



Pavle Marčić BSc

Kantrida
Stadium between cliff and sea

MASTER'S THESIS

to achieve the university degree of

Diplom-Ingenieur

Master's degree programme: Architecture

submitted to

Graz University of Technology

Supervisor

Univ. -Prof. Dr. -Ing Stefan Peters

Institut für Tragwerksentwurf

Graz, May, 2016

AFFIDAVIT

I declare that I have authored this thesis independently, that I have not used other than the declared sources/resources, and that I have explicitly indicated all material which has been quoted either literally or by content from the sources used. The text document uploaded to TUGRAZonline is identical to the present master's thesis dissertation.

Date

Signature

CONTENTS:

| | |
|-------------------------------------|---------|
| 1. SHORT HISTORICAL DEVELOPMENT | |
| - Greek | 3 |
| - Rome | 4 |
| - Middle age | 7 |
| - Modern | 8 |
| 2. KANTRIDA | |
| - Location | 11 |
| - Before WW 1 | 12 |
| - 1930. | 15 |
| - 1960. | 17 |
| - Present | 18 |
| 3. PROJECT | |
| - Football | 21 |
| - Fans | 23 |
| - Site | 24 |
| - Roof structure | 25 |
| - Stands | 26 |
| - Conclusion | 28 |
| 4. BIBLIOGRAPHY AND LIST OF FIGURES | |
| 5. STATIC ANALYSIS | |
| 6. PLANS | |
| - Main plan - roof | 1 :1250 |
| - Main plan – stadium | 1:1250 |
| - Plan – garage | 1:750 |
| - Plan – plateau | 1:750 |
| - Plan – roof | 1:750 |
| - Roof system | 1:750 |
| - Cross section A-A | 1:500 |
| - Cross section B-B | 1:500 |
| - Cross section C-C | 1:500 |
| - Cross section C-C - detail | 1:250 |
| - Facade East | 1: 500 |
| - Facade West | 1: 500 |
| - Facade South and North | 1: 500 |
| - Florplan +2.50 – detail | 1:250 |
| - Florplan +6.25 – detail | 1:250 |
| - Florplan +10.00 – detail | 1:250 |
| - Truss bearing detail | 1:10 |
| - 3D | |

SHORT HISTORICAL DEVELOPMENT

STADIUM – a big sports battleground with the stands for spectators. Stadium is the Latin form of the Greek word stadion (στάδιον), a measure of length equalling the length of 600 human feet. As feet are of variable length the exact length of a stadion depends on the exact length adopted for 1 foot at a given place and time and varies between 177 and 192 meters.

Sports stadiums are mostly big theatres where sports achievements of individuals or teams are presented. In those sports theatres we witness games of courage, passion, fears, challenges and sometimes even remarkable achievements and events. In stadiums, in architectural sense, there should be a fusion of dramatic function, a sense of bigness and balanced architectural form. First great prototype of a stadium where this harmony occurred was the Colosseum in Rome. This ancient structure represents fusion of all important components of a good stadium: clear visibility, great communication and flow, and it is all based on elliptical floor plan bases which integrates all functional elements to a maximum, and above all a balanced composition of formation of facade and all architectural elements.

Short historical development

First stadiums originated in Greece around the 7th century BC, during the Olympic Games which took place every four years ever since 776 BC, whilst the last ones were held in 394 AD. Greek Stadiums were mostly simple athletic tracks around which the stands of an elliptical U shape were formed. Tracks were 192 m long (one stadion) and 32 m wide, while the stands were frequently built by using the slope of terrain on one side. First stadiums could hold 45 000 spectators and with the growth of popularity of sports each Polis had its stadium.



fig. 01 Delphi stadium, Greece

Hippodromes were also built besides stadiums and they had same structural characteristics, but were used for horse races and fighting vehicle races. Best preserved stadiums are in Delphi, Ephesus and Athens. Ancient stadium Panathenaic in Athens from 331 BC was reconstructed for the first modern Olympic Games in 1896 while the latest reconstruction was carried out in 2004 for the Olympic Games in Athens.



fig. 02 Epidaurus theatre, Greece

Beside the stadium, the Greeks built many theatres, using the slope of terrain for the stands, and using semicircular stands they formed scene with a view from the stands to the landscape which was an integral part of a dramatic presentation. The most beautiful examples are the theatre in Epidaurus with a view on Peloponnese Mountains and the theatre in Taormina in Sicily with a view on Etna.

Romans developed a model of theatre and they built first amphitheatres which were adequate with new demands of the time with spectacles for more spectators and central space for presentation of gladiatorial combats in arena (harena, lat. sand). In 72 AD the biggest theatre called the Flavian Amphitheatre was built in Rome under the emperor Vespasian, which was later renamed in the Colosseum after colossal structure of the emperor Nero which stood in front of the main entrance. The Colosseum was built of travertine, stone, concrete and brick, and it represents a magnificent example of ancient architecture. It could hold 50 000 spectators, and communication within the amphitheatre was so well worked out that the evacuation of spectators could have been done in 10 minutes. Elliptical shaped structure with three floors of stone arcades and decorative columns and sculptures represented a unique example of architecture which is still a prototype for new and modern stadiums, and are an eternal exemplar and inspiration.

The amphitheatre was in function until the 6th century AD, and later it was used as a source of building material, until 1780 when it was protected as a sacred place.

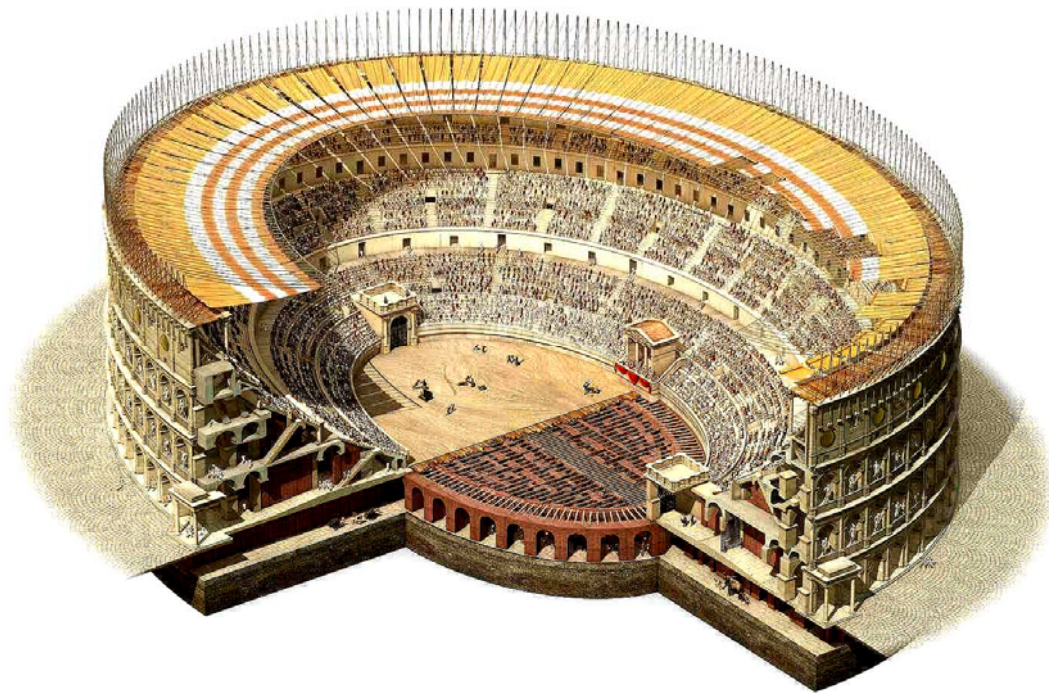


fig. 03 Colosseum in Rome, Italy

In the 1st century AD the Roman amphitheatre for 23 000 spectators was built in Pula in Istria. One of the best preserved amphitheatres in the world and still used today as a stage for various music and other performances. It is specific for the methods of building with four stone towers with staircases, and it was built along the sea coast.

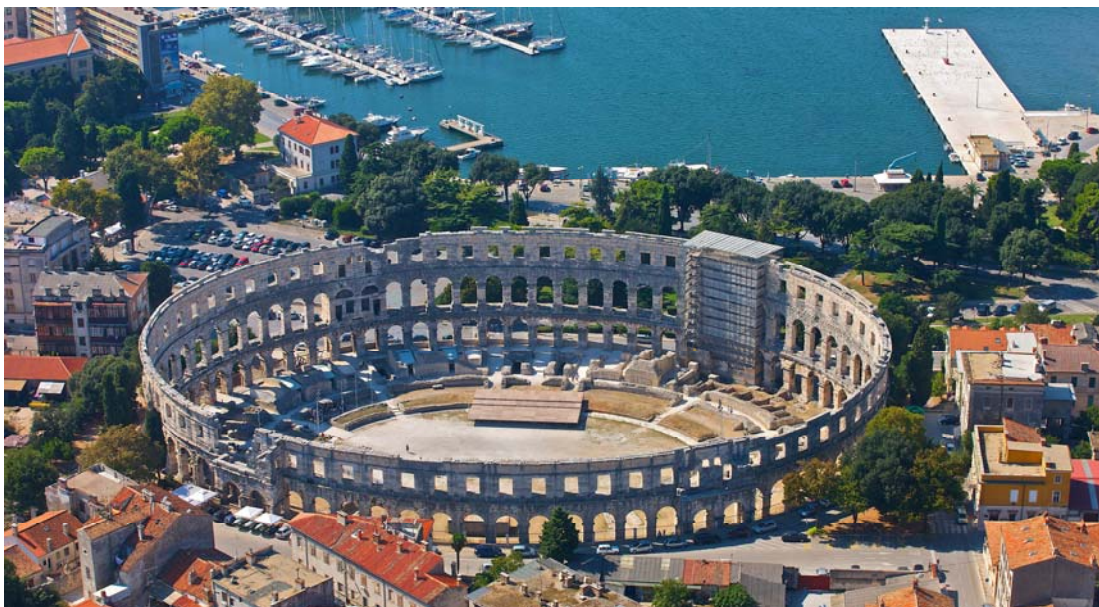


fig. 04 Arena in Pula, Croatia

In the ancient town of Salona, located in immediate vicinity of the City of Split, an amphitheatre was built in the 2nd century AD under the emperor Marcus Aurelius. The amphitheatre could hold 18 000 spectators and today it is in the protected zone of the Town of Salona. The architectural remains of this amphitheatre were discovered in 1846, and Don Frane Bulić (1846-1934) and Ejnar Dyggve (1887 – 1961) worked on the research and locality protection.



fig. 05 amphitheatre in Salona, Solin, Croatia

Circus developed in Rome from structures such as Greek hippodromes, and it was used for horse races. One of the most representative examples is the Circus Maximus, built in the 1st century in Rome. It was of elongated U floor plan, 600 m long, 200 m wide, and it could hold 200 000 spectators.

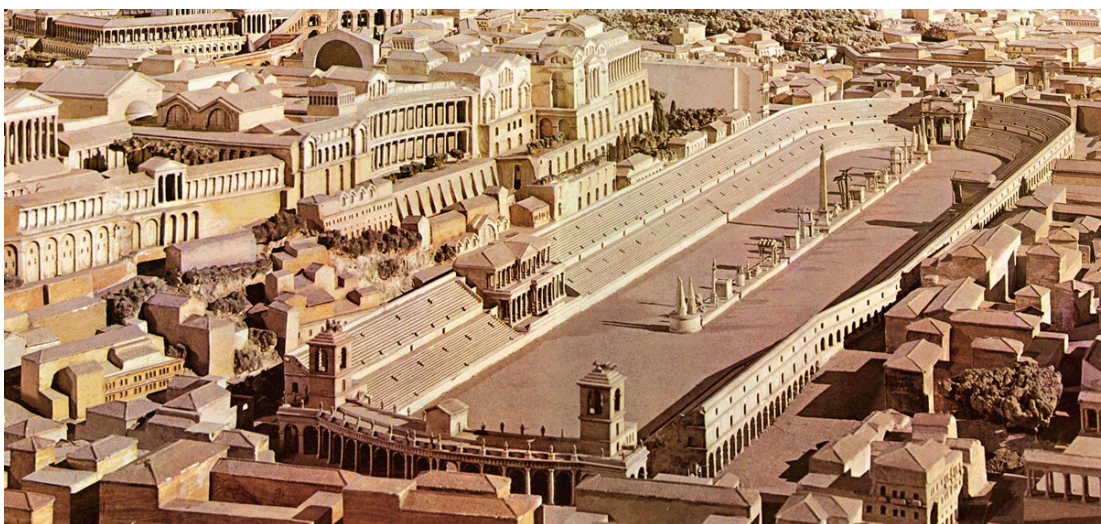


fig. 06 Circus Maximus in Rome, Italy

New typologies of structures developed in Europe during the Middle Ages: churches, cathedrals, different forts and fortifications. Ancient sporting structures fell into neglect and were forgotten in the Middle Ages, and were mostly used as a source of building material. Only in the Renaissance there was awakening of certain sports activities which took place in the open. One of the most famous sports activities was Palio horse races which has taken place ever since the 16th century in the Piazza del Campo in Sienna in Tuscany.



fig. 07 Palio in Sienna, Italy

In the second half of the 19th century, after the second industrial revolution and development of cities in Europe, there was also development of modern team sports such as football and rugby. Enthusiasm for new sports was particularly strong in Great Britain where a need was felt for building new structures which would hold a greater number of spectators of sporting events. At the same time there was development of a movement which supported renewal of the ancient Olympic Games. Modern Olympic movement was inspired in ancient Greece, and ideological leader of the movement Pierre de Fredy, Baron de Coubertin, a passionate athlete and enthusiast, succeeds in organisation of the first modern Olympic Games in Athens in 1896. 311 competitors from 13 countries participated in the first Olympic Games, held on the reconstructed Greek stadium in Athens. Ever since, the Olympics have taken place every 4 years, even though they were cancelled during the First and Second World War. Modest Olympic movement, which was based on sports spirit, community and classic values CITIUS, ALTIUS, FORTIUS, gradually developed until today and has become a modern and complex machinery where true sport is not its central value.

First Olympic stadium White City Stadium was built in London in 1908 and it can hold 80 000 spectators.

Since the Olympic Games were held in Helsinki in 1952, we can talk about the Olympic Games of the new age. An entire structural complex with a stadium and halls was built for the Olympic Games on Helsinki. The Olympic Games were held in Rome in 1960, and ever since the building of sports structures in Rome, a period of

buildings which became representative examples of contemporary architecture such as Pallazeto dello sport initiated, architect A. Vitellozzi and structure P.L. Nervi. For the Olympic Games in Munich in 1972 an entire part of the city was rearranged into an Olympic Park in Oberwiesefeld. New infrastructure of roads, railway and underground was developed.

All sports structures were built within the great park, and all contents were available on foot, so the Olympic Games were called “games of short walks“, and because of the formation of the landscape they were also called “games in a green park“. Architects Behnisch&Partner and designer Otto Frei built a representative complex of stadiums and halls covered in glass, which was fixed with steel cables and it was a revolutionary structure at the time. The stadium stands were partially leaning on the slope of surrounding terrain, so the stadium which could hold 80 000 spectators, mostly immersed into space with its volume.



fig. 08 Olympic Park in Munich, Germany

The 8th Mediterranean Games were held in Split in 1979 and for the occasion the football stadium in Poljud was built by the architect Boris Magaš. The stadium is a half-opened seashell-like structure of elliptical volume, located beside the sea and representing one of the best examples of modern stadiums built in the 20th century. Steel roof structure is made of semitransparent lexan. Stadium can hold 35 000 spectators. Poljud is tragically the last big stadium built in Croatia, which demonstrates state of football infrastructure and its gloomy future.

Modern stadiums have become more than sporting battlegrounds. They have to generate profit in order to repay huge investments and provide more than just live sport experience. Their presence shifted from architectural icon to flashy neon advert panel with shopping malls as indispensable attachments. Football was always about passion and sense of affiliation with city/region and other supporters.



fig. 09 Poljud, Split, Croatia



fig. 10 Stadio San Nicola, Bari, Italy



fig. 11 Allianz Arena in Munich, Germany

KANTRIDA

City of Rijeka is third largest city in Croatia and it has a population of 128,624 inhabitants (2011). It is located on Kvarner Bay, an inlet of the Adriatic Sea and because of its strategic position and its deep-water port, the city was fiercely contested, especially among Italy, Hungary and Croatia, changing hands and demographics many times over centuries.

