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Research paper

Planning and Design of the Automotive Engineering Building of SMKN 2 Surakarta with Green Architecture Concept

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ABSTRACT

Background: The Automotive Engineering Department of SMKN 2 Surakarta has a problem with not fulfilling the Standardization of High School Buildings and Furniture, which greatly affects student learning (teacher and learner performance). This research aims to (1) find out what are the space needs in the automotive engineering department; (2) What green architecture principles can be applied in making the room.
Method: This planning and design use the architectural programming method with a green architecture approach. The stages of architectural programming include determining goals, collecting facts, uncovering and testing concepts, determining needs, and designing. Data sources were taken from informants, archives, and documents. Data collection was conducted using observation, interview, and documentation techniques.
Result: Space requirements in the Automotive Engineering Department include classrooms, teachers' rooms, basic automotive workshops, material tool rooms, tool man rooms, and toilets. The application of green architecture principles includes conserving energy by utilizing solar panels, utilizing grey water, using brightly coloured paint, utilizing natural lighting and air conditioning, skylight applications, and cross ventilation, minimizing new resources related to conserving energy; and holistic.
Conclusion: The Automotive Engineering Building consists of two masses, namely the two-story main building (12 classrooms, 1 teacher's room, 4 toilets) and the one-story basic automotive workshop building (1 practice room, 2 toilets, 1 tool and material room and toolman room). The opening area for natural lighting and ventilation is 17-20%. The use of solar panels to save energy produces a power of 9,500 WP which can meet the power needs of 9,262.56 WP. The management of grey water which can then be used to flush toilets is 4,645.2 L/day (33%) of the water demand of 13,974 L/day (100%).

INTRODUCTION

Government Regulation of the Republic of Indonesia Number 19 of 2005 concerning National Education Standards CHAPTER VII Article 42, point 2 explains that to support an orderly and sustainable learning process, each education unit needs to have facilities and infrastructure, including land, classrooms, education unit leadership rooms, teachers' rooms, administrative rooms, library rooms, laboratories, workshops, production unit rooms, canteens, electricity and service facilities, sports venues, places of worship, playgrounds, creative areas and other necessary spaces/places. Further explained by Kemendikbud (2011) in the Guidelines for the Standardization of High School Buildings and Furniture, the infrastructure that is fulfilled, the building requirements, and the provisions applied will greatly affect student learning. Space, air circulation, and natural and artificial lighting are related to teacher and learner performance.

SMKN 2 Surakarta is one of the educational units at the SMK level located on Jl. Adisucipto No.33, Manahan, Banjarsari District, Surakarta City, Central Java, with a zip code of 57139. One of the Expertise Programs at SMKN 2 Surakarta is Automotive Engineering (Light Vehicle Engineering) which has several facilities to support the course of learning including a theory room (multimedia), engine workshop, chassis workshop, automotive electrical workshop, and basic automotive workshop. The reality shows the high inequality in the quality of education in Indonesia, including in vocational schools. According to Wirawan (2017), not all SMKs can provide decent, modern workshops, and can build strong cooperation with the world of work.

Based on preliminary observations made at SMKN 2 Surakarta, the Automotive Engineering department has a problem with the lack of classrooms used for theoretical learning. This is reinforced by the statement of the Deputy Principal for Curriculum at SMKN 2 Surakarta who explained that the Automotive Engineering department does not have enough classrooms, so it has to borrow other rooms which are located separately from the scope of the Automotive Engineering building area. The borrowed rooms are physics laboratories and classrooms belonging to other departments. SMKN 2 Surakarta also has plans to renovate the Automotive Engineering building but is still waiting for funds from the government. Some rooms in the Automotive Engineering department do not meet space comfort standards such as the minimum requirements for workshop height that are not met and the lack of openings for lighting and airing. Visual data on the existing conditions of the Automotive Engineering building obtained from observations are presented in Table 1.

Based on the data in Table 1, some spaces such as classrooms, basic automotive workshops, and tool and material rooms do not meet the minimum space standards. Conditions that are not ideal will certainly hurt students such as student comfort, student health, and student productivity will be disrupted. So, students will feel uncomfortable in the workshop room and students will experience a decrease in productivity (Yusufrakadhinata et al., 2022).

The concept of green architecture is rarely applied to buildings that have been built. According to Mauludi, A. F., et al. (2020), green architecture is an architectural planning approach that seeks to minimize various adverse effects on human health and the environment. The Automotive Engineering Department at SMKN 2 Surakarta needs to be studied further because it has a building and several rooms that do not meet the comfort aspects related to the principle of respect for use. The approach through the concept of green architecture was chosen because it adapts to the needs of the building at SMKN 2 Surakarta by paying attention to the comfort and health aspects of space in workshops, classrooms, tool and material rooms, and

several other spaces. The main objective of writing this journal is to plan and design the Automotive Engineering building of SMKN 2 Surakarta with the concept of green architecture. Although there is a lot of planning and design related to school buildings, there is no planning and design related to buildings at SMKN 2 Surakarta with the concept of green architecture. The planning and design of the SMKN 2 Surakarta Automotive Engineering building provides input and problem-solving for future development of the SMKN 2 Surakarta building.

Table 1.
Existing Condition Data

Room Name	Aspects reviewed	Existing	Standard	Source
Classroom	Floor area	1.6 m^2/student	2 m^2/student	Permendikbud No. 34 Thn. 2018
Basic Automotive Workshop	Floor area	1.3 m^2/student	3 m^2/student	Permendikbud No. 34 Thn. 2018
	Room width	9 m	>15 m	Book of "Modernisasi Bengkel Laboratorium Kejuruan Abad 21"
	Space height	5 m	>6 m	Book of "Modernisasi Bengkel Laboratorium Kejuruan Abad 21"
	Ventilation	No double ventilation	Double ventilation	Book of "Modernisasi Bengkel Laboratorium Kejuruan Abad 21"
Tools and Materials Room	Floor area	40 m^2	72 m^2	Ismara & Prianto (2019)

METHODS

This planning and design use the architectural programming method with a green architecture approach. The stages of architectural programming include (1) determining goals, (2) collecting facts, (3) uncovering and testing concepts, (4) determining needs, and (5) designing. Data sources were taken from informants, namely school managers and building users, archives, and documents. The sampling technique was done by purposive sampling. Data were collected using observation, interview, and documentation techniques. The data validity test technique used was method triangulation. Data analysis was conducted through interactive analysis and descriptive analysis. Interactive analysis was used to analyze data from interviews, observations, and documentation. Data used for planning and design were analyzed using a procedure called descriptive analysis.

