblue.com/
- OH! Stgo. (2017, February 27). #EntraYDescubre Edificio Transocéanica OH! Stgo 17. YouTube. https://www.youtube.com/watch?v=jWC26oRKGDE
- PED�AZA GARC�A JOHANA. (2021, October 22). DESARROLLO SUSTENTABLE EDIFICIO TRANSOCÉANICA/CHILE. YouTube. https://www.youtube.com/watch?v=YGo9uV5uucQ
- Canal13C. (2021, January 18). El llamativo Tribunal de Justicia de Burdeos | City Tour On Tour The Best. YouTube. https://www.youtube.com/watch?v=zjGAgzrTOPg
- OH! Stgo. (2022, July 5). Edificio Tánica y Edificio B. YouTube. https://www.youtube.com/watch?v=Bp-KsfSOl0Y
- OH! Stgo. (2022, March 16). Recorridos OH! Stgo 2022: Edificio Tánica y edificio Lo Recabarren B - Vitacura. YouTube. https://www.youtube.com/watch?v=6zJIEhi9Tbg
- OH! Stgo. (2022, January 28). OH! Stgo 2022 - Resumen. YouTube. https://www.youtube.com/watch?v=yJ7d_ritF6I
- Canal13C. (2019, November 7). Recorriendo el Edificio Transoceánica con sus arquitectos | City Tour. YouTube. https://www.youtube.com/watch?v=I1IlEHfqZl4
- Jia. (2024, May 10). ECM367 INDIVIDUAL ASSIGNMENT (TRANSOCEANICA BUILDING SANTIAGO DE CHILE,CHILE). YouTube. https://www.youtube.com/watch?v=z4_MUqmRliA
- Boximage SPA. (2016, September 21). TRANSOCEANICA Lo Recabarren. YouTube. https://www.youtube.com/watch?v=whQvh9ZSlvw
- Boximage SPA. (2017, August 10). Transoceanica LoRecabarren. YouTube. https://www.youtube.com/watch?v=hl0bAvZ3HOI
- GeCo. (2018, January 25). Video Lo Recabarren Transoceanica. YouTube. https://www.youtube.com/watch?v=PRy7xOBO004
- Luis Jesus Resendiz. (2020, October 23). EDIFICIO TRANSOCEANICA. YouTube. https://www.youtube.com/watch?v=FYKE0M65biQ
- Canal13C. (2019, November 7). Aprendiendo sobre la arquitectura moderna | City Tour. YouTube. https://www.youtube.com/watch?v=XZNYmBh3IIY
- meettransoceanica. (2010, November 5). Nuevo Edificio Transoceanica. YouTube. https://www.youtube.com/watch?v=FMy0svNzYtA

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