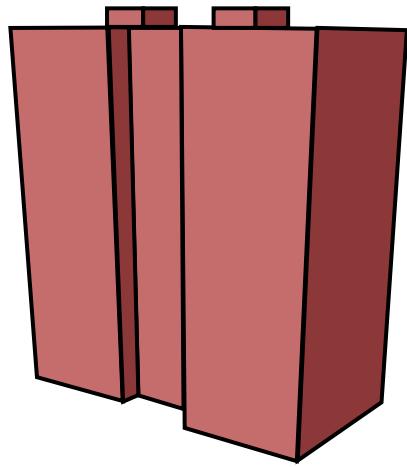


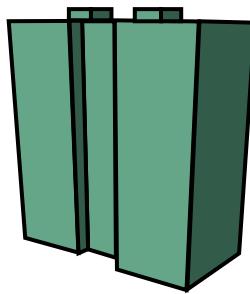


ARCHITECTURAL REPORT

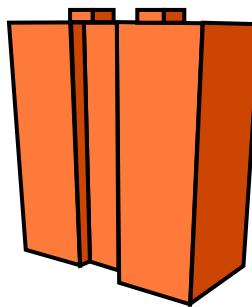
TEAM 6 | 41936 Advanced Building Design



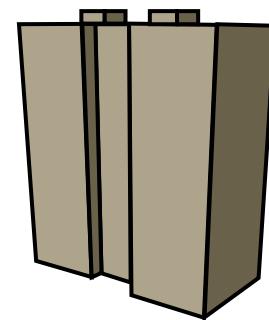
ARCH



MEP



STR



PM

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PROJECT

The challenge of this multidisciplinary project is to collaborate with various subject teams to design a building that not only meets aesthetic standards but also fulfills the specified functional requirements. Through intensive cooperation, all specialized skills are utilized to plan a high-rise building that adheres to the specifications of all disciplines and meets the necessary criteria to achieve the corresponding DGNB certification Gold.

The new Building 313 peaks 69m high over the DTU campus in Kgs. Lyngby and invites students, professors, and the public inside. The building offers a wide range of facilities including an auditorium, a café, a multipurpose room, office space for up to 1620 employees, and various student areas for 308 students, where everyone can find a space to work, meet, and connect. The Team has a budget of 75 000 dkk/m² and 35 months to design and construct an innovative and sustainable building, which follows the DTU standards and values. With only 16 stories the team created a functional building with very effective use of space in the office levels. And over all much smaller building than proposed.

TIME:
35 months

COST:
75k dkk/m²

DGNB:
Gold

PEOPLE/DESKS:
1600



Fig. 1: view from people perspective

BEATS

| | |
|---------------------------------|--|
| BUILDING HEIGHT | 69,1 m |
| GROSS FLOOR AREA | 29572 m ² |
| FLOOR TO FLOOR HEIGHT | 3,8 m |
| MINIMUM HEIGHT IN OFFICE SPACES | 3 m |
| HORIZONTAL DEFLECTION | 52,2 mm |
| FACADE TRANSPARENCY | 37 % |
| NUMBER OF WORK SPACES | 1620 |
| CORE VS. USABALE SPACE RATIO | 8,47 % |
| ENERGY RESILIENCE | heat breakdown: top > 20° cooling breakdown: T op increase by 2 °C within 4 hours |
| CO2 | 6,74 kgC02-e.g./m ² /yr. |
| COST | 1 140 335 849 DKK |
| HOURS | 2808 man hours |

SITE

The building 310 is located in the third quadrant of the DTU campus, adjacent to Mathematik Torvet, bike and car parking facilities, cafes, cantines, and DTU Skylab. The immediate goal is to make the site hospitable and transparent. By situating the building in the northern part of the site, more space was created in front of the building for outdoor seating in the café, inviting people inside and making the building more approachable from the south. The main entrance, positioned on the west side, is easily identifiable as the façade leads to the west and is set back from the rest of the structure. Pedestrians can access the building from all directions, while cyclists are directed to the south side where the bike parking ramp is located. Cars will pass only along the south side to minimize noise, but fire trucks will still have access to the building.



Fig. 2: Site Plan

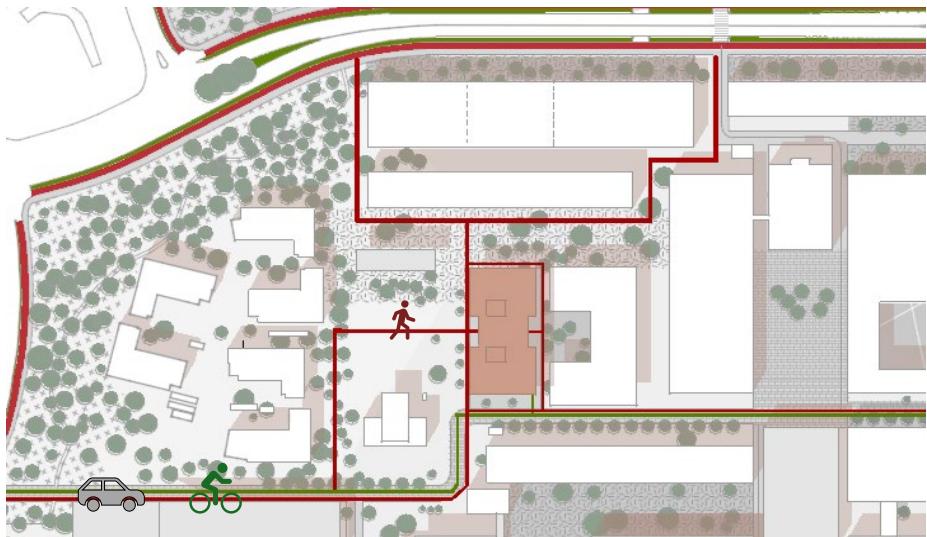


Fig. 3: Accessways

BUILDING

The architectural approach for this project focused on creating a functional building that attracts campus visitors and features generous open areas along with space-efficient office spaces. Initially, the concept included double-height spaces in the center of the building, but this idea was quickly discarded due to the high volume per person. The subsequent design proposed a 25-story block with a recessed middle section to ensure ample sunlight throughout the building. However, through efficient space management, we were able to reduce the height to 16 stories. To add visual interest, we considered varying the heights of the building's three sections. Unfortunately, this idea was not pursued due to the increased complexity and time required for structural calculations

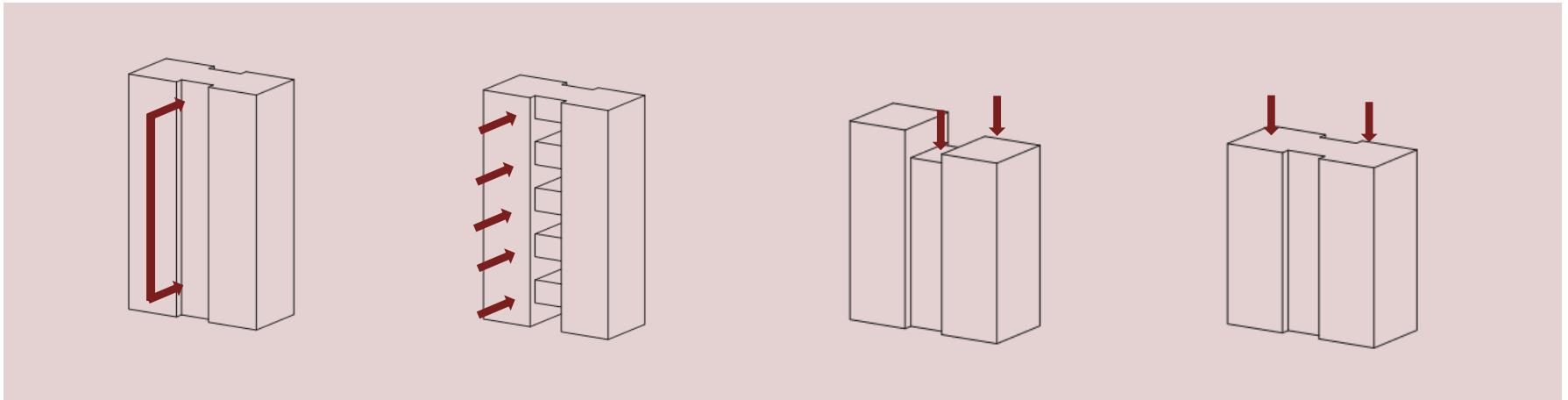


Fig. 4: Designprocess

SPACES

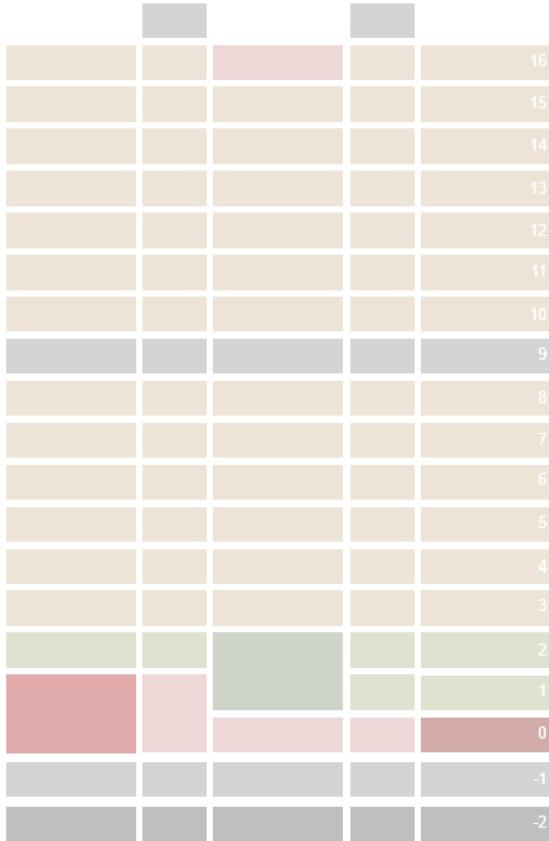


Fig. 5: Conceptual section of building functions

The building can be divided into open common spaces and more enclosed private areas. The ground floor, featuring a double height and a slanted ceiling created by the auditorium on the first floor, invites people inside and adds interest to the space. With a generous lobby, café, and multipurpose room for events, this floor is accessible to everyone. This openness continues to the top floor, which houses a public observatory. Open staircases and the open level above the ground floor allow for visual connectivity and interaction between different floors.

Student spaces are distributed across the first and second floors, offering a variety of environments where up to 308 students can work, meet, or relax. Above these floors, there are 13 office levels that accommodate 1,620 people in both closed and open office spaces. Technical spaces are located on levels -1, 9, and the roof. Additionally, the basement houses technical areas and bike parking for 1212 bikes.



GROUND FLOOR

The entire ground floor features floor-to-ceiling glazing and a double-height ceiling, creating a transparent and inviting atmosphere for students, professors, employees, and the public. Upon entering the building, visitors are greeted by a spacious and welcoming entrance area located centrally between the two cores, just behind the main entrance. One of the most interesting spaces in the building is the entrance hall, situated beneath the auditorium. The auditorium's slanted ceiling, adds a unique architectural feature to the space. The natural light streaming in from the opposite side of the entrance enhances the effect, drawing people inside. On the north side of the building, you can find the 266 m² big multipurpose room, that connects to the main entrance hall and has multiple doors opening to the outside, allowing it to function independently from the rest of the building and facilitating equipment transport with a forklift. On the opposite side of the building, the café spans 207 m² and accommodates at least 64 people. It connects to both the main hall and an outdoor seating area, offering a space for eating and socializing.



Fig. 6: Ground Floor



Fig. 7: Rendering of main entrance

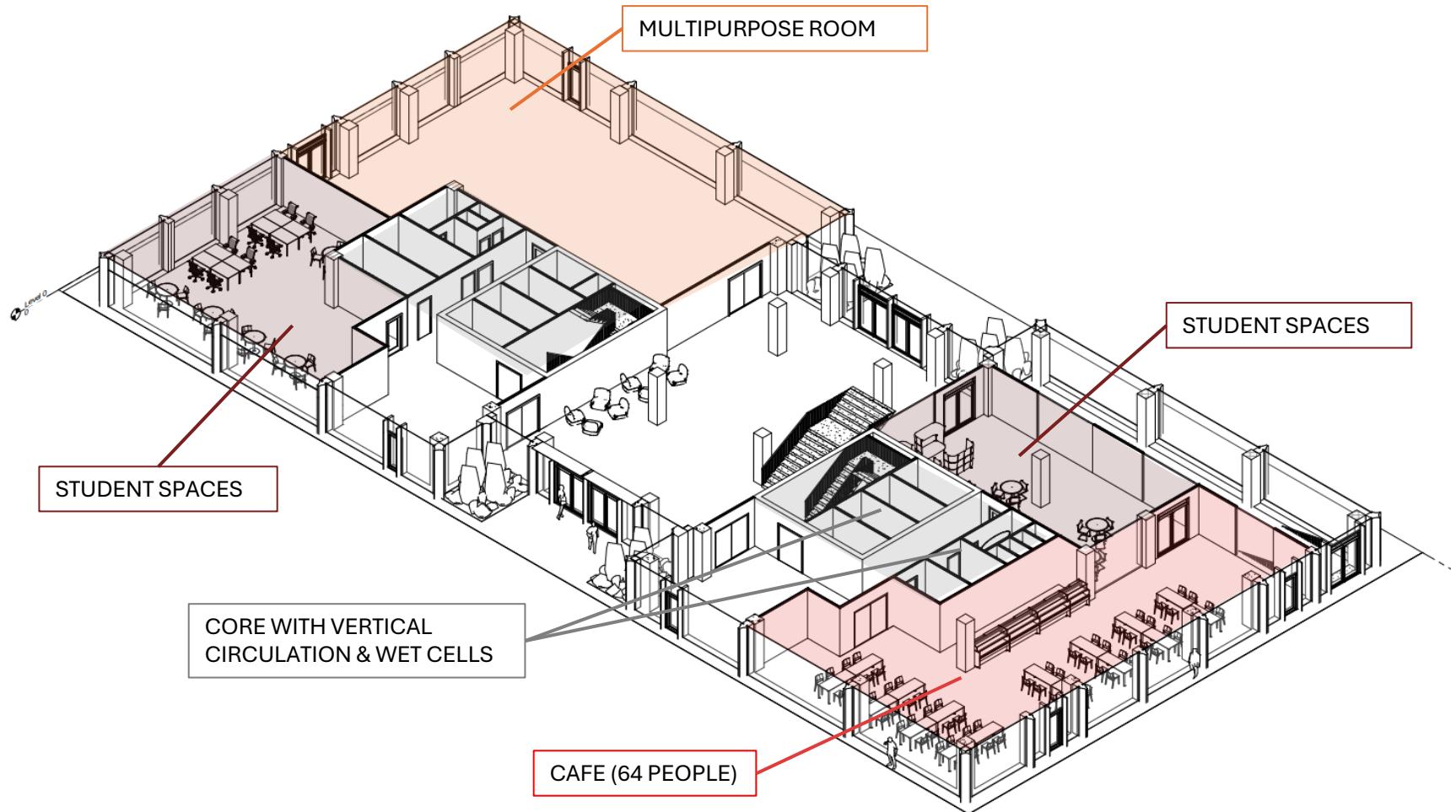


Fig. 8: 3D ground floorplan

AUDITORIUM

This floor is connected to the ground floor by a generous open stair case that leads to the auditorium, student spaces and up to the next levels of the building. The Auditorium can fit up to 100 people and is surrounded by various student spaces. As the slabs are not continuous around the whole floor it is possible to look down to the ground floor into the double height cafe and the double height multipurpose room. This emphasizes the openness of these floors to the public.

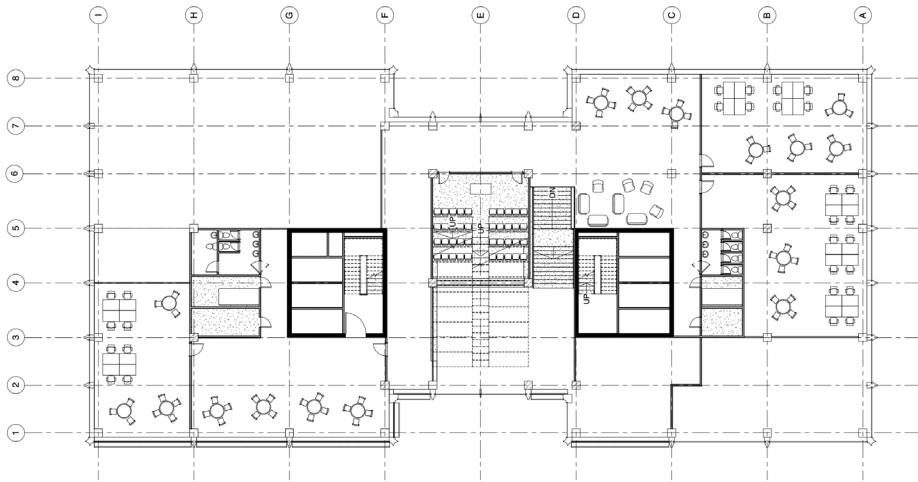


Fig. 9: Level 1 Auditorium



Fig. 10: Rendering of entrance area underneath the auditorium

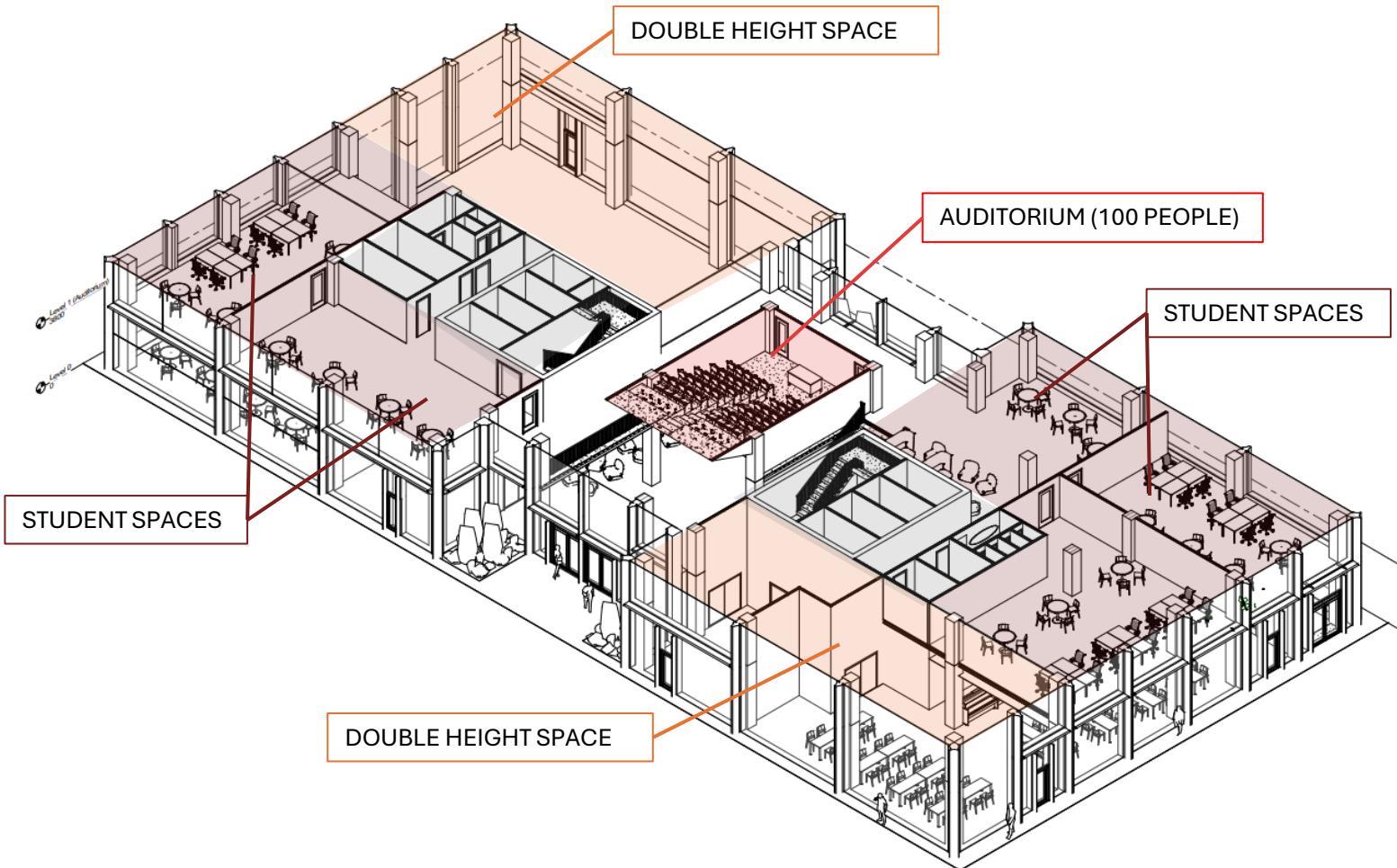


Fig. 11: 3D level 1 floorplan

STUDENT FLOOR

The auditorium's main entrance is on the first floor which means that it is accessible by taking the elevator and not having to take stairs. For overall better visual and acoustical performance the middle part of the auditorium is declined and has built-in seats.

