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Diplomarbeit

LIU JIA ZHI

Living in the courtyard : a sustainable restoration process
Zhou Shan, Puto District, China

unter der Leitung von

Univ.Prof.DDI Wolfgang Winter

**Institut für Architekturwissenschaften Tragwerksplanung und Ingenieurholzbau
Institute of Architectural Sciences Structural Design and Timber Engineering**

eingereicht an der Technischen Universität Wien
Fakultät für Architektur und Raumplanung

von

Raphaëlle-laure Perraudin
Matrikelnummer : 0527079
Goldeggasse 31/15 - 1040 Wien

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living in the courtyard : LIU JIA ZHI ; a sustainable heritage restoration process in China

FOREWORD

This project is born from a trip but also from a discovery: Wang Shu's work, and more specifically, his way to consider architectural heritage. I met him and his partner and wife, Lu Wenyu in 2009. Ever since, I am still wondering how this powerful architect is going to deal with the expectations of his own country, especially regarding his adaptation of traditional technics to modern construction.

This diplom work was for me a very rich way to put our work into perspective. The relation to heritage and traditional construction has to be considered from a special point of view. The one from Europe is not the same as the one from China. Our goals are different – so ar then our vision of the future.

I would like to thank Wang Shu and Lu Wenyu for the long discussions about construction and architecture.

I also would like to thank my husband, my children, my friends and colleagues for their support and patience.

Finally, I am grateful to Professor Wolfgang Winter for our always-stimulating conversations.



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living in the courtyard : LIU JIA ZHI ; a sustainable heritage restoration process in China



Introduction



Wang Shu - amateur studio



Wang Shu - Ningbo Museum

The birth of zhoushan project

The « zhoushan project » is born in China, in Wang Shu's Hangzhou Amateur Studio. Wang Shu is one of the first architect who has received the global Award for sustainable architecture. He got awarded the pritzker price in 2012.

I discovered this initiative of Wang Shu upon a conference he gave in Paris. I decided to take part of a trip organised with the "Ecole de Chaillot" and the "Cité de l'architecture et du patrimoine" in order to discover Wang Shu's work in China (mainly in the Hang Zhu province).

During this journey – we had the opportunity to discuss with him the new issues of China's architectural development, and especially the theme of refurbishment and patrimony conversion. It happened to be a very discrete concern at the moment in his country.

Wang Shu decided to describe the very latest initiative he had in the Pu Tuo district : the Zhu Shan Liu Jia Zhi program. He was then just beginning to draw the master plan. I could get a few documents and went there with the group to visit the site.

Nearer context

The local government of Zhou Shan (near Hangzhou and Ningbo – an archipelago of islands) commissioned Wang Shu with the project to rehabilitate the harbour and industrial area of the island into a touristic and cultural area. The deadline of delivery was the Universal Exhibition of Shanghai which ended in October 2010. The project would be used to present a multinational project of innovative contemporary architecture. The project is led by Amateur Architecture Studio (Wang Shu and Lu Wenyu).

In China, a number of "eco-cities" and green zones are initiated. The method however still involves starting from "tabula rasa". In southern Hangzhou, Wang Shu has a different perspective: Wang Shu studied the "classics" of Western architecture, then set about reviewing Chinese culture. When renovating ancient residences he rediscovered the cyclic construction :

"1,000 years ago, buildings were built in wood and brick, and they have survived because their design enabled constant renovation."

This was the beginning of my project development.

living in the courtyard : LIU JIA ZHI ; a sustainable heritage restoration process in China

I. Local Context



China

Local context

Geographical context :China - Zhe Jiang Province
- Zhou shan Archipelago – Putuo district –

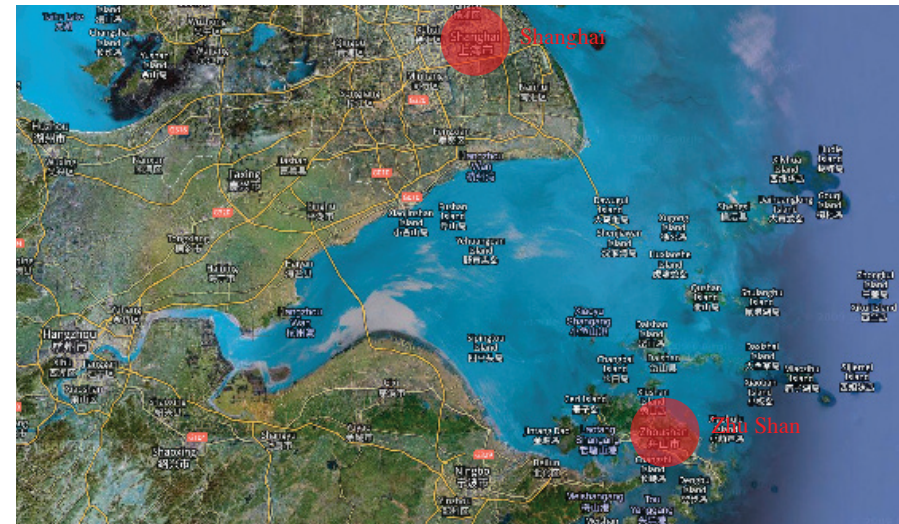


Chinese provinces

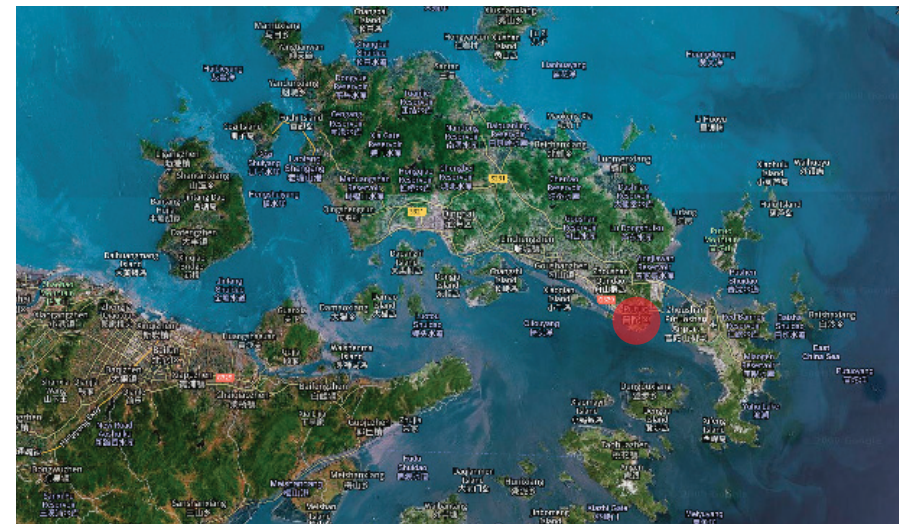
Geographical localisation

Located in the Zhoushan Islands of northeast Zhejiang, it is the only prefecture-level city in China established in islands.

It is located at the meeting point of the mouths of Yangtze River, Qiantang River and Yong River. The total area is 22.2 thousand square kilometers, in which land area is 1440.12 square kilometers, formed by 1390 islands, and they look like emeralds scattered on the blue East China Sea. The largest island is Zhu Shan Island, with 502.65 square kilometers, ranking the 4th in China only after Taiwan, Hainan and Congming.



Zhou Shan Archipelago





Pu Tuo district and harbour



Site picture



Site overview : connection the the sea - protected by the hill

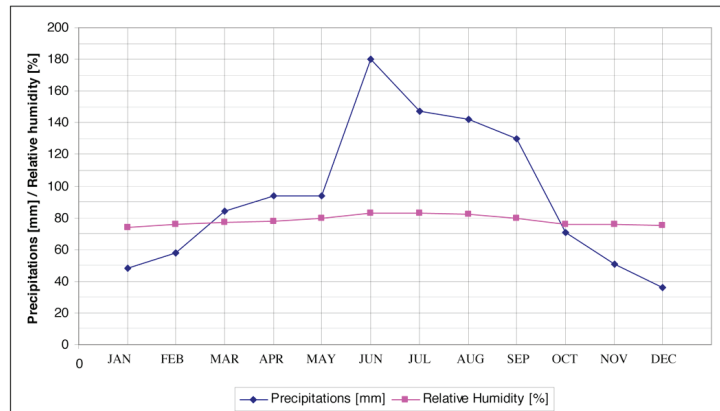
Between sea and hill

Our site is located along the coast. Its original activities were both repairing boats and fishing. This industry is preserved, at least from the atmosphere. On the other side of the site, the strong presence of the hill and vegetation on the south. This special context should be included into our reflection.

Ancient boats but also still active fishermans ships, as well as the whole tools, filets, cords, spools, etc. belong the the specificity of this industrial landscape.

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Precipitations [mm]	48.0	58.0	84.0	94.0	94.0	180.0	147.0	142.0	130.0	71.0	51.0	36.0
Relative Humidity [%]	74.0	76.0	77.0	78.0	80.0	83.0	83.0	82.0	80.0	76.0	76.0	75.0

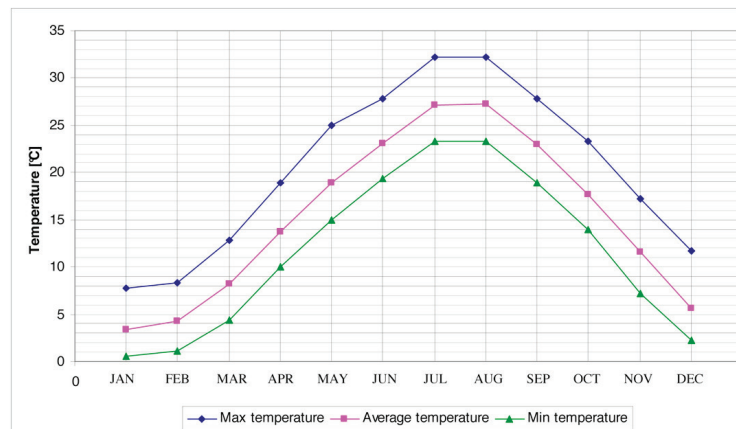
Table 2 – Meteorological data of Shanghai – Precipitations ³



Meteorological Data - Shanghai / Precipitations >

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Max temperature [°C]	7.8	8.3	12.8	18.9	25.0	27.8	32.2	32.2	27.8	23.3	17.2	11.7
Average temperature [°C]	3.4	4.3	8.2	13.7	18.9	23.1	27.1	27.2	23.0	17.7	11.6	5.6
Min temperature [°C]	0.6	1.1	4.4	10.0	15.0	19.4	23.3	23.3	18.9	13.9	7.2	2.2

Table 1 – Meteorological data of Shanghai - Temperatures ²

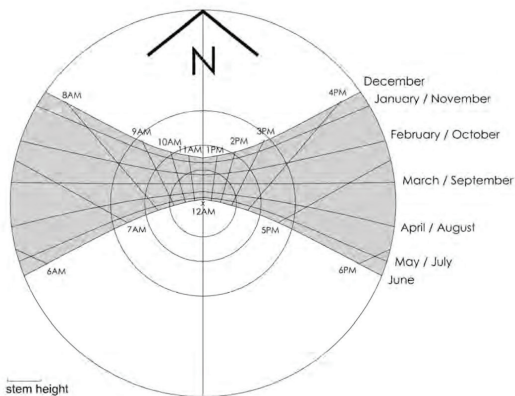


Climatic context humide and tempered

Zhou Shan offers a subtropical monsoon climate. The average temperature is around 15.3°C and the annual average rainfall is around 1135mm (of which the precipitation in the months from May to September accounts for 60%). The table hereunder gives the meteorological data of temperatures for the city of Shanghai (separated by less than 100km from Zhou Shan).

This means that every construction has essentially to deal with humidity constrains and need of ventilation.

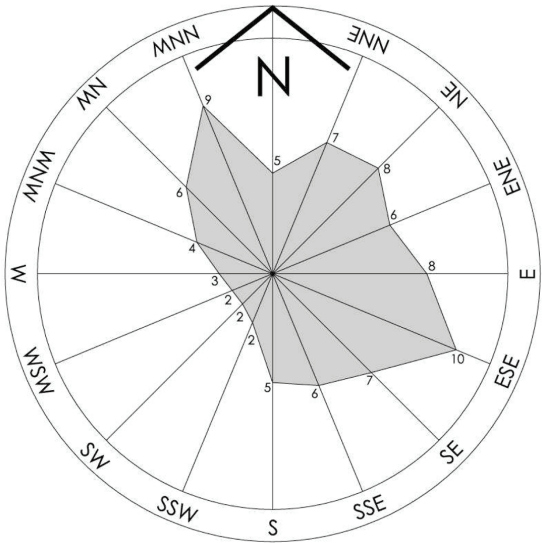
Meteorological Data - Shanghai / Temperatures >



Path of the sun

The **path of the sun** is described by the solar diagram hereunder. It describes the sun position at anytime of the year for the site location (29° 15' North / 122° 50' East). The curves are describing the months of the year from June (the closest curve from the center) to December (the more distant curve from the center). The solar hours of the day are described by the transversal lines from 6 AM to 6 PM. When the stem is placed in the center of the diagram, the length between the center and any point of the diagram express the shadow that the sun will make at a certain solar hour of a certain day (defined by the point in the diagram).

The **wind diagram** is illustrated by the figure hereunder. It shows an east-south-east and north-north-west preferential sectors orientations and the wind speed in knots (a knot = a nautical mile per hour = 1.852 km/h). They are fairly constant between 10 and 12 knots all over the year (the average wind speed is thus between 5.14 m/s and 6.17 m/s).



Wind diagram

Month of year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	SUM
Dominant Wind dir.	01	02	03	04	05	06	07	08	09	10	11	12	1-12
Wind probability > = 4 Beaufort (%)	46	43	52	46	42	34	42	35	44	31	45	38	41
Average Wind speed (Knots)	11	11	12	11	11	10	11	10	11	10	11	10	10

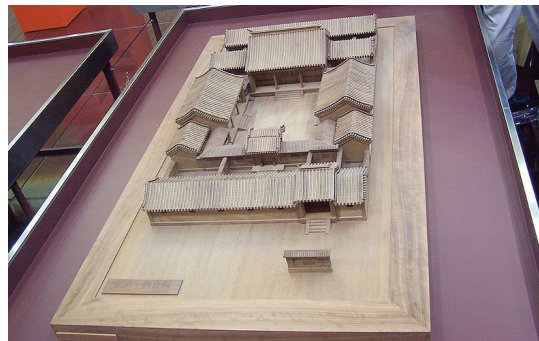
Politics

The recent economical development of China allowed by the politics of Deng Xiaoping and now Hu Xingtao was essentially based on destruction of ancient cities in order to rebuild new ones. The last twenty years were much more destructive than the «maoist» years.

The conservation of built patrimony stays a weak idea, compared to the modern idea of cities, including all the problematics of salubrity, comfort, space.

There, economical development is much more associated to new construction than to the values of old constructions.

The improvment of life quality has left behind the idea of cultural heritage.



Traditionnal housing around the courtyard

Everyone has heard about this issue in China, especially concerning Beijing and the extinction through destruction and reconstruction of the ancient «hutong» and «siheyuan». In fact, the whole China is threatened or already the victim of the disparearance of traditionnal architecture and city. The notion of heritage is defended by a few persons but should be reinforced in the next years.

Then, maintaining the old construction is one issue, but renovating them or transforming them into new entities is something new in China.

The Wang Shu's Zhoushan initiative is unique in China as it deals with industrial heritage (and not only hutongs as housing) as it is based on renovation and transformation of construction.



Traditionnal housing and urban disposal in china

Putuo Context : the progress of demolitions

The city is being partially, in fact almost totally demolished in order to rebuild new constructions and essentially housing programmes.

The new urban landscape is then made of disconnected entities of different scales, without transition between old and new constructions.

Some old housing remain as leftovers from the past.

The palimpsest of the original city brutally disappears, and the constructions progressively swallow the history of the harbour - city.

Rubbles from demolitions



*Ancient housing connected/
disconnected with new housing*



New constructions





*traditionnal house/ granit/
timber and tiles construction*

Putuo traditional housing

Traditional local houses are set around a central courtyard in which people hold their day-to-day activities such as cooking, washing, laundry drying, small gardening, and water collect.

They are now surrounded by new housing, and the urban pressure for the land property gets always stronger and tougher.

The inhabitants are often families with old people who have few resources to resist and keep their property.



*traditionnal house/ living
around the courtyard*



fishing activities

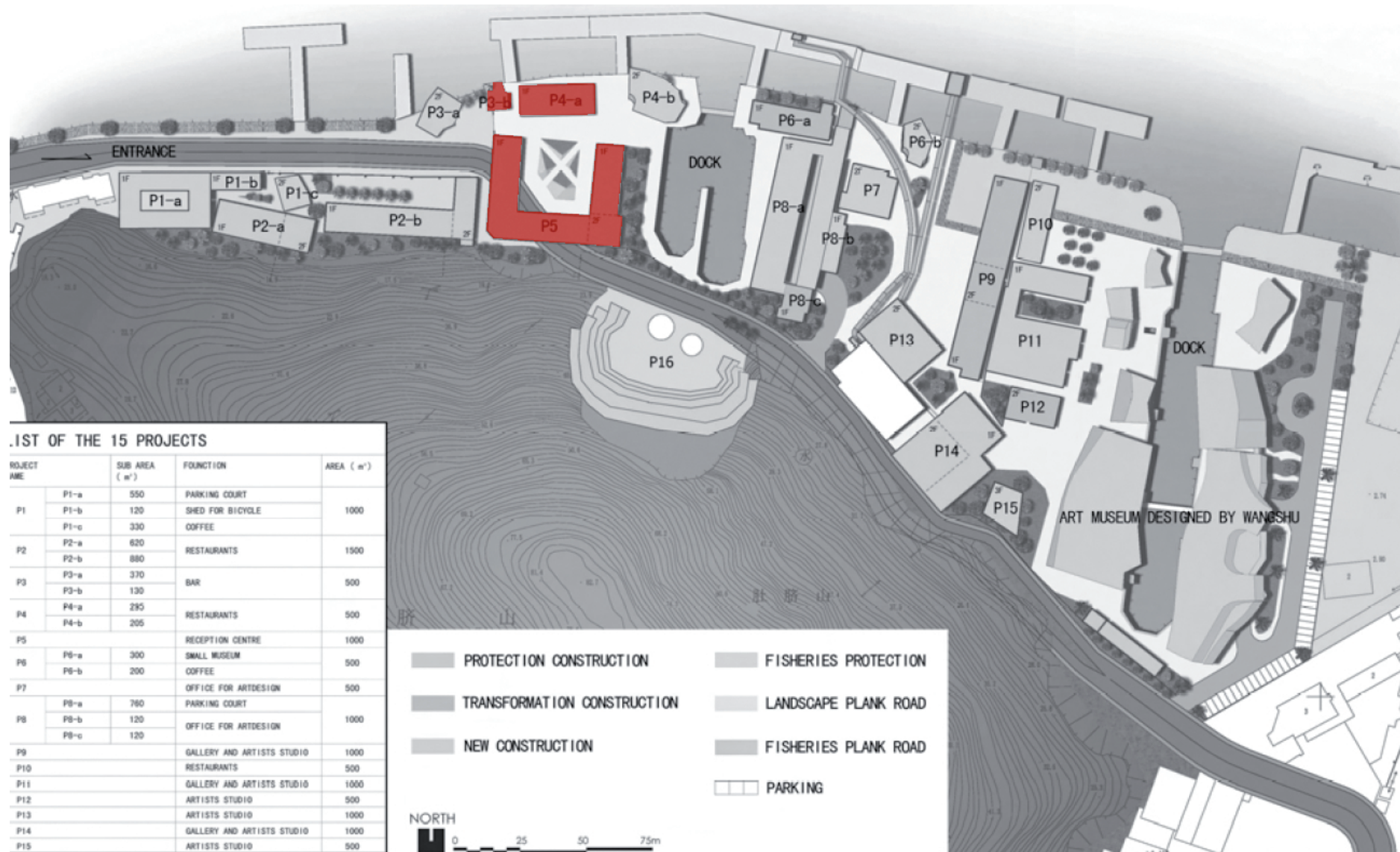


The harbour decline

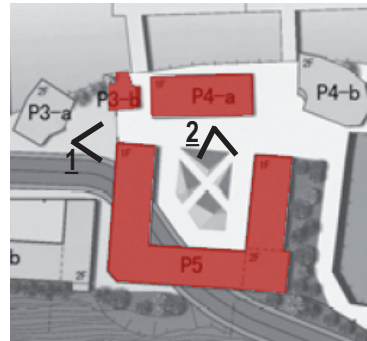
The site and its original activities are now in a real decline because of the development of a new industrial harbour just a few kilometers away. The new harbour can receive much bigger fishing boats, as the ancient installations were built on a more «human» and «handcraft» scale. If some women are still occupied by repairing the nets, the ancient docks are not used any more. The picture shows the last boats that entered the site in order to be taken care of..



Original Masterplan



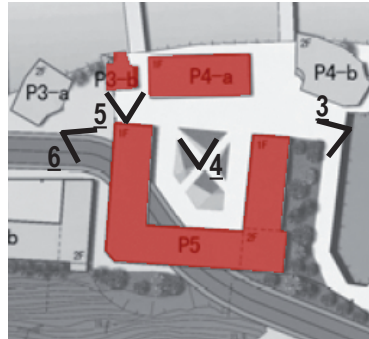
5. The courtyard P3, P4 & P5



3



Back side of the D



Courtyard side of the C

4



5



Front side of the A

6



Front side of the A



Constitution of the walls

The physical properties of the existing constructions are very different : made of granitic stones, bricks or bad reinforced concrete , all the walls are in a very bad state.
The existing windows, glazing and doors are also to be removed.

Roofs are mainly build in a traditionnal way with timber frame and tiles. However, airtightness and watertightness are not ensured. So far, they cannot be kept in this condition.

the roof of the B is a concrete roof, suffering of many waterleaks. As well, I could detect in many cases outgoing iron framework.

To sum up, the construction pathologies are abundant and shall be integrated in the renovation process.

Furthermore, the refurbishment shall not be based on the special architectural value of those buildings. None of them presents any particularity that should be put forward.

II. PROGRAMM AND ENVIRONMENTAL AND CONSTRUCTIVE ISSUES

1. Looking for the Genius Loci

The heritage value is to be found in the use and the layout of the construction and volume - and not in the architecture or aesthetic.

The courtyard must enhance its very rich social role : The history is still present on the concrete pillars through ancient writings on the wall remaining : «I am going to work in serenity»; then «I am going back home in serenity».

- **How to recreate the past use ?**
- **How to translate into a modern use the history of a site ?**
- **How to develop an answer that could be sustainable ?**

As the buildings were used for repairing boats, the courtyard was the main meeting place of the whole site - in connection with the external city. This friendliness brought by the courtyard's social use should be reinforced by the project.

