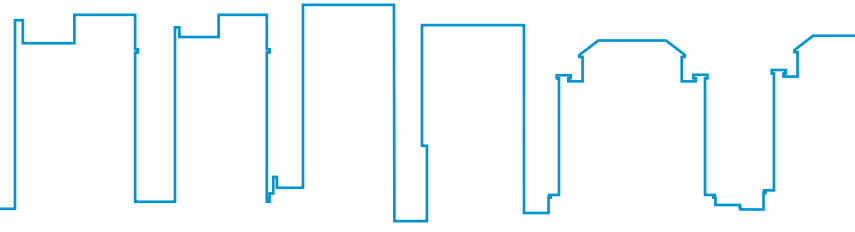


A TERRACE HOUSE IN TAIWAN



DIPLOMARBEIT

A TERRACE HOUSE IN TAIWAN

ausgeführt zum Zwecke der Erlangung des akademischen Grades einer
Diplom-Ingenieurin unter der Leitung von

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11734317

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Abstract

The terrace house is one of the typical and common housing types in Taiwan today. It is characterized by narrow width and long depth. This type of dwelling reflects Taiwan's high population density characteristics and has appeared as early as the early 17th century.

This thesis studies the development of terrace houses. Since Taiwan has a unique geographical location, architectural styles brought by immigrants and foreign colonists in different periods and solutions to various lifestyles were reflected in the historical development of terrace houses. In addition, another study of Borneo-Sporenburg, a high-density residential area in Amsterdam, analyzes solutions of different architects for similar site conditions by typology.

Therefore, the goal of this project is a terrace house developed by a design method according to previous research that adapts to the Taiwanese environment, regulations, structure, and lifestyle habits. And create a good quality of life for users and neighbors in the existing high building density environment.

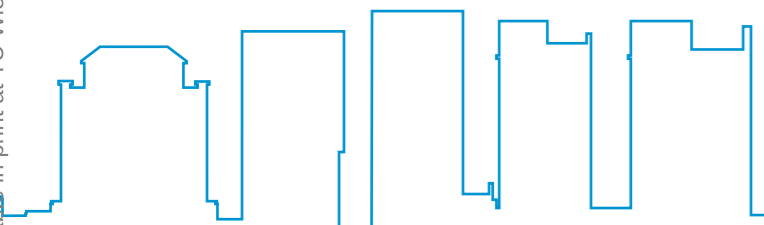
Das Reihenhaus ist heute eine der typischen und verbreiteten Wohnformen in Taiwan. Es zeichnet sich durch schmale Breite und lange Tiefe aus. Diese Art der Behausung spiegelt Taiwans hohe Bevölkerungsdichte wieder und tauchte bereits im frühen 17. Jahrhundert auf.

Diese Diplomarbeit untersucht die Entwicklung von Reihenhäusern. Da Taiwan eine einzigartige geografische Lage hat, spiegelten sich architektonische Stile, die von Einwanderern und ausländischen Kolonisten in verschiedenen Epochen mitgebracht wurden, und Lösungen für verschiedene Lebensstile in der historischen Entwicklung von Reihenhäusern wider. Darüber hinaus analysiert eine weitere Studie von Borneo-Sporenburg, einem dicht besiedelten Wohngebiet in Amsterdam, Lösungen verschiedener Architekten für ähnliche Standortbedingungen nach Typologie.

Daher ist das Ziel dieses Projekts ein Reihenhaus, das nach einer Entwurfsmethode nach früheren Forschungen entwickelt wurde und sich an die taiwanesischen Umgebung, Vorschriften, Struktur und Lebensgewohnheiten anpasst. Und schaffen eine gute Lebensqualität für Nutzer und Nachbarn in der bestehenden hochverdichteten Umgebung.

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Terrace house studies

Origins of terrace house

Terrace houses were first introduced from the southeast coast of China. Other Asian regions, such as Malaysia, Singapore, Japan, etc., were also affected by immigrants, so terrace houses can also be found.

The early settlements in Taiwan developed along the river banks, and the traditional buildings in the commercial market were terrace houses; therefore, they could also be called street houses. Because the previous taxation system was mainly based on the width of the storefront, it formed the characteristics of narrow width and profound depth. Since it is hot and rainy in summer, there was a pedestrian arcade in front of the building that could shelter from the sunlight and rain.

At that time, the function of the arcade was not only to isolate sunshine and rain; but it also formed the earliest concept of separation of people and vehicles and released private land as public space, such as sidewalks, commercial exhibition spaces, community communication spaces, worship, children's playground and space for weddings and funerals; arcade was a buffer space between buildings and roads, and an extension of indoor space.

The architectural style influenced by the southeast coast of China was the Southern Hokkien style. Two adjacent street houses were built using the same wall, and the benchmark was the center of the wall; it could reduce the construction cost and resist earthquakes. The street houses then took advantage of the characteristics of courtyard architecture: The long and narrow volume joined two atriums to help with ventilation and lighting; the house, therefore, was divided into three parts. The first part is usually a public space: the shop, the second space is the main hall, and the last private space is the living room space. Constrained by construction techniques, houses usually had only one floor so that atriums could play an influential role.

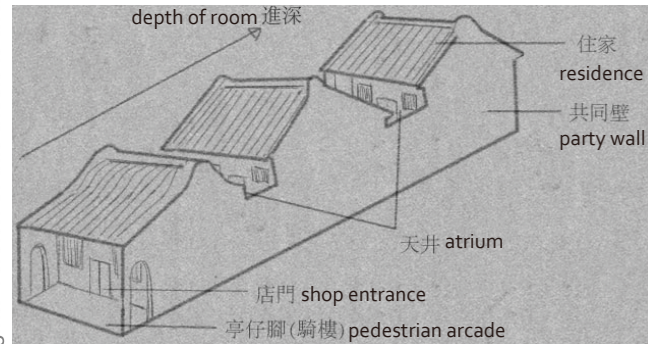


Fig.1 Origins of terrace house



Fig.2 Southern Hokkien style terrace house

Influence of colonial style

At the end of the 19th century, the British built foreign-style buildings in various parts of Taiwan as branches of their foreign firms, which significantly impacted the local area. In the river basin near the port, gorgeous foreign-style buildings appeared, especially the decorative elements on traditional buildings; they could all be regarded as imitating the colonial style of foreign firms.

In 1895, the era of Japanese rule began, and the introduction of new building technologies and materials led to architectural progress. At this time, Taiwan's architecture was turning towards modernization; because of the Japanese government's sewer plan and urban street profile correction, many building facades were demolished and rebuilt due to the widening of the road. Then the design of gables began to bring the skyline variations; the application of bricks led to the appearance of arches, led to innovation in the facade design, and the decoration was mainly made of ceramics, which made the facade more vivid.

A typhoon hit in 1912, and many rammed-earth houses collapsed. The Japanese government took this as an opportunity to rebuild the street with brick and wooden structures as a hybrid structure. The architectural style adopts the Renaissance style; the width of the pedestrian arcade was unified to 3.6 meters.

After 1914, the street houses in Taiwan were mainly in the Baroque style, and others included the Renaissance style, Byzantine style, Rococo style, etc.; 1925 was influenced by art deco from the International Exhibition of Modern Decorative and Industrial Arts; 1930 pursued simplicity-based internationalism after the industrial revolution.



Fig.3 baroque facade



Fig.4 Japanese-style red bricks and Western-style construction methods



Fig.5 Modern architectural street house

Typology

Terrace house can be divided into several types. The different positions of the stairs in the floor plan will affect the overall structure and lead to different spatial configurations; On the other hand, it can base on conditions, such as length and width, to choose a suitable solution. In this chapter, the Borneo-Sporenburg residential area and some houses worldwide will be used as examples to analyze the various possibilities.



Floor plan with transverse staircase:

The staircase lying in the middle of the floor plan directly divides the space into two; such a configuration needs to be wide enough to accommodate the entire length of the staircase.



Floor plan with side, lengthways staircase:

The type of straight-through stairs on the side of the floor plan is usually more flexible in space configuration. According to the stairs' front, middle, and rear positions, it can be an entire ample space or divided into two areas.



Floor plan with punctiform stairs:

The punctiform staircase increases the circulation area due to the platform generated by the turning of the stairs, and it is located in the middle of the floor plan, so to save space, it may be integrated with other spaces, such as toilets or storage rooms.



Floor plan with staircase at the front or the end of the house:

The stairs are located at the front or the end of the floor plan so that the starting point of the circulation is fixed. If the area is small, it can be used as the entire space; if it is divided into two or more rooms, a corridor is required.



Floor plan with split level development:

The staircase in the middle of the floor plan divides the building volume into two parts, which is different from other types: the split level visually connects the upper and lower floors.

Borneo-Sporenburg

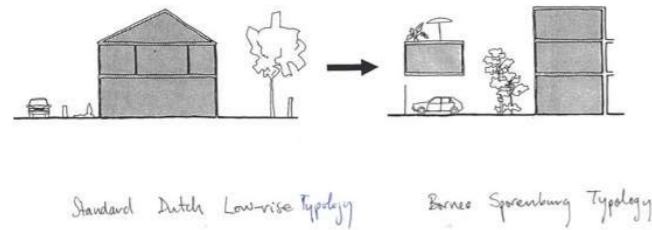


Fig.6 concept

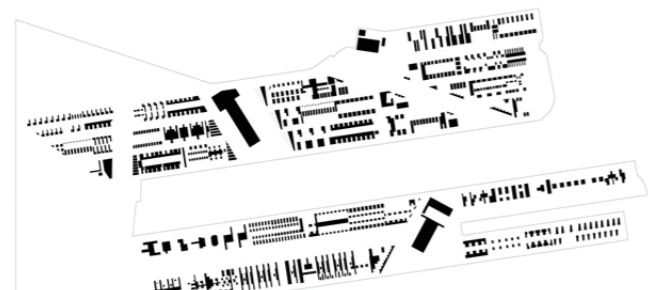


Fig.7 master plan



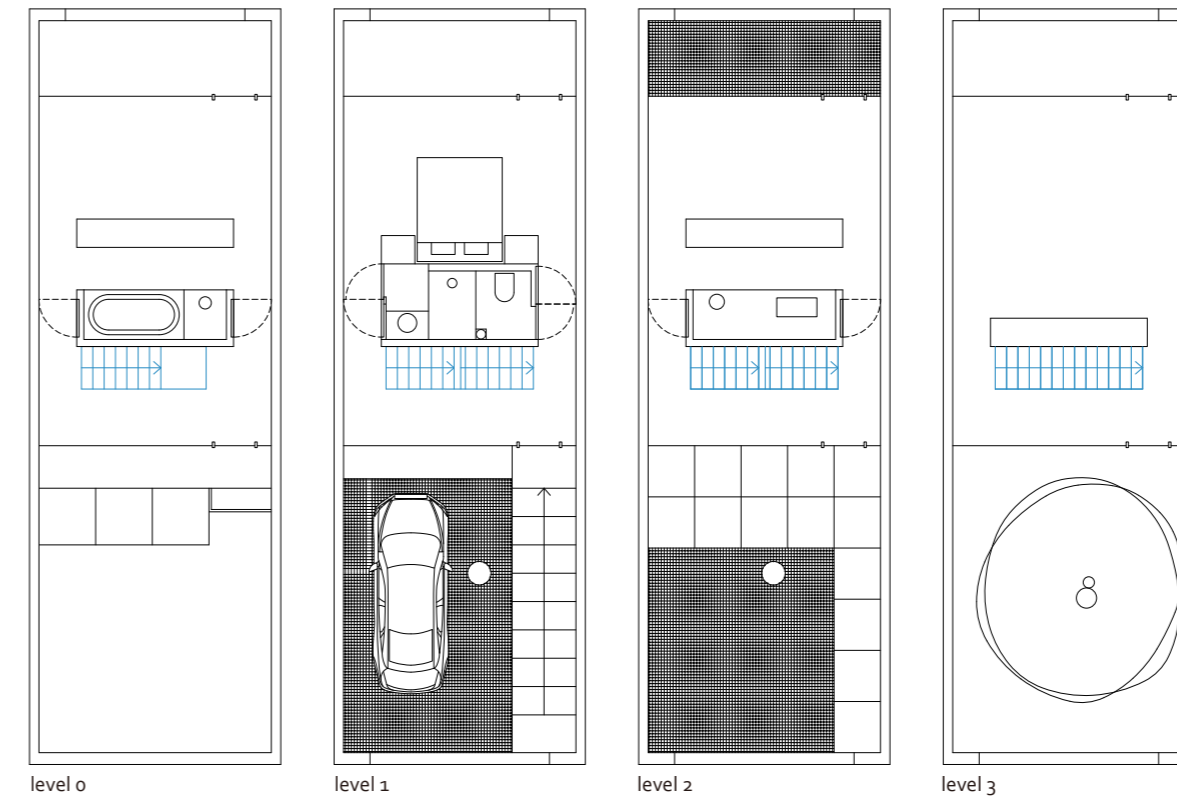
Fig.8 Borneo-Sporenburg

Landscape architect west 8 planned a high-density, low-rise residential area in the northeast of Amsterdam, Borneo-Sporenburg, two peninsulas located in the harbor. Between 1993 and 2000, under the master plan of west 8, it was handed over to the various architects to complete the individual housing design. There are 2500 houses in this area, which is equivalent to a high density of 100 dwellings per hectare.

There are four main design criteria for the residence in the master plan:

- The ground floor is 3.5m high so that in the future, it will not only be used for residential purposes but also for studios and shops.
- Structure: economical bulkhead design with standardized axle dimensions.
- The houses occupy the entire parcel, parking spaces and outdoor spaces become part of the house.
- The choice of material is fixed. All facades must be made of the same type of brick.

Residence Vos / Koen van Velsen architects Borneo-Sporenburg



level 0

Fig.9 Floor plan of Residence Vos

level 1

level 2

level 3

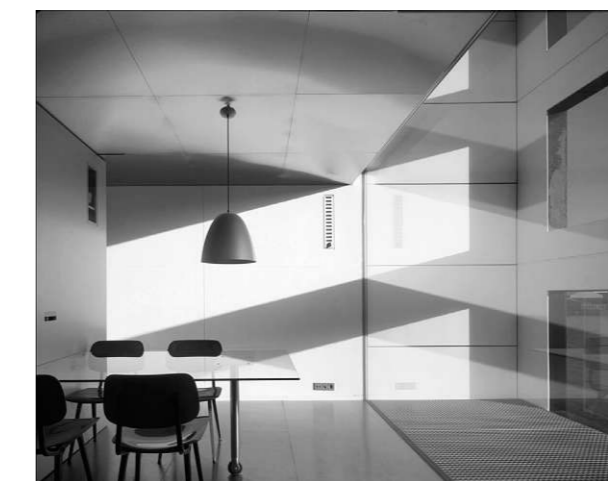


Fig.10 Interior

The stairs of Residence Vos are placed in the middle of the house, clearly dividing the space into two halves. Next to the stairs are the toilets or the kitchen, which are spaces, but they can also be thought of as thick compartments.

The facade has two layers, there is a distance in the middle for planting, and the second layer is made of a large glass, which retains the openness of the field of vision and ensures privacy. The overall material is smooth metal texture and glass, not only including walls, ceilings, floor surfaces, and furniture panels.



