International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 12 Issue 10 ǁ October 2024 ǁ PP. 173-182

Circuit Planning as a Forum for International Level Racing Sports with Neo Futuristic Architecture: Case Study in Kulonprogo Indonesia

Reinard David Abel Setiyoko[1], Yohana Nursruwening[2], Basuki[3]
[1,2,3] *Architecture Study Program Student, Faculty of Engineering, Wijaya Kusuma University, Purwokerto, Indonesia*

Abstract— *The popularity of motorsport in Indonesia is increasing with many Indonesians becoming fans of international racing series. Indonesia's participation as a venue or as a participant in international racing competitions has helped to raise the profile of motorsport in Indonesia. Motorsport also has great potential to develop tourism in Indonesia, because international racing sporting events can attract visitors from all over the world. The basic problem in Indonesia is the lack of racing infrastructure and poor accessibility. Realizing a standard-compliant racing circuit is the right step. The planning will produce a racing circuit concept with facilities in accordance with applicable standards to accommodate racing sports activities at local, regional, national and international levels in locations that support the achievement, circulation and racing requirements. The research method used is a qualitative method with case studies. Data collection techniques include observation, literature review and documentation. The results of this study are in the form of recommendations for racing circuit designs that comply with predetermined standards..*

Keywords— *Racing Circuit, Sport Infrastructure, Neo Futuristic Architecture*.

Date of Submission: 14-10-2024 Date of acceptance: 29-10-2024

I. Introduction

The sport of racing has a fairly long history in Indonesia, starting in the 1960s when motor racing events were first held in Indonesia. In October 1969, Jaya Antjol Race I was held with the condition that the circuit was only a residential street. After that the Indonesian government started investing in the development of more formal racing circuits and facilities such as the Jaya Ancol Circuit and the Sentul International Circuit in West Java, to the latest, namely the Mandalika Circuit. the popularity of the sport of racing has also continued to increase, many Indonesians have become fans of international racing series such as Formula One, MotoGP and World Superbike. Indonesia is one of the popular destinations of international racing sporting events, with several international racing series being held in Indonesia. This has helped to raise the profile of racing in Indonesia and attract more racing fans from around the world.[1]

The main problems faced in the development and growth of racing in Indonesia. One of the biggest challenges facing racing in Indonesia is the lack of infrastructure, such as race tracks and supporting facilities. There are only a few dedicated race tracks in the country, and most are outdated and in need of modernization. Based on the data there are only 3 international racing circuits that are active in Indonesia and only 2 have homologation or international standards. The data really shows the lack of racing sports facilities in Indonesia. In addition to the lack of racing sports facilities and facilities, reaching the existing racing sports facilities and facilities is still relatively difficult for the wider community because of the limited facilities and the remote location. Poor accessibility is an obstacle to the development of racing in Indonesia, because accessibility affects the ability of fans, racers, teams and sponsors to attend and participate in racing sporting events. If a circuit is difficult to reach or is located in an area with poor infrastructure, this can reduce attendance and hinder the development and success of events held there. Therefore, as much as possible the racing circuit can be accessed easily by its users. [1]

Kulon Progo is quite interesting and has potential as a racing circuit location. Geographically, Kulon Progo could be an ideal location for a racing circuit because it is surrounded by hills and mountains which provide a beautiful scenic backdrop and natural terrain for building circuits. Kulon Progo has easy access, because it is located in the Special Region of Yogyakarta province which is a popular tourist destination in Indonesia. Kulon Progo has an international airport that makes it easy for international visitors to reach this district. In addition, Kulon Progo is well connected to other cities in Indonesia through a network of national roads and railways. This will make it easier for circuit users to reach the location. [2] [3]

Neo-futuristic architecture is a style suitable for racing circuit planning. The emphasis on state-of-the-art technology, organic shapes and sustainability is well suited to the needs of race circuits, which often require innovative solutions for safety, performance and environmental impact. One of the advantages of neo-futuristic architecture in the context of a race circuit is its ability to create visually striking and dynamic structures that can enhance the overall racing experience. The use of bold colors, dramatic lighting and other design elements can help create a sense of energy and excitement, which can be especially effective in the context of the sport of racing.

