ARCHITECTURE
UIN MALANG - INDONESIA

UNDERGRADUATE THESIS

AQUATIC SPORTS CENTER IN SURABAYA WITH ECO-TECH ARCHITECTURE APPROACH

AISSYAH HANRINI NURSHOKH
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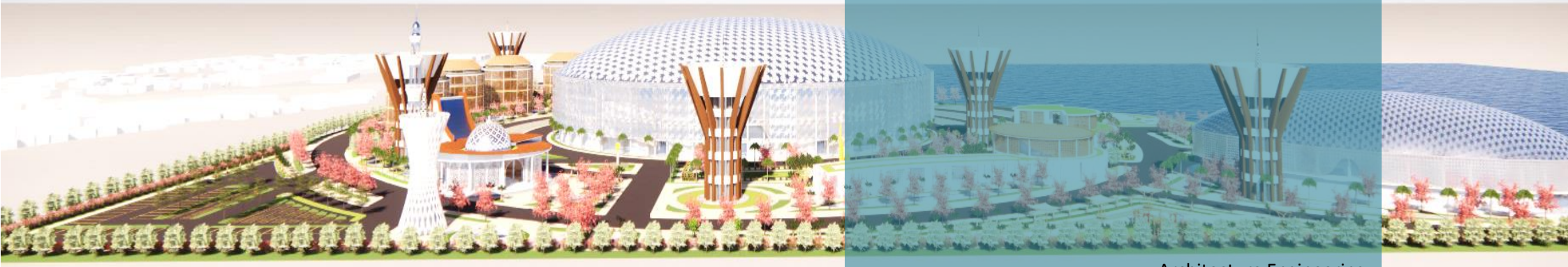

Architecture Engineering
Faculty of Science and Technology
Maulana Malik Ibrahim State Islamic University

2022

APPROVAL SHEET

UNDERGRADUATE THESIS

AQUATIC SPORTS CENTER IN SURABAYA WITH ECO-TECH ARCHITECTURE APPROACH

BY :

AISSYAH HANRINI NURSHOKH

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Exam Date: 15 Juni 2022

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Title : Aquatic Sports Center In Surabaya With Eco-Tech Architecture Approach
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The revision has been completed in accordance with the revision notes of the Final Final Assignment Session and declared eligible to PRINT Architecture Engineering Final Project file/report 2022. Thus, this printable statement has been prepared to be used properly.

STATEMENT OF UNDERGRADUATE THESIS AUTHORSHIP

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I certify that the undergraduate thesis entitled "AQUATIC SPORTS CENTER IN SURABAYA WITH ECO-TECH ARCHITECTURE APPROACH" is truly my original work to fullfil the requirement for the Bachelor Degree of *Sarjana Arsitektur (S. Ars)*. It does not incorporate any material previously written or published by another person, except those one that are cited as references and written in the bibliography. Due to this fact, I am the only person who responsible for the undergraduate thesis if there is an objection or claim.

Malang, 9 Juni 2022
The Author

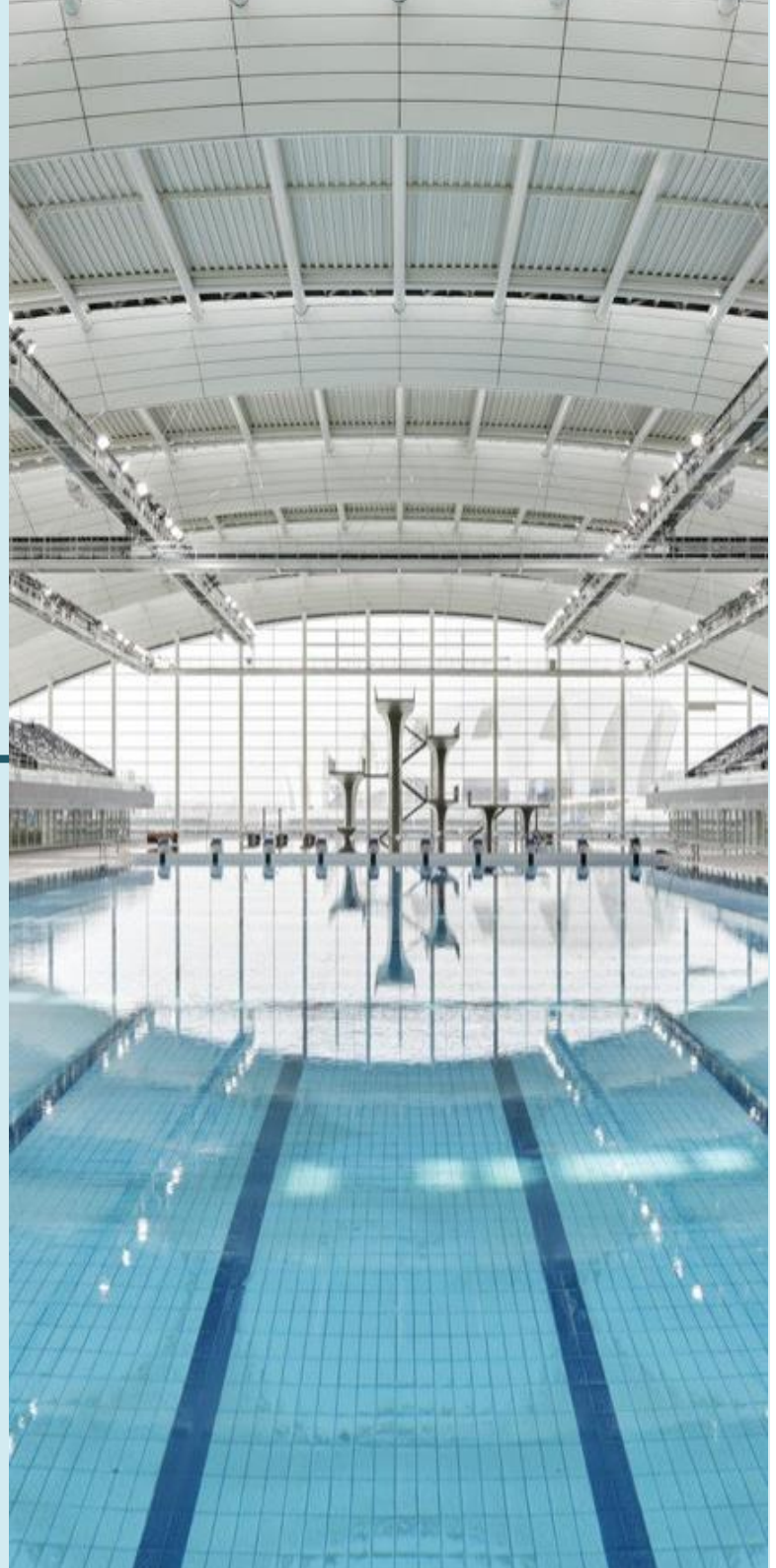
Aissyah Hanrini N
15660096

MOTTO

“Any obstacle is breakable”

Rosé

—Another day, another story, always be positive.

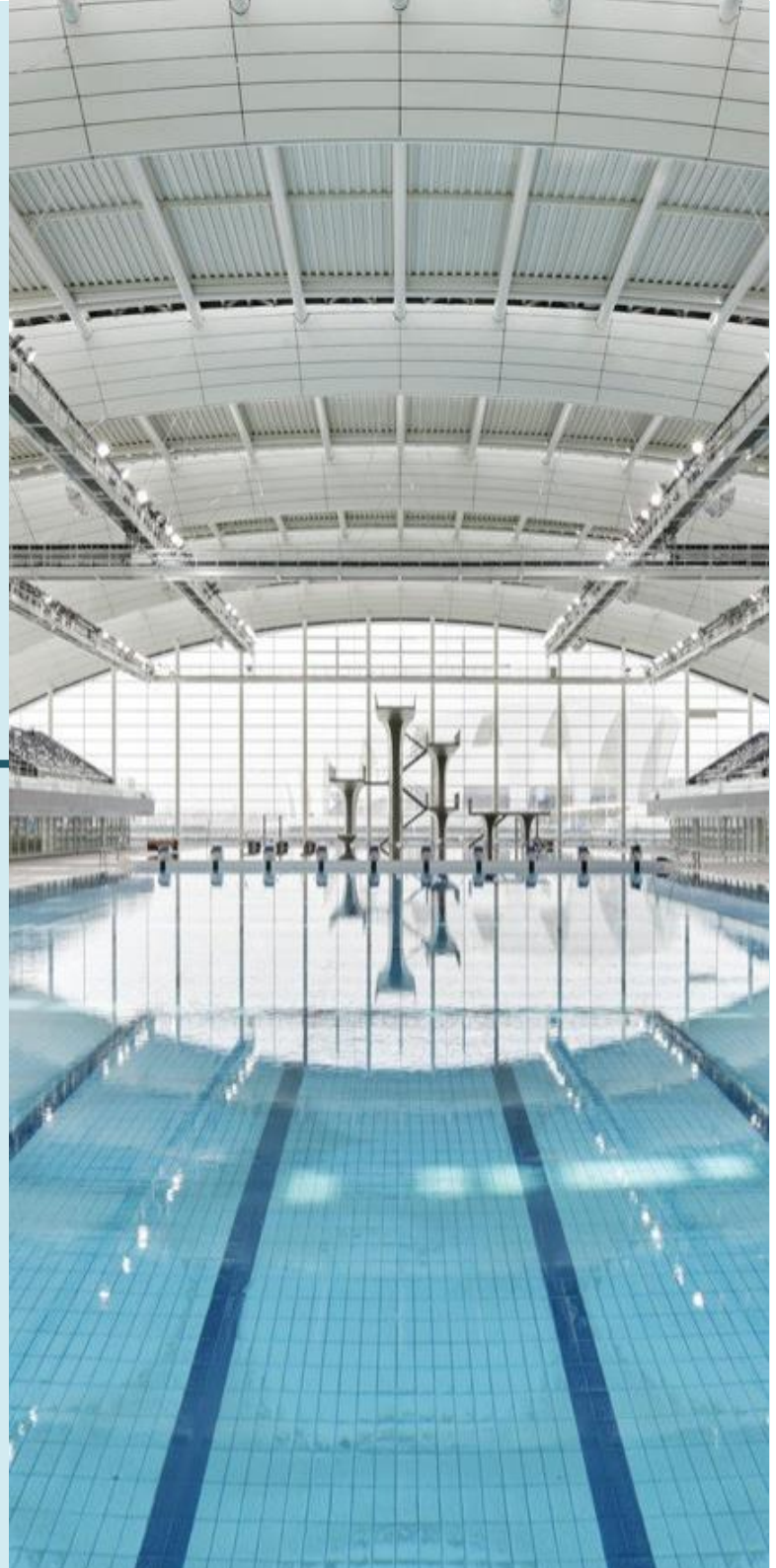


DEDICATION

I proudly present this undergraduate thesis to my father Shokeh, S.Pd and my mother Nur Qodariyah who always give me supports and love. They have become my number one supporter. Also, thanks to my beloved sister Annadziroh and little brother Amin Tanbiri who always support me by giving any encouragement, motivation and inspiration for finishing this undergraduate thesis.

Last but nor least, I wanna thank me, I wanna thank me for believing in me, I wanna thank me for doing all this hard work, I wanna thank me for having no days off, I wanna thank me for never quitting, for just being me at all the times. I would like to give a million thanks to myself for not giving up and trying the best for this thesis.

Allahamdulillahirabbil'alaamiin.



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Assalammualaikum Wr. Wb.

All praises and thanks to Allah SWT, the highest power, the Most Gracious, and the Most Merciful, for pouring his blessings and graces upon me in order for me to fullfil this undergraduate thesis. Second, *sholawat* and *salam* may always be poured by Allah SWT to our Great Prophet Muhammad SAW, who bring us warm whises and leads us down the path of truth. This undergraduate thesis entitled "AQUATIC SPORTS CENTER IN SURABAYA WITH ECO-TECH ARCHITECTURE APPROACH" as a requirement for the Bachelor Degree of *Sarjana Arsitektur (S, Ars)*.

I was able to complete this undergraduate thesis succeccfully because to some wonderful people who are always willing to offer advice, guidance, critique, and encouragement in order to help me improve it. As a result, it is my pleasure to express my heartfelt gratitude to the following individuals for their contributions to the completion of this under graduate thesis.
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2. Mr. ARIEF RAKHMAN SETIONO, M.T as my First Advisor. Thank you for your invaluable guidance, understanding, direction and hundereds of corrections, as well as your critical advice and knowledge which enabled me to complete this undergraduate thesis well.

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11. My college friends, Irfan F., Nila R., and Ariyati, who have provided assistance and advice to the author that I cannot mention one by one so that they have brought me to this stage.

I really admit that this undergraduate thesis is far from great and might use some improvement. As a result, I am hoping that all readers and other student would offer suggestions and constructive criticism in order to improve my undergraduate thesis. Despite the fact that it is far from perfect. I hope this undergraduate thesis will be usefull to anyone who knowledge about this thesis.

However, the author is very grateful for the completion of this undergraduate thesis. *Alhamdulillahirabbil'alaamiin.*

Wassalammualaikum Wr Wb.

Malang, 9 Juni 2022

Aissyah Hanrini N

AQUATIC SPORTS CENTER IN SURABAYA WITH ECO-TECH ARCHITECTURE APPROACH

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ABSTRACT

Health is the most important thing in life. One of the activities that can keep the body in top shape is swimming. Aquatic sports enthusiasts in Surabaya and East Java are increasing rapidly every year. Activities and development of water sports as a center for fostering hobbies and achievements are the basis for the Design of the Aquatic Sports Arena in Surabaya. A good strategy for the City of Surabaya is to improve water sports facilities and infrastructure in building a healthy community and achievement by combining water sports and recreation activities. The design of the Aquatic Sports Center in Surabaya applies the overall principles of eco-tech architecture, the application of sub-principles of eco-tech architecture in climate adjustment. The scope of architectural eco-tech includes the function, capacity, form, and structure of the building to become a new and modern architectural masterpiece. The Aquatic Sports Center utilizes the use of water as an aesthetic and as a renewable energy source. Use of appropriate forms and structures for iconic buildings.

Keyword : Aquatic Sports Center, Eco-Tech, Iconic, Water

GELANGGANG OLAHRAGA AKUATIK DI SURABAYA DENGAN PENDEKATAN EKOLOGI-TEKNOLOGI ASITEKTUR

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ABSTRAK

Kesehatan adalah hal terpenting dalam hidup. Salah satu aktivitas yang dapat menjaga badan tetap prima adalah berenang. Peminat olahraga akuatik di Surabaya dan Jawa Timur setiap tahunnya meningkat pesat. Kegiatan dan pengembangan olahraga air sebagai pusat pembinaan hobi dan prestasi menjadi dasar dari Perancangan Gelanggang Olahraga Akuatik di Surabaya. Strategi yang baik bagi Kota Surabaya adalah meningkatkan sarana dan prasarana olahraga air dalam membangun masyarakat dan prestasi yang sehat dengan memadukan aktivitas olahraga air dan rekreasi. Perancangan Gelanggang Olahraga Akuatik di Surabaya ini menerapkan keseluruhan prinsip eco-tech arsitektur, penerapan sub-prinsip eco-tech arsitektur dalam penyesuaian iklim. Ruang lingkup eco-tech arsitektur meliputi fungsi, kapasitas, bentuk, dan struktur bangunan untuk menjadi karya arsitektur baru dan modern. Gelanggang Olahraga Perairan memanfaatkan penggunaan air sebagai estetika dan sebagai sumber energi terbarukan. Penggunaan bentuk dan struktur yang sesuai untuk bangunan ikonik.

Keyword : Gelanggang Olahraga Akuatik, Ekologi-Teknologi, Ikonik, Air

AQUATIC SPORTS CENTER IN SURABAYA WITH ECO-TECH ARCHITECTURE APPROACH

اسم الطالبة :عائشة حنريني نورشوخ
عدد الطلاب :١٥٦٦٠٠٩٦
المستشار :عارف رحمان سيتونو ، إم تي
المستشار المشارك :د .نونيك جونارا ، إم تي

ABSTRACT

الصحة هي أهم شيء في الحياة .السباحة هي إحدى الأنشطة التي يمكن أن تحافظ على شكل الجسم في أفضل حالاتها .يتزايد عشاق الرياضات المائية في سورابايا وجاوة الشرقية بسرعة كل عام .تعتبر أنشطة وتطوير الرياضات المائية كمركز لتعزيز الهوايات والإنجازات هي الأساس لتصميم حلبة الرياضات المائية في سورابايا .تتمثل الإستراتيجية الجيدة لمدينة سورابايا في تحسين مرافق الرياضات المائية والبنية التحتية في بناء مجتمع صحي وتحقيق الإنجازات من خلال الجمع بين الرياضات المائية والأنشطة الترفيهية .يطبق تصميم مركز الرياضات المائية في سورابايا المبادئ العامة لهندسة التكنولوجيا البيئية ، وتطبيق المبادئ الفرعية لهندسة التكنولوجيا البيئية في تعديل المناخ .يشمل نطاق التكنولوجيا البيئية المعمارية وظيفة وسعة وشكل وهيكل المبنى ليصبح تحفة معمارية جديدة وحديثة .يستخدم مركز الرياضات المائية استخدام المياه كعنصر جمالي وكمصدر للطاقة المتجددة .استخدام الأشكال والهياكل المناسبة للمباني المميزة.

الكلمة الرئيسية :مركز الرياضات المائية ، التكنولوجيا البيئية ، أيقوني ، ماء

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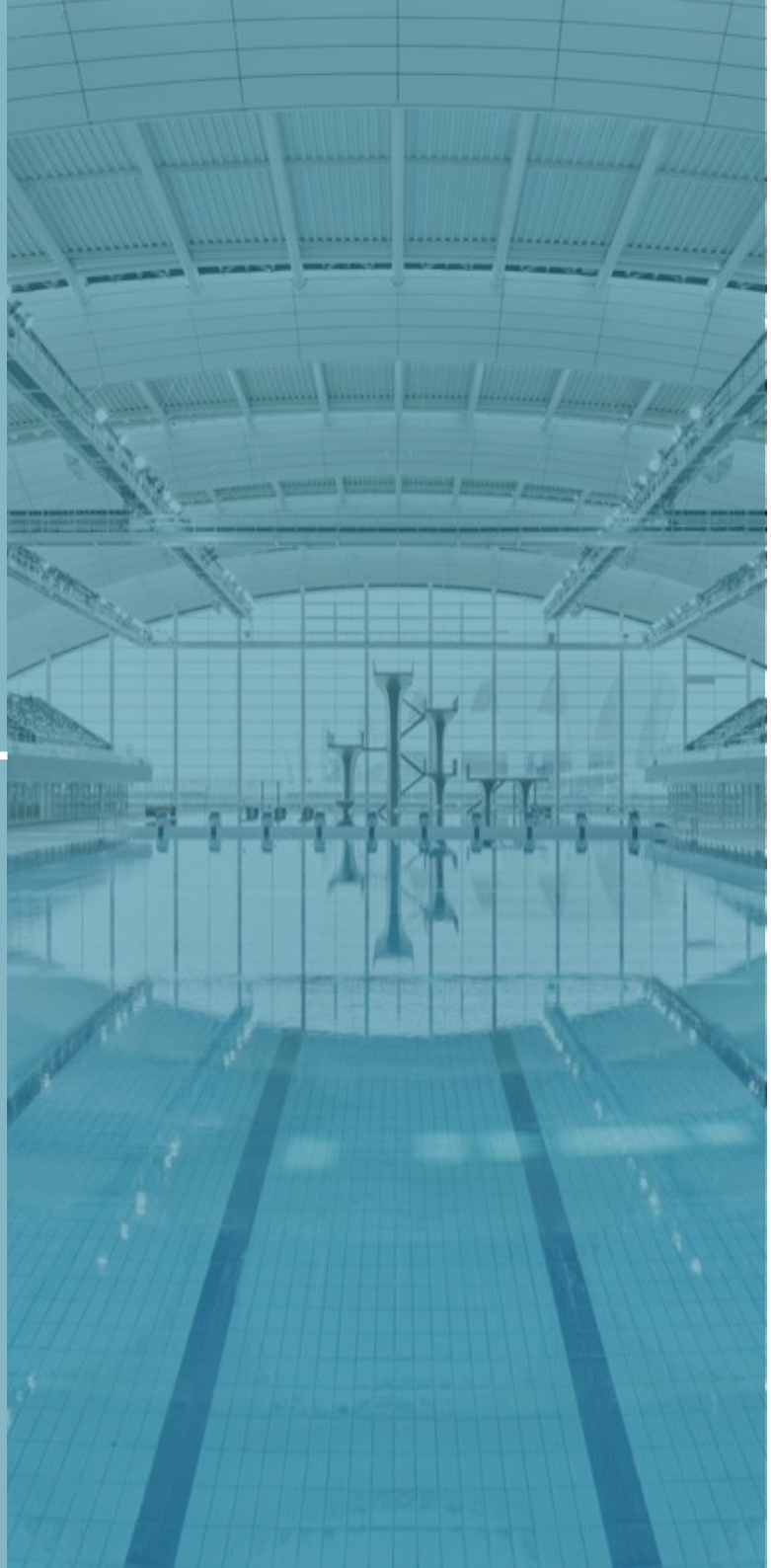
PRELIMINARY



ISSUE → *"Surabaya Rising Program"*

- The increasing number of aquatic sports fans is quite high in Surabaya.
- There is a PON implementation plan, so it requires facilities to fulfill the event.
- Restoration program (revitalization) city centers or sub-city centers conditions and functions have begun to decline, one of which is the sub-city sports facilities in Kenjeran.

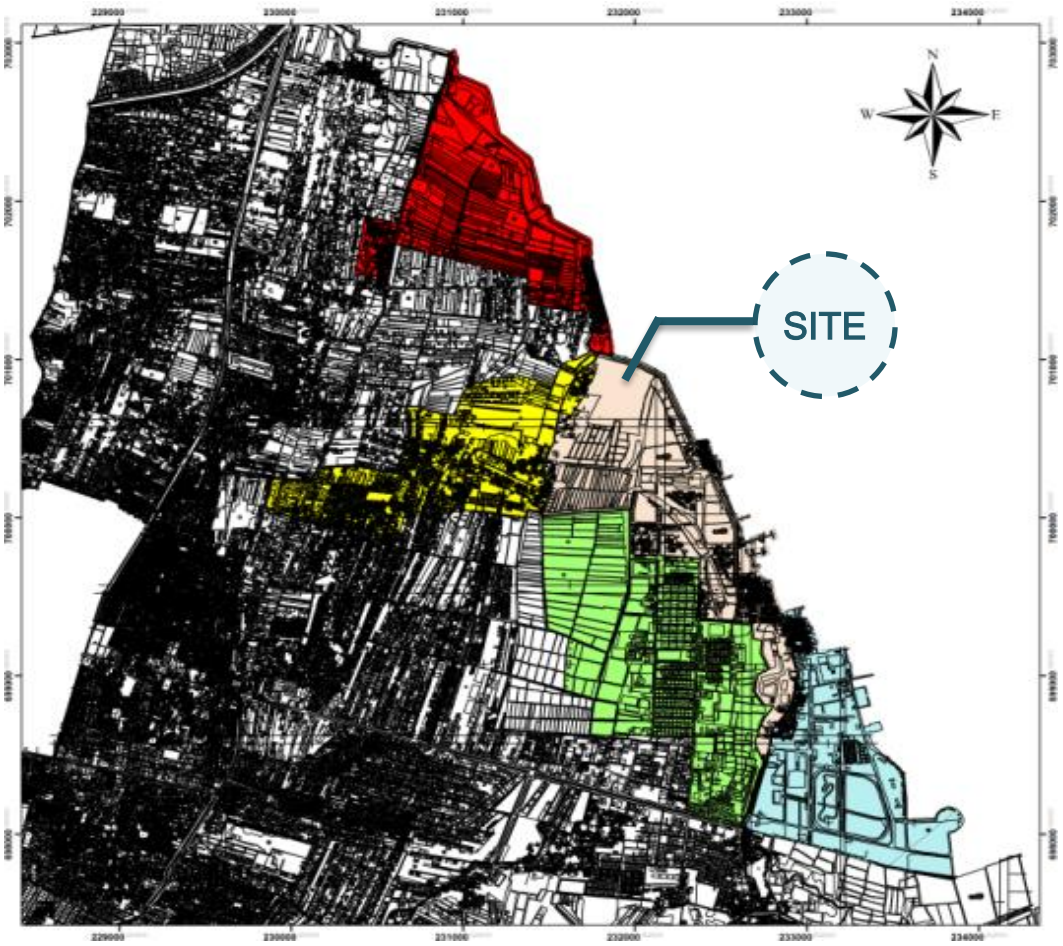
Based on Fact:

- Kenjeran, Surabaya has the potential as a provider of representative sports facilities according to the RTRW Surabaya.
- KONI sustainability program since 2005.
- Pengprov (PRSI) hold a competition every year at Surabaya. Surabaya has 12 swimming clubs and has around 1508 athletes who are still actively competing. This is clear reinforce why the facility needs thatwell needed in Surabaya. *(prsijatim.or.id)* [1]
- Water Ecotourism Development (Aquatic) in Watu-Watu Beach according to the RDRTK Tambak Wedi, Surabaya 2017.

Art 55

The purpose of structuring UP III Tambak Wedi as referred to in Article 2 paragraph (2) letter a is to realize the development of the area as a center for trade and service activities supported by settlements and marine tourism while maintaining the function of protecting nature. *(RDRTK Tambak Wedi, 2017)* [2]

Since 2005, the city of Surabaya, which is the capital of East Java Province, has launched a new slogan "Surabaya Rises to the City of Athletes" which was initiated by the former Chairman of KONI, Alisjahbana Sitepu. Surabaya is not yet worthy of being called an athlete city, because its sports facilities are quite minimal. Since becoming one of the hosts for PON XV in 200, there are no more sports facilities to be proud of in Surabaya. The PON heritage building is only a gymnastic building in the Citraland complex. The sports facilities owned by the City of Surabaya are in very poor condition.
(source: http: //beritadaerah.com) [3]

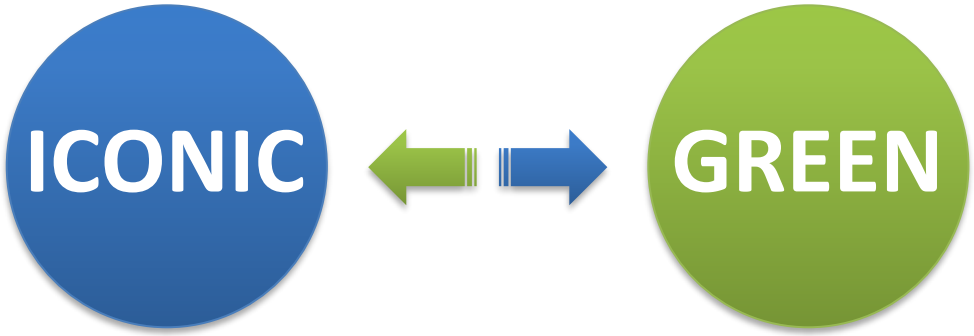


Development Program: 2015-2034

Plan:
1. Determine and optimize the river border area as green open space and non green open space.
2. Developing the provision of vegetation along river boundaries to support tourism and sports activities.

Program Indication: Preservation and control of development in areas with cultural heritage environments and / or buildings.
(RTRW Surabaya City) [4]

Sumber: Peta Surabaya 1:5000



In one verse, Allah (SWT) says:

"(To guide) there are many Signs in the structure of the heavens and the earth, in the constant alternation of night and day, in the vessels which is the speed of the carrying goods that are of profit to people, in the water which Allah sends down from the sky and thereby quickens the earth after it was dead, and dispersed over it all manner of animals, and in the changing courses of the winds and the clouds pressed into service between heaven and earth".
(Surah al-Baqarah: 164)

From the explanation of the Quran above, it is explained about the relationship between humans with the natural surroundings very close. Architecture has a special stage that connects people the greatness Of Allah SWT through its design. The application of the design, namely the building will create the best impression through the play of spatial patterns and shapes to visitors and as a reflection of the relationship between humans and the natural environment.

ISSUE → *Water Concious Design*

The **main zone** for Kenjeran ecotourism activities is the region coast, includes **maintaining and developing Public RTH** Kenjeran Beach and Watu-Watu Beach.
(RDRTK Tambak Wedi, 2017)

International level Kenjeran tourism promotion by creating region-specific **branding/slogans** Kenjeran integrated tours.
(RTRW Surabaya)

ICONIC:

Presents a building that is impact on branding tourism object in Kenjeran. Approach through **expression of structure and construction** integrated with environment. **Water** is the **linking element** betweeen the buildings as well to **making connections** between design and the environment.

GREEN:

Present a building that is impact on increasing tourism objects to promoting **renewable energy** generation **(water)** and accessibility.

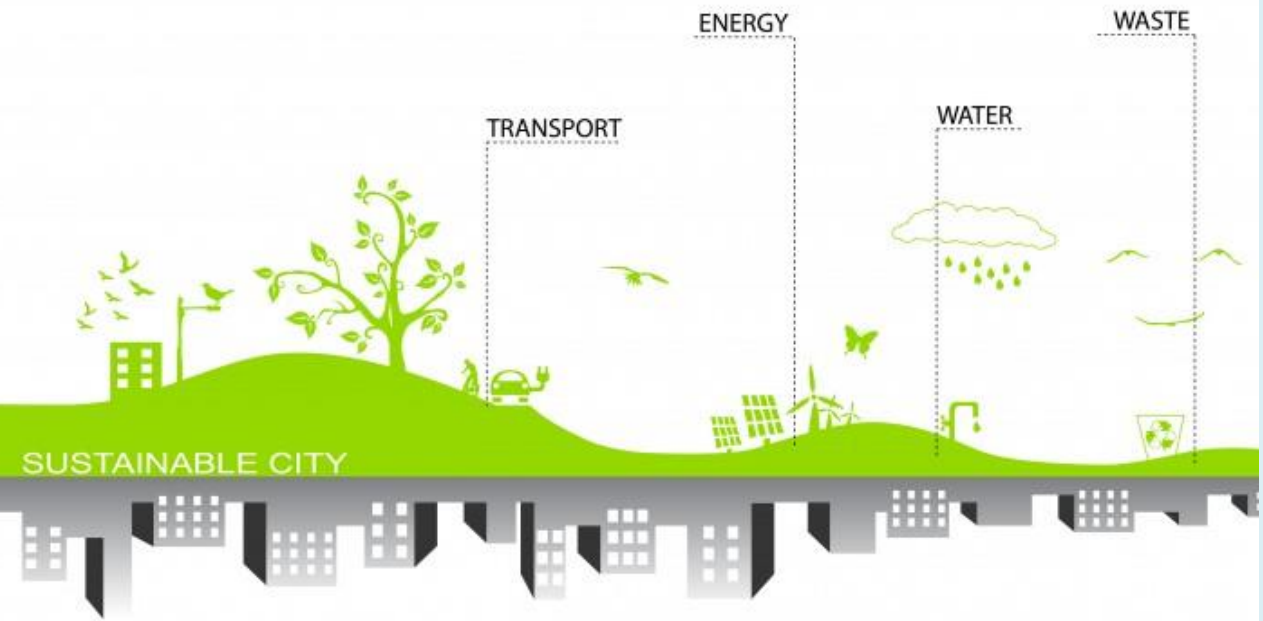
ECO-TECH ARCHITECTURE

DESIGN OBJECTIVES AND CRITERIA

As a **support** for aquatic sports infrastructure and **improve** the achievements of **regional athletes**, especially the city of Surabaya.

Providing **communal space** for the community that is **sustainable** as one of the plans for developing **environmentally friendly tourism.**

Becoming one of the **iconic buildings** in the corner of **Surabaya**, which is next to another icon, namely the Suramadu Bridge.



Eco-Tech Architecture can provide a sustainable design concept in architecture summarized as follows: ***promoting renewable energy generation and accessibility***.

The relationship between buildings and water is so close that users get the full experience of practising sports in their original environment. Innovation of water features, wide-span architecture and landscapes.

The principle of eco-tech is a combination of two principles in designing architectural forms, namely sustainable (sustainable development) and high technology [5]. According to **Catherine Slessor 1997** the characteristics of an eco-tech building, namely:

- **Expression** of structure and construction integrated with environment. Use of building **materials** that are not give a negative impact.
- Apply a **natural ventilation system** on building by utilizing building design. Utilizing **natural lighting** as well as possible.
- **Energy use** as little as possible on the exploitation and manufacture. Artificial building materials that can be **recycled** (recycling).
- Eco-tech buildings **are assessed in context city environment** or in other words looking at the response/**city response**.
- **Making connection** between design and the environment or **by analogy form or the function** of the building.
- Raising the role of building again as a **public symbol** by taking **the form** of a building different to find new values.

The mass structure in this project consists of two masses, the first mass is a public space (sports area) while the second mass is management office.

SCOPE, LIMITATION AND AREAS

Aquatic Sports Centre in Surabaya Kenjeran Beach, which combines aquatic sports activities and recreational. Various facilities include such as Aquatic Stadium, Training Center, and Management Office.

AQUATIC
STADIUM

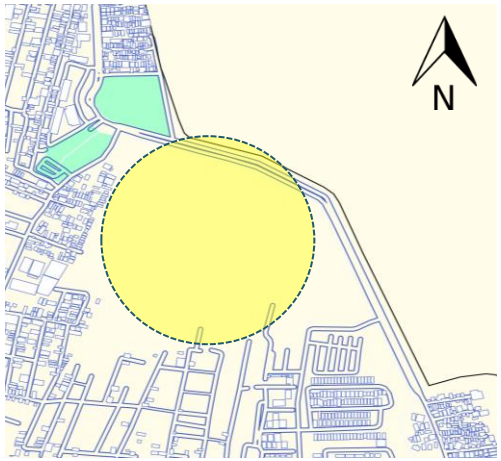
OBJECT

TRAINING
CENTRE

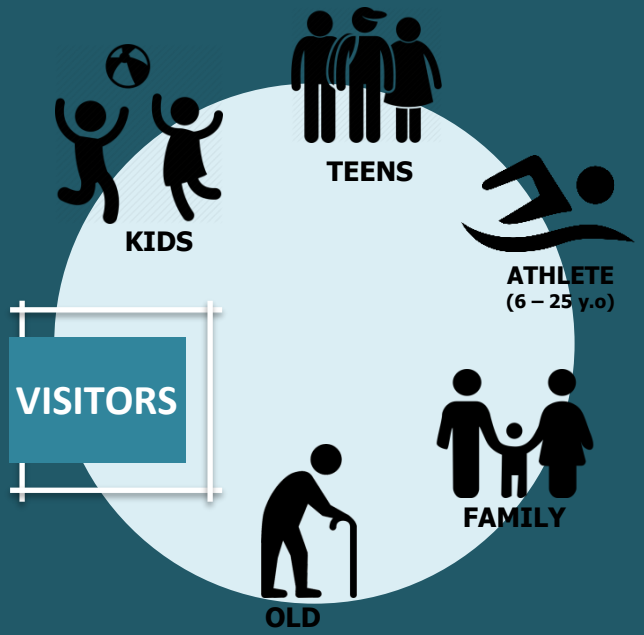
MANAGEMENT
OFFICE

A good strategy for the city of Surabaya to improve the facilities and infrastructure of aquatic sports in building community and healthy achievement.

Users of aquatic sports centre are addressed to athletes PRSI east java and the general public of Surabaya City.



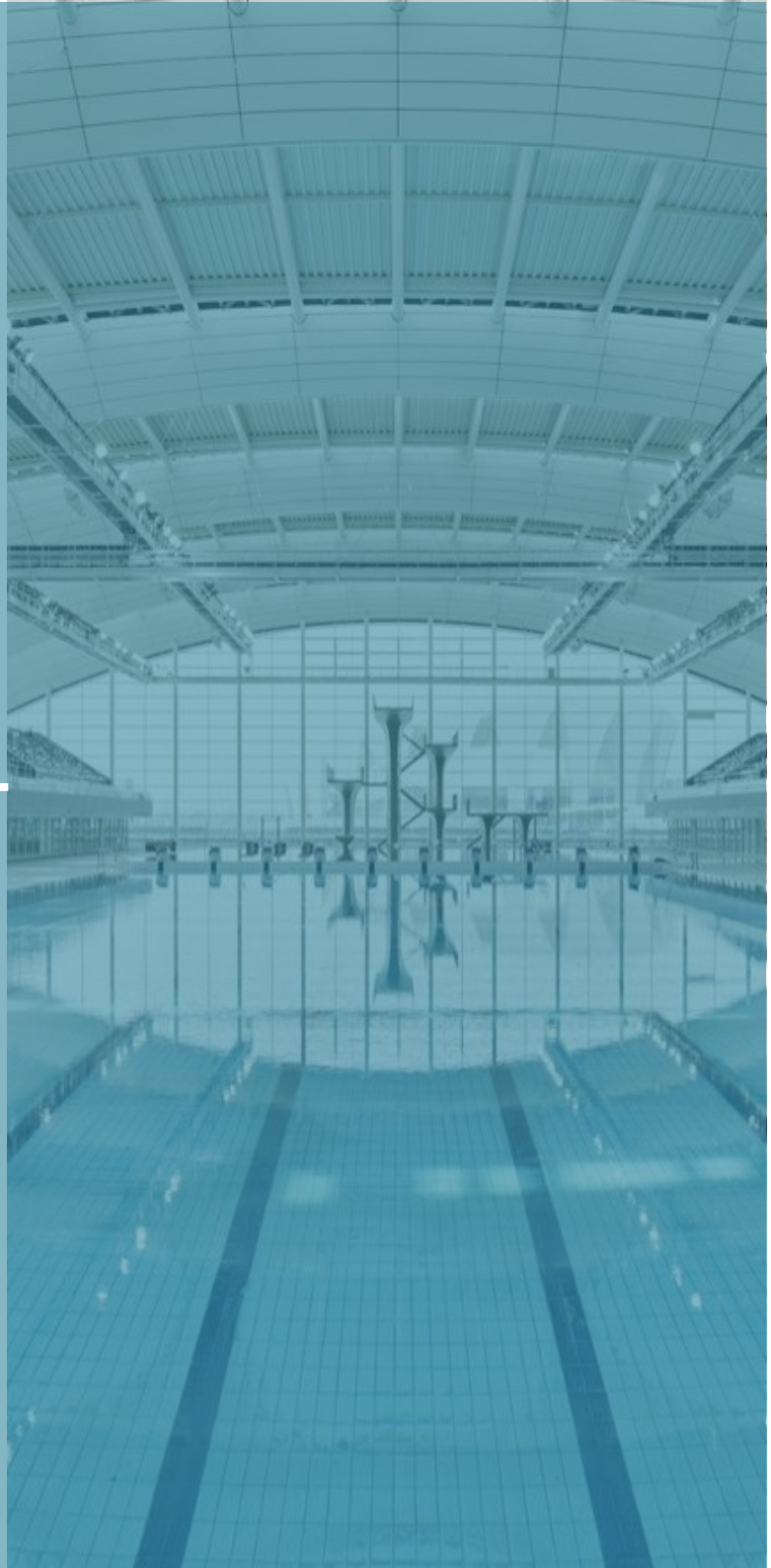
Aquatic Sports Centre located in Surabaya Kenjeran Beach, on the coast from the southern side of the Suroboyo Park and the Bulak Fish Centre.



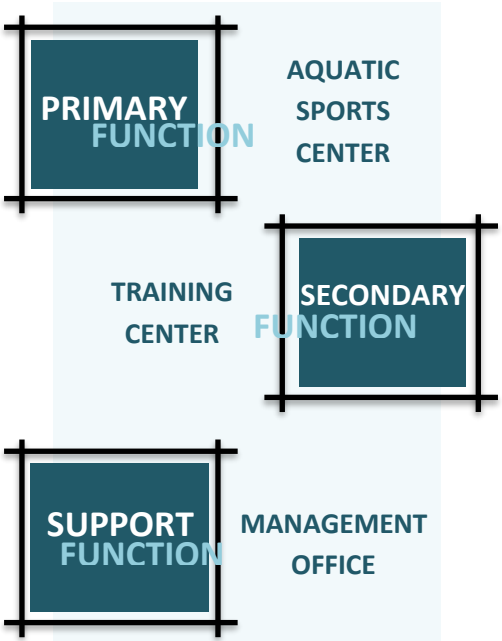
The scope of eco-tech architecture includes the function, capacity, shape, and structure of buildings to become new and modern architectural masterpieces. Designing Aquatic Sports Centre in Surabaya apply the whole principle of eco-tech architecture, but the sub-principle is applied especially that can meet local needs such as climate adjustment.

In this case, Aquatic Sports Centre use of water use as aesthetic and as a source of renewable energy. The use of an appropriate shape and structure for iconic building.

DATA



DESIGN OBJECT REFERENCES



FUNCTION

The design is carried out to determine the actors of activities, activity groups, facilities, spatial group relations and spatial capacity.

The main function in the design is the Aquatic Sport Center. Secondary functions are the Training Center. Other supporting functions include PRSI offices, management office, meeting rooms and warehouses.

AQUATIC SPORT CENTER

Aquatic is an activity by using water media. In general, the media can be a swimming pool or similar place that has the same characteristics that can be used as a place to perform various forms of physical activity, such as beaches, rivers, lakes or other simulators such as buckets or materials made of plastic balloons.

Aquatic centre means an arena for competitions and sports activities related to aquatic sports. However, there is also a possibility in this Aquatic centre there are recreation activities related to water. Some of the most common uses are:

- Swimming
- Diving
- Water Polo
- Synchronized Swimming
- Fins Swimming

Figure 2. 1 Shanghai Oriental Sport Center
Source: WES Landscape Architecture

AQUATIC SPORT CENTER CATEGORY

In accordance with some kind of sports arena then generally categorized for Aquatic Arena, namely:
1. Outdoor Arena
Is an arena for aquatic sports conducted without room cover. It has no roof cover and is just surrounded by the tribune area as well as existing facilities around the arena.
Weakness and advantages of outdoor arena:

- Affected by the weather eg rain and heat from sun.
- Small energy consumption.

2. Indoor Arena
This enclosed sports arena is an indoor arena room and has a roof covering. Weakness and advantages of indoor arena:

- Not affected by the weather eg rain and heat from sun.
- Large energy consumption.

ACTIVITIES

a. Competition
Competition activities are activities to improve achievements achieved, both achieved within the local scope, regional and international.

b. Training
These activities include theoretical activities and game exercises, activity theory is a coaching activity in order to improve sportsmanship. As for the exercise, a game is the application of stamina and technique training of the athletes. Technical and strategy skills are performed in the field to enhance teamwork and discipline players in their respective positions.

c. Service and Management
Service activities include services provided by the manager of the sports facility to the user includes administration, visitor control, control, publications, operations, utilities, electrical and service activities another.

CAPACITY OF AQUATIC SPORT CENTER

The capacity of the spectators on the arena or stadium must meet provisions as follows:

Tabel 2.1 The Capacity of Spectators [6]

CLASIFICATION	QUANTITY
Type A	3000 – 5000
Type B	1000 – 3000
Type C	<1000

(Source: http://kemenpora.go.id)

Information:

Type A is an Arena serving the Provinces

Type B is an Arena that serves the Regency or City area

Type C is the Arena that serves the District

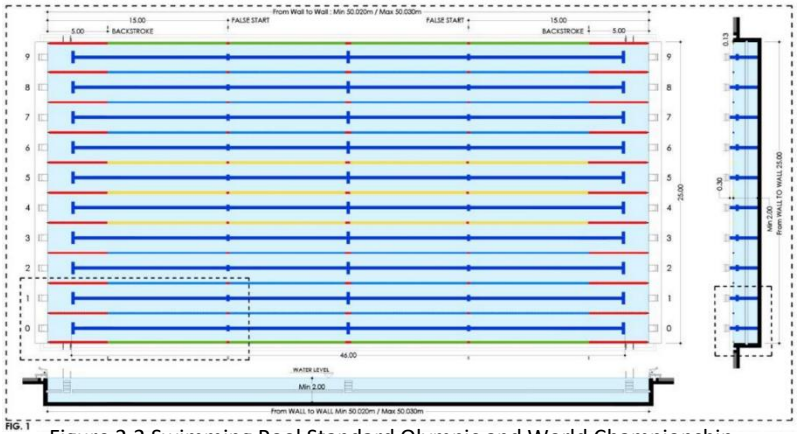


Figure 2.2 Swimming Pool Standard Olympic and World Championship
Source: Fina Facilities Rules 2017-2021

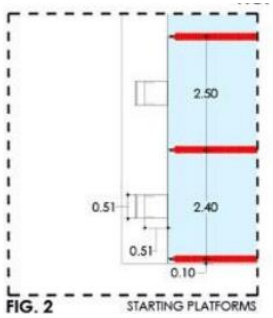


Figure 2.3 Starting Platform
Source: Fina Facilities Rules 2017-2021

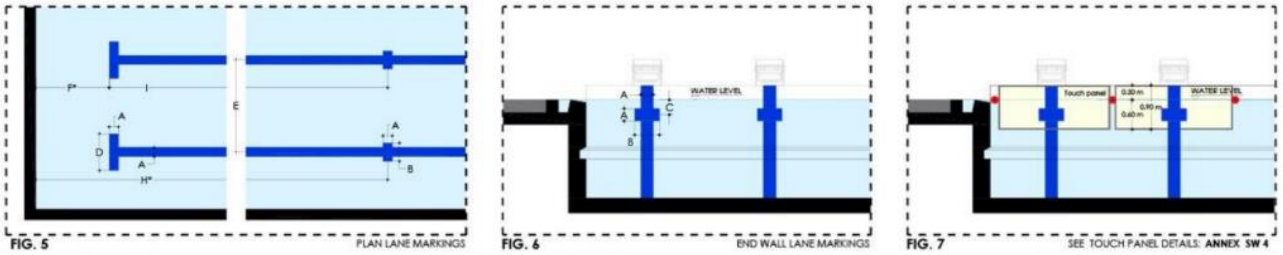


Figure 2.4 Plan Lane and End Wall Lane Marking
Source: Fina Facilities Rules 2017-2021

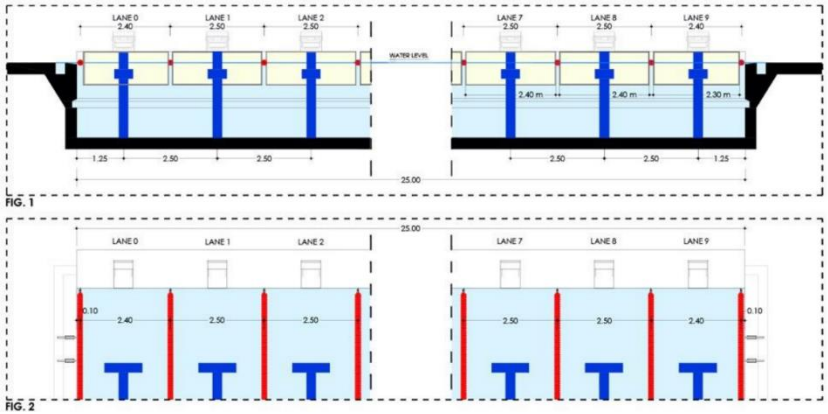


Figure 2.5 Diagram Lane Marking 0-9
Source: Fina Facilities Rules 2017-2021

FR 2.14 FINA LANE MARKINGS		
WIDTH OF LANE MARKINGS, END, LINES, TARGETS	A	0.25m ± 0.05m
LENGTH OF END WALL TARGETS	B	0.50m
DEPTH TO CENTRE OF END WALL TARGETS	C	0.30m
LENGTH OF LANE MARKER CROSS LINE	D	1.00m
WIDTH OF RACING LANES	E	2.50m
DISTANCE FROM END OF LANE LINE TO END WALL	F*	2.00m*
TOUCH PAD	G	2.40m x 0.90m x 0.01m
DIST. FROM CENTRE OF CROSS LINE TO END WALL	H*	15.00m*
DIST. FROM END OF LANE LINE TO CENTRE OF CROSS LINE	I	13.00m

FIG.4 *Pool tolerance has to be considered

Figure 2.6 Trajectory Line Size
Source: Fina Facilities Rules 2017-2021

CLASSIFICATION OF SWIMMING POOL

Swimming pool to host Olympic and championship competition the world must meet the standard requirements of (FINA, 2017-2021) [7]. The standard requirements are:

a) Swimming Pool Standard Olympic Games and World championship. This pool has a standard with a length of 50 m and a width of 25 m. Depth a minimum pool of 2 m, with a water temperature of 250-280 C. Many number of swimming trajectories 8-10 pieces. Each 1 lane lane has a width of 2.50 m. Trajectory (Lane Ropes) is divided into 3 kinds of colors are green, blue and yellow. Light intensity is not less than 1500 lux.

The international-scale swimming pool has starting platforms. These starting platforms have height 1 meter from the surface of the pool. The surface size of the starting platforms is 0.5 meters x 0.5 meters with a coated material that makes starting platforms not slippery and safe to use. The slope of starting platforms also need to be considered, ie not exceeding 10 degrees because it will affect repulsion or start prefix. (Rahmani, 2014 Page: 31)

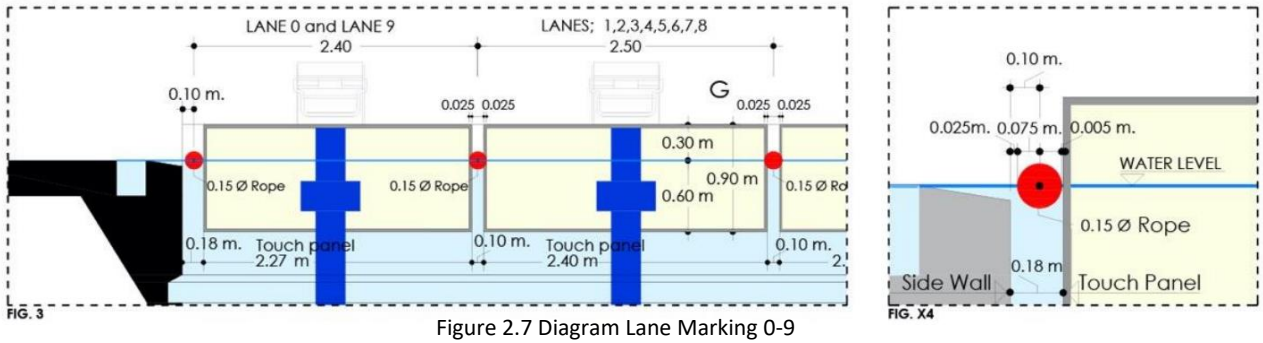


Figure 2.7 Diagram Lane Marking 0-9
Source: Fina Facilities Rules 2017-2021

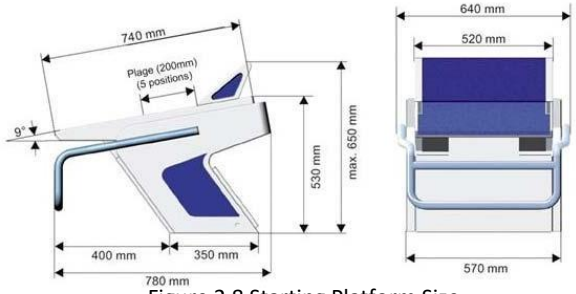


Figure 2.8 Starting Platform Size
Source: Fina Facilities Rules 2017-2021

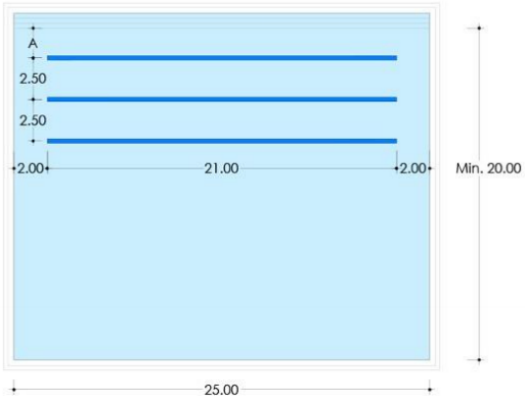


Figure 2.9 Line Signs for Diving
Source: Fina Facilities Rules 2017-2021

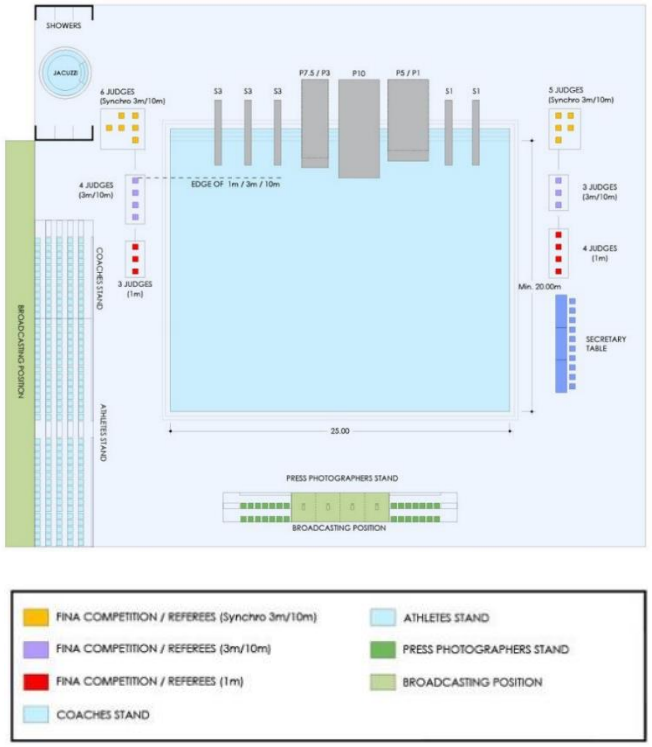


Figure 2.10 Layout Plan Swimming Pool for Diving
Source: Fina Facilities Rules 2017-2021

b) Swimming Pool for Diving Standard Olympic Games and World championship. The diving marks consist of 3 lines. Minimum line width is 0.2 m and maximum 0.3 m. Length 21 m for pond size 25 x 20 m. Distance of each dot line 2.5 m and the centre of the first row should be directly under the 3 m. Pool depth of at least 4.5 m but recommended with a depth of 5 m, with a water temperature of 250-280 C. If the size of the pool does not meet minimum standards, then the pool is not accepted and even can not be used. If the pool and diving pool are in the same area, then the minimum distance to separate the pond should be 5 meters. For that pool built from January 1, 2014 the minimum distance is 8 meters, but more on recommend 10 meters. Light intensity is not less than 1500 lux.

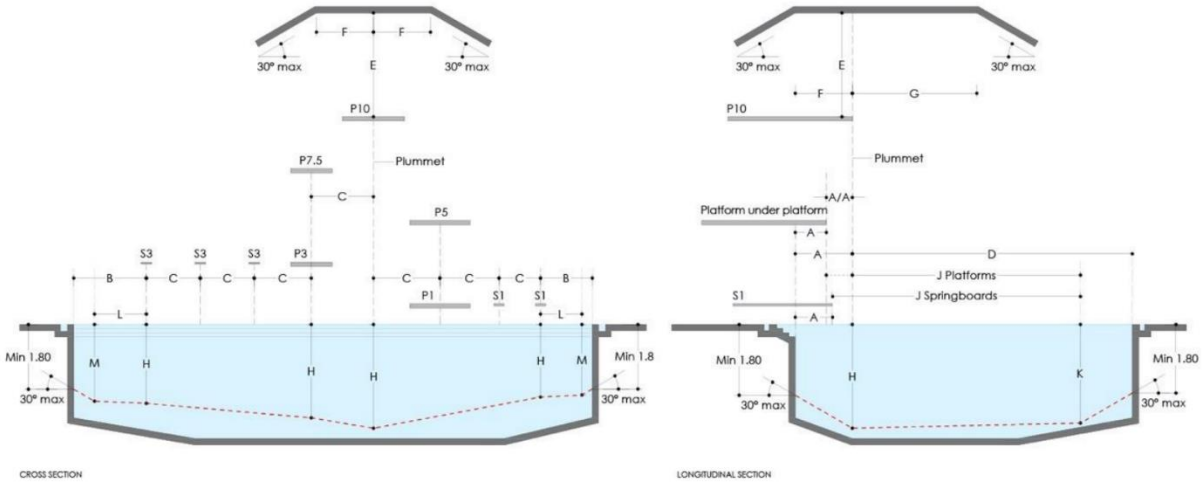


Figure 2.11 Section Diving Diagrams
Source: Fina Facilities Rules 2017-2021

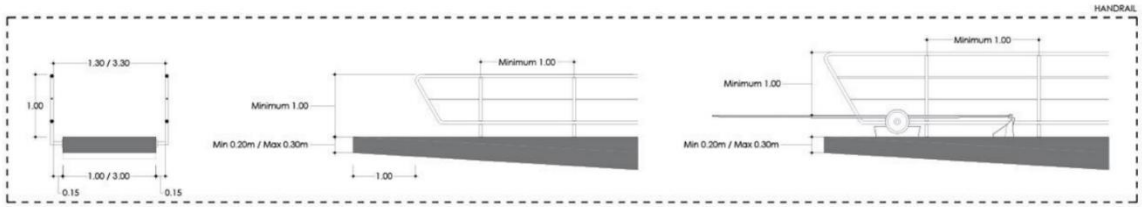


Figure 2.12 Diving Springboard
Source: Fina Facilities Rules 2017-2021

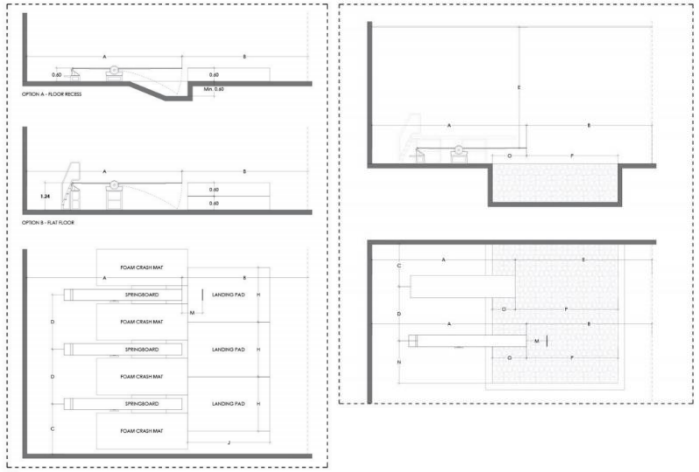


Figure 2.13 Diving Dry Land Training - Details
Source: Fina Facilities Rules 2017-2021

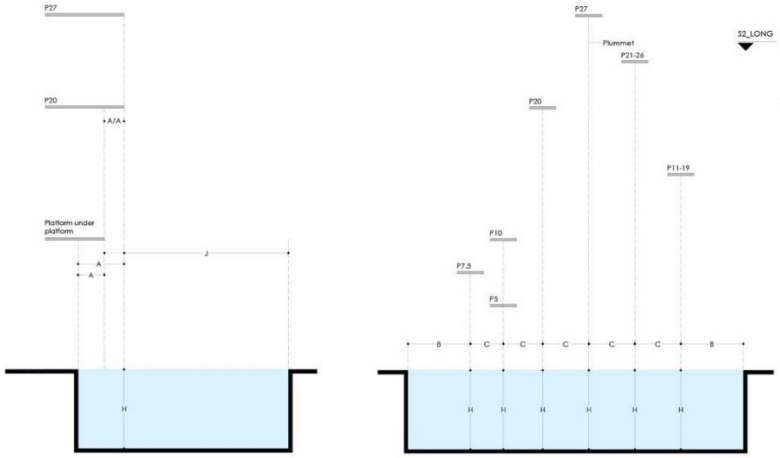


Figure 2.14 High Diving Diagrams
Source: Fina Facilities Rules 2017-2021

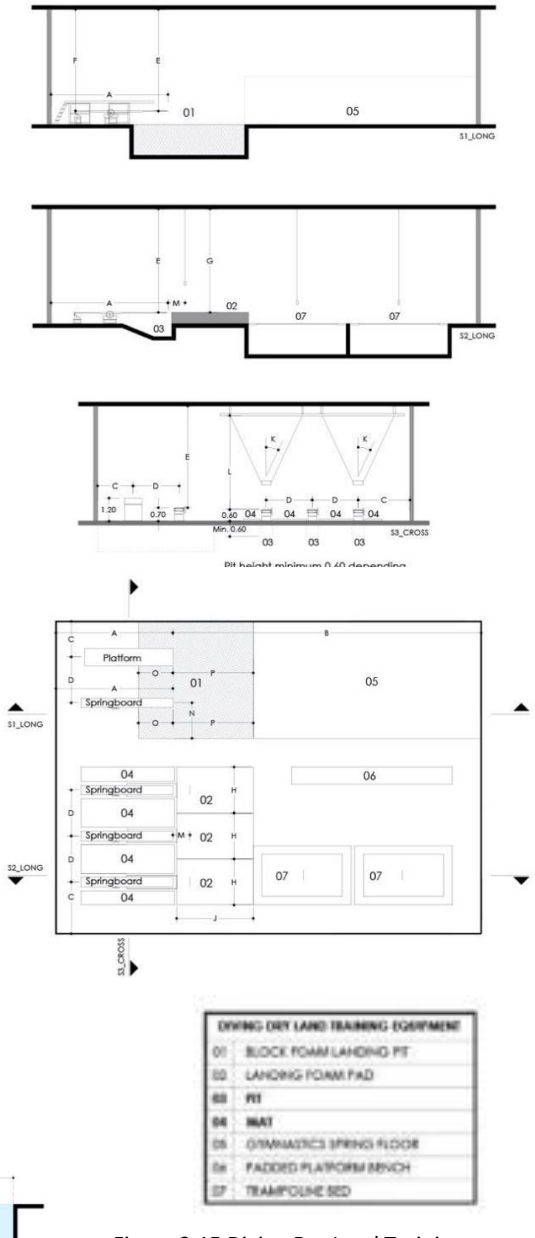


Figure 2.15 Diving Dry Land Training
Source: Fina Facilities Rules 2017-2021

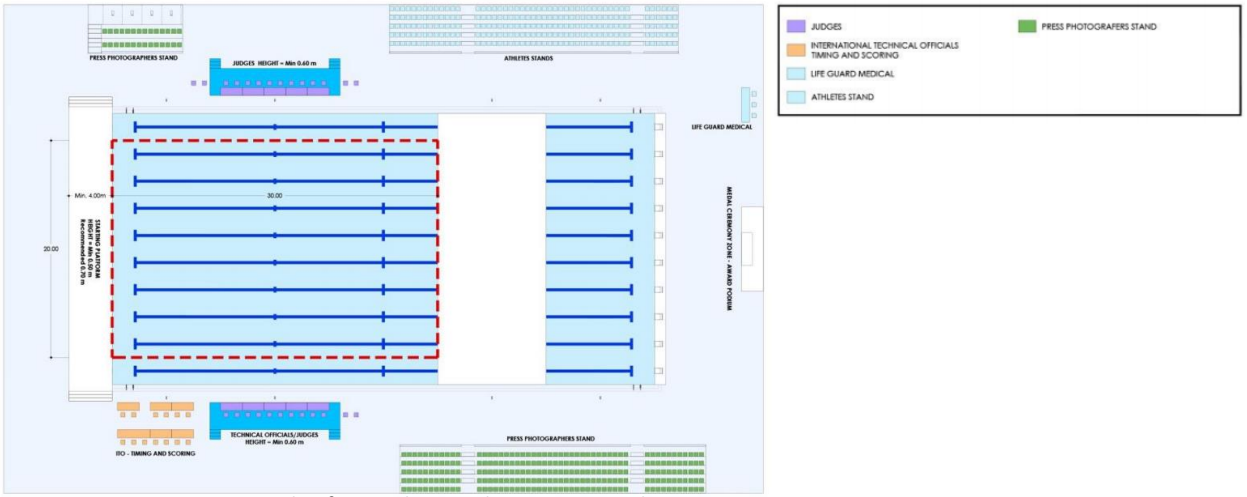


Figure 2.16 Layout Plan for Synchronized Swimming Pool
Source: Fina Facilities Rules 2017-2021

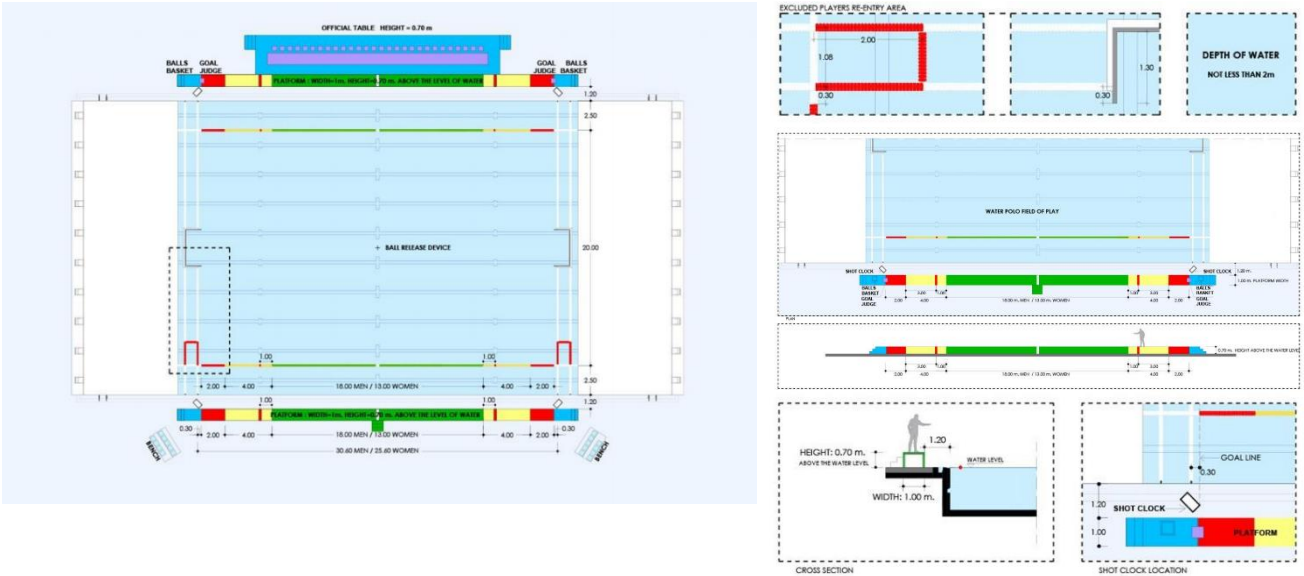


Figure 2.17 Layout Plan for Water Polo Swimming Pool
Source: Fina Facilities Rules 2017-2021

c) Swimming Pool for Synchronized Swimming Standard Olympic Games and World championship. Swimmig Pool for Synchronized Swimming must be eligible with a minimum area of 20 m and it is recommended with a width of 30m, where the area of 12 m by 12 m should have depth at least 3 m. The remaining area has a depth of at least 2.5 m. Area sloping with a depth of 3 m to 2.5 m should be over a distance of at least 8 m. Temperature water not less than 270C plus 10C minus 10 C. Starting board has size height minimum 0.5m and recommended 0.7m.

d) Swimming Pool of Water Polo Standard Olympic Games and World championship. The size of the pool for men with a length of 30 m and width of 20 m, while for female players has a length of 25 m and width of 20 m. Limit the game field at each end should be 0.30 m behind the goal line and comes with a special line mark. Pool depth is at least 1.8 m and recommended 2m, Water temperature should not be less than 260C plus 10C minus 10 C an must be water tasteless.

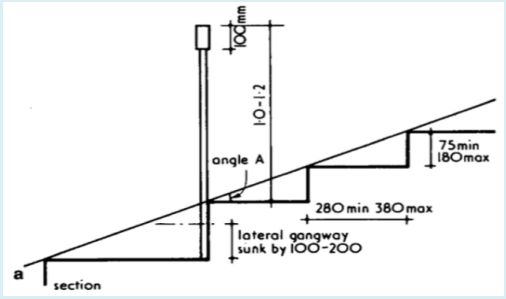
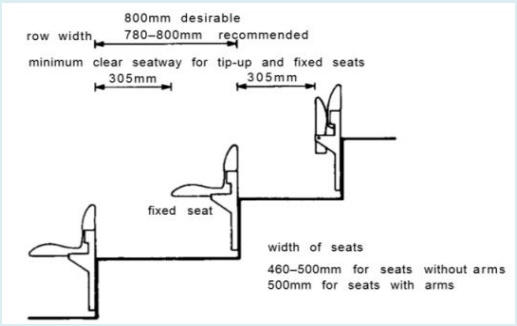


Figure 2.18 Details of Terraces for Standing Spectators. (Section)
Source: David Adler, Metrik Handbook Planning and Design Data (1999), Pages 393



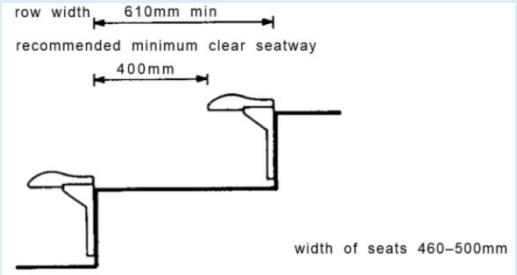


Figure 2.19 Spacing between Seating with and without Backs
Source: David Adler, Metrik Handbook Planning and Design Data (1999), Pages 393

These incorporate special qualities of turf and its sub-grade, together with appropriate facilities for the players and for spectators. While many sports events can be enjoyed by spectators situated on the sidelines or the boundary of the playing or competing area, there are a number of progressively more elaborate forms [8]:

- Viewing slopes. These are not suitable for large numbers, and should not be steeper than 17 per cent or 1:6.
- Open terraces, details of a terrace are shown in 2.18 Barriers are provided at intervals as a protection against crowd surge. Gaps are provided in the barriers, but these should.
- Viewing stands (which despite their name incorporate seating)overlooking part of a playing area and
- Stadium which are generally playing and competing areascompletely or substantially surrounded by seating, some even provided with permanent or removable roofing.

Outdoor stadium seats should be weather-resistant and robust as well as comfortable. Suitable materials include aluminium, some timbers and the most common material for modem stadium, some form of plastic. This has the greatest potential for moulding and shaping for comfort. Fire retardance also needs to be taken into account. With plastic, additives can be introduced but they often limit colour choice and sometimes will add only delay to fire resistance. The design of the seat is as critical as the material itself in regard to fire resistance.

The seat must be designed to drain and not hold water, and be easy to clean itself, around and underneath. This is important to avoid damage, as dirty seats encourage vandalism.

Forms of seating The quality of the seating will vary depending on the use, but also to produce a range of seats available in the stadium. Standards of comfort demanded by users tend to be rising. The better quality will be on an individual seat basis with a back, 2.19. The seat may fold back when not in use. This increases the seat gangway, providing greater convenience and safety. Spacing between benches without backs. These allow closer spacing but are less comfortable and are increasingly unacceptable.

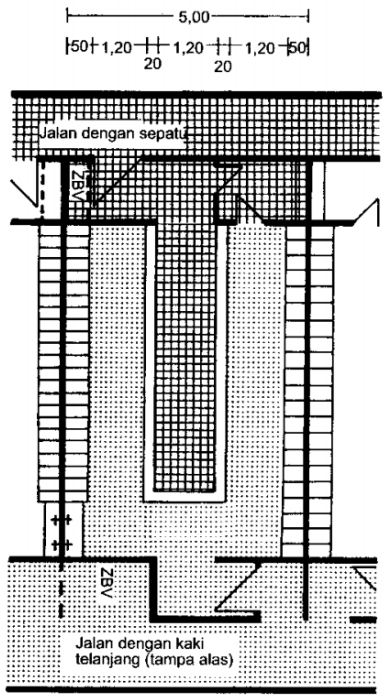


Figure 2.20 Open Changing Room with Bench
Source: Ernst Neufert , Architects Data - Second Edition, pages 189

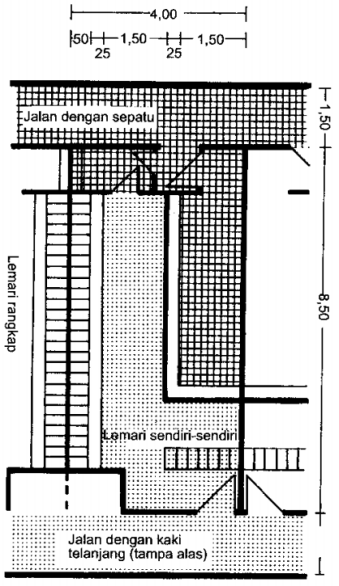


Figure 2.21 Open Changing Room
Source: Ernst Neufert , Architects Data - Second Edition, pages 189

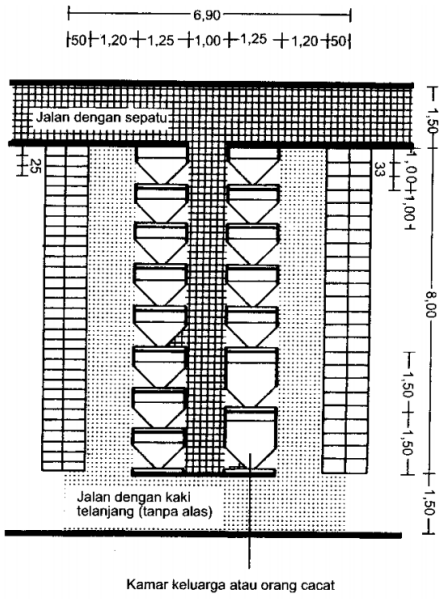


Figure 2.22 Cubicle Changing Room
Source: Ernst Neufert , Architects Data - Second Edition, pages 189

If the locker room and clothing storage facilities are separated, then recommended amount of changing room is as follows:

- One dressing room for every 8.4 m² of main pool area, or one for every 6.5 m² of recreational pool area.
- For a training pool of 1 piece per 4.2 m².
- If there is a special pool for the diving then it should be provided 2 additional dressing room.

The changing rooms for the swimming pool can generally be divided into 3 types [9], that is:

a) Indoor (Cubicle Changing)

Can be used by both sexes in the same area, but are separated in different zones. The use of this type will be increase the cost of work, but can save in terms of amount staff because it will facilitate supervision. Here's a Figure of space Cubicle.

b) Open (Open Plan Changing)

This type is widely accepted because most pool users are children. Open dressing rooms are usually cheaper, more flexible in terms of use of the room and easier in cleaning. Here's a Figure of open space.

c) Mixture

The most appropriate solution is the combination of an open dressing room with a number of locker rooms closed to create privacy. In room for ladies, privacy is more desirable therefore the amount of space closed dressing should be more than open space.

Changing Room Requirement

- Seats should be provided on the design of an open dressing room with a base calculation of 0.5 meters per adult and 400mm each children, with a height of 375 mm and a width of 300 mm.
- The dressing room size is at least 800mm x 900mm and for the wearer wheelchair size 2.5m x 1.5m.
- The position of the dressing room should be close to the rinse room, and for reasons security, these two rooms should be close to the shallow pool.
- To facilitate cleaning and avoid moisture then partition in the dressing room can be raised as high as 150-130mm from the surface floor.
- The height of the partition is quite as high as the shoulder (1.40m) or eye level (1.80m), while for the men's dressing room may be lower.

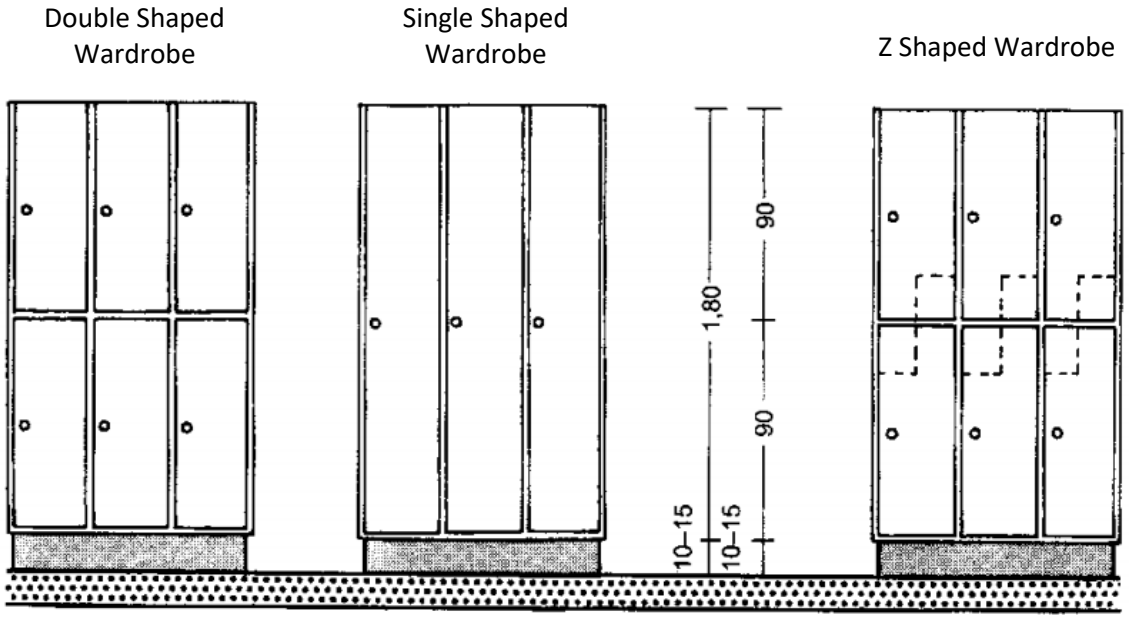


Figure 2.23 Locker of Changing Room
Source: Ernst Neufert , Architects Data - Second Edition, pages 189

Clothing Storage. There are two methods of storing clothing that can be used, namely:

- Use a basket bag and a hanger system), meaning the clothes brought by the visitor, after being replaced then entrusted to the clerk.
- Using a locker system, will be easier because visitors directly hold their own locker lock.

Placement of seats in the dressing room is better in cantilever form because it will be easier in cleaning [10].

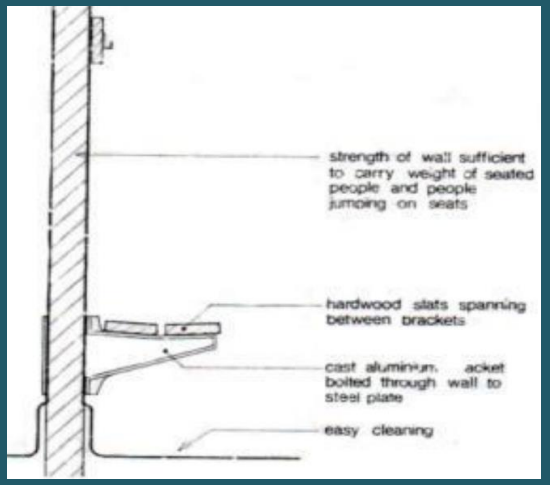


Figure 2.24 Placement Type Seat (Cantilever Seat)
Source: Geraint, 2004 : 124

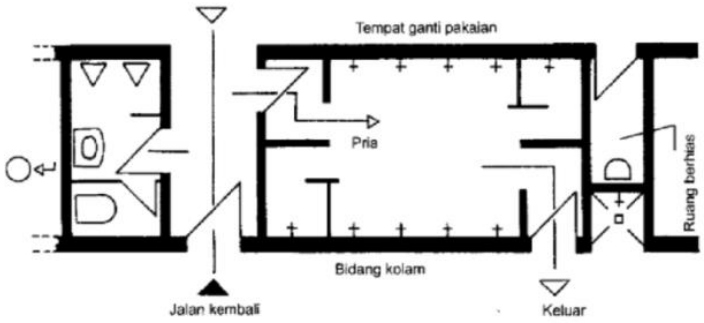


Figure 2.25 Mens Sanitary
Source: Ernst Neufert , Architects Data - Second Edition, pages 190

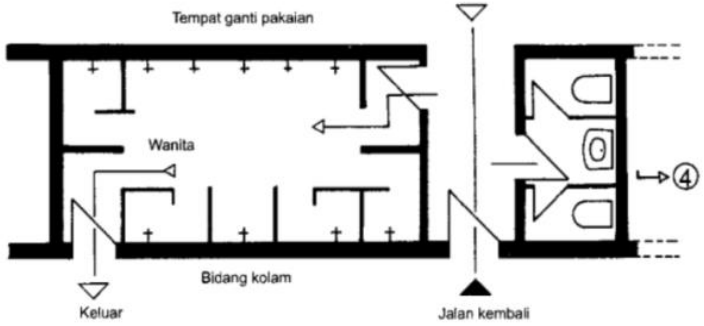


Figure 2.26 Womens Sanitary
Source: Ernst Neufert , Architects Data - Second Edition, pages 190

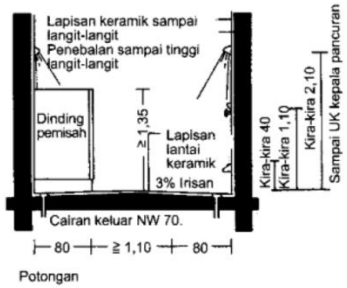
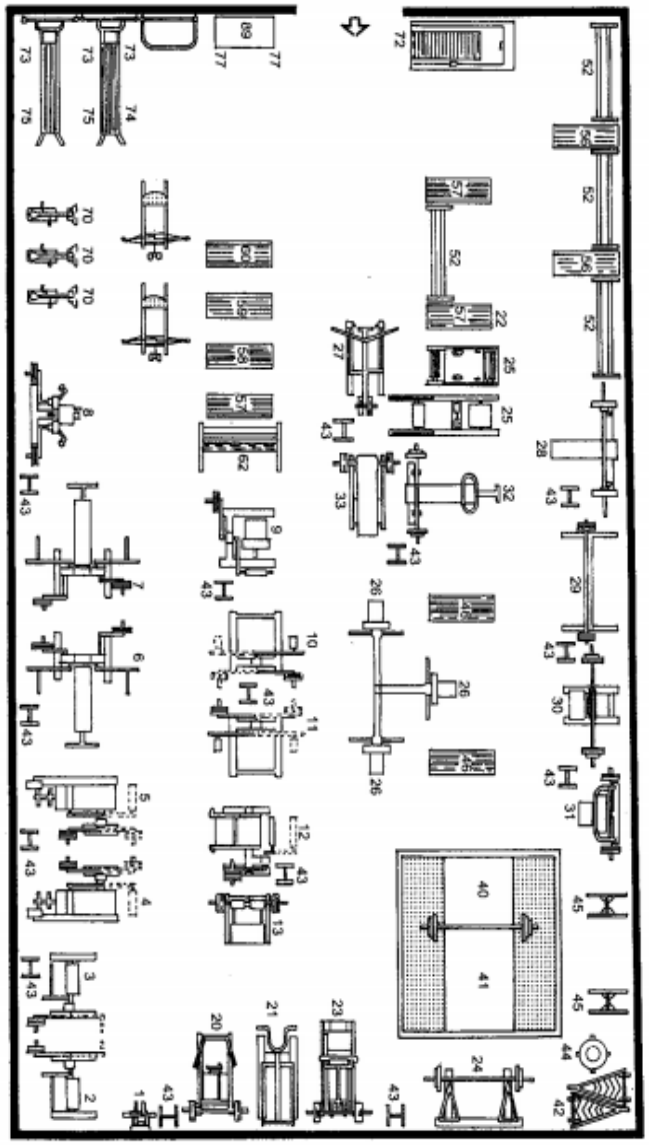


Figure 2.27 Disable Sanitary
Source: Ernst Neufert , Architects Data - Second Edition, pages 190

Sanitary areas include separate toilet and bathroom rooms by sex [11]. Located between the locker room and the pool. The toilet is arranged in such a way, so the user (to shower) after using it, cross the bathroom before returning to the pool. Standard benchmark values: Minimum basic equipment with a shower room for women and men with ten showers. Swimming pool with a surface area of one hundred to one hundred and fifty meters sufficient with a space that can be divided into five for women and men. Toilet, shower room for ladies arranged with two wc sitting, for men one toilet seat with two standing toilets.

Men's and women's bathrooms are several stands of room size including a bath with separation wall (shower row with water spray shield) with the width axis size 0.80 meters and 0.95 meters wide with a length of 1.40 meters and a height of 1.45, the width of the road between two rows of 1.10 meters showerhead, toilet seat with door opening in width 0.90 meters with length 1.40 meters with 2.00 meters high, width 0,75 and height 0,80, height of adult 0,70 and children 0,45, sink width 0,60 and length 0,80 meter with height of room minimum 2,50 meter.



