Final Architectural Design Studio

BUILDING PERFORMANCE & TECHNOLOGY LABORATORY

Design of Piyungan Yogyakarta Waste Treatment Building

with Building Skin Design to Decrease Odor from Waste Treatment Process

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WITH BUILDING SKIN DESIGN TO DECREASE ODORS FROM WASTE TREATMENT PROCESS

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FOREWORD

Assalamu'alaikum Warahmatullahi Wabarakaatuh

Praise and gratitude I pray to Allah SWT because, with the abundance of His grace, the author can complete a Final Architectural Design Studio with title "Design of Piyungan Yogyakarta Waste Treatment Building with Building Skin Design to Decrease Odors from Waste Treatment Process". This Final Architectural Design Studio was prepared and submitted as a condition for obtaining a Bachelor of Architecture (S.Ars) degree at the Faculty of Civil Engineering and Planning at the Universitas Islam Indonesia. The author realizes that the process of preparation and implementation of this Final Architectural Design Studio can not be done apart from the support of many parties, the author would like to express his appreciation and gratitude to:

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2. My Beloved family, Kusno Wibowo S.T, M.Si (Father), Noor Hidayati Zakiyah Pramulani S.Sos (Mother) Khansa Faradiba Koesnoputri (Sister) also Fairuz Muhammad Afkar Koesnoputro (Brother) for the prayer, moral support, and blessing that has been given to me.

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I realize that this Final Architectural Design Studio is still far from perfect and there are many shortcomings due to various limitations. For this reason, I will accept constructive criticism and suggestions afterward. I hope that Final Architectural Design The studio can be useful for all those who read it. May Allah SWT always give mercy and guidance to all of us, Aamiin.

Wassalamu'alaikum Warahmatullahi Wabarakaatuh

Yogyakarta, August 25th 2021

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STATEMENT OF AUTHENTICITY

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I state that this Final Architectural Design Studio Project that I write and work on is my own work, not the transfer of other people's writings or thoughts that I acknowledge as my own results or thoughts. As for the Final Architectural Design Studio work, there are parts of quotes from other people's work that I have written down according to the norms, rules, and ethics in writing.

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Assalamualaikum Wr. Wb.

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Wassalamualaikum Wr. Wb.

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Direktur

DIREKTORAT PERPUSTAKAAN – UNIVERSITAS ISLAM INDONESIA – YOGYAKARTA

Joko S. Prianto, SIP., M.Hum

ABSTRACT

Piyungan landfill has an important role in the flow of waste in Yogyakarta. Most of the waste from various regions in Yogyakarta will be accommodated in this Piyungan landfill. Unfortunately, the facilities to support waste treatment activities at the Piyungan landfill are inadequate. For this reason, a Waste Management Building is needed that can accommodate waste treatment activities at the Piyungan landfill which functions as a means for further processing of waste. This Waste Management Building requires several special aspects related to the waste treatment process, including specific room specifications and space placement. With its main function as a waste treatment building, issues such as the dominant smell of garbage become one of the focuses in design. Therefore, the design of the waste treatment building in Piyungan was developed with an Indoor Air Quality concept approach by paying attention to aspects of natural ventilation. One of them is the use of building skins that can reduce the effects of bad odors. The design will be tested using wind simulation to determine the effectiveness, so as to produce a design that answers the problem of waste processing facilities and the integration of the surrounding environment.

Keywords : waste treatment building, building skin, indoor air quality

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INTRODUCTION

1.1 DESIGN PREMISE

Piyungan is one of the main goals in waste distribution in Yogyakarta. Piyungan TPST itself is a place for garbage gathering from various regions. However, in its management, various solutions are still needed to solve the growing waste problem. A waste processing facility is needed to increase the efficiency of the Piyungan landfill itself, because the system used is still focused on the landfill system where more waste is piled than processed. With this waste processing building, it is hoped that it can solve existing problems. With a supporting function in the building in the form of a building skin that aims to reduce the smell of the waste processing process, it is hoped that air quality and indoor health and comfort will be well maintained. So that building users still have comfort and health in carrying out activities in the building so that they can improve the quality of the worker's performance.

Figure 1 Piyungan Landfill Condition

Source : Author

1.2 BACKGROUND PROBLEMS

Data from the Ministry of Environment and Forestry (KLHK) in February 2019, released that currently Indonesia produces at least 64 million tons of waste piles every year. Based on these data, about 60 percent of the waste is transported and dumped to the landfill, 10 percent of the waste is recycled, while the other 30 percent is not managed and pollutes the environment.(*Indonesia Hasilkan 64 Juta Ton Sampah, Bisakah Kapasitas Pengelolaan Tercapai Tahun 2025? Halaman all - Kompas.com*, no date)

The same issue also occurred in Yogyakarta. TPST Piyungan is a waste facility located in Bantul. However, Piyungan TPST itself has been overloaded since 2014. However, until now the DIY regional government is still optimizing Piyungan as a garbage dump for three regencies/cities in DIY, namely Sleman and Bantul, and Yogyakarta City.

Every day 500 tons of waste from various areas of Sleman, Yogyakarta, and Bantul are dumped in these places. However, various other problems such as problems with scavengers, residents also occur several times (*Berbagai Permasalahan TPST Piyungan Belum Ada Solusi - Harianjogja.com*, no date)

Head of the Piyungan TPST Waste Management Center Fauzan Umar said the Piyungan TPST has been overloaded or overcapacity since 2016. This has caused the local government to periodically repair the pier and fill up piles of garbage so that transport vehicles can enter with heavy equipment.(*Gunungan Sampah Bikin Susah Warga Piyungan DIY, Pemda Bisa Apa?*, no date)

Figure 2 Piles of garbage at Piyungan Landfill

Source : Author

The issues that exist in Piyungan TPST are quite varied, starting from the waste management that must be improved so that it is not just piled up in the area. In some conditions, the remaining waste and also the wastewater of the Piyungan TPST often sees, disturbing the comfort of the residents. Not only that, the frequency of garbage trucks that often come is also a problem in itself.

According to the Head of TPST Piyungan Sarjani, we met on Thursday (5/10/2017), one of the problems is that the place is actually no longer able to accommodate the garbage. "If the problem of the amount of waste here has been from 2012, we also have not been able to find the most appropriate solution," he said.

Currently, the only solution that can be given is to level the garbage with heavy equipment or cover it with soil. The backfill was arguably not smooth, this was due to the large number of scavengers and cows who were there, which made it take longer to cover the garbage. "How else is it difficult to manage the many people plus the number of cows, it's natural that sometimes there are lots of trucks waiting in line at the bottom," said Sarjani.

This problem is also added to some heavy equipment that is damaged or old so that it does not function optimally. Problems with residents and scavengers themselves are also unavoidable, starting with residents who are concerned about the smell, as well as the rest of the garbage that is scattered around the edges of their houses.

The solutions that are being tried are in the form of providing compensation, covering the garbage so it doesn't slide, and checking health. (*Berbagai Permasalahan TPST Piyungan Belum Ada Solusi - Harianjogja.com*, no date)

Figure 3 Savengers around Piyungan Landfill

Source : Author

Then, during the rainy season, the flow of water from the TPST flows into some of the houses of residents in Lengkong Hamlet. Residents, said Maryono, asked the government to build a proper dumping ground or garbage dock so that there would be no queues. In addition, residents requested that there be improved drainage so that rainwater from the TPST does not overflow into the settlements.

Figure 4 illegal place where scavengers sort out garbage

Source : Author

Nur Azizah, a political science doctoral candidate at the Australian National University who is currently conducting research on waste management in DIY, The first problem is regarding the TPST management model which still relies on the dumping or hoarding pattern and has not fully led to the 3R pattern, namely reducing, reusing, and recycling waste. The 3R pattern has been mandated by Law Number 18 of 2008 concerning Waste Management. The law mandates that the final waste disposal site (TPA) is designated as a place for waste residue disposal after previously being sorted, reused, or used as raw materials for certain industries. Like most other landfills in Indonesia, landfill is still a place for final disposal rather than a place for final processing.(*Gunungan Sampah Bikin Susah Warga Piyungan DIY, Pemda Bisa Apa?*, no date)

Ir. Rani Sjamsinarsi, MT as the Management of the DIY TPS Unit said that to improve the management function, Rani said, the Piyungan TPA with a land area of 12.5 ha was further expanded with an additional 2.3 ha. This expansion effort could only be carried out in 2017 due to the high price of land.

According to Rani, the reason for the need to expand the land is that the Piyungan landfill is already too full to accommodate the waste from the 1.3 million city residents in Yogyakarta. The problem encountered in TPA Piyungan is that the waste has not been sorted and its volume tends to always increase.

This problem is exacerbated by the absence of special tools used to sort waste. "Waste in the Piyungan TPA is still being separated by scavengers and cows," said Rani. According to him, the absence of this tool is caused by the lack of budget devoted to waste management.

At the end of the material presented by Rani, it was stated that the key to waste management is to increase awareness of waste, build government commitment, and develop research and waste processing technology.(Tita) (*Begini Permasalahan dan Solusi Pengelolaan Sampah di Piyungan, Bantul | kagama.co | Majalah Kagama Online*, no date)

Figure 5 Design Problem Solution

Source : Author

From the various descriptions of the problems above, it can be concluded that the absence of adequate waste processing facilities in Piyungan can cause various impacts. One of them is the problem of annoying odors and is not good for health. By designing a waste treatment building, it is hoped that it can support waste processing activities in Piyungan. For this reason, an Indoor Air Quality theory is used which is useful for minimizing the impact of waste processing that will be carried out on buildings. With a design focus on natural ventilation and how to protect it from external pollutans.

1.3 DESIGN PROBLEM FORMULATION

Based on the background of the problem that has been described, the formulation of the problem is, as follows:

General problems

1. How to provide a well-integrated waste treatment building?

2.How to design a waste treatment building that can keep the indoor air quality well preserved?

Specific problems

1.How to apply building skin that can reduce odor from waste treatment process?

2.How to Integrate natural ventilation system with building skin?

Goals

1. Having a well-integrated waste treatment building

2. Having a waste treatment building that can keep the indoor air quality well preserved

3. Having building skin that can reduce odor from waste treatment process

4. Having Integrated natural ventilation system with building skin

1.4 PROBLEMATIQUE

Figure 6 Problematique

Source : Author

1.5 DESIGN METHODS

DESIGN STUDY PHASE.

The first phase is to collect data according to the context and design issues. The data collected is divided into two based on the method of acquisition.

A. Primary Data Collection Method

Primary data collection method is a method that obtains data directly from the source by means of observation and interviews. Observations were made by observing the design location. Meanwhile, data collection by interview was carried out with the Head of Piyungan Waste Management to find out the current conditions regarding the management system in Piyungan.

B. Secondary Data Collection Methods

Secondary data collection methods are carried out indirectly from the source. Thus, the data obtained comes from books, journals, and literature studies.

The data collected relates to concepts and theories that will be the basis for designing buildings, such as:

1. Space requirements are needed in the waste treatment building

2. The need for infrastructure and other supporting facilities in the waste treatment building

3. Application of Indoor Air Quality in the waste treatment building which can improve the quality of the user.

4. Building Skin Application to reduce odors from the waste treatment process

DATA ANALYSIS PHASE

Data analysis in the design of waste treatment building are carried out in two ways, namely the macro analysis method and the micro analysis method.

A. Macro Analysis

Macro analysis was carried out in the Piyungan area. The area analysis consists of conditions and problems that exist today. Macro analysis is also carried out to observe what needs must be met in the waste treatment building.

B. Micro Analysis

Micro analysis is done by analyzing the typology of the waste treatment building in terms of design standards, building layout, space requirements, layout form, and building infrastructure that will be a solution to the problems that will arise when designing a waste treatment building.

DESIGN CONCEPT PHASE

The design concept phase is the problem-solving stage by producing alternative design concepts that will be made in accordance with the design study and variable analysis that has been carried out. This will be processed into a waste treatment building with the main concept of building skin to reduce odors from the waste treatment process.

DESIGN SYNTHESIS PHASE

The synthesis phase is the stage where the concepts that have been made in the previous stage will be made more perfect and mature. Which will then become one complete design from the initial stage to the finish. This completed design then enters the design test stage. The design test stage is carried out to test the suitability and success of the design with the quality to be achieved based on predetermined variables, especially Natural Ventilation and Indoor Air Quality. The design test method can be done in a way design simulation on the design results of waste treatment building with computational software to measure design performance. In this case, wind simulation is used.

1.5.1 Framework of Thinking

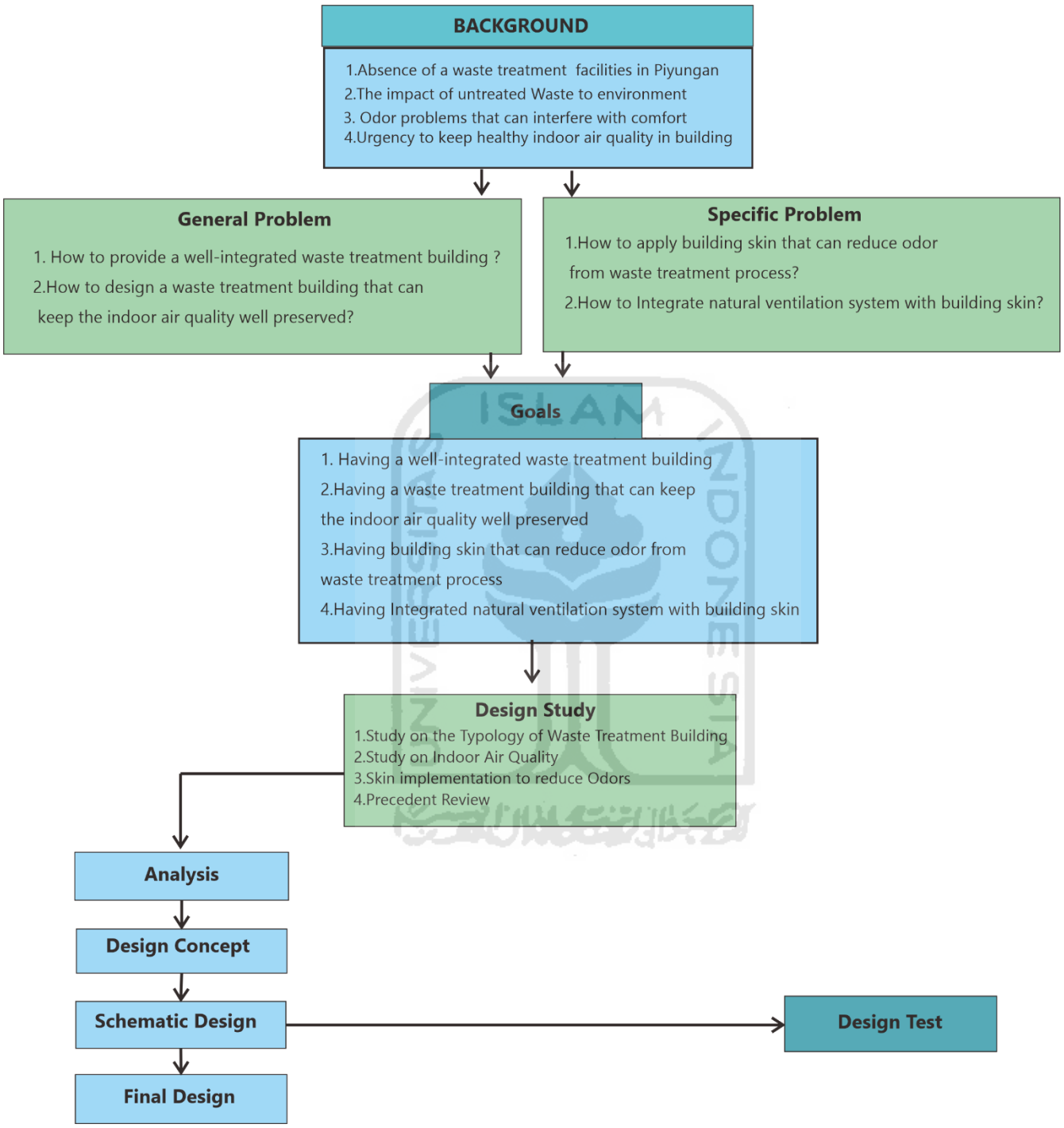


Figure 7 . Design Framework Thinking

Source : Author

1.6 DESIGN HYPOTHESIS

Piyungan waste treatment building, with an indoor air quality concept, is a facility for carrying out waste treatment activities for collecting, sorting, recycling, and final waste processing combined with public functions as an effort to promote waste management activities. This facility has several functions, namely: an industrial function to process waste, an educational function to introduce good waste management, and public functions. Apart from being a place to manage waste, the building also functions to reduce the impact resulting from this processing. With the principle of indoor air quality and with the use of building skins, it is hoped that it can minimize the impact of waste, especially with the smell problem caused by waste itself.

Figure 8 Conditions of landfill activities

Source : Author

1.7 ORIGINALITY & NOVELTY

A.

Title : *Living Laboratory of Waste in Piyungan*

Authors : Fairuz Rana Zhavira

Institution : Universitas Islam Indonesia

Location : Yogyakarta

Discussion : Design is waste management with a laboratory as a research area and providing shelter that accommodates scavengers

Similarity : Intend on designing waste treatment facility.

Differences : Different from the approach and focus, there are no building skin features and focus on the problem of the smell of garbage

CHAPTER 2

DESIGN STUDY

In this chapter, we will discuss the various data needed in designing a waste processing building and the theory that will be used. Starting from the location of the site design, which contains all data related to the site and applicable regulations, as well as the natural conditions of the site. Then the theory used in the design approach is Indoor Air Quality. And precedents as learning materials as well as guidelines in designing.

2.1 PIYUNGAN SITE CONTEXT

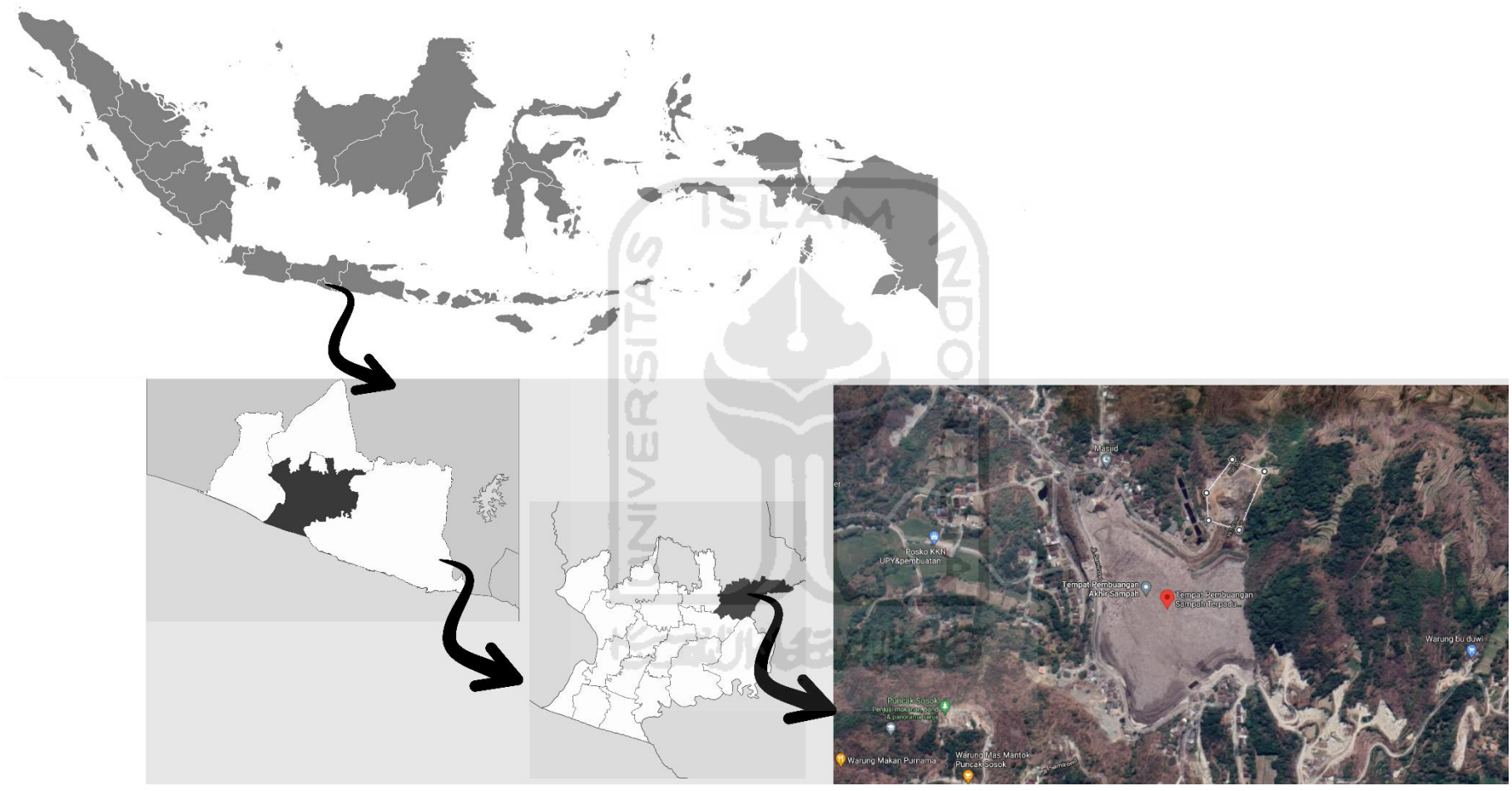


Figure 9 Piyungan Location

Source : maps.google ,Author modification

The location of Piyungan is in Bantul Regency, Yogyakarta Province, Indonesia. Geographically, Bantul Regency is located between 07º44'04" 08º00'27"South Latitude and 110º12'34" - 110º31'08" East Longitude. Bantul Regency is directly adjacent to, north of the city of Yogyakarta and the Regency of Sleman, on the west, is bordered by Kulon Progo Regency, to the south by the Indonesian Ocean, and to the east by the Gunung Kidul Regency. Most of the Piyungan areas are still simple settlements with less densely populated areas. However, the Piyungan Landfill itself has become a destination for various garbage estuaries in Yogyakarta

2.1.1 Piyungan Zoning Area

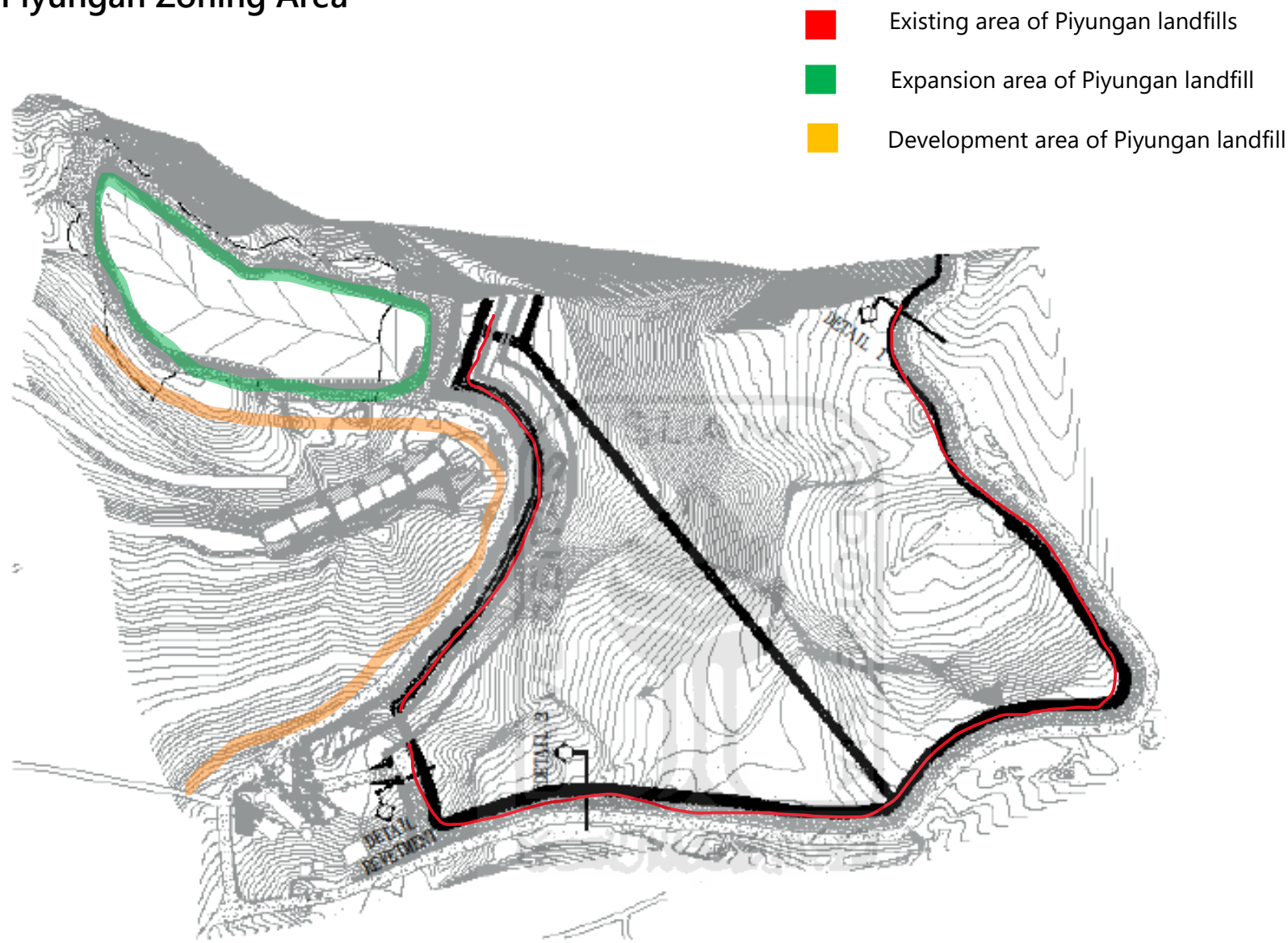


Figure 10 Piyungan Zoning Map

Source : Dinas PU DIY

Currently, the area of the Piyungan landfill is divided into three related to future land development. The first area, colored in red, is the main area of the Piyungan landfill, which is the main landfill area that is used to store waste every day. The second area, the green area, is an area that has been cleared by the Piyungan manager to anticipate the increasing amount of waste. In this area also the soil conditions have been prepared with no vegetation and extreme contours. Some parts of this area have also been used as garbage dumps. The third area is the orange area, where this area is planned to be an extension of the Piyungan landfill for further development.

2.1.2 Piyungan Accessibility

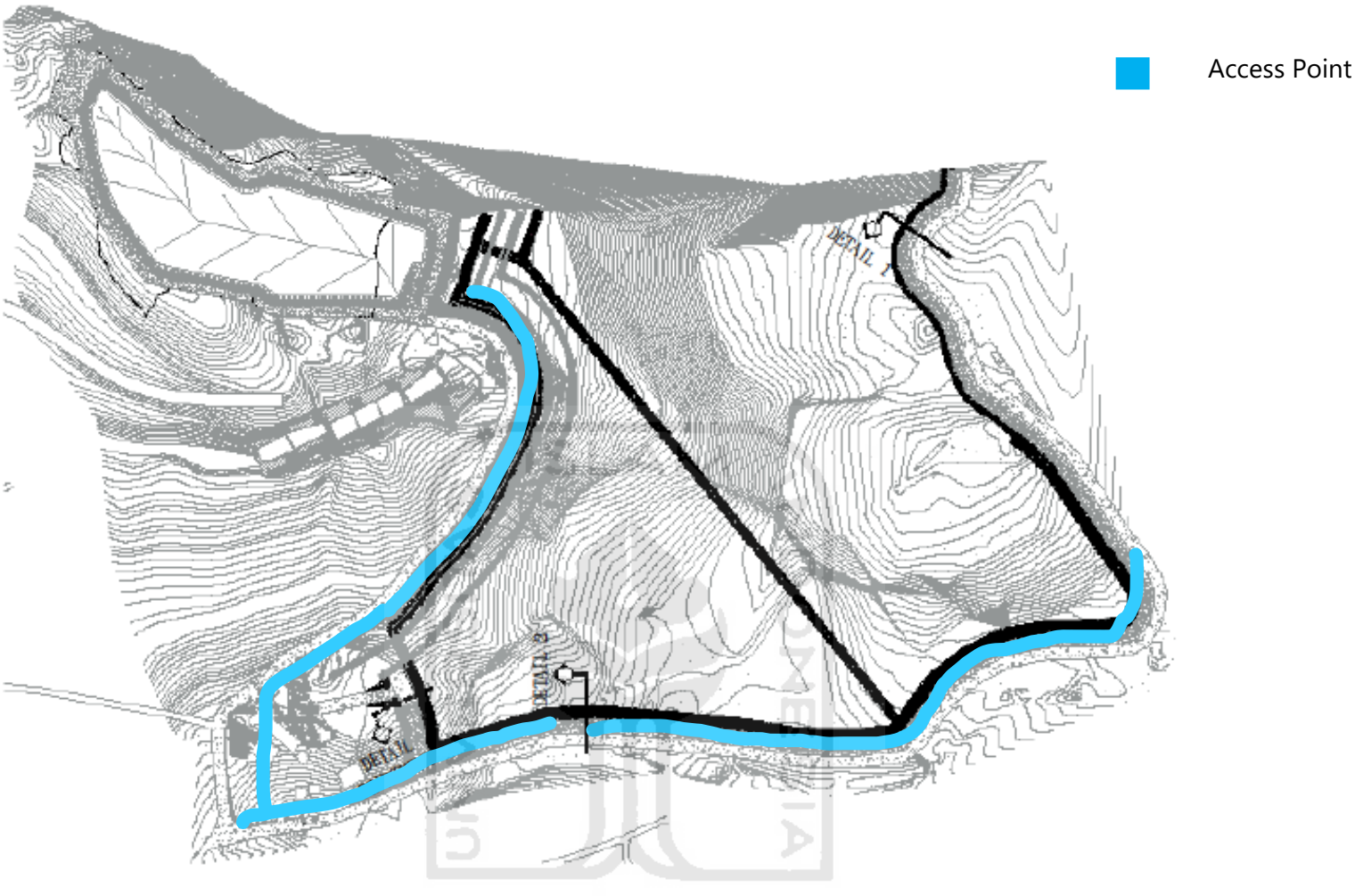


Figure 11 Piyungan Accessibility Map

Source : Dinas PU DIY

Access to the Piyungan landfill is in the western part, where there are two routes, one to the main landfill and the other to the sand dump as a landfill facility. There is a gate at the beginning of the entrance to the site which marks the Piyungan landfill area. There is a security post not far from the gate to monitor conditions. The access road in this area is not too big but sufficient for the circulation of garbage trucks.