All the buildings are actually in a very bad statement : their only value comes from the original use and activity, and mainly from the vacuum they created inside the courtyard inside them.

The function of the courtyard as entry of the site, as social link is much more important than the notion of building heritage. In fact, the cultural history of the site should be maintained in a new restored site, much more than pushing forward the buildings.

- **How to give a new life to the courtyard ?**

The project should offer different functions that could be a transition between the exterior world and the new life of this cultural garden.

The social links are to be reinforced as they were the bonding element between workers when they were still active there.

The main subject is then to welcome the visitors and give an answer to their primary needs :

- **how to deal with the traditionnal construction and climatic constrains ?**

- **how to reveale the strengh of a GENIUS LOCI ?**

The traditional building techniques solve the earthquake issues by creating constructions that can be easily repaired.

This concept off re-build-able construction is very important to understand the inner logic of the construction.

The project should be based on this idea that the structural schemes should give the possibility to exchange a part of the elements or simply to rebuild a part of it that could have been damaged. Every manipulation has to be simple and efficient.

2. Programm elements

Wang Shu gave some information about the programm : the refurbished buildings should be transformed into restaurants and bars.

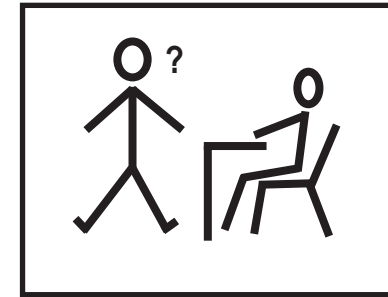
But a deeper analysis of the site made us think that we have to offer more functions to this place so that it fulfills its role of social connecting place.

The courtyard has to welcome the visitors walking through the gate. They should get there informations and facilities, as a main entry of a new touristic area.

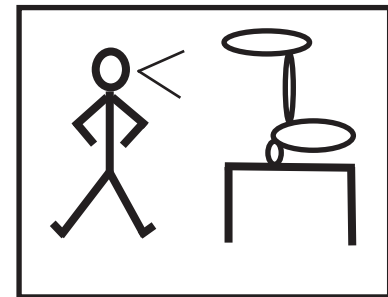
The diversity of possibilities should bring life to the courtyard.

The P3, P4 and P5 site become then a «reception center».

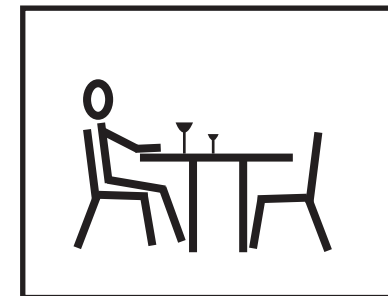
Therefore came the necessity of creating the «central place» which was the courtyard's original use. The project had to recreate a landscape but also a spatial layout that could gather activities and people.



1. Get information



2. Visit exhibition and shop



3. Have a drink / snack

Local traditional construction

The use of wood in structural schemes belongs to the tradition in China.

Wood is traditionally employed as a structural material in every ancient constructions, based on beams and pillars. Lacqued or raw, it has also a value in the way it is then sculpted (beams), giving informations on the family and its status.

Easily removable, timber construction is also a good response to the geographical hazards (earth-quakes).

The second traditional material is brick.

The surrounding constructions are all made with this compilation of brick and tiles (WAPAN tradition) that can be removed after an earthquake.





3. Exemples of urban refurbishment

1985 : China joined the World Heritage Convention».

1987: the first sites are listed on World Heritage.

2008 : the government issued a regulation regarding protection of historical and cultural cities and villages.

This very late conservation context gave the local government the possibility to get grants in order to begin the refurbishment of approved sites.

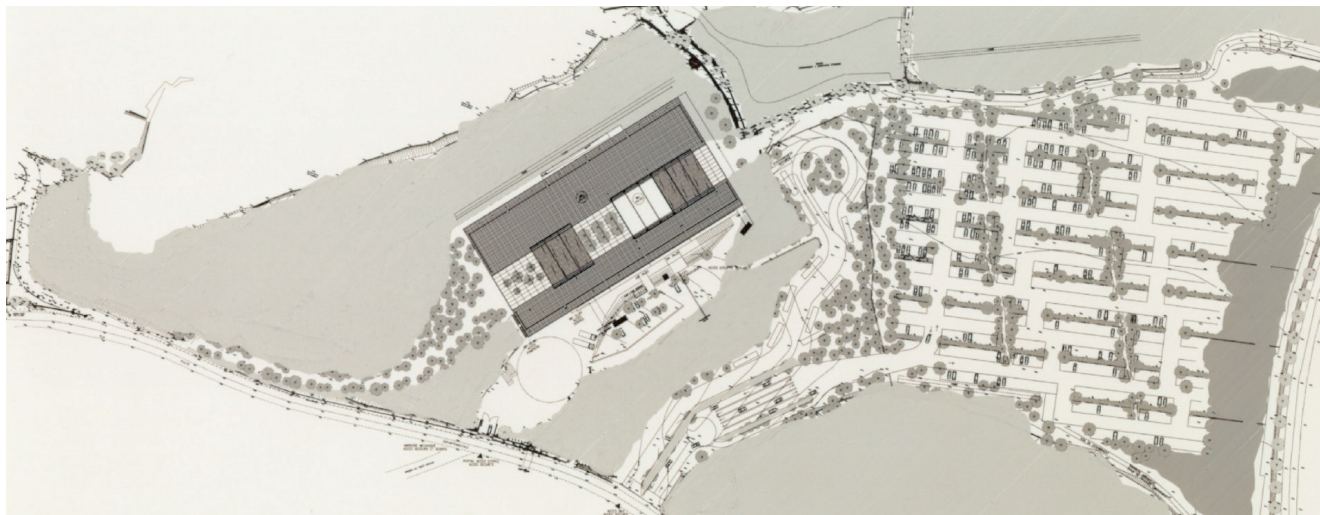
Some examples of refurbishment are then to be visited in China. Those examples aimed to maintain strictly the traditional aspect of constructions : black traditional tiles as well as white coating are kept in their traditional expression and execution details.

The pictures of Shaoxing historical district are significant from the 3 principles that have directed the restoration process :

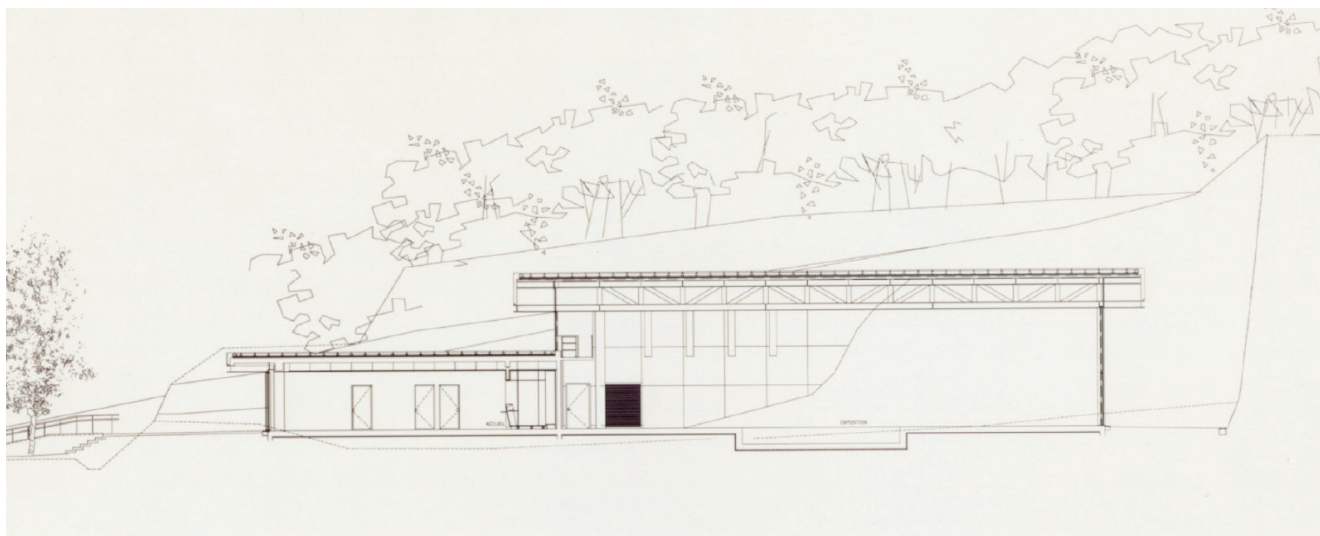
- respect of the construction authenticity as well as the urban constitution
- preservation of social fabric
- government project management - without seeking any profit.

source : *Villes et Patrimoine en Chine* - Cité de l'architecture et du patrimoine, 2011/





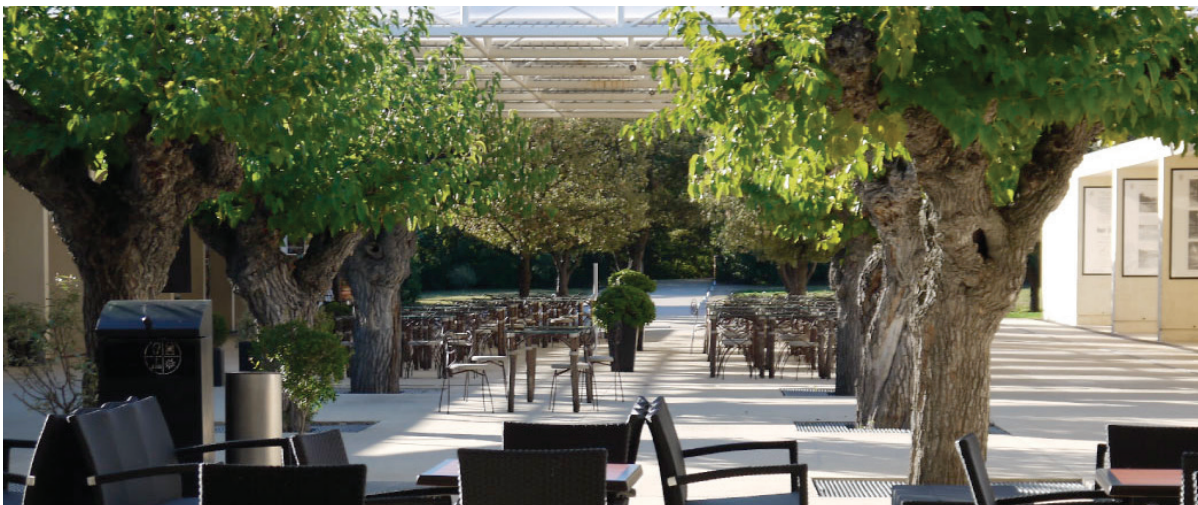
masterplan



*cross section on the covered
central street*



bird's eye view



covered street and social use

Similar programm

It is almost impossible to get similar examples in China. Ressources about realisations are rare. Furthermore, such case studies are a total new improvement in this country.

However - some realisations in France inspired my reflections mainly about the use of external spaces.

In this direction the work of Jean-Paul Viguier for the touristic installations next to «le pont du Gard» is very interesting.

This programm was completed 2001.

Directly after the parking places, a small center was created in order to densify the services. Then, several uses are settled like restaurant, souvenir shop, facilities, library, bookshop, information desk, etc.

The museographic center has a direct acces from the central circulation.

The main «street» is covered as the mediteranean climate ask for solar protection and cross ventilation. The roof creates an new area - socially very active thanks to the urban fourniture such as banks settled in the center and large trees.

Source : Jean-Paul Viguier Architecte - sttlement project

III. SPATIAL AND ARCHITECTURAL DISPOSITIONS OF THE PROJECT

1. Revisiting the masterplan

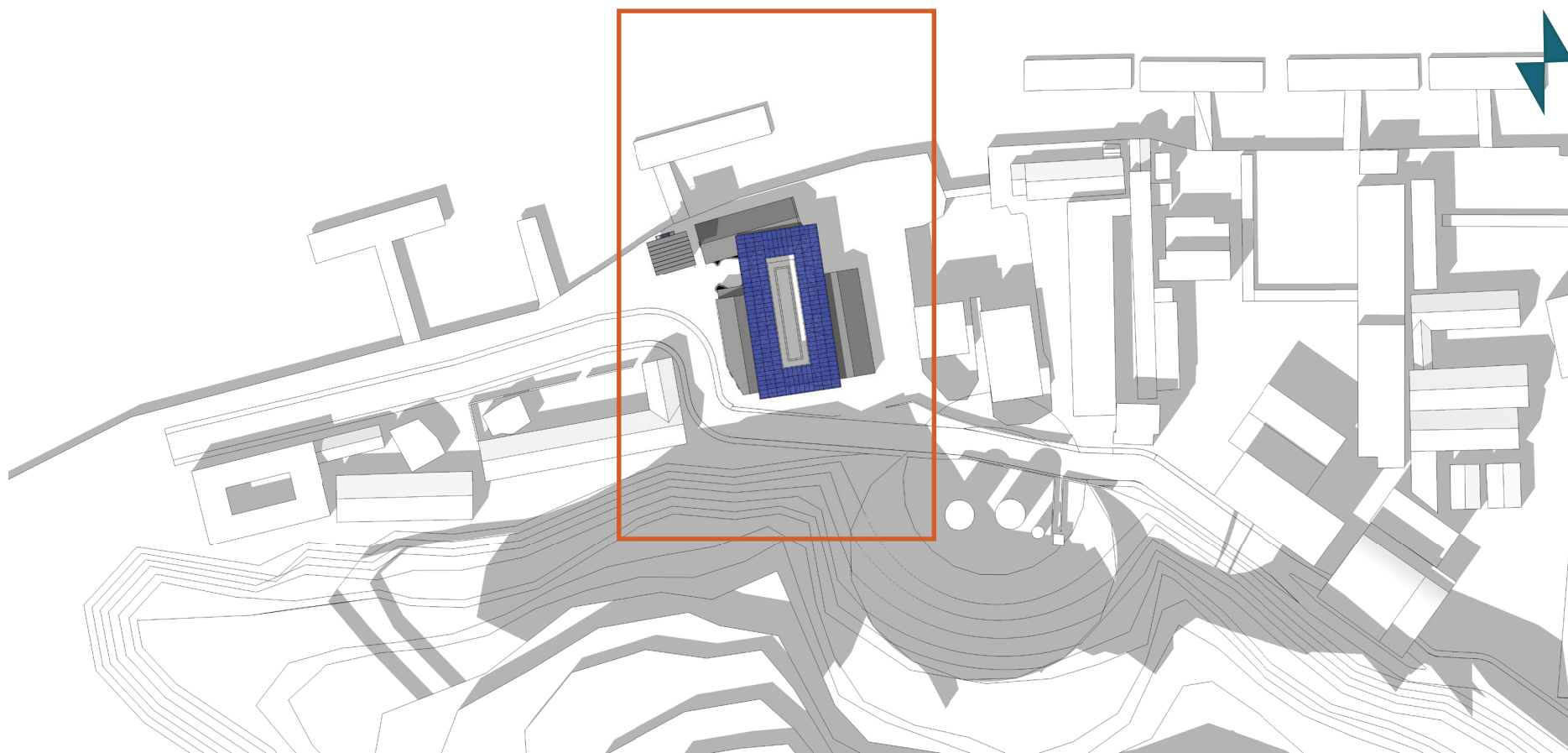
Original masterplan proposition :

Wang Shu made the proposition to add an «object» on the eastern part of the P4 building and to destroy only a part of the back courtyard building. The road is directly settled along the facade.



Curent masterplan proposition :

The «object» is transformed into a great roofing covering the courtyard. The back building is totally removed.



2. Applied programm

The current building is surrounded by three constructions : B, C and D. I decided to name them this way instead of the only distinction of P3 P4, and P5.

The A building is considered as a special object as it was the historical entry gate of the site. Our project offers to keep this different treatment that belongs to the site identity.

1. The gate

The A building is the entry gate of the site. Spatially slightly disconnected from the central area, it will keep its own identity. It is extended with two more floors in order to offer an overall point of view from the top floor. It allows to maintain the connection - physically and visually- between sea and land, sea level and hill level, ancient harbor and the cultural garden, inside and outside.

2. The back wall

The courtyard originally had a building at the end of the courtyard. However, Wang Shu's masterplan creates a road which outline goes through the building. It would then be demolished. Yet, the project keeps the elevation as a testimony of the original presence of the building. It is then considered as a decor, a back stage taking part in the courtyard layout.

It is also kept in order to protect the pedestrian from noise and danger when they enter the site.

3. B, C and D

The three buildings surround the courtyard. The original constructions were fishboat houses (D), repair areas or workshops (B) and small temporary and precarious housing (C).

The masterplan aims to restore those buildings and assign the new functions:

B - on the western side - connected to the entry - would be the visitors' first step in the site as they can get inside information and documentation about the activities and history of the site. B building also includes an administration office dedicated to the whole site, as well as concierges and guides lodges.

C - on the northern side - as an interface between sea side and land side - would be the bar-restaurant with a terrace looking onto the sea and the harbour.

D - on the eastern side - would be the shop and exhibition place where local handcraft and craftwork as well as work of art can be shown and sold. D buildings also includes toilets that are reachable from both part of the site.

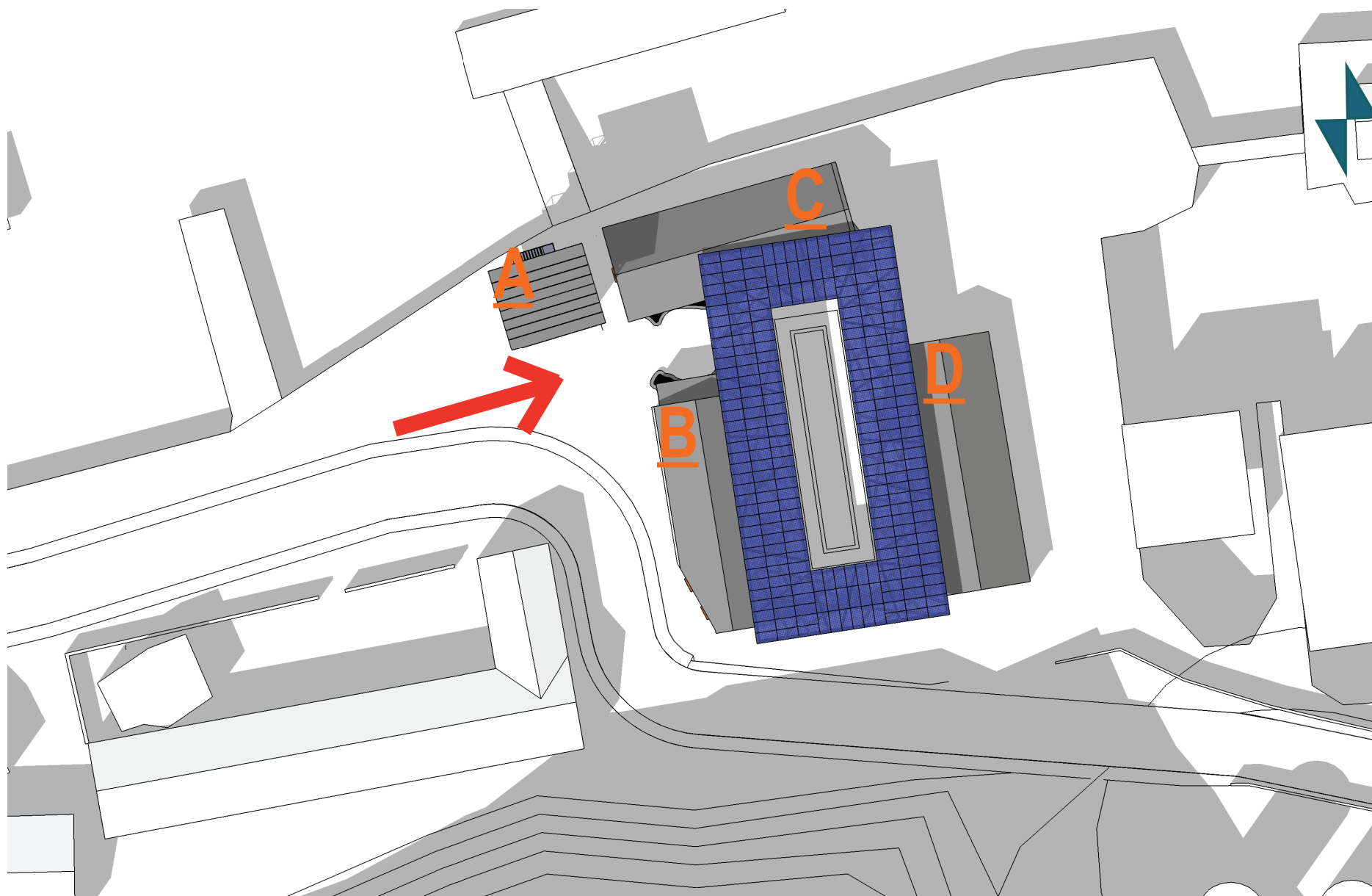
4. Landscape : on the ground

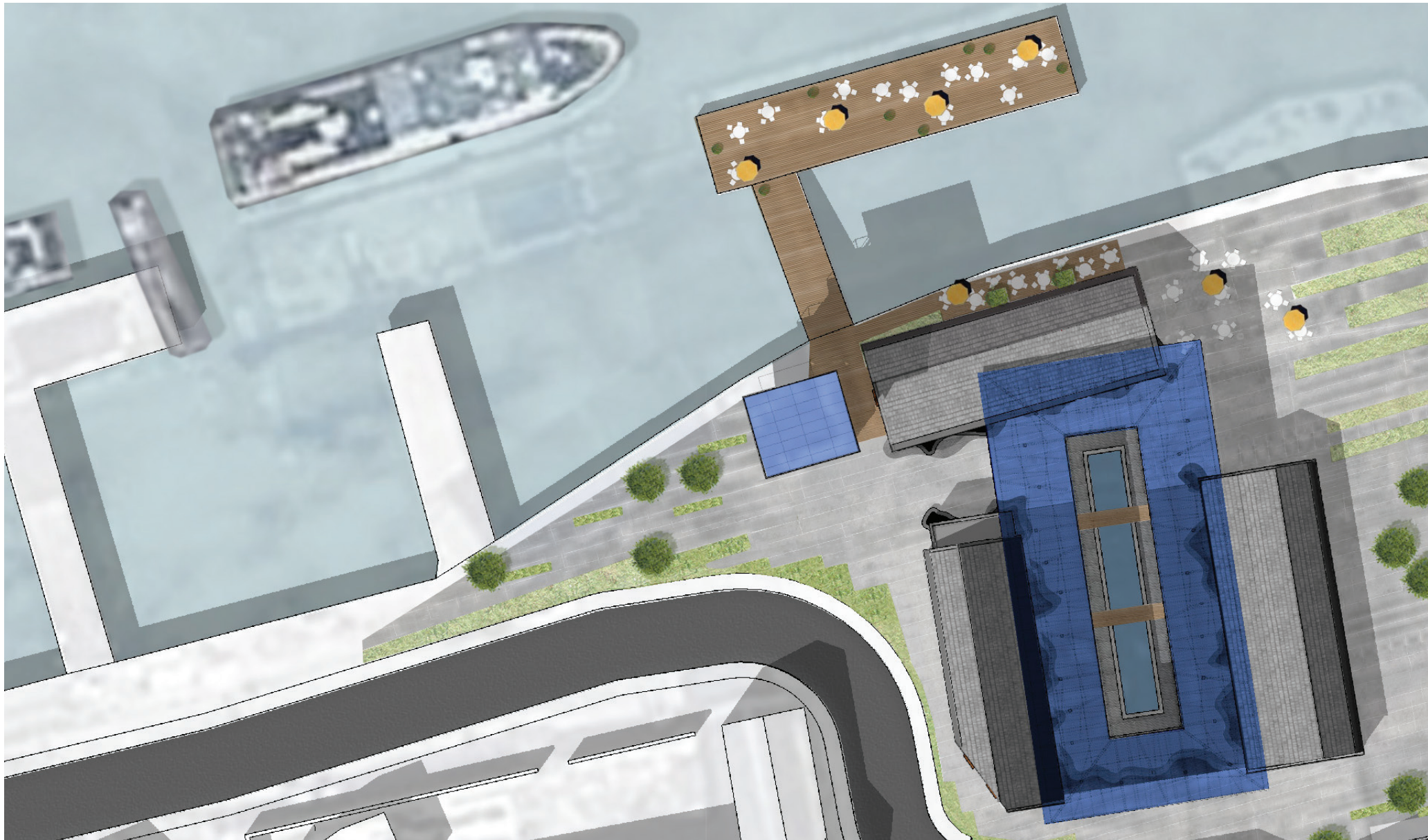
In order to recreate the courtyard, the exterior groundfloor - considered as a landscape - is a strong element. It maintains the continuity and create the spatial unity. Dedicated to pedestrian use, the courtyard floor is almost totally paved with traditionnal grey/black local granitic cobblestone. It is extended by cairns or small hills made of traditionnal black bricks collected from demolished traditionnal constructions.