The first stage in the architectural programming method is to determine goals, starting from the initial survey activities at SMKN 2 Surakarta to the building planning stage. The second stage is to collect facts which includes an initial site survey, literature study, data collection through interviews, observation, and documentation. Furthermore, the data that has been collected is then analyzed in the third stage, namely revealing and testing concepts. The fourth stage is determining needs, this stage is the planning stage for the Automotive Engineering building and the final stage is design which results in the design of the Automotive Engineering building.

RESULTS AND DISCUSSION

A. Block Plan SMKN 2 Surakarta

According to the data obtained from observations, the Automotive Engineering building area is shown with shading marks in Figure 1.

A : GERBANG DEPAN
B : AREA PARKIR
C : TECHNOPARK
D : R. PENGELOLA SEKOLAH, LAB KOMPUTER
E : R. KELAS, BENGKEL
F : LAPANGAN
G : AULA, LABORATORIUM
H : R. KELAS
I : PERPUSTAKAAN
J : MUSHOLA
K : R. KELAS, LABORATORIUM
L : BENGKEL MESIN
M : KANTIN, KOPERASI
N : BENGKEL OTOMOTIF DASAR
O1 : R. KELAS OTOMOTIF, R. GURU, R. ALAT DAN BAHAN
O2, O3, O4 : R. KELAS OTOMOTIF
P : BENGKEL OTOMOTIF TERPADU
Q : R. OSIS
R : GERBANG BELAKANG

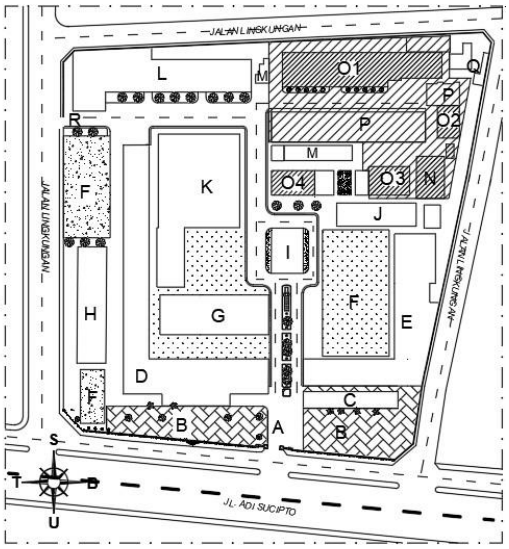

Figure 1. Block Plan of SMKN 2 Surakarta

Buildings with denser shading symbols in Figure 1 are the buildings to be designed, namely block N and block O. Block P is not included in this planning and design.

The interview was conducted on April 14, 2023, at SMKN 2 Surakarta. The resource persons appointed as informants included the Deputy Principal for Facilities and Infrastructure, the Head of the Automotive Engineering Department, and students majoring in Automotive Engineering. The results of the interview include the following:

1. Lack of theory classrooms in the Automotive Engineering Department. Currently, thereare only 9 classrooms while this department has 12 study groups.
2. The condition of integrated automotive workshops such as *engine* workshop*, chassis* workshop, and electrical workshop is representative.
3. The space for tools and materials is only 40 m^2, while the ideal standard according to Ismara & Prianto (2019) is 72 m^2.
4. SMKN 2 Surakarta already has a plan to renovate the Automotive Engineering buildingbut does not yet have a design drawing and is still waiting for funds from the government.
5. The absence of canopies on the windows or the absence of wall cladding in the basic automotive classrooms and workshops causes glare problems.
6. The Automotive Engineering Department has 12 study groups with an average number of 36 students per study group.
7. The basic automotive workshop is used for bench work, welding, and motorcycle repair.
8. The basic automotive workshop is only used for grade 10 (4 classes).
9. The tools and machines in the basic automotive workshop are used per group where each group consists of 6 students.

B. Site Analysis and Planning Program

1. Site Analysis

a. Accessibility

The main access to the Automotive Engineering building site is through the front gatewith the symbol A (Figure 2).

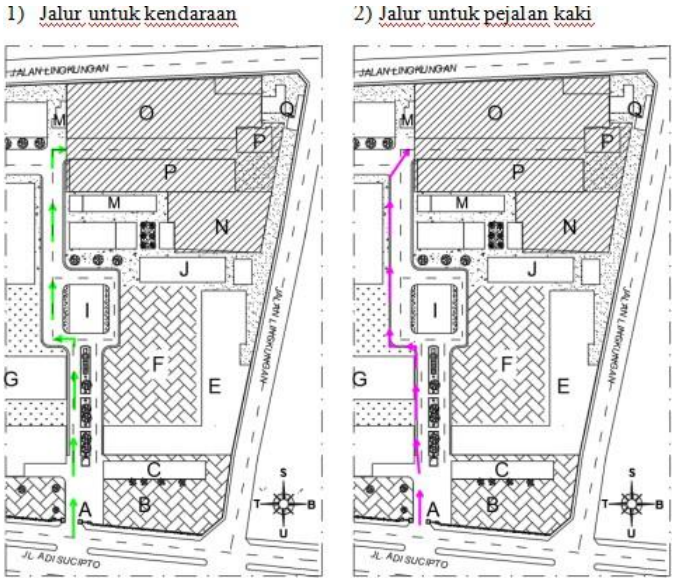

Figure 2. Accessibility of the Automotive Engineering Building

b. Sun Analysis

The direction of movement of the sun is rising from the east and sinking towards the west. To avoid glare and direct sunlight, the building is planned to face north with openings on the north and east sides of the building. In addition, there are land limitations such as the south side of the land bordering the fence, the shape of the land extending east-west, and the main access that is possible on the north side, so solar analysis and land limitation conditions are compatible (Figure 3). In addition, the annual apparent motion of the sun (Figure 4) results in the position of sunrise and sunset not in the same position or slightly shifted to the north-south direction. In this planning and design, although the building is not planned to face the direction of sunrise and sunset, it still requires heat dissipation on the north and south sides of the building. Therefore, the walls on the north and south sides of the building will be covered with roster walls and the use of vegetation.