1 Rol tangan
2 Alat untuk bisep
3 Alat untuk trisep
4 Mesin Pull – Over I
5 Mesin Pull – Over II
6 Mesin Latissimus I
7 Mesin Latissimus II
8 Alat untuk dada
9 Alat untuk badan
10 Alat pinggul I
11 Alat pinggul II
12 Alat untuk kaki
13 Alat untuk telapak kaki
14 Pusat multi latihan
20 Alat tekan/alat beban I
23 Alat tekan kaki
25 Alat untuk otot perut
26 Alat tarik
27 Palang besi untuk mengangkat beban
33 Halter lantai (tanpa alat) latissimus
3 Standar cakram ukuran kecil
6 Tempat duduk latihan
0 Halter tinju
1 Halter jarak pendek
2 Standar halter pendek
3 Latihan tiang halter
7 Bangku miring I
8 Bangku miring II
9 Bangku bundar
0 Bangku latihan multi guna
1 Halter padat/rapat
2 Standar halter
0 Argometer sepeda
1 Alat dayung/kayu
2 Ban berjalan
3 Dinding anak tangga
4 Pegangan/palang besi untuk mengangkat badan
5 Papan untuk latihan otot perut
9 Lemari peralatan

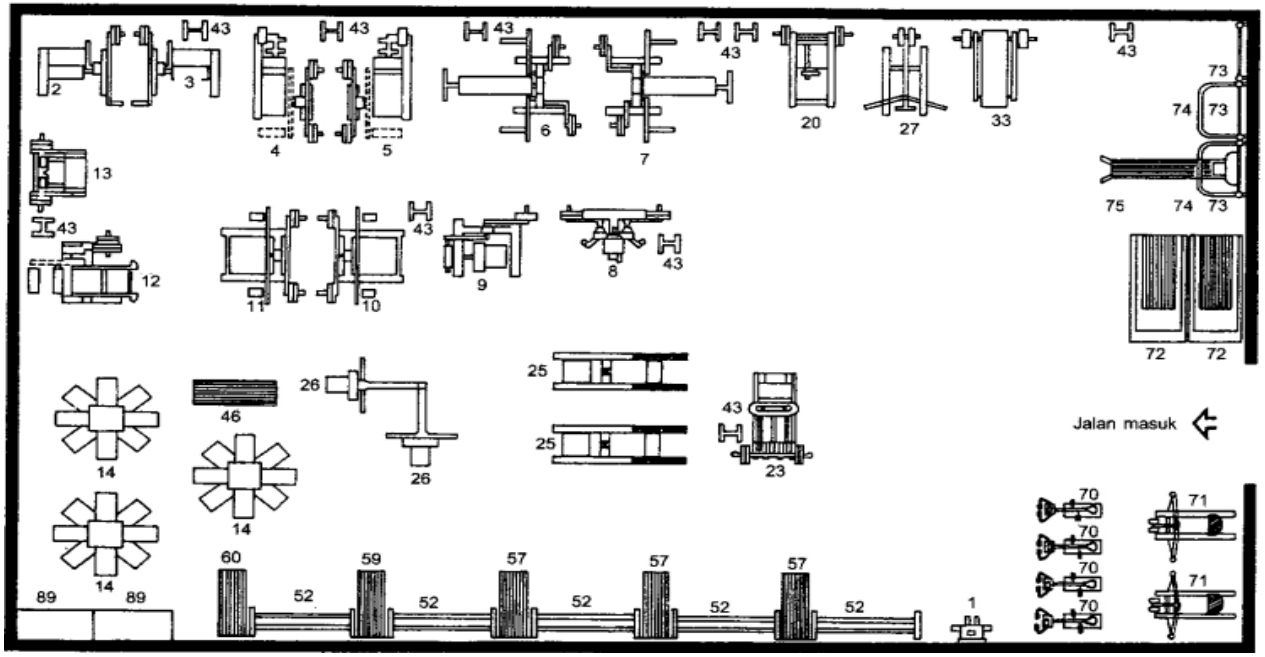


Figure 2.28 Fitnes Area w.200m²
Source: Ernst Neufert , Architects Data - Second Edition, pages 158

For 40-45 people must be based on the size of the room with a minimum outside of 2OO m2. Lamp height for all rooms is 3.0 m. Considering that the arrangement of equipment has optimal lines, then basically the condition of the fitness room must have an area of 6 m. The length of the room is <15 m, because otherwise the ability to master during training will be lost. The smallest size room of 40 m2 is suitable for 12 users [12].

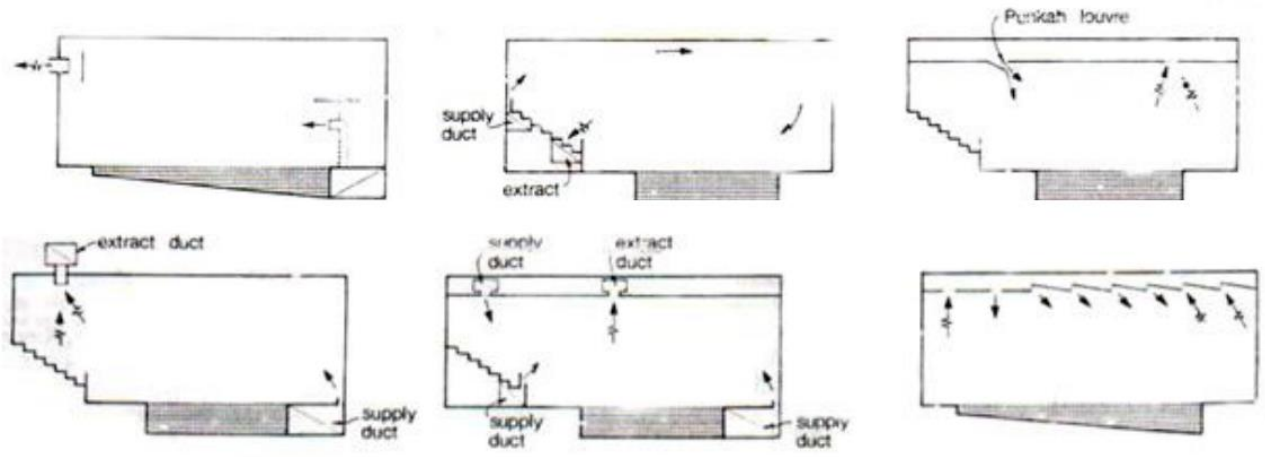


Figure 2.29 Alternative Air Delivery Systems for Swimming Pools
Source: Geraint, 2004:106

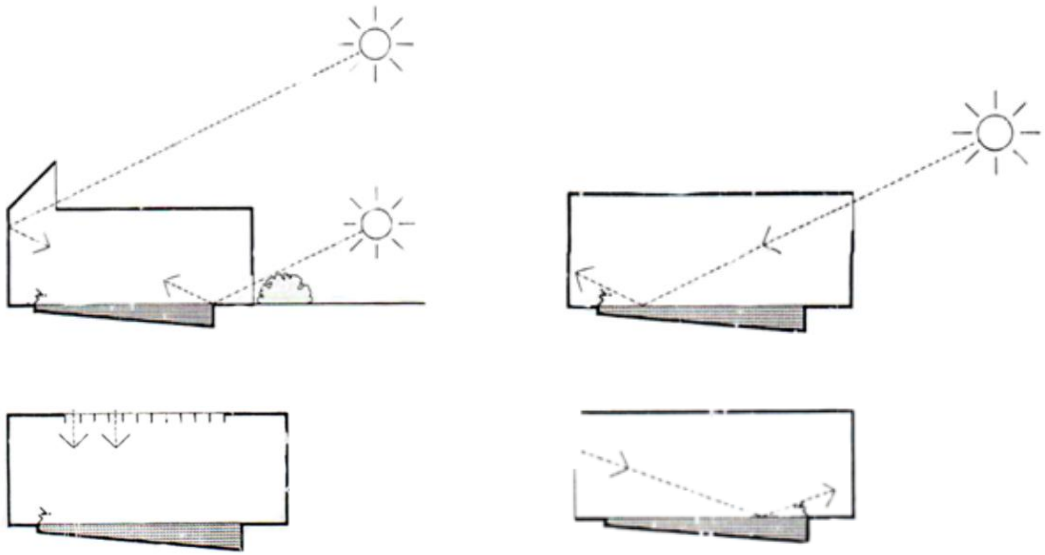


Figure 2.30 Natural Lighting Schemes for Swimming Pools
Source: Geraint, 2004:125

Ventilation System

Artificial ventilation/ventilation systems are needed, especially in pool spaces (pool halls) and locker room/ changing room [13]. This is due to humidity the space is very high and avoids the entry of chemicals for water treatment, odors agency and others. The condition of an artificial ventilation is not allowed to cause noise in the arena and spectator grounds.

When using natural ventilation, it must meet:

a) The minimum opening area is 6% of the effective floor area.

b) Natural ventilation placement must be adjusted to follow cross air movement.

Lighting System

Natural lighting in the pool should still be provided, but light direct is better avoided because it will result in glare on the wearer [14]. The use of v/h blinds, louvers, overhangs, tinted glass and so on is a great solution most appropriate, but it should be noted that users still want the view towards the outside of the building where it actually resulted direct light entering the room. Hence the use of a window with a sill low by combining it with the use of plants as light blocks in the outdoor space could be a good solution, following a natural lighting scheme in picture below. Lighting through the roof is natural lighting that can reduce reflection from the surface of the pool water and provide good lighting for pool.

Utility System

The swimming pool is made of reinforced concrete construction with a certain thickness which integrates with the construction of the utility, according to the Swimming Pool Macmillan Book Company (1997) [15]. Broadly speaking, swimming pools are classified into two circulation systems namely the Overflow circulation system and the Skimmer circulation system, which has a function and the same purpose is to clean the surface of the water from dirt or floating debris and unsinkable.

A. *Overflow* Sirculation System

In this **overflow** circulation system, water is sucked in by the pump from balancing The tank is then sent to the pond by going through a filtration process in the filter. Water that enters the pond through the inlet will overflow, which is made to overflow and spill into the gutter or channel that is made as a reservoir for the overflow. Then through the gutter drain, the water returns to the balancing tank, where it will then be sucked back up by the circulation pump. Generally, both commercial and domestic swimming pools use this system, because not much water is wasted when there is an increase in pool water level, either because of the increase in the number of pool users or the addition due to rain water will be accommodated in the balancing tank. The addition of water due to a reduction in pool water due to evaporation, etc., is carried out in the balancing tank.

B. ***Skimmer* Sirculation System**

In this skimmer circulation system, the process of circulating pool water is not requires a balancing tank, because the water is directly sucked in by the circulation pump from in the pool through the skimmer, and returned back to the pool. If there is an increase in the pool water level due to pool users or rainwater, it will be immediately discharged into the sewer and add water if there is a reduction the volume of water due to evaporation, etc. which is carried out in the pond. This system usually used for the process of circulation of a jacuzzi or whirlpool and partly domestic or home pool. This system has drawbacks for pool practitioners swimming that is considered quite significant is the addition of water too often new in every pool that is used, because there must be water wasted.

Artificial Lighting

Illumination levels, glare prevention and light sources meet the requirements where the horizontal illumination level for the person 1 m above the floor surface is:

a) For training a minimum of 200 lux is required.
b) For the competition a minimum of 300 lux is required.
c) To take video documentation, a minimum of 300 lux is required.
d) Artificial lighting and/or natural lighting should not cause glare on the player.
e) The light source or opening must be located in one area on the ceiling in such a way that shrinkage occurs between the lines connecting the light source with the point farthest from the arena 1.5 m high horizontal line minimum 300.

Acoustic System

Noise is a serious problem in designing swimming pool facilities, the noise generated must be overcome because it will reduce comfort visitors and disturb the environment around the building. The size of the room with finishing that comes from solid materials causes more noise caused, therefore this noise countermeasures must be considered. Time reverberation of the pool room is recommended for a maximum of 2 seconds with a frequency of 500 Hz, and level the maximum noise is 50db. while in the training pool the maximum echo is 1.5 second.

This noise prevention can take the form of a sound suppressor. Silencer can placed on the ceiling or wall, must be out of reach of visitors. The material used must be water and chemical resistant. For example by using gypsum board, fiberglass and mineral wool. Low ceilings and a profiled roof can help build acoustics in the room.

DESIGN APPROACH REFERENCE

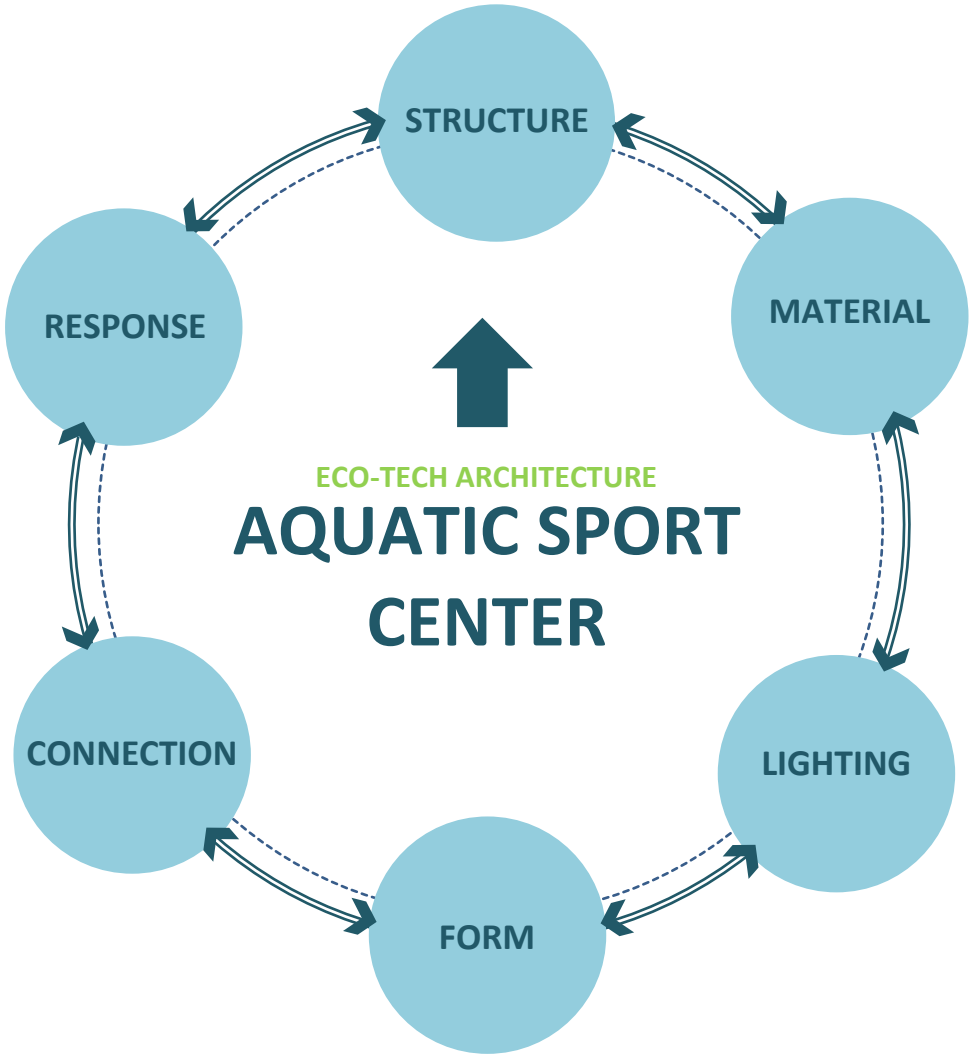


Figure 2.31 Scheme Diagram of Architecture Approach
Source: Author, 2021

Eco-tech is a combination of words between ecological and technology. According to **Catherine Slessor (1997)** [16], the study of Eco-Tech buildings is seen from several groupings of eco-tech building concepts, namely:

a) Structural Expression

Put forward the form of a building with a sophisticated structure whose application is integrated with nature.

b) Sculpting with Light

Focus on lighting systems, where buildings with light come alive by utilizing natural lighting for interior lighting.

c) Energy Matters

The energy efficiency used is one of the focuses of eco-tech building studies.

d) Urban Responses

Eco-tech buildings are assessed by looking at the context of the city environment or in other words looking at the response / response of the city.

e) Making Connections

The focus of eco-tech building studies is to make a relationship between design and the environment or by analogy with the form or function of the building.

f) Civic Symbolism

The building design re-enhances the role of the building as a public symbol by taking different forms of buildings to seek new values.

ISLAMIC VALUE REFERENCE

Aquatic Sport Centre provides aquatic sports facilities for the community. Not only as a forum for sports activists but as a medium of appreciation for the community, as well as a liaison for both so will be equally learned about it. As a medium of introduction of aquatic sports to the people who do not know so hopefully get the benefits of the new thing is known.

In Sahih Muslim, the Prophet(s) said "Any action without the remembrance of Allah is either a diversion or heedlessness except four acts: walking from target to target (during archery practice), training a horse , and learning to swim." (Reported by al Tabarani on good authority).

From the above hadith swimming is one of the sport of sunnah in Islam. Swimming activities can train people to be able to train their confidence, patience and discipline. Swimming involves all the muscular systems, skeletons and other body systems to coordinate and to maintain the safety of the disaster (Fitriadi, 2014).

"(To guide) there are many Signs in the structure of the heavens and the earth, in the constant alternation of night and day, in the vessels which is the speed of the carrying goods that are of profit to people, in the water which Allah sends down from the sky and thereby quickens the earth after it was dead, and dispersed over it all manner of animals, and in the changing courses of the winds and the clouds pressed into service between heaven and earth". (Surah al-Baqarah: 164)

The explanation of the Quran above, it is explained about the relationship between humans with the natural surroundings very close.

From the above verse and hadith can be an inspiration in good design and planning is the pursuit of environmental sustainability policy. Designing the Aquatic Sports Centre brings environmental sustainability as one part of the design concept. Design without damaging or exploiting the water element with a specific strategy in its construction. Application of environmental sustainability concepts on design structures, materials and energy spent.

FACILITIES THAT HAVE ISLAMIC VALUES

AQUATIC
STADIUM

TRAINING
CENTRE

MANAGEMENT
OFFICE

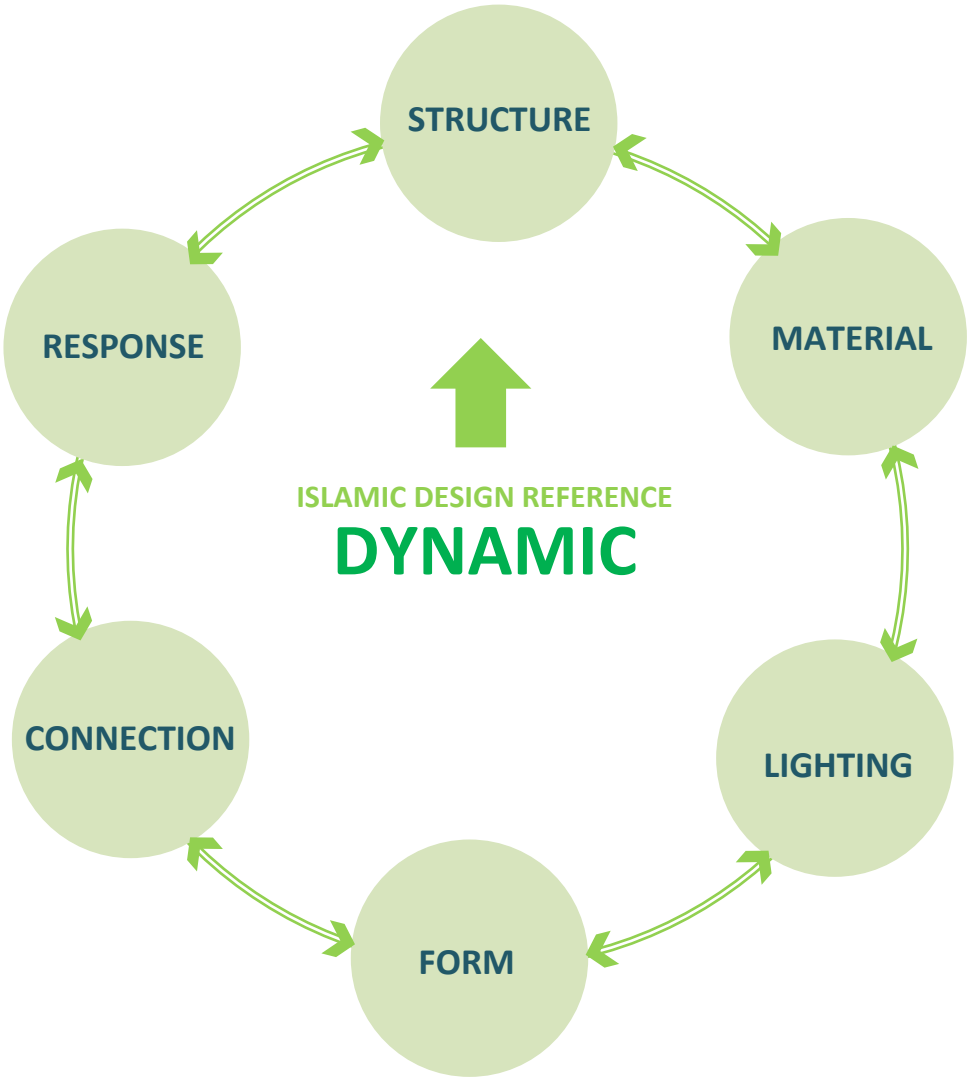


Figure 2.32 Scheme Diagram of Islamic Values
Source: Author, 2021

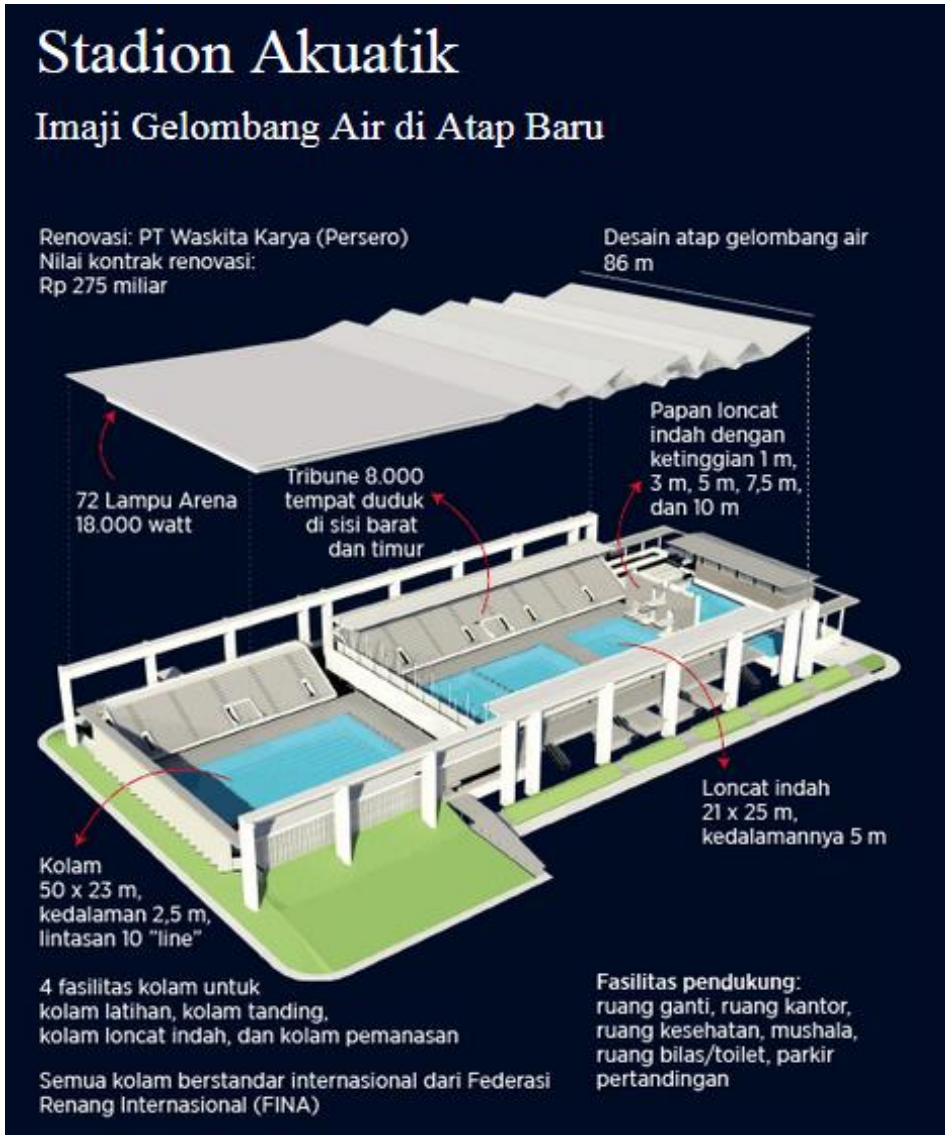
Islamic design is dynamic, that design should be enjoyed throughout era. The design should also take into account the environmental conditions based on climate, the history that applies to the design area.

"Such as remember Allah, standing, sitting, and reclining, and consider the creation of the heavens and the earth, (and say): Our God! Thou createdst not this in vain. Glory be to Thee! Preserve us from the doom of Fire." (Surah Al Imran, 3:191).

Tafseer Ibn Kathir explains verse 191 that in the order of heaven and earth and the beauty of the forecast and the wonder of His creation also in the alternation of day and night regularly throughout the year that we can feel its influence directly on our body and our way of thinking because of the influence of solar heat, the coldness of the night, and its influence on the world of flora and fauna is a sign and proof that shows the unity of God, the perfection of His knowledge and power [17].

So in the application of architectural design can produce a design that should be enjoyed throughout the ages. The design should also take into account the environmental conditions based on climate, the history that applies to the design area.

PRECEDENT STUDIES



Name of Object	: GBK Senayan Aquatic Stadium
Architects	: Andra Matin, IAI
Location	: Senayan, Jakarta Pusat, Indonesia
Area	: 2,12 Ha
Design	: Andra Matin, IAI
Main Contractor	: PT. Waskita Karya
Construction Period	: August 2016 – December 2017
Opening	: February 2018
Client	: Indonesia Administration Of Sport

GBK Senayan Aquatic Centre is the only Aquatic Stadium in Indonesia that is able to meet the requirements of a swimming pool facility specified by the international swimming sport or Fédération internationale de natation (FINA). Renovation process should be able to meet the rules of preservation of cultural heritage buildings. This 2.12 hectare swimming stadium is one of the largest aquatic centres in Asia and recognized by FINA. GBK Senayan Aquatic Stadium has three main pools and one Olympic-standard heating pool from FINA.

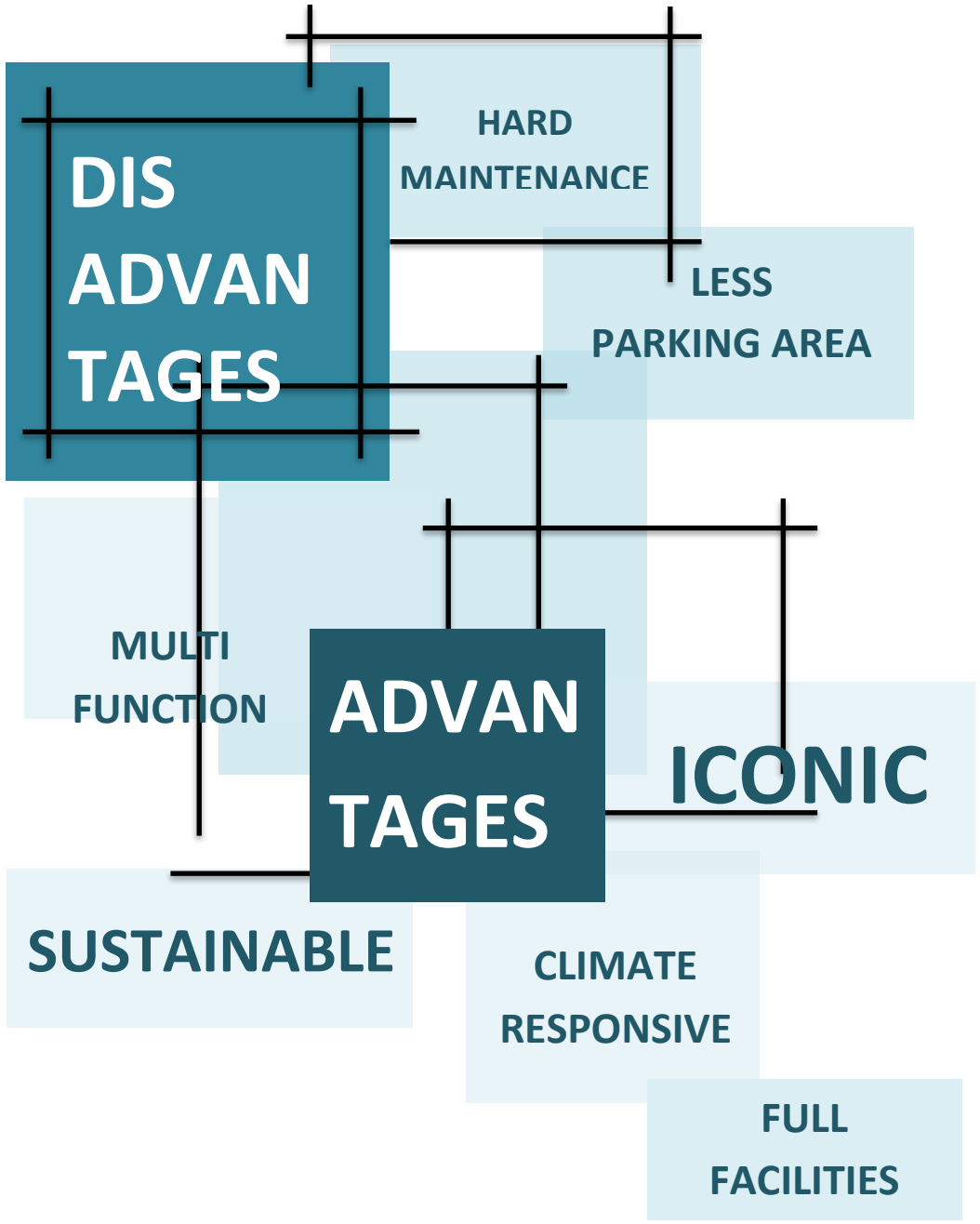
Aquatic stadium, which previously had an open roof, has now added a closed roof. This is done to maintain the temperature of the pool water so that it can meet FINA standards, which is a maximum of 26 degrees Celsius. The roof is quite long, which is about 200 x 100 meters. And once again, the new construction must not touch the old building construction.

The aquatic stadium is also designed to have lighting that is ideal for competitions at night and for broadcast standards. The stadium is also equipped with a modern sound system and a digital scoreboard.

GBK Aquatic Stadium has advantages and disadvantages in its design. The advantage of the GBK Aquatic Stadium design is that it is strategically located in the Jakarta sports complex. The location which is east of Gelora Bung Karno and south of Istora makes Aquatic Stadium easy to access because it is right in front of the main road. The design details are focused and have a responsive approach to the local climate, especially the approach to sunlight and temperature in Jakarta [18]. The design stands out and is unique with the addition of a roof that forms the image of water waves.

The unique water wave-shaped roof design also creates a memorable impression. There are five folds of varying sizes which are also equipped with flat parts such as calm air giving the impression of water with waves that are constantly moving and increasing in size.

The appearance of the Aquatic Stadium requires greater maintenance costs so that an adequate source of income is needed to maintain its condition. Based on these considerations, a multifunctional place is also prepared that can be used for organizing certain events, such as cultural performances, music, and other events. However, the parking area is insufficient if an international event is held, therefore parking to the Aquatic Stadium is diverted near Gelora Bung Karno.



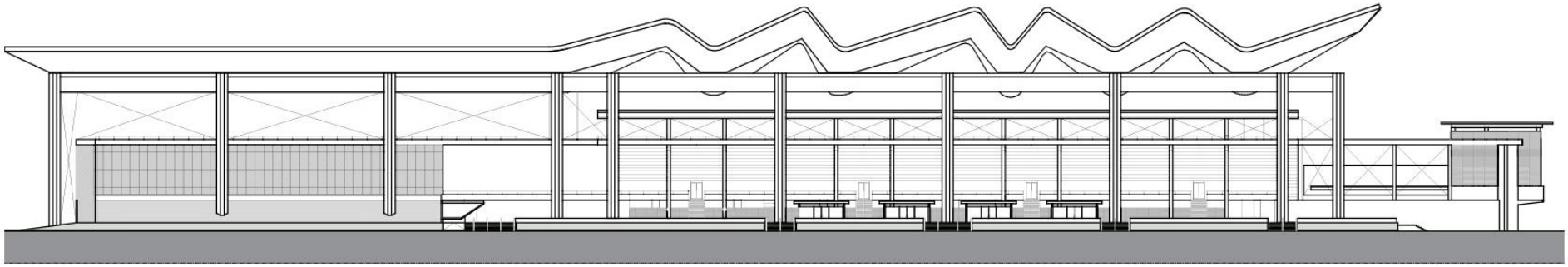


Figure 2.33 GBK Aquatic Stadium Right-Side View
Source: andramatin.com

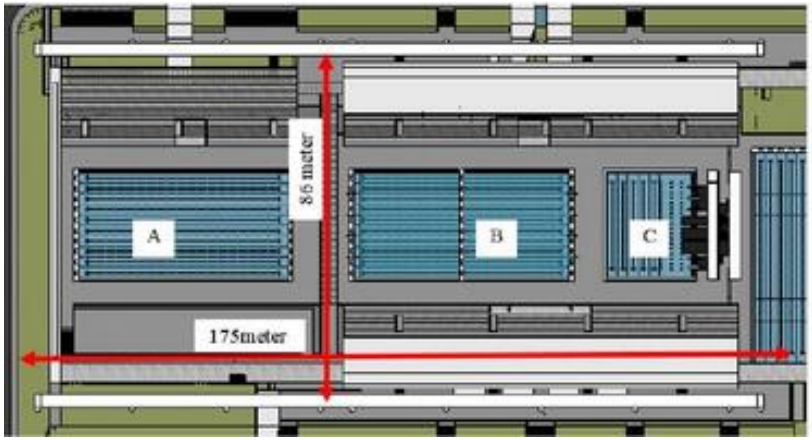


Figure 2.35 GBK Aquatic Stadium Plan, Polo Pool (A), Main Pool (B), Diving Pool (C)
Source: Designing Process of Efficient Lighting for Field of
Play at Aquatic stadium Journal, 2018

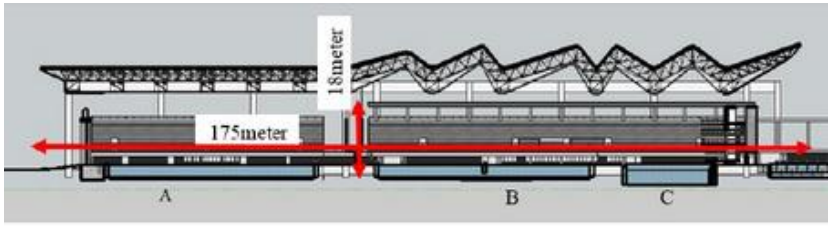


Figure 2.34 GBK Aquatic Stadium Section, Polo Pool (A), Main Pool (B), Diving Pool (C)
Source: Designing Process of Efficient Lighting for Field of
Play at Aquatic stadium Journal, 2018

Figure 2.36 GBK Aquatic Stadium Roof Truss
Source: The Aquatic Senayan of Gelora Bung Karno, Jakarta, 2016

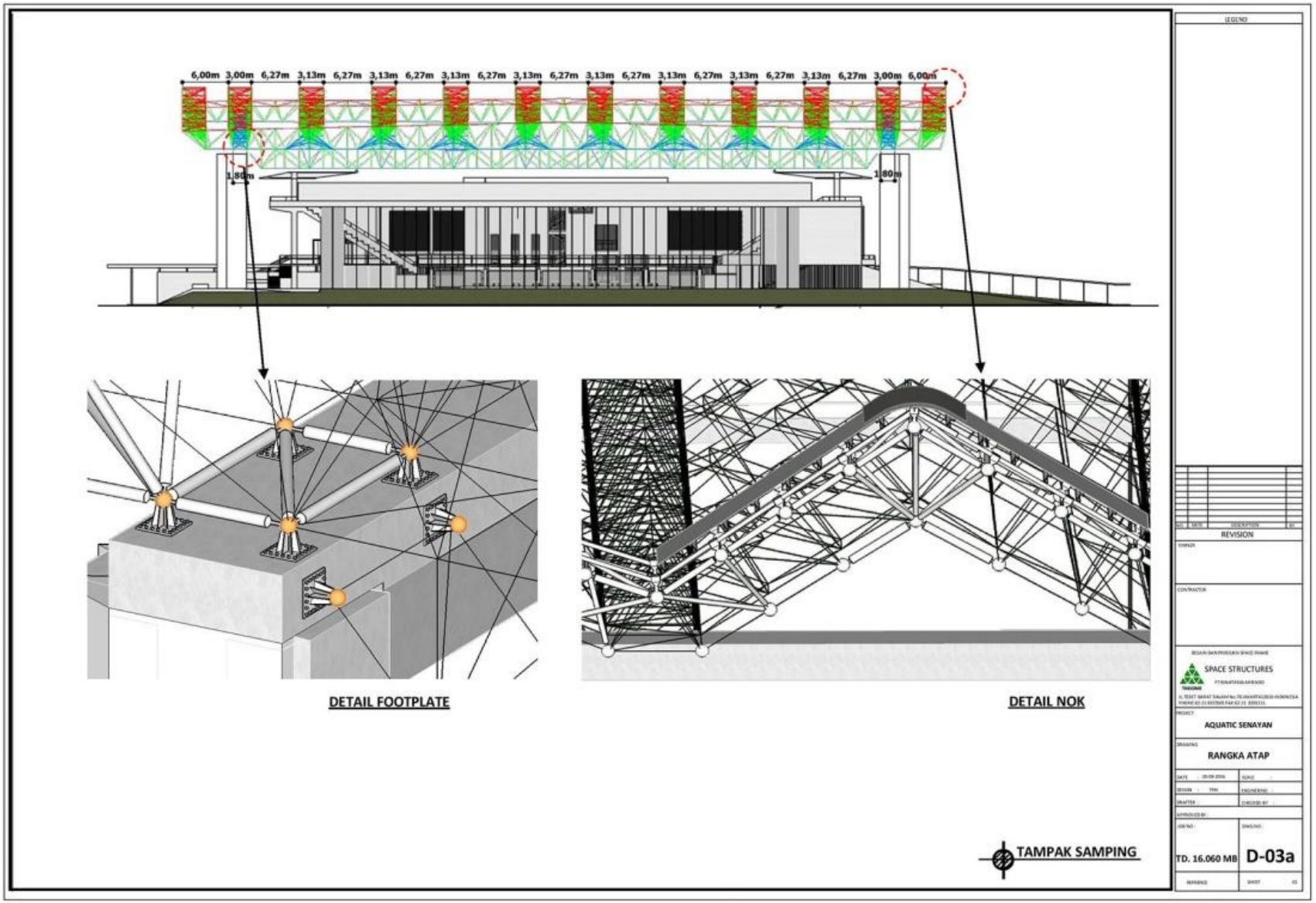


Figure 2.37 GBK Aquatic Stadium Roof Truss
Source: The Aquatic Senayan of Gelora Bung Karno, Jakarta, 2016

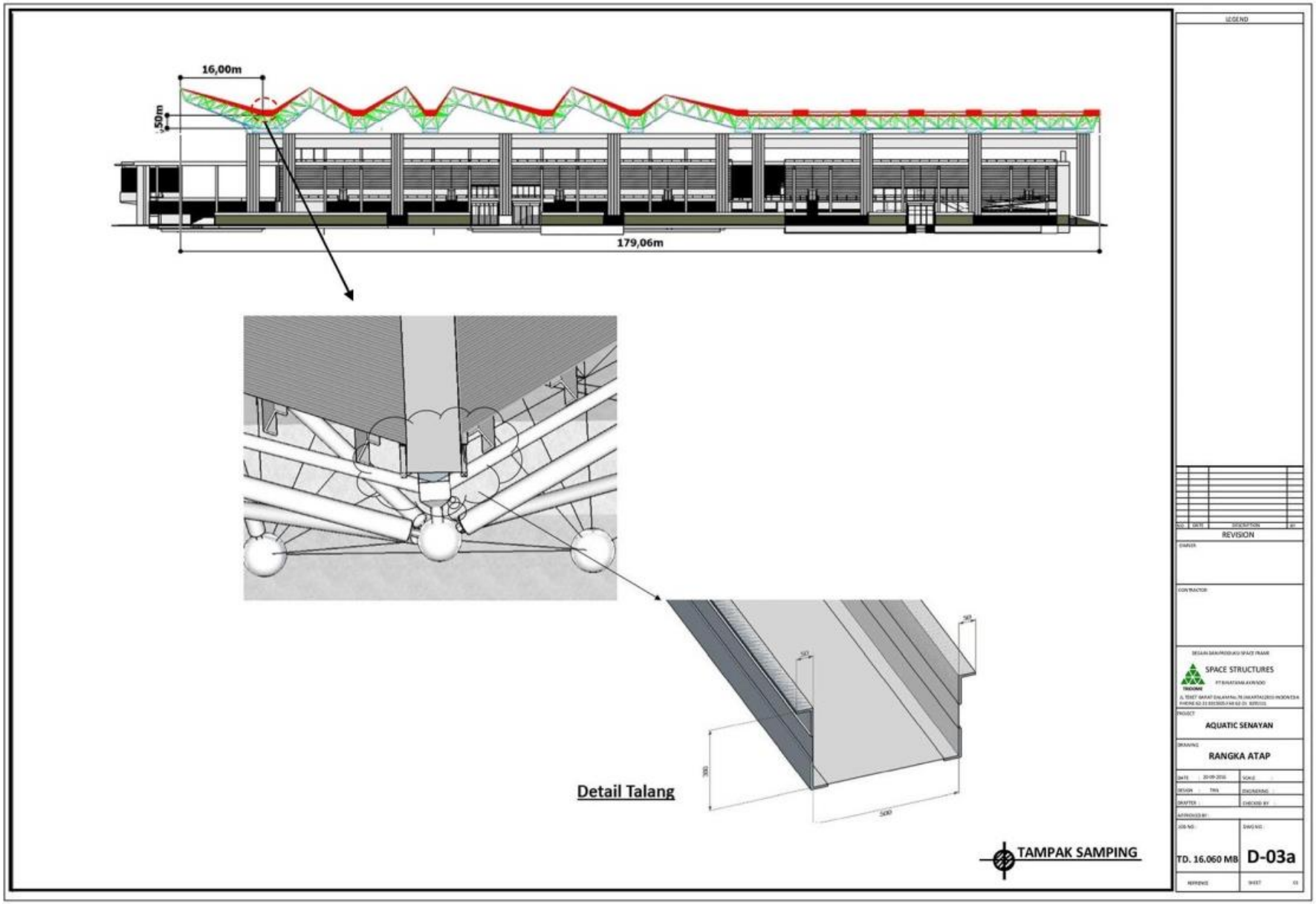


Figure 2.38 GBK Aquatic Stadium Roof Truss
Source: The Aquatic Senayan of Gelora Bung Karno, Jakarta, 2016

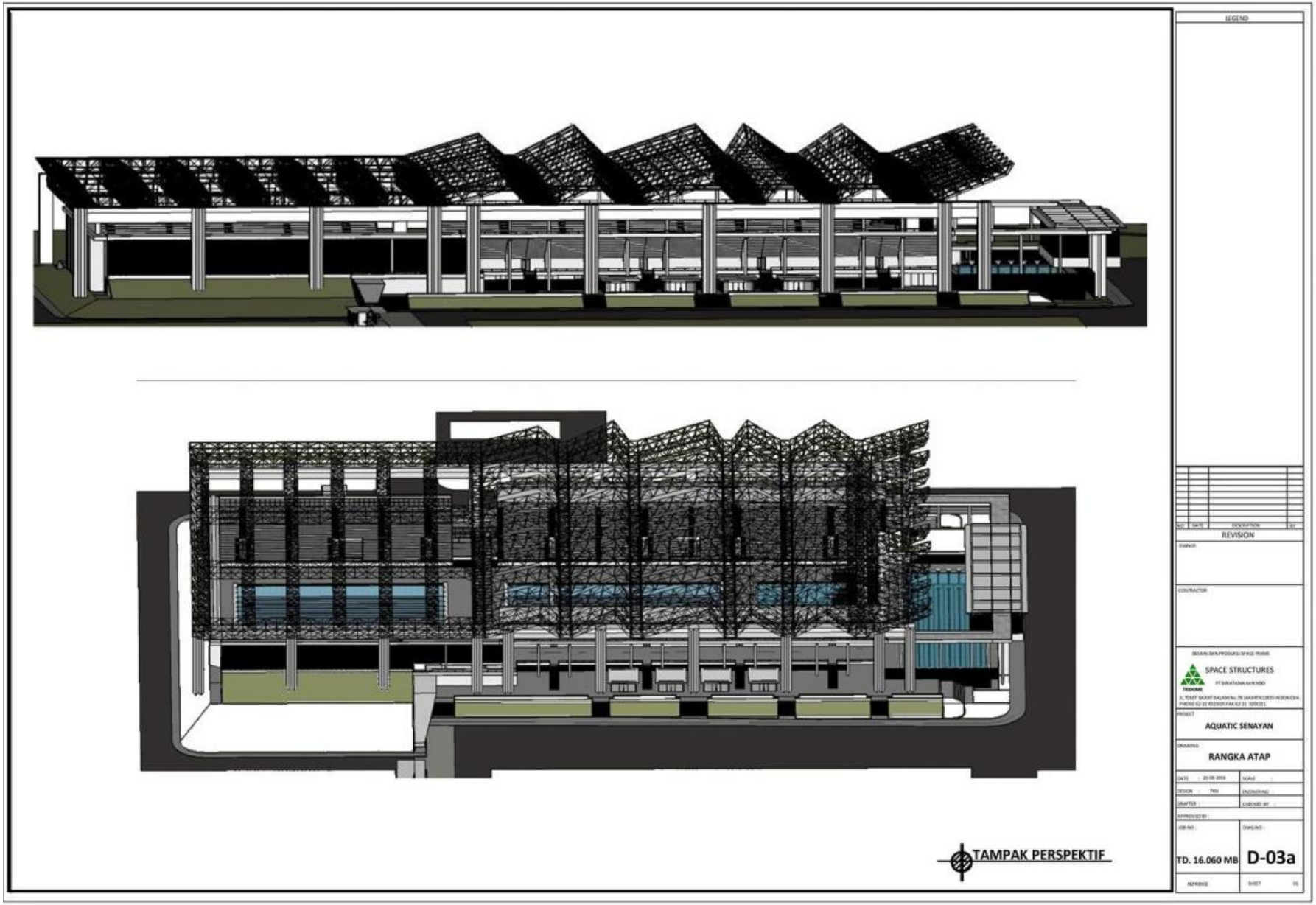
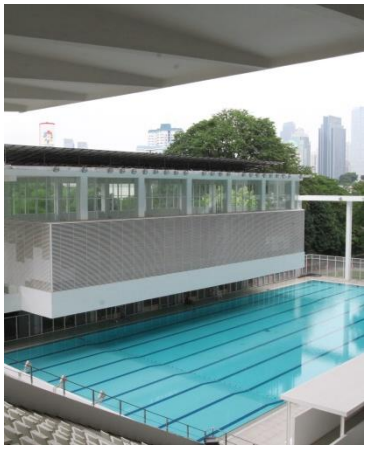
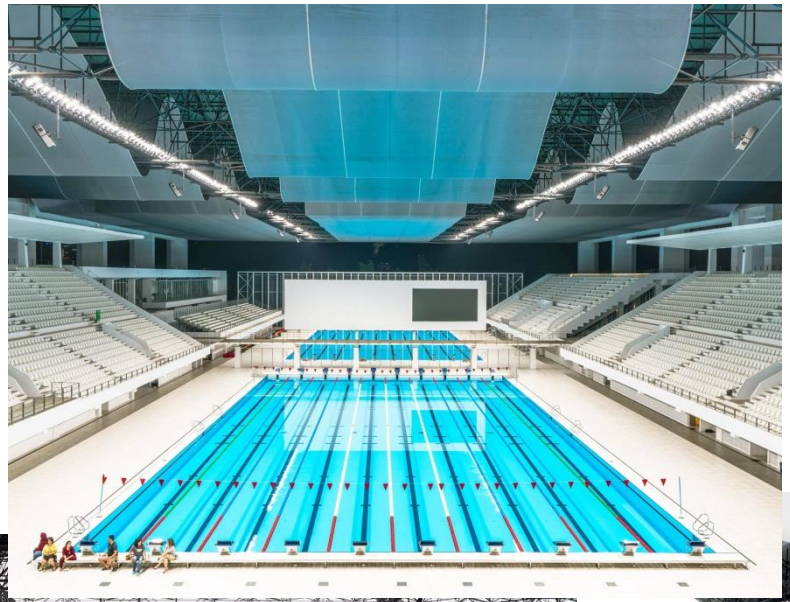


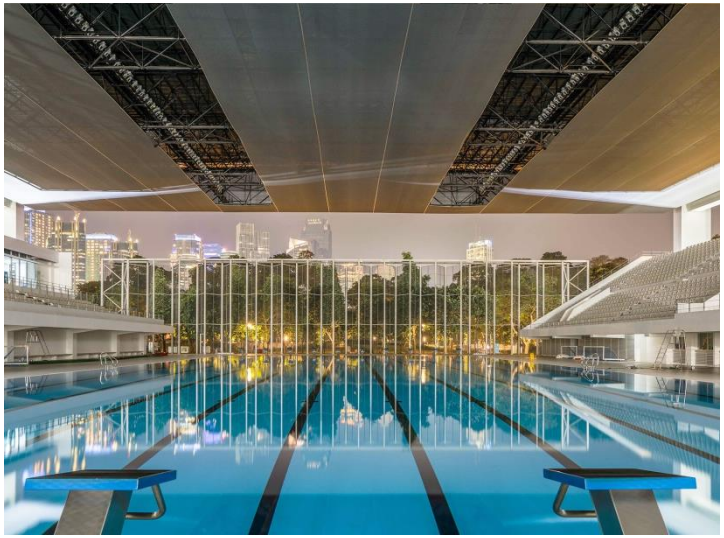
Figure 2.39 GBK Aquatic Stadium Roof Truss
Source: The Aquatic Senayan of Gelora Bung Karno, Jakarta, 2016

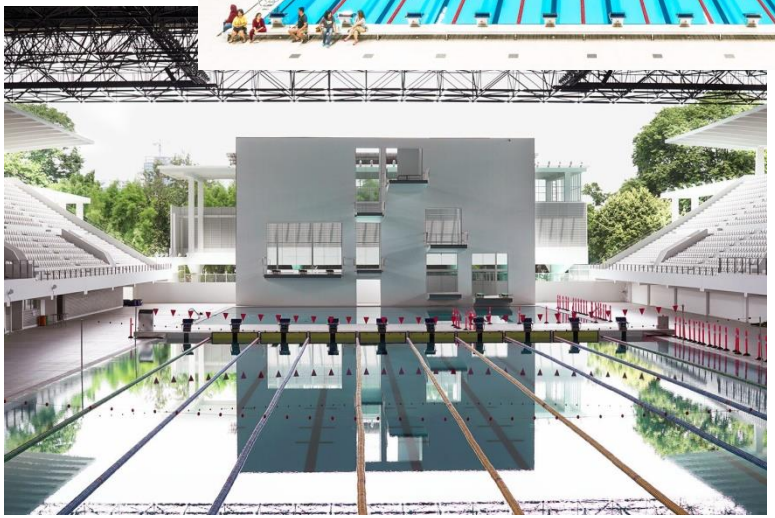
Figure 2.40 GBK Aquatic Stadium Perpective
Source: The Aquatic Senayan of Gelora Bung Karno, Jakarta, 2016

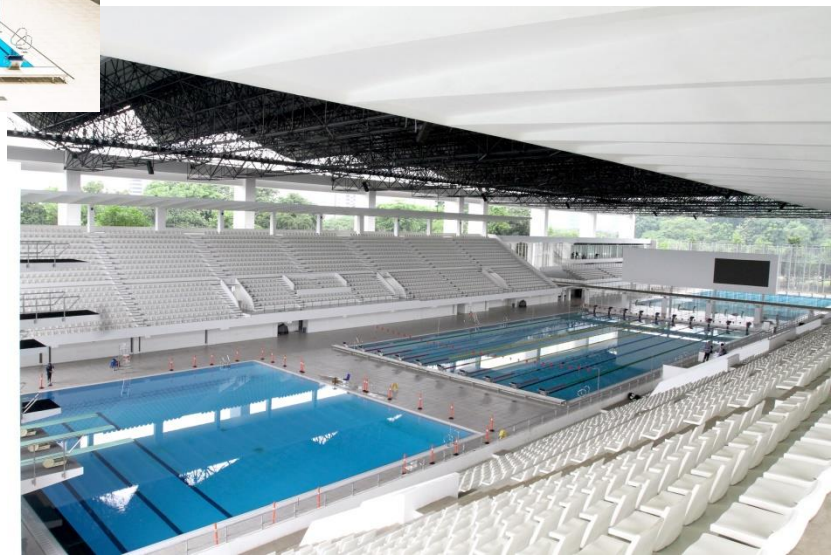
Figure 2.41 GBK Aquatic Stadium Interior
Source: andramatin.com











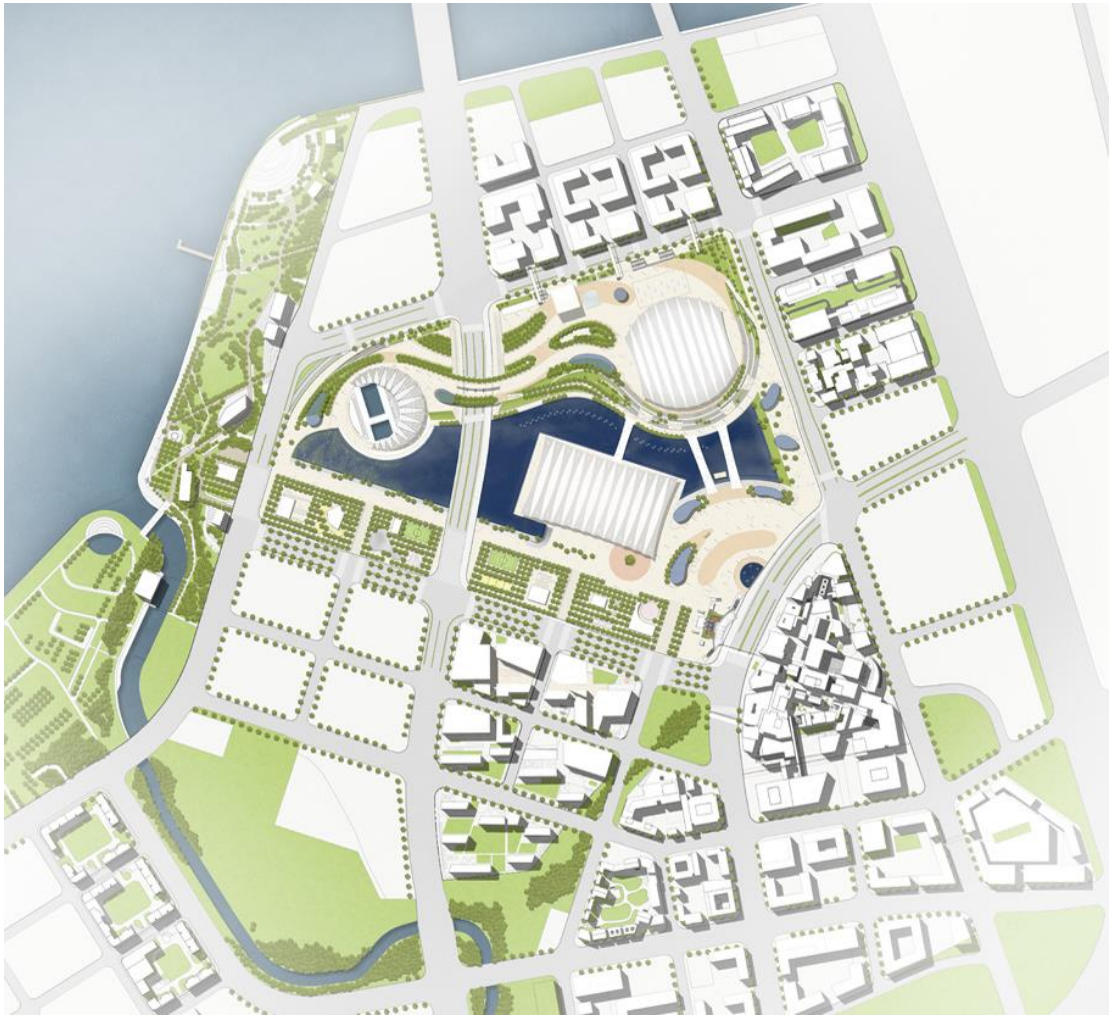


Figure 2.42 Shanghai Oriental Sport Master Plan
Source: WES Landscape Architecture

Shanghai Oriental Sports Centre

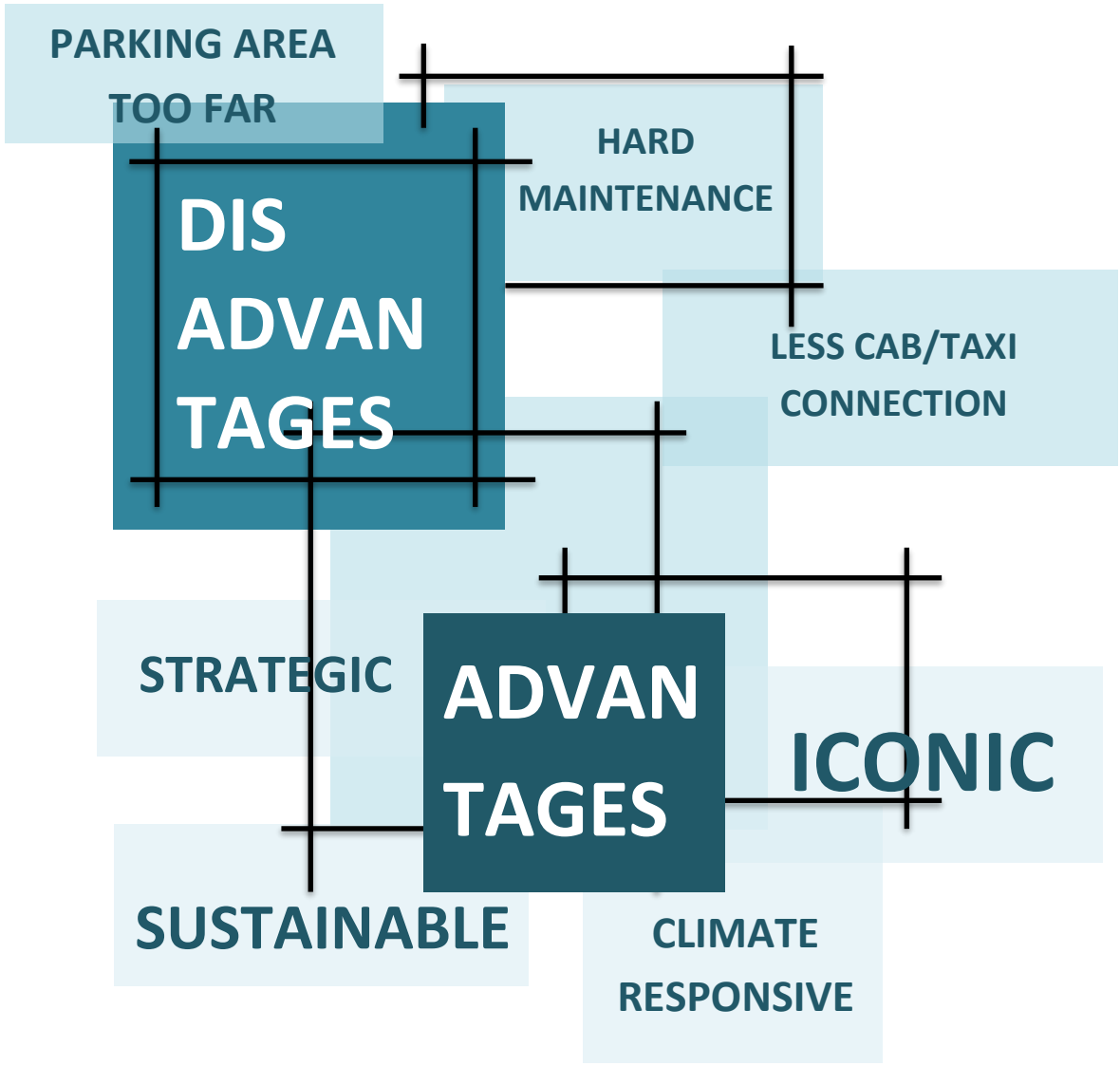
Name of Object	: Shanghai Oriental Sport Centre
Architects	: gmp architekten
Location	: Shanghai, China
Area	: 34,75 Ha
Design	: Meinhard von Gerkan and Nikolaus Goetze with Magdalene Weiss
Project Leader	: Chen Ying
Client	: Shanghai Administration Of Sport
Project Year	: 2011
Photographs	: Marcus Bredt

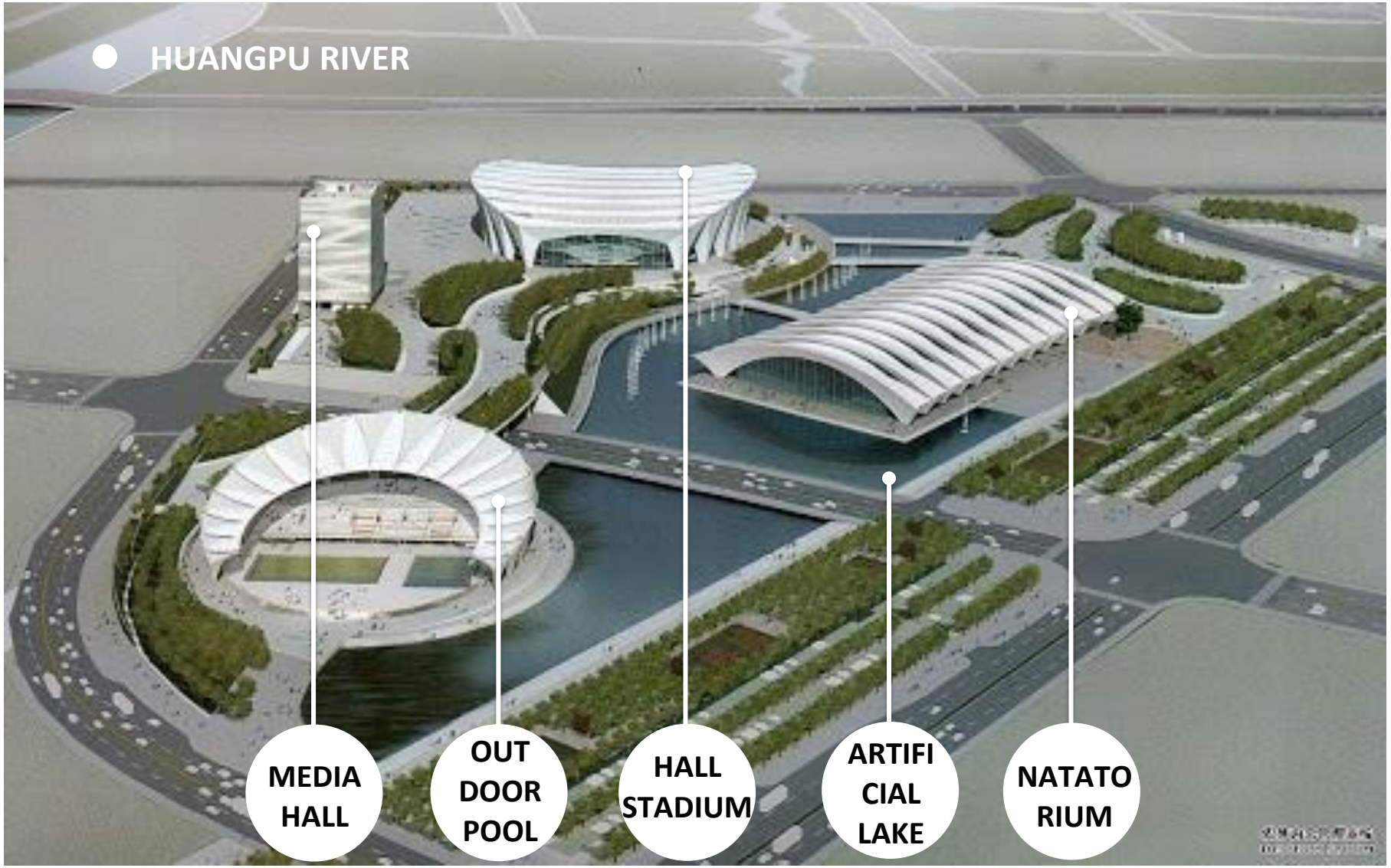
Shanghai Oriental Sports Centre (SOSC) was built for the 14th FINA World Swimming Championship from 16 to 31 July 2011 as well as the opening of the international event. The sports complex was designed and built by von Gerkan architects, Marg and Partners (gmp), who won competitive bids in 2008, and built them in less than two and a half years. It consists of a stadium hall for several sporting and cultural events, a natatorium (swimming hall), an outdoor swimming pool and a media centre. In keeping with sustainable urban development policies, SOSC is built on former brownfield industrial land along the Huangpu River [19]. Individual places are designed so that after the Swimming Championships, they can be used for various other purposes.

Water is the overarching theme of both the park and the architecture of the stadiums and the media centre. It is the connecting element between the buildings, which stand on raised platforms in specially constructed lakes. Thus the round stadiums have a curved lakeside shore round them, while the rectangular Natatorium has a straight lakeside shore.

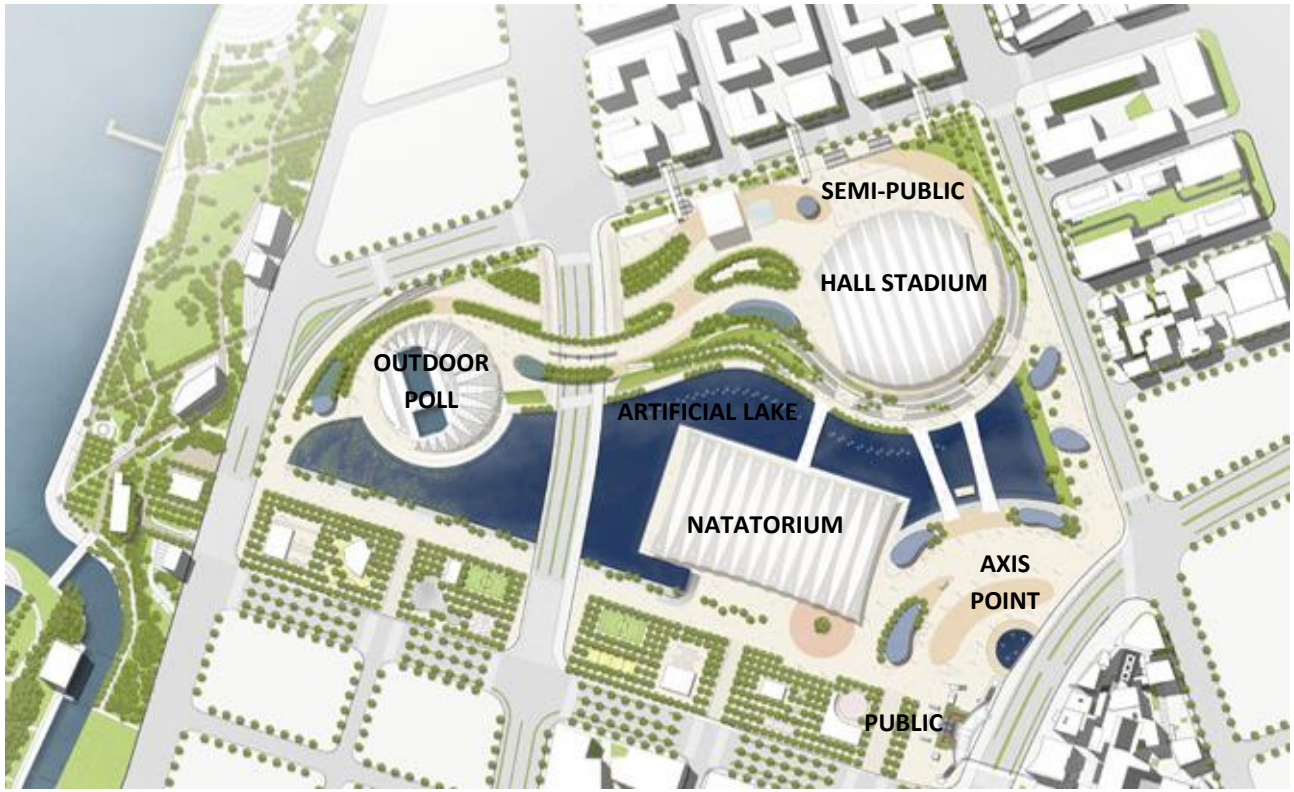
Design affinities and a shared formal idiom and use of materials give the three stadiums structural unity. The steel structures of broad arches with large-format triangular elements made of coated aluminium sheet form double-sided curved surfaces along the frame of the sub-structures, thus evoking sails in the wind.

The roof structure with triangular glass surfaces is around 210m long, 120m wide and 22m high. Direct, intrusive sunlight is forestalled by means of narrow toplights along the beams, without preventing natural daylighting. The roof trusses are carried by the building structure. A lightweight membrane between the modules provides protection against sun and rain. With its external shell of white, perforated aluminium panels, the building interprets the undulating shape of the adjacent lake. However the parking lot is too far from the main building. Distance from city center and difficult to get a taxi after the event.

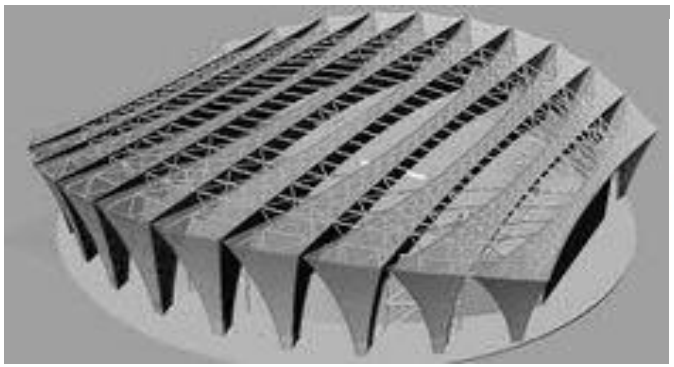




Water is the **linking element** betweeen the buildings as well, which stand on **raised platforms** and stick out into an **artificial lake**. On the north side, a softly **curving shoreline** runs round the round stadiums, while there is a straight edge for the Natatorium in the south. The links between the buildings are **bridges**. In this way, each building can be viewed **across an expanse of water** and is in an exposed position.



Design uses a lot of **natural light**, and water source heat *pump technology*, Shanghai Oriental Sport Center heated more "**low-carbon**". The stadium's water treatment system is used in all competition pools, training pools and water recreation area, and the **water quality** up to the standard of **drinking water** [20].



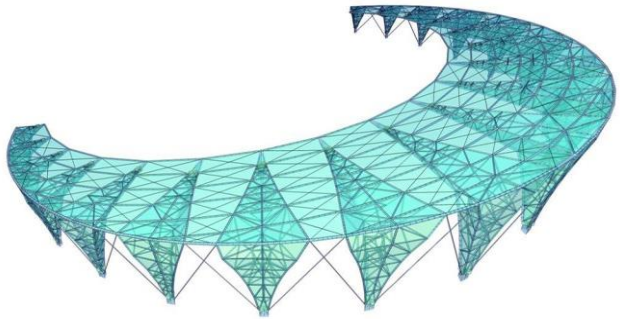
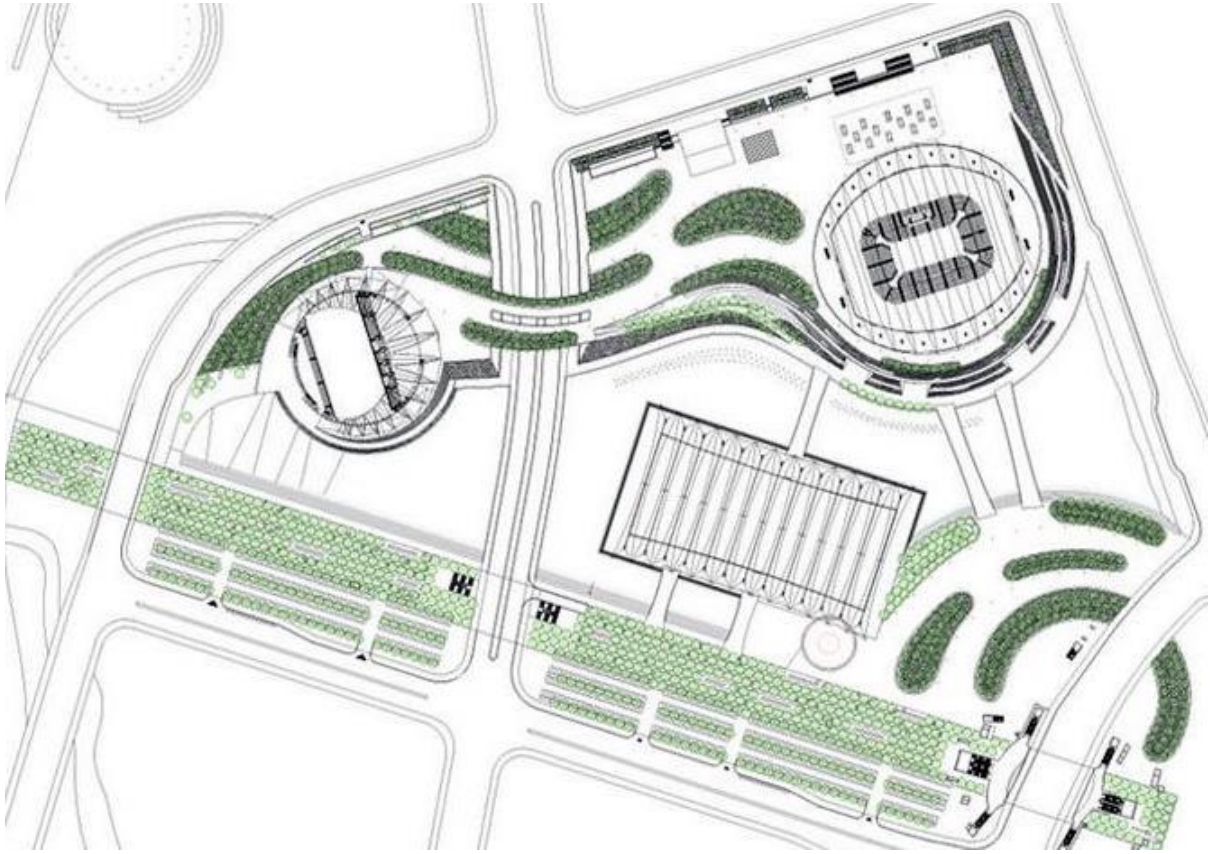
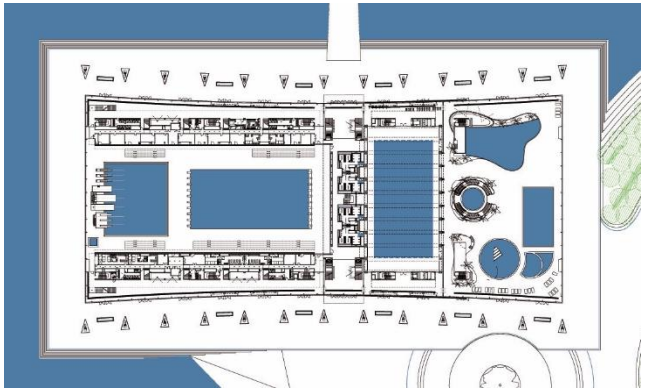
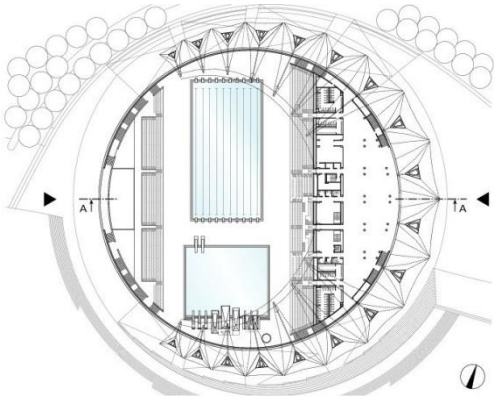


Figure 2.43 Shanghai Oriental Sport Master Plan
Source: WES Landscape Architecture







Outdoor diving pool is located on the island in the center of the **artificial lake, the roof structure** of a "**half-moon-shaped** plane, in the open seats, the audience can enjoy from angles throughout the Oriental Sport Center, **Overview of the Huangpu River water front landscape**.

Outdoor Pool

This swimmig complex is **located outdoor on an atificial island** and offers **2.000 fixed stadium seats.** The competitio-size diving pool and diving towers are complemented by a competition pool. As in the other stadiums, the roof structure with its external diameter of 130m reflects the **round ground-plan** of the shell of the buliding **lightweigh**t membrane between the modules provides **protection against sun and rain**.

Natatorium

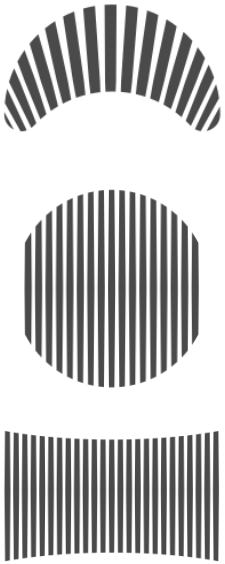
The Natatorium contains **four pools** arrayed in a row:two standard-sized, one for diving and a leisure pool. It has over **3.500 fixed seats**, which were expanded to 5.000 for the world championships. The swimmming hall is a **closed building with a rectangular ground plan, a main structure of reinforced concrete**.

Hall Stadium

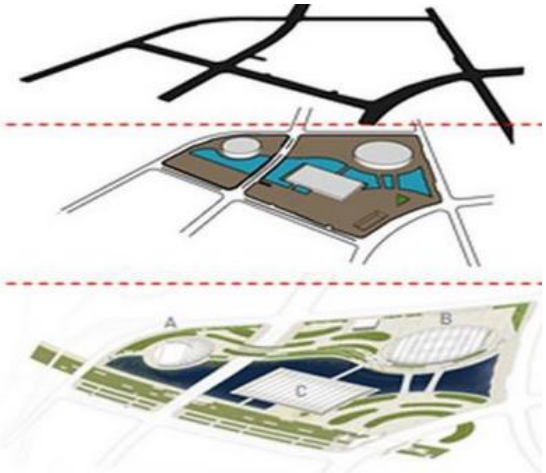
The hall has a capacity of **14.000**, which can be **increased to 18.000** by the use of **mobile seating**. The main structure of the closed **building with a round ground plan** consists of **reinforced concrete**.

HORIZONTAL AND VERTICAL CIRCULATION

1. Has 10 entrance from main road [Yaolong Road and Pudang Road]
2. Double lane & fourth lane was divided
3. Waking, bicycle & vehicle lane was divided at every direction



EXTERNAL CIRCULATION

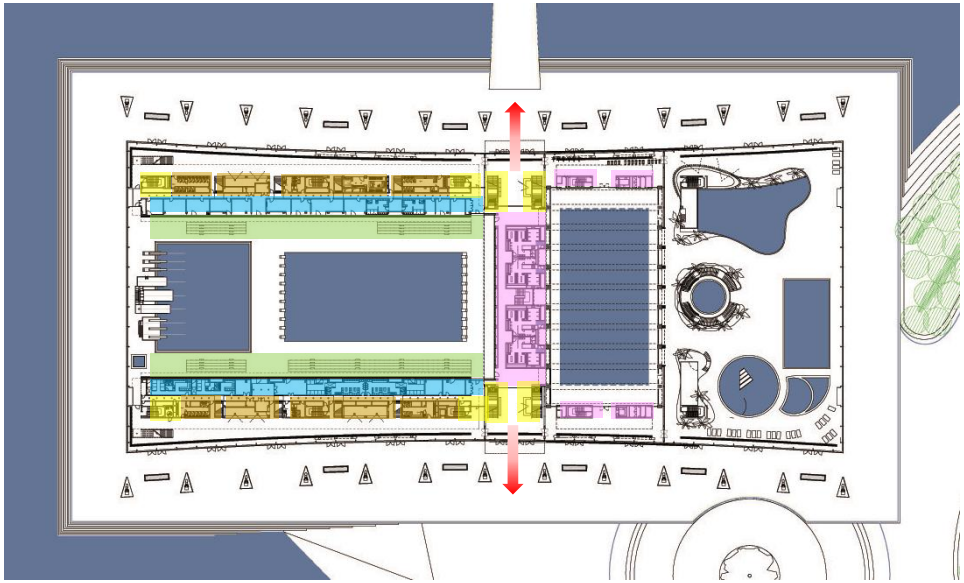


ROAD

LANDED

ORIENTAL SPORT CENTER

EXTERNAL CIRCULATION



Ground Floor Plan

Main circulation from outside to inside of building

Services Area

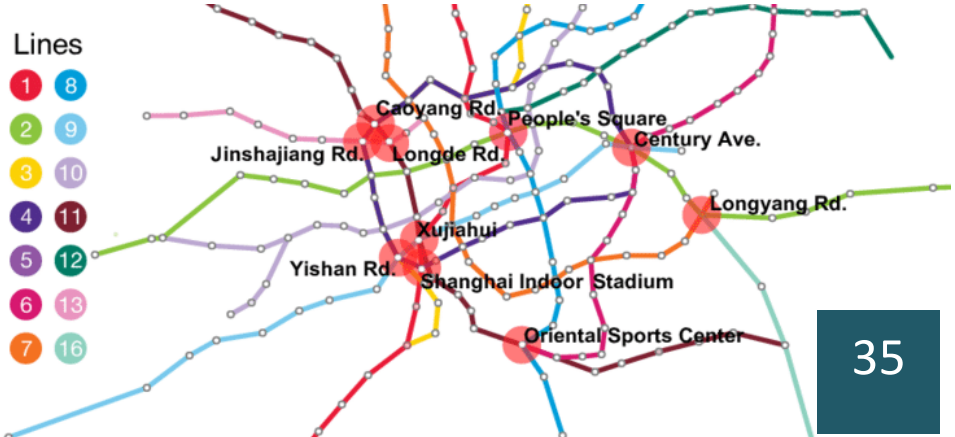
Stairs

Administrator

Athletes, coaches, and admin area

Visitors/supporter seats

SHANGHAI METRO SYSTEM



BARRIER FREE ENVIRONMENT

Open entrance for the OKU user to access into the building.

OKU lift are provided at the ground floor to access the first floor (audience seats).

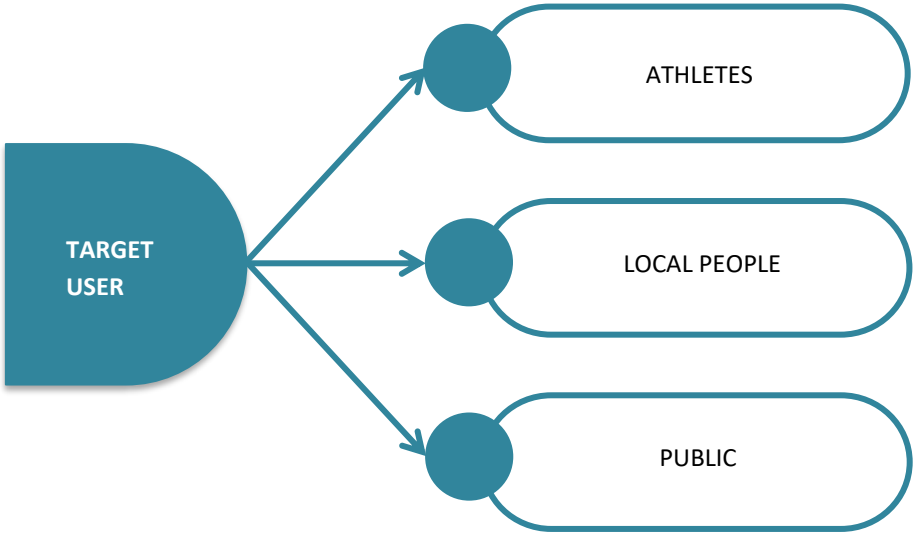
There is also an OKU path way from oriental sport center to the subway station.

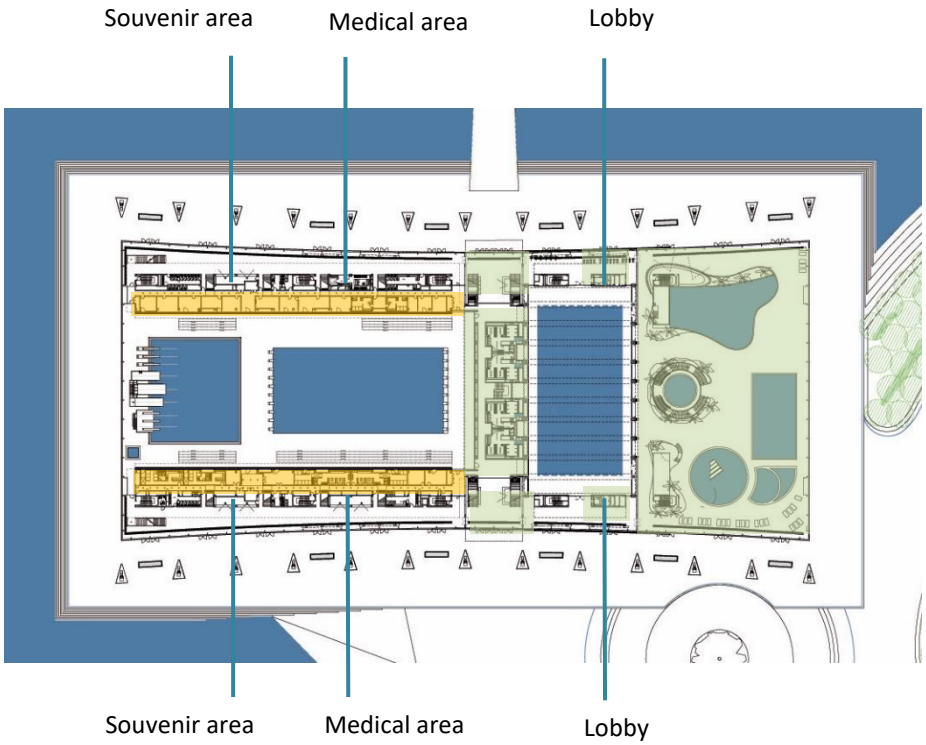
OKU seats spaceare provided at the audiencefloor level.

The corridor laneare very wide in width which can fit the OKU user.

