

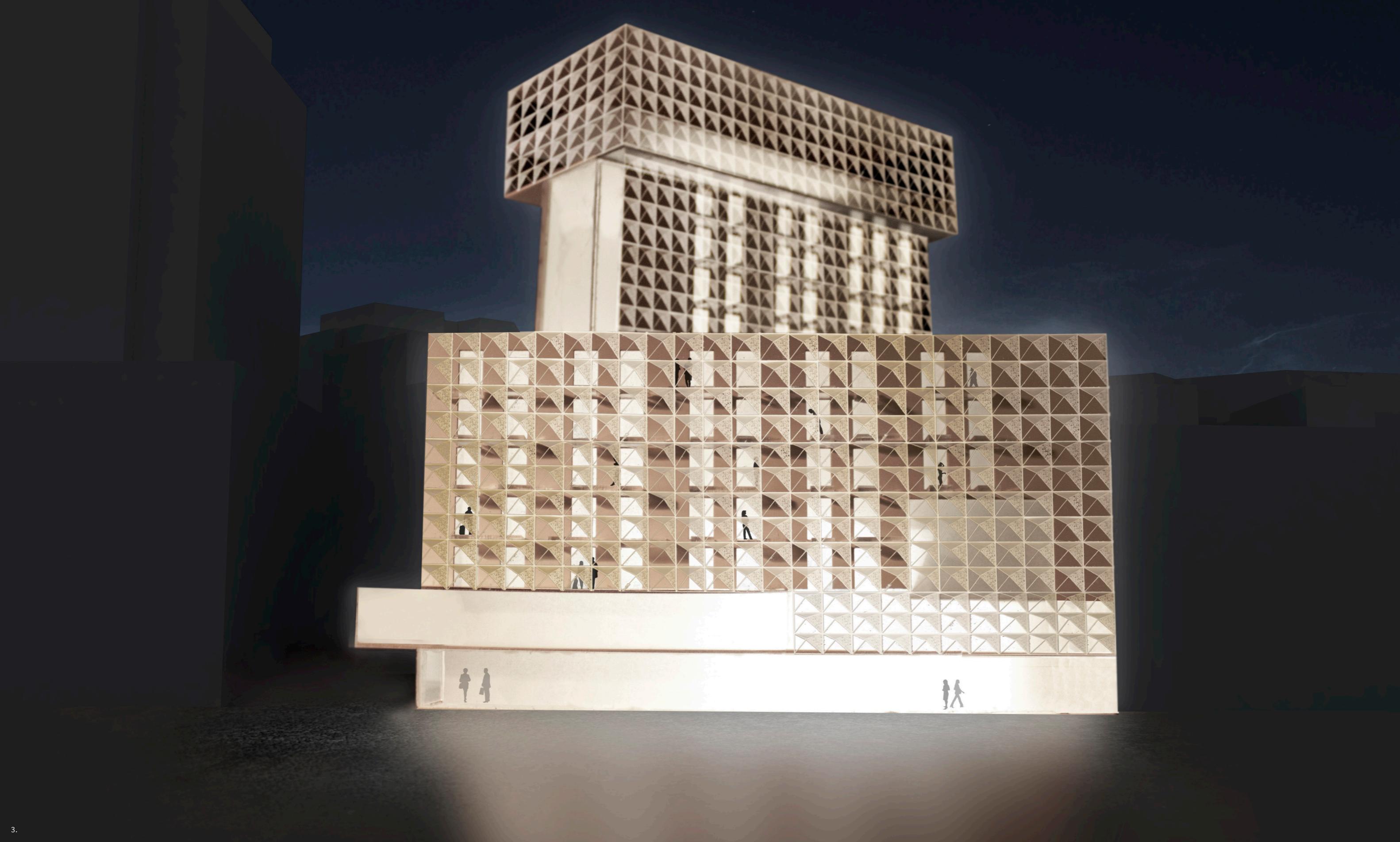


A SECOND LAYER

MASTER THESIS PROJECT IN ARCHITECTURE
MATTER SPACE STRUCTURE STUDIO
SPRING 2013
EMMA SVANSTRÖM

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A SECOND LAYER

MASTER THESIS PROJECT IN ARCHITECTURE, MATTER SPACE STRUCTURE STUDIO, SPRING 2013,
BY EMMA SVANSTRÖM

Facades have several functions and fulfill many purposes. A traditional facade is the component of the building that separates the inside from the outside and protects the building from climate loads to make it habitable all year round. Often the facade is what we perceive as a building's design, since it is the main feature seen from the outside.

As the facade is the feature of a building that is most exposed to impact from the outside, in form of climate loads, it is also the part of the building that is most likely to decay first. As a result, it is often because of the facade it is decided to demolish a building or rebuild it to fit in with today's environmental requirements. If you instead add an extra layer, a new skin, to a building's facade, the existing building can be preserved. The new layer does not only provide a new exterior, it can also improve the building's performance and extend the life of a building.

Adding a new layer to an existing building is not a pioneering concept, but what is often forgotten is to utilize the space between the layers. The space between the layers becomes a transition between outside and inside, as well as a transition between the public outside and the private interior.

“A second layer” is a project that investigates what happens when you add an extra layer to a building's facade. It explores the building's change in appearance, environmental profits and particularly what happens in the space between the layers. With parametric design and analytical methods the facade is adapted to its surroundings to ensure a better indoor climate and create a more energy efficient building.

The project is based on an existing building in Gothenburg, the Riverton hotel, which is located between two vibrant and lively parts of the city, Brunnsparcken and Järntorget. The four star hotel has ambitions to expand and develop its brand but is held back by the building's shattered and bland exterior and despite its sky bar with one of the city's best views, it is not sufficient to attract the public.



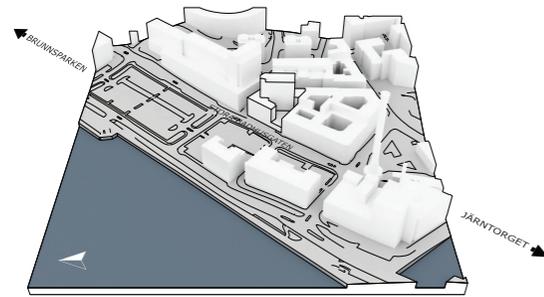
EXISTING WATERFRONT

STENHÄLLSSTRÅKAN

INDELÖRSGATAN

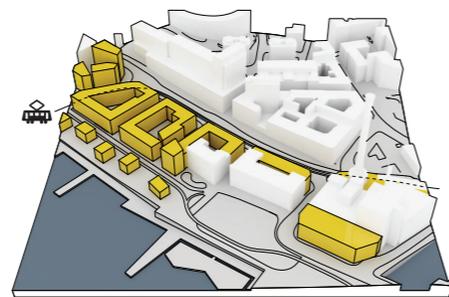


SITE



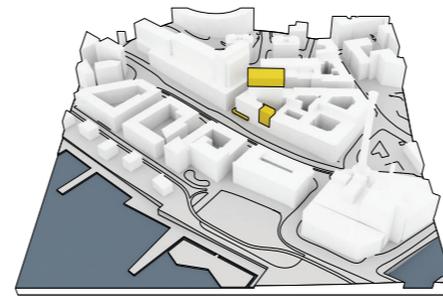
RIVERTON HOTEL

The four star hotel Riverton is situated close to the waterfront between Brunnsparcken and Järntorget in Gothenburg City. The building is wedged in with the block, aligned with the buildings along Stora Badhusgatan. It was first built in 1934 as a residence building consisting of the higher building part along Ingenjörsgatan. In 1984 the building was converted to a hotel together with the extension of the lower part.



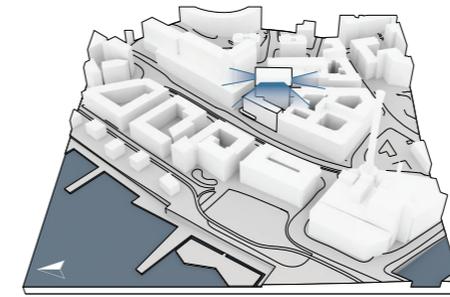
NEW AREA DEVELOPMENT

The area today is perceived as deserted and empty but the new development plan presents a large exploitation of the area in the near future. The waterfront will soon be exploited with a new waterfront stroll together with buildings within a block structure, including both residences, offices and retail. Along Stora Badhusgatan, a new tramline will connect the city centre and Järntorget. Just northwest of the site a new node for all public transport will connect the public ferries, trams and busses.



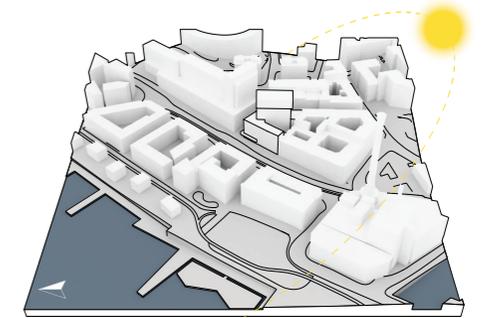
REFURBISHMENT PROPOSAL

The new development plan includes a refurbishment of the hotel. The proposal is developed by White Architects. With the refurbishment Riverton aims to renew the hotel to be able to hold its position as a four star hotel as the neighborhood starts to expand. The hotel wish to attract new customers not only as a hotel but also by promoting their range of public venues, such as their restaurant, bar and conference facilities.



VIEWS

Riverton's top attraction is its views and apart from the increased activity from the new development the views is what will attract new visitors and customers to the hotel. From the top of the building where the current sky bar and restaurant is located, you can view out over Gothenburg in all directions. The views stretch all the way from the city centre in the northwest, across the harbor and the inlet of Göta Älv River, all the way to Masthugget in the south.

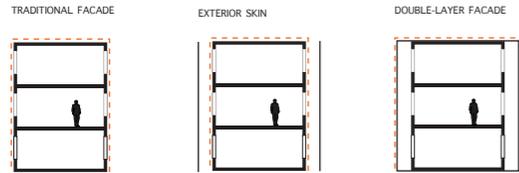


ORIENTATION

The front of the building along Stora Badhusgatan faces northeast. The higher part has its largest facades facing east and west receiving the lower sun in the morning and the afternoon.

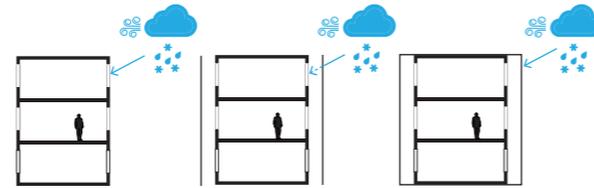


A LAYERED FACADE



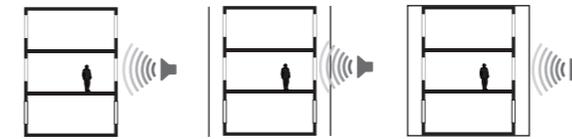
SEALING LAYER & CLIMATE ENVELOPE

There are different types of layered facades and they function in different ways. The difference between an exterior skin and a double layered facade is the placement of the sealing layer which affects what part of the envelope that has an impact on the climate loads from the outside environment.



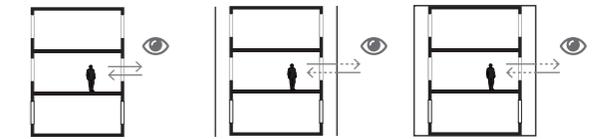
WEATHER & WIND

The double layer facade provides a barrier against loads from weather and wind and can relieve the inner facade from these loads. An exterior skin protects to some extent against these loads depending on its permeability.



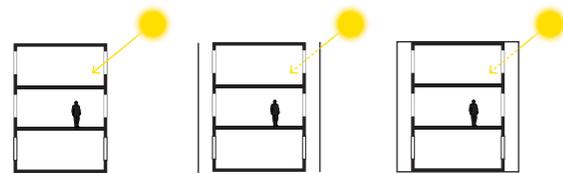
SOUND

Sound from traffic and noisy surroundings can transfer through the building's envelope and decrease the quality of the indoor climate. Depending on the materials used the double layered facade can decrease the amount of sound transferred through the building envelope.



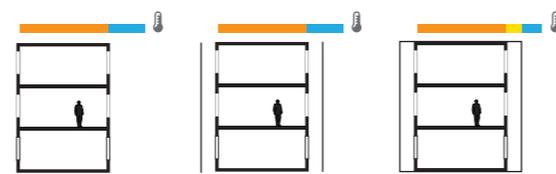
PRIVACY & VIEWS

The views to the outside will decrease to some extent when adding a second layer. On the other hand the in between-space can function as a privacy buffer zone. A second layer filters the views in both directions providing a more private space on the inside.



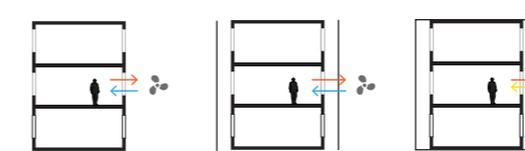
SUN & DAYLIGHT

Sun supply the interior with light to provide a good indoor lighting. At the same time solar gain heats the building, which can cause overheating. A traditional facade handles the amount of incoming light by the size and placement of openings. A facade with a second layer can handle the incoming light in two steps making it easier to control.



