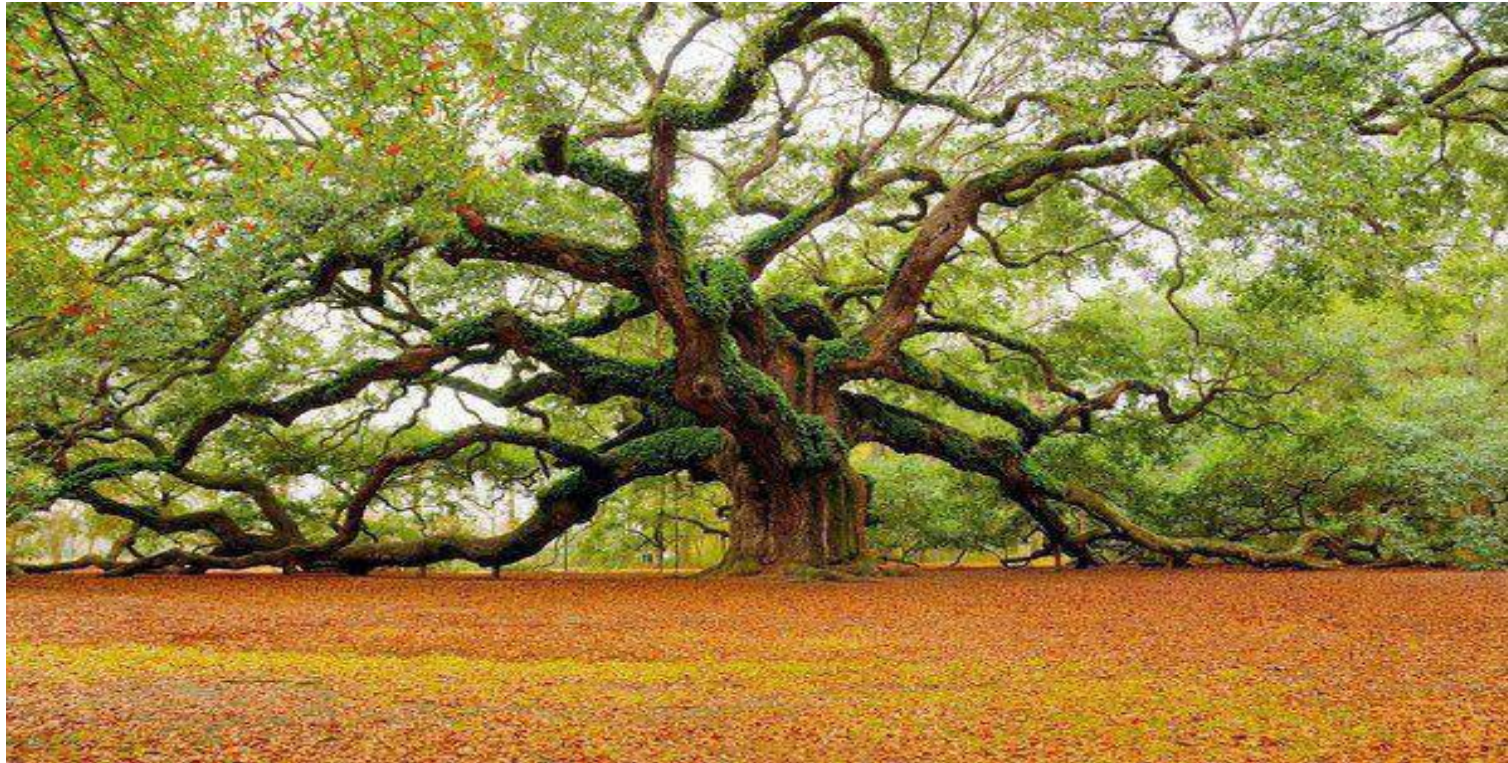


Design Follow nature



Yonghui Huang 4502914
Architecture Engineering
Graduation Project, P4 Studio
2017-05-23

Menkema Historical Garden
Earthquake
population Shrinkage

CONTEXT

Botanical Garden

PROGRAM

TECHNOLOGY

- Structure
- Solar-tracking Louver
- Responsive skin



Research Question :



-1.How to design a seismic resistant building?

-2.Biocmimicry technology integrated into the architecture design to respond to the nature?

Research Approach :

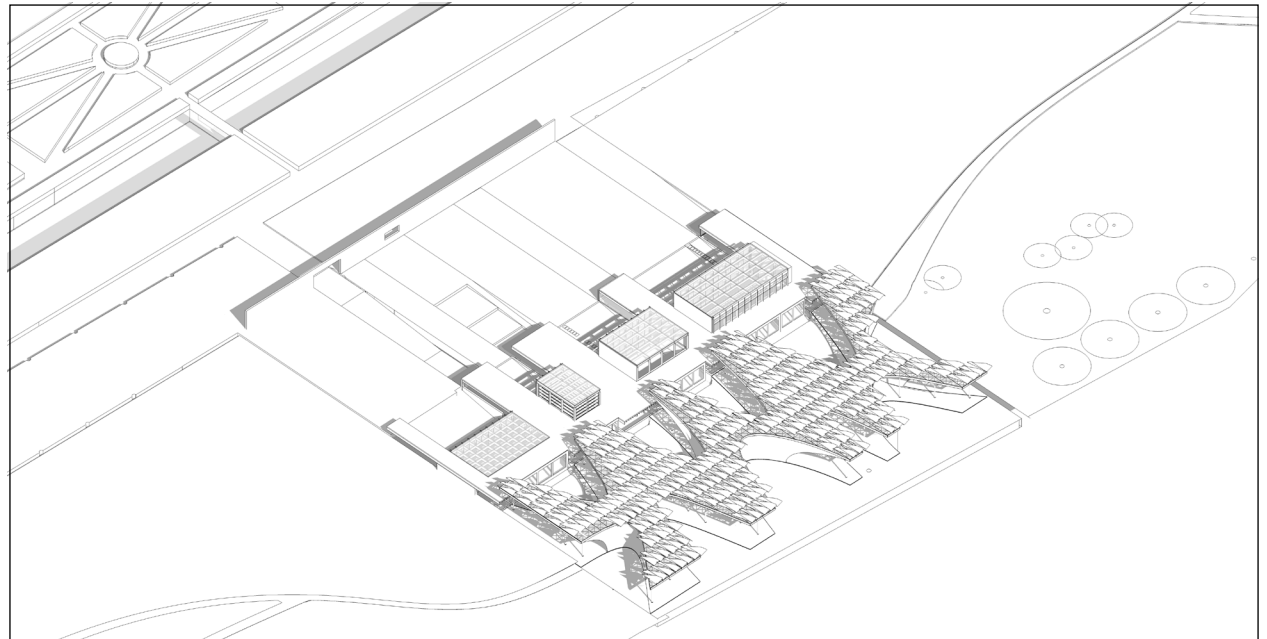


1. Structure design in seismic area

2. Responsive skin: Solar-tracking louvers, deployable sun-shading facade system



Design



Research : Seismic Design Principle



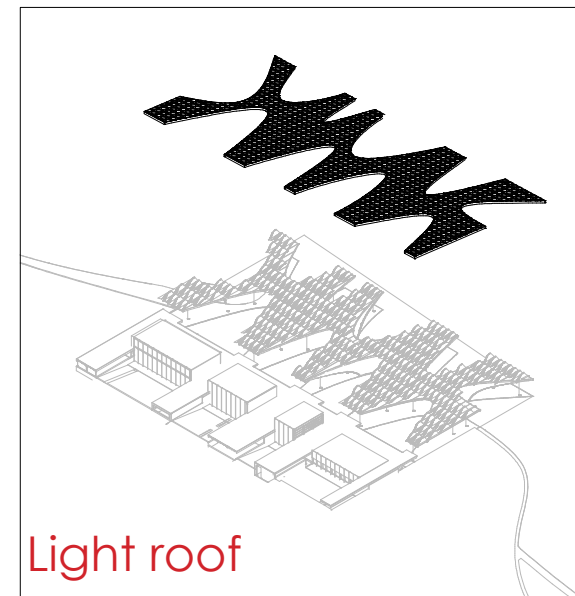
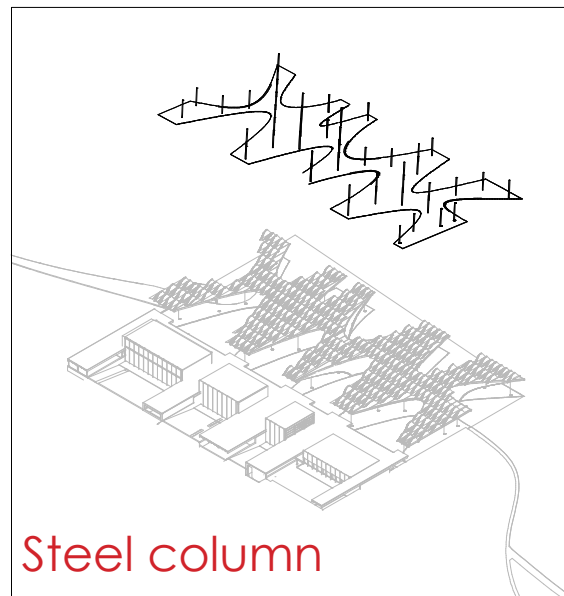
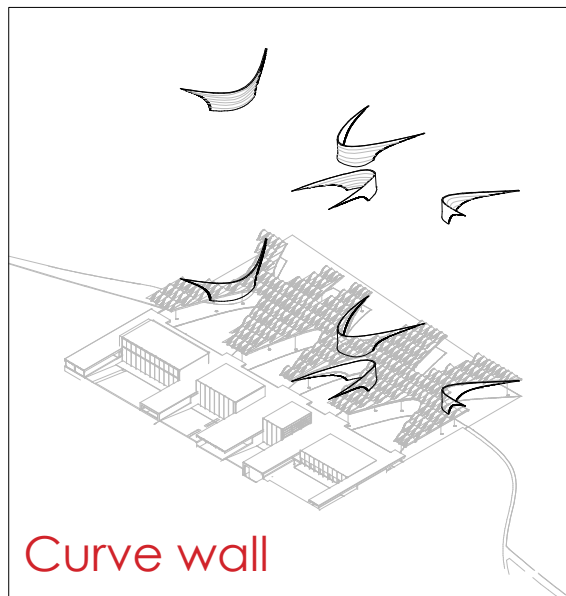
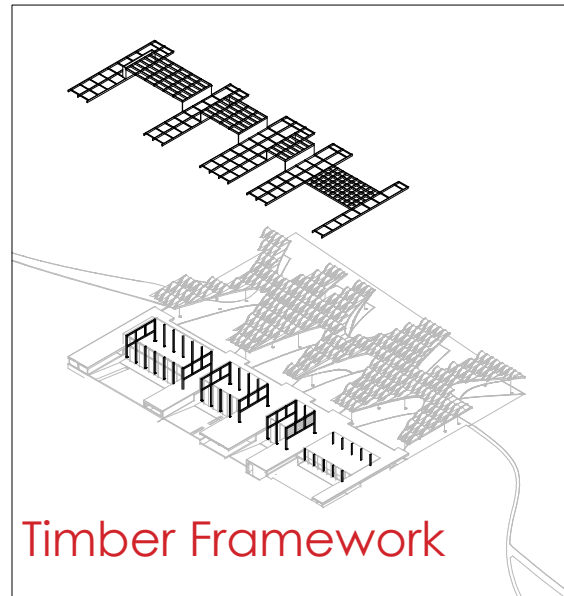
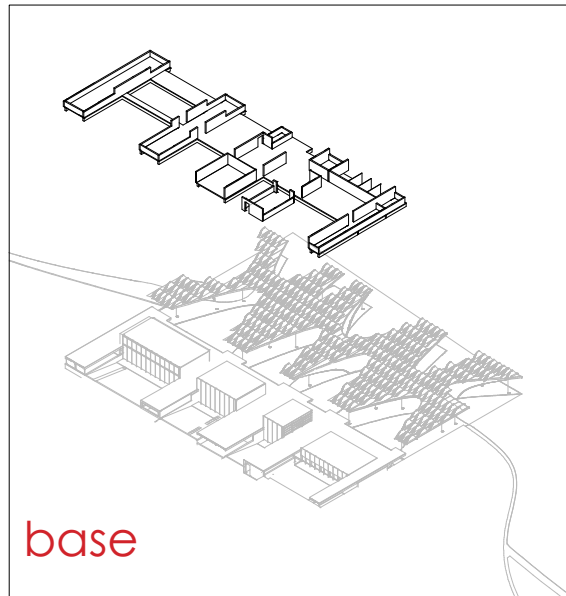
Stablization

1. Load transfer: Stiff Foundation
2. Buidling configuration- Plan& Elevation regularity in arrangement
3. Curve wall, Bond beam

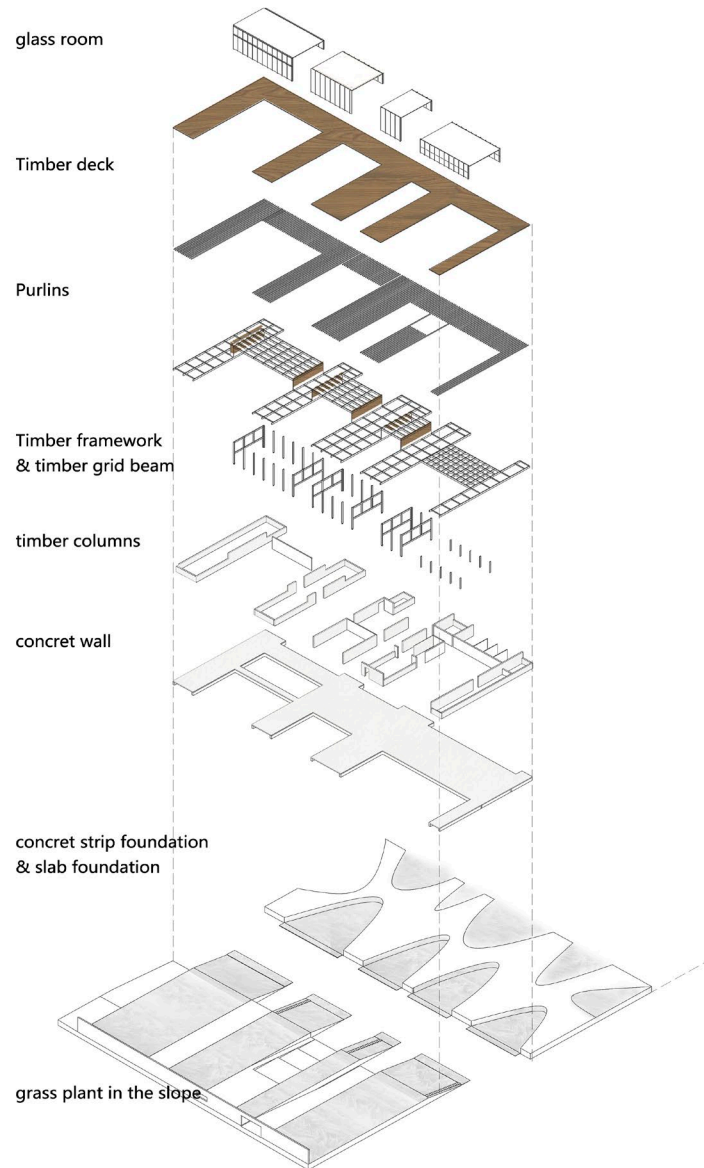
Dissipate Energy

4. Non-structure Construction: diagonal grid window
5. Technical solution: Damping joint
6. Light-weight structure material: timber, membrane structure.

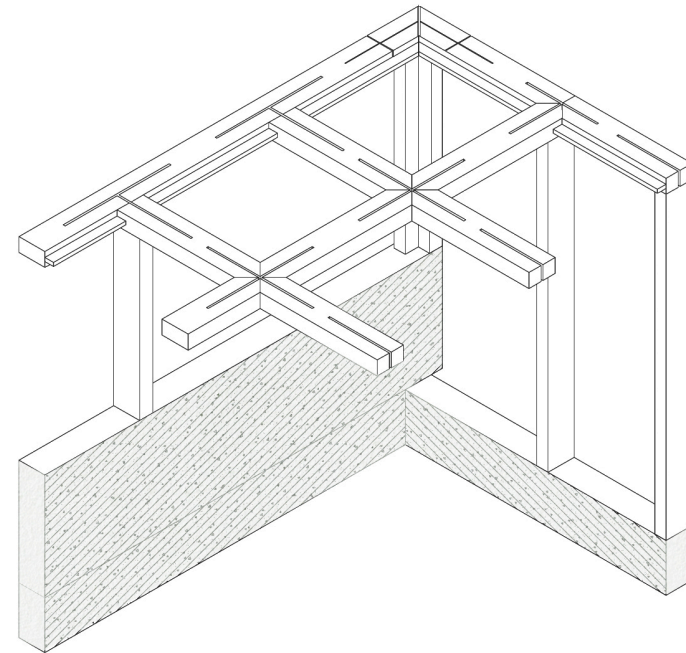
Design: Exhibition Education Center and Pavilion