Figure 2.44 Shanghai Oriental Sport
Source: WES Landscape Architecture

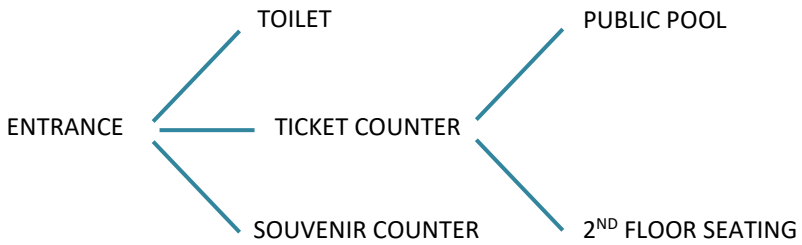
USER BEHAVIOUR AND REQUIREMENTS



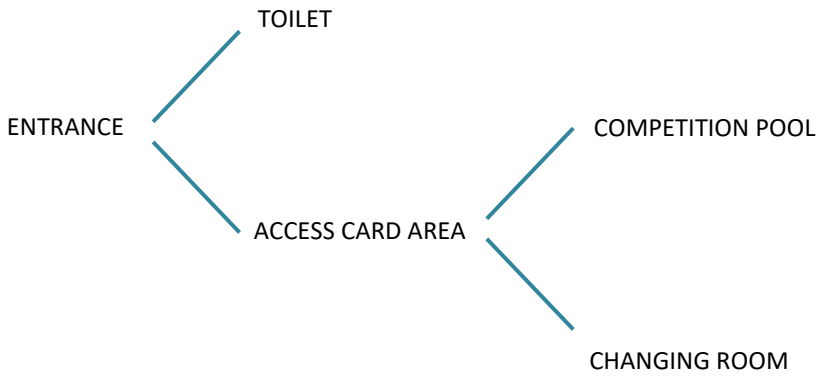


PUBLIC AND ATHLETES ACCESS

PUBLIC ACCESS



ATHLETES ACCESS



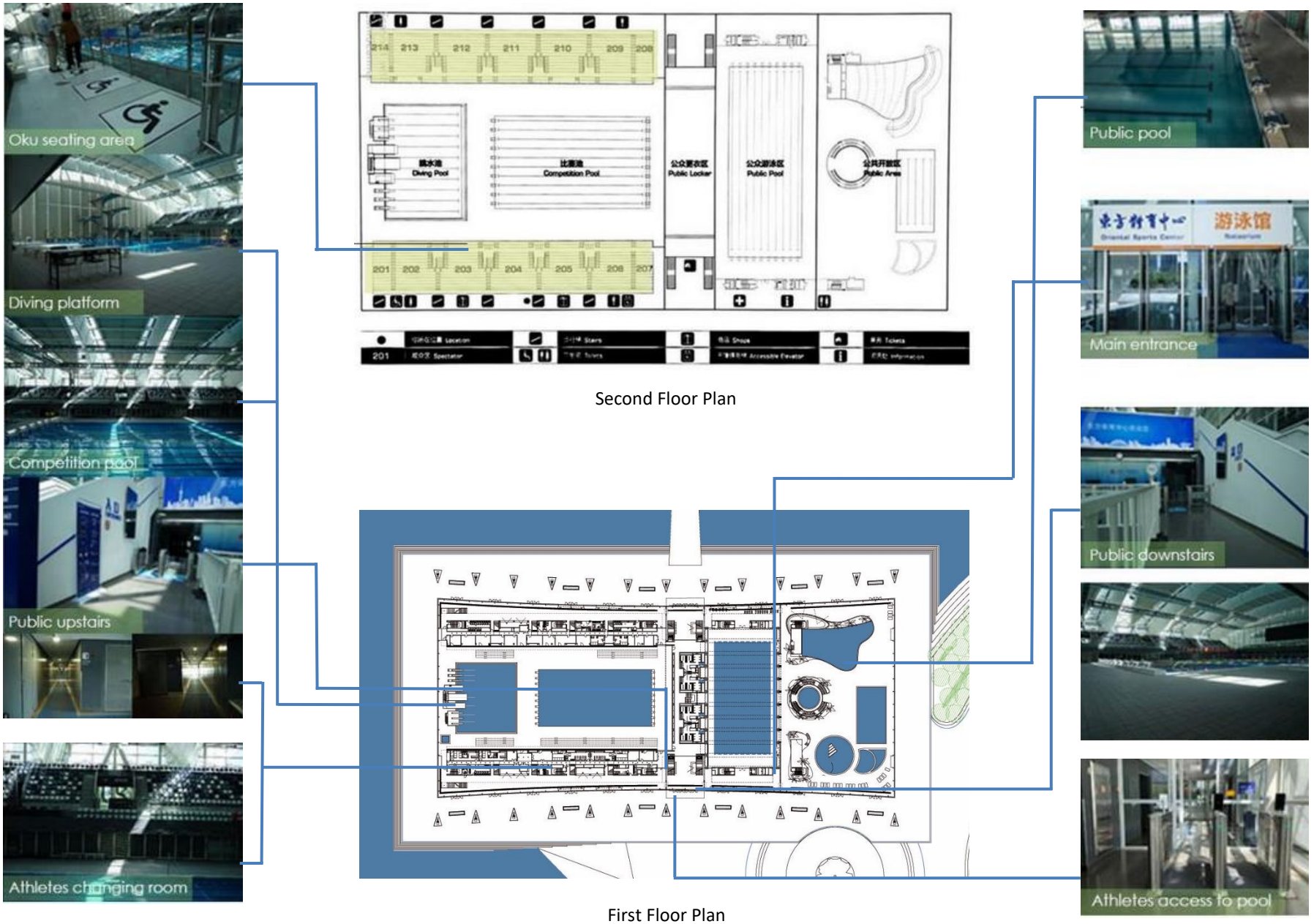
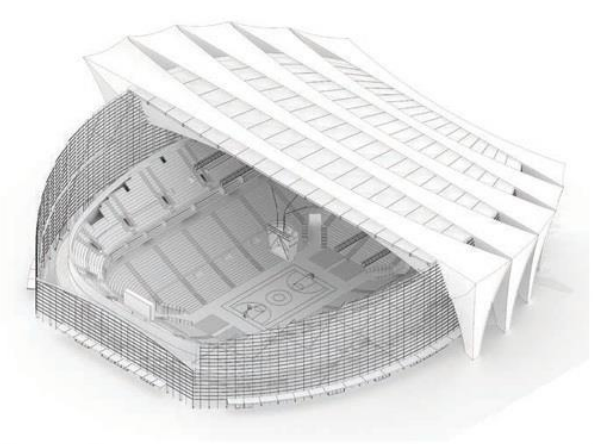


Figure 2.45 Shanghai Oriental Sport Utility Plan
Source: WES Landscape Architecture

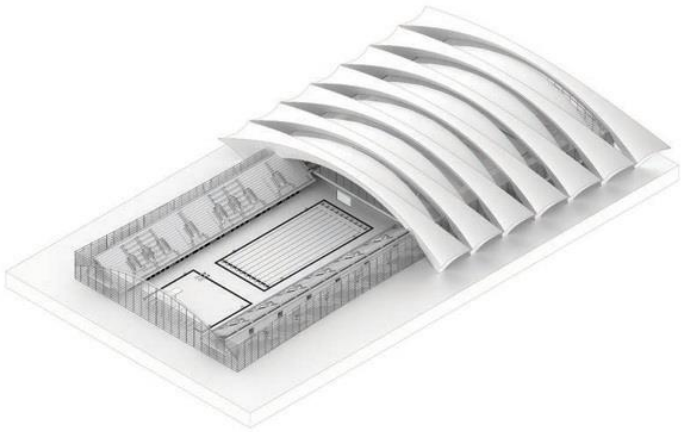
SHANGHAI ORIENTAL SPORTS CENTER

PARAMETRIC DESIGN IMPROVES COORDINATION EFFICIENCY: It was necessary to consult back and forth with the structural engineer, facade consultant. With the parametric model, we could adjust the cladding geometry instantly and visually, which significantly improves the efficiency of the design and coordination, thus the quality of the design.

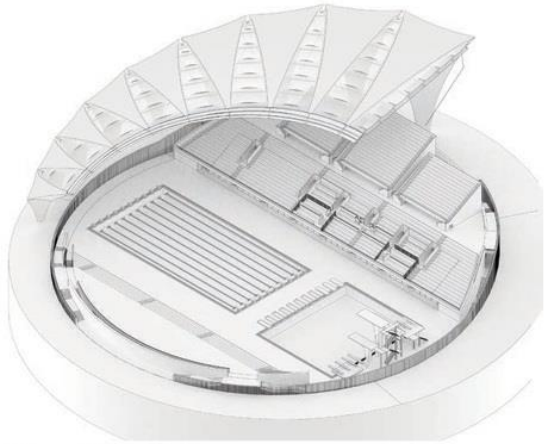
Architectural Axon Drawings



Gymnasium



Natatorium



Outdoor Diving Pool

Photographs

Gymnasium

Natatorium

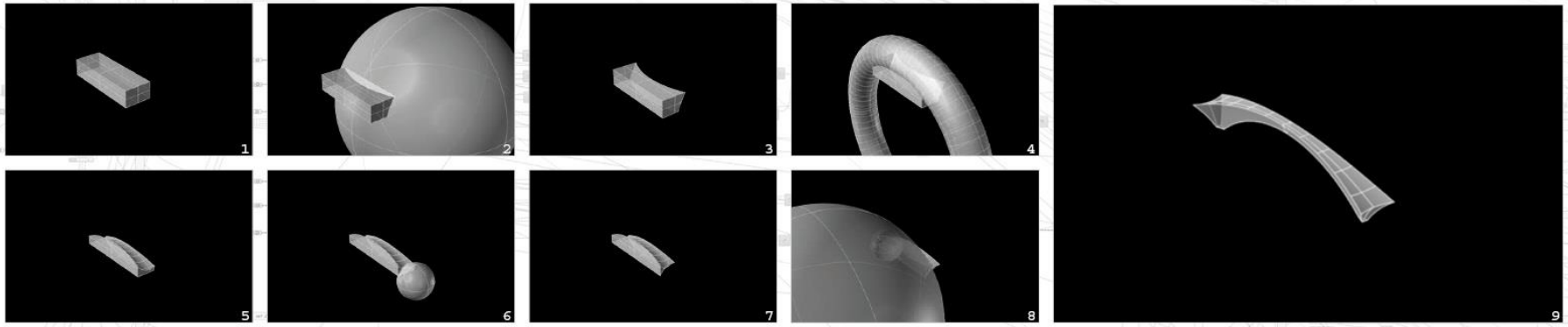
Outdoor Diving Pool

SHANGHAI ORIENTAL SPORTS CENTER

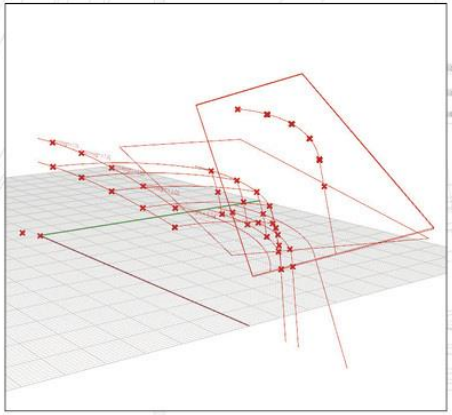
PARAMETRIC FORM FINDING & OPTIMIZATION: In Construction Design phase, we need a more precise 3D-model in which each surface is part of a standard geometry, which has fixed curvature, such as spheres or tubes. Since construction of double-curve-surface requires very expensive steel molds, such method of geometry description will dramatically reduce mold number, thus the construction costs. The mold number and costs are list below (take Natatorium as example):

	Mold Number	Construction Costs for Mold
Free Curvature Surface	= Division Number = 9900	9900x, 78% of total roof construction costs
Describe by Developed Geometry	= Standard Geometry Number = 40	40x, 0.5% of total roof construction costs

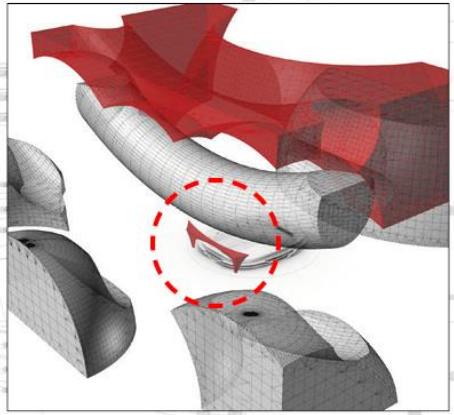
Process of Cutting out One Truss Geometry out of Spheres and Tube



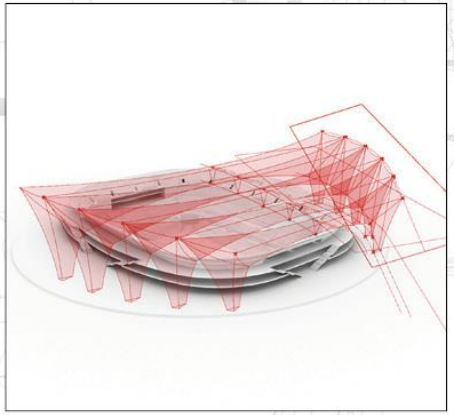
Parametric Modeling Process in *Rhino Grasshopper*



Define Axises & Key Points



Boolean Difference



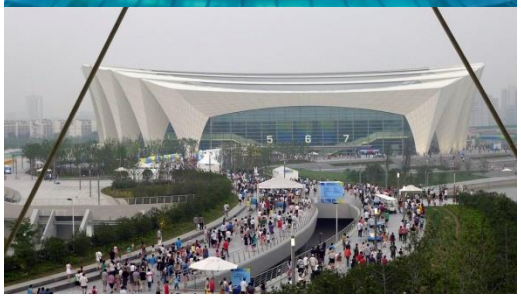
Multi-object Parametric Operation

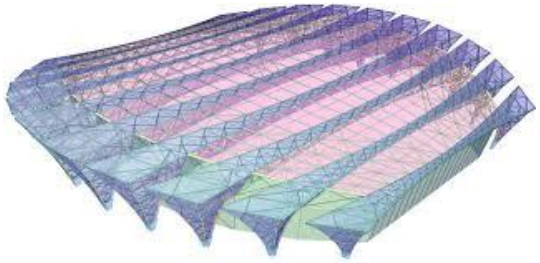
CONCEPTUAL SKETCH OF SHANGHAI ORIENTAL SPORT

The shapes of gymnasium and swimming hall are inspired by Chinese traditional stone arch bridge [21]. Wide-span arch structures are arranged in a row and their surfaces are finished with white color and large triangular alumunium plate, looking like a white sail on the sea. These buildings are separated by water and connected through bridges. When walking among them, people may be impressed with an excellent

A steel structure of wide arches, with large-format triangular elements made of coated alumunium sheet forming the two-sided curved sufaces of identical radius along the frame of the understructure, evokes sails billowing in the wind.

MATERIALS





Direct, intrusive sunlight is forestalled by means of narrow toplights along the beams, without preventing natural daylight.

The roof structure is made of sectional steel girders with triangular glass surfaces and spans over four pools in a row. Roof trusses with a lightweight membrane cantilever above the circular grandstands of the outdoor pool, providing protection against sun and rain.

Hard plastic chair which can be extended from 3500 fixed seats for to 5000 seats for world championship according to FINA requirement.

Glass and steel structure frame for façade and roof.

Hinged joints or pinned joint was a main structure act as a column. Weld steel structure to connect beam and roof griders.

FORM AND FUNCTION

Large basketball arena inside the building with double volume seating area for large viewing.

Large staircase from the natatorium to the main entrance of the gymnasium.

Has large meeting pount area or the pre-function area before enter the main building.

In front of the gymnasium there are grand stairs before enter the main building with some landscaping to give the pleasant view at the area.

- The structure of the façade continuous with the roof structure.
- It is supported by the steel column structure.
- It used steel frame structure to make the façade design.

Main entrance of the Natatorium

Gives natural lighting from the sun and shadow casting from the façade structure.

Grand entrance with the façade act as shading area.

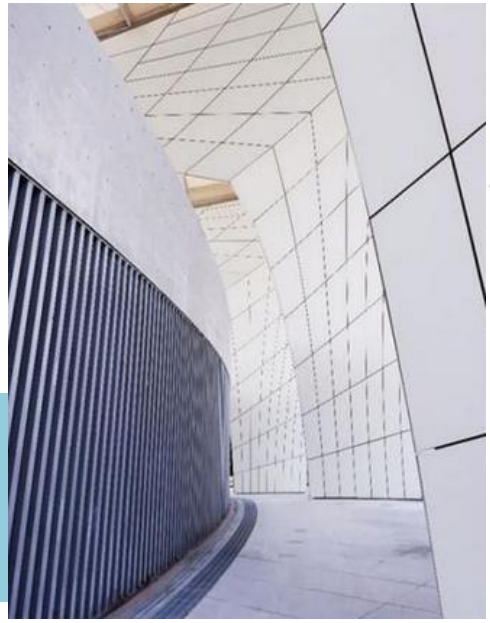
Assembly area before the main entrance with huge gap give more ventilation.

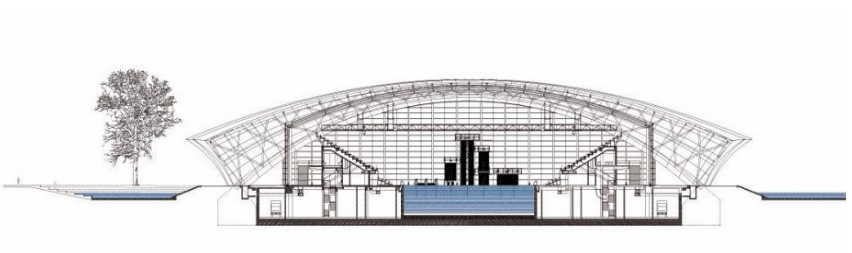
Using steel space frame structure.

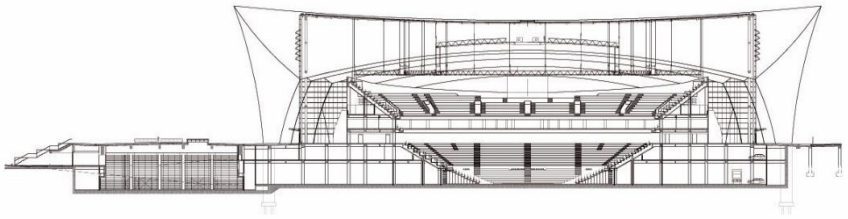
Continuous shapes from the natatorium and gymnasium.

Use as outdoor diving poolthat can fit more capacity of audience.

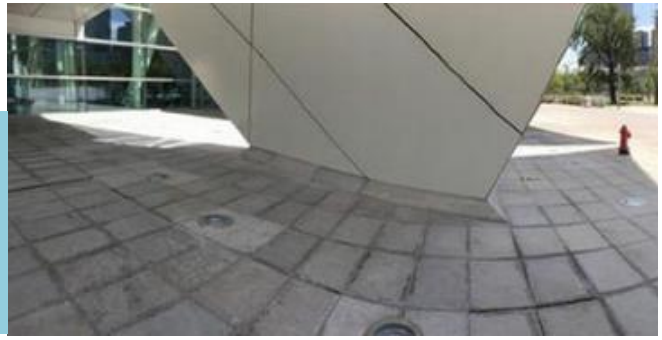
The use of glass as the wall in between building is to give more natural light to pass through. It can reduce the electricity usage of the building.



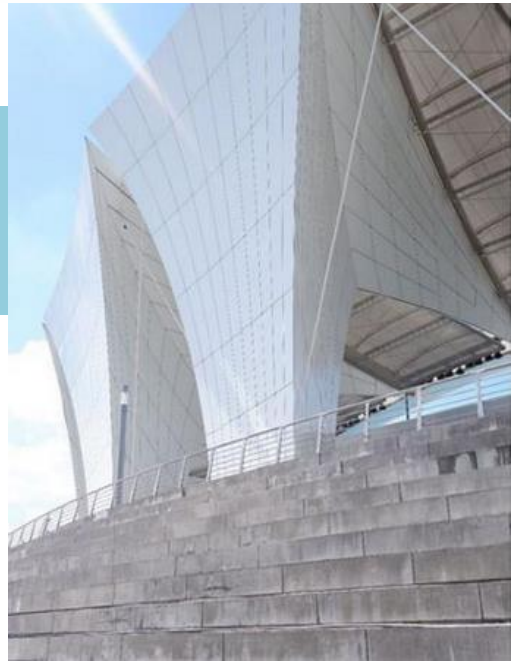




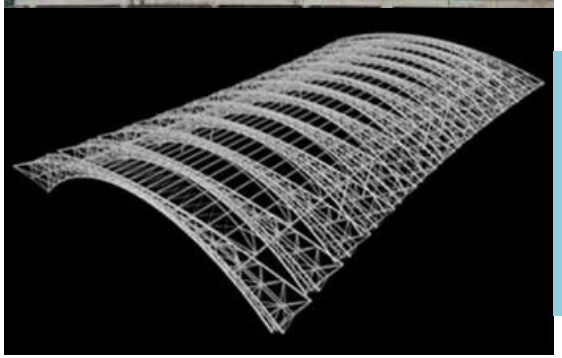
Staircase can also act as seating area for the audience to see the view of lakeside around the building.



They provide spotlight from the ground to enhance the building façade at night and during the event.

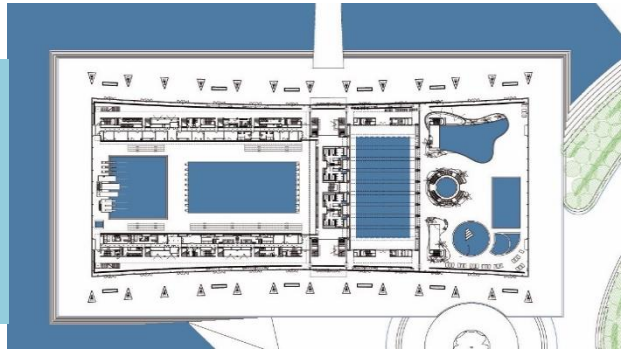


The steel column structure is one of the structure that support the whole building include the space frame structure for the façade and roof.



- Wide gap at the walkway for the audience viewing.
- Easily to see the activity inside the pool from the seating area.
- Give more airyspace for the ventilation in the building.

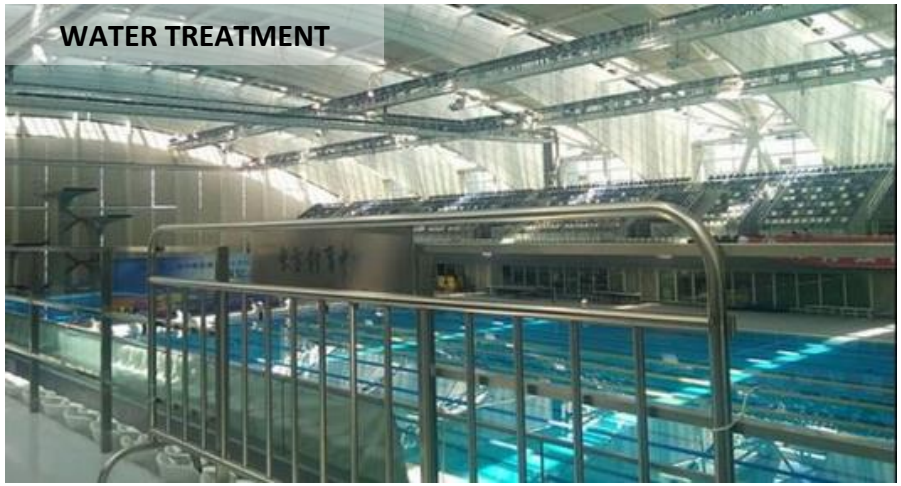
- The repetition of the façade design shows that the main center pool is hierarchy of the building.
- There are pre-function hall before enter the main space (allow visitor to easily pass through the main area while wating).



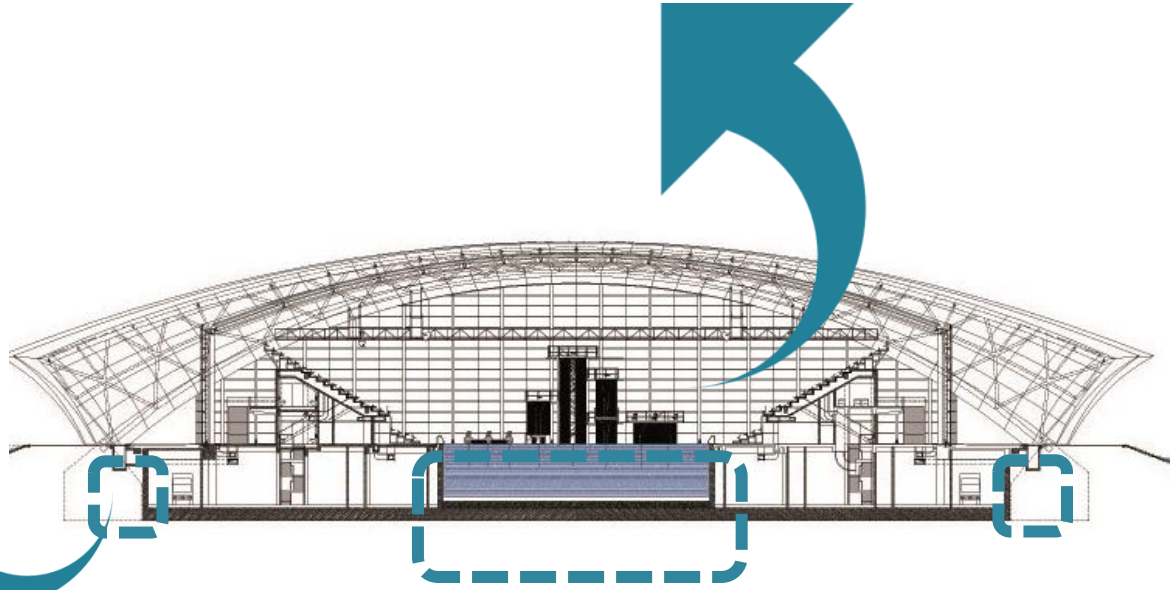
The use of skylight is to capture that natural lighting into the building. It use welded jointing for the connection of structure [22].

- 4 volume height.
- Suitable for the diving board height.
- Larger space that proportion to the audience capacity of the seating area.
- Can fit more audience seating area.


UTILITY AND ENHANCEMENT
Water Supply
Collections
Water Treatment
Electric
Waste Water Treatment


WATER TREATMENT


WATER SUPPLY



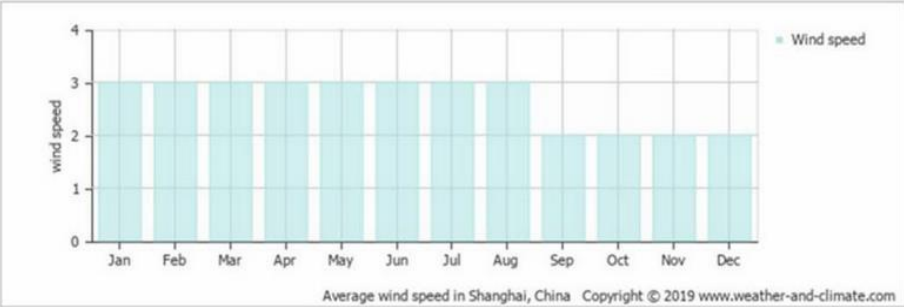
SHANGHAI WEATHER BY MONTH //WEATHER AVERAGES

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	4.3	4.9	8.8	14.4	19.4	23.5	28	27.9	23.9	18.6	12.8	6.9
Min. Temperature (°C)	0.8	1.5	5.2	10.5	15.6	20.1	24.6	24.5	20.5	14.9	8.9	2.9
Max. Temperature (°C)	7.8	8.4	12.5	18.3	23.3	27	31.5	31.4	27.3	22.4	16.8	10.9
Avg. Temperature (°F)	39.7	40.8	47.8	57.9	66.9	74.3	82.4	82.2	75.0	65.5	55.0	44.4
Min. Temperature (°F)	33.4	34.7	41.4	50.9	60.1	68.2	76.3	76.1	68.9	58.8	48.0	37.2
Max. Temperature (°F)	46.0	47.1	54.5	64.9	73.9	80.6	88.7	88.5	81.1	72.3	62.2	51.6
Precipitation / Rainfall (mm)	44	56	73	87	91	168	138	134	133	53	49	40

Between the driest and wettest month, the difference in prepicipation is 128 mm.
The variation in temperatures throughout the year is 27°C.

AVERAGE WIND SPEED OVER THE YEAR

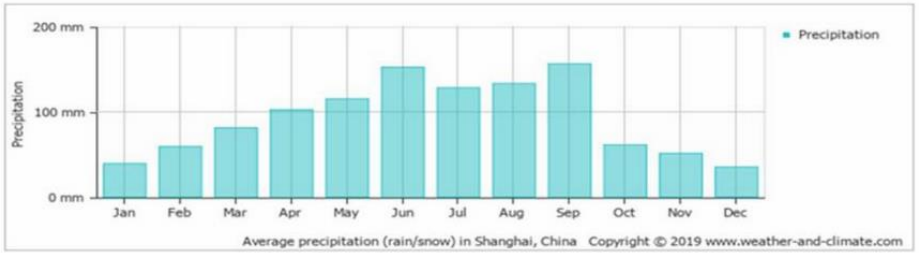
This is the mean monthly wind speed (meters per second).



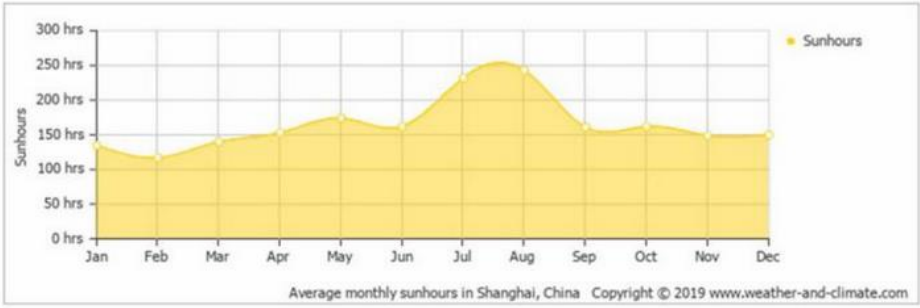
AVERAGE MONTHLY HOURS OF SUNSHINE OVER THE YEAR

AVERAGE MONTHLY PRECIPITATION OVER THE YEAR (RAINFALL AND SNOW)

This is the mean monthly precipation, including rain, snow, etc. Show in Inchess »

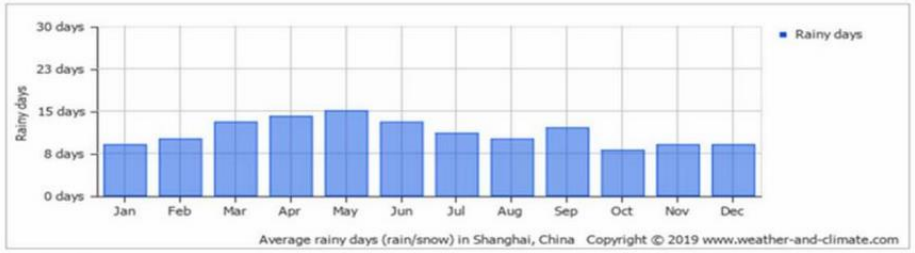


This is the monthly total of sunhours.



AVERAGE MONTHLY RAINY DAYS OVER THE YEAR

This is the number of days each month with rain, snow, etc.



The sinuous volume – a gymnasium , natatorium and outdoor pool – are visually connected through a series of man-made ponds and islands. Dictated by the shapes of the buildings, the calm and reflective water seeks to integrate the divided sites and alludes to a much more natural environtent.

CLIMATE AND ENVIRONTMENT

Figure 2.46 Garden by the Bay Site Plan
Source: ArchDaily

Gardens by the Bay / The Gardens

Name of Object	: Garden by the Bay
Architects	: Grants Assosiates
Location	: Singapore
Area	: 101 Ha
Project Year	: 2012
Manufactures	: Marcus Bredt

This project is an integral part of Singapore's "City in a Garden" vision, designed to raise the profile of the city globally while showcasing the best of horticultural and gardening arts [23].

Taking inspiration from orchid shapes, the Grant Associates master plan is a rich blend of stewardship of nature, technology and the environment. The stunning architectural structure is combined with a wide variety of horticultural displays, daily light and sound shows, a lake, forest, event space and a number of dining and retail offerings. The whole plan has a smart environmental infrastructure, allowing endangered plants, which normally cannot be grown in Singapore to thrive, providing free time and education for the nation.

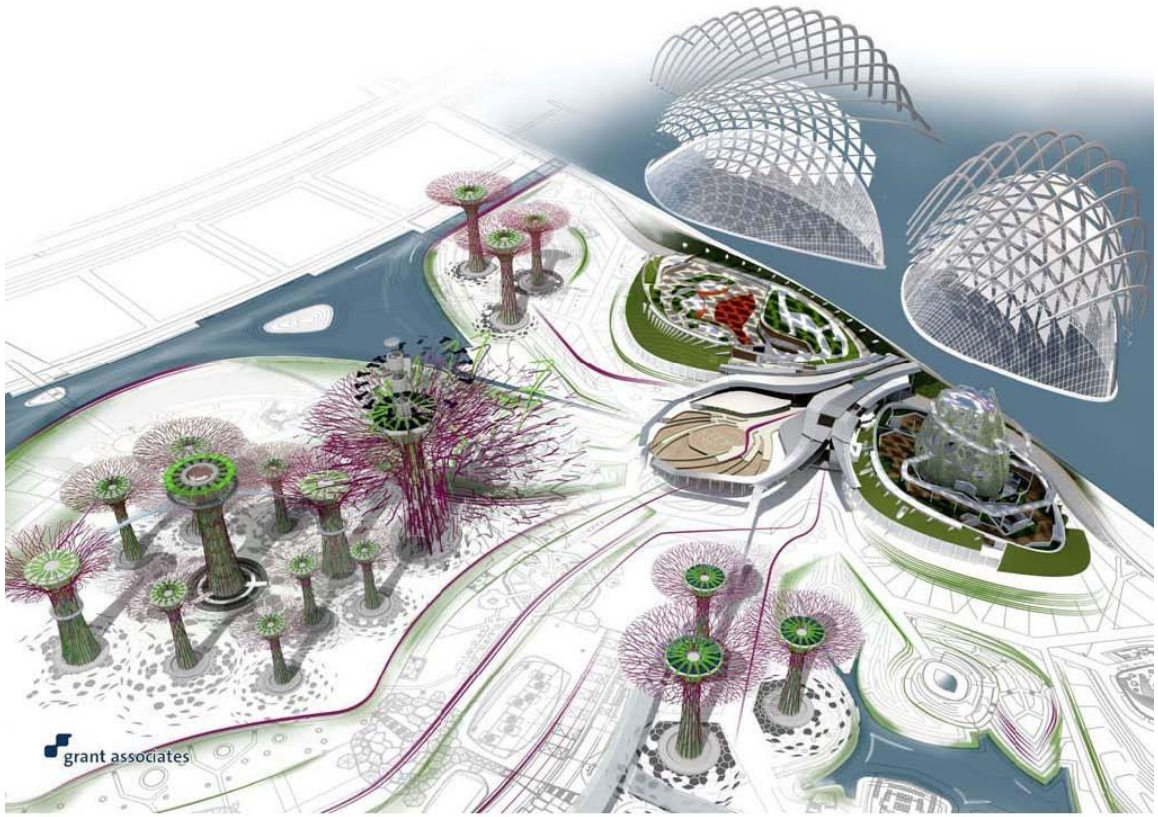


Figure 2.47 Garden by the Bay Perspective
Source: ArchDaily

The highlights of Gardens by the Bay are many and include [24]:

1. Cooled Conservatory

   Two gigantic biomes designed by Wilkinson Eyre Architects - the Flower Dome (1.2 hectare) and the Cloud Forest Dome (0.8 hectare) - showcase plants and flowers from the Mediterranean type climate region and the Tropical Montane (Cloud Forest) environment and provide an all-inclusive weather "edutainment" space inside the garden.

2. Super tree

   Between 25 and 50 meters in height, the 18 Supertree designed by Grant Associates is an iconic vertical garden, with an emphasis on creating the “wow” factor through vertical displays of tropical flowering plants, epiphytic plants and ferns. At night, this canopy comes alive with projected lighting and media. The Supertrees' suspended aerial walkways offer visitors a unique perspective on the park. Supertree is equipped with sustainable energy and water technology integrated with Cooled Conservatories cooling.

3. Horticultural Garden

   Two collections of The Heritage Gardens and The World of Plants are centered on 'Plants and People' and 'Plants and Planet'. Together with mass flowering and landscapes of colored foliage, they form a spectacle of color and texture and fragrance within the garden, providing a dazzling experience for visitors.

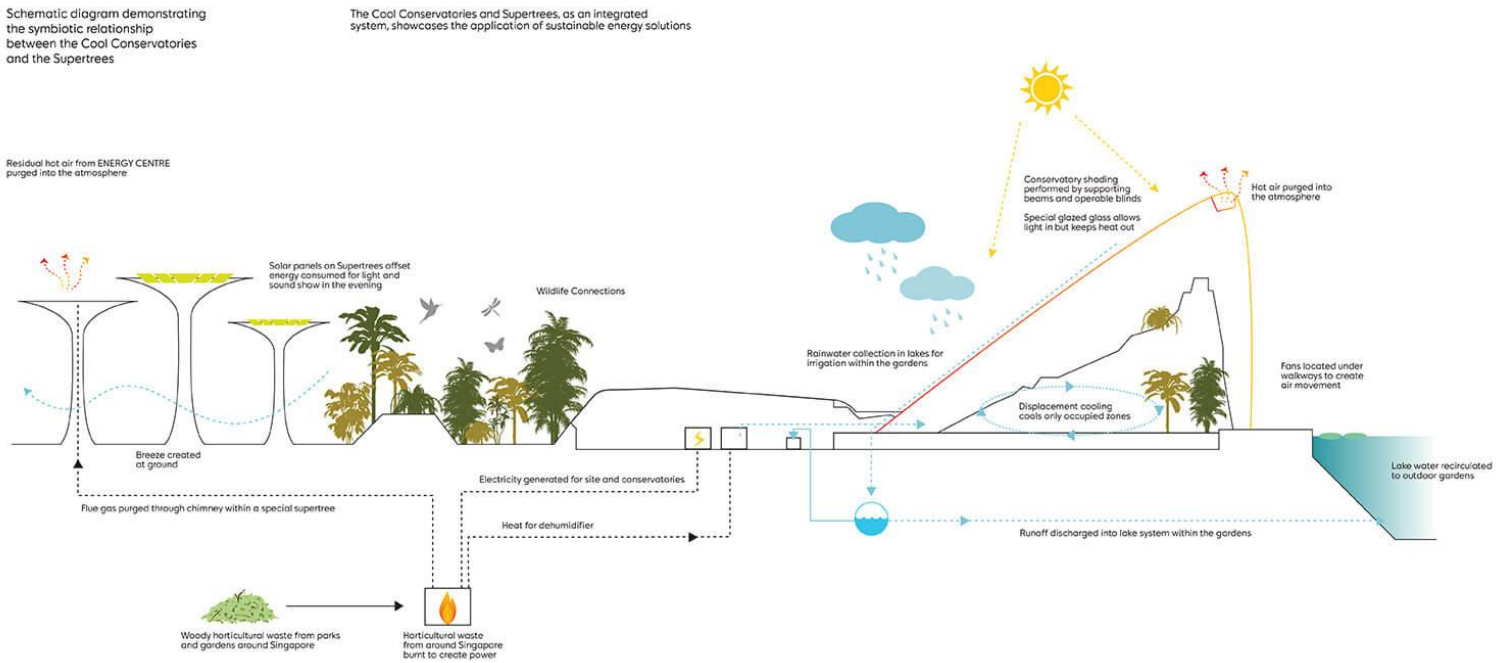


Figure 2.48 Garden by the Bay Utility System
Source: ArchDaily

WATER SUSTAINABILITY SYSTEM

The lake system depicts the role and importance of plants in the healthy functioning of our ecosystem. It raises awareness of the value that aquatic plants play in nature, and highlights the significance of clean water in sustaining biodiversity [25].

Filtering of water run-off

Filter beds, comprising of aquatic reeds, and wetlands are located where water enters and discharges from the lake system. Water flow is reduced and sediments are filtered out.

Reducing nutrient load

Islands of aquatic plants and reed beds are incorporated to absorb nutrients such as nitrogen and phosphorus in the water. A reduction of nitrogen levels is critical to minimising alga bloom and ensures better water quality.

Maintaining an aquatic ecosystem

Habitats for fish and dragonfly are created within the lake system by maintaining a diversity of aquatic plants, good water circulation and aeration. This keeps in check potential problems such as mosquito breeding.

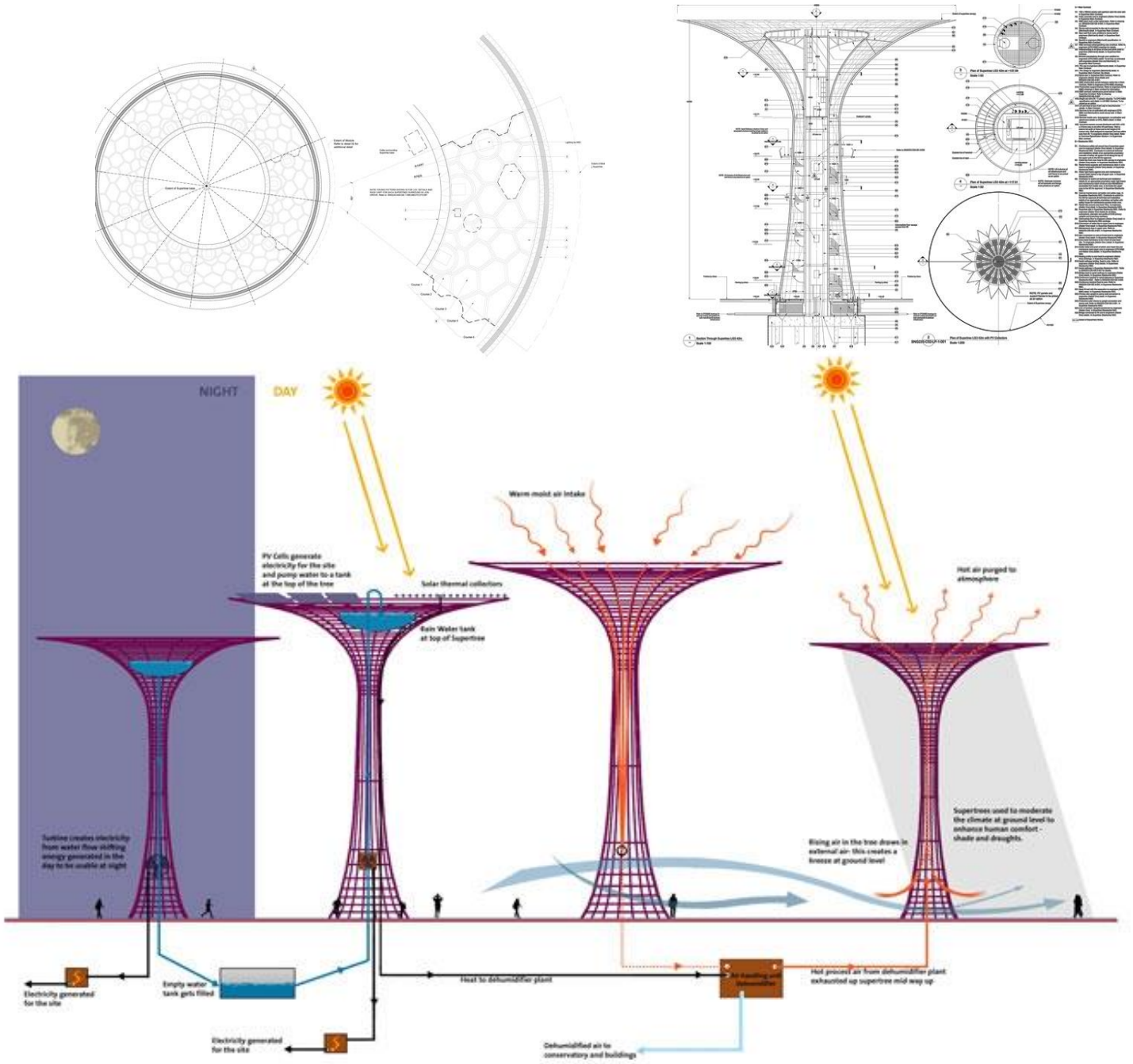


Figure 2.49 Garden by the Bay Solar System
Source: ArchDaily

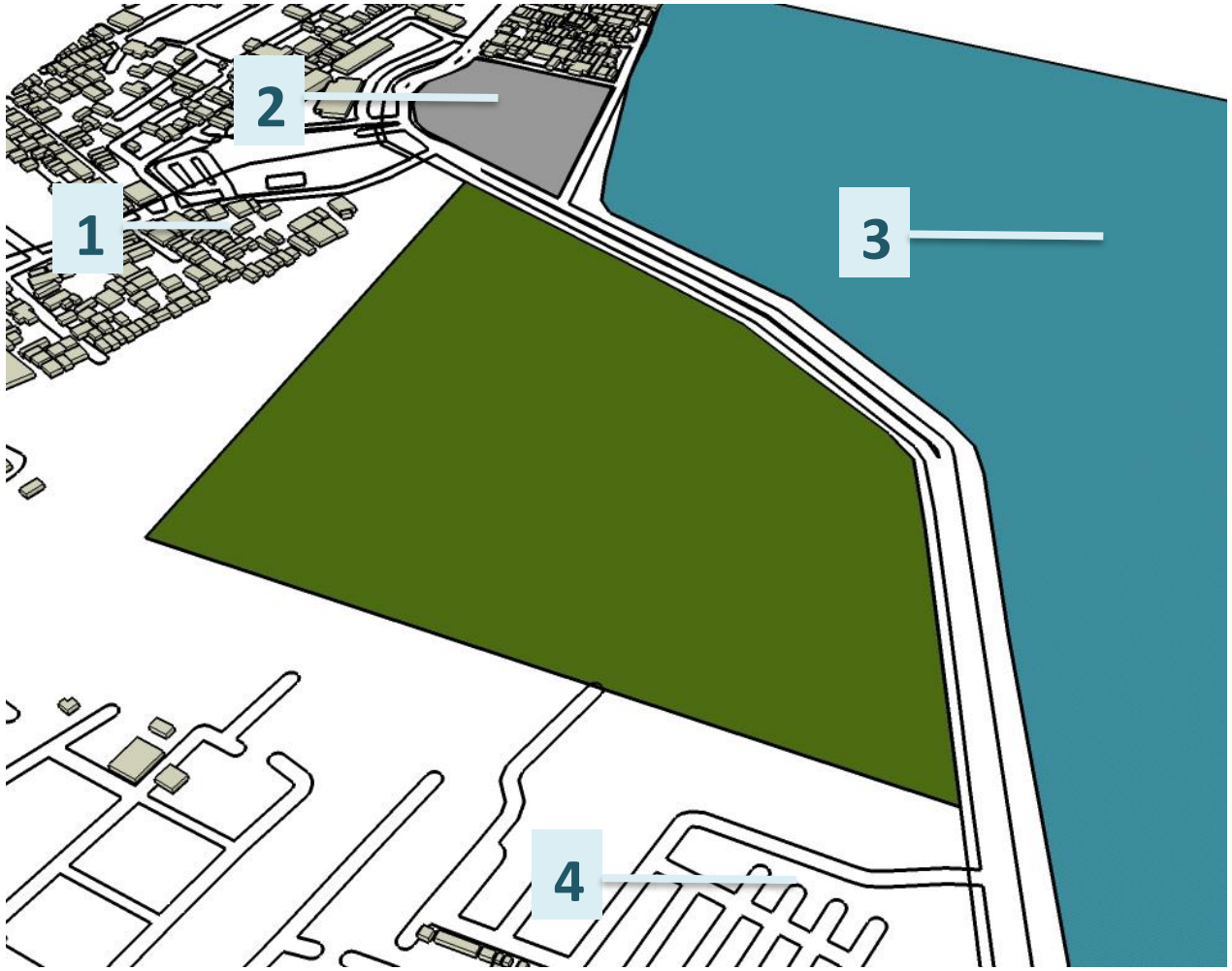
Minimising Solar Heat Gain

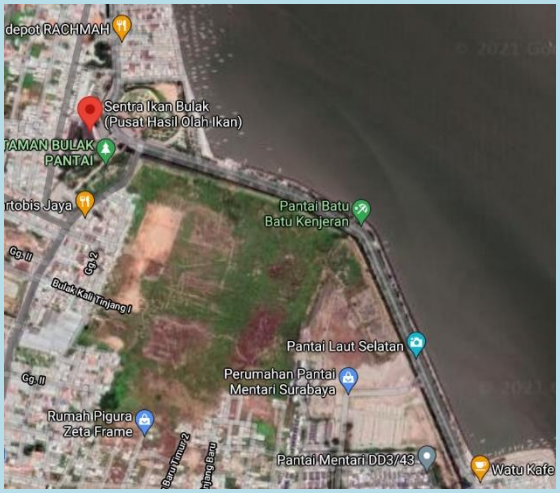
The two conservatories are fitted with specially selected glass that allows optimal light in for plants, but reduces a substantial amount of heat. The roof is fitted with a sensor-operated retractable sails that opens automatically to provide shade to the plants when it gets too hot.

Cooling only the occupied zones

The Conservatories apply the strategy of cooling only the lower levels, thus reducing the volume of air to be cooled. This is achieved through thermal stratification – ground cooling by chilled water pipes cast within the floor slabs enabling cool air to settle at the lower occupied zone while the warm air rises and is vented out at high levels.

REGIONAL DATA





The location of the Aquatic Sport Center site is at Sukolilo 7 St. City of Surabaya, East Java. In general, the area is a tourism development area, sports, trade and environmental conservation. Many people carry out activities that make the area densely populated. The Kenjeran area is dominated by fishermen and traders. There are various infrastructure developments for tourism, trade and transportation locations such as Kenjeran Park, Bulak Fish Center and Suramadu Bridge in the area. The location of the young Aquatic Sport Center is accessed and included in the Kenjeran tourism linkage. In addition, the location is strategic to highlight the landscape of the Watu-Watu Kenjeran beach.

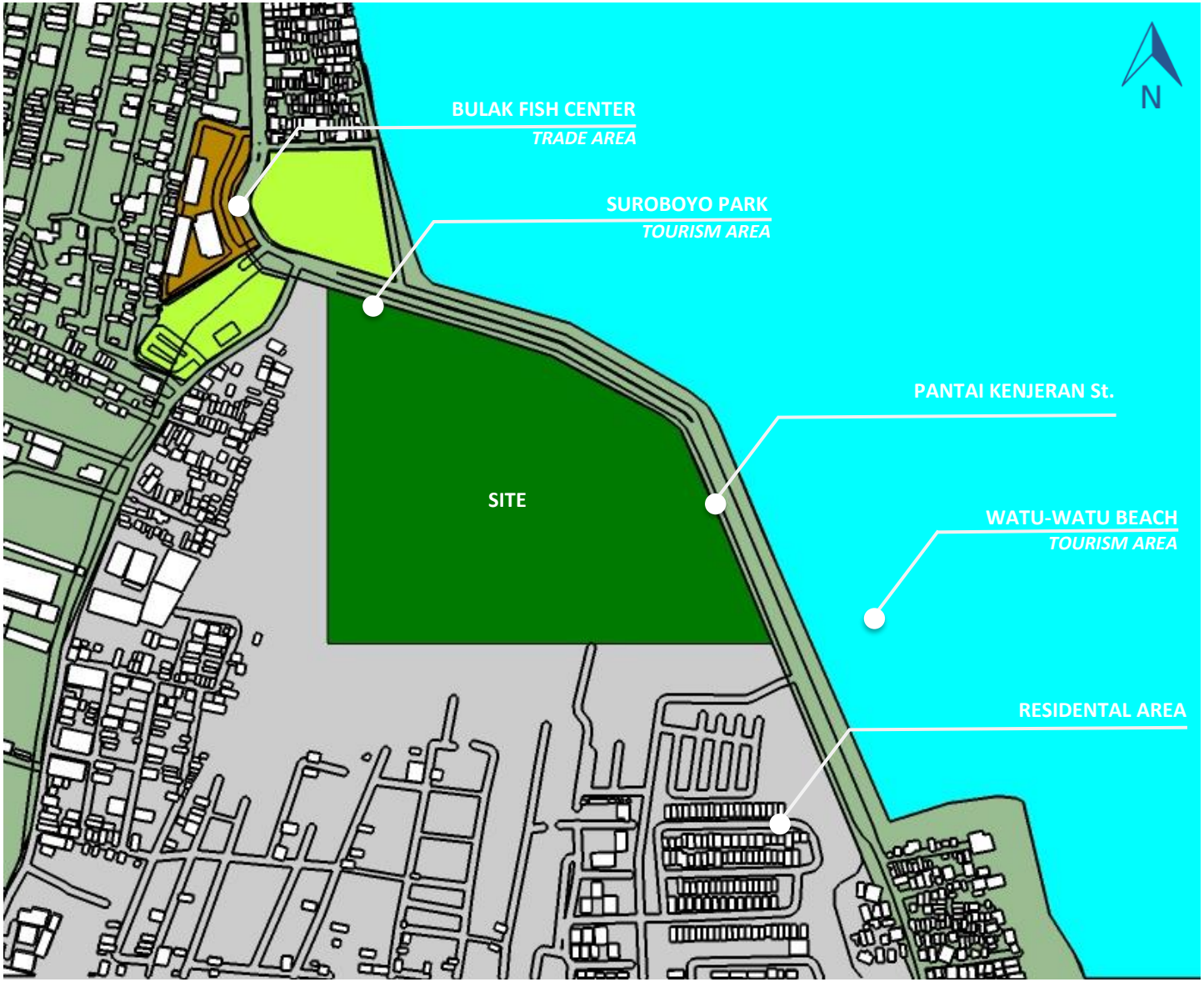
1


2


3


4


Figure 2.50 Regional Data
Source: Author, 2021


BULAK FISH CENTER
TRADE AREA
SUROBOYO PARK
TOURISM AREA
PANTAI KENJERAN St.
SITE
WATU-WATU BEACH
TOURISM AREA
RESIDENTAL AREA
N


SENTRA IKAN BULAK


taman
suroboyo

SITE DATA

Figure 2.51 Site Data
Source: Author, 2021

EDGES

Area **: 90.698,15 m^2**
Periphery **: 1,32 km**

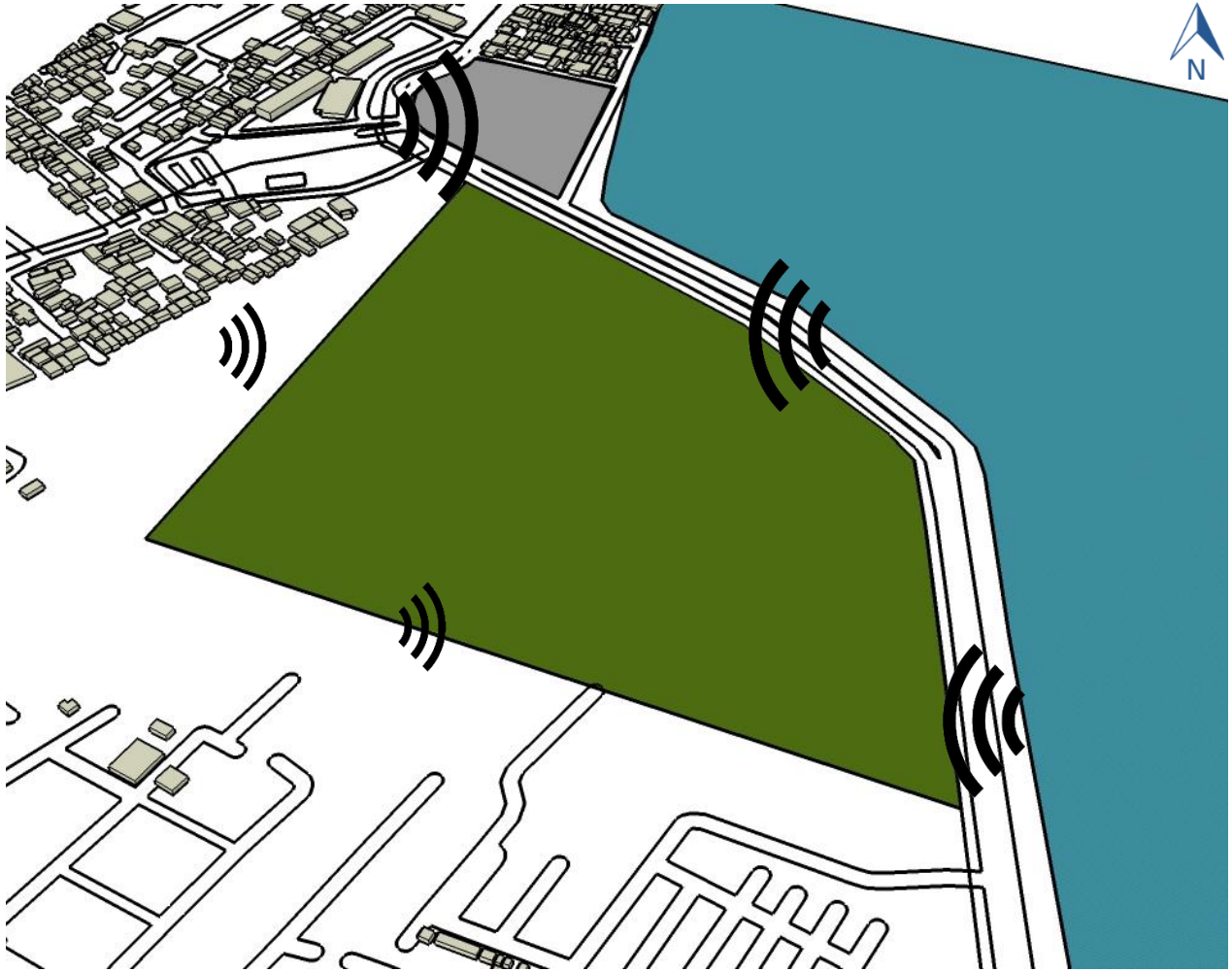
The site is in a strategic place close to the main road, the location of the site gets a wide view of the sea landscape. The area is always busy with residents' activities as fishermen and traders. There are many eco-based attractions in the vicinity. Integrated with Kenjeran and Surabaya city icons.

NORTH
Bulak Fish Center, Fisherman's Village, Suroboyo Park and Bulak Park.

EAST
Watu-watu Beach and Sea.

SOUTH
Pantai Mentari Housing.

WEST
Residential.



NOISE

NORTH
High noise, the source of noise comes from the activities of fishermen, traders and tourists.

EAST
High noise, the source of noise comes from the activities of fishermen, transportations, traders and tourists.

SOUTH
Low noise, not much activity in Pantai Mentari housing.

WEST
Middle noise, children activity in residential and Bulak Park.

Figure 2.52 Site Data of Noice
Source: Author, 2021

VEGETATION

1

Shrubbery.

2

3

Petai Tree.

RIVER POTENTION

Figure 2.53 Site Data of Vegetation
Source: Author, 2021

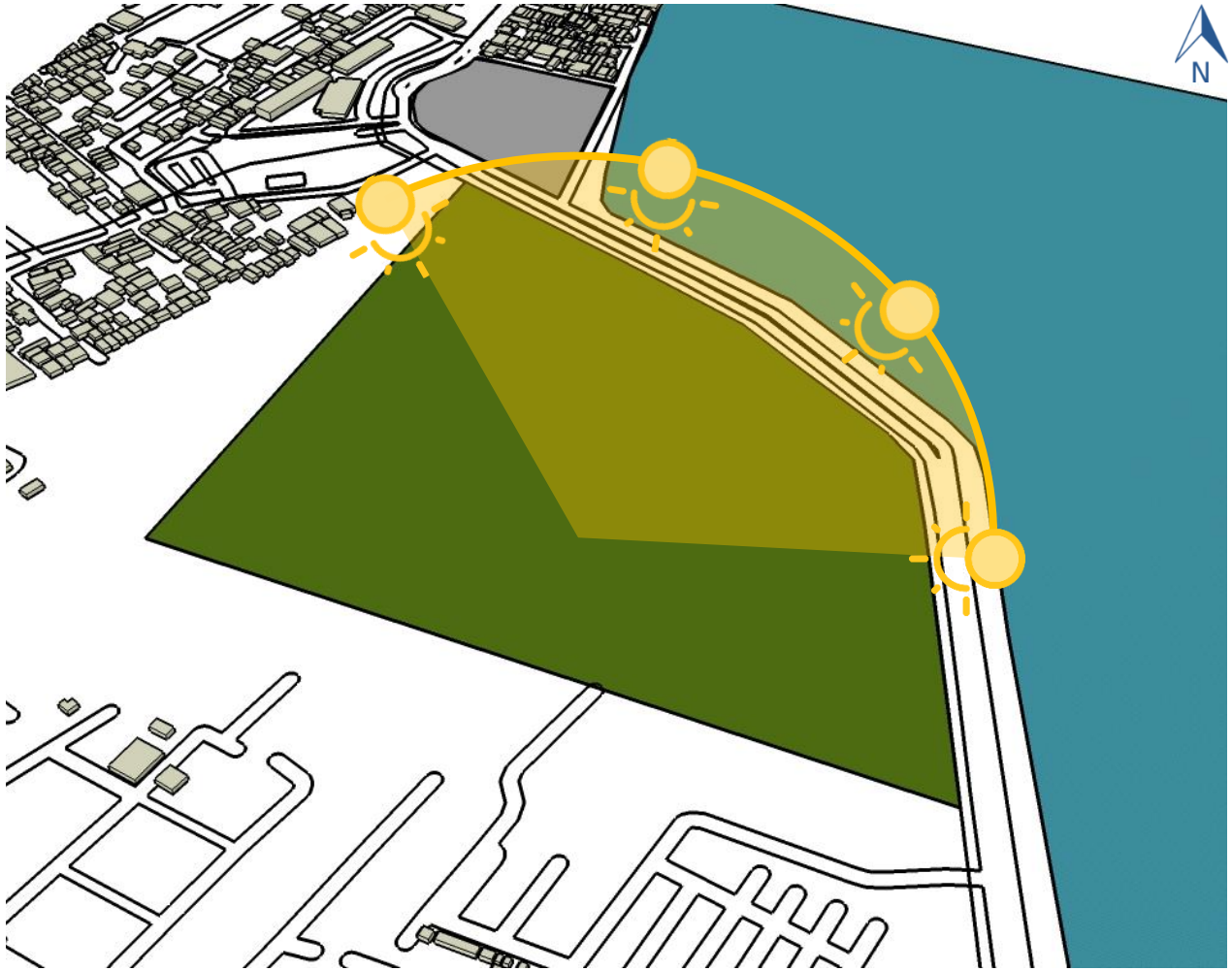


Figure 2.54 Site Data of Sun Path
Source: Author, 2021

SUN PATH

NORTH
Full sun because it is not blocked by any building.

EAST
The sun is full, only when the sun rises until 09.00 WIB it is blocked by trees from across the road.

SOUTH
Full sun because it is not blocked by any building.

WEST
Full sun because it is not blocked by any building.

Figure 2.55 Site Data of Wind
Source: Author, 2021

WIND

NORTH
The wind blows from the sea to the land. The wind speed is high because it is not blocked by anything.

EAST
The wind blows from the sea to the land. The wind speed is high because it is not blocked by anything.

SOUTH
The wind speed is low because it is blocked by resindential.

WEST
The wind speed is low because it is blocked by shrubbery.

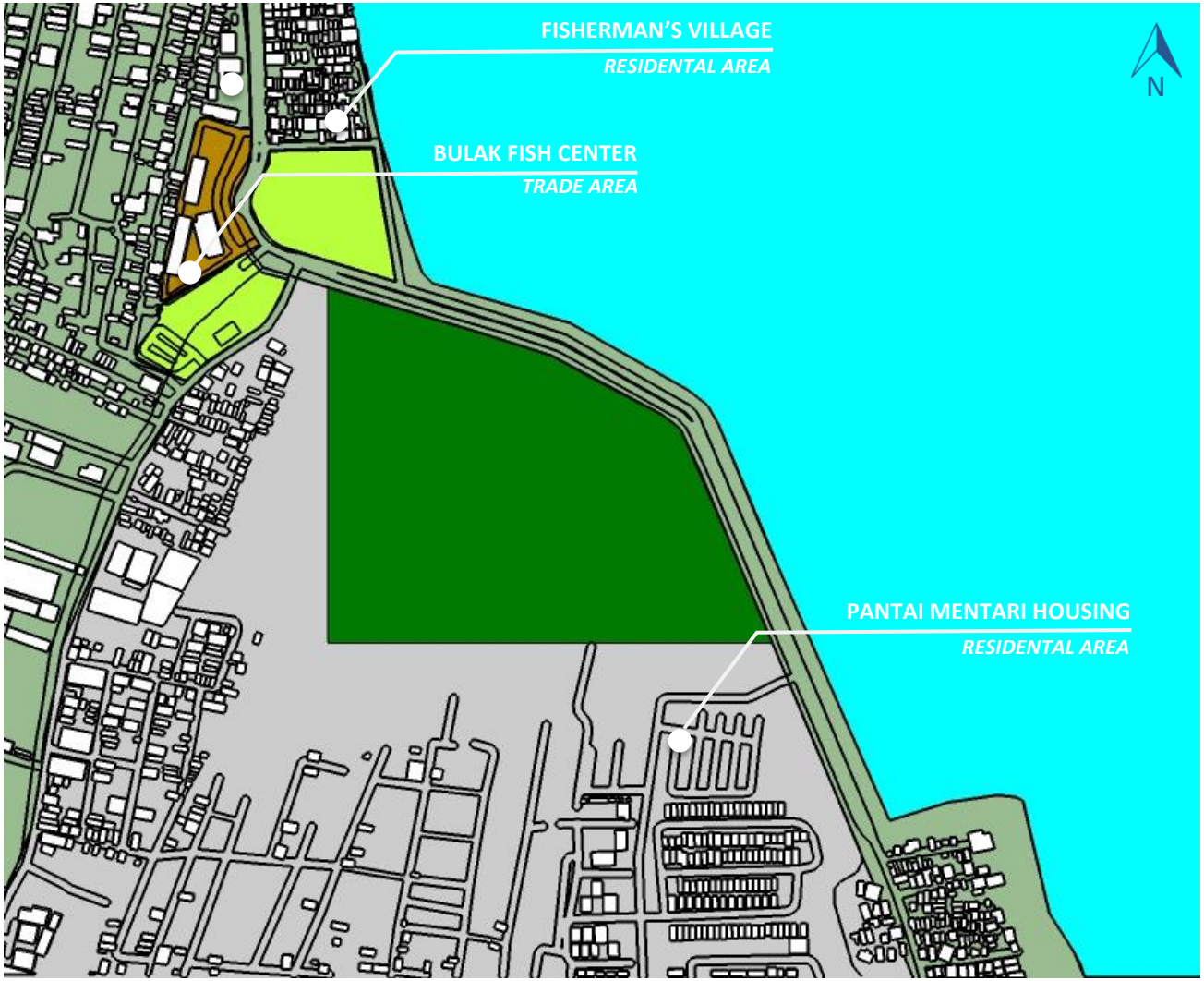


Figure 2.56 Site Data of Social and Economy
Source: Author, 2021

SOCIAL AND ECONOMY

BULAK FISH CENTER
The social conditions of the people around Kenjeran beach mostly work as fishermen and traders, besides that there are many tourist activities that help the local economy. The Bulak fish center is a building facility for collecting fisherman products and as a main market for the distribution of local fishermen's products.

PANTAI MENTARI HOUSING
Pantai Mentari Housing is a real estate that wants to support the economy in the residential sector so that the local economy is more advanced, this housing is the largest housing estate in the area.

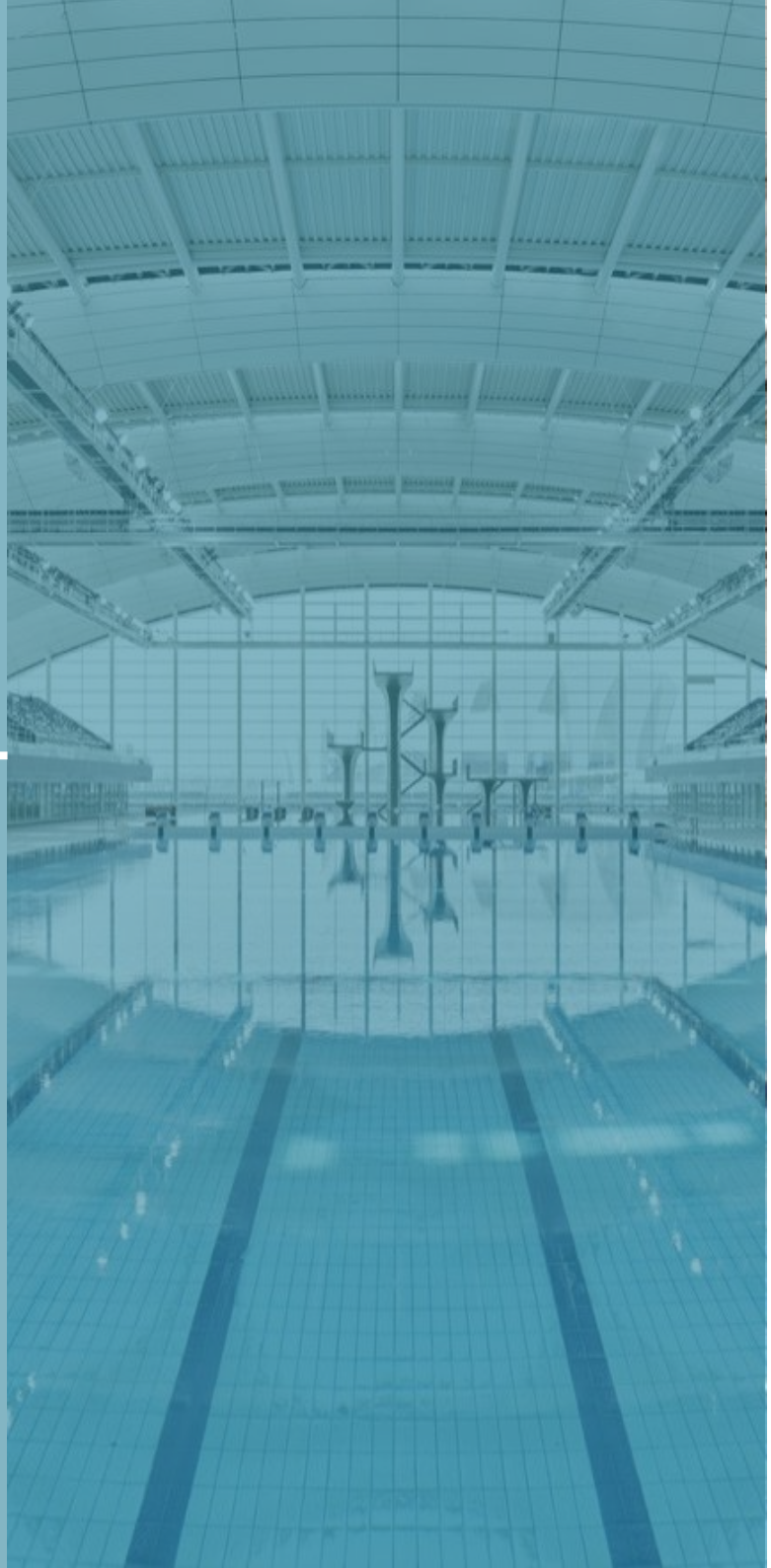
FISHERMAN'S VILLAGE
Kenjeran Fisherman's Village is a village inhabited by local residents who work as fishermen and is located on the coast with many boats across the village, now the fishing village has become a thematic village, namely the colorful village that is the icon of the village.

VIEW OUT

VIEW IN

RIVER POTENTION

DESIGN PROCESS



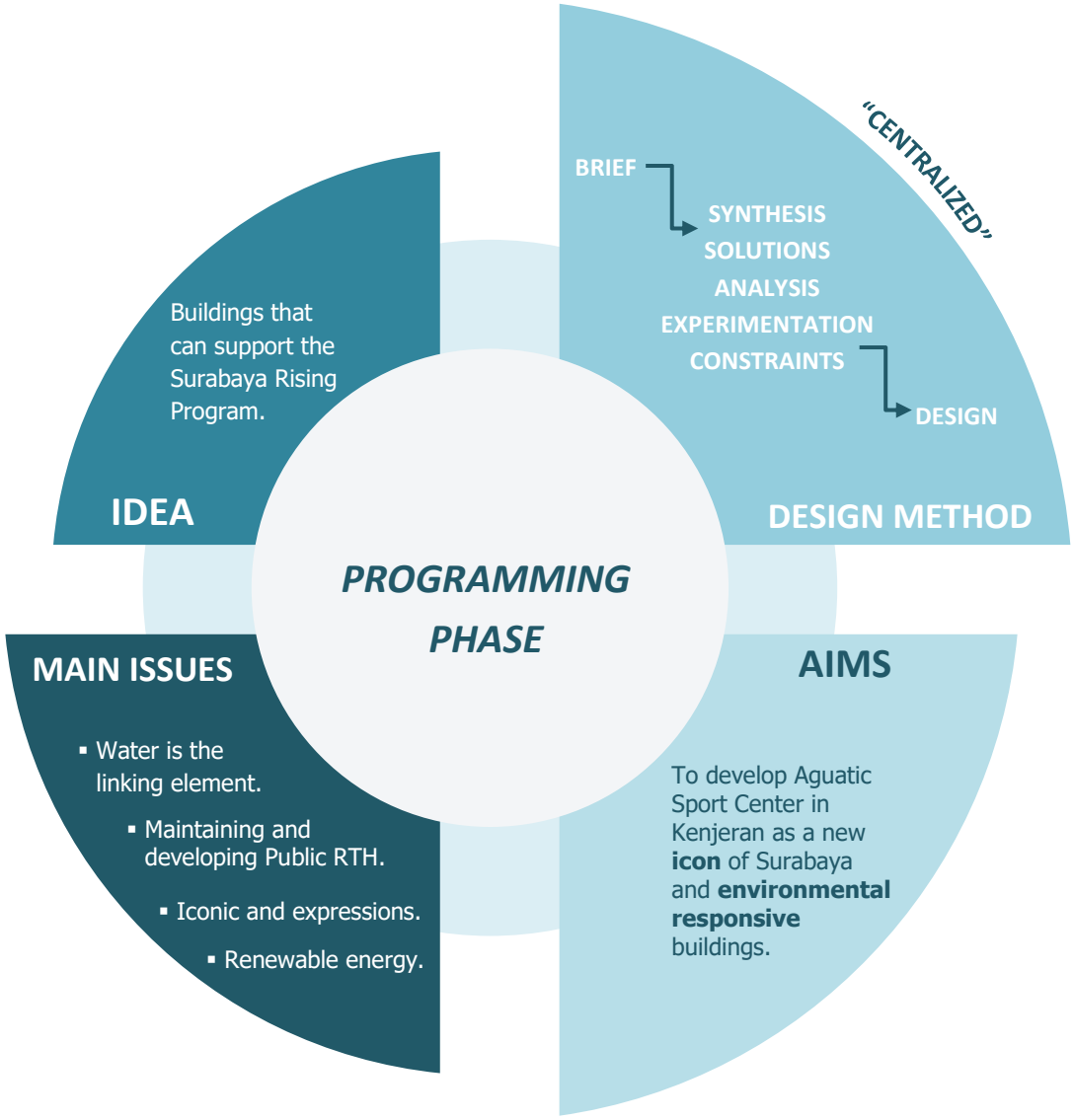


Figure 3.1 Scheme Diagram of Programming Phase
Source: Author, 2021

TOOLS

Eco-tech: Sustainable Architecture and High Technology by **Catherine Slessor 1997.**

Incremental (centralized) design process strategy by **Jones & Lawson.**

PRE-DESIGN PHASE

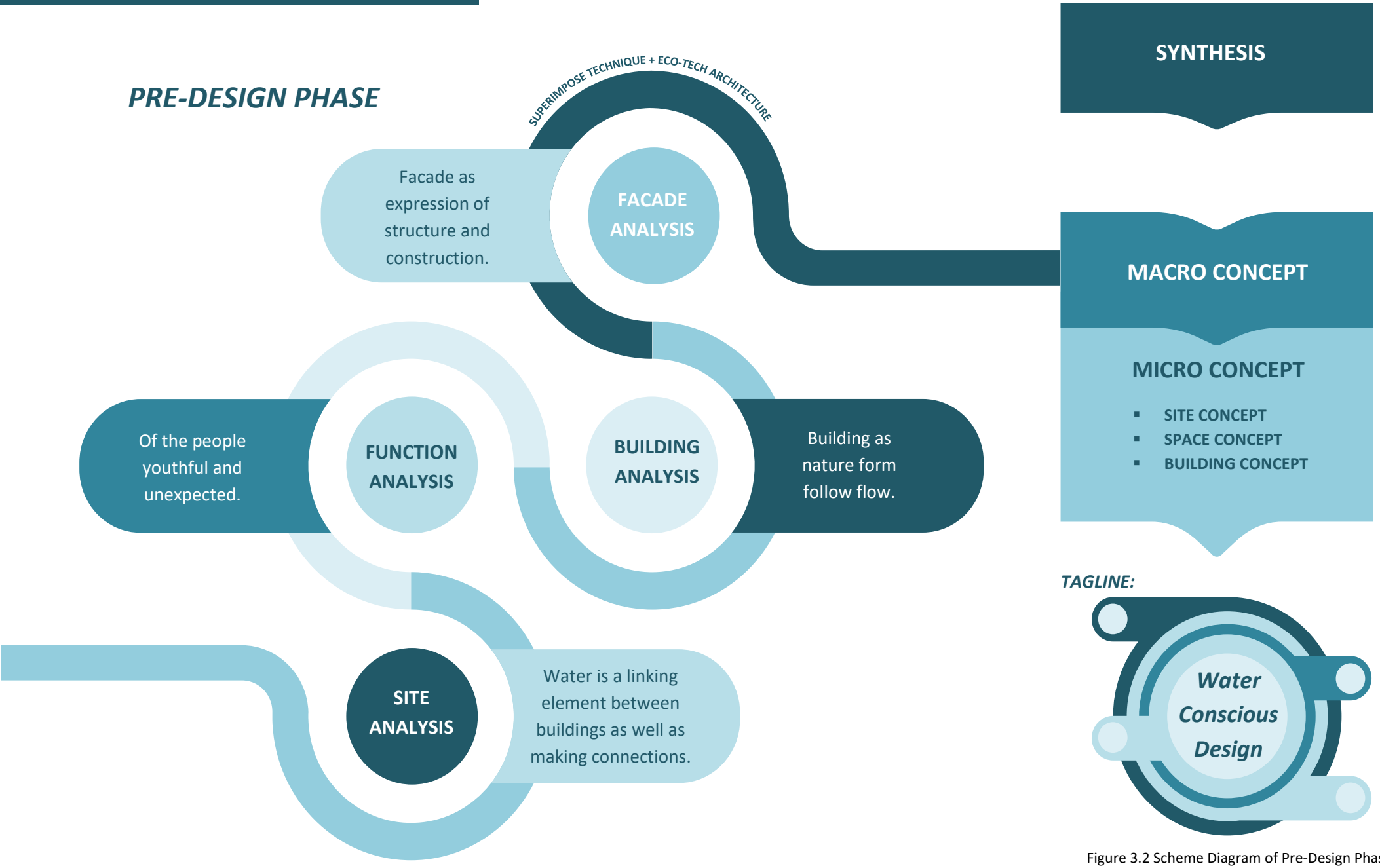


Figure 3.2 Scheme Diagram of Pre-Design Phase
Source: Author, 2021

TOOLS: Redmi Note 7 Pro, Asus Zenbook Duo, Drawing Pen, Pencil 2B, Sketchbook, Eco-Tech Architecture Principle

DESIGN PHASE

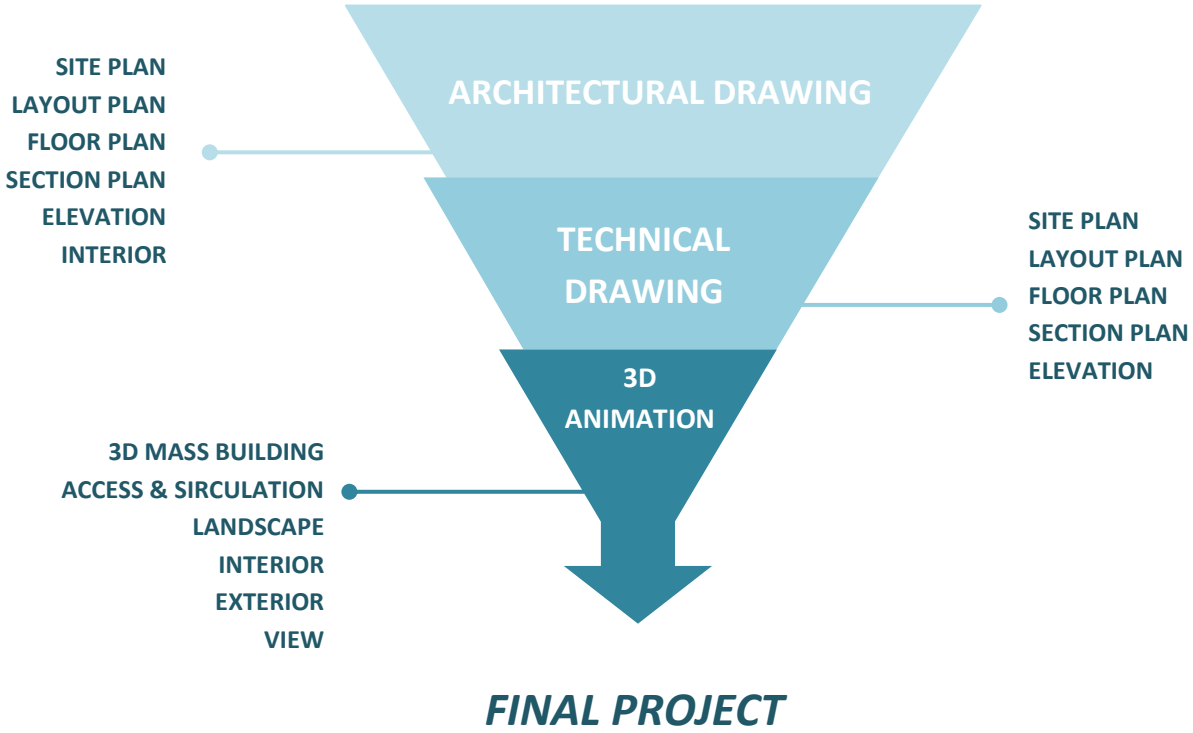


Figure 3.3 Scheme Diagram of Design Phase
Source: Author, 2021

The design process stems from issues that exist in the site area as a design limitation to be designed.

All issues and potentials that have been analyzed produce a relevant architectural approach.

The results of the analysis process are combined to form a complete concept, then the concept will be developed into a perfect design.

TOOLS: Sketch Up, AutoCAD, Lumion, V-ray, Adobe Premiere, Adobe Photoshop, Corel Draw, Stationary, etc.

BASIC IDEA

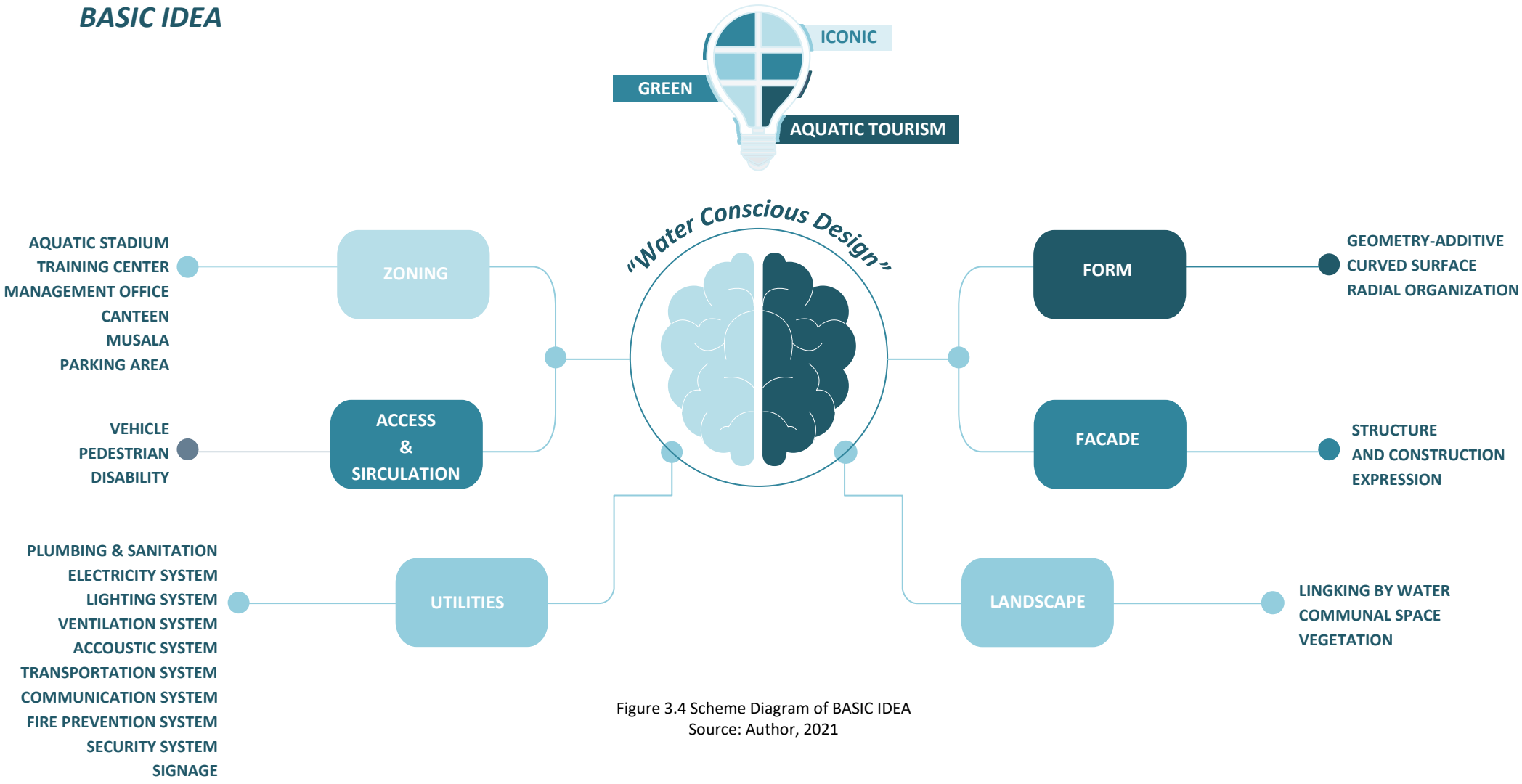


Figure 3.4 Scheme Diagram of BASIC IDEA
Source: Author, 2021

WATER CONSCIOUS DESIGN

WATER EXPLORATION AS A BUILDING CONNECTOR AND AS A MAIN ELEMENT THAT IS POSSIBLE IN UTILITY SYSTEMS OR LANDSCAPE

.