II. Literature Review

A. Circuit Overview

A circuit is a closed arena, either permanent or temporary, where the start or start and finish or finish are located at the same capture point and are built or adapted specifically for car and motorcycle racing (FIA) [1] [4]. Meanwhile, according to the Indonesian Motor Association [1], a circuit is a place containing tracks or tracks that are used for racing arenas. The usual circuit is a straight track, a circular track or a combination of the two.
Circuit has several functions that are reviewed from the users or actors of the activities in it. According to Hardianto, circuit functions are [2]:
a. Race Participant
1) As a place to compete to test skills and courage.
2) It is an arena for testing technology
3) As an arena for routine practice
4) As a vehicle for automotive promotion and those that support it
b. Racing Spectators
1) A place of entertainment for the community.
2) A place for distributing automotive hobbies.
3) An event to introduce the application of new automotive technology.
c. Organizers of automotive championship activities as a place to hold legal automotive championships.
d. Other users , namely:
1) Motor vehicle manufacturers , as a means of commercial promotion of the vehicles produced by supporting a team by providing the vehicles used so that the public knows the vehicle when it is launched. It can also be a means of proving product quality to the public.
2) Manufacturing of automotive supporting products (spare parts, fuel, oil, tires, accessories, etc.), as a means of product promotion from the factory.
3) Sponsors who wish to promote by using the available spaces in the circuit or the vehicle used.
4) Automotive institutions , such as IMI (Indonesian Motor Association) or automotive clubs and communities by utilizing supporting spaces for offices and meeting places.
e. Race school, as a place to practice on a real circuit
Types of circuits for racing sports or motorsports include multi-function permanent circuits, permanent circuits with special functions, permanent circuits with a single function, and temporary circuits. Circuits used for racing sports activities must have a level of safety determined by the Fédération Internationale de l'Automobile (FIA, car) and the Fédération Internationale de Motocyclisme (FIM, motorcycle) [5] [6]. While for the most part complementary, there are some differences to cater for the more open nature of motor racing in accidents. The level of the racing circuit is based on the assessment of the international racing federation body, as follows:
a. Assessment of the Fédération Internationale de l'Automobile (FIA) [5]
1)Grade 1
2)Grade 2
3)Grade 3
4) Grade 3E
5)Grade 4
6) Grade 4 Historical
c. Assessment of the Federation Internationale de Motocyclisme (FIM) [6]
1) Grade A
2) Grade B
3) Grade C
4) Grade D
5) Grade F
6) Grade E

Based on the regulations and standards of international racing bodies, a permanent circuit with international standards, besides consisting of the race track itself, must also have other circuit facilities [7]. These facilities are in the form of a pit building, racing control tower, medical center, helipad, paddock, main grandstand, marshall post, scrutineering area, media center, covered parking lot [8] [9].

B. Neo Futuristic Architecture

The most advanced available resources to make the future possible. Etan J. Ilfeld argues that neo-futurist design works in complex media that was not possible before the computer age. Neo-futurism talks about all the futurist architecture built since the late 1960s. The characteristics of neo- futurism in architecture are [10]:
a. Organic and Fluid Forms or Organic and Liquid Forms
b. Transparency and Lightness or lightness.
c. Precise style in order to have maximum freedom and flexibility in the selection of materials.
d. Futuristic buildings can continue to be said to be futuristic as long as they are updated regularly with the latest technology.
e. Material use in design elements such as glazed facades, lightweight aluminum construction and structural steel supports for enhanced performance and longevity.
f. Not limited in the type of building, so it can be a field for architects to explore designs.
Some of the most prominent pioneers of Neo-futurism are Eero Sarinen, Alvar Alto, Buckminster Fuller, Le Corbusier, Santiago Calatrava, Michael Graves, Zaha Hadid, Oscar Neimeyer and Tadao Ando [11].
Zaha Hadid is a figure who is very synonymous with neo-futuristic architecture [12]. His visionary approach and iconic design have made a lasting impact on the world of architecture. Hadid's architectural style is characterized by bold, fluid forms, dynamic curves, and innovative use of materials. Hadid pushed the boundaries of traditional architectural norms and challenged ideas of what buildings should look like.
Design strategies and characteristics of neo-futuristic architecture applied by architect Zaha Hadid, namely [12]:
a. Light Mass Game
b. Floating Effect
c. Movement Circulation, Function, and Natural Lighting
d. Attaching Forms with Context.

