23190

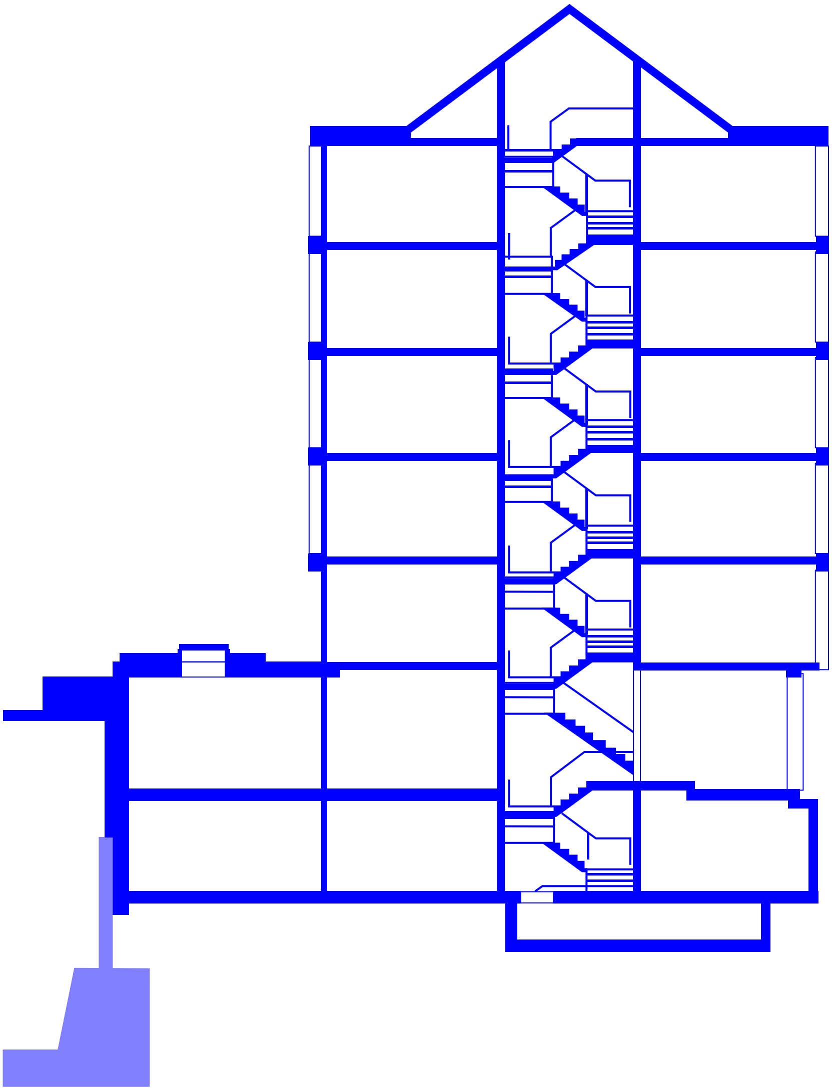
Epernay

Case study Low-Tech & Zero Waste

3D Render of the Epernay Front Building

00.2
Project Stakeholders/ Participants

Project	LUX ADM 2312 18 EPERNAY
Client	POST Group Luxembourg
Structural engineering	INCA
Building services	Jean Schmit Engineering
DGNB	E3 Consult
Safety coordination	E3 Consult
Low Tech	Lars Junghans
Room acoustics	INCA
Inspection office	Secolux
Surveyor	GlobeZenit
Architect	metaform architects



01
project introduction & framework

metaform dar

01.1
Introduction

Epernay 18 rethinks office architecture through a Low-Tech approach, where comfort is achieved primarily by architecture itself rather than complex building services.

The new building on Rue d'Epernay is a modern office building offering flexible workspaces across five floors. On the ground floor, a commercial unit is planned for retail or service use, contributing to the activation of the surrounding area.

According to Article C.4.1 (PAP-QE), the new building at 18 Rue d'Epernay must provide a residential area equivalent to two full storeys. This area may be located either within the building itself or in another building within the same zone. As the new building on Rue d'Epernay is intended exclusively for office and commercial use, the required residential floor area is provided at Rue d'Epernay 8-12.

At number 18, a residential area of approximately 2 × 137 m², i.e. around 274 m², is required. This area is provided at Rue d'Epernay 8-12 on the third floor, where a total residential floor area of 328.85 m² is created.

Construction is to be carried out using conventional, craft-based building methods in accordance with generally accepted rules of technology. Changes remain reserved should new technical findings or building regulations make them necessary. In accordance with the Grand Ducal Regulation, the building envelope will be constructed to be airtight.

The building's climate control is implemented using a Low-Tech approach. This concept reduces heating and cooling systems to a minimum.

The five-storey building volume features large punched windows with deep reveals and high, openly designed interior spaces. Conventional heating, cooling, and ventilation systems are used only to a very limited extent and primarily serve to ensure comfort. This means that on the coldest and hottest days of the year, additional heat input is required via floor convectors. For the most part, however, the building is intended to rely on architectural means alone, combined with automatically controlled ventilation flaps integrated into the façades, to provide its users with indoor temperatures between 22 and 26°C throughout the year — without any compromise in indoor air quality.

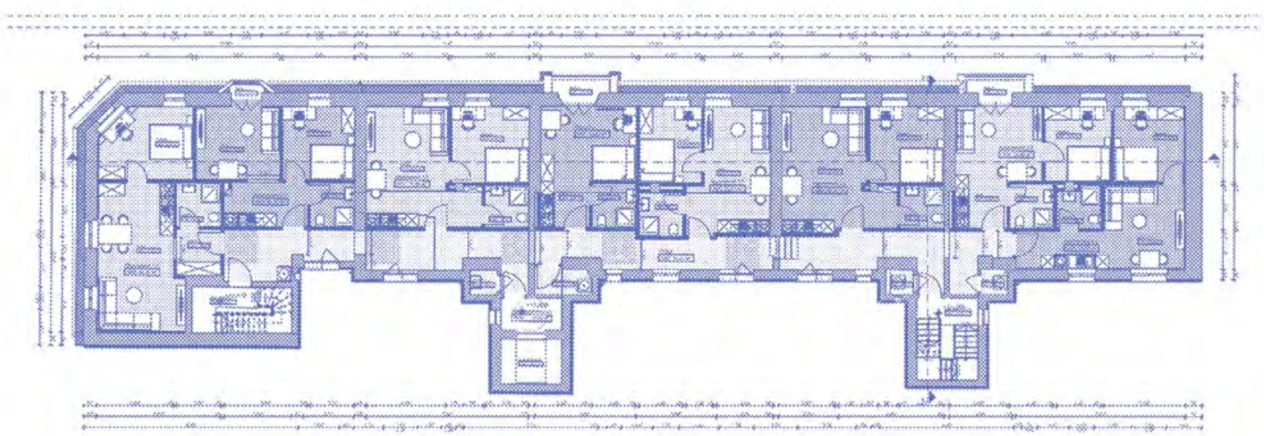
The vacant plot at 18 Rue d'Epernay is to be closed as originally planned with an office building. The project will create an office building with up to a maximum of 60 workstations, as well as a commercial unit on the ground floor.

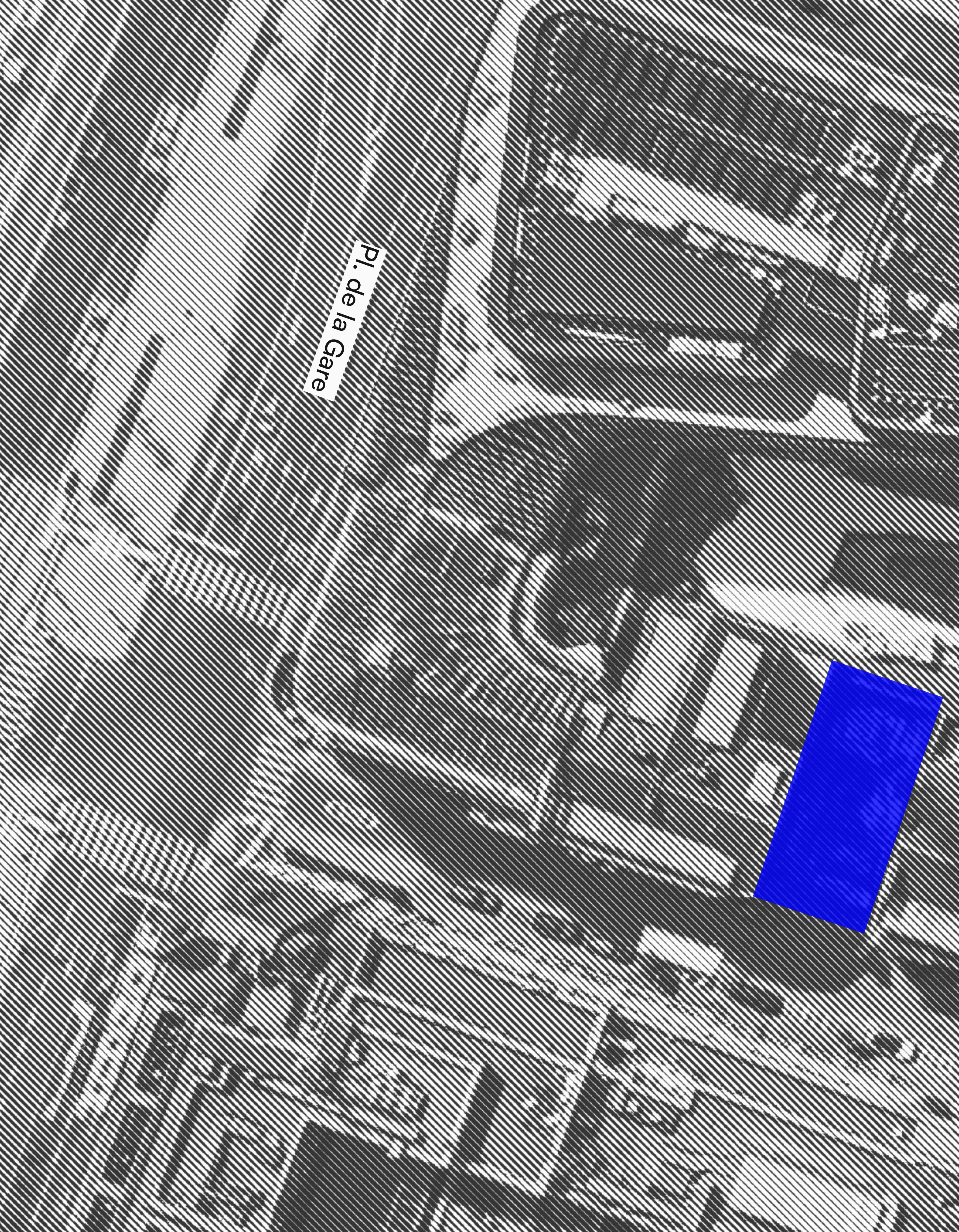
The ground floor will accommodate a commercial space designed to be as flexible as possible, allowing it to host a wide variety of business types. The planning and implementation of the spaces are intended to meet diverse functional r equirements. Various studies have already been conducted to assess the suitability of the space for different types of businesses, including insurance offices, hair salons, kiosks, and other commercial uses. Particular emphasis has been placed on a modular spatial layout, adaptable technical infrastructure, and flexible access design in order to enable future tenants to optimally adapt the space to their specific needs.

The architects propose implementing the building as a Low-Tech structure. Initial simulations show that the originally planned building is well suited to a Low-Tech approach, requiring only minor adjustments. The Low-Tech concept challenges — and in some respects questions — many fundamental principles of building services engineering.

Epernay 18 is intended to function largely without conventional heating, ventilation, and cooling systems. Heating is provided primarily through the waste heat generated by occupants, technical equipment, and lighting. Sensor-controlled ventilation wings regulate temperature and CO_2 levels, ensuring a consistently comfortable indoor climate.

It is essentially the architectural means that fulfil this promise: massive walls and ceilings that act as insulation and thermal storage; a finely balanced interaction between façade and window areas; and carefully considered proportions, materials, and light. Equally fundamental is the building management system, which measures internal and external conditions and uses this data intelligently to regulate temperature.




Pl. de la Gare


Rue Epernay

01.2
Site and context
Surveying of the Building Gap / Plot

Precise surveying and 3D data capture ensure accurate planning and seamless integration into the urban fabric.

01.2.1 | 3D Model IFC

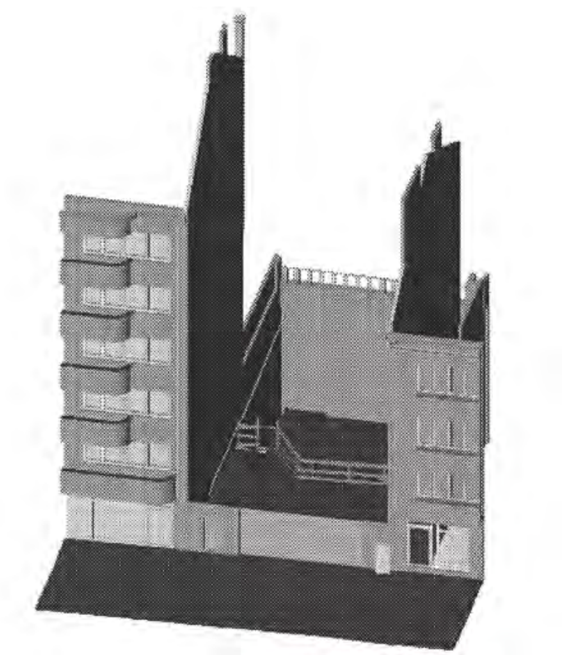
On Rue d'Epernay, there is a vacant plot of land designated as the future site of a modern office building. In order to ensure precise and efficient construction planning and execution, a surveyor was commissioned to carry out a detailed survey of the site.

The surveyor began the work with a comprehensive on-site inspection to assess the existing conditions. During this process, the exact boundaries of the property were determined and all relevant features were documented. The accurate recording of property boundaries is particularly important in order to avoid potential legal and neighborhood-related conflicts at a later stage.

Modern surveying techniques were used to measure the vacant plot. With the help of GPS technology and digital theodolites, the surveyor was able to take highly precise measurements. These technologies provide the level of accuracy required to create a reliable development plan. In addition, laser scanners were used to capture three-dimensional data of the terrain. These 3D models provide valuable information for architectural planning and subsequent construction.

During the surveying process, potential challenges and specific site conditions were also taken into account. In an urban environment such as Luxembourg City, it is essential to consider existing infrastructure, including underground utility lines and neighboring buildings. These factors were carefully integrated into the survey to ensure that the planned office building fits harmoniously into the existing urban fabric and that no unexpected issues arise during construction. After completing the survey, the surveyor produced a detailed survey plan. This plan serves as the basis for architects and structural engineers who will design and construct the office building. It contains all relevant data on property boundaries, elevation profiles, and key topographical features.

The precise survey carried out by the surveyor ensures that the construction project on Rue d'Epernay can be implemented smoothly and efficiently. It forms the foundation for careful planning and contributes significantly to ensuring that the new office building meets high standards of quality and safety.

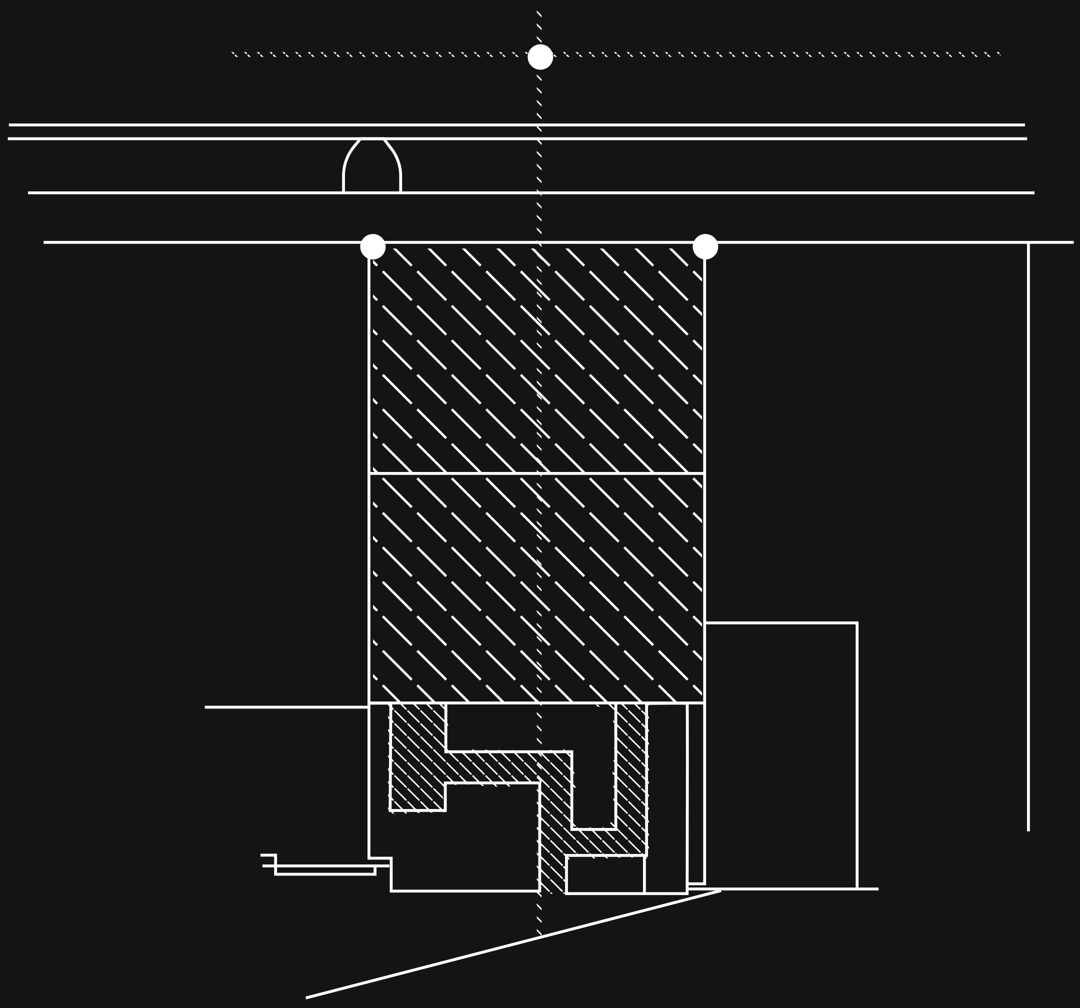


3D model of the existing neighbouring buildings

“How much technology does a building need, and above all, which technology?”

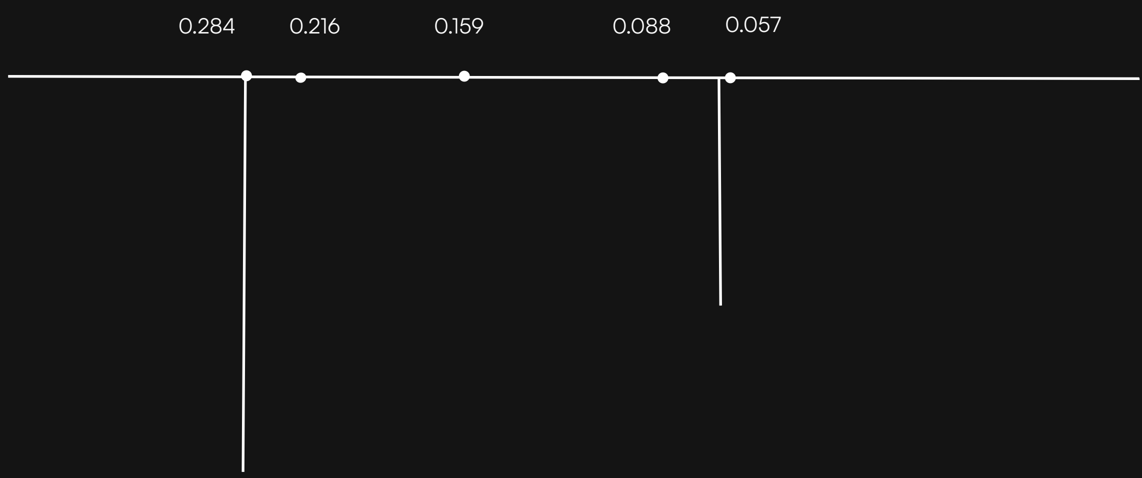
01.2.2 | Elevation data

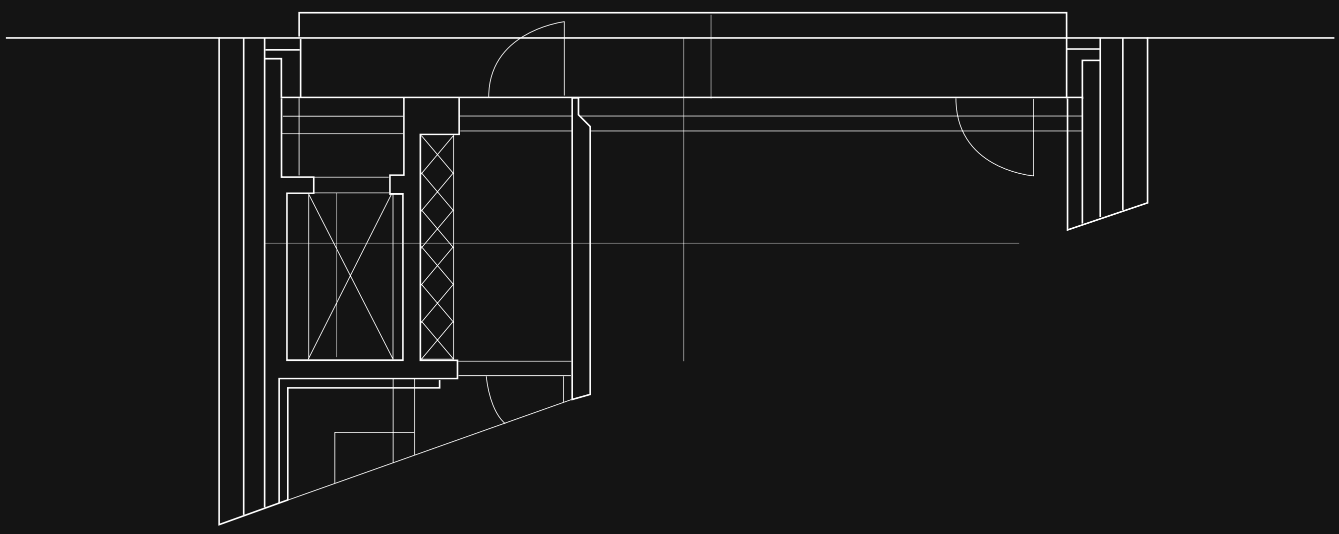
Elevation reference point axis building / axis road



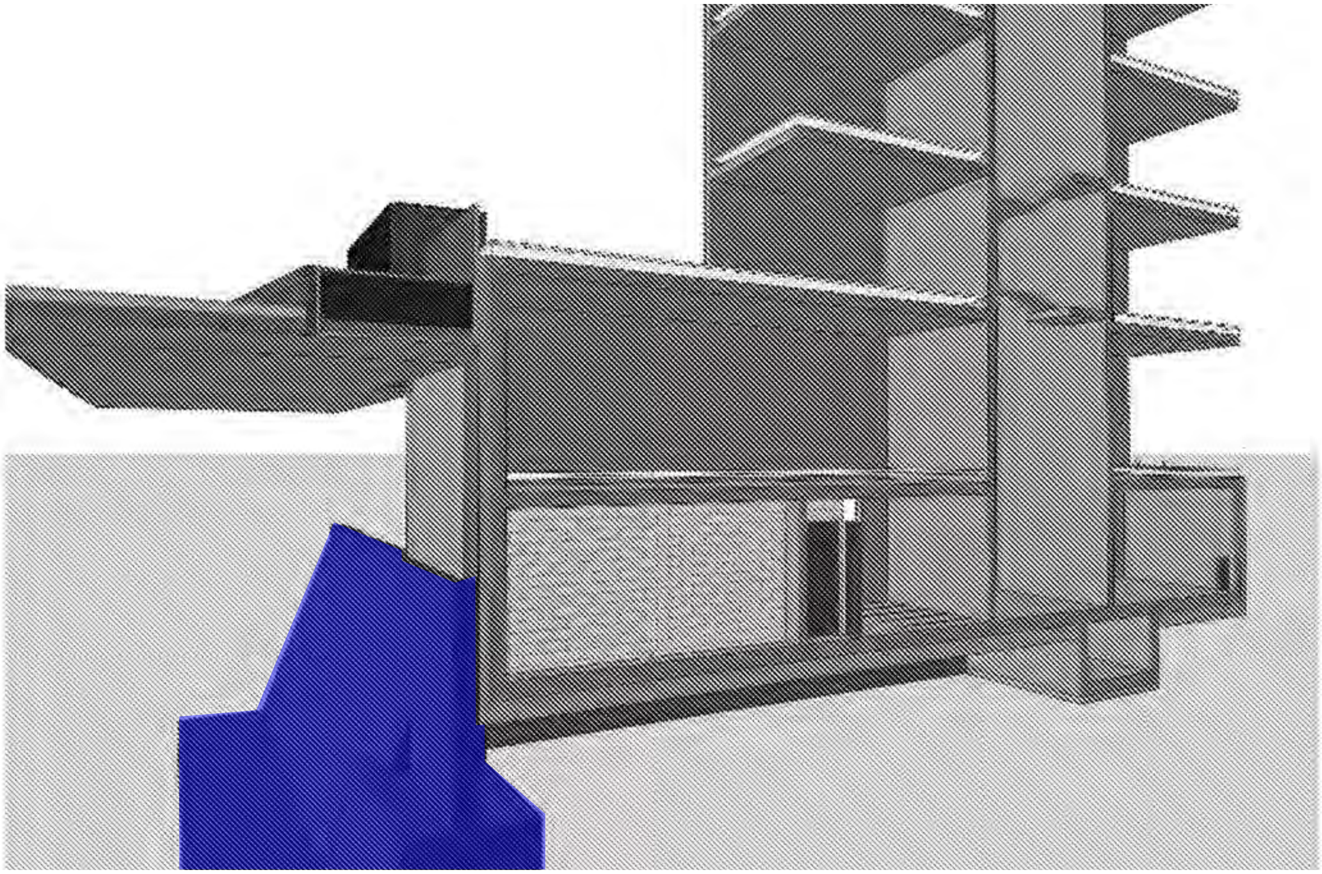
ZREF. 1
0.000

Road axis / Parcel axis





01.3
Helix Epernay Connection



The blue components show the original structure. The wall between Helix and Epernay is significantly thinner than initially assumed.

The building services connection between the Helix and Epernay buildings will be installed in the basement. Precise core drilling will be carried out in the first basement level to enable the necessary pipes to be laid. This drilling will ensure the smooth installation of the building services systems and ensure that both buildings are efficiently connected to each other.

01.4
Space Planning

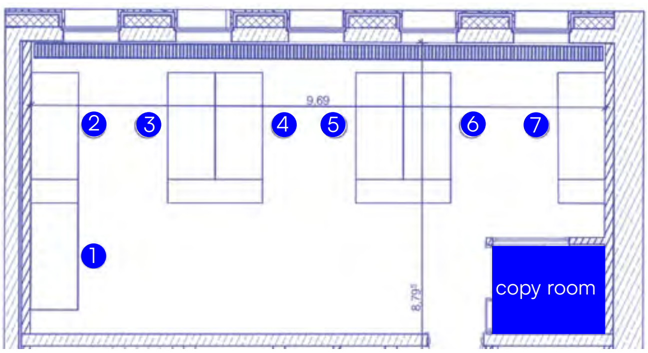
Space planning takes into account the purpose of the spaces and who will use them. Space planning is a process that involves several steps. In the first step, the possible options were examined. Space planning helps ensure that space is used efficiently without waste.

The program includes:

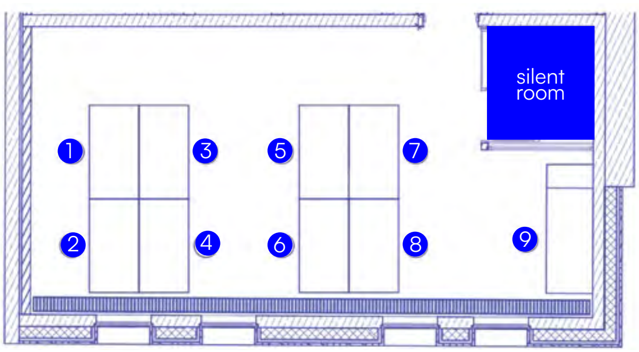
- Open office (8 workstations)
- Single office
- Meeting room (6 people)
- Silent rooms
- Break area
- Copy corner

01.4.1 | Space Planning in the Upper Floors

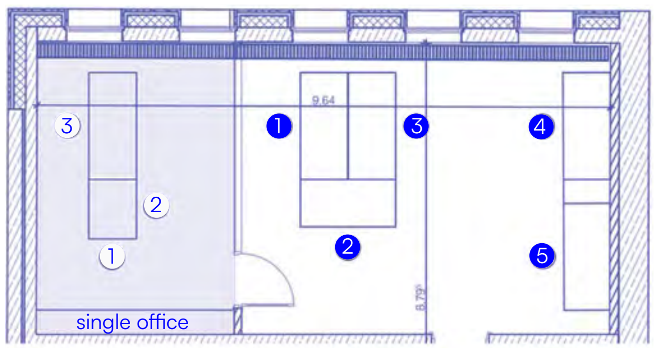
Several layout variants were explored to balance flexibility, concentration, and collaboration:



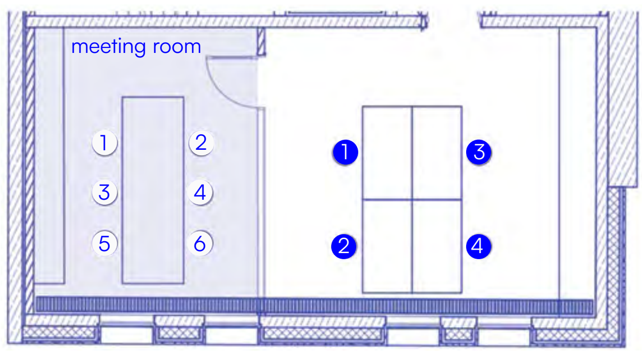
Variant 1: Open office with one copy corner and 7 workstations.



Variant 2: Open office with one silent room and 9 workstations.



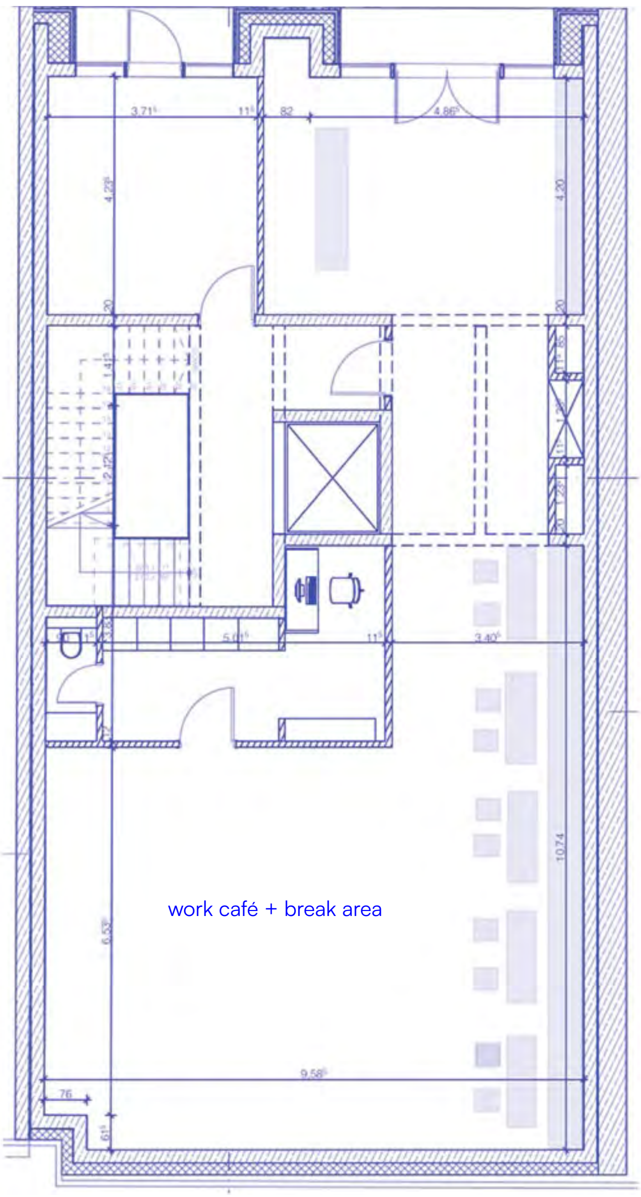
Variant 3: Single office and open office with 5 workstations.



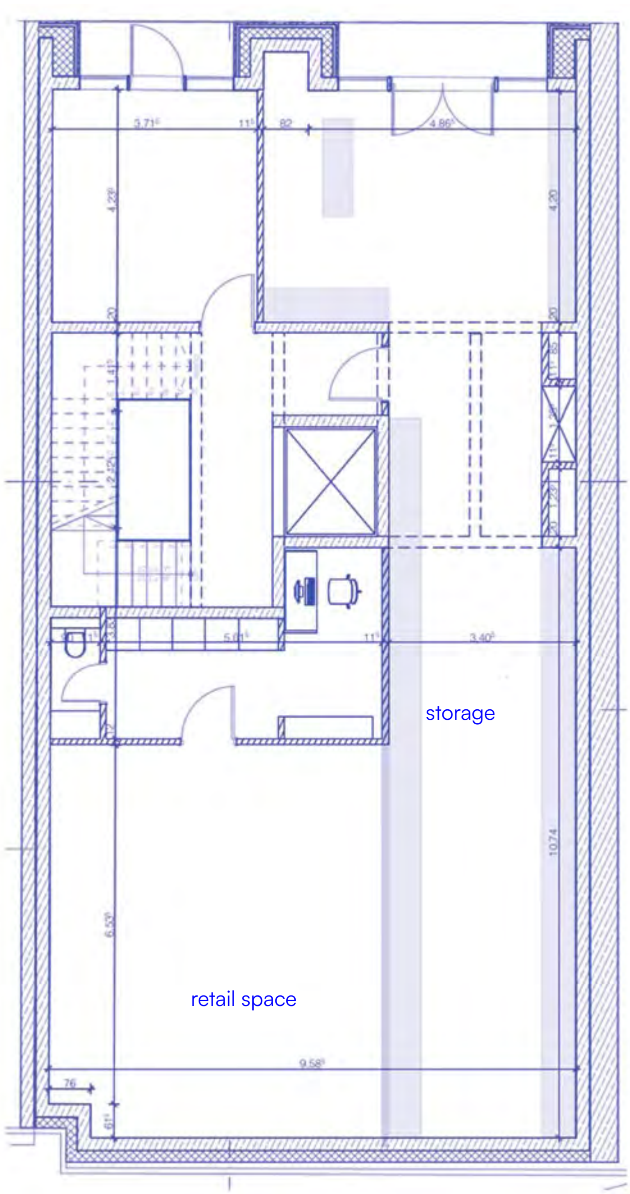
Variant 4: Meeting room and open office with 4 workstations.

01.4.2 | Space Planning on the Ground Floor

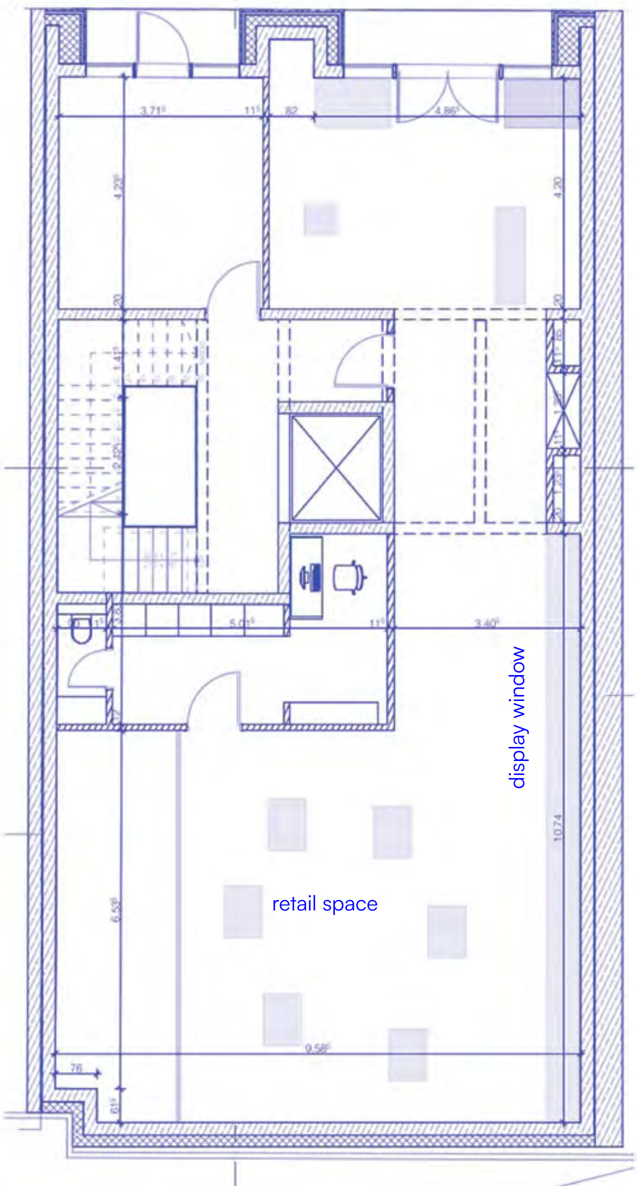
The ground floor is conceived as a flexible, publicly oriented space with multiple possible uses:



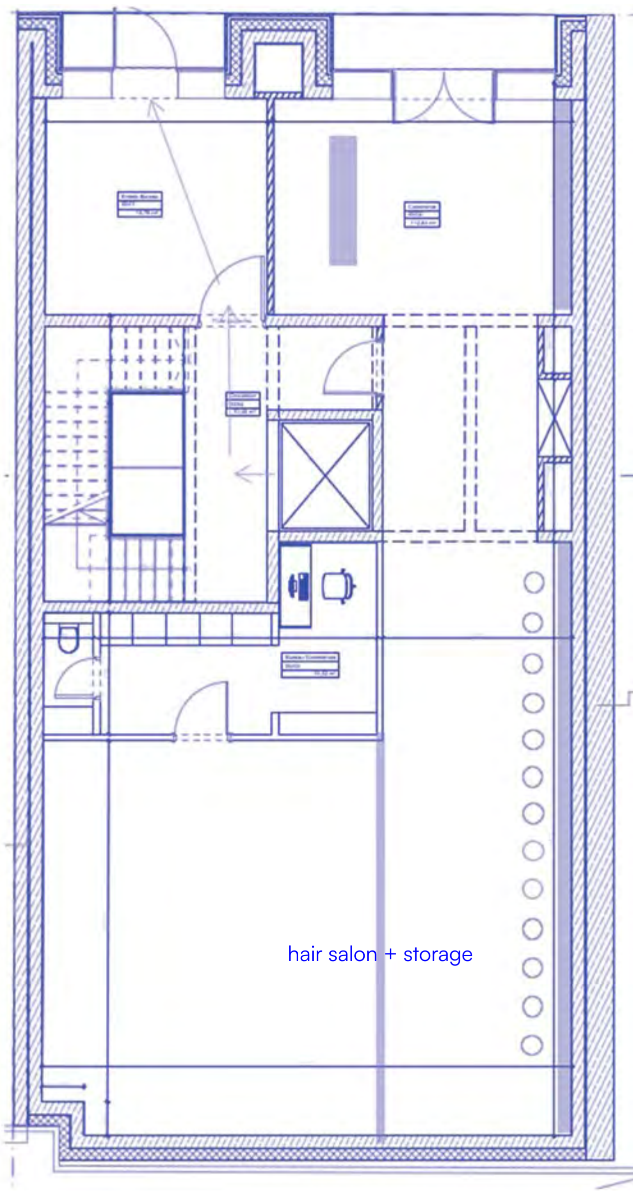
Variant 5: Work café serving as a break area for office employees



Variant 6: Small retail space with storage (e.g. wine shop)



Variant 7: Retail space with display window (e.g. shoe store)



Variant 8: Hair salon with integrated storage area

02
Structural Concept & Shell Construction

02.1
Shell Construction

The decision to use concrete instead of timber for the structural shell of the new office building on Rue d'Epernay is based on a thorough evaluation of various ecological and practical factors. Although timber is generally regarded as a more environmentally friendly construction material, a closer analysis shows that concrete can achieve a comparable or in some cases even more advantageous, environmental balance under certain conditions.

02.2
Structural System

The planned new building is a conventional reinforced concrete structure comprising one basement level, a ground floor, and six upper floors. The new building will be constructed between two existing buildings. The building width is approximately 10,00 m; the building depth is approximately 20,00 m at basement and ground floor level and approximately 14,50 m on the upper floors.

The basement is designed as a "white tank" system, featuring 25 cm-thick reinforced concrete exterior walls and an elastically supported foundation slab with localized reinforcements beneath the columns, and the principles and benefits of this system will be explained in the following paragraph. In the area of vertical circulation, wall thicknesses are reduced to 16 cm, as no water ingress is anticipated in this zone.

The stair core extends continuously from the 4th upper floor down to the foundation slab and is activated as the primary bracing core. The stair flights can be executed either as prefabricated elements or cast in situ, with acoustically decoupled bearings.

In the current building layout, the floor slabs have a thickness of 23 cm. Vertical load transfer to the foundations is carried primarily by the reinforced concrete walls of the stair core and the two gable walls. Along the front and rear façades, the floor slabs are supported by a beam-and-column system, also constructed in reinforced concrete.

The overall building height up to the ridge is approximately 24,00 m above street level. Lateral stability is provided by reinforced concrete shear walls. The gable walls adjoining the neighboring buildings are also designed in reinforced concrete.

The façades are designed as a perforated reinforced concrete façade system, 20 cm thick and cast in situ, contributing to the transfer of vertical loads from the horizontal structural elements. The floor slabs are executed as 23 cm thick reinforced concrete plates with vertical supports on both internal and external walls. In the slabs above the basement and ground floor levels, beams supported by columns are constructed beneath the rear façade line. The roof structure is intended as a traditional timber construction.

Beneath the planned foundation slab, there is an existing crane foundation measuring approximately 8 × 8 meters in plan, which was constructed for the development of the new post building. This existing foundation is to be statically integrated into the foundation system of the new building at No. 18. The crane foundation is founded on bedrock and therefore represents a very stiff structural element. For this reason, it is intended to found the remaining foundation area also on bedrock in order to ensure continuity of vertical deformations.

“Reinforced concrete building with a ‘white tank’ basement, bracing stair core, 23 cm floors, 20 cm façades, founded on bedrock for stability.”

02.3
Zero Waste & Excavation

As the Zero Waste concept also applies to the structural shell, prefabricated concrete elements are used wherever possible. In the execution planning phase, the type of formwork is also carefully considered, as further resource savings can be achieved in this area.

Due to the specific location of the site, two different excavation methods are required.

On the front side, the new building is planned directly on the property boundary. Because of the adjacent sidewalk and the utility lines running beneath it, sloped excavation is not possible, as this would encroach too far into the pedestrian and roadway areas. For this reason, a so-called excavation support system is installed along Rue d'Epernay. Steel profiles are driven into the ground at regular intervals along the length of the future excavation pit. During excavation, the soil layers outside the construction site, towards the street, are stabilized by inserting timber beams between the steel profiles. From a depth of approximately 2 meters, the timber beams can be replaced by a reinforced shotcrete wall.

The use of timber beams down to a depth of 2 meters facilitates the later dismantling of the support system, which is required by the road authority up to this depth.

On both gable sides, the planned excavation borders existing buildings. Both neighboring buildings have basements, while the planned level of the new foundation slab lies slightly deeper. To prevent damage to the existing structures, the two existing gable walls must be underpinned. This is carried out in several phases, constructing a reinforced concrete wall beneath the existing buildings down to approximately 50 cm below the level of the new foundation slab. At the rear of the site, the excavation can be executed along the external wall of the significantly deeper Helix building.

White Tank

02.3.1 | Use of a “White Tank” Basement System

For the planned new building on Rue d’Epernay in Luxembourg City, which will accommodate a modern office, a specific construction measure is planned: the installation of a “white tank” system in the basement. This decision was made to ensure safe and durable waterproofing of the underground levels, particularly in response to fluctuating groundwater conditions in the surrounding area.

Although the neighboring Accinauto building, which lies at a lower level, shows signs of varying groundwater levels, there is no immediate groundwater risk for the new building. Nevertheless, the “white tank” provides an additional layer of safety and eliminates any risk of moisture ingress. This is especially important as the basement will accommodate several critical functions, including waste rooms, building services, IT rooms, showers, and storage areas.

A “white tank” is a construction method in which the entire basement is built from waterproof concrete. This technique eliminates the need for additional wall and floor waterproofing, as the concrete itself, together with specially sealed joints between concrete elements, acts as a water barrier.

The use of this system offers several advantages:

• Reliable waterproofing

The “white tank” provides long-term and dependable protection against moisture and water ingress, which is particularly important for sensitive areas such as IT and building services rooms.

• Elimination of additional waterproofing materials

Since walls and floors are made of waterproof concrete, no extra waterproofing layers are required. This reduces construction time and costs.

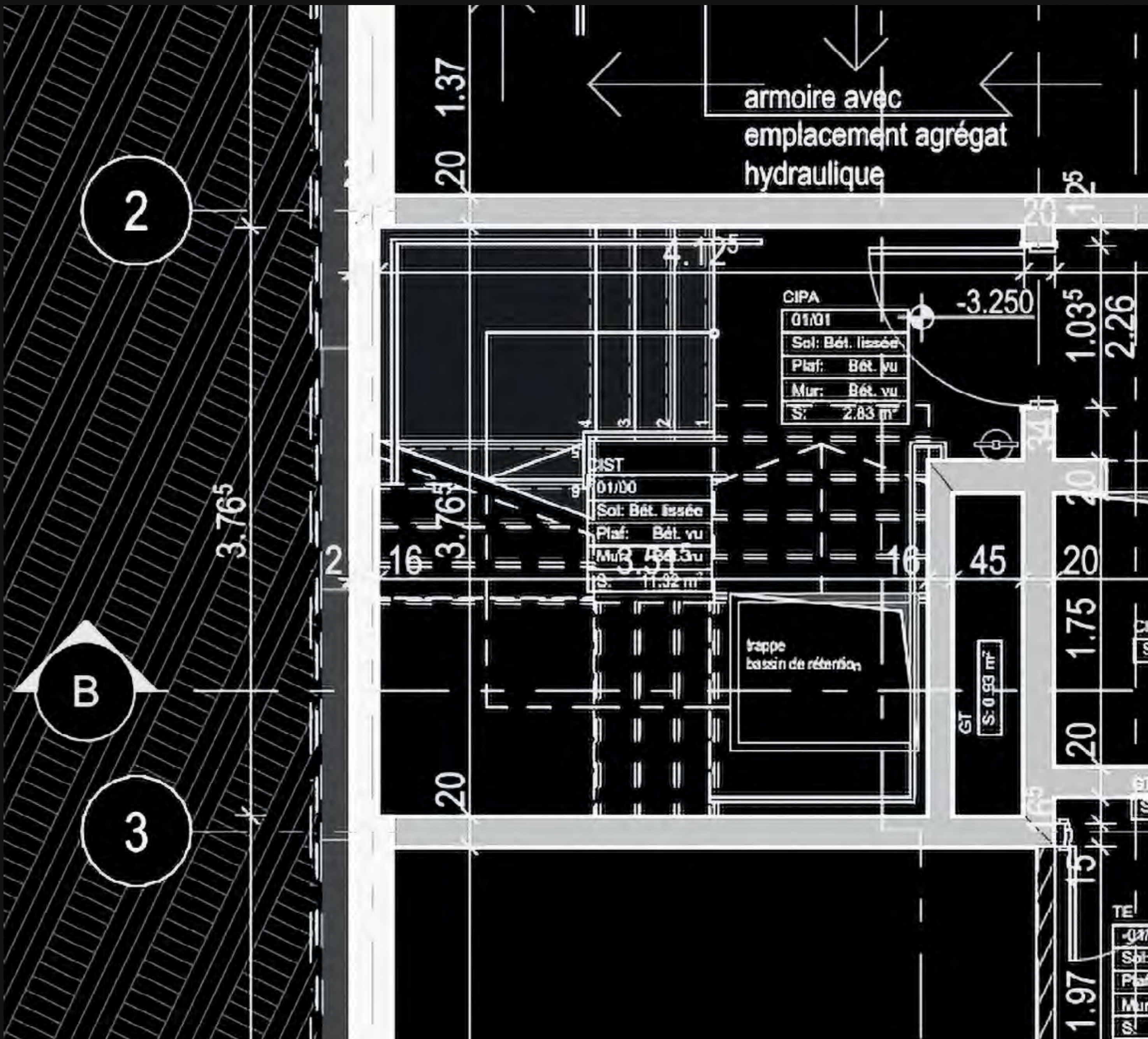
• Durability and low maintenance

The “white tank” is an extremely durable solution and requires less maintenance compared to traditional waterproofing methods. Both the concrete and the sealed joints are designed for a long service life.

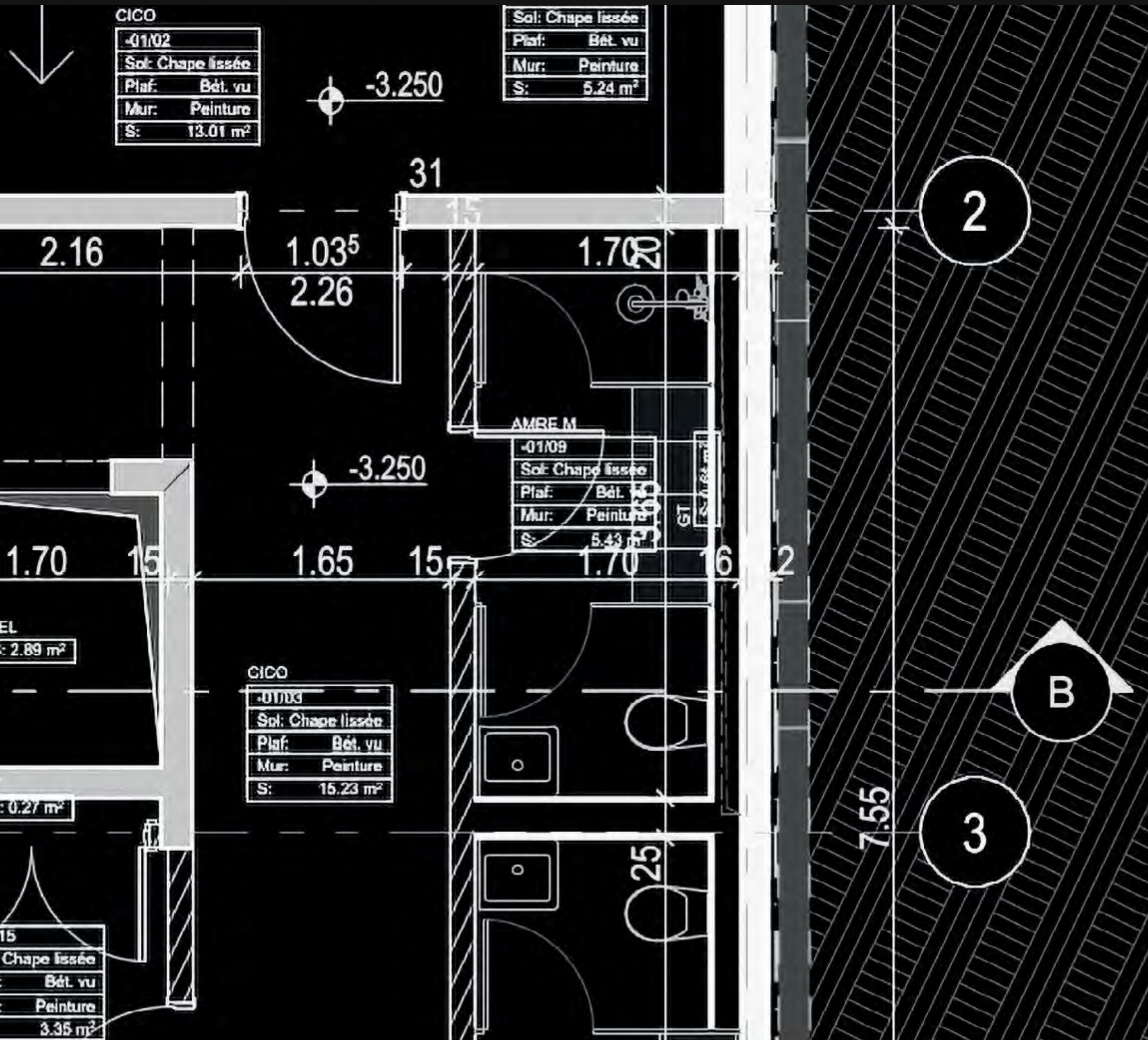
• Safety and comfort

The additional security provided by the “white tank” ensures that basement functions can operate without risk, increasing the overall comfort and reliability of the building.

Overall, the “white tank” system offers an optimal solution for the specific requirements of the new building on Rue d’Epernay. It ensures that the basement remains dry and protected even under fluctuating groundwater conditions, while enabling an efficient and cost-effective construction process without additional waterproofing measures.



The walls of the white tank will be reduced to 16 cm in the area of the access core. No water can accumulate in this area.


CICO
-01/02
Sol: Chape lissée
Plaf: Bét. vu
Mur: Peinture
S: 13.01 m²
-3.250
Sol: Chape lissée
Plaf: Bét. vu
Mur: Peinture
S: 5.24 m²
31
2.16
1.03^5
2.26
1.70
2
AMRE M
-01/09
Sol: Chape lissée
Mur: Peinture
S: 5.43 m²
GT
-3.250
1.70
15
1.65
15
1.70
16
2
EL
2.89 m²
CICO
-01/03
Sol: Chape lissée
Plaf: Bét. vu
Mur: Peinture
S: 15.23 m²
B
0.27 m²
7.55
3
25
15
Chape lissée
Bét. vu
Peinture
3.35 m²

02.4
Exposed Concrete

The stairwell walls are executed in exposed concrete, requiring a high level of precision in both formwork and concrete casting to achieve a visually refined finish.

Specialized formwork is used to create smooth and uniform surfaces. Depending on the design requirements, materials such as steel, plastic, or formwork liners are applied. All joints and tie-hole positions are carefully planned, as they remain visible after formwork removal and can be intentionally integrated as part of the architectural expression.

The concrete mix is specifically designed for exposed concrete to ensure a consistent color and texture. High-quality aggregates and additives contribute to the desired surface appearance. After stripping the formwork, the concrete undergoes controlled surface treatment, which may include grinding, polishing, or sealing. The concrete is left in its natural grey tone.

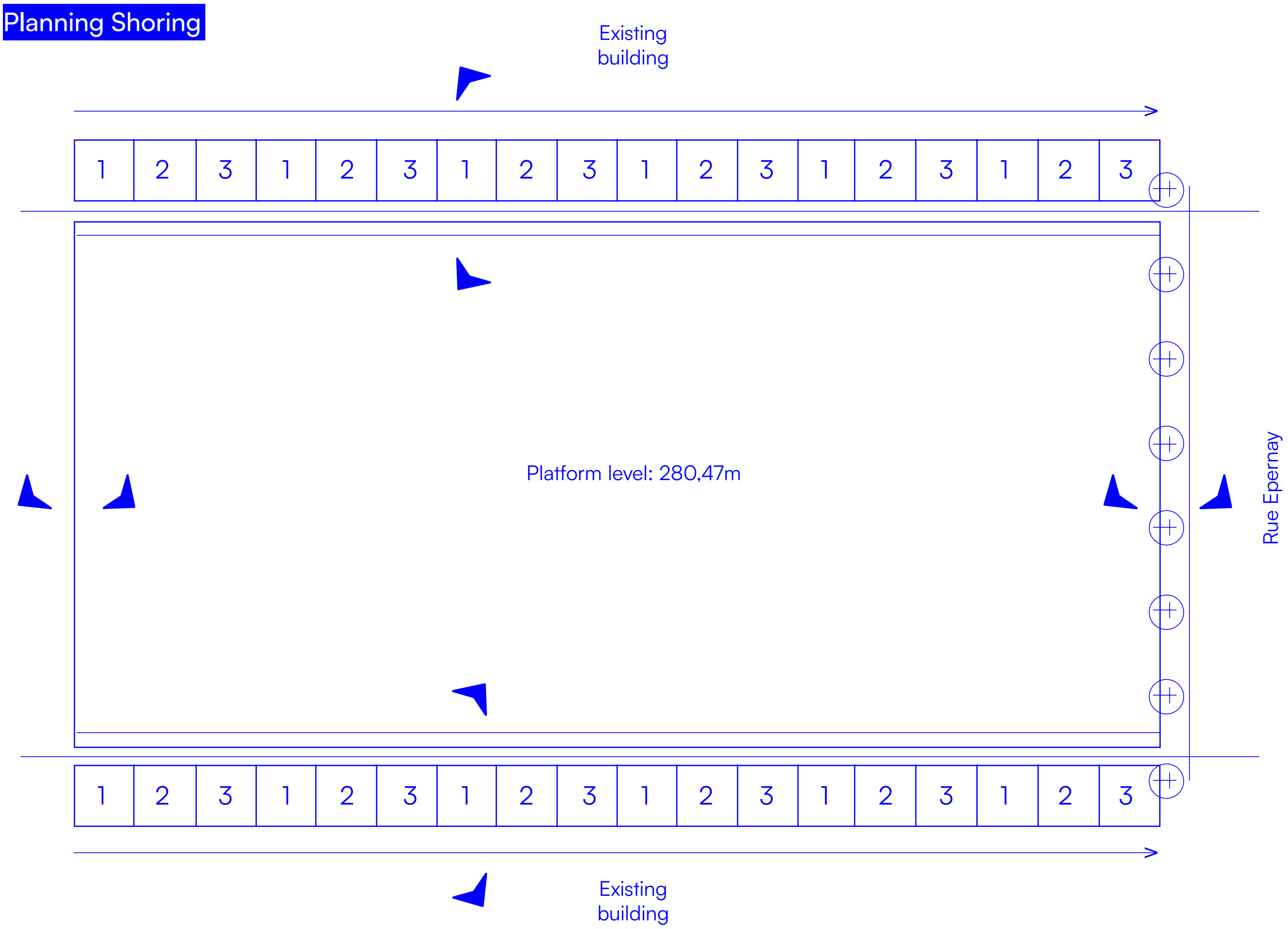
Exposed concrete offers high durability and resistance to mechanical wear, making it particularly suitable for heavily used areas such as stairwells. Its smooth surfaces are easy to clean and require minimal maintenance.