Exhibition Part Design: **Concret Base**

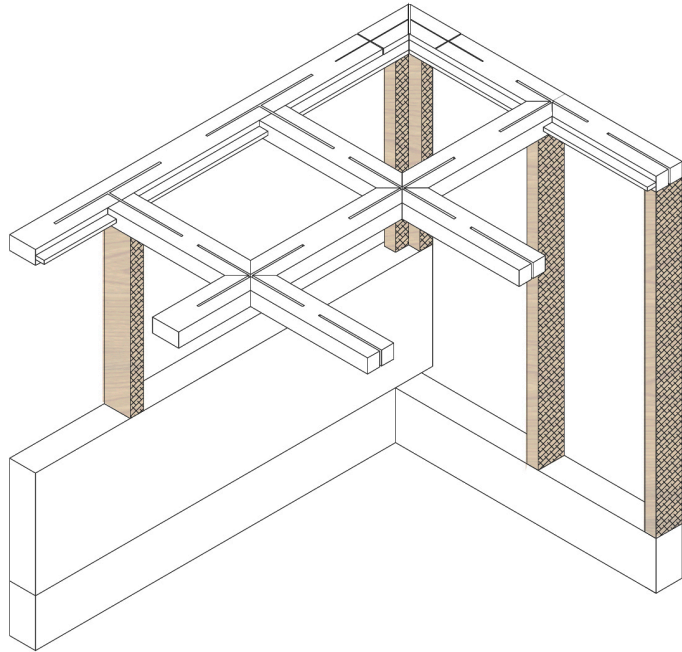


1. Concret strip Foundation and concret wall was placed in 1.5 meters below the ground level.

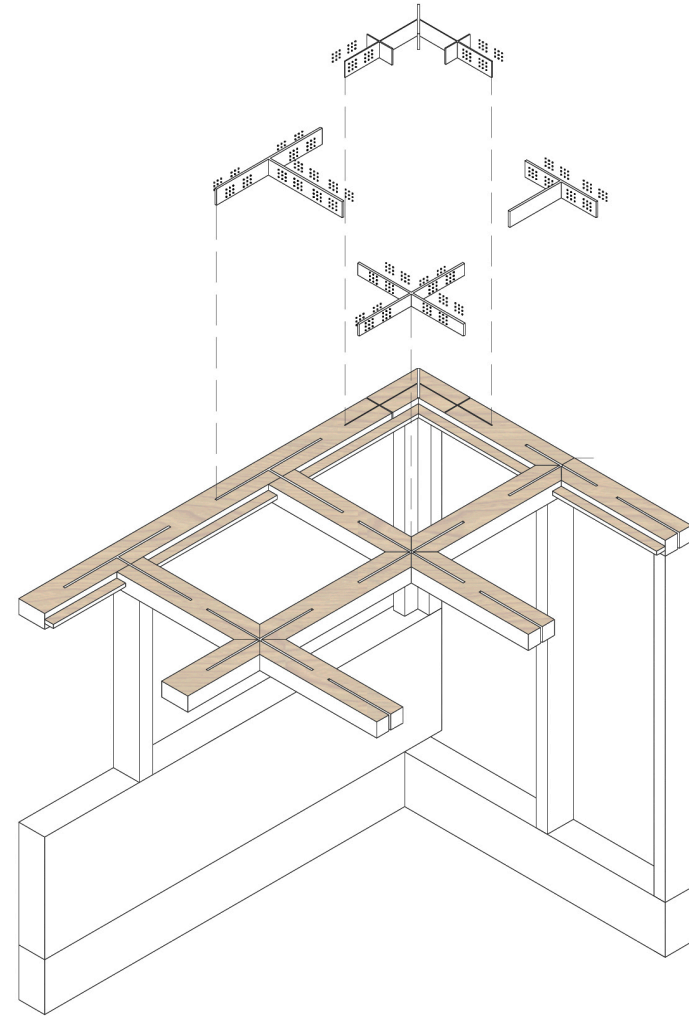


Exhibition part Design: **Timber Framework**

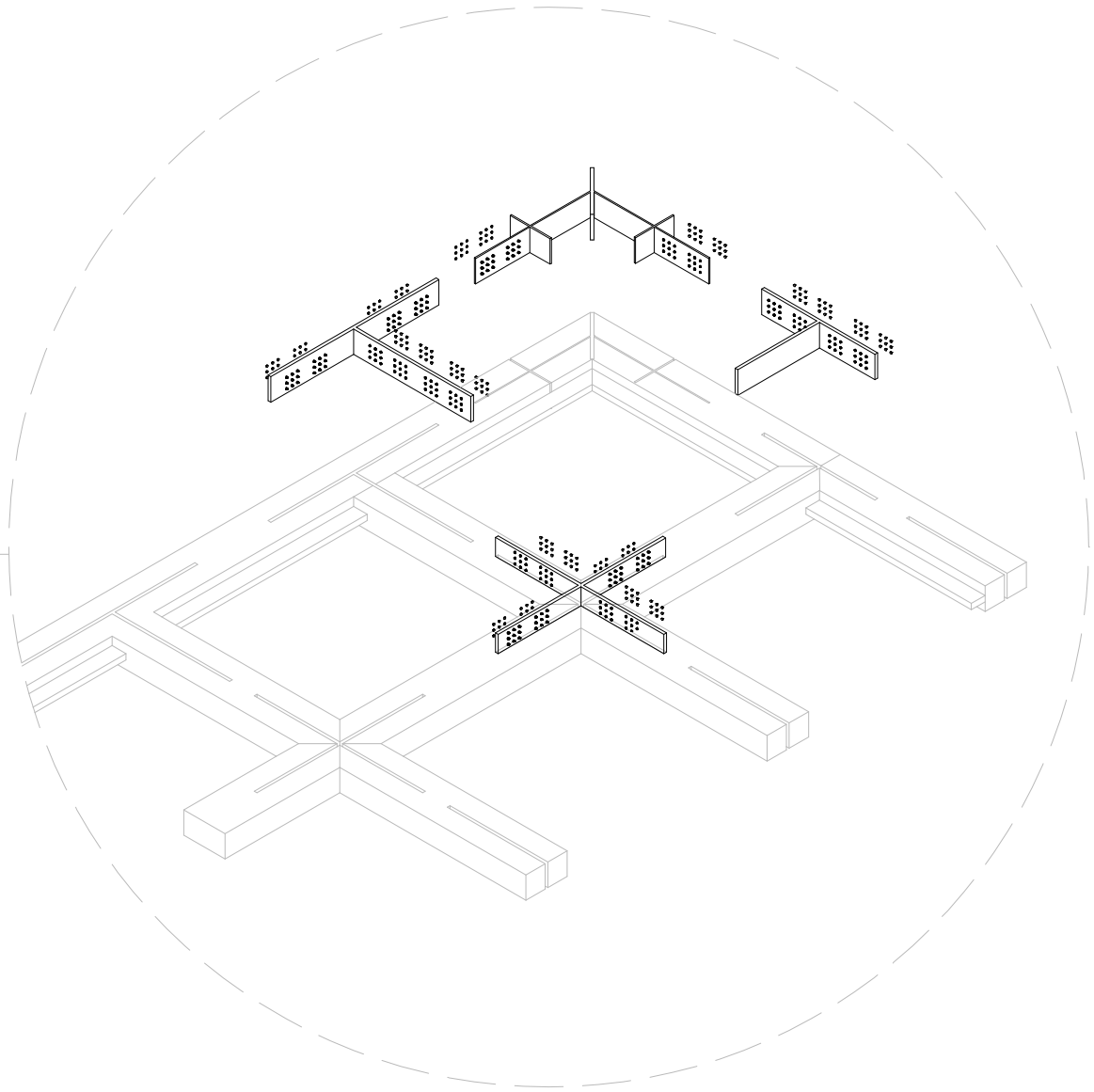
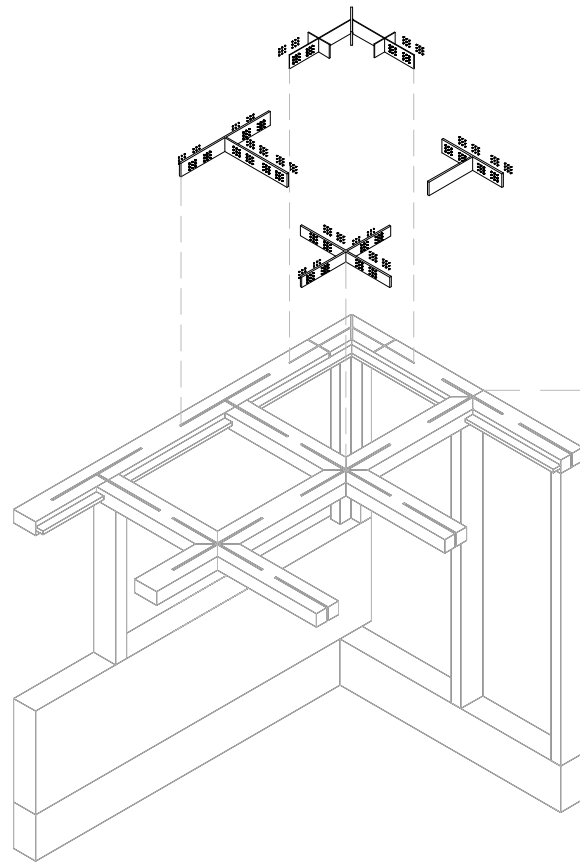
2. Timber column stands on the stiff concrete base to resist the earthquake force



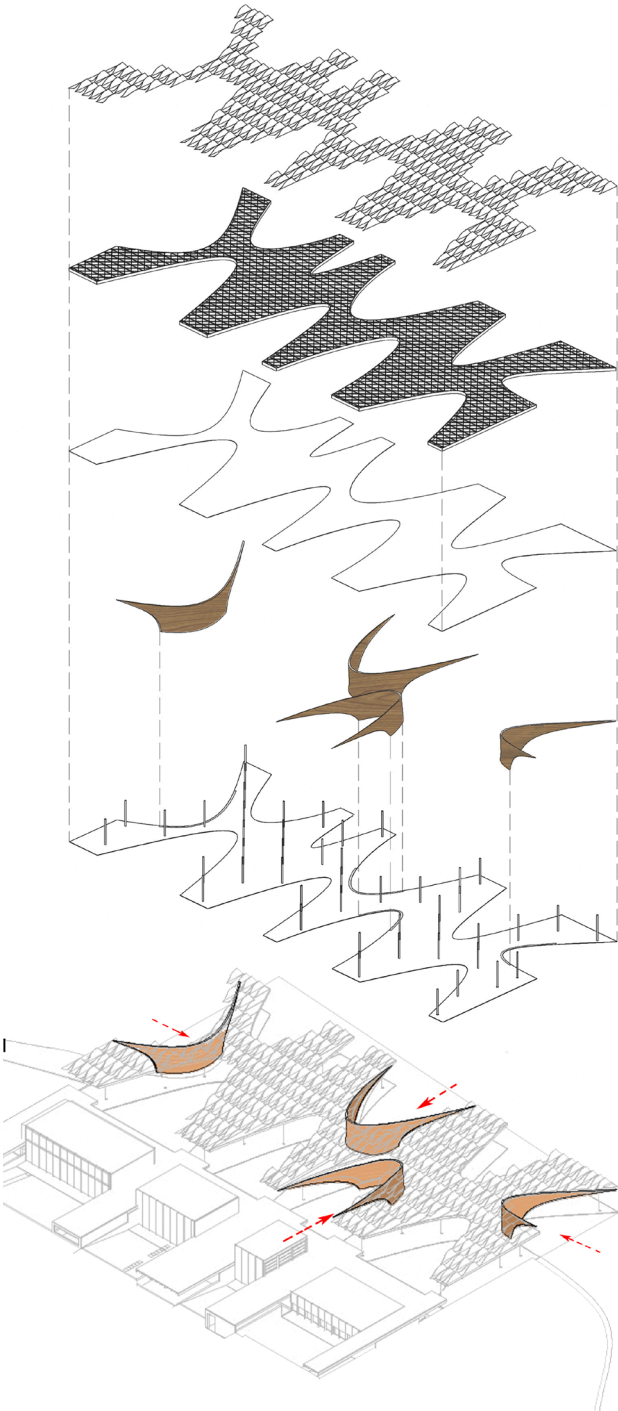
3. timber grid roof is lightweight and flexible



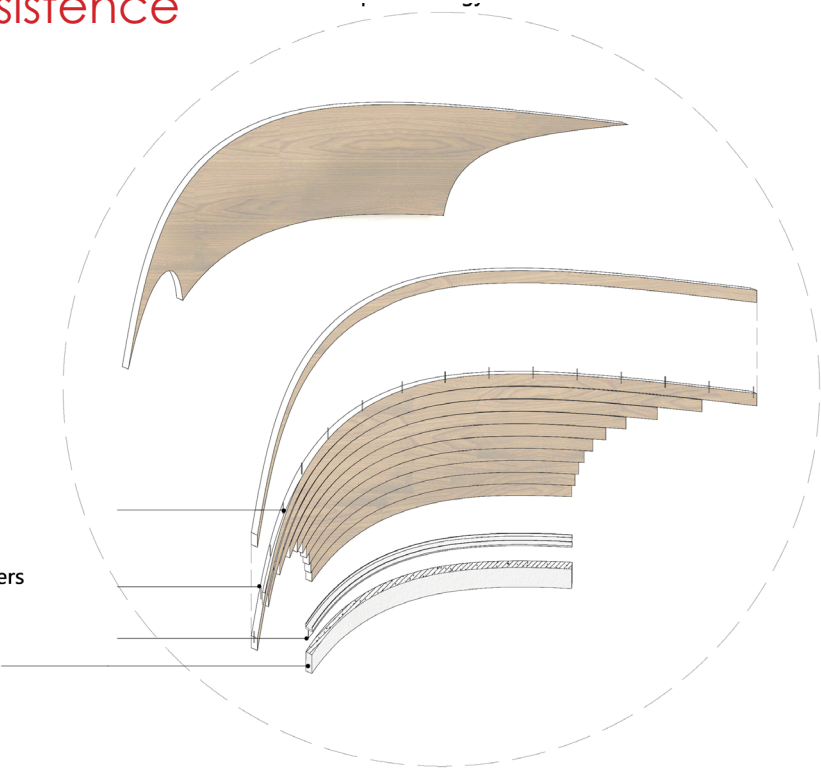
Construction Detail Of Timber grid beam



Pavilion Design: Loadbearing wall, horizontal resistance



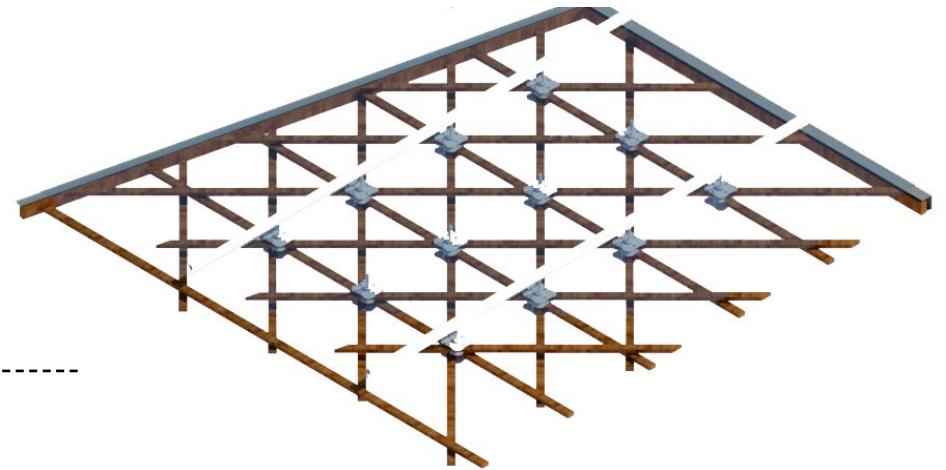
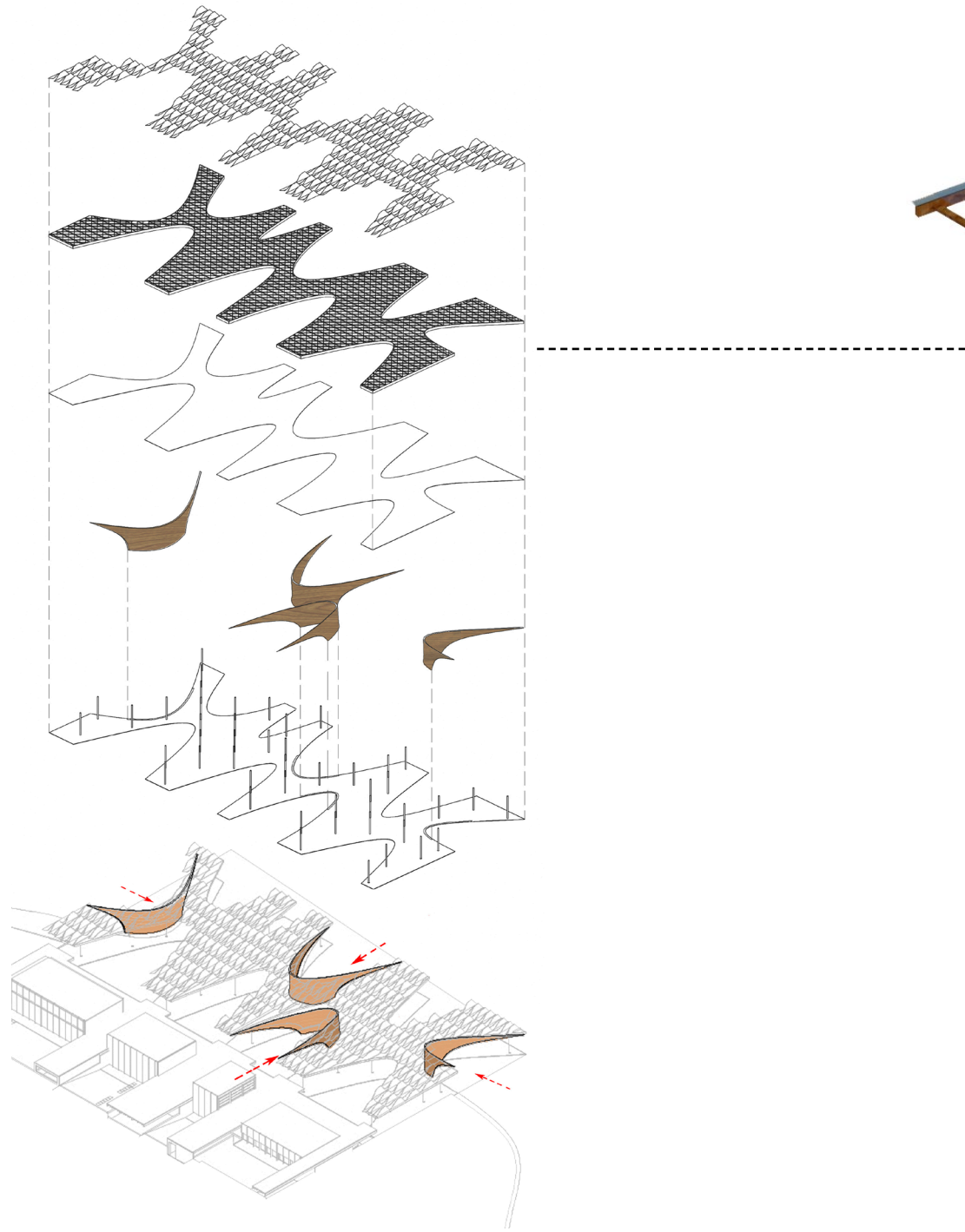
- 1. steel bolt in between connecting adjacent part
- 2. solid wood stack by layers
- 3. steel anchor support
- 4. strip Foundation



Cross-Laminated Timber Wall



Pavilion Design: diagonal grid roof

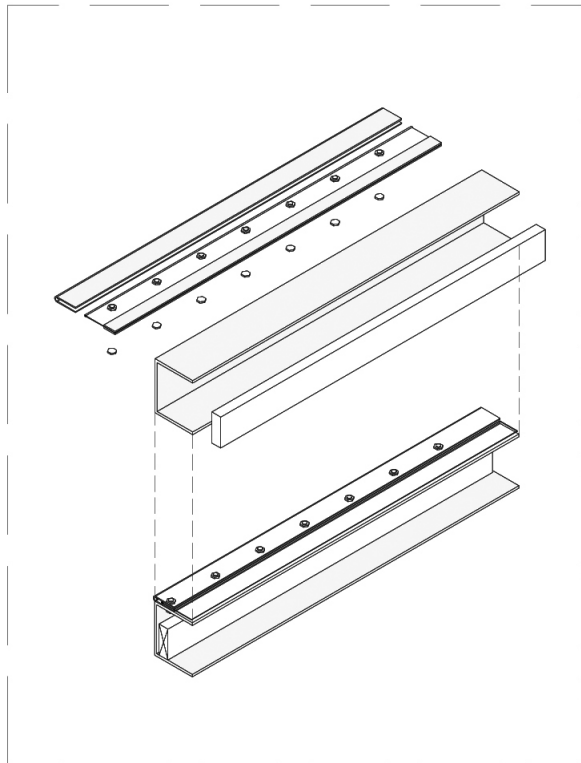


Diagonal grid timber system:Light weight

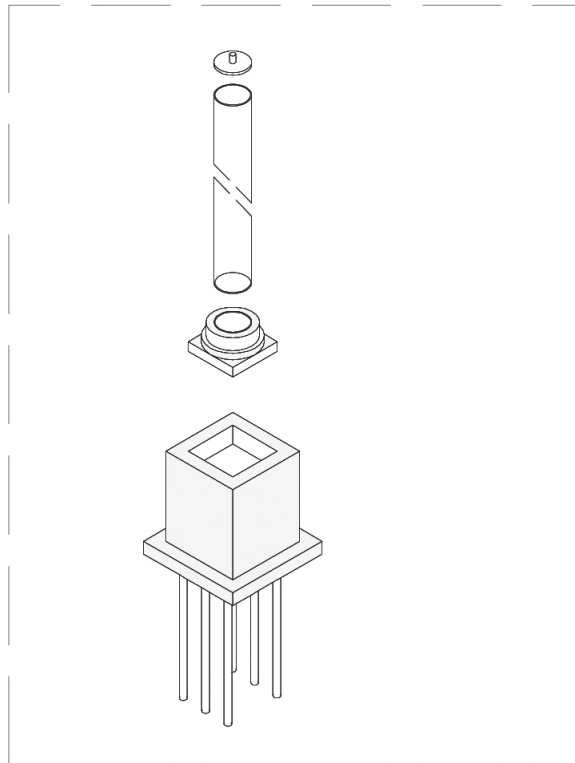


reference structure application

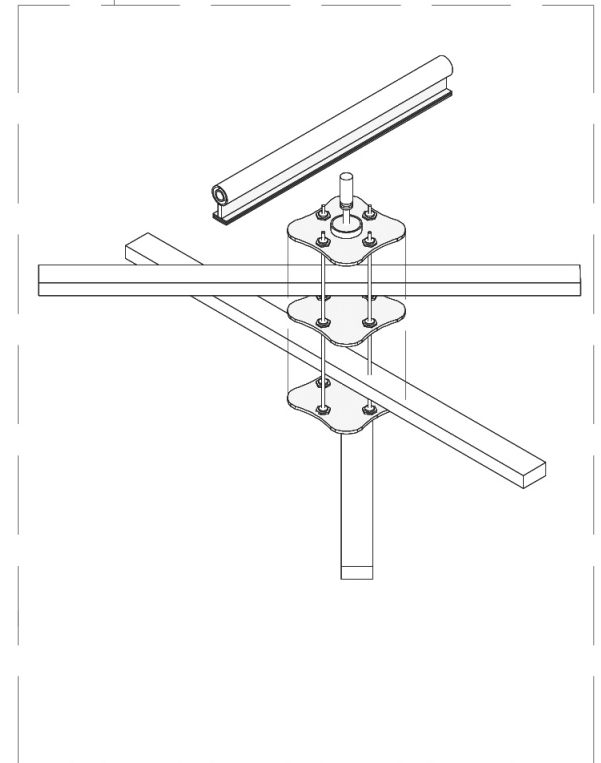
Pavilion Design: the Roof, Eave and column



Eave: Waterproof



Damping material between Base and steel column



pile up one batten above the other and clip with steel joint.



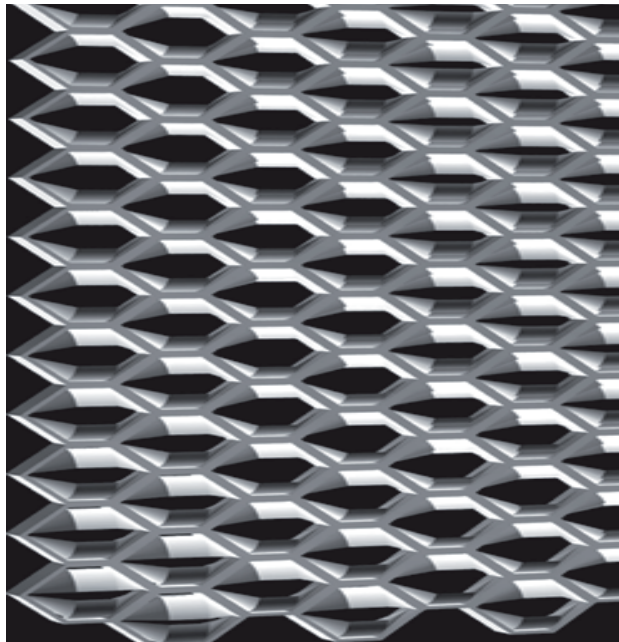
"The Skin of biological organisms are directly analogous to the external walls of buildings: both perform multiple functions. The key challenge, I would argue, is to learn from the levels of integration and performance that can be seen in biological examples and combine that with the best that human ingenuity can deliver."