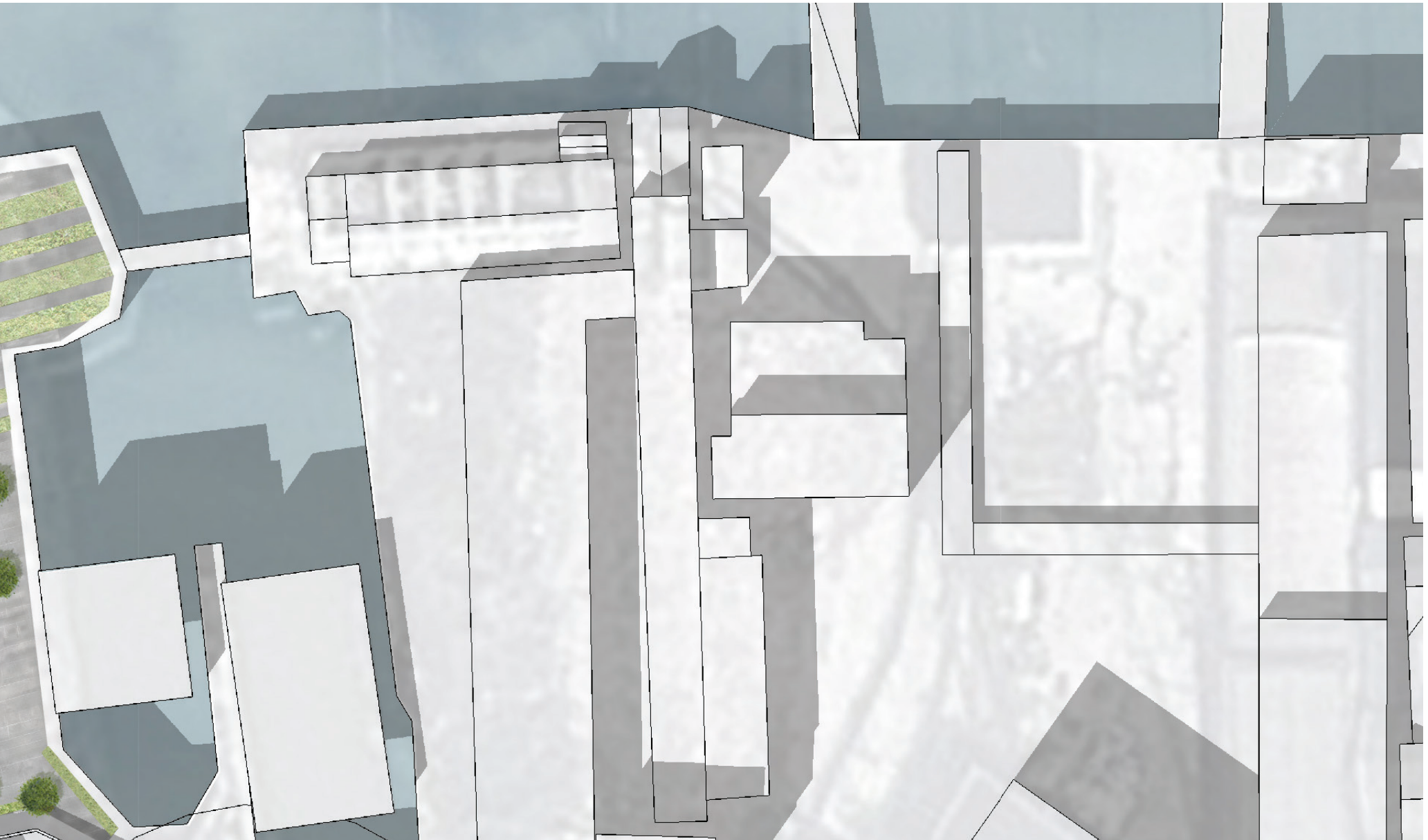
Those cairns offers seats positions for visitors. In the middle of the courtyard there is a bassin wich collects rainwater.

5. Landscape : Canopy

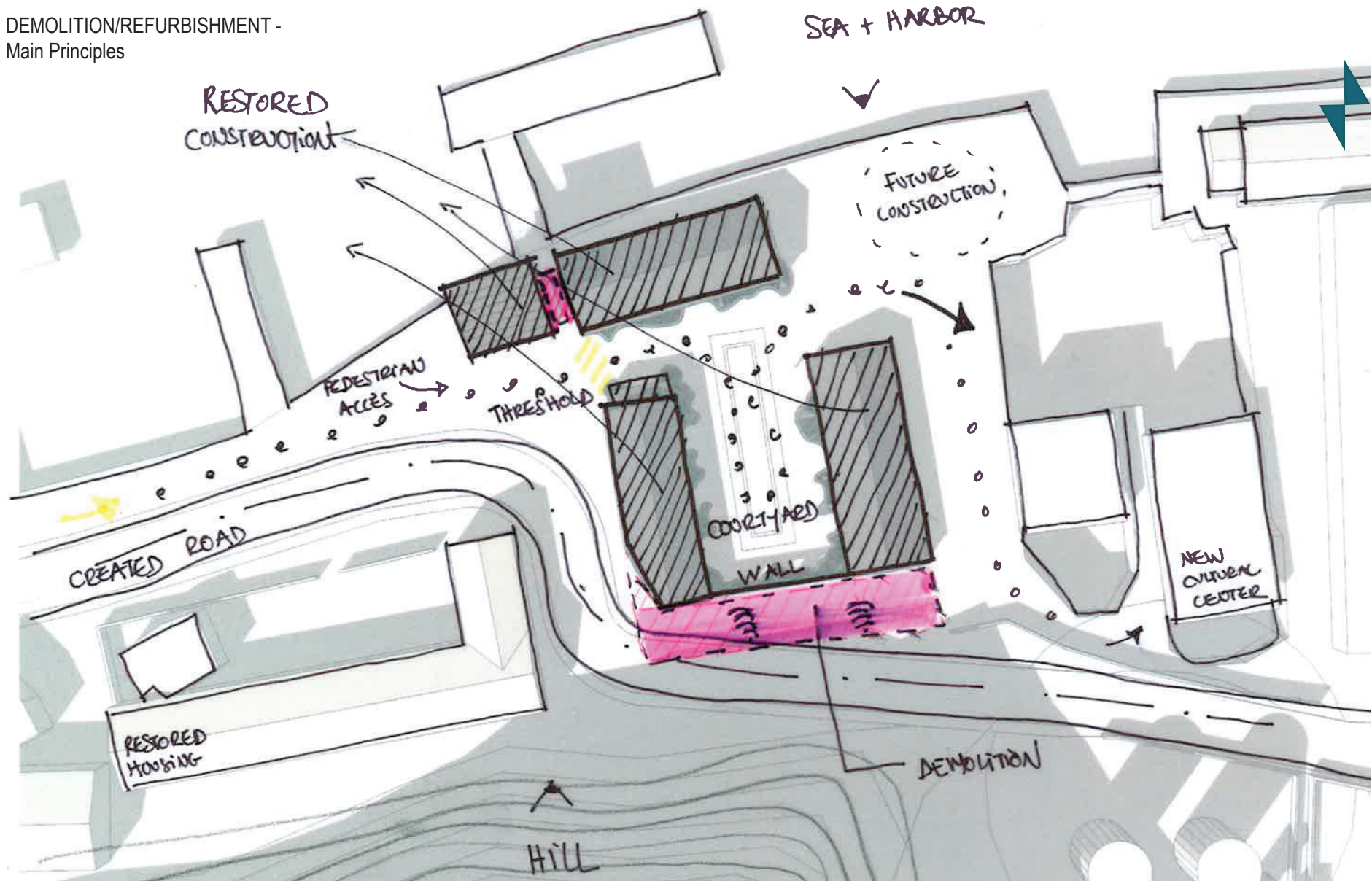
The courtyard is protected by a great canopy - a wooden structure covered by glazed pannels of PV cells, creating shadow and protecting from the rain. Big «trees» are supporting the canopy. The trunks are disposed randomly, planted with deferent axes as well as the branches support the canopy that build up the courtyard sentiment.





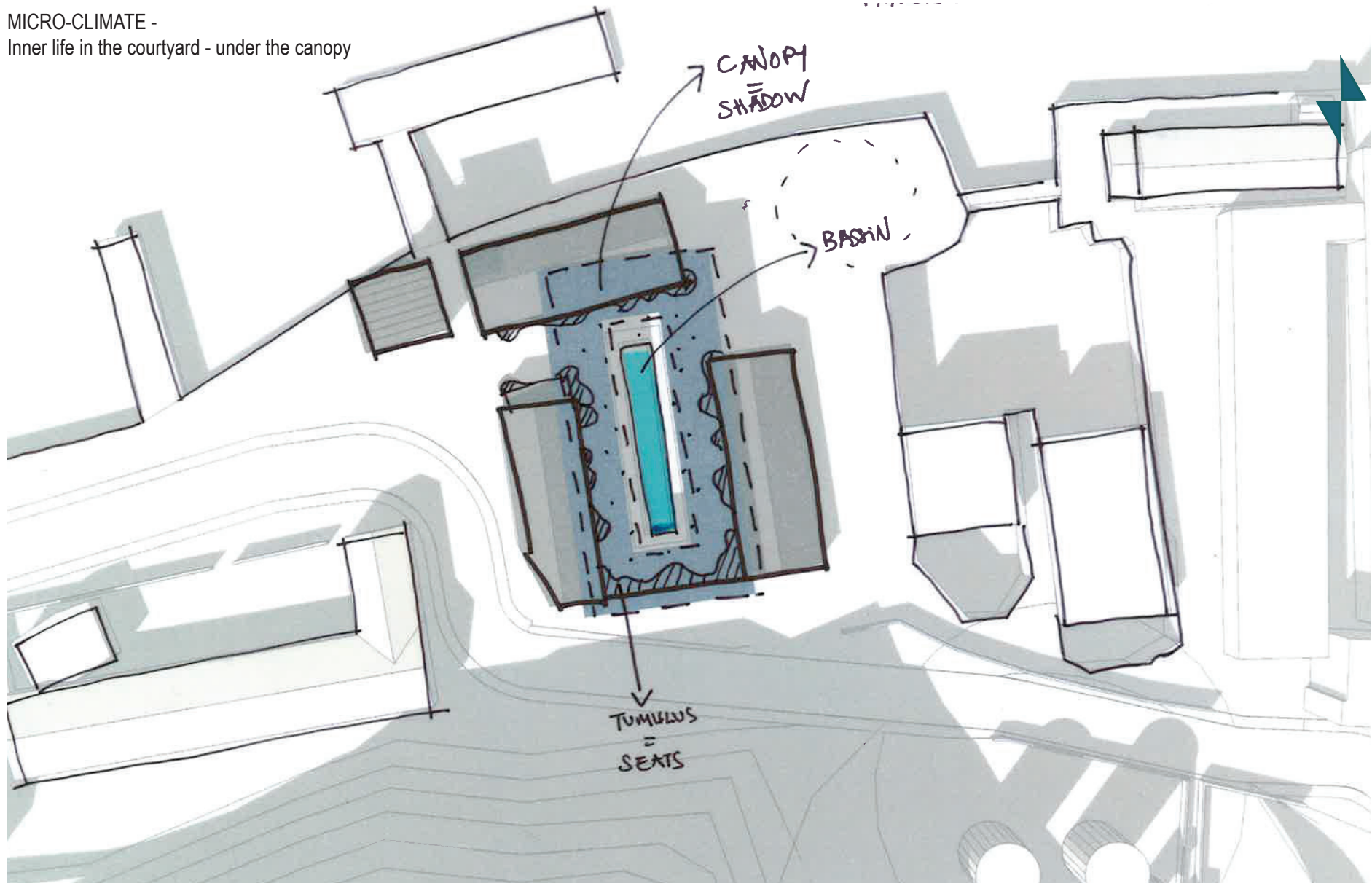


DEMOLITION/REFURBISHMENT -
Main Principles

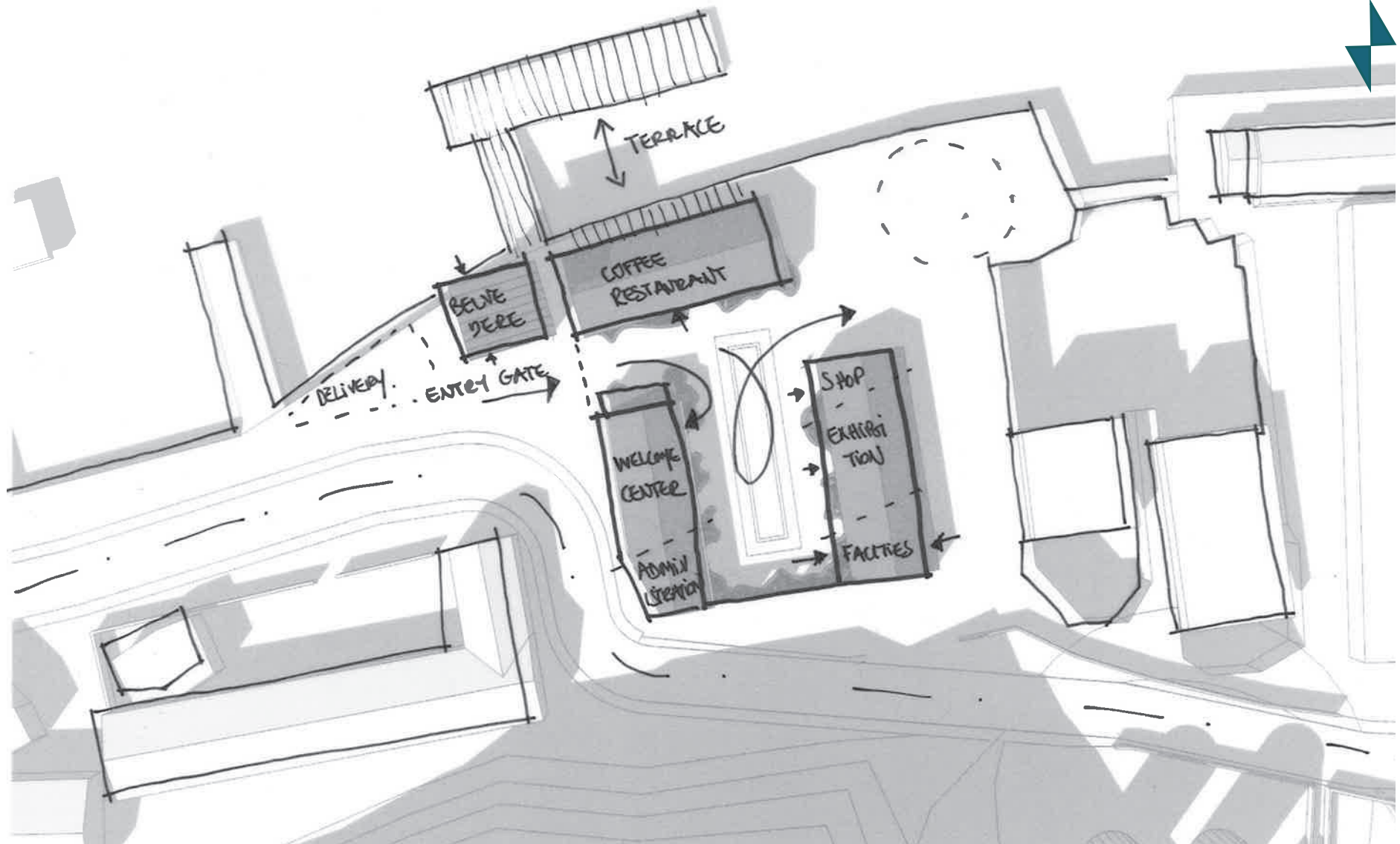


MICRO-CLIMATE -

Inner life in the courtyard - under the canopy



PROGRAM AND MAIN FUNCTIONS & ACCESS



3. Architectural concept : living in the courtyard - under the canopy

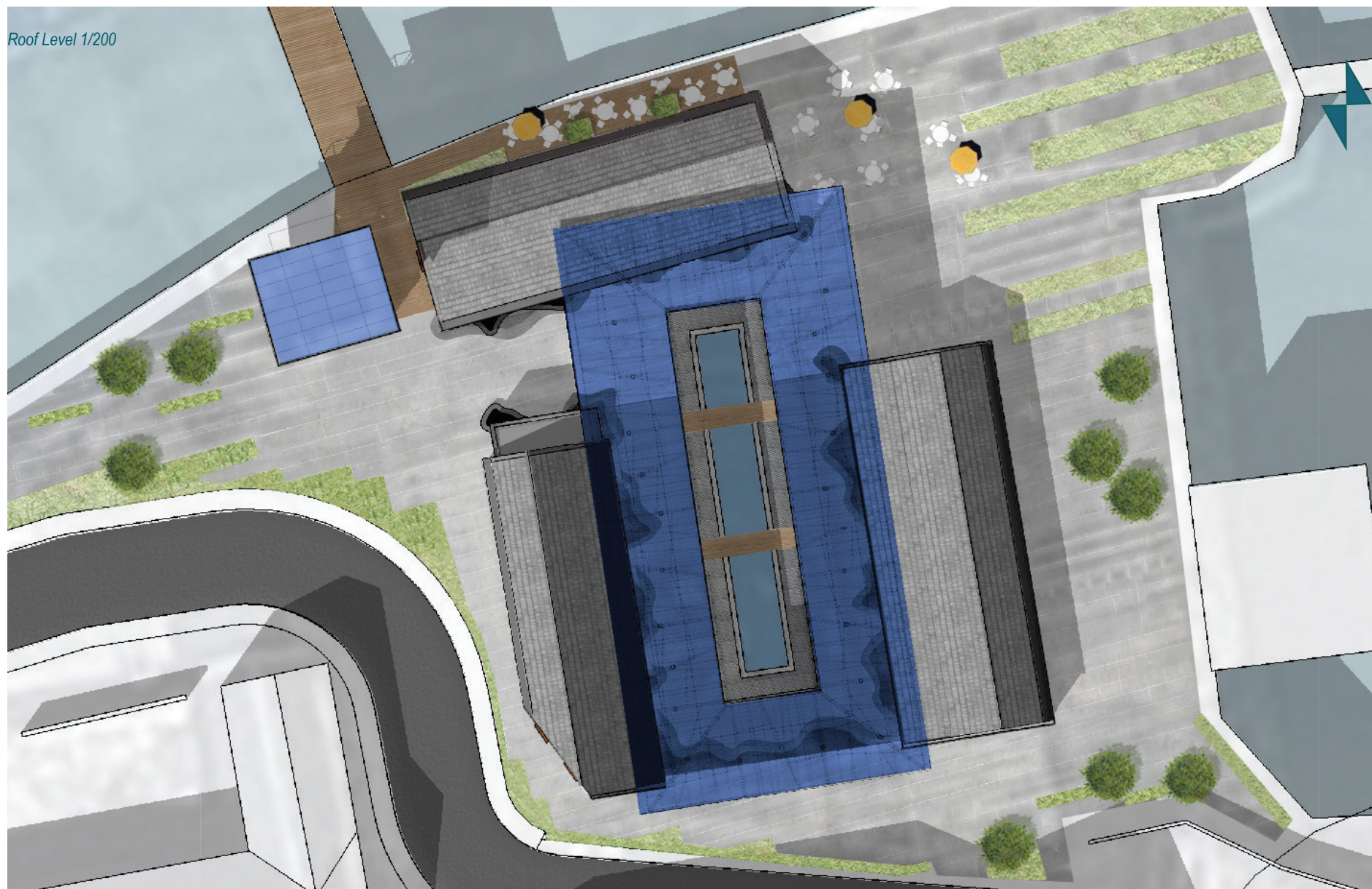
The concept is born of two different images : another location in the area - planted of old trees producing shadows and welcoming the visitor - creates a protecting space out of nothing but the empty space left. Empty - but SHELTERED. The presence of nature had to find an other way to exist in the site - into a new expression: therefore came the idea of canopy. This idea had a strong echo with the traditional housing disposal - around the courtyard - as a universal but also local way to socialise (work, experience, stories, etc.) with other people.

Then, I thought about ancient washhouses that left the emptiness get its own expression through the hole left in the roof in order to collect rainwater.

Dealing with heritage is not only to consider the architectural value of a building. In this case our constructions are totally «usual». Every building are toughly damaged (caused by the very low construction materials quality especially). The real impact of this place is related to its spatial organisation and function. The heritage is to be found in the use of this place which was the entry of every worker coming every morning to work there on repairing the boats.