Next to the auditorium, there are mainly student study spaces on the second floor. Similarly to the first floor there are open spaces with sofas, beanbags and tables. These spaces allow individual rearranging of working spaces and are ideal for group work. More quiet individual work can be done in closed off study rooms on the opposite side of the building. Additionally, two spacious meeting rooms, each accommodating up to 25 individuals, are available for communal use on this floor. These rooms are accessible for everyone and help mix student and office spaces and also the public.

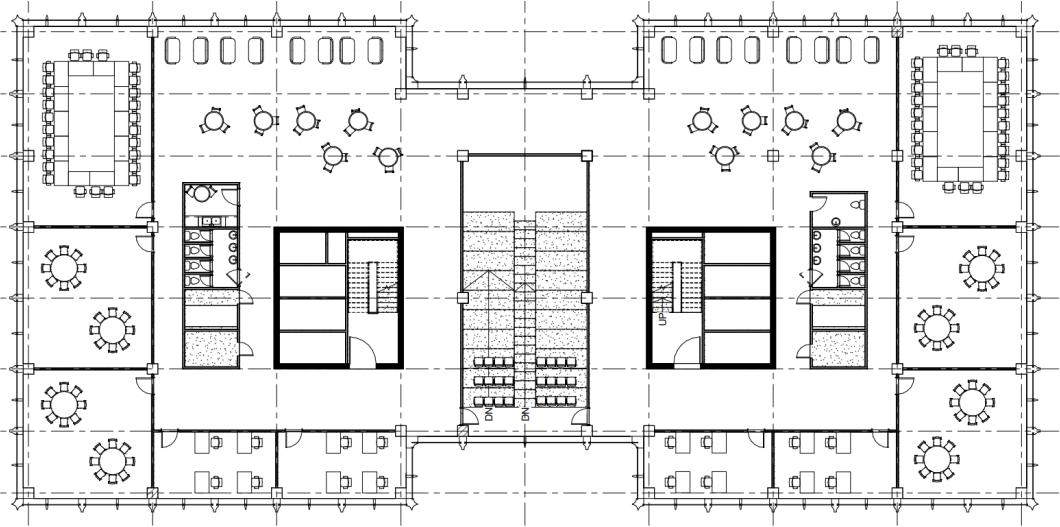


Fig. 12: level 3 floorplan



Fig. 13: rendering of meeting room

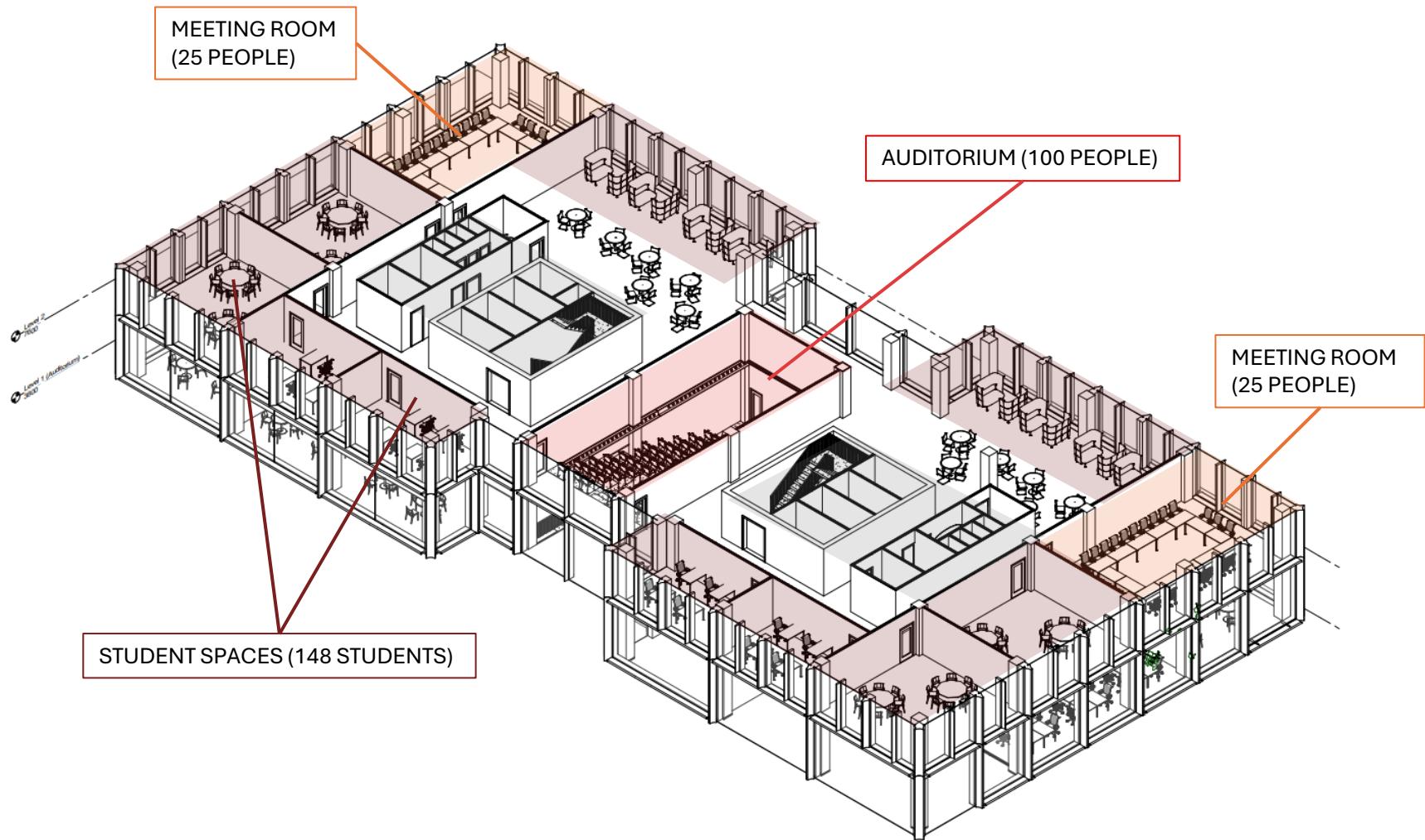


Fig. 14: 3D level 3 floorplan

OFFICE FLOOR

The majority of the spaces in this building are offices. 1620 desks are distributed on the 13 office floors that hold 126 desks each and the top floor that has 108 desk spaces. Additionally, every office floor has one meeting room that holds 15 people and six soundproof work booths. The office spaces are located along the facade to ensure optimal lighting. The size of the offices varies between cell offices for up to six people to offices that accommodate up to 14 people. The majority of the middle part of the office floor is an open office that comfortably fits 18 people.

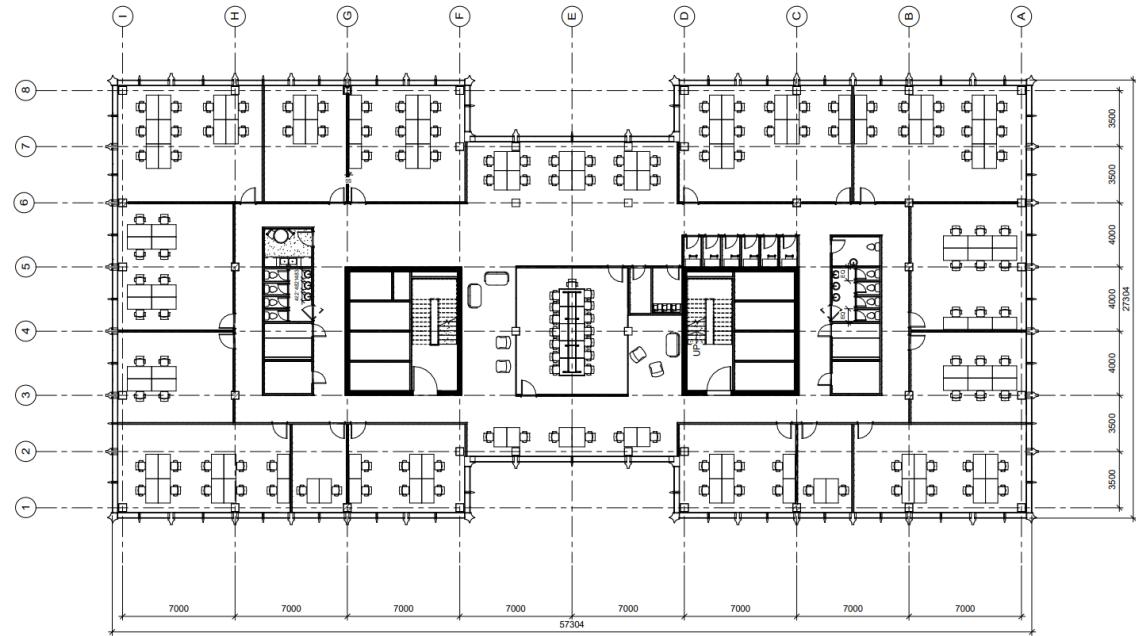


Fig. 15: level 5-8 & 10-15 floorplan



Fig. 16: Rendering of office

The meeting room in the middle separates the work spaces from each other and provides lounge areas next to it. The wide variety of work spaces enables group work, team meetings and individual work. On the side of one of the cores there is a kitchenette that creates a space to take a short break and grab some coffee and sit down in the lounge areas. Copy room and storage room are considered core functions and are located between core and meeting room.

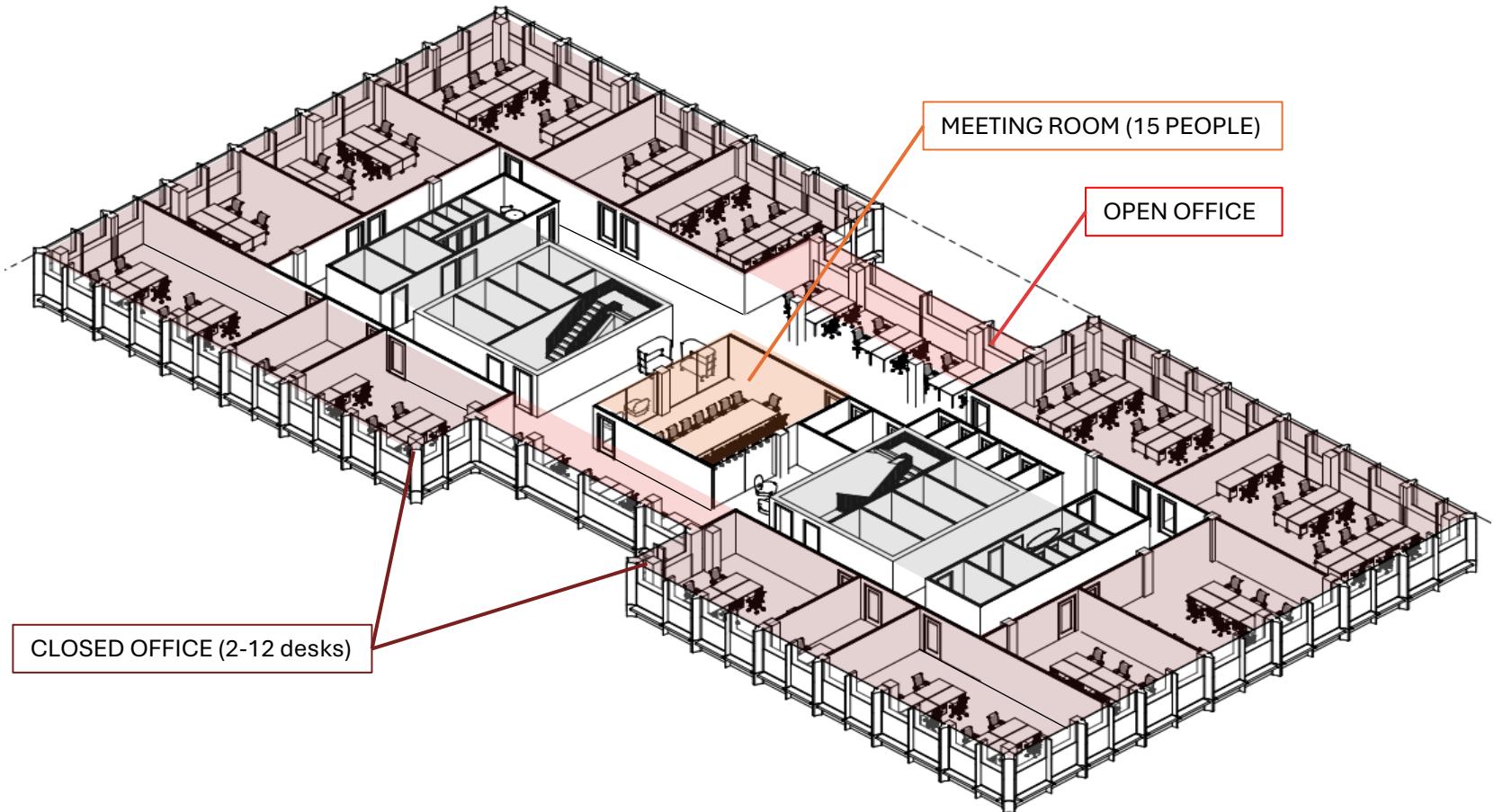


Fig. 17: 3D office floor

TOP FLOOR

The top floor provides a similar layout of offices. Except for the middle part. Here you can find the observatory of the building overlooking the whole Campus of DTU. It is open to the public and separated from the offices to ensure the employees are not being disturbed. The big open space with floor-to-ceiling glazing offers space for a variety of activities and events, as well as being a spot for taking a break from work.

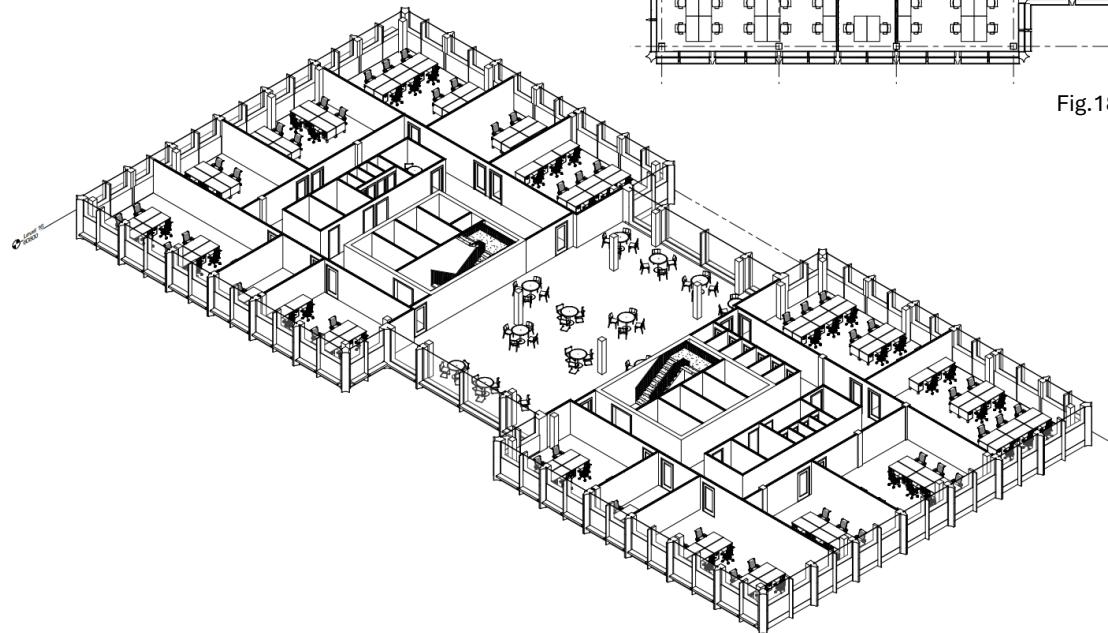


Fig. 19: level 16

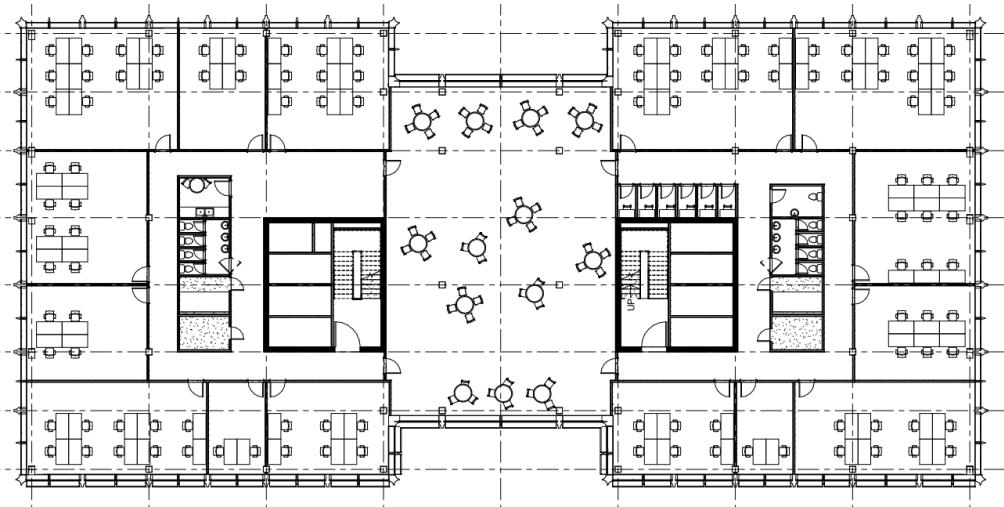


Fig.18 : level 16

BASEMENT

After consulting with the MEP engineers, it was decided to reduce the basement to two floors. The first basement floor is dedicated to bicycle parking and MEP rooms, while the second basement floor is solely for bicycle parking. The bicycle parking area is conveniently accessed via a ramp connecting to the ground floor. With space for 1,212 bikes across the two floors, the required bike parking capacity of 940 is exceeded.