<Biomimicry Architecture>

Biomimetic Skin: deployable facade system

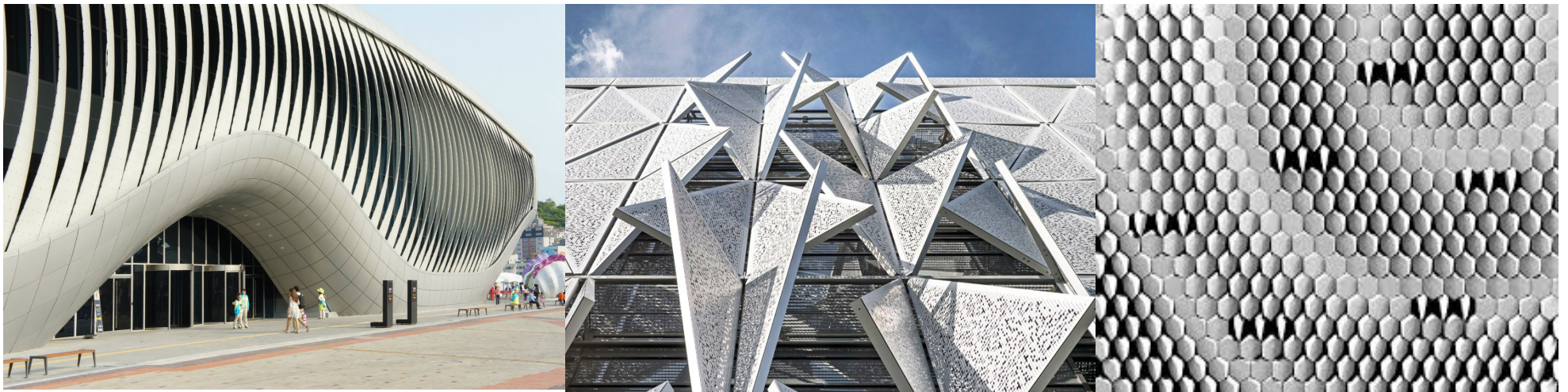
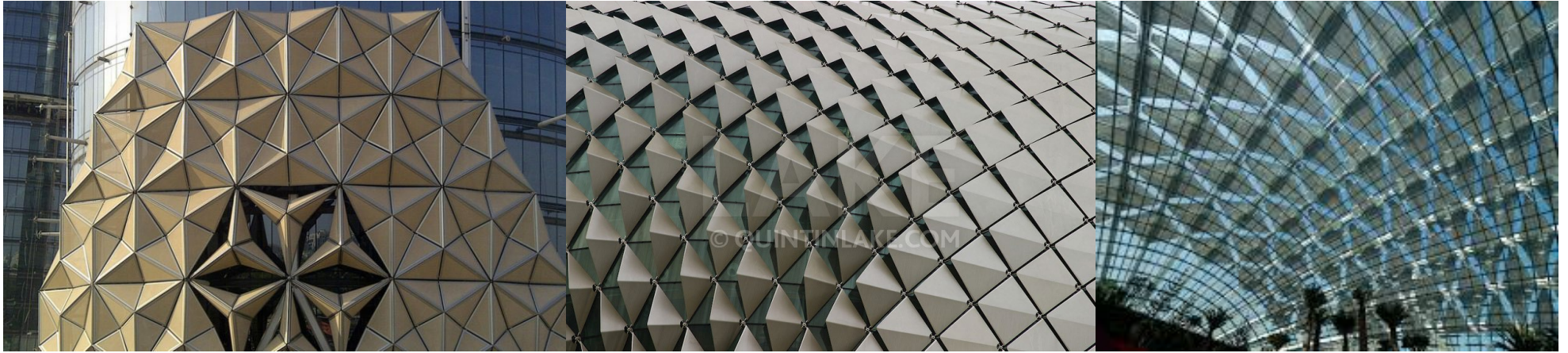


photosynthesis
pores
transpiration of water and CO₂
A double-layer skin



guard cells controlling light and heat transmission
The inner layer of louvers can respond to the various light condition, such as low and high angle light, diffusion light, direct light as for heat entry and dissipation

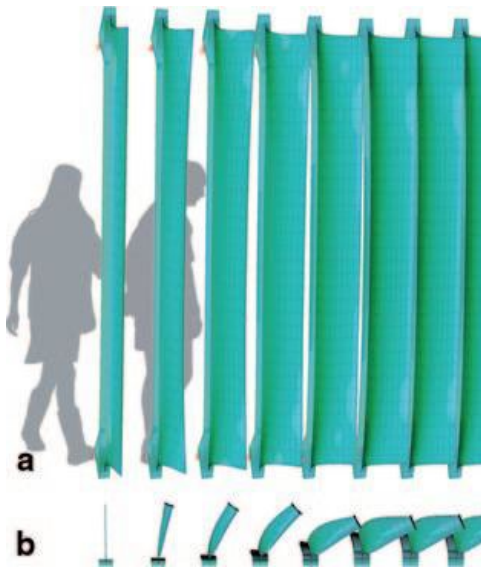
Architecture Application : deployable surface



Responsive facade design

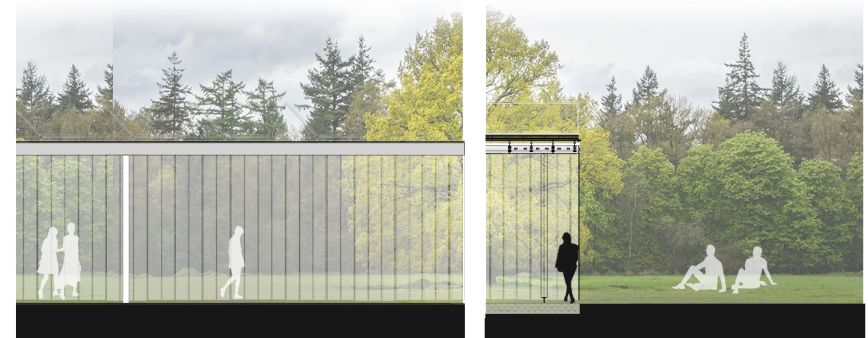
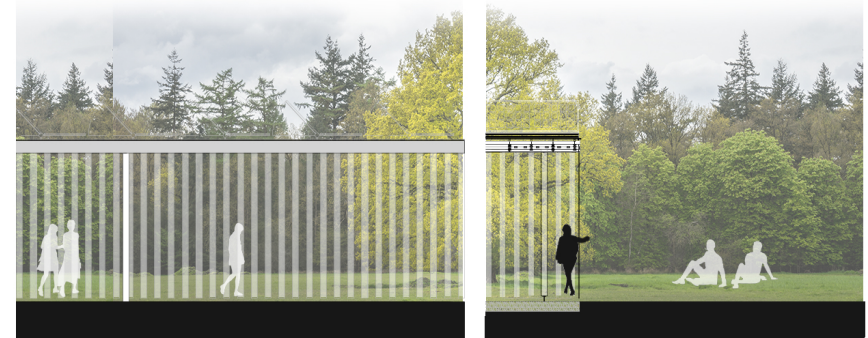
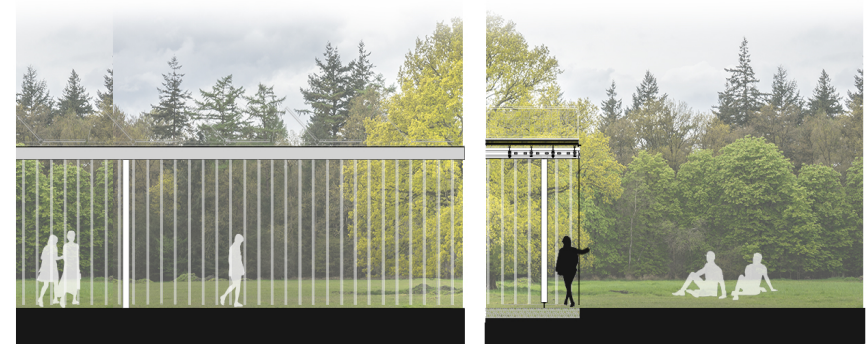


Non-autonomous facade system of "One Ocean" Expo pavilion



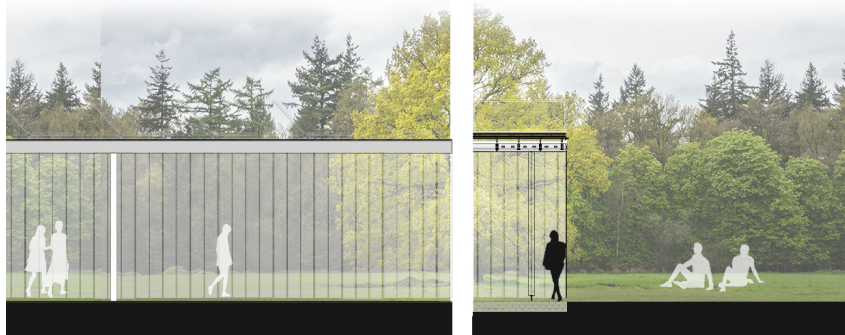
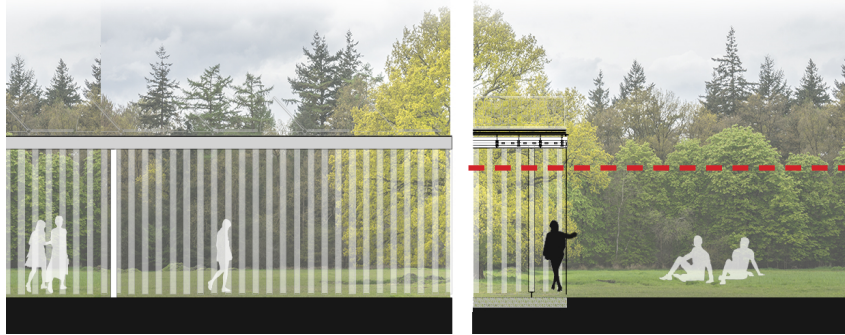
Closed white polymer: Block sight view

Transformation



From Seeing to Touching

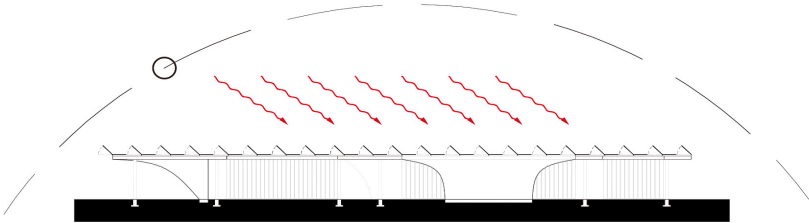
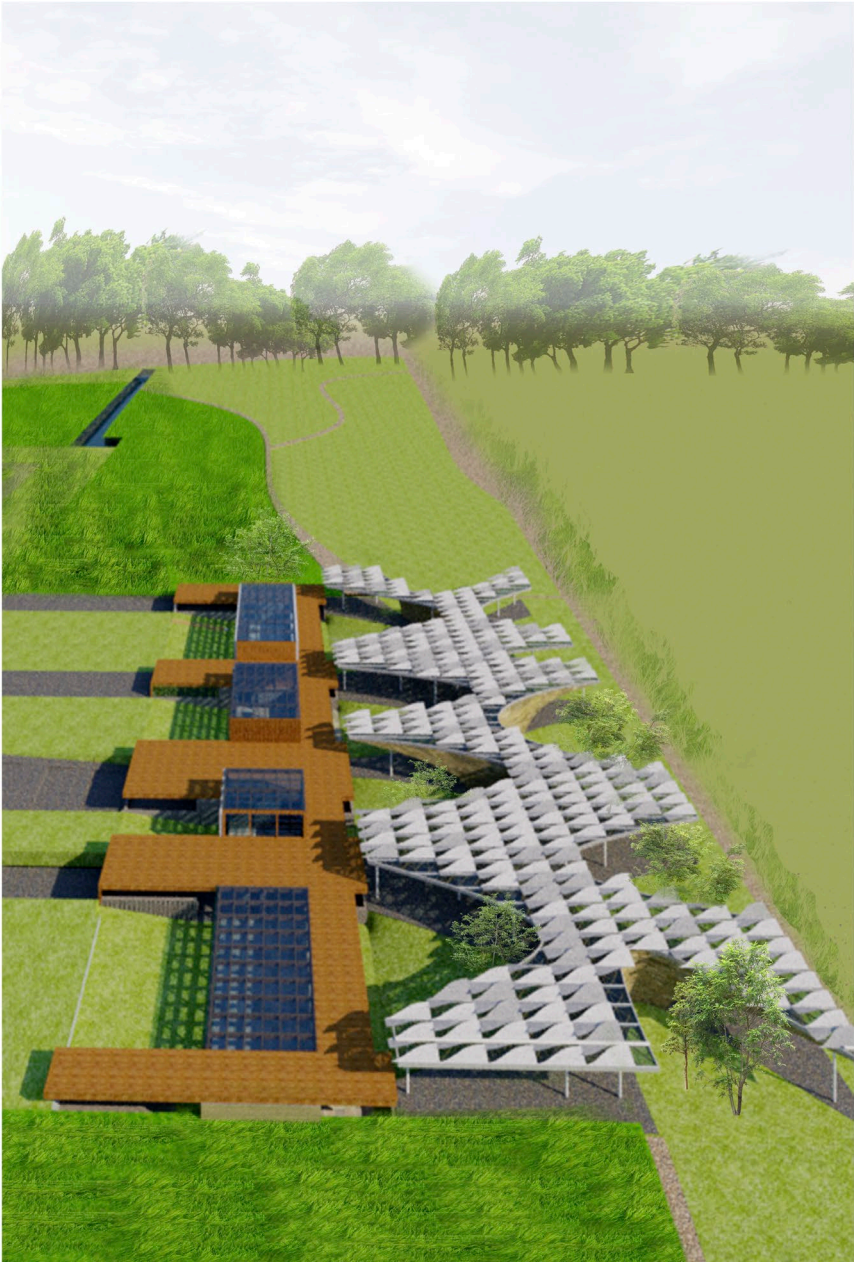
Responsive facade design: materialization



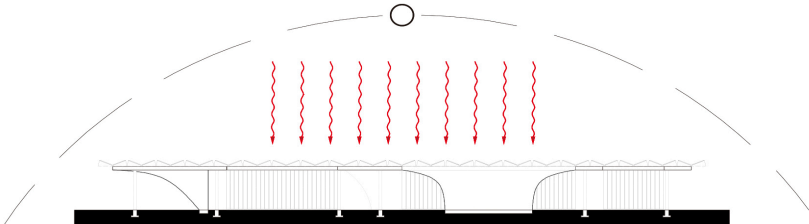
An Landscape Museum Design by RCR Ateiler

95% Transparent PVC : extend sight view

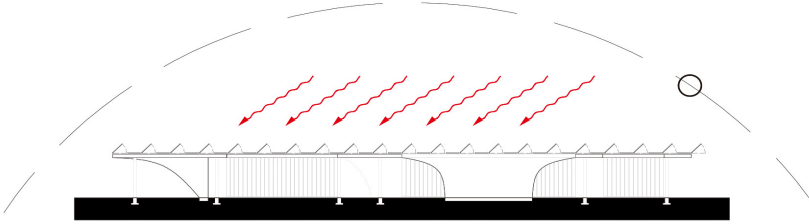
Solar-tracking Louver design



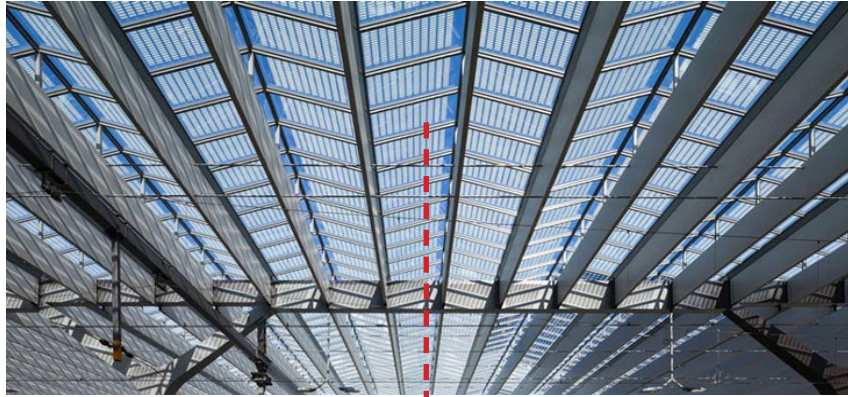
Morning



noon



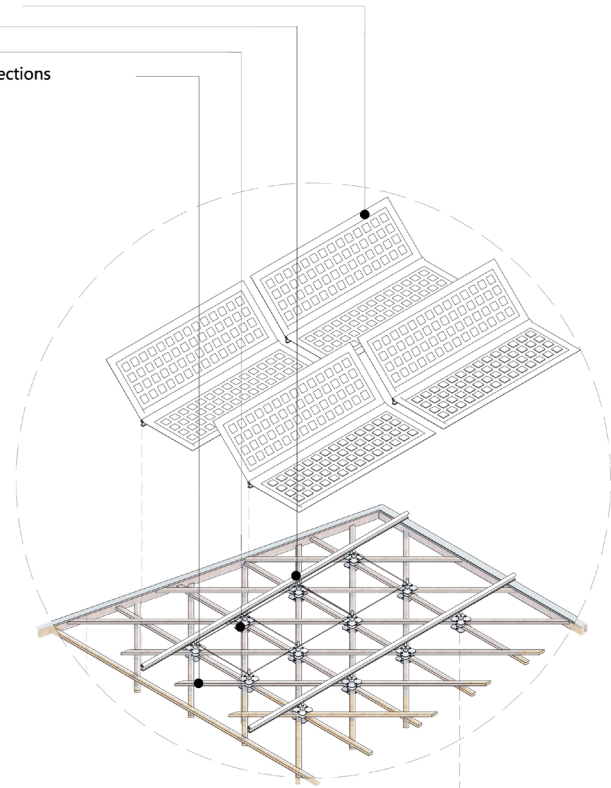
Solar-tracking louver: Material



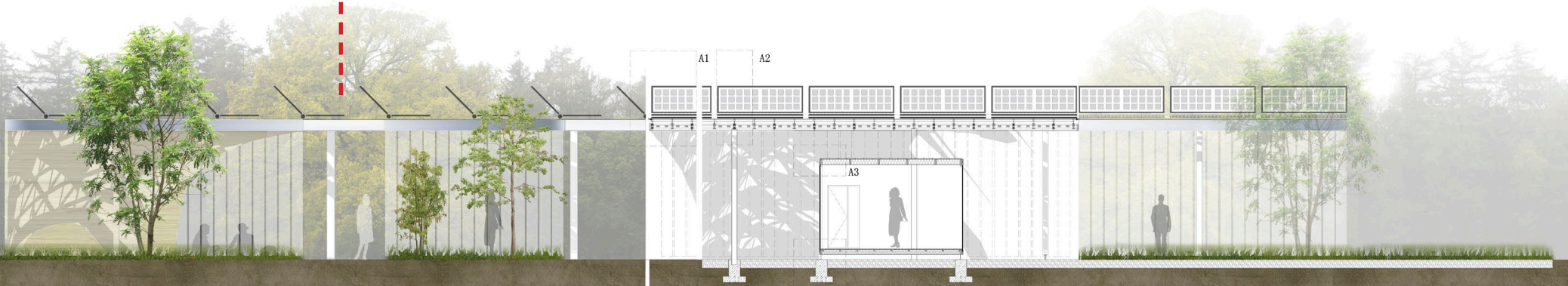
silicon solar cells on the glass louver panels

1. Solar-tracking louvers
2. rotating bar
3. steel joint
4. timber battens in three directions

solar-tracking louvers



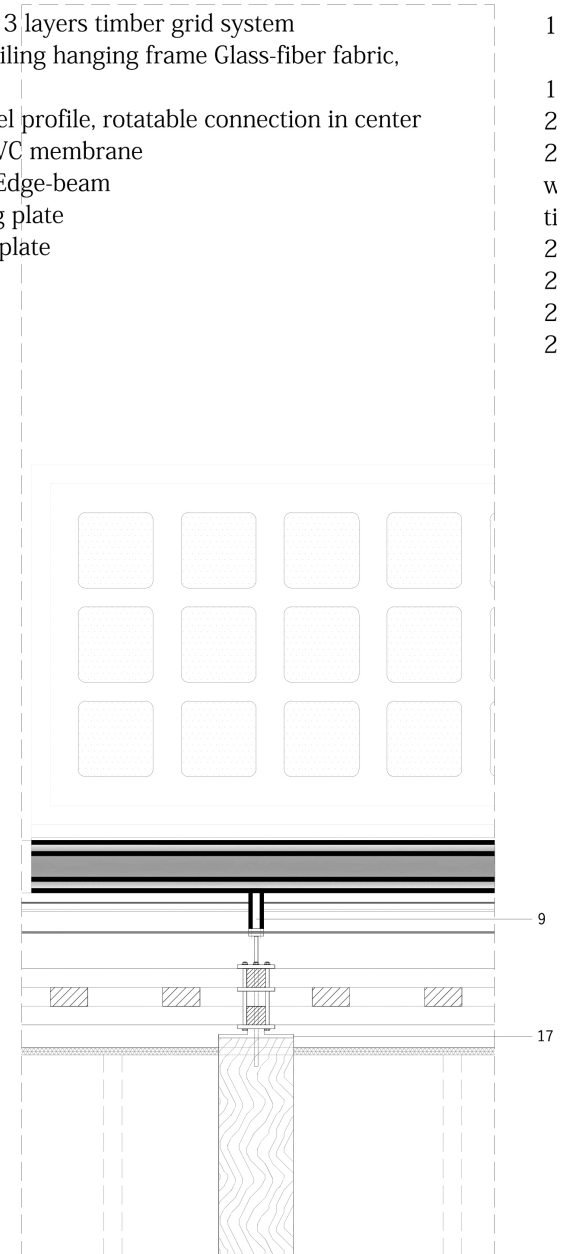
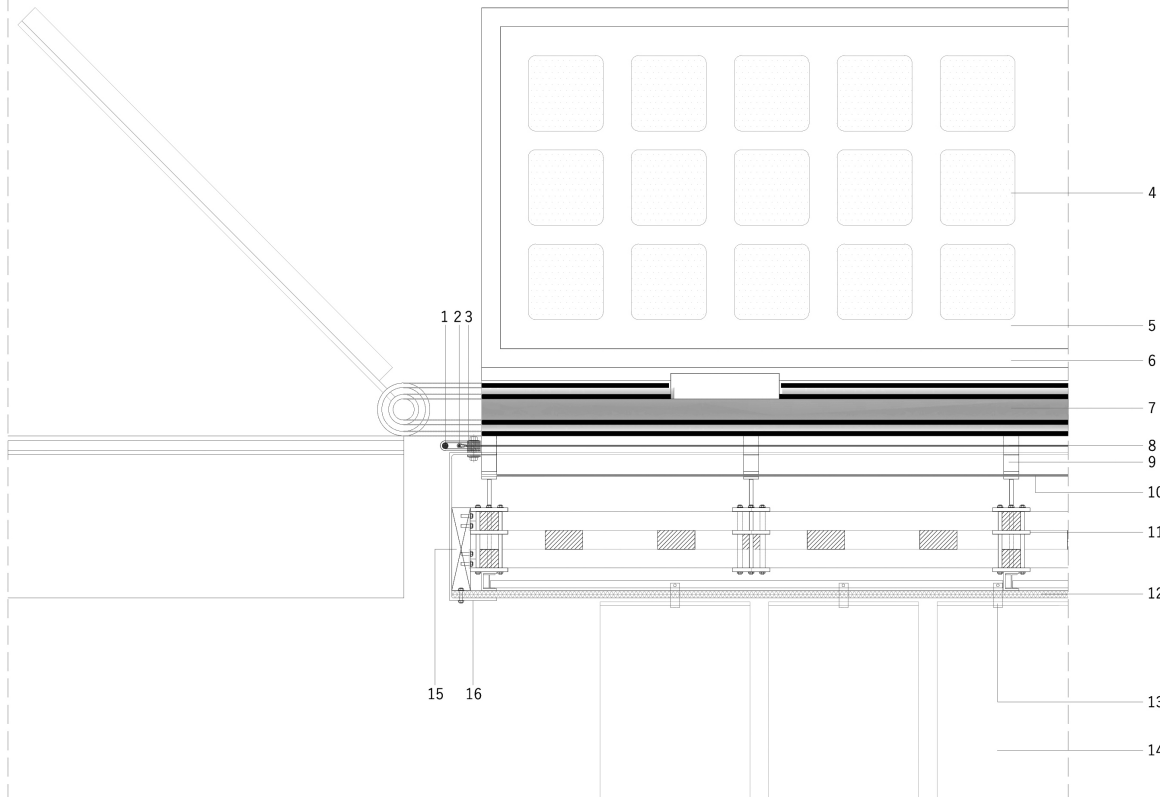
Diagonal grid roof system



