AARHUS STADIUM COMPETITION - STAGE 2

SKOVENS ARENA

NEW STADIUM IN AARHUS

ARCHITECTURE, FUNCTIONALITY AND TECHNICAL SOLUTIONS
CONSTRUCTION COSTS AND ROBUSTNESS

ARCHITECTURE, FUNCTIONALITY AND TECHNICAL SOLUTIONS

COMPETITION STAGE 2 DESIGN

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ARCHITECTURE, FUNCTIONALITY AND TECHNICAL SOLUTIONS

1.1 ARCHITECTURAL AND LANDSCAPE CONCEPT

ARCHITECTURAL CONCEPT

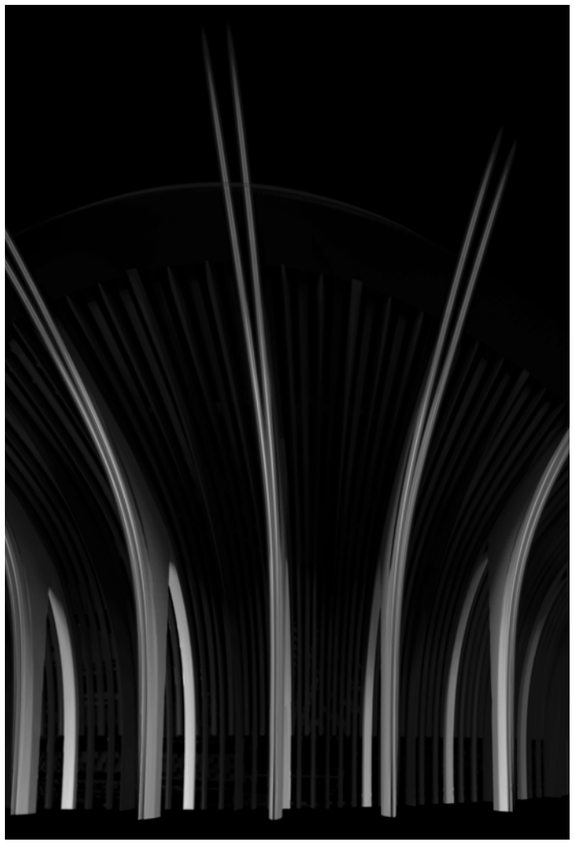
The New Aarhus stadium is inspired by its context and club legacy, aiming to become a new catalyst for fans and the local community, a new identity for the club and a new landmark on the national and international football fraternity.

CONCEPT AND INSPIRATION: Inspired from the vertical rhythm of the 47m tall trees, the proposal sees this new stadium as an extension of the forest with the continuation of verticality in its form with colonnades and wooden ribs befitting its context. These vertical gestures flow from the forest towards the landscaped plaza, further onto the colonnade in the external and internal concourse. Together with the intricate hierarchy of ribs in the facade and roof, it subdivides the large horizontal volume into a human scale to the stadium whilst at the same time offering a sense of grandeur on arrival for the fans in the plazas all around.

SHELTER AND FLEXIBILITY: The roof design maximises weather protection and shelter to increase the comfort level around the whole stadium, in the outer circulation ring as well as at concourse level. This allows the proposal to offer a sheltered 360 degree public circulation independently from the event schedule; an added offer to the local community, the park complex users and the city of Aarhus.

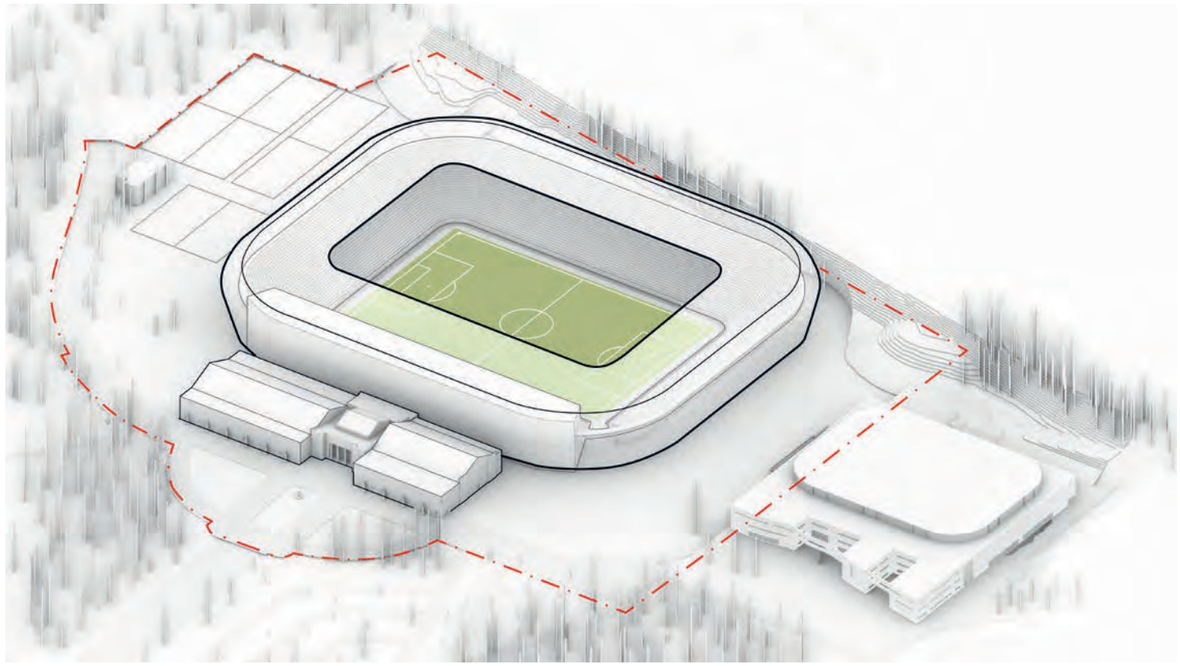
PROGRAM AND WAY FINDING: Visual identity and visual connectivity to the surroundings are paramount to the proposal. The transparent roof and gaps within the ribs, reveal glimpses of the surrounding forest and the permeable colonnades blurs the boundary between different programs.

The east and west side feature open colonnades that acts not only as an intuitive wayfinding system marking the main entrances to the stadium, but also as a permeable interface between public and stadium programs; allowing for the two to expand into one another maximising the potential offering on different event modes, day time and seasons.

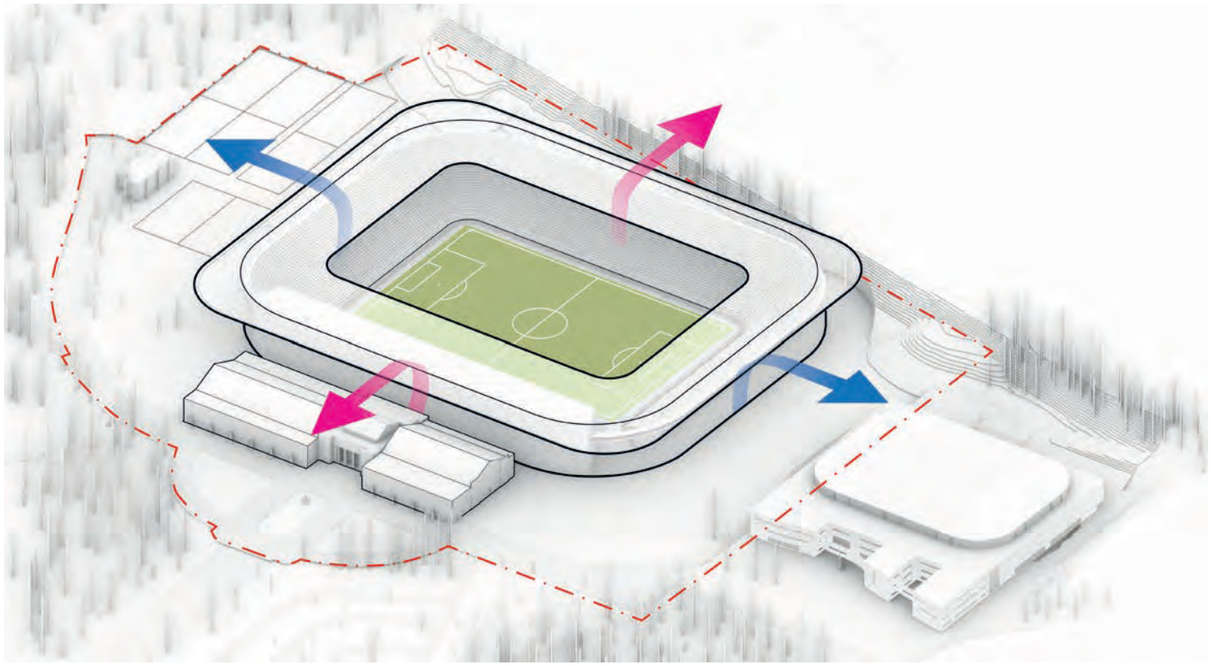


1.1 ARCHITECTURAL AND LANDSCAPE CONCEPT

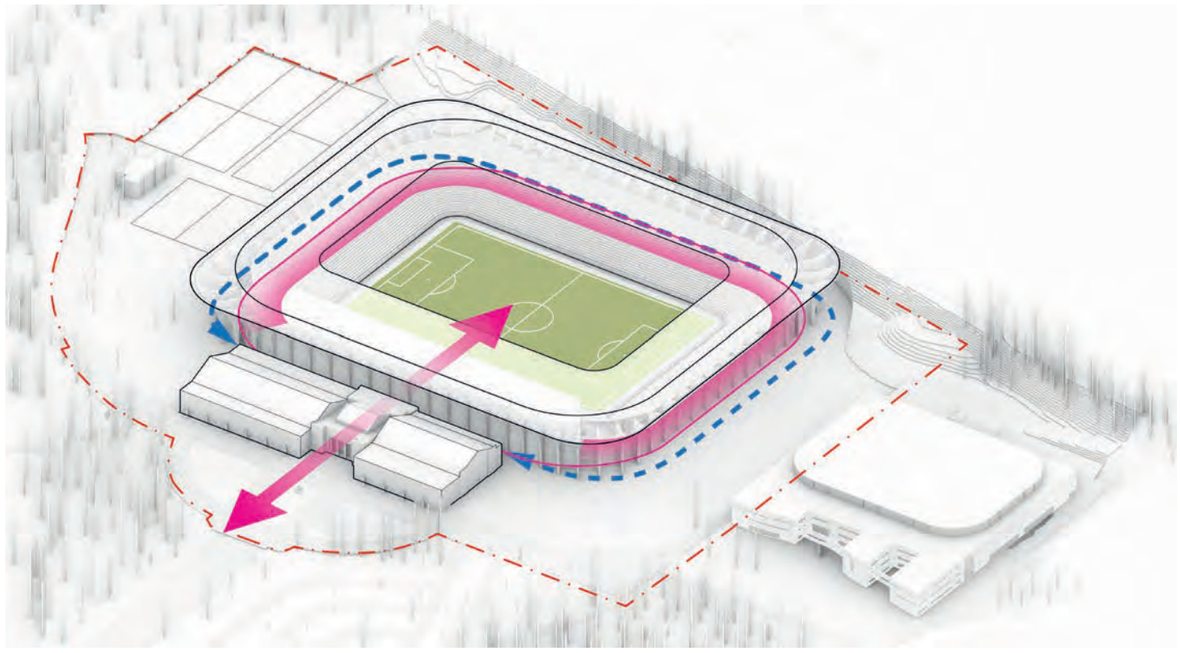
MASSING DIAGRAM



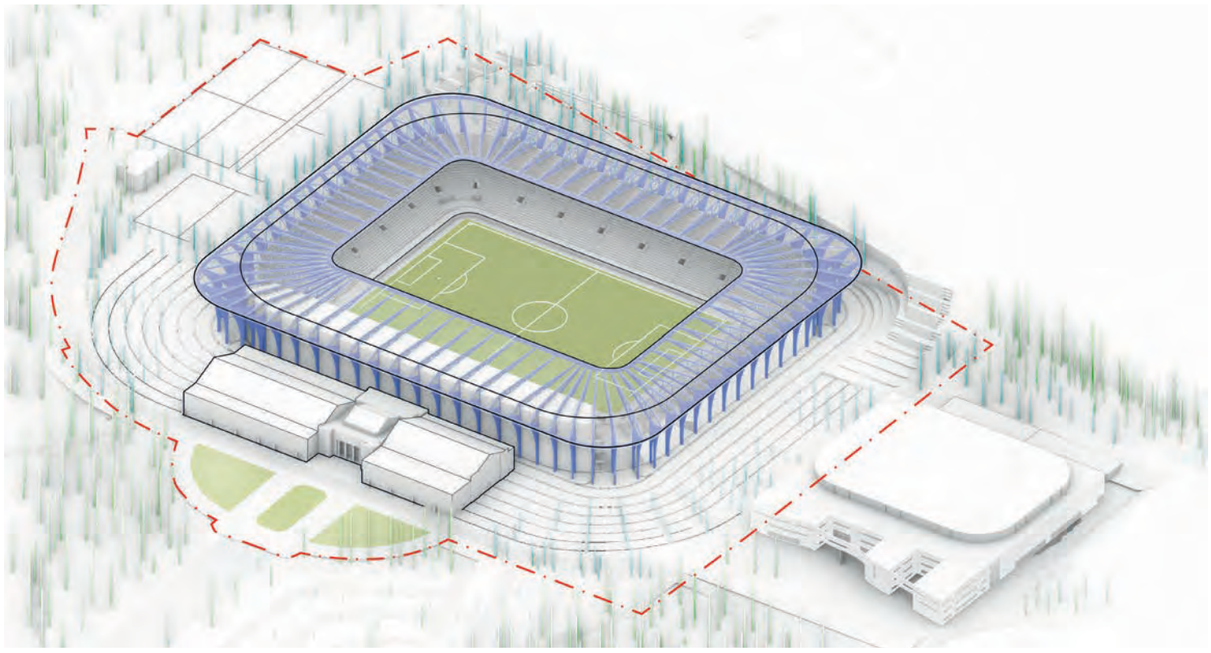
MASSING PROPOSAL IN BRIEF



EXTENSION OF ROOF TO PROVIDE LARGER WEATHER PROTECTION



PROTECTED CONCOURSE ON EAST AND WEST AND SOUTH



THE STADIUM AS AN EXTENSION OF VERTICAL FOREST

1.1 ARCHITECTURAL AND LANDSCAPE CONCEPT

PROJECT PHASES

FROM DISASSEMBLY TO NEW CONSTRUCTION

The process of delivering a new state of the art football stadium in the historical setting in Kongelunden will be done in a series of phases to be set out and defined in detail during the design and project development. Overall, we can divide the process into three main phases: Disassembly, Renovation and New build. Subdivisions would break these up further and include site preparation, grading and more. Overlaps between phases will also be further detailed in dialogue with the client and contractor.

DISASSEMBLY

The existing stadium bowl is removed with the intention to reuse and recycle as much as possible of the structure. By taking down the existing stands the south façade of the Heritage building will be exposed.

RENOVATION

The South façade of the Heritage building is restored and rebuilt to the original elevation layout.

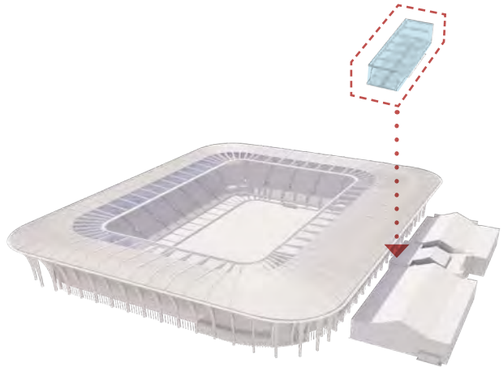
NEW BUILD

The new stadium is constructed.

1. EXISTING BOWL IS REMOVED

2. HERITAGE BUILDING SOUTH FACADE RESTORED TO ORIGINAL

4. GLASS BRIDGE CONNECTION (OPTIONAL)



3. NEW STADIUM CONSTRUCTION

STADIUM

1.1 ARCHITECTURAL AND LANDSCAPE CONCEPT

CONTEXT AND CONNECTION

The new stadium is quite literally built on top of history. Placed in a clearing in the forest of Kongelunden and with the more than 100-year-old historical location, the new stadium will point to the future and be the connecting dot in the soon to be update sport park of Aarhus. The stadium and the existing heritage building – Stadionhallerne has the prominent location at the end of Stadion Allé which will act as the grand main entrance to the stadium and the sport park. The stadium and the surround landscape will link up with the existing roads and access points, and create new ones.

KONGELUNDEN

LOCATION IN AARHUS

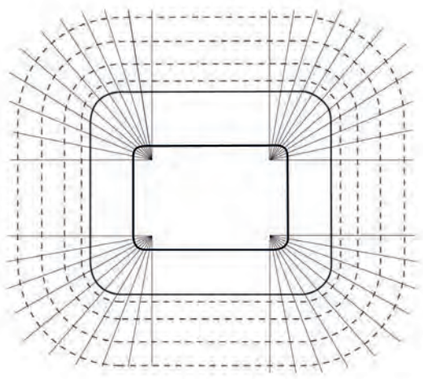
1.1 ARCHITECTURAL AND LANDSCAPE CONCEPT

LANDSCAPE CONCEPT

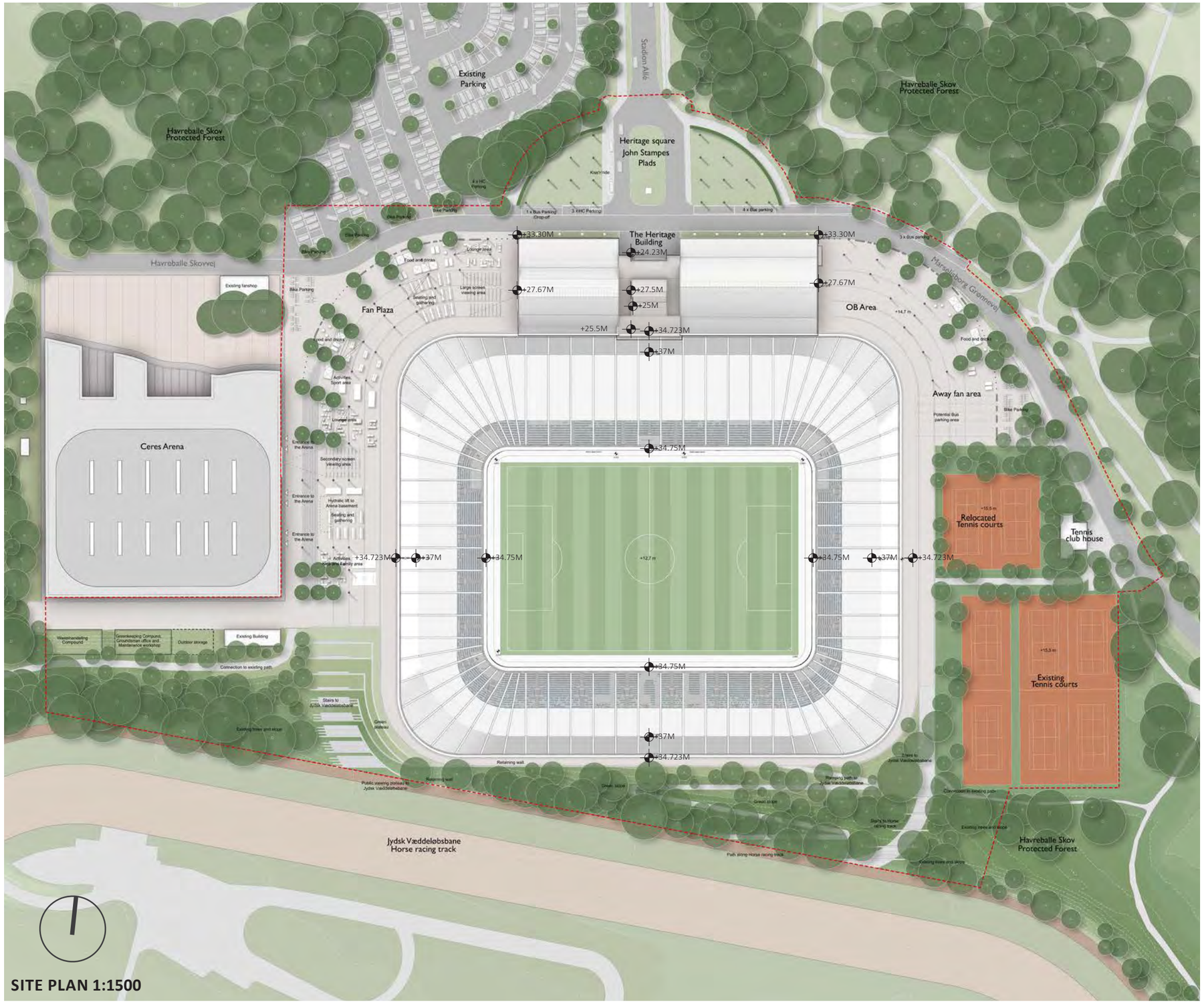
The new stadium and landscape seek to emphasize the unique location of a stadium within the forest. The areas surrounding the stadium accentuate the connection and transition from the neighbouring forest and classical heritage building to the new stadium. The natural green hall of vertical pillars formed by the beech trees gradually transitions into a less dense plaza of trees and vertical columns where the trees fan out from the heritage building and creates a open plaza towards the stadium. The density of the trees scale down towards the heritage building and stadium like a natural clearing in the forest marking the importance of the place.

The stadium carves into the existing landscape and seamlessly connects to the existing heritage building, the arena, and tennis courts. Working with the existing terrain enhances the synergy and flow between the unique sports facilities in the area and creates a new loop and movement pattern by connecting the south slope with the new plaza.

The landscape follows the lines of the stadium's iconic roof curvature creating a grid and markings in the pavement like raindrops in the water. The grid ties the individual buildings into a classical order creating a hierarchy for organizing the surrounding landscape elements. The spatial grid is translated into vertical elements by the clear architectural rhythm of the neoclassical heritage building, the structural columns of the new stadium, and the poles and trees in the landscape.



LANDSCAPE CONCEPT



SITE PLAN 1:1500

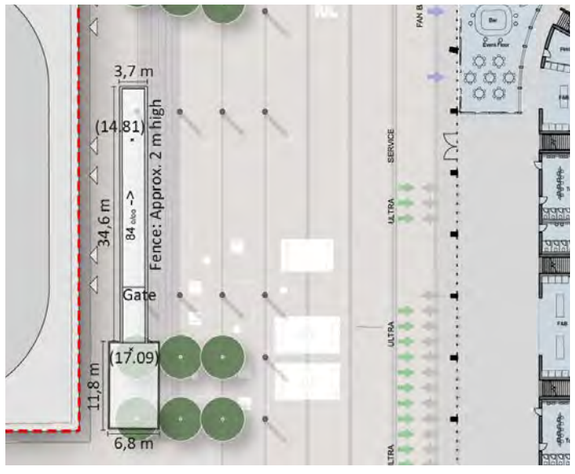
1.1 ARCHITECTURAL AND LANDSCAPE CONCEPT

PERIMETER:

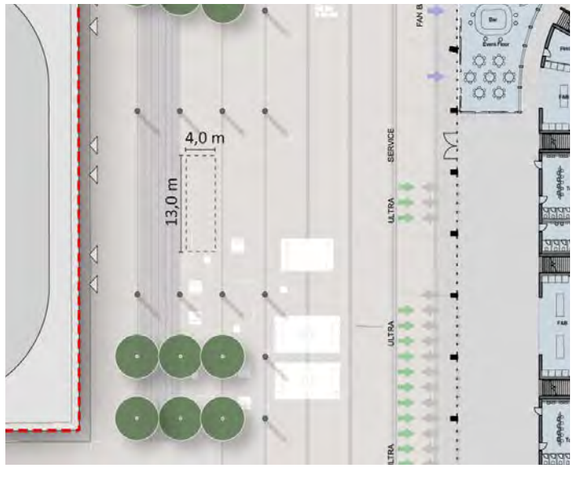
The new landscape solution creates a strong connection between Ceres Arena, the tennis courts and the heritage building with a minimum of excavation and a minimum of stairs and retaining walls.

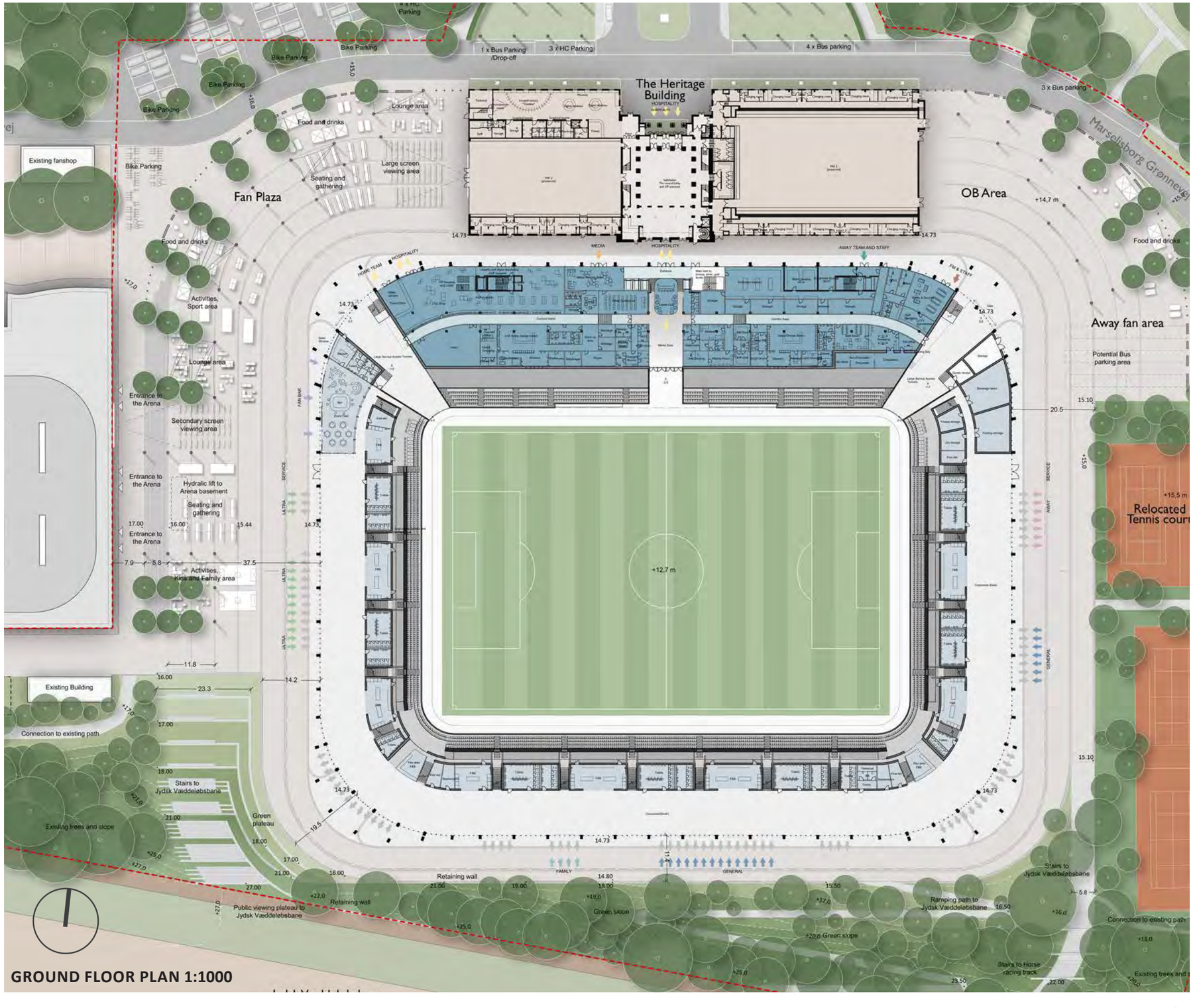
The original 35 m long, fenced service ramp to the arena will be replaced by a hydraulic lift, which is not visible when not in use.

THE 35 M LONG ORIGINAL RAMP ALONG THE ARENA SURROUNDED BY A 2 M HIGH FENCE



NEW HYDRALIC LIFT TO THE ARENA BASEMENT, 4X13 M



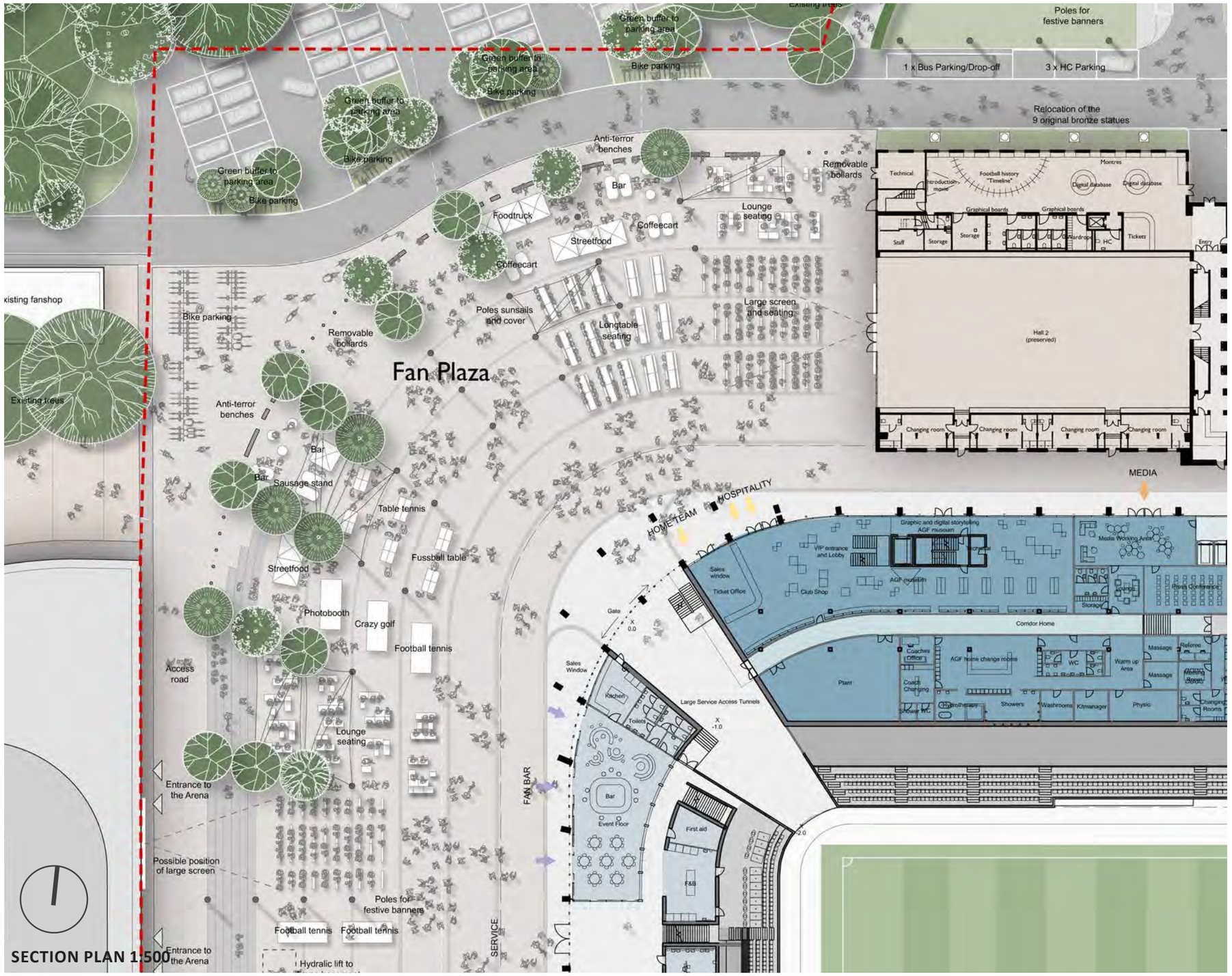


GROUND FLOOR PLAN 1:1000

1.1 ARCHITECTURAL AND LANDSCAPE CONCEPT

SECTION PLAN OF NORTH-WESTERN PART OF DESIGNATED PROJECT AREAS, MATCH DAY

The North-West Fan Plaza creates an arrival area for fans as well as creating a gathering space made up of different zones of activities that contribute to the fan experience before and after matches.

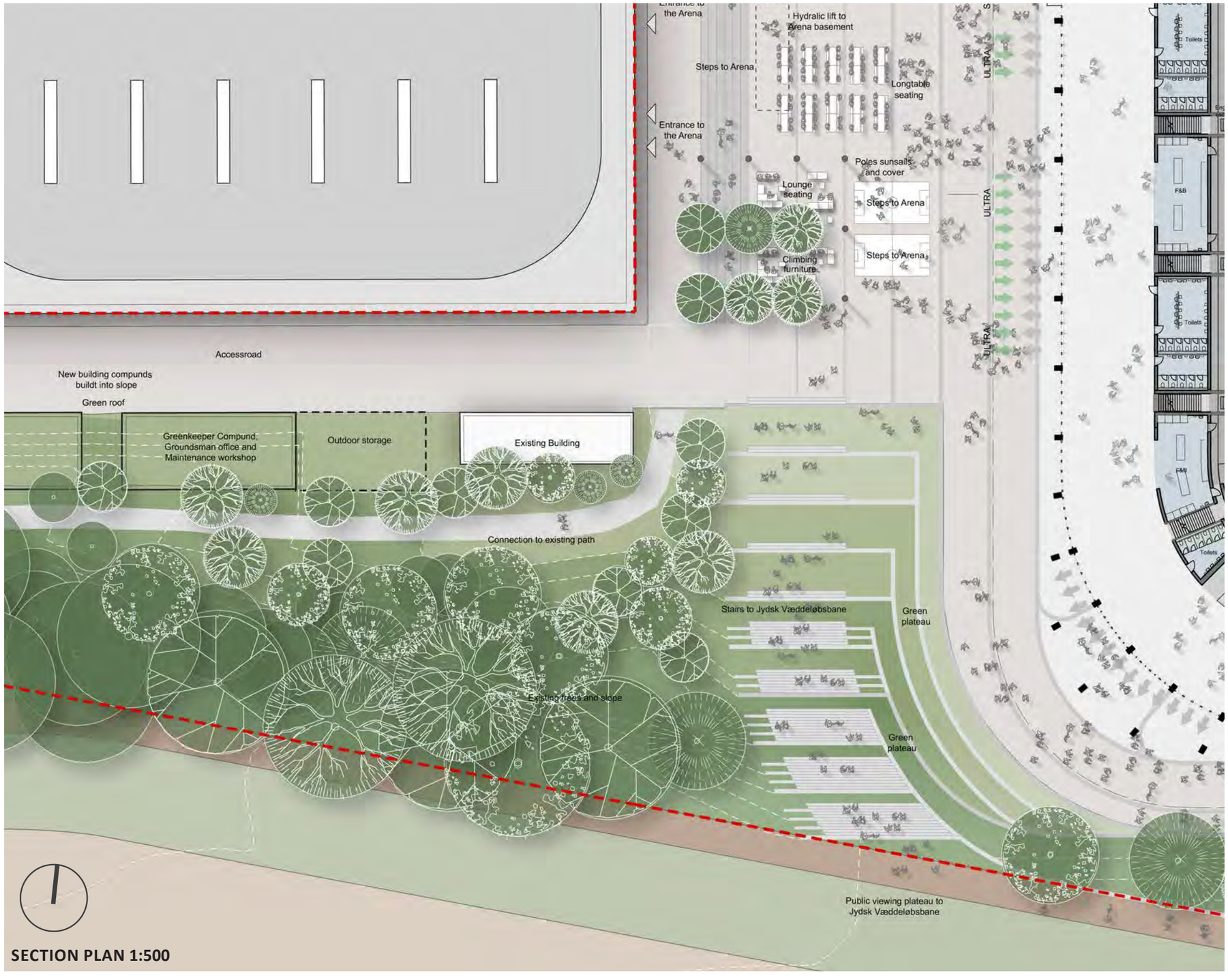


SECTION PLAN 1:500

1.1 ARCHITECTURAL AND LANDSCAPE CONCEPT

SECTION PLAN OF SOUTH-WESTERN PART OF DESIGNATED PROJECT AREAS, MATCH DAY

A feature staircase in the landscape connects JCB to the arena plaza allowing for a strong connection to the racetrack and allows for large crowds to exit after match days.

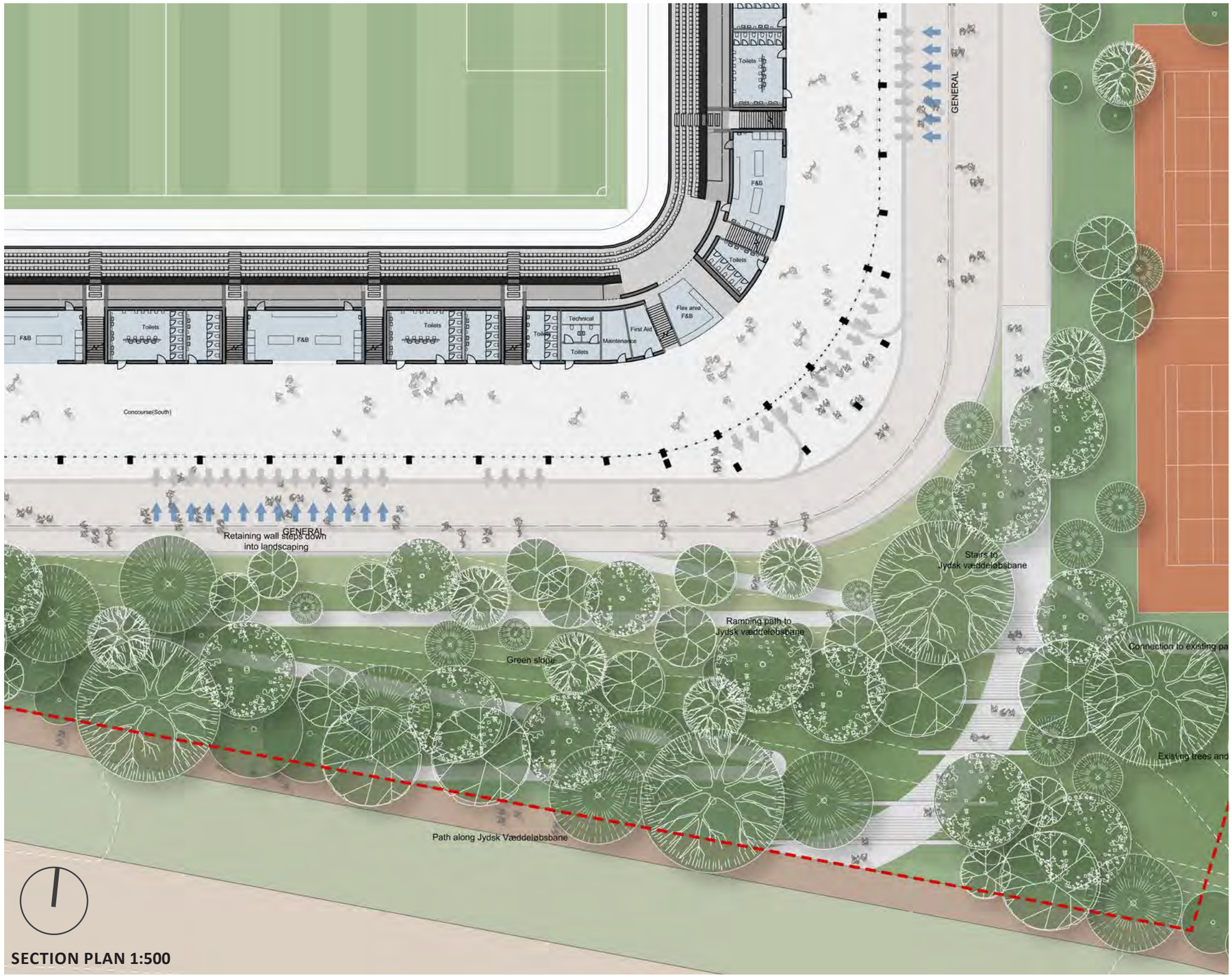


SECTION PLAN 1:500

1.1 ARCHITECTURAL AND LANDSCAPE CONCEPT

SECTION PLAN OF SOUTH-EASTERN PART OF DESIGNATED PROJECT AREAS, MATCH DAY

A ramp winds down the hill from the racetrack through the landscape to the stadium. An additional staircase allows for more direct access and allows for a large volume of fan circulation leaving the stadium after the match has ended.



SECTION PLAN 1:500

1.2. CHOICE OF MATERIAL

EXTERIOR

The stadium facade timber louvres provides a natural finish colour that draws parallels with the surrounding forest, which contrast and highlight the concrete structural columns. Louvres utilize market standard profiles to reduce cost and simplify construction. The roof design seeks to enhance the sunlight levels on the pitch throughout the year, whilst providing shelter for the spectators by the use of metal cladding and transparent PTFE.

WOOD: Market Standard Dimension Timber Slats

ZHA - Green Forest Stadium

ZHA - Aquatic Centre

Accoya

New Kebony

Thermowood

WOOD DURABILITY CLASS

Klasse 1 - meget varig 45-50 years	Klasse 2 - varig 25-30 years	Klasse 3 - Moderat varig >20 years
Ipe	Europærisk Eg	Yellow Cypress
Merbau	Western Red Cedar	Sibirisk lærk
Cumaru	Thermofyr	Douglas - Nord amerikansk
Teak	ThermoGran	
ThermoAsk	Kebony Character	
Accoya		
Kebony Clear		

Klasse 4 - Ringe varig Treatment needed	Klasse 5 - Ikke varig Treatment needed
Rødgran	Bøg
Europærisk lærk	Ask
Skovfyr	Pine - radiata
Douglas - Dansk	Ahorn

Red pine for glulam
Heattreated wood
Sustainable treatment

CORRUGATED METAL

PTFE

CONCRETE

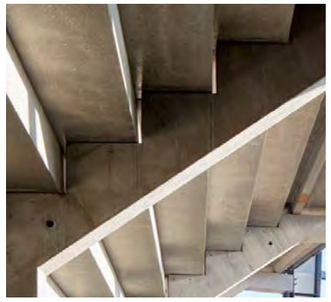
1.2. CHOICE OF MATERIAL

THE BOWL

Concrete Rakers support a system of pre-fabricated concrete stands and steps on which seats are attached. Above, the corrugated metal and PTFE roof envelops and protects the stands and LED screens from the elements.

PRE-FABRICATED CONCRETE

EXPOSED CONCRETE



SEATS & CHAIRS

LED SCREENS

CORRUGATED METAL

PTFE

PITCH

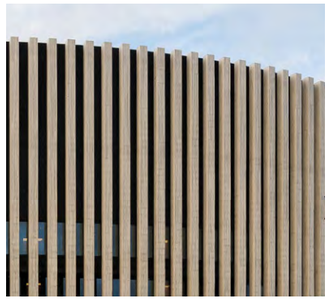
1.2. CHOICE OF MATERIAL

CONCOURSE

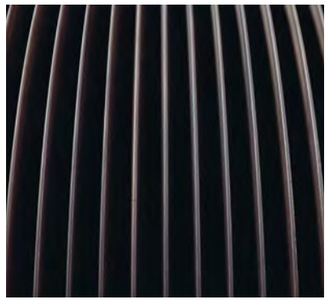
The Concourse materials comprise of two sizes of standard profile timber slats which share a dialogue with facade, and exposed concrete behind expresses the structure and simplicity inspired by Nordic architecture.

Concealed LED lighting behind the timber louvers can enhance the fan atmosphere. Banners and signage can be hung from the ceiling while signage and F&B can use the club's colours to add to the fan experience.

ACCOYA WOOD



METAL SLATS



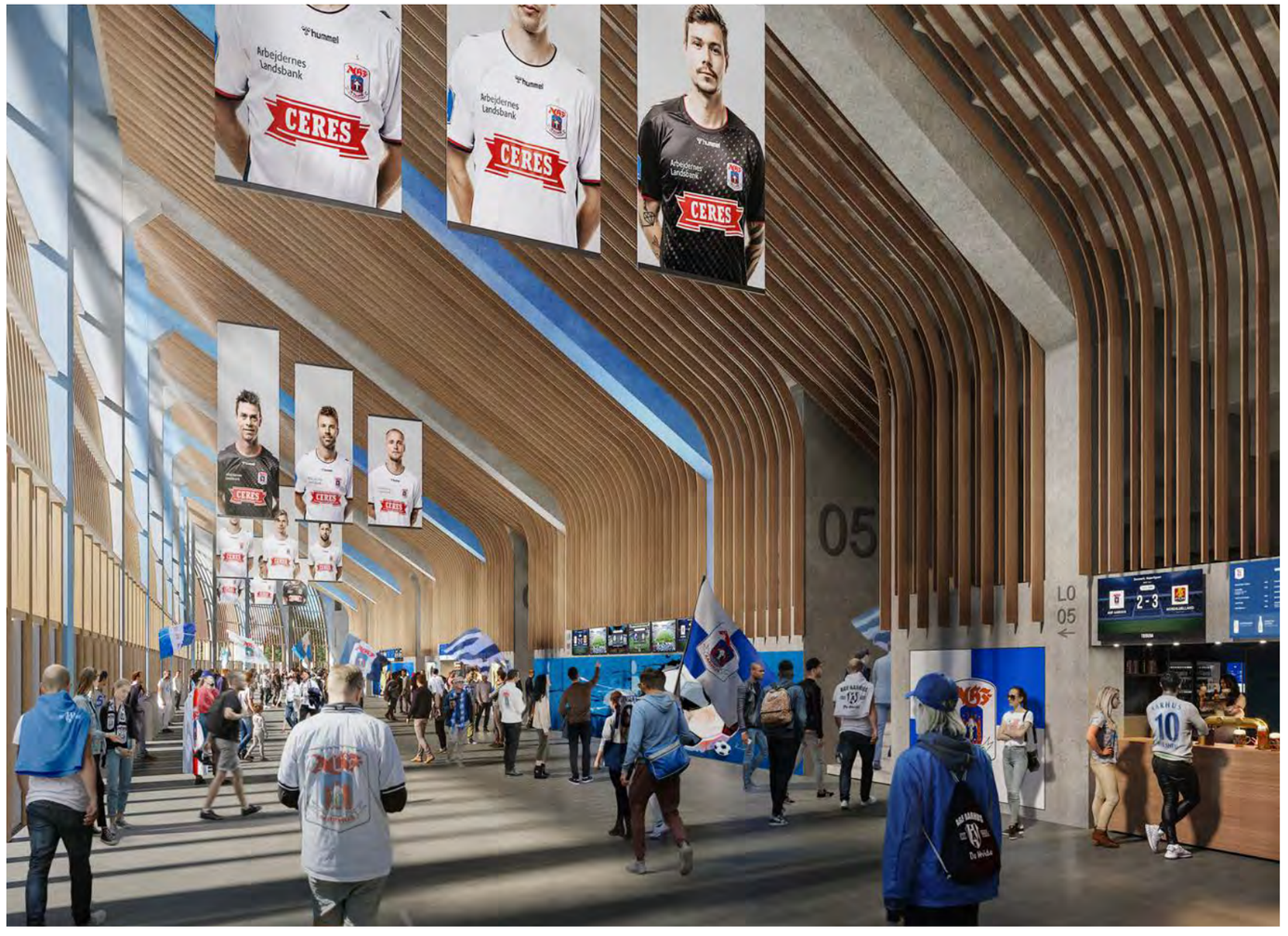
CONCRETE

PAINTED SIGNAGE

CONCRETE FLOOR

ADVERTISEMENT BOARDS

PROGRAMMABLE WALL

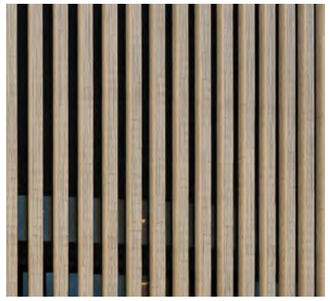


1.2. CHOICE OF MATERIAL

INTERIOR FAN TUNNEL

Two sizes of market standard timber louvres transition the space from the pitch opening up to a simple glass box of the Tunnel Club. Exposed concrete structure forms the backdrop of the walls and flooring with a wooden floor highlighting the Tunnel Club.

WOOD



EXPOSED CONCRETE

GLAZING

CONCRETE FLOOR

WOOD FLOOR

LINEAR LIGHTING

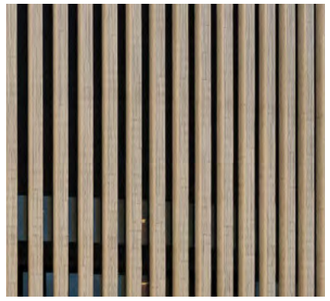
METAL MULLION

1.2. CHOICE OF MATERIAL

VIP

Wooden timber slats define the central circulation area, transitioning between stairs, balcony and bar which are set against minimal background of exposed concrete walls, floors and white ceiling acoustic panels. Simple glazed volumes form the VIP boxes.

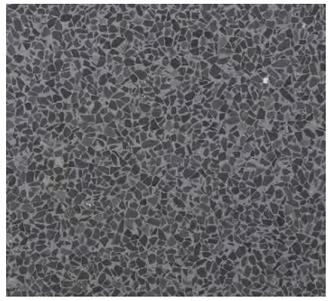
WOOD



EXPOSED CONCRETE

GLAZING

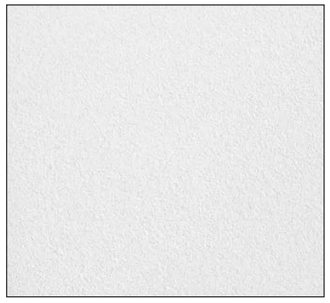
TERRAZZO FLOOR



TIMBER CEILING

WHITE PAINTED WOOD

ACOUSTIC CEILING PANEL

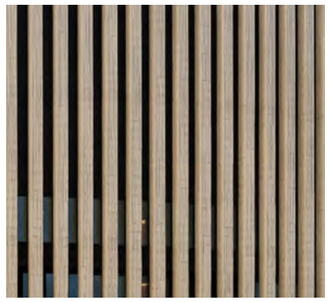


1.2. CHOICE OF MATERIAL

PLAYER CHANGING ROOM

The player changing room has the exposed concrete walls with timber louvers in front. Each player has the locker with their names and hanging jersey in front. Ceiling with black mesh integrated linear light on the back. Concrete flooring with team logo printed.

WOOD

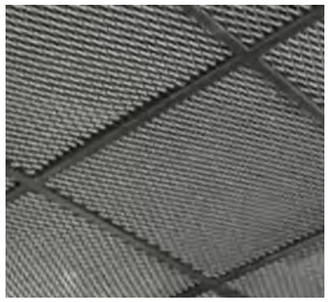


EXPOSED CONCRETE

CONCRETE FLOOR

METAL CLADDING

MESH CEILING



LOGO PAINT

LINEAR LIGHTING

AWAY FAN PLAZA

1.2. CHOICE OF MATERIALS

SURFACES

The plaza is covered with a light surface dressing with lake material (“Majs”) divided by concrete curbs that follow the arched curvature from the stadium and creates a fanned-out grid that’s marked with trees and light fixtures. Surface dressing is a low-maintenance pavement that ensures a flexible plaza that allows for a temporary marking for street sport and wayfinding. The light colour with a surface of small stones has a familiarity with the gravel paths in the surrounding forests.

The outline from the stadium roof marks a pavement change. Here a grate is the final curved pavement marker between the asphalt and broomed concrete that the stadium sit on. The broomed concrete continue inside to the concourse making a seamless transition between inside and outside.

REFERENCES

Surface dressing “Majs”

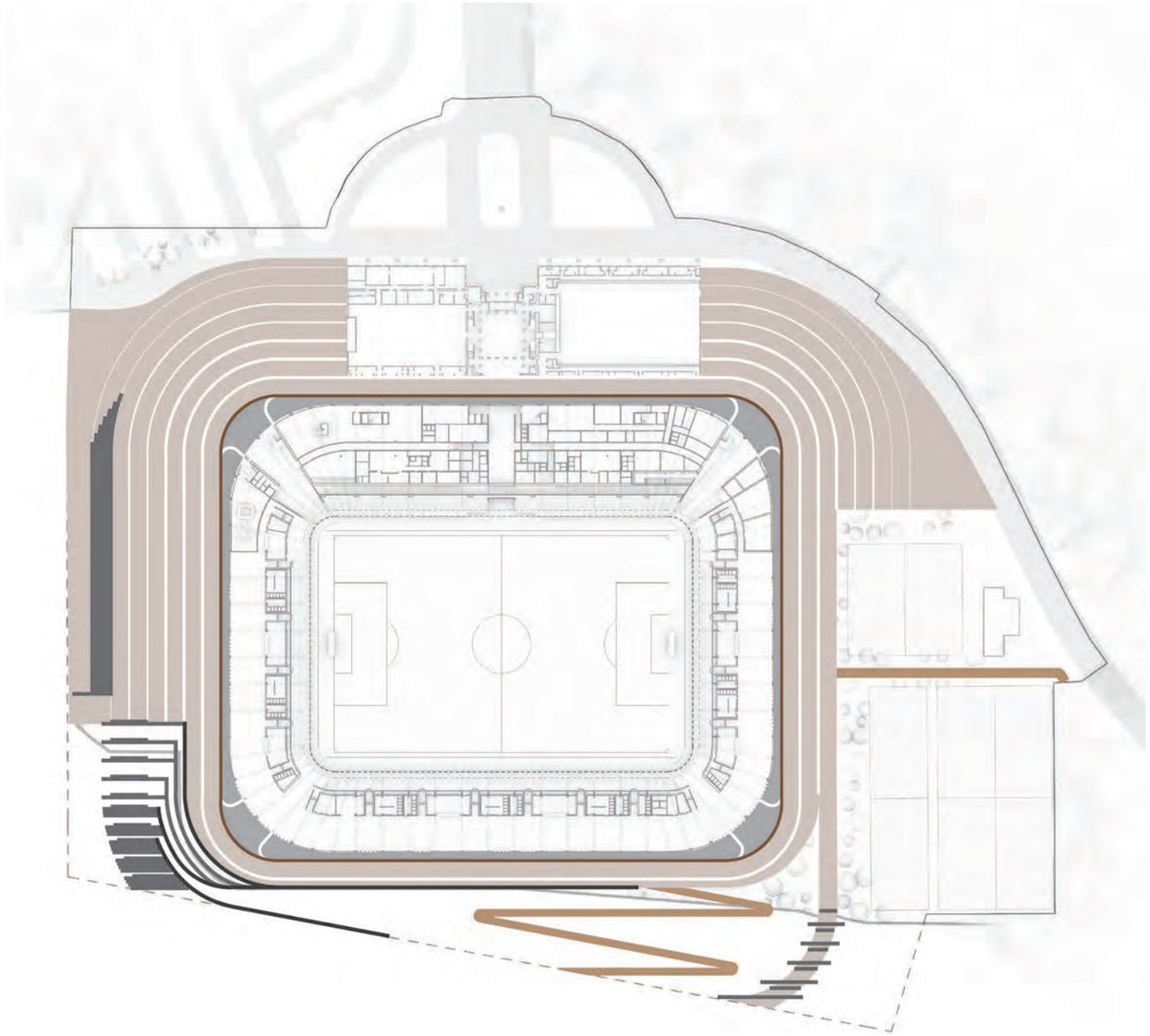
Concrete Curbs

Concrete Coating

Concrete Stairs

Concrete Wall

Gravel Path



LEGEND

- Surface dressing, light
- Broomed concrete, coating
- Concrete, stairs
- Concrete, retaining wall
- Gravel
- Dranaige grate
- Concrete curbs, prefabricated elements

1.2. CHOICE OF MATERIALS

VEGETATION

The trees are placed in a fanned-out grid from the heritage building and out. The formation ensures high visibility and clear wayfinding close to the stadium. In west and east the density of the trees is higher, to break the wind and create recreational zones. The trees are high stemmed trees that will ensure both good visibility at eye level and support the use of the plaza for events. The trees are of different species to offer a robust planting strategy with a high level of biodiversity. The tree species suggested have been chosen to ensure the trees are robust to drought, salt and future climate changes. The most used tree will be common oak; a native tree and that also ties in with the surrounding Havreballe forest. The retaining walls will be covered by climbing and creeping plants as Boston Ivy and Common Ivy to draw nature in close to stadium.

REFERENCES

English Oak

Norway Maple

Common Alder

Black Locust

European Hackberry

White Willow

PLANT MIXTURE FOR THE STADIUM PLAZA

TREE COUNT: 34

25 %

Quercus robur, English Oak

75 %

Acer platanoides 'Farlakes Green', Norway Maple

Alnus glutinosa, Common Alder

Celtis australis, European Hackberry

Liquidambar styraciflua, American Sweetgum

Robinia pseudoacacia, Black Locust

Salix alba 'Saba', White Willow

PLANT MIXTURE FOR THE PERIMETER

TREE AND BUSH COUNT: 242

50 %

Quercus robur, English Oak

50 %

Acer platanoides, Norway Maple

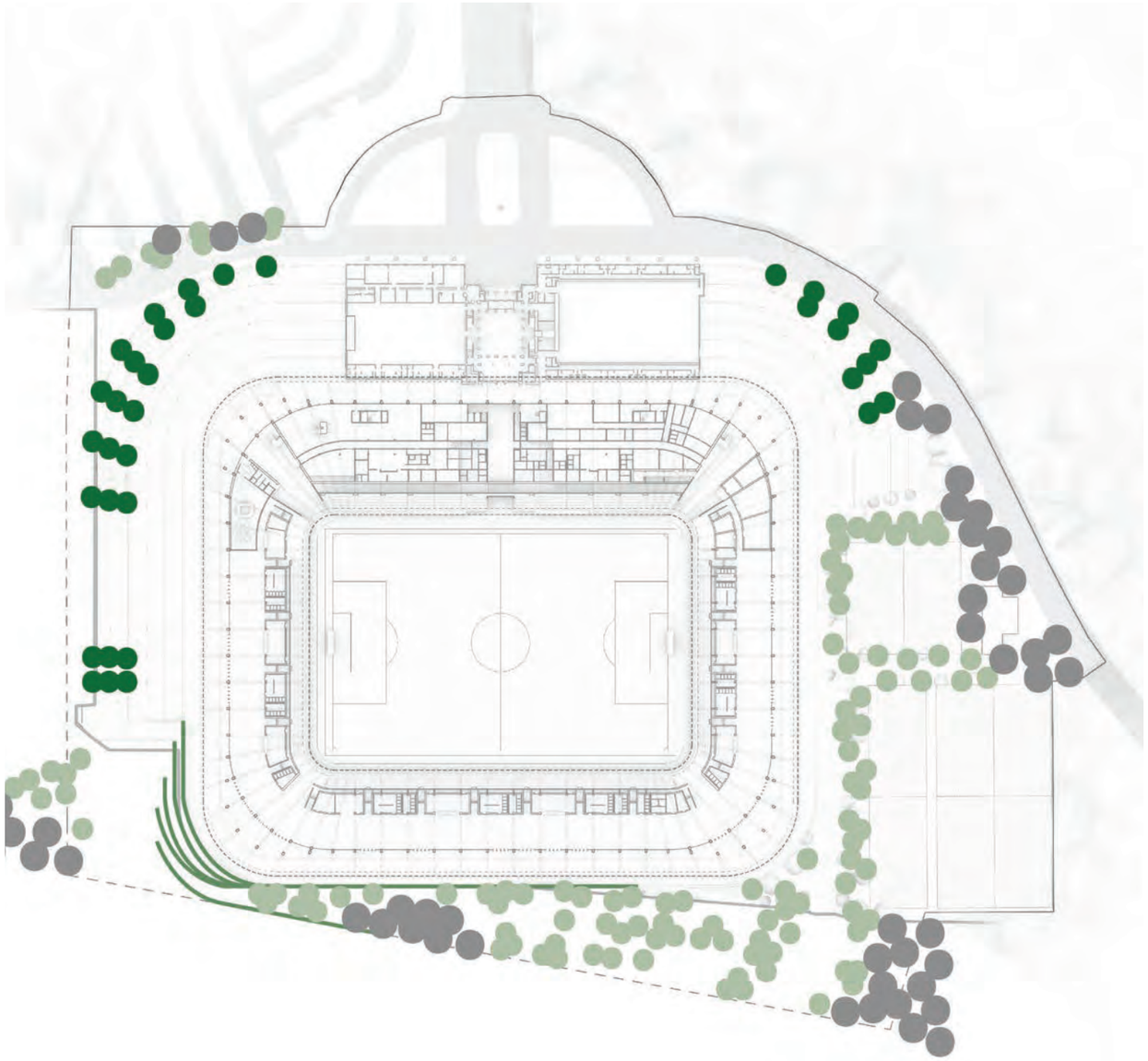
Alnus glutinosa, Common Alder

Carpinus betulus, Hornbeam

Fagus sylvatica, Common Beech

Prunus avium, Wild Cherry

Tilia cordata, Little-leaf Linden



LEGEND

- New trees, stadium plaza
- New trees and bushes, perimeter
- Greening of walls
- Existing trees

1.3. SUSTAINABILITY

SUSTAINABILITY CONCEPT

The location of the new stadium, in the green area of Kongelunden calls for at sustainable approach and respect for the surroundings.

Therefore, the landscape around the new stadium strives to keep, reuse and strengthen the existing qualities found at the site - to boost the sustainability and enrol in the biodiverse and lush forest area.

SPORTSPARK

In the Sportspark where the new stadium is located, the area can be seen as a large clearing in the forest with a surrounding and mature vegetation with old tress. There are a number of large old oak and beech trees which are worth identifying and preserving, and which can stand as solitary elements for the enjoyment of the daily sportsmen, and as biodiverse residences for e.g. bats and woodpeckers.

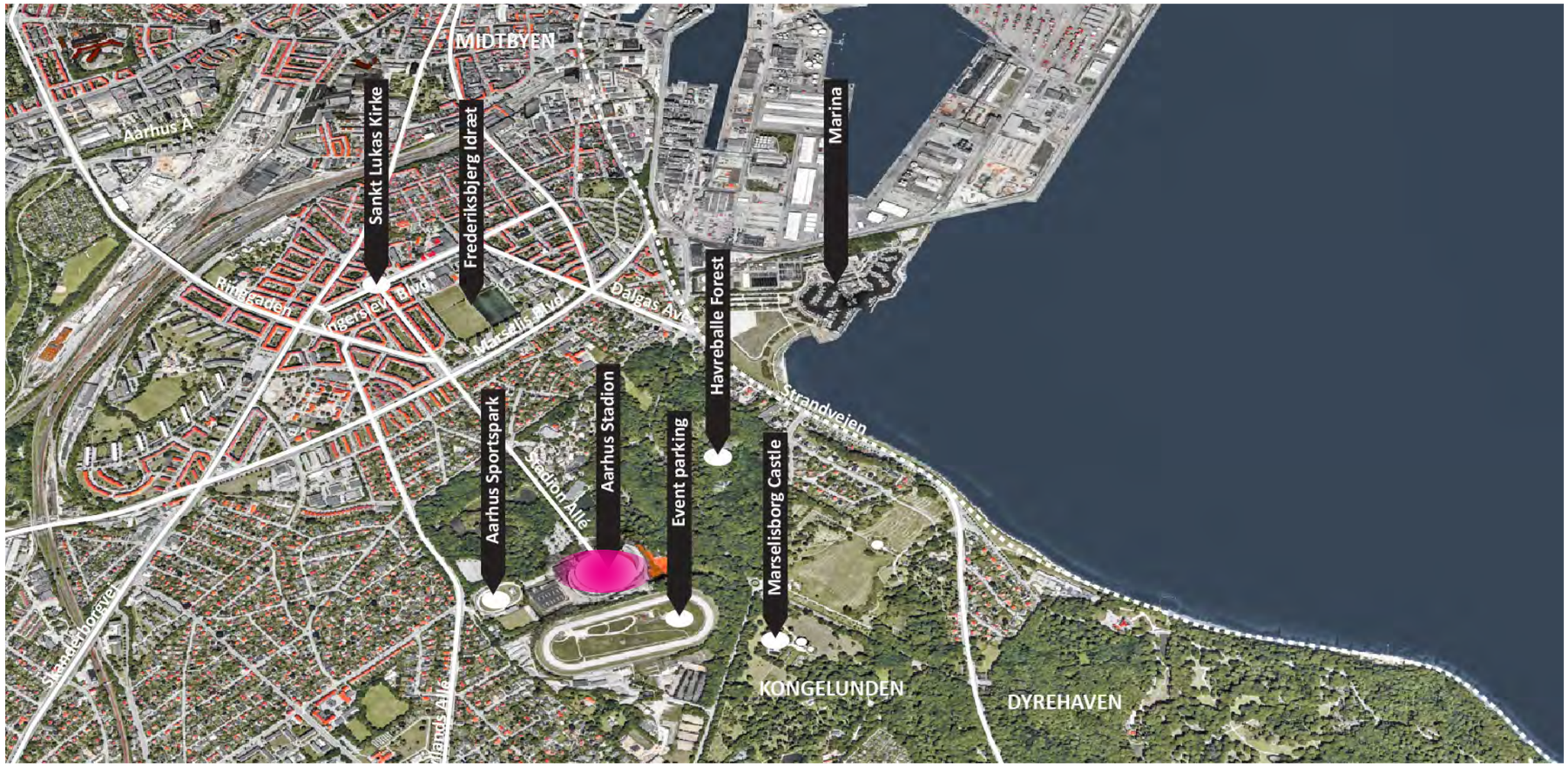
THE FOREST

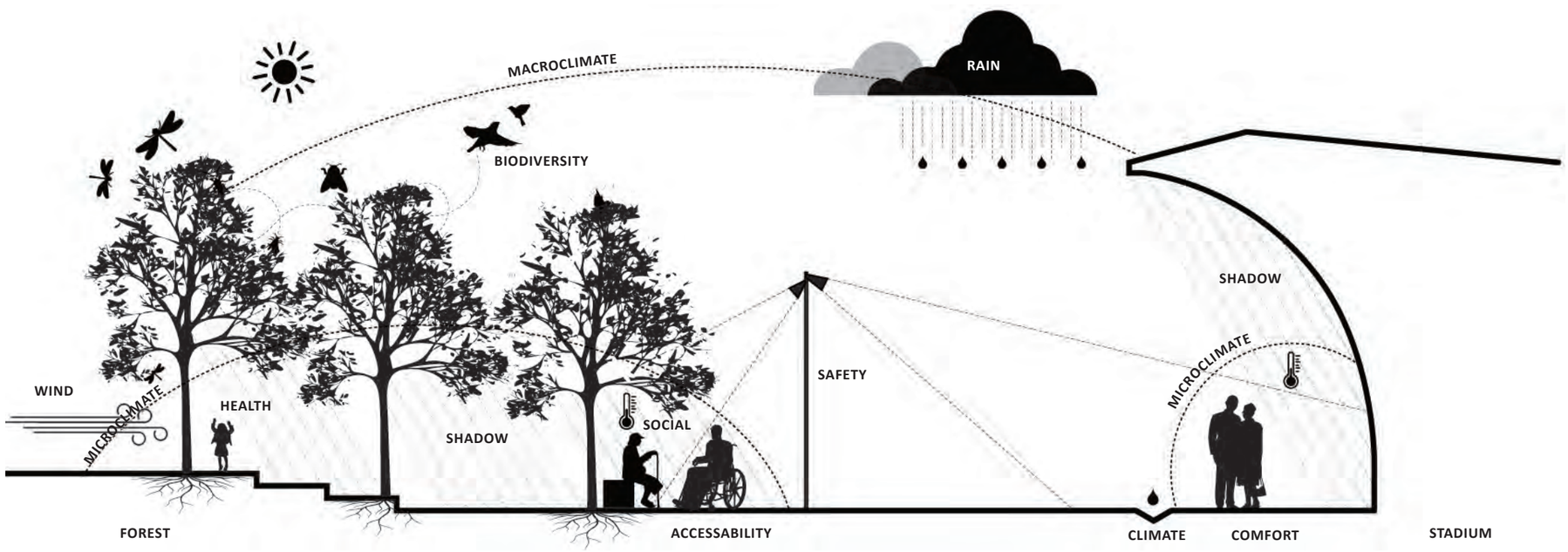
The large trees, with a particular focus on the old oak trees, must be ensured good growth conditions in terms of e.g. new pavings. Under the old beech trees that stands on the edge around the Sportspark, there is a lot of dead wood, which must remain as a part of the forest foundation to degrade as part of the forest circular system and which has many associated species. In addition, dead trunks will be able to function as a training and climbing elements in terms of obstacle courses in the forest etc.

The rainwater collected in the area will primarily drain to the lakes in the northern part of the forest, as the sports facilities have a relatively high paving rate. Along the way, the water will be delayed by means of terrain depressions where water is collected.

SOCIAL SUSTAINABILITY

In connection to the nature, the social sustainability also plays an important role in the design of the landscape creating new strong communities for both sports and recreational use. The surrounding area of the stadium is not only supporting stadium facilities but is also a health-promoting landscape, setting the stage for movement and play on an everyday basis. Universal access to safe, inclusive and accessible, green spaces are in this way provided for the public, not only creating places for football guys, but also for women and children, for older people and for people with disabilities.





1.3. SUSTAINABILITY

LANDSCAPE

The overall strategy is to use what already works. That means that it is possible to keep a substantial amount of the existing roads, parking, terrain, and trees around the stadium.

MATERIALS

The materials that cannot be reused directly is recycled, to be included in other elements. In the surrounding landscape that is mainly in the form of concrete from the old stadium and the existing pavements of asphalt and gravel.

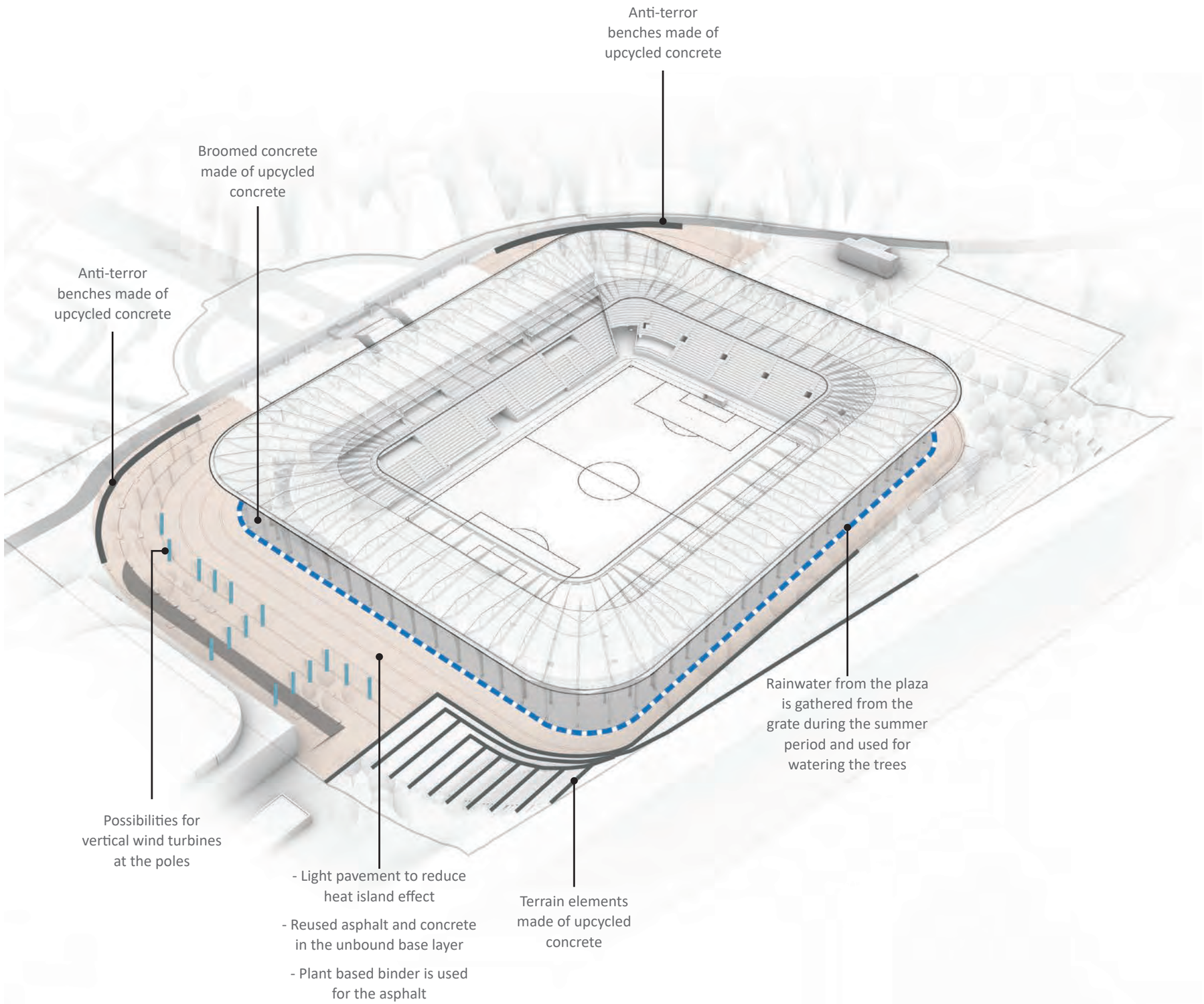
We propose to use upcycled concrete for the construction of stairs, retaining walls and anti-terror benches. The existing concrete from the stadium can be used as aggregate for new concrete. The old concrete structure can also be used as unbound base layer under the new plaza and the surrounding pavements. Other than that we propose a new type of concrete with a reduced CO_2-emission. The new type of concrete uses clay and calcium as a binder to reduce the amount of cement needed in the concrete.

Asphalt can be used directly as the unbound base layer in the build-up of new asphalt and under new roads. The light surface dressing could be a plant-based binder instead of bitumen that is extracted from oil. This way the CO_2 that is absorbed during plant growth is bounded in the binder in the entire function period.

As an alternative to lighter surface dressed asphalt, we could use a permeable asphalt which will reduce the amount of hard surfaces and allow for rainwater to penetrate directly into the ground again and become an addition to the groundwater.

RAINWATER AND WIND

External climate impacts like rainwater and wind can be used as a green energy source, for example by harvesting wind. The poles and light fixtures can be replaced by vertical wind turbines in the area between the arena and stadium that's effected by wind to produce green wind energy. In addition, the rainwater grate that runs in the paving around the stadium will collect and reuse the rainwater for watering the trees to lower the use of groundwater in the dry periods.



1.3. SUSTAINABILITY

COMMUNITY

SOCIAL SUSTAINABILITY

Our integrated design process means that we work with sustainability from a holistic perspective so that nuanced and coherent sustainable initiatives are incorporated in every aspect of the new stadium. This ensures that the project's environmental, economic, and not least social sustainability dimensions are converted into visible and tangible solutions.

With regards to social sustainability, we have designed a stadium that is clearly rooted in Kongelunden and actively contributes to the local community. A public destination in the Marselisborg forests that balances large scale events as AGF's home turf and the city's new cultural venue with the everyday needs of residents and visitors alike, weather you come to exercise, meet with family and friends, walk your dog, or just enjoy nature.

SAFE AND INVITING

Experienced safety is a key element in social sustainability as it is a prerequisite for people to use the facilities and engage in the social life of an area or building.

To contribute to a safe environment and inviting atmosphere we have emphasized transparency at the building's lower levels and ground floor. The louver façade and slender columns lend a light and visually accessible appearance to the large building volume, which in combination with the cantilevering roof provide inviting, accessible, and sheltered outdoor areas all way round. Moreover, the rounded corners support clear orientation and a natural, uninterrupted flow around the stadium without dead ends. Supported by the lighting strategy, this creates a safe public environment both day and night.

INVOLVEMENT IS KEY – SUSTAINABLE CONSTRUCTION SITE

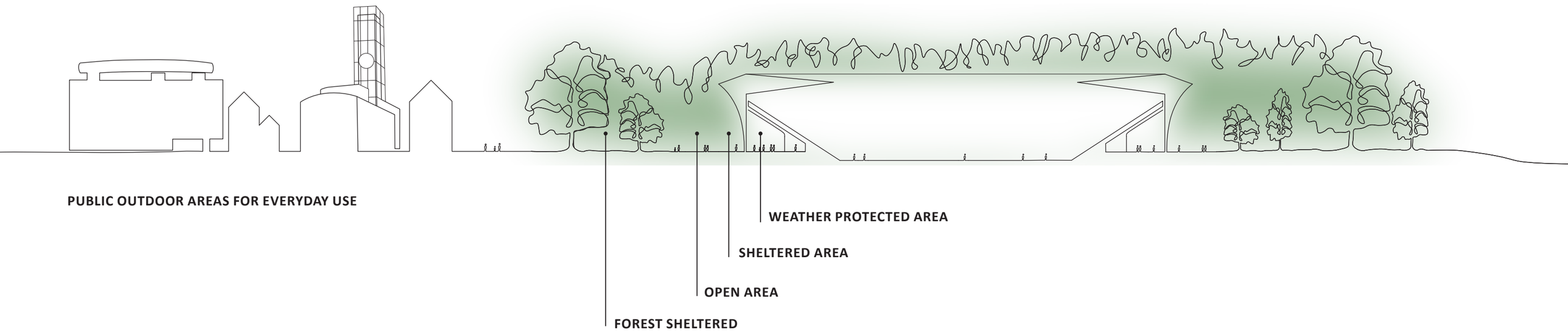
Local anchoring starts with communication. Our team knows from experience that it creates value for the local community, when we "open" the construction site to neighbours, residents and parties interested in the progression of the project. An involving site that invites the public to guided tours, milestone celebrations etc. opens the project for tangible communication about visions and progress – with emphasis on sustainability initiatives – thus building anticipation and creating sense of ownership ahead of completion.

Furthermore, site fences and signs can be activated for communication about energy consumption, waste volumes, CO2-emissions etc. to make the project's sustainability parameters visible for the public.

PUTTING THE OLD STADIUM TO NEW USE

An essential aspect of building the new stadium lies in utilizing the potentials for reuse of materials and components from the existing stadium to the largest extent possible. We are looking forward to exploring the possibilities for recycling elements such as steel trusses in the new building as well as alternative options for repurposing building components throughout the development plan for Kongelunden, e.g. a new athletics stadium.

In addition to the positive effect on the new stadium's environmental impact, the local reutilization of the old stadium will contribute to the local anchoring of the project, bridging between the past and the future development of Kongelunden as Aarhus' central sports and leisure destination.



1.3. SUSTAINABILITY

MATERIALITY

MEANINGFUL MATERIALS

We propose a stadium, in which design, structure, and materials are optimized with regards to environmental impact, functionality and experienced value. We have therefore focused on using the right materials for the right function, that is applying them, where quantities can be reduced to the absolute minimum and where strength and robustness add the greatest possible value.

Thus, our proposal is characterized by three primary materials: concrete for columns, steel for trusses and wood for façade cladding.

WOOD

Wood as façade material adds environmental, aesthetic, and experiential value to the stadium. Responsibly sourced timber is among the most sustainable building materials as it is renewable and carbon neutral. In addition, its organic tactile qualities contribute to a warm and welcoming atmosphere that naturally reflects the surrounding forests in Kongelunden.

The wood cladding is integrated into the overall design of the stadium with focus on optimizing its lifespan, so it has a durability of at least 50 years. Firstly, the cantilevering roof provides natural protecting of the façade from the elements. Secondly, the cladding is placed as high off the ground that it is further protected from weather conditions as well as from vandalism and graffiti.

CONCRETE

Concrete forms an essential part of the stadium's architectural identity, structure, and durability. Concrete is one of the most durable building materials as well as much less absorbing for graffiti than other materials, which makes it especially suitable for the building parts, which are exposed to the elements as well as to the wear and tear of daily use. Furthermore, it can be crushed and reused in the future.

The distinctive concrete columns combine structure and design in one element that is defining for the stadium's architecture and identity. The main columns are optimized so that the cross section is the widest, where the main load is at its heaviest, while gradually decreasing downwards so that the static forces are mirrored in the design.

We propose that the concrete elements are prefabricated to minimize construction time. In addition, they will be produced in a controlled environment, which makes it possible to achieve a higher and thus more durable quality.

STEEL

Using steel for the roof allows for a light structure with an optimized, minimal material consumption as steel has a very high strength and rigidity. In the same way as concrete, the longevity of steel allows for future repurposing once the building has exceeded its lifespan.

This also makes it an obvious possibility to reuse the steel structure of the existing stadium, if it can be verified that it possesses the necessary strength.

1.3. SUSTAINABILITY

LANDSCAPE

The micro climatic conditions play a big part in how and to what extend the outdoor areas will be used. The placement of trees will create smaller sub-areas in the larger plaza with shading. The placement of trees also creates a barrier for the wind - especially in the west area. On warm days the canopies will create shade for the users and together with the lighter surface treatment on the paved area surrounding the stadium it will help to reduce the urban heat island effect on the area.

TREE SPECIES

By choosing native tree species we create more habitats for birds and insects an help to boost bidoversity. The selected tree species are robust which means a long-life expectancy. By having a variation in species the tree stand will have a higher resilience to climate change and differing temperatures. By planting them in raised planting beds we protect the trees from salt, bikes and humans.

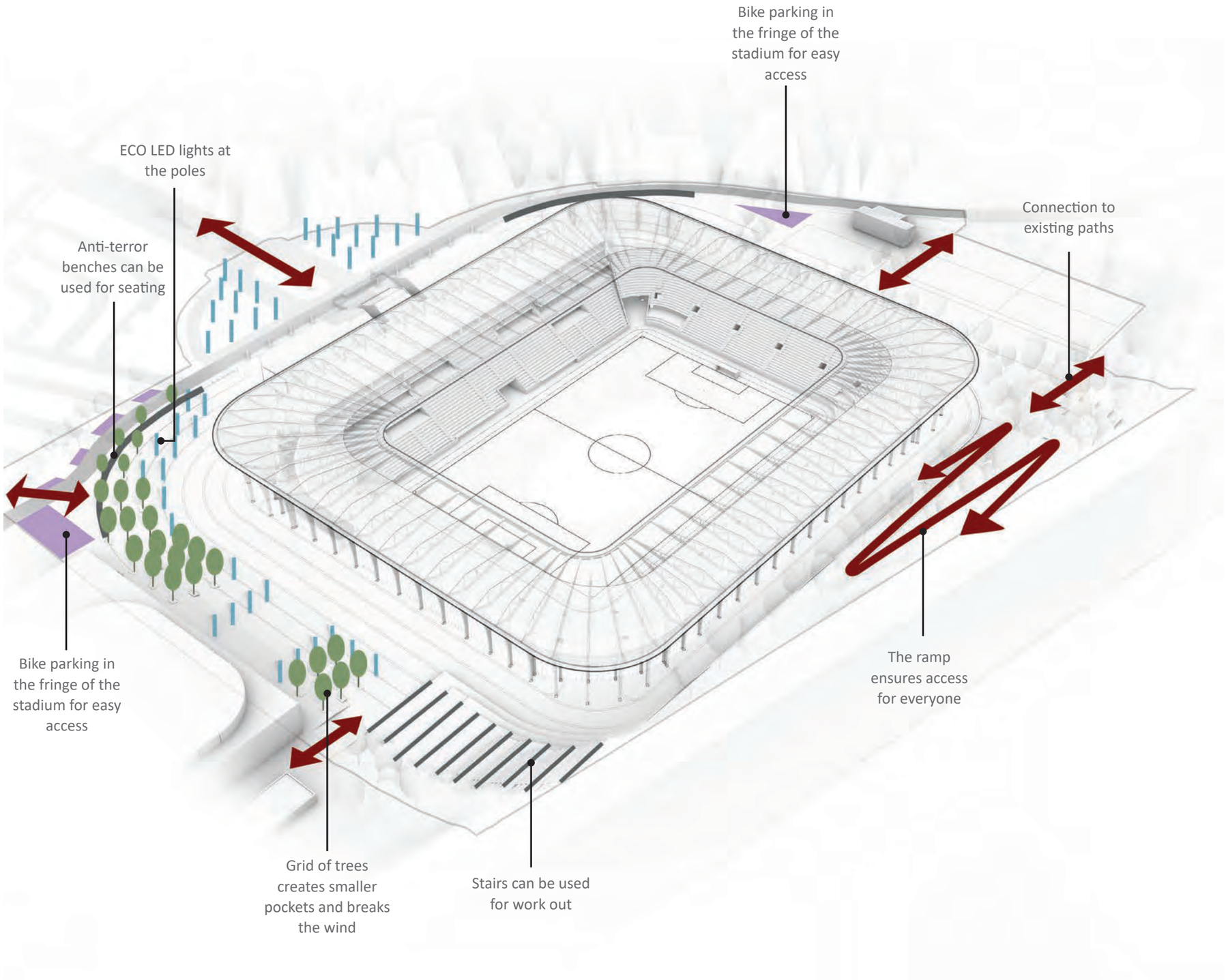
LIGHTS

The lighting fixtures that are placed on the poles is using ECO LED lights reducing light pollution and thereby not disturbing the nocturnal wildlife.

GREEN MOBILITY

With the location in Kongelunden the stadium already links to existing paths in the forest for both pedestrians and bikes and support the green mobility. The landscape strategy focuses on enhancing the connectivity both within the site and with the surroundings. The loop, stairs and new sports features around the stadium calls for daily use by sports groups and visitors. To nudge visitors to come by bike we have strategically placed bike parking closest to the entrance and ensured enough bike parking for the area.

The new urban landscape offers experiences and spaces for all users. The ramp in south as well as the terrain strategy in north, east and west insures accessibility all around the stadium and invites into a democratic landscape that ensures the inclusion for all users.



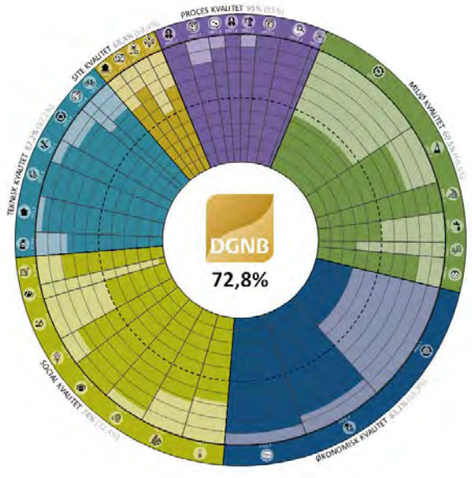
1.3. SUSTAINABILITY

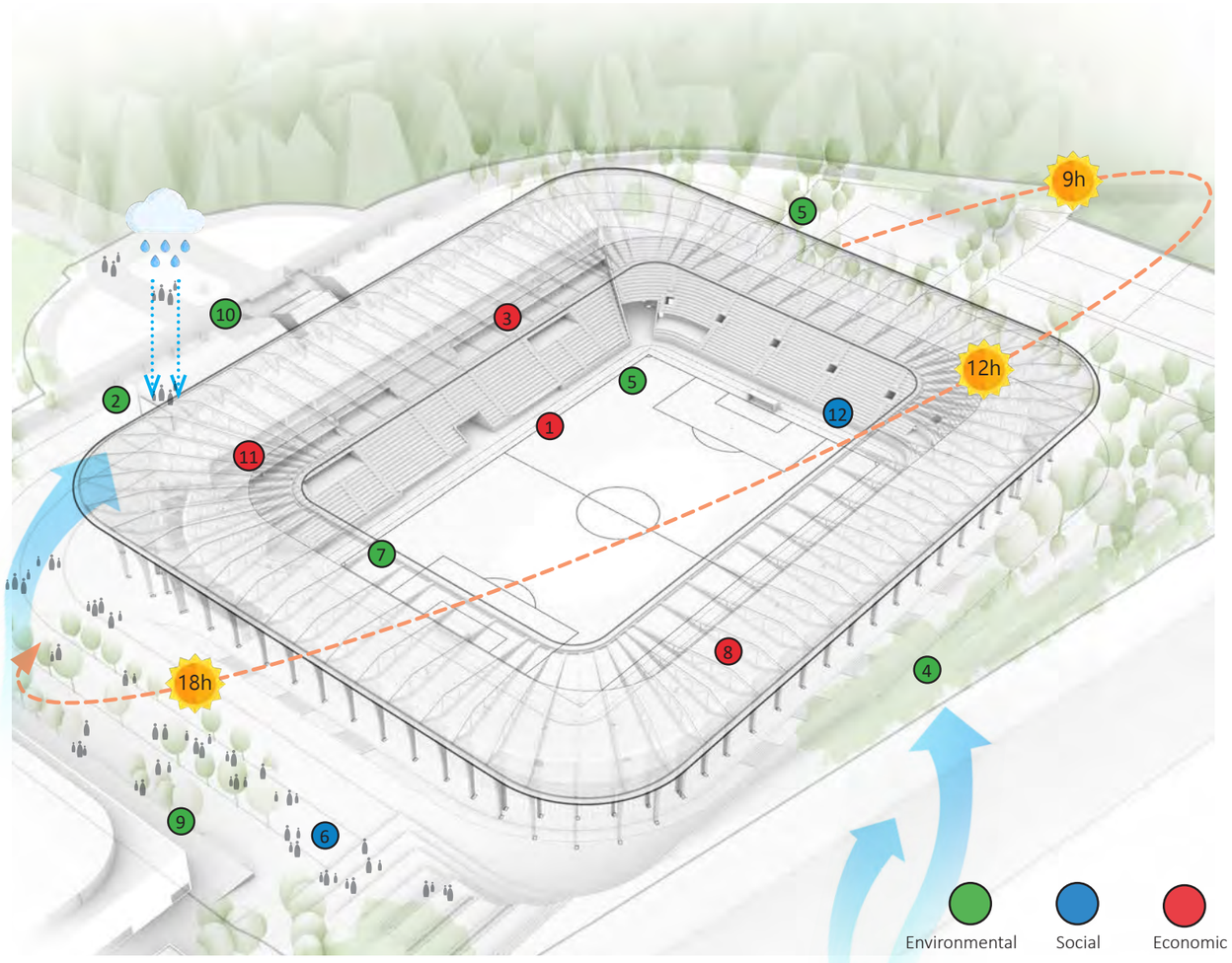
HOLISTIC APPROACH

Our approach to sustainability is a holistic assessment of the project and sustainable solutions has been a vital part of our design process and will continue to be an important focal point going forward.