Figure 12 Piyungan Gate area

Source : Author

2.1.3 Piyungan Area Regulation

According to Perda DIY No.5 Tahun 2019 tentang Rencana Tata Ruang Wilayah Daerah Istimewa Yogyakarta Tahun 2019 – 2039 (Gubernur DIY, 2019) buildings built with a Basic Building Coefficient (KDB) between 20% (twenty percent) to 60% (sixty percent).fo RTH (Green Open Space) minimum 20%. And for the KLB is 2

2.1.4 Piyungan Land Ownership

Figure 13 Piyungan Project Ownership

Source : Author

This project is managed by the Yogyakarta city government, especially the Public Works and Environment Agency.

In developing the site, the city government of Jogja has purchased new land in an effort to increase the waste disposal area. But for the future plan, this project will be given to the private state, still, the Public Works Agency is the manager of land and development while the environmental office manages the operational flow and processes for the management and operational, as said by Drs. Jito, Head of Waste Management Office of Piyungan. DIY Environment and Forestry Service.

A. Vision and Mission in the Future Development of Piyungan Landfill

Figure 14 Interview Process

Source : Author

From interviews conducted with Drs. Jito, Head of Waste Management Office of Piyungan, in the future for Piyungan Landfill, several developments will be carried out. For the stockpiling process in the middle area, it is better to use a pyramid or terracing system so that the waste can be denser. This system has been implemented in several landfills in Indonesia, one of which is the Bantar Gebang landfill in Bekasi, West Java. Meanwhile, in the operational plan, the Piyungan landfill manager as the government will cooperate with business entities. This collaboration is carried out for the development of facilities at the Piyungan landfill itself, so that in addition to receiving financial support, it can also provide better waste processing results.

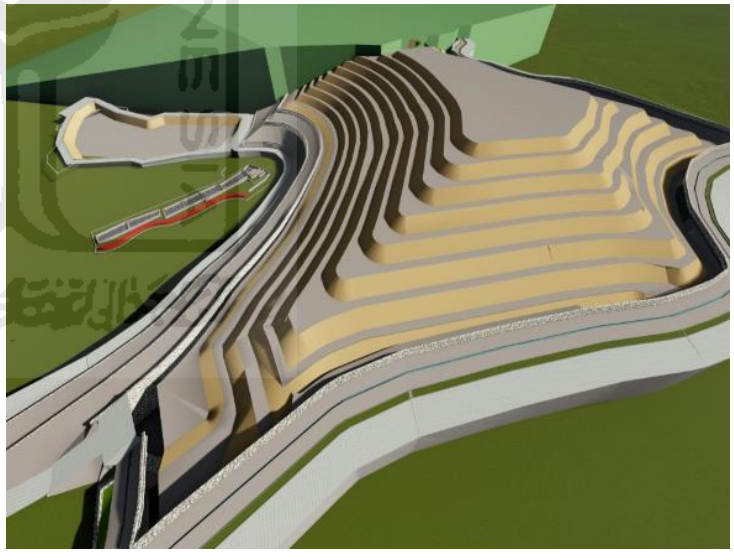


Figure 15 Development of Piyungan Landfill

Source : Author

2.2 SITE LOCATION

Figure 16 Site Urban Context

Source : Author

Located in Ngablak, Sitimulyo, Kec. Piyungan, Bantul, Daerah Istimewa Yogyakarta
Site Area : 7000 m2

-Adjacent to the main access and adjacent green space.
Green area helps reduce odors and gives a cool impression to the location

-Got main road access.
easy access for anyone, including garbage trucks

-More Private area
The site itself is not near housing and surrounding by green area also open area.

-Located in the northern part of the landfill.
a sufficiently effective distance in the operation of the waste processing flow, both waste transfer and monitoring and check

Figure 17 Site Location

Source : maps.google , Author modification

Site Area : 7000 m2
KDB 60% : 4200 m2
RTH 20% : 1400 m2
KLB 2 : 8400 m2

2.3 ANALYSIS OF THE DESIGN SITE CONDITION

2.2.1 Climatic and Geographical Conditions

A. Sun Direction and Temperature

The direction of the sun on the site in Piyungan is the same as in many areas in Yogyakarta. With this it can be a consideration in designing the mass of the building and also the opening in order to maximize natural lighting.

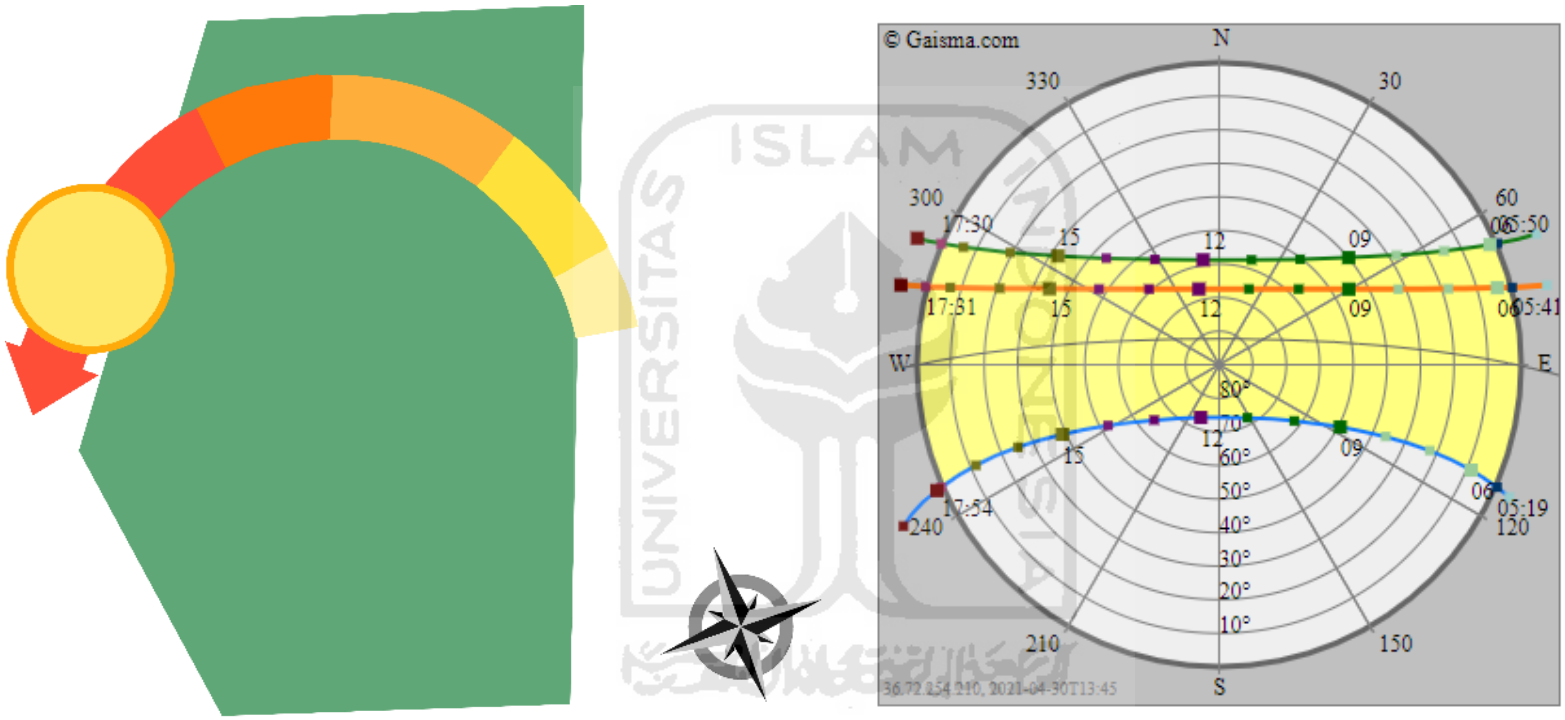


Figure 18 Sun Direction in Site

Source : meteoblue.com

The air temperature in the piyungan ranges from 25-30 degrees, but this condition is also influenced by several environmental factors, one of which is the existence of the Piyungan landfill which makes the atmosphere hotter than usual.

B. Prevailing Wind/Wind Direction/Wind Flow

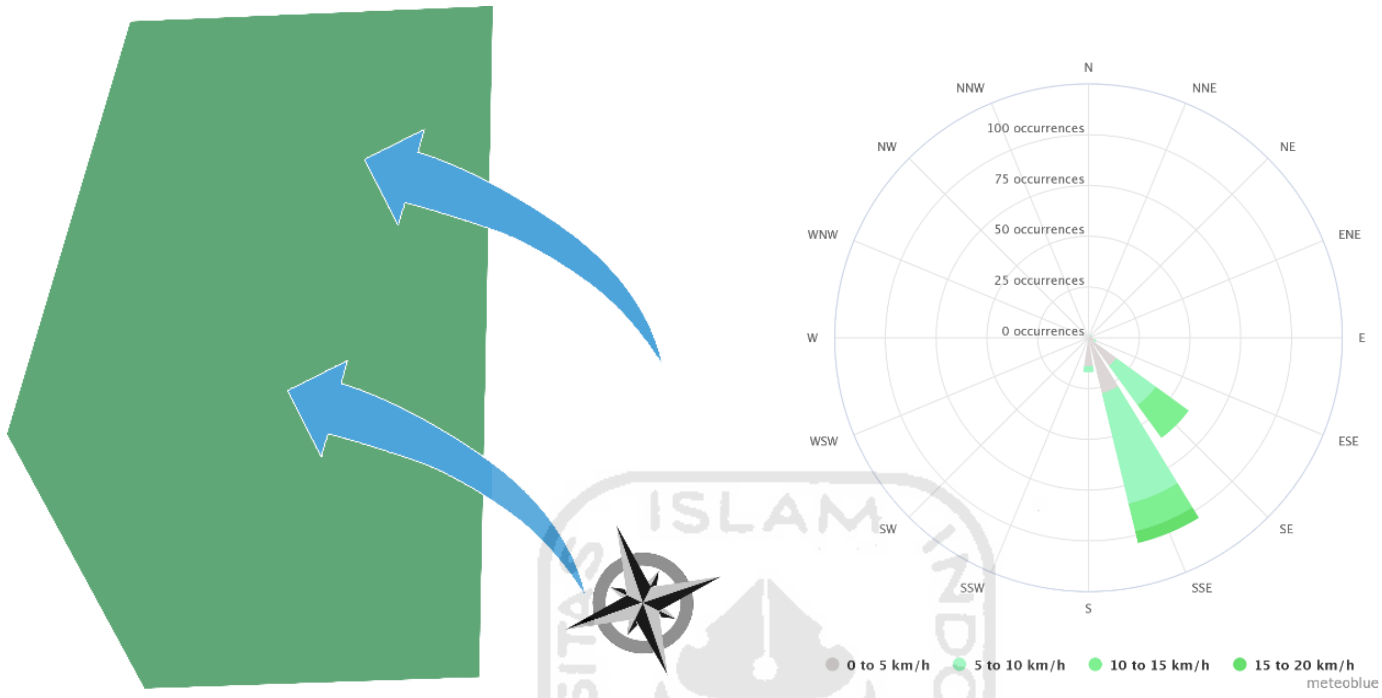


Figure 19 Wind Direction in Site

Source : meteoblue.com

The wind direction at the site in Piyungan is mostly from the southeast. With this it can be a consideration in designing the mass of the building and also the opening in order to maximize natural ventilation.

D. Site Surrounding

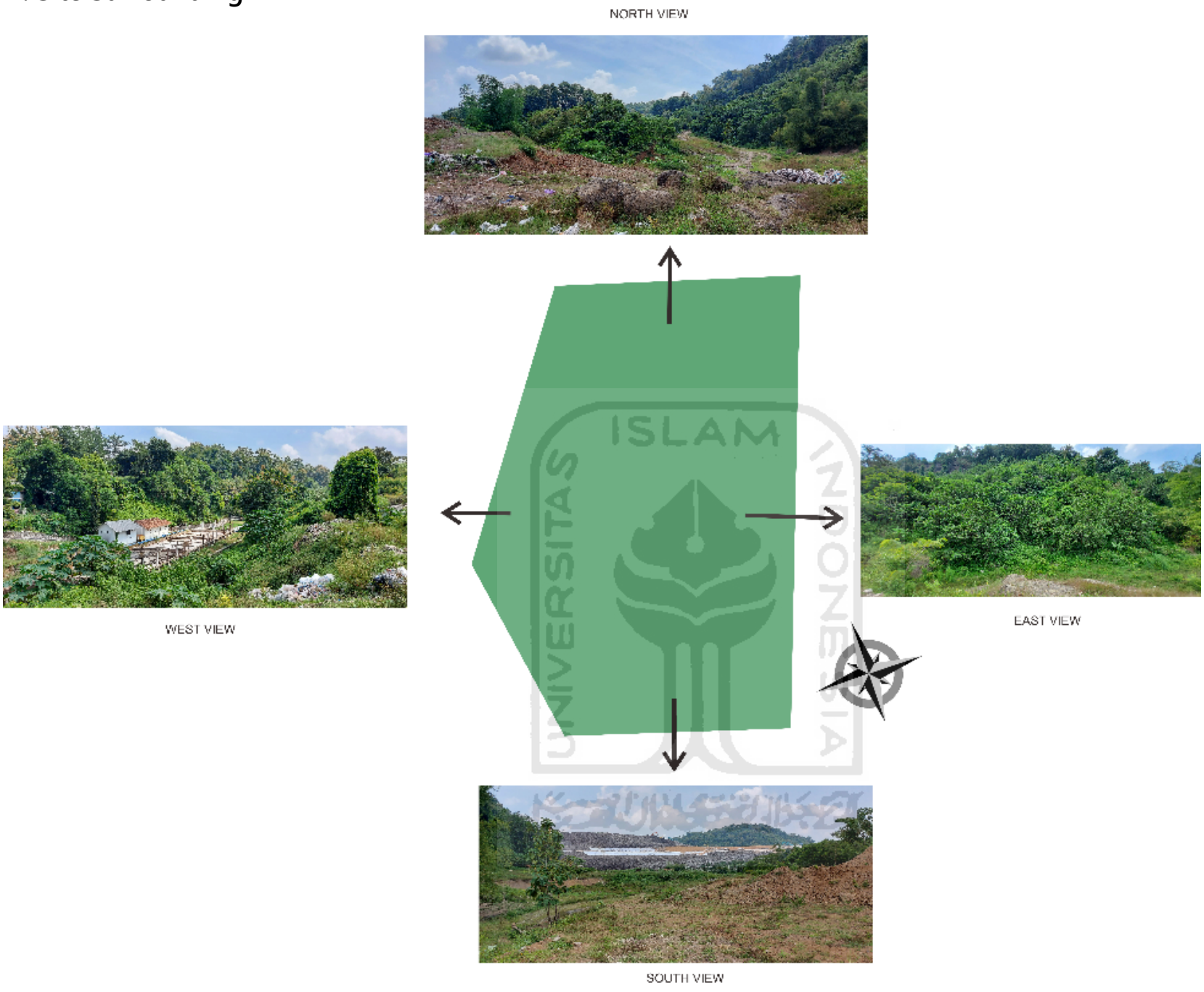


Figure 20 Piyungan Site Surrounding

Source : Author

In the southern part of the site, adjacent to the Piyungan Landfill itself, so that it can be easily seen while on site. Odor and visual considerations are important. In the northern part of the site, it is still a green and untreated area. The eastern part of the site is also a green area with quite dense trees. In the western part of the site, there is an existing building, namely a water treatment plant from the remaining waste at Piyungan Landfill.

E. Odors Around the Site

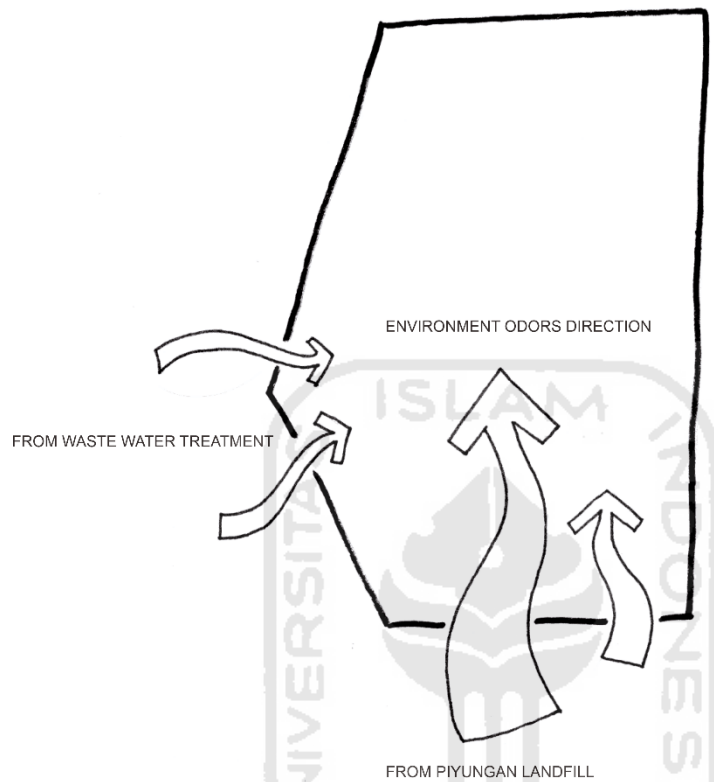


Figure 21 Odors around Site

Source : Author

The smell that is considered in the design comes mostly in the southern part of the site, which is the Piyungan Landfill area itself, while in the western part of the site there is a liquid waste treatment facility from Piyungan Landfill. By understanding the source of this odor, it is hoped that it can generate a consideration in the design.

2.4 STUDY OF DESIGN THEMES

2.4.1. Indoor Air Quality

Indoor air quality (IAQ) is linked to people's happiness, comfort, and health when they are in a building. Pollution with gaseous chemicals, fine particles (nonbiological), and other airborne contaminants has an impact on IAQ. bioaerosols are a type of bioaerosol (Soreanu et al., 2013; van Ras et al., 2005). One of the most common. Sick building syndrome (Soreanu et al., 2001) is a sign of poor air quality. Severe health problems known as "building-related sickness" and "multiple chemical sensitivity" can occur in some situations

Natural Ventilation

Ventilation's relevance as a component influencing indoor air quality is widely acknowledged. To limit the accumulation of emissions that cannot be avoided, such as bioeffluents from building occupants, good ventilation is required. Local exhaust ventilation can help reduce localized indoor pollution effectively. Ventilation is insufficient for mitigating contaminants with significant uncontrolled indoor emission rates. It is vital to ventilate adequately and effectively in order to ventilate well. The amount of air provided at any given time must be sufficient for local demands, and it must be distributed properly. Ventilation regulations define sufficient in a variety of ways, including a minimum volume flow rate per occupant plus an additional increment per square foot of building floor space, or a minimum air change rate. To be effective, occupants should be provided with low-contaminant ventilation air. Ventilation, on the other hand, is effective if the exhaust air expelled from an interior environment is more contaminated than the air in the room as a whole. (Nazaroff, 2013)

Indoor temperatures can be controlled with the use of ventilation and shading. Indoor airborne contaminants from indoor sources are also removed or dilute by ventilation. This lowers the number of pollutants and enhances the quality of indoor air (IAQ). When there are outside sources of pollutants nearby, such as smoking or garbage, carefully consider employing ventilation to reduce indoor air pollutants.

One key component in promoting optimum air quality is the introduction of outdoor air. Air can enter a house in a variety of ways, including:

• by allowing natural ventilation through windows and doors

• through infiltration, a process in which outdoor air flows into the house through openings, joints, and cracks in walls, floors, and ceilings, as well as around windows and doors, through mechanical means such as outdoor air intakes associated with the heating, ventilation, and air conditioning (HVAC) system

To some extent, infiltration occurs in every home.

Air circulation through open windows and doors is referred to as natural ventilation. Natural ventilation, when used properly, can assist moderate the indoor air temperature, which can become too hot in homes without air conditioning or when power failures or brownouts limit or prevent the use of air conditioning.

Natural ventilation can also help to enhance interior air quality by lowering contaminants. • opening windows and doors are examples of natural ventilation.

• window coverings, such as blinds that are closed

(*Improving Indoor Air Quality | US EPA*, no date)

Protect Against Outdoor Pollution

The air outside is frequently dirty, and it is frequently unhealthy to breathe. Outdoor air in metropolitan areas, where the majority of people now live, is more frequently unhealthy than outdoor air in rural areas. Even in rural areas, however, outdoor air pollution can come from a variety of sources, including cooking, heating, agriculture, industry, and waste management. Many countries have regulatory programs in place to track outdoor air pollution and create and implement control measures to fulfill health-based guidelines. Even after decades of work, the requirements are still not routinely attained in sophisticated economies. Outdoor air pollution levels in underdeveloped economies are typically substantially greater than in advanced economies.(Nazaroff, 2013)

2.5 BUILDING TYPOLOGY AND PRECEDENTS

2.5.1 Typology of Building Functions

Industrial buildings can be categorized as ordinary type industrial buildings and special type industrial buildings. The regular type is a warehouse building type with a simple roof structure on an open frame which requires a large span and an unobstructed clear area which provides adequate flexibility & facilities for the latter to change the layout of the production machine/factory without major changes. This type is usually used for workshops, warehouses, factories etc.

Industrial buildings are generally designed as spaces that provide functional space for internal activities with adequate main production space for the use of suspended equipment or overhead cranes and provision of office space or mezzanine floors. These buildings are usually made of steel structures and manufactured from factories.

A special type of industrial building is, steel factory building which is used for the manufacture of heavy machinery, automobile production, fabric industry etc. (*Pengertian Bangunan Industri dan Karakteristknya*, no date)

Industrial Building Configuration and Characteristics

The configuration of each building depends on the requirements, the number of spaces can be built side by side with each other. The choice of structural configuration depends on the span between the rows of columns, the nature of the roofing material and its type and the main space. Portal trusses made of steel trusses or roof trusses can be used if the span is relatively small. Wide span structures can be used if the span of the building is large.

Floor

Various types of floors are used according to functional requirements such as, production, workshops, shops, facilities, and administration. Service conditions will vary greatly at different levels. So, a different type of flooring is required.

Industrial floors must have resistance to abrasion, acid action, temperature and impact depending on the activity to be carried out. The foundation for the vibrating machine must be separated from the adjacent floor to avoid vibration by laying it on rock or hard ground.

Roof

Qualities such as strength, waterproofness, insulation, fire resistance, durability, maintenance costs and cost must be considered when planning the roof of an industrial building. Various factors for roof coverings that must be considered when designing a roofing system are insulation value, acoustic properties, appearance, leakage, weight, and maintenance.

Deflection limits for purlins and steels depend on the sheet type. Generally, corrugated roofing sheets, galvanized, asbestos, cement sheets and ductile roof coverings can be used in industrial buildings.

Lighting

The intensity and uniformity of lighting levels are good lighting requirements for industrial buildings. It would be more economical and wise to use natural light as daylight for adequate lighting in industrial buildings anywhere.

Ventilation

Ventilation is important in any type of building. This can be done by natural means such as aeration or by mechanical equipment such as fans. This will be used to remove dust, remove heat and the used air can be replaced with fresh air.

(*Pengertian Bangunan Industri dan Karakteristknya*, no date)

2.6 WASTE TREATMENT PRECEDENTS

2.6.1 Waste Treatment System, Spaces and Activities

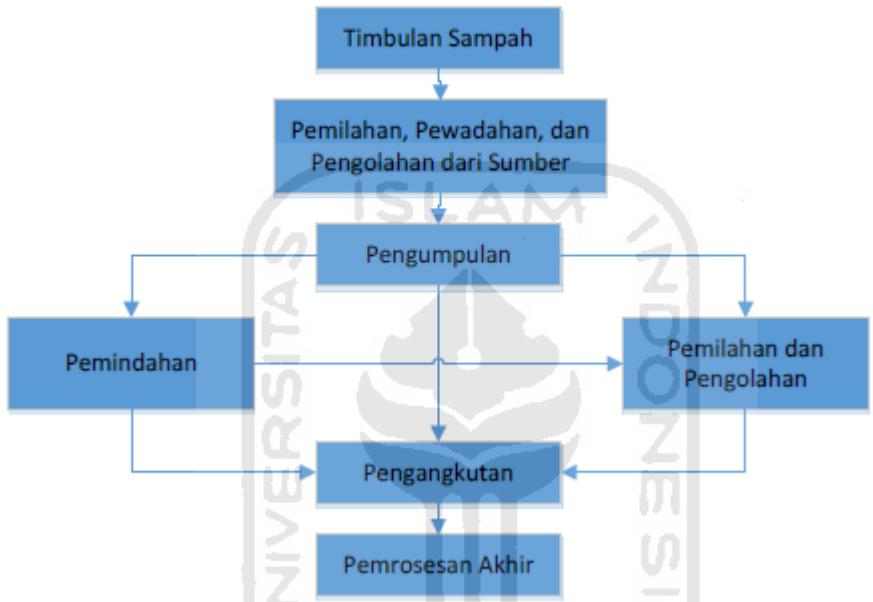


Figure 22 Waste Processing Flow

Source : Kementrian PUPR , Pengantar pengolahan sampah secara umum

GENERAL OPERATING PRINCIPLES OF 3R TPS

In principle, the implementation of 3R TPS is directed at the concepts of Reduce (reduce), Reuse (reuse), and Recycle (recycling), where efforts are made to reduce waste from the source on a communal or regional scale, to reduce the burden of waste that must be processed properly. directly at the landfill. Along with the continuous development of waste processing technology. Until now, the waste processing process indicated in a 3R TPS is to sort waste into organic waste and non-organic waste. Organic waste is processed biologically, while non-organic waste is recycled for economic value or managed through a waste bank, while inorganic waste which is a residue from 3R TPS is transported to a waste landfill. (PU, 2016)

CRITERIA FOR WASTE TREATMENT PLACES (TPS) 3R

TPS 3R has a minimum capacity of 400 families, with a minimum area of 200 m2. consisting of a gate bearing the logos of the Regency/City Government and the Ministry of Public Works and Public Housing, roofed hangars, offices, mixed-waste outpouring units, mixed-waste sorting units, organic waste processing units (including organic waste chopping machines), processing units /inorganic/recycled waste collection, processing unit/residue waste storage, warehouse/container for solid/liquid compost/bio gas/recycled waste/residue waste, garbage collection cart/motorcycle

Based on its composition, waste is distinguished by its nature, namely:

1. Organic waste, can be decomposed, easily decomposed (degradable), such as food scraps, vegetables, dry leaves, straw, etc.;

2. Inorganic waste, not biodegradable, not easily decomposed (undegradable),

such as plastic food packaging containers, paper, plastic toys, bottles and drinking glasses, cans, etc.;

3. Hazardous and Toxic Waste (B3) such as used syringes, infusions, batteries, chemical waste, etc.

TPS 3R has the following characteristics:

1. Able to serve a minimum of 400 families or 1600 – 2000 people which is equivalent to 4-6 m3 per day.

2. Garbage is in a mixed state, but it will be better if it is sorted.

3. Use a minimum area of 200 m2.

4. The collection is carried out using manual carts or motorized carts with a capacity of 1 m3, with 3 cycles per day.

5. There is a mixed-waste outpouring unit, a mixed-waste sorting unit, an organic waste processing unit, an inorganic waste processing/retention unit (recycling), and an inorganic waste (residue) processing/retention unit.

inorganic

In physical process-based technology, it is generally carried out at the pre-treatment stage to carry out the next stage of waste processing

Processing of inorganic waste that can be recycled includes specific sorting such as sorting paper, bottles, cans, metal, plastic, etc. Then it can be compressed (pressing) so that it can be sent to advanced recyclers who are located close to the 3R TPS location. In addition, waste processing can also be done by chopping the plastic into small sizes and then washing and drying it. The next step is that the small plastic can be processed by heating so that it can be formed into the product we want.

Organic

Composting is one of the elements in a waste management strategy that can be applied to a mixture of waste or specific waste such as leaves, yard waste and food waste.

Composting is a decomposition process carried out by microorganisms on biodegradable organic materials. The purpose of composting is to convert biodegradable organic materials into biologically stable materials, thereby reducing their volume or mass. This natural process breaks down organic matter into humus and mineral matter.