Fig.11 Outdoor space

DOK architecten
Borneo-Sporenburg

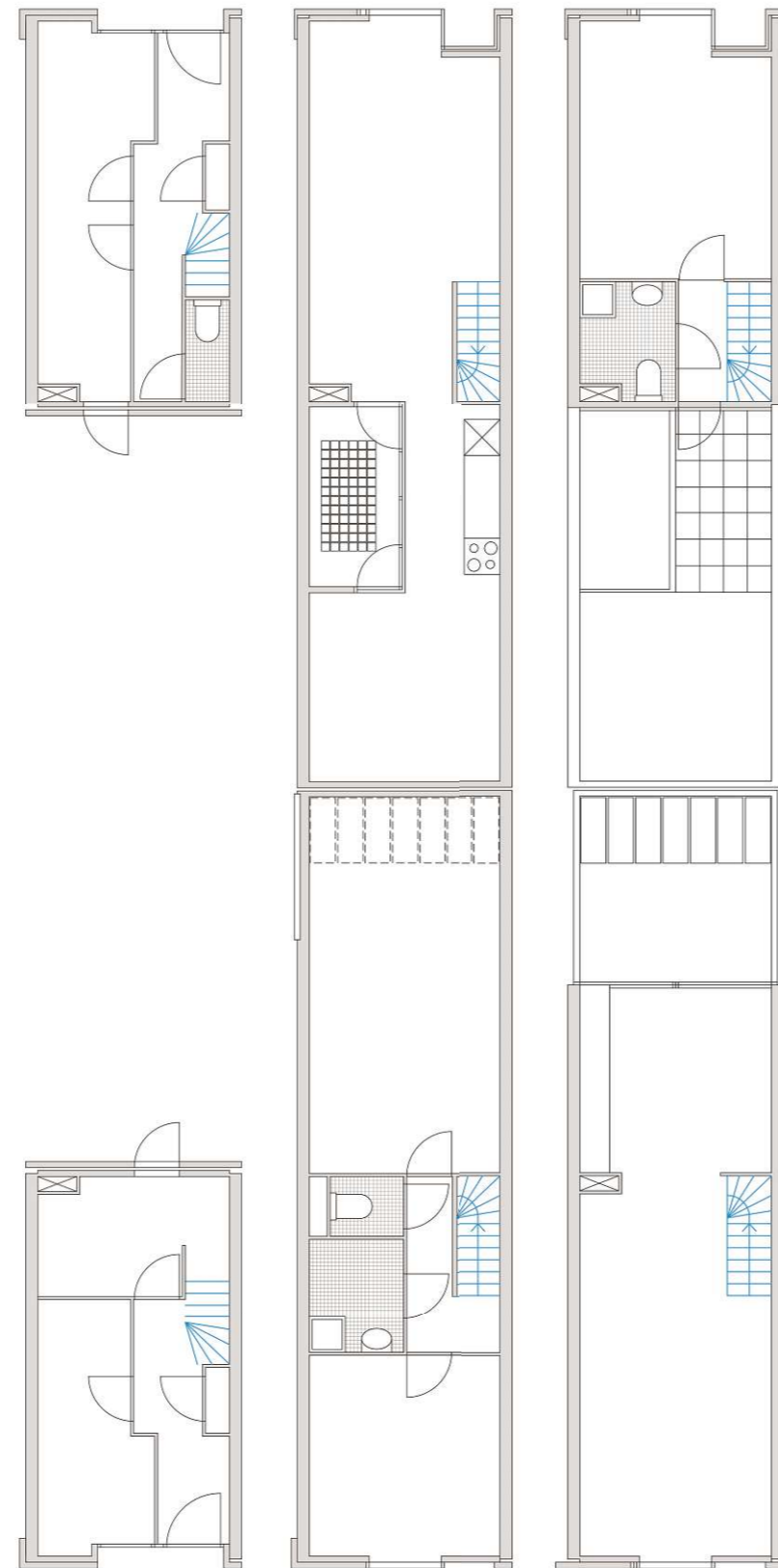
This project is also known as a back-to-back house. It is a community designed by the same architect; the overall plan sets the driveway at the same entrance, and the middle half of all units on the first floor are parking spaces, which also solves the problem of no sunlight in the central part.

The staircase occupies a quarter of the width on the side of the wall. The area of the passage space from the entrance to the stairs on the first floor is relatively larger. The upper staircase, passage space, and toilet form a service core in the middle of the house, dividing the space into two, while another floor without partition walls can be ample space.

The community house has no garage door on the front facade of the building, and the division design of the facade has been considered an entire. The façade of this project is framed with wood, then filled with brick walls or glass, and the entrance is recessed to emphasize.



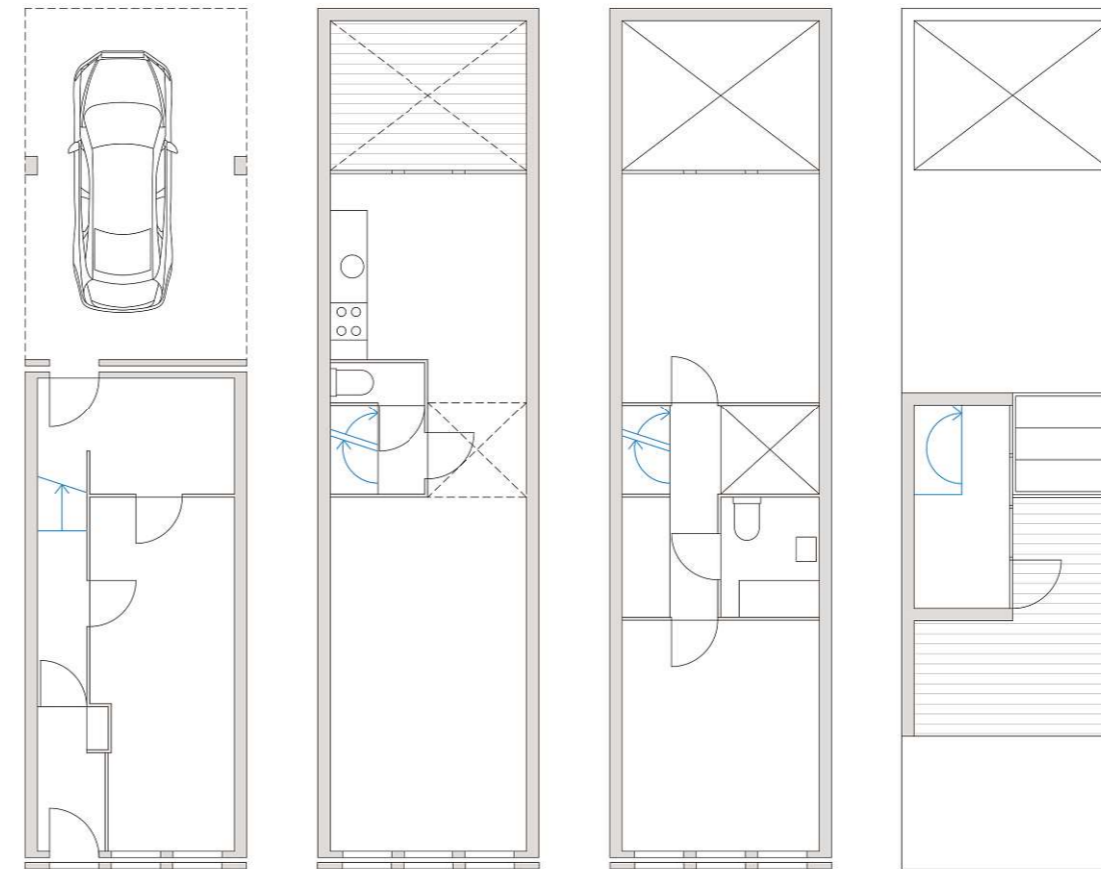
Fig.13 Facade



level 0 (left)
level 1 (middle)
level 2 (right)

Fig.12 Floor plan by DOK architecten

KAAN
Borneo-Sporenburg



level 0

Fig.14 Floor plan by KAAAN

level 1

level 2

level 3

KAAAN architects designed several types, among which this type is also a back-to-back house. The driveway to the parking lot is set up separately, and there is no garage door on the front facade. The long staircase is in the middle of the house against the wall, and service spaces such as toilets are in the middle to form a core.

This is a typical introverted house, the open space is left at the back of the house and is separated from the adjacent house at the rear by a wall, so it has absolute privacy.

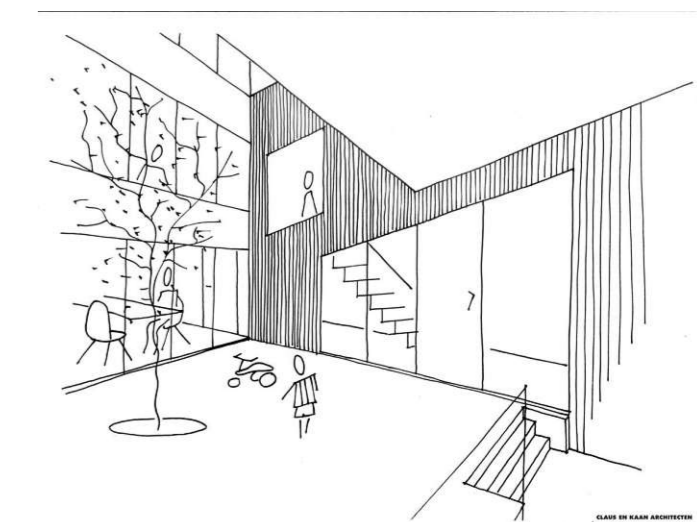


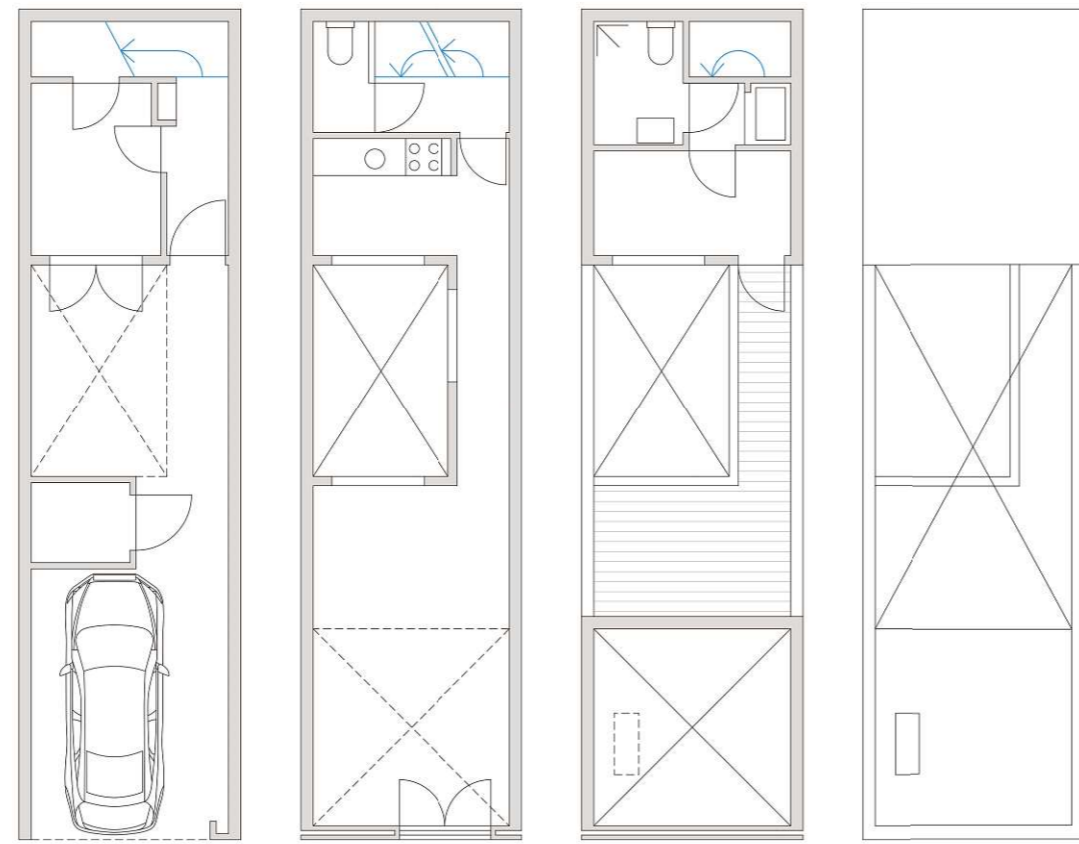
Fig.15 Introverted courtyard

KAAN
Borneo-Sporenburg

KAAN architects designed another back-to-back house, but this type of garage is independent at the front of the house. Therefore, the rear of the first floor needs lighting, and the light well is larger than the previous type.

The stairs are placed at the end of the house, thus requiring aisle space; coupled with the relatively large area of light wells, this type of house has a smaller room area.

The facade material is bricks, with only one open window, and Indoor light sources come from the light well. The introverted house's appearance gives the sense of being heavy and closed.



level 0
Fig.16 Floor plan by KAAAN

level 1

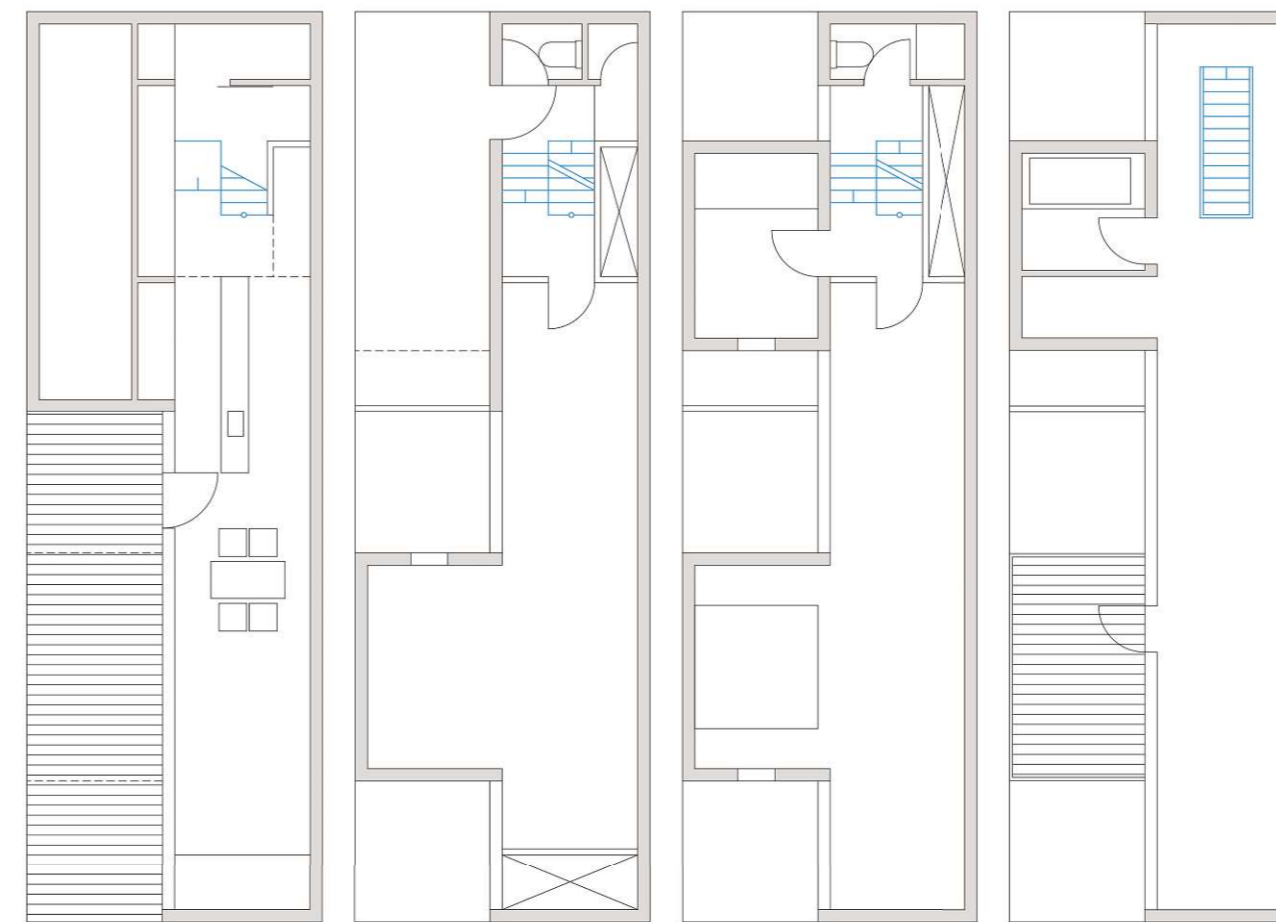
level 2

level 3

MVRDV / Borneo 12
Borneo-Sporenburg

The house Borneo12, designed by MVRDV, has a total width of five meters, the architects cut the width in half to 2.5 meters, closed the front and back facades, and the side facade is glass; the idea is to turn an extreme narrow house into a wide house. It not only achieves a good lighting effect but also ensures privacy.