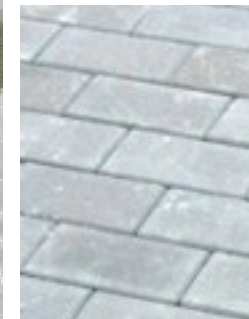
The heritage is to be found into the spatial use - as well as the social and historical value. It is to be found in the existing settlement of constructions - around the courtyard.



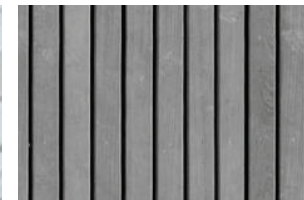




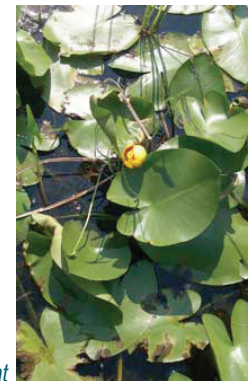
bricks



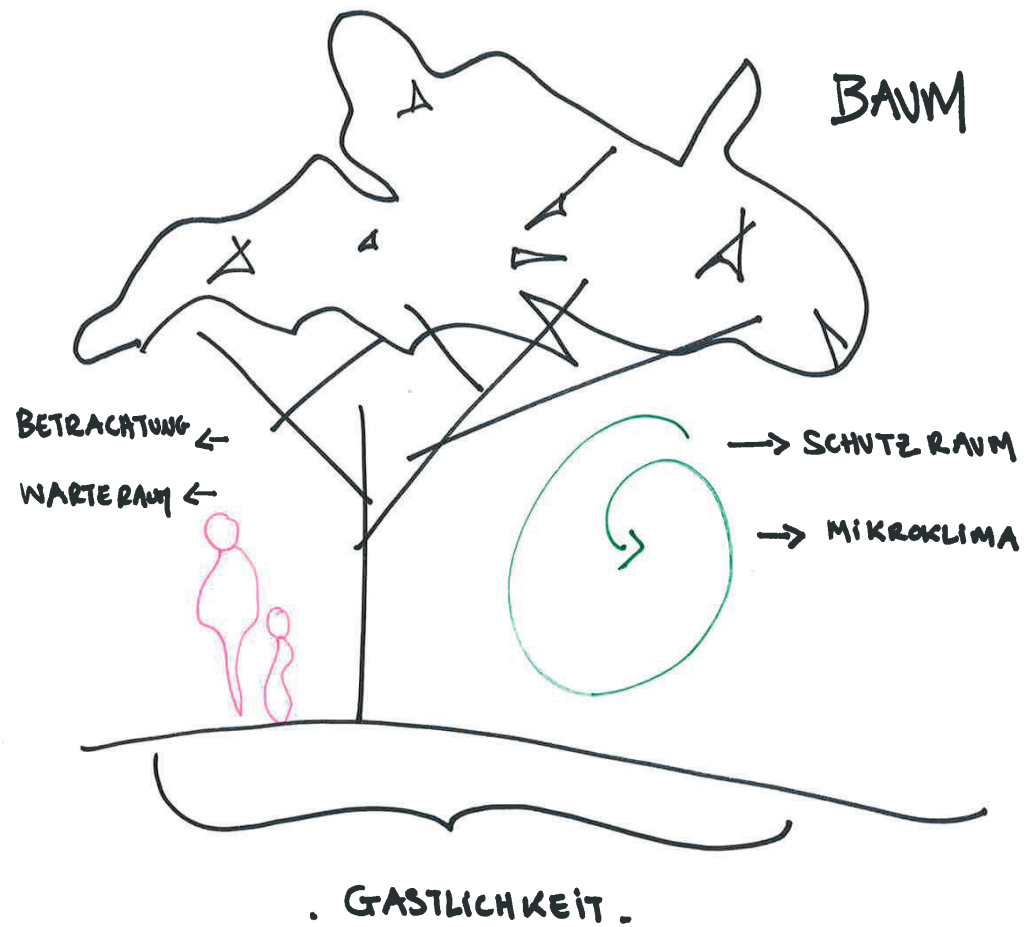
granit pavement



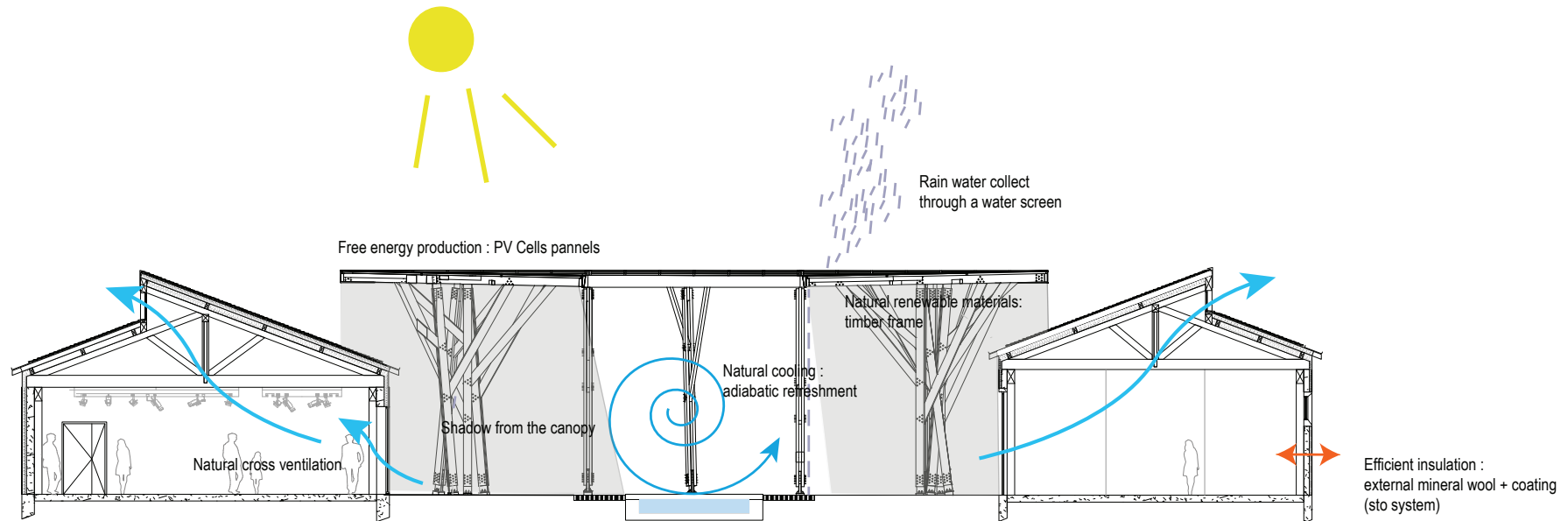
wooden deck



aquatic plant



The connection between roof, shelter and tree fern structures could be taken as a willingness to restore the link between nature and artefact. It feels then natural to find back natural forms in construction a sign of common sense integrated to spatial disposals. The project offers also to pay tribute to the original and immemorial social role that play the generous shelter of a tree canopy.



4. Sustainable refurbishment

1. Ground : the use of ground is strictly limited to what it was as the project partially densify the tenement (belvedere).

The inner courtyard is kept. As the ground is strongly polluted by oil, the ground floor is covered by a new coating of tile. The water is then collected and driven to a main collector for reuse.

2. Water : the climate in Zhu Shan is very rainy. The project offers to collect rain water in a central pool. The roof construction is built as an IMPLUVIUM.

This traditional layout allows to store water for different uses such as : watering, maintenance, etc. The pool in the middle – completed with the natural ventilation presents the possibility of adiabatic refreshment during summer as the air is naturally cooled as it flows above the basin.

3. Air : natural ventilation is one of the main subject of the project. The new roof should protect from the sun – but also allows a natural cross ventilation.

As well ; the renovated buildings are deeply opened thanks to new windows and doors. The roofs are also equipped with openable windows. Mechanic ventilation should also be installed.

As the attendance level should be very variable - the air regulation system should be very flexible in order to answer to the needs (sometimes very high - sometimes very low).

The strong humidity rate should also be regarded - then controlled. Natural ventilation seems a good answer during spring and summer - as well as mecanical dobble flew system during automn and winter.

4. Energy

The renovated buildings spare energy thanks to natural ventilation, natural lightening and thermal insulation in order to minimize heat or cooling-needs.

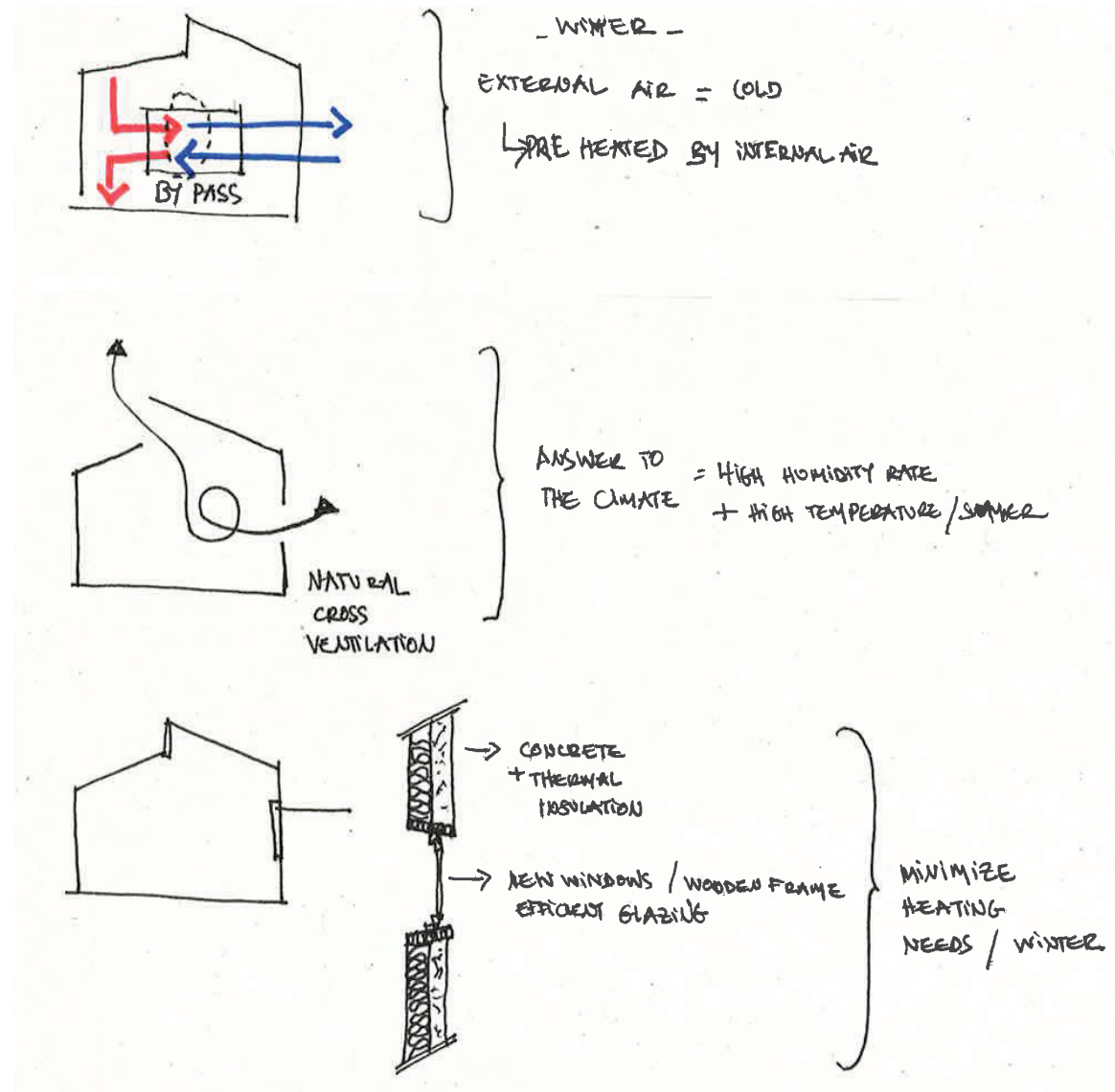
The refurbishment process includes external thermal insulation (vertical walls and roof) and efficient free energy is also provided through a photovoltaic extensive field installed on the roof. As well known, China is for many years the first producer of PV Cells in the world. They export a lot – but the local use is still to be develop.

In our case, I chose to use solar cells into sheets of glass in order to provide shelter but also let the natural light pass trough the roof.

5. Materials

I chose to renovate the ancient buildings as well as the new roof construction with timber.

This material is a full part of the traditionnal construction in China, particularly concerning timber framework. This very ancient tradition allows an easily repaired structure and is totally in harmony with sismic constraints.



5. Restoration prescriptions

Generally - the existing walls and structures of the constructions are in a very bad state. The project aims at keeping them as much as possible. However the original timber frameworks are too damaged to be kept, or even restored. The project then proposes to re-create a double internal structure so as to relief the ancient walls from heavy mechanical constraints.

A new framework is installed on the roof to support the tiles. This framework is not supported by the existing walls but by new timber beams and new load bearing walls (timber frame). The doubling system reinforces the existing structure agreeing to the seismic condition and particularly bracing efforts.

A new structural raster is then applied in both directions.

The existing concrete is repaired and a thermal insulation is installed - as well as new doors and windows (wooden frame). Sun protections (sun-screens) are installed on windows of the outside facades of the courtyard (East and West. The new canopy protects the internal facades.

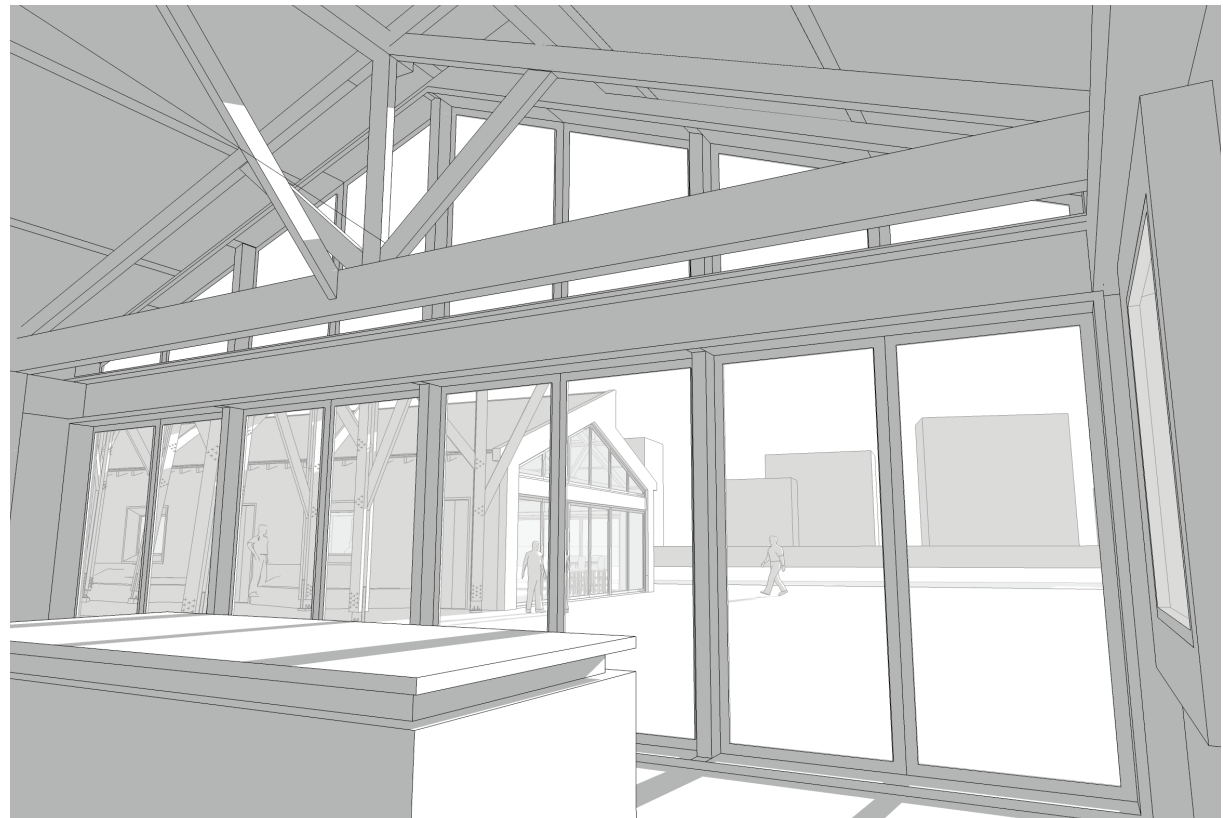
Every external walls are covered with a white coating. The deliberately very simple treatment of the facade, as well as the white colour aims to make

the buildings profile almost spectral - as if they were fading into the landscape.

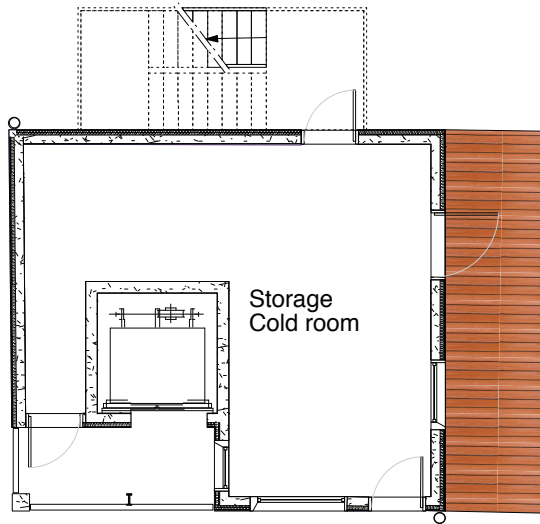
Every roof are restored with traditional black tiles and black metal sheet to collect rainwater and conduct it to lateral waterspout. The most important difference in the volumes and architecture are the windows (mechanically

controlled and motorized) between the two levels of the roof). This system should bring light and allows natural cross ventilation which the building strongly needs considering the high humidity rates.

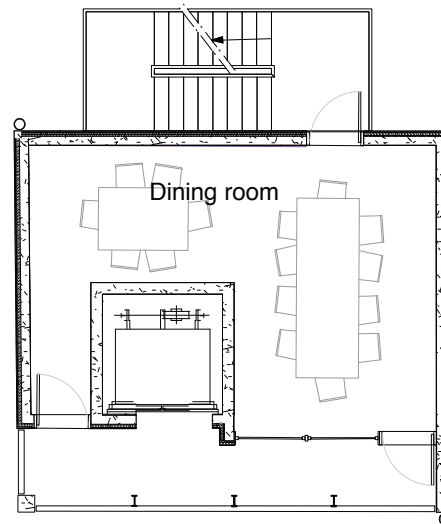
The inside spaces are totally renewed in order to install the new functions.



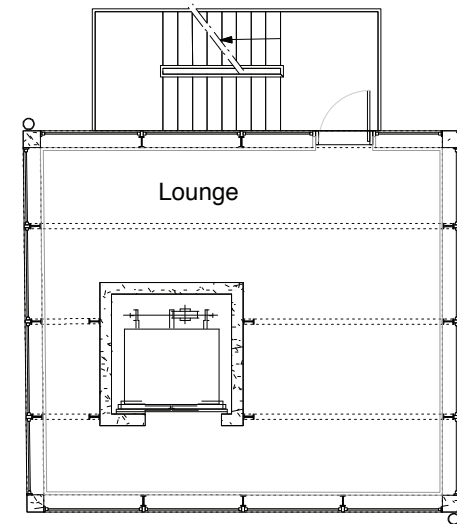
6. A Building : the «belvedere»