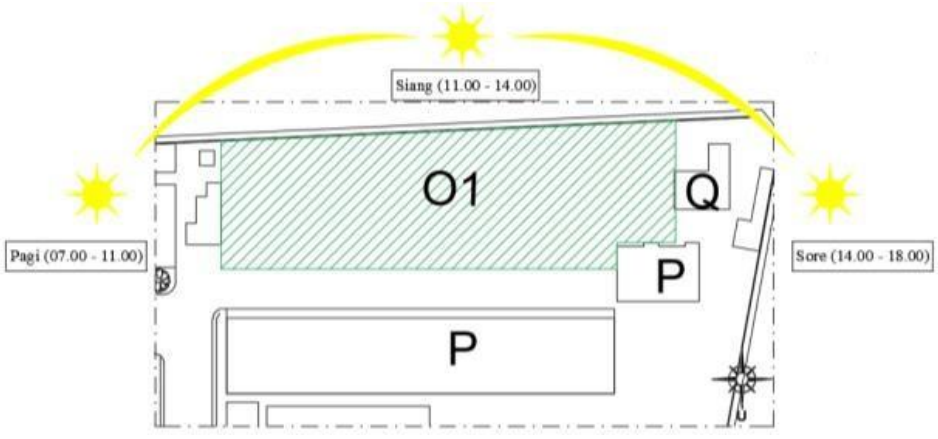

Figure 3. Sun Movement Analysis

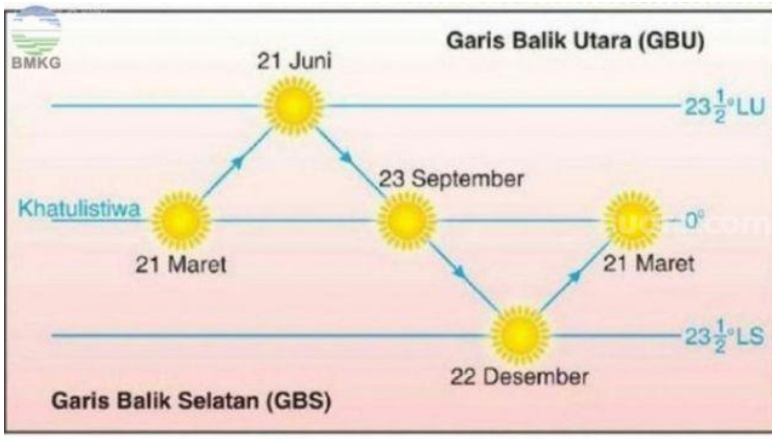

Figure 4. Illustration of the Sun's apparent motion

2. Planning Program

a. Actors, Activities, and Space Requirements

The actors and activities carried out in the Automotive Engineering building of SMKN 2 Surakarta are written in Table 1. Several spaces are needed for learning activities inthe Automotive Engineering department. Some of these spaces include:

1) Space in the Automotive Engineering main building: classrooms, teacher's room, restrooms
2) Spaces in the basic automotive workshop building: workshop/practice room, tool and material room, toolman room, toilet.

b. Relationship Between Spaces

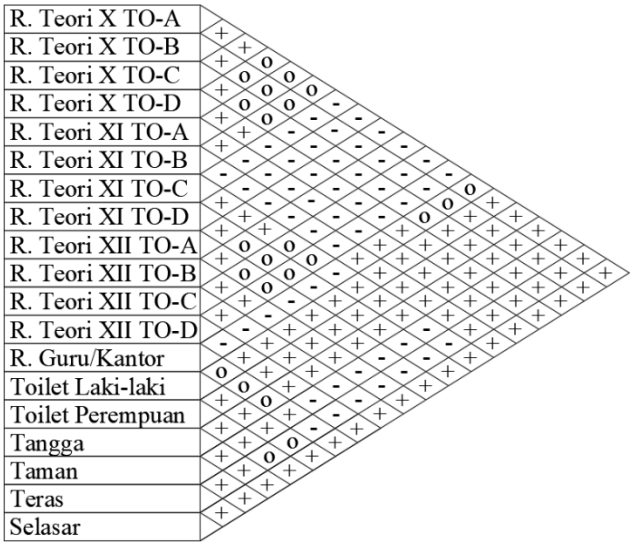

Figure 5. Space Relationship Matrix for Automotive Engineering Main Building

Keterangan :
+ : dekat (bersebelahan)
o : sedang (melalui 1 atau 2 ruang lain)
- : jauh (melalui beberapa ruang lain)

Figure 6. Basic Automotive Workshop Space Relationship Matrix

c. Building Planning Through a Green Architecture Approach

According to Brenda and Robert Vale (1991), there are six principles of green architecture. Principles that can be applied to the planning and design of the Automotive Engineering building SMKN 2 Surakarta are as follows:

1) Conserving Energy

The Automotive Engineering building of SMKN 2 Surakarta is planned to minimize the use of fuel or electrical energy.

a) Utilization of solar panels, to obtain maximum energy, solar panels installed on the roof of the building are tilted from top to bottom towards the east-west wall following the direction of solar circulation. Based on the design of Asyari, H., et al. (2022), the solar panel installed on one of the buildings in Surakarta has a tilt angle of 15° because this angle is the most effective and the losses are not too large. In addition, Surakarta is also located south of the equator so the solar panels in the Automotive Engineering building are planned to face north.

b) Utilization of gray water, based on the calculation of wastewater discharge (Siswanto, et al, 2016) is that 80% of clean water usage will turn into wastewater and 75% of wastewater is gray water. Therefore, the gray water generated in the main Automotive Engineering building will be calculated to be utilized by flowing into the ground gray water tank and then used to flush the toilet and water the plants.

c) Selection of bright paint colors, the choice of paint color in the Automotive Engineering building is white to increase the intensity of light in the room.