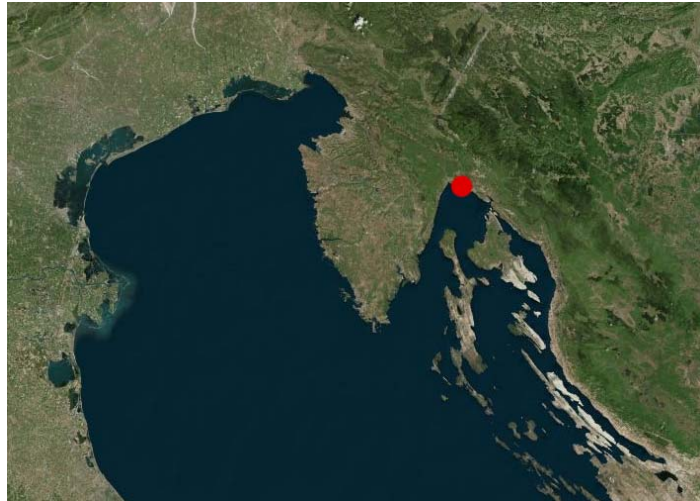


fig. 12 Rijeka, Croatia

Kantrida, the western part of the suburbs of the City of Rijeka, was once an industrial area and today it is a wider part of the city with residential, sports and touristic contents. Due to quite complicated geo political opportunities in history, the vicinity of the port Rijeka and more narrow space around the City of Rijeka, there were many changes in boundaries, empires and states during the course of the 19th and 20th century.

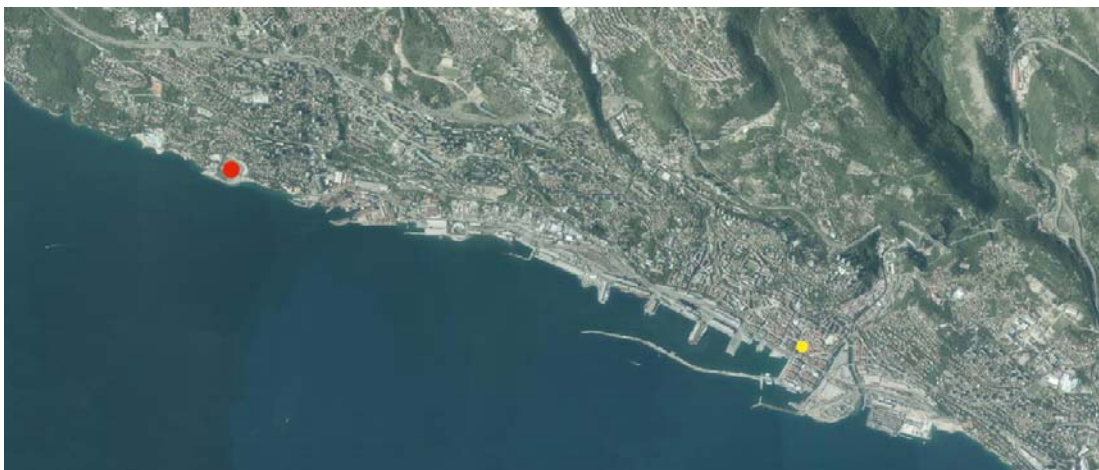


fig. 13 Kantrida, Rijeka, Croatia

According to a legend, name Kantrida (Italian *la cattedra* – the chair) originated from the name for a stone plaque which was placed above today's stadium and which was used for seating and relaxation for passengers who walked across the border between the two states. The border with the customs office was near today's stadium and the stone plaque was not preserved, that is where currently the main road passes and goes towards the pool.

Like many other similar border places, the City of Rijeka developed through history and continuously aspired towards its independent status of a city – state ever since the 18th century when it became a free port. Ever since it has been a location for numerous political conflicts, many migrations influenced social image of the city which was permanently marked with the presence of the border.

According to a settlement from 1868 the territory of the City of Rijeka belonged to the Hungarian Monarchy. This agreement is known as “the Rijeka patch” and the

border between Austria and Hungary went through the territory of Kantrida. Later, after the First World War the City of Rijeka remains in the Kingdom of Italy and the border was relocated to the east from the City of Rijeka, between Italy and the Kingdom of Yugoslavia.

The process of modernisation of Rijeka takes place mostly in the area of industry, commerce and civil engineering, but the City of Rijeka follows European trends even in the domain of sports. In 1873 the first football match was played in Rijeka, on the territory of today's Croatia. English technicians, Hungarian railwaymen were employed on building the railway between Rijeka and Karlovac and at the same time they played football. For the occasion of opening the railway line Rijeka – Karlovac the first football match was played with participation of technical staff employed in the factory “Stabilimento tecnico fiumano” in October 1873. In the rich city history, multi-ethnic population always existed so the sporting events meant more than a game, assuming a dimension of national promotion.

Besides the natural beauties the stadium Kantrida has an interesting historical story. Sports in Rijeka were indirectly connected to changes of the city appearance and its development, particularly during the construction of the city breakwater and city port. Construction of the new Rijeka breakwater started in 1868. Leading designer was Hilarion Pascal, a Frenchman who designed ports in Trieste and Marseilles, and the work was carried out by the company Sivel&Comp from Marseilles. Stone for the big breakwater was brought from several quarries, amongst which was the quarry in Kantrida. Hungarians wanted to confront the Rijeka port to the Austrian port in Trieste. As the greatest Hungarian port connected with the railway Rijeka at the beginning of the 20th century, it rapidly changed its appearance.



fig. 14 quarry Kantrida, Rijeka, Croatia

At the end of the 19th century a commercial ship line was established between Rijeka and Liverpool so the English sailors played football in the Rijeka port quite frequently. They even brought different sports equipment after which this ball game became rather popular between the citizens of Rijeka. Football was a modern sport which turned out to be the most dynamic one, so its fast and massive development is not a surprise.

At the beginning of the 20th century the City of Rijeka had sixty thousand inhabitants, and the near Sušak only about thirteen thousand of inhabitants. In 1908 students from the grammar school in Sušak established a Secondary school club Victoria. Besides swimming the members of the club promoted many sports amongst which football as well. With growing popularity of football there was a demand of payers for building a sports playground which they never had before. At the time the idea was born on construction of a sports playground in Kantrida, part of the city which belonged to Austrian part of the Monarchy and Municipality of Kastav.

The Municipality of Kastav gave in concession the quarry in Kantrida to a Hungarian company Schwarz und Gregerson for extraction of the stone for the Rijeka breakwater. Sports enthusiasts had intention of restructuring the spacious plain at the foothill of the old quarry into a playground, suitable for playing football matches. Destiny of the future sports arena was determined. The quarry was out of function since 1912.



fig. 15 Kantrida sometime before WWI, Rijeka, Croatia

Interestingly, writers Vladimir Nator and Miloš Crnjanski helped in reuse of the quarry into a sports playground. Serbian writer Miloš Crnjanski attended school in the Rijeka commerce academy and he was a sports enthusiast who frequently trained in 1912 with young men from the Sušak Viktorija club. His uncle was a

managing director of the company Shcwarc and Gregerson, so Crnjanski mediated in negotiations on a possible reuse of the terrain. Besides the agreement from the company they also needed agreement from the municipal council of the Municipality of Kastav. A great Croatian poet and writer Vladimir Nazor was a councillor in the municipal council Kastav, so he sensibly influenced councillors for bringing such important decision on reuse of the terrain in Kantrida from a quarry to a sports facility.



fig. 16 HŠK Victoria football match 1919, Rijeka, Croatia

In 1912 the Sušak students got all required agreements and started cleaning the quarry. The terrain was neglected and bumpy, so it took taking out of about five hundred carriages of stone and covering canals and holes in the terrain. Sand foundation was gradually rebuilt into a flat one, which was 100 metres long and 50 metres wide – the first playground of standard dimensions on Kvarner.

At the entrance of the playground there was a stone plaque with a historical inscription “Playground of the Croatian sports club Viktorija“. Even though the ground was still quite hard, the first football matches were played. The opening ceremony of the playground took place on 1 June 1913.

After the First World War Rijeka belonged to Italy and Sušak to the Kingdom of Serbs, Croats and Slovenes, so the people from Sušak were prevented from using the playground in Kantrida.

The Rijeka clubs Olympia and Glorija played on the renovated sports playground in Kantrida.

After the dissolution of the Austro-Hungarian Monarchy, despite of illusive peace, the political situation in Rijeka was rather serious and the status of the City of Rijeka became a great international problem. After the Treaty of Rome from 1924 Rijeka formally belonged to Italy and Sušak to the Kingdom of Yugoslavia. Croatian-Italian conflicts reflected in the domain of sports and football matches took dimensions of ethnical rivalry, in the first place between the Olympija from Rijeka and Viktorija from Sušak.

The playground in Kantrida was renovated in 1925 so that the footballers from Rijeka could participate in the national championship of the Kingdom of Italy. First wooden stands were built at the place of today's middle stands and the playgrounds contoured as a real sports structure which could hold 5000 spectators.



fig. 17 Kantrida before 1925, Rijeka, Croatia

Ten years after the first renovation in 1935 the city management (Comune di Fiume) starts with a design of another renovation of the stadium in Kantrida. The design was entrusted with a young architect Eneo Perugini who was a member of the city government and later even became a deputy mayor. The aim of the project was to ensure a greater number of visitors, so the concrete stands with seating places were designed and the capacity of visitors increased at 8000. Foundation of the playground got earth covering and a new draining system. The stadium also got an athletic track. Access to the stadium from the east and west was also renewed.



fig. 18 Olimpia 2:3 Gloria 1924, Rijeka, Croatia

Between the two World Wars the name of the structure also changes from Campo sportivo and Campo Unione Sportiva Fiumana to Stadio Comunale dell' Littorio (according to the fascist terminology) and this name remains until the collapse of Italy in 1943.

After the end of the Second World War there was a unification of Rijeka and Sušak, the city goes through a socialist transformation fundamentally changing its demographic structure. The Rijeka port and shipyard were renovated after the war cut backs, so the stadium in Kantrida was also renovated as well as the other city boroughs. The stadium was not renovated thoroughly but it was restored minimally so that the football matches could take place.



fig. 19 speedway race on Kantrida 1932, Rijeka, Croatia

Rijeka Football Club enters the First Yugoslav federal league in 1958 and for this occasion the earth ground of the playground was renovated. During the post-war period there was also a rapid development of athletics, so the stadium was used for different athletic manifestations as well. Coexistence of athletes and footballers was not ideal, there was no fixed agreement on common maintenance of all parts of the stadium. Even though the facilities were predetermined for common use, the athletes were lacking in their own entrance to the stadium, so they jumped over the fence so they could train. Dressing rooms with accompanying bathrooms were reserved for the footballers, so taking a shower for athletes depended on the mood of the employees who worked on maintenance of the club premises. Athletes frequently took a bath in the sea after training, but it depended on the weather conditions.

In 1962 a disaster almost happened during the match Rijeka – Hajduk when a part of the rock broke off above the northern stands. Panic occurred between the fans on the northern stands. In this commotion visitors hurried to the grass in fear of the possibility of another, even greater break off of the rock. In this occasion many spectators who were standing along the fence got hurt because they were in the way of a panic stampede of people. Under the pressure of a mass of people the wire fence loosened and about a hundred of people were injured. After the interruption, the match was still finished.



fig. 20 Rijeka – Hajduk 1962, Rijeka, Croatia

In 1960s the stadium was renewed and fixed, and when the Association for physical education of the City of Rijeka was the best one in Yugoslavia in 1965, even greater work on renovation of the stadium was carried out. New semicircular staircase stands for the spectators to stand were built next to the central stands on the eastern and western part of the playground.

A beach behind the concrete stands on the south contributed to the impressive appearance of the stadium. Swimming area called Lučica, positioned on a beautiful pebble beach next to a small port, was the favourite one for the inhabitants of Rijeka. Many swimmers would watch happenings on the stadium in summers and during the half-time they would enjoy in grilled specialities from the nearby, quite popular restaurant “Arena“, which was located in a former German bunker.

Economy in Rijeka was developing rapidly in this period, so the economical growth reflects on sporting life in the city as well. Building a new opened pool in Kantrida was finished, and the stadium with accompanying facilities continuously underwent small renovations and improvements in conditions of infrastructure. Due to these conditions in 1974 UEFA offers Rijeka organisation of the tournament UEFA Cup for amateur football teams.

Major building procedures on the stadium lacked in happening until 1975 when Kantrida assumed its current appearance. Boxes were built on the central stands, grass was renewed and the dressing rooms were renovated. The greatest procedure was filling the beach to get space for parking vehicles which was a problem for functioning of the stadium. Space for additional field was cleared on this filled ground which the stadium was lacking. New lighting was installed, so since 1975 the matches have been played at night as well.



fig. 21 Rijeka – Hajduk 1978, Rijeka, Croatia

Filling the shore and destroying natural beaches forever changed appearance of the original playground with the rock on the north and the nearby beach. This intervention was accompanied by demonstrations of many citizens and visitors of Kantrida. The concrete bunker with the famous restaurant Arena was knocked down and during the demolition a poplar tree, famous for many young fans climbing its branches during matches, was also destroyed.

In 1978 Rijeka Football Club wins the first trophy in the history of the club and it was the trophy of Marshal Tito, so the stadium and the club enjoy in great popularity which was later reflected in greater attendance. Industry in Rijeka was expanding and the shipyard was at its peak which was reflected in sports achievements. The city attracts people from different parts of the country, so in 1981 Rijeka had 164.000 inhabitants. Kantrida, the western part of the city, during the middle 1980s became a real Mecca, and a sports-recreational centre called “May, 3rd” was opened not far from the stadium. The same year a new electric scoreboard of dimensions 10X2 metres was installed at the western part of the stadium. In 1984 Rijeka played against Real Madrid and broke stadium attendance record – 25000 fans. In fantastic atmosphere Rijeka won 3:1, but later lost in Madrid and didn’t qualify further.



fig. 22 Rijeka 3:1 Real Madrid 1984, Rijeka, Croatia

A rather gloomy atmosphere and state of apathy ruled the country prior to the collapse of Yugoslavia, and politicisation was expressed in sports as well. Activities held on the stadium did not cease even during the Croatian War of Independence, so during the match with Olimpija from Ljubljana fans from Rijeka organised a big Croatian coat of arms made from red and white pieces of cartons.

Besides the footballers, the stadium in Kantrida is also used by other athletes from Rijeka, first of all modest athletes from Kvarner Athletic Club. One of the best athletes in Croatia came from their lines – Luciano Sušanĳ who won the first place in 800 m race during the European Championship in athletics in Rome in 1974.

Kantrida in recent years stands empty while new management is in process of obtaining build permit for new stadium.

Football matches are played on temporary stadium in training camp and all over Istria and Croatian Littoral, but Kantrida has been an epicentre from which everything starts. Kantrida is one of a kind; it is the most favourable, unforgettable, endlessly loved, eternal. A legend which must be cherished respected and preserved no matter the potential difficulties with building modern stadium on cramped location.



fig. 23 Kantrida 2015, Rijeka, Croatia

PROJECT

FOOTBALL

Rijeka Football Club in Rijeka uses the stadium in Kantrida and participates in competitions for the Croatian National League (HNL). At the beginning of 2010 the club privatisation occurred as well as changes in the ownership structure. An investor from Italy set up his men in the Managing board of the club and established new guidelines for functioning and development of the club. The new owner has also stabilised the club and has worked on the aim of having Rijeka Football Club in the fight for the title of a champion of the Croatian Football League which would lead to participation in European football competitions. With the aim of development of Rijeka Football club a new training camp has been built for footballers in Rujevica (a part of Rijeka) and the plan is to build a new stadium in Kantrida.

Current condition of the old stadium in Kantrida is such that it requires a complete reconstruction or building a new stadium. Today, football matches of Rijeka Football Club are played on a temporary stadium in the training camp.



fig. 24 training camp Rujevica, Rijeka, Croatia

Architecture design documentation for building the new stadium is in progress and the investor is in procedure for getting the Building permit. Changes must be made in Spatial planning of Rijeka to get the building permit, so the entire procedure of building the new stadium is slowed down.

With impulsive arrival of new capital and economic rescue of the club from a possible bankruptcy, the new owners of Rijeka Football Club were in a position of having complete control over bringing key decisions for the future of the club. Due to economic situation in Croatia, each arrival of new capitalists and investors were welcomed with enthusiasm and without setting even minimum conditions.