Additionally, level -1 includes a waste room where trash from the chute, located in the building's core, is collected. The waste can be easily picked up by pushing the containers up the bike ramp for immediate collection. Level -2 contains two waste water tanks. They are located next to the cores and are designed to collect the waste water of all the sinks in the building. This water will be used to flush the toilets.

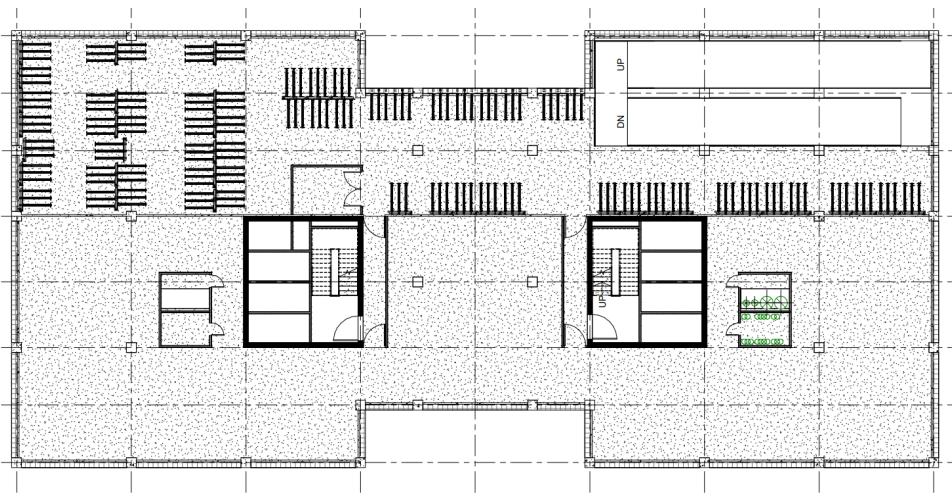


Fig. 20: level -1

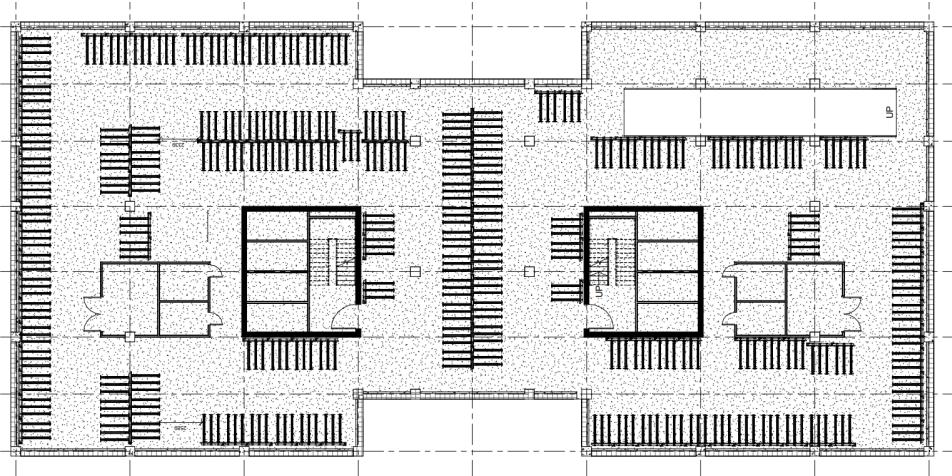


Fig. 21: level -2

SECTION

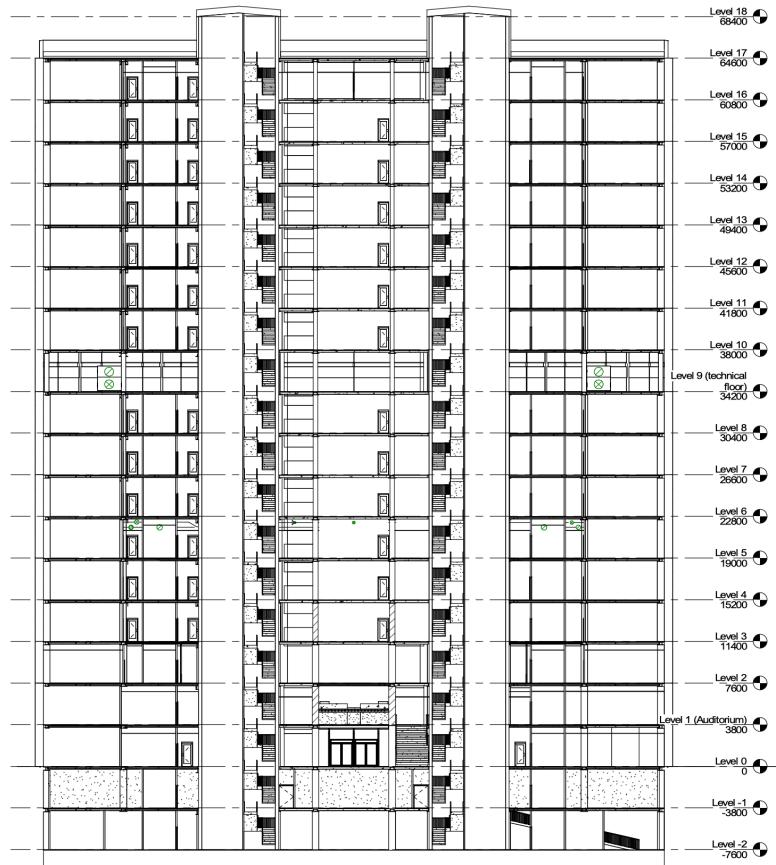


Fig. 22: section A-A

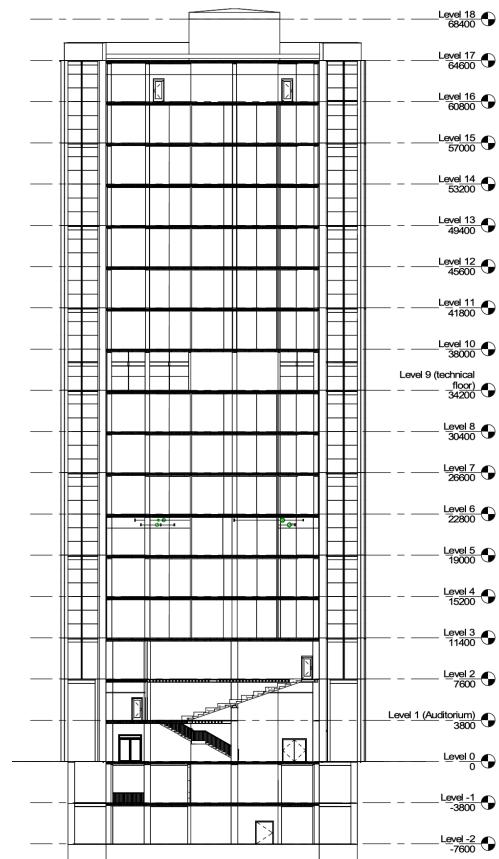


Fig. 23: section B-B

STRUCTURAL INTEGRATION

The design emphasizes straightforward geometry and a consistent system throughout the building. In collaboration with structural engineers, a grid was established. The longer side features a uniform 7-meter grid, while the shorter side's grid aligns with the core position, resulting in an irregular pattern of 3.5 meters and 4 meters.

While the office floors adhere perfectly to this grid and the column placement, the ground floor and first floor required special attention and adjustments to the column positions. Additionally, the structural engineers enabled the creation of a tilted ceiling above the ground floor, enhancing the entrance's visual appeal.

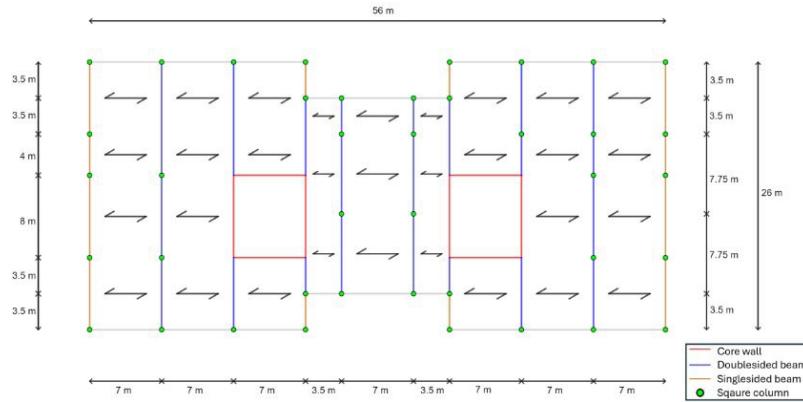


Fig. 24: Grid



Fig. 25: 3D Structural Modell (STR)

CORE

The building is made up of one big tower and therefore two cores. The core goes through all levels from the ground floor to the 16th floor. Located inside each core are the four elevators, with one fire elevator opening into the staircase. The pressurised core ensures that the staircases and evacuation elevator are smoke- and fire-free escape routes. The bathrooms are placed across from the elevators next to the technical room, outside the structural core. Overall the cores are stabilizing the whole building both vertically and horizontally.

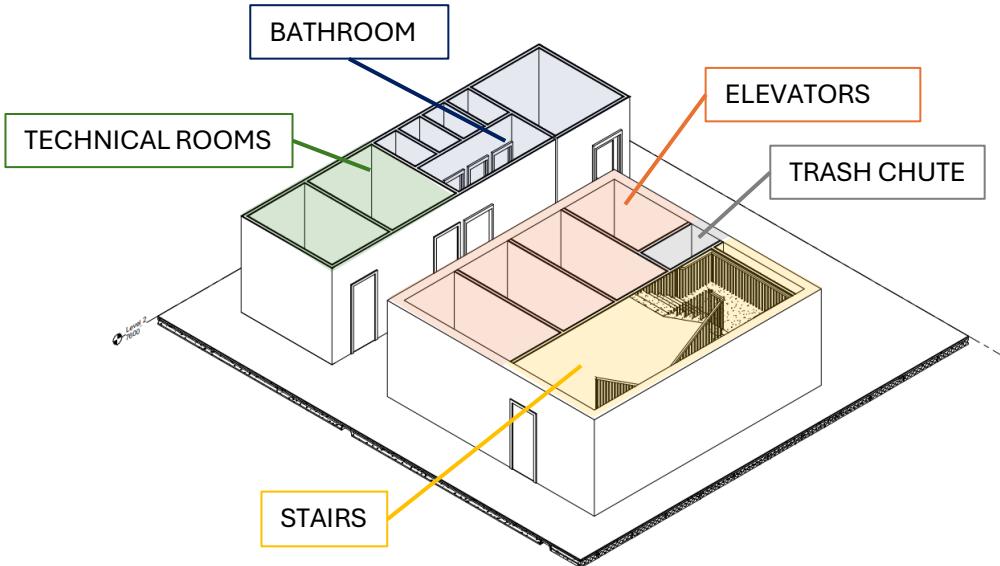


Fig. 26: 3D Core

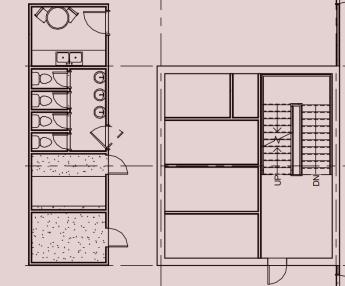


Fig. 27: Core north

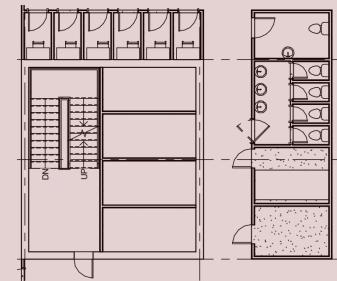


Fig. 28: Core south

TECHNICAL INTEGRATION

The floor-to-floor height on the office floors of the building is 3.8 meters. Mechanical, Electrical, and Plumbing (MEP) installations require 1.05 meters in the hallways and 0.55 meters in the offices. This arrangement, decided in collaboration with MEP engineers, ensures a higher ceiling height in the offices. The resulting floor-to-ceiling height of 3 meters is considered optimal for office spaces. The ground floor features a greater ceiling height of 6.3 meters to accommodate functions such as the representative lobby, café, and multipurpose room. MEP rooms are located outside the core, adjacent to the bathrooms, based on collaborative decisions with MEP and structural engineers. Technical rooms are situated in the basement, 9th floor, and the roof. This layout allows for smaller pipes and ventilation ducts, thus requiring less ceiling space.

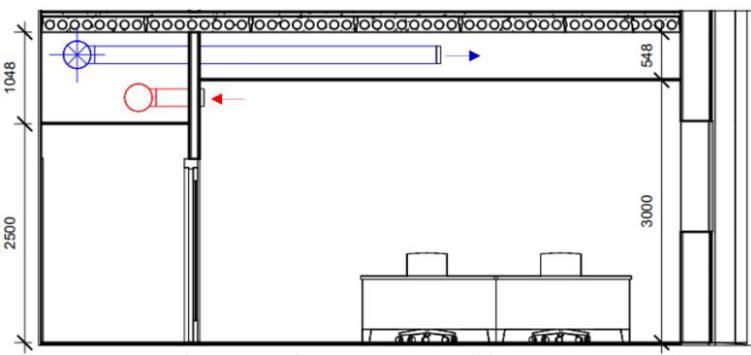


Fig. 29: section suspended ceiling (MEP)

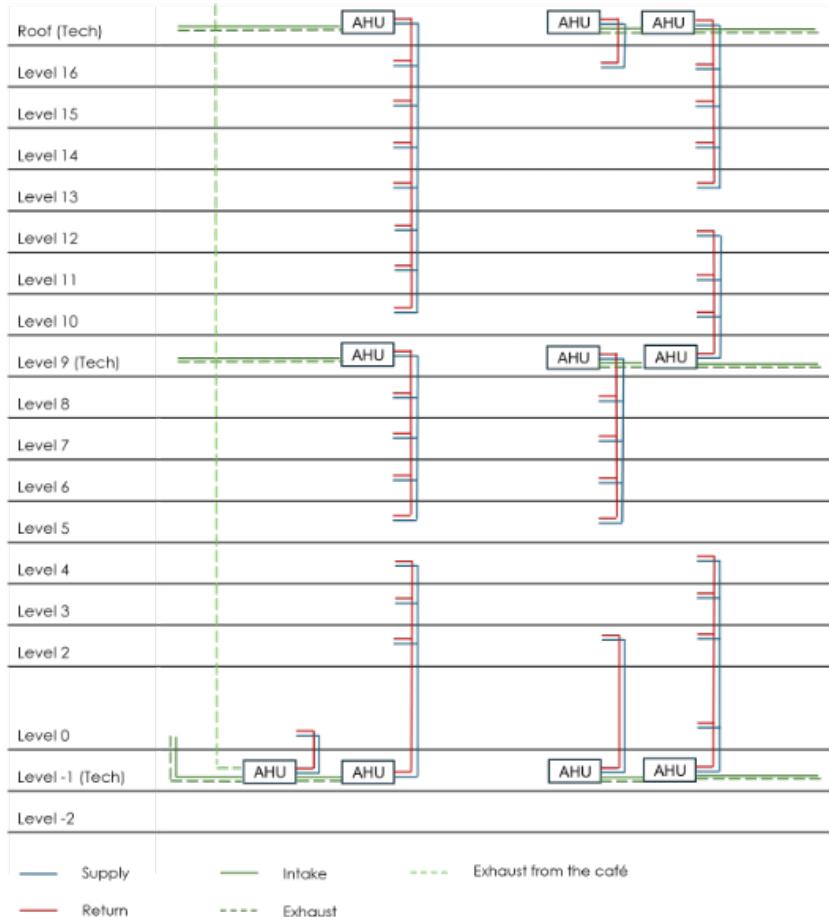


Fig. 30: Building flow

FACADE

The design of the facade was carefully crafted with three main goals in mind: to provide effective sun shading, to utilize sustainable materials, and to seamlessly integrate with DTU's architectural style. The building is encased in a curtain wall system comprised of a sturdy steel structure, adorned with terracotta clay tiles.



Fig. 32: Rendering of facade



Fig. 31: Rendering of facade close up

These tiles, boasting an impressive BREEAM Rating of 72.8%, not only contribute to the building's eco-friendliness but also make the building stand out with DTU's characteristic red aesthetic. The main idea behind this choice of color was rather than trying to make a 69m high building fit into the campus architecture, we wanted to make the DTU color visible from far away and make it stand out even more. Incorporating various sizes of pillars into the facade design not only adds visual interest but also serves a functional purpose. These pillars act as delineators between public and private spaces within the building, making it easy to distinguish between different areas from the outside. Additionally, the width of these clay pillars has been carefully considered to provide natural sunshading, thereby reducing the need for manual adjustments to control sunlight penetration inside the building. This thoughtful design approach not only enhances the building's energy efficiency but also contributes to a more comfortable indoor environment for its occupants.