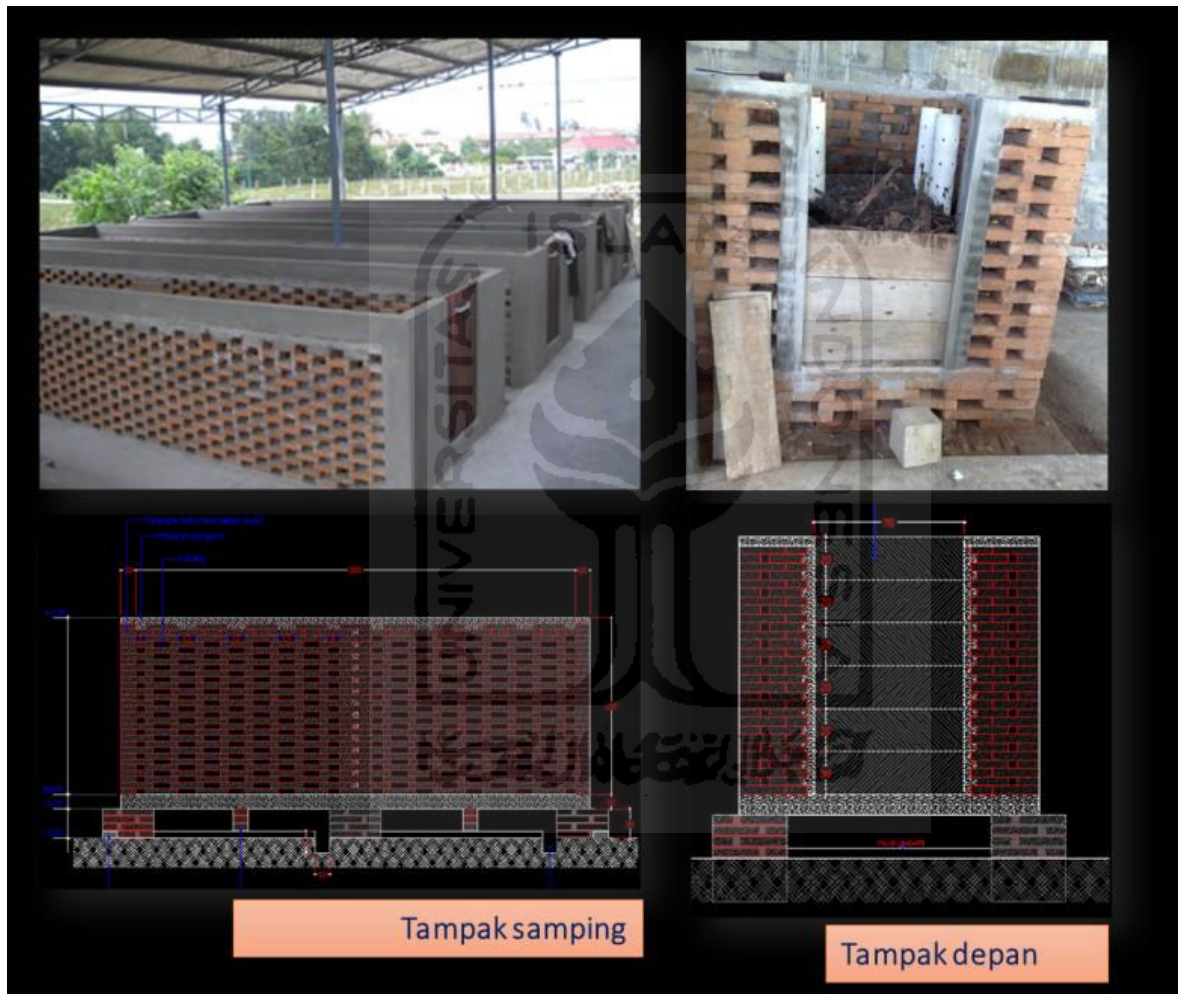


Figure 23 Composting Unit

Source : Petunjuk Teknis TPS 3R

MINIMUM TPS 3R BUILDING DESIGN

The design of the 3R TPS building must at least contain the following:

1. Receiving area/dropping area;
2. Sorting/separation area;
3. Enumeration area with a chopping machine;
4. Composting area with the chosen method;
5. Compost/wind ripening area;
6. Has a compost warehouse and stall as well as a residue area;
7. Have a minimum office;
8. Have clean water and sanitation facilities.

2.6.2 Waste Treatment Equipment

Bag Splitter

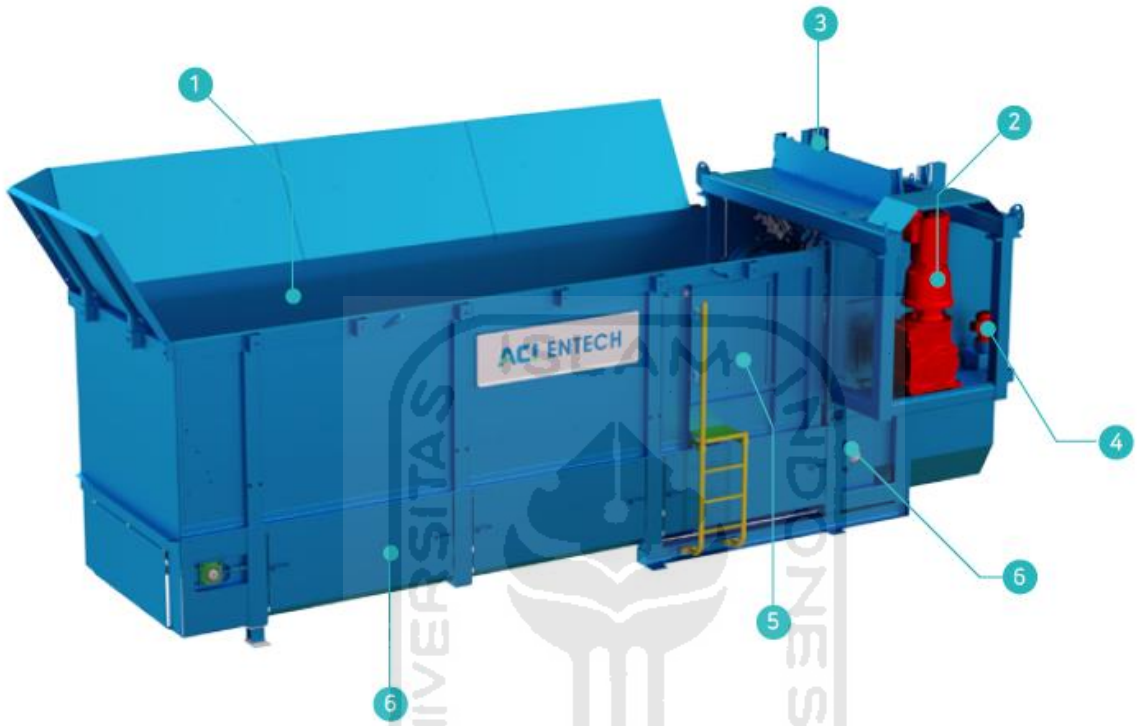


Figure 24 Bag Splitter

Source : ACI ENTECH

Ballistic Separator

Technical Data

* Standard Density: 0.06ton/m³

	ACI-BC-40	ACI-BC-60	ACI-BC-80	ACI-BC-120
Capacity	60m³/hr 3.6ton/hr	90m³/hr 5.3ton/hr	120m³/hr 7.1ton/hr	180m³/hr 10.7ton/hr
Power Consumption	5.5kW	7.5kW	11.0kW	
Paddle Length	5.5m			
Paddle Q'ty	4EA	6EA	8EA	12EA
Power Supply	380-400V, 50/60Hz			
Dimension W x L x H	2,260 x 7,955 x 2,600mm	3,050 x 7,955 x 2,600mm	3,440 x 7,955 x 2,600mm	4,625 x 7,955 x 2,600mm

* Depending on properties and bulk densities of input materials, the abovementioned capacity may vary*
* The specifications can be modified for the quality improvement

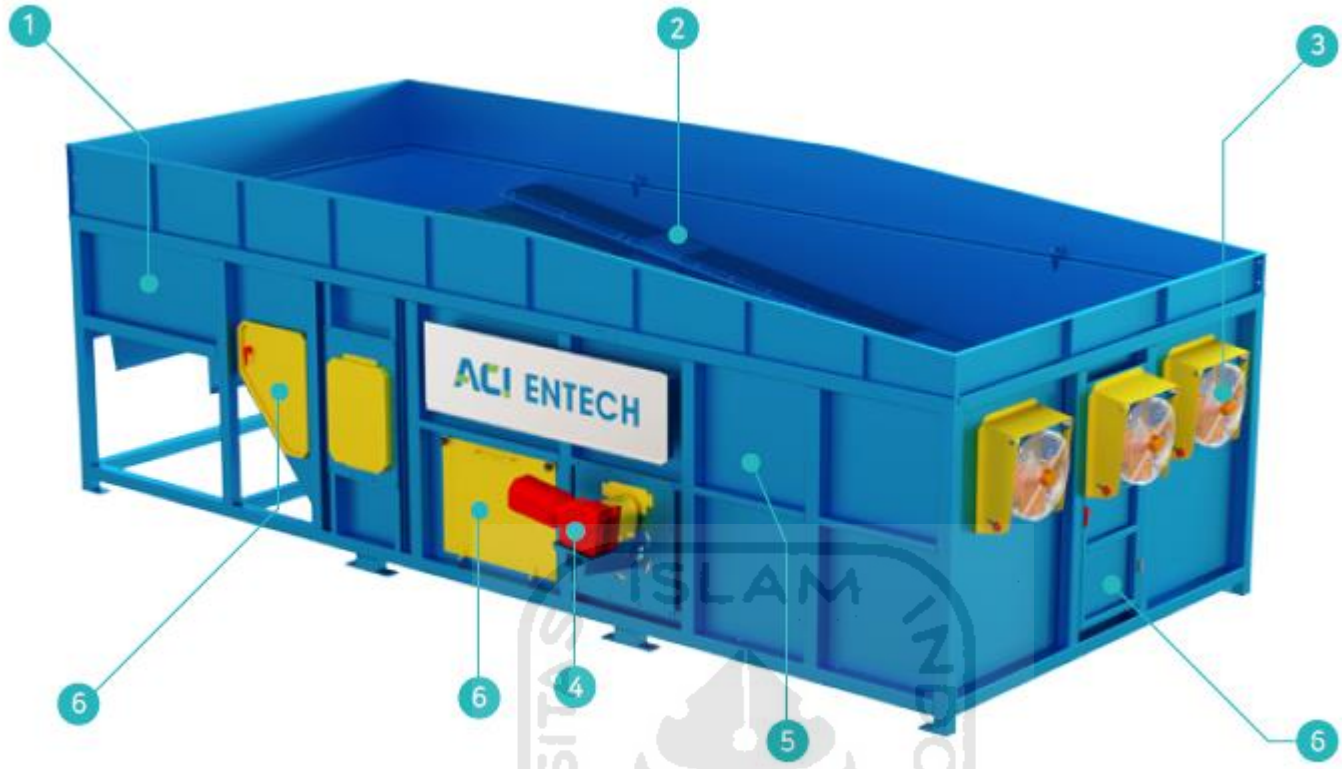


Figure 25 Ballistic Separator

Source : ACI ENTECH

PET Bottle Piercer

Technical Data

* Standard Density: 0.06ton/m³

	ACI-PM-N8	ACI-PM-N14
Capacity	0.5ton/hr	0.9ton/hr
Power Consumption	2.2kW	3.0kW
Power Supply	380-400V, 50/60Hz	
Dimension (W x L x H)	1,100 x 1,200 x 1,000mm	1,500 x 1,200 x 1,000mm

* Depending on properties and bulk densities of input materials, the abovementioned capacity may vary
* The specifications can be modified for the quality improvement

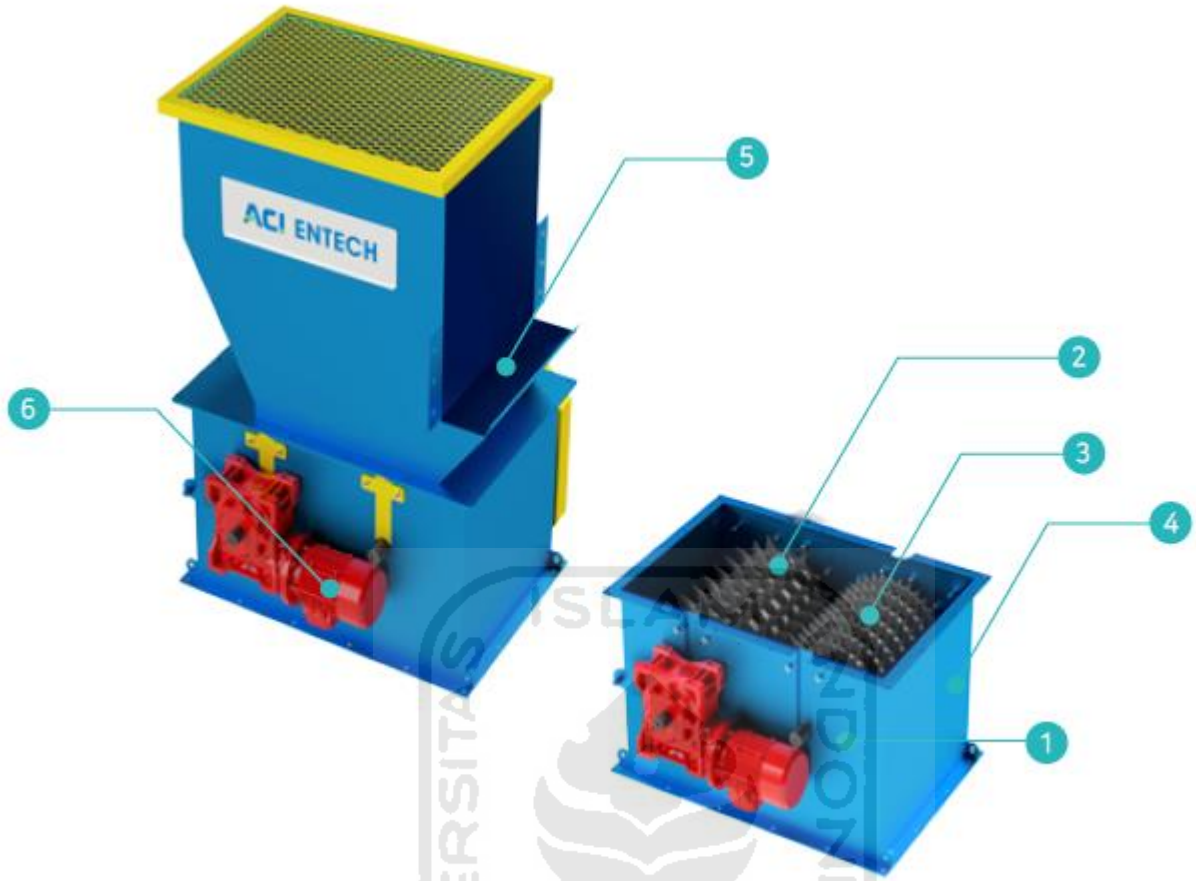


Figure 26 PET Bottle Piercer

Source : ACI ENTECH

Semi Automatic Baler

Technical Data

* Standard Density: 0.06ton/m³

	AVOS 141-15/50	AVOS 181-15/50
Bale Dimension(WxH)	1,100 x 750mm	
Bale Weight	660kg(Max)	
Cycle Time	42sec	54sec
Press Force	500kN	
Power Consumption	15.0kW	
Dimensions (W x L x H)	2,200 x 7,200 x 2,350mm	2,200 x 8,080 x 2,350mm

* Depending on properties and bulk densities of input materials, the abovementioned capacity may vary
* The specifications can be modified for the quality improvement

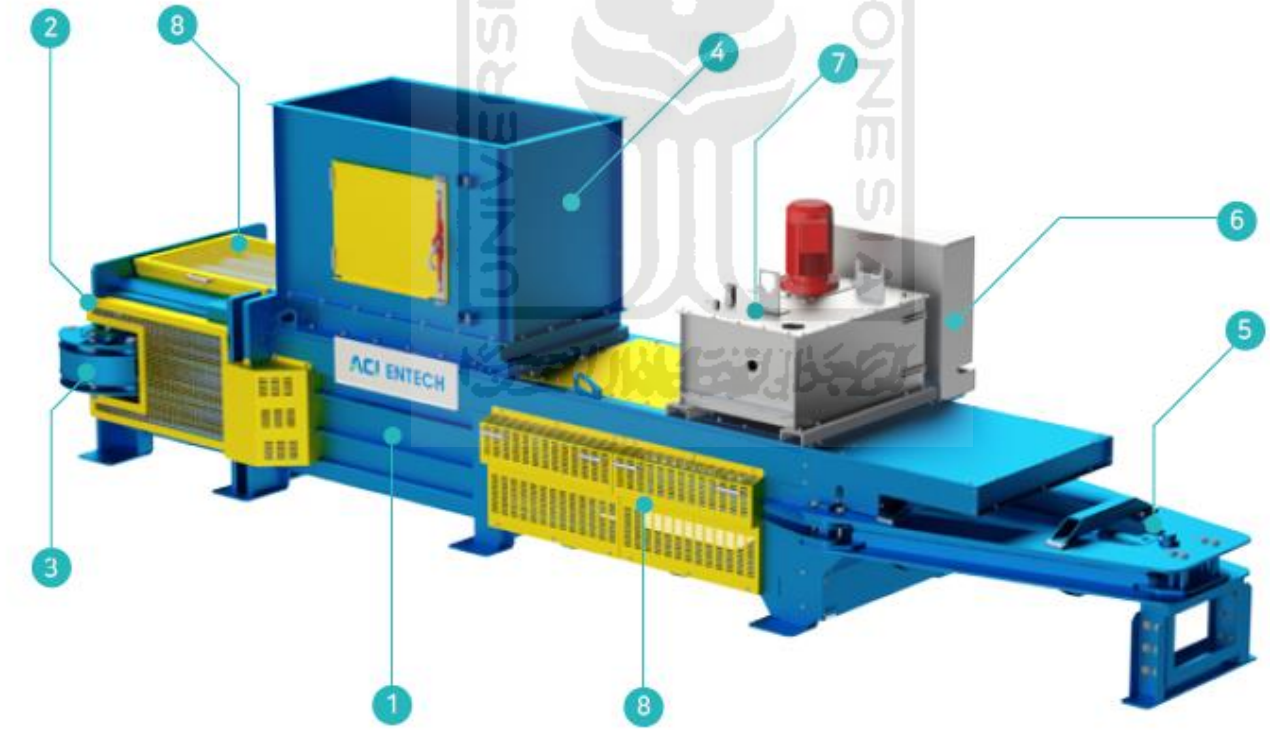


Figure 27 Semi Automatic Baler

Source : ACI ENTECH

Waste Truck Standard

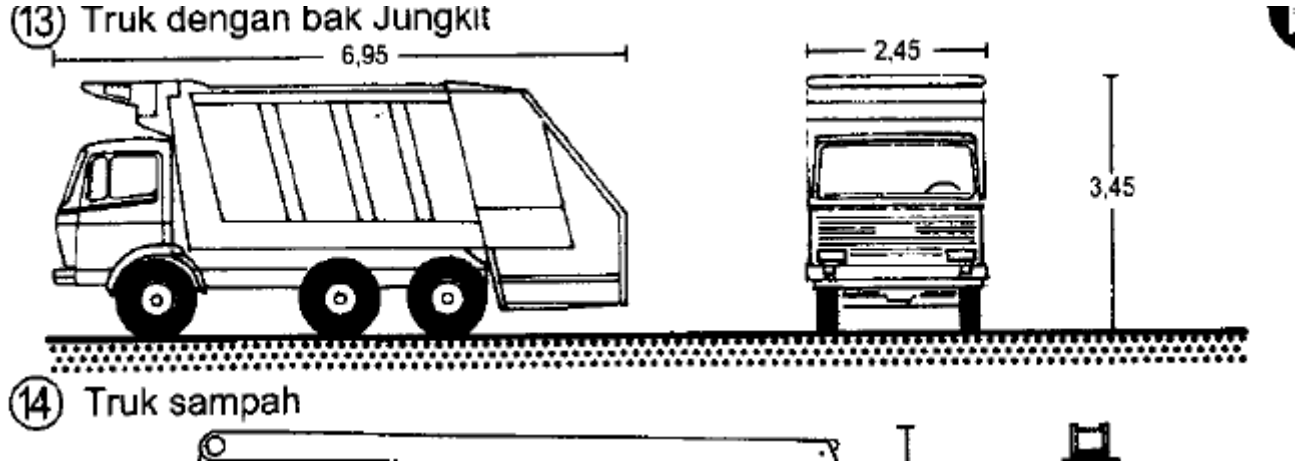


Figure 28 Garbage Truck Dimension

Source : Data Arsitek Jilid 2

Garbage trucks by standard have a length of about 7 meters with a width of 2.5 meters and a height of 3.5 meters.

For circulation, a road of more than 3.5 meters is needed for better circulation. (Data Arsitek Jilid 2)

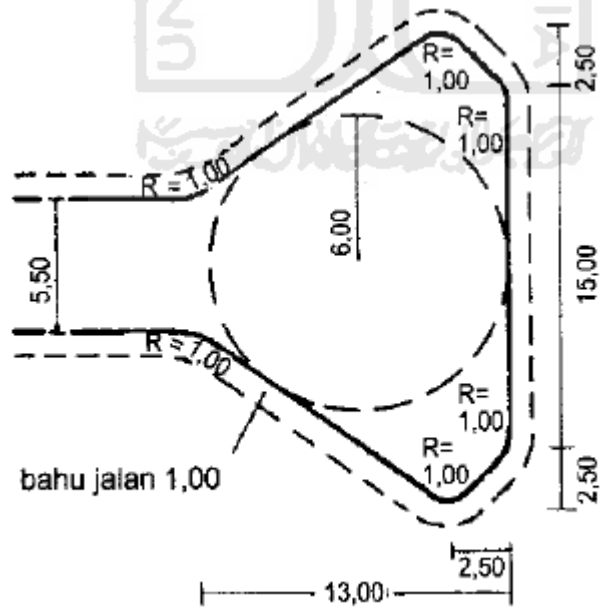


Figure 29 Truck rotation dimension

Source : Data Arsitek Jilid 2

2.7 WASTE TREATMENT BUILDING PRECEDENTS

TPA Bantar Gebang

Figure 30 TPA Bnatar Gebang

Source : PEMPROV DKI JAKARTA

Bantar Gebang landfill is a waste processing facility in Jakarta. In its waste processing system, Bantar Gebang has many systems used in waste processing.

From the start of the waste transportation flow, it has been planned systematically, one of which is by having a control building to check every incoming truck. Not only that, once done, this truck will be cleaned and ready to do the job again.

In Bantar Gebang itself has facilities such as the Wastewater Treatment facility and also a garbage power plant that utilizes methane gas from the waste

Sunset Park Material Recovery Facility

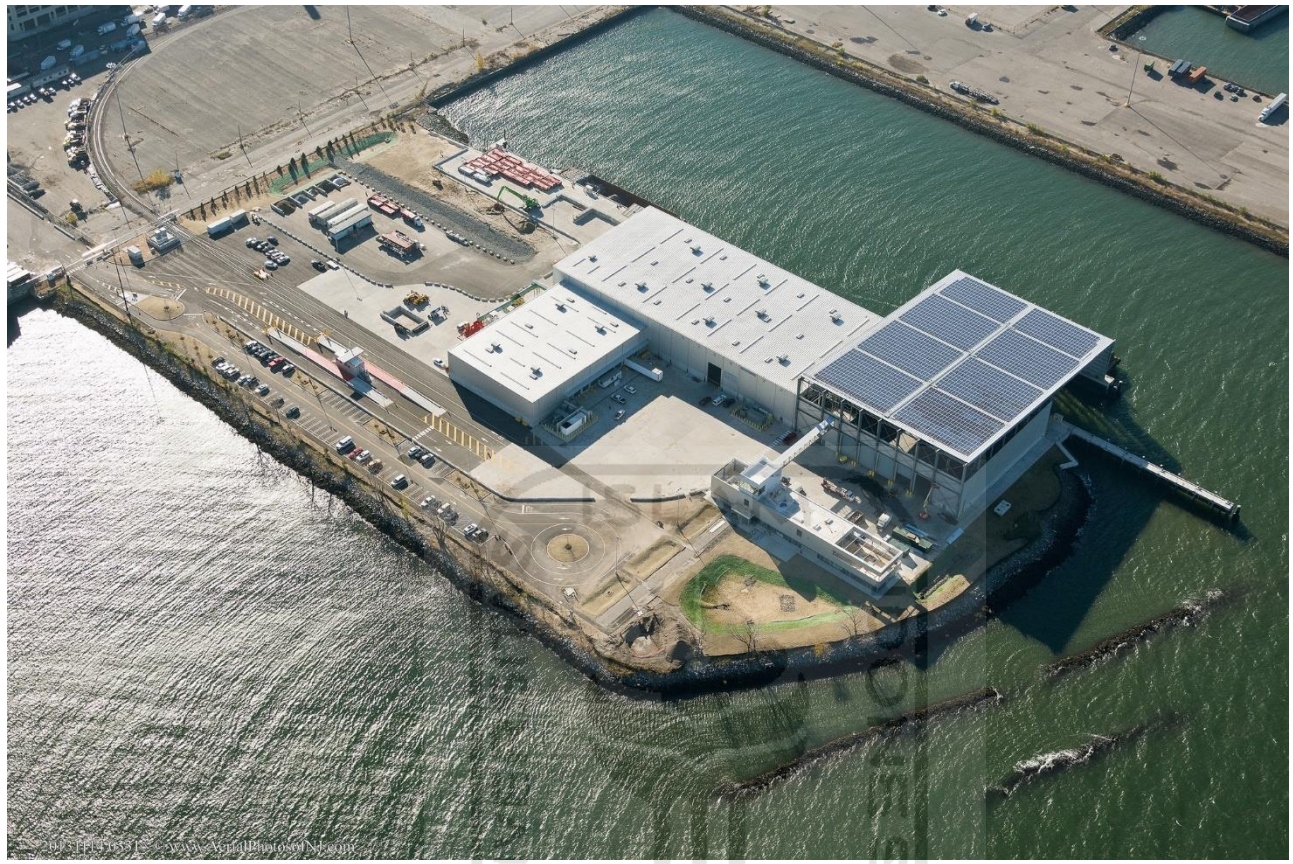


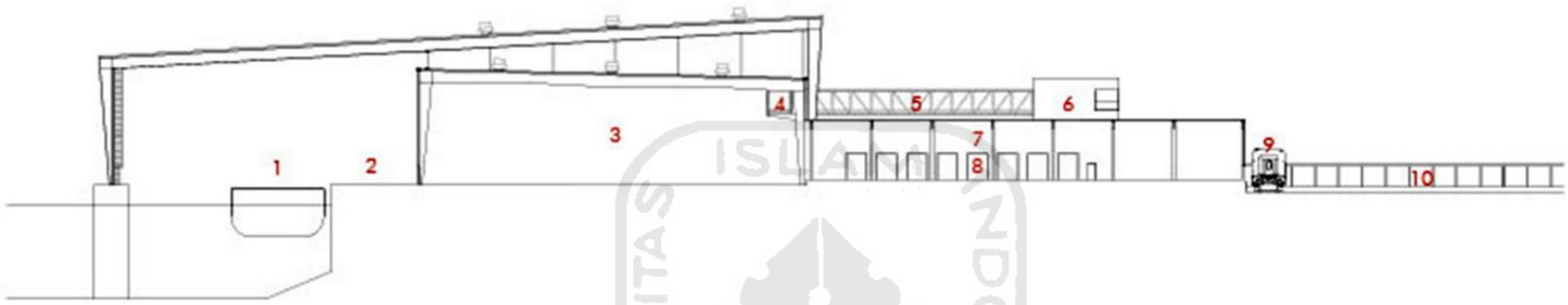
Figure 31 Sunset Park Material Recovery Facility

Source : archdaily.com

The concept organizes buildings to support functionality, adds two acres of natural vegetation, and develops discrete circulation networks to safely separate visitors from operations. Buildings are also arranged to create a unique urban backdrop for the property. The 140,000-square-foot facility includes a Tipping Building, which receives recyclables by barge and truck; a Processing Building, which houses more than $25 million in complex sorting equipment, as well as an electrical compressor, fire pump, and supervisor rooms; a Bale Storage Building with eight loading docks; and a personnel building (lunch room, locker rooms, and offices).