III.METHOD

The aim of the planning is to plan an international racing circuit, so the research method used is a qualitative research method. From the results of the research, recommendations will be made in the form of a circuit design for racing circuits with facilities in accordance with applicable standards to accommodate racing sports activities at local, regional and national levels in locations that support achievement, circulation and racing requirements where the buildings inside apply neo futuristic architecture. . Data collection is done in three ways, namely:
1) Observation
Observation is in which researchers go directly to the field to find out conditions, potential locations and conditions of other places similar to the object being discussed to find data and samples.
2) Literature
Literature in the form of articles or other written materials is obtained through textbooks, journals, and internet access such as websites related to the title. The literature includes:
a) Regulations of the International Racing Federation for motorcycles (FIM) and automobiles (FIA).
b) Books that support the review of racing circuits
c) Books that support the discussion architecturally.
3) Documentation
Documentation is a record of past events. Documents can be in the form of writing, pictures, or monumental works of a person. Documents needed in this research are graphical data, in the form of pictures, photos, or graphics that support literature data.
The discussion on circuit planning in Kulon Progo as a forum for international level racing sports with neo-futuristic architecture uses a descriptive method. The discussion is carried out by analyzing the object as it is with supporting documents, such as the results of analysis with random sources and respondents, as well as survey results in the form of existing data on environmental conditions.

IV.RESULTS AND DISCUSSION

A. Sites

In the site selection process several considerations were taken including the RTRW, achievement or access to the site, distance to facilities, estimated needs for area and geometric shape of the site, as well as the environment around the site.

Fig 1. Site Dimensions and Boundaries

Selected site is on Jalan Kyai H. Moh. Yunus Anis which is directly connected to the Purworejo-Jojgakarta road or the National Route 3 road. The total area of the selected site is 870,712 m2 or 87 hectares. Site is land that contains empty land in the form of yards and rice fields. Considerations for site selection apart from site weighting also highlight the location of the site which is in the economic growth area of the Temon-Wates-Yogyakarta connecting corridor, not a protected productive wetland area so that it can be used as land to build an international racing circuit. Then with the existence of a racing circuit it can also support and increase Kulon Progo's economic growth and tourism. In addition, consideration is given to the proximity of the site to Yogyakarta International Airport (YIA) as well as supporting facilities such as lodging accommodations, restaurants and proximity to health facilities.

B. Site Concept

1. Site Circulation Concept

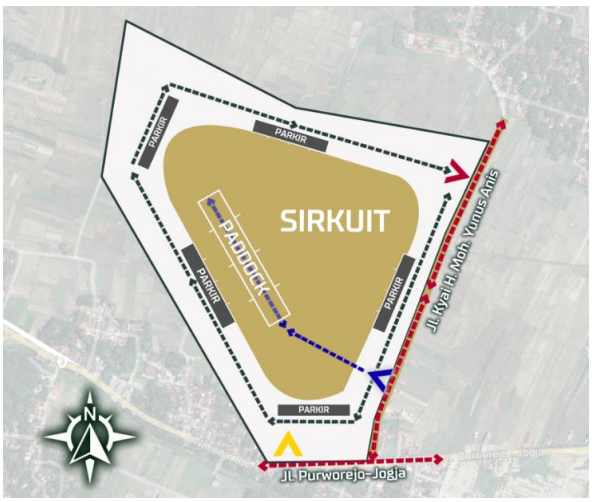

Fig 2. Site Circulation Analysis

Circulation of racers, teams, organizers and circuit staff, using vehicles or on foot, is made easy from the main entrance (ME) directed directly to *the paddock* through the race track through a tunnel or bridge. To *exit* adjust. Spectator circulation is made to rotate from the main entrance (ME) using circulation around the site ending in *the exit* . Spectator circulation is made to rotate directly directing the audience to the designated stands or viewing places so that they can go directly to the location. Types of user circulation on the site are divided into two, namely the circulation of users with vehicles and the circulation of users on foot. For the circulation of

users with vehicles using the road within *the site* . The road in the site is given a pedestrian or sidewalk for pedestrians to also go through that route. The circulation of users who walk, there are those who follow the path of the vehicle, there are also those that are made with the intention of shortening the distance of the user's walk to be as close as possible.

