NEW STADIUM IN AARHUS

KRONEN I KONGELUNDEN

5.2 ARCHITECTURE, FUNCTIONALITY AND TECHINCAL SOLUTIONS

CONTENTS

View along Stadium Allé

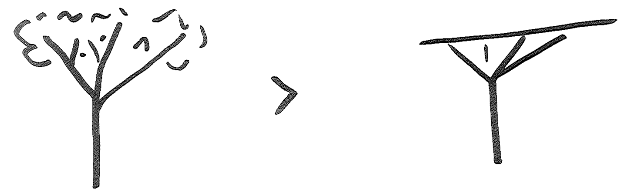
1. ARCHITECTURAL CONCEPT

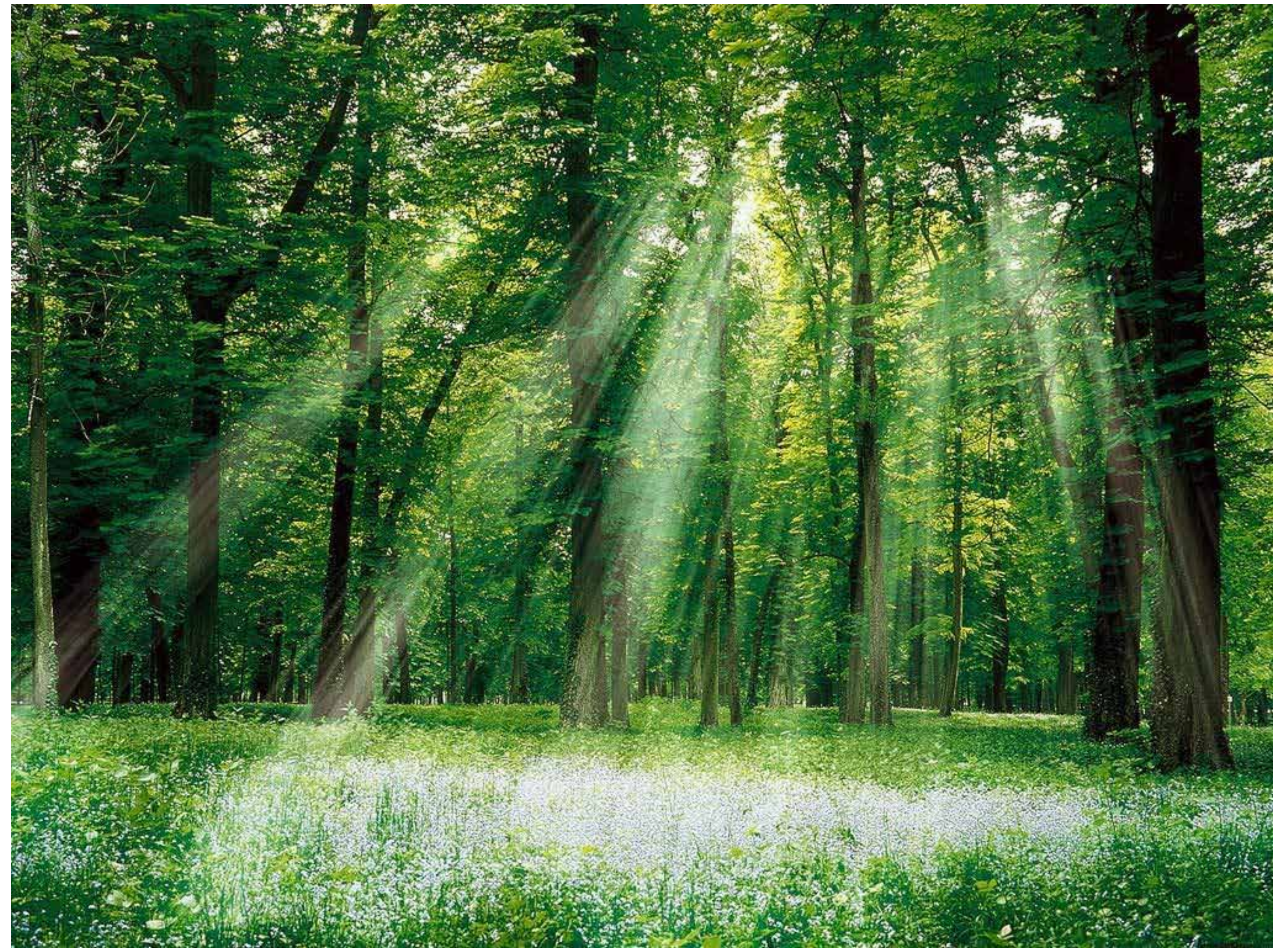
Flanked by trees on both sides, the walk along the prominent axis of Stadion Allé towards the characteristic red stadium halls is a heightened sensory experience drawing you into the woodlands of Kongelunden towards a shining clearing. For the strong community of AGF it is a walk of anticipation and excitement with the new Aarhus Stadium representing a forceful and proud culmination. Becoming a new unique landmark, it is crowned by its protective canopy resting on a tree-like structure, celebrating nature, history, unity, and the victories to come.

Although the design of the new Aarhus Stadium has been adjusted and modified throughout the last phases, the intangible experience of arriving from the main axis and seeing the stadium gently rise above the Heritage Building as a clearing in the forest remains the same. The sense of closeness and community is intensified beneath its canopy. All changes have been made to secure a more sustainable and cost-efficient stadium without ever compromising the architectural vision or quality. The prominent motif of a tree crown is maintained in a simple, white steel structure where form and materiality together create an even more intense and intimate stadium experience. With its sculptural lightness, the new Aarhus Stadium expresses sympathy for both the nature and the history of Kongelunden.

The new Aarhus Stadium interprets and celebrates the unique atmosphere in Kongelunden. It contributes to a sense of place and a collective memory of magic by responding to its context. With its location in the lush ancient beech forest, vicinity to the rich coastline, and in a strong connection to the city, the new stadium invites everyone to experience Kongelunden in new ways and unites nature, history, urban life, and the community of sports. In the evening the stadium reflects a warm light– a golden shine that radiates from the clearing, illuminating the treetops, expressing pride and the exhilarating sense of victory.

Already visible from Marselis Boulevard, the Heritage Building with its classical colonnade entrance is the centrepiece of the point of view from the main axis. It is underlined and complimented by a floating roof, a forest canopy defining the New Aarhus Stadium as a clearing in the forest. The white canopy and façade compliment and juxtapose the characteristic red façade of the Heritage Building – paying homage to its home team. By changing the beam structure of the roof to a truss structure, we are able to reduce the necessary amount of metal by 10 percent while maintaining the prominent canopy motif. Still providing an efficient cover from the weather, the semi-transparent textile in the roof is changed to a more cost-efficient combination of metal sheets and polycarbonate which both enhances the structural geometry, improves the acoustic performance, and allows for a unique play of light and shadow in the bowl. Placing the polycarbonate towards the edge of the roof lets natural light filter through the cover with beams of sunlight reaching the pitch.





A CLEARING IN THE FOREST

A FOLDED PAPER MODEL OF THE ROOF

2. SUSTAINABILITY CONCEPT

We have the highest ambitions for the new Aarhus Stadium in terms of both sustainability, responsibility, and inclusivity. We strongly believe it is our obligation to strive to create the most sustainable stadium in the world. This is only possible if we have the right focus from the very beginning. Therefore, we have identified four central goals:

1. To design a stadium with the lowest possible carbon footprint

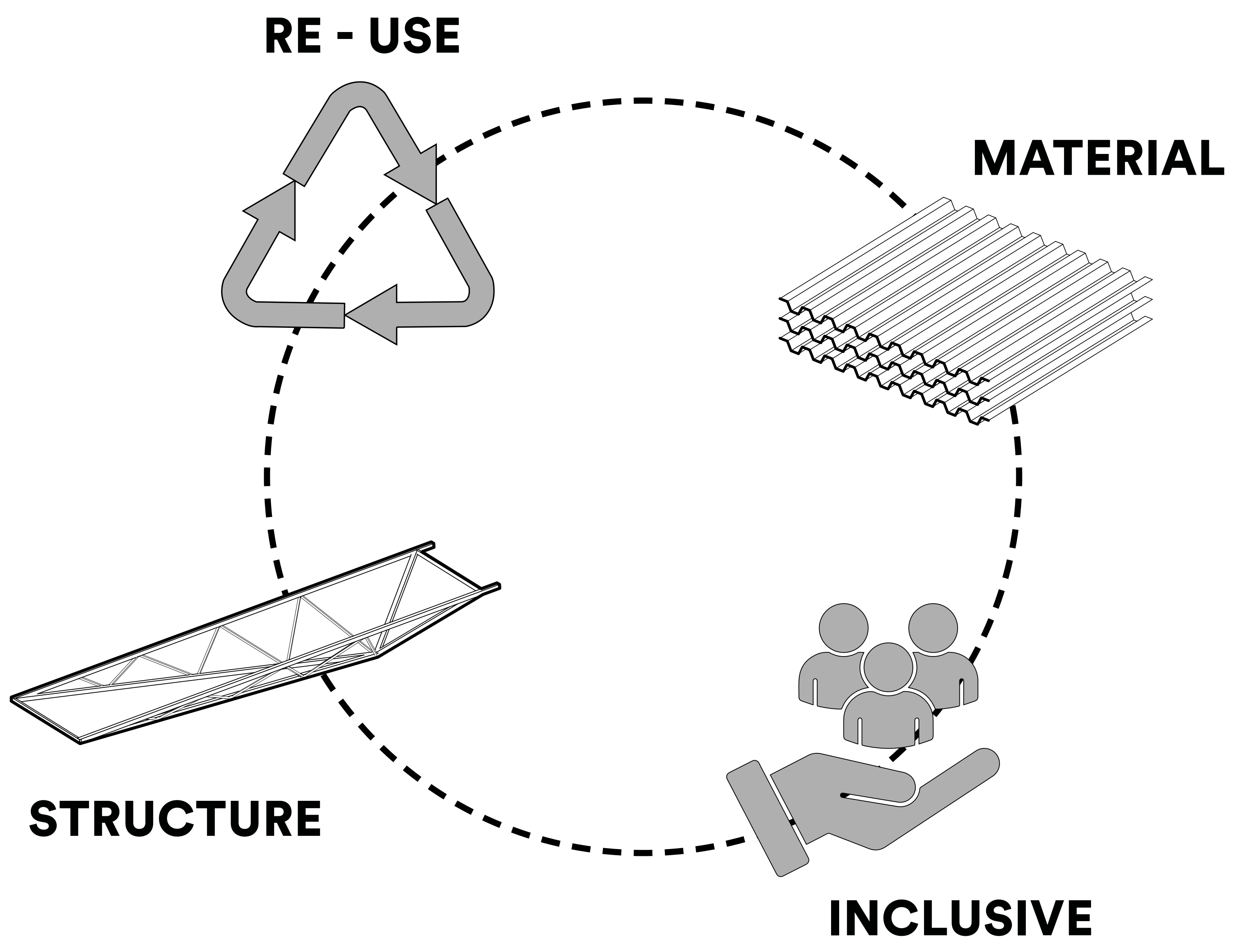
2. To reuse up to 100 percent of all materials from the existing stadium

3. To establish a socially responsible, inclusive, and democratic stadium

4. To ensure the lowest possible energy consumption in operation

In our presentation of the initial tender, we presented the sustainability aspirations that have informed our decision-making. We have also identified potentials that we want to investigate further in the negotiation phase and as a part of the revised tender.

In the preliminary tender, our main emphasis was on optimised utilisation of resources, environmental impact from materials, energy and water, universal design, and ensuring synergy with the local community. Within these areas, we see potentials for both positive and negative impact if they are not managed correctly during the decision-making process from initial stages to handover and use.

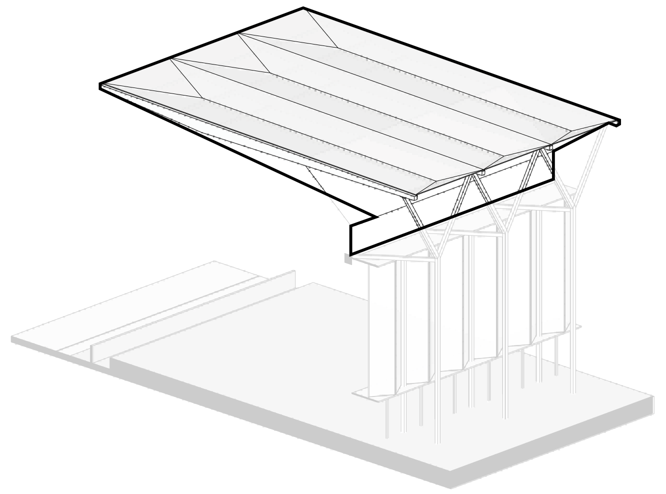


Aerial view of new Aarhus Stadium during a match

STRUCTURE

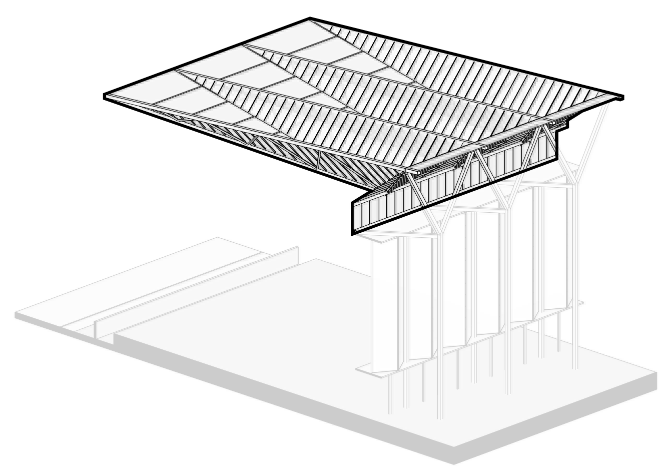
From initial tender until final submission, we have aimed at reducing the amount of steel as much as possible.

To ensure a cost efficient and sustainable stadium without compromising the architectural concept, we have optimized the structure creating a light weight construction made up of 140 trussess. The high degree of repetition is a key element, to ensure cost efficiency and buildabillty. The many geometrically identical elements yields significant gains in efficiency.

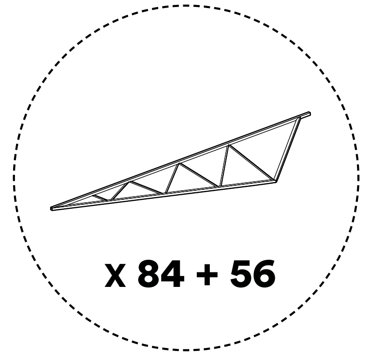


PHASE 2 - PRELIMINARY PROPOSAL

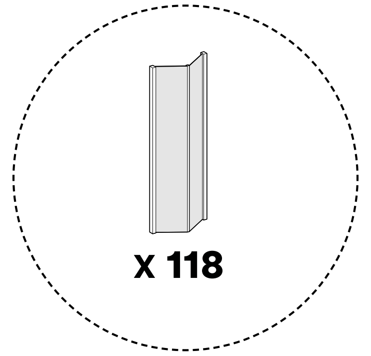
10 % REDUCTION
IN STEEL TONNAGE

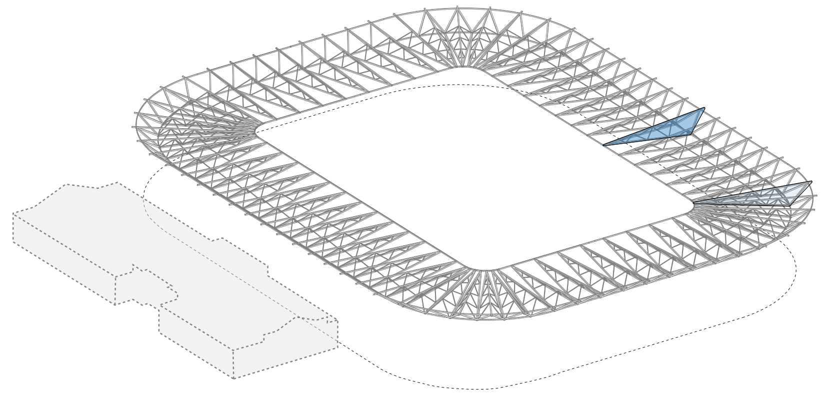


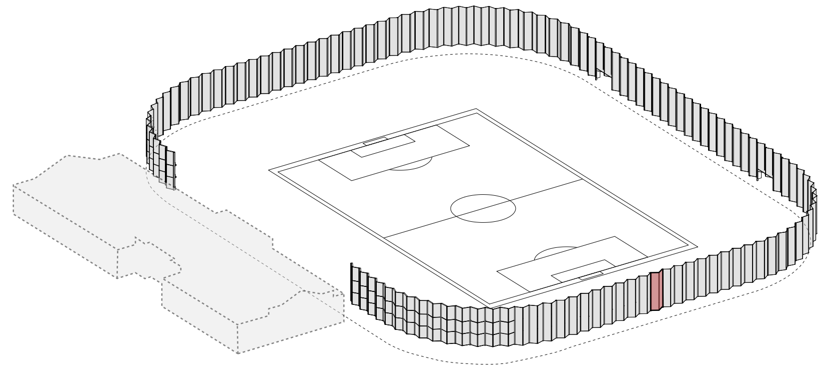
PHASE 2 - NEW SKETCH



REPETITION OF THE SAME ELEMENT SAME CONSTRUCTION PRINCIPLE



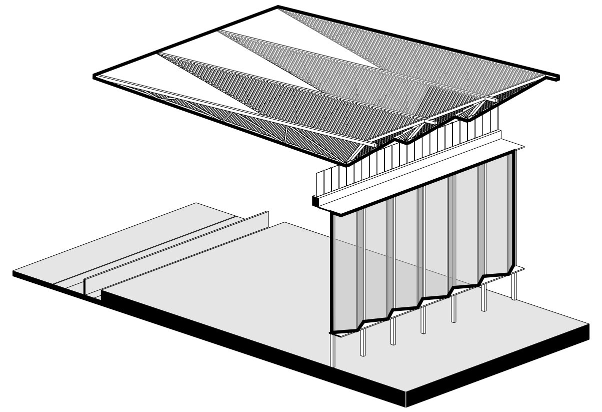


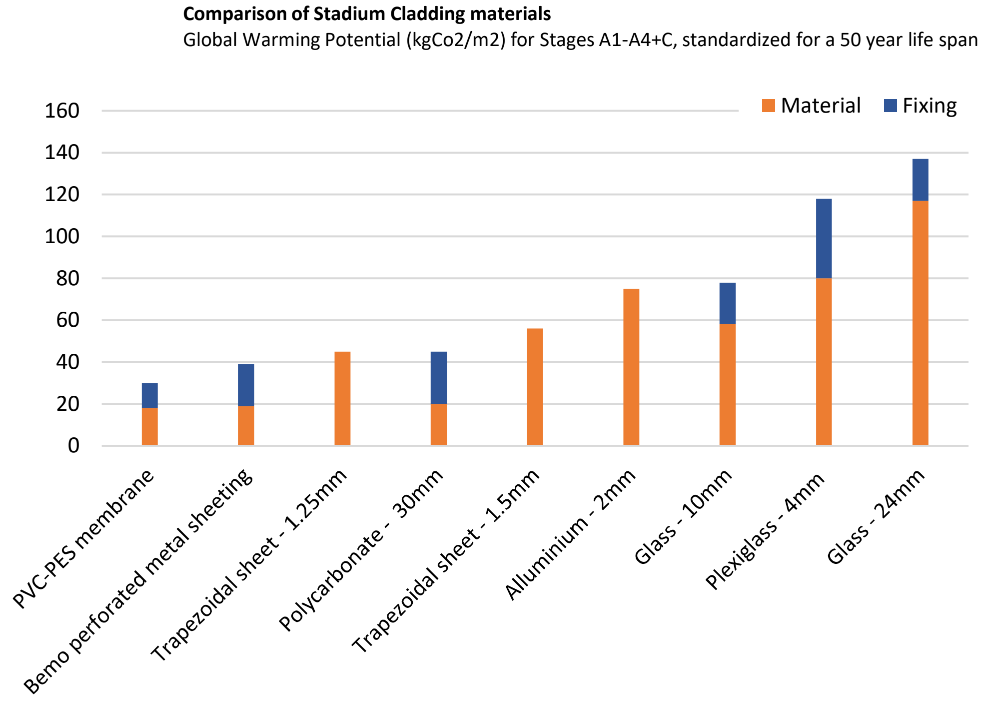


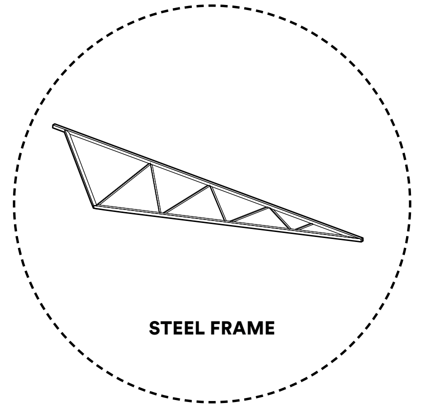
MATERIAL

Throughout the design, we have continuously focused on cost efficient, sustainable materials to reach the lowest possible carbon footprint. At the same time, we have ensured the beauty and robustness of the material choices as well as their durability and maintainance.

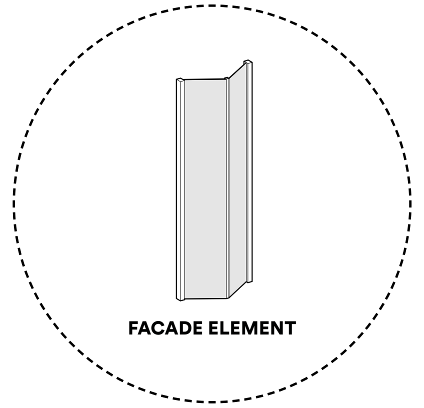
The right material has been carefully placed to enhance both structure as well as the stadium experience.
Inside the bowl, we have created an acoustically intense and immersive atmosphere, providing a bright and intimate feeling both in the concourse and stadium bowl.



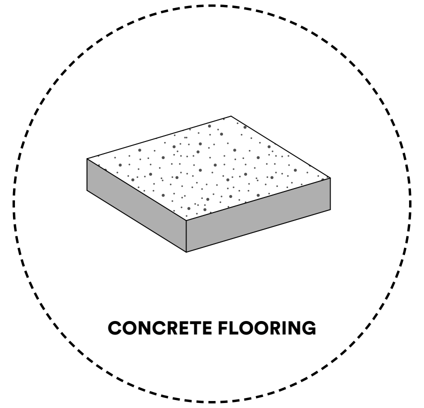




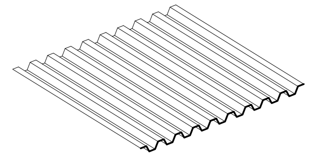
All of the steel structure can be easily deconstructed and reused in the long run, since the main structural joint used in the project is a bolted connection, rather than welded. Lightweight construction to minimize material use.



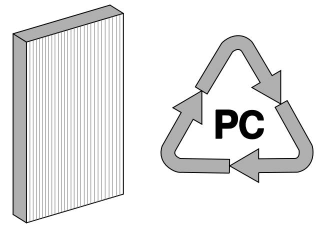
Analysis of the inpact of the light polycarbonat allowing the metal structure to be light, feeding the concrete, which needs to be heavy.



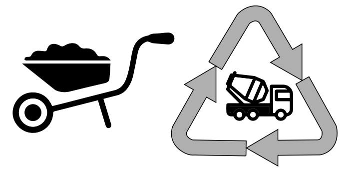
Recycling construction and demolition waste in the production of recycled aggregate concrete is an attractive approach in terms of environment and economy.



CORRUGATED METAL SHEETS



POLYCARBONATE FACADE PANEL



RECYCLED AGGREGATE CONCRETE

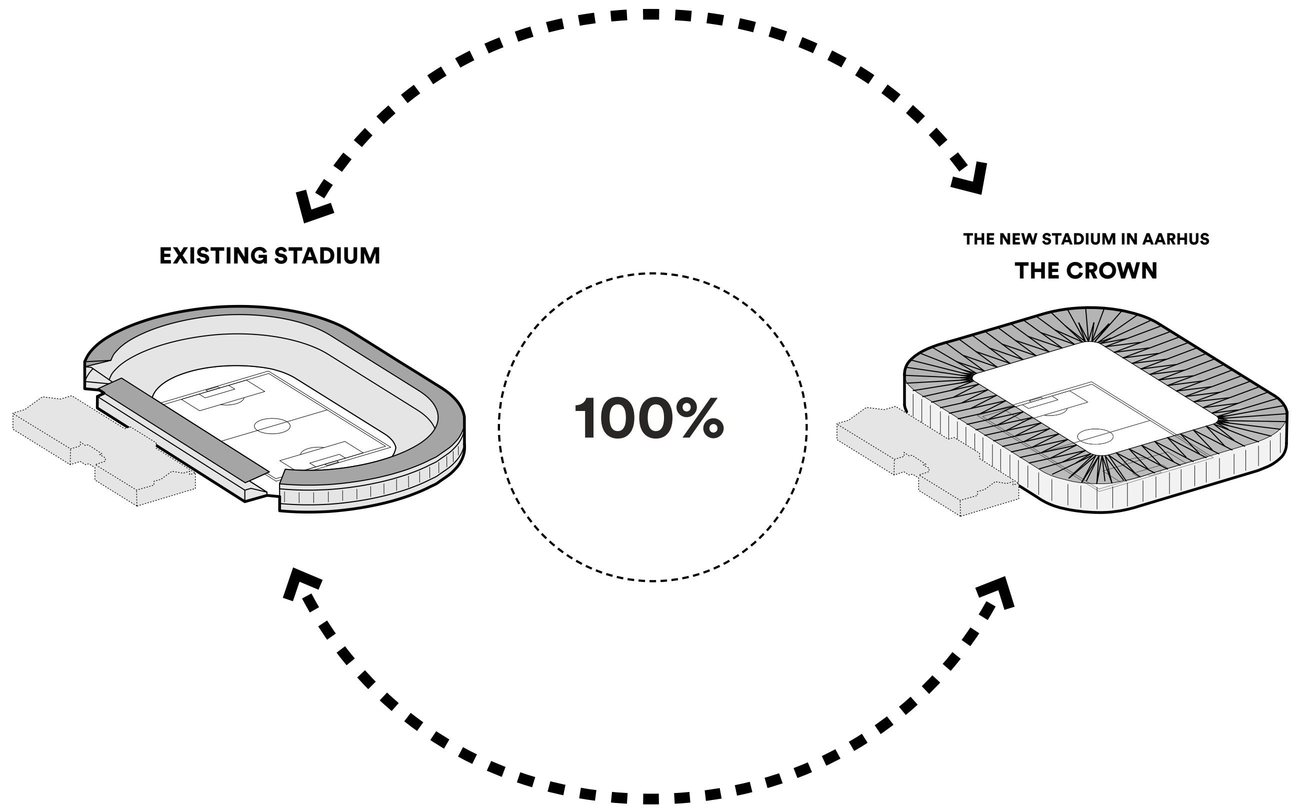
RE-USE

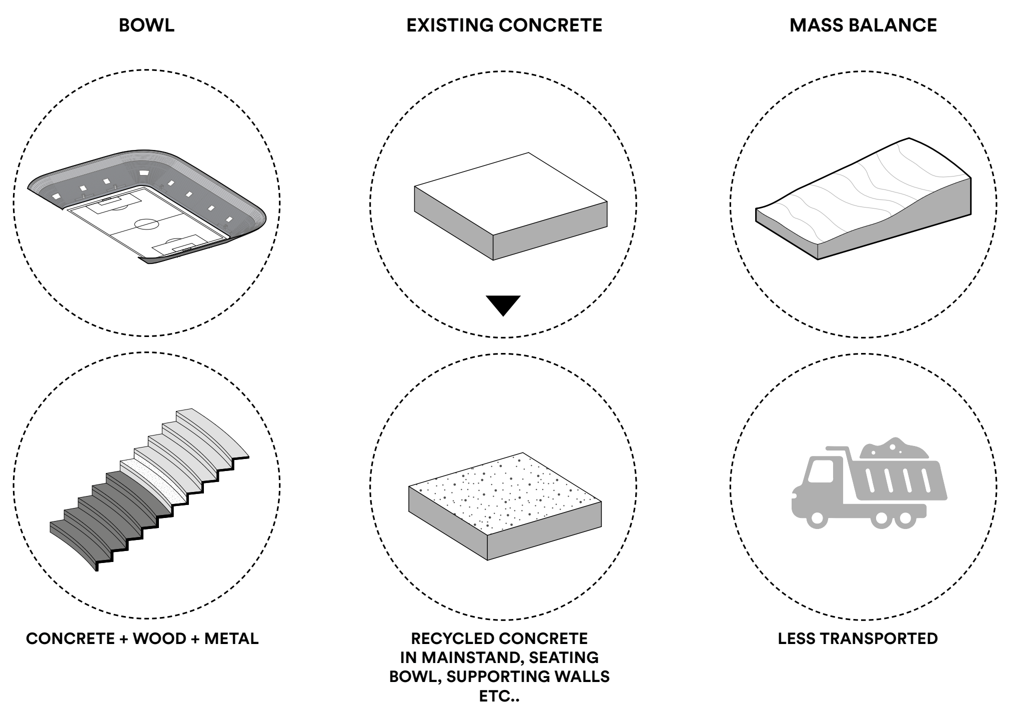
The existing Aarhus Stadium was built in 2001 with a new main stand and a grand stand for 21.000 spectators. The grand stand consists of a heavy concrete base and a light superstructure of galvanized steel, while the roof comprises of trapezoidal aluminium panels and a translucent fiberglass cover.

From a life cycle perspective, it is our responsibility to ensure that we use as much as possible from the existing structure – ideally 100 percent. At the same time, the stadium must be designed to stand the test of time and be able to be dismantled and reused in the future.

We have identified several possibilities of reuse:

- Reuse the superstructure of steel in the new bowl
- Reuse the concrete as concrete aggregate in the new main structure
- Reuse railings where possible
- Reuse interior materials from the old main stand in the new main stand



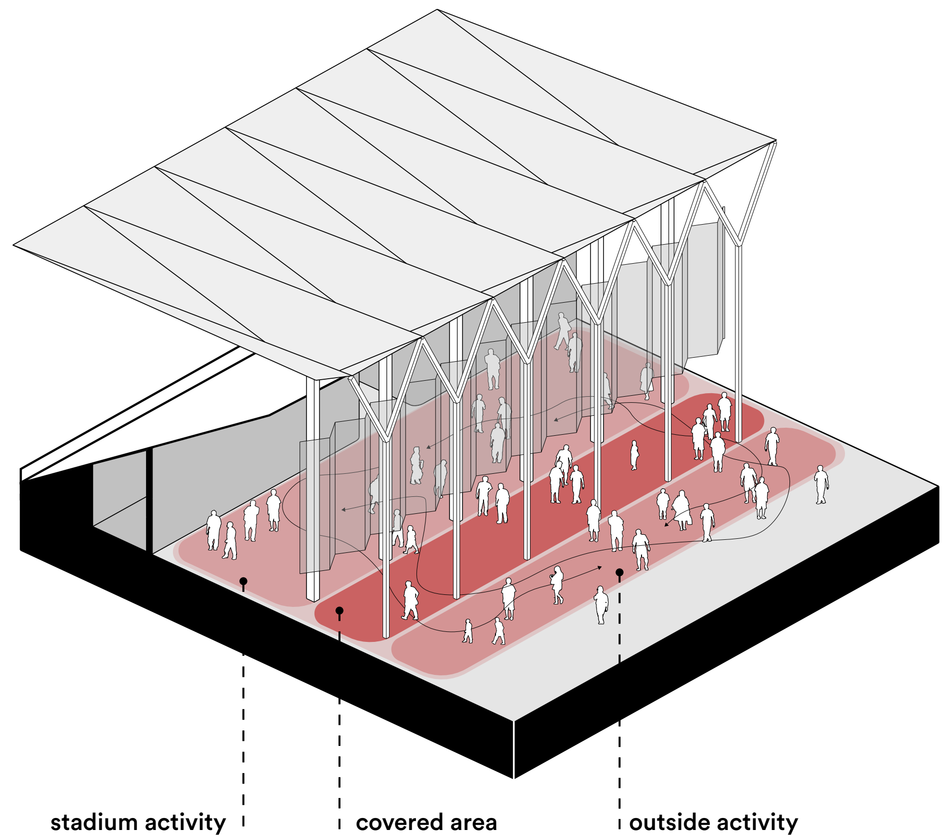


INCLUSIVE

Solidarity, friendship, and respectful fair play is a natural part of a strong sports community. Therefore, we see it as crucial that the new Aarhus Stadium celebrates these values and presents itself as an inclusive and socially responsible partner in the clearing of Kongelunden. Several users, spectators, fans, families, young athletes, sport clubs, etc. will visit the stadium grounds every week. With an inviting and open environment, the stadium reinforces community and everyday social interaction in a way that makes everyone feel welcome.

To meet these requirements we have incorporated the following measures:

- Designed the outer perimeter of the roof and facade to create a weather protected zone for spectators lining up before entering the stadium.
- Formed visual and physical connections between the fan plaza, VIP levels, and the fan bar.
- Created the possibility to open the concourse towards the fan plaza and the recreation zone when needed.
- Established a public area between the façade, the enclosed concourse, and the columns anchoring the roof construction of the stadium.



STADIUM ACTIVITIES

An inviting concourse that generates events connected to football fans needs.

EVENTS

A flexible zone around the stadium creates an active and playful atmosphere.

3. FACADE & ROOF

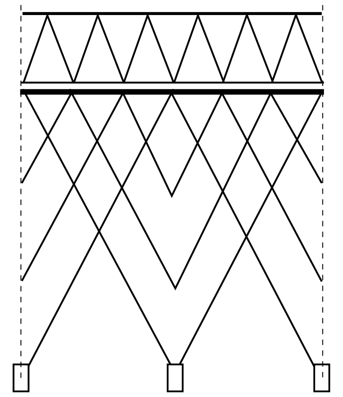
The classical understanding of proportions and hierarchy has been an important aspect of the initial design. It provides a simple and clear composition that both gives life to a ground-breaking stadium and is sympathetic to its surroundings. Therefore, the clear vertical division between entrance level, middle partition, and the roof are maintained in the revised design.

The façade is pushed back in both entrance level and top level. At both levels, this creates a wind and rain protected cover. The balcony surrounding the stadium at top level is omitted and the height of the stadium lowered to create a more intimate and intense stadium experience and enhance the function of the fan plaza as an active gathering place. A translucent membrane is added between the upper tier and the canopy, providing complete cover from wind and rain, while still allowing daylight to filter through and preserving the beautiful views of Kongelunden.

A clear polycarbonate façade in the top and at the entrance provides full transparency, and the visual contact to the inside is enhanced by the sloping landscape. The middle partition has been changed from a folding textile membrane to a translucent polycarbonate façade to lower costs, while still creating rhythmic relief and reflecting light. In the evening, the façade can be illuminated, creating an inner light that flows out and sheds light on the treetops. Different colour settings can come into play depending on the event, providing an ethereal quality and a unique stadium experience in the clearing.

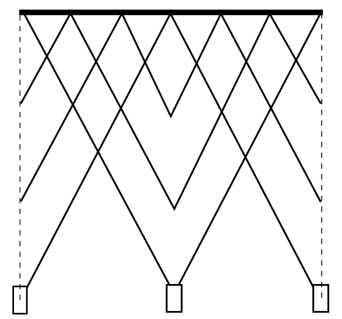
The developed roof will be clad with a mix of two different cladding materials. The inclined areas of the folded trusses will be clad with trapezoidal metal sheeting, while the flat triangular areas in between will be clad with polycarbonate. These cladding materials are strong, durable, waterproof and have great acoustic qualities.

Architecturally, they allow for the stadium's unique roof shape. The polycarbonate provides the stand with natural light, due to its translucency. The trapezoidal metal sheeting in the outer areas of the roof fulfill the requirements of an intimate stadium experience combined with a simple and proven construction. It also has economic advantages, as it is one of the most economic materials for roof cladding. Polycarbonate and metal cladding have been successfully used in many stadia worldwide.



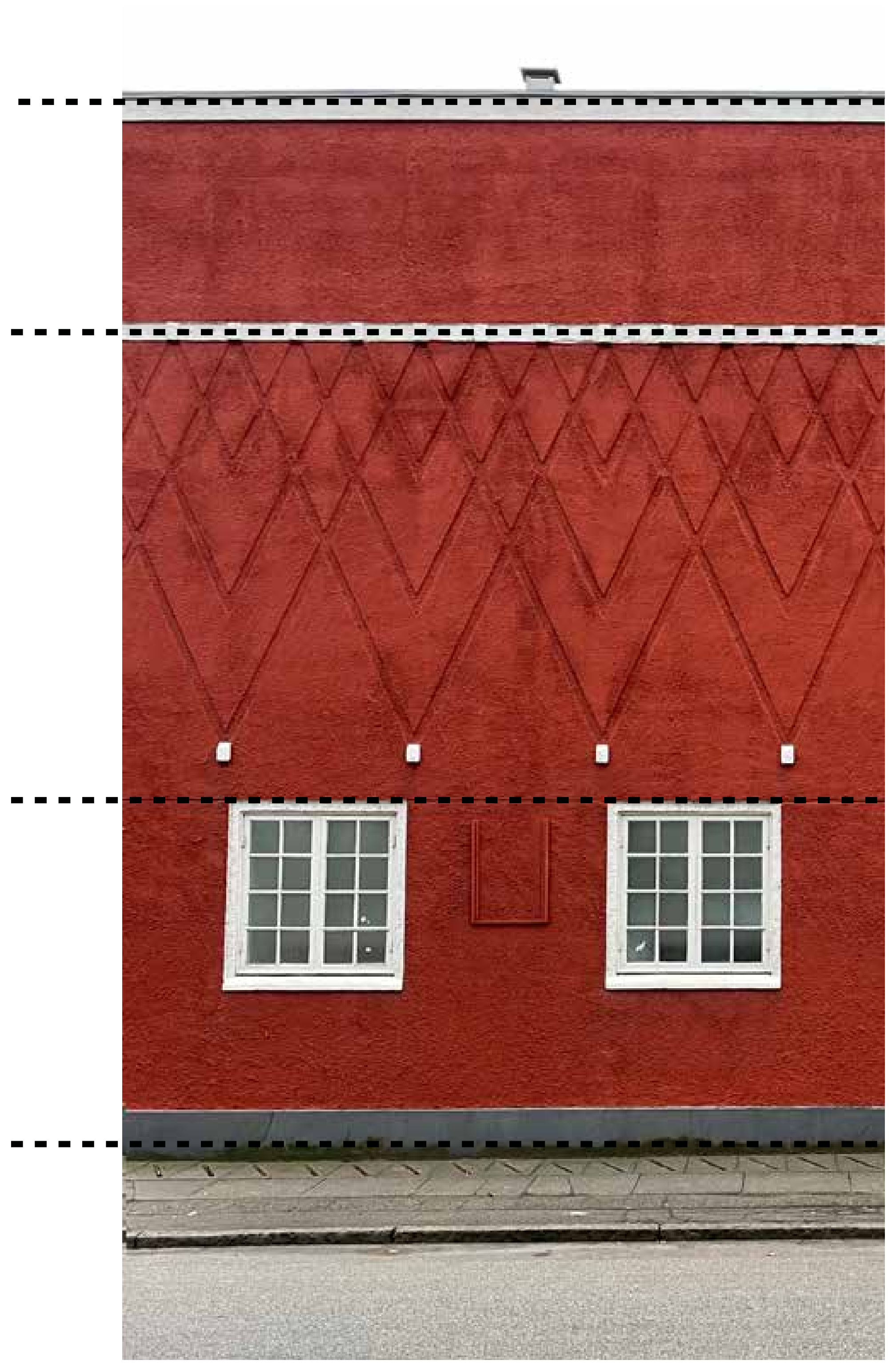
2025

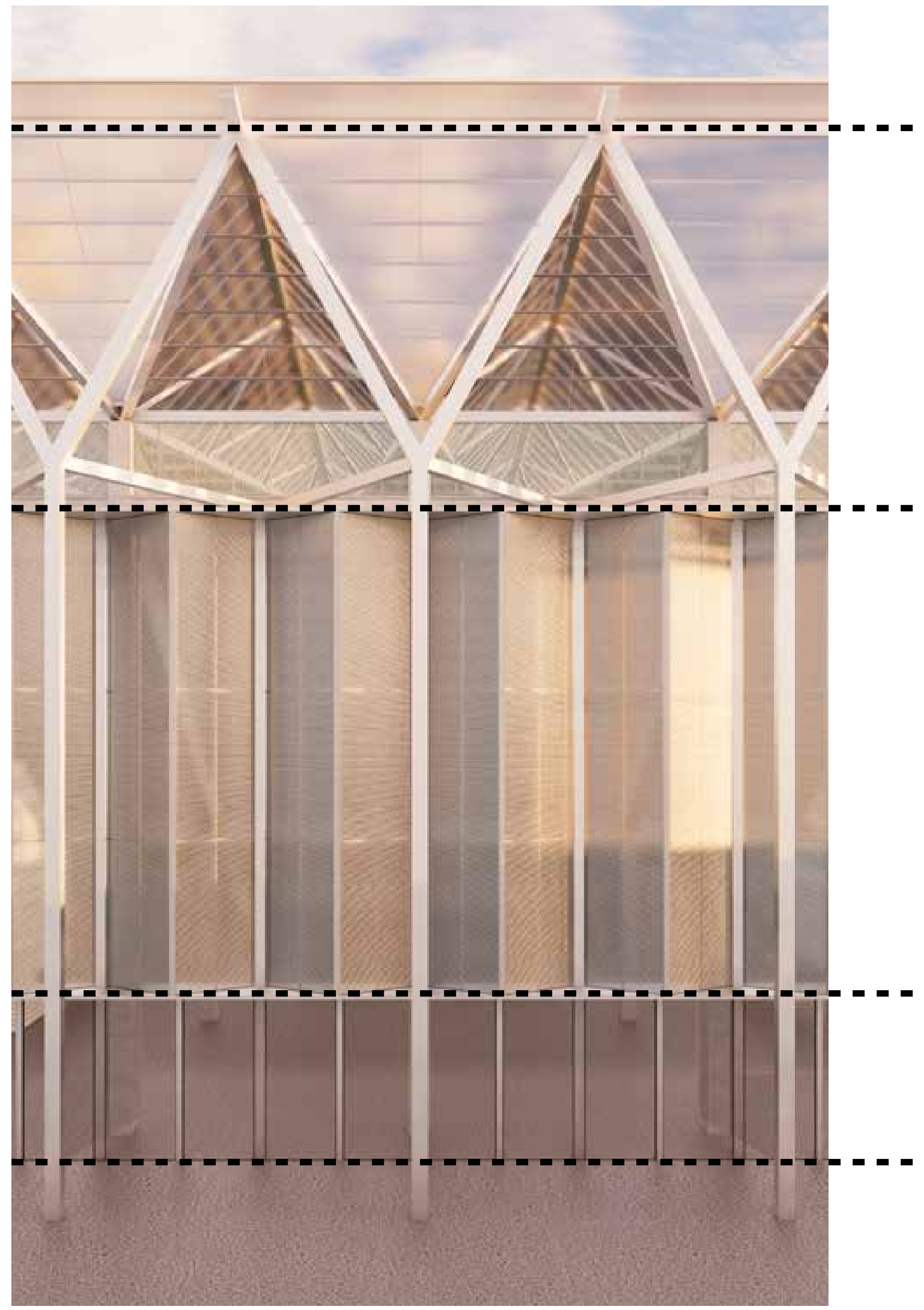
CONNECTING LINES
OF HISTORY



1902

THE STARTING POINT
OF THE FOOTBALL CLUB





PROPORTIONS

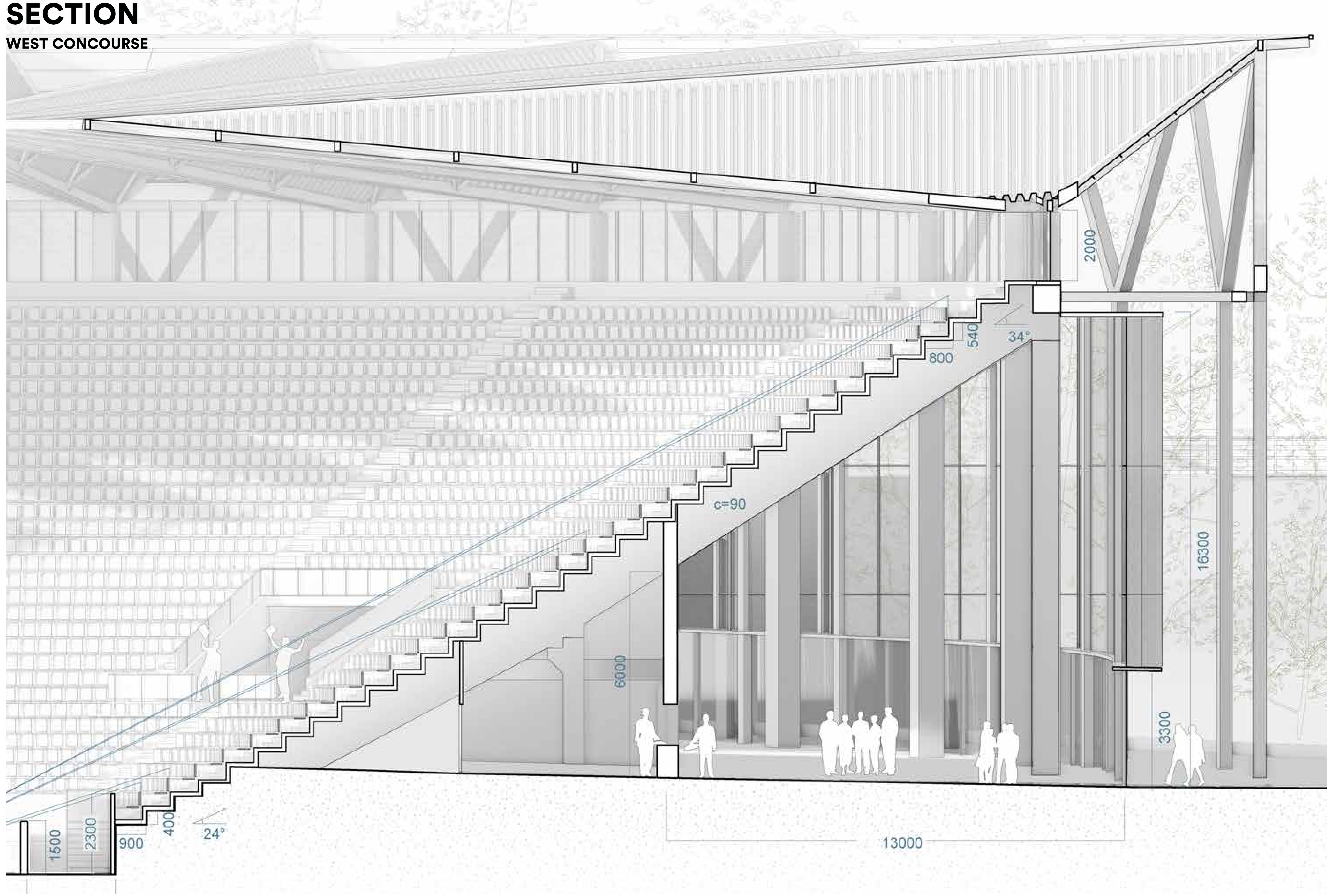
ELEVATION - WEST CONCOURSE

Roof & facade detail

ROOF PLAN

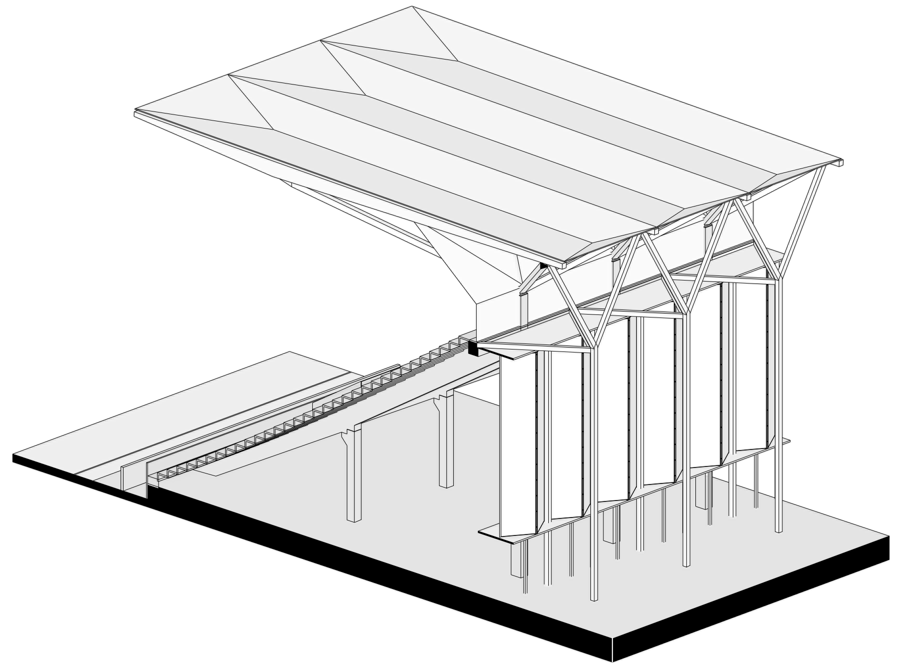
SECTION

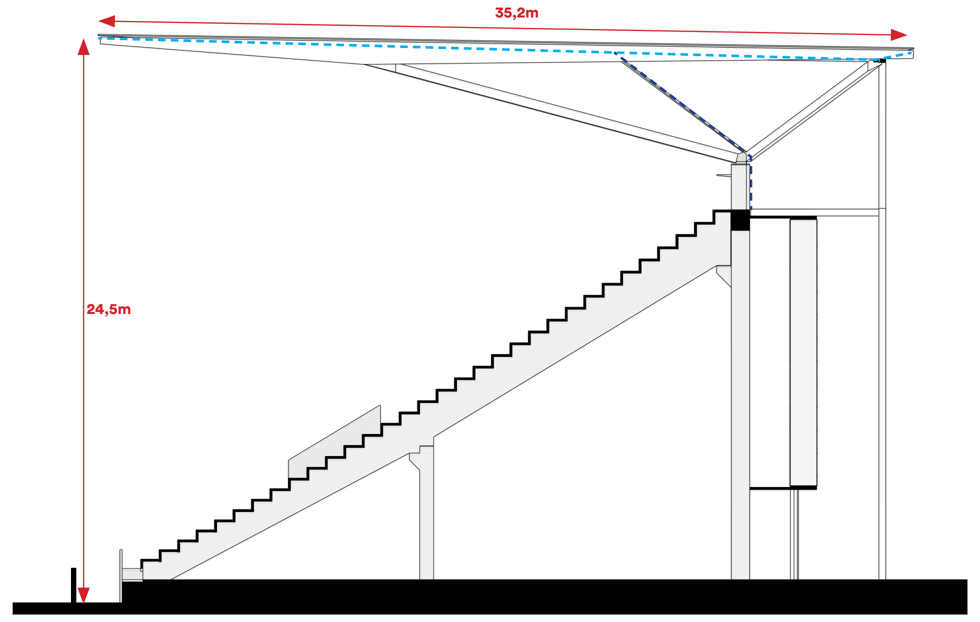
WEST CONCOURSE



View from Fan Plaza on Match Day

PHASE 2 – PRELIMINARY PROPOSAL





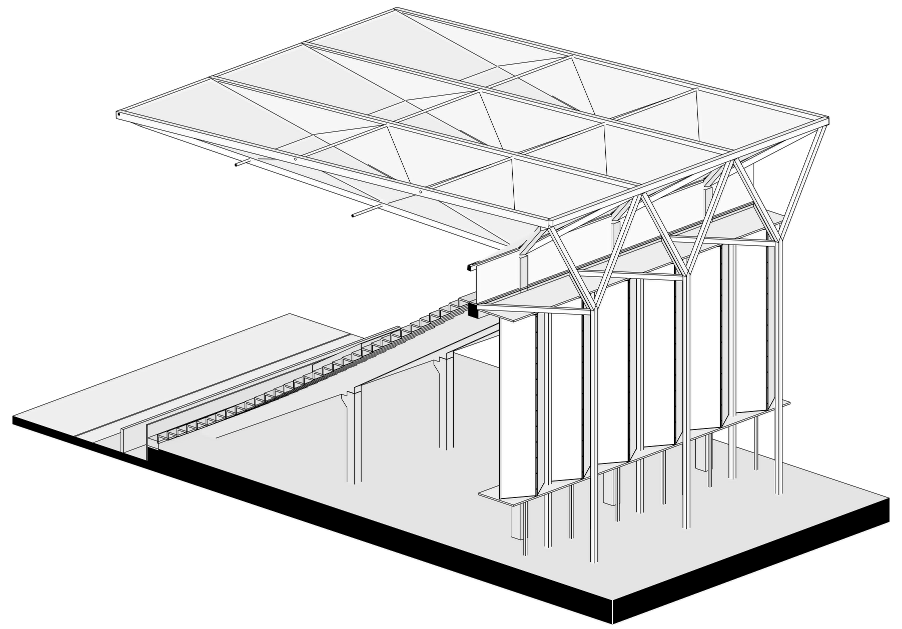
ROOF AREA:
17.500 m²

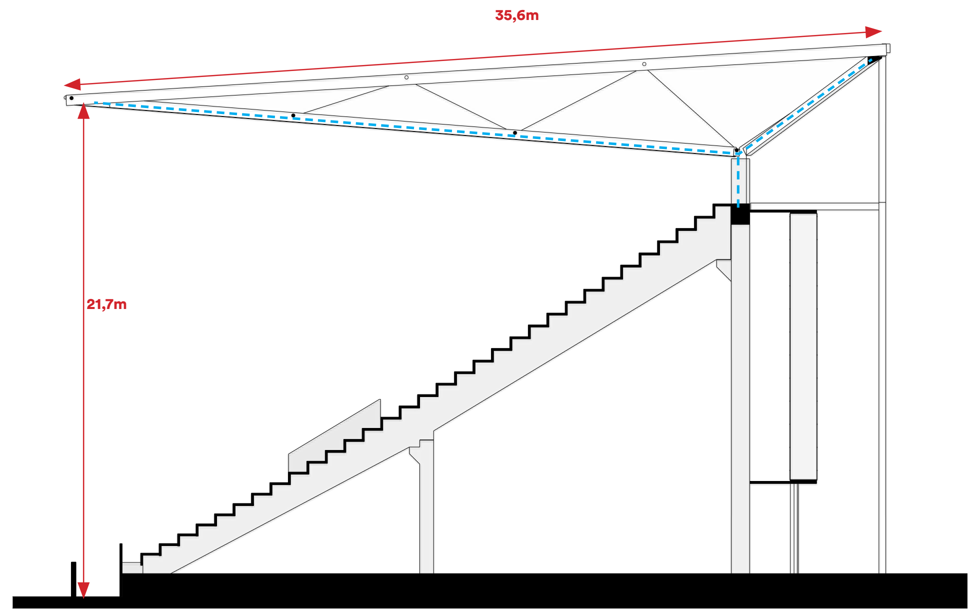
UPPER WALL AREA:
3.200 m²

TOTAL
20.700 m²

PHASE 2 – NEW SKETCH

10% reduction in steel tonnage
Inclined roof angle = less substructure





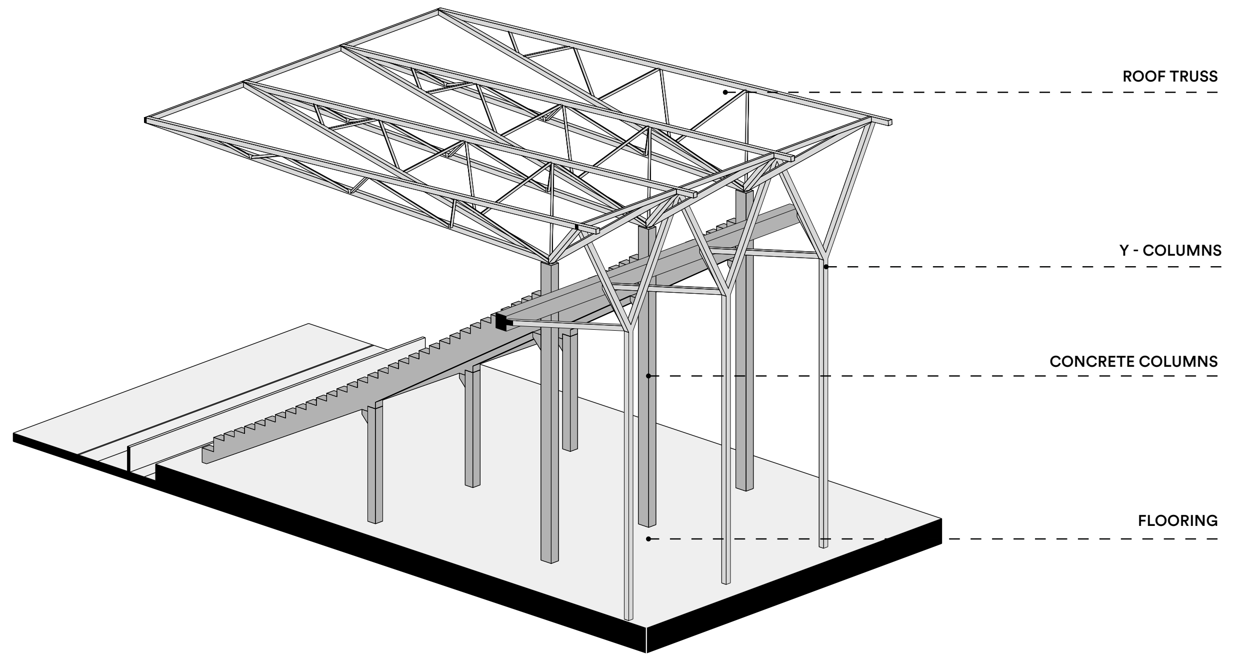
ROOF AREA:
24.150 m²

UPPER WALL AREA:
970 m²

TOTAL
25.120 m²

4. ROBUSTNESS

The high degree of repetition is a key element of the project and a fundamental feature to minimize the economic costs. Due to the changing terrain height around the stadium, only the lengths of the lowest raker beams and the columns will vary. All other elements are geometrically identical, leading to significant gains in efficiency through reuse of formwork, repetition in connections, and mounting sequences. This is not only the case for the bowl structure, but also for the roof structure which is identical all the way around the stadium. The latest roof structure has been developed into a system of inclined trusses forming a folded roof shape. The reason for this design development is, on the one hand, to create a more intimate stadium atmosphere with excellent acoustics, and, on the other hand, to gain a further extent of robustness. Due to the stiffer truss structure, the roof is now able to carry higher loads, such as heavier cladding materials (polycarbonate, metal, etc.). This flexibility substantially contributes to the robustness of the stadium. With the stiffer structural system, we were able to save approximately 10% of the steel tonnage in the roof structure.



