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Design Of Railway Station Facilities Based On Contemporary Architecture

Kivly E. Sarajar, Jefri Muhaling, Defie R. Wawointana, Ronald C.E. Kalesaran
Institute of Technology Minaesa, Indonesia
Email: kivlyenossarajar@gmail.com

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Train, Facility Design, Contemporary Architecture

A B S T R A C T

Transportation in Indonesia plays a very important role in people's lives. Along with the development of the times, the transportation process as a means of transportation has developed and progressed. All of this has taken place since the development reform which is followed by the need for mass and cheap modes of transportation. Trains are transportation that is chosen as a means of transportation that is able to transport goods and passengers in large quantities, free of obstacles and has a high level of security. The government built the Trans-Sulawesi railway line because the infrastructure will open regional access, bring production between regions to the exit of goods and services with a higher transport scale, accelerate the traffic of goods, increase accessibility, reduce production costs, make the production scale higher, and encourage comparative advantages of products, so that all of them can trigger regional economic development. Bitung City is one of the cities included in the government program as a priority line for railway lines. Bitung City has a strategic area to facilitate the distribution of goods and services to various regions in East Asia so that transportation costs are also cheaper in contrast to through ports in other regions. Over the past few years, the government has determined to make Bitung the forefront of the economy with the determination of Bitung Port as an International Hub port and the existence of a Special Economic Zone. The government's move to develop Bitung as the front line of Indonesia's economy against the world market has attracted great attention from foreign countries. The design of the railway station in the city of Bitung is to provide land transportation facilities between cities and provinces with a safe and comfortable place for its users. The philosophy applied to the design of Class A Railway Station is an informal building. This informal nature comes from the main function of the design of the class A railway station in the city of Bitung, namely services that offer goods and services, so that it has an impact on the basic form of the building, namely informal. Based on the nature and type of activities, one of the right architectural concepts to be applied in the design of the Class A Railway Station in Bitung City is Contemporary Architecture.

Introduction

Trains are one of the means of interprovincial land transportation that is very popular with the community. The railway system is increasingly advanced and developing in Indonesia. Developers are increasingly competitive which continues to be driven by PT. Kereta Api Indonesia (persero). The plan to build the trans Sulawesi railway line is very feasible with various adequate and modern facilities as needed. Including excellent service to passengers to be more reliable to use train transportation services.

Trains are transportation that is chosen as a means of transportation that is able to transport goods and passengers in large quantities, free of obstacles and has a high level of security. This is in accordance with Law No. 23/2007 concerning railways, namely Railways as one of the modes of transportation in the national transportation system that has mass transportation characteristics and its own advantages, which cannot be separated from other modes of transportation. The development of this potential provides a role as a regional liaison, both national and international, to support, encourage, and drive national development to improve the welfare of the people. The safety factor is also very high and the pollution level is low and more efficient than other modes.

The government plans to build the Trans-Sulawesi railway line because the infrastructure will open regional access, bring production between regions to the exit of goods and services with a higher transport scale, accelerate the traffic of goods, increase accessibility, reduce production costs, make production scale higher, and encourage comparative advantages of products so that all of them can trigger regional economic development. Bitung City as the final railway line from Makassar is one of the cities that is the national government's priority line for railway lines. Bitung City has a strategic area to facilitate the distribution of goods and services to various regions in East Asia, so that transportation costs are also cheaper in contrast to through ports in other regions. The construction of the railway line in Sulawesi has started since November 13, 2015. The first phase to be built is the Makassar – Pare Pare route.

Methodology

Research Location and Architectural Design Process
Location of Railway Station Design in the Bitung Special Economic Zone (SEZ), North Sulawesi Province.