Even the idea of building a new stadium was implemented without announcing an Architecture competition, but the investor chose designers as well as the design for

the stadium himself. Kantrida is a part of the City of Rijeka with the stadium, it has its interesting history and it represents great significance and value to the city. Solving the construction of the stadium in Kantrida without announcing an architecture competition means missing an opportunity of finding the best design for this valuable space.



fig. 25 proposal for new Kantrida, Rijeka, Croatia

The Kantrida site has been known to a wider public as one of the most interesting sites for the stadium so it can be assumed that announcing an architecture competition and choosing a good design would attract even more attention. An example of a similar site and a great design which promoted the city and club is the stadium in Braga, designed by the Portuguese architecture Eduardo Souto de Moura who was even awarded the Pritzker Prize in 2011 for this structure.



fig. 26 Estádio Municipal de Braga, Braga, Portugal

A conceptual design of the new stadium in Kantrida was published on the official club sites, and the construction was determined for the following year. Besides the structure of stadium there should have been a construction of hotels, shopping centres and other additional contents which are a constituent part of modern stadiums. The new stadium is designed to fit any site. The micro-location of Kantrida lacked respect by all means, but it leaves an impression that additional contents on exclusive location were more important to investors than a sports battlefield itself.

Following Croatian Football League for years as a fan of the rival club Hajduk from Split I was familiar with all activities inside Rijeka Football Club. I feel disappointed that an opportunity was missed in Rijeka for such a valuable location to be devastated and not used properly.

All these events motivated me to choose building the new stadium in Kantrida as a topic of my Master's Thesis.

While working on the design I learnt even more about the history of Kantrida and aimed my design at valorising all values of the site as well as creating a stadium that would suit the fans.

FANS

As football developed in the modern age, we have become more aware that football is more business and less sport. A modern football match has become a festival of overpaid players surrounded with neon advertisements and expensive sponsors.

Stadiums are designed to have more VIP lounges only to show prestige and power. The quality of catering and wine as well as negotiating new business is what matters in those exclusive spaces, and football is only a cover. Television coverage of football matches dictate a schedule of the matches and viewers on the other side of the screen become more important than the spectators on the stands.

It is a paradox that expensive stadiums are built, price of tickets are increased but all this results in a decrease in number of true fans who, with their enthusiasm and with players on the pitch, create atmosphere which represents the greatest value of football and going to the stadium. The stadium should be designed with the aim of putting forward football and atmosphere of the most loyal fans.



fig. 27 Armada, Rijeka, Croatia

SITE

The stadium site in Kantrida is exceptionally specific because the stadium space is located in a narrow part between rocks of the old quarry and sea shore. The main road was built above the quarry, and the site is accessed from the local roads in the east and west from the stadium.

The existing stadium is oriented so that the side stands are under the rocks of the quarry. Since the best view to the stadium and game is from the side stands, increase in capacity of these stands would entirely cover the stone rock.

For this reason the design is directed towards a change in orientation of the football pitch. This enables the same capacity of the eastern and western stands and the natural rock of the quarry is presented in the interior of the stadium as well as outside it.

The most loyal fans were located on the Western stands behind the goal until now, but according to the new design they are located on the northern stands "UNDER THE ROCKS" – which is also an official nickname of the stadium.

Rotating the orientation of the stadium north – south resulted in having the best stands on the eastern and western side where the main walkway entrances are located. The pitch configuration is used for easier communication and a plateau is designed at half height of the eastern and western stands. This way the new pedestrian walkway in the outside area around the stadium is defined, and under the plateau it is planned to have a local road with a parking area and stadium services.

The plateau around the stadium is planned for gathering of fans before a match and a more simple entrance to the eastern, western and southern stands. At the same time it is space outside the stadium which leads to the newly renovated beach on the south of the structure complex with accompanying hospitality services.

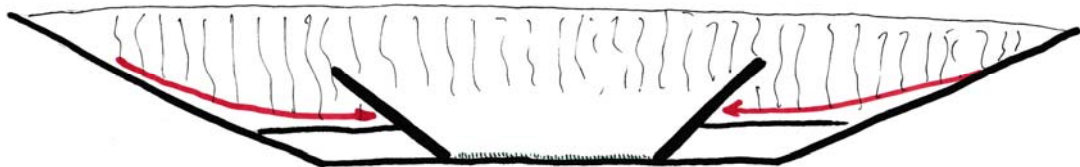


fig. 28 sketch of basic concept

Parking lots are reserved for subscribers of the eastern stands and when football matches are not played the lots are at free disposal to the citizens.

Access to the stadium from the sea became available after building a smaller breakwater between the two beaches.

Portić – a small port for smaller ships on the western side is kept, and the new access is formed. Natural beach on the eastern side with the cult cafe "Morski prasac" (Eng. "Sea pig") is secured and defined after building a smaller breakwater.

Vertical communication from the parking area to the walkway plateau is planned from the stairway with a regular grid. This stairway and garage air vents define a border between the inside and outside area of the stadium.

The stadium stands are separated with dominant volumes which carry entire steel roof structure of the stadium. Inside these regularly distributed volumes there are vertical communications between the stairway and lifts.

Roof, as one of the main structured elements of the stadium, dominates the space as a strong steel grid. The roof structure is at the same height as the top of the quarry rock and the main road on the north. This enabled connection of the space above the quarry with the stadium, surrounding space up to the sea in the south. This communication north – south gives additional value and it additionally enriches the area of Kantrida.

The roof structure is used for additional contents such as a restaurant, cafe and fan shop.

While the matches are played the access to the area is at the same time the entrance to the stadium. When matches are not held, free communication is allowed over the roof area of the stadium from the northern side to the area in the south by the sea. The roof stadium with a view to the sea becomes a new, pleasant and attractive space at disposal of the Rijeka citizens.

ROOF STRUCTURE

Formation of the roof structure came from the idea of having a less covered view of the quarry stone rock. It was achieved by lifting the roof structure above the upper height of the quarry. Concrete volumes which support the roof structure are moved away from the rock so that the quarry rock remains intact. The space between volumes and the rock are planned as main entrances to the northern stands for fans.

Not only lifting the roof resulted in presentation of the Kantrida rock but removing the roof from the stands offers the stadium a certain amount of spaciousness. Separating the roof from the stands imposes a question of whether the roof area belongs to the stadium or it is an independent architectural element.

Since the roof area may be used even when the matches are not played, it can be interpreted as an independent element. This way the area above the Quarry gets new contents and it results in use of the Kantrida area on daily bases by the citizens.

The roof becomes a promenade towards the sea with new views and sights of the quarry, stadium and sea. Due to great roof span, the height of the steel grid is such that useful spaces are located inside the steel raster of the structure.

Brutal steel roof structure does not hide itself but is used as new formative element of the open space. To get an effect of simplicity and uniqueness of the structure during the formation, a laminated girder without vertical elements which covers the outside and the inside roof edge was chosen.

The roof structure integrates the area above all four stands and, for formative reasons above the southern stands, the promenade on the roof structure is not covered.

Covered area above the northern stands is in fact the front space of the stadium entrance. Majority of fans who use public transport arrive directly in front of this northern entrance. This covered area is a bus stop, a place for purchasing tickets and a position which offers a stadium view. During the football matches the roof above the northern stands is the only part of the roof which can be approached

without tickets. This allows a certain number of citizens to follow activities on the stadium free of charge.

People who go to football matches may spend time before matches in the club cafe, restaurant or fan shop. There is also a possibility for a certain number of visitors to spend time only on the roof before the match for a certain fee.

Four regularly distributed concrete volumes which support the roof include main vertical communication of the stadium. Two dog leg stairs are in each of them and they lead towards different stands and lifts.

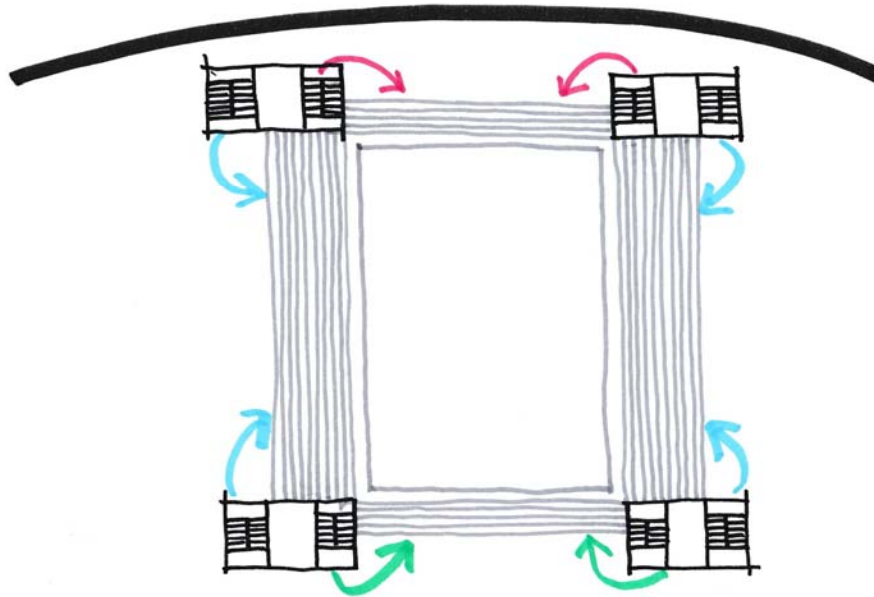


fig. 29 sketch of different stand entrances

STANDS

Stands for spectators are as close as possible to the pitch so that the fans could create best atmosphere possible during matches. For the same reason the stands are designed to be as steep as possible.

The northern stands are planned for the most loyal fans of home teams. They are designed with the aim of creating a homogenous cheering wall (example Westfalen Germany) which means that entrances are not at the same height as for the other stands. They are approached from the plateau above the highest row. This enables the fans to create a unique visual image from the stands. For the matches of increased interest seating places may be transformed into standing ones. All chairs have their storage under the stands. The stone rock presents itself in the background of the stands and the highest rows of the northern stands have a sea view.

The opposite southern stands are the lowest ones and are planned for the fans of the guest teams. For their small height a half of the eastern and western stands have a sea view. The southern stands have access from the plateau around the stadium or directly from the parking area. They are separated from the eastern and western stands with access for ambulance and fire brigade.



fig. 30 Gelbe Wand, Dortmund, Germany

The eastern and western stands have the maximum capacity and provide the best view of the stadium. A VIP lounge with a buffet room on its disposal is located in the middle part of the western stands.

The VIP lounge is for visitors who are firstly there for football reasons and classic VIP boxes are not a part of this stadium.

Area for reporters is located above the VIP lounge. VIP guests and reporters have direct access to the stands from the garage area. All basic rooms for the participants in the matches are located under the western stands. Substitute players and team staff have their places in the first rows of the western stands under the VIP lounge during a football match.

An adequate number of toilets for visitors of the stadium is located under all stands. Smaller snack bars for visitors are located behind the eastern and western stands and between the entrances.

Capacity of the new stadium is 14 482 spectators, seating places and if the standing places are put into use on the western stands, the total capacity of the stadium amounts about 16 000 visitors.

| | | |
|------------------------|-------|--|
| Separately per stands: | EAST | 5200 seating places |
| | WEST | 4760 seating places |
| | NORTH | 2690 seating places (4100 standing places) |
| | SOUTH | 1830 seating places |

Garage which is in the first place intended for a limited number of subscribers has a total capacity of 365 spaces. The western part of the garage is intended only for the VIP guests, team buses, club and players.

Basic structure of the stands and vertical roof grids is a reinforced concrete structure with the finish – béton brut.

The roof structure is a steel grid and the roofing is an aluminium sandwich panel. Roof pavement, plateau around the stadium and all open spaces are designed in lighter asphalt shades.

The stadium playground was designed according to all European requirements set by UEFA.

CONCLUSION

Kantrida is a specific location with values to protect and they will be accentuated and enriched with this design.

Building the stadium does not cover a view of natural stone rock from the quarry and new communicational space between the part of the city above the quarry and the stadium towards the sea is opened. The new Kantrida with steep stands and their immediate vicinity to the pitch creates ideal preconditions for great atmosphere, which is after all the primary aim of any stadium.



fig. 31 The Kop, Liverpool, England

BIBLIOGRAPHY AND LIST OF FIGURES

Bibliography:

Koroznjak Boris, Zgrade za sport , Zagreb 2012.

Lazzarich Marinko, 100 godina Kantride, Rijeka 2013.

Koster Philipp and Angelika Schnell, Stadien 2006, Berlin 2005.

Gerain John and Rod Sheard and Ben Vickery, Stadia: A design and Development Guide, Oxford 1998.

Ngo. Anh – Linh: Sport und Spektakel in Arch +169/170, Aachen 2004.

Herzog & de Meuron Unsere Stadien sind Wahrnehmungsmaschinen Zwischen Zuschauer und Spielfeld – Ein Gespräch mit Herzog & de Meuron, in Detail Konzept JG.45 Heft 9 Munchen 2005.

Nixdorf,Stefan; Volkwin Marg: Die Komposition von Stadien – Zwischen Multifunktion und Ruckbau; in Deetail Konzept JG.45 Heft 9, Munchen 2005.

LIST OF FIGURES

fig.01 Delphi stadion, <http://www.athenstaxitours.org/wp-content/uploads/2011/11/delphi-stadium-greece.jpg>

fig.02 Epidaurus Theatre, <http://media.web.britannica.com/eb-media/26/61026-050-BEAA5C5.jpg>

fig.03 Colosseum, http://4.bp.blogspot.com/_zflBbyE_ZPK/VqjCkGpBgkI/AAAAAAAAAcM8/8yJdITidbok/s1600/Colosseum%2B-%2BReconstruction%2B-%2BRoman%2BPrincipate%2B-%2BPeter%2BCrawford.jpg

fig.04 Arena Pula,
http://cache.carlsonhotels.com/pkp/images/PK%20europe/Croatia/Arena_Panorama.JPG

fig.05 Amphitheatre in Salona,
http://www.smokvina.hr/common/a6/s/5651/Amphitheatre,_Salona,_Dalamatia_%2810380958035%29.jpg

fig.06 Circus Maximus in Rome, <http://www.circusmaximus.us/circmax.gif>

fig.07 Palio in Siena, <http://www.antennaradioesse.it/wp-content/uploads/palio-lug-2015-panoramica.jpg>

fig.08 Olympic Park in Munich,
http://www.pritzkerprize.com/sites/default/files/gallery_images/Frei-Otto-Rooftop-for-main-sports-facilities-in-the-Munich-Olympic-Park-07.jpg

fig.09 Poljud stadium in Split,
<http://www.vecernji.hr/media/cache/db/b9/dbb9cb245340e0616e061134cbe76ecc.jpg>

fig.10 Stadio San Nicola in Bari, https://i.ytimg.com/vi/0-NKcHX_3dw/maxresdefault.jpg

fig.11 Allianz Arena in Munich, https://www.allianz-arena.de/media/images/wallpaper/rot/rot02_1024.jpg

fig.12 Rijeka, Croatia, <http://www.bing.com/maps/>

fig.13 Kantrida, Rijeka, Croatia, <http://geoportal.dgu.hr/>

Fig.14 quarry, Rijeka, Croatia, Marinko Lazzarich - 100 godina stadiona Kantrida pg.23

Fig.15 Kantrida before WW1, Rijeka, Croatia, www.lokalpatrioti-rijeka.com/media/images/3221125.jpg

fig.16 Victoria football match, Rijeka, Croatia, Marinko Lazzarich - 100 godina stadiona Kantrida pg.135

fig.17 Kantrida before 1925, Rijeka, Croatia, Marinko Lazzarich - 100 godina stadiona Kantrida pg.140

fig.18 Olimpia 2:3 Gloria 1924, Rijeka, Croatia, Marinko Lazzarich - 100 godina stadiona Kantrida pg.152

fig.19 Speedway on Kantrida, Rijeka, Croatia, Marinko Lazzarich - 100 godina stadiona Kantrida pg.153

fig.20 Rijeka – Hajduk 1962, Rijeka, Croatia, Marinko Lazzarich - 100 godina stadiona Kantrida pg.156

fig.21 Rijeka – Hajduk 1978, Rijeka, Croatia, Marinko Lazzarich - 100 godina stadiona Kantrida pg.158

fig.22 Rijeka 3:1 Real Madrid 1984, Rijeka, Croatia, Marinko Lazzarich - 100 godina stadiona Kantrida pg.161

fig.23 Kantrida 2015, Rijeka, Croatia, <http://static.panoramio.com/photos/large/98929576.jpg>

fig.24 training camp Rujevica, Rijeka, Croatia,
<http://www.skyscrapercity.com/showthread.php?t=1755253&page=132>

fig.25 proposal for new Kantrida, Rijeka, Croatia, <http://www.stadionkantrida.hr/wp-content/uploads/2015/09/SK4.jpg>

fig.26 Estádio Municipal de Braga, Braga, Portugal,
<http://www.manutd.com/~media/BB6978ECD7BB4326B8CCB2BA60A93AC3.ashx>

fig.27 Armada, Rijeka, Croatia,
<http://www.novilist.hr/var/novilist/storage/images/multimedija/foto/rijeka-zilina-2-1-foto-silvano-jezina/rijeka-protiv-ziline-foto-silvano-jezina-5/3063566-1-cro-HR/Rijeka-protiv-Ziline-Foto-Silvano-JEZINA-5.jpg>

fig.28 sketch of basic concept, hand drawn

fig.29 sketch of different stand entrances, hand drawn

fig.30 Gelbe Wand, Dortmund, Germany,
<http://static.panoramio.com/photos/large/56876940.jpg>

fig.31 The Kop, Liverpool, England,
<http://i3.liverpoolecho.co.uk/incoming/article7745875.ece/ALTERNATES/s1227b/zzdti35814.jpg>

STATIC ANALYSIS

ASSESSING OF TRUSS ROOF RAILS CAPACITY

In collaboration with Branimir Kunjašić, a fourth year student of Civil Engineering in Zagreb structural analysis of steel truss was carried. The main roof girder will be performed as truss supported on reinforced concrete structure.