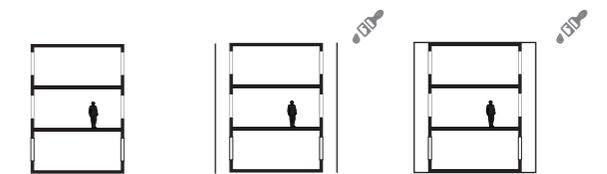
TEMPERATURE & ENERGY

Traditionally the temperature difference between inside and outside is a sharp border. With a double-layered facade the space in between the layers becomes a buffer zone, a semi-climated space. This increases the building envelope's resistance to fast changes in temperature, decreasing heat losses and heat gains with the daily temperature changes.



AIR EXCHANGE

With the temperature buffer zone of the double-layered facade, the space in between the facades can be used to heat incoming air before entering the building. Ventilating the inbetween-space with shutters at the bottom and the top creates a natural airflow removing the need for mechanical ventilation which also prevents the building from overheating due to solar radiation.



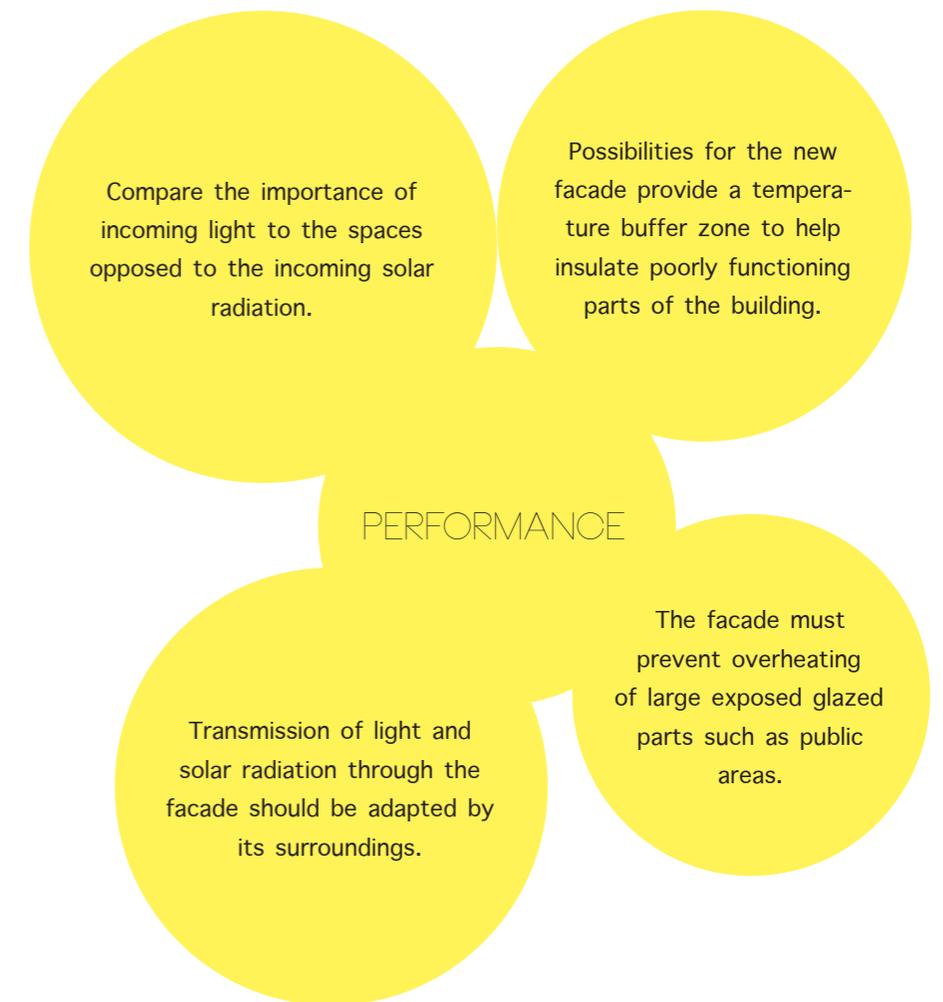
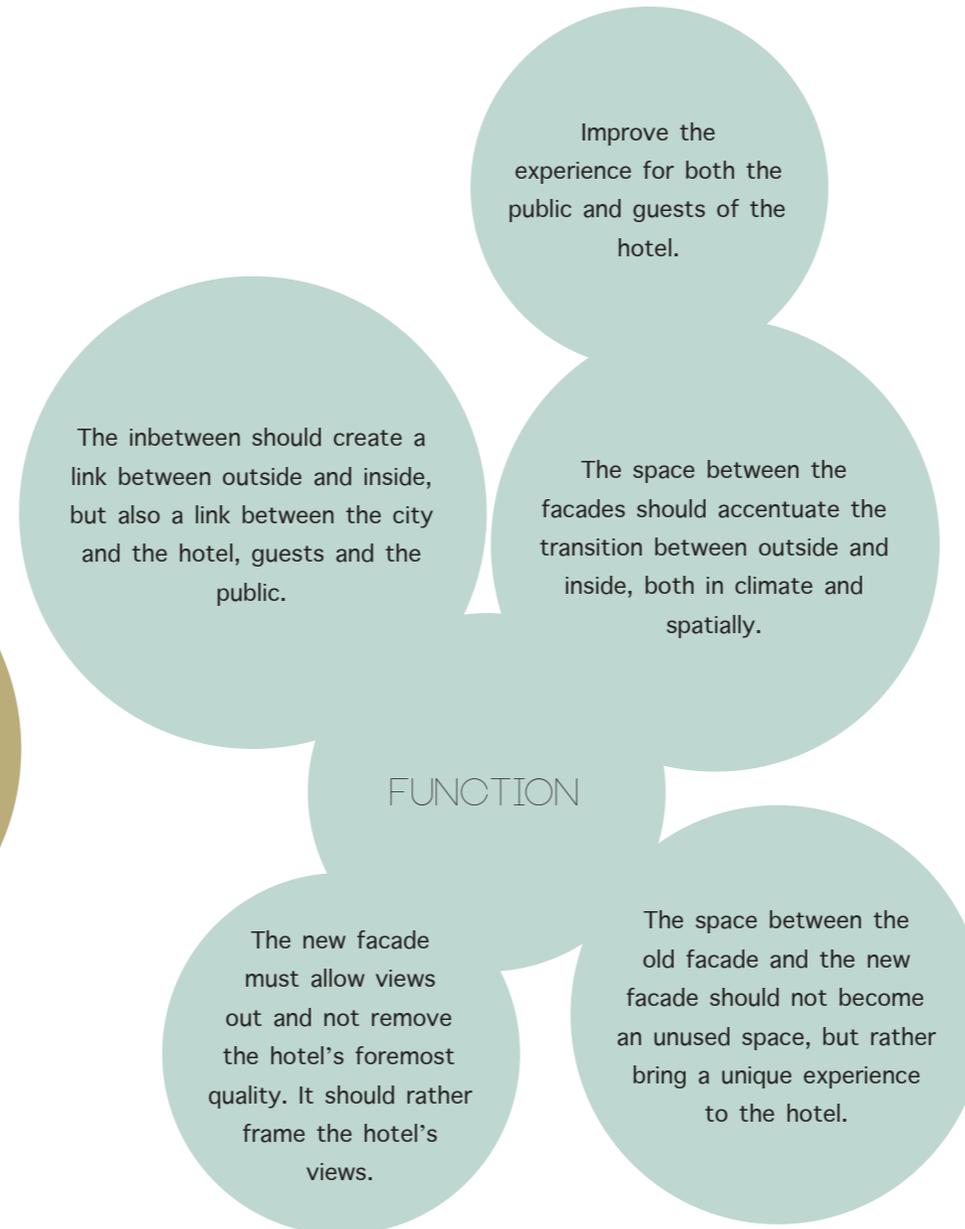
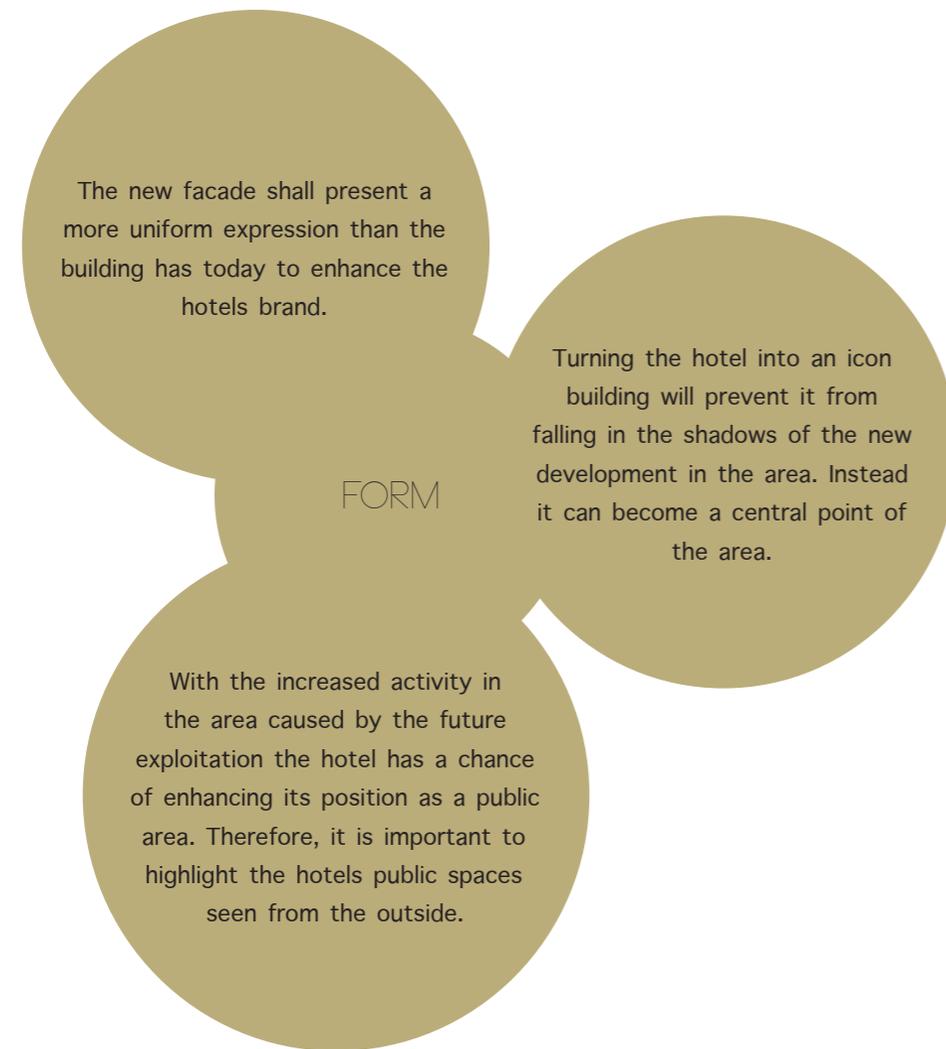
NEW LOOK

Adding a second layer to an existing building can be an option to a refurbishment of the existing facade or even to demolish it and building something new. A second layer can increase the existing buildings performance and function as well as giving it a new identity and character with a new look.

ASSIGNMENT & ACHIEVEMENT

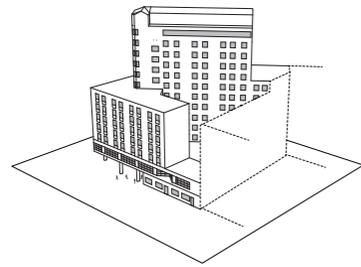
FORM, FUNCTION AND PERFORMANCE.

After investigation and evaluation of the assignment and its background, some points were especially important to emphasize and take advantage of for the benefit of the project's nature and create a set of values to use as a base for the thesis. By analyzing the location and its surroundings, the development of the hotel's brand and performance and ambition for the second layer these points became a foundation for the thesis, what it would achieve and communicate in terms of appearance, functionality and technology.



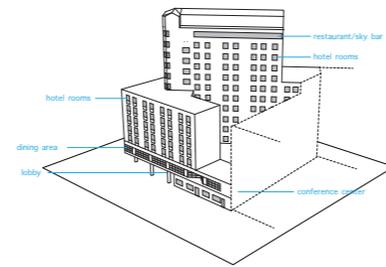
DESIGN

EXISTING BUILDING & REFURBISHMENT PROPOSAL



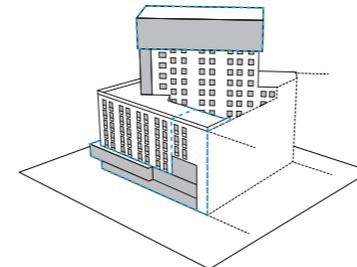
RIVERTON TODAY

The facade today presents a shattered expression with a mix of sheet metal cladding and red brick. Together with the different volumes the building doesn't present a uniform expression. The higher building clad with sheet metal, is poorly insulated making it sensitive for temperature changes. The entrance to the hotel reception and lobby is withdrawn from the street making it hard to detect and uninviting.