Solar-tracking louver: Construction

1. metal strip, edge cable
2. Keder
3. Clamping bar
4. 200um in thickness bulk solar cell, crystalline silicon
5. 3000/900mm solar-tracking sun-shading louver panels
6. 40/40/5mm alluminum frame hooking solar-tracking sun-shading louvers
7. 140/12mm,80/12mm CHS rotating bar of solar-tracking sun-shading louver panels
8. tensioned PTFE coated glass-fibre cloth.
9. 40/5mm CHS supporting bar
10. steel cable connecting timber diagonal grid structure

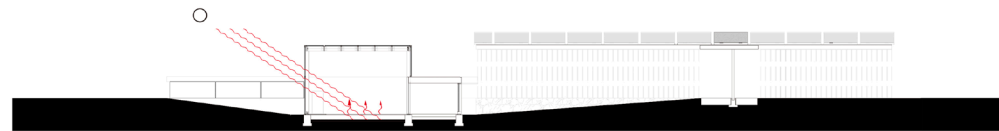
11. 180mm steel clamp 3 layers timber grid system
12. 50/50/5mm SHS ceiling hanging frame Glass-fiber fabric, silicon coated ceiling
13. 1.5mm stainless-steel profile, rotatable connection in center
14. 3mm transparent PVC membrane
15. 220/50mm timber Edge-beam
16. 6mm metal covering plate
17. upper steel bearing plate



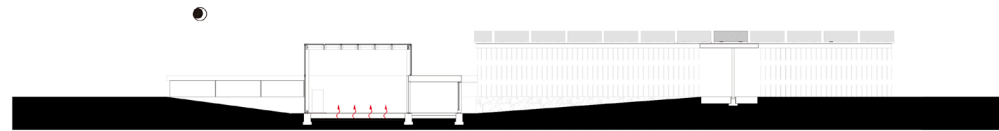
1
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Climate Design & Light Environment

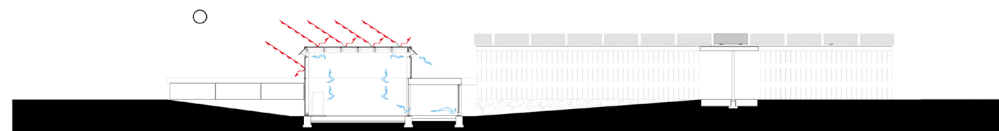
overheated- Temperature- Heat Pump- Passive ventilation system



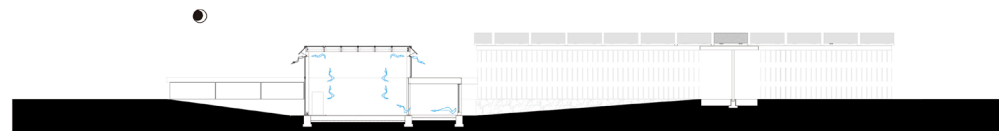
Winter day



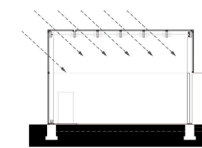
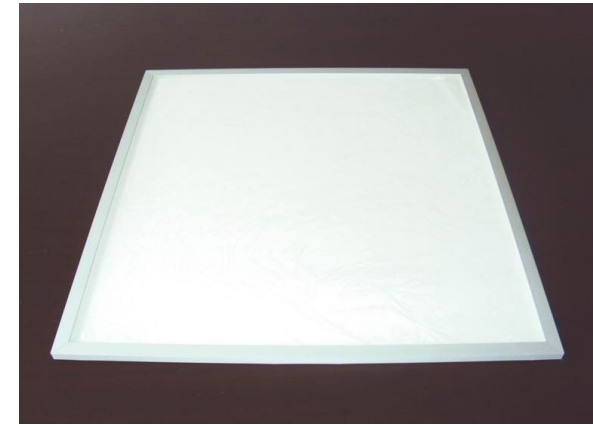
Winter night



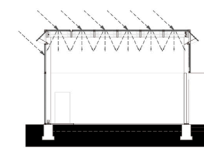
Summer day



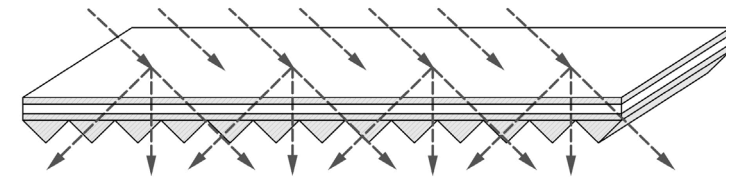
Summer night



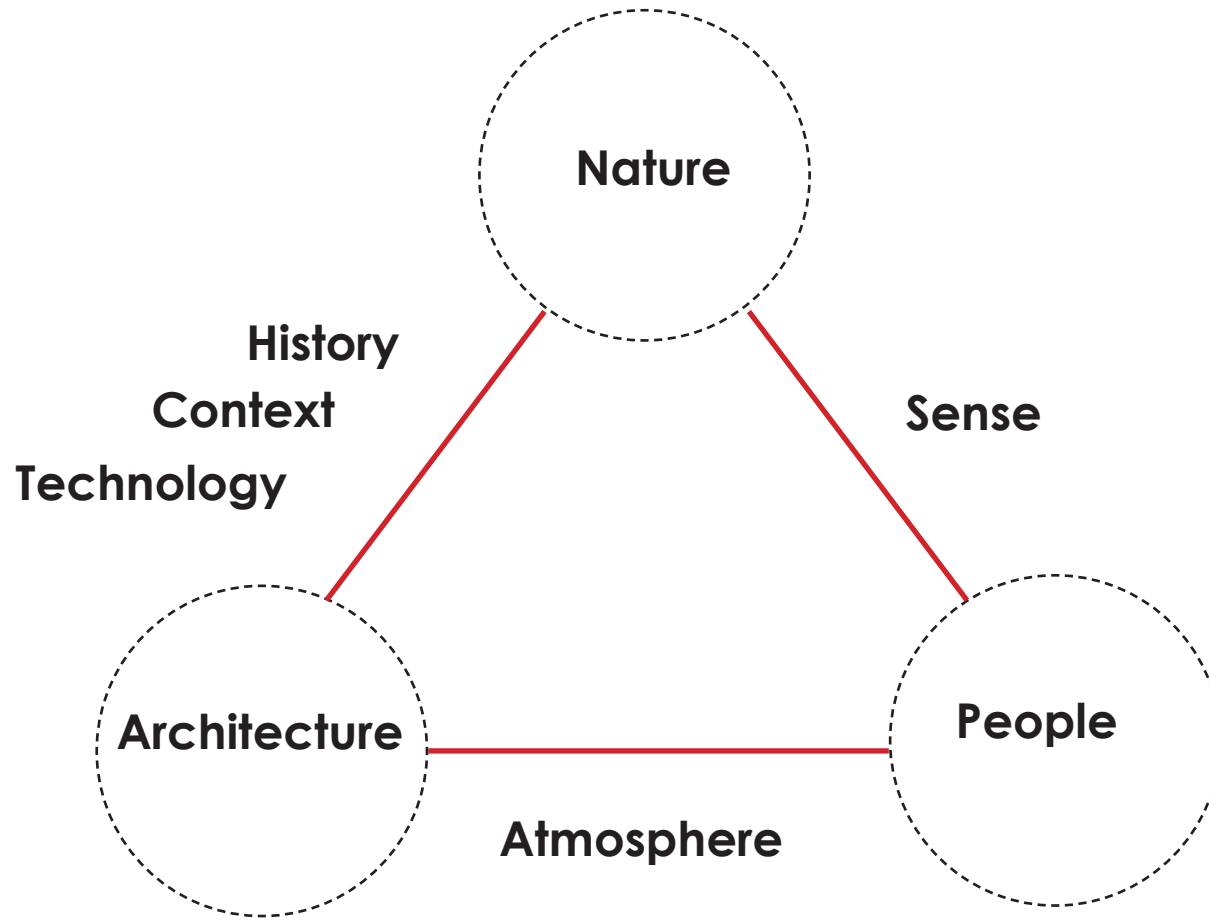
Direct light



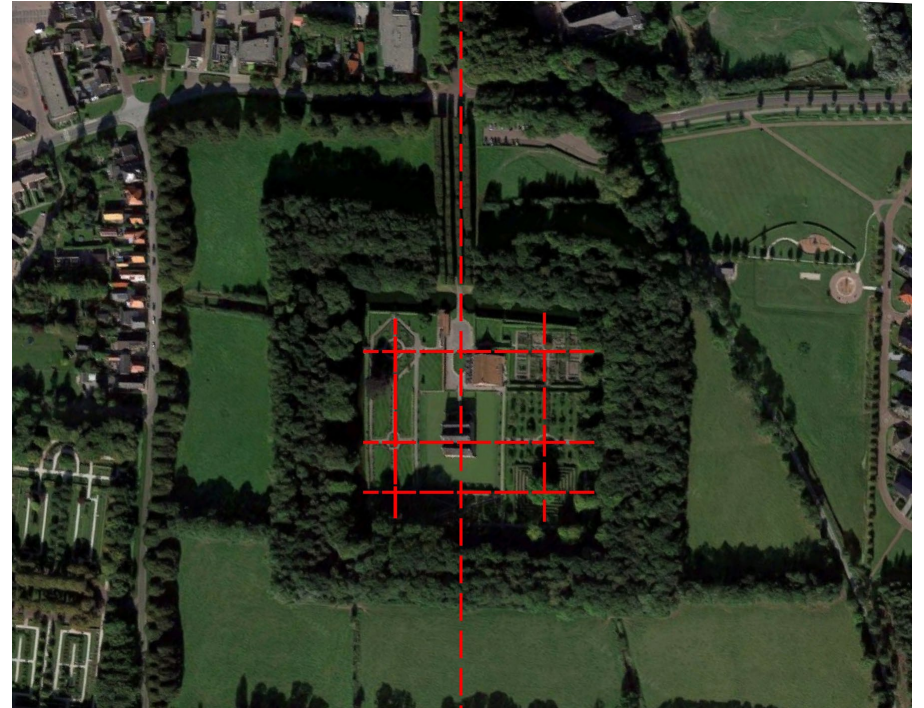
diffusion light



prismatic glass diffuse light

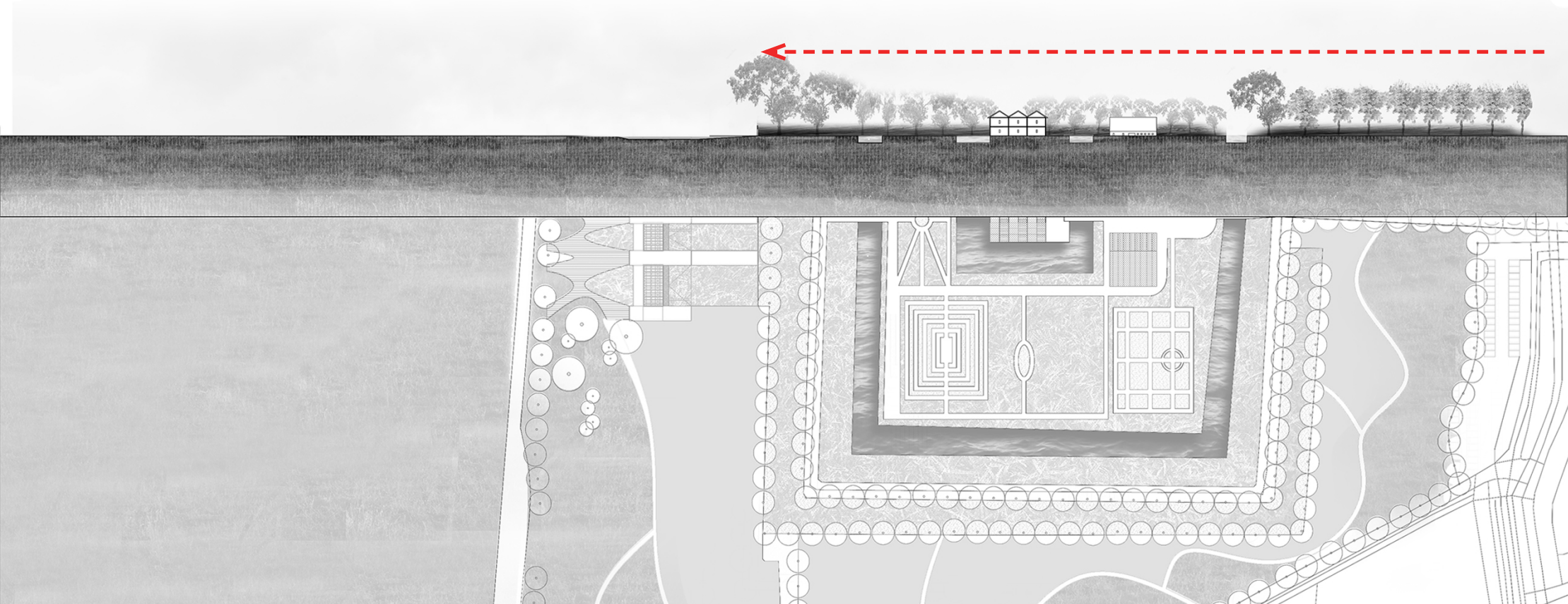


CONTEXT

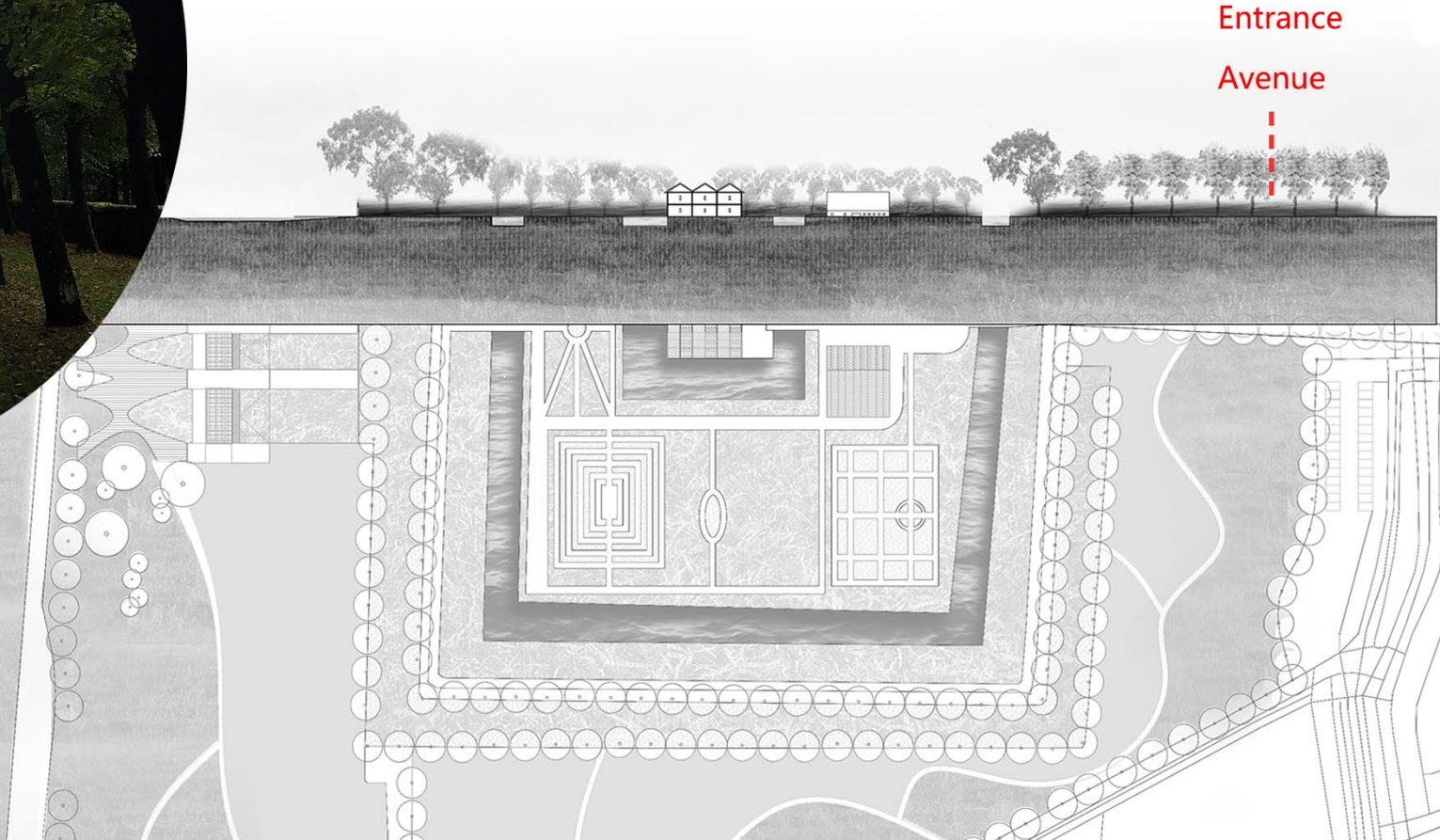


"The gardens are marked by a clear cut, orderly and symmetrical layout with principal axis and a transverse axis which intersect at the center of the house. The style proclaims "rationalism is the ruler of nature."

How Do we experience the Nature?



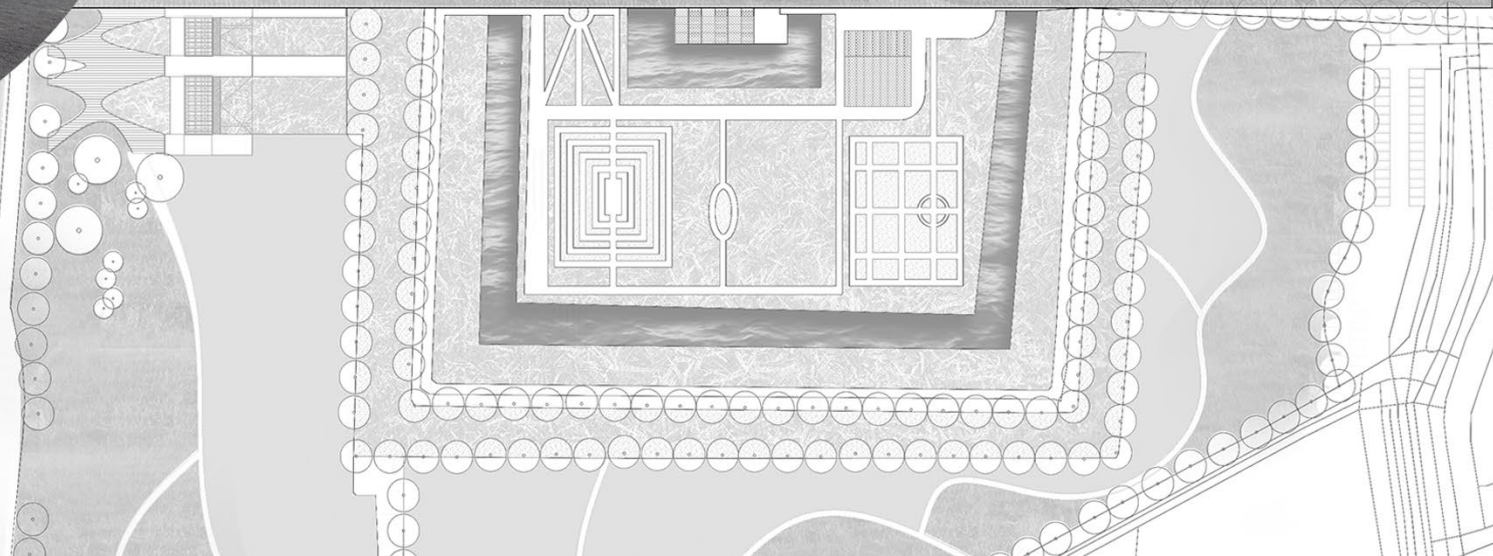
Spatial Sequence :



Spatial Sequence :