ZONING IDEA

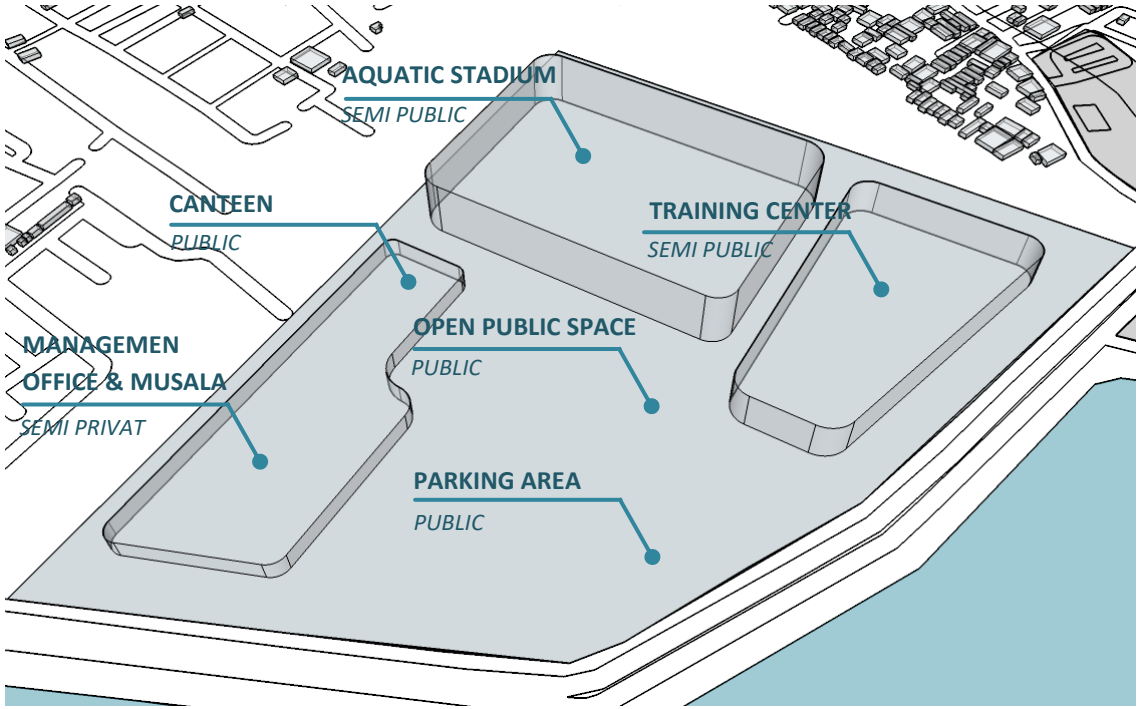
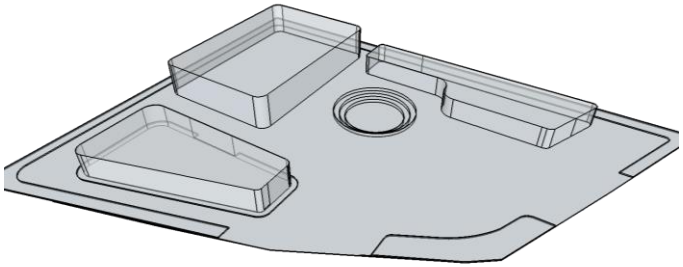


Figure 3.5 Zoning Idea
Source: Author, 2021

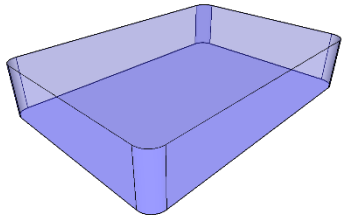
Zoning is adjusted through the functions to be designed, there are 3 functions, namely primary, secondary and supporting. Based on this function, zoning is made with different areas according to the needs of the function.

In addition to referring to space requirements, zoning is made according to the conditions in the site. In a fairly wide site, it is ideal to use -shaped zoning radial organization that combines centralized and linear forms. This initial zoning highlights the Aquatic Stadium as a point of view from outside the site, so that an iconic impression is achieved.Secondary and other supporting buildings follow the needs of the primary building so that their placement is flexible. Like the parking area there are several areas, toilets and communal space are located in several areas.

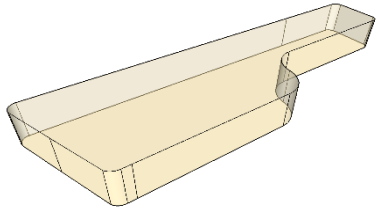
Supporting buildings are placed with the main access, namely the entrance so that it is easy to reach and easy to use, while the Aquatic Stadium and Training Center buildings are placed further from access in the hope of being a solution to the surrounding acoustic problems.



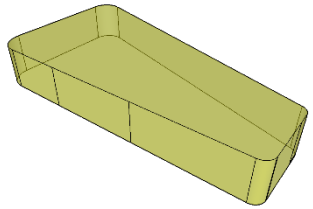
AQUATIC SPORT CENTER



AQUATIC STADIUM



MANAGEMENT OFFICE



TRAINING CENTER

ACCESS AND CIRCULATION IDEA

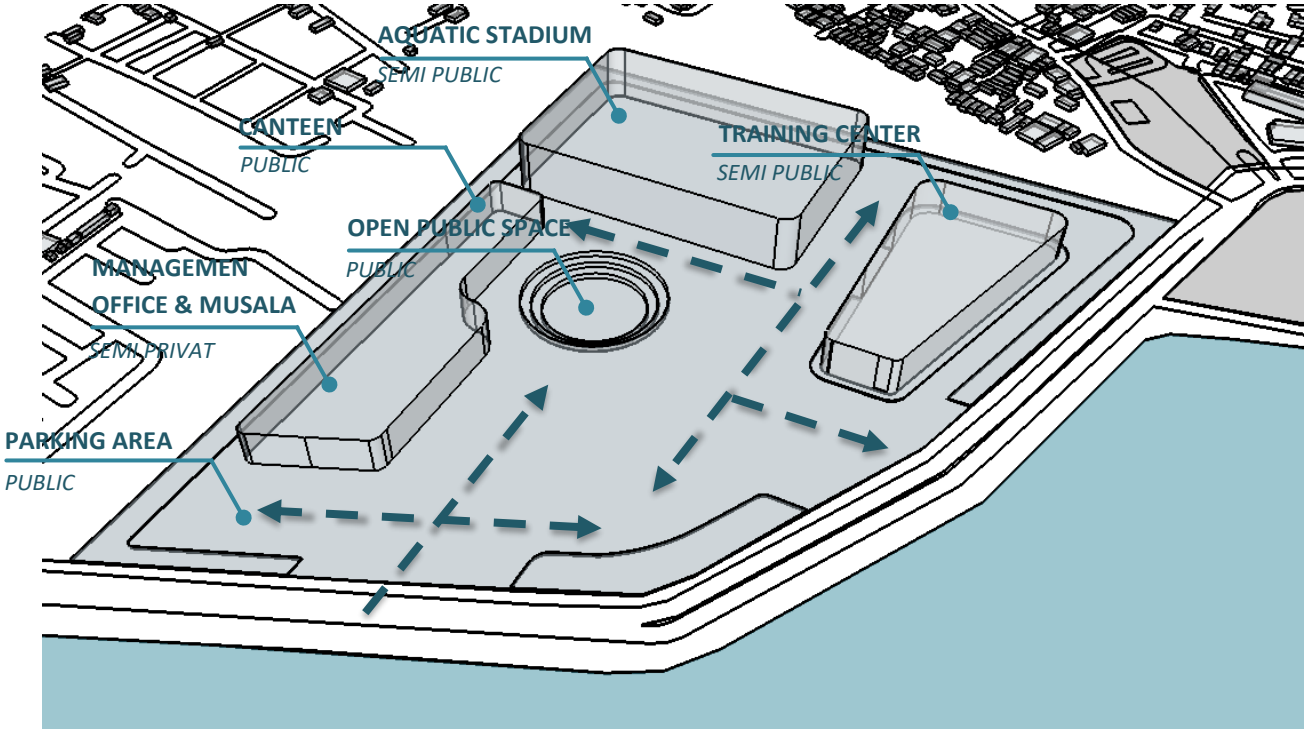


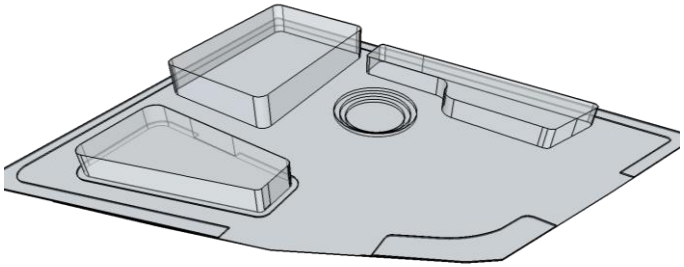
Figure 3.6 Access and Circulation Idea
Source: Author, 2021

The access and circulation applied to the design adjusts to the zoning placement, so as to create continuity of circulation and access between buildings. Entrance and exit are distinguished so as not to create congestion when a competition or event is held, parking is very wide and close to the entrance to speed up visitors to park or leave the Aquatic Sport Center area.

Circulation in the design is more intended for pedestrians than vehicles, as an environmentally friendly form such as the approach carried out in the design.

A safe and comfortable circulation will be designed for all visitors from children and the elderly, as well as friendly to persons with disabilities.

Access to each building is wide open and can be seen directly from the entrance, making it easier for visitors to know which access to go to.



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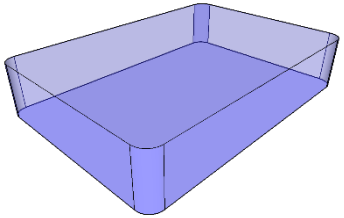

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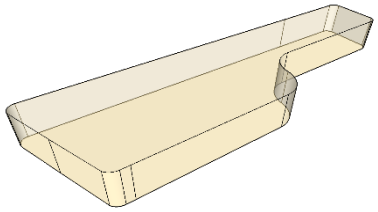

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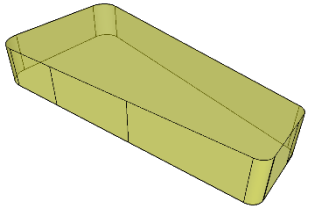


TRAINING CENTER

VEGETATION IDEA

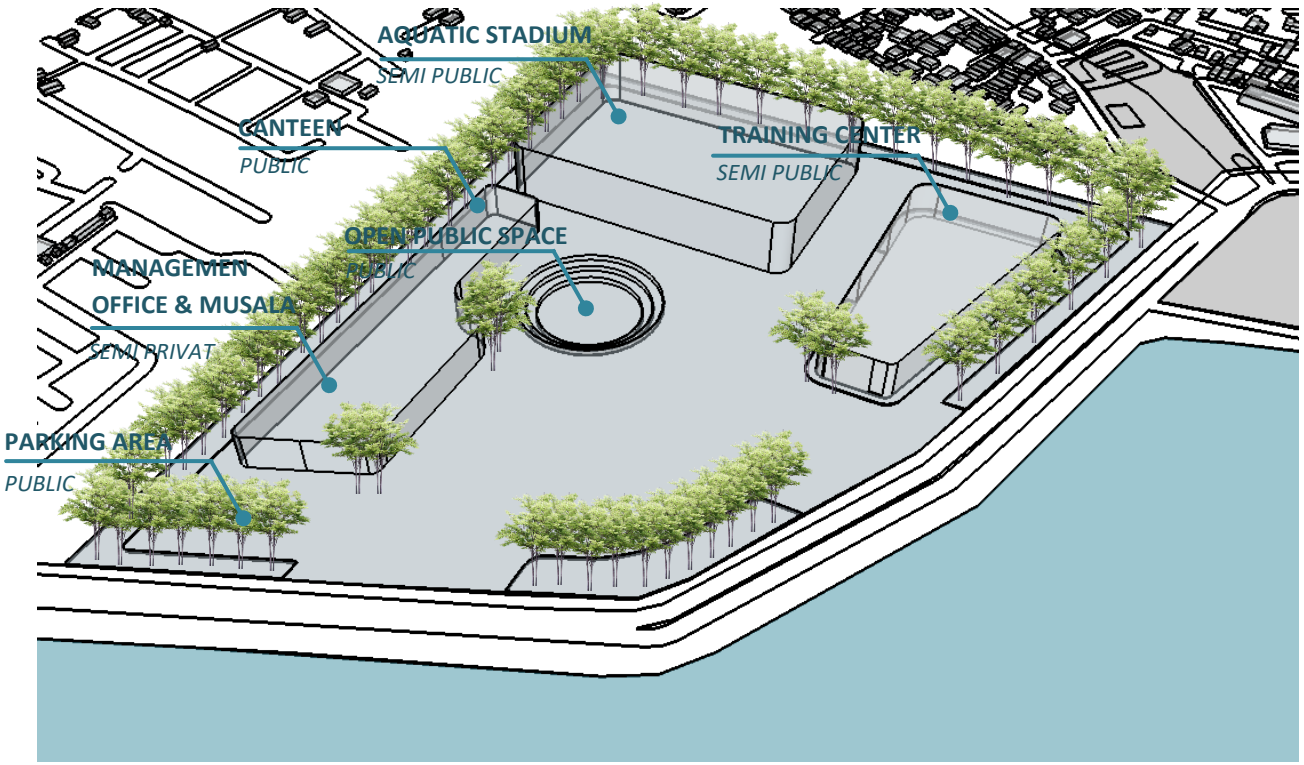
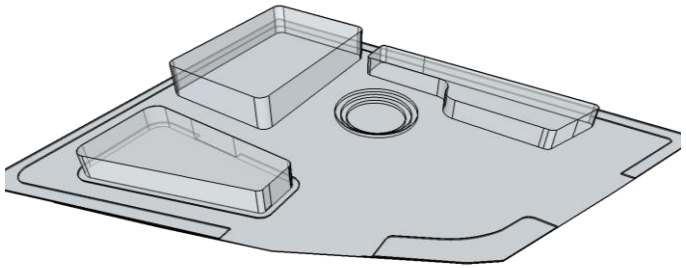


Figure 3.7 Vegetation Idea
Source: Author, 2021

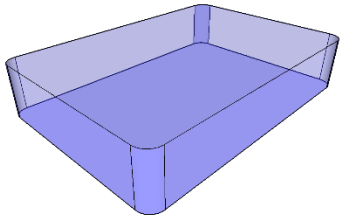
The placement of vegetation as one of the important elements in the design that prioritizes sustainability and environmental conservation, so as to create a design that maintains and develops Public Green Open Space.

In addition to vegetation in this design, there will be a water element, namely the development of the existing river potential as part of the connecting element between buildings. It will be designed into several pools that connect the open space to the main building in the Aquatic Sports Center design.

Apart from being a liaison, it is hoped that the design that refers to the water element can create a renewable energy. So that what is needed by the building can be fulfilled independently by landscape design and the design of the building itself.



AQUATIC SPORT CENTER



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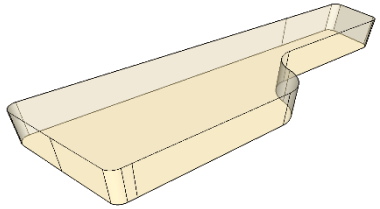

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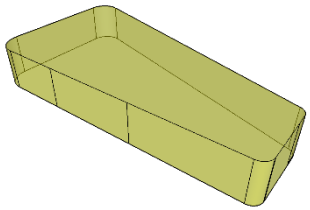
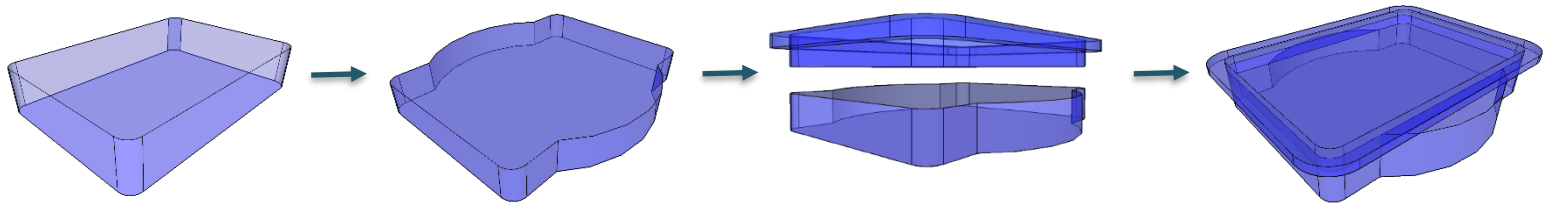


TRAINING CENTER

FORM IDEA



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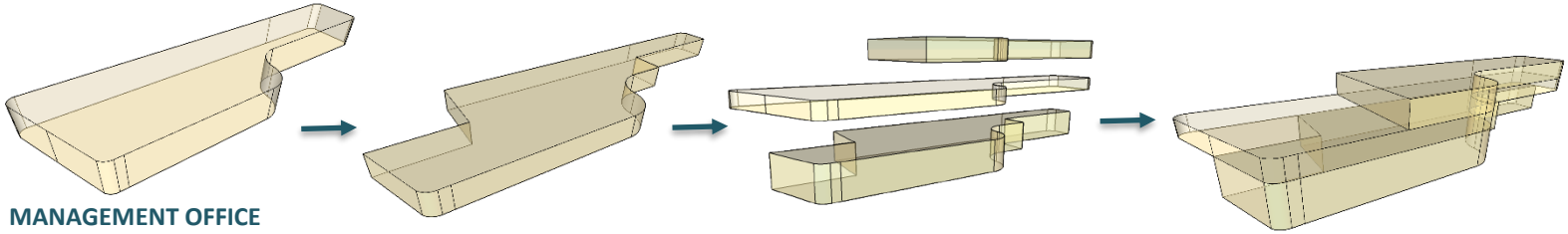

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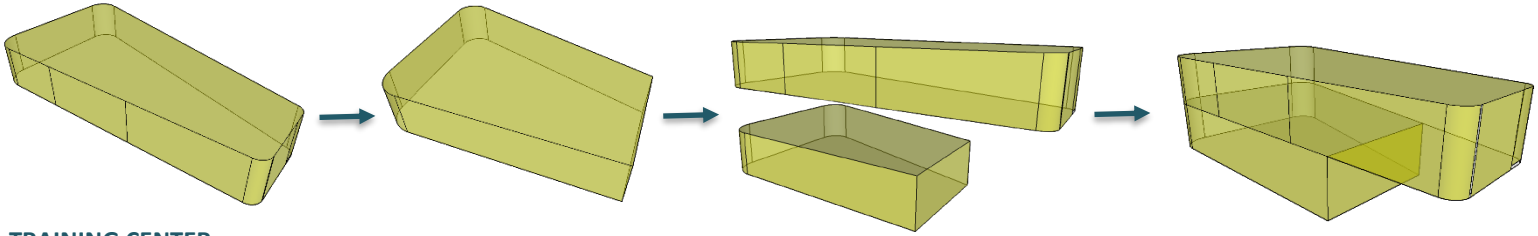


TRAINING CENTER

Figure 3.8 Form Idea
Source: Author, 2021

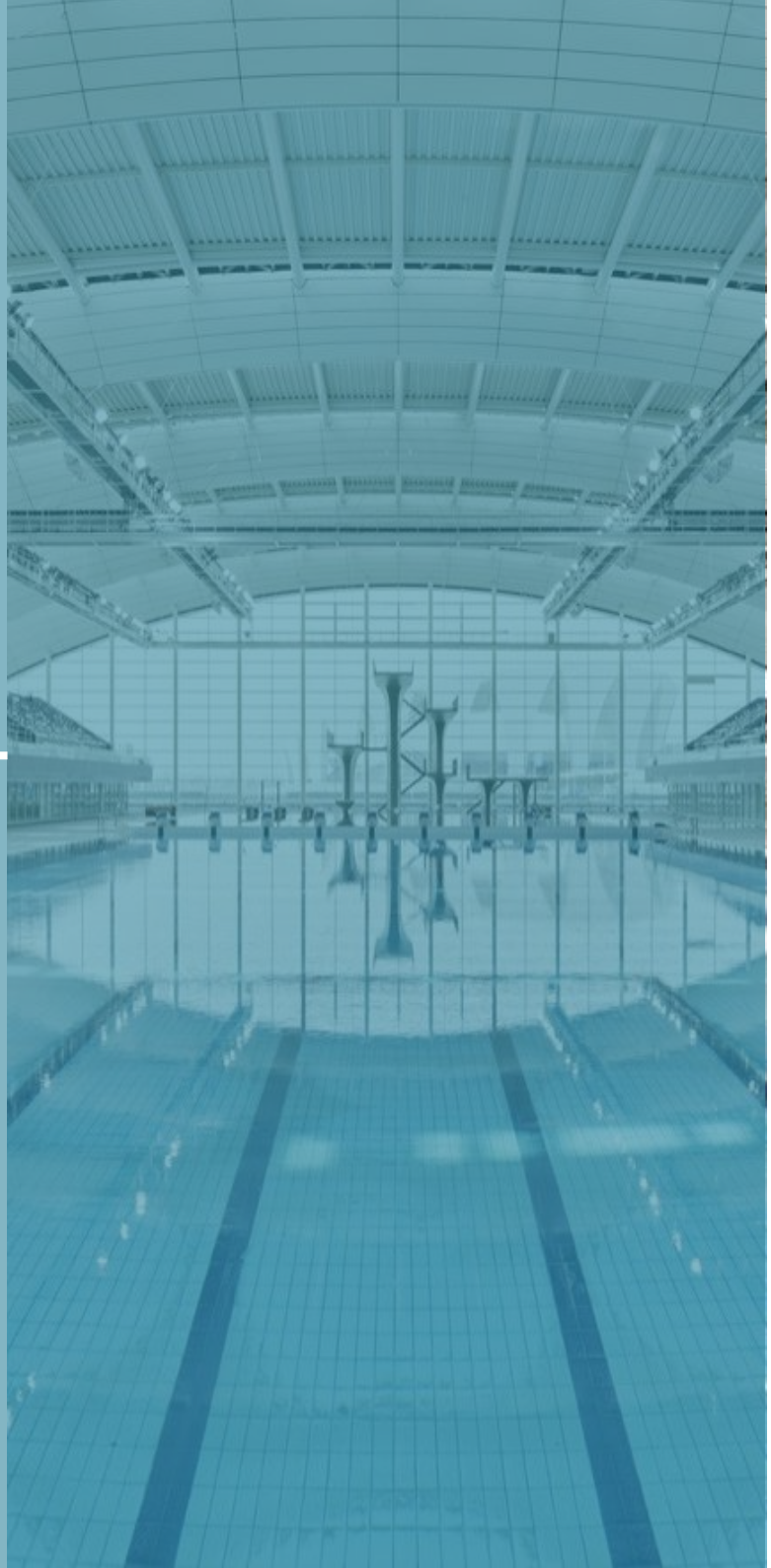
The initial idea of the shape adjusts to the site conditions and there are changes to the shape according to the required building mass. There are differences in building levels, the main building, namely Aquatic Stadium, has a larger size than the other two mass buildings, namely the Training Center and the Management Office.

In addition to differences in size, there are differences in building height and shape according to the needs of each building. So that the Aquatic Stadium is here as an iconic and prominent primary building.

The dominant building form uses a geometrical-additive form, in which there are additional elements in the volume that will be further developed later. Including the composition that will be highlighted on the facade and also the roof of the building.

The shape transformation from geometry to a form that is flexible to both the site and the user will be applied to the Aquatic Sport Center design.

ANALYSIS



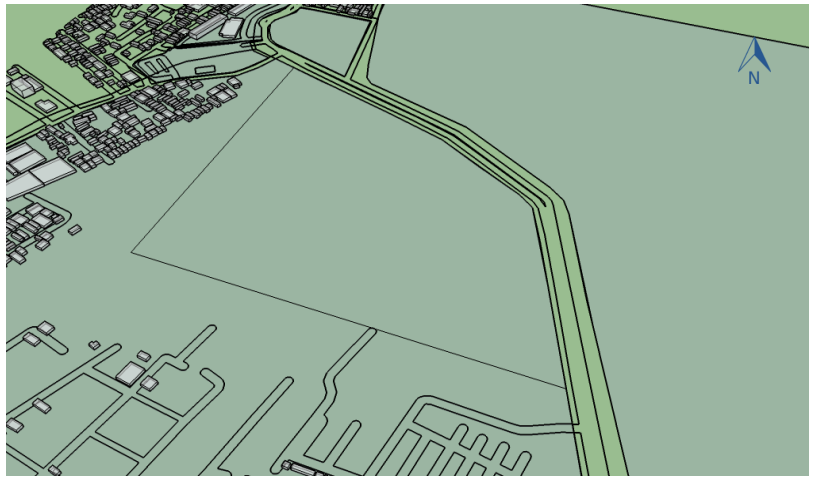


Figure 4.1 Site Ilustration
Source: Author, 2021

Based on the issues, approaches and design criteria, the analysis on the design starts from the area analysis. Analyzing existing buildings and regional needs to complement the infrastructure needs of the complex by analyzing site, function, user, activity and space. Then, analyze the form of the building, facade, utility and structure based on the values of the Eco-Tech Architecture approach.

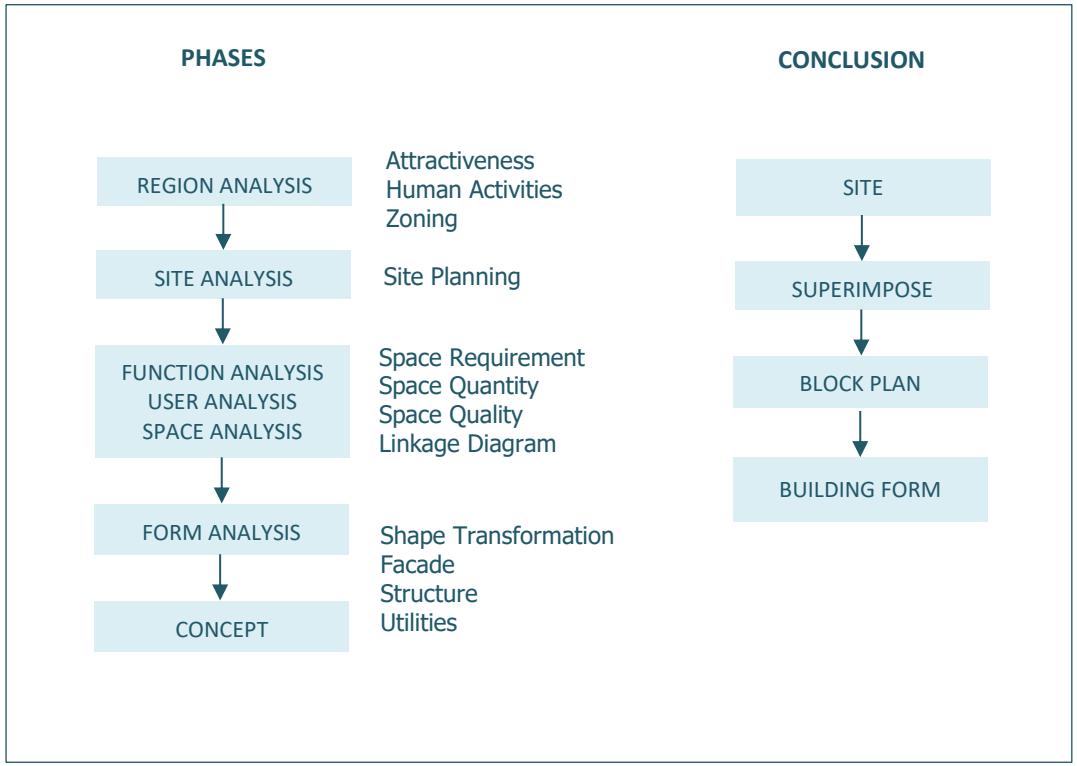


Figure 4.2 Design Phases
Source: Author, 2021

REGION ANALYSIS

INFRASTRUCTURE

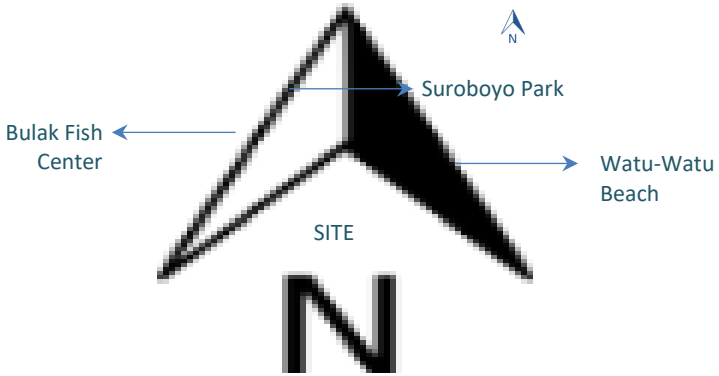


Figure 4.3 Site Ilustration
Source: CADmapper, 2020

The object of the area is close to the center of Bulak fish center and Kenjeran Tourism, only about 2-3 km from the site location.

MAIN ACCESS

Figure 4.4 Site Ilustration
Source: CADmapper, 2020

It has main access which is connected to the main route of Kenjeran Tourism, namely St. Pantai Kenjeran.

ZONING

Figure 4.5 Site Ilustration
Source: CADmapper, 2020

It is surrounded by residential, commercial and tourist zones.

LINKAGE

The existence of site which is adjacent to the Bulak Fish Center as a culinary tourism center for the city of Surabaya which is integrated with other tourism potentials, namely the Suramadu Bridge, Kenjeran Beach Amusement Park, and Ken Park.

ATTRACTIVENESS

Having an attractive ocean landscape view, you can see the iconic two areas between Surabaya and Madura, namely the Suramadu Bridge from the site. Located in a conservation area so that the natural condition is still good.

HUMAN ACTIVITIES

The community consists of divers and netters with outboard motor boat facilities, as well as fish processing traders including traders of smoked fish, fish crackers, shell crafts, food and beverages. The social condition formed is the interaction of fishermen and traders with visitors who are in the Kenjeran tourism environment.

Table 4.1 Table of Area Condition Evaluation Results

No.	Criteria	Evaluation
1.	Pedestrian Path	- Lack of pavement for pedestrian paths. - Lack of vegetation barrier for pedestrian paths. - Pedestrian paths do not have clear markings. - Pedestrian access is quite difficult.
2.	Green Open Space	- Lack of vegetation for shelter and as a guide for pedestrian paths. - Lack of shelter to enjoy the view of the beach.
3.	Parkir	- The parking location is not easily accessible and causes traffic jams. - There is no parking for Watu-Watu Beach tours. - There is no no-parking sign on the highway. - Parking directions are not clear.
4.	Highway Condition	- The main road condition is very good.
5.	Vehicle Circulation	- Vehicle circulation on the main road is very good, there is a vegetation barrier.
6.	Lighting	- The condition of the main street lighting is very good. - The lighting on the Green Open Space is poorly maintained.
7.	Fire Protection	- There are not sufficient utility systems to prevent fires in the area. - The fire protection system is only available at Bulak Fish Center with poorly maintained conditions.
8.	Landmark	There are landmarks on each tour, namely: - Suramadu Bridge - Surabaya Statue - Fish Sculpture at Bulak Fish Center
9.	Photospot	- There are many photospots with interesting and beautiful views. - Lack of maintenance of landscape elements in tourism. - Lack of cleanliness in photo spots.
10.	Visitors Facilities	- There is no restroom. - There are no public toilets. - Inadequate sanitation area. - Lack of trash cans and markers.

Source: Author Analysis, 2021

Based on the evaluation in Table 4.1, the assessment criteria related to the condition of infrastructure are obtained based on 4 aspects, as follows:

Table 4.2 Criteria for Assessment of Regional Infrastructure Conditions

No.	Aspects	Criteria	Value
1.	Comfort	Pedestrian Path	-
		Green Open Space	+
		Parking Area	-
		Public Transport	-
		Linkage System	+
		Highway Condition	+
		Sirculation	+
		Mass Planning	+
2.	Security	Pedestrian Path	-
		Lighting	+
3.	Safety	Building Structure	+
		Fire Protection	-
		Pedestrian Path	-
4.	Plesure	View	+
		Pedestrian Path	-
		Photospot	+
		Recreational	+
		Landmark	+
		Building Façade	+
		Anchor Tenant/Store	-
		Support Facilities	-

Source: Author Analysis, 2021

Information:
+ Positive variable conditions in the region.
- Negative variable conditions in the area.

Some things that have less value will be the main focus in the design concept.

Figure 4.6 Site Environment
Source: Survey, Redmi Note 7

SITE ANALYSIS

Circulation and Accessibility

Application of design through landscape at the analysis phases for circulation and accessibility.

Design Purpose

Has value in supporting the elements of eco-friendly tourism development in circulation and accessibility.

Design Criteria

- Easy access by all types of vehicles and visitors.
- Maintain the ecosystem of the site environment by following the river flow as circulation in the site.
- The use of matching colors with other tourist objects to be integrated.

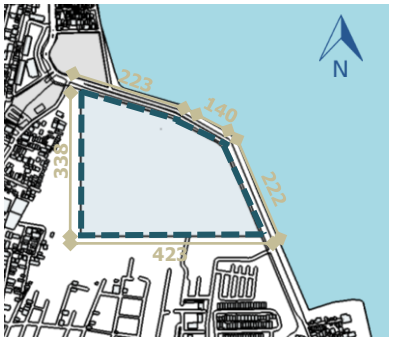
Regulation

- Developing the provision of vegetation along river boundaries to support tourism and sports activities.
- Determine and optimize the river border area as green open space and non green open space.
- Preservation and control of development in areas with cultural heritage environments and / or buildings.

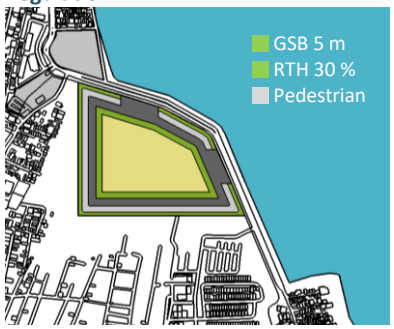
Source: Development Program 2015-2034 and RTRW Surabaya

SUPER IMPOSITION

Dimention



Regulation



Sirculation & Accessibility

Conclusion

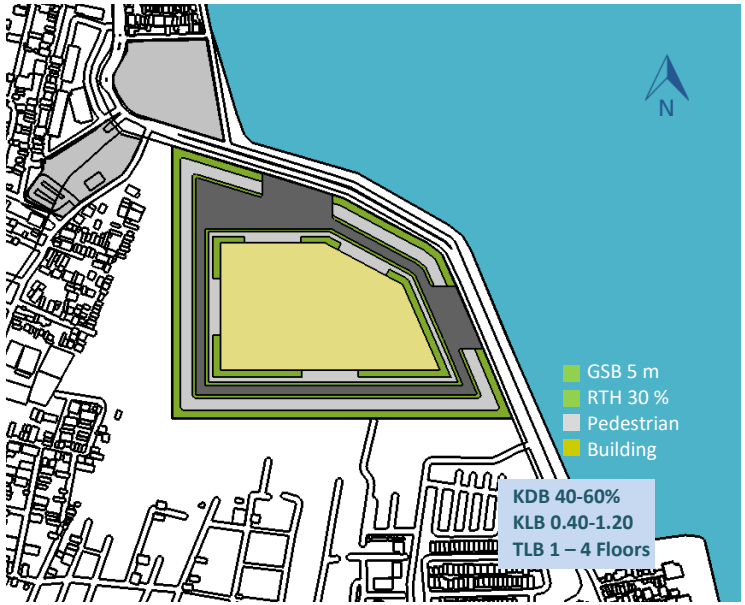


Figure 4.7 Site Planning Super Imposition Diagram
Source: Author Analysis, 2022

Design Principle

- Making Connection by analogy form or the function.
- Public Symbol by taking the form.
- Expression and integrated with environment.

SITE ANALYSIS

Climate

Application of design through landscape at the analysis phases for Climate response.

Design Purpose

Has value in supporting the elements of eco-friendly tourism development in Climate response.

Design Criteria

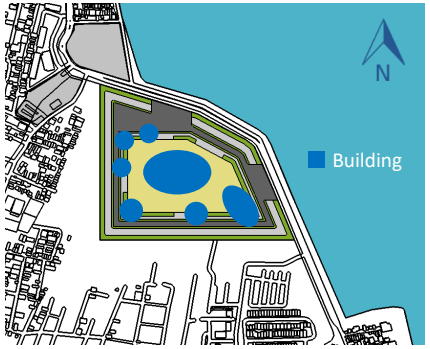
- Responds to winds from the sea.
- Maintain the ecosystem of the site environment by following the river flow as circulation in the site.
- Responds to the heat of the sun in coastal areas.
- Implementing nature and marine conservation in building design and mass

  The use of eco-energy use in several buildings such as solar panels.

Design Principle

- Making Connection by analogy form or the function.
- Public Symbol by taking the form.
- Expression and integrated with environment.

Mass

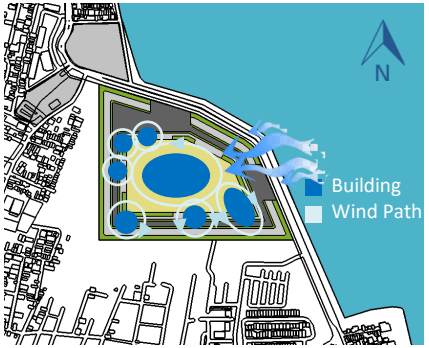


MASS ORDER PATTERNS

Centered Shape Pattern

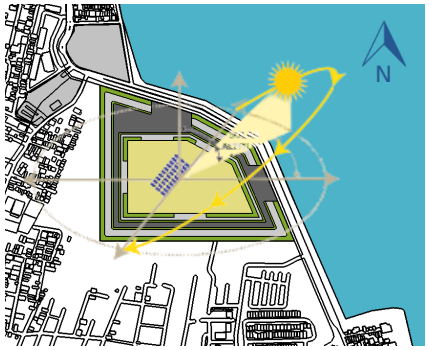
1. Focus the building on one point.
2. It is a pattern of mass order consisting of a number of secondary forms that surround the main building as a central point.
3. The mass order is created through a process of function analysis and block plan.
4. The shape of the building follows the main building in order to create a single unit.

Wind



- Provision of wide-titled vegetation as a deflector of wind direction and as a filter for dust entering the site.
- The shape of the building is circle and oval in order to maximize the deflection of the wind that enters the site and building.
- The use of wide openings in buildings to maximize ventilation.
- Use of roster on building vacade as secondary skin and wind filter.

Sun Path



- The use of fish ponds and fountains as a medium for neutralizing heat temperatures on the site.
- Applying vertical vegetation on the site and buildings to dispel the sun's heat.
- Provision of wide-titled vegetation in several places as shade.
- There are several corridors around the building and pedestrian areas as a place for visitors to rest.
- The use of secondary skin on the facade of the building as a heat dissipator and neutralizer of sunlight. In addition, it creates a shadow effect on the building.
- The orientation of buildings and openings is exposed to the right sunlight, thus maximizing natural lighting from morning to evening.

SITE ANALYSIS

Table 4.3 Table of Planting Plan

No.	Vegetation	Pictures	Source
1.	Angsana Tree (Pterocarpus Indicus)		https://lindungihutan.com/blog/angsana-ciri-budidaya-manfaat-pohon-angsana/
2.	Tabebuya Tree (Tabebuia)		https://www.tokopedia.com/ismataman/pohon-tabebuya-pink-ukuran-1-meter
3.	Flamboyant Tree (Delonix Regia)		https://threebouquets.com/blogs/article/bunga-flamboyan-ciri-filosofi-jenis-dan-manfaatnya
4.	Putri Palm Tree (Veitchia Merrillii)		https://bibittanaman.id/jual-pohon-palem-putri-tinggi-2-meter/
5.	Lotus (Nymphaea)		https://id.wikipedia.org/wiki/Teratai
6.	Mandevilla (Mandevilla)		https://nurserybloom.com/product/maroon-plant/
7.	Paris Lilies (Chiorophytum Comusom)		https://www.ilmukebun.com/2019/10/cara-merawat-dan-memperbanyak-tanaman.html
8.	Lavender (Angelonia Agustiafolia)		https://bobo.grid.id/read/08677805/bunga-lavender-dan-wanginya-yang-khas

Source: Author Analysis, 2021

Vegetation

Application of design through landscape at the analysis phases for Vegetation.

Design Principle

- Making Connection by analogy form or the function.
- Expression and integrated with environment.

Design Criteria

- Added vegetation to drown out the sound.
- Adding vegetation to break the wind and dispel the heat of the sun.
- Adding vegetation that supports the Islamic atmosphere and reminds of the beauty of Allah's creation.

Design Purpose

Has value in supporting the elements of eco-friendly tourism development in planting plan.

Planting Plan

Angsana Tree. As a shade, absorber of air pollution, wind breakers, road length limiters, circulation directors.

Tabebuya Tree. Placed along pedestrian paths and several park spots.

Flamboyant Tree. Placed in several garden spots as ornamental plants.

Putri Palm. Placed along pedestrian and park boundaries, as a noise breaker and directing circulation.

Lotus. Placed in a pool of water as a neutralizer of dirt and fish eggs.

SITE ANALYSIS

Utilities

Application of design through landscape at the analysis phases for utilities system.

Clean Water Utility

Source of Clean Water : The source of site clean water comes from PDAM which will be accommodated in reservoirs around the building.

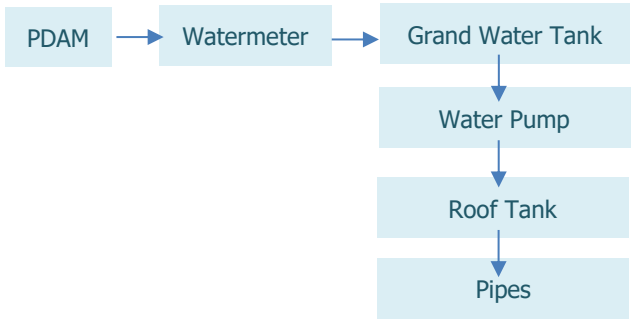


Figure 4.8 Scheme of Clean Water Utility System
Source: Author Analysis, 2022

Hydrants

Use of hydrants on the site to facilitate the distribution of water in the event of a fire.

The use of hydrants in buildings in the form of wall hydrants can facilitate extinguishing in the event of a fire in the building.

SUPER IMPOSITION

Waste Water Utility

The management of waste water pipes is directly channeled to infiltration wells, to septic tanks and control tanks.

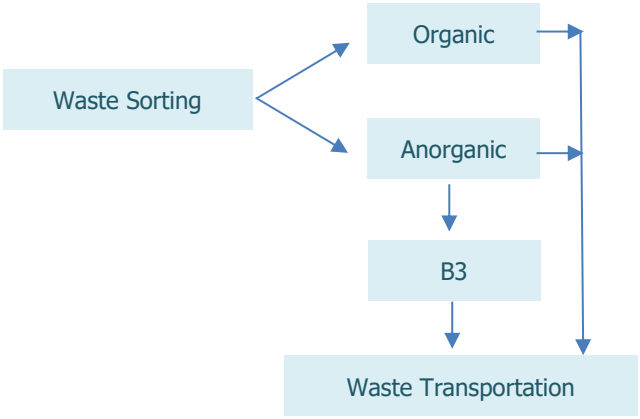


Figure 4.9 Scheme of Waste Utility System
Source: Author Analysis, 2022

Assembly Point

Use of assembly points on the site to facilitate the distribution of water in the event of a fire.

Efficient circulation on the site and there is a gathering point to facilitate the user's evacuation route in self-rescue.

Electrical

The main source of electricity is obtained from the local PLN, while the electricity source is supplied through the EEC room located in each building.

Use of an electric generator in case of a power outage or an urgent matter as a backup power source.

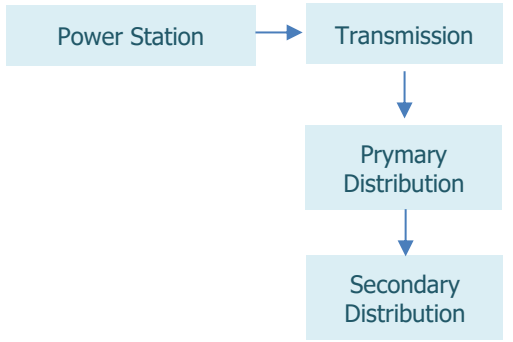


Figure 4.10 Scheme of Electrical Utility System
Source: Author Analysis, 2022

Waste Utility

Placing several trash cans at several points, to make it easier for users to keep the site clean.

The full waste will be collected at the site landfill, after which it is separated into organic and inorganic waste. Then the waste will be recycled.

SITE ANALYSIS

Utilities

Application of design through landscape at the analysis phases for utilities system.

Stormwater Utility

- Addition of biopori in green open spaces and green roofs.
- Added Manhole on the road in the tread.
- The existence of rainwater reservoirs as a reserve of clean water for building needs.
- Adding stormwater absorbing vegetation.
- Construction of a drainage path leading to the city's disposal.
- The use of wide-titled vegetation in the parking area to keep out rain on vehicles.

SUPER IMPOSITION

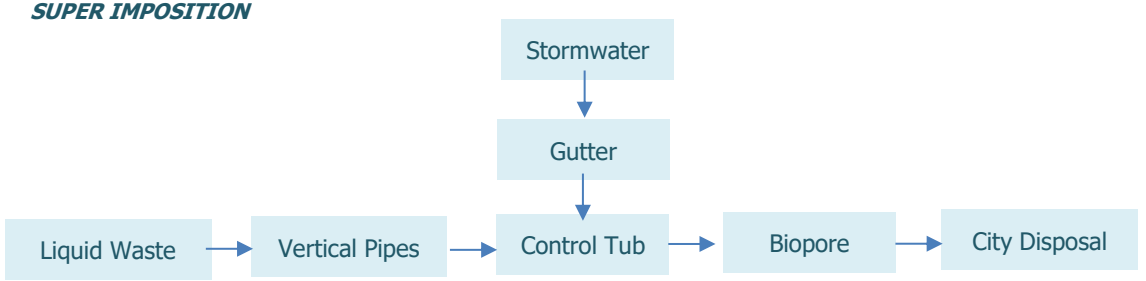


Figure 4.11 Scheme of Stormwater Utility System
Source: Author Analysis, 2022

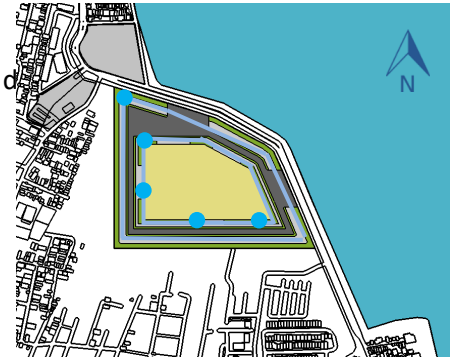


Figure 4.12 Water Tank Utility System
Source: Author Analysis, 2022

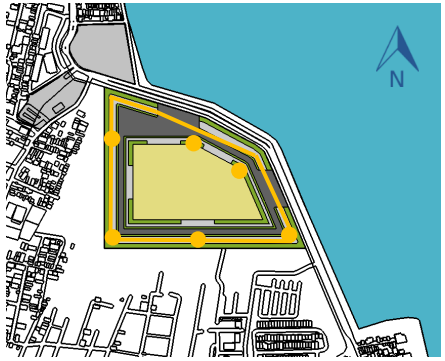


Figure 4.13 Waste Utility System
Source: Author Analysis, 2022

Figure 4.14 Electrical Utility System
Source: Author Analysis, 2022

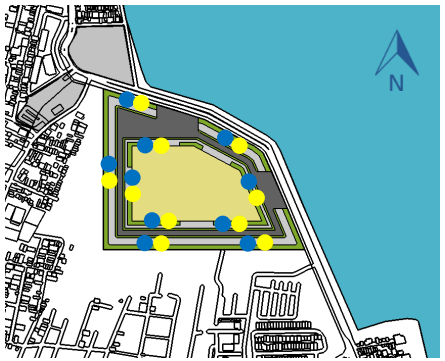


Figure 4.15 Hydrants Utility System
Source: Author Analysis, 2022

SITE ANALYSIS

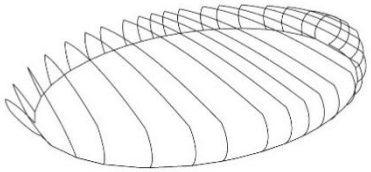
STRUCTURE

Application of design through landscape at the analysis phases for roof design.

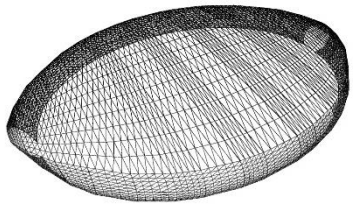
Wide Span Dome

Space Frame Structure

The use of skylight is to capture that natural lighting into the building. It use welded jointing for the connection of structure



Column Point Frame



Space Frame Structure

Skin/Plafon

Figure 4.16 Space Frame Roof Structure
Source: Author Analysis, 2022

UP Structure

The roof structure in each building uses a steel frame and mild steel with a slope that is adjusted to each building and follows the shape of the building.

MID Structure

- In the center of the building, a reinforced concrete column and beam structure is used.
- The use of latei beams is required to support the load on the frame.
- The size of the columns in each building is different depending on the level of the building.

SUB Structure

For the lower structure using a strauss pile foundation, because the building is of two floors.

Design Purpose

Has value in supporting the elements of eco-friendly tourism development in Structure.

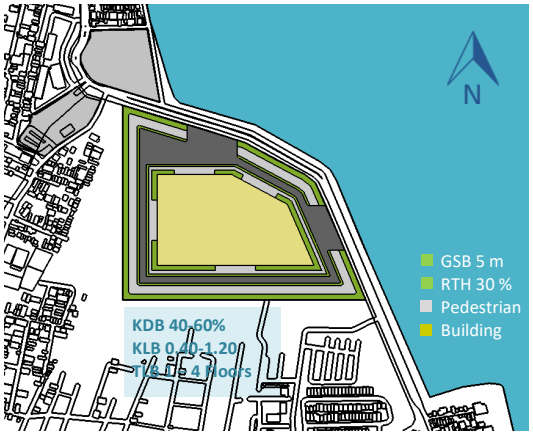
Design Criteria

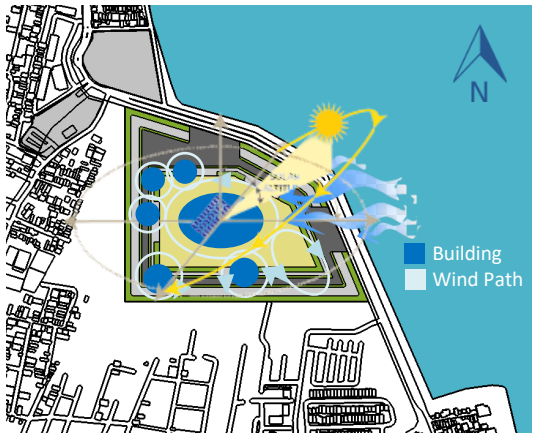
- Identify and apply unity between buildings.
- Implementation of the use of eco-friendly materials.
- The application of the beauty of the structure to the building.
- Dynamic function settings on the response to wind and solar heat.

Design Principle

- Making Connection by analogy form or the function.
- Public Symbol by taking the form.
- Expression and integrated with environment.

CONCLUSION OF SUPER IMPOSITION





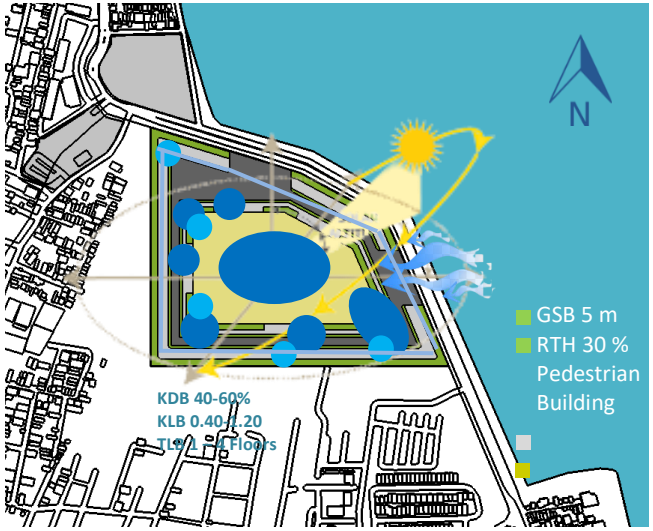


Figure 4.17 Conclusion of Super Imposition
Source: Author Analysis, 2022

Design Criteria

- Identify and apply unity between buildings.
- Implementation of the use of eco-friendly materials.
- The application of the beauty of the structure to the building.
- Dynamic function settings on the response to wind and solar heat.

Design Purpose

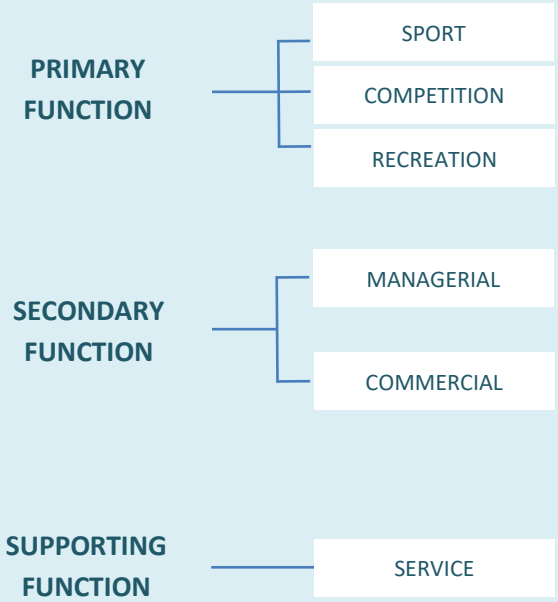
Has value in supporting the elements of eco-friendly tourism development in Structure.

Design Principle

- Making Connection by analogy form or the function.
- Public Symbol by taking the form.
- Expression and integrated with environment.

FUNCTION ANALYSIS

Functions are divided into 3, namely primary, secondary and supporting functions.



PRIMARY

Aquatic Sport Center and Training Center as a means of sports, competition and recreation.

SECONDARY

Management Office and Food Court as managerial and commercial facilities.

SUPPORTING

Musala and public facilities as supporting infrastructure.

Visitors
Visitors from swimming sports enthusiast and local residents who want to swim.

Seller
Local residents who want to sell in the area around the Aquatic Sport Center.

Manager
The committee that manages the infrastructure includes KONI and the Tourism Official.

Worker
Workers for the service department include, information, receptionists, cashiers, technicians, cleaning and security.

Figure 4.18 Function Analysis
Source: Author Analysis, 2022

ACTIVITY ANALYSIS

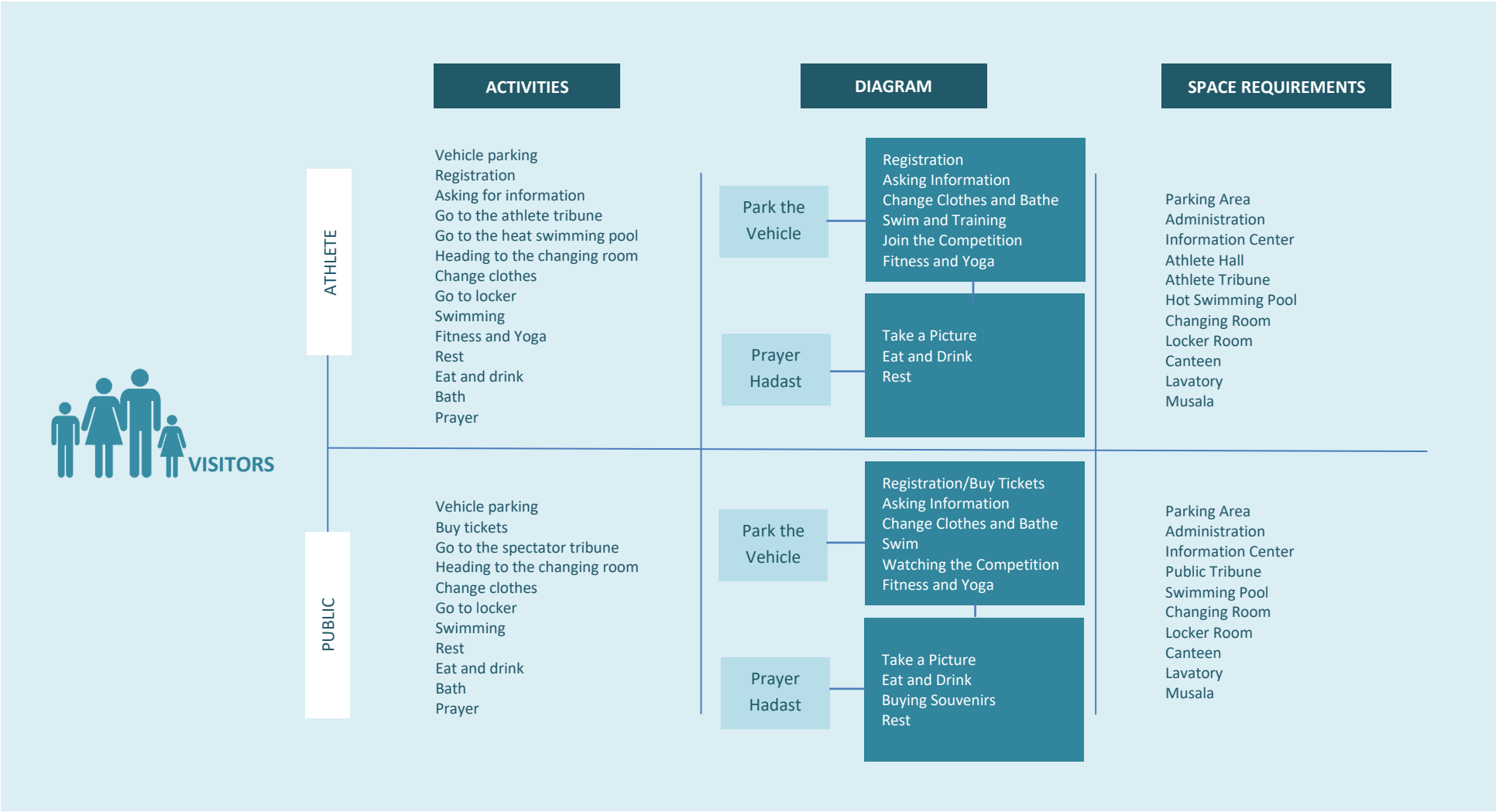
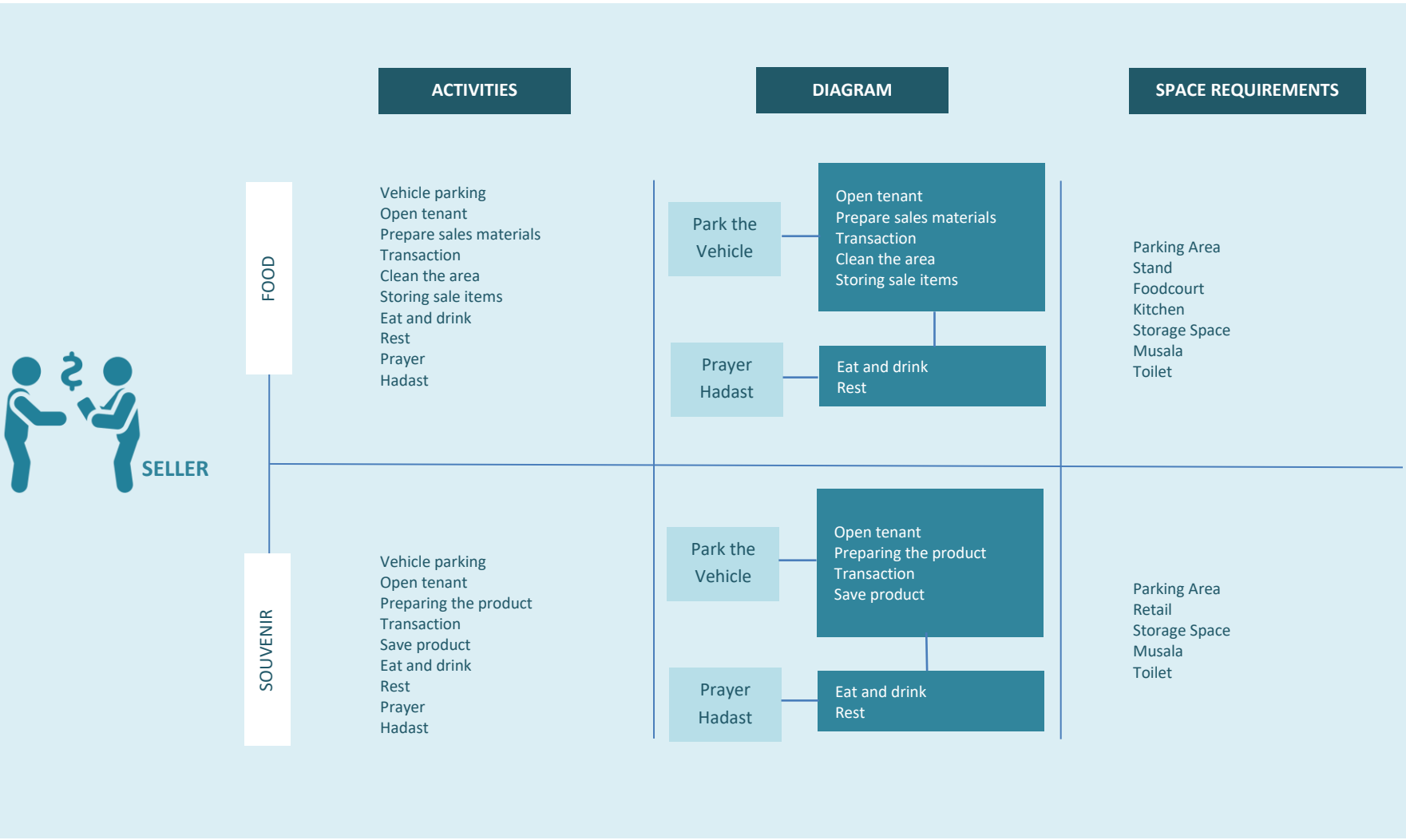


Figure 4.19 Activity Analysis
Source: Author Analysis, 2022


ACTIVITIES
DIAGRAM
SPACE REQUIREMENTS
SELLER
FOOD
Vehicle parking
Open tenant
Prepare sales materials
Transaction
Clean the area
Storing sale items
Eat and drink
Rest
Prayer
Hadast
Park the Vehicle
Open tenant
Prepare sales materials
Transaction
Clean the area
Storing sale items
Prayer Hadast
Eat and drink
Rest
Parking Area
Stand
Foodcourt
Kitchen
Storage Space
Musala
Toilet
SOUVENIR
Vehicle parking
Open tenant
Preparing the product
Transaction
Save product
Eat and drink
Rest
Prayer
Hadast
Park the Vehicle
Open tenant
Preparing the product
Transaction
Save product
Prayer Hadast
Eat and drink
Rest
Parking Area
Retail
Storage Space
Musala
Toilet

	ACTIVITIES	DIAGRAM		SPACE REQUIREMENTS
 MANAGER	Vehicle parking Provide information Serving visitors Manage administration Managing the aquatic sports center Manage and manage the achievement of competition Meeting Eat and drink Rest Prayer Hadast	Park the Vehicle	Provide information Serving visitors Manage administration Managing the aquatic sports center Manage and manage the achievement of competition Meeting	Parking Area Administration Information Center Employee Office Manager's Office Lobby Meeting Room Pantry Warehouse Smoking Area Reading Corner Toilet Musala
		Prayer Hadast	Eat and Drink Rest	
 WORKER	Vehicle parking Cleaning the arena Cleaning the pool Checking leftovers Ensuring visitor safety Making sure the arena is working Ensuring clean water Checking the visitor's situation Helping visitors Eat and drink Prayer	Park the Vehicle	Cleaning the arena Cleaning the pool Checking leftovers Ensuring visitor safety Making sure the arena is working	Parking Area Worker’s Room Locker Room Pantry Warehouse Smoking Area Rest Room Canteen Lavatory Musala
		Prayer Hadast	Checking the visitor's situation Helping visitors Eat and drink	

SPACE QUANTITY

Table 4.4 Primary Space Quantity Calculation

PRIMARY

NO	BUILDING	FUNCTION	ROOM TYPE	QUANTITY	DIMENSION	CAPACITY	SPACIOUS	SOURCE
1.	AQUATIC SPORT CENTER	Aquatic Sport Center for visitors (athlete and public) who want to swim, watch competitions, travel, and practice.	Administration Room	1	Man 3 (0.6x1.2) Table 1 (1x0.7) Chair 3 (0.6x0.6) Credenza 1 (0.6x1.2) 30% sirculation	3 people	6.058	
			Information Center	1	Man 3 (0.6x1.2) Table 1 (1x0.7) Chair 3 (0.6x0.6) Wardrobe 1 (0.6x1.2) Locker 1 (0.6x1.2) 30% sirculation	3 people	6.994	
			Athlete Hall	1	Man 200 (0.6x1.2) Chair 200 (0.6x0.6) Locker 10 (0.6x1.2) 30% sirculation	200 people	290.16	
			Athlete Tribune	1	Man 3000 (0.6x1.2) Seating 3000 (0.8x0.6) 100% sirculation	3000 people	7200	
			Public Tribune	1	Man 3000 (0.6x1.2) Seating 3000 (0.6x0.6) 100% sirculation	2000 people	7200	
			Swimming Pool	1	Man 100 (0.6x1.2) Swimming Pool 1 (25x50) Scale Assumption (25x50) 100% sirculation	100 people	6687.2	
			Diving Pool	1	Man 50 (0.6x1.2) Diving Pool 1 (25x20) Scale Assumption (25x20) 100% sirculation	50 people	2693.6	
			Hot Swimming Pool	1	Man 100 (0.6x1.2) Swimming Pool 1 (25x50) Scale Assumption (25x50) 100% sirculation	100 people	6687.2	
			Changing Room	10	Man 10 (0.6x1.2) Changing Room 8 (0.8x1) Wheelchair 2 (2.5x1.5) Scale Assumption 2 (1.5x1)	1 people	26.455	

PRIMARY					30% sirculation			
			Locker Room	3	Man 12 (0.6x1.2) Locker Room 3 (0.8x1.5) Scale Assumption 4 (1.5x1) 30% sirculation	6 people	23.712	
			Canteen	5	Man 50 (0.6x1.2) Table 5 (1x0.7) Chair 20 (0.6x0.6) Kitchen Set 1 (0.7x1.5) Displaywindow 1 (0.4x1.5) Scale Assumption 5 (1.5x1) 30% sirculation	10 people	72.605	
			Lavatory	2	Man 16 (0.6x1.2) Wheelchair 4 (2.5x1.5) Scale Assumption 4 (1.5x1) 30% sirculation	10 people	42.276	
			Musala	1	Man 30 (0.6x1.2) Credenza 2 (0.6x1.2) Scale Assumption 5 (1.5x1) 30% sirculation	30 people	39.702	
			Warehouse	2	Man 4 (0.6x1.2) Locker 4 (0.6x1.2) Scale Assumption 2 (1.5x1) 30% sirculation	2 people	11.388	

Source: Author Analysis, 2022

Table 4.5 Secondary Space Quantity Calculation

	NO	BUILDING	FUNCTION	ROOM TYPE	QUANTITY	DIMENSION	CAPACITY	SPACIOUS	SOURCE
SECONDARY	2.	TRAINING CENTER	Training Center for athletes who are doing regional training center before the championship. The Training Center can be accessed by the public but at different hours.	Administration Room	1	Man 3 (0.6x1.2) Table 1 (1x0.7) Chair 3 (0.6x0.6) Credenza 1 (0.6x1.2) 30% sirculation	3 people	6.058	
				Lobby	1	Man 6 (0.6x1.2) Table 1 (1x0.7) Sofa 2 (1.2x2) Credenza 1 (0.6x1.2) 30% sirculation	6 people	13.702	
				Gym Room	1	Man 50 (0.6x1.2) Gym Room 1 (15x20) 100% sirculation	50 people	873.6	
				Locker Room	2	Man 8 (0.6x1.2)	4 people	18.408	

SECONDARY					Locker Room 2 (0.8x1.5) Scale Assumption 4 (1.5x1) 30% sirculation			
			Yoga Room	1	Man 25 (0.6x1.2) Locker 2 (0.6x1.2) Credenza 1 (0.6x1.2) Yoga Room 1 (10x20) 100% sirculation	25 people	571.116	
			Sauna	2	Man 10 (0.6x1.2) Chair 10 (1x0.7) Credenza 2 (0.6x1.2) Sauna Room 10 (1.5x2) 30% sirculation	5 people	59.332	
			Lavatory	2	Man 16 (0.6x1.2) Wheelchair 4 (2.5x1.5) Scale Assumption 4 (1.5x1) 30% sirculation	10 people	42.276	

Source: Author Analysis, 2022

Table 4.6 Supporting Space Quantity Calculation

	NO	BUILDING	FUNCTION	ROOM TYPE	QUANTITY	DIMENSION	CAPACITY	SPACIOUS	SOURCE
SUPPORTING	3.	MANAGEMENT OFFICE	Information center for visitors regarding general information, management, and events.	Administration Room	1	Man 3 (0.6x1.2) Table 1 (1x0.7) Chair 3 (0.6x0.6) Credenza 1 (0.6x1.2) 30% sirculation	3 people	6.058	
				Information Center	1	Man 3 (0.6x1.2) Table 1 (1x0.7) Chair 3 (0.6x0.6) Wardrobe 1 (0.6x1.2) Locker 1 (0.6x1.2) 30% sirculation	3 people	6.994	
				Meeting room	1	Man 5 (0.6x1.2) Table 1 (1x0.7) Chair 5 (0.6x0.6) Credenza 1 (0.6x1.2) 30% sirculation	5 people	8.866	
				Manager's Room	1	Man 2 (0.6x1.2) Table 1 (1x0.7) Chair 2 (0.6x0.6) Credenza 1 (0.6x1.2)	2 people	4.654	

SUPPORTING

					30% sirculation			
			Employee Room	1	Man 4 (0.6x1.2) Table 1 (1x0.7) Chair 4 (0.6x0.6) Locker 4 (0.6x1.2) 30% sirculation	4 people	10.27	
			Lobby	1	Man 6 (0.6x1.2) Table 1 (1x0.7) Sofa 2 (1.2x2) Credenza 1 (0.6x1.2) 30% sirculation	6 people	13.702	
			Pantry	1	Man 2 (0.6x1.2) Table 1 (1x0.7) Chair 4 (0.6x0.6) Kitchen Set 1 (0.7x1.5) 30% sirculation	4 people	5.749	
			Reading Corner	1	Man 6 (0.6x1.2) Table 3 (1x0.7) Chair 6 (0.6x0.6) 30% sirculation	6 people	11.206	
			Smooking Area	1	Man 5 (0.6x1.2) Chair 5 (0.6x0.6) 30% sirculation	5 people	7.02	
			Musala	1	Man 6 (0.6x1.2) Credenza 1 (0.6x1.2) 30% sirculation	6 people	6.552	
			Toilet	2	Man 2 (0.6x1.2) Scale Assumption 2 (1.5x1) 30% sirculation	1 people	5.772	
			Warehouse	1	Locker 1 (0.6x1.2) Scale Assumption 2 (1.5x1) 30% sirculation	2 people	4.836	
4.	FOOD COURT & SOUVENIR SHOP	The Food Court building is a center for transacting food, drinks and souvenirs.	Stand	20	Man 3 (0.6x1.2) Table 1 (1x0.7) Chair 2 (0.6x0.6) Credenza 1 (0.6x1.2) 30% sirculation	3 people	6.058	
			Food Court	1	Table 25 (1x0.7) Chair 100 (0.6x0.6) Wastafel 4 (1x0.5) 30% sirculation	100 people	79.95	

SUPPORTING

			Kitchen	20	Man 3 (0.6x1.2) Table 1 (1x0.7) Chair 2 (0.6x0.6) Credenza 1 (0.6x1.2) 30% sirculation	3 people	5.59	
			Storage Space	1	Man 3 (0.6x1.2) Rack 4 (0.6x1.2) Scale Assumption (3x3) 30% sirculation	2 people	18.252	
			Retail Souvenir Shop	10	Man 50 (0.6x1.2) Table 5 (1x0.7) Chair 20 (0.6x0.6) Kitchen Set 1 (0.7x1.5) Displaywindow 1 (0.4x1.5) Scale Assumption (3x3) 30% sirculation	5 people	74.555	
			Storage Space Souvenir Shop	1	Man 6 (0.6x1.2) Table 1 (1x0.7) Sofa 2 (1.2x2) Credenza 1 (0.6x1.2) 30% sirculation	6 people	10.582	
			Smooking Area	1	Man 10 (0.6x1.2) Chair 10 (0.6x0.6) 30% sirculation	10 people	14.04	
			Lavatory	2	Man 16 (0.6x1.2) Wheelchair 4 (2.5x1.5) Scale Assumption 4 (1.5x1) 30% sirculation	10 people	42.276	
5.	SUPPORTING SYSTEM	The Food Court building is a center for transacting food, drinks and souvenirs.	Parking Area	1	Motorcycle 500 (2x0.75) Car 200 (2x5) Bus 25 (3.5x8) 100% sirculation	Motorcycle 150 Car 80 Bus 15	6900	
			Staff Parking Area	1	Motorcycle 80 (2x0.75) Car 30 (2x5) 100% sirculation	Motorcycle 30 Car 10	840	
			Receptionist	1	Man 3 (0.6x1.2) Table 1 (1x0.7) Chair 2 (0.6x0.6) 30% sirculation	3 people	4.654	
			Mechanical & Electrical Room	1	Man 2 (0.6x1.2) Genset 2 (3x1.5)	2 people	18.772	

SUPPORTING					Scale Assumption (3x3)1 30% sirculation			
			Security Room	1	Man 3 (0.6x1.2) Table 1 (1x0.7) Chair 3 (0.6x0.6) 30% sirculation	3 people	5.122	
			CCTV Room	1	Man 2 (0.6x1.2) Table 1 (1x0.7) Chair 2 (1.2x2) Locker 1 (0.6x1.2) 30% sirculation	2 people	6.812	
			Hydrant	1	Scale Assumption (0.6x0.6) 100% sirculation	2 people	1	
			Panel Control Room	1	Scale Assumption (3x3) 30% sirculation	2 people	11.7	
			Laystall	1	Scale Assumption (5x3) 100% sirculation	2 people	30	
			Nursery Room	1	Man 10 (0.6x1.2) Table 2 (1x0.7) Sofa 10 (1.2x2) Credenza 2 (0.6x1.2) 30% sirculation	10 people	44.304	
			Photospot	3	Scale Assumption (1x0.8) 100% sirculation	2 people	1.6	
			Gazebo	5	Scale Assumption (3x3) 30% sirculation	5 people	11.7	
			Lavatory	2	Man 16 (0.6x1.2) Wheelchair 4 (2.5x1.5) Scale Assumption 4 (1.5x1) 30% sirculation	10 people	42.276	
			Musala	1	Man 30 (0.6x1.2) Credenza 2 (0.6x1.2) Scale Assumption 5 (1.5x1) 30% sirculation	30 people	39.702	

Source: Author Analysis, 2022

Table 4.7 Calculation of Total Space Quantity

No.	Space Type	Total (m^2)
1.	Primary Function	14493.35
2.	Secondary Function	1584.492
3.	Supporting Function	8300.624
		29727.35

Source: Author Analysis, 2022

Total Site Area = 90698.15 m²

Total KDB = 29727.35 m² = 33%

KLB based on regulations:

0.40 x 90698.15 = 36279.26 m²
1.20 x 90698.15 = 108837.78 m²

KDB based on regulations:

40% x 90698.15 = 36279.26 m²
60% x 90698.15 = 54418.89 m²

CONCLUSIONS OF SPACE QUANTITY ANALYSIS

Total KDB obtained from the sum of the total quantity of design space. The following is related to the regulation on Spatial Planning based on the RDRTK Tambak Wedi (2017):

30% Green Open Space

KDB 40-60%

KLB 0.40 - 1.20

TLB 1 - 4 floors

Based on the calculations of Table 4.6, the result of the sum of the spatial planning in the complex design is 19096,108 m2, which if presented is 21% part of the site area. So that the planning area still meets the regulations of the KDB and KLB of the City of Surabaya.