PHASE 2 - PRELIMINARY PROPOSAL
Steel truss – PVC textile & ETFE foil

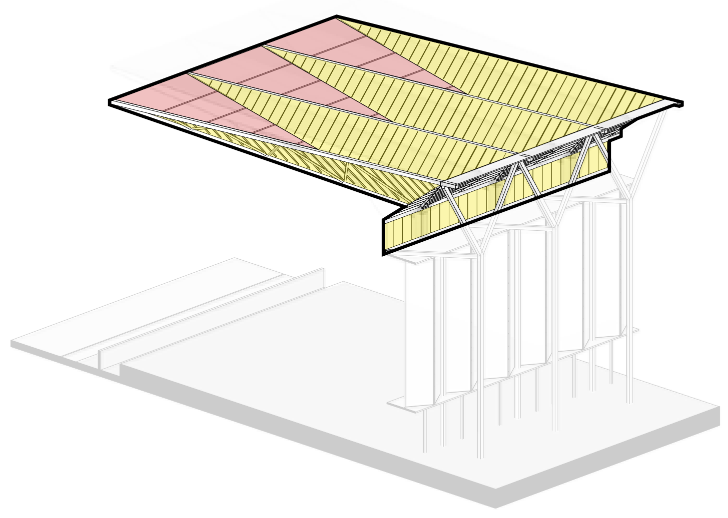
PHASE 2 - SKETCH
Steel truss – polycarbonate

PHASE 2 - NEW SKETCH B
Steel truss – polycarbonate & metal

PHASE 2 - NEW SKETCH C
Steel truss – polycarbonate & metal

General admission stands during an afternoon match

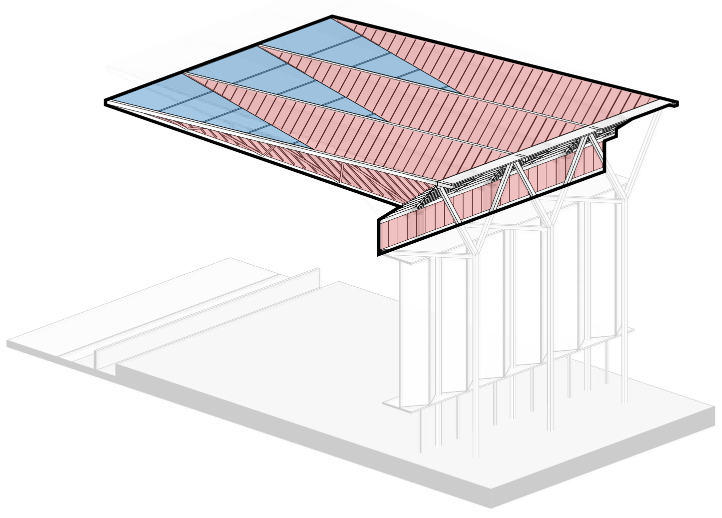
ROOF MATERIAL OPTIONS



Option 2
PVC textile and polycarbonate

PVC textile

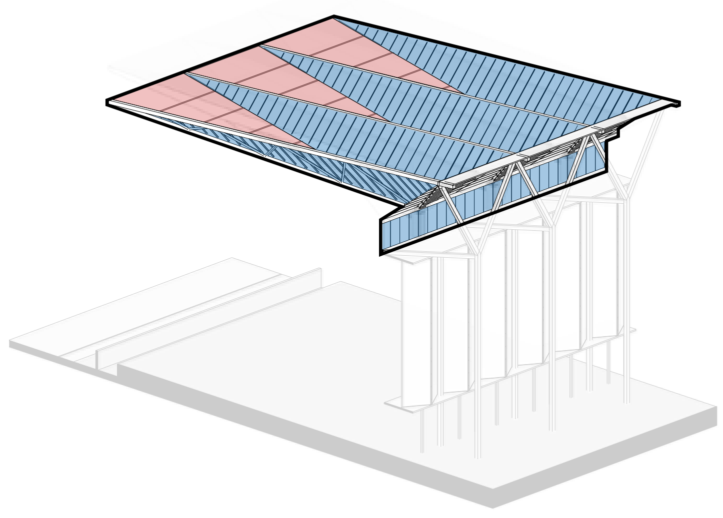
Polycarbonate



Option 4
Metal and polycarbonate (inverse)

Polycarbonate

Metal



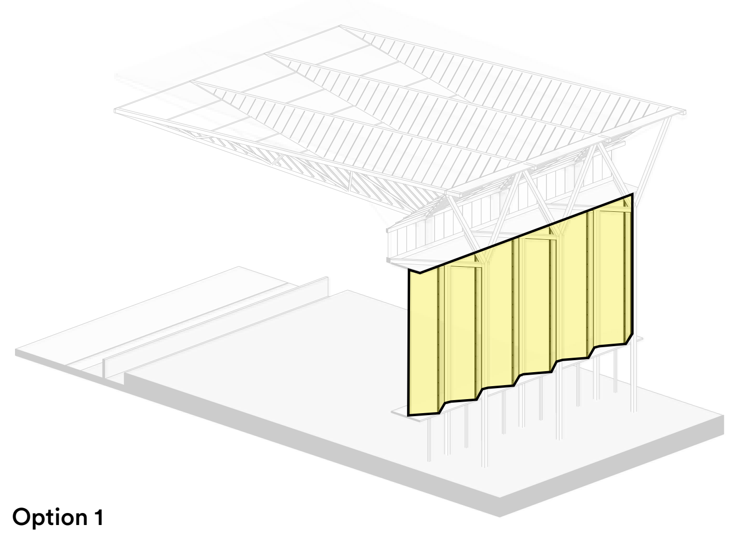
Option 3
Metal and polycarbonate

Metal

Metal and polycarbonate composite

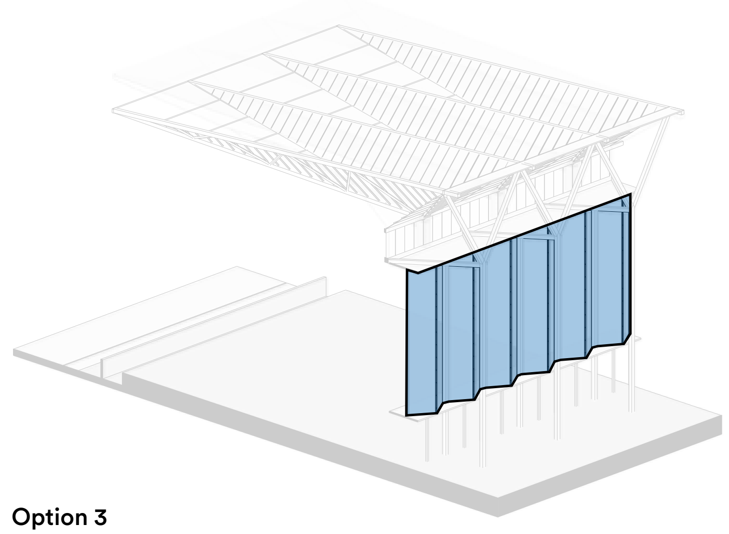
Polycarbonate

FACADE MATERIAL OPTIONS



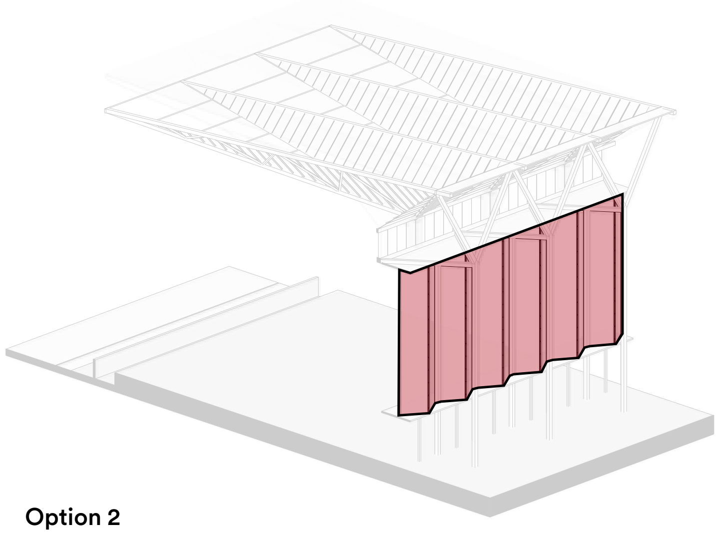
Option 1
PVC textile

PVC textile



Option 3
Metal

Metal



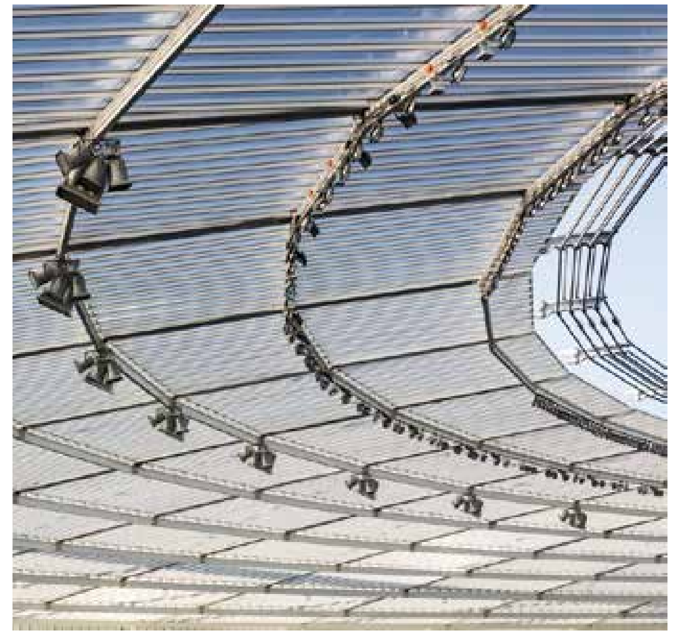
Option 2
Polycarbonate

Polycarbonate

POLYCARBONATE ROOF - CASE STUDIES

STADIUM SLASKI, sbp

Location: Chorzów, Polen
Type of structure: Ring cable Roof
Architect: gmp · Architekten von Gerkan, Marg und Partner
Completion: 2017
Roof area: 45.000 m²
Cladding: Polycarbonate
Seats: 54.800

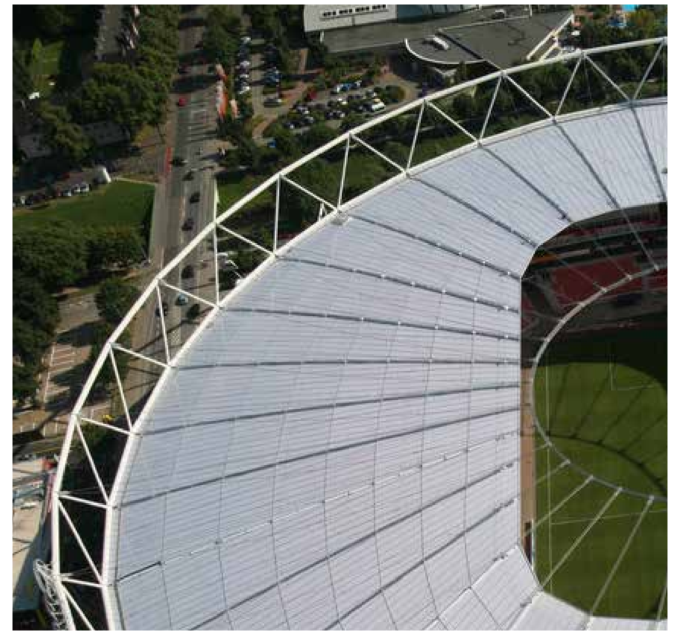


STADIUM COLOGNE, sbp

Location: Cologne, Germany
Type of structure: Suspended steel roof
Architect: gmp · Architekten von Gerkan, Marg und Partner
Completion: 2014
Roof area: 28.742 m²
Cladding: Polycarbonate
Seats: 46.253

STADIUM LEVERKUSEN, sbp

Location: Leverkusen, Germany
Type of structure: Ring cable Roof
Architect: HPP Hentrich-Petschnigg & Partner, Düsseldorf
Completion: 2009
Roof area: 28.000 m²
Cladding: Polycarbonate
Seats: 30.000



STADIUM ESSEN, sbp

Location: Essen, Germany
Type of structure: Cantilever Roof
Architect: Plan Forward GmbH
Completion: 2012
Roof area: 15.000 m²
Cladding: Polycarbonate, metal sheeting
Seats: 21.000, extension to 26.000 or 35.000 possible

POLYCARBONATE FACADE - CASE STUDIES

THE CRYSTAL, DORTE MANDRUP

Location: Copenhagen, Denmark
Type of structure: Steel and timber
Architect: Dorte Mandrup
Team: b&k brandlhuber & co., Architect
Jørgen Nielsen, Engineer
NH Hansen & Søn, Contractor
Completion: 2006
Size: 3.500 m²
Cladding: Polycarbonate

DAY-CARE CENTRE SKANDERBORGGADE, DORTE MANDRUP

Location: Copenhagen, Denmark
Type of structure: Load bearing concrete columns
Architect: Dorte Mandrup
Team: Jørn Tækker A/S, Engineer
NCC Brøndby, Contractor
Completion: 2005
Size: 555 m²
Cladding: Polycarbonate

5. LANDSCAPE

The New Aarhus Stadium will rest in its lush and sheltered forest as a clearing where life and light will flow through the open generous space of celebration and recreation. This high quality space will be the marking of the Aarhusian and Danish ambitions for public well being and recreational sports in relation to larger cities. A celebration to sport, leisure and life itself.

FOREST HALO
Like halos, the public space graduates from a lush green to a mineral plane where the new Stadium rests. The stadium area is designed to create natural pedestrian paths. Thus, the precinct is entered through sequences of earth and asphalt, existing and newly planted trees. Looking in reverse, the stadium slowly dissolves into and becomes the forest.

Aarhus dwells between land and sea on moraine plains and Kongelunden is the forest that connects the city to East Jutland's great landscape features. From Brabrandsøen in the west to the sea in the east, the water travels through the landscape and opens up a range of natural qualities and experiences.

The stadium marks a center for the numerous visitors in the forests that stretch their beech blankets over 10 kilometers along the Jutland coast. Here in Kongelunden, everyone is allowed to be by virtue of the trees. The value of Kongelunden must be maintained for its close neighbors, for the whole of Aarhus and the whole of East Jutland. We protect and further develop Kongelunden by thinking of the forest as a unified narrative based on all the natural and cultural values that it holds.

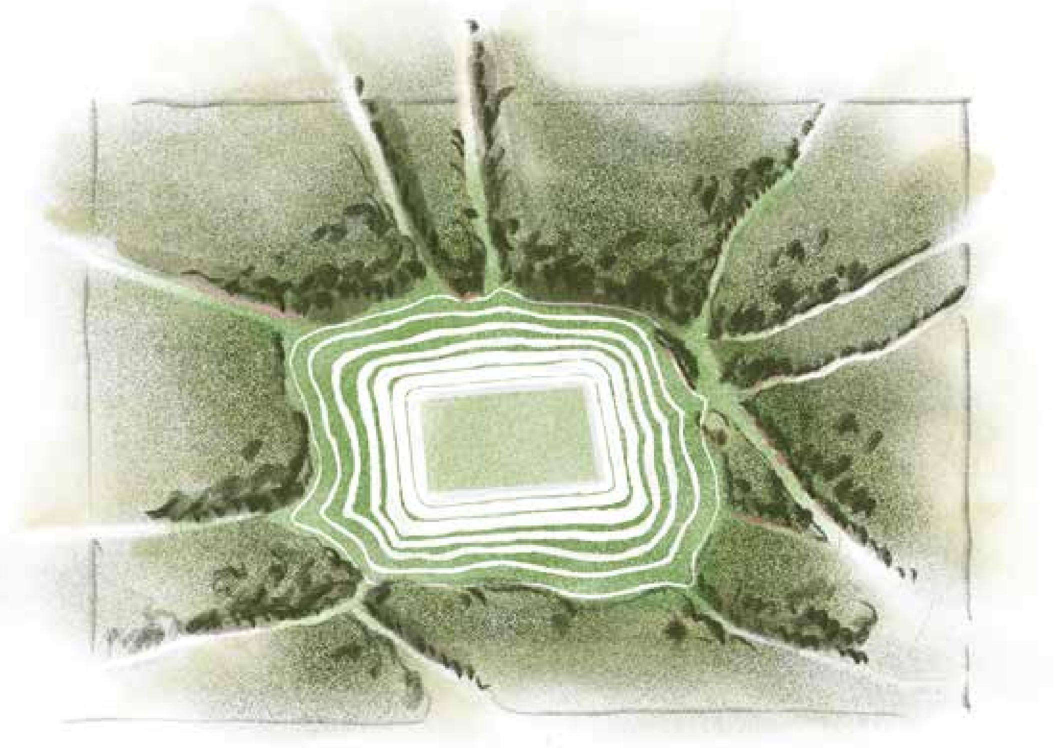
The area of the Stadium shall act like a gathering plain where forest meets public space.

FLOW, FUNCTIONALITY AND SAFETY
The slope from the Stadium precinct to the Jutland Racecourse is an essential part of the existing situation. The pedestrian flow coming from the racecourse and the planned parking situation inside it is integrated in the stadium halos, catching fans and visitors from east and west of the racecourse and leading them into the stadium perimeter. An integrated ramp and staircase makes way for smooth pedestrian flows around the precinct.

Strategically and functionally, the area is understood as 360 degree halos around the new stadium, connecting architecture and landscape. The halos create atmospheres and zones that hold capacity for easy access. Lighting features and readable colour schemes integrated in the halos guide visitors in safe flows in the precinct. Robust and resilient materials allow easy access around the area. The landscape and outdoor areas within the precinct must ensure good accessibility for all users, irrespective of functional level.

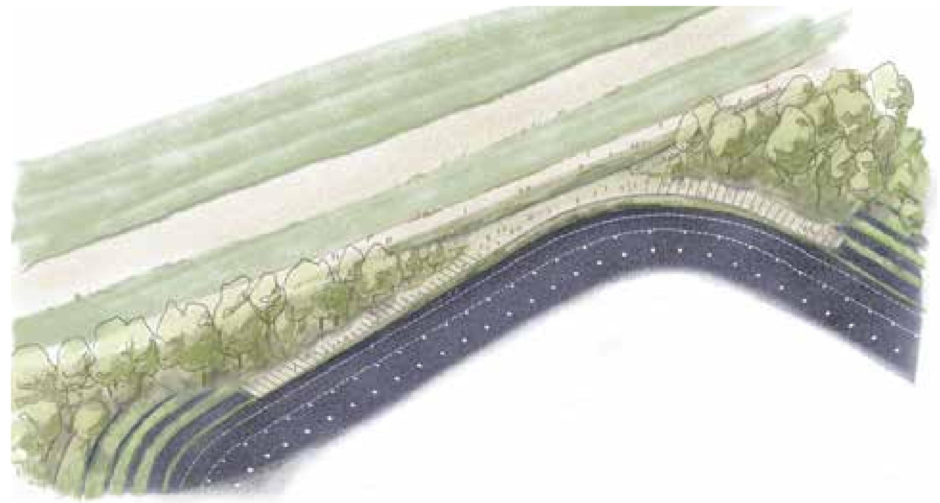
Visiting vehicles will arrive from major roads in Kongelunden and from Stadion Allé. Along these, convenient parking is placed, making easy access and exit situations for all. The inner safety perimeter is designed to mediate the circulation of pedestrians inside the Stadium precinct. Direct flow lines from the inner safety perimeter to the main infrastructure make it easy to enter, empty, and evacuate the stadium. 300 bike parking spots are placed east of the tennis courts and 200 are placed in front of the Heritage Building. Optional locations for 300 more bike parking spots exist along Stadion Allé and Havreballe Skovvej. Direct access routes run from the main infrastructure to inside the stadium bowl. Along the 360-degree safety perimeter, interior service routes run with optimal access to BOH and waste facilities. The greenkeeping compounds are split in two for smaller optimized spaces.

MATERIAL PALETTE
Today, Kongelunden consists of several types of pavement: asphalt, gravel, granite or earthy trails meet at the stadium with no aesthetic coherence. The new stadium is placed on a coherent mineral plane with smaller green spaces reflecting the activities happening around the stadium. The main materiality is asphalt in plains with variation in grain size. Asphalt enhances the resilience and robustness that a functional space like this one must have. At the activity and sports park, warm red spots of cast rubber let visitors exercise and enjoy the public space on non-match days.



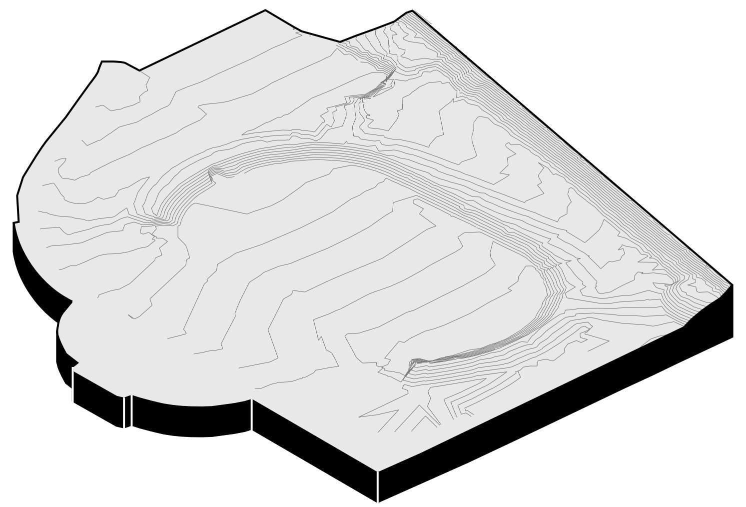
CONCEPT SKETCH

DRAWING OF EXISTING SITUATION

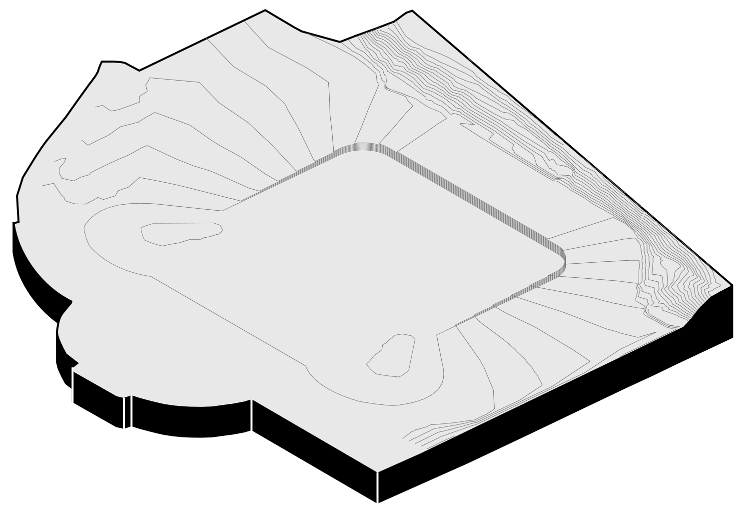


RAMP AND STARI INTEGRATED IN THE SLOPE.

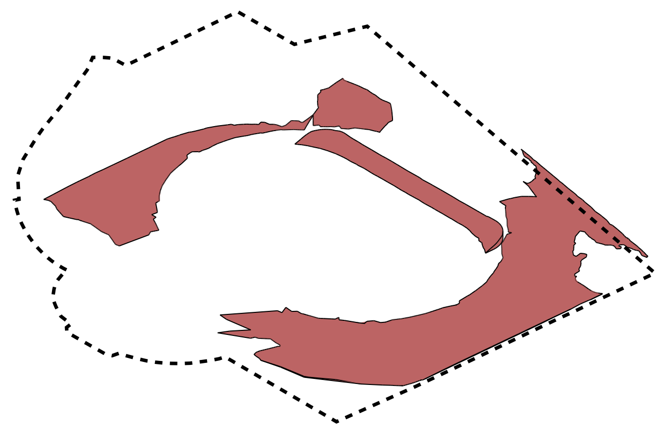
EXCAVATION DIAGRAM



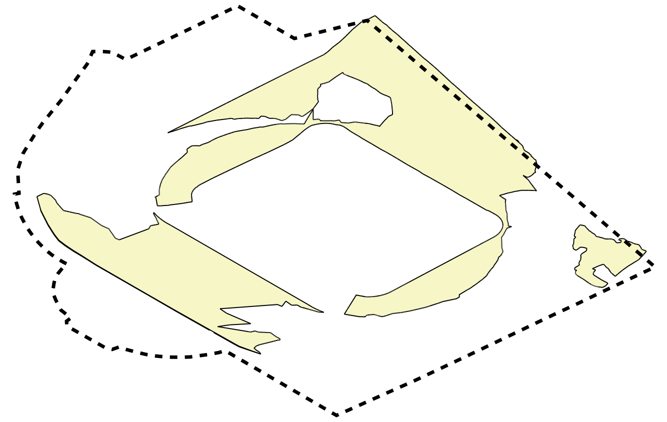
Terrain – existing



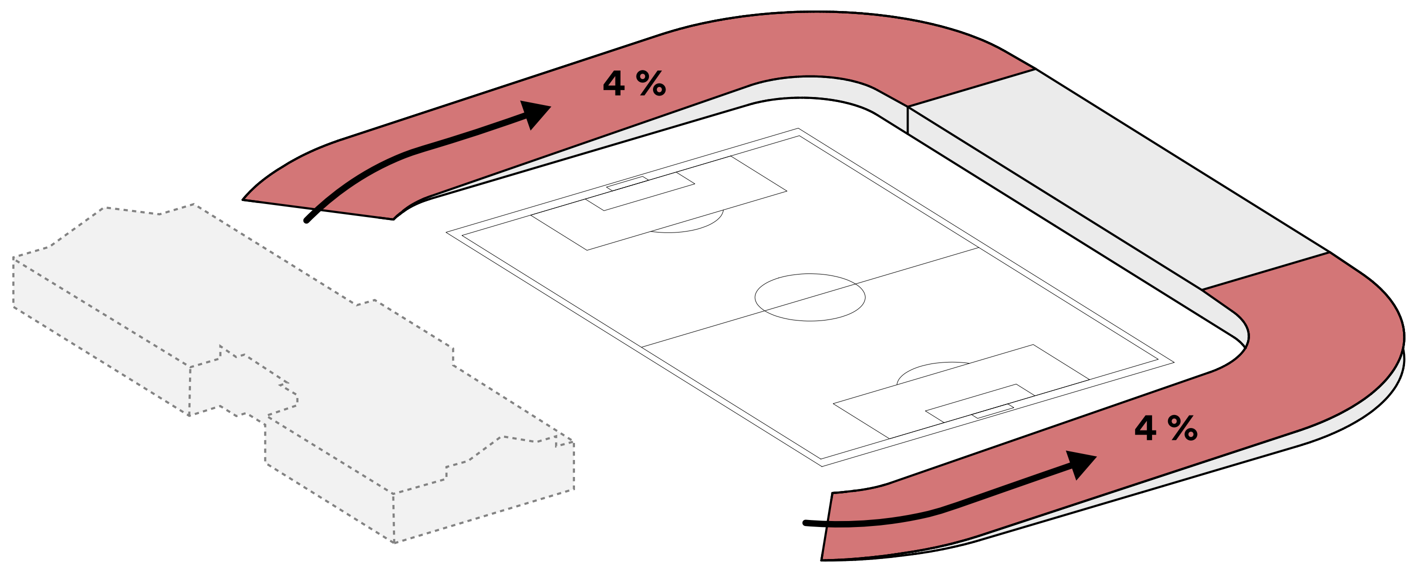
Terrain – new proposal

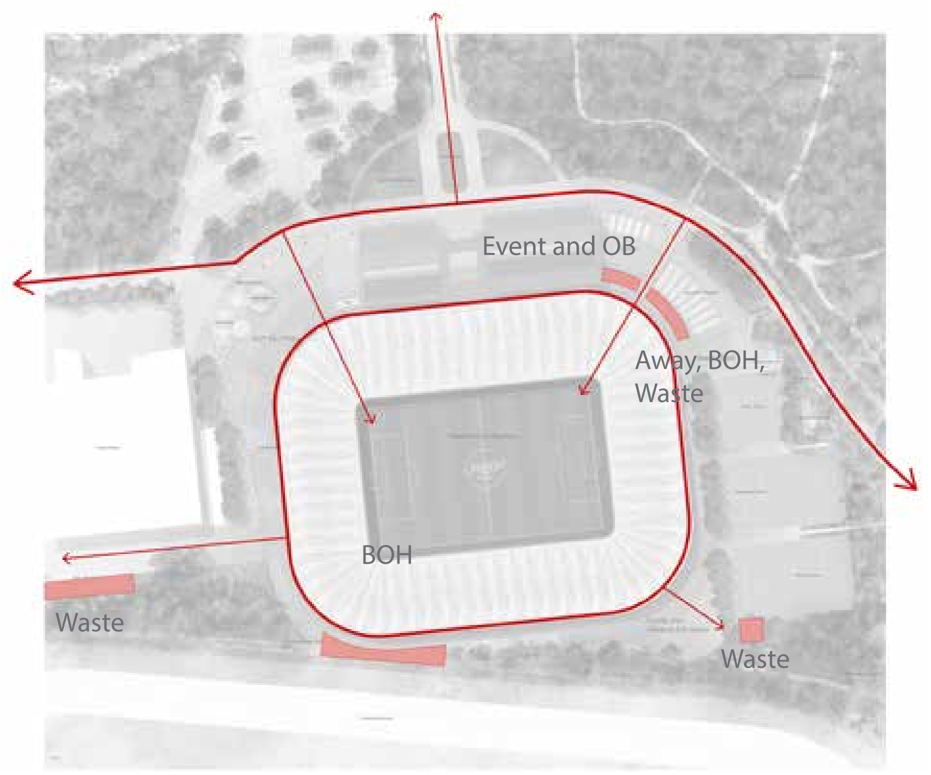


Excavation

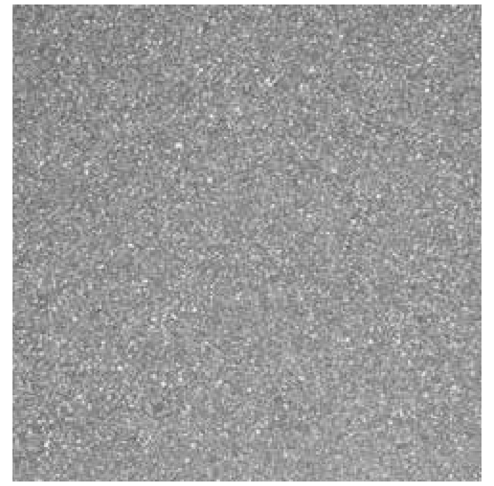


Fills

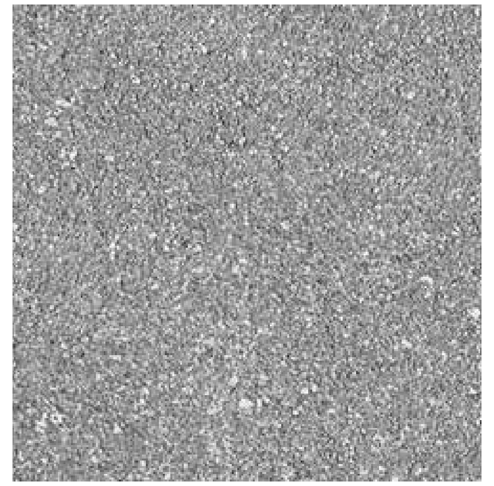




Sports Pavement



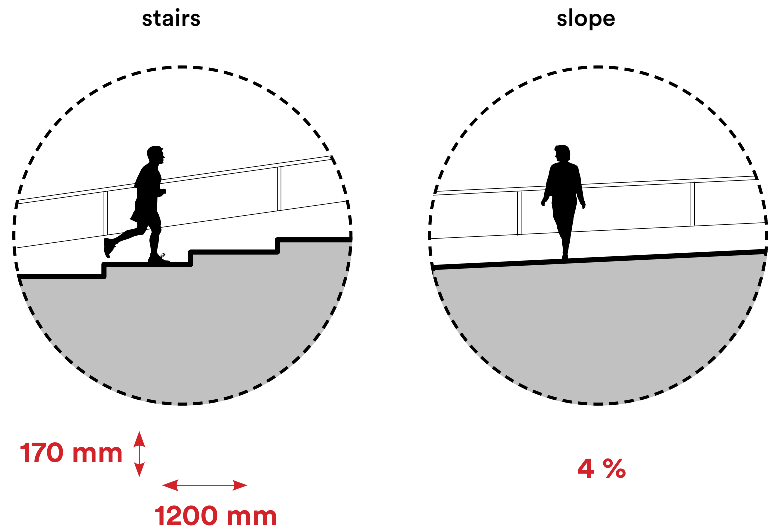
Light gray asphalt with fine upcycled grains



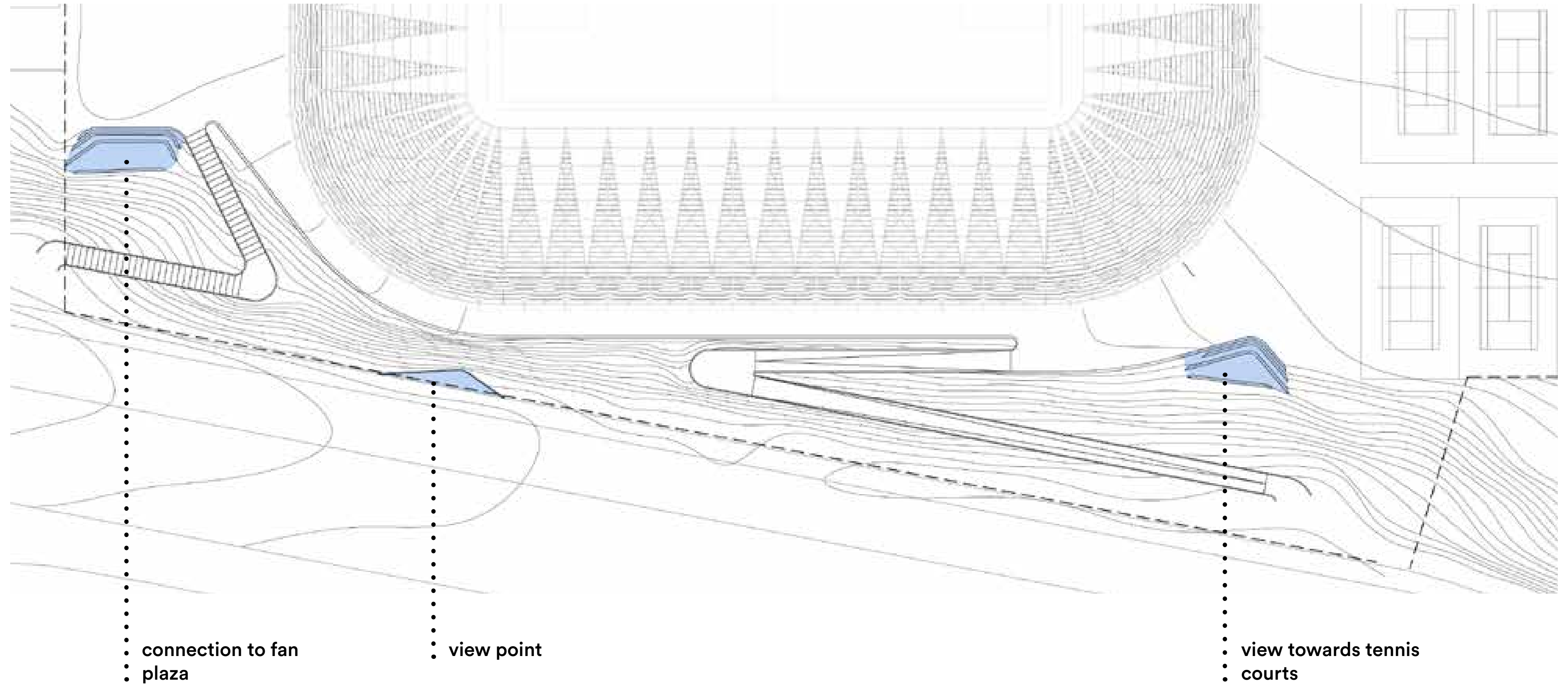
Medium sized upcycled grains

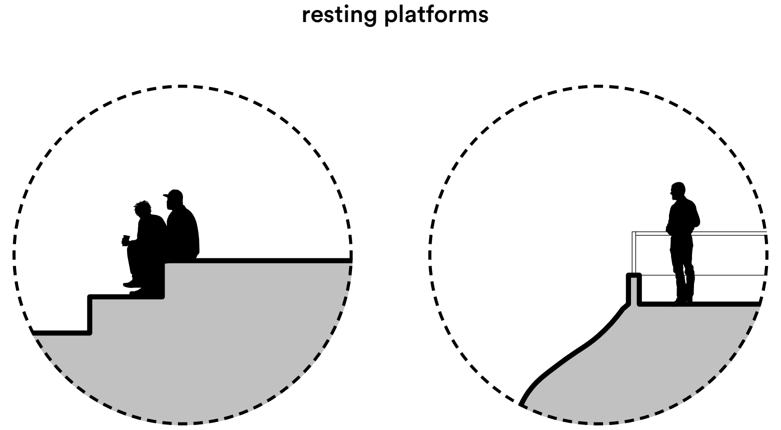
Largest upcycled grains close to the stadium

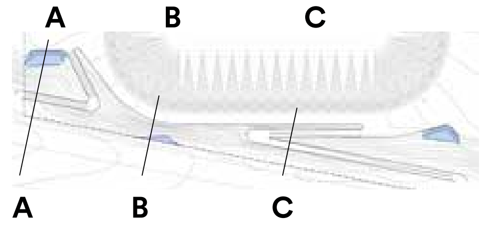
ACCESSIBILITY

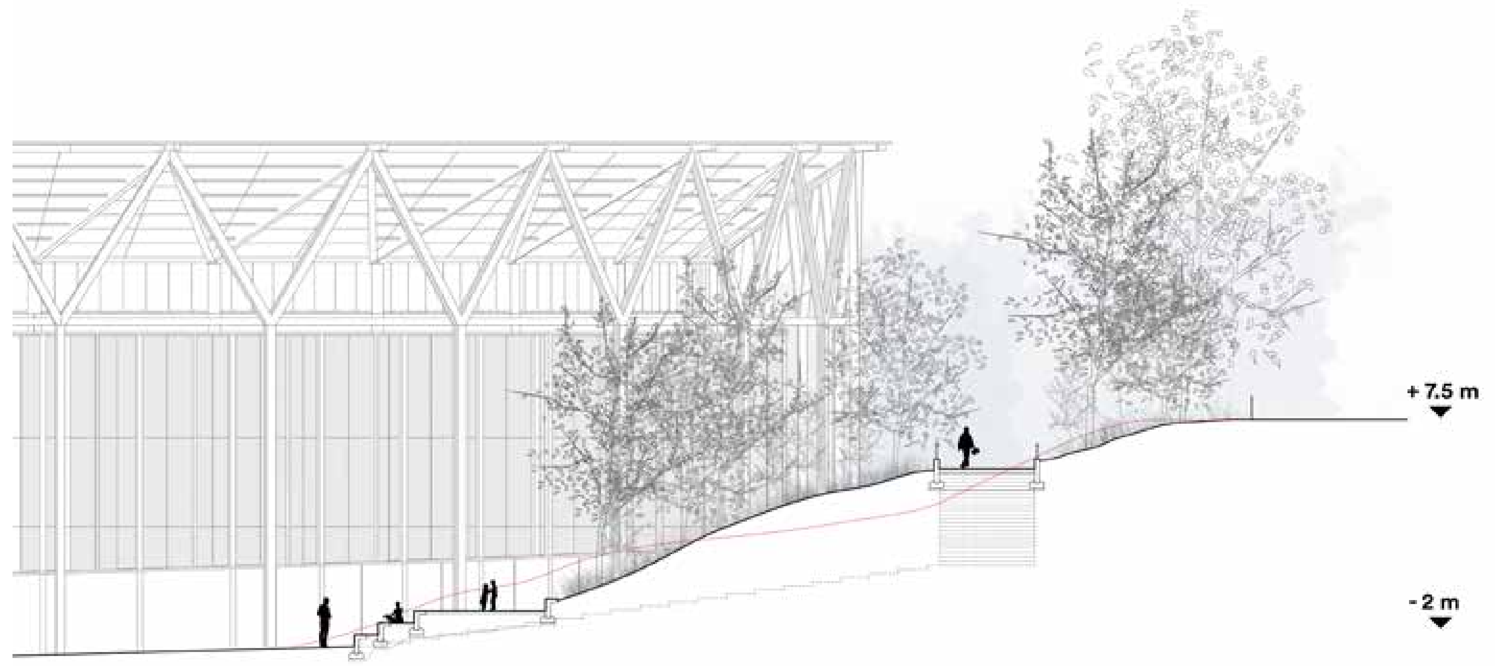


FUNCTIONALITY

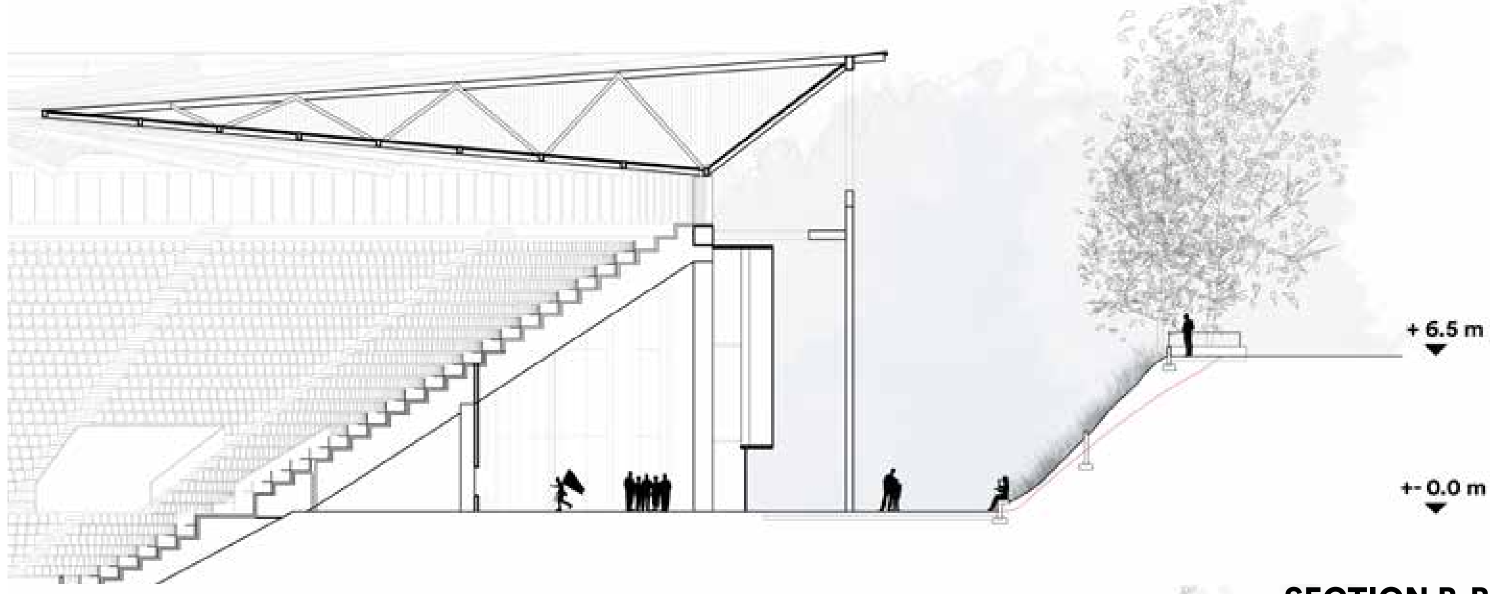








SECTION A-A



SECTION B-B

SECTION C-C

REFERENCES

CJ GROUP, Blossom Park
South Korea, 2017

Karres en Brands, ING campus
Netherlands, 2020

ZAP, Quinado park
China, 2020

SECTION

Scale 1:250

6 . FAN PLAZA AND CONCOURSE

FAN PLAZA AND ARRIVAL

The new open public space of The Fan Plaza is a place for celebration. Here, the public will meet a welcoming feeling of being in the heart of Aarhus Sports Park and Kongelunden forests. The Fan Plaza is a spatial gesture that marks the inevitable presence of the strong public bond between Aarhusians and the natural landscape they inherit. Like a clearing in the forest, this space is where we gather to execute well-needed recreation and leisure, combined with the activities we connect to the spirit of football. The Plaza is a part of the entire Stadium precinct marked by a coherent firm mineral surface that runs 360 degrees around the stadium.

The firm asphalt ground with variation in grain size form material sequences that lead one from the forest to the new stadium. High-stemmed and wide-crowned decidious trees continue the spatial relation between the treetrunks of the green forest and become a part of the stadium columns that interpret treetrunks into architectural structure. Lush beds of vegetation surround the trees of the plaza, giving good screened areas for relaxed stays and opportunities for families with children to enjoy the playground facilities. All in all, the Fan Plaza meets the needs of a contemporary urban space with diverse and flexible possibilities, giving space to celebration that Aarhus deserves.

The new fan plaza defines a common gathering place for all spectators and visitors before entering the stadium. To ensure a natural transition between the plaza and the surrounding landscape and create a fluid movement into the concourse, the plaza slopes down towards the building, recalling the originally sloping terrain of Kongelunden before the initial stadium was constructed. The slanted plaza forms a natural amphitheatre with tiered plateaus that can be utilised for public events both on and off matchdays or simply enjoyed as common hang-out spot in this remarkable location. Depending on future aspirations there is a possibility of integrating a screen in the façade composition.

To the south, the landscape ascends towards the racecourse, emphasising the levels of the existing landscape. Arriving from the racecourse, you follow a course of ramps down towards the stadium, catching glimpses of the pitch as you transcend. Creating a natural slope in the landscape allows nature to further enclose the stadium and ensures an organic transition from the soft, green landscape to the hard, paved surface of the surrounding area – a subtle transition from nature to culture. A new grey asphalt surface flows into the concourse, preserving the continuous flow around the building and the unbroken connection between inside and outside, the stadium and the public space.

The informal security barrier, formed by placing five sculptures from the former sculpture park as characteristic markers, is maintained in the revised design to ensure an inviting and open atmosphere.