2) Working with Climate (adapting to the climate and utilizing natural energy sources)

a) Utilization of sunlight as natural lighting

According to Esa D, et al. (2011), the way that sunlight can enter maximally into the room is by increasing the dimensions of the openings (windows and doors). The ideal opening area is 10-20% of the total floor area. Skylight applications will also be applied with the aim of helping the entry of natural lighting into the room.

b) Natural ventilation

The window opening area for the natural ventilation system is also related to the opening area for natural lighting, which is 10-20% of the total floor area. Window openings in the Automotive Engineering building will use a cross ventilation system (Figure 7) with a type of two openings-opposite walls as shown in Figure 8 bottom right. This system is intended so that air can be well distributed for room coolness.

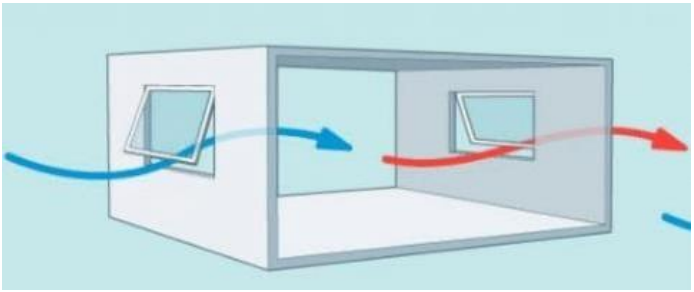

Figure 7. Illustration of Cross Ventilation

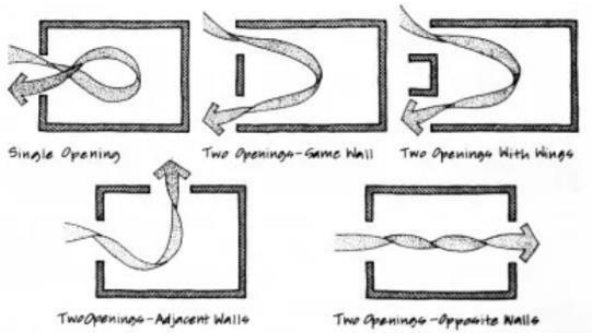

Figure 8. Natural Ventilation Type

3) Respect for the Site

Figure 9 shows the existing condition of the site and the land area of the main Automotive Engineering building (block O1) and the basic automotive workshop (block N). This figure refers to Figure 1 which shows the limited land so that the building is planned with a thin shape extending to the west-east.

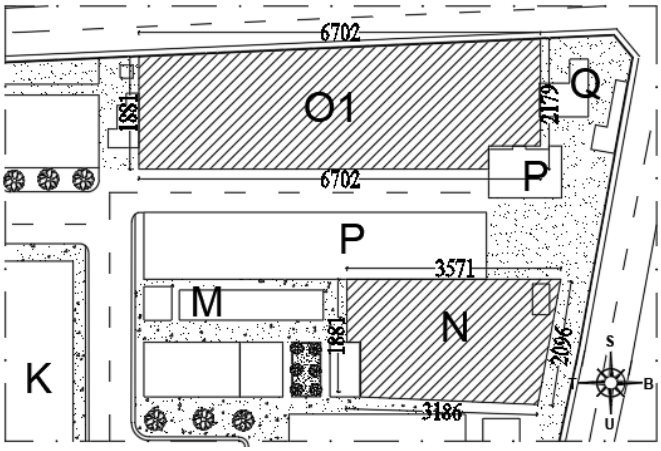

Figure 9. Building Land

4) Respect for Use

The room is planned to provide user comfort by paying attention to the aspects of space size, lighting, and ventilation. To provide a comfortable view of the users of the space, the installation of roster walls on the north and south sides is needed to block the sunlight entering through the windows. Not all walls will be covered with roster but half of the room wall area will be given vegetation, namely vines.

5) Minimizing new Resources

This principle is related to the principle of energy saving. The use of solar panels aims to reduce new power sources from PLN. The use of sunlight for natural lighting also aims to minimize the use of lights during the day. The use of grey water is also one of the efforts to minimize water resources.

6) Holistic

This holistic principle means that all green architecture principles are interconnected with each other and cannot be separated because it is a unity in the planning and design process.

d. Room Size

In line with the principle of green architecture, namely respect for use (paying attention to users), in planning the space needs to pay attention to the comfort of space users. Therefore, the space area must be taken into account so that it is comfortable when used.

Table 2.
Room Size of Automotive Engineering Building

Room Name	Space Capacity (people)	Number of Rooms	Extensive (m)^2	Total Space Area (m)^2	Standard
Classroom	36	12	80,64	967,68	Permendikbud No. 34 Thn. 2018
Teacher's Room	15	1	89,6	89,6	Permendikbud No. 34 Thn. 2018
Main Building Restroom	222	2	33,3	66,6	Architect's Data Volume I
Basic Automotive Workshop	112	1	337,5	337,5	21st Century Vocational Laboratory Workshop Modernization Book
Tools and Materials Room and *Toolman* Room		1	72	72	21st Century Vocational Laboratory Workshop Modernization Book
Basic Automotive Workshop Restroom		1	18	18	Indonesian Public Toilet Standard Guidelines
Total Floor Area of Automotive Engineering Building				**1551,38**	

e. Building Utilities

1) Lighting System

Following the principle of green architecture that works with climate, the utilization of sunlight is needed for natural lighting. The window opening area as a way of entering light based on the statement of Esa D, et al. (2011) is listed in Table 3 below:

Table 3.
Window Opening Area in Automotive Engineering Building

Space	Floor Area	Standard Opening Area	Total Opening Area
R. Classroom	80,64 m^2	10%-20% floor area	13,44 m^2
R. Teacher	89,6 m^2	10%-20% floor area	17,54 m^2
Main Building Restroom	33,3 m^2	10%-20% floor area	6,64 m^2
Basic Automotive Workshop	337,5 m^2	10%-20% floor area	56,25 m^2
R. Tools Materials, R. *Toolman*	72 m^2	10%-20% floor area	14,4 m^2
Basic Automotive Workshop Restroom	18 m^2	10%-20% floor area	3,6 m^2

2) Air Conditioning System

Following the principle of green architecture, namely working with climate, the utilization of ventilation is very necessary for natural ventilation. The existence of ventilation is intended so that the process of air exchange in the room can run well. The window opening area is a way in and out of the air following the standards listed in Table 3. In addition to paying attention to the window opening area, the use of a cross-ventilation system can provide good air circulation. This system distributes clean and cool air into the room by utilizing two opening paths whose

positions face each other.