SPACE QUALITY

Table 4.8 Primary Space Quality

Primary Function										
Room	Lighting		Ventilation		View		Calmness	Cleanliness	Sanitation	Accessibility
	Natural	Artificial	Natural	Artificial	In	Out				
Administration Room										
Information Center										
Athlete Hall										
Athlete Tribune										
Public Tribune										
Swimming Pool										
Diving Pool										
Hot Swimming Pool										
Changing Room										
Locker Room										
Canteen										
Lavatory										
Musala										
Warehouse										

Source: Author Analysis, 2022

Information:

- Need a certain time
- Need
- No Need

Table 4.9 Secondary Space Quality

Secondary Function										
Room	Lighting		Ventilation		View		Calmness	Cleanliness	Sanitation	Accessibility
	Natural	Artificial	Natural	Artificial	In	Out				
Administration Room										
Lobby										
Gym Room										
Locker Room										
Yoga Room										
Sauna										
Lavatory										

Source: Author Analysis, 2022

Information:

- Need a certain time
- Need
- No Need

Table 4.10 Supporting Space Quality

Supporting Function											
Room	Lighting		Ventilation		View		Calmness	Cleanliness	Sanitation	Accessibility
	Natural	Artificial	Natural	Artificial	In	Out				
Stand										
Food Court										
Kitchen										
Storage Space										
Retail Souvenir Shop										
Storage Space Souvenir Shop										
Smooking Area										
Lavatory										
Parking Area										
Staff Parking Area										
Receptionist										
Mechanical & Electrical Room										
Security Room										
CCTV Room										
Hydrant										
Panel Control Room										
Laystall										
Nursery Room										
Photospot										
Gazebo										
Lavatory										
Musala										

Supporting Function											
Room	Lighting		Ventilation		View		Calmness	Cleanliness	Sanitation	Accessibility
	Natural	Artificial	Natural	Artificial	In	Out				
Administration Room										
Information Center										
Meeting room										
Manager's Room										
Employee Room										
Lobby										
Pantry										
Reading Corner										
Smooking Area										
Musala										
Toilet										
Warehouse										

Source: Author Analysis, 2022

Information:

- Need a certain time
- Need
- No Need

SPACE LINKAGE DIAGRAM

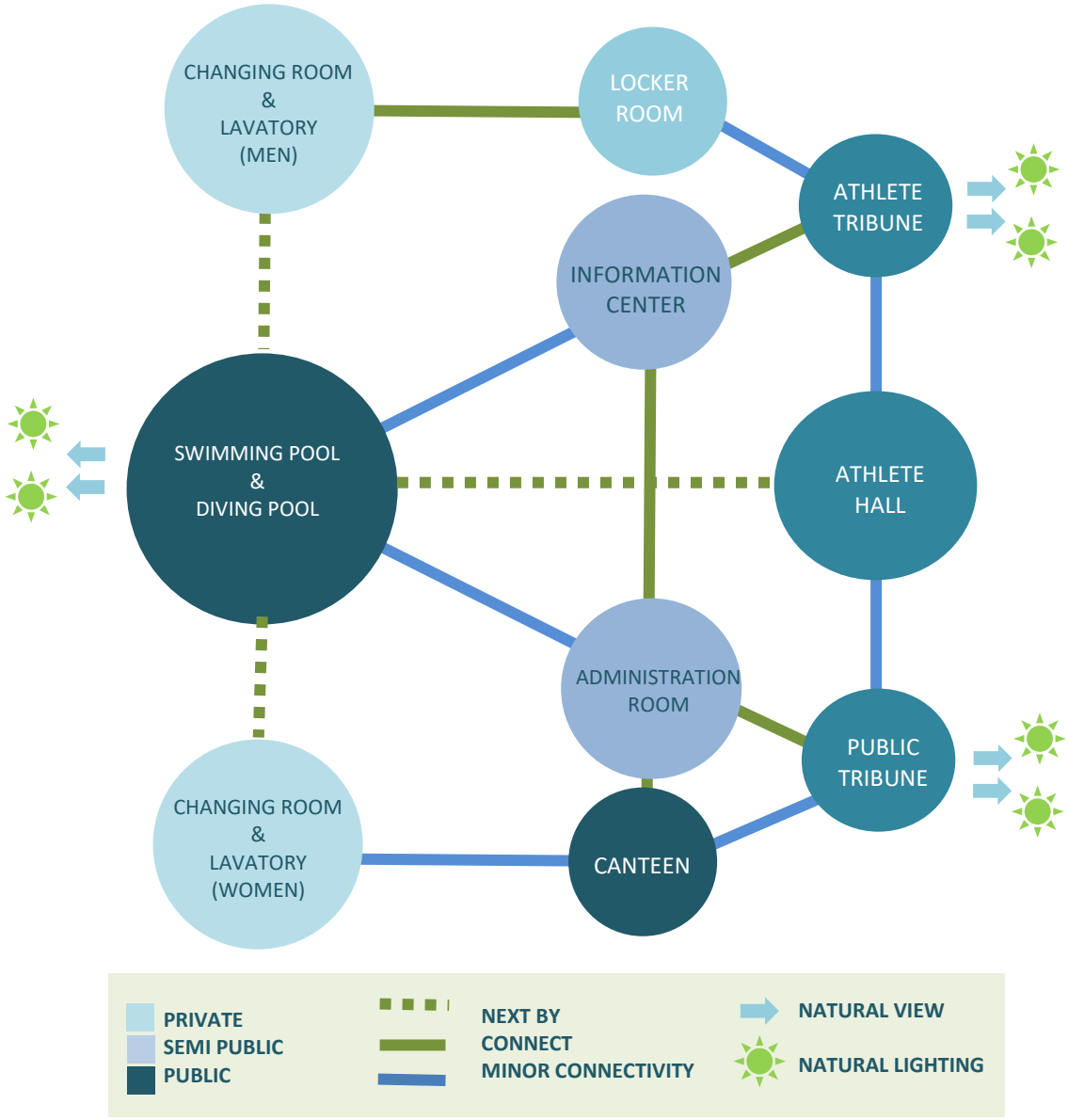


Figure 4.20 Space Linkage Diagram of Aquatic Sports Center
Source: Author Analysis, 2022

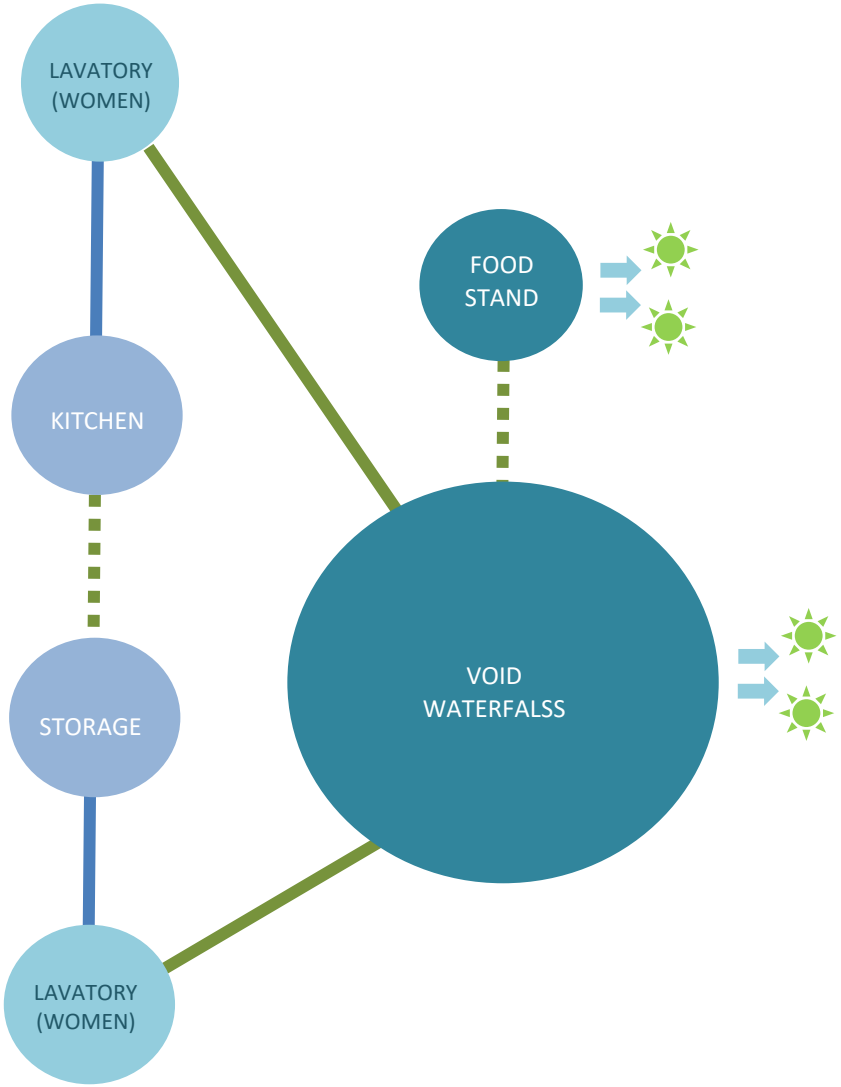


Figure 4.21 Space Linkage Diagram of Foodcourt
Source: Author Analysis, 2022

SPACE LINKAGE DIAGRAM

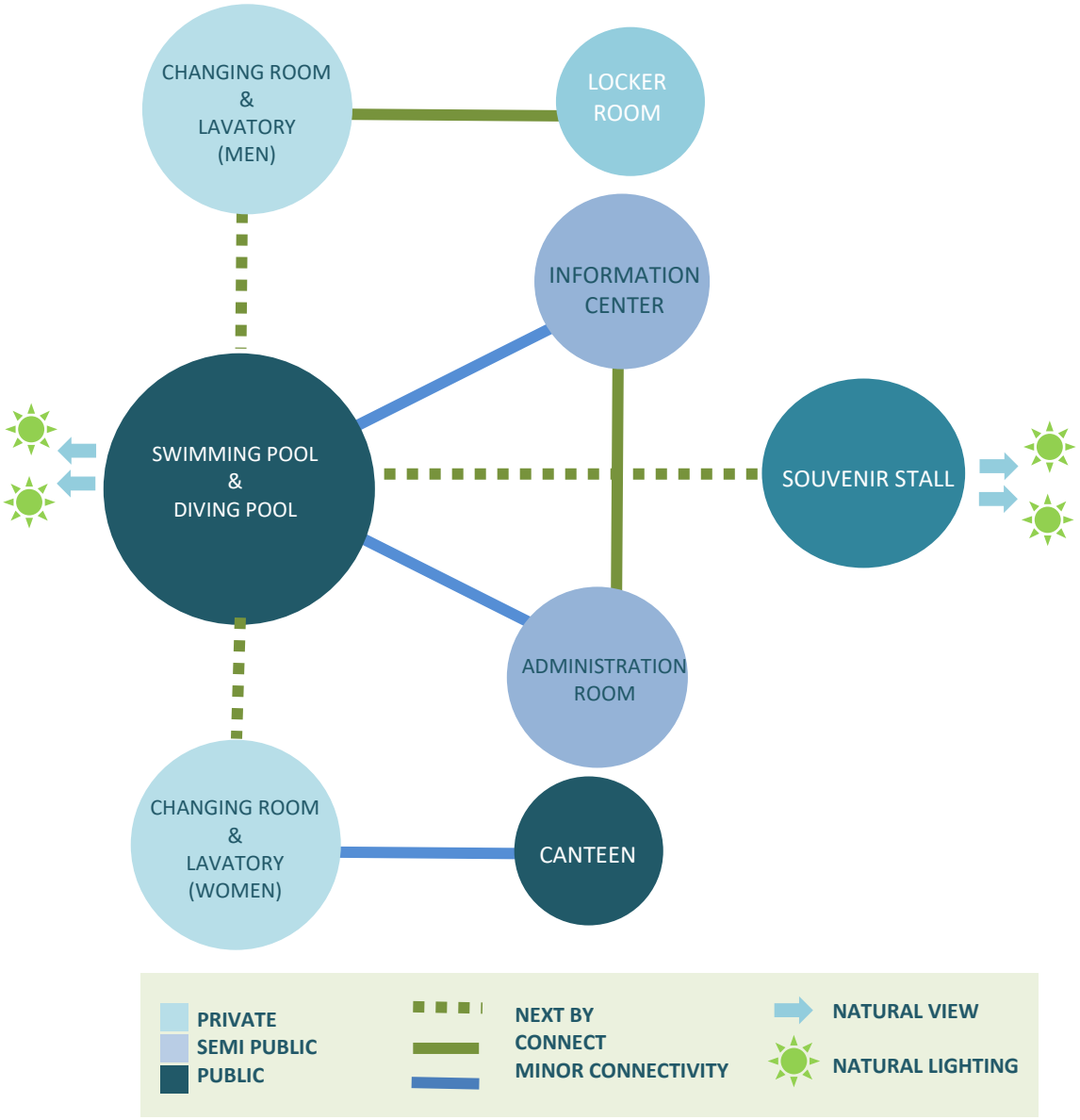


Figure 4.22 Space Linkage Diagram of Leisure Pool
Source: Author Analysis, 2022

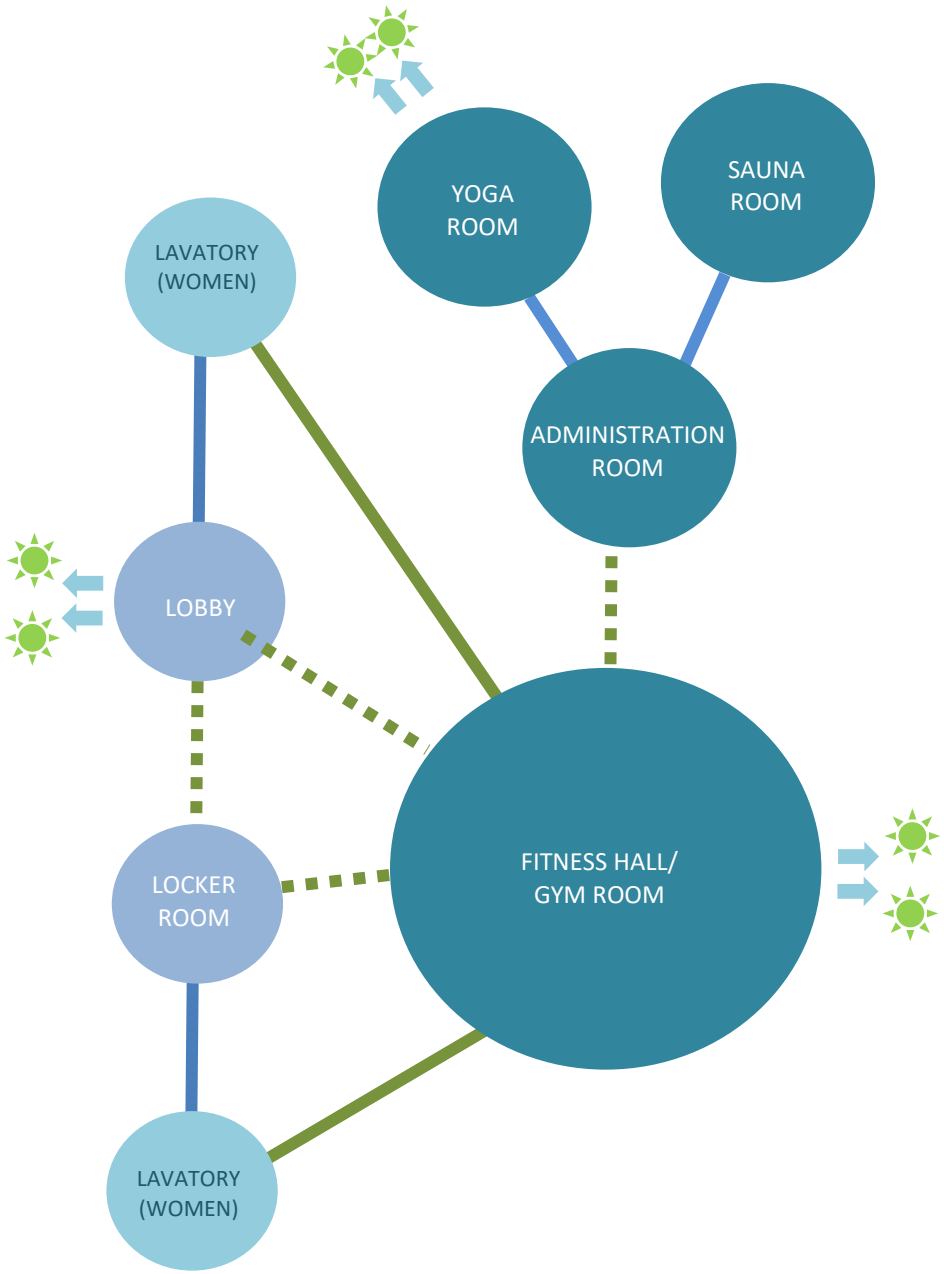


Figure 4.23 Space Linkage Diagram of Training Center
Source: Author Analysis, 2022

SPACE LINKAGE DIAGRAM

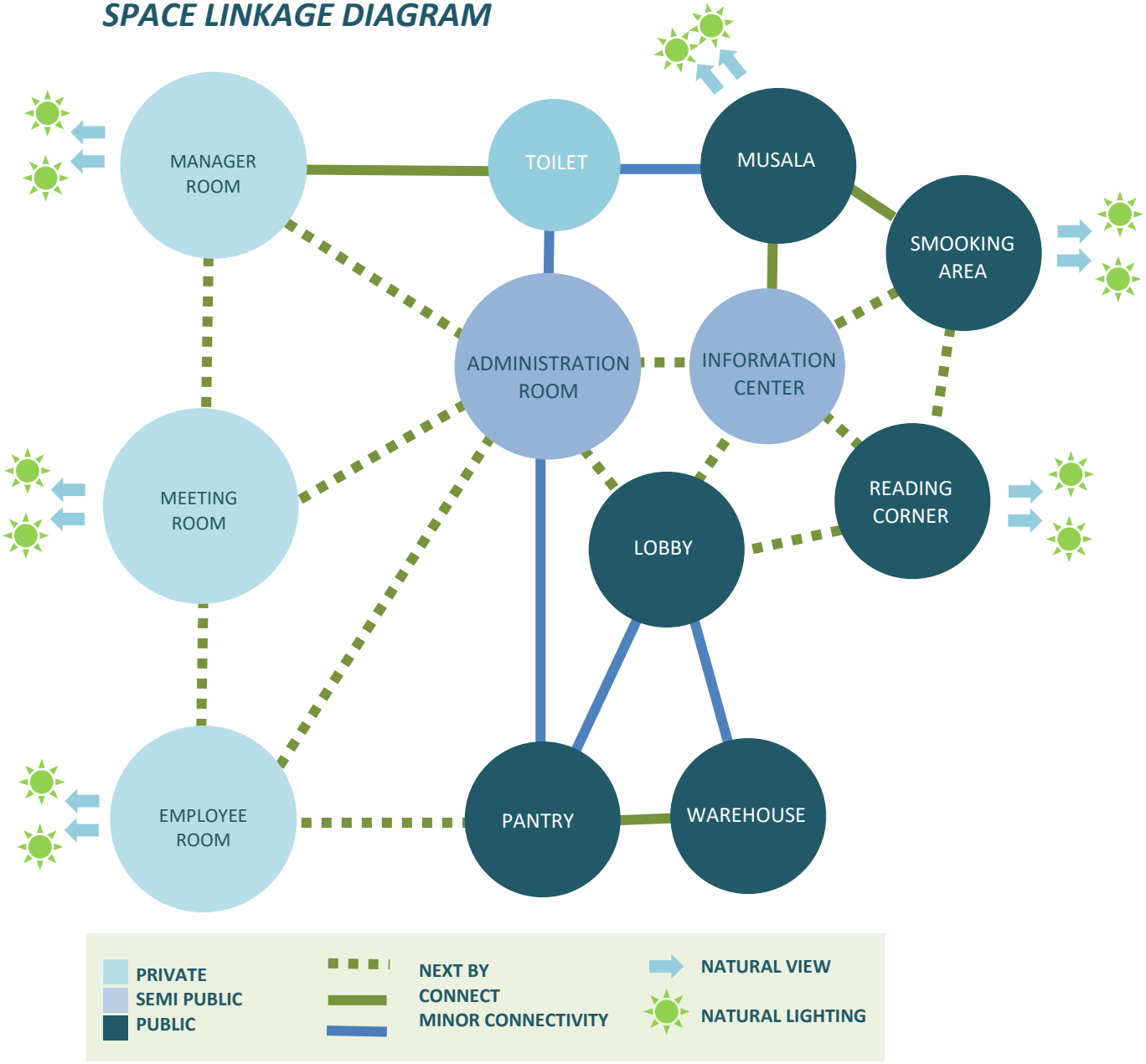


Figure 4.24 Space Linkage Diagram of Management Office
Source: Author Analysis, 2022

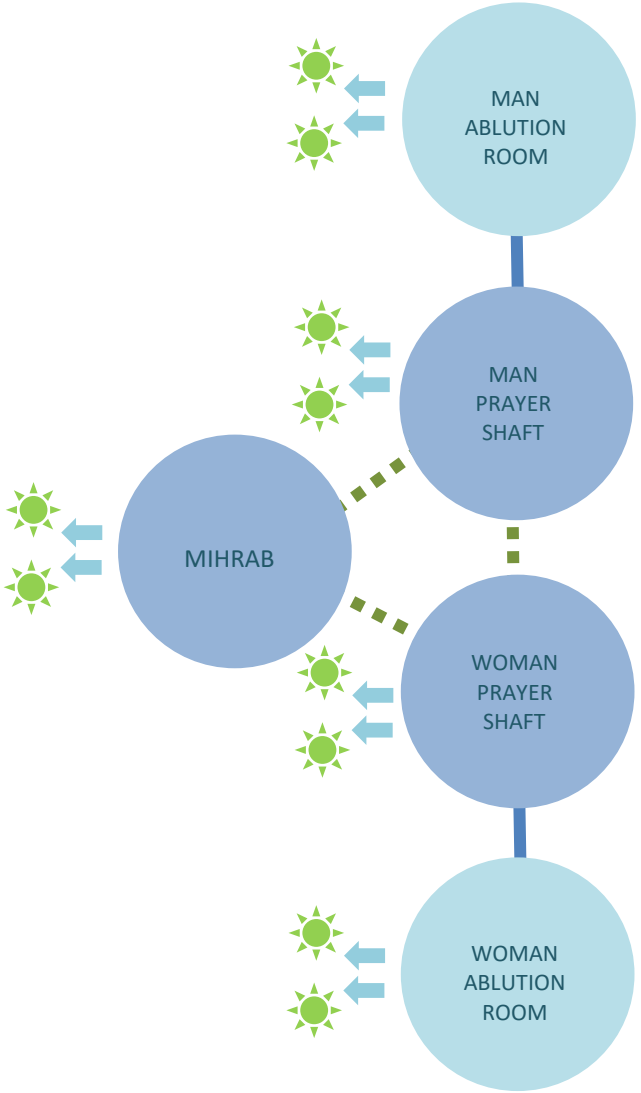


Figure 4.25 Space Linkage Diagram of Mosque
Source: Author Analysis, 2022

BLOCK PLAN

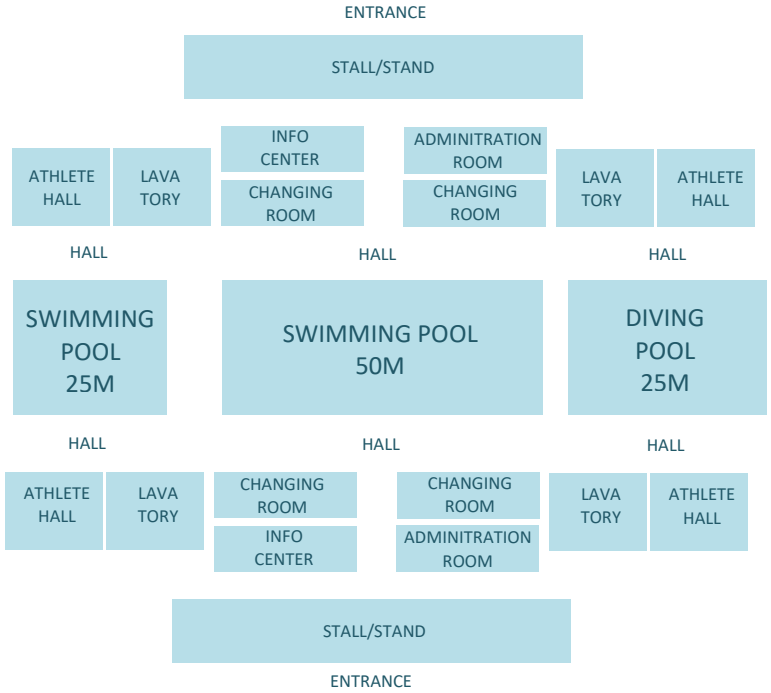


Figure 4.26 Block Plan of Aquatic Sports Center
Source: Author Analysis, 2022

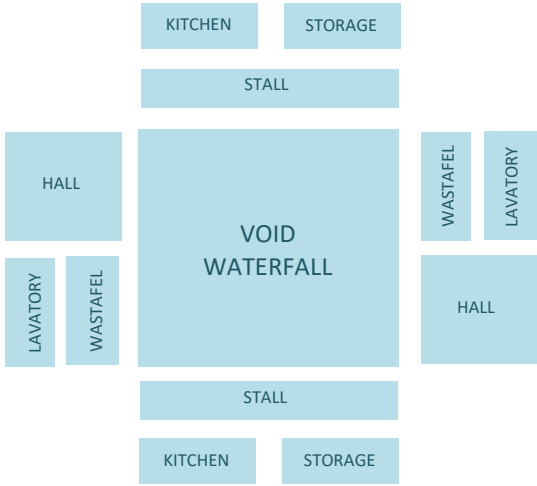


Figure 4.27 Block Plan of Foodcourt
Source: Author Analysis, 2022

BLOCK PLAN

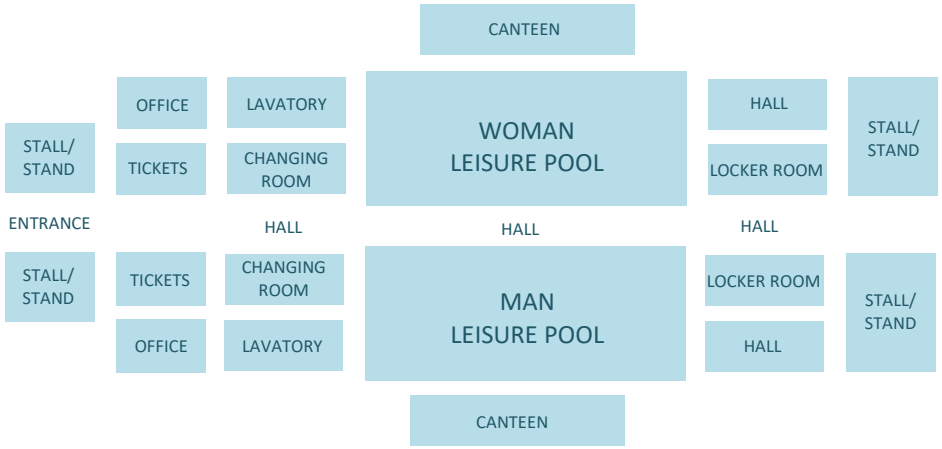


Figure 4.28 Block Plan of Leisure Pool
Source: Author Analysis, 2022

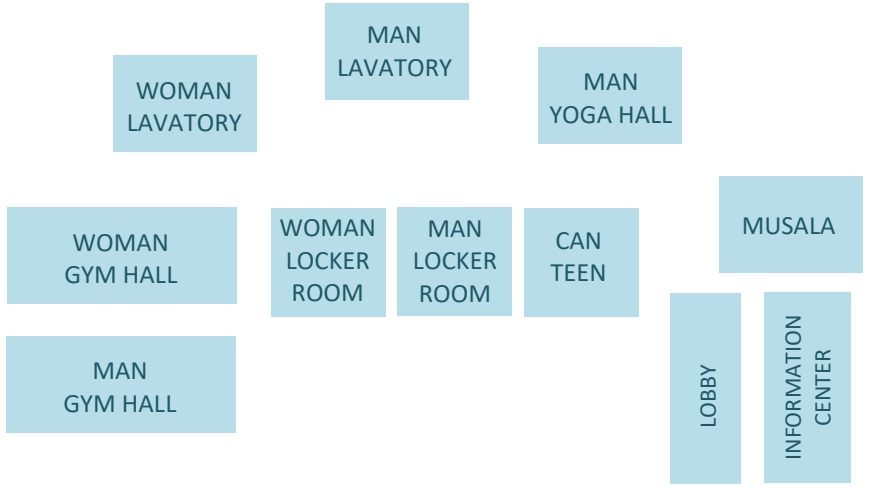


Figure 4.29 Block Plan of Training Center
Source: Author Analysis, 2022

BLOCK PLAN

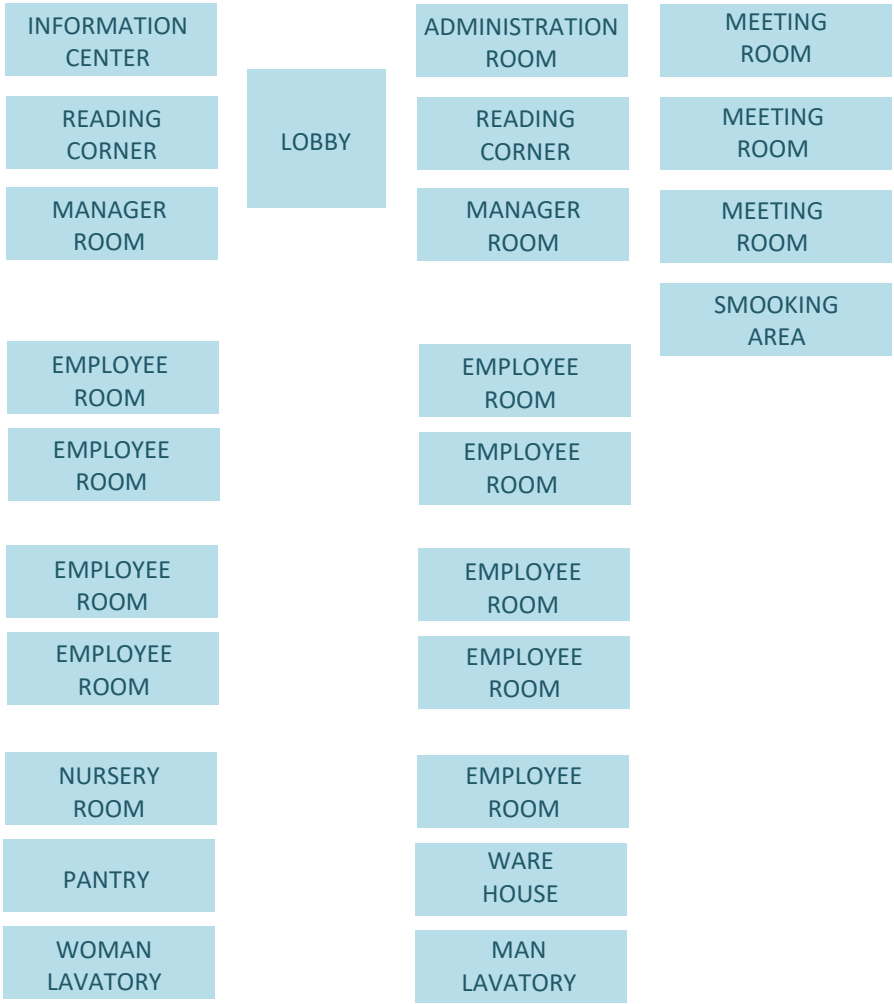


Figure 4.30 Block Plan of Management Office
Source: Author Analysis, 2022

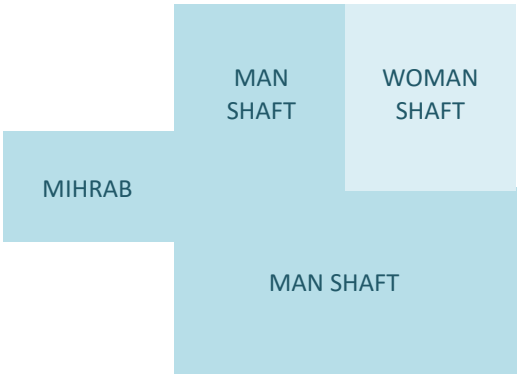
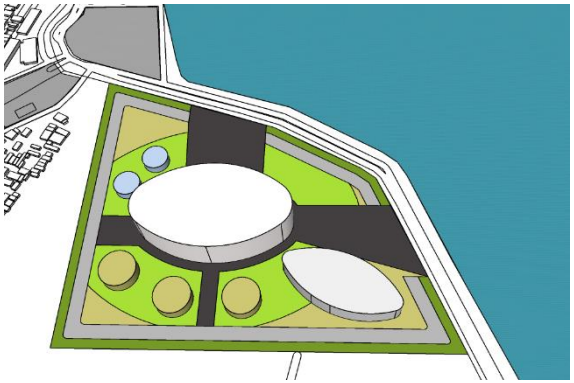
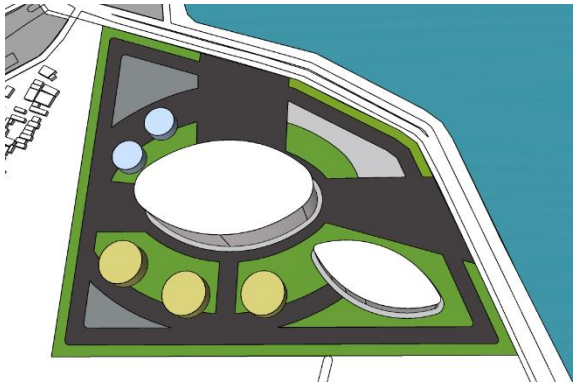


Figure 4.31 Block Plan of Mosque
Source: Author Analysis, 2022

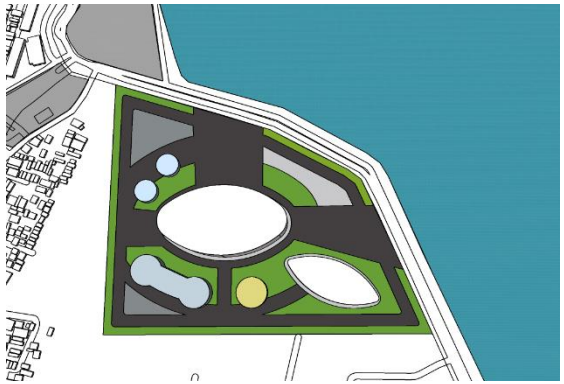
FORM ANALYSIS



The initial mass arrangement in the site is based on the response to site analysis, circulation and accessibility.



Adding open space and access to each building to maximize connectivity between the building and the landscape. As a symbol of the unity of the design.



The merging of two mass buildings that have the same function, other forms of composition are expected to be a new alternative in design.

The main building is the basic form for other buildings. Forming unity in the design, Change other shapes by cutting and adding circle shapes to some buildings so it doesn't seem monotonous.

The center for the development of the building form and mass structure is the Aquatic Sports Center, which is located in the center of the site. So that all the buildings are directed towards the Aquatic Sports Center.

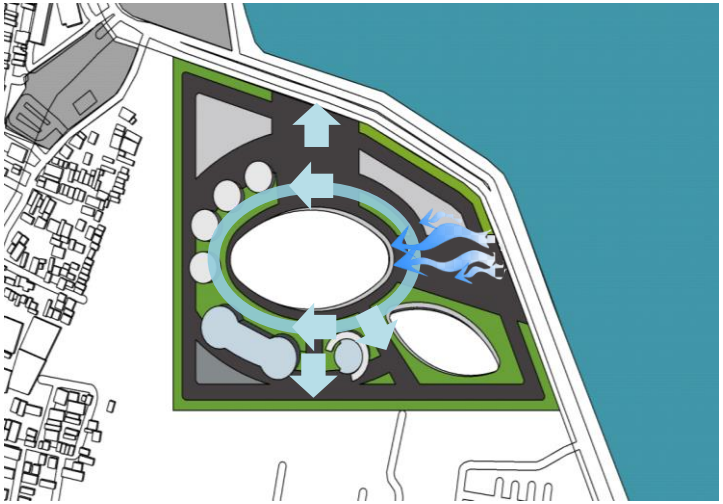


Figure 4.32 Form Analysis
Source: Author Analysis, 2022

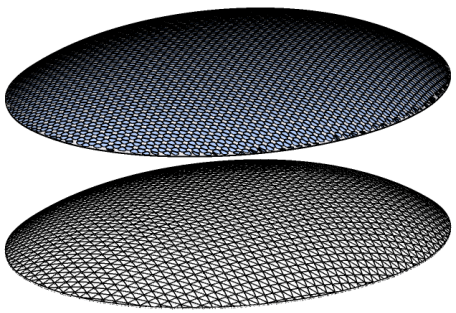
BLOCK PLAN
The basic form and building mass are calculated based on the function and space requirements.

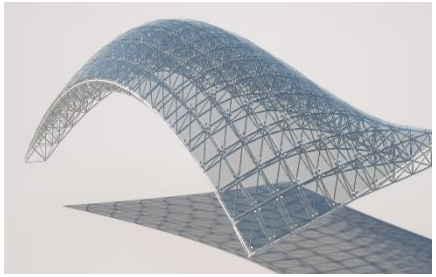
MASS LEVEL
The mass of the building is increased according to the function of the building.

CHANGES IN THE BASIC SHAPE OF MASS
Changes in shape are influenced by wind, sun, climate, and view.

MASS FINAL
The process of designing the building vacade as well as structuring the openings and vegetation in the building.

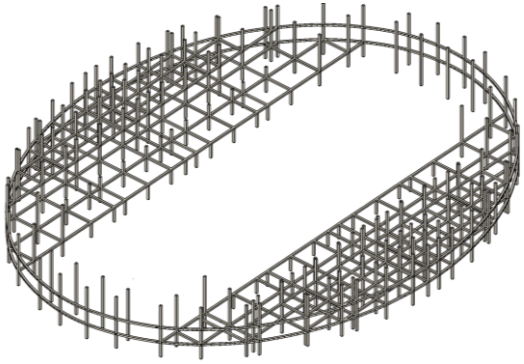
STRUCTURE ANALYSIS

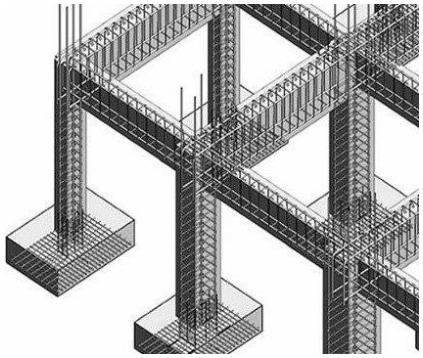




UP STRUCTURE

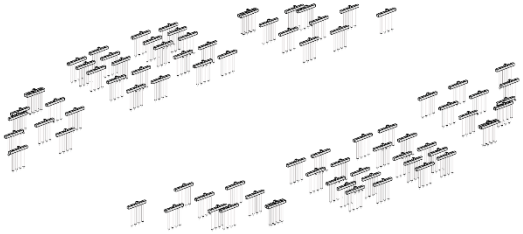
The roof structure in each building uses a steel frame and mild steel with a slope that is adjusted to each building and follows the shape of the building.

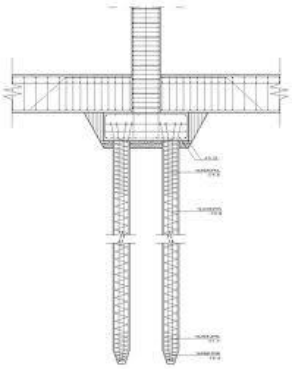




MID STRUCTURE

In the center of the building, a reinforced concrete column and beam structure is used.
The use of latei beams is required to support the load on the frame.
The size of the columns in each building is different depending on the level of the building.



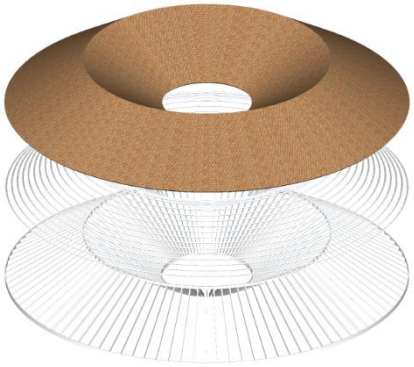


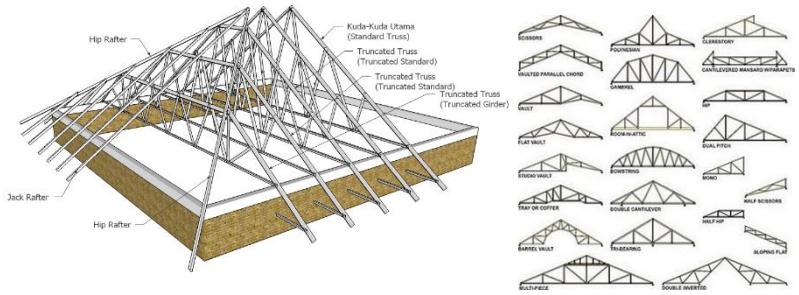
SUB STRUCTURE

For the lower structure using a pile foundation, because the building is of two floors.

Figure 4.33 Structure Analysis
Source: Author Analysis, 2022

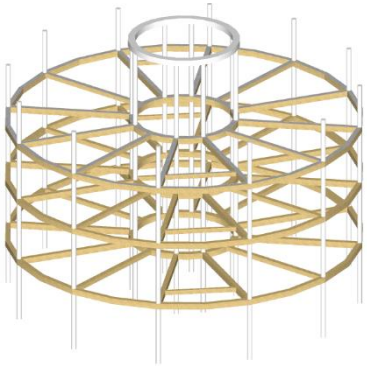
STRUCTURE ANALYSIS

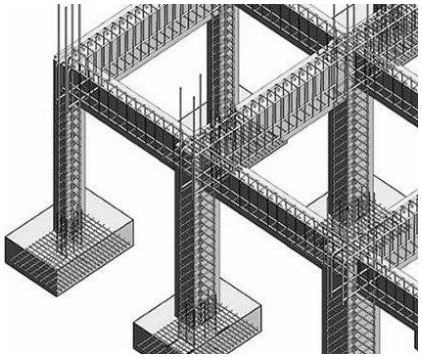




UP STRUCTURE

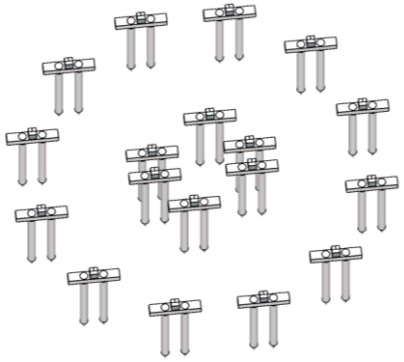
The roof structure in each building uses a steel frame and mild steel with a slope that is adjusted to each building and follows the shape of the building.

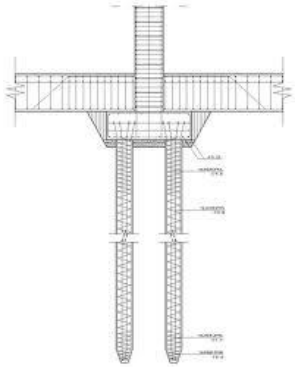




MID STRUCTURE

In the center of the building, a reinforced concrete column and beam structure is used. The use of latei beams is required to support the load on the frame. The size of the columns in each building is different depending on the level of the building.

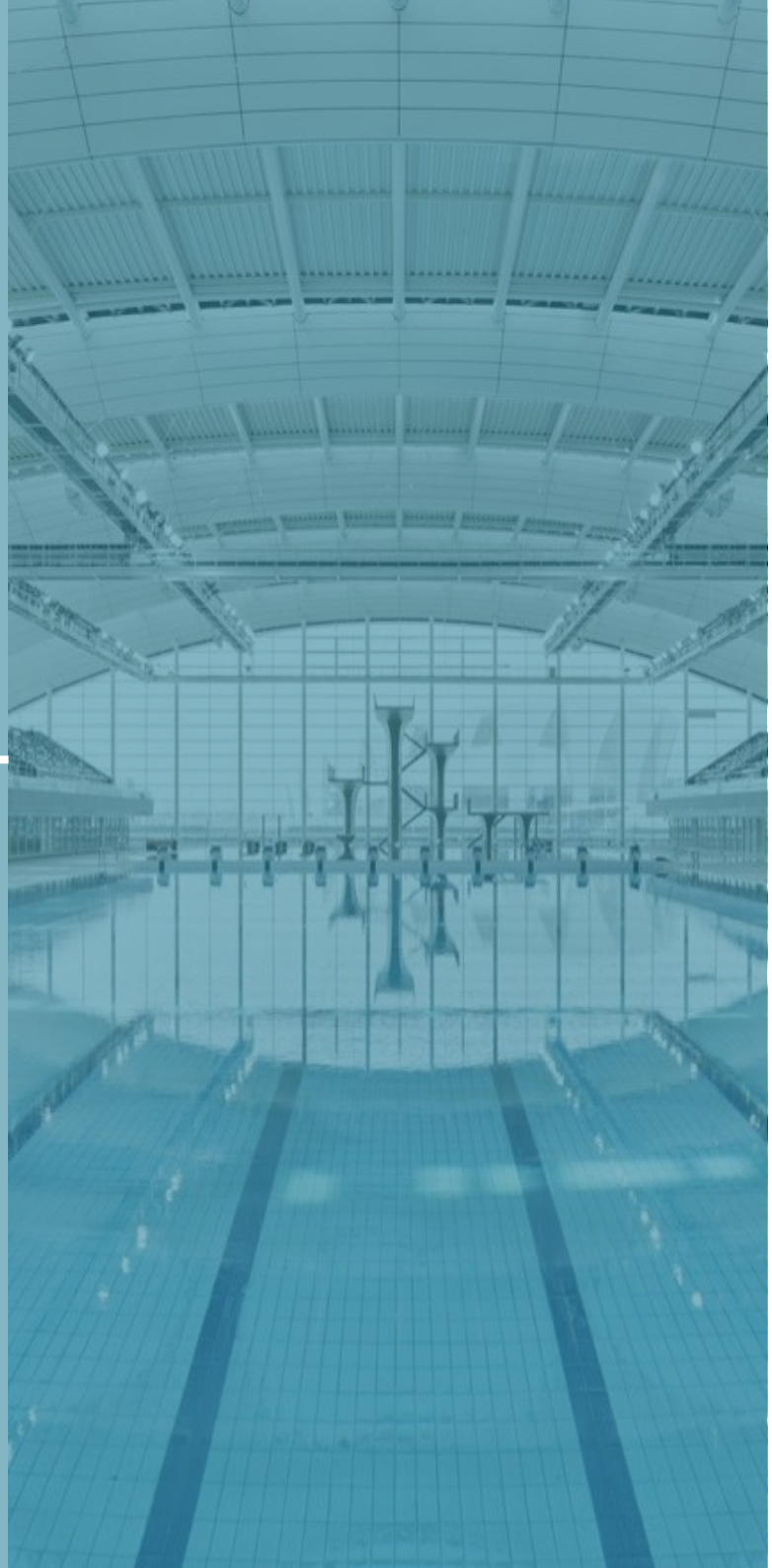




SUB STRUCTURE

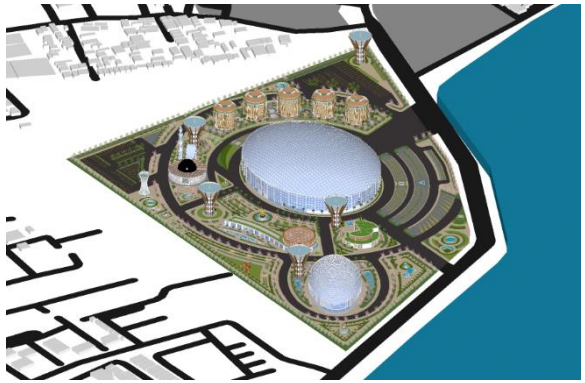
For the lower structure using a pile foundation, because the building is of 5 floors.

CONCEPT



BASIC CONCEPTS

This basic concept is the conclusion of the basic design idea. So that this basic concept will be used as a guideline or foundation that will be used to design the Sport Aquatic Center. The shape of the Sport Aquatic Center is the result of a process of analysis and shape transformation.



Harmonic formation:

Harmonious facade.

Materials, colors, textures and ornaments that are in harmony with the surrounding environment.

ISSUES

- Water is the linking element.
- Maintaining and developing Public RTH.
- Iconic and expressions.
- Renewable energy.

FACT

The strategic location of the site is close to recreational parks, settlements, trade centers. However, the condition of the waters around the site has not been well integrated so that it looks shabby and uncomfortable.

THEORY

Expression of structure and construction integrated with environment.
Apply a natural ventilation system and natural lighting.
Energy use as little as possible on the exploitation and manufacture.
Eco-tech buildings are assessed in context city environment.
Making connection between design and the environment.
Building again as a public symbol by taking the form.

Water Conscious Design

APPROACH

Using the Eco-Tech Architecture approach as a design basis.

- Water is the linking element.
- Maintaining and developing Public RTH.
- Iconic and expressions.
- Renewable energy.

ISLAMIC VALUE

Surah al-Baqarah: 164

- Connects people the greatness Of Allah SWT through its design.
- Create the best impression through the play of spatial patterns and shapes to visitors and as a reflection of the relationship between humans and the natural environment.

APPLICATION

- Designing a unique and attractive Aquatic Stadium building.
- Exploring structure as the essence of building aesthetics.
- Creating a functional and optimal space design.

PHILOSOPHY

The building must have a unique appearance and express the city of Surabaya.
The building must show a blend that is in harmony with its environmental ecosystem.
The building must maintain sustainability that is responsive to the water potential on the site.

Figure 5.1 Scheme of Basic Concept
Source: Author Analysis, 2022

TAGLINE

WATER CONSCIOUS DESIGN

The area around the site is a combination of public space, recreational areas, sports areas and green open spaces. Water Conscious Design is a tagline that is applied to the design as a basic idea. Water Conscious Design is applied in determining the structure of the building mass, the spatial pattern so as to create a transitional space between the building and open space, the transition space between the interior spaces, and the transition space between buildings. Water Conscious Design can be seen from the landscape design that prioritizes the element of water as a unifier of buildings and areas. In addition, landscape design that is focused by water linkage can be a design solution for climate response. These elements have one common goal, which is to be well integrated. Water Conscious Design is implied into 3 important points, namely "Green" "Iconic" and "Connected".

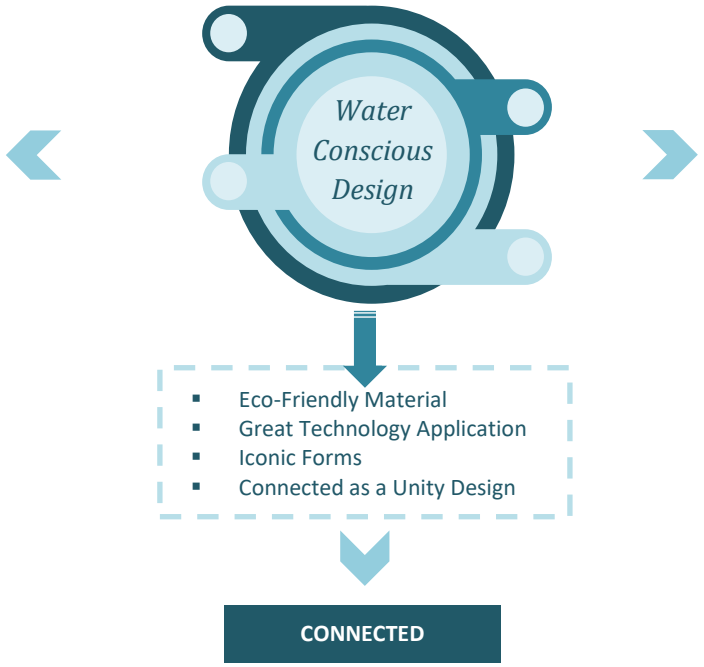


Figure 5.2 Scheme of TAGLINE
Source: Author Analysis, 2022

CONCEPT PRINCIPLES

PRINCIPLE : "CENTRALIZED"

The application of combining design principles from basic ideas forms a unified principle, namely "CENTRALIZED".

The following are the principles of Water Conscious Design which are applied to the design concept:

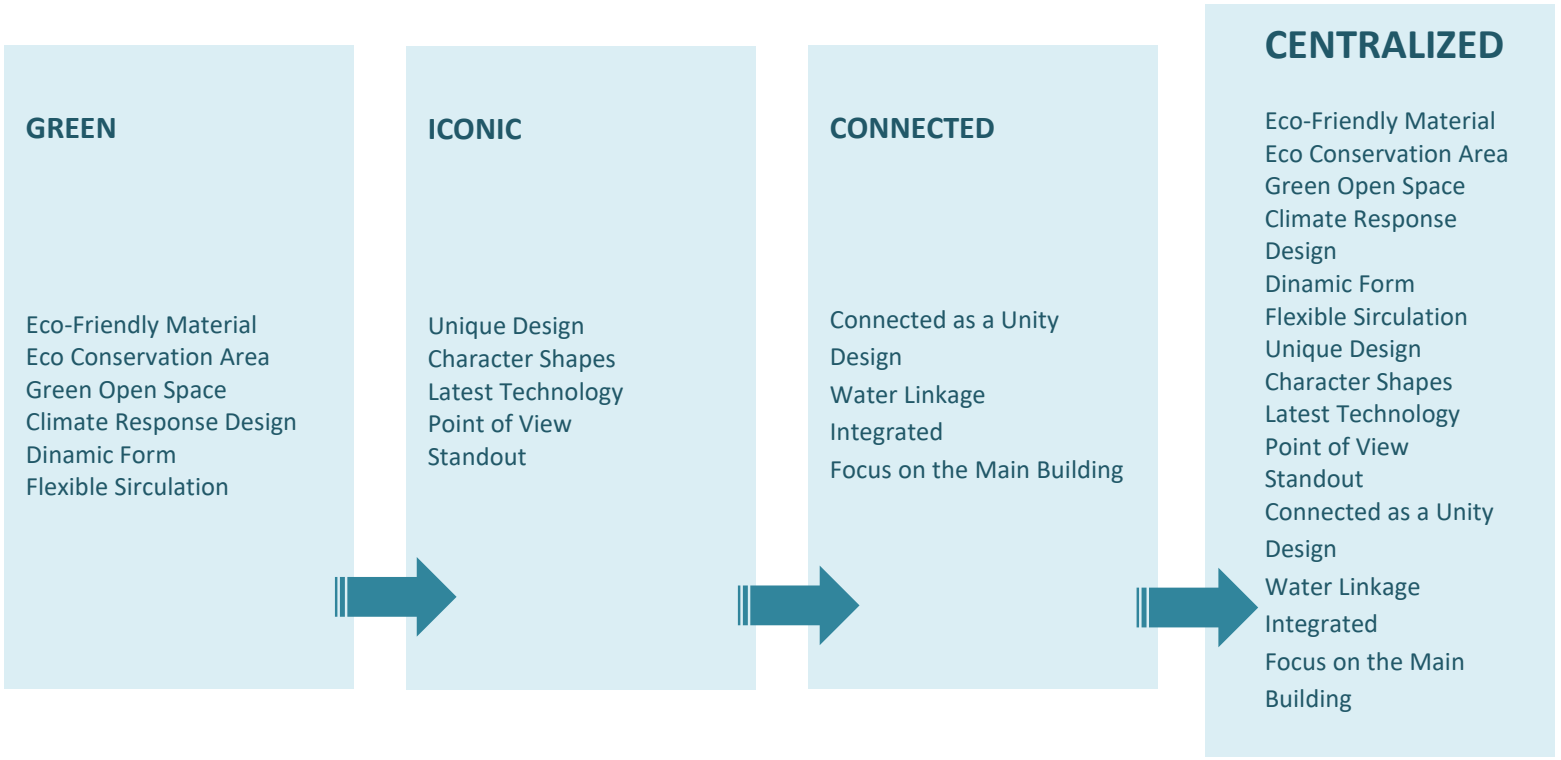
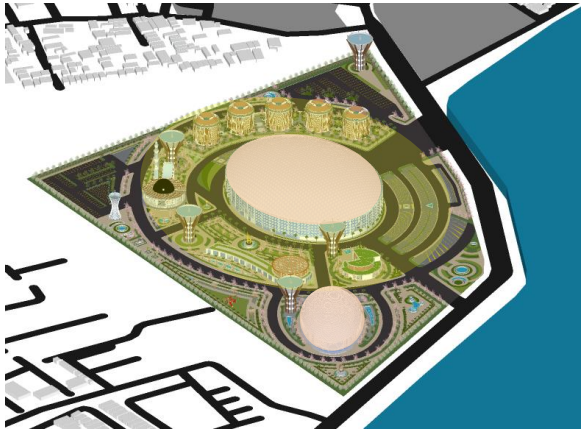
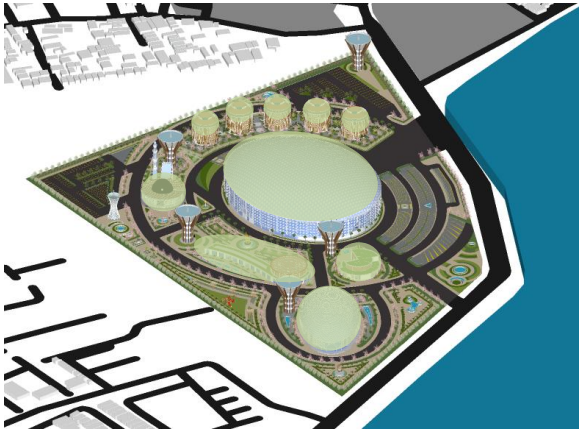


Figure 5.3 Scheme of CONCEPT PRINCIPLES
Source: Author Analysis, 2022

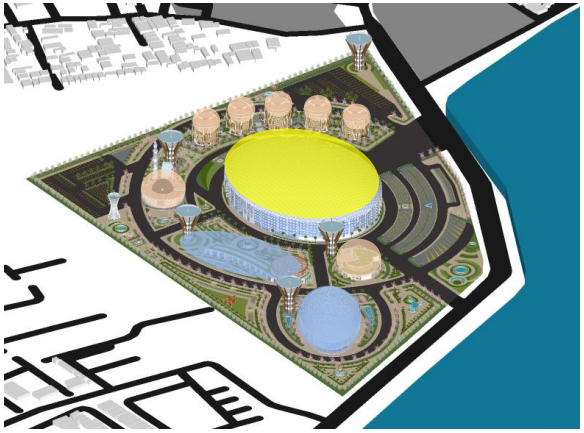
AREA CONCEPTS



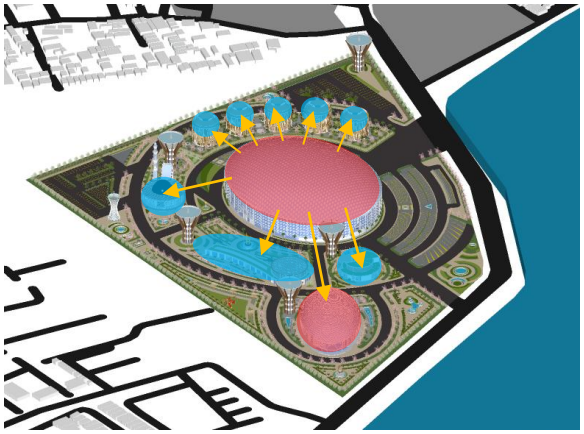
Creating a centered atmosphere in the area in the form of placement of functions, namely the middle and the outside.



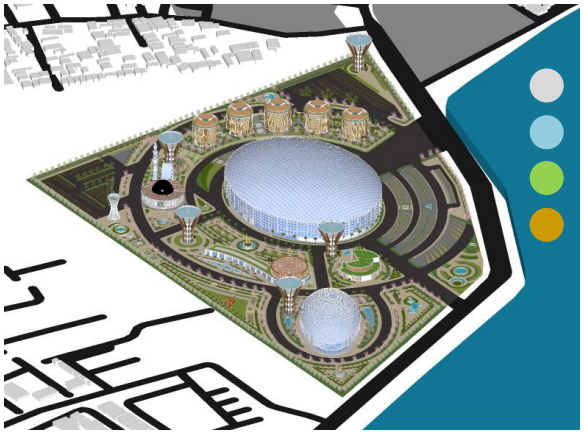
It is a pattern of mass order consisting of a number of secondary forms that surround the main building as a central point.



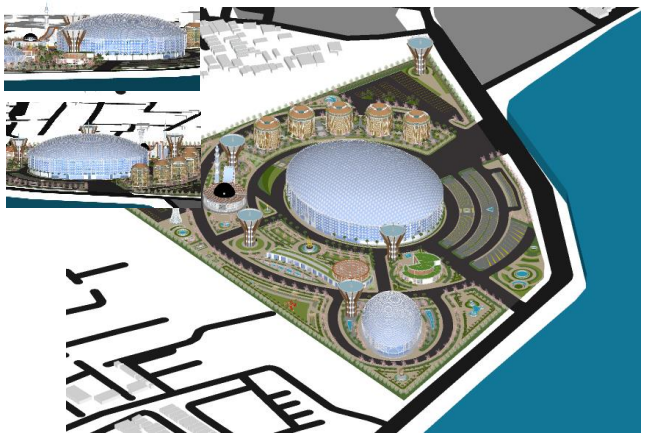
Creating a monumental and iconic impression in the area in the form of a size hierarchy.



Creating unity in the area in the form of a basic form following the shape of the main building.



Creating an eco-friendly feel through visuals in the area by applying materials, colors, textures and ornaments.

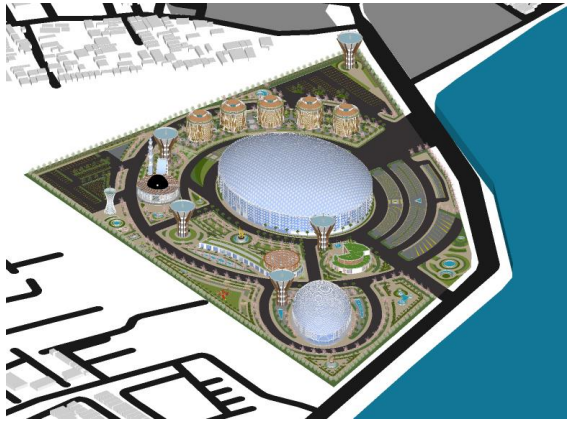


Creating a centralized view from the outside through the visualization of the iconic Aquatic Sports Center, entrances and exits of the area that are directly focused on the main building.

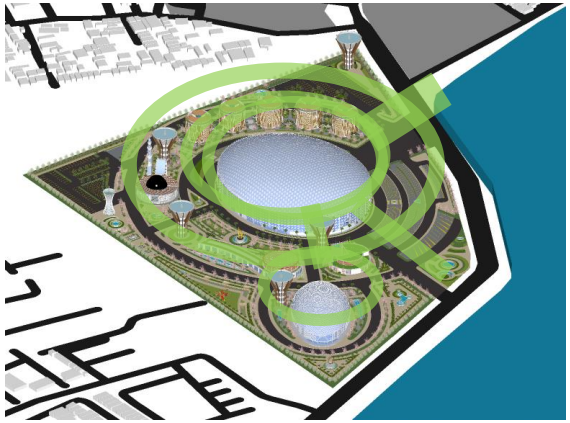
Figure 5.4 Area Concepts
Source: Author Analysis, 2022

SITE CONCEPTS

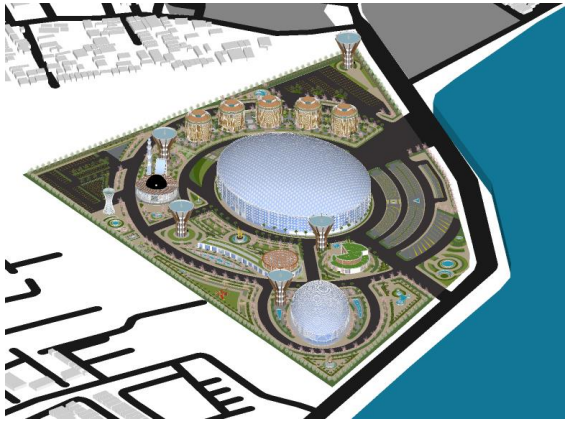
Centralized Mass :
Hierarchy by placement, basic shape, size and building axis.



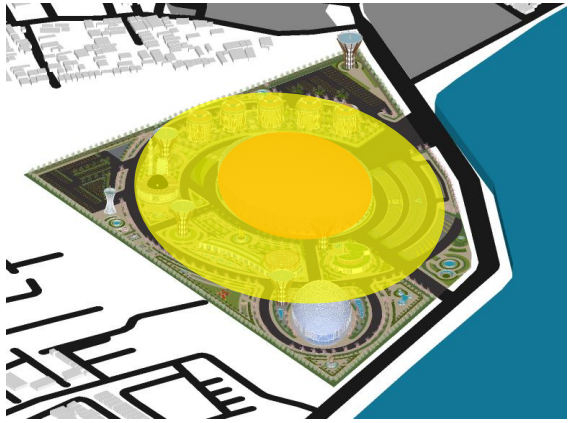
ZONATION
Zonation based on function. The bigger and more complex the space requirement by the user, the more iconic the building on the site.



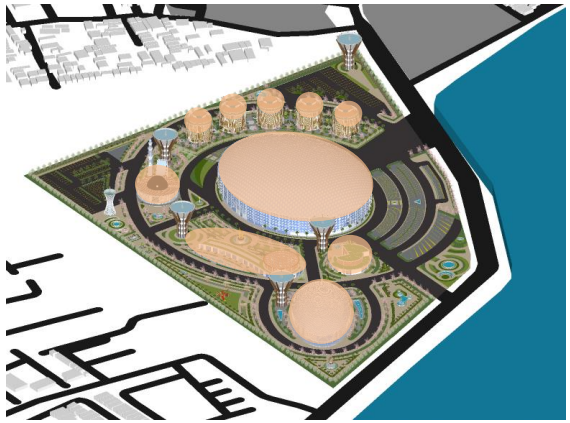
Circulation on an open site, bordered by gardens and pedestrian ways so that the building blends with circulation.



Provide plenty of open space around the site and around each building to allow room for air to enter the area and add cooling vegetation and fish ponds due to the hot climate of the seaside.



Application of transition between the main building and supporting buildings to accommodate user activities.



The pattern follows the site and the locality around it. The spatial pattern on the site pays attention to coastal conservation values and responses to coastal climate.

Figure 5.5 Zoning Concepts
Source: Author Analysis, 2022

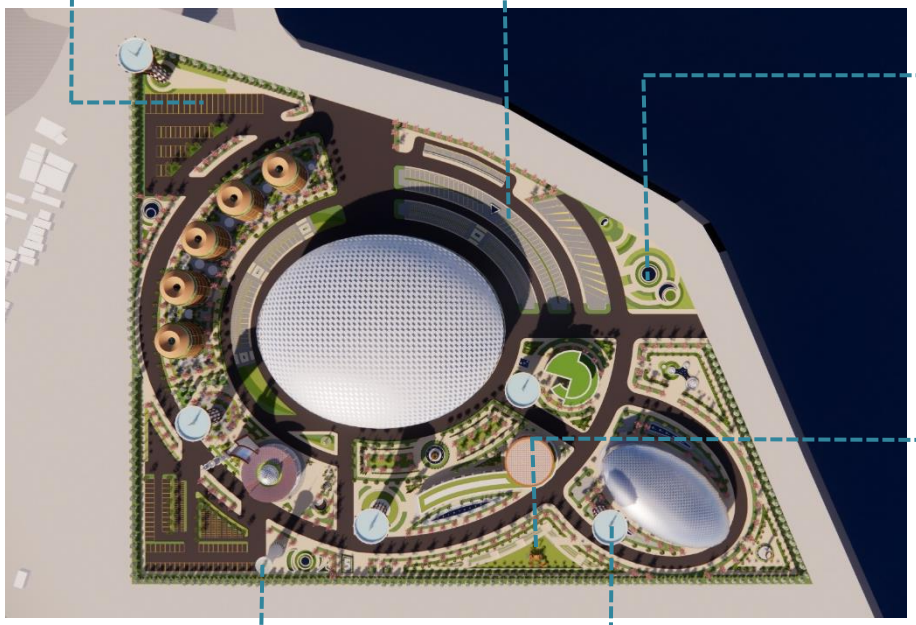
Figure 4.17 Green Open Space Illustration
Source: Writer Analysis, 2022

SITE CONCEPTS

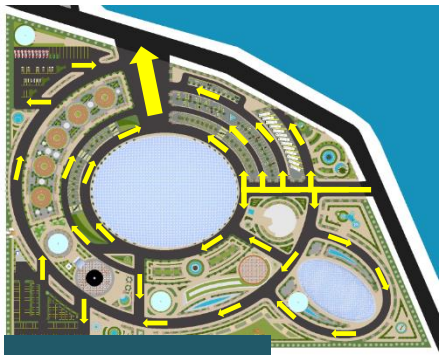
Centralized Mass :
Hierarchy by placement, basic shape, size and building axis.

The site concept comes from the conclusion of the analysis that has been summarized from several design elements, namely circulation, accessibility, zoning, mass management, vegetation, views and others.
So that the concept of the site is the application and subsequent process as a reference for designing the Aquatic Sports Center.

Provision of shade vegetation in the parking lot and drainage flow to dispel heat and minimize flooding. In addition, there are pedestrian paths and assembly points for emergency needs.

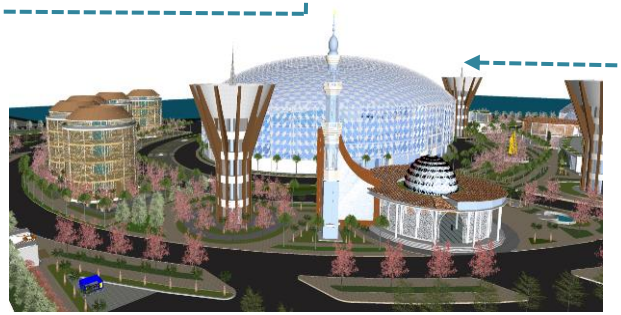


There is a sculpture and the name Kenjeran Aquatic Sports Center as a photo spot and area marker.



VEHICLE SIRCULATION

The Power Station as a source of electricity and the area's electric center is located on the west side of the area close to the local environmental power source.



Water Tower as a reservoir for water reserves and supply of water needs in buildings, each water tower can accommodate the needs of 1-3 buildings. About 70000L.

The playground as a family communal space, there is a gazebo for parents to monitor their children playing.

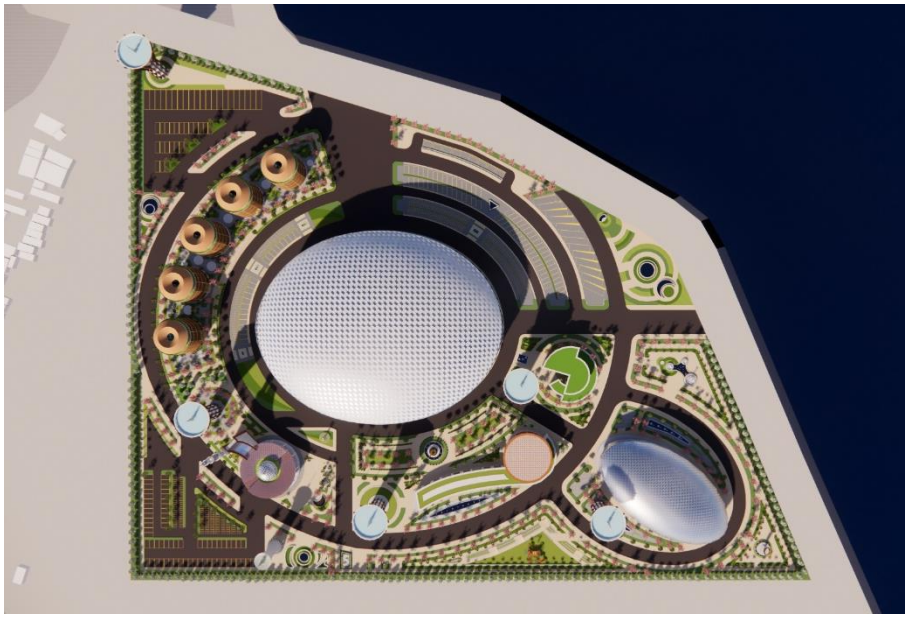
Figure 5.6 Site Concepts
Source: Author Analysis, 2022

VEGETATION CONCEPTS

Centralized Mass :
Hierarchy by placement, basic shape, size and building axis.

The application of guiding vegetation on the site is applying palm trees. Arranged in parallel rows as a guide for vehicle circulation and user circulation.

The application of ornamental vegetation on the site is applying flowers of various colors to add aesthetics and a cheerful atmosphere. This vegetation aims to build atmosphere, aesthetics, absorb pollutants and stabilize soil moisture.



The application of shade vegetation on the site is applying ketapang and tabebuya trees. A tree with a wide title as a shade for users and vehicles. Sun and noise blocker. Adding a barrier tree as a barrier for pedestrian circulation and vehicle circulation.

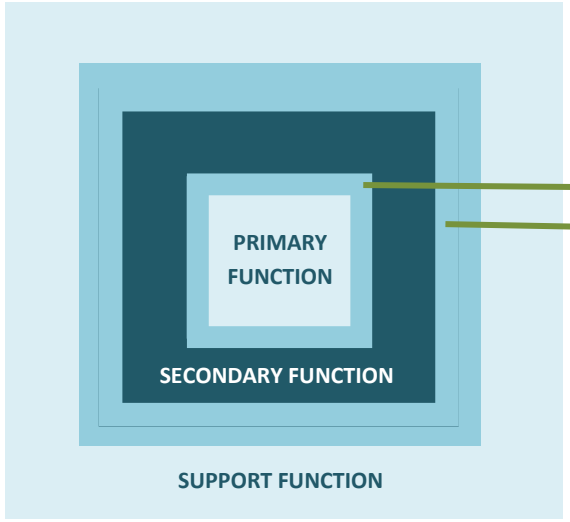
The application of fragrance vegetation on the site is applying Mandevilla flowers. This flower is resistant to hot weather and has a fragrant smell can neutralize unpleasant odors in the area.

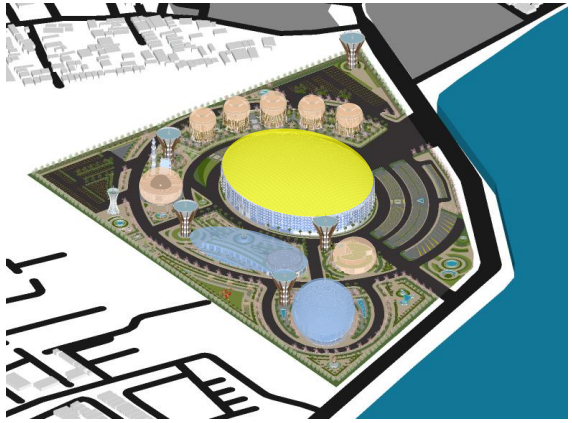
Figure 5.7 Vegetation Concepts
Source: Author Analysis, 2022

SPACE CONCEPTS

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.

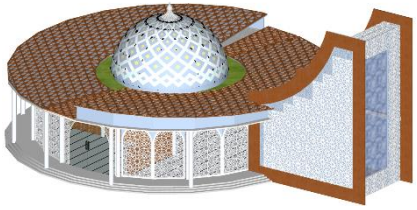


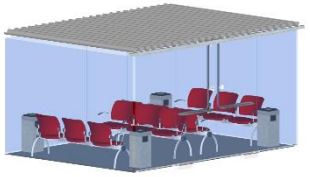


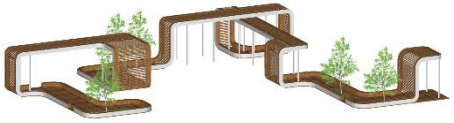
Provide a special space for private and public needs so that other activities can provide comfort.

Providing a transitional space in each building to show openness and friendliness to the natural surroundings as a form of eco-friendly application.

TRANSITION SPACE







Several private and public facilities, nursery room, playground, indoor smoking area and mosque.

TAGLINE : "WATER CONCIOUS DESIGN"

Applying WATER CONNECTING as a form of harmony between space and the building.

- Water is the linking element.
- Maintaining and developing Public RTH.
- Iconic and expression.
- Renewable energy.

Laying of pools between buildings to dispel the hot temperatures of the beach in the area and buildings.

Ponds pool become a water linking element between buildings, a transitional space for the unity and harmony of open space and private space.

The assembly point has a garden and a pool to build a calm atmosphere when an incident occurs in the building.

The application of artificial waterfalls in the voids of the food court building as a temperature controller in the building.

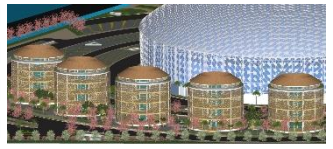
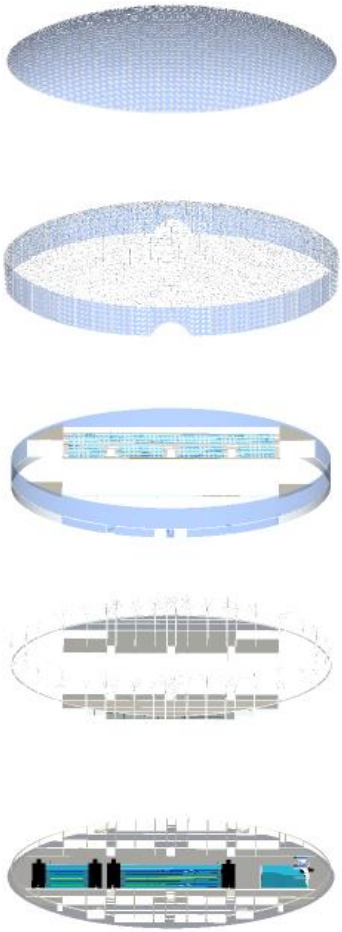


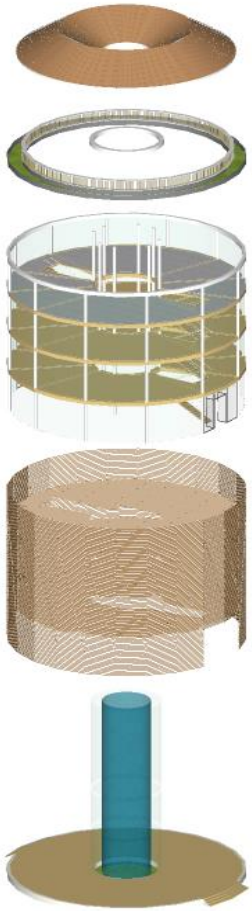
Figure 5.8 Space Concepts
Source: Author Analysis, 2022

SPACE CONCEPTS

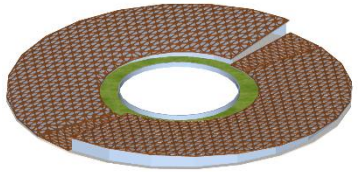
PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.

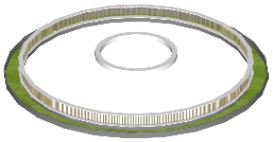


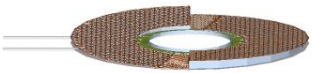


Several private and public facilities, nursery room, playground, indoor smoking area and mosque.



Several private and public facilities, nursery room, playground, indoor smoking area and mosque.



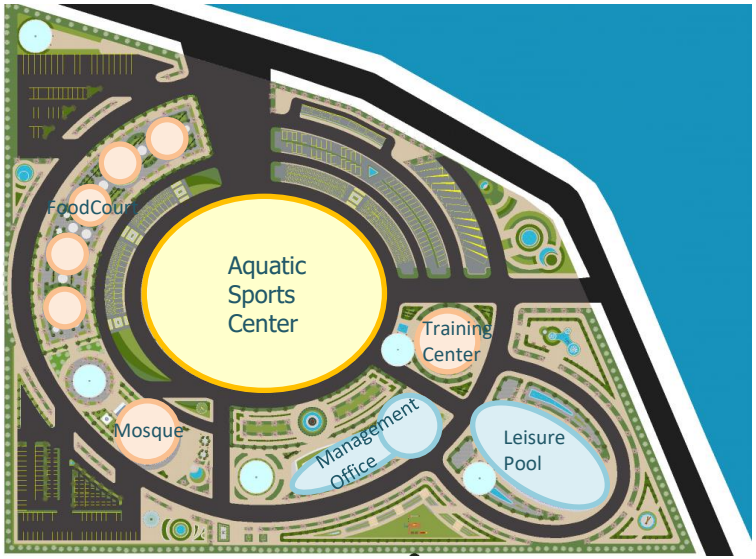


MATERIALS	Using materials with colors that symbolize peace and are environmentally friendly.
TEXTURE	Using natural materials such as wood, stones, steels, and clay tiles.
ORNAMENT	The application of the incorporation of circle ornamentation as a form of representation of unity between buildings and areas.

SPACE CONCEPTS

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.



Hierarchy of placement in the block plan macro.

MAIN BUILDING

TANSITION SPACE

SUPPORTING BUILDING

The concept of hierarchical placement in the macro block plan is the placement of transitional spaces between buildings that form a single unit within the area as a response to local conservation, ecology and climate values.

The main building as the core of the design becomes the center of the other buildings. Circulation emphasizes proximity to the main building.

White color as the basis of the room, to give a clean and spacious effect in the room.

Pastel colors as highlights for the base color of the room. The use of pastel colors can give the user a calming effect.

The floor material uses parquet to give the impression of being plain but environmentally friendly.

The use of wide openings to provide an in-out view of the building.

Circulation at the site is very well done.

The orientation of the building is centered on the main building.

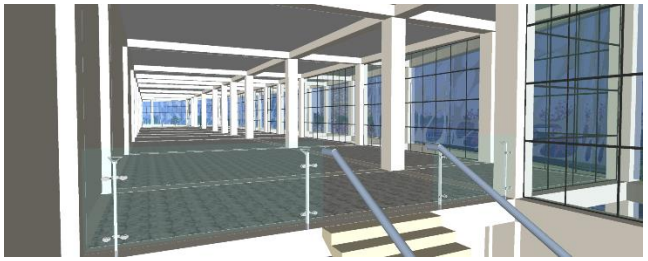
Providing an atmosphere of tranquility in buildings that require high privacy by providing indoor and outdoor quality to the design.

Providing relaxing areas, cafes, food courts, parks, playgrounds, and gazebos.

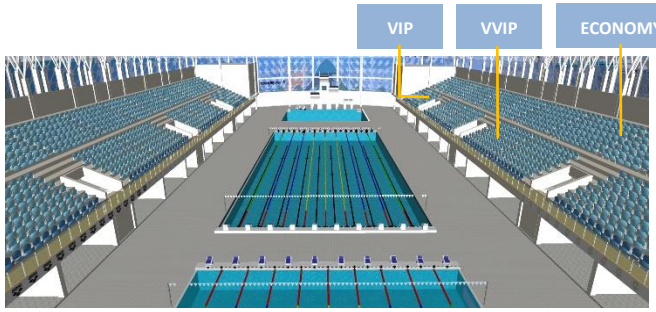
SPACE CONCEPTS

PRINCIPLE : "CENTRALIZED"

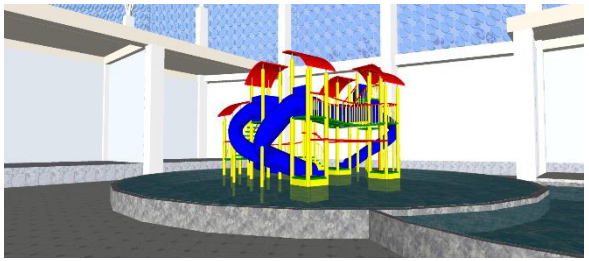
Applying centralized zoning as a form of harmony between space and the building.



There is a flexible room for conferences and exhibitions, where you can see the view around the site from the 2nd floor of the Aquatic Sports Center main building. Where each facade has translucent glass with a fairly large roster hole.



The tribune area is divided into 3 sections including VVIP, VIP and economy classes. There are many accesses to the stands to make it easier for users to reach the stands.



The leisure pool has a recreational pool for children with a waterslide and a circular water boom.

There is a locker room and locker room for athlete preparation and use when they want to swim or compete.

Provision of meeting rooms for athlete official/coach meetings when competitions are held at the Kenjeran Aquatic Sports Center.

There is a training center intended for athletes and the public with separate gym rooms for men and women.

Figure 5.9 Interior Concepts
Source: Author Analysis, 2022

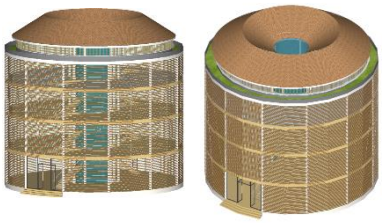
FORM AND FAÇADE CONCEPTS

PRINCIPLE : "CENTRALIZED"

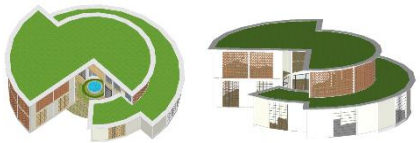
Applying a basic shape of Main Building to centralized as a form of harmony between space and the building.

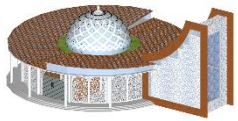
The secondary skin is in the form of a roster that is used as a serenity material to dispel and minimize noise, wind, and solar heat.

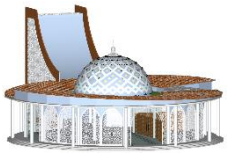
The main building form becomes a reference for other buildings as a focus on point in the design, so as to create a unity.



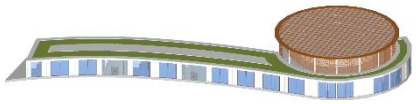
The change in the shape of the training center building wants to emphasize the addition and subtraction of a circle in order to create an attractive building.

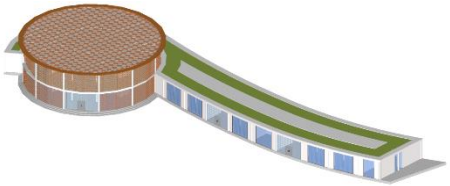






The food court and mosque building are circular in shape, the shape adapts to the function that is accommodated as a building that requires column-free space to gather.





The management office building has a circular and rectangular shape pattern. However, to form unity with other buildings, the rectangular section is curved.

The form of the leisure pool building identifies the unity form with the aquatic sport center as a secondary building.

Figure 5.10 Form and Facade Concepts
Source: Author Analysis, 2022

FORM AND FAÇADE CONCEPTS

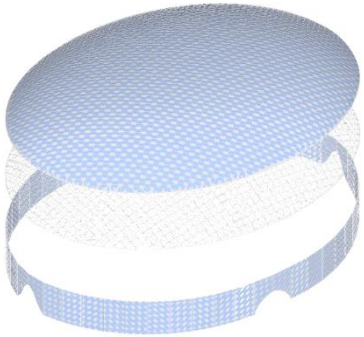
PRINCIPLE : "CENTRALIZED"

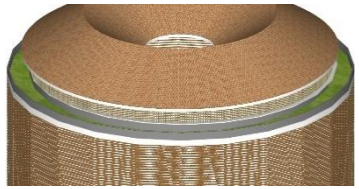
Applying a basic shape of Main Building to centralized as a form of harmony between space and the building.

The wall as a barrier as well as providing privacy control between spaces.

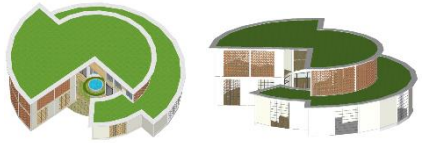
Small openings are used to accentuate privacy in rooms that require more privacy control.

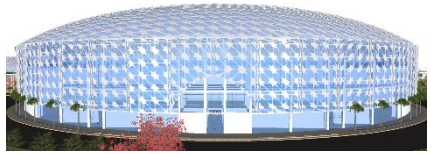
Secondary skin on the roof of the Aquatic Sport Center dome as an aesthetic element as well as openings and as natural lighting from morning to evening.





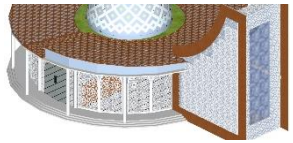
Green roof on the roof of the Training Center for rainwater absorption and heat dissipation due to the high temperature of the beach.

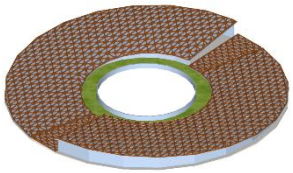


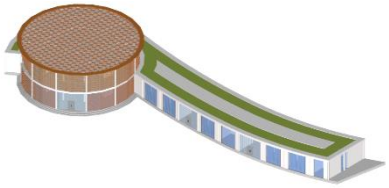


The clay tile roof and roster walls in the food court are intended as aesthetic elements and material harmony.

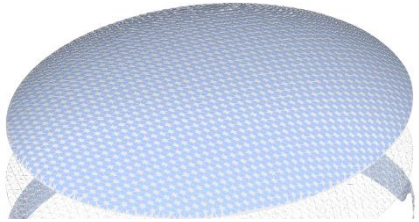
In addition, there are void holes that function as air controls in the building.







The wooden rooster as secondary skin in the Management Office and Training Center buildings is intended as an aesthetic and to block the sun's heat and filter the wind from entering the building.



Circle ornament in the shape of a flower as a symbol of unity and identification of 6 aquatic sports.

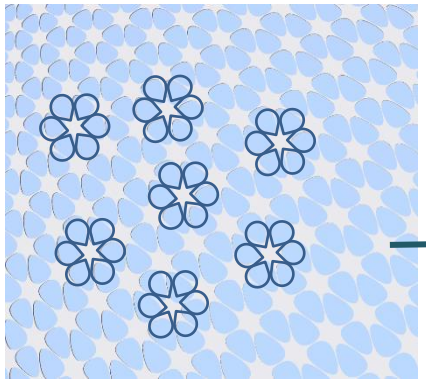
FORM AND FAÇADE CONCEPTS

PRINCIPLE : "CENTRALIZED"

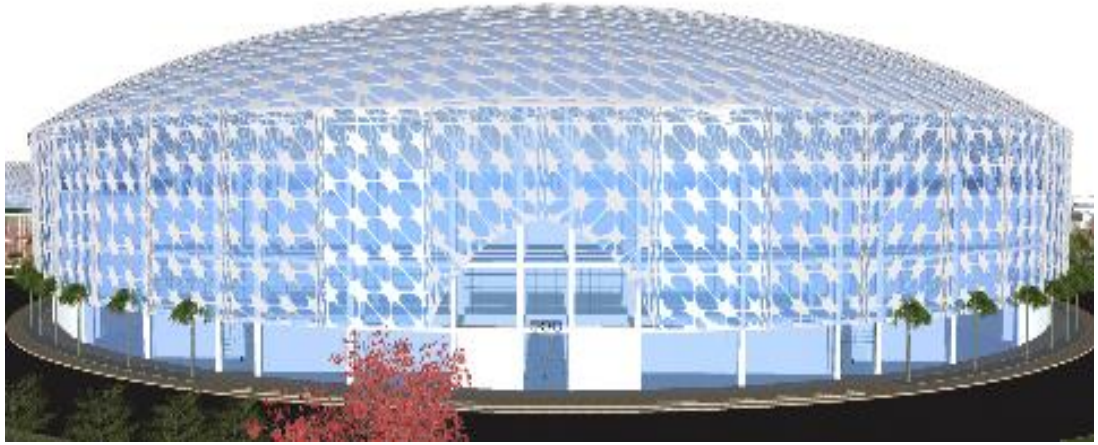
Applying a basic shape of Main Building to centralized as a form of harmony between space and the building.

Ornaments found on each building facade, in the form of a roster or in the form of a flower-shaped roof from **6** unified and repeated circular shapes.

The ornament is symbolic of the unity of **6 buildings** that facilitate **6 sports** of aquatic sports by applying Islamic values which are expected to increase faith as the pillars of faith which contain **6 pillars of islam**.

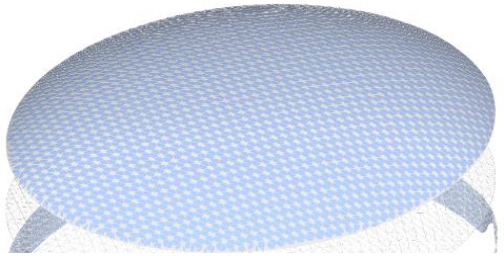


The circular ornament pattern that forms a single unit is an effort to embody the **CENTRALIZED** design principle which is the conclusion of the 3 important points of the Aquatic Sports Center design, namely **GREEN, ICONIC, and CONNECTED.**



The roof is not concrete with added ornamentation from the mold and is given the same color as a circular roster made of wood.

The ornamentation is as a fiberglass roster hole that can dispel heat and as an aesthetic for the roof structure of the Aquatic Sports Center.



The roof of the mosque uses a non-sloping roof so that it can drain rainwater, besides that there is a green roof in the middle of the roof as a rainwater reservoir.

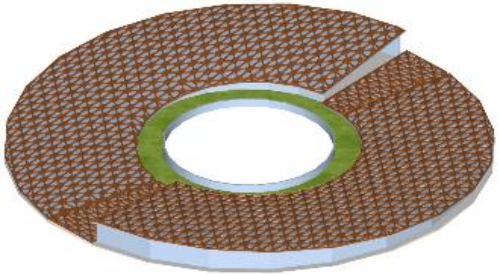


Figure 5.11 Facade Concepts and Ornament
Source: Author Analysis, 2022

STRUCTURE CONCEPTS

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.