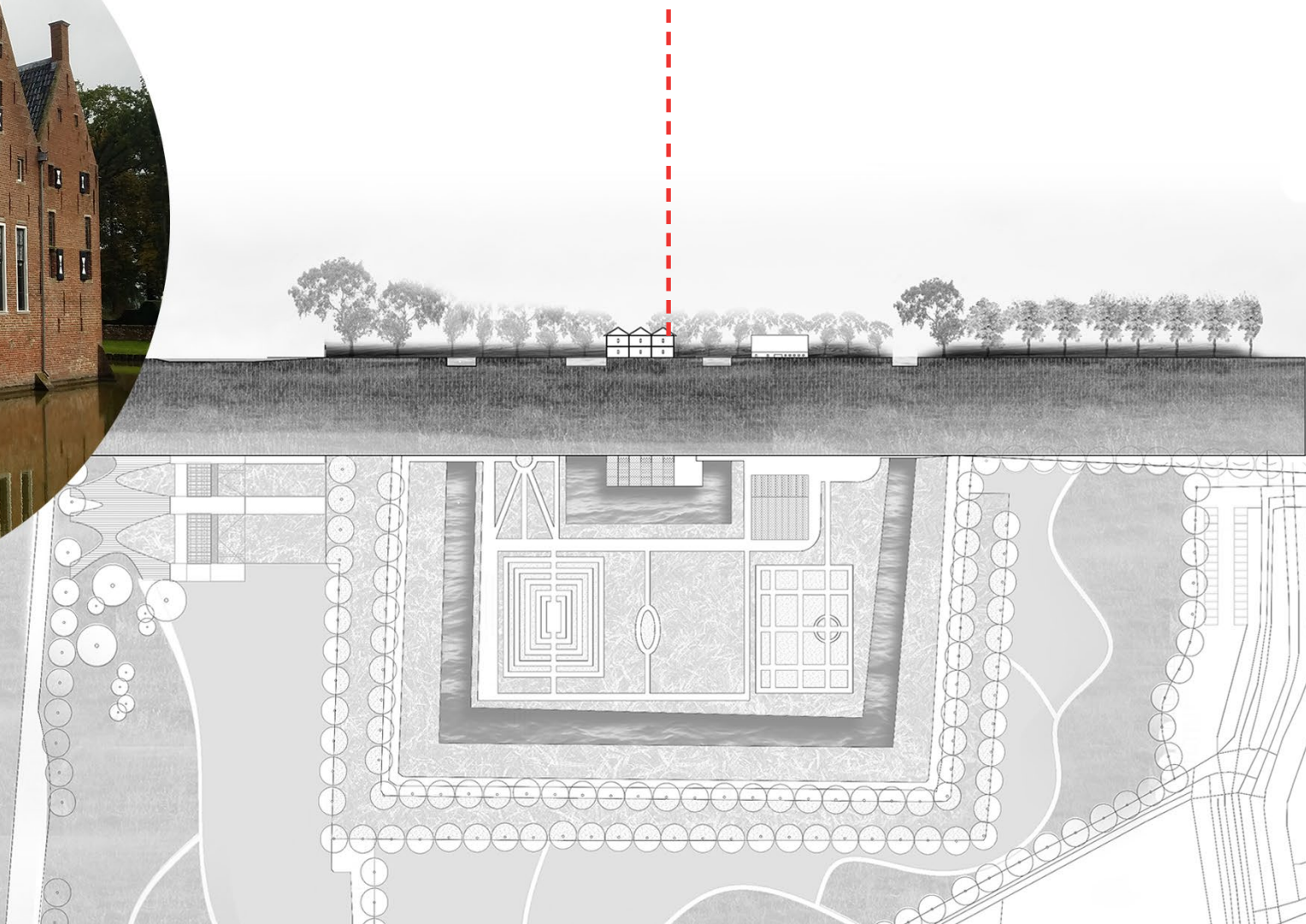
Small Square Closed Wall



Spatial Sequence :



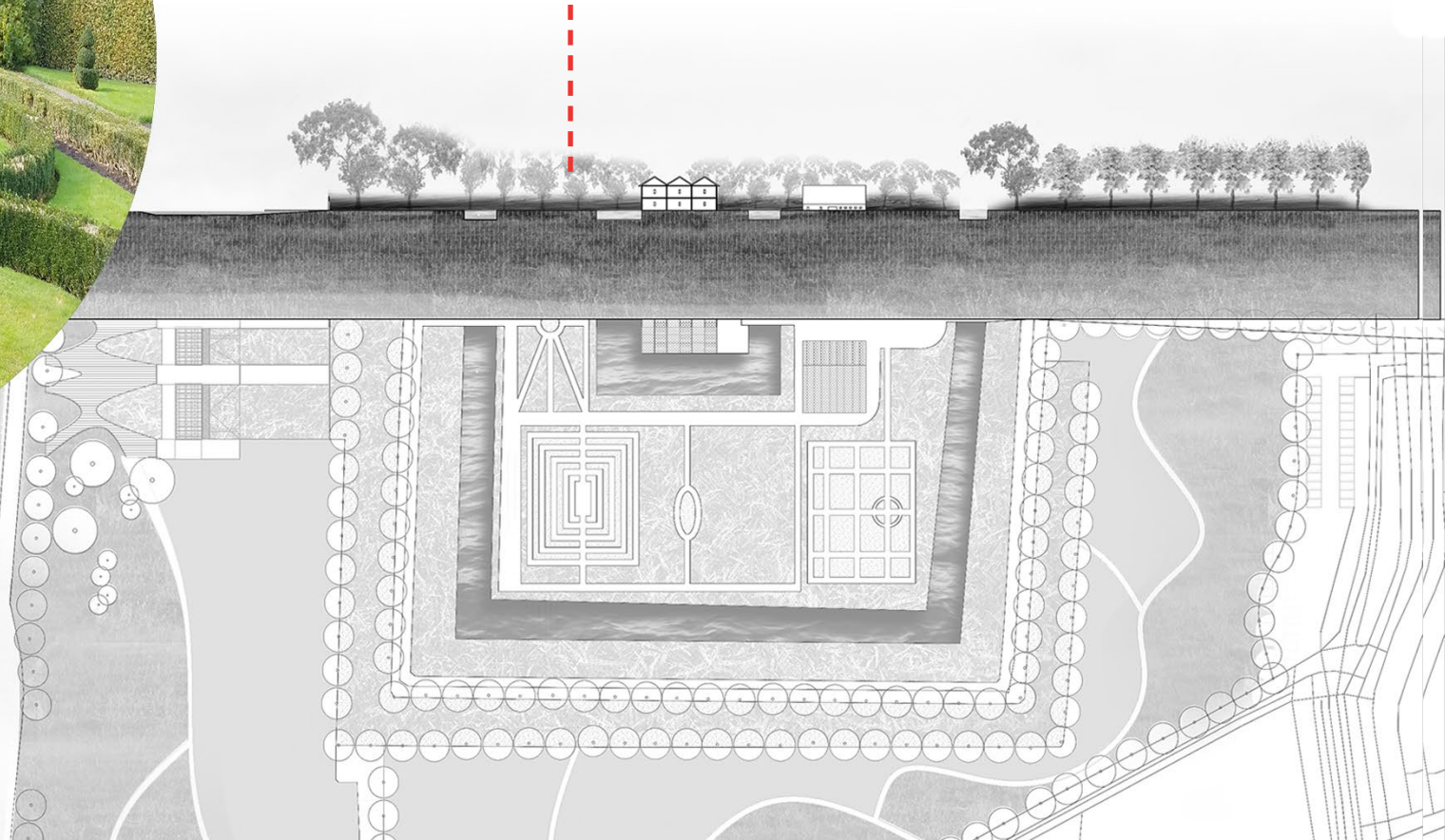
Historical Museum



Spatial Sequence :



Garden

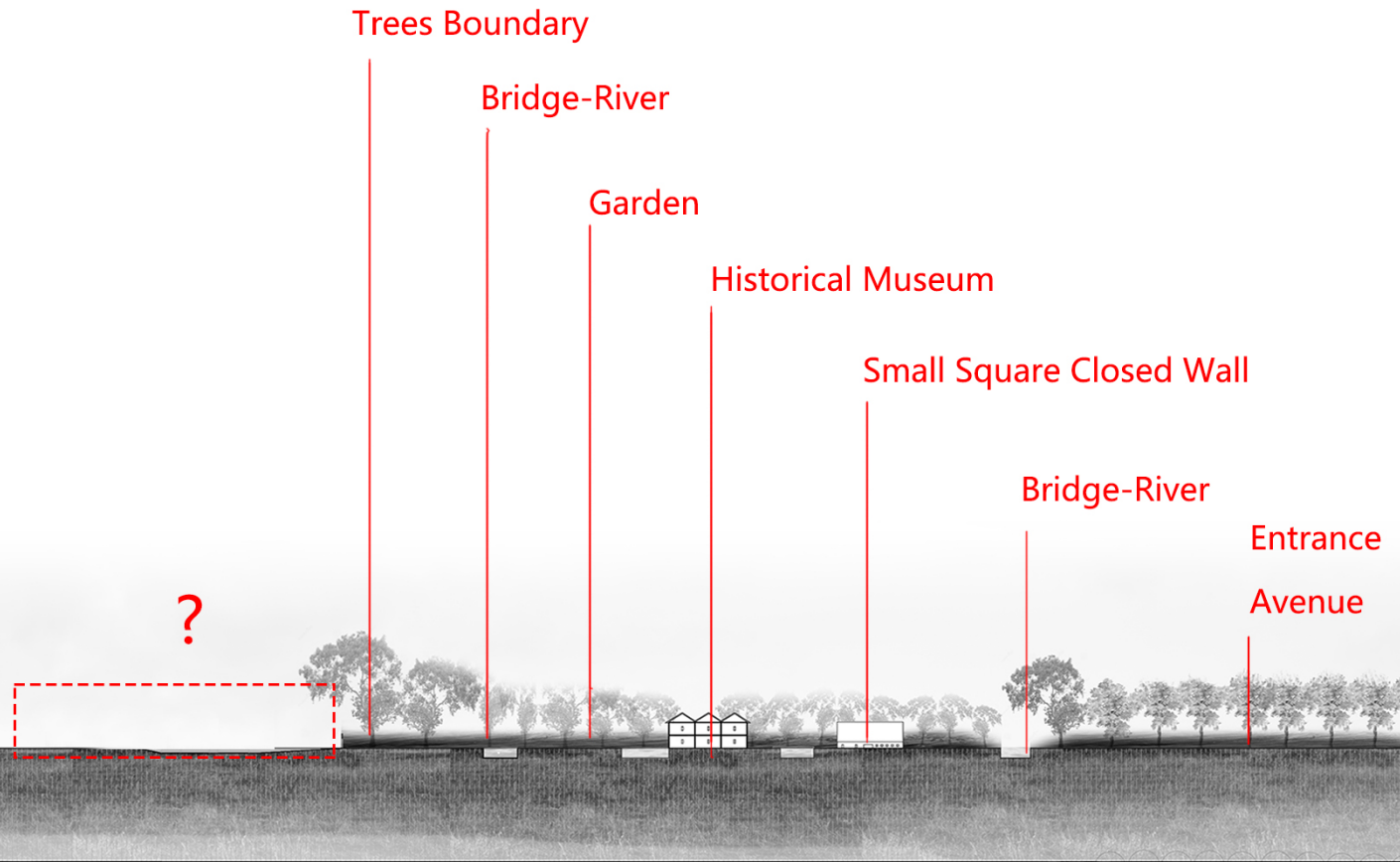


Spatial Sequence :

Trees Boundary



Spatial Sequence :



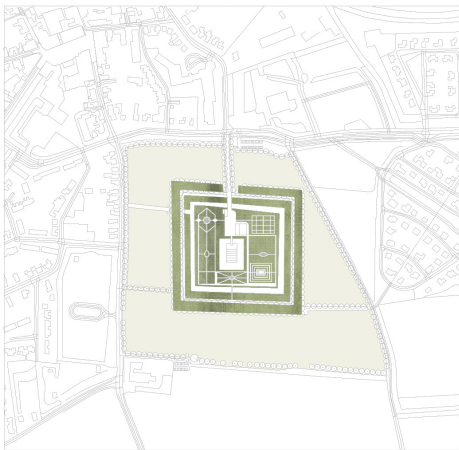
Design Question :

How to intervene into the existing context in a dialogue with the historical garden?

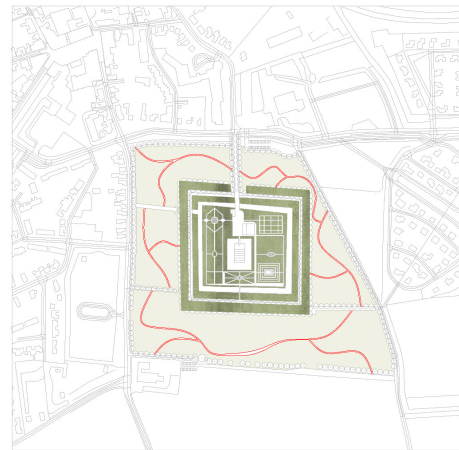
Design Approach :

Extending the existing Landscape into architecture , guiding people into new garden with continuous spatial sequence.

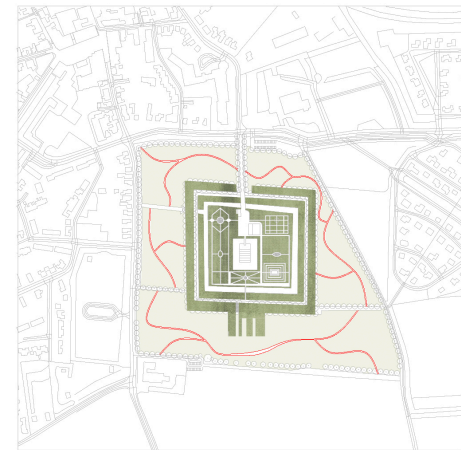
Intervention Into Context



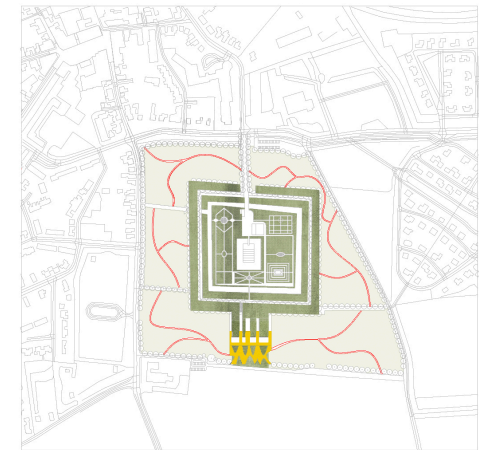
Original Historical Garden



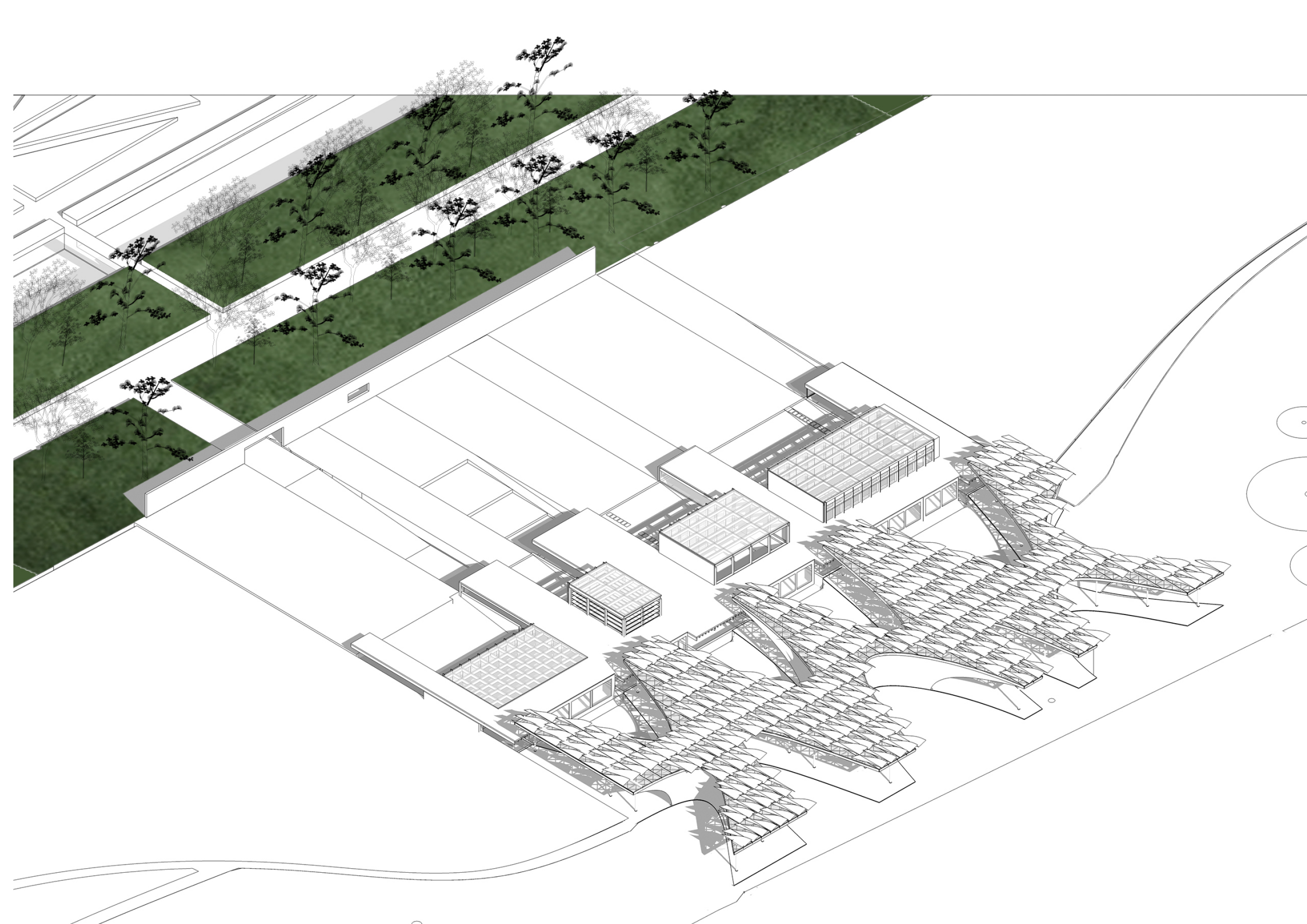
Insert a new walking route into the outer range of garden

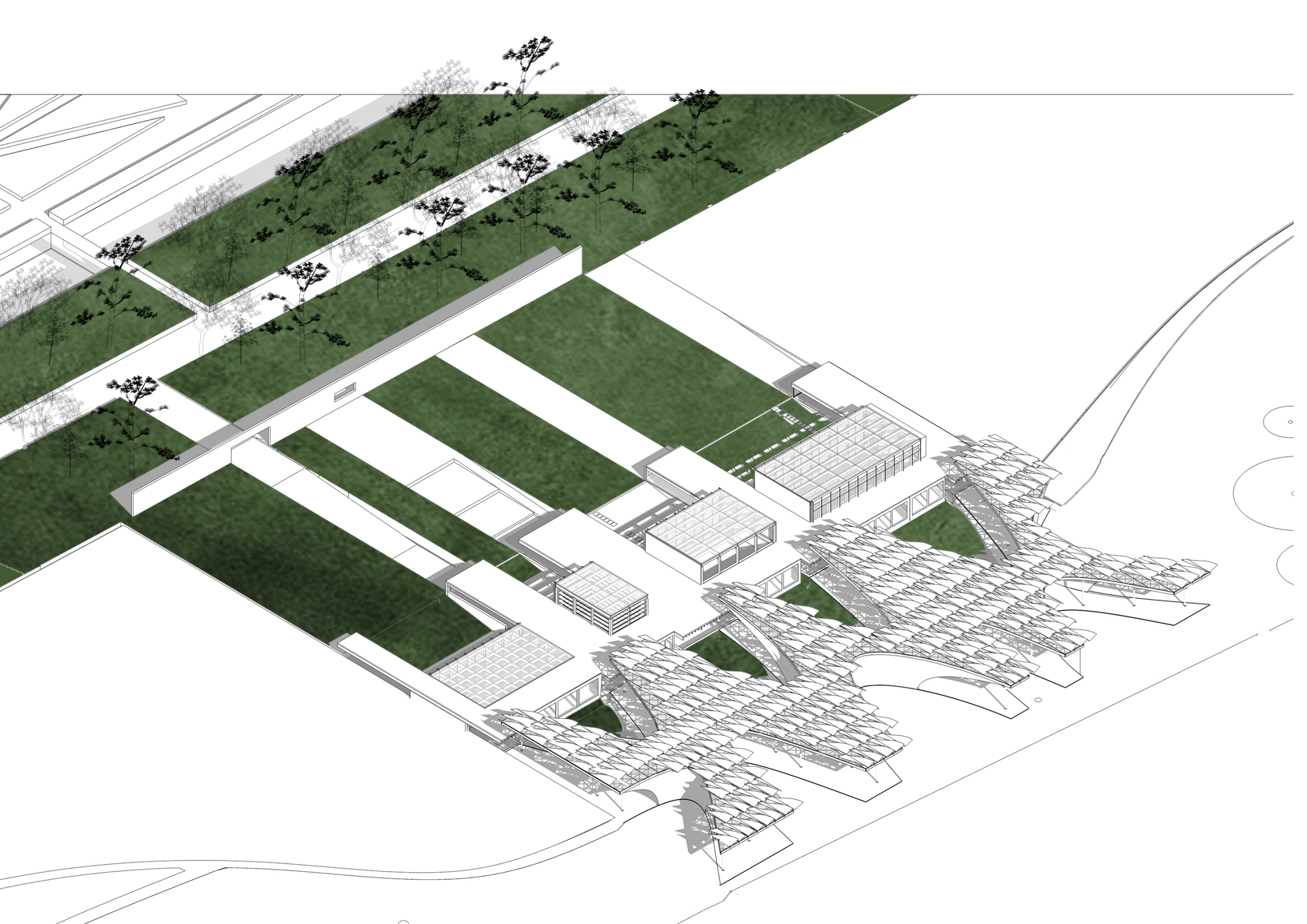


Extending the landscape of garden following center axis.



My botanical exhibition center design is at the end of the spatial sequence.