Our solution for a new stadium in Aarhus is not only focused on the actual stadium site but takes the local area and overall use of the surroundings into consideration. The sustainable solutions presented is therefore not only defined by the Voluntary Sustainability Class or the environmental impact of embodied carbon, but also by applying social context to the use of the site and focusing on biodiversity and the interaction with the forestation of Kongelunden to integrate the new stadium and the area around it in its surroundings.

Our approach includes evaluation of the sustainability of the project in a relative scale via the DGNB system. The DGNB system also includes the documentation of the projects compliance with the 7 relevant topics from the Voluntary Sustainability System (VSS).





1 PASSIVE DESIGN

- shading for all seating areas to reduce glare and solar overexposure.
- compact form for more energy efficiency

2 WATER MANAGEMENT

- rainwater capture to be used for flushing and irrigation
- use of efficient water fixtures

3 SELF -SUFFICIENT ENERGY PRODUCTION

- efficient electric systems for services to reduce energy consumption.
- potential integrated PV on roofs

4 LOW EMBODIED CARBON MATERIALS

- using less carbon-intensive materials: natural, local, and recycled materials
- using hybrid natural-wood finishings
- reusing existing materials on site

5 PROMOTING BIODIVERSITY

- existing greenery and trees will be integrated into the design
- protecting and increasing habitat for wildlife
- adding more trees and greenary to capture more Co2

6 SUSTAINABLE COMMUNITIES

- The design of the new stadium creates areas all around the stadium for social interaction
- Safe and quiet outdoor areas are created for the public to use
- clear access roads

7 MATERIALS&WASTE MANAGEMENT

- providing ways to reuse materials
- producing less waste which will conserving natural resources
- Modular construction systems to ensure that easy disassemblity, reusability and recyclability.

8 INNOVATION

- Advanced environmental analytics were used to evaluate the impact of the sun and create a shading envelope that could protect those seating inside the stadium reducing 70% of direct sunlight

9 DE-POLLUTING TECHNOLOGIES AND ECOLOGIES

- green terraces for air purification, biodiversity and evaporative cooling

10 GREEN TRANSPORT

- encouraging using electrical vehicles
- bikes & electrical scooters lanes

11 EFFICIENT ENVELOPE

- efficient thermal insulation to reduce heat loss through building envelope
- high efficient windows design for lower thermal loses in colder months
- The building envelops were calculated to optimise solar gain

12 OUTDOOR THERMAL COMFORT

- Trees to mitigate strong wind and improve outdoor comfort
- using material that will reflect energy and reduce the Urban Heat Island effect.

1.3. SUSTAINABILITY

WEATHER STUDIES

Solar dynamics

The solar diagram allows us to know the Azimuth angles and the altitude of the Sun, in each hour of the representative days of each season. The representation of the solar trajectory is described graphically, as if they were arcs, taking as a reference the 21 of each month, since the summer and winter solstices fall on June 21 and December, respectively. Due to the symmetry of the elliptical path around the sun, these arcs overlap, the solar vectors of half a year being identical to those of the other half.

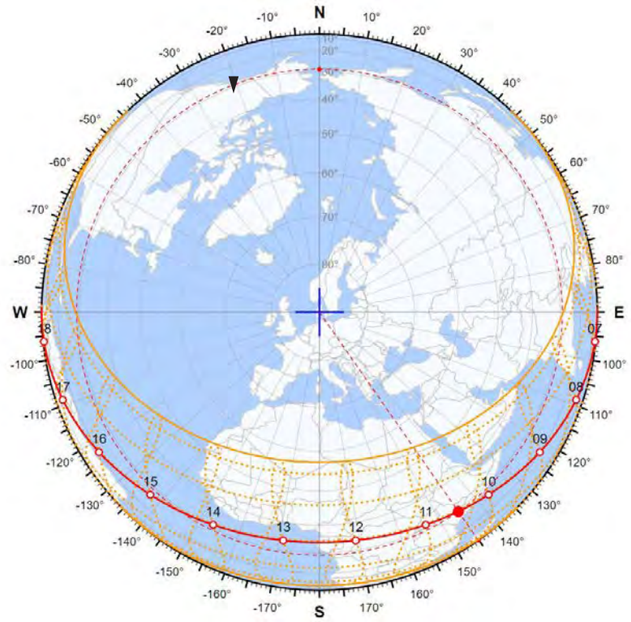
These vectors are used for solar analysis of architectural geometries, with which we can carry out 3D indoor and outdoor solar exposure maps.

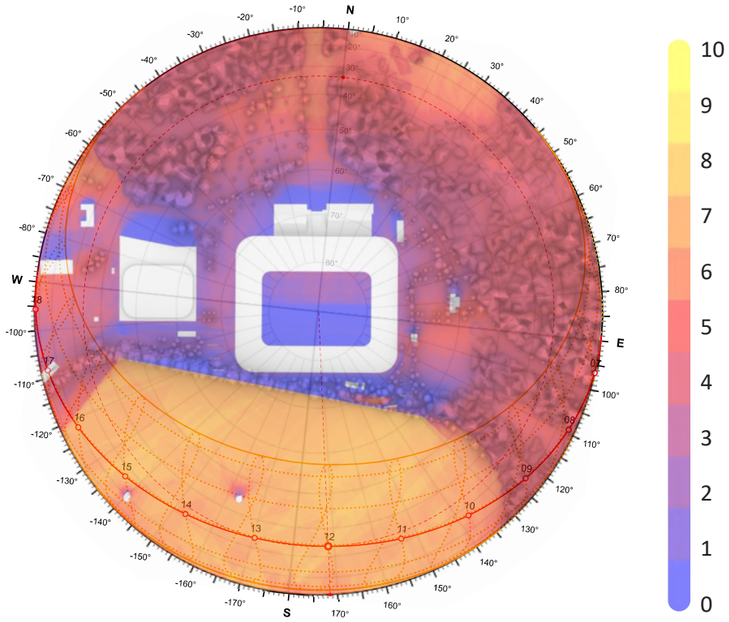
Comfort Map

This comfort map, based on Lawson wind comfort criteria, can help to determine suitable locations for specific programs, based on activity level. Blue areas are suitable for outdoor seating, while yellow and red zones are not suitable for sitting or strolling comfortably outdoors.

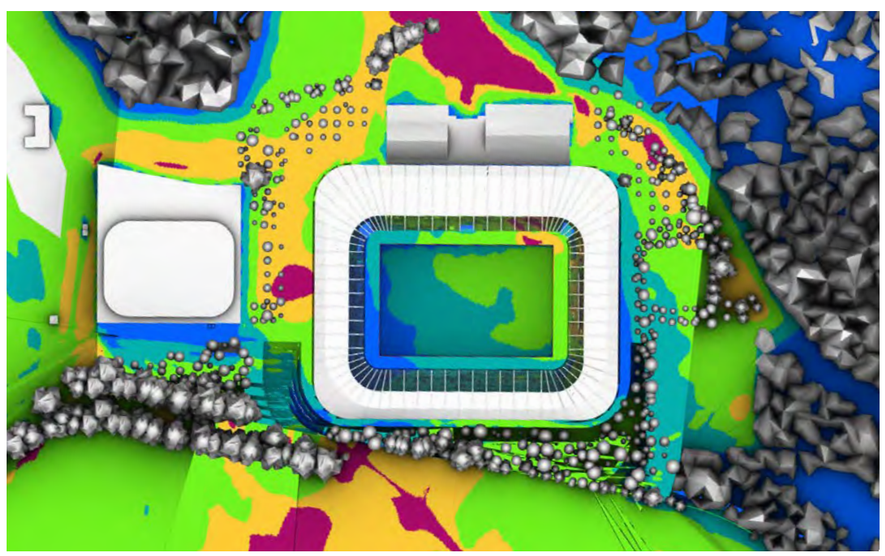
1. All seating areas will have a comfortable level for sitting and enjoying the matches that have been tested through Lawson wind comfort criteria. The landscape design provides comfortable area in the plaza and pitch area.
2. Semi Open Lamellas system provide better wind protection for the concourse area and Stadium area overall
3. Protection Mesh design is optimised to dissipate wind energy efficiently.
4. The Curvature of the Stadium design in particular the lamellas prevents the occurrence of High pressure down draft wind effect at the ground level

ANNUAL SUN HOURS (AVERAGE)





WIND ANALYSIS



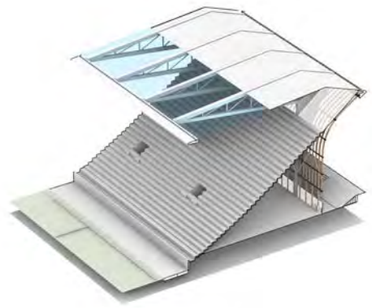
1.3. SUSTAINABILITY

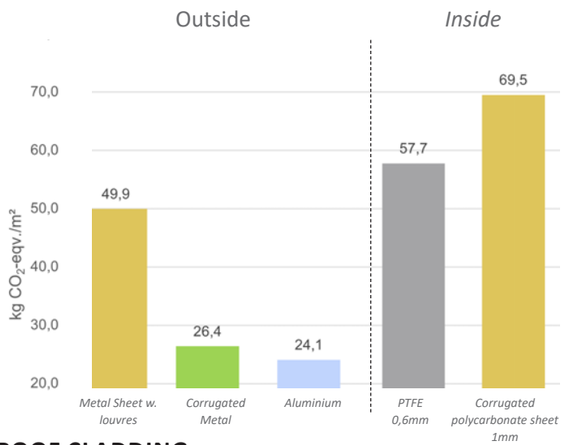
CLIMATE IMPACT

The New Stadium must comply with the Danish Building Regulations (BR18) which will be updated by January 2023 with legal requirements for the buildings max. climate impact (measured in kg. CO2eq). Target level is max. 12 kg. CO2eq pr. m² pr. year, based on 50-year lifespan.

During the design process the climate impact is monitored closely and variations for different materials have been analysed as part of the selection together with functionality, buildability, maintenance and price.

The climate impact of our proposal as in accordance with the upcoming BR18 is approximately 11 kg CO2eq/m² pr. year.

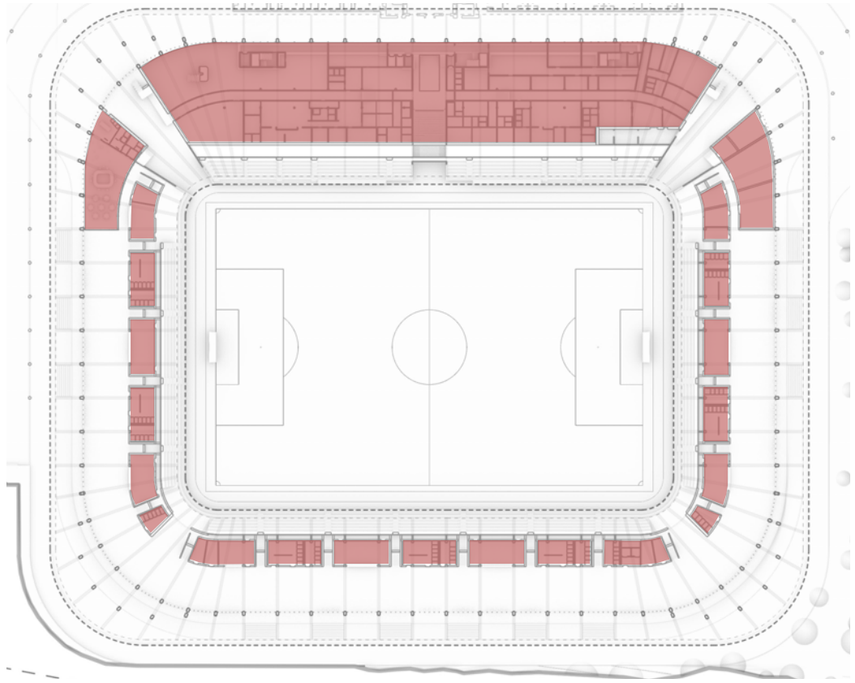




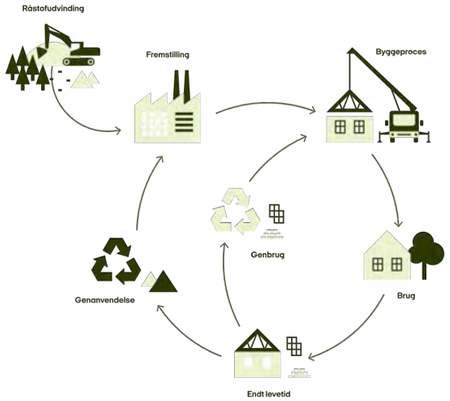
ROOF CLADDING

Analysis for different roof cladding materials.

HEATED FLOOR AREA (GROUNDFLOOR)



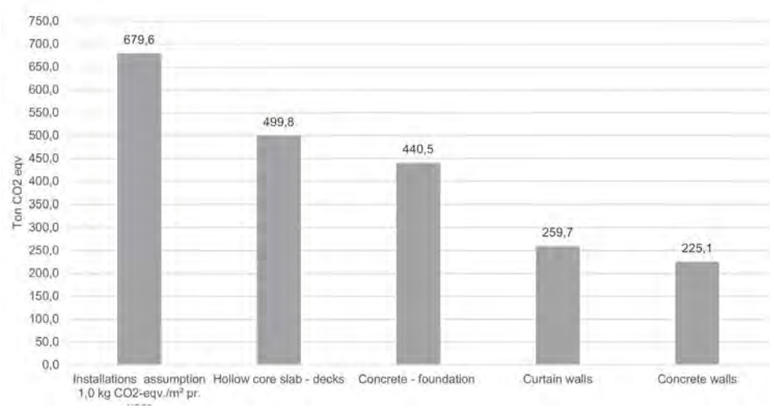
LIFE CYCLE ANALYSIS PHASES ACCORDING TO VSS.



Climate impact for the project has been decreased from initial proposal to now by changing:

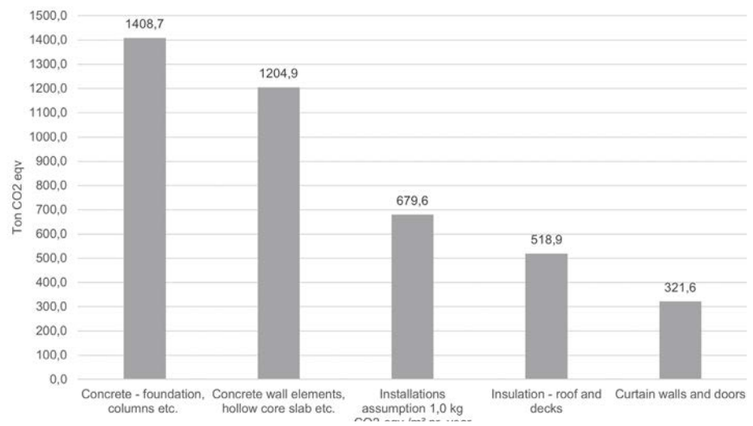
* Steel columns to reinforced concrete
* Optimization of volumes based on a more detailed BIM-model.
* Area of North Stand has been reduced

HOTSPOT MATERIALS - GWP - BUILDING ELEMENTS



Hot spot analysis from LCAbyg output for New Stadium Aarhus showing the impact from different building elements

HOTSPOT MATERIALS - GWP - MATERIAL USE



Hot spot analysis from LCAbyg output for New Stadium Aarhus showing the impact from different material groups.

1.3. SUSTAINABILITY

REUSE

The project for a New Stadium Aarhus is located on the grounds for the existing stadium and this provides a wide range of possibilities for reuse and recycling of existing material. Reusing existing materials requires compliance with the relevant codes, buildability, maintenance strategy and economy. Materials not used directly in the New Stadium project could be used in other local projects.

1. SEAT

Existing seats could be reused in the new stadium. Excess or broken seats could be used as cladding on food stands etc. as shingles.

Possible reduction in climate impact is around 300 ton CO2eq.

2. Material - Concrete

Existing concrete could be used as aggregate in foundations or other new concrete constructions. The climate impact of reusing concrete in this capacity is insignificant when looking at CO2eq. However it reduces the need for adding new material and is thus a possibility.

Another possible use for concrete is for new paving stones.

2. Material - Mesh Fences

Existing fences can be reused directly as part of the new project.

3. Steel

Reuse of steel beams from existing roof construction as part of the new stadium roof. Possible reduction in climate impact is around 2.700 ton CO2eq.

1. SEAT

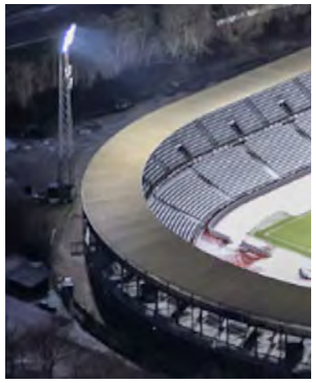
2. MATERIAL

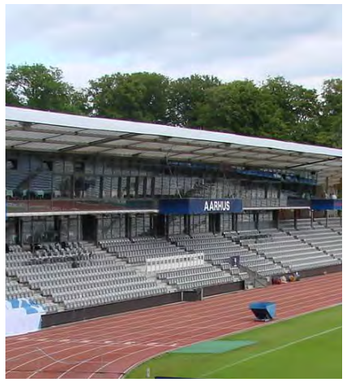
Concrete

Mesh Fence

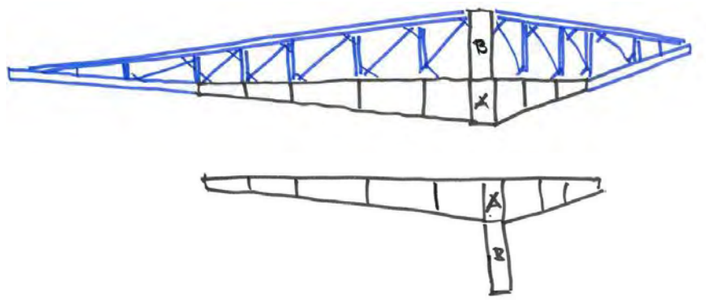
corrugated roof

polycarbonate roof





3. STEEL

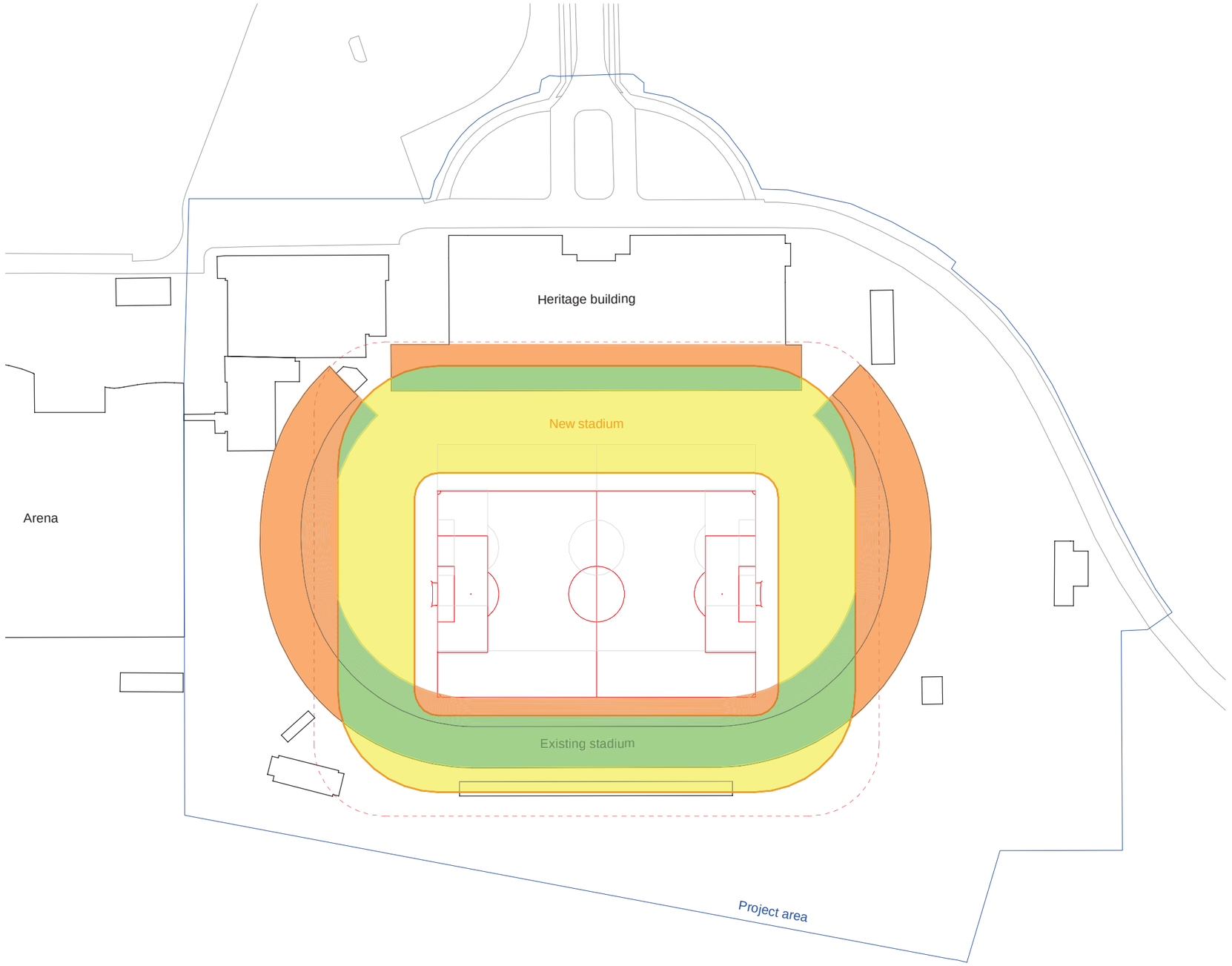


1.3. SUSTAINABILITY

REUSE OF GRAVEL PAD

It’s expected that the existing stadium is founded on a gravel pad. The sketch shows where the gravel pad can be reused directly, and where it is possible to reuse material by moving it.

It’s expected that the gravel pad for the new stadium can be made from approximately 50% reused material either directly reused or moved.



GRAVEL PAD

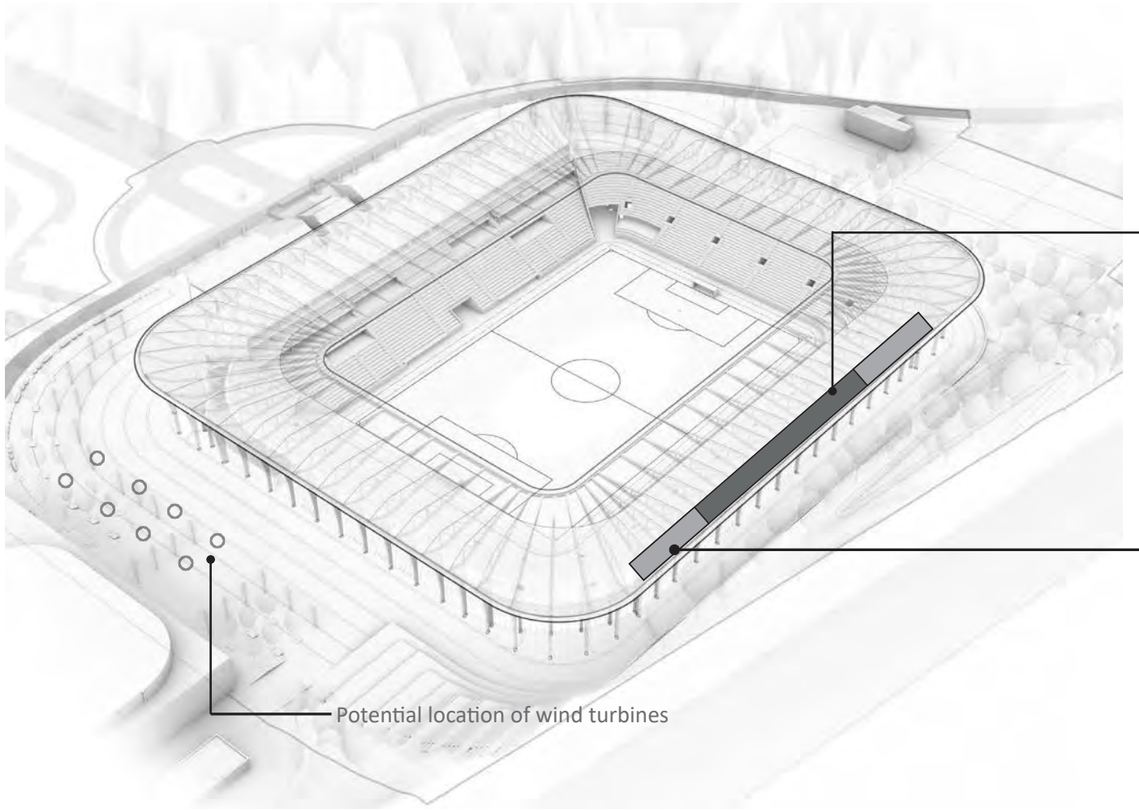
- DIRECT REUSE OF GRAVEL PAD
- GRAVEL PAD FROM EXCISTING STADIUM.
  POSSIBLE MOVE OF MATERIAL FOR REUSE UNDER NEW STADIUM.
- NEW GRAVEL PAD MADE FROM REUSED AND NEW MATERIAL.

1.3. SUSTAINABILITY

RENEWABLE ENERGY

In order to reduce the climate impact from operation and to comply with the demands in the Danish Building regulation with regards to building energy the New Stadium in Aarhus is equipped with solar panels .

A possibility to further decrease the energy consumption for the stadium site is to place vertical wind turbines in the surrounding areas, for instance as in Queen Elisabeth Olympic Park in London.




Solar panels


Wind turbines in Queen Elizabeth Olympic Park in London

1.4. FAN EXPERIENCE

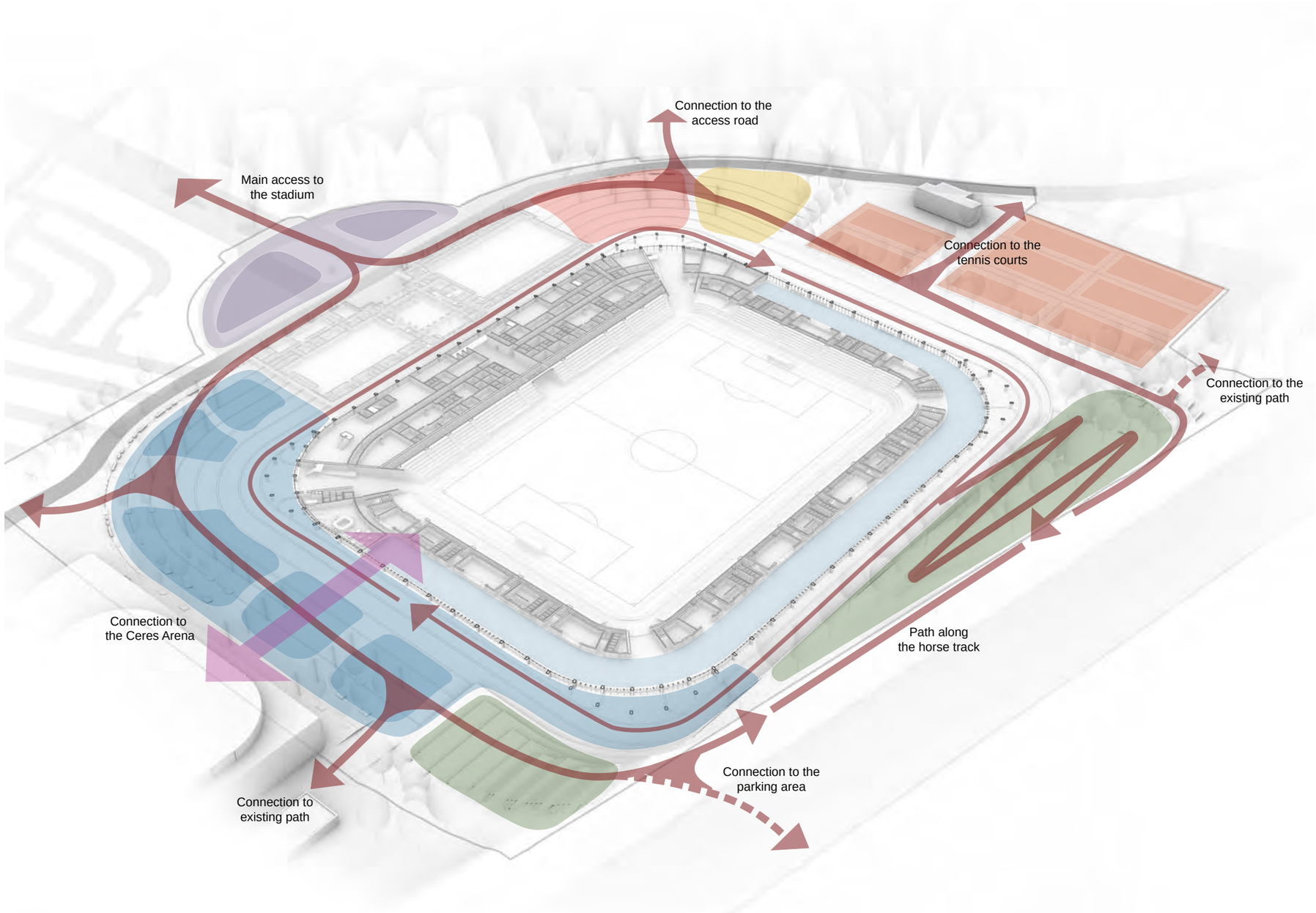
FUNCTIONS AND CONNECTIONS IN THE LANDSCAPE

The areas surrounding the stadium are programmed to work in everyday life, at matchdays and for major events. The functions outside are placed in relations to the stadium program to prolong the football experience on matchdays and ensure optimal flow, to and from the stadium. The flexibility and robustness of the area means that local sports clubs, communities, and neighbours benefit from the space and facilities on a day-to-day basis without compromising the football experience at matchdays or major events.

To support the future use of both the new urban space and the stadium, it has been a key design driver to improve the existing connections to the stadium grounds. Creating a direct access loop and a bigger loop tying in the south slope with the stadium through a grand stair in southwest, a small stair in southeast and a pathway running along the horse track. In addition, new routes are extended and connected to the existing network of paths within Kongelunden.

Special attention has been given to the fan plaza in northwest corner and the area between the arena and stadium on the west side. Here the programming is particularly important since this area has the broadest range of use. On matchday the area must appeal to a diverse group of fans – spanning from families with kids to die-hard fan groups. To accommodate the area have been divided into zones matching the entrance points at the stadium with lots of street sport activities, big screens and food and drink stands.

The landscape is shaped to optimize the connection and synergy between the neighbouring functions and the new stadium. The stadium sits at level +14,7 insuring a seamless connection to the heritage building. To meet the existing terrain at Ceres Arena at level +17,0, the terrain raises slowly from the stadium to the arena where wide steps ensure the connection and flow between the stadium and the arena. The tennis courts sit at level +15,5 and the difference in the terrain between the tennis courts and the stadium will be solved in the plant beds along the tennis courts.



ACCESS AND FUNCTIONS

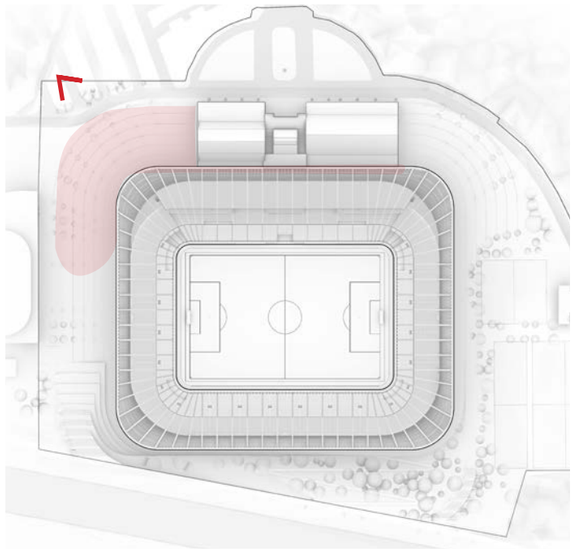
1.4. FAN EXPERIENCE

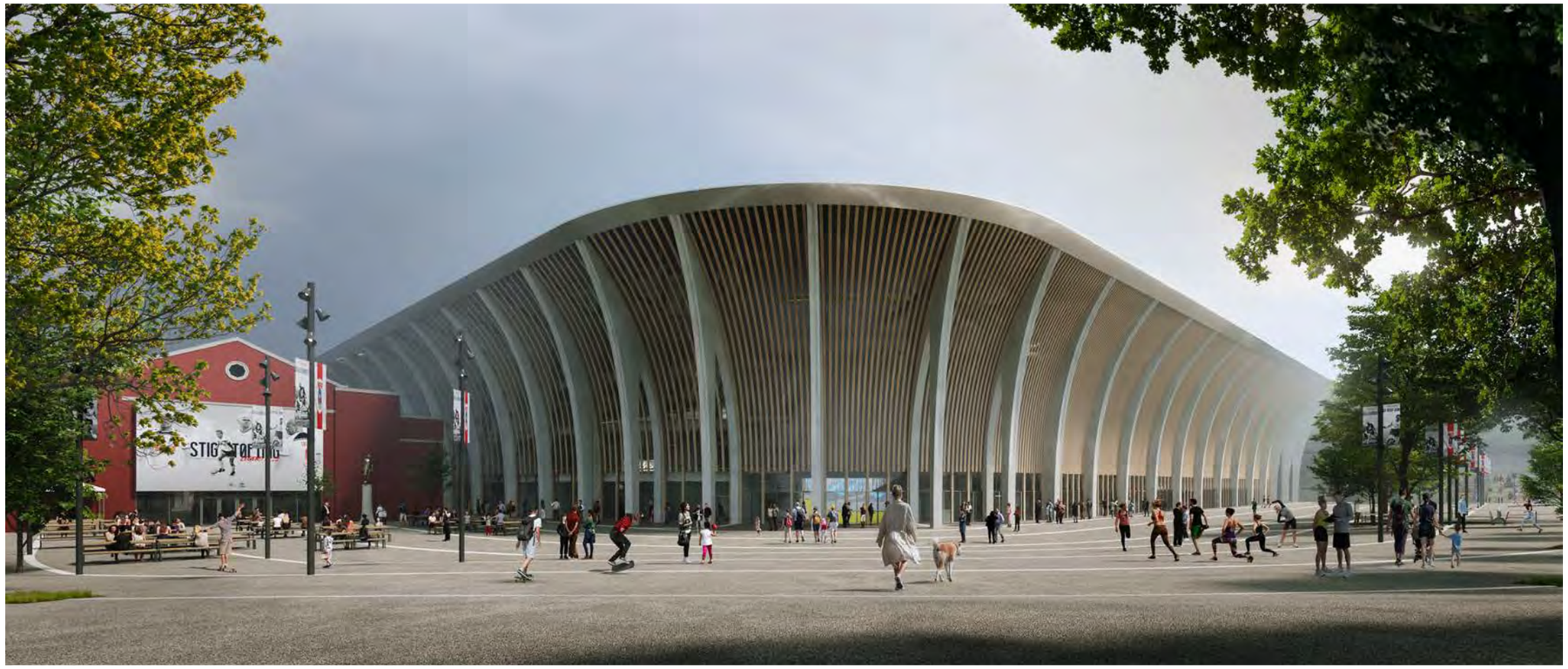
SØJLEHALLEN FAN PLAZA

The Fan Plaza located to the right of the Heritage building is the main meeting and gathering place for visitors to the Stadium, whilst also serving as the backdrop and visual connection between the stadium and the forest. It is a place that needs to be able to inhabit the festivities of a matchday or other big event at the same time appear presentable and inviting when the stadium functions are not in use.

A green buffer zone of vegetation between the Fan Plaza and adjacent existing parking are created by rearranging the southern most part of the parking area. This creates a green visual barrier between the parked cars and gathering spaces.

NORTH-WEST CORNER - FAN PLAZA -MATCH DAY



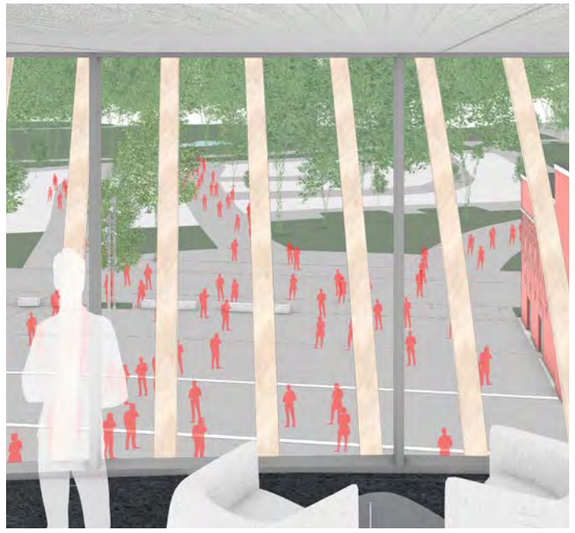


NORTH-WEST CORNER - FAN PLAZA -NORMAL DAY

1.4. FAN EXPERIENCE

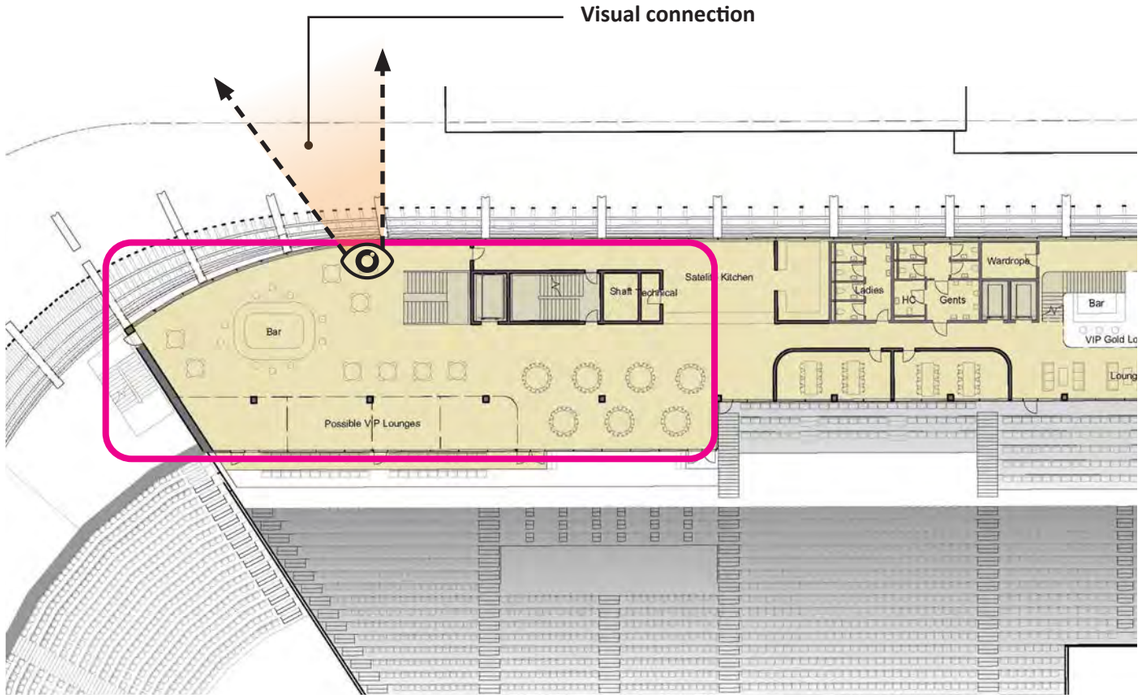
VIP LOUNGE FAN PLAZA VISIBILITY

A lower louver density towards the fan plaza allows a highter visual connection between the VIP area and the fan plaza and its fans. Hence, the atmosphere ruling the fan plaza, is able to penetrate deep into the VIP area on a matchday or other big events.

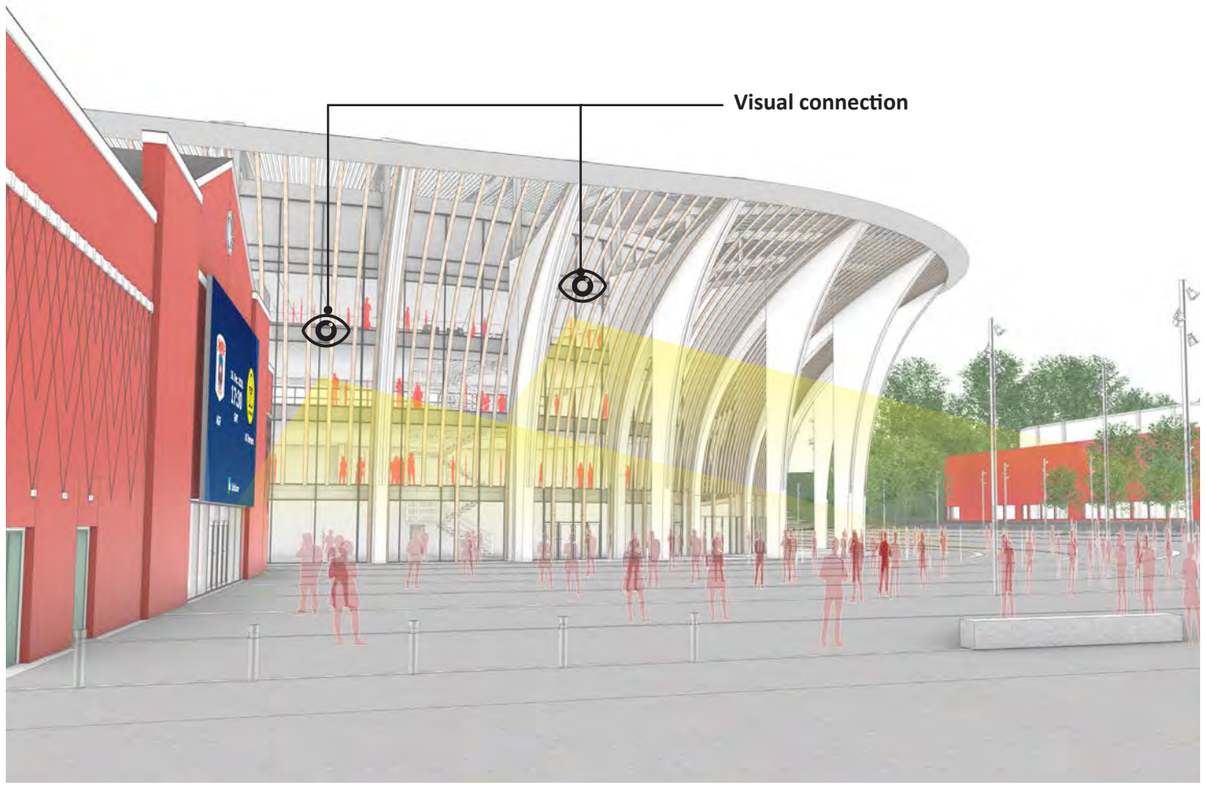


VIEW FROM VIP CLOSEP

VIEW FROM VIP LOUNGE TOWARDS FAN PLAZA



NORTH STAND 3RD FLOOR



VIEW FROM FAN PLAZA

1.4. FAN PLAZA

MATCH DAY

At matchdays the plaza will be refurnished to a fanzone so you can enter the plaza some hours before the match to get something to eat and drink, do different activities as table tennis, panna football, crazy golf and meet'n'greed with players etc. with your family and friends and hanging out in the lounge area from where you can follow what is shown at the two big screens.

After the match you can stay in the fanzone and get one more beer and a late night snack before you go home.

Beer sales

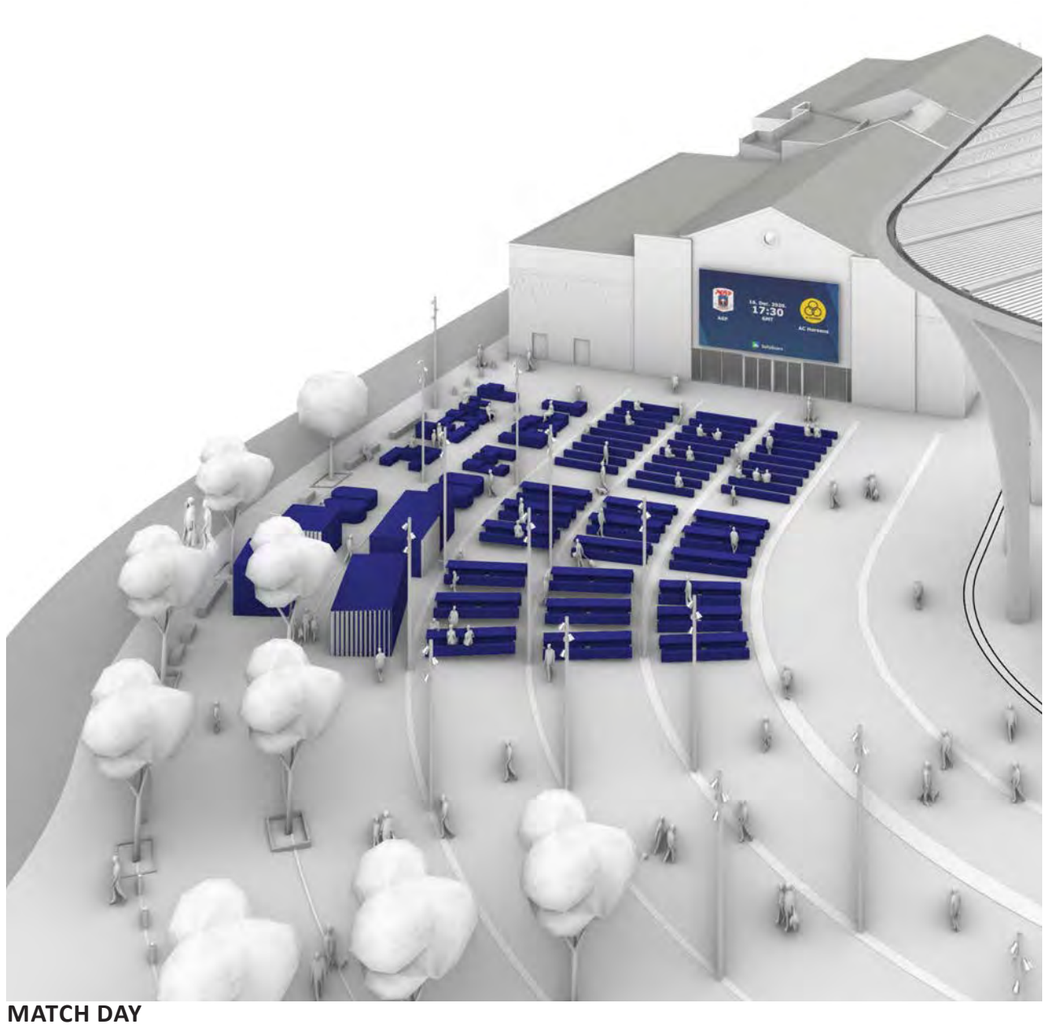
Different games

Crazy golf for families

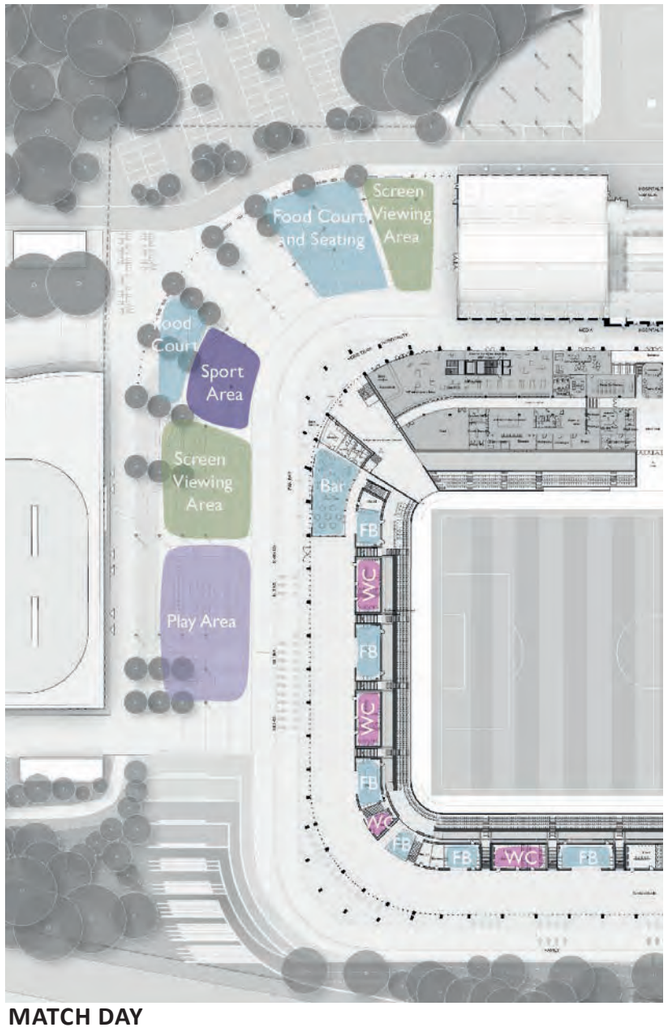
Table tennis

Food stalls

Table and benches



MATCH DAY



MATCH DAY

1.4. FAN PLAZA

DAILY LIFE

In day-to-day life the plaza will attract running clubs using the stairs and ramp to loop around the horse track and stadium, which also will be a popular area for skaters and cross fit clubs, while they can use the walls and edges for work out and tricks. The main open plaza will be furnished with removable panna ball courts, football tennis etc. The concourse in the stadium will be accessible for visitors and in the Heritage Building a new museum cafe will make sure you can get a cup of coffee while you are taking a break at the plaza. The plaza will be a natural part of many dog walkers daily route, where they can park the car in north and enter Kongelunden through the plaza.

Work out at edges

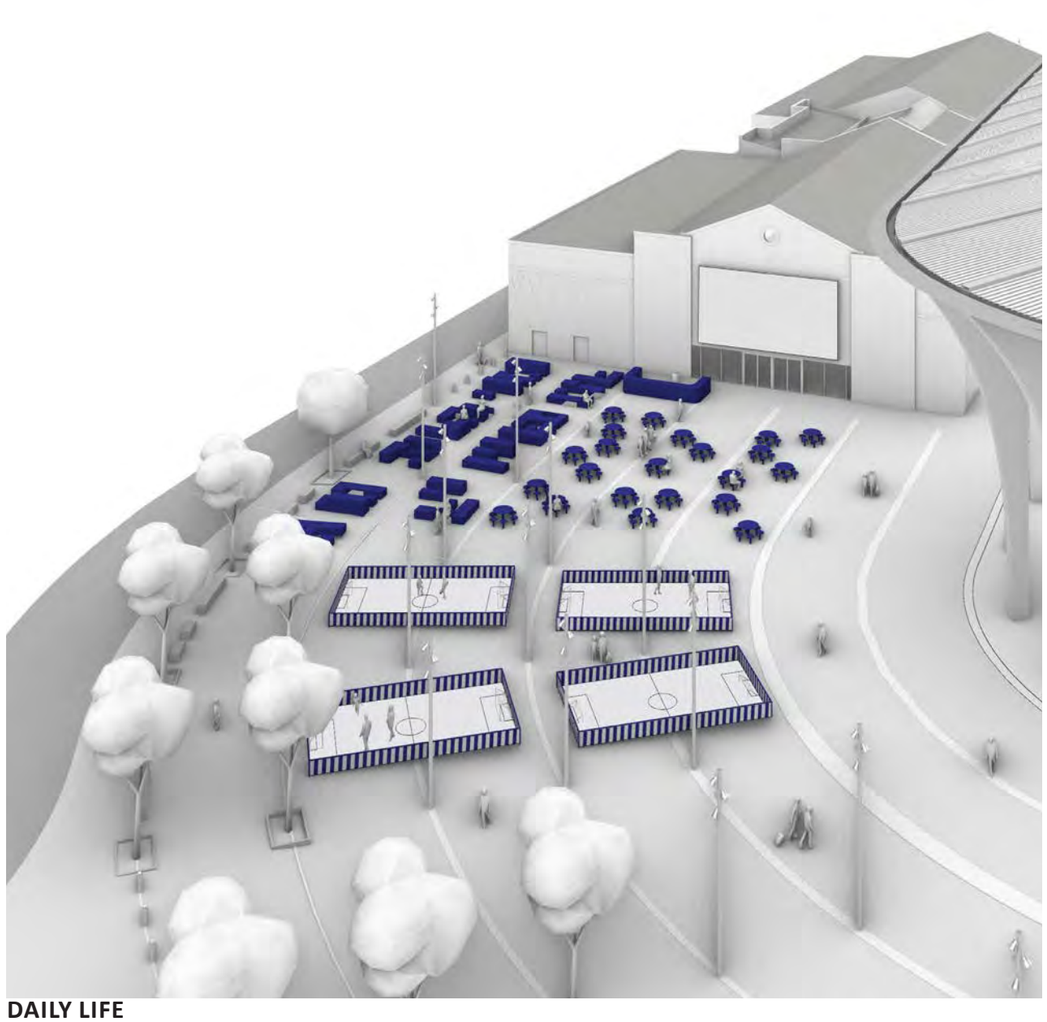
Time for a break

Areas for sport

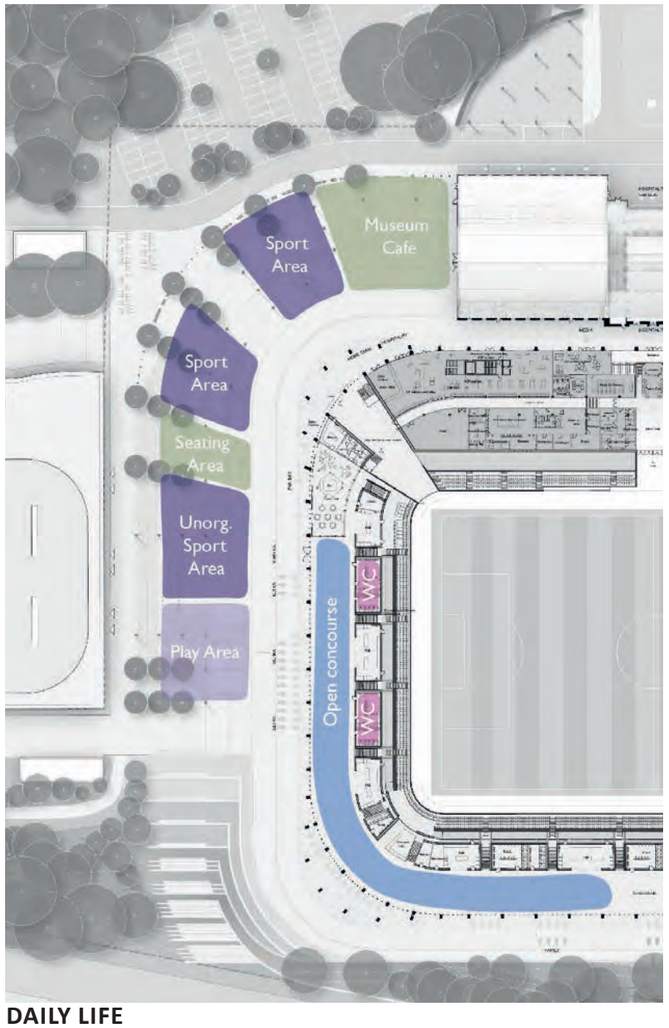
Dog walkers daily route

Furnitures for relaxing

Skating at the stairs



DAILY LIFE



DAILY LIFE

1.4. FAN PLAZA

MAJOR EVENT

When the stadium will be the host for a major event as a concert, the plaza will be unfurnished to handle almost twice as many guests as at a football match. In the perimeter the guests can stand at bar tables and enjoy food and drinks from the food stalls. Here you can also find stalls with merchandise. In the evening time event light can support the right mood and be the icing of the cake for the special evening.

Many visitors

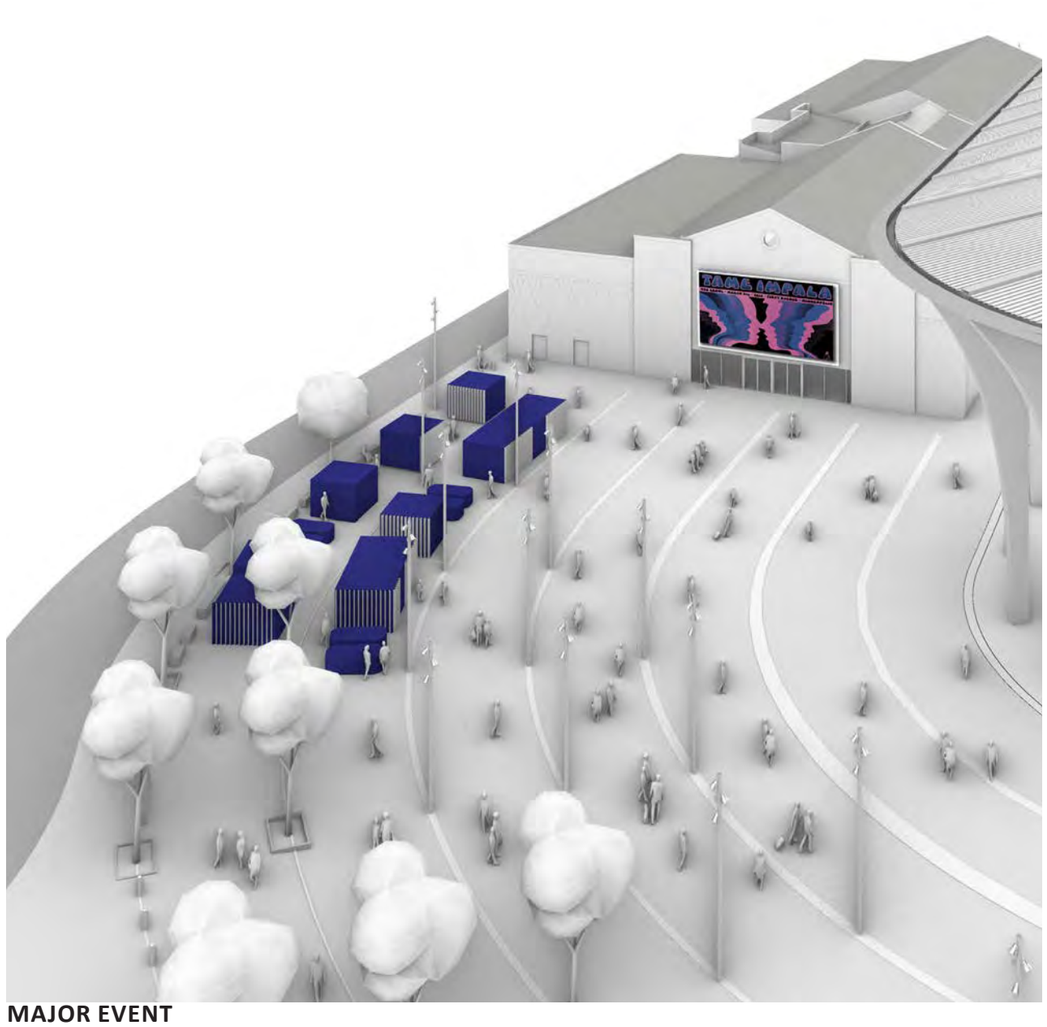
Beverage stalls

Food trucks

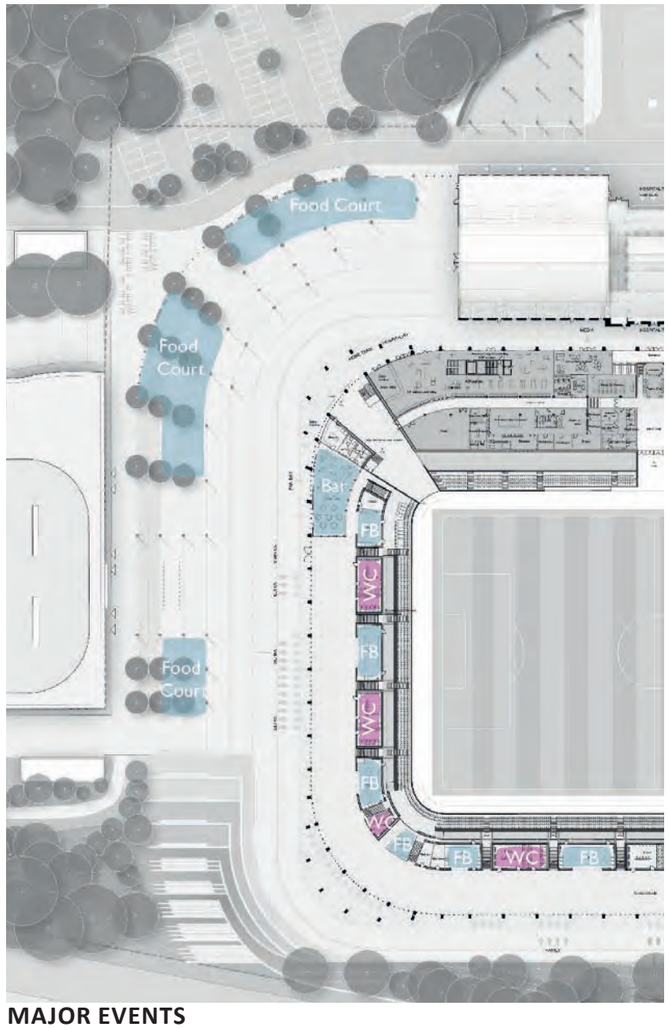
Merchandise stalls

Social gatherings

Event lights



MAJOR EVENT



MAJOR EVENTS

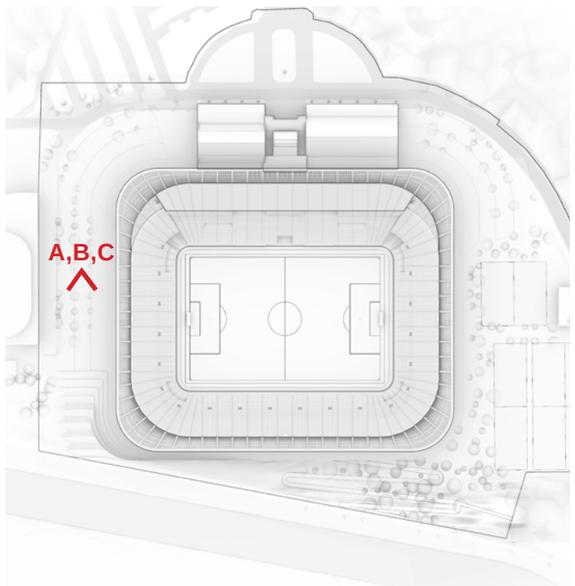
1.4. FAN EXPERIENCE

DIFFERENT USES OF THE FAN PLAZA

Between the stadium and the arena an almost 40 m wide area gives possibilities for various activities depending on whether it is an everyday situation or a match day. Along the arena wide steps ensures an easy flow between the arena and the stadium and the steps are also useful for daily workouts.

In the background the grand stair creates a new loop around the stadium and gives the visitors a unique opportunity to watch the horses train and run along the new path. At match days or major events, the stair leads to the event parking located in the centre of the horse track.

A) MATCH DAY



B) EVERYDAY LIFE

C) MAJOR EVENT

1.4. FAN EXPERIENCE

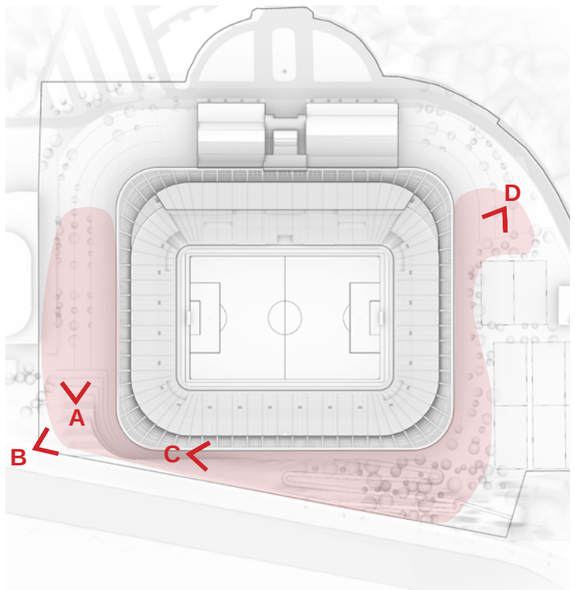
AROUND THE STADIUM

The south side of the site is characterised by dramatic sloping terrain with some large mature trees that visually separate the stadium from the horse racing track. As a natural extension of the Fan Plaza, a large inviting terracing of the landscape forms steps and seating plateaus in connection to the stadium and ensures the physical connection to the horse racing track.

South of the stadium a retaining wall runs along the perimeter, where climbing plants will green the wall and new trees grow up between the new ramp which runs between the horse racing track and the southern part of the stadium.

On the east side of the stadium the landscape meets the tennis courts. To ensure that the two functions can function simultaneous a fence combined with an inclosing area of trees are dividing the two areas.

A) WEST PLAZA STEPS



ZAHA HADID LTM, SWECO DANMARK A/S, TREDJE NATUR APS

B) SOUTHWEST CORNER

C) LOOKING FROM SOUTHWEST TO SOUTHEAST

D) AWAY FAN PLAZA

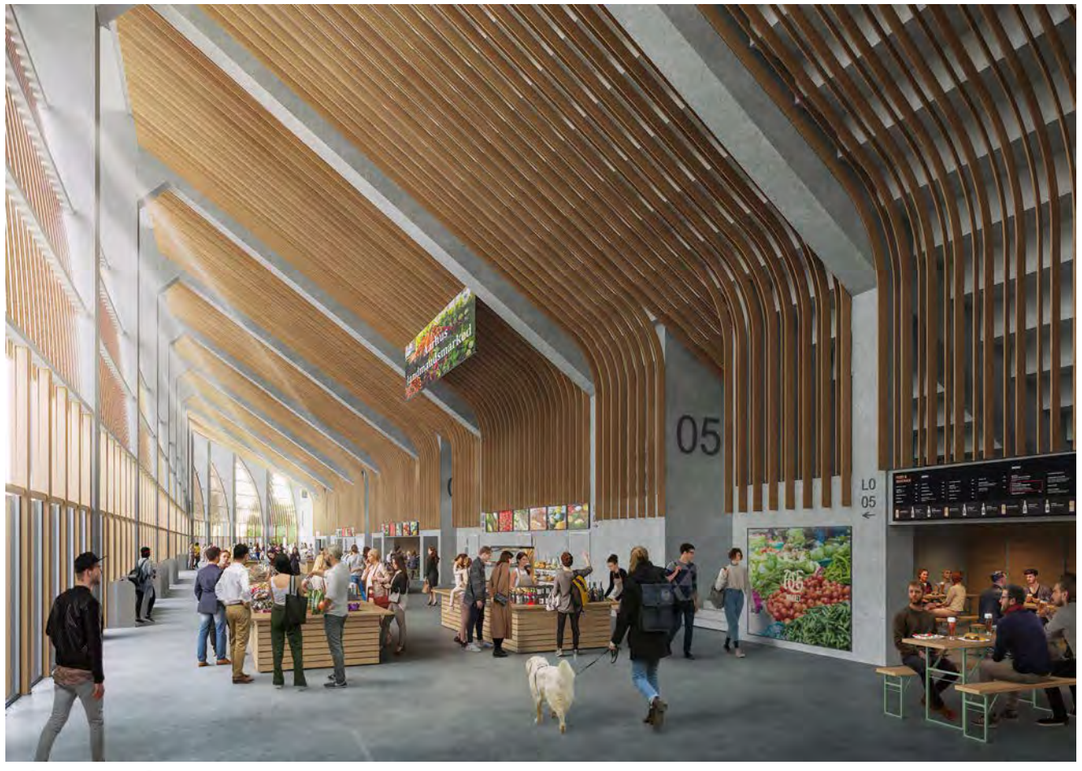
1.4. FAN EXPERIENCE

CONCOURSE FAN ATMOSPHERE

The Concourse atmosphere can change depending on the fan zone and the event taking place. In football mode concrete walls can be programmed by the fans to make the Concourse their own in addition to banners, lit columns, engraved signage and hall of fame add to the overall atmosphere. In normal mode the space can be re-arranged to host a wide array of functions. For larger events and concerts lighting and projections transform the space.

- **FAN PROGRAMMABLE WALLS**
- **PAINTED SIGANGE**
- **PROJECTION LIGHTING**
- **HALL OF FAME**
- **MVP**
- **DIGITAL SCREENS FOR LIVE MATCHES**
- **BANNERS**

FOOTBALL MODE



NORMAL MODE

EVENT MODE

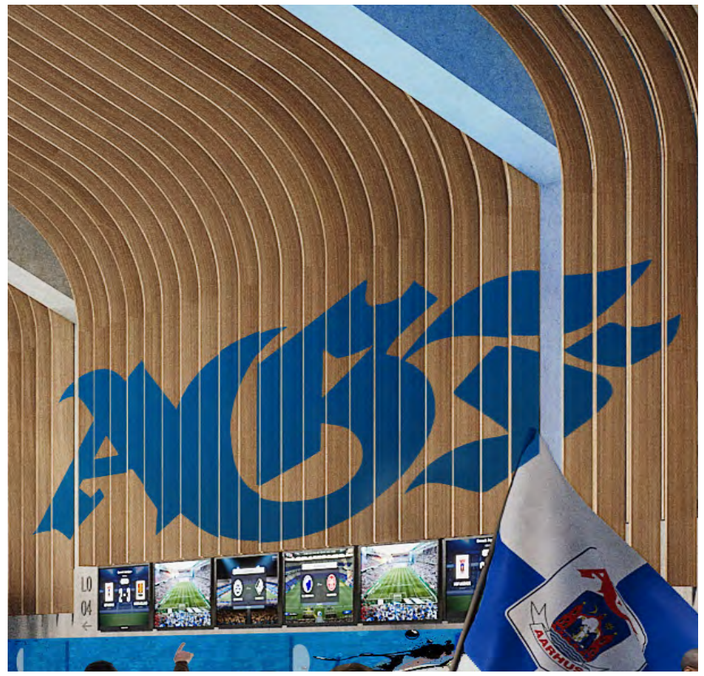
1.4. FAN EXPERIENCE

FAN ATMOSPHERE

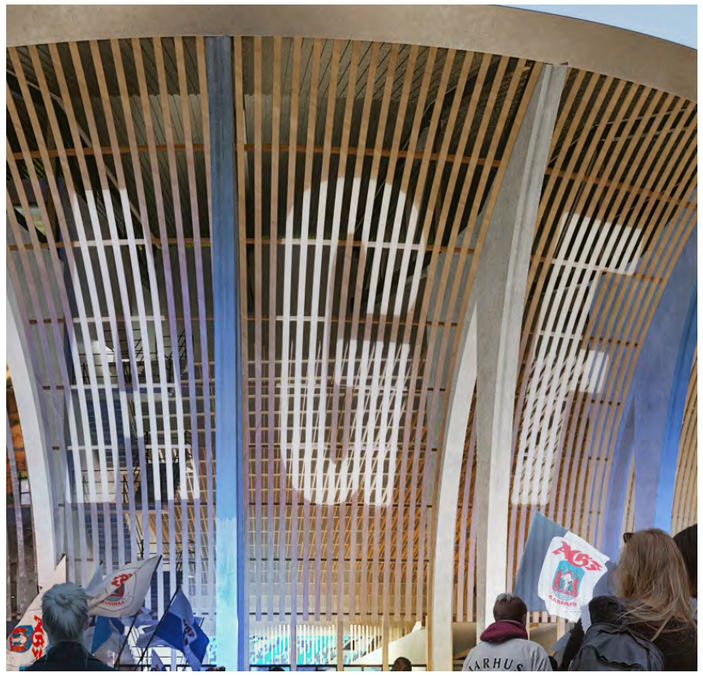
The stadium is customizable in terms of signage and graphics in order to enhance the overall fan atmosphere. On the exterior facade columns can be lit up with different colours during match days and events, and graphics can be projected on the timber louvers. Engraved signage personalize the stadium on the columns and interior wayfiding. In the Concourse graphics can be added the the vertical louvers.

- **COLUMN LIGHTING**
- **FACADE PROJECTION**
- **ENGRAVING**
- **LOVERS GRAPHIC**

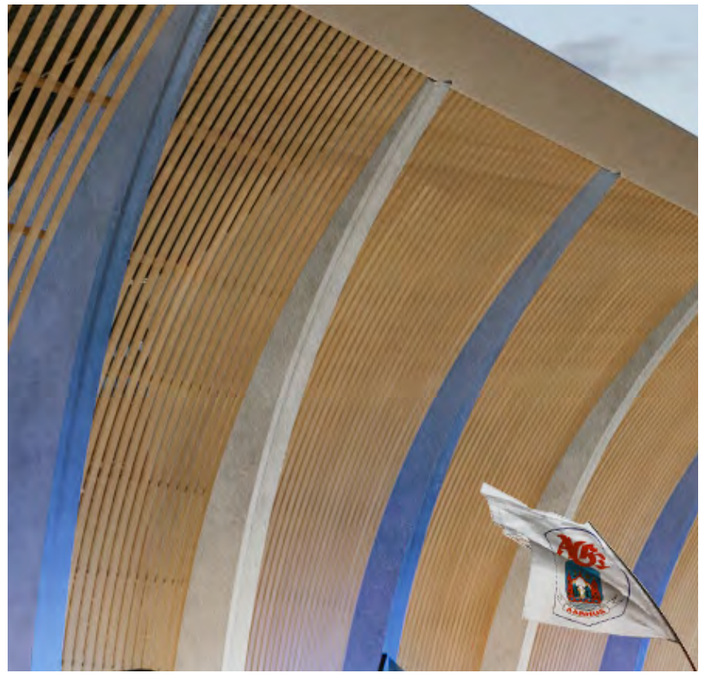
ENGRAVED CONCRETE SIGNAGE



LOUVER GRAPHIC



LIGHTING PROJECTION



COLUMN LIGHTING

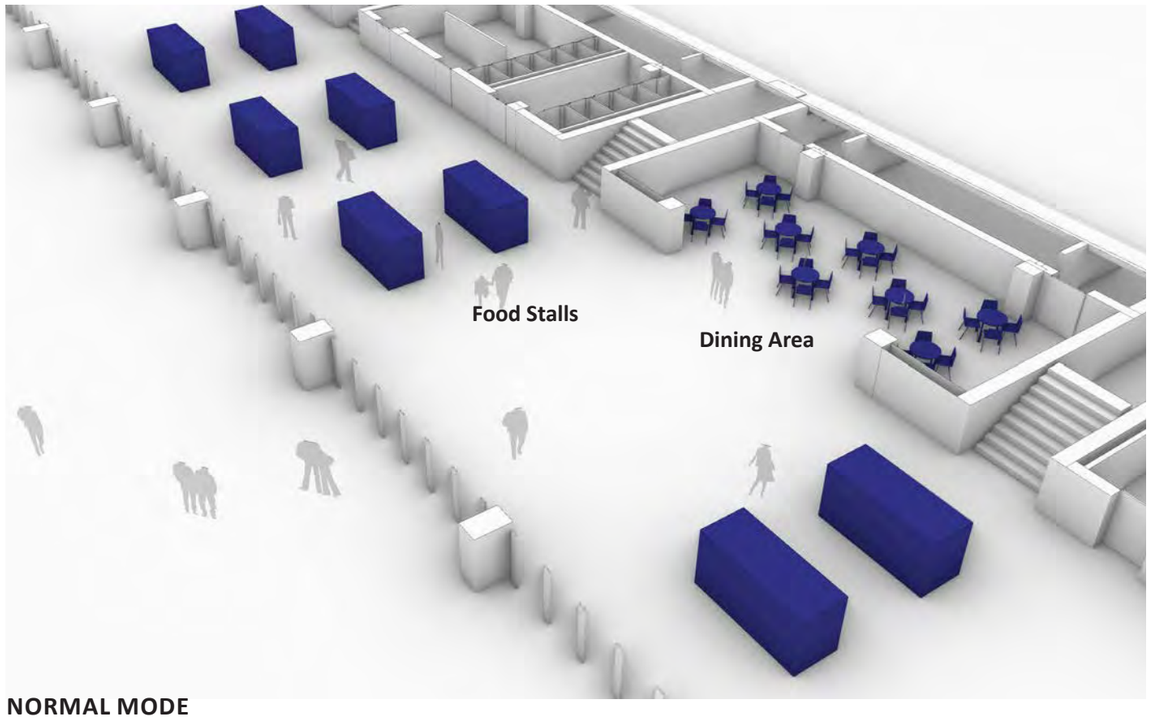
1.4. FAN EXPERIENCE

F&B FLEXIBILITY

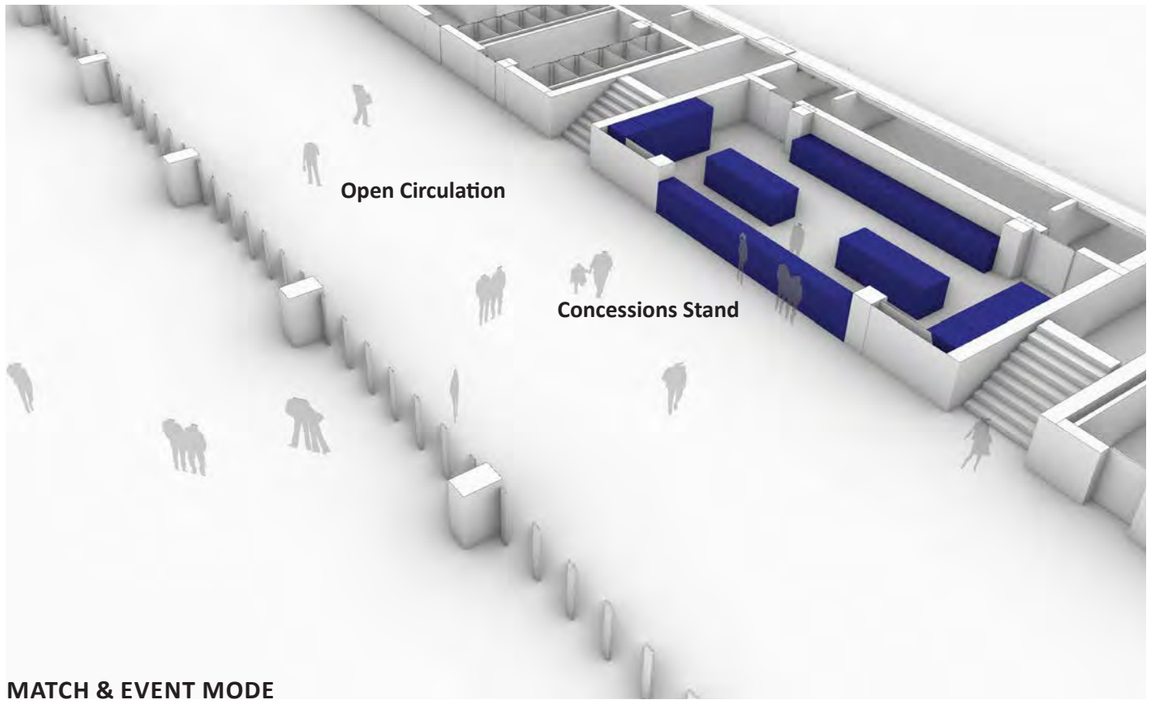
The F&B areas are made open and can adapt to different layouts depending on the event, which allows for greater flexibility in the Concourse. On match and event days the area can be used for concessions bar and kitchen, while on normal days the area can be used for dining area. There is also the flexibility to have some areas concessions and some as dining areas depending on the zone and needs.

REFERENCES

ZAHA HADID LTM, SWECO DANMARK A/S, TREDJE NATUR APS



NORMAL MODE



MATCH & EVENT MODE

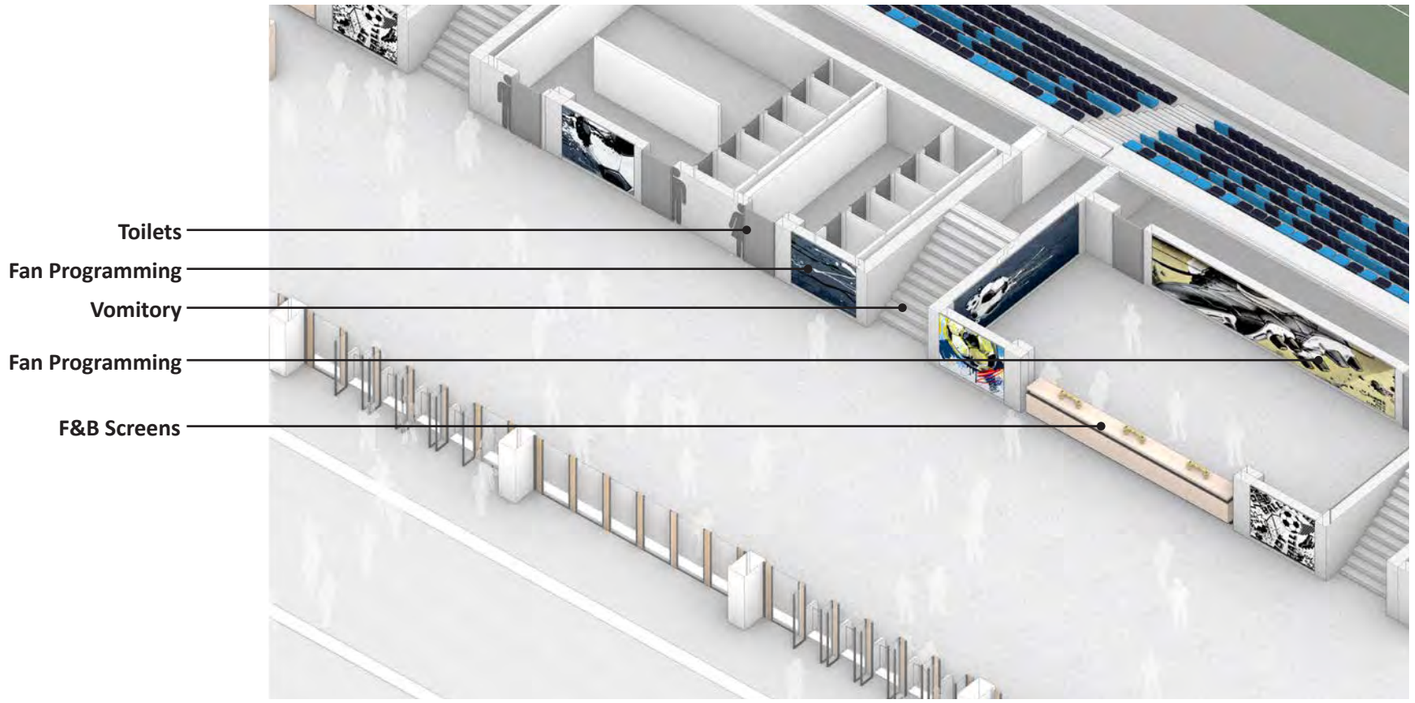
Flexible Furniture

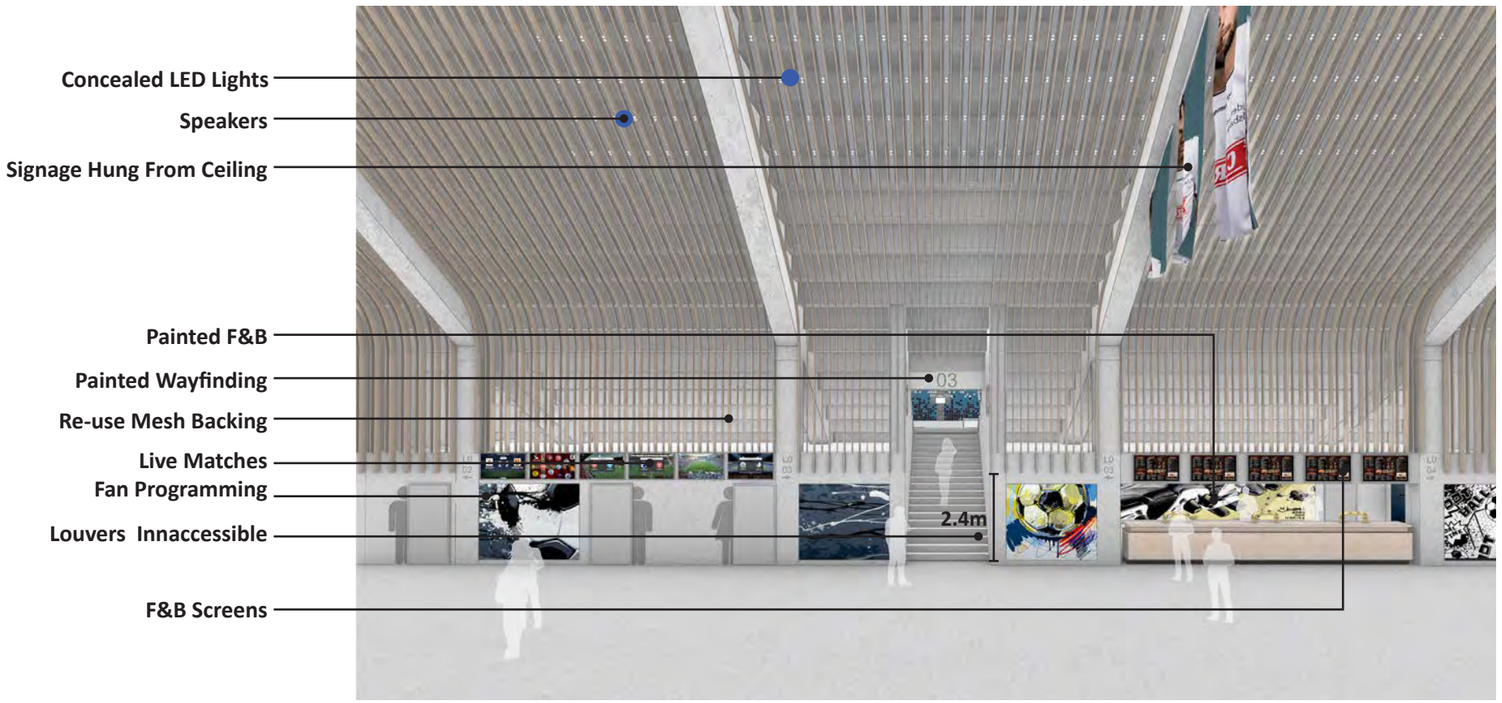
1.4. FAN EXPERIENCE

FAN ATMOSPHERE

The Concourse environment can be customized to enhance the fan experience by integrating signage, banners, screens, lighting, graphics, and programmable areas where fans can make stadium their own.

PROGRAMMABLE WALL REFERENCES

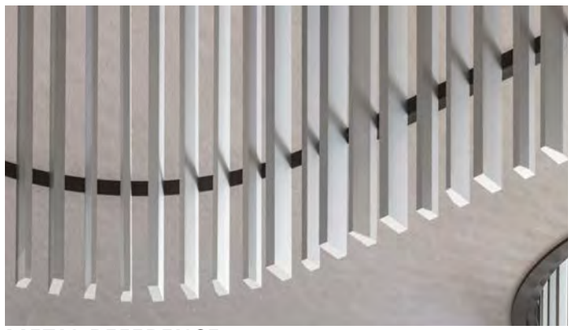




1.4. FAN EXPERIENCE

FAN ATMOSPHERE

Wood louvers create a dialogue with the external facade and make the Concourse a unique environment. They have been elevated to be out of reach to increase their robustness. There is a more robust alternative by having the lovers in metal which would create a more industrial atmosphere.



METAL REFERENCE

METAL OPTION

WOOD REFERENCE

WOOD OPTION

1.5.1. CONTINUOUS 360-DEGREE CLOSED SEATING BOWL

ZONES AND FLEXIBILITY

STADIUM BOWL LAYOUT The stadium bowl is composed of a series of zones with Ultra, Family, General admission, and Away fans located on the general stands East, West and South and Bronze, Silver and Gold seats on the North stand.

The separation of the different zones on the general stand is flexible, meaning the capacity of the individual zones can be adjusted. The design of the concourse supports this flexibility by offering a continuous space with possible access and egress all along the perimeter. This makes it possible to expand or contract different zones according to the specific need, which could change over time.

For the hospitality seats on the North stand, the proposal offers a great level of flexibility.

BRONZE In the shown setting, the bronze seats area located on the sides with access directly from the 1st floor terrace.

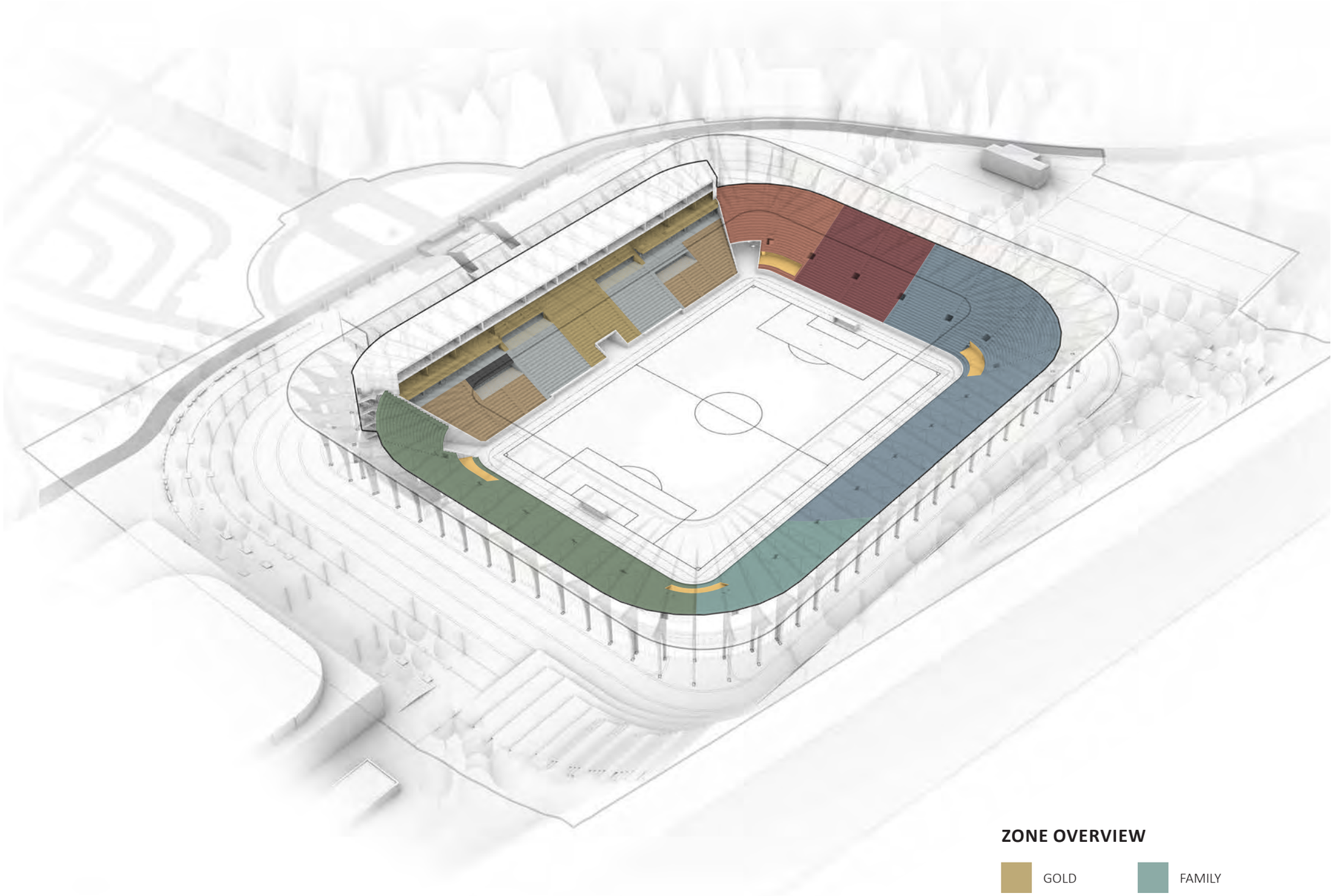
SILVER The silver seats are on either side of the central section with access from both the bronze and silver terraces from the 1st and 2nd floor.