The execution of exposed concrete demands the highest level of craftsmanship. Uniform texture, consistent coloration, and precise detailing are essential to achieving the specified SB 3 quality. Throughout production and construction, all measures must be taken to ensure this quality while adhering to the Zero Waste principle.

02.5
Structural Shell Planning

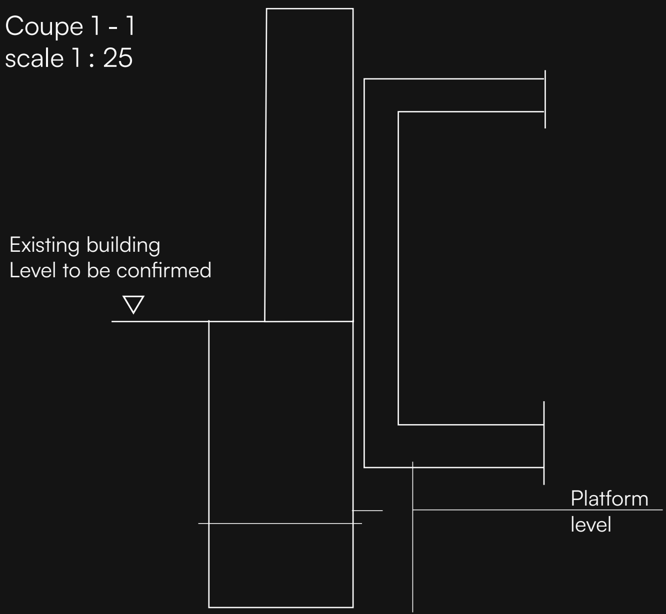
The structural shell drawings still need to be adapted to the current design. Through careful planning and strict monitoring of the construction processes, it is ensured that the project remains within budget and meets the highest quality standards. The project is located in a gap site within a dense urban context, which presents particular challenges. Limited space requires precise planning and coordination of construction activities in order to minimize disruption to the surrounding area and ensure an efficient construction process.

Planning Shoring

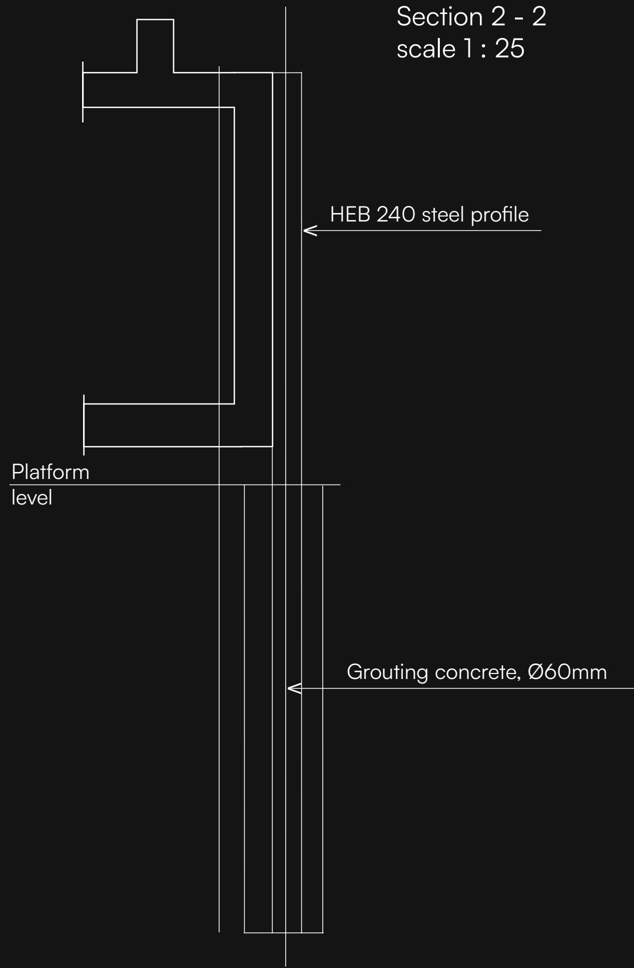


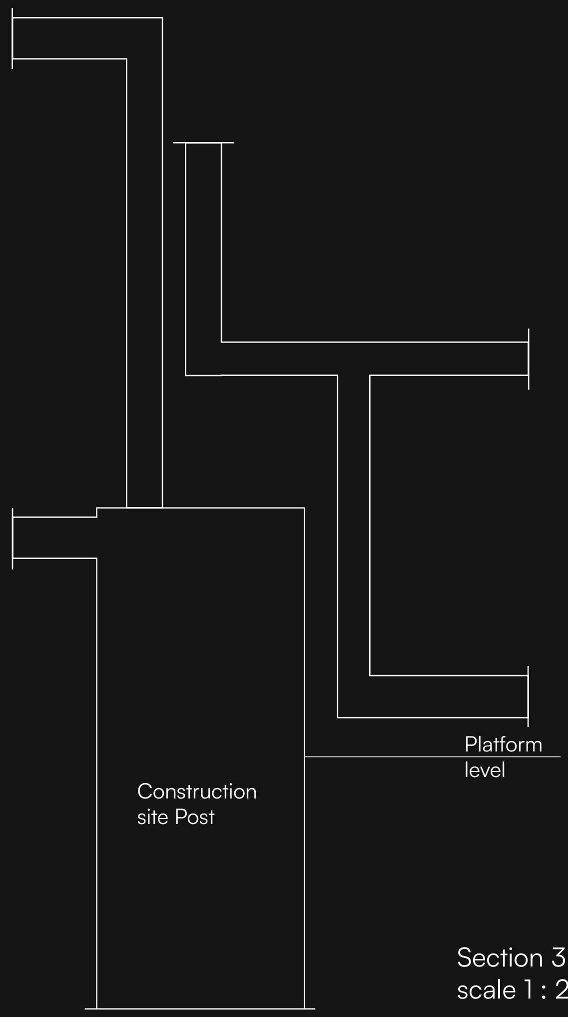
Planning Shoring

Coupe 1 - 1
scale 1 : 25

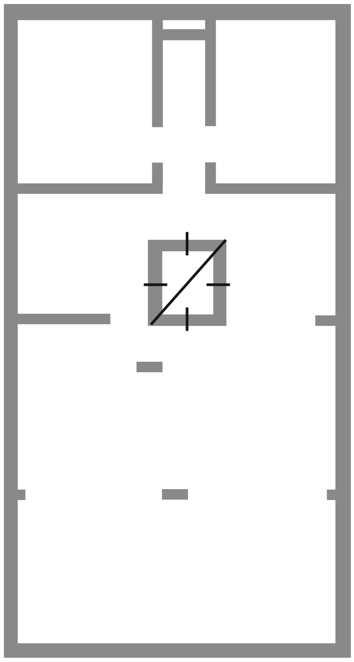


Section 2 - 2
scale 1 : 25

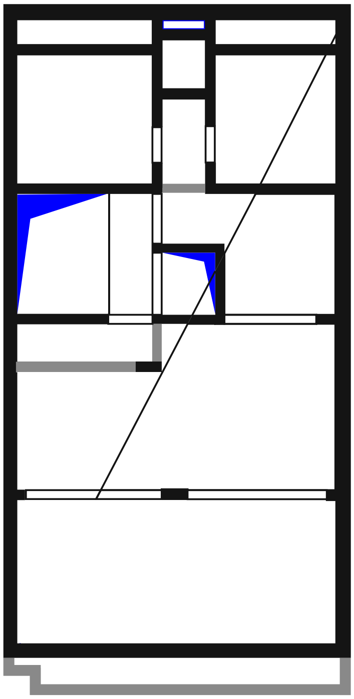




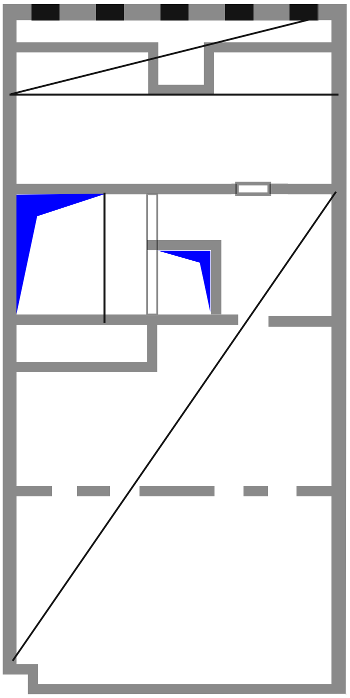
Section 3 - 3
scale 1 : 25



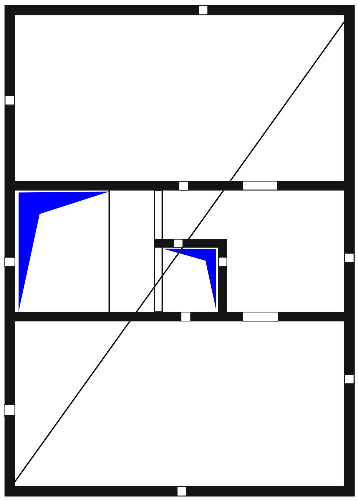
Raft foundation



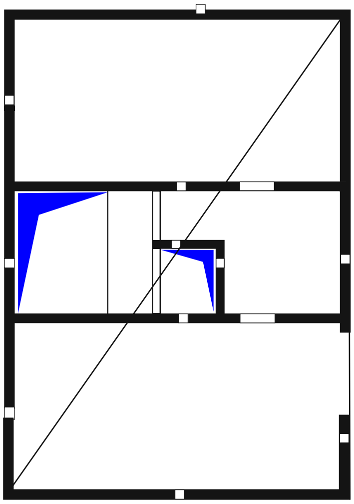
Slab on basement



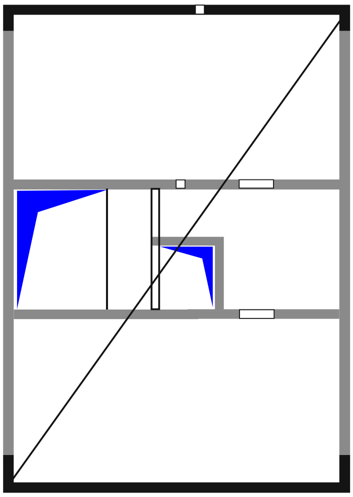
Slab on ground floor



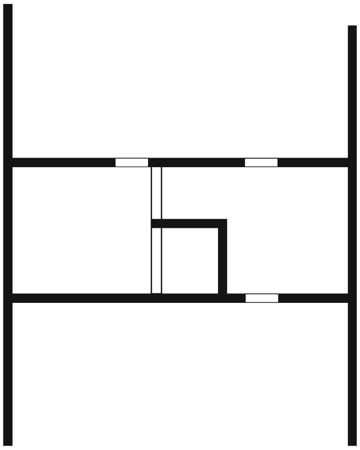
Slab on 1st floor



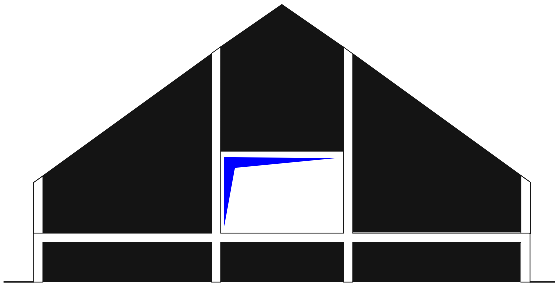
Slab on 2nd & 3rd floor



Slab on 4th floor



Structural walls - 1st floor



Shear wall elevation - 5th floor

02.6
Life Cycle Assessment | Concrete vs Timber

Transportation distances

One often overlooked aspect of timber construction is transportation. In many cases, structural timber must be transported over long distances to reach the construction site. These extended transport routes significantly increase CO_2 emissions. Concrete, by contrast, can be produced locally, greatly reducing transport-related emissions.

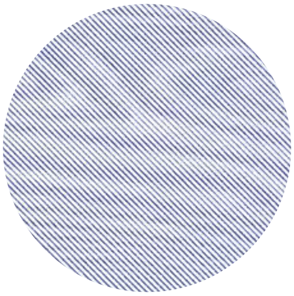
Durability and maintenance

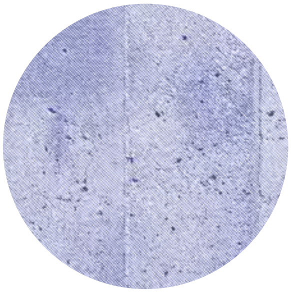
Concrete is known for its exceptional durability and low maintenance requirements. A concrete building can last for several decades, if not centuries, without the need for extensive repairs. This results in lower material and energy consumption over time, thereby reducing the overall environmental impact.

The load-bearing structure of the building is constructed in concrete. Despite the generally better ecological balance of timber, the decision was made in favor of concrete. The Low-Tech concept requires a maximum amount of thermal storage mass.

Recycling and reuse

At the end of its life cycle, concrete can be recycled and reused in new construction projects. Recycling concrete reduces the demand for new raw materials and minimizes the amount of waste sent to landfill.





02.7
Thermal Storage Capacity for the Low-Tech Concept

The decisive reason for choosing concrete lies in its excellent thermal storage capacity, which is central to the Low-Tech concept. Concrete has a high thermal mass, meaning it can efficiently store heat and release it slowly over time. This significantly contributes to a stable indoor climate and reduces the need for active heating and cooling systems. By utilizing the thermal mass of concrete, natural temperature fluctuations can be better balanced, leading to a substantial reduction in energy consumption for climate control. This approach aligns perfectly with the Low-Tech strategy, which relies on simple yet effective solutions to minimize energy use and maximize sustainability.

02.8
Additional Advantages of Concrete

Structural integrity

Concrete offers a high level of structural integrity and strength, which is of great importance for an office building. It is resistant to fire, water, and pests, ensuring additional safety and long-term durability.

Design flexibility

Concrete allows for a high degree of design flexibility and can be cast into a wide variety of forms and structures. This supports innovative architectural solutions and enables adaptation to specific construction requirements.

Both aspects were of particular importance for the site at 18, rue d'Epernay.

The choice of concrete for the structural shell of the office building on Rue d'Epernay is the result of a comprehensive evaluation of ecological, economic, and practical factors. Although timber is a valuable and environmentally friendly construction material, concrete offers significant advantages for the specific Low-Tech concept and the requirements of this project. Its thermal storage capacity, durability, local availability, and structural properties make it the ideal material for realizing a sustainable, energy-efficient, and long-lasting office building.

02.9
Fire Protection

Concrete's high performance under fire exposure can be described by the following properties. At temperatures of up to 1,000 °C, as may occur in a natural fire:

- Concrete remains largely structurally stable
- Concrete does not contribute to the fire load
- Concrete does not propagate fire
- Concrete does not produce smoke
- Concrete does not release toxic gases

Concrete generally meets the required fire resistance classes without additional measures such as protective coatings or cladding (in accordance with DIN 4102 and DIN EN 13501-2).

For so-called "hot design," Eurocode 2, Part 1-2 (DIN EN 1992-1-2 NA: Design of concrete and prestressed concrete structures, General rules, Structural fire design) applies, defining fire safety verification for the structural design of reinforced and prestressed concrete structures.

02.10
Accoustics

Due to its high density, concrete serves not only as an excellent sound insulation material but also as an effective thermal storage medium. As the office building at 18, rue d'Epernay is located near Place de la Gare, this inherent noise insulation contributes significantly to interior comfort.

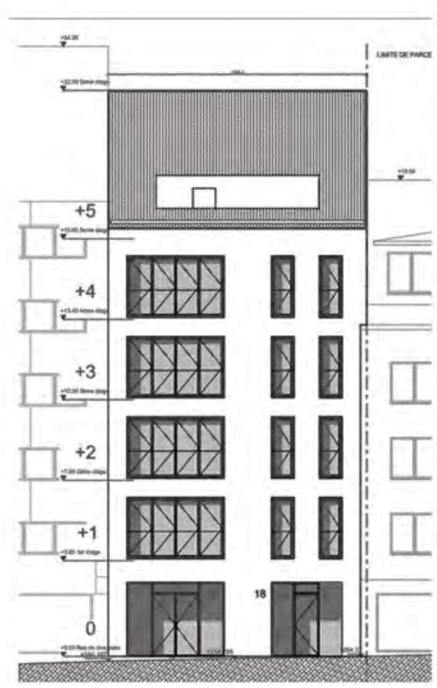
03
Architectural Envelope

03.1
Façades

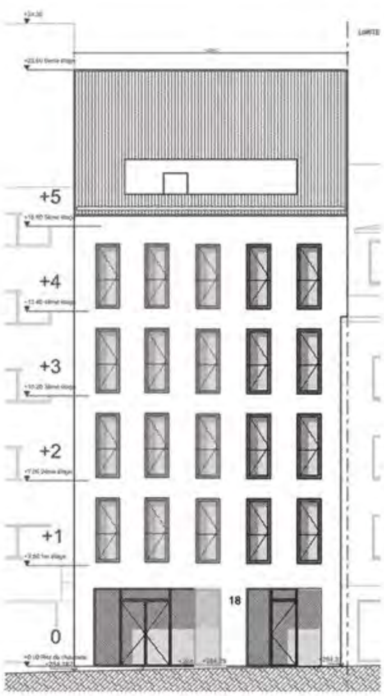
This chapter presents the design and development of the building façades, focusing on material choices, ventilation strategies, window positioning, and integration of sustainable technologies such as photovoltaic modules. It highlights energy-efficient, low-tech solutions and explores aesthetic, functional, and environmental considerations to create a durable and visually coherent exterior.

03.2
Adaptation of the North Façade

Where possible, the street façade should be adapted to the low-tech concept. The new window layout also creates greater flexibility inside the building.



Original Façade

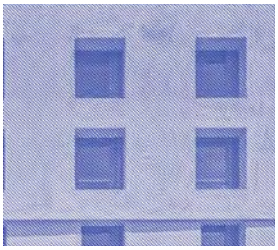
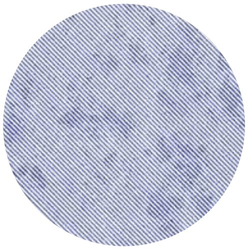


Façade adapted to low-tech

Coordinated low-tech façade

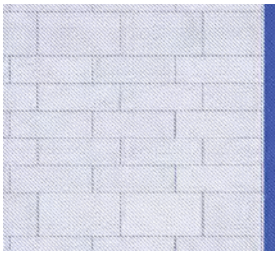
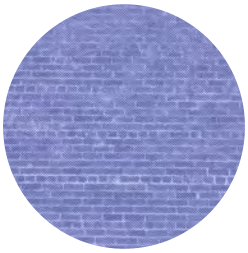
03.3
Façade Material

In principle, three possible façade materials are available for selection.

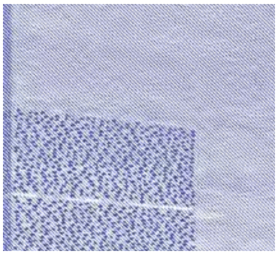
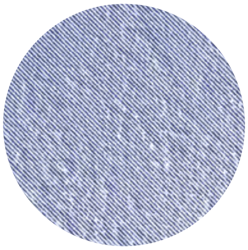
Natural stone façade (Giallo Istria)

Since the Helix building was already executed using Giallo Istra, it is logical to also use natural stone for the Epernay 18 office building.

Brick façade

The third option is a brick façade, which has the advantage that ventilation can potentially be integrated into the façade.

Plaster façade

The reference buildings were each constructed with a plaster façade. As both house numbers 16 and 20/22 were executed with a plaster façade, this option also represents a suitable solution.

03.4
Ventilation Principles & Window Position

03.4.1 Ventilation via a rear ventilation sash behind the curtain wall

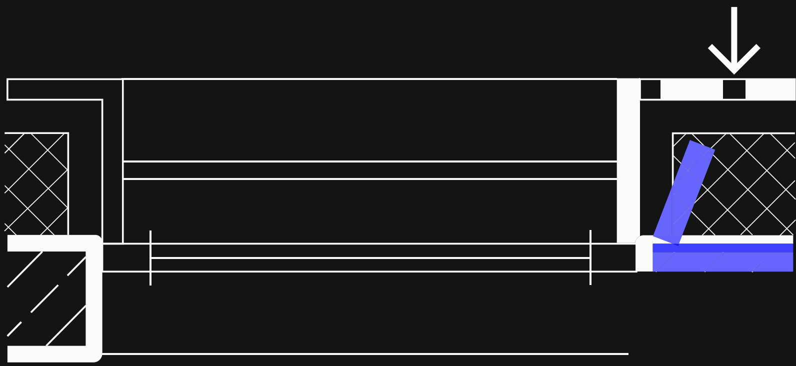
Ventilation is provided through a discreet rear ventilation sash integrated into the window system and positioned behind the curtain wall. This solution ensures a high level of burglary protection, as the opening remains small and largely concealed, while integrated insect protection further enhances user comfort. Fig.1

The deep window reveals play a key role in the overall façade performance. They provide effective rain protection, preventing weather-related issues, and contribute to reliable and low-maintenance daily operation. Fig.2

As the ventilation sash is fully integrated into the window system, it therefore forms an integral part of the window sash construction. Fig.3

In addition, the deep positioning of the windows within the façade allows for effective passive shading of the glazing. As a result, the use of an external sun-shading system can be omitted. Fig.4

This approach reduces solar gains while maintaining a clear and restrained façade expression. Regardless of the window type selected, all window sashes are equipped with an opening limiter to ensure controlled and safe operation. Fig.5



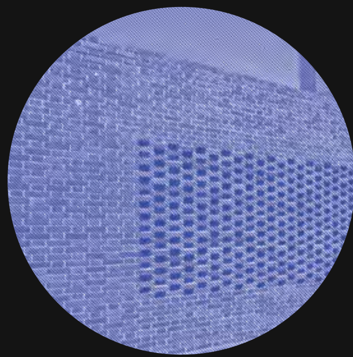
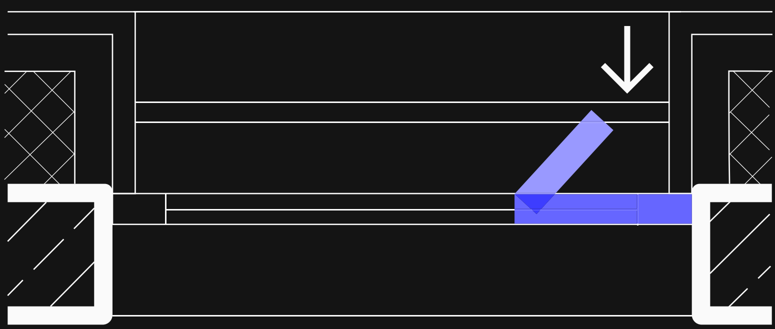


Fig.1



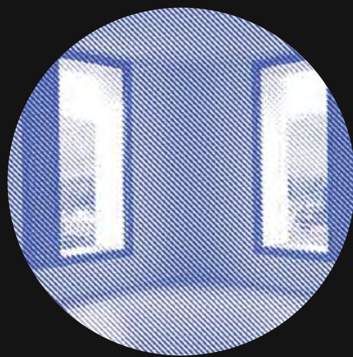
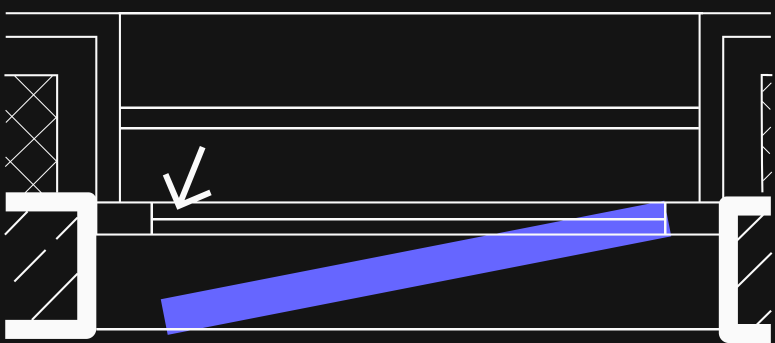


Fig.2



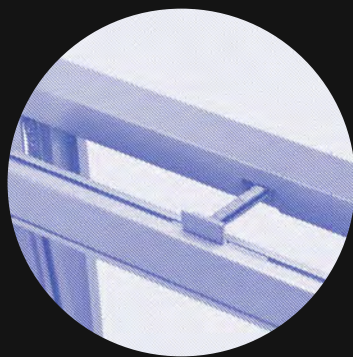


Fig.3

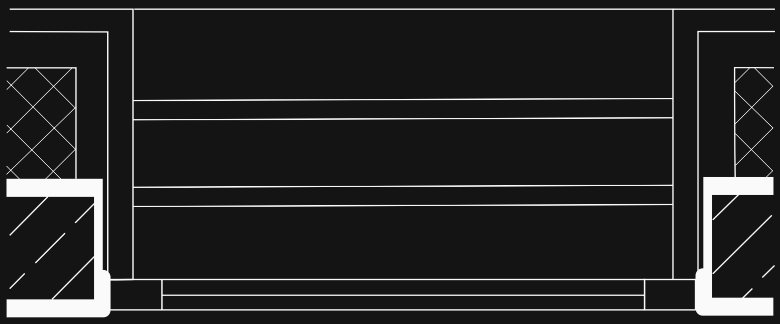


Fig.4

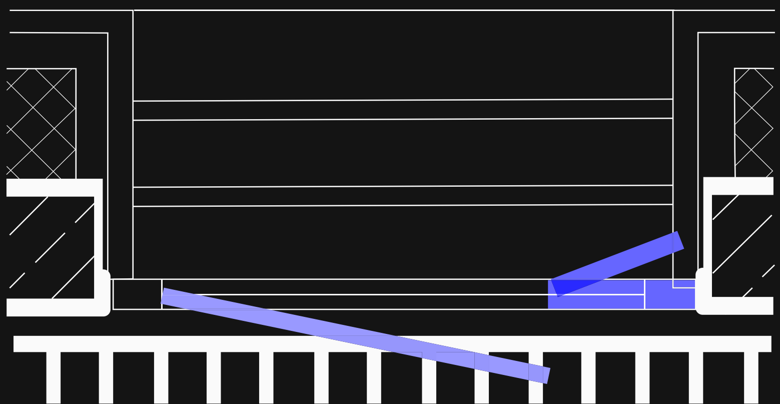
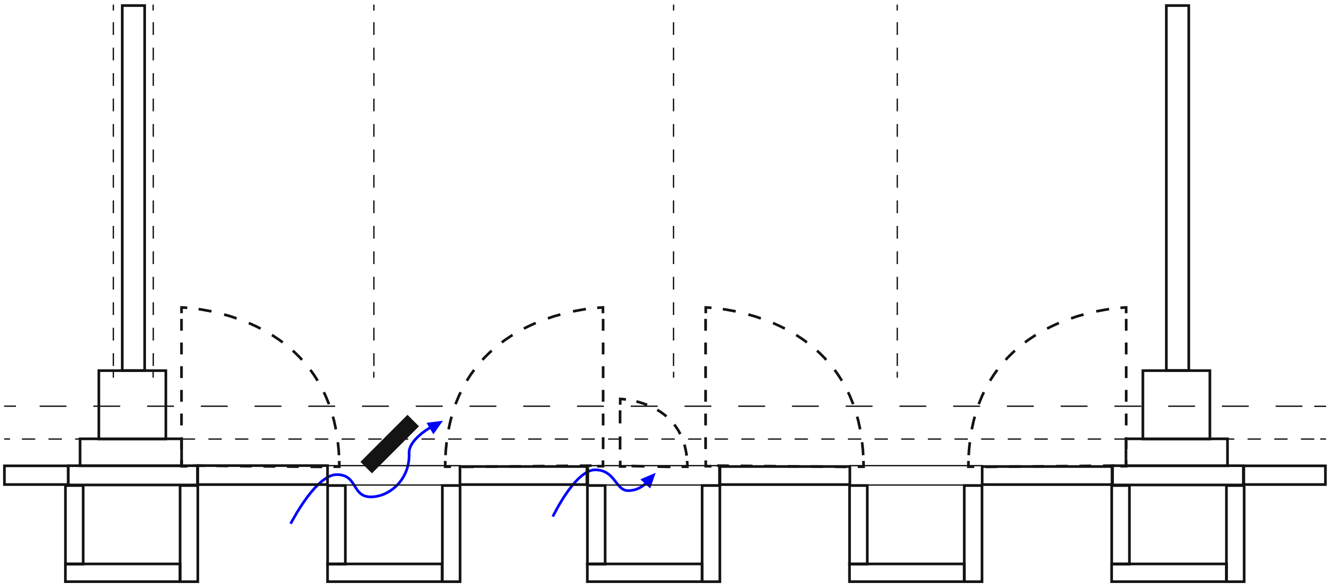


Fig.5

03.5
Façade Development & Variants

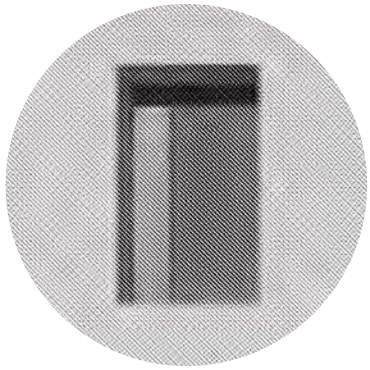
03.5.1 Integrated Ventilation

Example: German Bundestag building, Berlin.Integrated ventilation system, with window sashes that can also be opened.

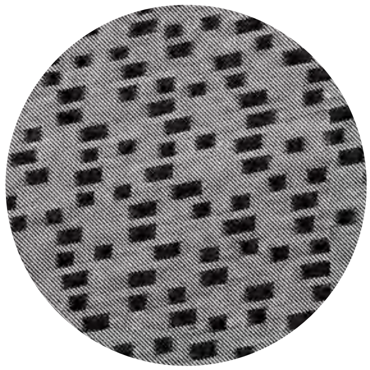


Various façade variants were developed, based on the low-tech simulations by Lars Junghans. These simulations serve as the foundation for energy-efficient, sustainable, and aesthetically pleasing façade solutions that meet the specific requirements of the project.

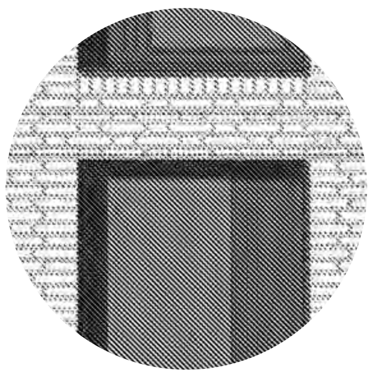
The simulations by Lars Junghans have shown that significant energy savings can be achieved through intelligent planning and the use of passive techniques. The façade designs were developed to translate these findings into practice and to create a building that is both ecologically and economically viable.



variant 1



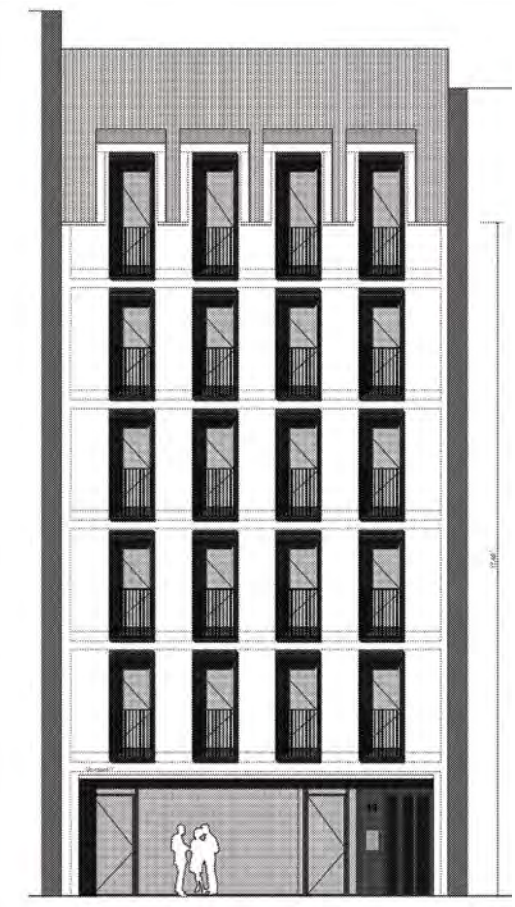
variant 2



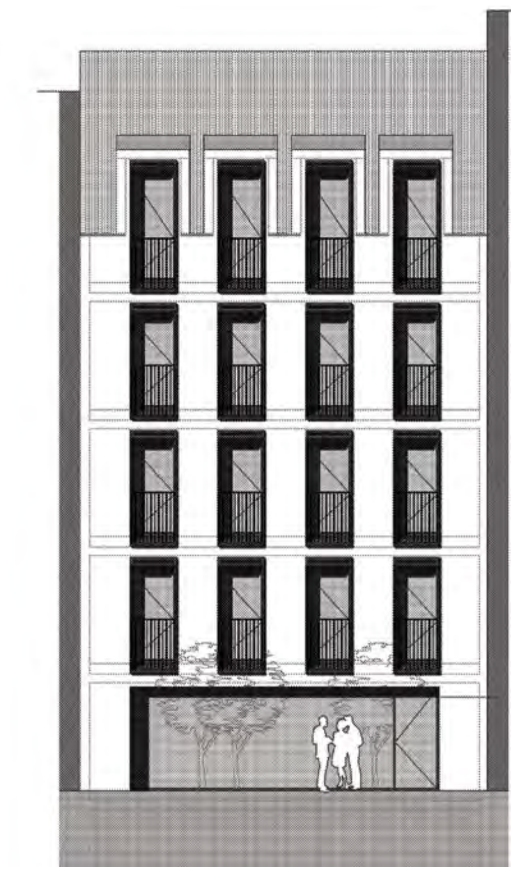
variant 3

Variant 1 | Vertical, storey-high ventilation opening

Variant 3 | This variant is based on the studies by Mr. Junghans



North façade | Street side

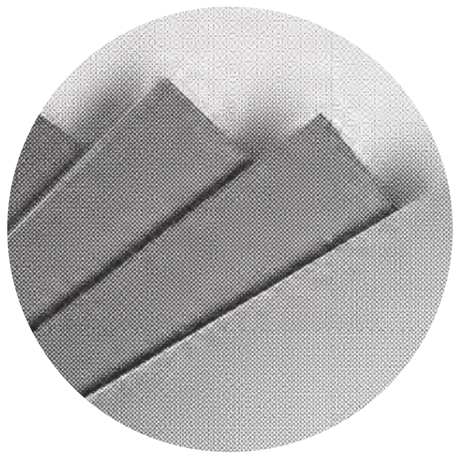


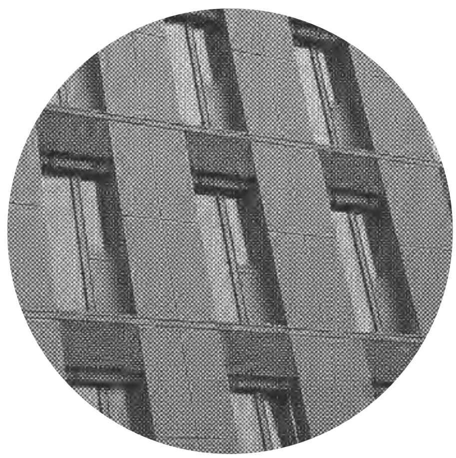
South façade | Courtyard side

03.5.1 Integrated Ventilation

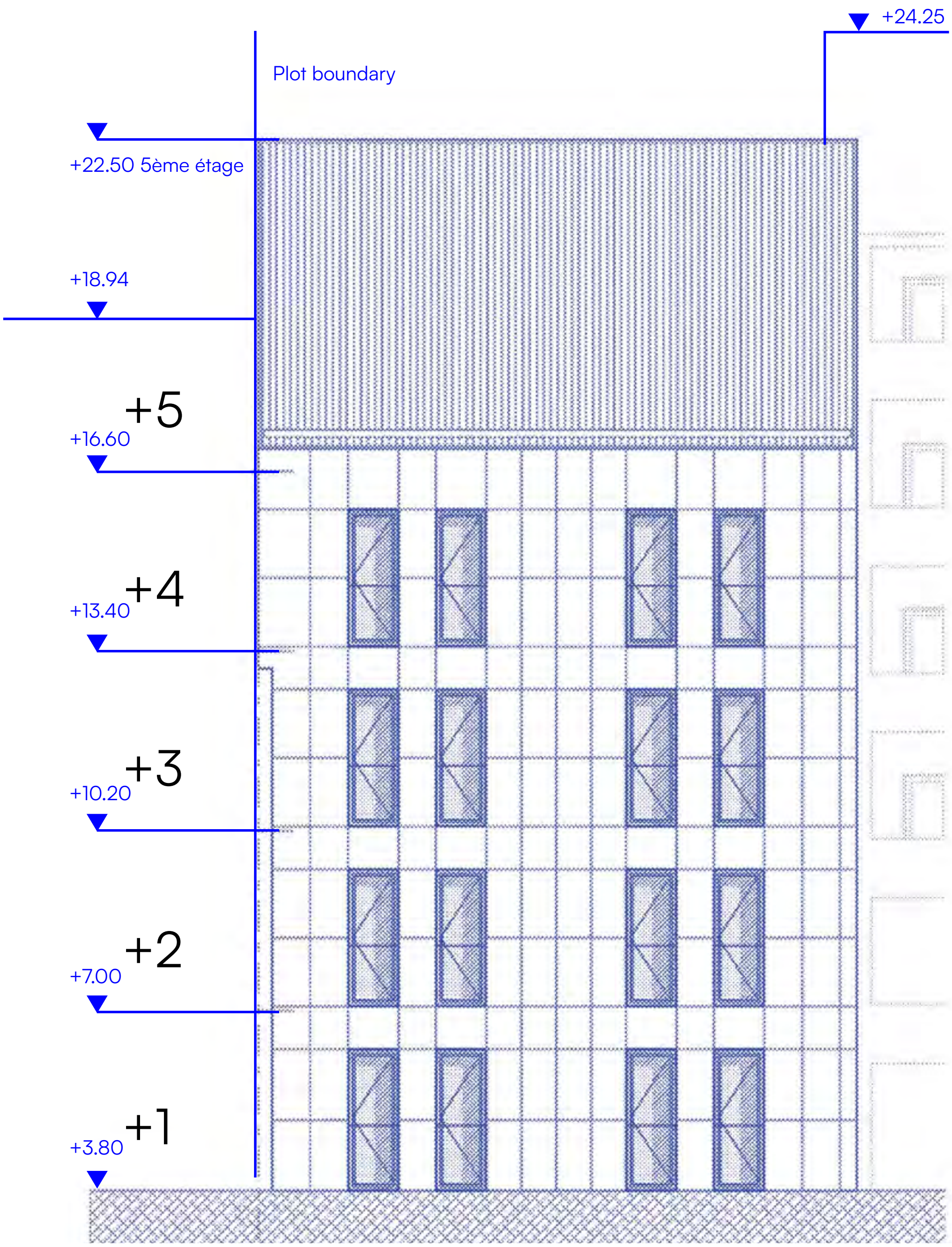
PV modules will be installed on the roof and on the south façade. Architectural PV modules will be used; these have been developed as premium components for the construction industry to meet the requirements of energy efficiency, design, and quality in solar façades, for public, commercial, and residential buildings.

With the innovative design of CIGS thin-film modules, SKALA offers a uniform, frameless surface in a consistent color. The unique rear rail system enables a form-fit installation of the system without visible clamping of the front glass. As a result, SKALA solar modules provide a smooth and elegant glass surface.





Example of a façade with PV modules



South façade | Helix Inner Courtyard

Fig.6 | Shading on January 1st at 12:30PM

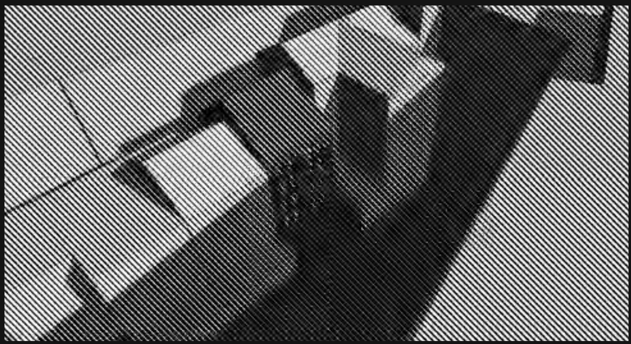


Fig.7 | Shading on March 1st at 12:30PM

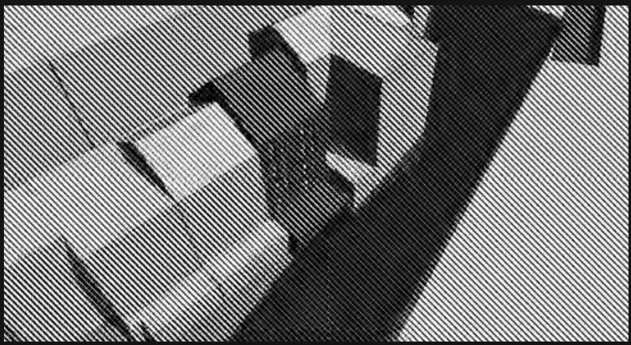


Fig.8 | Shading on May 1st at 12:30PM

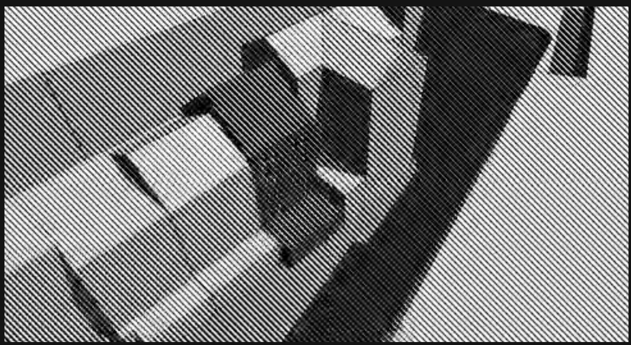


Fig.9 | Shading on July 1st at 12:30PM

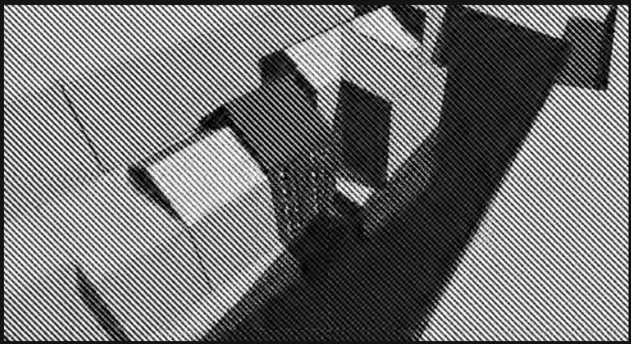


Fig.10 | Shading on September 1st at 12:30PM

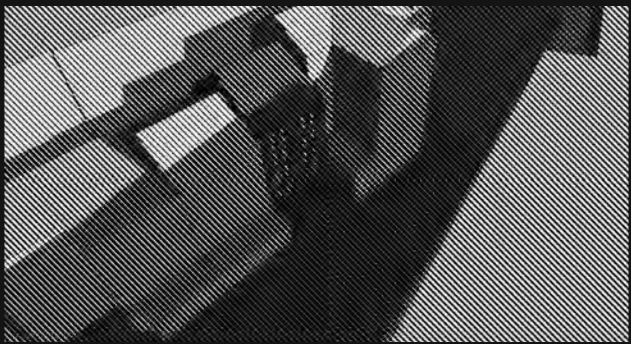


Fig.11 | Shading on November 1st at 12:30PM

03.6
Entrance Façade

Windows | Wood - Aluminium System (Upper Floors)

Wood - aluminum windows are a premium choice for modern building projects that aim to combine durability, aesthetics, and sustainability. This window system consists of a robust wooden interior and a weather-resistant aluminum exterior layer.

Construction and Materials

• Interior: The inner part of the window is made of high-quality wood. Commonly used wood types include oak, pine, or larch, valued for their natural insulation properties and aesthetic qualities.

• Exterior: The outside is clad with an aluminum shell that protects the wood from weathering and increases the window's longevity.

Durability

• Robustness: The combination of wood and aluminum makes these windows extremely durable. Aluminum protects the wood from moisture, UV radiation, and other harmful environmental influences, allowing the windows to last for many decades.

• Low maintenance: Thanks to the external aluminum layer, the windows require minimal maintenance. The aluminum does not need to be painted and is corrosion-resistant.

Sustainability

• Longevity: Due to their robust construction and high-quality materials, wood - aluminum windows have a very long service life. This reduces the need for frequent replacement and helps conserve resources.

• Resource efficiency: Wood is a renewable raw material, and the production of wood - aluminum windows ensures that the wood used comes from sustainable forestry.

• Energy efficiency: These windows offer excellent thermal and acoustic insulation. This improves the building's energy performance, reduces heating and cooling demand, and contributes to lowering CO_2 emissions.

Aesthetics and Design

• Variety: Wood - aluminum windows are available in a wide range of designs and colors. The natural beauty of wood adds warmth and elegance to interior spaces, while the aluminum exterior provides a modern and refined appearance.

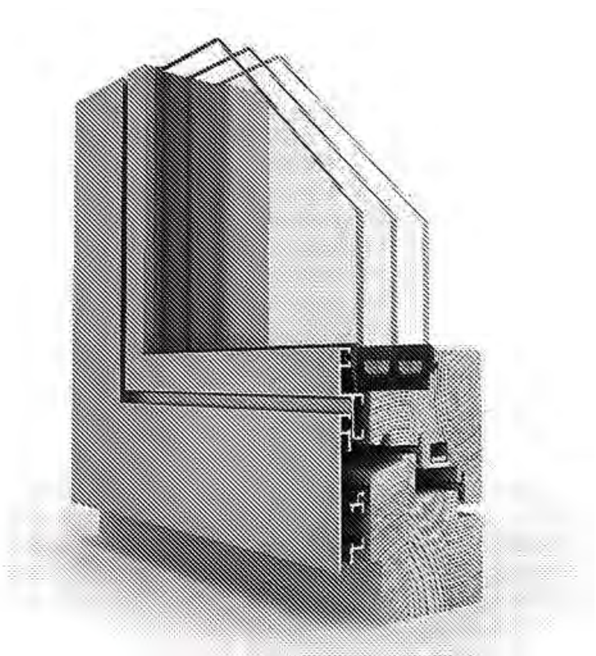
• Customization: The windows can be individually adapted to architectural requirements and personal preferences. Various wood species, stains, and colors are available, as well as different surface finishes for the aluminum.

Advantages

• Durability and low maintenance: The combination of wood and aluminum ensures an exceptionally long lifespan while significantly reducing maintenance efforts.

• Sustainability: The use of sustainable materials and high energy efficiency make these windows an environmentally friendly choice.

• Aesthetics: The natural warmth of wood combined with the modern look of aluminum creates an appealing aesthetic suitable for many architectural styles.

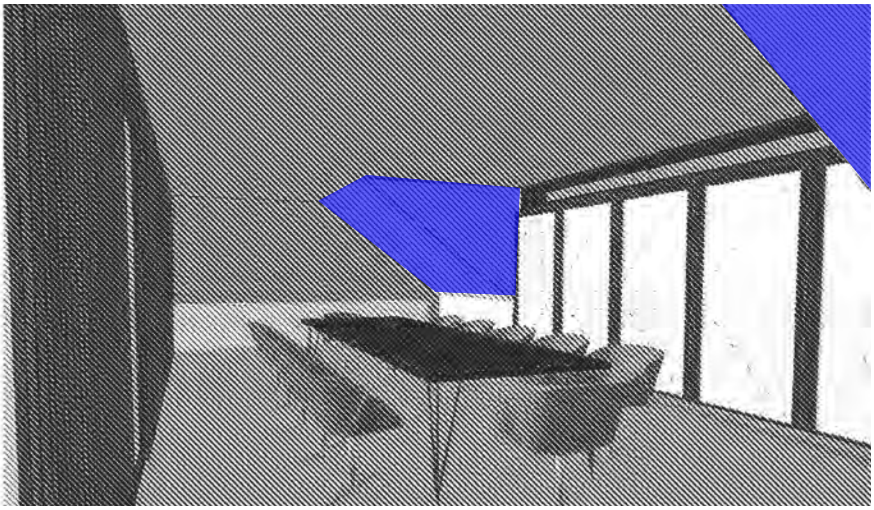


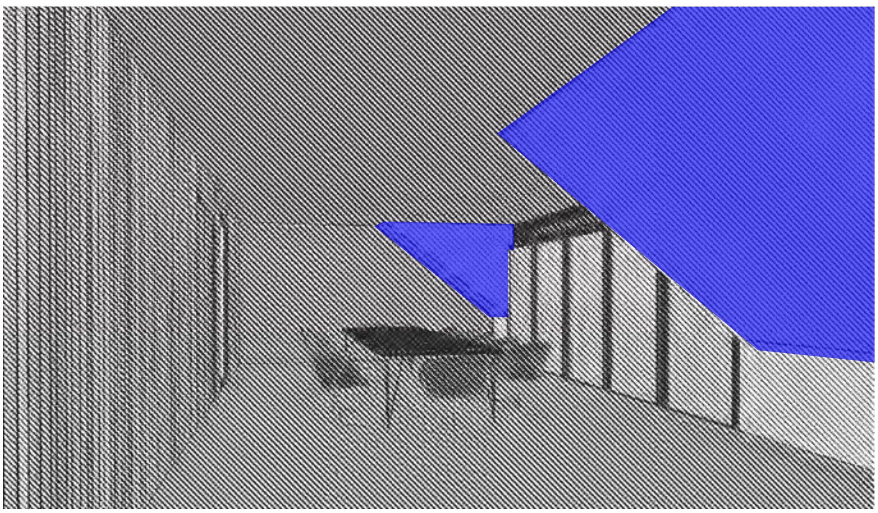
Wood - aluminum windows are therefore an excellent investment for any building that values durability, sustainability, and high-quality design. They combine the advantages of both materials while contributing to environmental conservation.

03.7
Roof

The building is topped with a classic gable roof clad in zinc. With its steep pitch of 36°, this roof form is particularly well suited to efficiently drain rainwater, especially in response to the increasing frequency of heavy rainfall events.

The roof structure is designed as a traditional rafter system, and dormers are planned at attic level to enhance both the spatial quality and usability of the interior spaces.

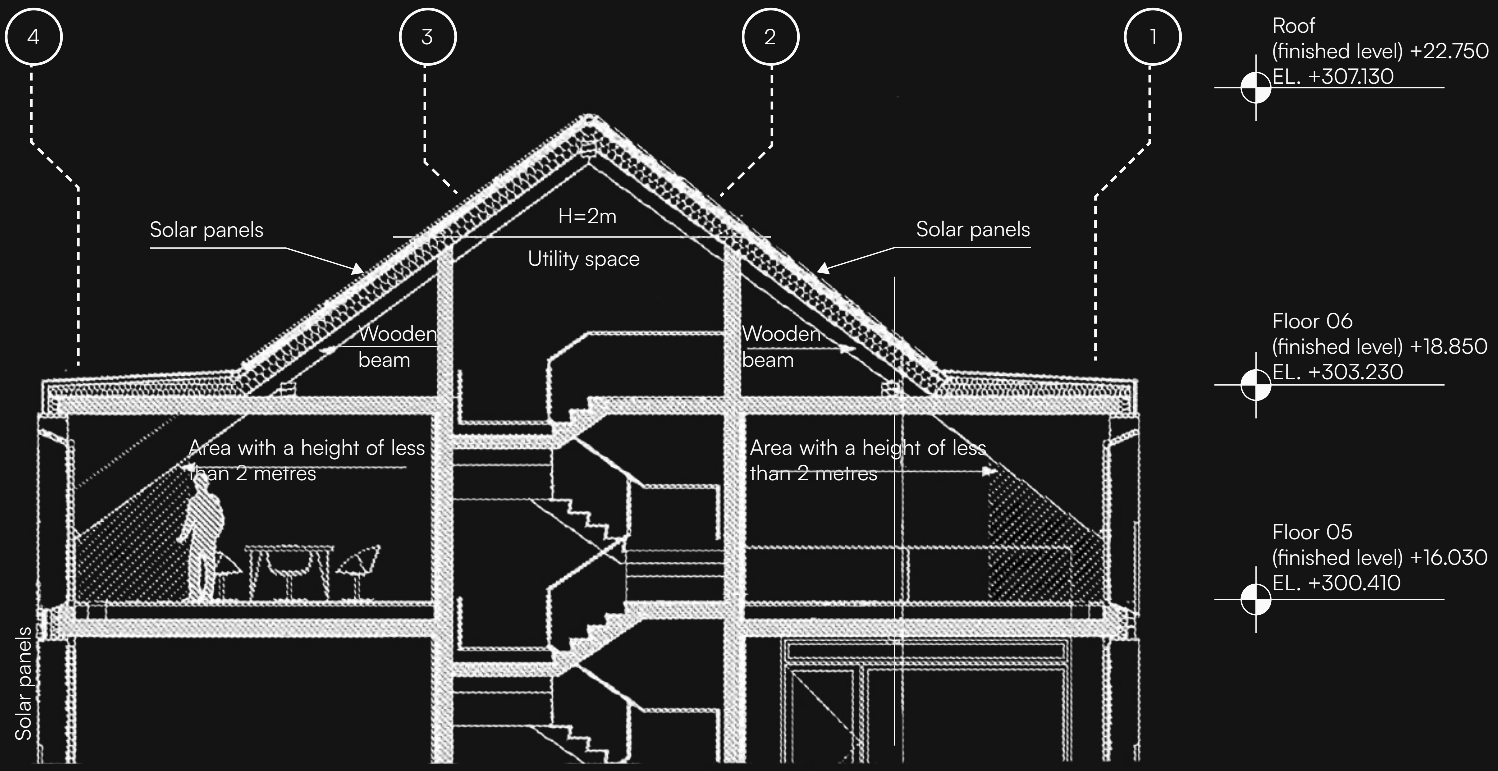


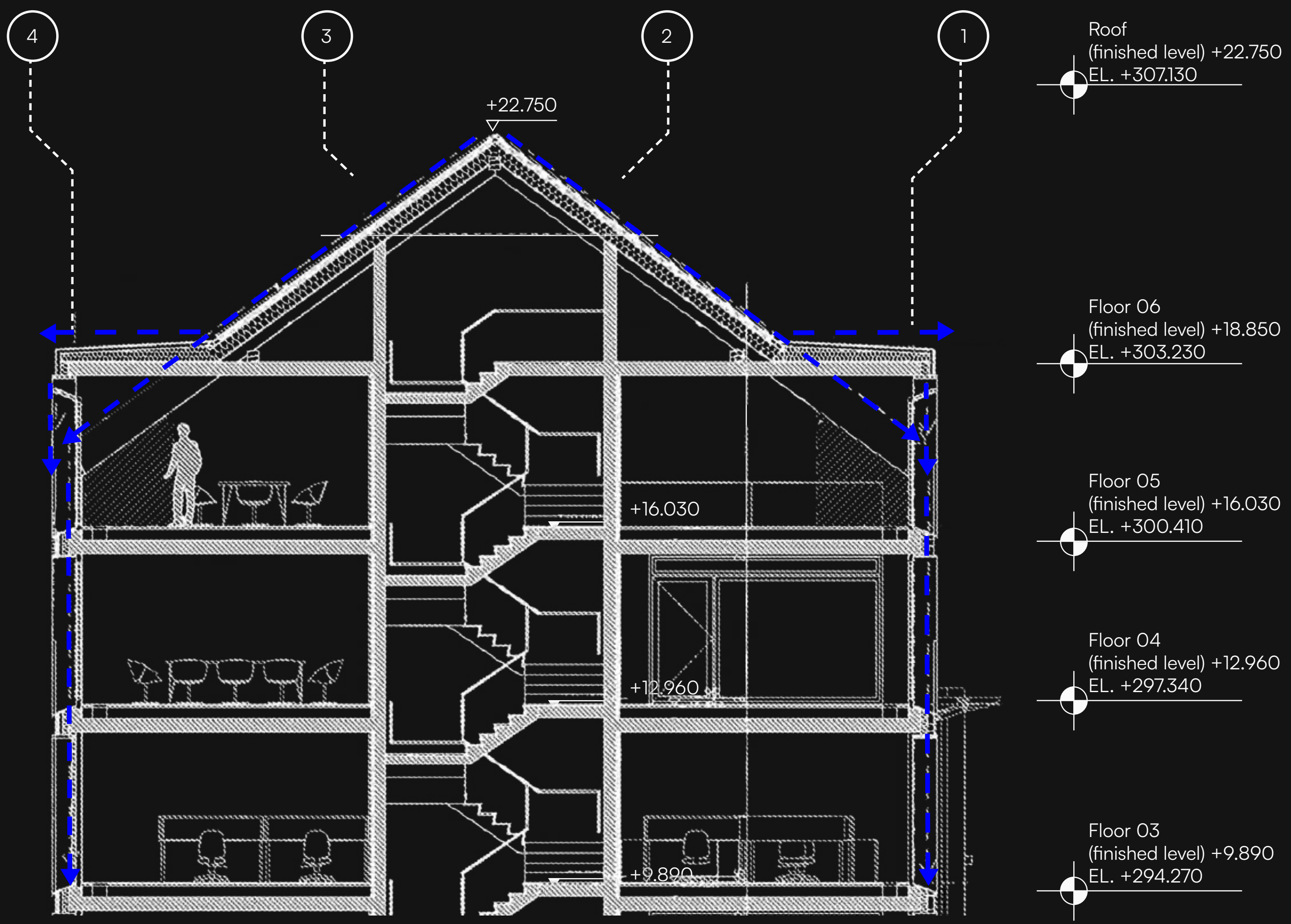


The rendering shows the new dormer.