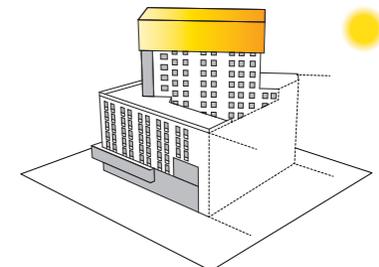
FACILITIES

The building's facilities include public areas such as the lobby, the conference center (mainly located in the building connected to the hotel) and at the top the restaurant and sky bar. The hotel rooms are situated in the lower building facing northwest and in the higher building facing both west and east.



REFURBISHMENT PROPOSAL

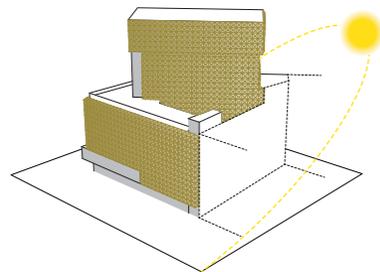
The proposal mainly includes a refurbishment of the public areas of the hotel. It focuses mostly on the sky bar and restaurant at the top of the higher building but it also includes other areas. The entrance floor is extended to align with the street with the entrance at the northwest corner of the building. The gap between the lower part and the adjoining building is filled, creating an inner courtyard, which is fitted with a glass roof to include a winter garden. A roof garden at the top of the lower part is also proposed.



THE GLASS BOX

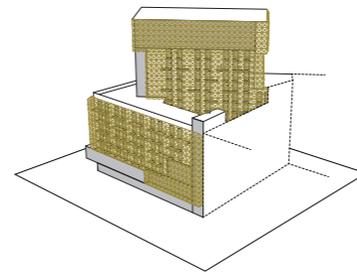
The refurbishment proposal uses the advantage of the hotel's views as it includes a major remake of the restaurant and sky bar at the top in form of an offset glass box with glass floor at the overhang towards west. But the transparency of the new volume at the top is a large problem. The glass box will be extremely sensitive for overheating due to solar gain and vulnerable for the daily temperature changes.

NEW DESIGN PROPOSAL



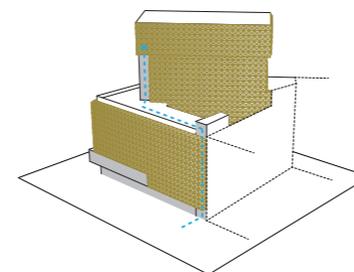
A SECOND LAYER

Adding a skin, a second layer to the building will present a uniform expression and become a trademark for the building without a major refurbishment of the existing building. The bold statement of the golden glass facade will enhance Riverton's brand as one of Gothenburg's finest hotels. The ventilated glass facade becomes a temperature buffer zone that evens out the daily temperature changes and helps to insulate the poorly functioning facade. The glass panels are optimized to protect the building from overheating from solar gain but still retaining the views out.



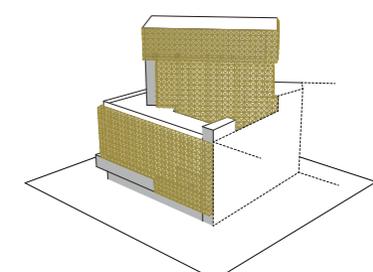
ACTIVATING THE FACADE

The space between the original facade and the second layer is a place for social interaction where guests can enter from their rooms to enjoy the views over Gothenburg. The in-between space makes the hotel exceptional opposed to other hotels, to offer the guest an unique experience staying at the hotel instead of only focusing on promoting the public areas.



PUBLIC ACCESS

A second entrance at the southwest part of the hotel increases the access to the public areas of the hotel. The entrance is connected to the conference reception and to the new stairwell that leads up to the roof garden on the top of the lower building. It also provides a direct access to the winter garden where the hotel can host events.



FACADE COMES TO LIFE

The solid expression of the facade changes as night falls. The lights and life from the hotel penetrates the second layer revealing the activity and life behind the glass facade. The transparency of the sky bar and restaurant becomes visible intriguing people to visit the top.

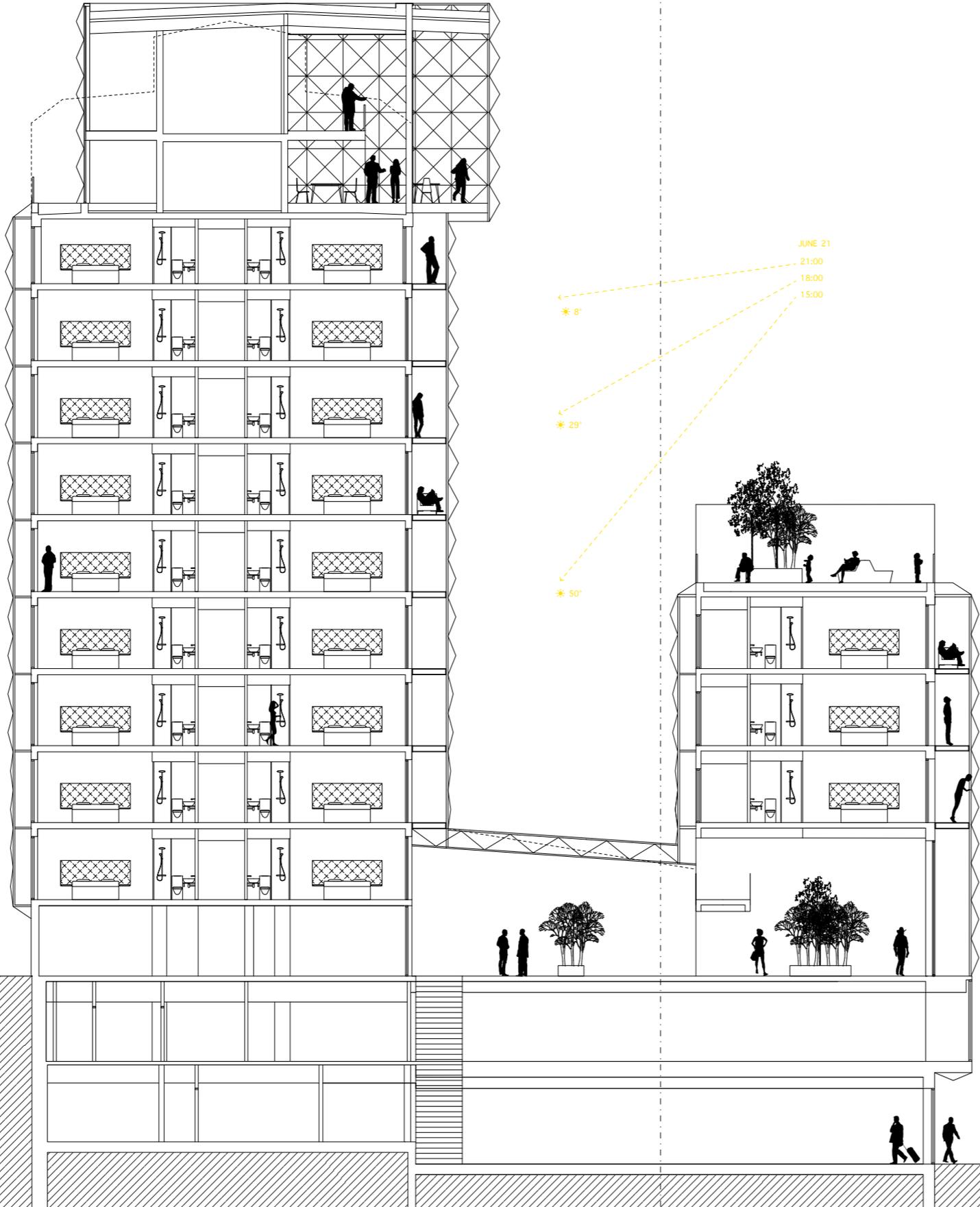
CROSS SECTION

JUNE 21
06:00
08:00
11:00

* 11°
* 28°
* 48°

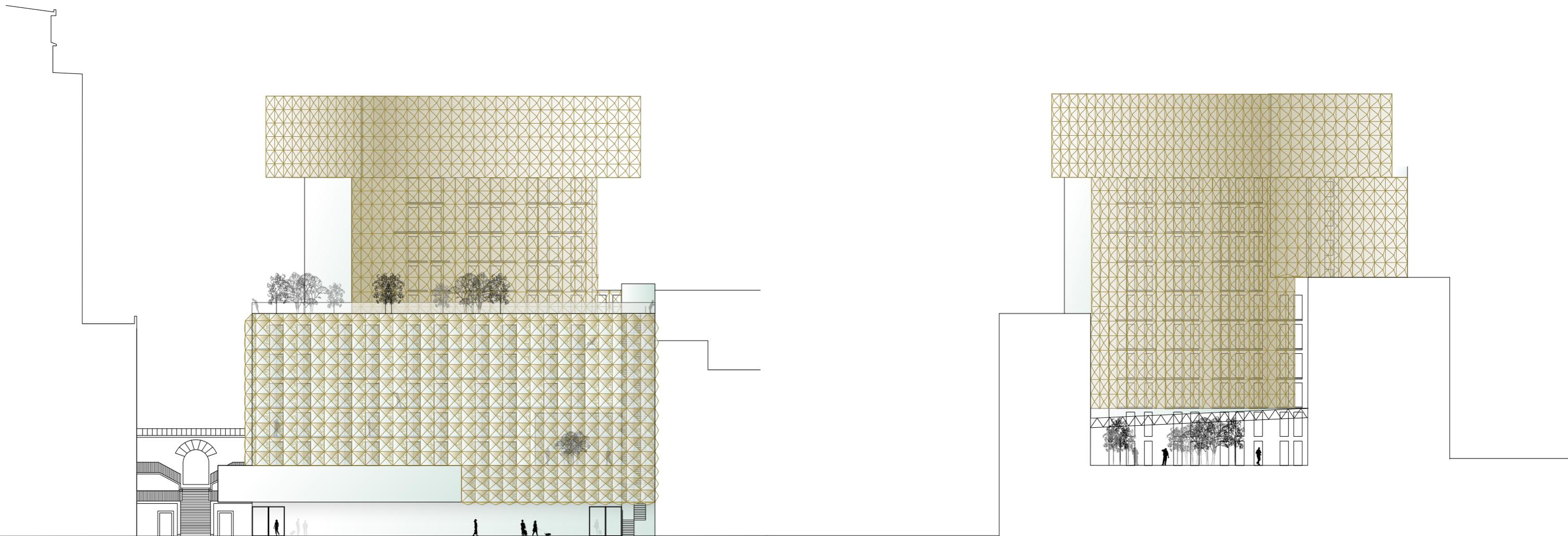
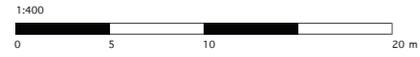
JUNE 21
21:00
18:00
15:00

* 8°
* 29°
* 50°

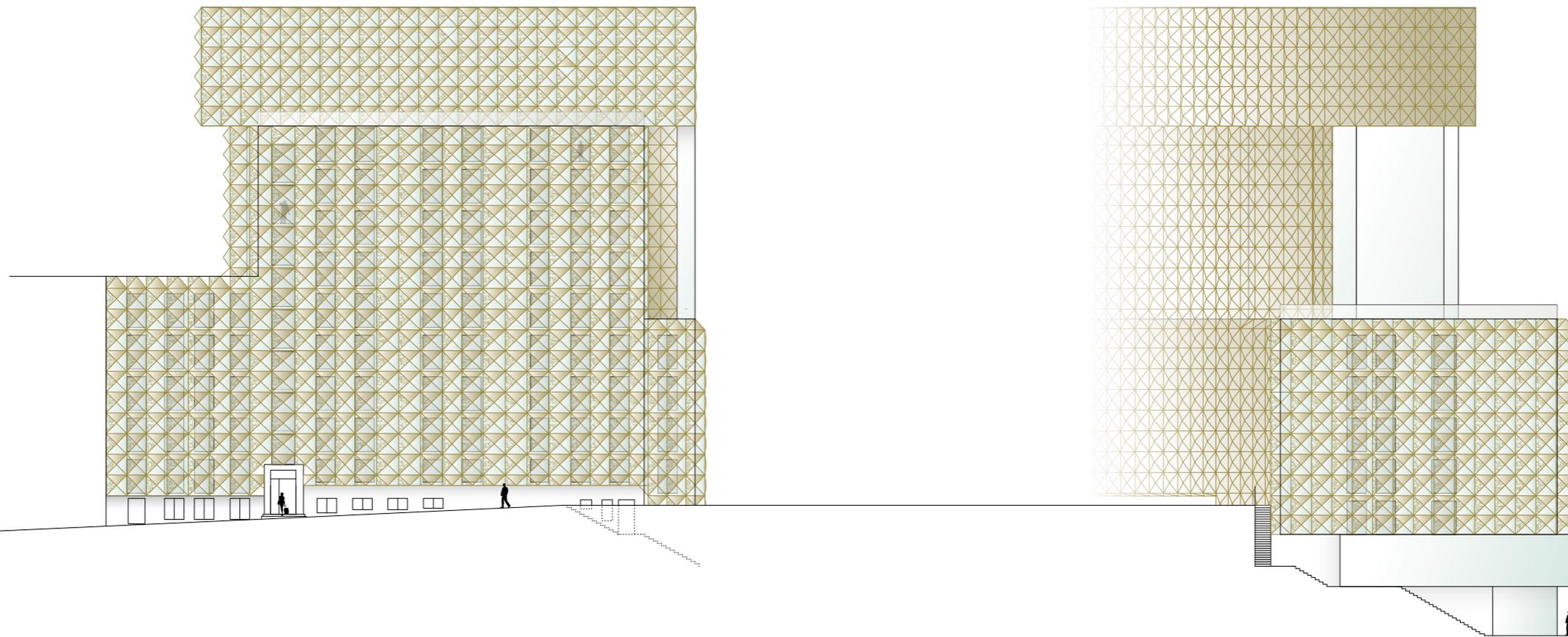
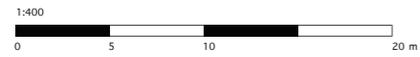