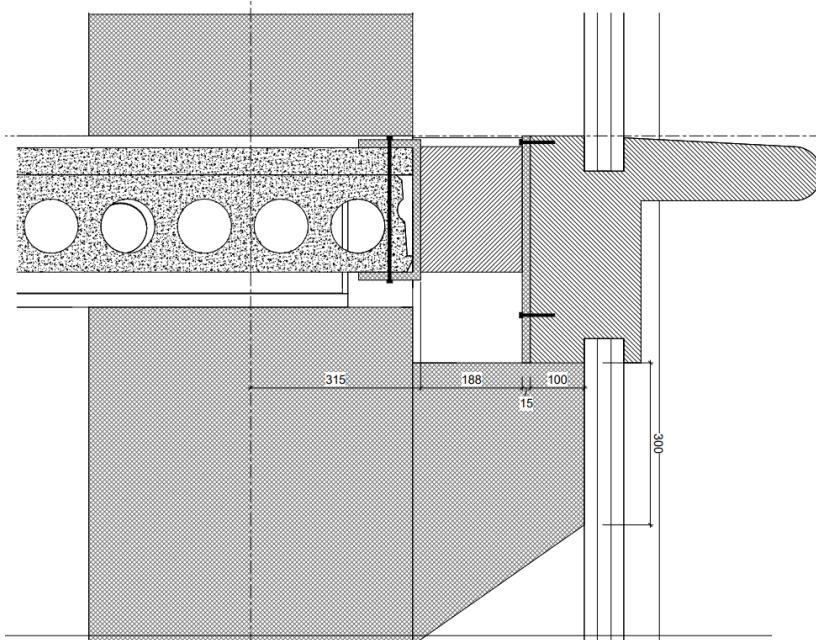


Fig. 33: Detail of facade structure

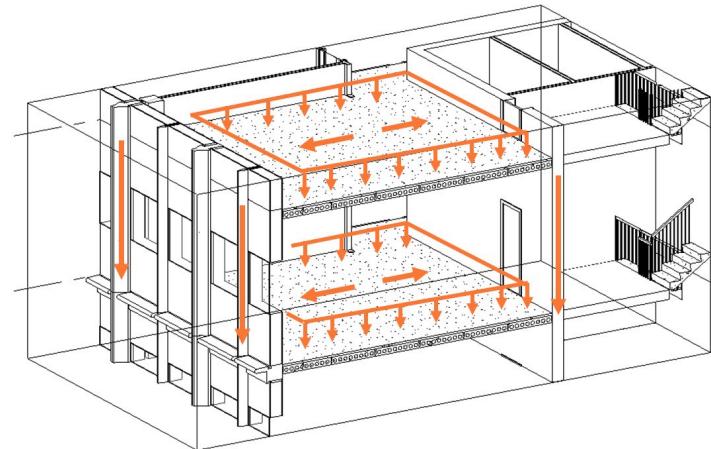


Fig. 34: Load distribution from facade to core

EVACUATION / SAFETY

The building can be accessed from the south, allowing car passage. The surrounding ground is paved, providing four areas (5m x 12m each) for fire trucks to access other sides of the building in case of an emergency.

The plans below illustrate the fire cells and fire sections in the office and ground floor, as well as the emergency exits.



Fig. 35: Fire truck accessways

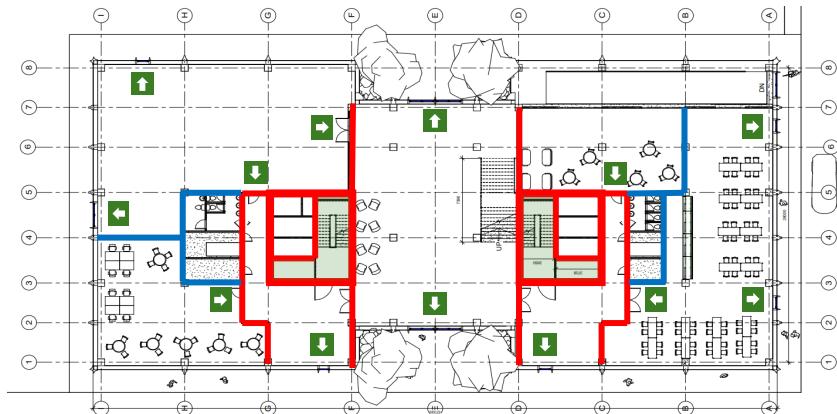


Fig. 36: Fire section & fire cells ground floor

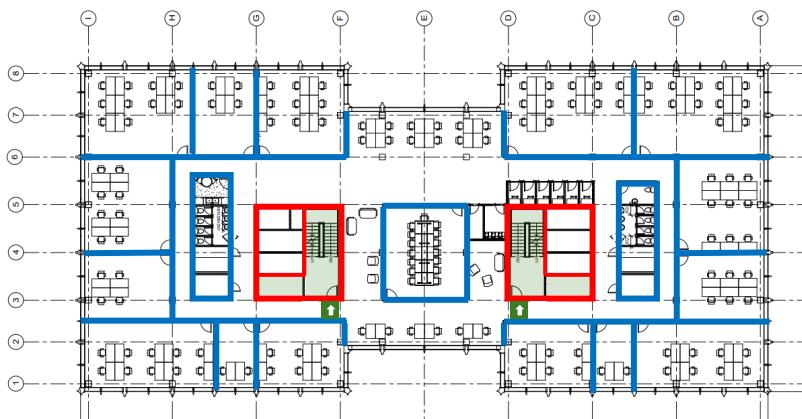


Fig. 37: Fire section & fire cells office floor

During the building's design, a strong emphasis was placed on fire safety. On all floors, the maximum distance from any desk to an escape route is 25 meters. The building features two staircases located in separate cores, each core equipped with a fire safety elevator that opens into pressurized staircases. On the ground floor, evacuees are directly guided to the emergency exit opposite the core. In the multipurpose room, there are three independent escape routes and four emergency exits, ensuring timely evacuation even at full capacity. The café is served by two independent escape routes and three emergency doors. This comprehensive approach guarantees efficient evacuation in case of an emergency.

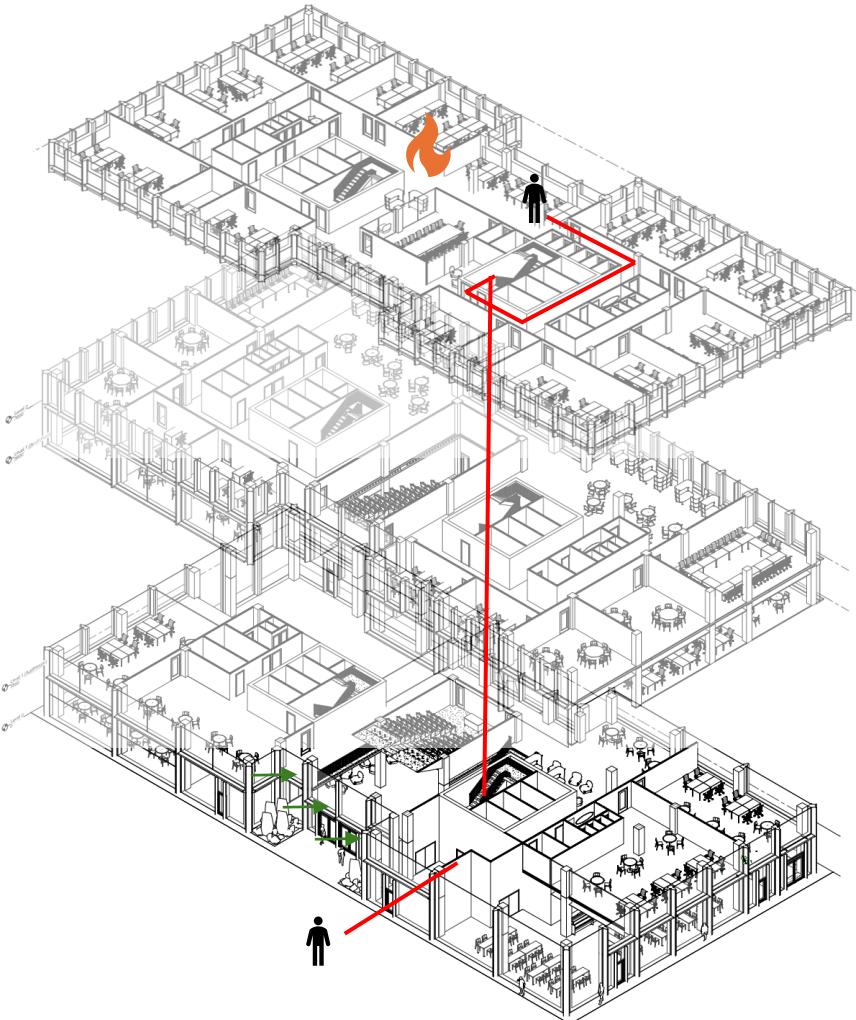
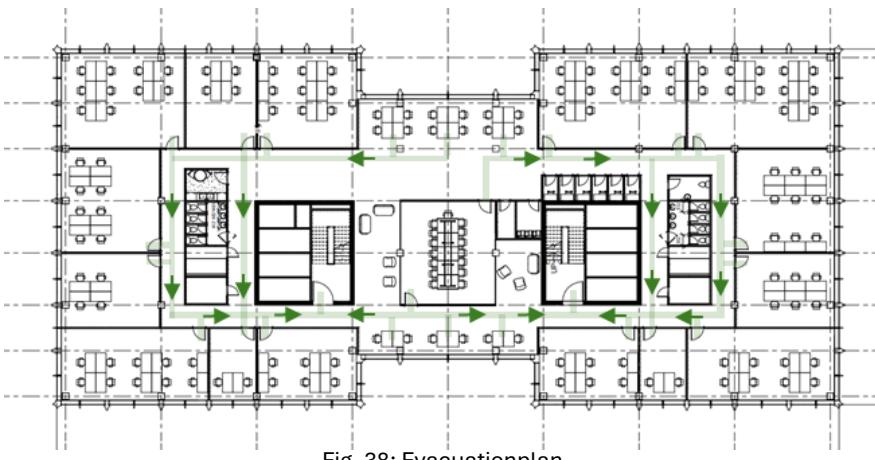
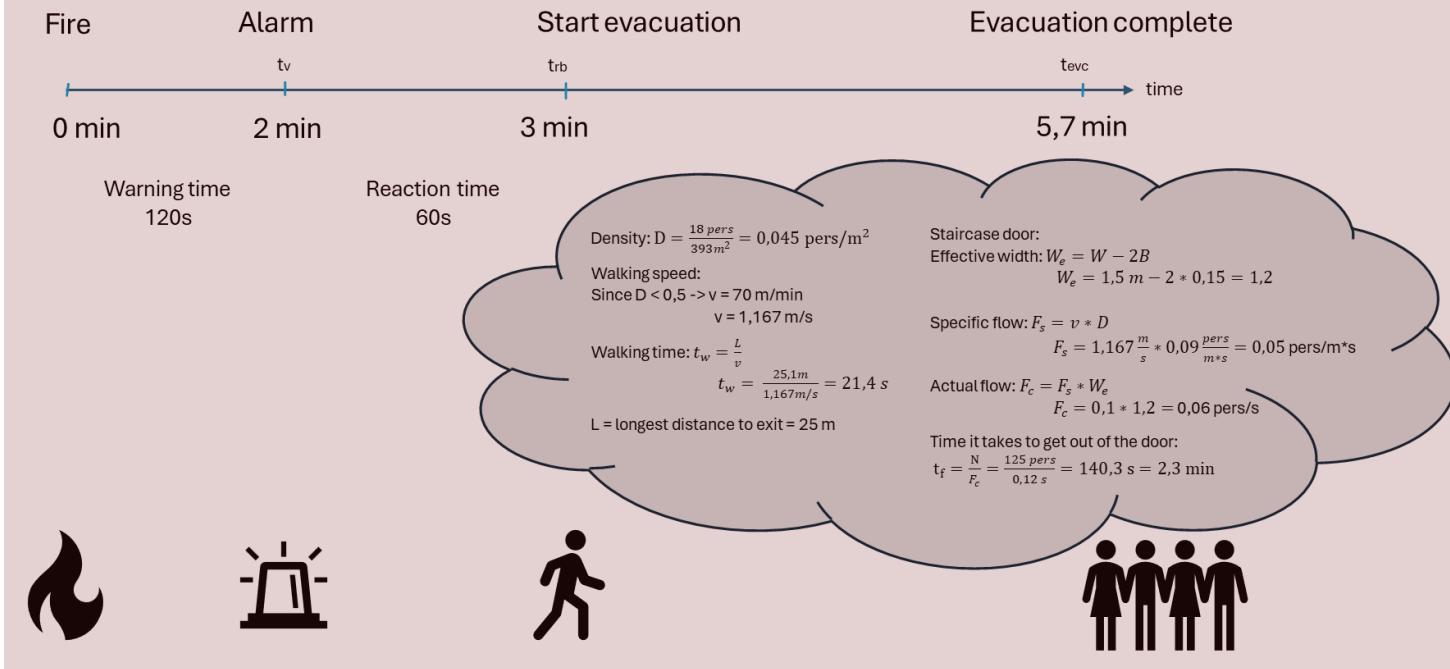
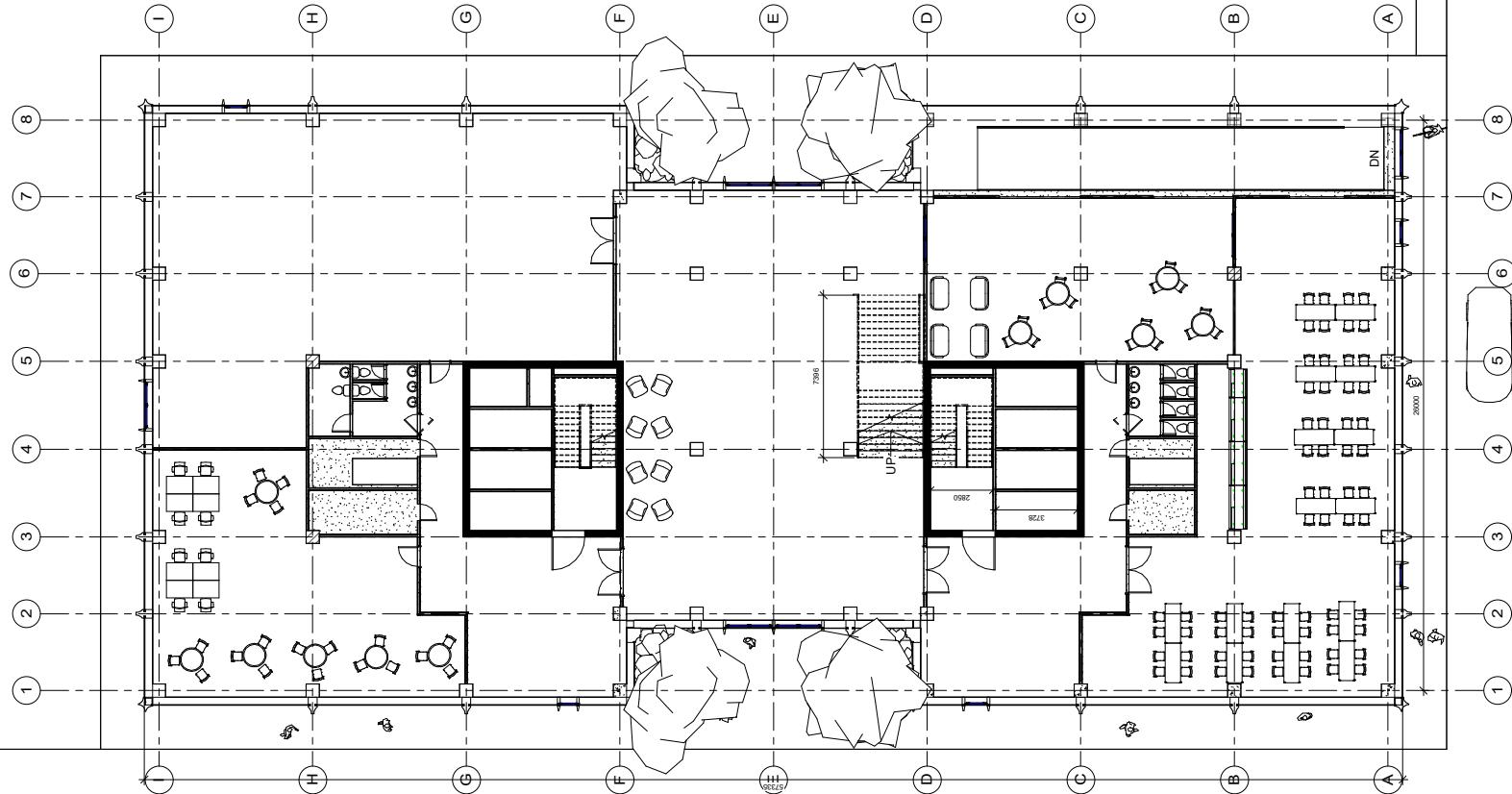


Fig. 39: 3D Evacuationroute

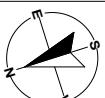


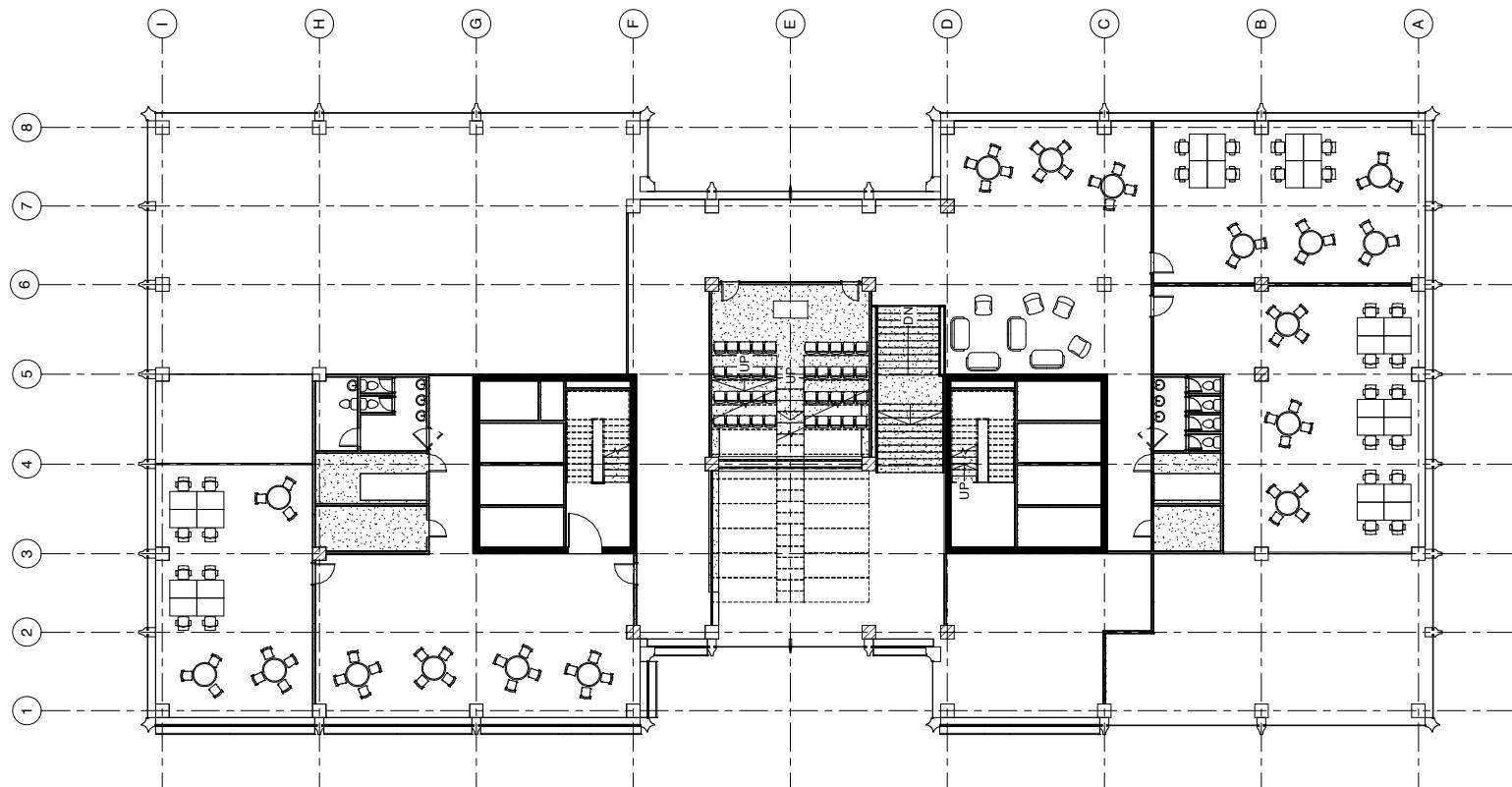
| Room | Capacity (pers) | Square meters (m ²) | Longest distance (m) | Evacuation time (min) |
|-------------------|-----------------|---------------------------------|----------------------|-----------------------|
| Office floor | 126 | 1411 | 25 | 11,7 |
| Cafe | 64 | 207 | 14 | 4,8 |
| Multipurpose room | 300 | 266 | 17 | 4,8 |
| Atrium/ Entrance | 300 | 266 | 19 | 4,85 |

The concept for the office floor is that all enclosed offices are designed as fire cells. The calculation for the evacuation of the open office space estimates an available safe egress time of 10 minutes. All rooms in the building comfortably meet this requirement, with ample safety margins, except for the entire office floor. However, this calculation does not account for the fire safety system, which includes sprinklers, wet risers, and hose reel risers serving all floors. The building is also equipped with sensitive smoke and heat alarm systems that reduce warning time, fire-resistant materials, and fire compartmentalization through the use of fire cells. Regular fire drills are conducted for the entire building. Therefore, the evacuation time for the whole office floor is considered to be sufficient.