GOLD The gold seats are located in the central section above the player tunnel, extending to the 3rd floor where seats are placed on the terraces all along the façade in direct connection with the interior gold lounge areas.

By having all rows, except from the upper gold levels, with the same 900mm depth, the proposal offers maximum flexibility between the capacity for each hospitality level. The use of terraces is flexible between bronze, silver, and gold with options to change allocation from match to match or do mixed settings as well. Vertical connections in the interior, as well as connected stairs on the stands, provide great options for linking between levels and zones.

ACCESSIBILITY Wheelchair access is possible on all floors of the main stand, with viewing terraces on both the bronze, silver and gold level.

In each corner of the stadium bowl designated accessibility terraces are designed to allow equal access for all spectators in every section of the stadium.



ZONE OVERVIEW

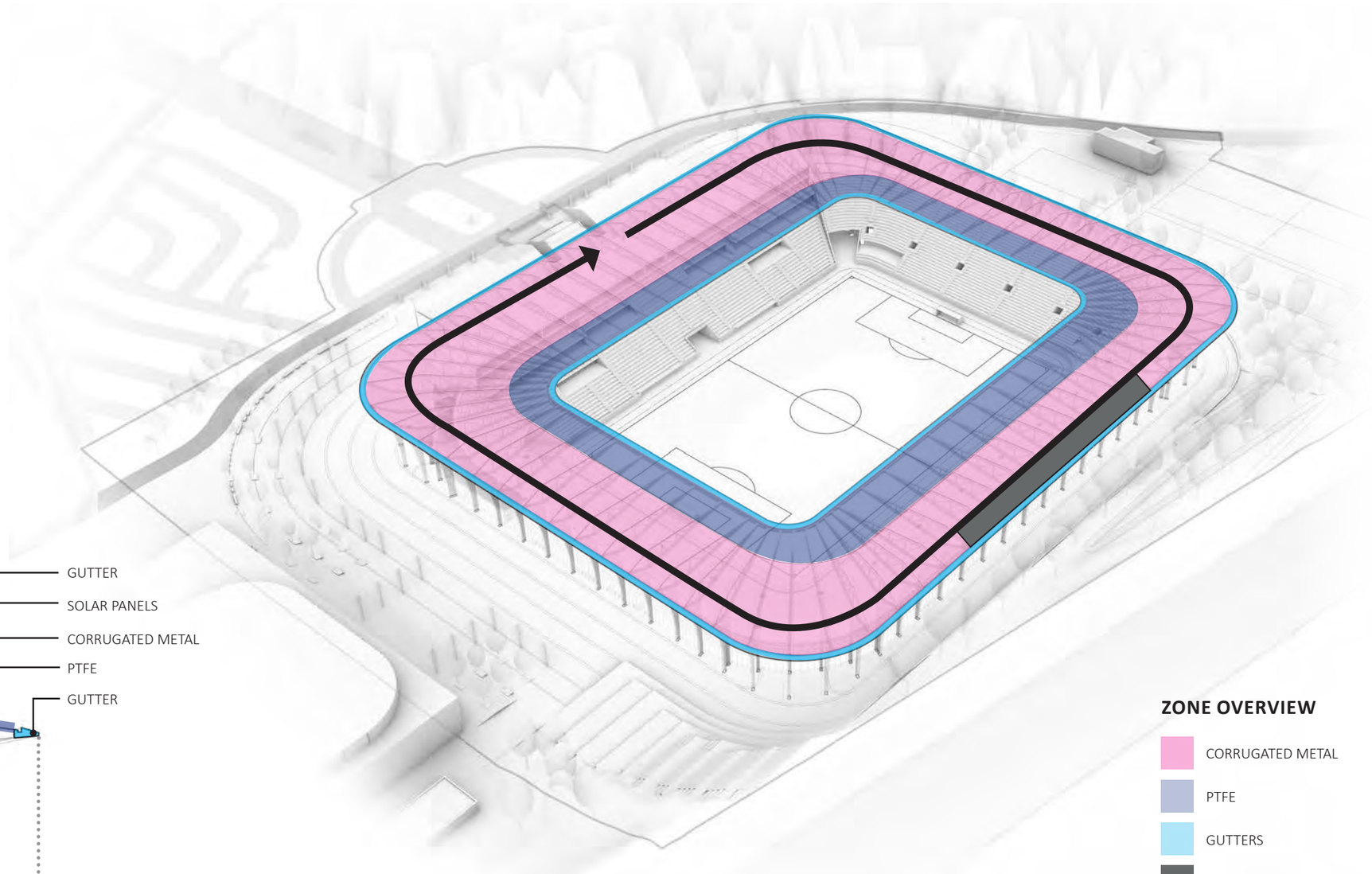
- GOLD
- SILVER
- BRONZE
- MEDIA
- ULTRA
- FAMILY
- AWAY
- AWAY / EXTENDABLE
- GENERAL ADMISSION
- ACCESSIBILITY

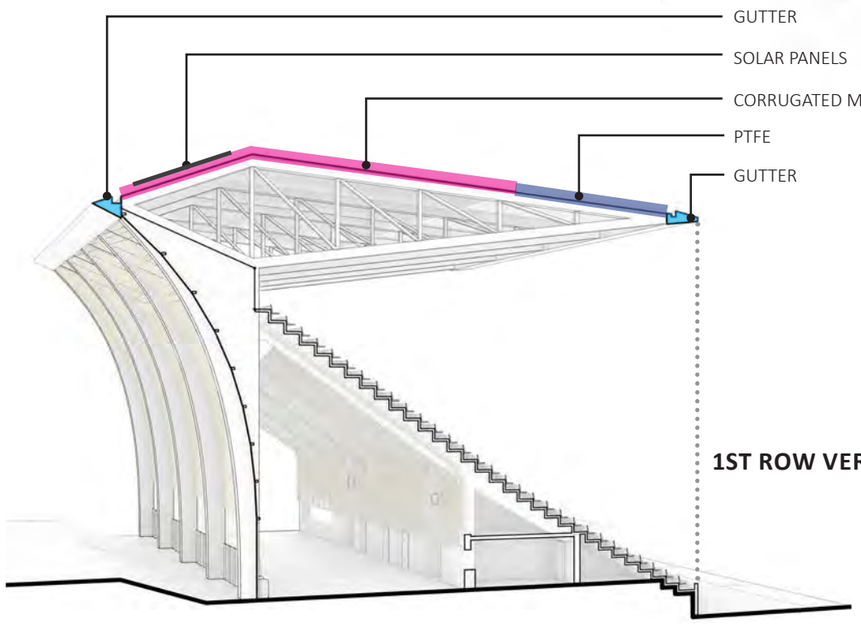
1.5.2. CONTINUOUS ROOF

FULL COVERAGE OF THE ROOF

The roof of the stadium is designed for full coverage of each seat in vertical projection.

The cantilevered roof offers both shelter for weather and adds to the experience and intensity of the stadium. In addition to the seats, the roof cantilevers outwards.





1ST ROW VERTICAL COVERAGE

ZONE OVERVIEW

- CORRUGATED METAL
- PTFE
- GUTTERS
- SOLAR PANELS

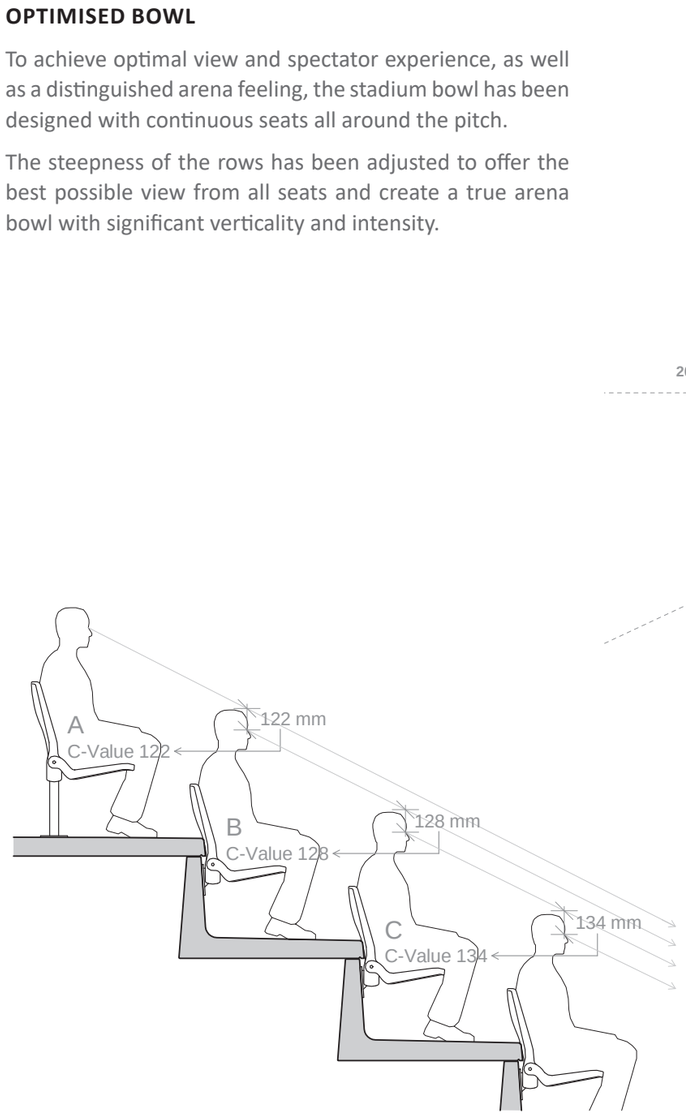
1.5.3. PROXIMITY TO THE FIELD OF PLAY

SIGHTLINES AND VIEWING QUALITY

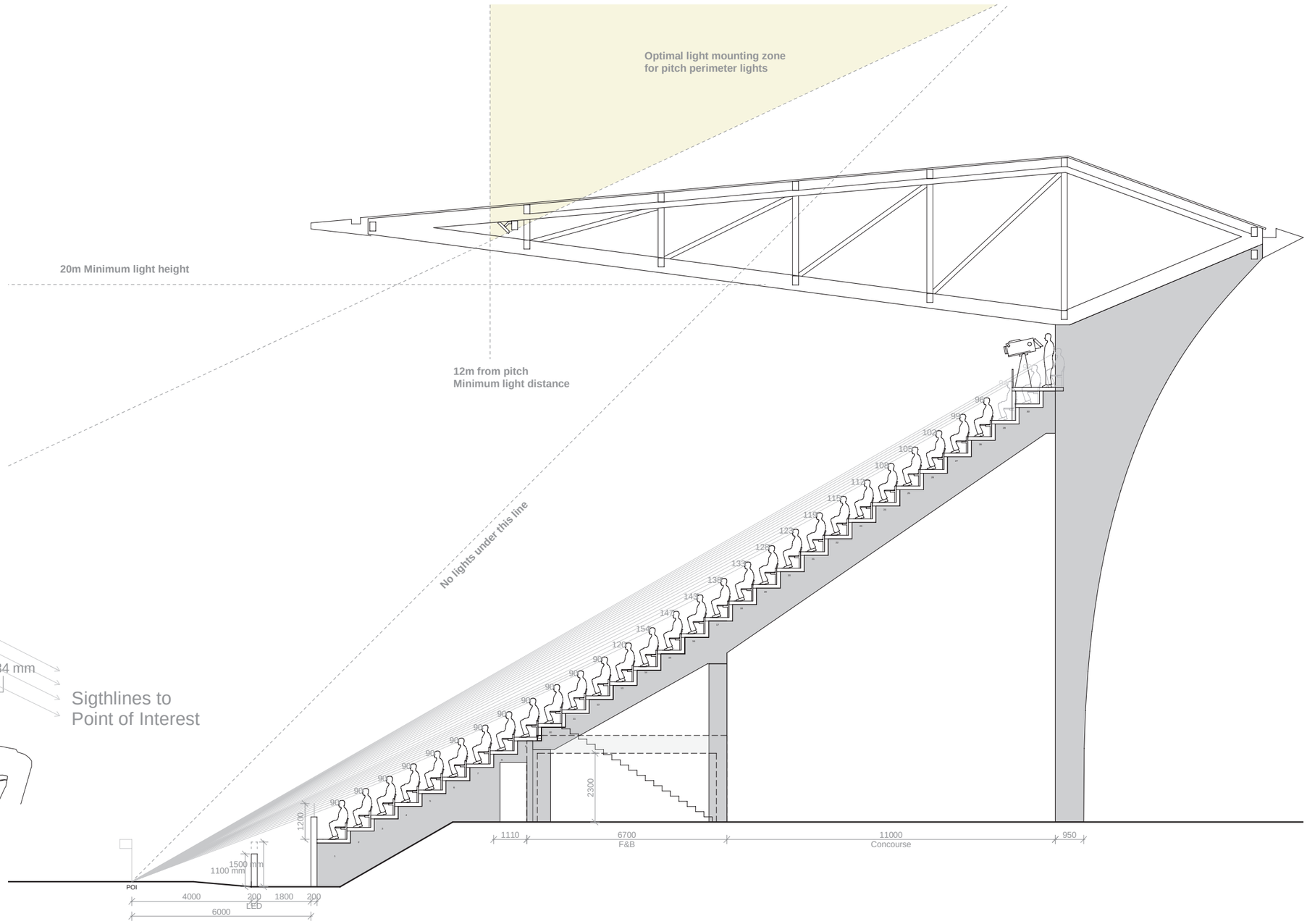
OPTIMISED BOWL

To achieve optimal view and spectator experience, as well as a distinguished arena feeling, the stadium bowl has been designed with continuous seats all around the pitch.

The steepness of the rows has been adjusted to offer the best possible view from all seats and create a true arena bowl with significant verticality and intensity.



C-VALUE MEASUREMENT



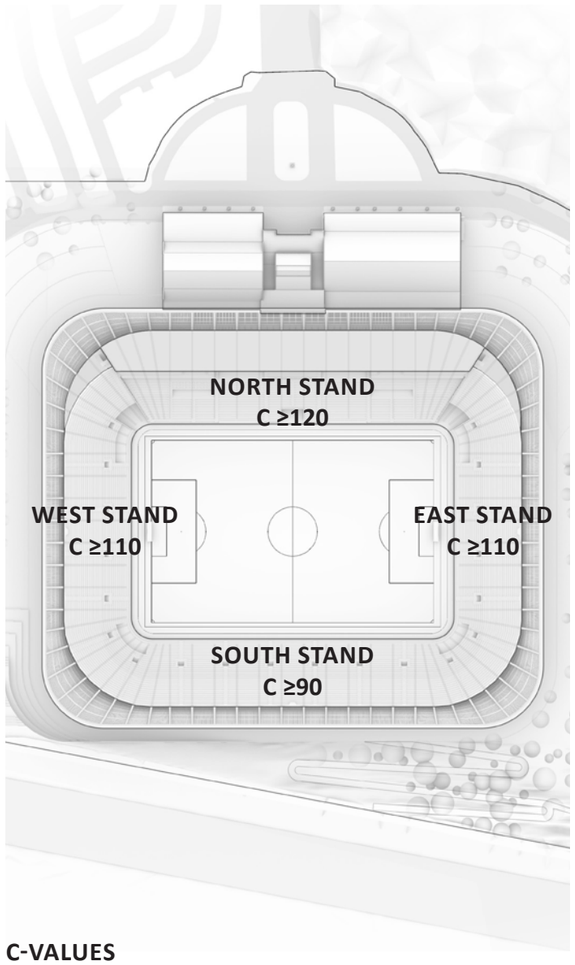
C-VALUES - SOUTH STAND

1.5.3. PROXIMITY TO THE FIELD OF PLAY

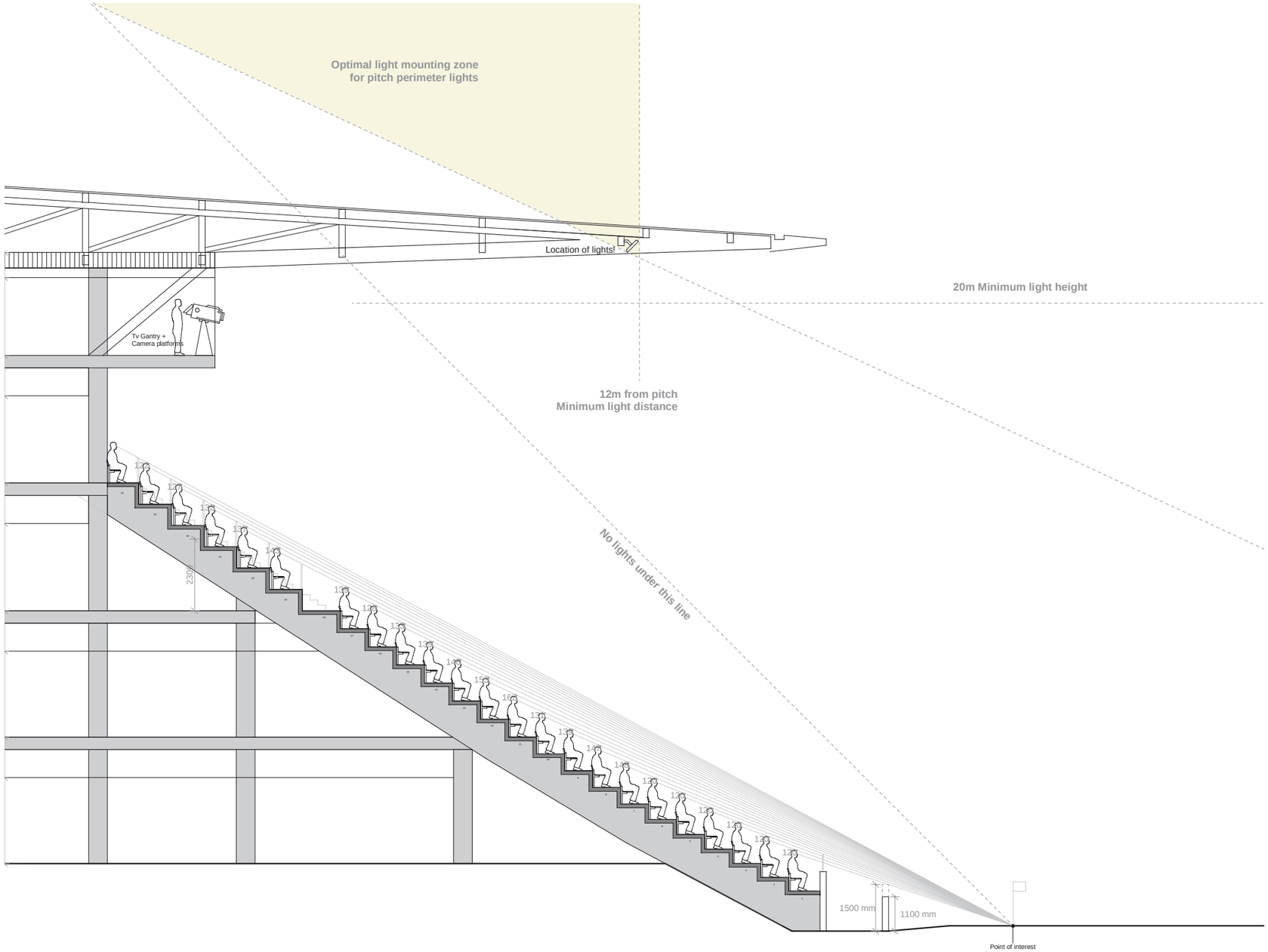
SIGHTLINES AND VIEWING QUALITY

On the North stand the slope, depth and height of the seating steps have been carefully arranged to fit both flow, sightlines, hospitality level and zoning as well the connection with the floor levels in the building.

All seats on the North stand offer optimal views with C-values above 120mm. The row depths add to the comfort and experience with 900mm on the bronze and silver seats and 1050mm on the gold balconies, with suggested additional gold seats located in the centre closest to the pitch with 900mm row depth.



C-VALUES



C-VALUES - NORTH STAND

1.5.4. SINGLE TIER

CONTINUOUS SINGLE TIER

The continuous single tier layout strengthens the atmosphere and coherence of the different sections; ultra, family, general and away. With bowl access on row 10, and an optimised design of stairs, access, vomitories and egress, the density of spectators in the bowl will be maximized while at the same time securing people flow and safety.

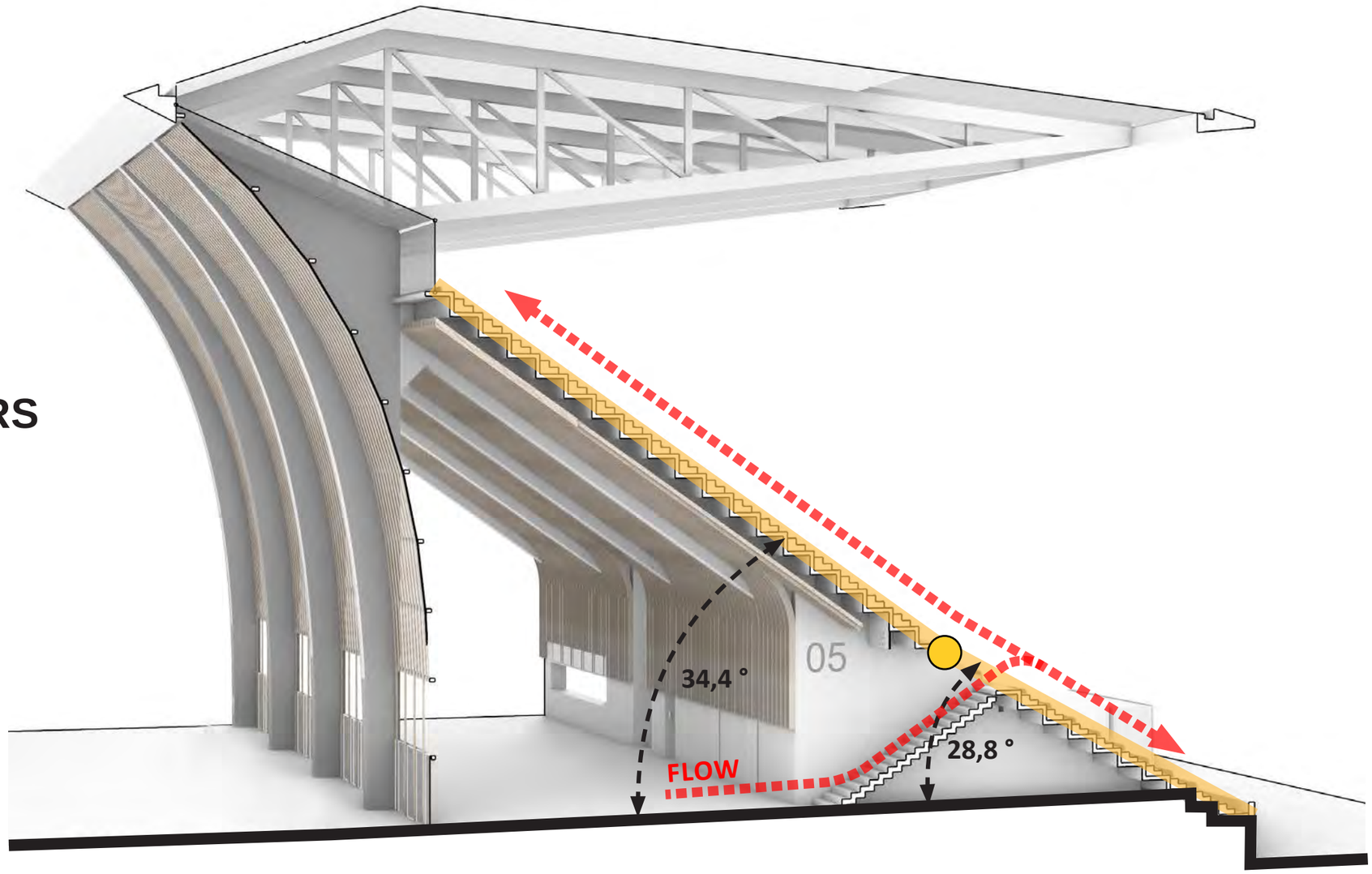
1.5.5. STEEP STAND RAKERS

SLOPE OF THE STANDS

The height of the stadium roof is, from a functional perspective, set by two factors: the height of the main stand building and the needed height for pitch perimeter lighting.

The slope of the stands is subsequently set with the aim to offer an optimal viewing experience and bowl atmosphere. This is achieved through design studies of changing slope and calculating c-values (sightlines).

The design of the east, south and west stand is comprised of an adaptive slope on rows 1-6 (28,8 degree in average) followed by a steeper 34,4 degree continuous slope from row 13-31.



1.5.6. SINGLE CONTINUOUS CONCOURSE

CONCOURSE PROGRAM

The concourse offers a generous space connecting the east, south and west stands. The concourse is optimised for people flow with entrance and egress as well as all service functions, food and beverage (F&B) sales, restrooms etc.

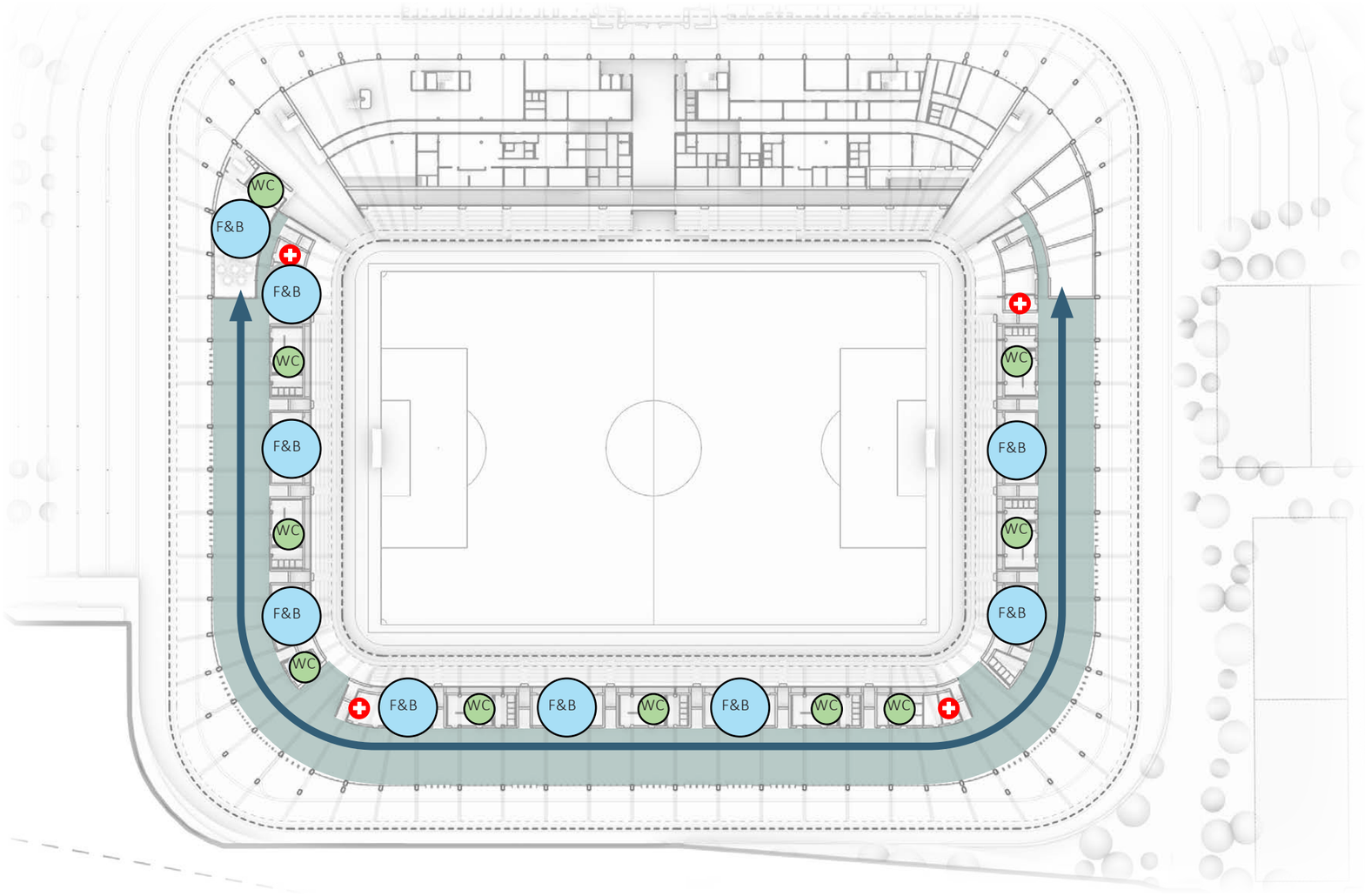
To keep the concourse centred on the flow of spectators and visitors, a service access corridor have been incorporated under the rake stands, behind the service, F&B and restrooms. This further allows for a functional undisturbed concourse with flow, experience and flexibility in focus.

1st Bronze	**1.250 people**	
Type	*Recommendation*	*Capacity offered*
Ladies	1.250/200 = **6,25**	**11**
Gents	1.250/200 = **6,25**	**10**
Urinals	1.250/200 = **6,25**	**8**
HC	1	**2**

2nd Silver	**950 people**	
Type	*Recommendation*	*Capacity offered*
Ladies	950/200 = **4,75**	**6**
Gents	950/200 = **4,75**	**6**
Urinals	950/200 = **4,75**	**8**
HC	1	**1**

3rd Gold	**300 people**	
Type	*Recommendation*	*Capacity offered*
Ladies	300/200 = **1,5**	**6**
Gents	300/200 = **1,5**	**6**
Urinals	300/200 = **1,5**	**8**
HC	1	**1**

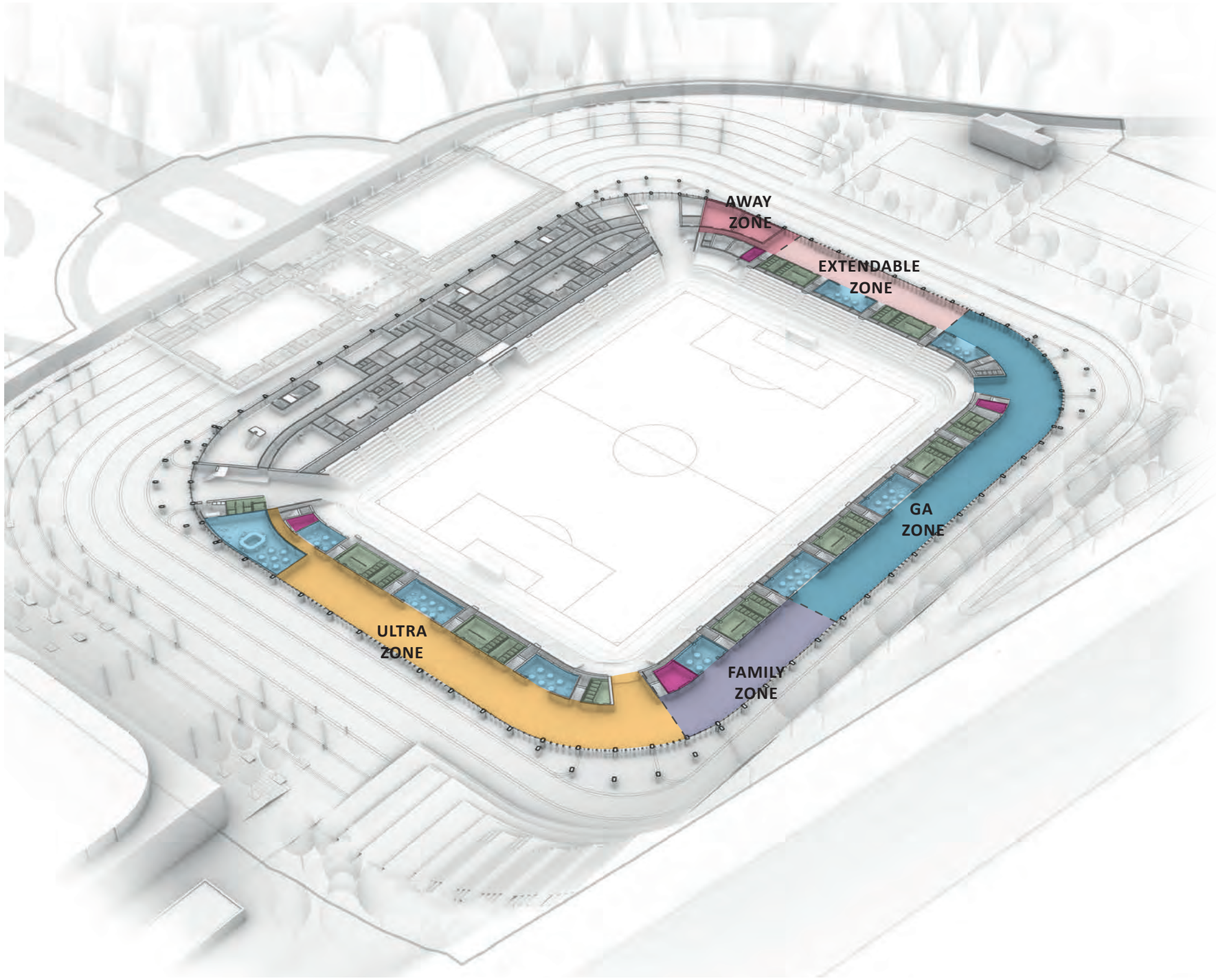
TOTAL	**2.500**	
Type	*Recommendation*	*Capacity offered*
Ladies	2.500/200 = **12,5**	**23**
Gents	2.500/200 = **12,5**	**22**
Urinals	2.500/200 = **12,5**	**24**
HC	**3** (one per level)	**4**



1.5.6. SINGLE CONTINUOUS CONCOURSE

CONCOURSE FLEXIBILITY

Concourse can be used at the same time for different events, each zone is function independently with all service, food and beverage (F&B) sales, restrooms etc.



LEGEND

- ULTRA ZONE
- FAMILY ZONE
- GA ZONE
- EXTENDABLE ZONE
- AWAY ZONE
- F&B
- WC
- MEDICAL

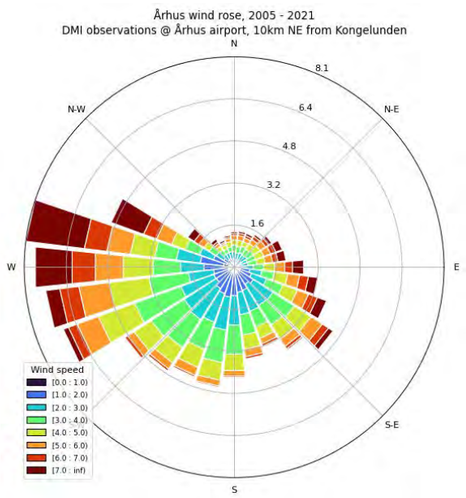
1.5.7. WEATHER PROTECTION

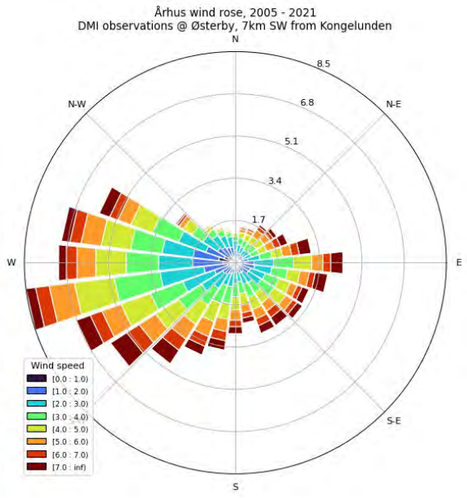
WEATHER CONDITIONS

Århus has a mild, temperate oceanic climate, being situated close to the Aarhus bay. Temperatures vary over the year, averaging to about 9°C, and typically varies between -2°C and 21°C, and is rarely below -9°C or above 26°C. The precipitation is at the lowest in spring and summer, and highest in autumn and winter.

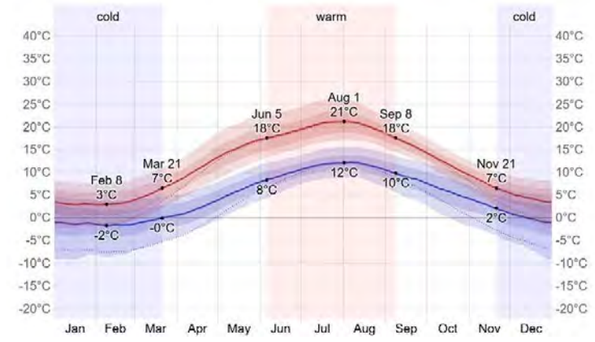
The wind is predominantly from the west and south, and the highest wind speeds are observed in the winter months from October to March, reaching approximately 7m/s on average. In the summer the average wind speed is 5m/s.

The closest DMI national forecaster weather station is located at Østerby, 7km southwest from Kongelunden. The difference in wind measured at Aarhus airport can be observed in the windroses to the right, where measured at Østerby is predominant from west-southwest, while Aarhus airport is predominant from west-northwest. The measuring station at Aarhus airport is probably less reliable as it is located relatively close to structures and buildings, and the Østerby far less so. The remaining graphics on precipitation, temperature and sun are produced from Aarhus airport data.

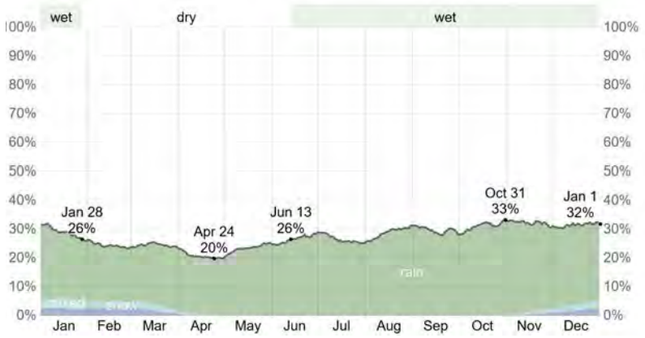




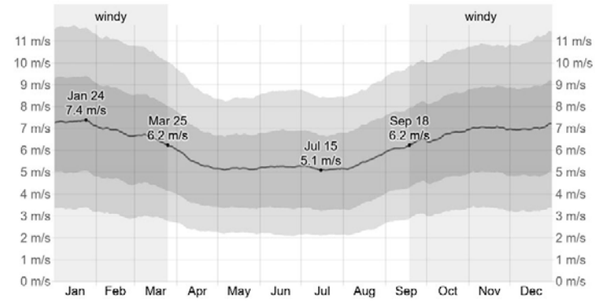
WIND ROSE



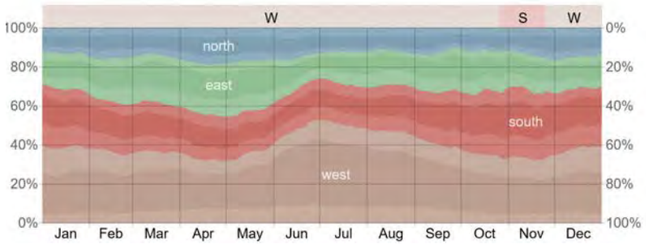
AVERAGE HIGH & LOW TEMPERATURE



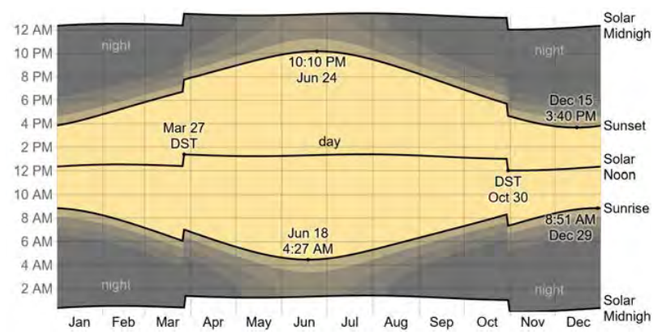
DAILY CHANCE OF PRECIPITATION



AVERAGE WIND SPEED



WIND DIRECTION



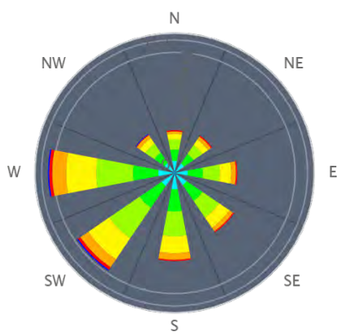
SUNRISE & SUNSET

1.5.7. WEATHER PROTECTION

COMFORT MAP

This comfort map, based on LDDC max wind speed comfort criteria, can help to determine suitable locations for specific programs, based on activity level. Blue areas are suitable for outdoor seating, while yellow and red zones are not considered suitable for sitting or strolling comfortably outdoors.

WINDROSE

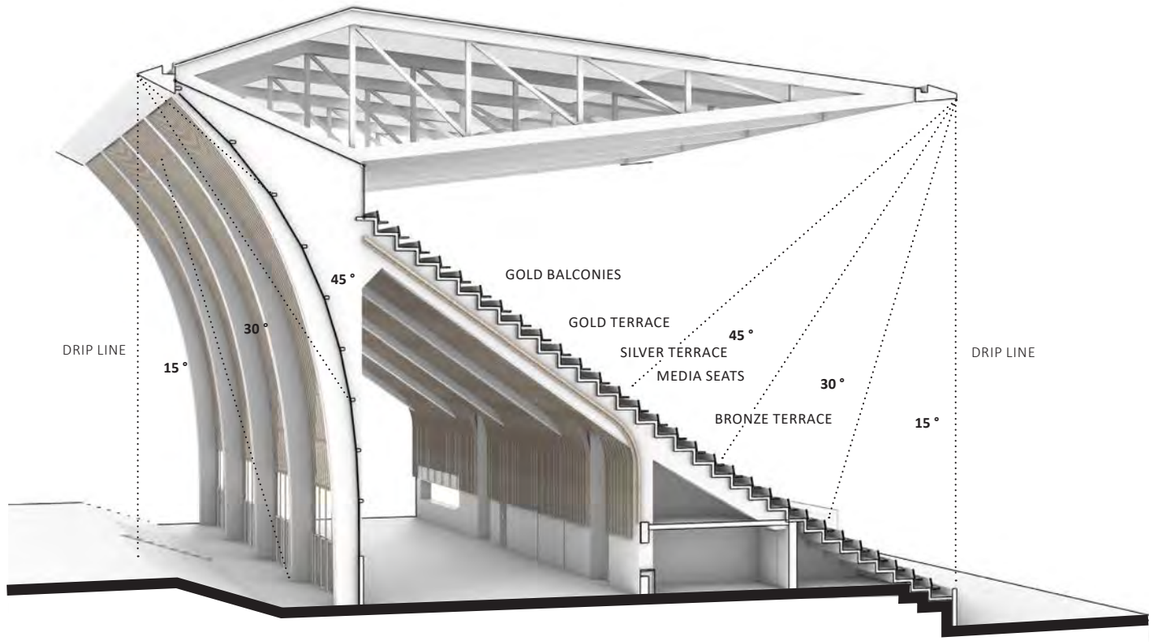


- 0 < x ≤ 0.3 m/s
- 0.3 < x ≤ 1.4 m/s
- 1.4 < x ≤ 3.3 m/s
- 3.3 < x ≤ 5.3 m/s
- 5.3 < x ≤ 7.8 m/s
- 7.8 < x ≤ 10.6 m/s
- 10.6 < x ≤ 13.9 m/s
- 13.9 < x ≤ 16.9 m/s
- 16.9 < x ≤ ∞ m/s

A	2.5 m/s	< 5%	Frequent Sitting
B	4 m/s	< 5%	Occasional Sitting
C	6 m/s	< 5%	Standing
D	8 m/s	< 5%	Walking
E	8 m/s	> 5%	Uncomfortable
S	15 m/s	> 0.022%	Unsafe

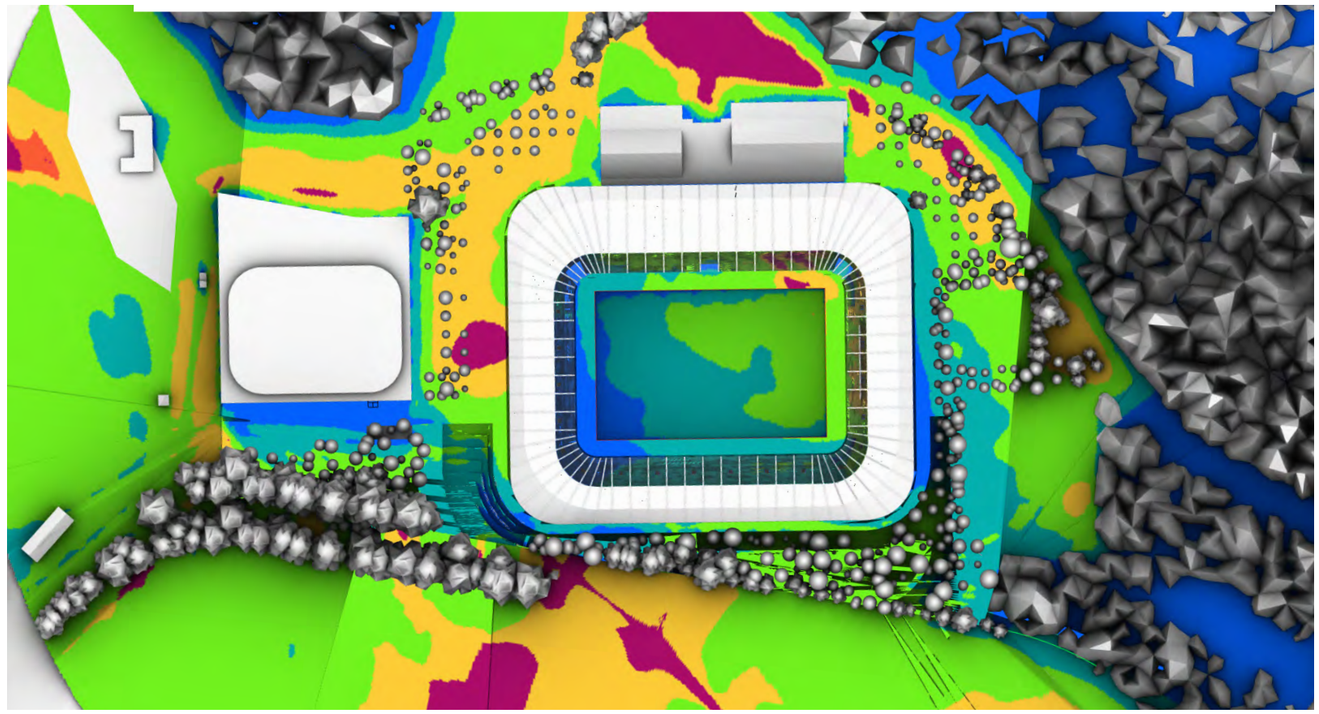
RAIN PROTECTION

- The Lamelas design in combination with stadium design of overhangs protect the concourse area from the wind - driven rain in adverse conditions.
- The increased covered area protects the seated spectators more effectively in comparison to the existing stadium
- Lamelas reduces the cross-section area for wind , reducing the wind speed and overall impact on the concourse area.



WIND PROTECTION

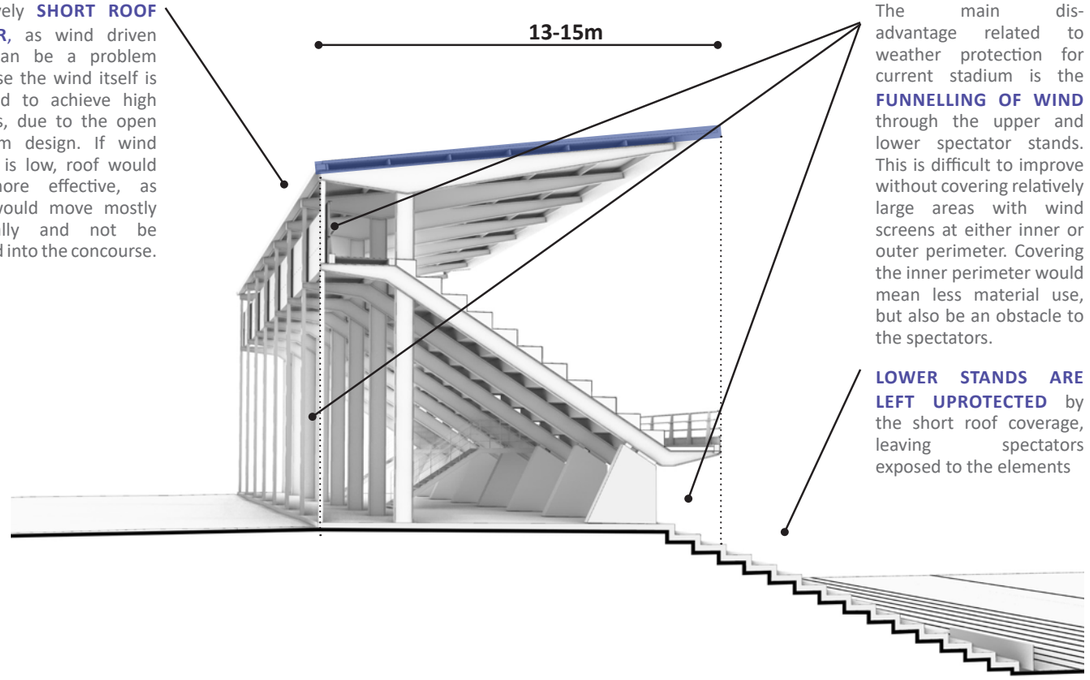
- The Lamelas design in combination with landscape design proposal creates a micro-climate in and around the stadium which creates favourable conditions for sports and cultural activities.



1.5.7. WEATHER PROTECTION

ROOF COVERAGE

Relatively **SHORT ROOF COVER,** as wind driven rain can be a problem because the wind itself is allowed to achieve high speeds, due to the open stadium design. If wind speed is low, roof would be more effective, as rain would move mostly vertically and not be carried into the concourse.

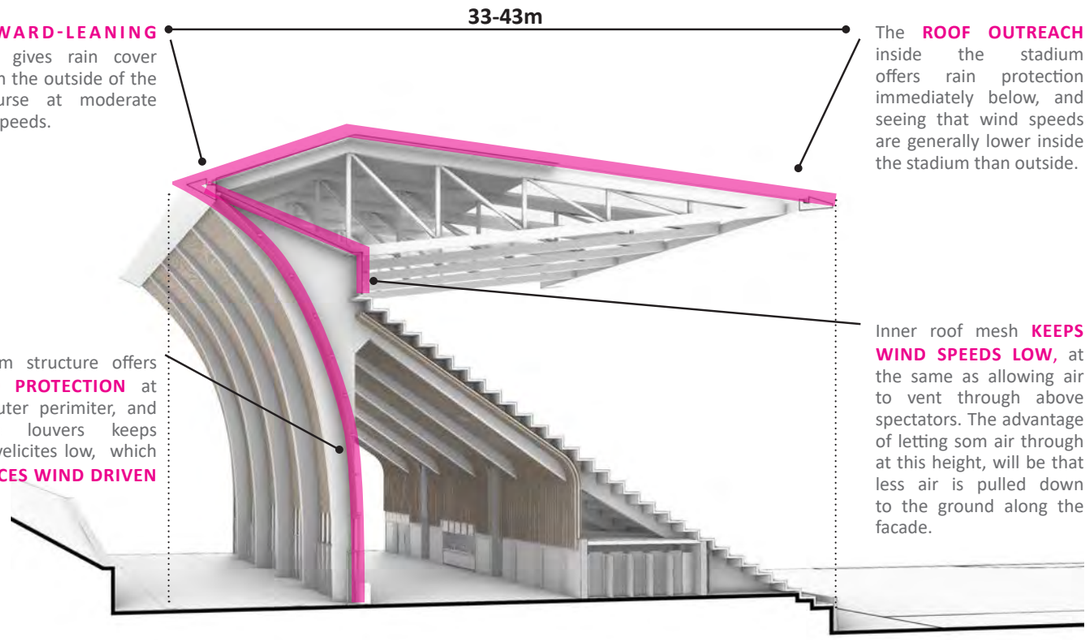


The main disadvantage related to weather protection for current stadium is the **FUNNELLING OF WIND** through the upper and lower spectator stands. This is difficult to improve without covering relatively large areas with wind screens at either inner or outer perimeter. Covering the inner perimeter would mean less material use, but also be an obstacle to the spectators.

LOWER STANDS ARE LEFT UPROTECTED by the short roof coverage, leaving spectators exposed to the elements

ROOF EXTENT EXISTING STADIUM

OUTWARD-LEANING ROOF gives rain cover also on the outside of the concourse at moderate wind speeds.



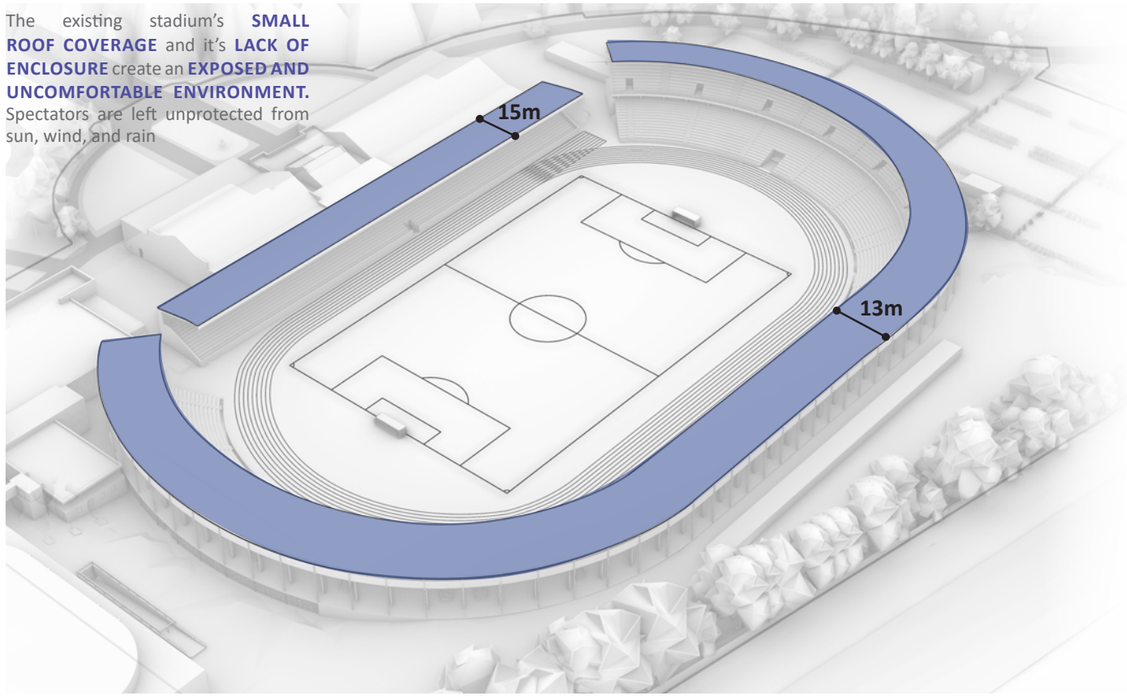
The **ROOF OUTREACH** inside the stadium offers rain protection immediately below, and seeing that wind speeds are generally lower inside the stadium than outside.

Stadium structure offers **WIND PROTECTION** at the outer perimiter, and facade louvers keeps wind velicites low, which **REDUCES WIND DRIVEN RAIN**.

Inner roof mesh **KEEPS WIND SPEEDS LOW,** at the same as allowing air to vent through above spectators. The advantage of letting som air through at this height, will be that less air is pulled down to the ground along the facade.

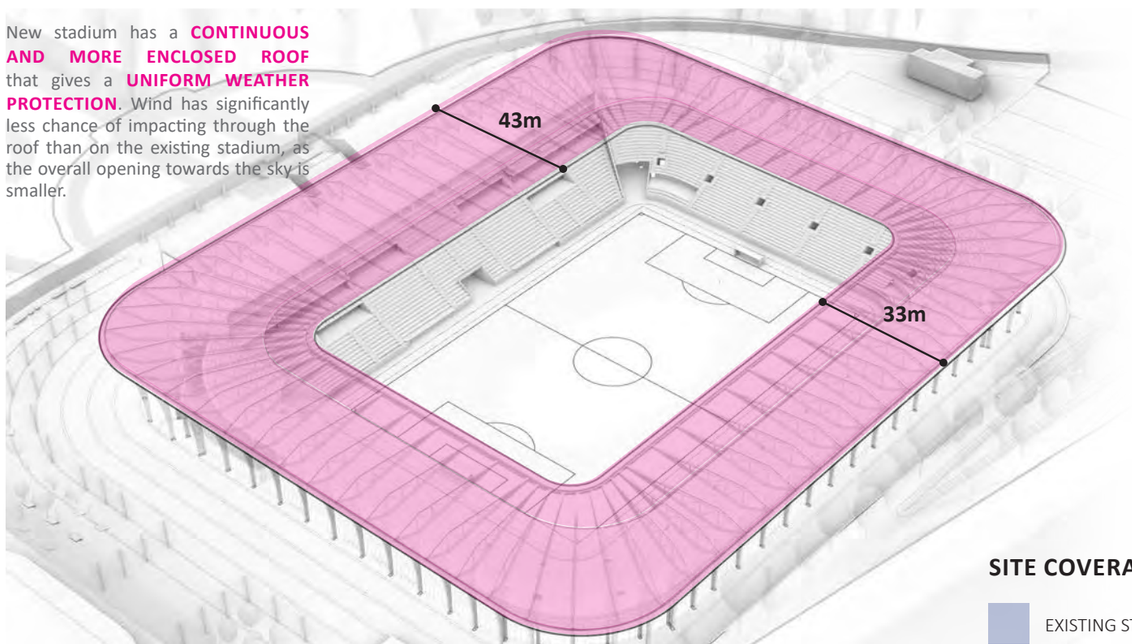
ROOF EXTENT NEW STADIUM

The existing stadium's **SMALL ROOF COVERAGE** and it's **LACK OF ENCLOSURE** create an **EXPOSED AND UNCOMFORTABLE ENVIRONMENT.** Spectators are left unprotected from sun, wind, and rain



ROOF EXTENT EXISTING STADIUM

New stadium has a **CONTINUOUS AND MORE ENCLOSED ROOF** that gives a **UNIFORM WEATHER PROTECTION**. Wind has significantly less chance of impacting through the roof than on the existing stadium, as the overall opening towards the sky is smaller.

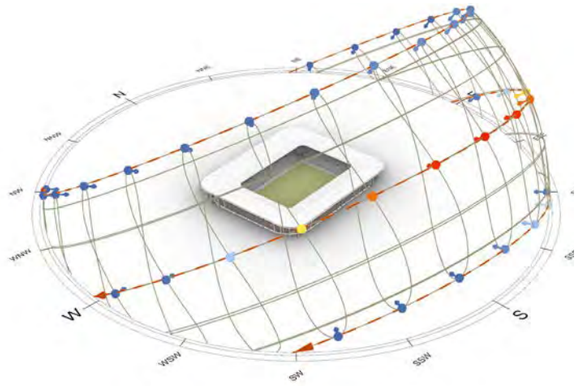


ROOF EXTENT NEW STADIUM

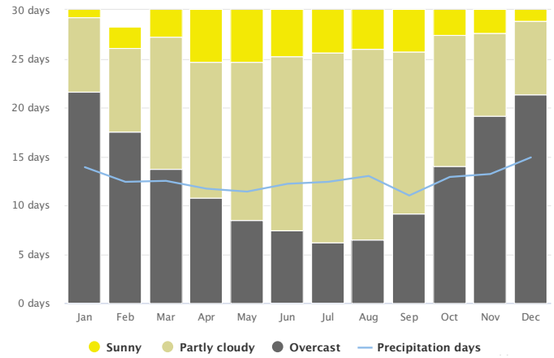
1.5.7. WEATHER PROTECTION

WEATHER PROTECTION-SUN

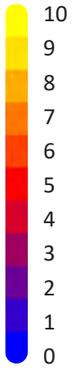
The solar diagram allows us to know the Azimuth angles and the altitude of the Sun, in each hour of the representative days of each season. The representation of the solar trajectory is described graphically, as if they were arcs, taking as a reference the 21 of each month, since the summer and winter solstices fall on June 21 and December, respectively. These vectors are used for solar analysis of architectural geometries, with which we can carry out analysis.



SUNPATH DIAGRAM



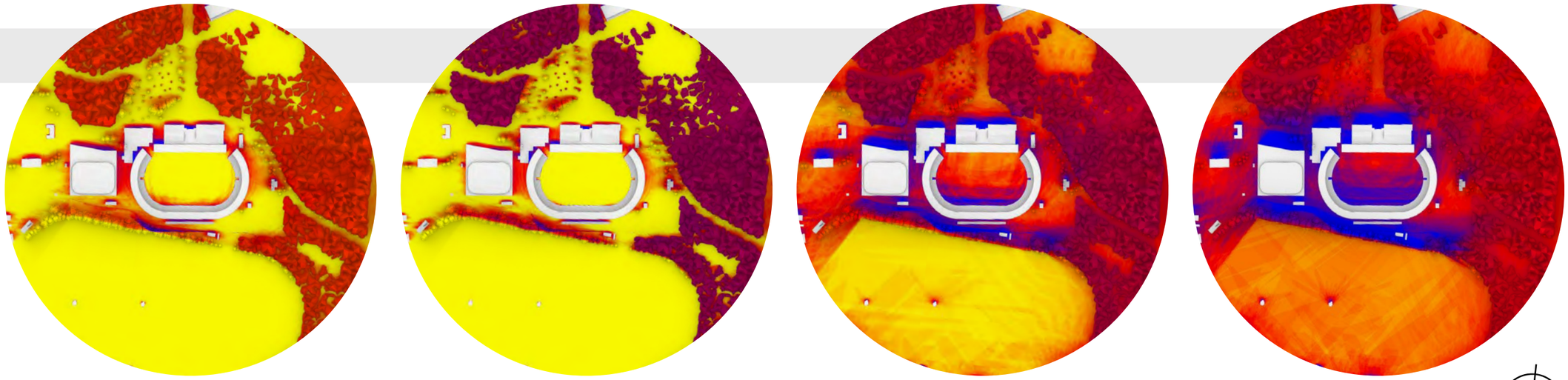
CLOUDY, SUNNY, AND PRECIPITATION DAYS



SUN HOURS [DAILY]

OLD STADIUM

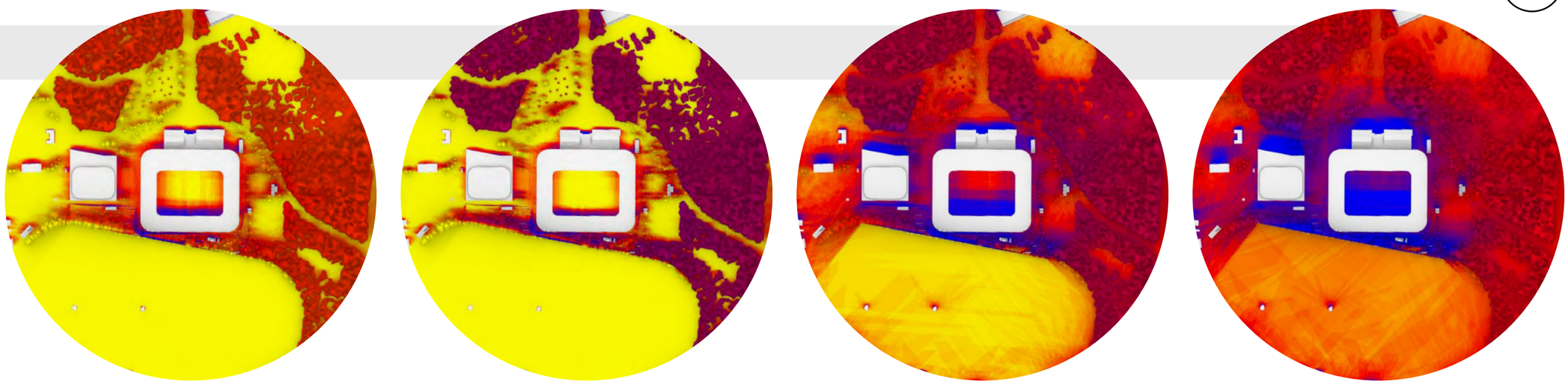
- Little protection of the seating and concourse area
- Surrounding area overexposed in summer and spring



SPRING | SUMMER | AUTUMN | WINTER

NEW DESIGN

- Seating area covered from extensive solar impact while maintaining sufficient exposure on the pitch surface
- Landscape intervention in the surrounding area improves the exterior comfort level



1.5.7. WEATHER PROTECTION

WEATHER PROTECTION-WIND

Due to overall dense vegetation, and the horse track being at a higher level protecting from southern wind, the main concern is the western wind, being somewhat exposed.

West is also the most frequent wind direction, where the 90° sector from 210° to 300° accounts for 50% of the overall wind in the period 2005-2021.

Graphics showing ground-level wind outside and inside the concourse, having wind from the west. These results are conservative as simulations at this point do not include vegetation or terrain. It is considered likely that the wind around the stadium will be less dramatic when including this.

The color scale has been constructed to better give a sense of the ground-near wind qualities: blues are generally good, with the fractions 30-40% being regarded as a good rule-of-thumb for where people gather. White marks a transition zone at 60%, and orange and finally red means either similar or higher wind than the far-field unhindered wind.

For the stadium, the wind comfort will be a trade-off between inside and outside wind intensities. But even though there are large areas with orange and red colours, at least the southern parts of this will most likely be reduced significantly when including more of the actual surroundings in the CFD-simulations.

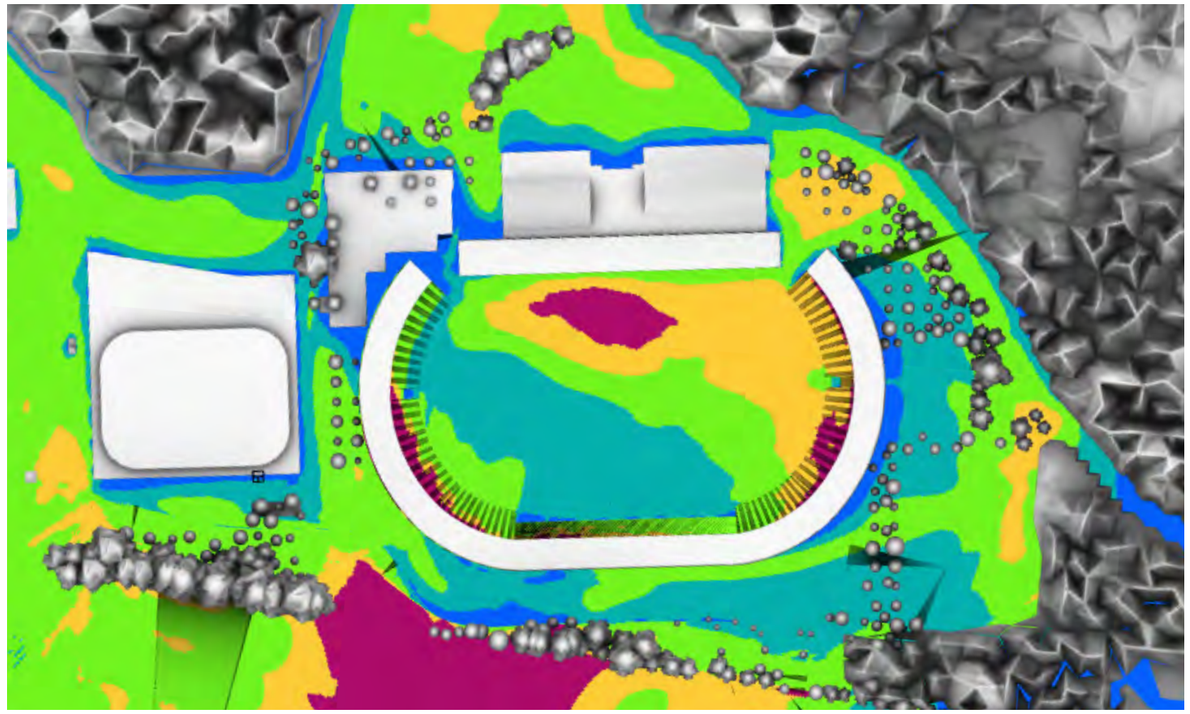
A	2.5 m/s	< 5%	Frequent Sitting
B	4 m/s	< 5%	Occasional Sitting
C	6 m/s	< 5%	Standing
D	8 m/s	< 5%	Walking
E	8 m/s	> 5%	Uncomfortable
S	15 m/s	> 0.022%	Unsafe

EXISTING STADIUM

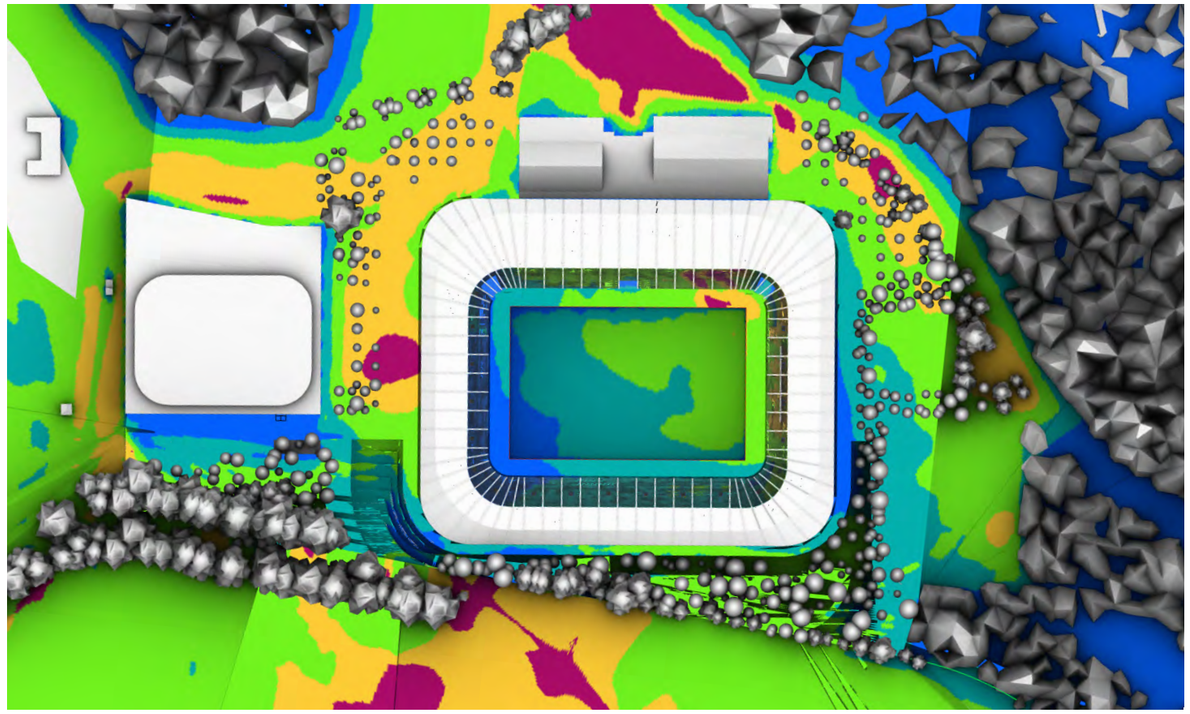
- The existing building being relatively open is highly exposed and doesn't provide sufficient protection for the players as well as the spectators.
- Due to the open design there is observable continuous wind flow across the spectator areas and playing field which creates high wind speeds leading to uncomfortable experience.

NEW STADIUM

- The proposed stadium design in combination with lamella design and landscape proposal work together breaks the continuous wind flow and reduces the wind speed providing necessary protection for the players and spectators in the stadium and surrounding areas.
- This makes the stadium and surroundings area better equipped and usable for sports and cultural events
- The lamella and porous mesh design diffuses the head on wind effects and creates protective zones for the players on the pitch and spectators in the seating and concourse zones.



WIND ANALYSIS EXISTING STADIUM



WIND ANALYSIS NEW STADIUM

1.5.7. WEATHER PROTECTION

WEATHER PROTECTION-WIND

The wind - driven rain analysis is done taking into account the effect of high wind speeds on rain. Existing stadium design is compared with the proposed stadium design.

Due to the open nature of the existing stadium, continuous wind flow patterns are created .

These lead to high wind speeds which creates heavy wind driven rain from which spectators don't have adequate protection.

The proposed stadium design diffuses the wind speeds and reduces the adverse effect of wind - driven rain.

The roof protects the spectator sitting areas as well as concourse areas as wind is also diffused due to the use of lamelas and porous meshes around the bowl.

The concourse areas with lamelas reduce the wind speeds and also provide lateral protection.

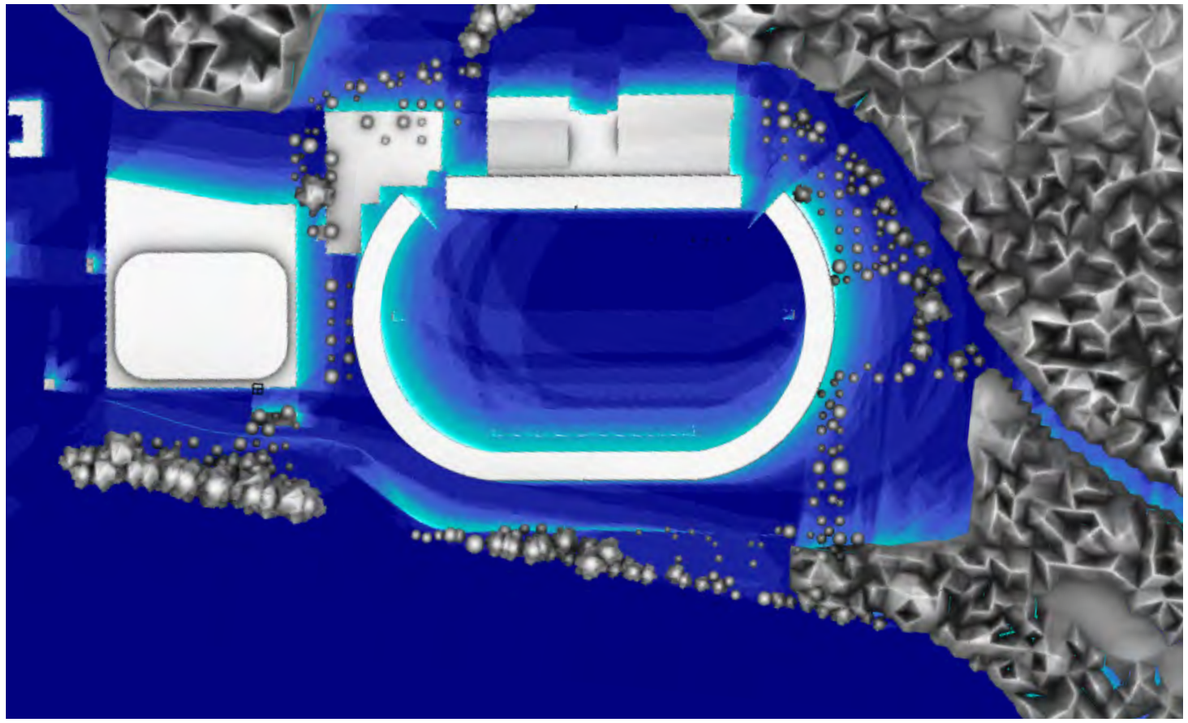
EXISTING STADIUM

- Open design leading to continuous wind flow patterns causing high wind speeds.
- Inadequate protection for the spectators in the seating area and surrounding areas.

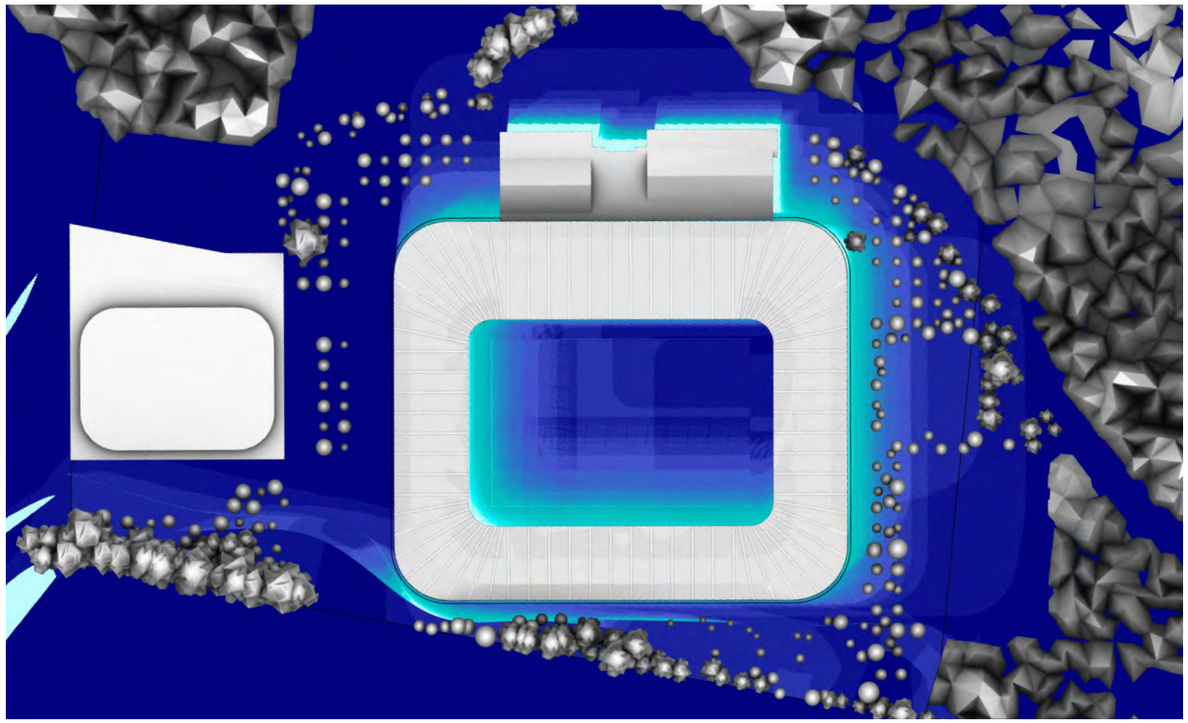
NEW STADIUM

- The lamelas design in combination with landscape intervention helps diffuse the wind speed
- The lamelas provide lateral protection in the concourse area in combination with the roof
- The roof also protects the spectator in the stands and surrounding areas

RAIN SIMULATION



RAIN ANALYSIS EXISTING STADIUM



RAIN ANALYSIS NEW STADIUM

1.6. MAXIMUM AUDIENCE CAPACITY AT EVENTS

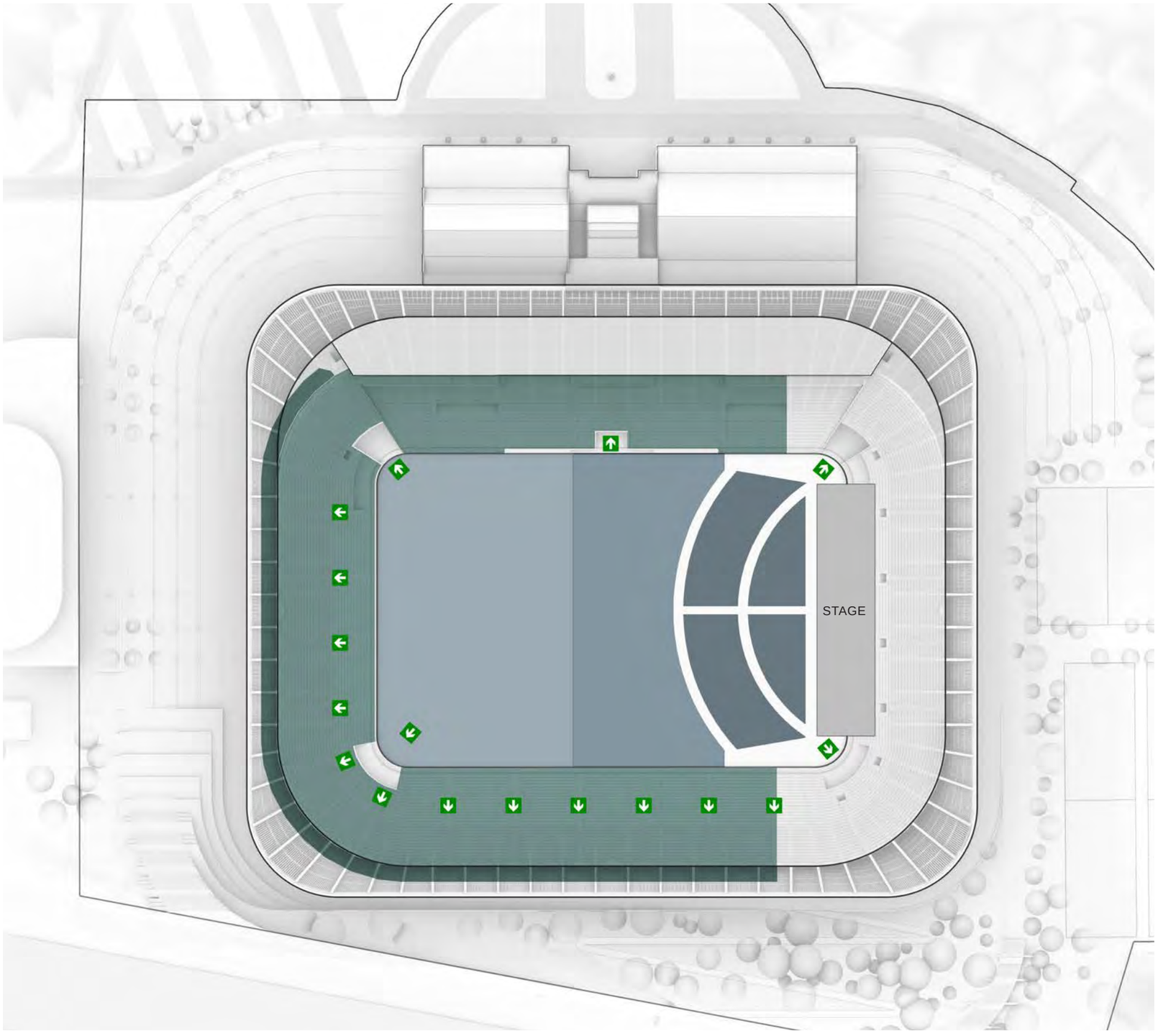
ZONE OVERVIEW

For concerts the pitch will offer standing area for 20-25.000 people depending on the specific setup. In the proposal an event is selected with at stage setup in the east stand, where the front section of the bowl will be demounted to allow room the stage.

In front of the stage fenced sections are suggested with security pathways in between to provide crowd control and safety for the most densely populated area. The remaining area of the pitch level is divided in two to allow for a transitioning density towards the stage. Crowd densities are indicative and depends on the specific setup and safety measures.

Base 20k seat stadium capacity
24.550 Standing on the pitch
13.450 Seated on the west, north and south stand
38.000 total capacity

Extended 24k seat stadium capacity (5 extra rows)
24.550 Standing on the pitch
15.600 Seated on the west, north and south stand including 2.150 on the extra rows
40.150 total capacity



ZONE OVERVIEW

- STANDING 4 PEOPLE/M2
- STANDING 3,5 PEOPLE/M2
- STANDING 2,5 PEOPLE/M2
- SEATED CAPACITY IN BASE 20K SEATSTADIUM
- SEATED EXTRA CAPACITY IN 24K SEAT STADIUM
- ESCAPE

1.7. CONSTRUCTION

THE STRUCTURE

MAIN STRUCTURE

Our proposal uses traditional and well-proven building methods and structures, which correspond with the character and use of the stadium building. The primary structure consists of steel and concrete, both of which are robust materials with a long lifespan and high reuse value. Furthermore, the basis of a tried and tested structural concept will provide maximum security and reliability in terms of buildability and financial framework throughout all project stages.

The main structure consists of a series of concrete beams, which hold the cantilevering roof structure based on two primary structural principles:

PRINCIPLE 1

A traditional cantilevering roof structure over the stadium bowl, which is retained by strong column structure along the outer perimeter of the seating bowl. These main columns are strutted and secured against overturning by the inclined concrete beams, which carry the stand elements. In combination with a tension member in the ground, these inclined beams establish the triangular structure, which ensures the stability of the roof.

Principle 1 is applied in the south, west and east section of the stadium.

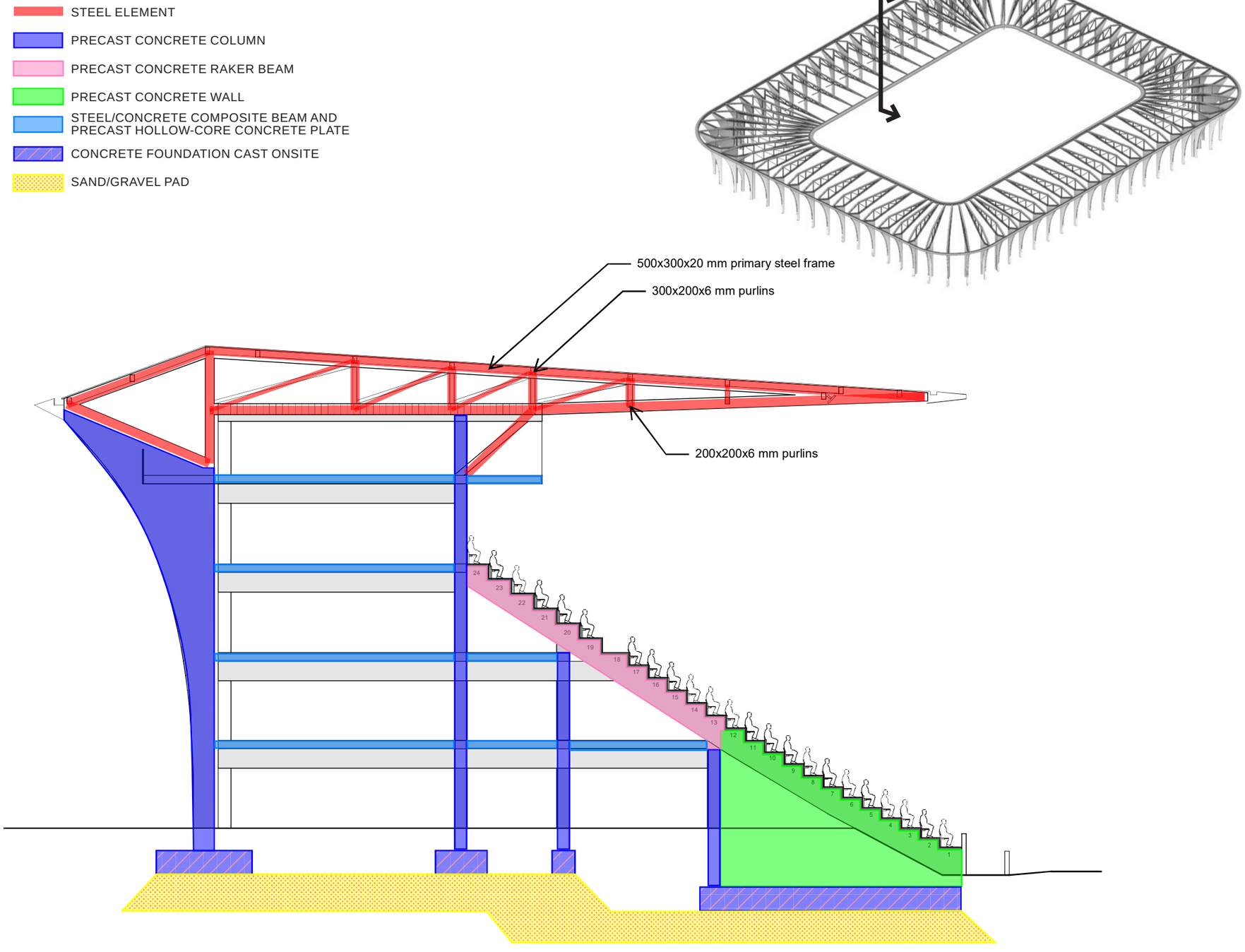
PRINCIPLE 2

A traditional cantilevering roof structure that is retained by a pair of columns, which absorb bending moment as tension and compression members respectively. The columns also carry composite beams carrying the concrete floors. The column closest to the pitch is also strutted by the inclined concrete beam that carries the stand elements.

Principle 2 is applied in the north section of the stadium.

This means that it is necessary to establish expansion joints in each of the four stadium corners, which results in four roof sections, each able to move freely horizontally. This allows for the large roof diaphragms to expand and contract according to outdoor temperatures.

In between the main steel structure in the roof, a secondary structure of smaller steel beams is established. These secondary structure carries the roof.