FACADES

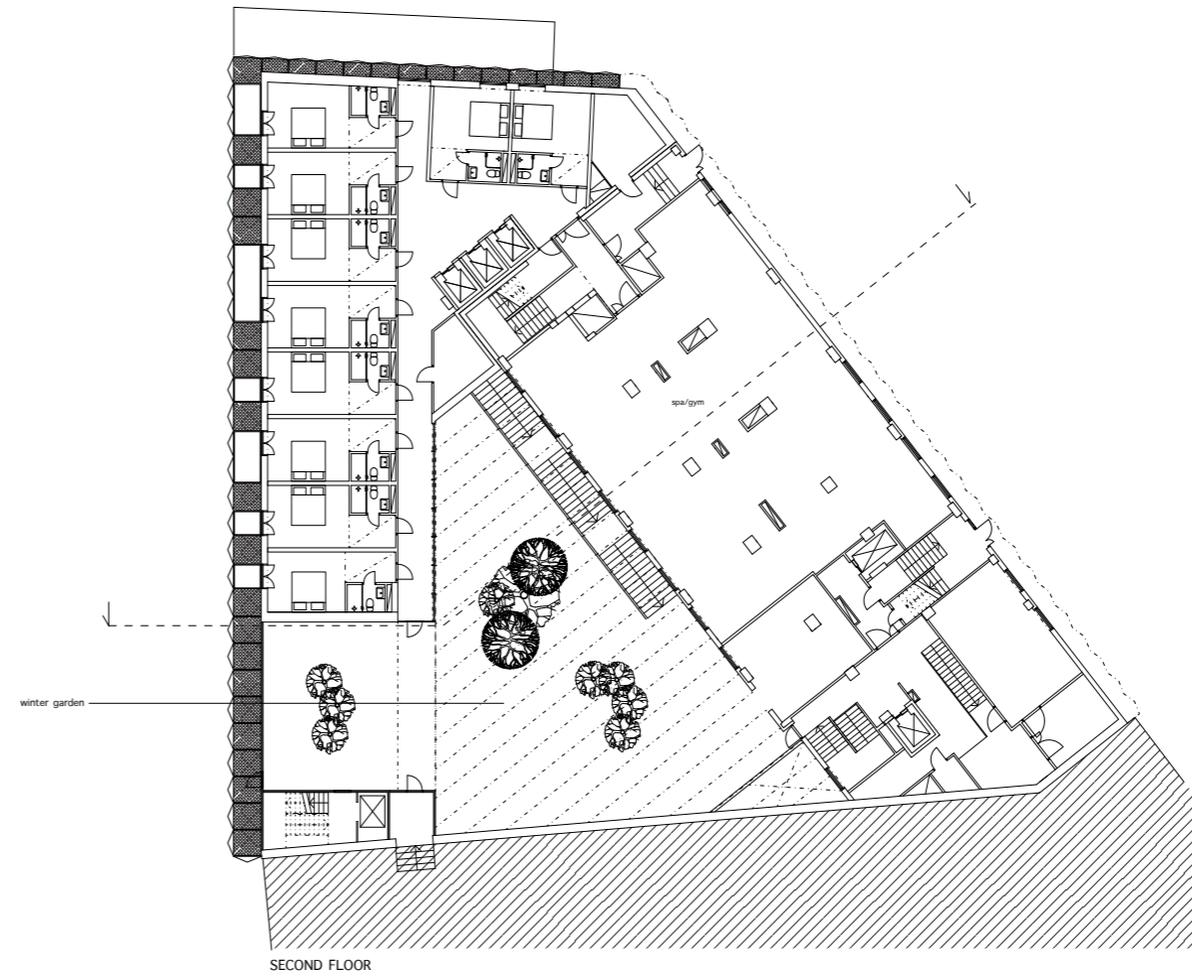
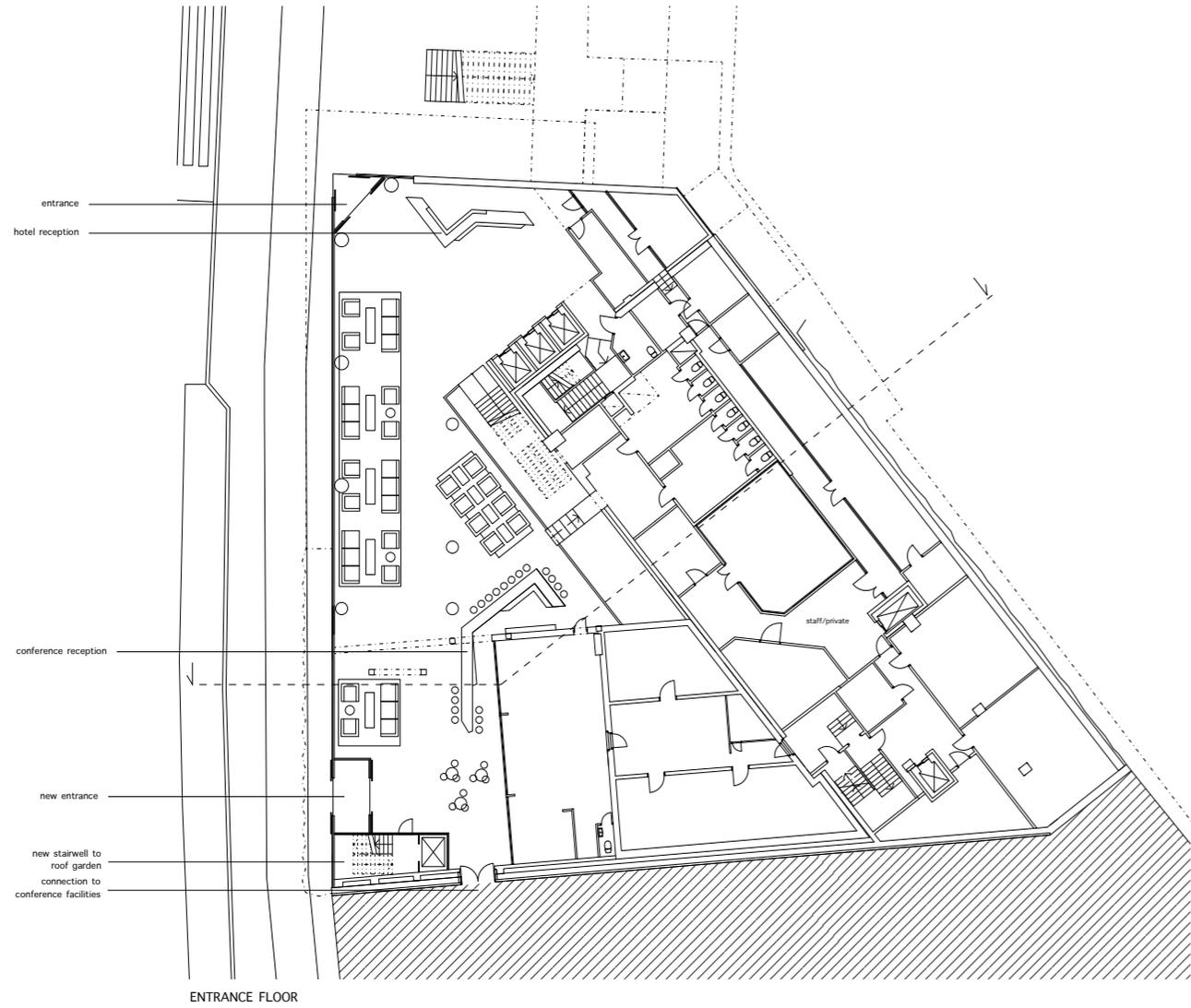
NORTHWEST & SOUTHWEST FACADE