CONCOURSE

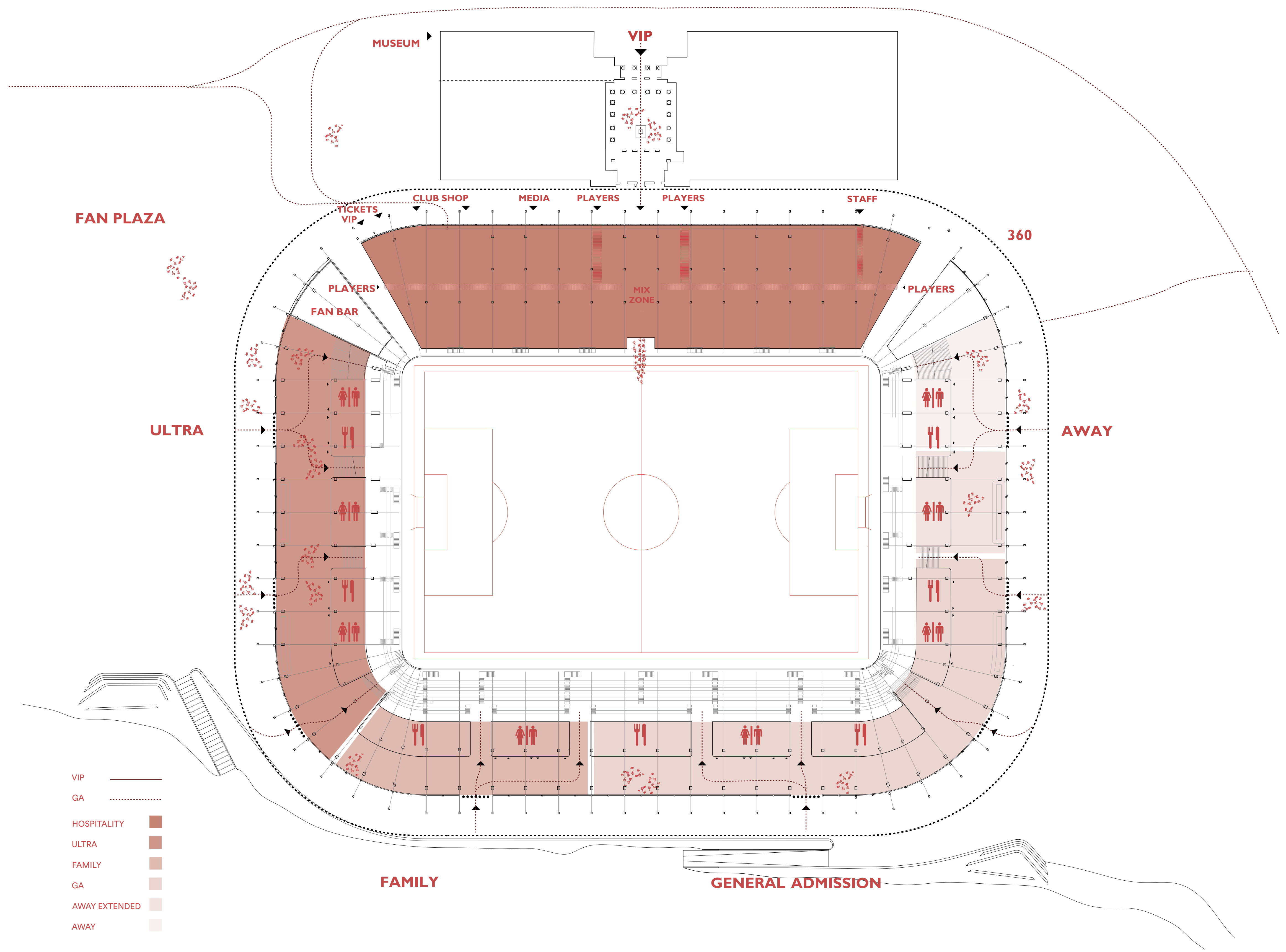
The outer perimeter of the concourse is reduced, enhancing the sense of closeness and unity when spectators move from the fan plaza to the concourse.

The façade is pushed in, outlining a flexible area that can be utilized to extend the concourse in the future by simply pulling the façade out. At the same time, it provides a covered area outside. Following the sloping landscape outside, the concourse continues the natural flow from the fan plaza into the stadium. When fans arrive from the plaza, they gradually move upwards along the accessible sloping concourse, following the existing landscape and reaching the height of the vomitory, where they can look down into the pitch.

The interior of the concourse has natural colours, forming a harmonious and calming ambience. AGF's characteristic white colours is prevalent, balanced by the grey asphalt deck and contrasted with blue details symbolising confidence and serenity. Shops and bars can be lit up, contributing to an inner light that radiates from the stadium in the evening and creates a warm and inviting glow in the clearing.

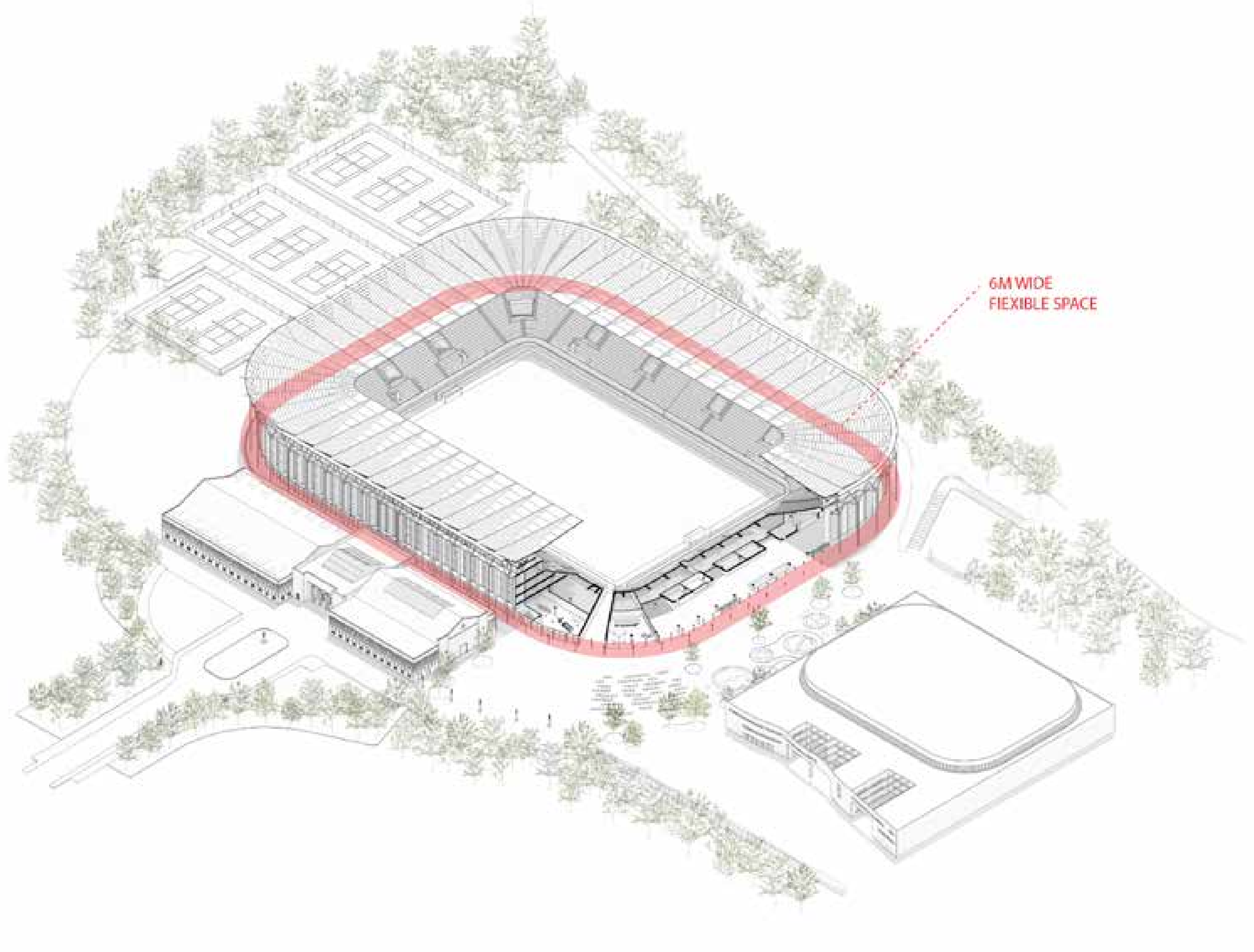
View western concourse

FLOW & ARRIVAL

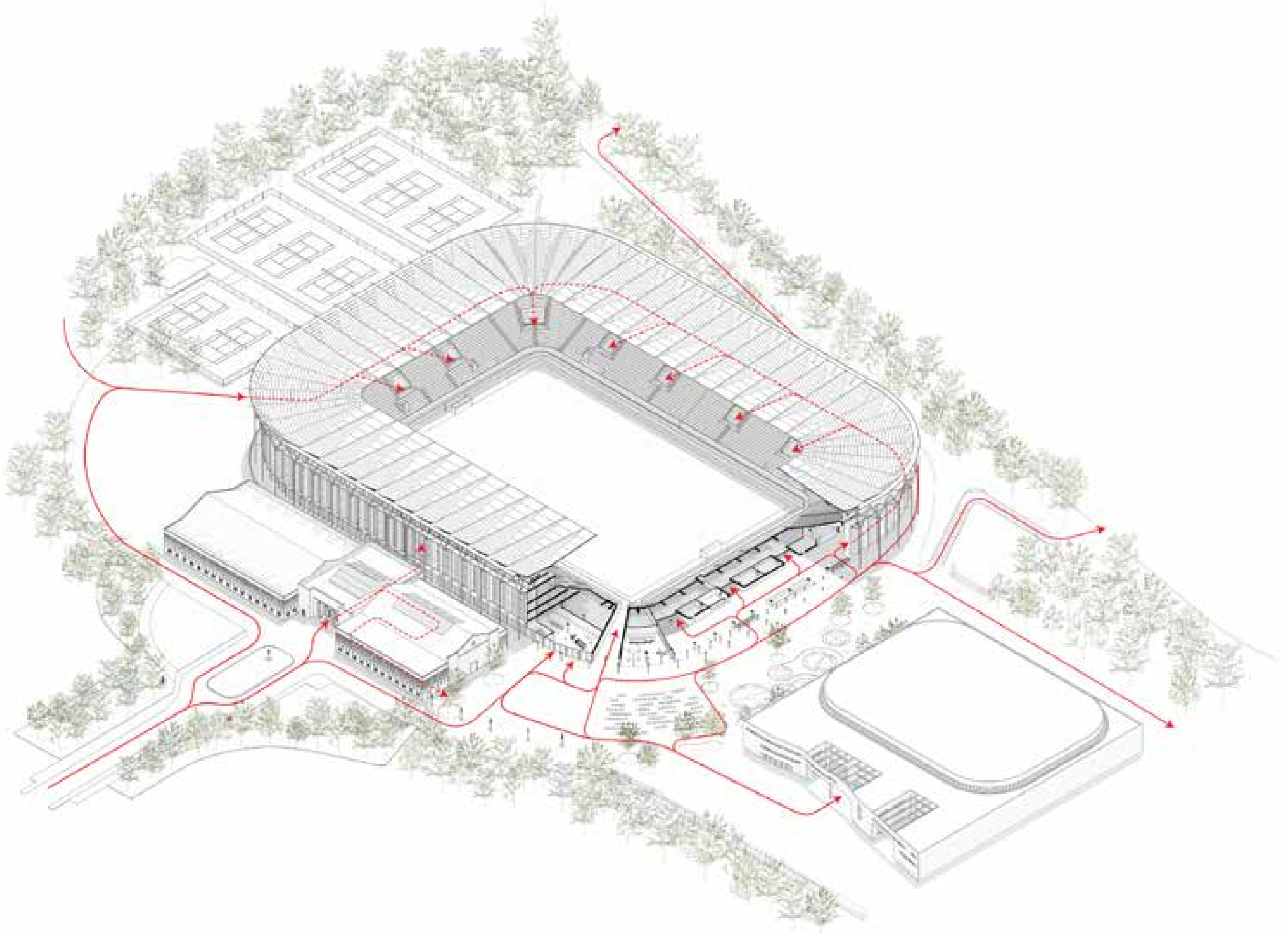


FAN PLAZA

MATCHDAY



6 M PERIMETER

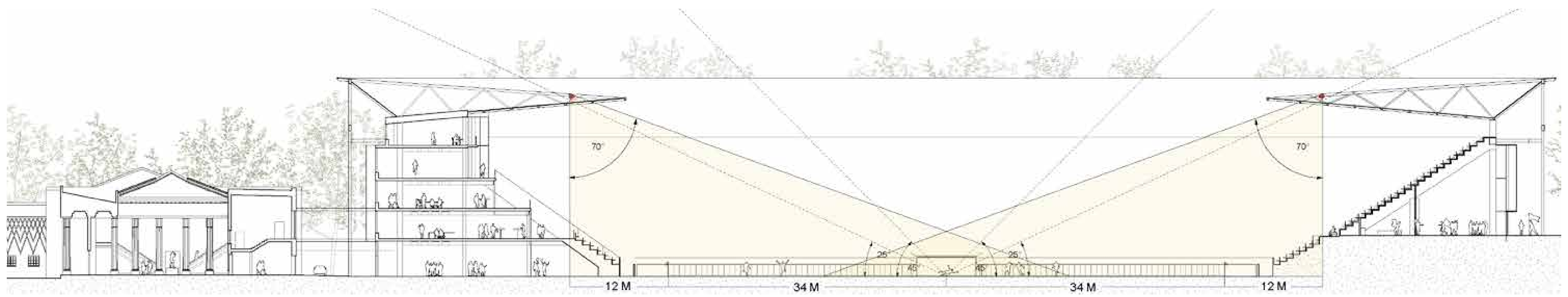


FLOW AND ARRIVAL

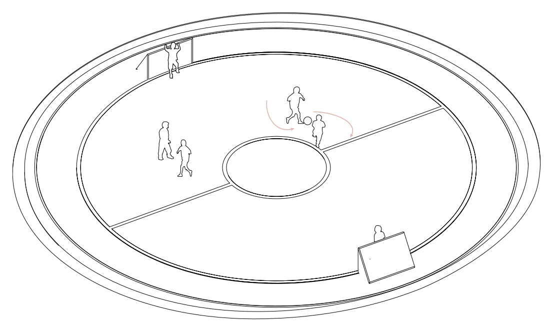
VIP

GA

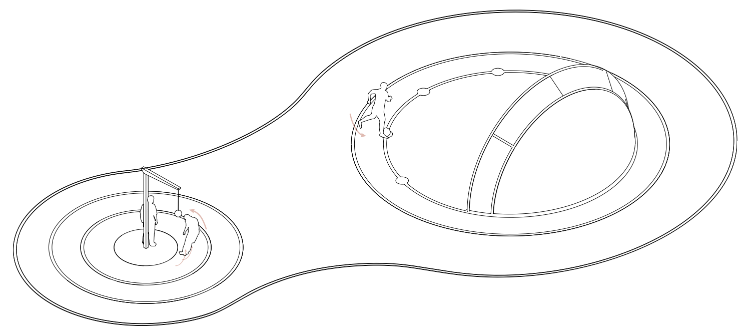
FLOOD LIGHTS IN RELATION TO UEFA REQUIERMENTS



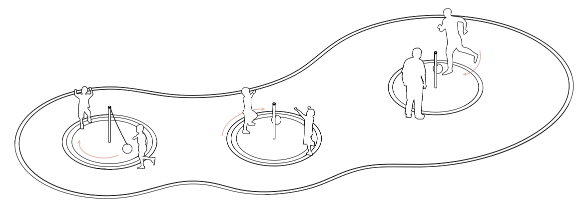
SPORTS PARK ACTIVITIES



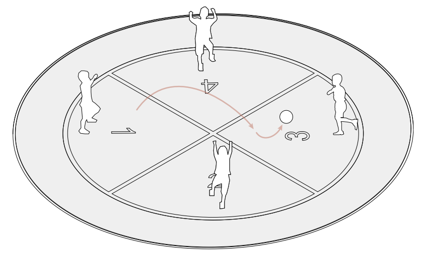
MINI PITCH



SKILLS GAME

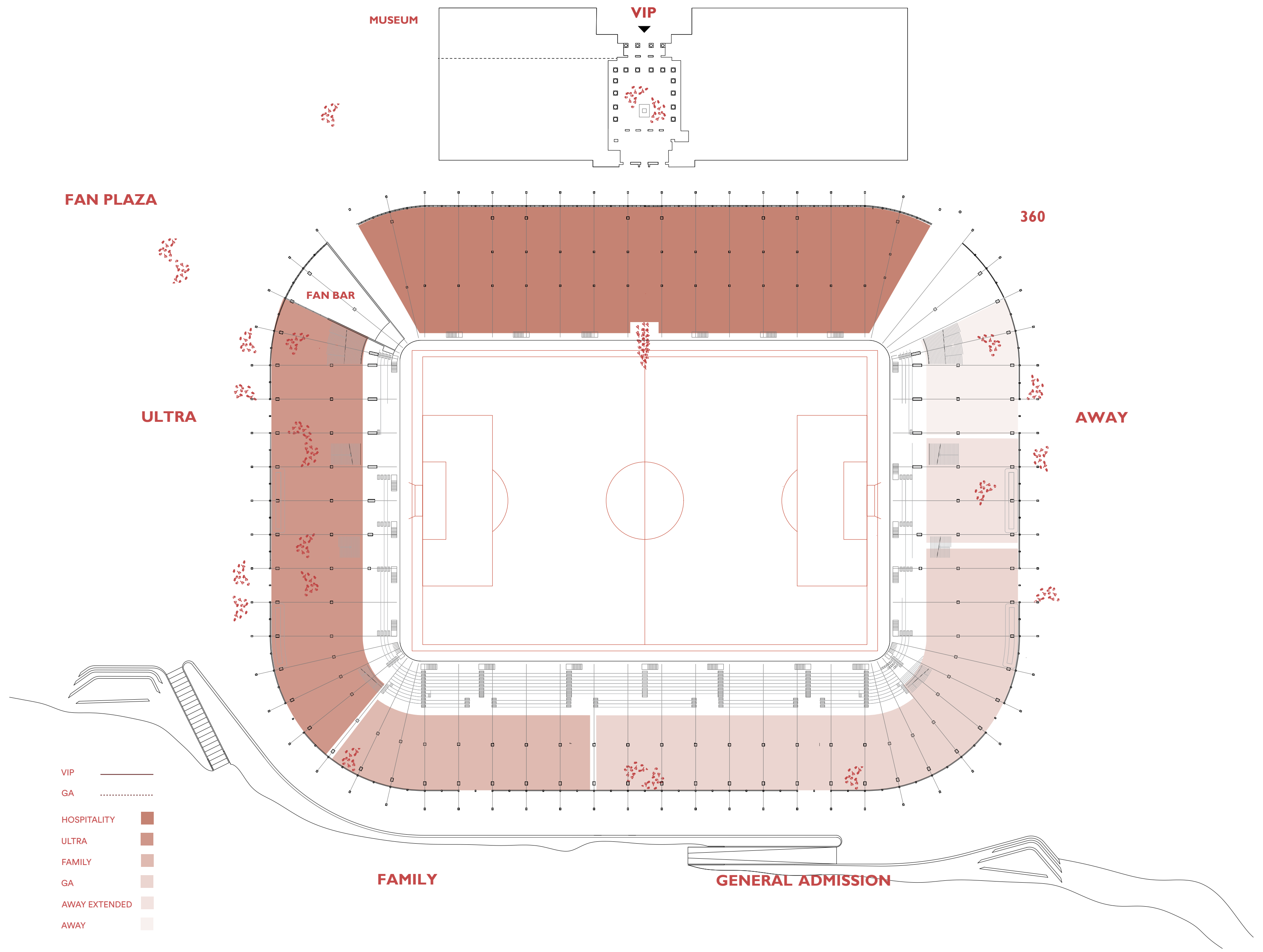


TETHER BALL



FOUR SQUARE

CONCOURSE EXPRESSIONS

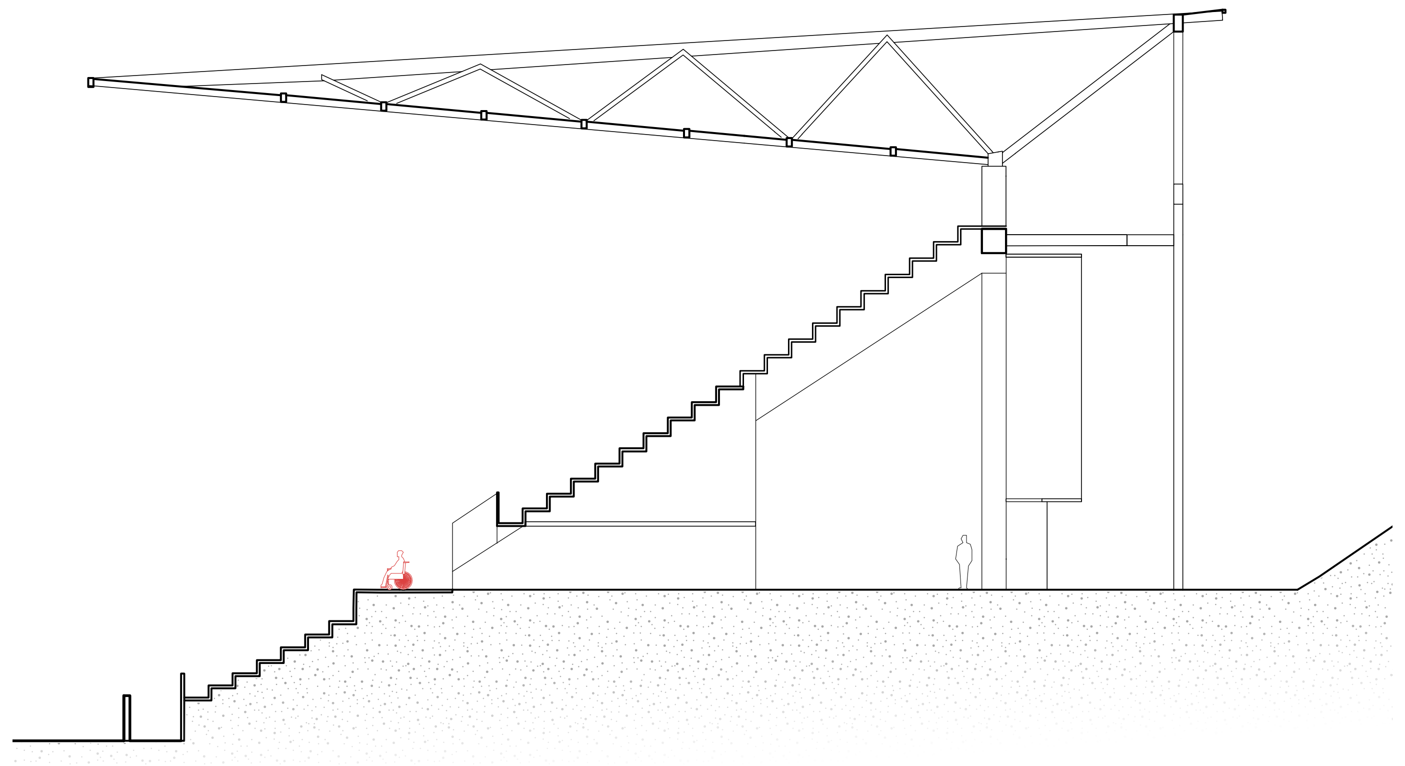


ULTRA

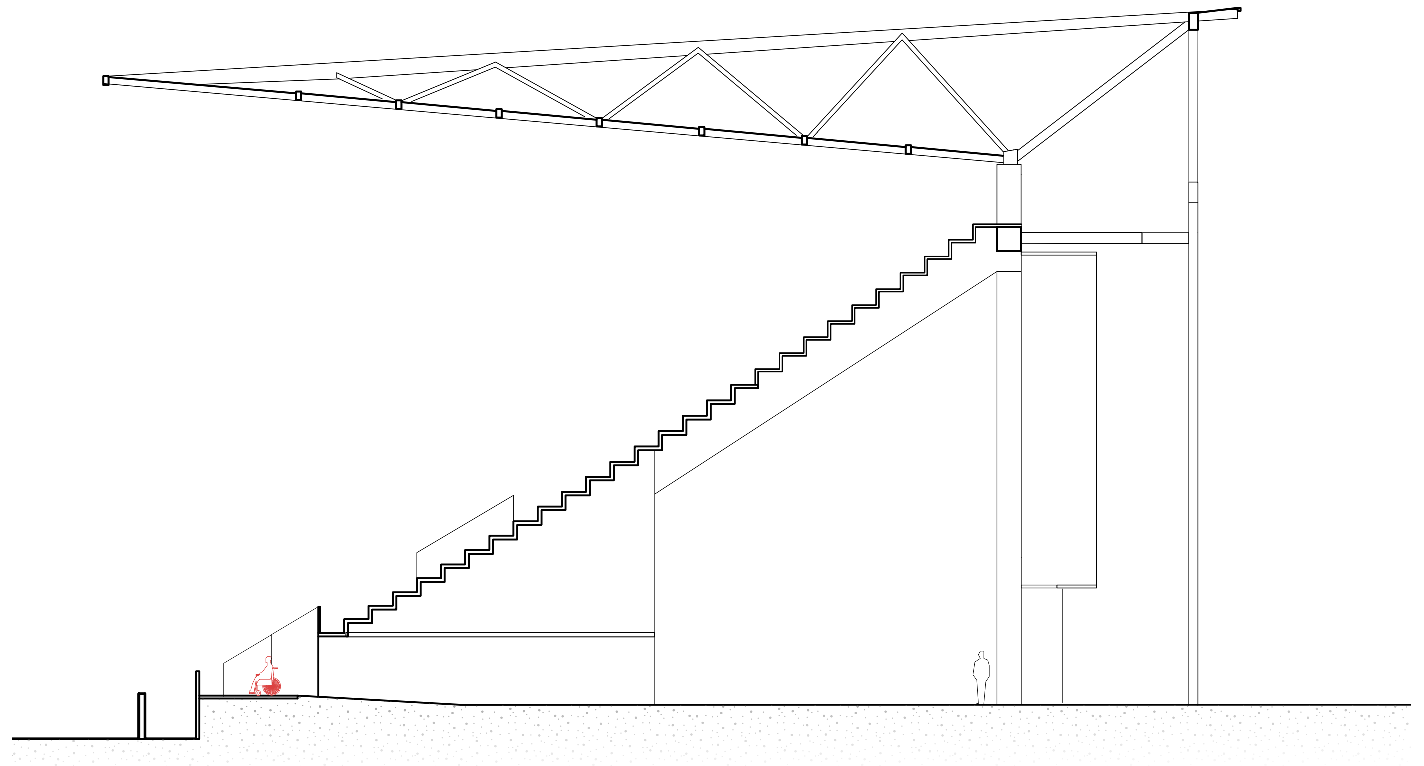
FAMILY

GA

ACCESSIBILITY



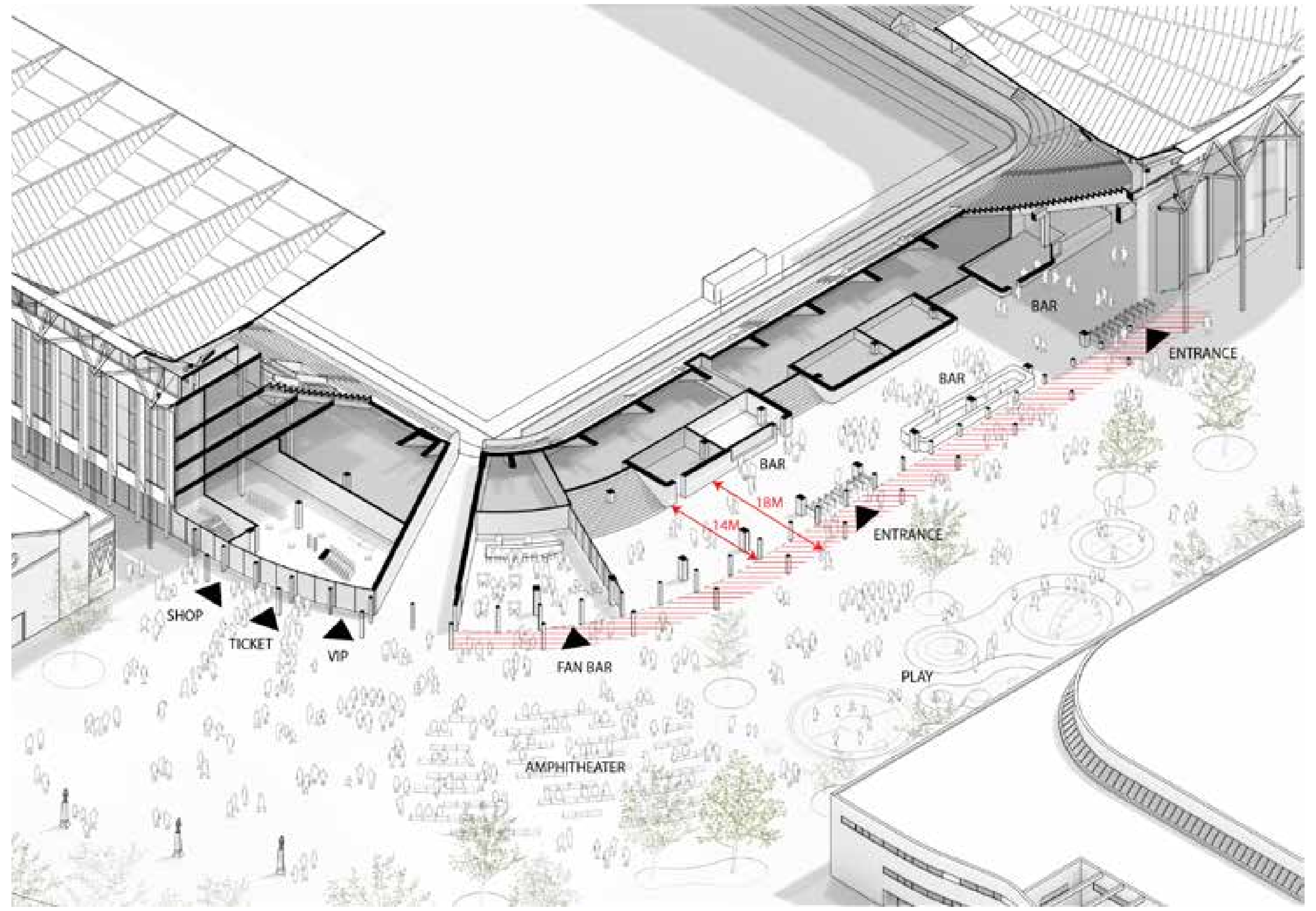
+ 3M SOUTH STAND THROUGH OPENING



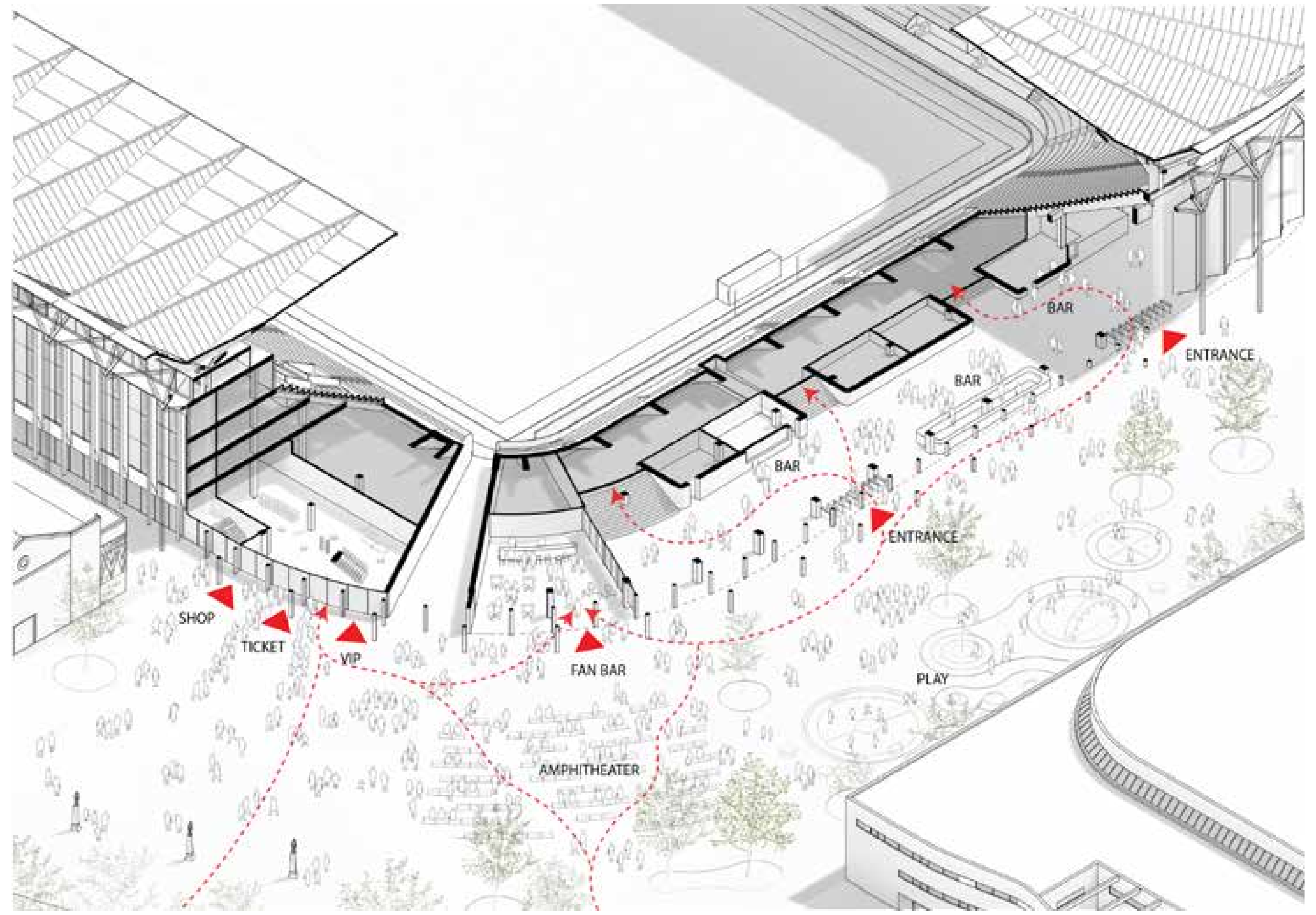
+ 0.5M WEST STAND

FAN PLAZA

MATCHDAY



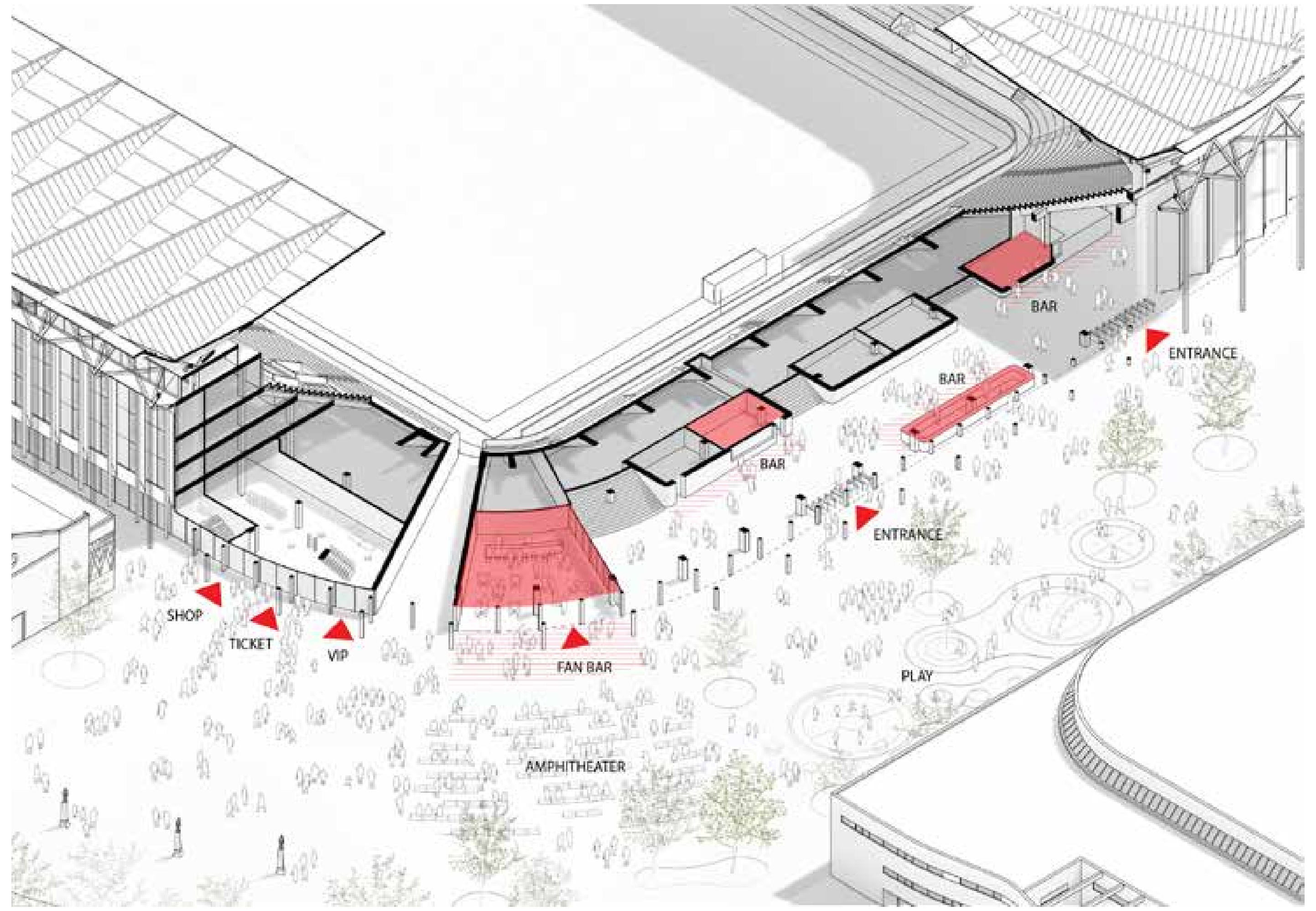
POSSIBLE FUTURE EXTENSION OF CONCOURSE



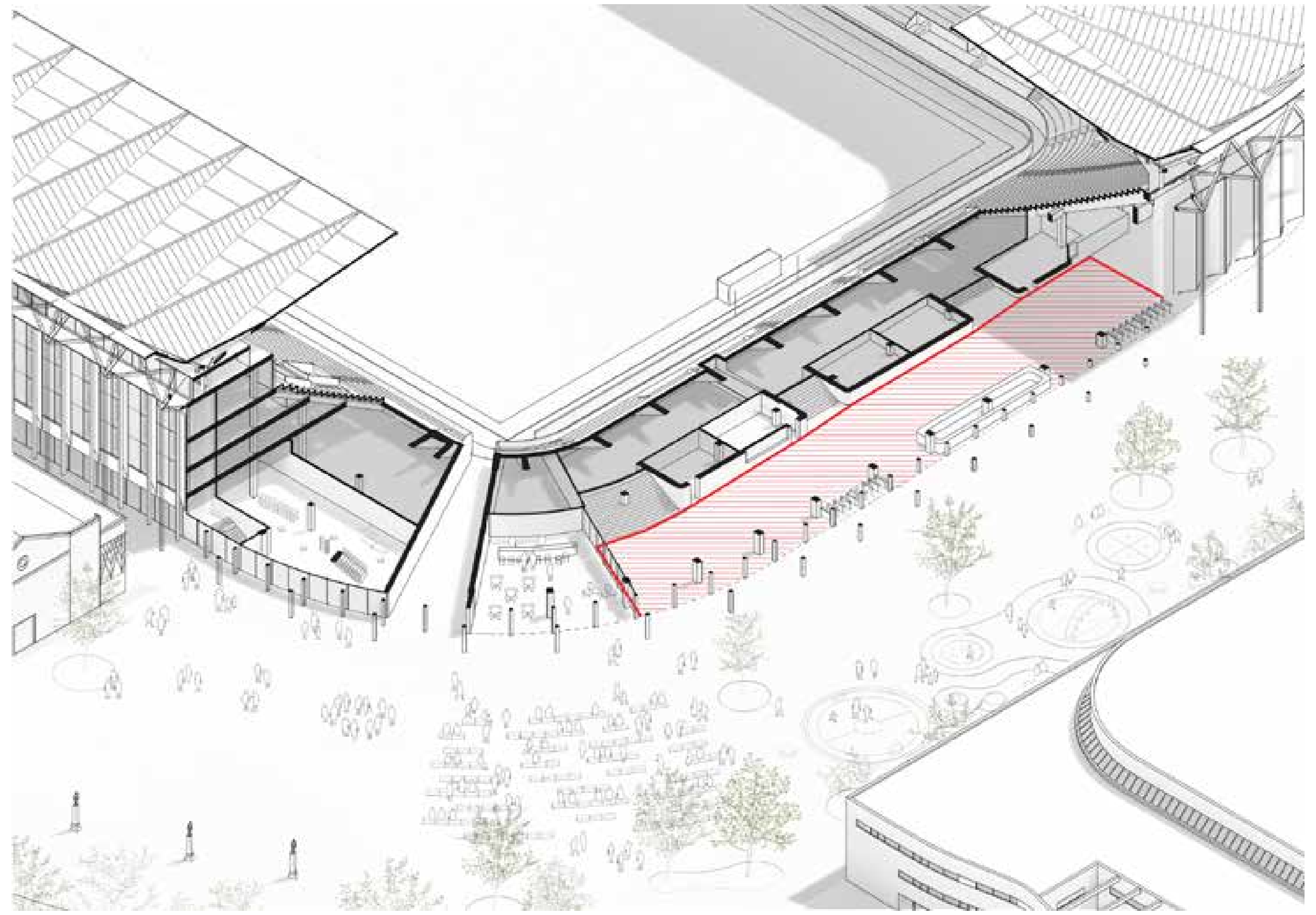
ENTRANCES AND FLOW

FAN PLAZA

MATCHDAY



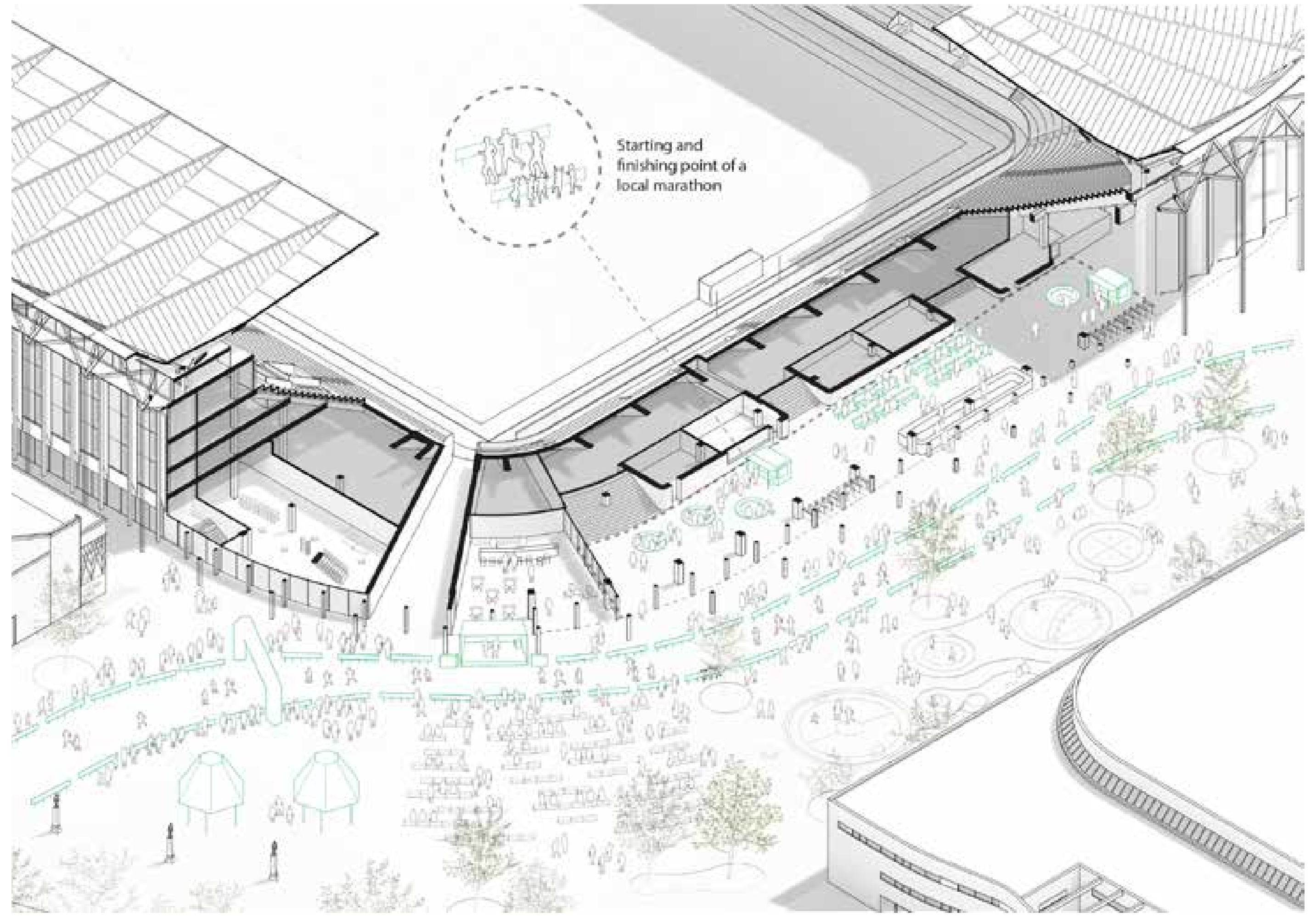
LOCATION OF BARS



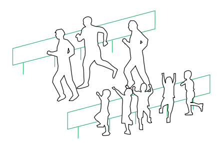
PART OF THE CONCOURSE THAT CAN BE OPEN ON NON MATCHDAYS FOR THE PUBLIC IN A SECURE WAY