DOMIESTOEN_rietorchis

沼泽兰花



wormwood

艾草



Harlem windbell

哈莱姆 风铃花



Melegris

川贝母



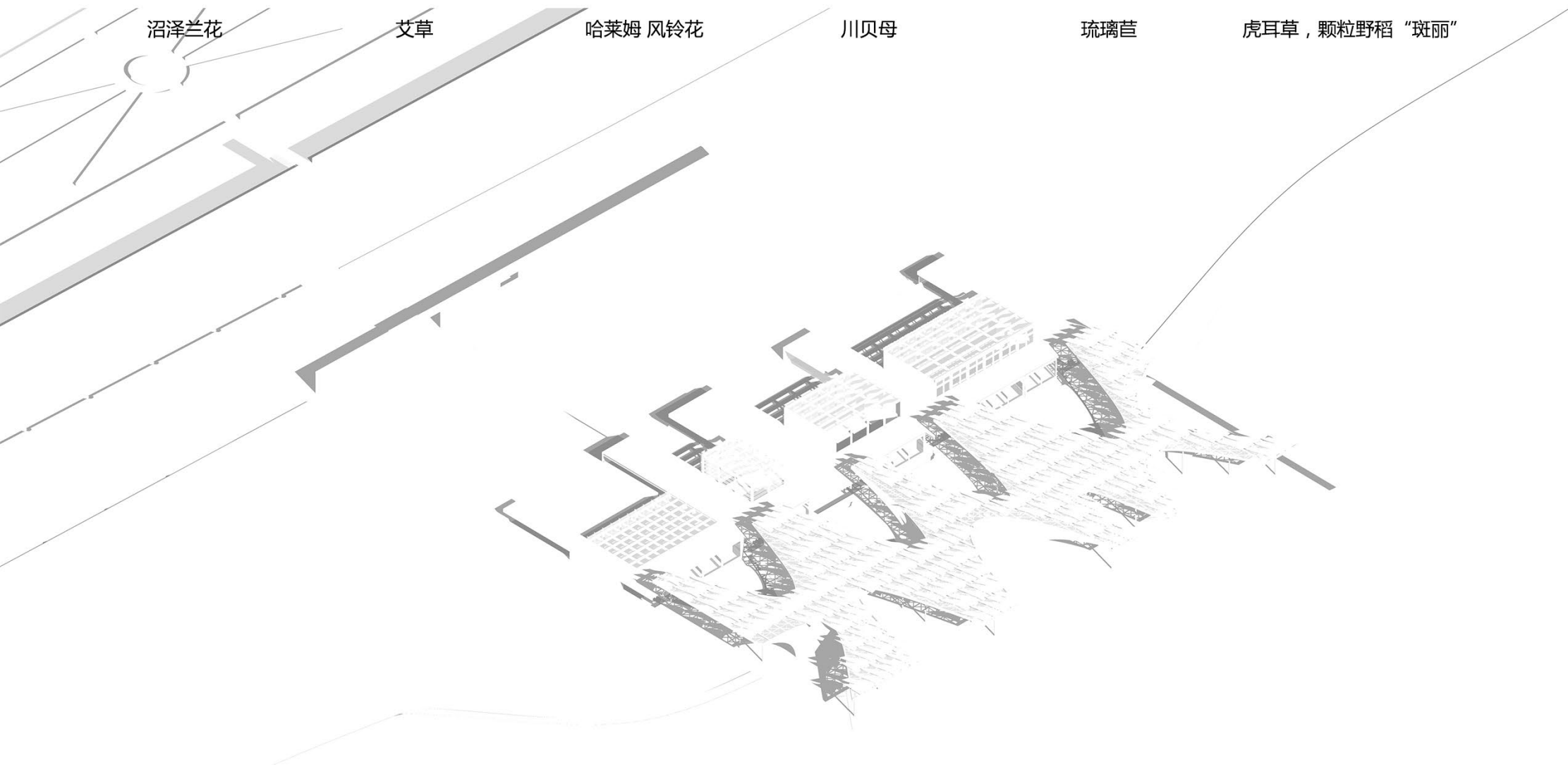
Borage

琉璃苣



Saxifraga granulata

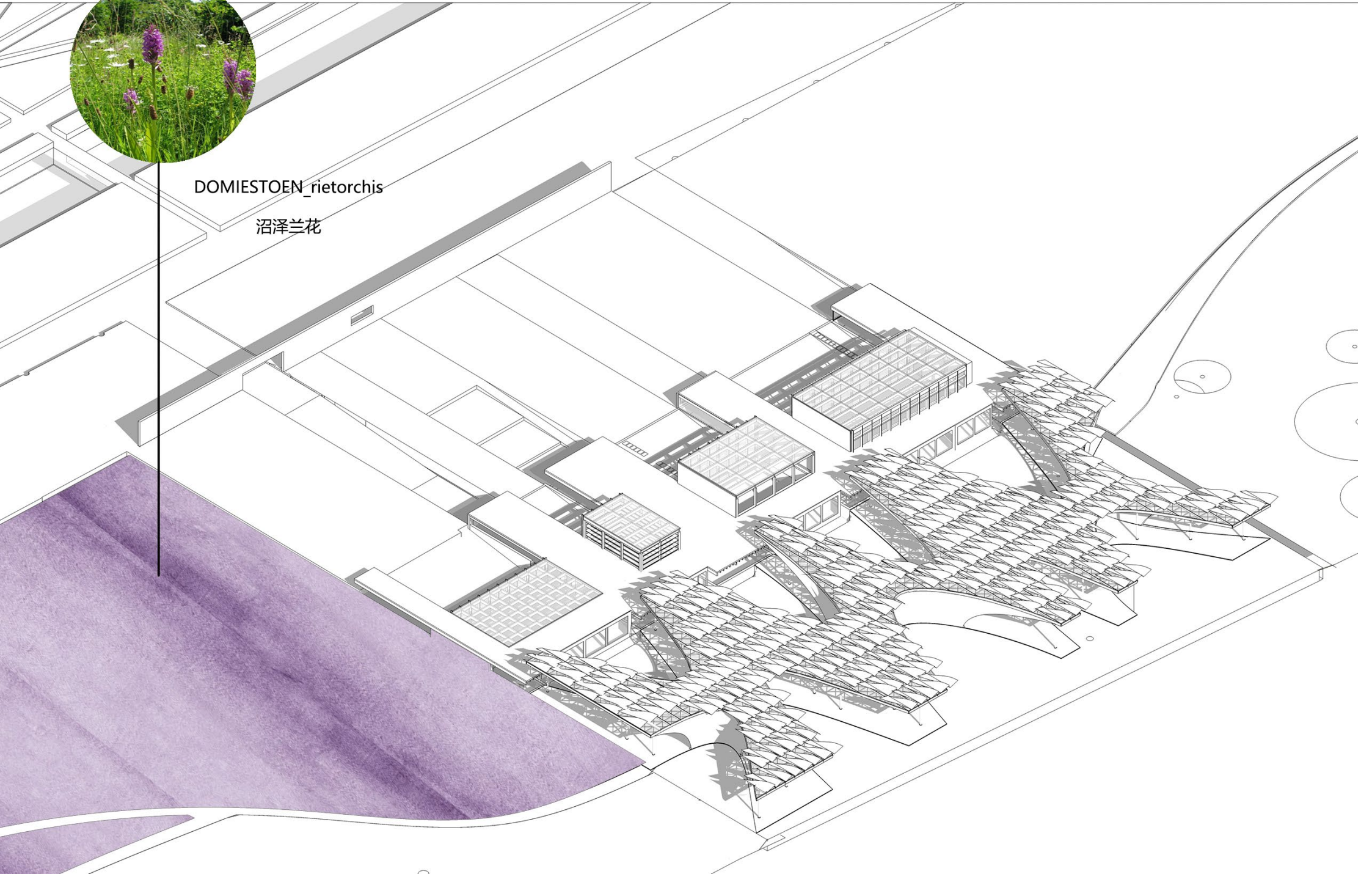
虎耳草, 颗粒野稻 "斑丽"





DOMIESTOEN_rietorchis

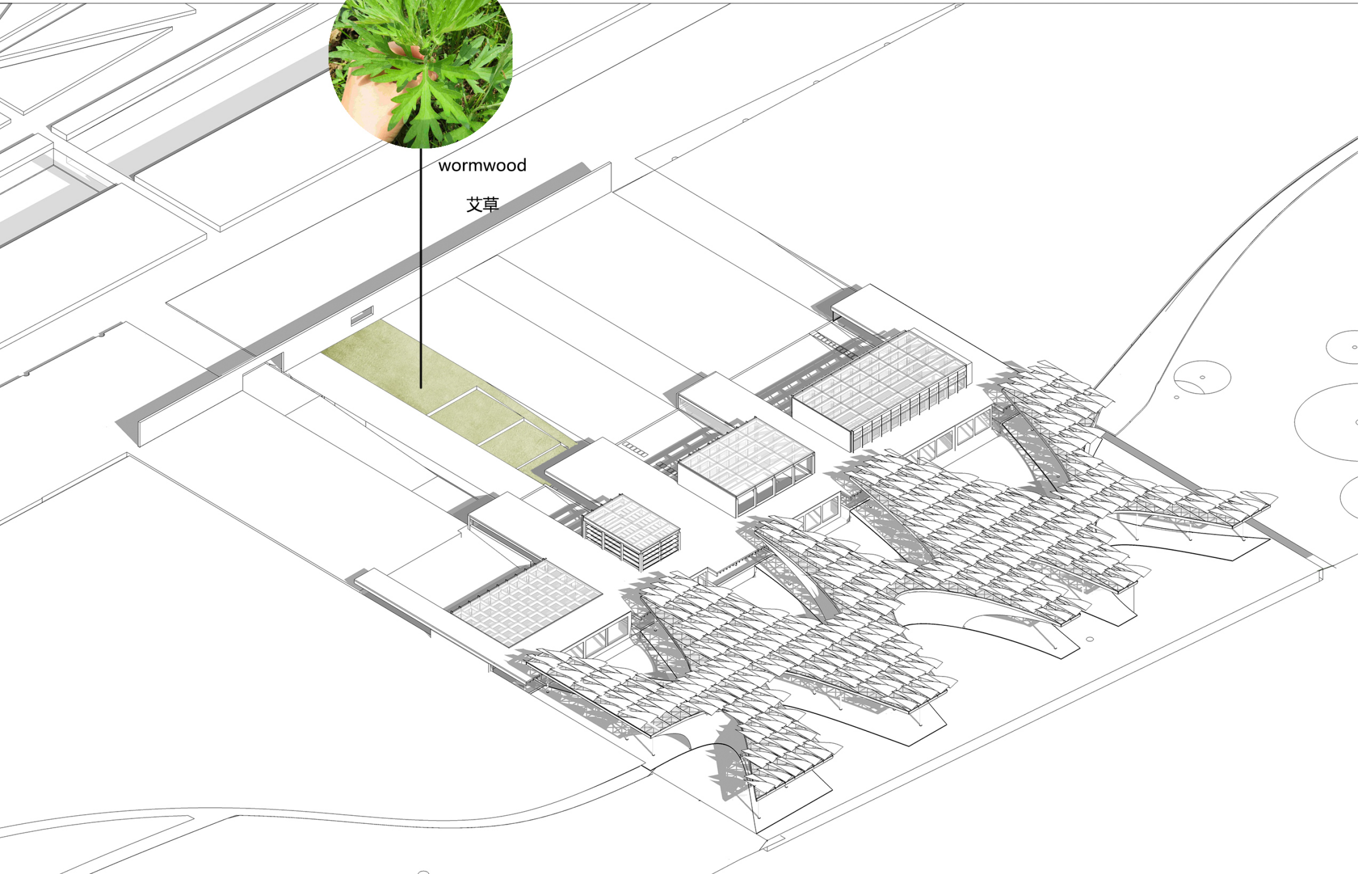
沼泽兰花





wormwood

艾草





Harlem windbell

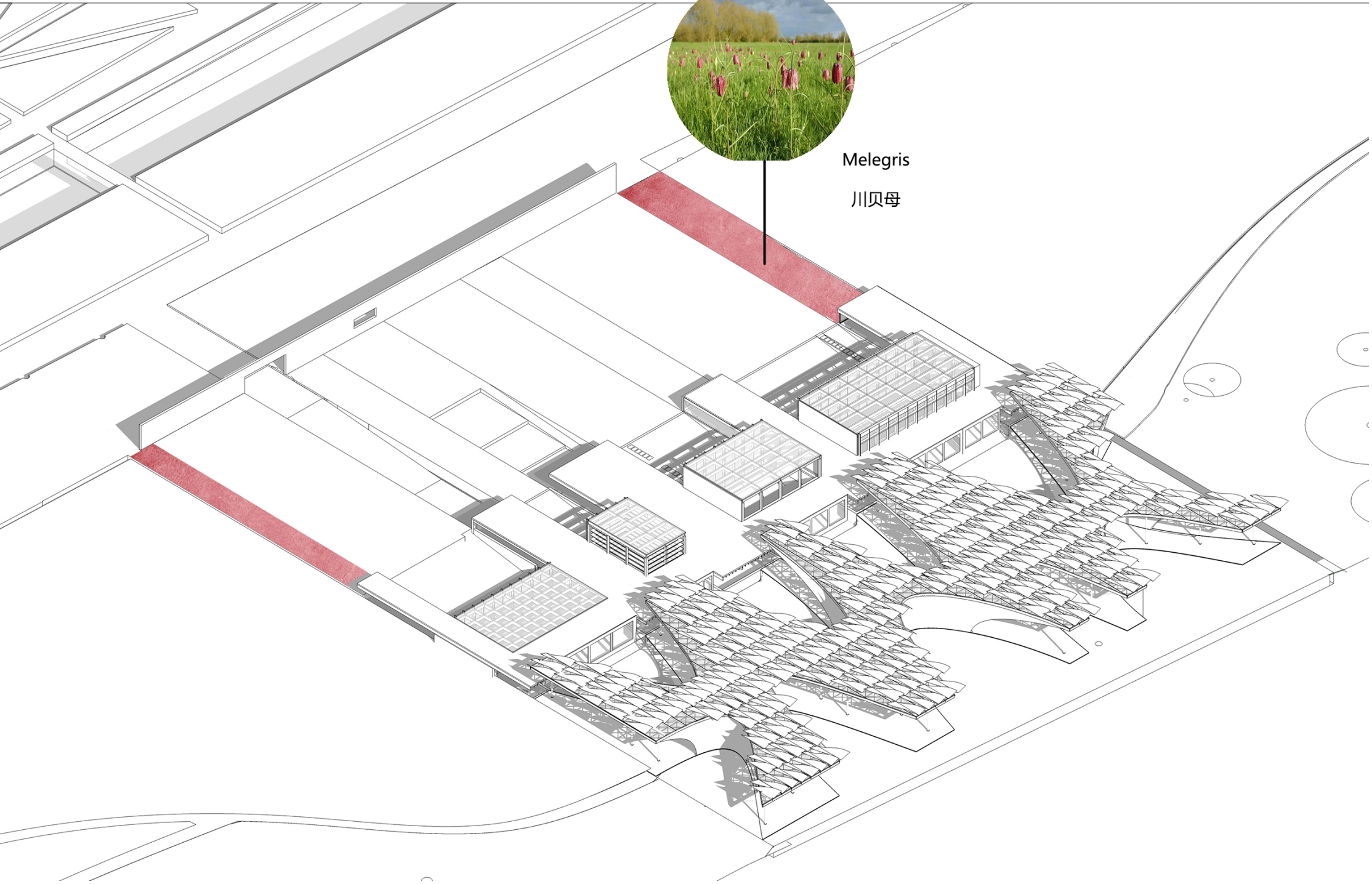
哈莱姆 风铃花





Melegris

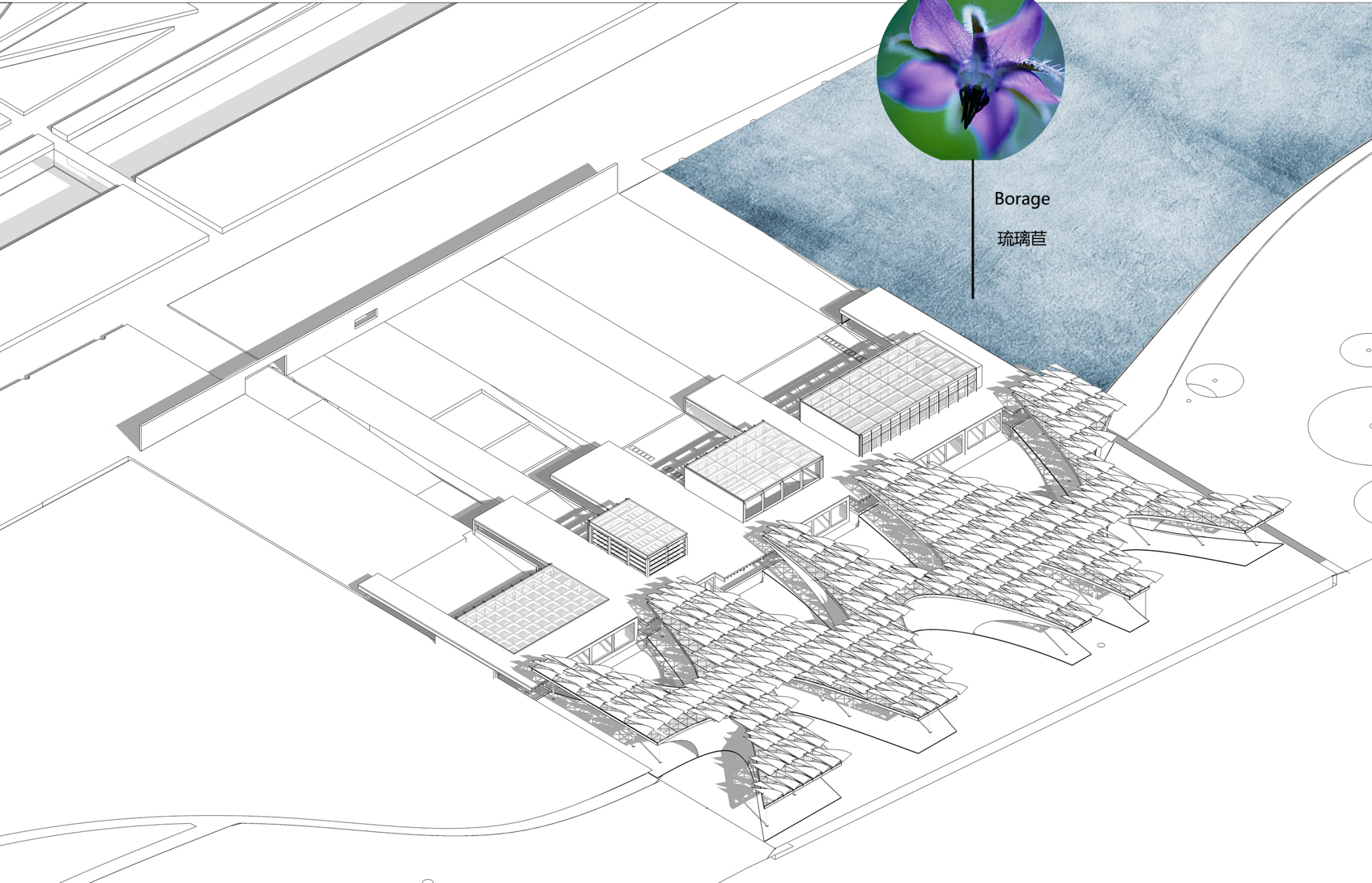
川贝母

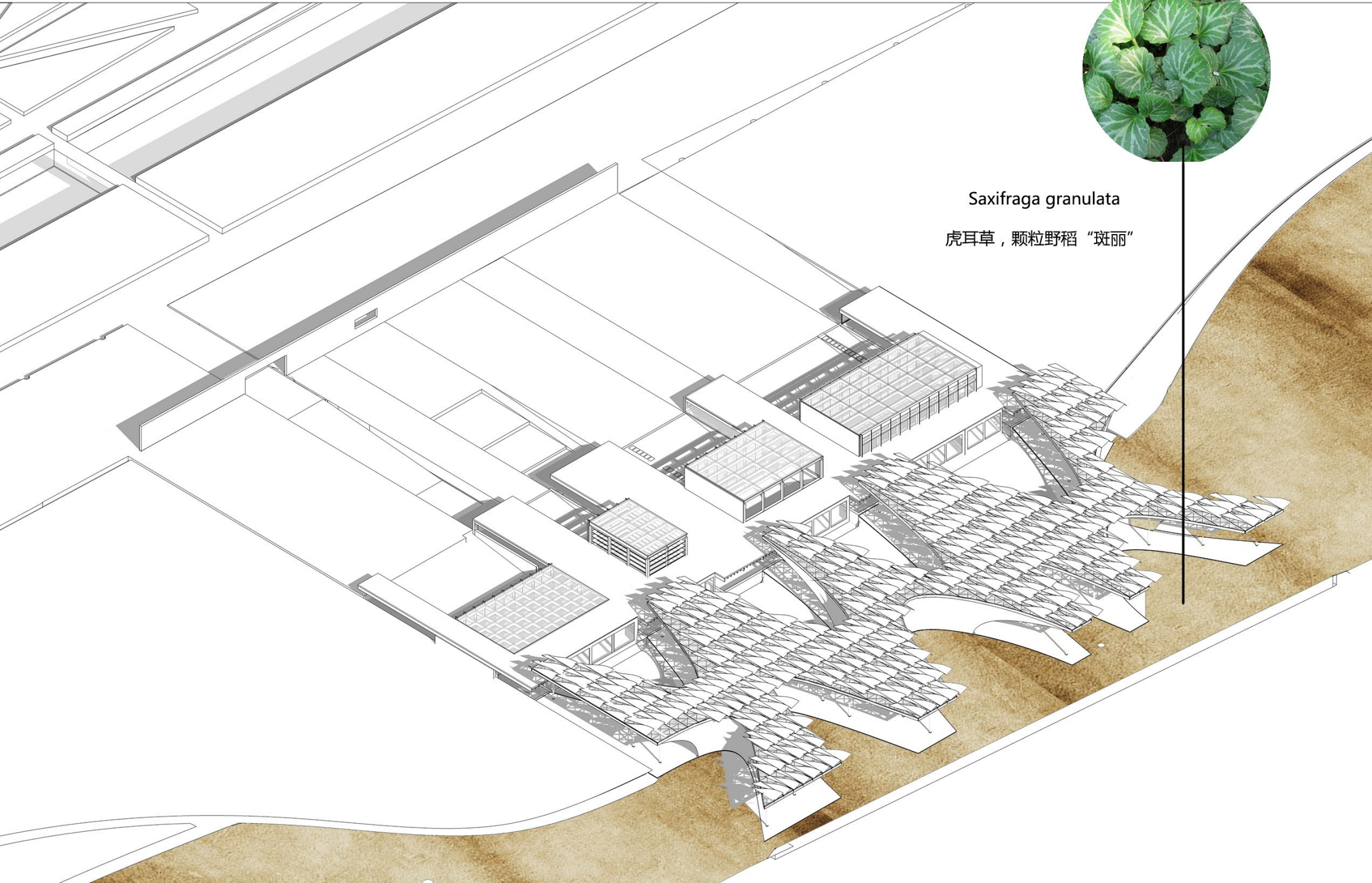




Borage

琉璃苣





Saxifraga granulata
虎耳草，颗粒野稻“斑丽”