UP STRUCTURE

The roof structure at the aquatic sport center uses a steel frame with a curved space frame structure.

The use of double skins, the first skin as a roof, the second skin as an aesthetic element, and a secondary skin to block the sun's

MID STRUCTURE

In the structure of the center of the building using reinforced concrete columns and beams.

The size of the columns and beams is adjusted for each building depending on the level and width.

The use of beams in wide openings to support the upper load.

LOW STRUCTURE

The lower structure uses a pile foundation by adjusting the surrounding areas.

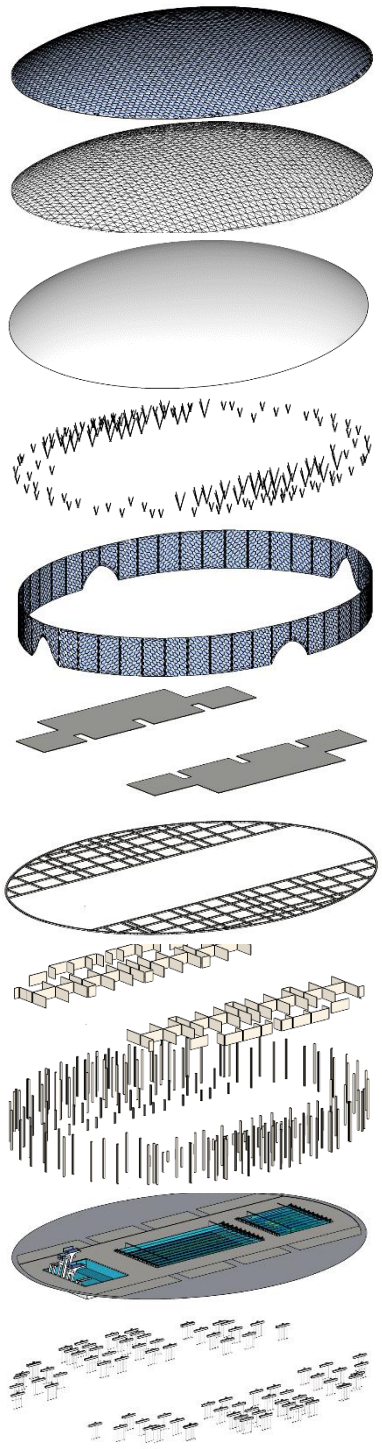


Figure 5.12 Structure Concepts
Source: Author Analysis, 2022

UTILITY CONCEPTS

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.

There are 5 towers to support the need for clean water in each building.

Fountains and public toilets do not need a water tank because they are flowed directly by the water tower.

Water sources are obtained from PDAM and accommodated in the main water storage reservoir, then distributed to buildings, ponds, fountains and public toilets.

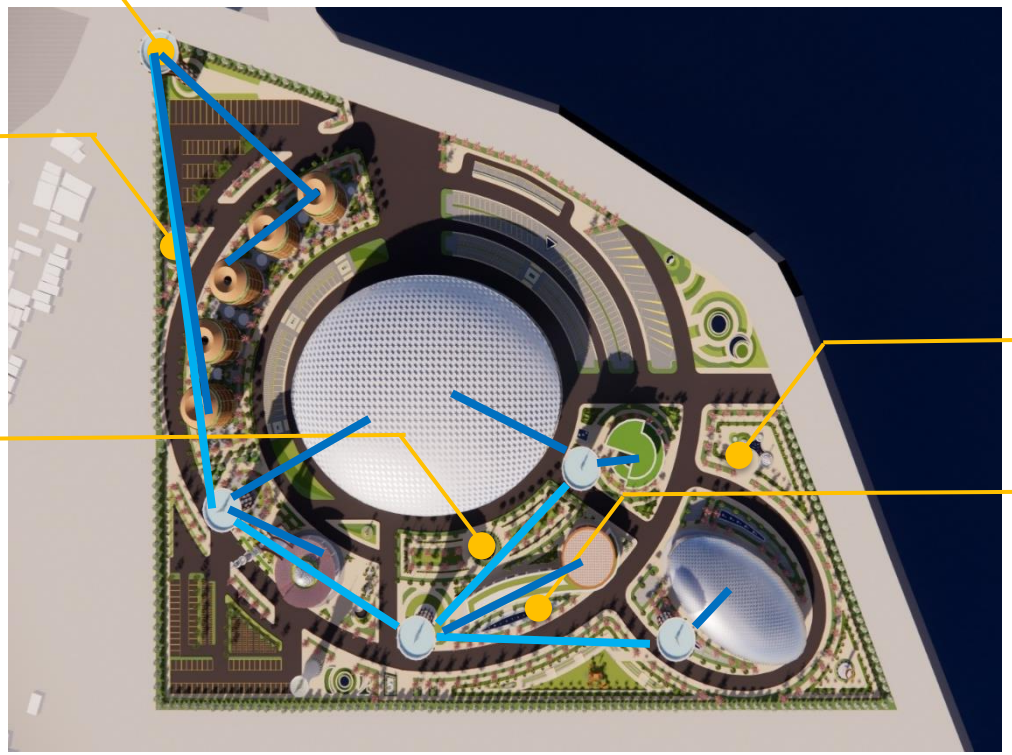
Green roof on the roof of the Training Center for rainwater absorption and heat dissipation due to the high temperature of the beach.

WATER TOWER

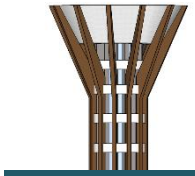
POND POOL

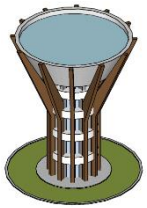
POND POOL

Water management in fish ponds and fountains is filtered using a tool and then reused, so that water needs within the area and between buildings are continuously met.



Each water tower can hold about 70000 liters of water. Every month the pool is filled with new water, the old water is filtered and managed again for reuse.





WATER TOWER

POND POOL

POND POOL

WATER TOWER PATH

PDAM PATH

Figure 5.13 Clean Water Utility
Source: Author Analysis, 2022

UTILITY CONCEPTS

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.

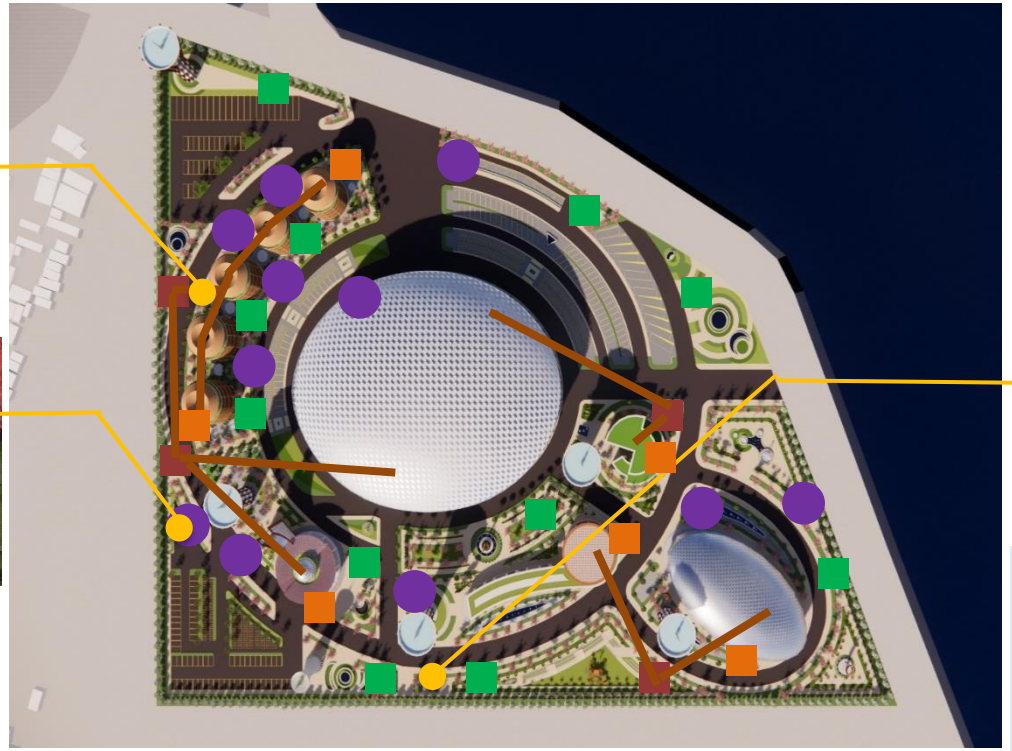
BIOPORE

TRASH CAN

TEMPORARY DISPOSAL

Placing several trash cans at several points on the site, to make it easier for users to keep the site clean.

There is a temporary disposal collection area which is quite spacious next to the parking area. The trash collection process in each building is carried out 2 times a day, morning and night. Then the waste is sorted based on organic and inorganic. Then the waste is forwarded to the nearest Final Shelter.



The waste water utility through the dirty water pipe flows directly to the septic tank and control tub. Added control tub to facilitate the passage of dirty water. Meanwhile, for the toilet, it goes directly to the septic tank.

Public Toilets are located at several points beside the park, to support the open public space facilities. Public toilets have toilets for the disabled. So that it is easier for people with disabilities to access public facilities.

PUBLIC TOILET

WASTE POINT

BIOPORE POINT

SEPTIC TANK POINT

WATER CONTROL TUB

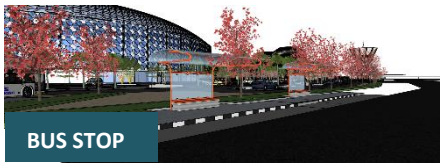
WASTE WATER PATH

Figure 5.14 Waste Water Utility
Source: Author Analysis, 2022

UTILITY CONCEPTS

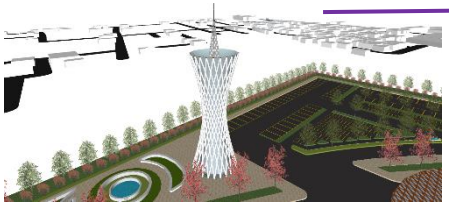
PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.



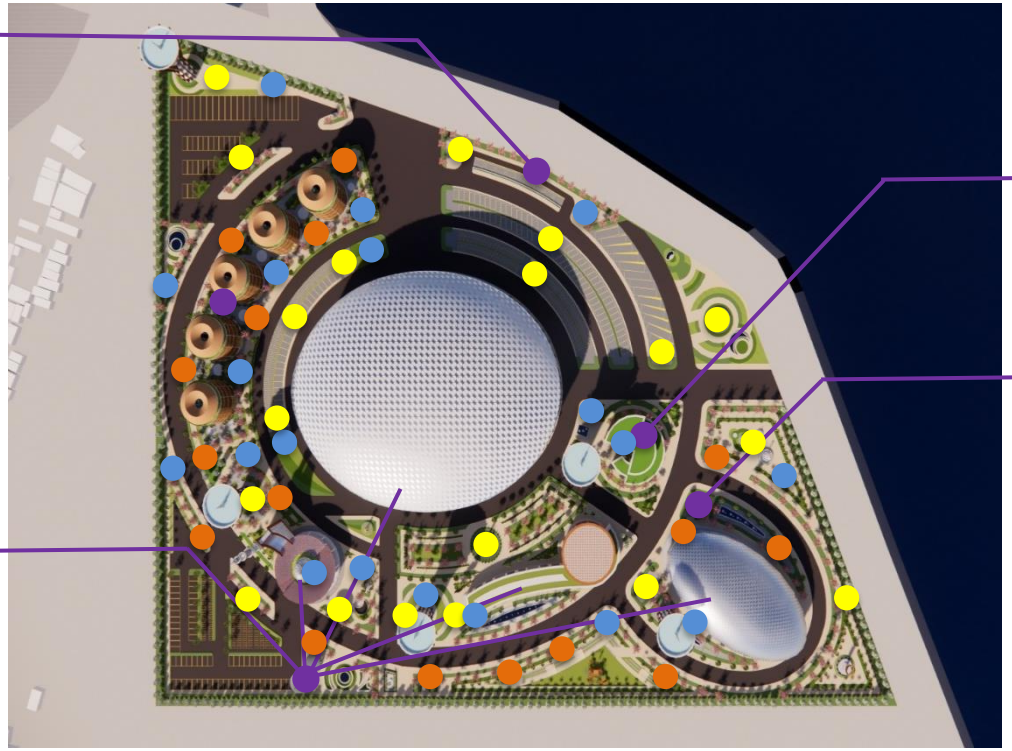
BUS STOP

To anticipate fires, hydrants and gathering points are provided in the area, outside the building area. This is so that the hydrant is able to reach the point of fire in the building. Hydrants are close to the water tower to speed up the flow of water needed to deal with fires. So as to minimize the risk and loss.

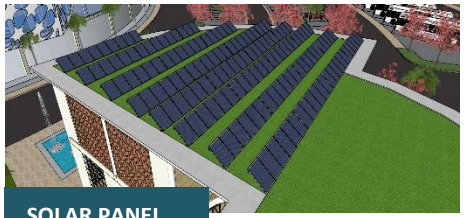


POWER STATION

There is a utility for temporary garbage collection. The existence of many trash bin facilities in the area is expected to be able to create a habit of users to dispose of waste in its place. Then the waste in the trash will be accommodated in a temporary dump and the roots are sorted according to their type. After that it is distributed to the local area Final Disposal Site.

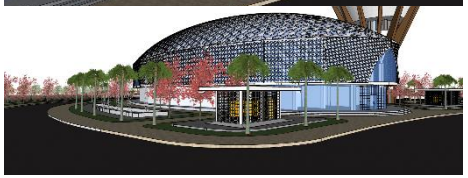


The site has the potential to produce alternative energy from solar panels installed on the roofs of several buildings such as management offices and training centers with flat roofs to facilitate maintenance. In addition, there is a generator and a power station as the main source of electricity for the area.



SOLAR PANEL

GENERATOR



ELECTRICAL POINT

ASSEMBLY POINT

HYDRANT POINT

TRASH CAN POINT

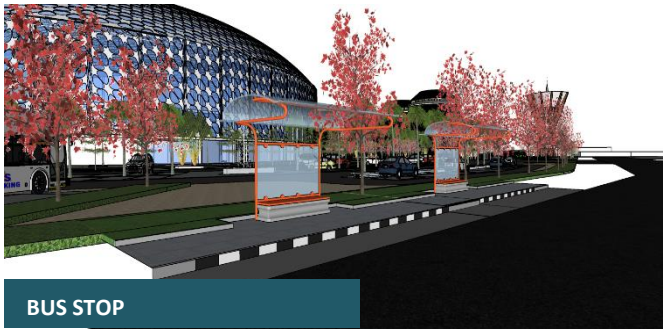
ELECTRICAL PATH

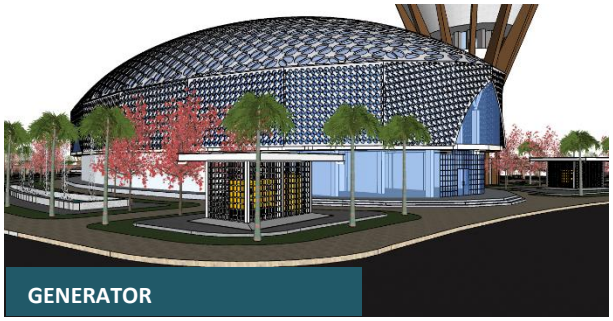
Figure 5.15 Electical Utility and Safety Utility
Source: Author Analysis, 2022

UTILITY CONCEPTS

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.





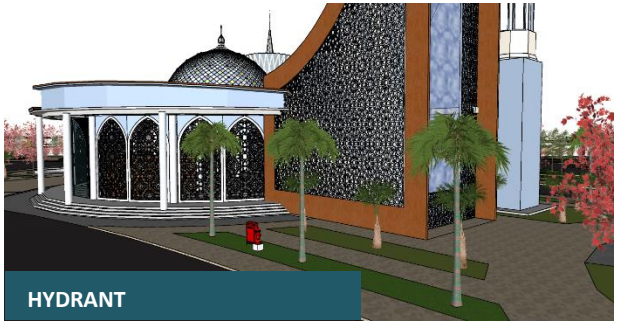
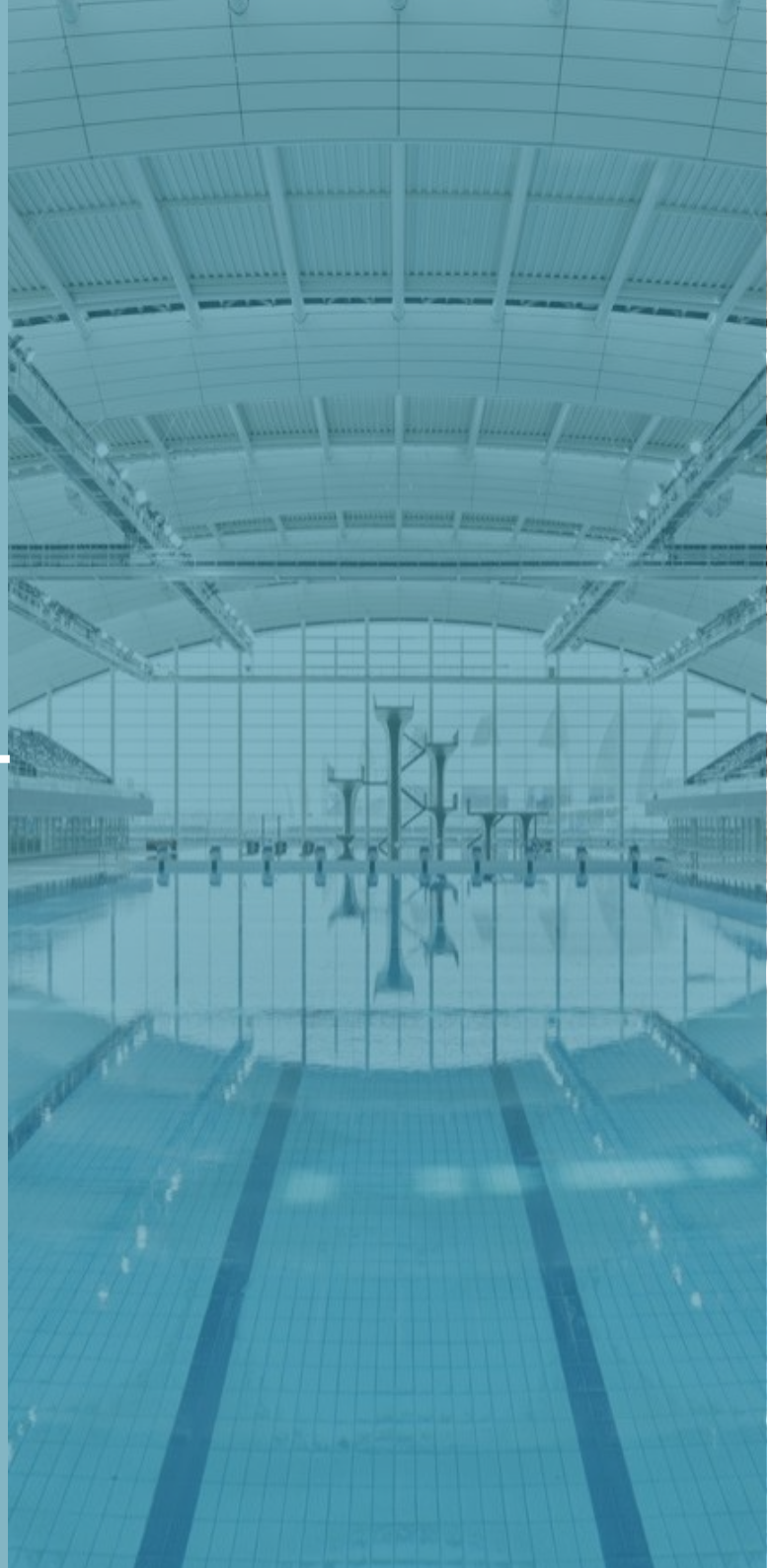


Figure 5.16 Area Utility
Source: Author Analysis, 2022

DESIGN RESULTS



DESIGN RESULT

The design of the Aquatic Sports Center applies the principles of the Architectural Eco-Tech approach. The principles of Eco-Tech Architecture applied are renewable energy, iconic, expression, and making connections. In the previous stage, the application of the super imposition method was not clear. So that will be detailed in the chapter on the design results.

Figure 6.1 Design Principles
Source: Author Analysis, 2022

SITE DESIGN RESULT

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.

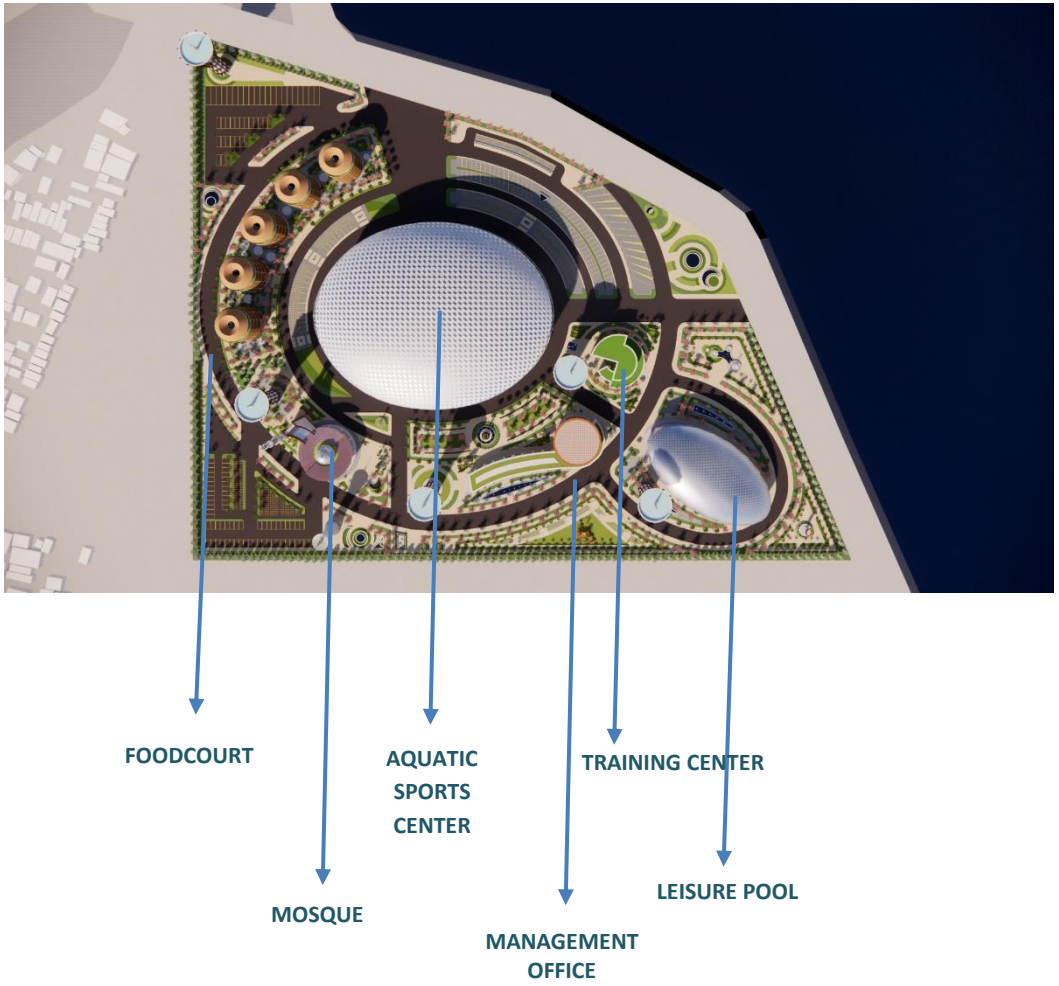


Figure 6.2 Zoning Design Results
Source: Author Analysis, 2022

MAIN BUILDING

Activities are centered on the Aquatic Sports Center building as the main function, so that it does not deviate.

↓

The linkage of functions as a horizontal-vertical axis in the mass order.

SUPPORTING BUILDING

The crowd is centered on one function, so that it does not interfere with the main function, but becomes a supporter of the main function.

↓

Applying centralized zoning as a form of harmony between space and the building.

AREA

The placement of the building is centered on the Aquatic Sport Center, the supporting buildings surrounding it.

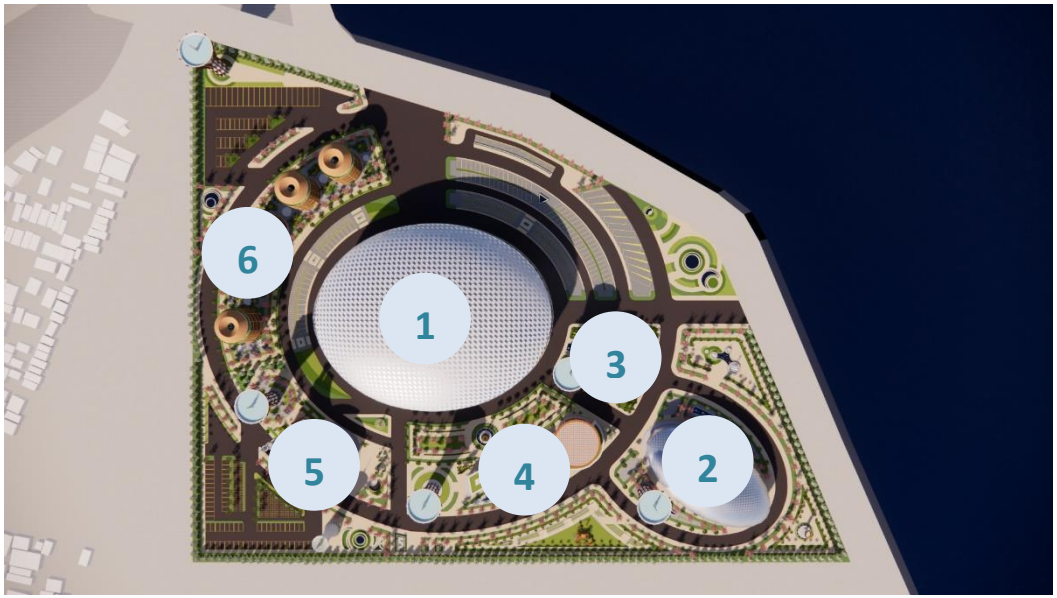
↓

Aquatic Sport Center as the center of the design process of form, space, facade, circulation, access, mass order and expression.

SITE DESIGN RESULT

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.



LEGEND

1. AQUATIC SPORTS CENTER
2. LEISURE POOL
3. TRAINING CENTER
4. MANAGEMENT OFFICE
5. MOSQUE
6. FOODCOURT

Figure 6.3 Site Design Results
Source: Author Analysis, 2022

SITE

The interrelationships between functions as a barrier to the main function with the supporting functions that produce mass order.

SPACE

Space is divided into private, semi-public and public spaces. Between spaces and between buildings there are transitional spaces in the form of parks, corridors and pedestrians.

FORM

Exploration of the existing form follows the function of the main building which accommodates as many as 15000 visitors. The existence of national and international events makes the composition must be attractive, iconic, and expressive. Selection of a circle shape to break the wind in the site and spread it between buildings, so that the wind circulation is

STRUCTURE

The combination of metal material with fiber glass as a wide-span roof covering at the Aquatic Sports Center is one of the choices of material that is quite flexible to wind, sun and local climate. In other buildings, wood, glass and clay tiles are used as local values and a response to the dry tropical climate of the beach.

UTILITY

Addition of ramps for the disabled, provision of biopore in parks and several roofs of buildings that use green roofs. There are 5 water towers as a reserve of clean water for building and site needs. Provision of power stations as controllers of electricity flow in buildings and sites. The existence of many gathering points as one of the steps to prevent victims in the event of a disaster.

SITE DESIGN RESULT

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.

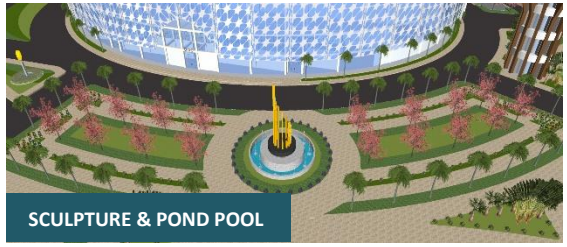
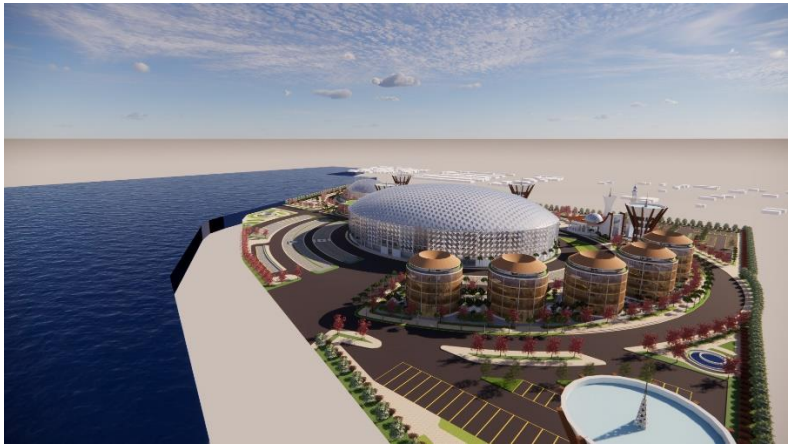


Figure 6.4 Parking Area Design Results
Source: Author Analysis, 2022



Separation of access and circulation for several types of vehicles and the level of vehicle emergency during the competition are the main points in the placement of entrances and exits.

Entrance is smaller than exit because it is reserved for the entry of visitors, while the exit is designated as the exit for visitors. However, the exit is also designated for the entry and exit of emergency vehicles such as ambulances, fire engines, police patrol cars and special interest cars.

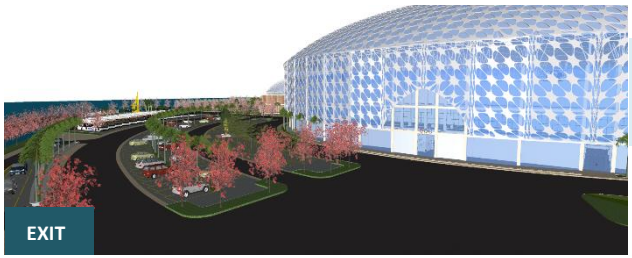
SITE DESIGN RESULT

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.

ENTRANCE

- The entrance is marked with the signage "Kenjeran Aquatic Sports Center", making it easier for visitors to remember and enter the Aquatic Sports Center area.



EXIT

- The exit from the Aquatic Sports Center is very wide to make it easier for vehicles that want to get out so they don't have to queue.

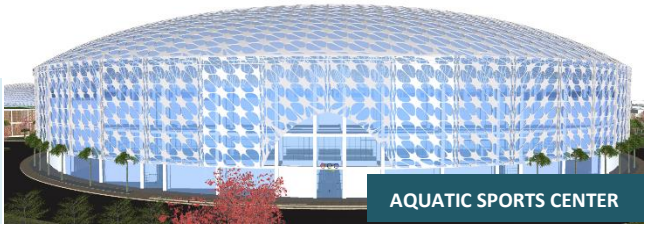
EXIT

- The western exit of the Aquatics Sport Center is a special lane for emergency vehicles.

MOSQUE

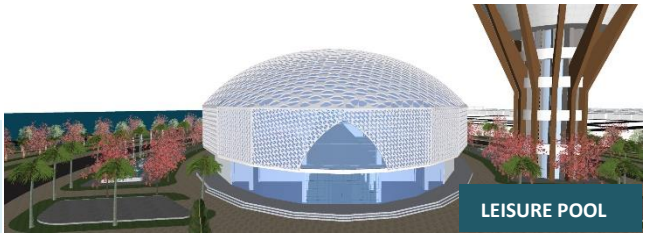
- The mosque can accommodate a congregation of about 600 people. So that the mosque can be used to perform Friday prayers as well as Eid and Terawih.

- Aquatic Sports Center as the main building and point of view in the design. So that all design factors follow the main building.



AQUATIC SPORTS CENTER

- Leisure Pool as a secondary building that supports the main building. Leisure pool accommodates the activities of visitors as a means of aquatic recreation.



LEISURE POOL

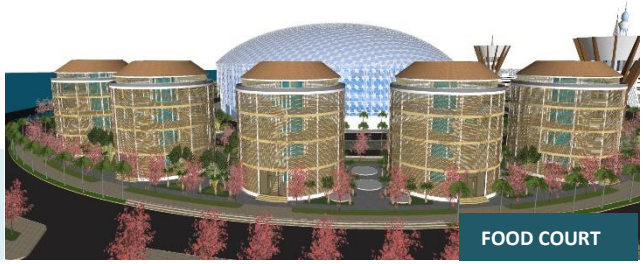
- The Management Office is intended by the manager of the Aquatic Sports Center and also as a forum for supporting events/competitions to be held.

MANAGEMENT OFFICE

- The Training Center is intended for athletes and general visitors. Distinguished between female and male visitors to apply Islamic values.

TRAINING CENTER

- FoodCourt consists of 5 buildings, each building has 5 floors. Each floor can accommodate about 50 people. It can accommodate when the competition is held.



FOOD COURT

Figure 6.5 Area and Building Design Results
Source: Author Analysis, 2022

SITE DESIGN RESULT

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.

BUS PARKING AREA

- Bus parking is distinguished from other vehicle parking due to the size and direction required when parking is sufficient.

PARK BENCH

- The park benches have shade trees, so that visitors can relax and not be too hot.

MOTORCYCLE & CAR PARKING AREA

- Car and motorbike parking are distinguished to facilitate access and make it easier for visitors to find their vehicles when they return home.

TRASH CAN

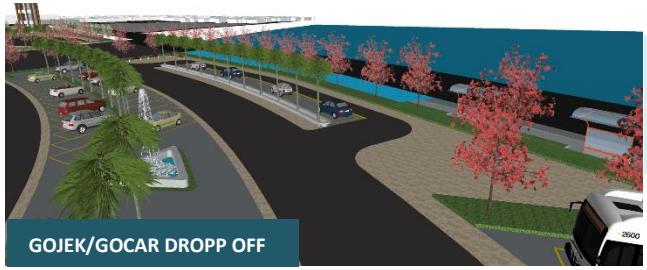
- FoodCourt consists of 5 buildings, each building has 5 floors. Each floor can accommodate about 50 people. It can accommodate when the competition is held.

EMERGENCY VEHICLES PARKING AREA

- Parking for emergency vehicles close to the exit area for easy entry and exit during an emergency.

PUBLIC TOILET

- There are public toilets around the building and gardens, to make it easier for visitors to access when they want to urinate or defecate.



GOJEK/GOCAR DROPP OFF

- Gojek/Gocar drop offs are intended for visitors who use the Gojek, Grab, Blue Bird, etc. applications. So that it does not interfere with the circulation of other visitor vehicles.

GOJEK/GOCAR PASSENGER SHELTER

- Shelter for gojek/gocar passengers so that visitors can wait for the vehicle leisurely.

Figure 6.6 Landscape Design Results
Source: Author Analysis, 2022

FORM DESIGN RESULT

PRINCIPLE : "CENTRALIZED"

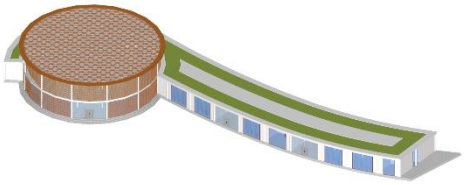
Applying a basic shape of Main Building to centralized as a form of harmony between space and the building.

In buildings with the concept of Water Concious Design using a circular roof exploitation. The basic form of a circle is taken from the Main Building as the center or point of view of the mass arrangement and site area. In addition, the circular roof can bend the wind direction from the sea spreading to all sides. So that all buildings get wind and air to the maximum.

FORM

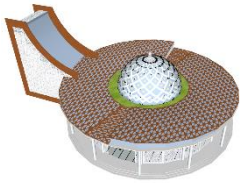
AQUATIC SPORTS CENTER

LEISURE POOL

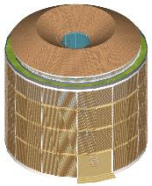


MANAGEMENT OFFICE

TRAINING CENTER



MOSQUE

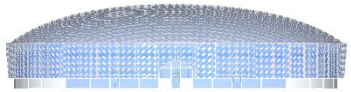


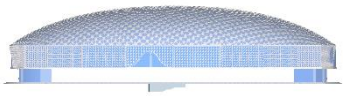
FOODCOURT

Formation that has harmony and continuity so as to form a unity. In addition, it is symbolic of "Water

Circular Form are explored into new shapes so that they still pay attention to local values.

Using facade elements, namely roster of wood and metal in combination with fiber glass.



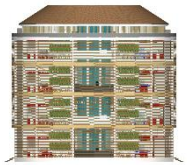


AQUATIC SPORTS CENTER

COMPATIBLE
The building height is higher than the surrounding buildings.
Create a dome formation that becomes the benchmark for other buildings.

LEISURE POOL

COMPATIBLE
The height of the building does not exceed the main building.
Applying an oval dome roof following the main building in response to the same function.



FOOD COURT

COMPATIBLE
The height of the building is the same as the Leisure Pool.
The food court building consists of 5 similar buildings to accommodate users when a competition is held.
Taking the form of a circle on the building and roof, the roof carries local values.

Figure 6.7 Form Design Results
Source: Author Analysis, 2022

FORM DESIGN RESULT

PRINCIPLE : "CENTRALIZED"

Applying a basic shape of Main Building to centralized as a form of harmony between space and the building.

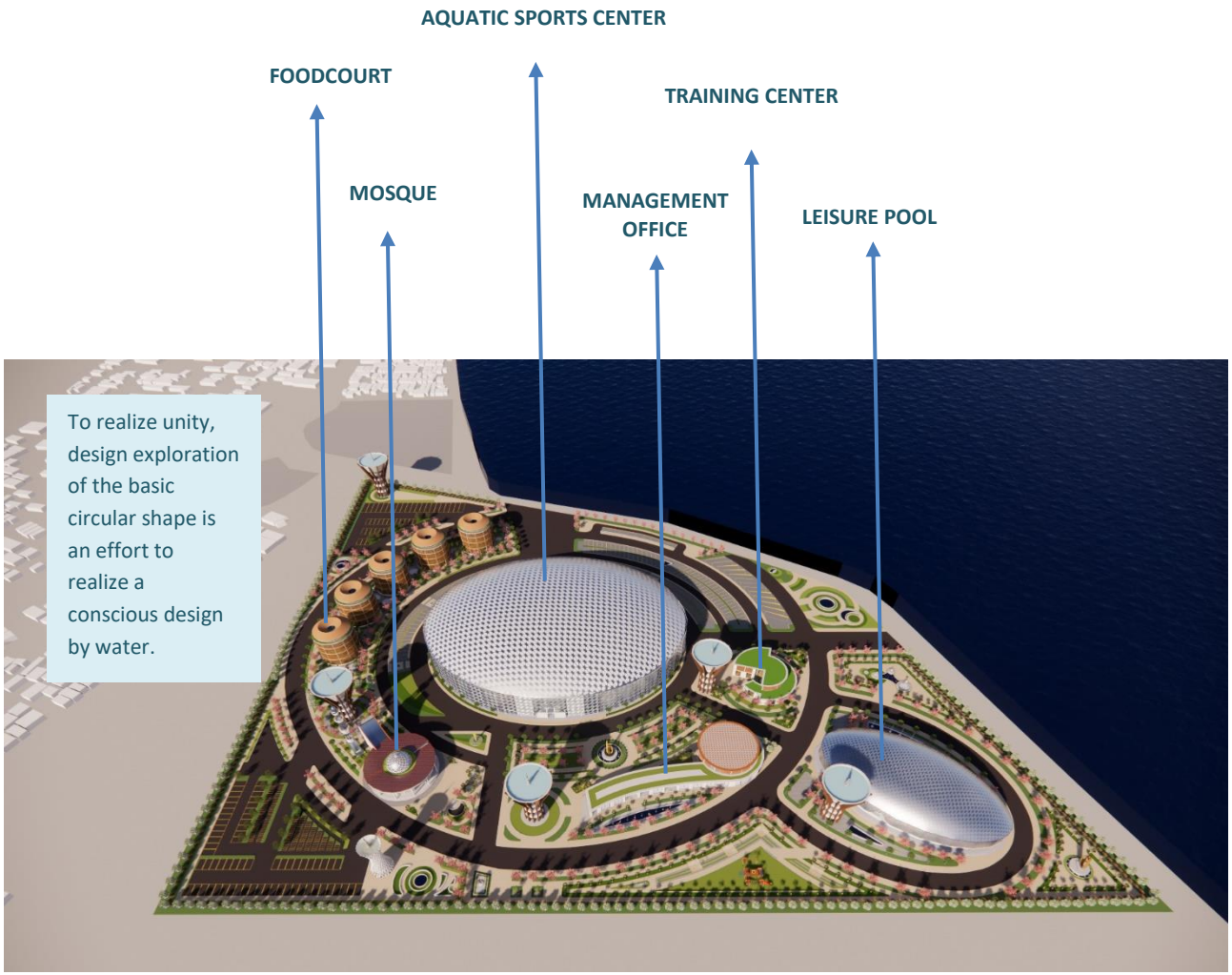


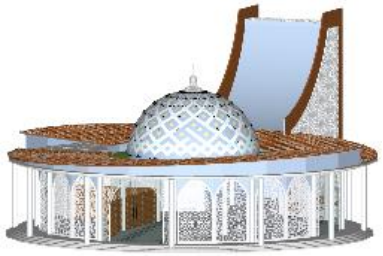
Figure 6.8 Form Final Concept
Source: Author Analysis, 2022

A simple, circular form with an additional curved shape to accommodate the required function space. The large part has ornamentation that is in harmony with the main building.

MANAGEMENT OFFICE

Subtraction and addition is an exploratory process to find new but harmonious compositions, it is applied to the training center building that maximizes ease of access and circulation.

TRAINING CENTER



Open formations with the addition of other geometric shapes that show height, as a symbol towards God. Shows continuity with others from the use and selection of materials.

MOSQUE

SPACE DESIGN RESULT

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.

Hierarchy of placement in the block plan macro.

MAIN BUILDING

TANSITION SPACE

SUPPORTING BUILDING

The concept of hierarchical placement in the macro block plan is the placement of transitional spaces between buildings that form a single unit within the area as a response to local conservation, ecology and climate values.

The main building as the core of the design becomes the center of the other buildings. Circulation emphasizes proximity to the main building.

Wood elements, with various ornaments.

MATERIALS

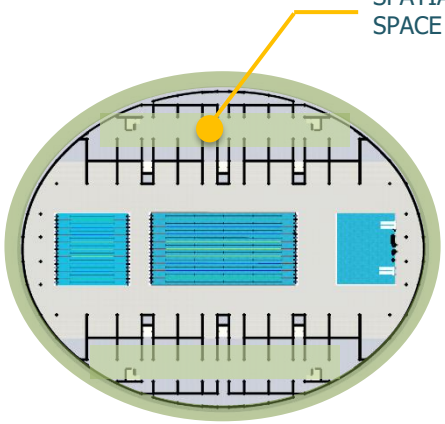
Using materials with colors that symbolize peace and are environmentally friendly.

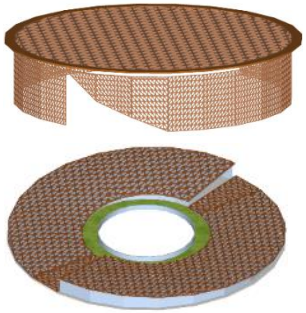
TEXTURE

Using natural materials such as wood, stones, steels, and clay tiles.

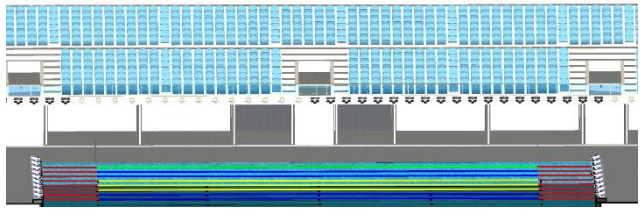
ORNAMENT

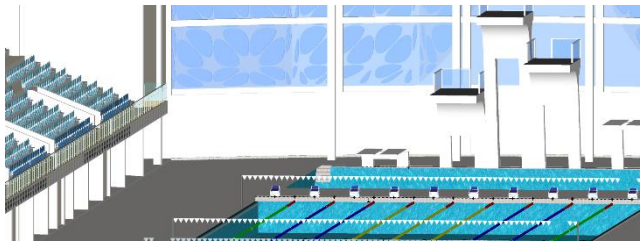
The application of the incorporation of circle ornamentation as a form of representation of unity between buildings and areas.

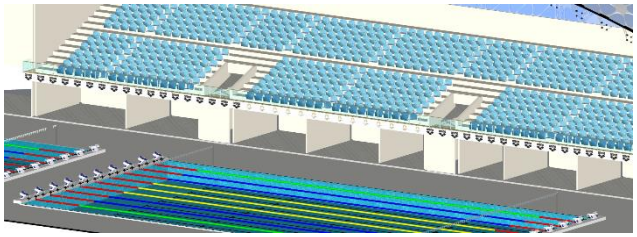


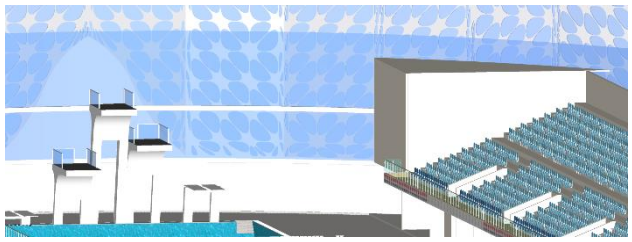


SPACE SCHEME
The adapted spatial pattern is a concept of spatial spatial pattern. Provide space in each building to know and get to know the natural surroundings.





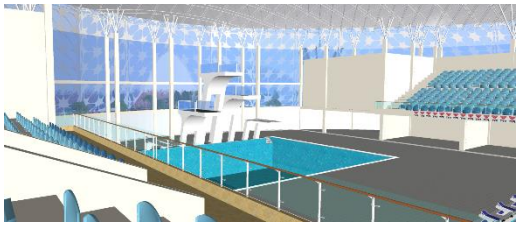


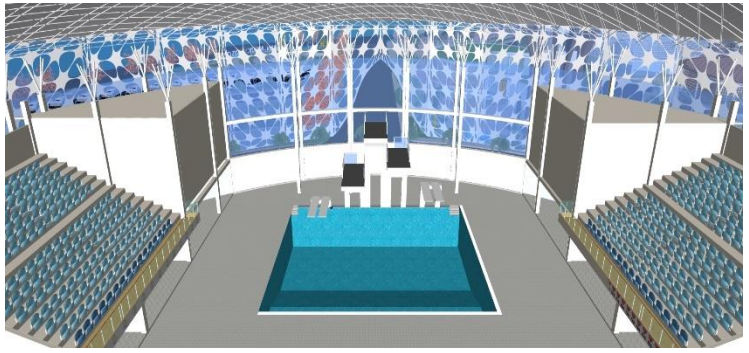


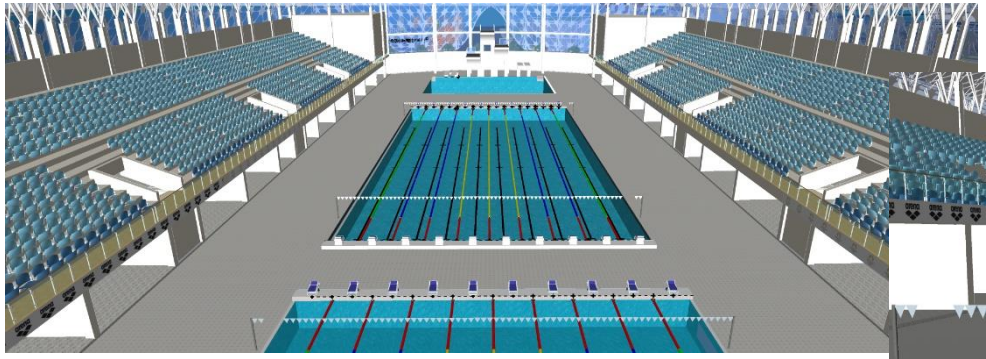
SPACE DESIGN RESULT

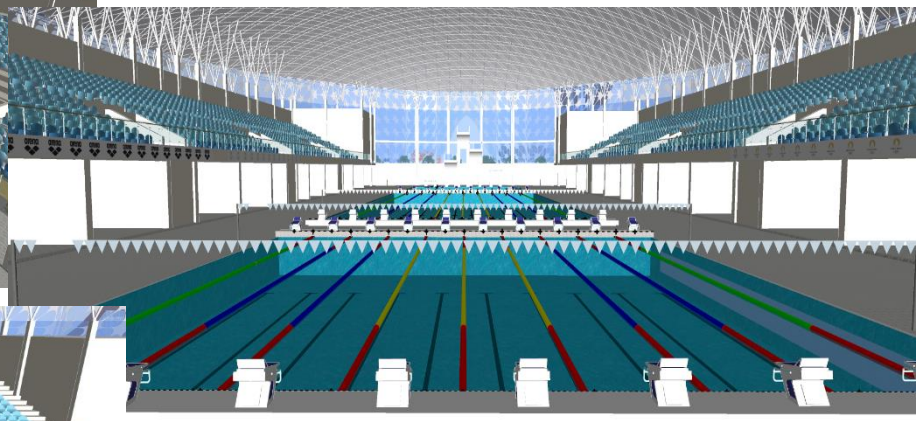
PRINCIPLE : "CENTRALIZED"

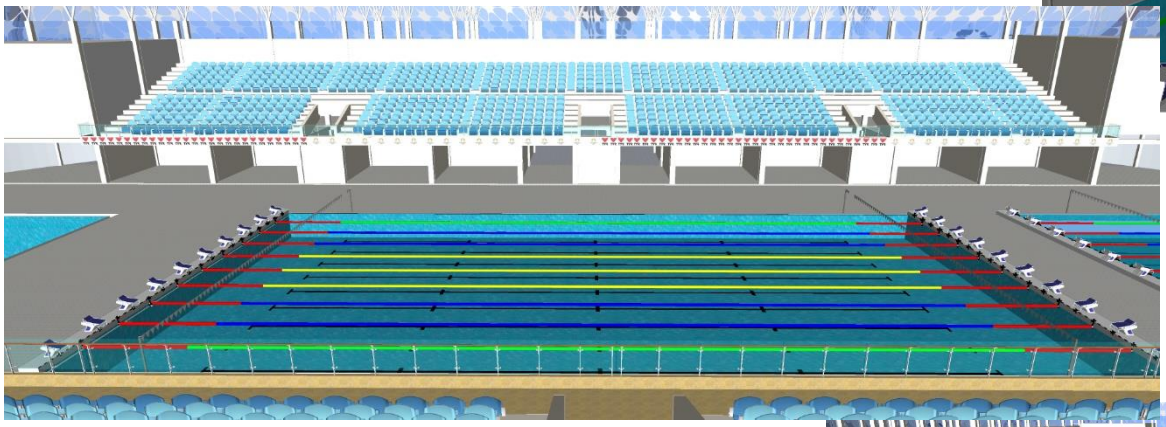
Applying centralized zoning as a form of harmony between space and the building.

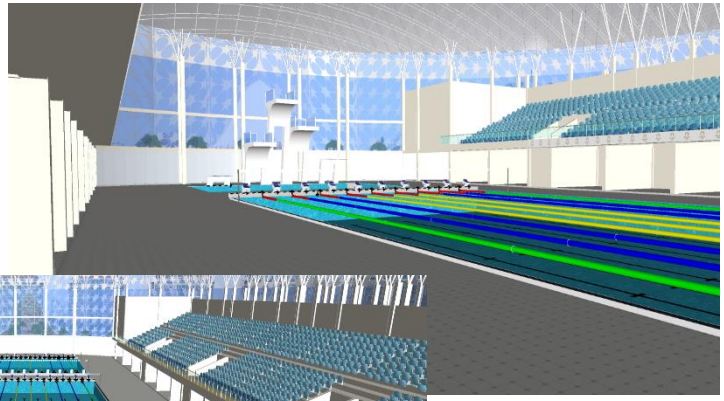


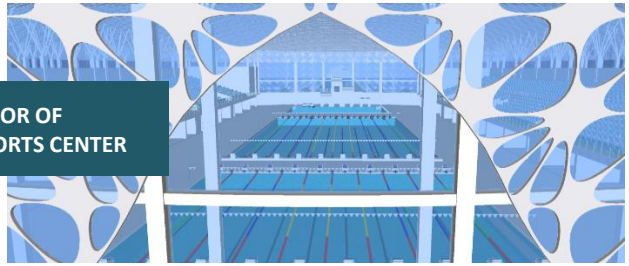












INTERIOR OF AQUATIC SPORTS CENTER

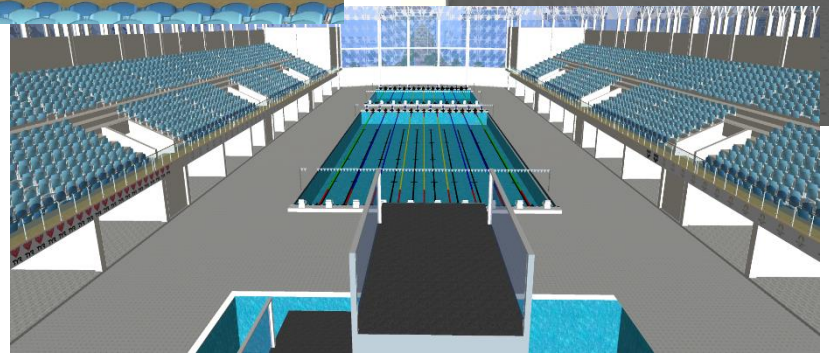


Figure 6.9 Interior of Aquatic Sports Center
Source: Author Analysis, 2022

SPACE DESIGN RESULT

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.

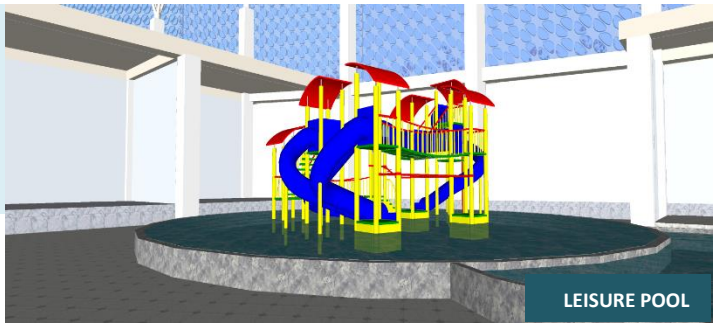
The Meeting Room is located in the Management Office Building which is usually used by managers with clients and the local government as a meeting place.

Lavatory in the management office used by managers and employees of the Aquatic Sports Center.

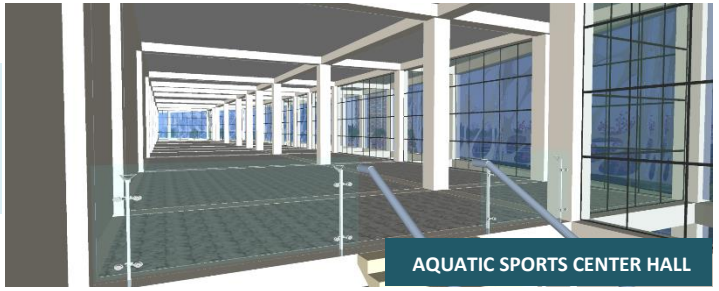
Locker rooms and changing rooms within the Aquatic Sports Center are reserved for athletes and general visitors alike.

Jersey stands and sports equipment are located at the Aquatic Sports Center on the 1st floor.

The leisure pool has a children's play pool containing water slides, water booms and other games. Distinguished between male and female swimming pools, as the application of Islamic values.



The hall on the 2nd floor of the Aquatic Sport Center is a flexible room that can be used for sports exhibitions or for exhibitions selling aquatic sports products.



The training center room for men has a special room for boxing rings and other gym equipment.

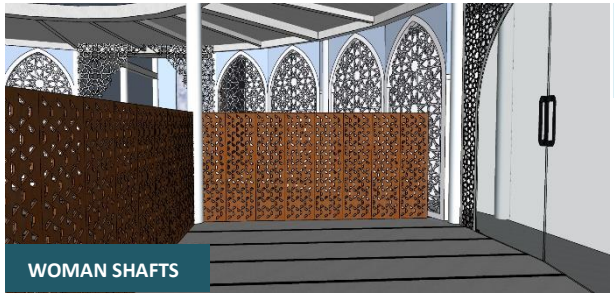
There is a special gym for women, there is a place for yoga, pilates and ribbon yoga on the 2nd floor of the training center building.

Figure 6.10 Interior Design Result
Source: Author Analysis, 2022

SPACE DESIGN RESULT

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.

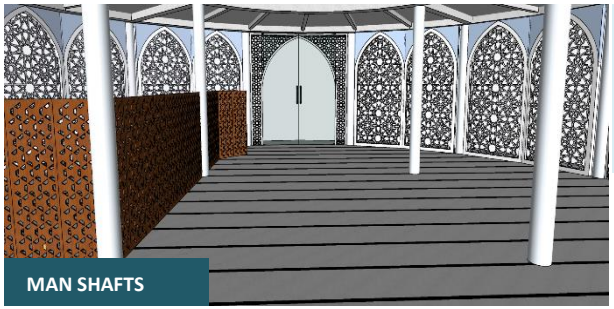


WOMAN SHAFTS

The prayer shafts for women are limited by a wooden partition, so that you can still hear the reading from the Imam.

CAFETARIA

The cafe is one of the main designs in the food court building, so that the interior arrangement and the selection of furniture that matches the color of the building become continuity in the room.

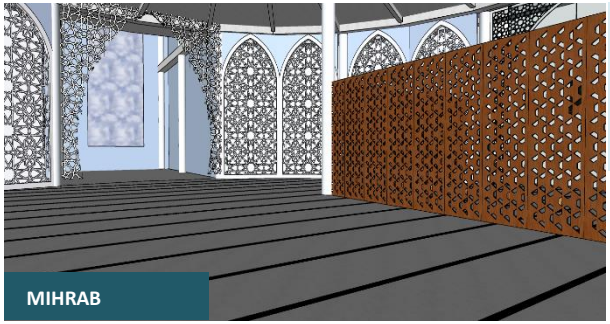


MAN SHAFTS

The prayer shafts for men are widened to accommodate congregational prayer activities such as Friday prayers, Eid prayers and terawih prayers.

COFFE SHOP/CAFE

Open formations with the addition of other geometric shapes that show height, as a symbol towards God. Shows continuity with others from the use and selection of materials.



MIHRAB

The pulpit has geometric shapes towering upwards symbolizing the high nature of divinity. To always remind the greatness of Allah SWT.

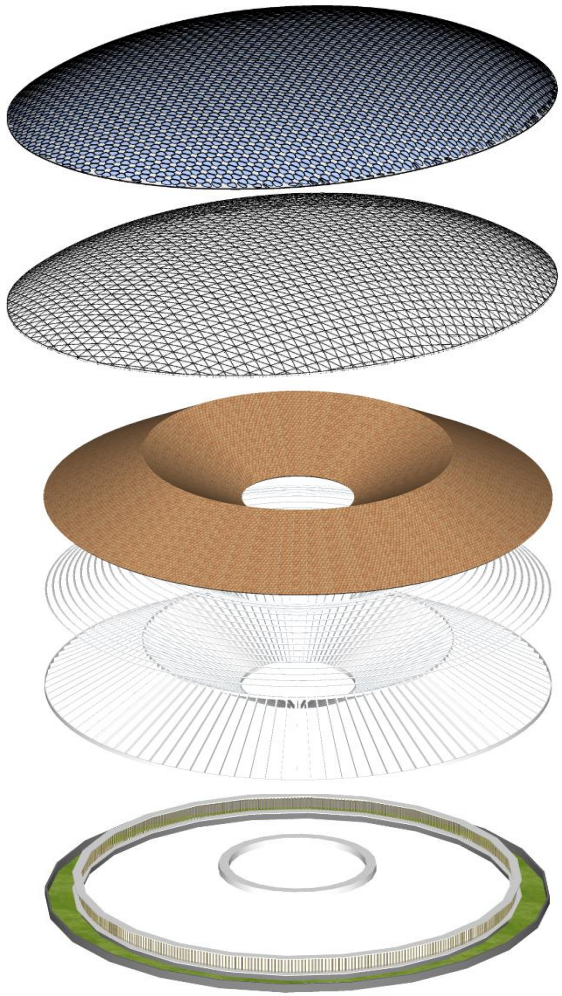
ROOF TOP/ SMOOKING AREA

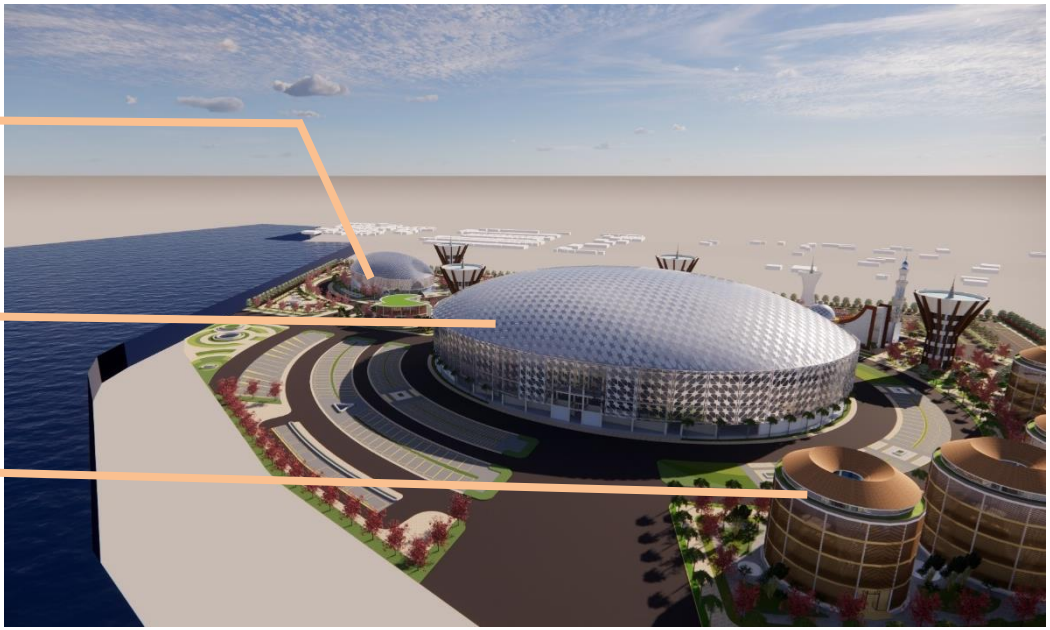
The rooftop in the foodcourt building is used as a smoking area and a place to view the skylights of the local area. The rooftop is on the 3rd floor of the Foodcourt building.

STRUCTURE DESIGN RESULT

PRINCIPLE : "CENTRALIZED"

Applying centralized zoning as a form of harmony between space and the building.





UP Structure Food Court

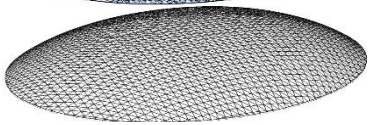
Wooden frame and circular saddle roof truss. Ceiling/Skin Under Structure : Ornamented wooden ceiling.

UP Structure Aquatic Sports Center & Leisure Pool

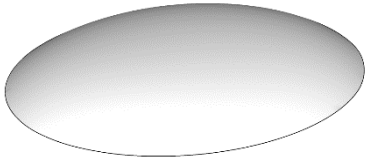
Space Frame: To support the load of the wide-span roof free of curved columns (DOME). Ceiling/Skin Under Structure: Using high quality metal materials to dissipate heat and reflect light in the room.

Figure 6.11 Structure Design Result
Source: Author Analysis, 2022

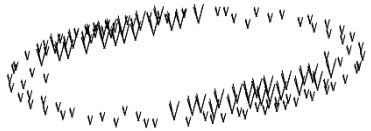
SECONDARY SKIN (ORNAMENT)



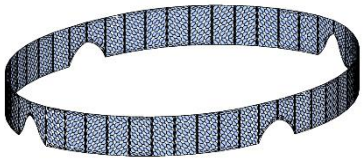
SPACE FRAME



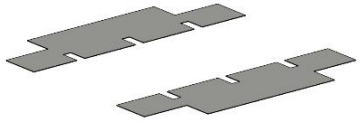
METAL SKIN ROOF



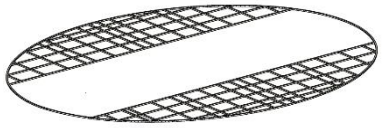
TRIANGLE



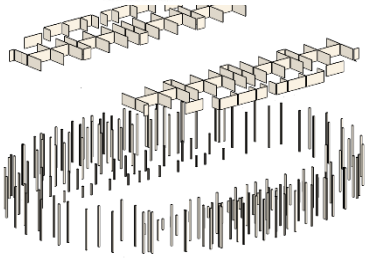
SECONDARY SKIN (ORNAMENT)



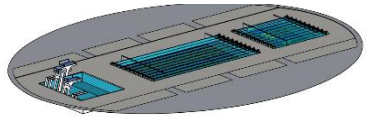
FLOOR PLATE



BEAM



WALL



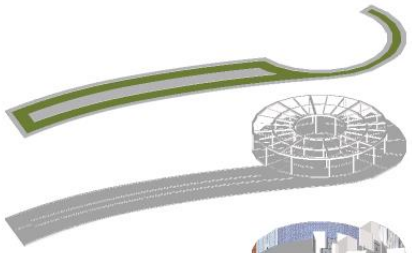
COLUMN

SLOOF

PILE FOUNDATION

CONCRETE ROOF & ORNAMENT

WALL AND GLASS



GREEN ROOF

FLOOR PLATE AND BEAM

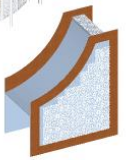
WALL AND GLASS

COLUMN

DOME

CONCRETE ROOF & ORNAMENT

BEAM AND COLUMN



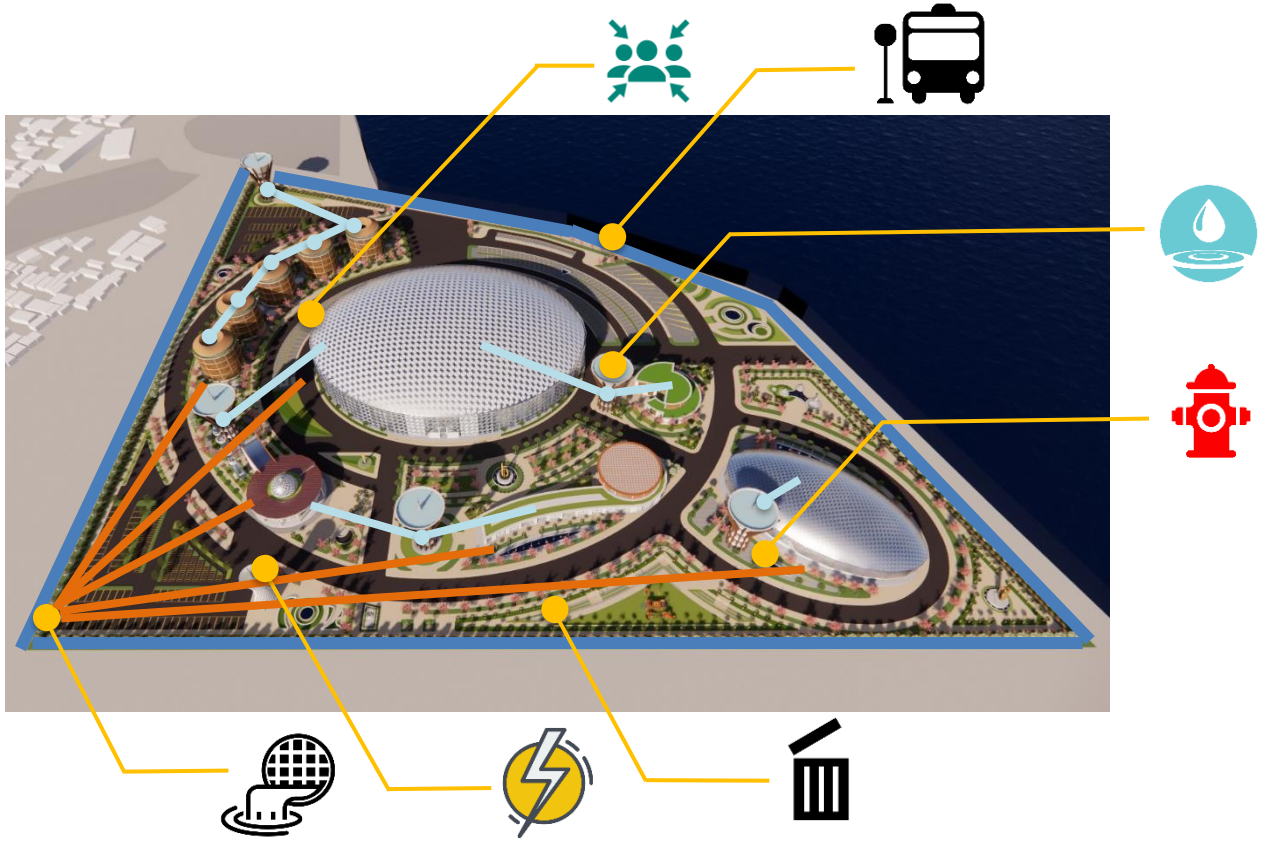
MIHRAB

FLOOR PLATE

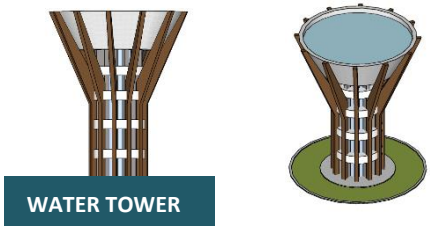
UTILITY DESIGN RESULT

PRINCIPLE : "CENTRALIZED"

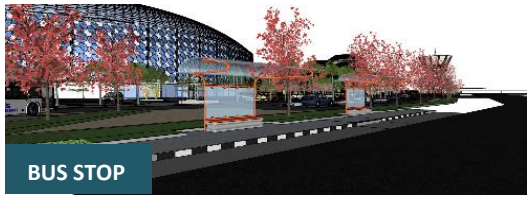
Applying centralized zoning as a form of harmony between space and the building.



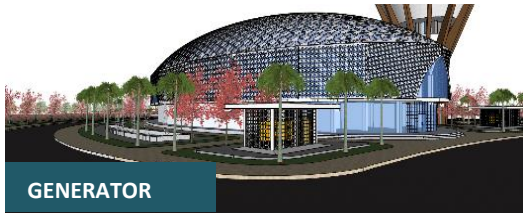
ELECTRICAL POWER STATION
WATER TOWER
SEPTIC TANK
BUS STOP
HYDRANT POINT
ASSEMBLY POINT
TRASH CAN POINT
DRAINAGE PATH
CLEAN WATER PATH
WASTE WATER PATH



WATER TOWER



BUS STOP



GENERATOR

POWER STATION

HYDRANT

Figure 6.12 Utilities Design Result
Source: Author Analysis, 2022

AQUATIC SPORTS CENTER IN SURABAYA WITH ECO-TECH ARCHITECTURE APPROACH

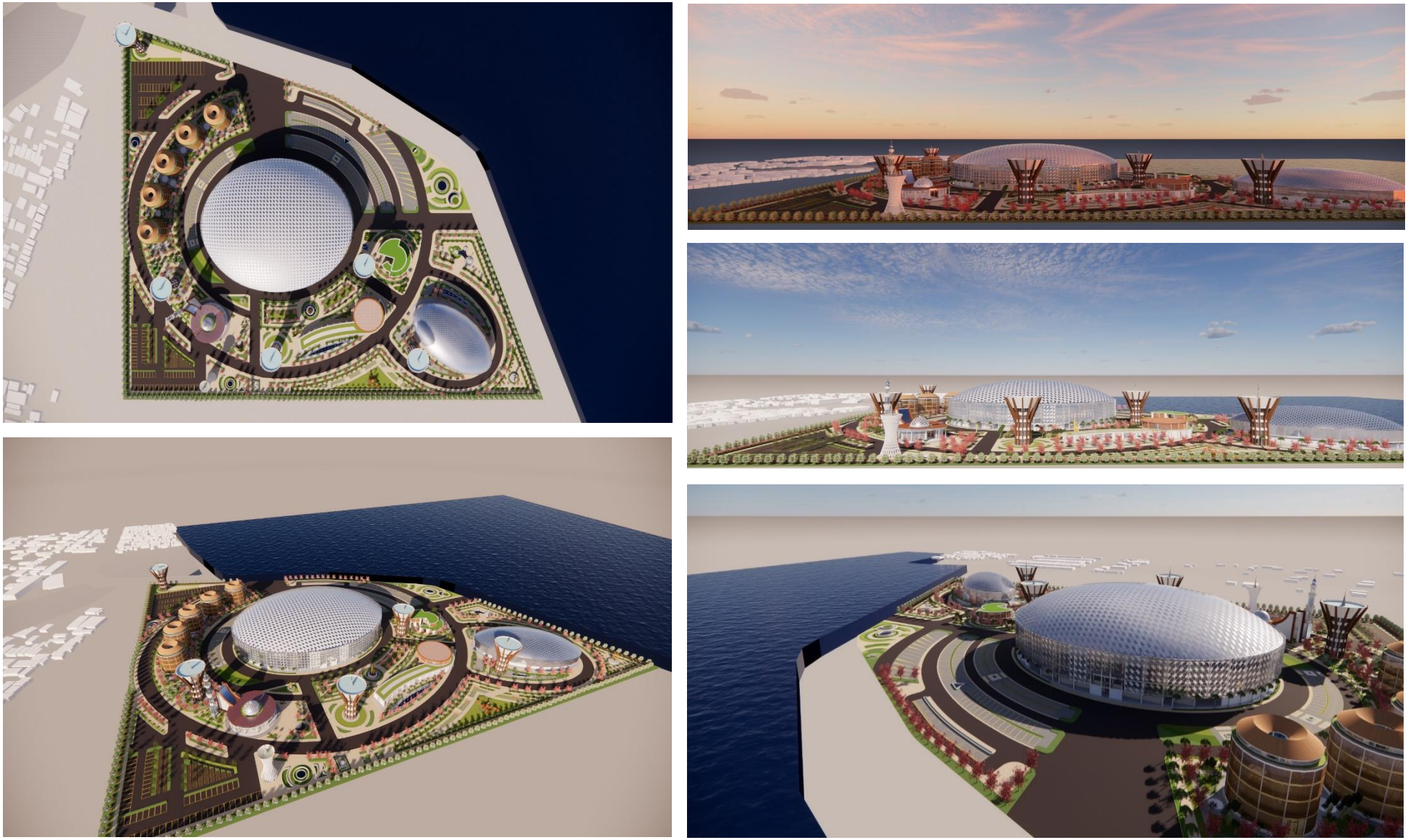
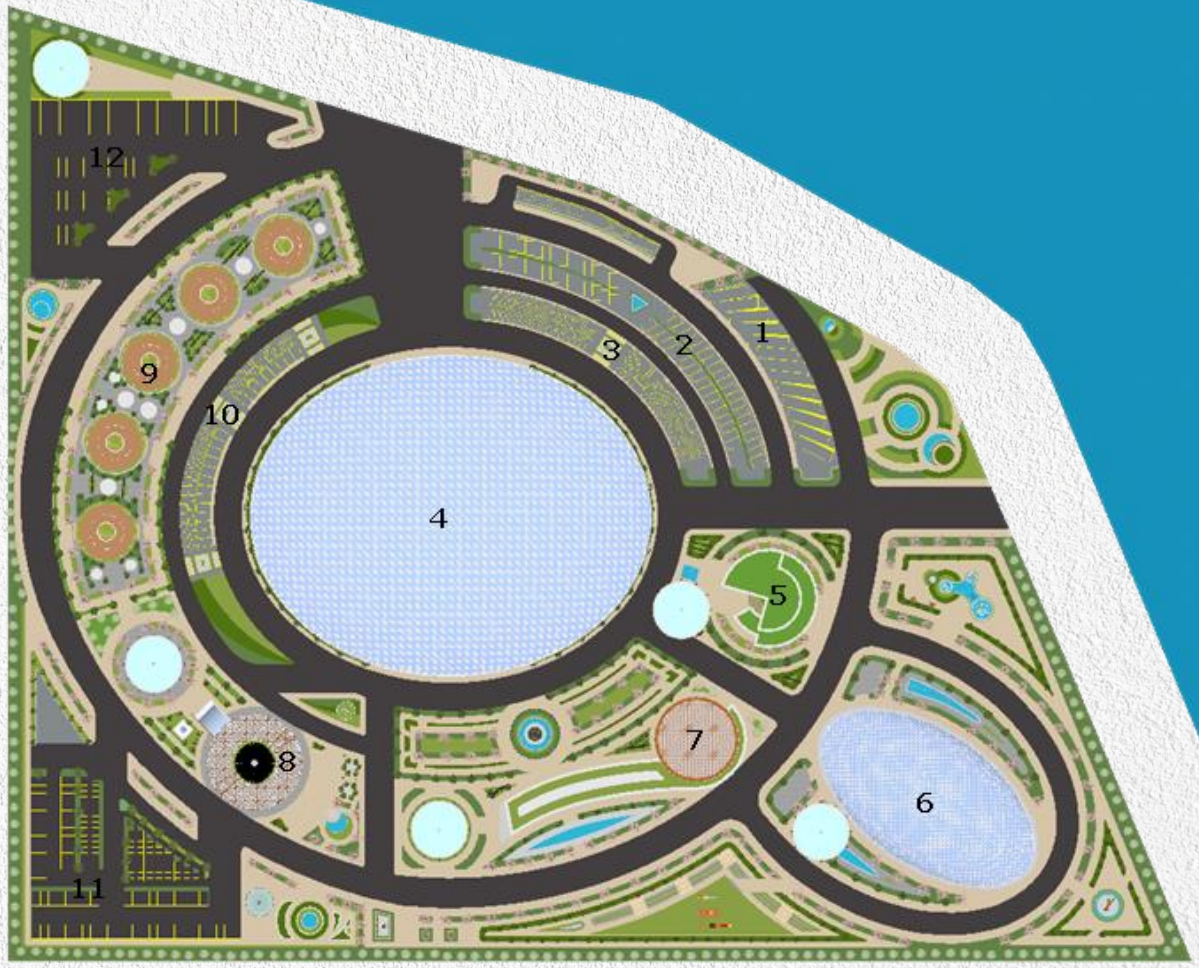


Figure 6.13 Aquatic Sports Center in Surabaya with Eco-Tech Architecture Approach
Source: Author Analysis, 2022

ARCHITECTURAL DRAWING

Berikut ini merupakan hasil redesain kompleks wisata religi makam sunan Bejagung yang ada di kabupaten Tuban berupa gambar arsitektural, gambar kerja dan beberapa gambar pendukung lainnya. Gambar – gambar tersebut meliputi :

ARCHITECTURAL DRAWING	DED/DETAIL ENGINEERING DESIGN
1. Layout Plan 2. Site Plan 3. Area View Drawing 4. Area Section Drawing 5. Aquatic Sports Center Floor Plan 6. Aquatic Sports Center Section Drawing 7. Aquatic Sports Center View Drawing 8. Leisure Pool Floor Plan 9. Leisure Pool Section Drawing 10. Leisure Pool View Drawing 11. Training Center Floor Plan 12. Training Center Section Drawing 13. Training Center View Drawing 14. Management Office Floor Plan 15. Management Office Section Drawing 16. Management Office View Drawing 17. Foodcourt Floor Plan 18. Foodcourt Section Drawing 19. Foodcourt View Drawing 20. Mosque Plan 21. Mosque Section Drawing 22. Mosque View Drawing	1. Aquatic Sports Center Floor Plan 2. Aquatic Sports Center Section Drawing 3. Aquatic Sports Center View Drawing 4. Aquatic Sports Center Foundation and Sloof Plan 5. Aquatic Sports Center Plumbing Plan



N

LEGENDA :

1. BUS PARKING AREA
2. PARKING AREA 1
3. PARKING AREA 2
4. AQUATIC SPORTS CENTER
5. TRAINING CENTER
6. LEISURE POOL
7. MANAGEMENT OFFICE
8. MOSQUE
9. FOOD COURT
10. PARKING AREA 3
11. PARKING AREA 4
12. PARKING AREA 5

5 10 15 20

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SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

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DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

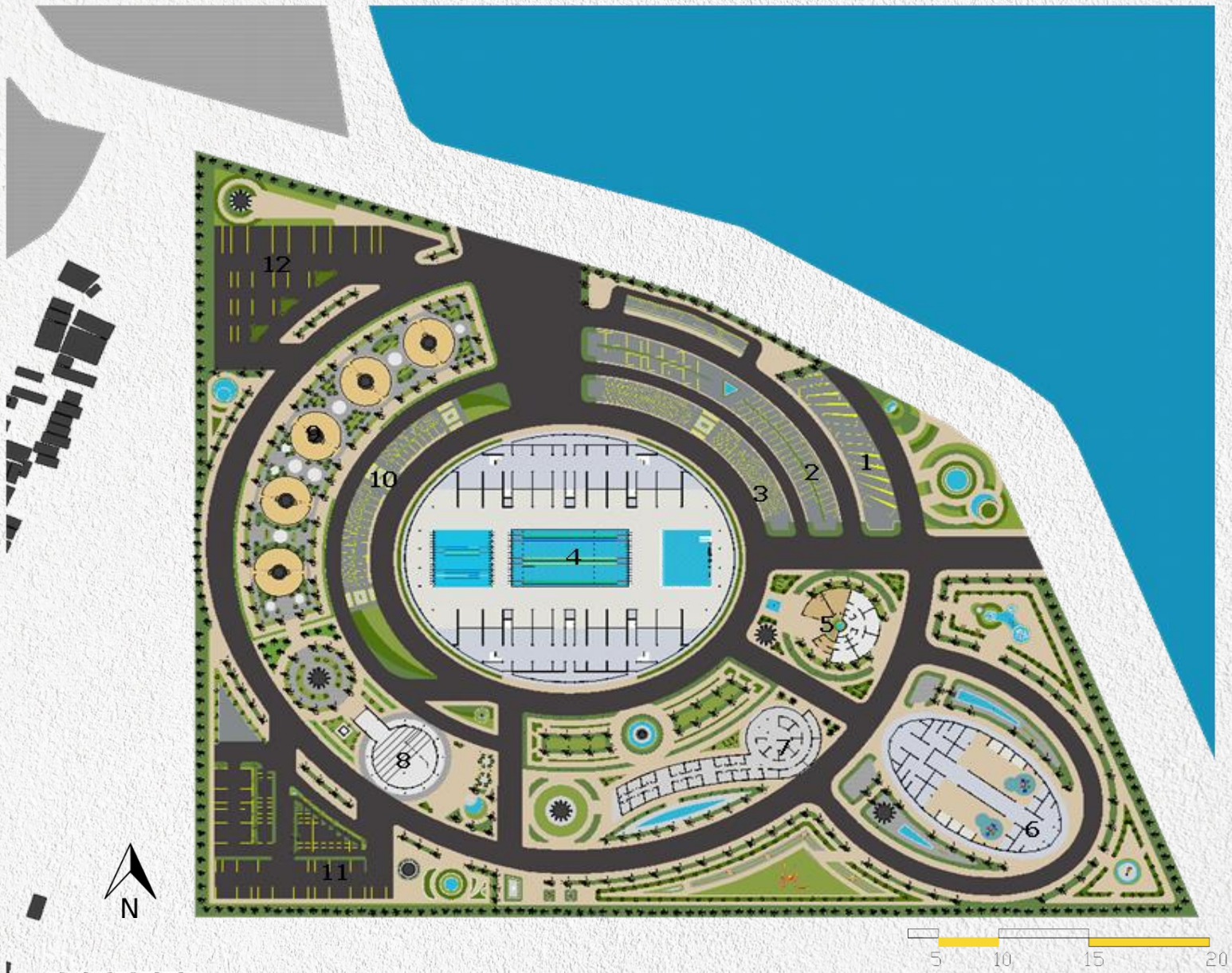
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

SITE PLAN

SKALA : 1:2400

NO. GAMBAR: 1



LEGENDA :