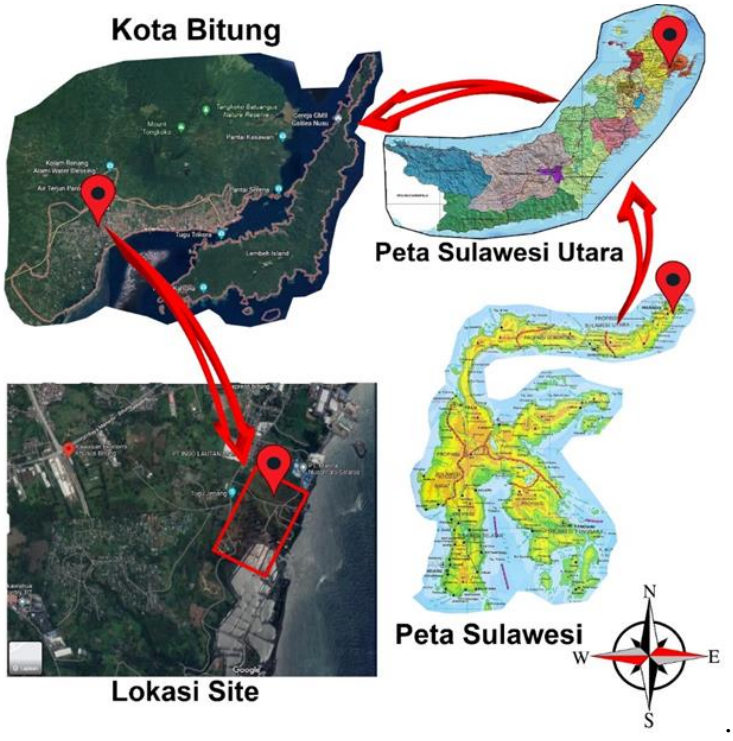


Figure 1. Railway Planning Locations in Bitung City

Figure 2. Map of Bitung SEZ Area

The architectural design process is a process or stage that is necessary and important to be carried out in the planning and design of an architectural work, so that the accuracy in the work process is in accordance with what is planned starting from the survey in the form of data collection to the design stage. The order of the design process is in the following chart:

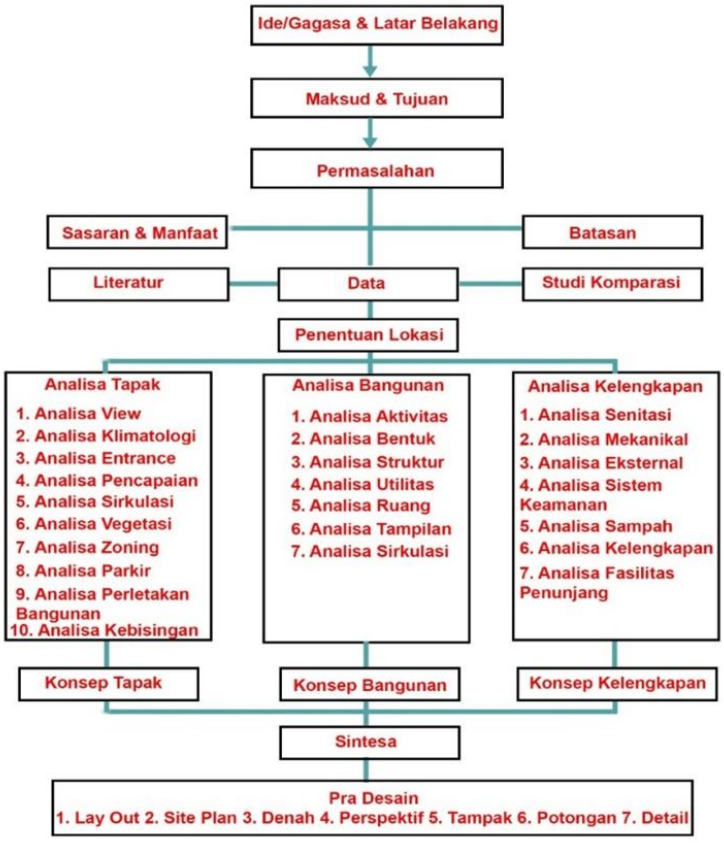


Figure 3. Design Process

1. Ideas and Ideas; including the background, purpose and purpose, identification of the problem, and formulation of the problem.
    a. Background: a starting point given as a basic understanding of the writing material to the reader.
    b. Purpose and purpose: is something that the writer wants as a writing target to be conveyed to the reader
    c. Problem identification and formulation: is a description of the problem that departs from the background, and becomes the basis of discussion in writing
    d. Goals and benefits: are objects that are specifically used as the purpose of writing and designing
    e. Problem limitations: is the scope of the discussion that is limited by the author, so that the explanation is not too broad.
2. Data; Includes physical and non-physical location data, literature (books, scientific journals, theses, magazines, and so on)
    a. Physical data: is data that relates and explains directly about the location. Physical data includes soil data, size, topography, and so on.
    b. Non-physical data: is data that is not directly related to location. Non-physical data includes the circumstances around the location, culture, economy and social aspects in the location.
3. Analysis; including the selection of location, site, space, building mass, activities, utilities, building structures, design forms, conditions and regulations related to objects and so on.
4. Synthesis; It is a combination of analysis, similar objects, input from various parties, and other information related to the object.
5. Design Concept; including basic concepts, planning themes, shape compositions.
6. Pre-Design; Includes lay outs, sie plans, plans, cuts, looks, and perspectives

The design of Class A Railway Stations, using Quantitative Data and Qualitative Data. Quantitative data in the form of the number of users, space area, local population and so on. Qualitative data is data that is narrative and cannot be explained in the form of numbers, only based on quality, qualitative data can be in the form of user characters, space needs, site conditions and so on. From these two types of data, primary data and secondary data are described as follows:

1. Site Survey; Collect data related to the site, including the existing site in which there is several data such as physical and non-physical data, as well as the geographical condition of the site. Site data also includes with the conditions around the site such as cultural and social.
2. Literature Survey; collect data related to the design object and architectural approach that will be applied through selected literature and reviewed in accordance with the design object determined by the author.
3. Standard Survey; collect architectural standard data related to design objects. This standard data includes standard size data and special needs that must exist in every architectural object design.
4. Presided Survey; collecting data related to design objects and architectural approaches through media such as journals, articles and other written sources.