3) Electrical Installation System

The source of electrical energy that will be used in the planning of the Automotive Engineering building of SMKN 2 Surakarta is the use of solar panels installed on the roof of the building and combined with electricity from PLN.

a) Solar Panel Needs in Automotive Engineering Main Building

The calculation of artificial lighting needs (lamps) supplied by solar panels is asin Table 4.

Table 4.
Electrical Power Requirements for Artificial Lighting (Lights) in the Automotive EngineeringMain Building

Room Name	Number of Rooms	Lamp Power(Watt)	Number of Lamps (pieces)	Power Consumption (Watts)
Classroom	12	20	26	6240
Teacher's Room	1	18	24	432
Toilet	2	5	27	270
Stairs	1st floor to 2nd floor	5	10	50
al Power Consumption per Hour			**98**	**6.992**

Based on the *website* gesainstech.com (accessed on June 29, 2023, 16.10), the calculation of solar panel requirements in Table 4 with a capacity of 250 WP is asfollows:

Total power consumption/day = total power consumption per hour x assumed on time
= 6.992 x 4
= 27.968 Watts

Coupled with an apparent load of 15% or 4,195.2 Watts, the total power requirement becomes 32,163.2 Watts. In Indonesia, the optimal *photovoltaic* process only lasts for 5 hours, so:

Solar panel = total power: optimal time
= 32,163.2 Watts: 5 hours
= 6,432.64 WP

If a 250 WP solar panel on the market is used, then,

Solar panel = 6,432.64 WP : 250 WP
= 25.73 pieces or 26 pieces (produces a power of 6500 WP)

b) Solar Panel Needs in Basic Automotive Workshop

The calculation of artificial lighting needs (lamps) supplied by solar panels is as in Table 5.

Table 5.
Electrical Power Requirements for Artificial Lighting (Lights) in Basic Automotive Workshops

Room Name	Number of Rooms	Lamp Power(Watt)	Number of Lamps (pieces)	Power Consumption (Watt)
Basic Automotive Workshop	1	18	154	2772
Tools and Materials Room and *Toolman* Room	1	18	13	234
Toilet	1	5	14	70
Total Power Consumption per Hour			**167**	**3.076**

With the same calculation as the calculation of solar panel requirements in the main building, the basic automotive workshop building requires 2,829.92 Watt Peak power. If a solar panel with a capacity of 250 Watt Peak is used in the market, then:

Solar Panel = 2,829.92 WP : 250 WP = 11.31 pieces
= 12 pieces (rounded) which produces a power of 3,000 WP.

So solar panels with a capacity of 250 WP for the Automotive Engineering building with a total of 38 pieces produce a power of 9,500 WP which can meet the power requirements (artificial lighting) of 9,262.56 WP.

4) Clean Water Plumbing System

The distribution of clean water can be seen in the scheme in Figure 10.

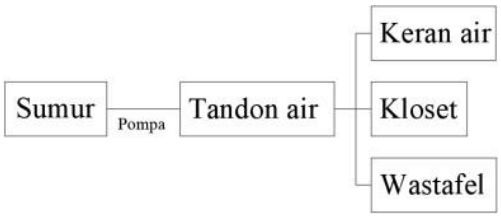

Figure 10. Clean Water Distribution

The need for clean water for toilet uses in the main Automotive Engineering building refers to SNI 03-7065-2005 with calculations as listed in Table 6.

Table 6.
Clean Water Requirements for Automotive Engineering Main Building

User	Number of Users (People)	Plumbing Tool Name	Every Usage (L/Day)	Total (L/Day)
Male Students	423	Faucet	10	4230
		Peturasan	5	2115
		Sink	10	4230
Female Students	6	Faucet	10	60
		Sink	10	60
Male Teacher	13	Faucet	10	130
		Peturasan	5	65
		Sink	10	130
Female Teacher	2	Faucet	10	20
		Sink	10	20
Total				11.060

5) Gross water Plumbing System

The dirty water in the main Automotive Engineering building is:

a) Gray water (derived from used water from wasfatel and floor drain toilets)

b) Black Water (from toilets and urinals) which is channeled to the septic tank.

The calculation of gray water discharge is as follows:

Average discharge of wastewater = 80% x average discharge of clean water
= 80% x 11,060 liters/day
= 8,848 liters/day

Average gray water discharge = 75% x average effluent discharge
= 75% x 8,848 liters/day
= 6,636 liters/day

However, there is water loss in the distribution process, according to Diasa, I. W., et al. (2019) is as much as 20-40%. So gray water that can be utilized is assumed to be only 30% of 6,636 liters/day, which is 4,645.2 liters/day. The water requirement for flushing toilets according to SNI 03-7065-2005 is 14 liters/person/day multiplied by the number of users, namely 444 people, the total water requirement for flushing toilets in the Automotive Engineering main building is 6,216 liters/day. While the water requirement for watering plants according to Isfandyari, F. (2018) is 2 liters /2 / day in the dry season and 1 liter /2 / day in the rainy season. The calculation of water requirements for watering plants is as follows:

Garden water requirement = Garden area x requirement per m^2

= 3,879 m2 x 2 liters/m^2/day

= 7,758 liters/m^2/day

So, the total water demand from gray water management for flushing toilets and watering plants is 13,974 liters/day. Based on the calculation of the total water demand from gray water management, only 4,645.2 L/day (33%) of the water demand of 13,974 liters/day (100%) can be met.

3. Design Program

The design program is based on the previous planning program to create a design.

a. Automotive Engineering Main Building

This building is used for theoretical learning. In Figure 1, this building is located inblock O1.

1) Floor Plan Drawing

Following the principle of respect for use, the rooms in this building are designed by paying attention to the minimum ratio of space for the convenience of movement and user activities. In addition, the building is also designed according to the principles of conserving energy and respect for the site, namely the building is made thin lengthwise with a length of 59.2 m and a width of 14.2 m with consideration of adjusting the limited land on the site.