MAIN STRUCTURE - SECTION OF MAIN STAND AND BUILDING

1.7. CONSTRUCTION

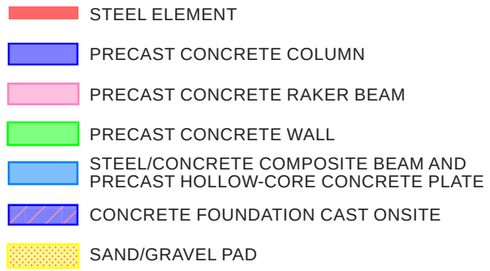
THE STRUCTURE

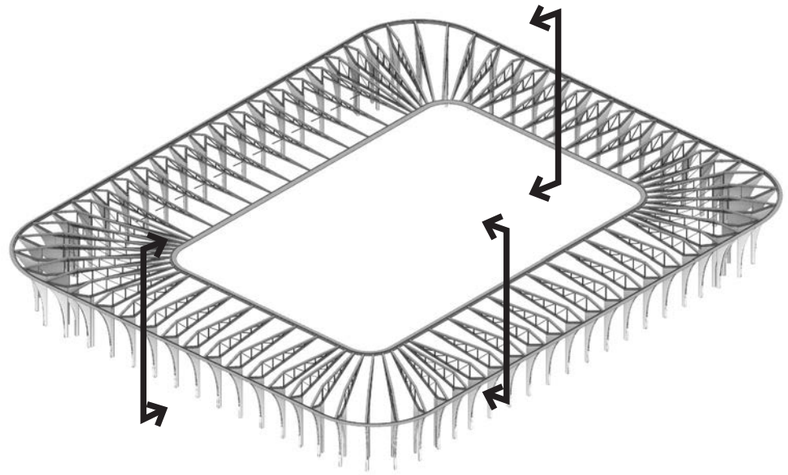
FOUNDATIONS

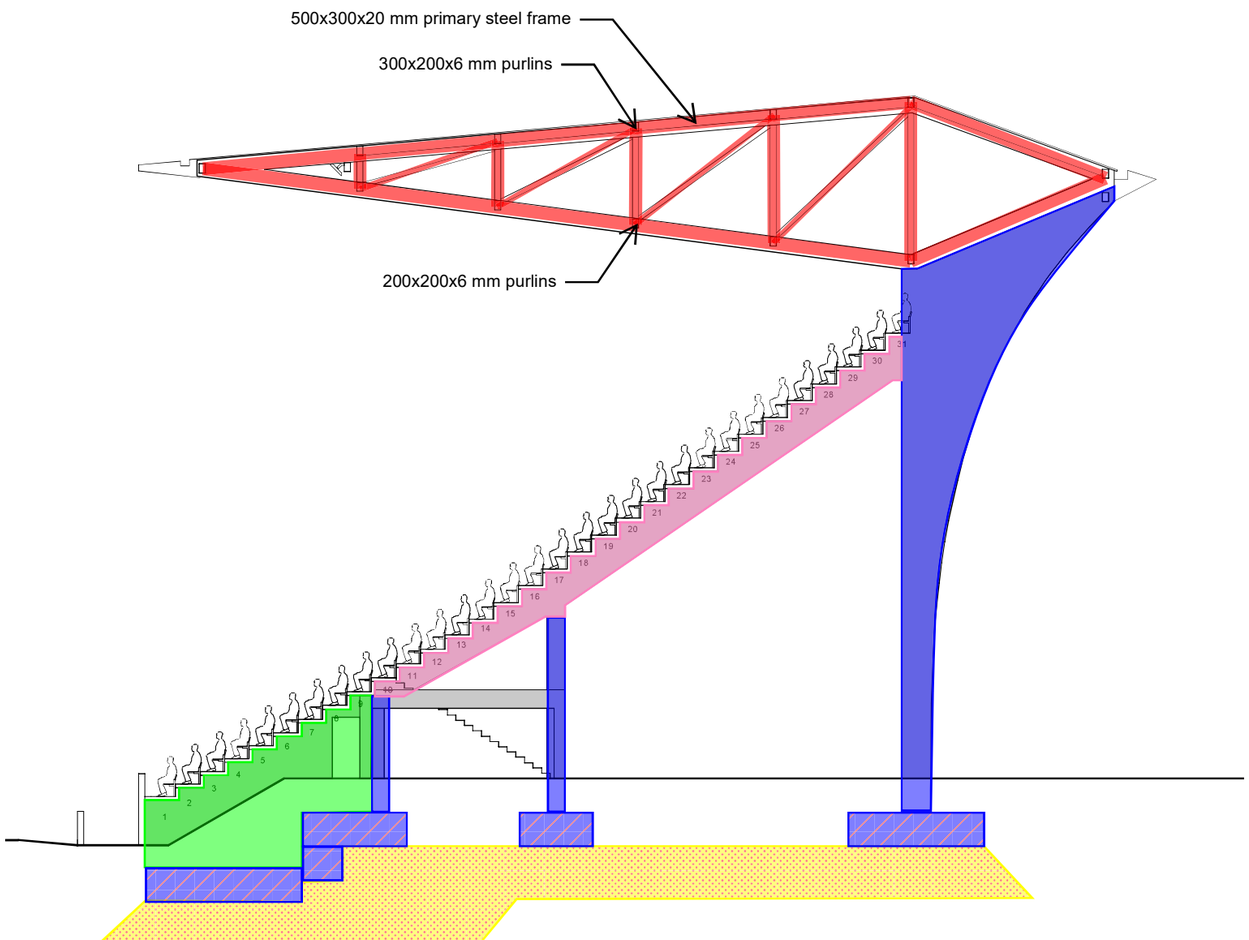
Foundations consist of in situ concrete on top of sand pad of approx. 2,0 m. The sand pad is established because the topsoil layer was determined to contain soft soil at a depth between 1,0 and 5,0 m. However, it needs to be emphasized that primarily solid soils fit for foundations were found on site. In addition, it is expected that the secondary ground-water level can be lowered by means of simple direct drainage for the short period that is required for establishing the sand pad.

Furthermore, it is expected that there already is a sand pad beneath the stand structures of the existing stadium, which we intend to reuse for the foundations of the new stadium.

Anchored permanent sheet piles are established to the south of the site to be able to accommodate the elevation difference between the new stadium and the horse racing track.



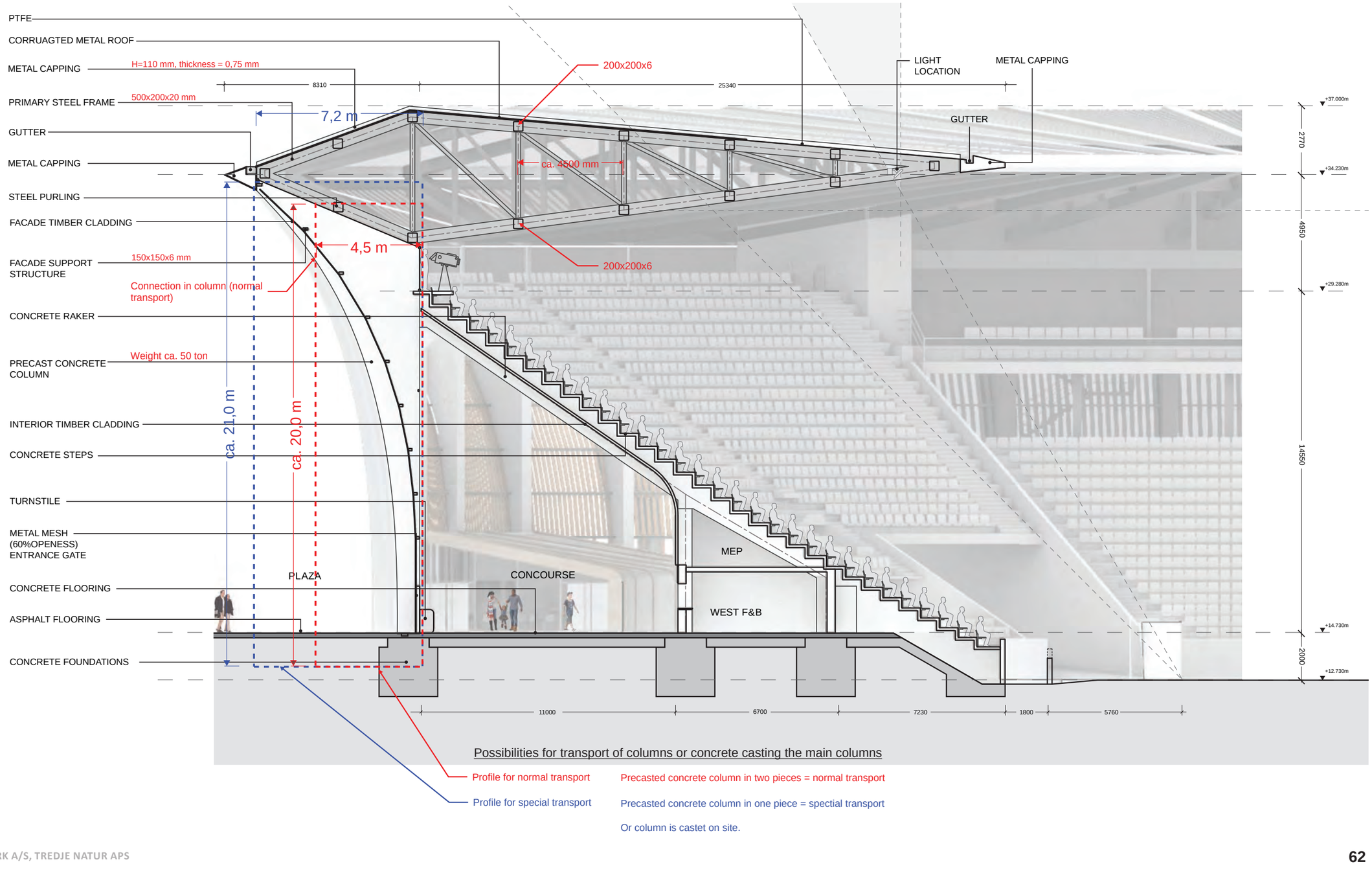




MAIN STRUCTURE - SECTION OF STANDS

1.7. CONSTRUCTION

THE STRUCTURE



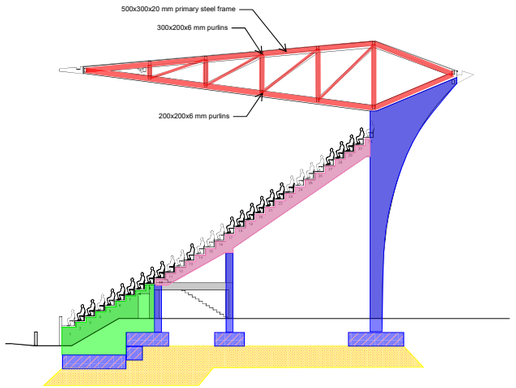
FACADE SECTION

ZAHA HADID LTM, SWECO DANMARK A/S, TREDJE NATUR APS

1.7. CONSTRUCTION

QUANTITY OF STEEL IN ROOF

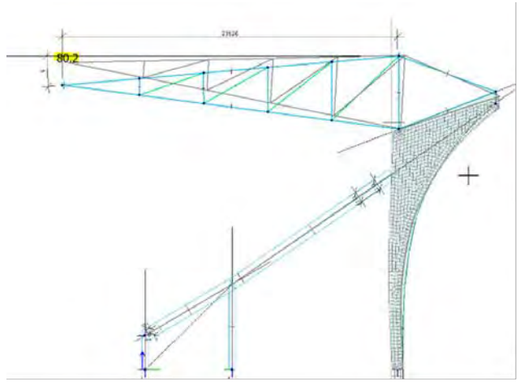
In a regular section (8,3m x 30,32m) on the east, west and south stand, the project estimates 20,329 tons of steel for the main frame, purlins ect. - equivalent to 80,8 kg/m2 roof.

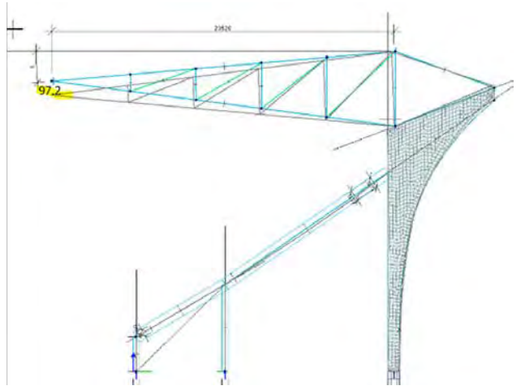


In a thought situation where the main column is made from steel will add approx. 5 tons pr. column equivalent to 19,9 kg/m2 roof. Resulting in a total of approx. 100 kg/m2 equal to expected amount.

CALCULATION OF ROOF STRUCTURE

The scope specifies a maximum deflection of cantilever roof construction of l/200 equal 117 mm. Calculations show a maximum deflection of 97 mm downwards and 80 mm upwards meeting the scope specifications.





Steelclass S355

	Count	Lenght	Total
Mainframe, west/east	18	81 m	1458 m
Backframe, west/east	18	19 m	342 m
Mainframe, corner	25	91 m	2275 m
Backframe, corner	25	20 m	500 m
Mainframe, north	15	85 m	1275 m
Backframe, north	15	17 m	255 m
Mainframe, south	15	67 m	1005 m
Backframe, south	15	19 m	285 m
Purlins	10	350 m	3500 m
Mainframe, total			6013 m
Backframe, total			1382 m

Part	Profile type	Square area mm2	Kg/m
Main frame	IPE 600	15600	122
Back frame	IPE 600	15600	122
Purlins	RHS 200x200x12	11500	72
Steelcolumn, south, lower part (10 m)	600x1200x70	225000	1755
Steelcolumn, south, higher part (11 m)	diff.	365000	2847
Diaphragme, roof			

Not OK, working with optimizing

Part	Profile type	Square area mm2	Kg/m
Main frame	HEB 800	33400	262
Back frame	IPE 600	15600	122
Purlins	RHS 300x200x6,3	11500	48
Steelcolumn, south, lower part (10 m)	600x1200x70	225000	1755
Steelcolumn, south, higher part (11 m)	diff.	365000	2847
Diaphragme, roof			

OK, but large deformations in roof

Part	Profile type	Square area mm2	Kg/m
Main frame	RHS 400x400x20	30000	235
Back frame	RHS 400x400x20	30000	235
Purlins	RHS 300x200x6,3	11500	48
Steelcolumn, south, lower part (10 m)	600x1200x70	225000	1755
Steelcolumn, south, higher part (11 m)	diff.	365000	2847
Diaphragme, roof			

OK, but large deformations in roof

Part	Profile type	Square area mm2	Kg/m
Main frame	RHS 500x300x20	30000	235
Back frame	RHS 500x300x20	30000	235
Purlins	RHS 300x200x6,3	11500	48
Steelcolumn, south, lower part (10 m)	600x1200x70	225000	1755
Steelcolumn, south, higher part (11 m)	diff.	365000	2847
Diaphragme, roof			

OK, but minor deformations in roof

Part	Profile type	Square area mm2	Kg/m
Main frame	RHS 600x600x50	120000	936
Back frame	RHS 600x600x50	120000	936
Purlins	RHS 300x200x6,3	11500	48
Steelcolumn, south, lower part (10 m)	600x1200x70	225000	1755
Steelcolumn, south, higher part (11 m)	diff.	365000	2847
Diaphragme, roof			

OK, but overdimensioned

1.7. CONSTRUCTION

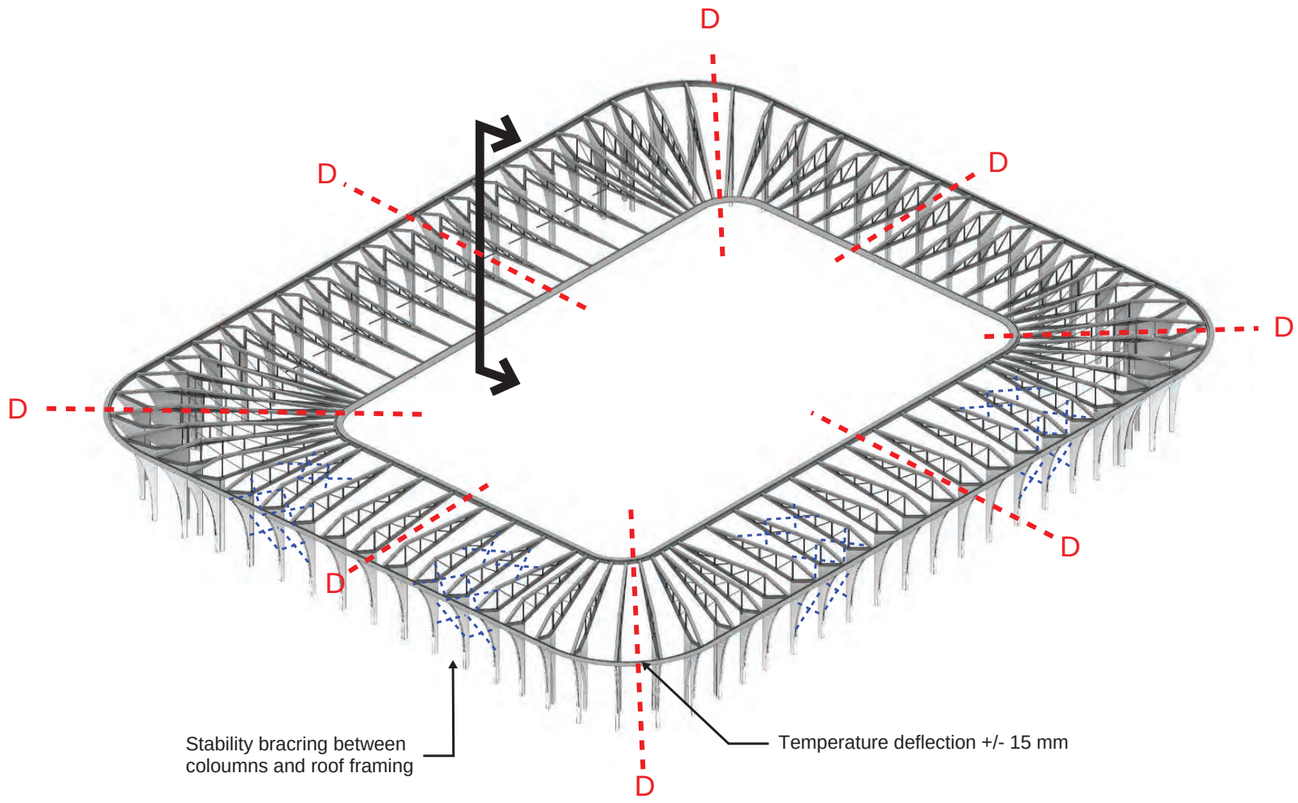
STABILITY

The structure is stabilized with bracing between columns and roof framing bays in selected locations. Several options have been studied, as shown, where the optimal solution avoids bracing in the corners.

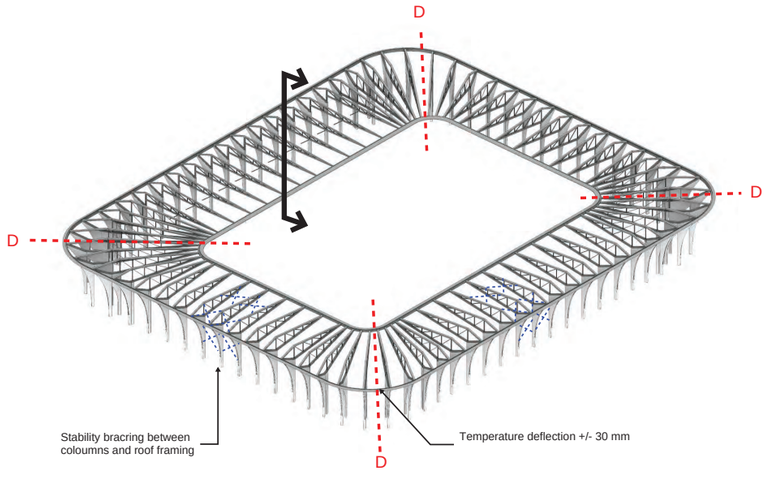
Between the bracing expansion joints are designed to allow thermal movement of the large lateral steel structures.

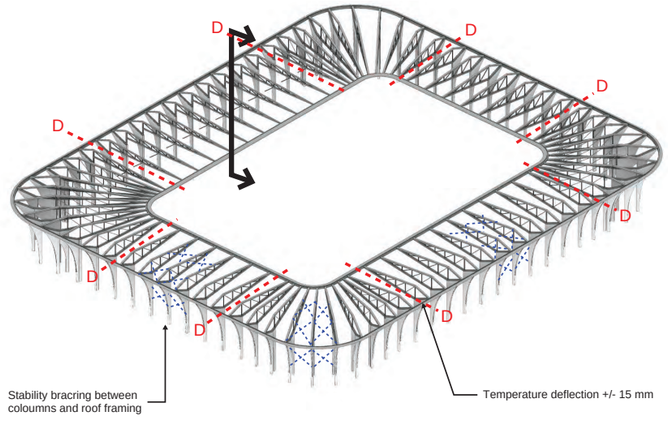
EXPANSION JOINT

STABILITY BRACING



PROPOSED OPTION





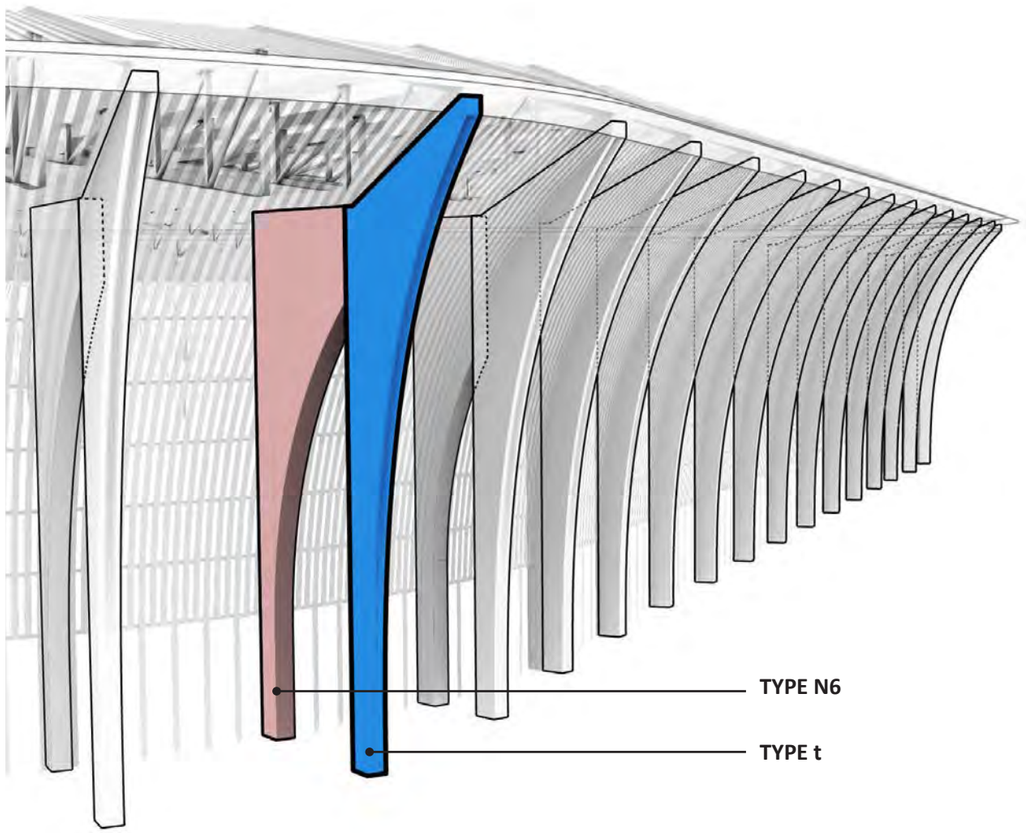
ALTERNATIVE OPTIONS

1.7. CONSTRUCTION

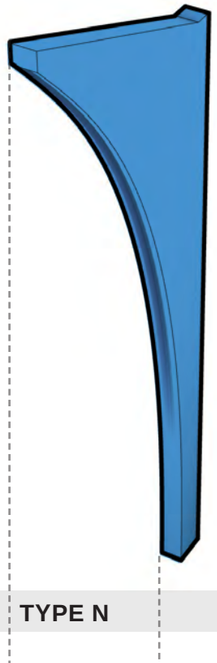
COLUMN CONSTRUCTION

The optimisations have allowed the expected saving and provided a significant contribution towards the target budget. The resulting design is stronger, buildable, closer to the local construction habits.

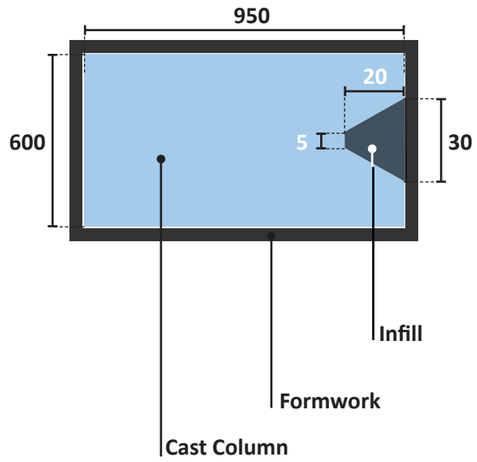
- Introduction of concrete columns instead of steel columns with cladding
- Only 2 standard construction form-works - with few polystyrene fillers - to build all architectural columns



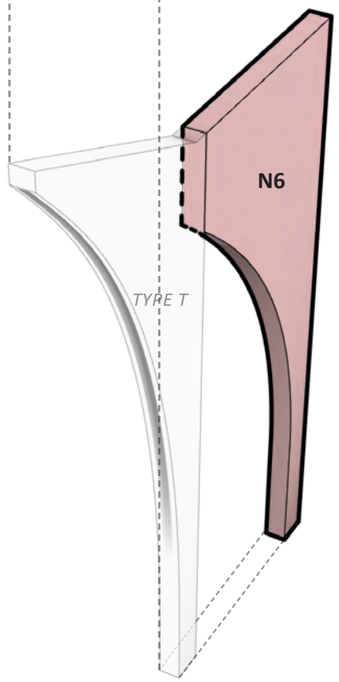
- **TYPE T**

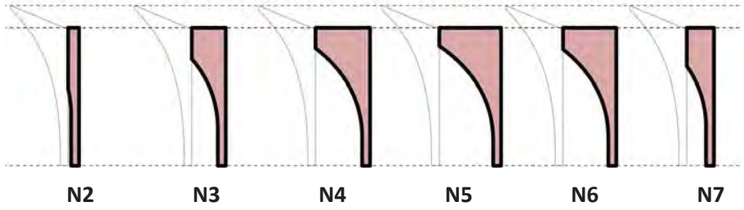


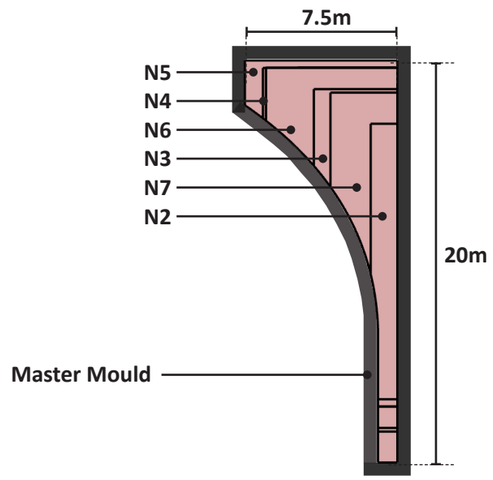
*Unit: mm



- **TYPE N**





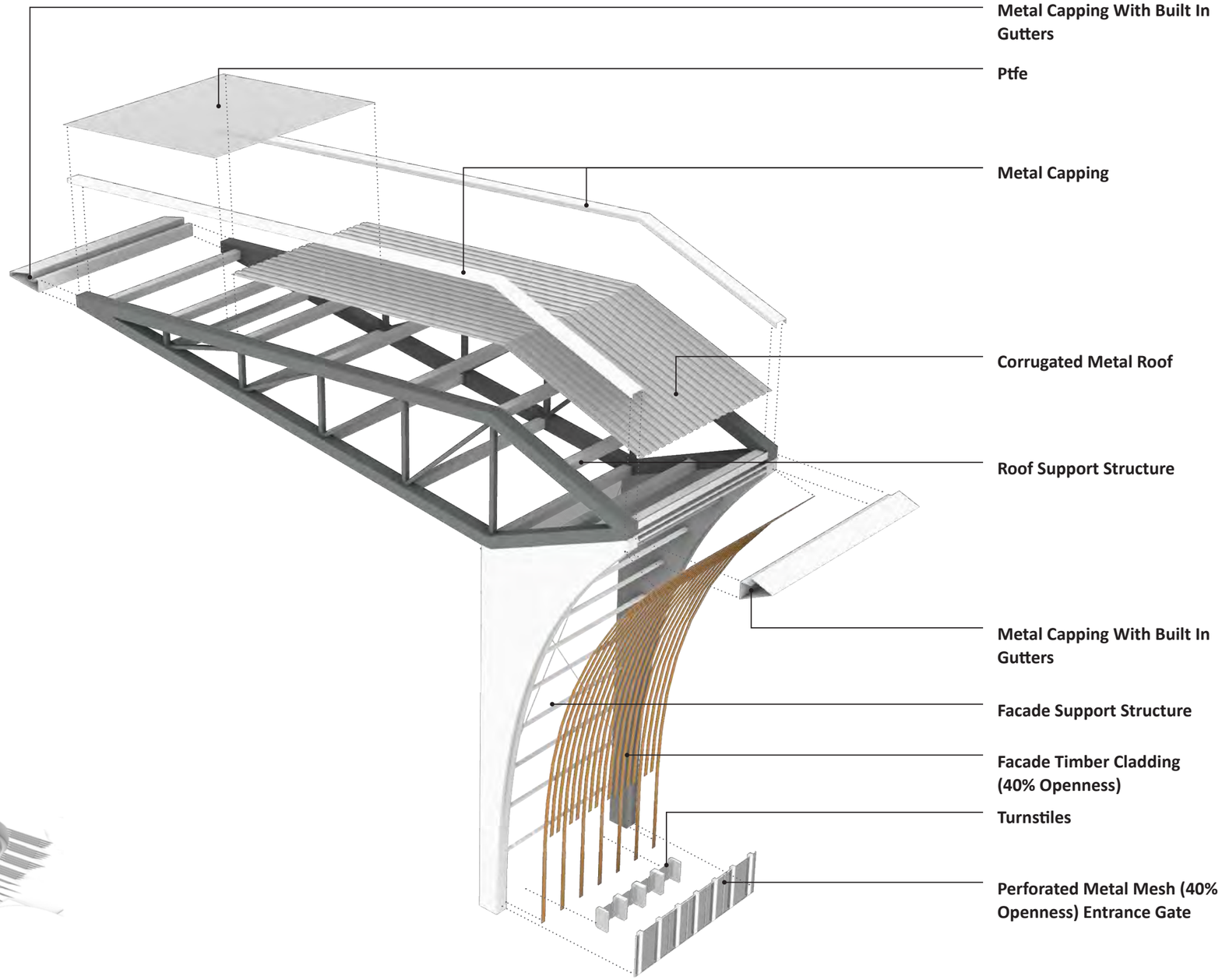


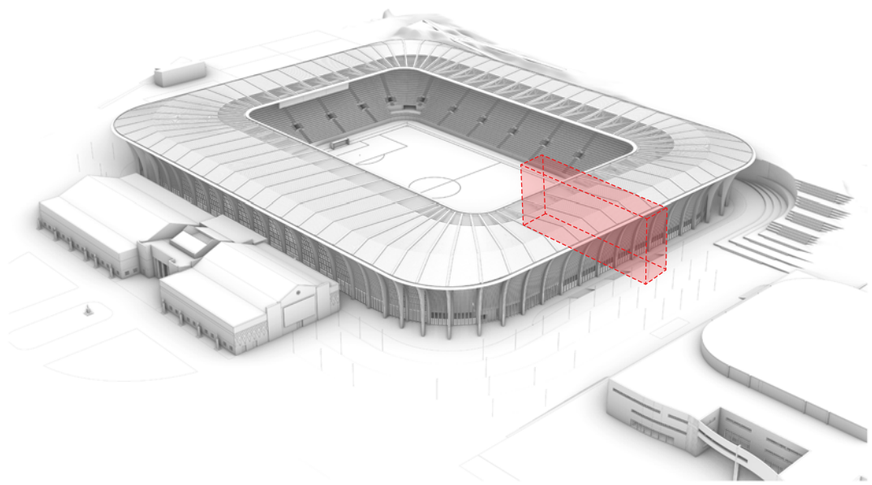
1.7. CONSTRUCTION

EXTERNAL FACADE AND ROOF CONSTRUCTION

Easy to assemble, the construction components of the roof and the facade are simply fixed to support structures located in between existing trusses and the precast concrete columns.

Most of them are standard “off the shelf” materials, except for the metal capping which are designed to seamlessly clad both the ends and the top of the trusses.



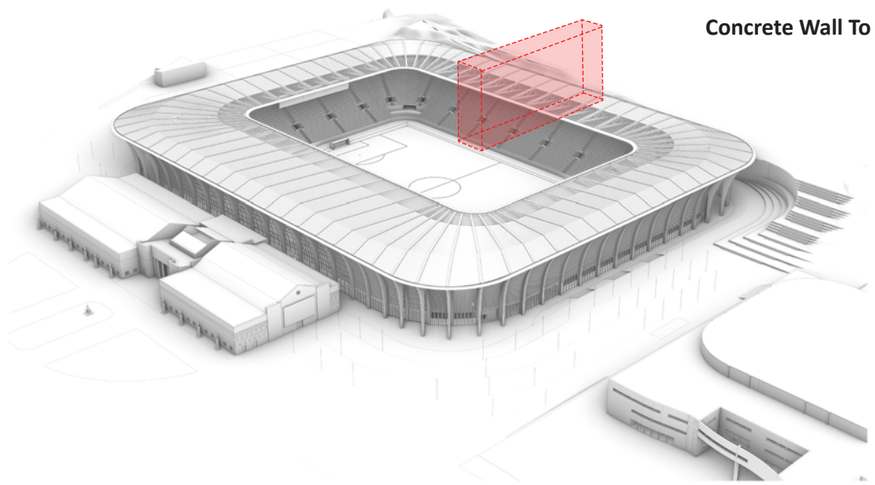


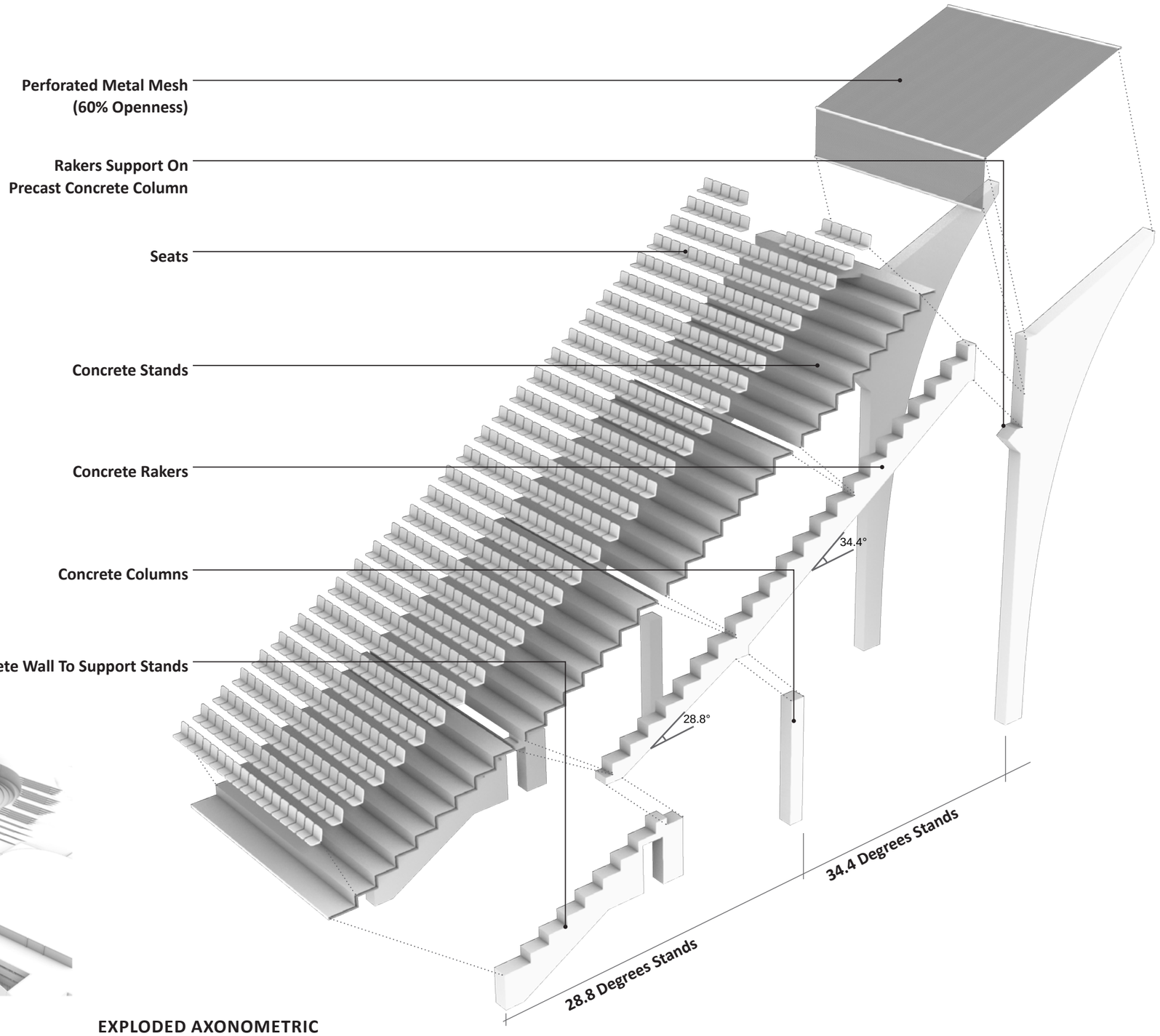
EXPLODED AXONOMETRIC

1.7. CONSTRUCTION

RAKER / STANDS CONSTRUCTION

The Stands are supported by a concrete structure composed of structural wall, column and precast column on which the rakers sit on.





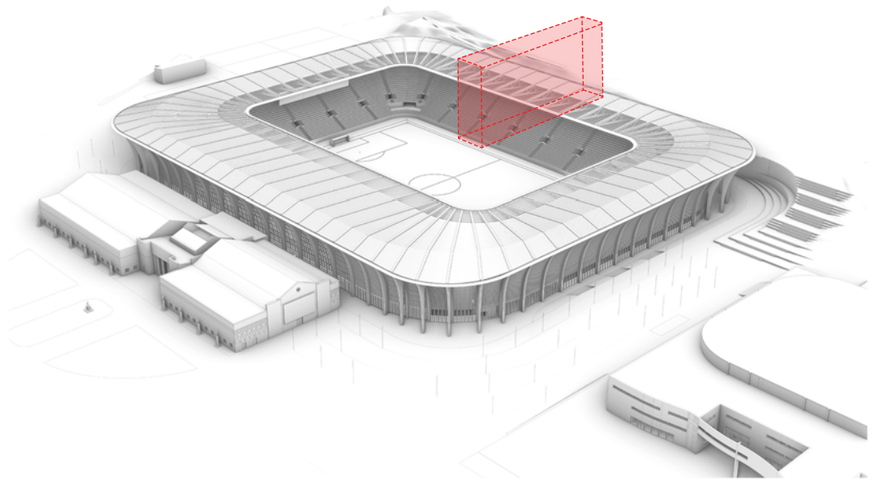
EXPLODED AXONOMETRIC

1.7. CONSTRUCTION

INTERNAL CONCOURSE CONSTRUCTION

The timber slats cladding in the concourse are fixed at the bottom of the stands by brackets at its sloped portion and at its vertical one, to a couple of beams fixed to the rakers.

Many areas from the program like snack bars, wash rooms, etc, are located between the columns that support the rakers.



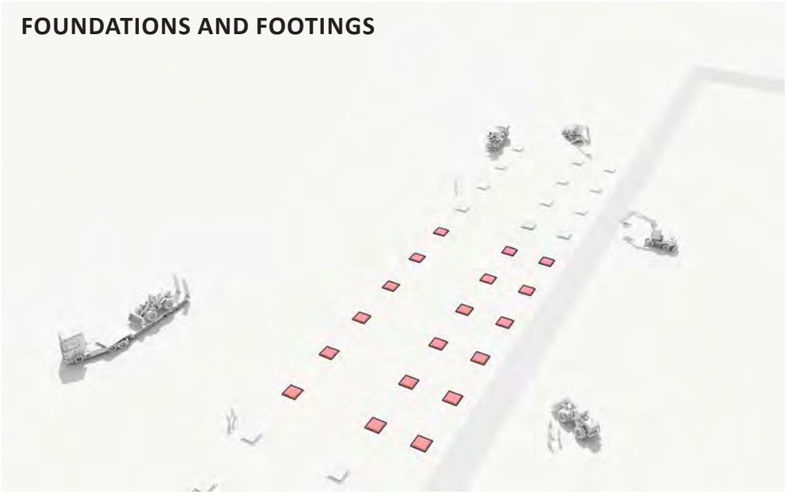
EXPLODED AXONOMETRIC

1.8. BUILDABILITY

CONSTRUCTION SEQUENCE

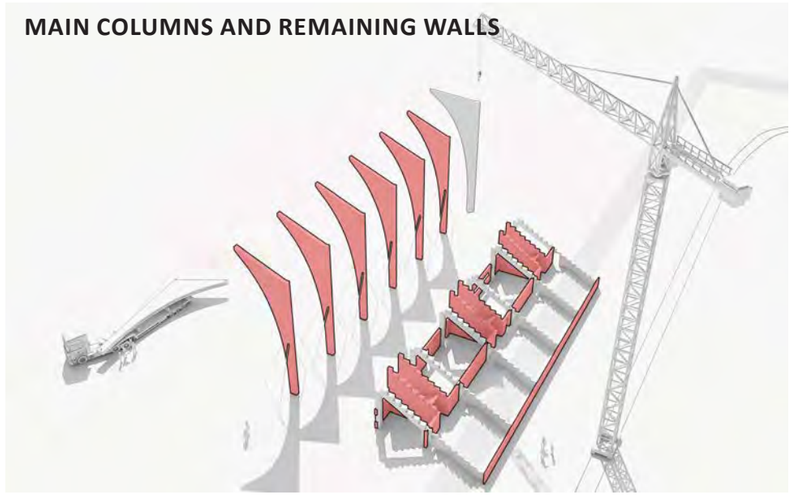
The construction of the stadium will benefit of a high degree of prefabrication with efficient onsite assembly. The diagrams show the construction and assembly of 5 bowl sections to illustrate the process involved from ground works to finish.

FOUNDATIONS AND FOOTINGS

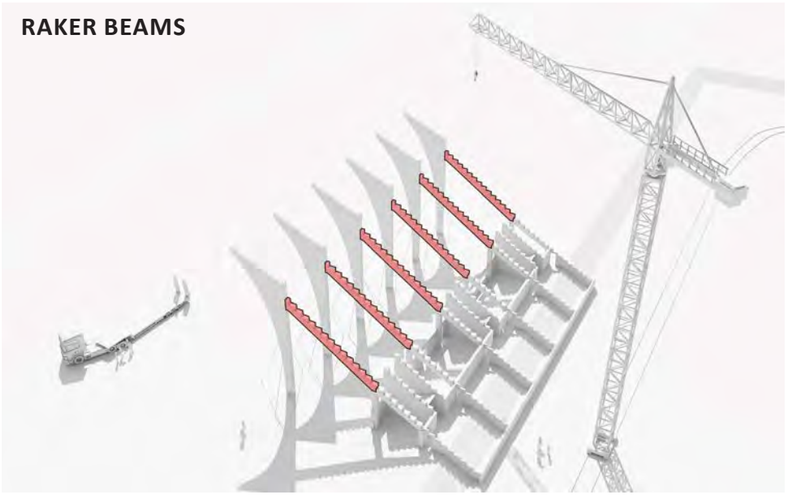


WALLS AND COLUMNS TO SUPPORT LOWER RAKES

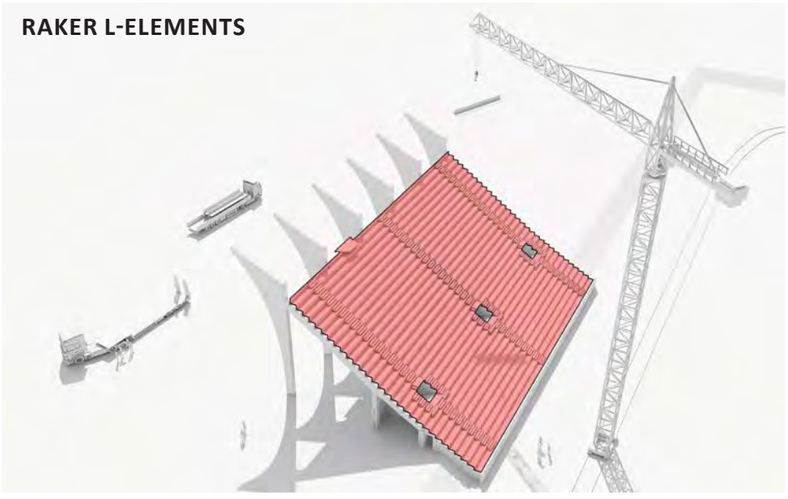
MAIN COLUMNS AND REMAINING WALLS



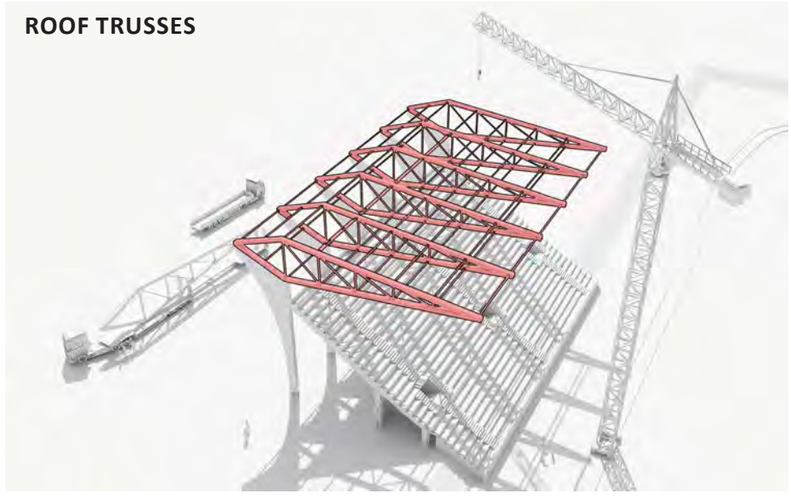
RAKER BEAMS



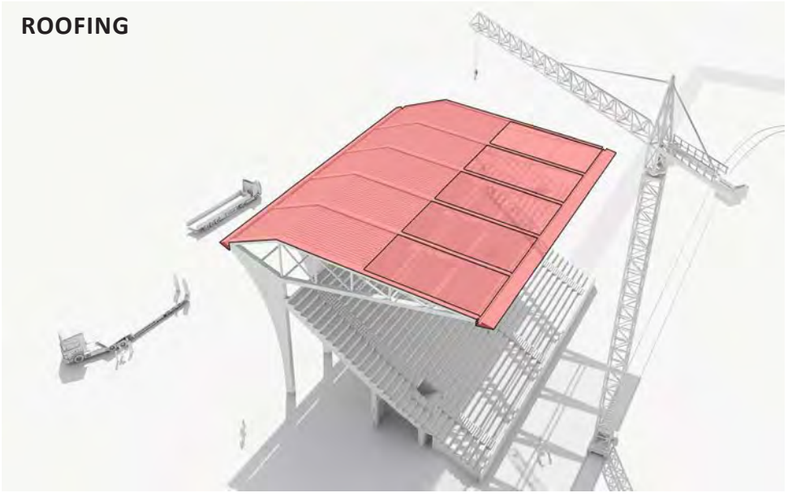
RAKER L-ELEMENTS



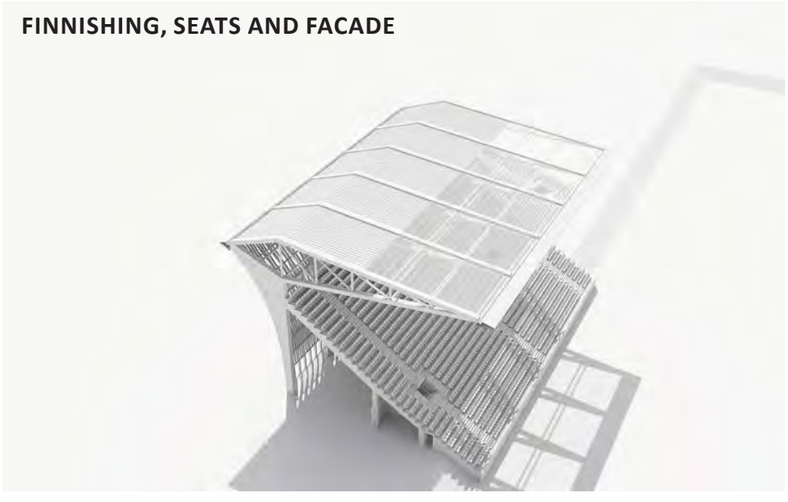
ROOF TRUSSES



ROOFING



FINNISHING, SEATS AND FACADE



1.8. BUILDABILITY

CONSTRUCTION TRANSPORT

The project team have consulted several transport providers regarding possible strategies for transport of the large main columns.

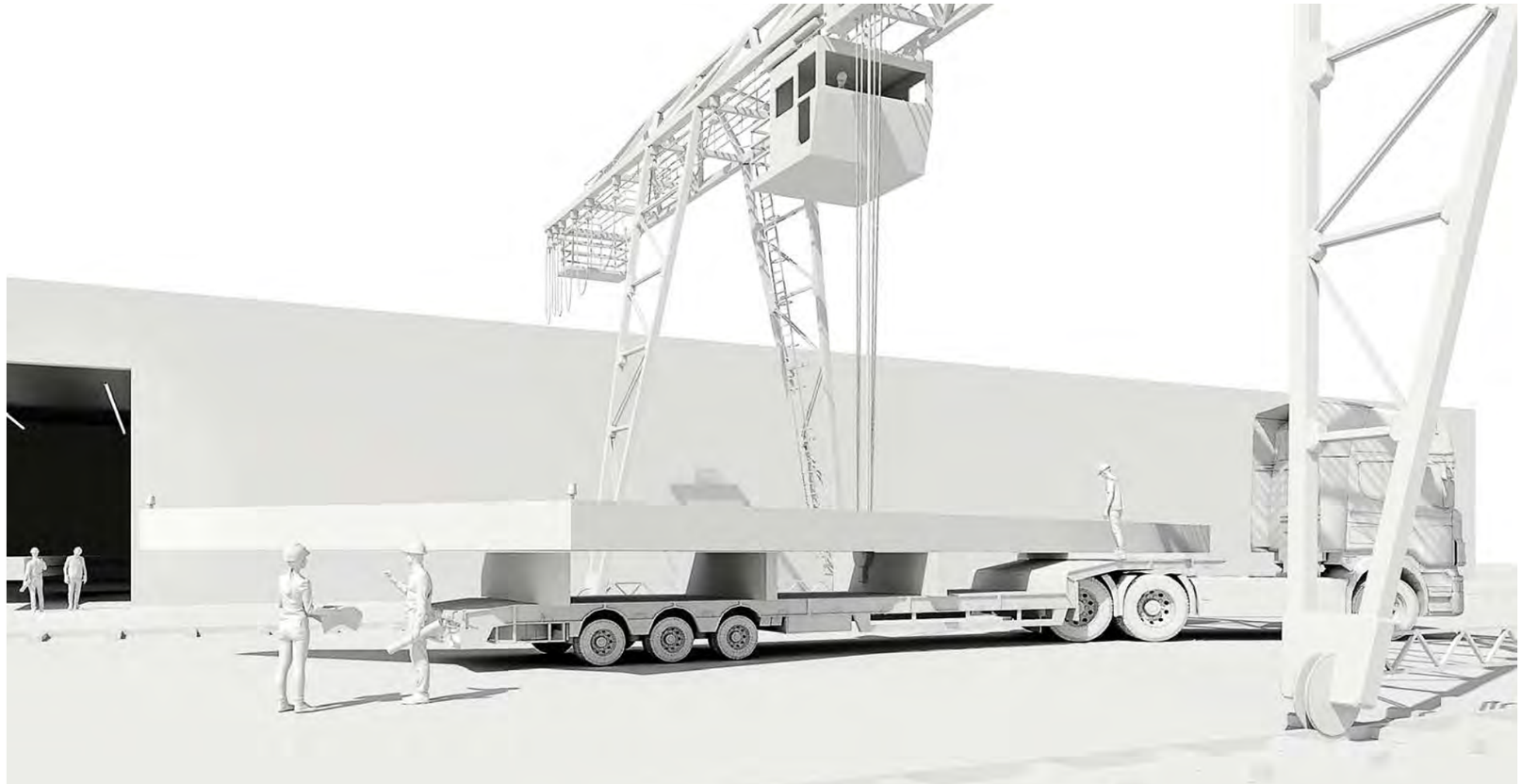
It is further confirmed be specialist in road infrastructure that the structural elements designed for the new stadium can be delivered within the available road conditions in the area and connected infrastructure.

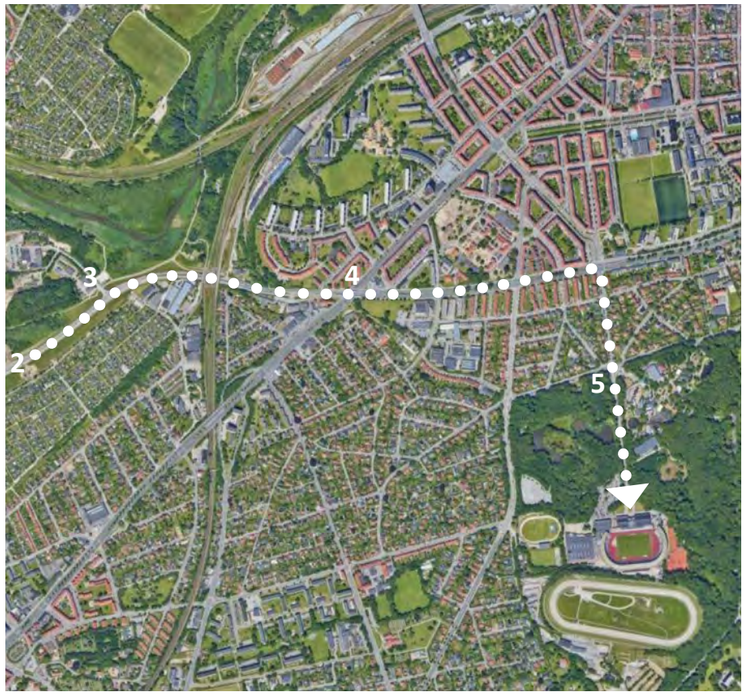
The main columns will be transported individually as special transports. There will be a total of 74 main columns and further 28 additional corner columns, giving a total of 102 special transports to site.

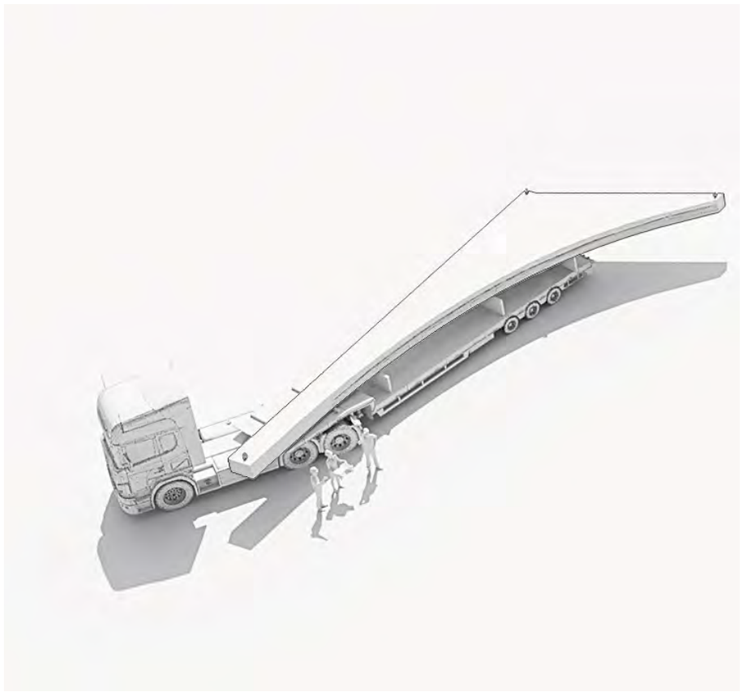
The proposed route of transport:

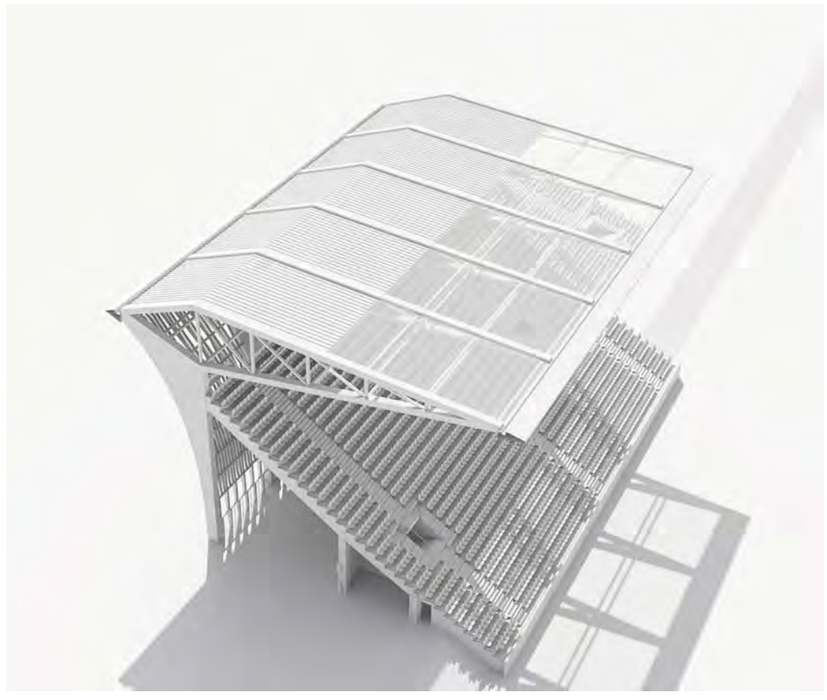
1. Starting route from E45 Freeway which connects to multiple concrete element suppliers.
2. Århus Syd Freeway
3. Åhavevej
4. Marselis Boulevard
5. Stadion Allé

Following this route there is only one turn (Marselis Boulevard og Stadion Allé). Other road changes are straight passes.









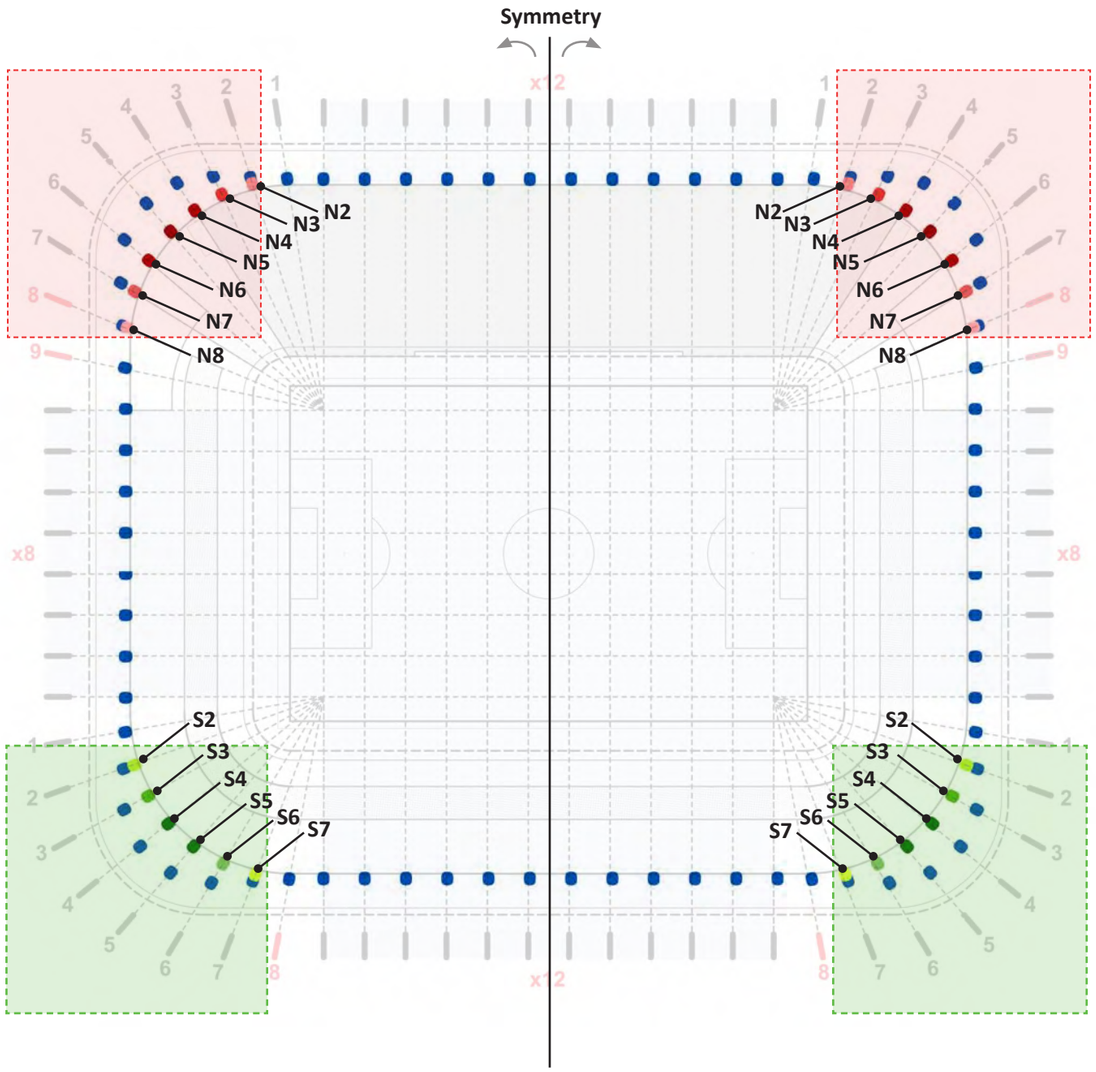
1.8. BUILDABILITY

REPETITION

Primary Columns	x74
Concrete Columns	x74

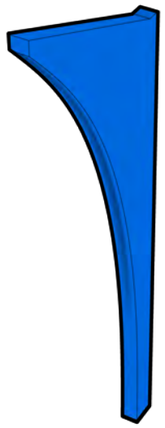
Secondary Columns (Type N+S)	x26
Type N x14 / *Type S x12*	Concrete Columns x26

TOTAL COLUMNS 100



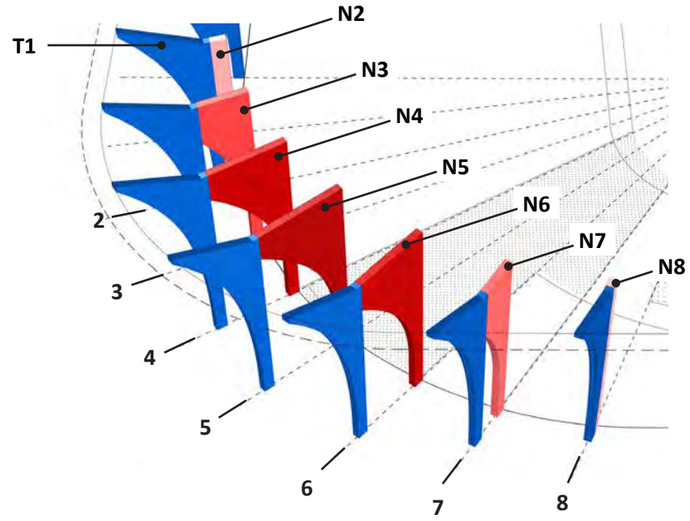
Type T (Typical)

Type	N2
Quantity	74
Total	74



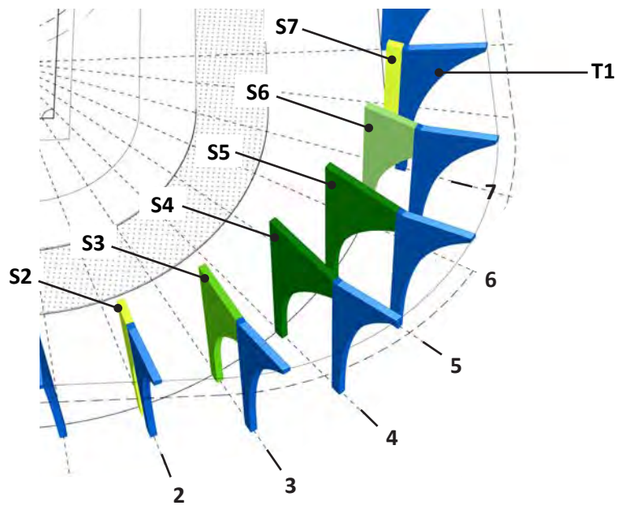
Type N (North)

Type	N2	N3	N4	N5	N6	N7	N8
Quantity	2	2	2	2	2	2	2
Total	14						



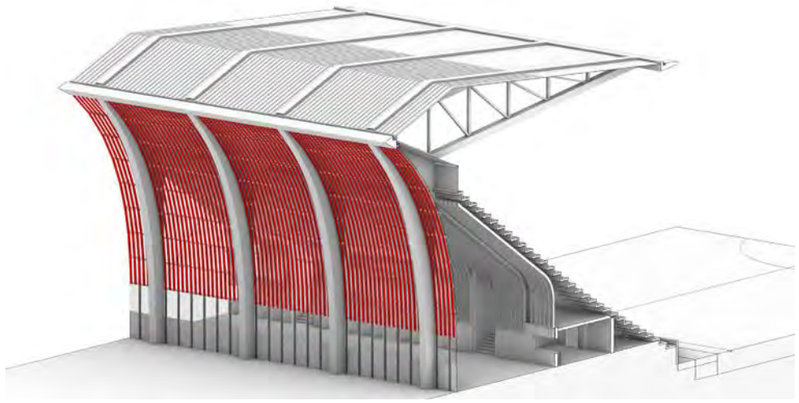
Type S (South)

Type	S2	S3	S4	S5	S6	S7	-
Quantity	2	2	2	2	2	2	-
Total	12						

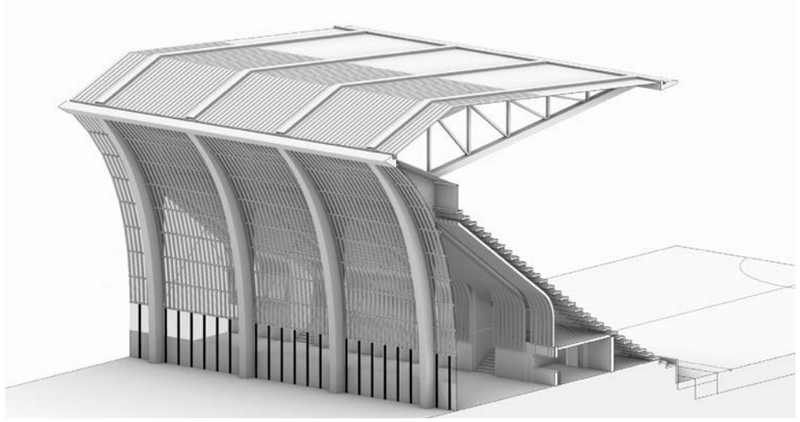


1.8. BUILDABILITY

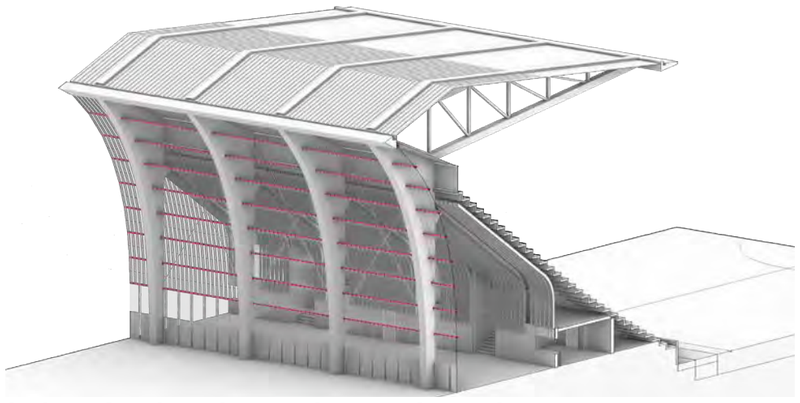
EXTERNAL FACADE



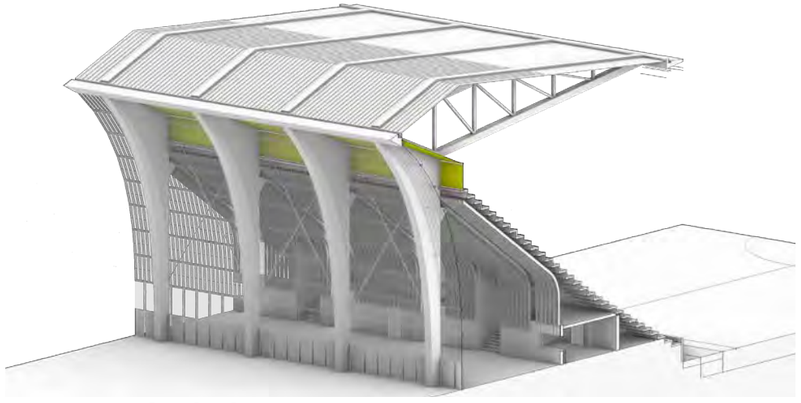
1 - LOUVRES



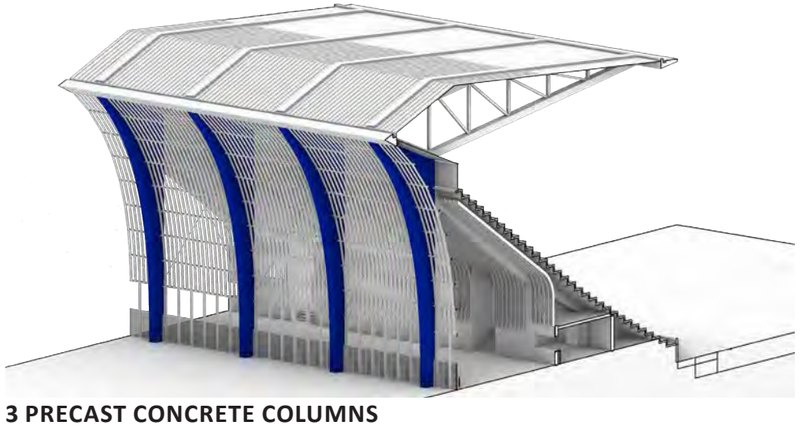
2 - VERTICAL TIMBER STRUCTURE



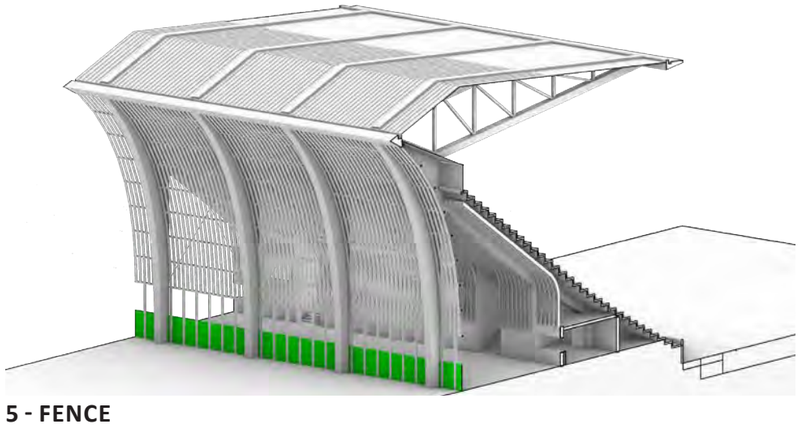
2 - SUPPORT STRUCTURE FOR THE LOUVRES



4 - WIND PROTECTION



3 PRECAST CONCRETE COLUMNS



5 - FENCE

1 - LOUVERS

material: timber (Accoya)

length: 24354 m

cross section: 20 cm x 2.5 cm

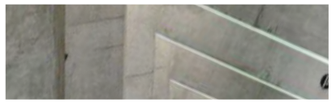
2 - SUPPORT STRUCTURE FOR THE LOUVERS

material: timber (Kebony)

length: 4920 m

cross section: 15 cm x 10 cm

3 - PRECAST CONCRETE COLUMNS



material: concrete

count: 74 type T columns

count: 14 type N columns

count: 12 type S columns

4 - VERTICAL TIMBER STRUCTURE

material: timber (Accoya)

length: 1655 m

cross section: 20 cm x 11 cm

5 - WIND PROTECTION

material: perforated steel mesh (openness of 40%)

area: 5099 m^2

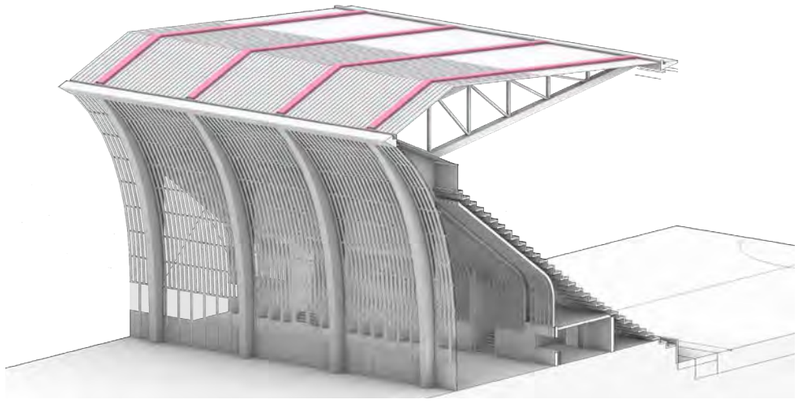
6 - FENCE

material: perforated steel mesh (openness of 40%)

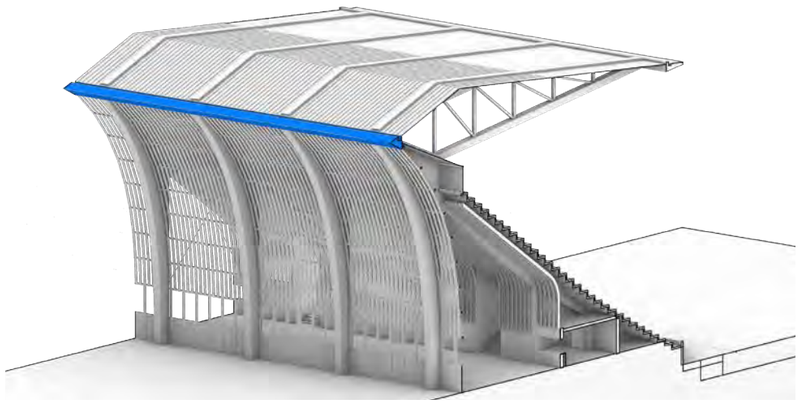
area: 796 m^2

1.8. BUILDABILITY

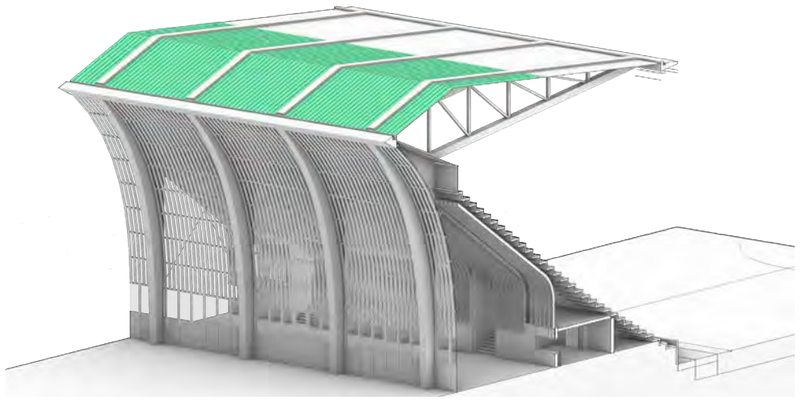
ROOF



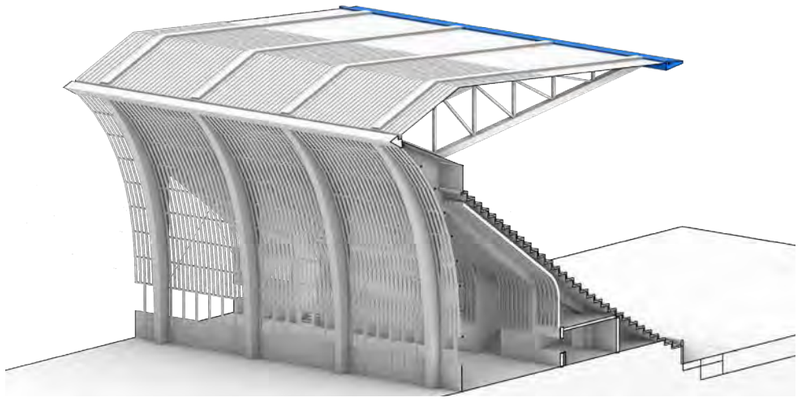
1 - METAL CAPPING



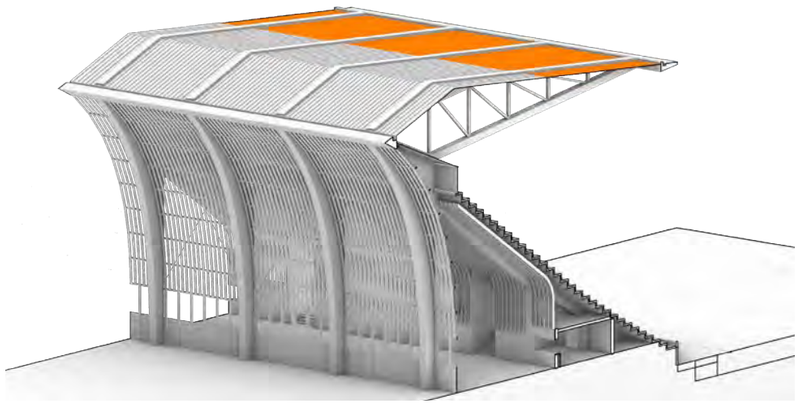
4 - OUTER GUTTER



2 - CORRUGATED ROOF



5 - INNER GUTTER



3 PRECAST CONCRETE COLUMNS

1 - METAL CAPPING

material: metal

length: 2612 m

cross section: 60 cm x 20 cm

2 - CORRUGATED ROOF

material: metal

area: 12214 m²

3 - PTFE

material: ptfe

area: 3996 m²

4 - OUTER GUTTER

material: metal

area: 2525 m²

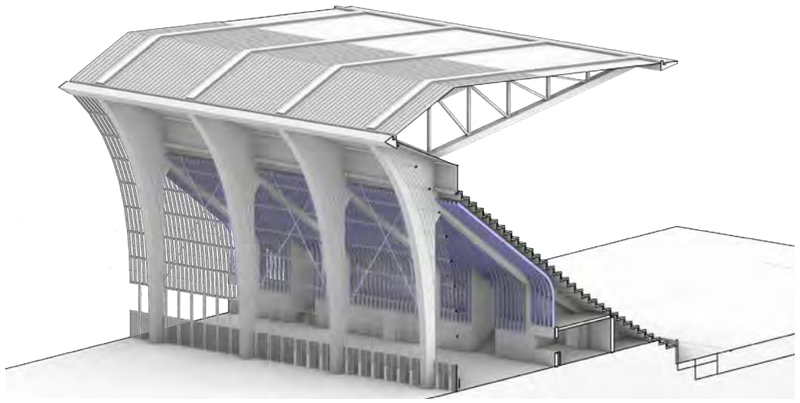
4 - INNER GUTTER

material: metal

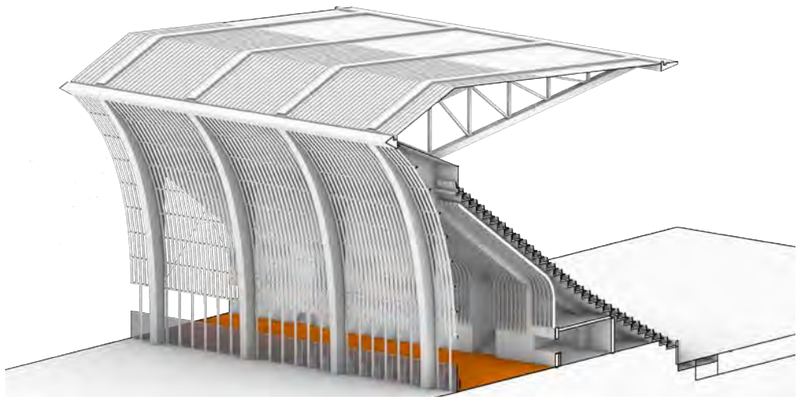
area: 2003 m²

1.8. BUILDABILITY

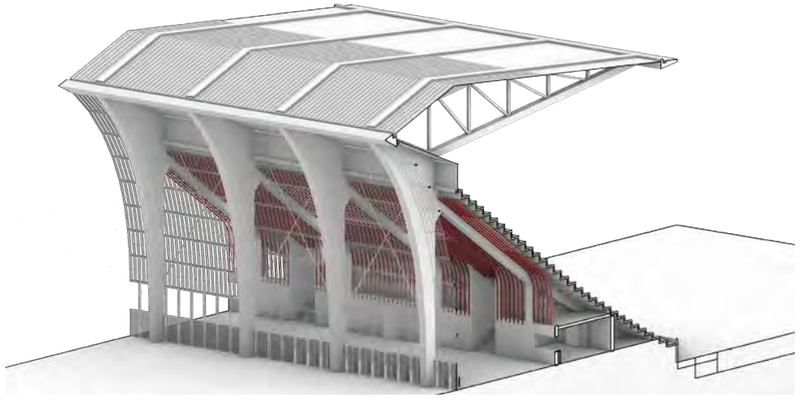
CONCOURSE



1 - PRIMARY LOUVRES



3 - FLOORING



2 - SECONDARY LOUVRES

1 - PRIMARY LOUVERS

material: timber

length: 15301 m

cross section: 20 cm x 2.5 cm

2 - SECONDARY LOUVERS

material: timber

length: 14065 m

cross section: 10 cm x 2.5 cm

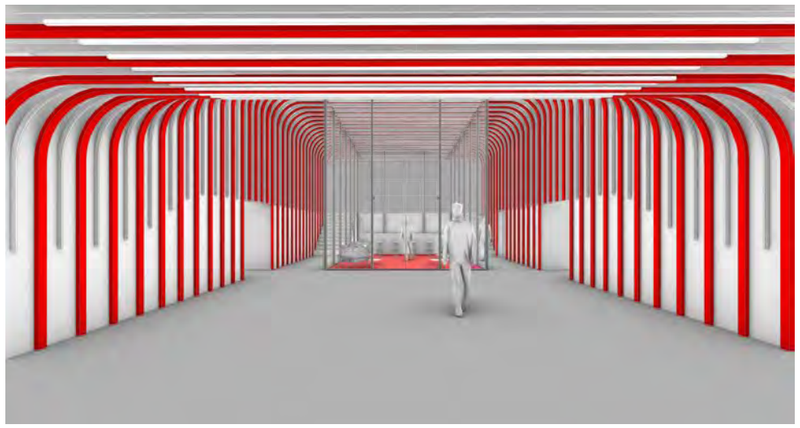
3 - FLOORING

material: concrete

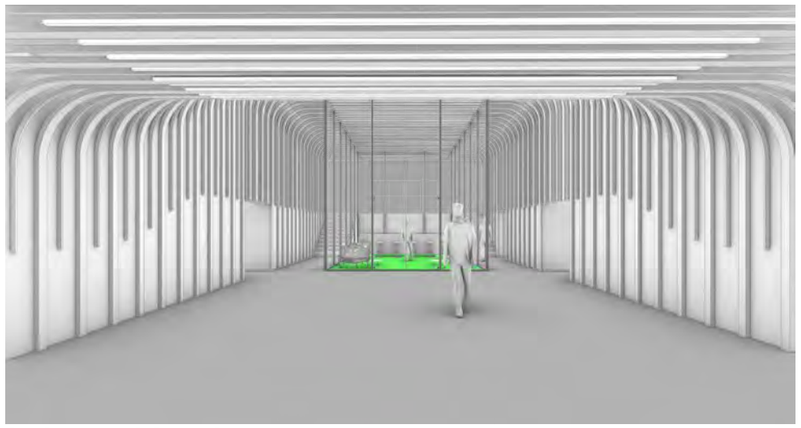
area: 3509 m^2

1.8. BUILDABILITY

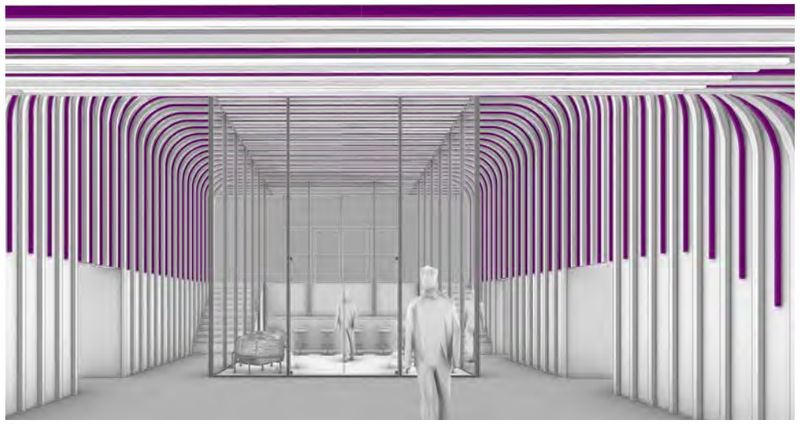
TUNNEL



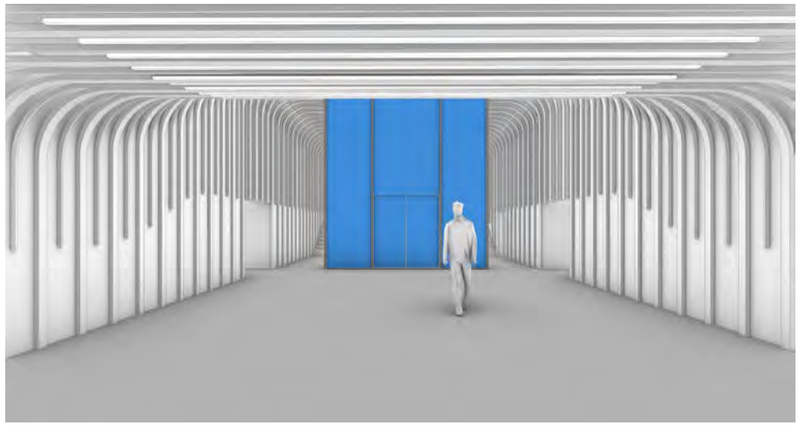
1 - PRIMARY LOUVRES



3 - CLUB FLOORING



2 - SECONDARY LOUVRES



4 - CLUB GLASS

1 - PRIMARY LOUVER

material: timber (box section)

length: 743 m

cross section: 10 cm x 5 cm

2 - SECONDARY LOUVER

material: timber

length: 611 m

cross section: 2 cm x 5 cm

3 - CLUB FLOORING

material: timber

count: 43 m^2

4 - CLUB GLASS

material: glass

area: 158 m^2

1.9. BUILDING SERVICES

MAIN PRINCIPLES FOR TECHNICAL INSTALLATIONS

PLANT ROOMS

All major plant rooms are located on the building's top storey. This means that intakes and exits for comfort and process air conditioning units can be incorporated into the top storey façade facing the Heritage Building and thus without nuisance for their surroundings. Furthermore, this location ensures the best possible conditions for both distribution and maintenance.

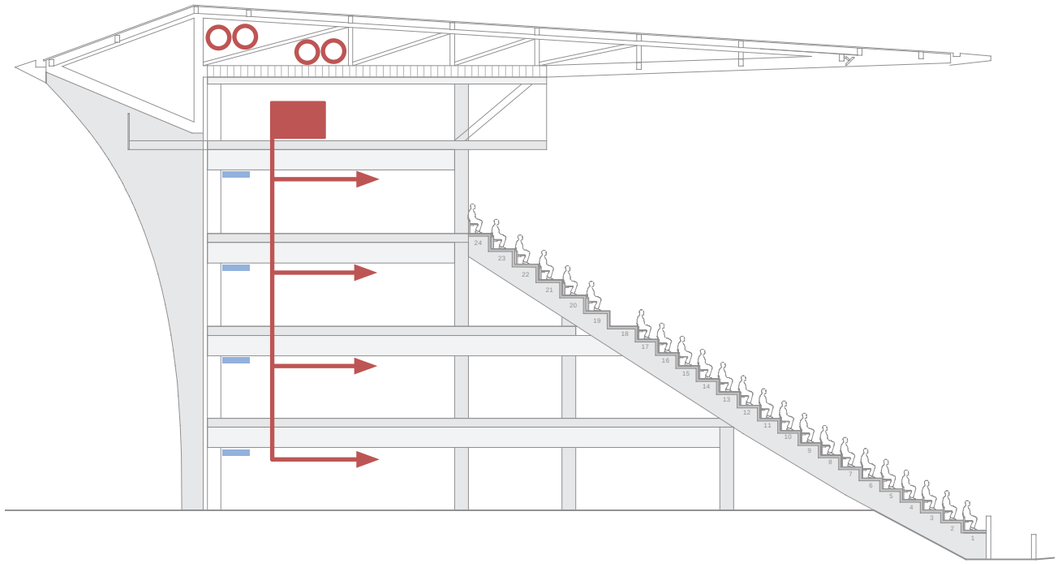
At ground level, primary utility plants are established, where utility lines are led into building. For electricity, each floor contains two secondary plant rooms for electrical installations' and fibre infrastructure.