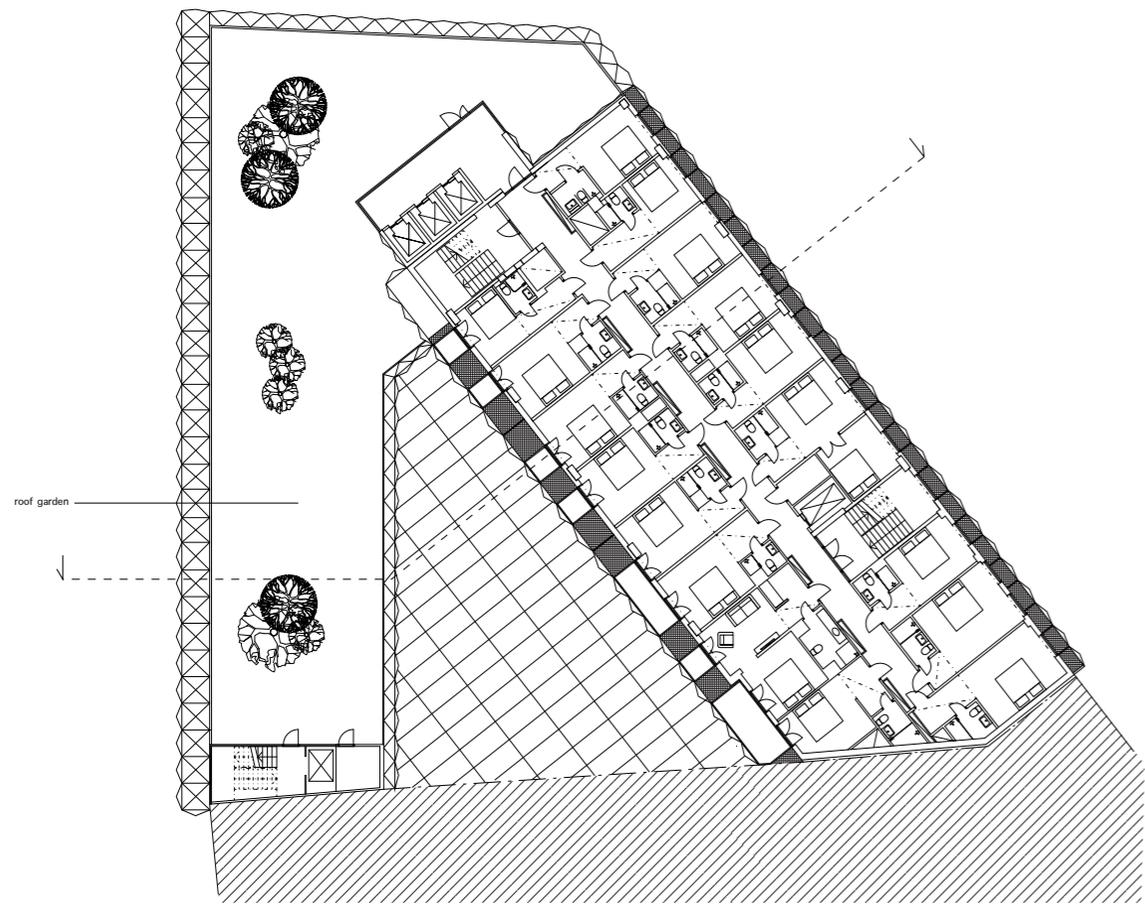


EAST & NORTHEAST FACADE

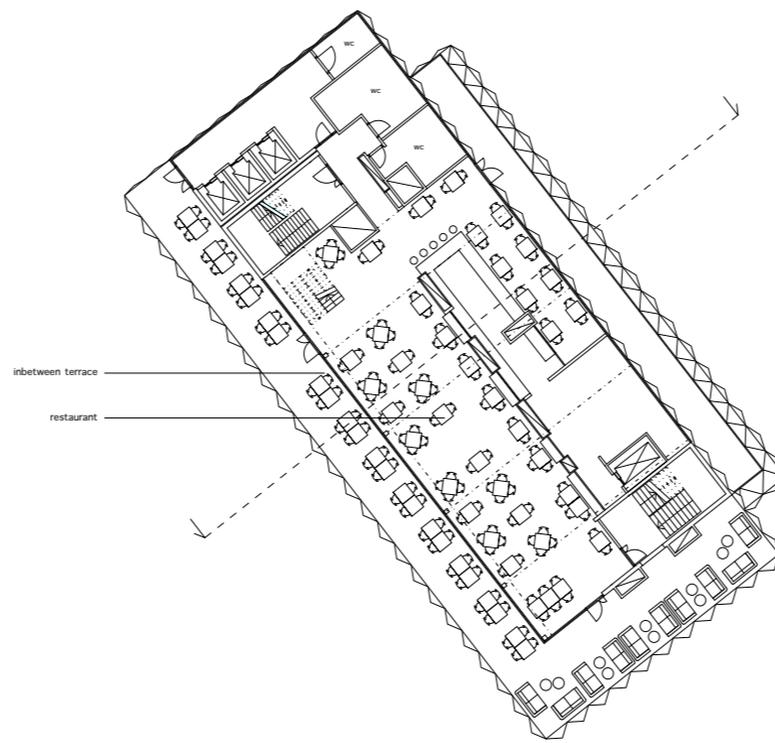


PLANS

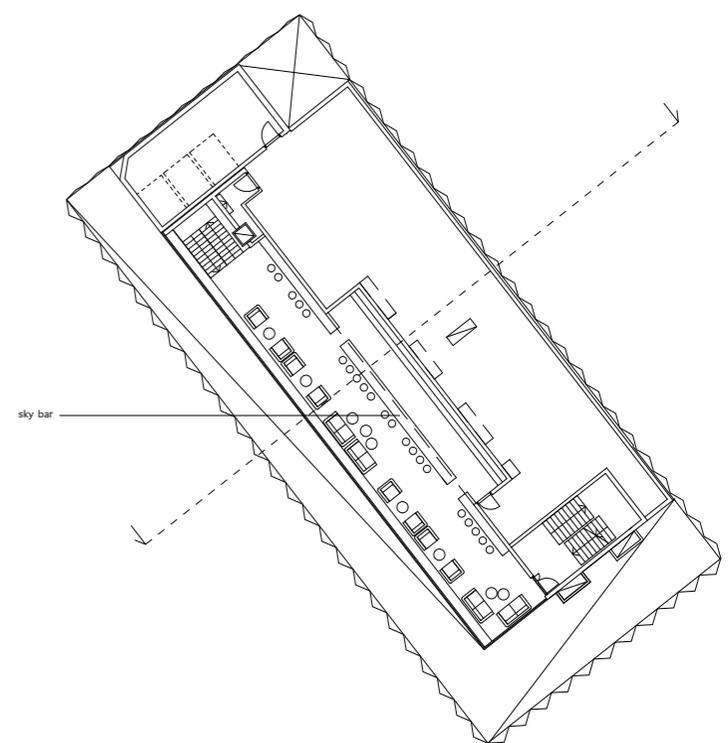




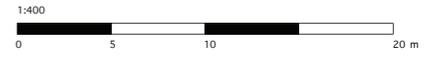
7TH FLOOR



12TH FLOOR



13TH FLOOR



INBETWEEN THE LAYERS

INTERACTION IN THE INBETWEEN

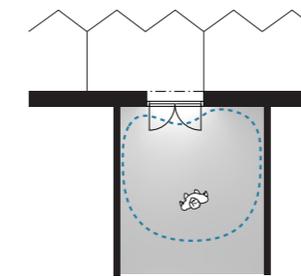
The inbetween space behind the second layer is a space where inside meets outside. The semi-heated space is not only a temperature buffer zone but also a buffer zone between the public and the private. Entering the inbetween the guests can enjoy the view over Gothenburg City and interact with others in the inbetween. Connected to the hotel rooms towards the west and northwest are private spaces in the inbetween but the space is transparent, allowing for interaction among the guests. Entering the inbetween the guests can seek contact with others, but at the same time feel private within their own room.

The interaction is not limited to the inbetween. The transparent second layer enables contact between the guest inside and the street outside. Particularly in the evenings the facade comes to life as the rooms lit up the second layer from the inside to reveal the activity in the inbetween.

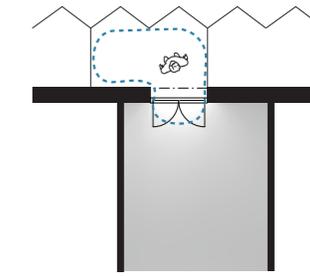
GIVING THE ROOMS CHARACTER

The rooms receive different characteristics depending on the configuration of the private area in the inbetween. Depending on the lateral boundary of the area the space can evoke various kinds of behavior and activity. A smaller space becomes a viewing spot, where a larger space encourages you to sit down and spend time there. Linking the spaces can encourage interaction if only by view or actually linking the rooms together through the inbetween.

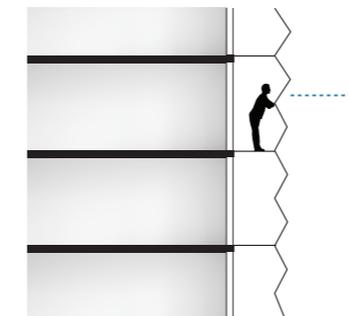
IN MY PRIVATE SPACE



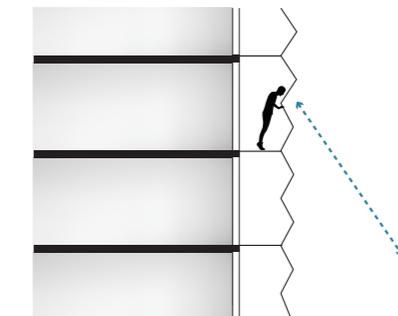
CURIOSLY SEEKING CONTACT



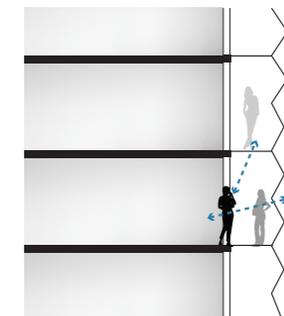
VIEW OUT



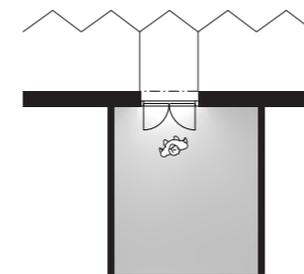
VIEW IN



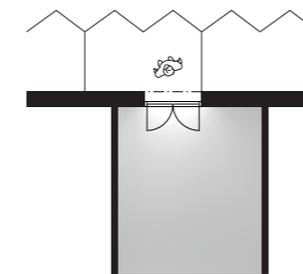
VIEW BETWEEN



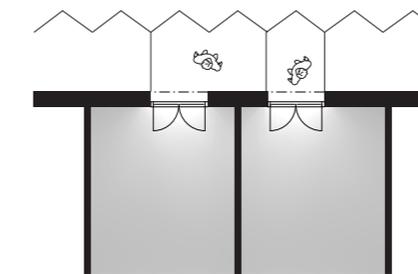
VIEW



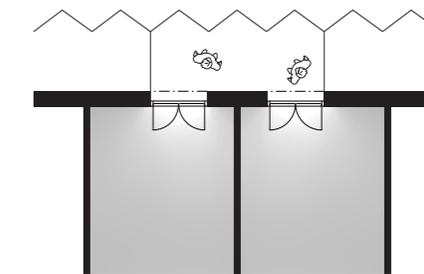
EXPANDED

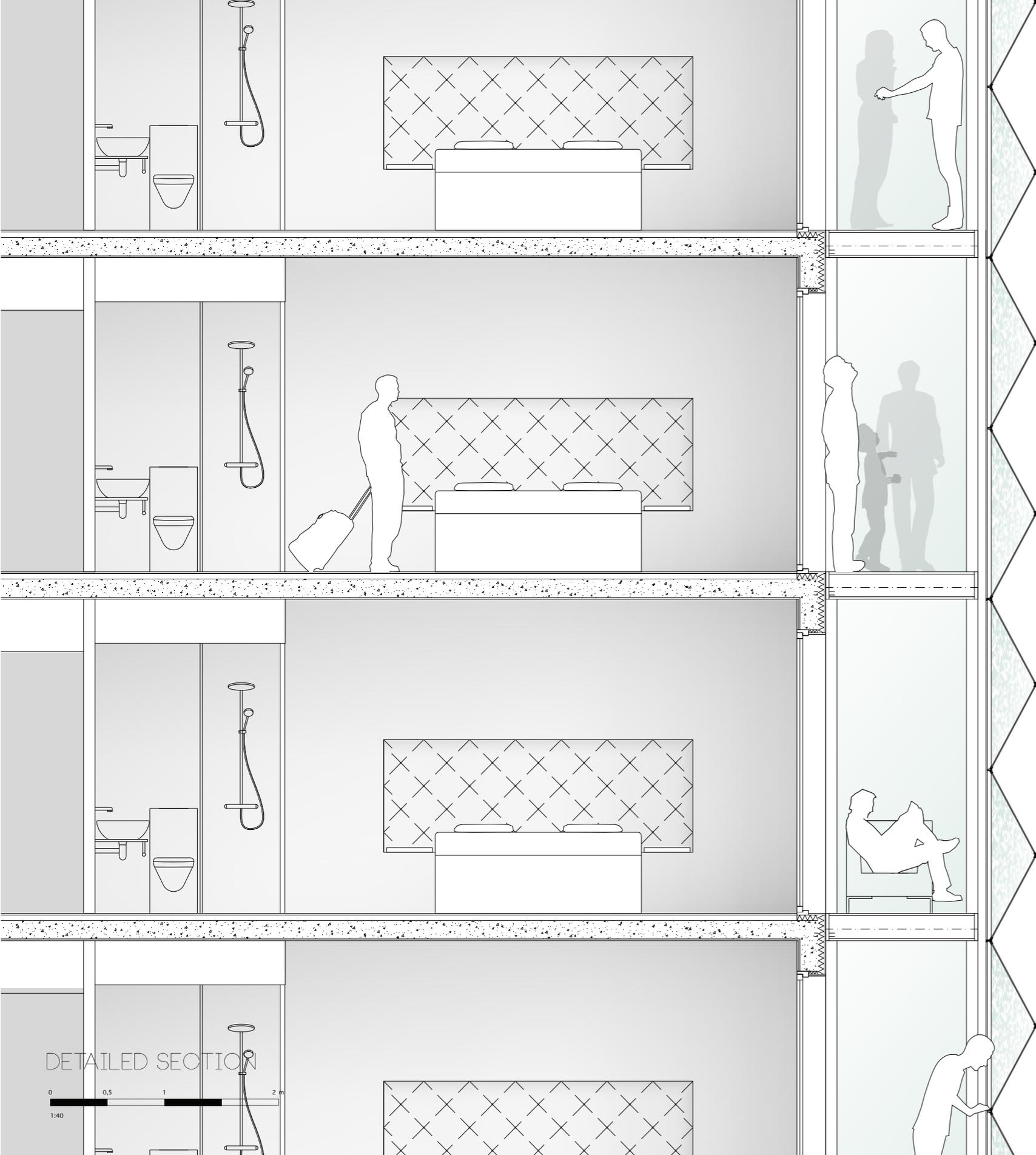


CONTACT



SHARED

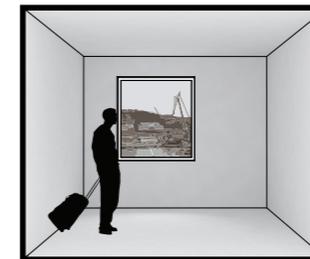




VIEW ATTRACTOR

The second layer facade frames the view over Gothenburg and emphasizes the hotel's best feature. Although the new facade impairs the view to some extent, it also acts as an attractor, drawing your attention towards the opening and the outside view. The translucent veil of the second layer catches your eye and leads you towards the opening where you can step out in the inbetween to take in and appreciate the view.