03.8
Roof Drainage

Rainwater must be drained in a controlled manner. This is handled by the roof drainage system. The required dimensions of the gutters and downpipes are determined based on the roof area and the local rainfall intensity.

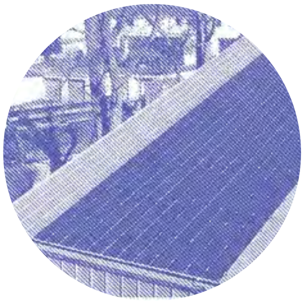

4
3
2
1
Roof
(finished level) +22.750
EL. +307.130
Solar panels
H=2m
Utility space
Solar panels
Wooden beam
Wooden beam
Floor 06
(finished level) +18.850
EL. +303.230
Area with a height of less than 2 metres
Area with a height of less than 2 metres
Floor 05
(finished level) +16.030
EL. +300.410
Solar panels

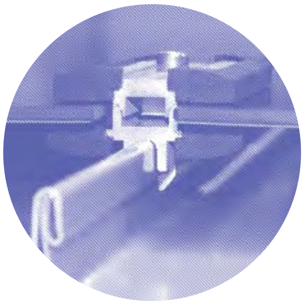

4
3
2
1
+22.750
+16.030
+12.960
+9.890
Roof
(finished level) +22.750
EL. +307.130
Floor 06
(finished level) +18.850
EL. +303.230
Floor 05
(finished level) +16.030
EL. +300.410
Floor 04
(finished level) +12.960
EL. +297.340
Floor 03
(finished level) +9.890
EL. +294.270

03.9
PV Modules Roof

Correct and professional installation, as well as the visual integration of the photovoltaic system, is essential. Only when the solar installation is properly coordinated with the metal or zinc roof can potential issues be avoided. The individual photovoltaic modules are quickly and securely fixed using specially developed module and seam clamps, while the frameless modules integrate seamlessly into the overall appearance of the building.

The result is a safe and architecturally refined solution that meets the highest design and technical standards. In total, the roof provides a photovoltaic area of approximately 80 m².



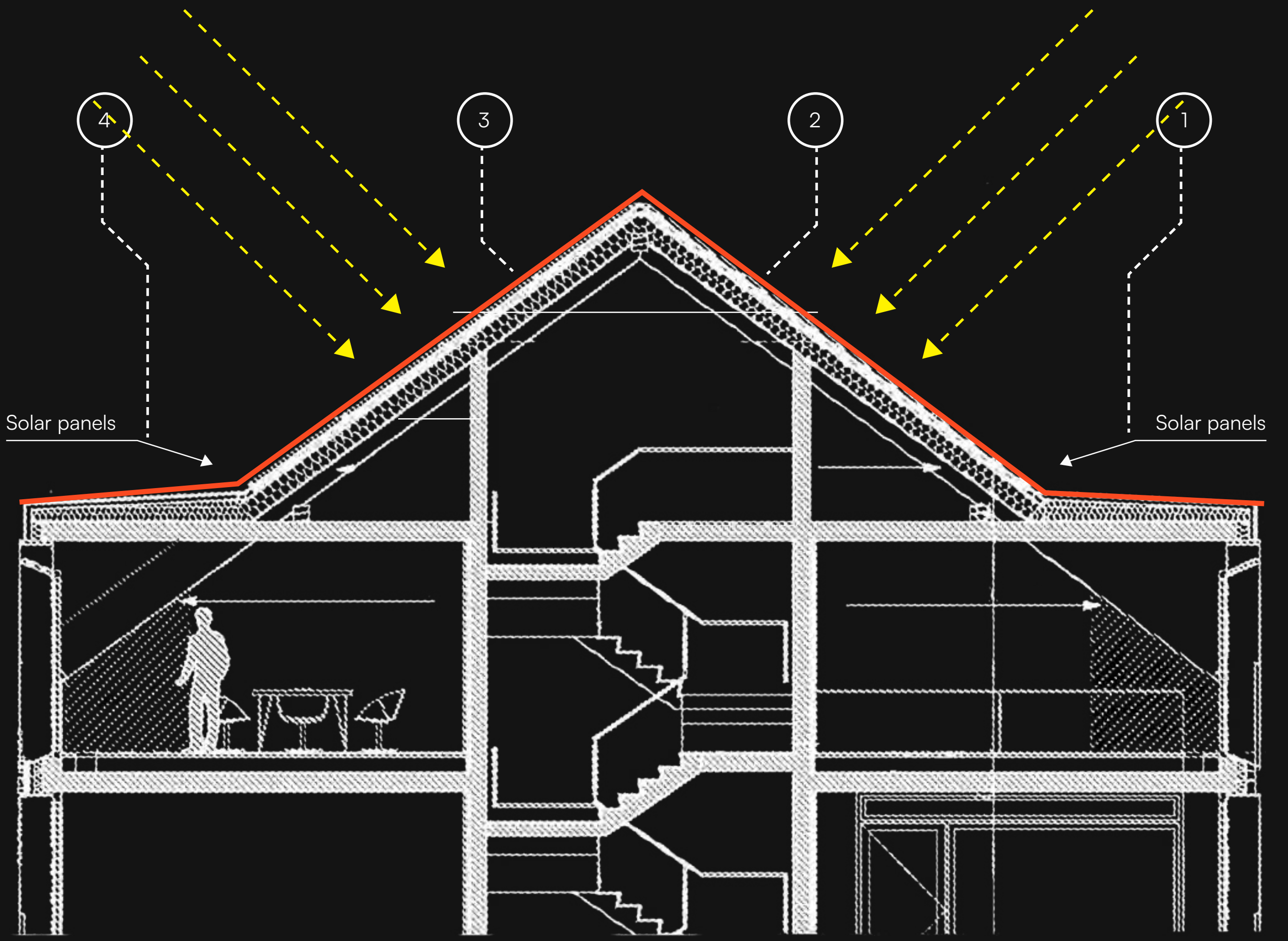


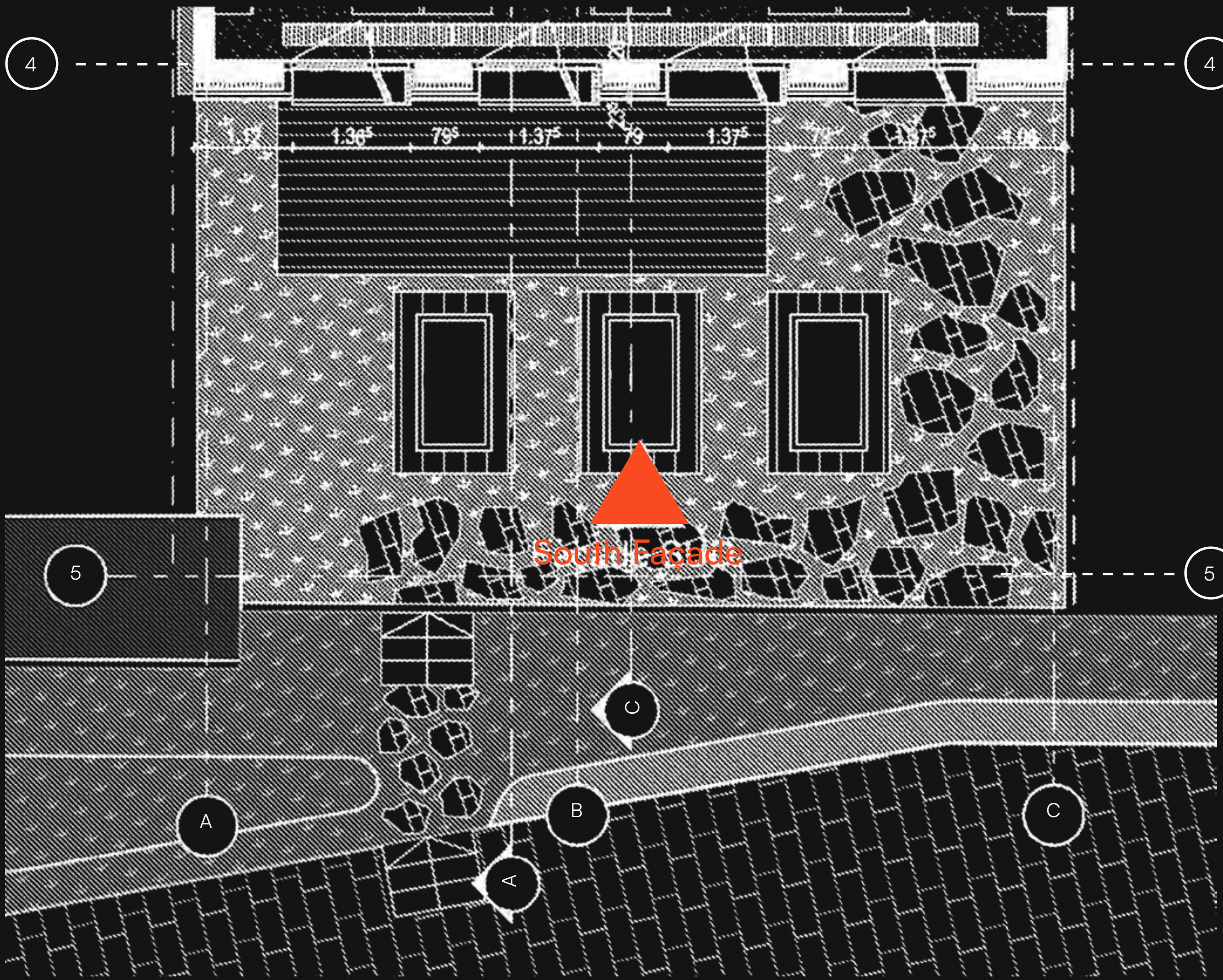
03.10
Roof Terrace

The roof terrace is intended to create a direct connection to the Helix. This means that the Epernay building can also be accessed via the roof terrace of the Helix.

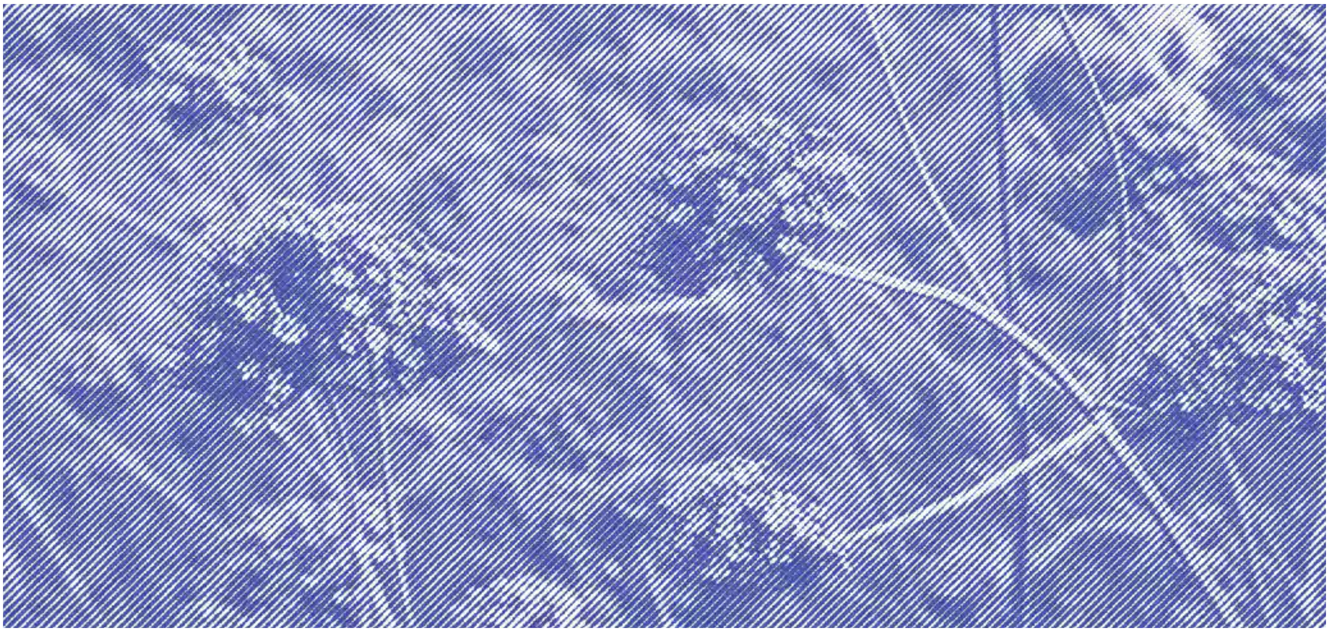
Terrace Greening with Irrigation System

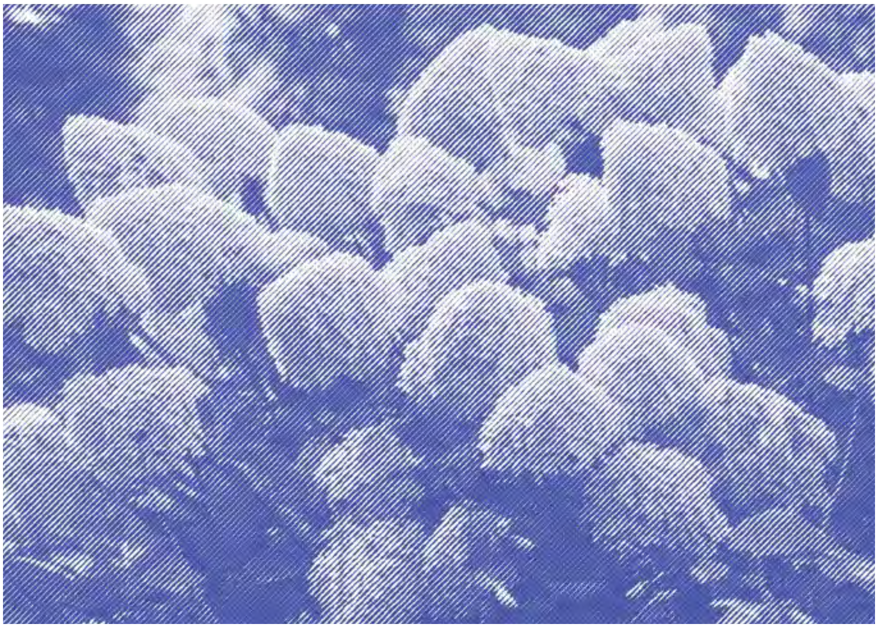
Various green areas are essential for the urban climate. In heterogeneous urban ecosystems, trees fulfill several biophysical functions. First, through their expansive canopies, trees can reduce the amount of short-wave radiation reaching the ground by up to 90 percent. This effect is particularly significant in summer, when deciduous trees in temperate and cold climate zones carry their leaves. Second, trees cool their immediate surroundings by approximately 1 to 8 degrees Celsius, while increasing relative humidity. This cooling effect is achieved through transpiration, meaning the amount of water released through the leaves during the process of photosynthesis.


4
3
2
1
Solar panels
Solar panels



4
4
1.36⁵
79⁵
1.37⁵
79
1.37⁵
South Façade
5
5
A
B
C
A
C





Pergola

In line with the current requirements of the German Sustainable Building Council (DGNB), increasing emphasis is being placed on sustainable and biodiversity-enhancing measures in construction projects. In this context, vertical greening, such as in the form of a pergola, is being considered in addition to conventional terrace planting. This measure serves not only an aesthetic purpose but also provides functional benefits for the ecological performance of the building.

Vertical greening, such as a pergola covered with climbing plants, contributes to ecological and social sustainability in multiple ways. By greening façades or vertical structures, the overall green surface area is increased, which in turn promotes biodiversity. Plants provide habitats and food sources for insects, birds, and small animals, thereby strengthening biodiversity in the urban environment.

Furthermore, planted areas improve the microclimate by cooling the surroundings through evaporation and by binding air pollutants and CO_2. Vertical greening systems can also reduce noise and enhance user well-being through their visual and thermal effects.

Maximizing the building's greening, both horizontally (e.g. on terraces) and vertically, supports the goal of achieving the highest possible level of biodiversity. This is a key aspect of the DGNB criteria, which aim to minimize environmental impact while maximizing ecological and social added value.

04
Low-Tech
& Energy Concept

04.1
Low-Tech Strategy

Controlled Natural Ventilation

Recent office buildings in Central Europe have shown that high indoor comfort can be achieved without complex building technology. Epernay follows this low-tech approach by relying on controlled natural ventilation instead of mechanical ventilation systems with heat recovery.

Fresh outdoor air is supplied as needed through natural ventilation openings, which are automatically regulated by intelligent control software. This ensures thermally comfortable spaces and consistently high indoor air quality throughout the year.

Compared to conventional mechanical ventilation systems, this strategy offers clear advantages:

- Reduced maintenance requirements
- Simple and robust installation
- Lower construction and operating costs

Enhanced Ventilation Strategy

The proposed system further develops this proven approach through innovative technologies.

• Predictive control (Model Predictive Control): anticipates future indoor conditions and optimizes ventilation performance accordingly.

• Plug-and-play automation: enables fast, efficient installation while avoiding complex commissioning processes.

Reference Project

This energy concept has been successfully implemented in the 22/26 Building in Lustenau, Austria (2013). As one of the first office buildings with demand-controlled natural ventilation, it operates without heating, cooling, or mechanical ventilation systems, demonstrating the long-term viability of a low-tech, energy-efficient design approach.

Photo: Hüber, Baumschlager Eberle Architekten

Building Envelope

A high-performance building envelope is essential to support the proposed low-tech ventilation concept. Epernay is therefore designed with an exceptionally well-insulated and airtight envelope, ensuring thermal stability, comfort, and energy efficiency.

High-quality glazing with very low U-values and optimized solar control limits heat loss while allowing controlled solar gains. Walls and roof elements achieve excellent thermal performance, and a high level of airtightness further reduces energy demand and ensures reliable indoor comfort throughout the year.

Glazing | U-value 0.4 W/m²K (glass),
U-value 0.5 W/m²K (window frame),
SHGC (g-value) 40%

Building envelope | Roof: 0.1 W/m²K

Walls: 0.12 W/m²K

Airtightness | < 0.6 1/h (n50)

Thermal Comfort

Indoor comfort conditions are defined by stable temperatures in winter and climate-adaptive comfort criteria in summer, following internationally recognized standards. This approach allows interior spaces to remain comfortable without reliance on intensive mechanical systems.

Internal Thermal Mass

The automated natural ventilation strategy relies on a higher level of internal thermal mass than conventional office buildings. This thermal mass absorbs and releases heat over time, smoothing temperature fluctuations and stabilizing indoor conditions across several days.

In winter, thermal mass helps retain warmth within a comfortable range; in summer, it prevents overheating by buffering peak temperatures.

Epernay primarily uses natural and low-impact materials to provide this thermal mass. Internal partition walls incorporate clay construction panels, while exposed CLT ceilings contribute significantly to heat storage. Wherever technically feasible, materials with high embodied CO_2, such as concrete and masonry, are largely avoided.

Façade and Ventilation Openings

The ventilation flaps are integrated into the façade and discreetly protected by a narrow outer cavity. This design offers multiple benefits:

- Improved acoustic performance through additional sound insulation
- Reduced cold air downdraught in winter when ventilation openings are active

The result is a façade that supports natural ventilation while maintaining acoustic comfort and thermal quality.

Backup Heating and Cooling

The automated natural ventilation concept significantly reduces heating and cooling demand compared to conventional systems with mechanical ventilation and heat recovery. However, during extreme weather conditions, a limited backup system is required.

Epernay uses a heat pump system for backup heating, replacing the electrical resistance heaters used in earlier reference projects. The heat pump also serves building zones not covered by natural ventilation.

Primary heating energy is drawn from the geothermal capacity of the ground via the building's foundations and base slab. Cooling is achieved through the lower temperature of the ground, providing an efficient and low-maintenance solution that has been widely proven in practice.

Backup heating is delivered through discreet floor-integrated convectors, ensuring comfort without compromising spatial or architectural quality.

Summer Comfort

Simulation results indicate that, on particularly hot days and under high occupancy, south-facing rooms may exceed comfort temperatures without additional measures. To address this, ceiling fans are integrated into the design.

By increasing air movement, ceiling fans significantly enhance perceived comfort during summer periods, allowing comfortable conditions to be maintained without energy-intensive cooling systems.

Solar Protection

Windows are positioned as deep as possible within the façade reveals, creating an integrated, fixed solar shading effect. This architectural solution functions as a permanent sun protection system, requiring no maintenance or operational input.

Comfort assessments based on ASHRAE 55 confirm that the chosen geometry effectively prevents overheating. In addition, an internal glare protection system is provided to ensure visual comfort for users.

Performance Assessment

The building's thermal behavior has been evaluated using dynamic simulations. This approach allows a detailed analysis of indoor comfort under realistic usage and climate conditions.

Key parameters assessed include indoor air temperature, operative temperature, humidity levels, thermal comfort, and CO_2 concentration. The simulations also incorporate individual building control strategies to reflect real operational conditions.

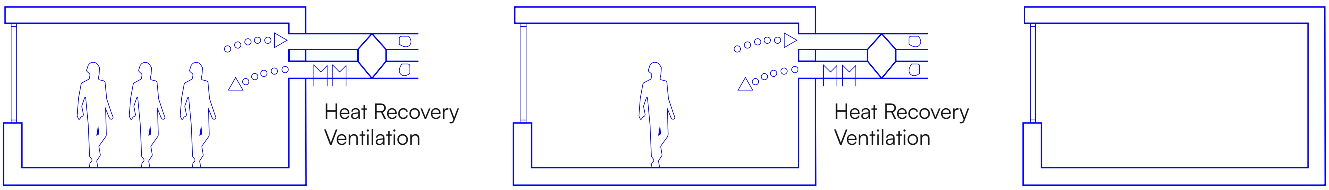
Performance Assessment

The results presented in this report reflect the best knowledge and assumptions available at the time of analysis. Actual performance may differ from simulated values, as outcomes depend on multiple variables such as climate data, envelope performance, building geometry, occupancy patterns, internal heat gains, scheduling assumptions, and material properties.

04.2
Principle | Low-Tech Ventilation

Conventional Ventilation
(Mechanical Ventilation with Heat Recovery)

Conventional office buildings typically rely on permanent mechanical ventilation systems. Fresh air supply is dimensioned for maximum occupancy and operates continuously whenever spaces are in use. Heat recovery systems are integrated to reduce energy losses, but this approach requires complex technology, continuous operation, and higher maintenance effort.



High density occupancy
High volume flow rate

Low density occupancy
High volume flow rate

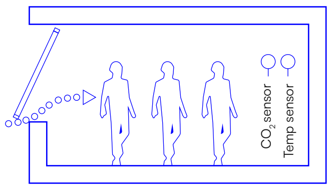
Night (no ventilation)

Low-Tech or 22/26 Technology
(Controlled Natural Ventilation)

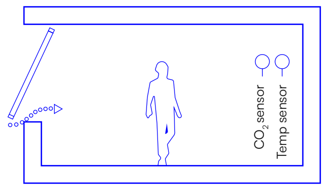
Epernay follows a demand-driven, low-tech ventilation strategy that responds directly to real indoor conditions. Temperature, humidity, and CO_2 concentration are continuously monitored, allowing fresh air to be supplied only when and where it is actually needed.

During winter operation, natural ventilation is activated only when indoor air quality requires it. Fresh air is supplied exclusively when spaces are occupied, minimizing heat losses while maintaining healthy indoor conditions.

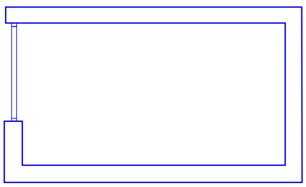
Demand Controlled Ventilation



High density occupancy
High volume flow (natural vent.)



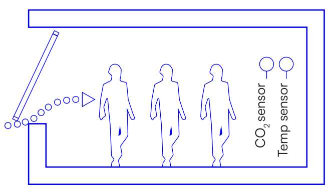
Low density occupancy
Low volume flow (natural vent.)



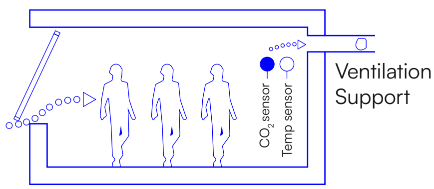
Night (no ventilation)

Support of Natural Ventilation

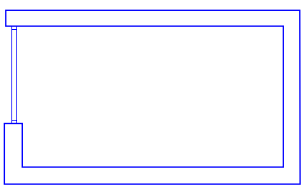
If natural ventilation alone is insufficient, it is selectively supported by mechanical exhaust air. This system is activated only when CO_2 levels exceed defined comfort thresholds, ensuring reliability without permanent mechanical operation.



High density occupancy
High volume flow (natural vent.)



High density occupancy
Ventilation support when CO_2 levels too high

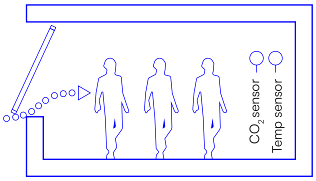


Night (no ventilation)

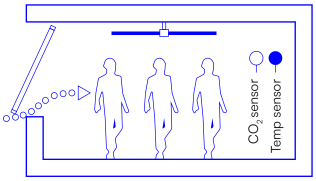
Summer Operation

In summer, natural ventilation is used whenever outdoor temperatures allow. Ceiling fans enhance comfort during warmer periods by increasing air movement. When a risk of overheating is predicted, night ventilation is activated to cool the building mass and stabilize indoor temperatures.

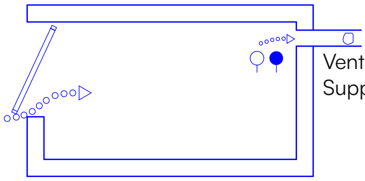
Ventilation Summer



High density occupancy
High volume flow (natural vent.)



High density occupancy
Fan when room temperature is high



Night ventilation when overheating is expected

04.3
Night Ventilation

Assessment Method

Summer indoor temperatures were assessed in accordance with DIN EN 16798 and DIN EN 7730. The simulations focus on office spaces with high occupancy and south-facing orientation, using climate data provided by the German Weather Service (DWD).

Two climate periods were analyzed:
- 2023—2030, based on DWD climate data for 2023
- 2031—2060, based on projected DWD climate data for 2050

The evaluated scenarios assume an office or meeting room with a south-facing orientation and an occupancy of eight people.

Comfort Categories (DGNB)

The assessment follows the comfort classifications defined by DGNB:
- Category I: Enhanced comfort
- Category II: Good comfort (minimum requirement)

According to DGNB guidelines, up to 5% of occupied hours during the cooling season may exceed the defined comfort range.

Night Ventilation Performance

The simulations demonstrate that night ventilation with an air change rate of 1.0 h^{-1} is sufficient to maintain indoor temperatures within the comfort range. This applies both to current climate conditions and to projected future temperature scenarios.

Even under increased outdoor temperatures, the evaluated spaces meet DGNB Category I (enhanced comfort) requirements.

Evaluation Summary

- Night ventilation with an air change rate of 1.0 h^{-1} effectively stabilizes indoor temperatures within the comfort range.
- The comfort criteria of DGNB Category I are met for both present-day and future climate scenarios.

Note on Simulation Updates

Since 23 February 2024, an improved version of the building automation system has been used in the simulations. The night ventilation algorithm has been refined and is now activated more consistently during summer periods compared to earlier versions. As a result, minor deviations from previous simulation results may occur.

“Increasing night ventilation from 1 to 3 ACH significantly improves summer comfort and reduces overheating.”

Summer Comfort Assessment | Night Ventilation (ACH $3h^{-1}$)

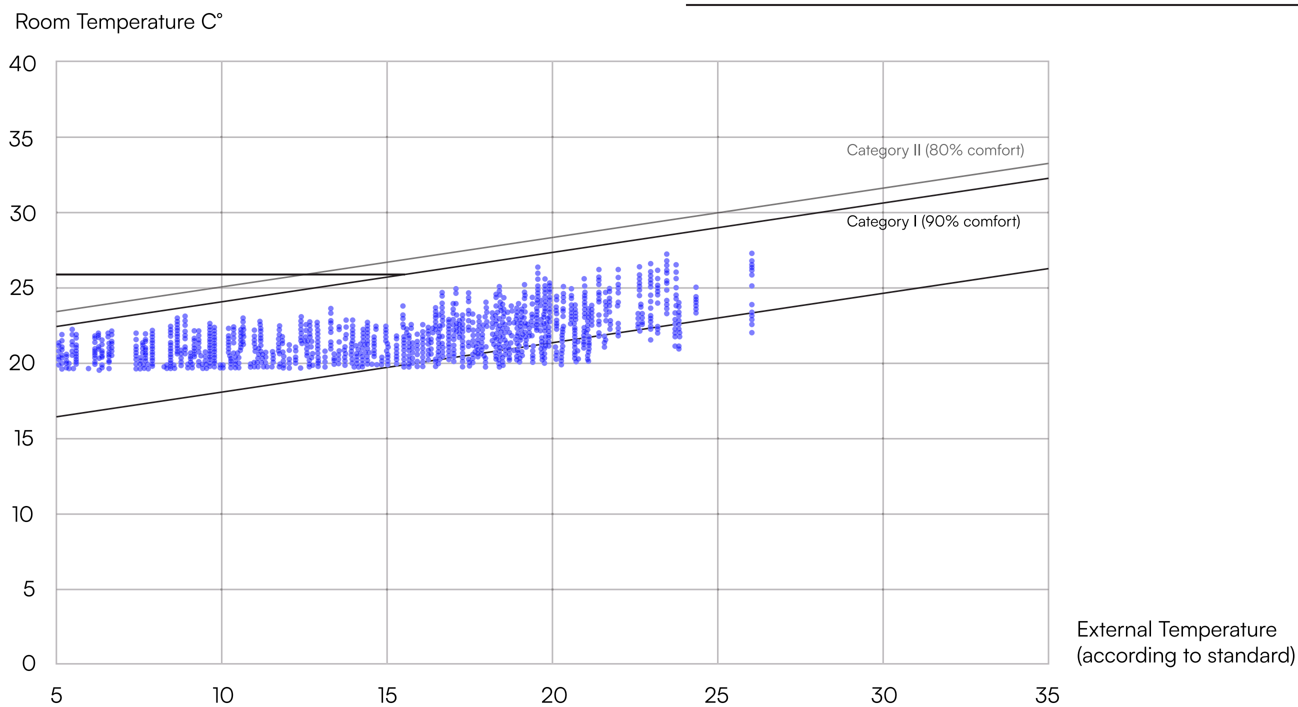
- Standards: DIN EN 16798/DIN EN 7730
- Space: South-facing office
- Occupancy: 8 people
- Climate data: German Weather Service (DWD), 2023
- Ventilation strategy: Night ventilation
- Air change rate: $3h^{-1}$

Comfort categories (DGNB):

- Category I: Increased comfort
- Category II: Good comfort (min. requirement)

According to DGNB, up to 5% of occupied hours during the cooling season may exceed the comfort limits.

	Fan	# hours/year	Kh (cooling)	% above
Category I	No Fan	3	1.0	0.1
	Fan 0.3 m/s	0	0.0	0.0
	Fan 0.5 m/s	0	0.0	0.0
Category II	No Fan	0	0.0	0.0
	Fan 0.3 m/s	0	0.0	0.0
	Fan 0.5 m/s	0	0.0	0.0



Summer Comfort Assessment | Night Ventilation (ACH 1h⁻¹)

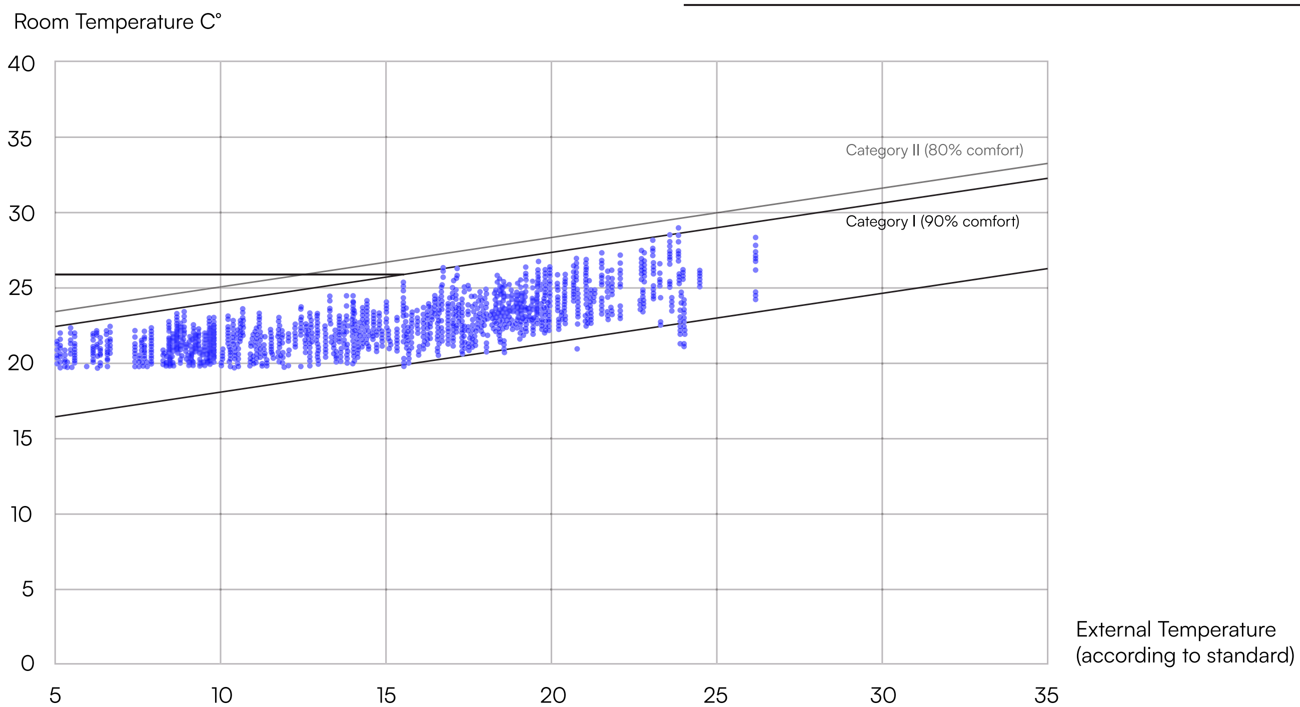
- Standards: DIN EN 16798/DIN EN 7730
- Space: South-facing office
- Occupancy: 8 people
- Climate data: German Weather Service (DWD), 2023
- Ventilation strategy: Night ventilation
- Air change rate: $1h^{-1}$

Comfort categories (DGNB):

- Category I: Increased comfort
- Category II: Good comfort (min. requirement)

According to DGNB, up to 5% of occupied hours during the cooling season may exceed the comfort limits.

	Fan	# hours/year	Kh (cooling)	% above
Category I	No Fan	24	10.4	0.5
	Fan 0.3 m/s	4	0.6	0.0
	Fan 0.5 m/s	0	0.0	0.0
Category II	No Fan	2	0.0	0.0
	Fan 0.3 m/s	0	0.0	0.0
	Fan 0.5 m/s	0	0.0	0.0



Summer Comfort Assessment | Future Climate Scenario (2031-2060)

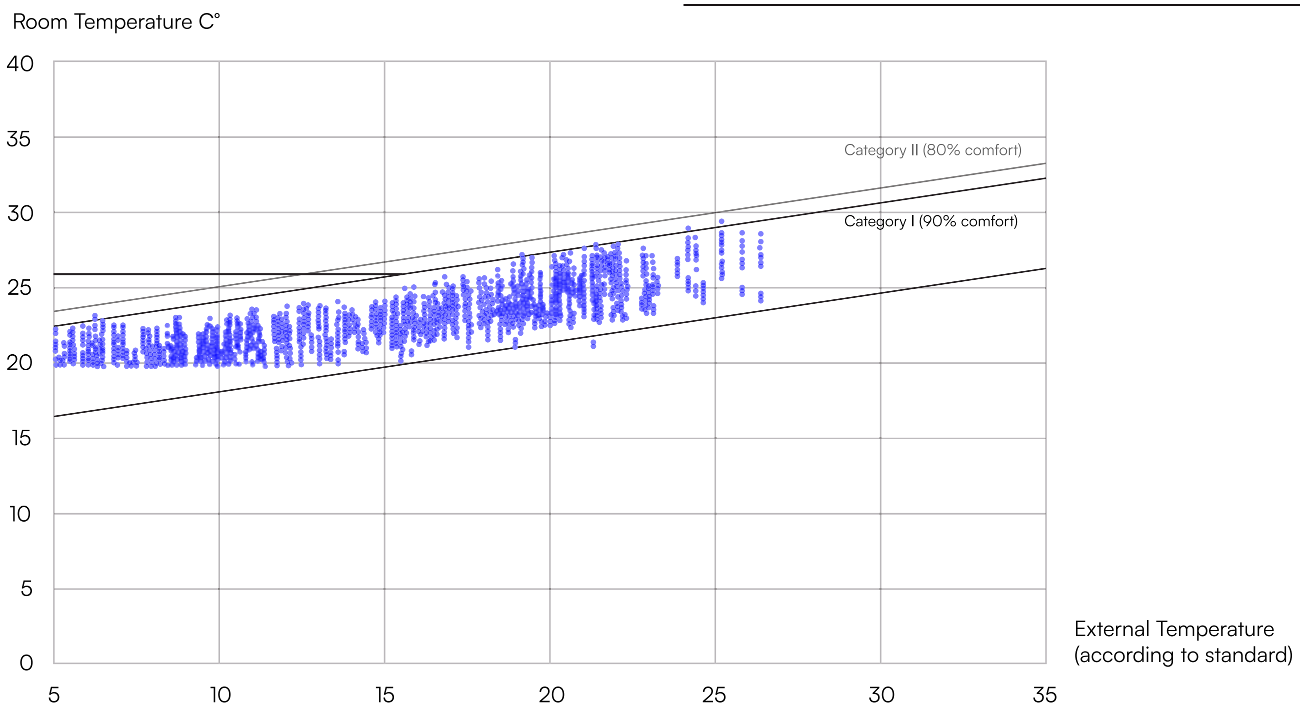
- Standards: DIN EN 16798/DIN EN 7730
- Space: South-facing office
- Occupancy: 8 people
- Climate data: German Weather Service (DWD), reference year 2050
- Ventilation strategy: Night ventilation
- Air change rate: 1h $^{-1}$

Comfort categories (DGNB):

- Category I: Increased comfort
- Category II: Good comfort (min. requirement)

According to DGNB, up to 5% of occupied hours during the cooling season may exceed the comfort limits.

	Fan	# hours/year	Kh (cooling)	% above
Category I	No Fan	37	16.5	0.8
	Fan 0.3 m/s	4	1.5	0.1
	Fan 0.5 m/s	1	0.1	0.0
Category II	No Fan	3	0.9	0.0
	Fan 0.3 m/s	0	0.0	0.0
	Fan 0.5 m/s	0	0.0	0.0



04.4
Control | Ventilation Openings

Winter Operation (Heating Season)

A demand-driven, controlled natural ventilation strategy is implemented. Ventilation openings are partially opened when indoor CO_2 concentrations exceed the defined setpoint of 800 ppm, creating a controlled and minimal air exchange. Openings are adjusted progressively according to demand.

When required, the natural airflow is selectively supported by mechanical exhaust ventilation. This support increases only when rising CO_2 levels indicate higher ventilation demand.

If necessary, short periods of intensified ventilation can be scheduled at defined times during the day.

Summer Operation (Cooling Season)

During summer, the building is passively cooled through controlled natural night ventilation. Cooler night-time temperatures are used to cool the internal thermal mass, stabilizing indoor conditions during the following day.

Night ventilation is activated when elevated temperatures are forecast for the coming three days and is deactivated when cooler daytime conditions are expected. This predictive control strategy is based on weather forecasts provided by online meteorological services.

Minimum and maximum indoor temperatures comply with recognized comfort standards (DIN EN 16798 and DIN EN 7730), including the early morning hours.

04.4.1 Assessment of Local Thermal Comfort in Naturally Ventilated Spaces

Assessment Criteria

Local thermal comfort is evaluated based on the following parameters:

- Temperature: Local indoor temperatures should not fall below 18 °C.
- Air velocity: Air speeds should remain below 0.1 m/s during winter operation in order to avoid wind chill effects.

Variant 1 | Vertical Ventilation Opening | Full Height (Floor to Ceiling) 5°C | Winter

The assessment considers a winter condition with an outdoor temperature of 5 °C. Under these conditions, the following indoor performance is achieved:

- Minimum indoor temperature: 20 °C
- Window surface temperature: 15 °C
- Heating surface temperature: 20 °C

The simulation confirms that local comfort criteria are met, even with a full-height vertical ventilation opening.

Variant 1.1 | Vertical Ventilation Opening | Full Height (Floor to Ceiling) 0°C

- Outside temperature: 0 °C
- Minimum indoor temperature: 20 °C
- Window surface temperature: 15 °C
- Heating surface temperature: 35 °

Variant 1.2 | Vertical Ventilation Opening | Full Height (Floor to Ceiling) -5°C

- Outside temperature: -5 °C
- Minimum indoor temperature: 20 °C
- Window surface temperature: 15 °C
- Heating surface temperature: 45 °

Variant 1.3 | Vertical Ventilation Opening | Full Height (Floor to Ceiling) -10°C

- Outside temperature: -10 °C
- Minimum indoor temperature: 20 °C
- Window surface temperature: 15 °C
- Heating surface temperature: 55 °

Variant 1.4 | Vertical Ventilation Opening | Full Height (Floor to Ceiling) 35°C | Summer

- Outside temperature: 35 °C
- Minimum indoor temperature: 24 °C
- Window surface temperature: 24 °C

Variant 2 | Vertical Ventilation Opening on Top 5°C

- Outside temperature: 5 °C
- Minimum indoor temperature: 20 °C
- Window surface temperature: 15 °C
- Heating surface temperature: 20 °

Variant 2.1 | Vertical Ventilation Opening on Top 0°C

- Outside temperature: 0 °C
- Minimum indoor temperature: 20 °C
- Window surface temperature: 15 °C
- Heating surface temperature: 35 °

Variant 3 | Opening Above Window on Top 5°C

- Outside temperature: 5 °C
- Minimum indoor temperature: 20 °C
- Window surface temperature: 15 °C
- Heating surface temperature: 20 °

Variant 3.1 | Opening Above Window on Top 0°C

- Outside temperature: 0 °C
- Minimum indoor temperature: 20 °C
- Window surface temperature: 15 °C
- Heating surface temperature: 35 °

Variant 3.2 | Opening Above Window on Top -5°C

- Outside temperature: -5 °C
- Minimum indoor temperature: 20 °C
- Window surface temperature: 15 °C
- Heating surface temperature: 55 °

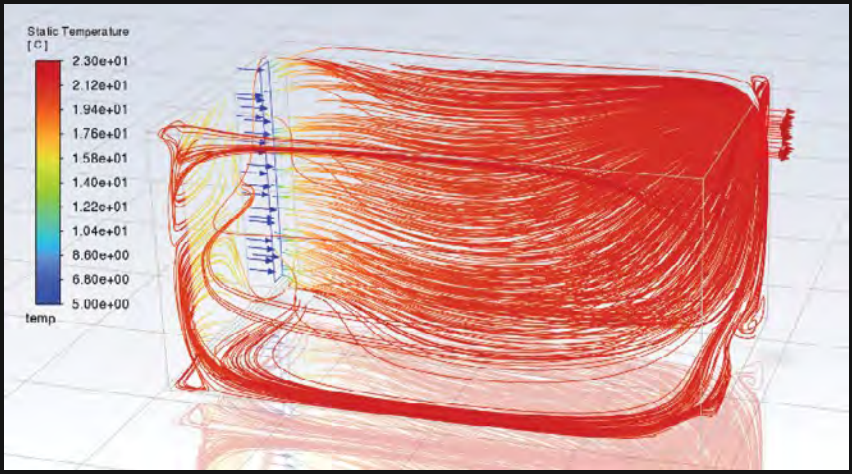
Variant 3.3 | Opening Above Window on Top -10°C

- Outside temperature: -10 °C
- Minimum indoor temperature: 20 °C
- Window surface temperature: 15 °C
- Heating surface temperature: 55 °

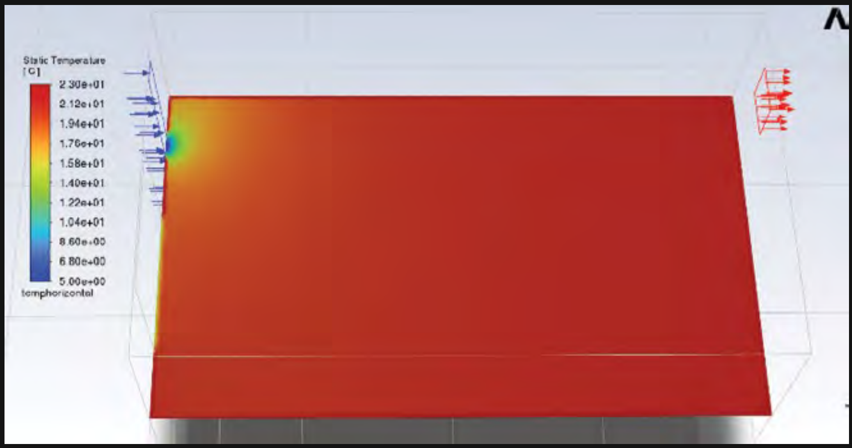
Variant 3.4 | Opening Above Window on Top 35°C Summer

- Outside temperature: 35 °C
- Minimum indoor temperature: 24 °C
- Window surface temperature: 24 °C

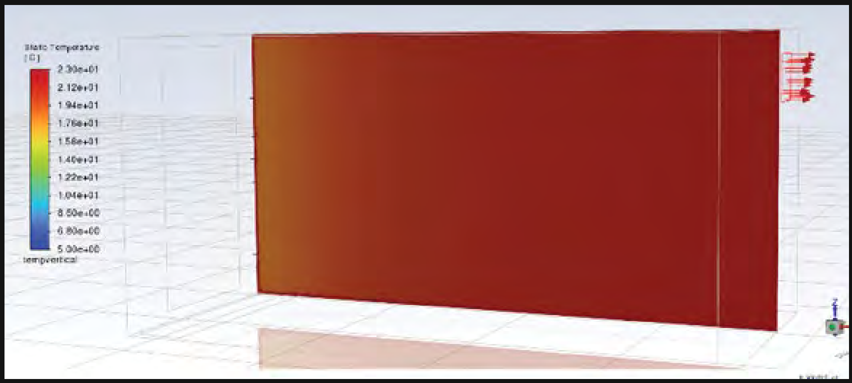
The following simulations illustrate temperature development and air movement within the spaces under natural ventilation conditions. The simulations were conducted by the University of Michigan's Taubman College of Architecture and Urban Planning.



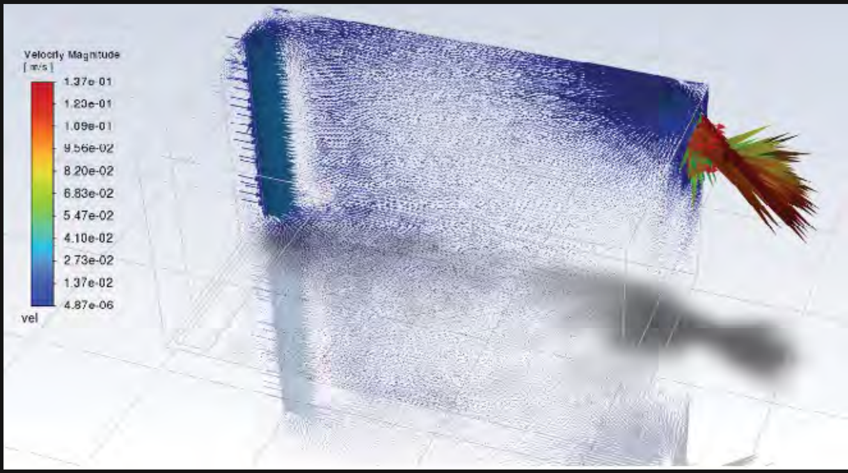
Variant 1 | Temperature Pathlines



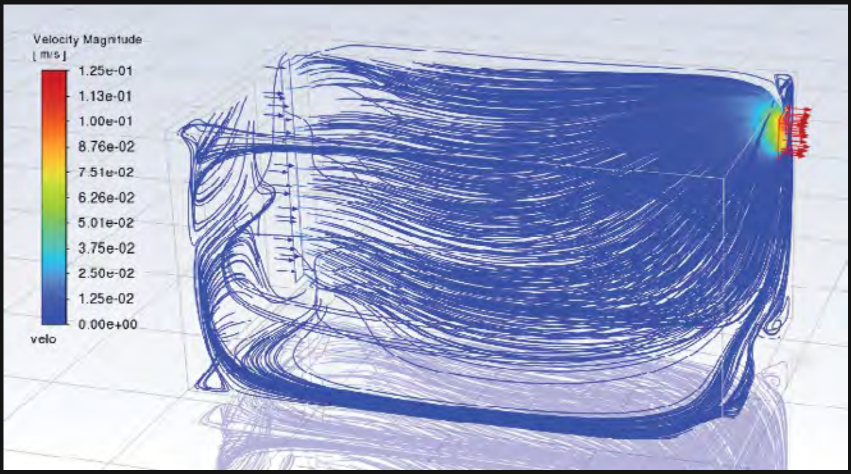
Variant 1 | Temperature Horizontal Section



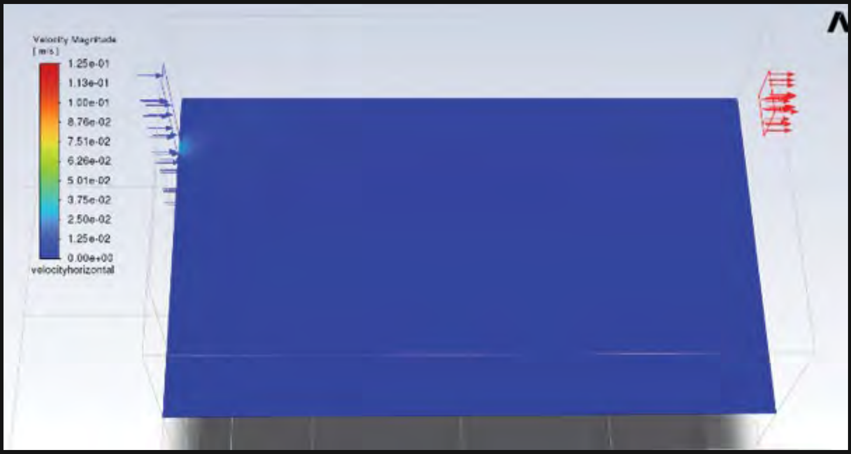
Variant 1 | Temperature Vertical Section



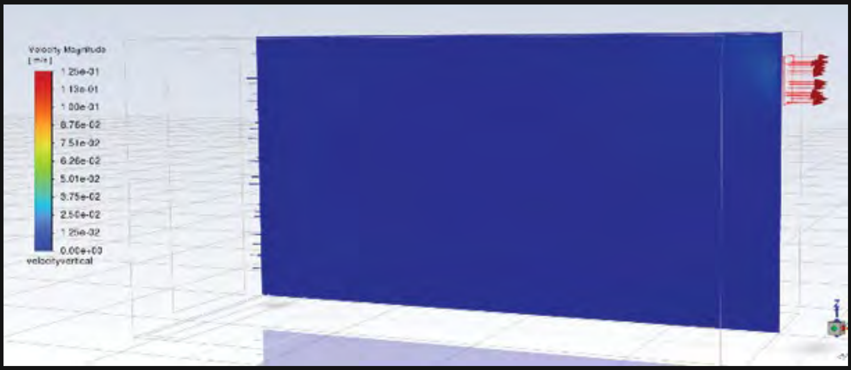
Variant 1 | Airflow vectors



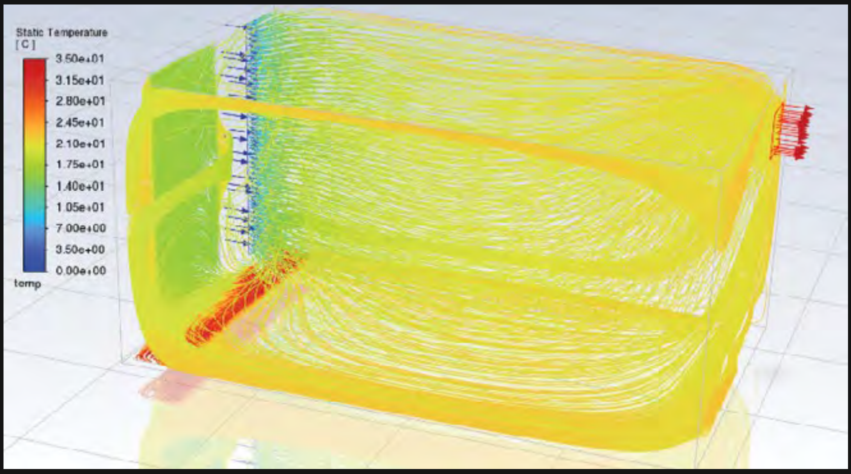
Variant 1 | Airflow pathlines



Variant 1 | Airflow Horizontal Section

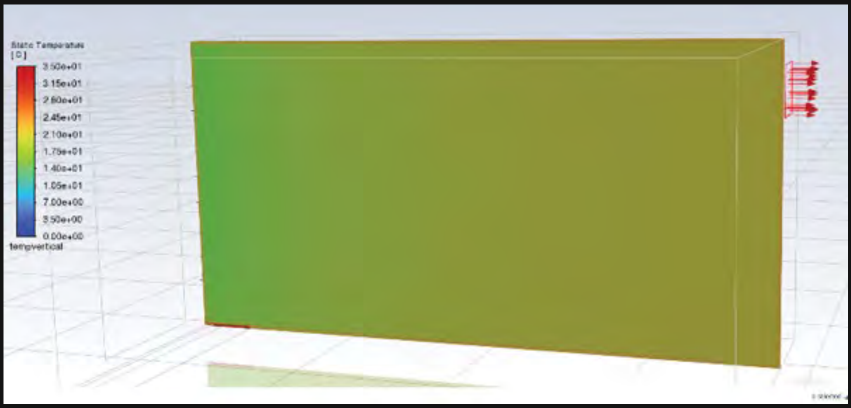


Variant 1 | Airflow Vertical Section

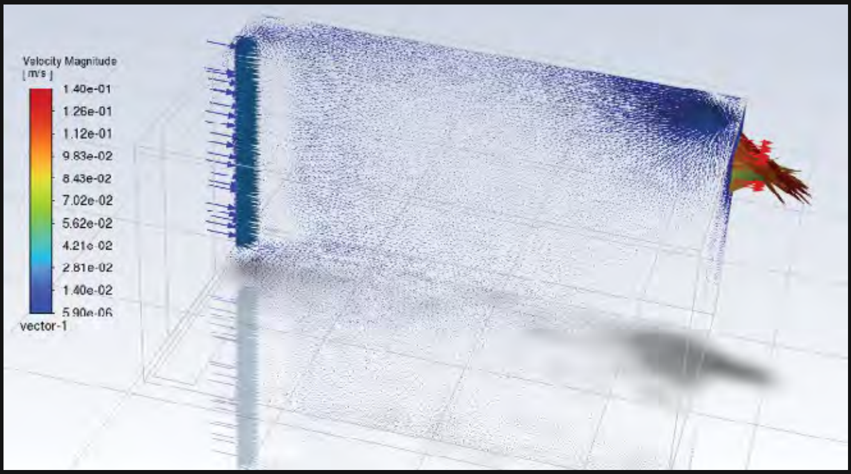


Variant 1.1 | Temperature Pathlines

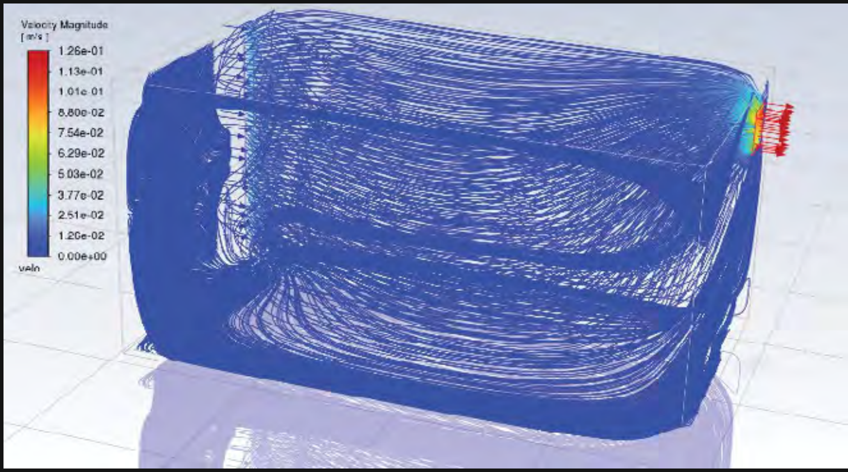
Variant 1 .1 | Temperature Horizontal section (1.2 m height)