2.5 meters is precisely the width of a parking space, and it is also enough for a room. Two of the protruding volumes are used as rooms and a toilet. The stairs are placed at the end of the house, but such an extremely narrow plane is just right to form private and open space in a left-right relationship and does not take up too much aisle space like a typical placed endly staircase.



level 0
Fig.18 Floor plan of Borneo12

level 1

level 2

level 3



Fig.19 Interior

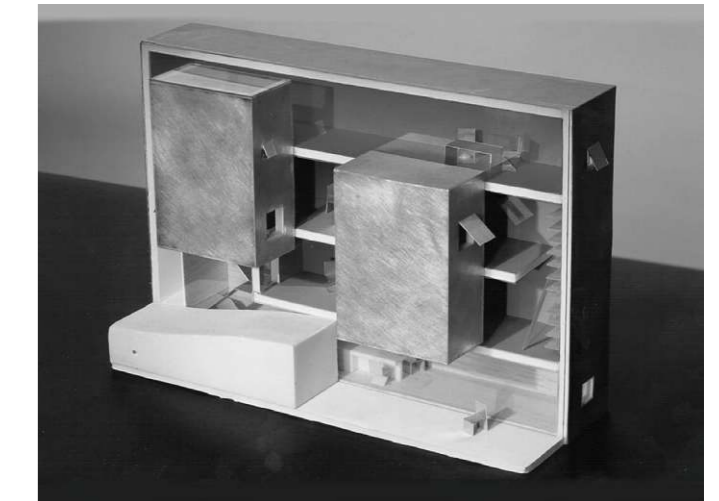


Fig.20 Model

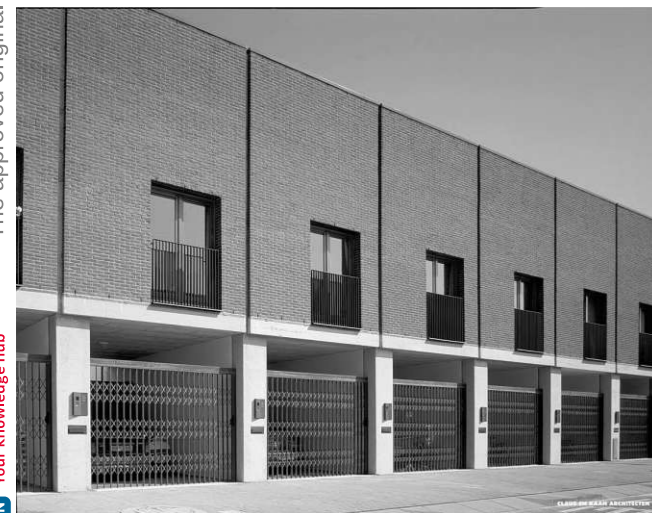
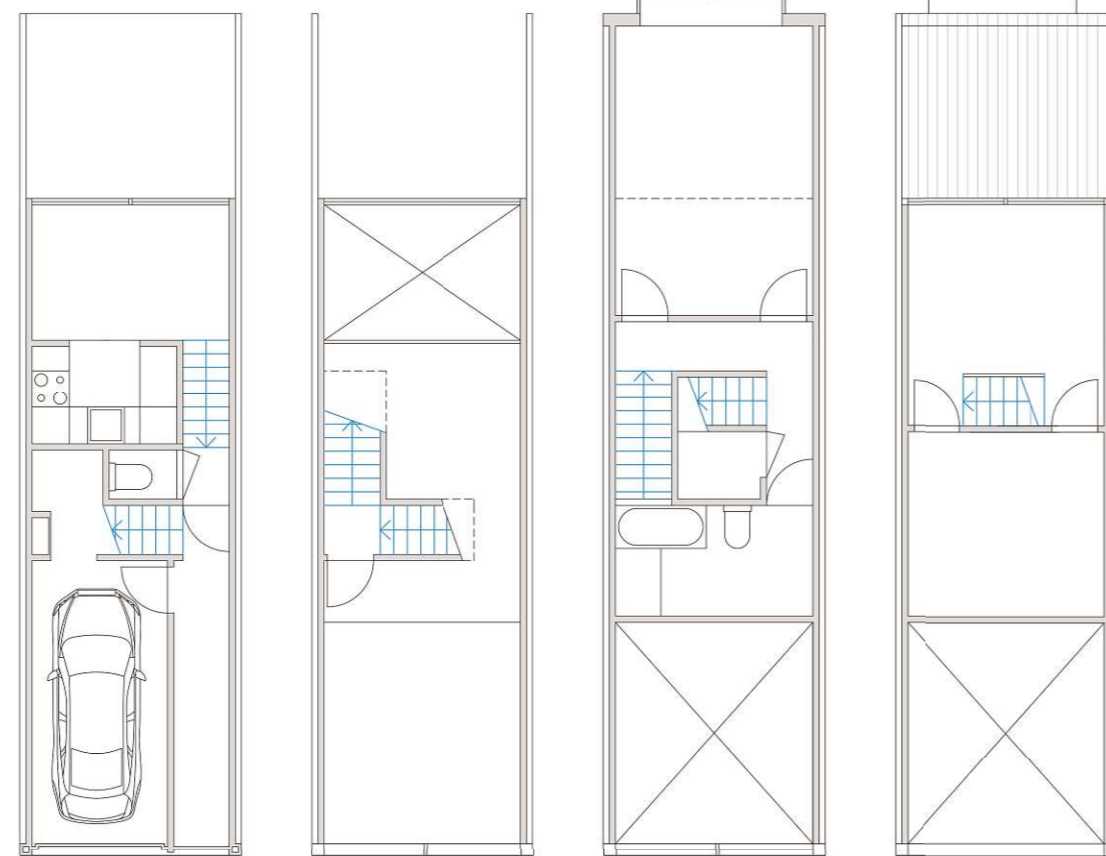


Fig.17 Facade

MVRDV / Borneo 18
Borneo-Sporenburg

The house Borneo18, designed by MVRDV, has one side on the waterside, the whole volume is close to the roadside, and the third floor is moved to the waterside so that there is a three-story balcony on the waterside at groundfloor.

Because the volume is pushed outward, the two public spaces have three-story ceilings connected to the outdoor space and have good lighting. The location of the stairs is in the center, which is the intersection of the two volumes. The punctiform staircase surrounds service spaces such as toilets, which meet the needs of each area.



level 0
Fig.21 Floor plan of Borneo18

level 1

level 2

level 3

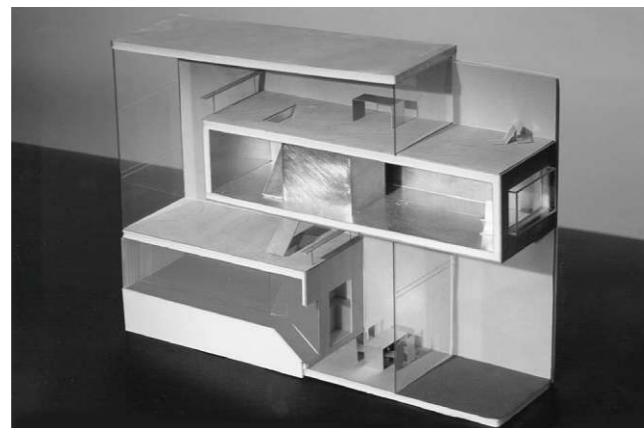


Fig.23 Model

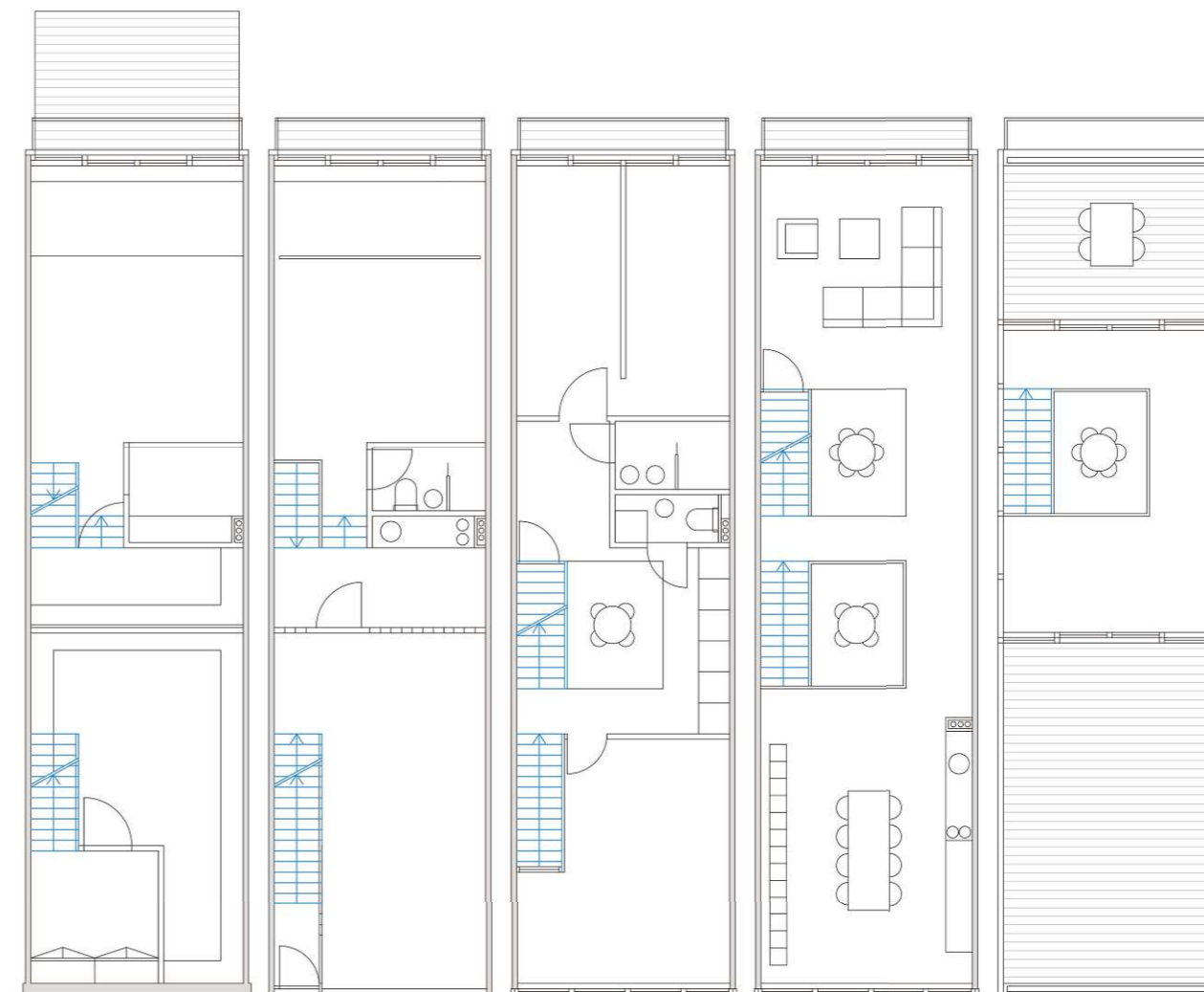


Fig.22 Interior

Slawik
Borneo-Sporenburg

The house designed by Slawik Architects has one side facing the water, which is relatively open compared to the facade on the roadside.

The lengthways stairs are placed on the side of the floor plan, and their position is shifted back as the floor goes up so that the space size of each floor can be adjusted according to the position of the stairs, which is a flexible and effective solution.



level 0
Fig.24 Floor plan by Slawik

level 1

level 2

level 3

level 4



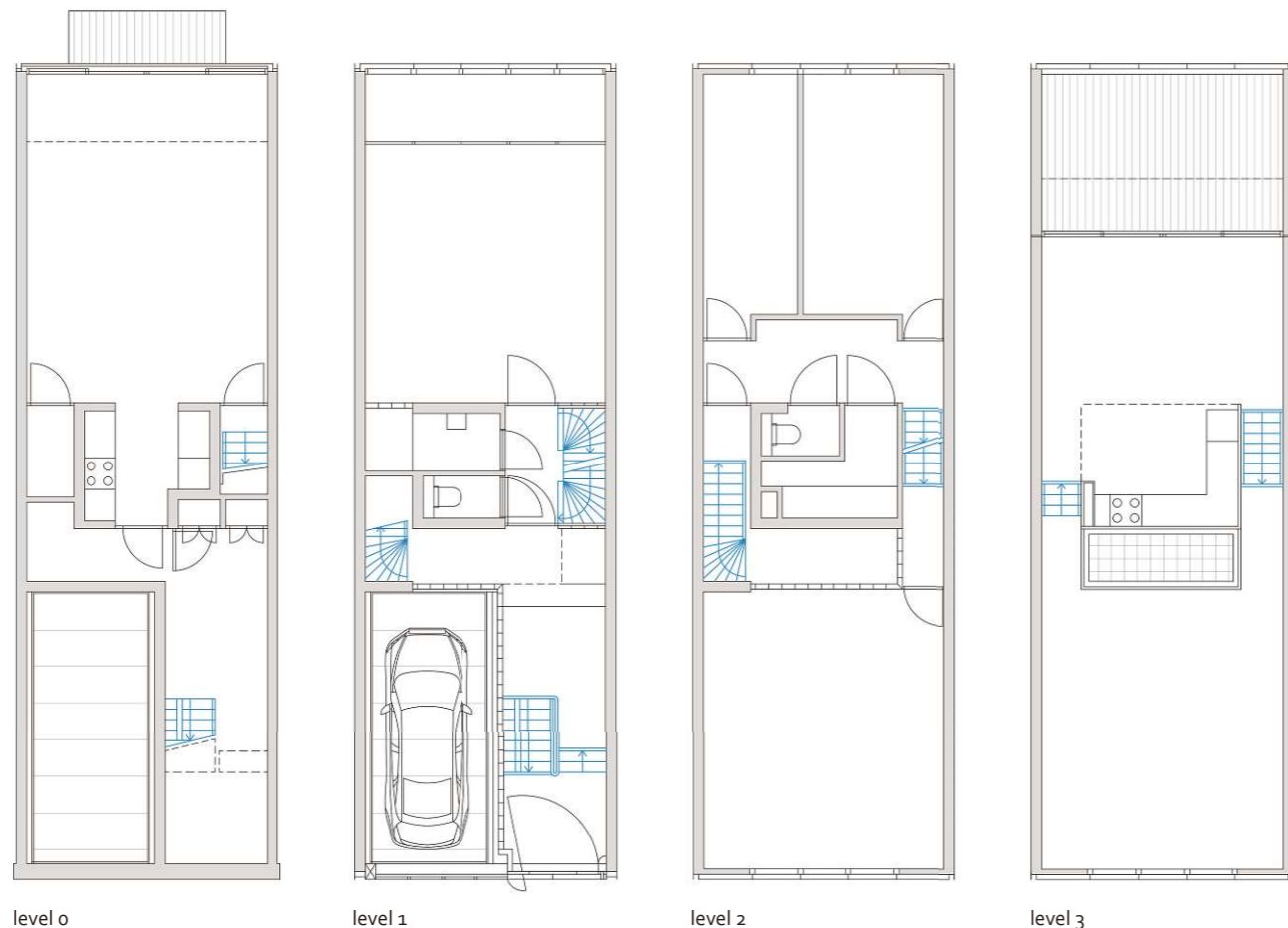
Fig.25 Facade

Kavel 37 / Heren 5 architecten
Borneo-Sporenburg



The house Kavel 37, designed by Heren 5 Architects, is clad in a layer of corten steel to merge with the environment of the houses that surround the harbor and have mostly brick facades.

The floor adopts a split-level design, which can flexibly adjust the height required by each space. The bathroom and stairs are placed in the center of the floor plan so that both the front and rear rooms get daylight and can be considered as a thick compartment between the two spaces.



level 0
Fig.26 Floor plan of Kavel37

level 1

level 2

level 3



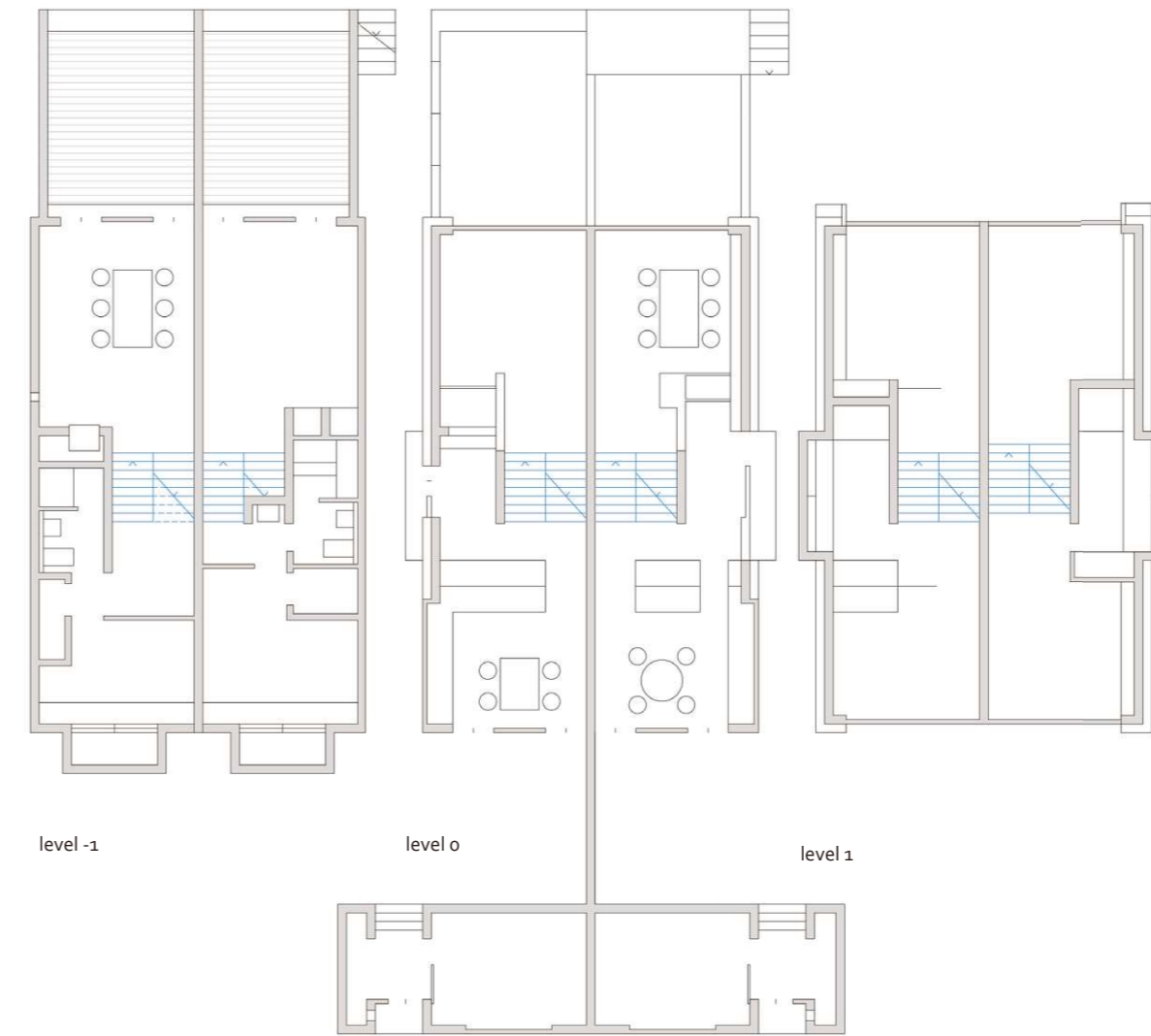
Fig.27 Waterside facade

Arno Lederer, Jórunn Ragnarsdóttir, Marc Oei,
Architekten BDA
Stuttgart



The small semi-detached house in Stuttgart is a split-level design. The role of the stairs, in this case, is not only to connect the upper and lower floors but also to create a visual connection between the floors; because the stairs have no risers, they look visually light.