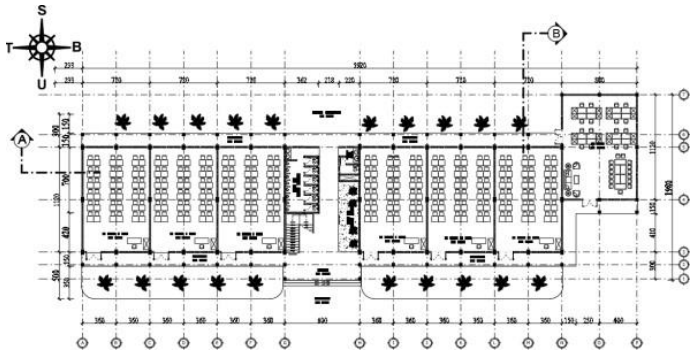

Figure 11. Plan of the Automotive Engineering Main Building 1st Floor

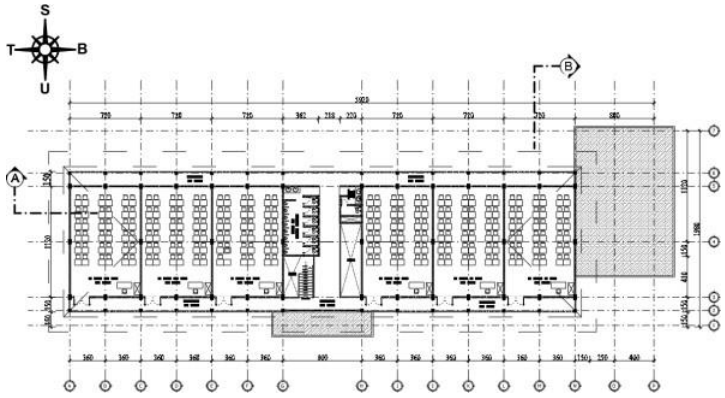

Figure 12. Plan to Draw of Automotive Engineering Main Building 2nd Floor

2) Viewing Image

Door and window openings are located on the north (front) and south (back) sides of the building. By paying attention to the principle of working with climate, the opening area is calculated at 17 - 20% of the total floor area so that sunlight as natural lighting can be maximized. Roster walls and vegetation in the form of vines are also applied to this design to reduce glare and solar heat entering directly into the room to provide a comfortable view.

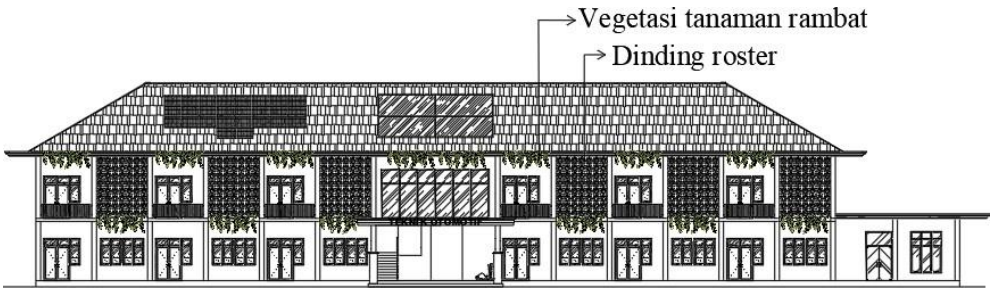

Figure 13. Front View of Main BuildingAutomotive Engineering (North)

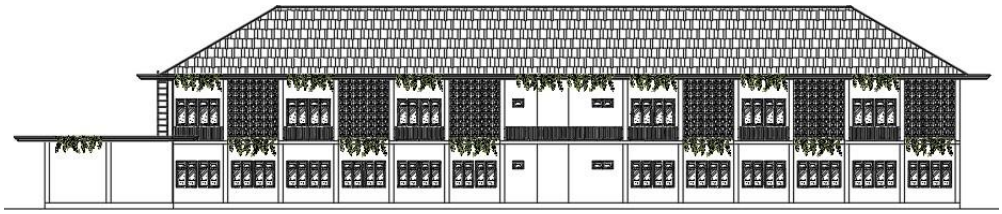

Figure 14. Rear View of Main BuildingAutomotive Engineering (South)

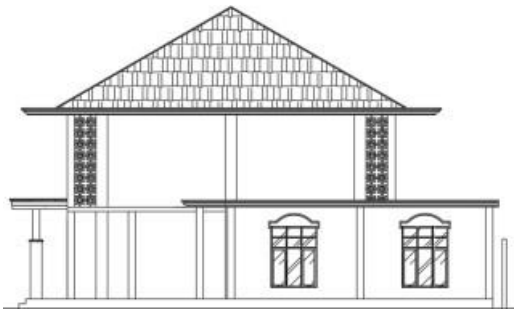

Figure 15. West Side View of Automotive Engineering Building

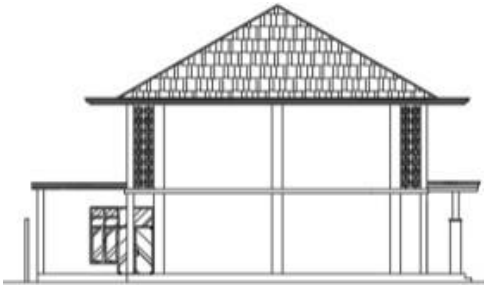

Figure 16. East Side View of Automotive Engineering Building

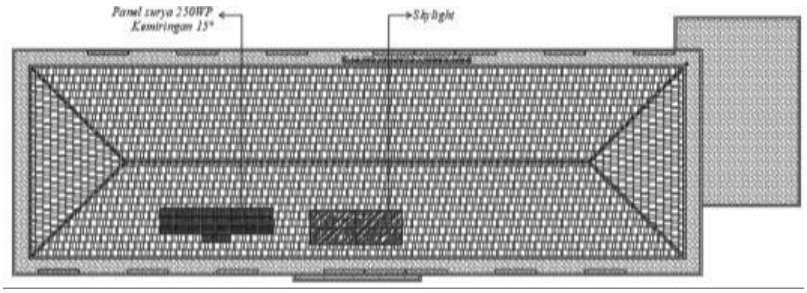

Figure 17. Top View of Automotive Engineering Main Building

3) Cut out Drawing

The roof frame of the Automotive Engineering main building uses a lightweight steel frame with a ceramic tile roof covering. Ceramic tile has the advantage of being able to make the room cool. The height of the second floor of this building is 4 meters with a total building height of 12.7 meters. In each room, there is a 3.2-meter-high gypsum ceiling.