2 Site Zoning Concept

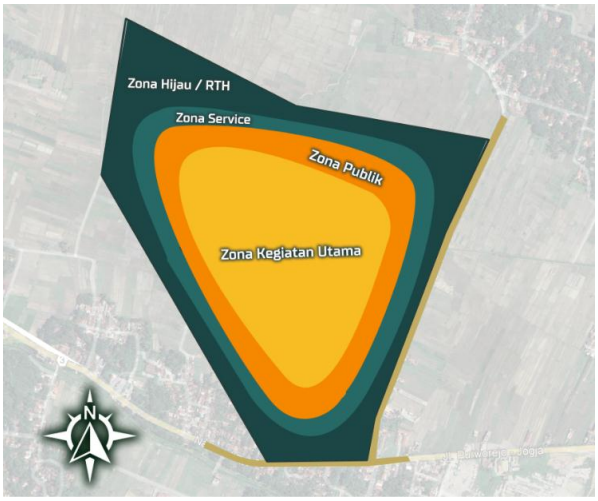

Fig 3. Zoning Site Concept

The concept of zoning on the site is to divide the site into five zones. The public zone includes spaces that accommodate viewers in their viewing activities. This zone is placed adjacent to the entrance and adjacent to the service zone, optimized on the outside of the main zone. Then the main zone includes spaces that accommodate racing activities and their supports. This zone is placed in the middle because it is the center and main goal of visitors. Main buildings will be located in this zone. The service zone is placed in such a way that it can support and be reached from other zones. Each zone is connected via circulation within the site. The green zone includes vegetation and landscape arranged in such a way as to surround the other zones.

B. Site Noise Concept

Fig 4. Site Noise Concept

To reduce noise originating from outside the site and also directly help reduce noise generated from within the site, the solution is to place vegetation as a sound barrier in places that are in direct contact with the noise source. Zoning inside the site so that the outermost zone becomes a green zone. The outermost part of the site is made with the concept of a green belt or a green belt that surrounds the site. This is directly so that the vegetation in it reduces the noise produced. Vegetation functions as a sound barrier as well as being a green aspect of the site. Then also put buildings that have the possibility of producing high noise levels by being spread out, not converging in one place. This allows the sound to be reduced due to the distance.

3. Circuit Concept

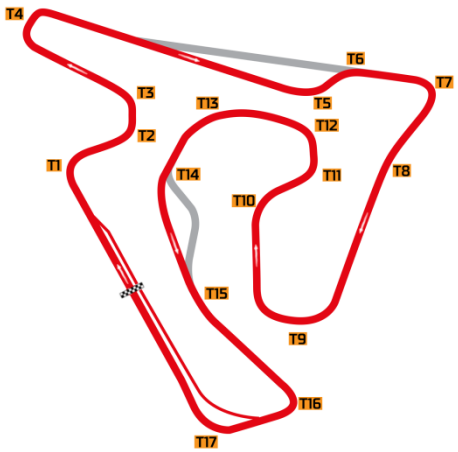

Fig 5. Circuit Layout Concept

The planned total length of the circuit is 4,551 m with 17 bends, 9 to the right and 8 to the left, with the consideration that the entire track can be accommodated on the site. The width of the track on planning is 16 m. In addition to meeting FIM standards, the width of 16 m is sufficient to give drivers the opportunity to perform overtaking actions and determine the race track easily. The circuit elevation is in accordance with that on the contour map, not too extreme. The slope of the site follows the standards of the FIM, namely the transverse slope of the straight track: 1.5% - 3% and the transverse slope of the bend is 5%.

4. Concept of Space

The spatial circulation pattern that occurs on the racing circuit is divided into two parts, namely circulation outside the building and inside the building. Determination of circulation patterns is based on various considerations. Circulation adjusted to spatial relations. The spatial relationship serves to show the closeness of the relationship between each room in an activity group. The criteria for determining the nature of spatial relationships are influenced by the character of the activities carried out in one room and another. Based on the spatial analysis that has been carried out, the calculation of the overall building area is obtained as follows:

TABLE 1. Total Circuit Space Amount [4]

Activity Group	**Total Amount of Space**	
	Space Group	**Studio Area**
Major (Racing Sports)	Circuit Room	97,487 m2
	Pitbuilding Room	5,785.5 m2
	Paddock Room	31,216 m2
Main (Audience)	Spectator Room	50,199.07 m2
Support	Support Room	1,931.5 m2
Manager	Management Room	328.09 m2
Services and Services	Service Room and Service	891.5 m2
Parking	Parking Space	60,033 m2
Total		247,871.66 m2
Total Area Amount of Space (+ circulation 20%)		300,225.66 m2

5. The concept of the physical expression of the building

A. Mass Arrangement Concept

The placement of the building mass on an international racing circuit plays an important role in creating a functional and visually appealing environment. The strategic placement of buildings within the circuit optimizes traffic flow, enhances the spectator experience and provides efficient access to key facilities. Main grandstand placement and pitbuilding are strategically positioned along the main straight. The other stands are placed spread out on the outside of the bend straight track so that the view of the spectators is clear and unobstructed from the racing action.