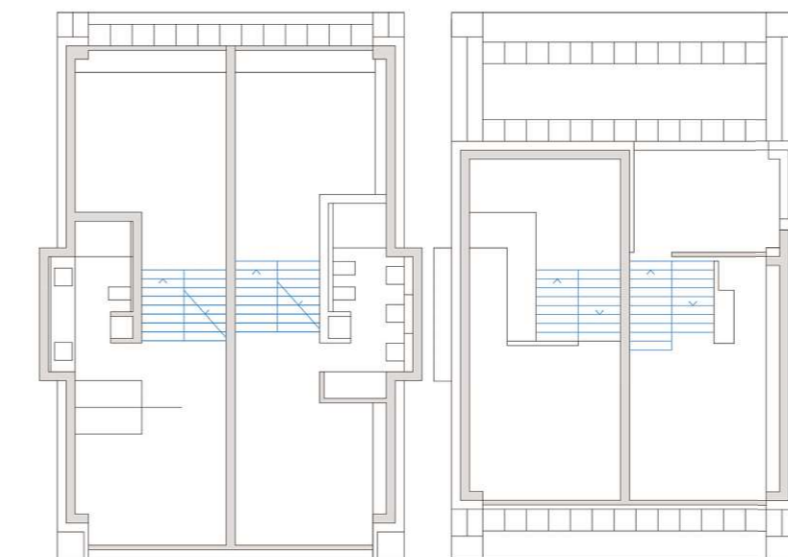
The storage space is added to the outside of the ground floor, making the courtyard between the two volumes private and introverted.



level -1

level 0

level 1



level 2 (left)

level 3 (right)

Fig.28 Floor plan of small semi-detached house in Stuttgart

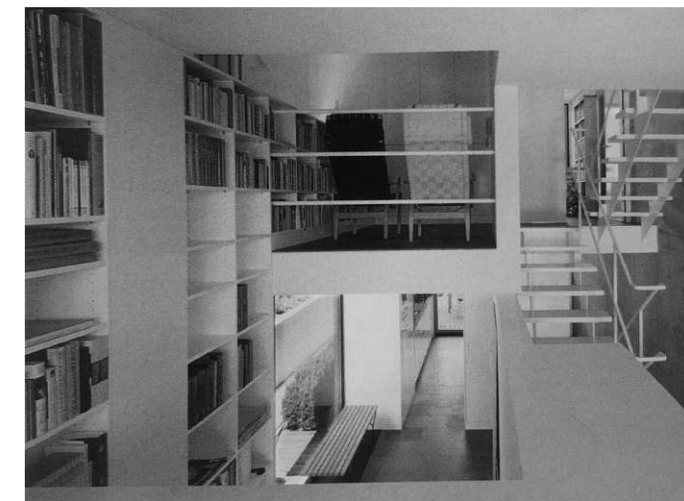
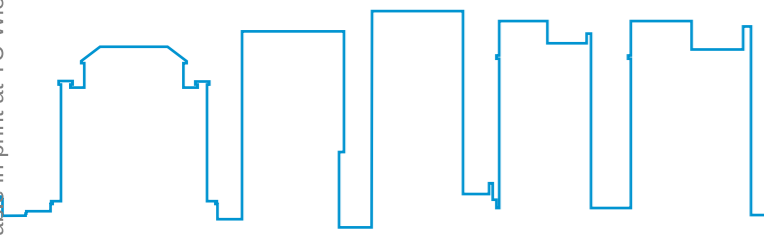


Fig.29 Interior



Site analysis

Taiwan

Taiwan, also known as Formosa, is an island located on the southeast coast of the Asian continent and the west coast of the Pacific Ocean. It covers an area of 36,000 square kilometers and has a population of about 23 million people; two-thirds of the island is alpine forest land, and most of the population is concentrated on flat ground.

The climate of Taiwan is bounded by the Tropic of Cancer, the subtropical monsoon climate to the north, and the tropical monsoon climate to the south. In summer, there is a southwest monsoon, which is hot and rainy and often hit by typhoons; in winter, there is a northeast monsoon, which is primarily cool but occasionally affected by cold currents; spring is the rainy season, which brings abundant rainfall.

Taiwan is located at the junction of the Philippine Sea Plate and the Eurasian plate. It is a seismically active area in the Pacific Rim volcanic belt, causing frequent earthquakes in Taiwan and prone to major disasters.



Fig.30 Significant cities and Tropic of Cancer locations in Taiwan

Taichung

Taichung's mountainous area accounts for 46%, and most of the population is concentrated in the Taichung Basin, where the site is located. The distribution of public transportation is mainly developed along the main road - Taiwan Boulevard; the transportation network is therefore concentrated rather than spread throughout the city; citizens' car ownership rate is the highest in Taiwan.

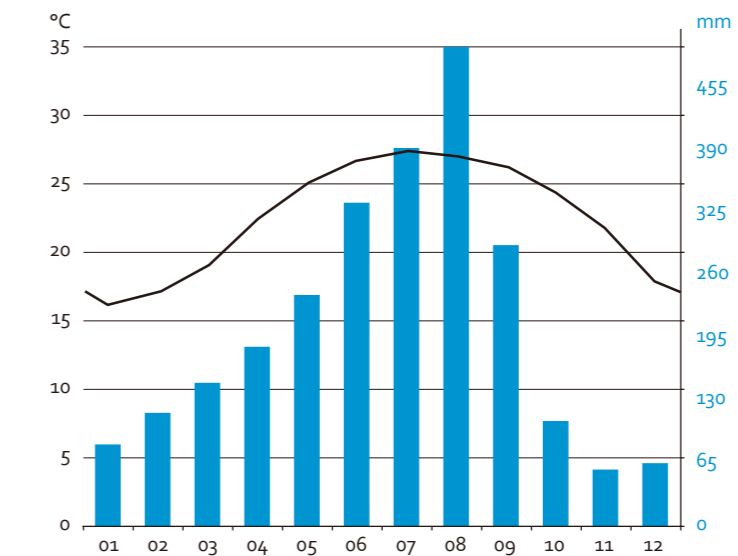


Fig.31 Climate Taichung city



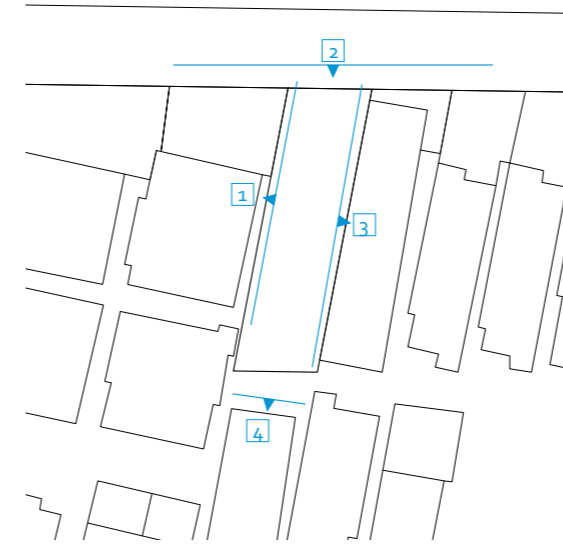
Fig.32 Taichung road network

Neighbourhood context

The site is located in the residential area of Xitun District, Taichung City, and there are adjacent houses to the east, west, and south of the site. The north side is currently an unorganized green space; in the future, the road will be widened and connected to the main external roads, and the green space will also be planned as a city park.

The adjacent house on the east side of the plot is built close to the land boundary and is a tiled wall without an opening; the adjoining house on the west side is built with a setback of 1.5 meters, with windows and air conditioners external unit on the facade.

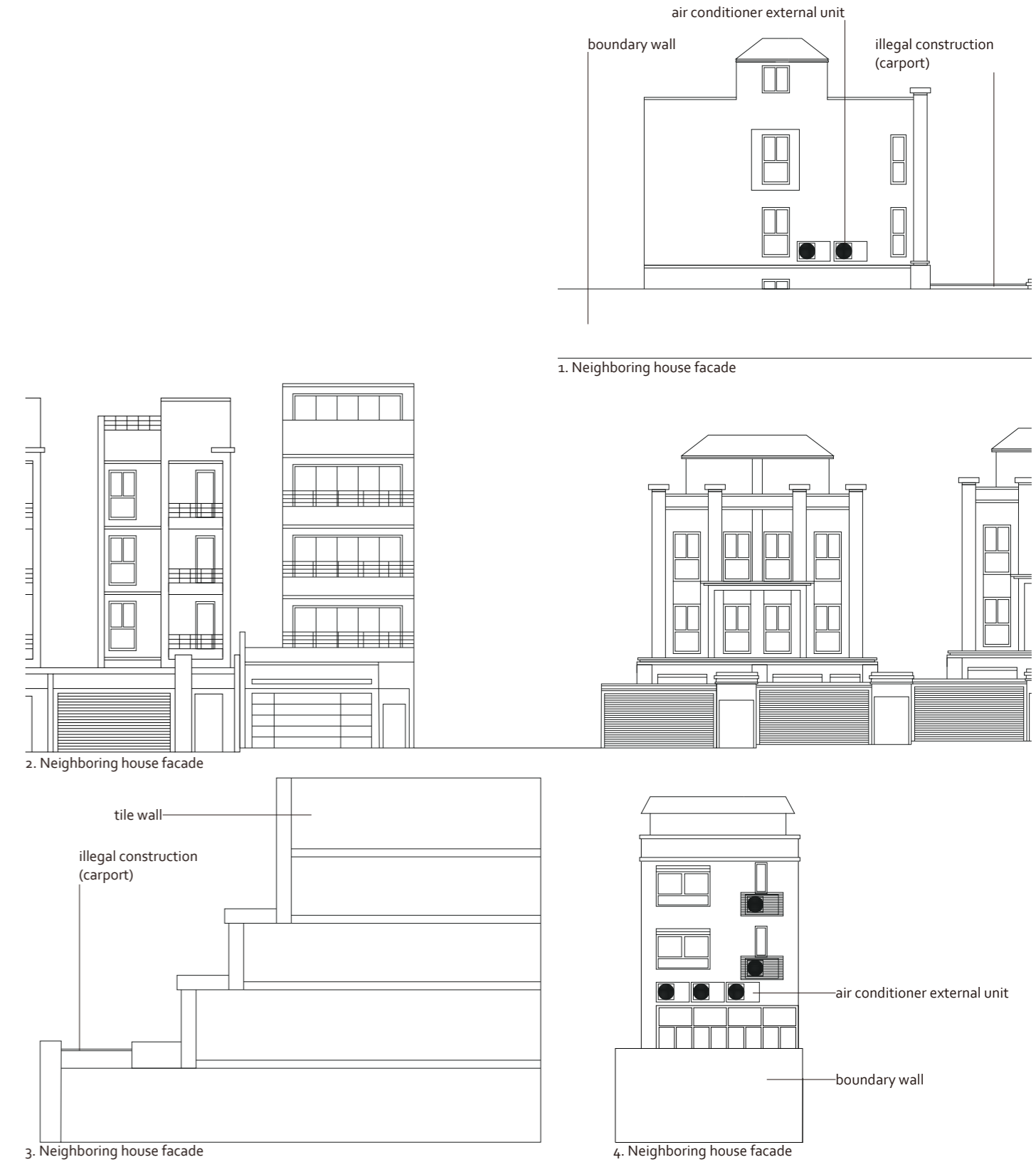
Therefore, in the end, considering privacy and visual sense, the building volume is placed on the west side, and the open space is left on the east side.



current status of site



future planning



1. Neighboring house facade

2. Neighboring house facade

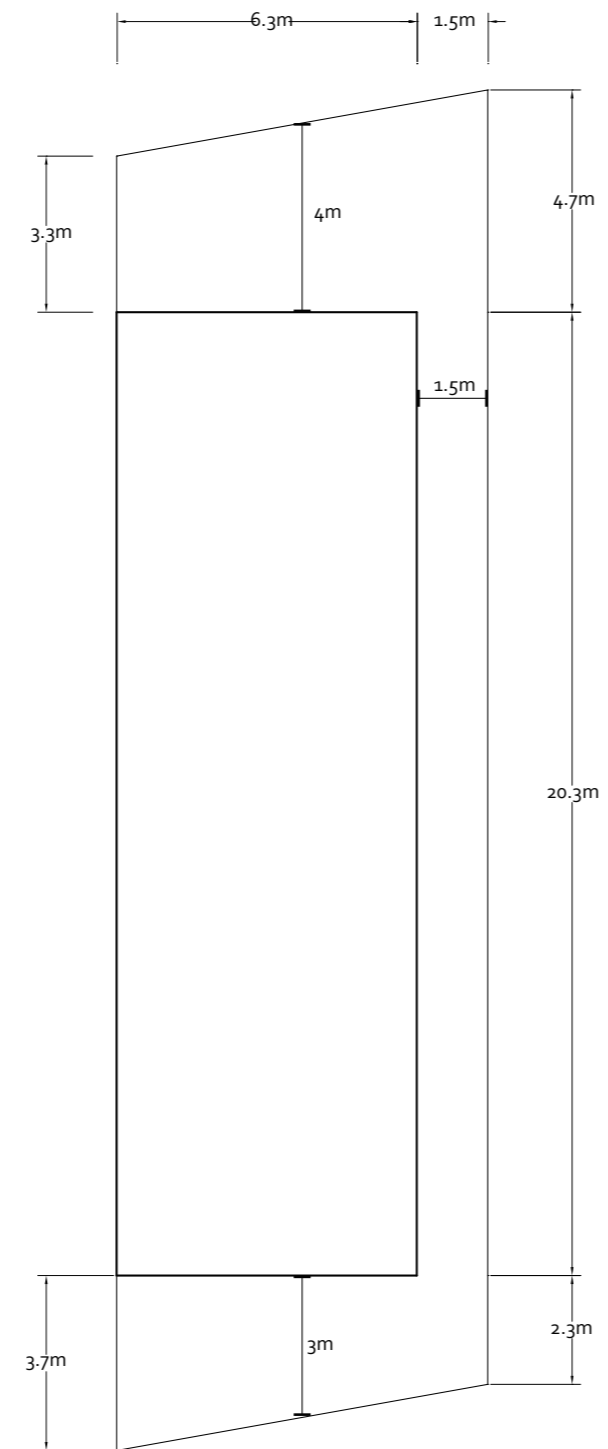
3. Neighboring house facade

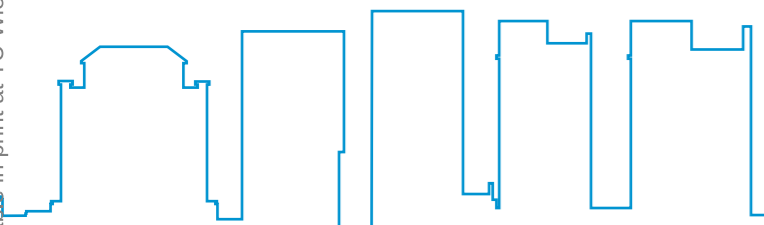
4. Neighboring house facade

Building Technical Regulations

According to the Taichung City Urban Plan, the base belongs to the first category of residential land. The building coverage ratio is 50%, and the building bulk is 140%; the front yard must be set back 4 meters, the side yard 1.5 meters, and the back yard 3 meters; and must have at least one parking space.