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12. PARKING AREA 5

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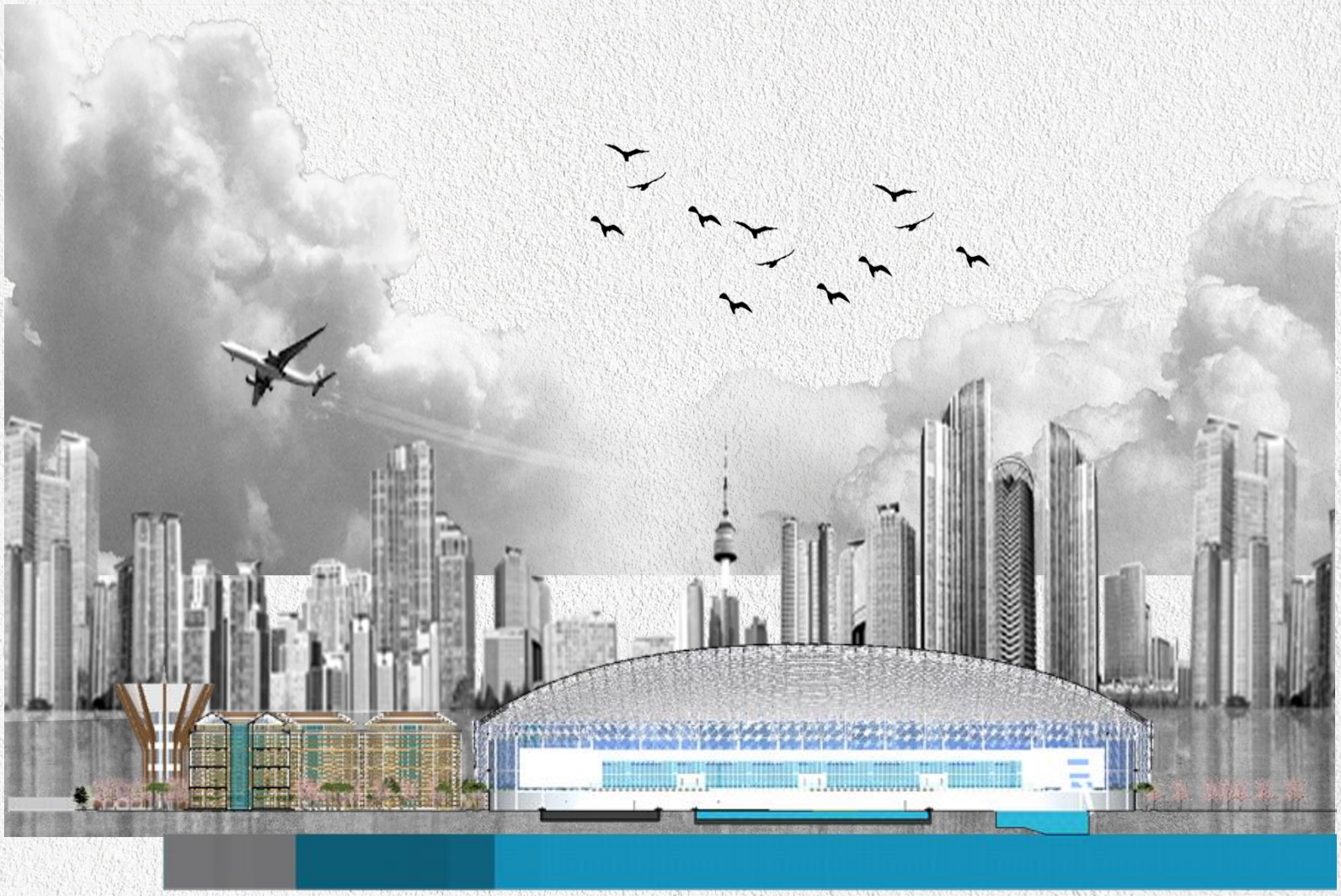
JUDUL GAMBAR

LAYOUT PLAN

SKALA : 1:2400

NO. GAMBAR: 2



5 10 15 20

POTONGAN KAWASAN A'-A'

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JUDUL GAMBAR

POTONGAN A'-A' KAWASAN

SKALA : 1:1200

NO. GAMBAR: 3

POTONGAN KAWASAN B'-B'

5 10 15 20

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POTONGAN B'-B' KAWASAN

SKALA : 1:1200

NO. GAMBAR: 4

TAMPAK DEPAN KAWASAN

5 10 15 20

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TAMPAK DEPAN KAWASAN

SKALA : 1:1200

NO. GAMBAR: 5

TAMPAK SAMPING KAWASAN

5 10 15 20

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DOSEN PEMBIMBING 2:
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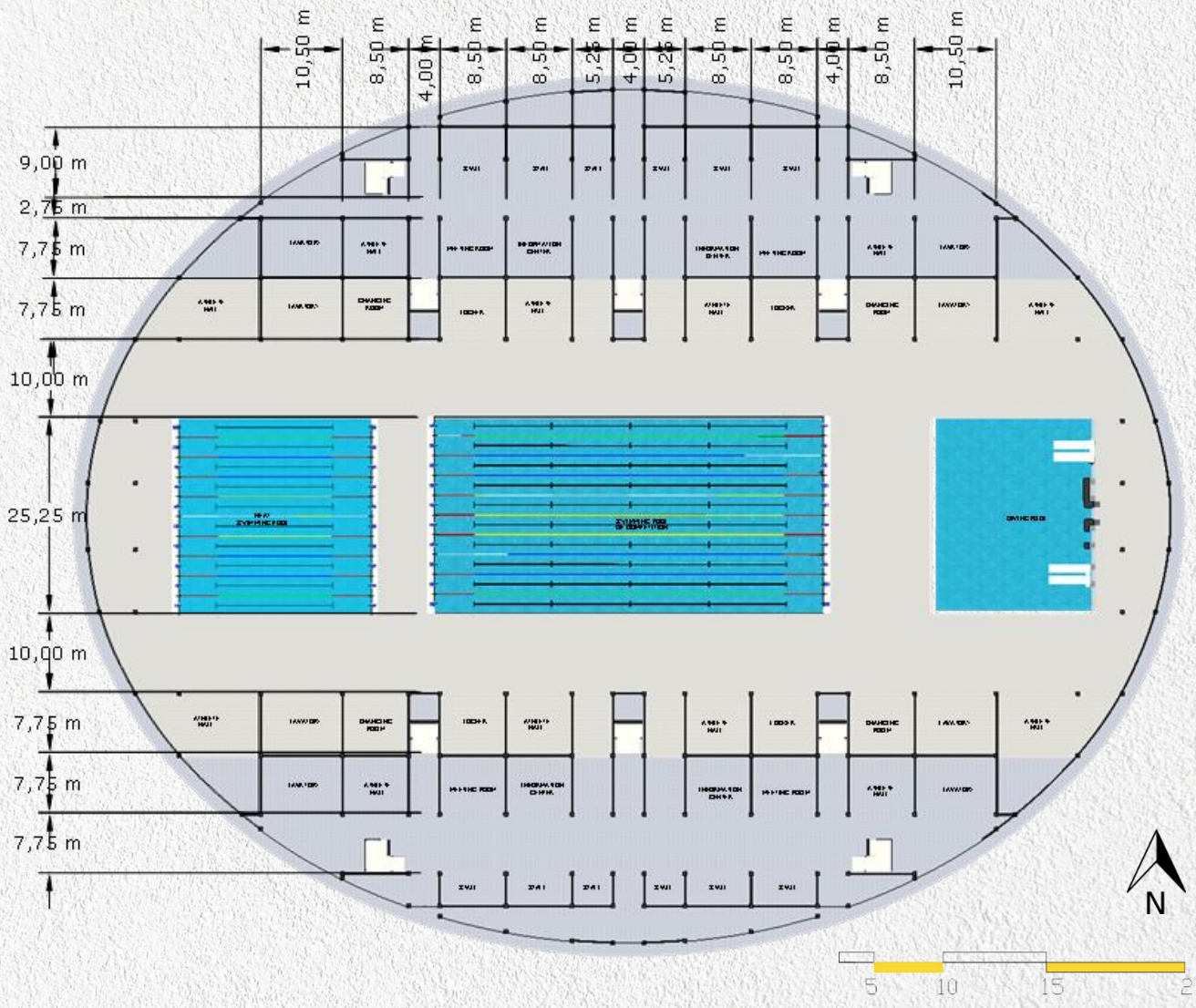
JUDUL GAMBAR

TAMPAK SAMPING KAWASAN

SKALA : 1:1200

NO. GAMBAR: 6



DENAH LANTAI 1 AQUATIC SPORTS CENTER

ARCHITECTURE

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AISSYAH HANRINI NURSHOKH

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DOSEN PEMBIMBING 2:
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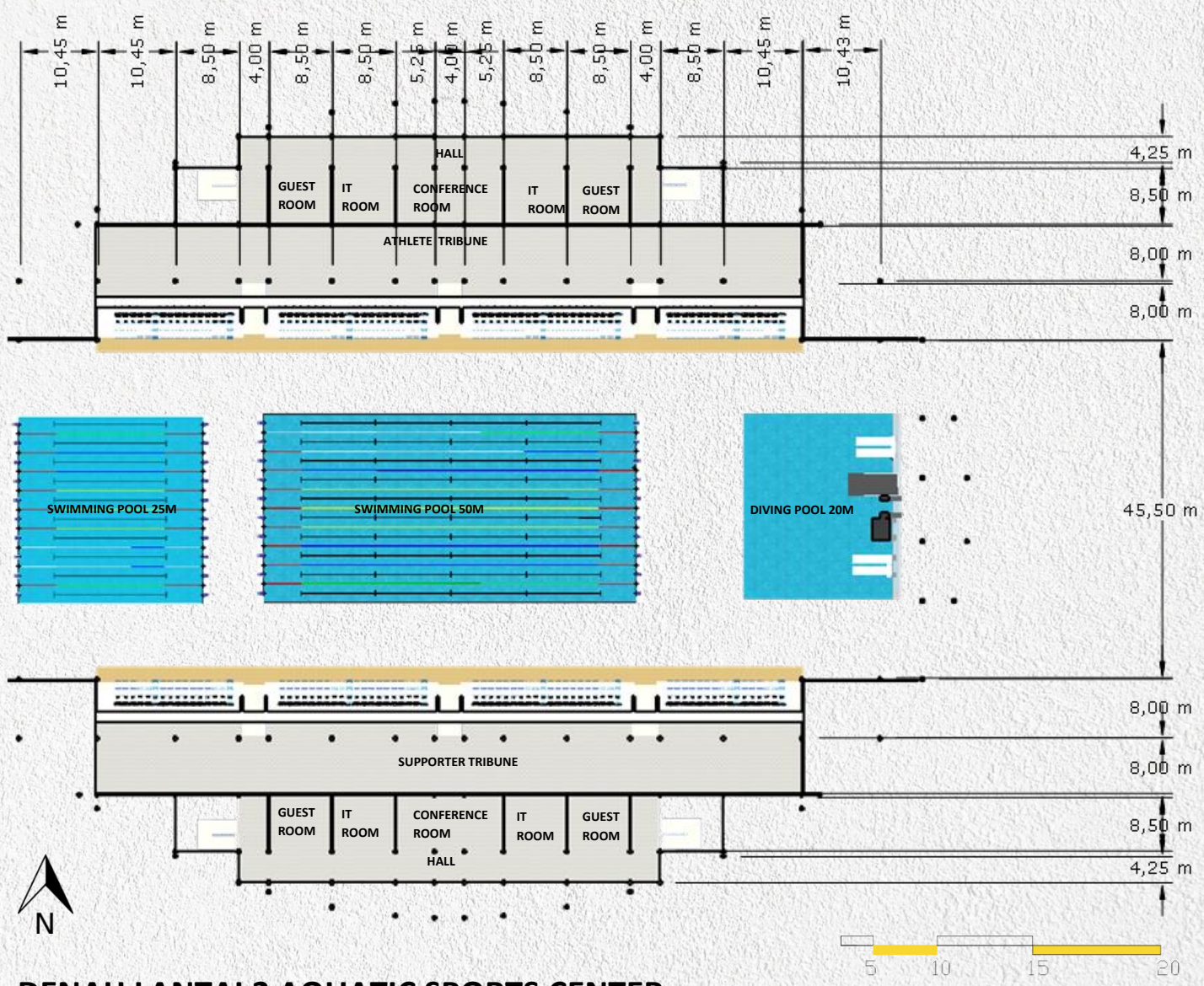
JUDUL GAMBAR

DENAH LANTAI 1 AQUATIC SPORTS CENTER

SKALA : 1:720

NO. GAMBAR: 7



DENAH LANTAI 2 AQUATIC SPORTS CENTER

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NAMA MAHASISWA:

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DOSEN PEMBIMBING 1:

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DOSEN PEMBIMBING 2:
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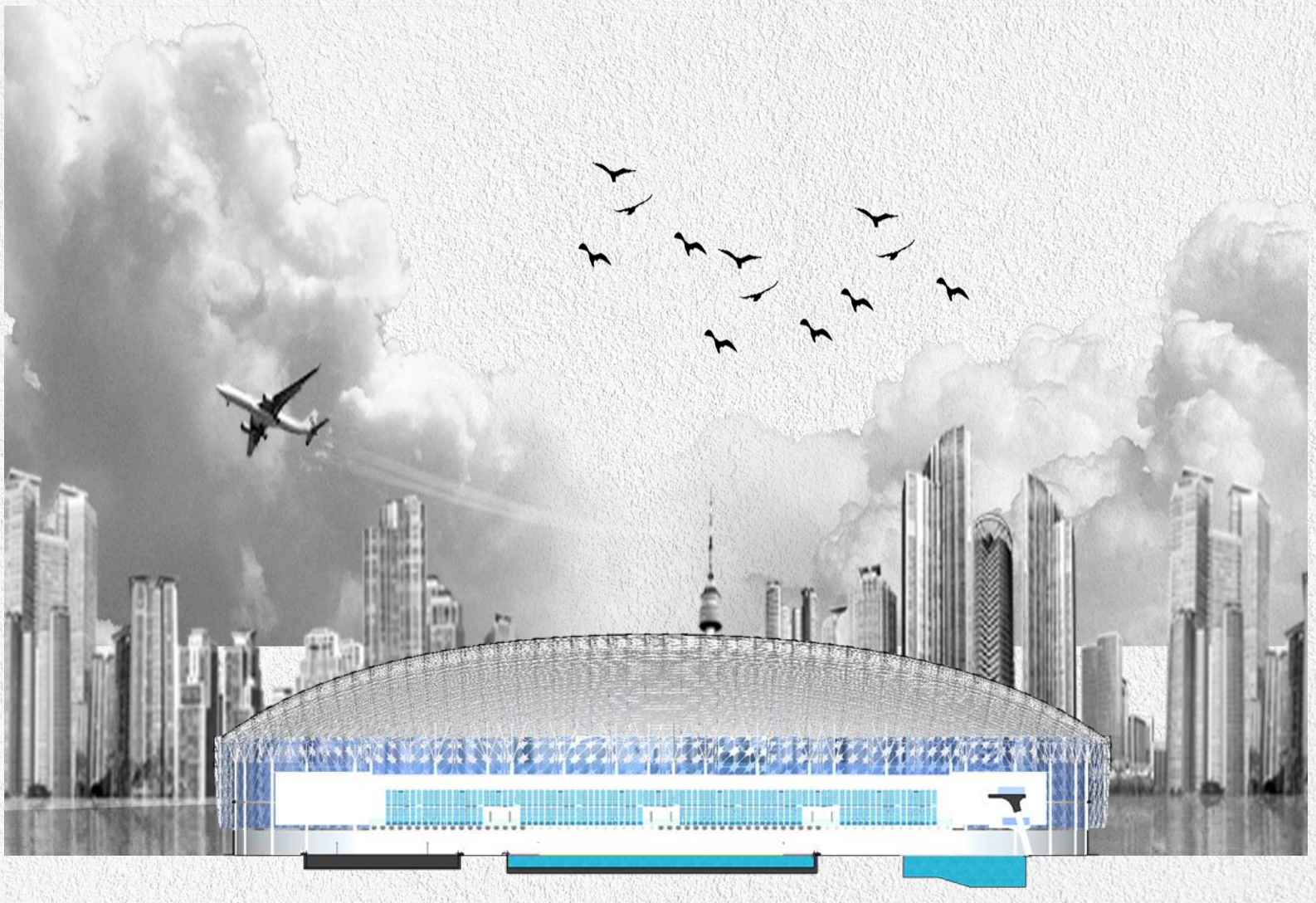
JUDUL GAMBAR

DENAH LANTAI 2 AQUATIC SPORTS CENTER

SKALA : 1:720

NO. GAMBAR: 8



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POTONGAN A'-A' AQUATIC SPORTS CENTER

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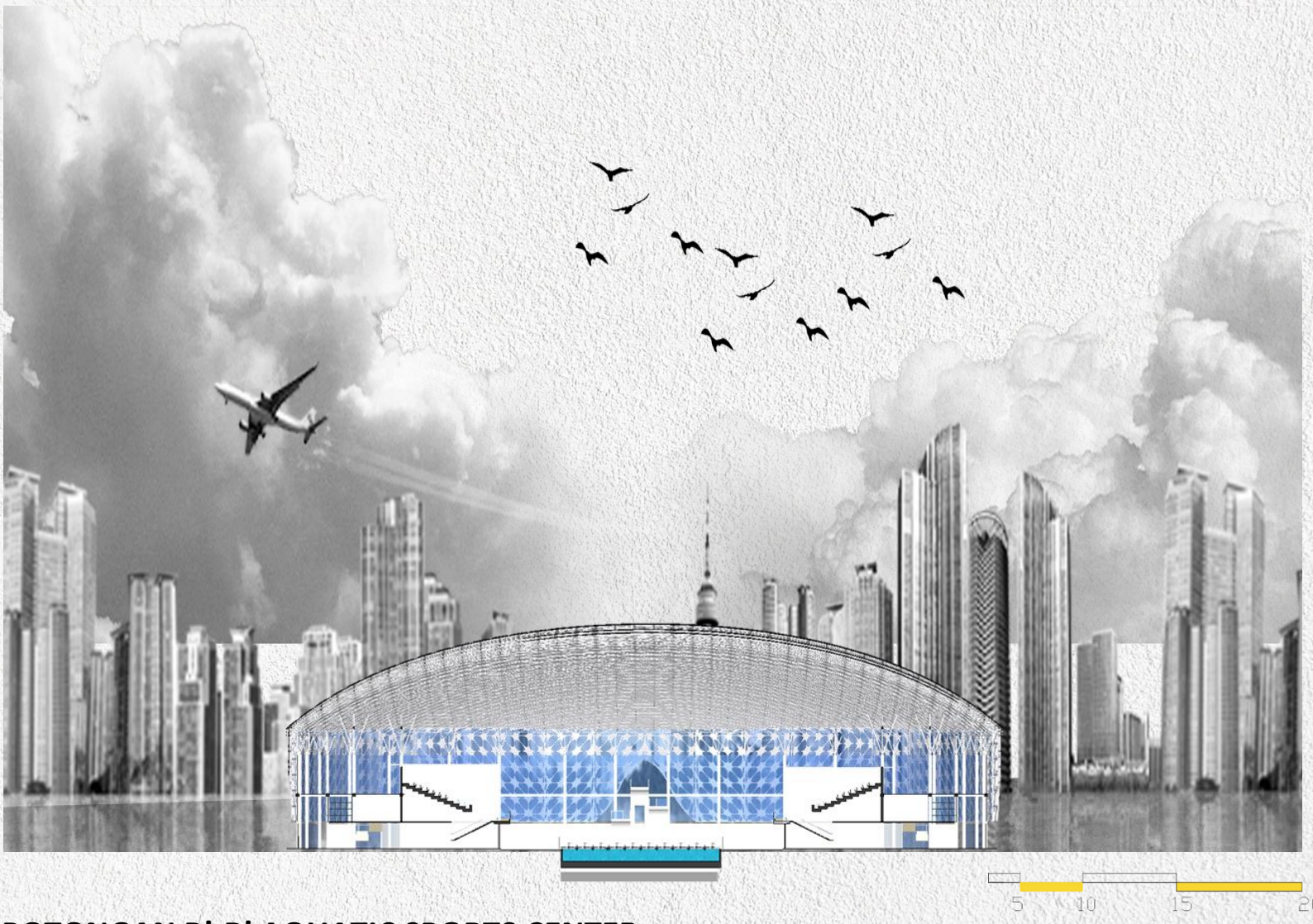
POTONGAN A'-A' AQUATIC SPORTS CENTER

SKALA : 1:720

NO. GAMBAR: 9



POTONGAN B'-B' AQUATIC SPORTS CENTER

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POTONGAN B'-B' AQUATIC SPORTS CENTER

SKALA : 1:720

NO. GAMBAR: 10

TAMPAK DEPAN AQUATIC SPORTS CENTER

5 10 15 20

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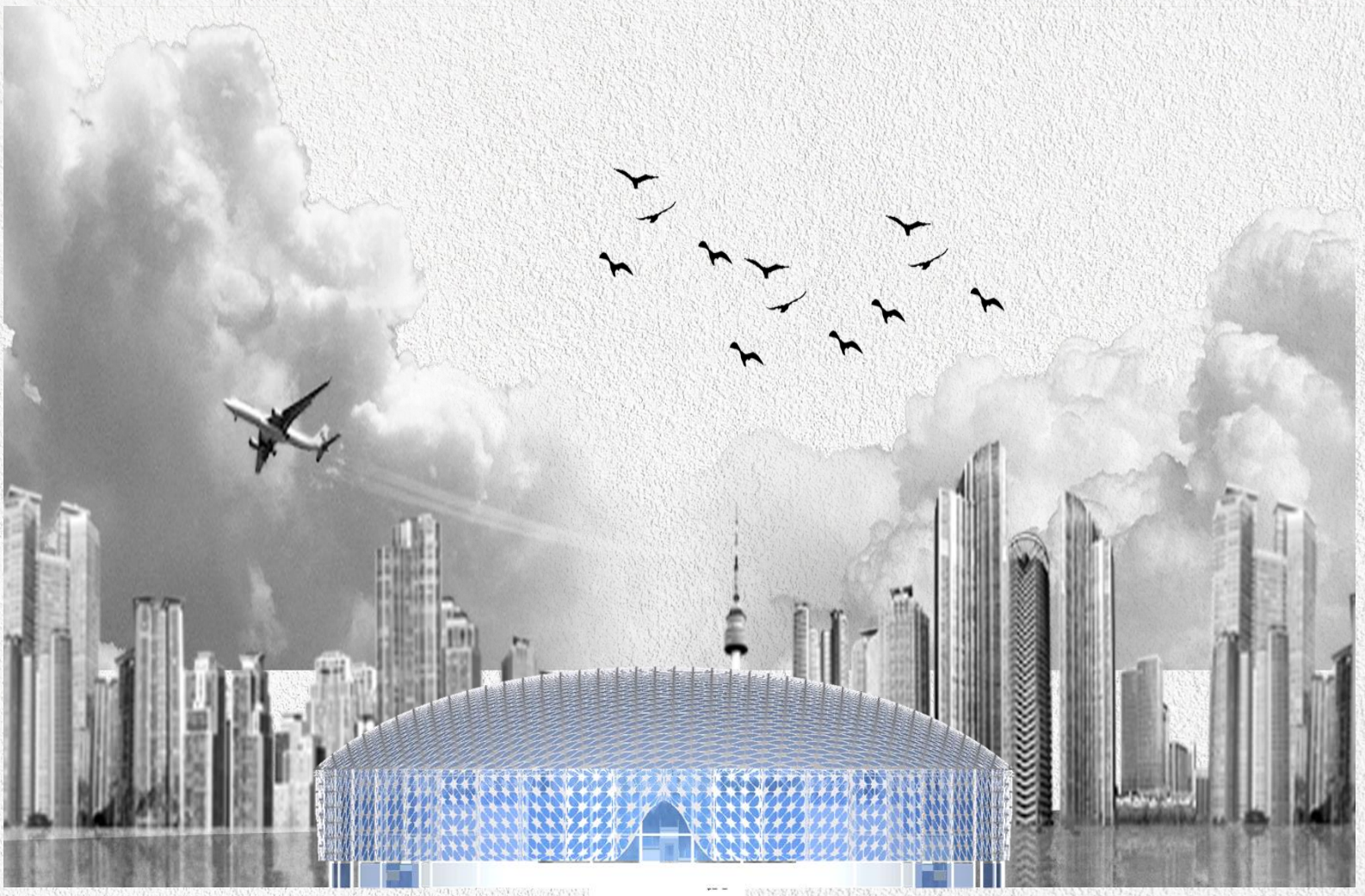
TAMPAK DEPAN AQUATIC SPORTS CENTER

SKALA : 1:720

NO. GAMBAR: 11



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TAMPAK SAMPING AQUATIC SPORTS CENTER

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DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

DOSEN PEMBIMBING 2:
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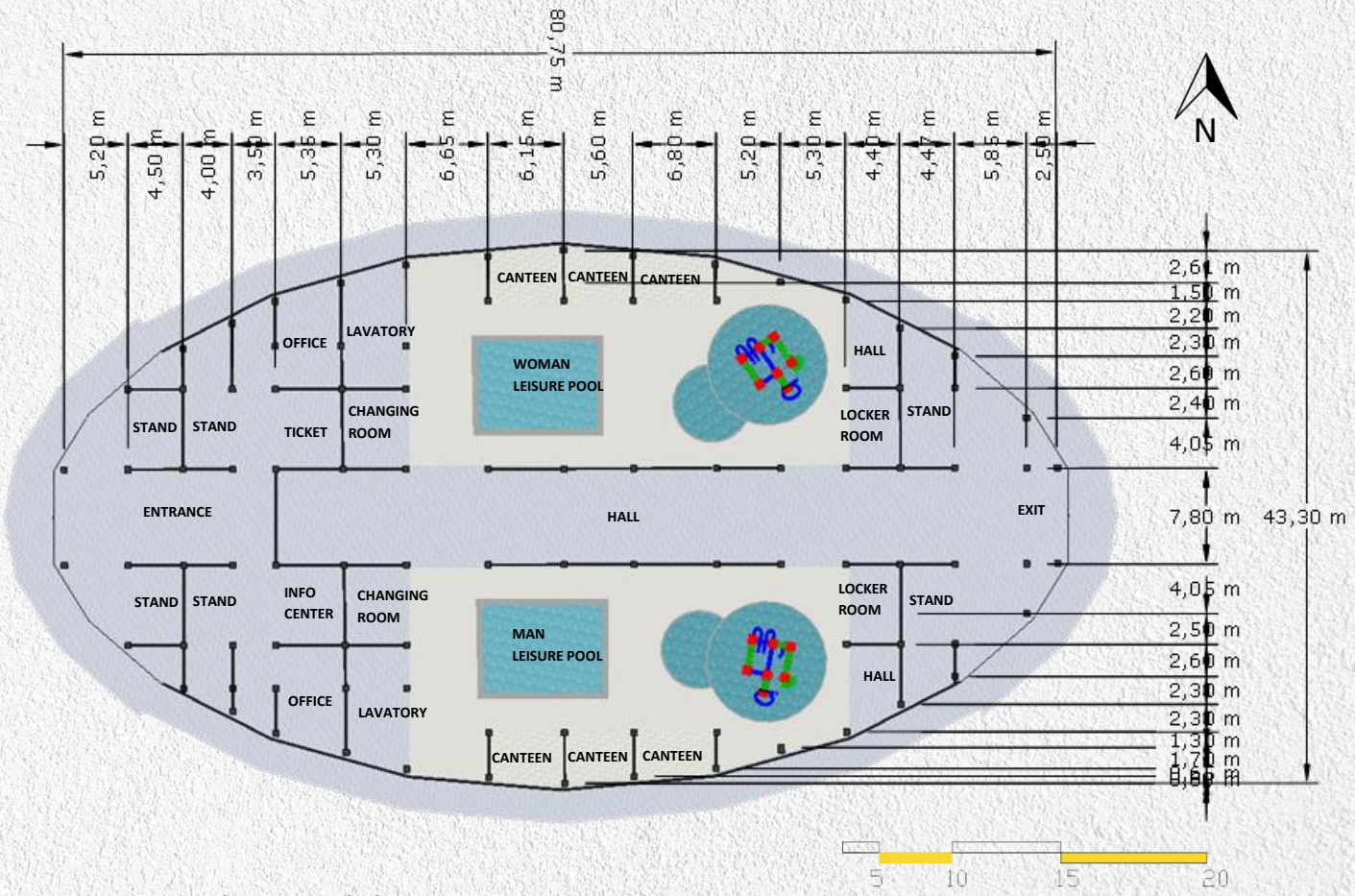
JUDUL GAMBAR

TAMPAK SAMPING AQUATIC SPORTS CENTER

SKALA : 1:720

NO. GAMBAR: 12



DENAH LEISURE POOL

ARCHITECTURE

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DOSEN PEMBIMBING 2:
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JUDUL GAMBAR

DENAH LEISURE POOL

SKALA : 1:600

NO. GAMBAR: 13

POTONGAN A'-A' LEISURE POOL

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ARIEF RAKHMAN SETIONO, M.T

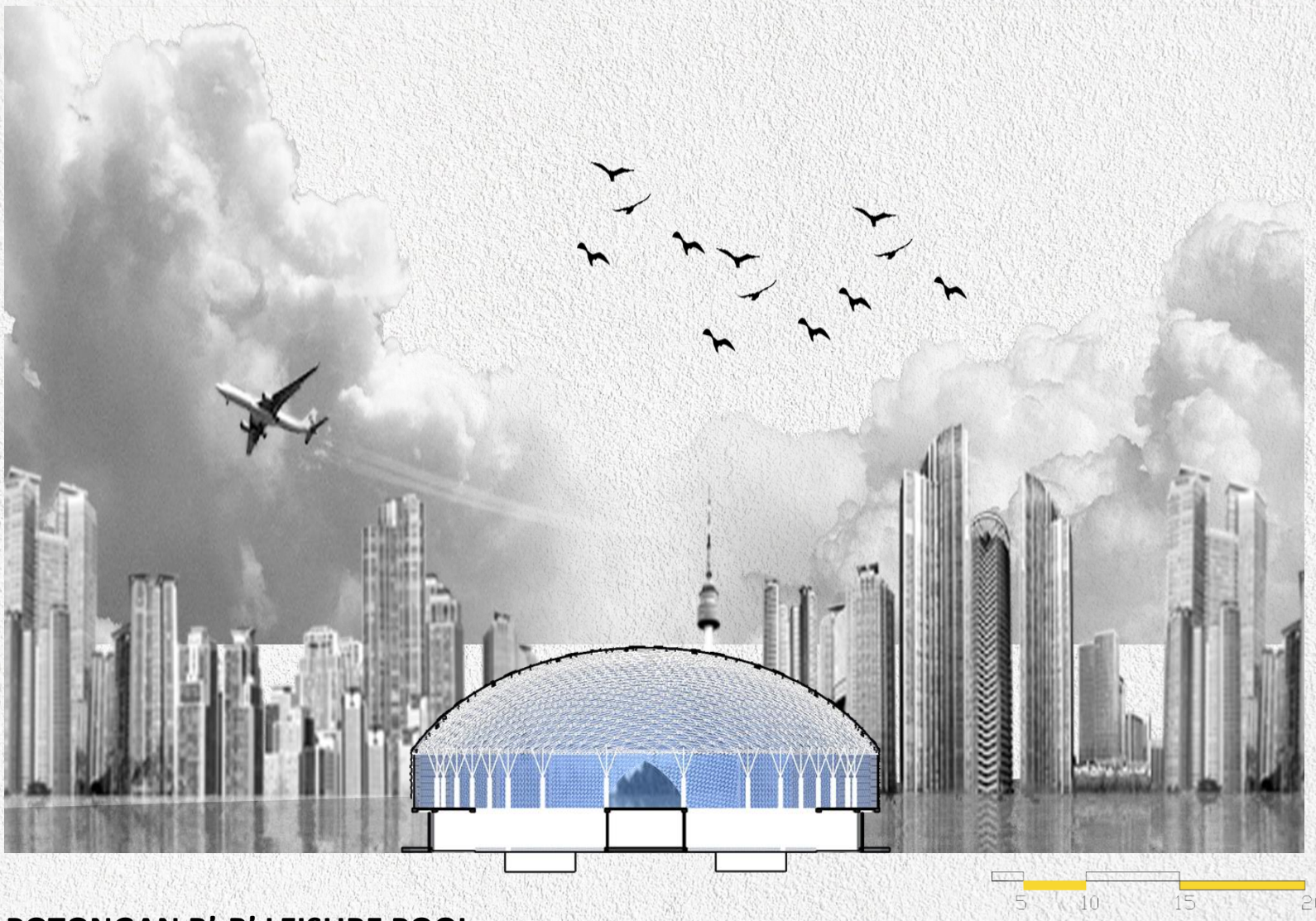
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

POTONGAN A'-A' LEISURE POOL

SKALA : 1:600

NO. GAMBAR: 14



POTONGAN B'-B' LEISURE POOL

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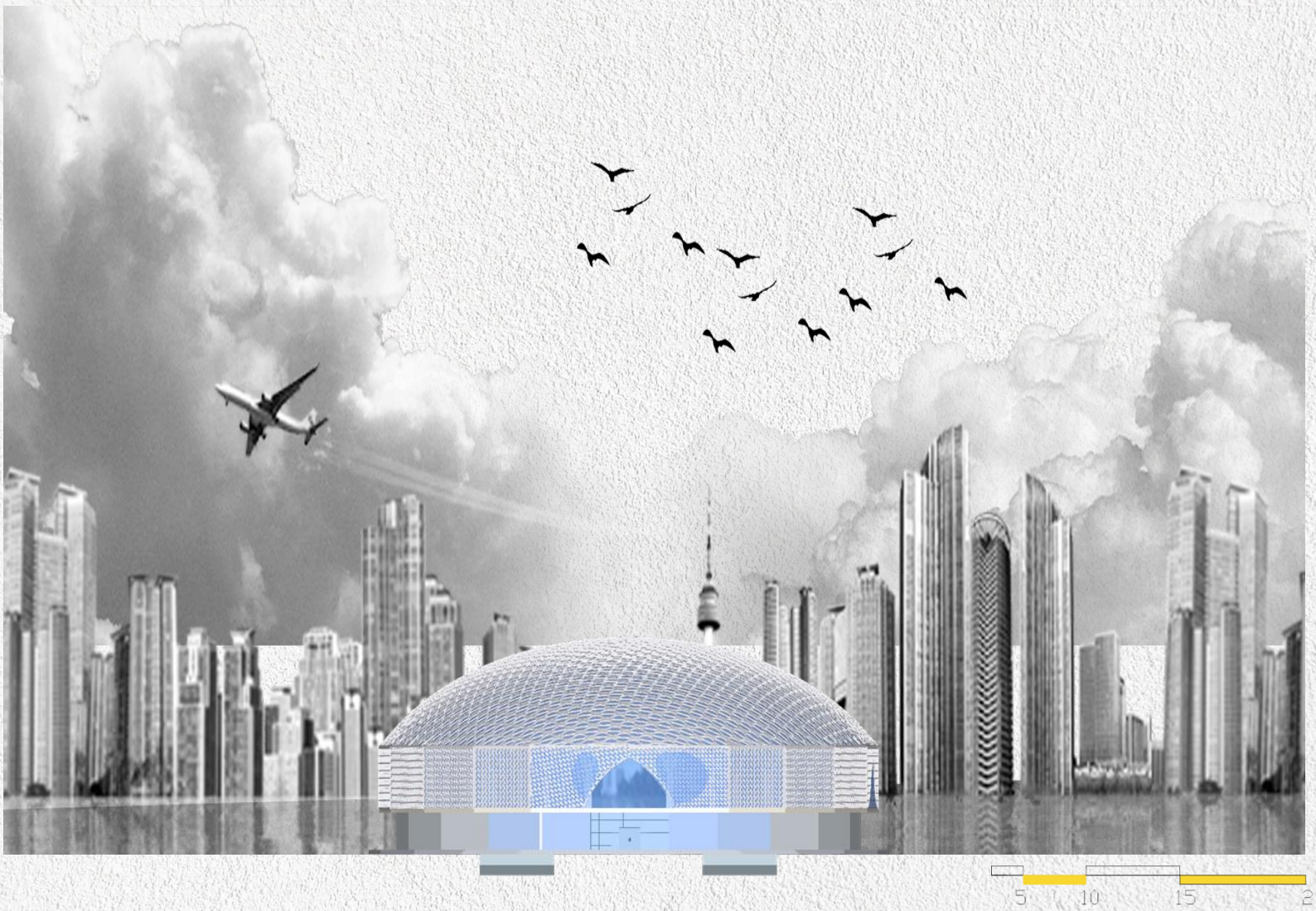
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

POTONGAN B'-B' LEISURE POOL

SKALA : 1:600

NO. GAMBAR: 15



TAMPAK DEPAN LEISURE POOL

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

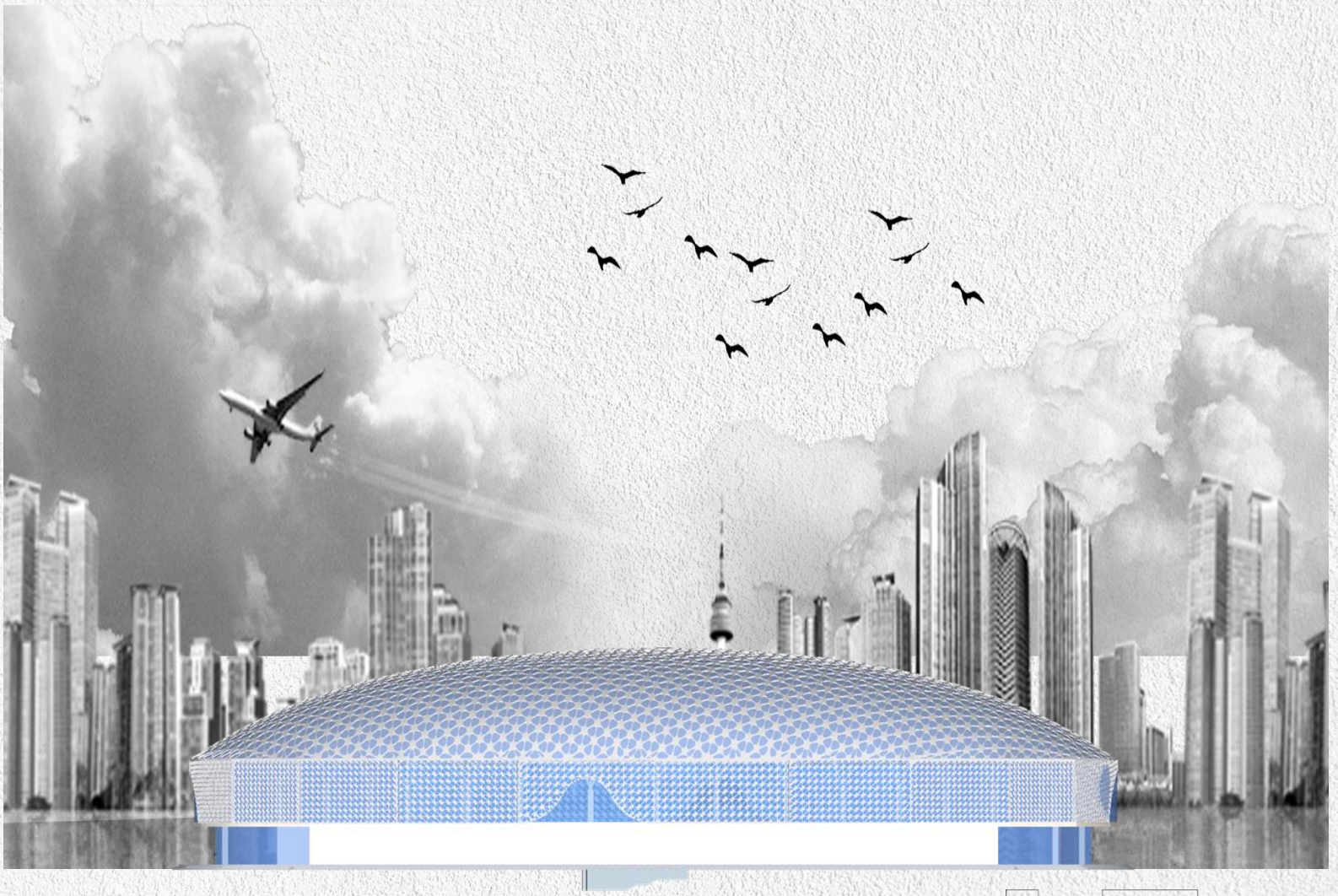
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

TAMPAK DEPAN LEISURE POOL

SKALA : 1:600

NO. GAMBAR: 16



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TAMPAK SAMPING LEISURE POOL

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

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NAMA MAHASISWA:

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NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

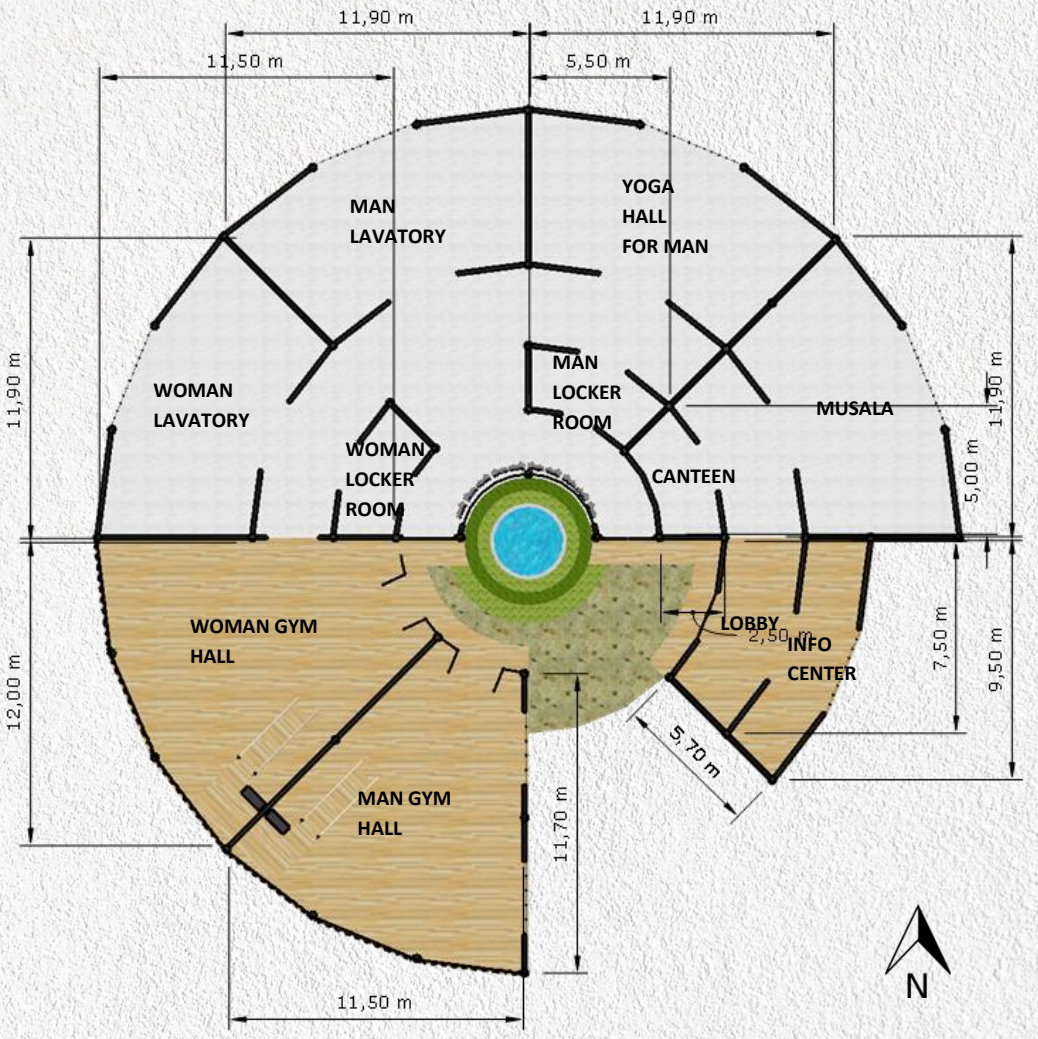
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

TAMPAK SAMPING LEISURE POOL

SKALA : 1:600

NO. GAMBAR: 17



DENAH TRAINING CENTER

ARCHITECTURE

UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

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NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

DENAH TRAINING CENTER

SKALA : 1:126

NO. GAMBAR: 18

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POTONGAN A'-A' TRAINING CENTER

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

POTONGAN A'-A' TRAINING CENTER

SKALA : 1:200

NO. GAMBAR: 19

5 10 15 20

POTONGAN B'-B' TRAINING CENTER

ARCHITECTURE

UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

POTONGAN B'-B' TRAINING CENTER

SKALA : 1:200

NO. GAMBAR: 20

TAMPAK DEPAN TRAINING CENTER

ARCHITECTURE

UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

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NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

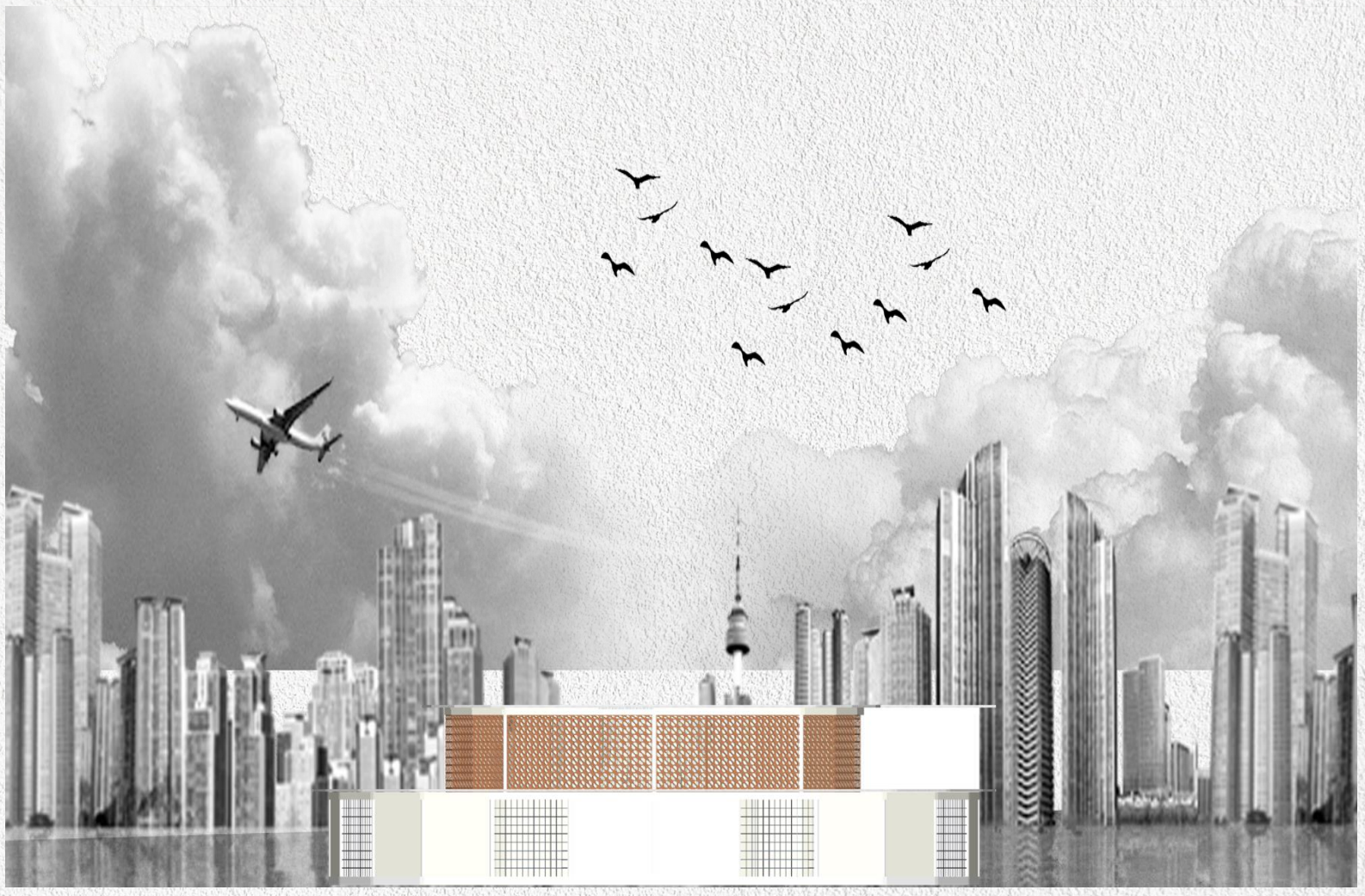
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

TAMPAK DEPAN TRAINING CENTER

SKALA : 1:200

NO. GAMBAR: 21



5 10 15 20

TAMPAK SAMPING TRAINING CENTER

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

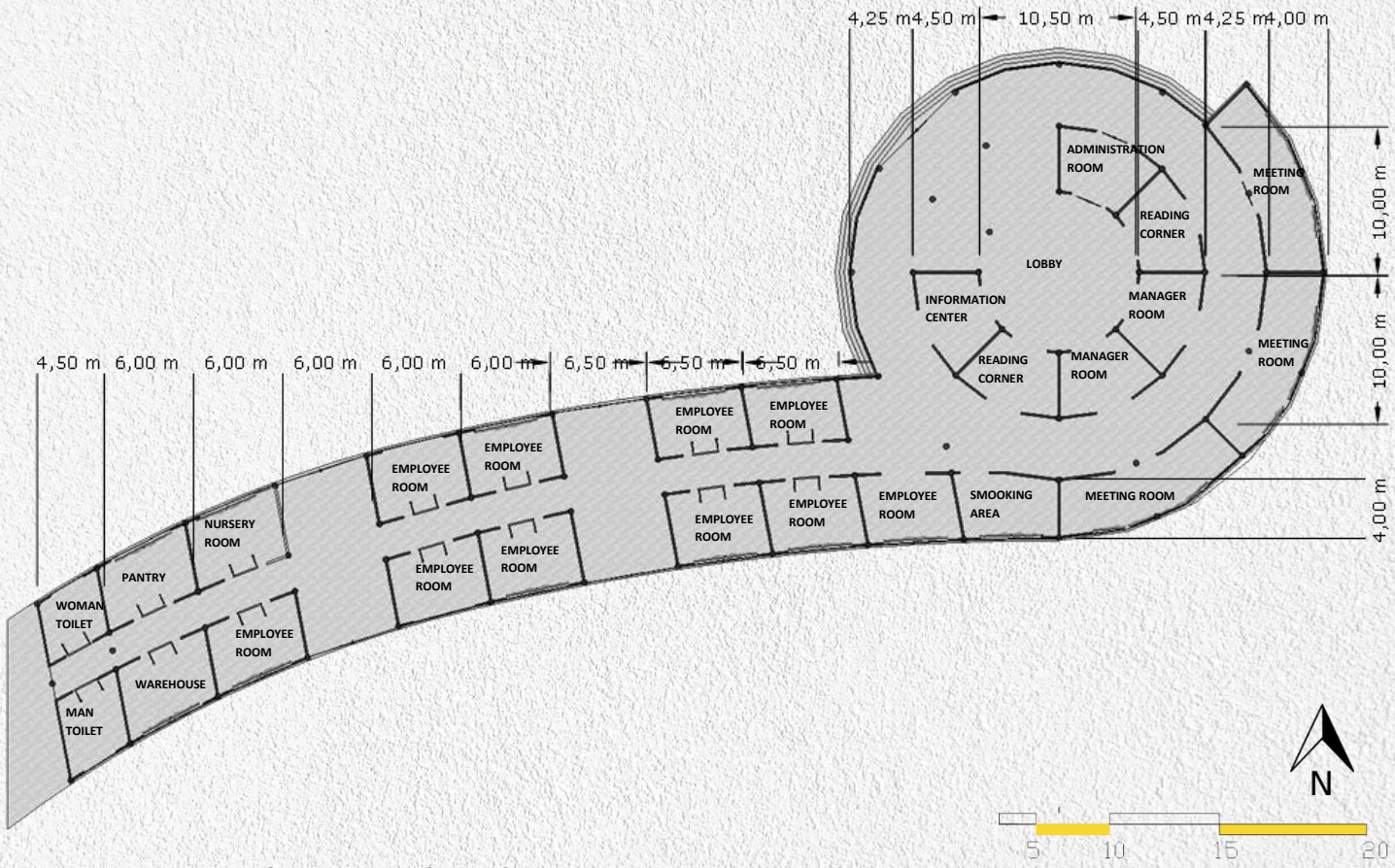
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

TAMPAK SAMPING TRAINING CENTER

SKALA : 1:200

NO. GAMBAR: 22



DENAH MANAGEMENT OFFICE

ARCHITECTURE

UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

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NIM 15660096

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DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

DENAH MANAGEMENT OFFICE

SKALA : 1:192

NO. GAMBAR: 23

5 10 15 20

POTONGAN A'-A' MANAGEMENT OFFICE

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

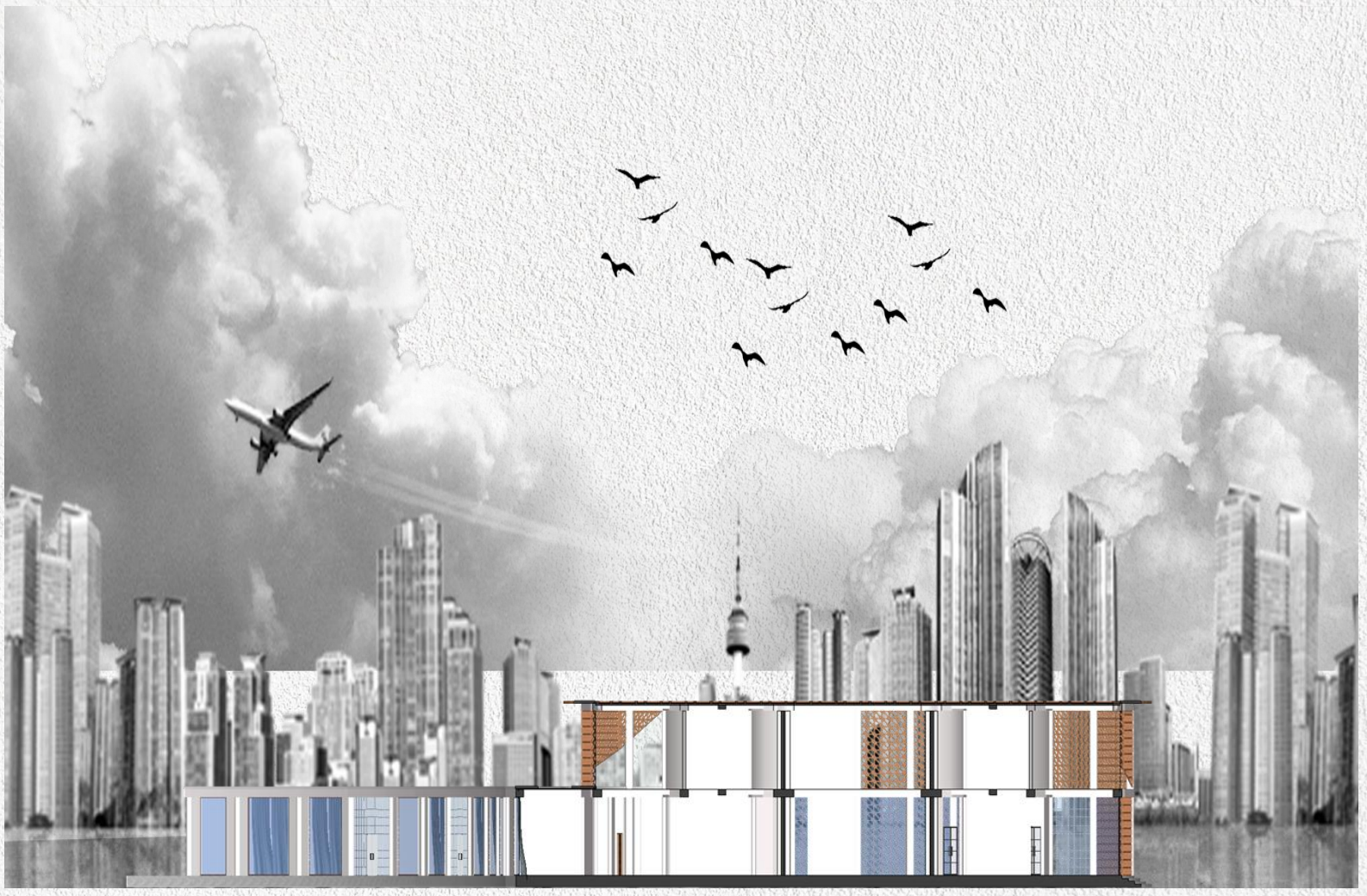
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

POTONGAN A'-A' MANAGEMENT OFFICE

SKALA : 1:200

NO. GAMBAR: 24



5 10 15 20

POTONGAN B'-B' MANAGEMENT OFFICE

ARCHITECTURE

UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

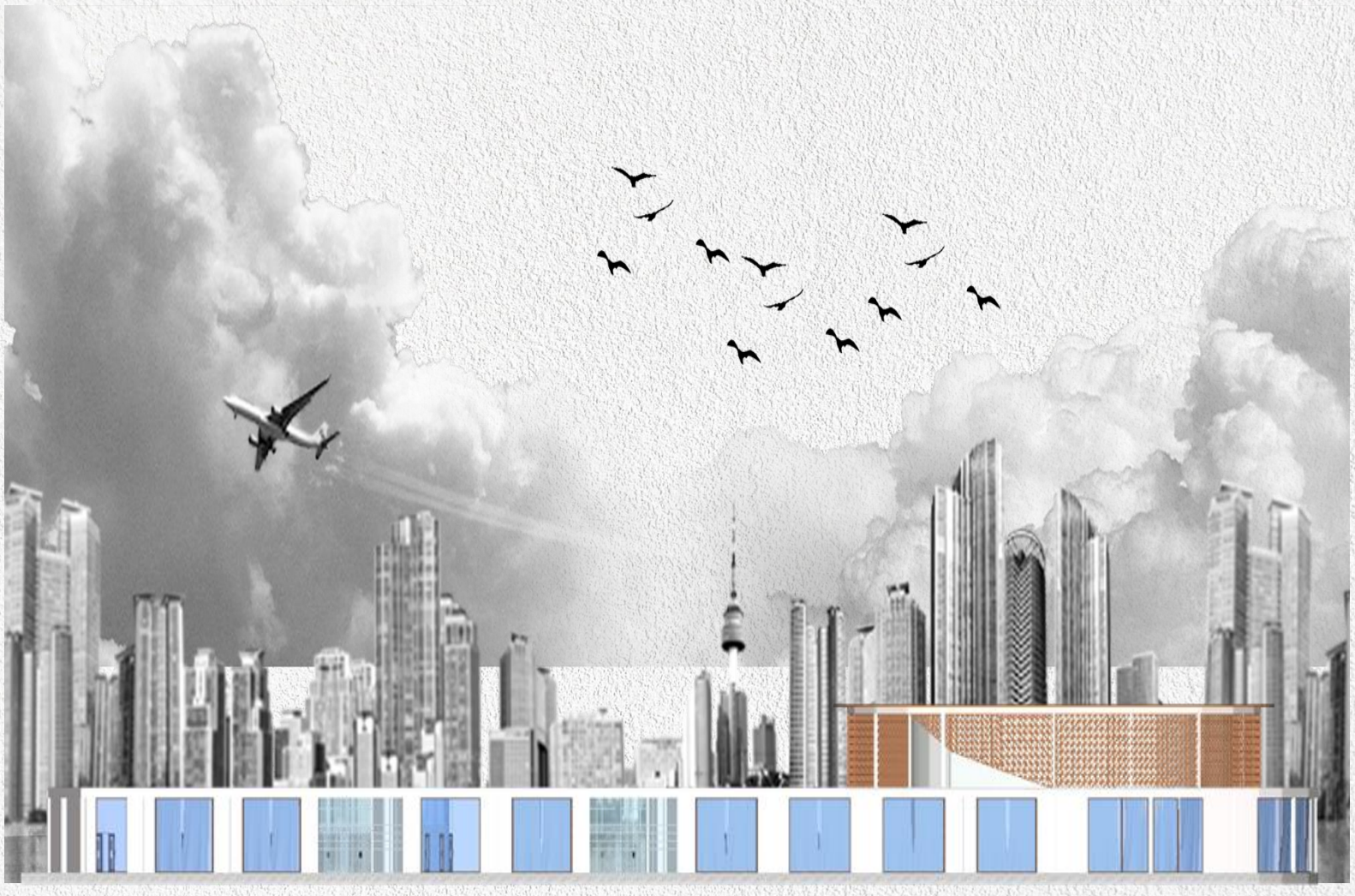
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

POTONGAN B'-B' MANAGEMENT OFFICE

SKALA : 1:200

NO. GAMBAR: 25



5 10 15 20

TAMPAK DEPAN MANAGEMENT OFFICE

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

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NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

TAMPAK DEPAN MANAGEMENT OFFICE

SKALA : 1:1200

NO. GAMBAR: 26

5 10 15 20

TAMPAK SAMPING MANAGEMENT OFFICE

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

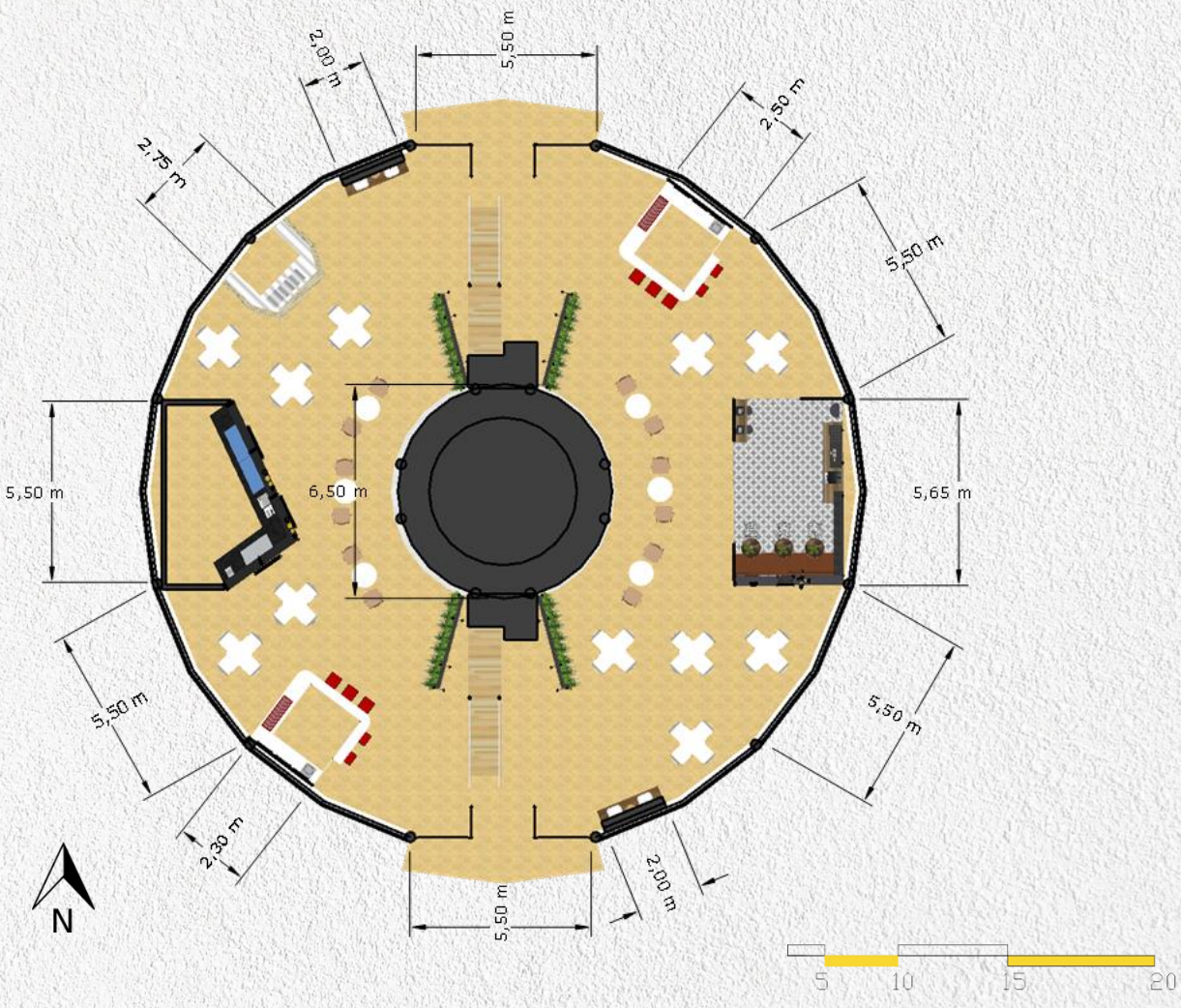
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

TAMPAK SAMPING MANAGEMENT OFFICE

SKALA : 1:200

NO. GAMBAR: 27



DENAH LANTAI 1-4 FOODCOURT

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

DENAH LANTAI 1-4 FOODCOURT

SKALA : 1:120

NO. GAMBAR: 28

POTONGAN A'-A' FOODCOURT

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

POTONGAN A'-A' FOODCOURT

SKALA : 1:200

NO. GAMBAR: 29

POTONGAN B'-B' FOODCOURT

ARCHITECTURE

UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

POTONGAN B'-B' FOODCOURT

SKALA : 1:200

NO. GAMBAR: 30

TAMPAK DEPAN FOODCOURT

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

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NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

TAMPAK DEPAN FOODCOURT

SKALA : 1:200

NO. GAMBAR: 31

TAMPAK SAMPING FOODCOURT

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
ARCHITECTURE
UIN MALANG - INDONESIA
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

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NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

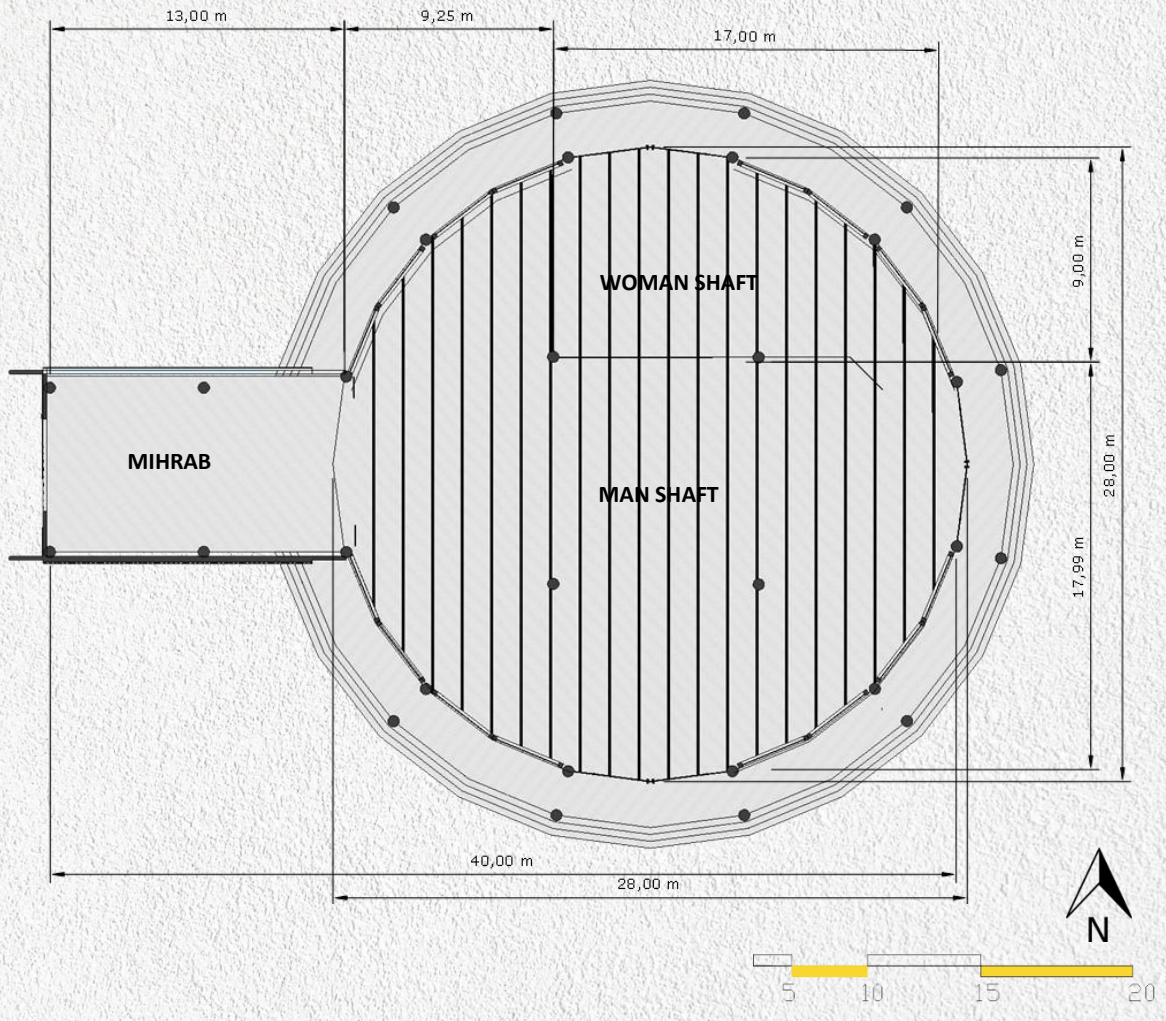
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

TAMPAK SAMPING FOODCOURT

SKALA : 1:200

NO. GAMBAR: 32



DENAH MOSQUE

ARCHITECTURE

UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

VJUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

DENAH MOSQUE

SKALA : 1:120

NO. GAMBAR: 33

POTONGAN A'-A' MOSQUE

ARCHITECTURE

UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

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NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

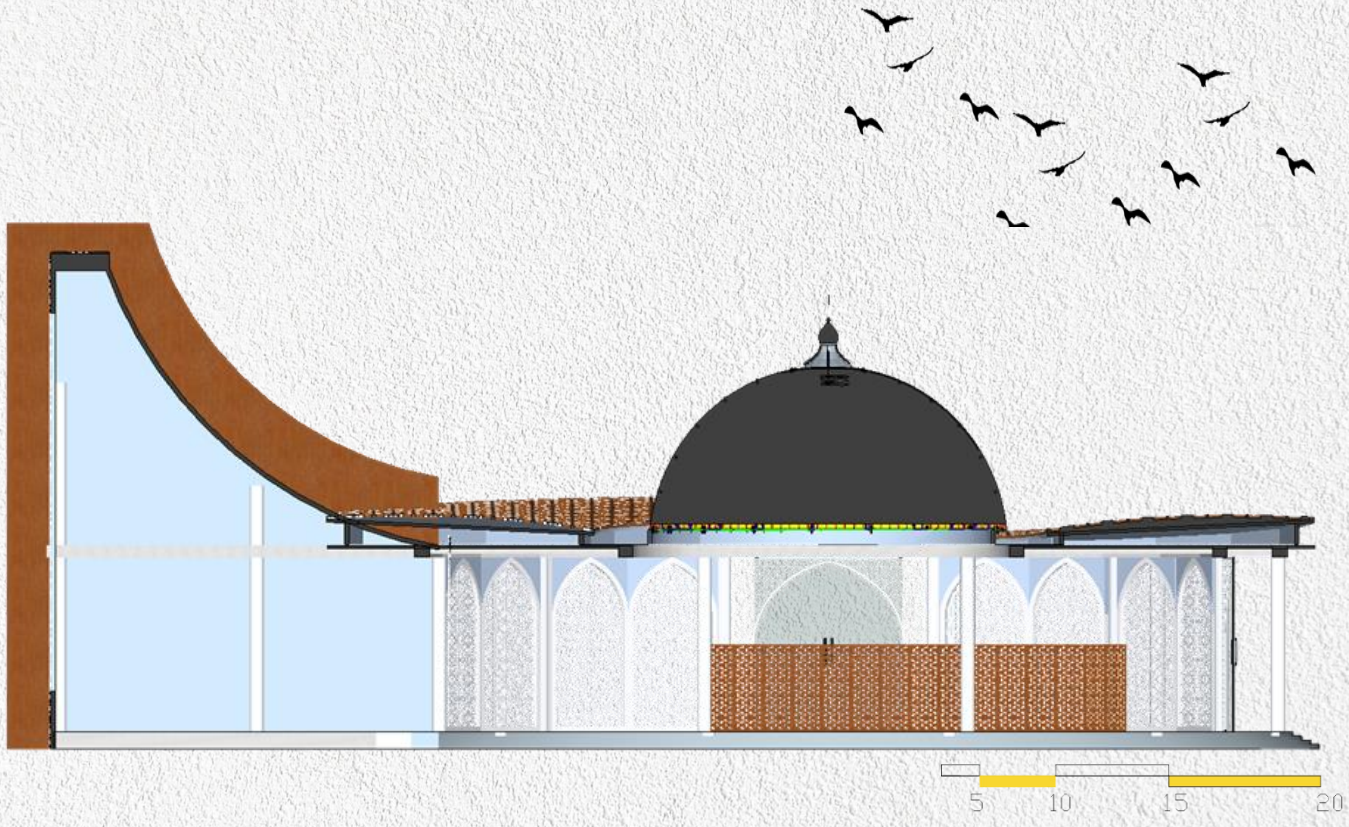
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

POTONGAN A'-A' MOSQUE

SKALA : 1:120

NO. GAMBAR: 34



POTONGAN B’-B’ MOSQUE

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

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NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

POTONGAN B’-B’ MOSQUE

SKALA : 1:120

NO. GAMBAR: 35

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

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NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

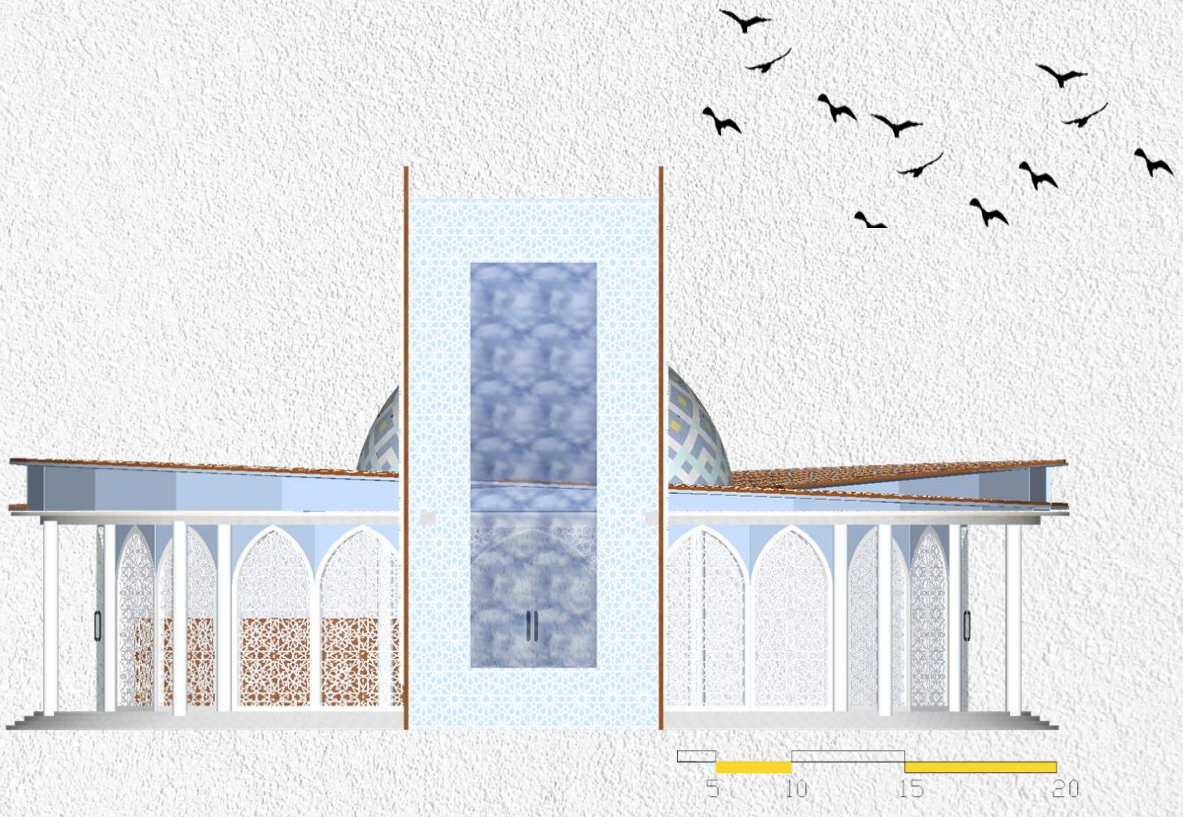
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

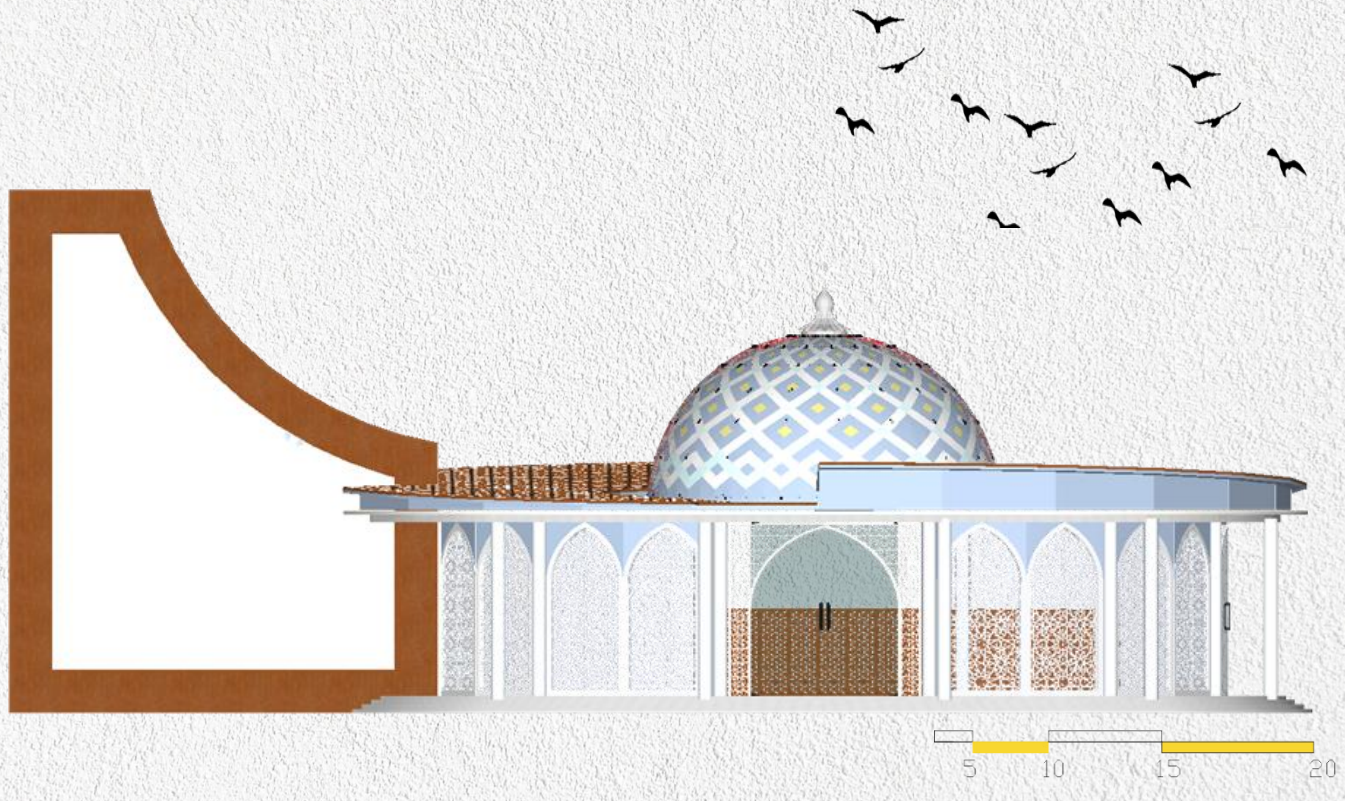
TAMPAK DEPAN MOSQUE

SKALA : 1:120

NO. GAMBAR: 36



TAMPAK DEPAN MOSQUE



TAMPAK SAMPING MOSQUE

ARCHITECTURE
UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

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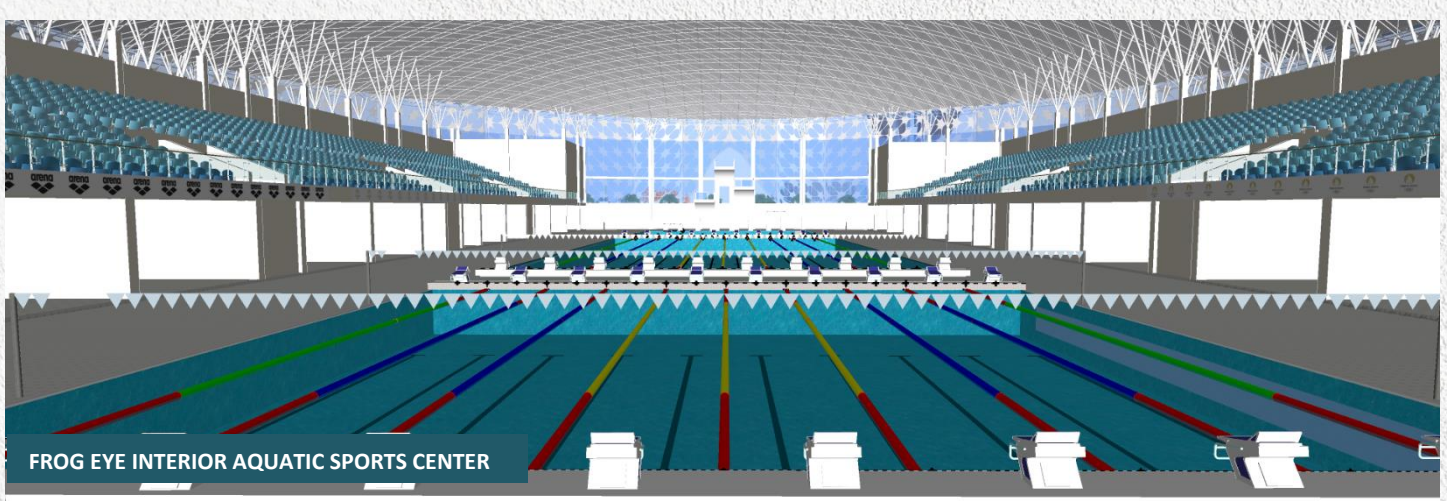
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

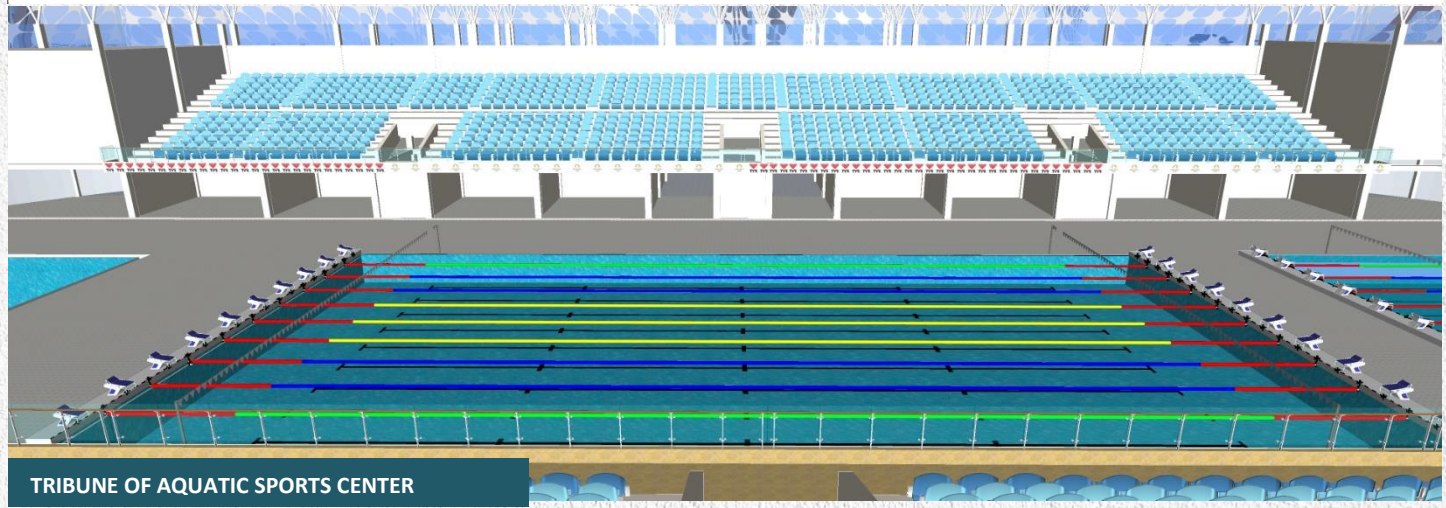
TAMPAK SAMPING MOSQUE

SKALA : 1:120

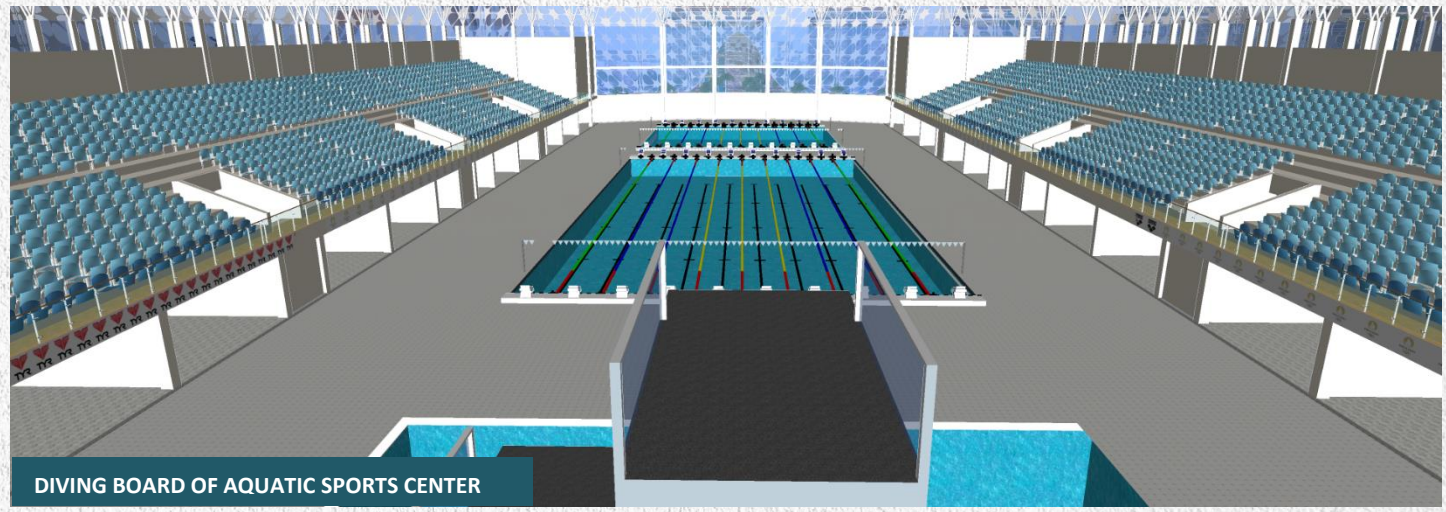
NO. GAMBAR: 37



FROG EYE INTERIOR AQUATIC SPORTS CENTER



TRIBUNE OF AQUATIC SPORTS CENTER



DIVING BOARD OF AQUATIC SPORTS CENTER

ARCHITECTURE

UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

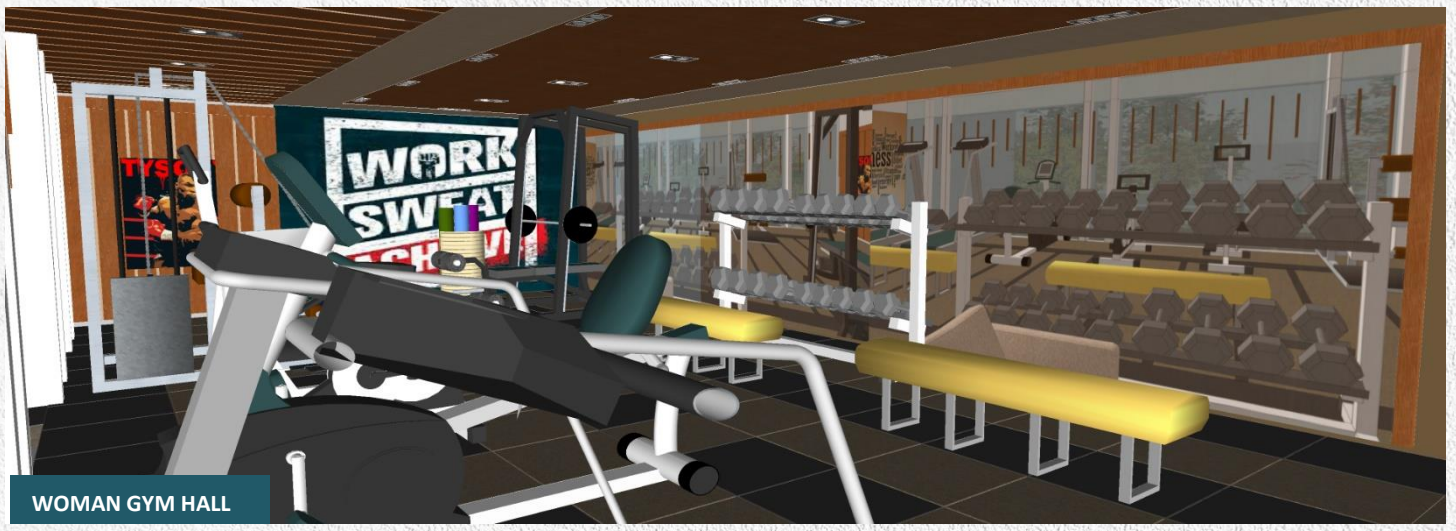
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