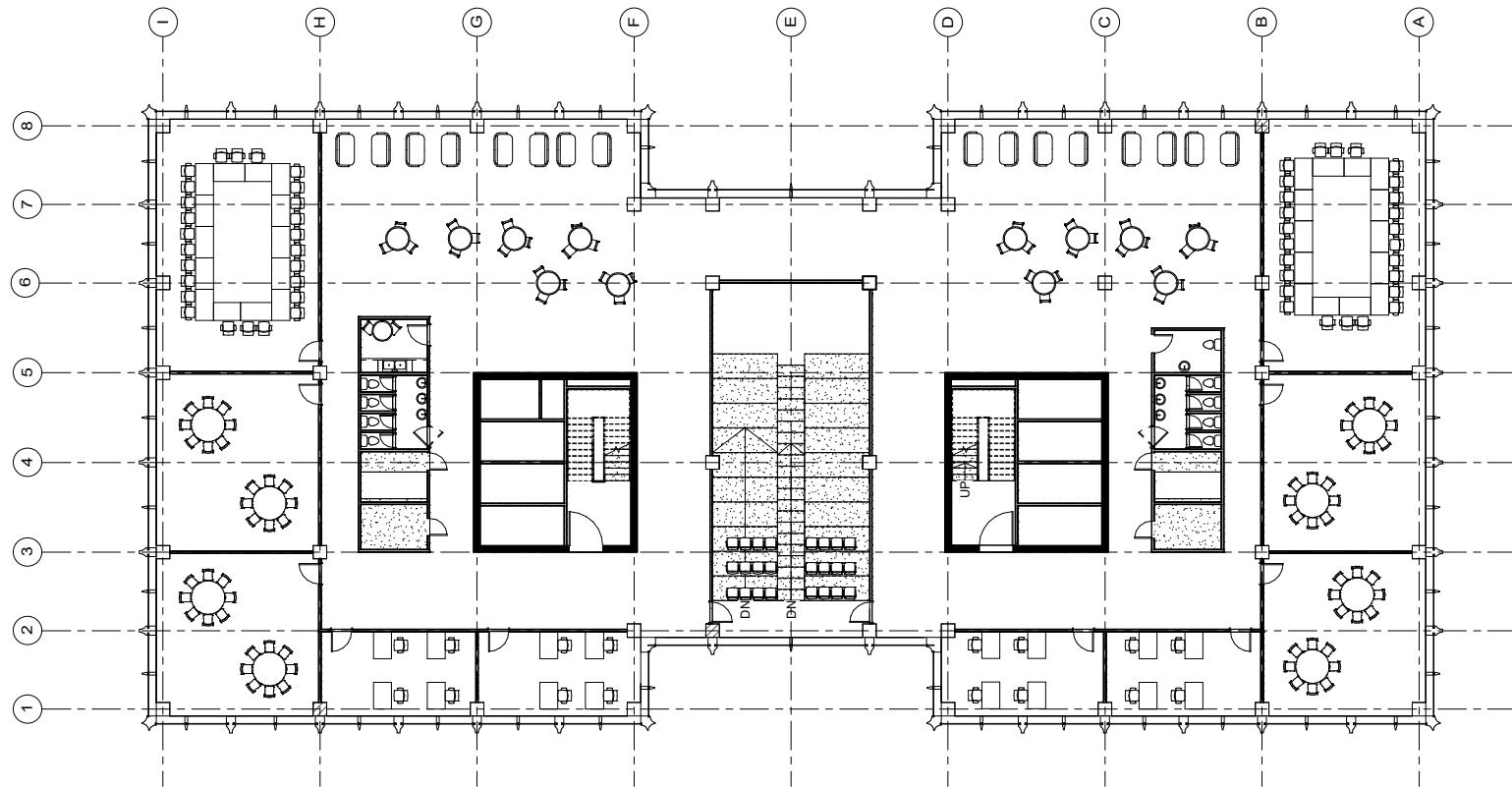
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| Scale: | 1 : 100 |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |



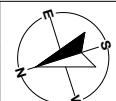


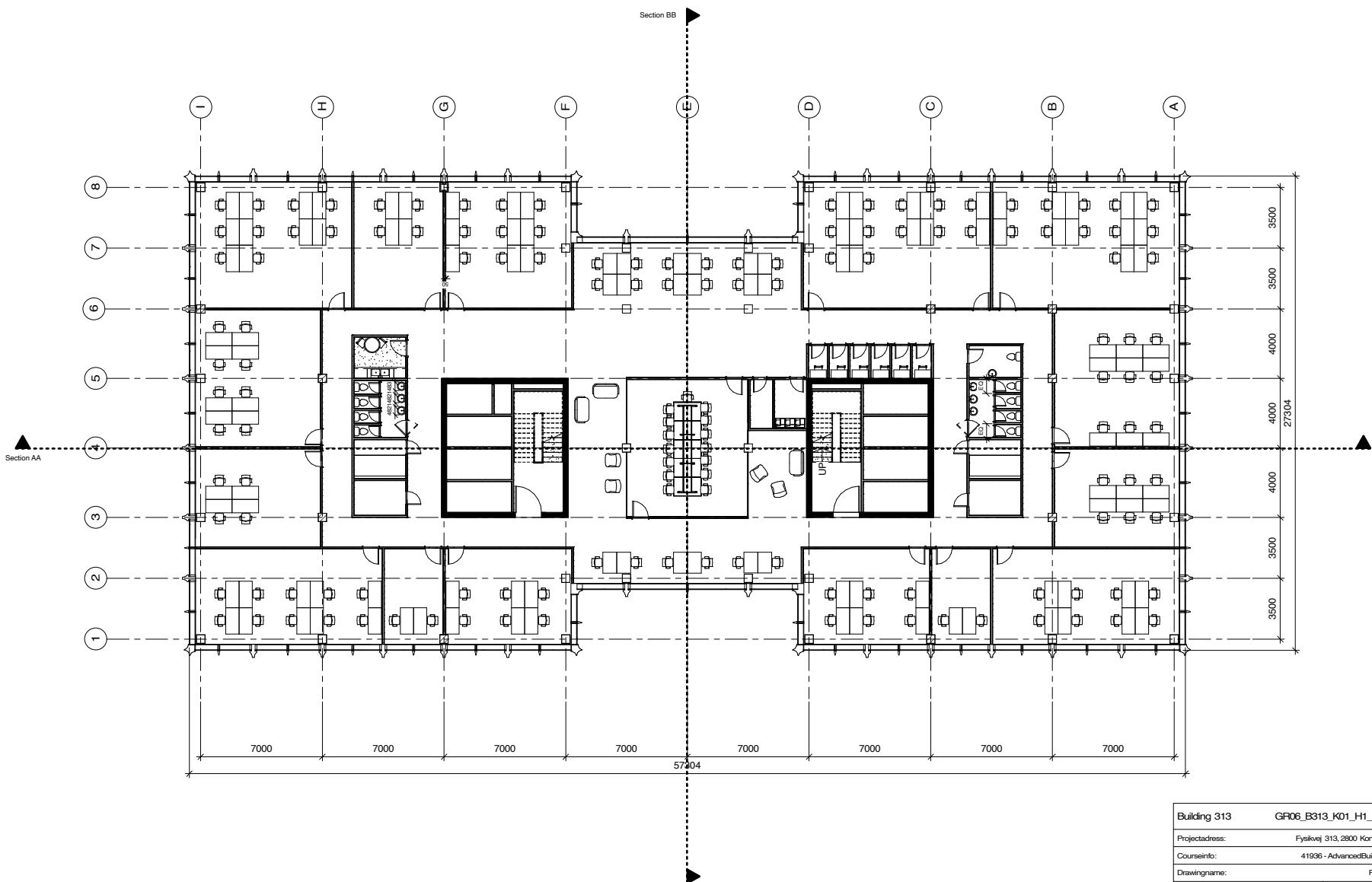
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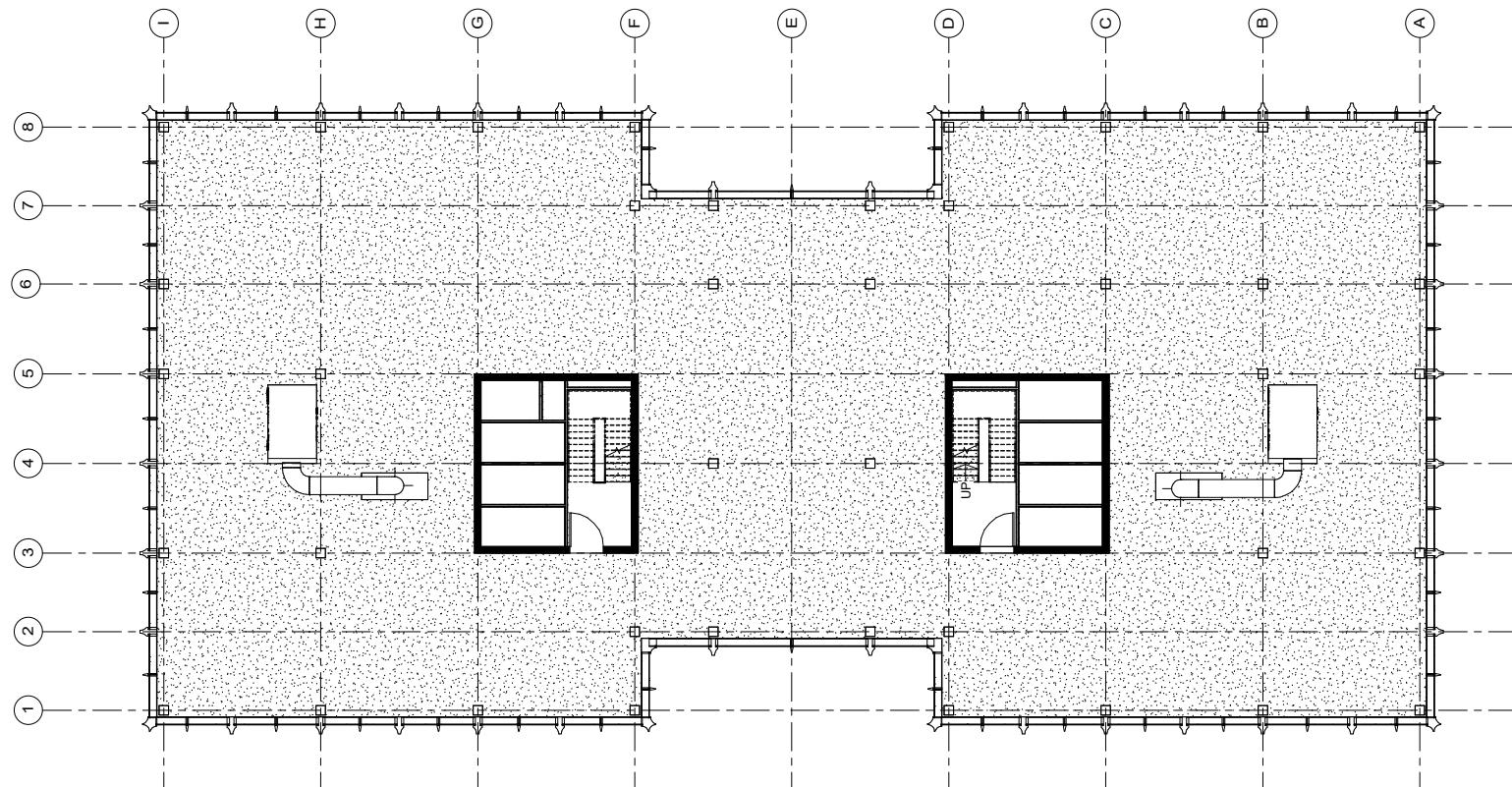
First floor - Auditorium



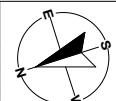
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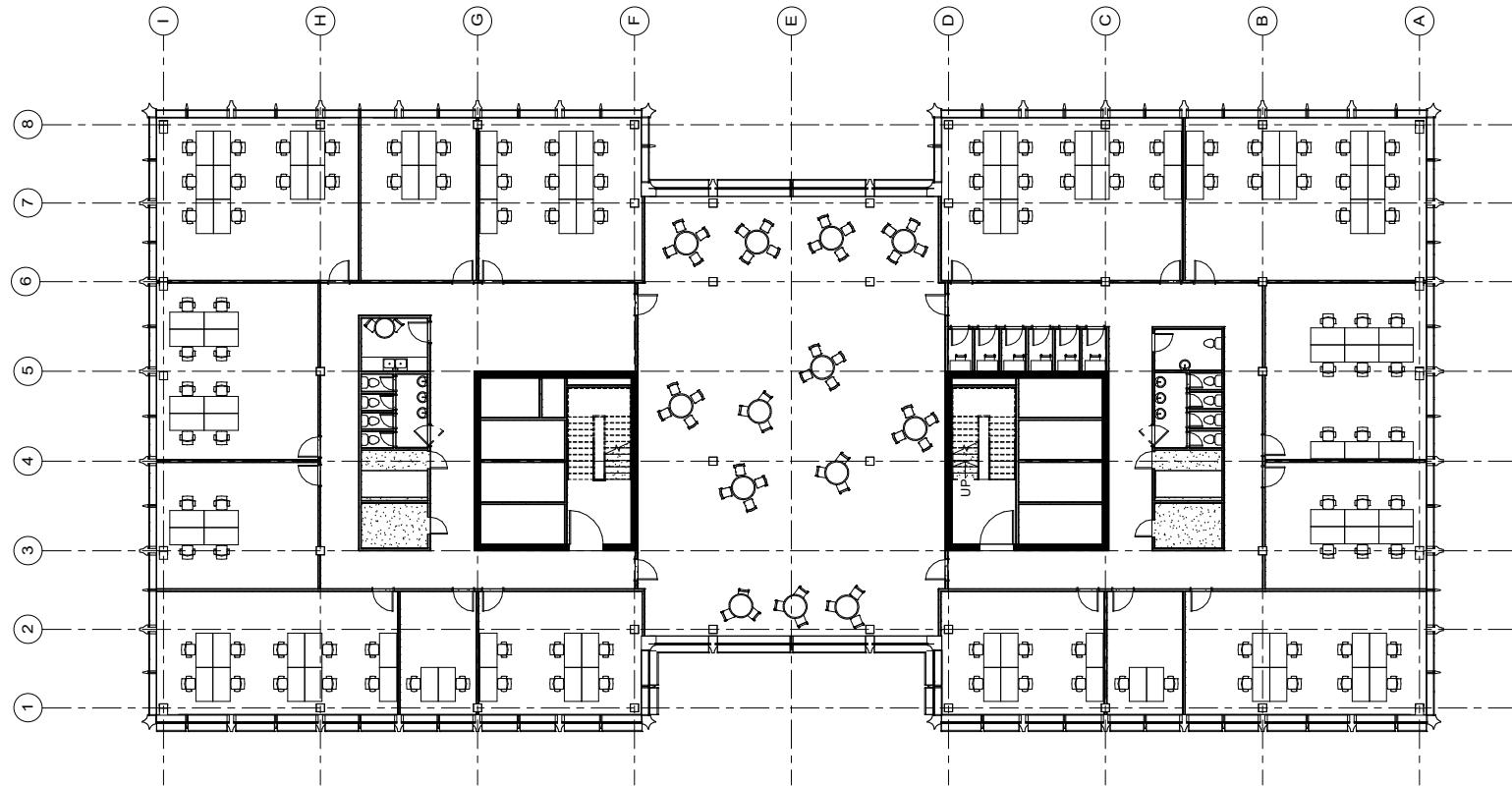