PRESENT VIEW TO THE OUTSIDE

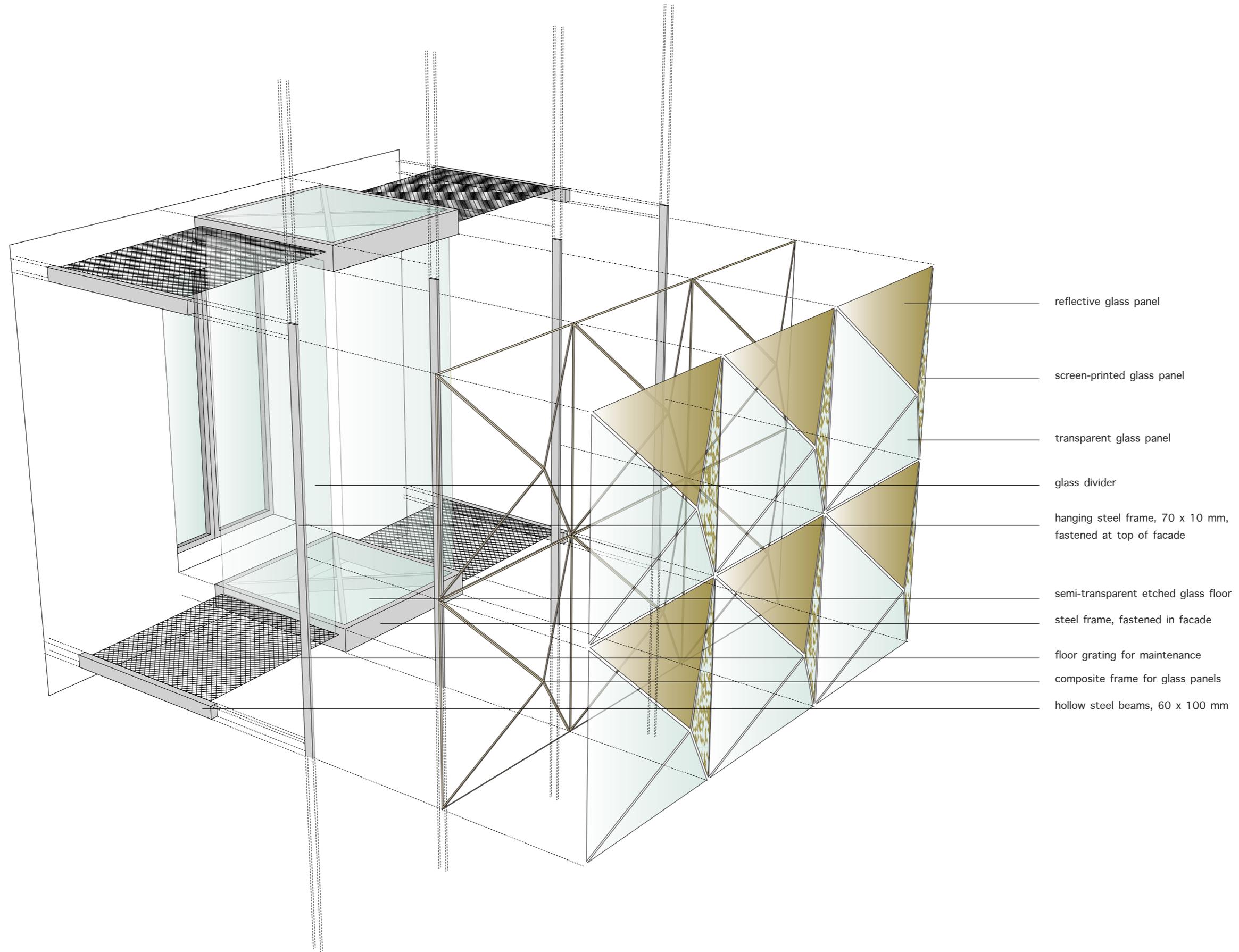


VIEW ATTRACTING YOUR ATTENTION



DETAILED SECTION





reflective glass panel

screen-printed glass panel

transparent glass panel

glass divider

hanging steel frame, 70 x 10 mm,
fastened at top of facade

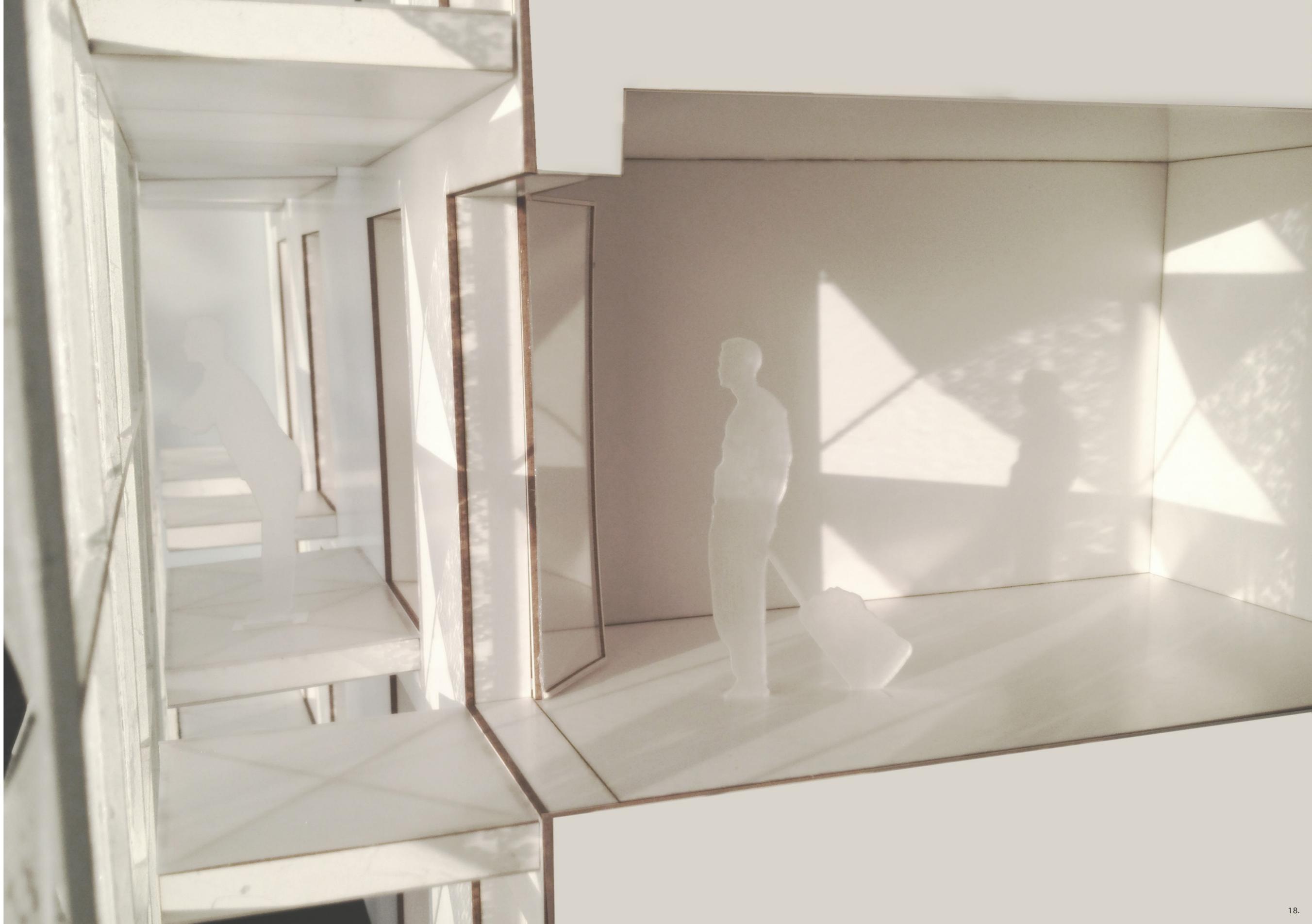
semi-transparent etched glass floor

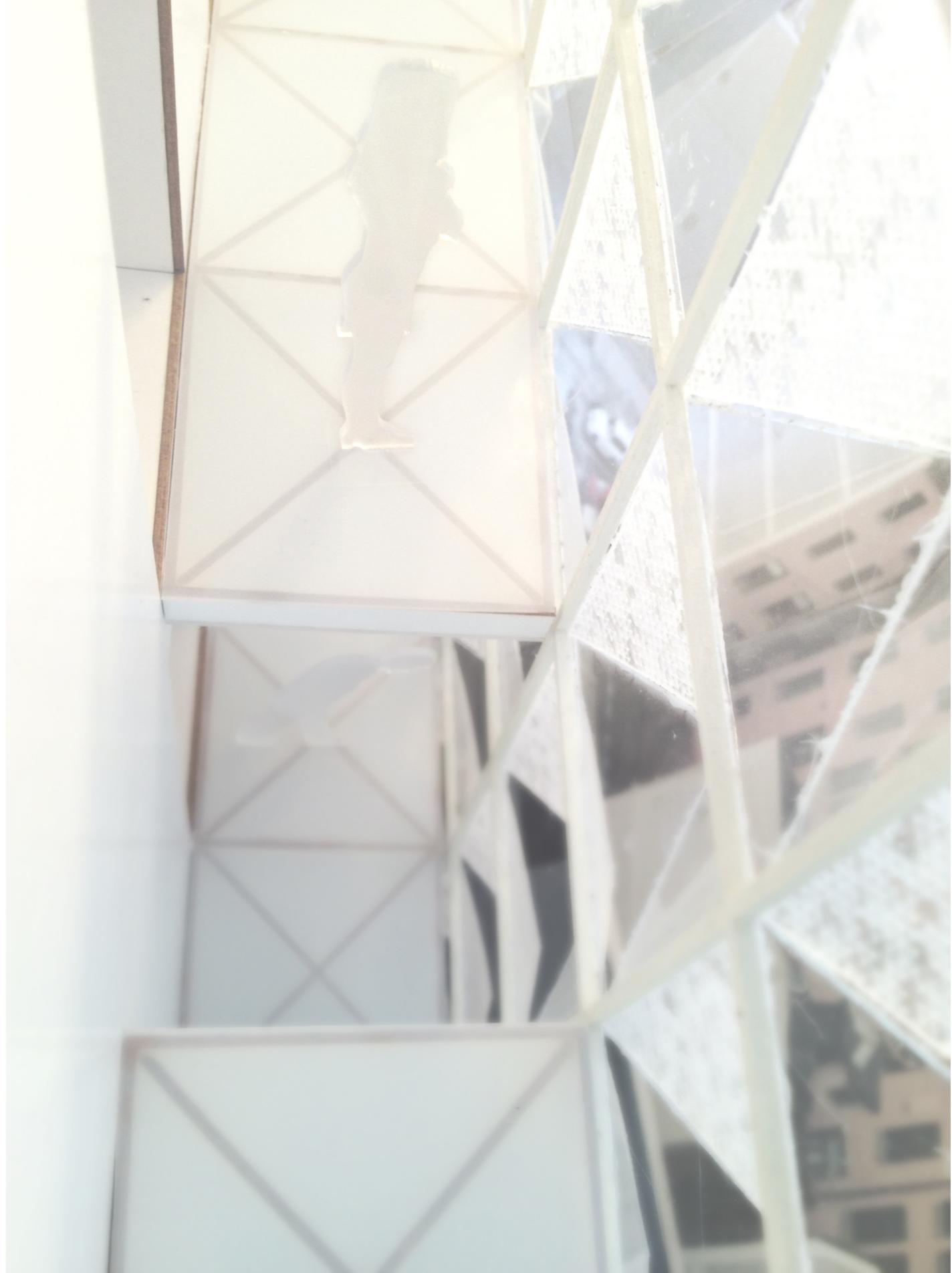
steel frame, fastened in facade

floor grating for maintenance

composite frame for glass panels

hollow steel beams, 60 x 100 mm









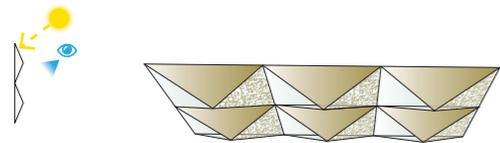


PANEL FUNCTION

REFLECTING AND DIFFUSING LIGHT

Extruding the tip of the glass panels outwards creates a shade for the inner facade. Different materials on the different sides of the panels have different functions depending on their orientation and the wanted effect. They can either be reflective, diffusive or transparent. The reflective panel is placed on the top to avoid the high sun from overheating the building when its at its' strongest. The diffusive panels are oriented towards the south, depending on the orientation of the facade. The screen-printed panels diffuse the light coming from the south but will still enable views out. From the outside the reflective panel and the print of the diffusive panel have a golden tint but white from the inside. The light coming through the diffusive panel causes a shadow play on the surfaces that is hit by the light. A light play that changes over the day as the sun moves across the facade.