Architectural Concept

1. Object Philosophy. The philosophy applied to the design of Class A Railway Station is an informal building. This informal nature comes from the main function of the design of the class A railway station in the city of Bitung, namely services that offer goods and services, so that it has an impact on the basic form of the building, namely informal. Based on the nature and type of activities, one of the right architectural concepts to be applied in the design of a class A railway station in Bitung City is contemporary architecture.
2. Object Environment. Bitung City is one of the cities in North Sulawesi. Bitung City is located in a geographical position between 1° 23' 23" - 1° 35' 39" N and 125° 1' 43" -1 25° 18' 13" E and a land area of 304 km². Bitung City consists of 8 sub-districts and 69 urban villages. Bitung City is a cityindustryEspeciallyFishing Industry with a density of 718 people/km². From the topographic aspect, most of the land of Bitung City is undulating with hills of 45.06%, mountainous 32.73%, sloping land of 4.18% and uneven 18.03%.
3. Micro Environment. The location of the design of the Class A Railway Station in Bitung City is located in the Bitung Special Economic Zone (SEZ). The Bitung SEZ is located in North Sulawesi Province and was stipulated through Government Regulation Number 32 of 2014. The Bitung SEZ has a very strategic location and is an economic gateway to countries in the Asia Pacific. This accessibility is supported by the existence of the Bitung International Hub Port as a trade hub for the Eastern Region of Indonesia. Located 44 km from the capital city of Manado, the Bitung SEZ is expected to become a center for the growth and distribution of goods as well as logistics support in the eastern region of Indonesia.

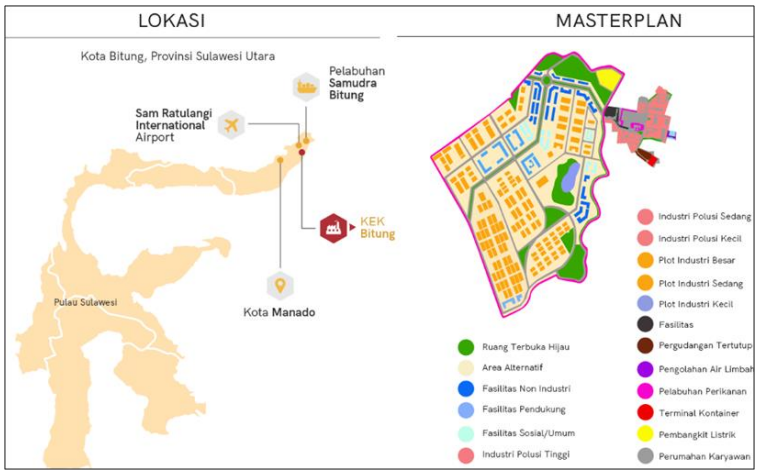


Figure 4. Location & Master Plan

With a total area of 534 ha, the Bitung SEZ is based on the advantages of regional commodities in North Sulawesi Province. As one of the largest fish producers in Indonesia, the Bitung SEZ focuses on the fishery processing industry to produce international quality export commodities. In addition to fisheries, the Bitung SEZ also focuses on the coconut industry and its derivative products which have a very wide market and are in demand both on a national and international scale.

Contemporary Architecture Concept

Contemporary architecture is 12th-century architecture that follows the latest model, this style of architecture incorporates many cutting-edge technologies and contemporary construction materials. Contemporary architecture is a style of art that looks at the development of today's times. This style will be applied differently depending on the trend that develops, but still has its own characteristics. Contemporary art often follows the development of cangih technology and the use of modern materials. Contemporary styles continue to develop according to the times. One of its main characteristics is the use of glass materials in buildings.