MAIN ROUTING

From the plant rooms located on the top storey, the highly insulated ventilation ducts are distributed via the roof structure to the vertical shafts in the building. Pipework are on the top storey distributed horizontally over the suspended ceiling from shafts to the plant rooms.

In general the vertical main distribution shafts are without bends and from these vertical shafts installations are distributed horizontally over the suspended ceilings in the circulation areas on the individual floors.

We thereby avoid the unnecessary use of space above suspended ceilings for transitions and offsets of installations.



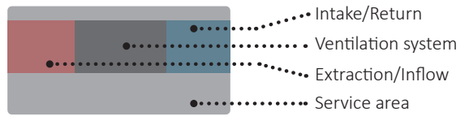
MAIN ROUTING PRINCIPLE - REPRESENTATIVE SECTION OF MAIN BUILDING

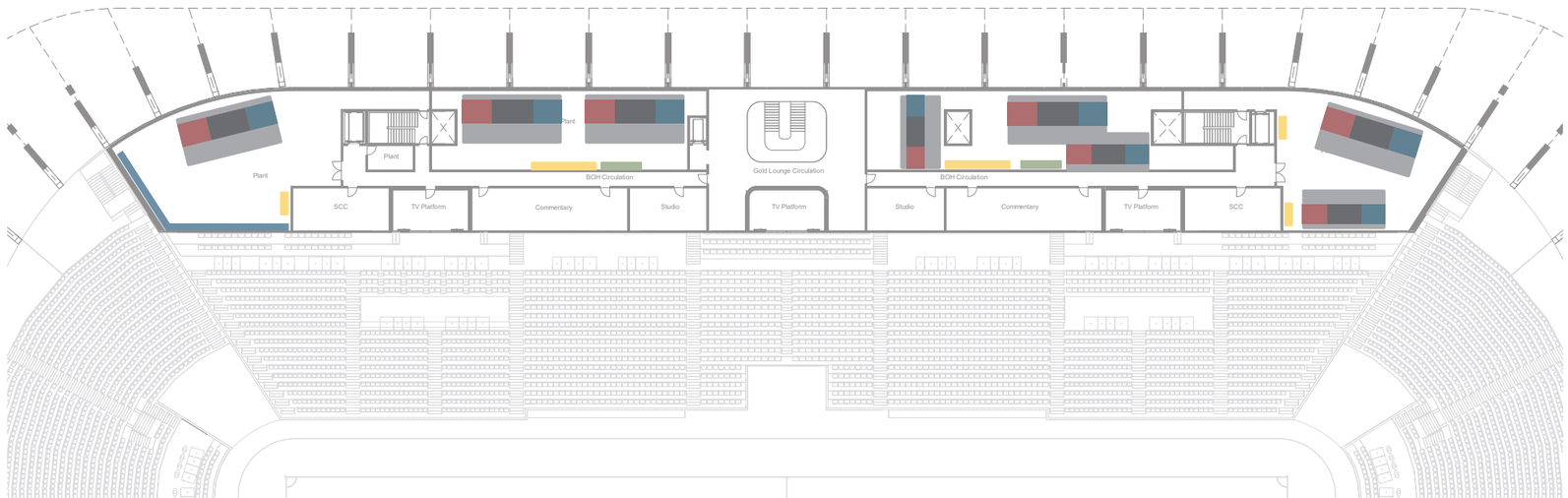
SIGNATURES, SECTION

- Main route for destruction of electricity supply incl. low voltage installations
- Ventilation plant room
- Air supply and return air
- Air supply

SIGNATURES, PLAN

- Water/heat
- Electrical board
- Mixing circuits and switchboard





MAIN ROUTING PRINCIPLE - REPRESENTATIVE 4TH FLOOR PLAN OF MAIN BUILDING

1.9. BUILDING SERVICES

ENERGY CONCEPT The proposal aims at minimizing the need for installing alternative energy sources for the benefit of the project's life cycle costing (LCC) and energy-efficient solutions, which are fully incorporated into the stadium design. We therefore focus on integrating energy-efficient design solutions and energy-reducing installations from the project's earliest development stages.

To ensure compliance with energy calculations, solar panels are necessary. We propose the panels to be incorporated into the stadium roof structure between the structure itself and the translucent membrane. The final solution for the solar panel location will be decided in dialogue with the client during the subsequent design stages.

UTILITIES CONCEPT Water, heating, and electricity is supplied by the utility companies of Aarhus. All utilities are connected to the city's main lines from Stadion Allé, as indicated in the illustration on this page.

The decision whether to establish a redundant electrical system or a diesel generator will be made in close dialogue between the client and the lead consultant team.

HEATING, WATER AND SANITATION
Sanitation and fixtures are hard-wearing quality to withstand heavy use of large crowds during matchdays, concerts etc.

Domestic hot water is decentrally produced in each individual building section.

To ensure maximum comfort in all usage scenarios, heating is provided by fast acting heat emitters supported by floor heating in barefoot areas. Therefore, radiators and convectors are used as primary heating elements, whereas heat emitters in the Gold Lounge are sunk into the floor along the facades for minimal visibility while still counteracting minor downdraft along the facades.

The cooling effect necessary for the ventilation system to meet the indoor climate requirements for different building sections is produced by integrated heat pump solutions within the ventilation devices. This makes good sense in a building such as the new stadium, as the building floors with the highest occupancy levels are divided into few, large zones. Therefore, all ventilation air is cooled to avoid the need for numerous zone cooling systems.

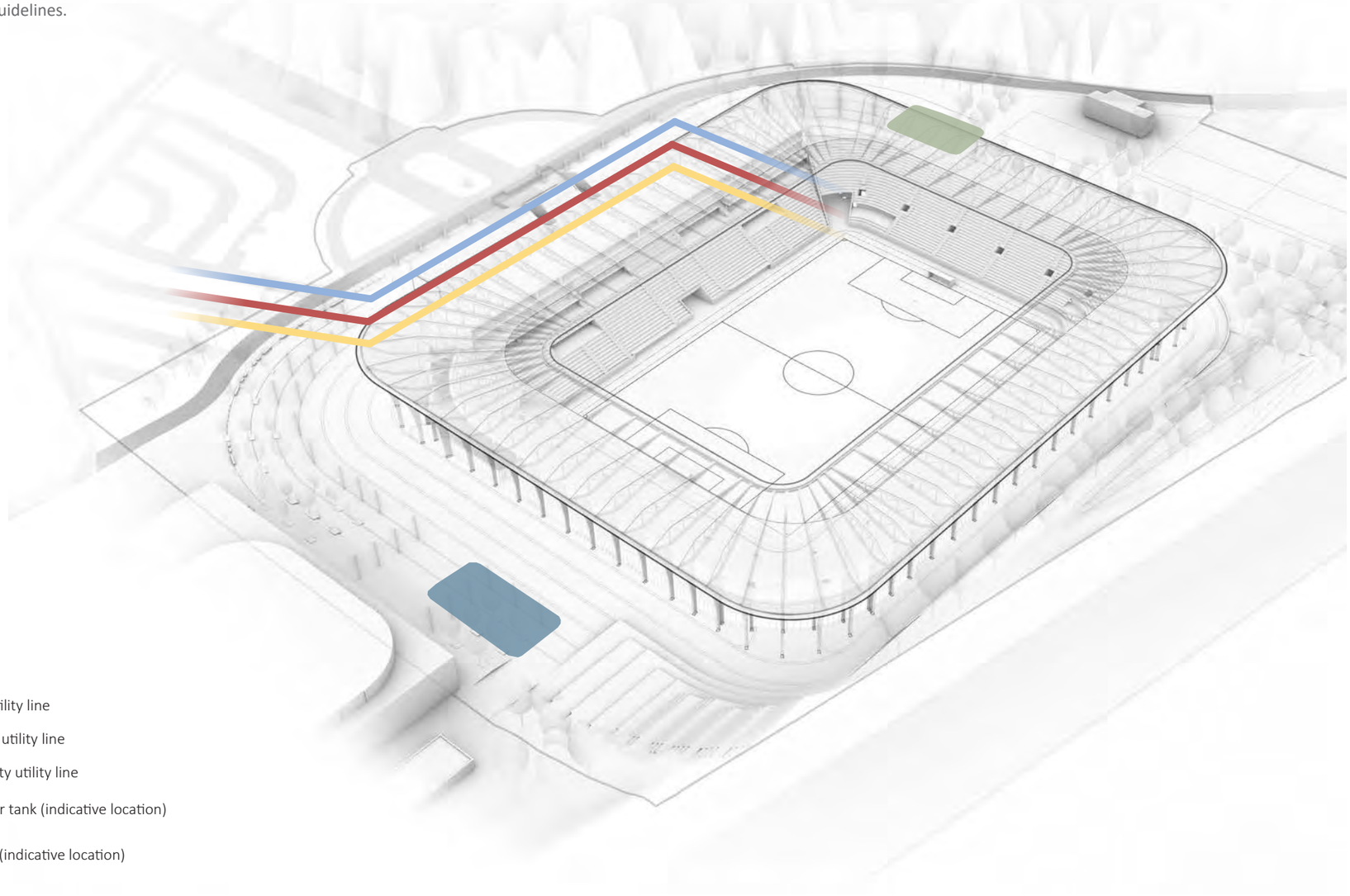
ELECTRICITY A joint plant room for electrical BMS/EMS and heating, water, sanitation/ventilation is established. All electrical equipment is carried out as "Europa-materiel" with Belgian/French socket system.

A maximum of five workstations is connected per double-pole double-pole combi-relay.

Leakage current on the drivers for the lighting fixtures are considered by following the instructions from the manufacturer.

Lighting fixtures are supplied from double-pole combi-relay. Lighting is controlled via DALI drivers as well as motion sensors in combination with motion sensors with daylight incidence measuring.

Pitch lighting is included in accordance with the UEFA and FIFA stadium lighting guidelines.



SIGNATURES

- Water utility line
- Heating utility line
- Electricity utility line
- Sprinkler tank (indicative location)
- Fascine (indicative location)

1.9. BUILDING SERVICES

MAIN PRINCIPLES FOR TECHNICAL INSTALLATIONS

14.7 VENTILATION

Ventilation in the building's common areas is to the largest extent possible handled by devices with rotating heat exchangers.

Common areas are served by diffuse air supply distributed across the entire ceiling area with exhaust through exhaust fittings. This allows for a very homogenous ceiling surface throughout the lounge and office areas.

14.8 INDOOR CLIMATE

It is a priority for our team to ensure an optimal indoor climate, as it has a major impact on the overall stadium visit experience for staff, fans, and other guests alike. The most important aspects in this regard are temperature, air, light, and sound – the collective experience of these elements is at the base of an optimal indoor climate and experienced comfort.

THERMAL AND ATMOSPHERIC INDOOR CLIMATE

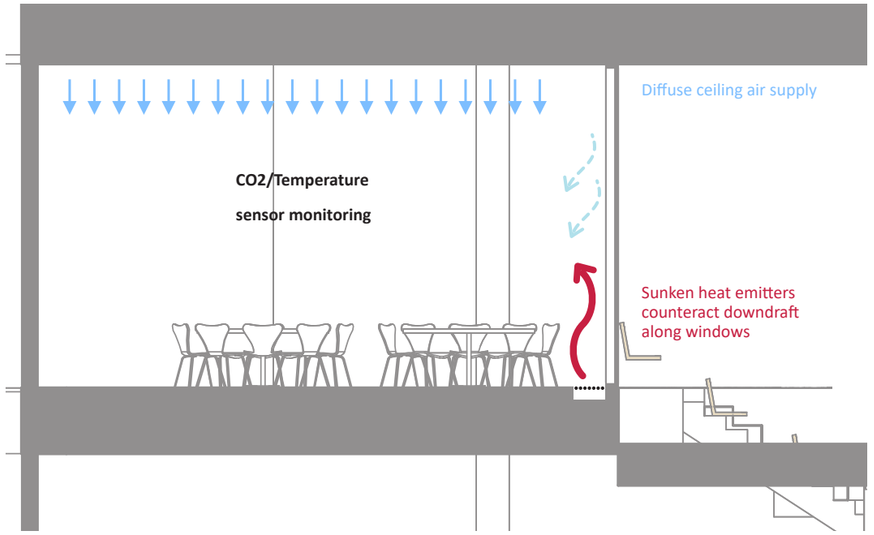
We have put great emphasis on constructional solutions, such as thermal mass, low U-values and protected window areas depending on façade orientation, to ensure a stable thermal and comfortable atmospheric indoor climate.

The architecture's large roof overhang provides extensive shading for the interior functions, thereby eliminating the need for solar control glass and additional solar screening. The lounge areas will thus be able to enjoy clear and unobstructed views of the pitch without uncomfortable overheating.

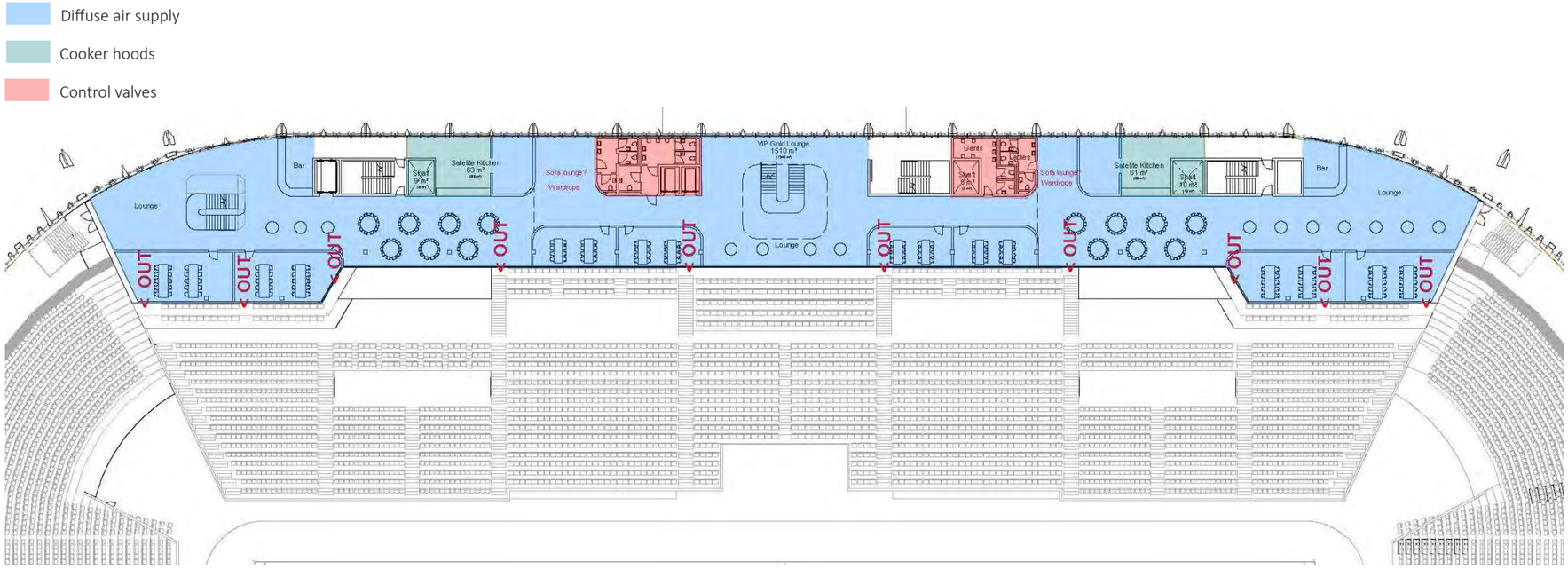
Furthermore, the mechanical ventilation is continuously adapted to match current needs, thus ensuring effective heat utilisation, and reducing energy consumption.

During the design stages, the thermal and atmospheric indoor climate will be tested and documented based on indoor climate simulations. For instance, the different spaces will be exposed to simulated interior and exterior thermal loads and compared to the installed ventilation.

The thermal and atmospheric indoor climate will, at the minimum, be designed and dimensioned according to indoor climate class "Standard" as described in "Branchevejledning for indeklimaberegninger" as well as the DGNB manual.



INDOOR CLIMATE REGULATION - REPRESENTATIVE SECTION OF LOUNGE AREA



VENTILATION PRINCIPLES - REPRESENTATIVE PLAN OF MAIN BUILDING

1.9. BUILDING SERVICES

OVERALL PRINCIPLES FOR FIRE AND ESCAPE STRATEGY

This section describes the overall fire strategy for the new stadium in Aarhus. It also forms the basis for further processing during the subsequent design stages towards the preparation of detailed fire safety documentation in accordance with the building regulation and the fire safety certification requirements.

At this initial stage, the purpose is to provide an overall overview of the fire safety principles, so that the contractor and consultant team are provided with a solid and realistic project for further processing to develop a safe stadium through integrated fire safety solutions.

FIRE RESISTANCE OF LOAD-BEARING AND STABILISING STRUCTURES

The fire resistance of the load-bearing and stabilising structures are designed in accordance with Building Regulations 2018 (BR18), Chapter 5: “Fire”, Chapter 3: “load-bearing structures”. Structures in general: R 120 A2-s1,d0

EVACUATION AND RESCUE OF OCCUPANTS E

Escape routes are designed to lead occupants directly to terrain outside or to emergency staircases that lead to terrain outside. Escape routes will be a combination of emergency hallways, open evacuation areas, open staircases from tribunes and traditional emergency staircases.

The stadium will be designed for a person load of 20.000 people. The number of independent exit doors and number of independent exits for escape routes are dimensioned according to the pre-accepted solutions for fire safety in BR18. All occupants will be warned and evacuated at the same time equivalent to total evacuation.

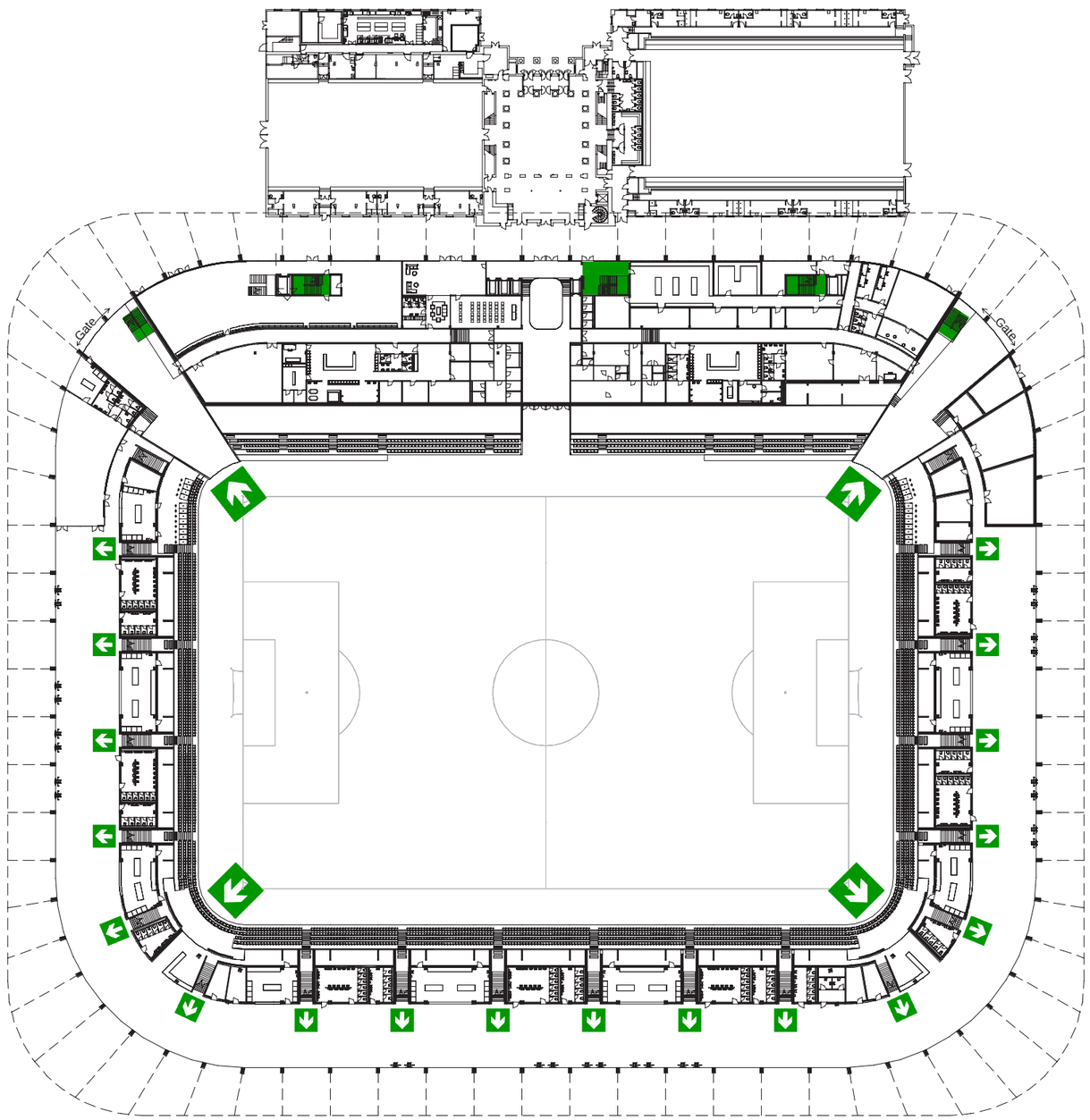
The stadium must be able to be used for other events, such as concerts. Evacuation analysis will be carried out for all known situations, designing the entire escape route system from the stadium (including from the football pitch) to terrain outside of the stadium building. Occupants are not considered to be in safety when being on the football field.

See Figure 1 for an illustration of preliminary emergency exits from the football field.

CONDITIONS FOR THE FIRE BRIGADE

The conditions for the fire brigade are designed according to BR18, Chapter 5: “Fire”, Chapter 5: “Emergency response opportunity”, to the widest extent possible. Access points for the fire brigade are evenly distributed around the stadium.

It is assumed that the conditions for the fire brigade cannot fulfil all the preaccepted requirements in the regulations, and a dialogue with the Fire Brigade in Aarhus must be established early on in the further design process of the stadium to address all necessary aspects.



PRELIMINARY EMERGENCY EXITS FROM THE FOOTBALL PITCH AND ESCAPE ROUTE STAIRS FROM MAIN BUILDING

1.9. BUILDING SERVICES

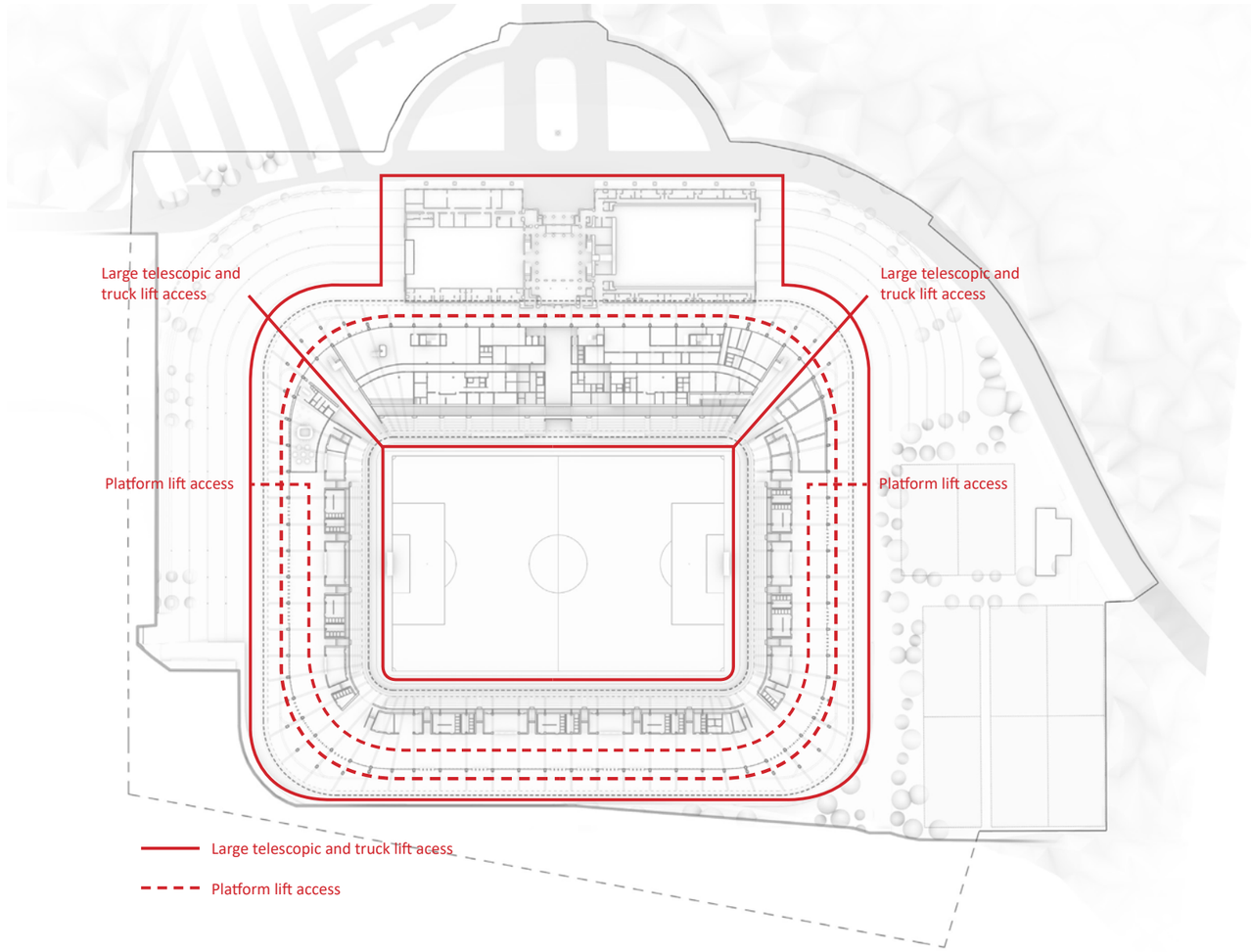
MAINTENANCE ACCESS

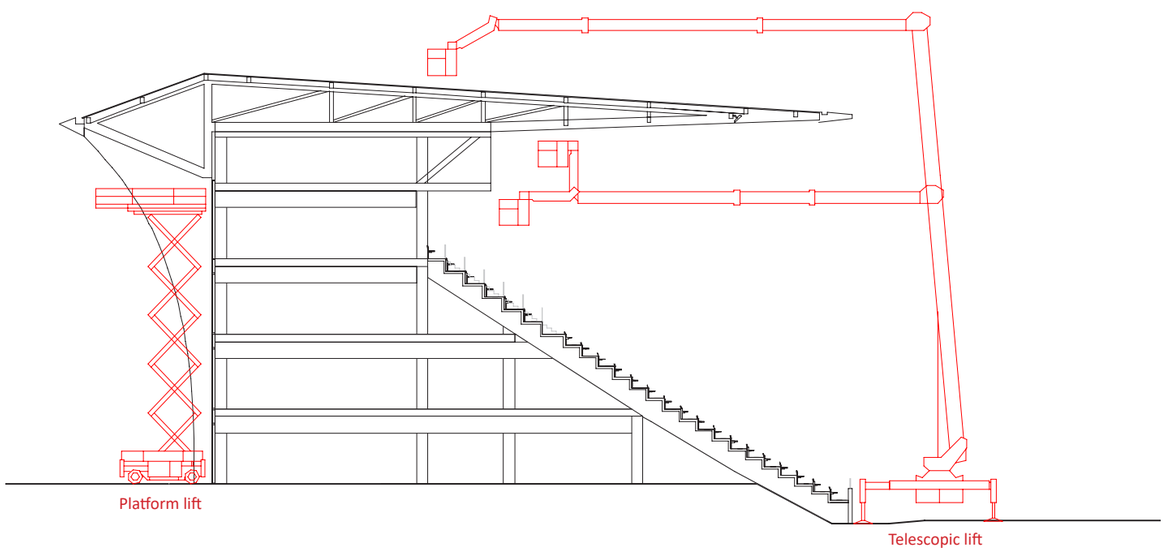
Maintenance access is offered to every section of the stadium structure and areas. Every area not directly reachable from the different floors can be reached by lifts.

Around the outer perimeter of the stadium access is secured for lard telescopic lifts, making it possible to maintain, repair and access the structure, facades, and roof all around the stadium.

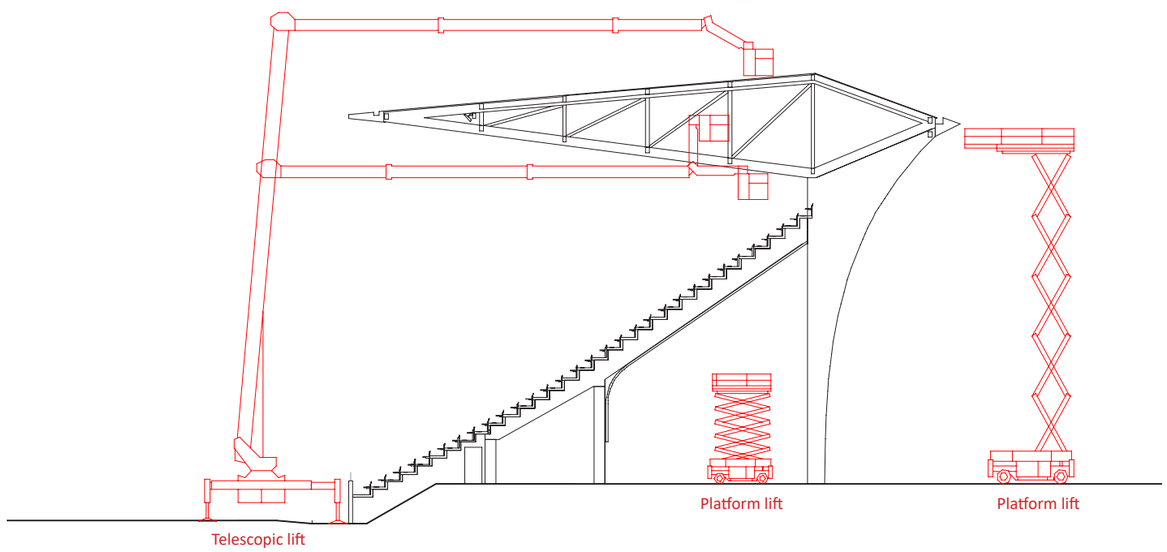
The super-vomitories in the north corners allows for the telescopic lifts to enter the stadium at the pitch perimeter. Here they will be able to reach all rows on the stands, the roof beams and rim as well as the roof of the bowl. This allows easy access to changing and adjusting lights and speakers and more.

Inside the concourse the inner facades and ceilings can be reached be smaller platform lifts that can enter through designated service access gates.





NORTH STAND



WEST, SOUTH AND EAST STAND

1.9. BUILDING SERVICES

COMMISSIONING

The commissioning manager helps you and your employees set requirements for the building's function, energy consumption, operation and operatingeconomy, which can be verified throughout the entire constructionprocess.

1. REQUIREMENTS FOR BUILDING PERFORMANCE AND OPERATION

Architectural and engineeringprojects are scrutinized interdisciplinary by operational experts to verify that the project meets the Commissioning requirements.
The commissioning team functions as a critical partner and ensures that the project is adapted to the requirements, in the best way. Adaptations made in the design process are significantly cheaper than adaptations later in the process.

2. QUALITY MANAGEMENT OF THE PROJECT: FUNCTION AND BUSINESS ECONOMICS

Transversal test paradigms are drawn up and the completed building is tested across disciplines and companies to verify that the Commissioning requirements are met.

3. TEST OF THE BUILDING TECHNOLOGY

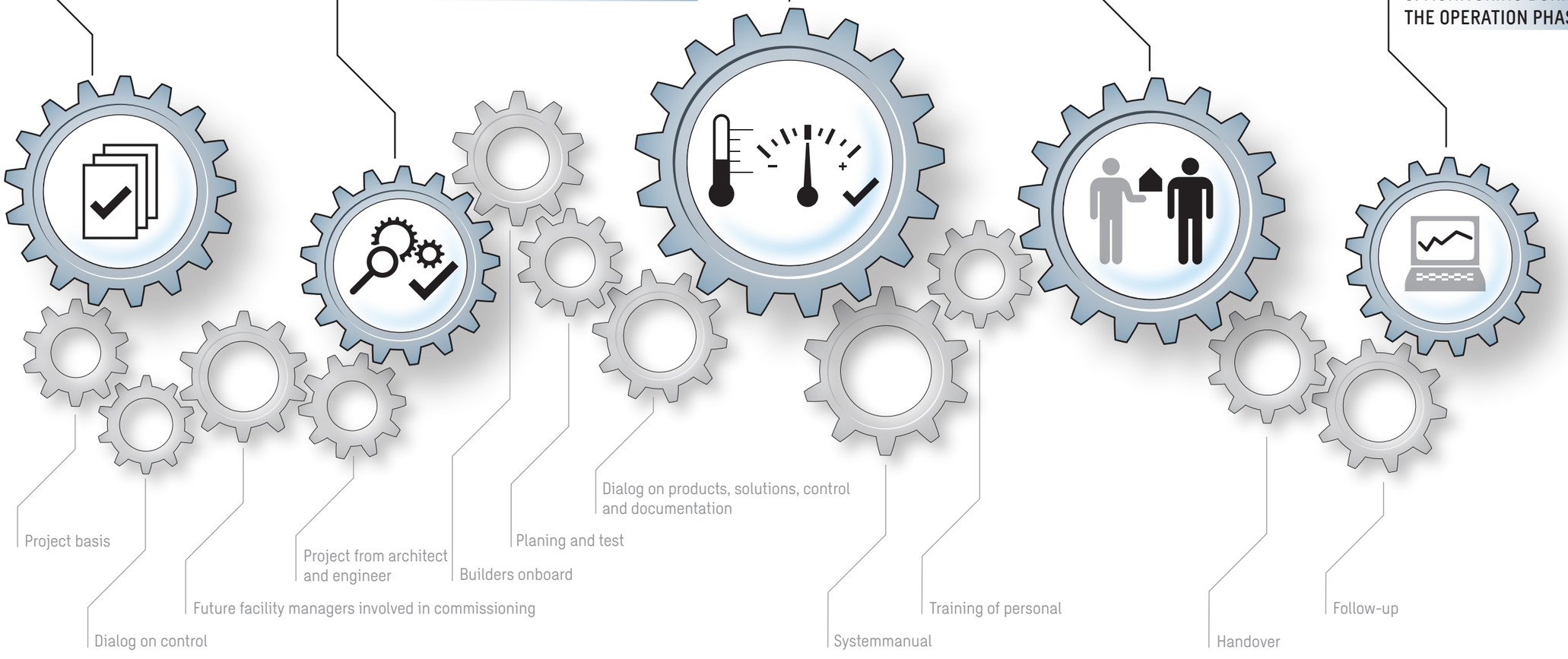
An intensive training course is carried out by the operating employees to ensure that the employees are prepared to operate the building optimally from day one.

The building's documentation, project material, quality assurance, operation and maintenance material are continuously collected in your own format, and this material is used as the basis for the teaching.

4. THE BUILDING BEING HANDED OVER

When the building is in operation, the conditions are monitored, which you can use, partly to maintain the quality from the completion of the construction, partly to provide material for continuous comparison with other buildings and to make optimisations. This is typically energy consumption and settings and overrides of technical systems.

5. MONITORING DURING THE OPERATION PHASE



1.10 BOWL ACOUSTICS

STADIUM EXPERIENCE Providing optimum acoustic conditions in the bowl is essential for creating the intensity and intimacy of the football match, vital to the full experience of the game.

The focus of the acoustic design is the interaction between the spectators as well as between spectators and players to ensure a great experience for everyone.

STADIUM DESIGN FEATURES Several design features improves the acoustic experience of the stadium, e.g.:

Proximity from field to stands optimizes distribution of direct sound between field and stands.

Large stand roofs create sound reflections that enhances reverberation and sound distribution in the bowl.

Perforated steel mesh in upper rear part of stands reduces unwanted sound reflections in concert setup.

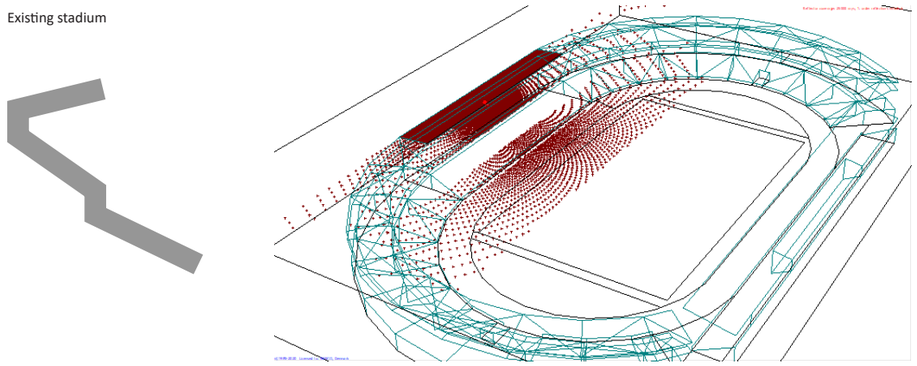
Sound reflecting surfaces that can potentially cause slapback echoes are minimized.

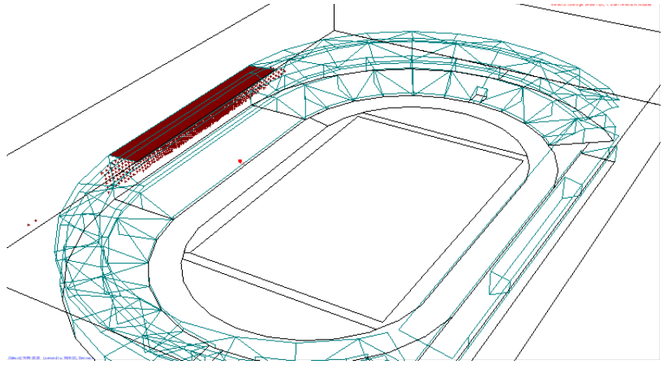
ACOUSTIC ANALYSIS During the development of the stadium design, initial acoustic analysis have been conducted in order to achieve the optimum slope of the ceiling.

For reference the acoustic analysis have been compared with the existing Ceres Arena.

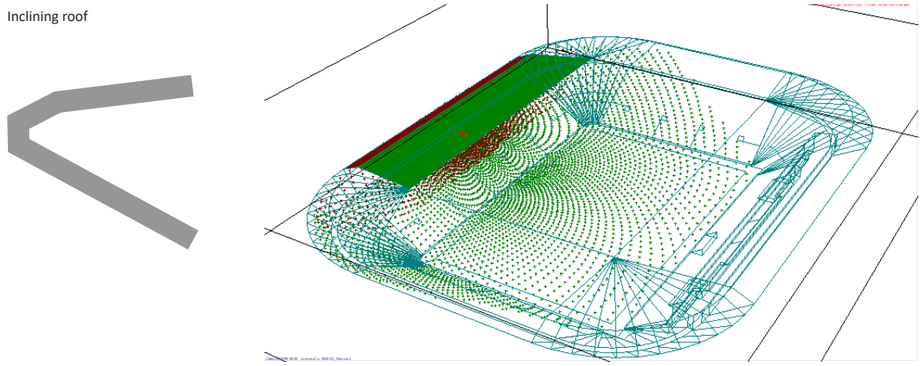
Among others, the reflection coverage of the stand roofs has been investigated. The analysis show that the optimum reflection coverage is achieved with a slightly declining roof profile that optimizes the balance between sound reflections to the pitch and on the stands.

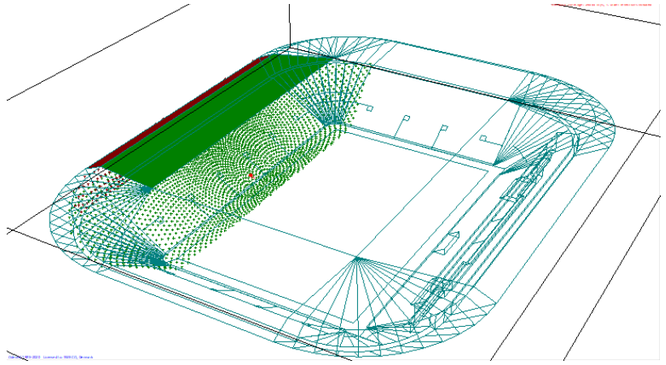
Existing stadium





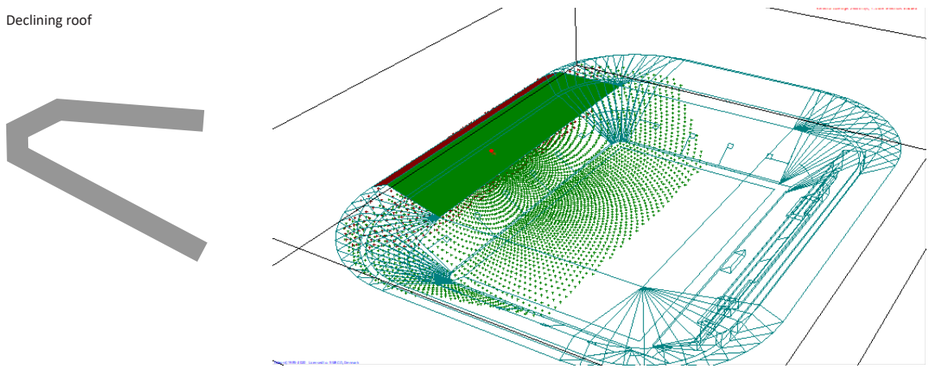
Inclining roof

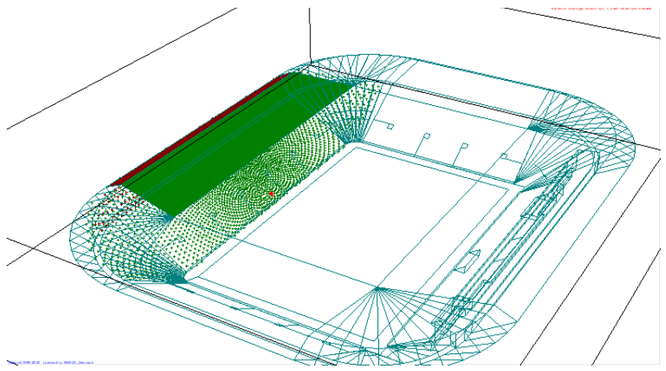




PROPOSED OPTION

Declining roof





Spectator on rear part of stand

Spectator near the field

STAND PROFILE COMPARISON - REFLECTOR COVERAGE ANALYSIS

1.10 BOWL ACOUSTICS

FINAL LAYOUT The declining roof balances the natural amplification on the stands and between stand and pitch.

The comparative analysis with existing arena shows a strong improvement of a number of acoustic parameters important to the stadium experience:

Increased reverberation time - improved feeling of spaciousness and envelopment

Reduced spatial sound decay - enhanced interaction between audience and players

Improved sound strength distribution - increased sound levels

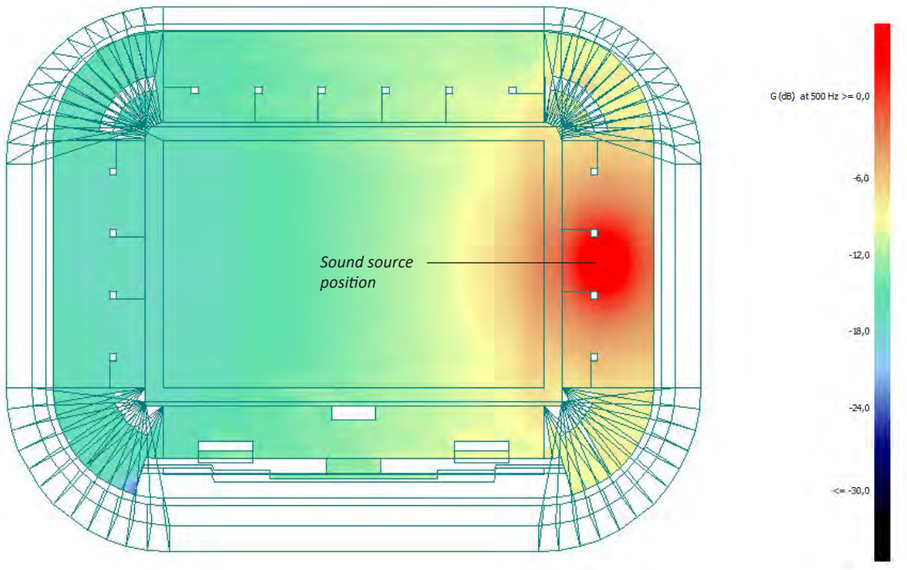
Greater reflector coverage - helps projecting the sound from the spectators to the field to create the 'roar of the crowd' and to increase sound intensity on the stands.

CONCERT SETUP The stadium design is well suited for concerts using line arrays that direct the sound towards to listernes. The declining roofs help reducing unwanted late sound reflections towards listernes, providing a good combination of direct and reverberant sound.

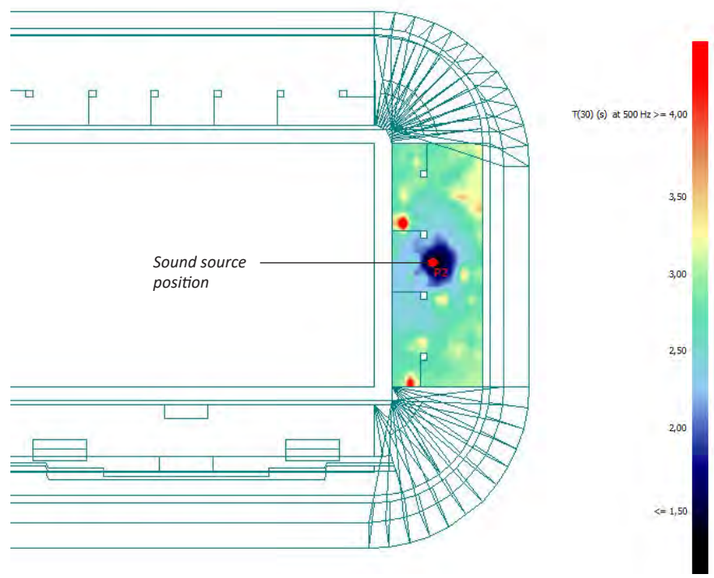
As an option an additional retractable curtain can be mounted in the rear part of the ceilings to further reduce sound reflections.

EXTERNAL NOISE The external noise transmission to the surroundings will be reduced compared with the existing stadium.

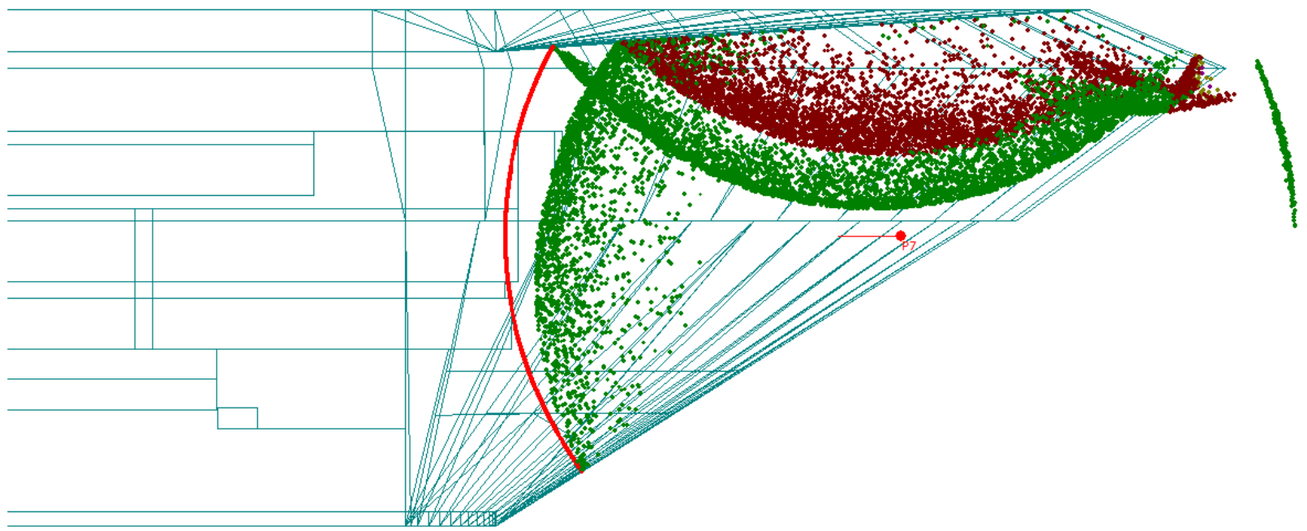
Noise from rainfall on the stand roofs is handled using multilayered PTFE. Rainfall on corrugated metal roofs with the given metal sheet thickness is not expected to be obtrusive.



SOUND STRENGTH DISTRIBUTION ANALYSIS



REVERBERATION TIME ANALYSIS



1.10. BOWL ACOUSTICS

ACOUSTIC ANALYSIS

REVERBERATION TIME

Reverberation is an essential part of stadium acoustics. Longer reverberation times enhances the envelopment and feeling of spaciousness.

The graphs show distribution of reverberation time in different zones on the stands under varying levels of occupancy.

The reverberation time varies from approx. 2,3-3,1 seconds at mid frequencies with an occupancy from 30-100%.

This can be compared to approx. 1,4 seconds at mid frequencies for the existing stadium at full occupancy which means a clearly more reverberant space. Further, it can be compared to the reverberation time in the national Danish stadium Parken of approx. 3,0 seconds at mid frequencies - however this stadium is considerably larger and will have a natural longer reverberation time. The sensation of reverberation is thus expected to be comparable to Parken.

100 % OCCUPIED

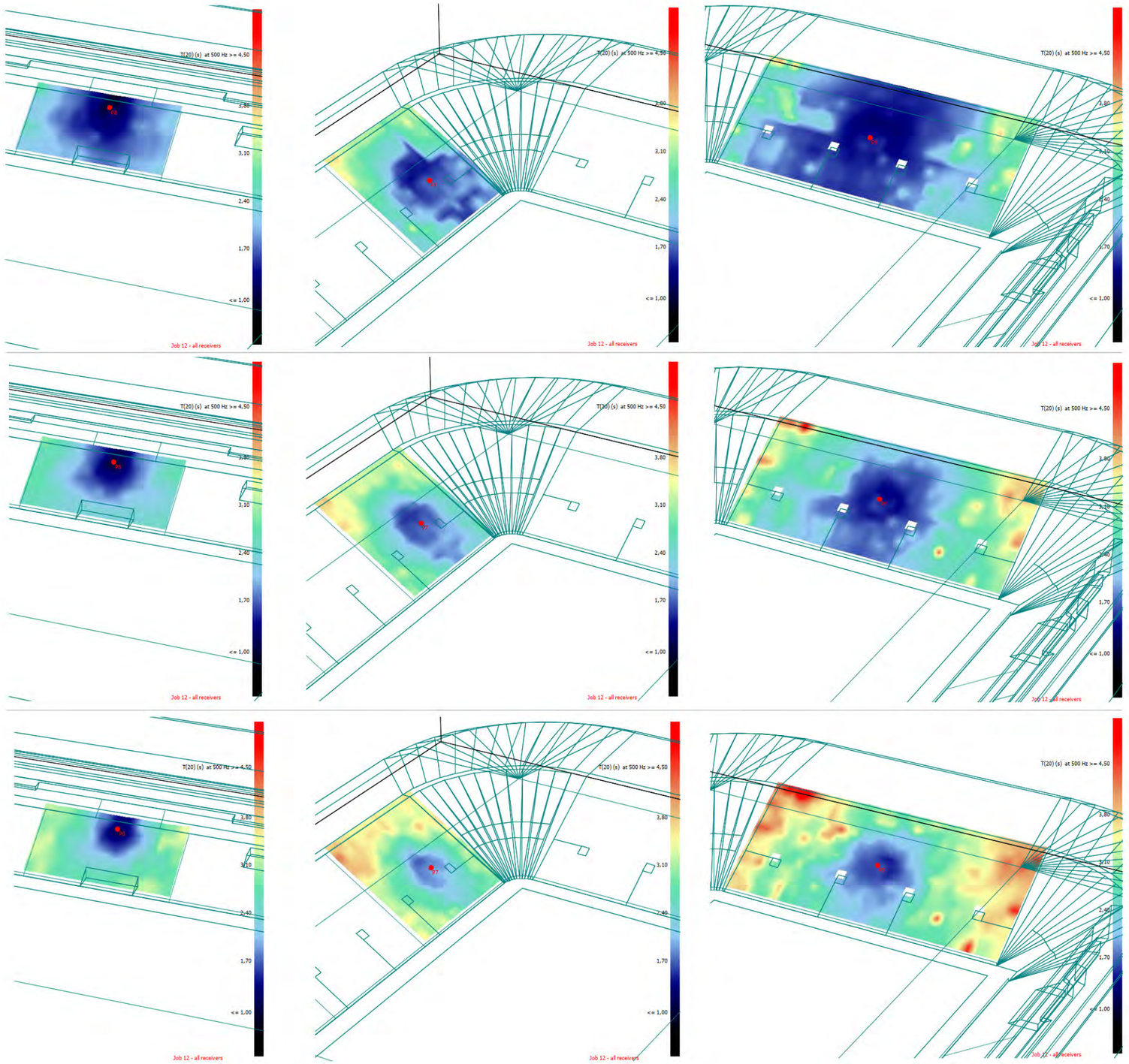
$T_{20,500Hz}$ = 2,3 SEC

60 % OCCUPIED

$T_{20,500Hz}$ = 2,6 SEC

30 % OCCUPIED

$T_{20,500Hz}$ = 3,1 SEC



1.10. BOWL ACOUSTICS

ACOUSTIC ANALYSIS

DIRECT SOUND DISTRIBUTION

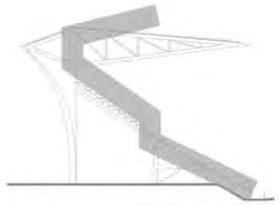
The graphs show calculation of direct sound distribution in fully occupied stadium.

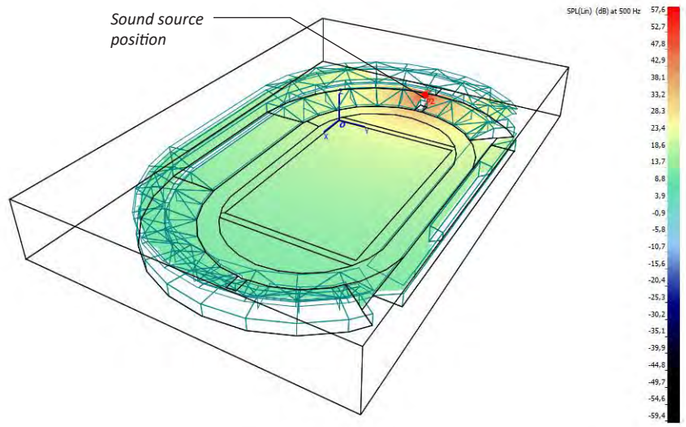
The direct sound does not include reflected sound and therefore only depends on distance from the sound source and the degree of clear sight from sound source to receiver.

The calculations have been carried out with the existing stadium and two different layouts of the new stadium.

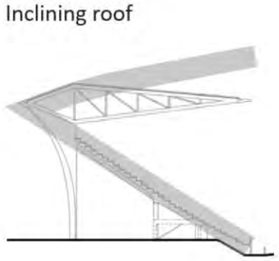
- Compared with the existing stadium, the shorter distance from the stands to the pitch show a higher level of direct sound distribution from stand to pitch. This will also be the case in opposite direction, meaning higher sound level from pitch to stands.
- The change in roof inclination does not affect the direct sound distribution

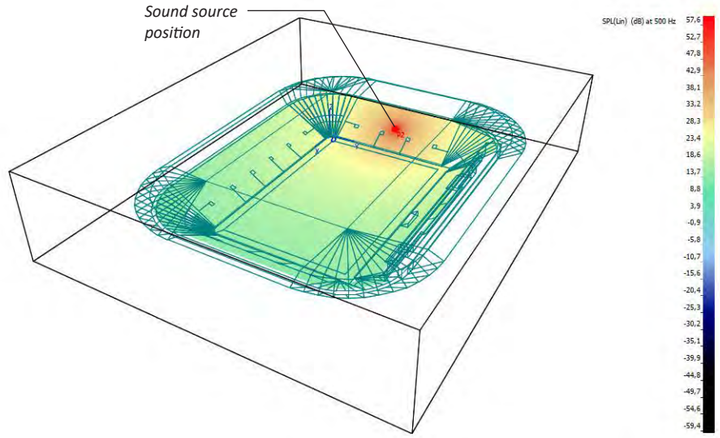
Existing stadium





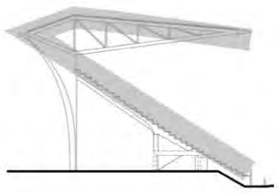
Inclining roof

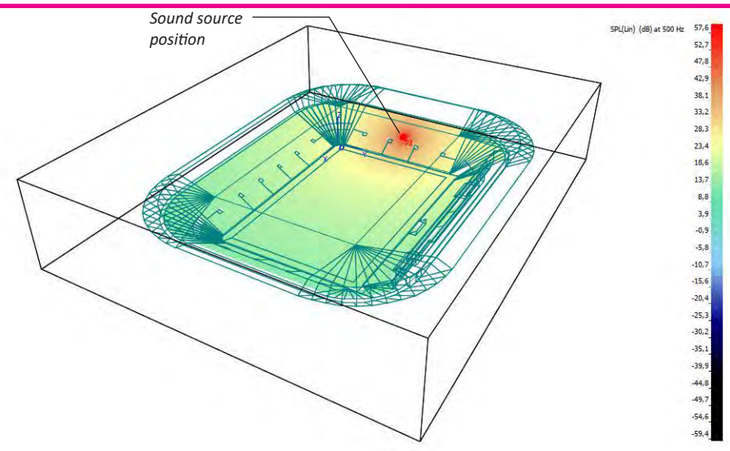




PROPOSED OPTION

Declining roof





1.10. BOWL ACOUSTICS

ACOUSTIC ANALYSIS

SOUND STRENGTH DISTRIBUTION

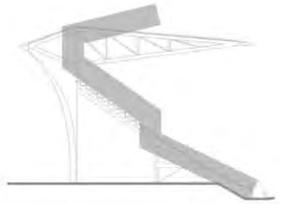
The graphs show calculation of sound strength distribution in fully occupied stadium.

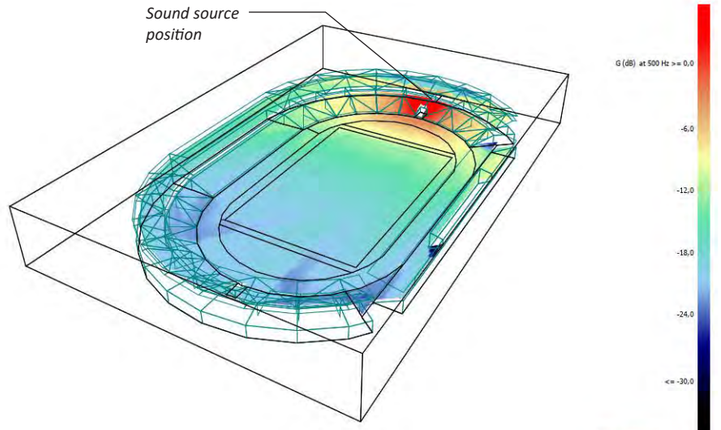
The calculations have been carried out with the existing stadium and two different layouts of the new stadium.

The sound strength is a measure of the room's contribution to the sound level and higher values of sound strength means improved natural amplification of the sound.

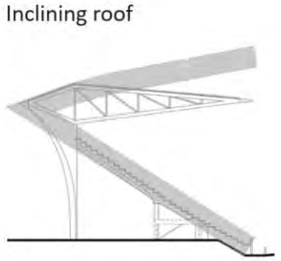
- The new stadium design shows clear improvements of sound strength compared to the existing stadium, meaning an overall louder and more enveloping experience.
- The version with declining room gives an improved gain on the stands compared the inclining roof due to the improved ceiling reflections.

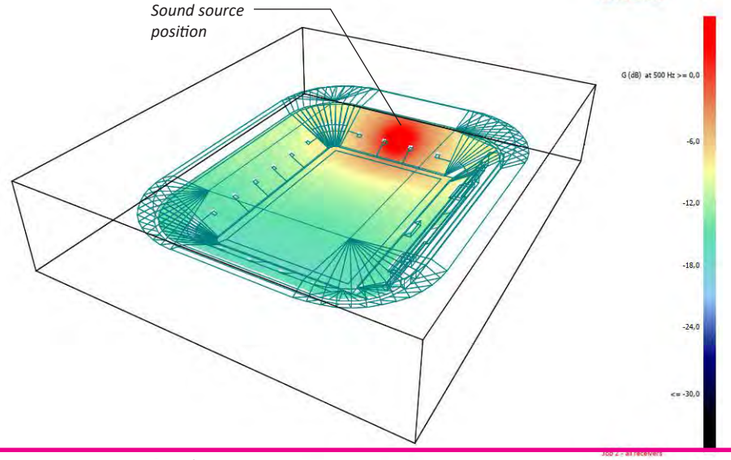
Existing stadium





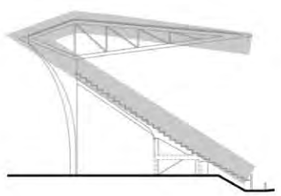
Inclining roof

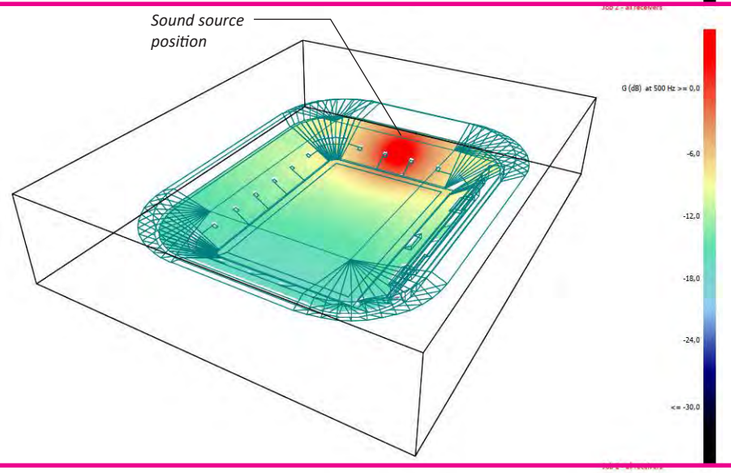




PROPOSED OPTION

Declining roof





1.10. BOWL ACOUSTICS

ACOUSTIC ANALYSIS

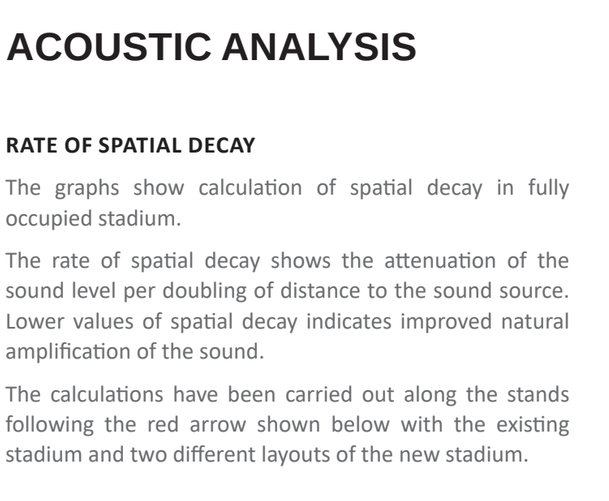
RATE OF SPATIAL DECAY

The graphs show calculation of spatial decay in fully occupied stadium.

The rate of spatial decay shows the attenuation of the sound level per doubling of distance to the sound source. Lower values of spatial decay indicates improved natural amplification of the sound.

The calculations have been carried out along the stands following the red arrow shown below with the existing stadium and two different layouts of the new stadium.

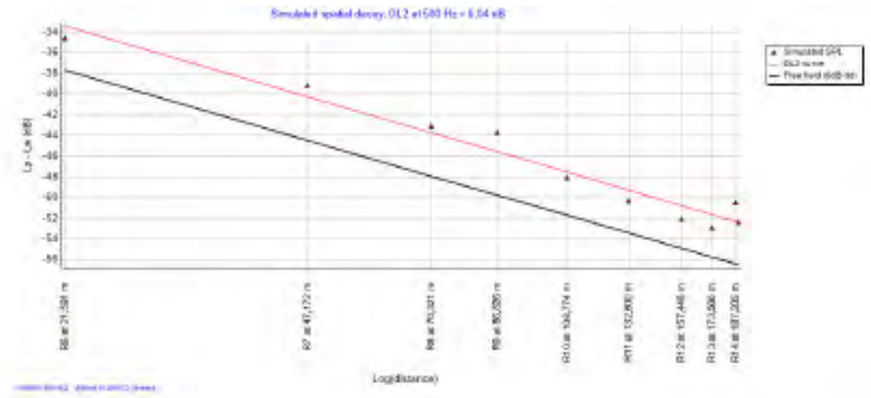
- The spatial decay is clearly reduced when the existing stadium is compared to the new, meaning that the sound is less attenuated. This gives an improved intensity and interaction between the spectators.
- The declined roof gives a small improvement on the stands compared to the inclined roof due to the higher amount of sound reflections.



PLAN LAYOUT

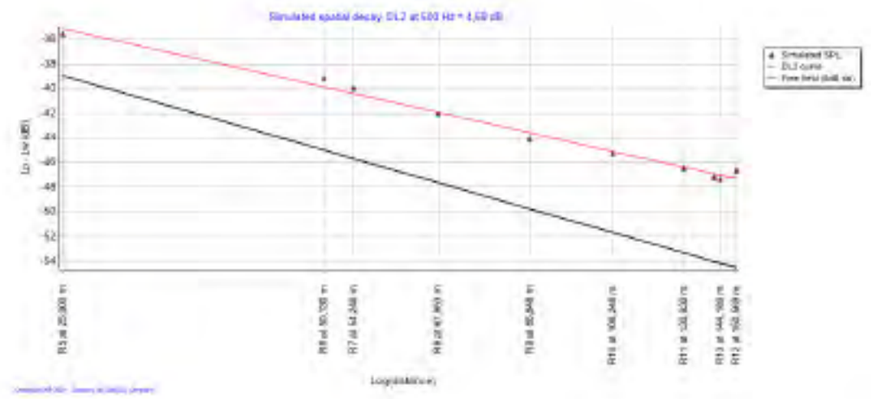
Existing stadium

$DL2_{500Hz}$ = 6,0 dB



Inclining roof

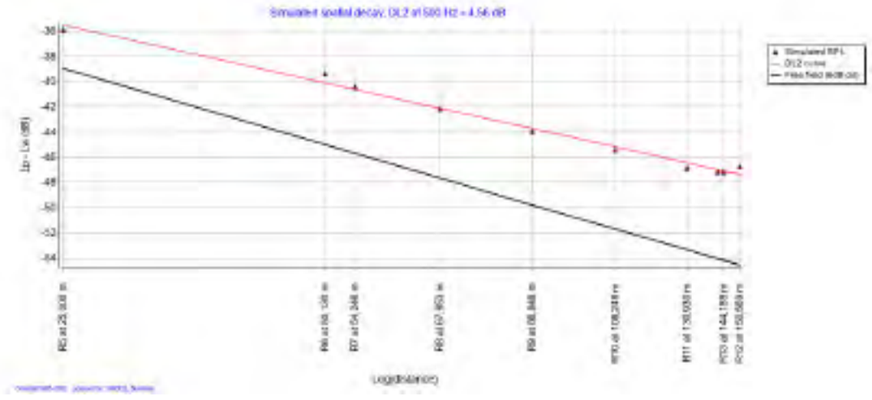
$DL2_{500Hz}$ = 4,7 dB



PROPOSED OPTION

Declining roof

$DL2_{500Hz}$ = 4,6 dB



1.10. BOWL ACOUSTICS

PAVA DESIGN

INDICATION OF PRELIMINARY PAVA DESIGN

The preliminary PAVA design consists of the following:

Directive full-range speakers mounted in the stadium roof front with approx. 12 m distance. The speaker system is designed to provide a clear speech signal to the spectators and also provide music support for sports events.

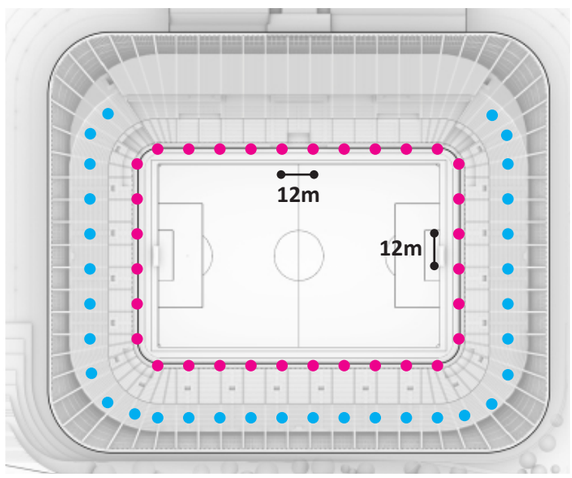
Two larger focused array speakers are used to cover the field.

In the concourse area directive speakers are used to provide the necessary sound level and speech intelligibility.

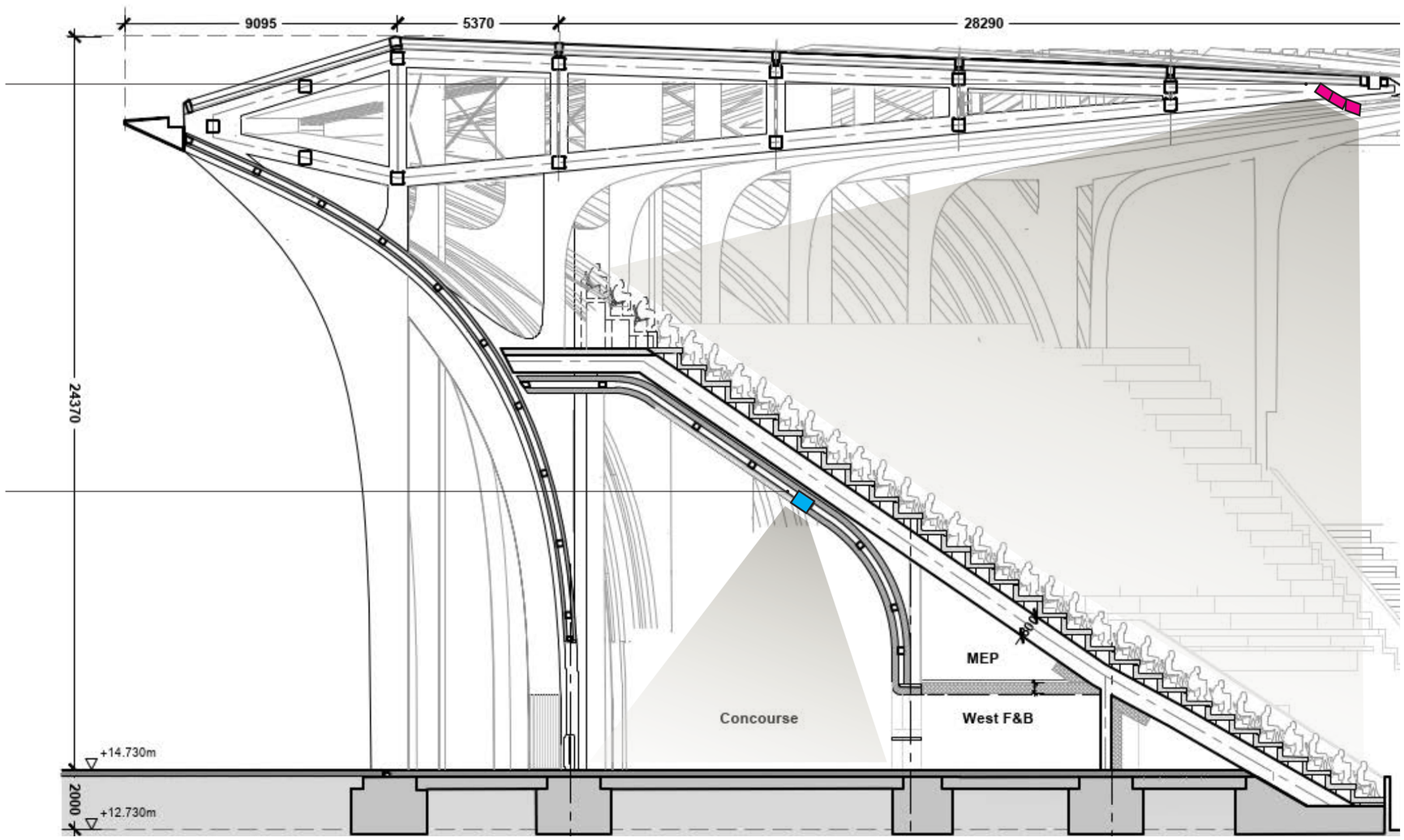
In the lounge areas distributed ceiling mounted speakers are used to provide a clear speech signal.`

Directive speakers, designed to cover the spectator area

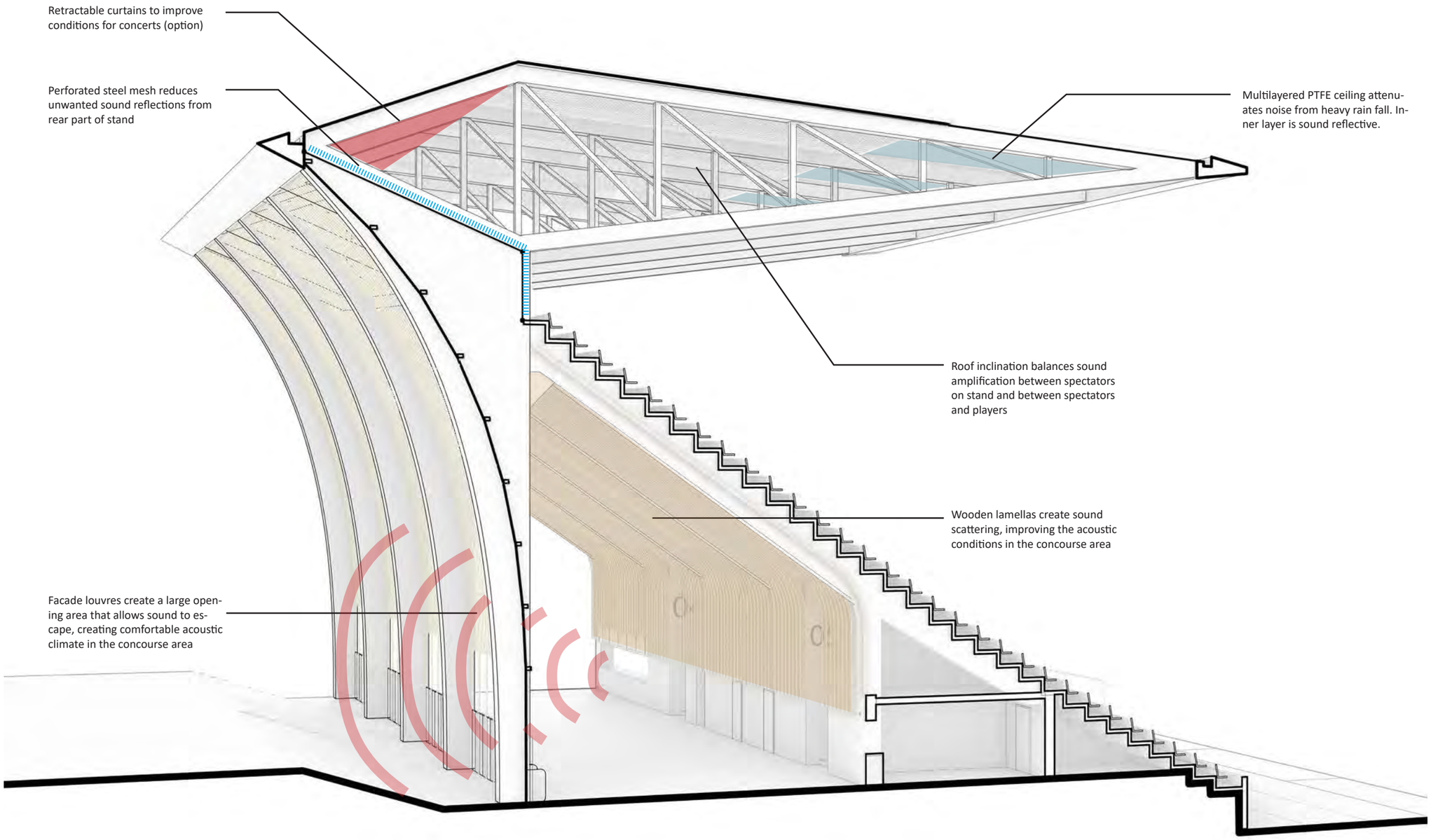
Directive speakers, designed to cover the floor space in the concourse areas



PLAN LAYOUT



1.10 BOWL ACOUSTICS



1.11. CONCOURSE AND BOWL ENVIRONMENT IN RESPECT OF SHELTER

SOLAR DYNAMICS - PITCH

All plants require light and CO2 for photosynthesis. Stimulating or adjusting the Daily Light Integral (DLI) can help reducing the rooting time of cuttings and seedlings, and increasing crop quality.

By increasing the natural daylight we decrease the need for artifical supplements and thus save energy and provide more sustainable design.

Monthly sun hour analyis allows us to understand the sun penetration and exposure of the pitch. We can use it to understand the areas which receive too little amount of sun and thus needs artificial lighting to preserve grass.

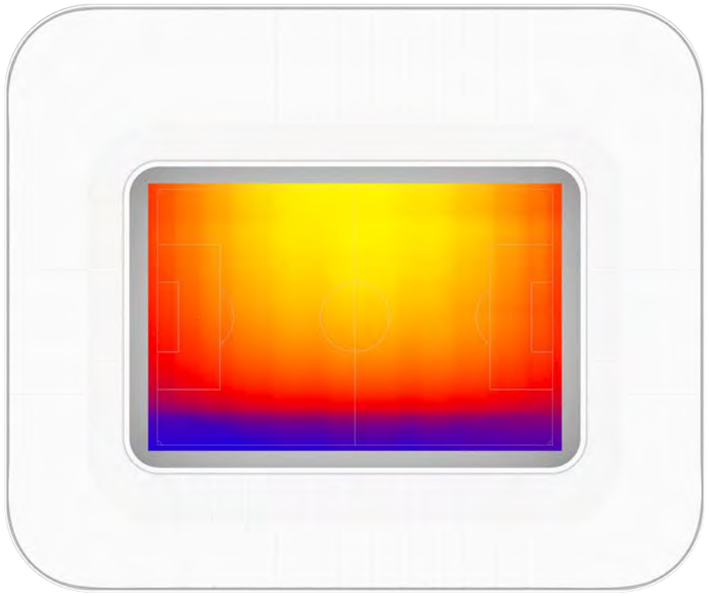
The grass needs to have a minimum of between 3-6 hours of direct sun daily.

The treshold of 3 is highligted with white outline; The treshold of 6 is highlighted with green outline.

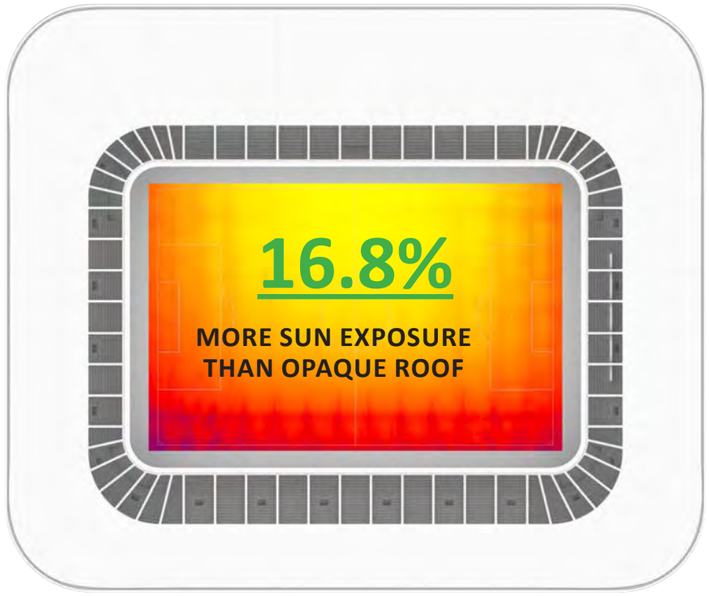
Annual Sun Hours (Cumulative)

2500
2222
1944
1667
1389
1111
833
556
278
0

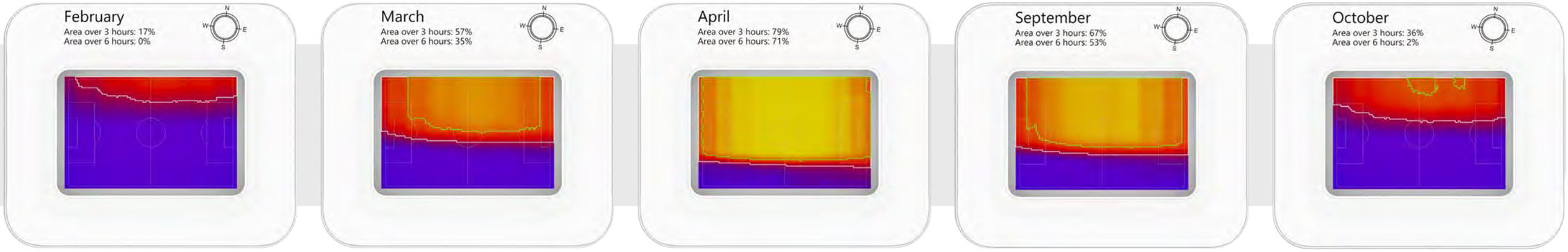
SOLAR ANALYSIS SOLID ROOF



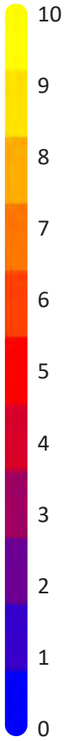
SOLAR ANALYSIS PTFE ROOF



SOLID ROOF



PTFE ROOF



1.11. CONCOURSE AND BOWL ENVIRONMENT IN RESPECT OF SHELTER

WIND SIMULATION

WIND COMFORT MAPS

These maps show the wind speed and wind comfort we will achieve on the site once the project is built.

During the design process we considered certain elements to improve outdoor passive comfort levels, like:

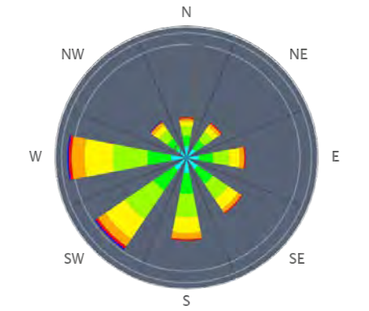
Landscaping - improves the quality of the plaza area making it a communal space for different activities

Lamella structure provide protection from the wind

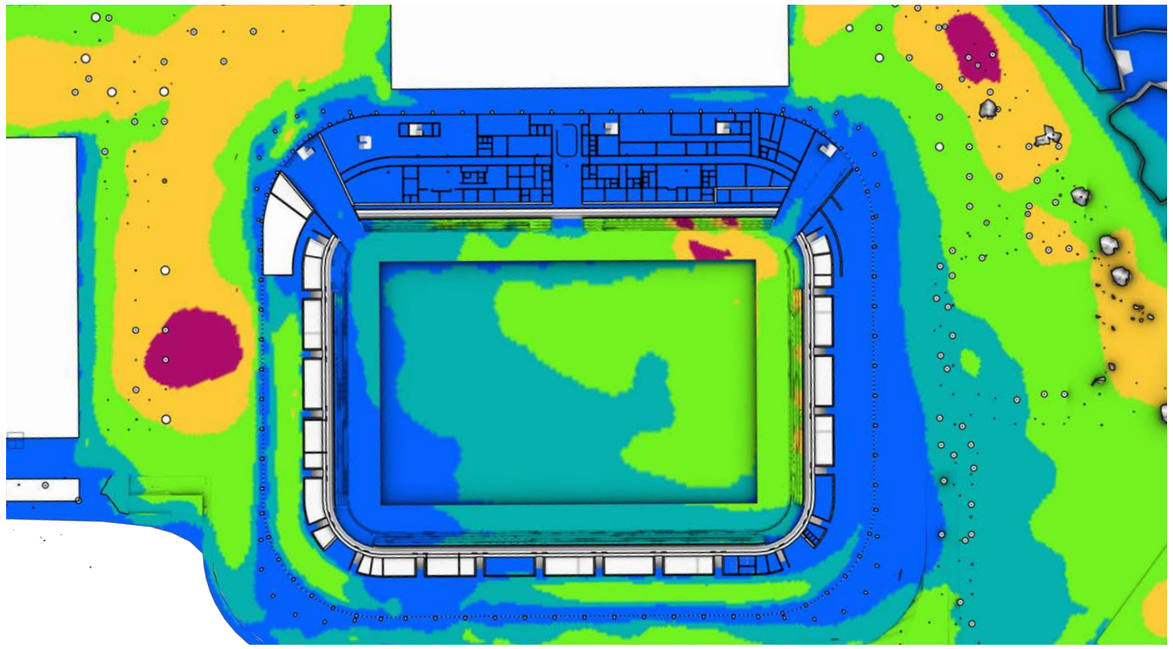
The curvature of lamellas prevents excess down-draft wind at ground level

Uniform design of Lamella structure exerts uniform hindrance to wind which reduces uncomfortable near-ground wind

Mesh structure keeps wind passing to and from the stadium area via the concourse. The design is optimised to 60% open with density composition to dissipate wind energy efficiently

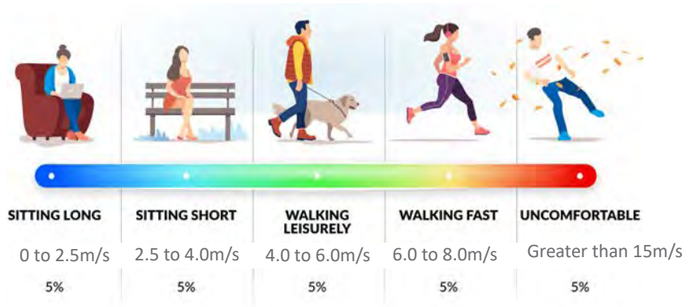


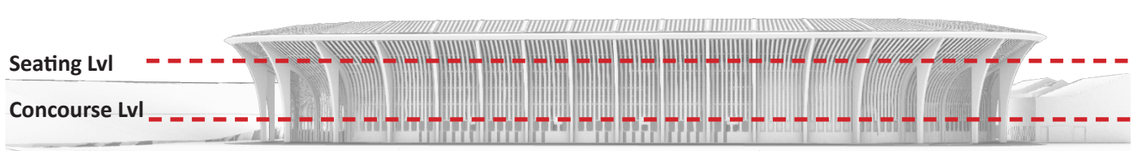
WINDROSE

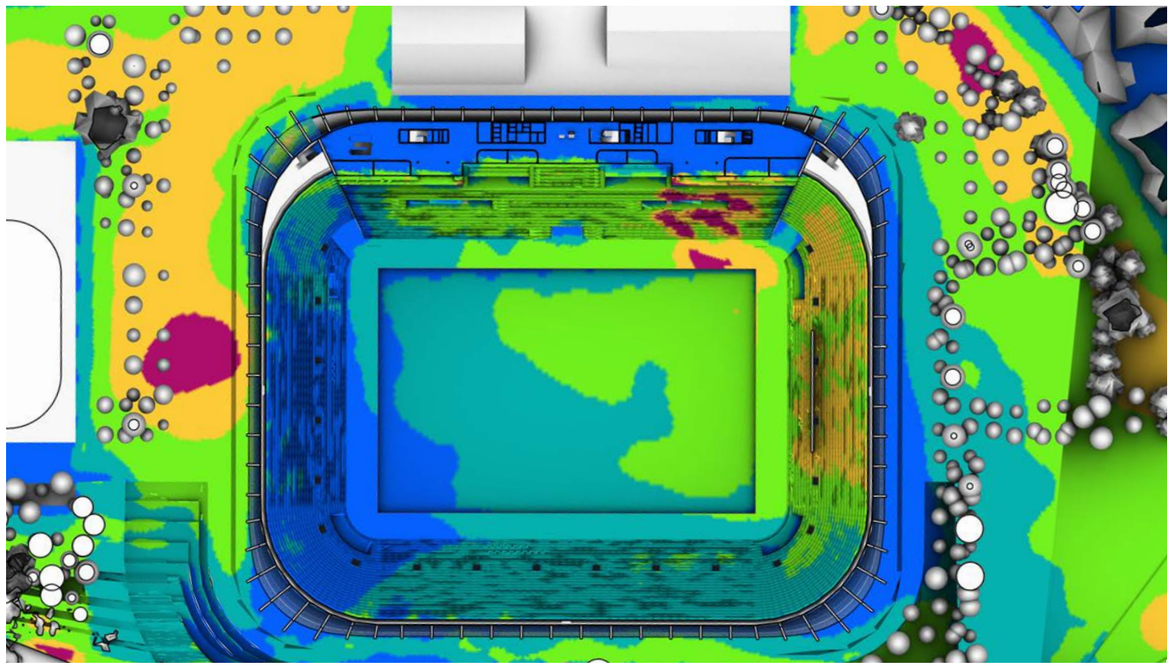


CONCOURSE LVL- PEDESTRIAN COMFORT -(BASED ON ALL WIND DIRECTION / ANNUAL DATA)

A	2.5 m/s	< 5%	Frequent Sitting
B	4 m/s	< 5%	Occasional Sitting
C	6 m/s	< 5%	Standing
D	8 m/s	< 5%	Walking
E	8 m/s	> 5%	Uncomfortable
S	15 m/s	> 0.022%	Unsafe







SEATING LVL- PEDESTRIAN COMFORT -(BASED ON ALL WIND DIRECTION / ANNUAL DATA)

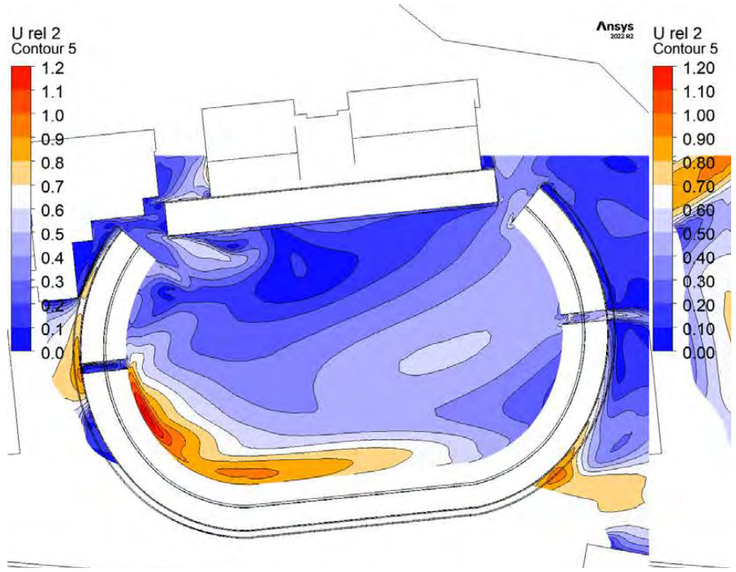
1.11. CONCOURSE AND BOWL ENVIRONMENT IN RESPECT OF SHELTER

KEY AREAS-WIND

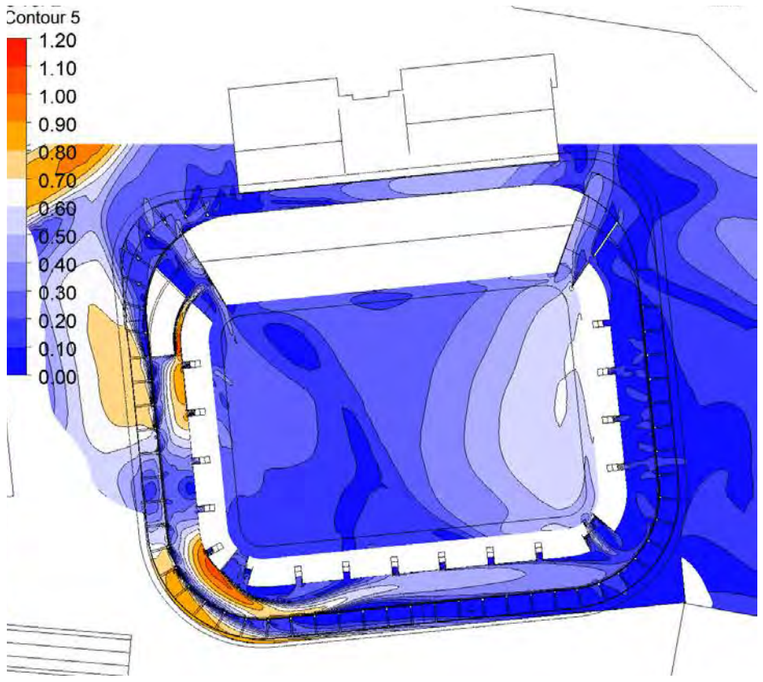
Graphics showing a plane 1.5m above new stadium ground-level, and wind outside and inside the concourse, wind from the west.