SUNSET PARK MATERIAL RECOVERY FACILITY
SECTION BB

0 16' 32' 64'



1 BARGE
2 BARGE UNLOADING
3 PROCESSING BUILDING
4 VIEWING PLATFORM
5 PEDESTRIAN BRIDGE
6 EDUCATION CENTER AND ADMINISTRATION BUILDING
7 BALE STORAGE BUILDING
8 TRUCK LOADING
9 RAIL LOADING
10 COVERED WALKWAY

Figure 32 Sunset Park Zoning

Source : archdaily.com

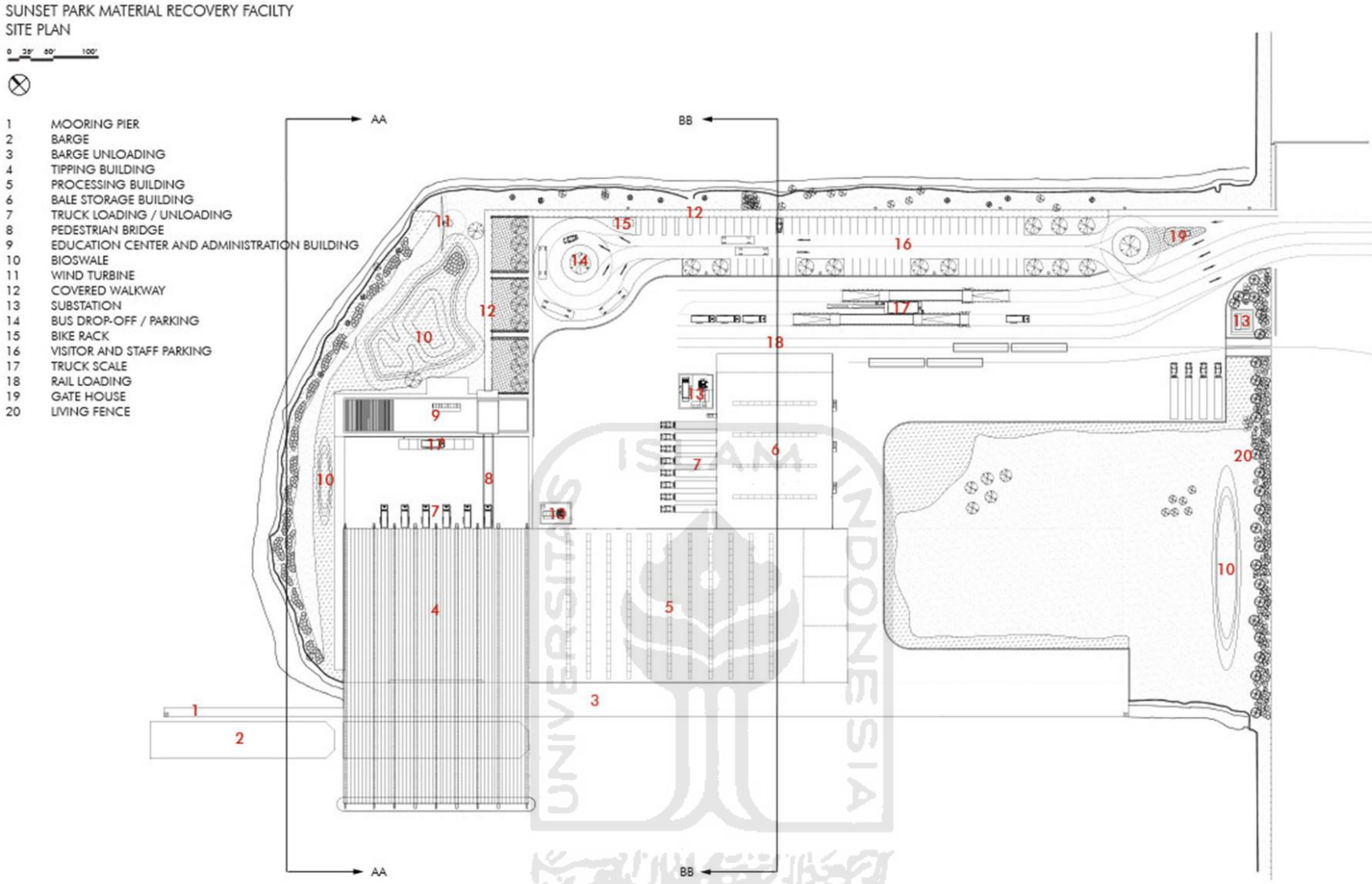


Figure 33 Sunset Park Siteplan

Source : archdaily.com

One of the project's most distinctive elements is the Education Center. Classrooms, exhibitions, and interactive demonstration displays are among the facilities available to schoolchildren and the general public. A steel bridge connects the Education Center to a viewing platform inside the Processing Facility, which is a crucial feature of the design. Students and guests can watch the recycling process in action from the viewing platform.

2.8 BUILDING SKIN PRECEDENTS

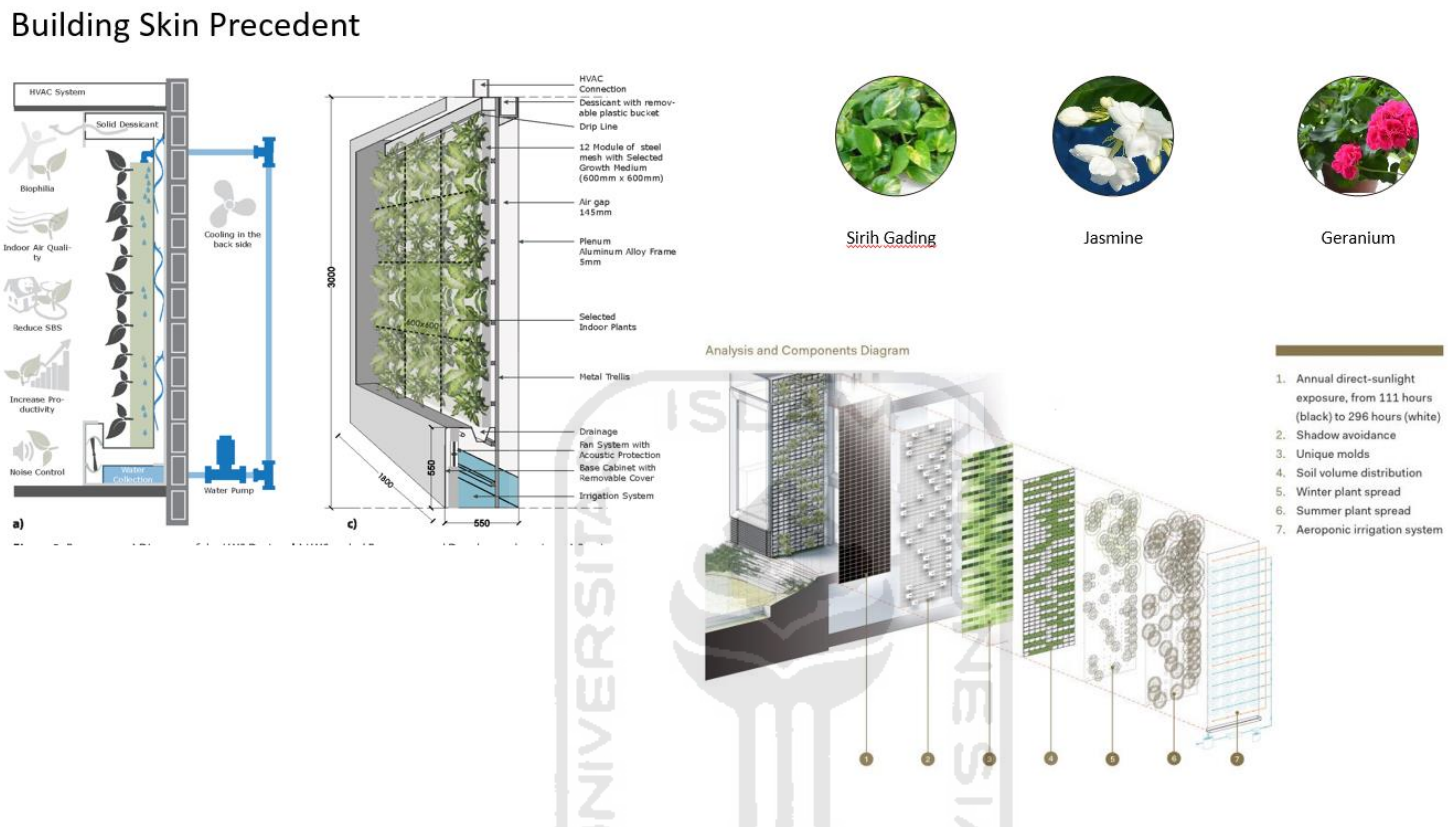
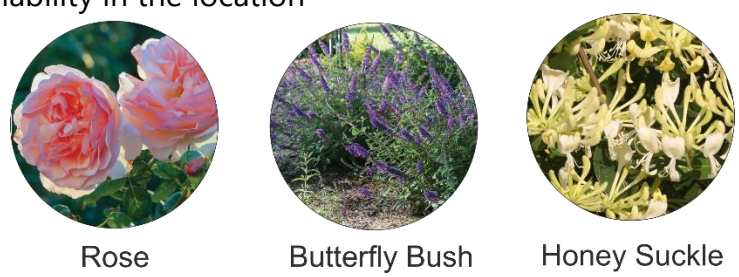


Figure 34 Plant Building Skin

Source: archinect.com

Several related technologies regarding building skins are used as references. Various building skins have different uses. In this case, an example of a building skin using plants is used as an effort to reduce odors. These plants are then selected based on their effectiveness as well as their availability in the location



CHAPTER 3

DESIGN CONCEPT

In this chapter, we will discuss the design concept to solve the problem based on the review from the previous chapter. The concept begins with the formulation of the function and type of building typology, where more in-depth concepts will be discussed regarding matters relating to the needs and functions of space. Followed by the concept of the surrounding environment, with various considerations in formulating a site-focused design. Then it will be continued with a more detailed design

3.1 WASTE TREATMENT BUILDING AS INDUSTRIAL FACILITIES

Waste Treatment Building is a building that is included in the typology of industrial buildings.

3.1.1 Functions: Waste Treatment Facilities

There are problems that are really important to solve in design with many consideration regarding finding the design solution.The first one is this site **located in a not ideal environment** therefore the **Urgency to keep the indoor air quality** in a building is important. In the process to keep the air quality, there are some aspects that need to be considered, there is the **Need for natural ventilation** as a healthy air source and the need for **building skin to filter the odors** from the waste treatment process.

And there are the main point in this design as a design requirement

1. How to design building skin that can reduce odor from the waste treatment process?
2. How to design a building that can keep the indoor air quality well preserved?
3. How to Integrate a natural ventilation system with building skin?

The design method used in the design of the Waste Treatment Building in Piyungan is a problem-solving method. Looking for problems that can be solved by architectural theory, green architecture and focusing in indoor air quality. Analyze the design approach on architectural components including, space, footprint, shape and appearance buildings, structures, and building utilities. Formulate a concept from the results of the analysis which will be the reference in designing a Waste Treatment Building. Carrying out a design transformation from concepts that produce a result Waste Treatment Building design in Piyungan. Then do a more detailed design development.

In the process of designing a building, matters relating to the technology to be used will be adjusted to the context of the problem with reference to various sources. And for the performance of the build itself, design tests will be carried out using several simulation software. After going through the evaluation process, a final design will be produced that meets these evaluation standards.

The main function of the building is the waste treatment building, where several room criteria and standards are needed to ensure that the operational system works optimally.

3.1.2 Space programming for Waste Treatment Building Spatial Relation Concept

Space program in a building that contains various criteria and types of space needed to fulfill the function of the building.

1.Reception / dropping area;

2. The sorting/separation area;

3. The enumeration area with a chopping machine;

4. Composting area with the selected method;

5. Has a compost warehouse and shelters as well as a residue place;

6. Have a minimum office

Approaches to the surrounding environment that need to be considered in site processing. Access can be distinguished between garbage trucks that go directly to the bunker. Then access for pedestrians and also working staff. At the front of the site, a hall is provided which can be used for various activities.

In the operational process, the garbage truck will directly enter the building to the tipping hall and transfer the waste to the bunker that has been provided. Then the waste will be processed in the next process which will produce output both energy and other objects.

Space organization contains relationships between spaces, where distances and connections are taken into account in order to have a well-integrated design.

The waste processing process itself has various different types, both organic and other types of waste. In processing, there are at least three different processes for each type of waste. Namely physical, biological and thermal. For those specific process , need an integration of room programming , also spatial zoning that can work well each other and make optimum condition for waste processing

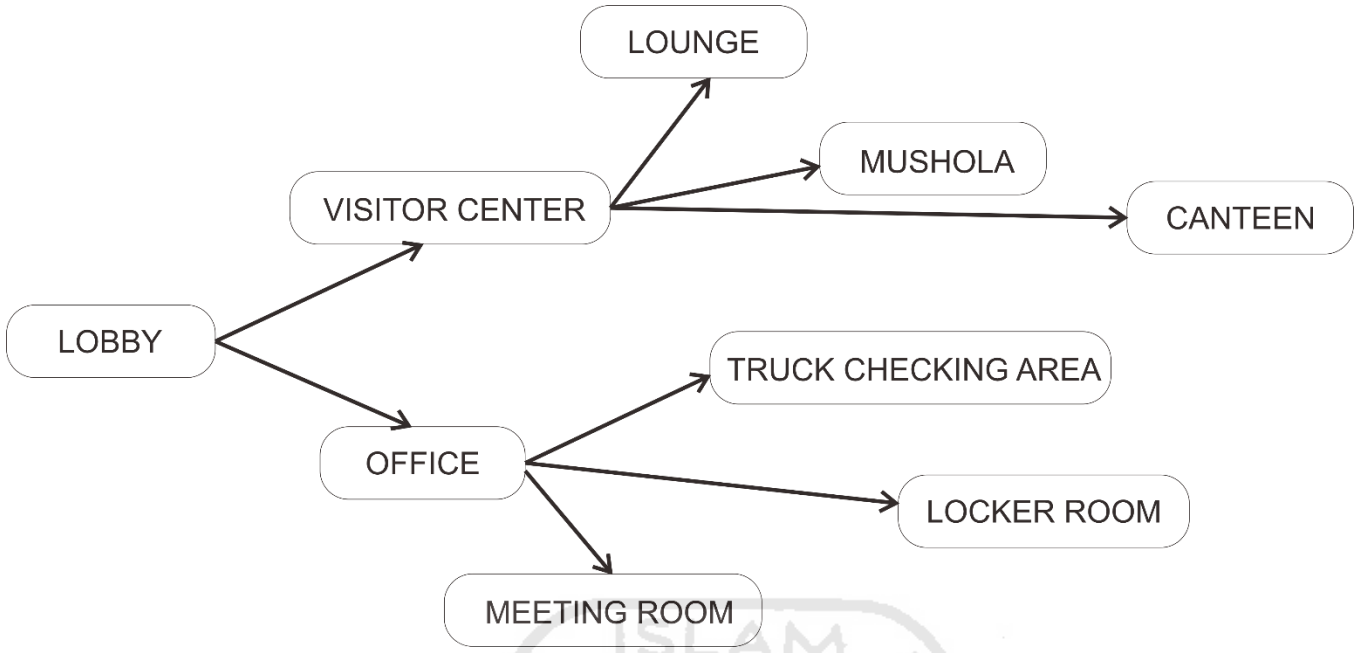


Figure 35 Room Programming for Building Facility

Source : Author

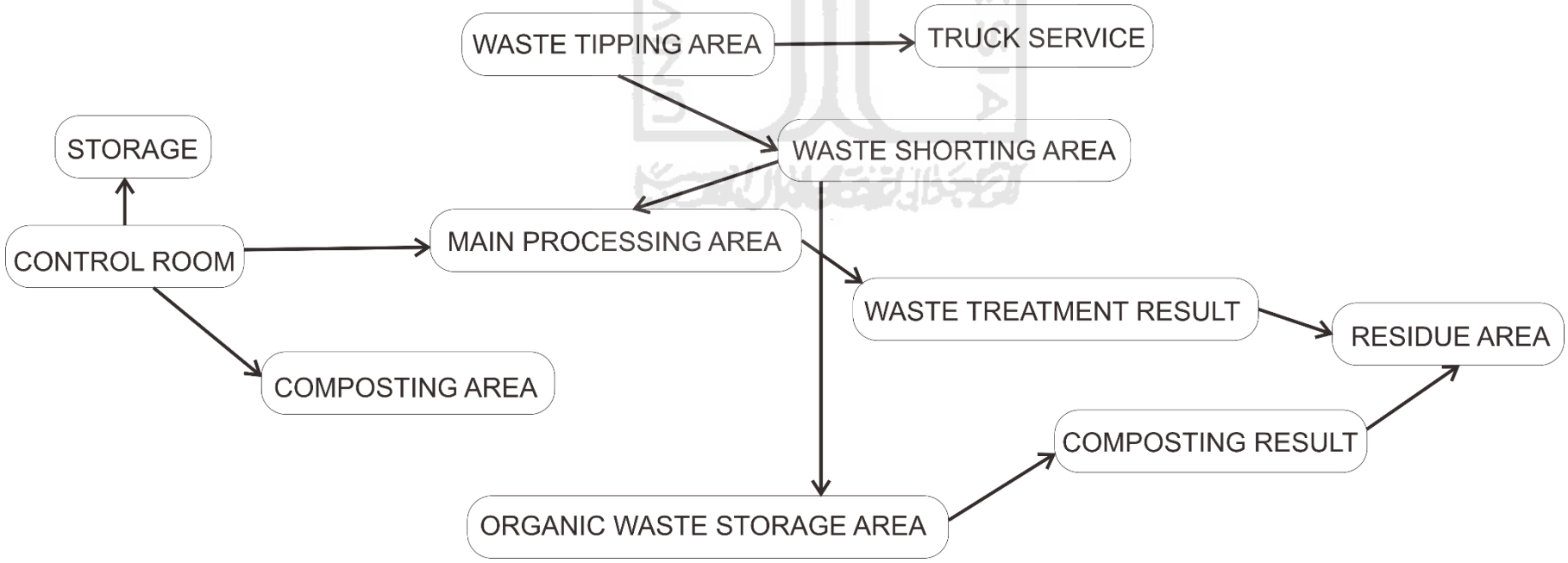


Figure 36 Room Programming for Waste Treatment Process

Source : Author

In the first, the waste processing flow starts from dropping and then a zone separates between organic and inorganic. These two zones are located between the office which makes it easy for monitoring. However, the office itself is located within the dropping area to avoid the added smell of trash so that it cannot be fully controlled. The solution will be a special office for dropping trash.

Classification of function rooms based on their specific uses. By classifying the space, it will be easier to arrange the mass of the building in more detailed aspects, such as orientation and opening. Also its considering the flow of the waste treatment itself from beginning.

3.2 SITE CONCEPT AND BUILDING FORM FOR WASTE TREATMENT BUILDING

Site and Neighborhood is an important consideration in formulating a concept, where this aspect becomes a consideration for how the building has a connection to the surrounding environment. The concept of building mass, and others is the formulation of this approach.

3.2.1 Building mass based on Indoor Air Quality Concept

Configuring the shape of the building mass, where various aspects need to be considered related to the shape and arrangement of the building.

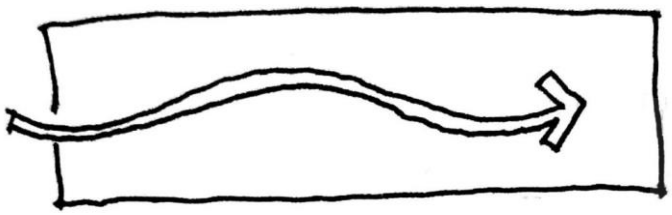


Figure 37 Mass Alternatif 1.

Source : Author

The shape of the building mass which is the first alternative is a rectangular building. This form was chosen because it has an elongated building area so that the waste processing system in the building can run well due to one unit without any boundaries.

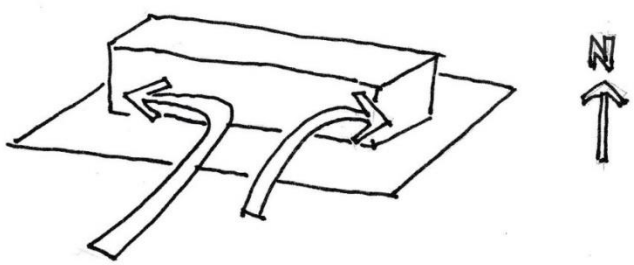


Figure 38 Building Mass Alternatif 1.

Source : Author

The building mass has a compact shape with an elongated shape. The advantage of this mass is that the system integration in the building can be more integrated through a mass. But the drawback is that with its large shape, the wind and air circulation and sunlight are less than optimal.

This mass concept is not really ideal, because for the circulation of the site itself will be difficult to enter.

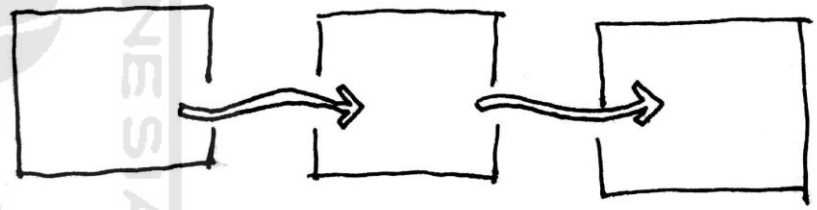


Figure 39 Mass Alternatif 2

Source : Author

The shape of the second building is in the form of a box, where the room is smaller but on the other hand can be more detailed in differentiating the waste processing process at certain stages, such as a special room for sorting, or a room for composting.

The wind is one of the factors in determining the configuration of the building mass, the dominant wind direction is from the southeast. By considering the orientation and openings at the site, it is hoped that this

natural wind will be one of the important values in maintaining indoor air quality.

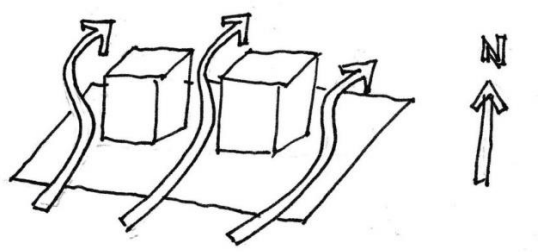


Figure 40 Building Mass Alternatif 2

Source : Author

The second alternatif is choosen because its more suitable in the concept. The movement of the air is one of the consideration to make optimum aspect of indoor air quality

For building mass , the main consideration about orientation in alternative 1 is about the sun direction itself , that affect in forming a mass. And the placement of the each mass is based on the area that affected by odors. With that space hoped its alright . In the future development with the vegetation around the site to keep the air quality good, also added some specific plant in the site

The building mass has several separate masses. The advantage of this form is that it is easy to circulate air and also natural lighting that enters the building due to the many openings in each mass. However, the drawback is that it requires its own system for each mass so that it is better operational

3.2.2 Building orientation and opening for Indoor Air Quality

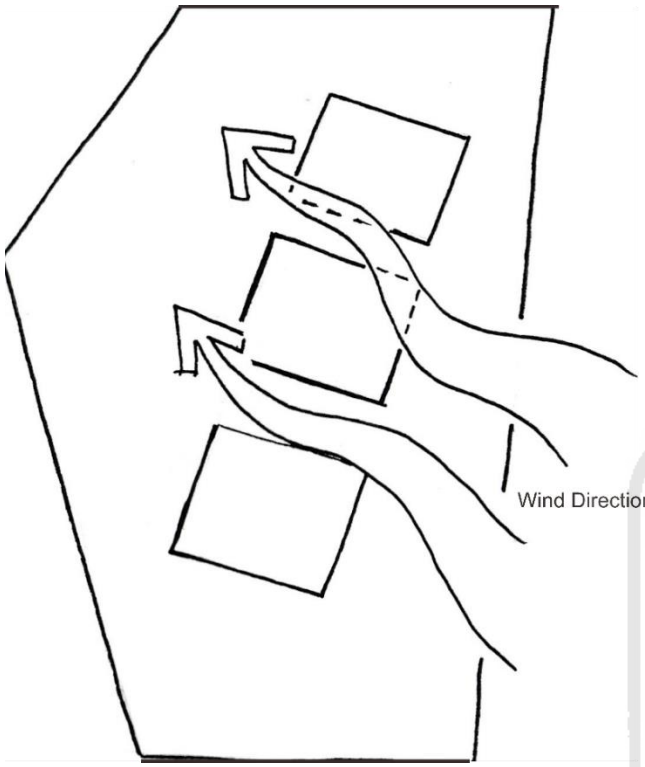


Figure 41 Building Orientataion Alternatif 1.

Source : Author

The building orientation in the first alternative maximizes natural wind flow with the building mass facing south east.

With mass that split into multiple , give it gap to wind for go through the mass and make the condition more breeze.

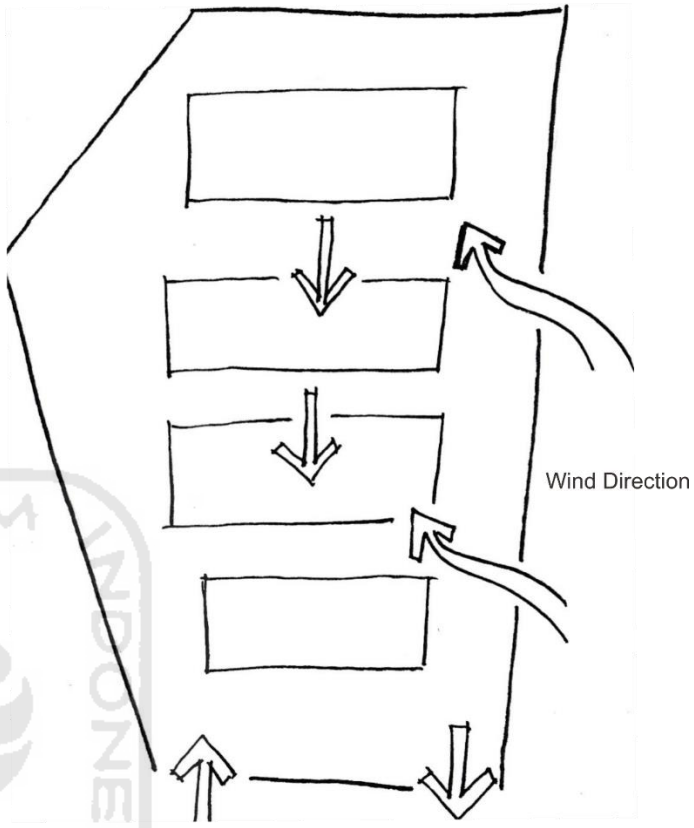


Figure 42 Building Orientataion Alternatif 2

Source : Author

the second alternative is the mass of the building oriented towards the main access so as to produce a mass form that extends sideways. With the mass that extends to the side, making the wind less effective in reaching all parts of the building

The first alternative was chosen because it is more suitable and effective for indoor air quality, where the wind from the site can be utilized by the building period.

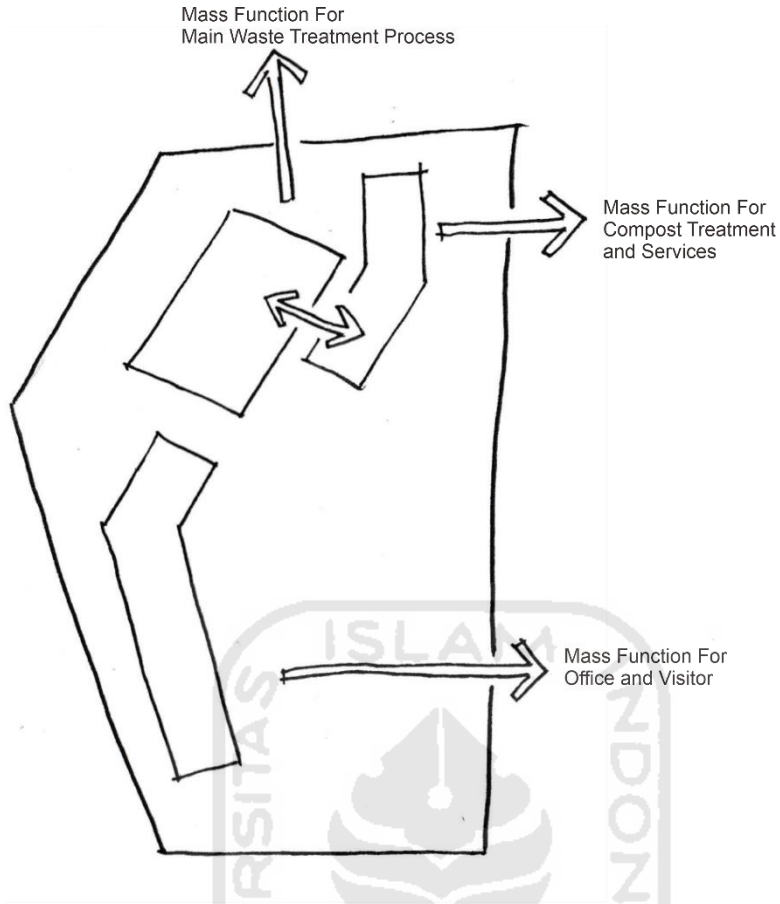


Figure 43 Building Mass Function Separation

Source : Author

From the selected mass form, it is then adjusted to the Waste Treatment Building space program so that 3 different masses are produced. The first mass is a building that functions as the management office of the Piyungan Waste Treatment Building. Inside there are various facilities for the office and visitors. The second mass is the main building for processing waste, where there is a tipping area and also the main tool for processing waste using machines. While the 3rd Mass is a building that functions as a place for composting waste and also a garbage truck service area.