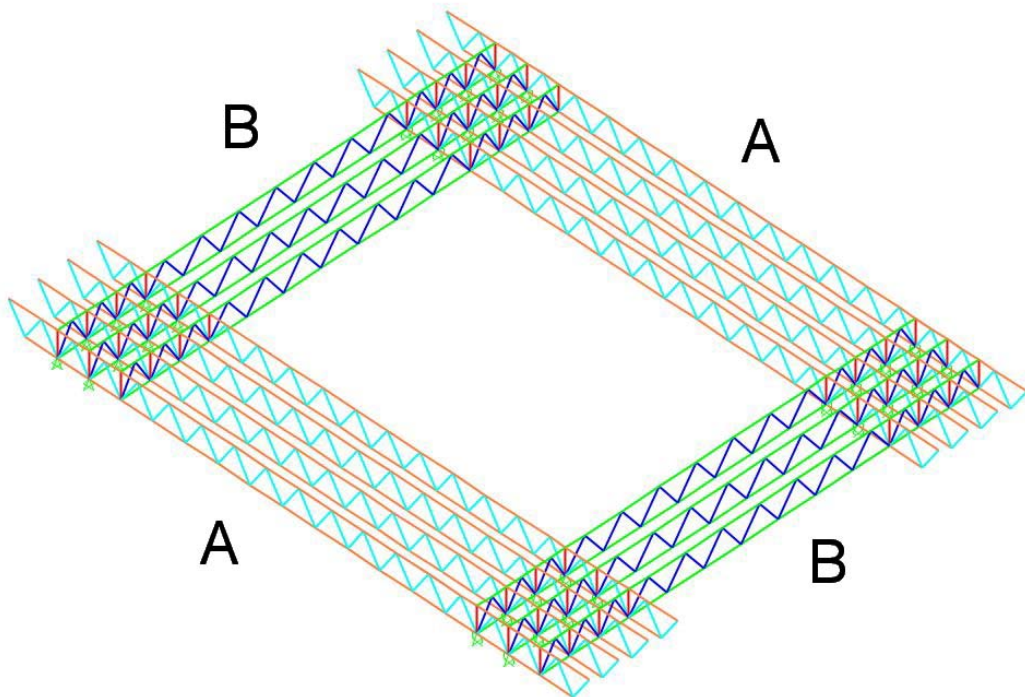
Truss girders (in Figure 101 labelled "A" and "B") lengths of 80 m and 119 m, height 8.60 m are made of steel rectangular cross section size 300x600x20 mm for longitudinal girder (upper and the lower chord of the truss) and 300x300x20 mm for diagonal members.

Loads for structural analysis were defined according to Eurocode 1- Actions on structures: Self-weight, permanent load, imposed load, snow and wind.

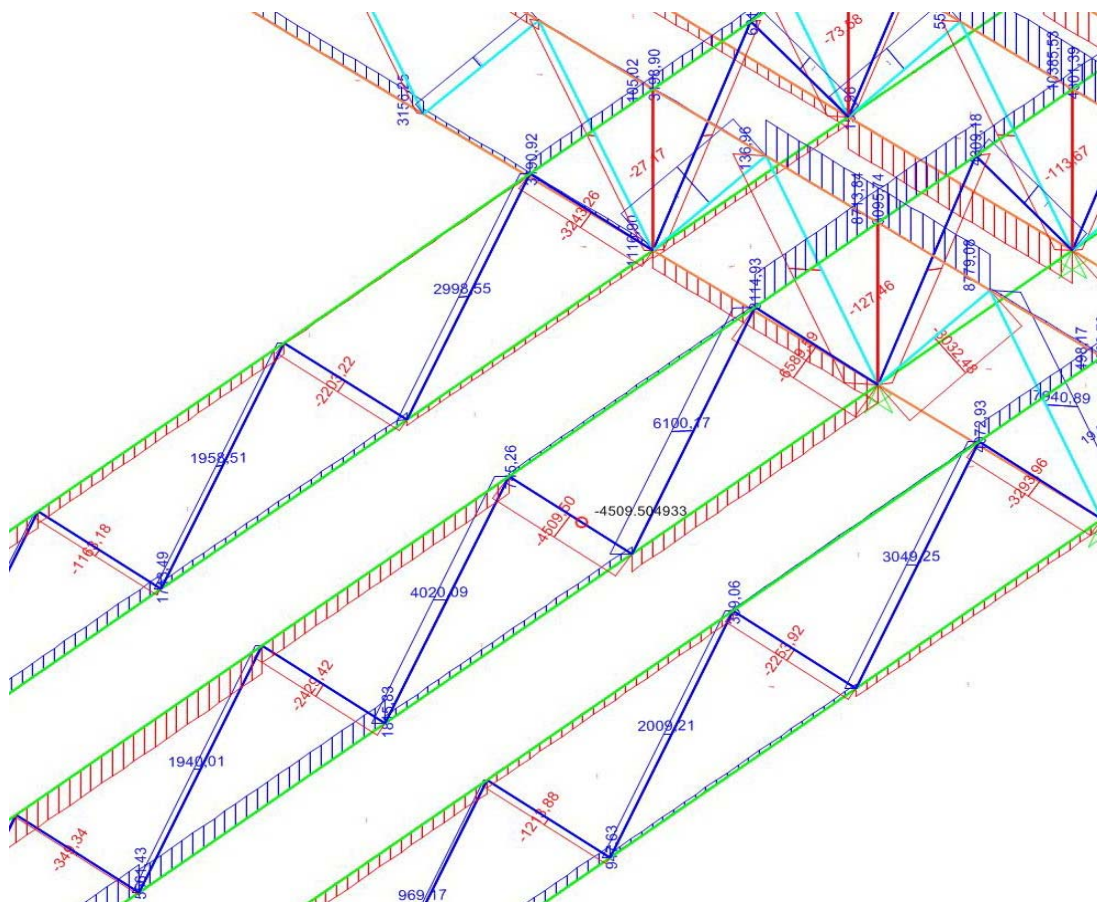
Computer program "SAP 2000" was used to carry out structural analysis for the ultimate limit states.

Because of the scope and complexity, only part of the results of structural analysis is shown on figures 1-11.

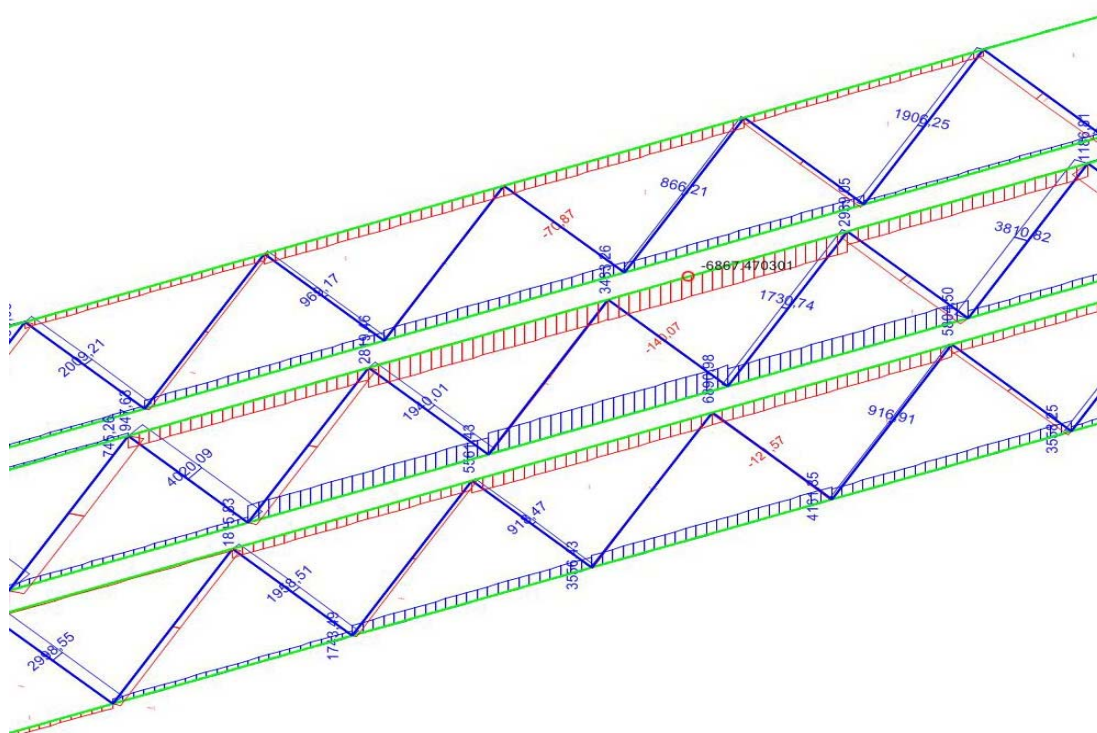
According to the results of structural analysis, tensile and compressive axial forces in all the elements are very small, and the assumed dimensions of the rectangular sections in the upper and lower chord and diagonal members are detained.



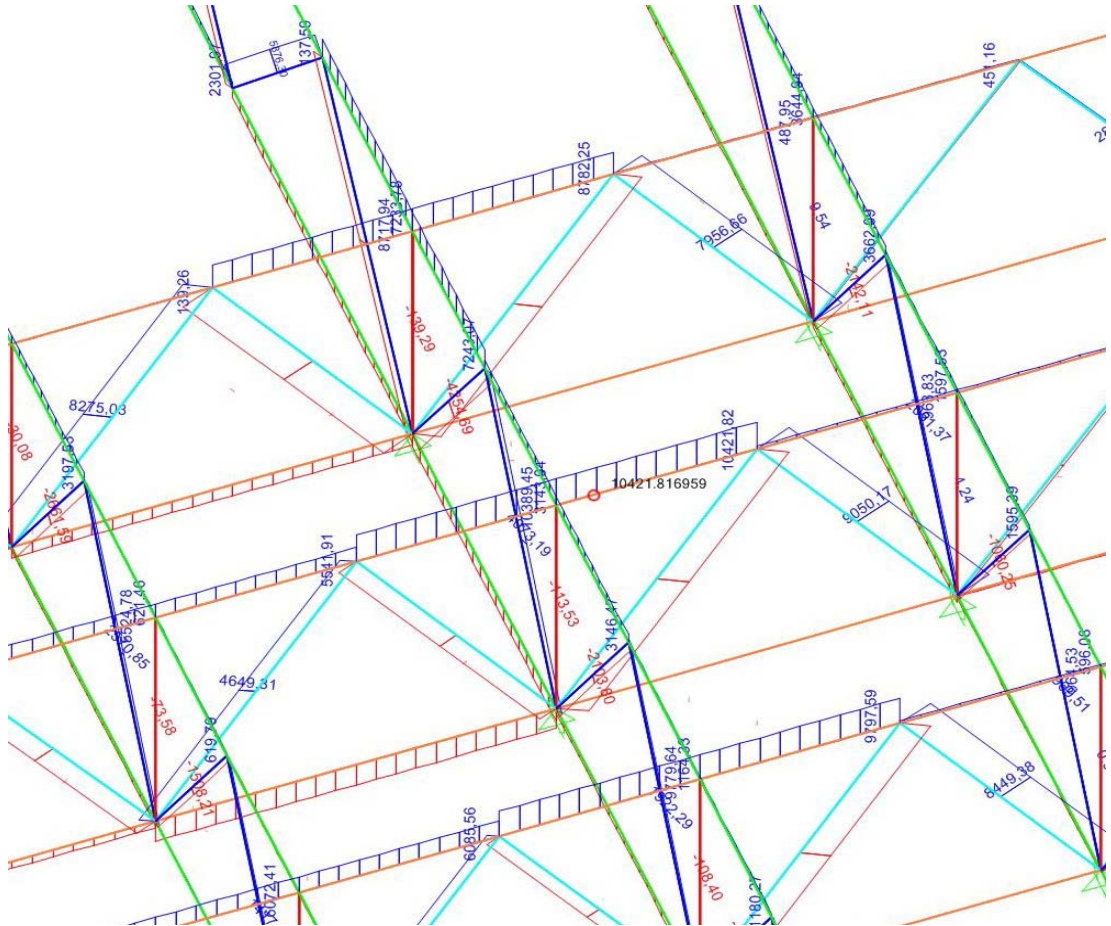
1: roof girders



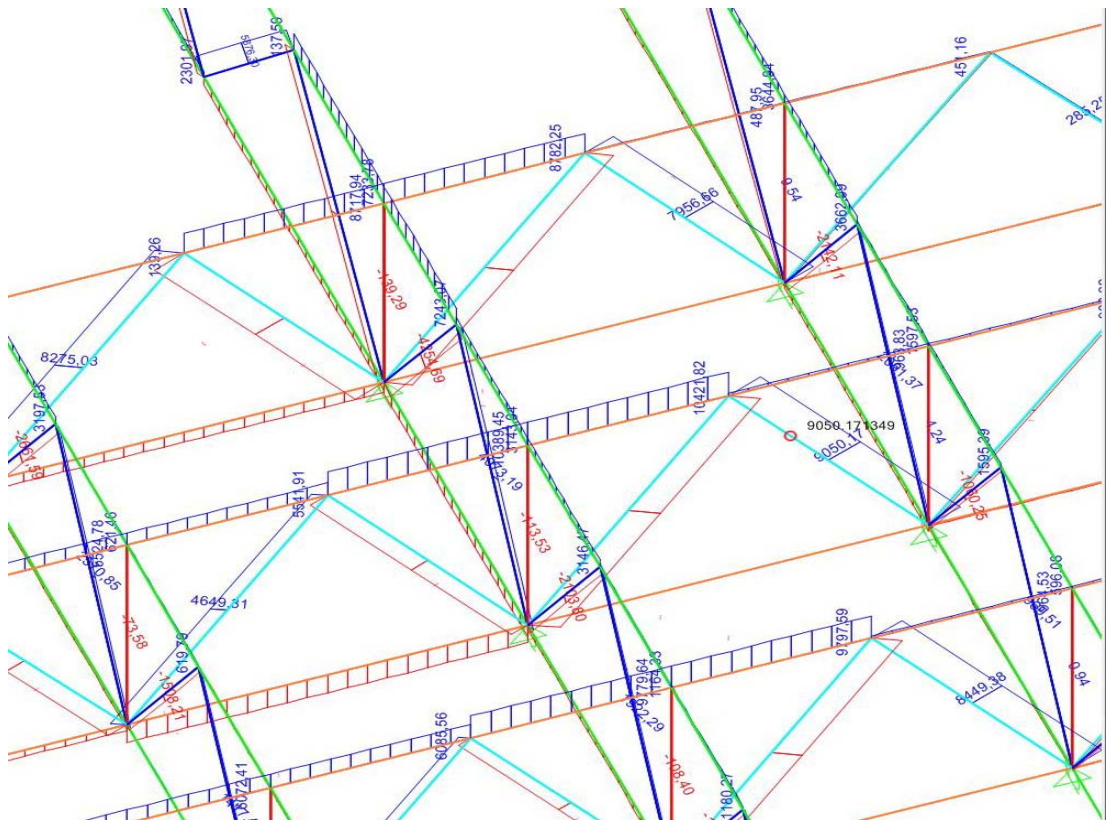
2: the maximum compressive force of diagonal member- girder "B"