Variant 1.1 | Temperature Vertical Section

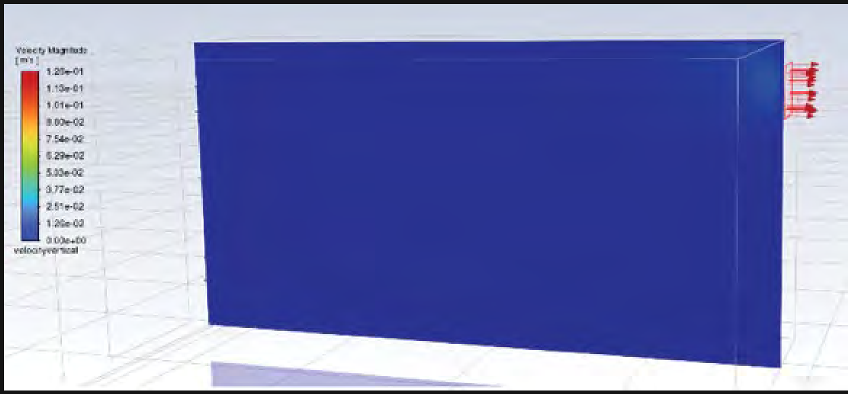


Variant 1.1 | Velocity Vectors

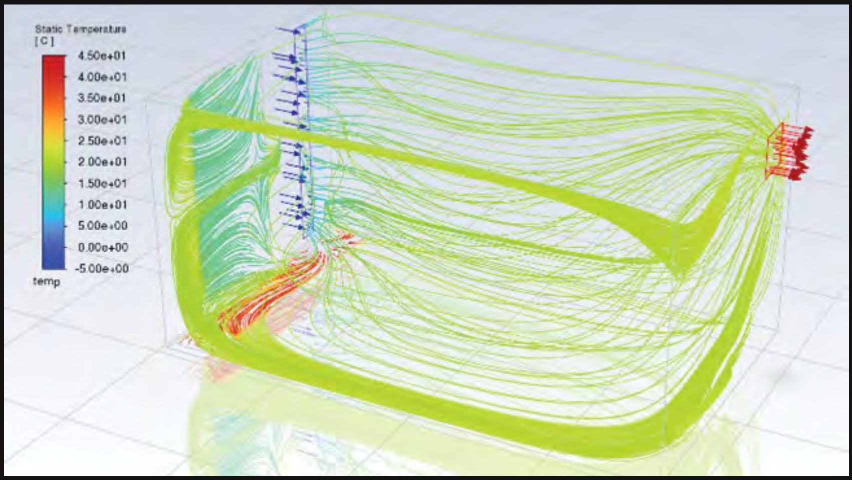


Variant 1.1 | Velocity pathlines

Variant 1.1 | Velocity Horizontal Section



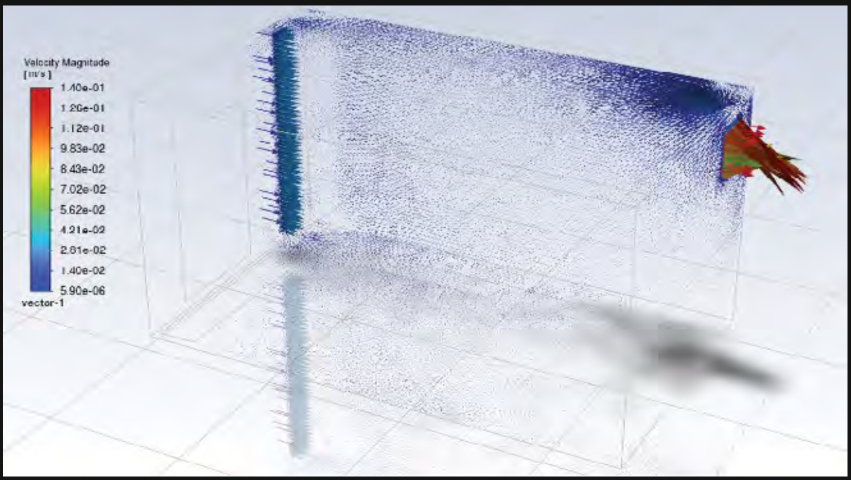
Variant 1.1 | Velocity Vertical Section



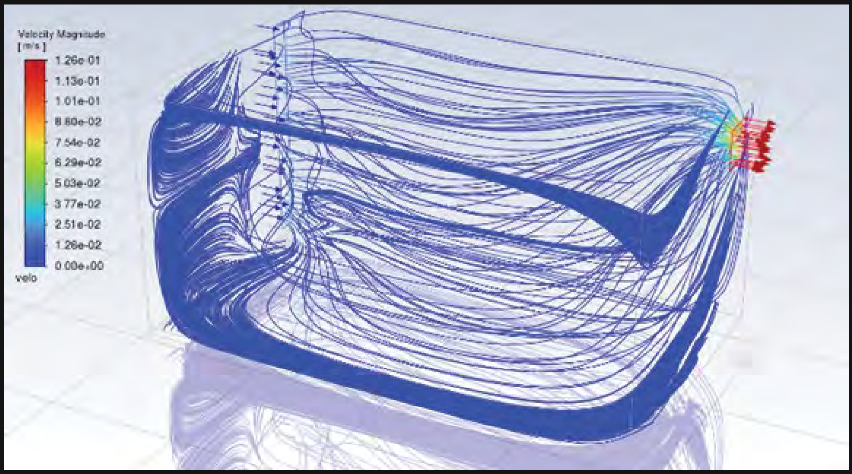
Variant 1.2 | Temperature Pathlines

Variant 1.2 | Temperature Horizontal Section (1.2 m Height)

Variant 1.2 | Temperature Vertical Section



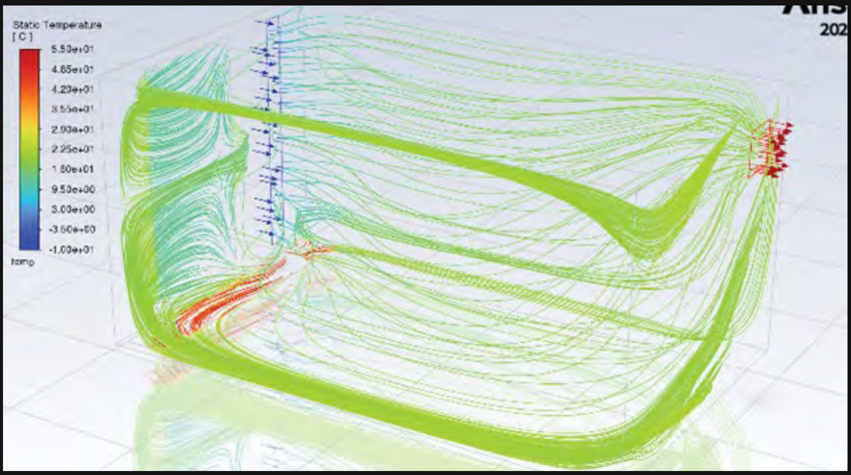
Variant 1.2 | Velocity Vectors



Variant 1.2 | Velocity Pathlines

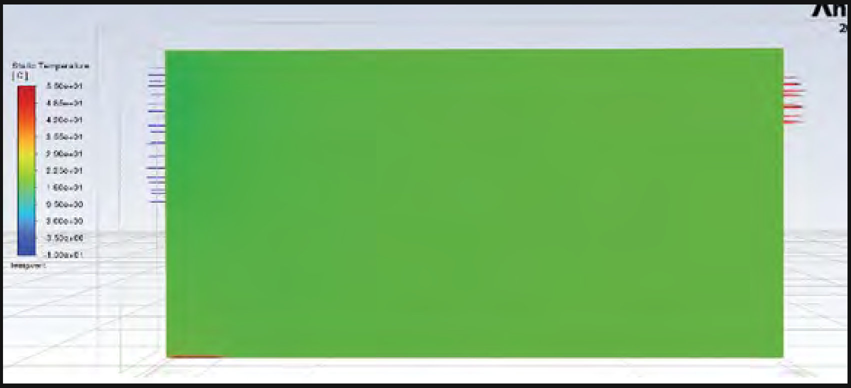
Variant 1.2 | Velocity Horizontal Section

Variant 1.2 | Velocity Vertical Section

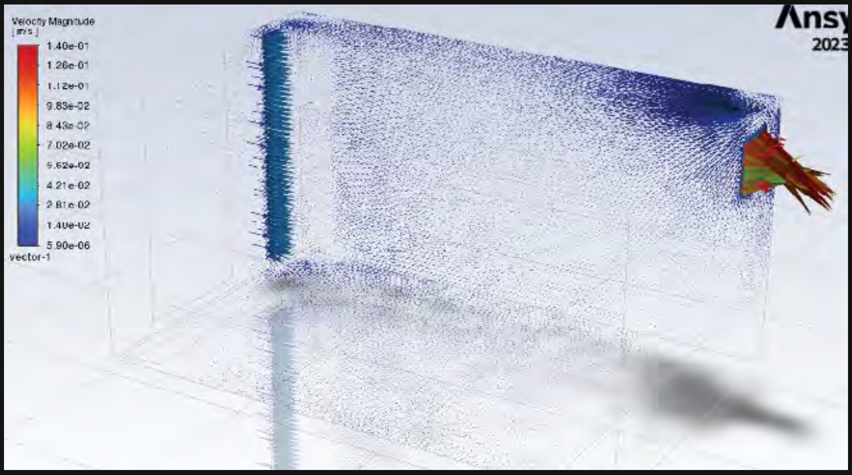


Variant 1.3 | Temperature Pathlines

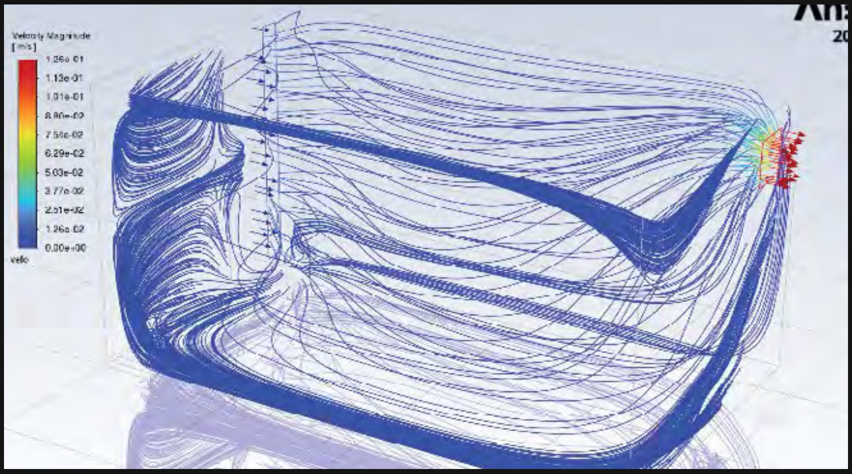
Variant 1.3 | Temperature Horizontal Section (1.2 m Height)



Variant 1.3 | Temperature Vertical Section



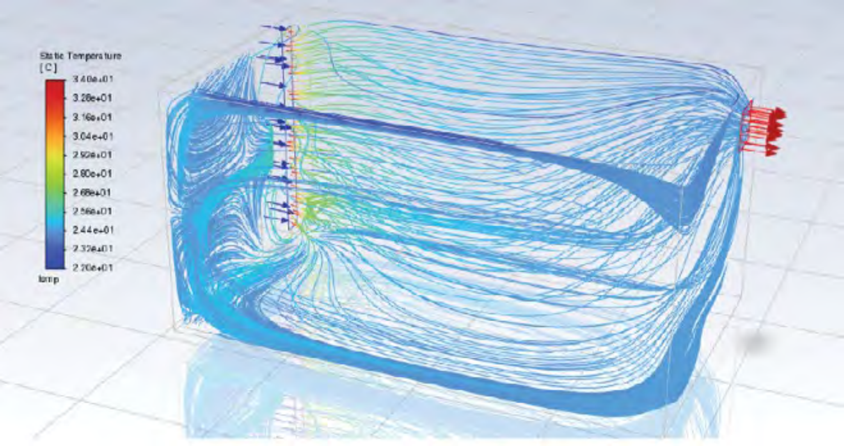
Variant 1.3 | Velocity Vectors



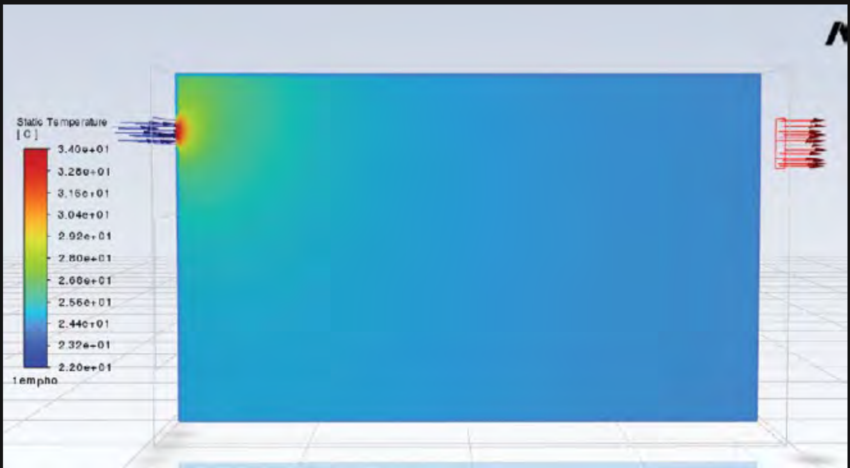
Variant 1.3 | Velocity Pathlines

Variant 1.3 | Velocity Horizontal Section

Variant 1.3 | Velocity Vertical Section

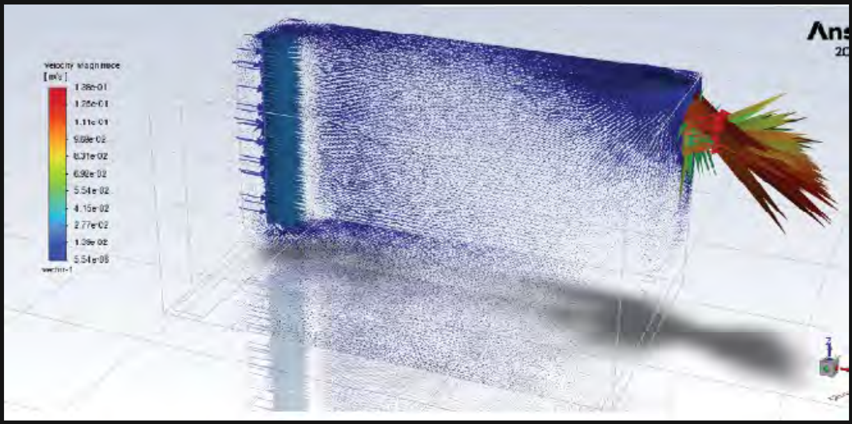


Variant 1.4 | Temperature Pathlines

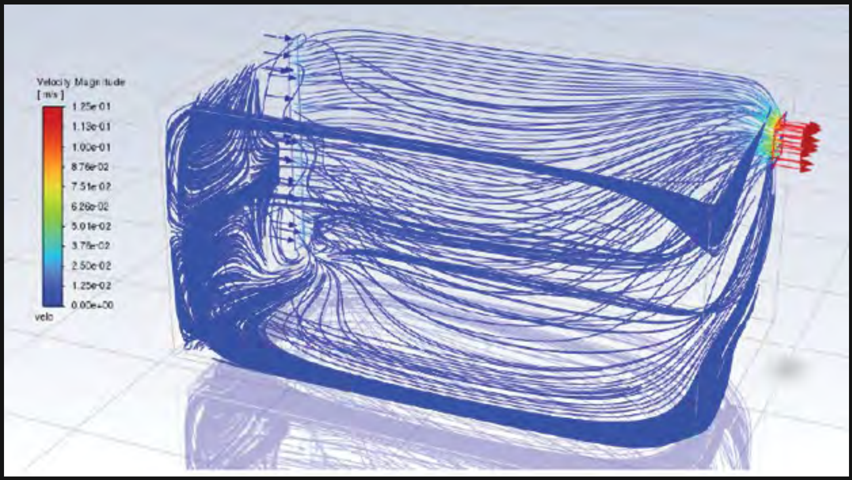


Variant 1.4 | Temperature Horizontal Section

Variant 1.4 | Temperature Vertical Section



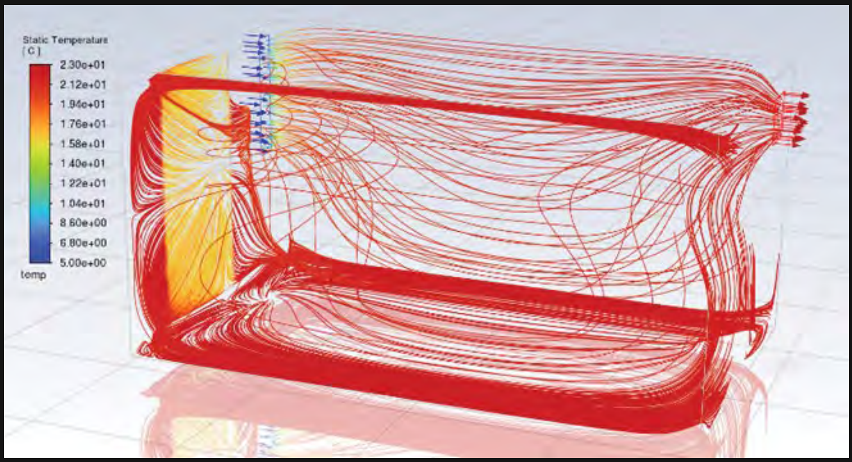
Variant 1.4 | Velocity Vectors



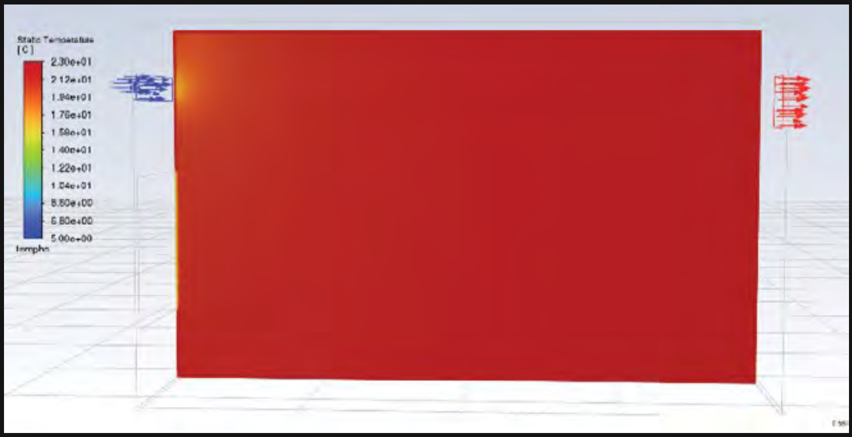
Variant 1.4 | Velocity Pathlines

Variant 1.4 | Velocity Horizontal Section

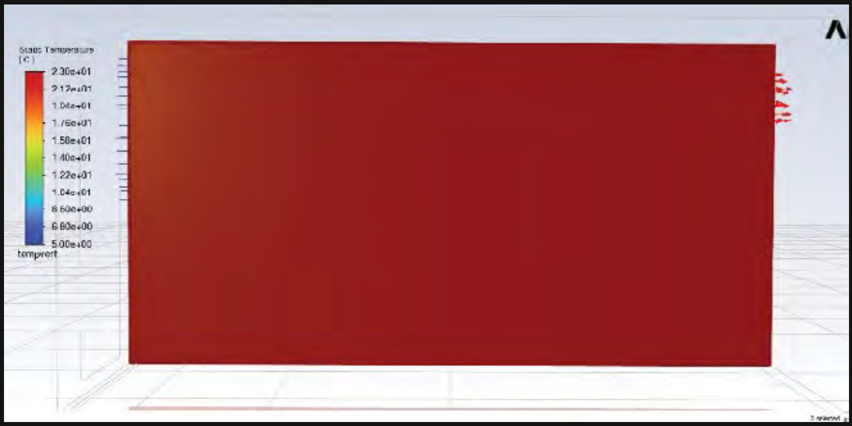
Variant 1.4 | Velocity Vertical Section



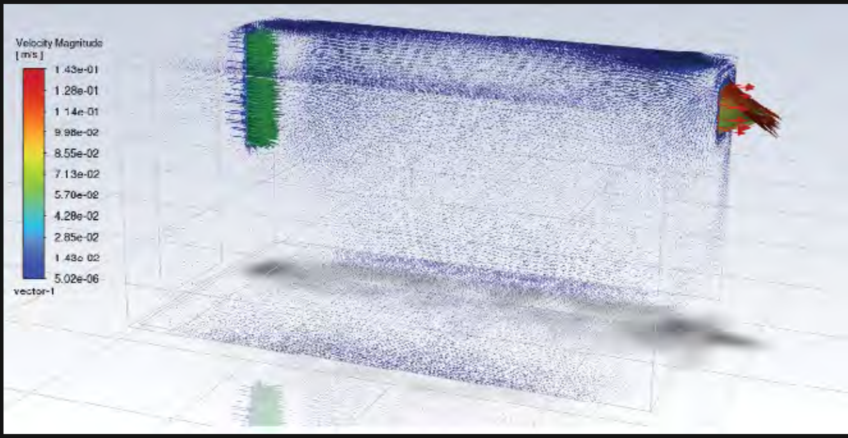
Variant 2 | Temperature Pathlines



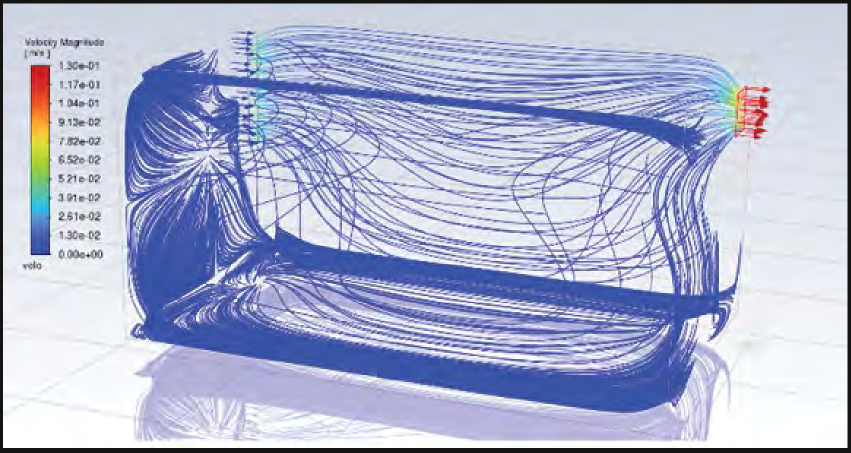
Variant 2 | Temperature Horizontal Section (1.2 m Height)



Variant 2 | Temperature Vertical Section



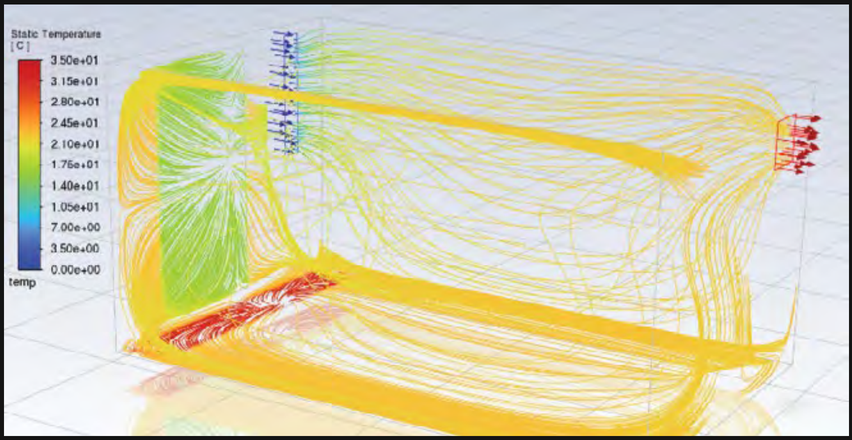
Variant 2 | Velocity Vectors



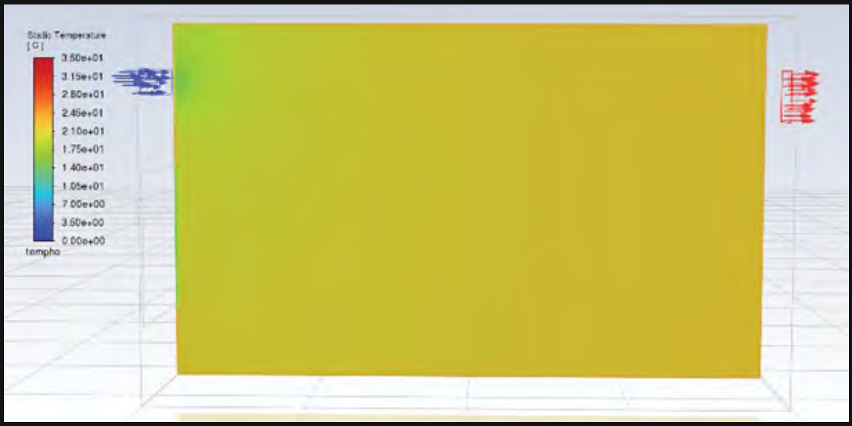
Variant 2 | Velocity Pathlines

Variant 2 | Velocity Horizontal Section

Variant 2 | Velocity Vertical Section

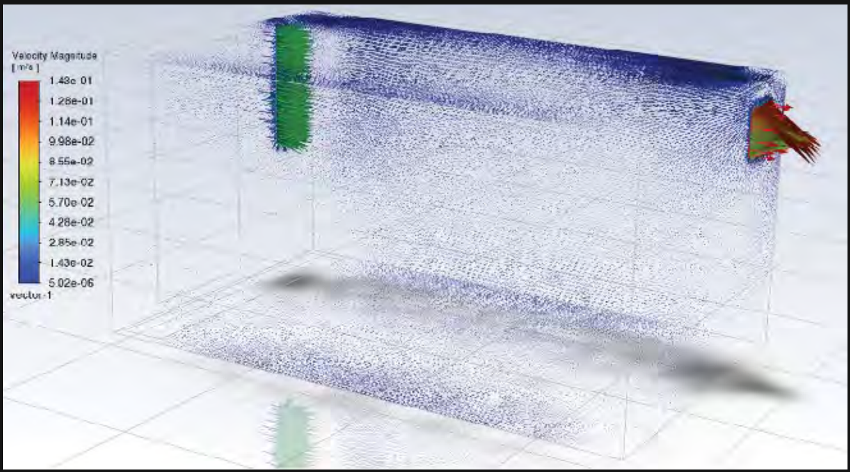


Variant 2.1 | Temperature Pathlines

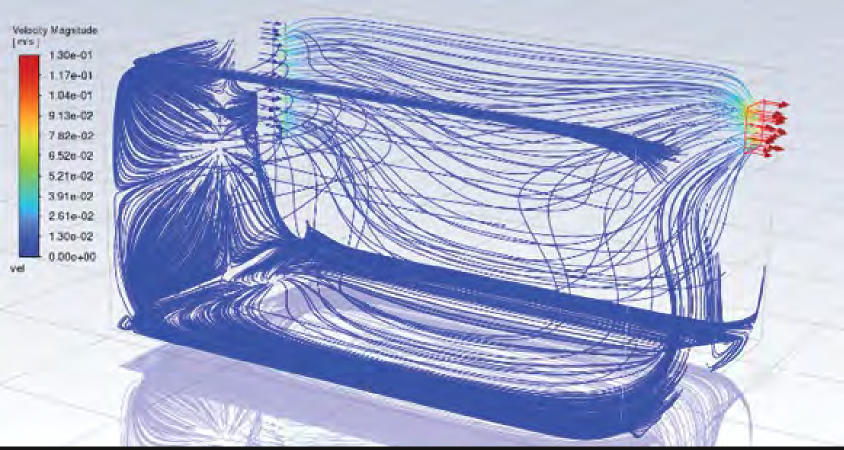


Variant 2.1 | Temperature Horizontal Section (1.2 m Height)

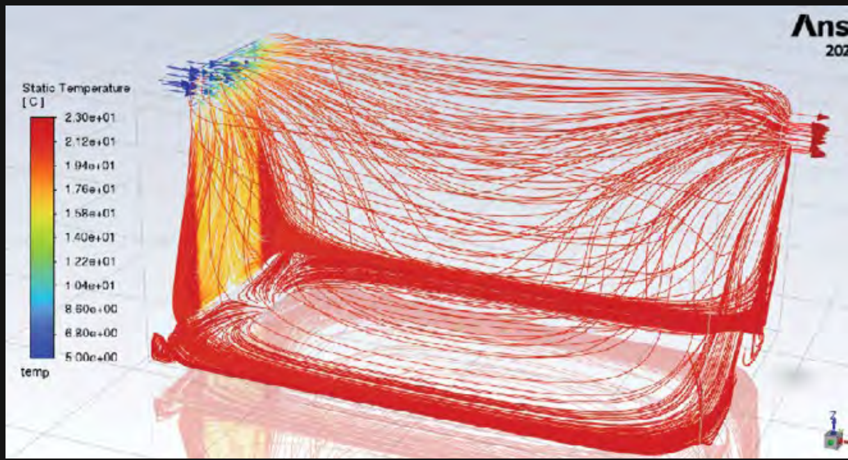
Variant 2.1 | Temperature Vertical Section



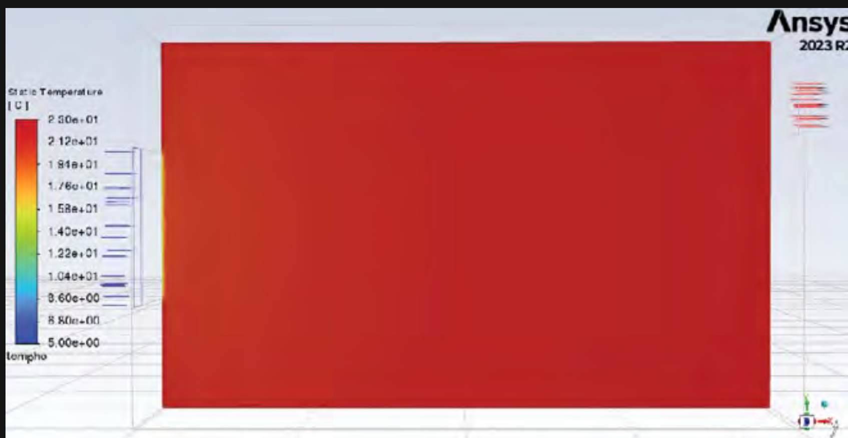
Variant 2.1 | Velocity Vectors



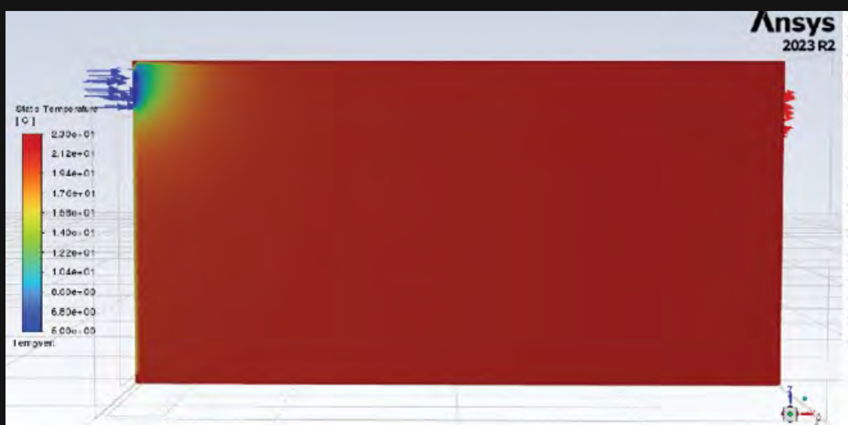
Variant 2.1 | Velocity Pathlines



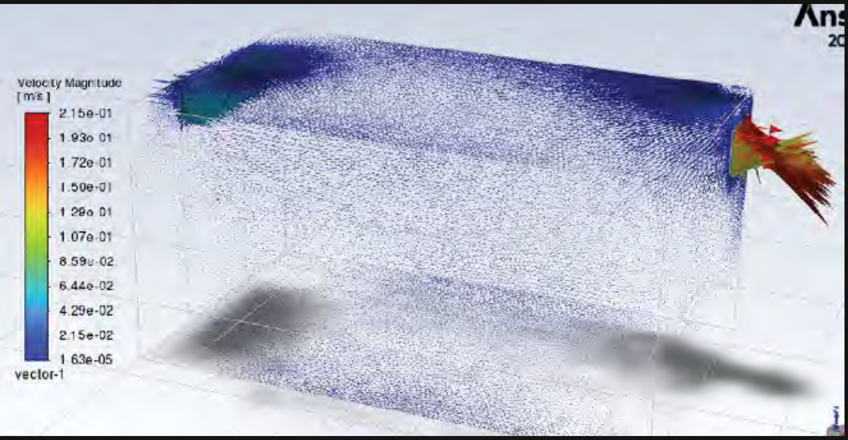
Variant 3 | Temperature Pathlines



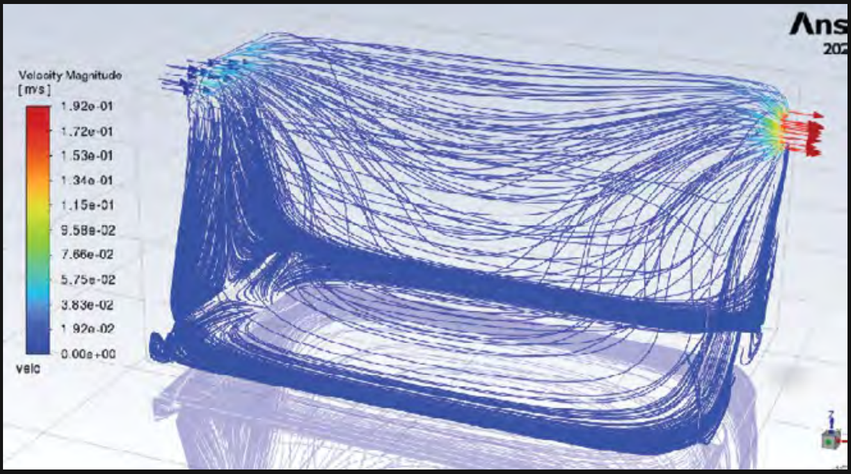
Variant 3 | Temperature Horizontal Section (1.2 m Height)



Variant 3 | Temperature Vertical Section



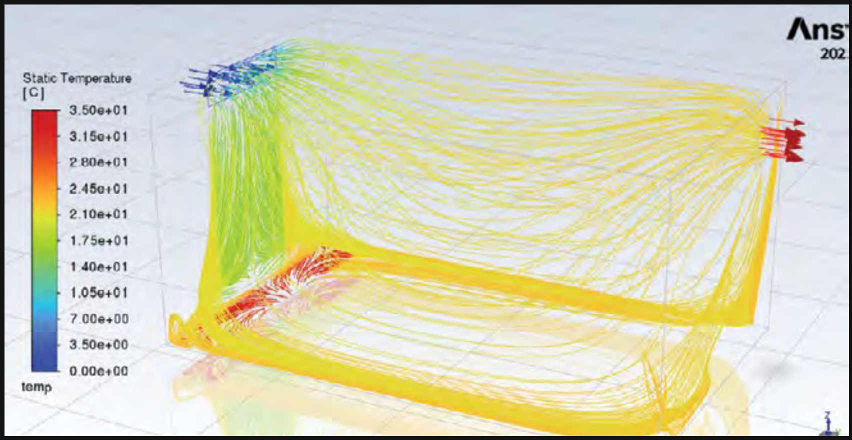
Variant 3 | Velocity Vectors



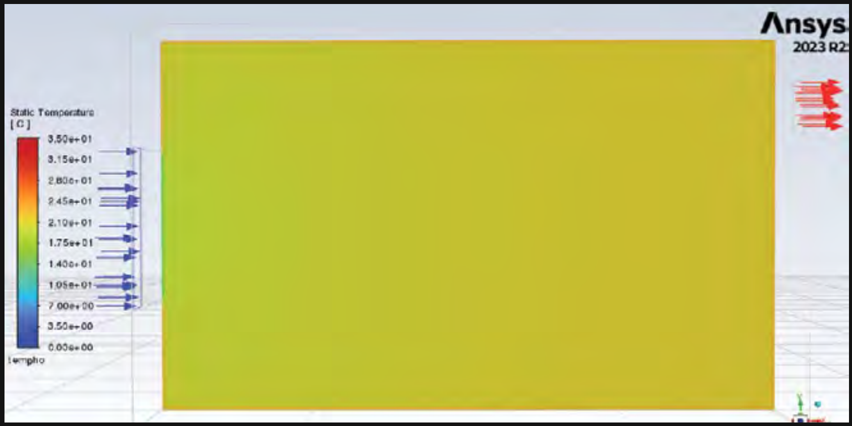
Variant 3 | Velocity Patlines

Variant 3 | Velocity Horizontal Section

Variant 3 | Velocity Vertical Section

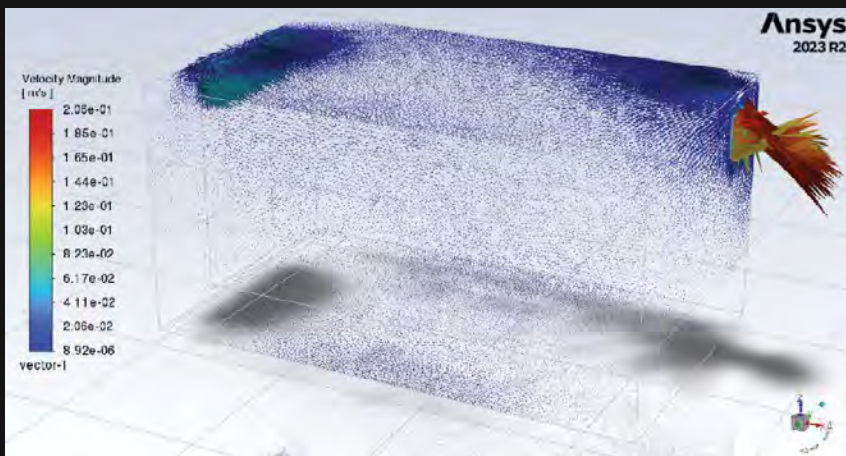


Variant 3.1 | Temperature Pathlines

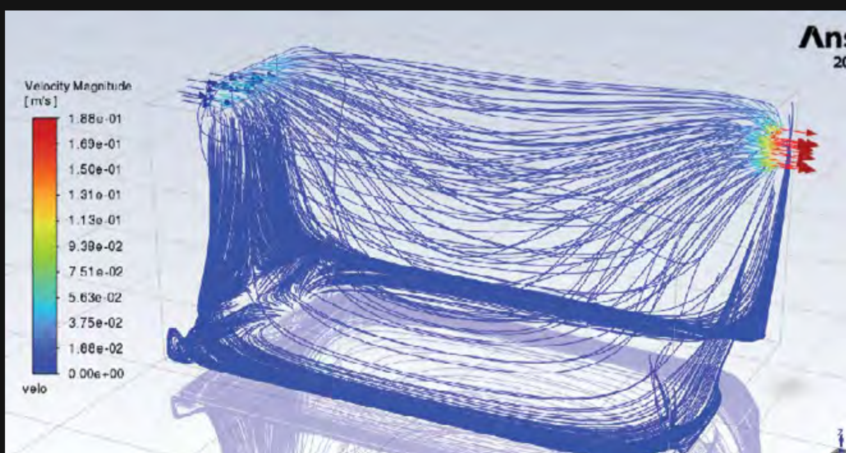


Variant 3.1 | Temperature Horizontal Section (1.2 m Height)

Variant 3.1 | Temperature Vertical Section



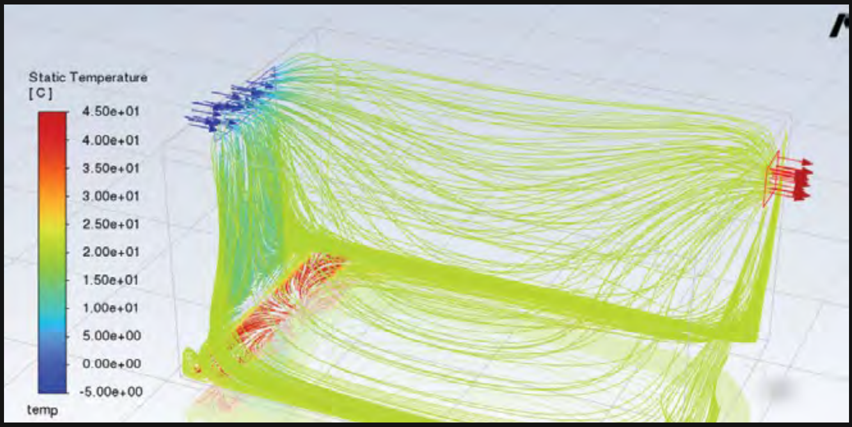
Variant 3.1 | Velocity Vectors



Variant 3.1 | Velocity Pathlines

Variant 3.1 | Velocity Horizontal Section

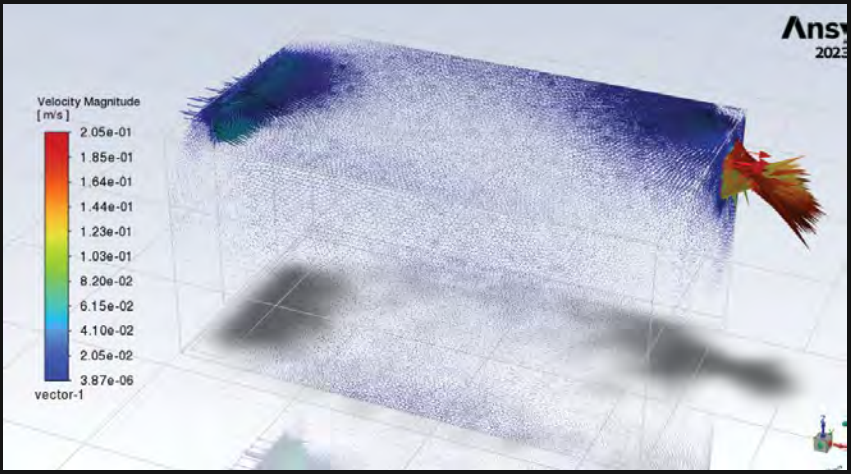
Variant 3.1 | Velocity Vertical Section



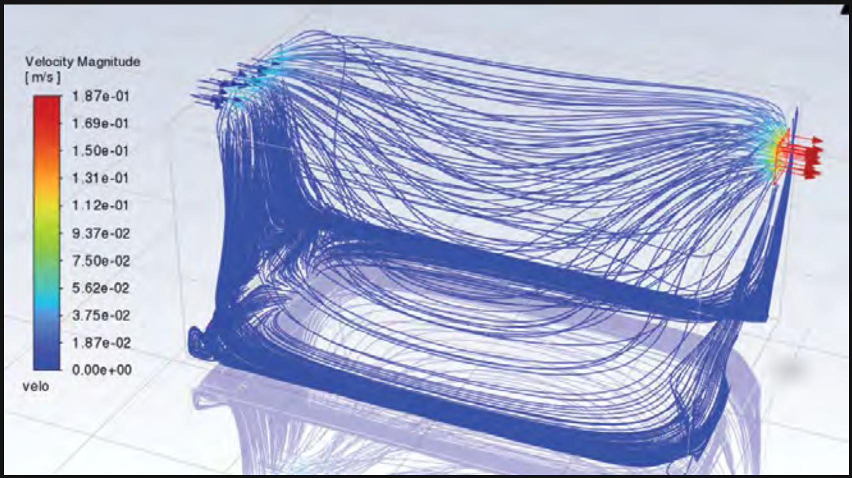
Variant 3.2 | Temperature Pathlines

Variant 3.2 | Temperature Horizontal Section (1.2 m Height)

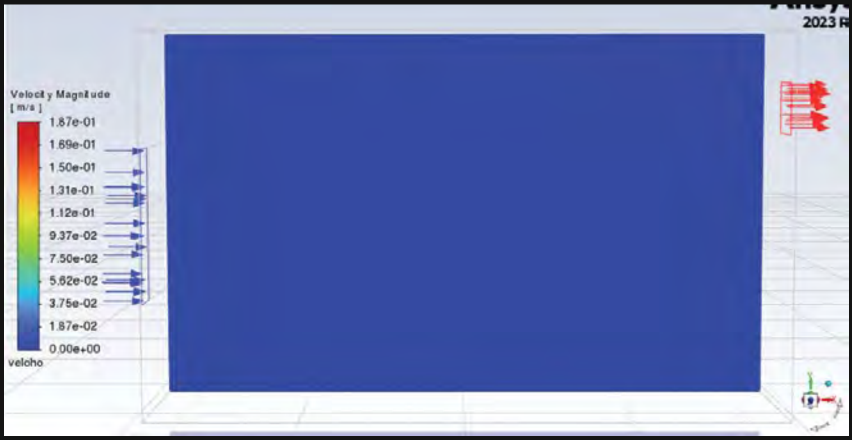
Variant 3.2 | Temperature Vertical Section



Variant 3.2 | Velocity Vectors

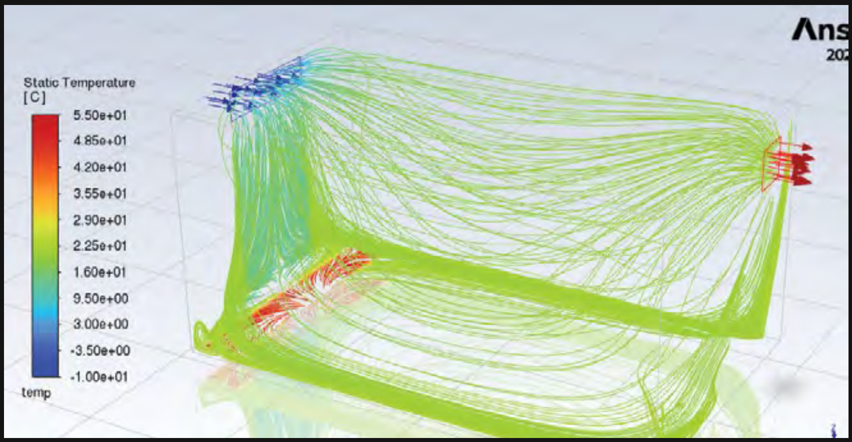


Variant 3.2 | Velocity Pathlines



Variant 3.2 | Velocity Horizontal Section

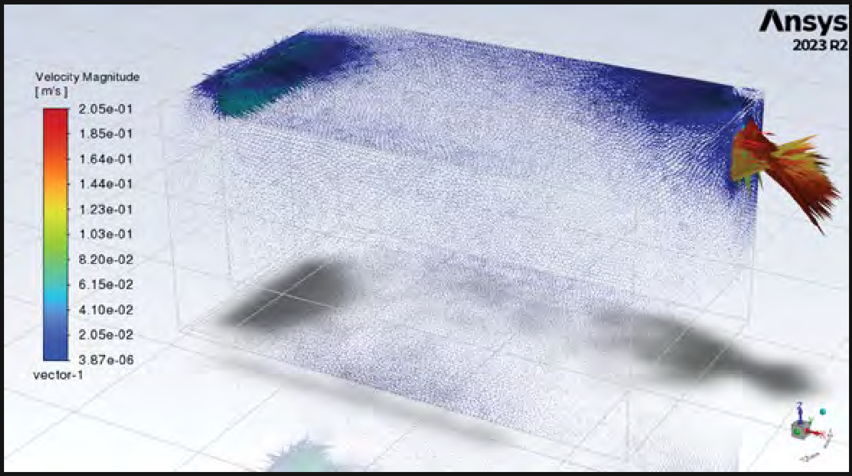
Variant 3.2 | Velocity Vertical Section



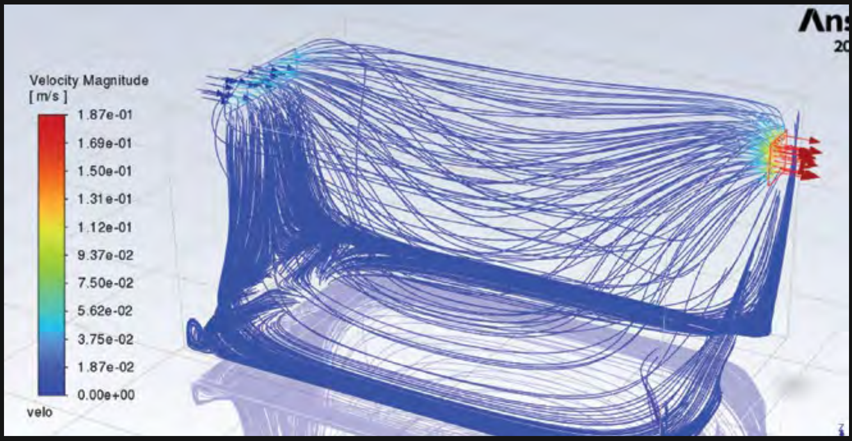
Variant 3.3 | Temperature Pathlines

Variant 3.3 | Temperature Vertical Section

Variant 3.3 | Temperature Horizontal Section



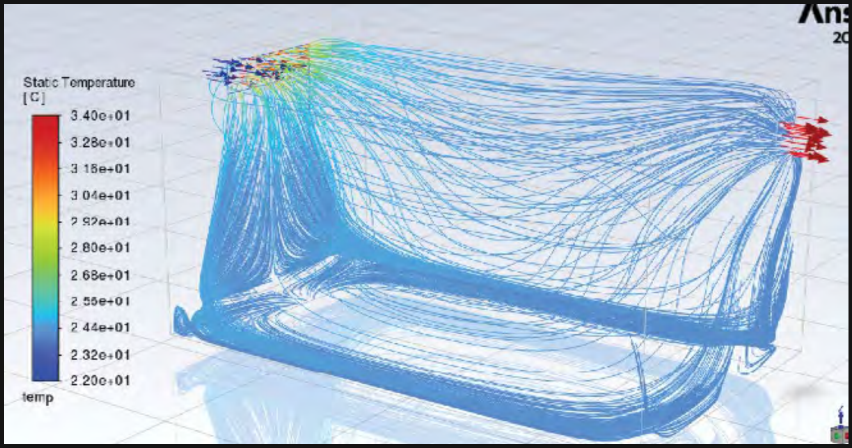
Variant 3.3 | Velocity Vectors



Variant 3.3 | Velocity Pathlines

Variant 3.3 | Velocity Horizontal Section

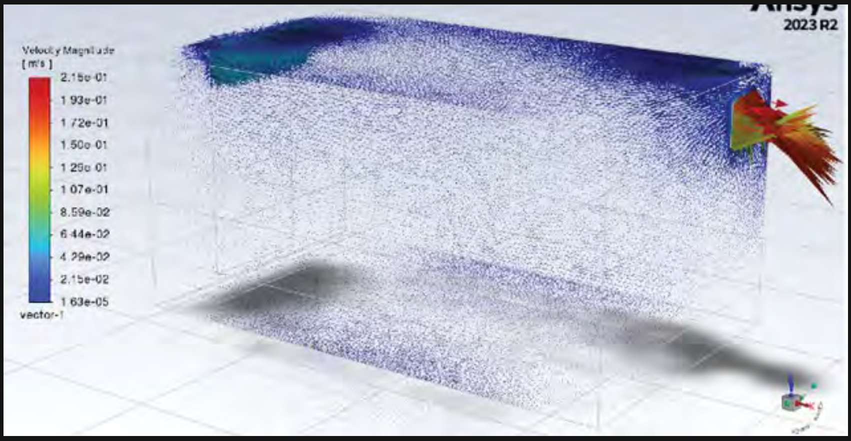
Variant 3.3 | Velocity Vertical Section



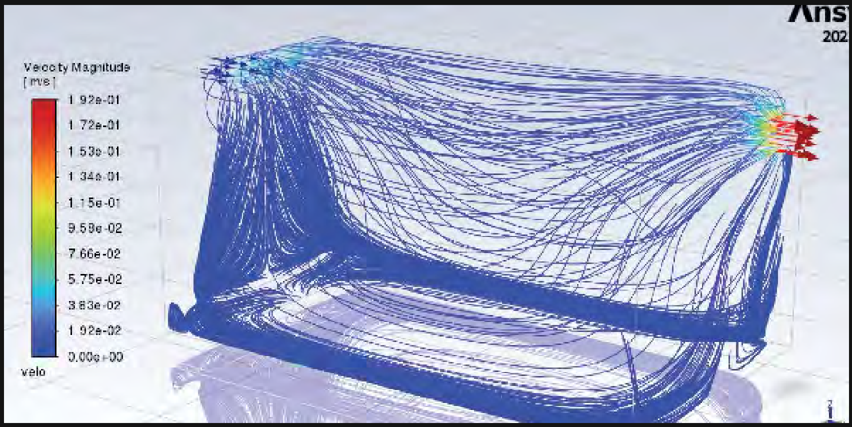
Variant 3.4 | Temperature Pathlines

Variant 3.4 | Temperature Horizontal Section

Variant 3.4 | Temperature Vertical Section



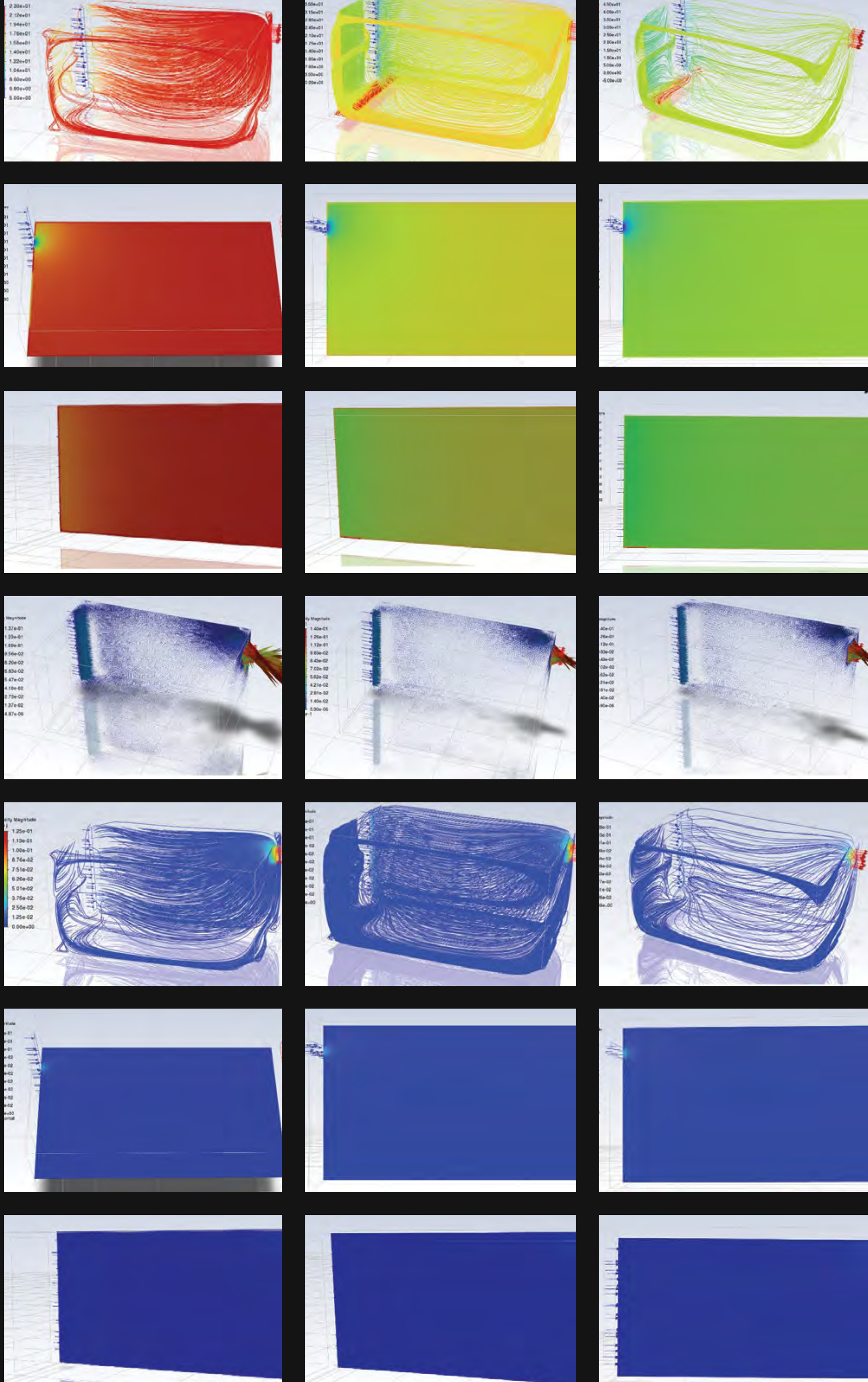
Variant 3.4 | Velocity Vectors

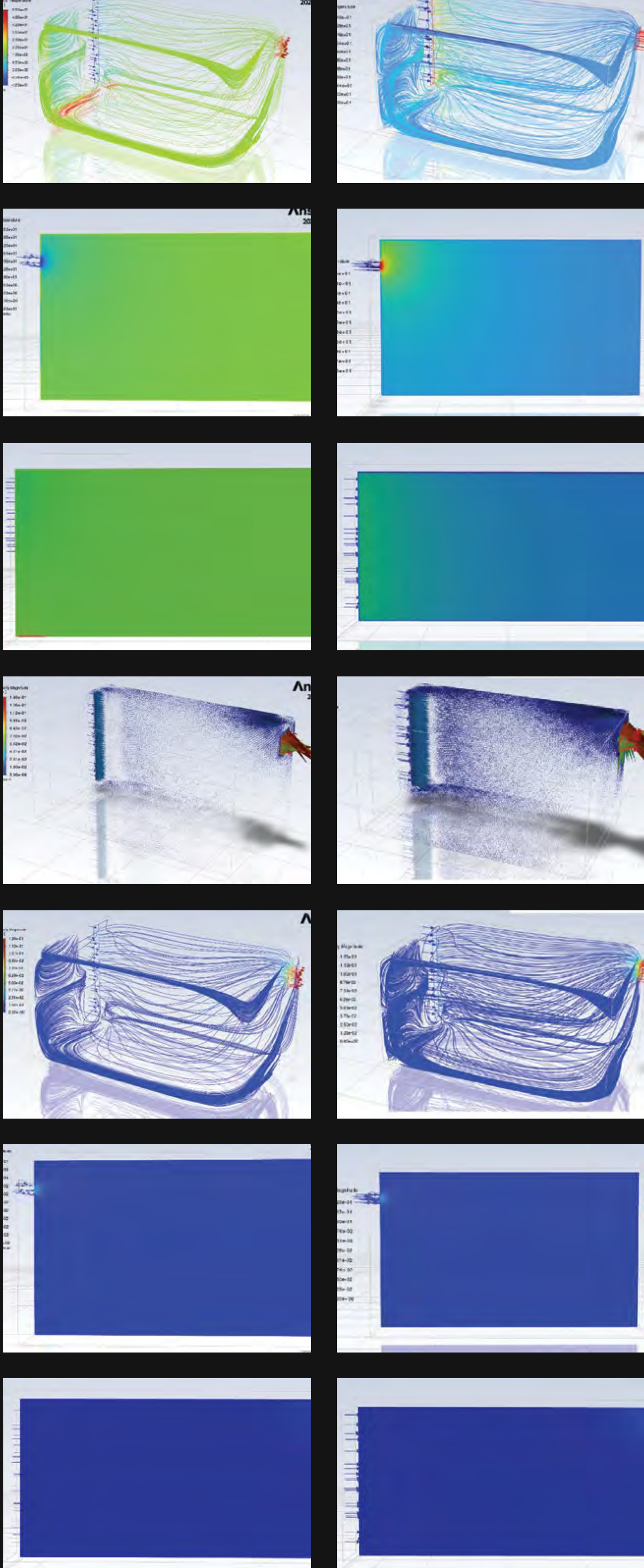


Variant 3.4 | Velocity Pathlines

Variant 3.4 | Velocity Horizontal Section

Variant 3.4 | Velocity Vertical Section

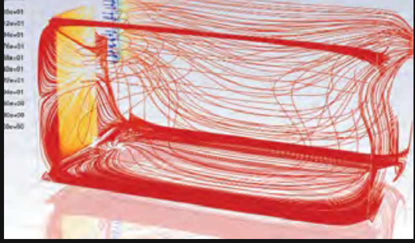


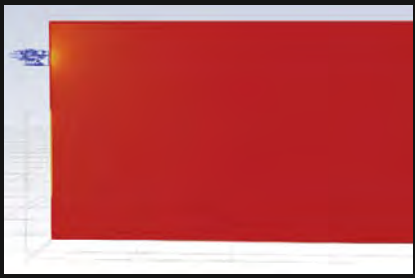


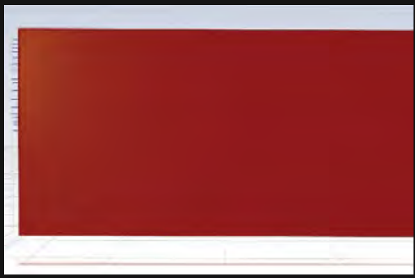
Overview

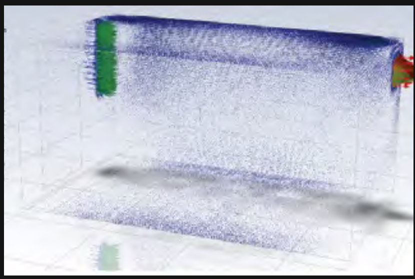
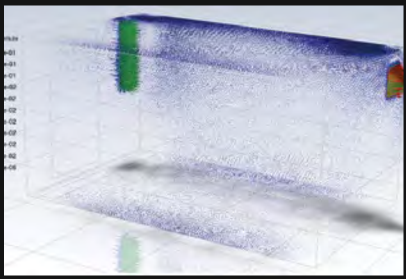
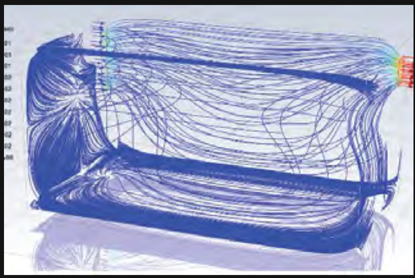
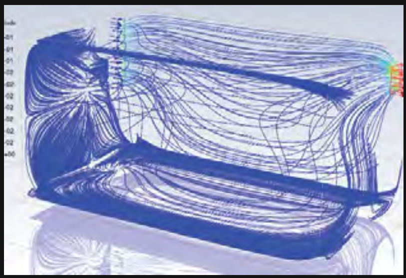
Variant 1 | 1.1 | 1.2 | 1.3 | 1.4
Vertical Ventilation Opening Full Height (Floor to Ceiling) |
Winter (5 °C, 0 °C, -5 °C, -10 °C)
Summer (35°C)