B. Building View Concept

In the circuit's two main buildings, *the pitbuilding* and main grandstand, the design combines sleek, aerodynamic shapes with dynamic lines and curves on the roof, as well as state-of-the-art materials and finishes that convey a sense of speed, agility and precision.The shape of the composition is taken as inspiration from the shape of the front wing of a *Formula One car* which is a racing car with the most advanced technology or the *pinnacle of motorsport* and has a futuristic impression. The front wing of a formula racing car is a part of the car that plays a very important role in the aerodynamics of the car. In the *CFD (Computational Fluid Dynamics) simulation* , the front wing of a Formula One racing car at high speed creates a curved *airflow* .

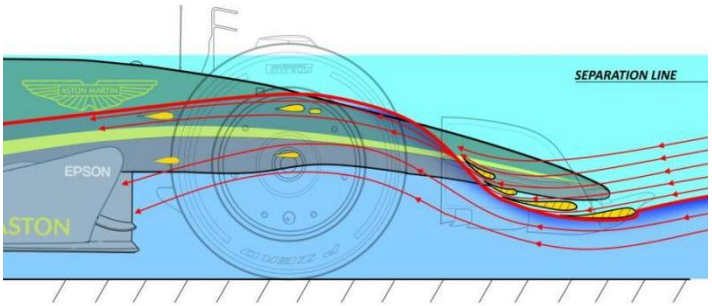

Fig 6. Mass composition of the main building [1]

The shape of the air flow becomes the inspiration for mass compositions that are in accordance with the unlimited neo-futuristic concept. The airflow-inspired form of the front wings of a formula one car embodies the essence of neo-futuristic architecture where its sleek, dynamic shape mimics the aerodynamic contours and smooth lines of a race car evoking a sense of speed and energy.