- Land area: 214.76 m²
- Building coverage ratio: 50% (107.38 m²)
- Building bulk: 140 m² (300.66 m²)





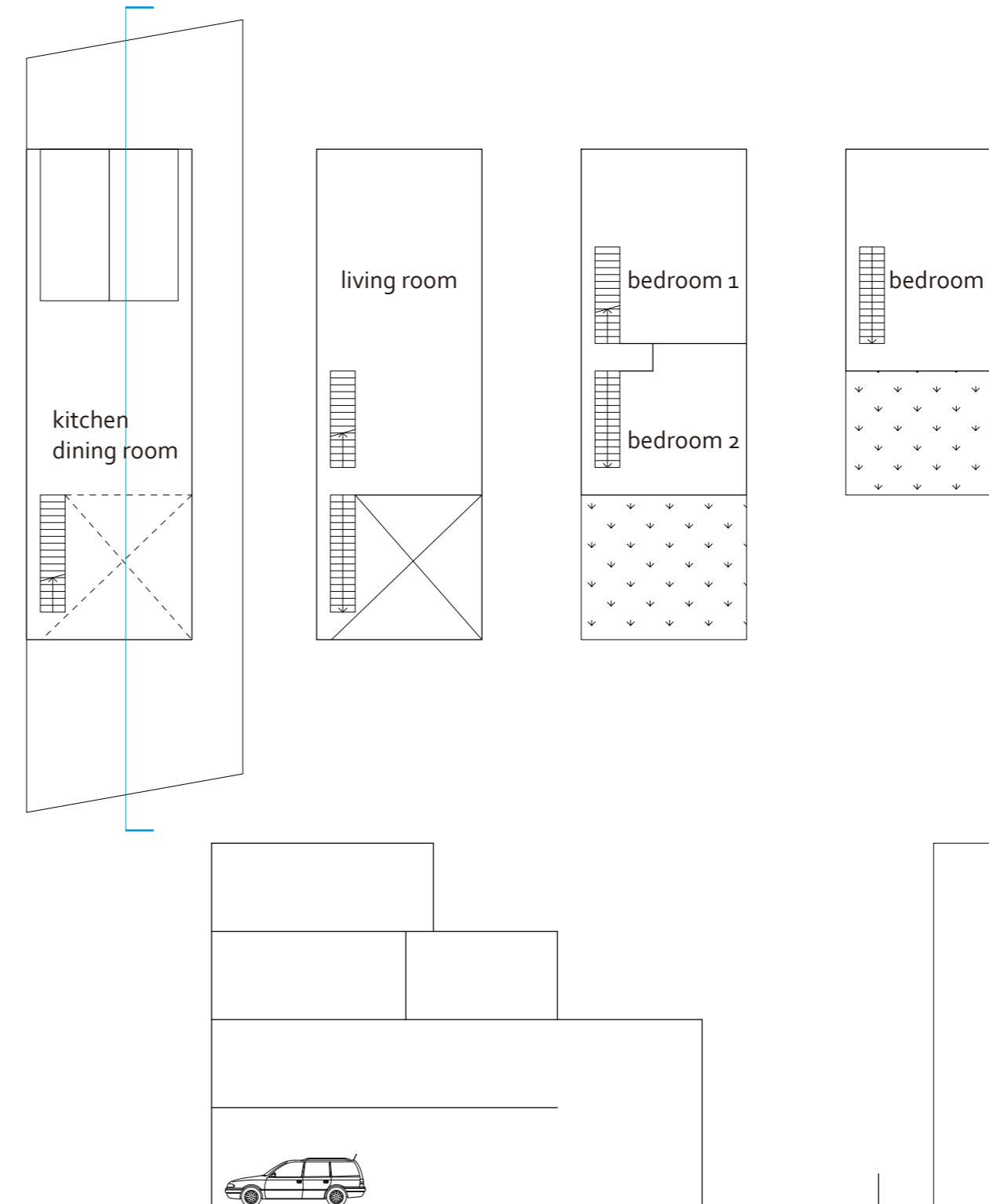
Concept

Spatial planning

The house is built for a family of four and contains two parking spaces, a living room, a kitchen, a dining space, and three bedrooms.

Based on the previous research, several types are selected for spatial arrangement on the site, and they are analyzed to choose the optimal solution (Scheme 1).

Scheme 1 (final scheme)

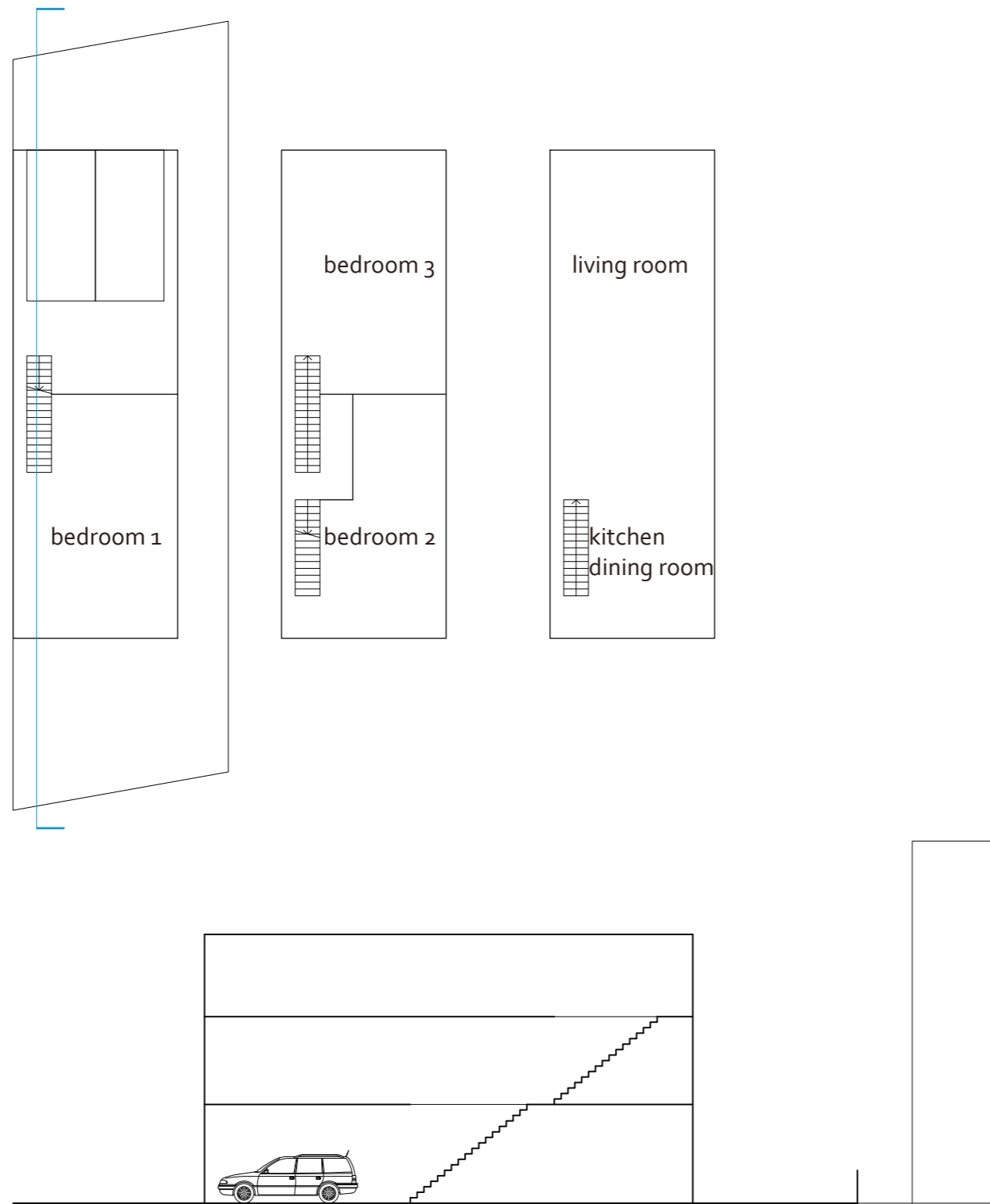


- Advantages: The lengthways staircase on the side allows the space to be reasonably allocated according to needs; the lower volume in the south is conducive to daylighting.

- Disadvantage: The terrace faces the back facade of the neighboring house.



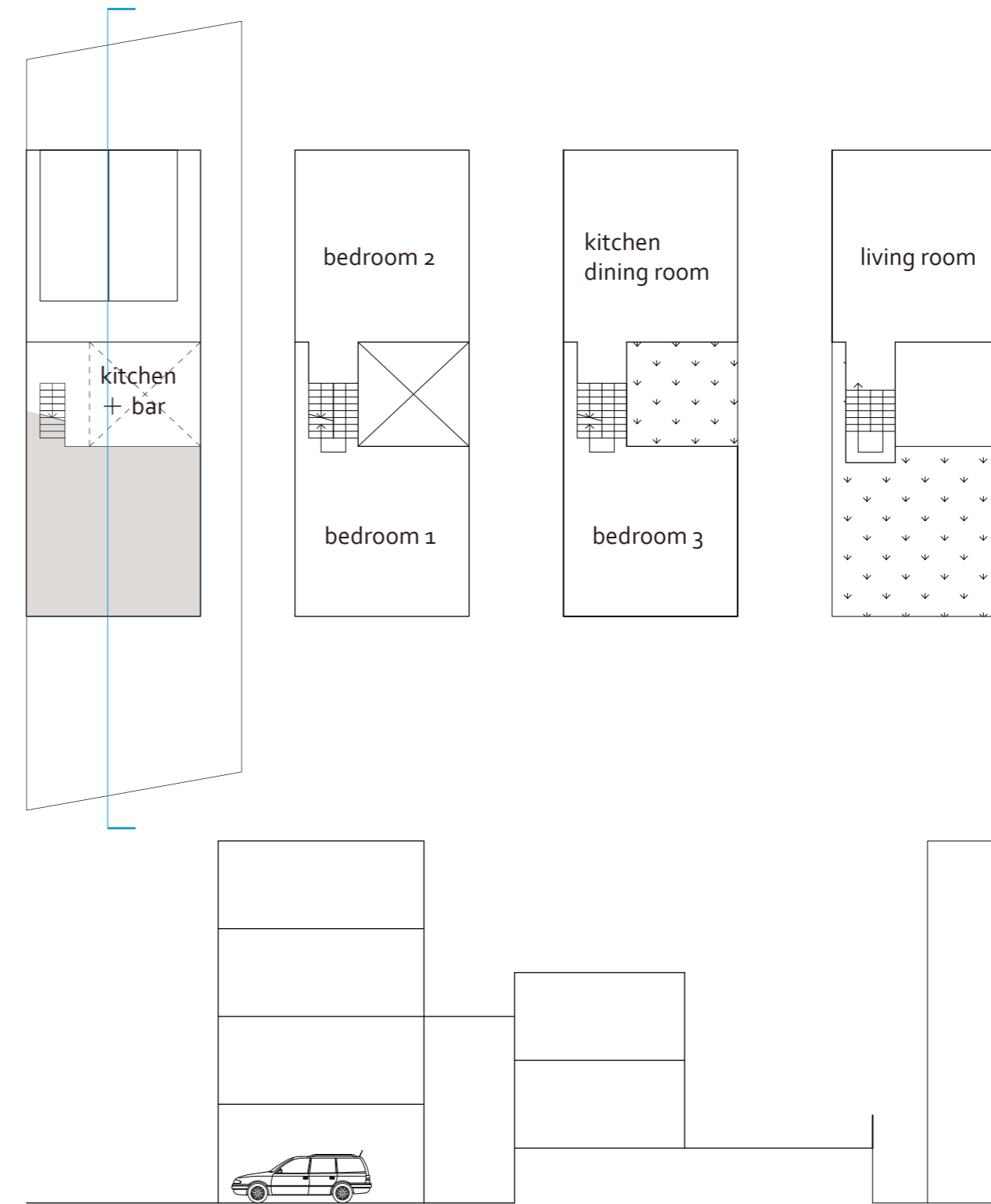
Scheme 2



- Advantages: Both common spaces, the dining room and living room, have optimal lighting and views; Indoor floor area utilization achieves high efficiency.

- Disadvantage: Lack of outdoor space.

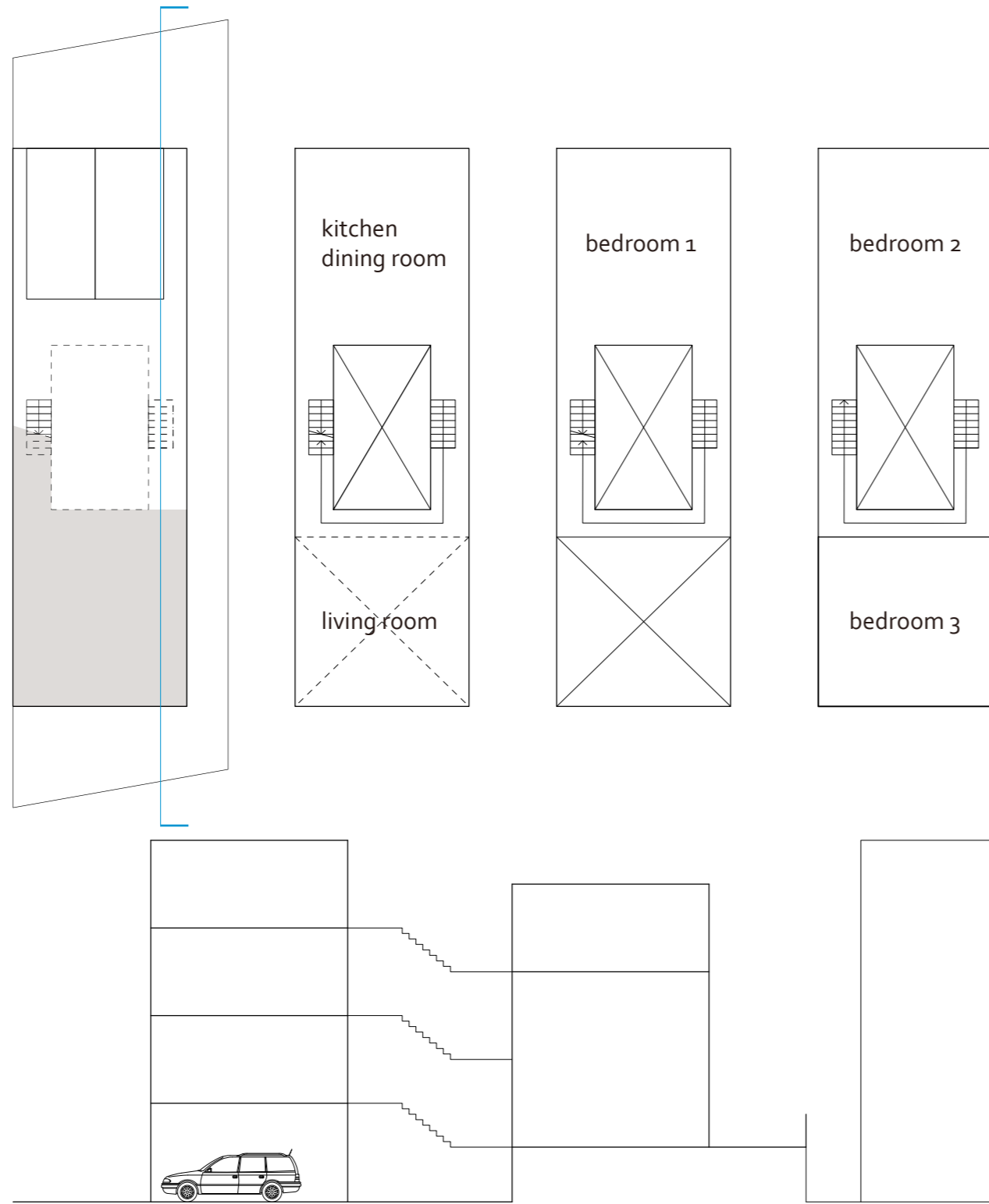
Scheme 3



- Advantages: Spaces do not interfere with each other.

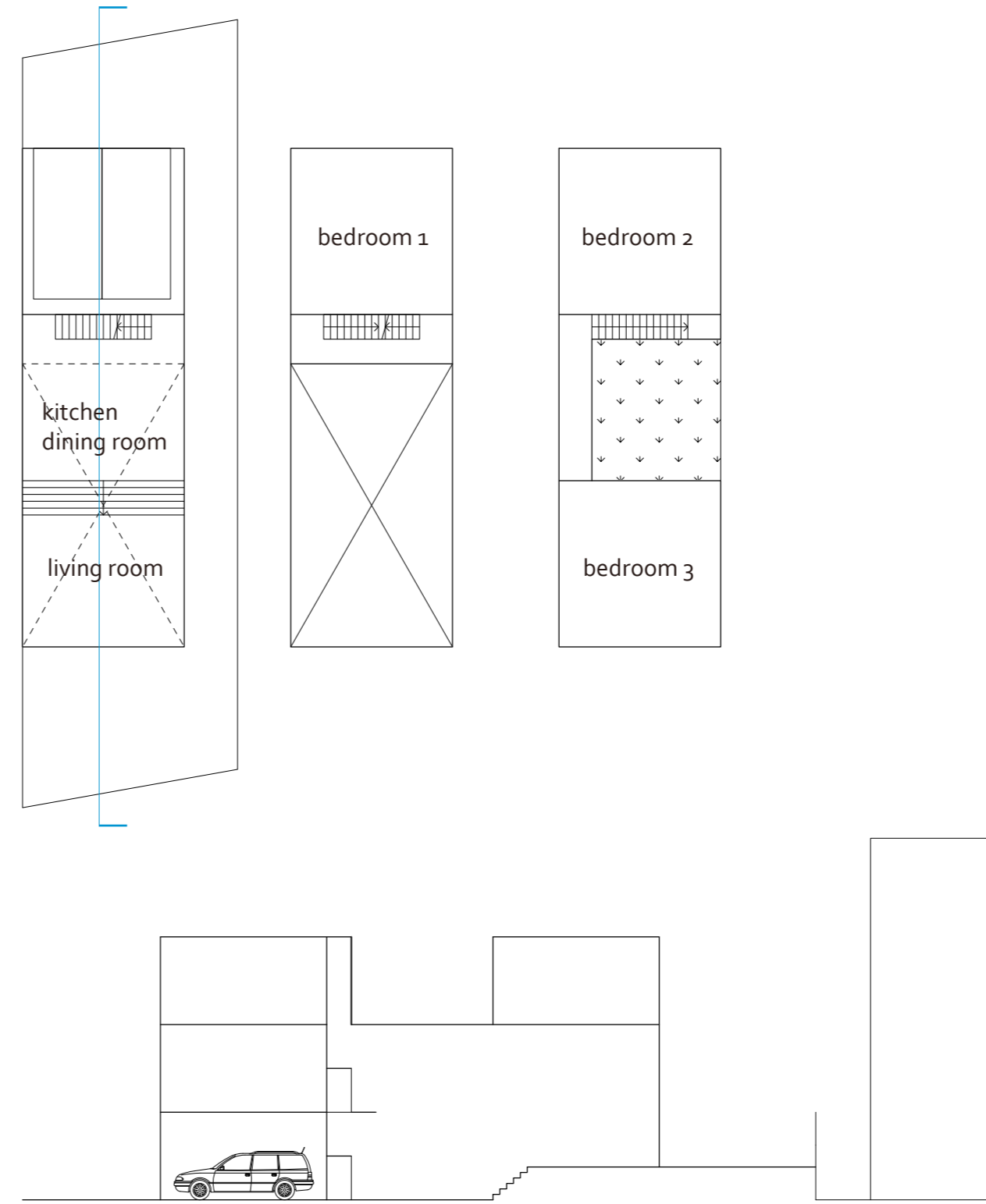
- Disadvantage: The upper and lower floors block the spatial connection between the dining room and the living room; And the two public spaces and the terrace are split by half a floor. The efficiency of the lighting effect of the atrium is not ideal.