Contemporary architecture did not appear suddenly, this style of architecture was based on the spirit of change rooted in the industrial revolution in Britain. The industrial revolution resulted in the emergence of new building typologies that had never existed before, such as typologies for factories, warehouses, and so on. The industrial revolution also resulted in the existence of new materials and techniques in architecture. Contemporary architecture emerged because of the need for new styles at that time and then continued to develop into the era of art and craft, namely the situation that people began to be saturated with fabrication and carried out social movements of craftsmanship. Characteristics and characters of contemporary architecture:

1. The spaces are more open and integrated; Interior spaces in contemporary architecture are usually accessible and interconnected with each other. As a result, contemporary architecture combines various structural changes to allow for a large open space without being obstructed by a structure in the middle.
2. Shape; The dominant element in contemporary architecture is straight lines, as we can see and observe. Contemporary architecture, on the other hand, seems to avoid this tradition with a predominance of curved lines. In certain cases, a structure is made entirely of curved lines. In certain cases, curved and straight lines are combined to create a pattern.
3. New materials; The use of modern materials in the interior and exterior is another characteristic of contemporary architecture. Glass, wood, stone, and metal are preferred over other materials.
4. Using natural light; Natural resources continue to be utilized along with the development of architectural patterns. This is also seen in modern architecture, especially in the use of natural light.
5. Roof; One of the characteristics of contemporary architecture is the shape of the open roof. In today's world, you are more likely to see flat and overstacked shapes to protect buildings from the scorching sun than shielded roofs.
6. Materials for exterior; The exterior of a house or building is a dynamic space without boundaries in contemporary architecture. Starting with the use of plain traditional materials and continuing to the use of dynamic unconventional materials that can be applied to traditional architectural styles.

7. Harmonization with the outside environment; The ability of contemporary architecture to establish a harmonious relationship between buildings and the natural environment is one of its advantages. Not only in the use of local materials and a combination of landscape design, but also in the integration of the environment and nature into the building itself, both visually and functionally. As a result, buildings designed in a contemporary architectural style will adapt to any climate, including those with bad weather conditions.
8. Room layout; Curved lines can also be used to create other spatial shapes besides cubes. Buildings with circular shapes are very popular in contemporary architecture. When straight lines are used in contemporary architecture, more unique spatial compositions are formed. With this spatial composition, interior spaces with an unusual layout can be developed. Contemporary architecture is the perfect alternative for those who enjoy something different.
9. Window; Contemporary architecture also has larger and more windows. Often, windows are installed in unusual locations. Contemporary architecture is an option if you enjoy natural light and beautiful scenery. However, if you are concerned about privacy and intend to create a house in an urban area with dense neighbors, you should pay special attention to the placement of windows.
10. Paying attention to the environment; Eco-housing is a term that is often used in contemporary architecture. Many traditional structures use environmentally friendly and energy-efficient materials. Contemporary architecture seeks to blend the house with the surrounding nature in terms of residential development. The goal is not only to protect the atmosphere from distractions, but also to give a unique personality to the house.

Figure 5. Contemporary Building Models

Figure 6. Application of Contemporary Concepts

Figure 7. Contemporary Building Design

Site Analysis

1. Climatological Analysis

Morning sun exposure is in the range of 6 am to 10 am. Exposure to daytime sunlight is in the range of 11 a.m. to 2 p.m. (14.00). And afternoon sun exposure is in the range of 3 pm (15.00) to 6 pm (18.00). Based on data, the average temperature in Bitung City per year during the day reaches 30.00° C to 31.00° C.