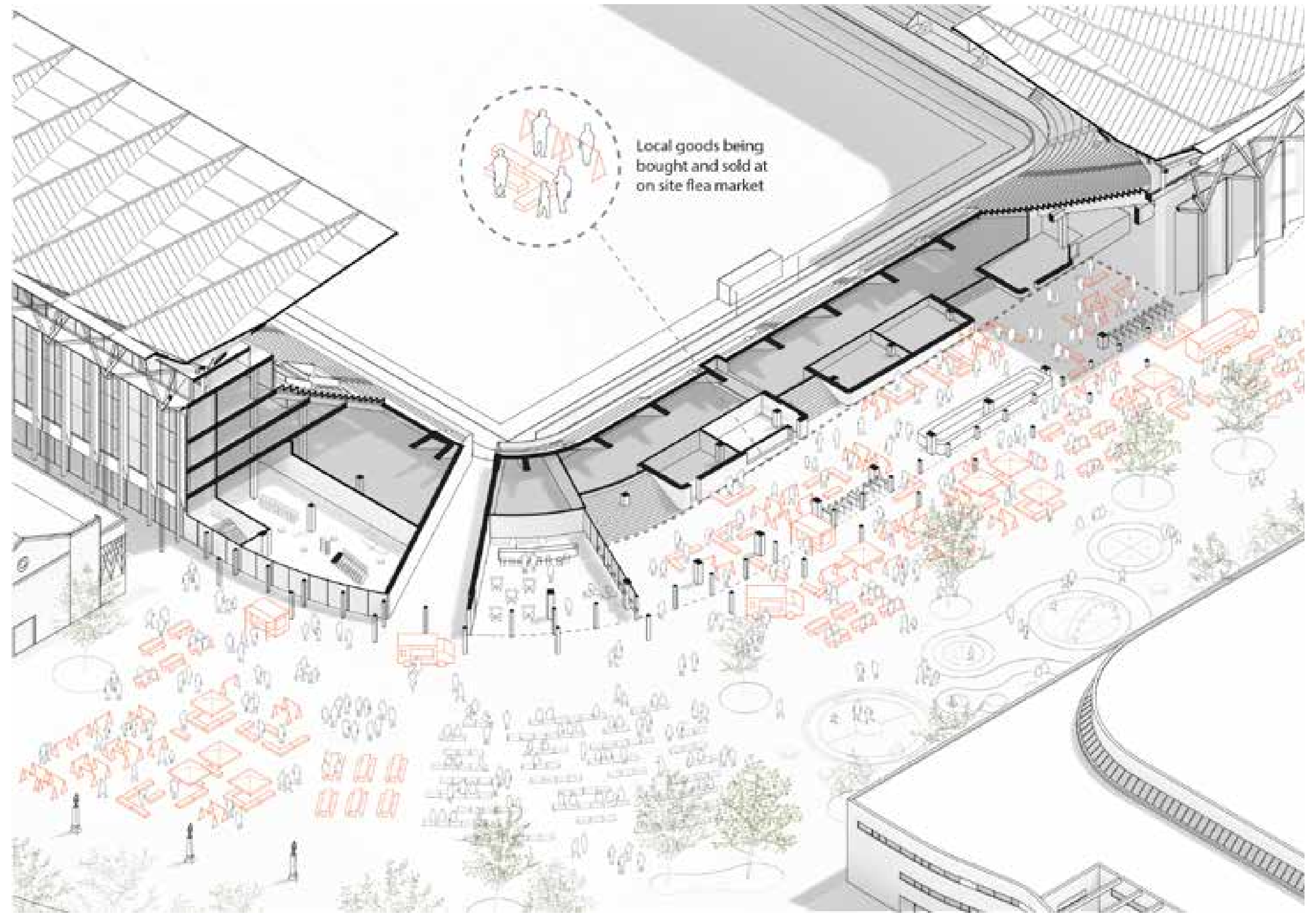
FAN PLAZA

EXAMPELS OF NON-MATCHDAY ACTIVITIES

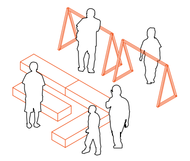


STARTING POINT FOR BESTSELLER AARHUS CITY HALFMARTHON



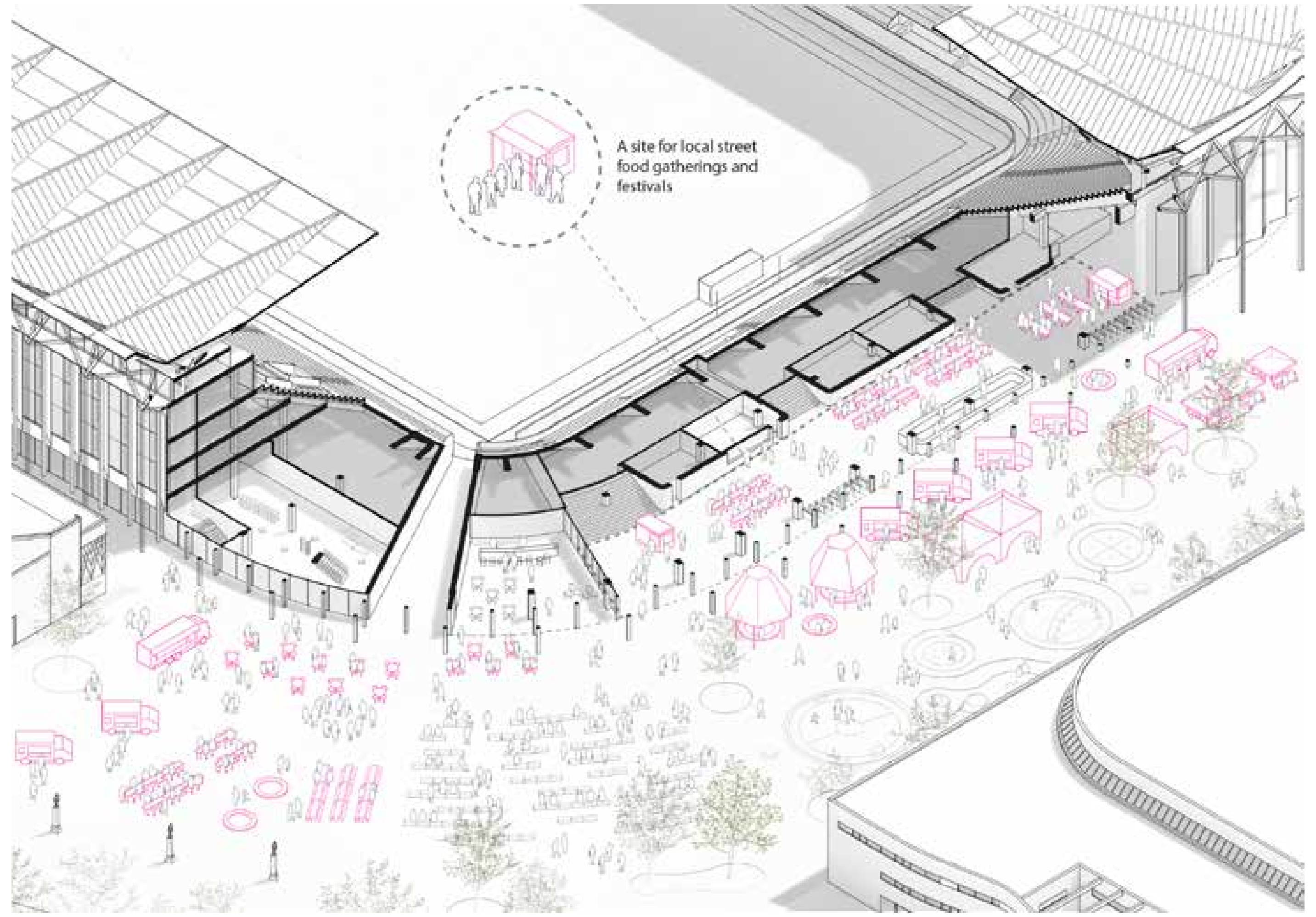


FLEA MARKET AT THE STADIUM

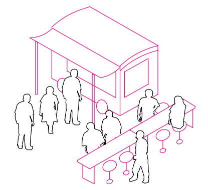


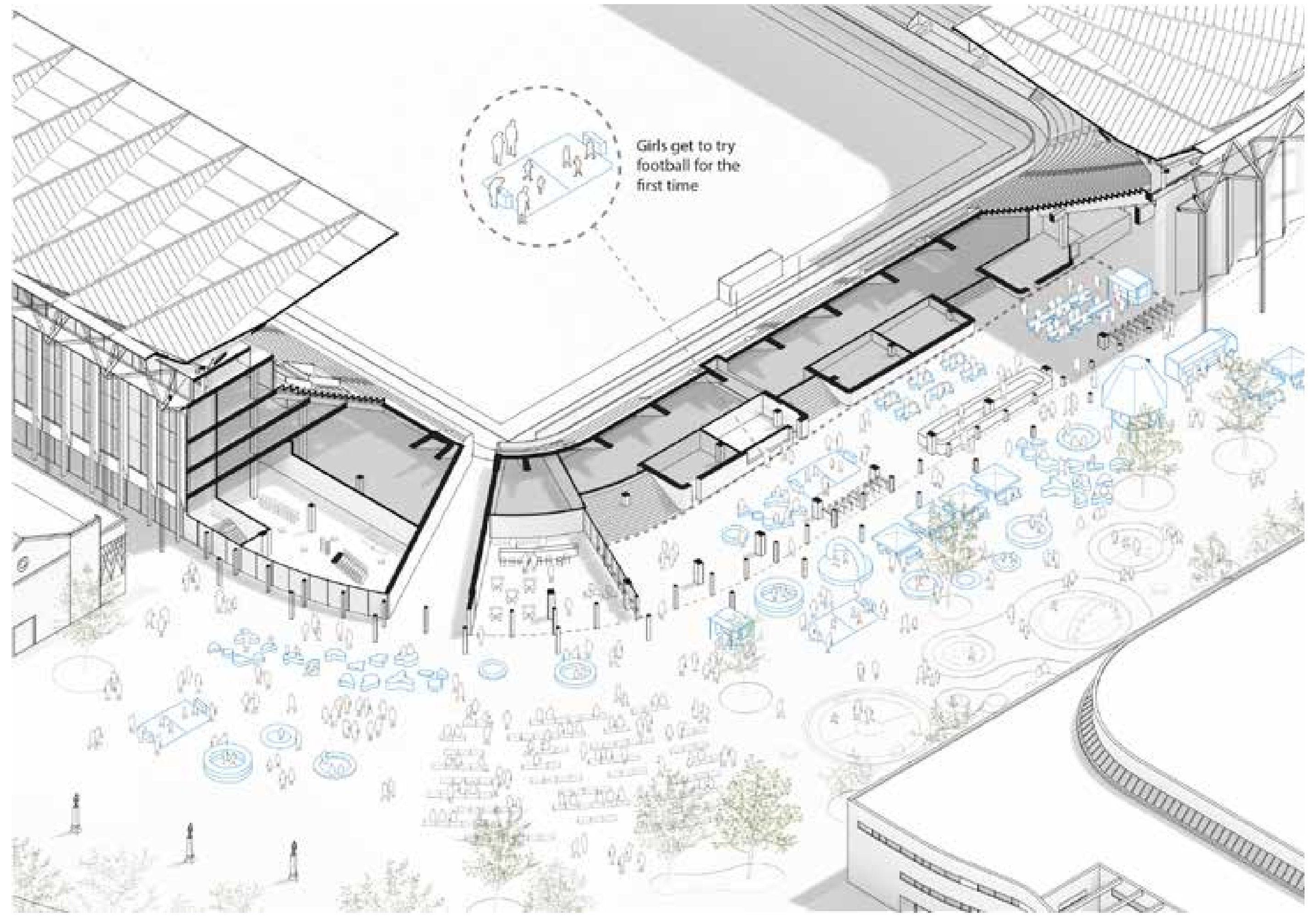
FAN PLAZA

EXAMPELS OF NON-MATCHDAY ACTIVITIES

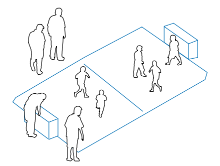


“SMAG PÅ AARHUS” IN KONGELUNDEN



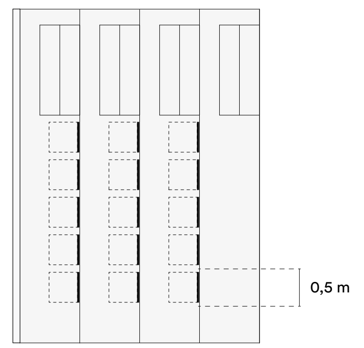


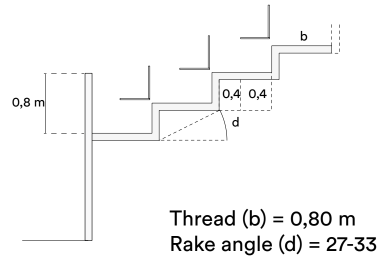
FOOTBALL FOR YOUNG GIRLS EVENT



FUTURE EXPANSIONS

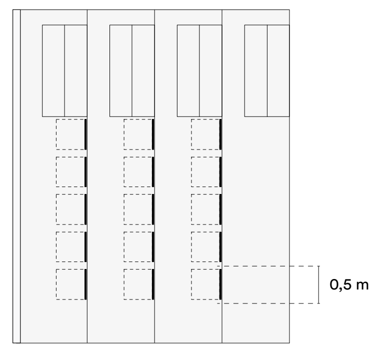
GENERAL ADMISSION

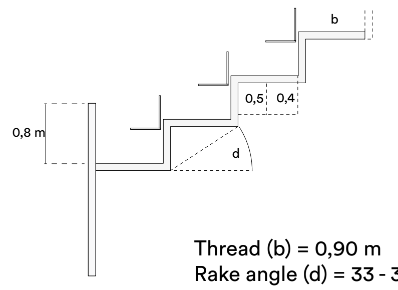




Thread (b) = 0,80 m
Rake angle (d) = 27-33°

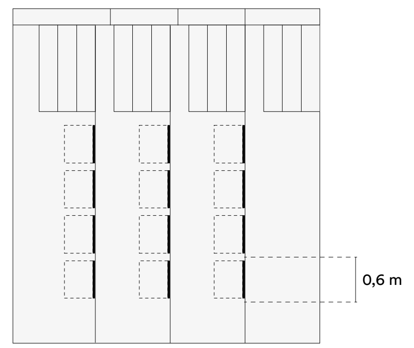
BRONZE

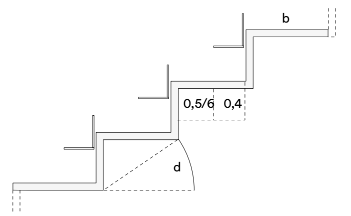




Thread (b) = 0,90 m
Rake angle (d) = 33 - 34°

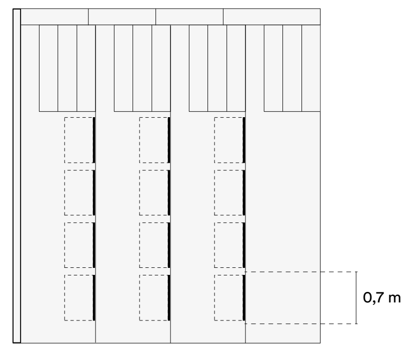
SILVER

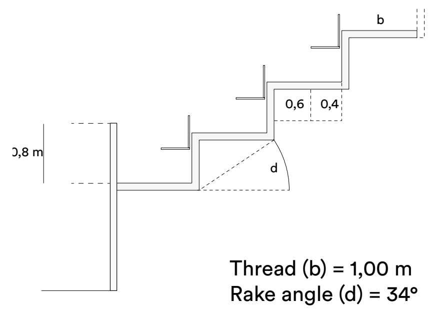




Thread (b) = 0,90 / 1,00 m
Rake angle (d) = 28 - 34°

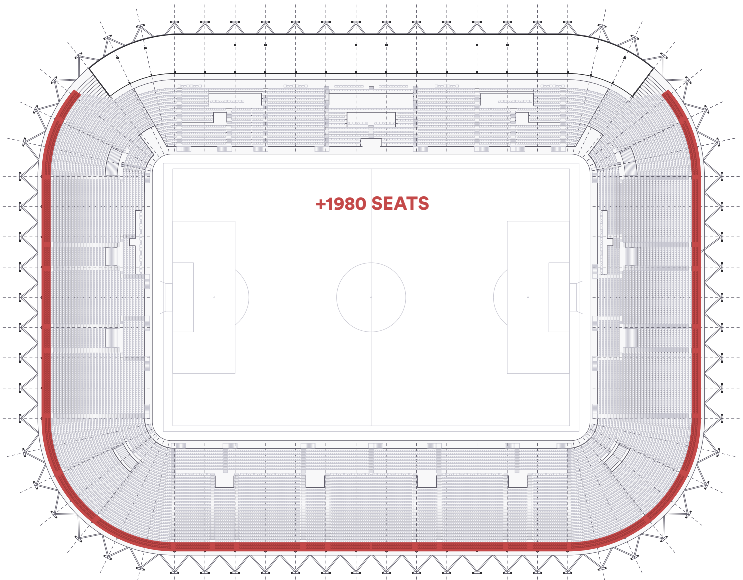
GOLD



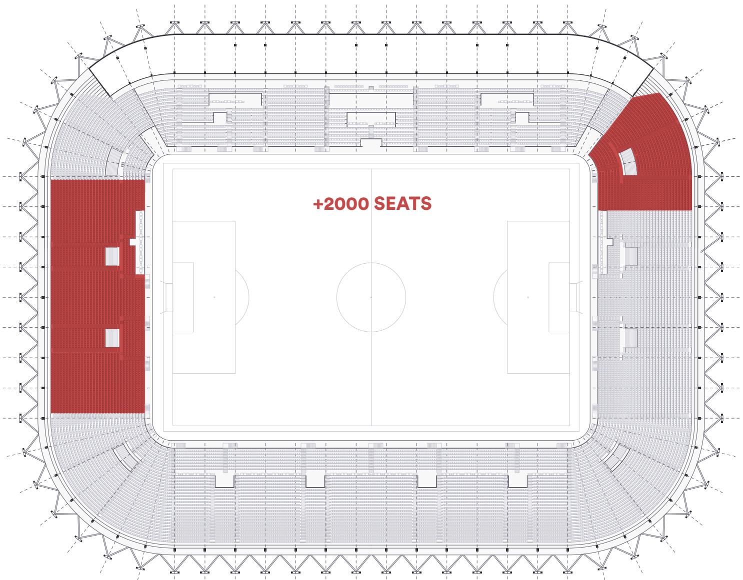


Thread (b) = 1,00 m
Rake angle (d) = 34°

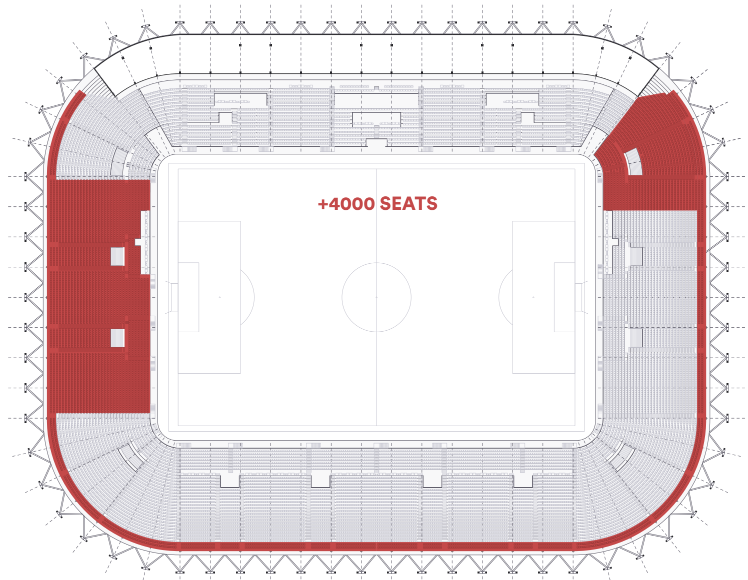
FUTURE EXPANSION 3-EXTRA ROWS



FUTURE EXPANSION STANDING



FUTURE EXPANSION 3-EXTRA ROWS + STANDING



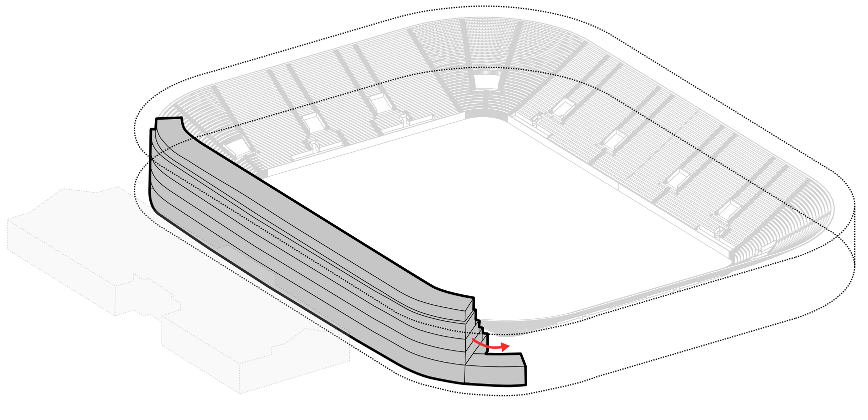
View towards east stand general admission

7. MAIN STAND

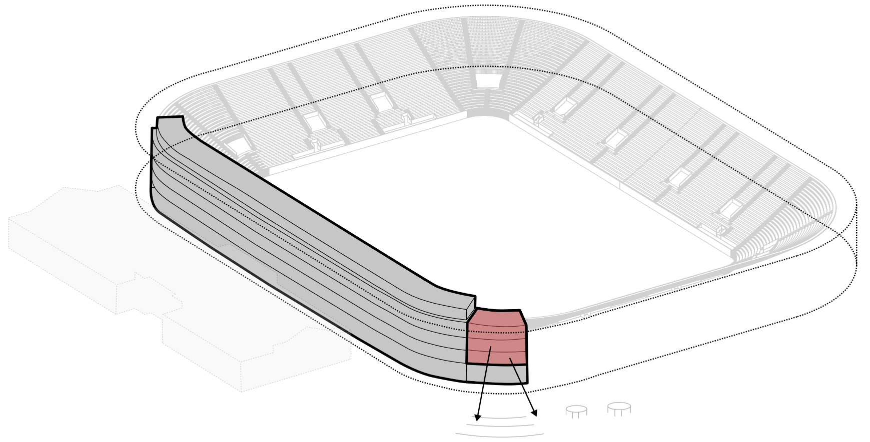
The main stand building is lowered and reduced in size. By elongating the main stand, we establish better visual contact between the fan plaza and VIP areas. The VIP entrance is located on the northwest corner of the fan plaza in close connection to the club shop. With everyone arriving at the fan plaza, it becomes a vibrant, common meeting place for all AGF supporters before and after matches.

In the main stand building, there is access to the players tunnel club on entrance level. Technical spaces, commentator boxes, and TV Studios are located on the top floor with the office's spaces relocated to the first floor on the north-east corner to ensure that the open views to the surroundings and good daylight conditions are preserved.

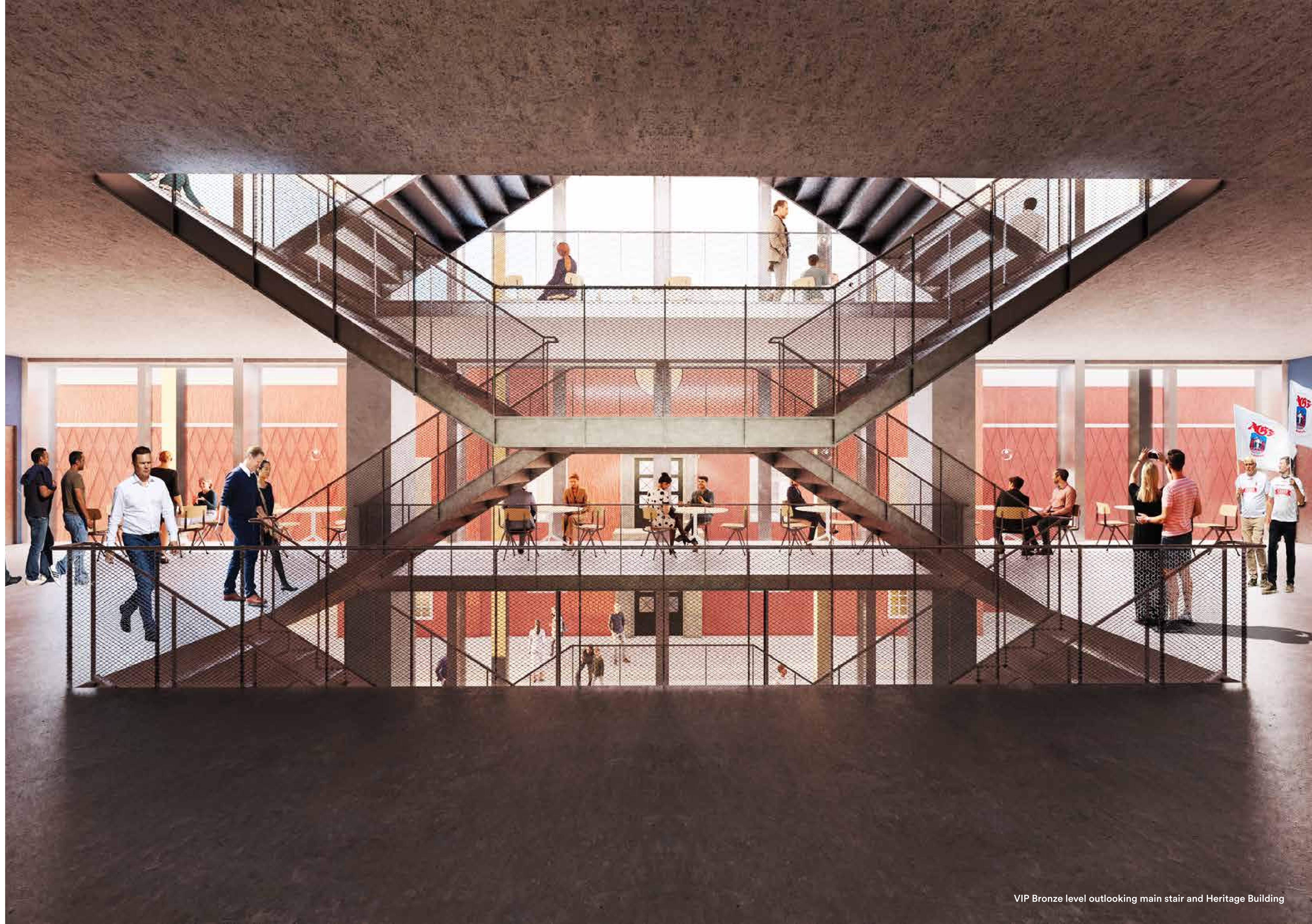
Entering from the fan plaza, a staircase leads visitors up through the VIP levels. In the central axis, the grand open staircase connects all VIP levels and creates a natural connection between each of them. From bronze level, there is direct access to the fan bar which spans over two floors by a mezzanine, allowing VIP members to feel the buzzing atmosphere of the concourse. Following the grand staircase, visitors will reach panoramic views of the pitch on both bronze and silver level. Gold level offers a full panoramic view and provides access to an atrium on the upper level where they can catch rare, behind-the-scenes glimpses from commentator boxes. From the upper level, gold members can reach a balcony with undisturbed views towards Stadion Allé and the city. The large staircase connecting the different VIP levels is located to allow for the Heritage Building to be connected to the new Aarhus Stadium in the future.



EXTENSION OF THE MAIN STAND



BETTER CONNECTION TO THE FAN PLAZA



VIP Bronze level outlooking main stair and Heritage Building

GROUND FLOOR

Scale 1:250

PLAN LEVEL 1

BRONZE

PLAN LEVEL 2

SILVER

Scale 1:250

PLAN LEVEL 3

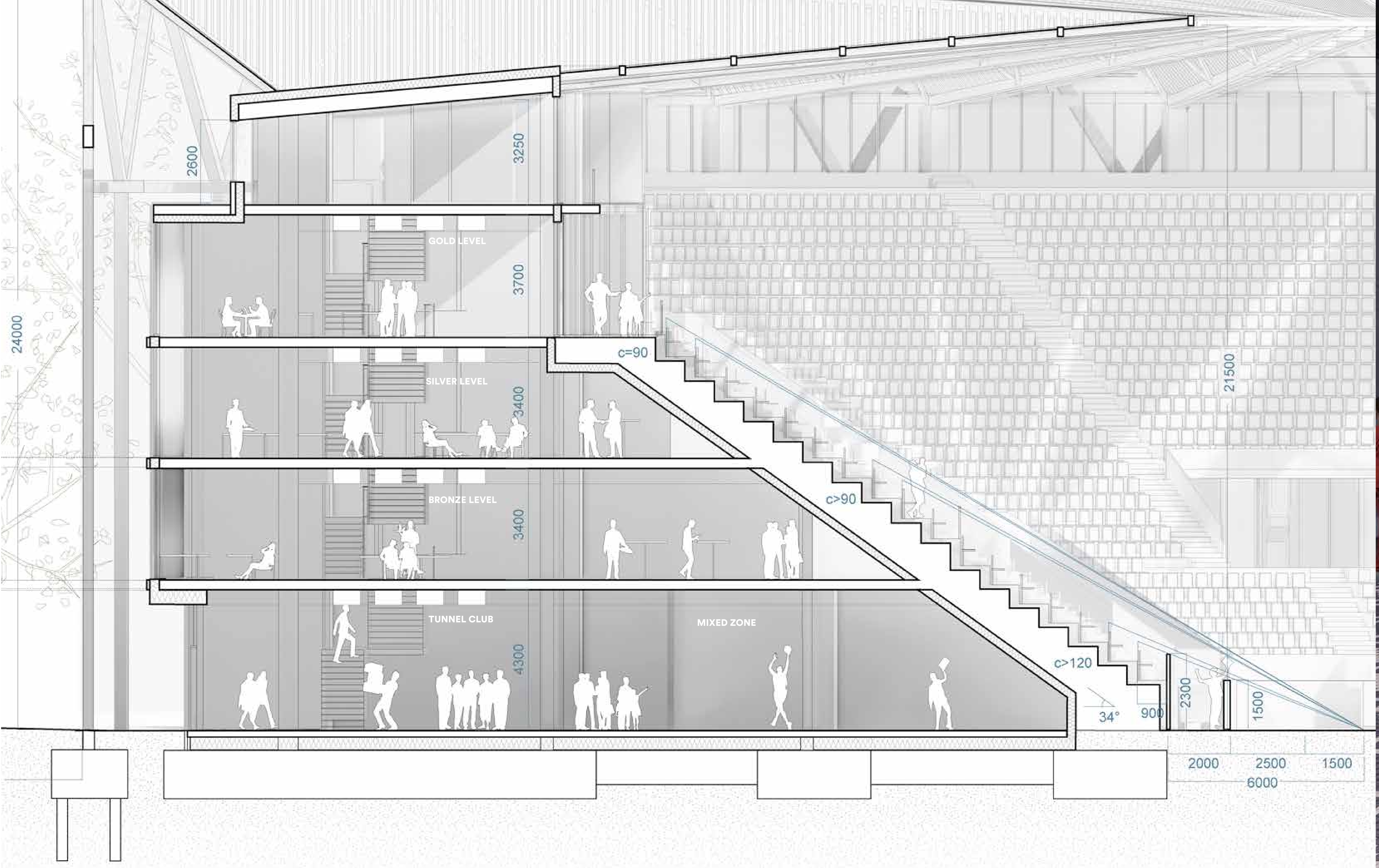
GOLD

Scale 1:250

PLAN LEVEL 4

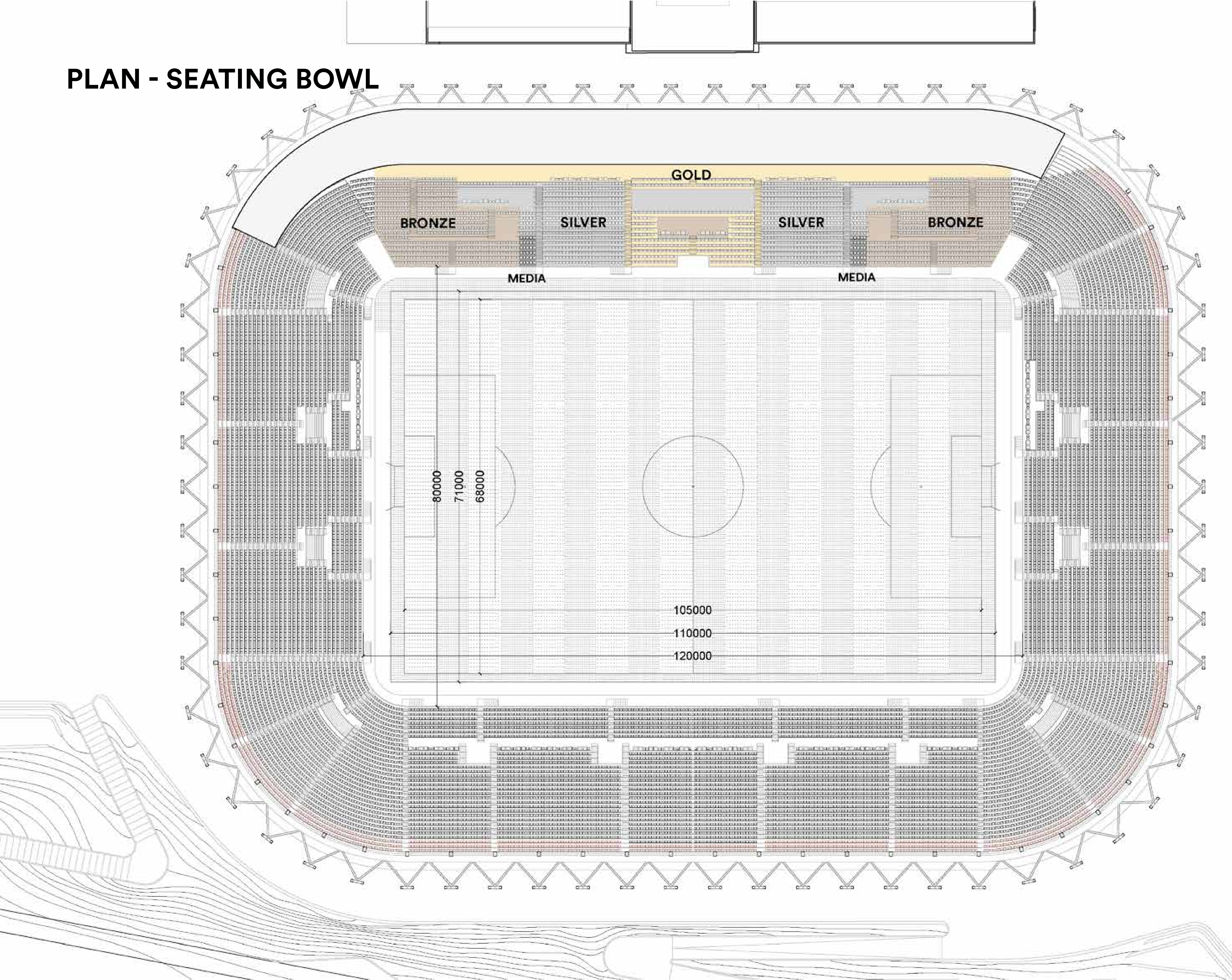
Scale 1:250

SECTION MAINSTAND



Søjlehallen

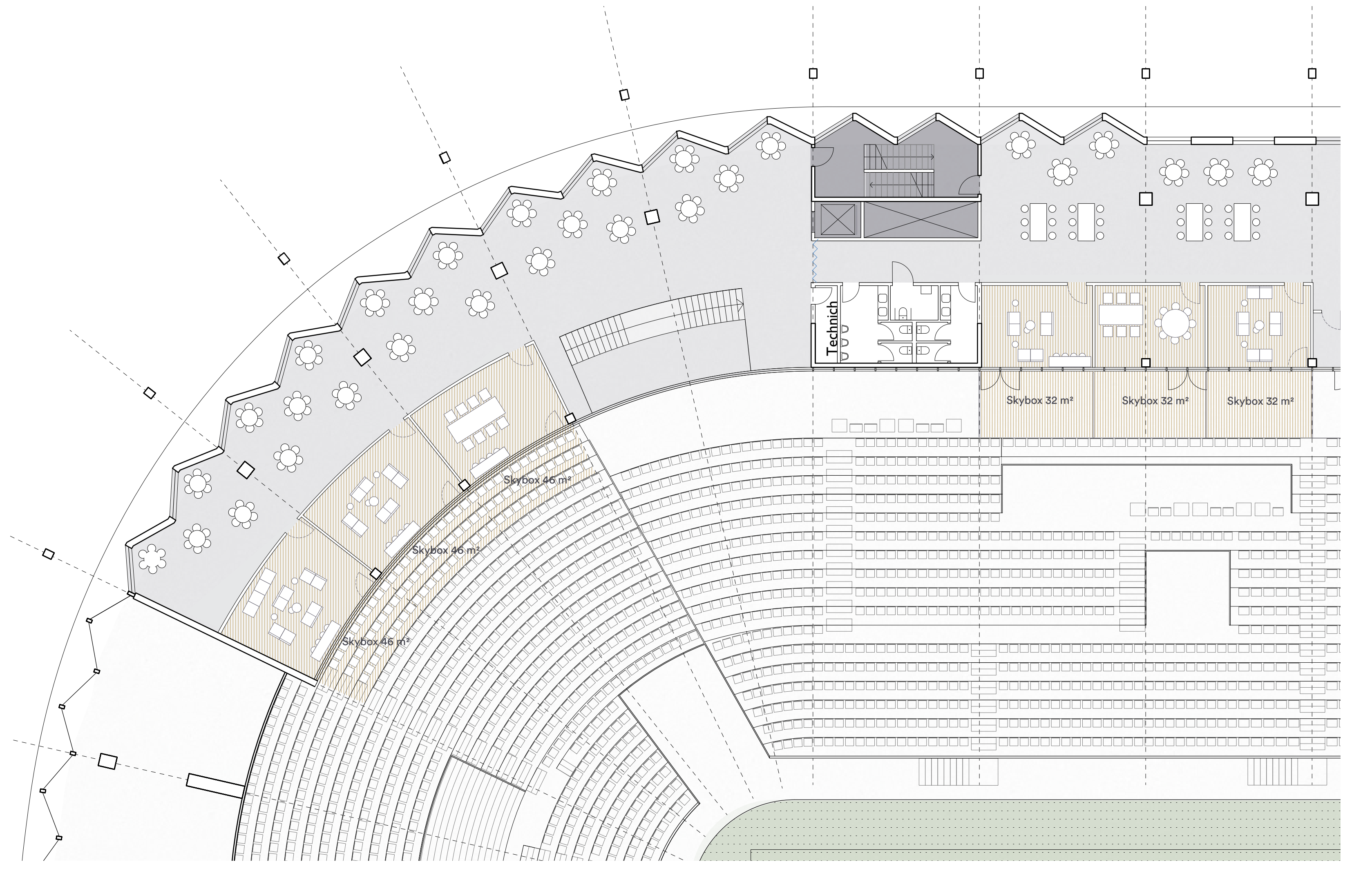
PLAN - SEATING BOWL



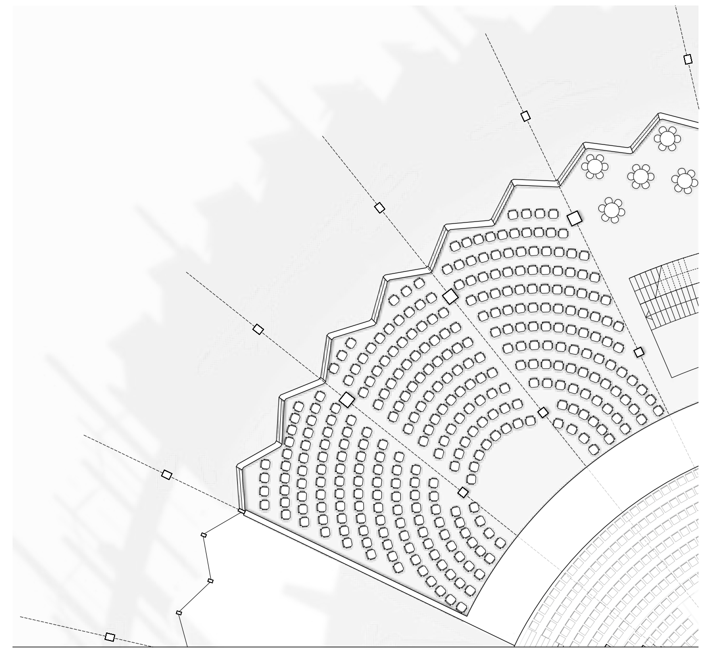
VIP Silver level outlooking main stair and stadium bowl

SKY BOXES AND CONFERENCE SEATING

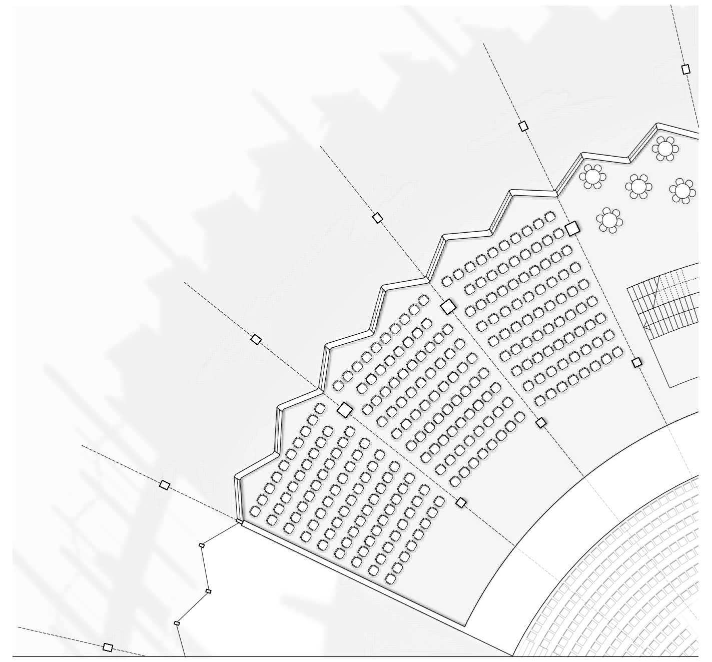
SKY BOXES - GOLD LEVEL



CONFERENCE SEATING - SILVER LEVEL



OPTION A 320 seats



OPTION B 237 seats

VIP ENTRANCE TOWARDS THE FAN PLAZA ON BRONZE LEVEL

VIEW FROM THE WEST CORNER ON GOLD LEVEL

8. MICROCLIMATE

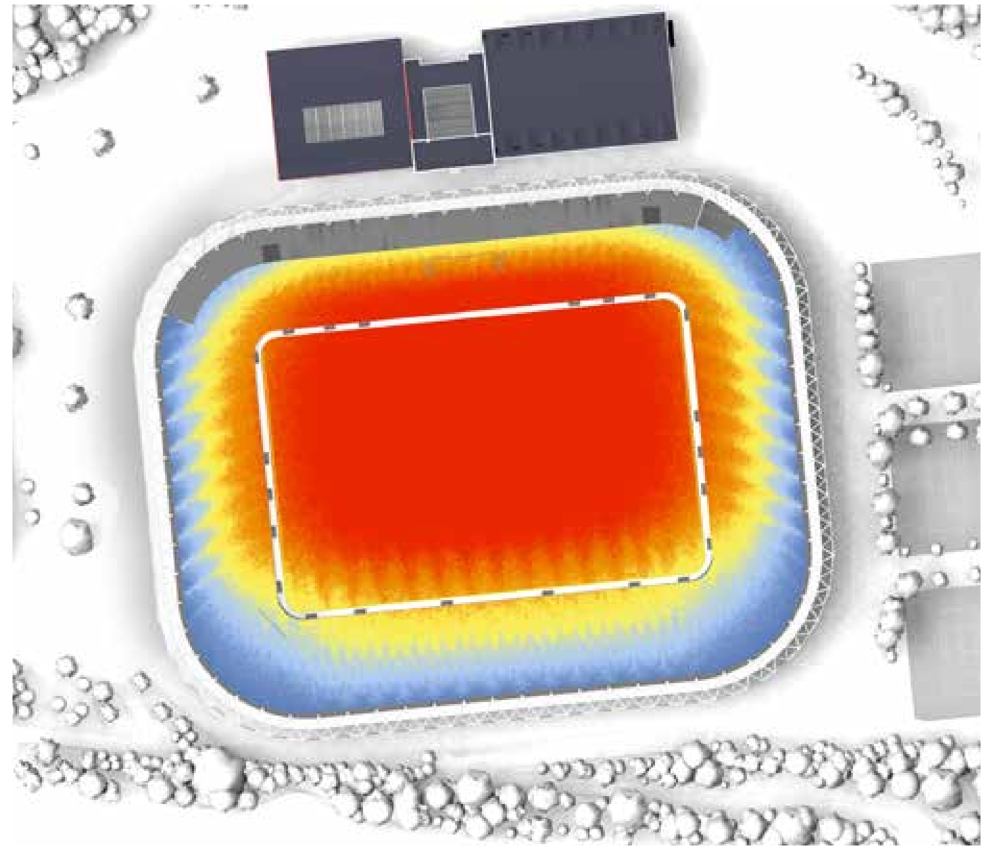
The microclimate concerns the climatic conditions evaluated in a localized area close to the stadium and is paramount to achieve a comfortable spectator experience. The localized climate conditions are strongly affected by the surrounding buildings and height variations in the terrain. To achieve the best spectator experience when visiting the stadium, the microclimatic conditions both surrounding and within the stadium bowl has been considered in the design process, with the aim to maximize outdoor comfort in terms of wind and thermal conditions. Furthermore, the growth of the grass on the pitch can be encouraged by the microclimatic conditions.

Analyzing a wind rose based on historical meteorological weather data shows that the prevailing wind direction is from the west. The wind flow around the stadium and surrounding buildings has a major impact at the fan experience when residing at the fan-plaza, concourse, and the stands. In the western part of the site, the existing arena shelters the stadium and breaks the wind to reduce wind speed. Furthermore, strategically placed porous trees can help reduce turbulence.

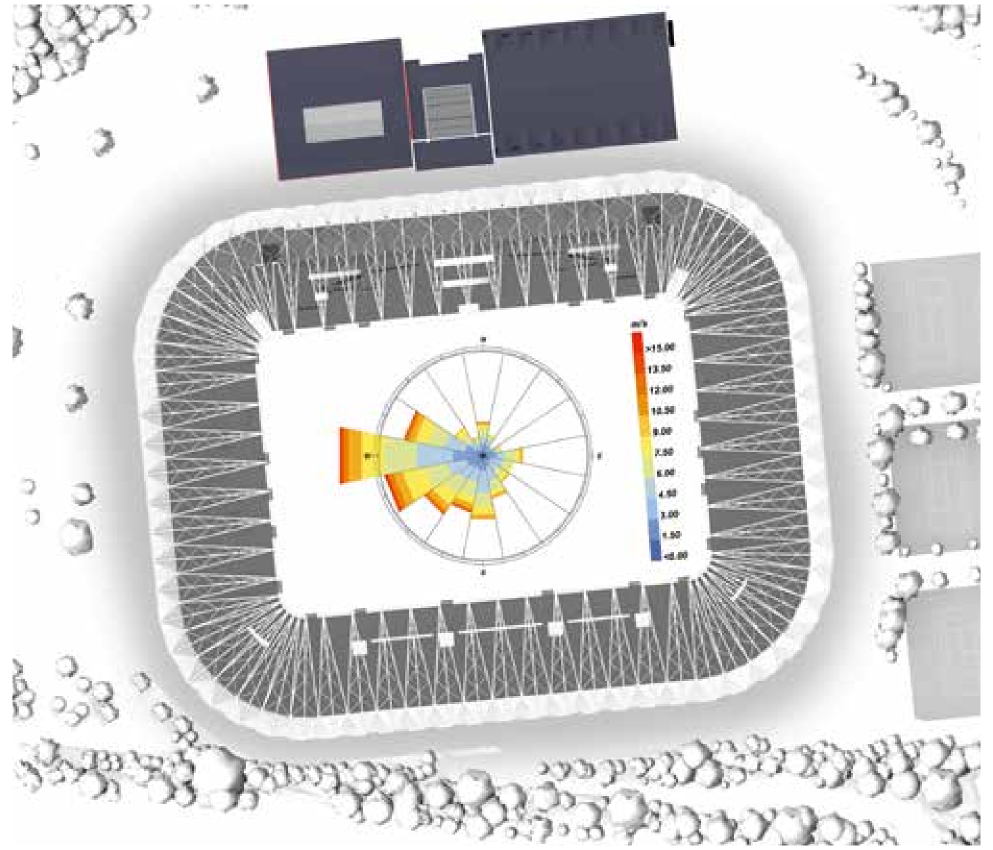
In terms of solar conditions, the objective is to obtain a suitable balance between the amount of the solar radiation on the stands in summer and winter periods, respectively. Simultaneously, ensuring that the solar radiation on the pitch is uniform distributed across the field of play.

To evaluate the solar conditions, initial simulations of the annual solar radiation have been performed on the stand and pitch. The preliminary results show that the solar distribution on the pitch is approximately uniform with minor variations, but no dark areas are observed.

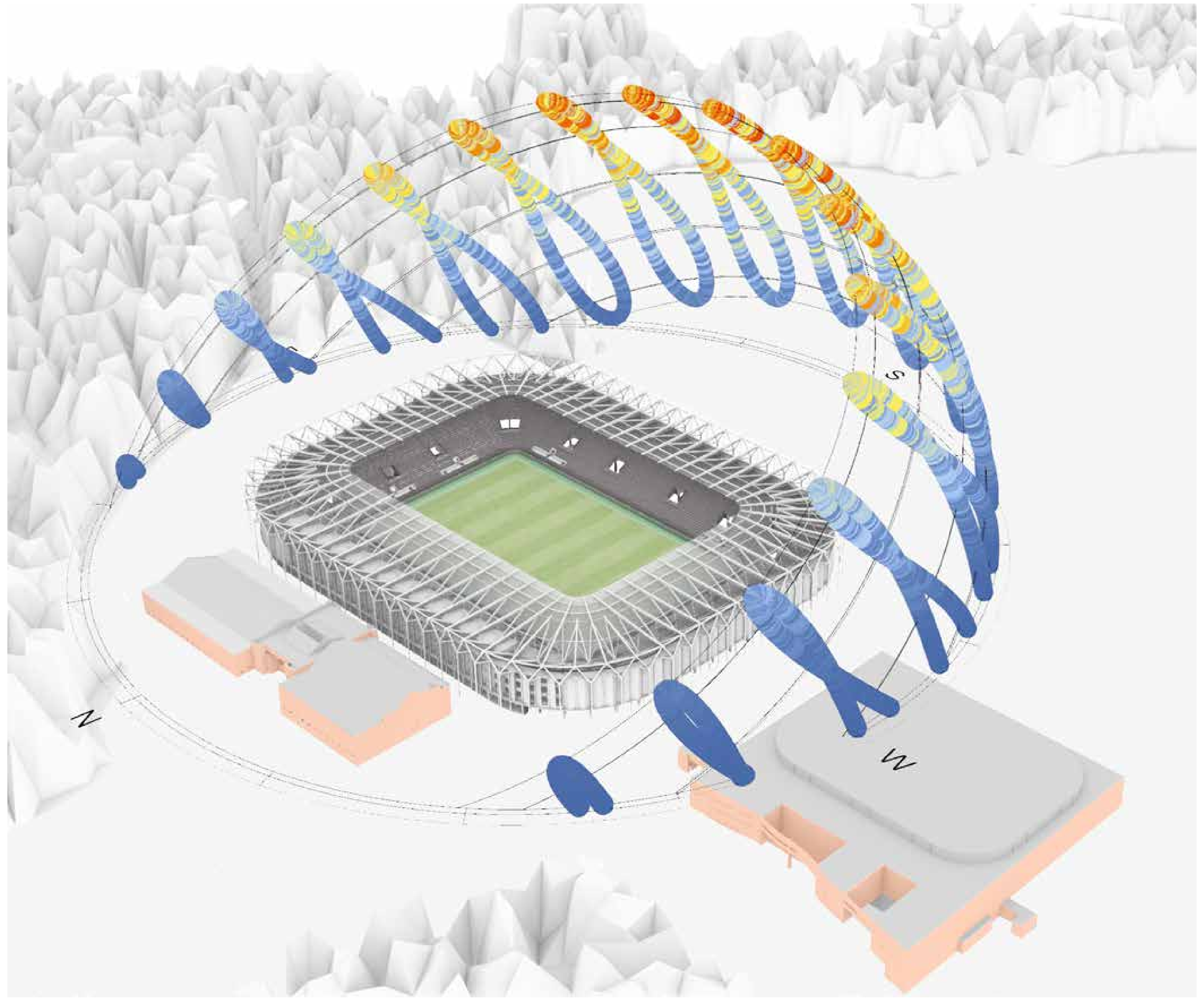
On the stands the distribution of solar radiation differs depending on the orientation and the derived effect of the roof. This is expected due the opaque materials at the top of the stand which ensures an intimate fan experience and benefit the acoustical environment.



Solar radiation



Wind rose



WIND

WIND SIMULATIONS

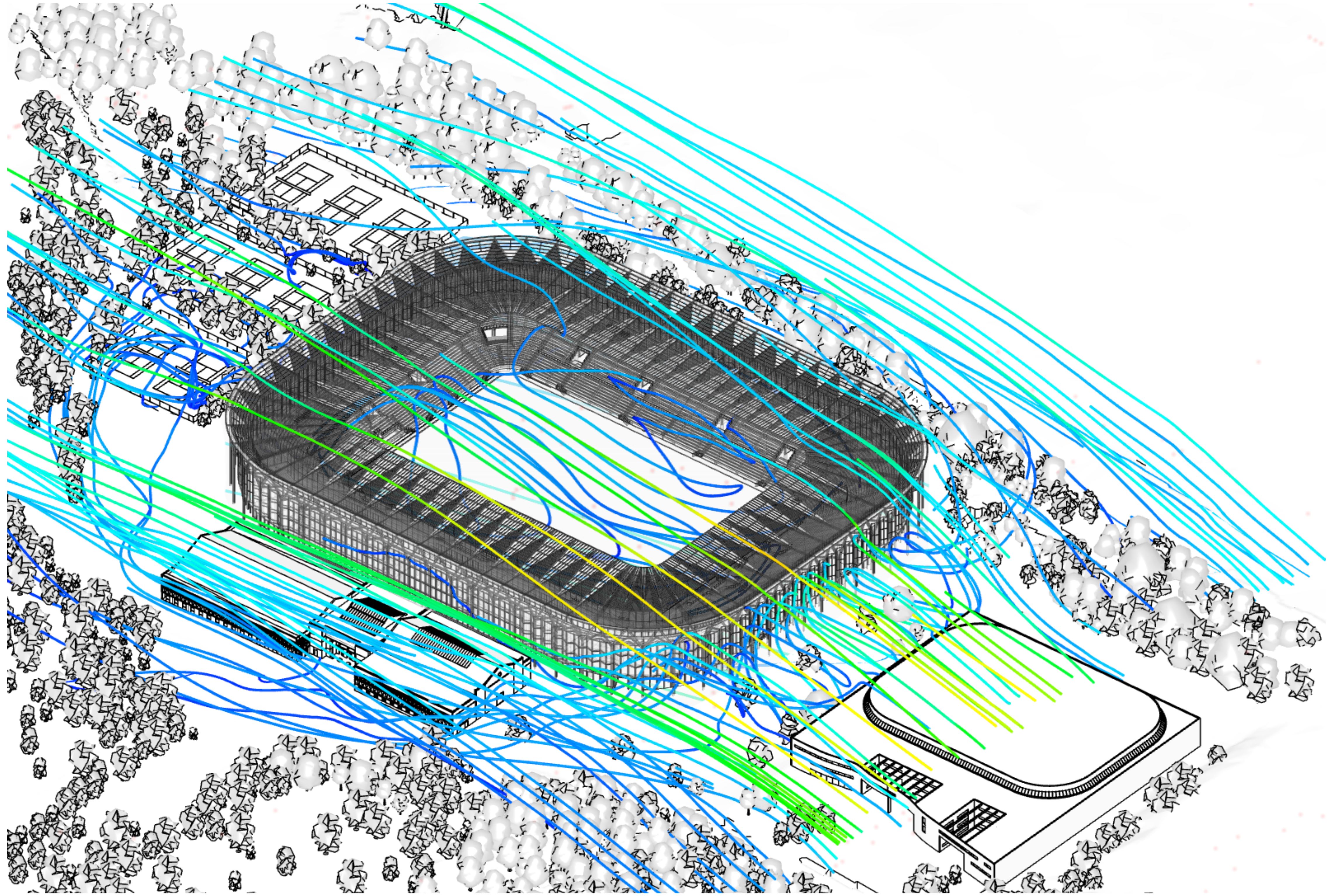
To evaluate the wind comfort at pedestrian level, detailed 3-dimensionel CFD simulations has been carried out using historical weather data considering 16 wind directions. The simulation covers the full project site (wind tunnel size of approx. 1.5km x 1km x 0.4m) considering surrounding buildings, height variations in the terrain and trees. The trees and forest are simulated as porous objects and surfaces, respectively, using standardized data for the leaf index. The objective of the simulations is to evaluate how people experience the differing in wind conditions.

WIND COMFORT CRITERIA

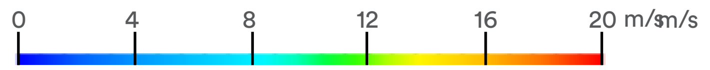
The evaluation of the wind comfort is based on the Lawson LDDC comfort criteria, which describes a threshold value of the wind speed together with a maximum allowable probability of wind speeds exceeding the threshold. The different windspeeds thresholds, as well as the probabilities, describes the level of comfort. The thresholds correspond to an acceptable condition to perform an activity, such as outdoor dining (A) , sitting (B), standing (C) etc.

The exceedance probabilities are determined based on statistical weather data. The evaluation is based on the maximum wind speeds obtained in the simulation. The comfort criteria are determined in a spatial grid on relevant surfaces (the outdoor terrain, within the concourse and at the spectator stands) at a height of 1,5m (standard height).