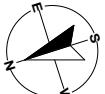


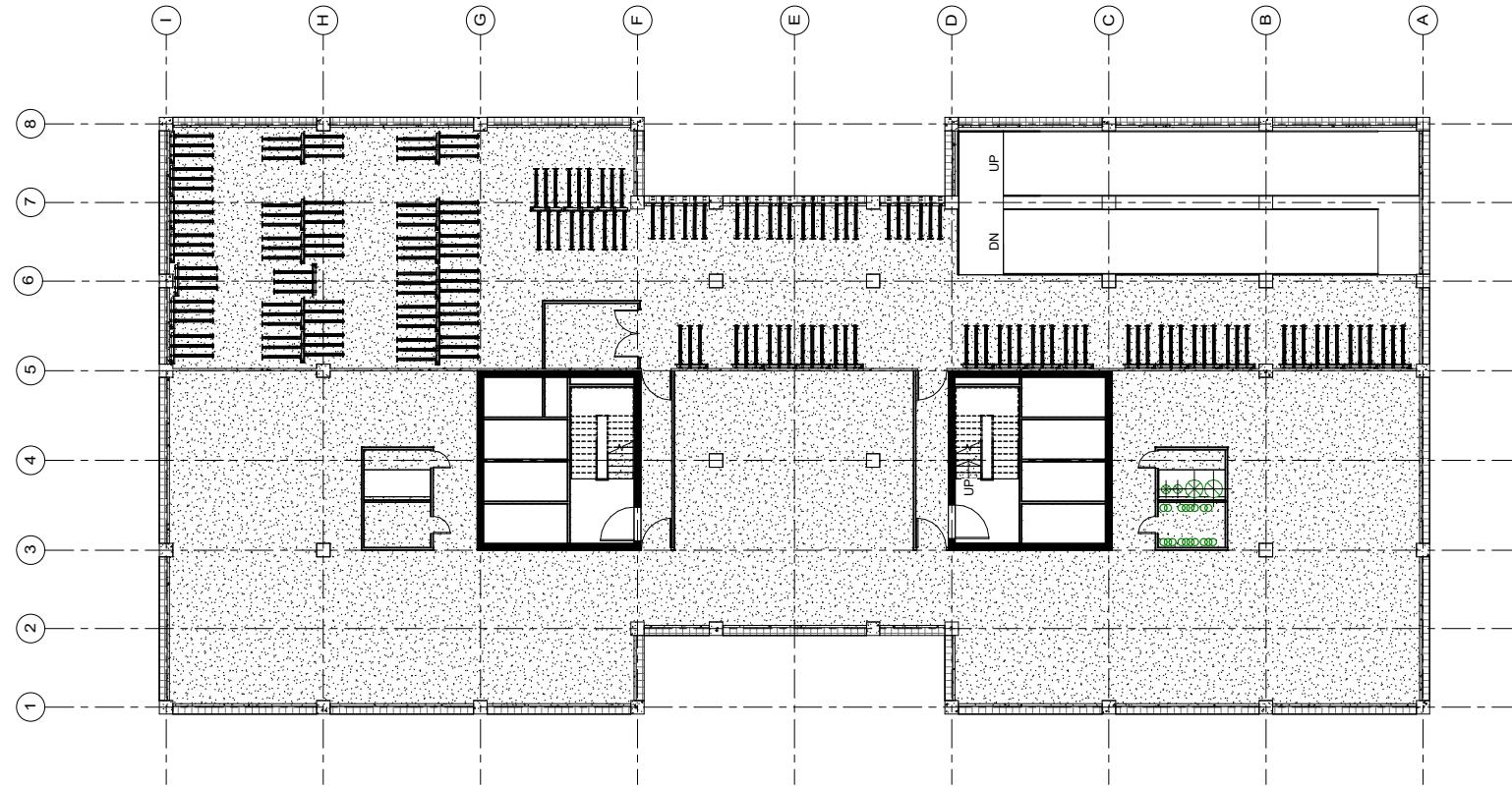
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| Author: | ARC-Team |
| Date: | 2024-06-21 |



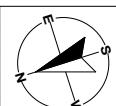


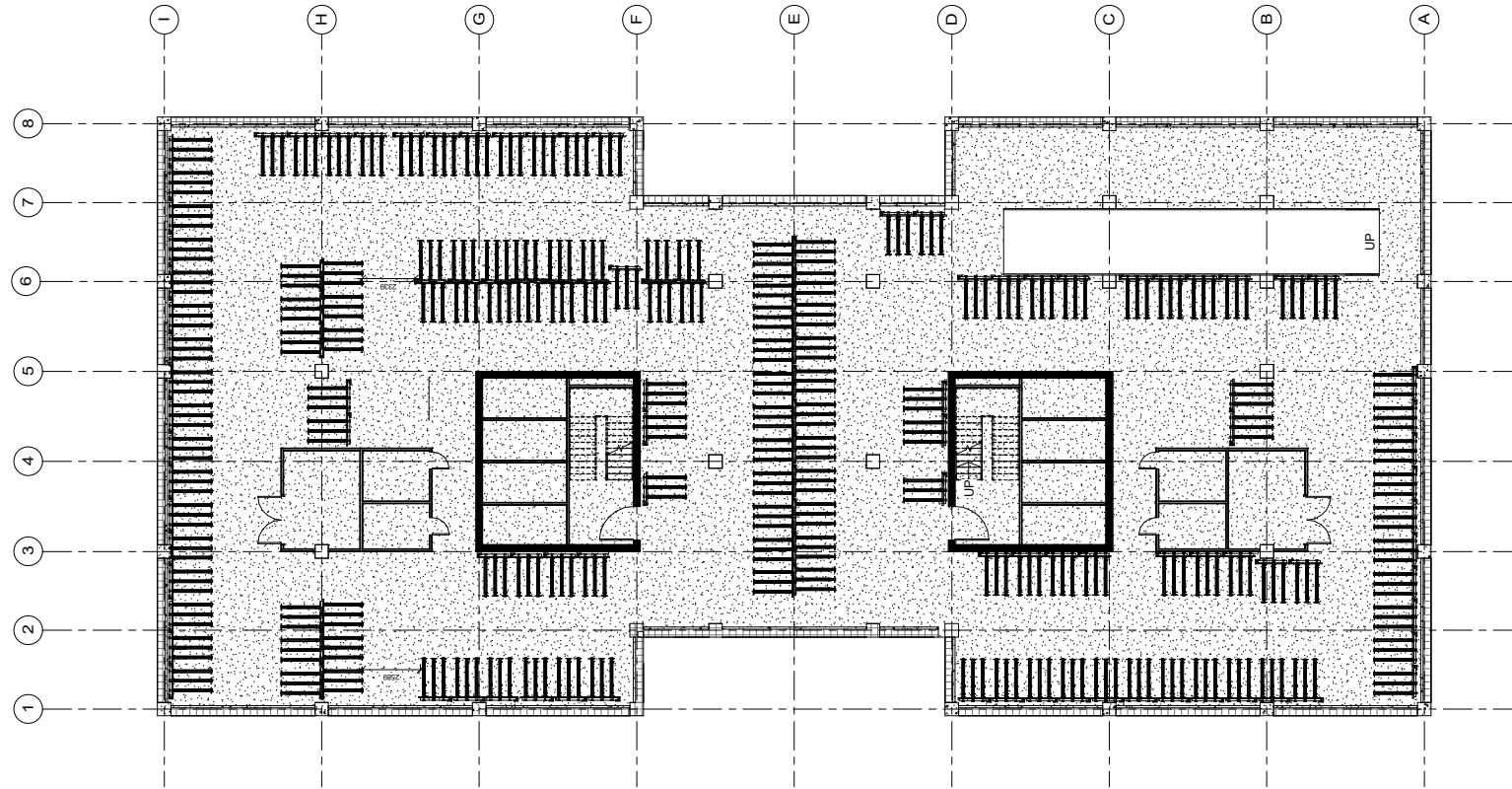
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| Building 313 | GR06_B313_K01_H1_E16_N01 |
| Project address: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | Floorplan lvl 16 |
| Drawing format: | A3 |
| Scale: | 1: 100 |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |



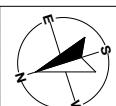


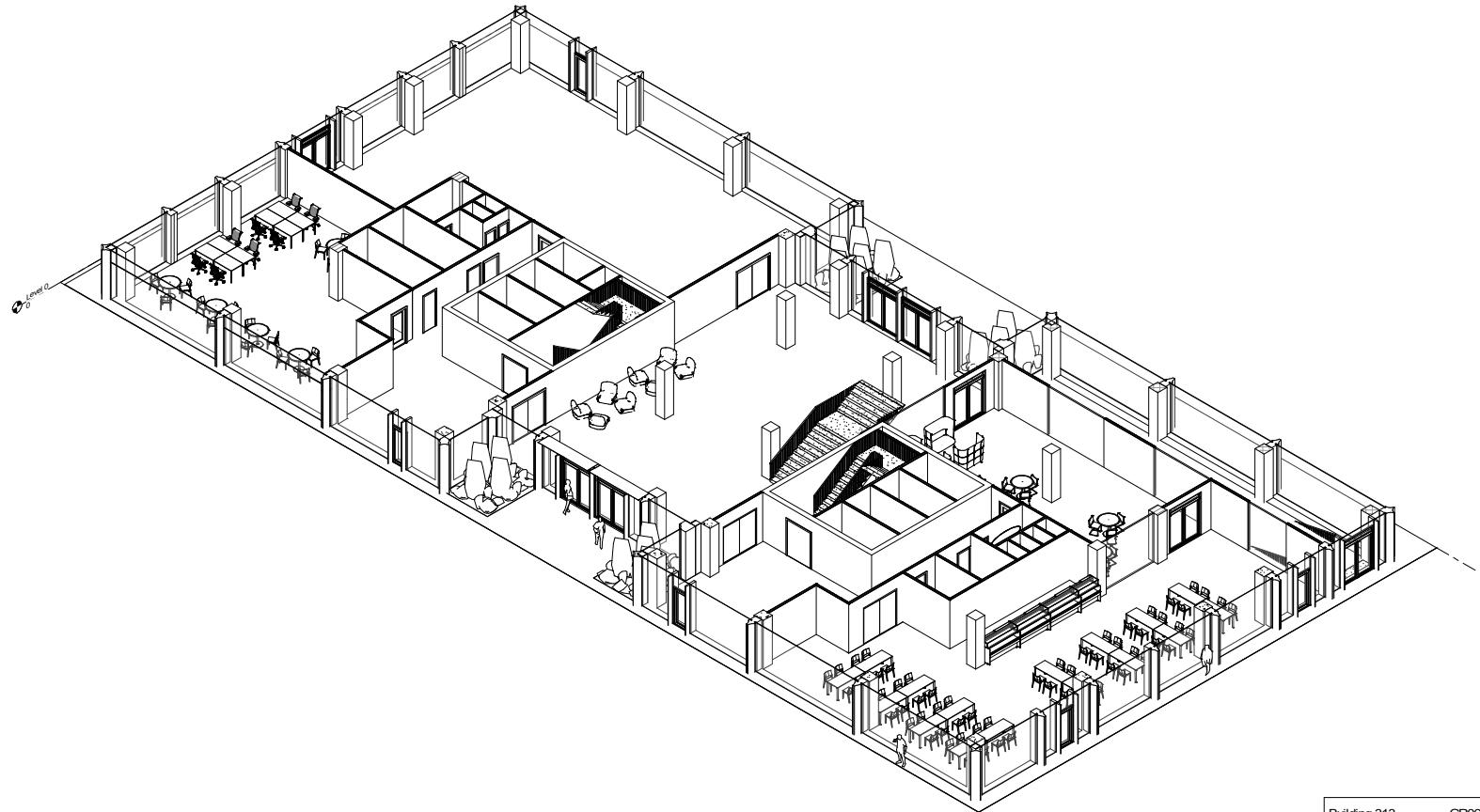
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| Building 313 | GR06_B313_K01_H1_EK1_N01 |
| Project address: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | Basement -1 |
| Drawing format: | A3 |
| Scale: | 1: 100 |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |



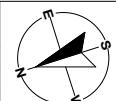


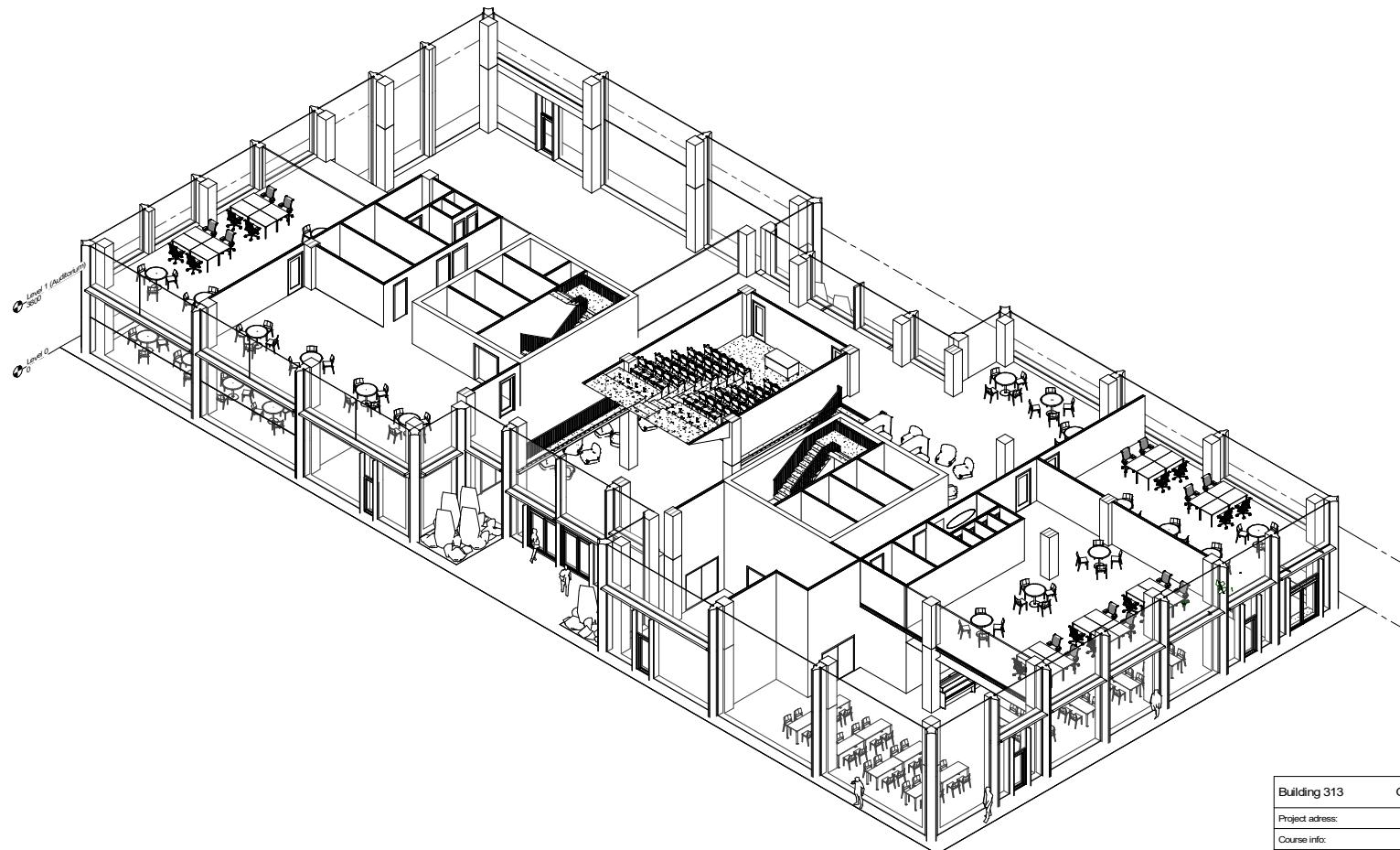
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| Project adress: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | Basement-2 |
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| Scale: | 1: 100 |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |



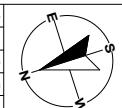


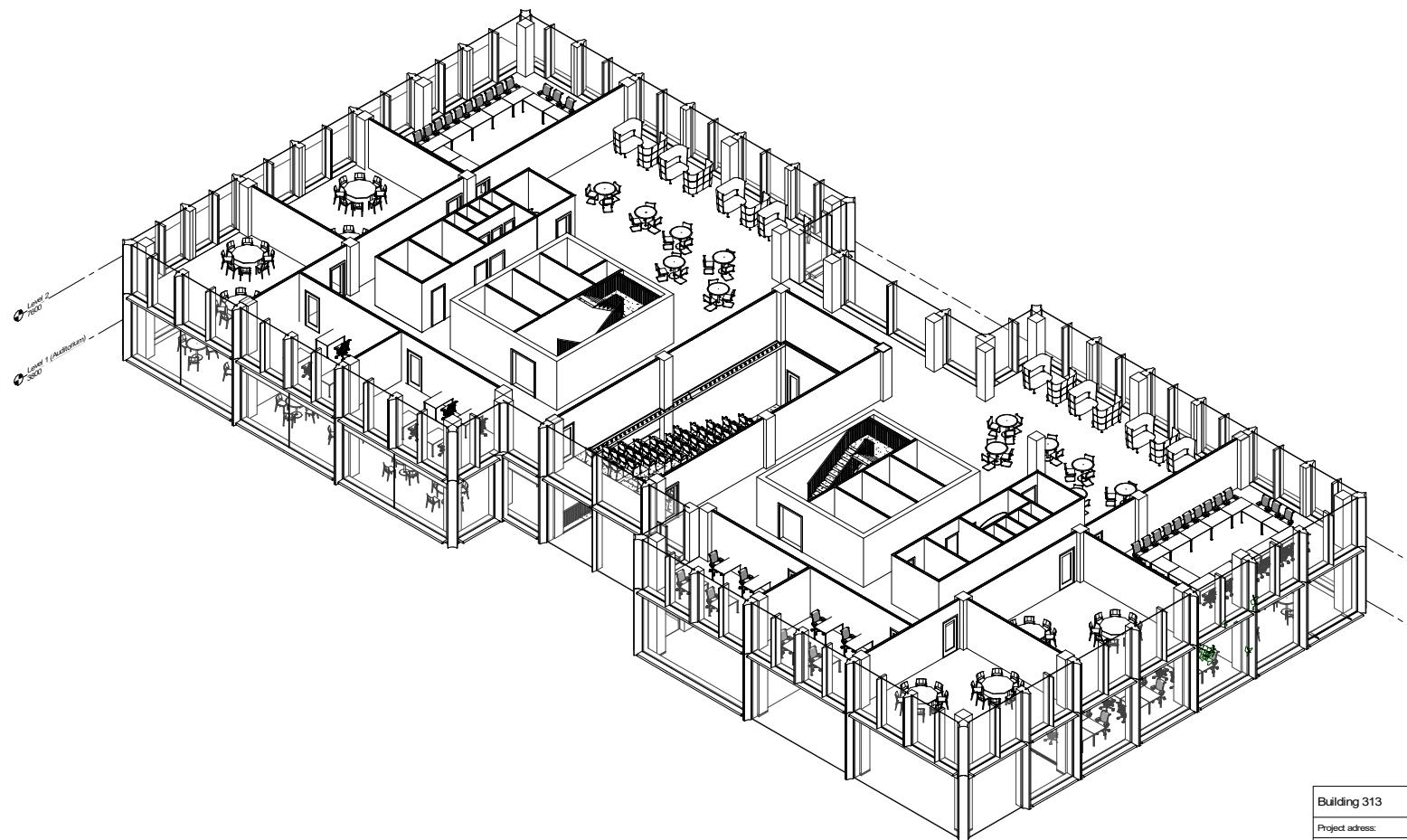
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| Project adress: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | 3D IV 0 |
| Drawing format: | A3 |
| Scale: | |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |



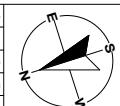


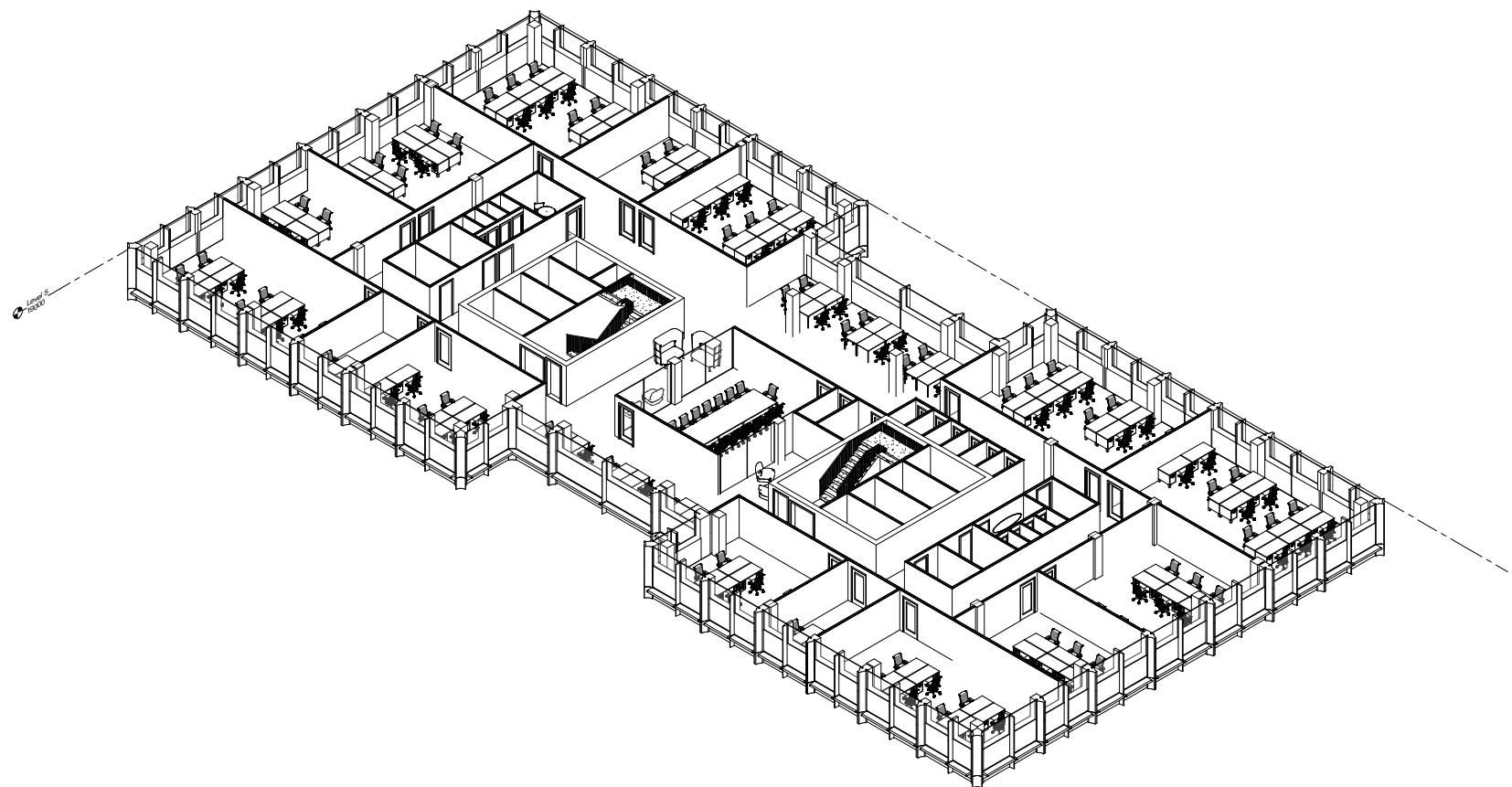
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| Project adress: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | 3D M 1 |
| Drawing format: | A3 |
| Scale: | |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |



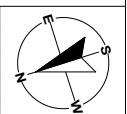


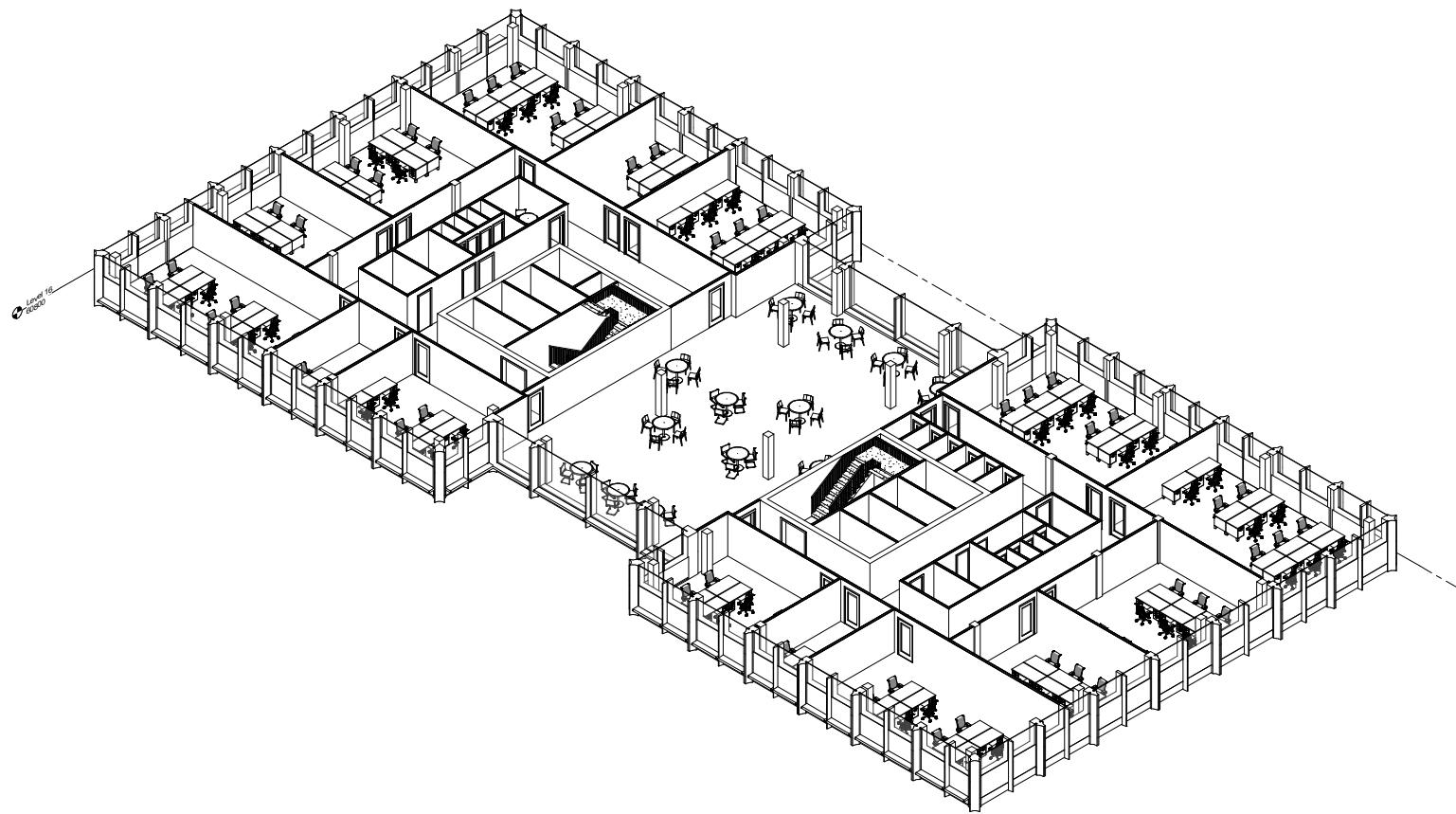
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| Building 313 | GR06_B313_K01_H0_E02_N01 |
| Project adress: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | 3DM 2 |
| Drawing format: | A3 |
| Scale: | |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |



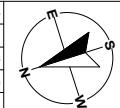


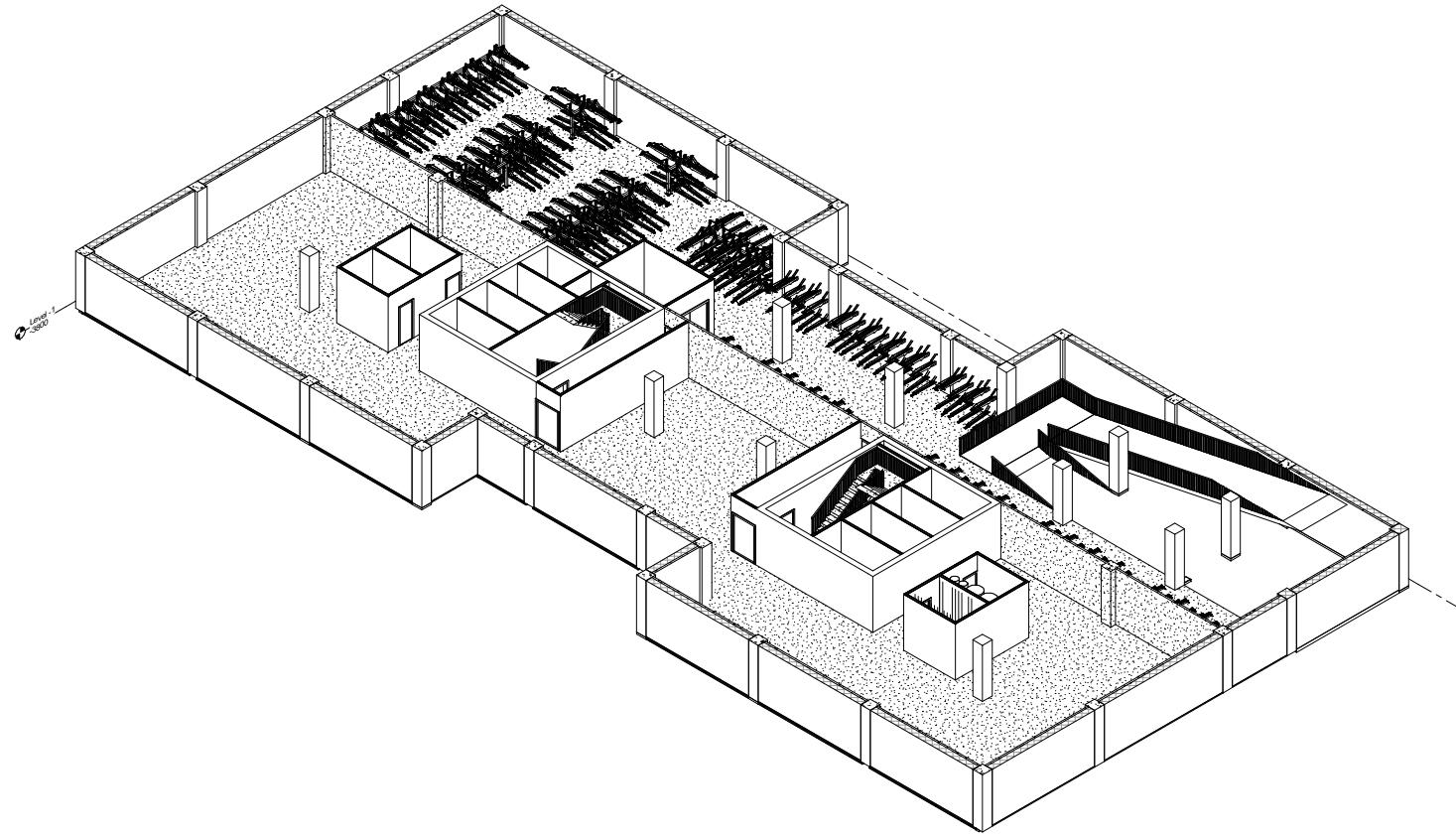
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| Project adress: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | 3D M 5 |
| Drawing format: | A3 |
| Scale: | |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |





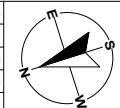
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| Project address: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | 3D M 16 |
| Drawing format: | A3 |
| Scale: | |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |

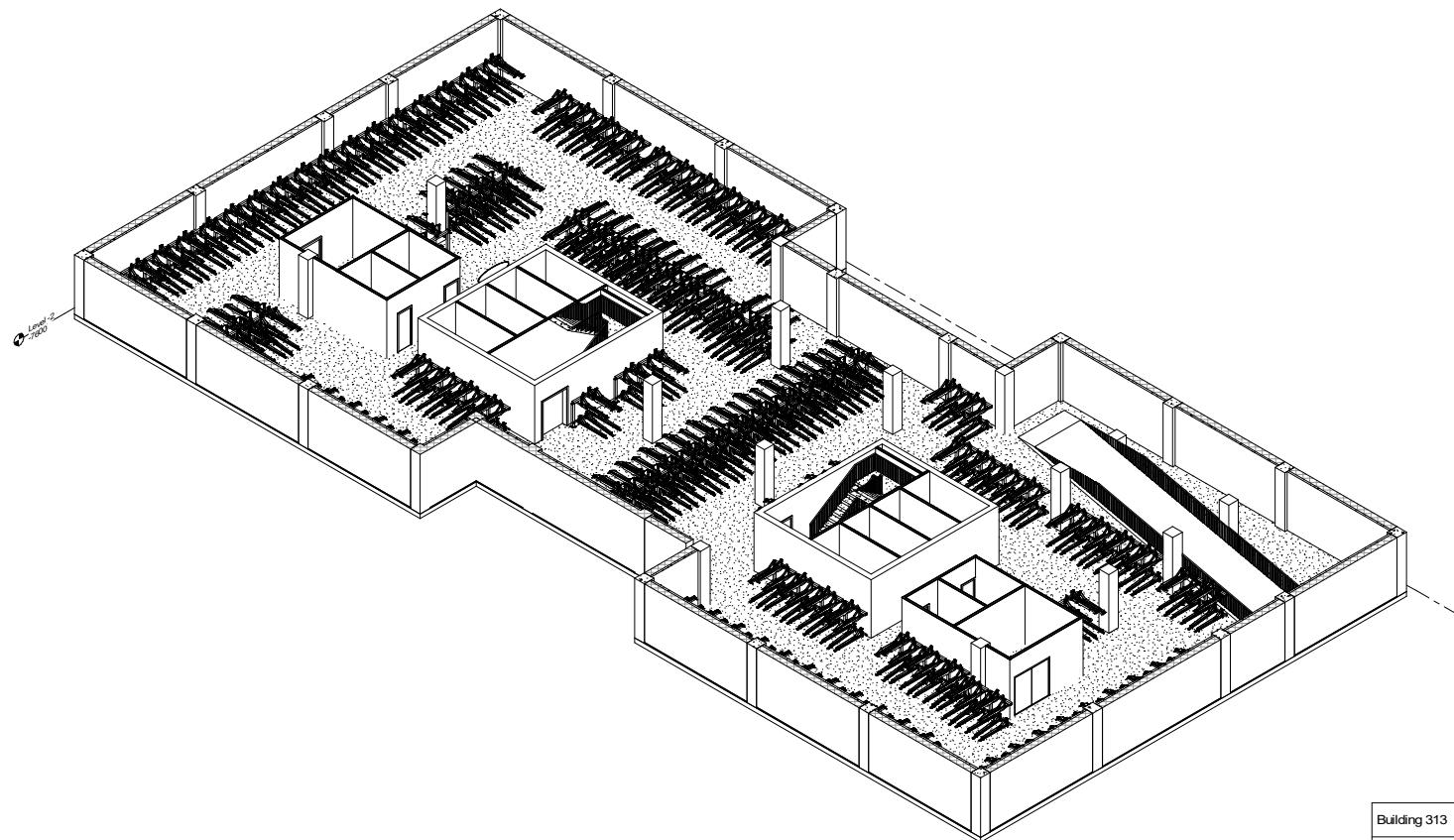




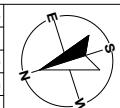
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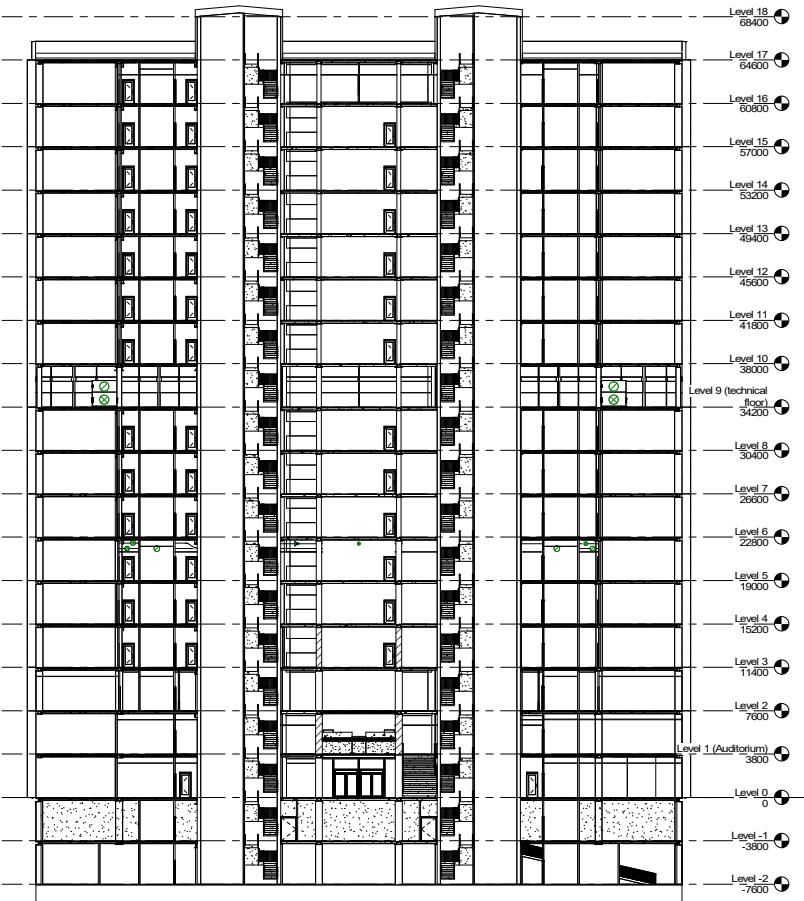
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| Building 313 | GR06_B313_K01_H0_EK1_N01 |
| Project adress: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | 3D M -1 |
| Drawing format: | A3 |
| Scale: | |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |