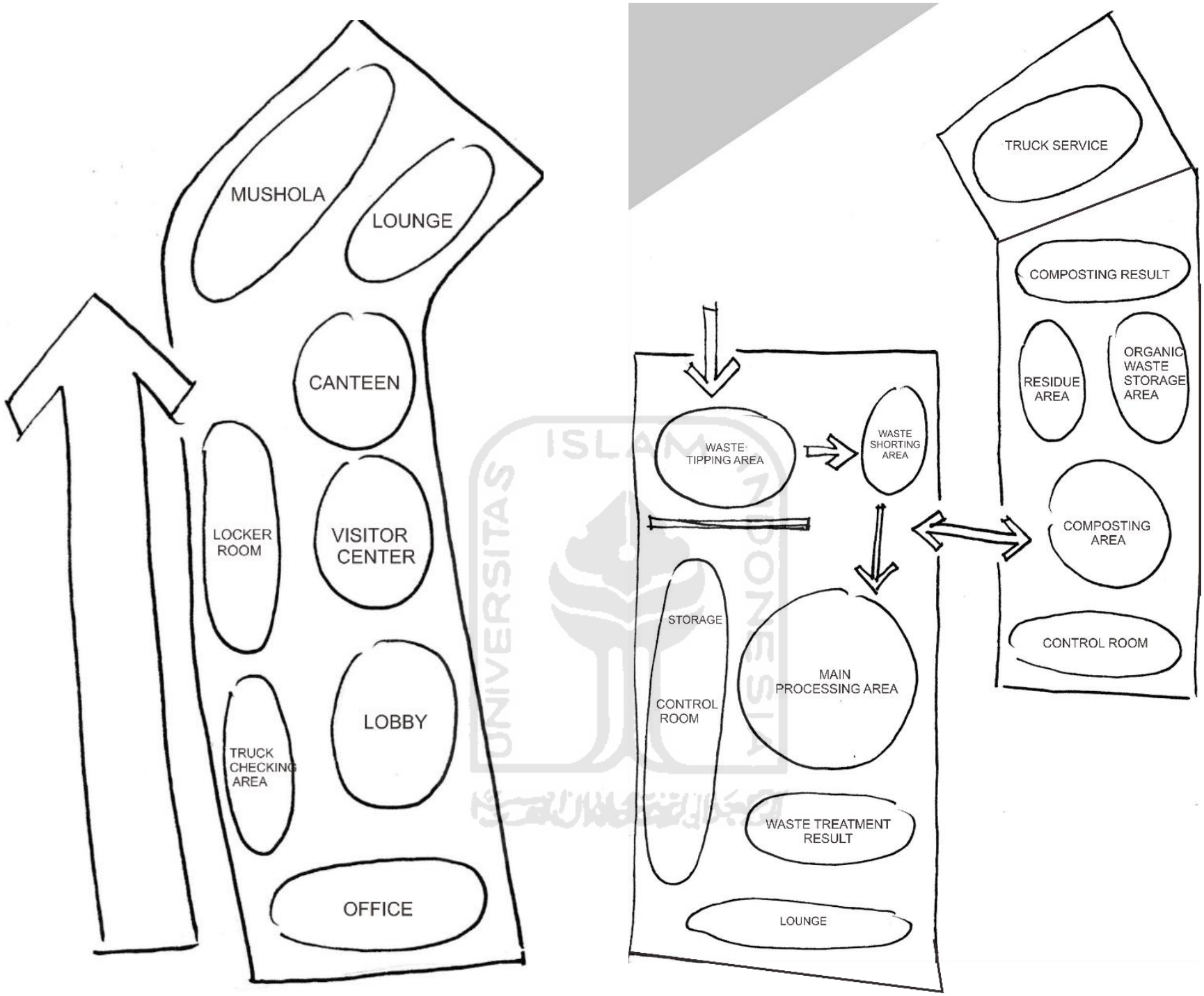


Figure 44 Building Mass Room Layout

Source : Author

3.2.3 Building Opening in Order to Maximize Indoor Air Quality

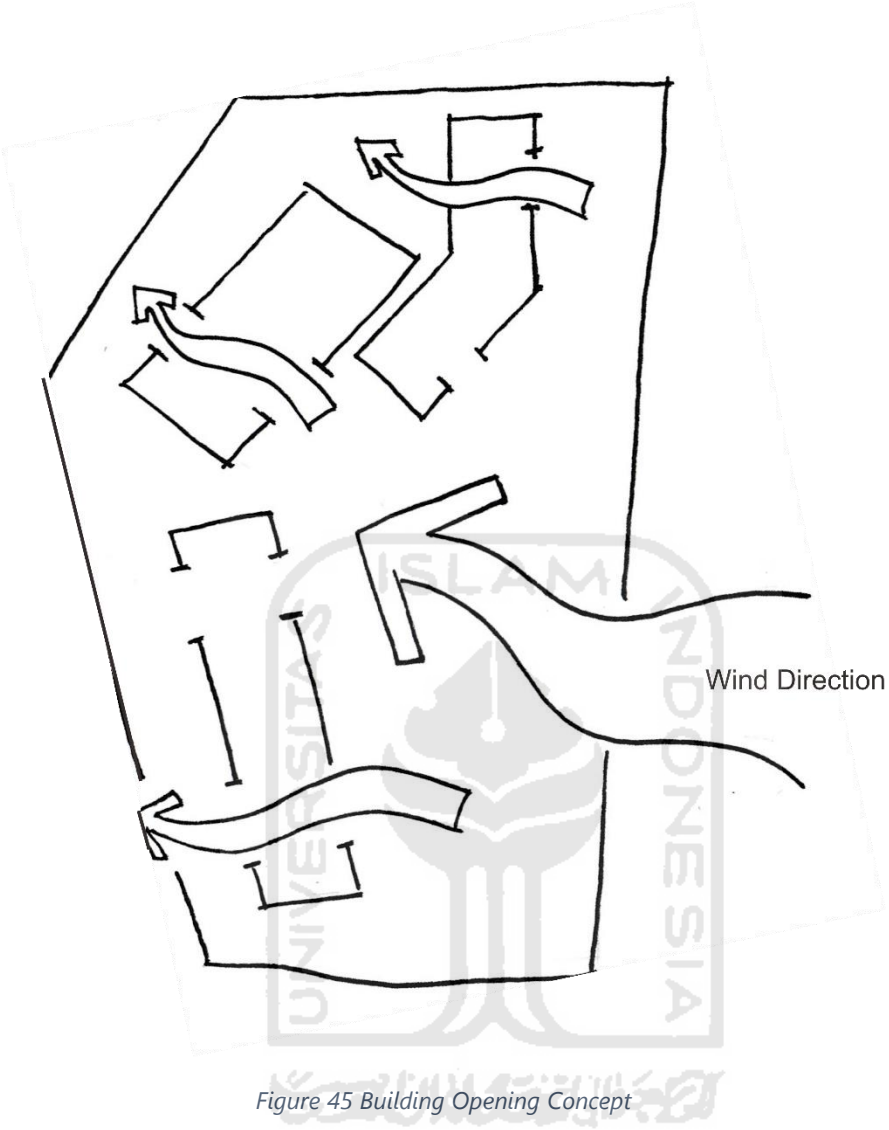


Figure 45 Building Opening Concept

Source : Author

The opening in the building is made so that it produces a lot of cross ventilation from natural air. So that the condition of the space in the building becomes fresher and the air circulation is smooth

3.2.4 Effectiveness of Building Access for Waste Transportation Process

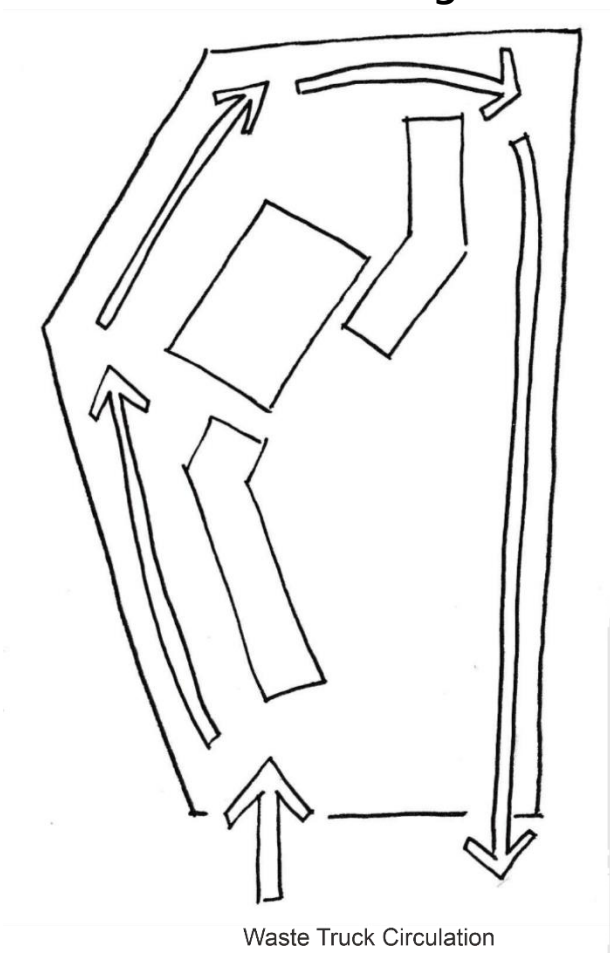


Figure 46 Garbage Truck Access Concept

Source : Author

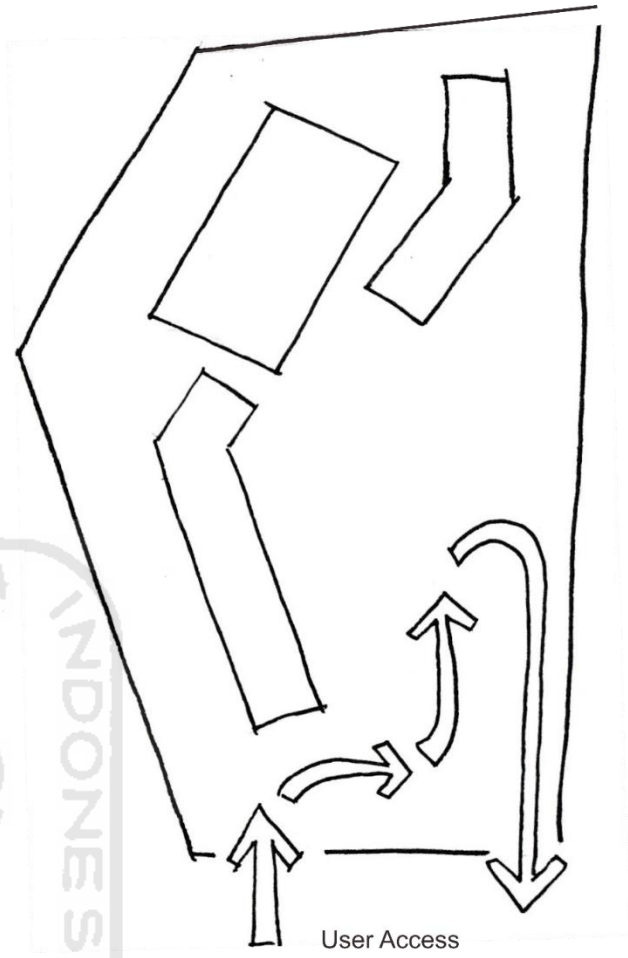


Figure 47 Vehicle Access concept

Source : Author

Circulation is designed so that vehicles, especially vehicles for transporting garbage, can operate optimally, so that access is provided to the inside of the building.

The building orientation in the alternative based on access, with buildings facing the main access, it is hoped that it will facilitate the transportation of waste that occurs

Then for visitor access and office workers, namely through the main access which then goes to the parking area in front of the site

3.2.5 Landscaping and Vegetation as Odor Absorbers

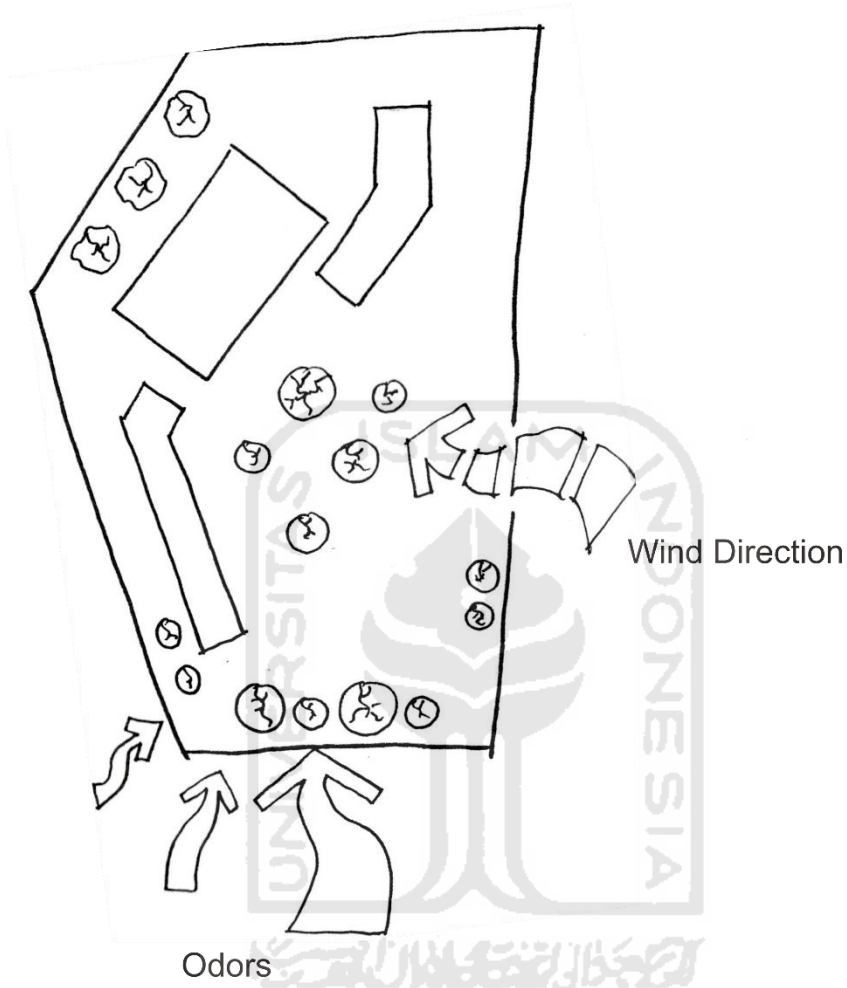


Figure 48 Vegetation Concept

Source : Author

Because the majority of odors come from the front of the site, by using vegetation as a barrier against odors so that the impact can be reduced

In the Site , there are many spot that provide a garden space , this garden function to reduce the odors from several spot in this waste treatment building area. This garden is consist of various aromatic plant such as lavender that is plantable in the site.

The plant that used to decrease the odors is varied based on the sized also the compatibility , the smallest one there are mint and lavender because of their size and easy to plant as the result can reduce odors.

3.3 BUILDING ELEMENTS CONCEPTS FOR WASTE TREATMENT BUILDING

3.3.1 Building Envelope and Roof for Indoor Air Quality

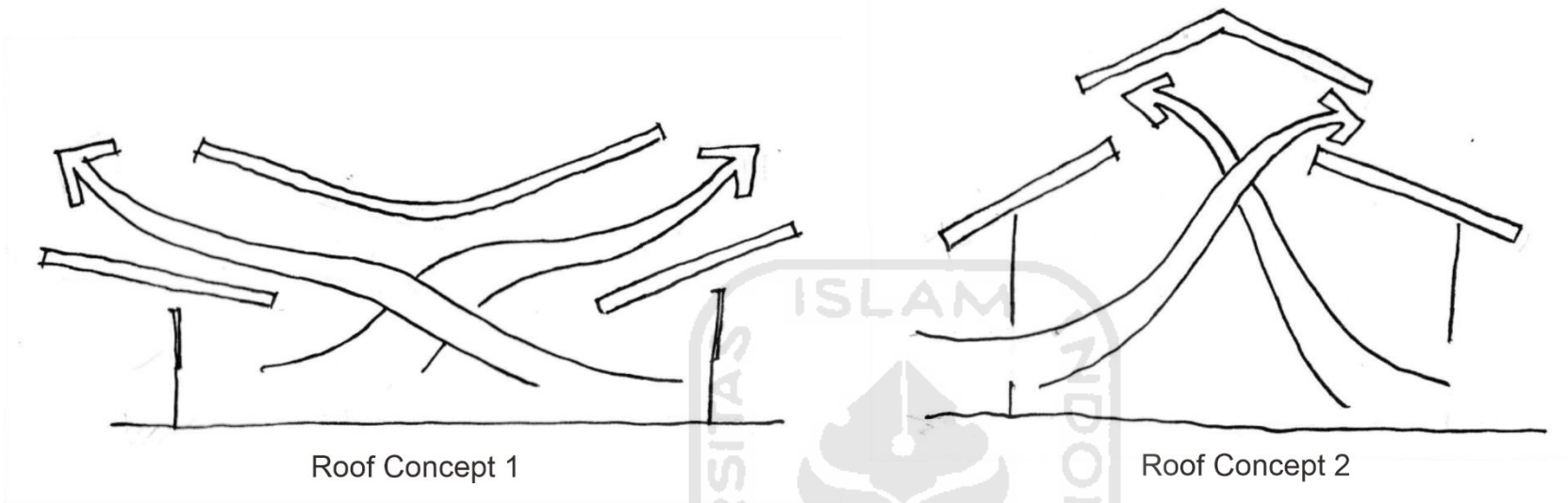


Figure 49 Roof Concept

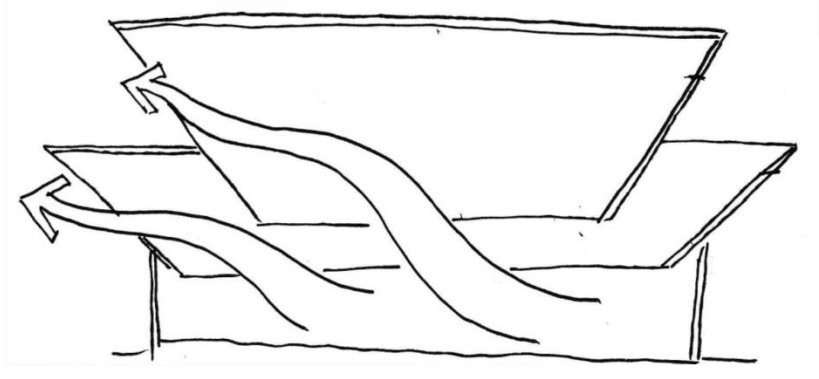
Source : Author

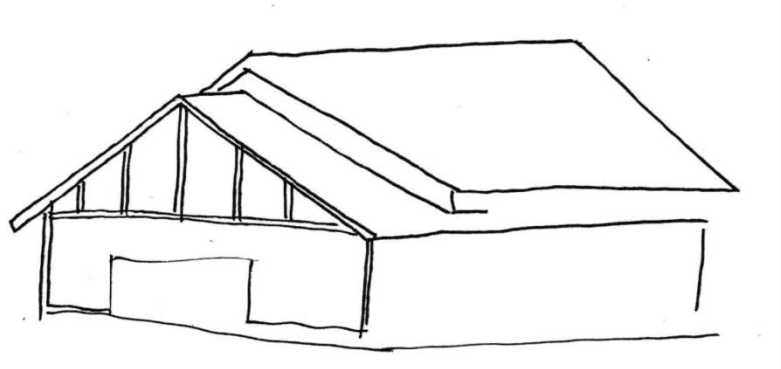
the shape of the building that has a different height at the top makes it easier for hot air to get out of the building.

In the first roof concept, the roof has an opening on the right and left. However, it is not very suitable for tropical climates where when it rains, water will easily enter.

In the 2nd roof concept , the roof has an opening at the top along the main roof , so that air gets circulation at the top . This roof also has a slope that is suitable for use in tropical climates

For the main building of the Waste Treatment Building, the 2nd roof concept is more appropriate.





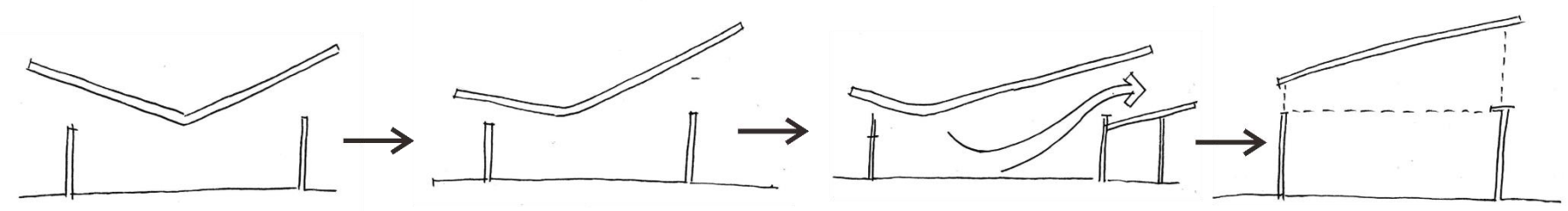
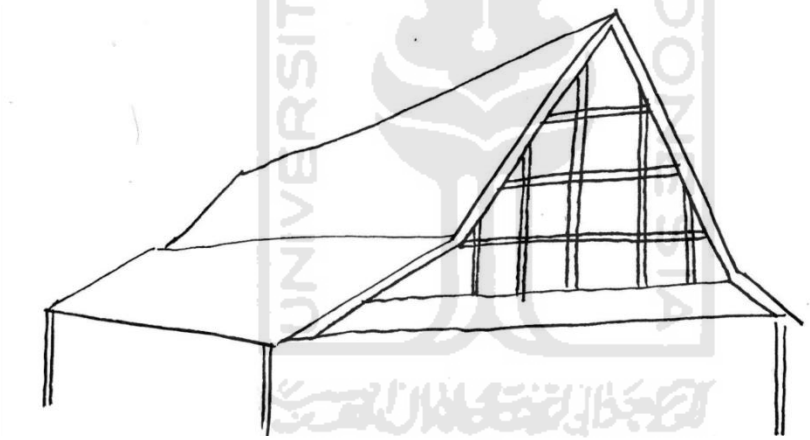
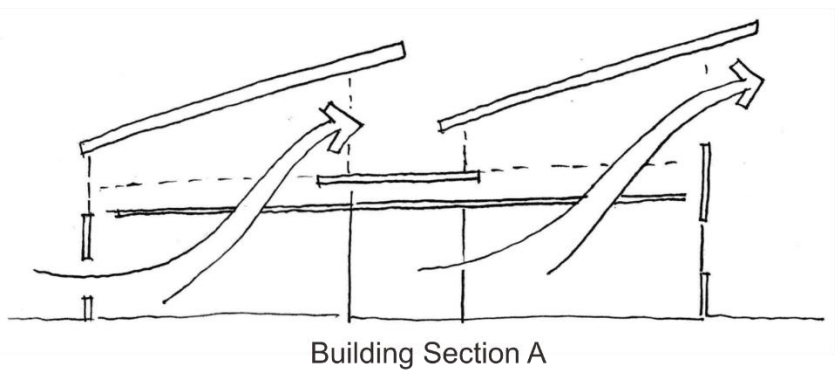


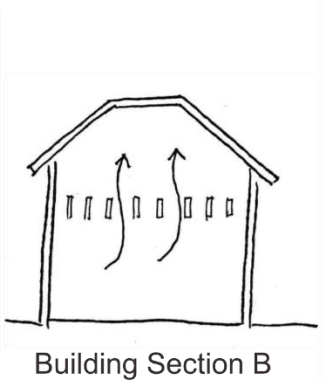
Figure 50 Roof Concept 2

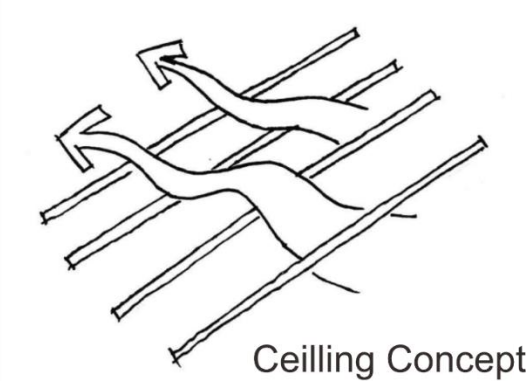
Source : Author

For the concept of a smaller building roof, the concept is formed by making an opening on the roof so that natural ventilation considerations can be fulfilled. Then the shape of the roof is adjusted to the climatic conditions and coupled with the connection between the roofs as a single building unit.









The ceiling concept is to maximize natural ventilation as best as possible, so that a thin and slim building ceiling is formed so that air circulation is better.

3.3.2 Building Façade and Skin for Odors Decrease Function

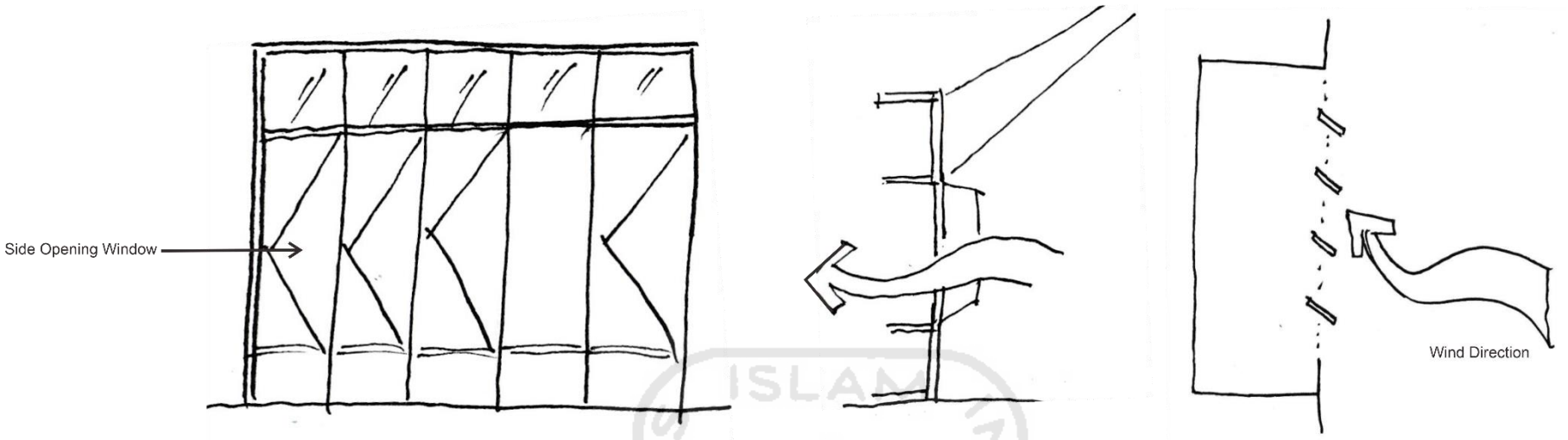


Figure 51 Building Skin Concept

Source : Author

Building Skin which also uses plants as the first step in filtering odors in buildings, with the addition of a glass motif that can add natural light into the building

This building skin concept has openings in it that lead to the direction where the majority of air comes to the site so that natural ventilation can be better. And because this opening can be opened and closed so it can adjust according to conditions

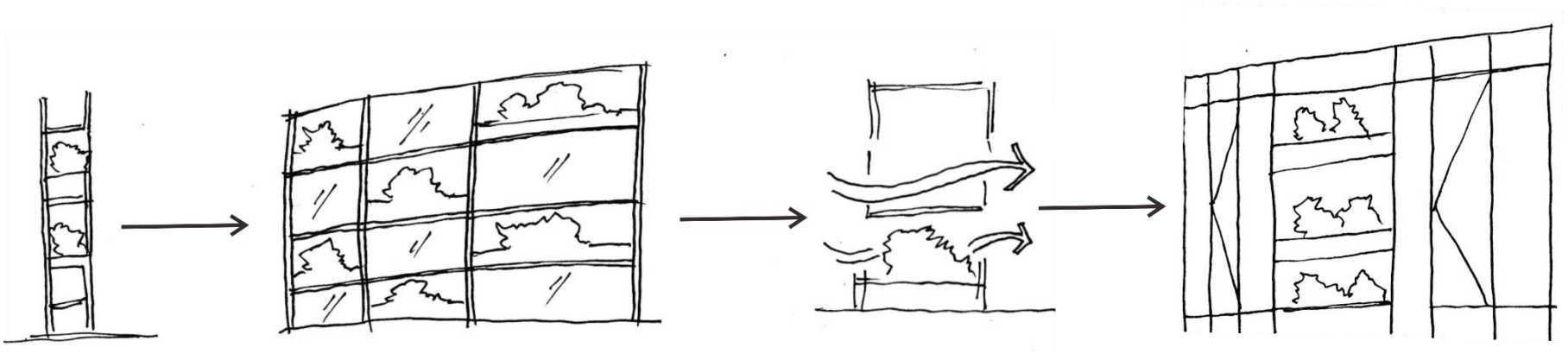


Figure 52 Building Skin Concept 2

Source : Author

The building façade is combination between glass and plant. The glass material is used to make more natural light come to the building and the plants is to filter the odors.

The building skin is design to have a plant that can reduced the impact of odors from the waste process in building . The aromatic plant itself is can be lavender and rose

3.4 BUILDINGS SUPPORTING SYSTEM CONCEPTS FOR WASTE TREATMENT BUILDING

3.4.1 Structural system supporting the Waste Treatment

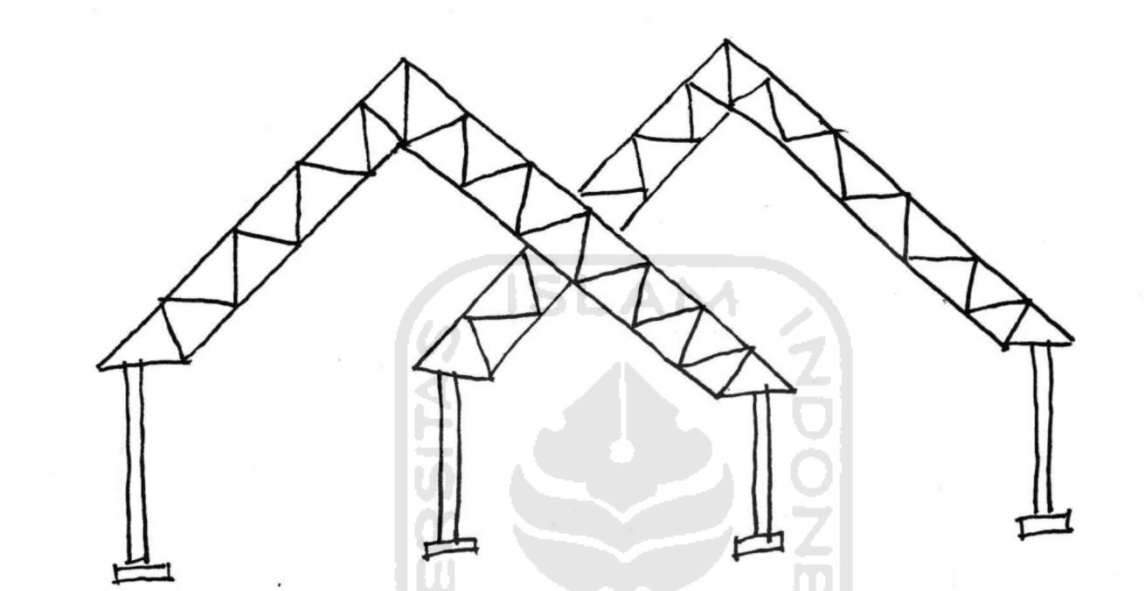


Figure 53 Structural Concept

Source : Author

To support Waste treatment activities which require a large space, the structure that is suitable for use is a truss frame which is used to support the roof of the building.