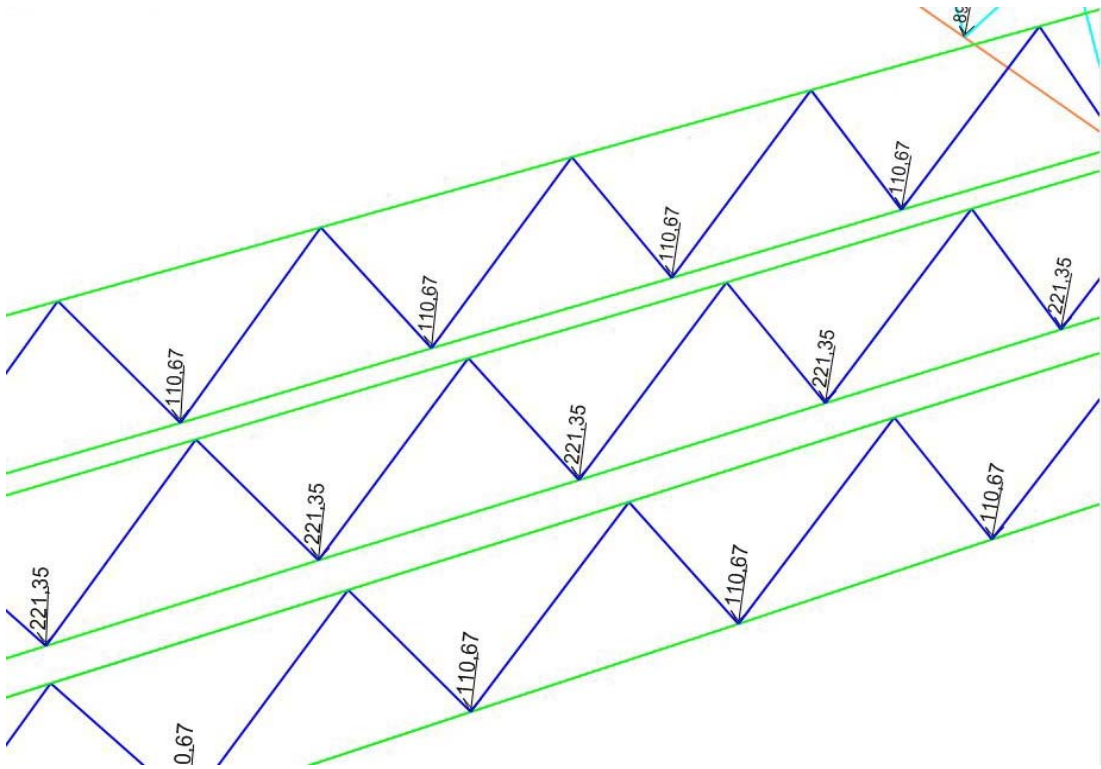
3: the maximum compressive force of longitudinal girder (upper and lower chord)- girder "B"



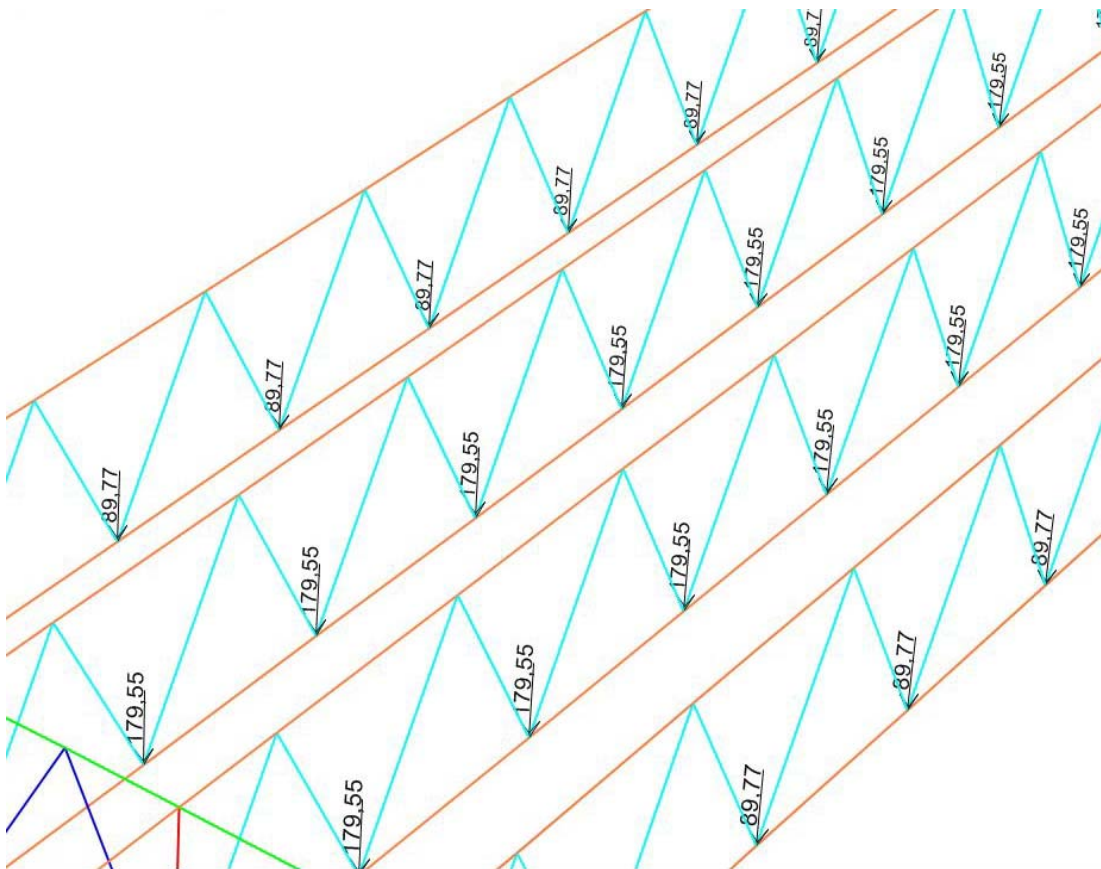
4: maximum tensile force of longitudinal girder (upper and lower chord) - girder "A"



5: maximum tensile force of diagonal member-girder "A"



6: forces in nodes of the permanent load girder "B"

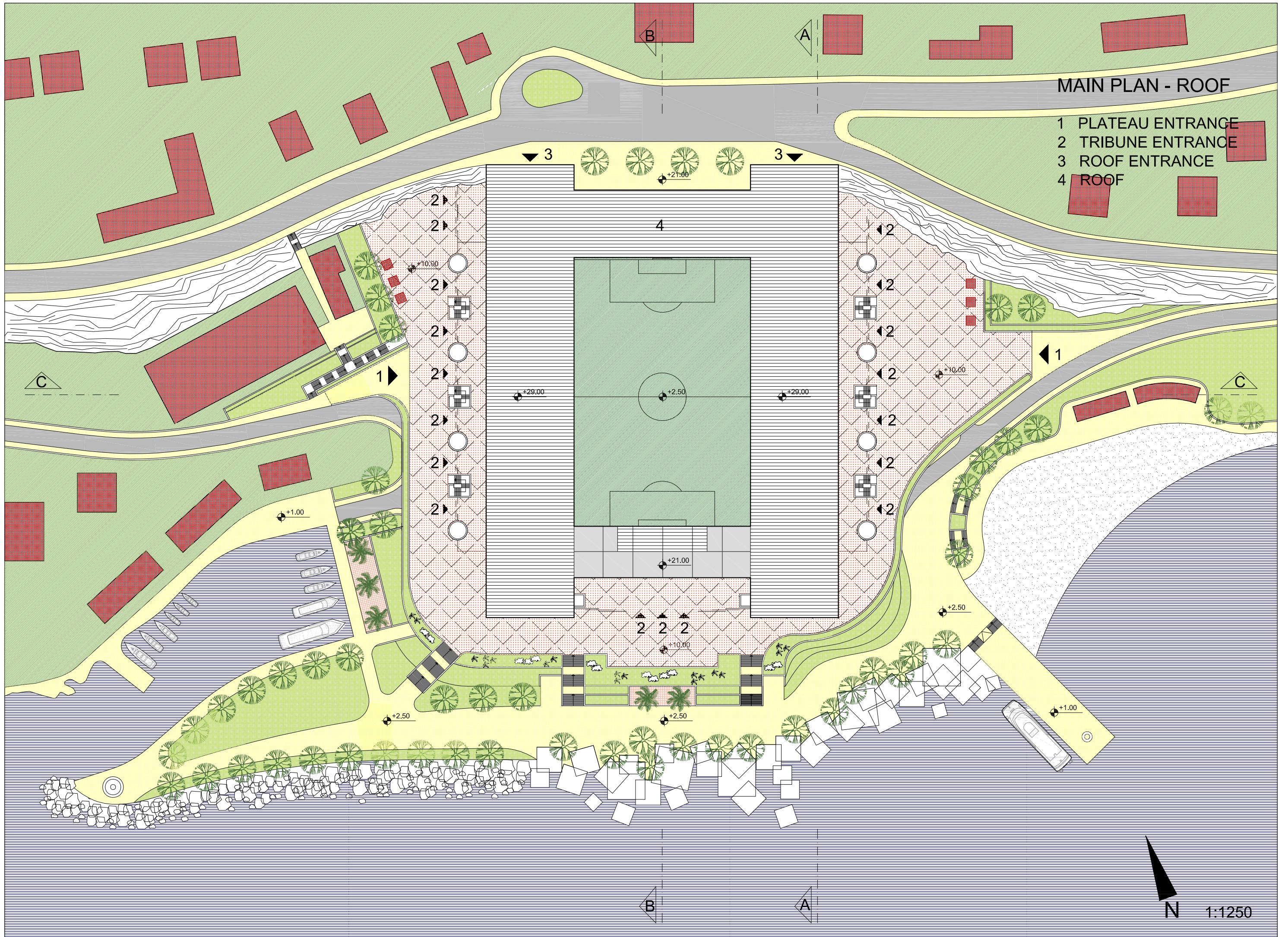


7: forces in nodes of the permanent load girder "A"