Scheme 4



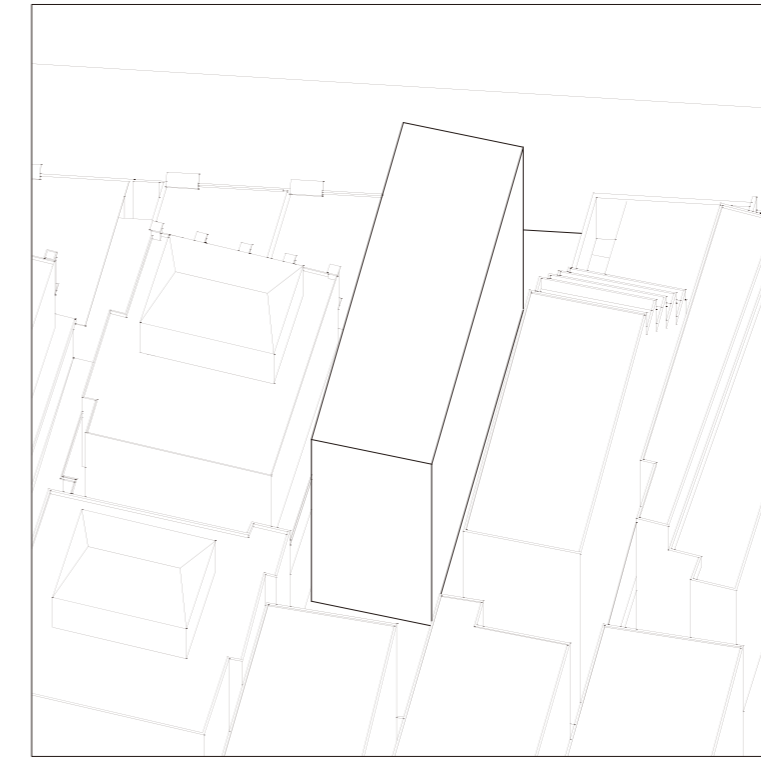
- Advantages: The split level of the half-floor makes the living room and dining room independent but visually connected.
- Disadvantage: Lack of outdoor space.

Scheme 5

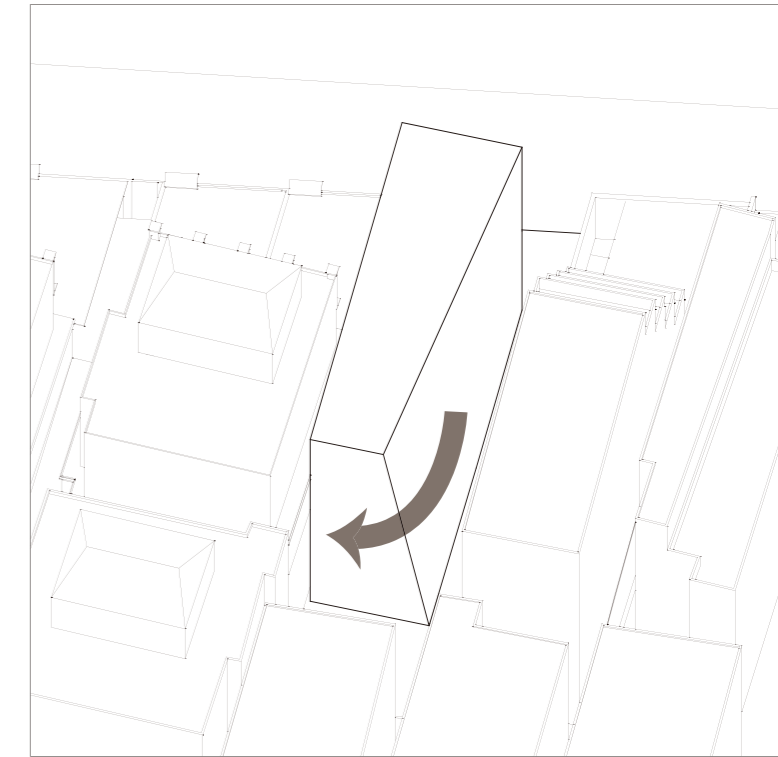


- Advantages: Each room does not interfere with the other; the roof terrace has absolute privacy.
- Disadvantage: Corridors take up too much floor space.

Volumetric concept



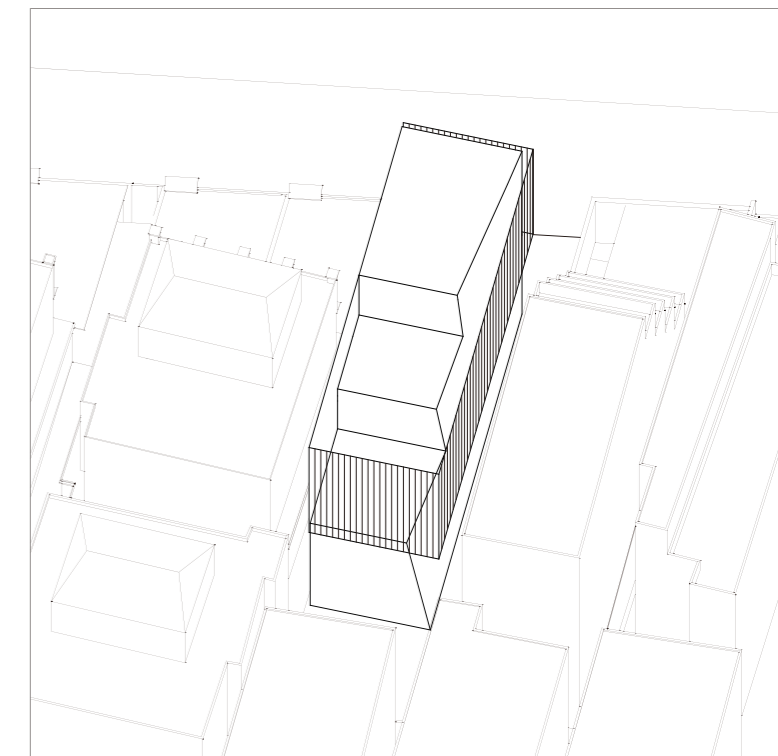
1. Building volume that is set back according to legal distance and then extruded.



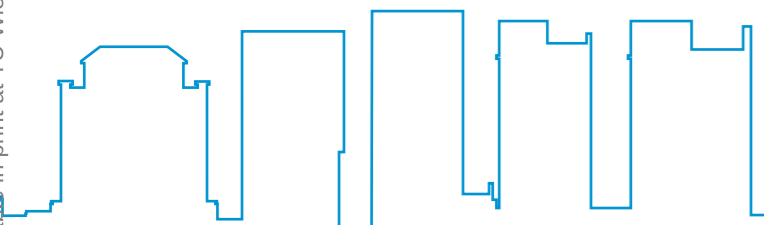
2. Twist the building volume to distance itself from the neighbors.



3. Corresponding to the space planning: the excellent lighting of the terrace and the summer monsoon make the house better ventilated.



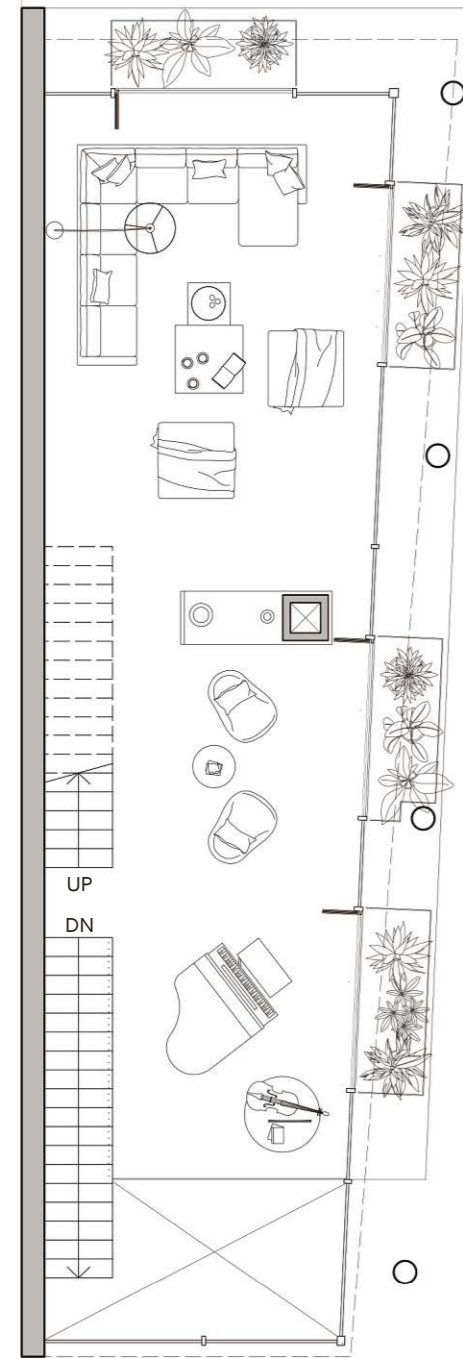
4. Add a second layer of facade for privacy.



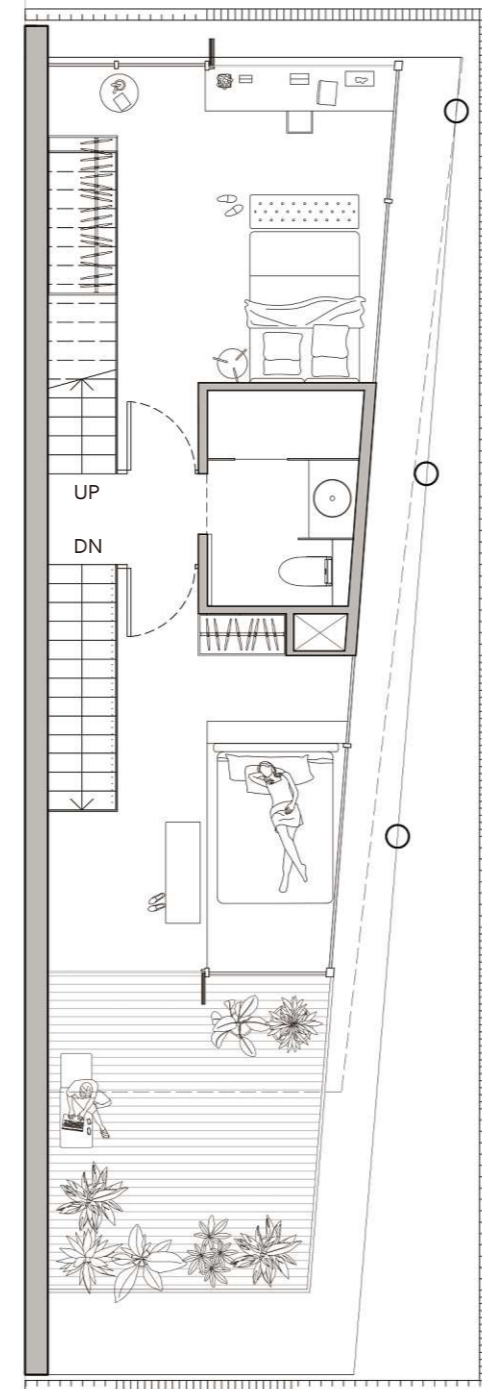


Ground floor plan s:1/100

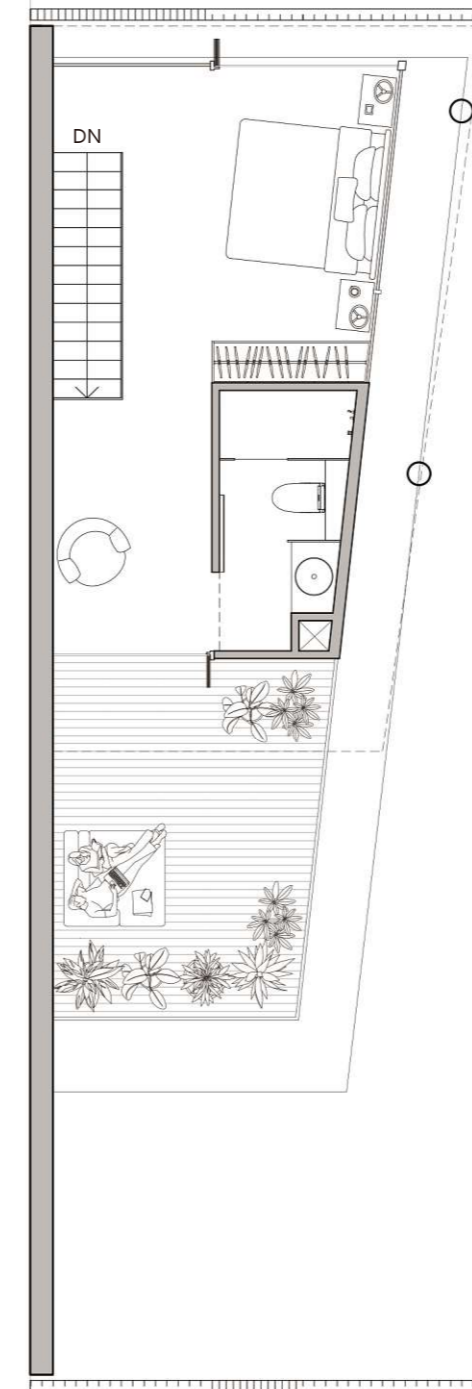




1. floor plan s:1/100



2. floor plan s:1/100



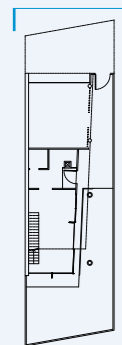
3. floor plan s:1/100



The starting point of the circulation on the first floor is near the end of the floor plan, so the space is open and large, yet it is divided into three parts by furniture.

The circulation starts from the middle on the second floor, dividing the space into two bedrooms of equal size, and the bathroom, including the wardrobe, can be regarded as a thick compartment.

The terraces on the second and third floors are semi-introverted; the aluminum grille and the distance from the rear building visually block the adjacent buildings.

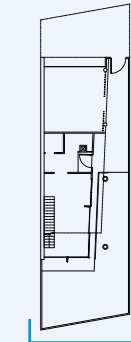
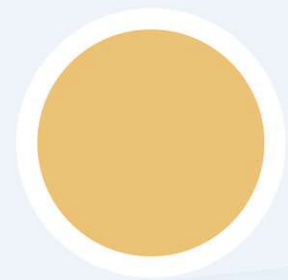
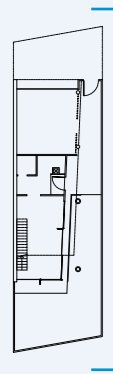


North elevation s:1/100

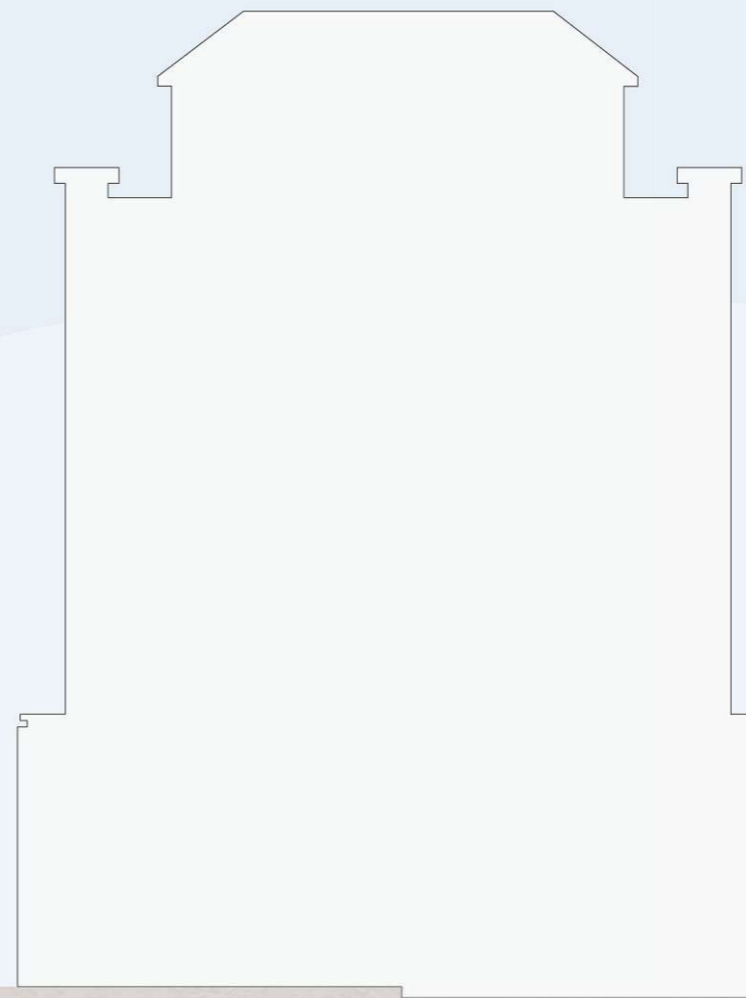
The aluminum grille on the facade can correspond to the indoor space requirements and is divided into two types according to the density with units of 120 cm. In addition, the grille preserves the view of the outside world but ensures privacy and shading of the private space.