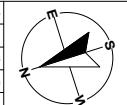
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|-----------------|-----------------------------------|
| Building 313 | GR06_B313_K01_H0_EK2_N01 |
| Project adress: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | 3D M - 2 |
| Drawing format: | A3 |
| Scale: | |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |

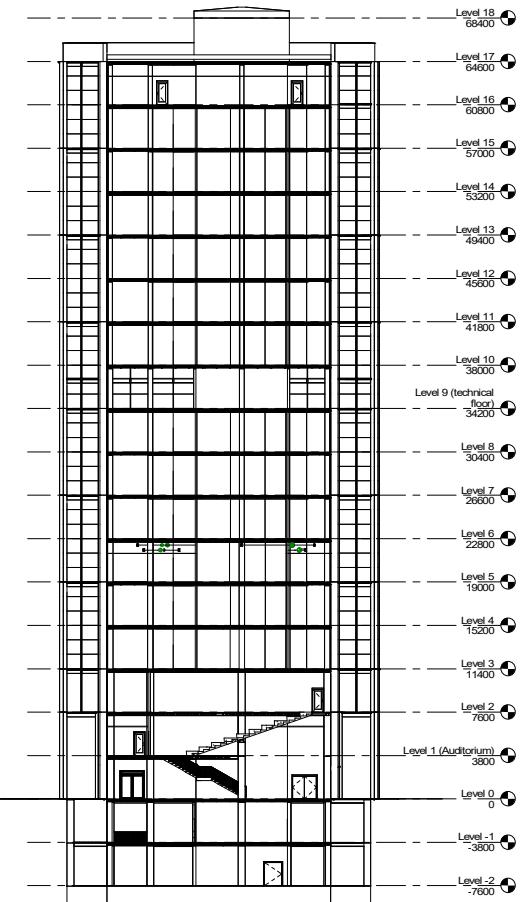




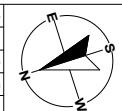
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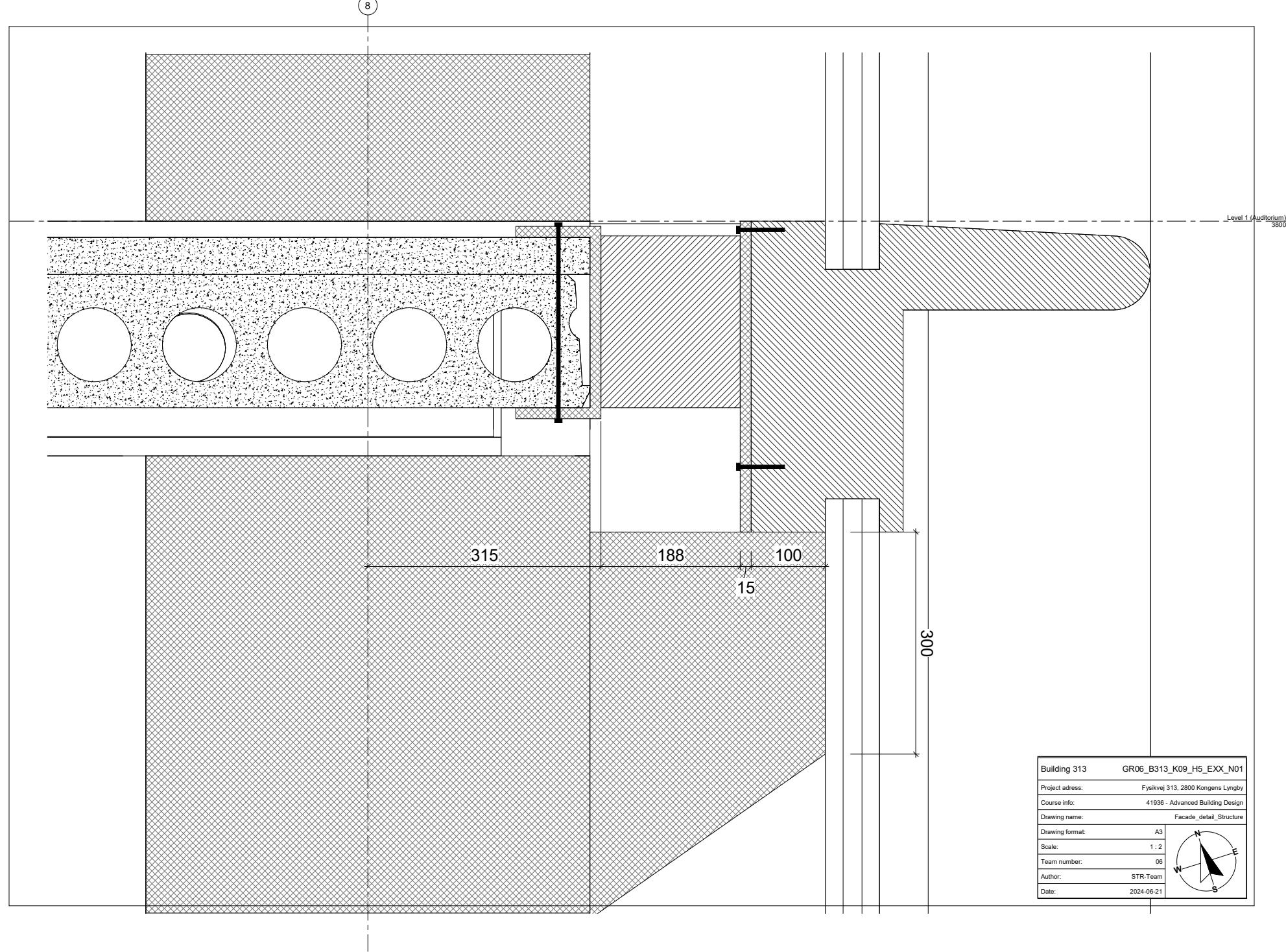
| Building 313 | | GR06_B313_K01_H3_AA_N01 |
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| Project adress: | Fysikvej 313, 2800 Kongens Lyngby | |
| Course info: | 41936 - Advanced Building Design | |
| Drawing name: | Section AA | |
| Drawing format: | A3 | |
| Scale: | 1:200 | |
| Team number: | 06 | |
| Author: | ARC-Team | |
| Date: | 2024-06-21 | |

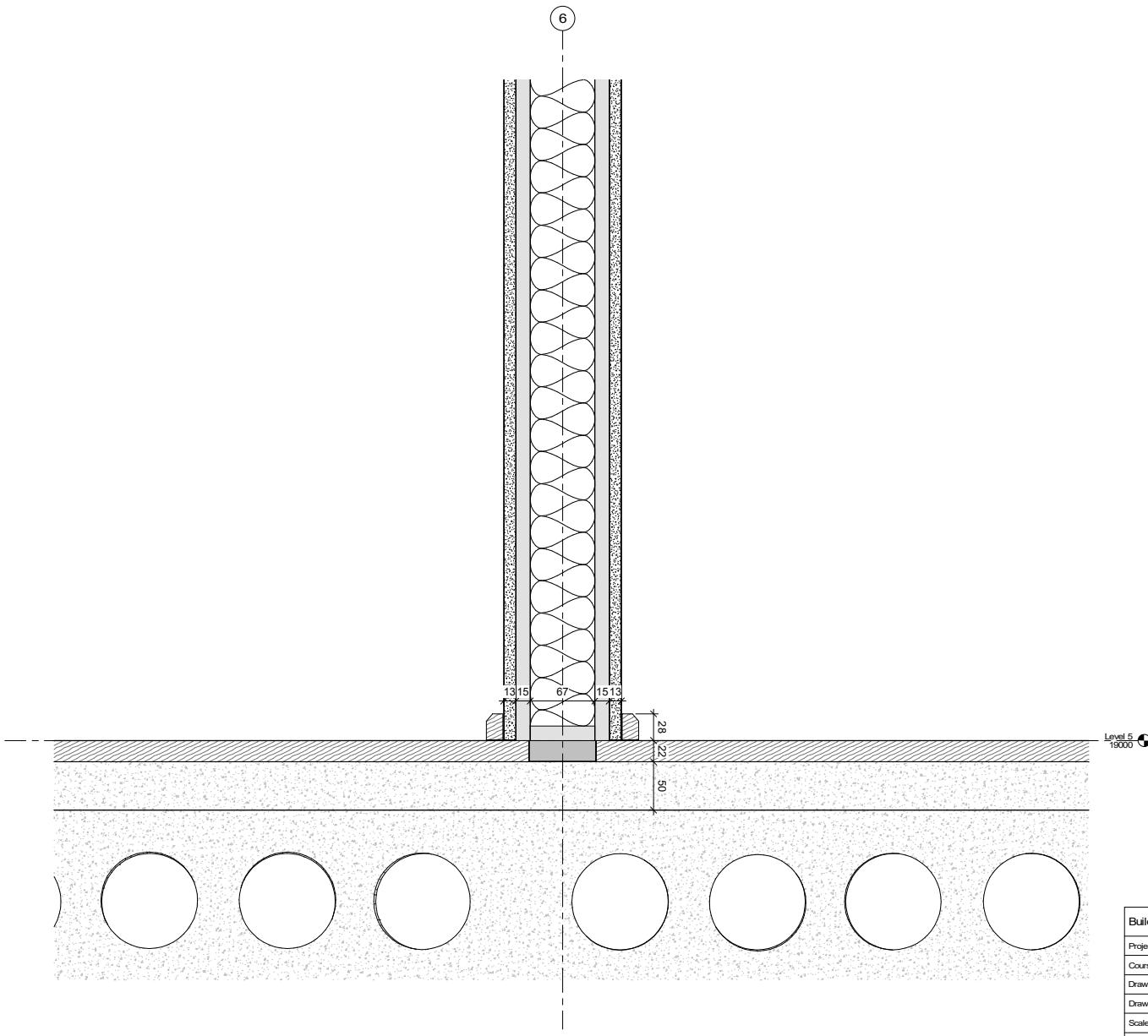




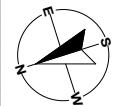
| Building 313 | GR06_B313_K01_H3_BB_N01 |
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| Project adress: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | Section BB |
| Drawing format: | A3 |
| Scale: | 1 : 200 |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |

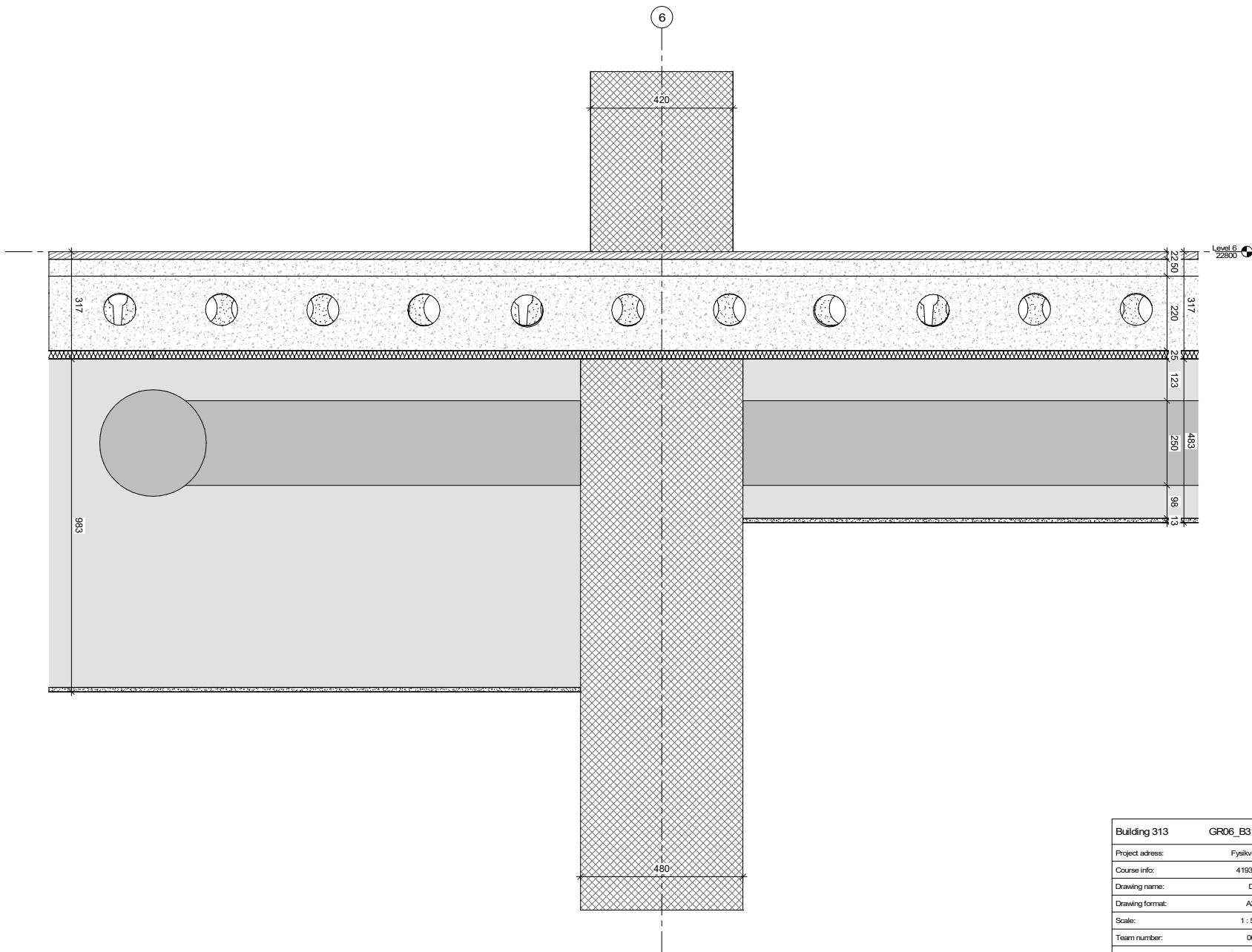




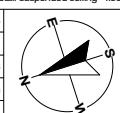


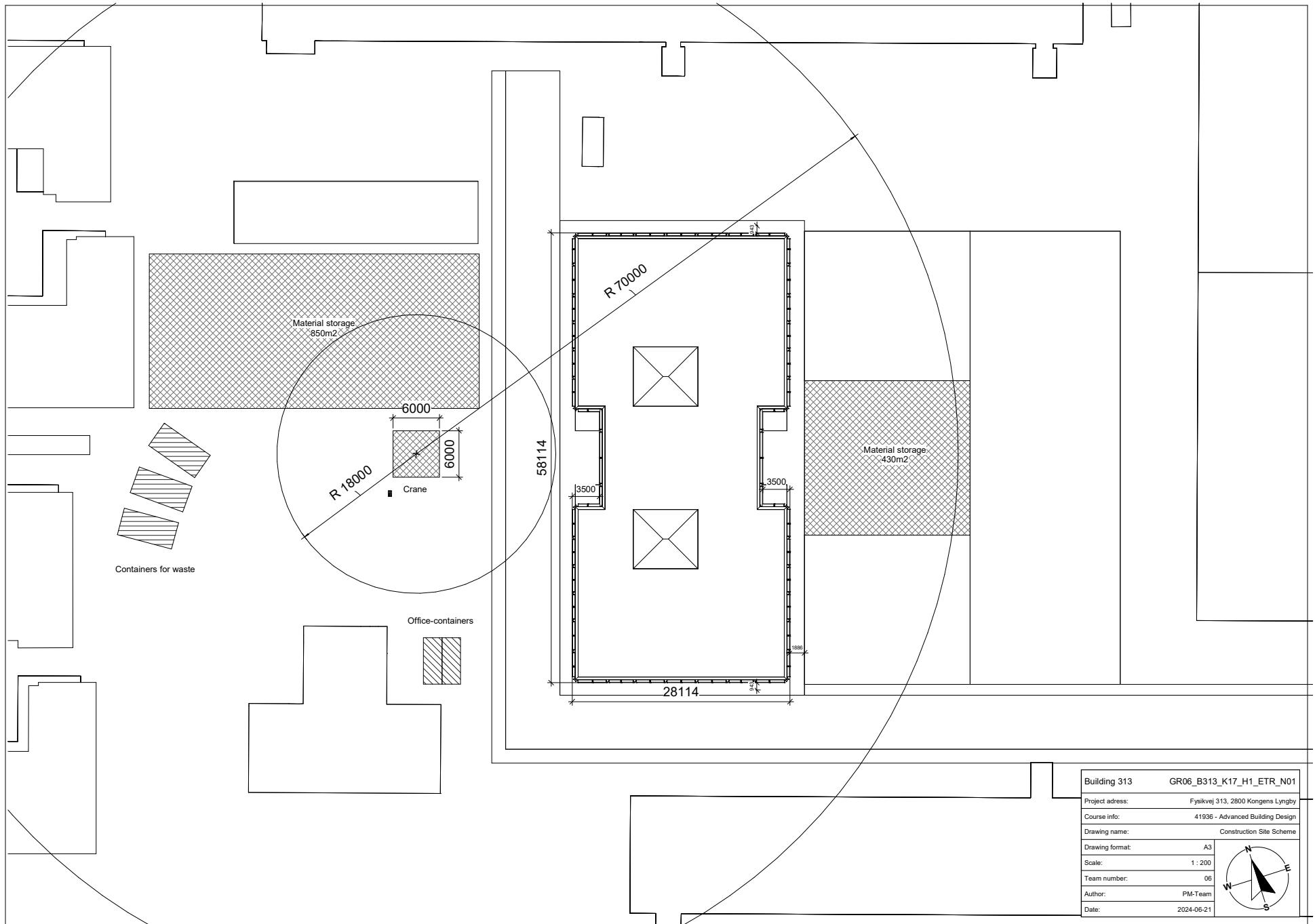
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|-----------------|-----------------------------------|
| Building 313 | GR06_B313_K01_H5_EXX_N02 |
| Project adress: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | Detail floor - wall |
| Drawing format: | A3 |
| Scale: | 1 : 2 |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |





| Building 313 | GR06_B313_K01_H5_EXX_N01 |
|-----------------|-----------------------------------|
| Project adress: | Fysikvej 313, 2800 Kongens Lyngby |
| Course info: | 41936 - Advanced Building Design |
| Drawing name: | Detail suspended ceiling - floor |
| Drawing format: | A3 |
| Scale: | 1 : 5 |
| Team number: | 06 |
| Author: | ARC-Team |
| Date: | 2024-06-21 |





| Building 313 | | GR06_B313_K17_H1_ETR_N01 |
|-----------------|-----------------------------------|--------------------------|
| Project adress: | Fysikvej 313, 2800 Kongens Lyngby | |
| Course info: | 41936 - Advanced Building Design | |
| Drawing name: | Construction Site Scheme | |
| Drawing format: | A3 | |
| Scale: | 1 : 200 | |
| Team number: | 06 | |
| Author: | PM-Team | |
| Date: | 2024-06-21 | |