A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

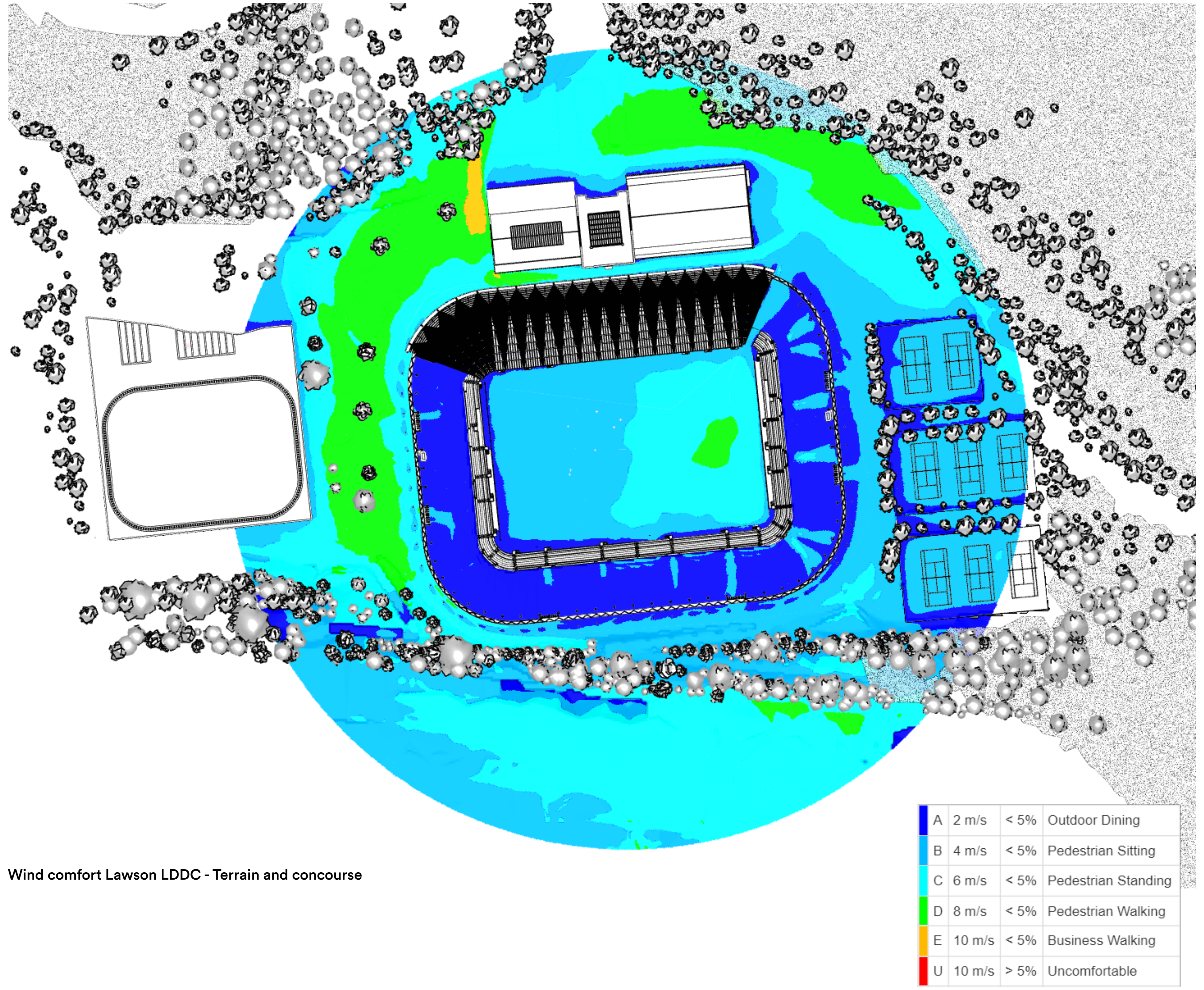


Streamline Velocity Magnitude



WIND COMFORT AT TERRAIN

Statistical simulation results of the wind conditions for the surrounding terrain in proximity to the stadium indicates wind conditions allowing for stays and comfortable walks around the stadium. On the fan plaza and in front of the heritage building, the wind flow is higher thus allow for shorter stays and walks. However, the obtained result for this area is highly dependent on the overall masterplan for the Kongelunden area in term of obstacle objects (for instance buildings, trees etc.) and must be optimized in collaboration with the development of the masterplan project. The wind conditions on the tennis fields are generally calm. In the concourse the wind conditions are generally comfortable allowing for stays of longer duration.

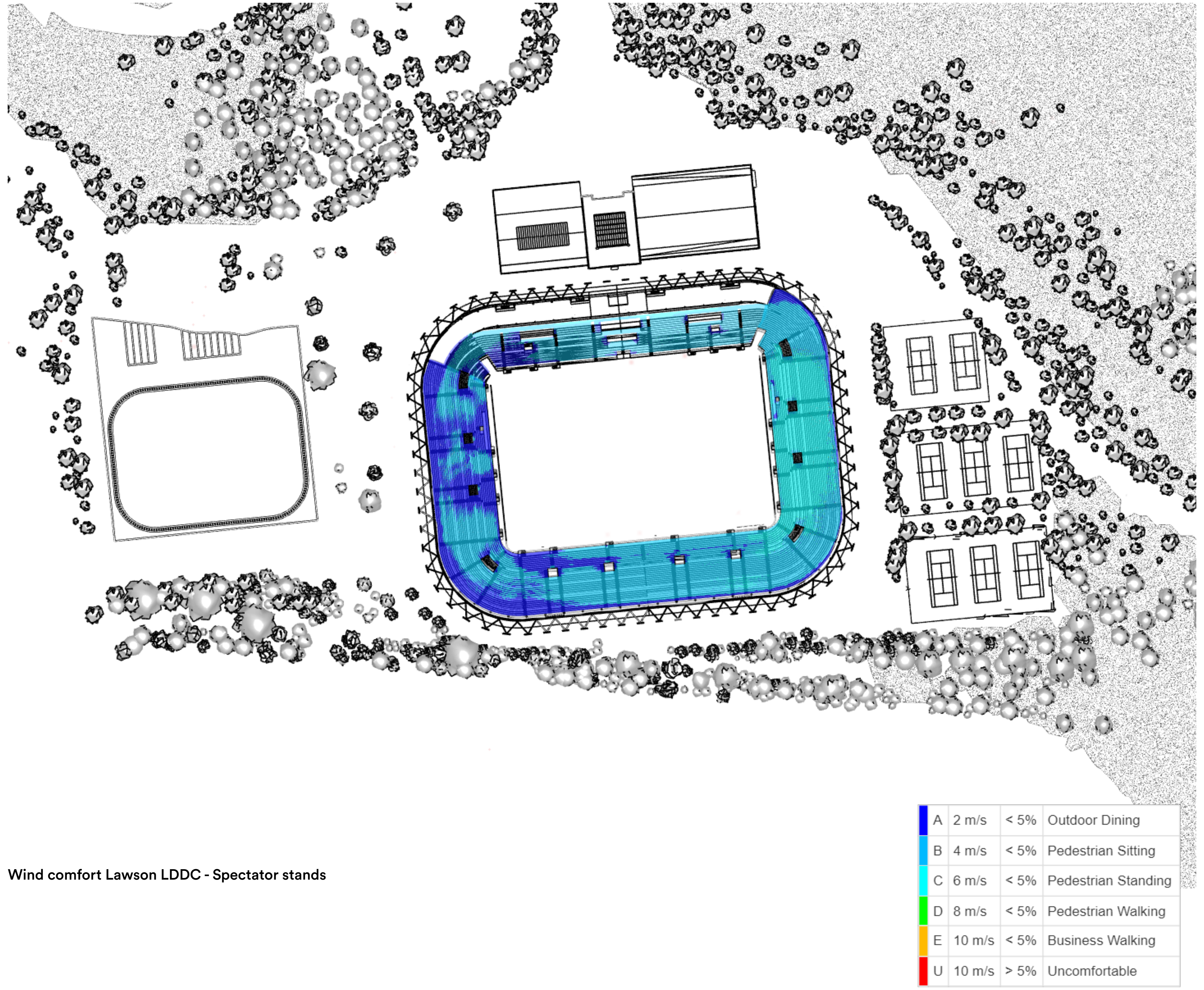


Wind comfort Lawson LDDC - Terrain and concourse

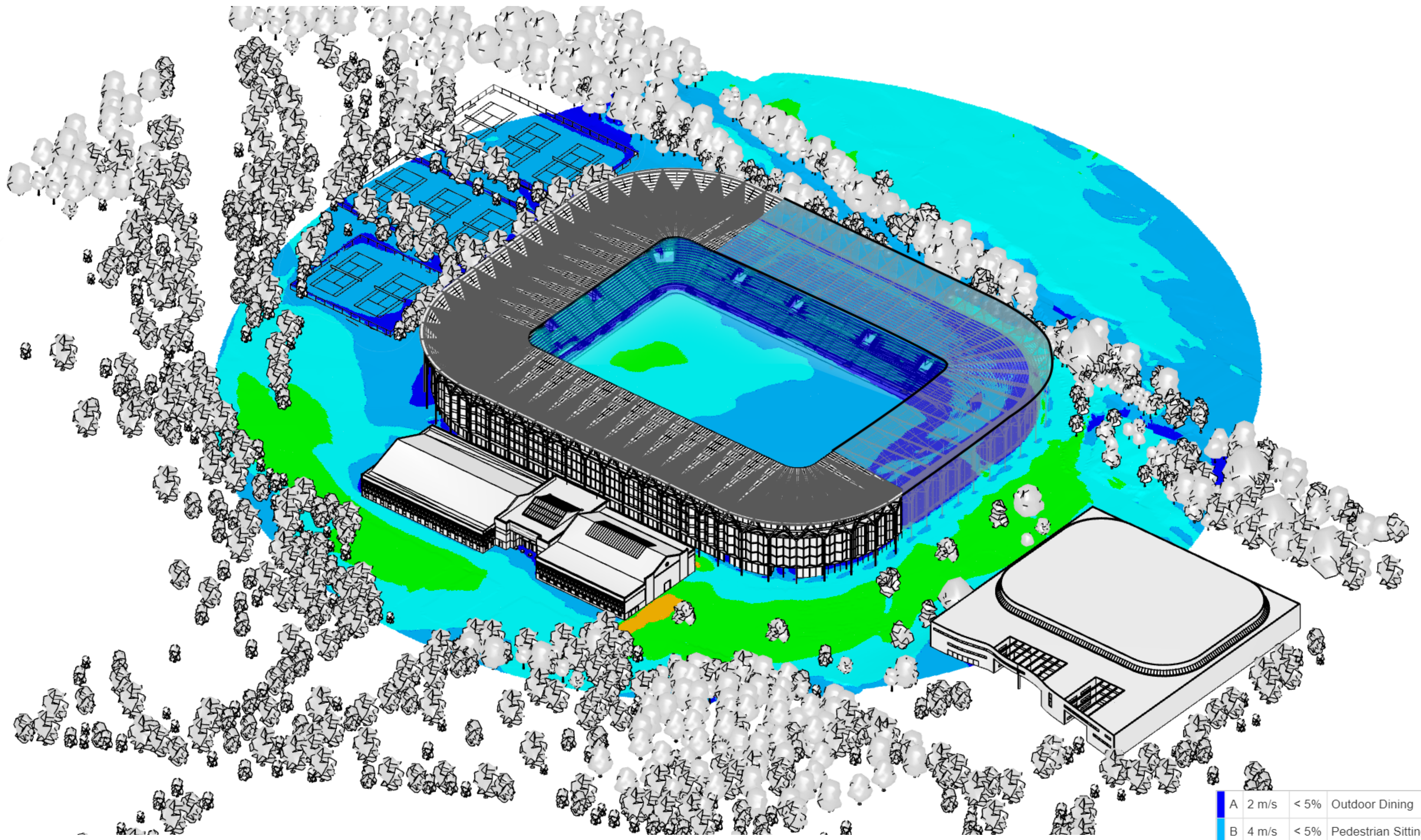
WIND COMFORT AT SPECTATOR STANDS

The wind comfort criteria were also evaluated at the stands within the stadium-bowl. To create intimacy and simultaneously achieve comfortable wind conditions, the entire stadium-bowl is closed with an opaque upper façade and roof cover. The results show that the wind comfort is highest on the west-stand where the cover significantly shelters the stand from the prevailing west directional wind flow. On the remaining stands the wind comfort are slightly lower, but still within an acceptable range. Especially when bearing in mind that the evaluation in done by considering the maximum obtained velocities. Assessing the mean velocities shows that the entire stands lie within criteria A and B.

On the pitch the wind flows are generally low and provides a safe environment for the players, suggesting that the stadium design allows for excellent conditions for hosting football matches.

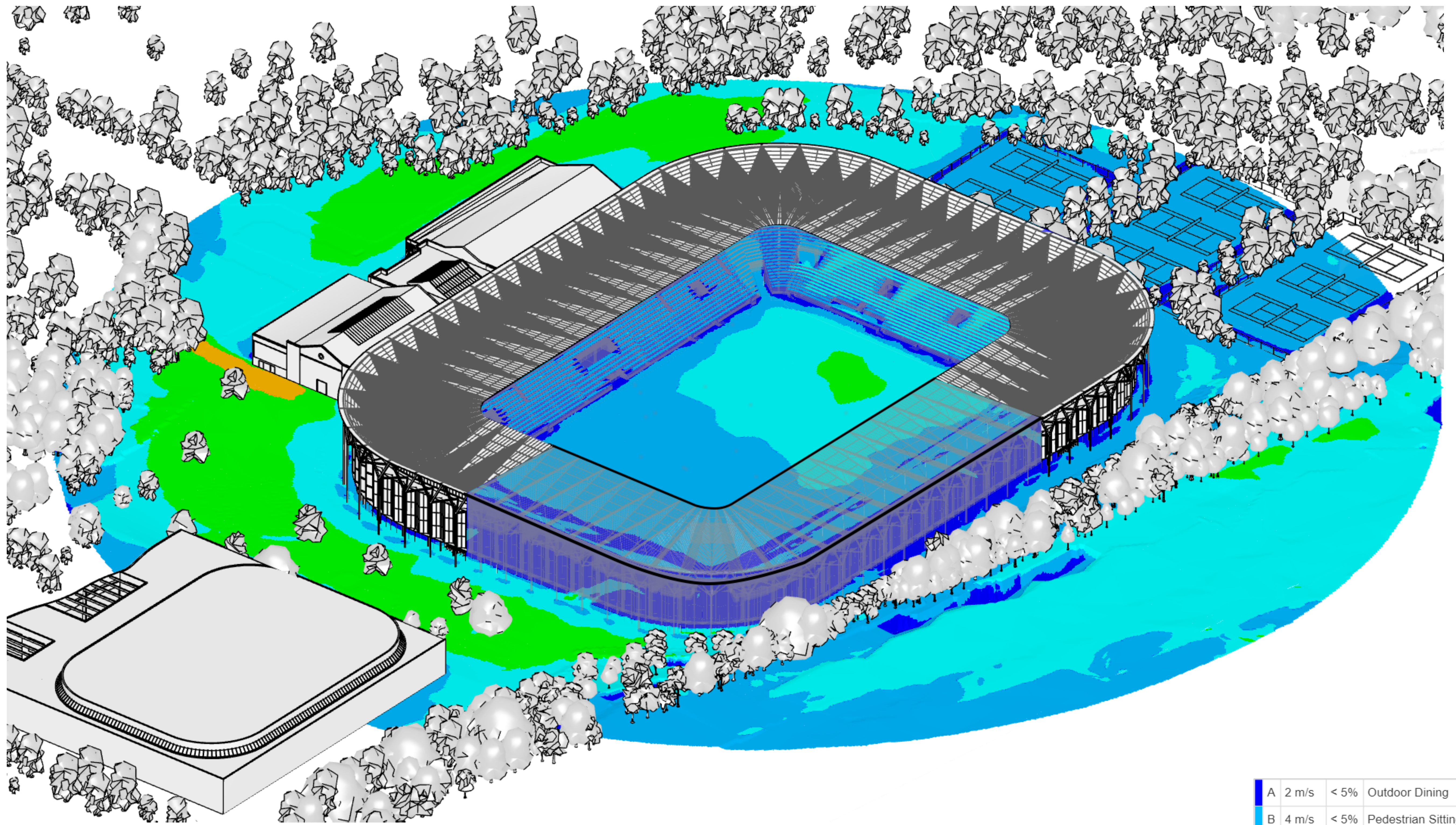


Wind comfort Lawson LDDC - Spectator stands



A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

Wind comfort Lawson LDDC

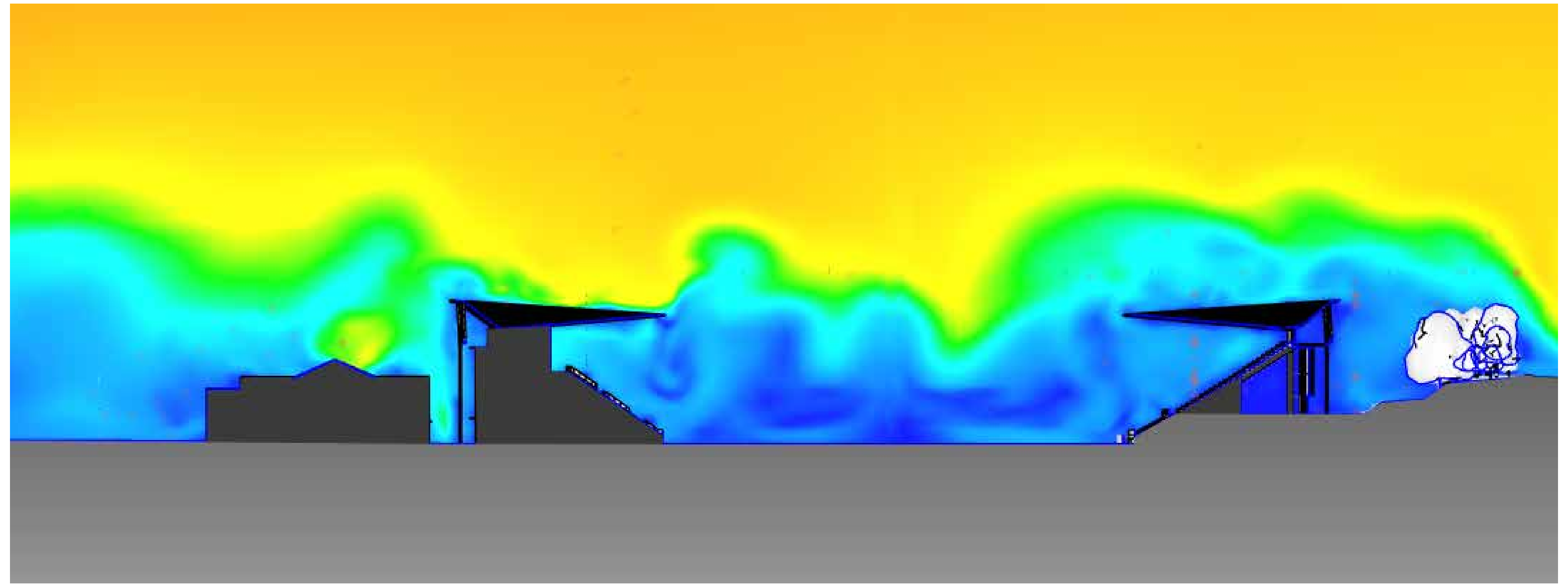


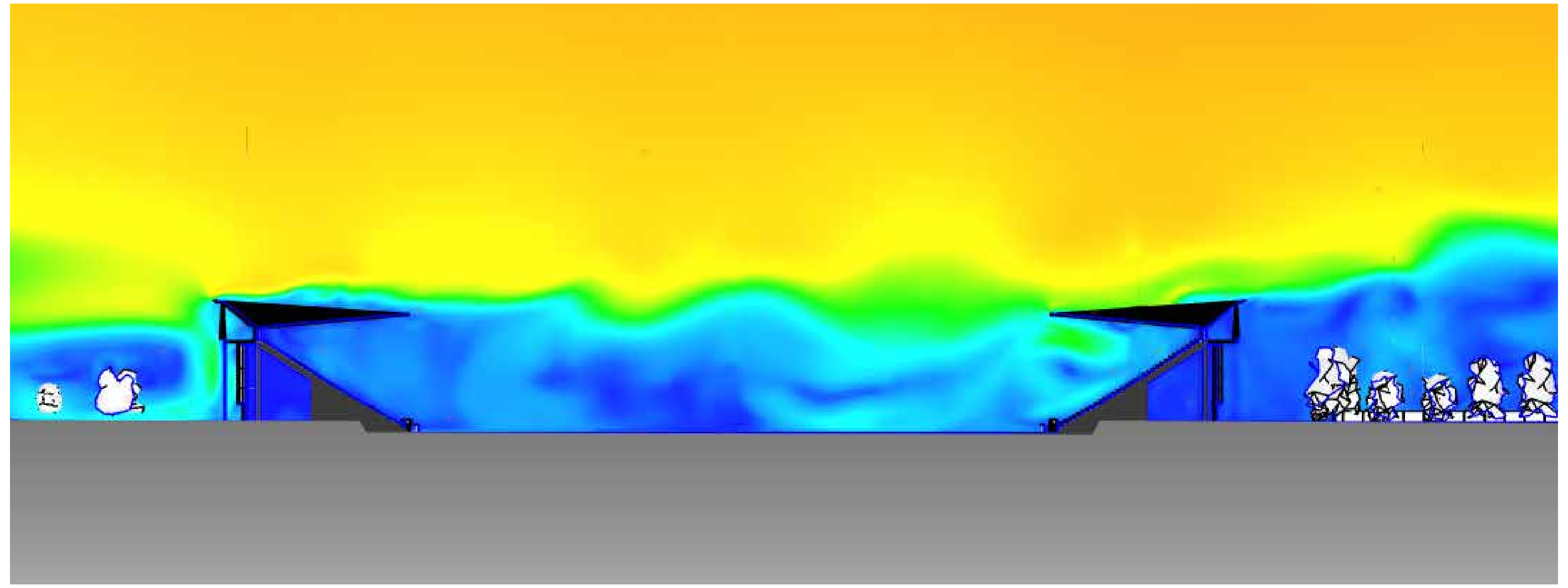
A	2 m/s	< 5%	Outdoor Dining
B	4 m/s	< 5%	Pedestrian Sitting
C	6 m/s	< 5%	Pedestrian Standing
D	8 m/s	< 5%	Pedestrian Walking
E	10 m/s	< 5%	Business Walking
U	10 m/s	> 5%	Uncomfortable

Wind comfort Lawson LDDC

WIND FLOW SECTIONS

The cross and longitudinal sections of the wind flow give a good indication on how the upper face shelters the stadium bowl and stands. Furthermore, the flow patterns expressively display how the design of the roof structure principally directs the wind flow in an upwards direction, thus leading to lower wind flows within the stadium bowl. The longitudinal section also illustrates the vortex which is formed between the arena and stadium when the wind flows from west.

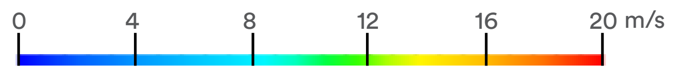




WIND SIMULATION

SIMULATION VIDEO WILL BE BROUGHT TO THE PRESENTION IN AARHUS

Velocity Magnitude



THERMAL COMFORT

The fan experience will be affected by the outdoor thermal comfort at the spectator stands. Assessing the outdoor thermal comfort is a complex task, as it depends on interactions between several environmental phenomena, which tend to be transient phenomena that varies with time. To evaluate the outdoor thermal comfort a commonly applied metric is the Universal Thermal Comfort Index (UTCI), which determines an equivalent perceived temperature accounting for air temperature, radiant temperature, humidity, and wind speed to give an overall comfort score.

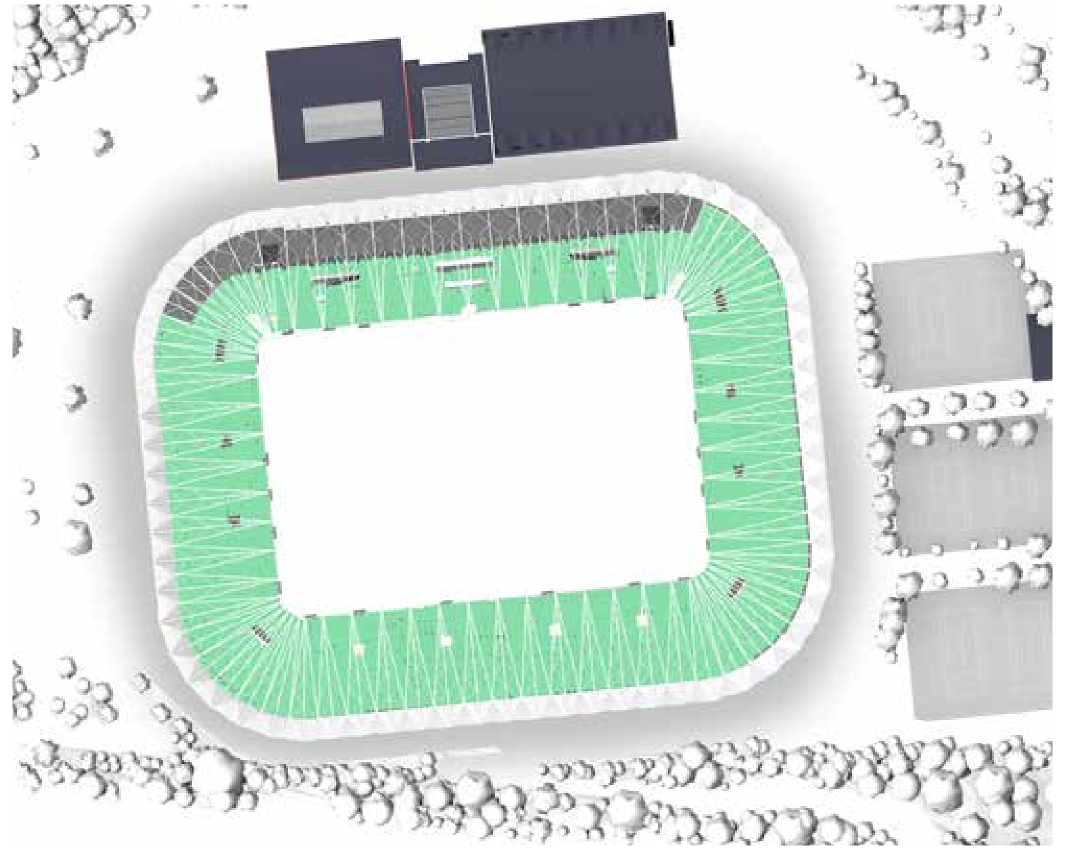
For the calculation of the UTCI, historical local weather data for air temperature and relative humidity are used together with wind speeds obtained in the CFD simulations (prevailing wind direction scaled according to the weather data). Furthermore, the mean radiant temperature is determined across the stadium depending on the geometric shades and orientation. The UTCI is calculated for each day at 12:00 and evaluated as monthly average.

The obtained results shows that the thermal conditions in winter (evaluated in January) generally is perceived as cold, which is expected as the project don't hold any heating for the spectator stands. In the summer period (evaluated in July) the UTCI yields comfortable perceived temperatures.

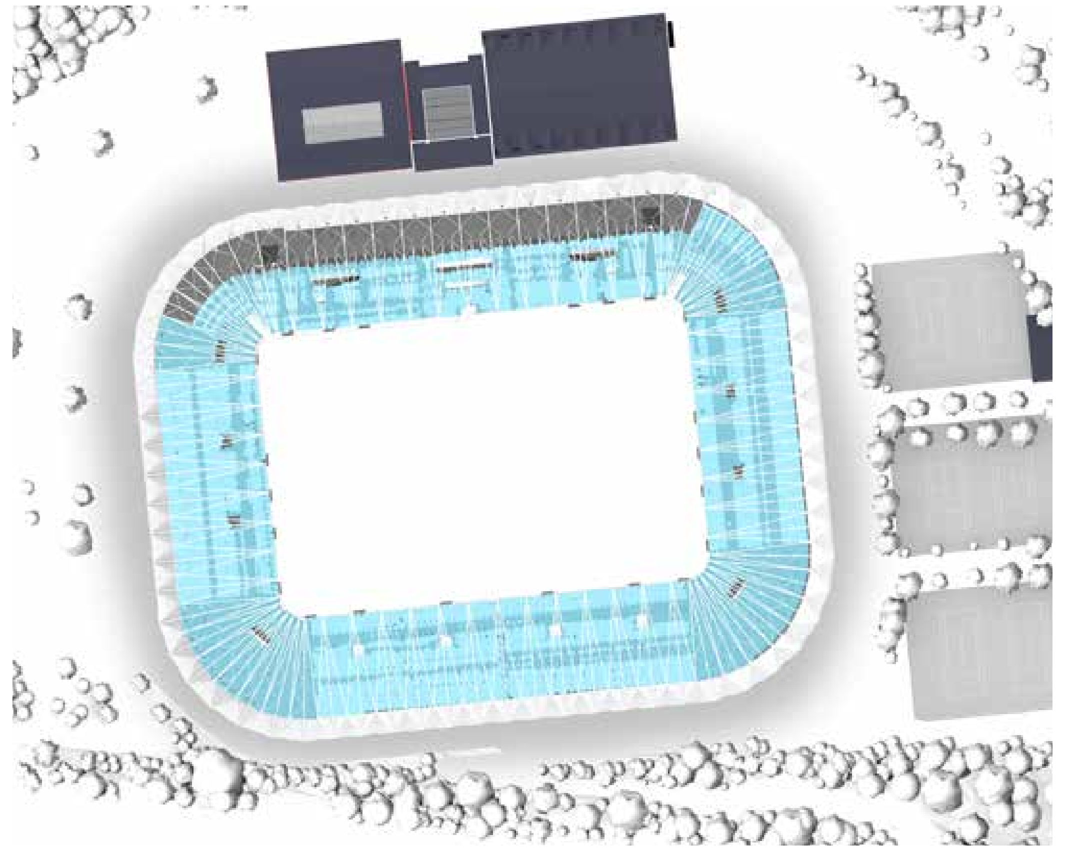
The thermal environment in the concourse is initially screened based on detailed hourly simulations. . Since the space is not mechanically cooled, the temperature is strongly correlated with the variations of the ambient temperature. However, the results suggest that natural ventilation via the vomitories to the stands efficiently ensures a high air quality and acceptable air temperatures. To further increase the efficiency of the natural ventilation, openings in the external upper façade are establish at strategic places, thus allowing for cross ventilation. Consequently, the risk of condensation is consideres practically neglectable.

UTCI range

<-40°C	-27°C	-13°C	0°C	9°C	26°C	32°C	38°C	>46°C	
extreme cold stress	very strong cold stress	strong cold stress	moderate cold stress	slight cold stress	no thermal stress	moderate heat stress	strong heat stress	very strong heat stress	extreme heat stress



UTCI July



UTCI January

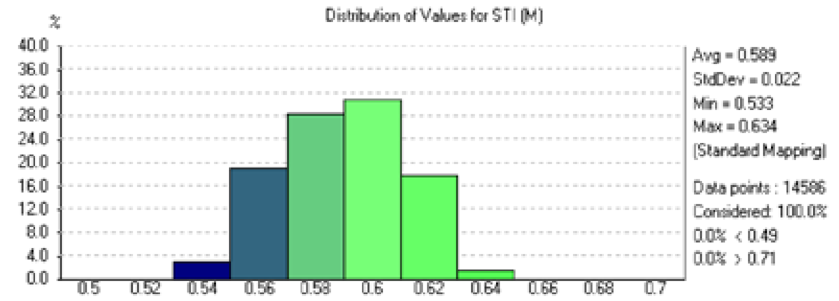
9. BOWL ACOUSTICS

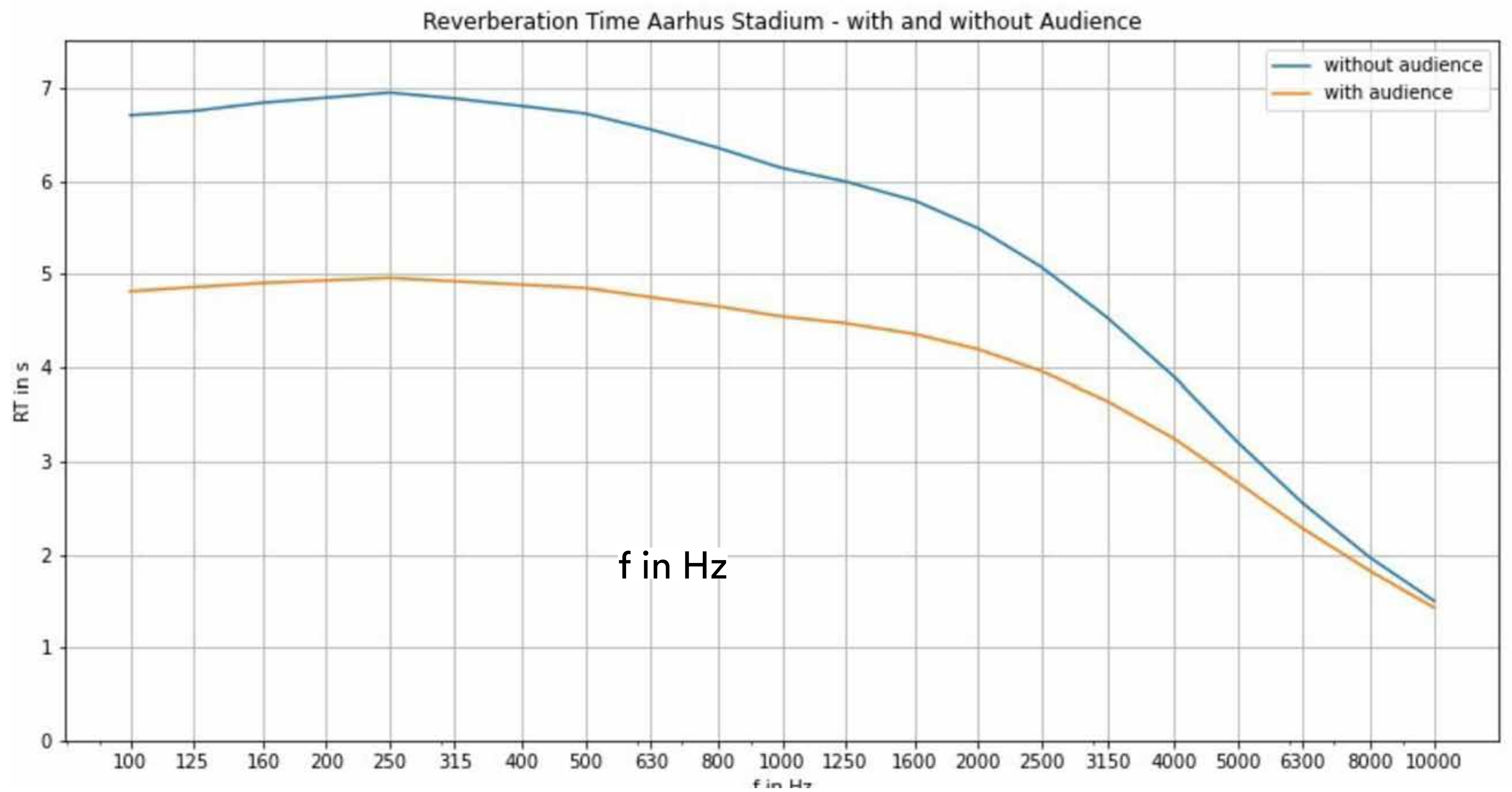
The acoustical environment is an important parameter to maintain across the spectator area to ensure a unique and intimate fan experience during matches. This calls for a loud sound level and a stadium that “roars” for instance when a goal is registered. These qualities require a long reverberation time where sound is reflected into the stands as well as being reflected to the stand on the opposite side of the stadium without creating flutter echo.

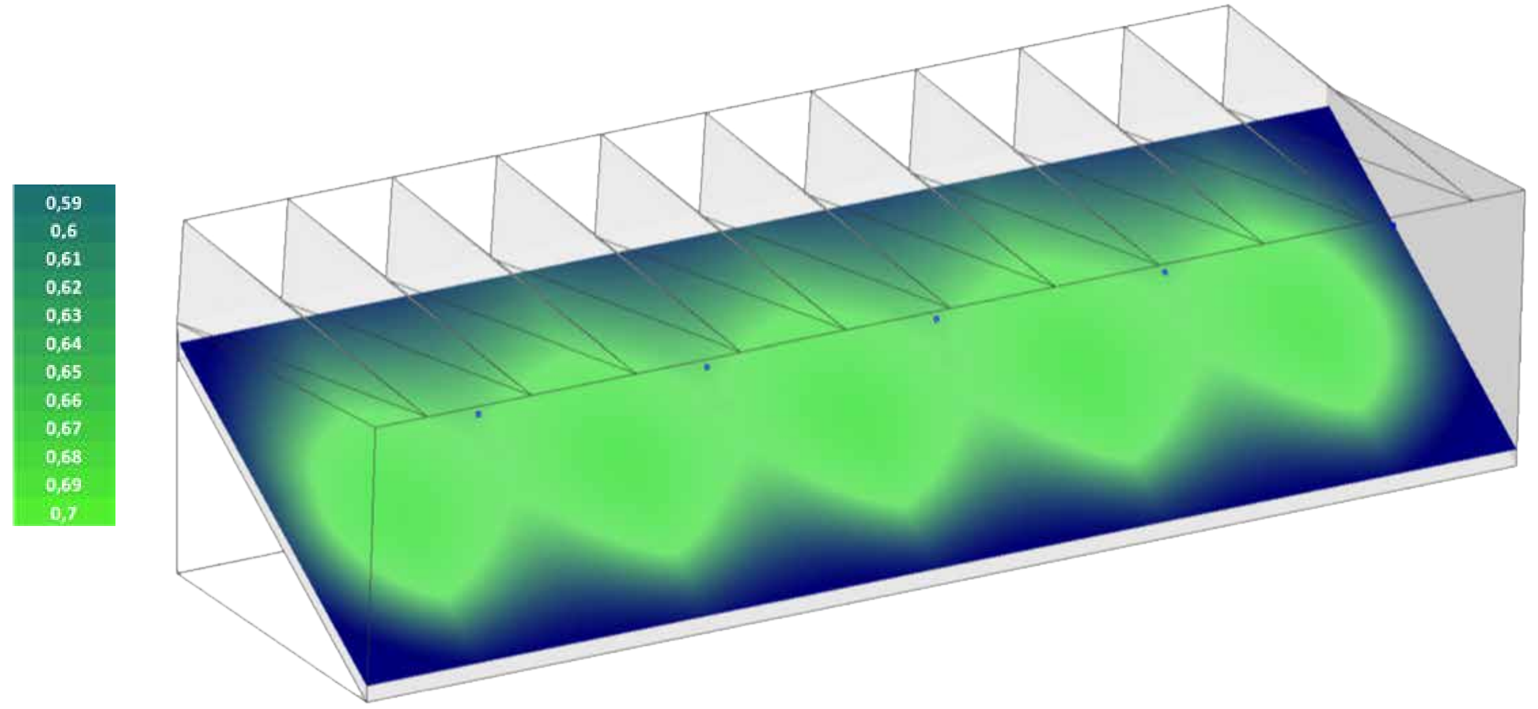
To enhance the spectator experience the geometry (tilting and inclination) and materials of the roof has been designed to reflect sound back into the stand, by using materials that are highly sound reflective (metal and polycarbonate). Initial acoustical simulations have been carried out to evaluate RT60, which describes the time taken for a sound to decay by 60 dB from its original level. The results indicate a RT60 between 4 to 5 seconds in a stadium with audience and between 5 to 7 seconds in a stadium without audience.

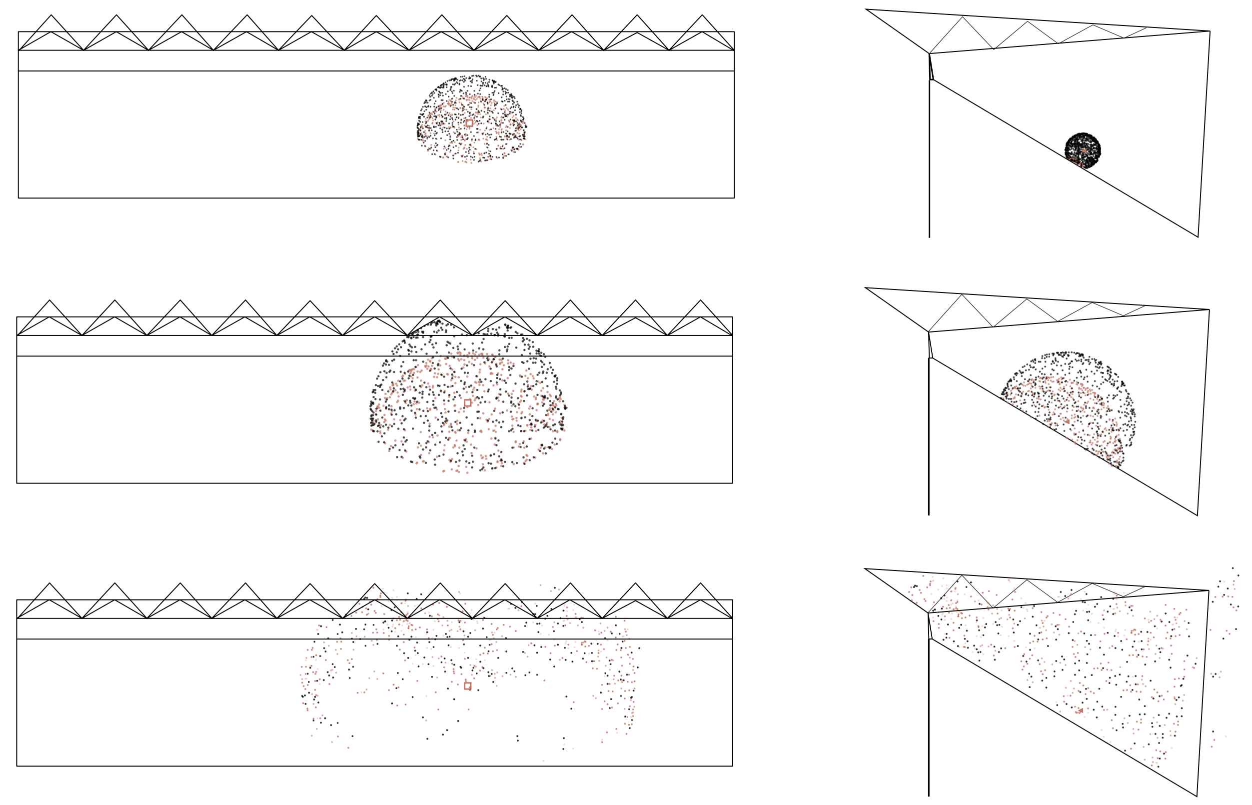
Furthermore, to ensure a safe operation of the stadium it is fundamental that the PAVA-system achieves a satisfying Speech Transmission Index (STI). The European Standards require an STI of minimum 0.5 for PAVA Systems, which are used for emergency and evacuation. The STI indicates the Speech Intelligibility and assumes a value between 0 and 1. An Initial simulation of a section of the stand based on a preliminary PAVA design of 5 speakers in the respective section yields an STI average of 0.589 over the considered section. The distribution of the simulated STI values shows that the minimum requirement of 0.5 is well achieved in all areas of the considered section. There remains a few factors of the PAVA system which needs to be defined at a later stage in the project to make a proper system design, but the preliminary simulation results suggest a really good acoustic result.

In the main stand focus have been on implementing acoustical solutions that supports the requirements in the construction brief, both in terms of qualities of vertical and horizontal building parts. Together with furniture and fixtures, this will ensure an acoustic indoor climate that balances the use of the rooms. The open office area with permanent workplaces, will be acoustically regulated to ensure comfortable conditions. Noise levels stemming from technical installations, especially the ventilations system, are treated carefully when designing the systems and penetrations are acoustically insulated and sealed.





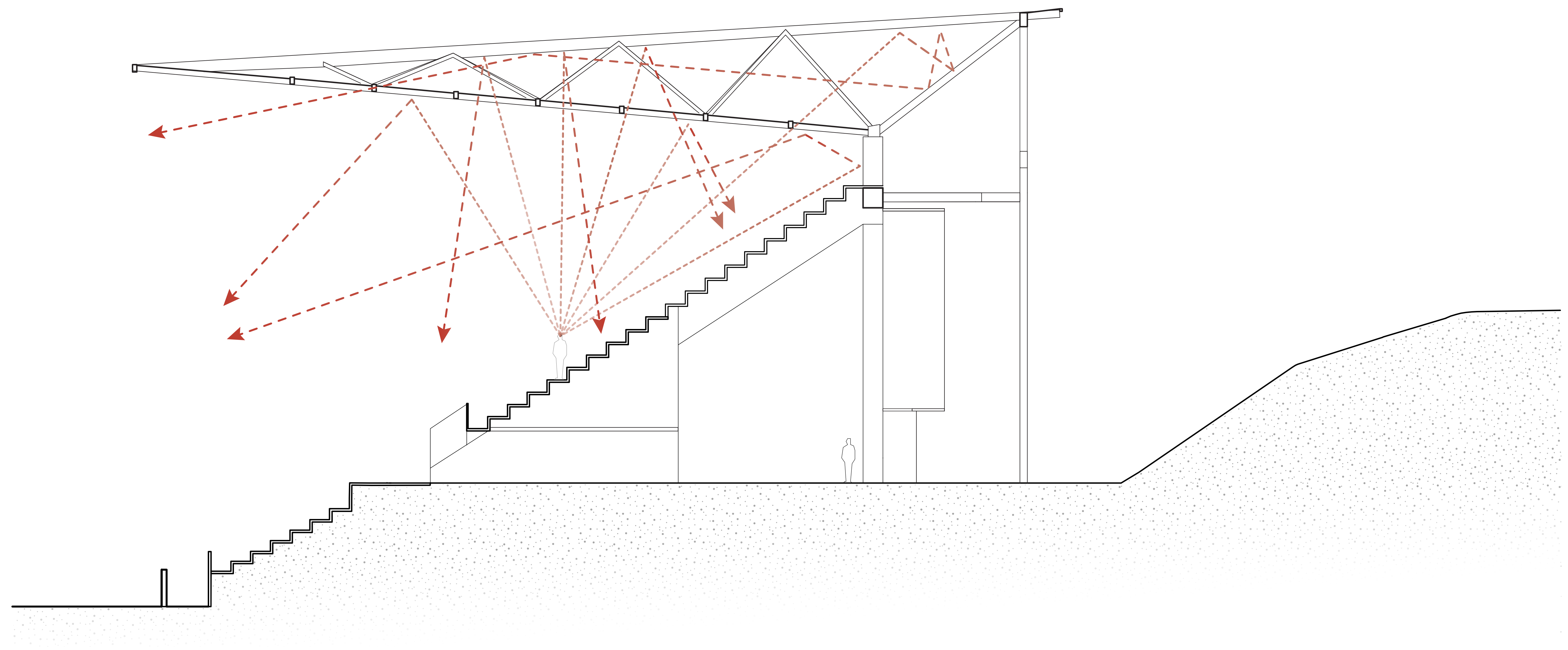




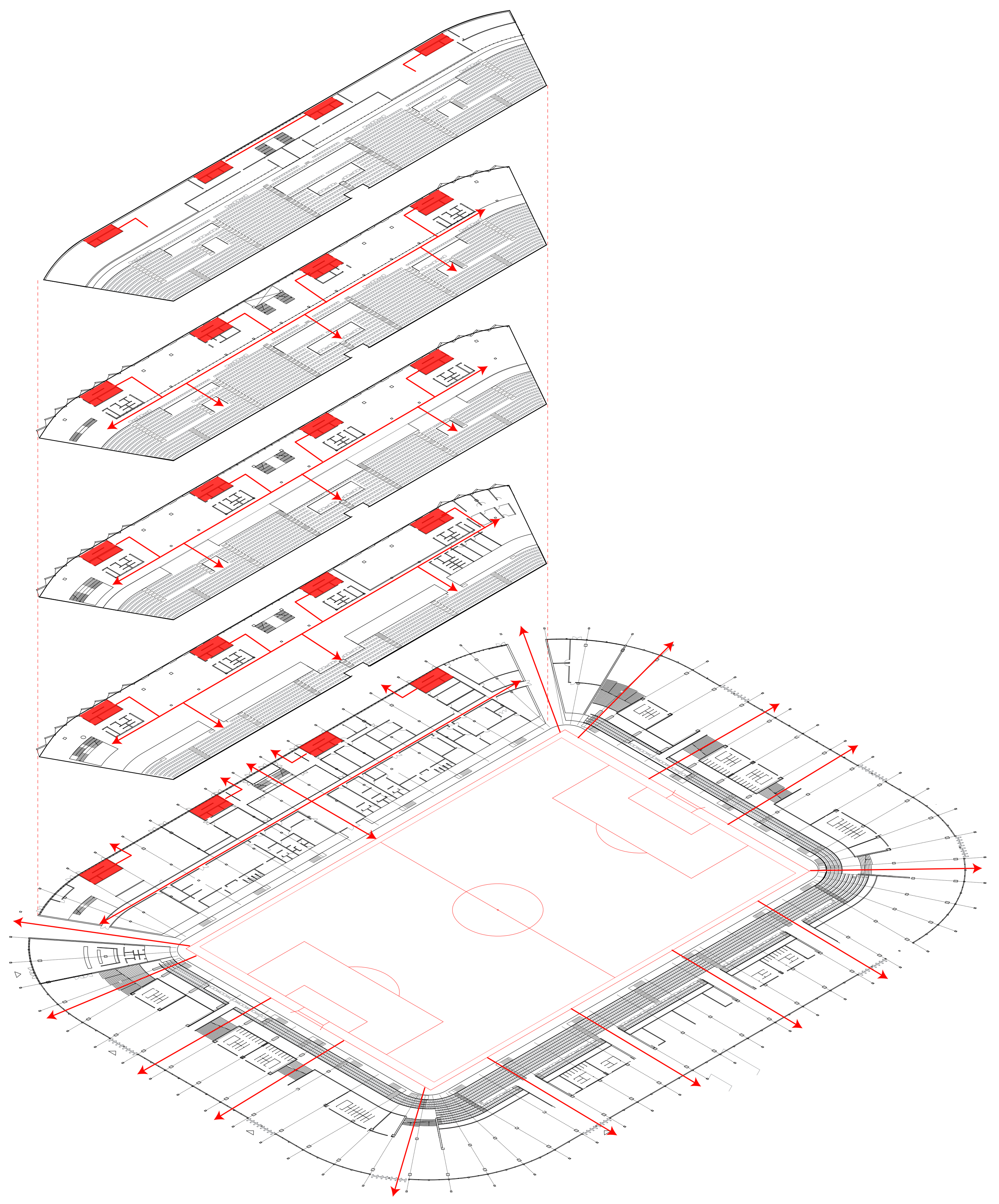
ACUSTIC SIMULATION

SIMULATION VIDEO WILL BE BROUGHT TO THE PRESENTION IN AARHUS

ACOUSTIC SECTION DIAGRAM



FIRE ESCAPE DIAGRAM



10. FIRE AND ESCAPE STRATEGY

INTRODUCTION
The new stadium in Aarhus is a visionary building, also from a fire protection perspective, potentially pushing the boundaries of fire protection in Denmark without compromising safety. However, it is still considered realistic to obtain a sufficient level of safety, since the design of the building contributes to good conditions in terms of overview, active/passive fire protection measures, escape possibilities as well as minimizing spread of fire and smoke.

The fire strategy must be based on the Danish Building Regulations 2018 chapter 5 §82-§158 and the new certification scheme, which prescribes that throughout the design phase, it must be ensured that satisfying fire protection is obtained. This also concerns spreading of fire to other buildings located on the same or surrounding plots. Furthermore, individuals should be rescue in a safely manner while extinguishing work is carried out in the event of fire.

To demonstrate the safety level, a combination of traditional methods is applied using pre-accepted solutions from the appendices to BR18 V5, along with the development of fire technical comparative analyses, reasoned assessments, and fire-technical dimensioning. Together, these methods form the documentation of the overall fire safety level.

The stadium is mainly classified as usage category 3, i.e. daily occupancy familiar with the escape routes and able to escape unaided. However, minor areas are classified to usage category 1, i.e. daily occupancy not familiar with the escape routes but able to escape unaided. The risk class for a building section is determined based on the intended use of the section and the design of the building related to several risk factors. The stadium is categorized as risk class 4. Based on the building's risk class and the documentation methods for fire safety, the stadium is classified as fire class 4.

CONCEPT FOR EVACUATION AND RESCUE
The overall evacuation strategy is based on a total evacuation via designated escape routes, which has been designed carefully to allow a safe evacuation. All individuals can be evacuated to the outside terrain before being exposed to critical conditions. All areas are designed with access to either safe locations, protected escape stairs or directly to the outside. The escape routes and doors etc. in the stadium have been designed to accommodate the maximum number of occupants, using experts experience from international stadiums, and can be used for evacuation purposes at any time.

The main stand contains four internally protected staircases connecting all levels, which forms the main escape routes together with evacuation out through the stands. Furthermore, evacuating to the stands are considered for an adequate number of people, and from here secured escape routes are designed.