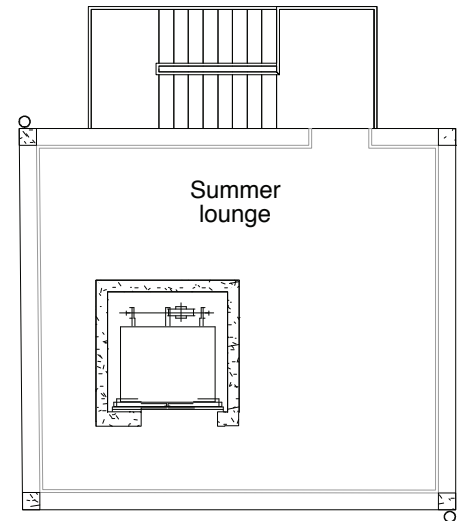
Ground Floor 1/200



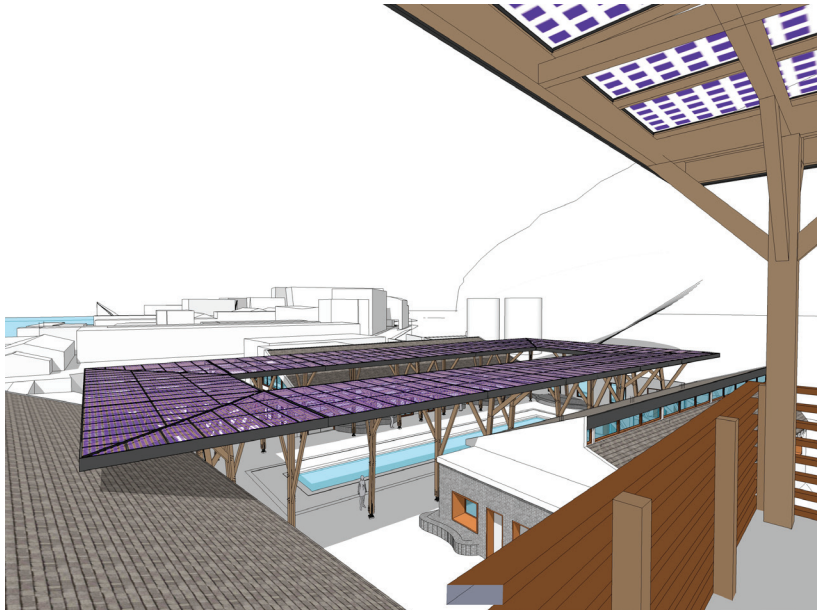
First Floor 1/200



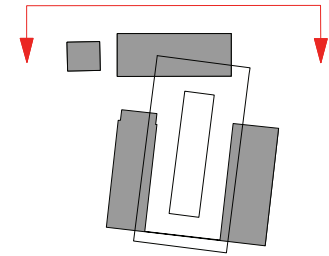
Second Floor 1/200



Third Floor/terrace 1/200

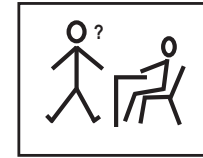


View over the site from the Belvedere

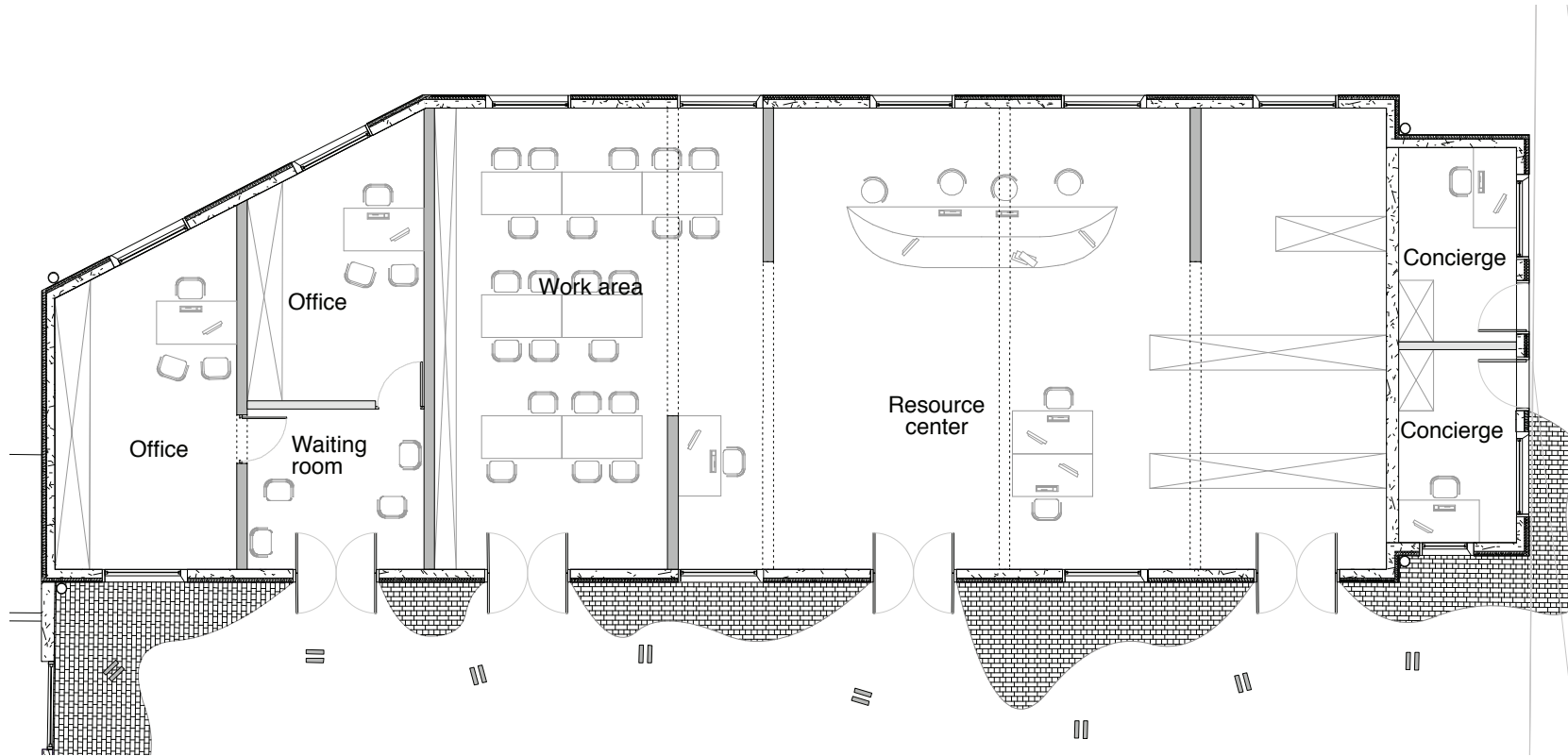


Elevation 1/200

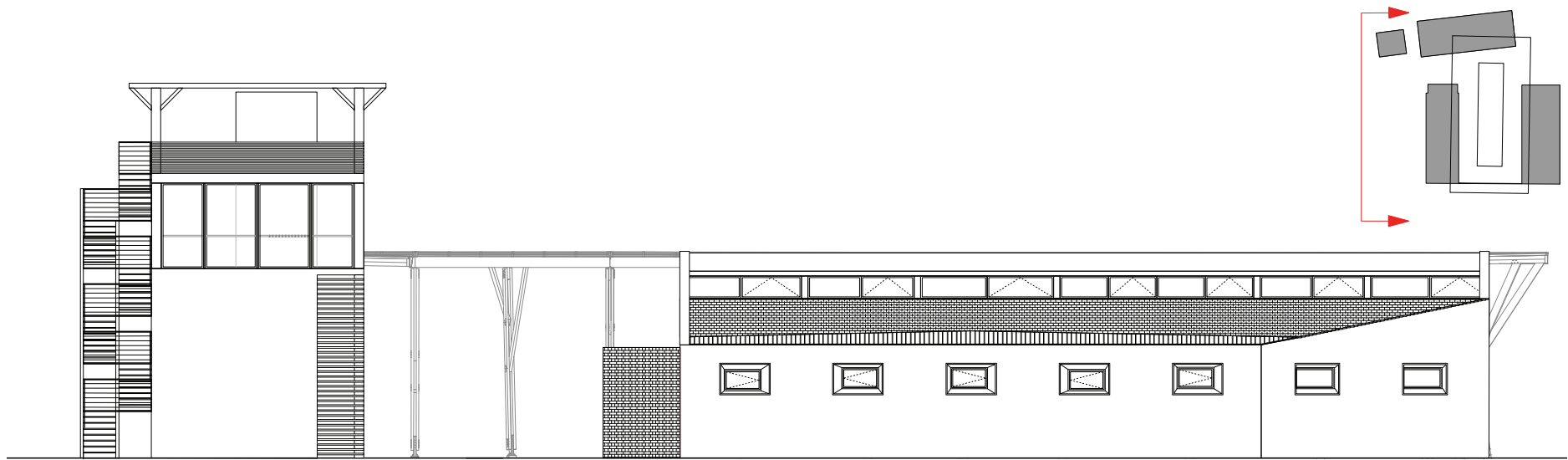




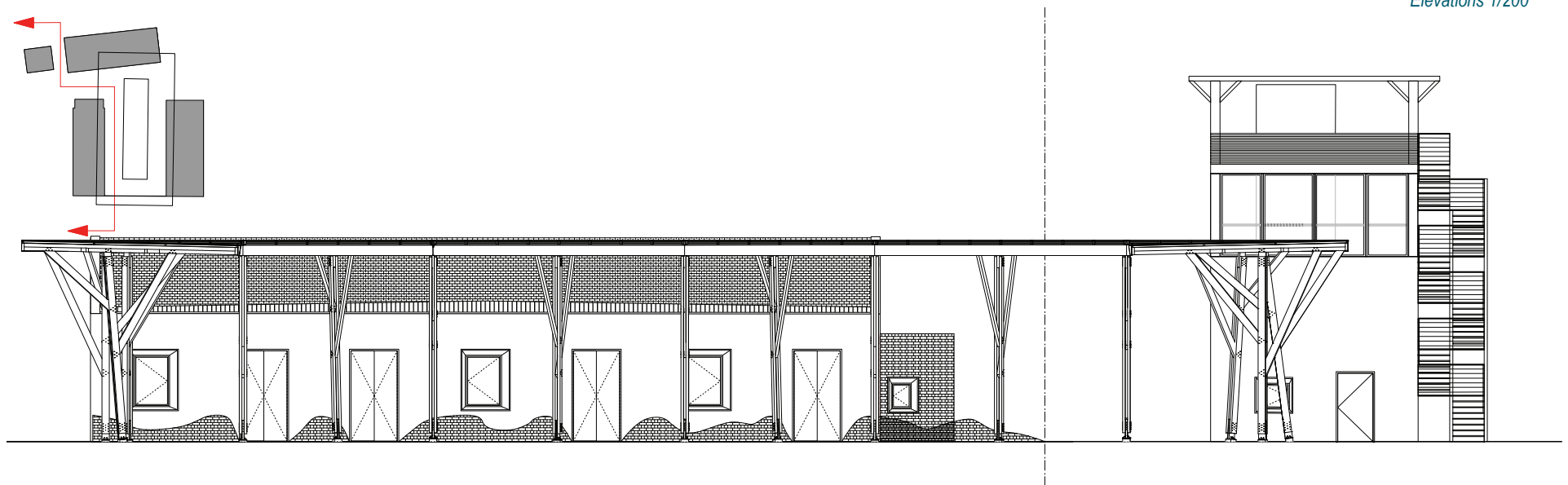
7. B Building : the reception center

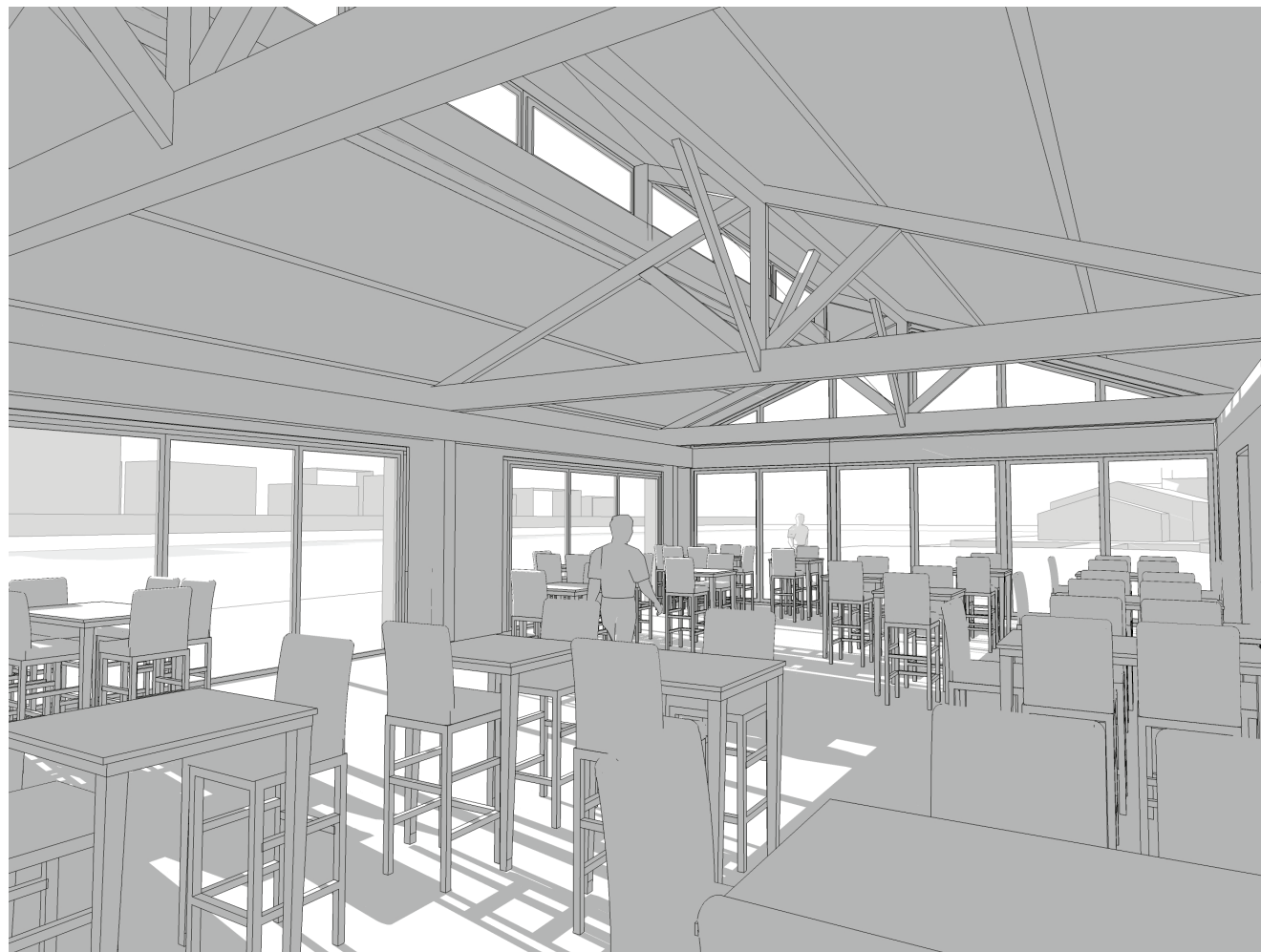


Ground Floor 1/150

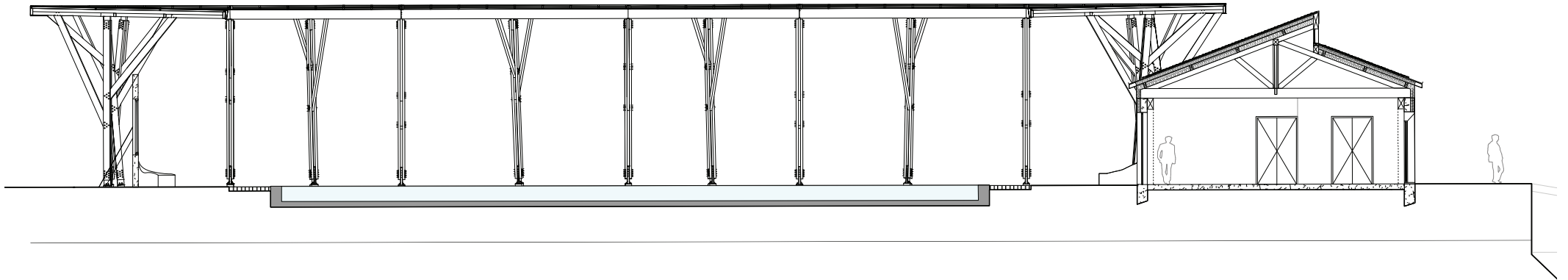


Elevations 1/200

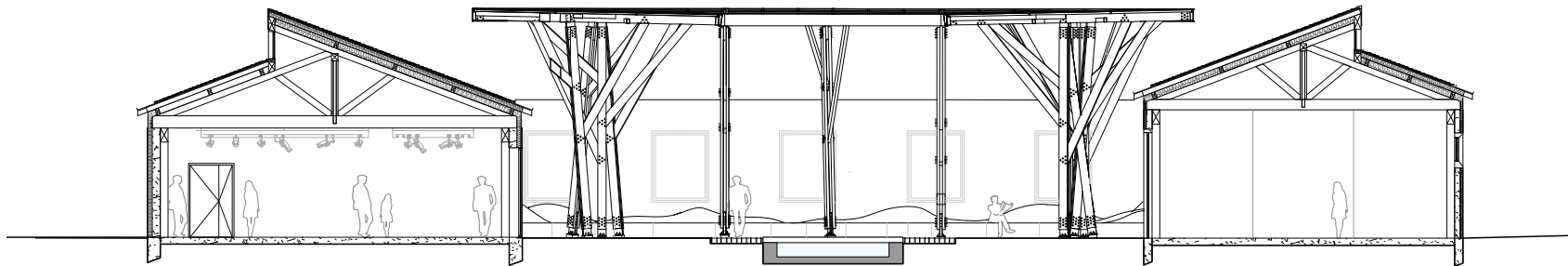


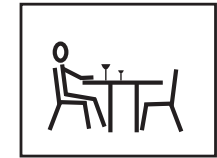


View of the inner space of the restaurant

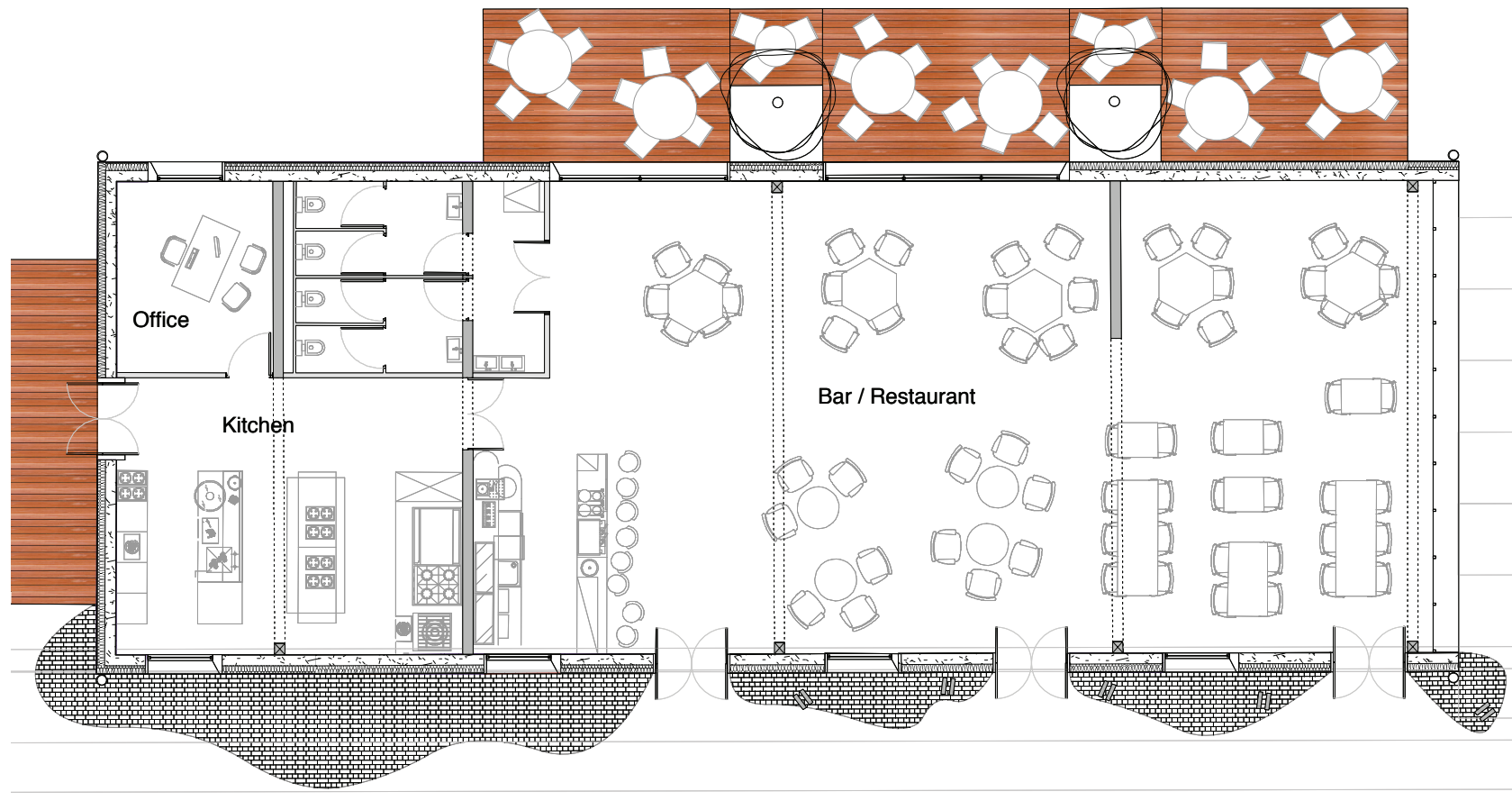


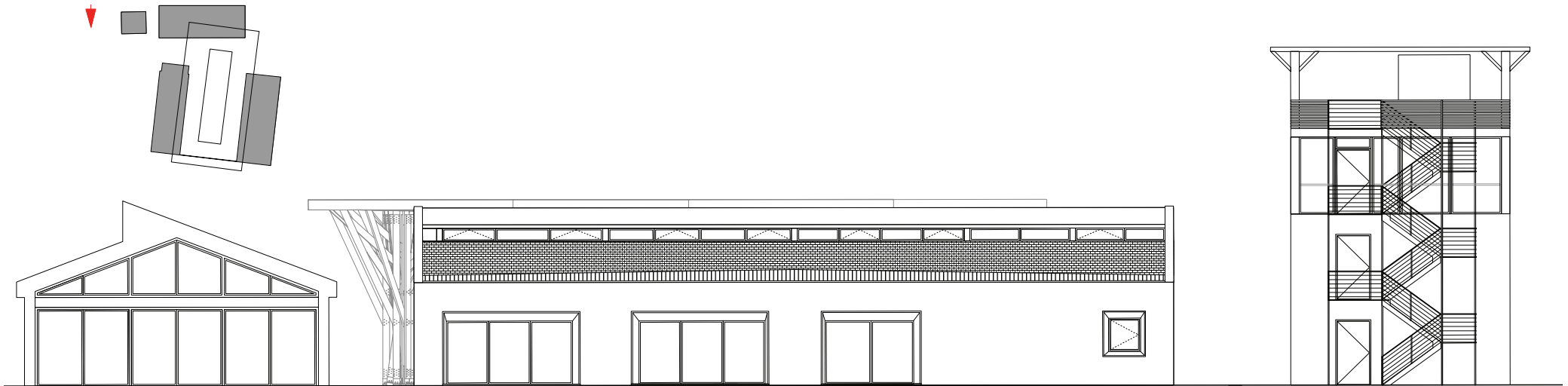
Cross sections 1/200



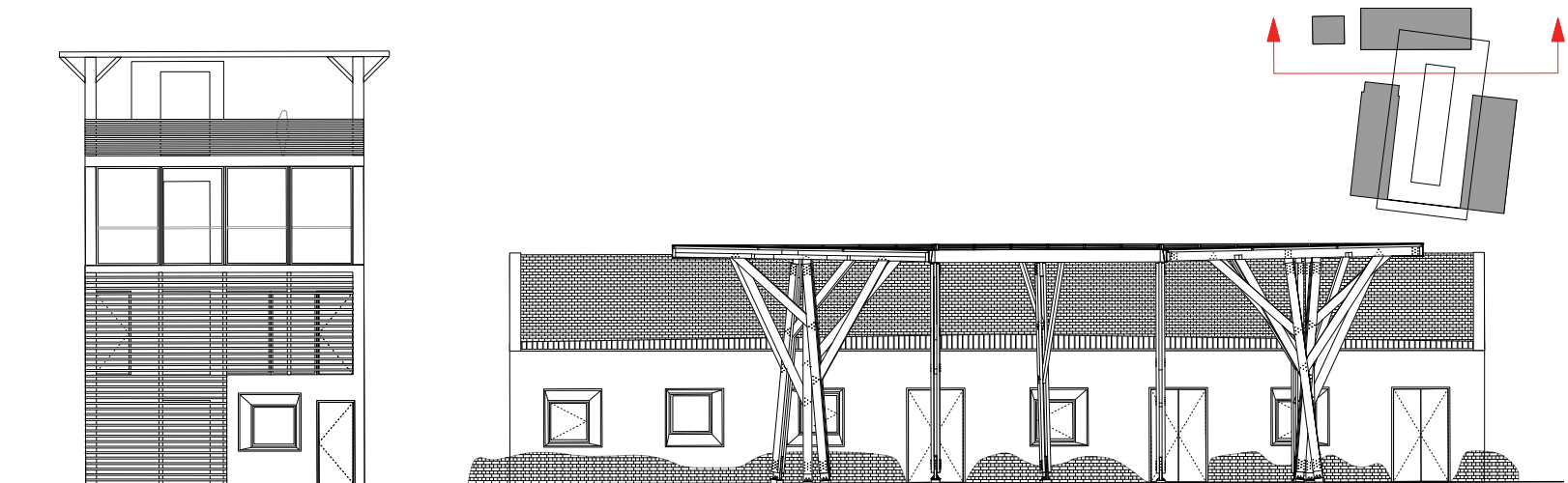


8. C Building : the restaurant/ bar

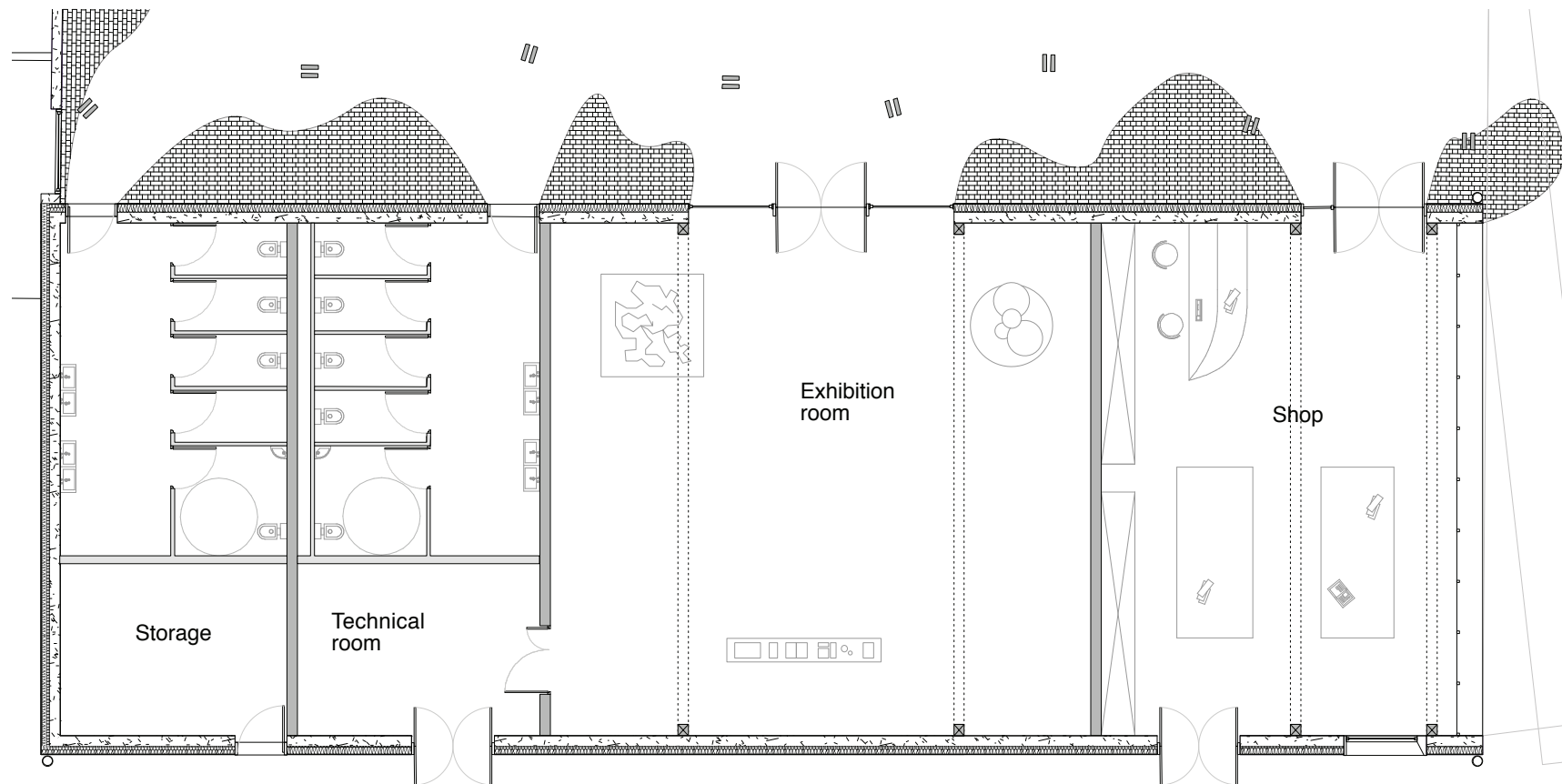
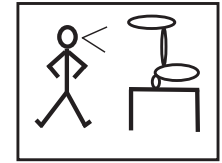


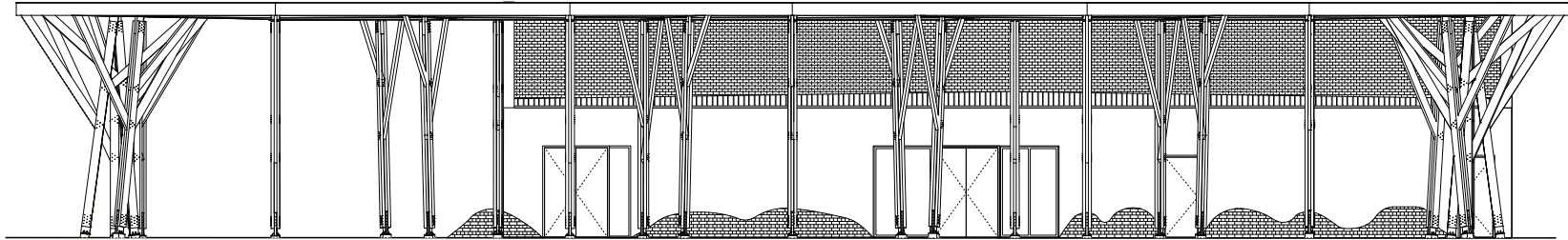


Elevations 1/200

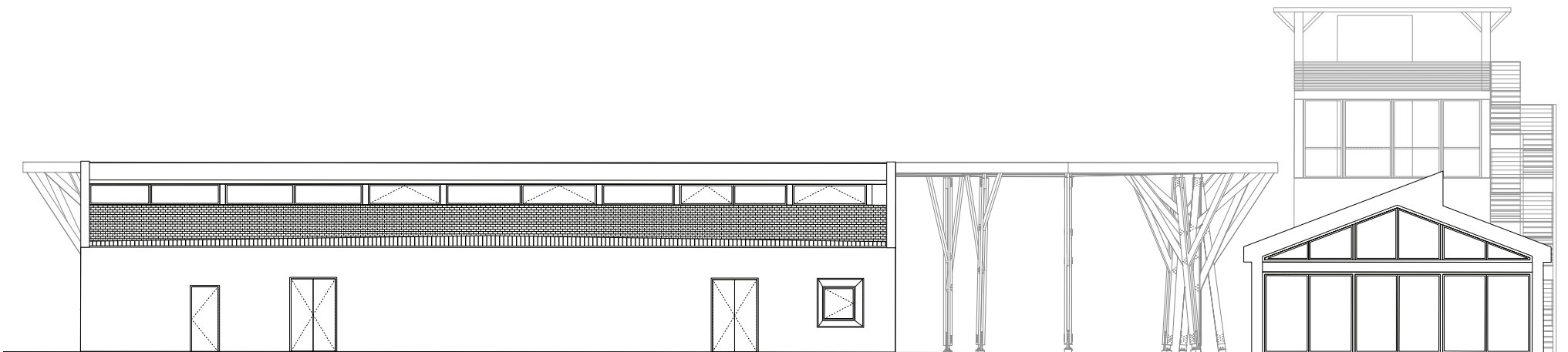


9. D Building : Exhibition and shop





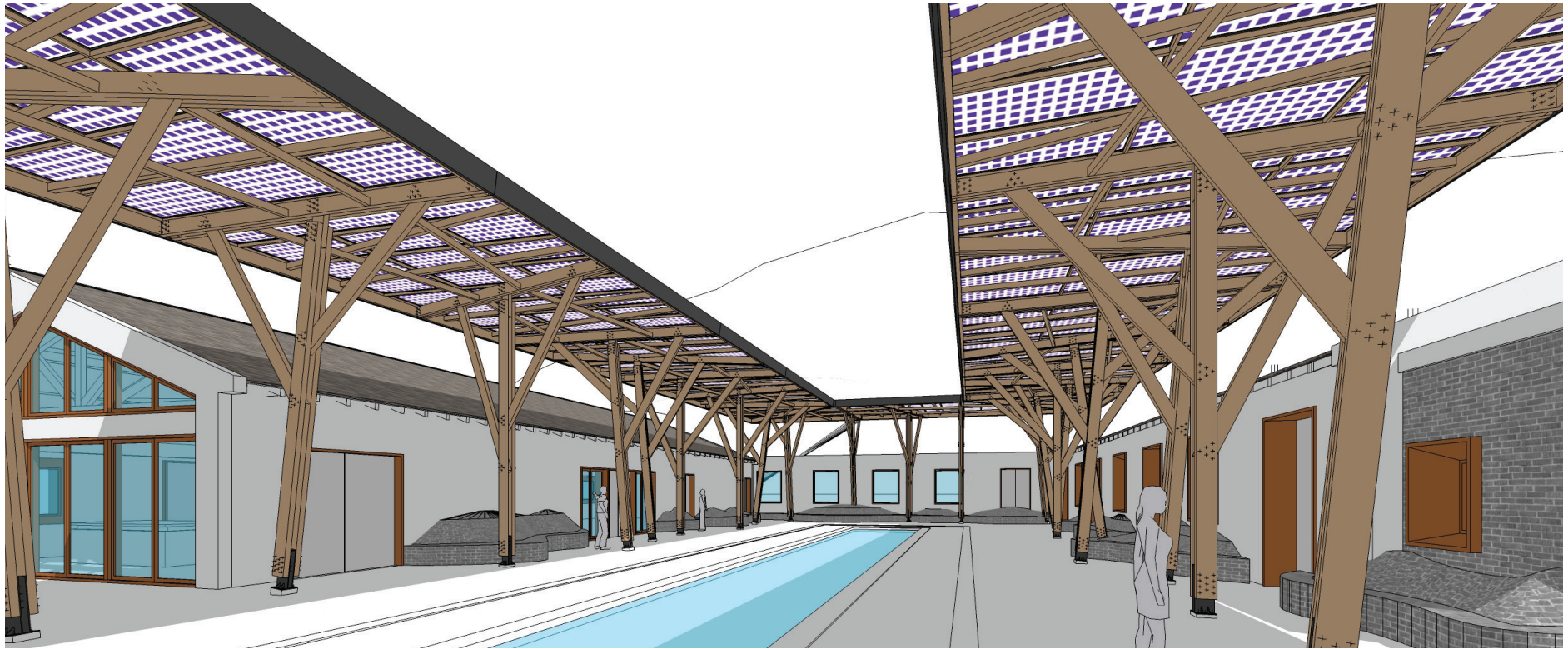