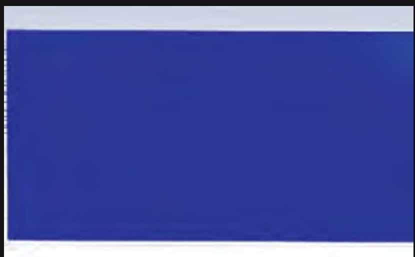
metaform dar



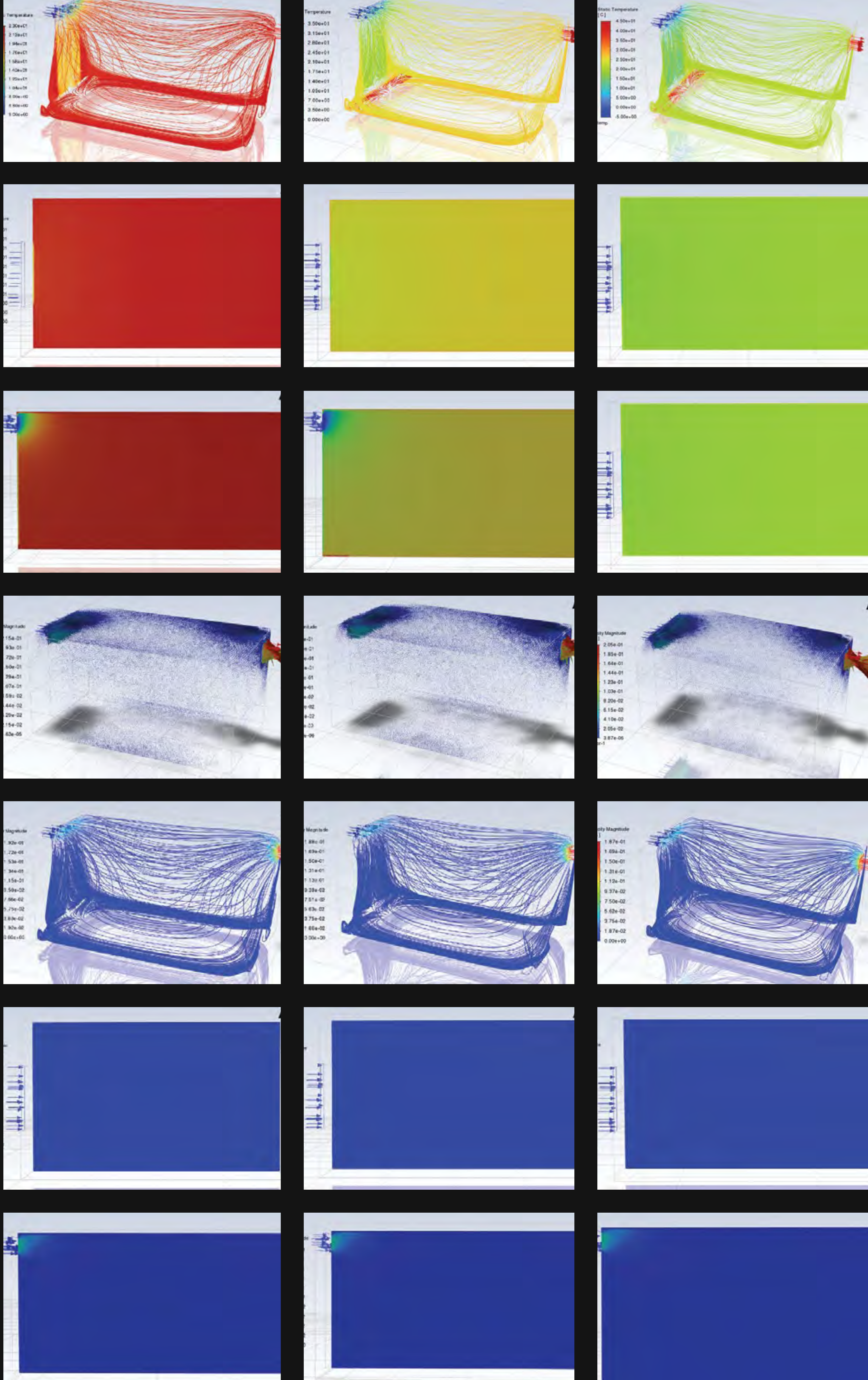


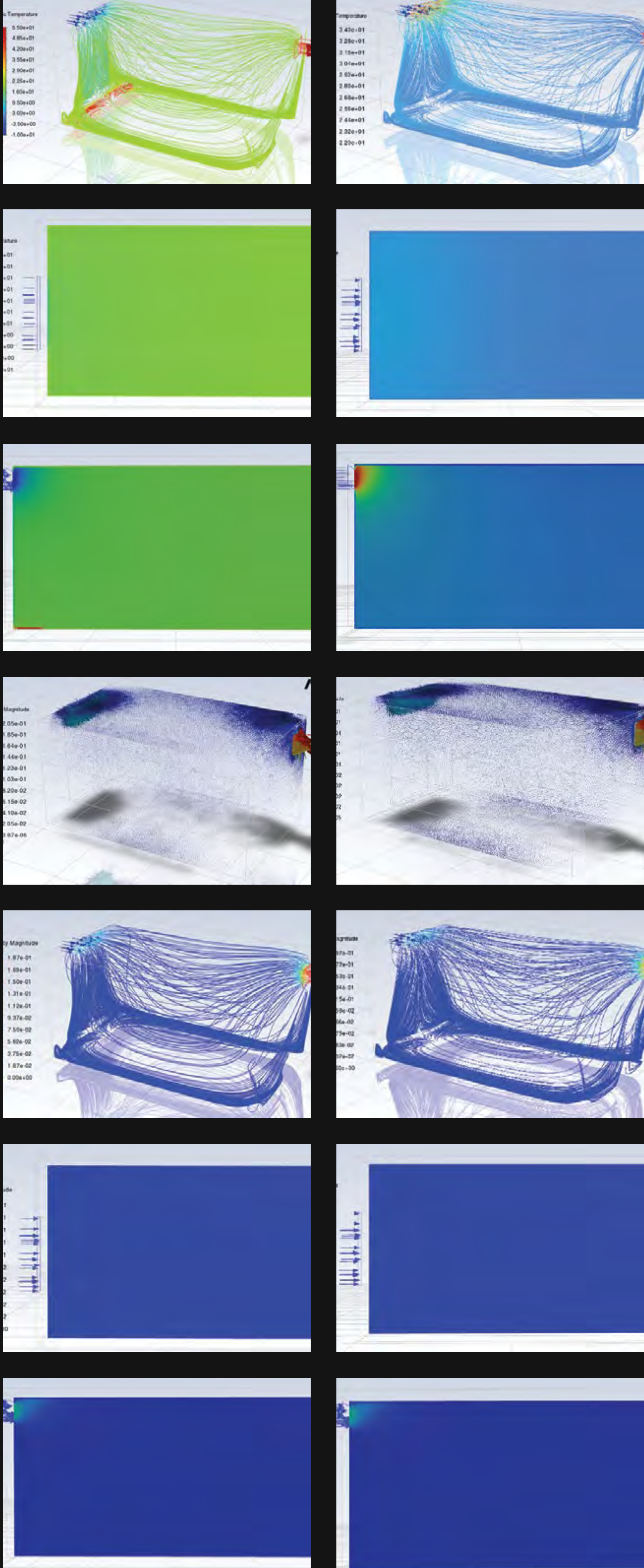




Variant 2 | 2.1
Ventilation Opening on Top |
Winter (5 °C, 0 °C)


Static Temperature
[C]
4.50e+01
4.00e+01
3.50e+01
3.00e+01
2.50e+01
2.00e+01
1.50e+01
1.00e+01
5.00e+00
0.00e+00
-5.00e+00



Overview

Variant 3 | 3.1 | 3.2 | 3.3 | 3.4
Opening Above Window on Top |
Winter (5 °C, 0 °C, -5 °C, -10 °C)
Summer (35°C)

04.5
Conclusion | Local Thermal Comfort

The following analysis compares three ventilation configurations and illustrates how each one influences indoor thermal comfort under changing outdoor conditions. The diagrams visualize air movement, temperature distribution, and comfort zones across a full annual cycle, based on outdoor temperatures ranging from, 10 °C to 35 °C.

Rather than identifying a single "best" solution, the graphs reveal how each configuration performs differently depending on the season and operating conditions.

Ventilation Configurations

Three ventilation strategies were examined:

• Full-height vertical ventilation opening
Enables continuous air movement from floor to ceiling and supports strong vertical air circulation

• Upper vertical ventilation opening
Concentrates ventilation in the upper zone of the room, where warm air naturally accumulates.

• Horizontal ventilation opening above the window
Introduces fresh air at a fixed height, resulting in a more controlled but limited airflow pattern.

Reading the Results

Across all diagrams, it becomes clear that thermal comfort is closely linked to how air enters, moves through, and exits the space.

• Cold conditions (down to —10 °C):

The graphs show that the full-height vertical opening generates strong air movement but also allows cold air to reach the occupied zone, increasing the risk of drafts. In contrast, the upper vertical opening limits air movement near floor level, keeping the occupied zone more stable while still allowing warm air to escape at the top. This results in more comfortable temperature distributions near the user level.

• Moderate conditions (0 °C to 5 °C):

Both the upper vertical opening and the horizontal opening produce relatively even temperature fields and moderate air velocities. The diagrams indicate stable comfort conditions with minimal drafts. However, the horizontal opening shows less adaptability, as airflow patterns remain largely fixed regardless of changing conditions.

• Hot conditions (35 °C):

At high outdoor temperatures, the diagrams highlight the advantages of full-height vertical ventilation. Rising warm air is efficiently removed, leading to lower indoor temperatures and improved comfort. The horizontal opening, by comparison, shows weaker vertical air movement and reduced heat removal.

Optimal Strategy: Combining Variants 1 and 2

When all climatic scenarios are considered together, the diagrams clearly indicate that a combination of full-height and upper vertical ventilation offers the most robust performance. This strategy uses a split vertical ventilation opening, with one operable vent in the lower zone and another in the upper third of the space. The visual data shows several key benefits:

• Adaptive control
Airflow can be adjusted seasonally. In winter, the lower opening remains closed to prevent drafts, while warm air exits through the upper vent. In summer, both openings can be used to support continuous ventilation and cooling.

• Balanced air movement
The combined configuration supports natural convection, allowing warm air to rise and escape while fresh air enters without disturbing the occupied zone.

• Reduced energy demand
By relying on natural air movement rather than mechanical systems, the diagrams demonstrate lower reliance on heating or cooling, supporting an energy-efficient low-tech approach.

Recommendation

Based on the graphical analysis, both Mr. Junghans and the architectural office Metaform identify the split vertical ventilation system as the most effective solution. It achieves the best balance between comfort, adaptability, and efficiency across the year and aligns with the project's low-tech and climate-responsive design principles.

Overall, the results show that combining upper and lower vertical ventilation openings provides the most versatile and resilient strategy for addressing varying outdoor temperatures while maintaining local thermal comfort.

04.6 Lighting Control

The artificial lighting system is designed to ensure an illuminance level of 500 lux in all primary work areas during operating hours. Lighting is automatically switched off when sufficient daylight is available and the minimum level of 500 lux is reached. This daylight-responsive control follows standard best practice.

Throughout the building, lighting has been conceived with a strong focus on energy efficiency, user comfort, and flexibility. Long-life, energy-efficient linear LED luminaires are used and integrated into an intelligent, daylight-dependent control system. This system continuously adjusts artificial lighting to the prevailing daylight conditions, maximizing the use of natural light, reducing energy consumption, and extending the lifespan of the LED fixtures.

Zone-Based Lighting Control

The lighting concept is tailored to the different functional areas of the building. The zones include:

- Office areas, requiring uniform and comfortabl lighting to support focused work
- Circulation areas and staircases, where lighting primarily ensures safety and orientation
- Meeting rooms, requiring flexible and adaptabl lighting for presentations and discussions
- Break and lounge areas, designed to promote a relaxed and welcoming atmosphere
- Sanitary areas, requiring functional yet energy-efficient lighting

Each zone is equipped with individually controllable linear LED luminaires, enabling demand-based lighting that responds both to functional requirements and user needs.

Dimmable LED Technology

The dimming capability of the linear LED luminaires allows for continuous adjustment of light intensity. In office areas, for example, brightness can be adapted according to time of day and type of use. Higher light levels support optimal working conditions in the morning or under low daylight conditions, while reduced lighting levels create a more comfortable atmosphere in the afternoon or during presentations. This flexibility contributes directly to energy savings, as lighting output is always aligned with actual demand.

Maximizing Daylight Use

A key element of the lighting concept is the maximum utilization of natural daylight. In areas with large window façades, daylight is prioritized to reduce the need for artificial lighting to a minimum. The system automatically detects daylight availability and adjusts the intensity of the LED luminaires accordingly. On particularly bright days, artificial lighting remains almost completely switched off, resulting in significant energy savings while also extending the service life of the LED fixtures.

This strategy not only reduces operational energy costs but also contributes to the building's sustainability by lowering its overall environmental footprint.

Individual User Control

In addition to automated control, the system allows for individual adjustment of lighting within the different zones. Users can adapt light levels according to their needs and personal preferences. This is especially valuable in meeting rooms, where lighting scenarios may vary depending on the type of meeting, as well as in break areas, where softly dimmed lighting supports a more relaxed atmosphere.

User-controlled adjustment enhances comfort while further improving energy efficiency by avoiding unnecessary energy consumption.

Integrated Lighting Concept

Overall, the lighting control system provides an intelligent, energy-efficient, and user-oriented solution that flexibly responds to varying functional requirements and daylight conditions. The combination of daylight-responsive control, dimmable LED luminaires, and individually adjustable lighting zones creates a high-quality working and living environment, supporting both user comfort and the building's sustainability objectives.

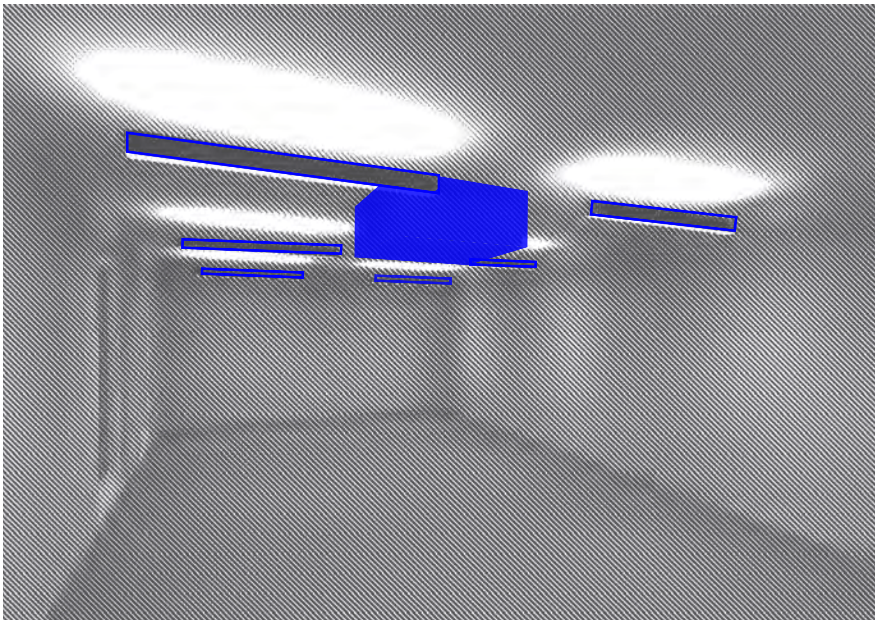
Lighting and Ceiling Fan Integration

The ceiling fan is ideally positioned centrally within the room. This placement ensures optimal air circulation, creating a balanced and comfortable airflow throughout the space. It prevents local overheating and avoids uncomfortable draughts in corner or peripheral areas, significantly enhancing overall spatial comfort.

The linear luminaires are carefully arranged to avoid unwanted shadowing. Uniform illumination is essential for a pleasant and functional lighting environment. To achieve this, the luminaires are slightly suspended from the ceiling, allowing light to spread evenly across the space and eliminating dark zones or disruptive shadows.

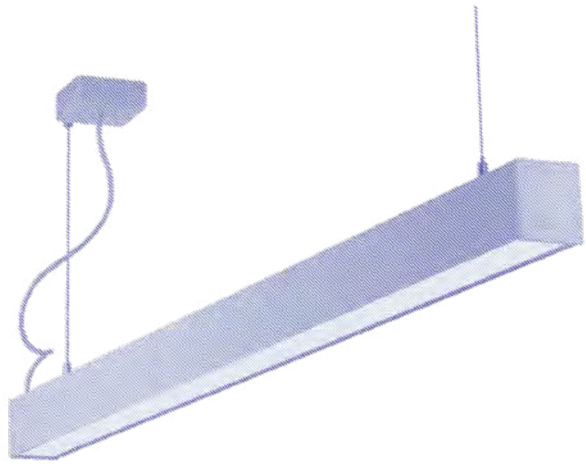
The additional suspension of the luminaires also enables indirect lighting, creating a diffuse light source that gives the space a softer and more comfortable atmosphere. This indirect lighting not only enhances visual comfort but also supports the architectural design by introducing subtle accents and ensuring a balanced, uniform light distribution. Overall, the suspended linear luminaires contribute to a harmonious and well-lit spatial concept that combines functional performance with aesthetic quality.

The positioning of the luminaires has been carefully coordinated with the location of the ceiling fan to ensure optimal spatial comfort and visual coherence.

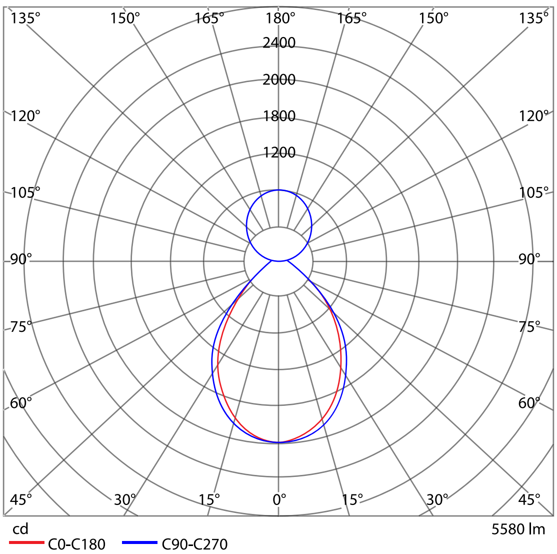


“Daylight-driven lighting with smart LEDs for comfort and efficiency.”

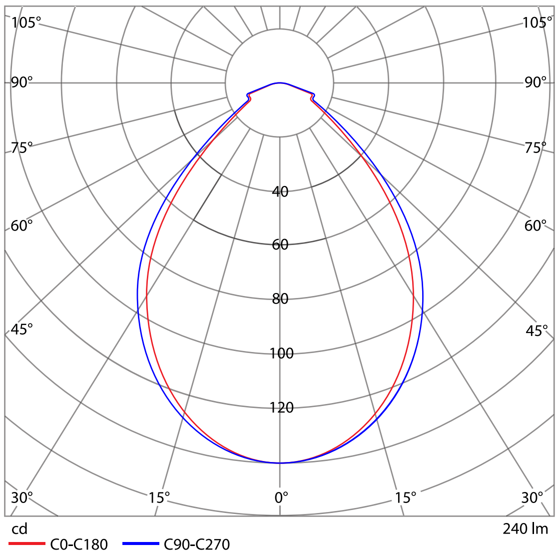
Lighting Design Calculation
Halla Lina 80



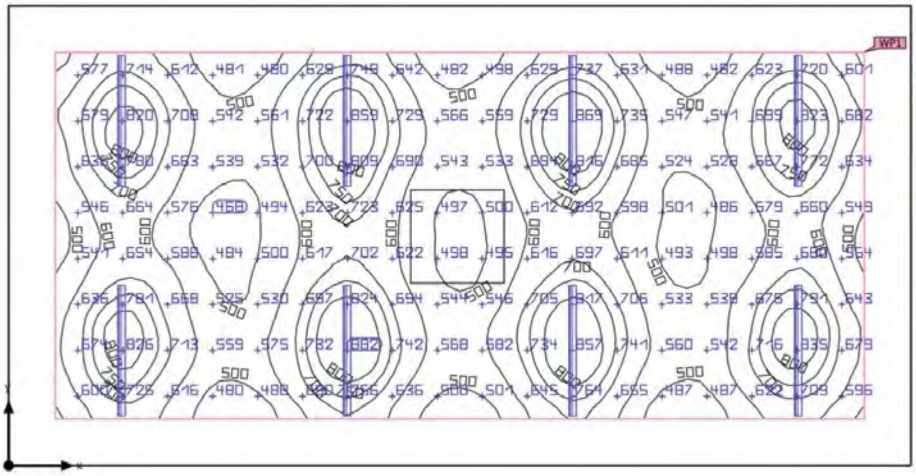
Article no.	11-5011-25GGM/840
P	49.2W
$P_{emergency\ lighting}$	1.5W
$\Phi_{lighting}$	5580lm
$\Phi_{emergency\ lighting}$	240lm
ELF	100%



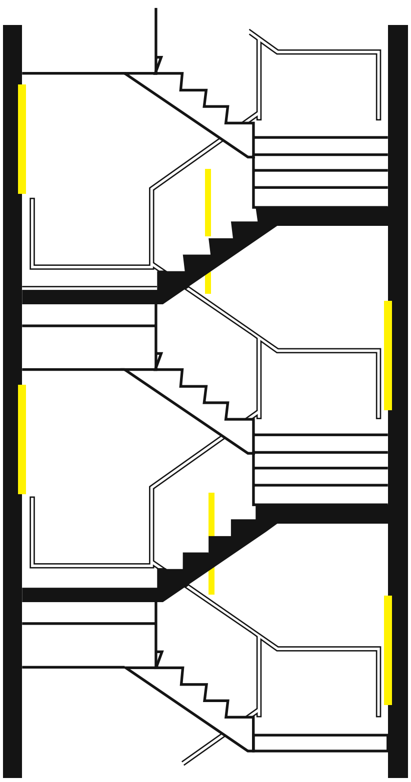
CRL polaire

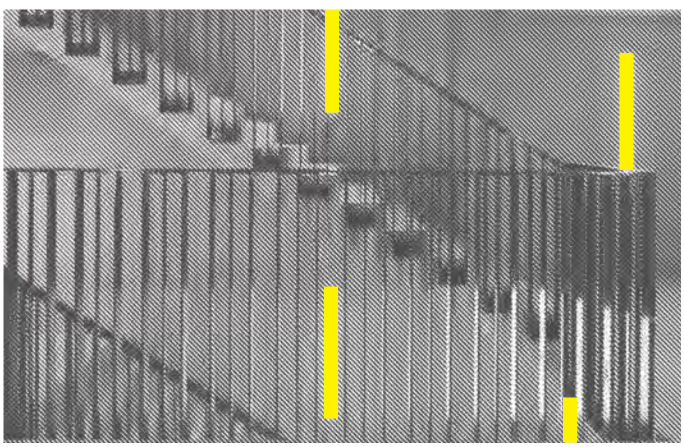


CRL polaire



Staircase Lighitng





04.7
Ceiling Fans

Simulations related to the Low-Tech concept are not yet fully finalized. However, it may be advisable to provide ceiling fans in the office areas. Ceiling fans enhance occupant comfort, with a perceived temperature reduction of approximately 2 °C.

Provision for a power connection is included from the outset. For reference, ceiling fans have been successfully integrated in office areas such as the Bundestag building in Berlin. The electrical connection in the exposed concrete ceiling requires careful planning and execution to meet both functional and aesthetic requirements. Therefore, the connection is planned and installed during construction.

1. Planning and Preparation

• Positioning: The ideal location for the fan is at the center of the room. The electrical connection must be aligned accordingly. The fan's position is coordinated with the lighting to prevent any unwanted shadows during operation.

• Conduit routing: Before casting the concrete ceiling, the electrical wiring for the fan is positioned to ensure it is fully embedded but accessible for later connection.

2. Installation of Connection

• Installation box: A dedicated recessed or concrete-compatible junction box is integrated into the formwork at the planned location. This box will serve as the mounting point and electrical connection for the fan.

• Cable routing: The power cable is guided through the formwork into the junction box and securely anchored, so it remains accessible after the concrete is cast.

3. Concrete Ceiling Casting

• Casting: The exposed concrete ceiling is poured, embedding the junction box and wiring. Precise placement of the box is essential to avoid issues when installing the fan later.

4. Fan Installation

• Electrical connection: After the concrete has cured and the ceiling is complete, the fan can be mounted. This step is expected to occur at a later stage.

5. Finishing

• Visual integration: Any visible transitions between the fan and the ceiling are refined to ensure a harmonious appearance. Often, special covers or casings are used to integrate the fan aesthetically.

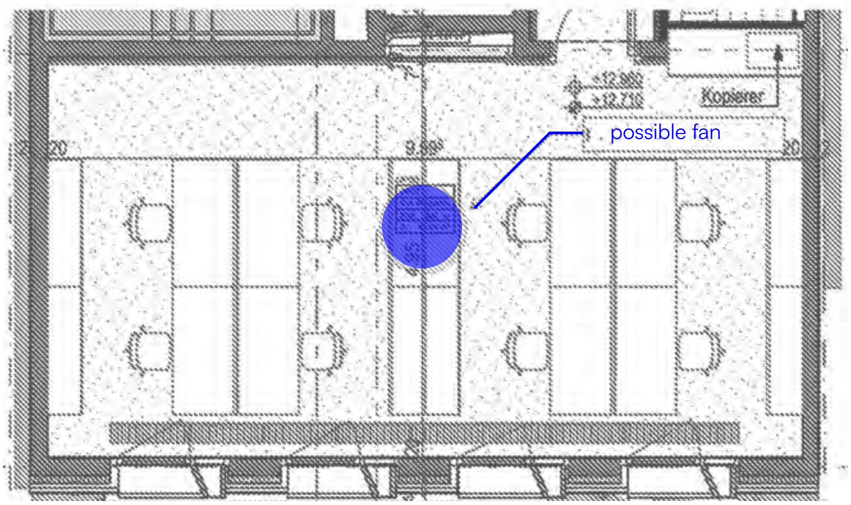
• Testing and commissioning: Finally, the fan is tested for proper function and the installation is approved.

This procedure ensures that the ceiling fan's power connection is safe, functional, and visually integrated into the exposed concrete ceiling.

An alternative solution is a floor convector, which can also serve as a fan if required.

Example: ceiling fan for improved comfort

Reference planning German Parliament building,
Berlin | Office space with fan



04.8
Backup Heating & Cooling System

A backup heating and cooling system using floor-mounted convectors is provided on the different floors of the building.

These convectors are supplied with heating water and chilled water from the substation located in the basement, which is in turn supplied by the Helix building.

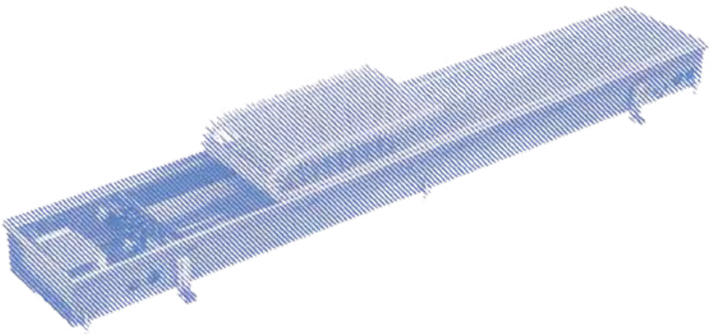
The temperature regimes are as follows:

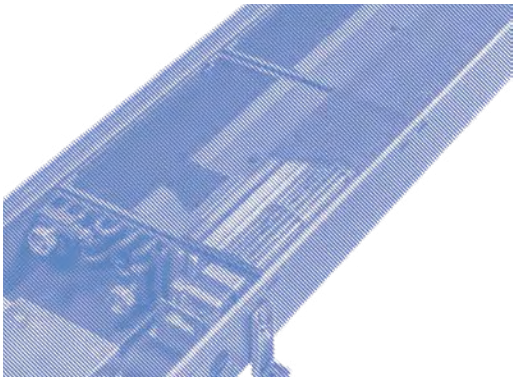
- Heating water: 50 / 30 °C
- Chilled water: 16 / 18.5 °C

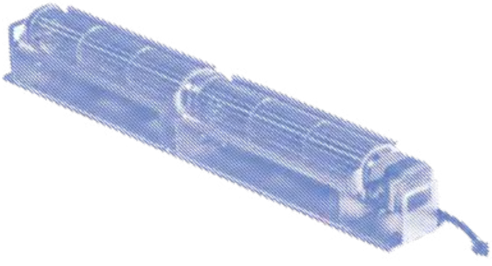
A model of a reversible convector (heating and cooling) equipped with a fan is used. The black convectors are fitted with a fan, required for the distribution of cooling in summer, and are covered with a black grille.

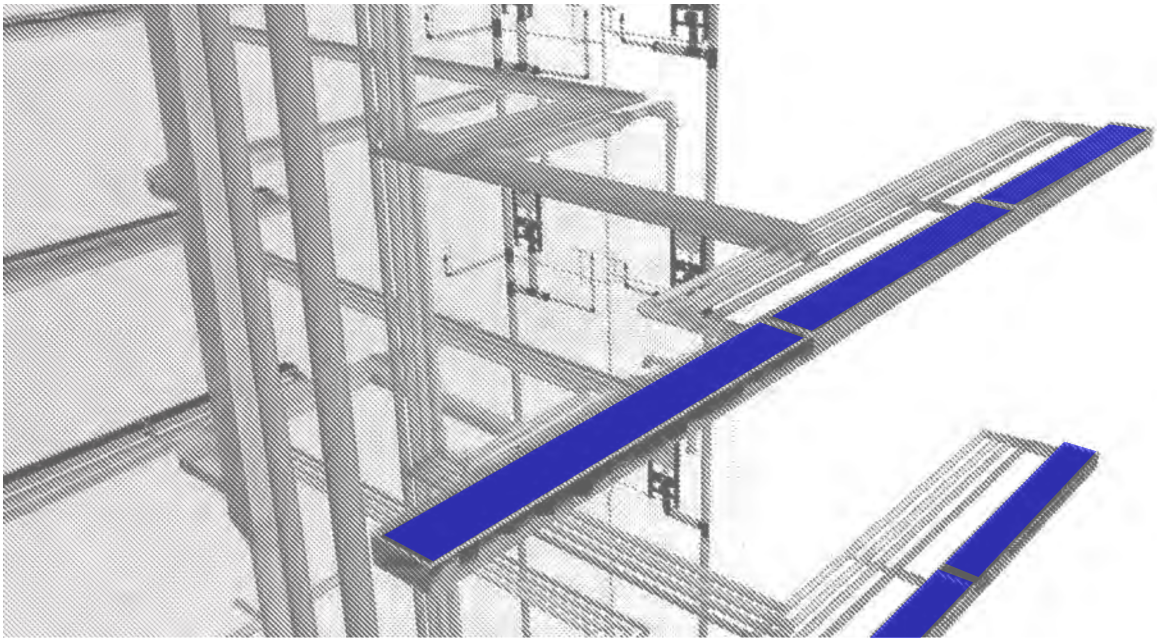
The convectors are installed along the façades, as close as possible to the windows. An extract from the BIM model illustrates the heating and cooling pipe network as well as the convectors on the upper floors.

For the ground floor, connections for heating water, chilled water, and cooling are provided for the tenant.









04.9
Ventilation System

Ventilation of Ancillary Rooms | Basement

In the basement, ventilation of the various rooms, including the waste rooms, is ensured by the installation of a compact air-handling unit with highly efficient heat recovery using a plate heat exchanger.

The ventilation unit is specifically designed to ensure that exhaust air from the waste rooms is not mixed with the supply air. This is of particular importance in order to effectively isolate unpleasant odours from the waste rooms and to prevent them from spreading to other areas of the building.

The ventilation system operates according to a strict air separation principle. Exhaust air from the waste rooms is extracted separately and discharged directly to the outside without coming into contact with the supply air. As a result, the fresh air supplied to the upper floors and other areas of the building remains completely free of odour contamination. Fig.12

Ventilation of the Commercial Area | Ground Floor

The fresh air intake is positioned on the roof of the ground floor.

For the potential gastronomy area on the ground floor, an outdoor air and exhaust air duct network is provided to allow for the installation of an extraction hood. While the outdoor air connection is routed via the terrace above, the exhaust air duct is led through the technical shaft and discharged above roof level.

The remaining areas of the rental space are naturally ventilated via the planned roof skylights. Fig.13

Ventilation of Office Floors (R+1 to R+5)

Hygienic ventilation of the office areas on the upper floors is provided, as described in detail in the previous chapters, through natural air supply via motorised façade openings. The corresponding exhaust air is extracted on a floor-by-floor basis from the sanitary rooms located in the core area via a duct network and discharged above roof level by means of an exhaust fan installed on the top floor. Fig.14

Air extraction from the sanitary rooms is carried out via disc valves located above the WC installations.

Air transfer from the office spaces to the sanitary rooms is achieved through acoustic transfer elements installed in the partition walls separating the offices from the sanitary areas. Fig.15

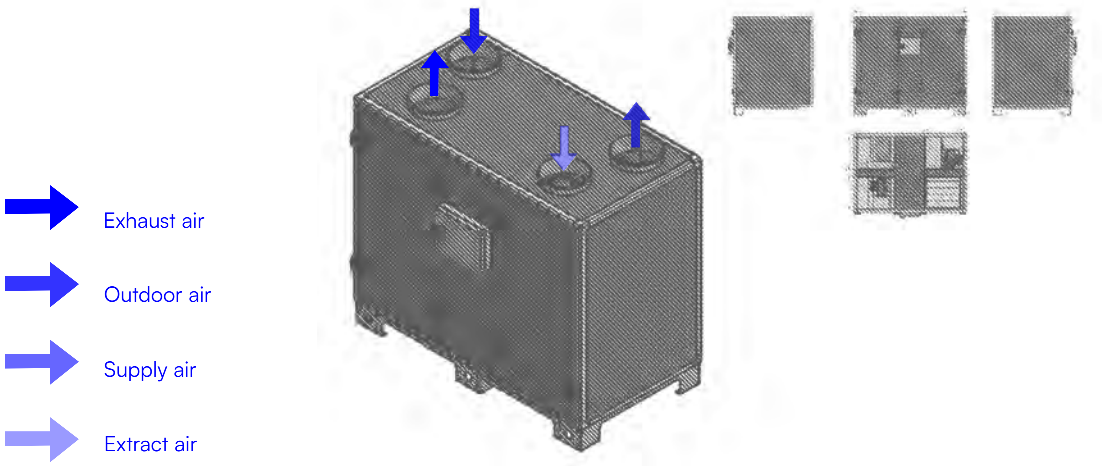


Fig. 12 | Compact Heat Recovery Ventilation Unit

Fig. 13

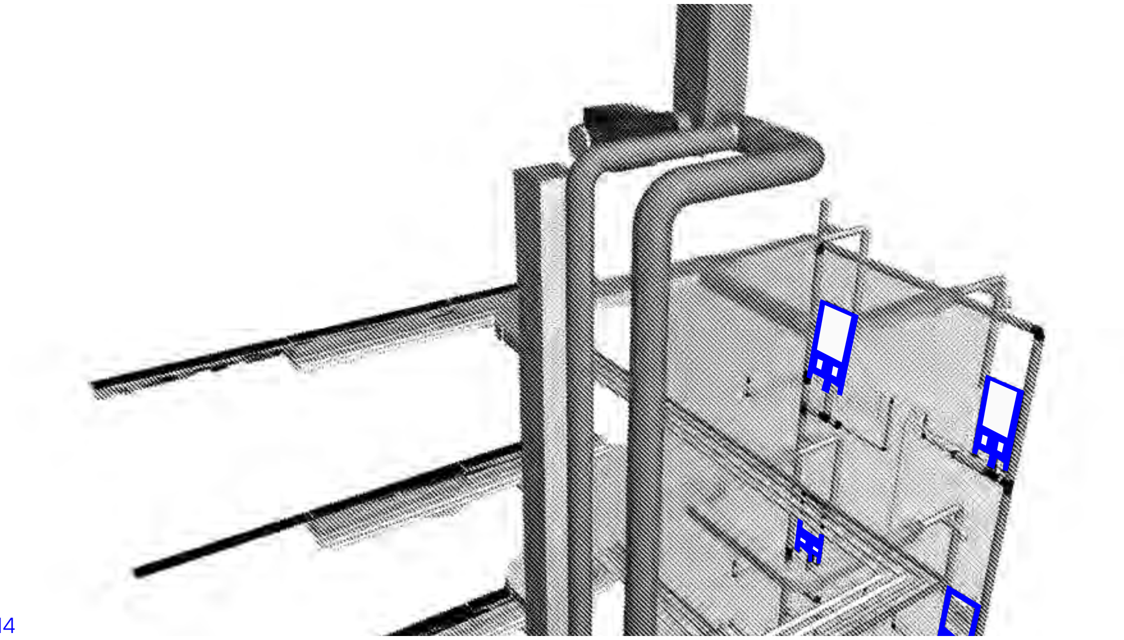
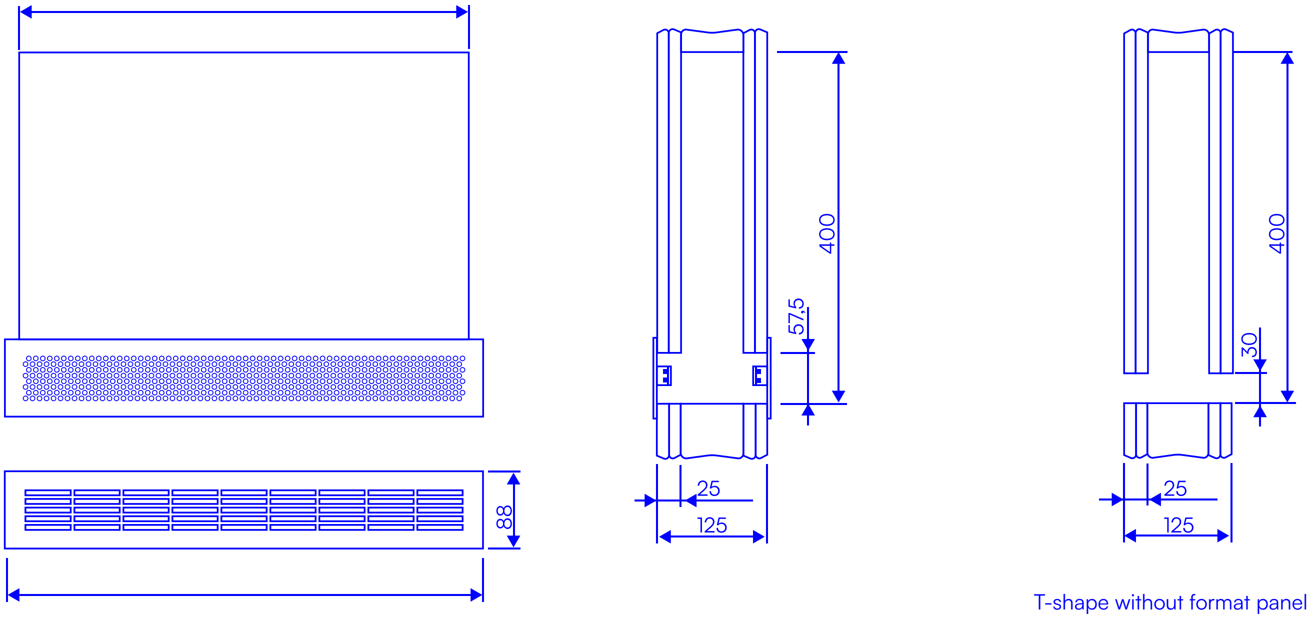


Fig. 14

T-shape with format panel



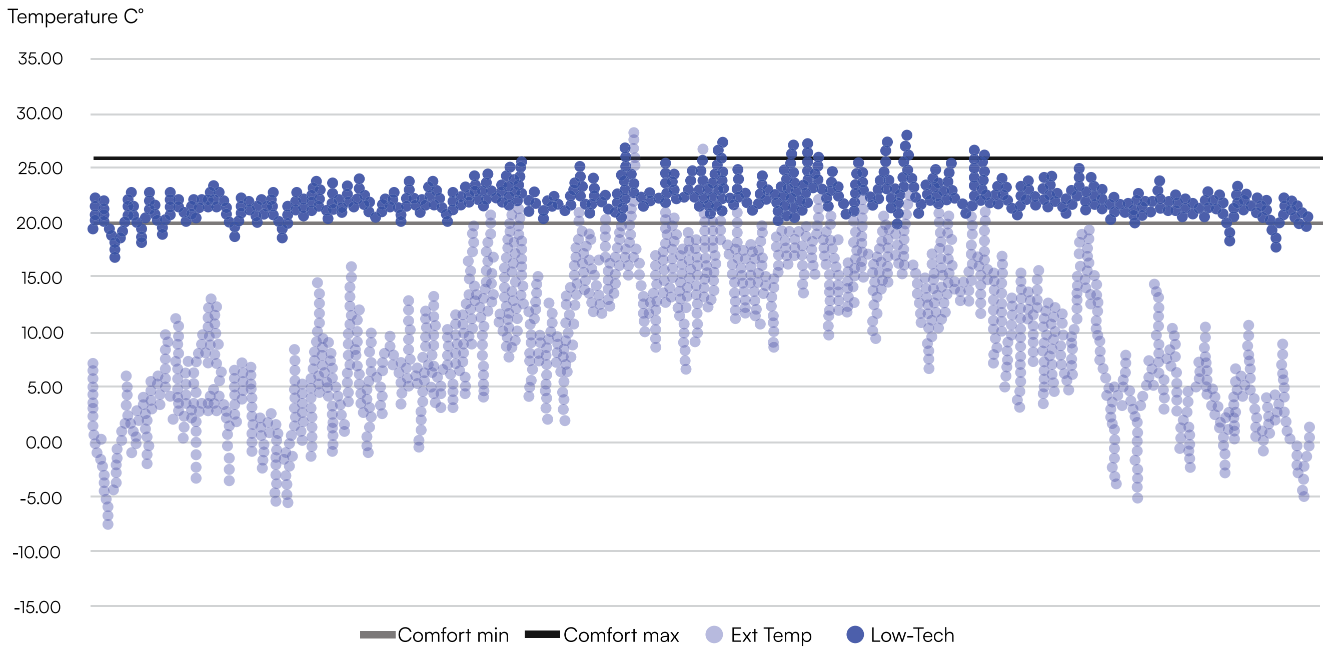
T-shape without format panel

Fig. 15

04.10
Calculation Results

Office Room Temperatures | South Orientation

Hourly room temperature profiles over the course of the year for a south-facing office. The building is naturally ventilated and operates with the proposed low-tech strategy. No active heating or cooling is applied; indoor conditions follow free-running temperatures.



04.11
Calculation DIN EN 16798 | Overheating

Office Area with High Occupancy

Summer indoor temperatures were assessed for a south-facing office with an occupancy of eight people, based on standard external temperature conditions. The assessment was conducted in accordance with DIN EN 16798 and DIN EN 7730.

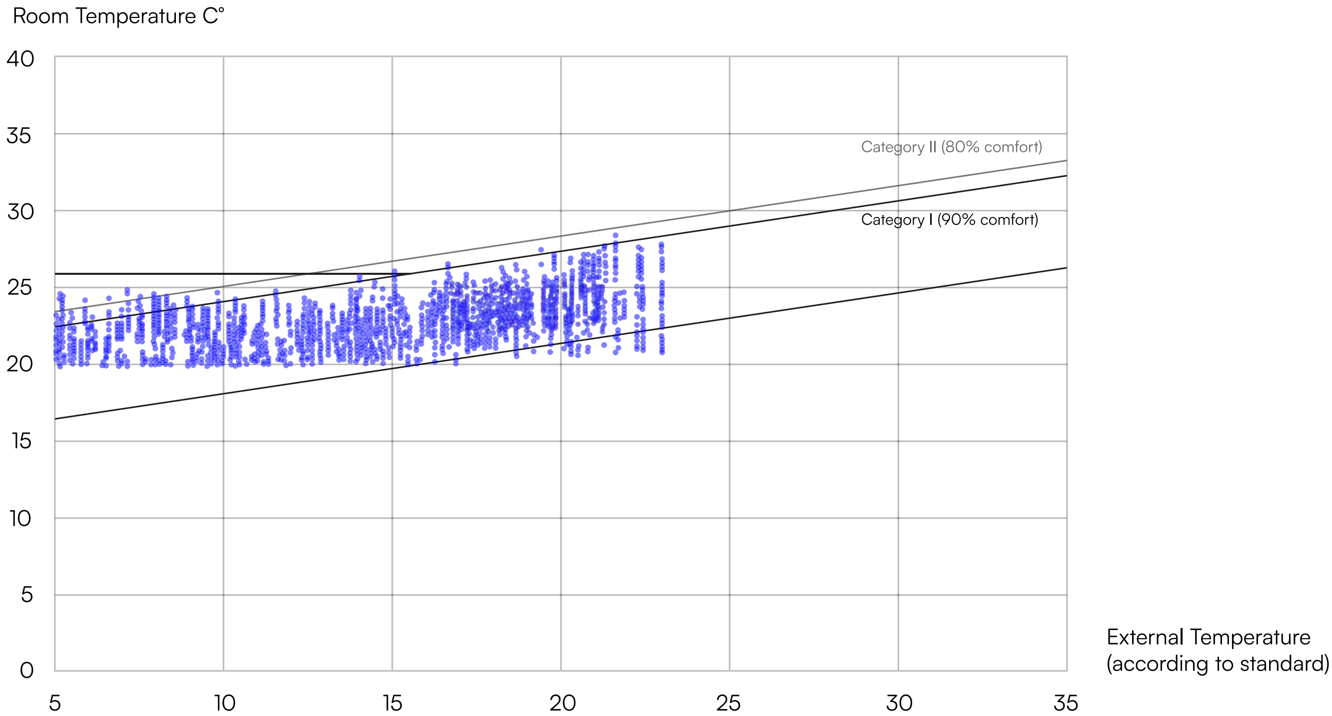
Comfort Categories

Category I: Enhanced comfort
Category II: Good comfort (required)

Results

The calculation results show that the south-facing office with high occupancy (8 persons) does not experience overheating. The use of ceiling fans is therefore not required.

	Fan	# hours/year	Kh (cooling)	% above
Category I	No Fan	31	15.5	0.8
	Fan 0.3 m/s	5	2.3	0.1
	Fan 0.5 m/s	1	0.1	0.0
Category II	No Fan	4	1.4	0.1
	Fan 0.3 m/s	0	0.0	0.0
	Fan 0.5 m/s	0	0.0	0.0



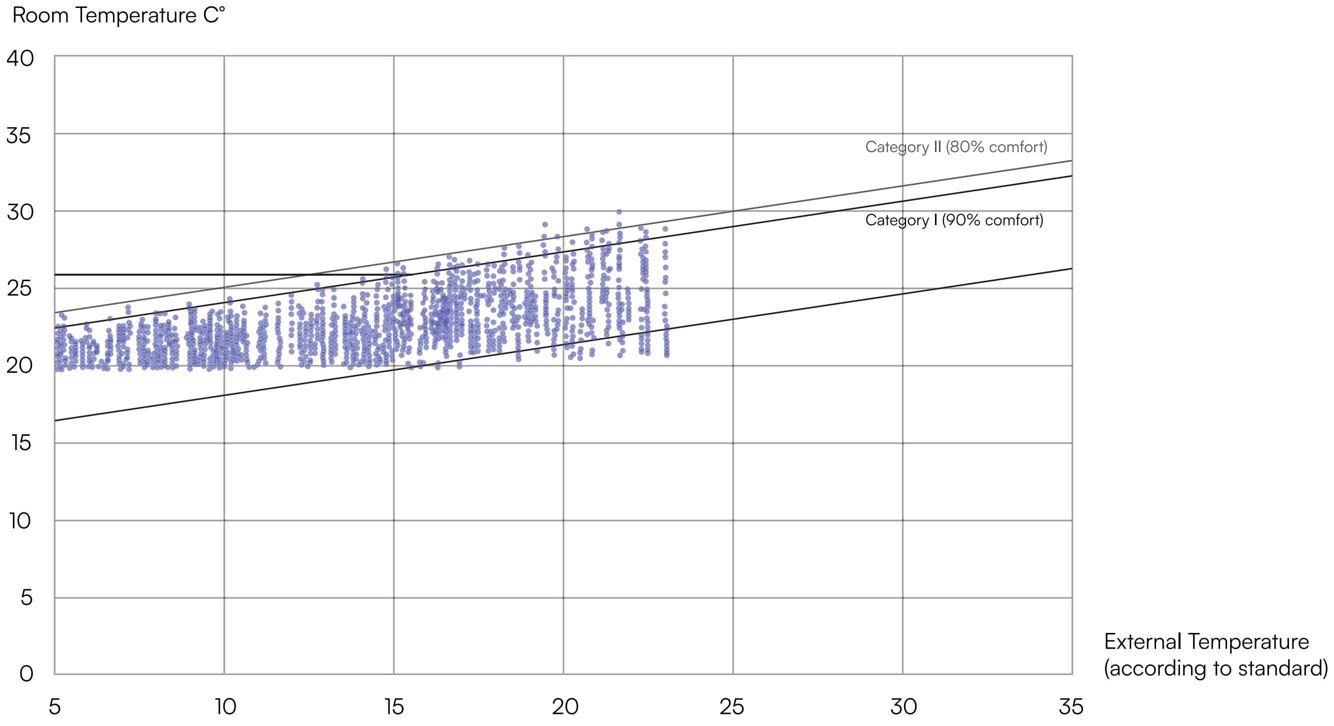
Meeting Room with High Occupancy

Summer indoor temperatures were assessed for a south-facing meeting room (18 m²) with an occupancy of eight people. The assessment was conducted in accordance with DIN EN 16798 and DIN EN 7730.

Results

The calculation results show that the south-facing meeting room with high occupancy (8 persons) exhibits only minor overheating. The proportion of time with temperatures exceeding the comfort limit is low (3%). The space meets the requirements for enhanced comfort (Category I).

	Fan	# hours/year	Kh (cooling)	% above
Category I	No Fan	88	60.6	3.0
	Fan 0.3 m/s	29	17.9	0.9
	Fan 0.5 m/s	9	5.3	0.3
Category II	No Fan	29	13.8	0.7
	Fan 0.3 m/s	6	3.0	0.1
	Fan 0.5 m/s	1	0.7	0.0



04.12
Calculation DIN EN 16798 | Overheating 2050

Office Area with High Occupancy

Summer indoor temperatures were assessed for a south-facing office with high occupancy (eight occupants), based on climate assumptions for the year 2050. The evaluation uses climate data from the German Weather Service (2031—2060), with a maximum external temperature of 35.5 °C. The assessment was carried out in accordance with DIN EN 16798, with an additional evaluation of summer thermal comfort in accordance with DIN EN 16798 and DIN EN 7730.

Comfort Categories

The calculation results indicate that the south-facing office with high occupancy (8 persons) remains within acceptable thermal limits and does not experience overheating.