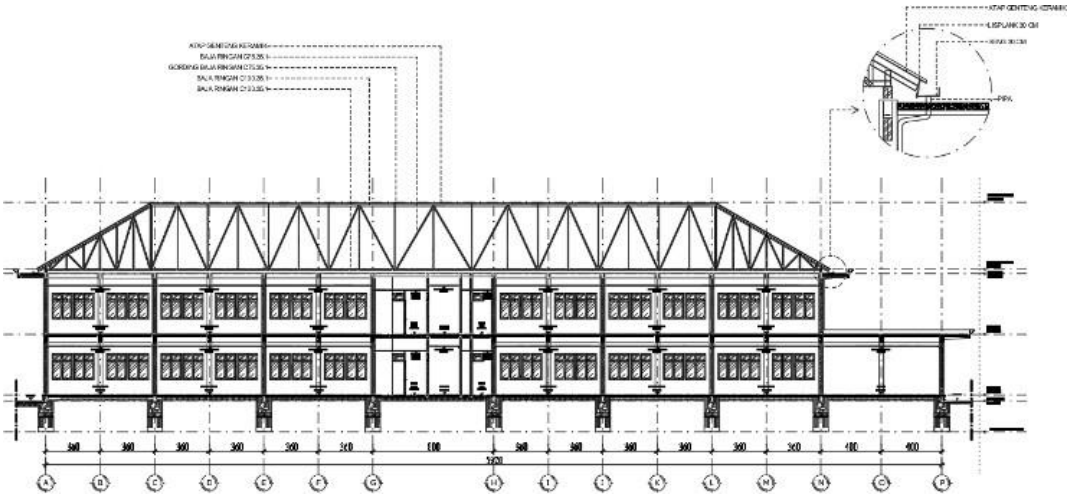

Figure 18. A-A section Automotive Engineering Building

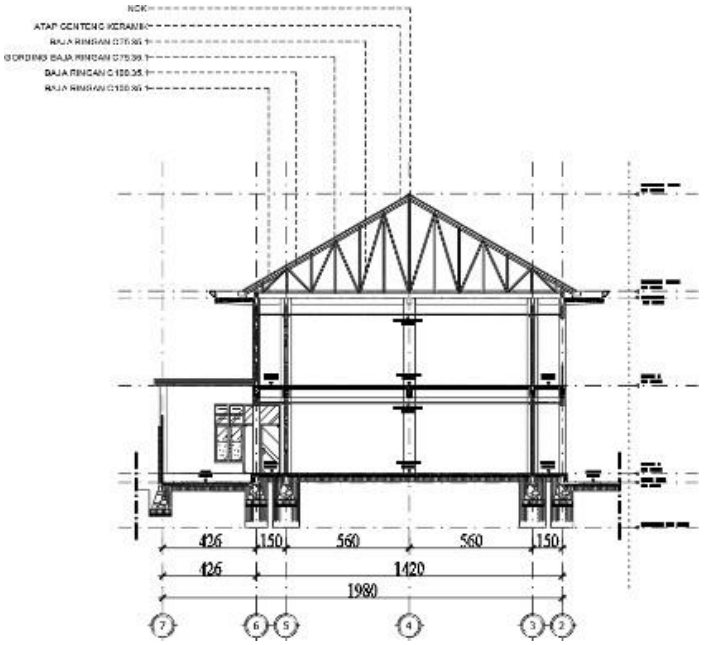

Figure 19. B-B section of the Automotive Engineering MainBuilding

4) 3D Image of Main Building

Figure 20. 3D drawing of Automotive Engineering Main Building

b. Basic Automotive Workshop

1) Floor Plan Drawing

The building is designed according to the principles of conserving energy and respect for site, namely, the building is made thin lengthwise with a length of 28.5 m and a width of 17 m with consideration of adjusting the limited land on the site. The workshop is designed with one floor facing south. The entrance to this workshop is on the south side.

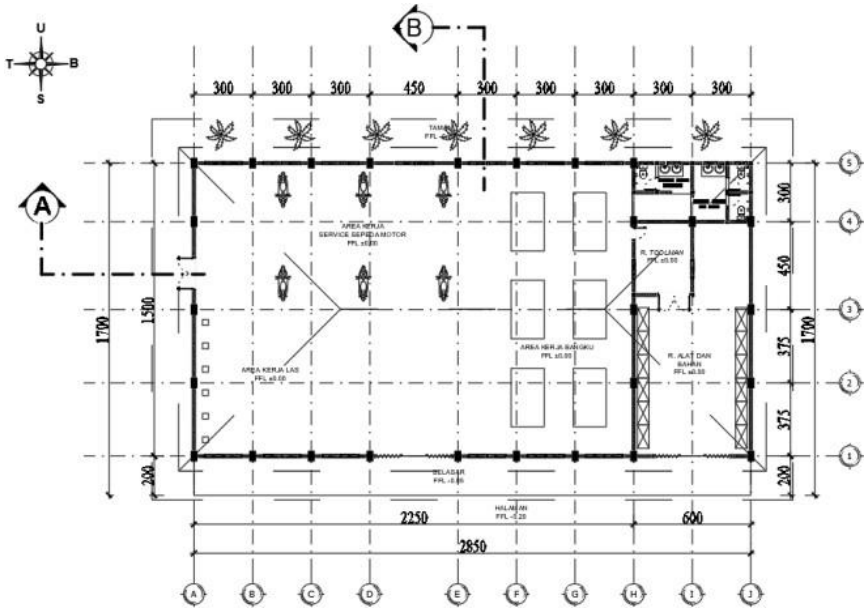

Figure 21. Floor Plan Drawing

2) Cut out Picture

The roof frame of the Automotive Engineering main building uses a steel frame with a ceramic tile roof covering. The height of the building is 11.6 meters, while the wall height is 6.5 meters.