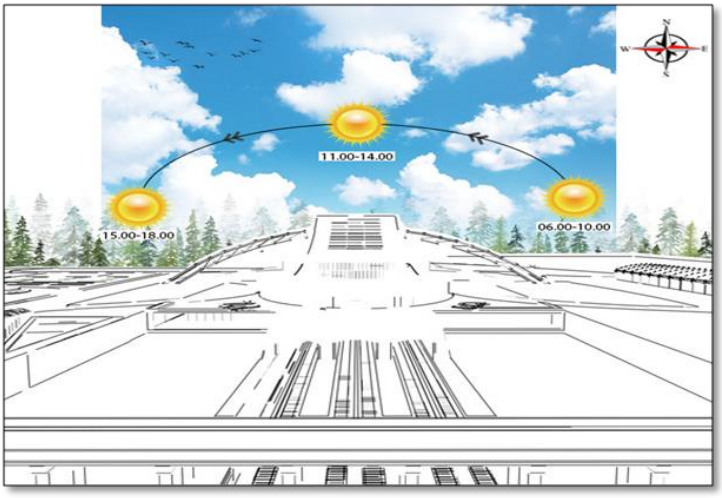


Figure 8. Solar Analysis

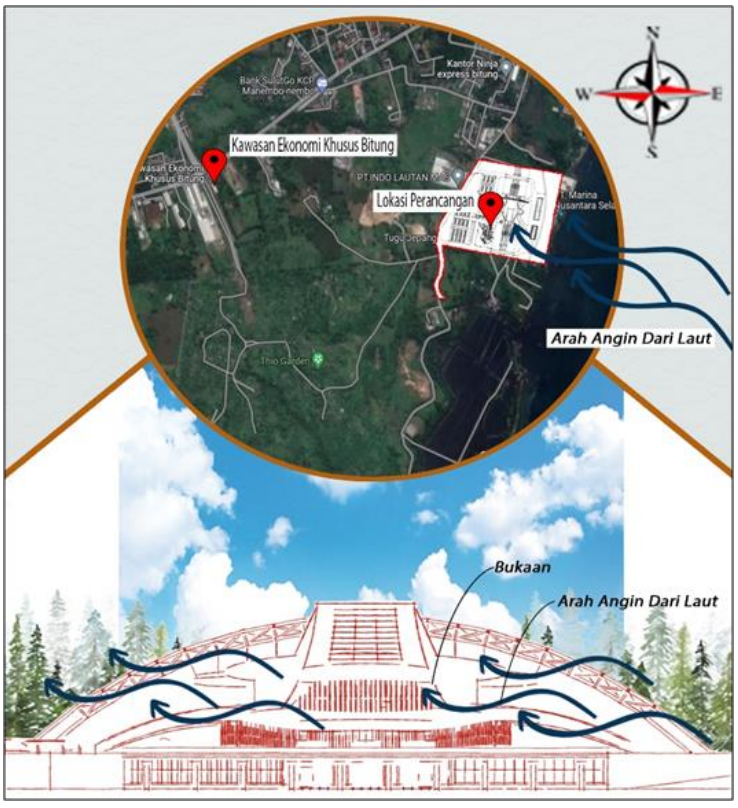


Figure 9. Wind Analysis

Based on the data above, the wind blowing towards the location of the windiest object is from the sea direction which blows continuously alternately in August with an average wind speed of 15.7 km/h. Based on the above analysis, the design of the railway station utilizes the vegetation around the building which functions as a wind speed damper, and can filter the air naturally, especially in the direction of the wind which has a high percentage of wind blowing, namely in the east. In addition, reducing openings in buildings facing east can be one solution.

2. Analisa Entrance

Based on the existing site conditions, the road that has already existed to get to the location is Efraim Lengkong road with two directions, and on the train there is no road that has been used as an entrance. Therefore, a good analysis is needed so that the airport entrance position is located properly so as not to interfere with vehicles that are driving, considering that the road around the site is a two-way trans road.

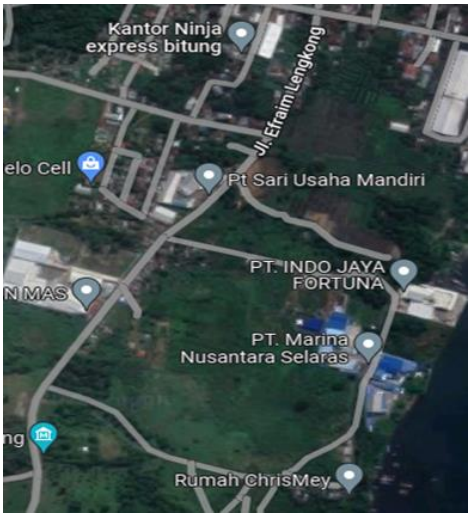


Figure 10. Entrance Analysis

Based on the author's analysis for the position that is used as the main *entrance* (gate) is taken on the left side of the railway design site, for the entrance is placed on a straight road so as not to hinder the vehicle that is driving.

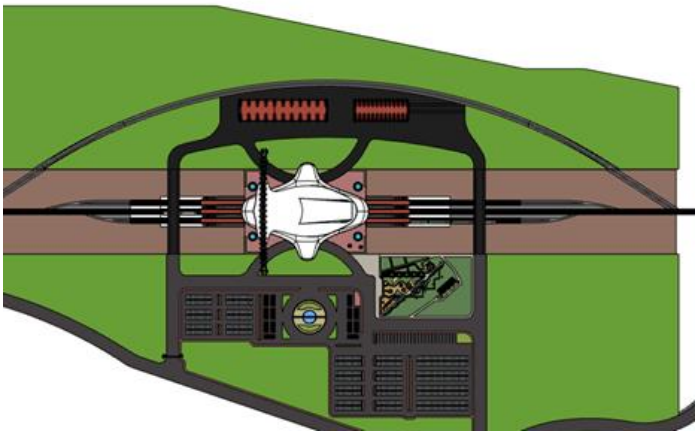


Figure 11. Analytics Entering the Terminal

Based on the current condition of the design site, access to the location is a 2-way road that can be reached through the road plan in the Bitung SEZ, as well as from the direction of Manembo-nembo Tengah. So that the suitable position as an *entrance* is from the north or from the direction of Lower Manembo-nembo, while the *exit* position is south.