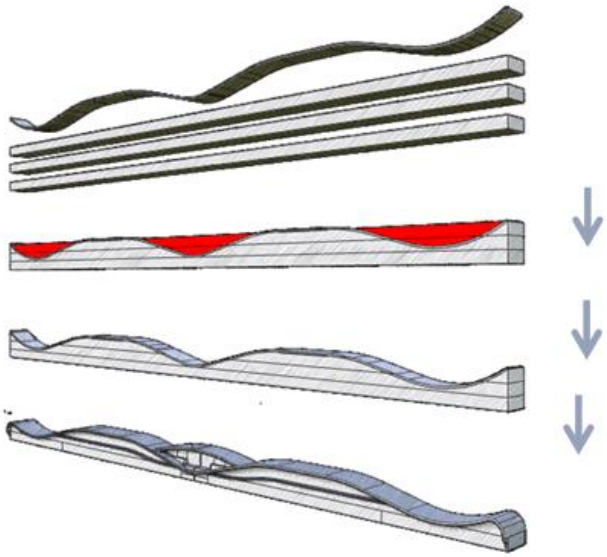

Fig 7. Mass composition of the main building

B. Design Results

A. Site plan

Fig 8. Site plan

B. Regional Perspective

Fig 9. Regional Perspective

Fig 10. Regional Perspective

Fig 11. Regional Perspective

C. Building Perspective

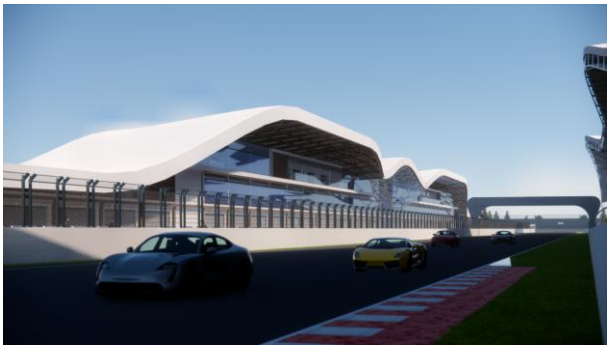

Fig 12. Pitbuilding Perspective

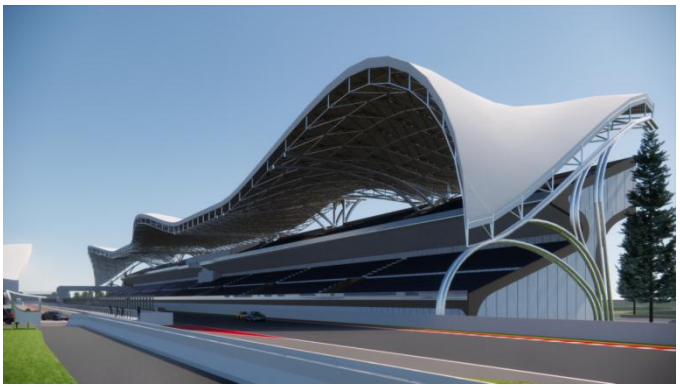

Fig 13. Main Tribune Perspective

Fig 14. Perspective of Open Tribune

Fig 15. Medical Center Perspective

.

II. CONCLUSION

Circuit planning in Kulon Progo as a forum for international racing sports with neo-futuristic architecture aims to plan a racing circuit with facilities that comply with applicable standards to accommodate racing sports activities at local, regional, national and international levels in locations that support the achievement, circulation , and racing requirements, as well as applying neo-futuristic architectural principles that attach form to planning context. The growing development of racing sports in Indonesia and the development of tourism can support the establishment of an international racing circuit in Indonesia, especially the island of Java.

REFERENCES

[1] IMI. 2022. Motorcycle Racing Circuit Guide. Indonesian Motorcycle Association. Indonesia

[2] Hardianto, R., 1999, Sirkuit Permanen untuk Road Racing, Karting, dan Drag Racing di Yogyakarta. Universitas Islam Indonesia. Yogyakarta, https://dspace.uii.ac.id/handle/123456789/20554 accessed 14 April 2023

[3] Regional Regulation of Kulon Progo Regency, 2012, Spatial Planning for Kulon Progo Regency 2012-2032, Regional Government of Kulon Progo Regency, Kulon Progo, https://peraturan.bpk.go.id/Home/Details/16103 accessed 8 March 2023.

[4] Racing Circuits And Their Geometric Design Characteristics Professional paper / Stručni rad (Received: 03 July 2019; accepted: 01 November 2019) Hrvoje Kmoniček SB Consulting j.d.o.o., mag.ing.aedif. Filip Ruška Zavod za urbanizam i izgradnju d.d. Osijek, mag.ing.aedif. Ivana Barišić University of Osijek, Faculty of Civil Engineering and Architecture Osijek, Associate Professor Corresponding author: ivana@gfos.hr https://www.researchgate.net/publication/338134810_

[5] Fédération Internationale de Motocyclisme, 2021, FIM Standards For Circuits. FIM, Spanyol.

[6] Federation Internationale De L'automobile, 2005. Yearbook of Automobile Sports 2005 - Appendix, Appendix H, FIA, Paris

[7] Abdalwahid, 2013, Zaha Hadid Form Making Strategies For Design, Thesis Universitas Teknologi Malaysia, Skudai.

[8] Aseel Naif Jamjoom, Abdelmoniem Mahdy El-Shorbagy, Zaki Mallsi. (2020) Jeddah Formula 1 International Circuit. Journal of Critical Reviews Vol 7, Issue 8

[9] Syarizal A. R., Norailis Ab. Wahab, Nurshadira Mohd. Raof, Raja Rosnah Raja Daud, Munirah Mahshar Motorsports Tourism: Synergy And Prospects DOI: https://doi.org/10.17762/pae.v57i9.469 http://psychologyandeducation.net/pae/index.php/pae/article/view/469

[10] Farhan Asim ,Venu Shree A Century of Futurist Architecture: from Theory to Reality https://www.researchgate.net/publication/330139601_A_Century_of_Futurist_Architecture_From_Theory_to_Reality.

[11] Tatiana V. Portnova Futurism Concept in the Design and Architectural Solutions of the 20th and Early 21st Centuries. Civil Engineering and Architecture 11(3): 1125-1136, 2023 http://www.hrpub.org DOI: 10.13189/cea.2023.110302

[12] https://www.re-thinkingthefuture.com/top-architects/a295-30-projects-that-define-zaha-hadids-style/