Elevations 1/200



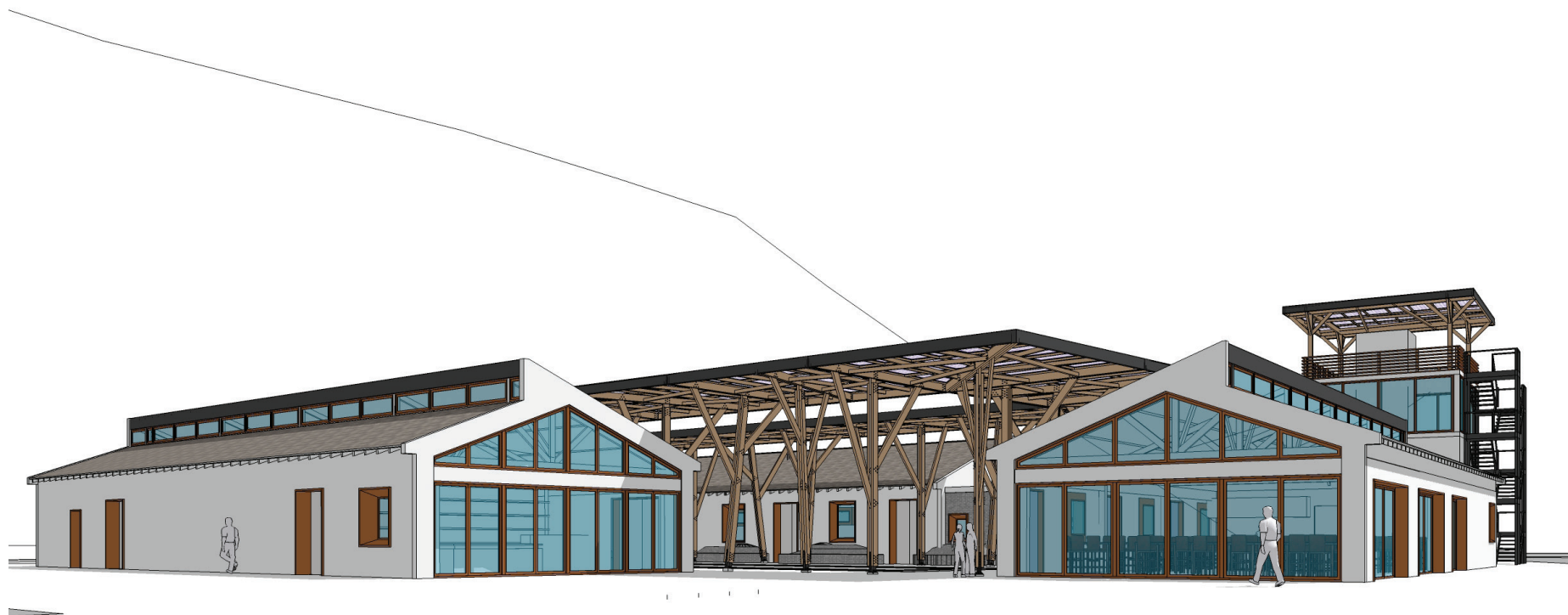
living in the courtyard : LIU JIA ZHI ; a sustainable heritage restoration process in China



The courtyard / before



The courtyard / after

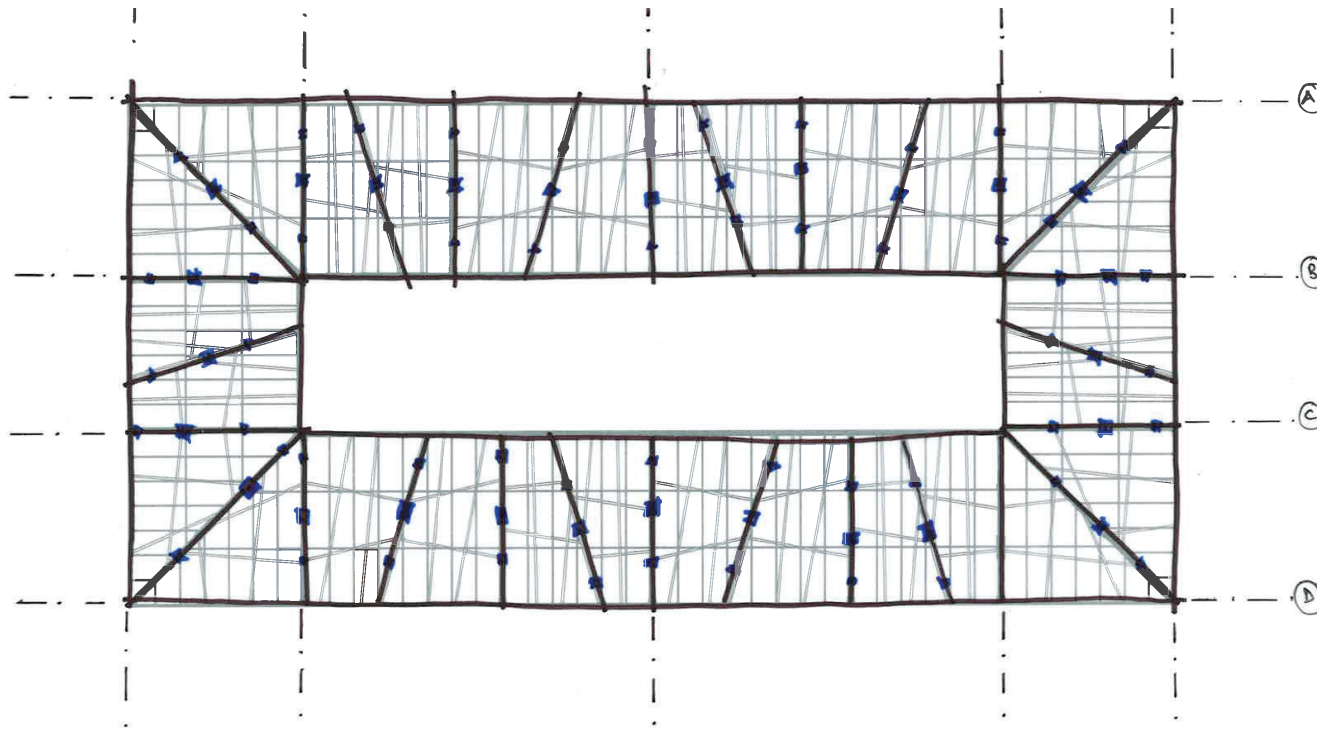


General view from the eastern side



General view from the western side / gate

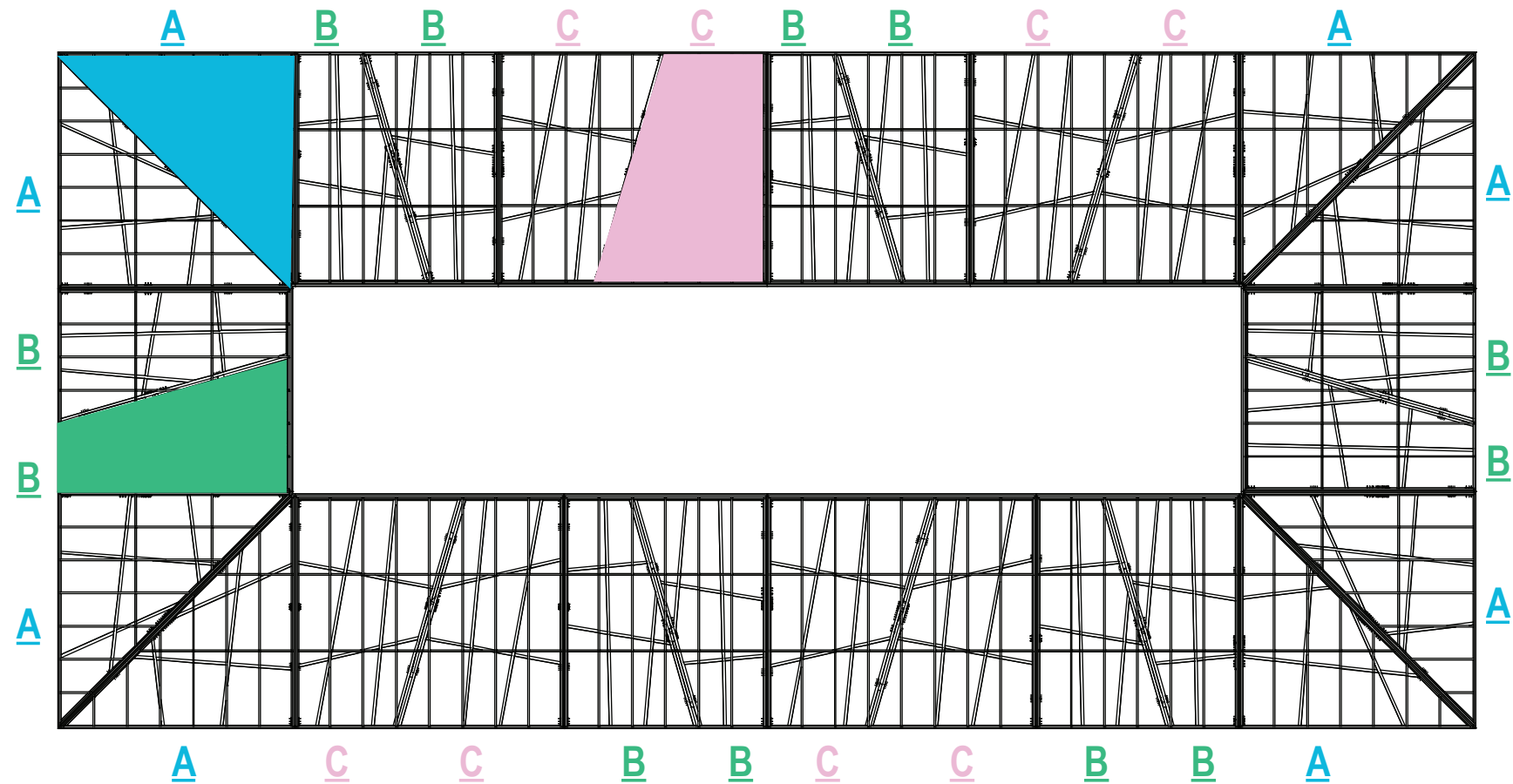
10. The canopy and architectural details



The main architectural concept is to keep a strong impression of randomness - as if it were a disorganised scheme.

In fact, the projects develop a compromise between raster and spontaneity, organisation and disorder, structural rationality and appearance of randomness.

The main structural axis (1, 2, 3, 4, 5 & A, B, C, D) alternate with a secondary voluntarily not aligned set of frames and branches.



A

A Type : 7x7x10



B

B Type : 7x7,2 x 2 x 4

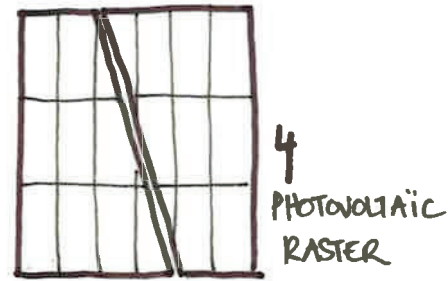
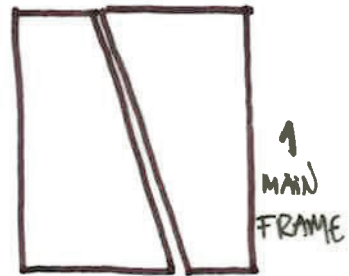
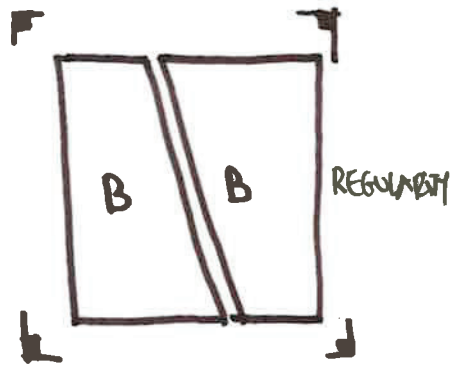


C

C Type : 7 x 7,2 x 3 x 5

PREFABRICATED PANELS

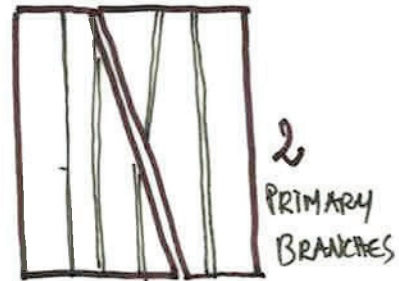
The design is based on 3 different panels. This principle aims to be prefabricated - while still expressing randomness.