3. Achievement Analysis

Based on the current existing condition of the site, to reach the location of the new design can be achieved by taking the road from the north or from the direction of Lower Manembo-nembo. However, in accordance with the Bitung SEZ plan, it can be reached through the main gate of the Bitung SEZ, making it easier to reach. The footprint can be reached either by vehicle or on foot. The achievement of public facilities and social facilities to the location is as follows:

a. From Bitung Port (27 minutes by car, 25 minutes by motorbike, and 2 hours 6 minutes on foot).
b. From Manado - Bitung Toll Road (36-39 minutes by car, 26 minutes by motorbike, and 2 hours 26 minutes on foot)
c. From the joint office of Samsat Bitung, the village head office of Sagerat Weru Satu, the office of the training center, and from the Sagerat health center. 12 to 34 minutes on foot).

4. Circulation Analysis

The circulation in the design of the class A railway station site in the city of Bitung is divided into two, namely vehicle circulation and human circulation. Vehicle circulation is divided into motorcycles and cars. Circulation for vehicles must be made by paying attention to the direction of the circulation, and separated between the circulation of motorcycles and cars, so as not to cause congestion in the design location later.

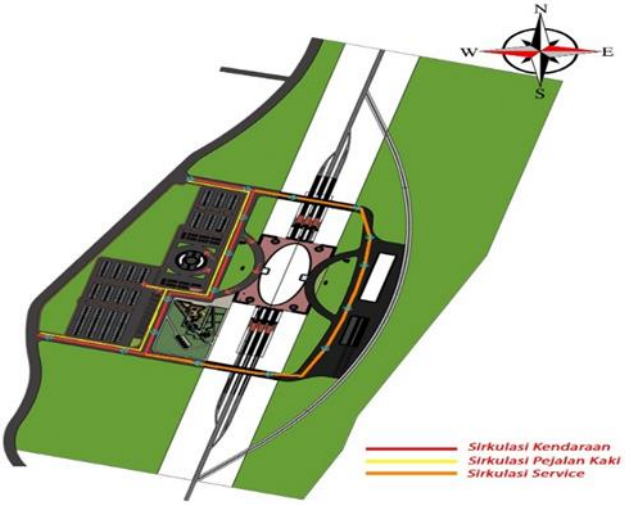


Figure 12. Circulation Analysis

Vehicle circulation in this design needs special attention, because the majority of train station users use vehicles to enter. As for human circulation on the design site, it is not specifically considered, but it is still provided in accordance with existing standards.

5. Vegetation Analysis

Vegetation as a complementory architecture is vegetation that can be a factor that complements a building, such as plants that can help filter the air, shade, and reduce noise. This type of plant is placed in areas that need vegetation such as the side of the road and the front of the sides of buildings. Vegetation as a soften line (line softener) is a vegetation that can clarify the line. This type of plant is placed next to the road according to the groove of the road.

Figure 12. Vegetation Analysis

In the western part, there are plants that have the main function of providing shade such as ketapang tree plants because this direction is a place dedicated to vehicle parking areas. For the playground area, there are shade plants and other ornamental plants such as cape trees, and for the eastern and southern parts there are types of plants that can inhibit wind speed and filter the air such as spruce trees, and red shoots.

6. Analisa Zoning

The zoning analysis in the design of a class A railway station in Bitung city is adjusted to other conditions/circumstances and other interrelated analyses.

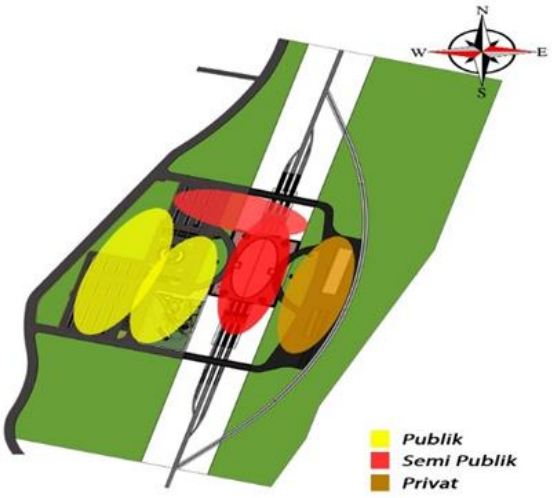


Figure 13. Zoning Analyst

Public areas are areas that can be accessed by anyone, from the parking area to the passenger station. Semi-public areas are areas that are provided specifically for service needs. As for the private area, it is an area that cannot be entered by just anyone, where it can only be entered by people who have certain permits or interests. The private area is in the form of a manager's office.