CHAPTER 4

DESIGN RESULT

In Chapter 4, we will discuss the results of the design concept that has been realized in a finished design. Starting from the discussion of the concept on the site plan more deeper into building skin. With the concept that has been finalized in the previous chapter regarding problems in the design, namely the provision of a Waste Treatment Facility and also the application of the Indoor Air Quality concept that focuses on natural ventilation and also reducing pollutant using plants

4.1 WASTE TREATMENT BUILDING SITE PLAN DESIGN

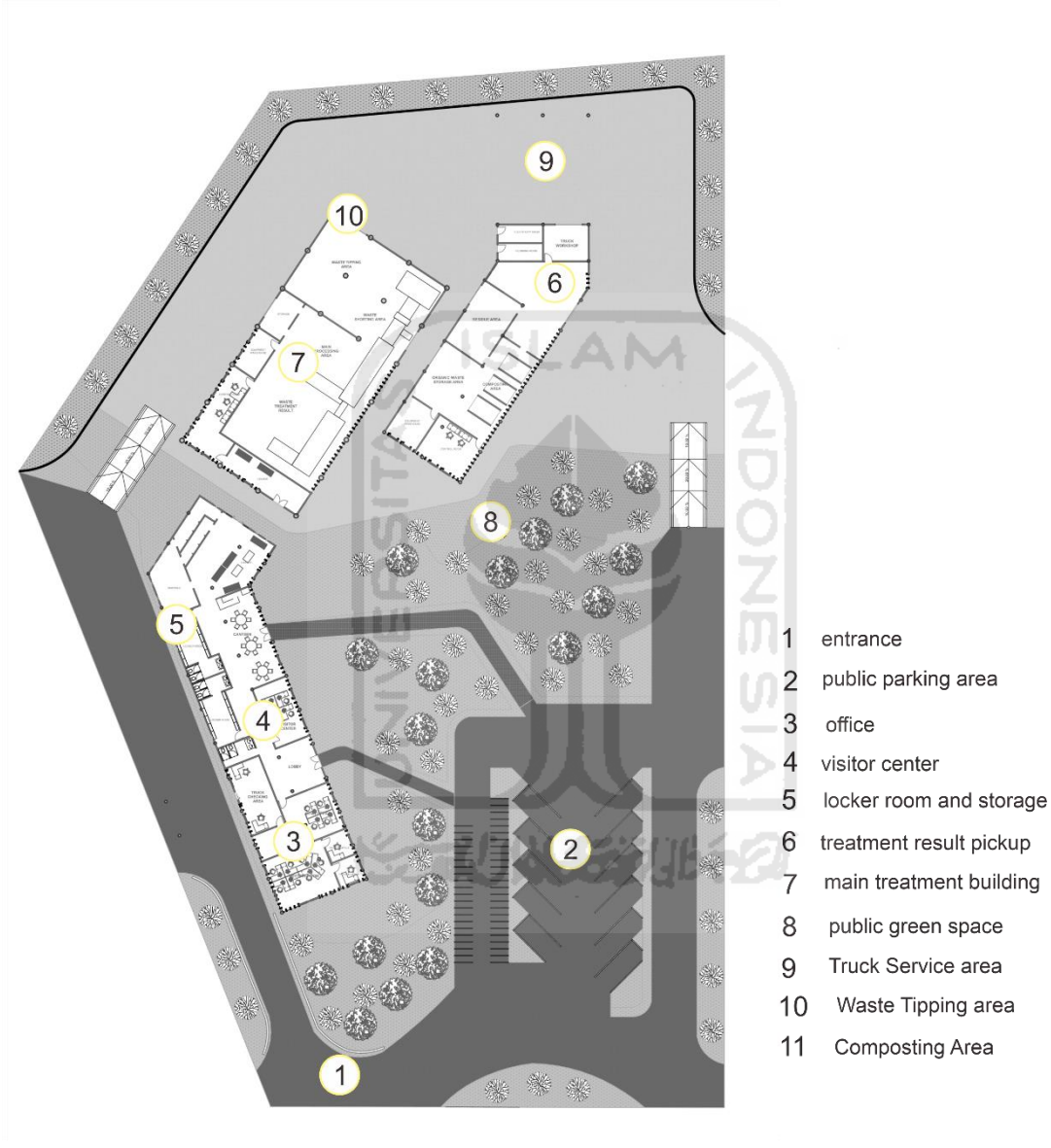


Figure 54 Site Plan from Piyungan waste treatment building

Source : Author

at the front of the site plan is the entrance where garbage trucks and visitors enter the site. for trucks the lanes will be separated to facilitate accommodation. For visitors, parking is provided in the front area.

For the building itself, there is a difference in height, in addition to related functions but also as a marker for each building.

4.1.1 Site Plan Design for Function Zoning

The front area of the site is focused on management needs and towards the back is more private. In addition, the waste processing area is focused on the rear to reduce odors in the front area of the site.

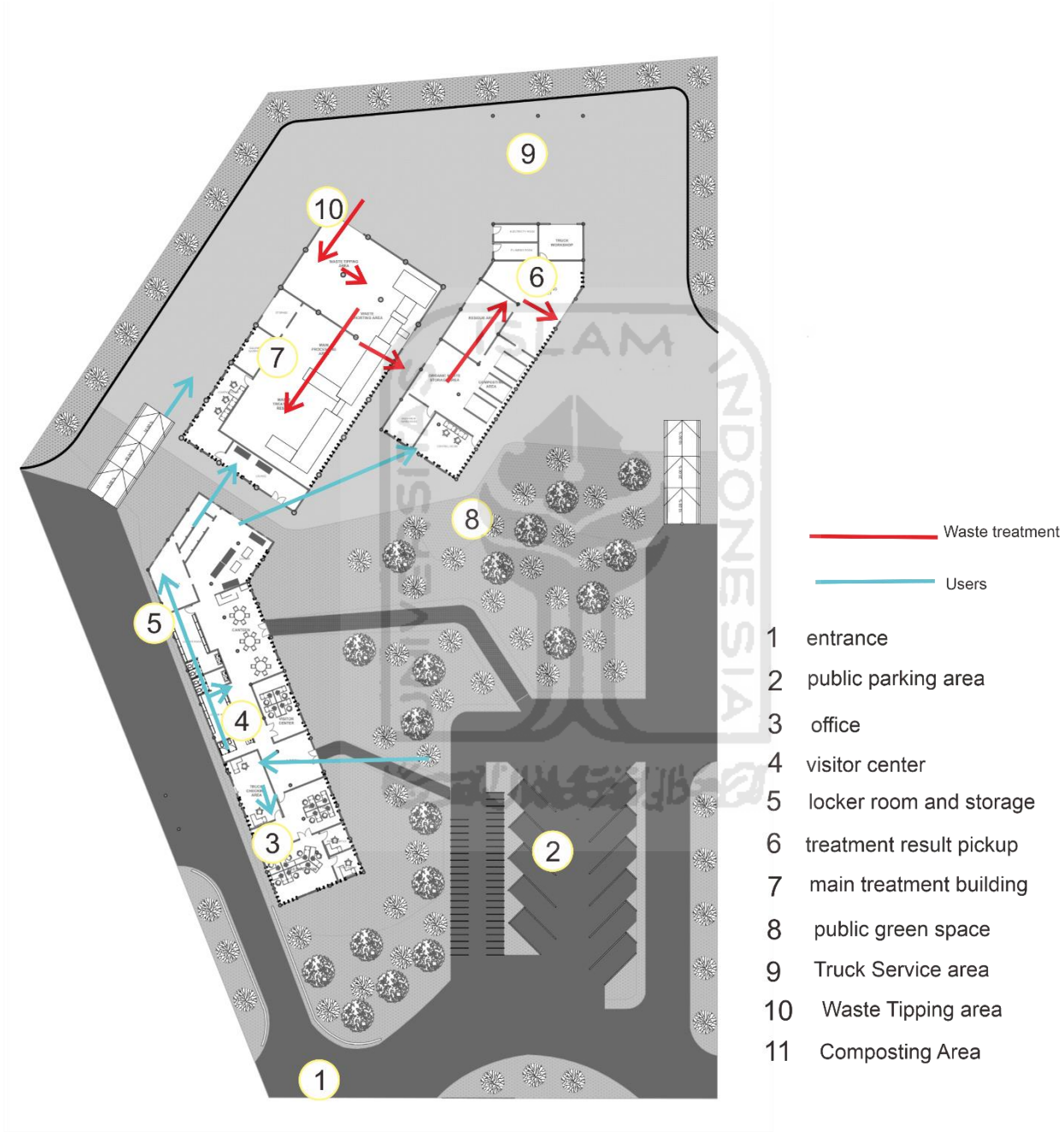


Figure 55 Site Plan Zoning

Source : Author

4.1.2 Site Plan Design for Waste Transport Circulation and Accessibility

truck circulation becomes one of the main points in consideration in establishing access. At the site, circulation is designed to facilitate trucks by creating roads that connect to various buildings.

Then for visitor access and office workers, namely through the main access which then goes to the parking area in front of the site. Circulation is designed so that vehicles, especially vehicles for transporting garbage, can operate optimally, so that access is provided to the inside of the building.

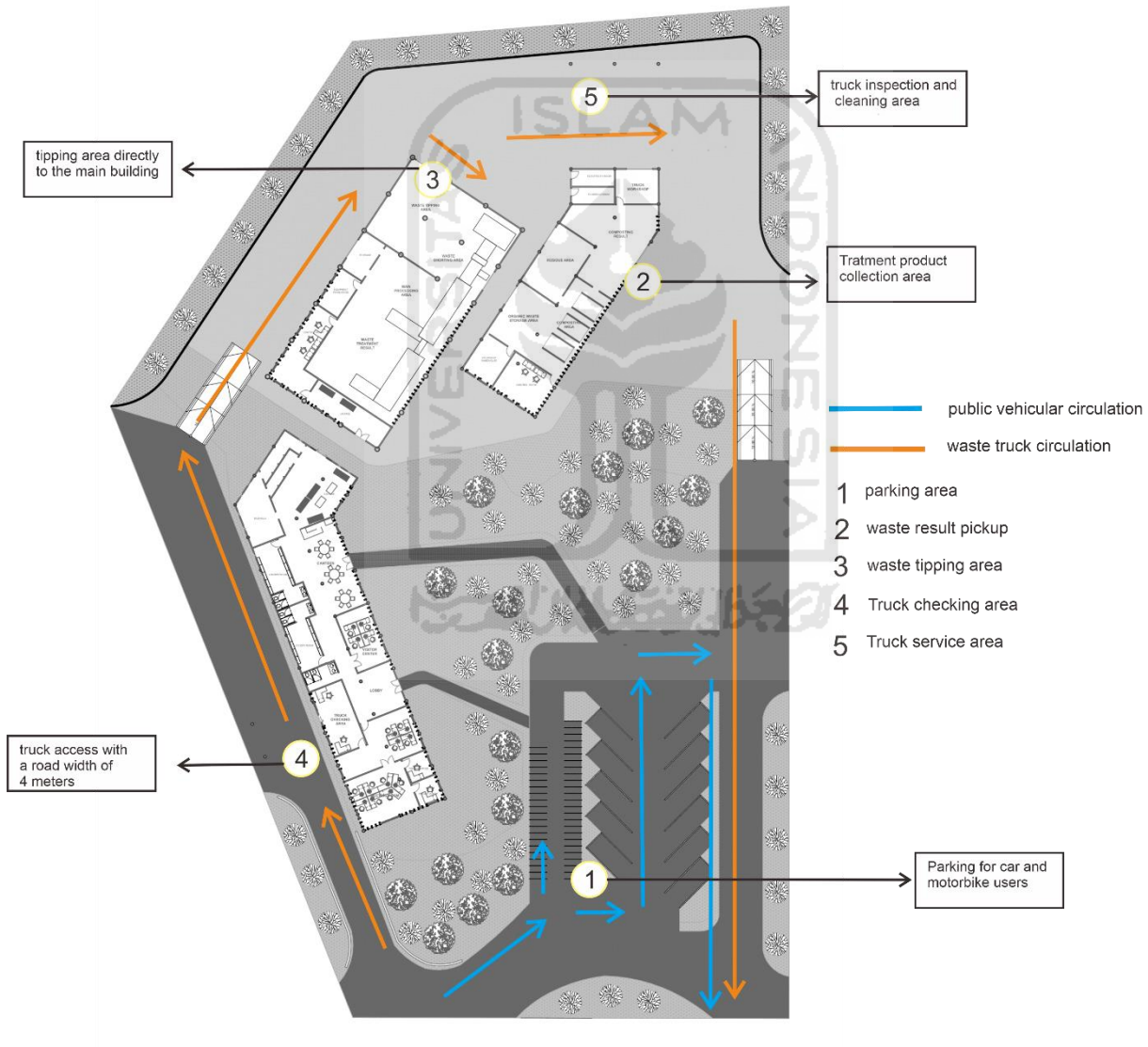


Figure 56 Siteplan Accessibility

Source : Author

4.1.3 Site Plan Design for Vegetation to decrease Odors

vegetation on the site used to reduce odors by placing several trees in certain areas of the site that receive the most odors. Vegetation can help reduce odors. The vegetation used is the type of Cempaka which has a fresh aroma

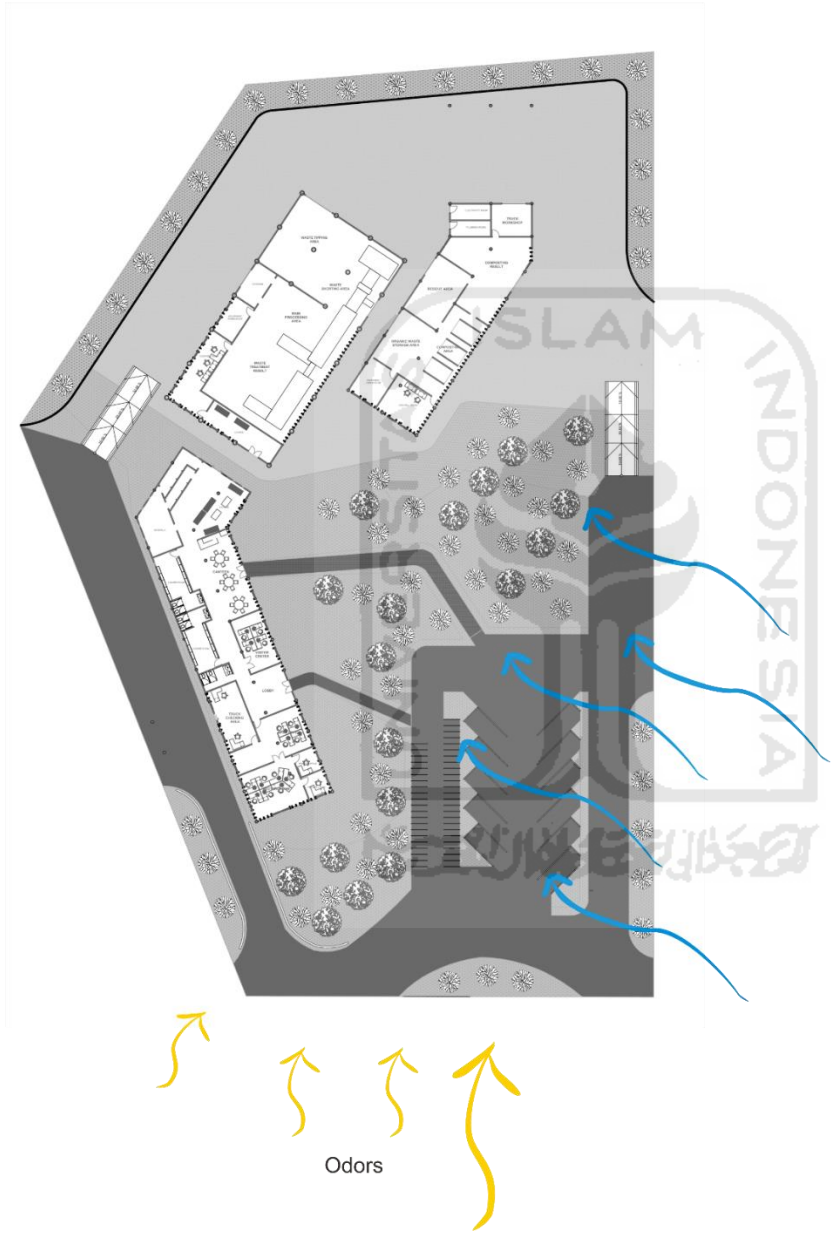


Figure 57 Siteplan Vegetation

Source : Aut

4.2 WASTE TREATMENT PLAN DESIGN

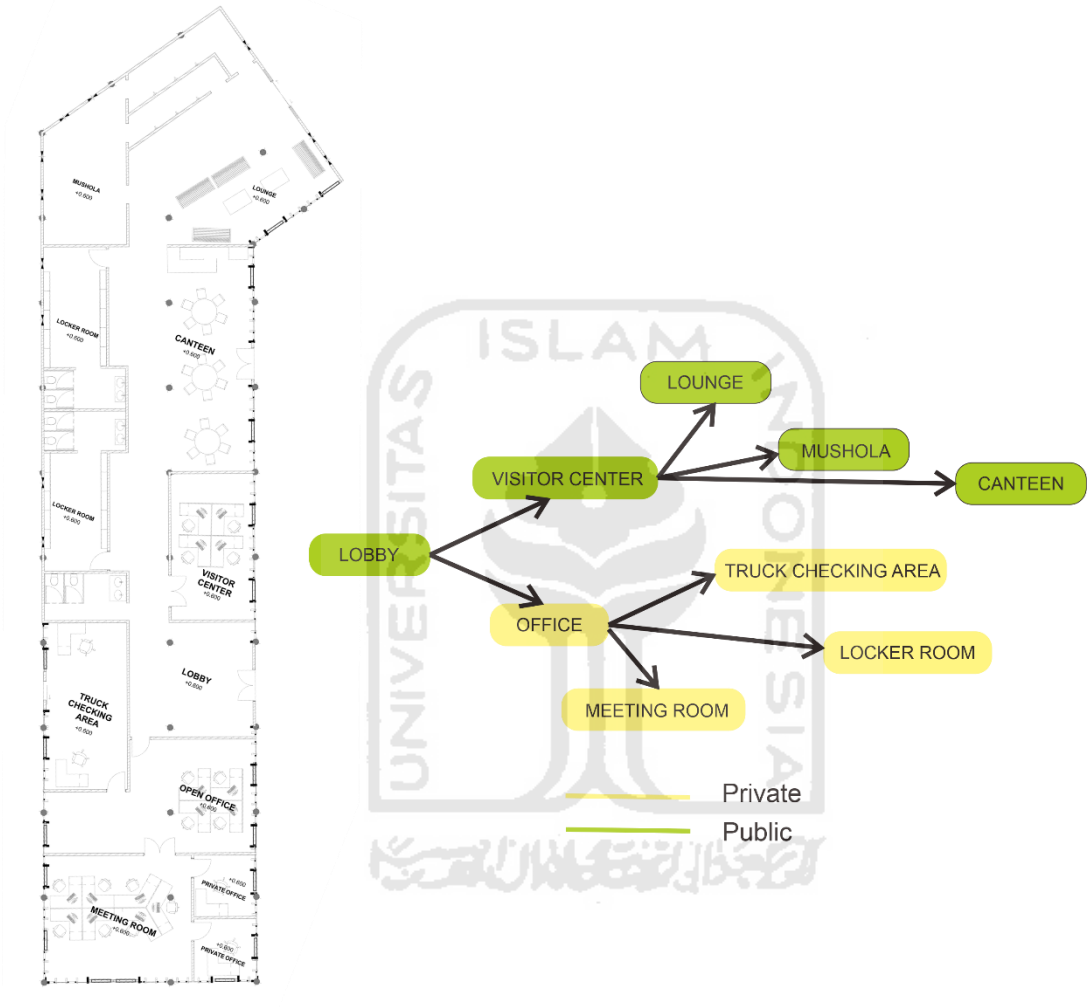


Figure 58 Mass 1 Space Layout

Source : Author

In building mass 1, it is intended as the management office of the Piyungan Waste Treatment Building and also various facilities to support waste processing activities. There are offices and meeting rooms. Garbage truck check area that is useful as a control truck activity. Locker room as a place for workers to change and store goods. Visitor Center as a means of supporting education. The lounge and canteen are located close to the prayer room so as to facilitate the activities of the workers.

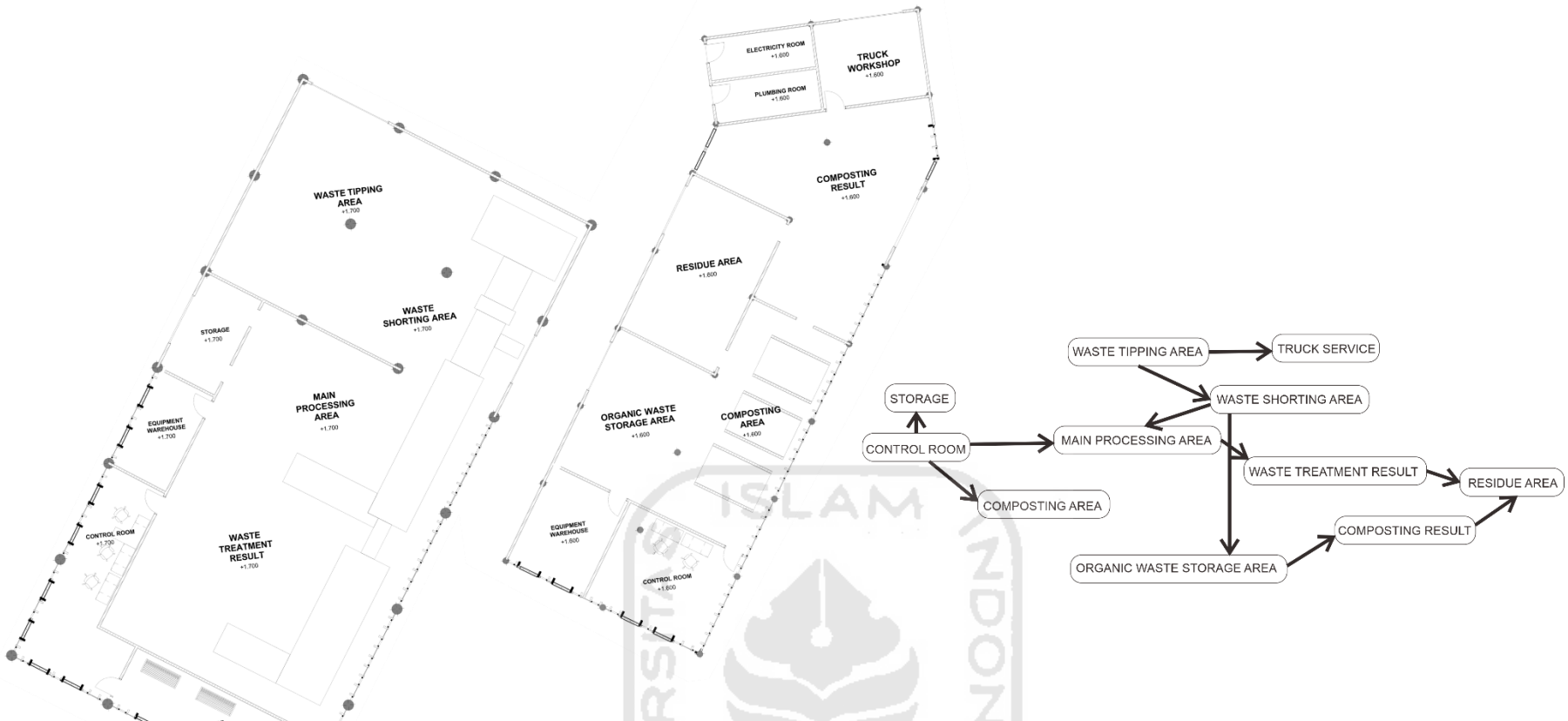


Figure 59 Mass 2 and 3 Space Layout

Source : Author

In buildings 2 and 3, the main function is the Waste Treatment building, where in the main building there is a tipping area where the garbage transported by trucks will be given. Then it is directly connected to the shorting area, where waste will be separated between organic and inorganic. Then the waste will be treated according to its type. If it is Organic, a composting process will be carried out which will take place in the 3rd building mass. Control rooms are also provided in these two buildings. In building mass 3, there is an outside area as a means of service trucks and also an area for transporting the results of waste processing.

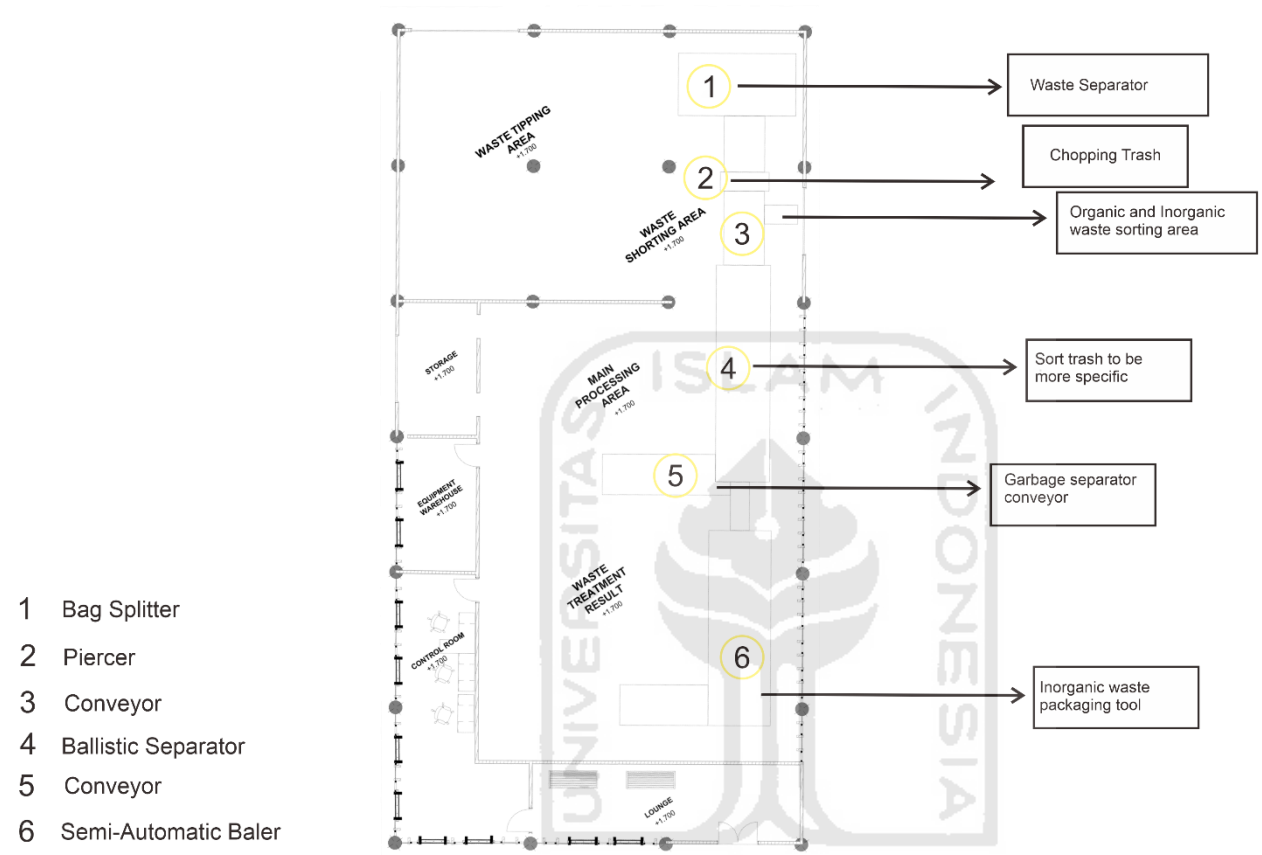


Figure 60 Equipment Layout

Source : Author

There are several types of machines used in the Waste Treatment Building, namely Bag Splitter and Piercer which are useful for breaking up waste, then conveyors as sorting between inorganic and organic. Followed by a ballistic separator to separate waste with special materials which will be forwarded to the Semi-Automatic Baler for packaging

4.3 WASTE TREATMENT BUILDING SECTION DESIGN

4.3.1 Site Section for Indoor Air Quality and Odors reduction

Figure 61 Site Odors Reduction Design

Source : Author

Because the majority of odors come from the front of the site, by using vegetation as a barrier against odors so that the impact can be reduced

At the front of the site there is a citrus type plant that can help block odors entering the site, then added with building skin on the building which also adds to odor reduction.