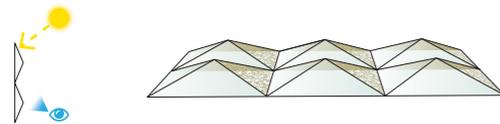
VIEW FROM ABOVE



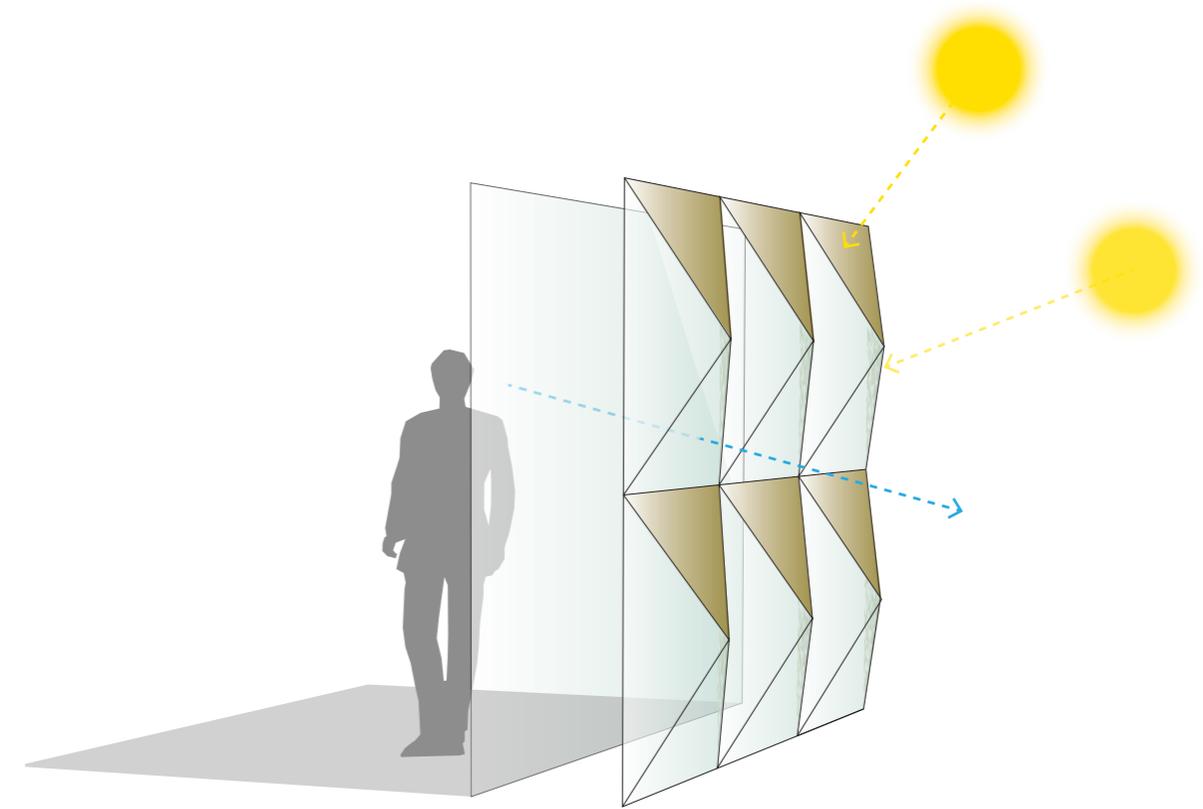
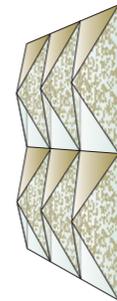
VIEW FROM DIFFUSIVE SIDE

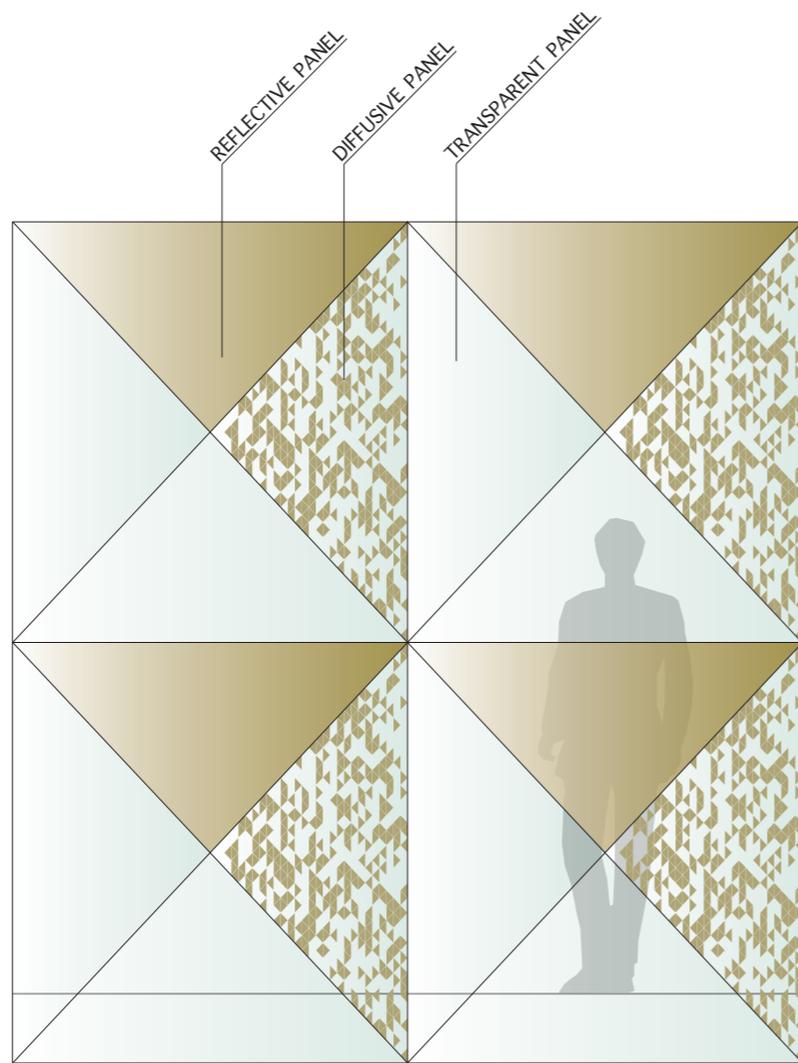


VIEW FROM GROUND

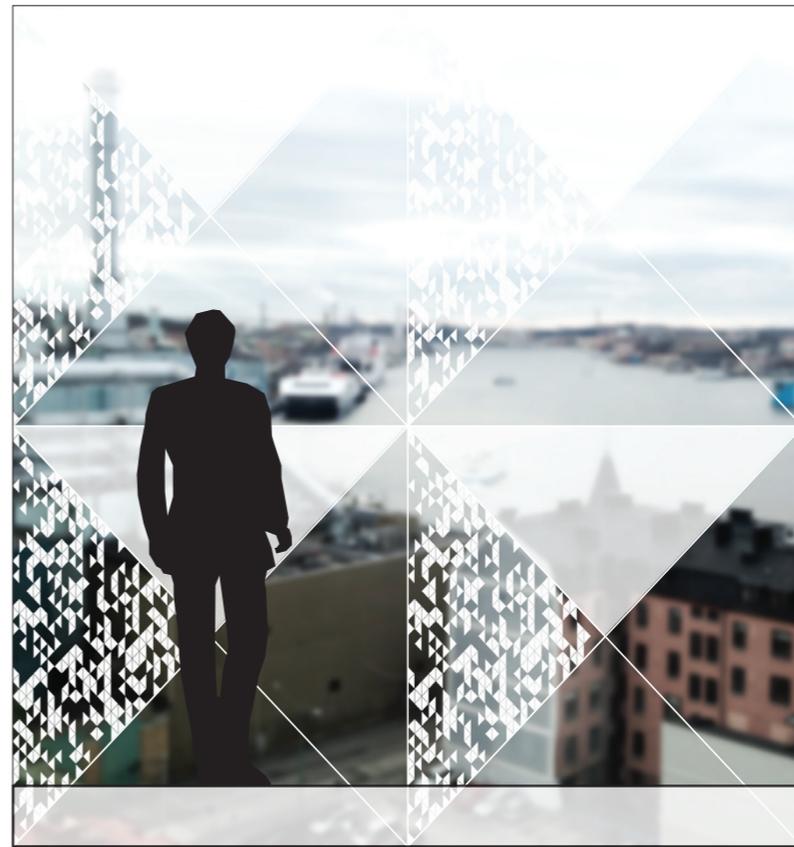


VIEW FROM TRANSPARENT SIDE





VIEW FROM OUTSIDE

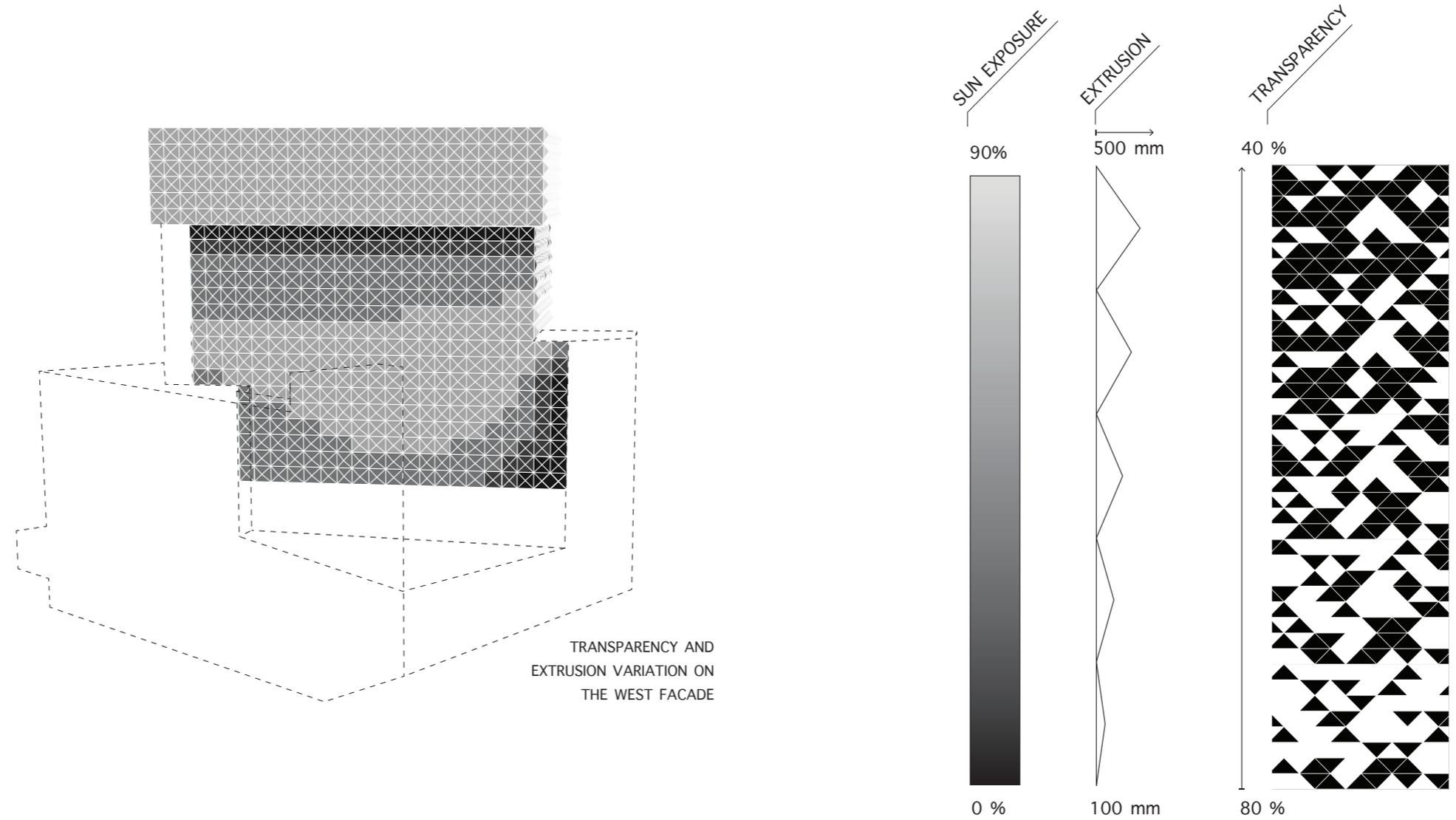


VIEW FROM INSIDE

ADAPTATION TO THE SURROUNDINGS

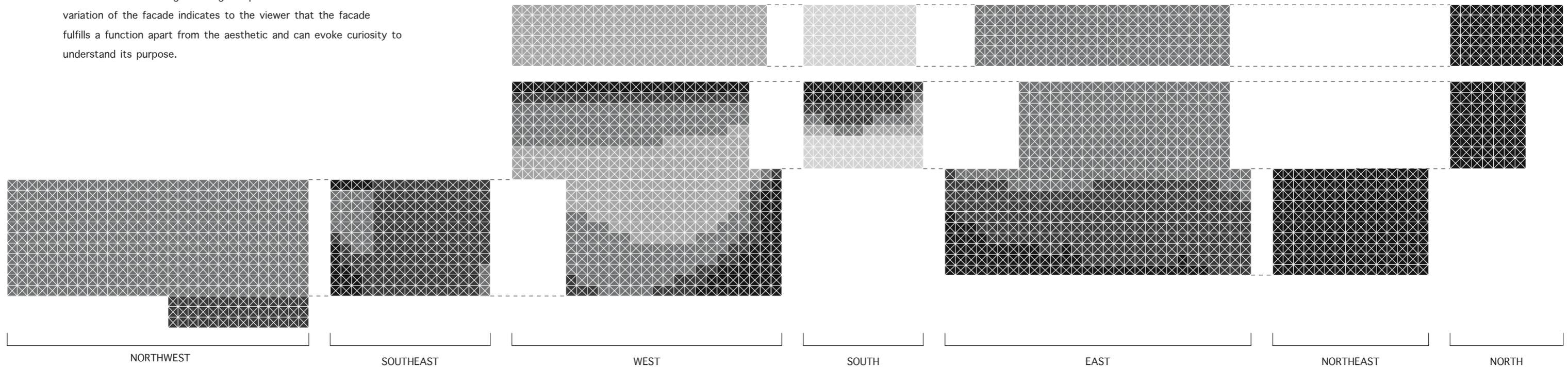
PANEL EXTRUSION AND TRANSPARENCY

The panels' transparency and shading effect is adapted to the amount of sun exposure the facades receive over the year. Some parts of the facade are more shaded than others depending on the orientation and the shading of surrounding buildings. The panels' extrusion and the diffusive panels' transparency vary with the sun exposure. A smaller amount of sunlight on the facade means less extrusion of the panel and increased transparency of the diffusive panel. This way the annual amount of sunlight penetrating the second layer is more evenly spread over the buildings facade. The variation allows for the shading of the second layer to be more effective where needed and allow more light to penetrate into the building where the facade is not as exposed and vulnerable.