Results

Category I: Enhanced comfort

Category II: Good comfort (required)

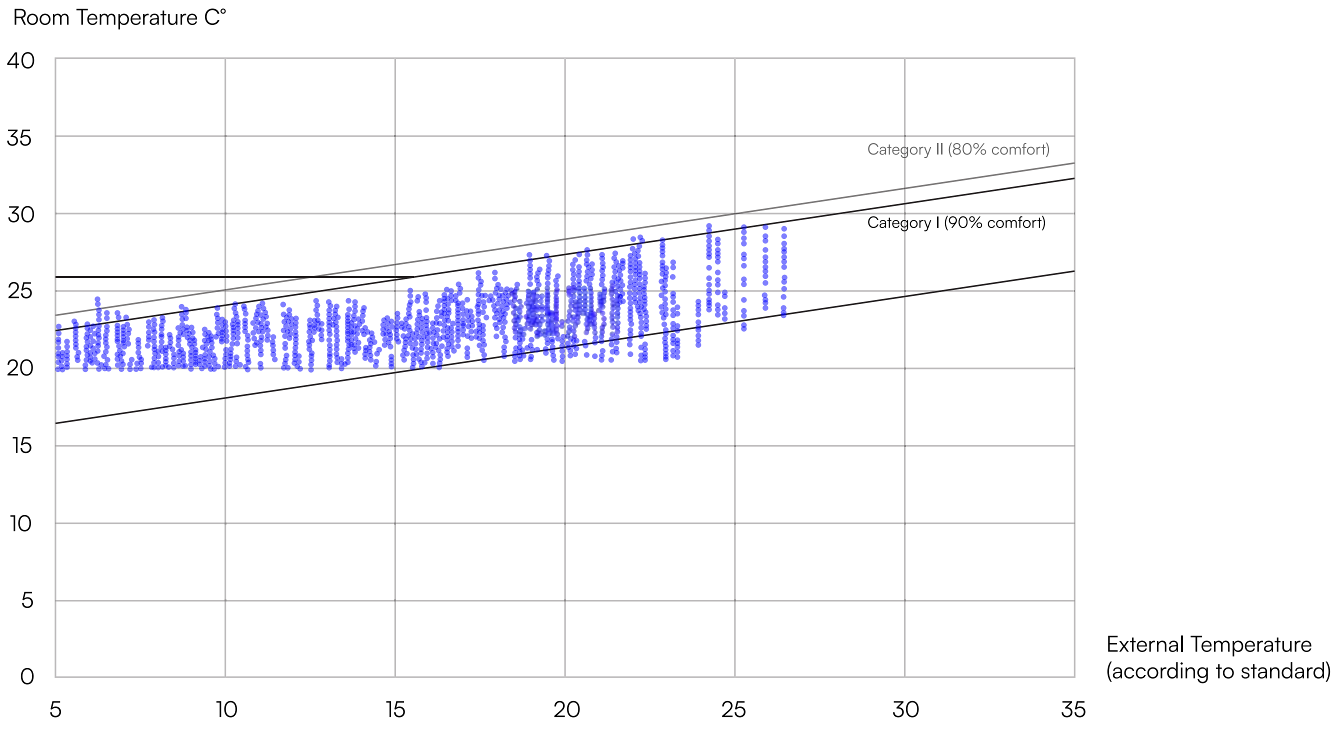
According to DGNB guidelines, up to 5% of the hours during the cooling season may lie outside the defined comfort range.

Assessment

• The calculation results in accordance with DIN EN 16798 and DIN EN 7730 show that the comfort range with increased summer temperatures, as defined by DGNB Category I, can be maintained.

• The calculated heating energy demand corresponds to the results of the previous calculations (based on climate data for the year 2023).

	Fan	# hours/year	Kh (cooling)	% above
Category I	No Fan	70	36.4	1.8
	Fan 0.3 m/s	16	5.0	0.2
	Fan 0.5 m/s	3	0.5	0.0
Category II	No Fan	8	2.7	0.1
	Fan 0.3 m/s	1	0.0	0.0
	Fan 0.5 m/s	0	0.0	0.0



Calculation Assumptions and Heating Energy Demand

	Area (m2)	No Rooms (-)	Sum Area (m2)	Low Tech (kWh/m2y)	(kW/h)
Office N	48	4	192	22.5	4320
Office S	48	3	144	21.5	3096
Café	48.15	1	48.15	15	722.25
Sanitary	30	1	30	11	330
Ground floor N	50	1	50	37	1850
Ground floor S	100	1	100	16	1600
Circulation	201	1	201	11	2211
Cave	98.5	1	98.5	23	2265.5
Secondary space	35	1	35	25	875
Technology	63	1	63	16	1008
Sum			961.65		18277.75
Spec. Energy Demand (heating)					19.00666 kwh/m2y

Dynamic simulation of the entire building

Results

• The total heating energy demand (net energy demand) of the building amounts to 18.8 kWh/(m^2 year).

• The heating energy demand can be slightly reduced by incorporating an unheated basement.

• The ground floor can be operated using the proposed low-tech strategy; however, its heating energy demand is higher than that of other areas.

04.13
Heating Energy Demand | Conventional vs. Low-Tech

Calculation of primary energy demand and CO_2 emissons associated with building operation

The aim is to demonstrate that the building operated with a low-tech strategy meets the requirements of the energy performance certificate in accordance with DIN EN 18599. The building was first assessed using the standard energy performance calculation. The results of the dynamic simulation were then incorporated. Coefficient of performance (COP) values, primary energy factors, and specific CO_2 emission values were taken from DIN EN 18599. The calculations apply to the entire building.

Results

The heating energy demand (net energy demand) using conventional systems and the proposed low-tech ventilation strategy is nearly identical

Primary Energy Demand and CO_2 Emissions for Building Operation

Results

• The calculations show that the building, operated with a low-tech strategy, meets the requirements of the energy performance certificate.

• Significant savings are achieved through the reduced energy demand for ventilation.

Maximum primary energy demand and CO2 emissions (according to DIN EN 18599)

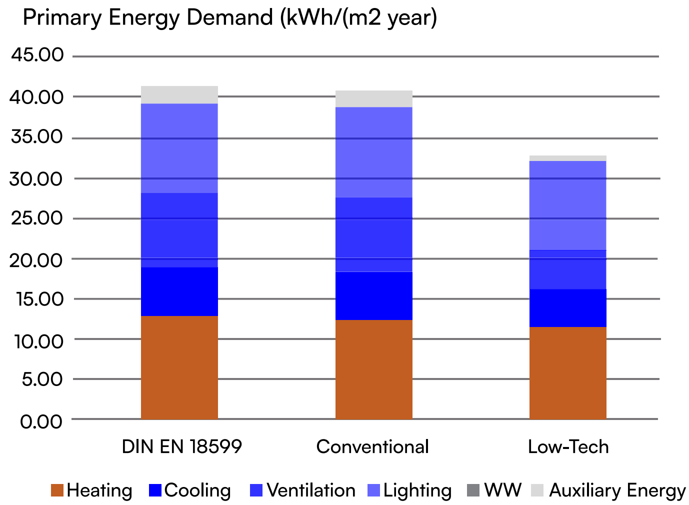
		Heating	Cooling	Ventilation	Lighting	Auxiliary energy
Utility energy	kWh/(m2a)	21.30	14.60	0.00	7.40	0.00
Final energy	kWh/(m2a)	8.66	3.74	6.14	7.40	1.63
Primary energy	kWh/(m2a)	12.99	5.95	9.21	11.10	2.10
CO2 Emission	kg CO2 em. /(m2a)	3.18	1.37	2.25	2.71	0.60

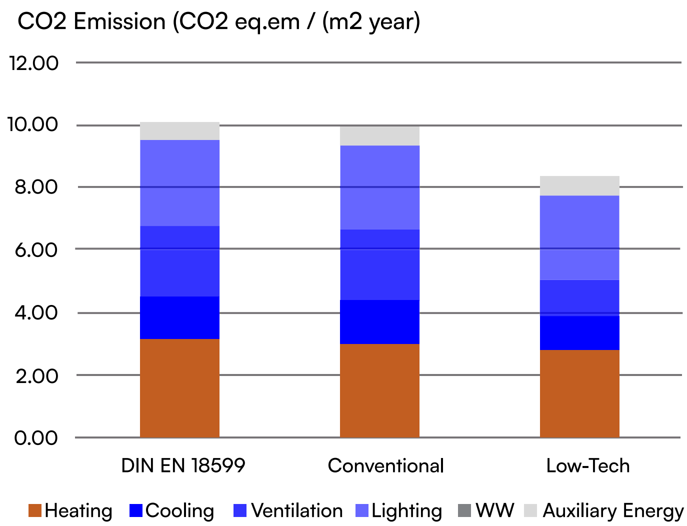
Conventional

		Heating	Cooling	Ventilation	Lighting	Auxiliary energy
Utility energy	kWh/(m2a)	20.40	14.60	0.00	7.40	0.00
Final energy	kWh/(m2a)	8.29	3.74	6.14	7.40	1.63
Primary energy	kWh/(m2a)	12.44	5.95	9.21	11.10	2.10
CO2 Emission	kg CO2 em. /(m2a)	3.04	1.37	2.25	2.71	0.60

Low-Tech

		Heating	Cooling	Ventilation	Lighting	Auxiliary energy
Utility energy	kWh/(m2a)	19.00	2.92	0.00	7.40	0.00
Final energy	kWh/(m2a)	7.72	2.92	3.20	7.40	1.63
Primary energy	kWh/(m2a)	11.59	4.65	4.80	11.10	2.10
CO2 Emission	kg CO2 em. /(m2a)	2.83	1.07	1.17	2.71	0.60





Maximum primary energy demand and CO2 emissions

Primary energy	Sum	41.35 kWh/(m2a)
CO2 Emission	Sum	10.11 kg CO2 em. /(m2a)

Conventional

Primary energy	Sum	40.80 kWh/(m2a)
CO2 Emission	Sum	9.97 kg CO2 em. /(m2a)

Low-Tech

Primary energy	Sum	34.23 kWh/(m2a)
CO2 Emission	Sum	8.39 kg CO2 em. /(m2a)

04.14
Renewable Energy | Photovoltaics

The annual solar irradiation on the façades was calculated, taking the surrounding buildings into account. The results are expressed as annual solar irradiation per square metre of roof or façade area (kWh/m² a).

Calculations were carried out for all façade surfaces, including:

Calculation Results

The calculation results for the photovoltaic system are presented below. The efficiency of the photovoltaic installation is assumed to be 16%.

Since the roof geometry has changed following the initial calculation, the assessment must be adapted to the current roof areas:

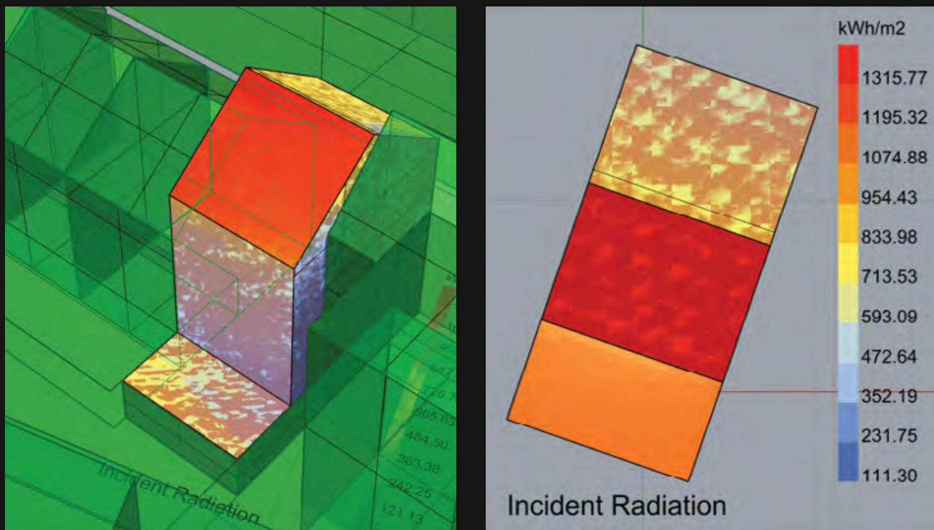
- South-oriented roof: 88 m²
- North-oriented roof: 88 m²

Due to the revised roof design, a slightly larger roof area is now available.

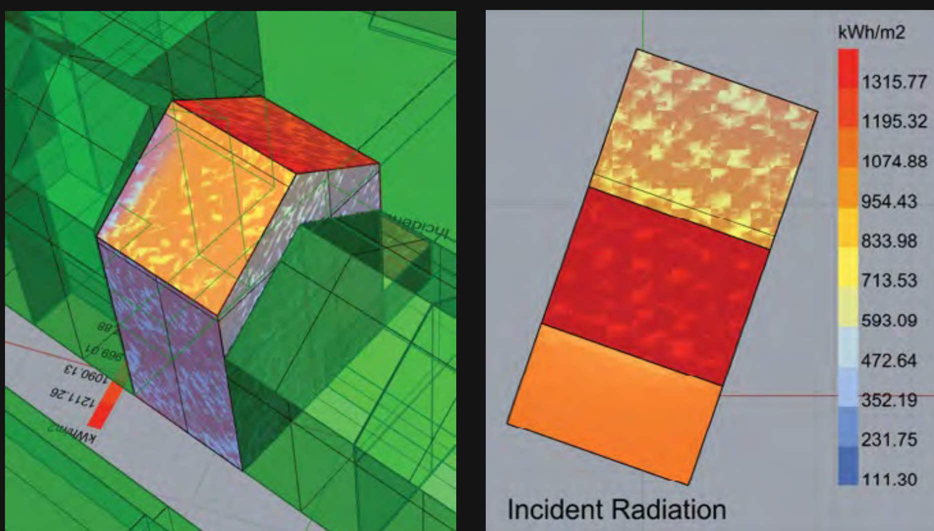
Commentary

- The calculation results indicate that the installation of a photovoltaic system on the south-facing façade as well as on the roof (north- and south-oriented) is technically and energetically viable.
- The electricity produced per unit of floor area amounts to 25,6 kWh/(m² year).
- The building has the potential to be realised as a CO_2-neutral (net-zero) building.

	Area	Radiation		Electricity
	m2	kWh/m2	kWh	PV El kWh
Roof S	98.0	1015.5	99523.0	15923.7
Roof N	50.0	720.0	36000.0	5760.0
Facade S 4 Upper floor	16.0	438.0	7008.0	1121.3
Facade S 3 Upper floor	16.0	383.6	6137.1	981.9
Facade S 2 Upper floor	16.0	346.7	5546.7	887.5
Facade S 1 Upper floor	16.0	272.6	4361.1	697.8
Summe			158575.8	25372.1

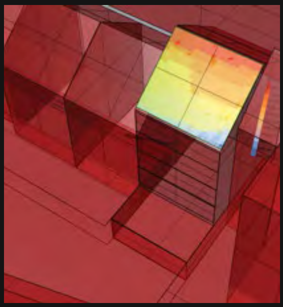


Annual solar irradiation on the south-oriented façade

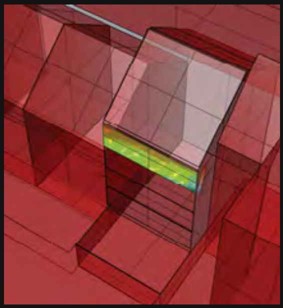


Annual solar irradiation on the north-oriented façade

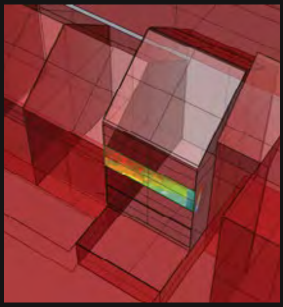
Additional calculations were conducted for façade and roof surfaces with potential photovoltaic installation, including:



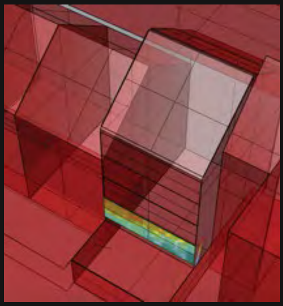
South-oriented roof



South-oriented façade | 4th floor



South-oriented façade | 3rd floor



South-oriented façade | 1st floor

04.15
Rainwater Retention Basin

Rainwater Retention

The rainwater retention basin is used to attenuate runoff from precipitation by providing temporary storage. It serves to protect the sewer network from hydraulic overload and allows for a reduction in the required cross-sections of drainage systems.

Dimensioning

Rainwater retention basins are dimensioned either using static precipitation data and the simple method according to DWA-A 117 for small and simply structured drainage systems, or using long-term precipitation-runoff simulation.

The following parameters were used to determine the required size of the rainwater cistern:

With regard to the size of the cistern to be planned, the following recommendations apply:

- Autonomous building operation period (rainwater cistern volume 6,5 m^3): 10 days
- Autonomous building operation period (rainwater cistern volume 9,5 m^3): 15 days

From a planning perspective, the size of the cistern should be between 6,5 and 9,5 m^3.

Components

The rainwater retention basin is equipped with a calming inlet, a retention volume, and a throttled outlet. The latter may be designed either as a simple throttling pipe or as a flow control device with a constant discharge rate. With appropriate design, the functions of rainwater retention and rainwater treatment can be combined.

Consumption	Number of employees (-)	Taps (-)	Water volume (l / taps)	Demand (l / working day)
Men’s WCs 1x / day	35	1	4,5	157,5
Men’s Urinals 2x / day	35	2	0,8	56
Women’s WCs (large button) 1x / day	35	1	4,5	157,5
Women’s WCs (small button) 2x / day	35	2	3	210
Green space (watering in summer) 20m2 / 15l / week	20	15	5	60
Total				641

05
Sustainability, Circularity & Health

05.1 Circular Economy

The Epernay project embraces circular construction by prioritising the reuse of building components, reducing waste, conserving resources, and extending the life cycle of materials.

Since the post-war era, the new has been regarded as a guarantee of progress. To this day, architecture has been shaped by the conviction that buildings constructed from the latest materials and newly manufactured components represent the future. Criticism of this mindset is growing steadily and is further reinforced by the figures of current climate impact assessments.

For the second consecutive year, the building sector in Germany has failed to meet its climate protection targets. Each year, approximately 230 million tonnes of construction and demolition waste are generated by the building sector, accounting for around 55% of total waste in Germany. This raises the question of how existing resources can be utilised more effectively and how materials such as bricks, windows, doors, and façade elements can be reused. In view of the targeted climate neutrality, it is essential to avoid demolition and disposal to landfill wherever possible.

Progressive architecture therefore relies on the principles of the circular economy and the multiple use of building components.

For the Épernay 18 project, the use of reclaimed building components is envisaged in several areas:

- Façade: brick façade
- Fit-out: raised floor systems
- Interior elements: doors

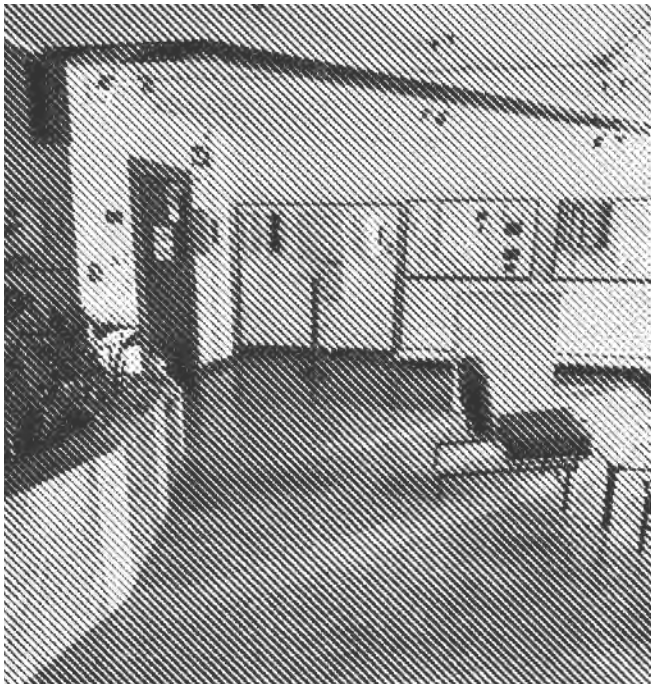
In coordination with E3 Consult, initial materials have already been assessed. Concular, a marketplace for circular building materials, offers a wide range of high-quality reclaimed construction products sourced from deconstructed buildings. Each product is inspected individually and evaluated with regard to its circular quality, ensuring that only high-quality reclaimed materials re-enter the material cycle.

As part of the Épernay construction project, particular emphasis is placed on the reuse of materials in order to enhance the overall sustainability of the development. In parallel with this project, two older buildings belonging to Post Luxembourg, namely Minerias 1 and 2, are currently being demolished. In this context, a detailed assessment is being carried out to determine which materials from these existing buildings can be reused in the new construction or in other projects.

The material reuse approach aims to conserve resources, minimise waste, and reduce the ecological footprint of the construction project. Materials such as steel, concrete, and timber, as well as windows, doors, and technical components, are being assessed for their quality and reusability. This systematic analysis seeks to identify the potential for integrating these components into the Épernay project or for alternative reuse.

This process represents an important step towards a circular construction economy that extends the life cycle of building materials and reduces the environmental impact of construction activities. The reuse of suitable materials not only contributes to cost efficiency but also strengthens the project's position with regard to sustainable construction and resource efficiency.

Detailed assessment procedure of reusable materials
Minerias 1 and 2



The raised floor could be dismantled, refurbished and reinstalled

05.1.1 Façade

In order to prevent excessive overheating of the street space, the façade along Rue d'Épernay is planned to be executed in a light-coloured material. Light surfaces reflect solar radiation more effectively than dark surfaces and therefore contribute to reducing ambient temperatures.

The use of light-coloured reclaimed bricks is envisaged. In addition to their aesthetic qualities, these bricks support the project's sustainability objectives by incorporating reused materials. Their application contributes to mitigating the so-called urban heat island effect, in which urban areas experience higher temperatures than their rural surroundings.

North Façade: 125m^2

Brick Specifications

- Dimensions (width × depth × height): 25 cm × 12.5 cm × 6 cm
- Hardness: medium-hard
- Required quantity: 52-54 bricks per m^2
- Total number of bricks required: 6,750 units = 6885,00 euro

old brick imperial size yellow/light
(price: 1,02 € / brick
total: 6.885,00 €)

05.1.2 Fire Protection Doors

The fire protection doors are designed as flush, robust elements with a restrained appearance, integrated discreetly into the interior architecture while meeting all relevant fire safety requirements.

Fire door — interior with door closer DIN R 160 x 1020 x 2150
(price: 650 €)

05.2
Resource Conservation & CO_2 Reduction

Various approaches are currently being examined to reduce resource consumption and CO_2 emissions associated with the use of concrete.

Carbon-reinforced concrete may represent a potential alternative. Its main advantage lies in material reduction: the use of carbon concrete can save approximately 50% of concrete and sand and reduce CO_2 emissions by up to 70%.

Beyond alternative concrete types, additional strategies are available to reduce CO_2 emissions when using concrete as a construction material. The following solutions are outlined and require further detailed investigation:

05.2.1 Use of CO_2-Reduced Cement

Cement is the primary source of CO_2 emissions in concrete production. Substituting conventional Portland cement with CO_2-reduced cement can significantly lower the carbon footprint.

• Blast Furnace Cement (CEM III)

This cement type contains a high proportion of granulated blast furnace slag, a by-product of steel production, thereby reducing the demand for clinker, which is CO_2-intensive.

• Pozzolanic Cements (CEM IV)

These cements incorporate natural or artificial pozzolanic materials, further reducing the clinker content and associated CO_2 emissions.

05.2.2 Use of Concrete Admixtures

Admixtures can reduce the required amount of cement or improve concrete performance, contributing to lower CO_2 emissions.

• Fly Ash

A by-product of coal-fired power plants, used as a partial cement substitute. Fly ash improves workability and durability.

• Silica Fume

A by-product of silicon and ferroalloy production, which increases the strength and durability of concrete.

• Limestone Powder

Finely ground limestone that can reduce the cement content of concrete without compromising quality.

05.2.3 Optimisation of Concrete Mix Design

Optimising the concrete mix design can reduce the quantities of cement and water required, thereby lowering CO_2 emissions.

• Mix Design

Precise coordination of the individual components (cement, aggregates, water, admixtures) increases efficiency and minimises material waste.

• Use of High-Performance Concrete (HPC)

These concretes achieve higher strengths and can be used in thinner sections, reducing overall material demand.

05.2.4 Use of Recycled Materials

Integrating recycled materials into concrete mixes reduces the demand for virgin resources and lowers CO_2 emissions.

• Recycled Aggregates

Use of recycled concrete or bricks as aggregates instead of newly extracted natural aggregates.

• Industrial By-products

Incorporation of waste materials from other industries, such as slag from steel production, as substitutes for natural aggregates.

05.2.5 Improving Energy Efficiency in Cement Production

Cement production is highly energy-intensive. Improving energy efficiency in manufacturing processes can significantly reduce CO_2 emissions.

- Modern Kilns

Use of energy-efficient rotary kilns and preheaters to reduce energy consumption.

- Alternative Fuels

Utilisation of biomass or industrial waste as fuel instead of fossil fuels.

05.3
Carbon Footprint | LCA | DGNB Certification

Sustainable building emerges from the coherence of many decisions. From design to materials and systems, each choice shapes comfort, efficiency, and long-term performance.

Review of the E&E Proposal

E&E has presented the topic of carbon footprint in a clear and visually well-structured manner. From a technical perspective, the methodology applied by E&E is correct.

However, the method proposed by E&E for calculating the carbon footprint represents only one of many calculation approaches currently used on the market. As a result, outcomes may vary significantly depending on the methodology applied and are therefore not directly comparable.

Differences between calculation methods may arise from the following aspects:

- Definition of the reference area

The calculated CO_2 potential is divided by a defined reference area (e.g. gross floor area, net usable area). The choice of reference area has a significant influence on the area-related carbon footprint.

- Life cycle assessment modules considered (A-D)
- CO_2 equivalents included in the assessment (e.g. elevators, refrigerants, user electricity consumption)

DGNB System Version 2023

The new DGNB system version 2023 came into force on 1 December 2023. While the DGNB system version 2018 already represented a substantial step towards more stringent climate protection (the Helix project is still being certified under system version 2015), the topic of climate protection and carbon footprint has gained even greater importance in the 2023 version.

In addition, DGNB System Version 2023 is closely aligned with the requirements of the EU Taxonomy and therefore reflects these criteria comprehensively.

The optimization measures proposed by E&E (steps 1A to 1D) are also included within the DGNB System Version 2023 and are effectively mandatory for achieving DGNB Platinum certification due to their weighting. Likewise, Phase 1E of the proposal is obligatory within the DGNB certification process. Consequently, all calculations proposed by E&E are already covered within the DGNB framework.

However, the calculation method proposed by E&E using the software OneClick LCA does not currently correspond to the DGNB calculation methodology, as the software is not yet able to fully reflect the DGNB method. This would result in two parallel carbon footprint optimization processes.

As the carbon footprint represents only one of several quality criteria within DGNB-certified buildings, DGNB does not currently award a separate "carbon footprint label" for new buildings.

Nevertheless, buildings that are demonstrably climate-neutral in operation may receive the "Climate Positive" label after at least one year of verified climate-neutral operation.

Life Cycle Assessment Strategy for DGNB Platinum Certification

A favorable life cycle assessment result in pursuit of DGNB Platinum certification can be achieved through the following measures:

- Reduction of required concrete and steel quantities, use of CO_2-reduced concrete, and integration of reused construction materials and components
- Selection of construction variants with lower CO_2 emissions based on comparative life cycle assessments
- Use of materials and building components with long service lives and reduced replacement frequency

DGNB Mobility Concept

- Public Transport Accessibility

The office building is located within walking distance of Luxembourg Central Station, a major transport hub offering connections by train, bus, and tram. A key advantage is that public transport in Luxembourg is free of charge, providing a strong incentive to reduce private car use and promote sustainable mobility.

- Bicycle and Scooter Parking

A total of 12 bicycle parking spaces are provided in the basement to encourage cycling as an environmentally friendly mode of transport. Additional parking spaces for e-scooters support the use of micromobility. Selected bicycle parking spaces are equipped with power outlets for e-bikes, facilitating the use of electric bicycles.

- Car Parking and Charging Infrastructure

Barrier-free car parking spaces are provided in the Helix underground garage. These spaces can be equipped with electric vehicle charging stations with a capacity of 10 kW if required, promoting e-mobility and reducing CO_2 emissions from transport.

- Promotion of Sustainable Mobility

Given the free public transport system in Luxembourg, additional incentives such as public transport tickets for employees are not required. The building's location and excellent connectivity significantly contribute to reducing individual car traffic and supporting sustainable commuting.

Additional Mobility Services

No additional mobility services such as car sharing or shuttle services are planned. The proximity to public transport, combined with good accessibility by bicycle and e-scooter, ensures adequate mobility coverage.

"Every decision counts — shaping comfort, performance, and sustainability."

05.4
EU Taxonomy | Sustainable Finance

05.4.1 Scope of Services — Review of EU Taxonomy Compliance

With the adoption of the EU Taxonomy Regulation, the European Union has established a framework defining which economic activities may be classified as sustainable.

The building and real estate sector is directly affected by these regulations. For new construction projects, (major) renovations, as well as the acquisition and ownership of real estate, specific qualitative minimum requirements must be met in order to demonstrate taxonomy compliance.

To be classified as "EU Taxonomy-compliant," all relevant criteria for a substantial contribution (environmental objectives 1, 2, and 4), the Do No Significant Harm (DNSH) requirements, and the minimum safeguards must be fulfilled.

When assessing investments in the real estate sector, the following six environmental objectives, as well as minimum safeguards, are considered:

- **Environmental Objective 1 |** Climate change mitigation
- **Environmental Objective 2 |** Climate change adaptation
- **Environmental Objective 3 |** Sustainable use and protection of water and marine resources
- **Environmental Objective 4 |** Transition to a circular economy
- **Environmental Objective 5 |** Pollution prevention and control
- **Environmental Objective 6 |** Protection and restoration of biodiversity and ecosystems

EU Taxonomy Compliance Review by DGNB and CPEA

Financial market participants, project developers, and property owners or clients can have the compliance of their real estate assets with EU Taxonomy requirements reviewed and officially confirmed by DGNB (German Sustainable Building Council) and CPEA (Climate Positive Europe Alliance).

According to its own statement, DGNB represents Europe's largest sustainability network.

The Climate Positive Europe Alliance AISBL (CPEA) is an independent think-and-do tank based in Brussels.

For investments in the real estate sector to be classified as EU Taxonomy-compliant, the following criteria must be met:

1. Compliance with minimum safeguards in the areas of social responsibility and governance

2. Fulfilment of the requirements for a substantial contribution, currently possible for:

- **Environmental Objective 1**
- **Environmental Objective 2**
- **Environmental Objective 4**

3. Proof of Do No Significant Harm (DNSH) for Environmental Objectives 1-6

4. (Submission of documentation by an ESG manager approved by DGNB; E3Consult currently has three approved ESG managers)

Proposed Structure for Demonstrating EU Taxonomy Compliance

For the present project, the following approach to demonstrating EU Taxonomy compliance is selected, as illustrated in the accompanying diagram:

1. Compliance with minimum safeguards in the areas of social responsibility and governance

2. Fulfilment of the requirements for a substantial contribution to climate change mitigation (Environmental Objective 1)

3. Proof of Do No Significant Harm (DNSH) for Environmental Objectives 2, 3, 4, 5, and 6

05.4.2 Preparation of a DGNB-Compliant Dossier for EU Taxonomy Review

The following steps are included within the scope of the EU Taxonomy compliance review:

a. Explanation of the requirements, particularly the minimum safeguards in the areas of social responsibility and governance, within up to three meetings with the client and, if required, the project team

b. Collection of all relevant information required for the EU Taxonomy compliance review

c. Definition of requirements for the planning team regarding compliance with the substantial contribution to climate change mitigation and the DNSH criteria for Environmental Objectives 2-6, which go beyond the current requirements of DGNB certification

d. Preparation of an EU Taxonomy Compliance Dossier for submission to DGNB by an approved ESG manager

e. Clarification of all open questions with DGNB to obtain the ESG verification report

f. (Issuance of the ESG EU Taxonomy compliance report by DGNB)

(1) Climate change

(2) DNSH Climate Change Adaptation
(3) DNSH Sustainable use of water resources
(4) DNSH Transition to a circular economy
(5) DNSH Prevention of pollution
(6) DNSH Protection of ecosystems & biodiversity

- OECD Guidelines for multinational enterprises
- UN Guiding principles on business & human rights
- ILO Guiding principles on fundamental principles & rights at work
- International covenant on human rights

05.5
Zero Waste | Strategy and Implementation

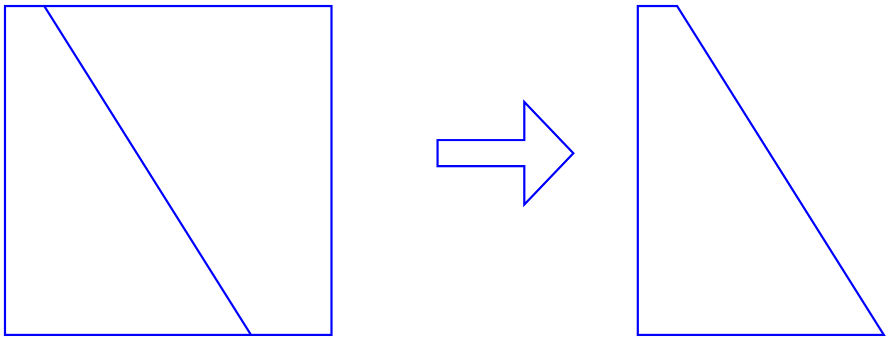
05.5.1 Case Study Project

METAFORM Architects realized the practice spaces with a strong focus on resource efficiency and sustainability. Zero waste was a key design principle throughout the project. While construction waste on a typical building site is difficult to quantify precisely, it generally accounts for approximately 30% of the total weight of delivered construction materials. In the SKINPERIUM project, waste was reduced to less than 1%. The insights gained from this case study are intended to be transferred to the project at 18 rue d'Épernay.

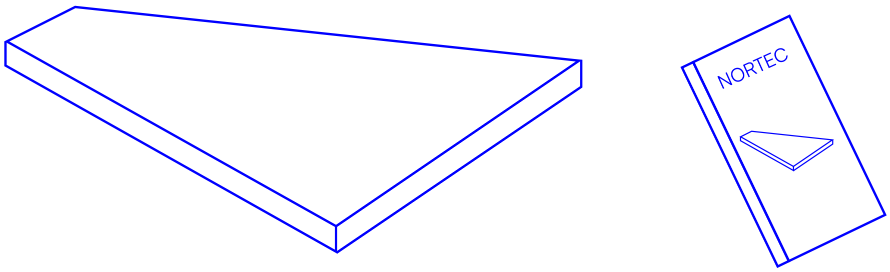
Zero Waste Case Study: SKINPERIUM

Reuse potential of Nortec

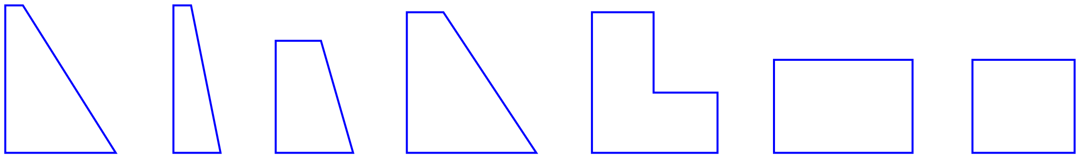
Reuse of offcuts that would otherwise be waste



When laying the raised floor, there will be waste.



This cut should be documented...



and, like other composite panels, is to be used elsewhere in the building.
The aim is to keep as much material as possible in the circular economy system for as long as possible.

05.5.2 Procedures

Similar to DGNB certification, the Zero Waste concept must be integrated into the project from the very beginning. Key decisions can already be made during the design phase.

Analysis of Current Waste Generation

Before planning waste prevention measures, a thorough analysis of existing waste generation is essential. This includes identifying waste types, quantities, and frequency, as well as determining the main sources and causes of waste.

Definition of Goals and Priorities

Based on the waste analysis, clear goals and priorities for waste prevention should be established. These objectives should be specific, measurable, achievable, relevant, and time-bound to ensure effective implementation.

Implementation of Waste Prevention Strategies

Development and implementation of strategies aimed at reducing both the volume and scope of waste. Measures may include optimization of production and construction processes, use of environmentally responsible materials, promotion of recycling and reuse practices, and awareness-raising among all project participants.

Integration of Circular Economy Principles

Incorporation of circular economy principles into planning, with the objective of using, reusing, repairing, and recycling products and materials throughout their entire life cycle rather than disposing of them after single use. This may include low-waste design approaches, extending product lifespans, and establishing take-back systems for materials and packaging.

Tendering

All tender documents and requests for proposals must explicitly state that waste generation on site is to be avoided and that material offcuts should, wherever possible, be directly integrated on site.

Construction Management, Monitoring, and Evaluation

Construction management plays a key role in the implementation of the Zero Waste strategy. A monitoring and evaluation system is established to track, measure, and assess progress in waste reduction. This includes regular monitoring of waste streams, performance analysis, and audits to identify opportunities for improvement.

Continuous Improvement and Adaptation

Ongoing review and adjustment of waste prevention strategies based on collected data and practical experience. This ensures maximum effectiveness, identifies weaknesses, and reveals further potential for waste reduction.

"The most sustainable waste is the waste that is never generated."

05.6
Absence of Pollutants & Health of Building Users

As part of the DGNB certification for this project, the client has defined specific requirements regarding material quality, material approval procedures, and enhanced environmental standards during the construction process.

These requirements aim to ensure the use of low-emission and environmentally responsible building materials, environmentally considerate construction practices, and a healthy indoor climate for future occupants. For this project, the highest quality standard for pollutant-free construction (Quality Level IV) is being pursued.

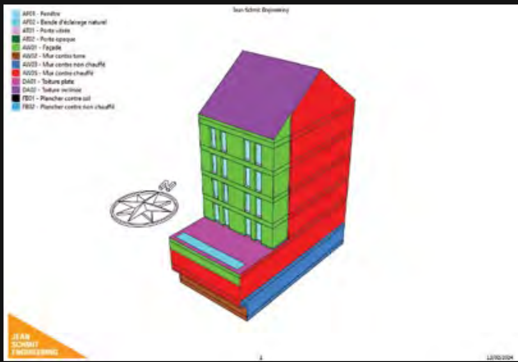
The application of this quality level ensures a healthy indoor environment and the avoidance of harmful substances in installed building products. This level of pollutant-free construction also forms a key prerequisite for the future reintegration of materials into technical or natural cycles at the end of the building's life cycle, in accordance with the principles of the circular economy.

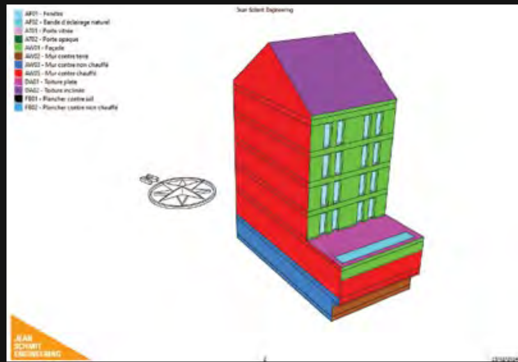
06
Building Services & Interior

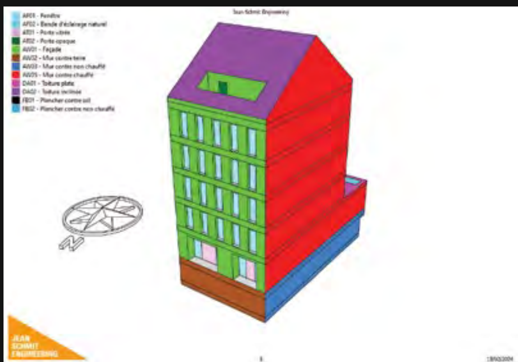
06.1
Building Services | (HVAC/MEP)

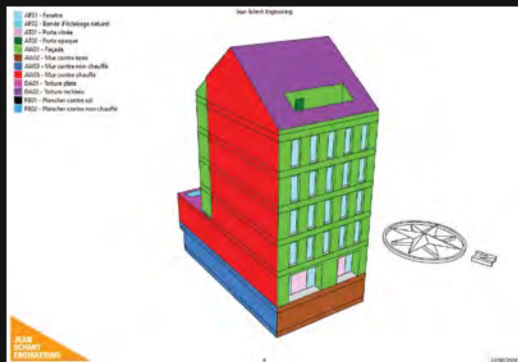
Energy Performance Certificate

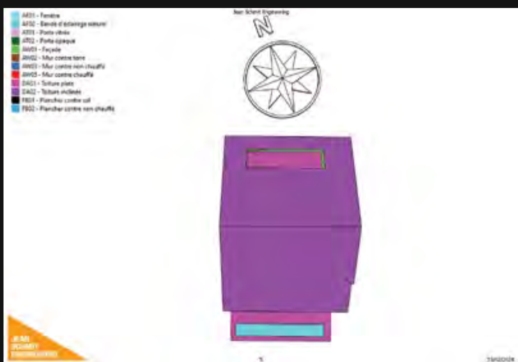
The planning of the thermal building envelope forms the foundation for achieving the targeted energy performance standards and ensuring long-term efficiency and comfort. The following images illustrate the key principles and design strategies applied.

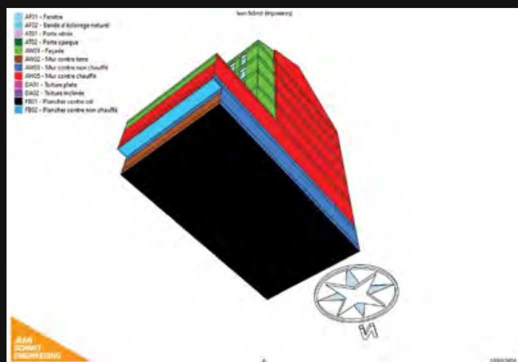












06.2
Water Consumption

In addition to the low-tech design approach, the responsible use of water plays a central role in the project. Water consumption is reduced to a minimum through targeted planning and the use of efficient systems.

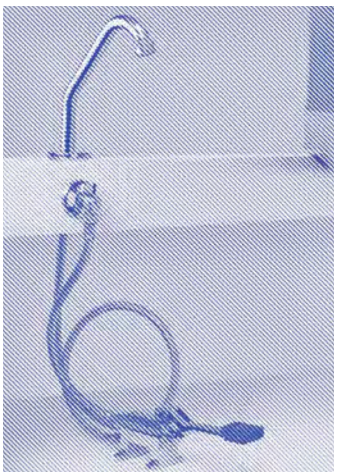
To minimize the demand for the valuable resource of drinking water, all sanitary fittings and flushing systems are designed to be as water-efficient as possible.

For toilet facilities, dual-flush systems with reduced flushing volumes are used. Where applicable, urinals can be installed as waterless systems.

For washbasins, the following solutions are considered to further reduce water consumption:

1. Infrared-controlled washbasin fittings with adjustable flow limiters
(higher investment, contact-free operation)
2. Mechanical self-closing washbasin fittings with adjustable flow limiters
(lower investment, manual operation)
3. Mechanical self-closing washbasin fittings with foot pedal
(lower investment, operation via foot control only)

1. Product example GROHE



3. Product example IDRAL

2. Product example GROHE

06.3
Heating & Ventilation

Connection to the Exisitng HELIX Building

Based on calculations of the required heating and cooling loads in accordance with applicable standards and guidelines, the following performance values have been determined:

- Heating load: 21 kW
- Cooling load: 19 kW

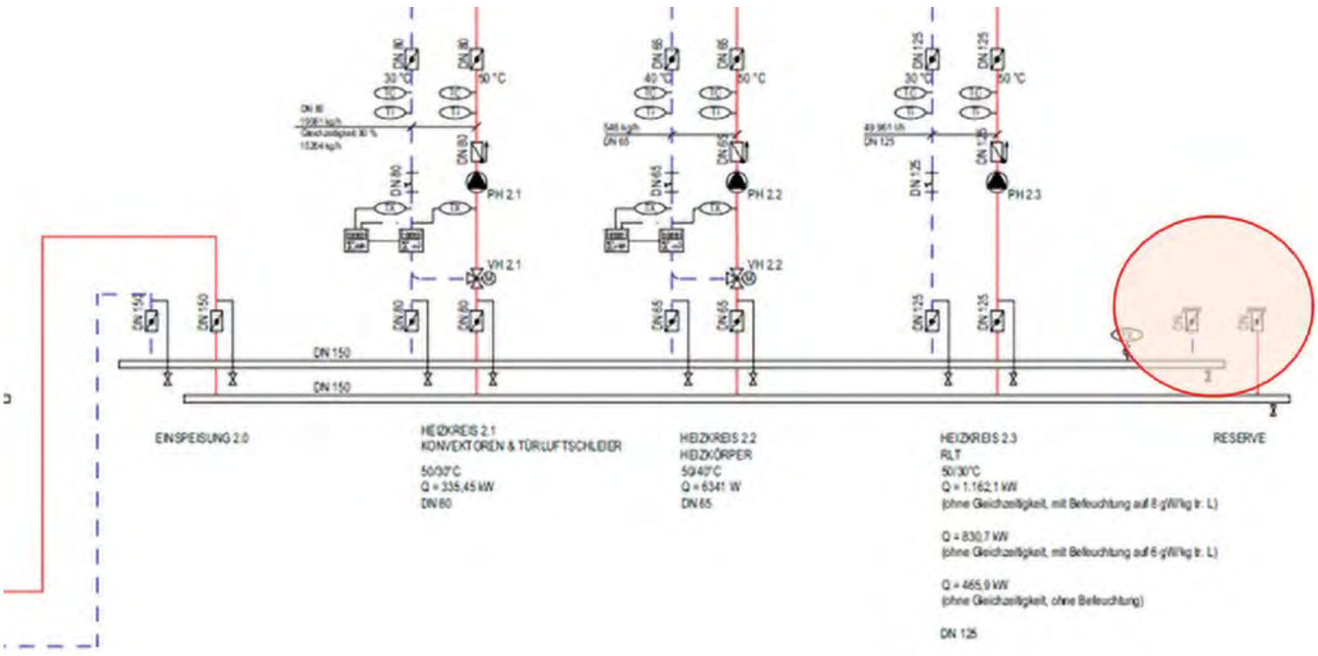
These loads are based on the following scenarios:

- **Coverage of demand during extreme weather conditions** (very cold winter days and very hot summer periods)
- **Heating of the building during periods without regular occupancy** (partially or temporarily unoccupied areas with reduced internal heat gains)
- **Coverage of increased demand resulting from future climatic developments**
- **Coverage of increased demand caused by changes in underlying assumptions** (occupancy levels, use patterns, etc.)

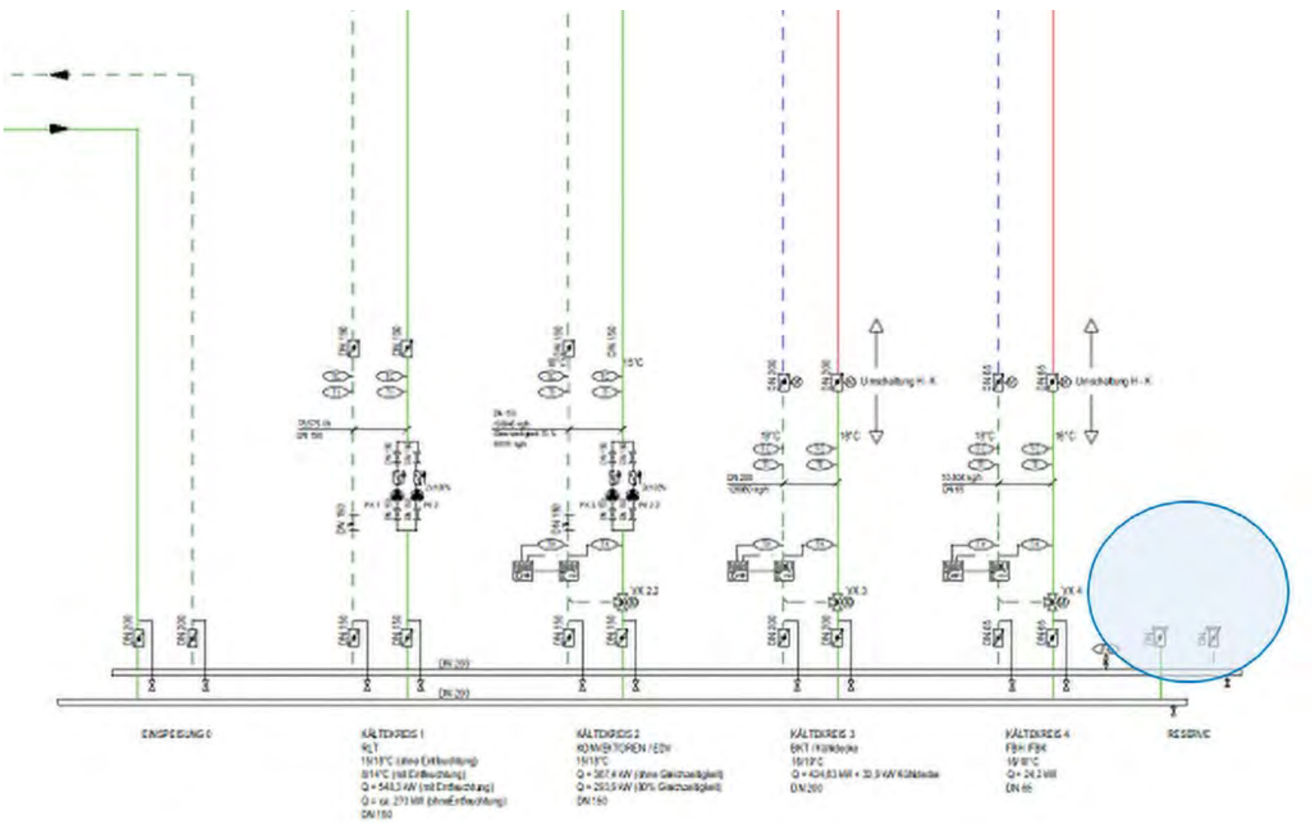
For these reasons, the above performance values are proposed as the basis for sizing the backup systems.

The loads for domestic hot water preparation (electric solution via instantaneous water heaters for kitchenette areas) as well as mechanical ventilation (currently not planned) are not included in these calculations.

Following the on-site inspection and analysis of the as-built documentation of the HELIX building, the following system connections are planned:



Heating-side connection (excerpt from HELIX as-built schematics)



Cooling-side connection (excerpt from HELIX as-built schematics)

06.4
Elevator | Passenger & Goods

The lift cabin is wheelchair-accessible and sufficiently large to accommodate the transport of furniture.

It is intended to design the cabin with a robust finish, as this lift will also be used to transport additional loads.

A durable lift cabin designed for both passenger and goods transport requires a special construction that meets a wide range of requirements. Below is a description of such a cabin with a foldable ceiling:

1. Construction and Materials

• Robust construction: The cabin is made of high-strength steel or stainless steel to ensure passenger safety while providing sufficient load-bearing capacity for heavy goods. The walls and floor are reinforced to withstand impact loads and to ensure long-term durability.

• Non-slip flooring: The cabin floor is equipped with a non-slip surface, ensuring safety for passengers and stability during goods transport. Integrated floor rails or fixing points allow loads to be secured during transport.

2. Foldable Ceiling

• Ceiling mechanism: The cabin ceiling is designed to be foldable, allowing the transport of oversized items that would otherwise not fit inside the cabin. The folding mechanism is equipped with robust hinges and hydraulic or mechanical lifting devices to ensure safe and easy operation.

• Safety locking system: When closed, the ceiling is secured by a locking system that prevents accidental opening during operation. Additional safety interlocks ensure that the ceiling can only be opened when the cabin is stationary and properly secured.

3. Interior Design

• Reinforced walls: The interior walls are designed to withstand daily passenger use as well as the occasional transport of bulky or heavy loads. They are resistant to impacts and scratches.

• Ventilation and lighting: The cabin is equipped with durable, efficient lighting to ensure sufficient visibility during goods transport. A dedicated ventilation system ensures a comfortable indoor climate even when the cabin is fully enclosed.

4. Safety and Control Systems

• Load sensors: The cabin is equipped with load sensors that monitor the weight of transported goods. These sensors prevent overloading and provide warnings if the maximum load capacity is exceeded.

• Emergency call systems: All passenger safety standards remain in place even during goods transport. An integrated emergency call system allows occupants to quickly request assistance in case of an emergency.

5. Accessibility and Controls

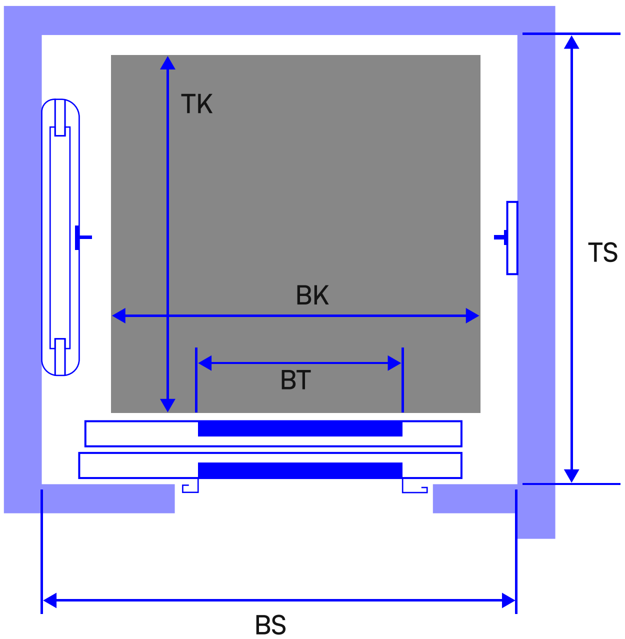
• Floor-level and side access: The cabin features wide doors and, where required, additional side access to facilitate loading and unloading of large items. These doors are reinforced and equipped with robust locking mechanisms.

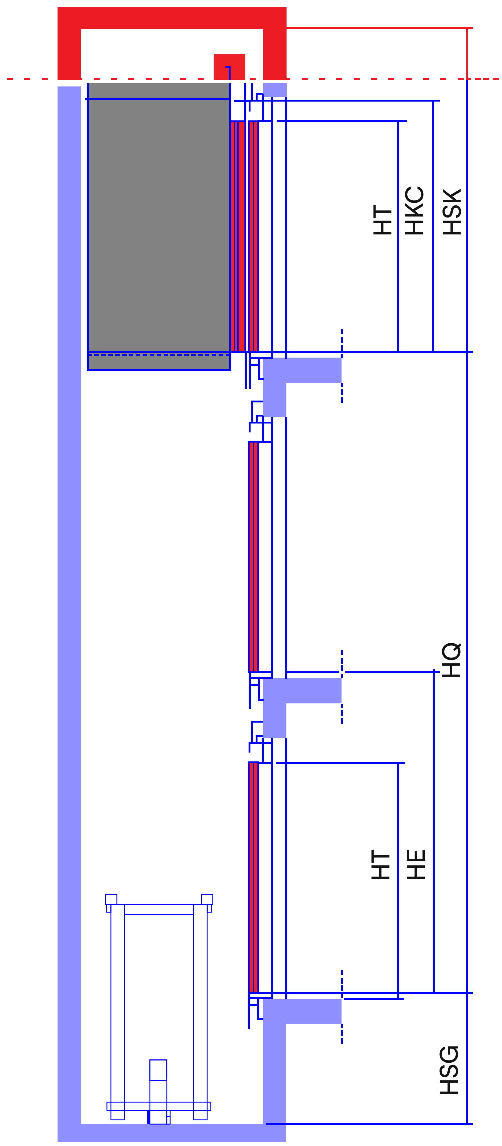
• Flexible control system: The control panel supports standard passenger operation as well as dedicated functions for goods transport, including control of the foldable ceiling and a safety lock that prevents operation while the ceiling is open.

This description summarizes the key features of a multifunctional lift cabin designed for the safe and efficient transport of both passengers and goods, including oversized items enabled by a foldable ceiling.

Cabin Layout

Shaft size: 1650 × 1650 mm
Cabin size: 1400 × 1100 mm
Door width: 900 mm (clear opening)
Door height: 2300 mm





06.4.1 Goods Lift

The goods lift is intended for the transport of waste containers and bicycles and must meet various transport requirements. Passenger transport is not permitted with this lift.

Location and Configuration

• Floors: The goods lift connects the basement level (-1) with the ground floor.

• Door mechanism: The lift door at ground-floor level opens towards the sidewalk, allowing waste containers to be removed directly at street level.

Operation

• Control system: The lift is operated via a simple control mechanism that enables safe and efficient transport of both waste containers and bicycles between floors. Passenger transport is not permitted.

• Safety: The lift is equipped with safety devices to ensure incident-free transport, including sensors and emergency stop functions.

• Capacity: The lift is designed to accommodate the size and weight of standard waste containers, allowing multiple containers to be transported simultaneously.

Advantages

• Time and effort efficiency: The use of the lift eliminates the need to manually transport waste containers via staircases, saving time and reducing physical strain.

• Safety and hygiene: Direct transport via the goods lift minimizes the risk of contamination and accidents associated with manual handling.

Technical Specifications

• Drive system: The lift is electrically operated and equipped with a robust motor to ensure reliable vertical transport.

• Materials: Constructed from durable materials such as stainless steel or galvanized steel to withstand daily use and mechanical stress.

• Dimensions: The cabin is dimensioned to match standard waste containers, providing sufficient space for easy loading and unloading.

A goods lift of this type offers a practical and efficient solution for waste management in buildings where waste is collected and disposed of across multiple levels.

Electricity and Water Metering

To ensure maximum flexibility in the use and leasing of the building, separate electricity and water meters will be installed on all floors. These meters allow for precise measurement of consumption per floor, which is particularly advantageous when floors are leased individually.