PLANS

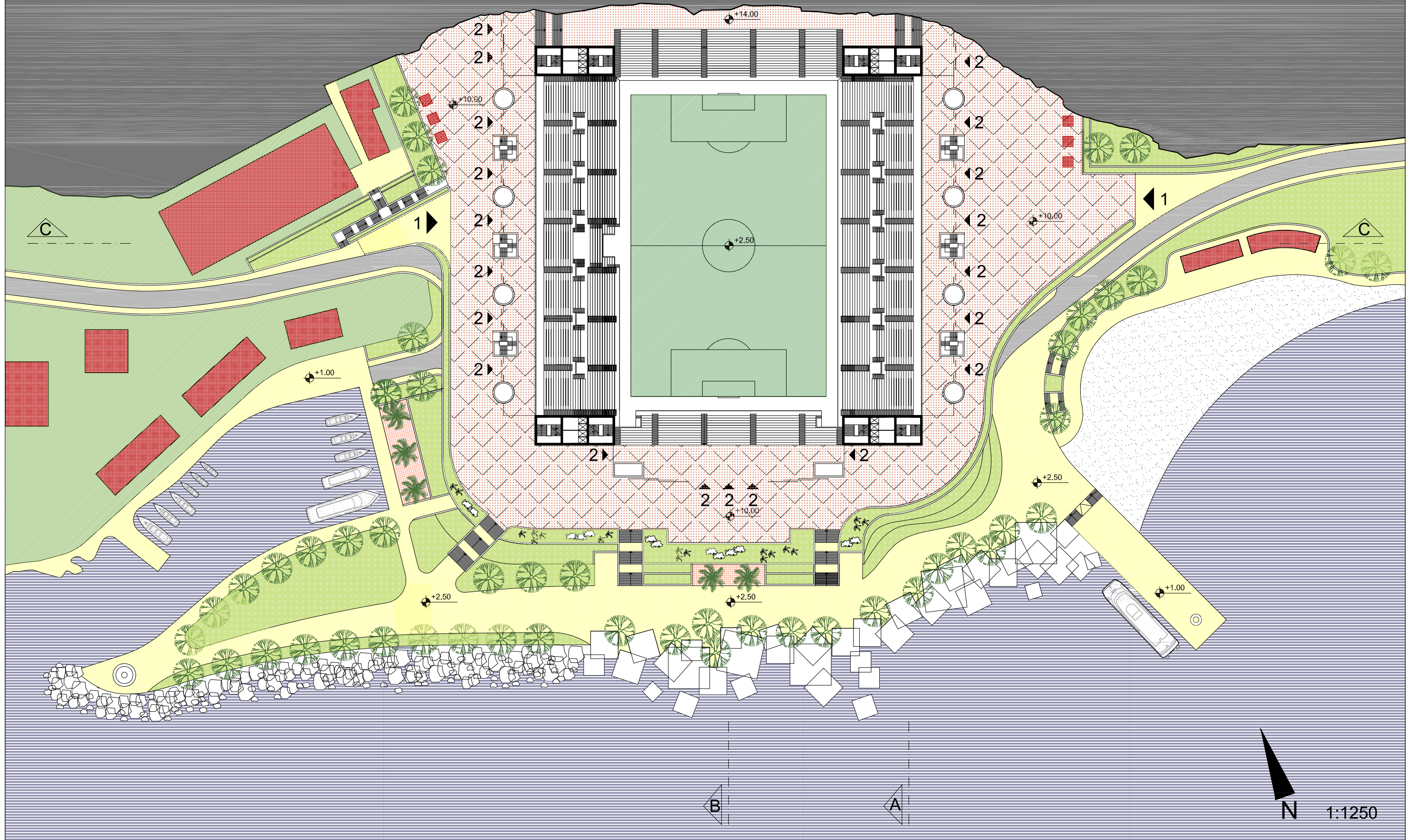
MAIN PLAN - ROOF

- 1 PLATEAU ENTRANCE
- 2 TRIBUNE ENTRANCE
- 3 ROOF ENTRANCE
- 4 ROOF



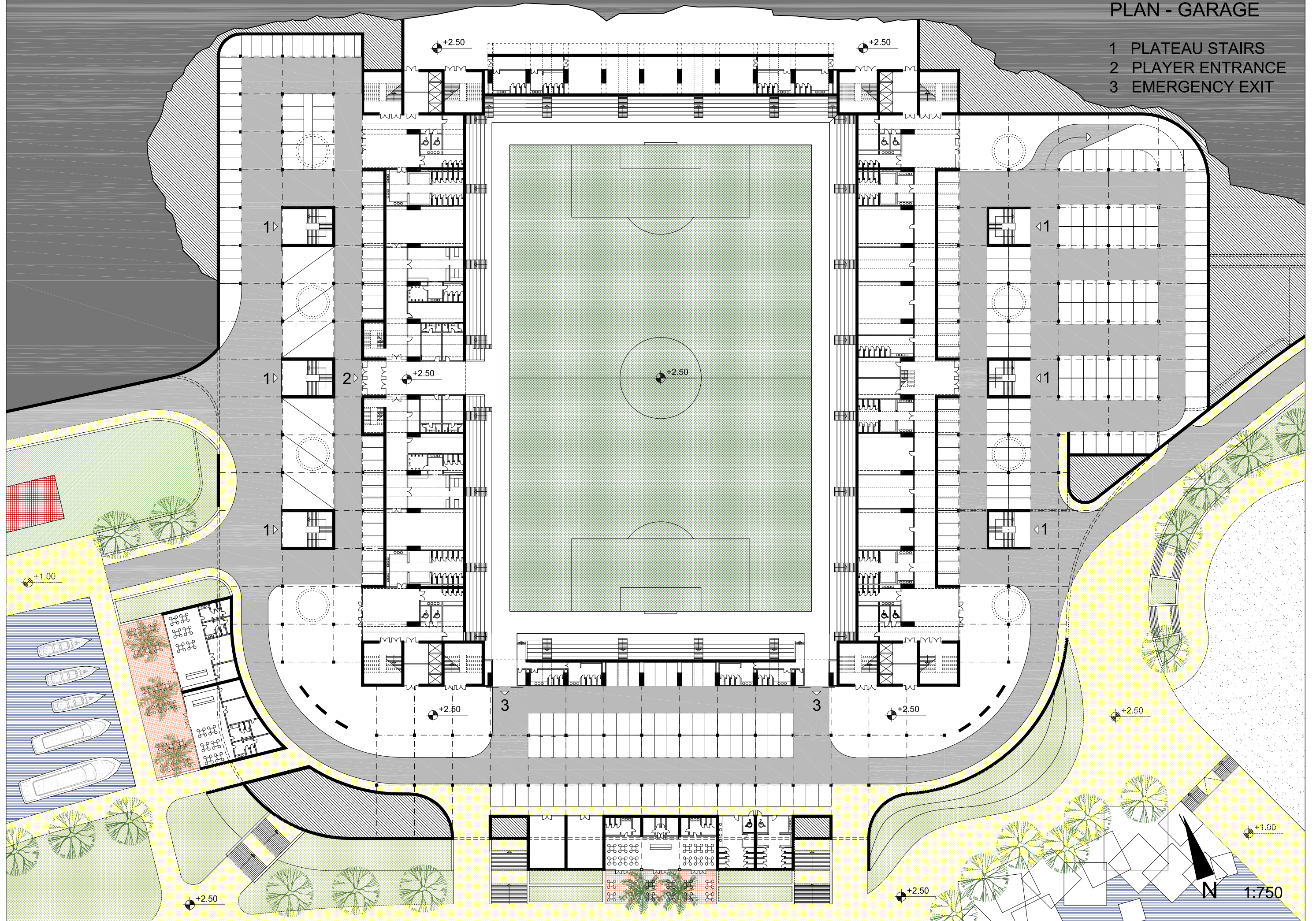
MAIN PLAN - STADIUM

- 1 PLATEAU ENTRANCE
- 2 TRIBUNE ENTRANCE



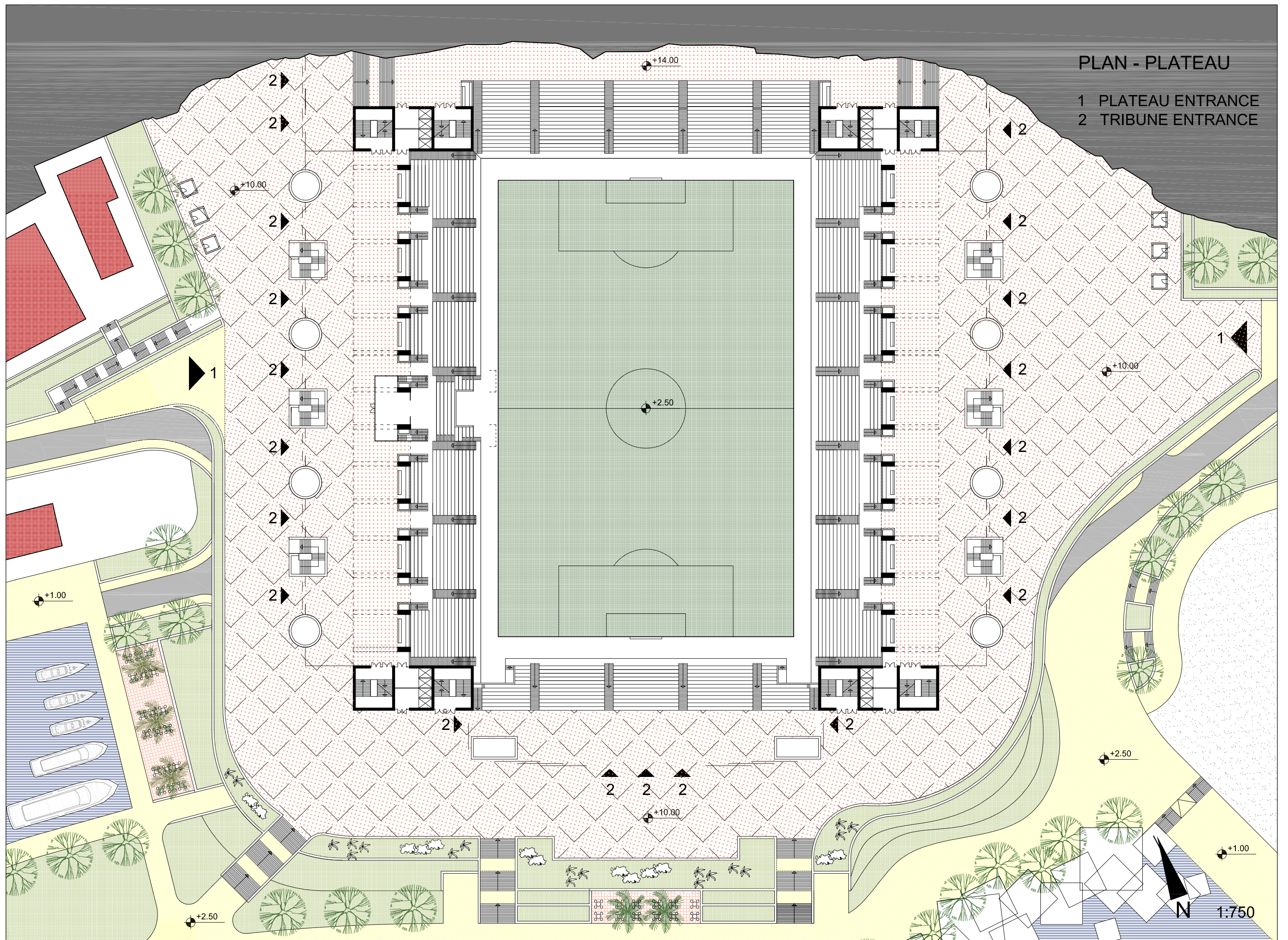
PLAN - GARAGE

- 1 PLATEAU STAIRS
- 2 PLAYER ENTRANCE
- 3 EMERGENCY EXIT



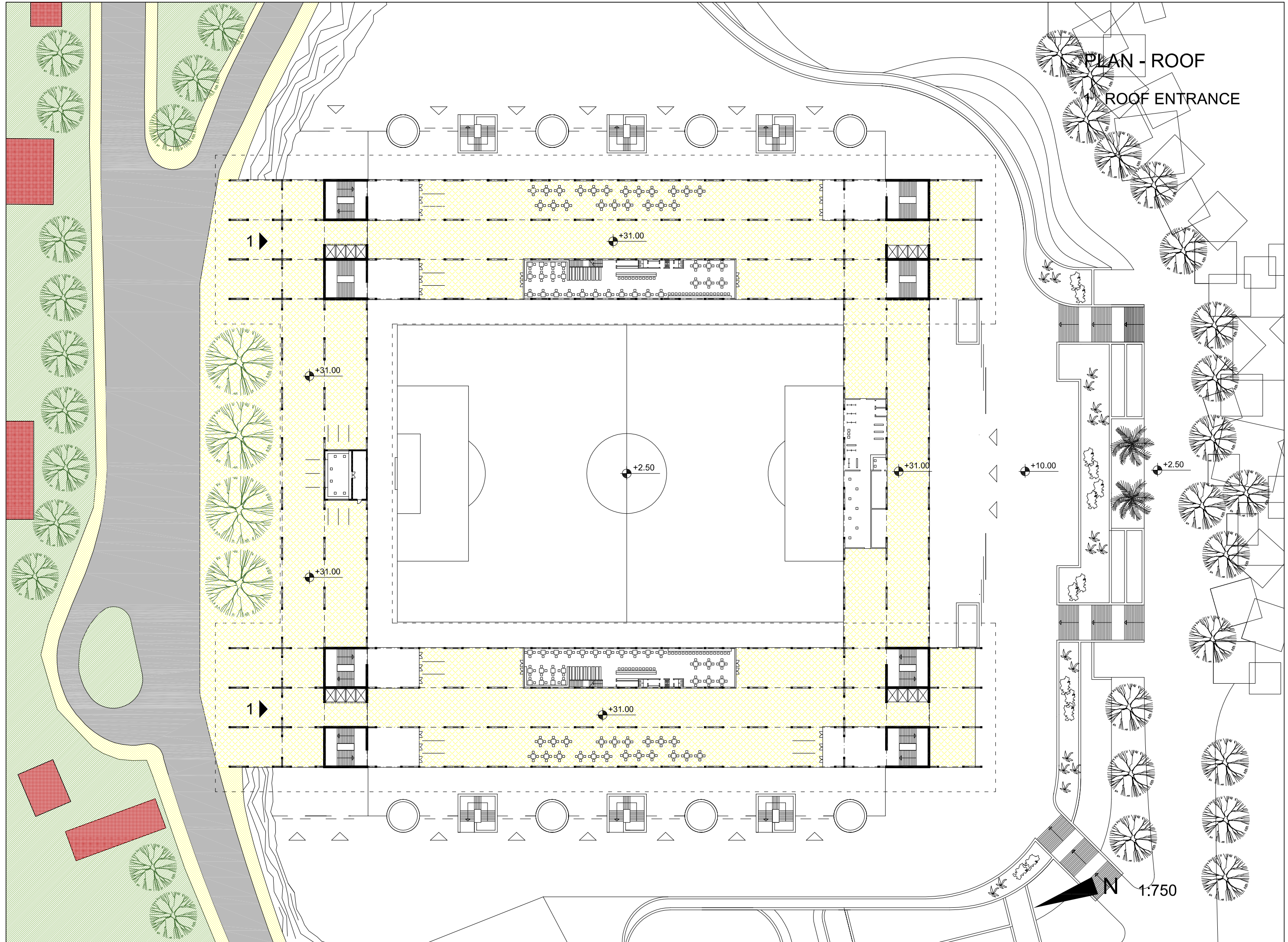
PLAN - PLATEAU

- 1 PLATEAU ENTRANCE
- 2 TRIBUNE ENTRANCE