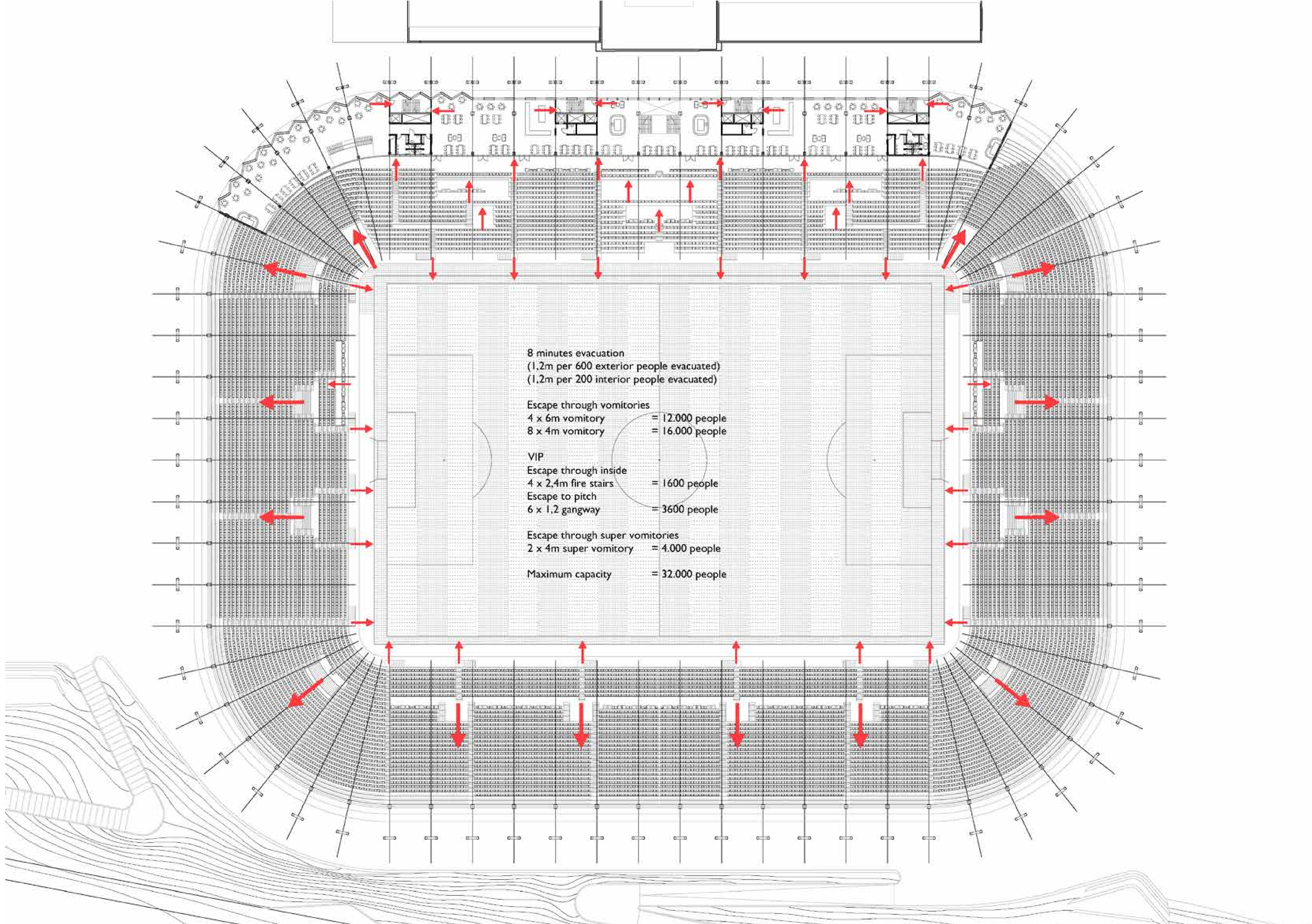
The people who occupy the field will mainly escape through the two large super vomitories that have a free width equivalent to being accessible to even trucks. The overall evacuation strategy is supported by both active and passive fire protection measures.

CONCEPT FOR PASSIVE FIRE PROTECTION
The building is separated into primary and secondary fire compartments to protect against fire and smoke spreading between different areas. These, together with the requirements for interior surfaces and fire doors from the pre-accepted solutions in BR18, ensures the optimal conditions for the escape routes and extinguishing works. This also ensures that the evacuation strategy and that the operational conditions of the emergency services are obtained even during an event of fire. The compartmentalizing is based on the building being equipped with automatic sprinkler systems (AVS), which also reduces the risk of fire spread and allows for larger primary fire compartments.

The stadium roof structure consist of inclined steel truss element forming a folded structures covered in materials classified as B-s1,d0. Likewise, the façade of the concourse and main stand are to classified as B-s1,d0.

CONCEPT FOR ACTIVE FIRE PROTECTION
The active fire protection is based on the installed fire protection installations, e.g., an automatic fire alarm system (ABA) which is the backbone of the overall fire protection and evacuation strategy. The automatic fire alarm system serves the purpose to ensure early detection and alerting of the local emergency service, as well as warning people in the building via a link to an automatic warning system (AVA), so the people can evacuate safely before being exposed to any critical conditions. Furthermore, an automatic water sprinkler system backs up exactly those fire related aspects, by controlling and limiting a fire, so that the emergency services can carry out extinguishing work in a safely manner.

Safety lighting is installed throughout the building (F&P) as an active fire protection measure, to ensure a safe evacuation. The running men signs are placed in rooms with occupancy, larger technical rooms, escape routes etc.

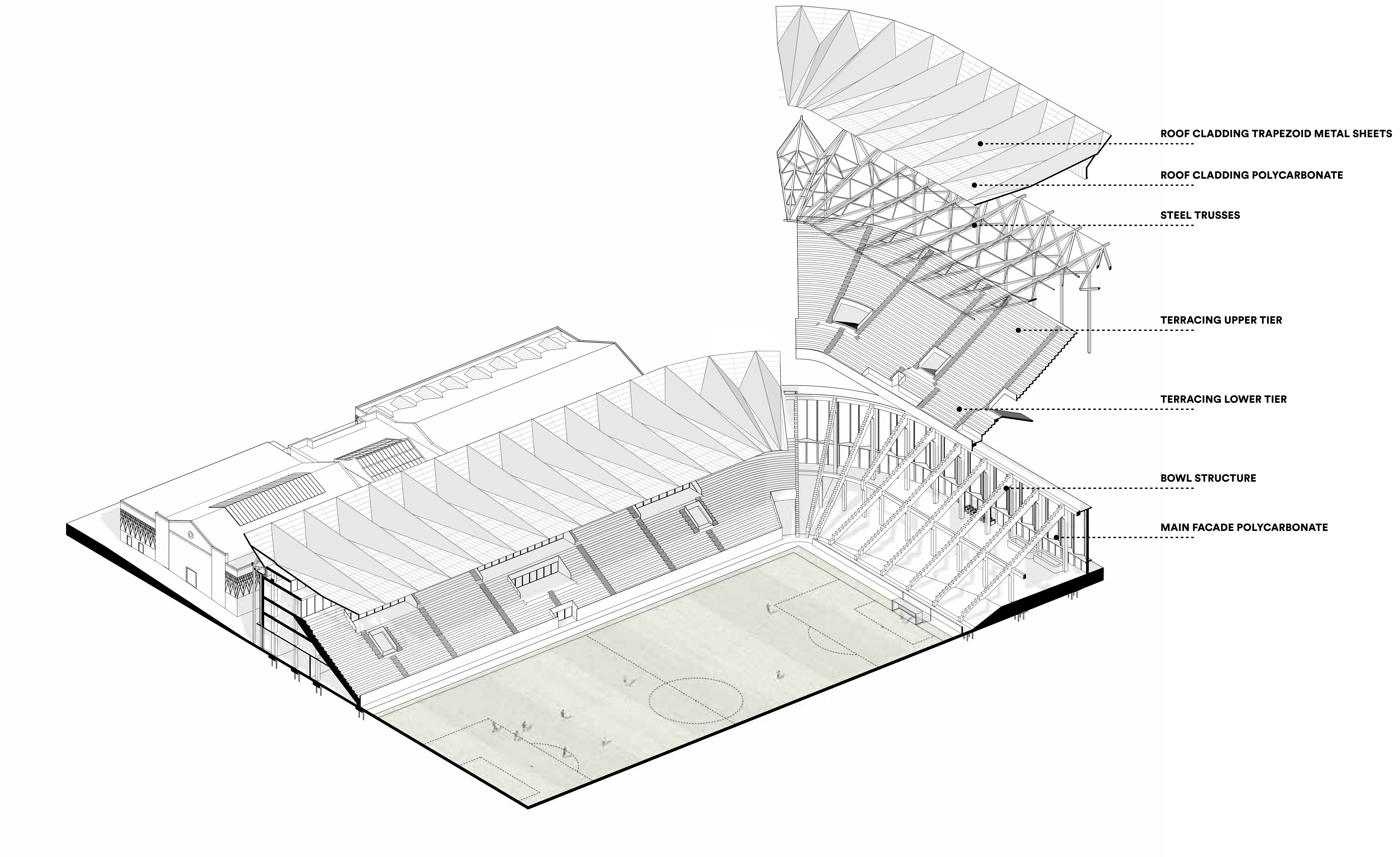


11. CONSTRUCTION AND BUILDABILITY

OVERVIEW
A holistic design approach integrating the various disciplines and equally considering functional, architectural, environmental and economic requirements has been applied to the development of the Aarhus Stadium structure.

Through the choice of efficient structural systems with optimized geometries and suitable material selections a structural system has evolved throughout the design process which offers the highest level of functionality for a state-of-the art stadium while at the same time minimizing construction cost and resource input.

The following image gives an overview of the stadium elements and their building types and materials. All elements will be described in more detail on the following pages.



BOWL STRUCTURE

The stadium bowl is made up from a modular, highly repetitive construction kit of precast concrete elements. This forms a robust and highly functional structure and enables a fast installation process on site, allowing for a minimized impact on the Aarhus stadium operations during construction. Modularity also fosters the potential for a reuse of the elements at the structure's end of life, supporting a Circular Economy in the construction sector. The stadium grid has been optimized regarding spans especially for the precast concrete steps and total number of elements, leading to a regular grid with 8m spans.

The main system is made up from steps resting on precast raker beams, which themselves are supported by precast columns transferring all loads to the foundations.

The structural bowl design fulfils all requirements regarding statics, robustness and dynamics.

FOUNDATION

In general, columns, walls and raker beams are founded with pad- and strip foundations. Drill tests from north to south indicate varying bearing capacities of the soil in relation to the structure. Therefore, we expect that 10-20% of the north-west corner needs deeper foundation using precast concrete piles (assumed 150 piles of a length of 15 meters).
To compensate the cantilevered roof structure a tension rod (column) is applied at the outer perimeter of the stadium to retain the tension by four concrete piles (assumed to be 10 meter long) for each pad foundation benith the columns.

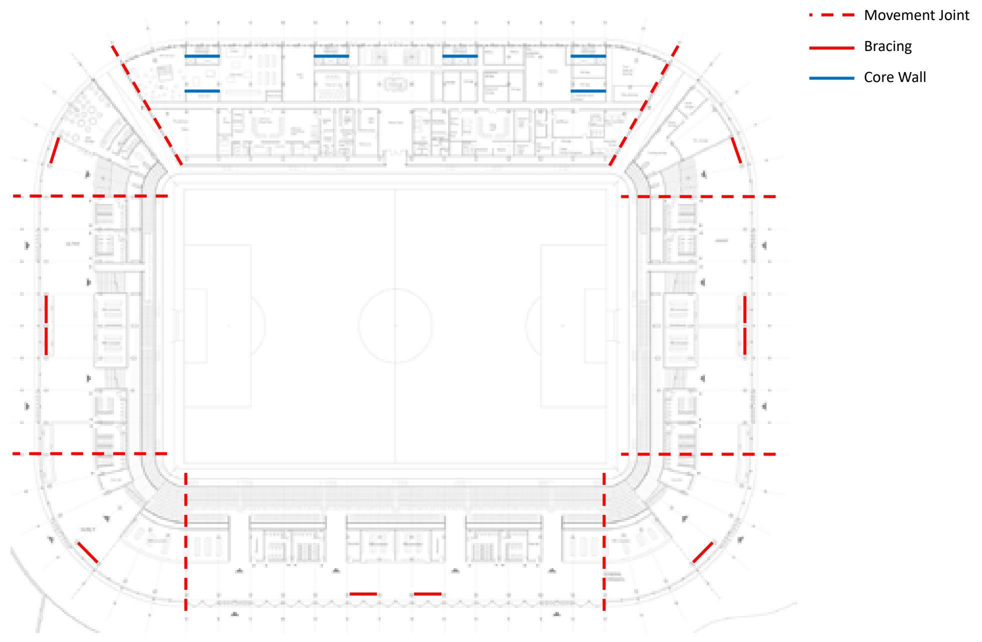
STRUCTURAL SYSTEM

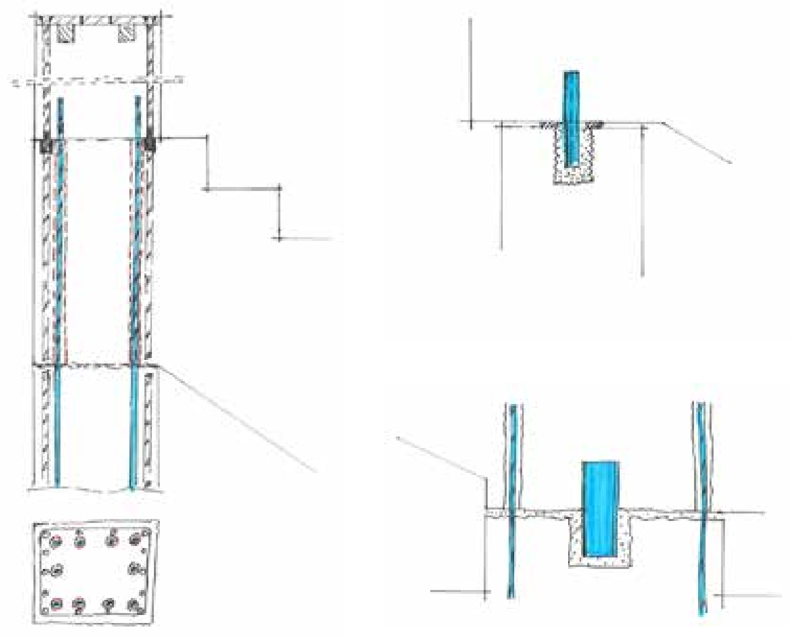
The following pictures show the load transfer of the bowl structure in vertical and horizontal direction:

To compensate thermal movements, the stadium structure will be divided into eight segments separated through movement joints.

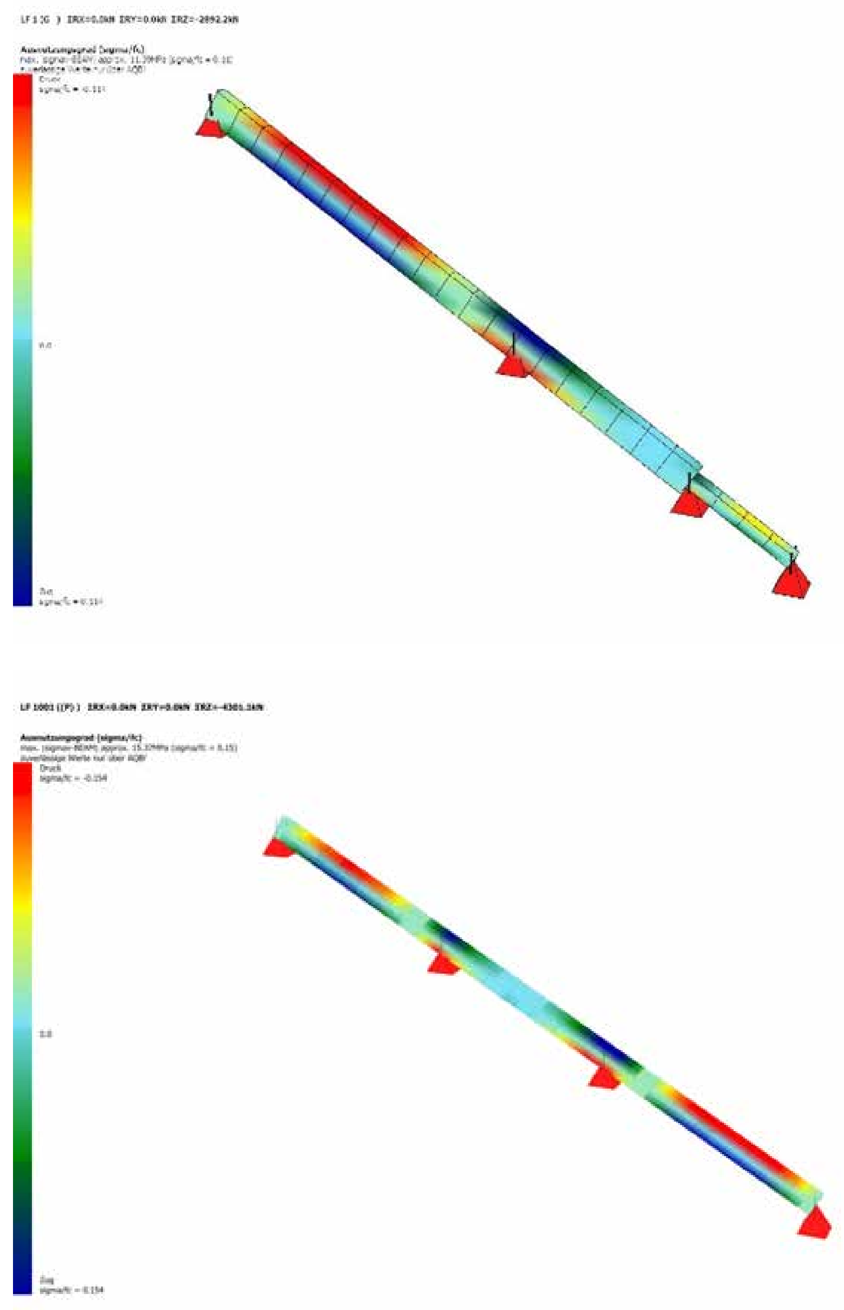
Each segment will be stabilized individually to withstand lateral loads. In radial direction, the inclined raker beams serve for transferring lateral loads to the foundations.

In tangential direction, the bowl segments are stabilized by cross bracings spanning between the main concrete columns. Two bracings are positioned in each of the straight segments and one bracing in each of the corner segments. In the main stand building six continuous concrete core walls are incorporated into the structure, fulfilling the same purpose as the bracings in the other segments.

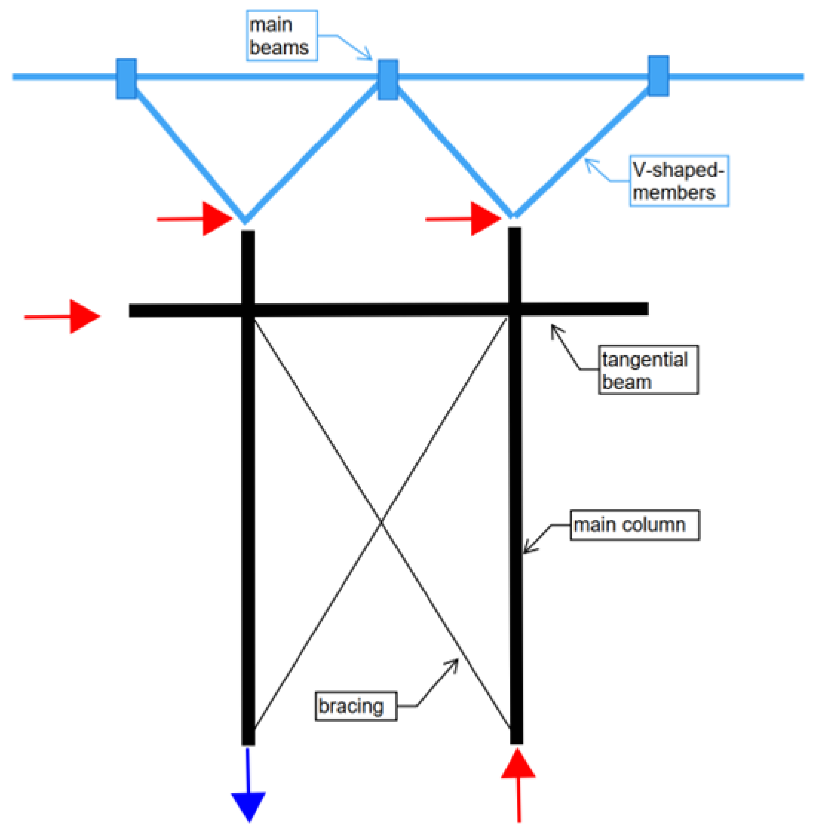




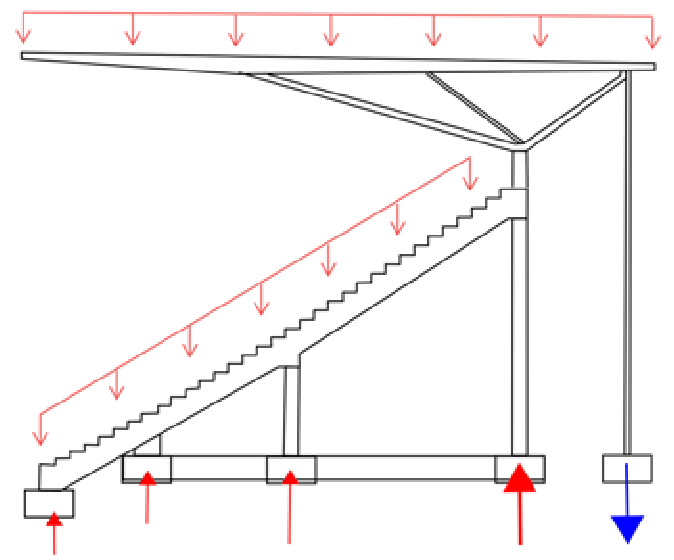
Structural details of the raker beams (main column, intermediate support, lower support)



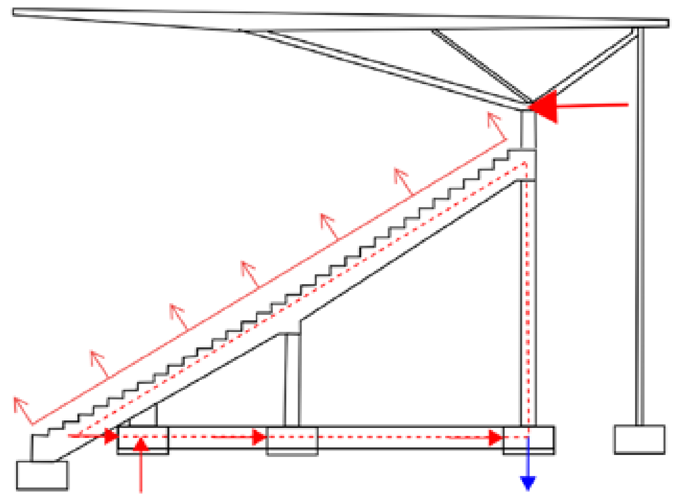
Structural model of the raker beam (bowl structure)



Horizontal load transfer in tangential direction



Load transfer in vertical direction



Horizontal load transfer in radial direction

TERRACING

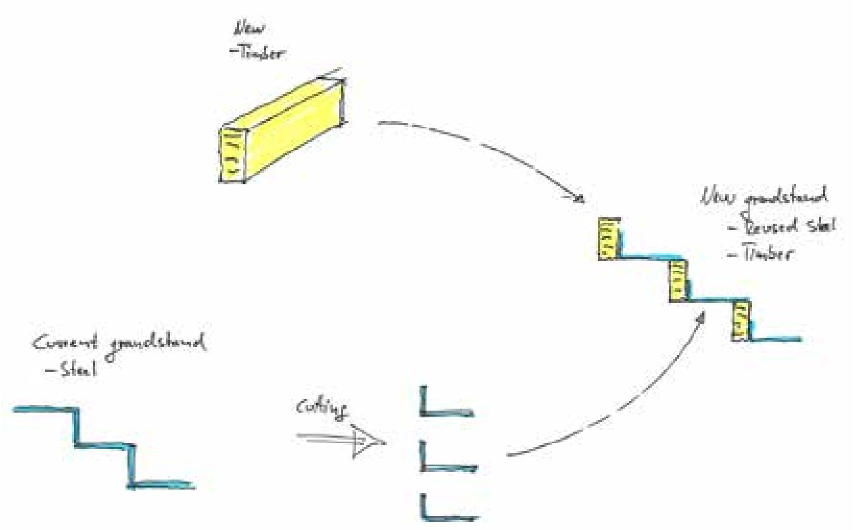
The stadium bowl steps are the essential elements for spectators to rest and move on and thus play an integral role for the stadium's functionality. At the same time, the steps typically make up for around 30% of a stadium bowl's carbon footprint and thus need special attention when designing for minimum embodied carbon. Partial reuse of the existing stadium steps can significantly reduce the new stadium's carbon footprint.

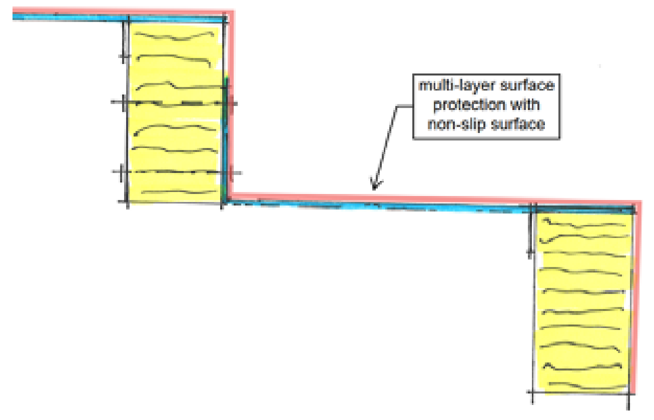
The lower tier is today built with precast concrete elements which are difficult to reuse as whole elements as the geometry cannot be amended. Recycling of these steps will be pursued by crushing them and reusing the crushed material directly as aggregates for the new concrete elements.

The upper tier of the existing stadium is made from folded steel plate steps which are structurally viable and in good shape. A direct reuse of these steps would not be possible due to different geometries and spans. Therefore, a partial reuse of the steps is pursued where the horizontal steel elements are cut to new geometries and connected to timber risers, forming fully functioning steps with a significantly reduced carbon footprint.

Since availability of existing steel steps for reuse is limited, not all terracing of the new stadium could be realised from reused materials. New precast concrete steps will form the lower rows of the new stadium as well as the main stand, where geometries are more irregular. The remaining parts of the stadium bowl will be formed by reused steel – timber steps.

Partial reuse of the existing steps will have a significant impact on the stadium carbon footprint compared to fully using conventional concrete steps, without having an impact on functionality or cost of the structure.

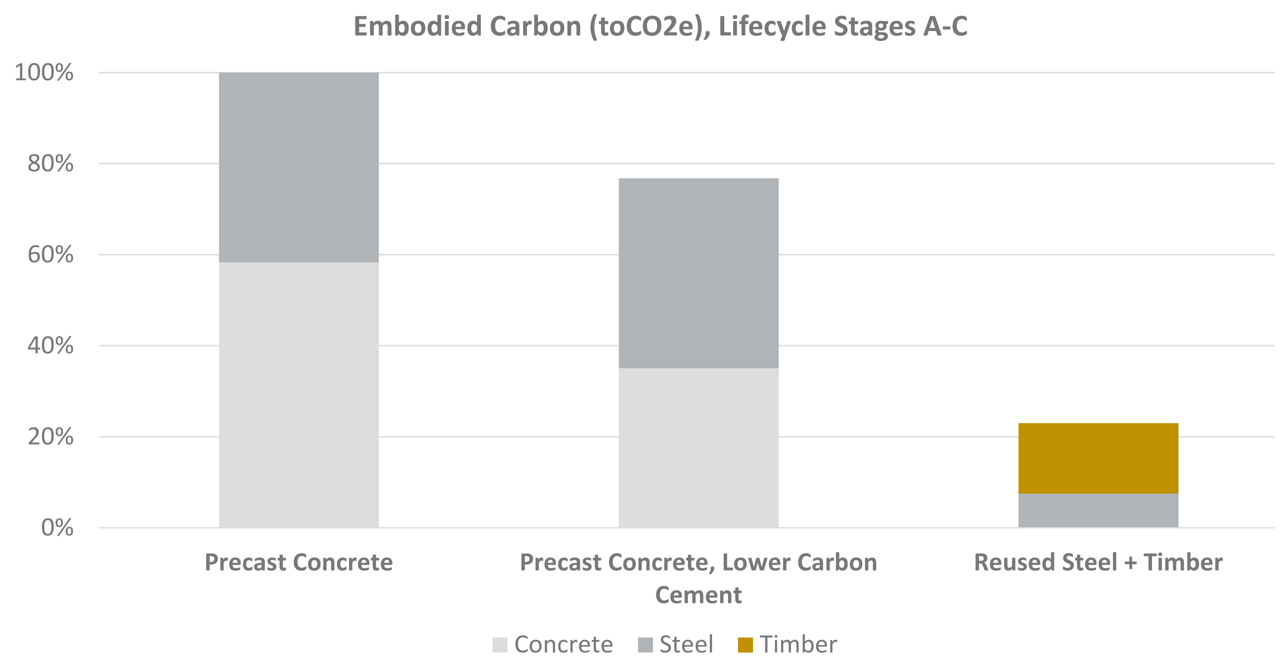


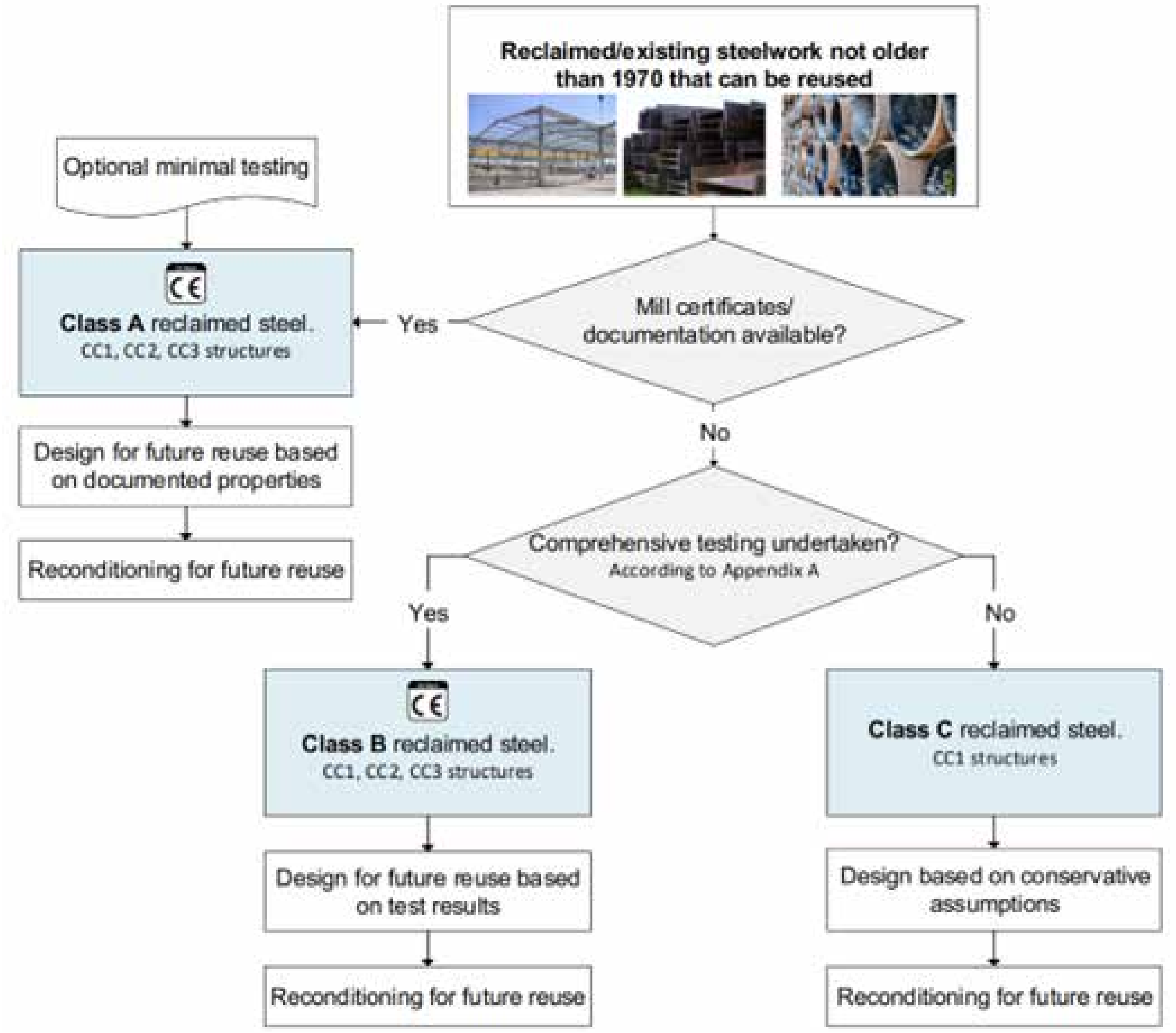


Partial reuse of existing steel steps for all other terracing

Existing concrete steps on lower tier (top), Existing steel steps on upper tier (bottom)

New precast concrete steps for lower rows of the stadium bowl and for main stand terracing



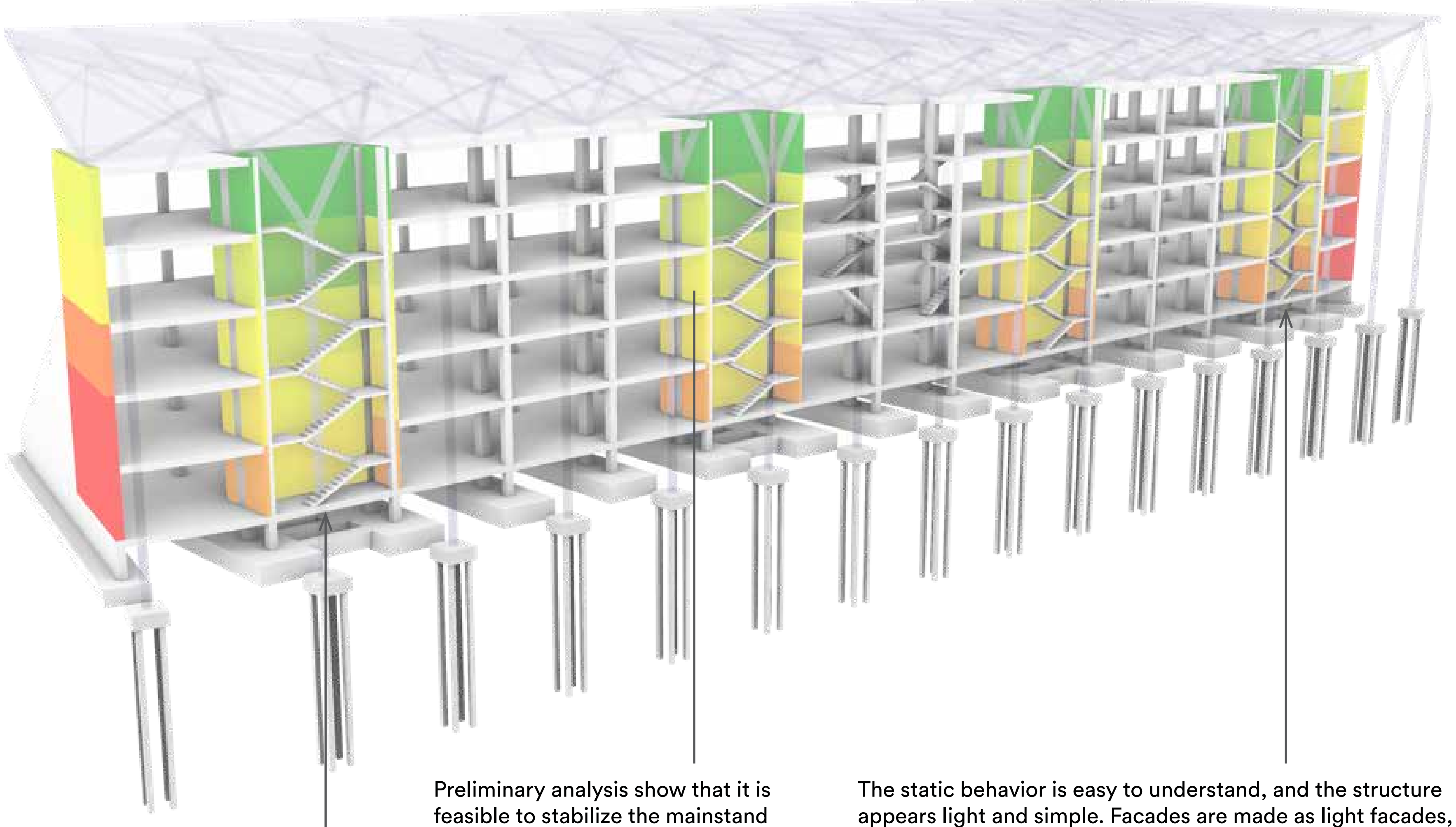


ECCS – European Convention for Construction Steelwork

MAIN STAND

The load-bearing structures are designed as in-situ cast concrete, which allows for uncomplex structures and honest architecture. With an in-situ cast concrete building, we achieve a wide range of advantages. In relation to static connections, the in-situ cast solution is more robust and flexible than a prefabricated concrete element solution. Robustness is expressed, for example, in the continuous constructions. Flexibility is increased in relation to future structural refurbishment. The in-situ cast structural solution allows for new holes to be cut in slabs and walls providing the building with a longer life expectancy than less flexible systems.

The flat slab deck structure results in a very simple structural design, where we completely avoid beams under the deck. By casting the mainstand building as a traditional in-situ cast concrete house, it is also possible to optimize routing for heating, where routing with an in-situ solution can be led directly from main conduits under the deck to radiators above the deck. This is because there is no need for an edge beam at the facade with an in-situ cast flat slab deck. The structural principle allows us to optimize the total floor height, as there is no need for beams that obstruct guideways. This results in a reduction of the total building height and less material consumption and cost.

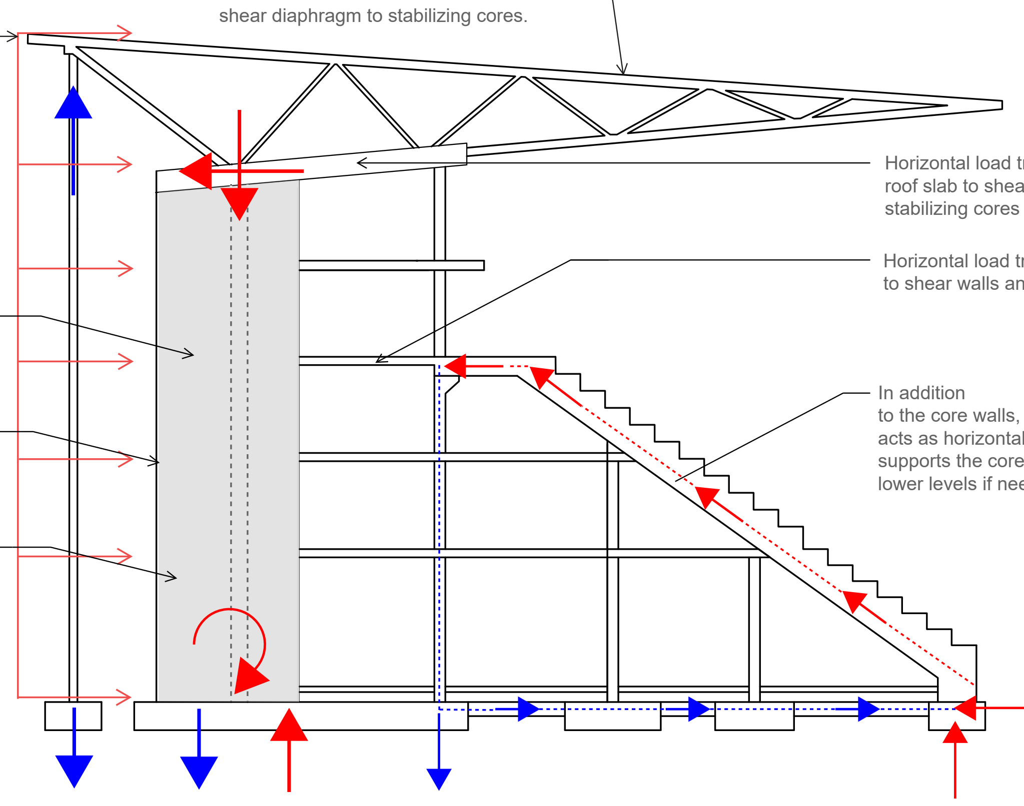


Preliminary analysis show that it is feasible to stabilize the mainstand building using cores and shear walls

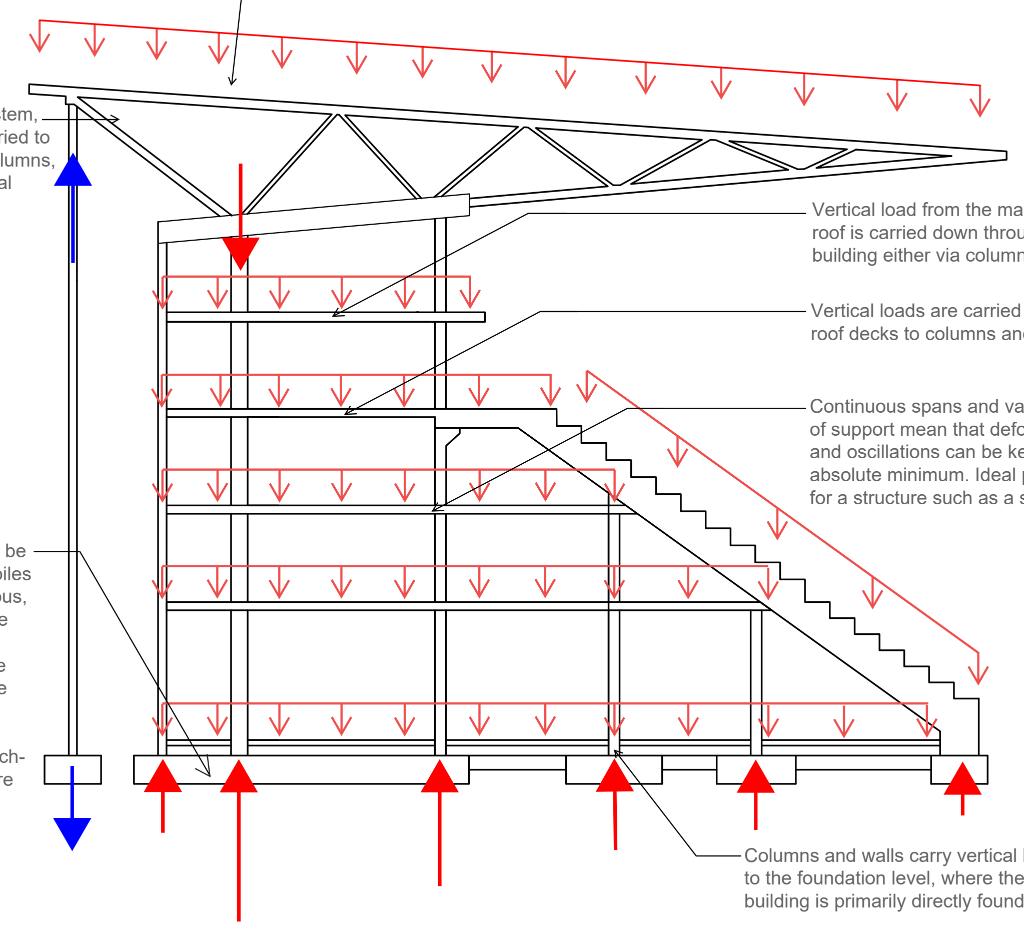
The extent of fixed walls in concrete is limited to a minimum to ensure future flexibility on the floors. It is our intention to make four stabilizing cores containing stairs, ventilation ducts, plumbing and other installations. All of which are cast on site. The rest of the walls that form part of the interior are done as light walls. Lightweight partition walls can be placed where necessary in relation to the desired interior design.

The static behavior is easy to understand, and the structure appears light and simple. Facades are made as light facades, which can be freely suspended from deck edges without the need for additional facade beams. Visually, this means that the facade can have a large degree of transparency without facade beams having to be hidden behind blind partitions. With in-situ cast flat slab structure, it is possible to make cantilevered deck edges in, for example, atriums. The atrium edge does not necessarily have to align with the position of columns in the bearing line. By constructing the raw house as an in-situ cast concrete house, continuous spans will increase rigidity and cause better comfort. Natural frequency and accelerations are significantly better with a coherent in-situ cast solution, and are not dependent in the same way on the stiffness of individual precast elements to meet functional requirements.

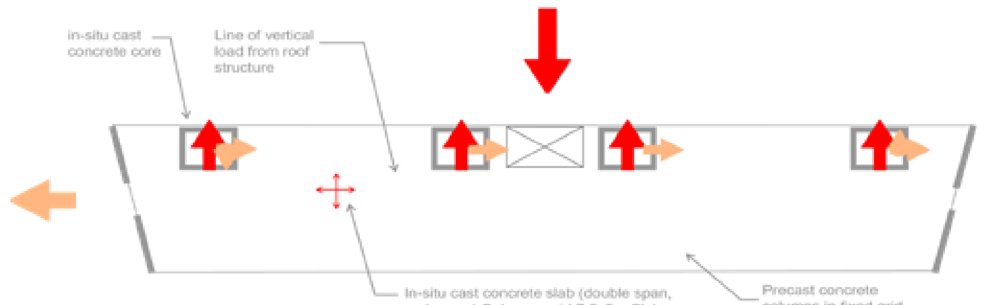
STRUCTURAL SYSTEM



Horizontal load transfer



Vertical load transfer



Horizontal load transfer

ROOF AND FACADE STRUCTURE

The roof structural system has been developed to achieve a lightweight and material efficient structure with structural elements clearly following the intuitive flow of forces. All roof structural elements are steel sections.

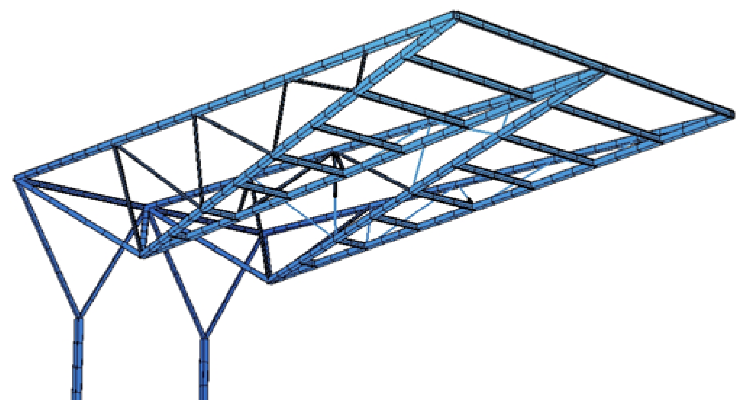
The roof structure has been developed to a System of inclined trusses forming a folded roof shape. The flat areas between the triangular trusses are generated by secondary steel members to connect the trusses and to support the cladding. At the back of the roof, the trusses are supported by Y-shaped backstay columns going down all the way to the ground.

The upper and lower chords of the truss will be steel boxes (welded)whereas the diagonals will be circular hollow sections in different sizes depending on length and loading. The Y- shaped columns will be closed box sections to efficiently resist buckling. All secondary elements in the roof surface (purlins, secondary beam supporting the cladding) are standard I-sections.

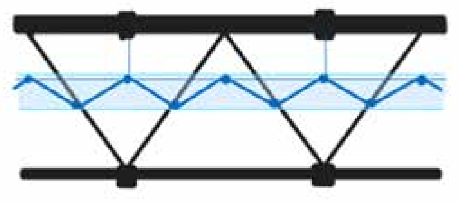
Connection details are all made by off-site welding and bolted/ screwed connections to speed up the on-site installation process and to ensure the potential for demounting the structure into its components at the end of life. On-site welding will be avoided.

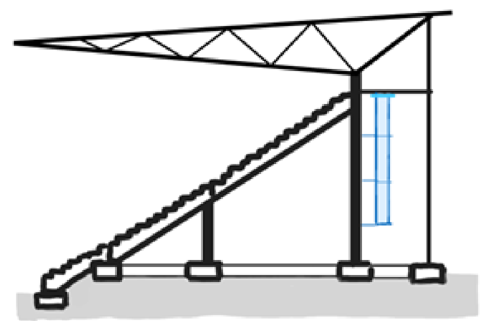
Wrapped around the perimeter of the stadium is the identity-creating polycarbonate façade that runs in a zig-zag between the main bowl columns and the Y-shaped backstay columns.

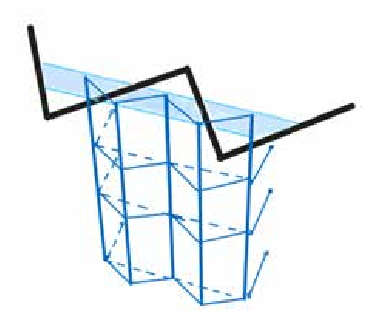
The facade structure will be suspended as a curtain wall from the steel elements which are running in W-shapes between the main stadium bowl and the Y-shaped backstay columns. Due to the dominance of tensile loads in the suspended façade frame, all steel frame elements are very slender sections. For stability and to withstand lateral loads, the zig-zag frame is closed to triangles with small struts at its back and attached laterally to the bowl in three positions along its height.