7. Parking Analytics

The estimated number of visitors on certain days is a maximum of 5,000 people, from this number it can be known the number of parking spaces needed by calculations:

a. Visitor Assumption : 4000-5000 Visitors
b. Visitors by vehicle: 70% of car users, 10% of motor vehicle users, 20% of BUS vehicles
c. Car Users = 70% x 4000-5000 Visitors = 2,800-3,500
d. 1 car vehicle with a load of 4 people so that 2,800-3,500 visitors / 4 = 700-875 cars
e. Car parking area requirement = 12.5 M2
f. Up to 700-875 x12.5 M2 = 8.750M2 – 10.937.5M2
g. Motor vehicle users = 10% X 4000-5000 visitors = 400-500
h. 1 vehicle with a load of 2 people, so 400-500 visitors / 2 = 200-250 motorcycles
i. Motorcycle parking area requirement = 2 M2
j. Up to 400-500 motors x 2M2 = 800-1,000 M2
k. Bus Vehicle Users = 20% x 4000-5000 visitors
l. 1 Bus vehicle with a load of 25 people, so 800-1000 visitors / 25 = 32-40
m. Bus parking area requirement = 48 M2

8. Building Placement Analysis

The placement of buildings at the location is adjusted to other analyses such as climatological analysis, view, entrance, achievement, zoning, noise and other related/related analyses.

Figure 14. Building Placement Analysis.

Result and Discussion

1. Outdoor Space Planning

Figure 15. Outdoor Space Planning

Figure 16. Entrance

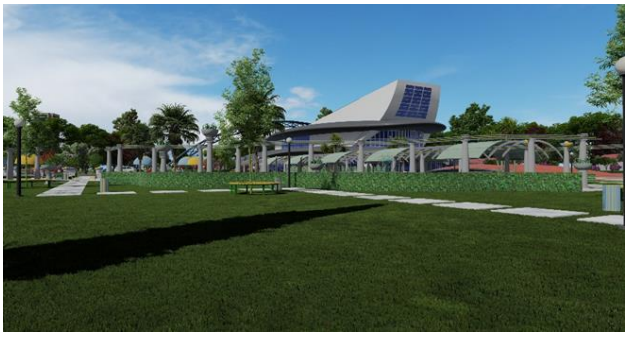


Figure 17. Vegetation

2. Building Planning

Based on the analysis of activity grouping activities in the design of railway buildings based on the function of the building. There are two groups of activities based on function, namely the primary function in the form of Service Facilities related to Railways. There is also a secondary function which is divided into two, namely special support, namely activities that are still related to Railway Transportation and other supporting facilities, and entertainment and general support, namely activities that generally exist in every public building such as parking and service activities.

Based on the spatial analysis above, the spaces in the *Railway building* are grouped based on three factors, namely the grouping of spaces based on activities, the grouping of spaces based on their nature, and the grouping of spaces based on their users. The grouping of spaces based on their functions is divided into three, namely primary/primary, special support and general support. Groupings based on their nature are divided into public, semi-private, private, and service. And the grouping of spaces based on their users is divided into managers, VIP *members*, *regular members*, and visitors. Each space included in its grouping becomes a benchmark in the planning and design process of the Fire Flats

Analyze the shape above, the shape of the Kerata Api building. Combining each line and basic shape in architecture, namely diagonal and curved lines, each of which presents a square, triangle and circle shape and applies a contemporary style to the shape of the building, This building shape is also taken from the analogy of the shape of the blodok fish.

Figure 18. Shape

In body structures, there are various types of structures for wide-span buildings, namely Form Active Structure System (a structure that follows a free shape, so it seems unique), Bulk Active Structure System (rigid structures both

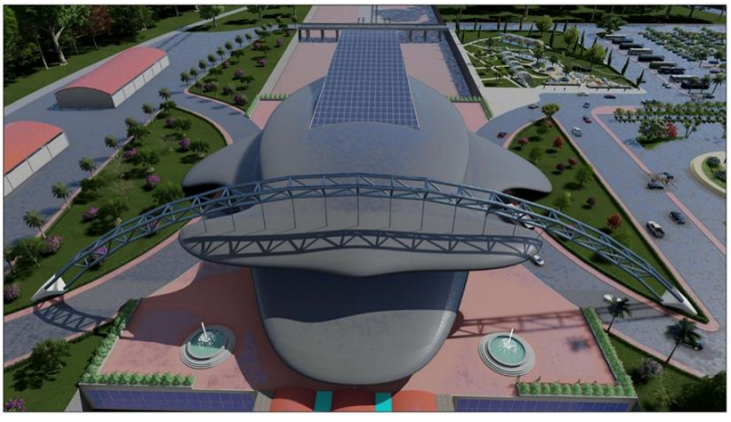
horizontal and vertical), Vector Active Structure System (structures that channel external forces from compressive and tensile elements) and Surface Active Structure System (an active structure system with a flexible surface). For foundation structures that are commonly used for wide span and multi-storey buildings, they are divided into two, namely deep foundations, namely piles, drill piles, piers and wells. As for shallow foundations, namely longitudinal foundations/paths, rafts, cobwebs and site foundations. In its design, the structure used on the Railway must be considered to suit the needs.