The folding aluminum doors can make the facade have contrasting variations - open or transparent; and can also correspond to different seasons, ventilation in summer, blocking the northeast monsoon in winter.

The overall material selection is light in color and uses many metal materials, such as galvanized steel as the structural material and aluminum grille/door panels, making the house's appearance visually lightweight.

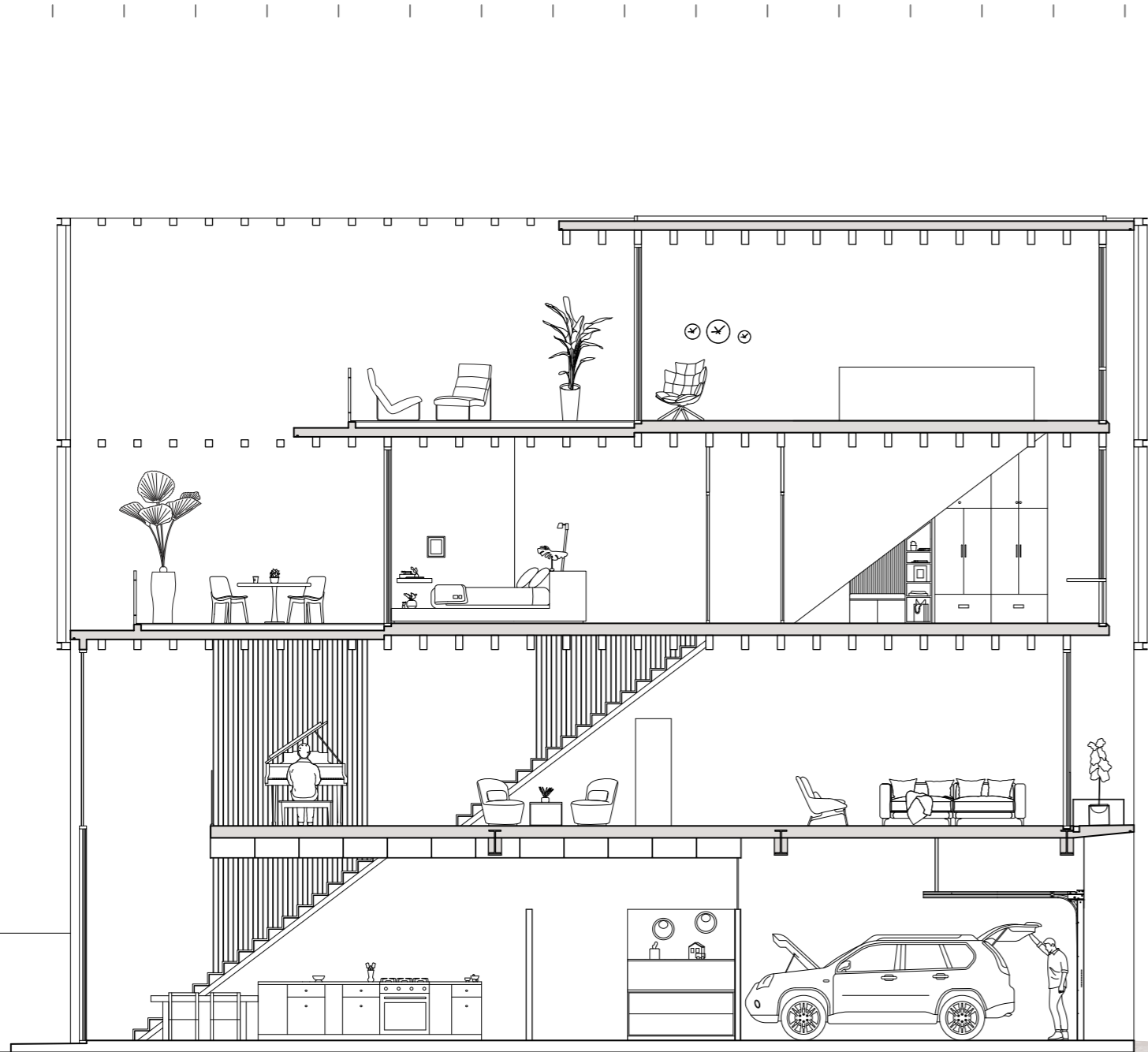
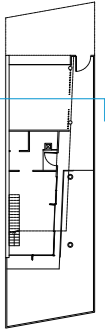
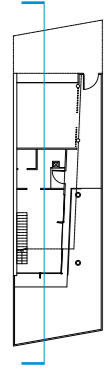


East elevation s:1/100



South elevation s:1/100



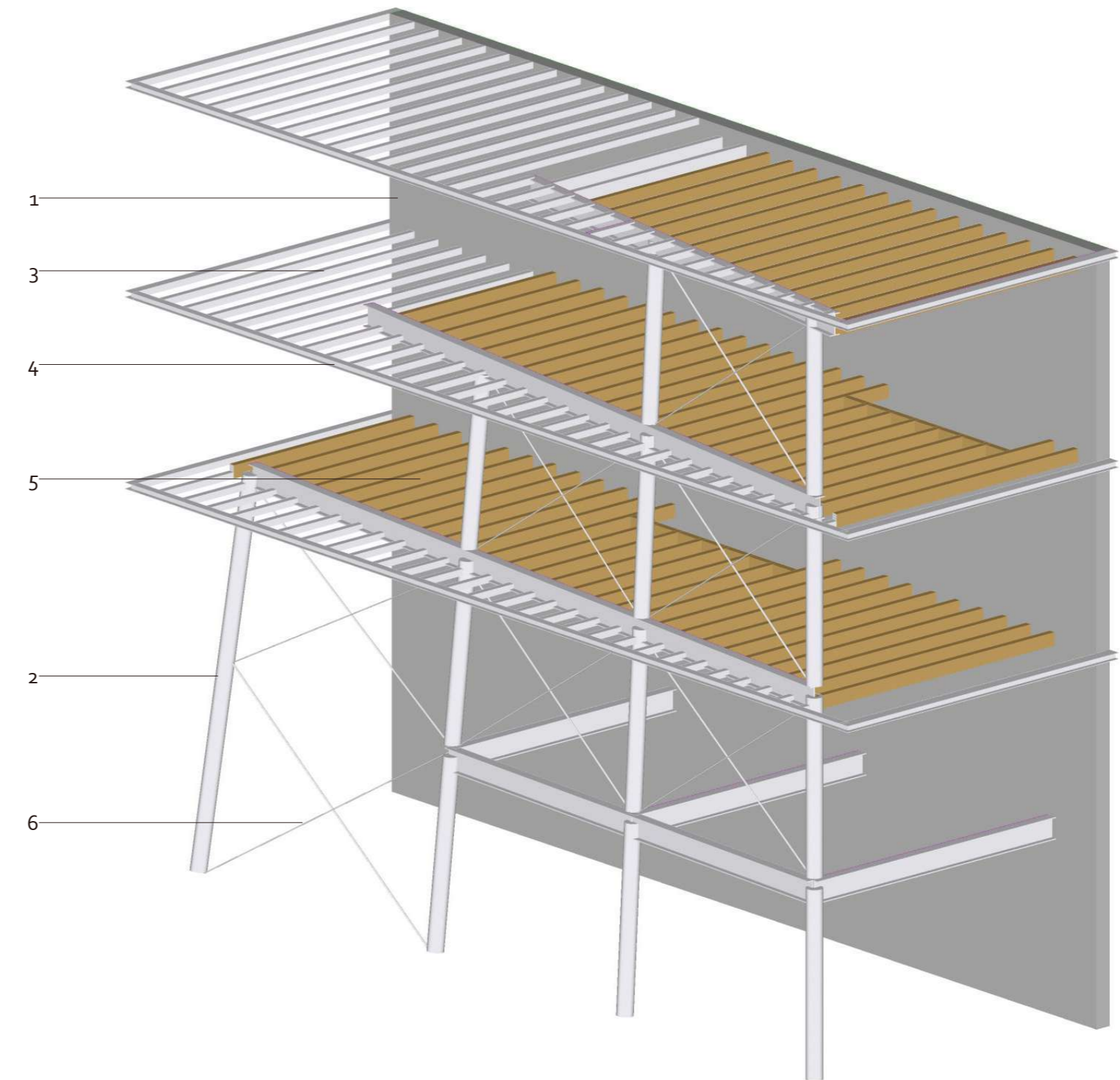


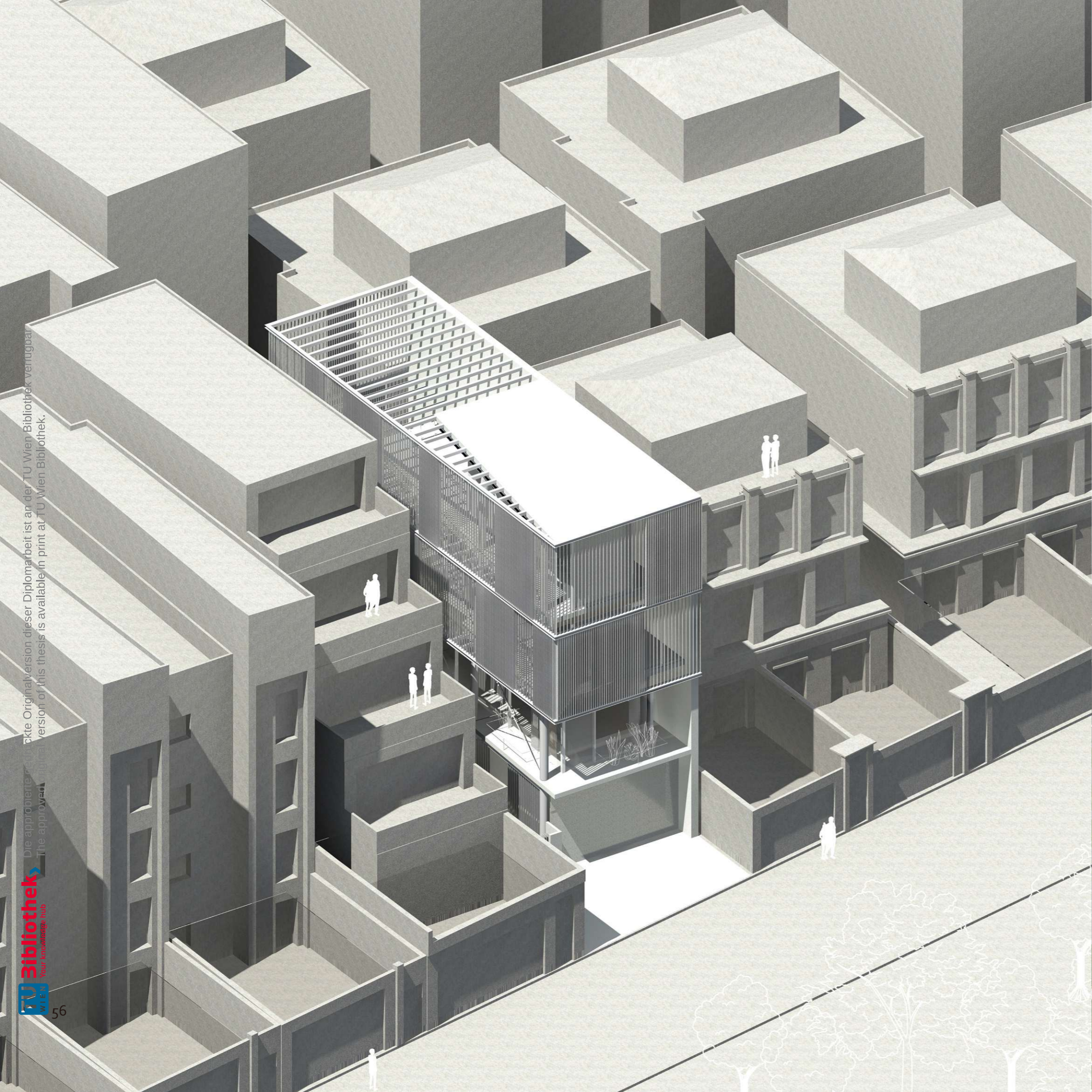
A-A' section s:1/100



B-B' section s:1/100

1. Load-bearing wall:
The heavy load-bearing wall completely blocks the connection with the adjacent house, and it is beneficial for indoor space design.
2. Steel column:
Steel columns have good shock resistance and provide more flexibility.
3. Galvanized steel Beams:
In addition to being a structural system, it also provides shade for the terrace.
4. Galvanized steel frame:
The structural system of the aluminum grille.
5. Cedar beam:
Wooden beams are used for spaces on the 2nd floor and above to provide interior the sense of warmth.
6. Structural tension cable:
Prevention of long-direction shaking movement during earthquakes.





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living room



roof terrace

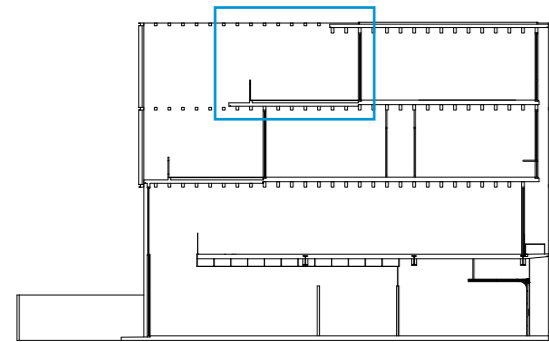
Externally, the material is primarily metal elements, while internally is covered with wood material on the metal structure for the sense of comfort:

The folding door panels are made of aluminum surfaces, and the inner layer is inlaid with teak boards; the stairs are of steel structure, and the surface layer is teak board flooring.

The green outdoor space is mainly on the south side. In addition to better access to sunlight and blocking the northeast monsoon in winter, it also has a greater distance from the house in the rear to ensure the quality of space on both sides.