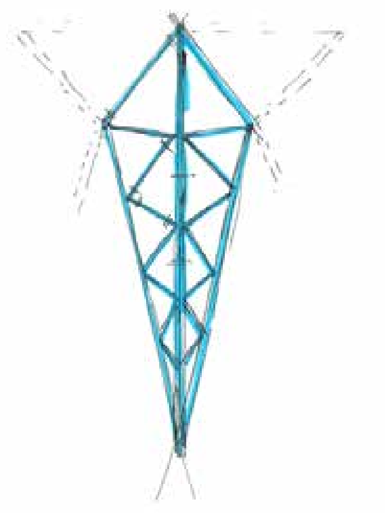


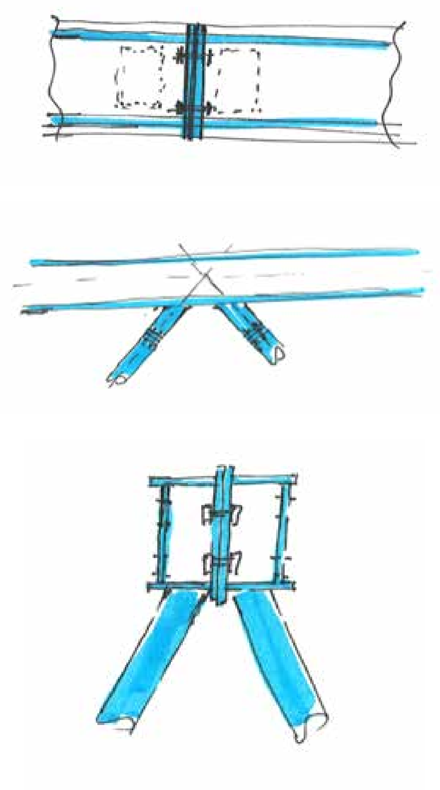
Calculation Model of Roof Section)





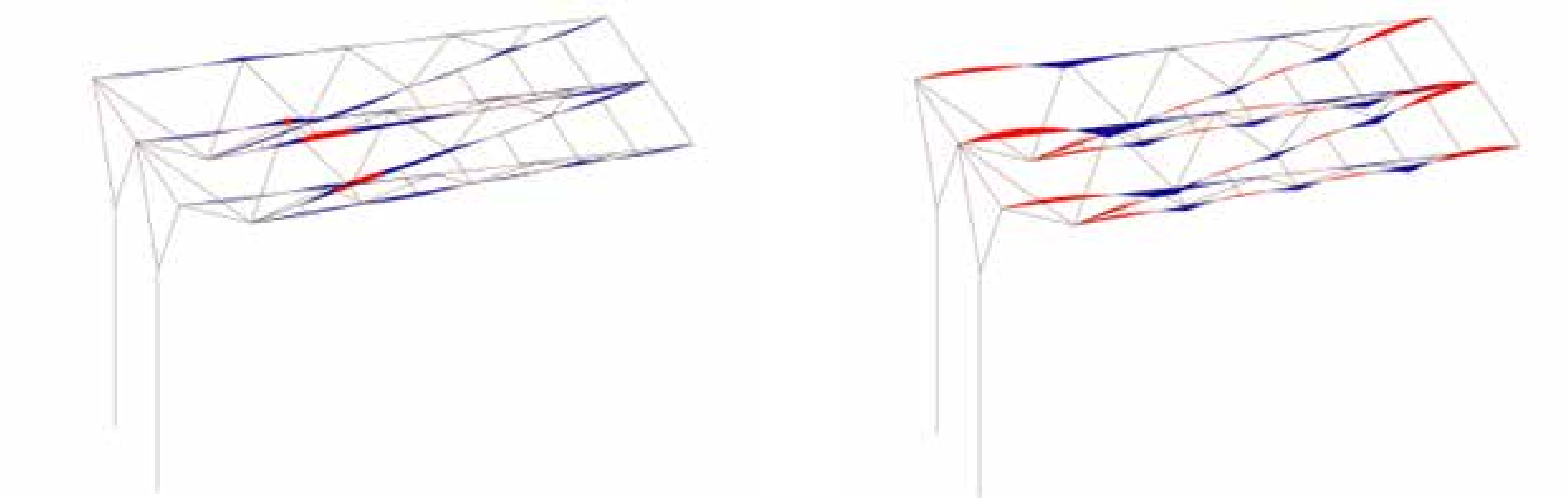




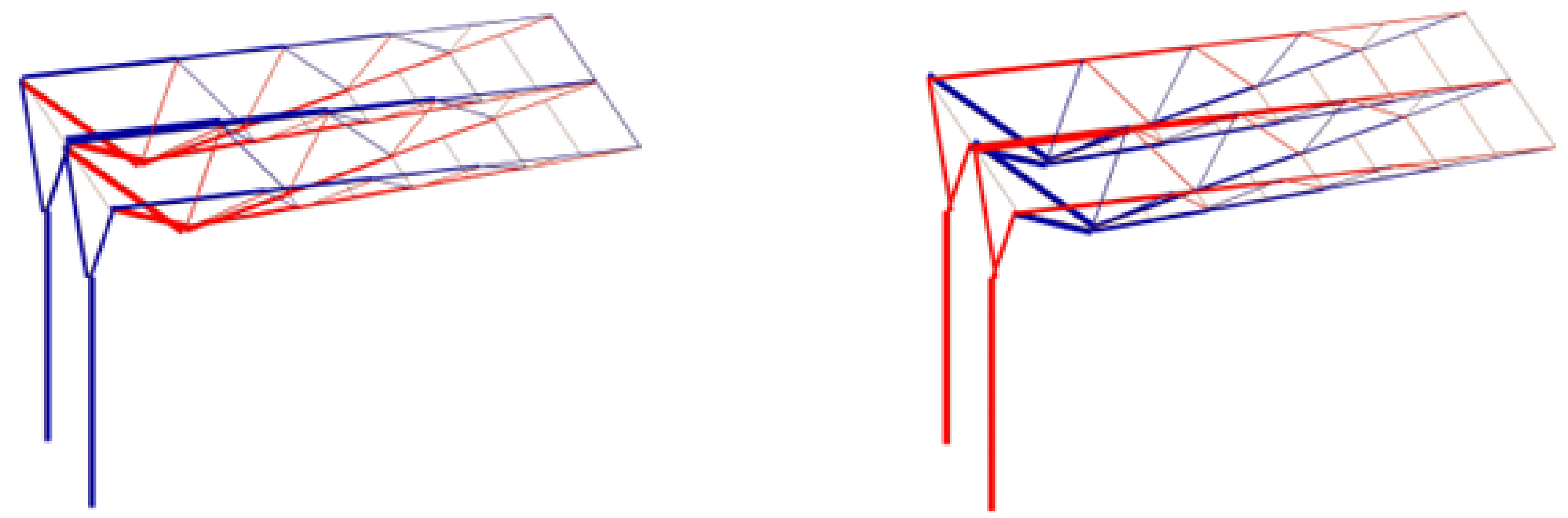


Modularity + buildability

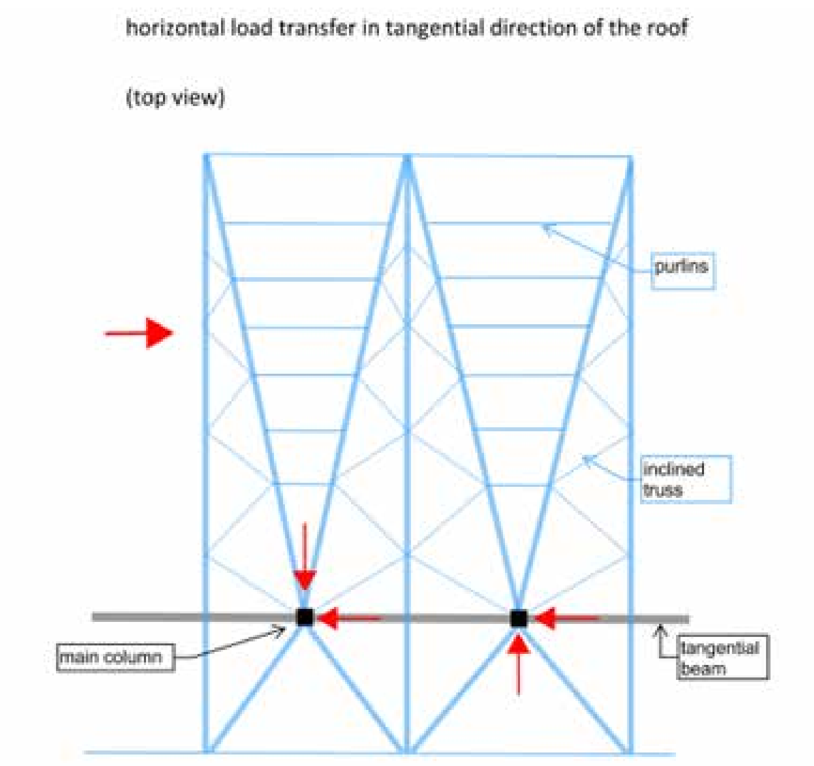
- repetitive structure
- modular truss system
- transport in small parts possible
- bolted connections, easy to mount
- low weight for lifting/ installation



Bending moments under wind pressure (left) and wind suction (right)



Axial loads under wind pressure (left) and wind suction (right)
Red: Compression Blue: tension



12. SUSTAINABILITY STRATEGY

The new stadium in Aahus will be a light-house project demonstrating how stadium buildings can be more extroverted and embracing of their surrounding environments. The design enables this without compromising the stadium experience in which the inside of the stadium is a special place.
The new stadium contributes to the local environment by offering new experiences and functionalities and provide an improved connection between high and low-level terrain in the area. We envision a space with weekly markets, playdates for childen and family picnics.
At the same time the stadium demonstrates the latest knowledge and technologies within environmental sustainability e.g. new and future developments within onsite reuse of materials, use of reused materials from other buildings and best in class when it comes to environmental impact from new materials. To ensure that the stadium is best in class when it comes to sustainability, we have identified 11 targets for the stadium that we wish to incorporate into the stadium.

In the first leg of the competition we identified the following topis as central to our approach to sustainability:

- optimised utilisation of resources,
- environmental impact from materials,
- energy and water,
- universal design and
- ensuring synergy with the local community.

These are areas where we feel this project has the potential to have both a positive and a negative impact if not managed correctly during the decision-making process from the initial stages to the use stage of the building. The processdiagramme on this page and the next addresses how we will ensure a sustainable foundation for the ongoing decision-making process.

Competition stage

- Identify focus areas for and conceptual approach to sustainability.
- Develop initial design concept for focusareas (landscape, building design, structures, indoor climate, energy-efficient design, material selection etc.)
- Propose sustainability targets (level of ambition for targets) based on market analysis and project analysis.
- Perform LCA and the carbon requirement that enters into force as of January 1st 2023.
- Assessment of micro-climate
- Assess LCC based on SBP's experiences from other stadium projects and supplement with LCC calculations if necessary.

Concept design stage

- Prioritise targets in dialogue with construction client.
- Daylight simulations to investigate compliance with the Voluntary Sustainability Standard (VSS)
- Detail concepts and perform initial calculations for rainwater management, thermal indoor climate, building and stadium acoustics and water use.
- Update LCA, LCC, Energy and Daylight calculations as the project develops to ensure compliance with legislative requirements and VSS / legislation.
- Catalogue materials in the existing building and reassess targets for reuse set in competition stage
- Identify materials with risk of containing unwanted substances and investigate potential substitutes.
- Perform DGNB screening (if DGNB is added) and identify potentials and challenges for certification.
- Update process plan and stakeholder responsibilities.

Detailed concept stage

- Update LCA, Energy, Termal comfort and Daylight calculations to ensure compliance with legislative requirements and the VSS/ legislation.
- Update material catalogue from concept design stage and ensure compliance with VSS.
- Update calculations for DGNB and collect stakeholder documentation (if added).

Municipal approval

- Submit LCA calculation to ensure compliance with VSS (not a part of BR23 legislation).
- Collect documentation from Fire Engineer and Energy Engineer (if DGNB is added).

Main project and tender

- Perform LCC calculations on technical solutions as the project detail increases.
- Assess impact from transportation of materials and waste generated on the construction site for different types of materials and incorporate appropriate requirements in tender material.
- Follow-up on compliance with VSS and Legislative requirements (LCA, Daylight and Energy) as the level of detail increases.
- Prepare tender material for sustainability incl. list of materials and requirements for prevention of unwanted substances, material performance requirements for selective deconstruction and new construction (focused on carbon) and contractural lists of required documentation from construction and handover and general quality assurance of tender material to ensure compliance with legislative demands, VSS (measurements and O&M manual) and DGNB (if added).

Construction stage

- Kick-off workshop(s) with construction manager, working environment coordinator, quality assessor and discipline leads for all contractors.
- Sparring with contractors and disciplines responsible for quality assurance.
- Pre-approval of materials prior to purchase and application on site to ensure compliance with the carbon class and VSS criterion for unwanted substances.
- Collection of documentation of compliance from contractors
- Quality assurance of collected documentation and on site measurement of TVOC/formaldehyde (for VSS and/or DGNB).
- Completion of O&M manual in collaboration with indoor climate engineer, HVAC engineer and contractors for HVAC and BMS.
- Completion of additional measurements for DGNB (if added).

Handover

- Submission of report on compliance with sustainability targets set in collaboration with client in the competition and concept design stages.
- Submission of material for municipal approval (Energy, Daylight, LCA).
- Submission of DGNB report and documentation to DK-GBC (if added).

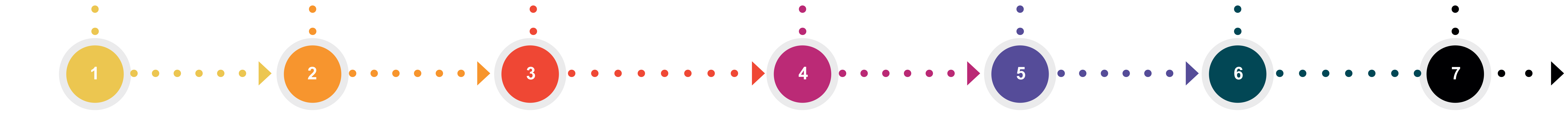


Illustration: An overview of analyses and other types of activities throughout the project.

SUSTAINABILITY TARGETS

In the second leg of the competition we have specified the following prioritised targets that we wish to have a dialogue about in the dialogue meetings in this stage of the competition. The prioritised targets below are ordered by level of importance and after how ambitious the target is compared to best practice. We are looking forward to discussing these in the upcoming dialogue meetings. In supplement to the these we would like to have a dialogue about how the New Stadium in Kongelunden can contribute to sustainable transport of stadium employees, users and guests in close collaboration with the masterplan for Kongelunden.

1 Design for social coherence with neighbourhood

Target	Purpose
Establish a public area between the façade and the enclosed concourse and the columns anchoring the roof construction of the stadium. How this space is to be activated is up for further clarification in our dialogue meeting but we dream of market days, seating and elements of play - e.g. distance marks and timings in the pavement for AGF's fastest running football players etc.	Ensure a high interaction between the stadium and Kongelunden.

2 Promoting healthy materials without human- or ecotoxic content

Target	Purpose
Promoting healthy materials without human- or ecotoxic content in coherence with REACH and the DGNB criterion ENV1.2 and ensuring socially responsible purchase of materials by applying the methodologies developed by DGNB (ENV1.3) and BREEAM (MAT03) naming appropriate schemes for ensuring socially and environmentally responsible procurement in the building industry. This list is long and we have thus not included this in this submission. We are however happy to provide this in an upcoming dialogue meeting. This includes compliance with the Voluntary Sustainability Standard.	Ensure user health and prevent biocide.

3 Prioritise materials with a high level of recycled content.

Target	Purpose
The level of recycled content is still to be decided based on the level amongst suppliers, however our initial target is at least 40-50% recycled content for steel reinforcement and other types of construction steel, 35-50% for aluminium panes in windows and doors, 30-50% recycled content in non-biogenic insulation, 80-100% recycled content in plastic seating, 50-70% recycled content in Polycarbonate panels, 40-60% recycled content in opaque glass panels, 70-100% recycled content in electrical cables.	Reduce consumption of virgin materials and reduce environmental foorprint from new materials.

4 Reuse 60-80 % of steel from the existing stands

Target	Purpose
Please refer to section construction and buildability, section on terracing for further specification of solution. As mentioned in this section, the possibilities of doing this may be restricted by the project time schedule if no CE-label is available for the existing stands.	Reduce environmental impact from deconstruction and new materials.

5 Recycling of all remaining recyclable materials

Target	Purpose
Recycling of all remaining recyclable materials in collaboration with the contractor selected for selective deconstruction of the existing stadium. This will be a competitive parameter in the tender for deconstruction where we are currently testing our methodology for how to include calculation of carbon-savings in the competition stage for tendering of deconstruction contractors.	Ensure a high percentage of reuse of materials from deconstruction and thus environmental footpring from these processes and new materials.

6 Compliance with Danish Carbon Class

Target	Purpose
Ensure compliance with the Danish Carbon Class which comes into force 1st of January 2023. Please refer to paragraph on LCA calculations on the next page where we have enclosed LCA calculations for stage 1 and 2 of the competition. This calculation will be updated continuously in the project to ensure compliance.	Ensure legislative compliance and identify potentials for reducing environmental impact from the construction and operation of the building.

7 Design for future reuse of stadium seating, stands and membranes

Target	Purpose
Design for disassembly and reuse of stadium seating, stands and membranes though the use of modular systems for the stands.The modulat system is based on international best practice.	Ensure flexibility, a long lifespan for the stadium and increase probability of future reuse of ressources. .

8 Reduce use of drinking water

Target	Purpose
Reduce the use of drinking water in showers by 80% through the introduction of Orbital system or similar systems.	Reduce environmental and operation costs.

9 Local rainwater management

Target	Purpose
Ensuring local rainwater management in collaboration with the rest of Kongelunden.	Reduce risk, promote rainwater management as a recreational element, reduce environmental and financial costs associated with rainwater management.

10 Comfortable and affordable indoor climate

Target	Purpose
Securing a comfortable and affordable indoor climate. Please refer to section energy concept, section on indoor climate for further specification. This includes compliance with the Voluntary Sustainability Standard.	Promote user health, ensure compliance with VSS and reduce hidden energy costs for cooling.

11 Energy-efficient operation

Target	Purpose
Ensuring energy efficiency through the design of the building envelope and technical installations.Please refer to section energy concept, section on energy for further specification.	Reduce financial and environmental costs from operation.

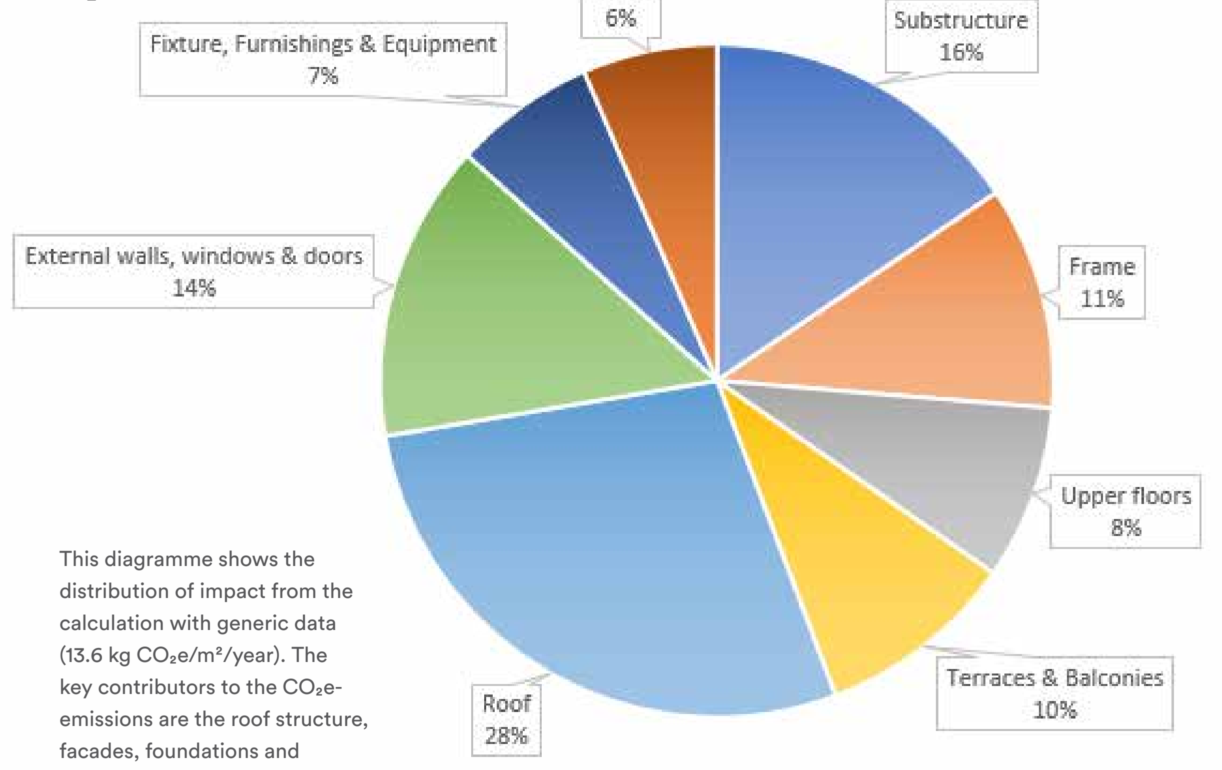
LCA

We have completed calculations to investigate whether it is possible for a stadium to comply with the upcoming Carbon Class in the Danish Building Regulations. The target of a maximum 12 kg $CO_2e/m^2/year$ for a 50 year periode was set based on a dataset of a total of 60 office and residential buildings. Material extensive buildings have proven to be challenged when it comes to compliance. We have therefore prioritised LCA calculations from this leg in the competition to reduce the risk of redesign or non-compliance. The calculation method has been cleared with BUILD and the Danish Bolig og Planstyrelsen. The area of seating is included by a factor of 0,25 whilst the area of the concourse and the main stand are included by a factor 1. The calculations are based on the information level of materials and quantities at this stage in the competition.

We have primarily used generic data for material emissions corresponding to the database that may be used in the forthcoming building regulation in 2023. If no generic data is available, relevant EPD's from possible manufacturers have been used. Due to the early stage a buffer of 10% is added to the material emissions. We have furthermore investigated the sensitivity of our preliminary results by investigating best and worst carbon emissions for each material type. The results of our calculations are presented in the illustrations on this page. At this point it is our conclusion that the building can be expected to have a CO_2e-emission at approximately 15.8 kg $CO_2e/m^2/year$, 13.6 of these are from materials used. The CO_2e-emissions are quite high and the average value is higher than the forthcoming limit in the building regulations. For a high material intensity building this is expected.
The sensitivity analysis shows a range of results from 10.9-20.7 kg $CO_2e/m^2/year$ depending on the choice of suppliers and materials.

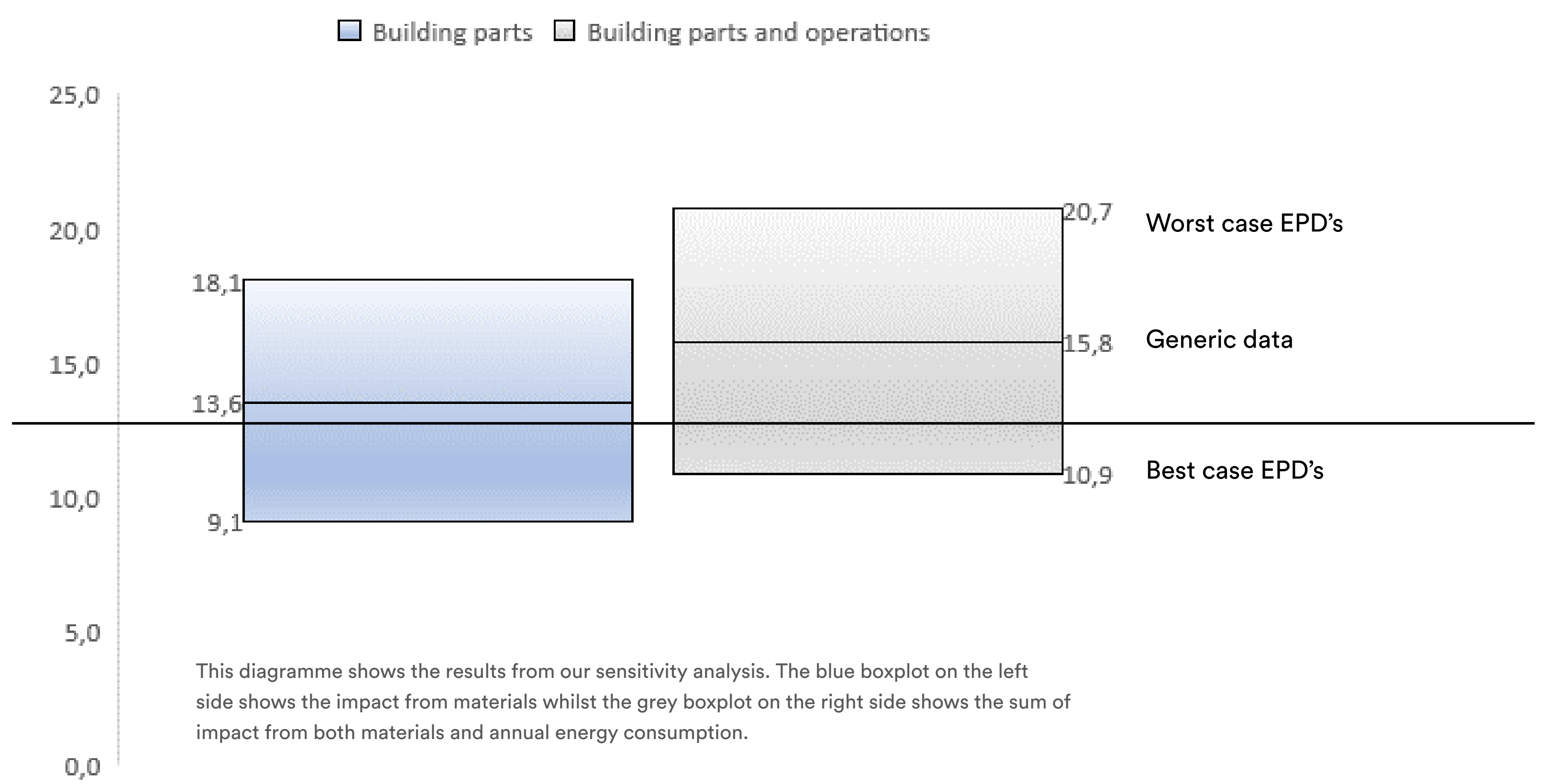
An increase in the resue of materials, purchase of reused materials as well as purchase of materials with a high content of recycled materials will reduce the carbon emissions further than shown in the diagramme below. This in combination with manufacturer development of low-carbon alternatives will in many cases reduce the impact further.
The analysis shows the importance of including LCA calculations and the resulting CO_2e-emissions continuously in the decision-making process. The analysis furthermore highlights that the key contributors to the CO_2e-emissions are the roof structure, facades, foundations and concrete structures in general.

CO_2E EMISSIONS ON BUILDING PARTS



This diagramme shows the distribution of impact from the calculation with generic data (13.6 kg $CO_2e/m^2/year$). The key contributors to the CO_2e-emissions are the roof structure, facades, foundations and concrete structures in general.

SENSITIVITY ANALYSIS SENSITIVITY ANALYSIS CO_2E-EMISSION IN KG $CO_2E/M^2/YEAR$



This diagramme shows the results from our sensitivity analysis. The blue boxplot on the left side shows the impact from materials whilst the grey boxplot on the right side shows the sum of impact from both materials and annual energy consumption.

13. BUILDING SERVICES

All installations in the main stand are exposed to underline the honest design expression. The routing is arranged with a special care for simple and rational guideways. The technical installations are controlled by a complete BMS system. Sprinkling is established according to the fire strategy.

HEATING

The building is supplied with district heating from the utility led to the plant room on level 0. From here the main space heating pipe is led to vertical shafts and distributed through the building and supplied to the rooms via radiators and convectors. Mixing loops for the under-floor heating in the changing rooms, space heating and production of domestic hot water are placed on level 0. Mixing loops for the ventilation heating coils are placed near the ventilation units on level 4. In the main entrances on level 0, air heating blankets are established to minimize the energy consumption and to ensure a comfortable indoor climate.

At this stage, the pitch heating is planned as a hydronic system to achieve low energy use and thus operating cost. The system is controlled so that the soil temperature stays within a specified range to keep the soil from freezing and to protect the grass.

COOLING

The cooling system for ventilation cooling coils and cooling for storages in the production kitchen are placed on level 4. From here, the cooling pipes are distributed to the technical rooms and the kitchen through vertical shafts. Mixing loops for the ventilation cooling coils are placed near the ventilation units.

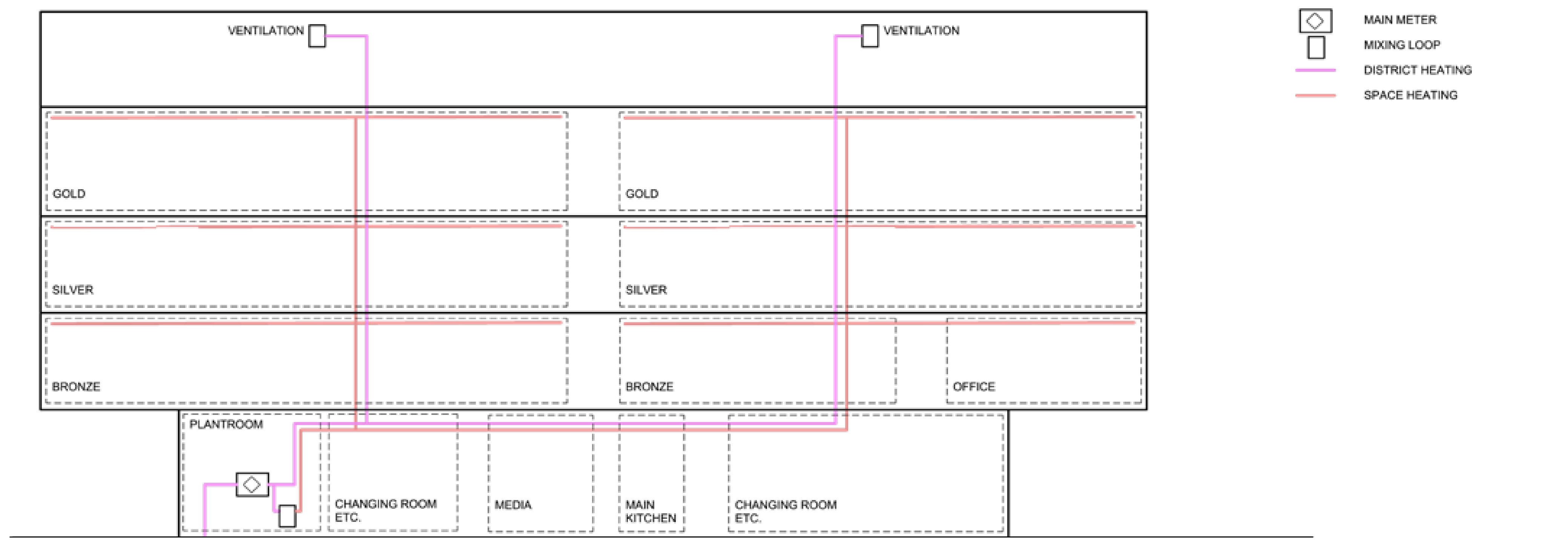
During the coming project phases, the possibility for supply of district cooling from the utility are to be investigated to both reduce the necessary technical areas and reduce operational costs.

VENTILATION

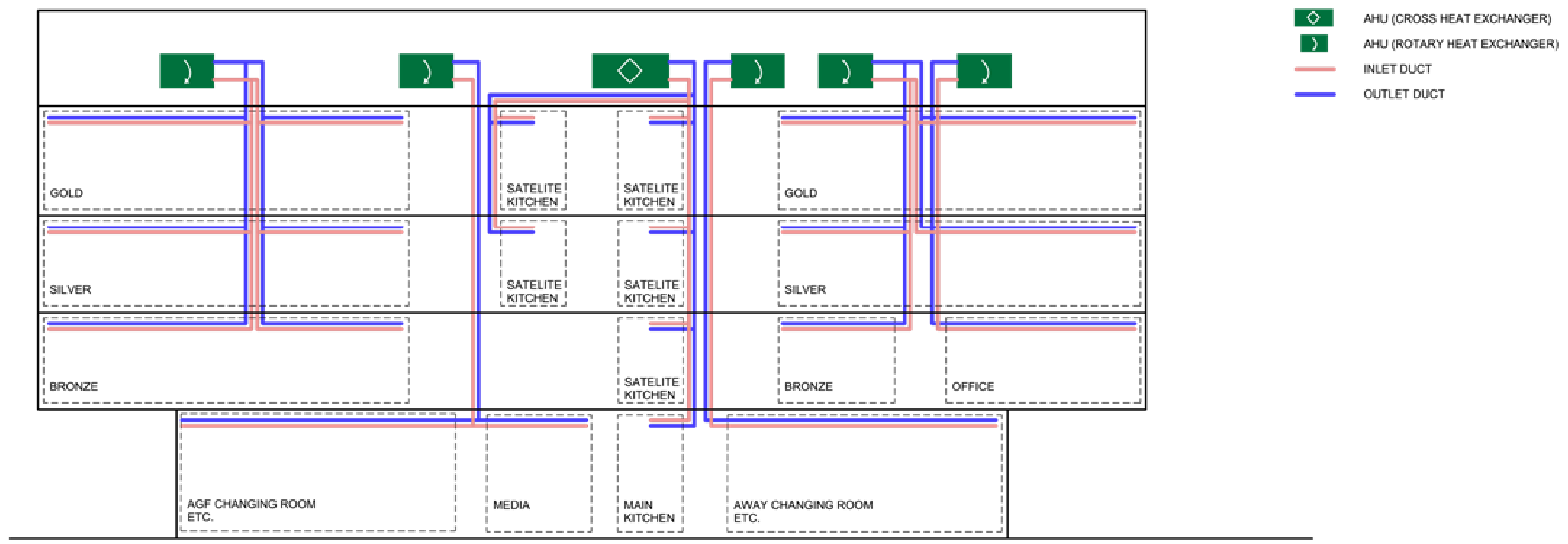
The main stand building is equipped with mechanical ventilation following the principle of balanced VAV. Due to the very different usage patterns and ventilation requirements, independent units are established for the VIP-lounges, office area, production kitchen, and changing rooms. In general, the units are supplied with a high efficiency rotary heat exchanger. The unit supplying the kitchen is established with a cross heat exchanger due to risk of odor nuisances.

The ventilation units are placed on level 04 and distributed vertically via shafts. To reduce duct sizes and ducts lengths the large VIP-lounges are supplied from several units from each end of the building. The units are equipped with both heating and cooling coils to ensure a comfortable thermal indoor climate.

In the VIP-lounge areas, the mechanical ventilation ensures a basic supply of fresh air. At high load periods when the occupancy and heat gains are high, additional fresh air is supplied via natural ventilation. This hybrid-ventilation principle reduces the energy consumption while decreasing the investment and operational costs. The natural ventilation is established as cross-ventilation with automatic openings strategically placed in the north and south facing façades. Additional thermically-driven chimneys are established as vertical shafts close to the staircases, which increases the efficiency of the natural ventilation.



HEATING



VENTILATION

WATER INSTALLATIONS

The main water utility connection is placed in the plant room on level 0. From here the main water pipe is distributed through the main stand building to the technical rooms and taps. The DHW production units are placed in the technical room on level 0 and circulation pipes are established when necessary to ensure a short response time. In the heated spaces around the concourse, decentralized DHW productions units are established to reduce the operational costs and heat loss from pipes.

ELECTRICAL SYSTEMS

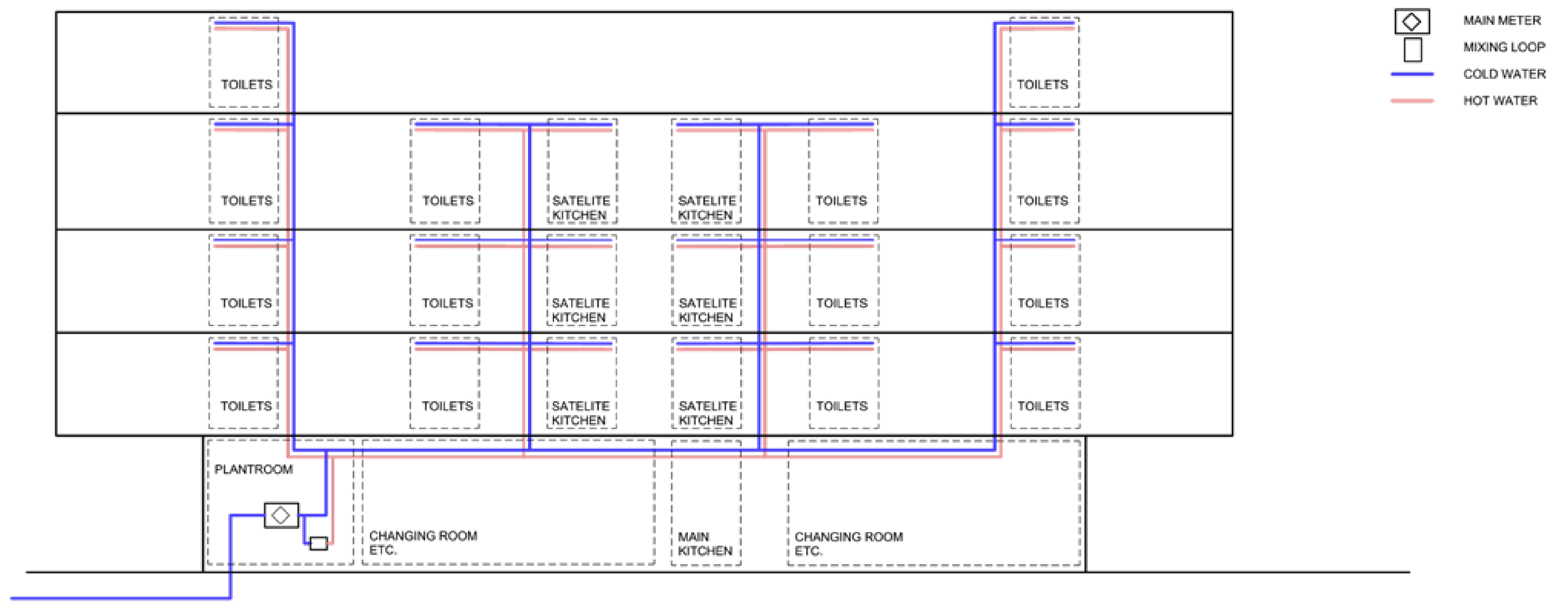
A transformer for the main stand is established on level 0 by the local utility company. A secondary transformer is established to supply the stadium. If the voltage disappears on the public network, a back-up generator ensures the supply. In the short time until the voltage is restored, selected installations are supplied via a UPS system on level 4. The Main switchboard is established close to the transformer at level 0 and sub-switchboards are established on all floors to minimize the lengths of group cables.

Low voltage and low voltage installations are established for all special installations, including TV transmissions, installations in the production kitchen, VIP lounges and other facilities. Likewise, installations are made in technical rooms, toilets, meeting rooms, shop areas, changing rooms and fan-bars, which comply with the Electrical Safety Act and the qualities described in the competition brief.
The PDS-installations are performed as Cat-7 around the building, where cross-field rooms with rack cabinets are placed in the building on each floor so cables do not exceed 90 meters. A 'star network' will be established with backbone on the fiber installations. Outlets for access points are made with POE and placed so that full coverage of the wireless network can be obtained in the building.
A PAVA sound system is included, which is connected to the sound system for screens and speaker systems and connected to the emergency-warning system. A DAS system to amplify signals for mobile phones has been included, which ensures coverage during events that take place at the stadium.

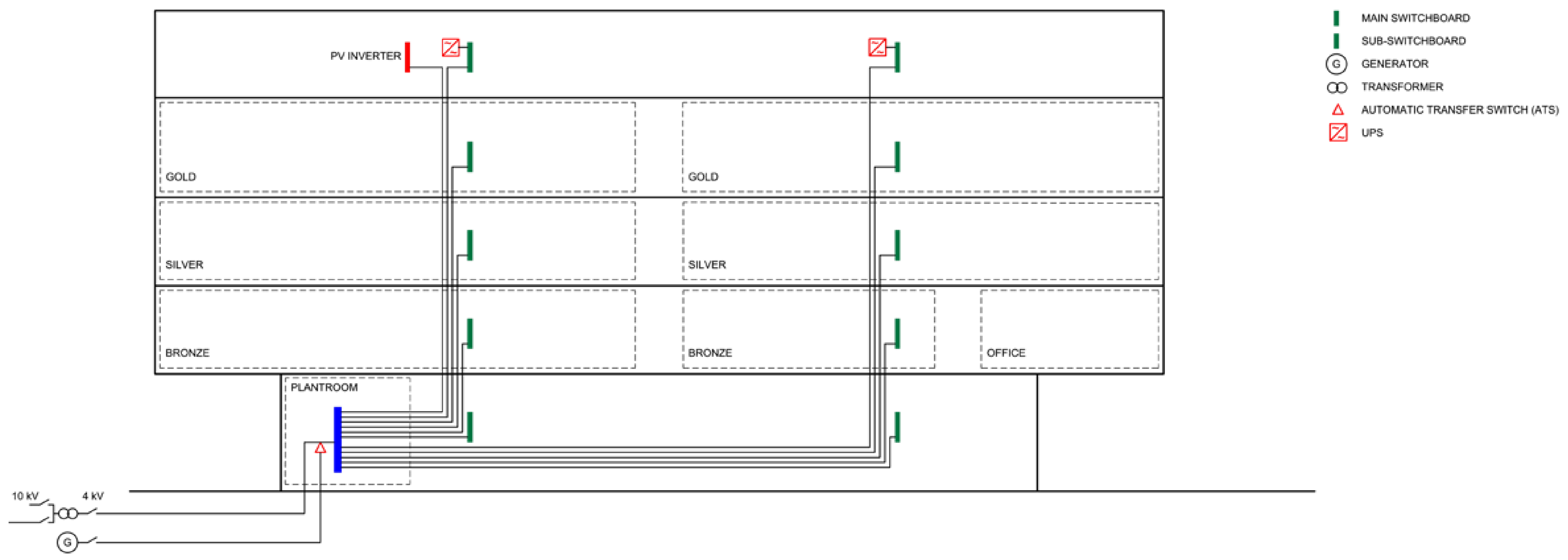
Stadium lights are established according to the UEFA requirements for the TV-transmission of international matches, where a level of 1500 lux is required. For now, this is based on Philips LED luminaires where control of the light is also included, giving the opportunity for special lighting and sessions during for instance the entrance to football matches. Lighting on public areas and in other rooms is established in accordance with the rules in DS / EN 12464 which considers the layout of the surrounding rooms and quality requirements for the room.

DRAINAGE

The wastewater system is established in a traditionally way with soils pipes placed in vertical shafts near the toilet areas throughout the building. Wastewater derived from the production kitchen passes a grease separator before being led to the sewer system. For the toilets around the concourse, the wastewater is divided into two separate systems for each toilet section in case one is plugged the other will function to ensure operation during peak periods (ex. during games). The wastewater system is generally equipped with sufficient cleaning possibilities.
The rainwater from the roof is collected and used for watering of the pitch, cleaning of windows and such.
Drainage of the surrounding landscape are collected from wells and led to retention reservoirs and then led to the utility connection.



WATER INSTALLATIONS



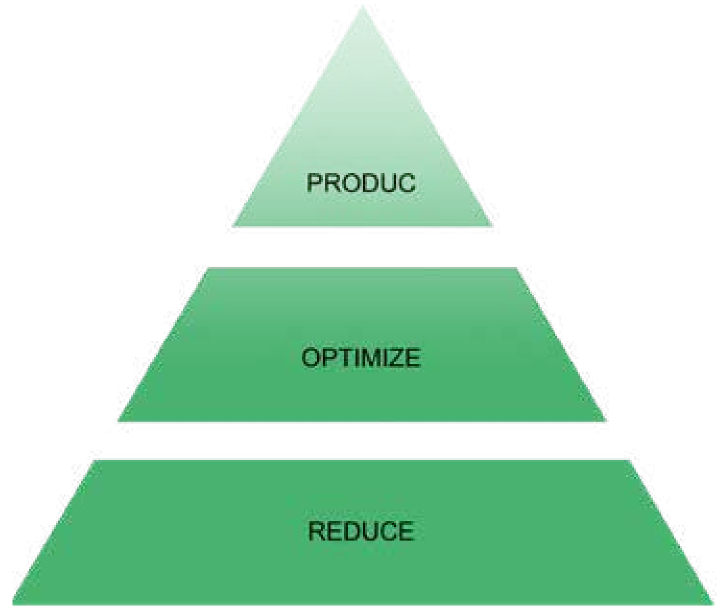
ELECTRICAL SYSTEMS

14. ENERGY CONCEPT

ENERGY

The project group has worked from the following hierarchical energy concept, in order to optimize the energy consumption and respecting a holistic integrated approach considering for instance indoor climate and aesthetic. First and foremost, the focus has been on reducing the energy consumption via implementing passive design initiatives. Passive measures include the 360° roof construction and associated cover that serves as an efficient solar shading (overhang) which supports a comfortable indoor and outdoor climate. This is ideal to reduce the heat gain from the summer sun, while allowing the heat gain from the low winter sun to advantageously contribute to heating the space in the winter period. Furthermore, the office area is oriented towards north-west, thus minimizing the solar heat gain and allowing a great look out to the surroundings.

Secondly, energy consumption is optimized by choosing energy-efficient active technical solutions, i.e. glazing with a low solar heat transmittance (g-value) and relying on natural ventilation in peak periods with high heat gains. Finally, renewable energy producing facilities have been added for compliance with the energy framework (photovoltaics).

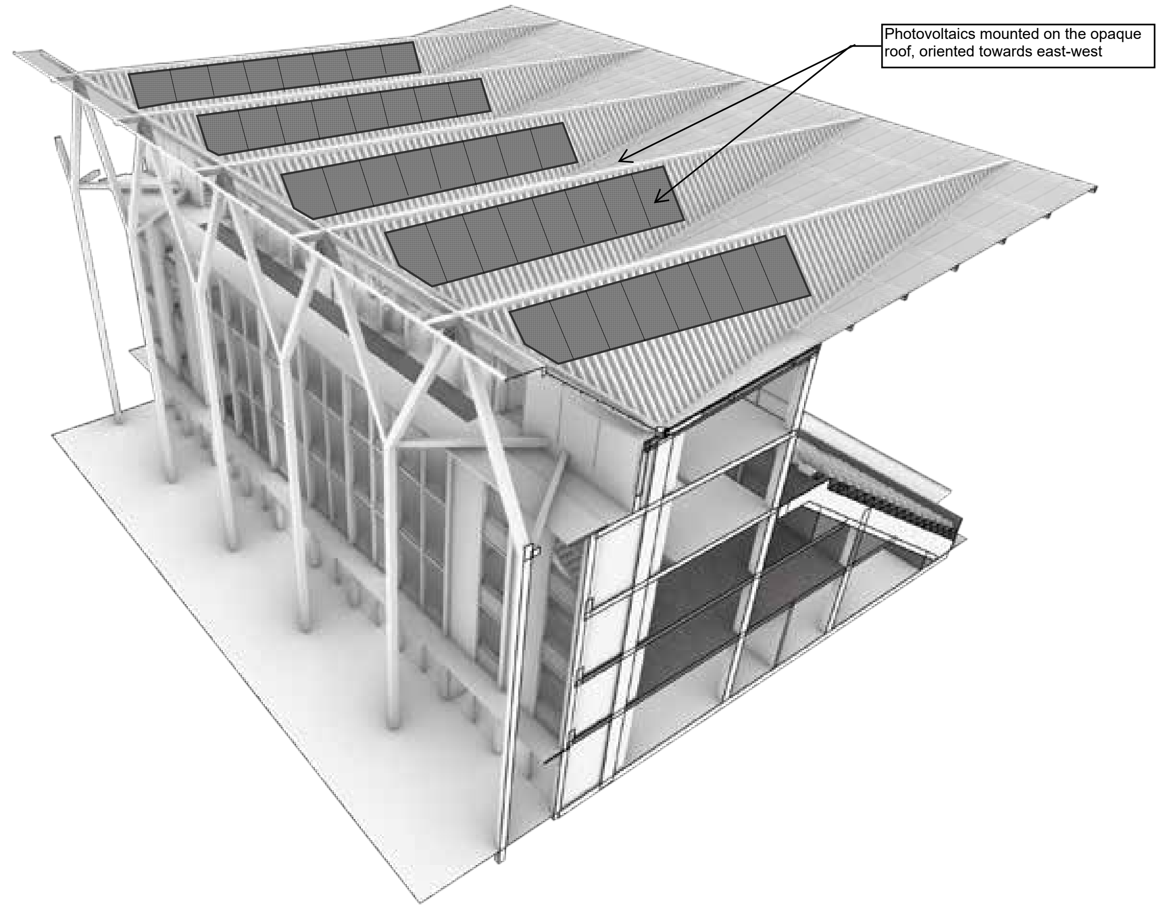


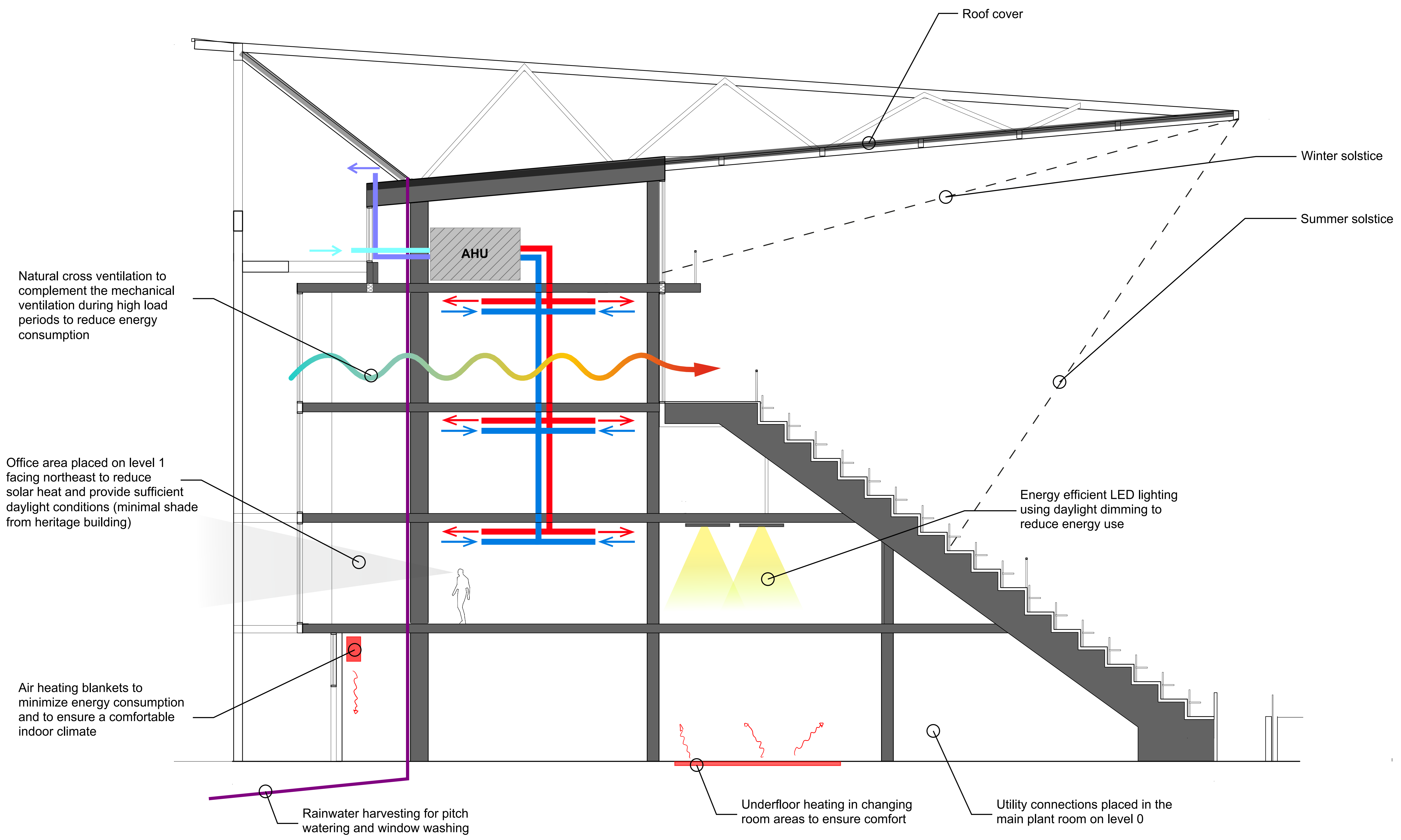
The heated building areas are all subject to compliance with the energy frame and maximum transmission loss through the building envelope according to the Danish Building Regulations. The areas are treated under one energy frame altogether. In the design phase, an initial energy screening has been carried out to assess how the building performs in terms of energy, which shows that to comply with the energy frame it is necessary to establish a PV system. The photovoltaics are mounted on top of the opaque roof cover oriented towards east/west, thus prolonging the timer of daily production compared to south-orientated photovoltaics.

INDOOR CLIMATE

The indoor climate in the main stand building provides healthy and comfortable conditions for the employees in the office area as well as the guests in the VIP lounges. The indoor climate consists of several parameters which influence comfort, for instance room temperature, air quality, acoustics, daylight and electrical lighting conditions etc.

The main stand building and the technical installations are designed in a way which enables the indoor climate to fulfill with the "Standard" class according to the 'Branchevejledning for indeklimaberegninger". To ensure this, preliminary detailed hourly simulations has been performed to assess the thermal and atmospheric conditions, using standard occupancy profiles and standard weather conditions for Denmark. The results show compliance with both the thermal and atmospheric requirements for an air-change rate of approx. 6h-1. During peak periods with high heat gains, the mechanical ventilations system I supplemented by natural ventilation through automatic openings of windows.