INTERIOR AQUATIC SPORTS CENTER

SKALA :

NO. GAMBAR: 38



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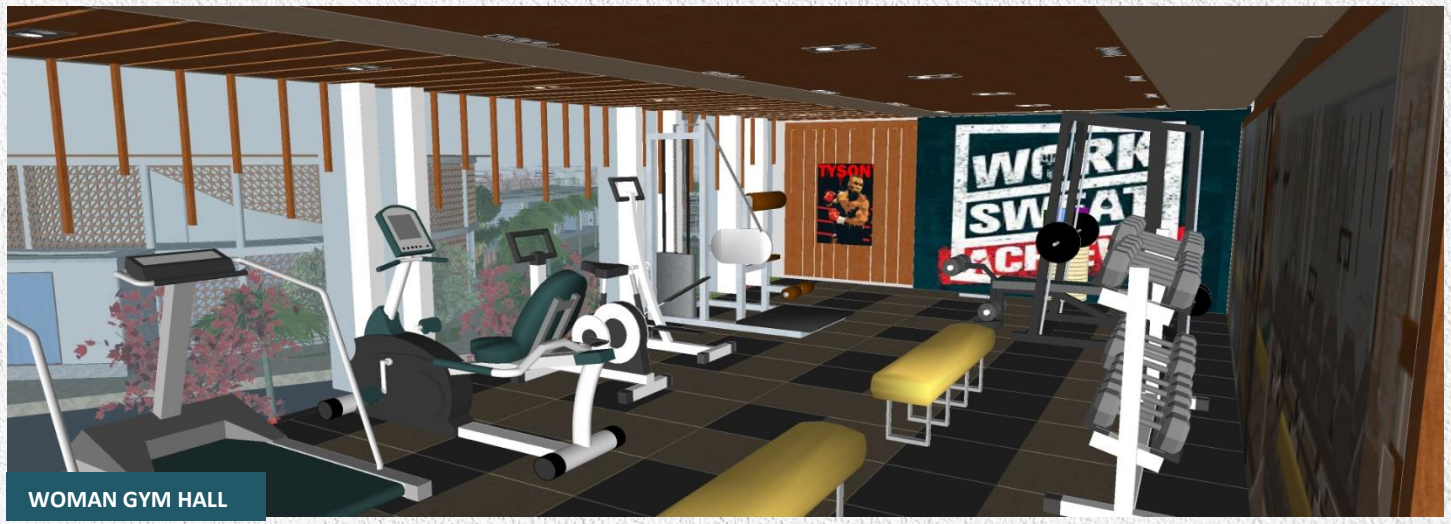

WOMAN GYM HALL

MAN GYM HALL

ARCHITECTURE

UIN MALANG - INDONESIA

PRODI TEKNIK ARSITEKTUR FAKULTAS SAINS DAN TEKNOLOGI
UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

JUDUL PERANCANGAN:

AQUATIC SPORTS CENTER IN SURABAYA

WITH ECO-TECH ARCHITECTURE APPROACH

LOKASI PERANCANGAN:

SURABAYA

NAMA MAHASISWA:

AISSYAH HANRINI NURSHOKH

NIM 15660096

DOSEN PEMBIMBING 1:

ARIEF RAKHMAN SETIONO, M.T

DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

INTERIOR TRAINING CENTER

SKALA :

NO. GAMBAR: 39

MEETING ROOM

MEETING ROOM

LAVATORY

ARCHITECTURE

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JUDUL GAMBAR

INTERIOR MANAGEMENT OFFICE

SKALA :

NO. GAMBAR: 40

SPORTS STATION STALL

LOCKER AND CHANGING ROOM

LEISURE POOL

ARCHITECTURE

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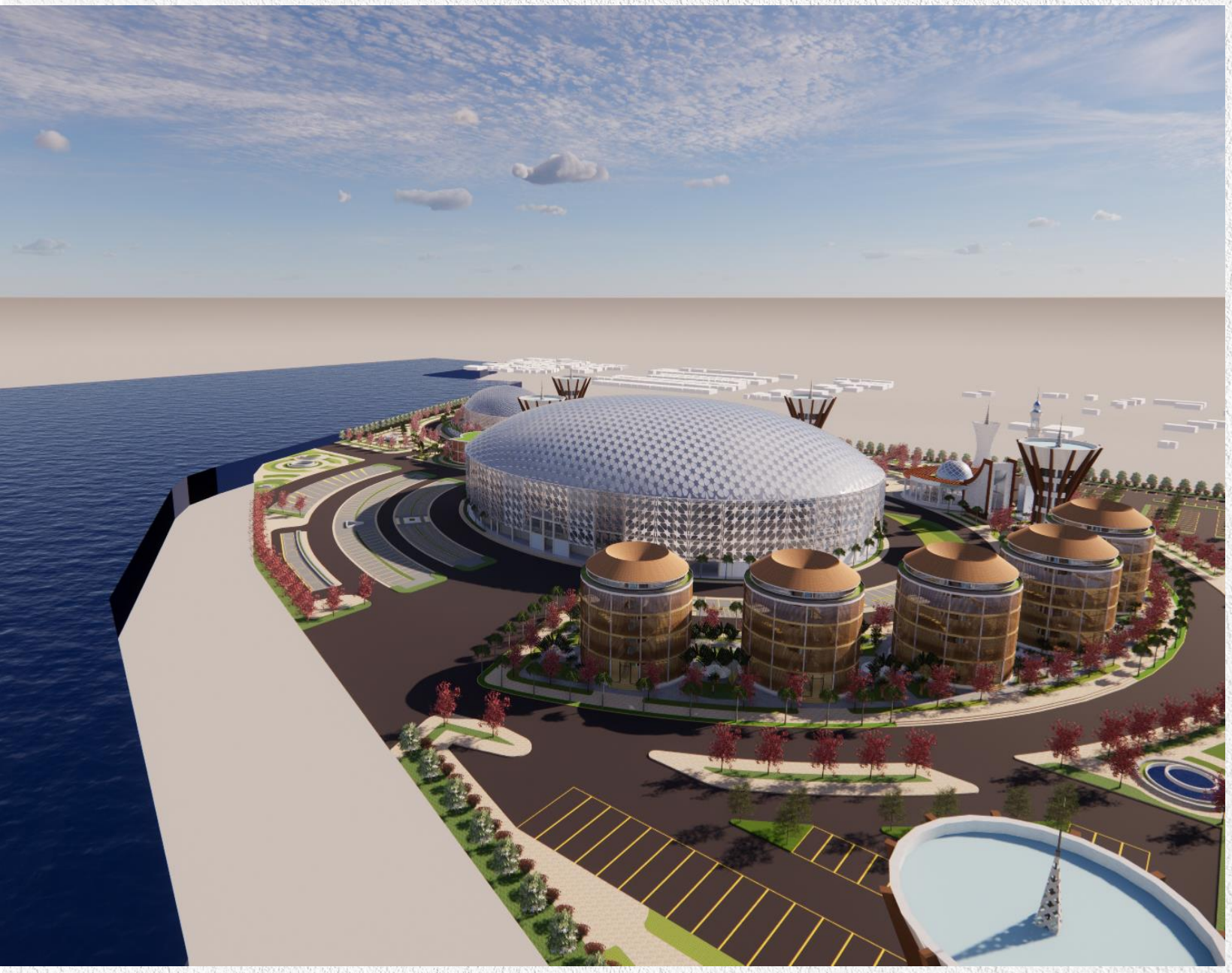
JUDUL GAMBAR

INTERIOR STALL, LOCKER ROOM AND LEISURE POOL

SKALA :

NO. GAMBAR: 41



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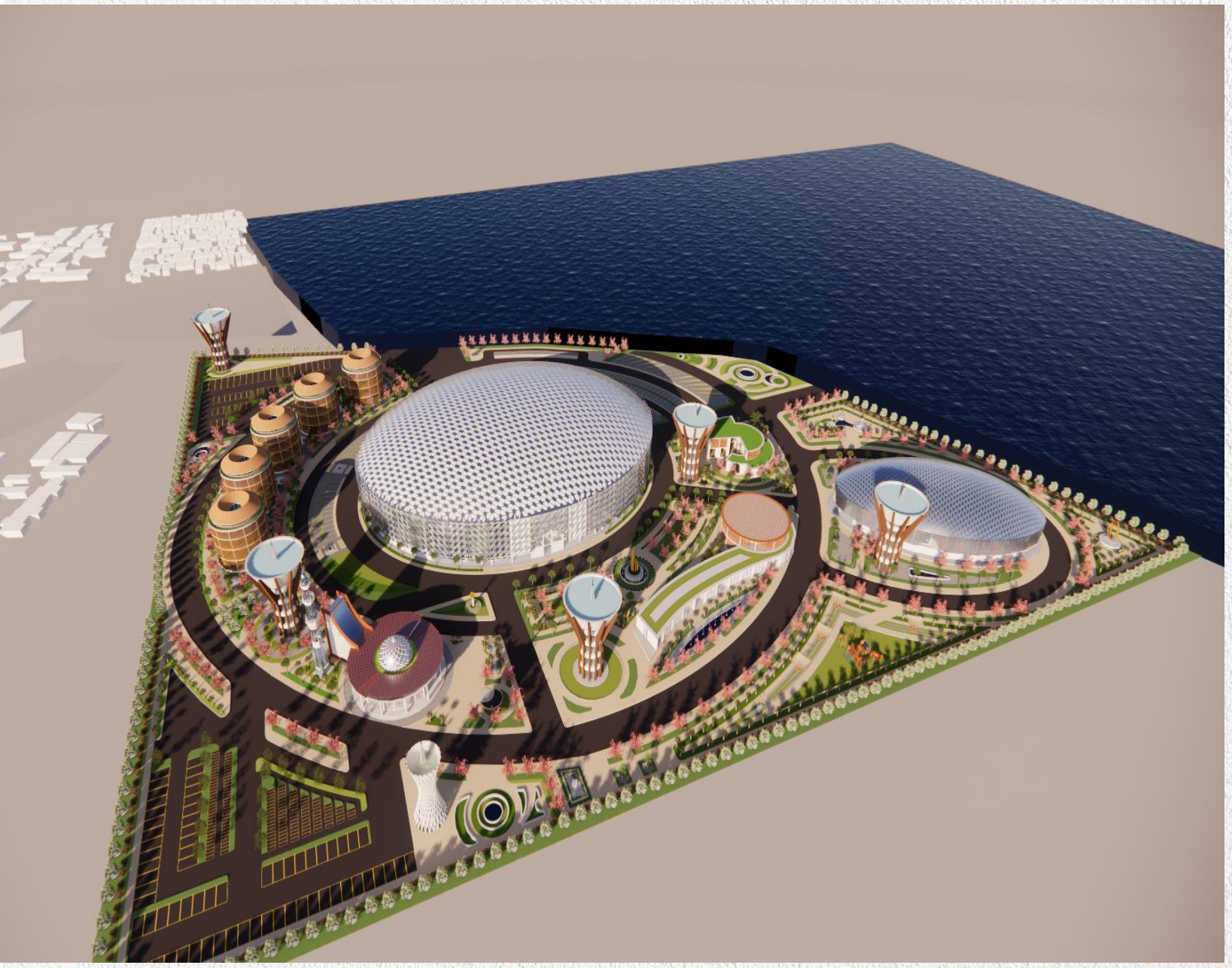
JUDUL GAMBAR

PERSPEKTIF KAWASAN

SKALA :

NO. GAMBAR: 42



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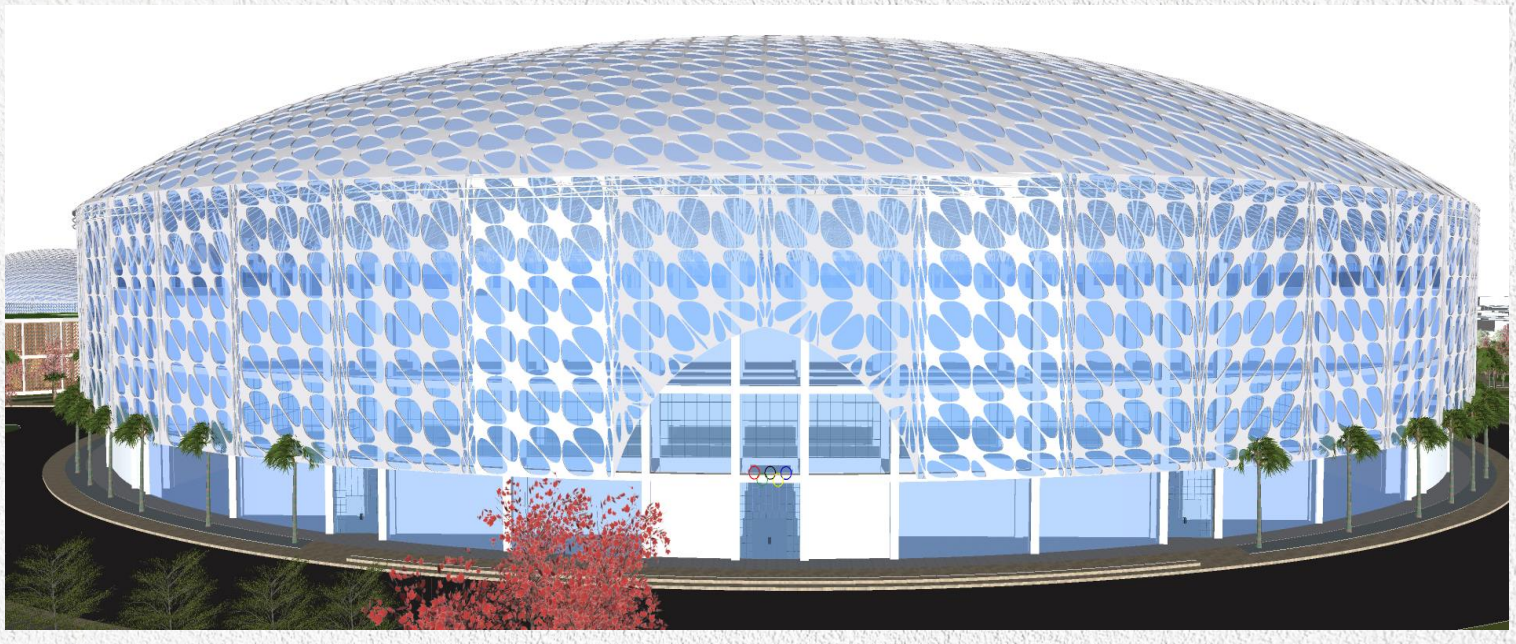
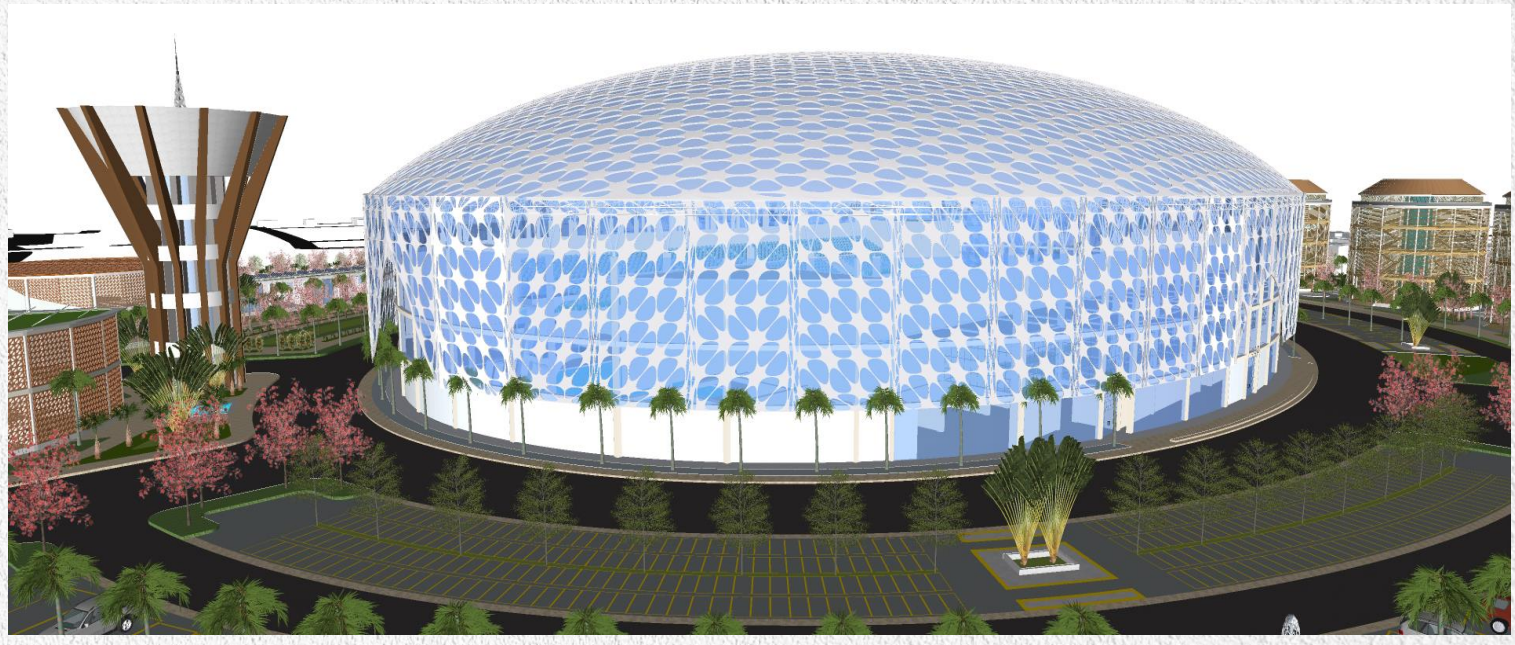
PERSPEKTIF KAWASAN

SKALA :

NO. GAMBAR: 43





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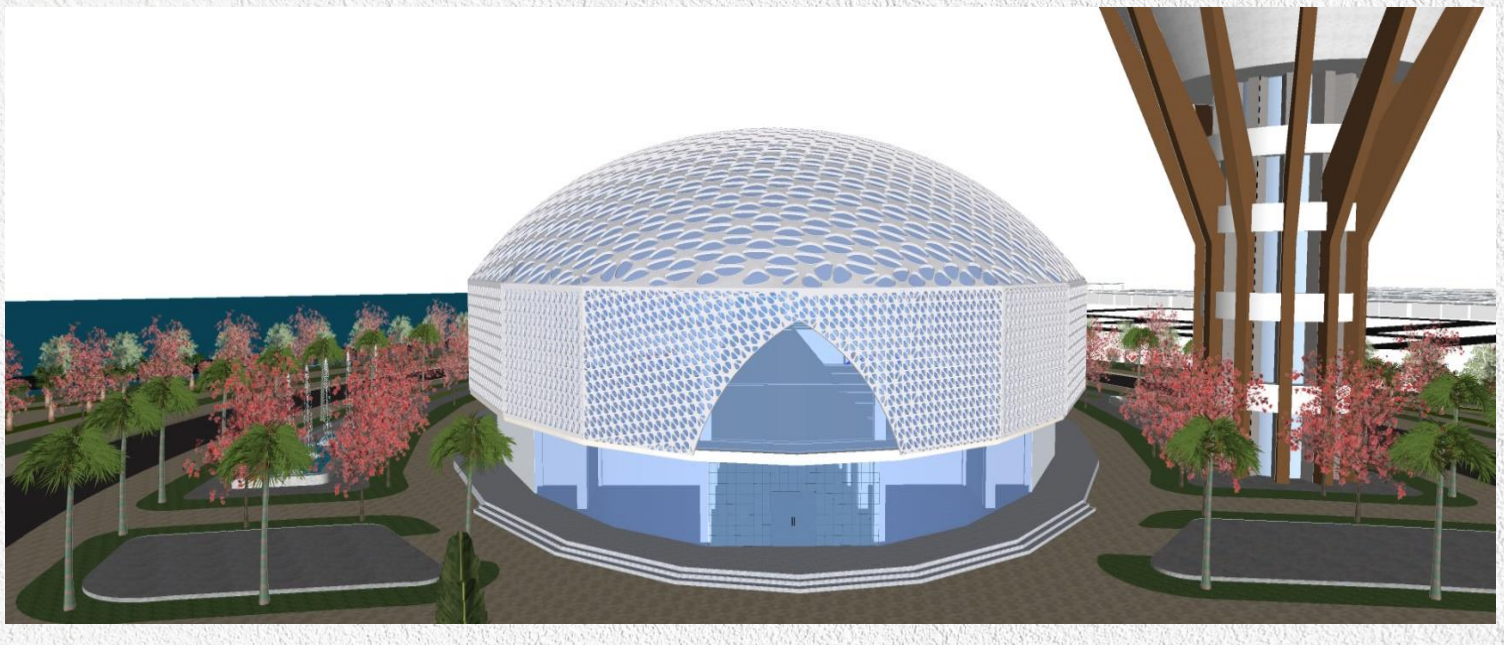
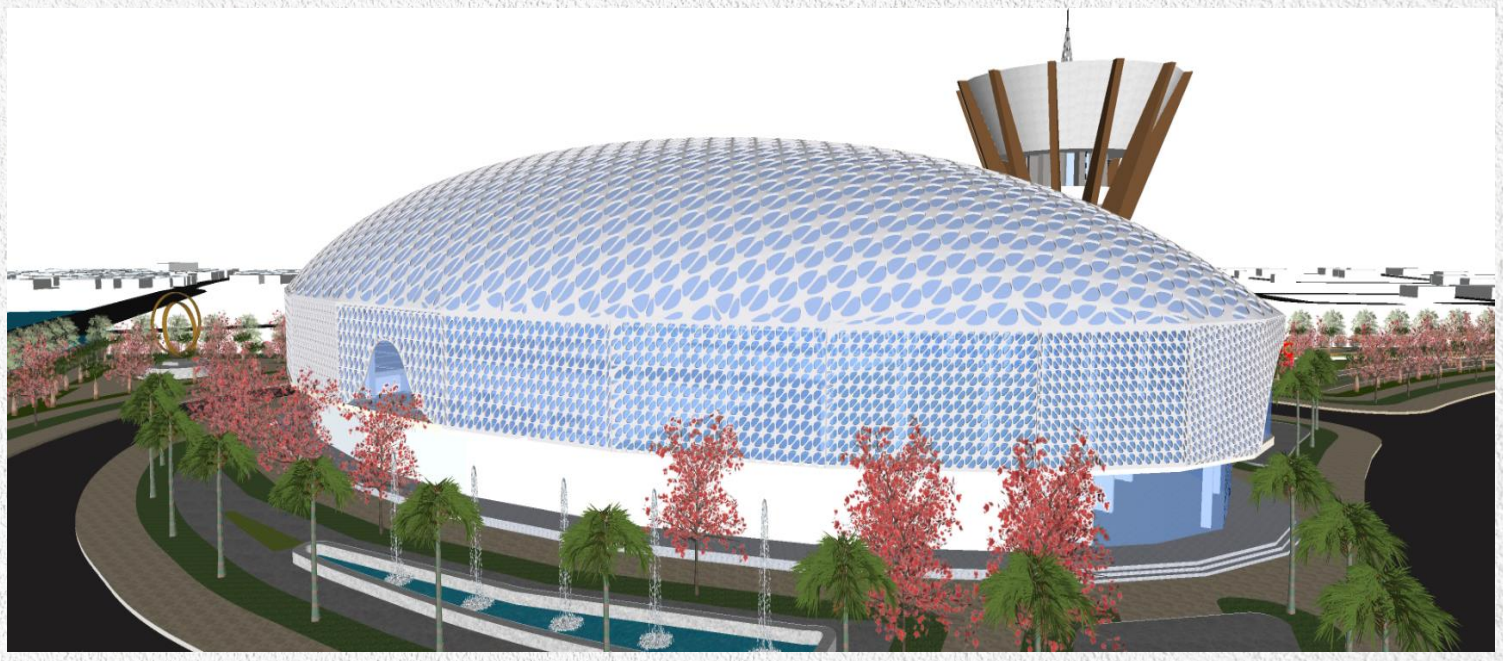
JUDUL GAMBAR

EKSTERIOR AQUATIC SPORTS CENTER

SKALA :

NO. GAMBAR: 44





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JUDUL GAMBAR

EKSTERIOR LEISURE POOL

SKALA :

NO. GAMBAR: 45

ARCHITECTURE

UIN MALANG - INDONESIA

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UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

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JUDUL GAMBAR

EKSTERIOR MANAGEMENT OFFICE

SKALA :

NO. GAMBAR: 46

ARCHITECTURE

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UNIVERSITAS ISLAM NEGERI MAULANA MALIKIBRAHIM MALANG

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DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

JUDUL GAMBAR

EKSTERIOR TRAINING CENTER

SKALA :

NO. GAMBAR: 47

ARCHITECTURE

UIN MALANG - INDONESIA

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JUDUL GAMBAR

EKSTERIOR MOSQUE

SKALA :

NO. GAMBAR: 48

ARCHITECTURE

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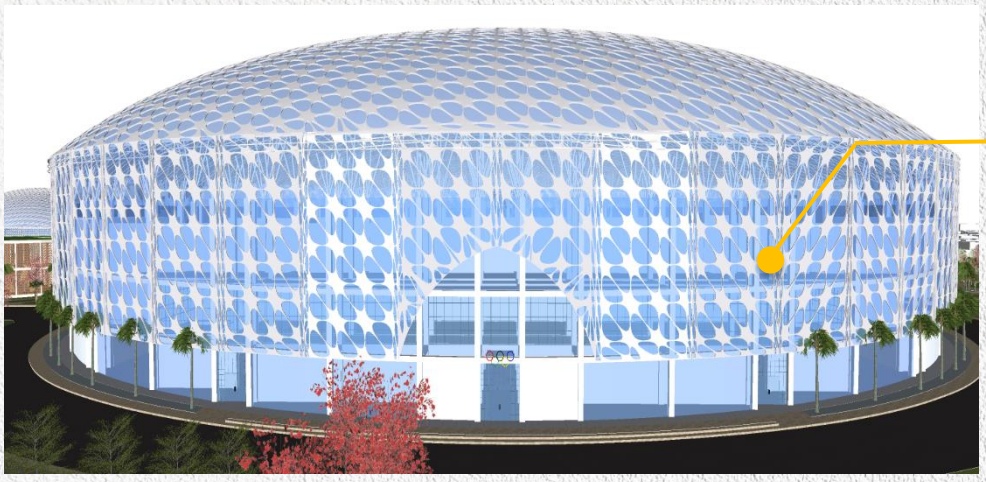
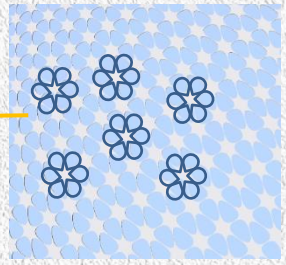
JUDUL GAMBAR

EKSTERIOR FOOD COURT

SKALA :

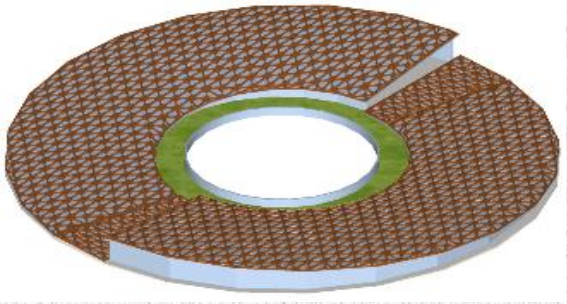
NO. GAMBAR: 49



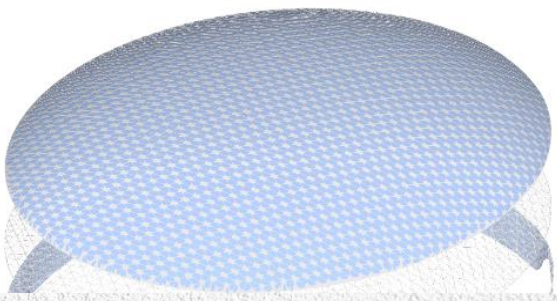


The roof is not concrete with added ornamentation from the mold and is given the same color as a circular roster made of wood.

The roof of the mosque uses a non-sloping roof so that it can drain rainwater, besides that there is a green roof in the middle of the roof as a rainwater reservoir.



The ornamentation is as a fiberglass roster hole that can dispel heat and as an aesthetic for the roof structure of the Aquatic Sports Center.



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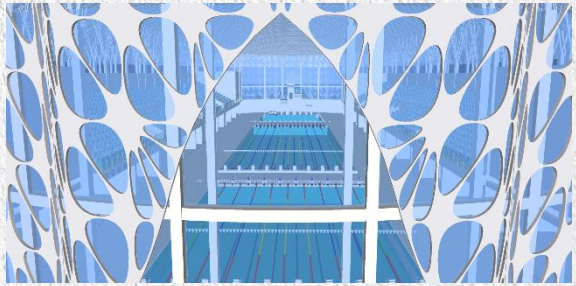

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ARIEF RAKHMAN SETIONO, M.T

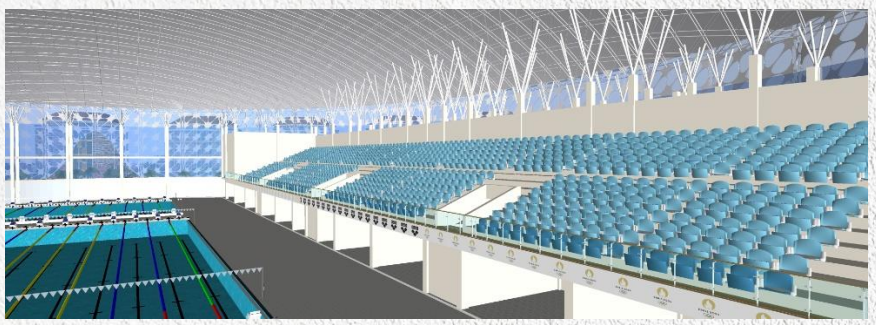
DOSEN PEMBIMBING 2:
Dr. NUNIK JUNARA, M.T

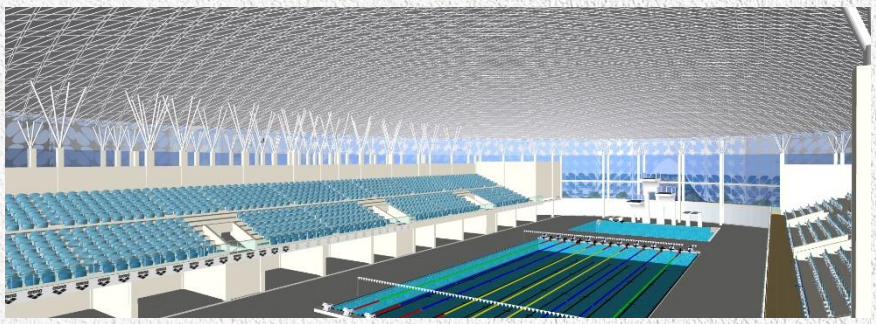
JUDUL GAMBAR

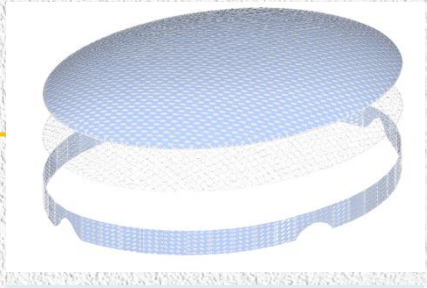
DETAIL ARSITEKTUR

SKALA :

NO. GAMBAR: 49



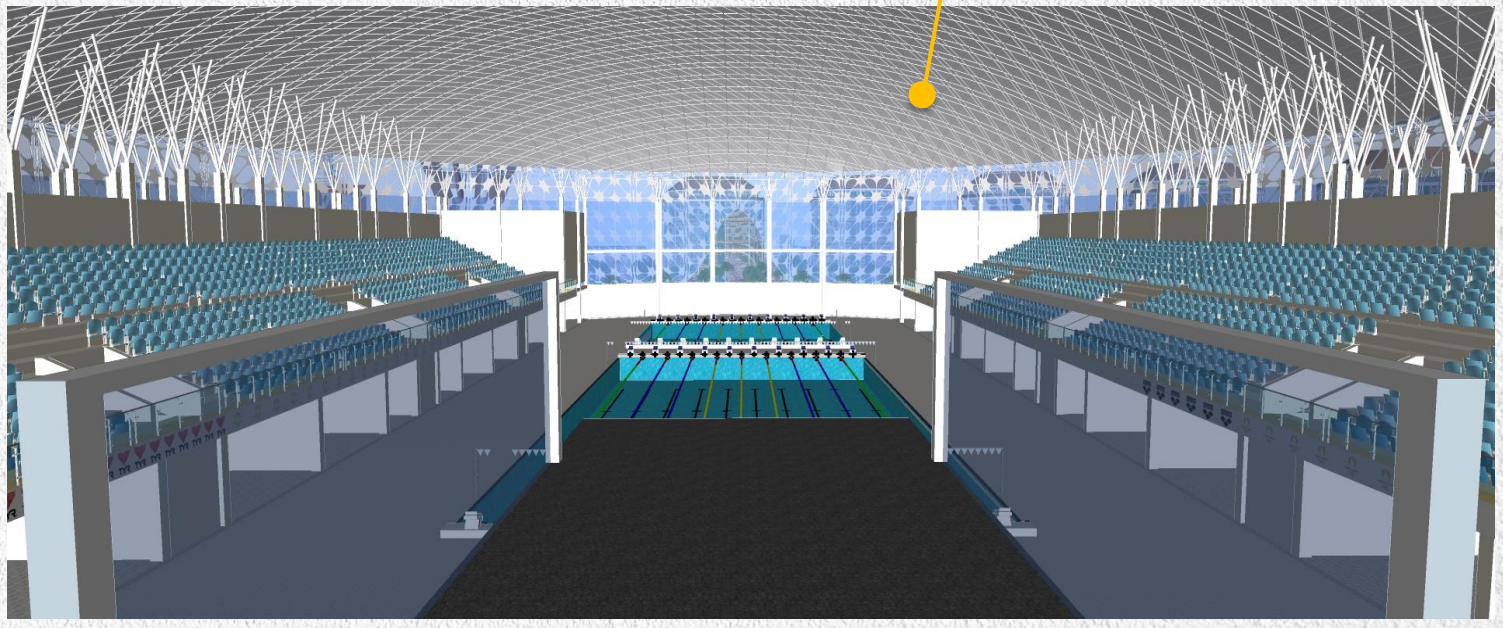




UP STRUCTURE

The roof structure at the aquatic sport center uses a steel frame with a curved space frame structure.

The use of double skins, the first skin as a roof, the second skin as an aesthetic element, and a secondary skin to block the sun's heat.



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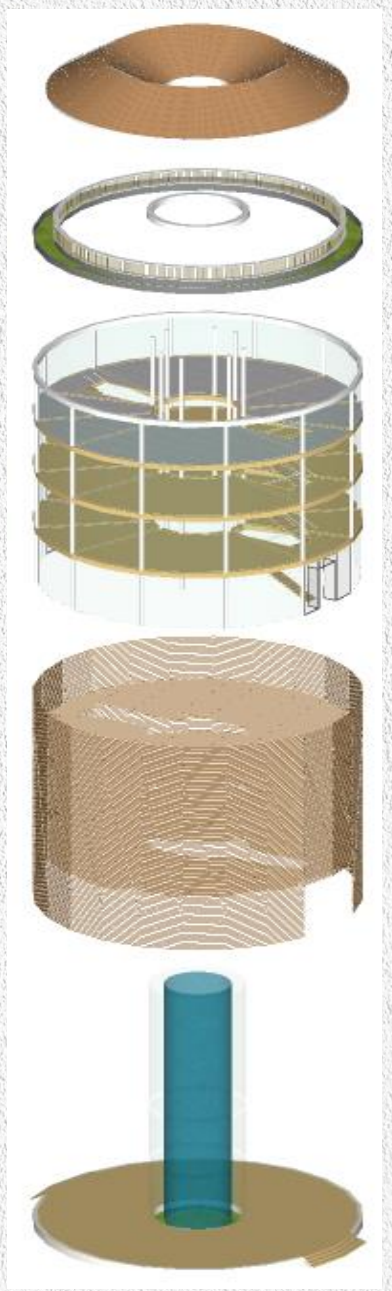
JUDUL GAMBAR

DETAIL ARSITEKTUR

SKALA :

NO. GAMBAR: 50



The clay tile roof and roster walls in the food court are intended as aesthetic elements and material harmony.

In addition, there are void holes that function as air controls in the building.

The rooftop in the foodcourt building is used as a smoking area and a place to view the skylights of the local area.

The rooftop is on the 3rd floor of the Foodcourt building.

The food court building are circular in shape, the shape adapts to the function that is accommodated as a building that requires column-free space to gather.

The foodcourt has a void in the middle with a garden inside and an artificial waterfall flowing as an element for regulating room temperature and filtering air circulation. The void is one of the implementations of climate-responsive design and the existing beachfront from a site that is very hot during the day. So with the water element is expected to help cooling in the building.

ARCHITECTURE

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JUDUL GAMBAR

DETAIL ARSITEKTUR

SKALA :

NO. GAMBAR: 51

- Bus parking is distinguished from other vehicle parking due to the size and direction required when parking is sufficient.

- Car and motorbike parking are distinguished to facilitate access and make it easier for visitors to find their vehicles when they return home.

- Parking for emergency vehicles close to the exit area for easy entry and exit during an emergency.

- Gojek/Gocar drop offs are intended for visitors who use the Gojek, Grab, Blue Bird, etc. applications. So that it does not interfere with the circulation of other visitor vehicles.

ARCHITECTURE

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JUDUL GAMBAR

DETAIL LANSEKAP

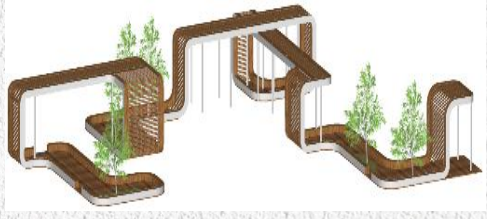
SKALA :

NO. GAMBAR: 52

- Signage is used to provide an identity for the design product, in addition to other functions as a photo spot.

Laying of pools between buildings to dispel the hot temperatures of the beach in the area and buildings.

Ponds pool become a water linking element between buildings, a transitional space for the unity and harmony of open space and private space.



The playground as a family communal space, there is a gazebo for parents to monitor their children playing.

ARCHITECTURE

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JUDUL GAMBAR

DETAIL LANSEKAP

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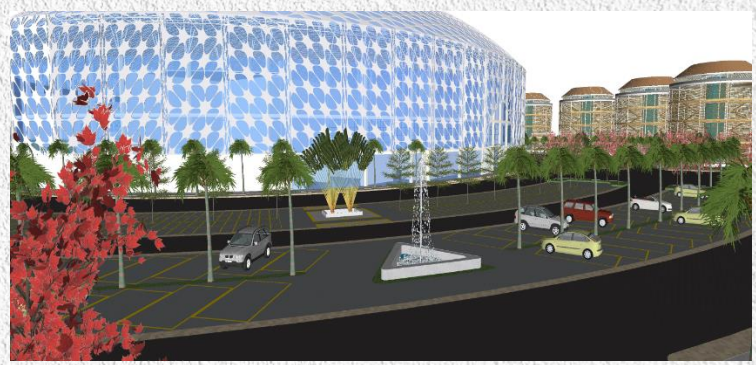
NO. GAMBAR: 53

Sculpture as an aesthetic design option and a place to take pictures as one of the characteristics of the regional landscape. The existence of Sculpture as a signage of the position of the building and also the layout of the area.

Fountains and fish ponds as aesthetic elements and builders of a beautiful and cool atmosphere. In addition, the sound of the fountain as a sedative for visitors under the hot sun by the beach.



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SKALA :

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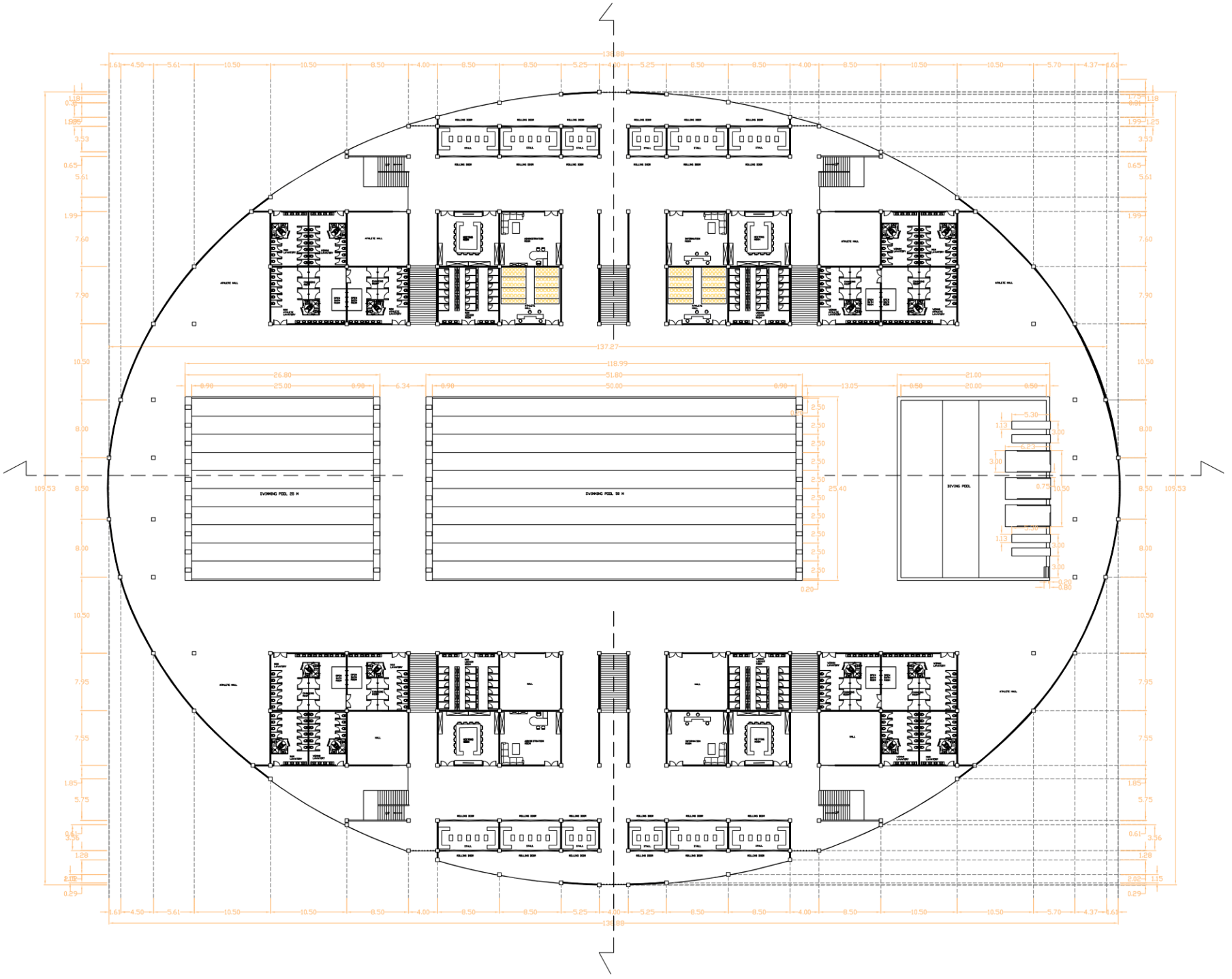
JUDUL GAMBAR

PERSPEKTIF KAWASAN

SKALA :

NO. GAMBAR: 55



ARCHITECTURE
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MAULANA MALIK IBRAHIM
MALANG

JUDUL PERANCANGAN

AQUATIC SPORTS CENTER
IN SURABAYA
WITH ECO-TECH
ARCHITECTURE APPROACH

LOKASI PERANCANGAN

JL. SUKOLILO 7 NO.24
KEDUNG COWEK KEC. BULAK
KOTA SURABAYA

NAMA MAHASISWA

AISSYAH HANRINI NURSHOKH

NIM

15660096

DOSEN PEMBIMBING 1

ARIEF R. SETIONO, M.T

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Dr. NUNIK JUNARA, M.T

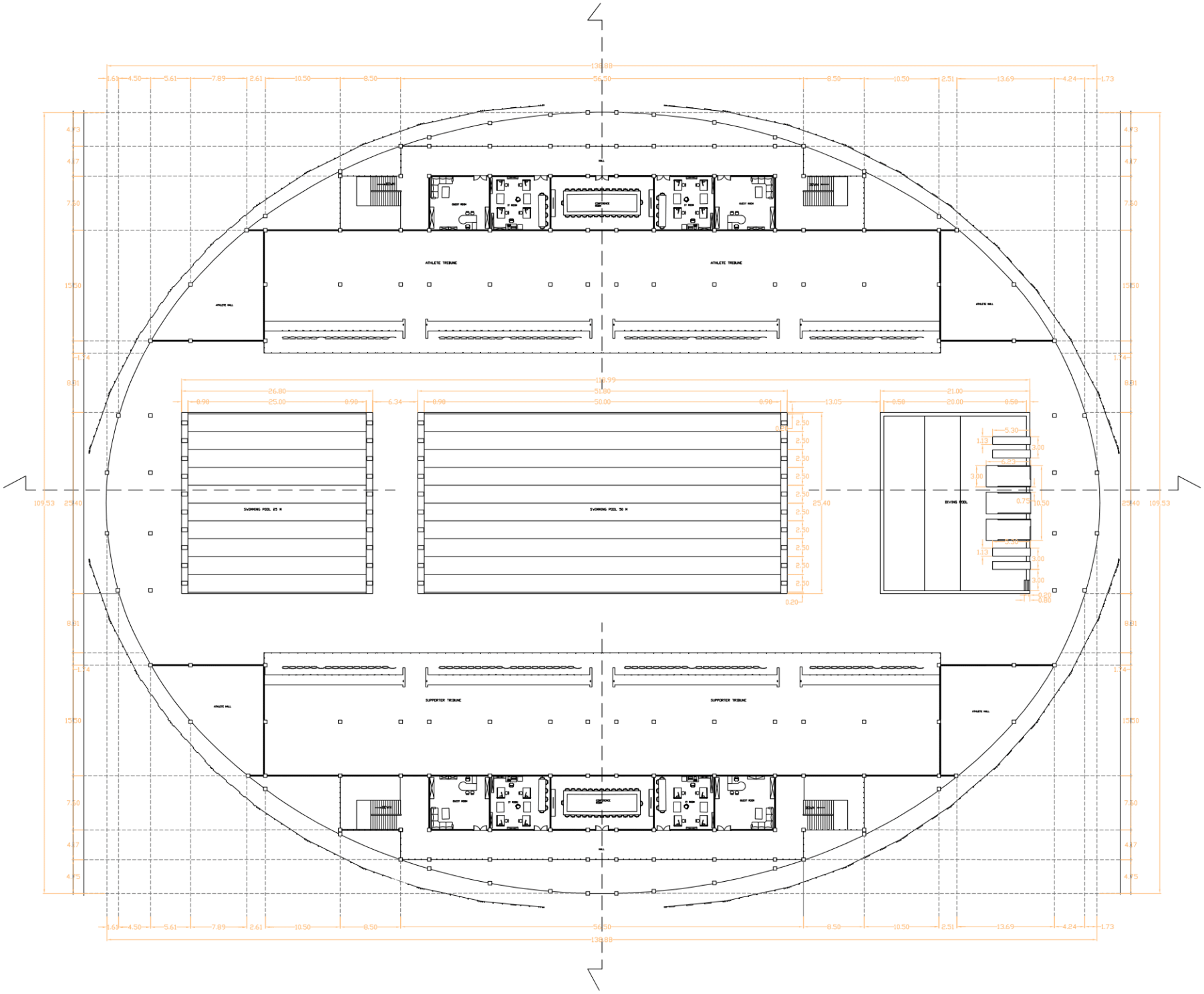
JUDUL GAMBAR

DENAH LANTAI 1
AQUATIC SPORTS CENTER

SKALA

1 : 50

NO.GAMBAR



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MAULANA MALIK IBRAHIM
MALANG

JUDUL PERANCANGAN

AQUATIC SPORTS CENTER
IN SURABAYA
WITH ECO–TECH
ARCHITECTURE APPROACH

LOKASI PERANCANGAN

JL. SUKOLILO 7 NO.24
KEDUNG COWEK KEC. BULAK
KOTA SURABAYA

NAMA MAHASISWA

AISSYAH HANRINI NURSHOKH

NIM

15660096

DOSEN PEMBIMBING 1

ARIEF R. SETIONO, M.T

DOSEN PEMBIMBING 2

Dr. NUNIK JUNARA, M.T

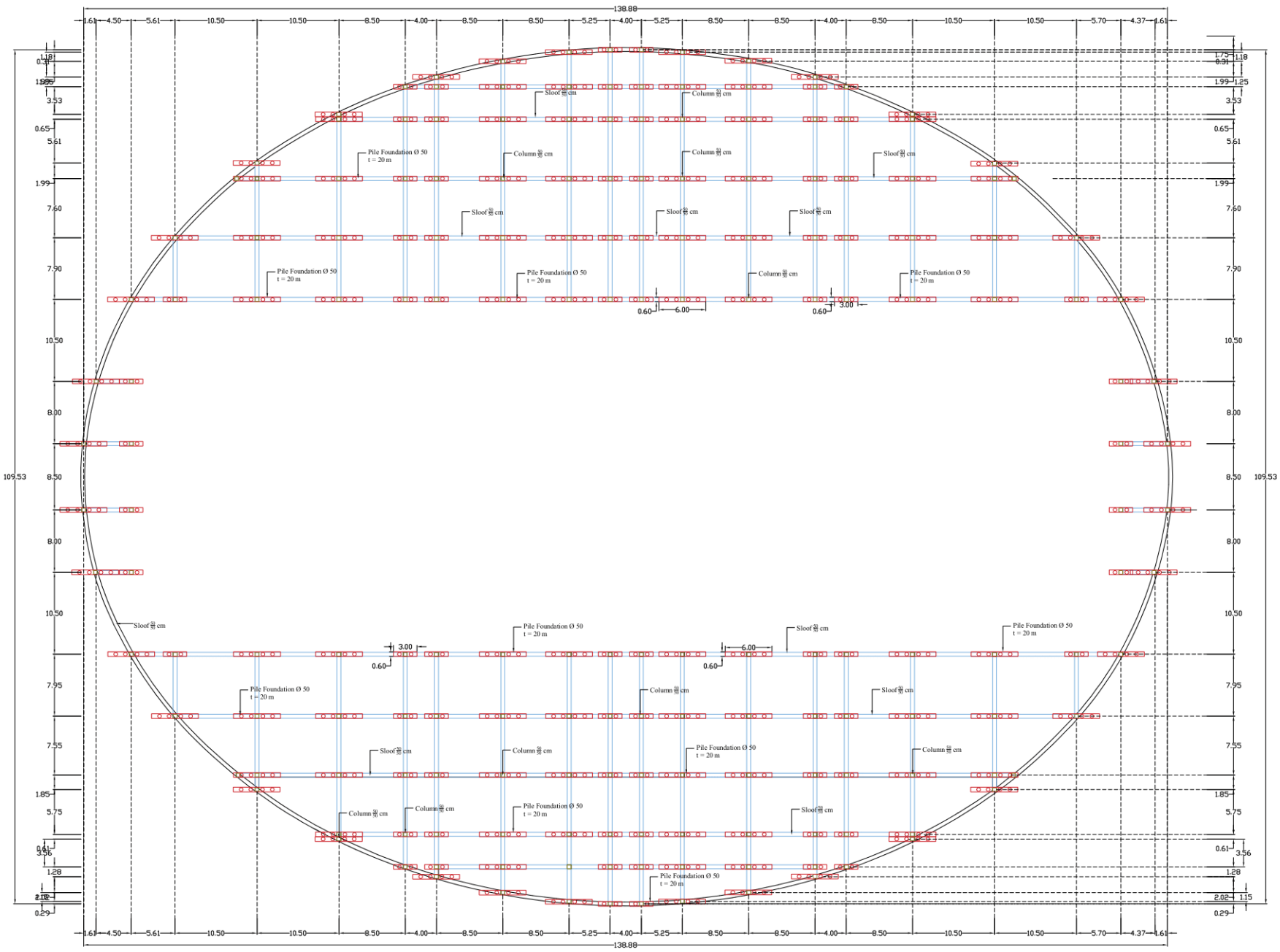
JUDUL GAMBAR

DENAH LANTAI 2
AQUATIC SPORTS CENTER

SKALA

1 : 50

NO.GAMBAR



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JUDUL GAMBAR

RENCANA PONDASI & SLOOF
AQUATIC SPORTS CENTER

SKALA

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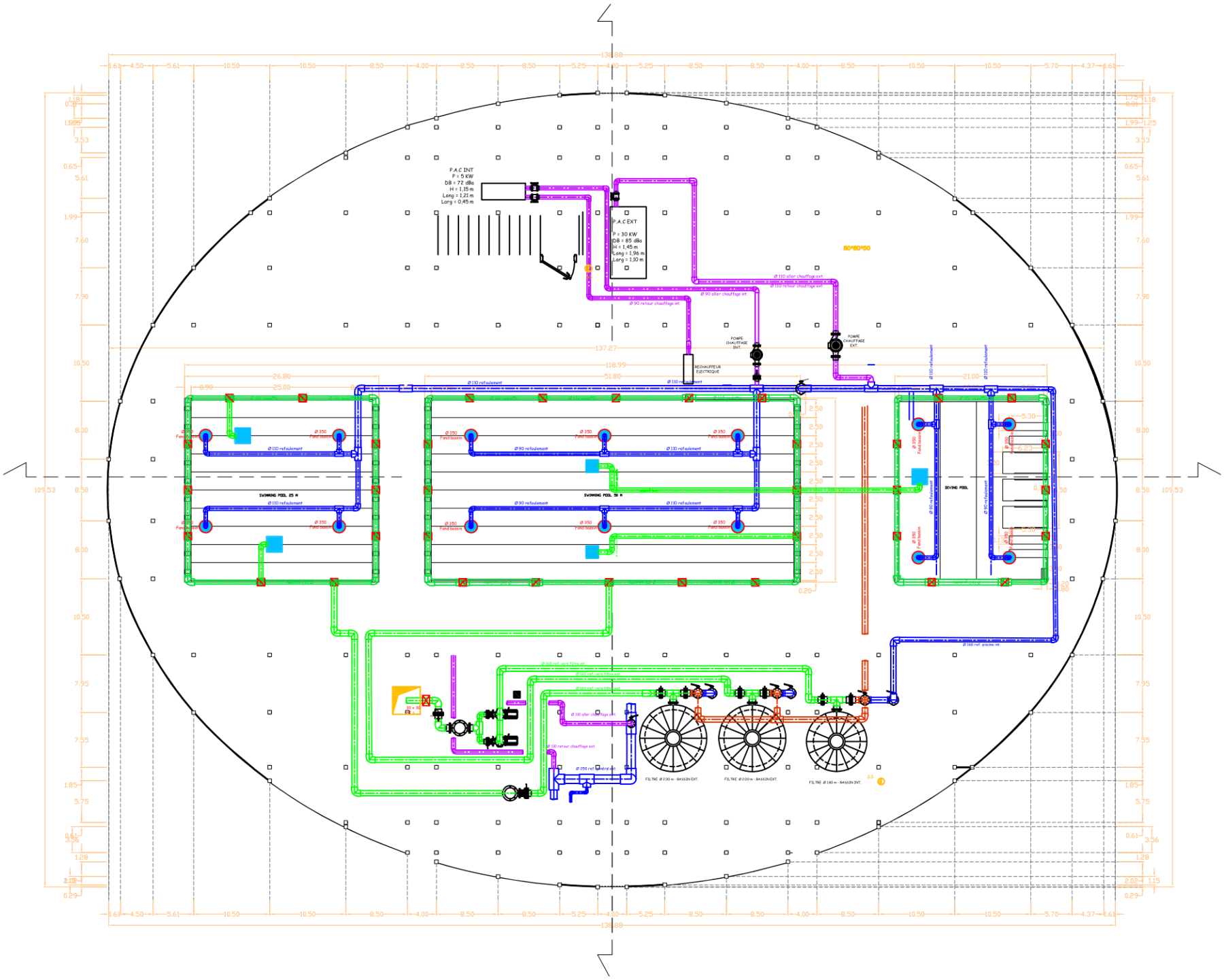

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JUDUL GAMBAR

DENAH PLUMBING
AQUATIC SPORTS CENTER

SKALA

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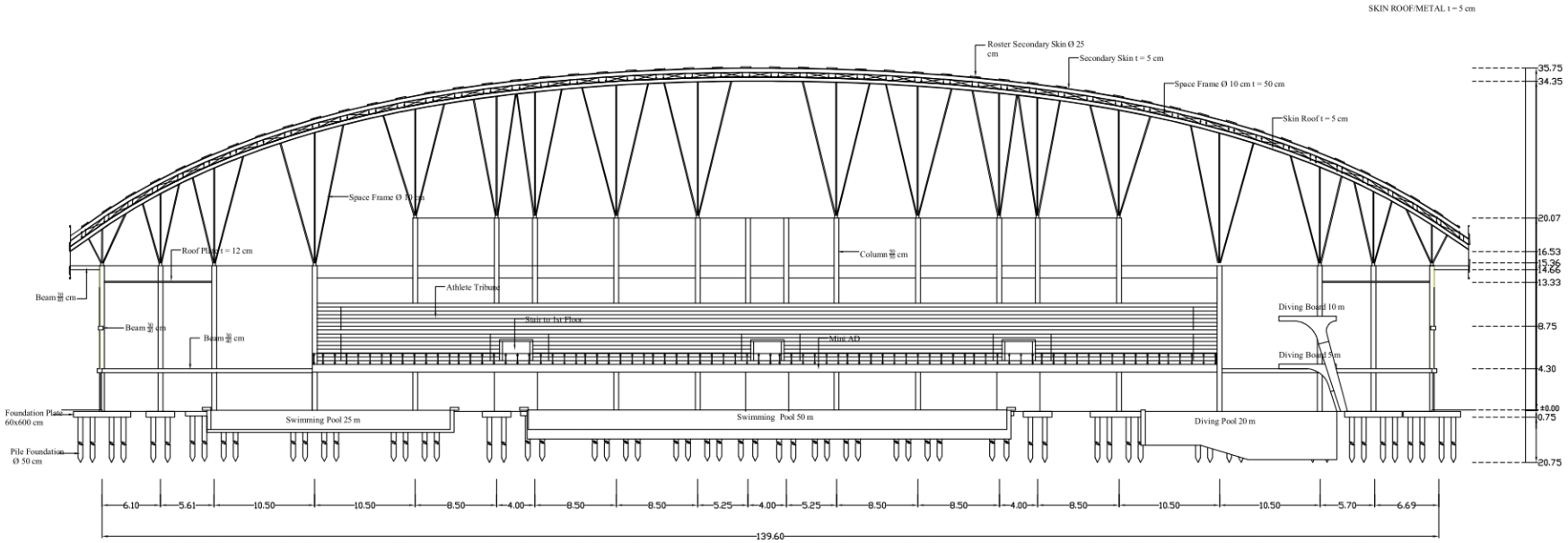
NO.GAMBAR



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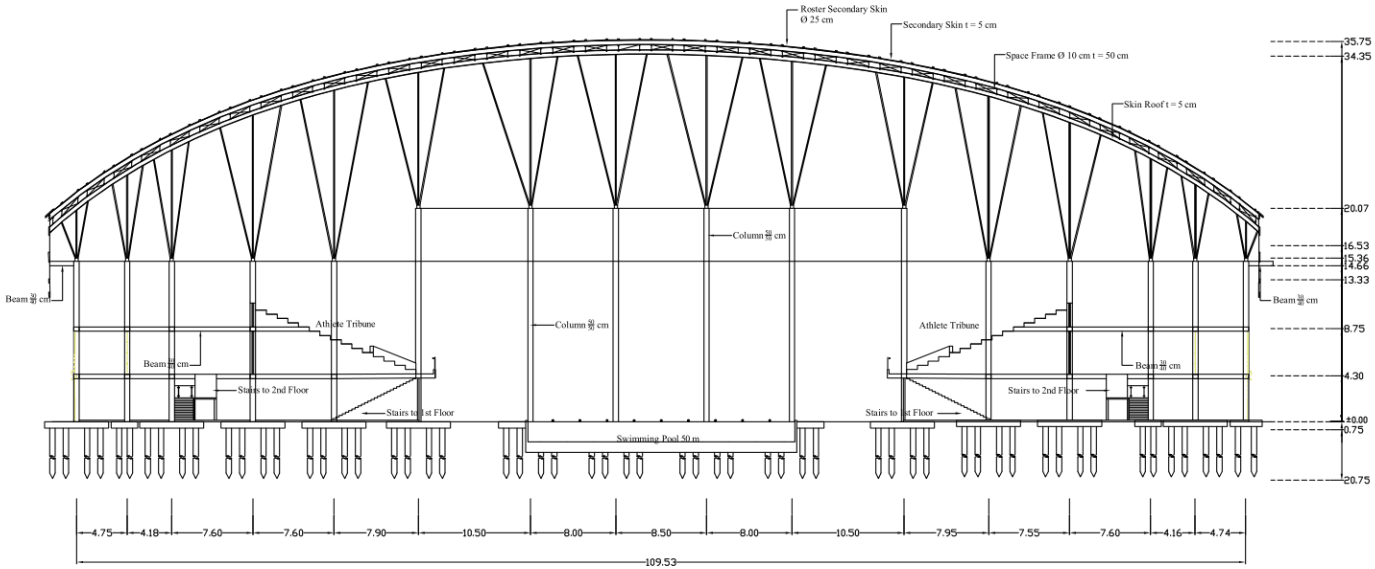
POTONGAN A – A
AQUATIC SPORTS CENTER

SKALA

1 : 50

NO.GAMBAR



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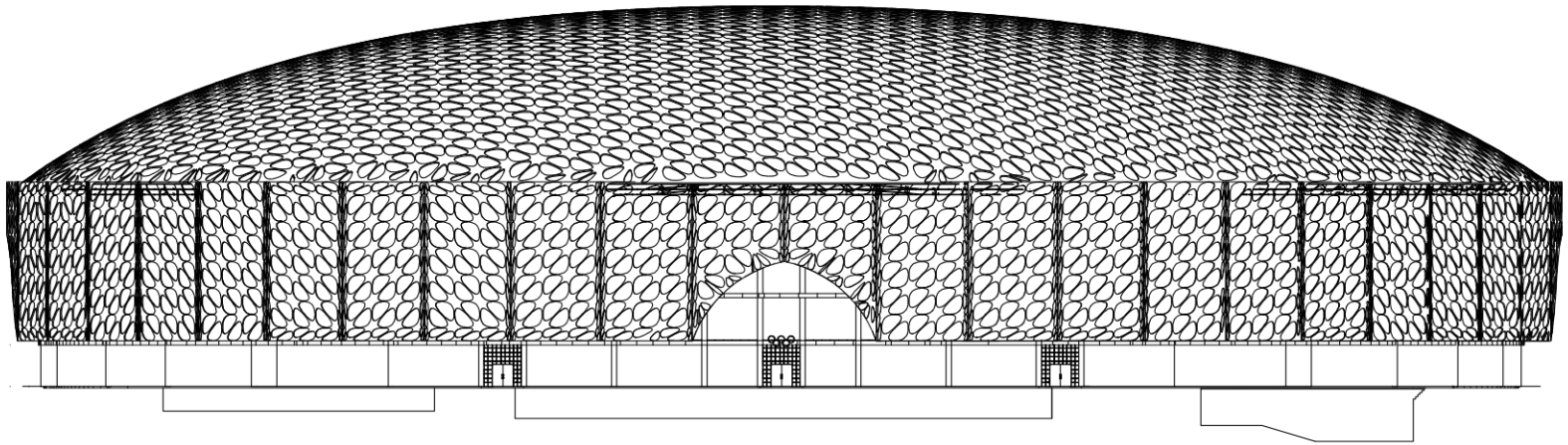
JUDUL GAMBAR

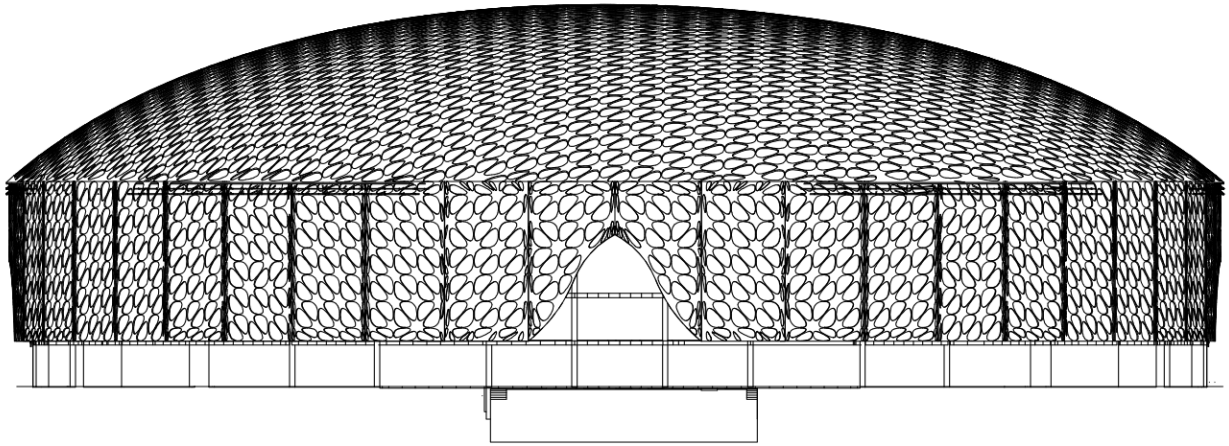
POTONGAN B – B
AQUATIC SPORTS CENTER

SKALA

1 : 50

NO.GAMBAR





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JUDUL GAMBAR

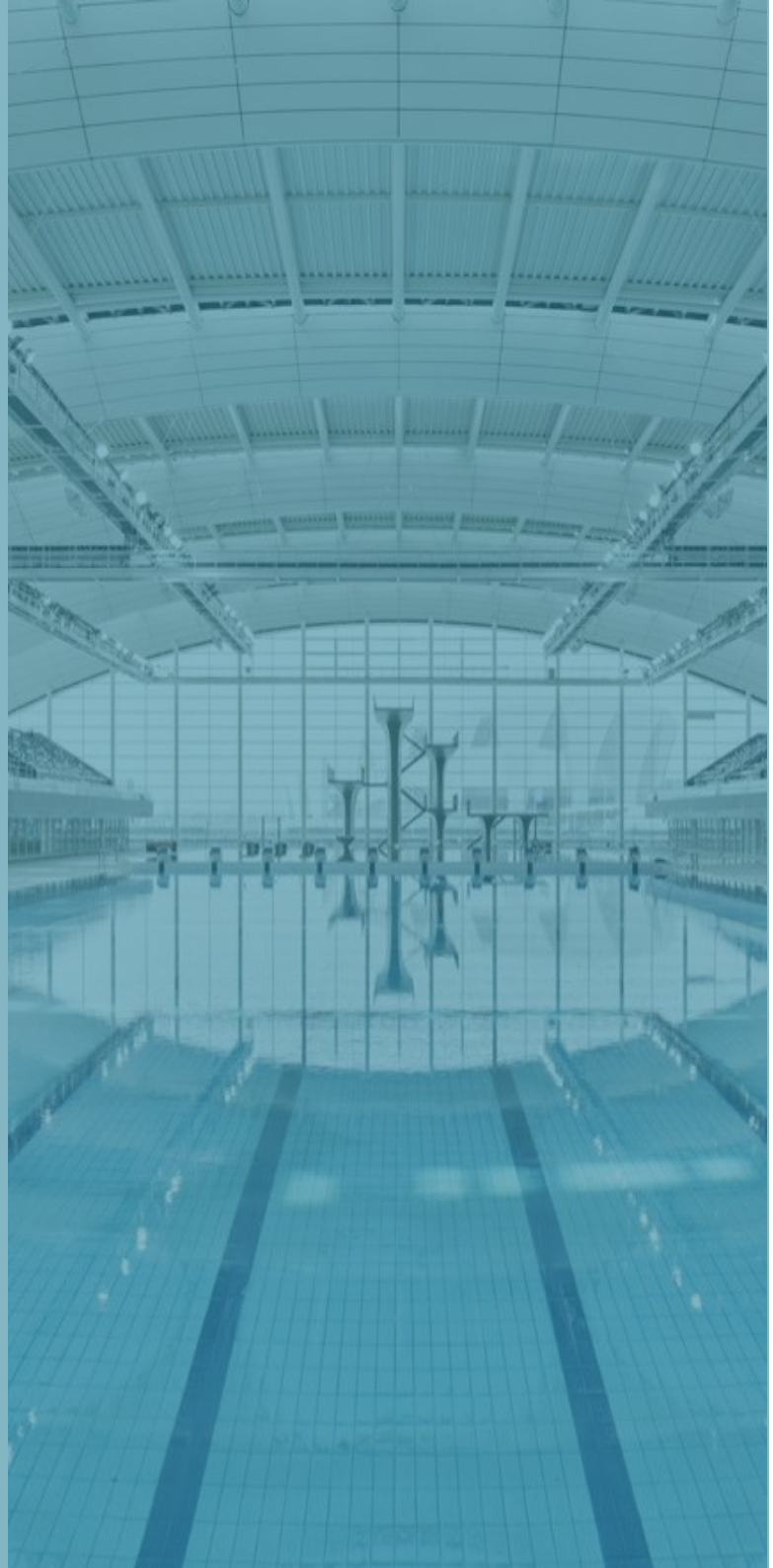
TAMPAK DEPAN
TAMPAK SAMPING
AQUATIC SPORTS CENTER

SKALA

1 : 50

NO.GAMBAR

CONCLUSIONS AND SUGGESTIONS



CONCLUSIONS

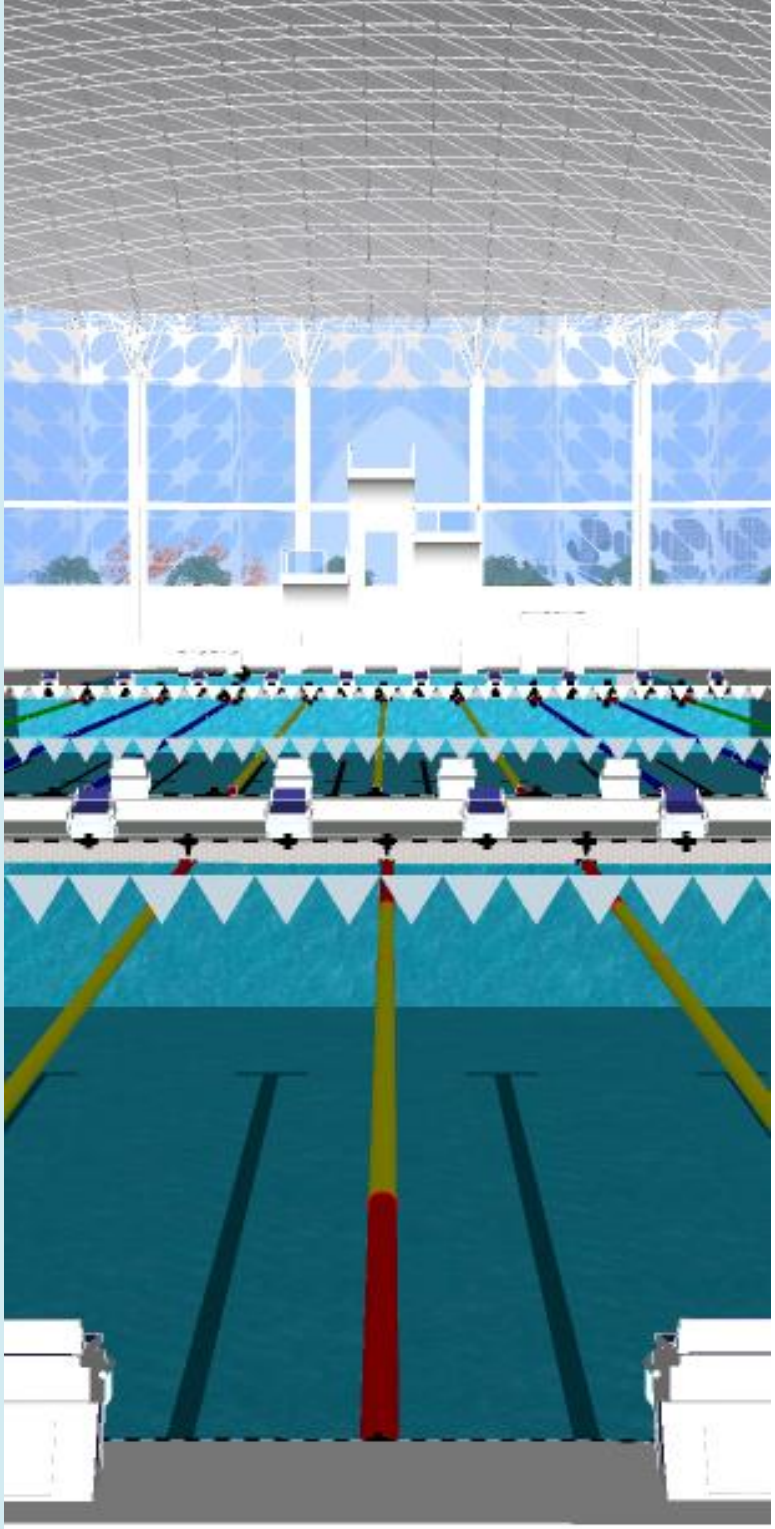
Aquatic Sports Center is an important facility and must be in every city. As a national and international scale aquatic sports facilities. Everyone, starting with children, teenagers, adults, to the elderly, likes aquatic sports. Therefore, the availability of the Aquatic Sports Center as a means of recreation and competition in prestigious sporting events requires a very large space.

The idea of designing the waterfront Aquatic Sports Center using the Eco-Tech Architecture approach is an effort to create sports facilities that are oriented towards nature conservation, especially the sea and the beach.

As the design refers to the tagline WATER CONSCIOUS DESIGN as one of the design principles so that the design becomes a unity.

KENJERAN AQUATIC SPORTS CENTER, is expected to be one of the facilities for the pride of local residents and can support both achievement, economy and tourist attraction in the city of Surabaya.

AQUATIC SPORTS CENTER IN SURABAYA WITH ECO-TECH ARCHITECTURE APPROACH is one of the designs that meet the needs of aquatic sports infrastructure in Surabaya.

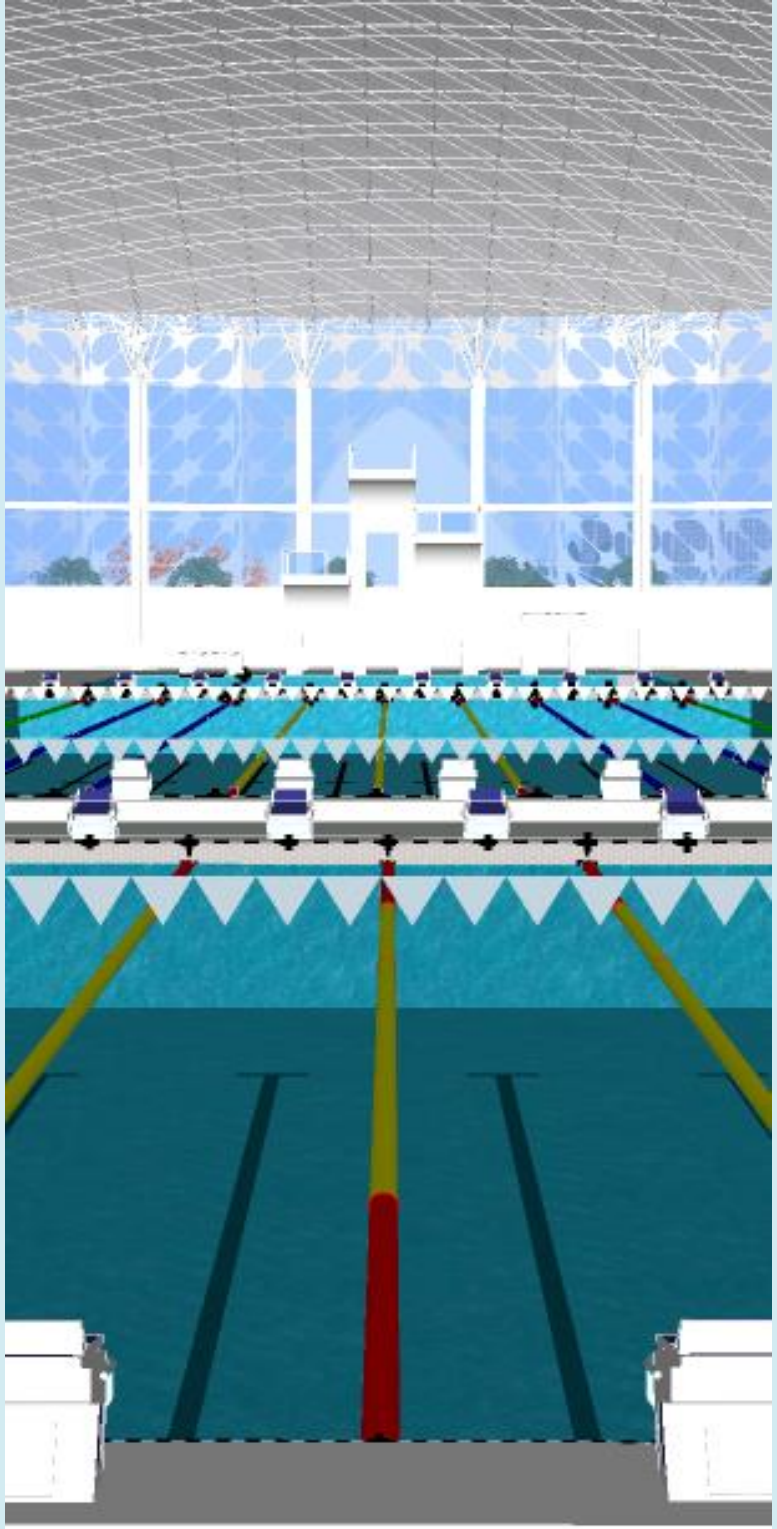


SUGGESTIONS

Through the process that was passed during the preparation of the Final Project in the Design of the Aquatic Sports Center with the Eco-Tech Architecture Approach, this was far from perfect. The difficulties experienced in the process of completing this design are social limitations given the current corona virus pandemic.

Therefore, suggestions for writers in the future to make more efforts to get data and references related to the compiled design. More data and references on related issues will of course become a further architectural discussion study about the Aquatic Sports Center.

With this, it is hoped that this design can be developed to be more complete, so that it can be useful for architectural science and understanding of the design object.



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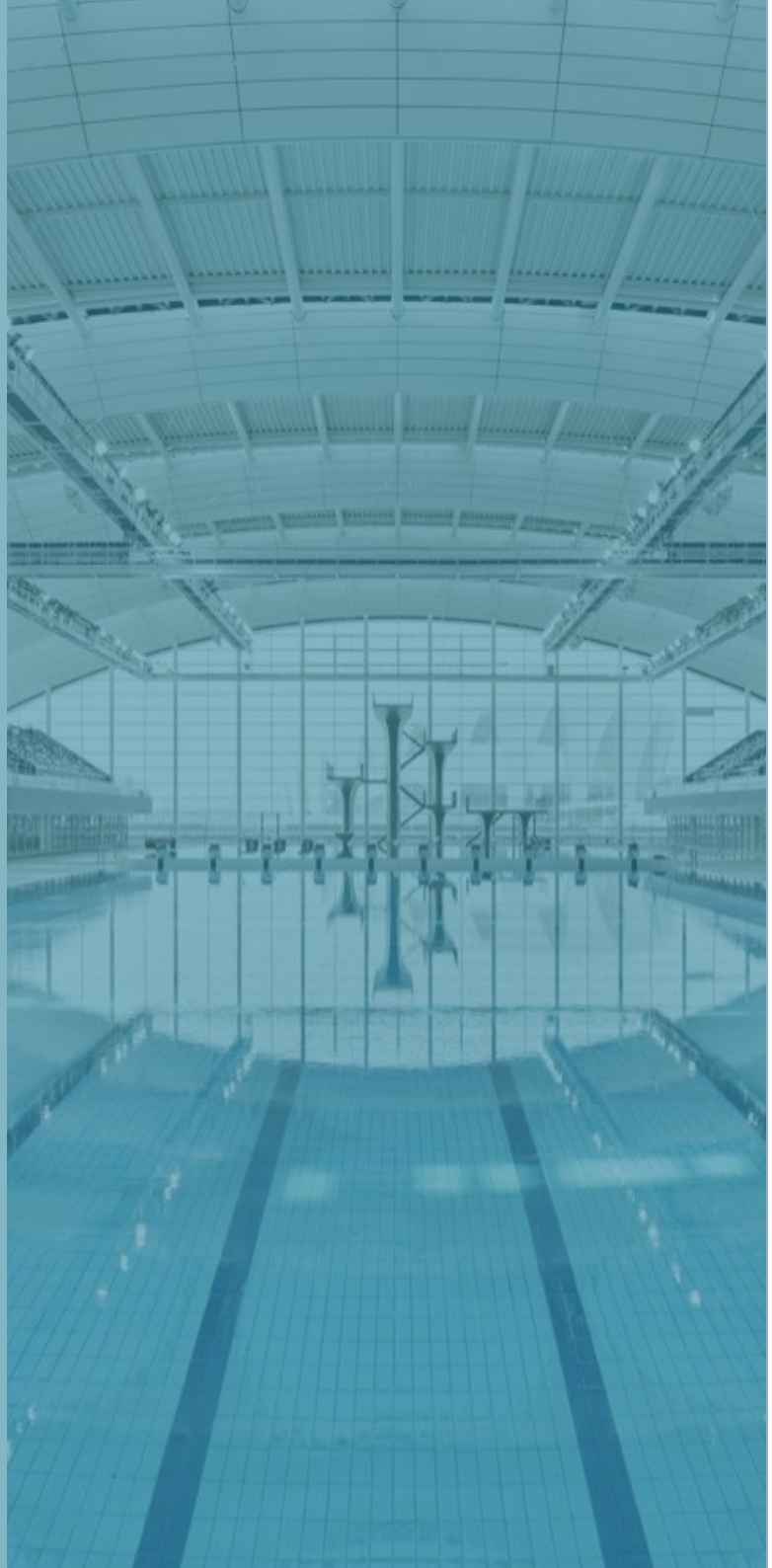

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