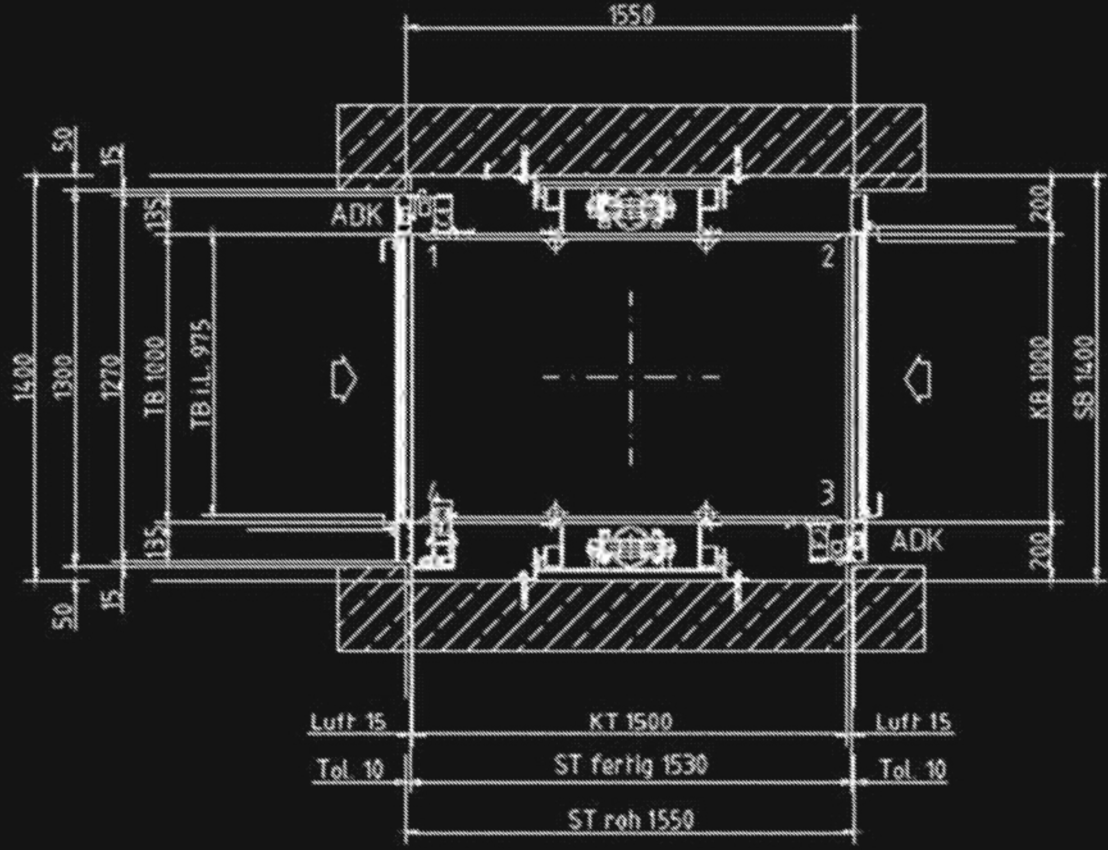
This setup enables utility costs for electricity and water to be allocated accurately and transparently to the respective tenants, ensuring fair and comprehensible billing. This is especially relevant when the building is occupied by multiple tenants rather than a single user. Each tenant is therefore charged only for the consumption they actually generate, significantly simplifying the allocation of operating costs.

This approach provides a high degree of flexibility for both leasing and building use. Whether entire floors or smaller office units are rented, the independent metering system allows for easy adaptation to tenant-specific requirements. This increases the building's attractiveness for a wide range of tenant constellations, from single occupants to multiple companies sharing a floor.

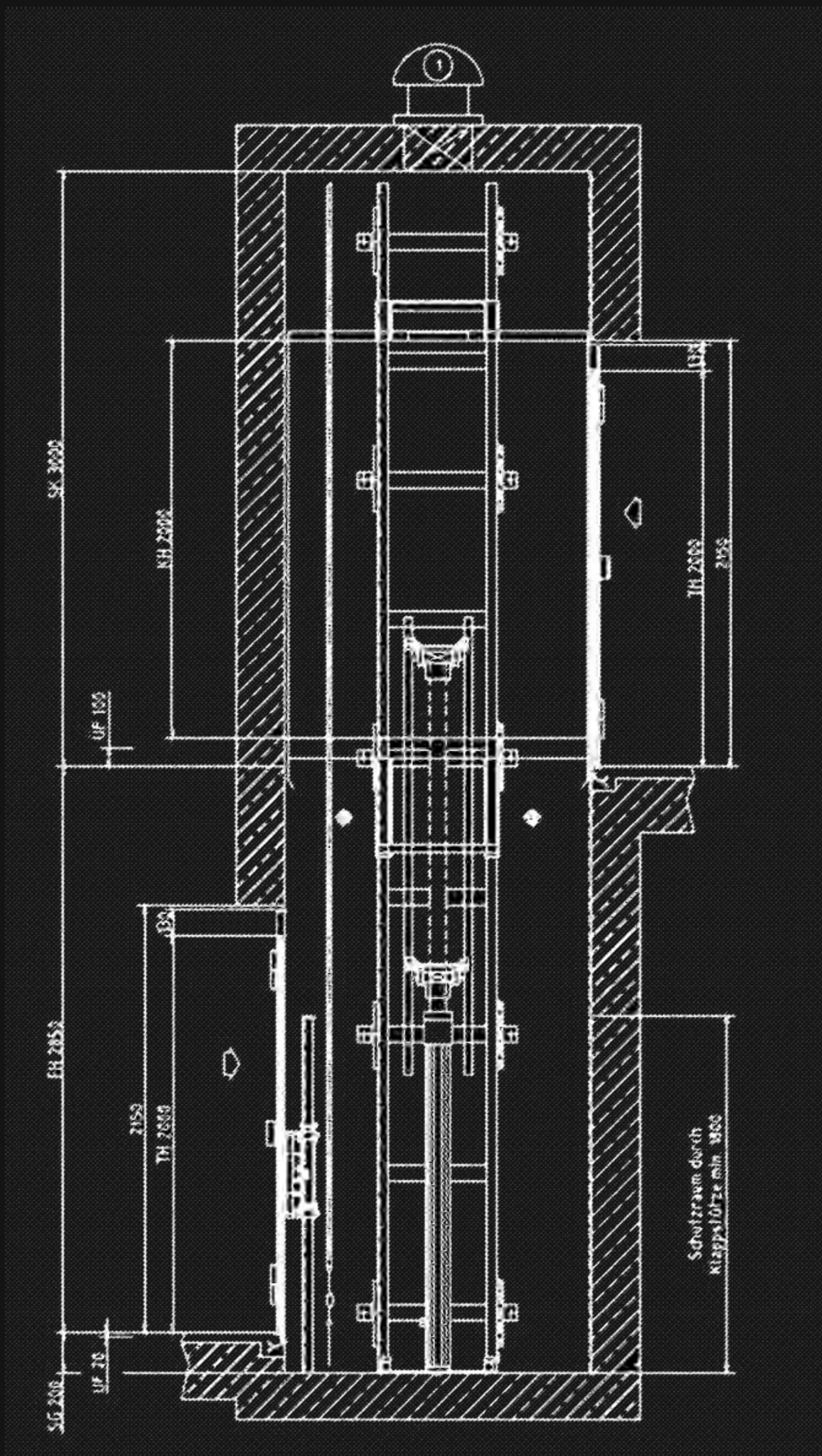
In addition, this form of consumption monitoring ensures transparency and helps avoid disputes regarding utility cost settlements, as individual consumption is clearly and unequivocally traceable. Overall, the installation of separate meters contributes to a future-proof leasing strategy based on flexibility, fairness, and efficiency.

Cabin Layout

Load capacity: 1.000 kg
Cabin (W × D × H): 1.000 × 1.500 × 2.000 mm
Shaft dimensions: 1.400 × 1.550 mm
Pit depth: 200 mm
Headroom: 3.000 mm



Waste Elevator Floor Plan



Waste Elevator Vertical Section

06.5
Interior Fit-Out

As a general principle of sustainability, the direct reuse of materials is generally preferable to recycling. The simple reuse of building components has a positive impact on the environment by reducing CO_2 emissions and environmentally harmful waste.

As part of the construction project on Rue d'Epernay, materials from the existing Minerais 1 and 2 buildings are intended to be reused. In parallel with the new construction planning, a comprehensive assessment is currently being carried out to determine which materials are suitable for reuse. The objective is to conserve resources and promote sustainable construction practices by integrating valuable building materials into the new building.

06.6
Raised Floor "Re-use"

In the office areas, a raised floor made of wood will be used. This natural, renewable material is particularly well suited for further processing into raised floor panels.

It is planned to use these wooden panels in a reused condition. In the meantime, several suppliers have specialized in dismantling existing raised floors, refurbishing them in workshops, and reinstalling them.

If feasible, the raised floor from the Minerais 1 and 2 buildings will be reused. The feasibility of this approach still needs to be assessed.

Lindner
RELIFE W 38 ST x M

Reconditioned raised access floor

The RELIFE raised access floor system stands out for its high flexibility, excellent building-physics properties, and strong economic advantages. The reconditioned raised floor panels consist of high-density particleboard panels, are equipped with a steel sheet bonded to the underside, and are protected against impact and moisture by a peripheral edge band.

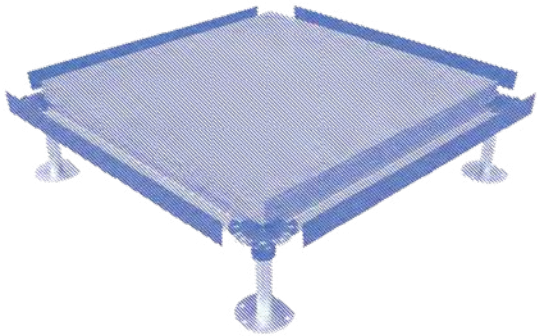
The cavity forming the plenum required for building services is created by height-adjustable galvanized steel pedestals from Lindner's own production, combined with acoustic decoupling pads.

Examples of Application Areas

Living areas, meeting rooms, offices, banks, universities, schools, residential buildings

Technical Data

Weight	33 kg/m2
Panel thickness	38,5 mm
Standard pedestal height	20 - 2.000 mm
Pedestal grid	600 mm x 600 mm
Dimensional tolerance	class 2

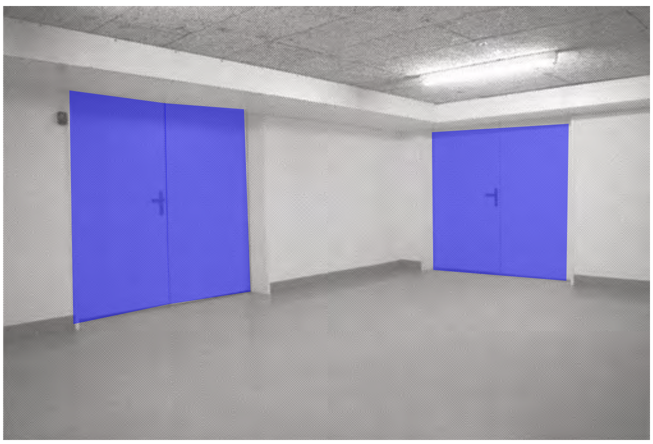


Structural Performance

Load and deflection class	DIN EN 12825	2B
Point load (breaking load)	DIN EN 12825	3kN (6kN)
Seismic safety		Anti-seismic version available

06.7
Steel Doors "Re-use"

Many doors are unnecessarily disposed of today, even though they remain fully functional. For this reason, reused steel doors are planned to be installed in the basement areas. With regard to fire-rated doors, the approval and certification requirements still need to be examined.



06.8
Floor Finishes

06.8.1 Carpet Flooring

Sustainable backing construction for improved room acoustics

Focused work is promoted by a calm and quiet environment. Especially in large, open spaces or rooms with many acoustically hard surfaces, acoustic measures are often required. The floor can also function as a sound absorber. A noise-reducing backing construction provides sound absorption and additionally has a fine-dust-reducing effect. As a result, carpet flooring is also suitable for people with allergies or asthma.

Carpet tiles are primarily used in commercial applications and are characterized by healthy and sustainable materials. They are free from bitumen, latex, or PVC and have a positive effect on indoor air quality.

For example, IVC carpet tiles are distinguished by their exceptional durability. In addition, the DGNB was convinced by the versatile technical properties combined in this innovative carpet tile: thanks to its patented technology, the carpet effectively binds fine dust particles in the air. According to studies conducted by the independent German testing institute GUI (1), fine dust concentrations in indoor spaces can be up to four times lower than with conventional carpet flooring.

Due to the Cradle-to-Cradle® Silver certification of the backing, the carpet can be reliably disassembled at the end of its service life and largely returned to the material cycle through separation processes. The acoustic backing exhibits excellent sound insulation and absorption properties and positively influences reverberation behavior. Fig.16

06.8.2 Tiles

Installation without adhesive is the starting point. The re-use approach is not feasible for many permanently installed materials, and this also applies to ceramic tiles. During dismantling attempts, breakage occurs, leaving the material suitable only for recycling.

As an innovation, Drytile has developed a dry-lay system for floor tiles that does not require adhesive. This solution is environmentally friendly and significantly faster than conventional installation methods. Furthermore, during demolition, the tiles can be removed intact and reused. Fig.17

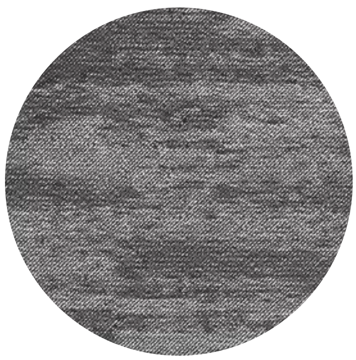


Fig.16

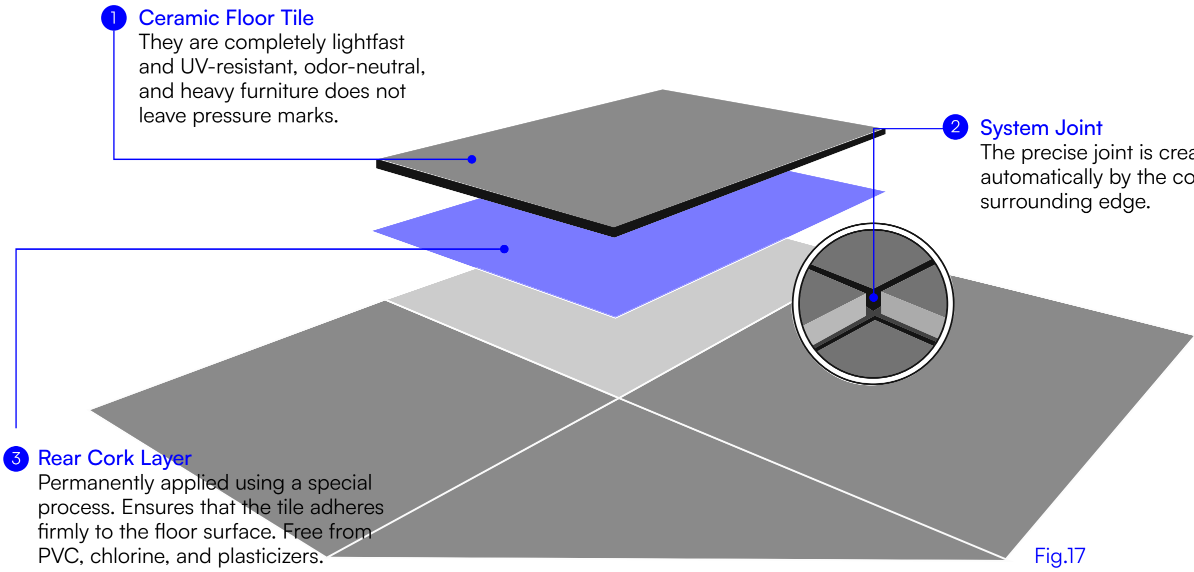


Fig.17

06.9 Ceilings

A large proportion of the ceilings will be executed as exposed concrete ceilings. In certain areas, suspended acoustic ceiling elements will be installed. Fig.18

- Offices: Exposed concrete ceiling
- Meeting rooms: Exposed concrete ceiling

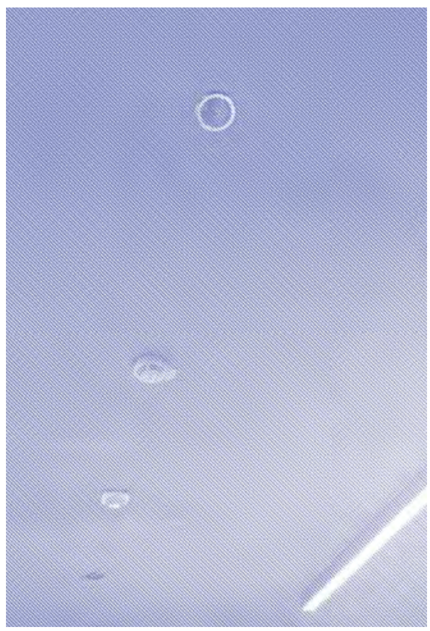


Fig.18

06.10
Material Concept

The material concept has been carefully developed to ensure a harmonious, sustainable, and durable interior and exterior design. The selected materials are not only aesthetically pleasing but also meet high ecological and functional requirements.

1. Exposed Concrete

Concrete plays a central role in the architecture of the building. It is used both for load-bearing structures and for visible surfaces. Concrete provides a robust and durable foundation that is timeless and versatile in its application. Its natural coloration integrates harmoniously into the overall concept and creates a solid, industrial aesthetic. Fig.19

Fig.19

2. Larch Wood

Larch wood is used for various interior details and façade elements. This type of wood is known for its durability and resistance to weathering. The warm, natural color of the larch wood forms a pleasant contrast to the cool concrete surfaces and gives the spaces an inviting and natural atmosphere. In addition, larch wood is a sustainable choice, as it is sourced from responsibly managed forests. Fig.20

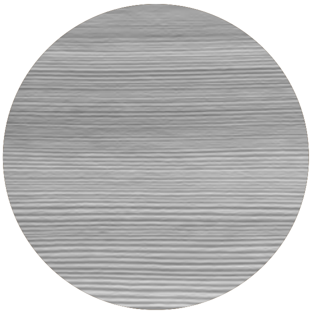


Fig.20

3. Drytile Tiles

Drytile tiles are used for floor coverings in highly frequented areas such as corridors and communal spaces. These tiles are characterized by their easy installation and high load-bearing capacity. They are available in various colors and textures and integrate seamlessly into the building's color concept. Drytile tiles are uncoated, making them easy to clean and recycle. Fig.21

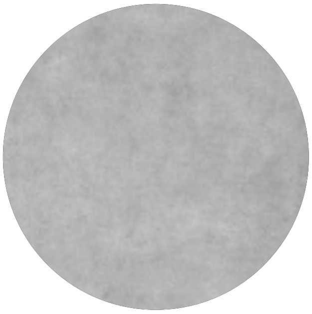


Fig.21

4. Carpet Flooring

Carpet flooring is used in the office areas, similar to the renowned Helix building. This type of flooring provides pleasant acoustics and a comfortable working environment. The carpet is designed in neutral, harmonious colors that complement the other materials used in the building. It is also durable and easy to maintain, simplifying long-term upkeep. Fig.22

Fig.22

5. Brushed Stainless Steel

Brushed stainless steel is used for various design elements and surfaces, such as handrails, door fittings, and accent details. This material offers an elegant, timeless appearance and is extremely durable. The brushed surface is resistant to fingerprints and easy to clean, making it a practical choice for areas with high foot traffic. Fig.23

Fig.23

Harmonious Color Coordination

All materials have been carefully selected to create a harmonious color scheme. The neutral tones of the concrete, the warm hues of the larch wood, the versatile shades of the Drytile tiles, and the refined appearance of the brushed stainless steel complement each other perfectly. This coordinated palette creates a calm and professional atmosphere throughout the building.

Sustainability and Recyclability

Sustainability was a key consideration in the selection of materials. All materials used are largely uncoated and highly recyclable, minimizing environmental impact and conserving resources. The durability and timelessness of the materials ensure that the building will remain modern and functional in the long term.

Conclusion

The material concept of the office building on Rue d'Epernay successfully combines aesthetics, functionality, and sustainability. Through harmonious color coordination and the selection of durable, timeless materials, a working environment is created that meets both current and future requirements.

06.11
Room Acoustics

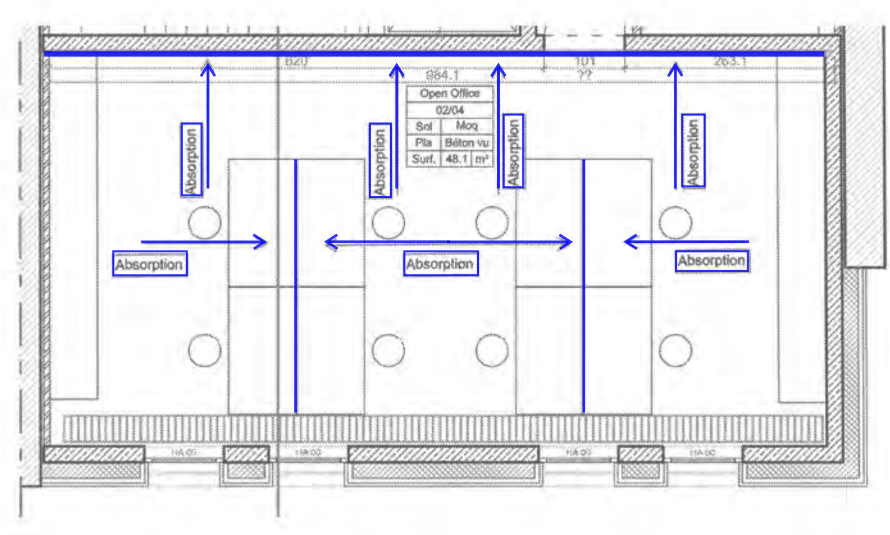
The room acoustics concept follows the principle applied in the Helix building, whereby the "corridor wall" is designed to be acoustically effective.

06.11.1 Open-Plan Work Areas

In an open-plan work area, between 6 and 8 workstations are typically arranged. Two open-plan work areas are separated from each other by the circulation core, so that only the corridor allows direct sound transmission.

The concept of the open-plan work areas is based on the principle that sufficient sound-absorbing materials are always positioned close to potential sound sources. In this way, a portion of the generated noise is absorbed directly and cannot spread further. This principle is applied to workstations, printers, coffee points, corridors, and sanitary areas.

Meeting rooms and individual offices are separated from the open-plan work areas by high-quality partition walls in accordance with DGNB requirements. The detailed concept is explained in Section XX.



06.11.2 Meeting Rooms and Individual Offices

According to DGNB, meeting rooms and individual offices for leading personnel are classified as "rooms with increased requirements." Partition walls must therefore achieve a weighted sound reduction index R'w of 47 dB in the installed condition (see Section 4.1). This can only be achieved by using a high-quality acoustic partition wall system.

It must be taken into account that partition walls can be significantly weakened by weak points such as transfer elements. In addition, connections to flanking building elements (façade, columns, walls, ceilings, floors) must always be executed with the greatest care. The most effective solution is achieved when connecting to a massive building element. In the case of a direct connection of a partition wall to the façade, increased acoustic losses must be expected.

As partition walls, the architecture office Metaform has proposed the product range of the company "Lindner" (see Appendix). In the envisaged version with a high proportion of glass, these products achieve Rw values of 46 / 48 / 51 / 54 dB.

06.11.3 Calculation of the Weighted Sound Reduction Index of an Office Partition Wall

As an example, the resulting sound reduction index is calculated here for an office on the 3rd floor, taking into account losses via flanking building elements. In this sample calculation, the wall is weakened by a high-quality transfer element (Dn,e,w = 52 dB). A partition wall model from the company Lindner is used (Rw = 54 dB minus 2 dB safety margin). The door is not considered in this calculation, as separate requirements apply to it.

06.12
ADAPTH | Accessibility & Inclusive Design

Due to new legislative requirements, the floor plan requires revision. As a result, the previously planned toilet layouts can no longer be implemented. Several solutions are currently being evaluated to address this issue. In addition, the stairwell layout must be adapted. The width of the stair flight has therefore been adjusted to 1.40 m.

06.12.1 Stairwell

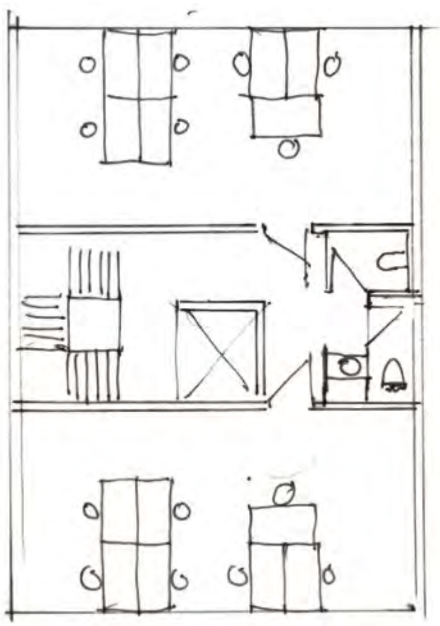
The stairwell and the sanitary facilities have been adapted to comply with the new regulations. Fig.24

06.12.2 Toilets

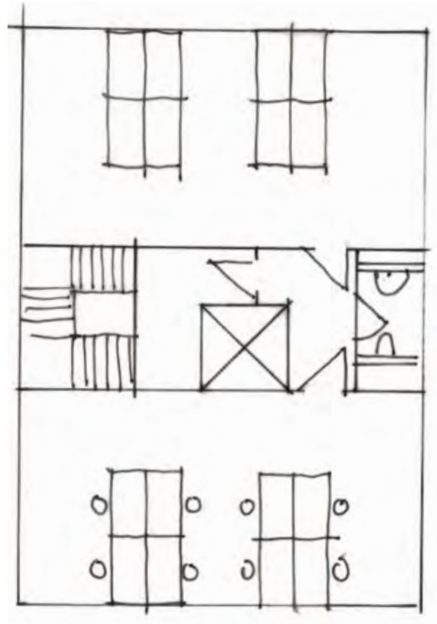
According to ADAPTH requirements, the clear passage width for toilet doors must be 90 cm. Fig.25

06.12.3 Coordinated Planning of the Circulation Core

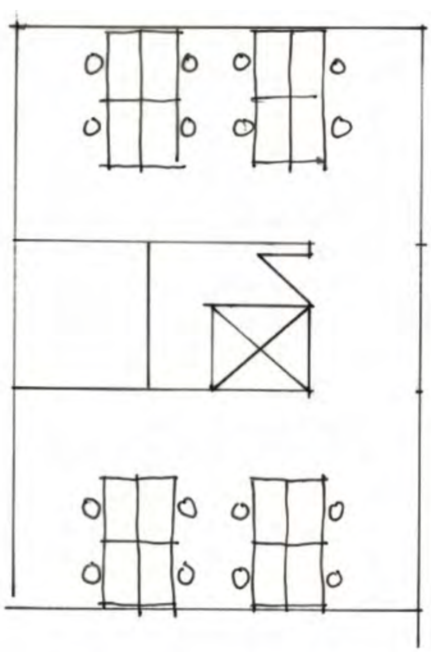
The circulation core has been adapted to ADAPTH requirements and coordinated with ADAPTH, JSE, and POST. Fig.26



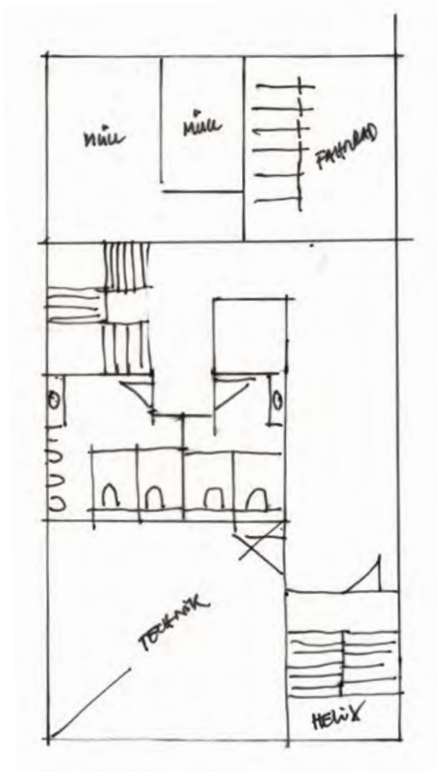
V1



V2



V3



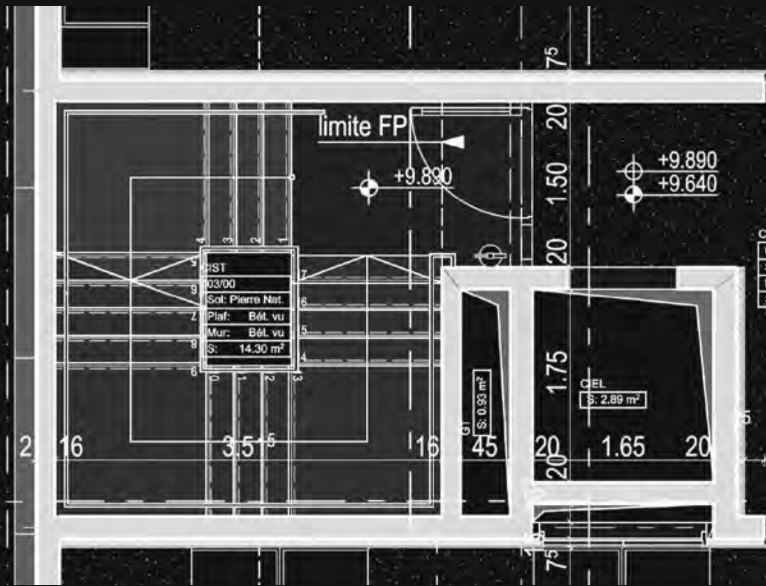
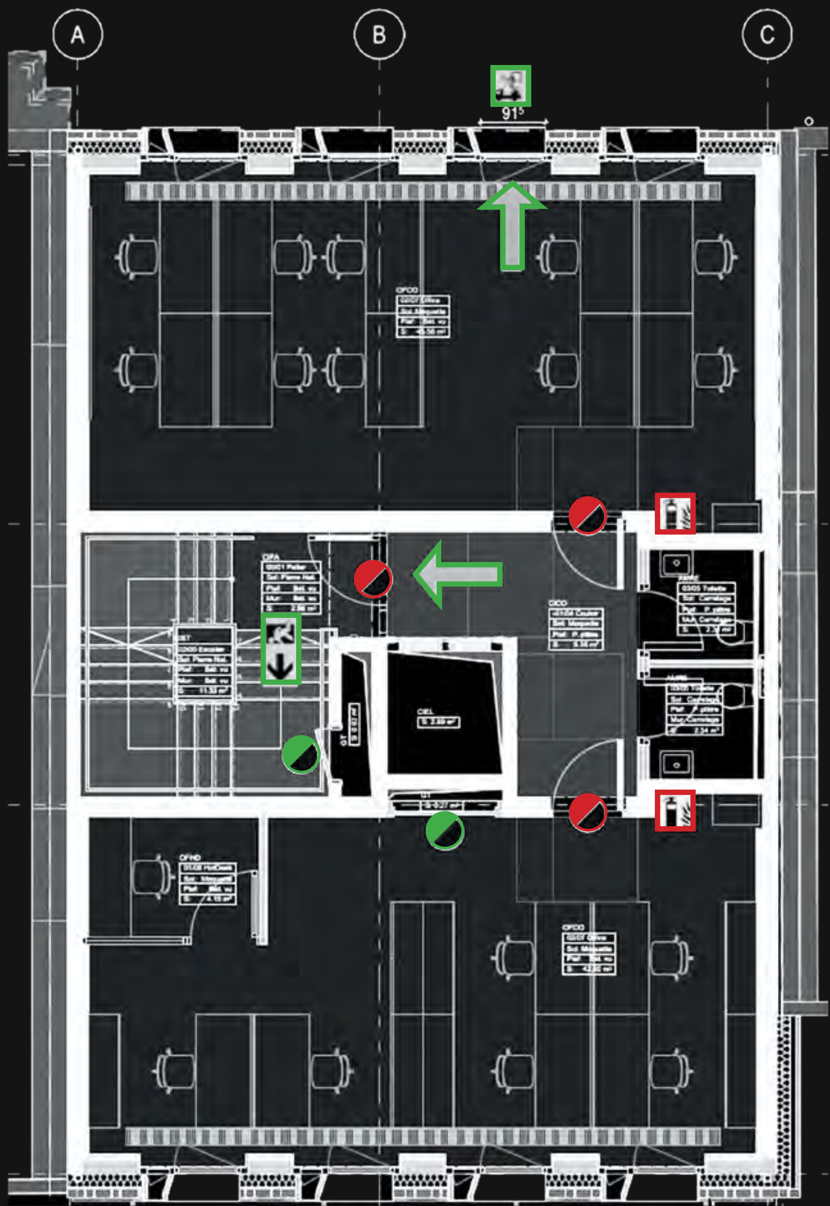


Fig.24

Fig.25

Fig.26



Principle diagram of escape route layout

06.13
Fire Protection

General Project Description

The building plot at 18, Rue d'Epernay is intended for the construction of an office and administrative building with a customer zone on the ground floor. Fig.27

The project explicitly provides for the construction of a multi-storey building consisting of five above-ground full storeys, an additional attic storey, and one basement level.

The planned building has a rectangular floor plan with a width of 10,00 m and a depth of 14,80 m. The existing building gap will be completely closed by the new construction.

The building height is 17,50 m above the defined ground level (0,00 m), measured at the eaves.

The finished floor level of the attic storey is 16,03 m, while the finished floor level of the uppermost full storey is 12,96 m.

As the building at 18 Rue d'Epernay

- is classified as a "bâtiment moyen", and
- the office areas on each level remain below the design threshold of 100 m²,

it is sufficient, in accordance with Section 8.3 of ITM-SST 1504.3, to provide one structural escape route for evacuation. The second escape route may therefore be provided via a window accessible to the fire brigade.

Building Use

Based on the submitted planning documents, the building's use is organised by level as follows:

- Basement Level (Level −1)

The basement accommodates sanitary facilities (WC areas), technical rooms, and waste management rooms. No storage rooms are provided on this level.

- Ground Floor (Level 0)

The ground floor contains the main office entrance area as well as a commercial space.

- First Floor (Level +1)

This level is used for office functions and includes a meeting room.

- Second to Fourth Floors (Levels +2, +3, +4)

These floors are exclusively dedicated to office use.

- Fifth Floor (Level +5)

The fifth floor comprises office spaces and a meeting room.

- Sixth Floor (Level +6)

No designated use is planned for this level.

Fire Brigade Access / Accessibility

The building is located on the northern side adjacent to a public traffic area (Rue d'Epernay) and is directly accessible to fire brigade vehicles via this road.

In principle, the fire brigade access via public traffic areas ensures that at least one façade of the building is accessible to emergency services.

Fire brigade positioning areas for aerial rescue vehicles, required to secure the second escape routes of the aforementioned façade openings, are generally provided via the adjacent traffic areas.

Staircase

The staircase and the adjoining vestibules are constructed as fire-resistant elements, using concrete components with a fire resistance rating of REI 120.

Lift System

Similar to the staircase, the lift shaft is designed as fire-resistant. This also applies to the basement level, as the lift system is continuous throughout the building.

On all floors, with the exception of the ground floor, fire protection curtains are installed in front of the lift doors. In the event of a fire, these curtains automatically descend.

Second Escape Route

The second escape route is provided via the north façade facing Rue d'Epernay. The clear opening dimensions of the windows must be at least 0,90 m × 1,20 m (width × height), with a minimum opening angle of 90°.

Basement Level

Within the scope of the fire protection concept, the following measures and conditions apply to the basement level.

Compliance with escape route lengths

The maximum permissible escape route length of 20 m is maintained throughout the entire building. This ensures that all occupants can safely and quickly evacuate the building in an emergency.

Use of the basement

The basement is only used infrequently, and it is ensured that no more than four persons are present at the same time. This low occupancy significantly reduces fire-related risks.

Fire protection measures in the basement

The basement includes the following rooms:

- Waste rooms

Equipped with fire-rated doors of type EI 60 to prevent the spread of fire and smoke.

- Technical rooms

Also fitted with appropriate fire-rated doors to ensure the safety of technical installations and the overall building structure.

- Bicycle storage and sanitary facilities

These areas are verified according to DGNB Platinum and ADAPTH requirements and equipped accordingly.

These measures ensure a high level of safety for all building users, particularly in the infrequently used basement areas.

Smoke Extraction Dome — Staircase

The smoke extraction opening complies with Article 10.2 of ITM-SST 1502.4 and has a clear cross-sectional area of at least 5% of the staircase floor area.

Smoke and Heat Exhaust Control Panel (RWA Control Unit)

A smoke and heat exhaust control unit (RWA control unit) is required for the smoke extraction opening and is located within the staircase on the top floor.

Manual control points and the smoke detector at the highest level are connected to this central unit.

Detailed planning is the responsibility of the specialist fire protection planner.

Escape Route Signage

Escape routes are clearly marked by suitable illuminated signage connected to the emergency lighting system.

Shafts

Installation shafts are separated from the storeys in a fire-resistant manner if they remain open at slab penetrations. Inspection openings made of drywall system elements for shafts connecting multiple storeys must also be designed to be fire-resistant. Otherwise, highly fire-retardant doors (EI 60-S) are sufficient.

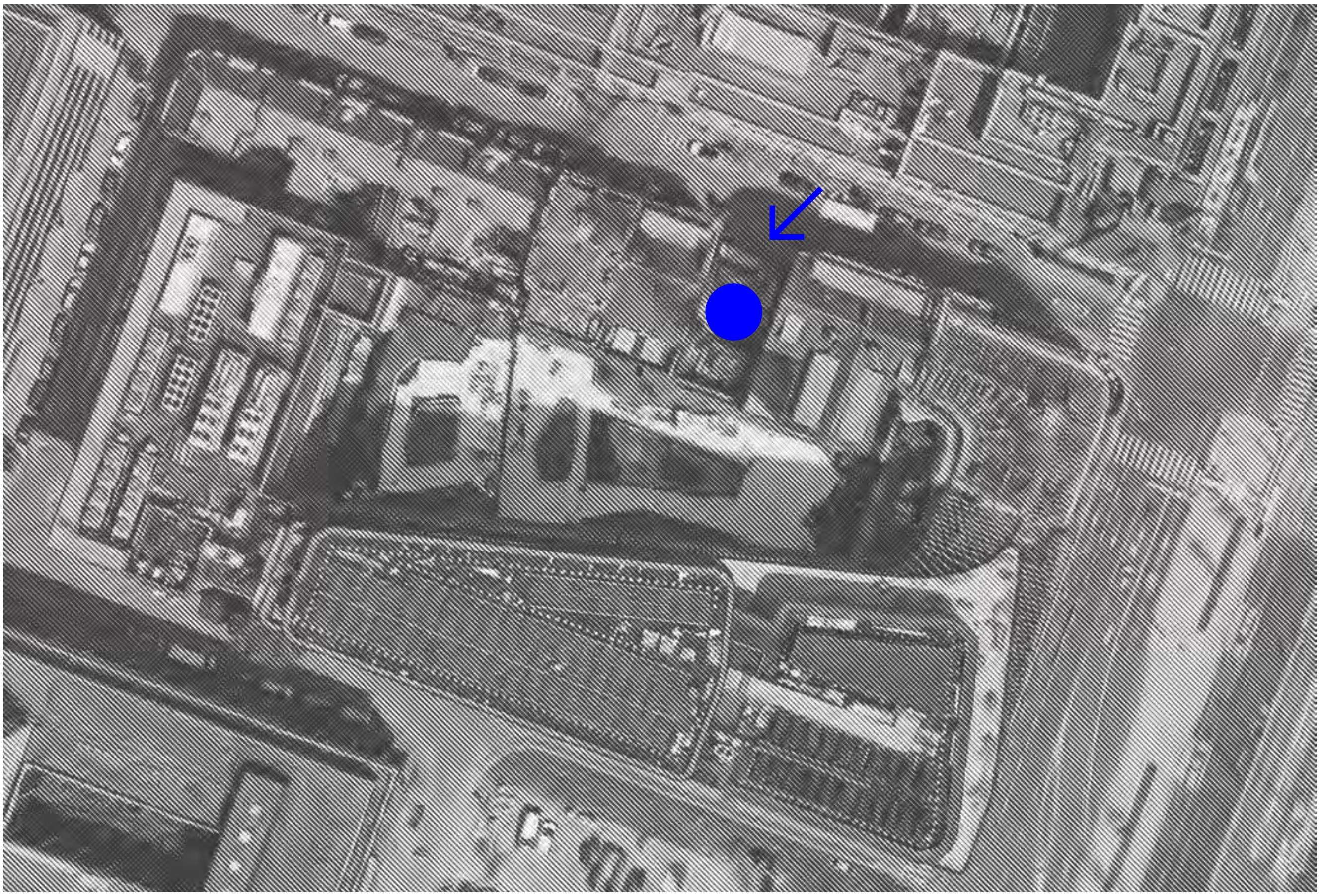


Fig.27 | Aerial view with marked location

07
Planning Construction & Operation

metaform dar

07.1
BIM Planning

The BIM planning for 18 rue d'Epernay is designed to set new standards within POST Luxembourg. The digital workflow optimises the entire life cycle of the project, from initial design and construction through to operation and maintenance. The objective is to consolidate all planning-relevant information within a single digital model, enabling a more efficient, transparent, and cost-effective construction process.

07.1.1 LOD 334: Precise Geometry and Coordination

At LOD 300, the BIM model already includes a high level of geometric accuracy and detailed workshop drawings for building components. This covers installation, quantities, dimensions, shape, position, orientation, as well as relevant non-geometric information.

The model also supports interdisciplinary coordination, clash detection, and reliable cost estimation.

The overarching goal of the BIM planning process is to demonstrate a clearly structured and coherent planning and construction workflow. To ensure seamless collaboration, different discipline-specific BIM software solutions must be interoperable. All partial models are therefore converted into the IFC format, allowing them to be imported without interface issues.

In coordination with POST Luxembourg, a Level of Development (LOD) 334 has been defined for the project. The BIM Execution Plan (BEP) is attached to the APD documentation (see Appendix). Fig.28

07.1.2 Dalux (cost estimation & scheduling/timeline)

Dalux is a digital construction management and collaboration platform that plays a central role in the project's BIM strategy. By serving as a shared data environment, Dalux enables efficient coordination, transparency, and quality assurance throughout all project phases.

Centralised Data Management

Dalux integrates BIM models and allows project teams to upload, share, and view 3D models in real time. All project-related documents — such as drawings, reports, and protocols, are stored centrally and made accessible to authorised users.

Seamless Project Communication

Real-time collaboration enables stakeholders to place comments and annotations directly within models or plans. Automated notifications ensure that all relevant parties are immediately informed of updates, preventing information loss and delays.

Task and Workflow Management

Issues and tasks can be recorded, assigned, and tracked directly within Dalux, always in direct reference to the BIM model or drawings. Defined workflows and responsibilities ensure timely execution and clear accountability.

Quality Management

Digital checklists support inspections and quality control processes, with results recorded directly on site. Defects can be documented, monitored, and resolved within the system, improving transparency and efficiency in defect management.

Mobility and On-Site Access

The Dalux mobile app allows teams to access project data on site, complete tasks, and report issues in real time. Offline functionality ensures uninterrupted data capture, with automatic synchronisation once a connection is restored.

Reporting and Analysis

Built-in reporting tools and customisable dashboards provide a clear overview of project progress and performance. All actions and changes are automatically logged, ensuring compliance, traceability, and audit security.

User and Access Management

Role-based access rights ensure that users can only view and edit information relevant to their responsibilities. External partners, such as subcontractors or consultants, can be securely integrated with precisely controlled access.

By working with Dalux, the project benefits from transparent processes, reduced errors, and optimised communication and coordination among all stakeholders, contributing to a smooth and efficient project delivery.

Reference Point

The reference point is defined at the left corner of the property boundary. Fig.29

- North (N): 49° 35' 54.9000"
- East (E): 6° 7' 50.1900"
- Elevation (Z): 284.38 m, corresponding to the ± 0.00 reference level

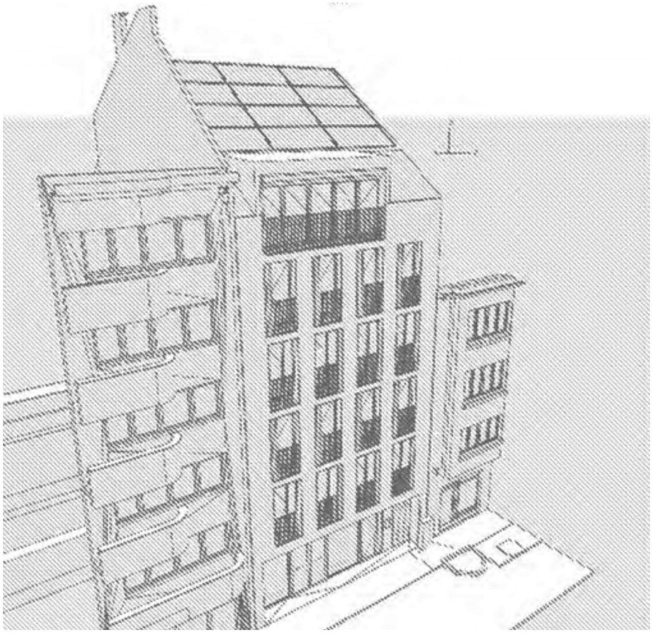
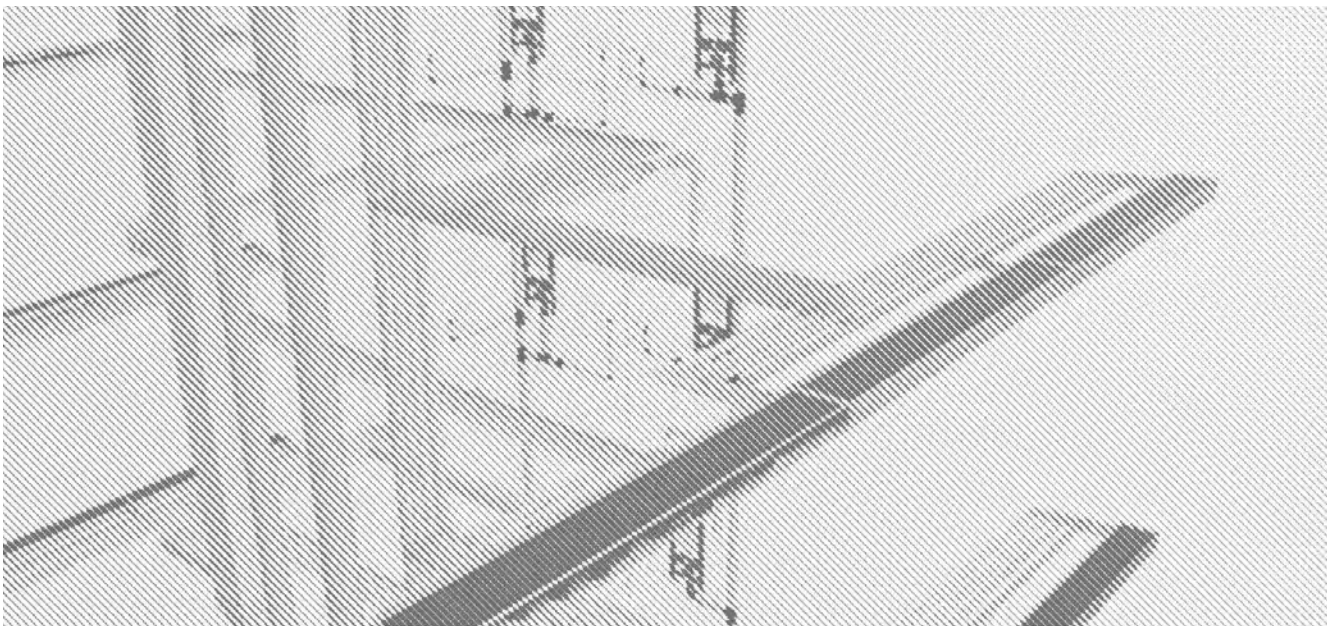


Fig.28 | Current BIM Planning



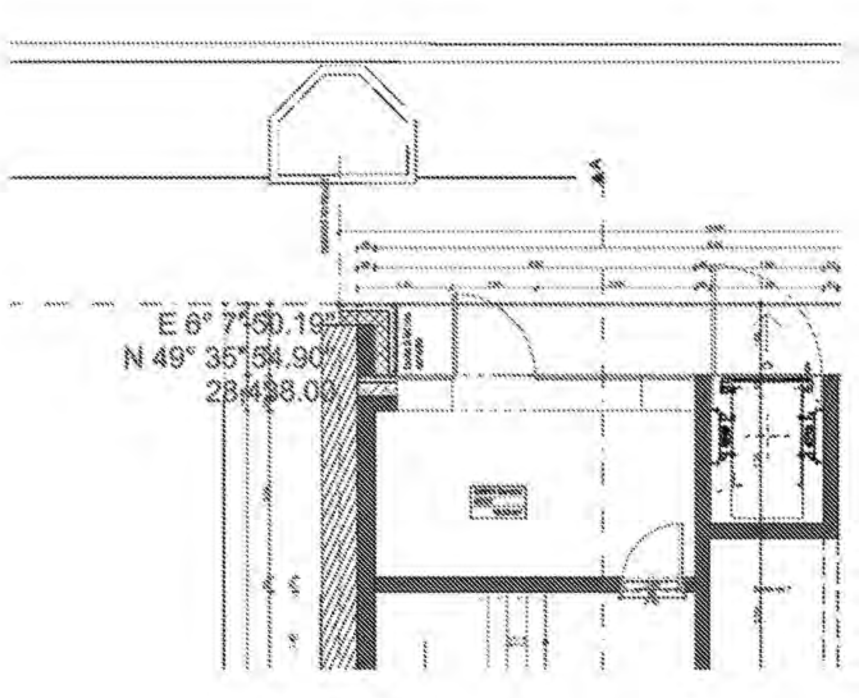


Fig.29 | Reference Point

07.2
Waste Disposal Concept

07.2.1 Project Framework

The office building at 18 rue d'Epernay is designed to accommodate up to 64 workstations across four upper floors. A 140 m² commercial space is located on the ground floor, creating a mixed-use programme within a compact urban footprint. All waste containers serving both the office and commercial units are discreetly located in the basement, ensuring an uncluttered streetscape. Given the limited space along the public sidewalk, waste handling is carefully coordinated to minimise visual impact and disruption.

07.2.2 Waste Infrastructure

Office Area Fig.30

- Residual waste: 770-litre capacity
- Paper and cardboard: 1.100 litre capacity
- Glass: 120-litre container
- Organic waste: 120-litre container
- 2,2 m² allocated for blue Valorlux bag storage

Commercial Unit Fig.31

- Residual waste: 240-litre and 120-litre containers
- Paper and cardboard: 660-litre container
- Glass: 120-litre container
- Organic waste: 120-litre container
- 1.4 m² allocated for blue Valorlux bag storage

07.2.3 Internal Waste Flow

Waste is collected internally and stored within the basement level. For scheduled collection, containers are temporarily positioned on the sidewalk, ensuring a smooth and efficient interface between building operations and public space. Fig.32 + 33

07.2.4 Integration of Technical Infrastructure

To allow for the installation of the waste lift, the electrical distribution cabinet has been repositioned as part of the overall building coordination. This adjustment ensures optimal spatial organisation and a clear, functional layout within the service areas. Fig.34

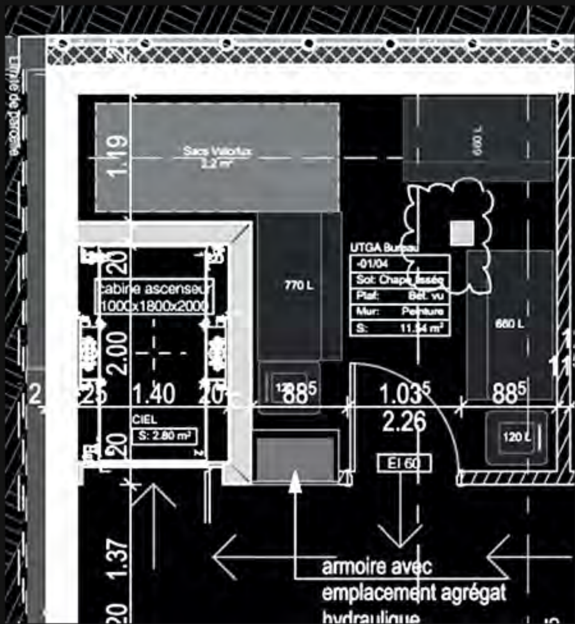


Fig.30

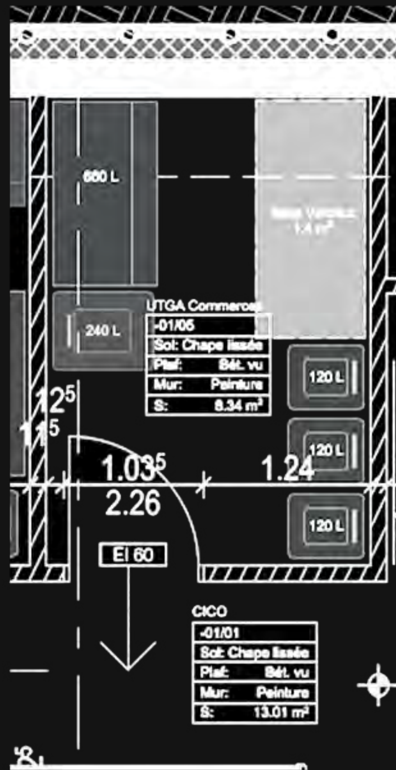


Fig.31

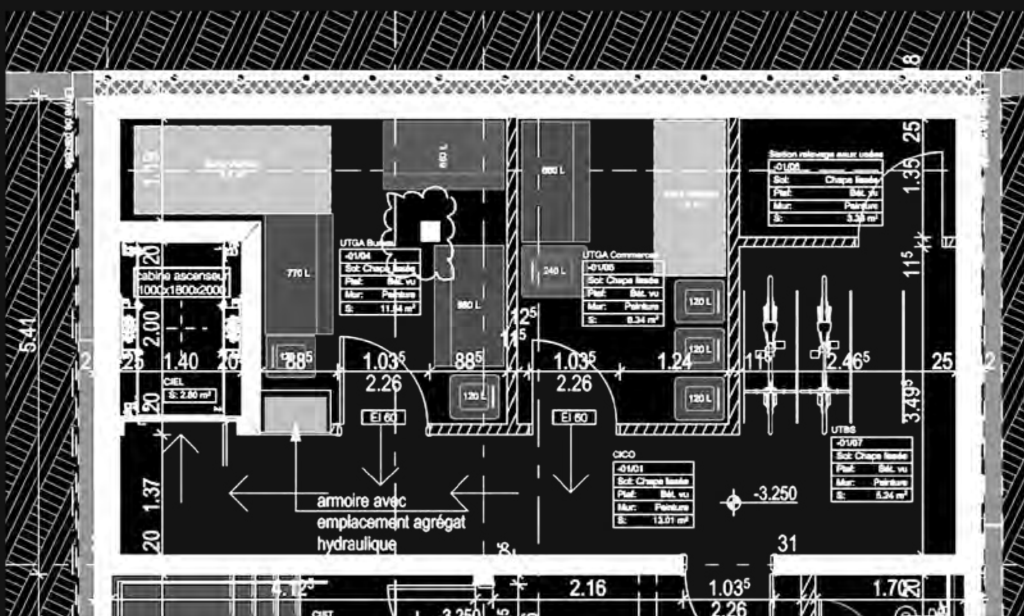


Fig. 32 | Internal functional sequence in the basement

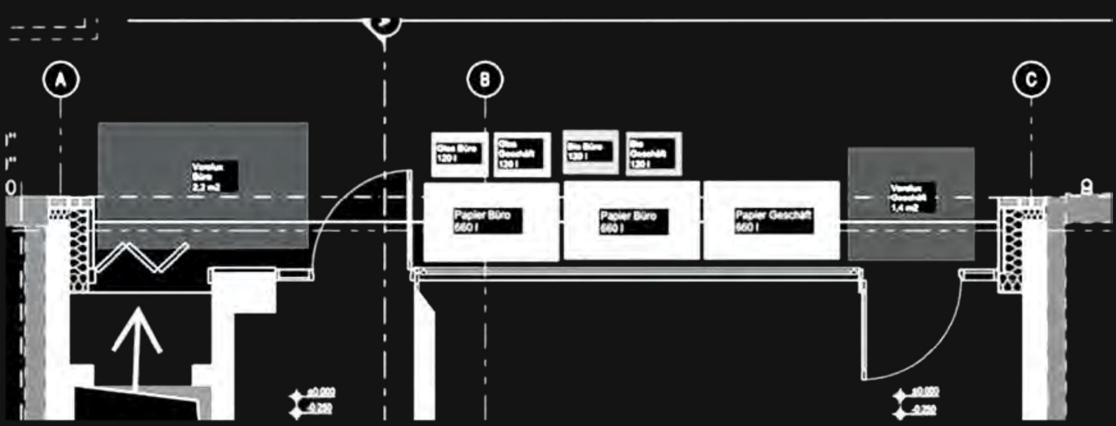


Fig.33 | Storage on the sidewalk during pickup

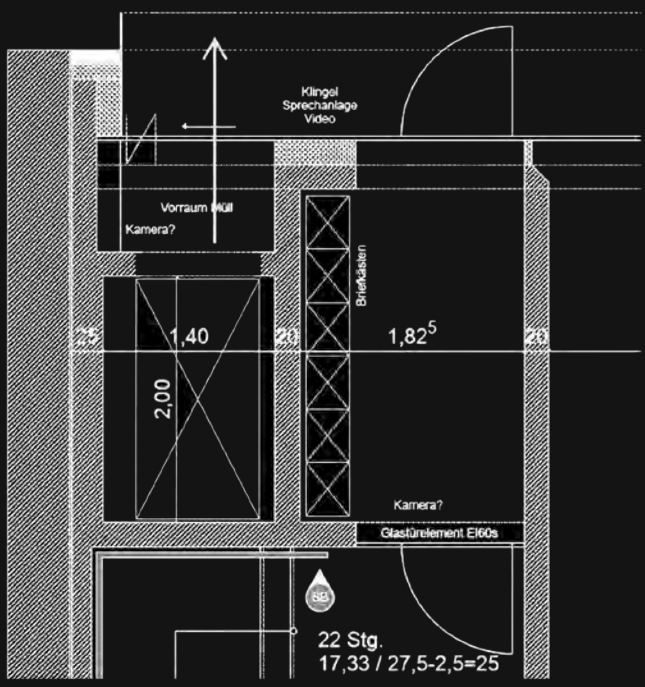


Fig.34

07.3
Construction Site Setup

The construction site setup for the new office building at Rue d'Epernay presents a particular challenge due to its dense urban context and limited available space. In response, carefully considered and efficient solutions have been developed to ensure a smooth and well-organised construction process.