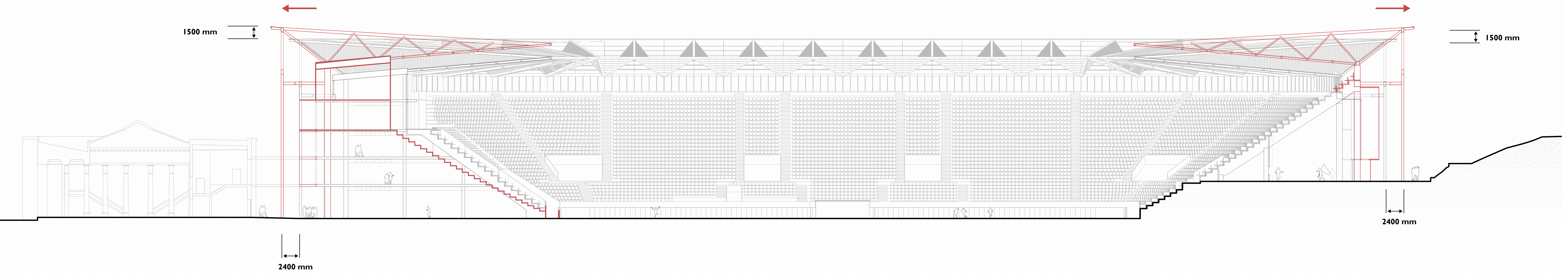
15. NEW DESIGN OPTIONS

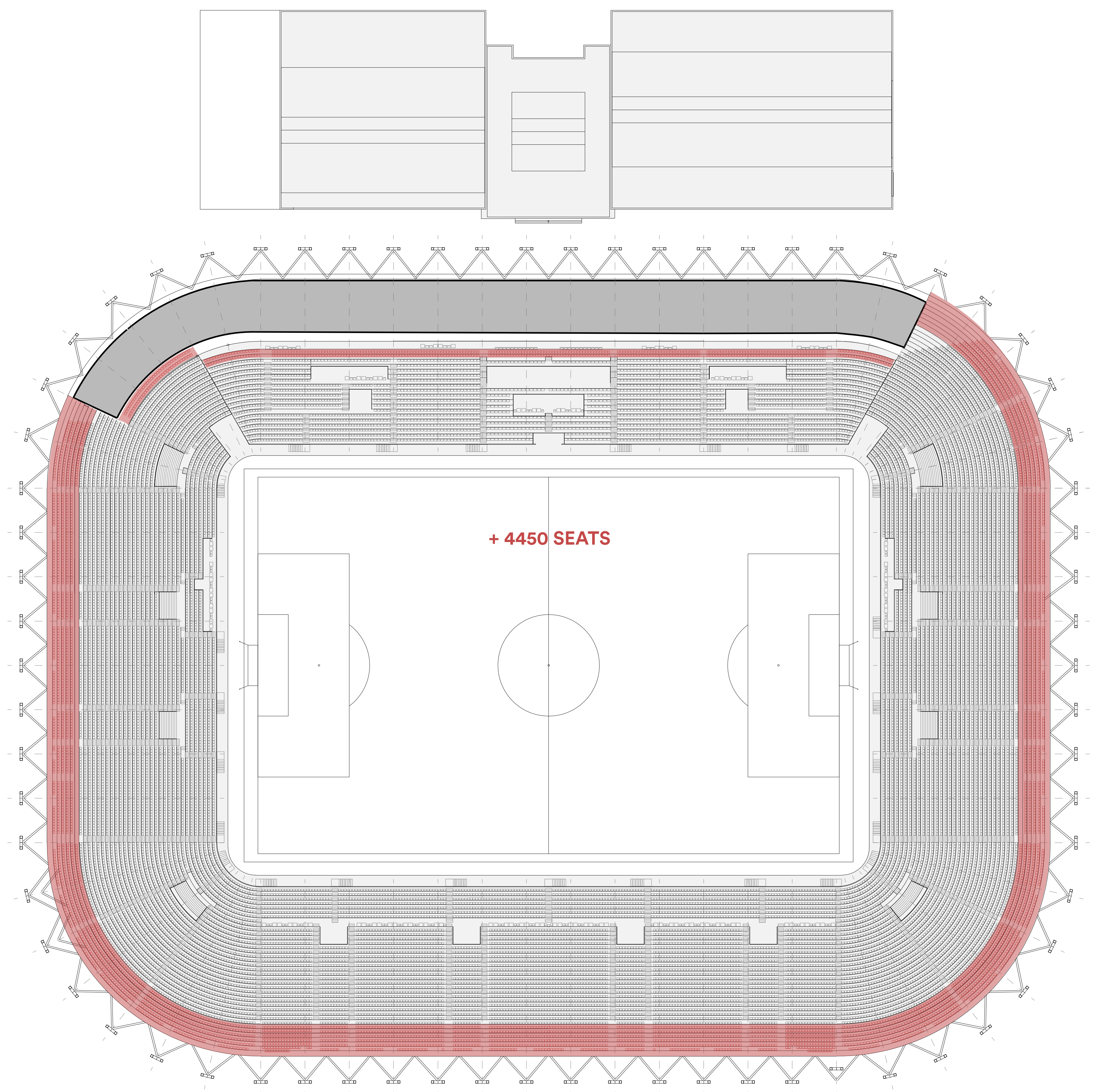
DESIGN OPTION 1: INCREASED SEAT CAPACITY TO 24,000

The structural concept of the roof and bowl remains the same with increased seat capacity. Primary columns need to be shifted by 2.4 meters, and the roof height and main cantilever need to be increased. Cross section sizes will increase due to the larger cantilever, especially the main roof girder, V-shaped columns, and Y-shaped backstays, leading to an increase in steel tonnage.

In the main stand building, an additional column will be introduced to keep slab spans in an efficient range. The distance from facade to heritage building remains above 6m.

The cost addition is estimated on p. 3 in "Construction cost and robustness"

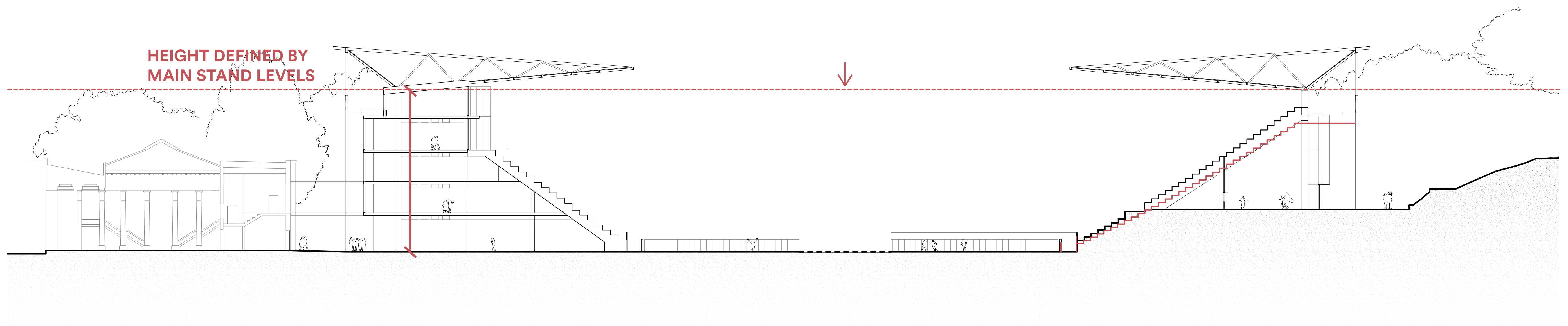


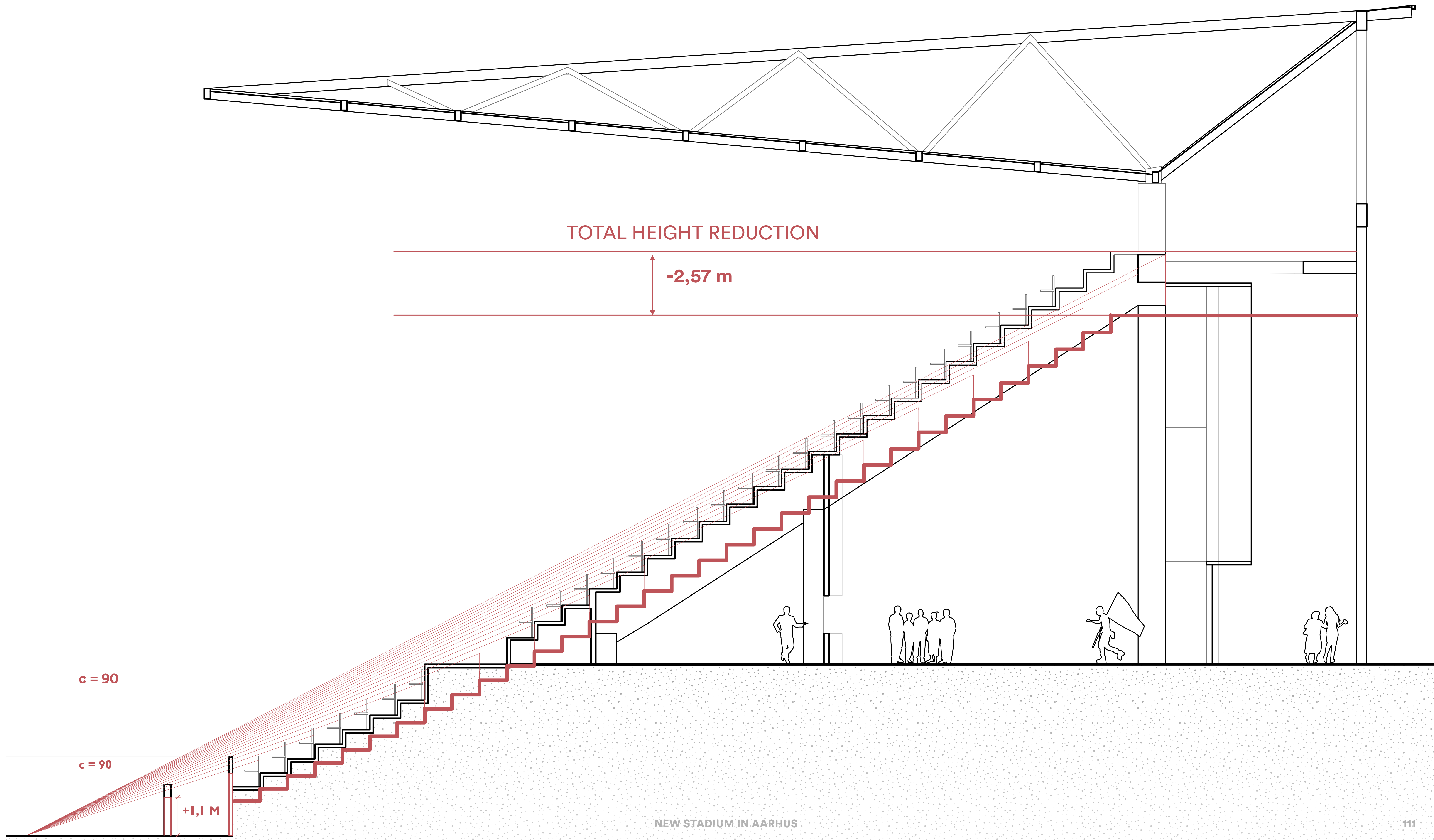


DESIGN OPTION 2: 1.1M LED PITCHSIDE ADVERTISING BOARDS

Reducing the pitchside advertising boards to 1,1m allows for less steep front row seating while maintaining a sightline value of c = 90. The resulting bowl height is 2,57 m below the current bowl. The roof height is defined by the main stand height, and thus remains at 24m. The principle structural concept of roof and bowl stays the same

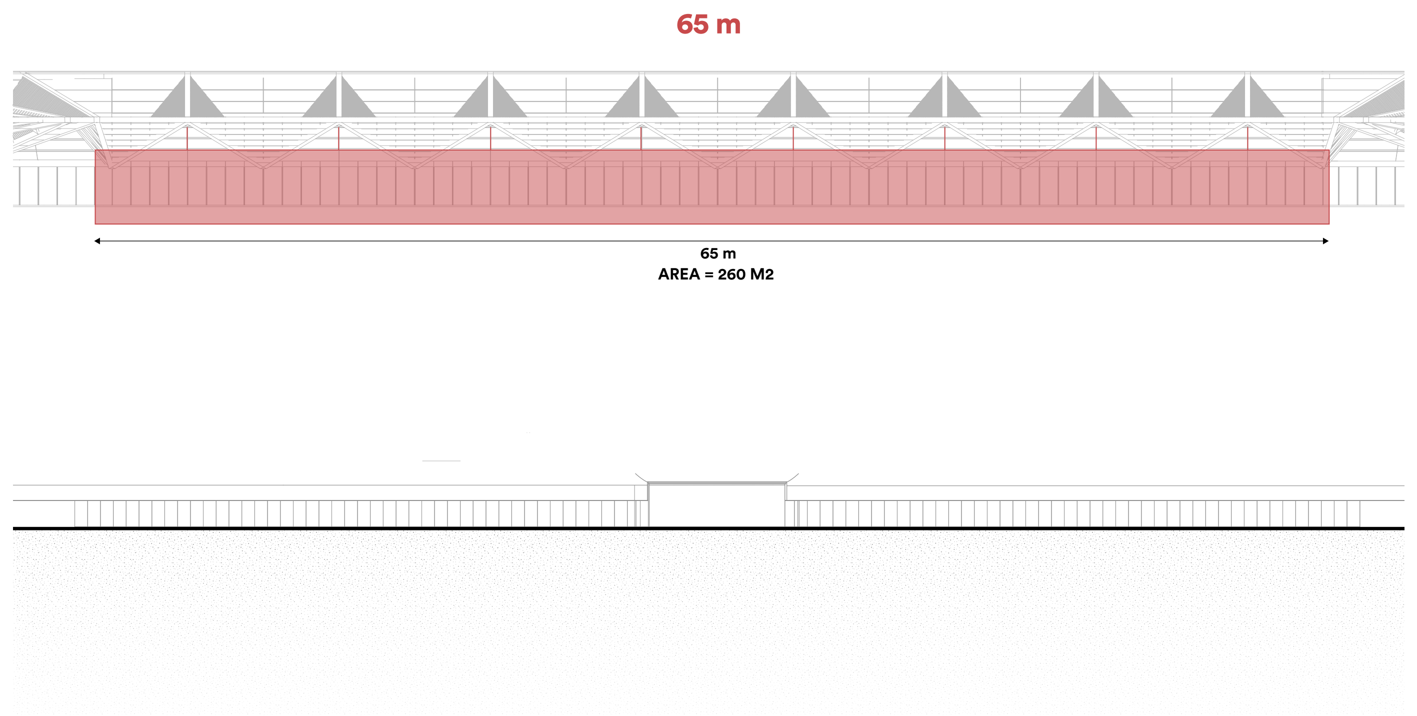
The cost deduction is estimated on p. 3 in “Construction cost and robustness”

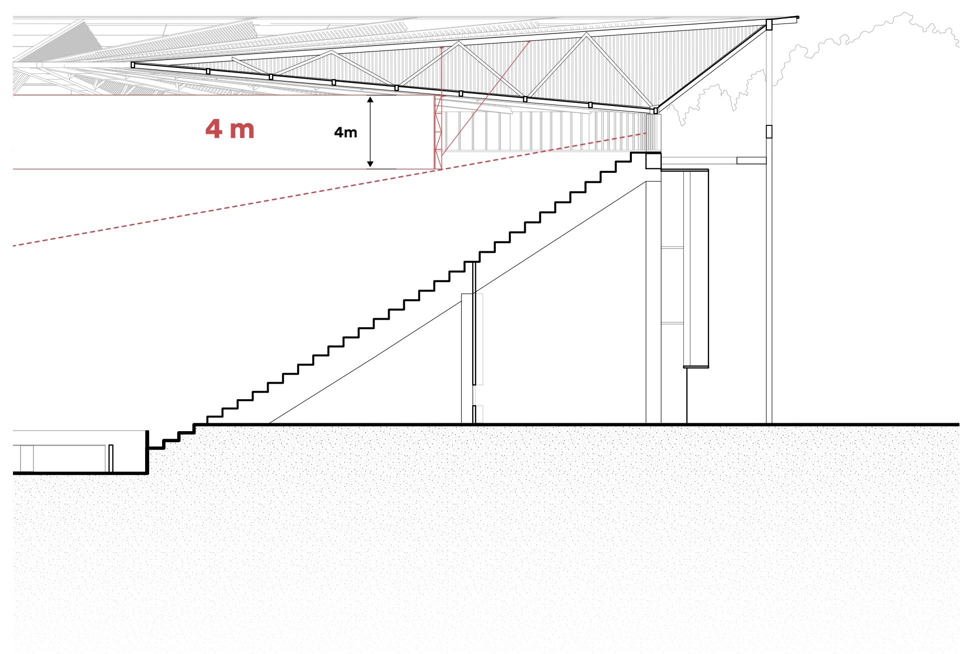


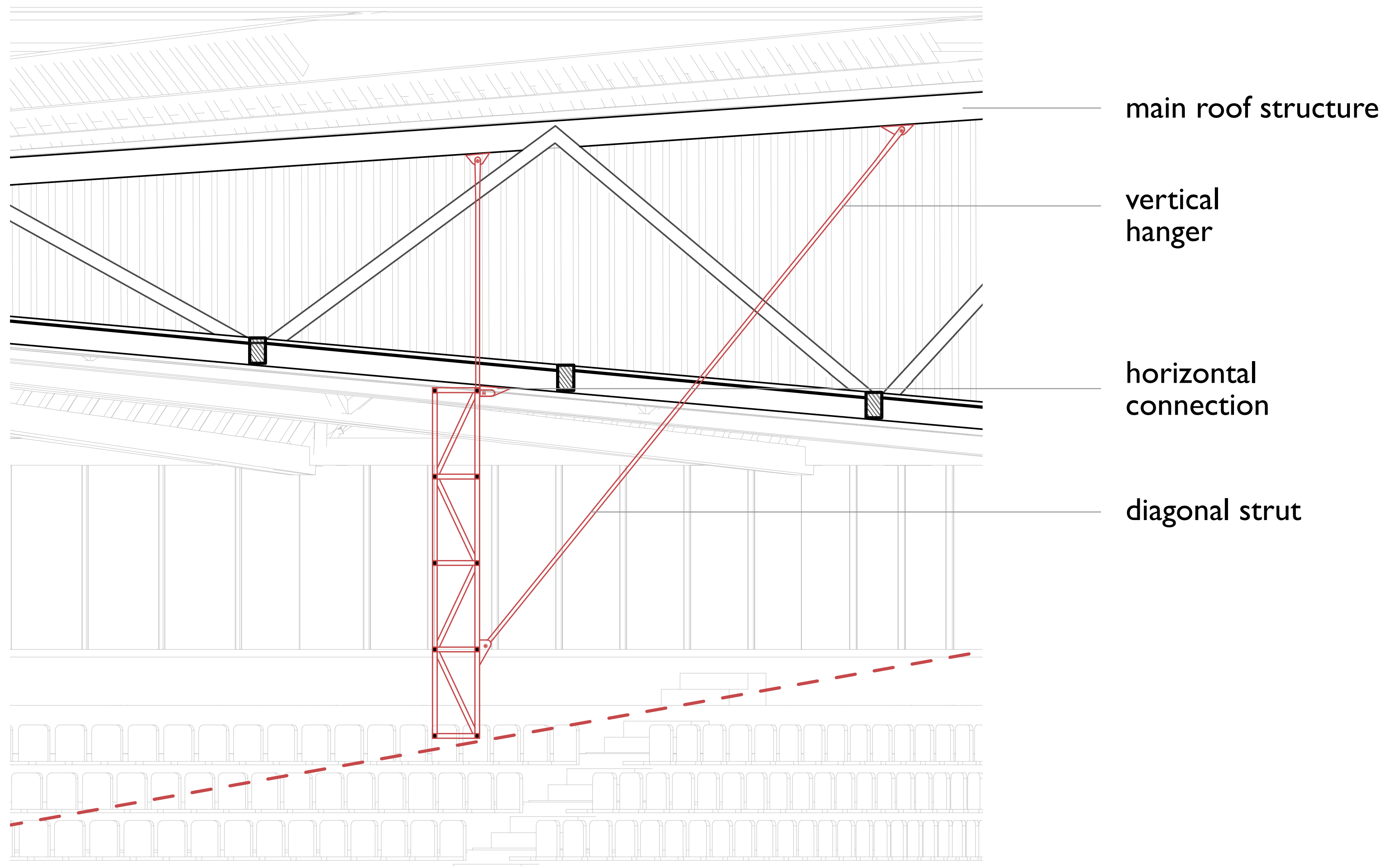


DESIGN OPTION 3: LED SCREEN PREPARATION

The cost addition is estimated on p. 3 in “Construction cost and robustness”







DESIGN OPTION 5: MAXIMUM EVENT CAPACITY

There are two alternatives for placing the stage in an event situation. It can be positioned in front of the east stand overlapping the bottom 3 rows allowing for a quick mounting process. Alternatively, the east stand can be designed to allow the bottom 9 rows of the stand to be lifted out positioning the stage further back, increasing the amount of people on the pitch.

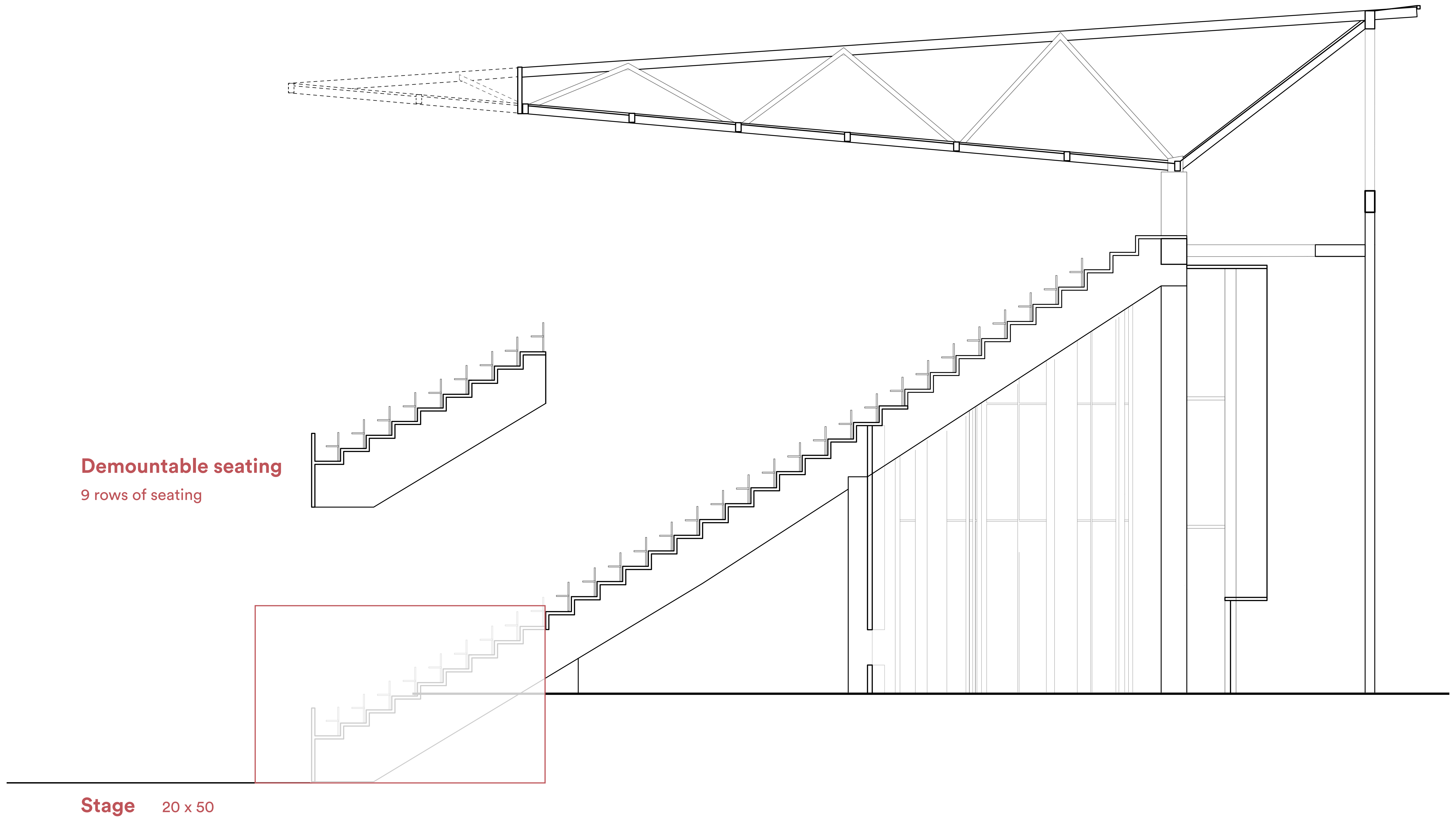
In alternative 2, the retractable part of the bowl structure is positioned in the part of the bowl section which is not part of the global load bearing system and thus can be replaced quite flexibly. Lightweight elements can form this part of the stands, consisting of steel raker beams and steps from timber and reused steel. These lightweight elements can easily be lifted and stored when required.

To reach the stage with lifting equipment from above, roof cladding would need to be demountable in the part above the stage. Eight-meter-wide frames with polycarbonate panels, is placed in the outer roof perimeter and can be mounted and demounted flexibly to the roof. Lifting equipment could then reach the stage in the eight-meter-wide segments in between the main cantilever beams.

The event capacity is based on the Danish building regulation 2018 Chapter 5 §82-§158 and calculated for 8 minutes evacuation time. Based on experience from national and international fire specialists, an average pitch density factor of 2 people per m2 is used, knowing well that people with gather closer together near the stage and spread out further from the stage. The 8 minute evacuation time is expected to be achieved by calculating escape witdhts road width based on the following guidlines:

1,2m escape road per 600 exterior people evacuated
1,2m escape road per 200 interior people evacuated

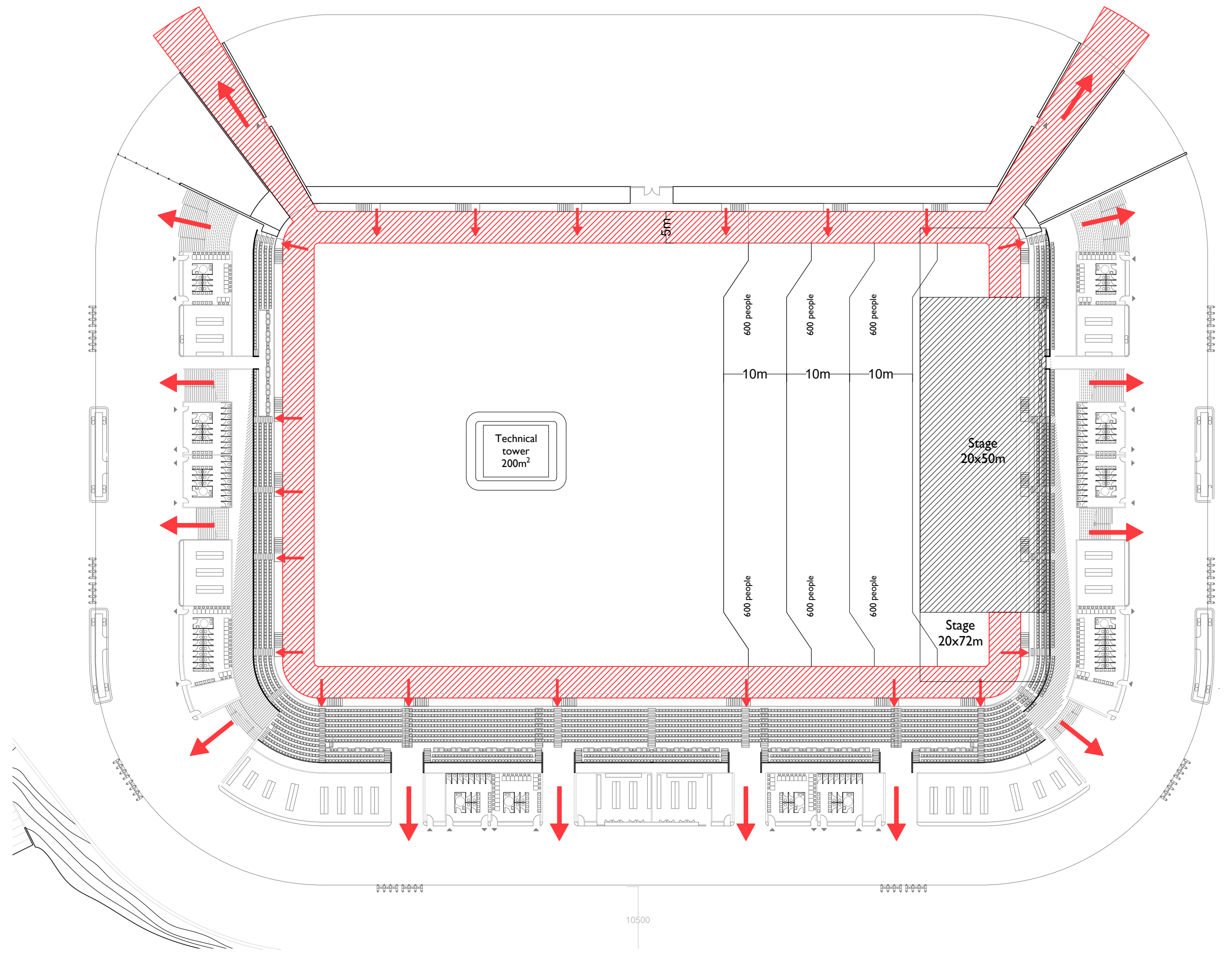
To demonstrate the level of fire safety for the stadium, a combination of traditional methods, comparative analyses, reasoned assessments, and fire-technical dimensioning are carried out at later design stages. Together, these methods form the documentation of the overall fire safety level.



The cost addition is estimated on p. 3 in "Construction cost and robustness"

Main stadium design - 20.000 Seated - no retractable seating

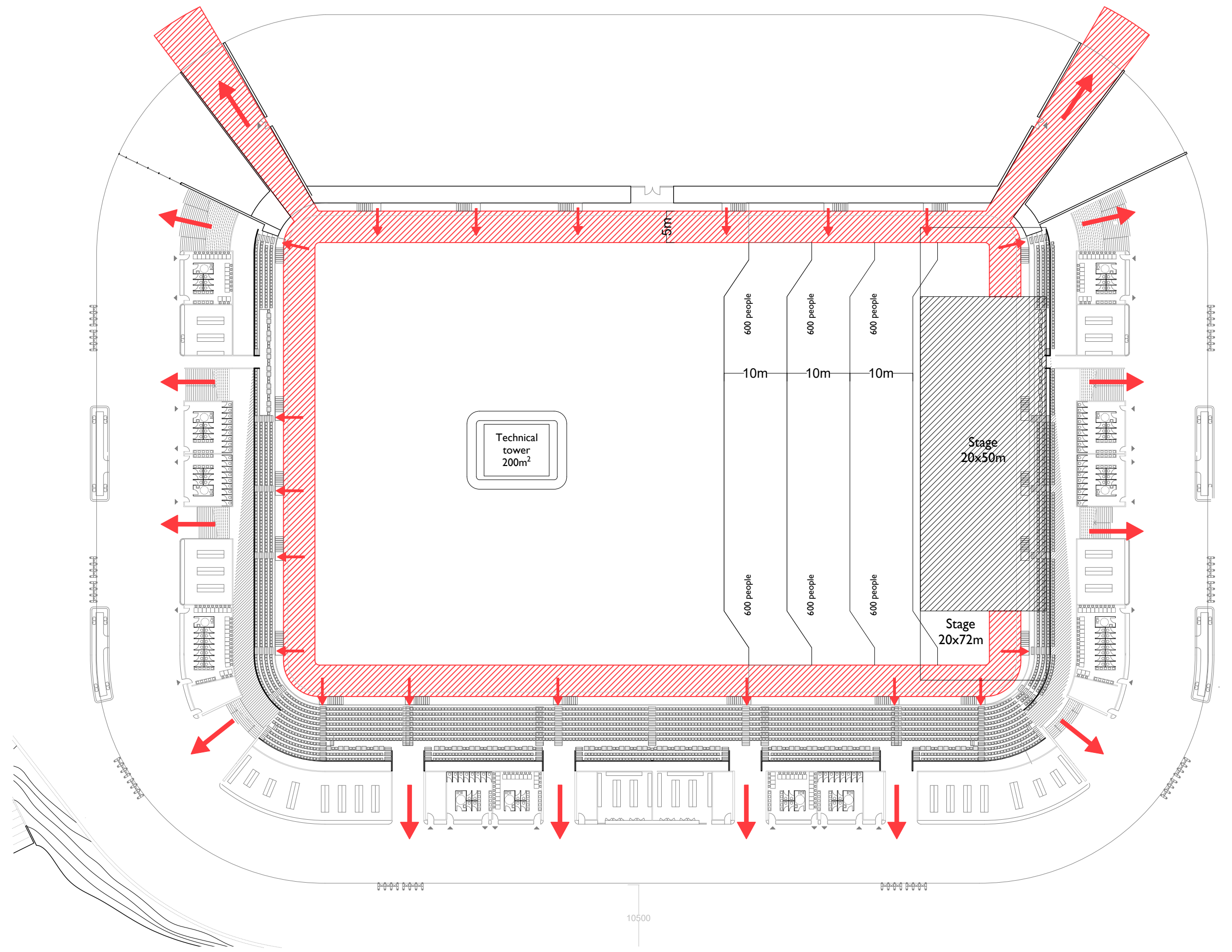
Pitch back area	= 5.760 m² (2 people/m²)	= 11.520 people
Pitch 3 x wavebreaker	= 1.800 m² (2 people/m²)	= 3.600 people
Bowl seats with view to stage		= 13.000 people
Total capacity		**= 28.120 people**
People on pitch		= 15.120
Evacuation through super vomitories	= 2 × 4m	**= 4000 people**
Evacuation stairs up to stands	= 19 × 1,3m	= 11.120 people
People to be evacuated in stands	= 11.120 + 13.000	**= 24.120 people**
Evacuation through Vomitories & mainstand (960 people)		= 8 × 4m + 4 × 6m
		= 28.960 people



20.000 Seated - no retractable seating

Main stadium design - 24.000 Seated and standing - no retractable seating

Pitch back area	= 5.760 m² (2 people/m²)	= 11.520 people
Pitch 3 x wavebreaker	= 1.800 m² (2 people/m²)	= 3.600 people
Bowl seats / standing with view to stage		= 15.500 people
Total capacity		**= 30.620 people**
People on pitch		= 15.120
Evacuation through super vomitories	= 2 × 4m	**= 4000 people**
Evacuation stairs up to stands	= 19 × 1,3m	= 11.120 people
People to be evacuated in stands	= 11.120 + 15.500	**= 26.620 people**
Evacuation through Vomitories & mainstand (960 people)		= 8 × 4m + 4 × 6m
		= 28.960 people

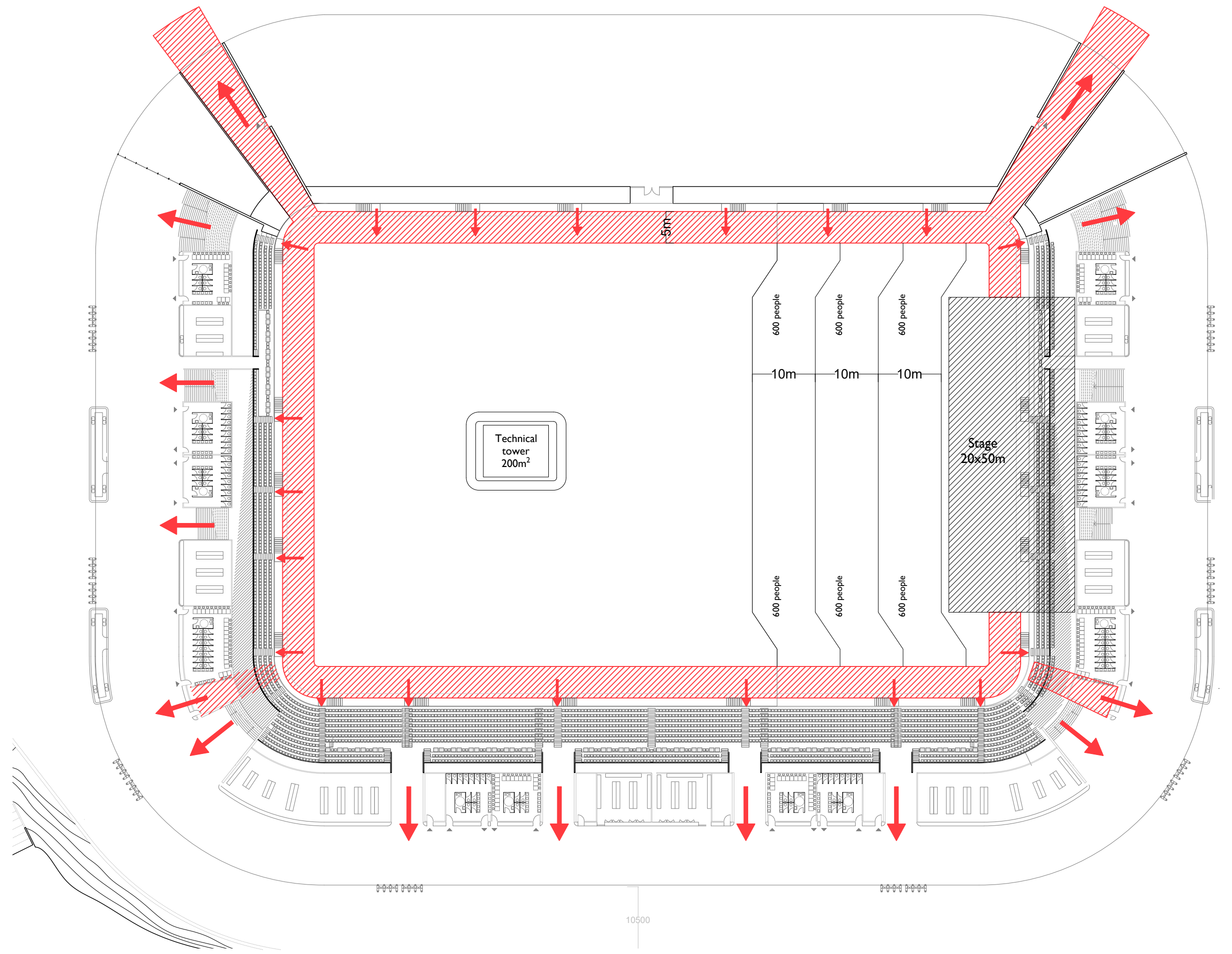


24.000 standing and seated - no retractable seating

Main stadium design - 24.000 Seated and standing - with retractable seating

Pitch back area	= 6.125 m² (2 people/m²)	= 12.250 people
Pitch 3 x wavebreaker	= 1.800 m² (2 people/m²)	= 3.600 people
Bowl seats with view to stage		= 15.500 people
Total capacity		**= 31.350 people**
People on pitch		= 15.850
Evacuation through super vomitories	= 2 × 4m	**= 4000 people**
Evacuation stairs up to stands	= 19 × 1,3m	= 11.850 people
People to be evacuated in stands	= 11.850 + 15.500	**= 27.350 people**
Evacuation through Vomitories & mainstand (960 people)		= 6 × 4m + 4 × 6m
		= 24.960 people

Requires additional super vomitories

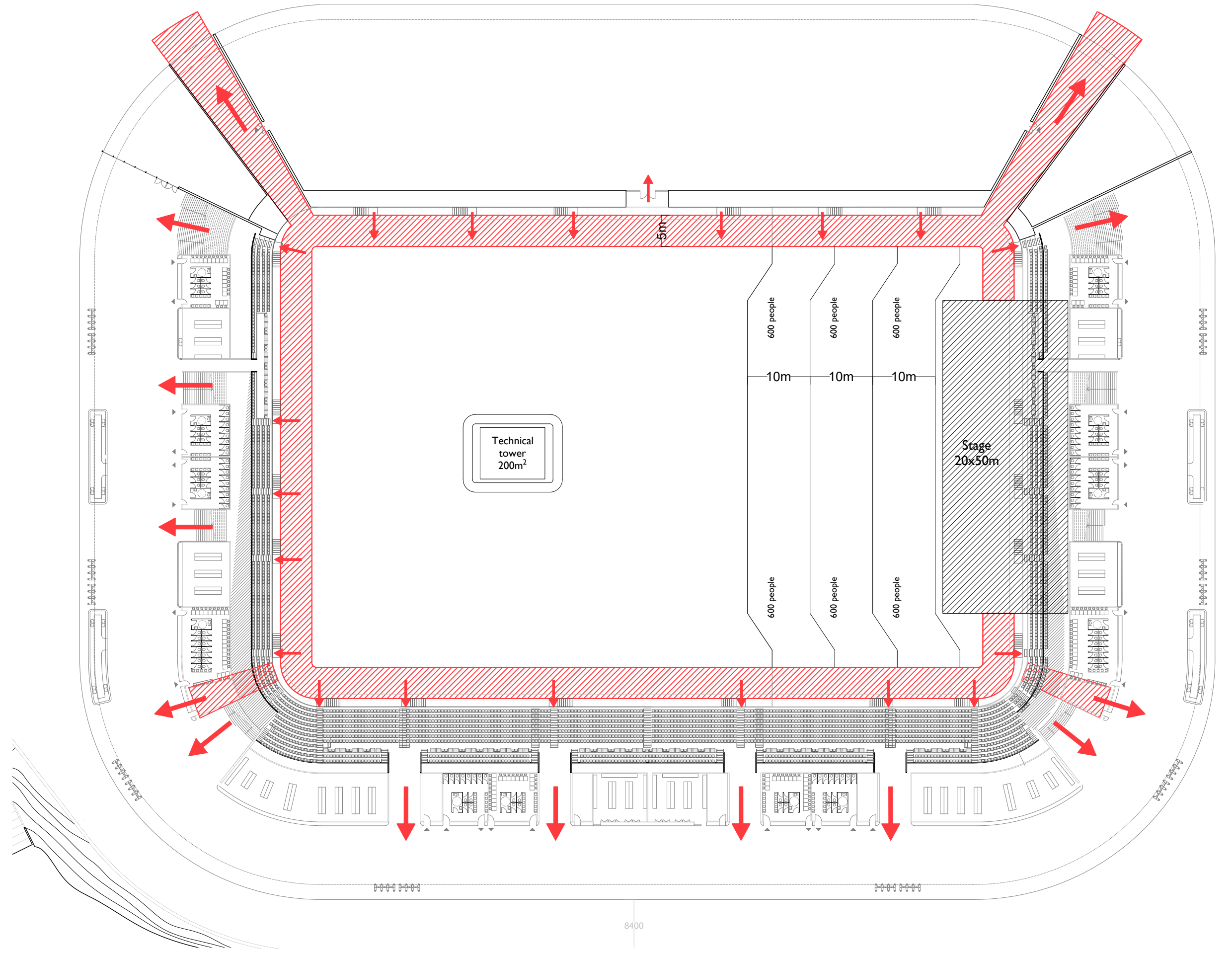


24.000 standing and seated - with retractable seating

Extended stadium design - 26.000 Seated and standing - with retractable seating

Pitch back area	= 6.125 m² (2 people/m²)	= 12.250 people
Pitch 3 x wavebreaker	= 1.800 m² (2 people/m²)	= 3.600 people
Bowl seats with view to stage		= 17.560 people
Total capacity		**= 33.410 people**
People on pitch		= 15.850
Evacuation through super vomitories	= 2 × 4m	**= 4000 people**
Evacuation stairs up to stands	= 19 × 1,3m	= 11.850 people
People to be evacuated in stands	= 11.850 + 17.560	**= 29.410 people**
Evacuation through Vomitories & mainstand (960 people)		= 6 × 4m + 4 × 6m
		= 24.960 people

Requires additional super vomitories and 0,5m increase in width



Extended stadium with 24.000 seated and retractable seating

DESIGN OPTION 6: ADDITIONAL EVENT EGRESS

Establishing two accessible pitch level southern vomitories requires the existing landscape to be completely excavated and consequently significant increase cost of enabling works, and structure price increase.

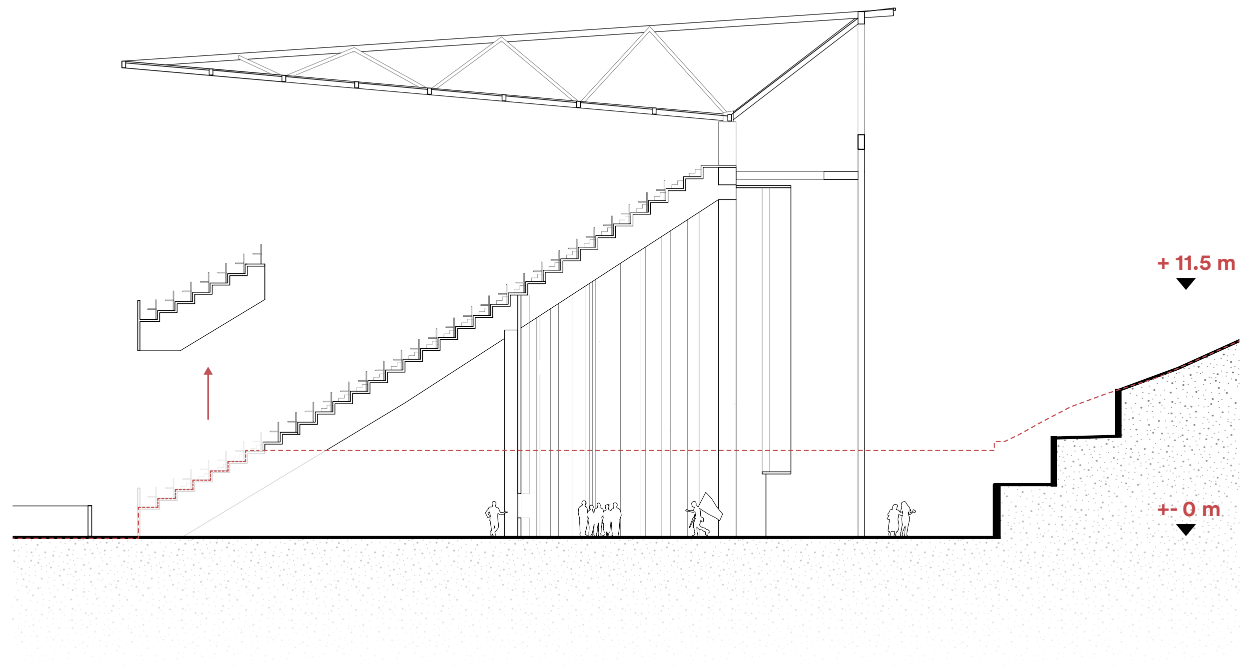
As an alternative, we propose accessible access through the existing super-vomitories and the establishment of two egress windows at south concourse level to fulfil the 8 minute maximum evacuation time for a 33.400 people event situation.

The escape ways consist of wide stairs that are well proportioned to ensure a safe and secure evacuation, without bottlenecks occurring.

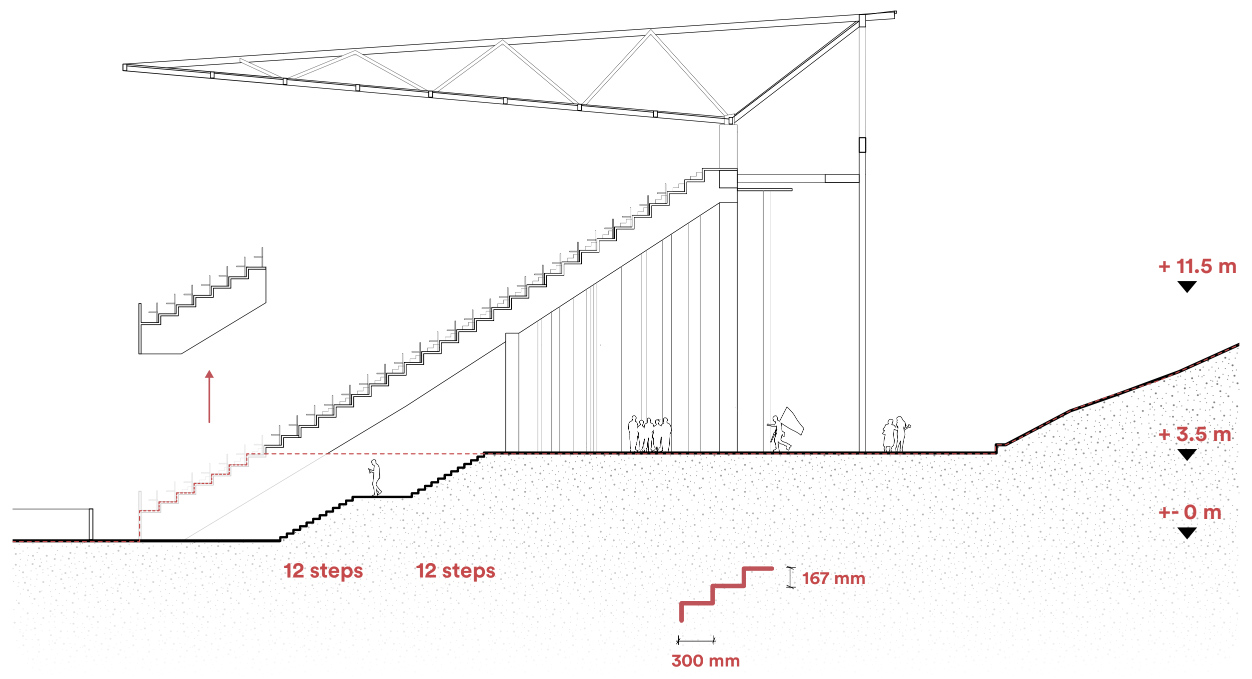
As the additional egress windows are positioned in between the raker beams, no changes to the primary structure need to be made to realise those. The steps in this area would need to be made from timber and reused steel to ensure lightweight elements which can easily be lifted and stapled when demounted.

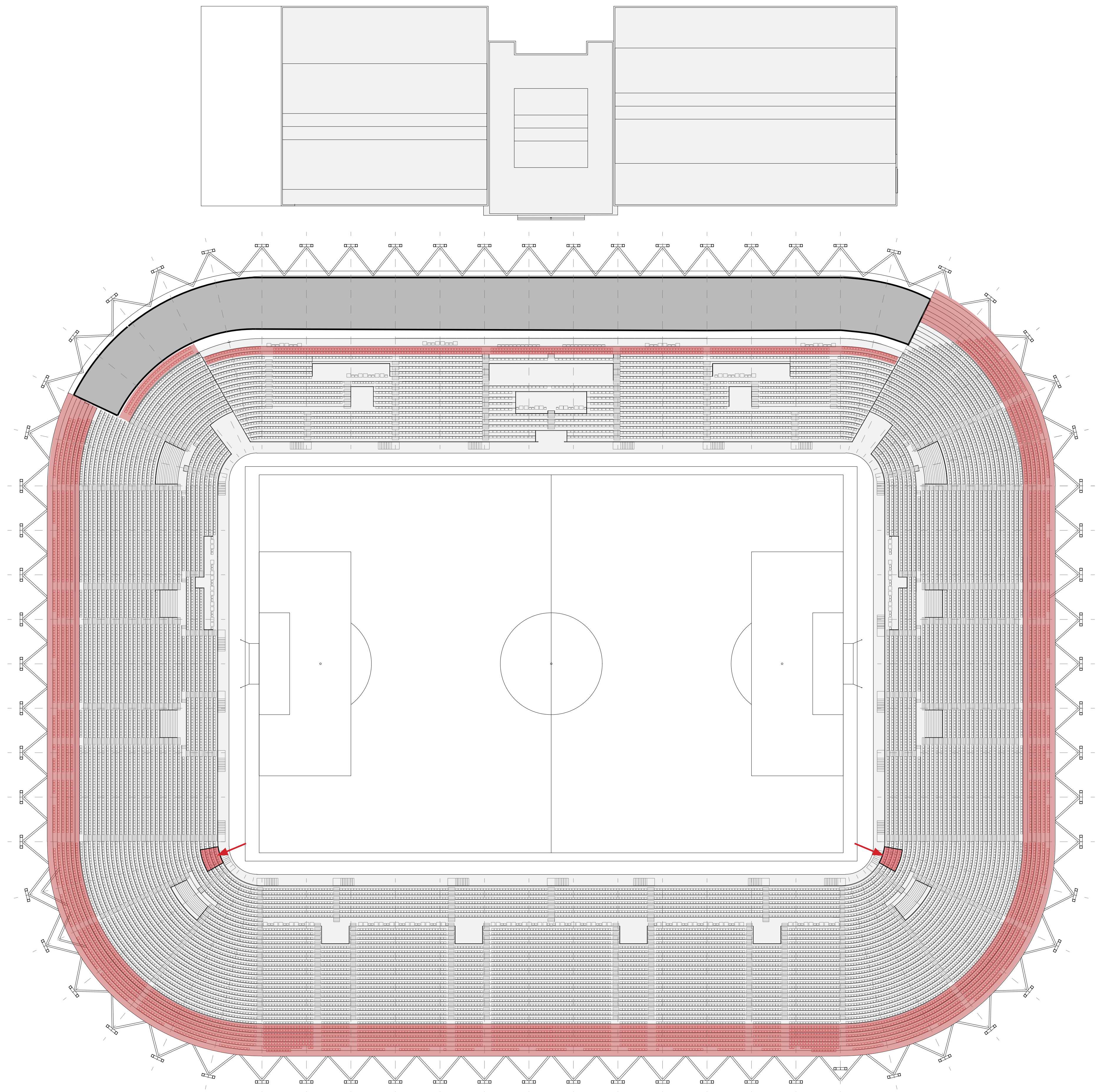
The cost addition is estimated on p. 3 in “Construction cost and robustness”

SOUTH STAND – OPTION A
Demountable seats 64 (32 behind stage)



SOUTH STAND – OPTION B
Demountable seats 64 (32 behind stage)






CERES
PARK