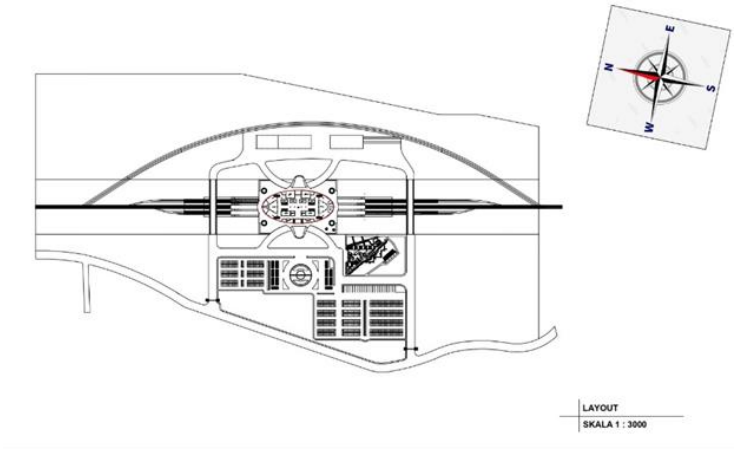
Based on the utility analysis above, utilities are an important part of the building that can support building activities. The utility system in the building is divided into lighting systems, air conditioning systems, and plumbing systems. In the design of a class A Railway Station in the city of Bitung later, the utility system applied must be based on the standards and applicable rules starting from the installation process, technical implementation to the use of materials used both nationally and internationally, so that the class A Railway Station building in the city of Bitung can be a comfortable building, Safe and user-friendly.

Based on the display analysis in Chapter IV, the appearance of the *railway building* adjusts to several factors such as the basic shape of the building, architectural philosophy and architectural concepts applied to the building. The appearance *of the railway* building carries a contemporary theme as the main concept in the design, so that the appearance of this building is identical to the firm diagonal lines and dynamic curved lines, which are also characteristics of contemporary architectural concepts.

Based on the analysis of circulation in the building above, circulation in the building is divided into two, namely horizontal circulation that connects the space and vertical circulation that connects the floor. Horizontal circulation is in the form of alleys and hallways, as well as vertical circulation used in the form of elevators, escalators, stairs and ramps. These two circulation are arranged based on applicable standards and rules, so that one circulation system does not interfere with the other.

3. Design Results





Conclusion

Berdasarkan dokumen mengenai Perancangan Fasilitas Stasiun Kereta Api Berbasis Arsitektur Kontemporer, dapat disimpulkan bahwa perancangan stasiun kereta api ini didasarkan pada kebutuhan untuk meningkatkan efisiensi transportasi serta mendukung pembangunan ekonomi regional di Sulawesi Utara, khususnya di Kota Bitung. Stasiun kereta api ini dirancang dengan konsep arsitektur kontemporer yang menekankan pada integrasi bangunan dengan teknologi modern dan lingkungan sekitar. Konsep ini bertujuan untuk menciptakan bangunan yang fungsional dan estetis, dengan menggunakan material yang modern serta menerapkan prinsip-prinsip ramah lingkungan.

Proses desain melibatkan analisa yang mendalam terhadap tapak, kondisi iklim, dan sirkulasi untuk memastikan kenyamanan dan keamanan pengguna. Berdasarkan hasil survei tapak, lokasi stasiun di Kawasan Ekonomi Khusus (KEK) Bitung sangat strategis karena dekat dengan Pelabuhan Internasional Bitung, yang memfasilitasi distribusi barang dan jasa ke Asia Timur dengan biaya yang lebih rendah. Desain bangunan juga memperhatikan elemen-elemen kontemporer seperti penggunaan material modern, ruang terbuka, pencahayaan alami, dan bentuk yang dinamis.

Perancangan ini diharapkan tidak hanya memenuhi kebutuhan transportasi masyarakat, tetapi juga berfungsi sebagai pusat kegiatan ekonomi dan sosial, yang akan mendukung pertumbuhan ekonomi daerah. Dengan arsitektur kontemporer sebagai konsep utamanya, stasiun ini dirancang untuk memberikan pengalaman transportasi yang modern, nyaman, dan efisien, serta mencerminkan kemajuan teknologi dan perkembangan infrastruktur di Indonesia.

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