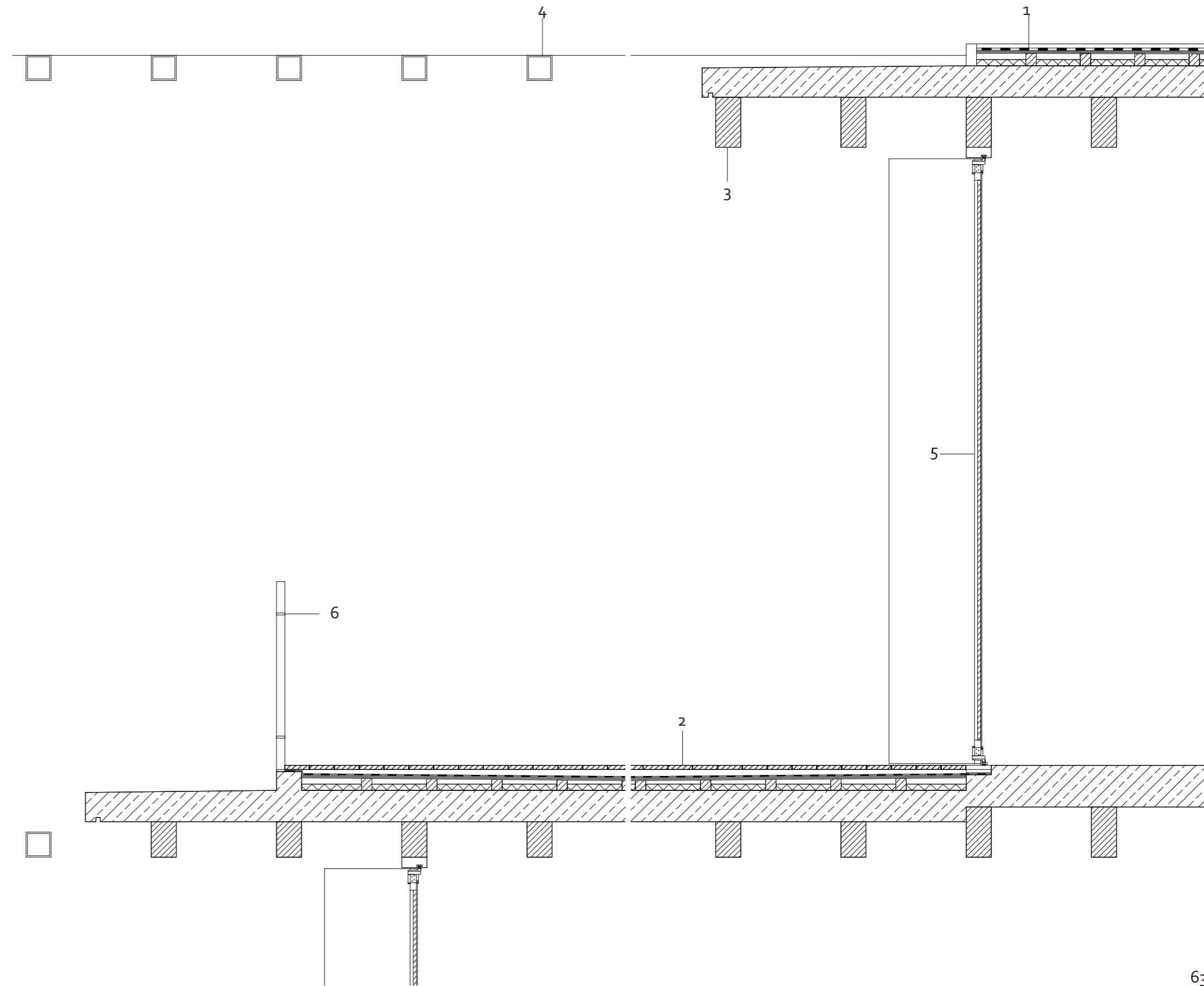


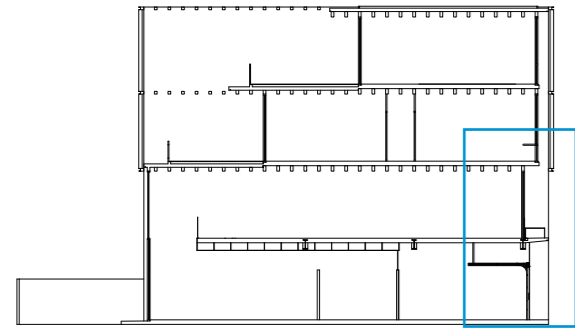
kitchen/ dining space



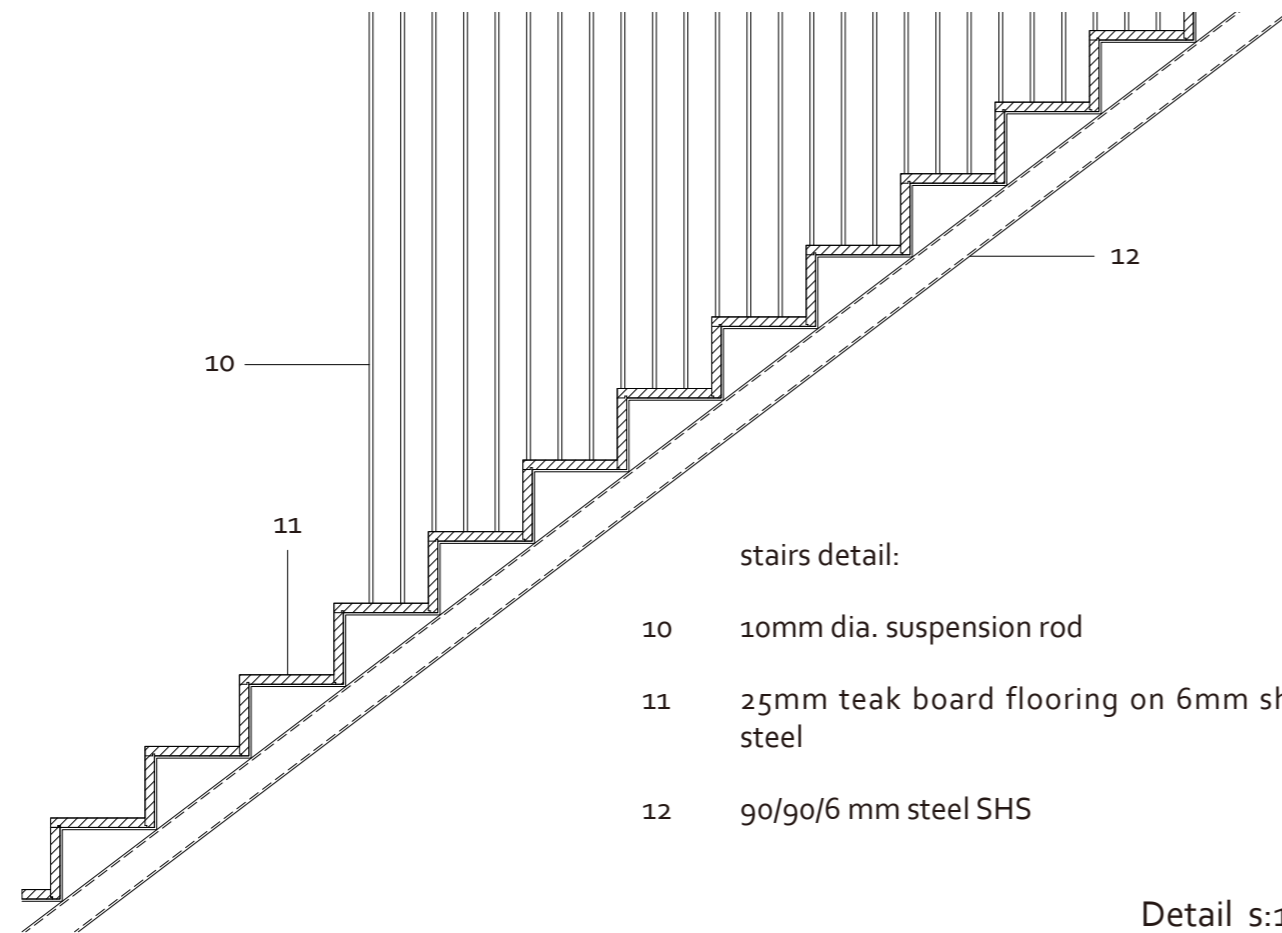
Roof terrace s:1/20

- 1 roof construction:
single-layer roof seal
15 mm plywood
40-60 mm bearers
30 mm thermal insulation
150 mm reinforced concrete roof
- 2 20 mm selangan batu boarding
40-60 mm bearers
single-layer roof seal
15 mm plywood
40-60 mm bearers
30 mm thermal insulation
150 mm reinforced concrete
- 3 240/120 mm cedar beam
- 4 120/120/10 mm galvanized steel SHS
- 5 15mm five-leaf track-run anodized-aluminum folding shutter with tubular frame
15mm teak board
- 6 10/40mm steel handrail





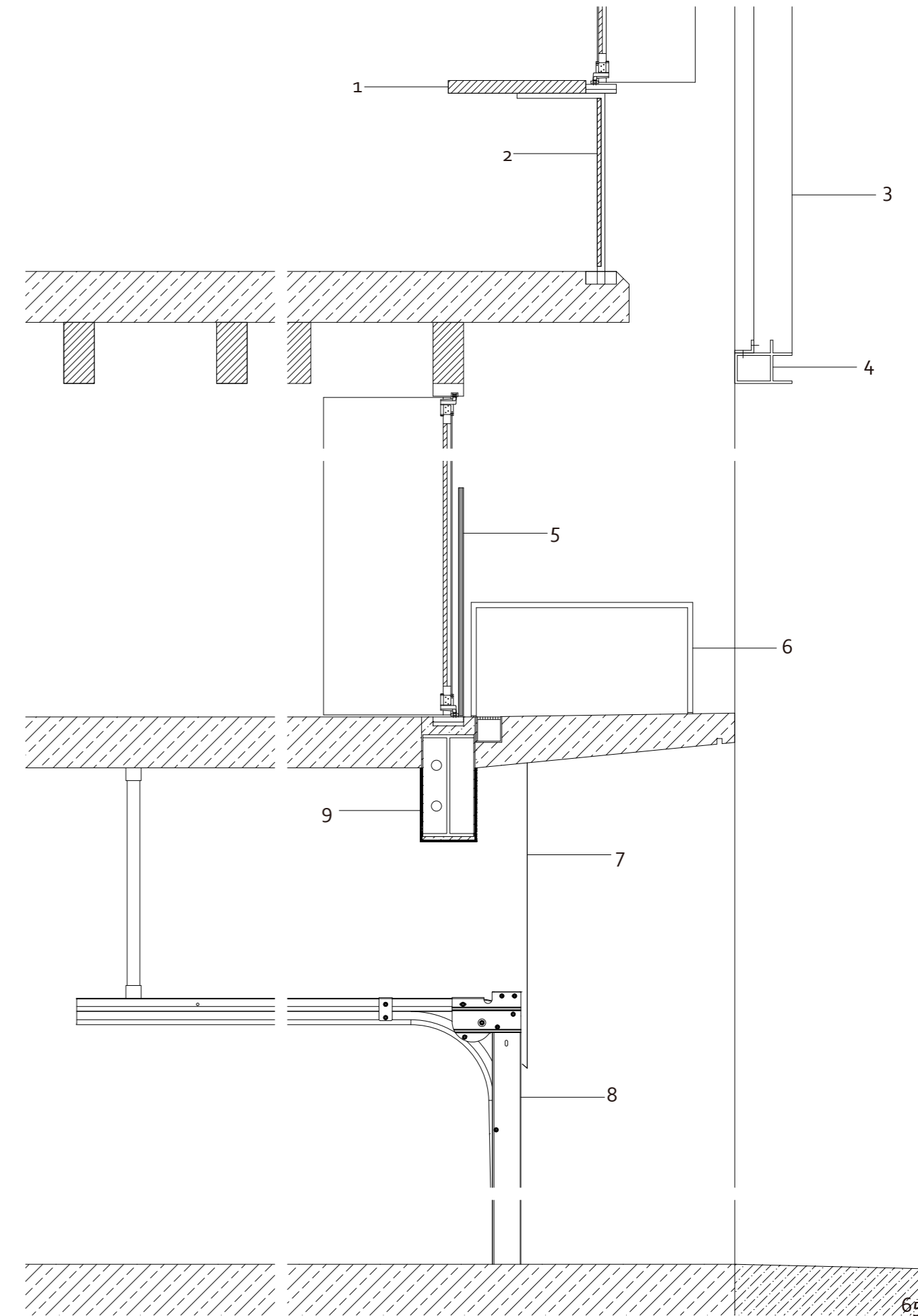
- 1 50mm teak desktop board
- 2 15mm teak board
15mm galvanized steel
- 3 anodized extruded aluminium grille
- 4 galvanized steel
- 5 safety balustrade: 2x 6 mm lam. safety glass fixed at sides with steel sections
- 6 20 mm dia. tubular steel handrail
- 7 2 mm anodized sheet-aluminium covering
- 8 sectional garage door with anodized sheet-aluminium covering
- 9 200/400/11 mm steel I-beam

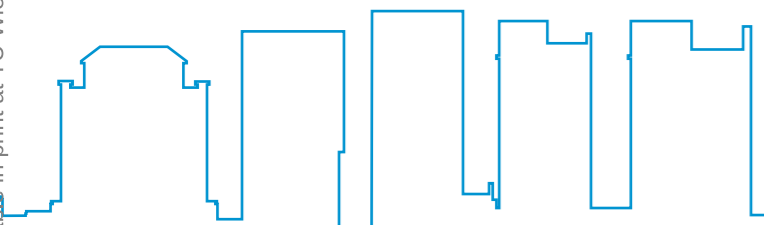


stairs detail:

- 10 10mm dia. suspension rod
- 11 25mm teak board flooring on 6mm sheet steel
- 12 90/90/6 mm steel SHS

Detail s:1/20





Attachment

Literature Reference

Pfeifer Gunter und Brauneck Per, Birkhauser: Wohnhauser: Eine Typologie, 2015

Herausgeber: Christian Schittich ; Autoren: Christian Schittich, Hannes Rössler, Tao Baerlocher, Zürich, München : Edition DETAIL: Wohnkonzepte in Japan : Typologien für den kleinen Raum = Housing in Japan : typologies for small spaces, 2016

Gool Rob van ,Stuttgart [u.a.] : Dt. Verl.-Anst.:Das niederländische Reihnhaus : Serie und Vielfalt Author statement, 2000

Heider Katharina, München : Dt. Verl.-Anst.: Doppelhäuser und Reihenhäuser : aktuelle Beispiele zeitgenössischer Architektur, 2006

Schramm Helmut , Teilw. zugl.: Wien, Techn. Univ., Habil.-Schr., 2003 Wien [u.a.] : Springer: Low rise - high density : horizontale Verdichtungsformen im Wohnbau, 2008

Online References

Study for Architecture Style and reuse of traditional town houses in Taiwan
https://www.abri.gov.tw/News_Content_Table.aspx?n=807&s=37563
retrieved on 3.5.2021

Taiwan architecture history
<https://vocus.cc/article/5a121a3ceceaed97b4026785>
retrieved on 3.5.2021

The spatial sequence of Taiwanese street houses
<https://kjmu.org.tw/%e5%8f%b0%e7%81%a3%e8%a1%97%e5%b1%8b%e7%a9%ba%e9%96%93%e7%a7%a9%e5%ba%8f/>
retrieved on 3.5.2021

Borneo Sporenburg
https://www.west8.com/projects/borneo_sporenburg/
retrieved on 30.5.2021
<https://www.slideshare.net/JiaXinChee/borneo-sporenburg>
retrieved on 30.5.2021

Borneo-12
<https://www.mvrdv.nl/projects/161/borneo-12>
retrieved on 30.5.2021

Borneo-18
<https://www.mvrdv.nl/projects/162/borneo-18>
retrieved on 30.5.2021

Taiwan
<https://zh.wikipedia.org/wiki/%E8%87%BA%E7%81%A3>
retrieved on 26.4.2022

Building Technical Regulations
<https://www.ud.taichung.gov.tw/media/178653/582614482324.pdf>
retrieved on 22.4.2022

Detail
<https://inspiration.detail.de/startseite.html>
last accessed May 2022

List of Figures

- Fig.1
<https://vocus.cc/@tripack1949/5a121a3ceceaed97b4026785>
retrieved on 8.5.2021
- Fig.2,3,4,5
<https://www.travel.taipei/zh-tw/pictorial/article/18490>
retrieved on 8.5.2021
- Fig.6
<https://www.miesarch.com/work/2742>
retrieved on 29.4.2022
- Fig.7,8
https://www.west8.com/projects/borneo_sporenburg/
retrieved on 30.5.2021
- Fig.9,10,11
<https://www.koenvanvelsen.com/en/projects/23>
retrieved on 30.5.2021, floor plan redrawn by the author
- Fig.12
<https://www.e-periodica.ch/digbib/view?pid=wbw-004:1999:86::1021#47>, S.35
retrieved on 30.5.2021, floor plan redrawn by the author
- Fig.13
<https://dokarchitecten.nl/en/project/sporenburg-ii-amsterdam>
retrieved on 30.5.2021
- Fig.14,15,16,17
<https://kaanarchitecten.com/project/borneo-sporenburg/>
retrieved on 30.5.2021, floor plan redrawn by the author
- Fig.18
<https://plans.arch.ethz.ch/archives/project/tp05-borneo-plot-12>
retrieved on 30.5.2021, floor plan redrawn by the author
- Fig.19,20
<https://www.mvrdv.nl/projects/161/borneo-12>
retrieved on 30.5.2021
- Fig.21
<https://www.archweb.com/en/architectures/drawing/borneo-house-plot-18/>
retrieved on 30.5.2021, floor plan redrawn by the author
- Fig.22,23
<https://www.mvrdv.nl/projects/162/borneo-18>
retrieved on 30.5.2021
- Fig.24,25
http://www.slawik.net/images/bautenundprojekte/pdf/slawik_borneo_projektblatt_d.pdf
retrieved on 5.6.2021, floor plan redrawn by the author
- Fig.26,27
<https://heren5.eu/portfolio/kavel-37-borneo-amsterdam/#>
retrieved on 30.5.2021, floor plan redrawn by the author

- Fig.28,29
Heider, Katharina, München : Dt. Verl.-Anst.: Doppelhäuser und Reihenhäuser : aktuelle Beispiele zeitgenössischer Architektur, 2006, P.43-45
floor plan redrawn by the author
- Fig.30
<http://library.taiwanschoolnet.org/gsh2007/gsh4867/chinese/a11.htm>
retrieved on 26.4.2022, redrawn by the author
- Fig.31
<https://en.climate-data.org/asia/republic-of-china-taiwan/taichung-city/taichung-city-1064/>
retrieved on 26.5.2021, redrawn by the author
- Fig.32
<https://www.mapbox.com/>
retrieved on 26.4.2022

illustrations: <https://toffu.co/>

The author Wan-Yu Chen drew all other pictures, plans, illustrations, and visualizations.