DOMIESTOEN_rietorchis
沼泽兰花



wormwood
艾草



Harlem windbell
哈莱姆风铃花



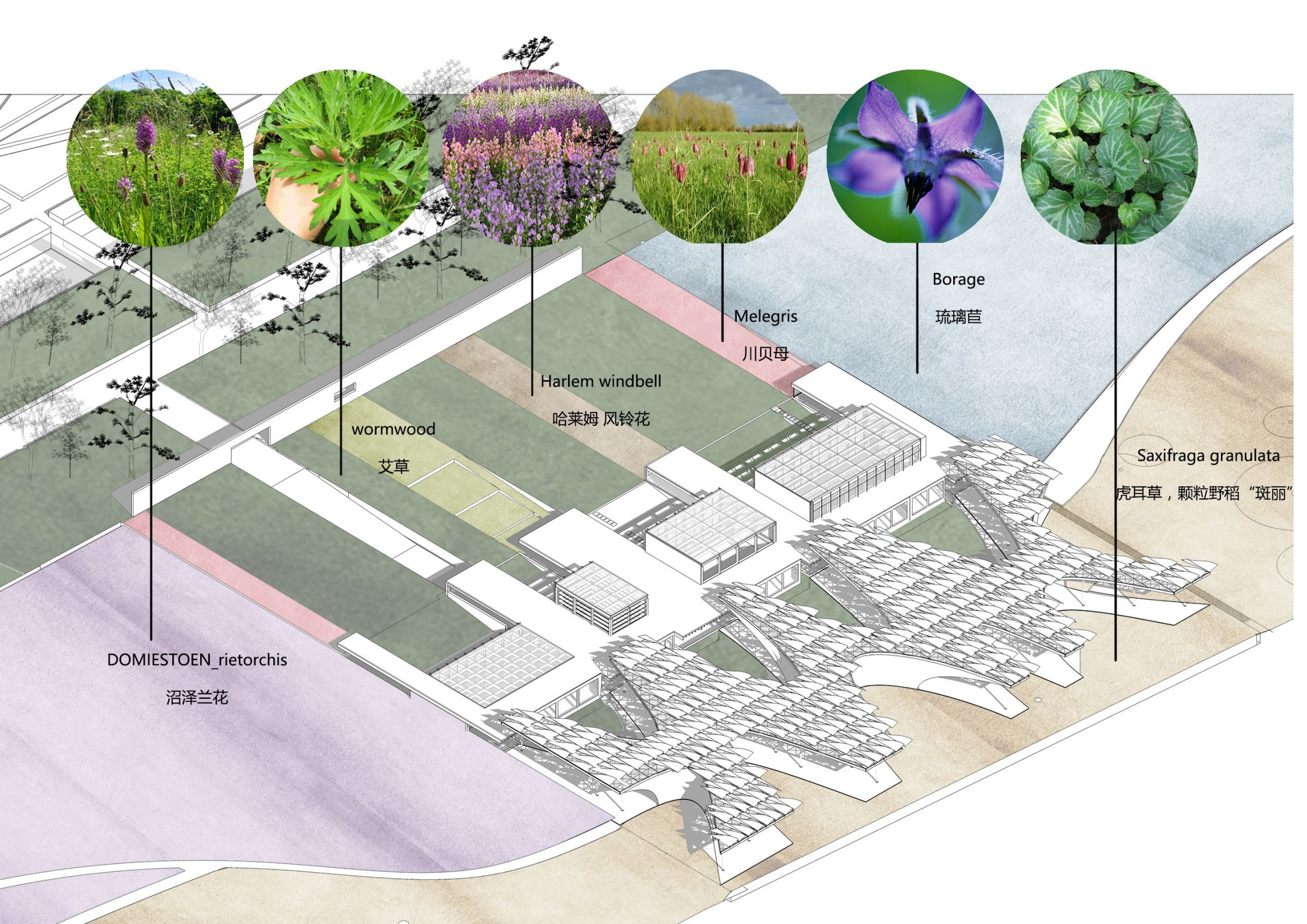
Melegris
川贝母



Borage
琉璃苣



Saxifraga granulata
虎耳草, 颗粒野稻 "斑丽"



Botanical Garden Program

Oberservation

- seed plant conservation
- tree root section
- pot plant
- Verfplanten(蕨类植物)
- Tropical plant: succulents and climbers 肉热带爬藤, 21,55,95
- Dead tree root

Exhibition

Production

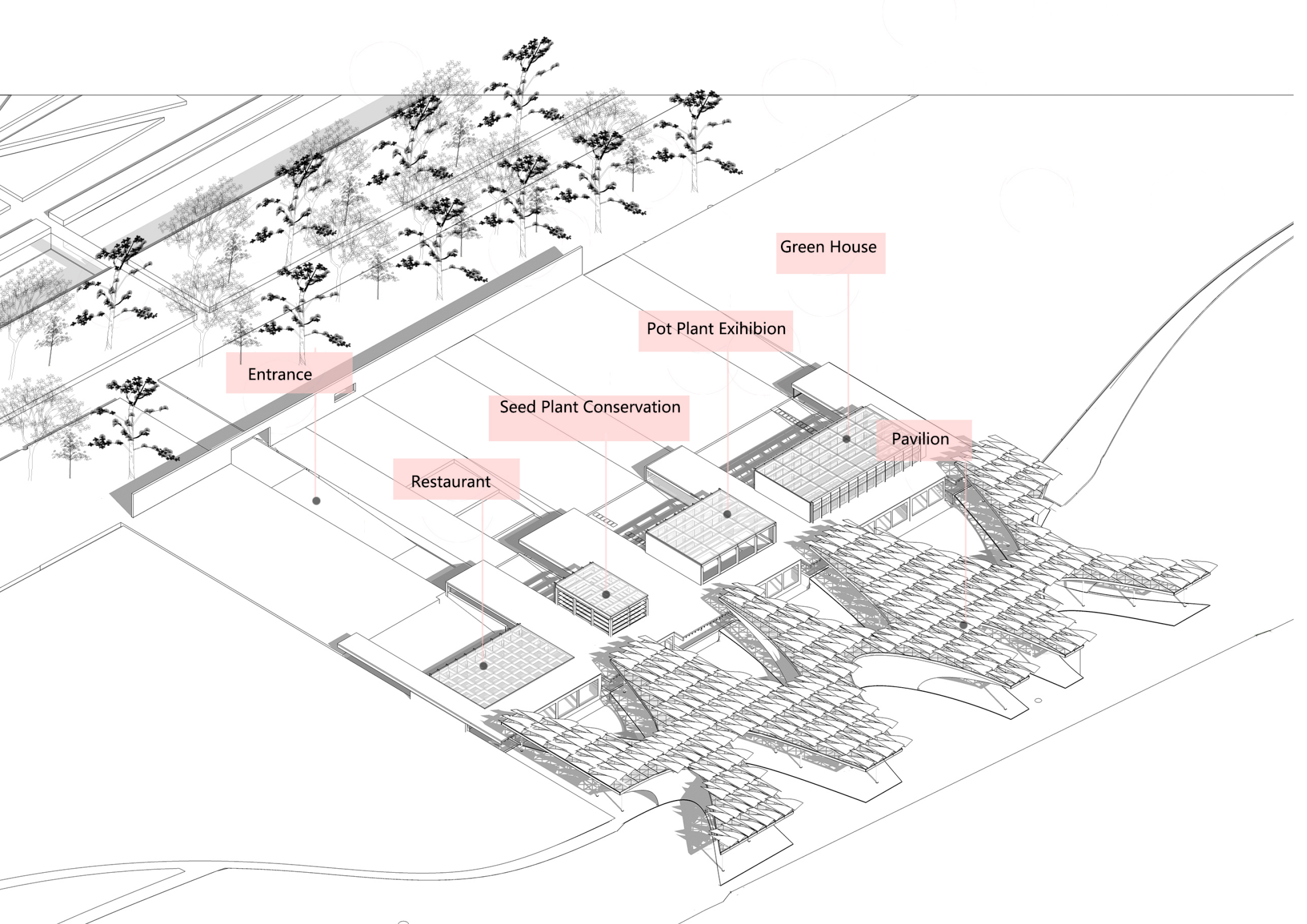
Organic Tea, perfume making Labortory, Plant Souverneer Factory

Selling Market

Protection

Honeybee House , bird cottage

Provision



Entrance

Restaurant

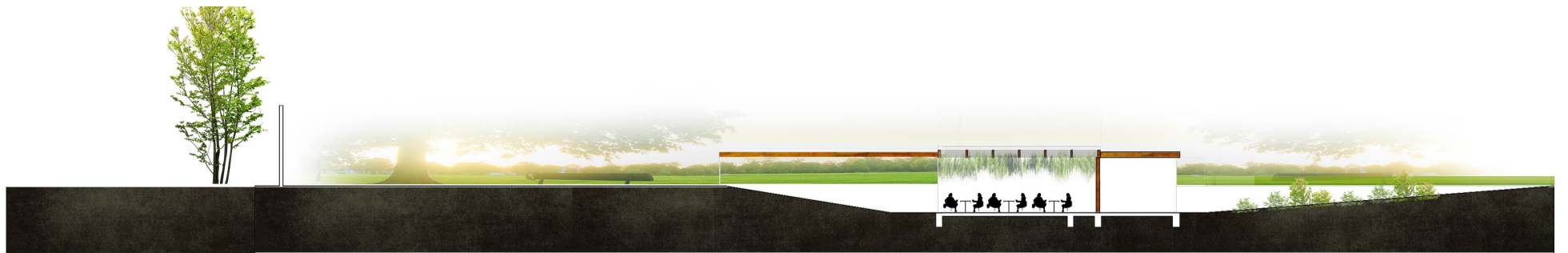
Seed Plant Conservation

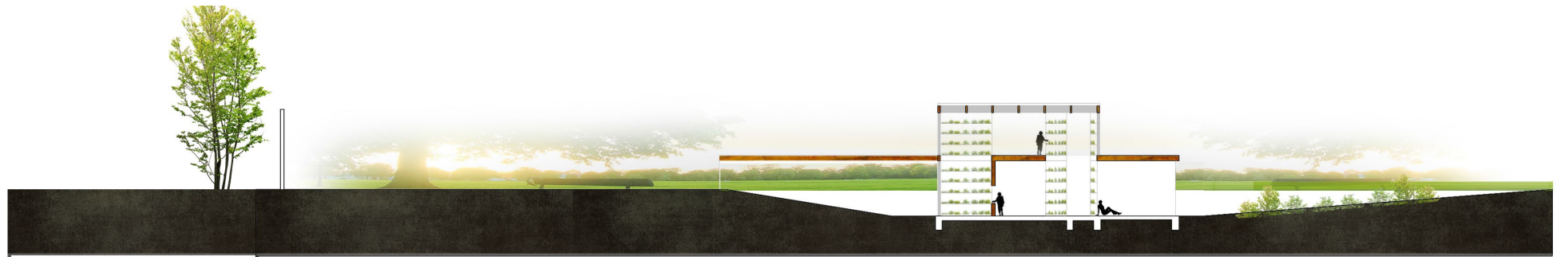
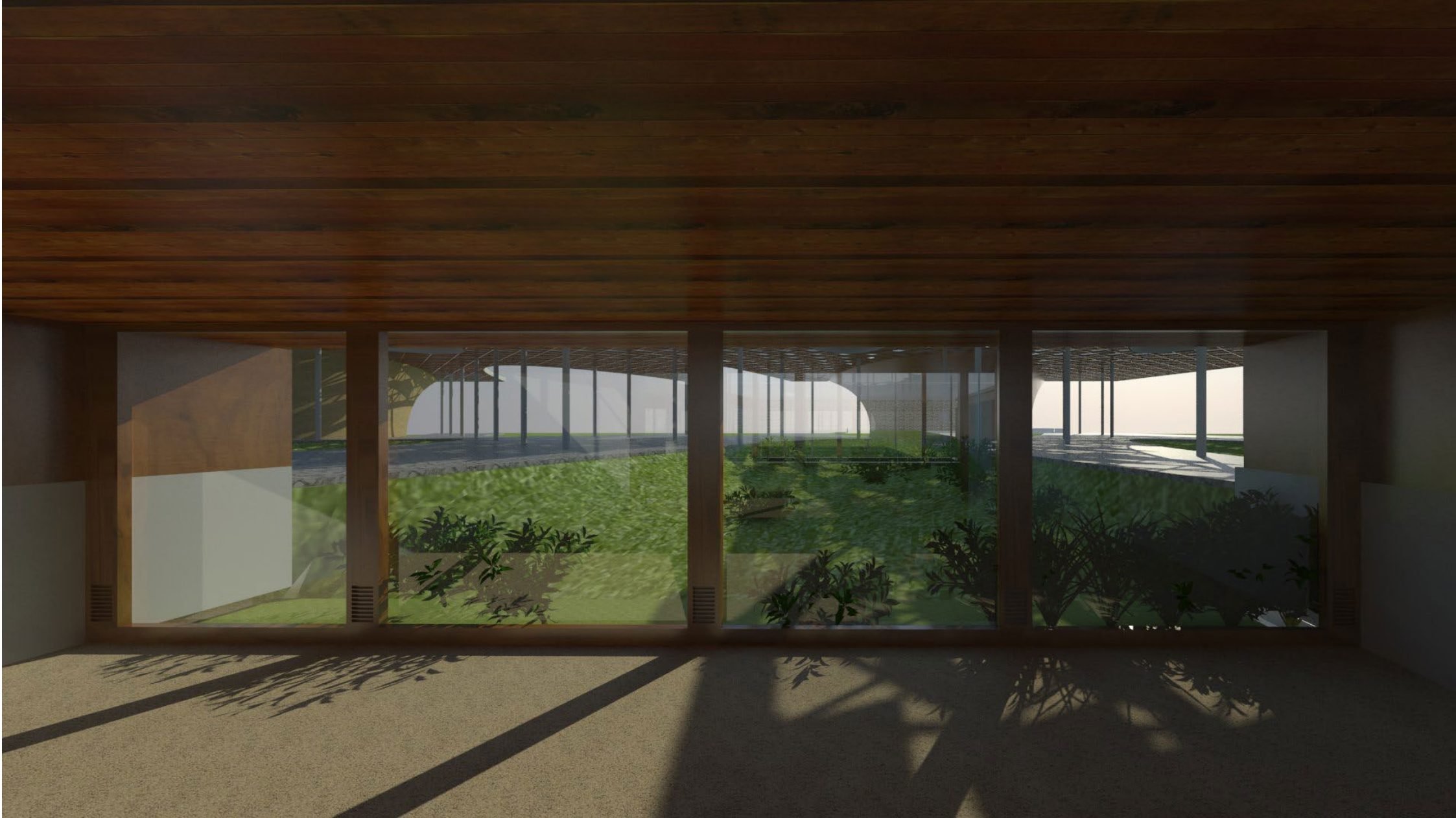
Pot Plant Exhibition