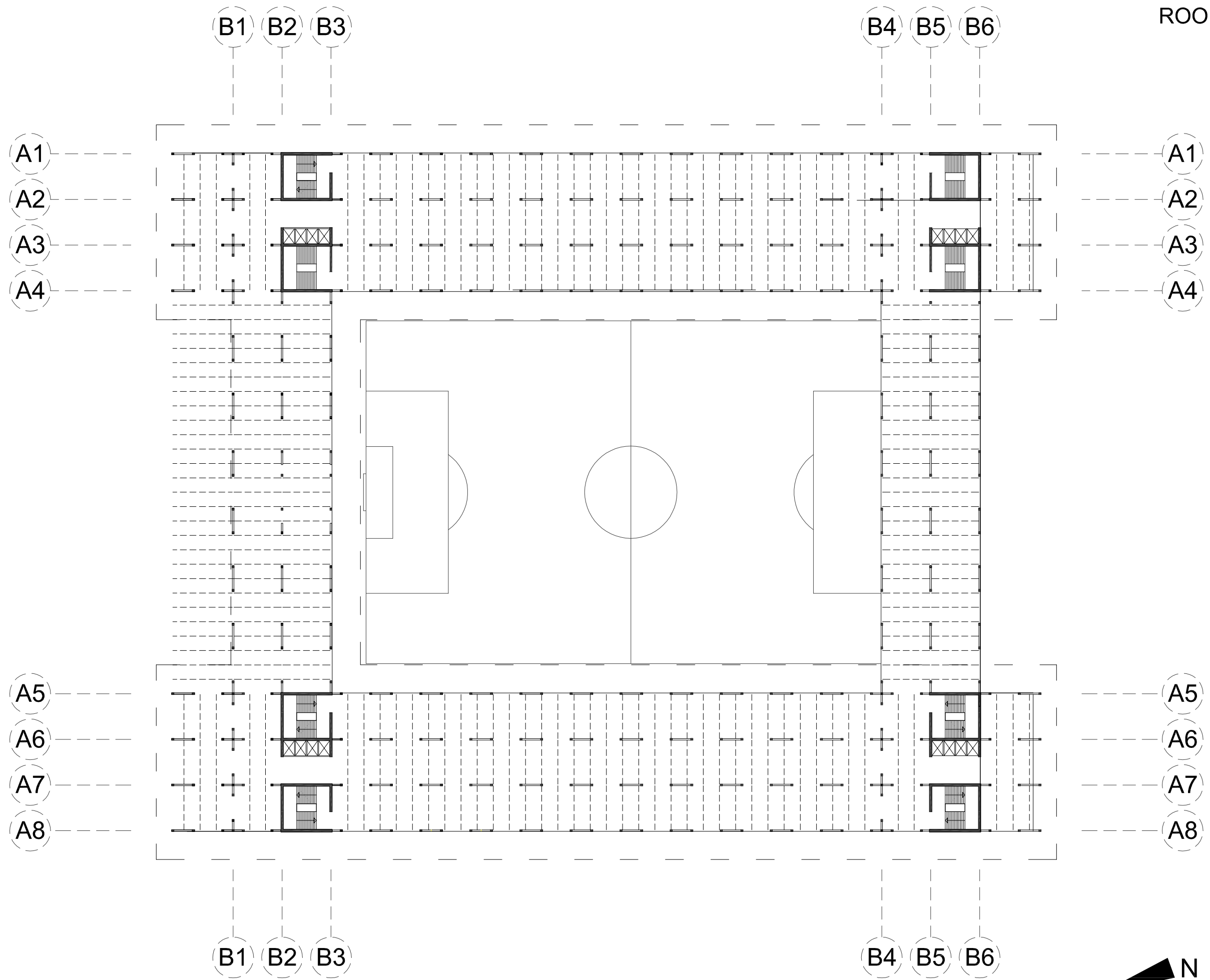


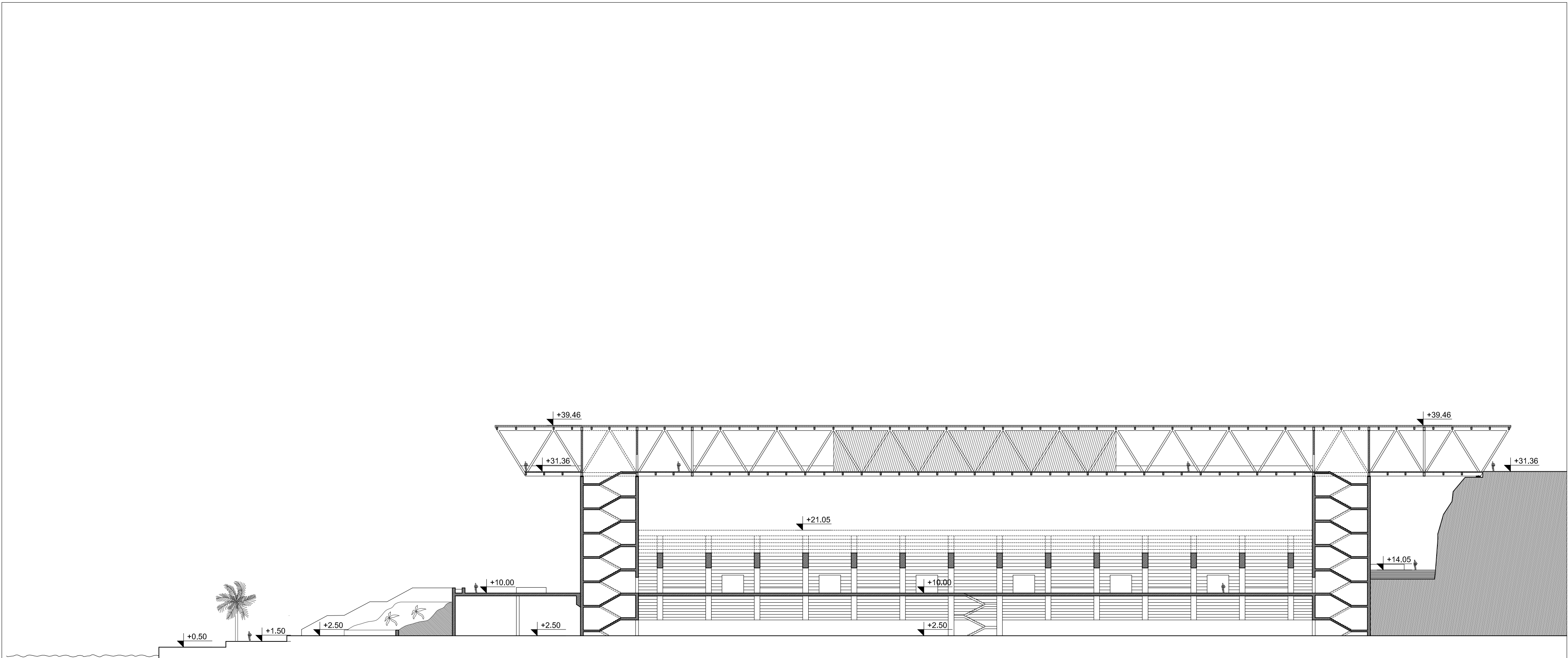
PLAN - ROOF

ROOF ENTRANCE



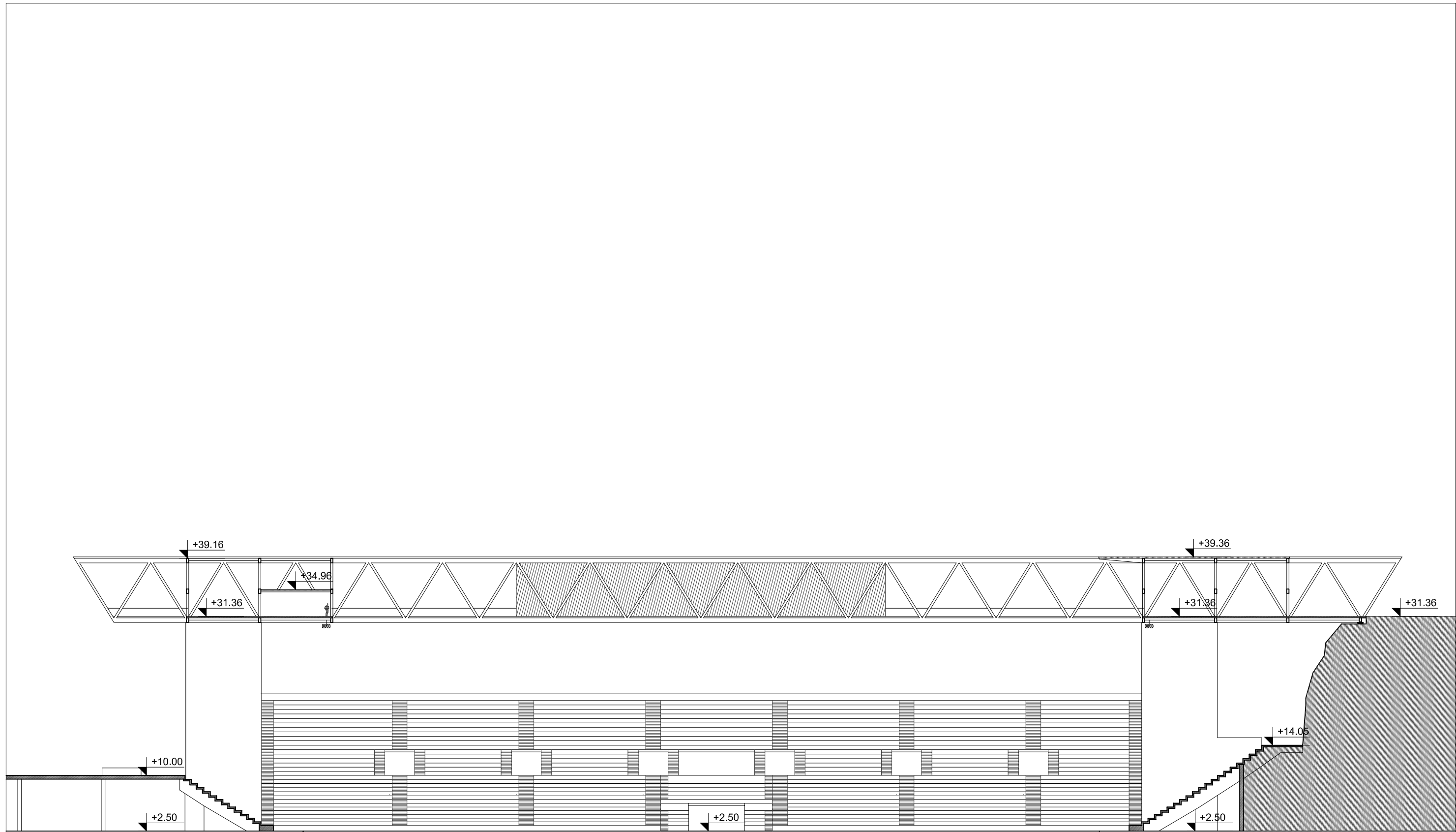
ROOF - SYSTEM





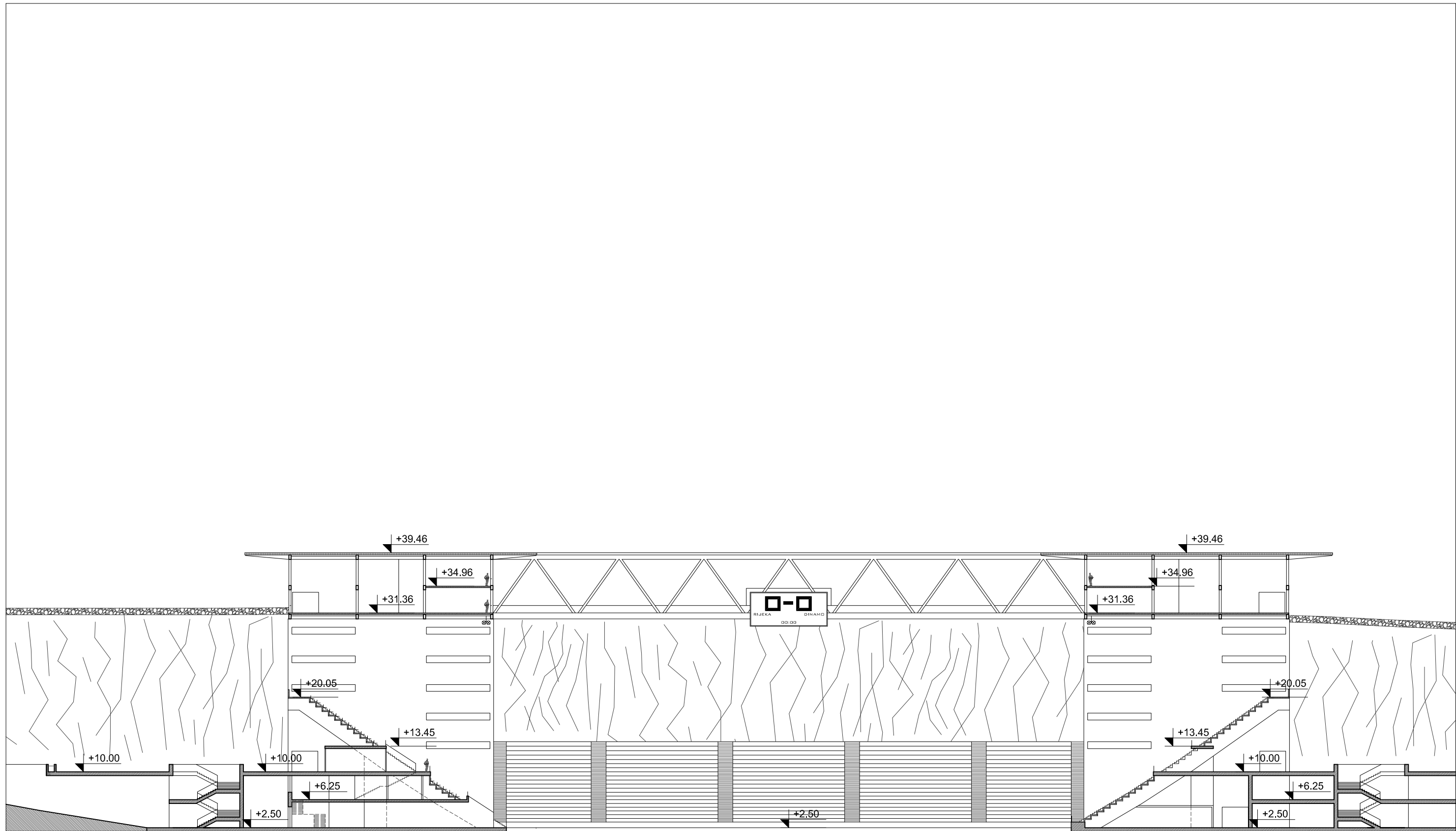
section AA

1:500



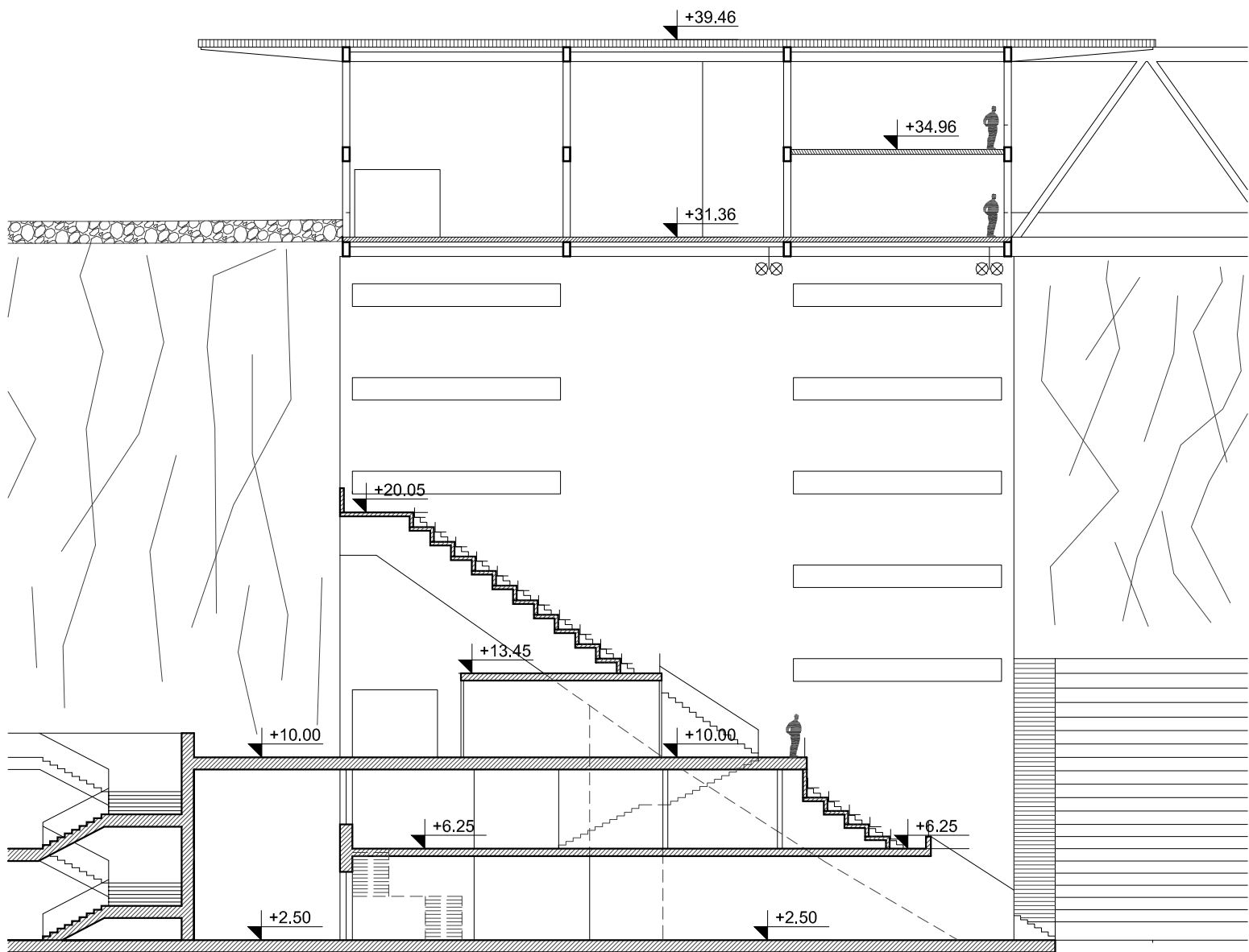
section BB

1:500

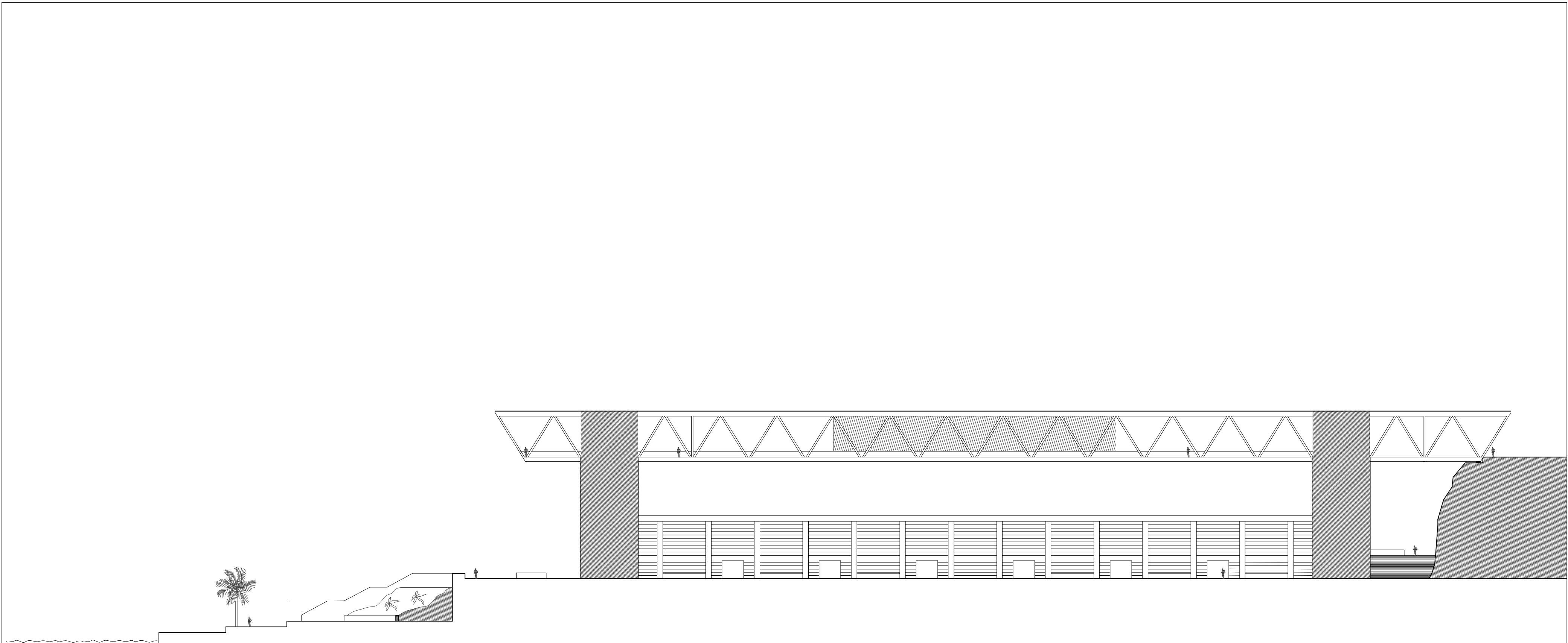


section CC

1:500

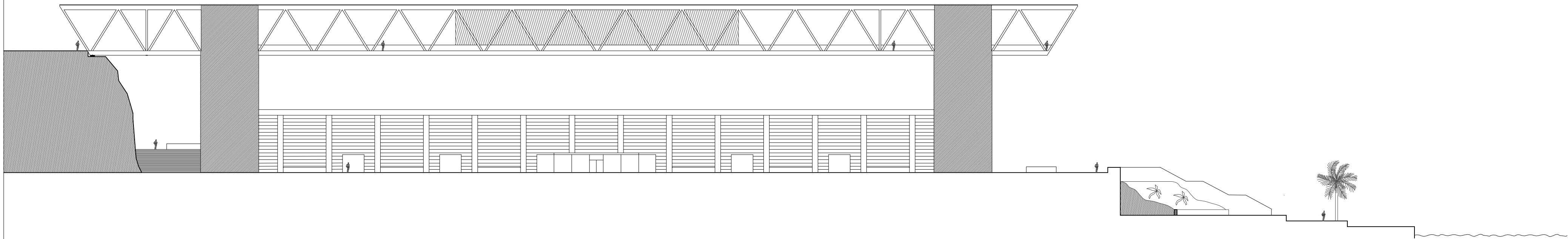


section CC detail 1:250



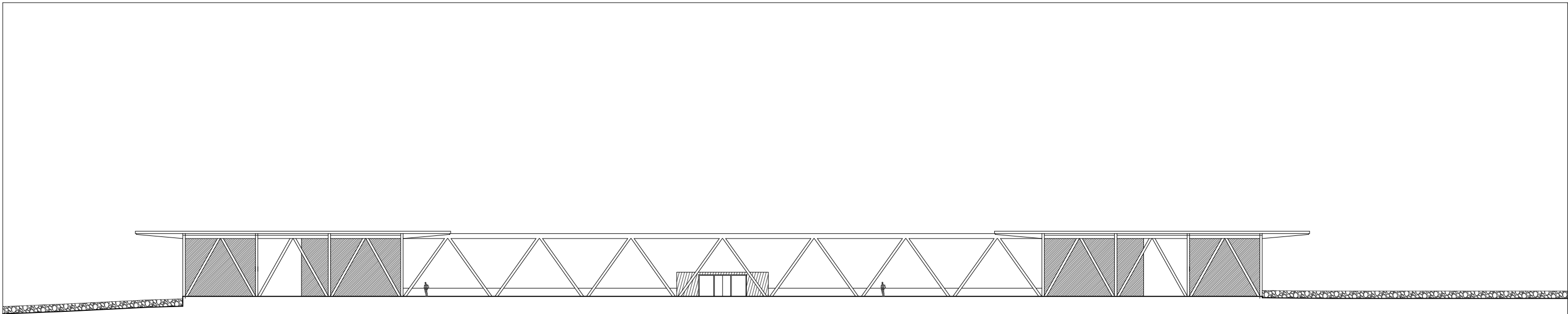