4.4 WASTE TREATMENT BUILDING ENVELOPE DESIGN

4.4.1 Waste Treatment Building Roof Design

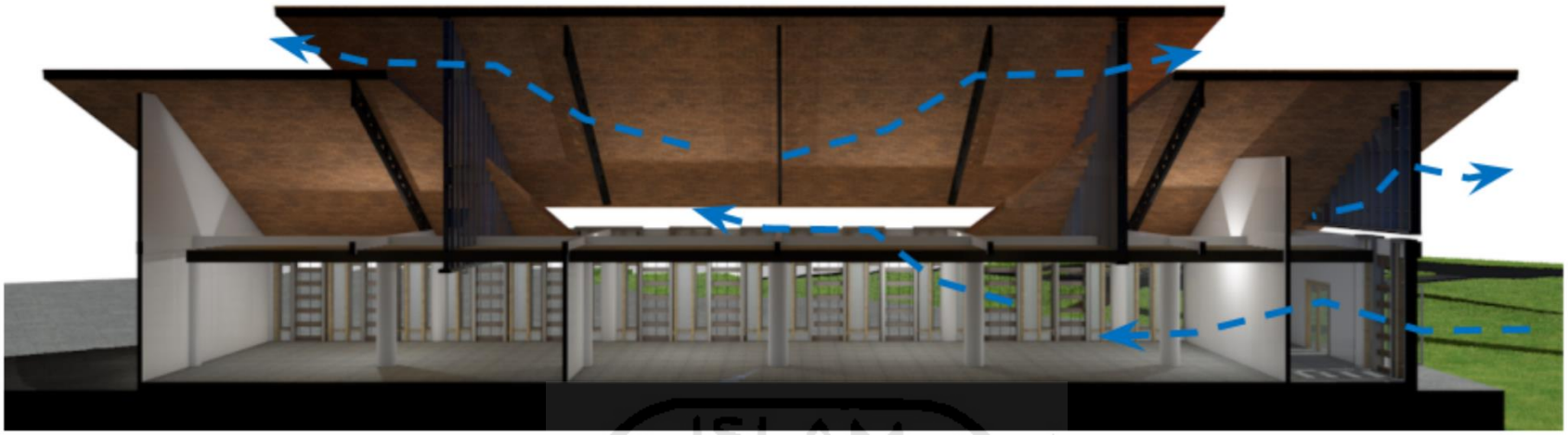


Figure 62 Mass 2 Natural Ventilation Design

Source : Author

The roof design on the main building of the Waste Treatment Building has natural ventilation on the top of the roof. This design allows hot air to circulate easily through the opening at the top. In addition, the ceiling uses a thin design and does not block the airflow.

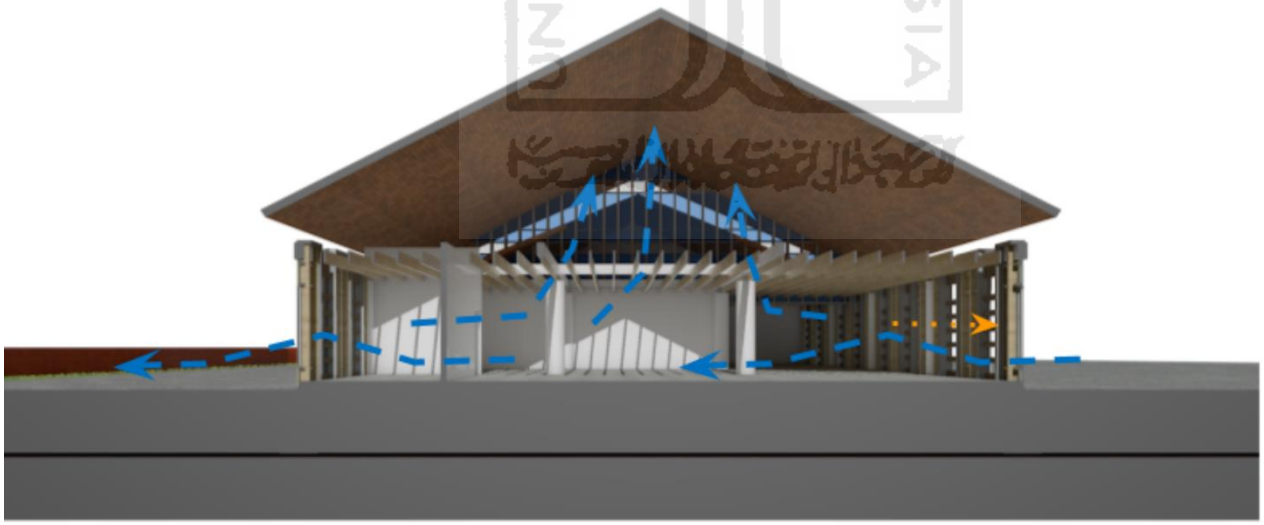
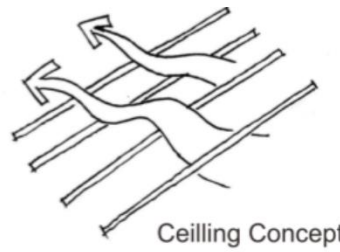


Figure 63 Mass 1 Natural Ventilation Design

Source : Author

For the design of a smaller building roof, the concept is formed by making an opening on the roof so that natural ventilation considerations can be fulfilled. Then the shape of the roof is adjusted to the climatic conditions and coupled with the connection between the roofs as a single building unit.



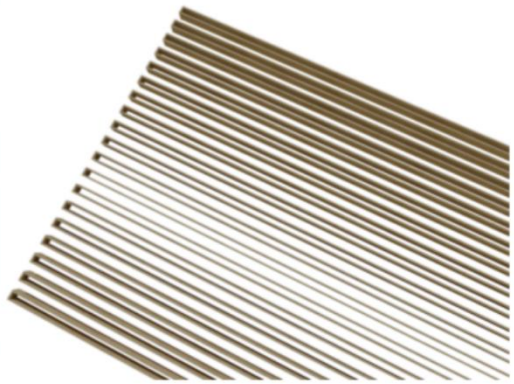


Figure 64 Ceilling Design

Source : Author

The ceiling concept is to maximize natural ventilation as best as possible, so that a thin and slim building ceiling is formed so that air circulation is better

4.4.2 Waste Treatment Building Skin Design

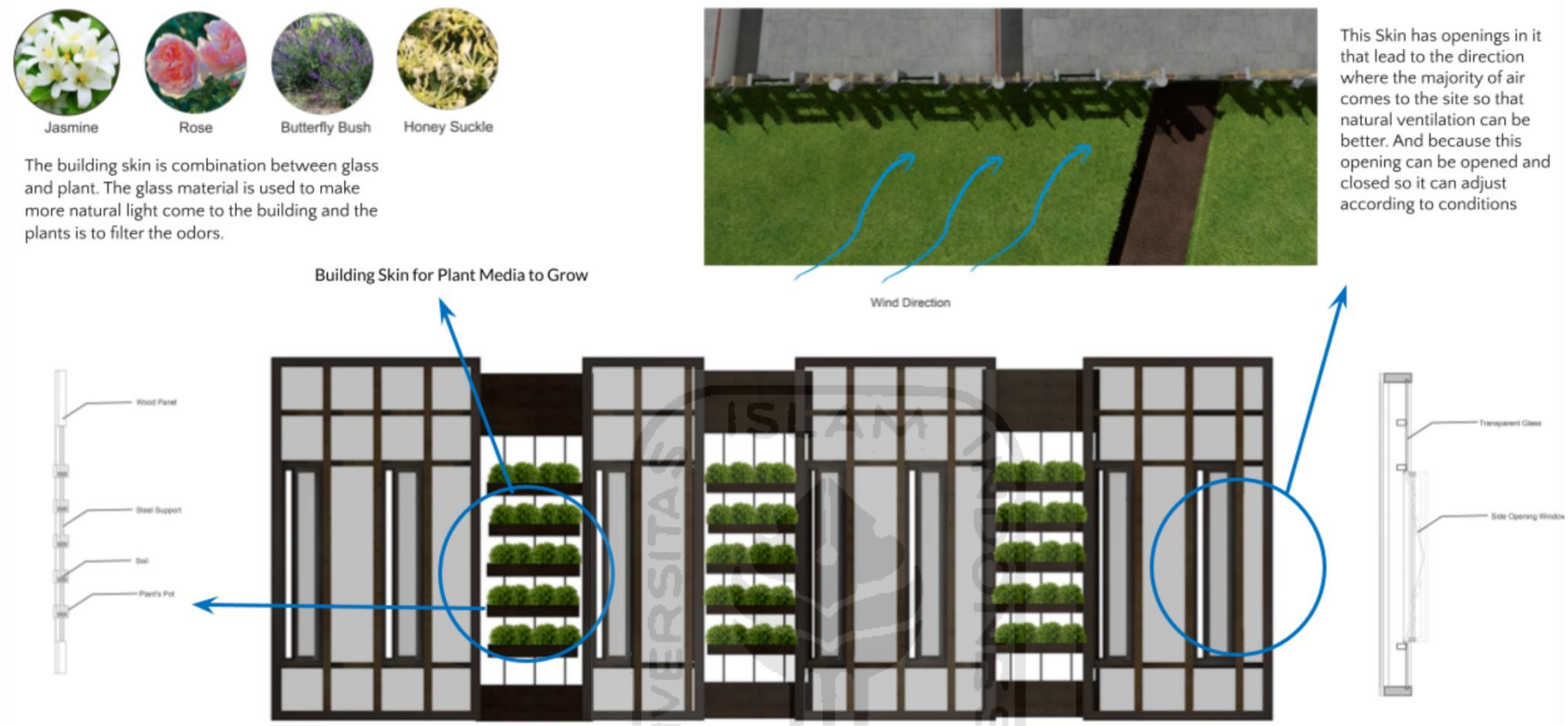


Figure 65 Building Skin Design

Source : Author

The building façade is combination between glass and plant. The glass material is used to make more natural light come to the building and the plants is to filter the odors.

The building skin is design to have a plant that can reduced the impact of odors from the waste process in building . The aromatic plant itself is can be lavender,rose,butterfly bush and honey suckle that are can be found easily.

This building skin concept has openings in it that lead to the direction where the majority of air comes to the site so that natural ventilation can be better. And because this opening can be opened and closed so it can adjust according to conditions

Figure 66 Building Skin Orientation

Source : Author

4.5 WASTE TREATMENT BUILDING STRUCTURAL SYSTEM DESIGN

4.5.1 Waste Treatment Building Structural System

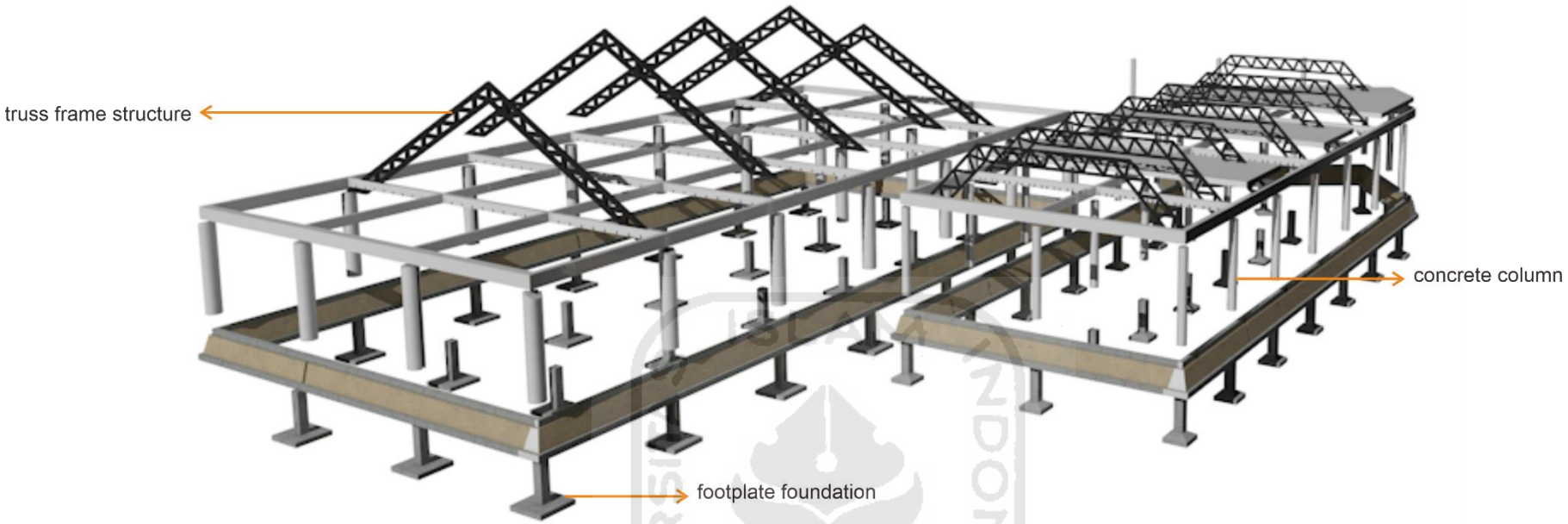


Figure 67 Structural System

Source : Author

To support Waste treatment activities which require a large space, the structure that is suitable for use is a truss frame which is used to support the roof of the building.

4.6 DESIGN SIMULATION

4.6.1 Design Simulation With AutoDesk Flow Design

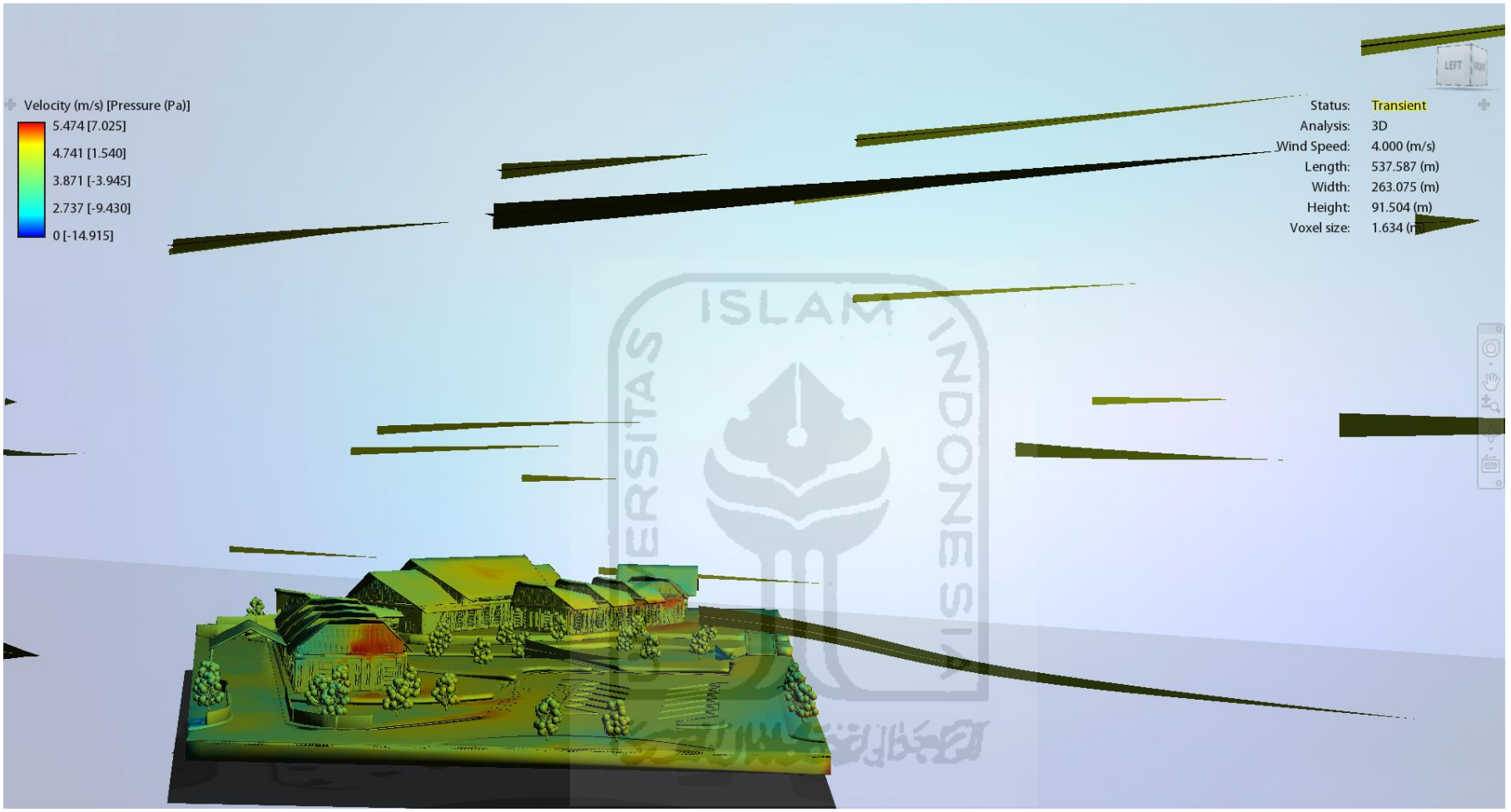
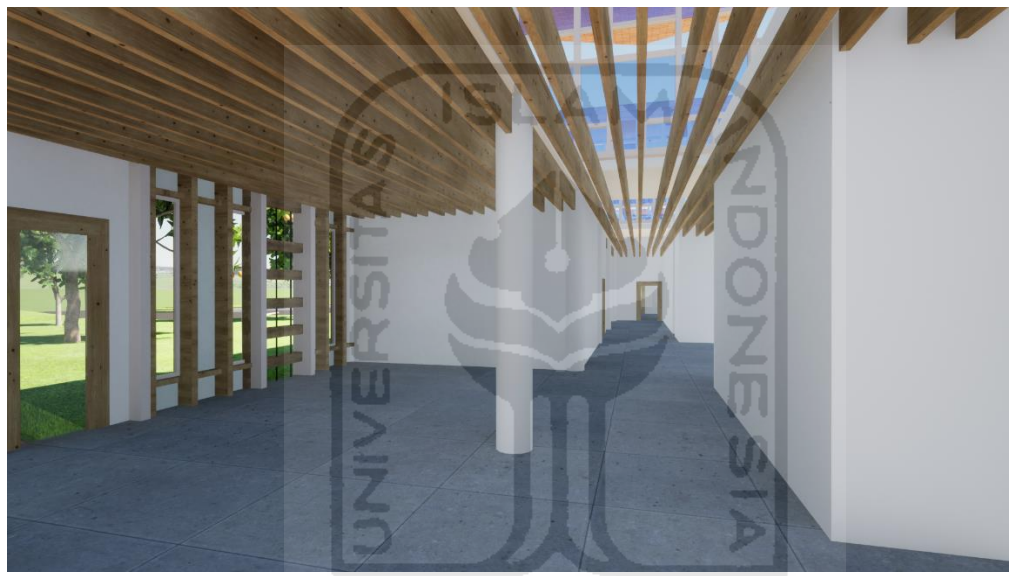


Figure 68 Design Simulation

Source : Author

Simulation of the wind flow is carried out using the AutoDesk Flow design to determine the movement of the wind that hits the building. The results obtained throughout the building get good air circulation.

4.7 DESIGN VISUALIZATION

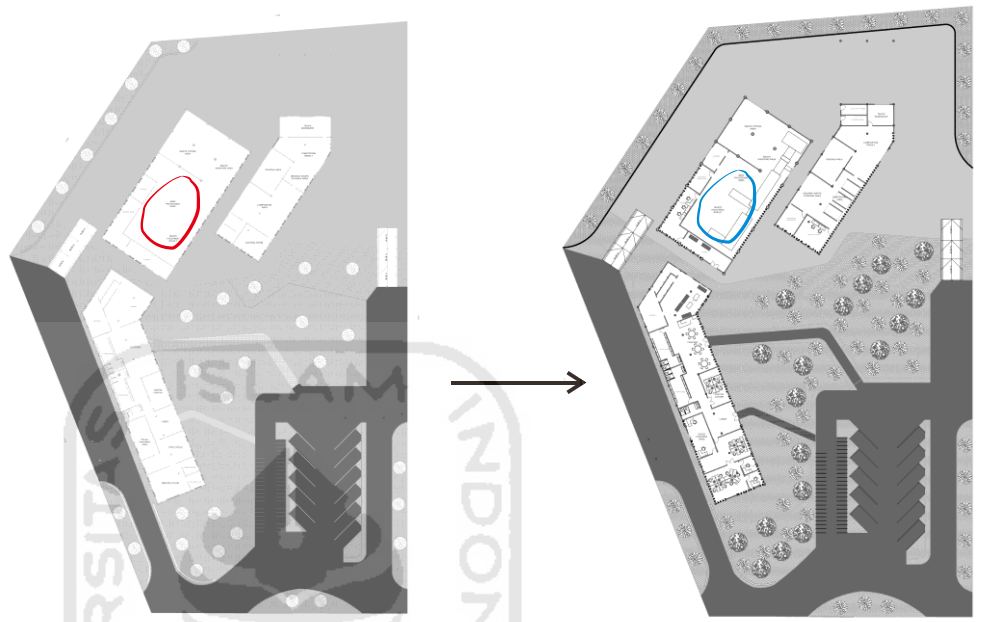
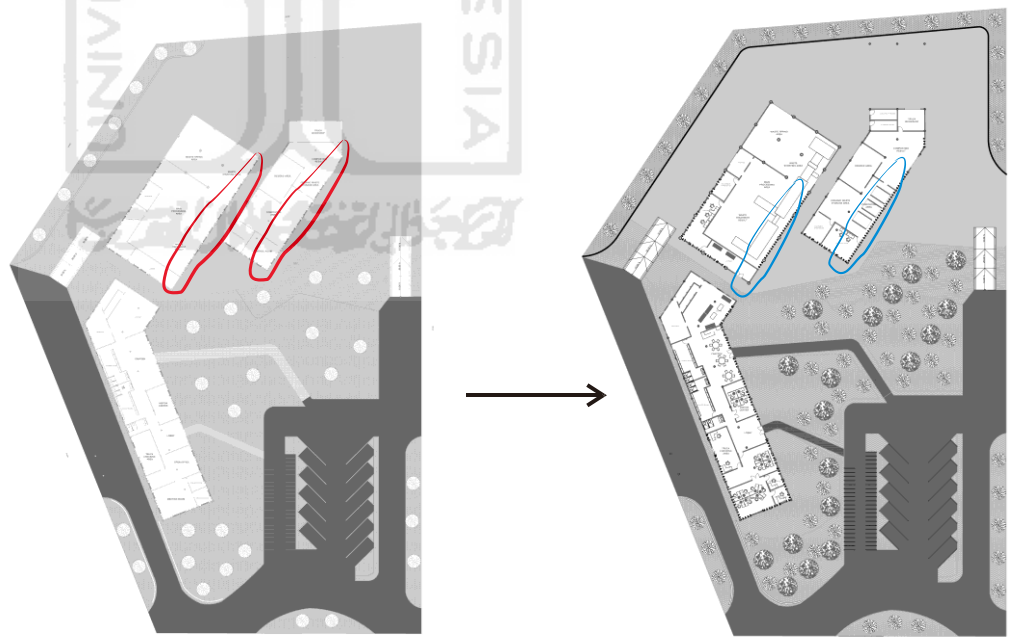


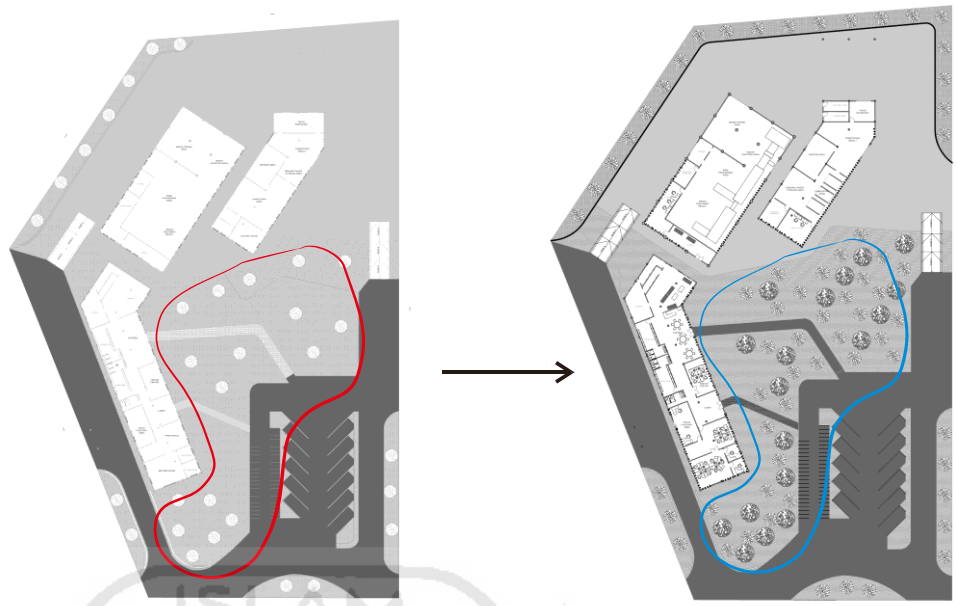
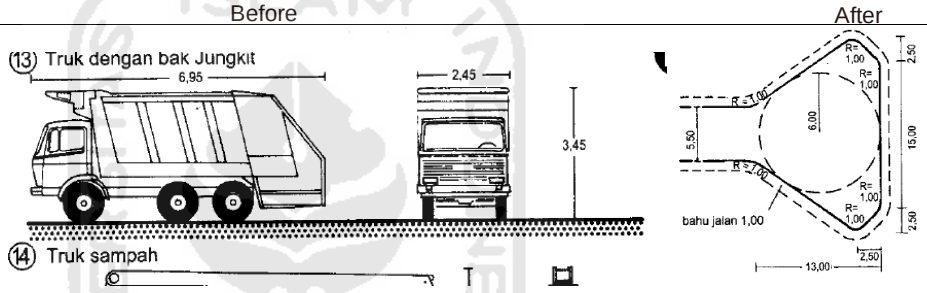
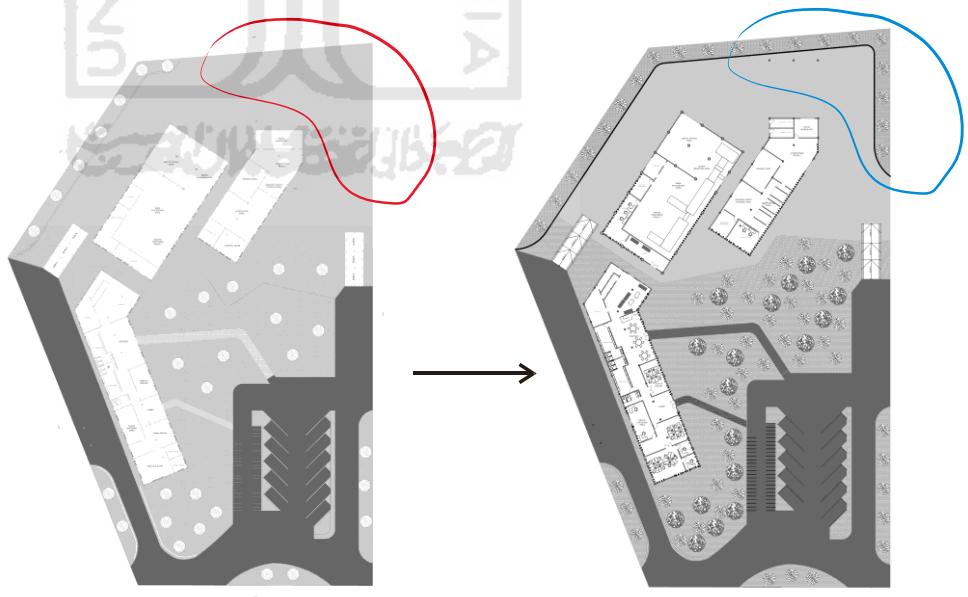
CHAPTER 5

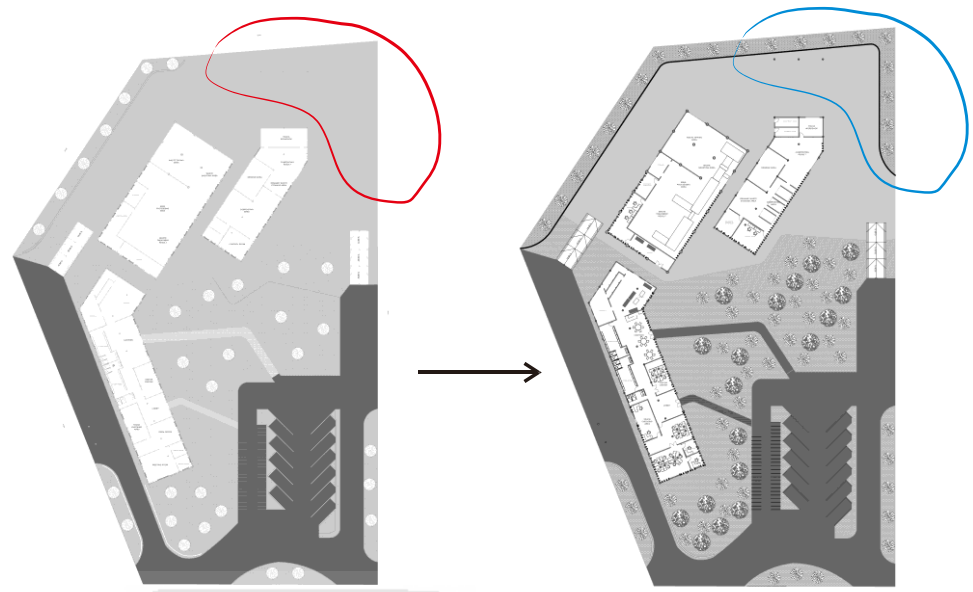
DESIGN EVALUATION

EVALUATION REVIEW AND RESPONSE

Based on the results of the evaluation carried out with the jury, there are several inputs related to the design of the Piyungan Yogyakarta Waste Treatment Building.