The color scale has been constructed to better give a sense of the ground-near wind qualities: blues are generally good, with the fractions 30-40% being regarded as a good rule-of-thumb for where people gather. White marks a transition zone at 60%, and orange and finally red means either similar or higher wind than the far-field unsheltered wind.

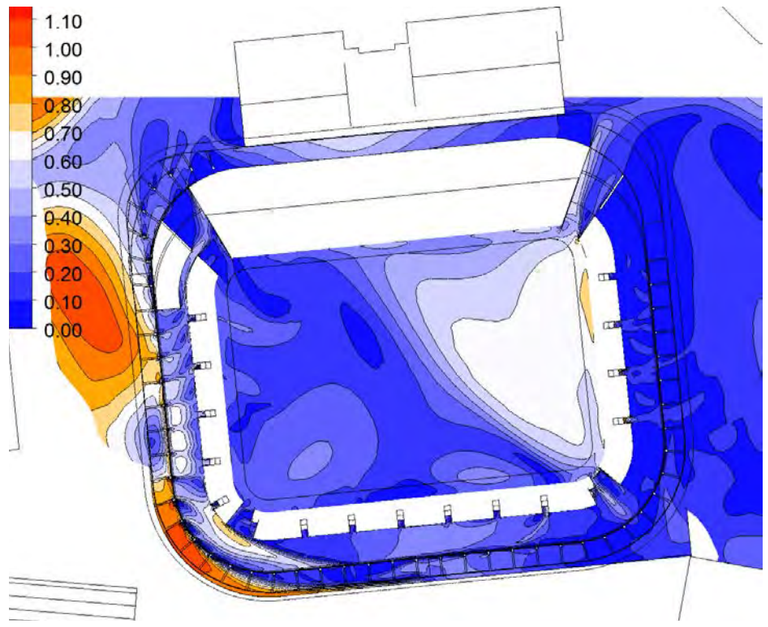
With the uniform lamella densities, there are some areas with higher winds inside the concourse. The wind speed through the lamellas is generally low, but still they all add up given the large façade meeting the wind, and the “accumulated” low-speed wind inside the concourse must exit somewhere. This yields the higher wind speeds, found in the southwest corner, and somewhat to the northwest corner as well. One possible solution to this is to make the western façade denser, though this also increases the ground-near wind on the outside. So for this new stadium, the wind comfort will be a trade-off between inside and outside wind intensities.



EXISTING STADIUM



POROUS STADIUM
40% OPEN WEST FAÇADE



FULLY ENCLOSED STADIUM
100% DENSE WEST FAÇADE

1.11. CONCOURSE AND BOWL ENVIRONMENT IN RESPECT OF SHELTER

KEY AREAS-WIND

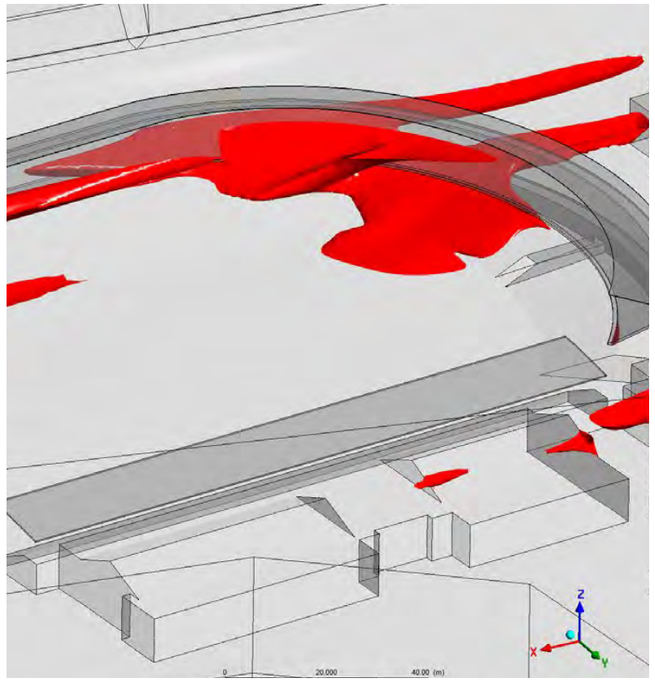
The current and new stadium is compared on a detailed level using CFD-software Ansys CFX, including terrain model and nearby vegetation. The conditions are similar for all simulations, using an average of 7m/s inlet wind speed. The actual wind speed used here is usually not considered important, as the wind will move in similar ways also for, say, 3m/s and 10m/s. Therefore the results are also reported in relative terms.

The new stadium proposes different lamella density distributions. In the detailed simulations shown here, a uniform lamella density is used. They have porosity of 61% (39% gap), and tall gates with the same pressure loss properties (the exact design of this can be settled at a later point).

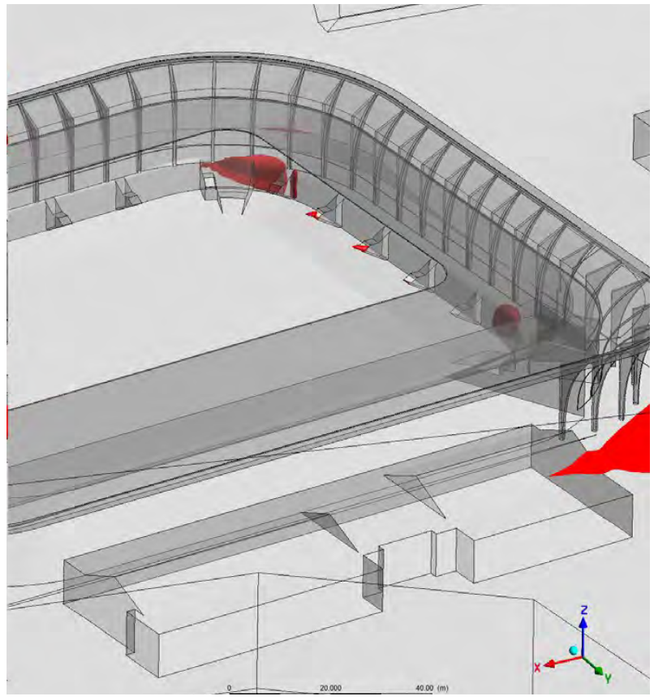
The red areas shown in images to the right are meant to highlight areas with relatively high local winds, and which is reduced only 30% from the far-field (inlet) wind. Doing this comparison will probably make it easier to understand the wind conditions on the new stadium, for people how know the conditions at the current stadium. Choosing to show 20% or 10% wind reduction instead could also be used here, it would pose the same advantage/disadvantage to both the old and new stadium, only the red regions would only be shrunk and less visible in the graphics.

Only few pockets of this high wind occurs in the new stadium, and none occur if west façade is closed, but this also means higher wind on the outside ground around the southwest corner.

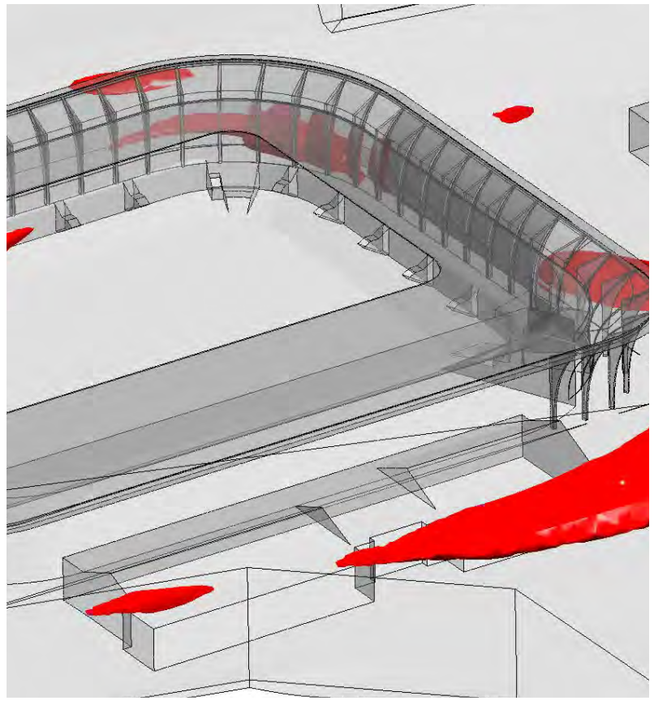
Technical details: in these simulations porous elements are used instead of exact lamellas, but separate simulations have been performed to determine the actual pressure loss curve. The simulations are all steady-state, using SST turbulence model, 2nd order advection, and achieves good convergence.



EXISTING STADIUM



POROUS STADIUM
40% OPEN WEST FAÇADE

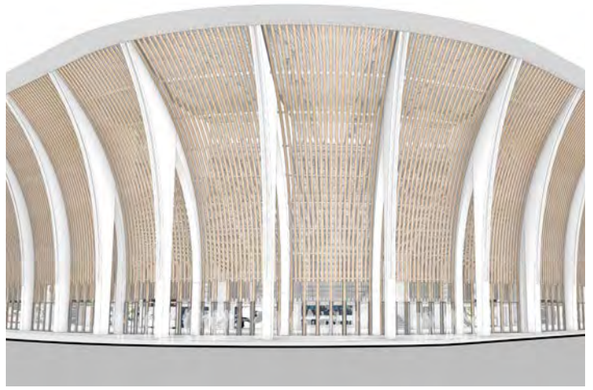


FULLY ENCLOSED STADIUM
100% DENSE WEST FAÇADE

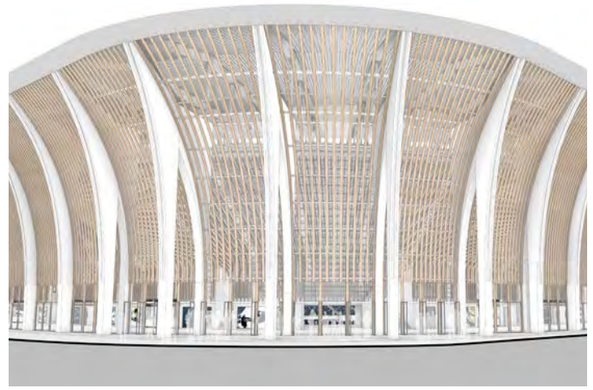
1.11. CONCOURSE AND BOWL ENVIRONMENT IN RESPECT OF SHELTER

LOUVER FLEXIBILITY

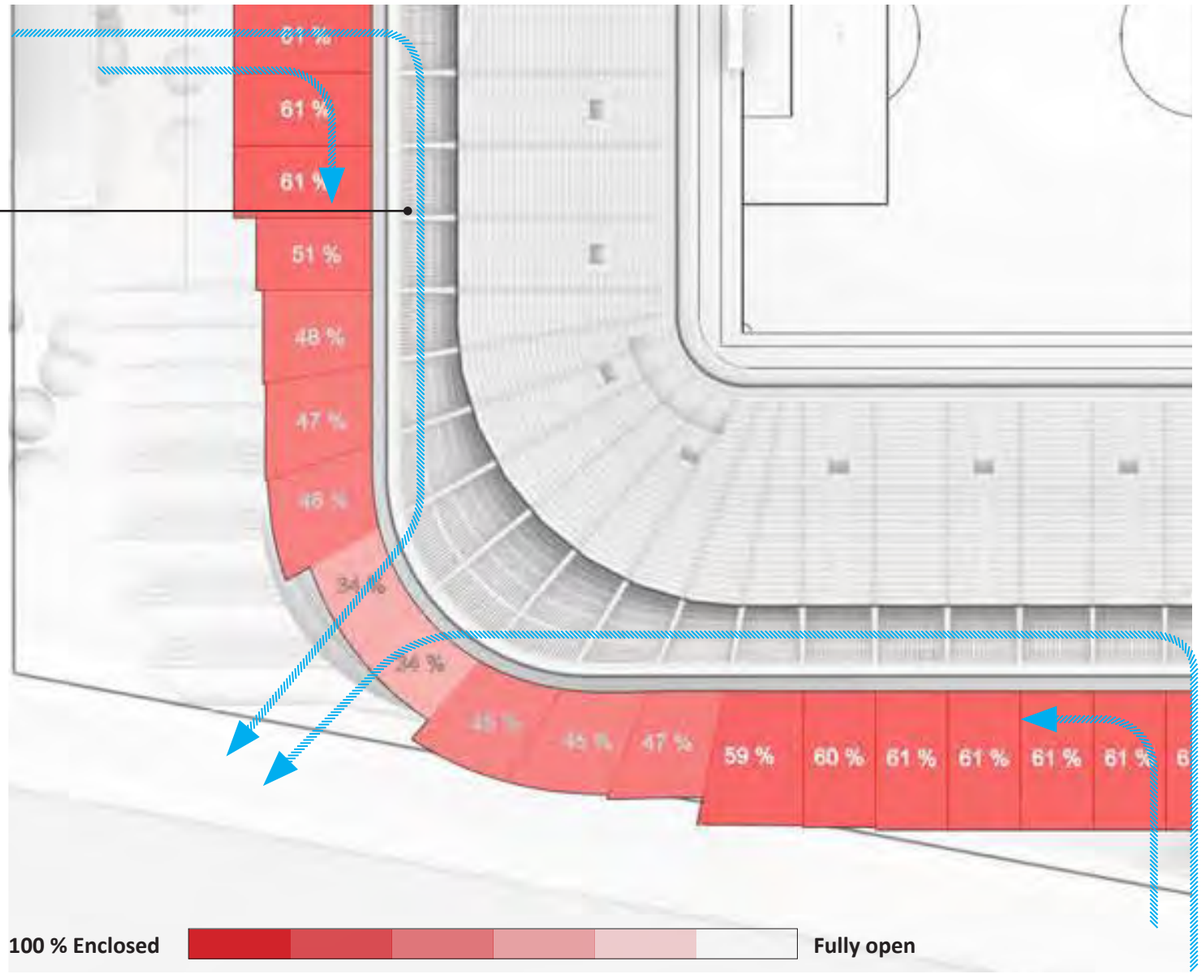
The louver density adjusts according to the challenges on site, and be adapted to to increase or decrease depending on wind protection needs, creating a much more comfortable environment.



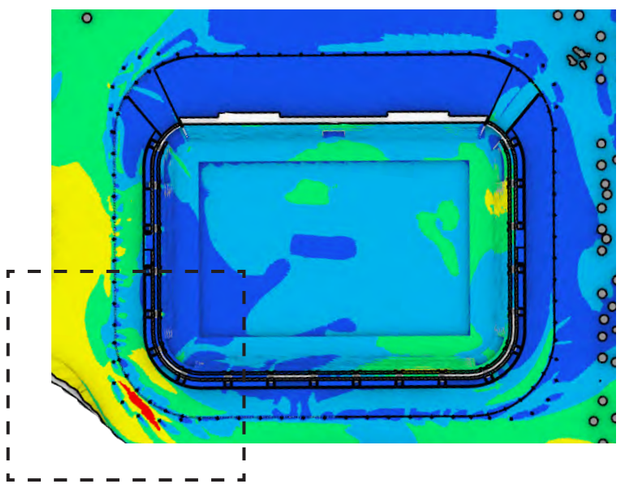
SOUTHWEST CORNER - DENSE COURNERS



SOUTHWEST CORNER - POROUS CORNERS



SOUTH-WEST CORNER PLAN



WIND ANALYSIS

ZAHA HADID LTM, SWECO DANMARK A/S, TREDJE NATUR APS

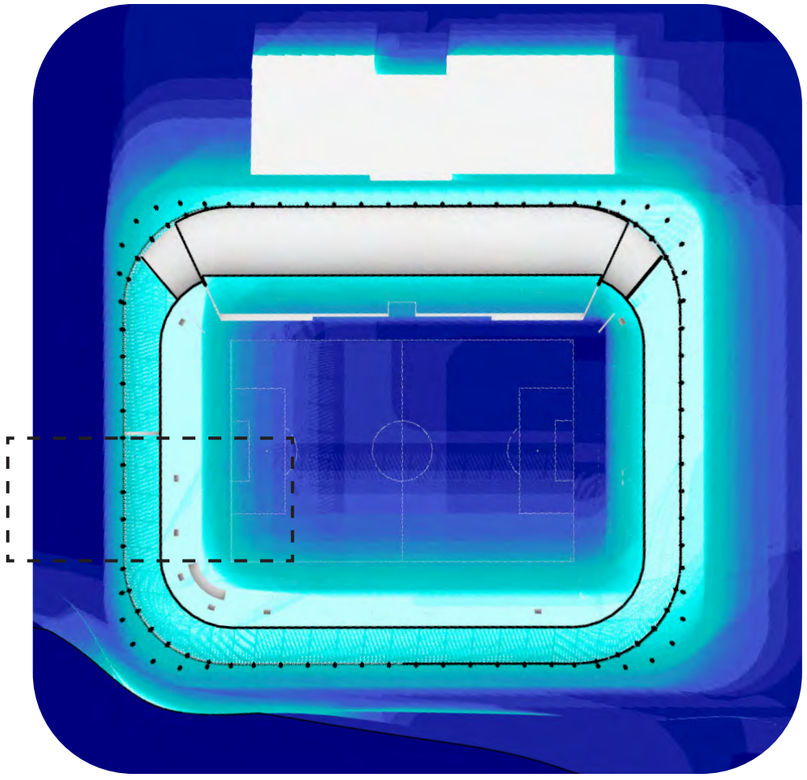
1.11. CONCOURSE AND BOWL ENVIRONMENT IN RESPECT OF SHELTER

WEATHER PROTECTION-RAIN

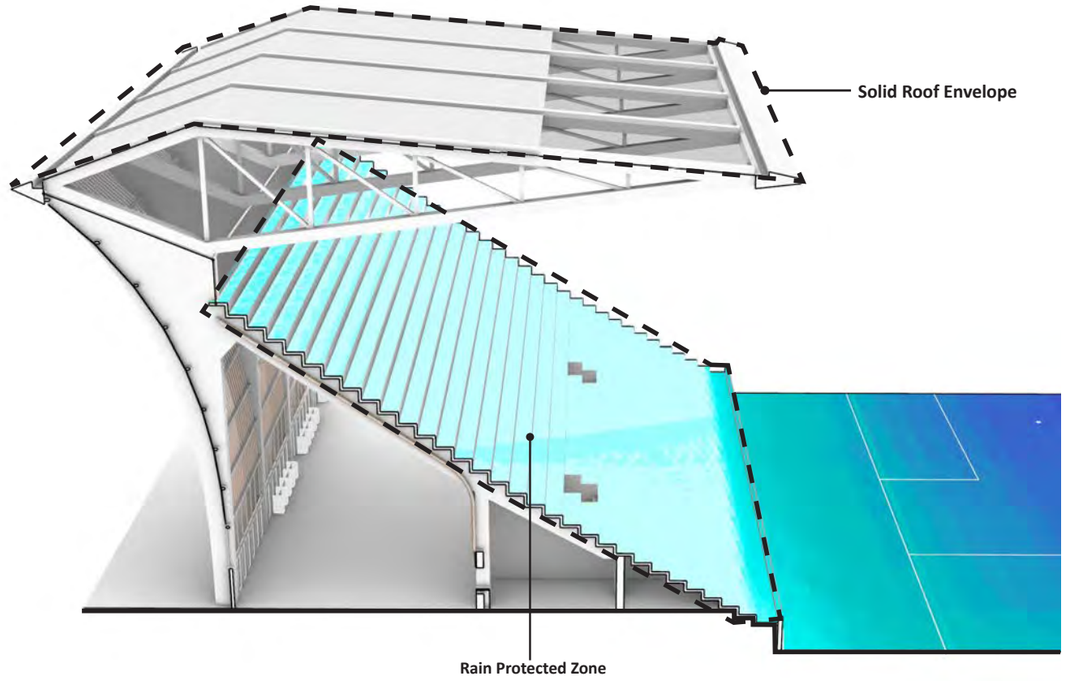
The wind - driven rain analysis is done taking into account the effect of high wind speeds on rain. The proposed stadium design diffuses the wind speeds and reduces the adverse effect of wind - driven rain.

The roof protects the spectator sitting areas as well as concourse areas as wind is also diffused due to the use of lamelas and porous meshes around the bowl.

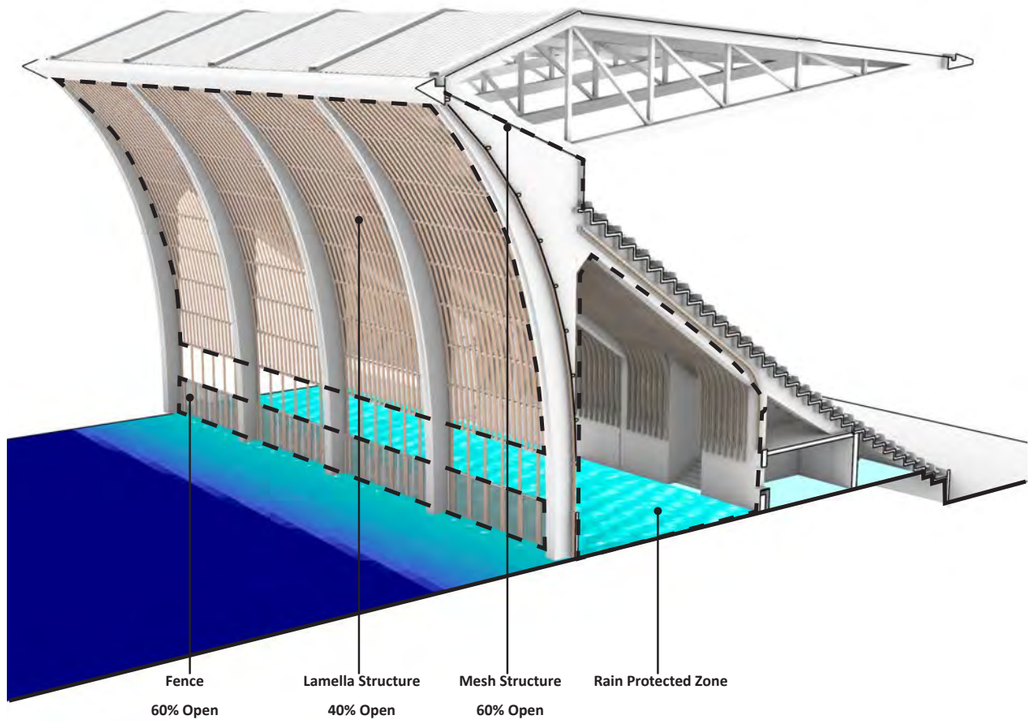
The concourse areas with lamelas reduce the wind speeds and provide lateral protection.



CONCOURSE PLAN - RAIN SIMULATION



BOWL SECTION



CONCOURSE SECTION WITH LAMELLAS

1.11. CONCOURSE AND BOWL ENVIRONMENT IN RESPECT OF SHELTER

THERMAL COMFORT ANALYSIS

Thermal comfort is a combination of the weather conditions, but also of the seasonal climate. Sun, wind, humidity and clouds are the key elements that affect how temperate humans are. UTCI

An assessment is made based on a consideration of the weather conditions, in particular the wind and sun analyses. For example: areas with little sun, low air temperatures and much wind can in the wintertime be particularly harsh. But in the summer, having strong sun radiation and higher air temperature, wind can be soothing and be less of an issue. We therefore distinguish between the two seasons.

The green and red regions marked can be interpreted as " thermally comfortable " and "thermally uncomfortable to some degree".

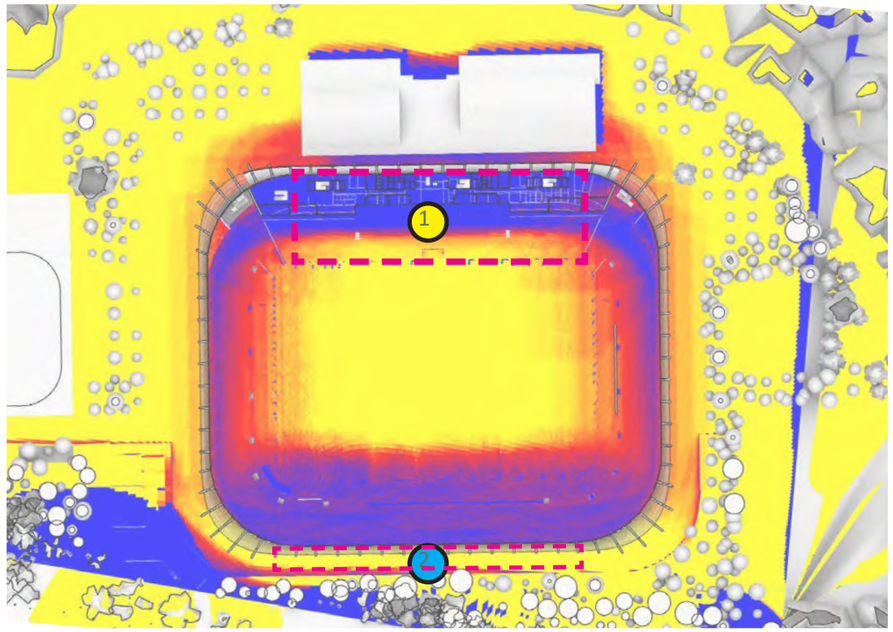
The areas on the northern seating areas and southern concourse area which experiences higher heat gain also experiences sufficient wind flow to facilitate convective cooling through adequate cross-ventilation driven design

1. The northern stand experiences more thermal gain but also with wind experiences convective cooling.

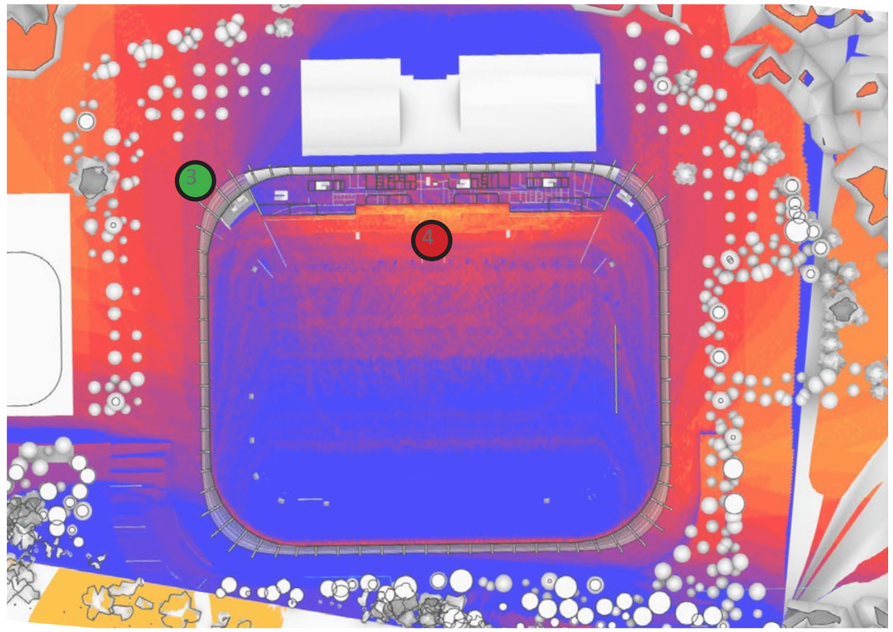
2.The sourthern concourse area also experiences higher solar heat gain but also receives adequate wind flow.

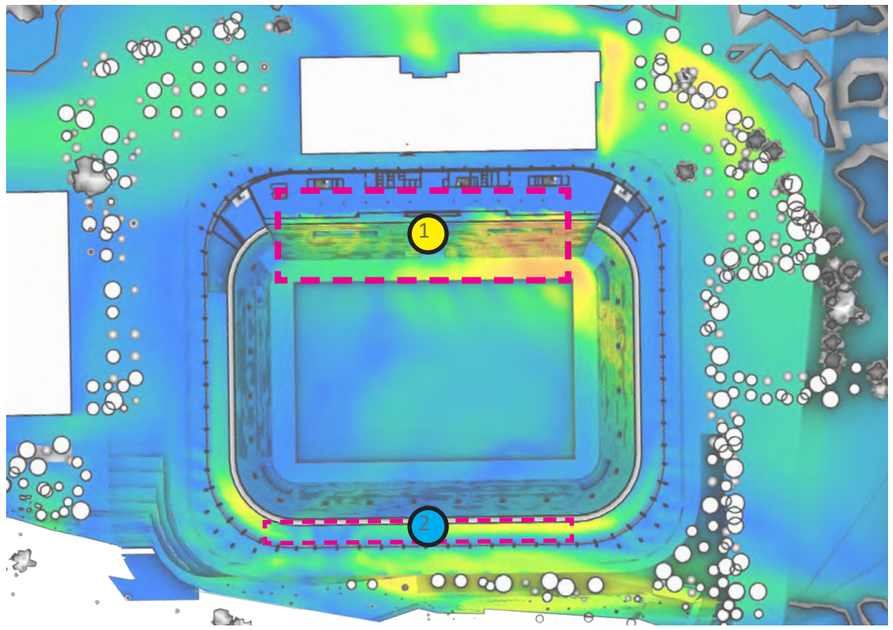
3. North - west corner also experiences wind flow and solar heat again which makes adequate space for cultural use

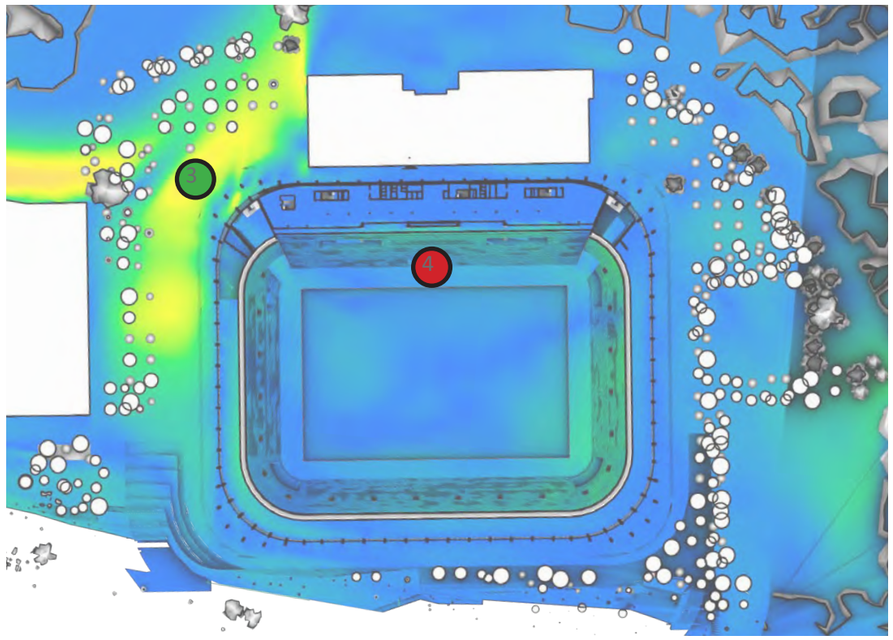
SUMMER SEASON



WINTER SEASON

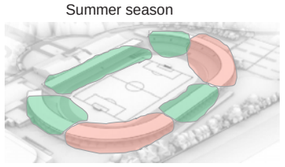




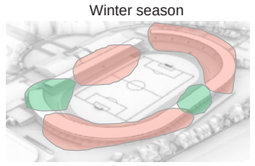


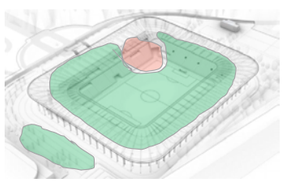
EXISTING STADIUJM

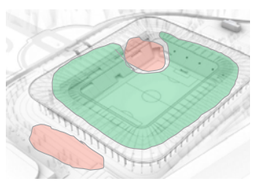
Summer season



Winter season







NEW STADIUJM

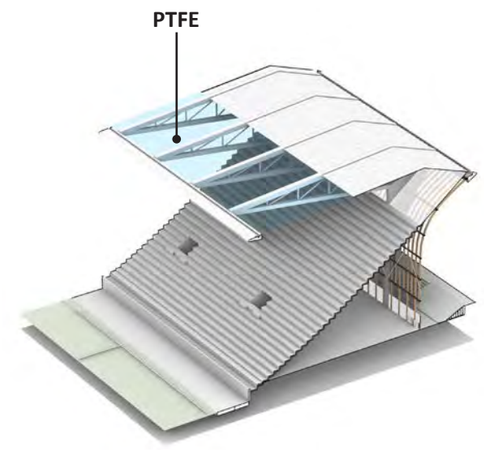
1.11. CONCOURSE AND BOWL ENVIRONMENT IN RESPECT OF SHELTER

DAYLIGHT ANALYSIS

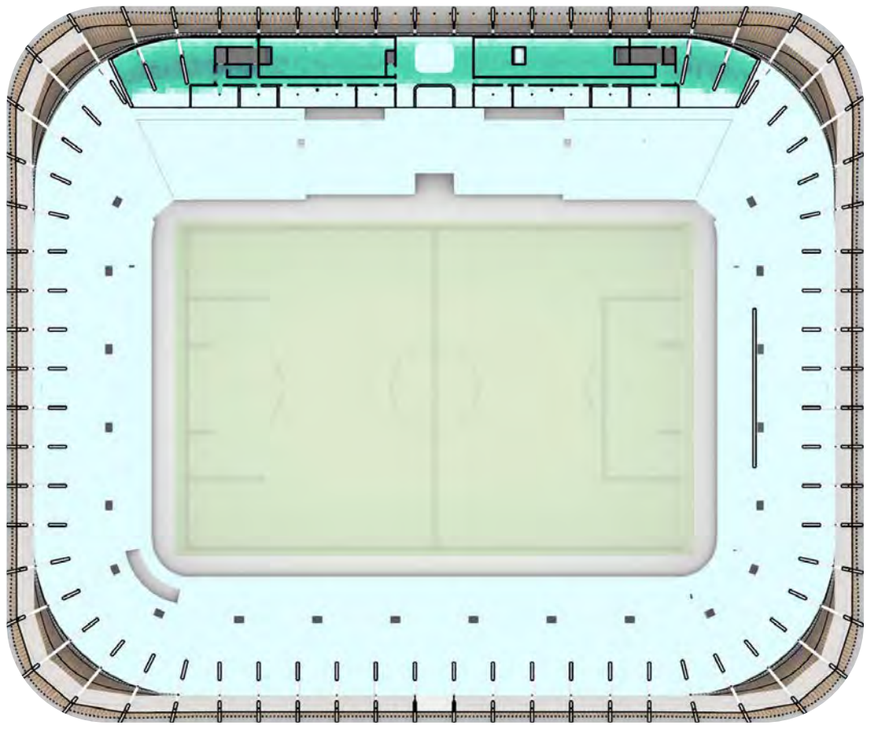
SEATING AREAS:

For the Analysis period for November to March From 10:00 - 18:00

This analysis period shows that the highest sitting areas may receive too little natural daylight without the utilization of the ETFE on the roof.



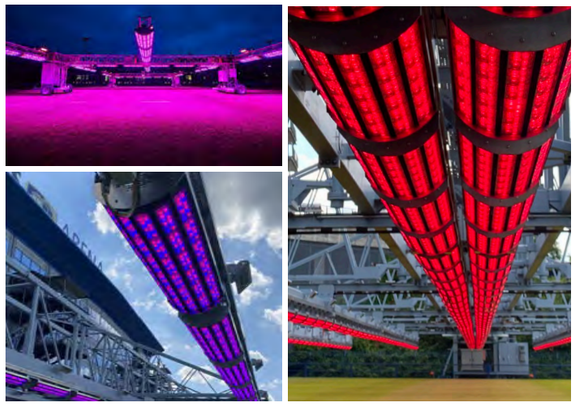
ANNUAL ANALYSIS 10:00 - 18:00



ANALYSIS PERIOD
NOVEMBER TO MARCH FROM 10:00 - 18:00

Reference Images:

Pitch artificial growth lights



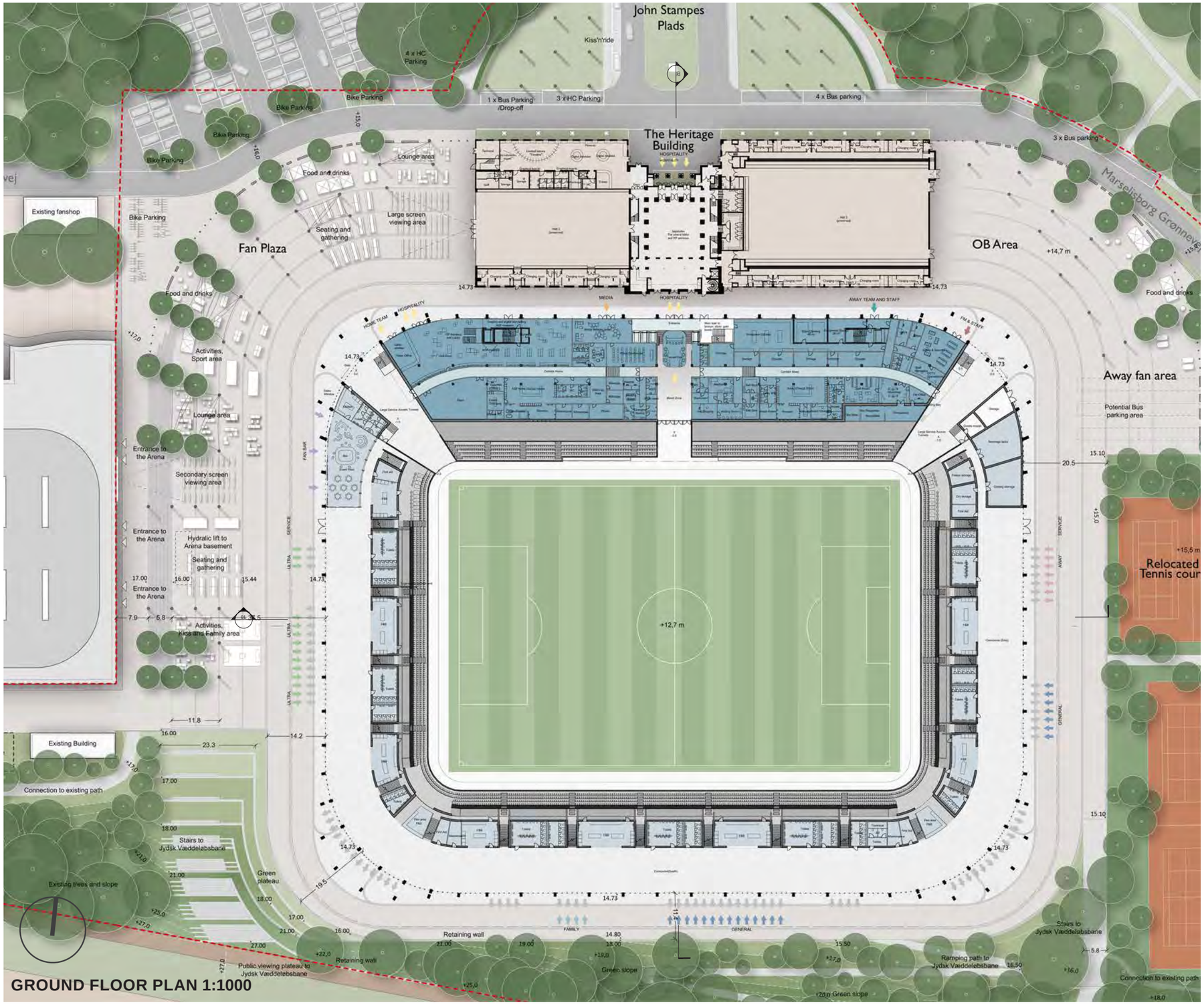
Average LUX Values

0 100 200 300 400 500 600 700 800 900 1000

2.0 DRAWINGS AND VISUALISATIONS

2.1.1. GROUND FLOOR OF THE ENTIRE PROJECT AREA

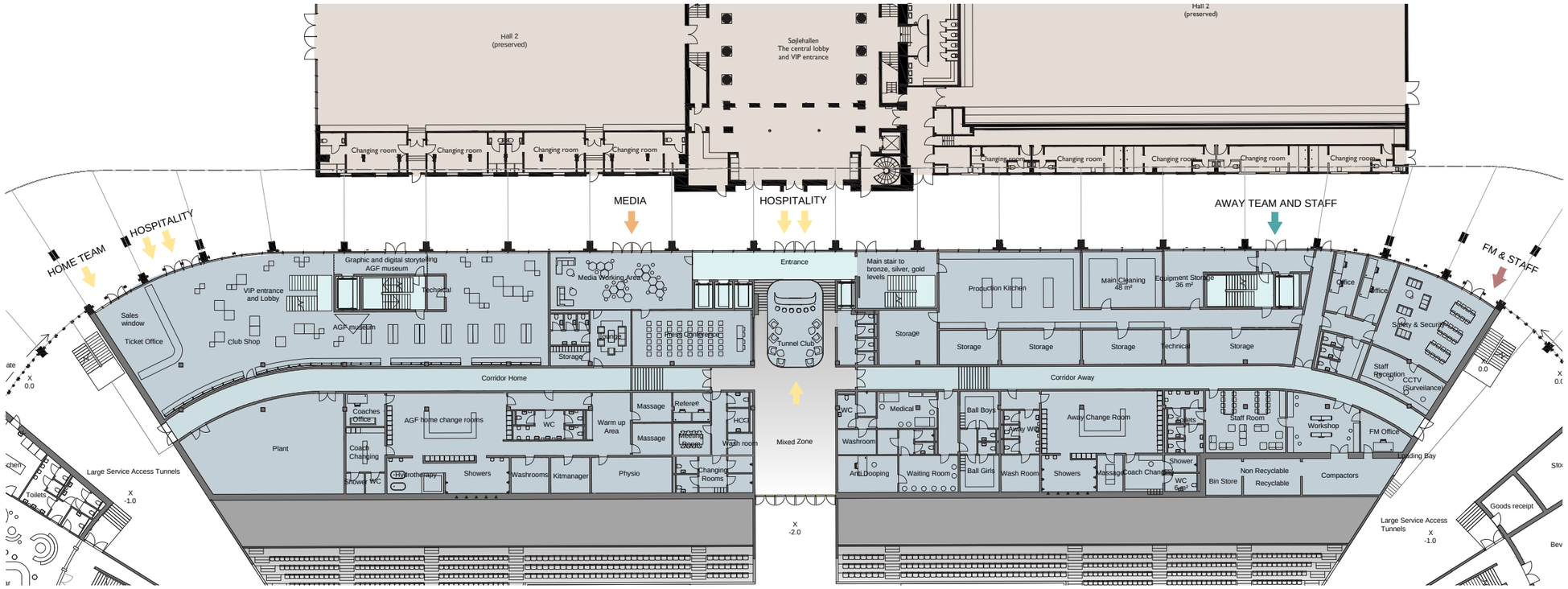
GROUND FLOOR



GROUND FLOOR PLAN 1:1000

2.1.2. MAIN STAND PLANS

NORTH STAND GROUND FLOOR 1:500

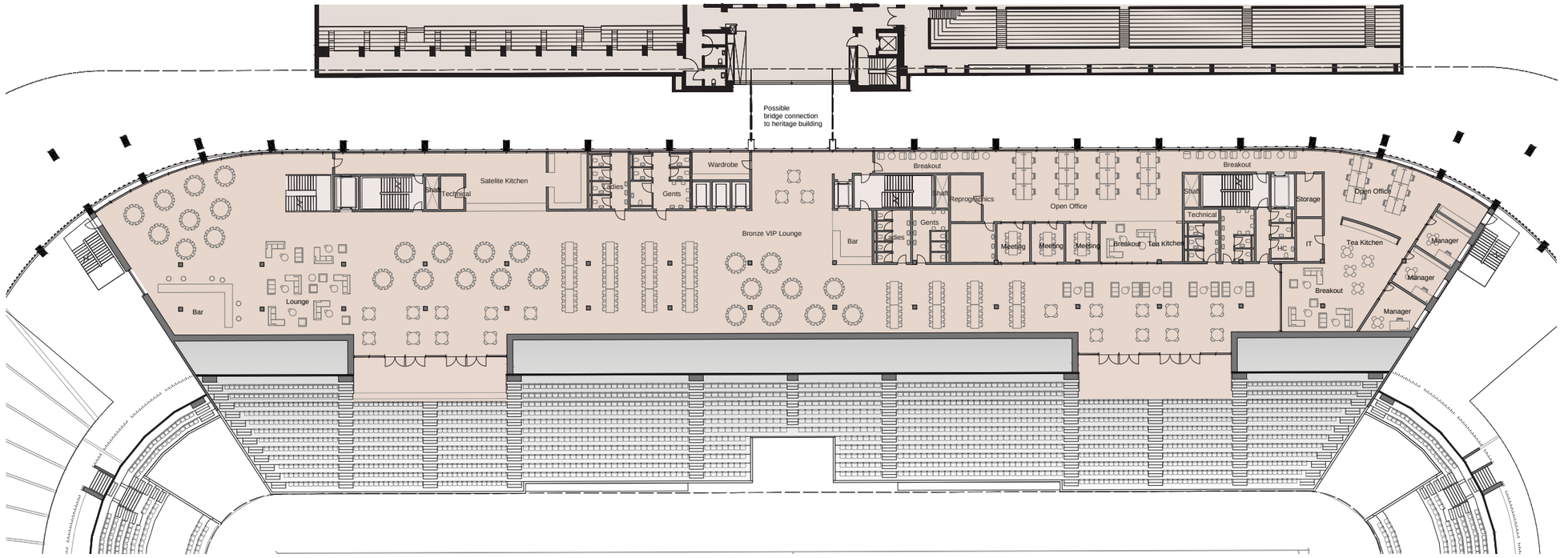


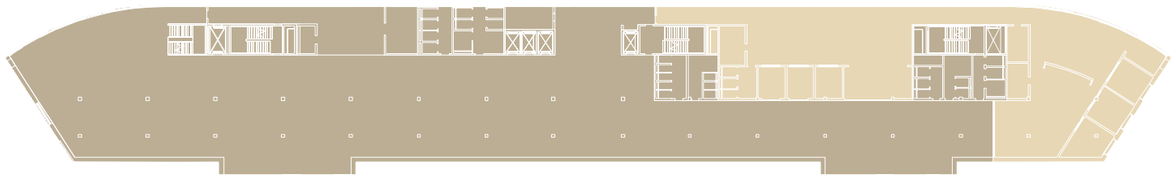
- Away Team
- Catering
- Circulation and Archillary
- Doping
- East Stand
- Fan Bar
- FM
- Home Team
- Media
- Medical
- Mixed Zone
- Office
- Officials
- Referee
- Security and Safety
- Tunnel Club
- TV
- VIP entrance and lobby
- West Stand

Timber Louvred Wall Finish With Exposed Concrete

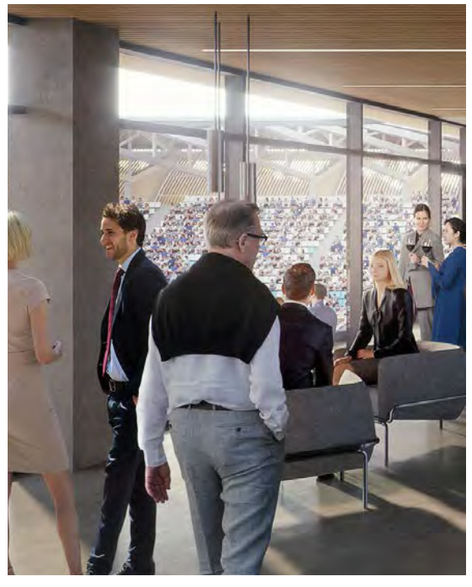
2.1.2. MAIN STAND PLANS

NORTH STAND 1ST FLOOR 1:500

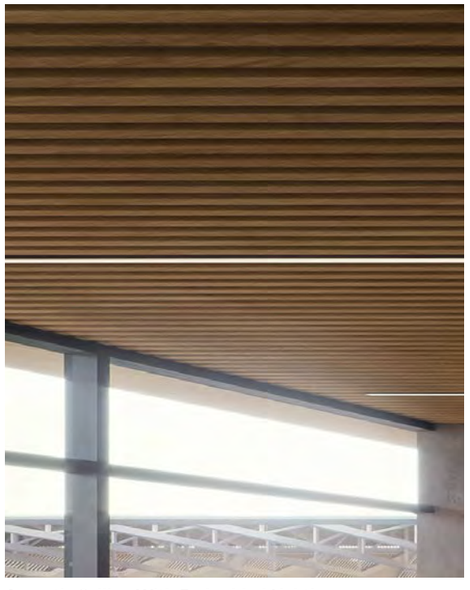




Bronze
Office



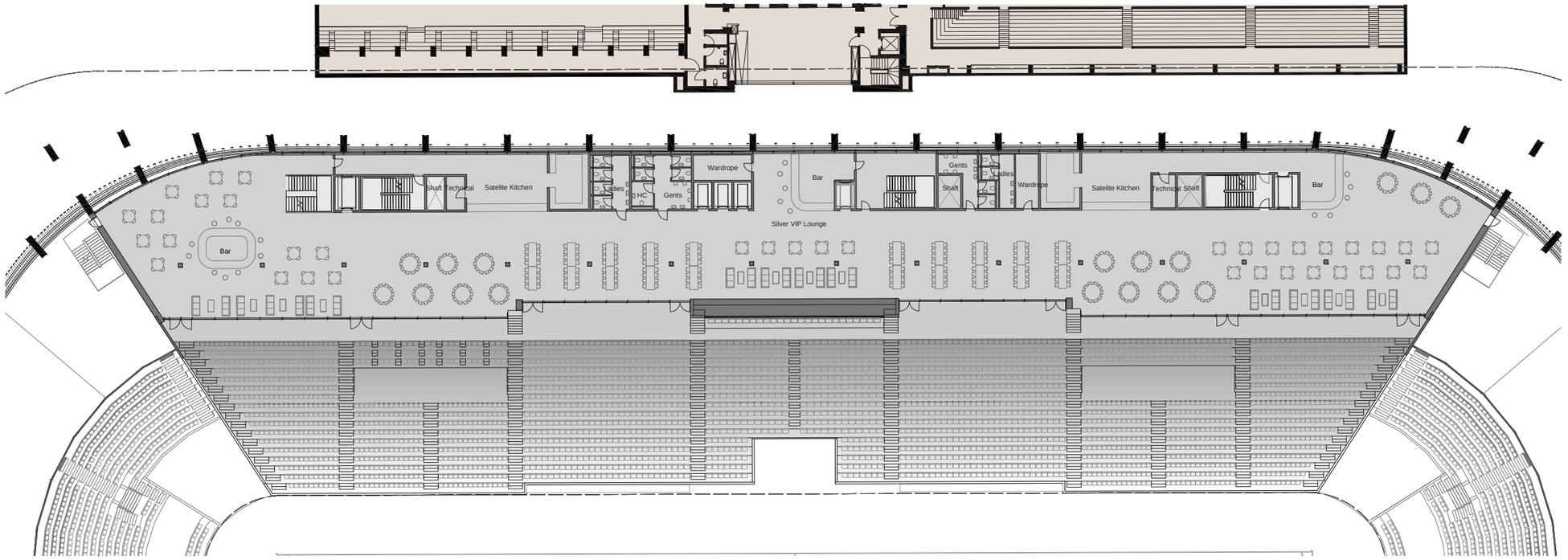
Lounge Seating And Clear Glazing



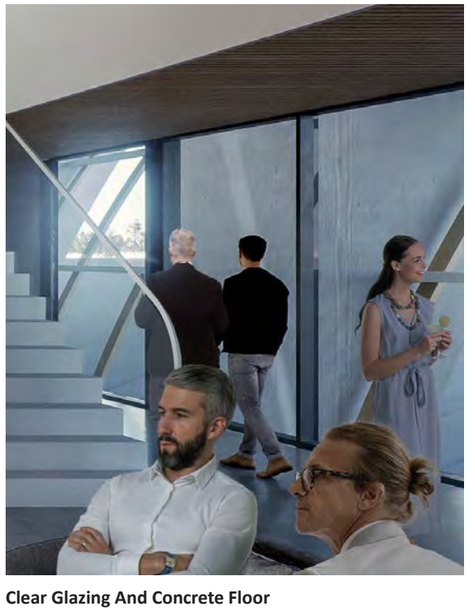
Acoustic Ceiling With Embedded Lighting

2.1.2. MAIN STAND PLANS

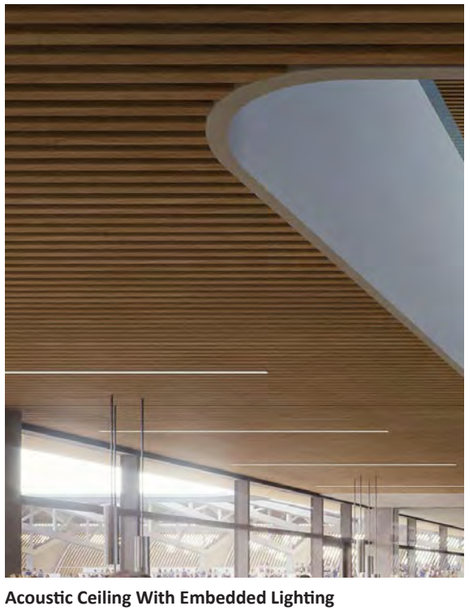
NORTH STAND 2ND FLOOR 1:500



Silver



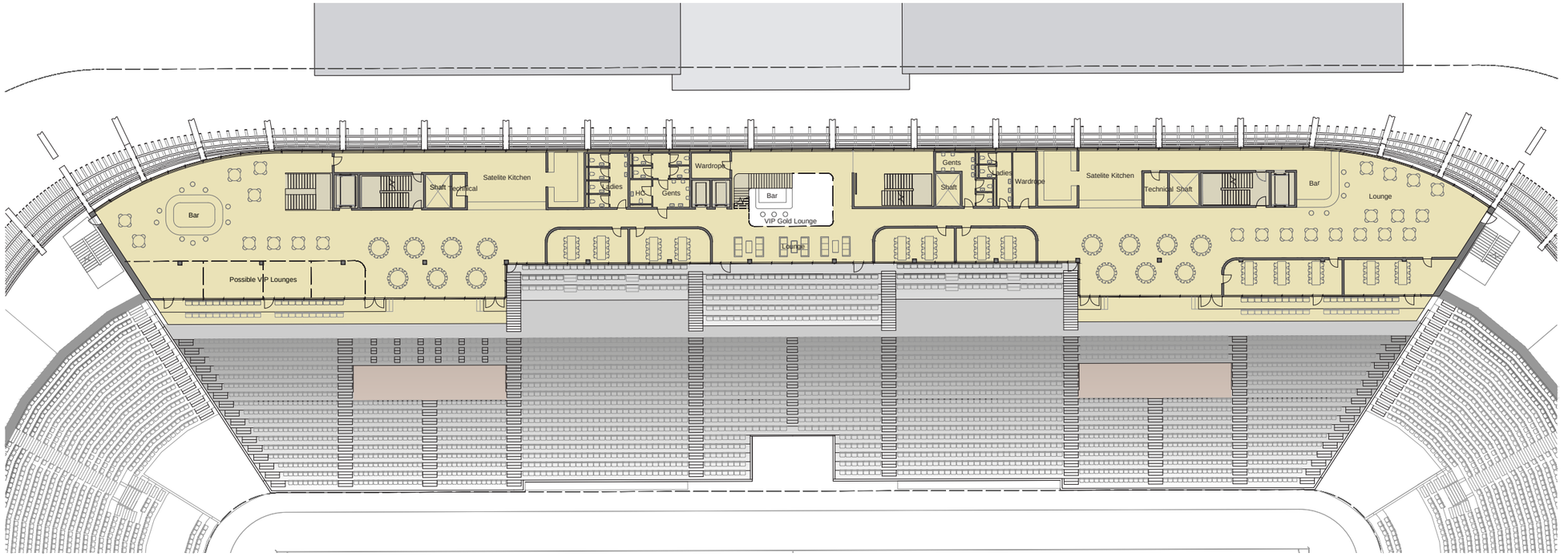
Clear Glazing And Concrete Floor



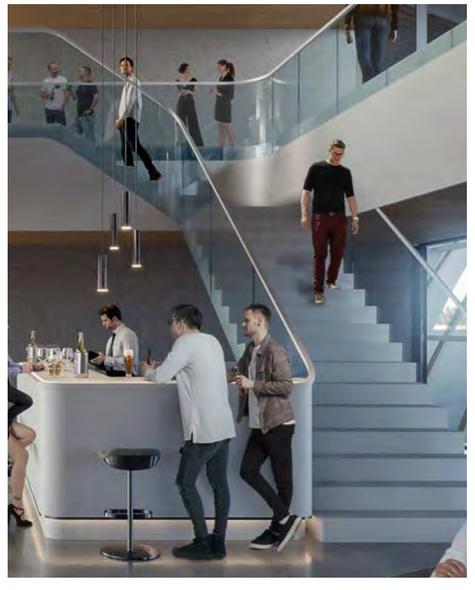
Acoustic Ceiling With Embedded Lighting

2.1.2. MAIN STAND PLANS

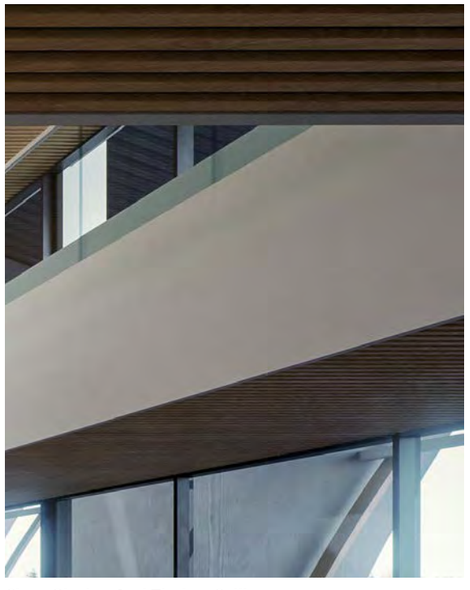
NORTH STAND 3RD FLOOR 1:500



Gold



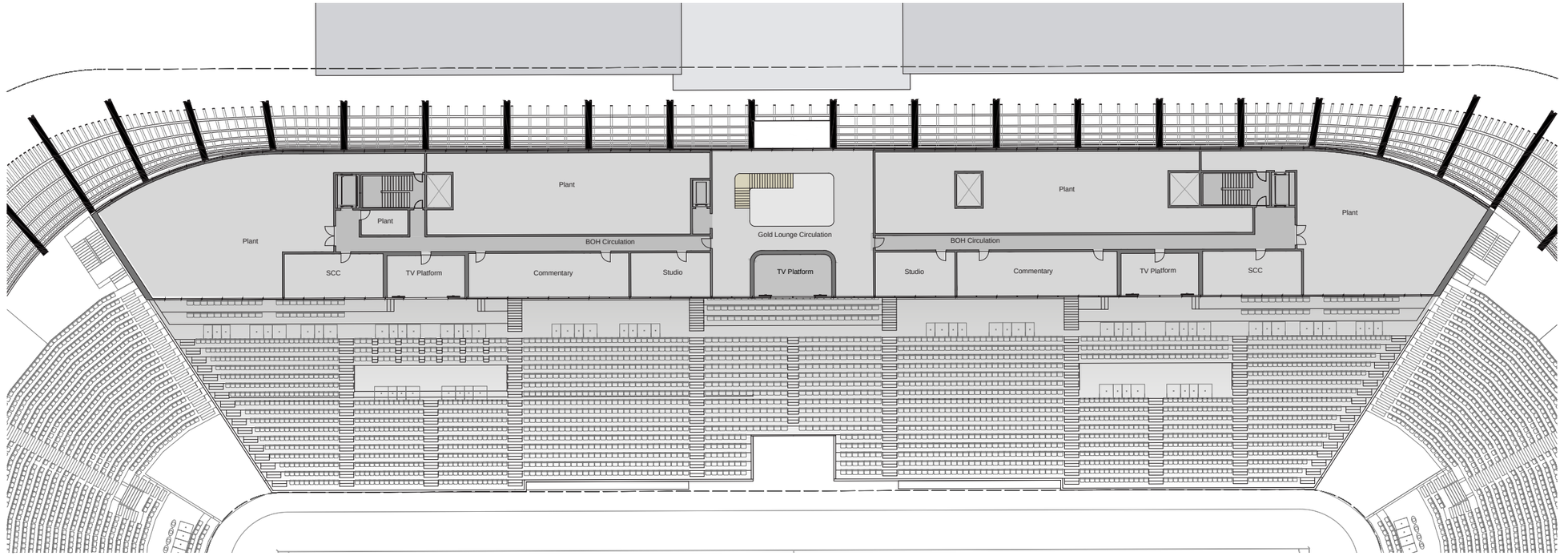
Concrete Stairs with glass balustrade



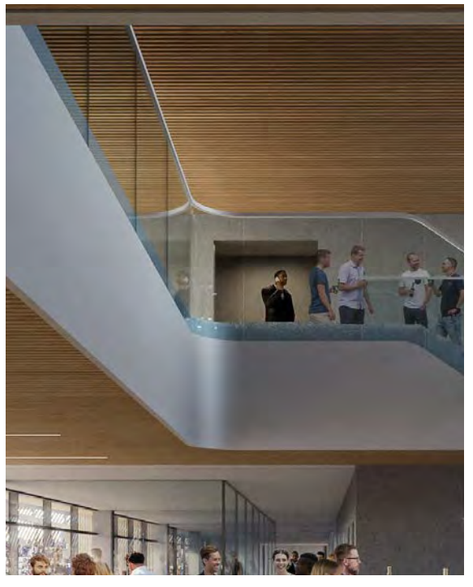
Clear Glazing And Timber Ceiling

2.1.2. MAIN STAND PLANS

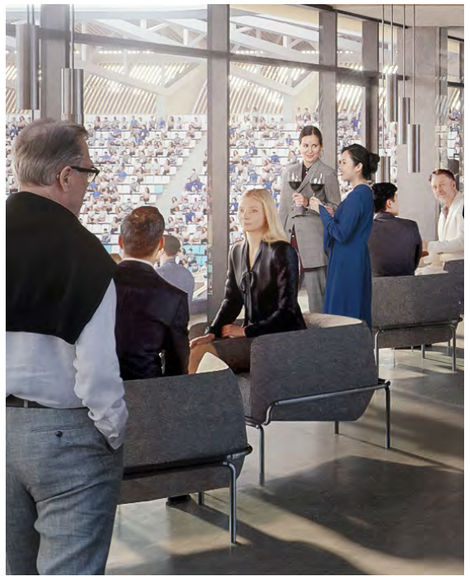
NORTH STAND 4TH FLOOR 1:500



Plant
TV



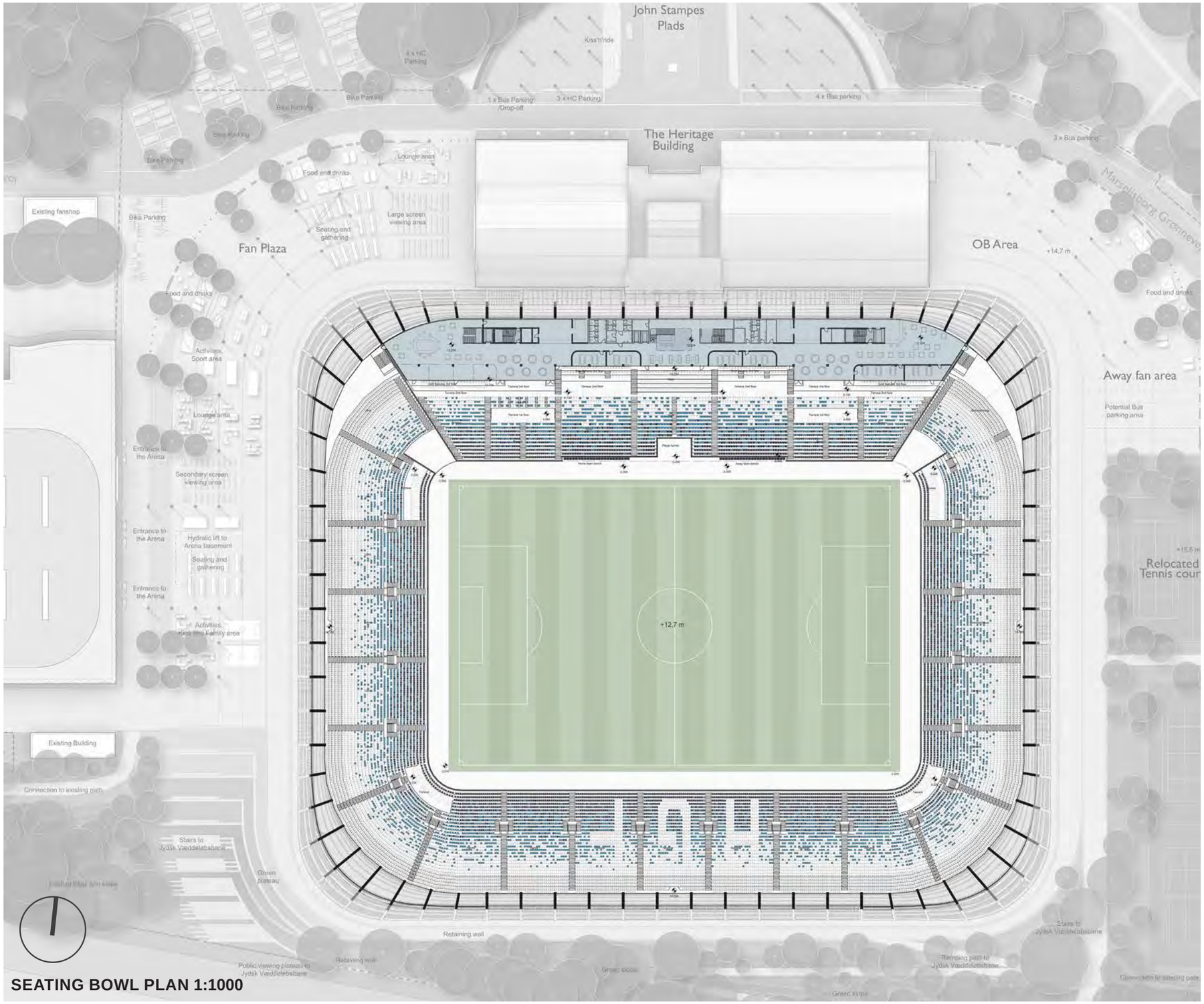
Timber Louvred Balustrade And Lighting



Clear Glazing With View Towards Outside

2.1.3. PLAN OF SEATING BOWL

PLAN OF THE SEATING BOWL



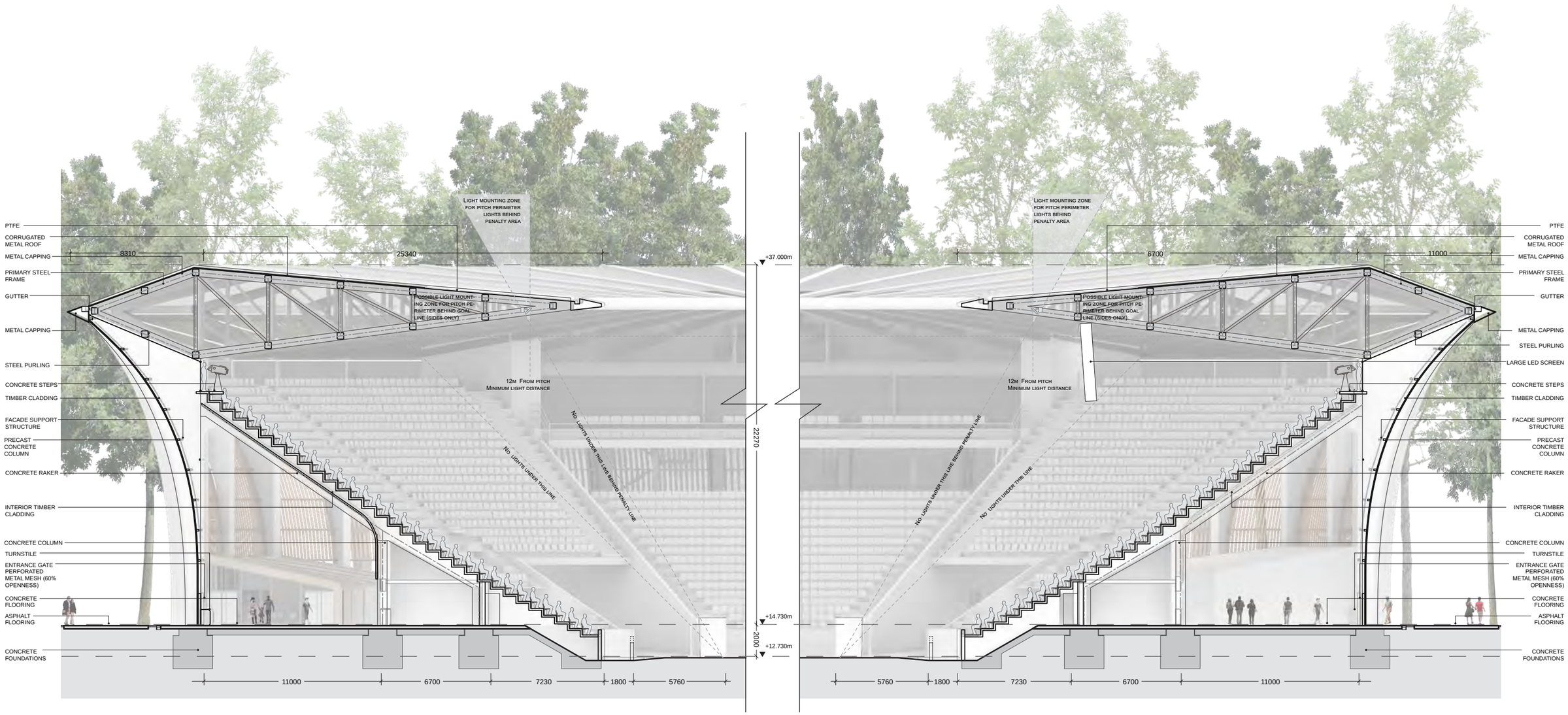
SEATING BOWL PLAN 1:1000

2.2.1. NORTH SOUTH-SECTION OF THE AXIS

NORTH SOUTH CROSS SECTION 1:500

ZAHA HADID LTM, SWECO DANMARK A/S, TREDJE NATUR APS

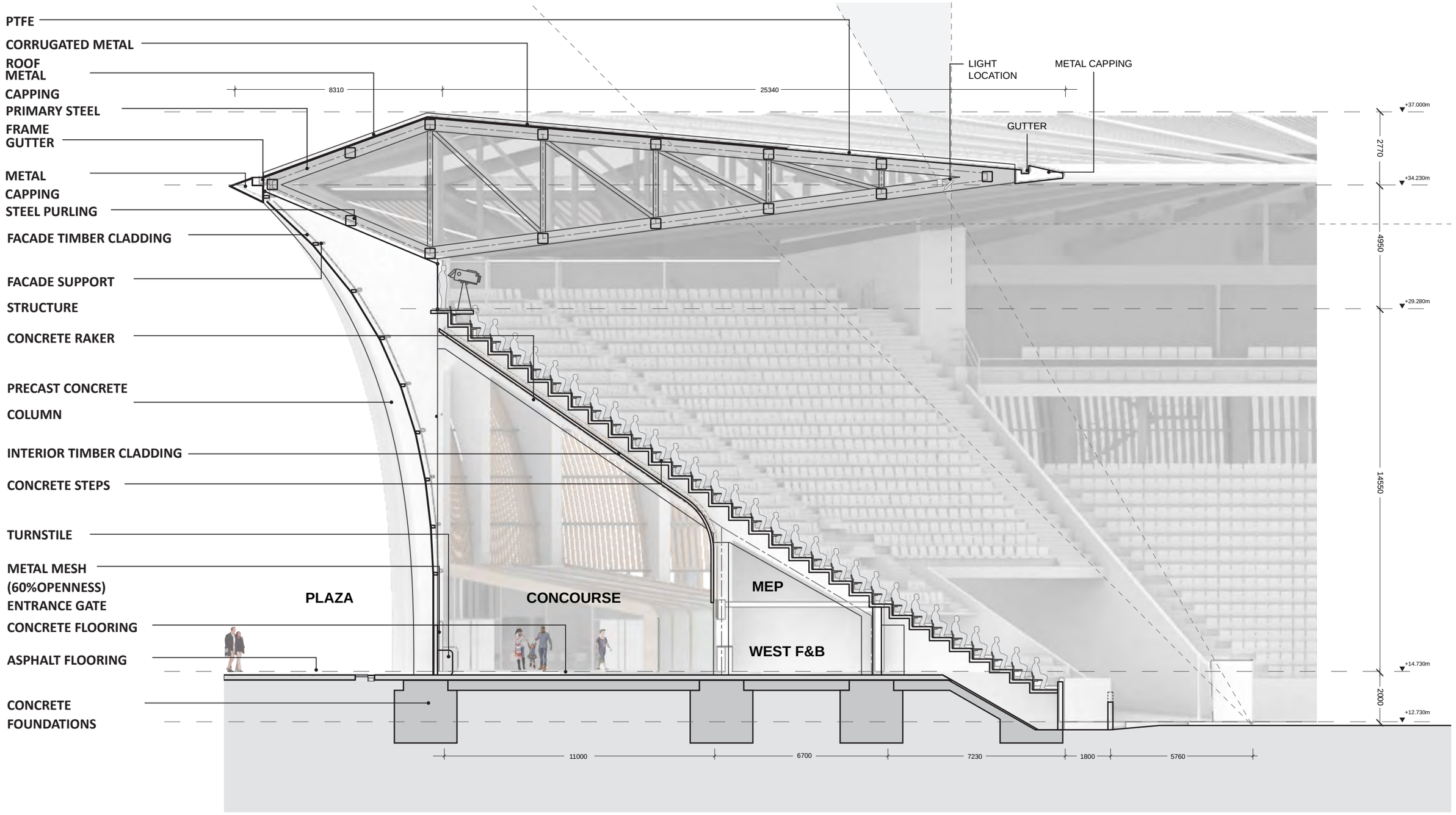
2.2.1. WEST EAST-SECTION OF THE AXIS



WEST CONCOURSE SECTION 1:250

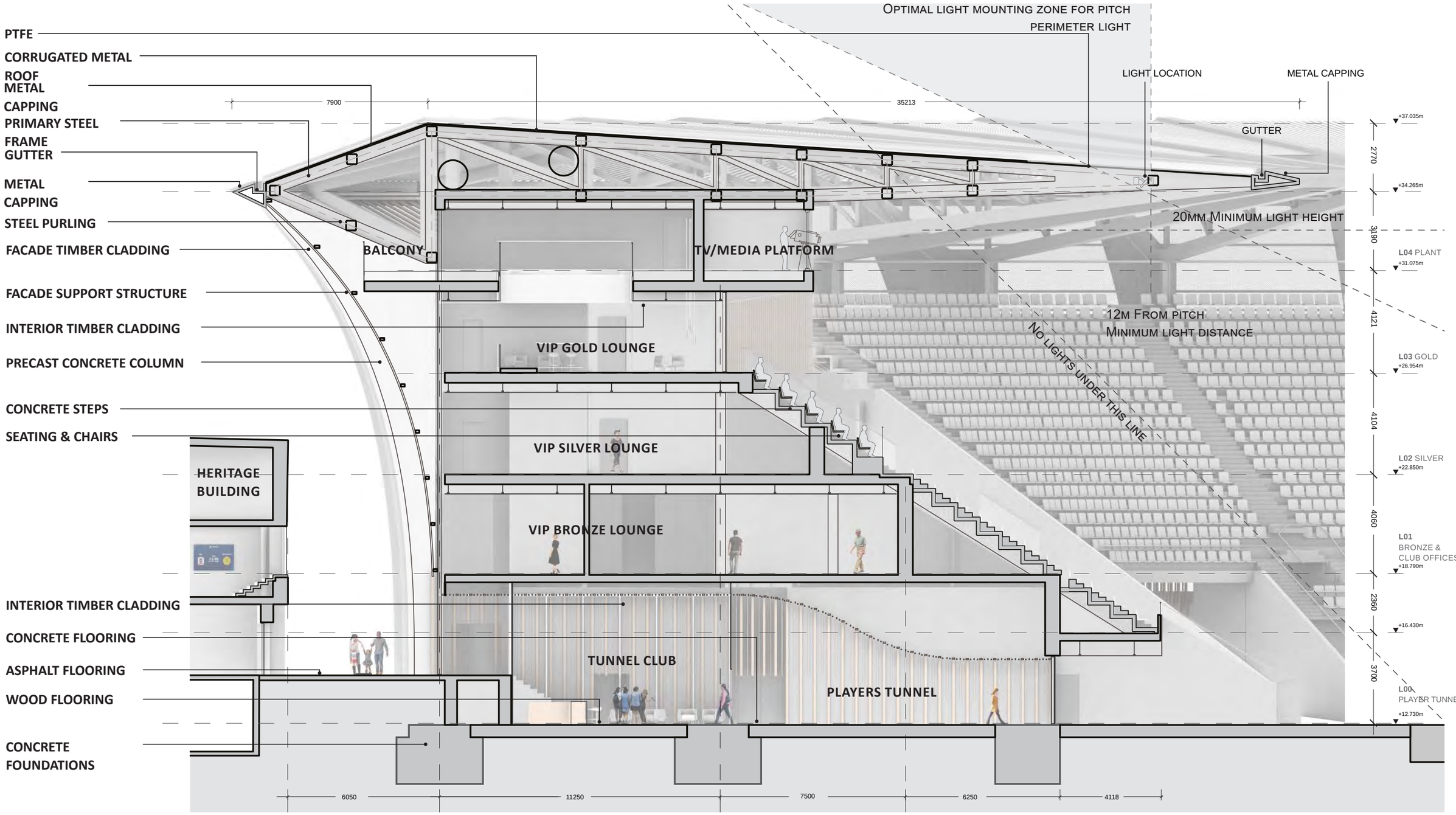
EAST CONCOURSE SECTION 1:250

2.2.2. SECTION THROUGH FAÇADE/CONSTRUCTION



WEST STAND SECTION 1:150

2.2.3. STADIUM BOWL - MAIN STAND SECTION



NORTH STAND SECTION AND RELATIONSHIP TO THE HERITAGE BUILDING 1:150

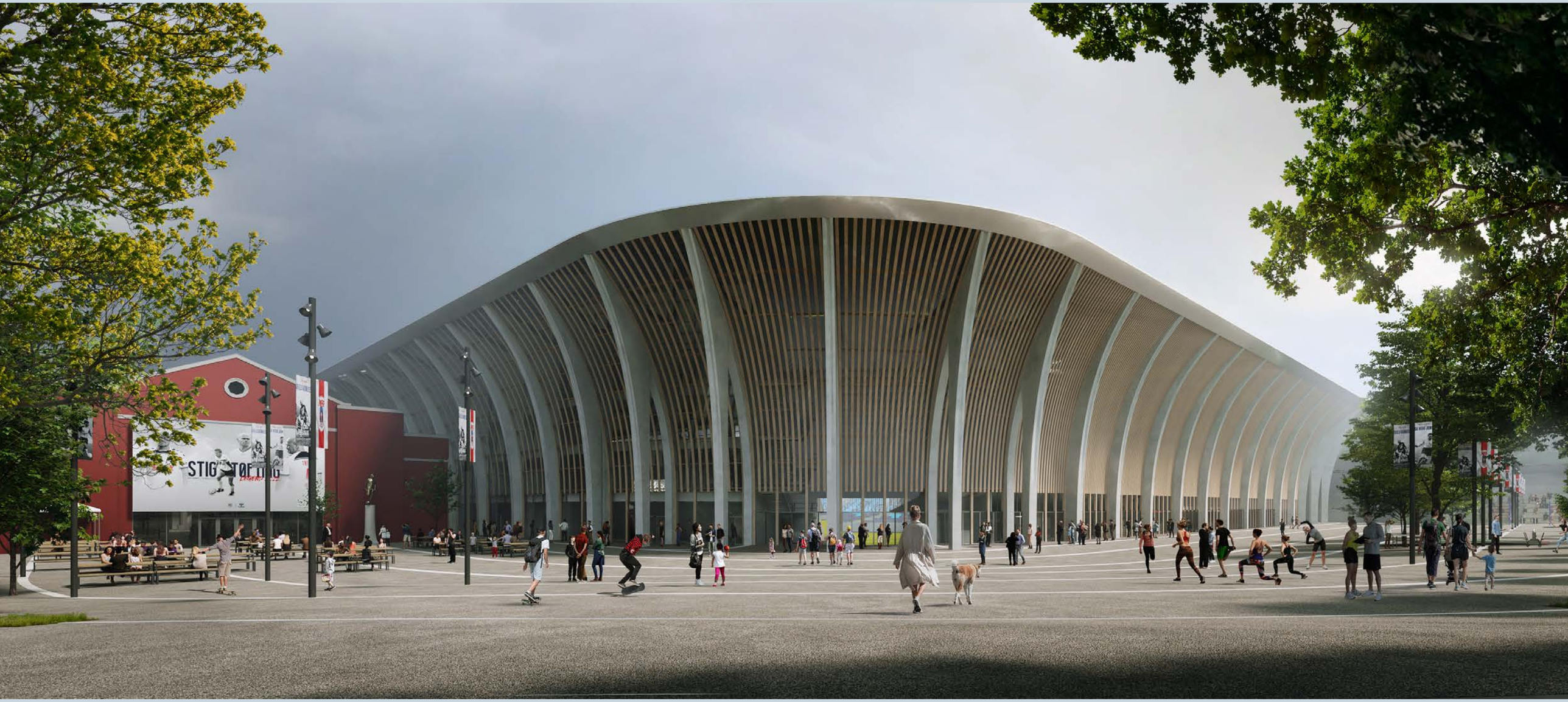
2.3.1. ARRIVAL FROM STADION ALLÉ

2.3.2. FAN PLAZA AND RELATION TO THE STADIUM

MATCH DAY

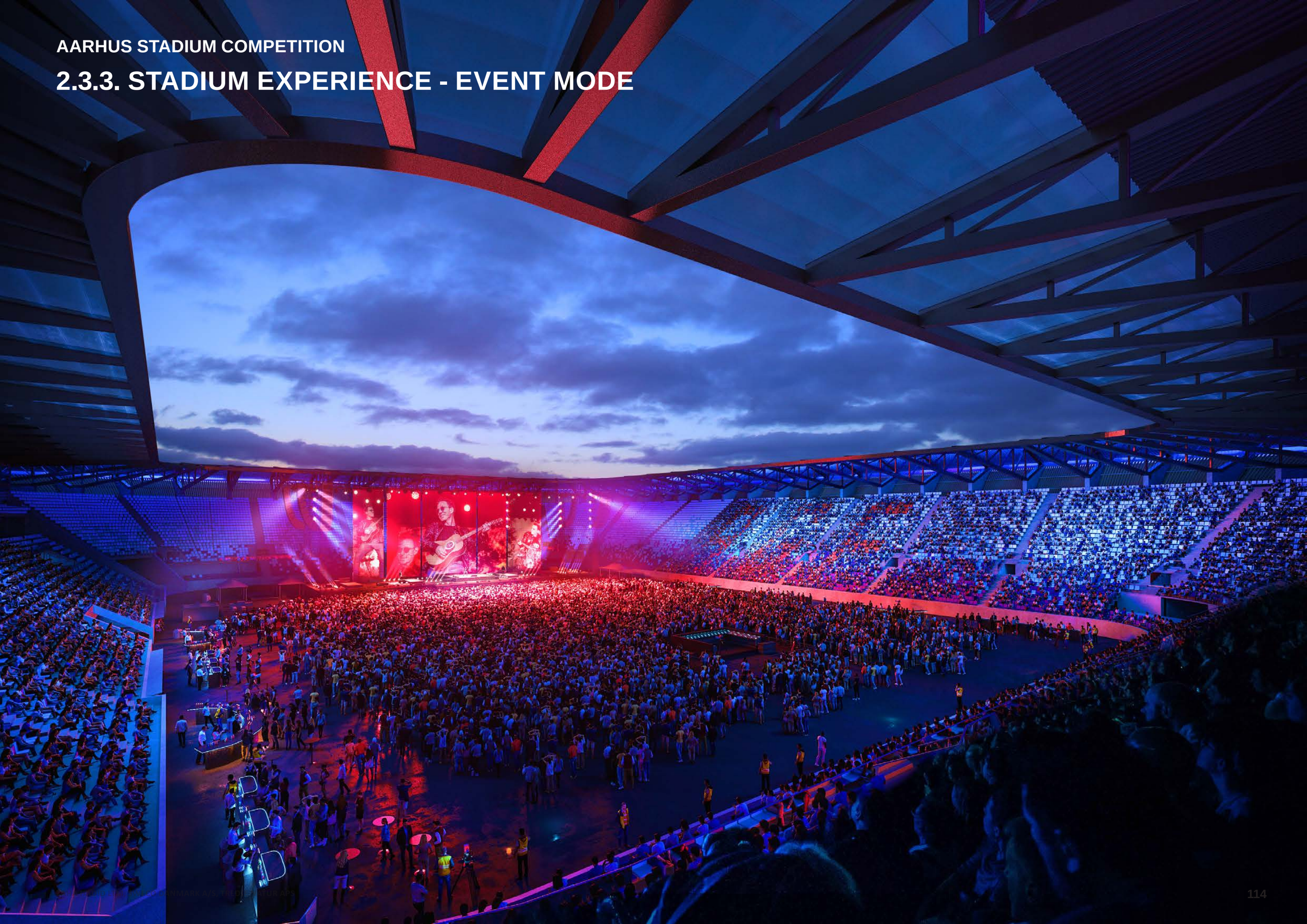
2.3.2. FAN PLAZA AND RELATION TO THE STADIUM

NORMAL DAY



2.3.3. STADIUM EXPERIENCE - FOOTBALL MODE

2.3.3. STADIUM EXPERIENCE - EVENT MODE



2.3.4. AROUND THE STADIUM

2.3.5. BIRD'S EYE VIEW.

2.3.6. INTERNAL CONCOURSE

MATCH DAY

2.3.6. INTERNAL CONCOURSE

NORMAL DAY

2.3.6. INTERNAL CONCOURSE

EVENT DAY

2.3.7. HOSPITALITY AREA

2.3.8. PLAYER”S TUNNEL

2.3.11. HERITAGE CONNECTION

2.4.1. FLOW AND ARRIVAL

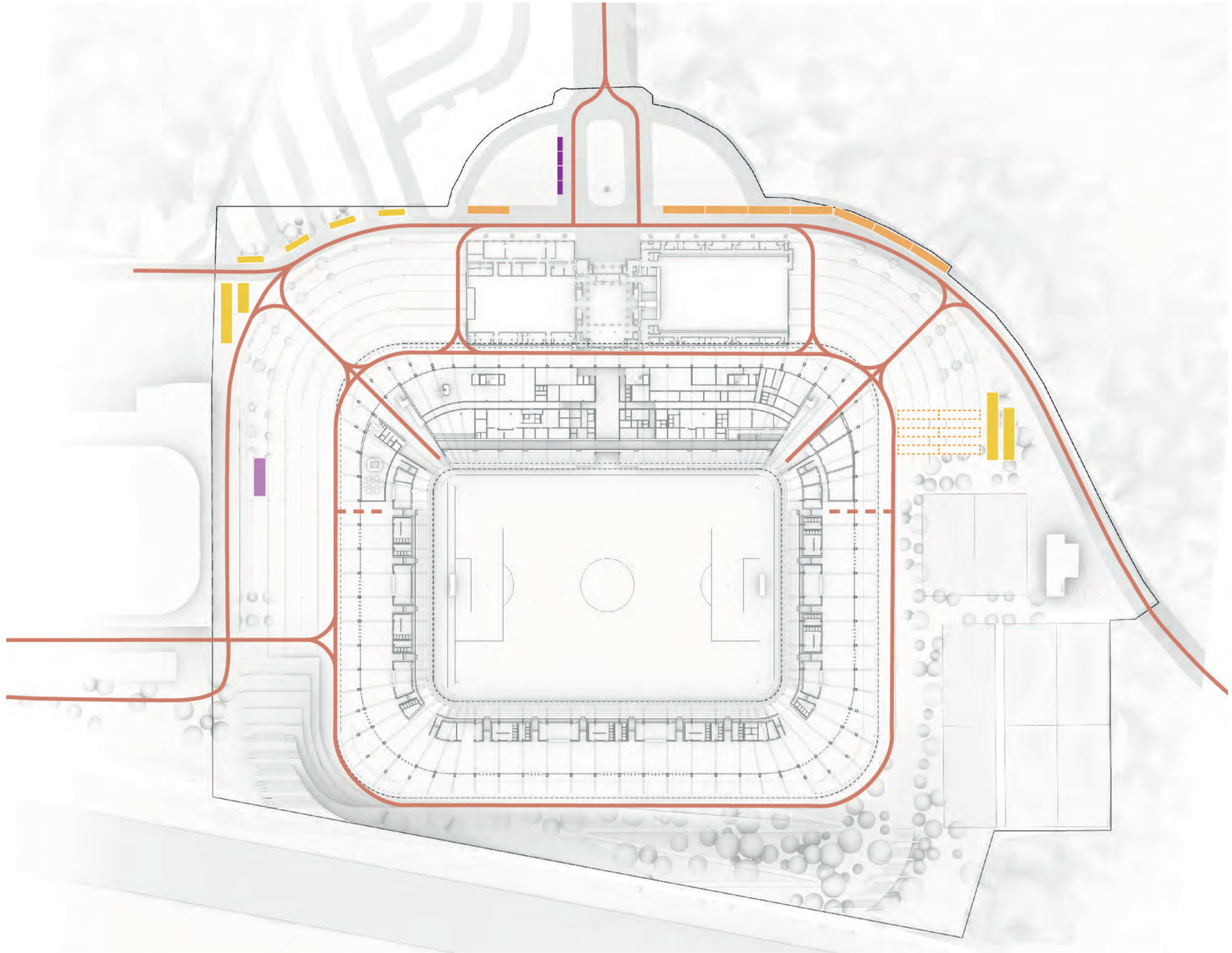
FLOW AND ACCESS TO THE SITE

The stadium allows for a direct 360 degrees access by a coherent urban space around the stadium which serves for both potential evacuation, daily logistics and maintenance and visitors. Visitors can access the stadium and grounds from multiple directions which provides better connectivity and synergy between the facilities of Aarhus Sports Park, whilst also improving the visitor experience on matchdays. Also the vehicles can access to both the stadium and surrounding grounds by multiple entries.