Regularity : Frames are conceived to be used two by two. They are matching together into a rectangle or a square – even if each frame has its own trapezoid form.

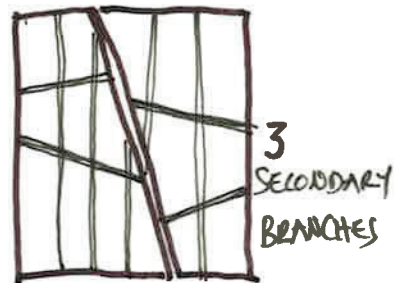
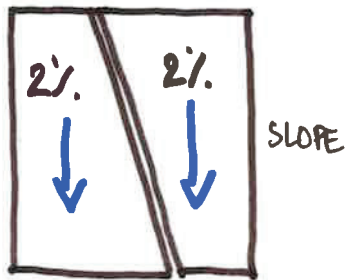
Asymetry : the main distances between the loading points are every time different (as well as the axes of the pillars)

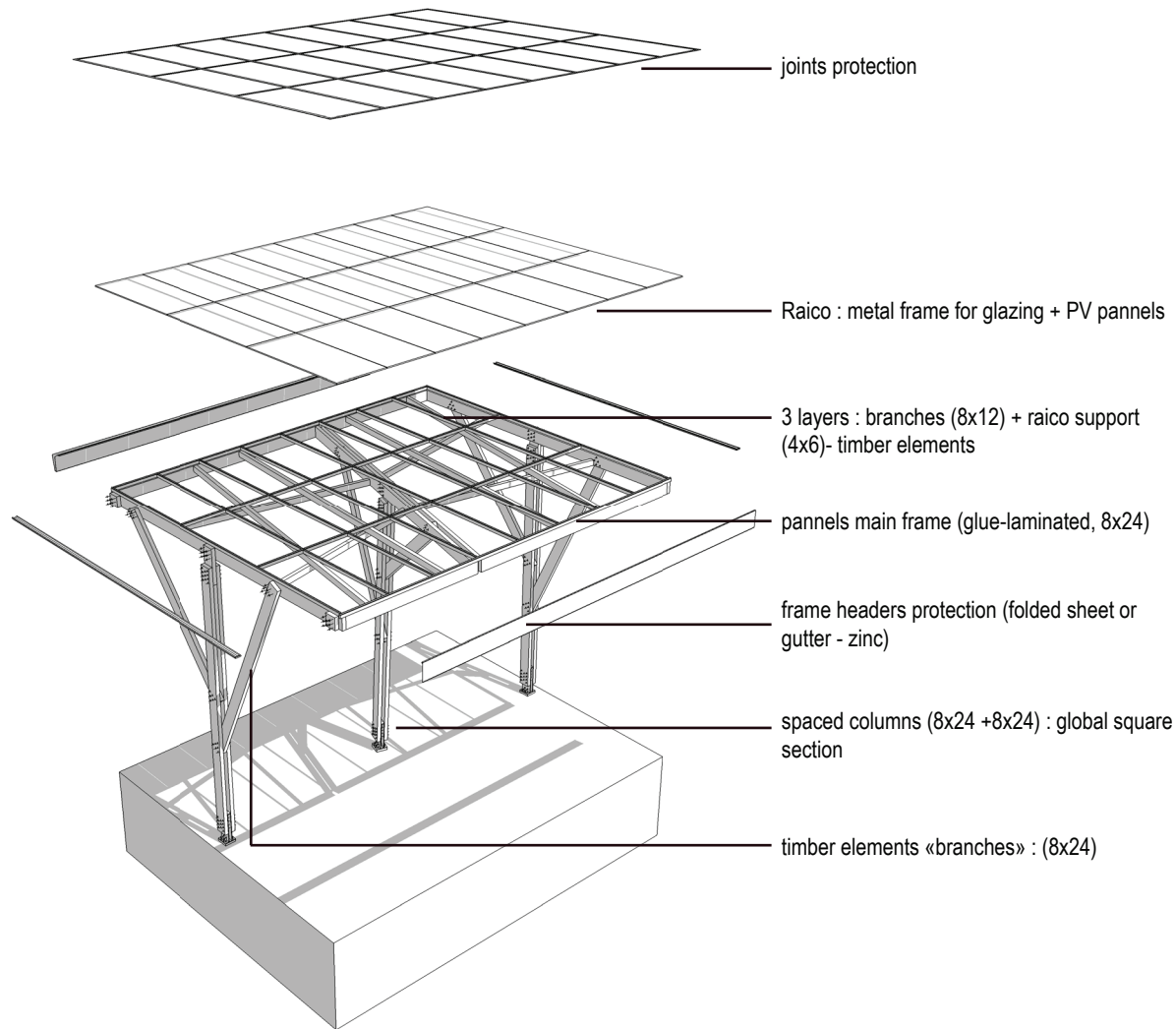
Slope : the frames are oriented to the centre of the impluvium (with a slope of 2%) in order to collect rainwater into a pierced gutter.



The main frames are constructed with beams – then comes a secondary system of branches places on top of each other and giving the rigidity to the frame.

The last raster is an orthogonal system in order to allow an easier cutting of the glazed PV panels.





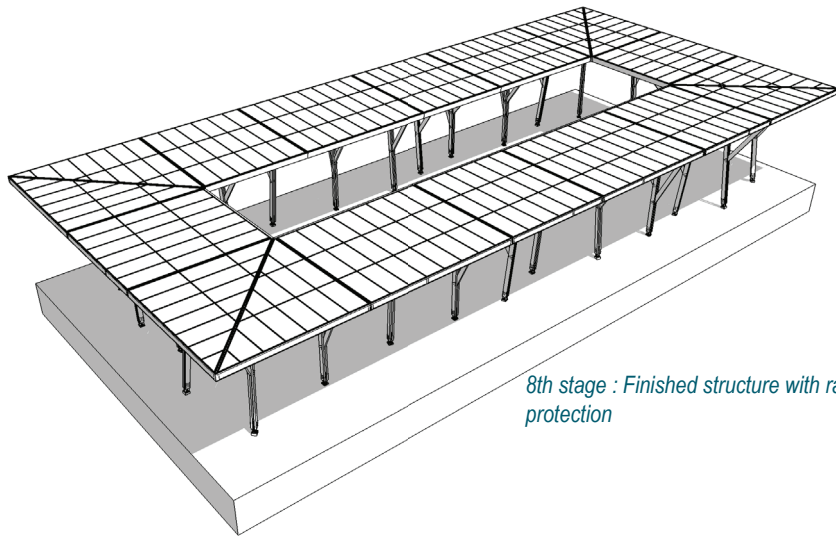
The canopy is conceived to be a very simple assemblage. It is meant to be easily repaired in case of extraordinary strong earthquake. The global rigidity of the disposal through a clumping system and a relative homogeneity of the canopy (conceived as a crown made of different panels) offers a good bracing system.

Each «tree» is made of different layers making the trunk, the branches and the leaves.

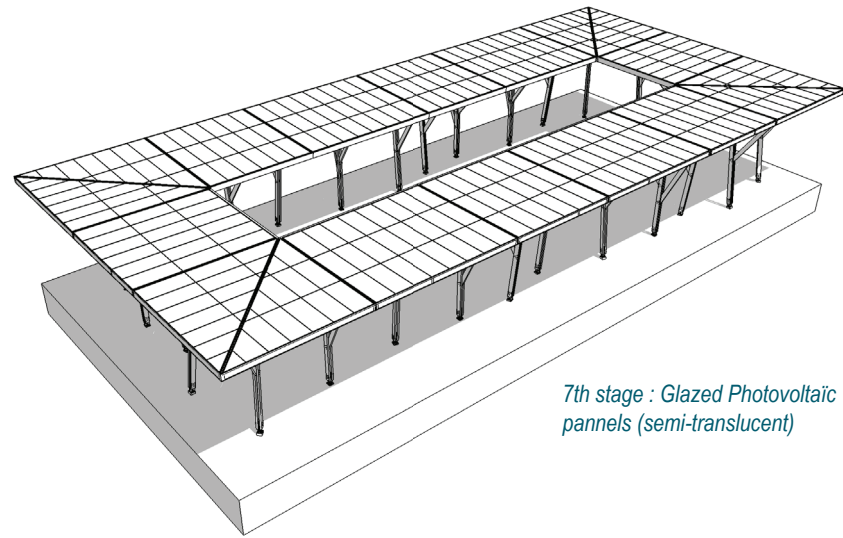
It is covered by PV cells (semi-translucent) providing shade and protecting the courtyard from water. They are placed on a third layer or structure (wood elements) that has a more regular rhythm. A «raico» system assembles the glazed panels together.

The pillars and branches have different axes in order to look as natural as possible. This randomness shall provide with a very special atmosphere under the canopy. Frame headers are protected from water by metal sheets (zinc) or equipped with gutters that are deep enough to collect rain water and let it fall in a water screen.

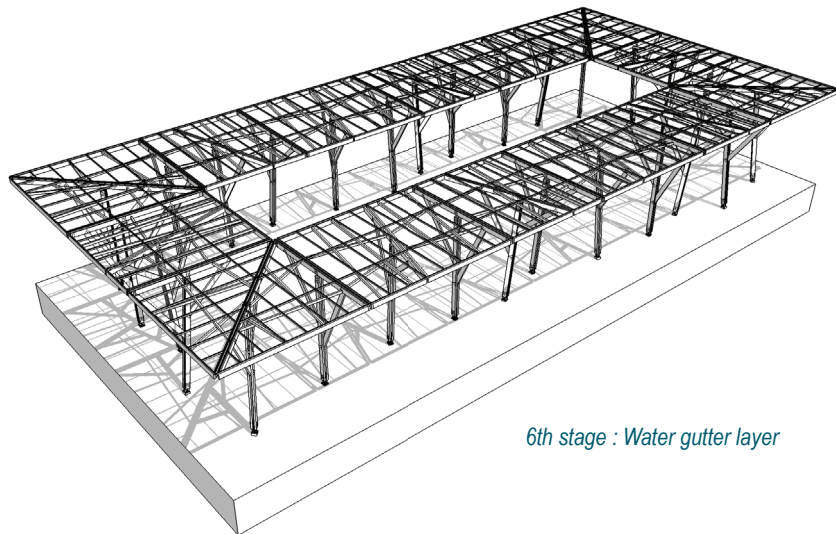
Entirely made of timber elements, the structure is totally renewable and exchangeable. Any damage should be very easy to repair - thanks to the construction process : every panel is connected to the other but can be replaced without impacting the rest of the structure. The montage system proves it.



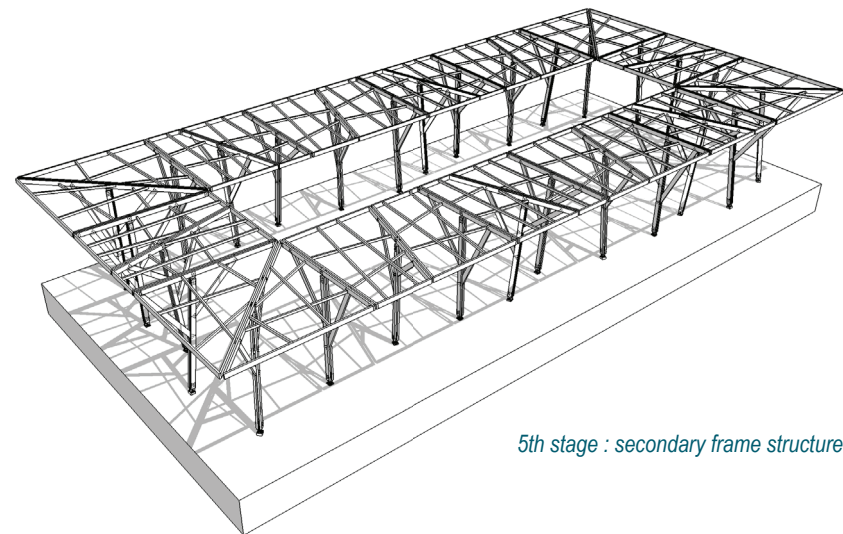
8th stage : Finished structure with raico protection



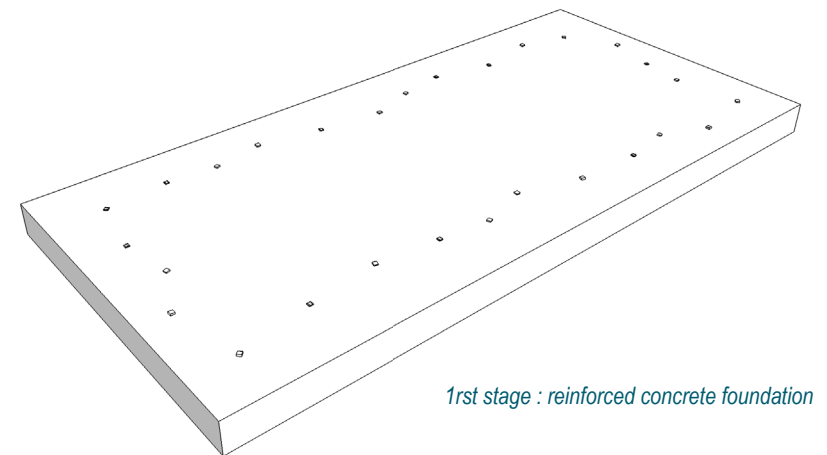
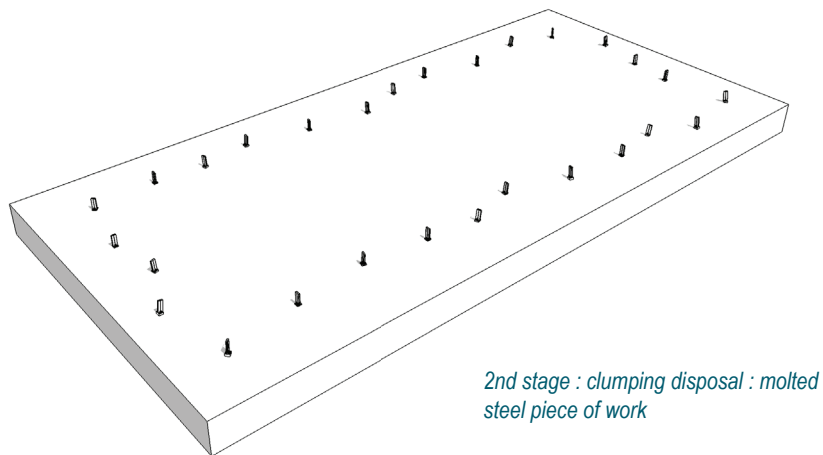
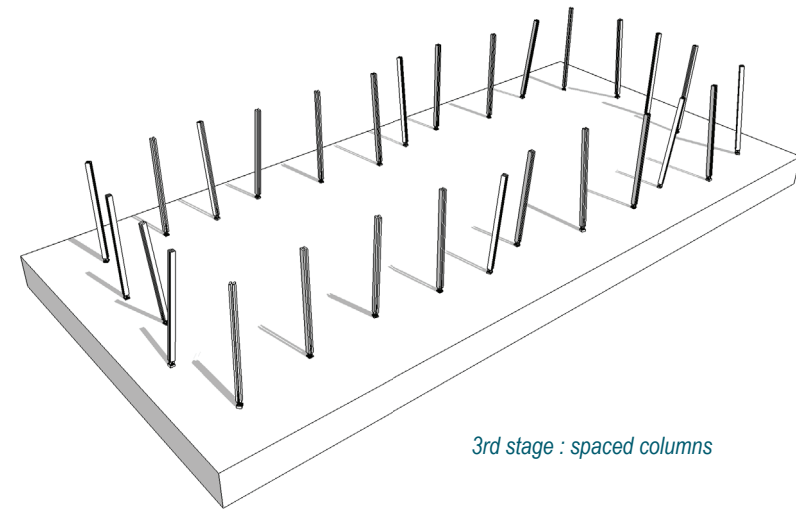
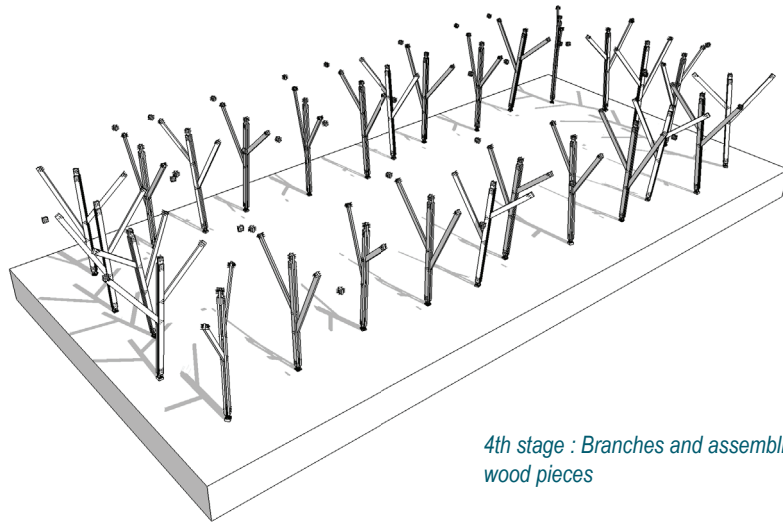
7th stage : Glazed Photovoltaic panels (semi-translucent)

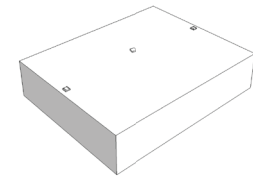
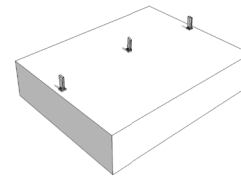
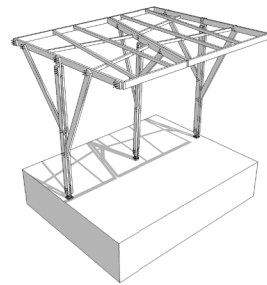
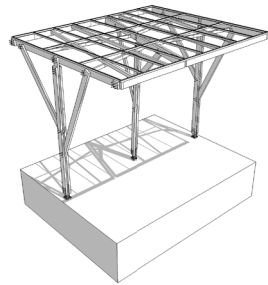
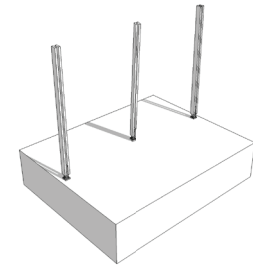
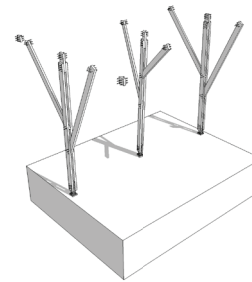
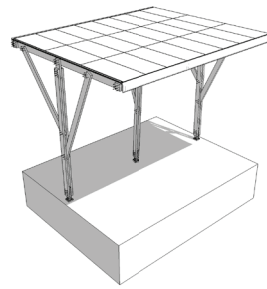
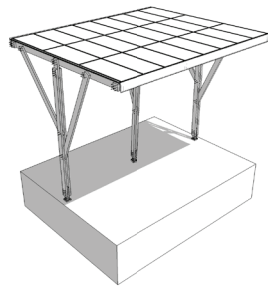


6th stage : Water gutter layer



5th stage : secondary frame structure





*Assembling principle /
2 pannels*

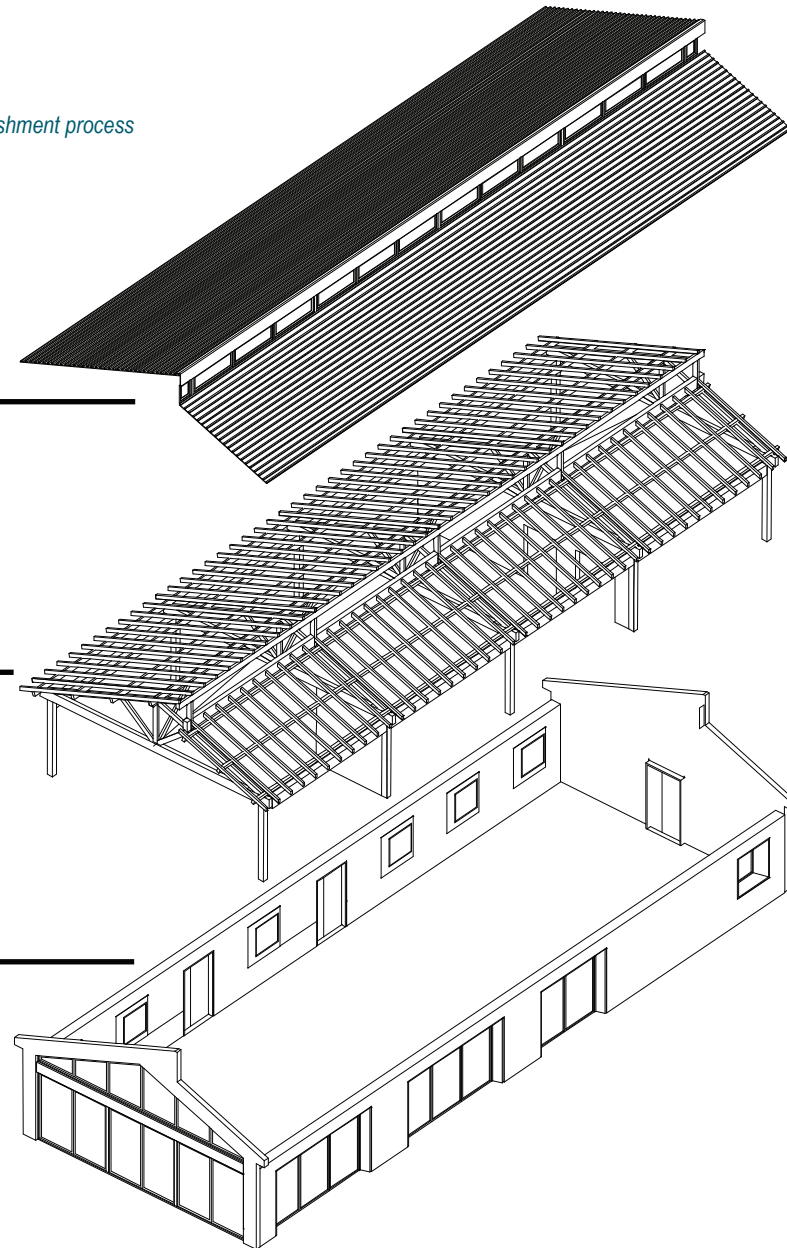


Refurbishment process

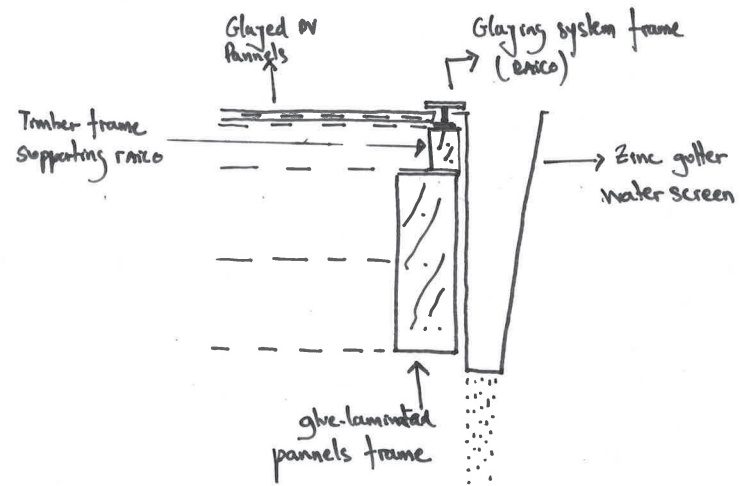
1 - New tiling + creation of windows for ventilation
in the roof. Rain water is collected.