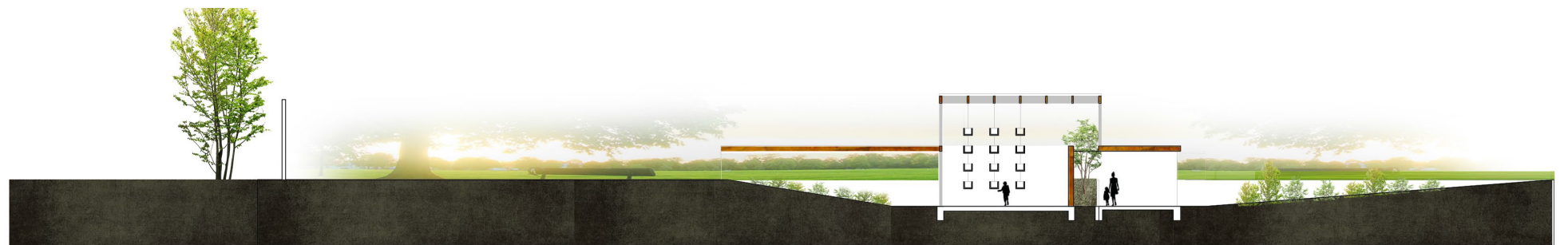
Green House

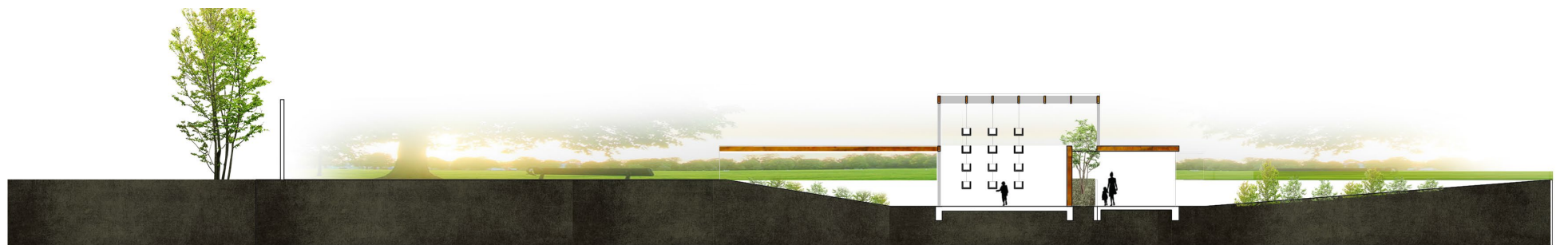
Pavilion



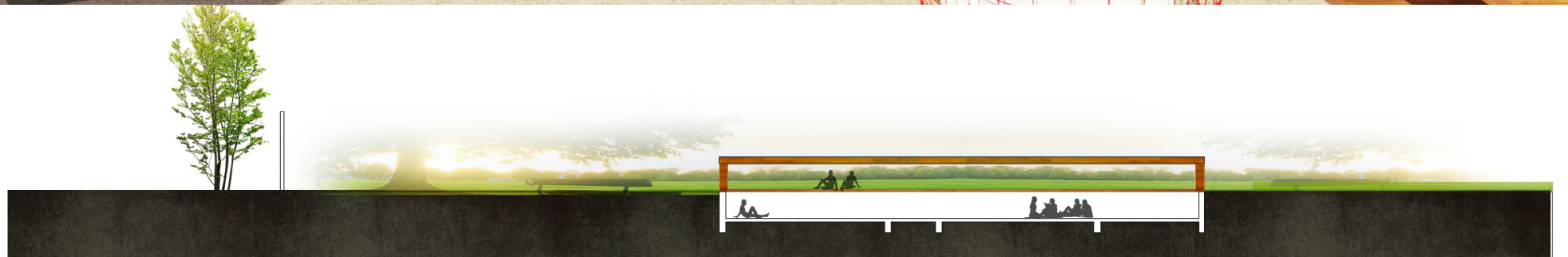






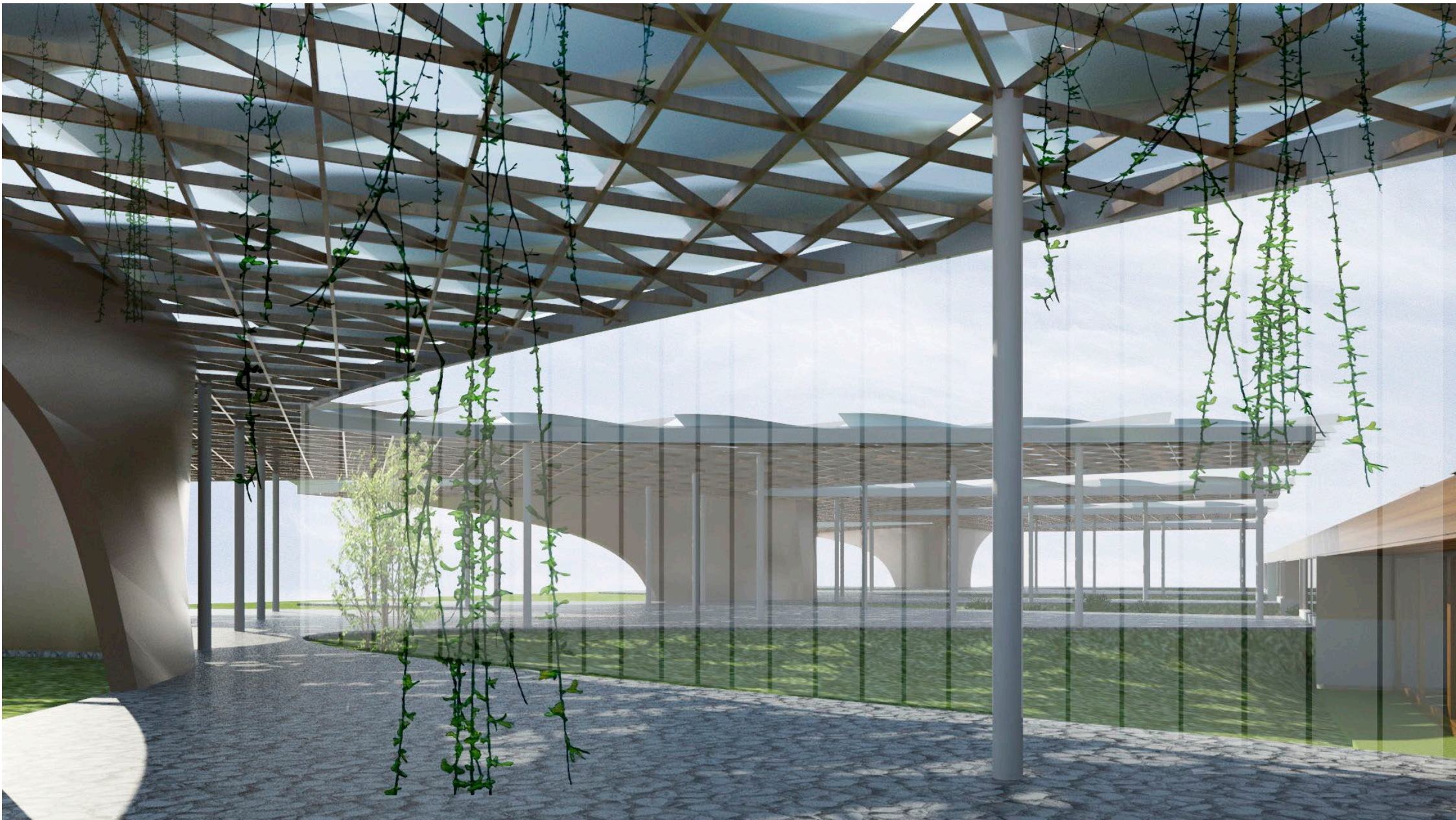


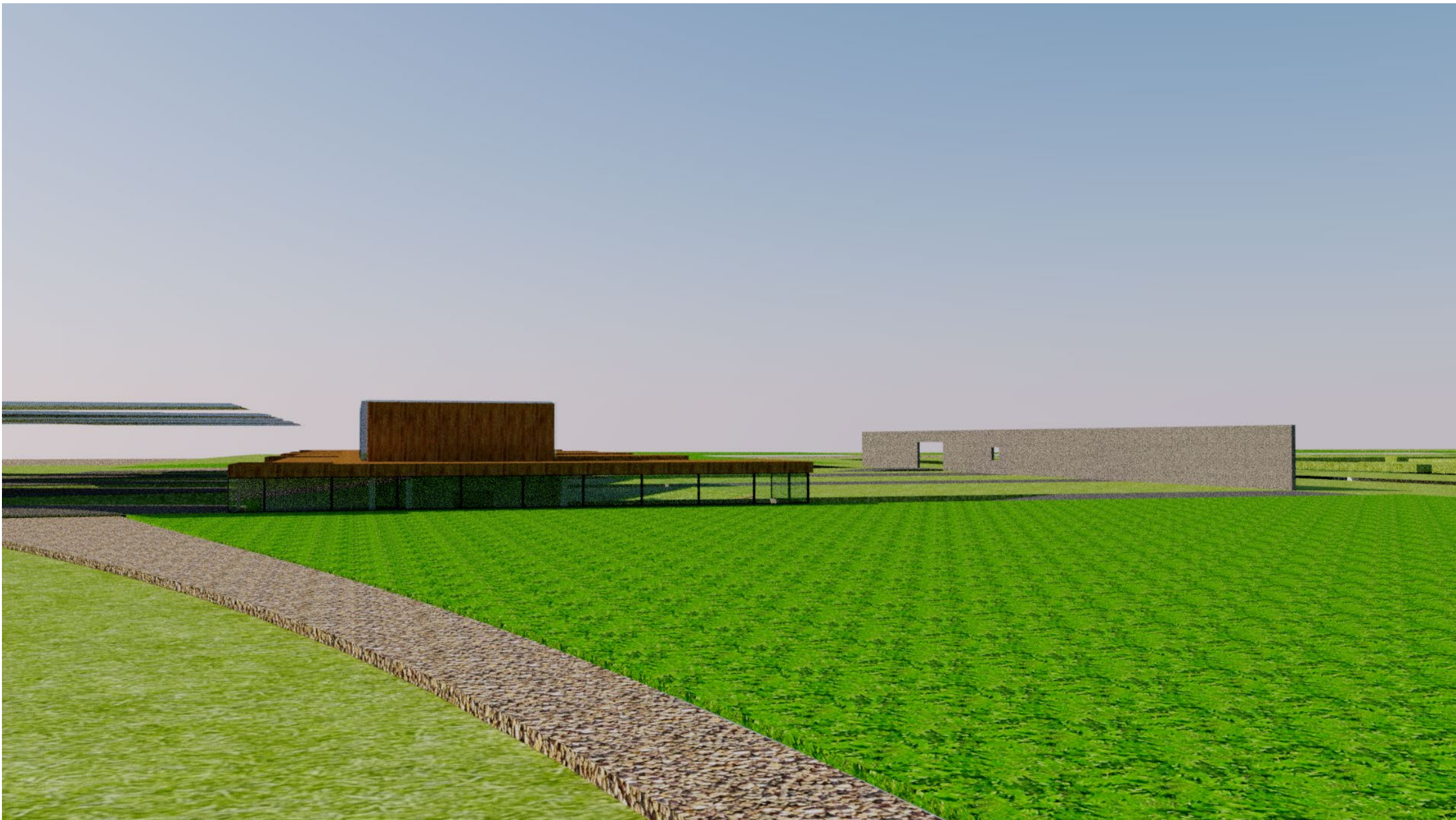


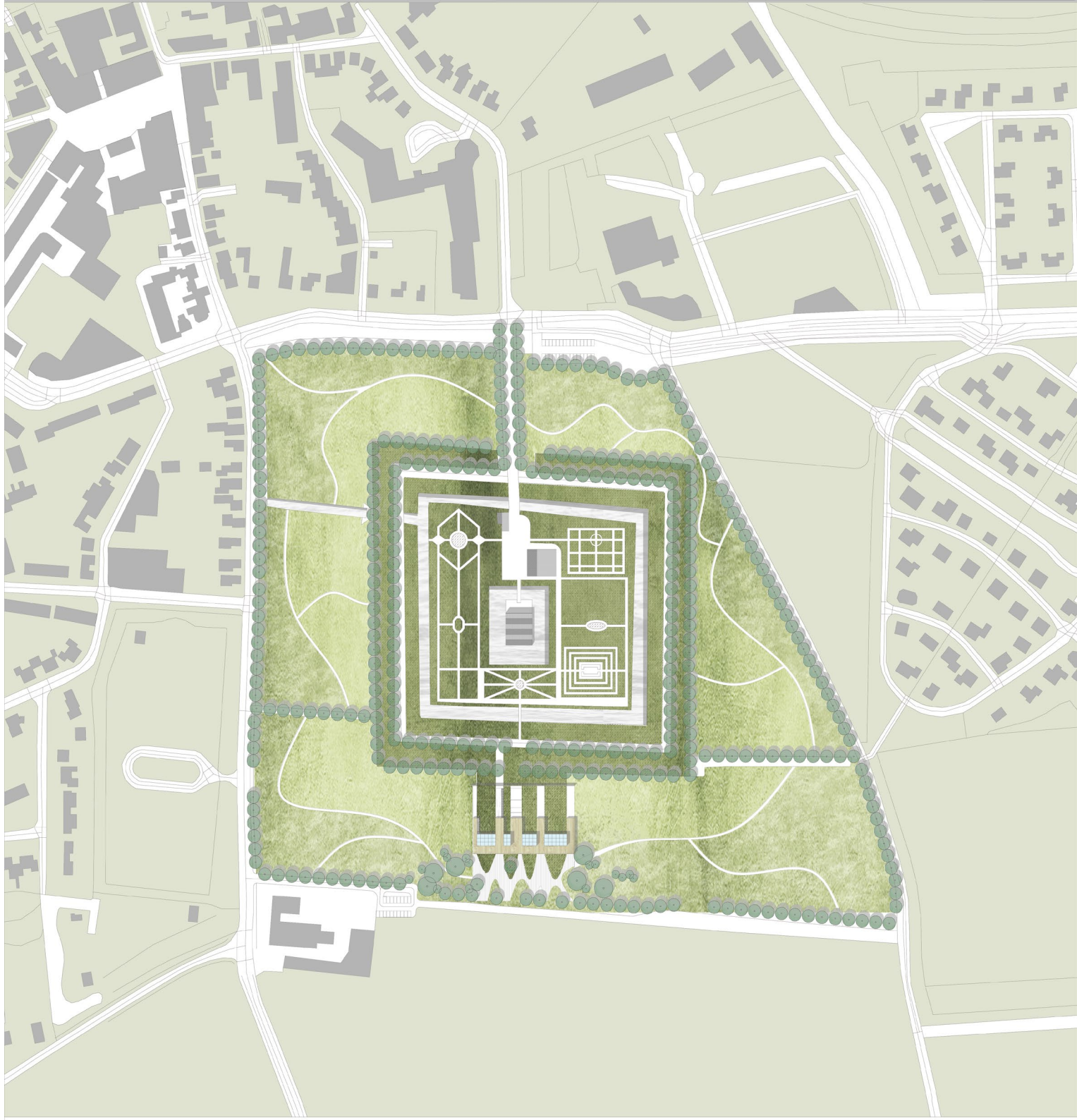


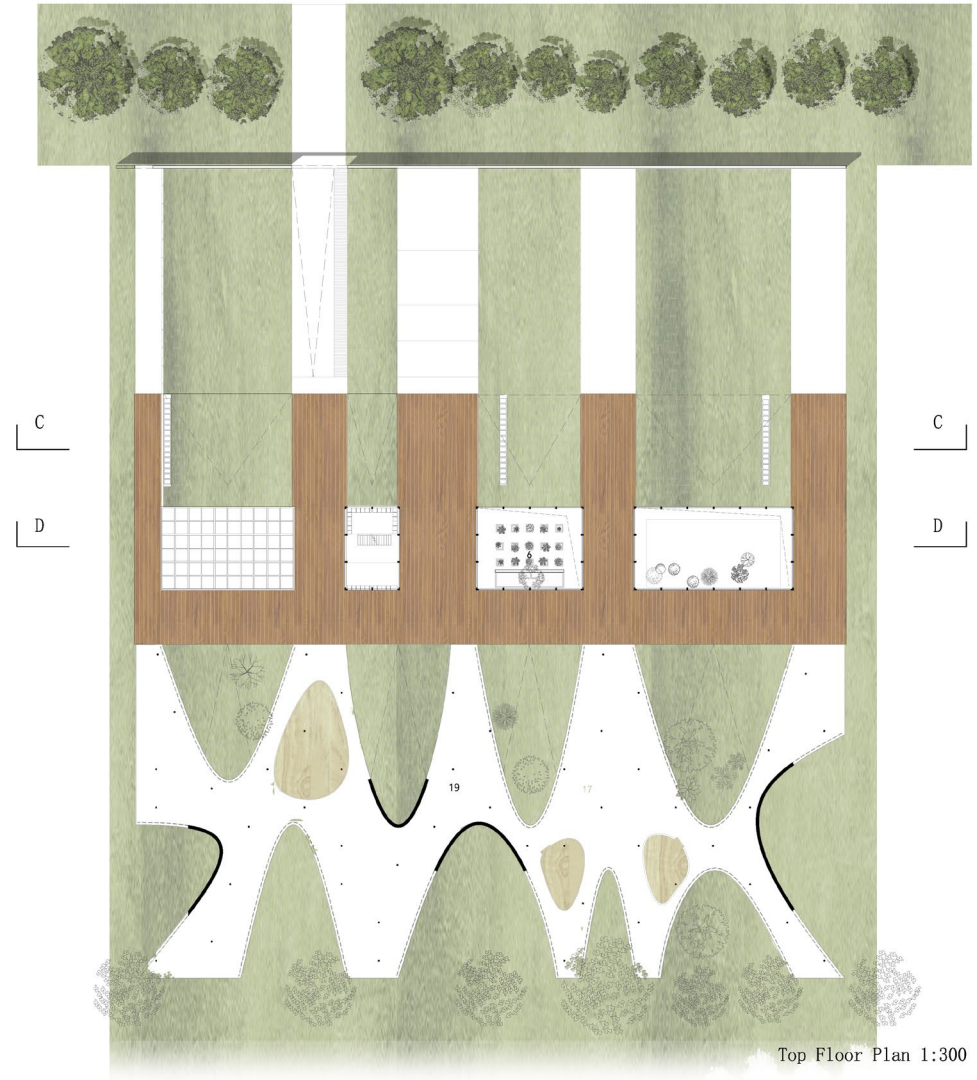
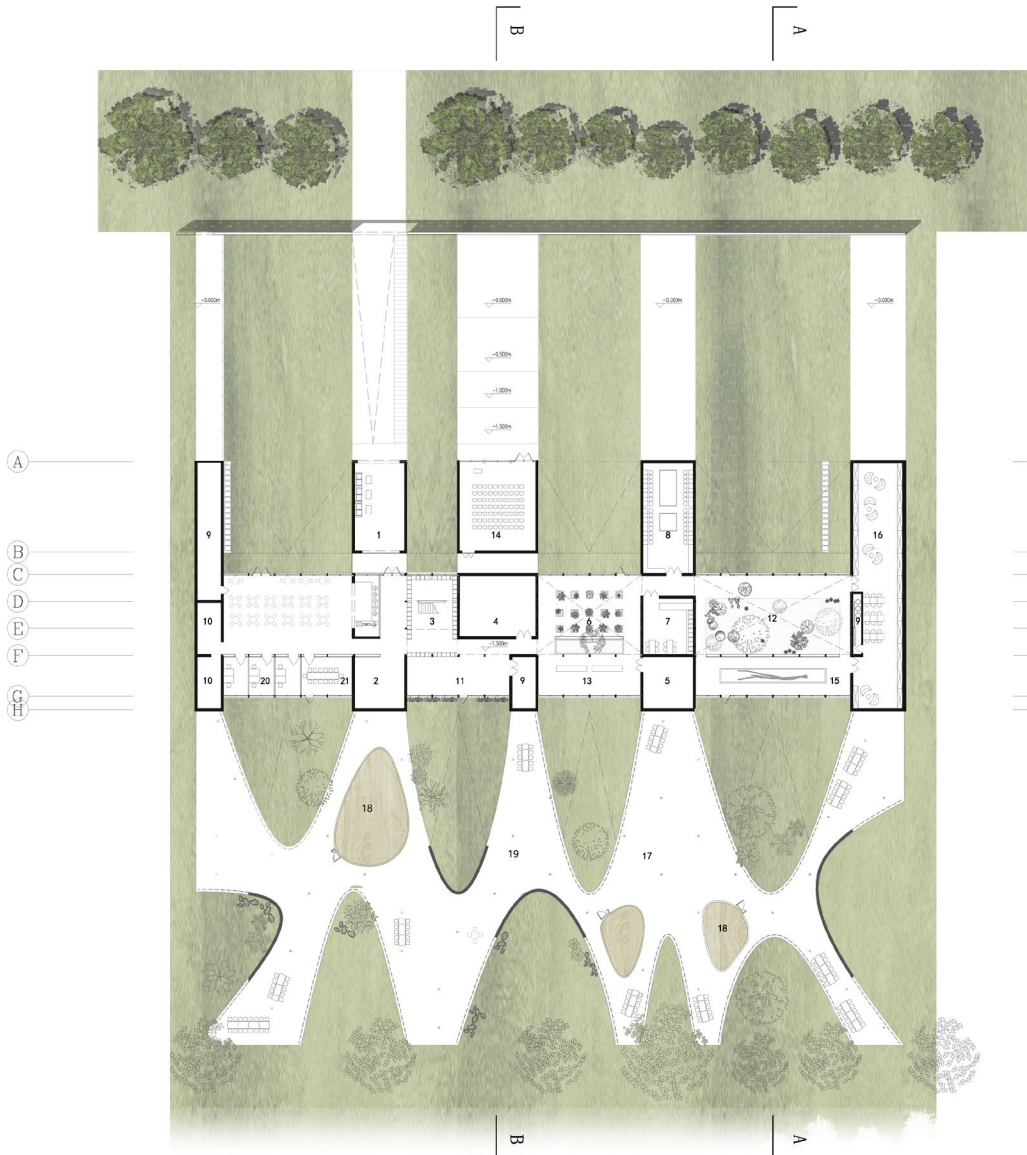










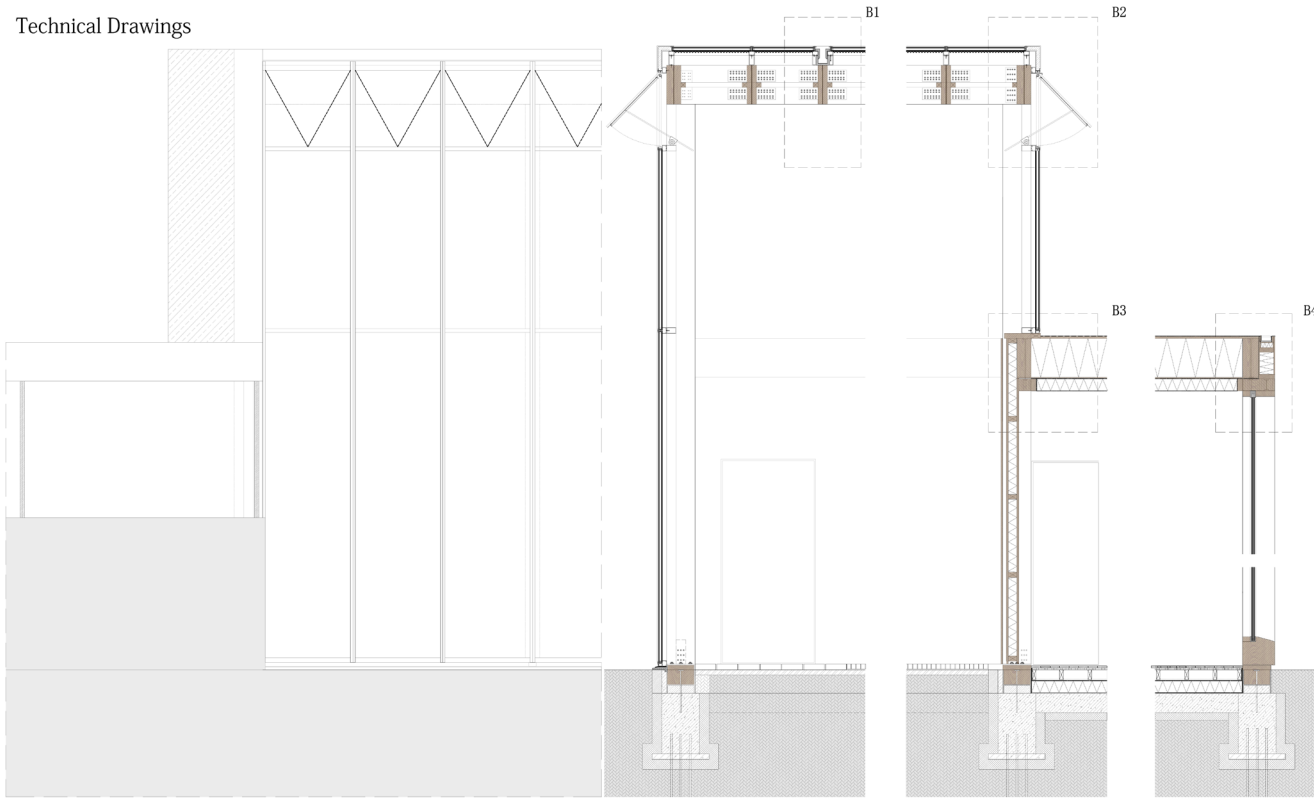


Top Floor Plan 1:300



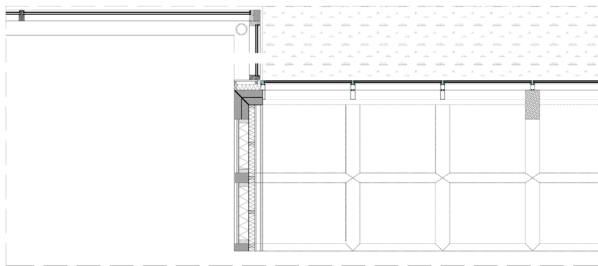
South Elevation 1:300

Technical Drawings

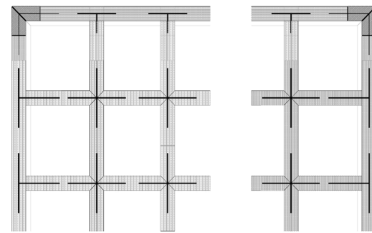


NORTH ELEVATION FRAGMENT 1:20

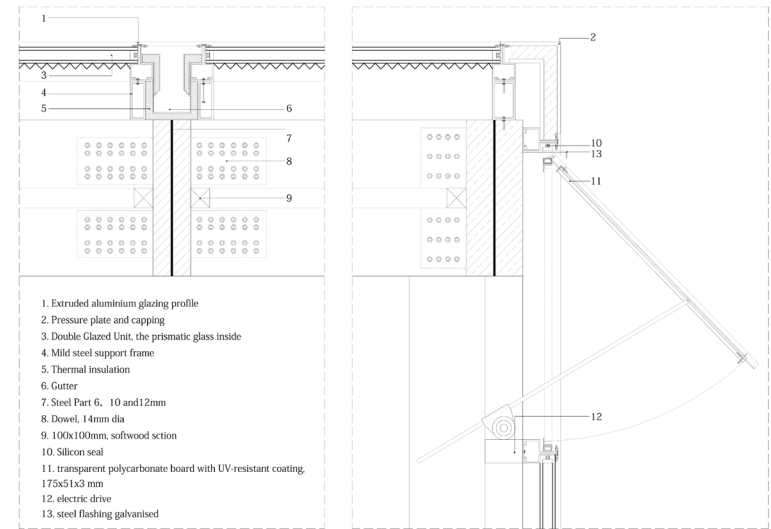
Section Construction Detail 1:20



PLAN SECTION FRAGMENT 1:20



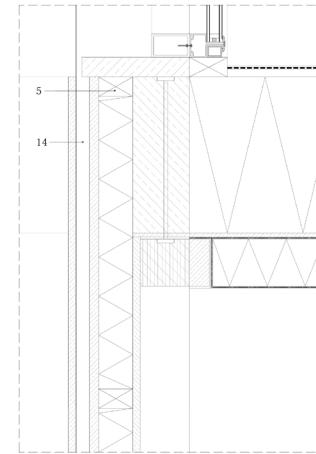
ROOF STRUCTURE FRAGMENT 1:20



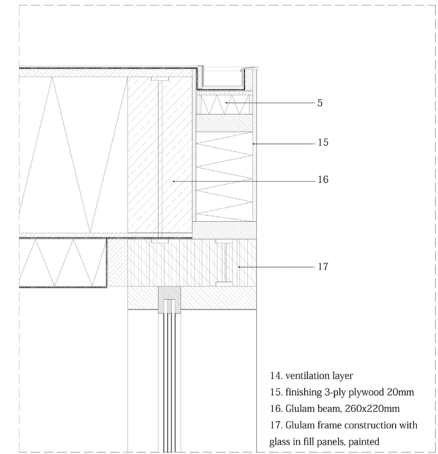
1. Extruded aluminium glazing profile
2. Pressure plate and capping
3. Double Glazed Unit, the prismatic glass inside
4. Mild steel support frame
5. Thermal insulation
6. Gutter
7. Steel Part 6, 10 and 12mm
8. Dowel, 14mm dia
9. 100x100mm, softwood section
10. Silicon seal
11. transparent polycarbonate board with UV-resistant coating, 175x51x3 mm
12. electric drive
13. steel flashing galvanised

Middle Gutter Detail 1:5

operable PVC window Detail 1:5



Transom & Roof Detail 1:5



14. ventilation layer
15. finishing 3-ply plywood 20mm
16. Glulam beam, 250x220mm
17. Glulam frame construction with glass in fill panels, painted

Eave & Gutter Detail 1:5



+4.500m

+1.500m

0.000m

A-A Section 1:100