VARIATION OVER THE FACADE

The diagram beneath shows the unfolded facade and the gradient of color indicates the panel variation of the building, which corresponds to the annual sun exposure. On the opposite side the diagram shows which transparency level and panel extrusion corresponding to the amount of sunlight hitting the particular surface. The subtle variation of the facade indicates to the viewer that the facade fulfills a function apart from the aesthetic and can evoke curiosity to understand its purpose.



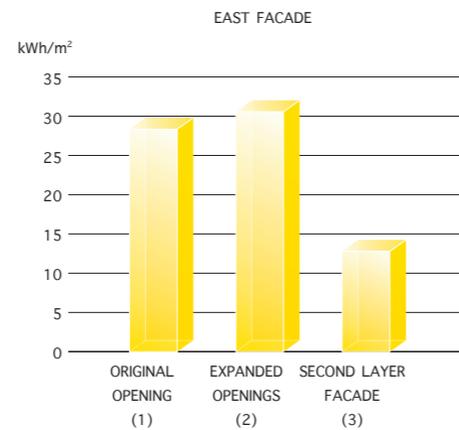
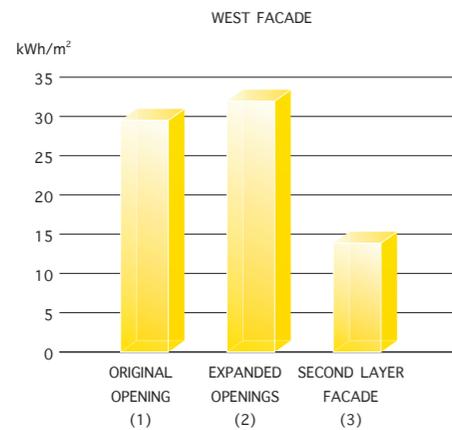
SUN EXPOSURE & ORIENTATION

DIFFERENT KINDS OF SUNLIGHT

The building has its largest facades towards northwest, east and west. The hotel rooms to the west and east are the ones most exposed to the sun. In these directions the sun angle is quite low but are also exposed to the higher stronger sun coming from the south as it travels from east to west over the day. The panels' function is to remove different amount of sunlight depending on the direction of the sun. It reflects away largest amount of sunlight at midday and lets in more sun as the sun reaches its lower angels.

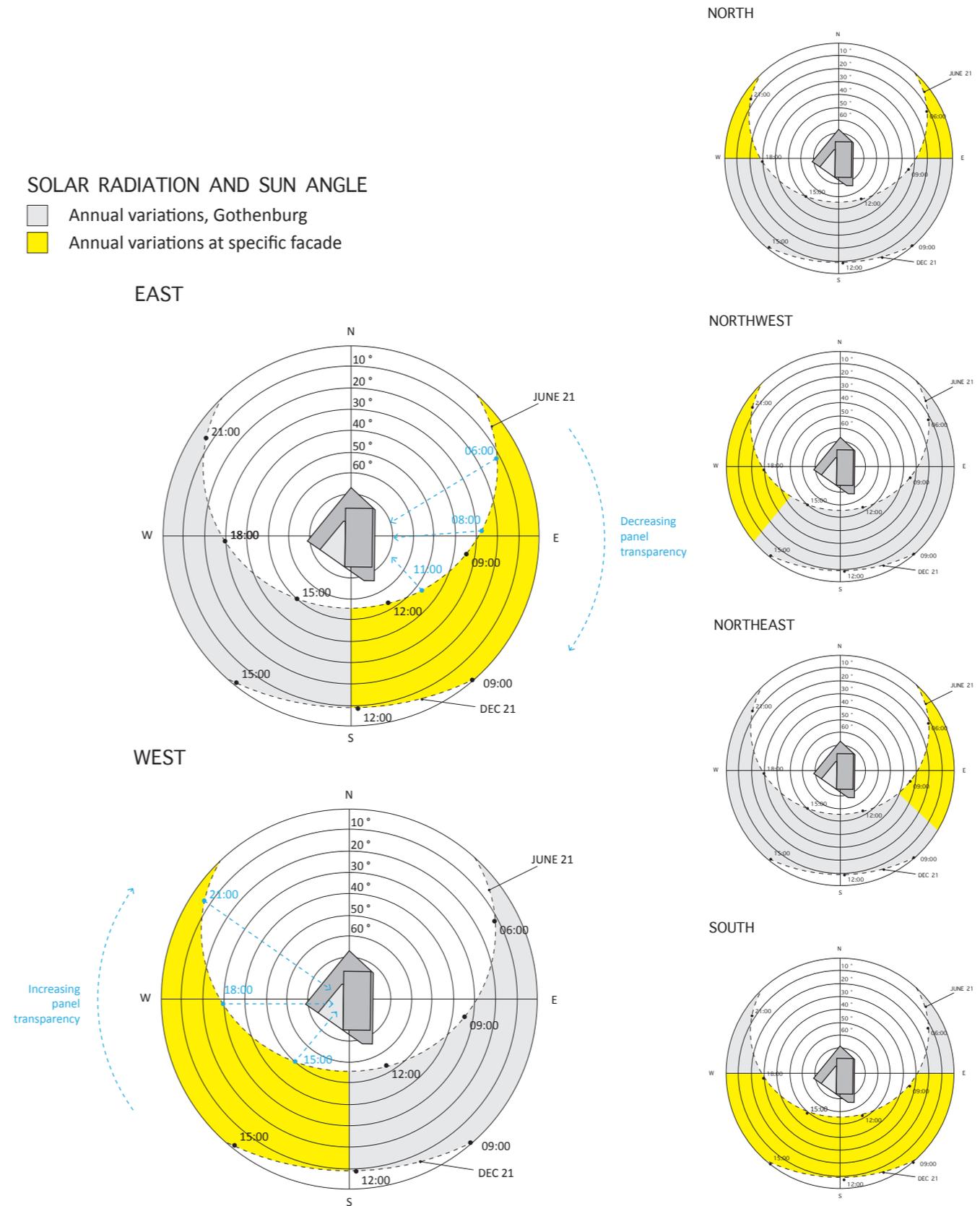
ANNUAL SOLAR RADIATION

The second layer decreases the annual solar radiation entering the hotel rooms with about 50%. The diagram on the opposite side compares the entering solar radiation from different directions to evaluate if the design of the panels to see if the transmission of solar radiation varies depending on the sun's angle and orientation of the facade. The goal is for the panel to remove more radiation when the sun is at its strongest.



SOLAR RADIATION AND SUN ANGLE

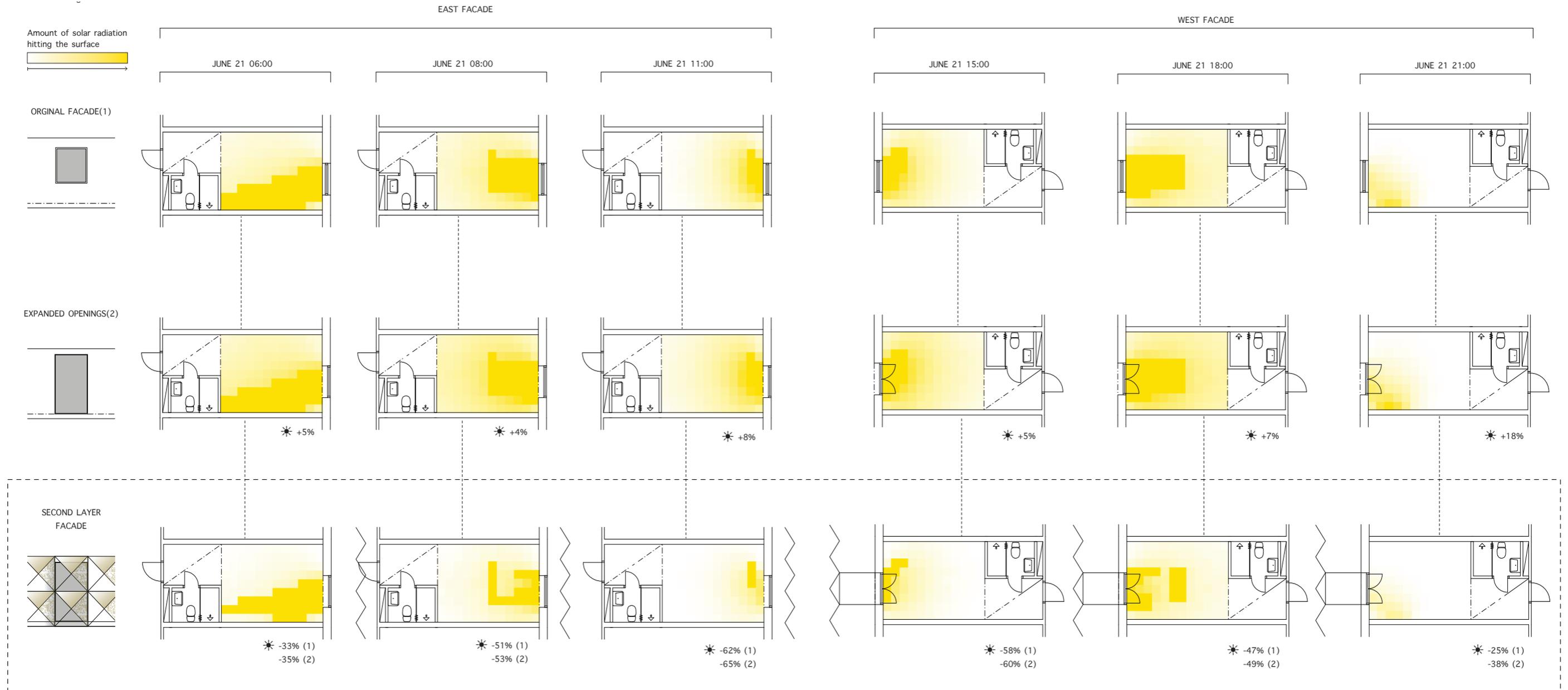
- Annual variations, Gothenburg
- Annual variations at specific facade



POINT IN TIME SOLAR RADIATION

Comparing the original facade with the new, which has larger openings but with the second layer added, the second layer removes about 60% of the incoming solar radiation into the hotel rooms when the sun is at a higher angle, thus stronger and lets in

about 70% of the solar radiation from the lower angles. The adaption of the second layer creates a varied surface to provide an increased solar shading when and where its needed the most and letting in more light and solar radiation where it can be allowed.



FINAL WORDS

FORM AND FUNCTION IN SYMBIOSIS

This thesis includes elements that are both technical and architectural. In my opinion the symbiosis between the technically functional and aesthetically appealing is where the most interesting architecture emerges, a perfect mix between form and function. What this project may lack in depth it makes up in diversity, an investigation in both performance and design and the combination between them both. Through the use of different analytical methods (in this case light and solar radiation evaluation) in order to adapt the architecture to create a design that performs according to its surroundings is something that will become more and more important in the future as we place greater demands on the buildings we use. However, it is just as important that the performance of the building is not only an attached technical solution but also can be experienced and utilized. It is then, when users understand the function of the building, they create an awareness to understand how everything we do has an impact on the environment, even how we live and use our buildings. When people's demand reflects a sustainable society we reached a turning point towards changing the world, as the demand is no longer controlled by economic gains. That's what I hope this project can illustrate that by adding something beautiful and useful, which at the same time has an important function can lead to arouse people's attention and influence them towards more sustainable decisions in the future.



The terrace at the skybar is bathing in sunlight as the light diffuses through the panels causing the shadowplay on the surfaces on the inside.