Jury	Comment	Response	Detail	Page
Yulianto Purwono Prihatmaji, ST. MT.,Dr. IAI	What is the layout of the waste treatment machine in your building?	Showing the layout of the waste treatment machine on the floor plan of building mass 2	 Before After	79-80
	Placement of Building Skins that are not suitable in some areas with wind conditions on the Site	Changing and customizing Building Skins that respond to wind conditions on the site	 Before After	77

	Vegetation on site too loose and irregular to filter air	Rearrange the placement of vegetation on the site to be more dense and regular to filter pollutants in the air		77
Putu Ayu Pramanasari Agustiananda,S.T. ,MA., Dr-Ing	State the Standard of Waste Truck, especially for access and circulation.	Added standard of Waste Truck in study design section		48
	How to cultivate the back land, so that it can be more functional and not look empty?	Cultivating the back land by adding vegetation as greenery and also increasing the comfort of the area		77

	How to cultivate the back land, so that it can be more functional and not look empty?	Cultivating the back land by adding vegetation as greenery and also increasing the comfort of the area	 Before After	77

4.6.2 Conclusion

1.Having a well-integrated waste treatment building that can provide a waste treatment process activity.

2. Having a waste treatment building that can keep the indoor air quality well preserved by natural ventilation and opening with building skin design with test simulation FlowDesign .

3. Having building skin that can reduce odor from waste treatment process by using plants as fragrance and odor reducer at the same time

4. Having Integrated natural ventilation system with building skin that is integrated through openings and the design of the building envelope

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BUILDING
PERFORMANCE &
TECHNOLOGY
LABORATORY

UNIVERSITAS
ISLAM
INDONESIA

INTERNATIONAL UNDERGRADUATE PROGRAM IN ARCHITECTURE

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2016

PIYUNGAN WASTE TREATMENT BUILDING

WITH BUILDING SKIN DESIGN TO DECREASE ODORS FROM WASTE TREATMENT PROCESS

BACKGROUND ISSUES

Absence of a waste treatment facilities in Piyungan

Odor problems that can interfere with comfort

PIYUNGAN WASTE TREATMENT BUILDING

with Building Skin Design to Decrease Odor from Waste Treatment Process

ISSUE

Absence of a waste treatment facilities in Piyungan that impact of untreated Waste to environment

APPROACH

Using Indoor Air Quality approach to Design Integrated Waste Treatment Building that can fulfill its function

GOALS

Having a well-integrated waste treatment building that can keep the indoor air quality well preserved

ISSUE

Urgency to keep healthy indoor air quality in building because of odor problems that can interfere with comfort

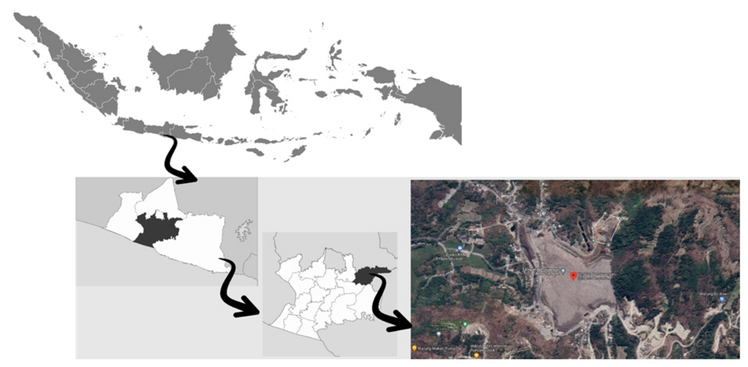
APPROACH

Using Skin Facade integrated with natural ventilation to reduce Odors from Waste Treatment Process

GOALS

Having building skin integrated with natural ventilation that can reduce odor from waste treatment process

SITE LOCATION



The location of Piyungan is in Bantul Regency, Yogyakarta Province, Indonesia.
Most of the piyungan areas are still simple settlements with less densely populated areas.
However, the Piyungan Landfill itself has become a destination for various garbage estuaries in Yogyakarta

Located in Ngablak, Sitimulyo, Kec. Piyungan, Bantul, Daerah Istimewa Yogyakarta
Site Area : 7000 m2

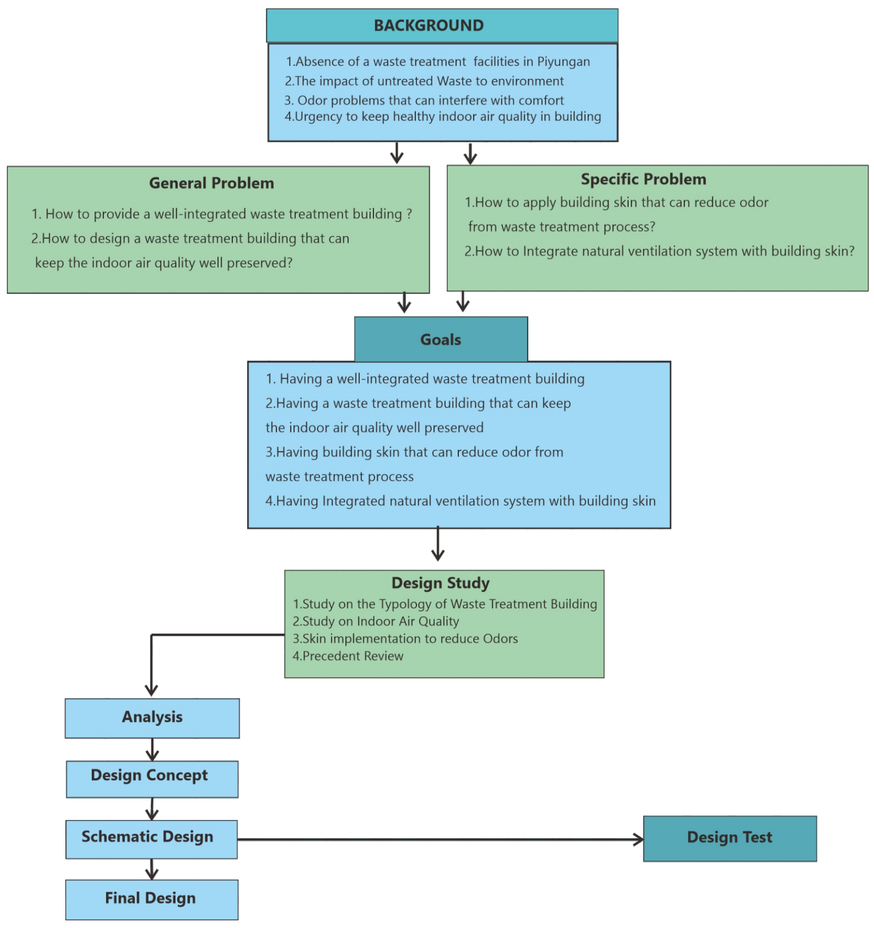
DEPARTMENT of ARCHITECTURE

SUPERVISOR : Prof. Noor Cholis Idham, ST., M. Arch., Ph. D
JURY : Yulianto Purwono Prihatmaji, ST. MT.,Dr. IAI
Putu Ayu Pramanasari Agustiananda,S.T.,MA., Dr-Ing

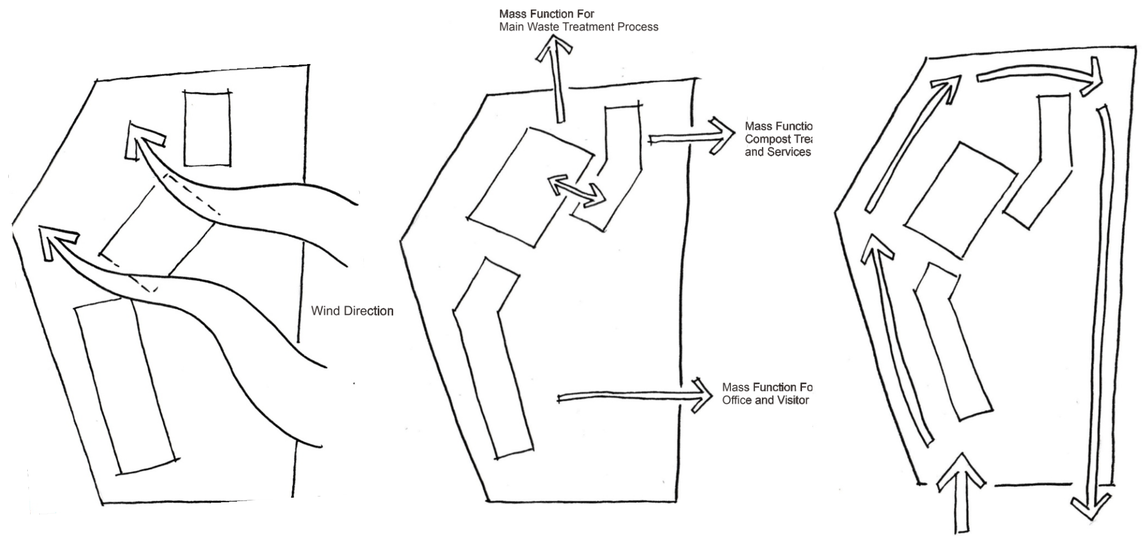
FINAL ARCHITECTURAL DESIGN STUDIO

HAIDARULLAH DHIA MU'AFA KOESNOPUTRO
17512109

DESIGN THOUGHT

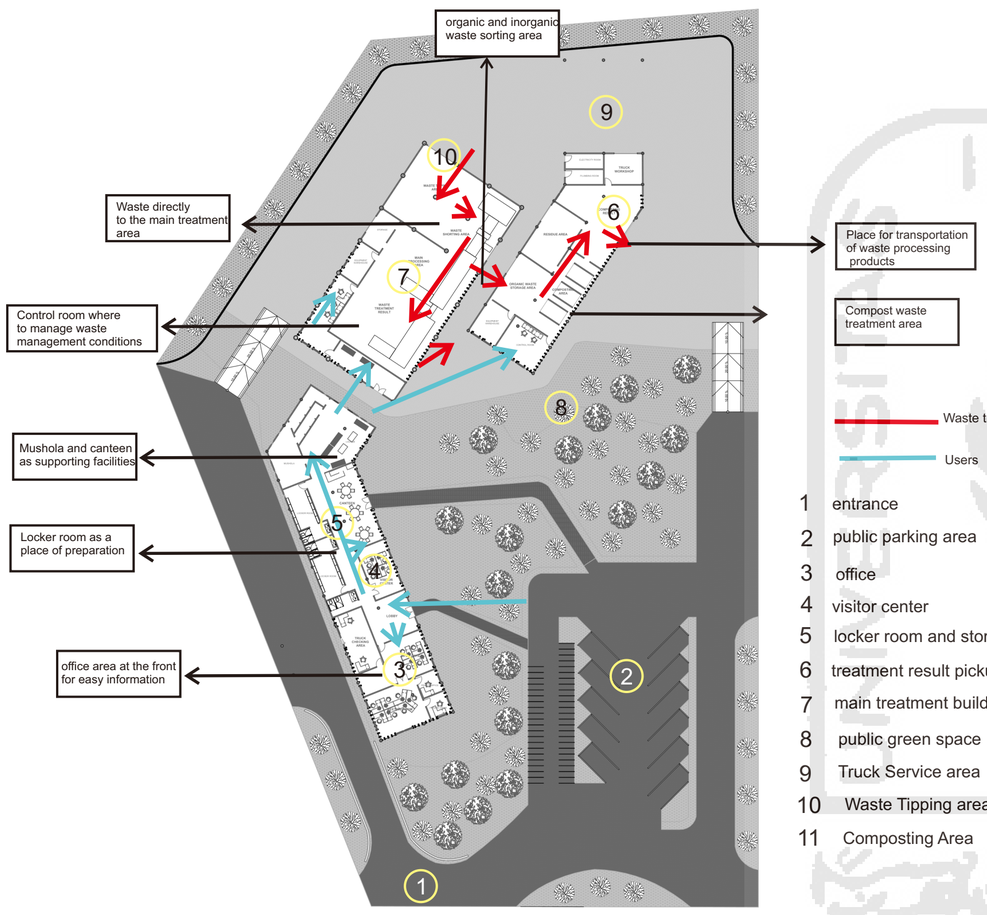


BUILDING MASS TRANSFORMATION

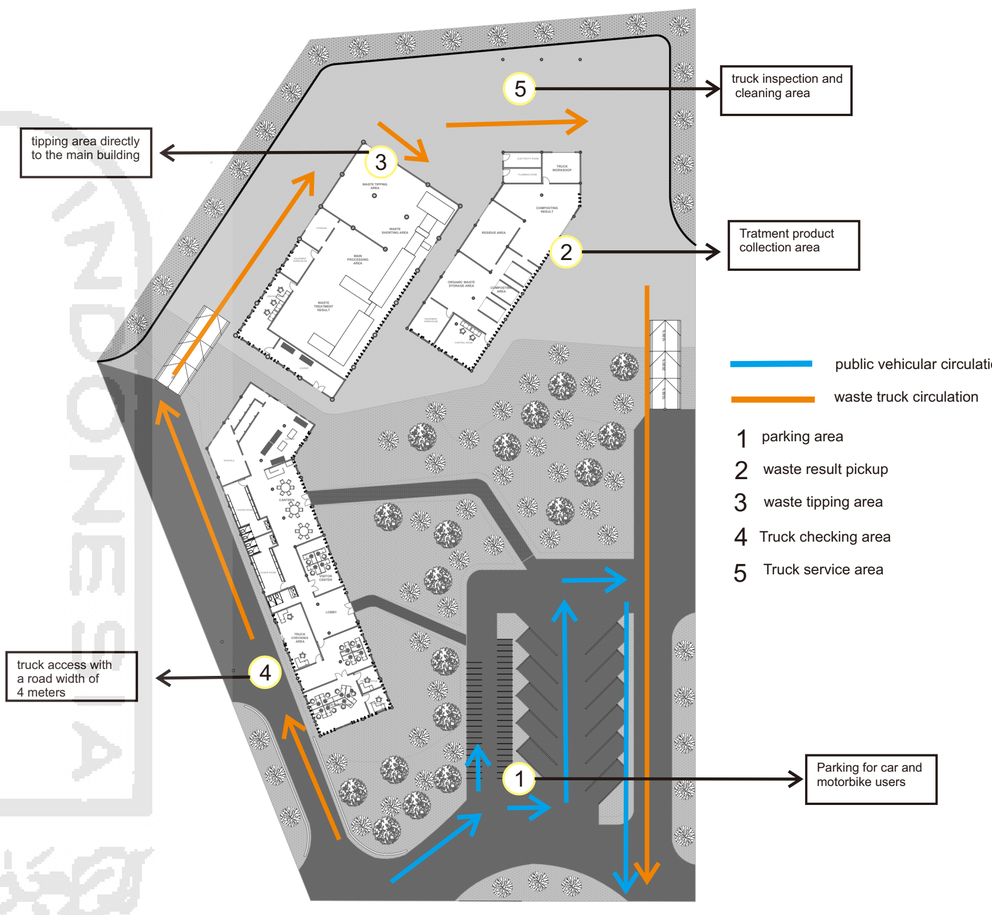


The formation of the building mass begins with orientation to the majority of the wind entering the site, namely in the south east direction. Then the mass is divided into 3 according to their respective functions. Mass 1 as management office and facilities. The 2nd mass building is the main treatment building and the 3rd mass is the composting area and service truck. then access is added taking into account the odor aspect and also the circulation effectiveness.

SITE PLAN



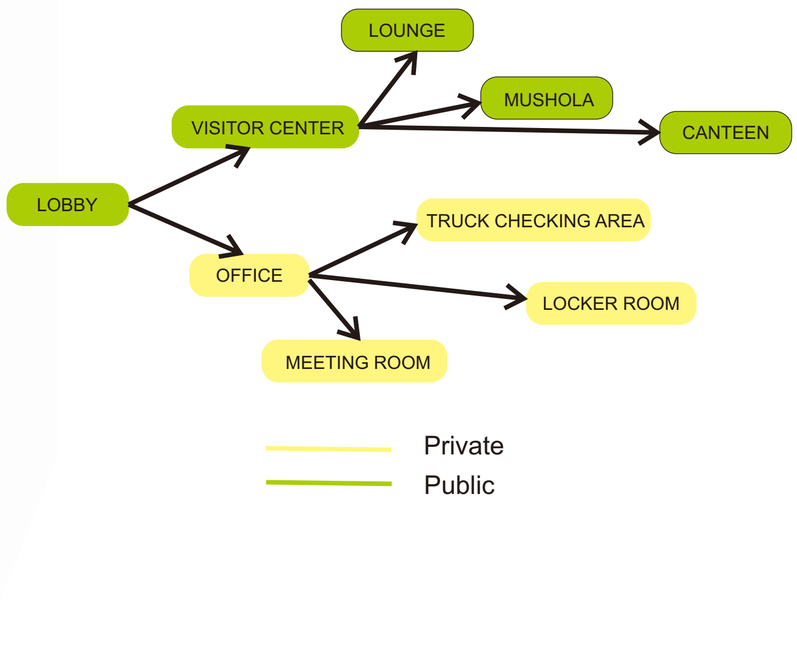
SITE PLAN CIRCULATION



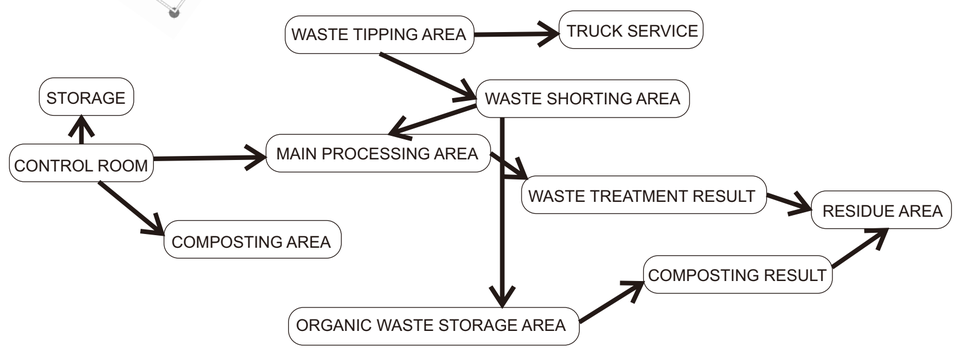
FLOOR PLAN

In building mass 1, it is intended as the management office of the Piyungan Waste Treatment Building and also various facilities to support waste processing activities.

In buildings 2 and 3, the main function is the Waste Treatment building, where in the main building there is a tipping area where the garbage transported by trucks will be given.

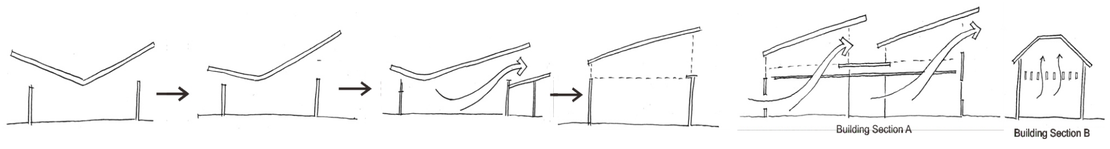


WASTE TREATMENT SCHEME



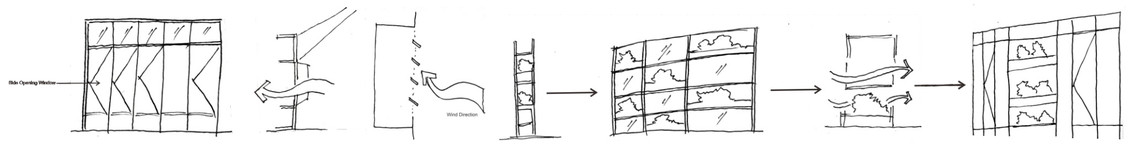
DESIGN TRANSFORMATION

Roof Concept



the concept is formed by making an opening on the roof so that natural ventilation considerations can be fulfilled.
Then the shape of the roof is adjusted to the climatic conditions and coupled with the connection between the roofs as a single building unit.

Building Skin Concept



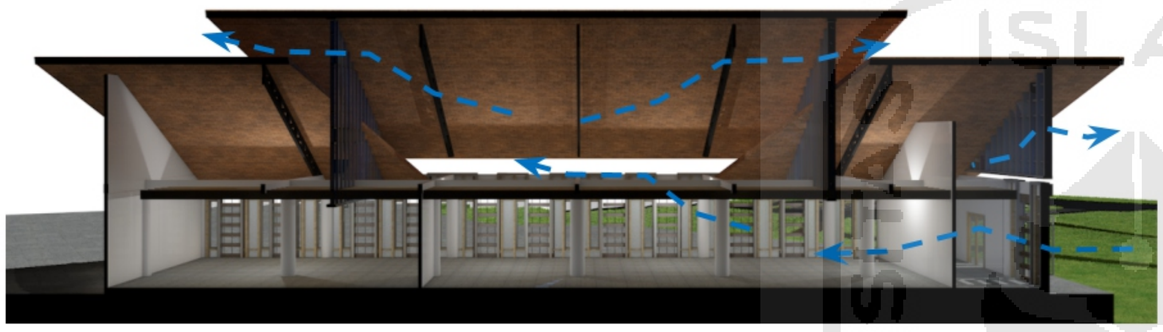
Building Skin which also uses plants as the first step in filtering odors in buildings, with the addition of a glass motif that can add natural light into the building .This building skin concept has openings in it that lead to the direction where the majority of air comes to the site so that natural ventilation can be better. And because this opening can be opened and closed so it can adjust according to conditions

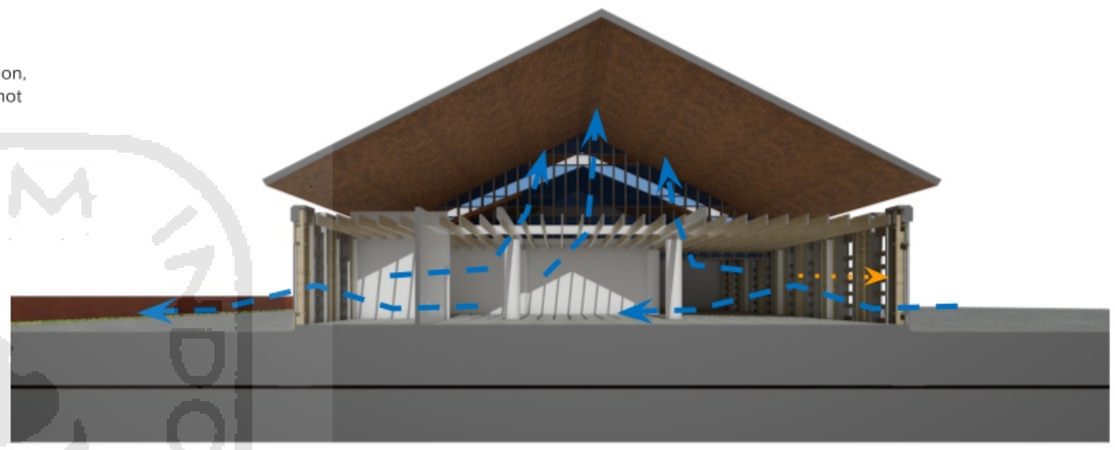
The building façade is combination between glass and plant. The glass material is used to make more natural light come to the building and the plants is to filter the odors. The building skin is design to have a plant that can reduced the impact of odors from the waste process in building .
The aromatic plant itself is can be lavender and rose

NATURAL VENTILATION FOR INDOOR AIR QUALITY DESIGN

Because the majority of odors come from the front of the site, by using vegetation as a barrier against odors so that the impact can be reduced. At the front of the site there is a citrus type plant that can help block odors entering the site, then added with building skin on the building which also adds to odor reduction.

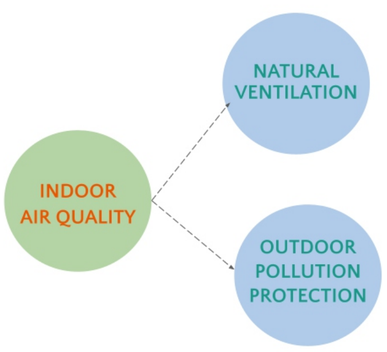
The roof design on the main building of the Waste Treatment Building has natural ventilation on the top of the roof. This design allows hot air to circulate easily through the opening at the top. In addition, the ceiling uses a thin design and does not block the airflow.





Main Treatment Natural Ventilation Design

BUILDING SKIN DESIGN



The importance of ventilation as a factor influencing indoor air quality is widely recognized. Good ventilation is needed to limit the accumulation of emissions that cannot be avoided

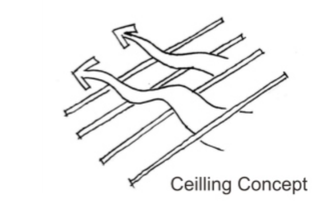
Outdoor air is commonly polluted and often sufficiently so that it is unhealthful to breathe. Outdoor air in urban environments, where most people now live, is more commonly unhealthful than outdoor air in rural environments

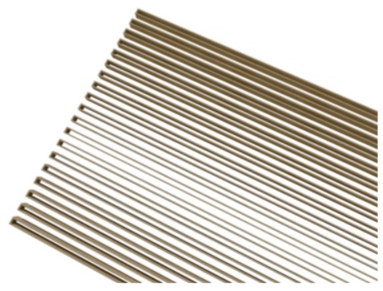
The building skin is combination between glass and plant. The glass material is used to make more natural light come to the building and the plants is to filter the odors.

This Skin has openings in it that lead to the direction where the majority of air comes to the site so that natural ventilation can be better. And because this opening can be opened and closed so it can adjust according to conditions

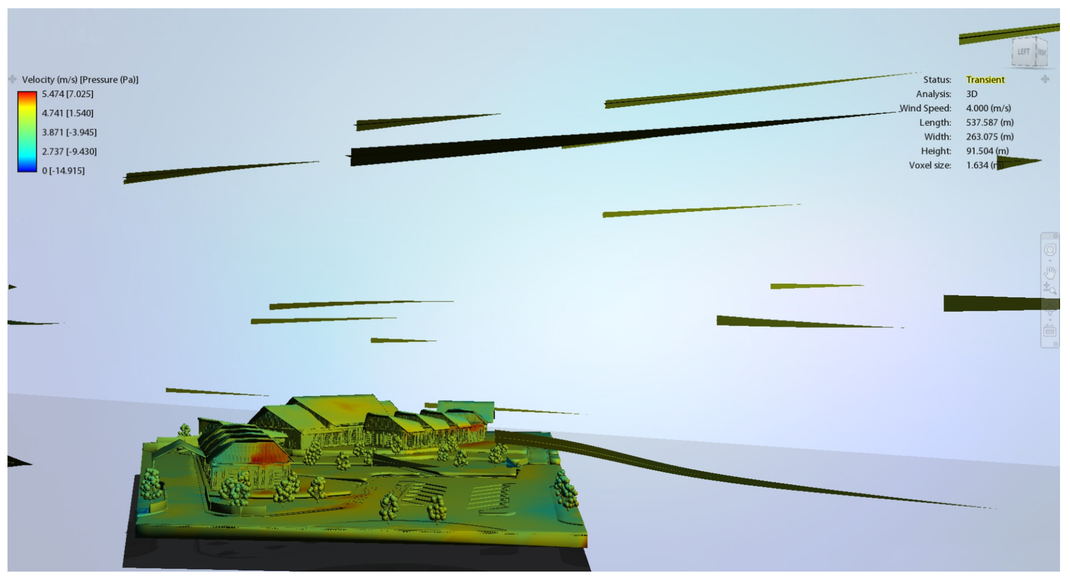
BUILDING CEILLING DESIGN

The ceiling concept is to maximize natural ventilation as best as possible, so that a thin and slim building ceiling is formed so that air circulation is better.



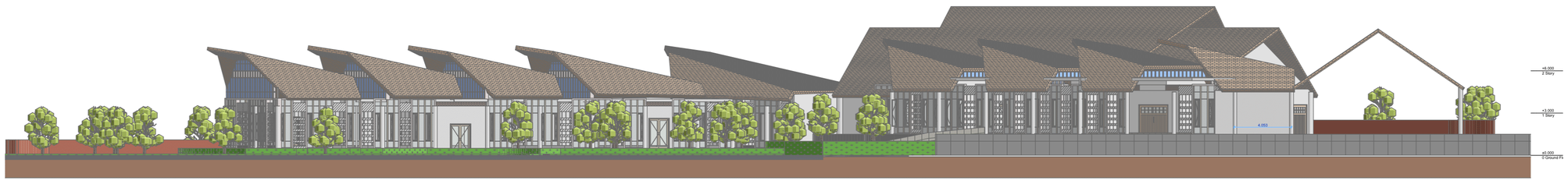


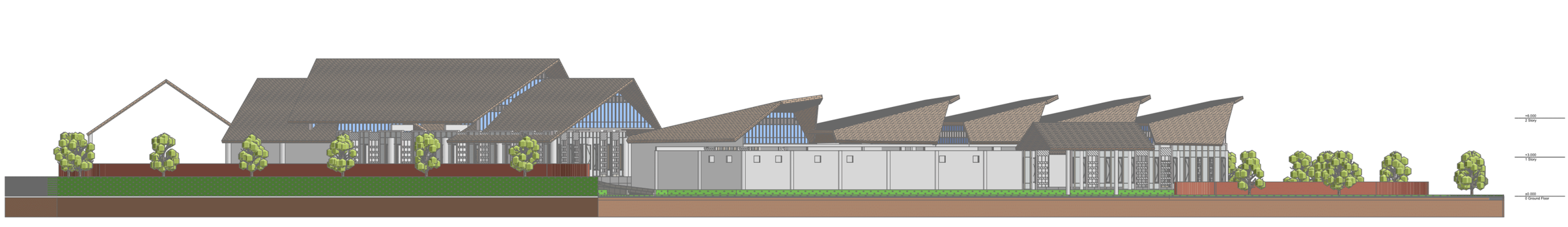
WIND FLOW SIMULATION



Simulation of the wind flow is carried out using the AutoDesk Flow design to determine the movement of the wind that hits the building. The results obtained throughout the building get good air circulation.

SITE ELEVATION





INTERIOR AND EXTERIOR

Green Space Area

Lobby Entrance

Treatment Product Collection Area

Public Parking Area

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