facade east

1:500



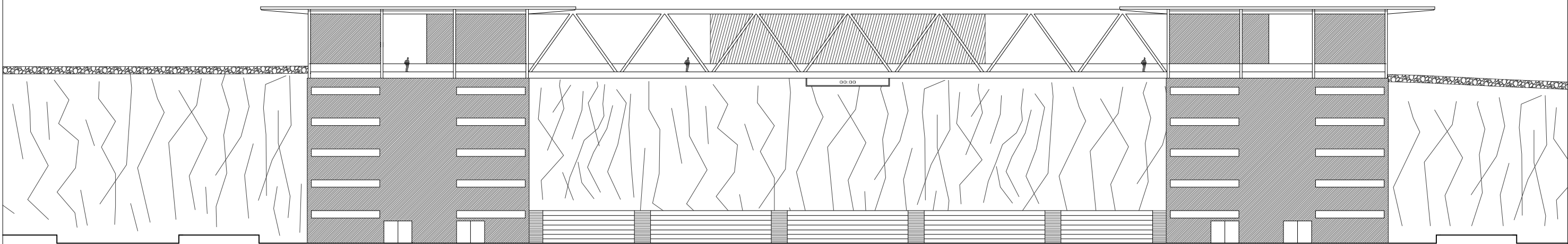
facade west

1:500



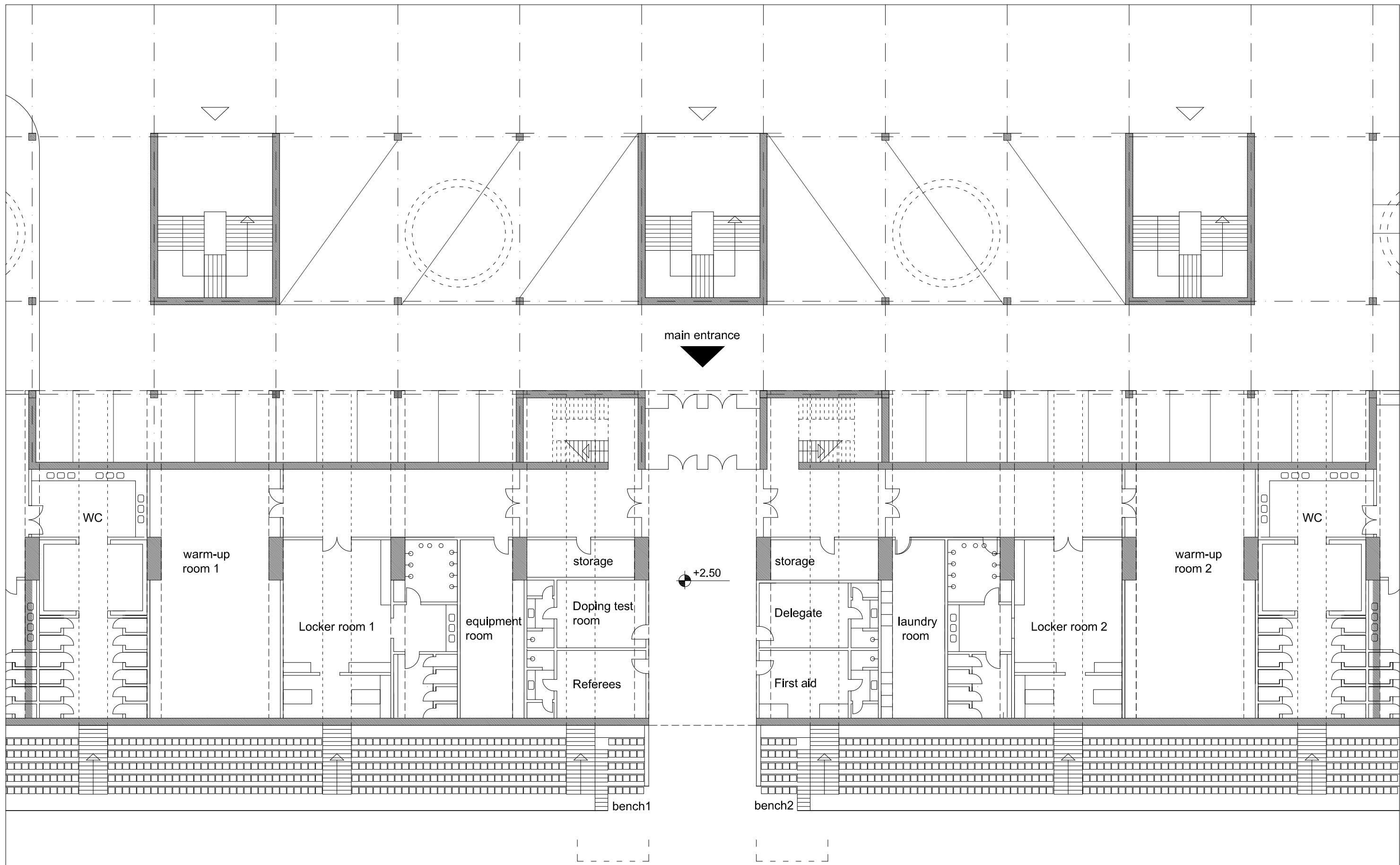
facade north

1:500



facade south

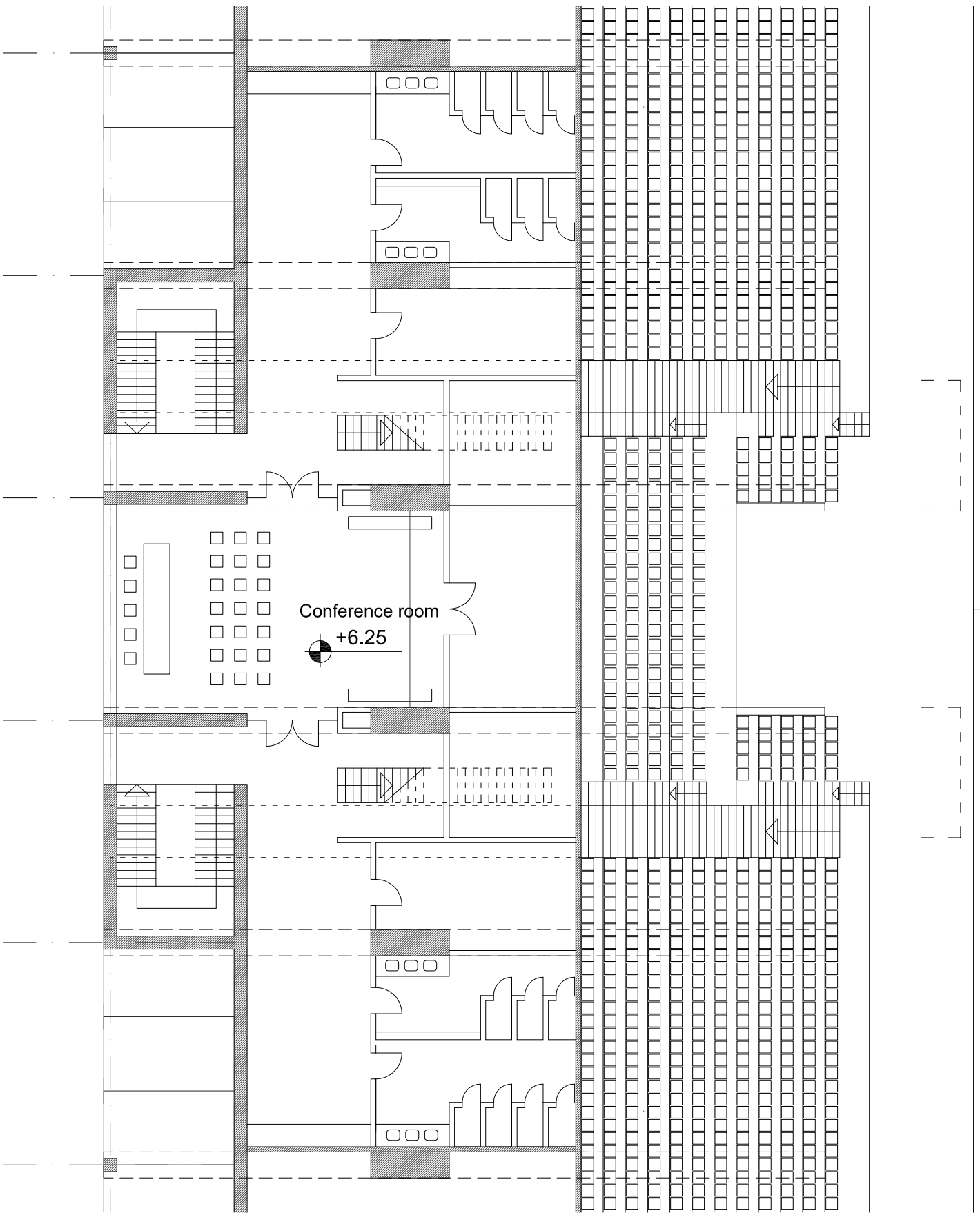
1:500



Florplan +2.50 - detail



1:250

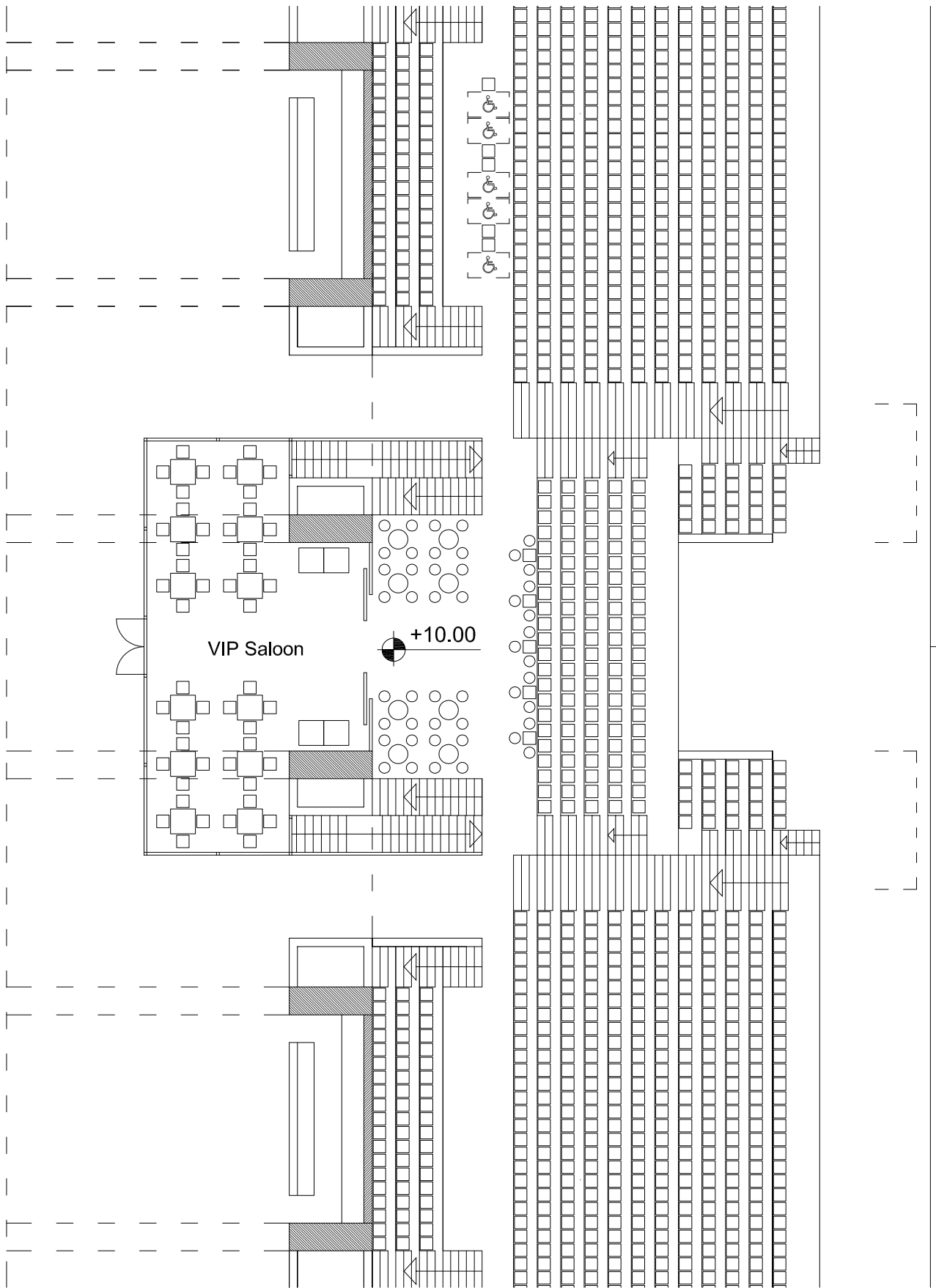


Floorplan +6.25 - detail



N

1:200

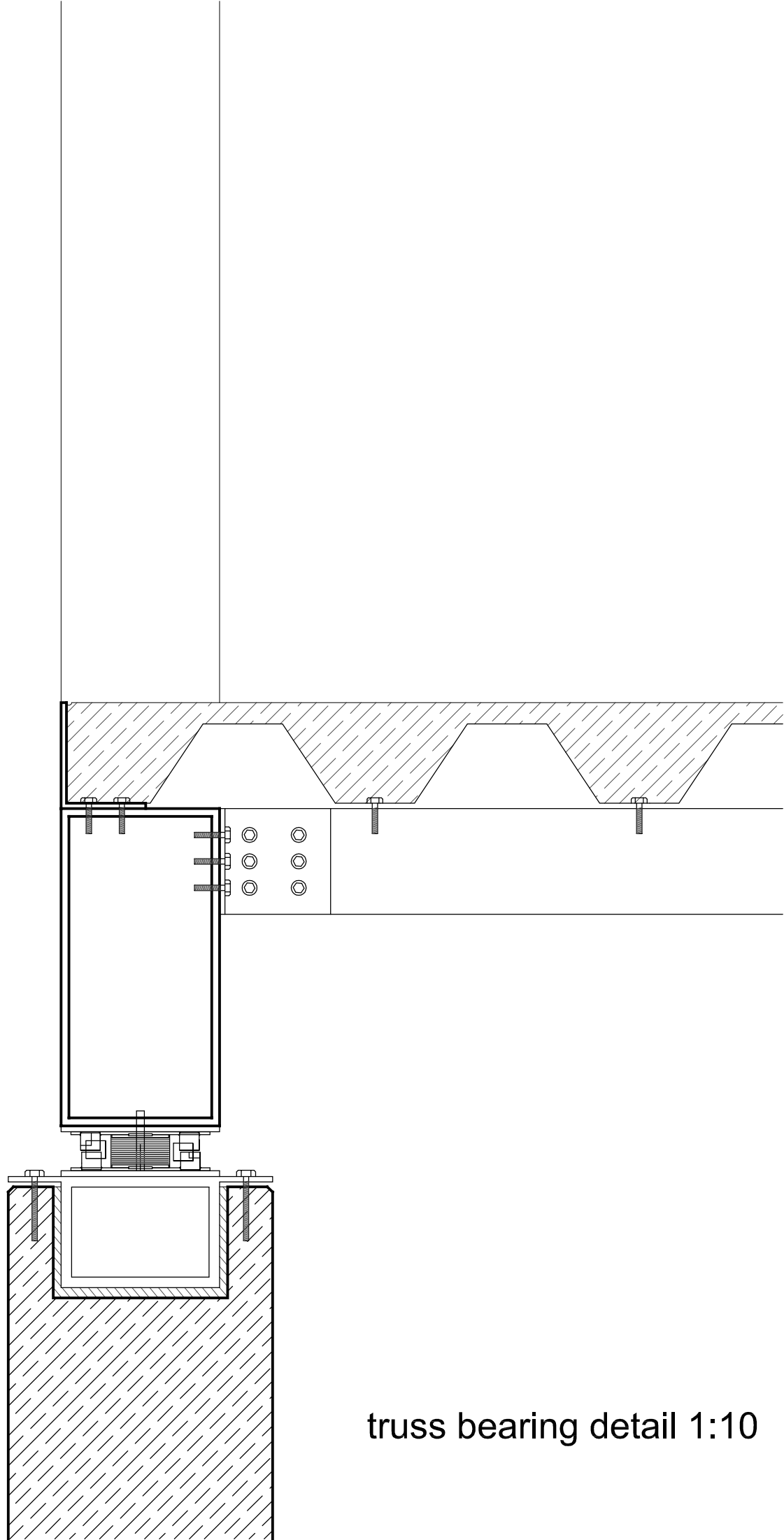


Floorplan +10.00 - detail



N

1:200



truss bearing detail 1:10