In south two stairways and a ramp up to the horse track will ensure a quick evacuation for pedestrians.

285 bicycle racks for both normal bikes and cargo bikes are placed outside the plaza to keep the plaza free from bikes.

The existing service ramp along the eastern part of the arena will be replaced by a hydraulic lift which will save space and keep the area between the arena and the stadium free from a long 2 m high fence.



VEHICLES ACCESS

2.4.1. FLOW AND ARRIVAL

FLOW AND ACCESS TO THE SITE

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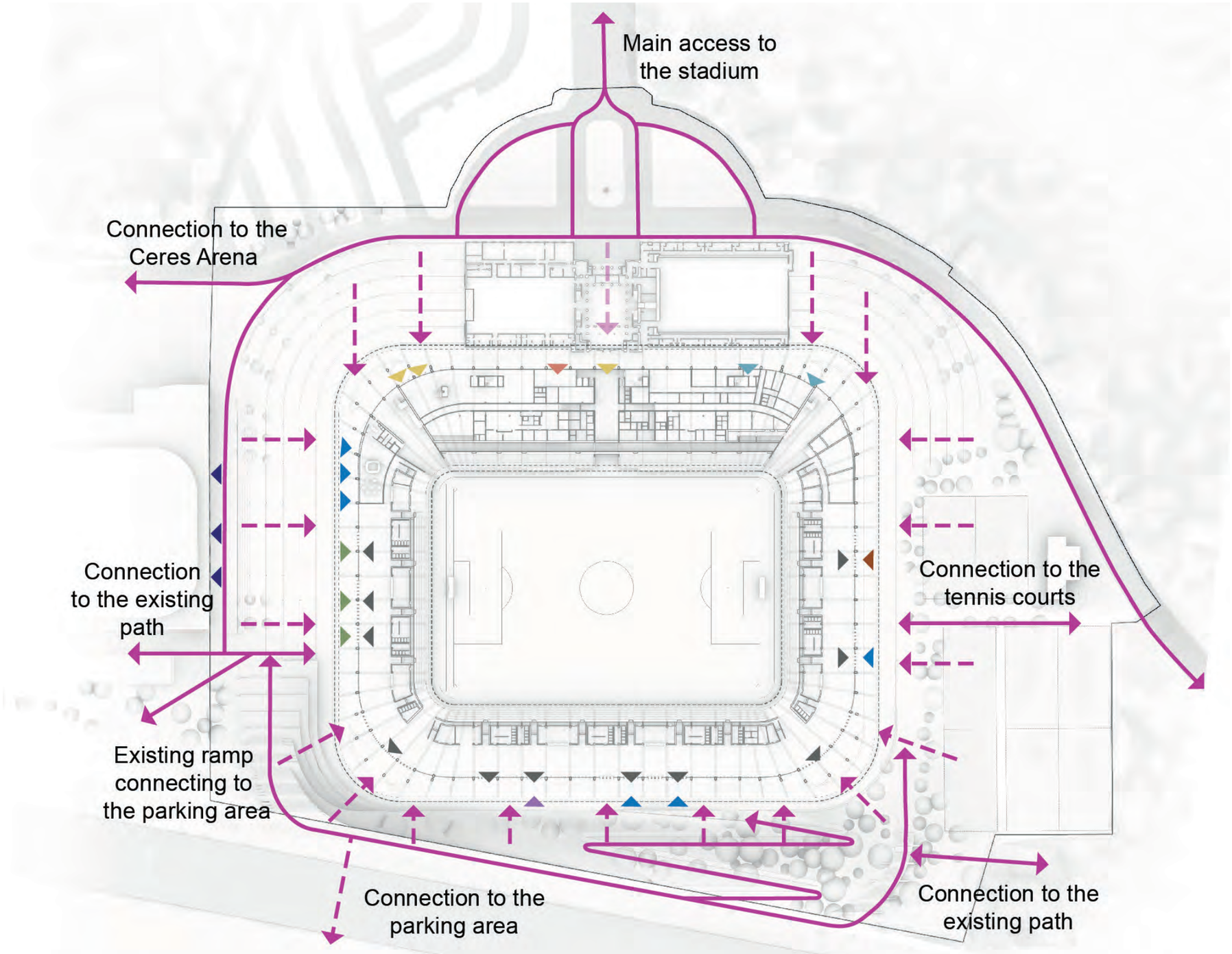


PEDESTRIAN FLOW

2.4.1. FLOW AND ARRIVAL

PEOPLE FLOW

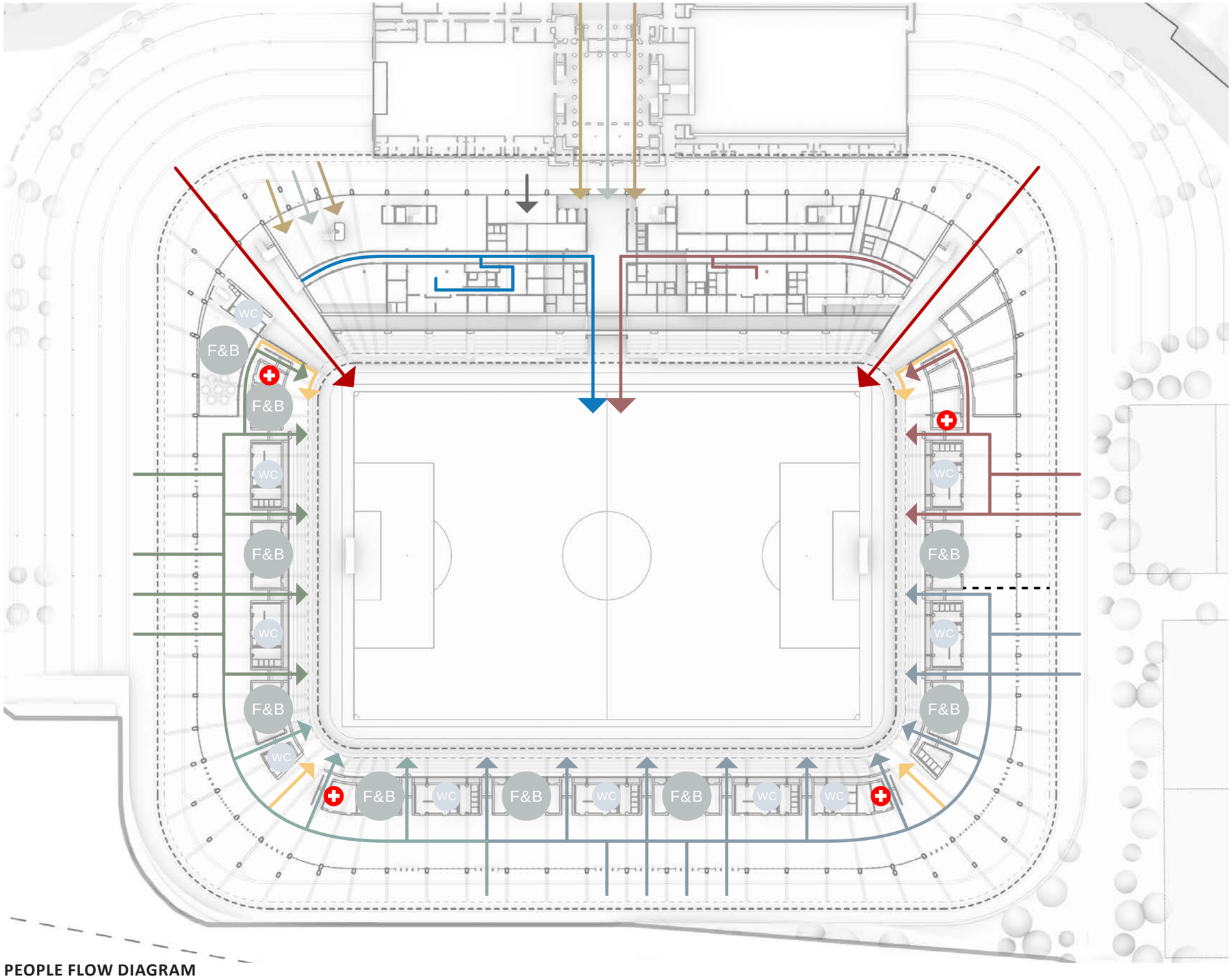
EAST, SOUTH, AND EAST STAND

With a continuous concourse, the proposed design incorporates great flexibility in planning and locating entrances and exits along the perimeter of the ticketed area. Circulation around the stadium, covered by the cantilevered roof, shelters people moving to find their designated entrance and provides protected gathering areas before entering the stadium, thereby contributing to a vibrant pre-match atmosphere all way around the stadium.

Entry and ticketing happen in relation to the different zones; Ultra, Family, General and Away.

Once inside, the spacious concourse flows continuously following the East, South and West stand. The concourse can be separated with temporary fences to divide zones, like the home and away fans. On other occasions it can be left open and connected.

Restrooms, Food & Beverage sales, First Aid rooms and services are evenly spread out through the concourse to offer sufficient capacity to each zone. Stair access to the stadium bowl is clearly marked for the different zones and seating sections, to secure wayfinding and flow.



- Gold
- Silver
- Bronze
- Media
- Ultra
- Family
- General
- Away Team
- Home Team
- Pitch Access
- Accessibility Access
- TEMPORARY SEPARATION
- First Aid
- Food And Beverage
- Toilets

PEOPLE FLOW DIAGRAM

2.4.1. FLOW AND ARRIVAL

PEOPLE FLOW IN THE VIP AREAS

NORTH STAND

VIP members can enter the north stand from three different locations; through the restored heritage build which is connected on the 1st floor, the main entrance to the west facing the fan plaza or centrally to the tunnel club, both offering vertical connections, visually as well as by stairs and elevators.

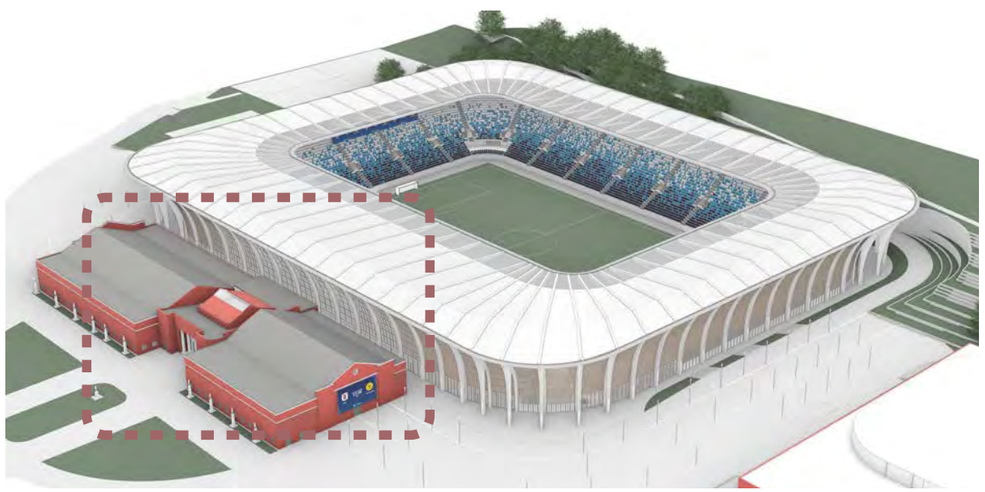
The multiple entry point result in a good flow and gives options for separating gold, silver, and bronze in 2 or 3 entries. For instance, the bronze members could enter through the lobby facing the plaza while the silver and gold members would enter through the heritage building and the central ground floor entrance.

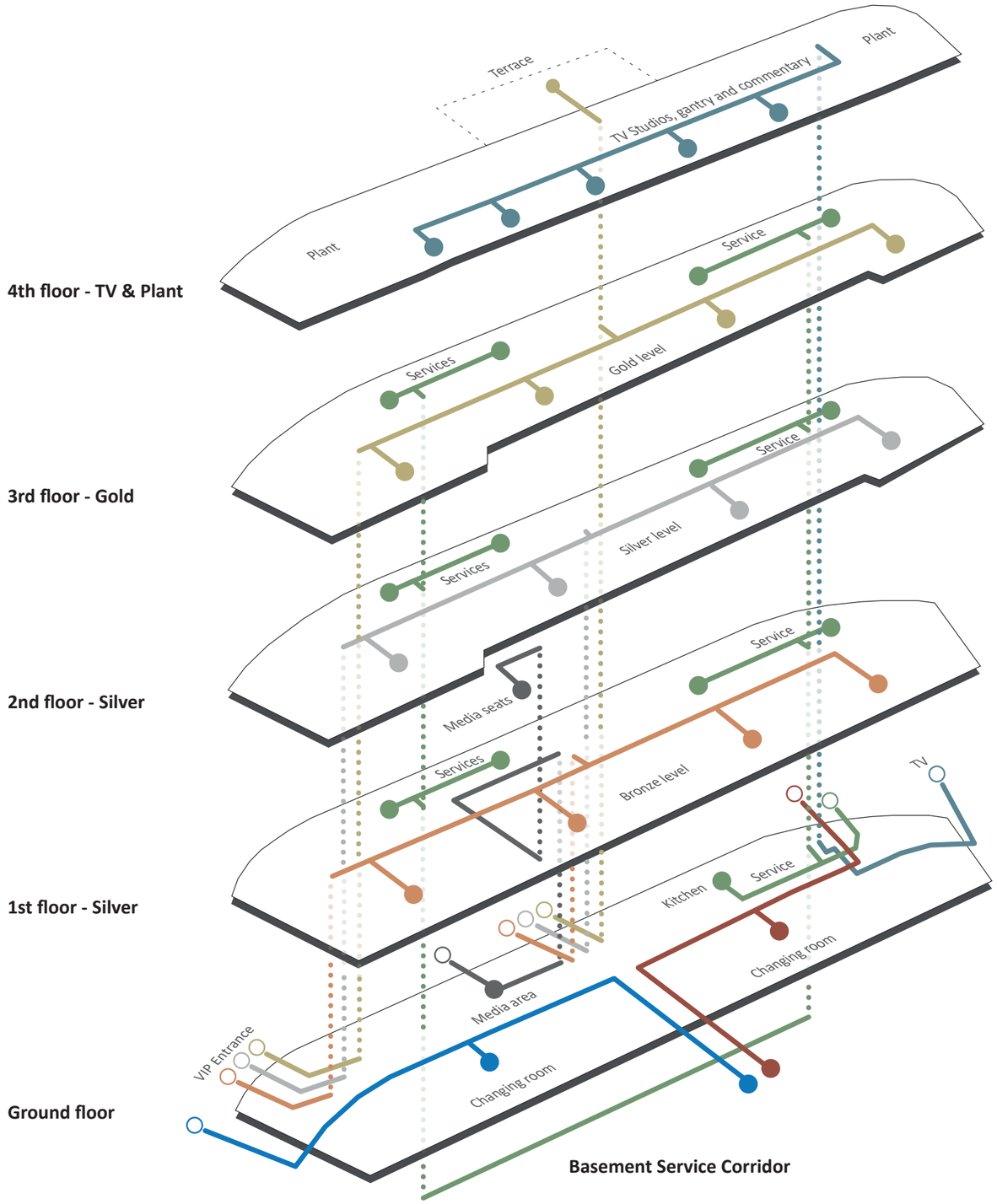
Separate entry points are proposed for home and away teams, media, tv crew, service, and staff. In the plan layout much care has been put into creating an ideal flow between the different user and service groups. An example would be the service access from the kitchen to the different satellite kitchens, bars and serving areas throughout the building. The location of the elevators makes it possible to transport food and catering without moving through the hospitality areas.

A corridor on basement level will offer service connection between the East and West elevator, further eliminating intersections between service and hospitality. Also, the distance from the media area to the designated media seats on the north stand is optimised for minimal intersection.

ZONE OVERVIEW

- Gold
- Silver
- Bronze
- Media
- Service
- Tv
- Away Team
- Home Team





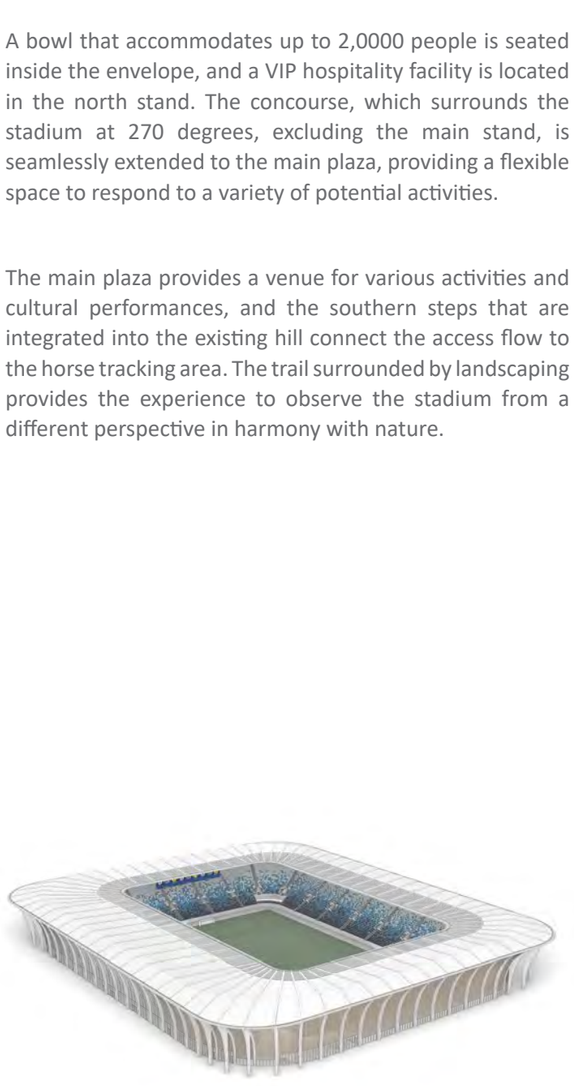
2.4.3. ARCHITECTURAL PRINCIPLES

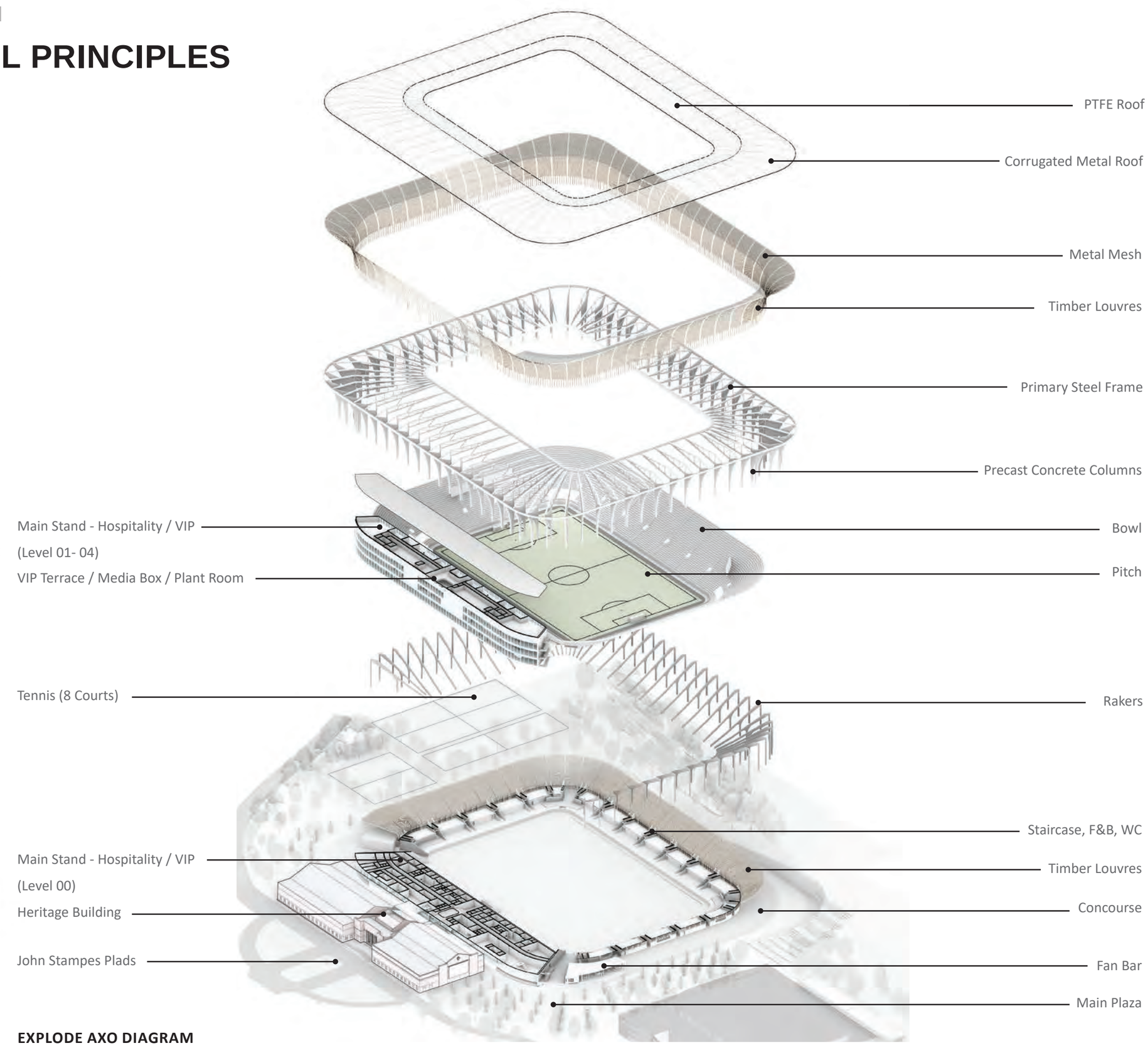
EXPLODED AXO DIAGRAM

The arena consists of three main components - the envelope, the bowl, and the landscape. The envelope is a key component defining the identity of the stadium as a landmark in Aarhus and a complete form combining structure and aesthetics at the same time. The primary columns are precast concrete and the roof is covered in PTFE and metal corrugated metal, while steel frames at 8.3m intervals support the entire stadium in all directions.

A bowl that accommodates up to 2,0000 people is seated inside the envelope, and a VIP hospitality facility is located in the north stand. The concourse, which surrounds the stadium at 270 degrees, excluding the main stand, is seamlessly extended to the main plaza, providing a flexible space to respond to a variety of potential activities.

The main plaza provides a venue for various activities and cultural performances, and the southern steps that are integrated into the existing hill connect the access flow to the horse tracking area. The trail surrounded by landscaping provides the experience to observe the stadium from a different perspective in harmony with nature.

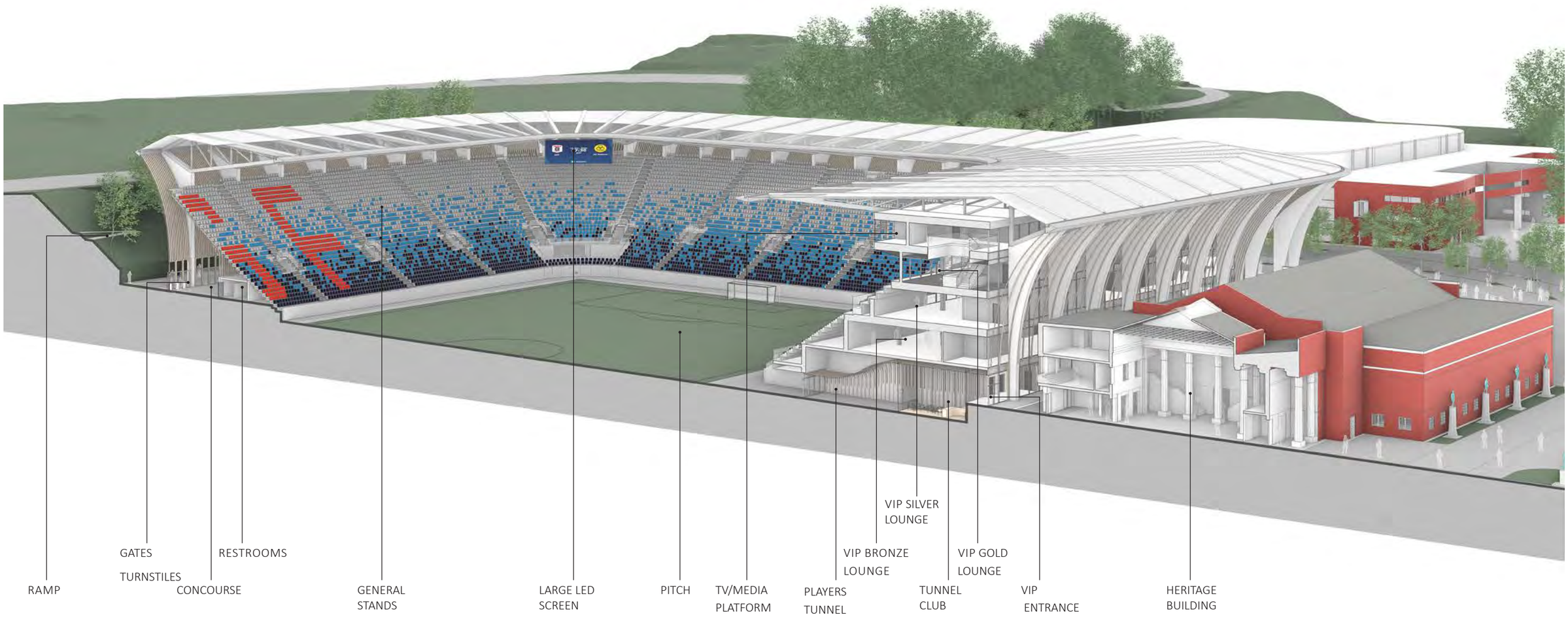




EXPLODE AXO DIAGRAM

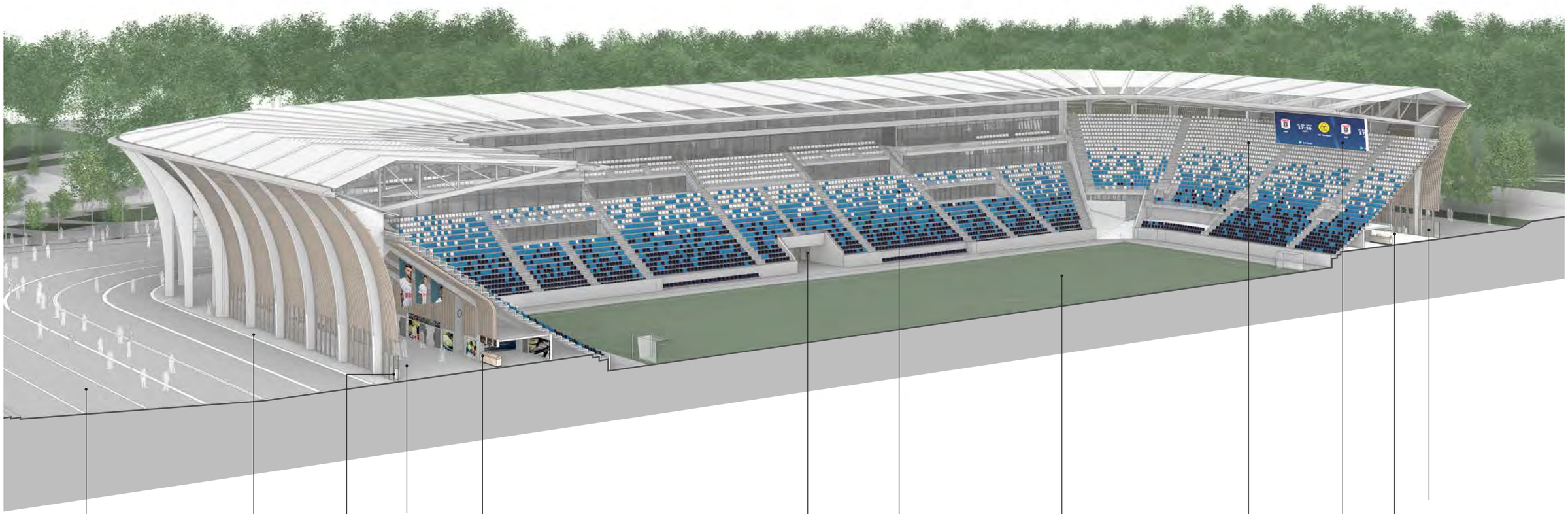
2.4.3. ARCHITECTURAL PRINCIPLES

3D SECTION ALONG SOUTH-NORTH AXIS



2.4.3. ARCHITECTURAL PRINCIPLES

3D SECTION ALONG EAST-WEST AXIS



2.4.4. PRINCIPLE OF A POSSIBLE EXPANSION

WEST SIDE EXPANSION

SINGLE CONCOURSE

DOUBLE CONCOURSE *ADDITIONAL COST: 15,031,222 DKK*

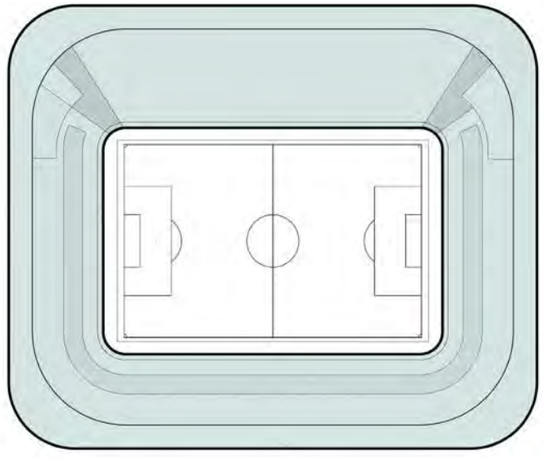
2.4.4. PRINCIPLE OF A POSSIBLE EXPANSION

WEST SIDE EXPANSION

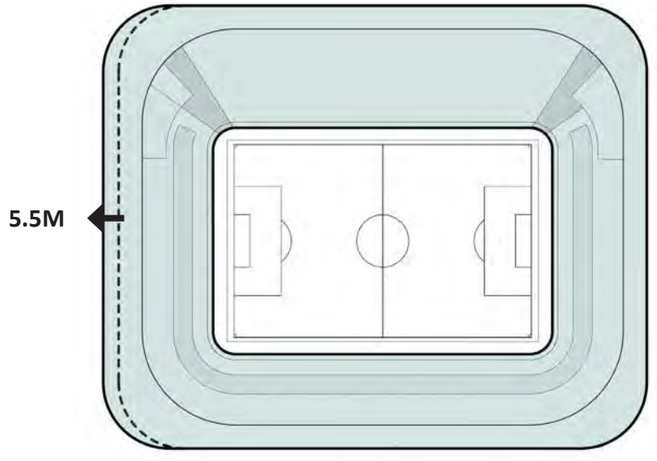
Our proposal is highly flexible for future stadium expansion. The design allows the gates to be relocated to the outer line of columns, providing over 4m extra width to the West concourse if required.

Additionally, a secondary PTFE membrane can be introduced along the outer columns to provide shelter to this expanded zone.

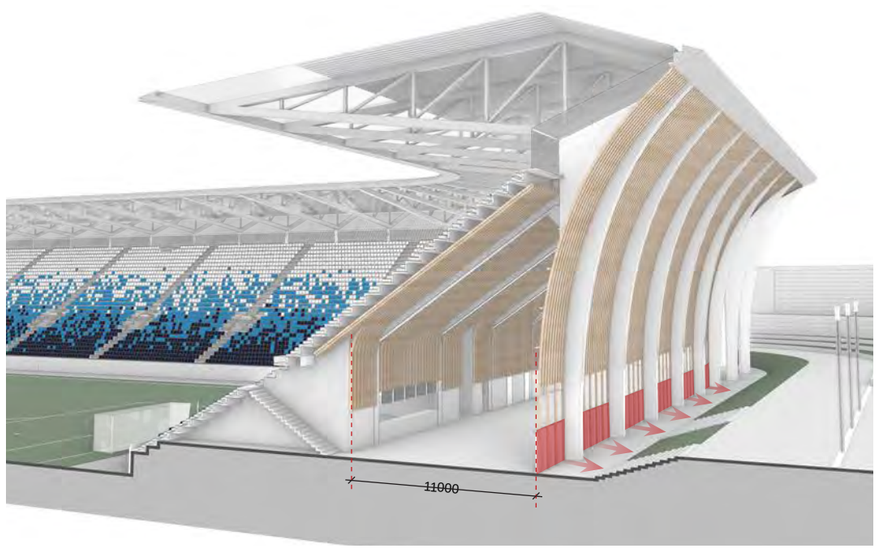
This expansion can be provided with minimal impact on the design intent and minimal additional materials.



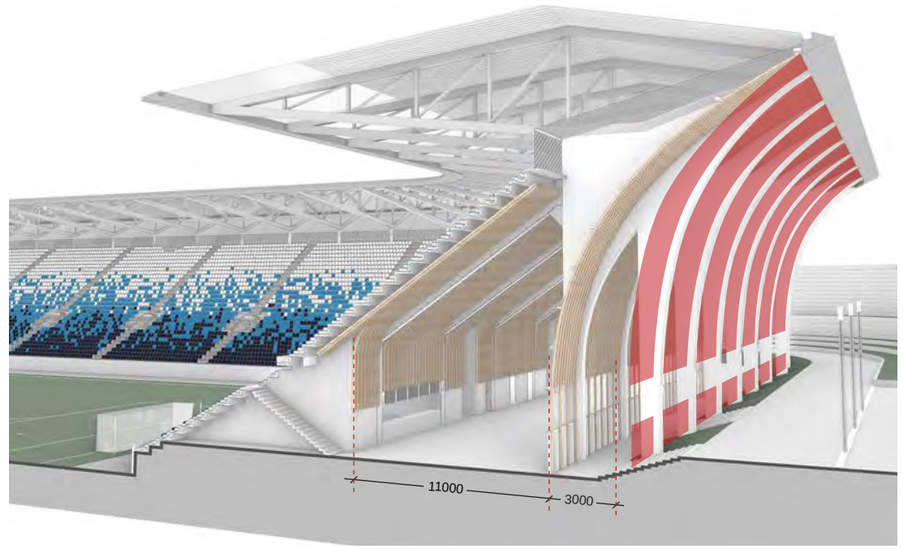
1. ORIGINAL CONCOURSE EXTENT



2. EXTENDED CONCOURSE



1. ORIGINAL CONCOURSE EXTENT



2. OPTION TO EXTEND THE WEST CONCOURSE BY PUSHING THE TICKETED LINE FORWARD AND ADDING A PROTECTIVE MEMBRANE

AARHUS STADIUM COMPETITION

3.0 AREA SCHEDULE

3.0. AREA SCHEDULE

MAIN STAND

Ground Floor	Gross Area (brief)	Actual Gross Area	Difference
PLAYERS/COACHES/OFFICIALS/ARTISTS	1015	1095	80
Home team	403	443	40
Away team	290	343	53
Officials	52	61	9
Medical	152	165	13
Antidoping	51	71	20
Refferee	67	12	-55
MEDIA & BROADCAST	325	317	-8
Media	205	208	
Mixed zone	120	109	
CATERING (BOH)	500	510	10
HOSPITALITY LOBBY / RECEPTION - TUNNELCLUB	150	153	3
SAFETY & SECURITY	125	150	25
AGF FAN BAR	290	289	-1
CLUB SHOP AND TICKETING / VIP ENTRANCE AND LOBBY	515	505	-10
CIRCULATION AND ANCILLARY	780	761	-19
FACILITY MANAGEMENT	245	249	4
Subtotal - Main Stand Level 0	**3945**	**4029**	**84**

Upper levels	Gross Area (brief)	Actual Gross Area	Difference
MAIN STAND - LEVEL 1	2586	2615	29
Bronze hospitality zone	1986	1980	
Club / Operational office	600	635	
MAIN STAND LEVEL 2	2120	2195	75
MAIN STAND LEVEL 3	1800	1834	34
MAIN STAND LEVEL 4	2130	1989	-141
Subtotal	**8636**	**8633**	**-3**
Total Main Stand	**12581**	**12663**	**82**

Concourse areas	Gross Area (brief)	Actual Gross Area	Difference
EAST STAND LEVEL 0	2005	1986	-19
SOUTH STAND LEVEL 0	2415	2445	30
WEST STAND LEVEL 0	1705	1730	25
Subtotal	**6125**	**6161**	**36**
TOTAL GROSS FLOOR AREA	**18.706**	**18.824**	**118**

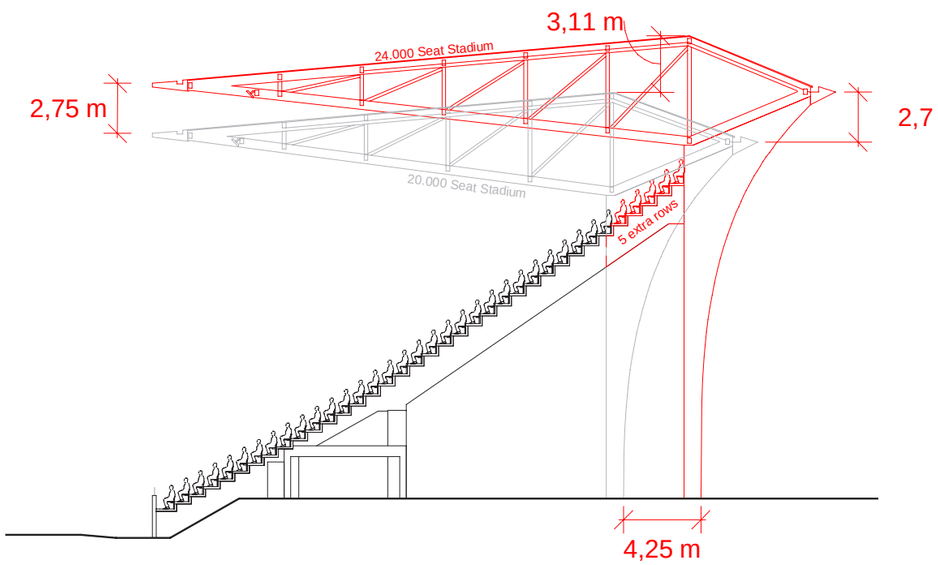
4.0 DESIGN OPTIONS

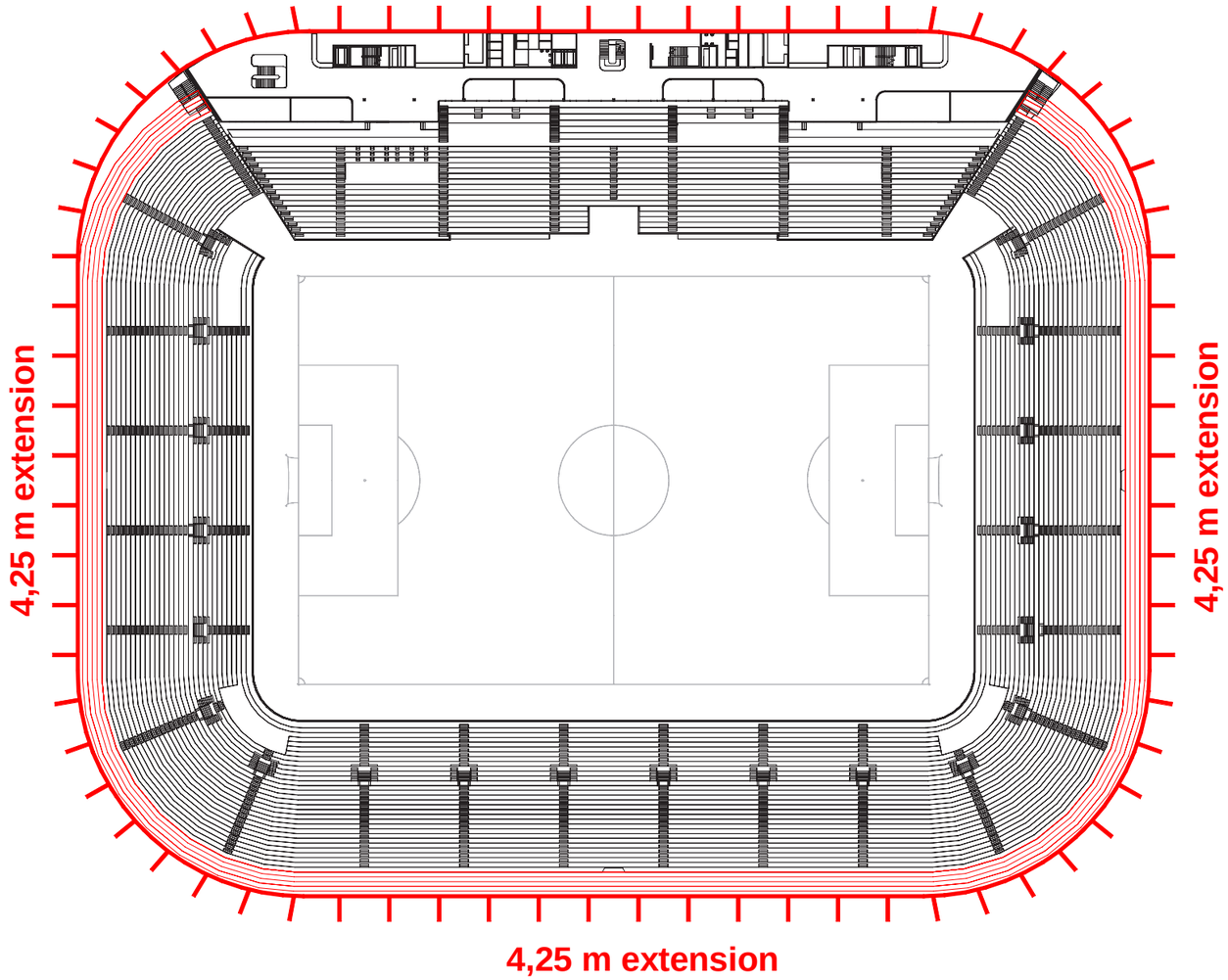
4.0 DESIGN OPTIONS

4.1 INCREASE SEATED CAPACITY TO 24,000

To increase the total seated capacity to 24.000 an additional 5 rows of seats must be added to the west, south and east stands.

To allow for this expansion the roof must be raised 2,8m, measured at the outer edge and the cantilevered span extended by 4,2m.



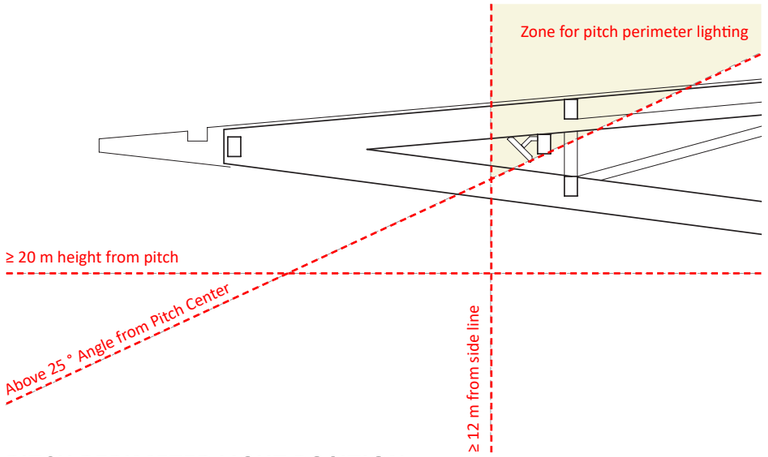


4.0 DESIGN OPTIONS

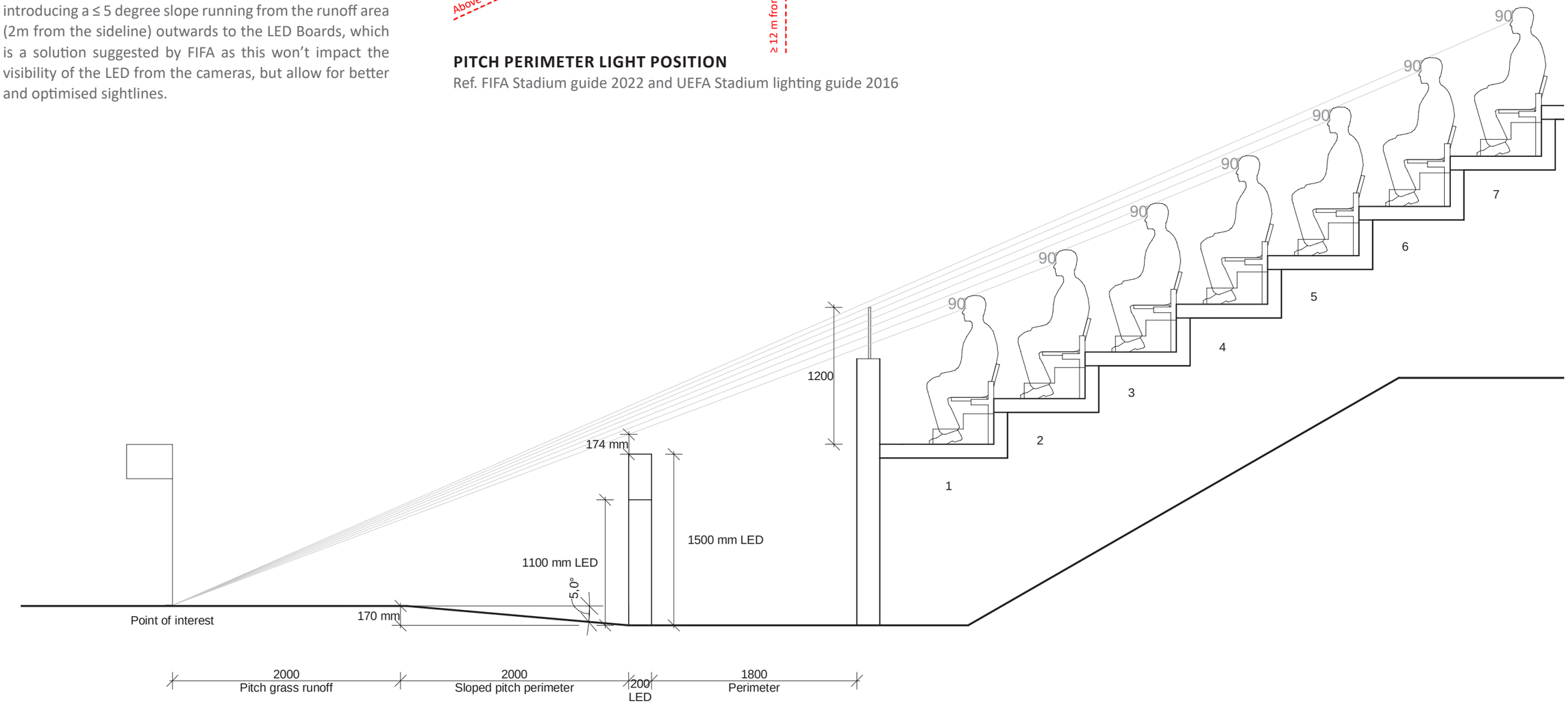
4.2 1. 1M LED PITCHSIDE ADVERTISING BOARDS

The stadium bowl and stands have been designed to allow for both 1,1m and 1,5m LED Advertising boards. This is done by having an adaptive slope or step height on the lower rows. If the option for 1,5m LED is not wanted, the adaptive rows can be adjusted to bring the front row down if desired. However this won't offer any cost saving on the height of roof, as this is locked by technical specifications for the pitch perimeter light. A lower roof will not allow for pitch perimeter light according to both UEFA and FIFA guidelines.

To further optimize sightlines the LED Board is lowered slightly related to the pitch level. This can be done by introducing a ≤ 5 degree slope running from the runoff area (2m from the sideline) outwards to the LED Boards, which is a solution suggested by FIFA as this won't impact the visibility of the LED from the cameras, but allow for better and optimised sightlines.



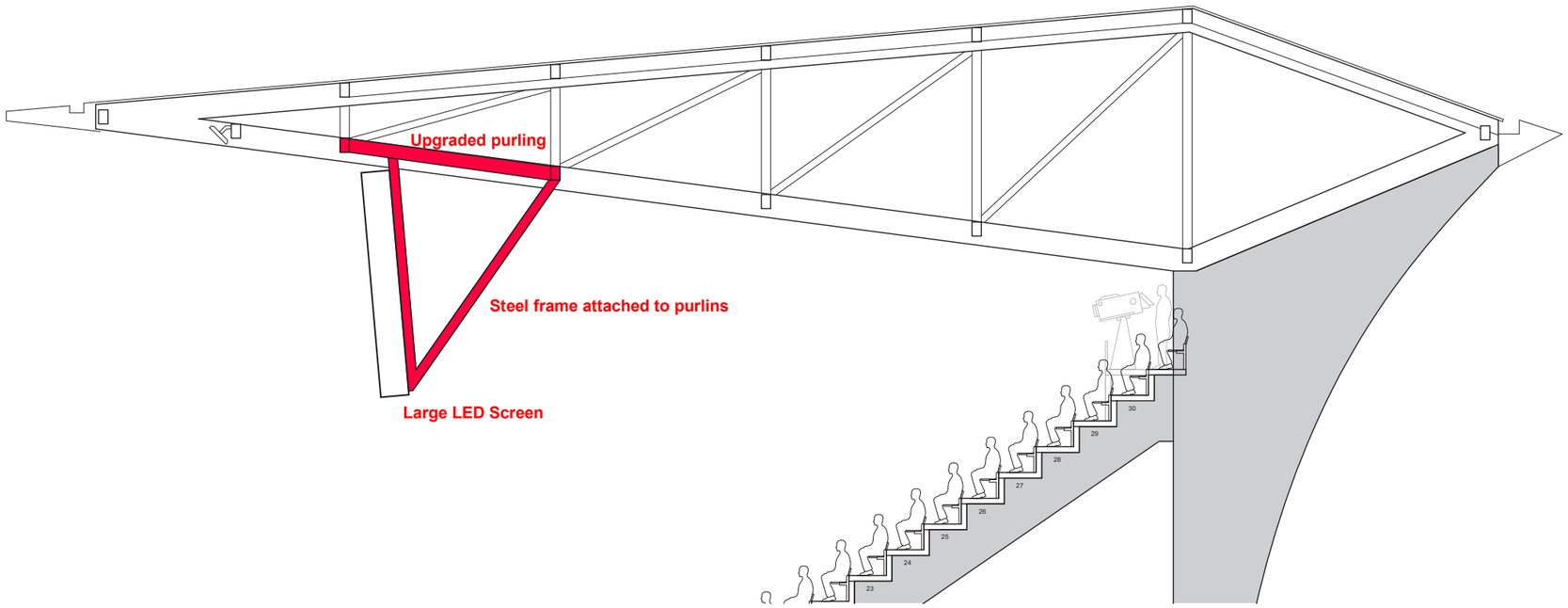
PITCH PERIMETER LIGHT POSITION
Ref. FIFA Stadium guide 2022 and UEFA Stadium lighting guide 2016



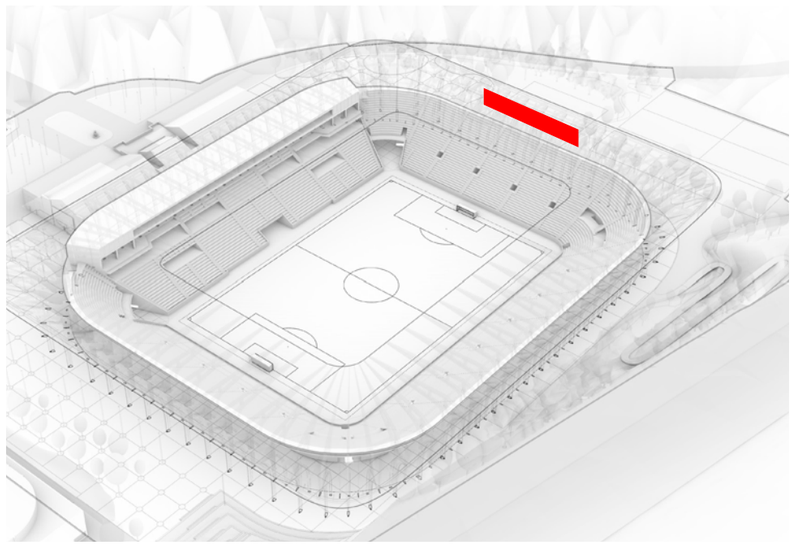
4.0 DESIGN OPTIONS

4.3 LED SCREEN PREPARATION

Suspension for a large LED screen (4,8m × 50m) is made with steel frames suspended in upgraded purlins in steel cantilevering roof structure.



STRUCTURE FOR LARGE LED SCREEN



LOCATION OF LARGE LED SCREEN

LED SCREEN TYPE AND STRUCTURE
(REGULAR SIZE SCREEN)

4.0 DESIGN OPTIONS

4.5 MAXIMUM EVENT CAPACITY

The stadium offers great flexibility for events, and with the introduction of retractable or demountable stands additional capacity can be achieved in a very cost-effective manner.

The options are all based on standing spectators on the pitch with a density heigher towards the stage, with crowd control, service, and security etc. All options are with seats on the stands. Changing of seating to standing on the stand would ad further flexibility and potential capacity increase.

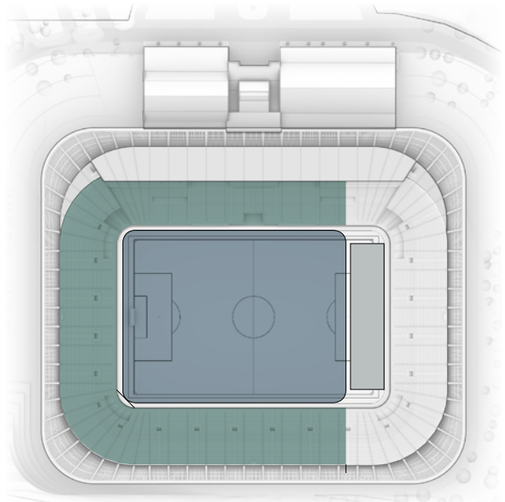
In many situations a demountable stand will be a better option than a retractable one, both in terms of cost, maintenance, and flexibility. If the shift in capacity for events are only done a few times a year, the demountable solution is recommended.

The exact event capacity depends on the event stage and AV setup, crowd control, risk level, artist, age group and more.

SCHEME A. BASE STADIUM

Pitch	23.050
Seated	12.650
Total	**35.700**

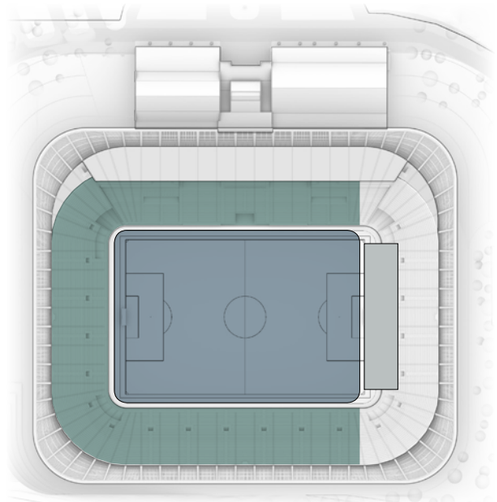
Free standing stage on the pitch, in front of the east stand.



SCHEME B. DEMOUNTABLE STAND EAST

Pitch	24.550
Seated	13.450
Total	**38.000**

Demountable or retractable lower east stand allows for a stage setup off the pitch, allowing for a greater capacity.

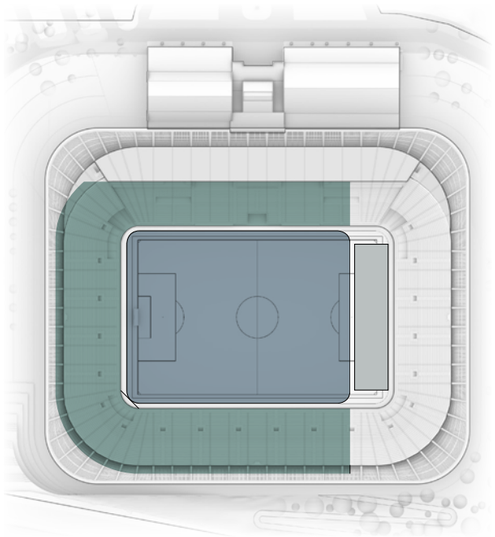


SCHEME C. 24.000 SEATED STADIUM

Pitch	24.550
Seated	15.600
Total	**40.150**

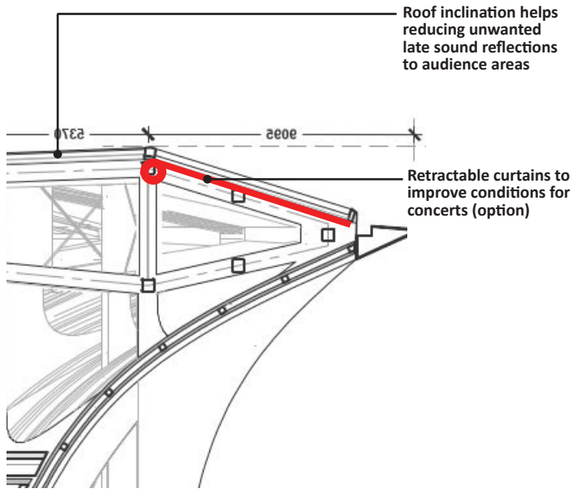
If the stadium is built to accommodate 24.000 seats, as described in an option previously, and additional 5 rows will be added. In this setup with a free-standing stage in front of the east stand (as Scheme A) these extra 5 rows will bring the capacity up without the use of demountable stands.

Combinen this option with the retractable stand (scheme B) will potentially allow for an even greater capacity.



ZONE OVERVIEW

- Standing
- Seating
- Stage Setup



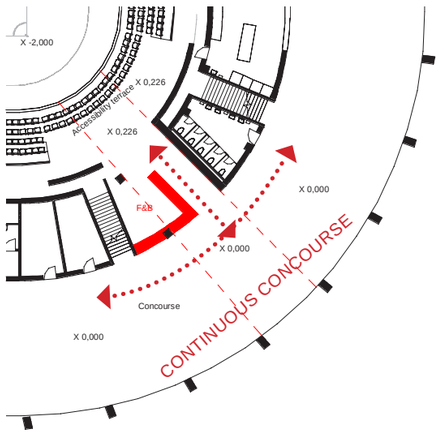
4.0 DESIGN OPTIONS

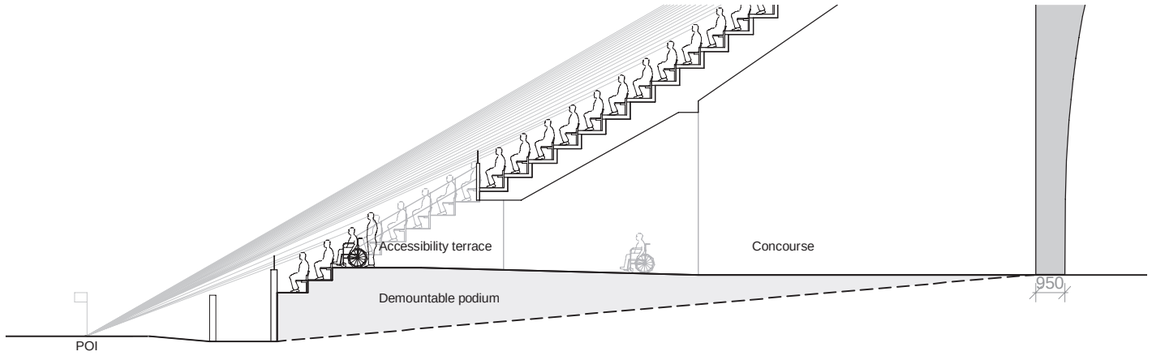
4.6 ADDITIONAL EVENT EGRESS

In the stadiums base setting, for football matches, the accessibility terraces in the south-east and south-west corners accommodates wheelchair access and view.

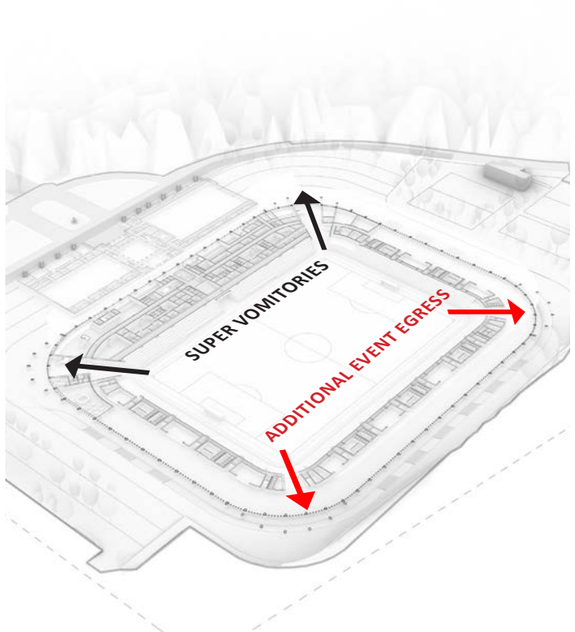
Between the terrace and bowl, a open removable F&B stand offers added flexibility.

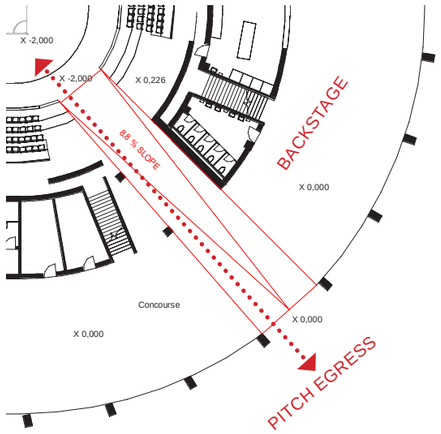
For additional egrees a solution has been developed to provide a ramped egress from the pitch level in event situations while still securing an uninterrupted concourse flow in the normal use, and keeping the optimal accessibility access as well. A ramp will connect the pitch level with the outer perimeter of the stadium, allowing for quick and efficient egress. As the ramp creates a void cutting through the accessibility terrace as well as the concourse, a demountable podium with flooring will be built to allow for a continuous concourse and preserved accessibility terrace and function when the stadium is not used for events.



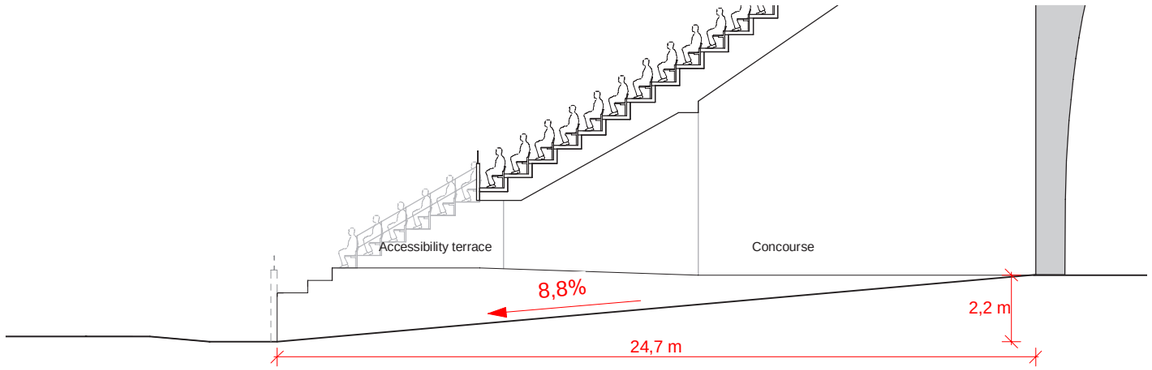


NORMAL USE / FOOTBALL MODE





CONCERT PITCH EGRESS / EVENT MODE



CONSTRUCTION COSTS AND ROBUSTNESS

2.2 ROBUSTNESS OF THE PROJECT

LIFE CYCLE

LIFECYCLE

The project uses material such as concrete and treated timber which can last 50 years or more. The lifecycle of these materials are robust and long lasting.-

MATERIALITY

In regard to robustness in terms of durability, our project is designed using long lasting and durable materials such as concrete, steel and Accoya, thoroughly tested in the Danish climate and also in similar places gathering big crowds.

The landscape material palette offers robust and easy manageable choices. The materials are found in the direct context and is easily blended with the surroundings..

REUSE

There is a possibility to reuse seats, concrete, beams, mesh. These are however limited to approval of warranty and subjected to testing of the current conditions of the material. In the landscape existings materials such as gravel, concrete and asphalt can be recycled into new pavement, new casted concrete and unbound base layer for the roads and new plaza.

FLEXIBILITY

Scalable design options with the possibility to add double colonnade to both west and east. It is also possible to reduce the double colonnade in the SW and SE corners without compromising the design intentions.

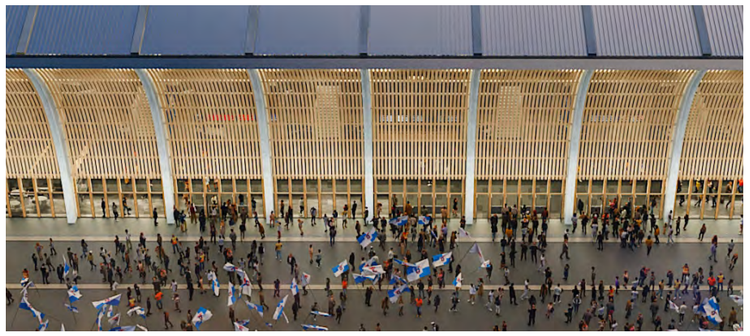
Asphalt is a flexible material which is easy work with, repair and make changes. Using prefabricated concrete elements makes it easy to repair.

The planting strategy and choice of different tree species ensure a robust and flexible planting. If a tree species dies because of illness or climate change it is easy to replace them with some other tree species.

MAINTENANCE

The metal corrugated roof is easy to clean and maintain with its natural 5% roof angle that helps drain water. The concrete columns on the facade are robust and requires very little maintenance.

The pavement materials used in the landscape are mainly hard surfaces what requires little to no maintenance and allows for easy snow- and leaves removal

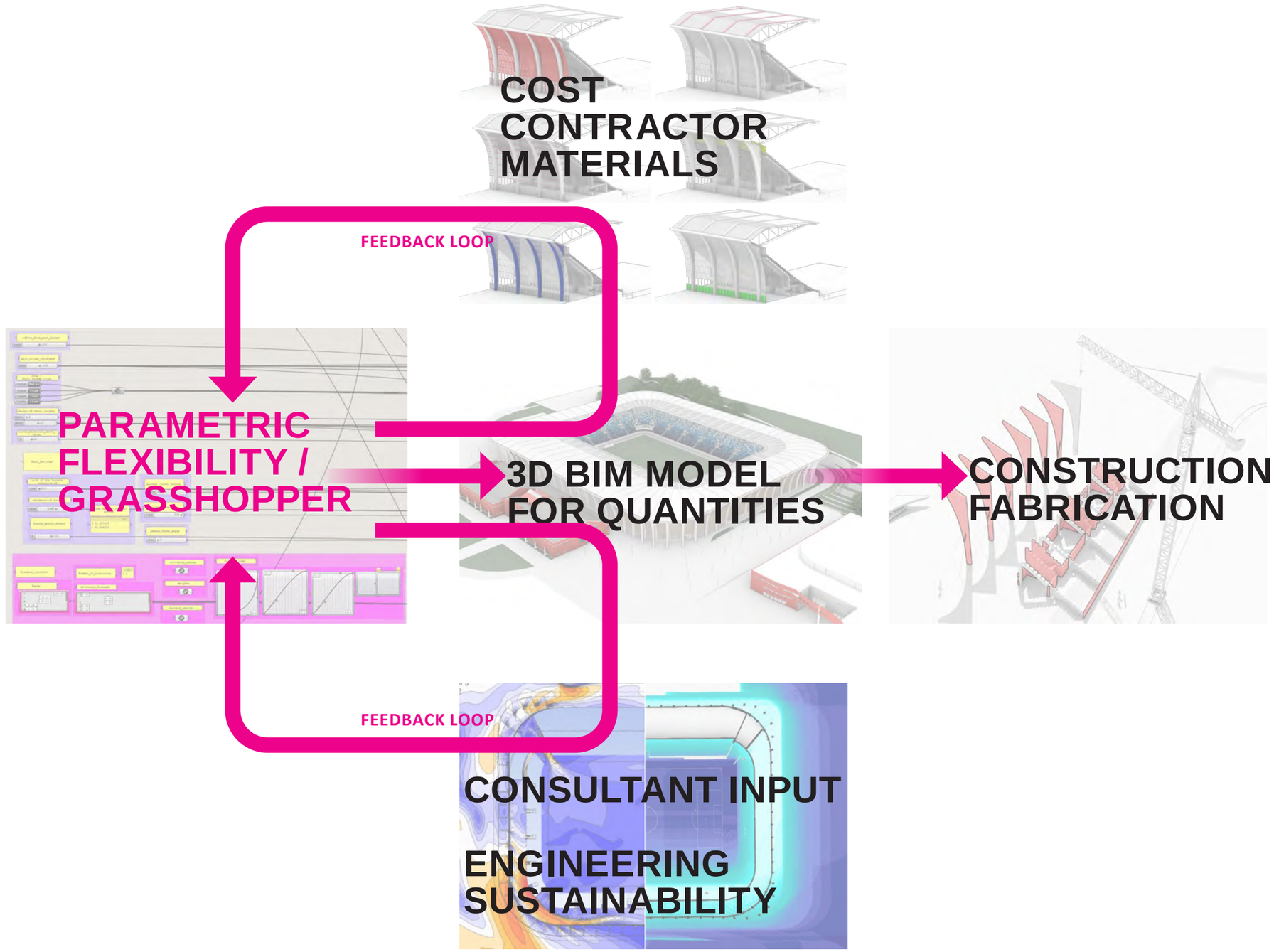


2.2 ROBUSTNESS OF THE PROJECT

DESIGN APPROACH

PARAMETRIC FLEXIBILITY

The use of scripting in the design process allows for a flexible collaboration between the Design team and the Contractor. It allows for changes to be quickly implemented and updated based on feedback in a short and cost-effective time-frame. When the contractor comes on board changes based on manufacturing, construction, pricing, and materiality can be updated while maintaining the architecture design quality. It also allows for the design to be modified based on environmental conditions and analysis, making the project more sustainable.



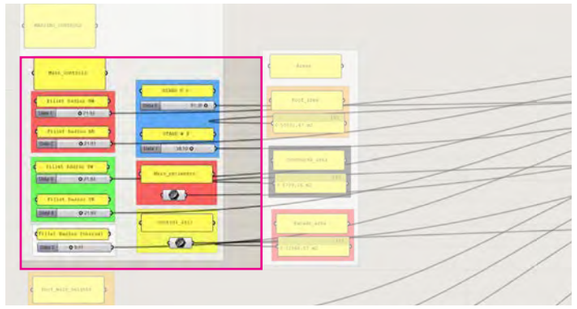
2.2 ROBUSTNESS OF THE PROJECT

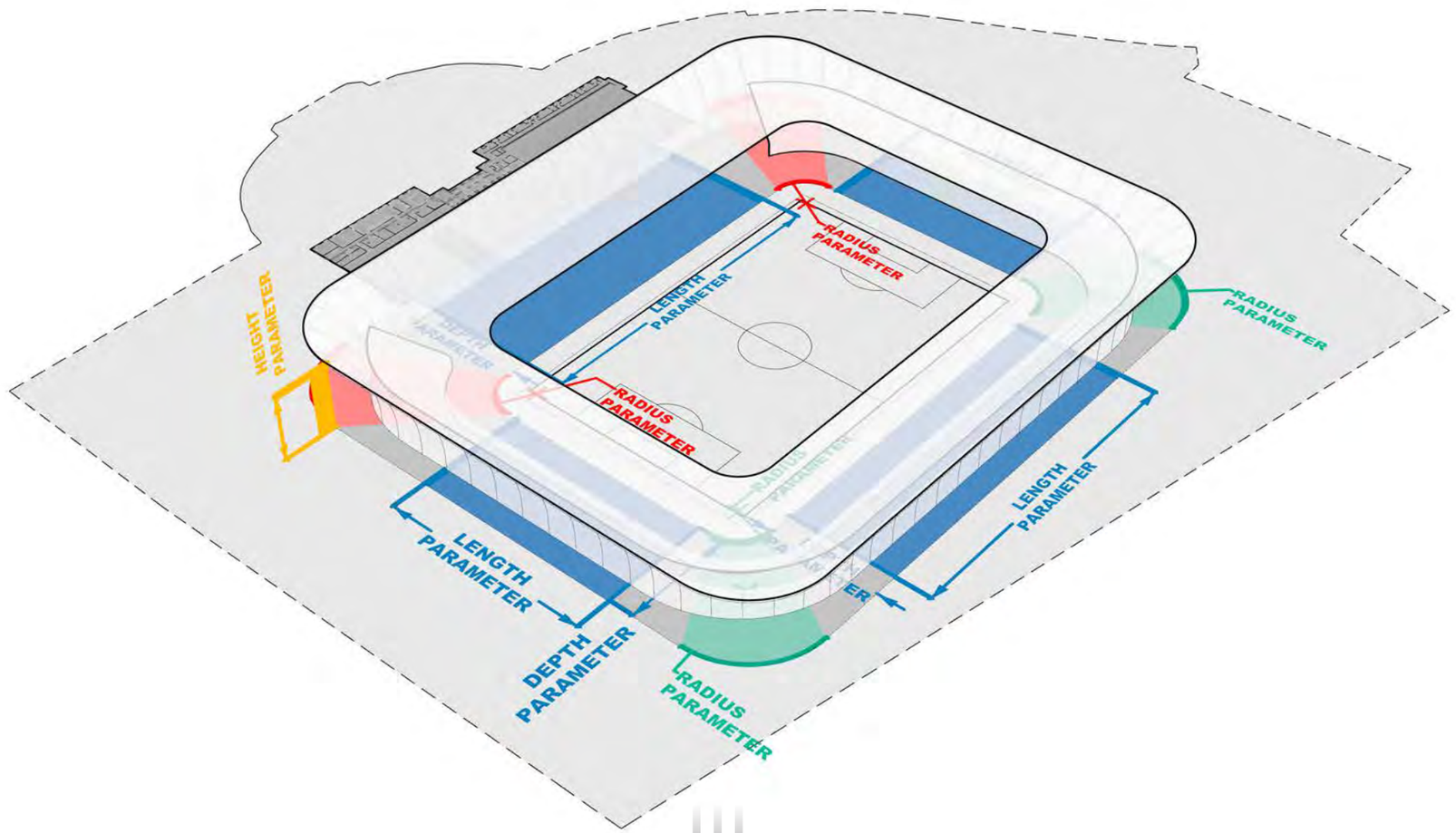
MASSING FLEXIBILITY

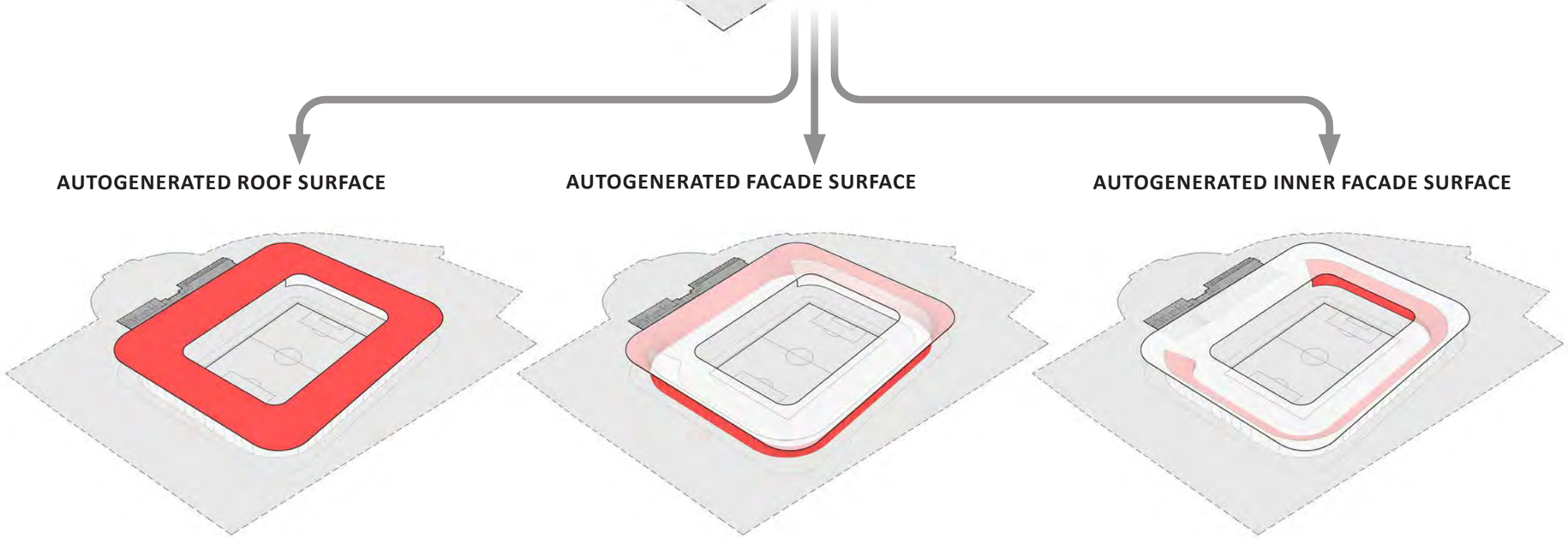
PARAMETRIC FLEXIBILITY

The massing can be adjusted depending on **cost, material, manufacturing, contractor and performance**. All further parameters, like structure grid, column geometry, façade, concourse and roofing adjusts accordingly.

MASSING FLEXIBLE AND CUSTOMIZABLE







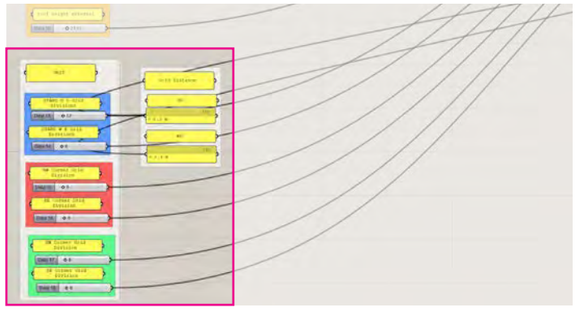
2.2 ROBUSTNESS OF THE PROJECT

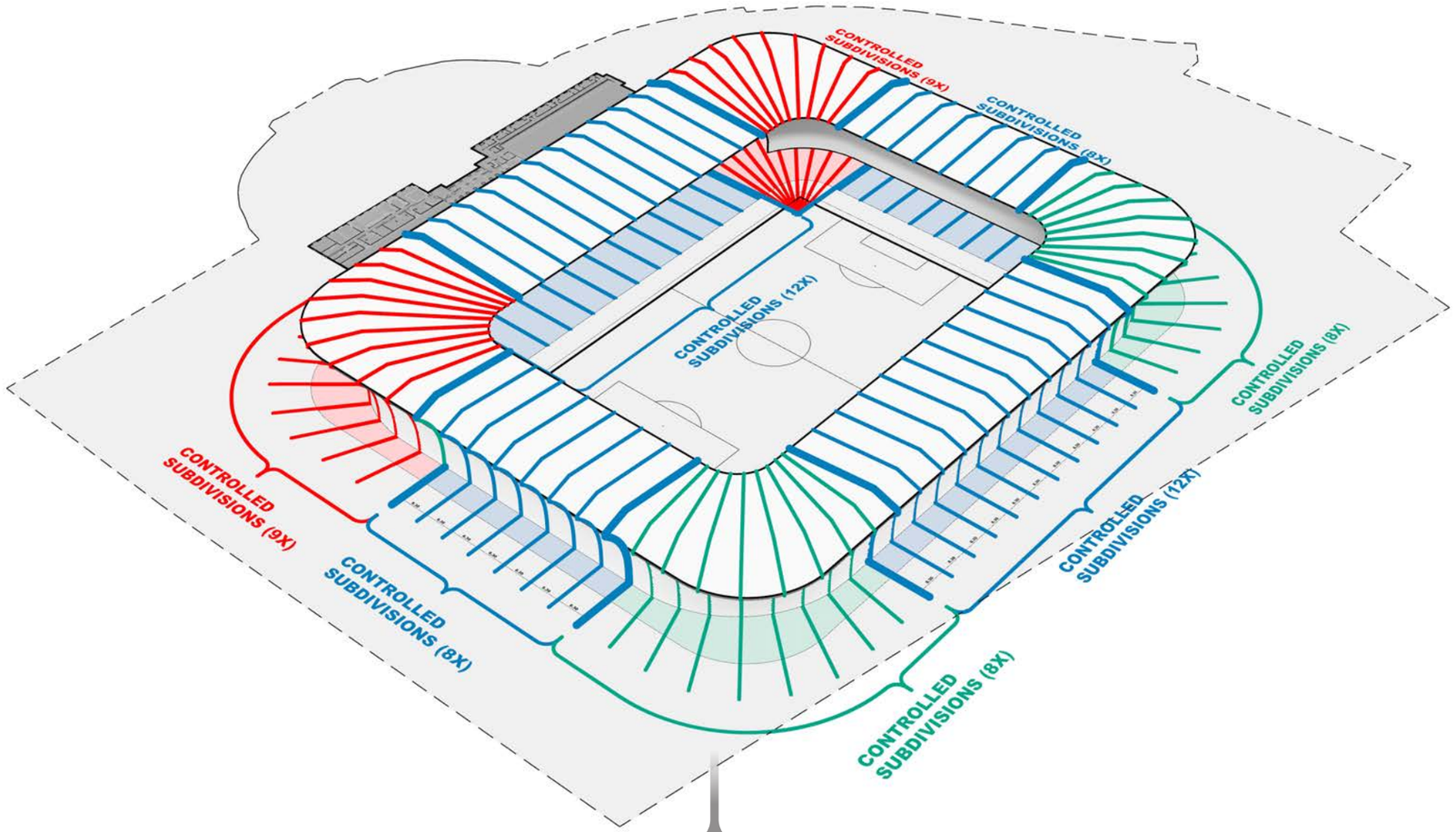
GRID AND STRUCTURE FLEXIBILITY

GRID & STRUCTURE FLEXIBILITY

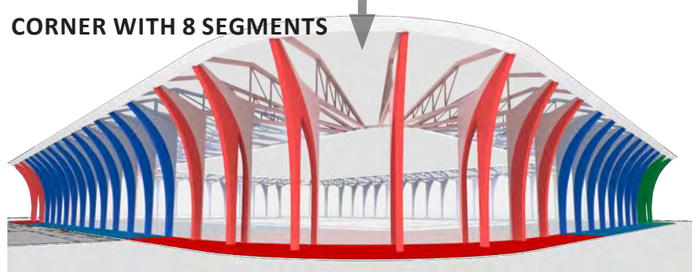
The grid raster can be controlled dynamically. It can be adjusted depending on **cost, material, manufacturing, contractor and performance**. The base for the grid derives from the parameters which have been set for the massing in the previous step. The grid setup is informed depending on structural feedback, visual preference as well as cost.

GRID FLEXIBLE AND CUSTOMIZABLE

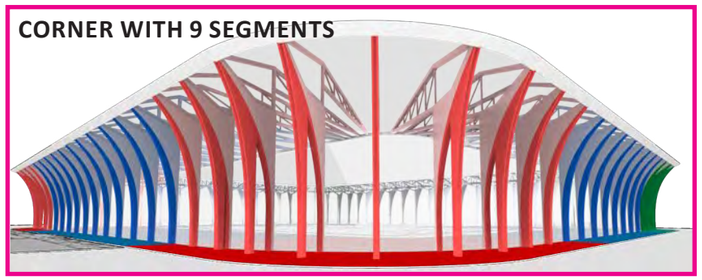




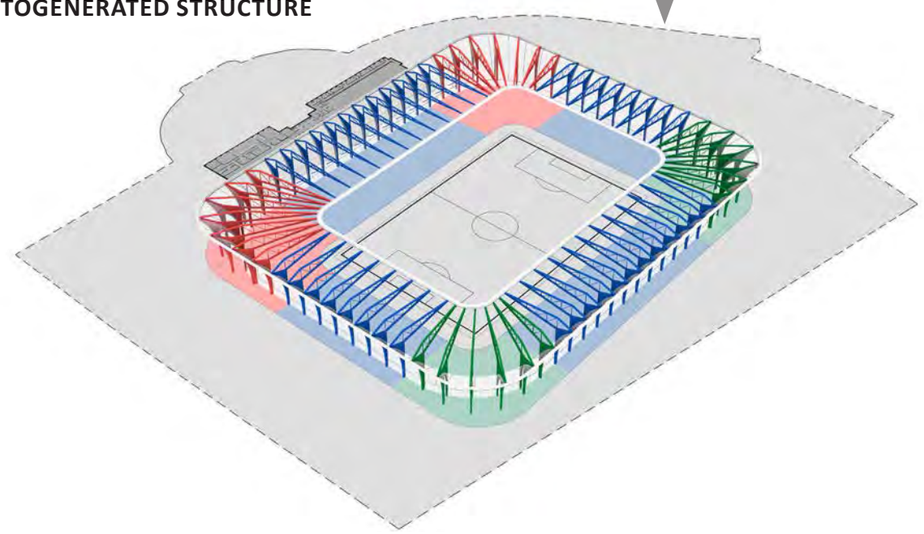
CORNER WITH 8 SEGMENTS



CORNER WITH 9 SEGMENTS



AUTOGENERATED STRUCTURE



2.2 ROBUSTNESS OF THE PROJECT

STRUCTURE RATIONALIZATION AND OPTIMIZATION

COLUMN TYPE OPTIMIZATION

The optimisations allowes the expected saving and provides a significant contribution towards the target budget. The resulting design is stronger, buildable, closer to the local construction habits.