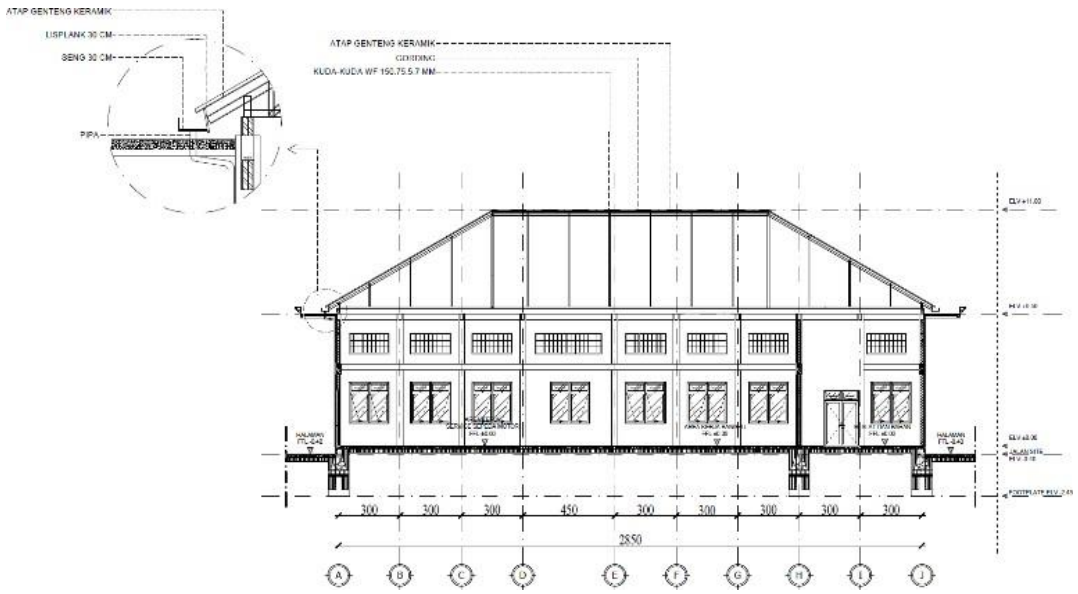

Figure 22. A-A section of Basic Automotive Workshop

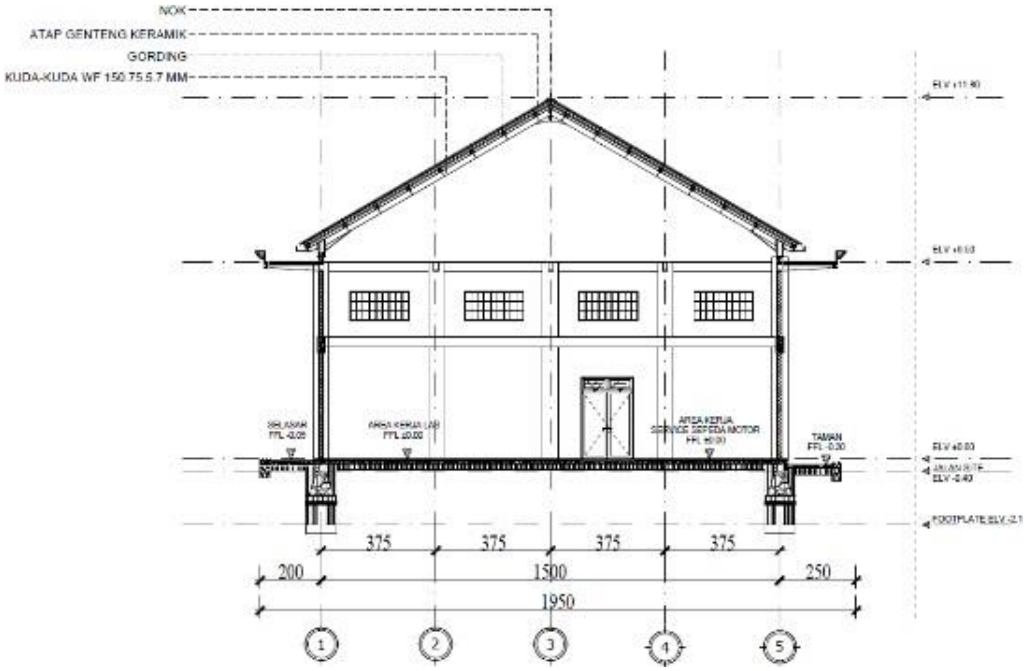

Figure 23. B-B Cutout of Basic Automotive Workshop

3) 3D Drawing of Basic Automotive Workshop

Figure 24. 3D drawing of Basic Automotive Work

CONCLUSION

Based on the above discussion, it produces two buildings, namely the Automotive Engineering main building with a total floor area of 1,583.57 m2 consisting of 12 classrooms, 1 teacher's room, 4 toilets; and a basic automotive workshop building with a total floor area of 471.2 m2 consisting of 1 practice/workshop room, 1 tool and material room and toolman room, and 2 toilets.

Automotive Engineering Building SMKN 2 Surakarta applies the six principles of green architecture. The opening area for natural lighting and ventilation is 17-20% following the guidelines for the opening area, which is 10-20% of the floor area. The calculation of the opening area is expected to produce enough ventilation holes so that it does not require artificial lighting/lights and air conditioning. The utilization of natural lighting and air conditioning is an application of the principle of conserving energy and the principle of working with climate or utilizing natural energy sources.

But in cloudy weather, it can use artificial lighting sourced from solar panels installed on the roof of the building producing a power of 9,500 WP which can meet the power needs of 9,262.56 WP. Water conservation is also applied to buildings with gray water utilization of 4,645.2 L/day (33%) of the water demand of 13,974 L/day (100%). This is an application of the principle of conserving energy and the principle of minimizing new resources.

The building is designed by adjusting the shape of the site which extends west-east in line with the principle of respect for site. The room is designed by paying attention to the minimum ratio of space for the convenience of movement and user activities. In addition to the comfort of movement, to provide a comfortable view of space users, the walls on the north and south sides of the building are installed with roster walls and use of vegetation to block sunlight entering through the windows. This is an effort to overcome the problem of glare in the room which is in line with the principle of respect for use. The entire application of these principles is a unity and cannot be separated (holistic).

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