07.3.1 Crane Installation within the Lift Shaft

A key element of the site setup is the installation of the crane on the sidewalk and adjacent roadway. This solution allows for crane operation despite the restricted site conditions, while ensuring the required lifting capacity throughout the construction phase. The crane has a footprint of 1.20 m × 1.20 m. Fig.35 + 36

07.3.2 Office and Material Containers in the Courtyard

Office and material containers are positioned on the CT parking spaces within the courtyard. This arrangement makes optimal use of the available space and ensures that site management and material storage are organised efficiently and coherently. Fig.37

Sanitary Facilities

To provide adequate sanitary facilities for construction workers, portable Dixi toilets are installed both in the courtyard and directly on the construction site. This ensures continuous access to hygienic facilities, regardless of the workers' location during construction.

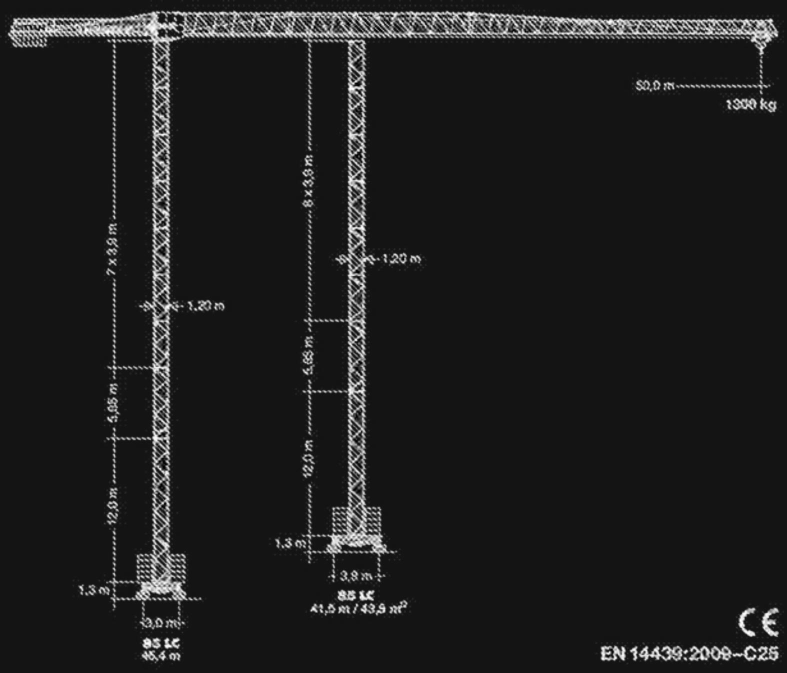


Fig.35

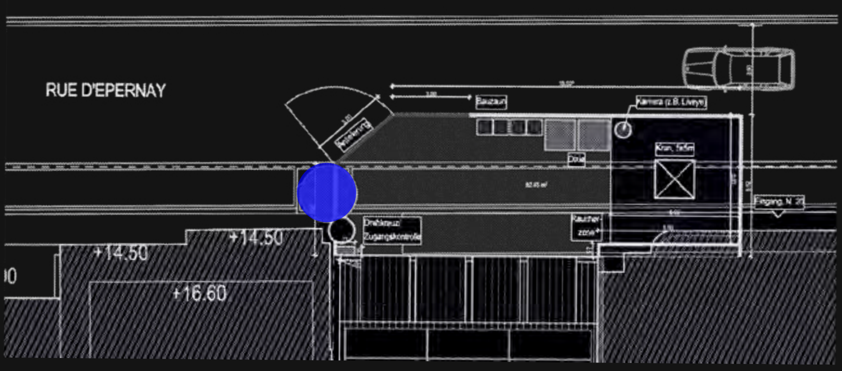


Fig.36

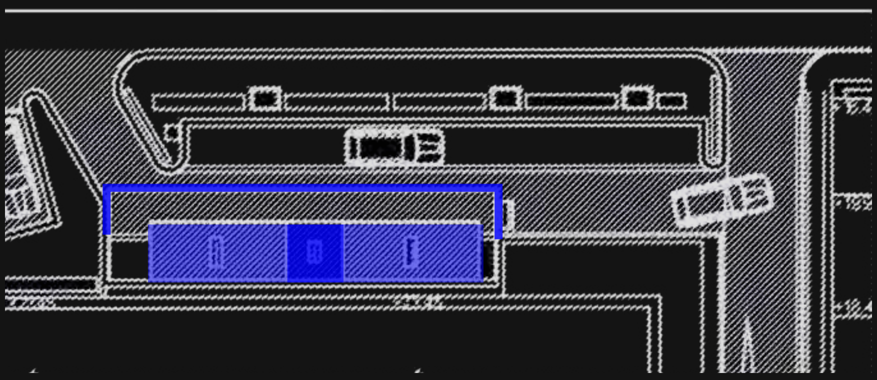


Fig.37

07.4
Cost Estimation & Scheduling | Timeline

For more detailed information on cost estimation and project scheduling, please refer to cf. 07.1.2 | p. 198.

07.5
Maintenance | Cleaning

Cleaning Concept
1. Guiding Principle

The cleaning concept is designed to ensure a clean, hygienic, and pleasant working environment for employees and visitors alike. Regular cleaning routines, targeted deep-cleaning measures, and preventive hygiene practices contribute to wellbeing, comfort, and long-term building quality.

2. Cleaning Areas and Frequencies

Daily Cleaning | Offices and Workspaces

- Dusting of desks, shelving, and office furniture
- Emptying of waste bins
- Vacuuming or sweeping and mopping of floors
- Disinfection of frequently touched surfaces (door handles, light switches, keyboards)

Sanitary Facilities

- Cleaning and disinfection of toilets, washbasins, and fittings
- Replenishment of consumables (soap, paper towels, toilet paper)
- Floor cleaning and mirror maintenance

Entrance Area and Reception

- Cleaning of entrance doors and glazed surfaces
- Vacuuming or sweeping and mopping of floors
- Dusting of reception desks and seating areas

Kitchens and Break Areas

- Cleaning and disinfection of worktops, tables, and seating
- Emptying and cleaning of waste bins
- Cleaning of coffee machines, microwaves, and appliances
- Replenishment of consumables (soap, paper towels)

Weekly Cleaning

Offices and Workspaces

- Damp cleaning of furniture and hard-to-reach areas
- Cleaning of window sills and blinds
- Dusting of computers and telephones

Sanitary Facilities

- Thorough cleaning of walls and doors
- Descaling of fittings and tiled surfaces

Entrance Area and Reception
- Cleaning of entrance mats
- Polishing of metal and glass surfaces

Kitchens and Break Areas
- Deep cleaning of kitchen cabinets and refrigerators
- Descaling of kettles and coffee machines

Monthly Cleaning

Offices and Workspaces
- Cleaning of carpets and upholstered furniture
- Interior and exterior window cleaning (All windows are operable, allowing cleaning from the inside. As no external guardrails are provided, anchor points are integrated into the concrete ceiling.)
- Cleaning of lighting fixtures

Sanitary Facilities
- Intensive cleaning and disinfection of all surfaces
- Inspection and cleaning of ventilation grilles and systems

Entrance Area and Reception
- Deep cleaning of floor finishes (e.g. polishing of tiles, carpet cleaning)

Kitchens and Break Areas
- Deep cleaning of wall tiles and splashbacks
- Cleaning and disinfection of refrigerators and freezers

Annual Cleaning

All Areas
- Comprehensive deep cleaning and disinfection
- Carpet cleaning or replacement as required
- Maintenance and cleaning of HVAC systems and radiators
- Inspection and, where necessary, renewal of wall and floor finishes

3. Hygiene Measures

- Disinfection stations located in entrance areas, cor ridors, and shared spaces
- Regular training for cleaning staff on hygiene stan dards and best practices
- Preventive measures during flu and cold seasons, including increased disinfection

4. Environmental Responsibility

- Use of environmentally friendly and biodegrad able cleaning products
- Waste separation and recycling, with a focus on reducing single-use plastics
- Application of energy-efficient cleaning equipment and methods

5. Quality Assurance

- Regular inspections to ensure consistently high cleaning standards
- A feedback system allowing employees to evaluate cleanliness and suggest improvements
- Ongoing training and professional development for cleaning staff

07.6
Parking Provision

The parking spaces required for the new building at Rue d'Epernay are provided within the Helix underground car park. The allocated spaces are located on Level −4, in close proximity to Staircase 1. From Staircase 1, there is direct access to the courtyard between 18 rue d'Epernay and the Helix complex. This courtyard ensures a clear and convenient pedestrian connection to the Epernay building, creating a comfortable and efficient link between parking and workplace. Fig.38

Parking Allocation Key

The following allocation standards have been applied.
• Commercial space: 1 parking space per 100 m²
→ 2 parking spaces required
• Office space: 1 parking space per 175 m²
→ 3 parking spaces required

07.7
Plans

In the final chapter, a series of floor plans and sections is provided to illustrate the building's layout and spatial organization. Fig.39, Fig.40, Fig.41, Fig.42, Fig.43, Fig.44, Fig.45, Fig.46, Fig.47, Fig.48, Fig.49, Fig.50

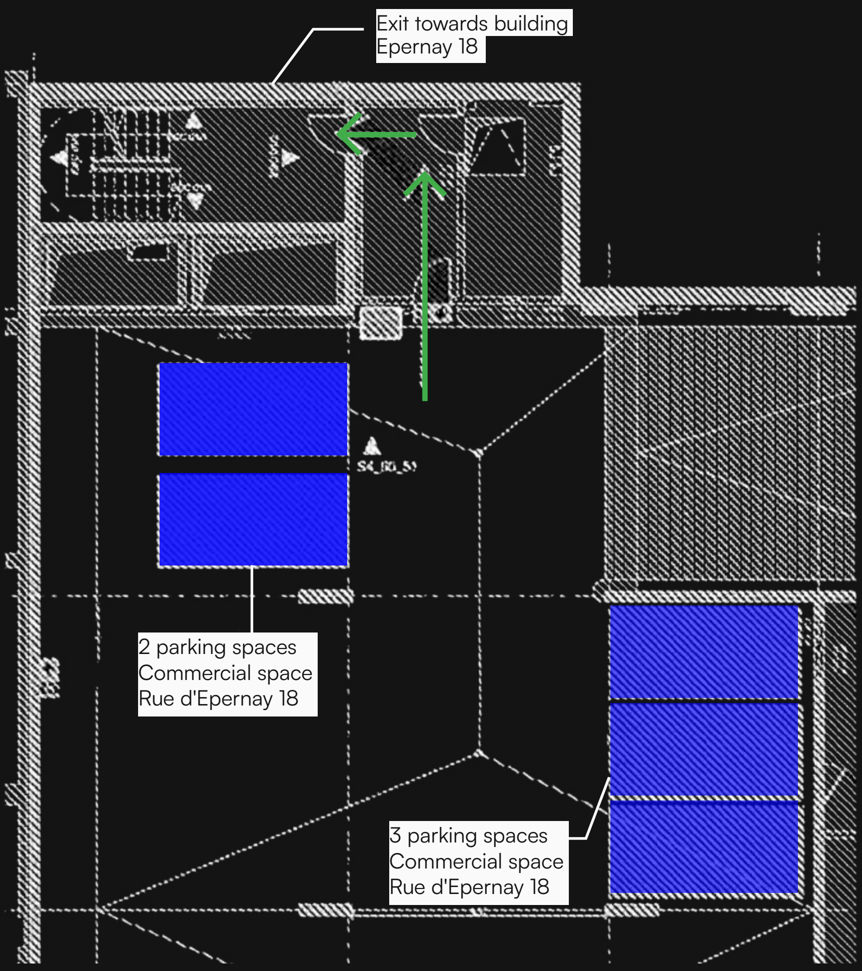
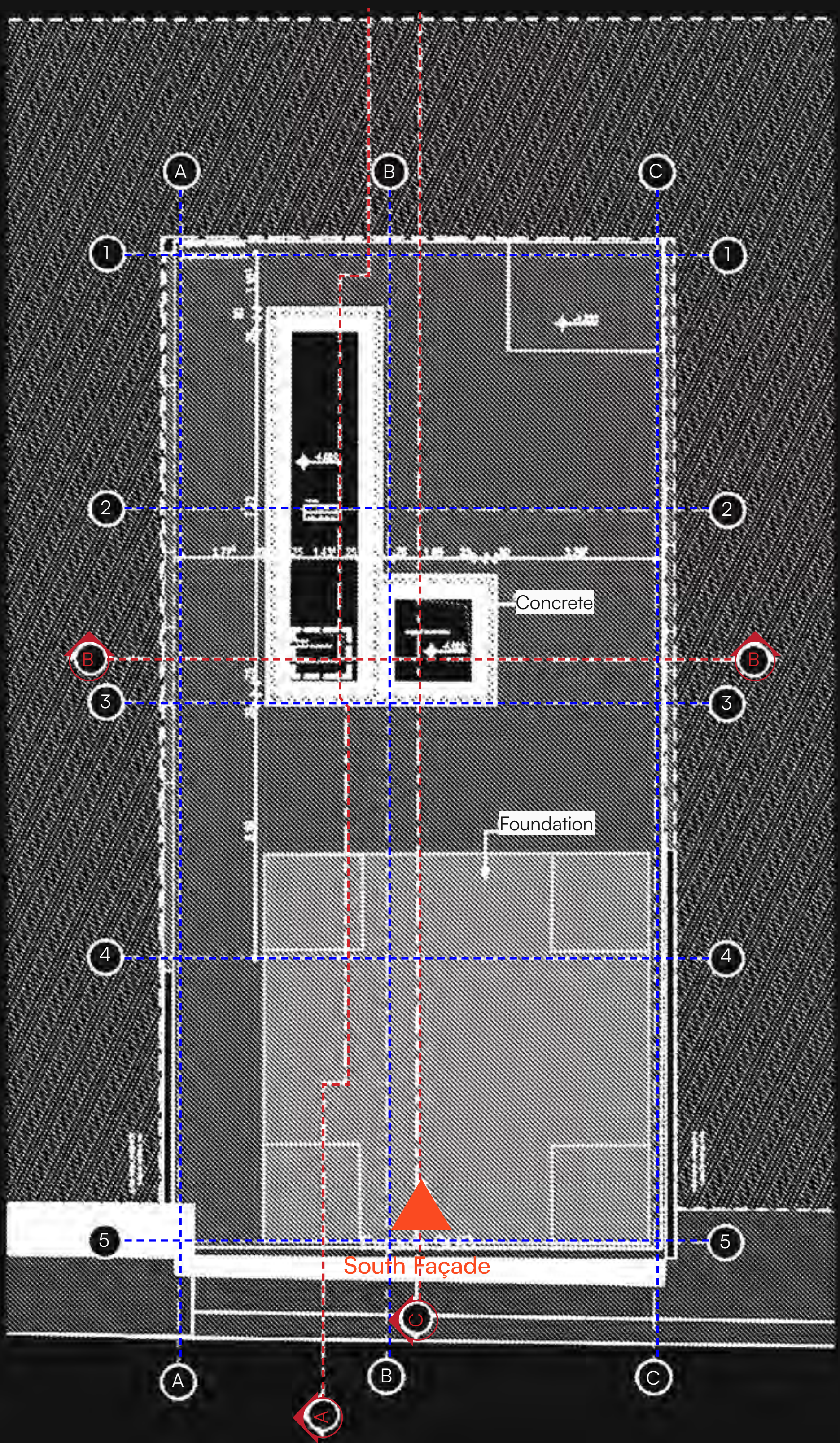

Exit towards building
Epernay 18
S4_00_51
2 parking spaces
Commercial space
Rue d'Epernay 18
3 parking spaces
Commercial space
Rue d'Epernay 18

Fig.38



Basement — Level -2

Fig.39

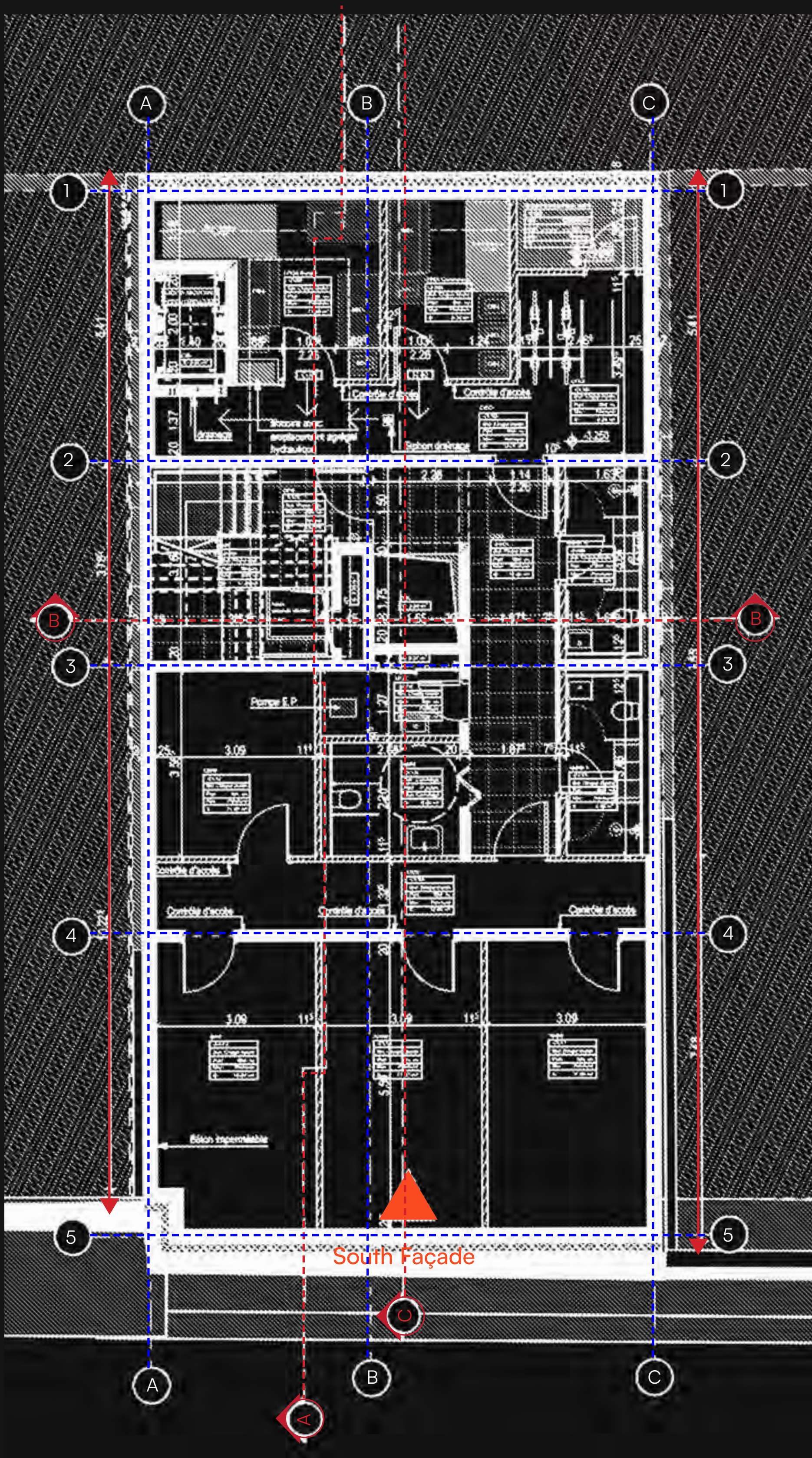
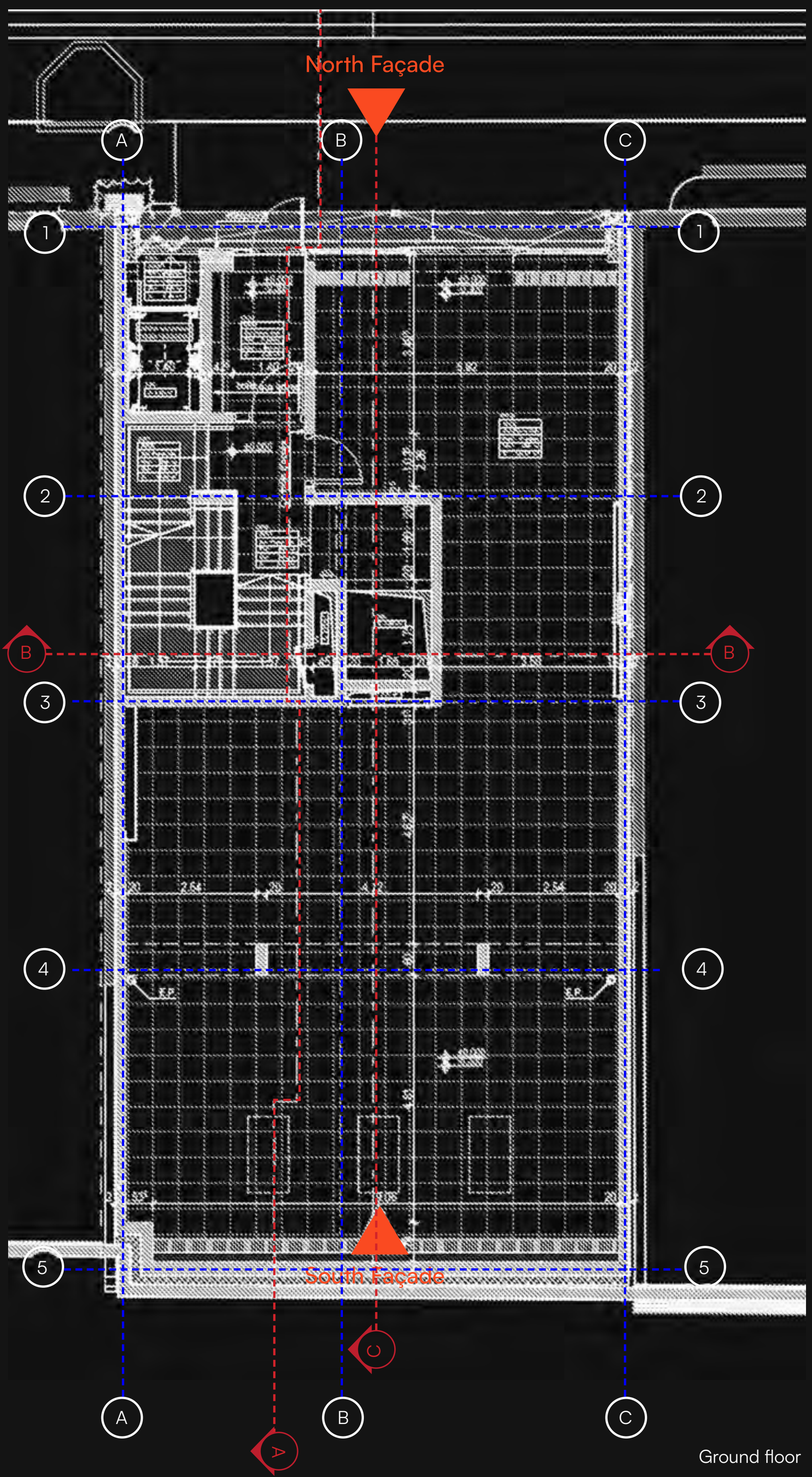


Fig.40 Basement — Level -1



Ground floor

Fig.41

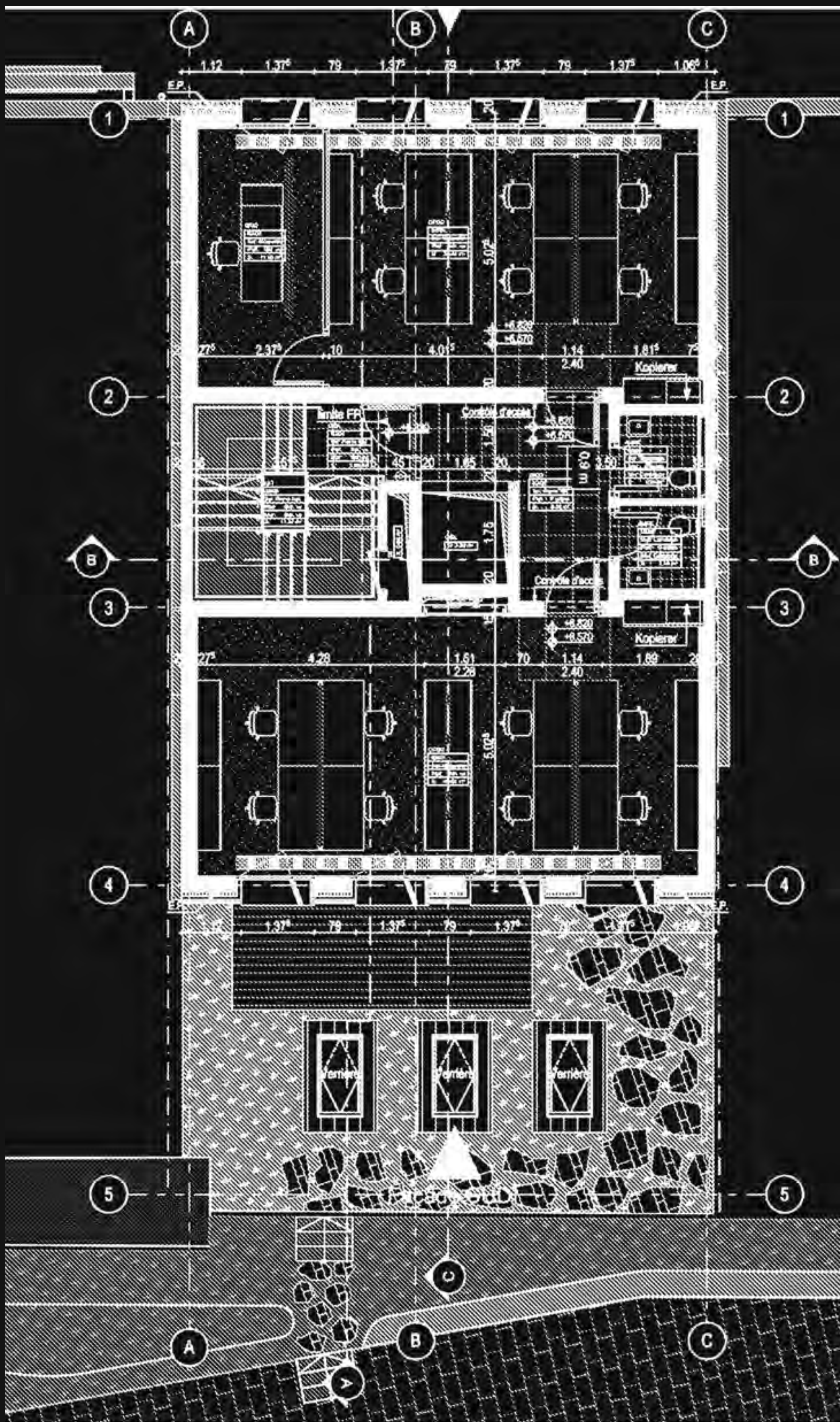
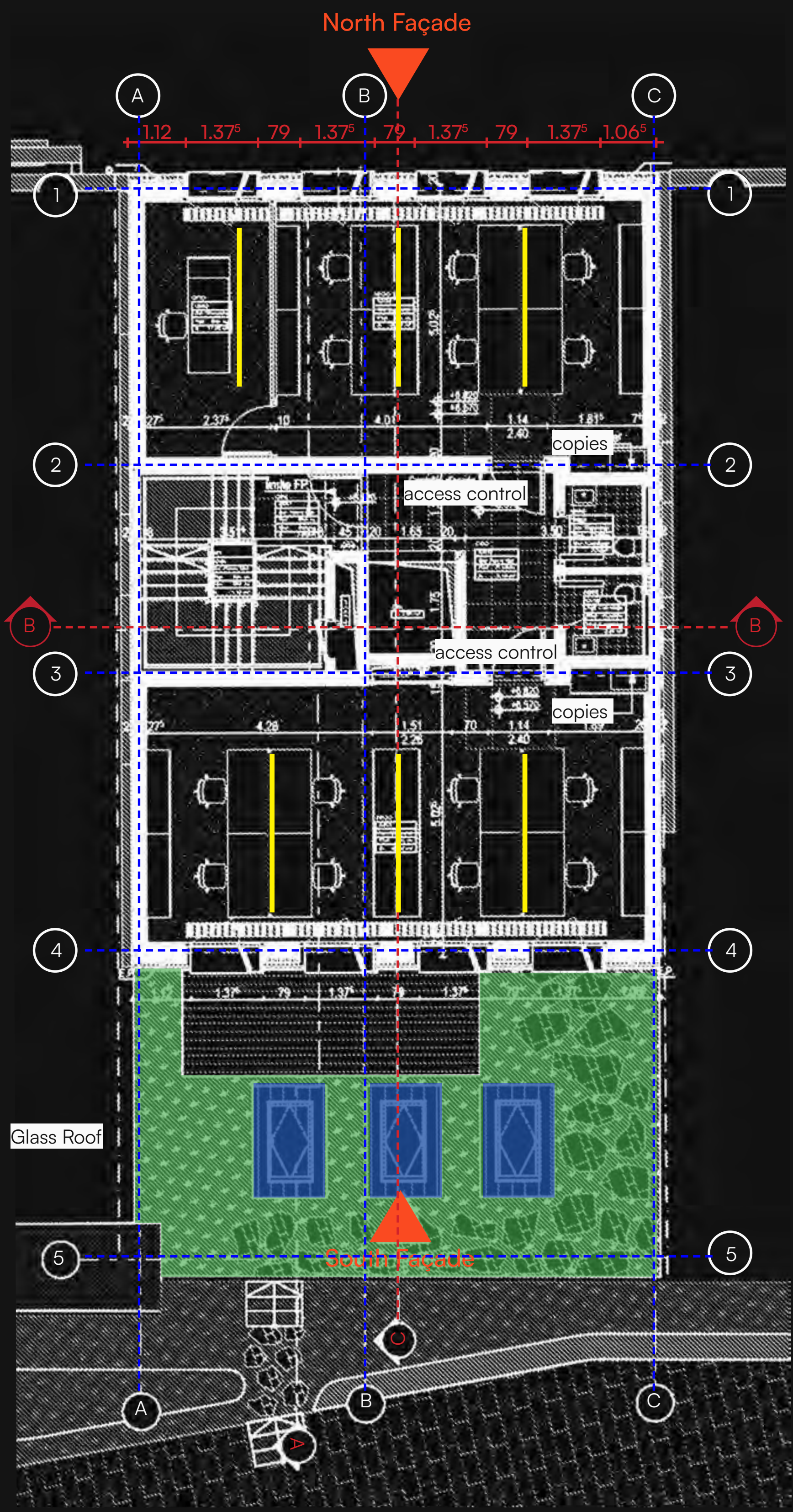


Fig.42 Upper floor — Level 1



Upper floor — Level 2

Fig.43

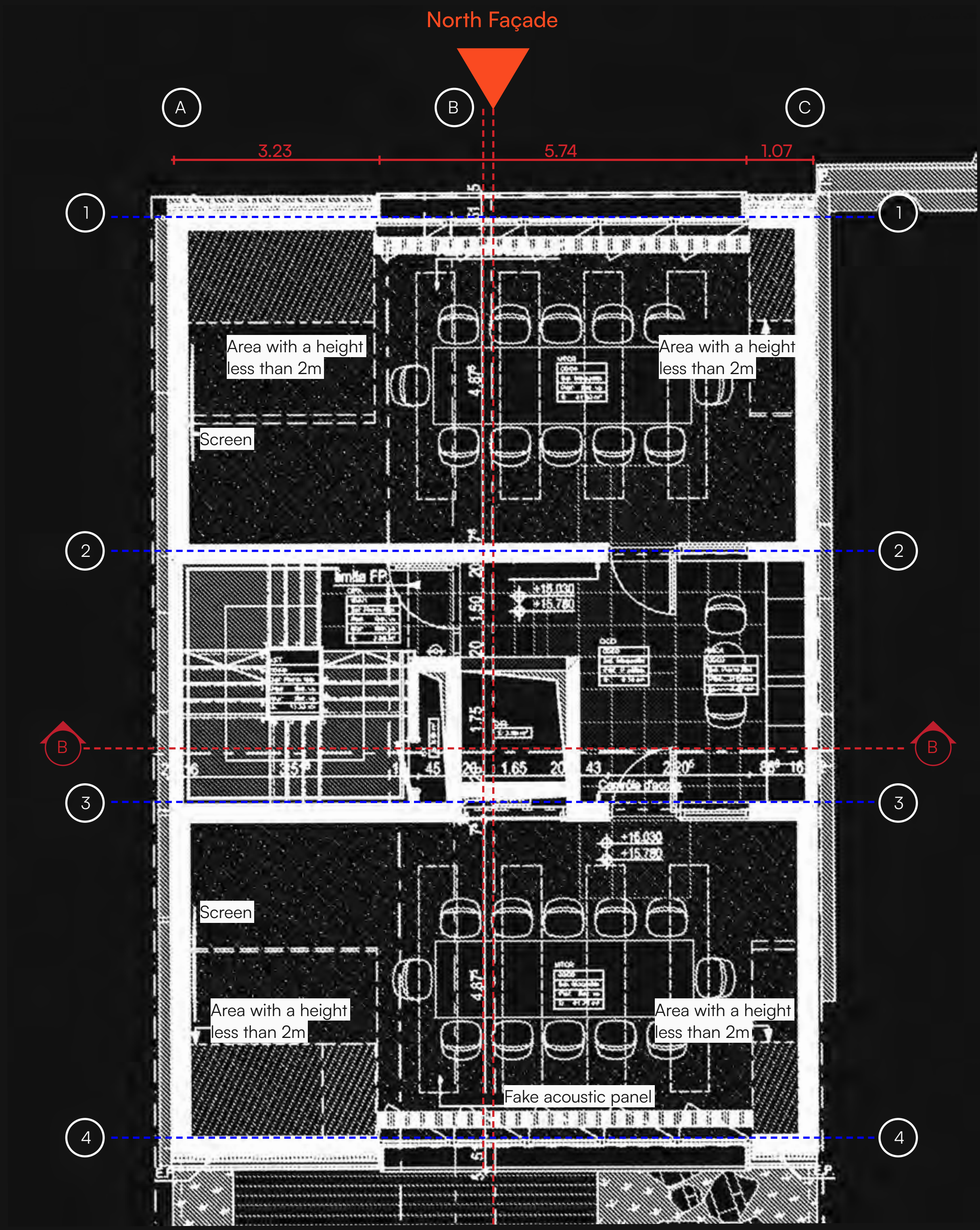
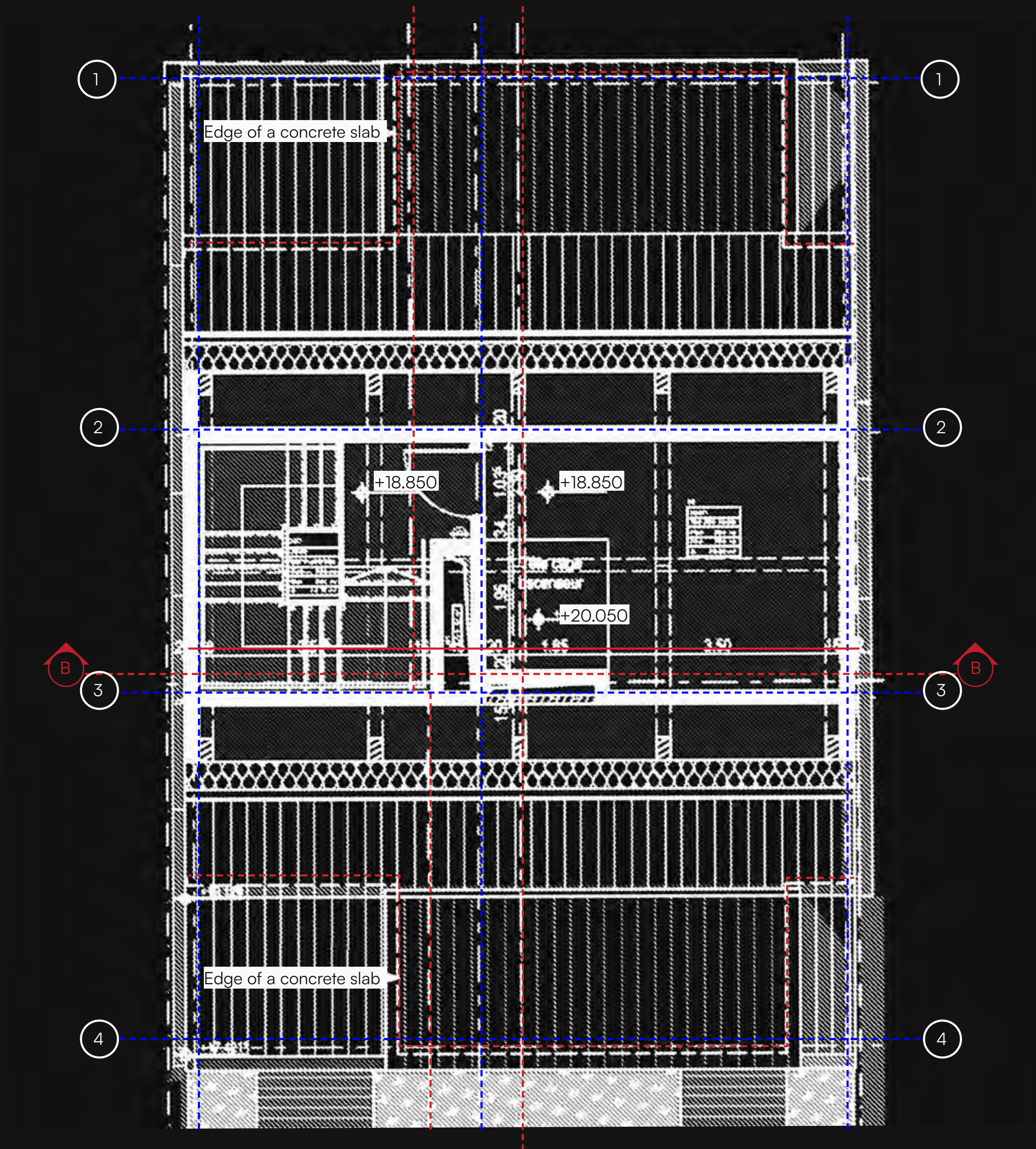


Fig.44 Upper floor — Level 5

metaform dar



Upper floor — Level 6

Fig.45

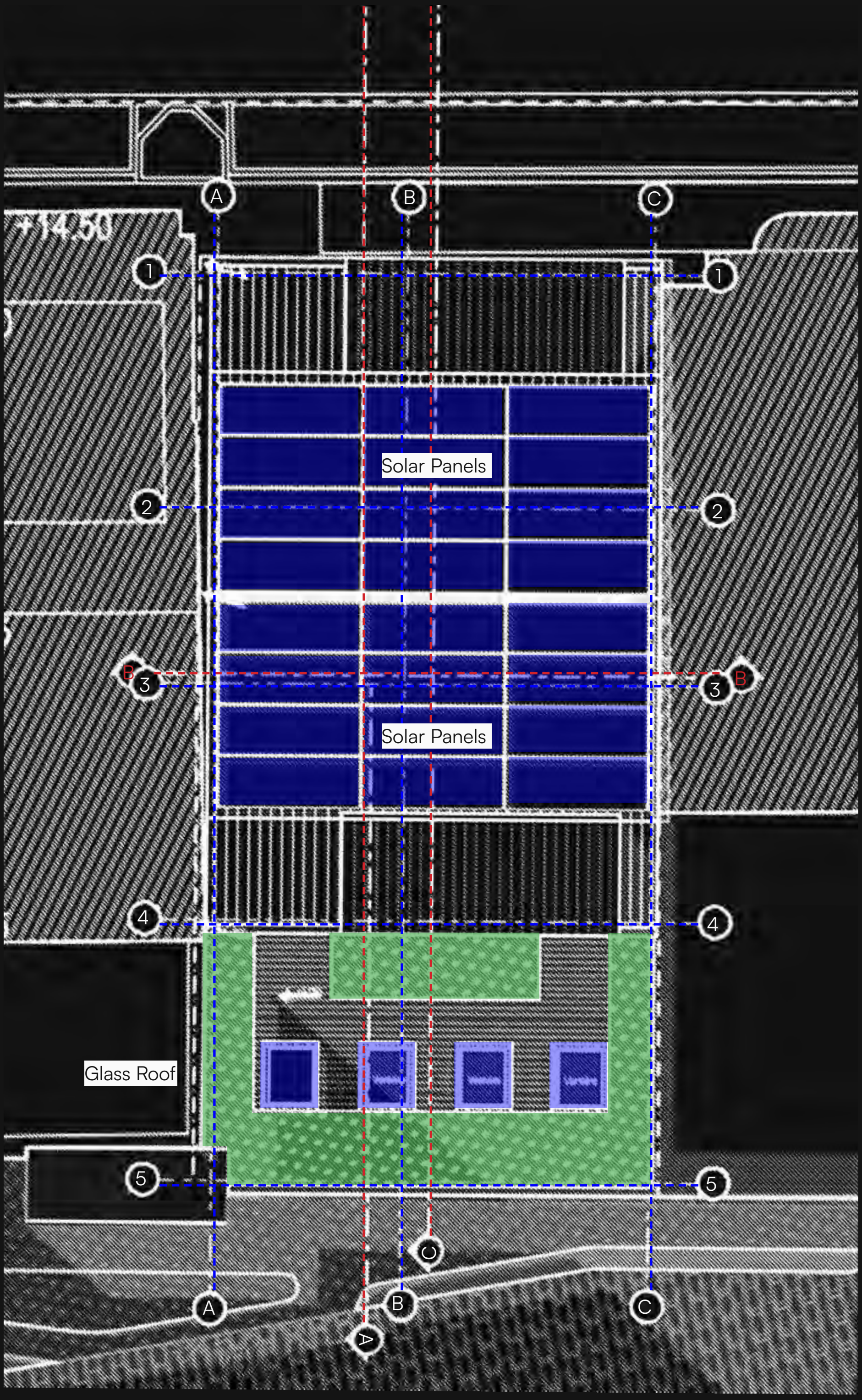
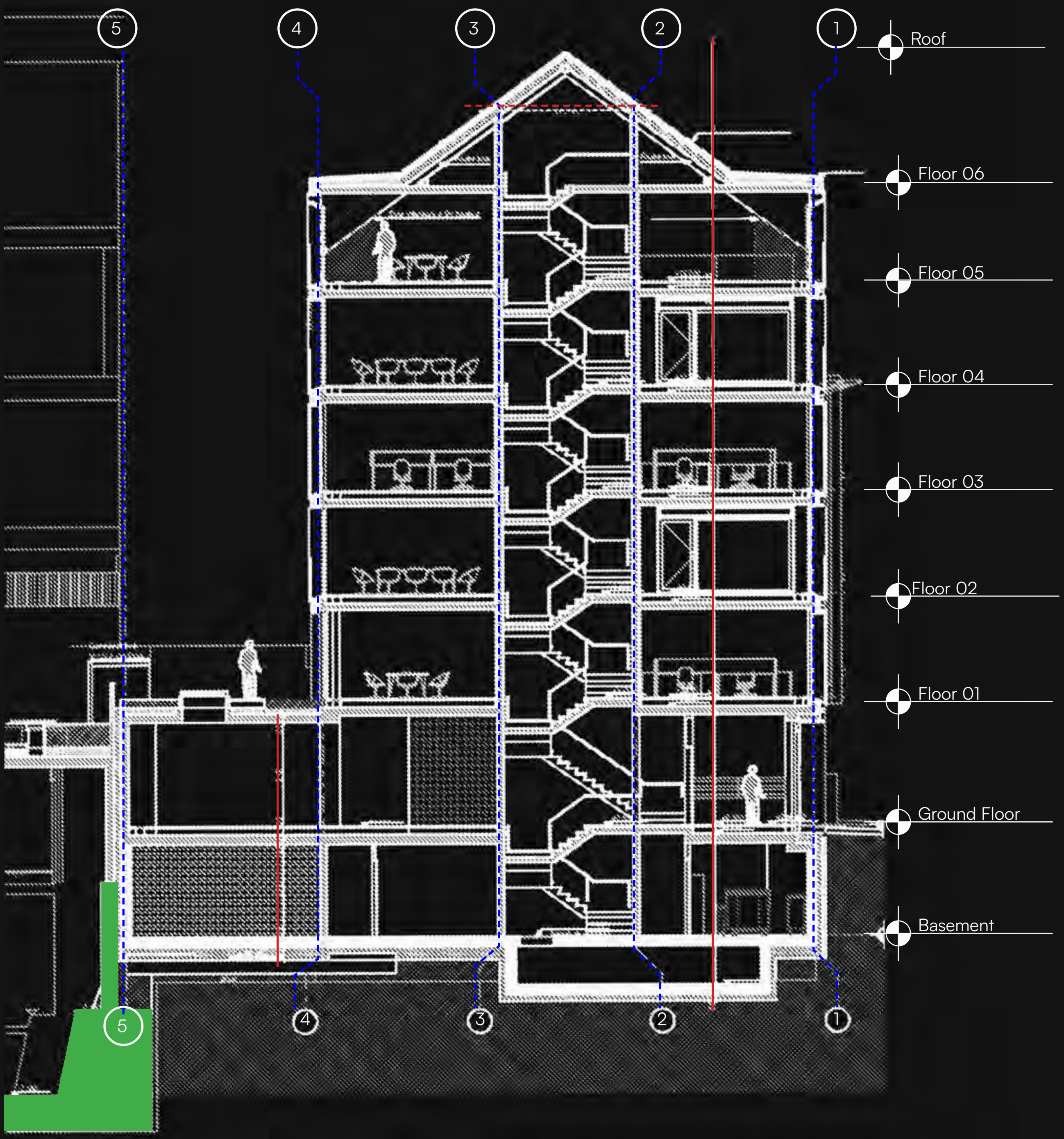


Fig.46 Roof Plan



Section A - A Fig.47

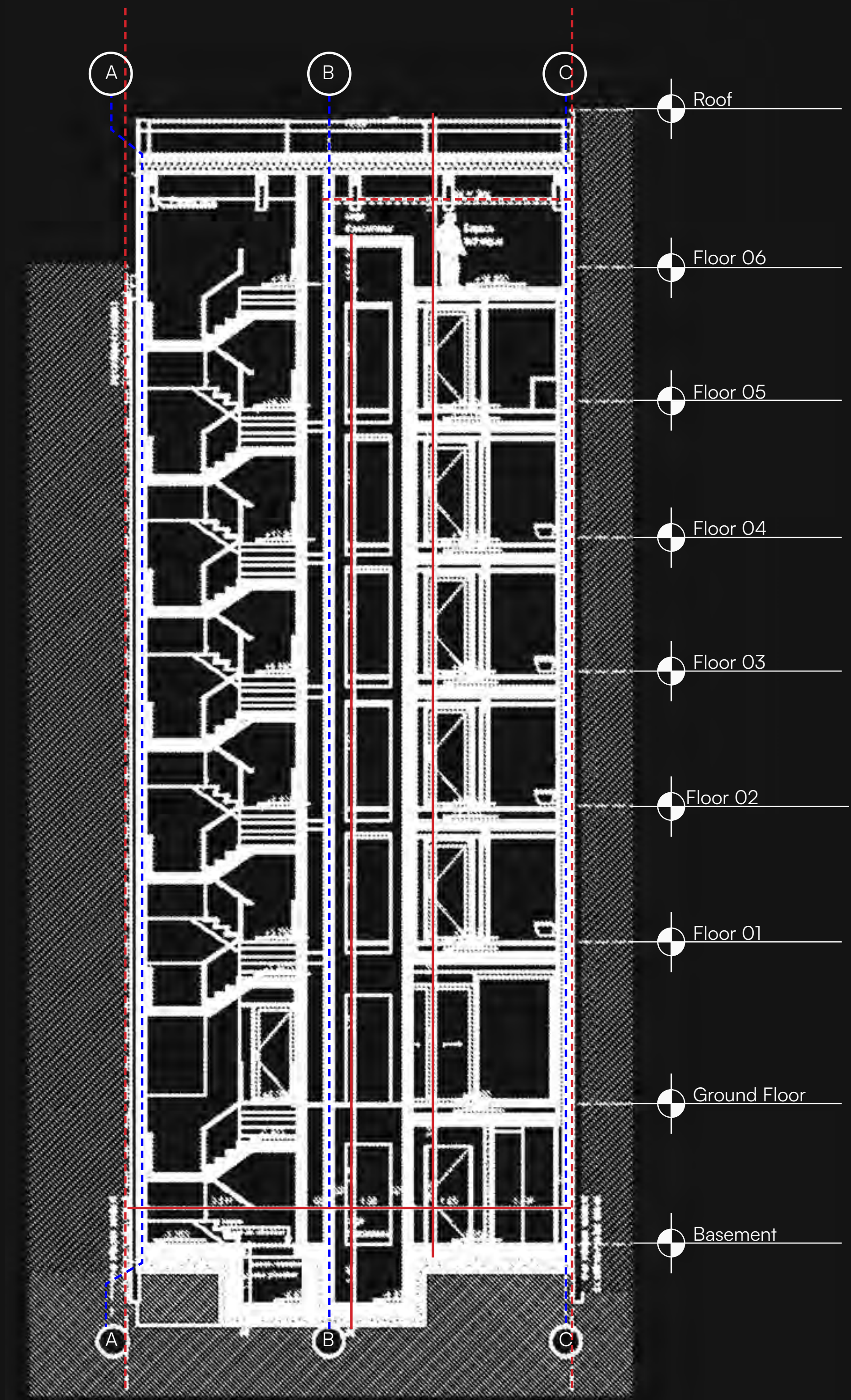
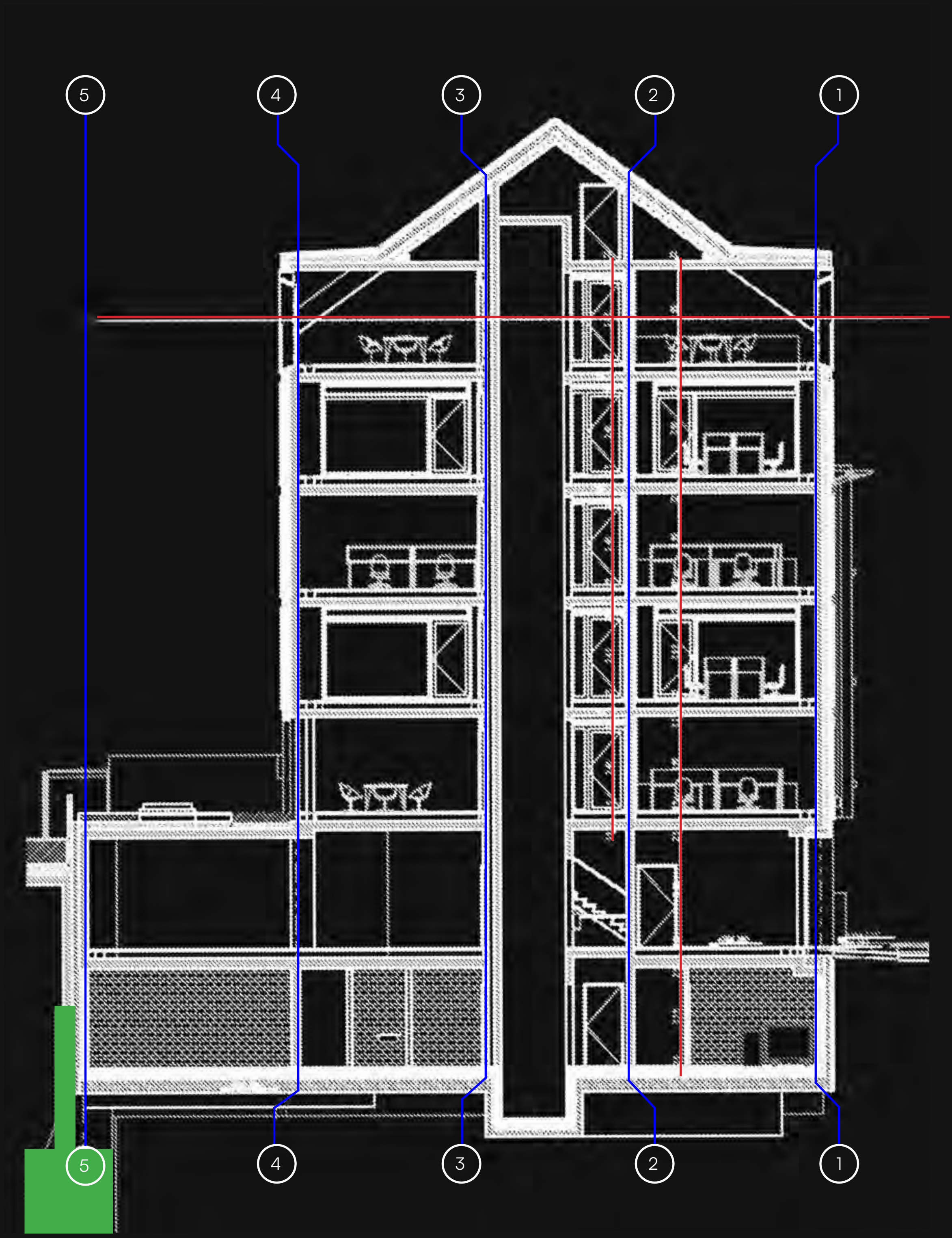


Fig.48 Section B-B



Section C - C Fig.49


+16.40
+17.10
+16.35
+15.85
+16.40
+15.85
+16.90
+18.95
+18.20
+18.20
+18.40
+18.40
+17.75
+17.75
+23.26
+25.30
+23.27
+23.22
+21.92
+23.22

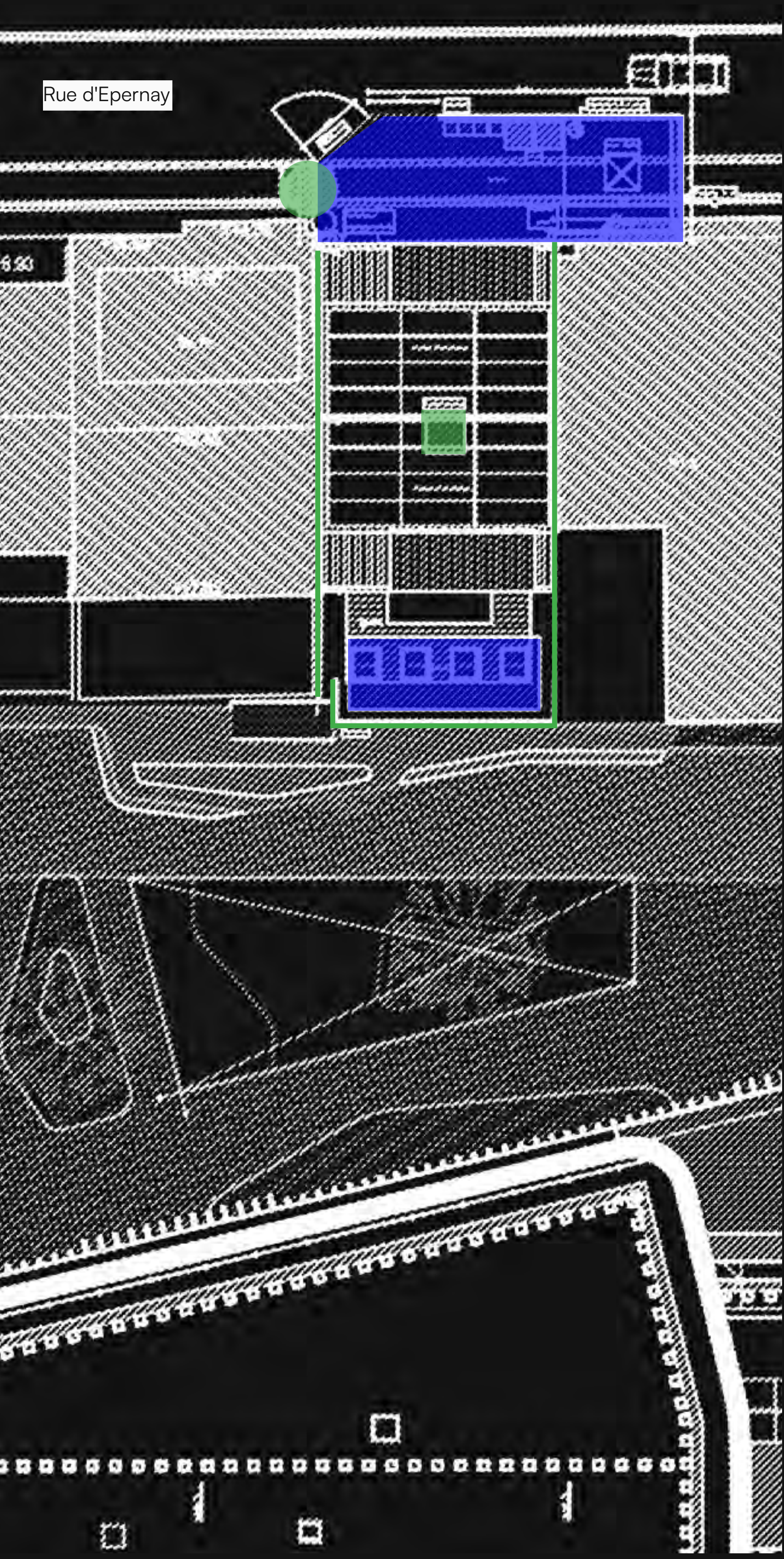


Fig.50 Construction Site Layout

" Every component that we reuse is a decision against waste and for continuity"

GG Kirchner architect and partner of metaform

3D Render of the Epernay Back Building