- Only 2 standard construction form-works - with few polystyrene fillers - to build all architectural columns

REPETITION

Primary Columns **x74**

	Concrete Columns	x74

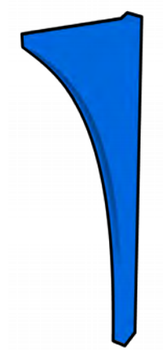
Secondary Columns (Type N+S) **x26**

Type N x14 *Type S x12*	Concrete Columns	x26

TOTAL COLUMNS **100**

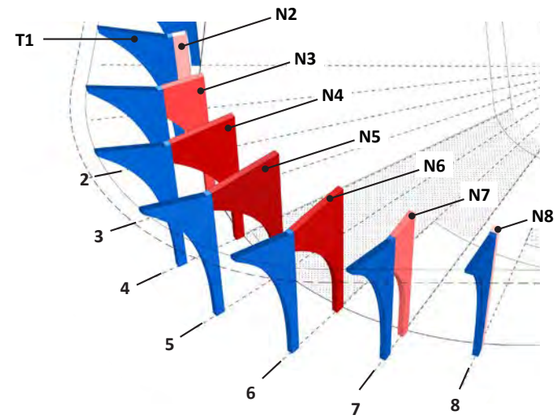
Type T (Typical)

Type	N2
Quantity	74
Total	**74**



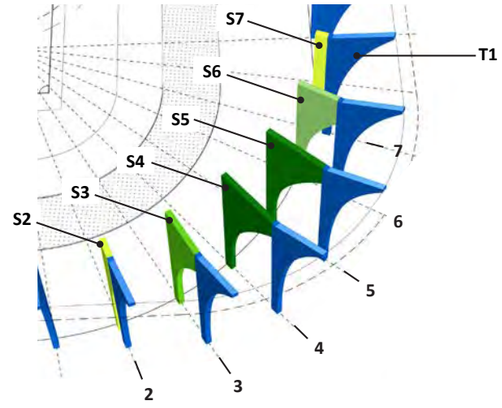
Type N (North)

Type	N2	N3	N4	N5	N6	N7	N8
Quantity	2	2	2	2	2	2	2
Total	**14**						

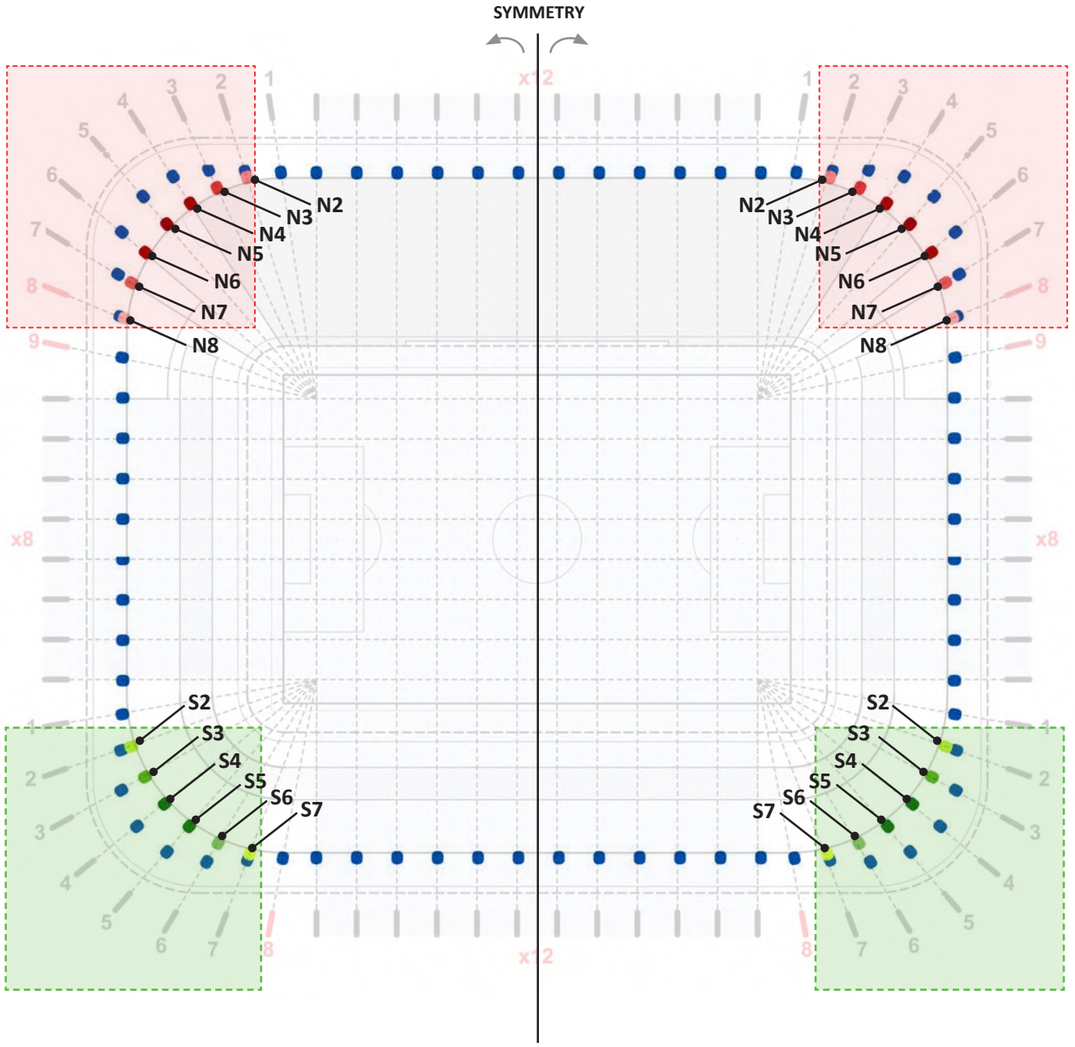


Type S (South)

Type	S2	S3	S4	S5	S6	S7	-
Quantity	2	2	2	2	2	2	-
Total	**12**						



TYPE T COLUMN - CONCRETE MODEL 1:20



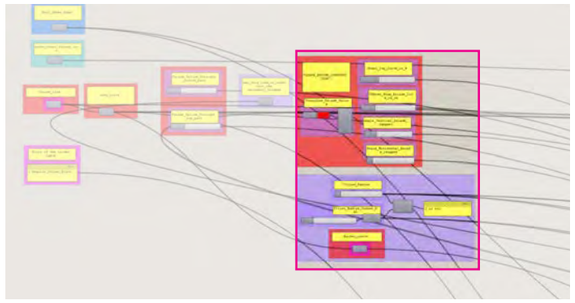
2.2 ROBUSTNESS OF THE PROJECT

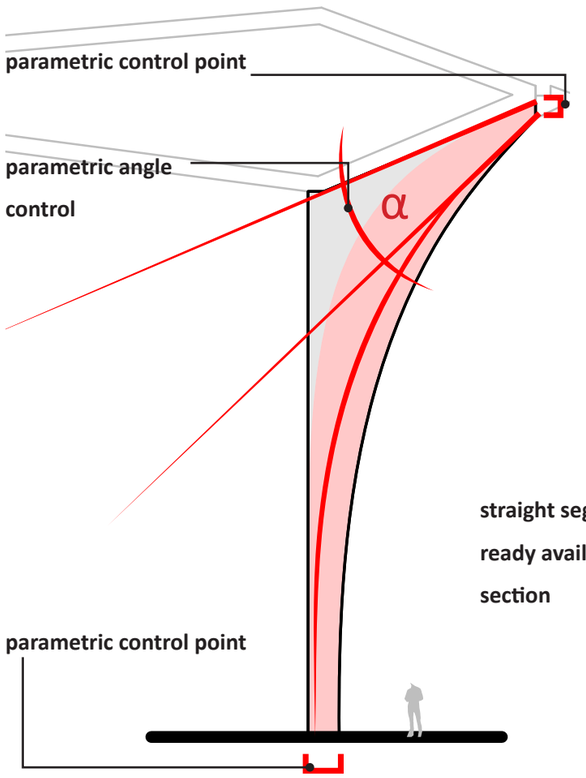
FACADE FLEXIBILITY

FACADE RATIONALIZATION

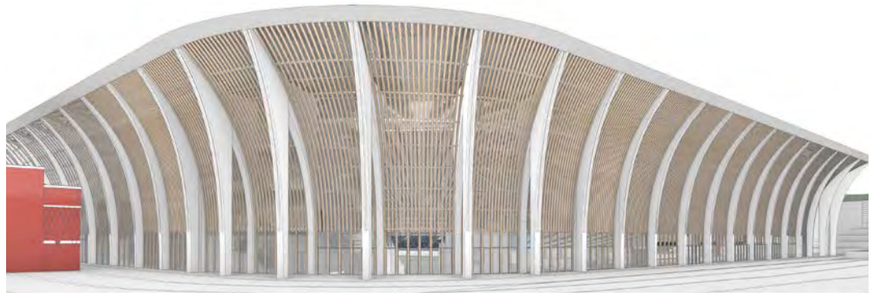
The facade timber louvers can be adjusted depending on **cost, material, manufacturing, contractor and performance.** They can be made out of straight, bend and straight and curved elements to create a fluid continuous facade.

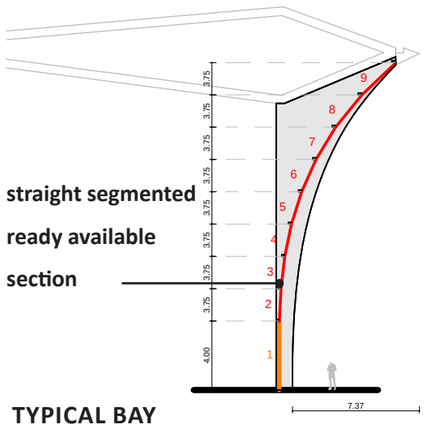
LOUVERS FLEXIBLE AND CUSTOMIZABLE

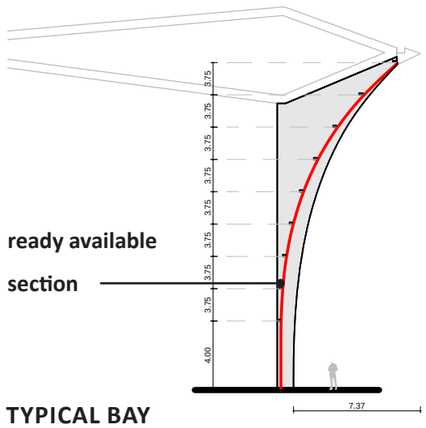


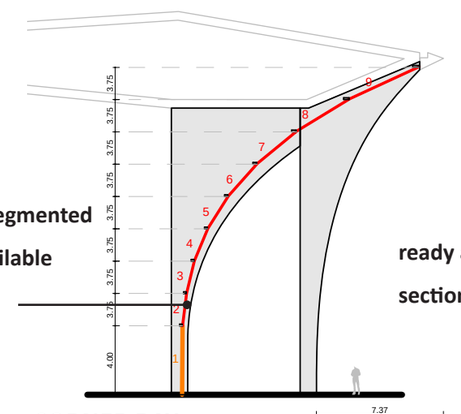


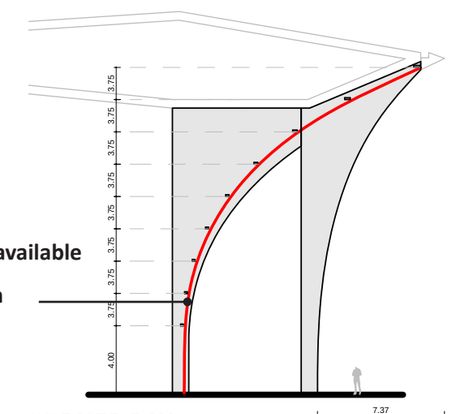
OPT1: STRAIGHT/ CURVED TIMBER LOUVERS
READY AVAILABLE SECTIONS



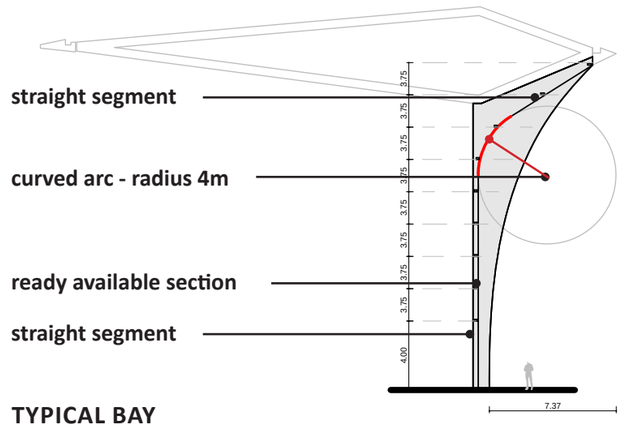


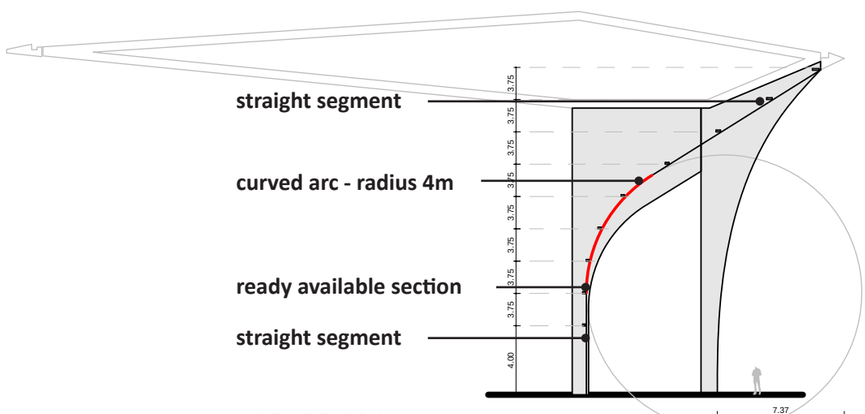






OPT2: STRAIGHT AND CURVED TIMBER LOUVERS
READY AVAILABLE SECTIONS





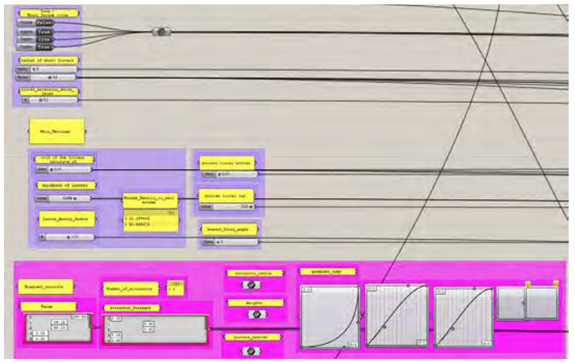
2.2 ROBUSTNESS OF THE PROJECT

FACADE PERFORMANCE AND FLEXIBILITY

OPTION 1A - DENSE CORNERS FOR LED ACTIVATION

The louver density can be adjusted to the architectural and environmental challenges. High density provides s**helter and comfort, low density openness, light and visual comunication.**

LOUVERS FLEXIBLE AND CUSTOMIZABLE

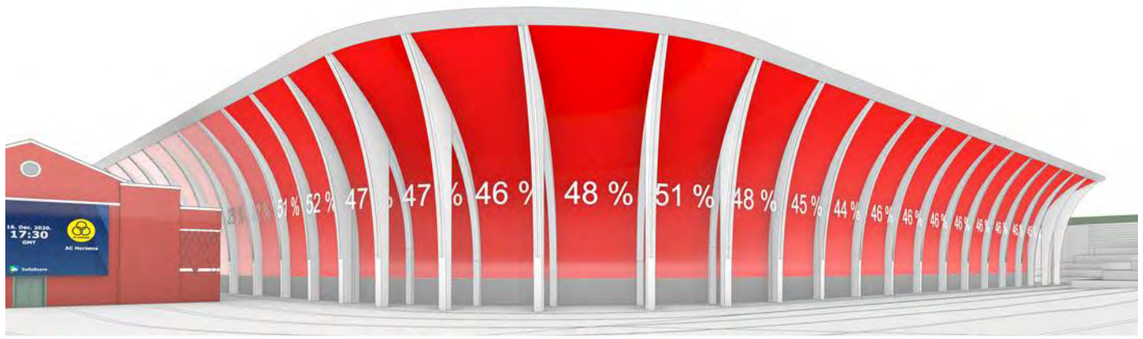


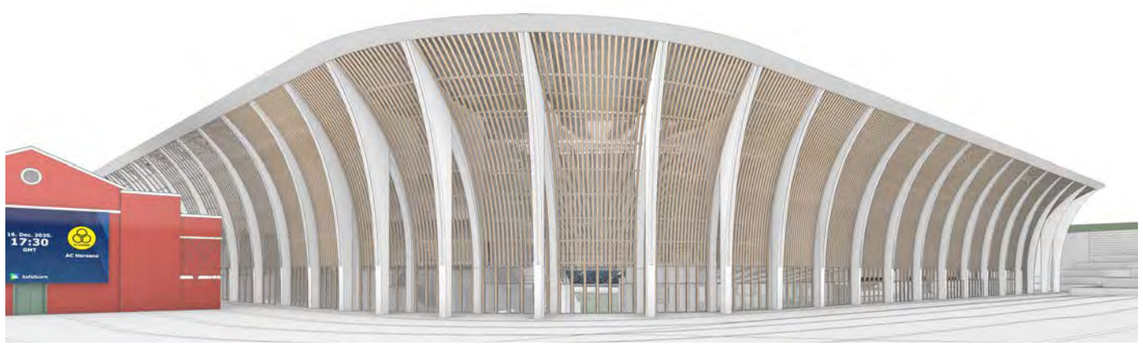
LOUVERS

material: timber (Accoya)

length: 22595 m

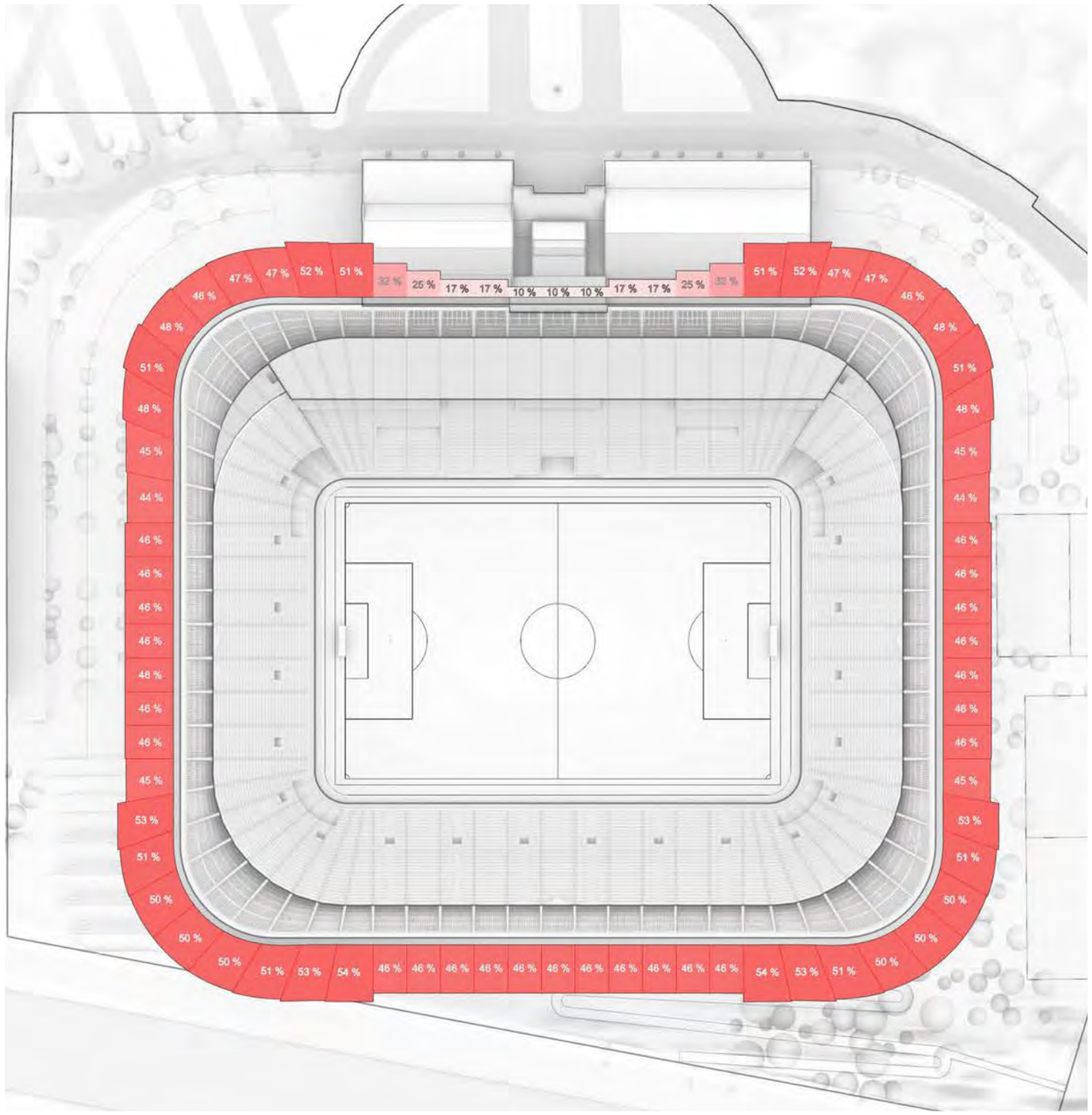
cross section: 20 cm x 2.5 cm





MAIN PLAZA

100 % Enclosed **Fully open**



PLAN

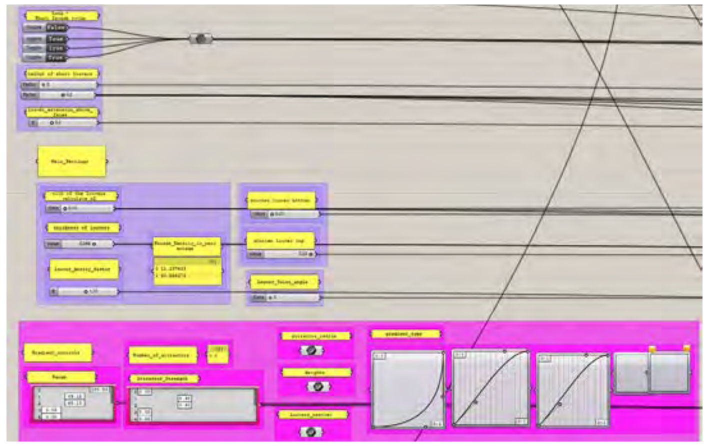
2.2 ROBUSTNESS OF THE PROJECT

FACADE PERFORMANCE AND FLEXIBILITY

OPTION 1B - POROUS CORNERS FOR TRANSPARENCY

A lower louver density towards the fan plaza would allow a higher **visual connection from the VIP area to the fan plaza, as well as a better illuminated main stand.**

LOUVERS FLEXIBLE AND CUSTOMIZABLE

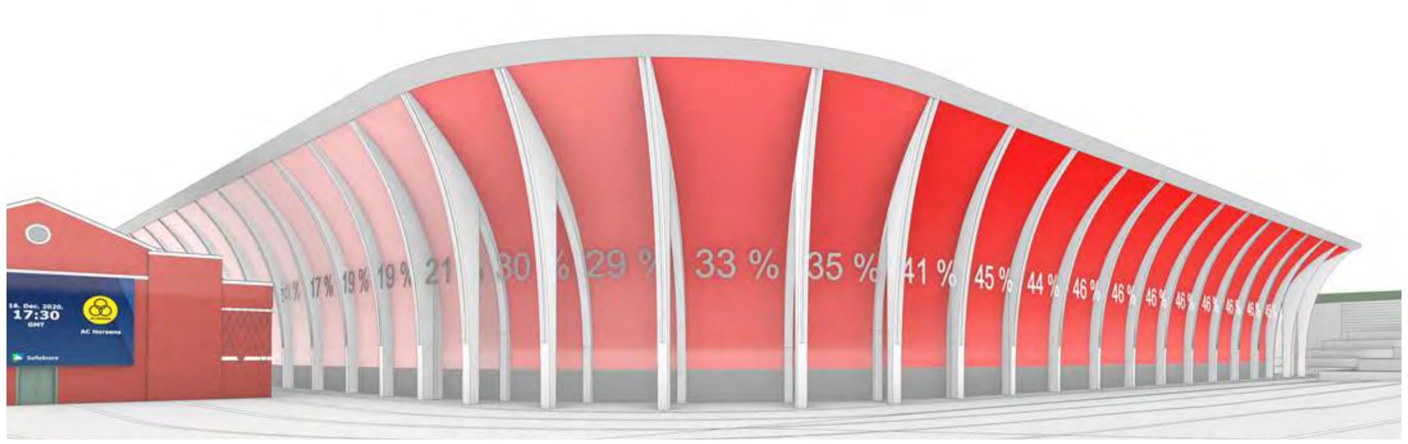


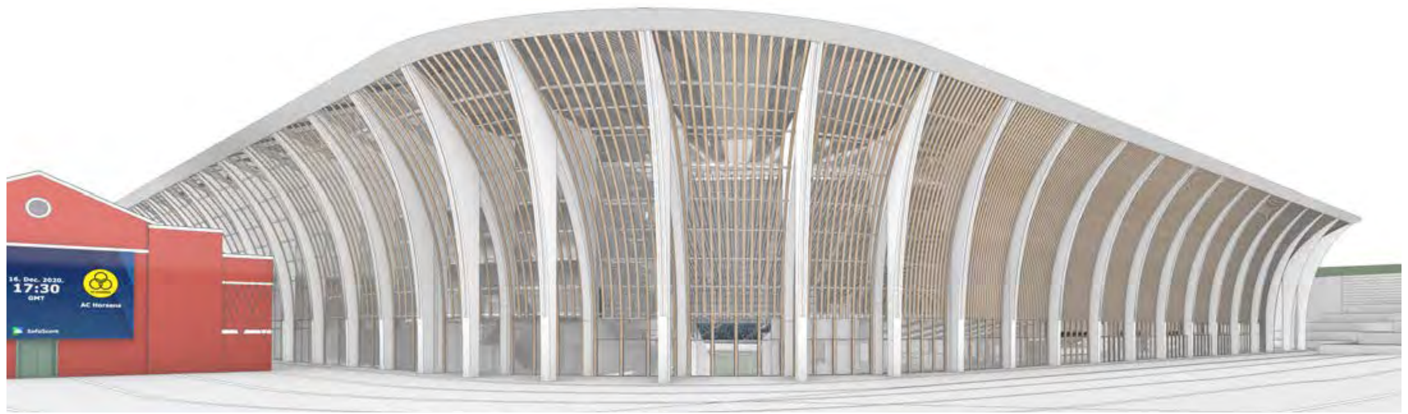
LOUVERS

material: timber (Accoya)

length: 19735 m

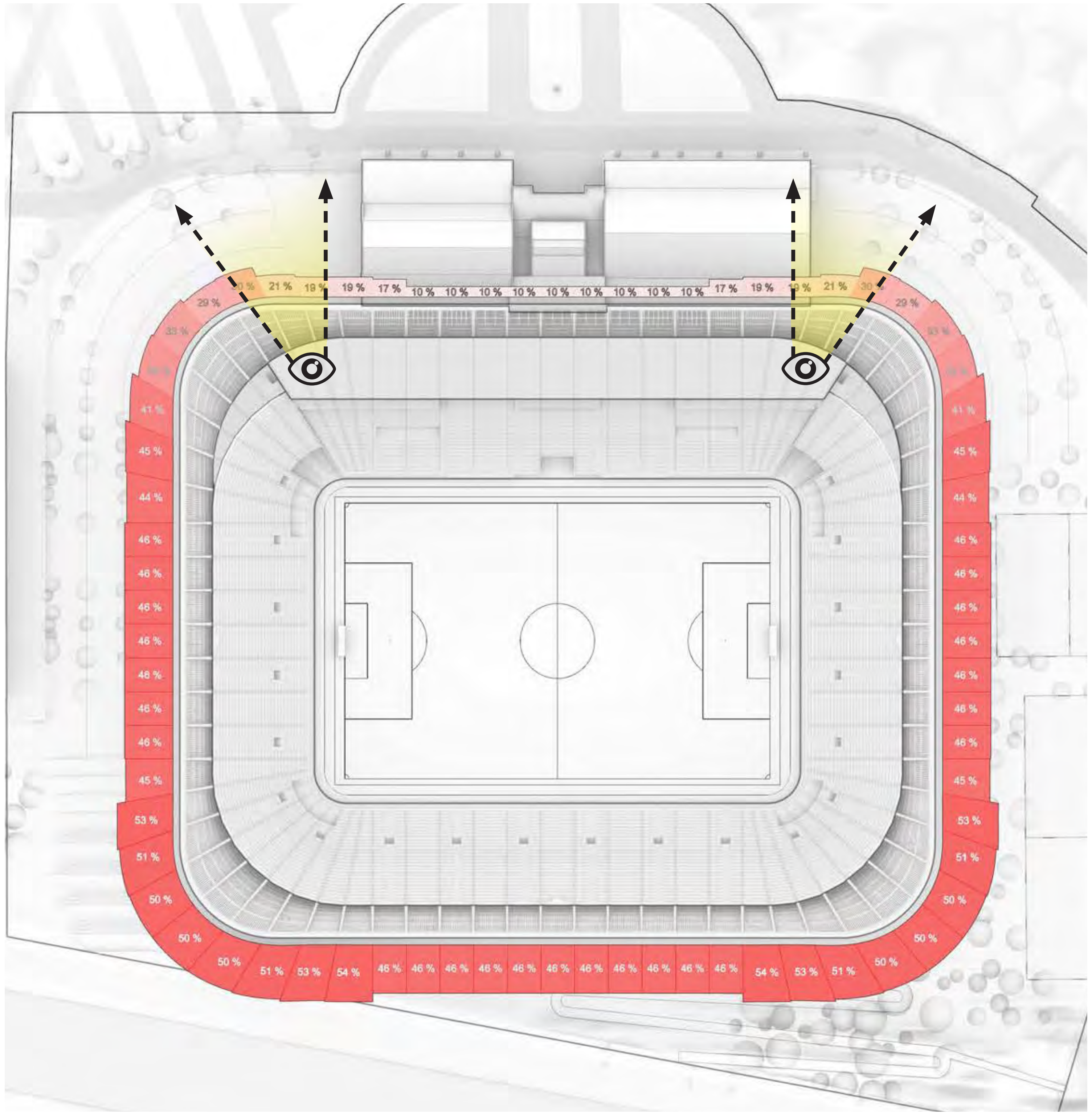
cross section: 20 cm x 2.5 cm





MAIN PLAZA

100 % Enclosed — Fully open



PLAN

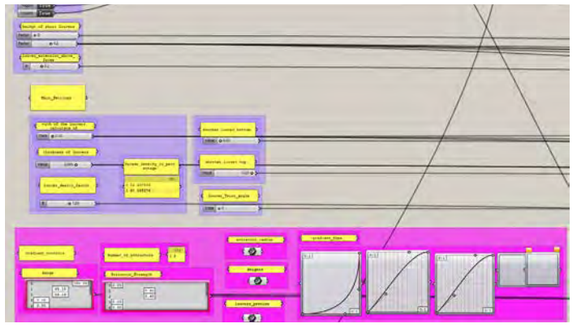
2.2 ROBUSTNESS OF THE PROJECT

FACADE PERFORMANCE AND FLEXIBILITY

OPTION 2B - PERFORMATIVE FACADE

The louver density adjusts according to the challenges on site. A lower louver density towards the fan plaza would allow a **higher visual connection from the VIP area to the fan plaza, as well as a better illuminated main stand**. The low density corners around the stadium allow for **air evacuation, reducing the winds inside the concourse**.

LOUVERS FLEXIBLE AND CUSTOMIZABLE

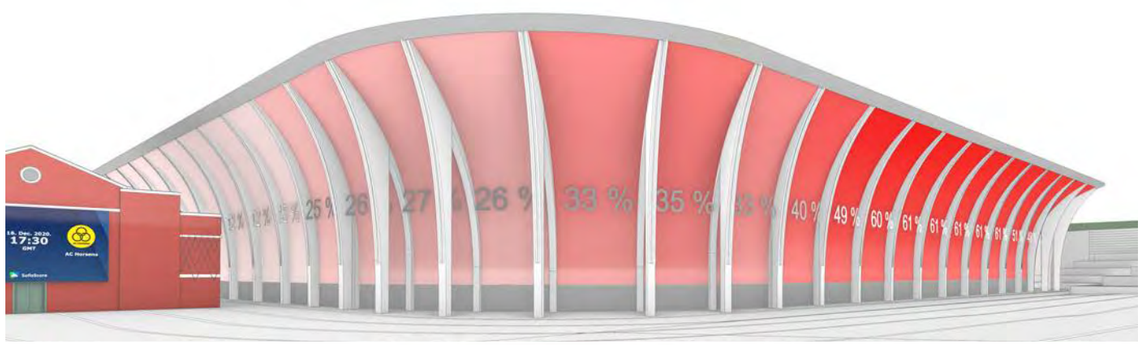


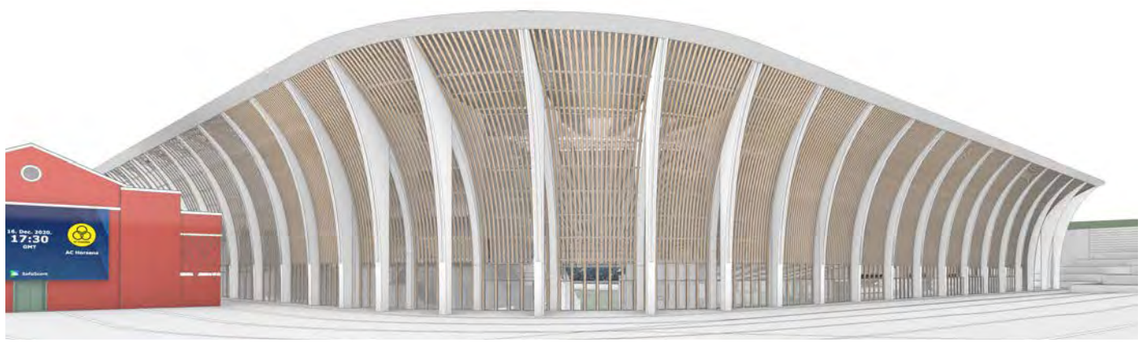
LOUVERS

material: timber (Accoya)

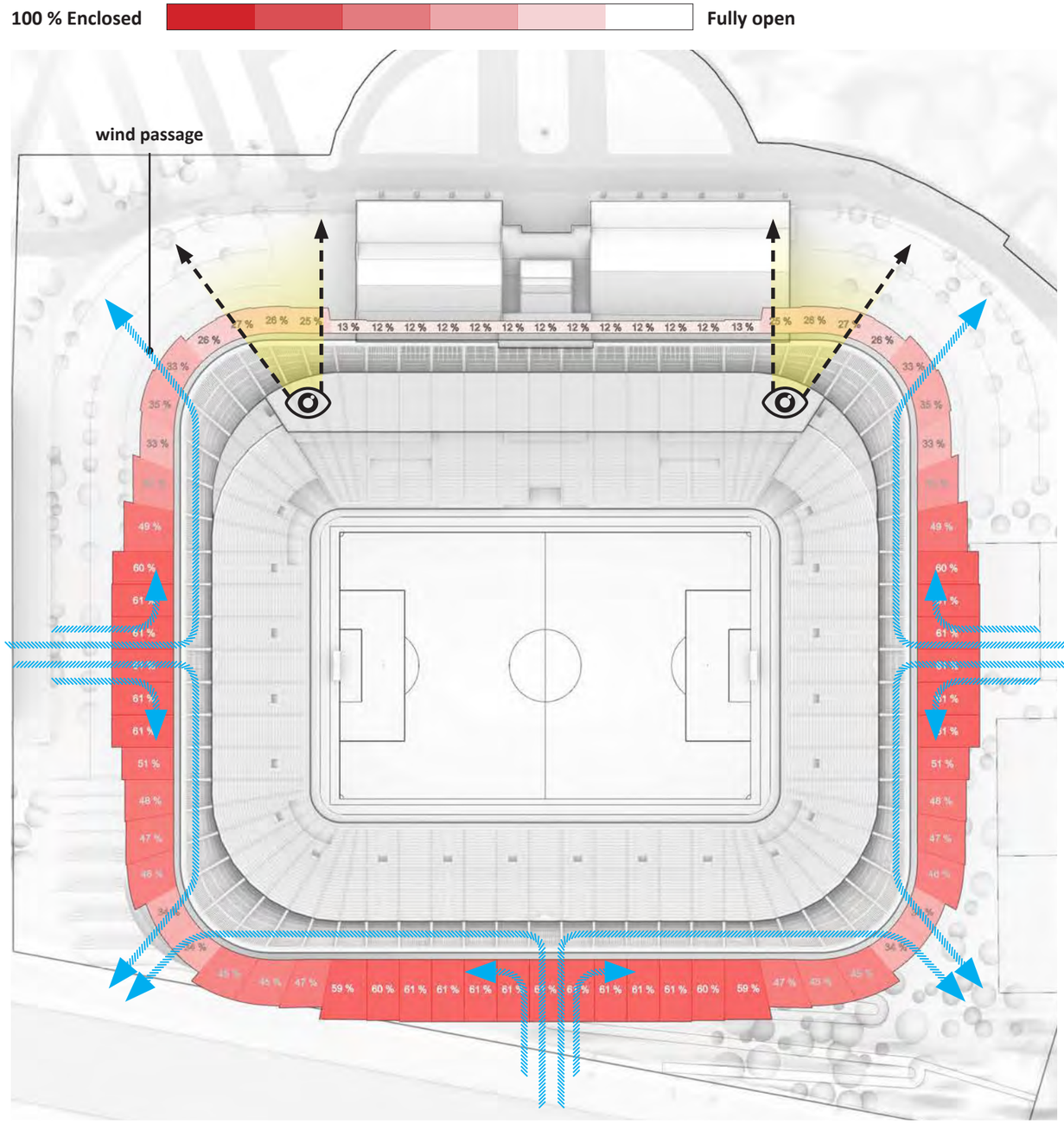
length: 21335 m

cross section: 20 cm x 2.5 cm





MAIN PLAZA



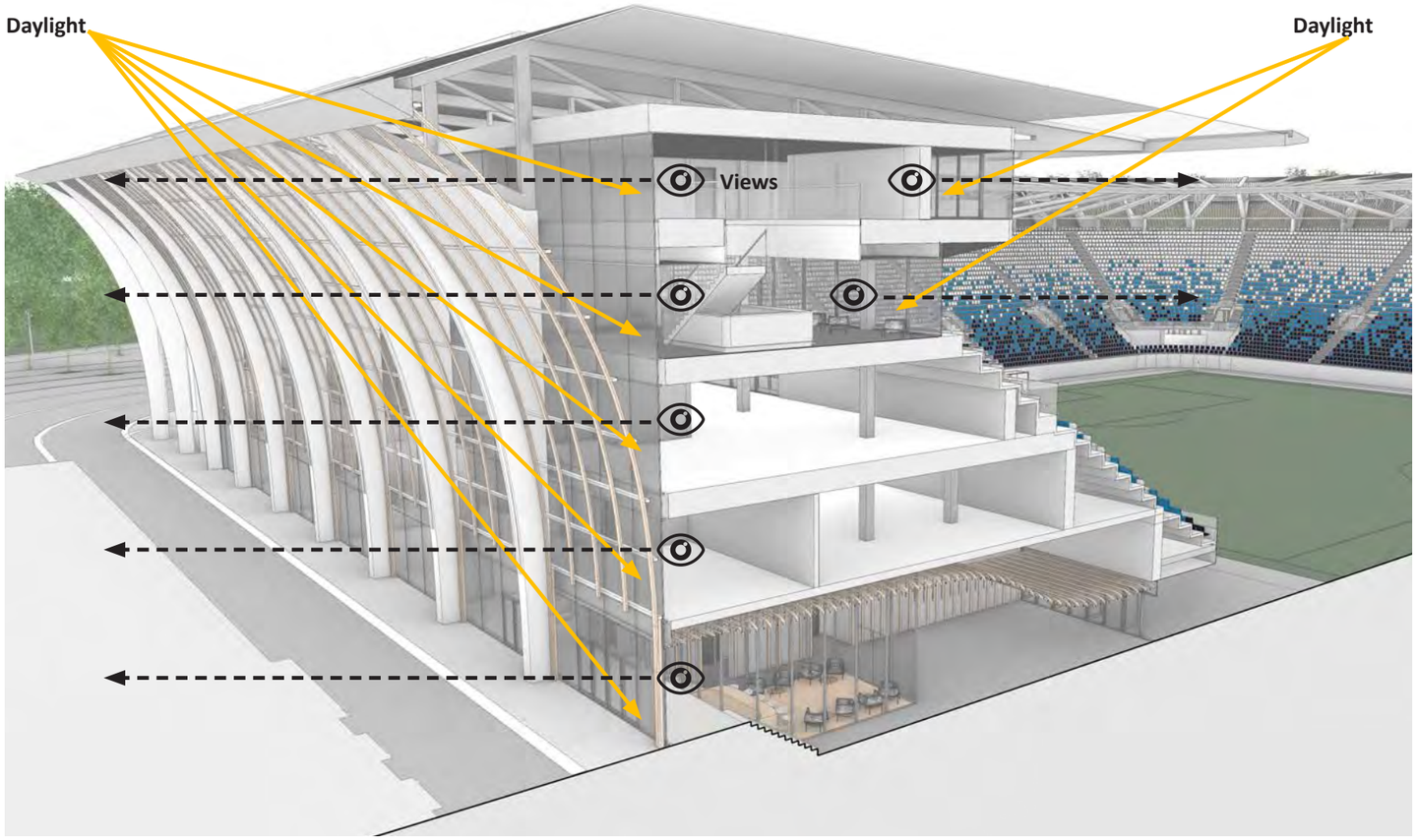
PLAN

2.2 ROBUSTNESS OF THE PROJECT

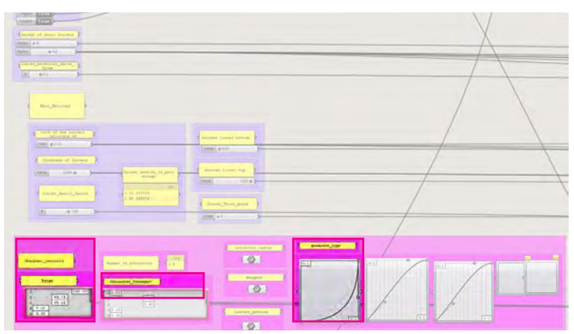
FACADE PERFORMANCE AND FLEXIBILITY

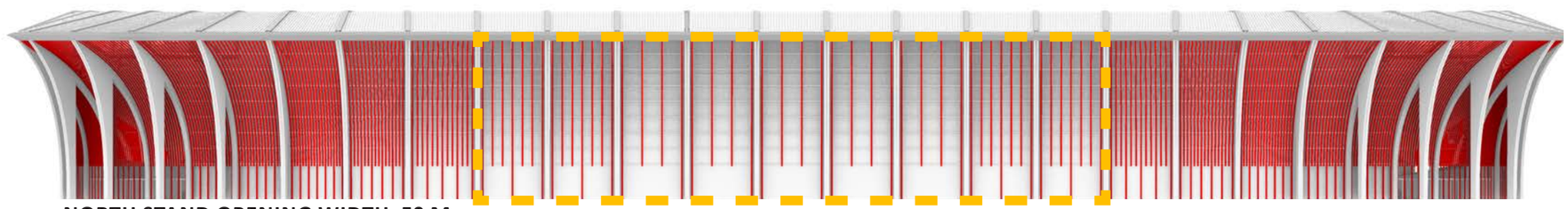
NORTH STAND DAYLIGHTING

The lamellas gradually become more spaced apart in the North facade in order for more daylight to reach the VIP and workplace areas and allow for more views out.

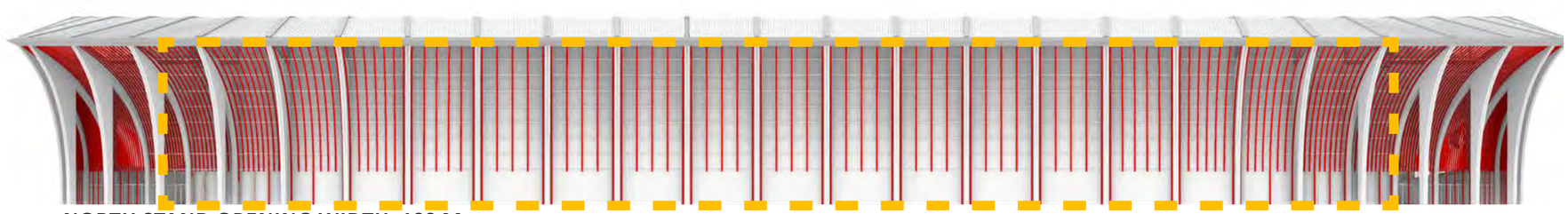


NORTH STAND POROCITY FLEXIBLE AND CUSTOMIZABLE





NORTH STAND OPENING WIDTH: 50 M



NORTH STAND OPENING WIDTH: 100 M

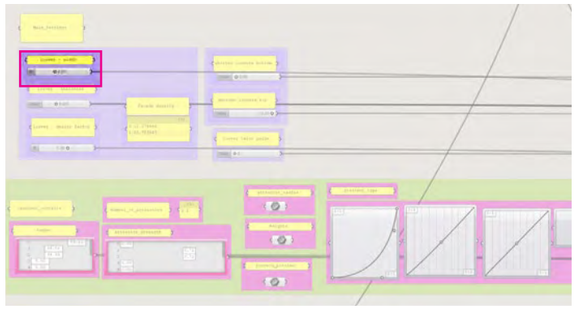
2.2 ROBUSTNESS OF THE PROJECT

MARKET STANDART PRODUCTS

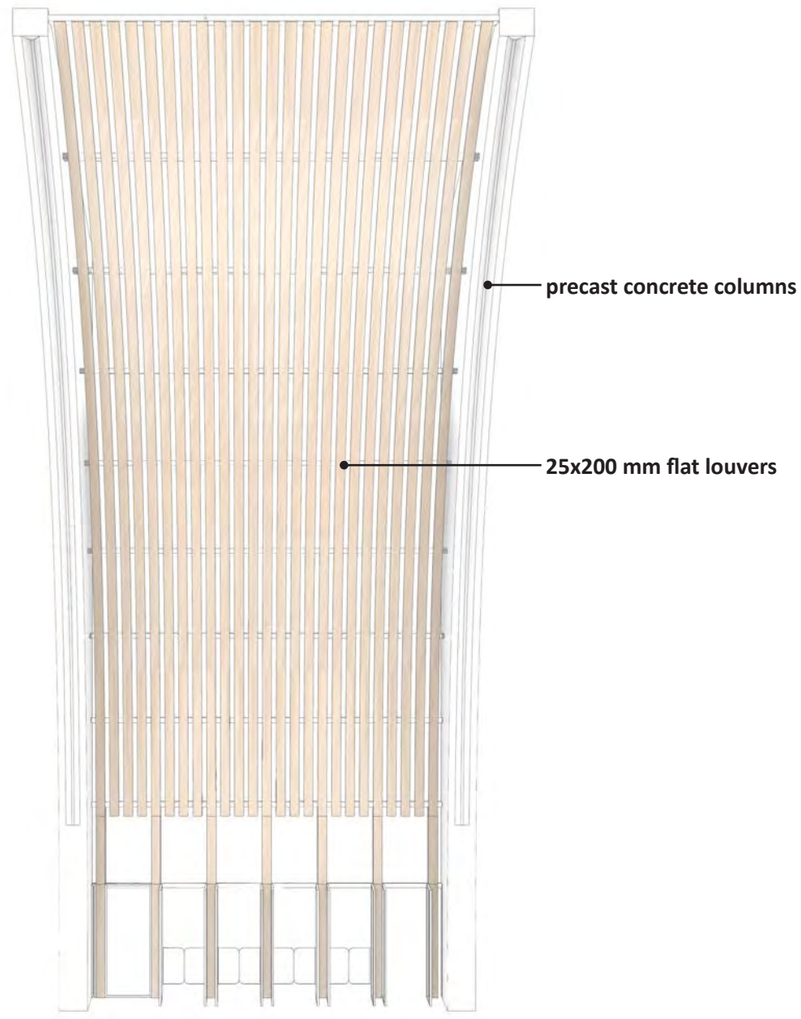
FLEXIBILITY OF FACADE LOUVERS

The louvers are market standard products. Their dimension can be adjusted rapidly depending on **cost, material, manufacturing, contractor and performance.**

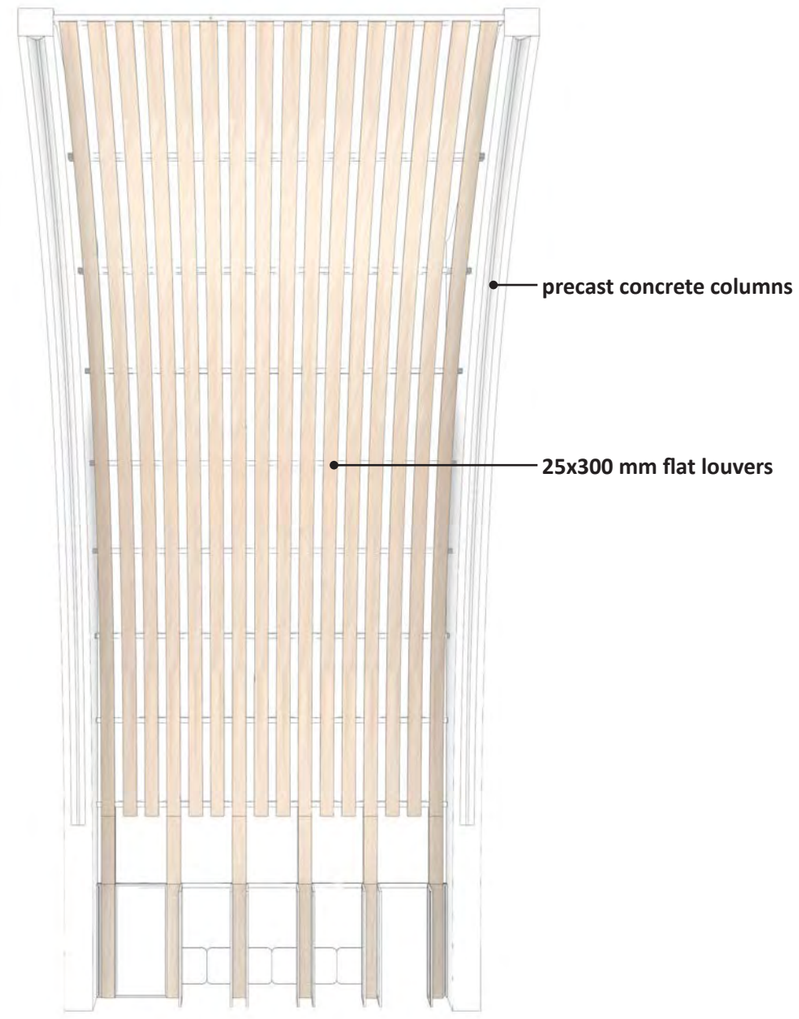
LOUVERS FLEXIBLE AND CUSTOMIZABLE



OPTION 1 - CURVED TIMBER LOUVERS - READY AVAILABLE SECTIONS



OPTION 2 - CURVED TIMBER LOUVERS - READY AVAILABLE SECTIONS



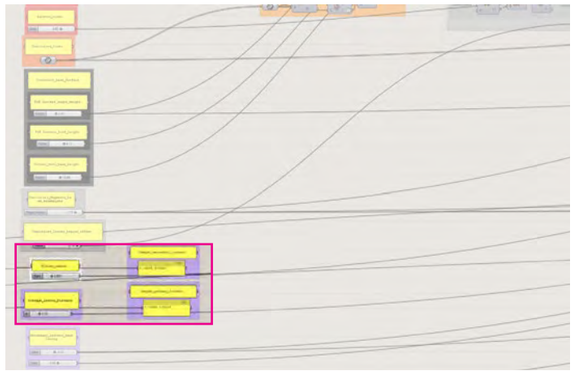
2.2 ROBUSTNESS OF THE PROJECT

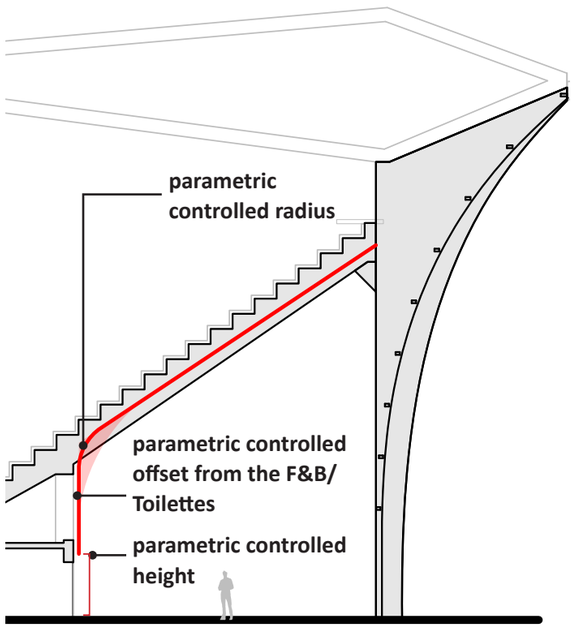
CONCOURSE LOUVER FLEXIBILITY

CONCOURSE LOUVER FLEXIBILITY

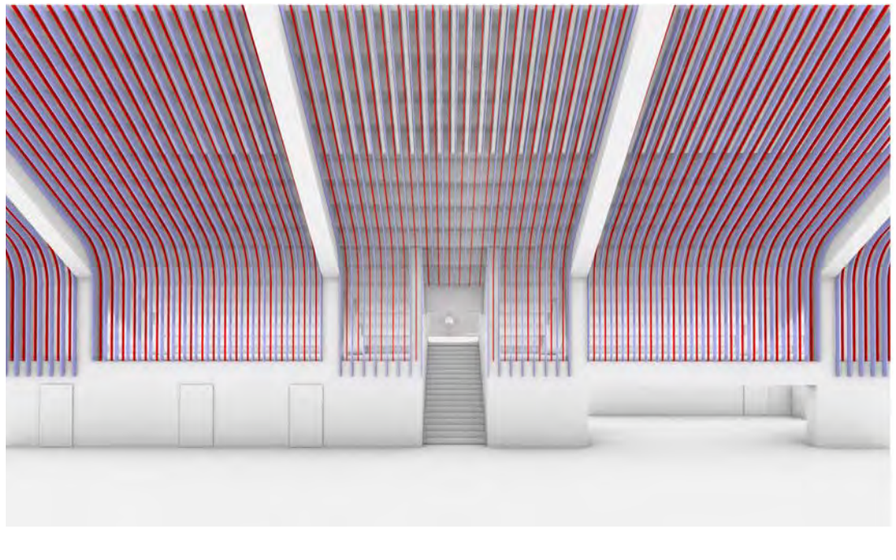
The louvers are market standard products. Their dimension, density and rhythm can be adjusted rapidly depending on **cost, material, manufacturing, contractor and performance**. The profile can be controlled parametrically, in order to iterate towards the optimal solution for the requirements.

CONCOURSE CLADDING FLEXIBLE AND CUSTOMIZABLE

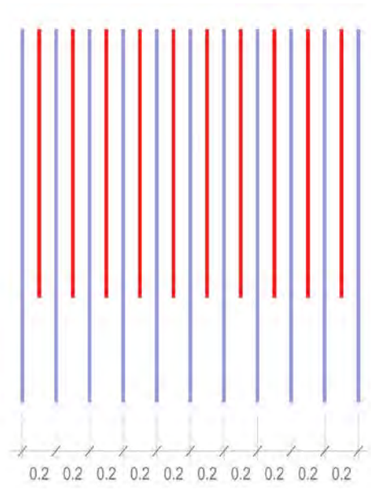




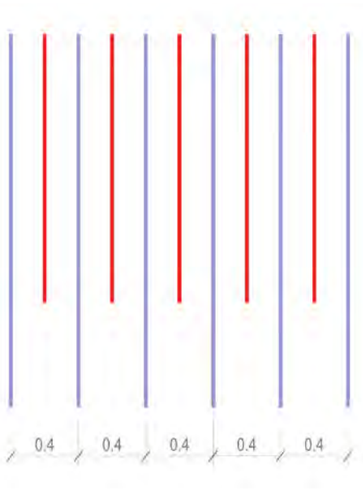
CONCOURSE LOUVER FLEXIBILITY



ORIGINAL



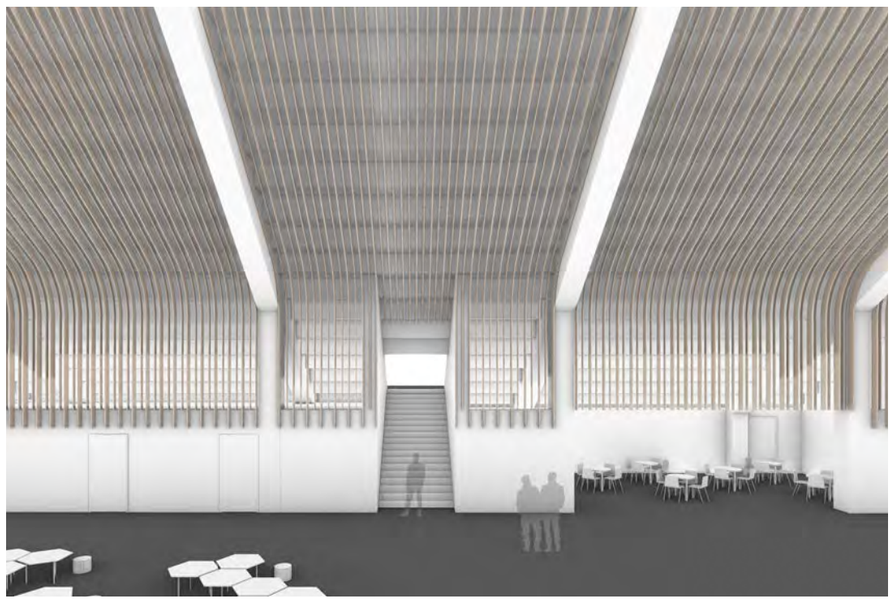
OPTION 1



ORIGINAL

1 - PRIMARY LOUVERS
length: 15363 m

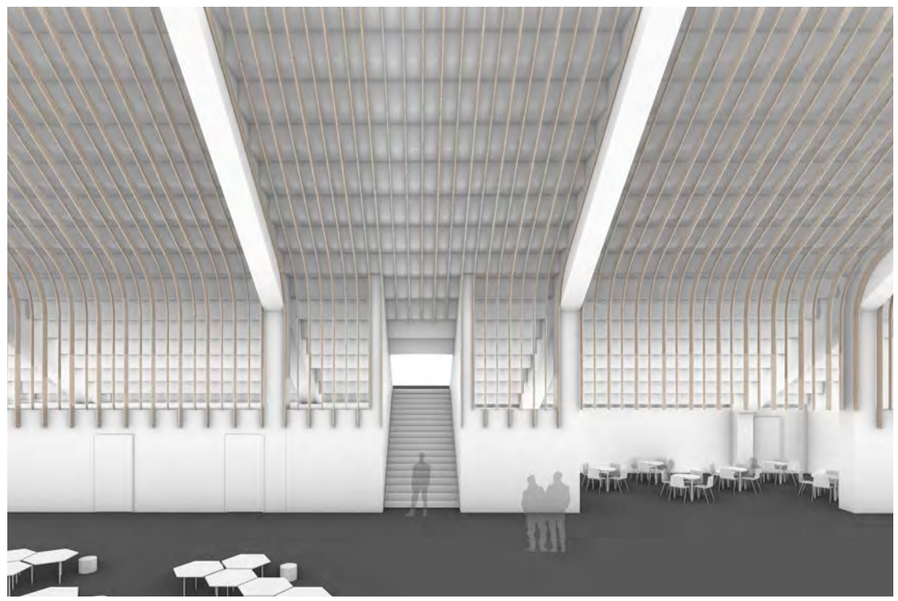
2 - SECONDARY LOUVERS
length: 14065



OPTION 1: LOUVERS REDUCED BY 50 %

1 - PRIMARY LOUVERS
length: 8627 m

2 - SECONDARY LOUVERS
length: 7461 m



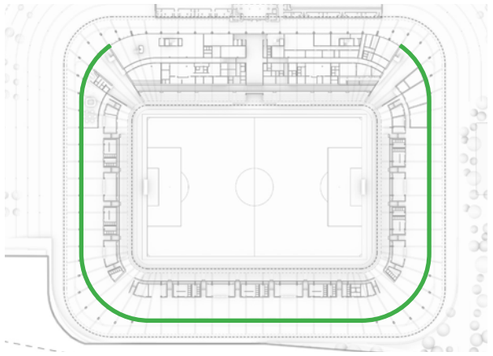
2.2 ROBUSTNESS OF THE PROJECT

OPENNESS

DESCRIPTION

The fence encloses the whole concourse. It can be made from a perforated steel mesh with an openness of 40% or security glass if there is the wish to have higher visual connection between the inner concourse and the outside. A compromise between cost and visual openness could be a hybrid of the two materials.

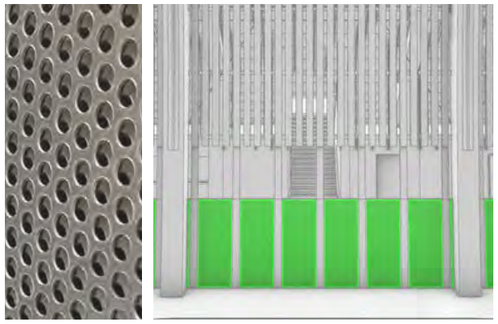
FENCE ROBUSTNESS



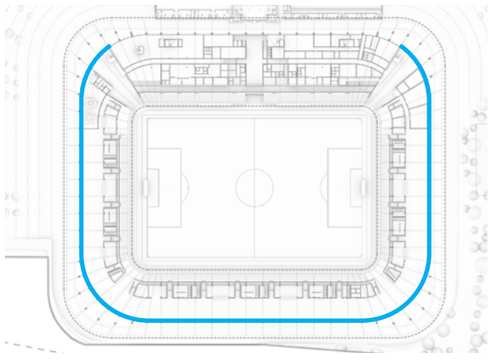
OPTION 1

material: perforated steel mesh (openness of 40%)

area: 796 m²



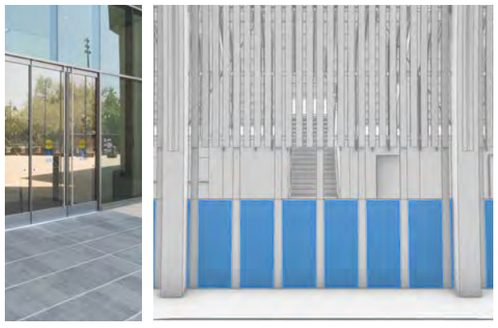
2.5 m high perforated steel mesh



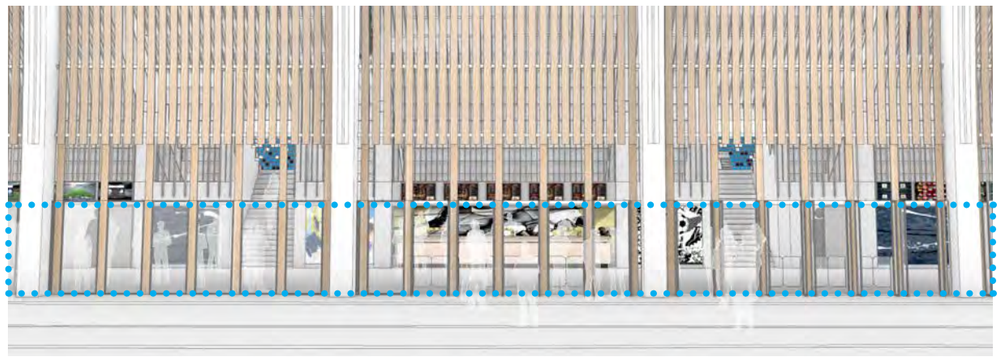
OPTION 2

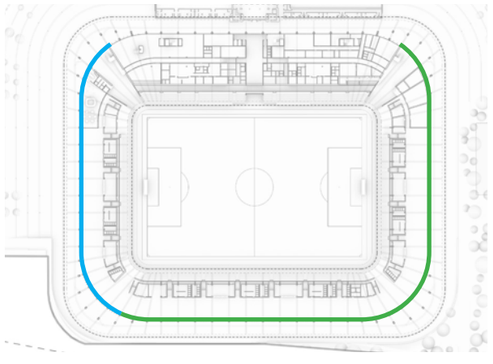
material: glass

area: 796 m²



2.5 m security glass





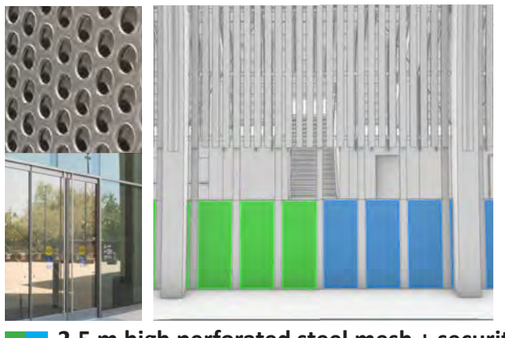
OPTION 2B

material: glass + perforated steel mesh (openness of 40%)

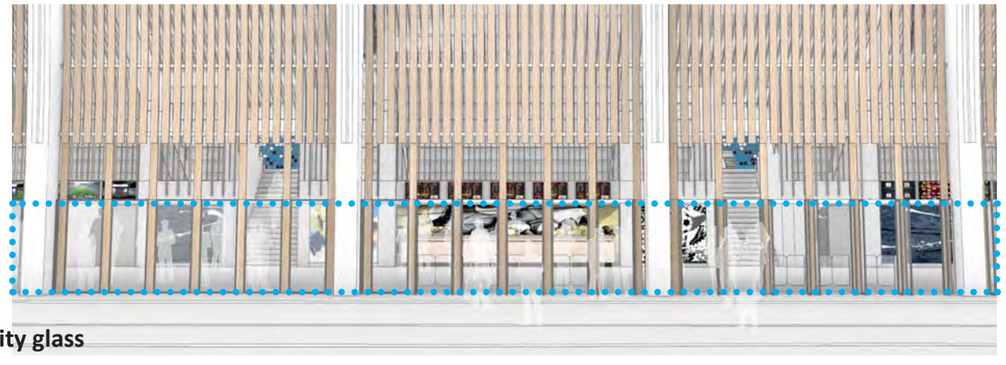
area: 796 m²

glass: 261 m²

perforated steel mesh :535 m²



2.5 m high perforated steel mesh + security glass



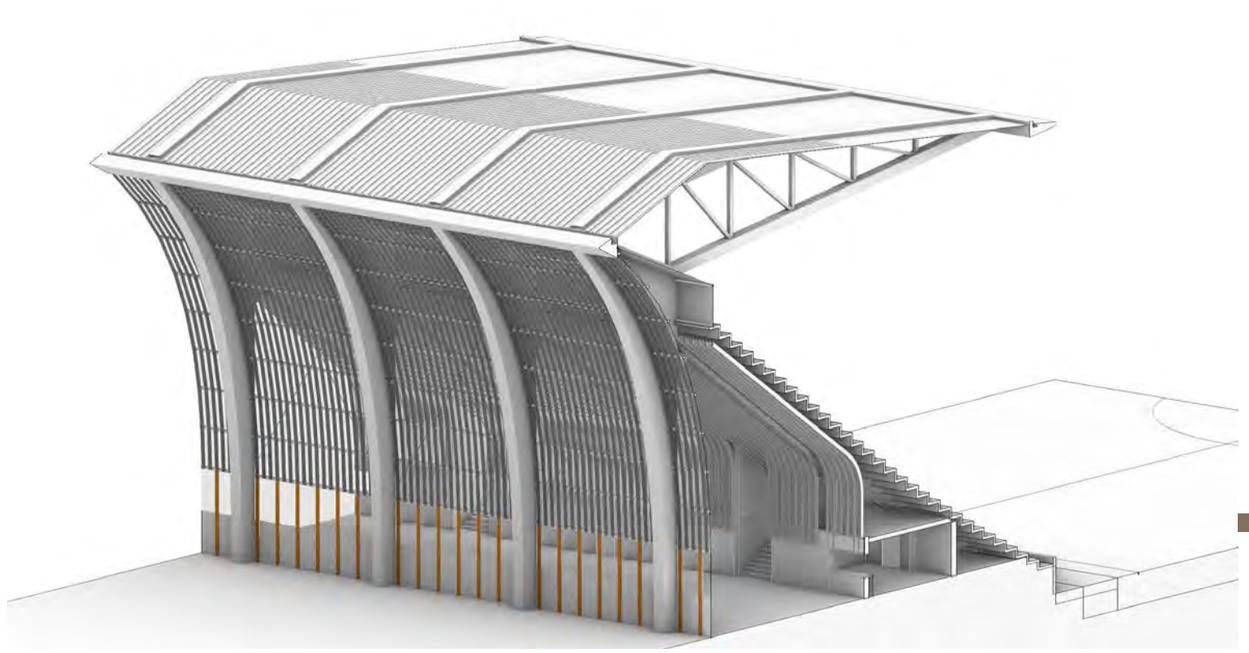
2.2 ROBUSTNESS OF THE PROJECT

GATE STRUCTURE

DESCRIPTION

The vertical structure grant stability to the gates. The vertical elements are market available products and can be adjusted depending on cost, material, and contractor. They can be made from wood profiles or metal profiles as a more robust solution.

FENCE ROBUSTNESS

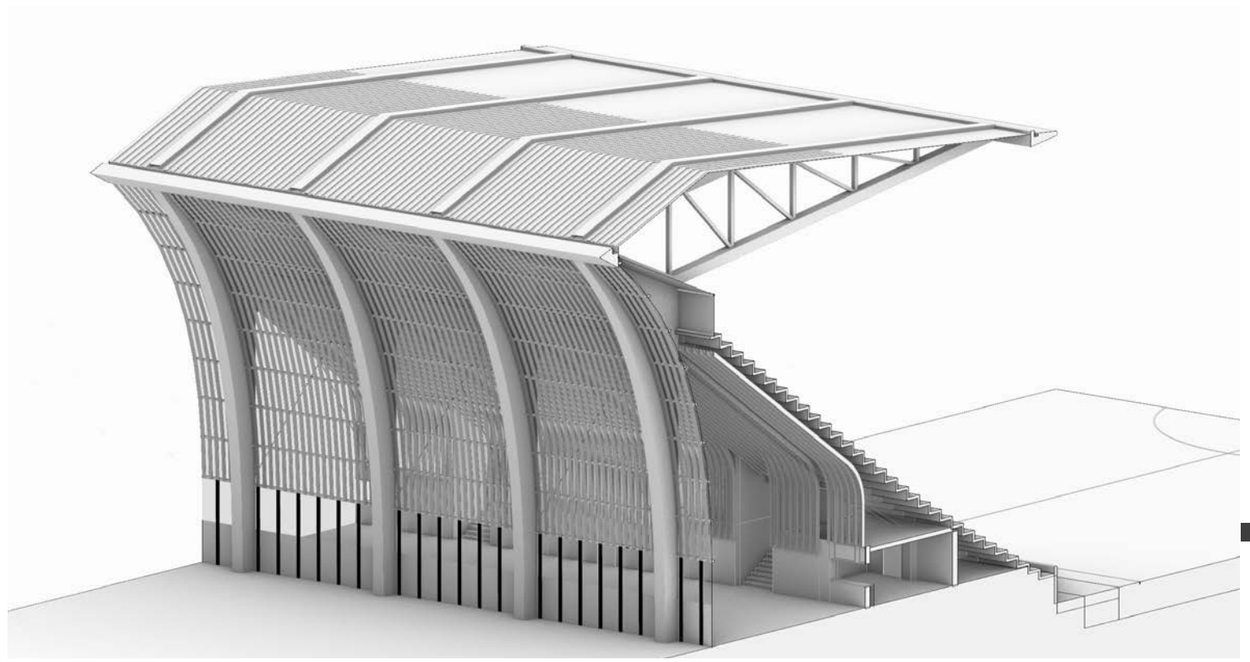


VERTICAL TIMBER STRUCTURE

material: timber

length: 1583 m

cross section: 20 cm x 10 cm



VERTICAL METAL STRUCTURE

material: metal

length: 1583 m

cross section: 20 cm x 10 cm

2.2 ROBUSTNESS OF THE PROJECT

ROOF MATERIALITY AND ROBUSTNESS

DESCRIPTION

The roof is made of light materials to minimize the amount of steel in the construction. The combination of steel and membrane gives the roof a smooth surface that requires a minimum of maintenance. Both roof types are well-tested and known materials used roofs in several stadiums. The material consumption is low and the lifespand long. Both materials are therefor a sustainable choice.

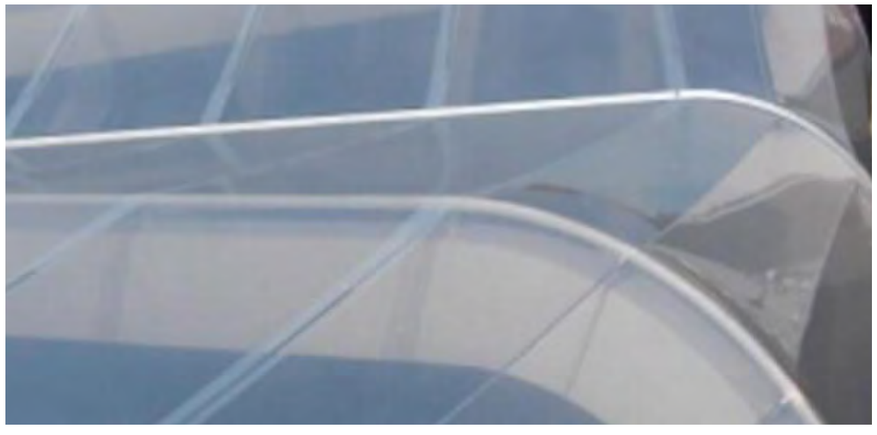
ROOF TYPES

BENEFITS OF CORRUGATED METAL ROOF

- Low material consumption = a sustastainable choice
- Warranty up to 30 years = Long lifetime
- Light weight = construction reduction
- Clean with water = Easy maintenance
- Smooth surfacs = Algae free
- Minimum of maintenance = low climate impact
- Coating with a high corrosion value (RC5) = no rust

BENEFITS OF MEMBRAN ROOF

- Roof material on several stadiums = Triet and testet
- Translucent = up to 95% of natural daylight
- Highly elastic = Extremely high breaking point
- Light weight = construction reduction
- Clean with water = Easy maintenance
- Smooth surfacs = Algae free
- Lifespand op to 30-40 years = Long lifetime

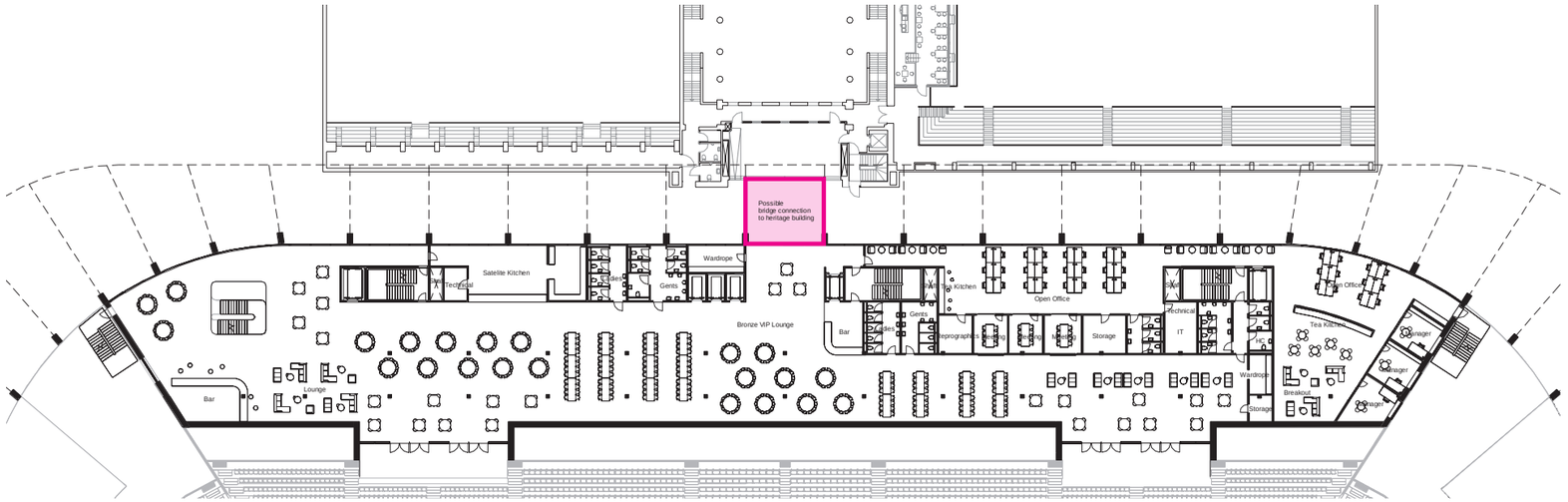


2.2 ROBUSTNESS OF THE PROJECT

BRIDGE

GRID AND COLUMNS OPTIMIZATION

The 1st floor, Bronze and office level, have been remodelled to allow for a possible bridge connection to the heritage building. The VIP people flow is concentrated to the west of the plan while the offices are gathered in the east end.

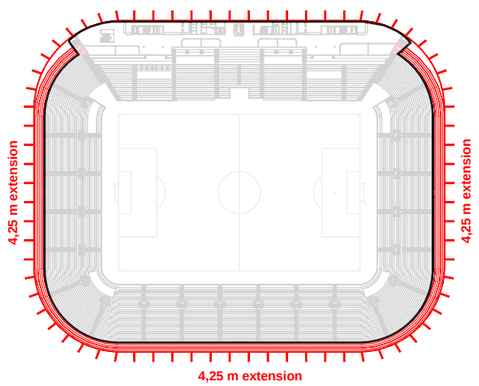


3. DESIGN OPTIONS

3.1. INCREASE SEATED CAPACITY TO 24.000

Total Cost **29.970.000 kr.**

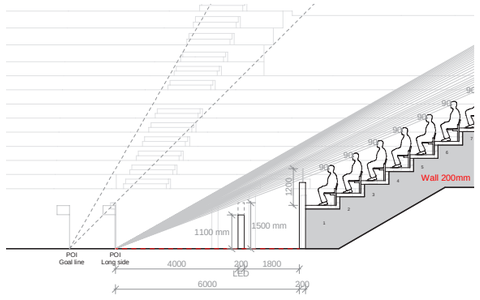
Price includes façade, roof, columns, concrete framing and raker beams, steel girders, seating bowl and terracing and extra seats.



3.2. 1.1 M LED PITCHSIDE ADVERTISING BOARDS

Total Construction Cost **0 kr.**

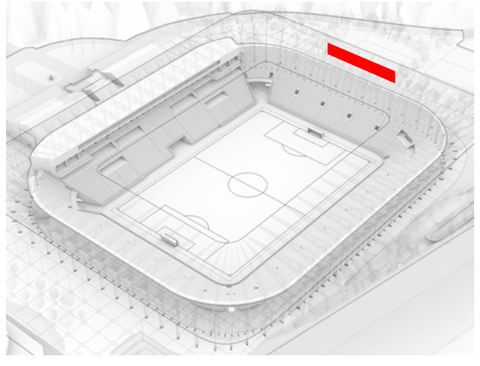
No extra cost or cost reduction, see “4.2 1.1m led pitchside advertising boards”



3.3. LED SCREEN PREPARATION

Total Construction Cost **1.593.000 kr.**

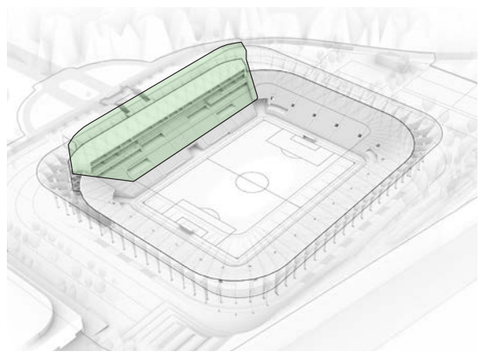
Price includes steel framework, mounting brackets and technical installations



3.4. INTERIOR FITTINGS OF MAIN STAND

Total Construction Cost **80.672.000 kr.**

Price includes deduction of costs regarding Internal walls, internal doors, wall finishes, floor finishes, ceiling finishes, FF&E and MEP

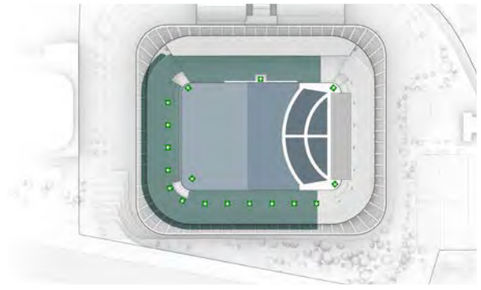


3.5. MAXIMUM EVENT CAPACITY

Total Construction Cost **2.907.000kr**

Price includes a retractable seating system, railing and steelwork, and the deduction of terracing, bowl metalwork and seats.

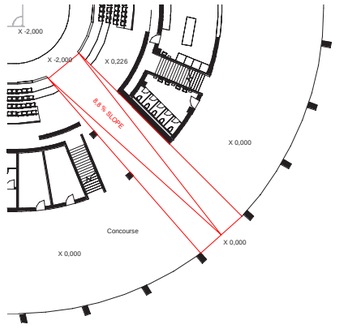
NOTE: Cost covers Scheme B or C shown in “4.5 40,000 event capacity”.



3.6. ADDITIONAL EVENT EGRESS

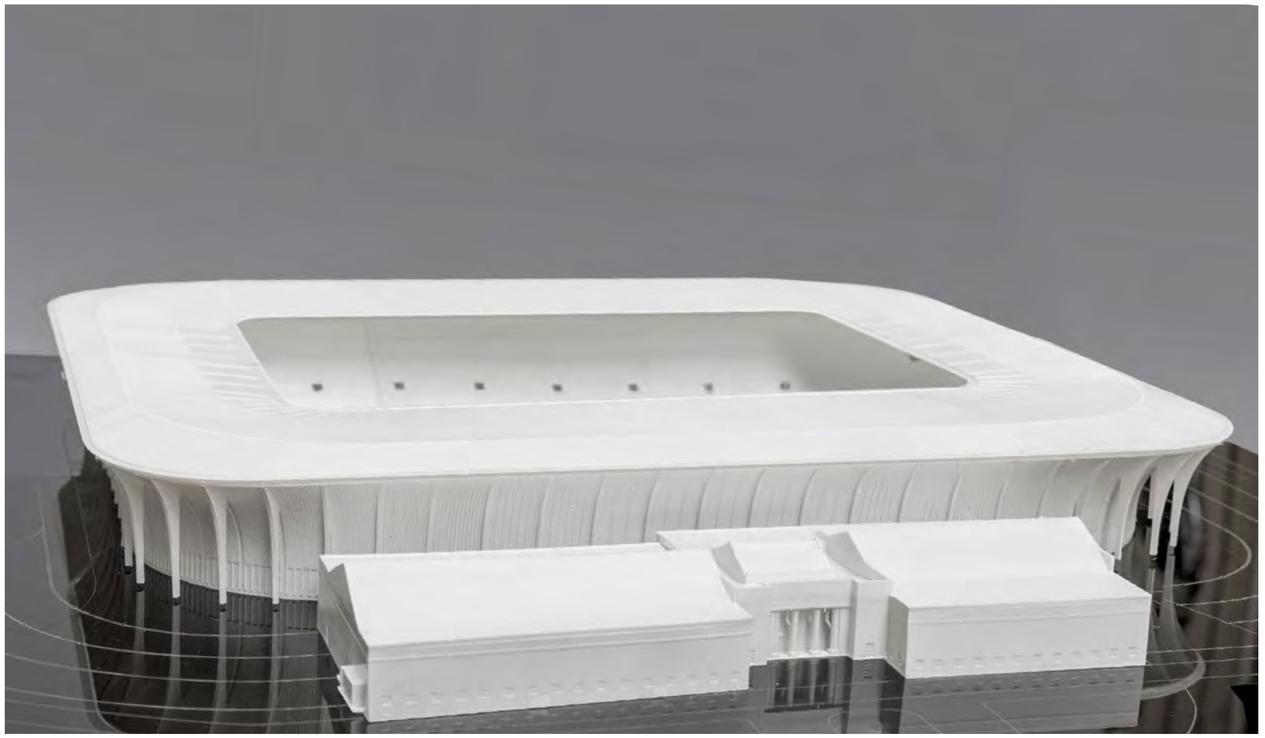
Total Construction Cost **1.633.000 kr.**

Price includes removable stair construction.



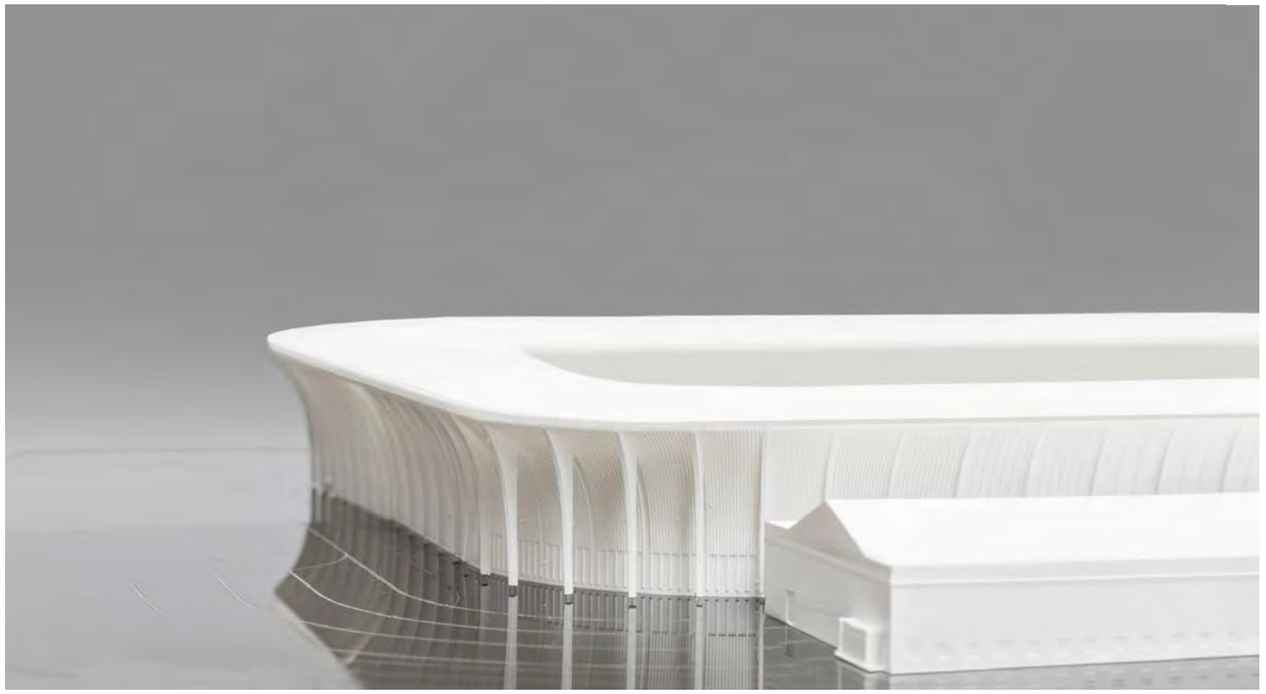
PHYSICAL MODEL

TYPE T COLUMN - CONCRETE MODEL 1:20



STADIUM MODEL 1:500

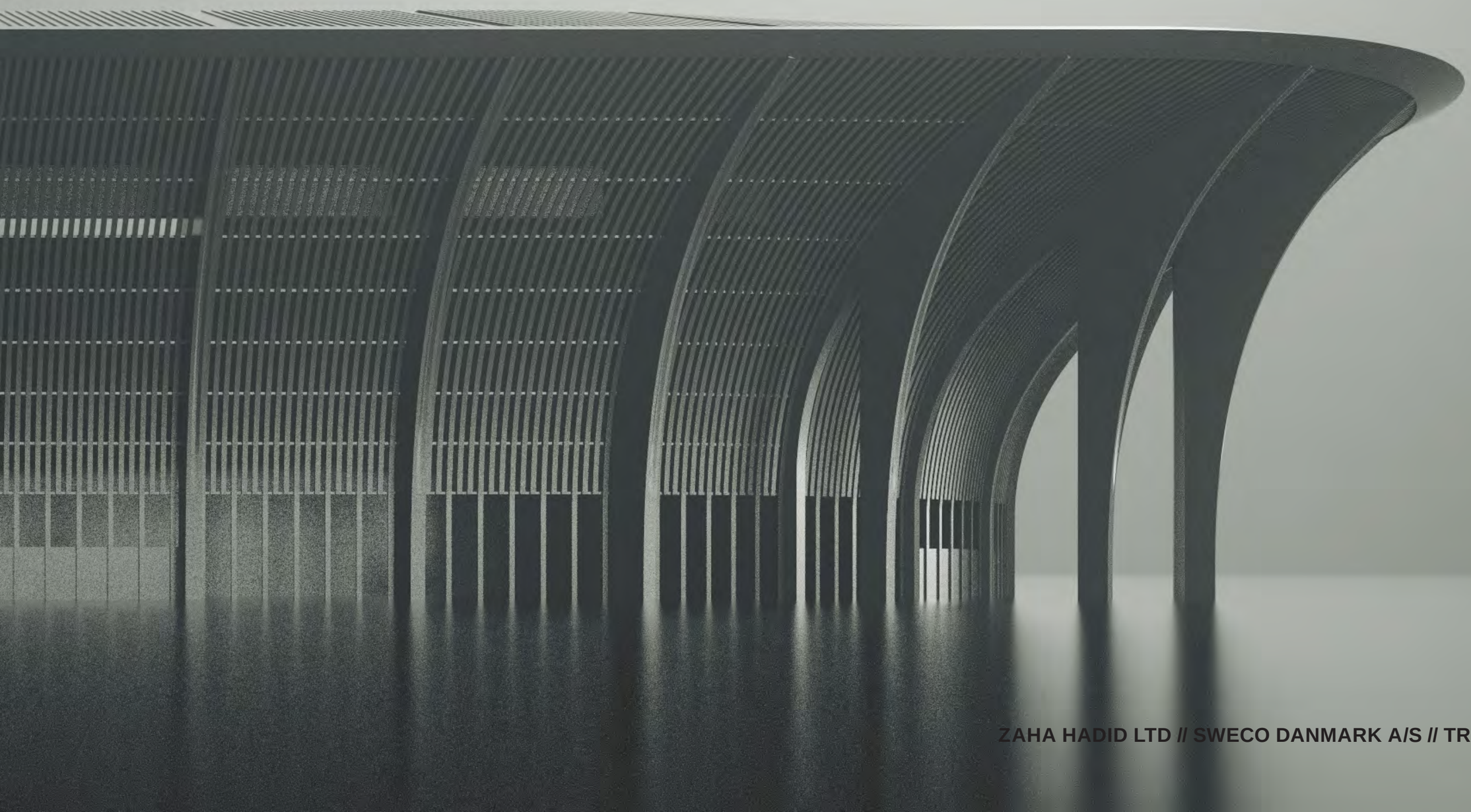
SECTION MODEL 1:200



STADIUM MODEL 1:500

SKOVENS ARENA

NEW STADIUM IN AARHUS



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