2 - New structure : roof + columns & beams + timber
walls for bracing

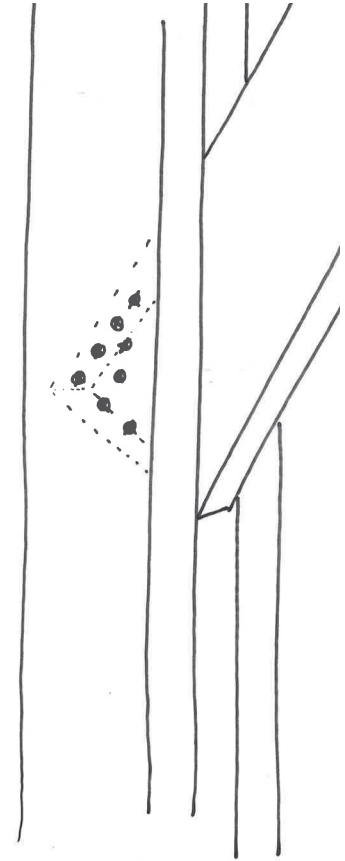
3 - Non-structural restoration of the existing constr-
uction + creation of windows and doors



Framing headers principle + water screen
sc : 1/10

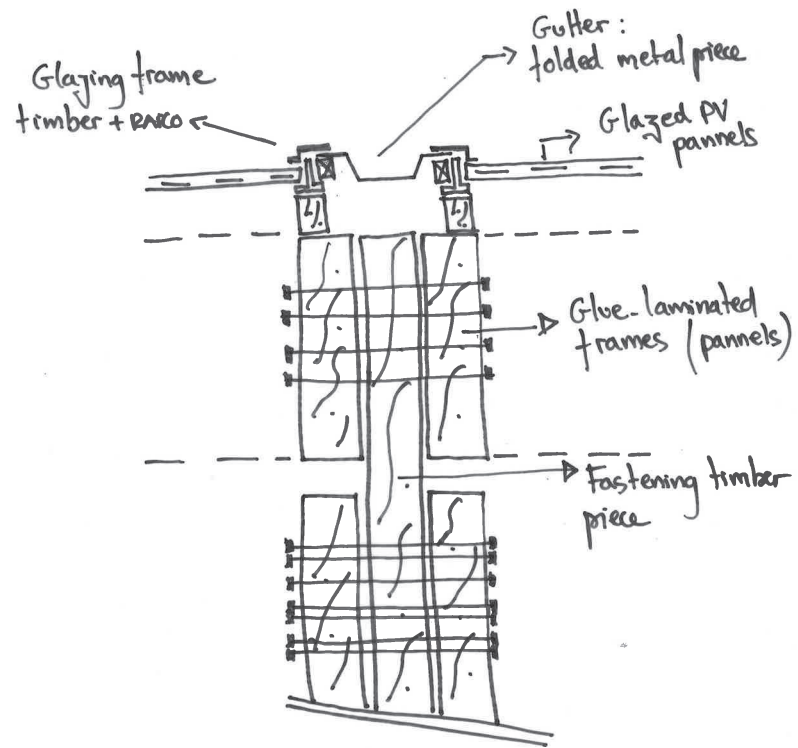


Branches/spaced column assemblage
sc : 1/10



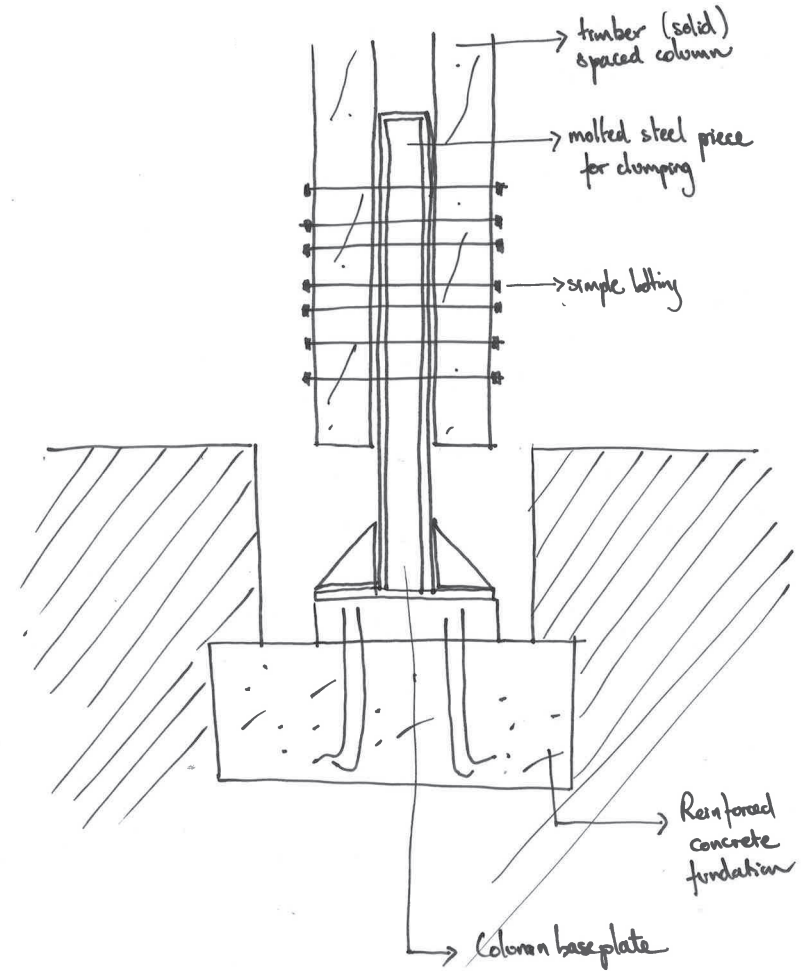
Column top & assembling principles

sc : 1/10

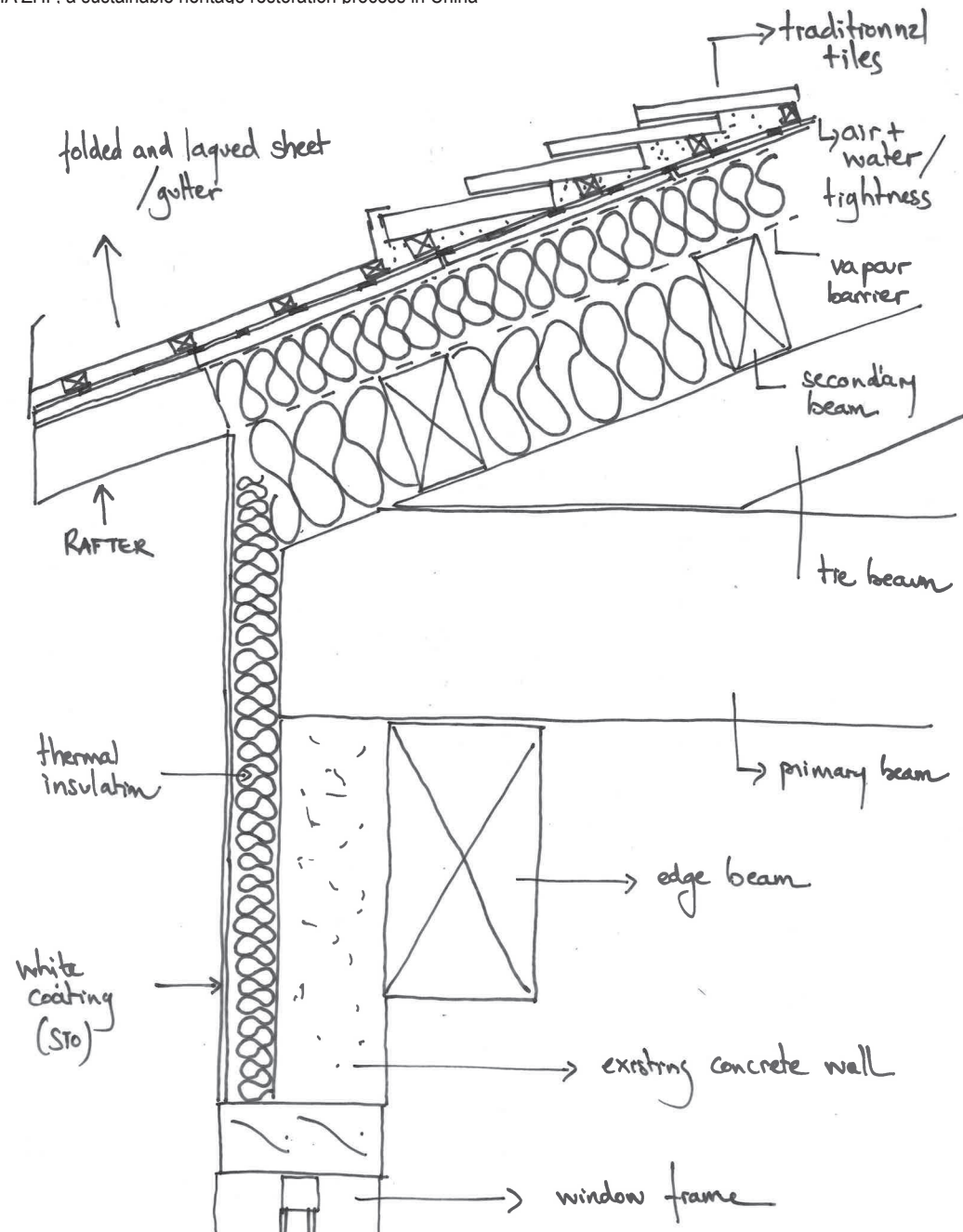


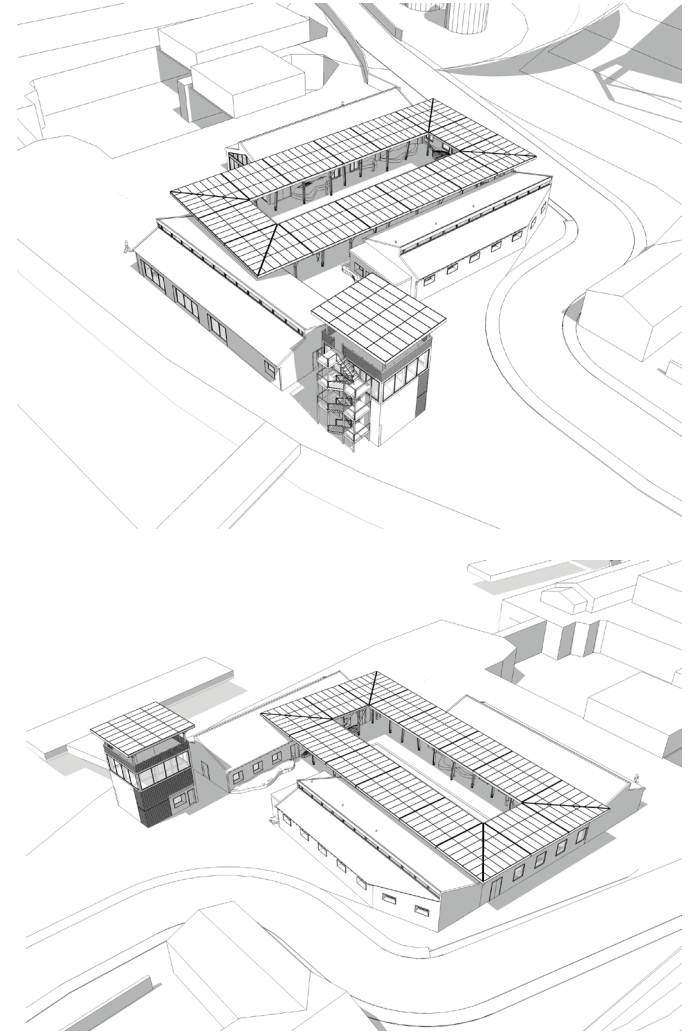
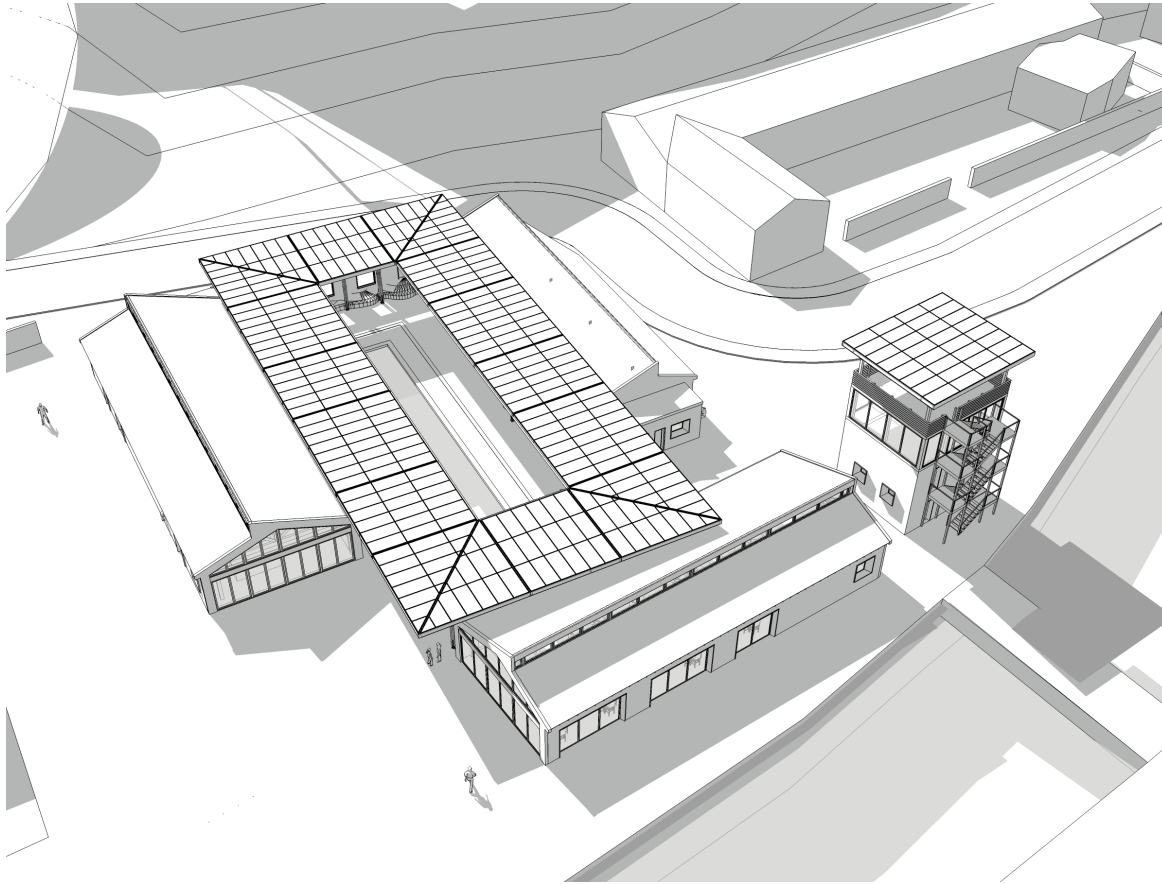
Column base & assembling principles

sc : 1/10

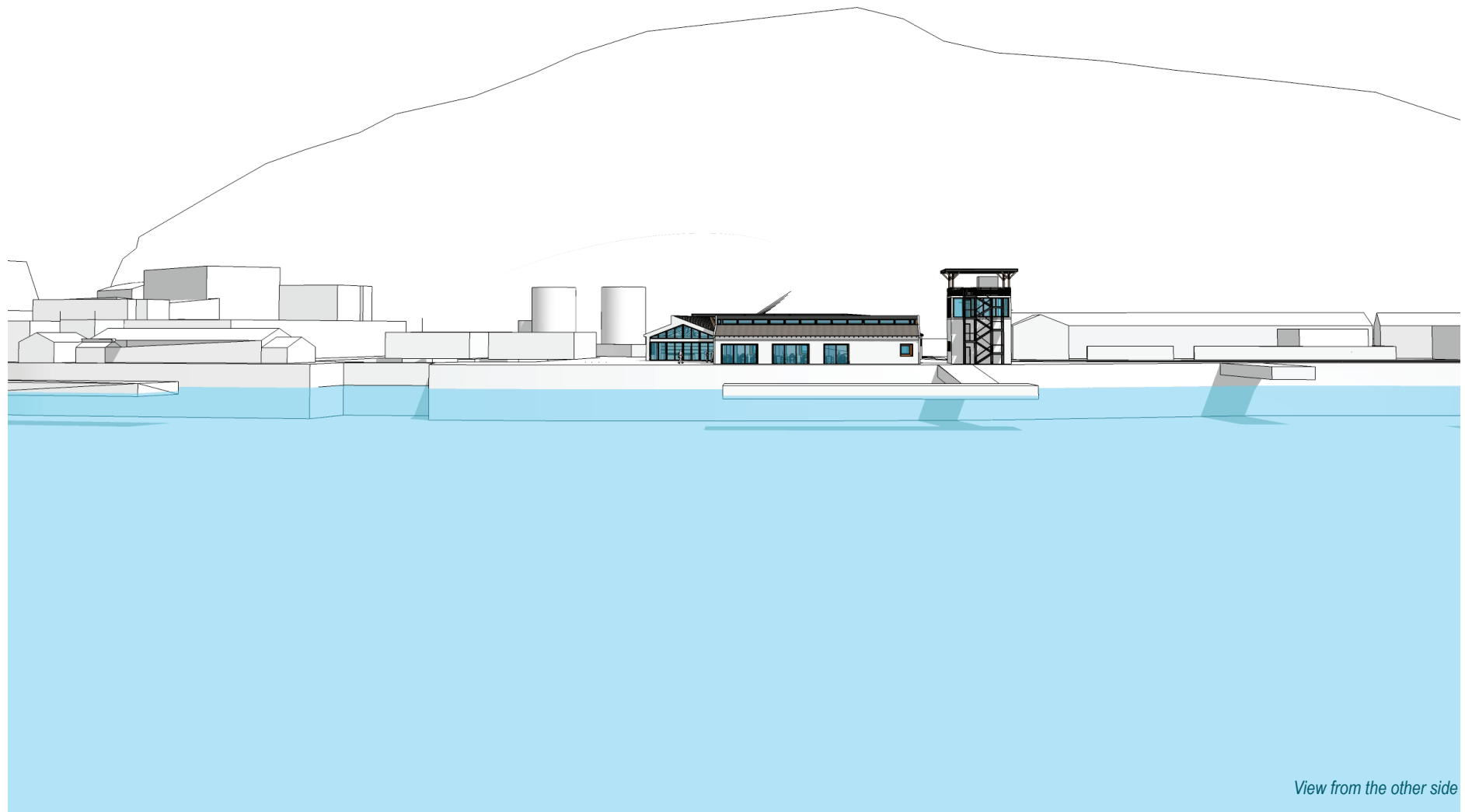


Restoration process - main details
sc : 1/10



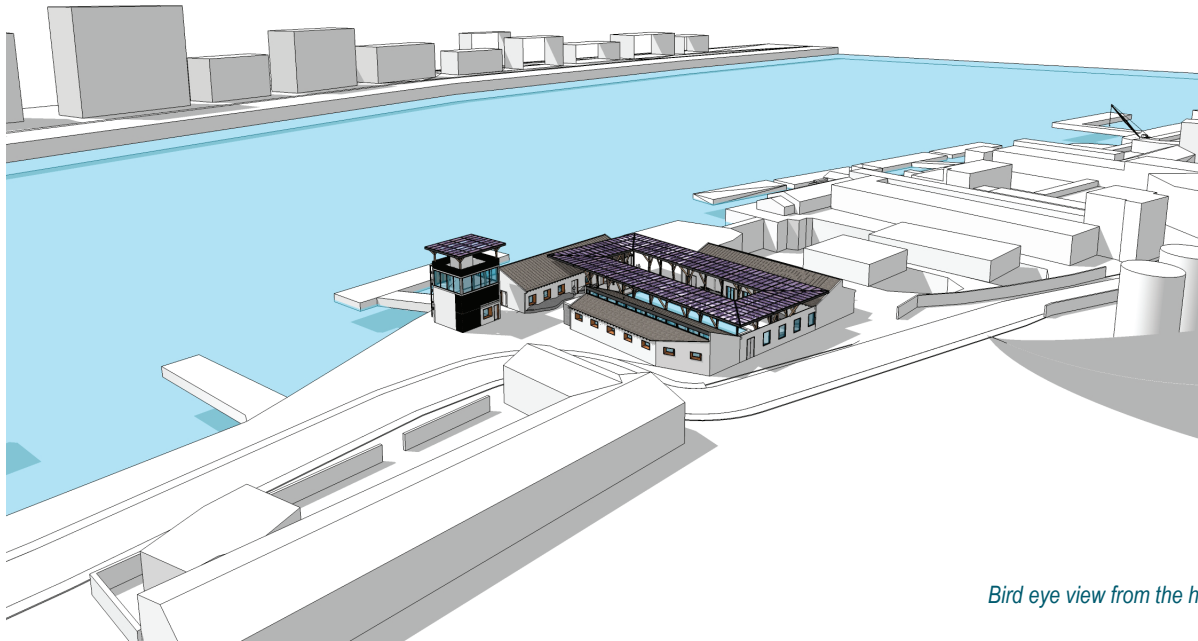


Bird eye views



View from the other side

Conclusion



Bird eye view from the hill

The project suggests to deal with two different items : refurbishment and new construction. This combination applied to the restructuration of ancient small industrial factories dedicated now for visitors entering the “liu jia zhi” cultural garden is brightened up by the new canopy that offers - in a sustainable way - a new shelter. The contemporary expression of the canopy shall make a link between nature and urbanity. It creates a new landscape, and moreover a new atmosphere base on a human scale.