

Weather-Resistance Bench Inspired by Young Badminton Logo

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Abstract: All year long, as a tropical country, it is hot and humid in Malaysia. An outdoor bench kept outside the roof will not endure for very long since the bench's material can become tarnished from exposure to moisture and harsh direct sunlight. As a result, the weather had numerous consequences that damaged outdoor furniture, making upkeep or buying new outdoor furniture expensive. Therefore, the purpose of this study is to define the criteria for designing and developing a prototype for a weather-resistant bench that draws its inspiration from the YOUNG badminton logo. A quantitative survey using Google Forms was carried out to establish the design criteria. A total of 50 individuals were surveyed who visitors at Taman Rekreasi Tasik Y in Batu Pahat, Johor. According to the analysis, the majority of respondents believe that rust is the most frequent type of bench damage, and 100% of respondents prefer benches that are resistant to the elements. Findings indicate that a bench in a leisure area must have a modern style design, be natural in colour, and be composed of a mix of mild steel and wood. The bench design was produced using the design requirements generated from the survey. The bench design process then proceeded to begin with visual research, 30 thumbnails, 6 ideations, and 4 idea development prior to the final design selection. Subsequently, mock-up and technical drawings were generated based on the selected final design. The prototype's construction materials included Chengal wood and mild steel with shellac and lacquer as finishing for wood materials. In summary, this research's design can make outdoor furniture more resistant to weather issues including exposure to water, moisture, and sunlight. Unprotected wooden furniture can warp and suffer other damages.

Keywords: Outdoor Bench, Weather-Resistance, YOUNG Badminton Logo

1. Introduction

According to Smardzewski (2015), furniture is a term used to describe pieces of applied art that are used to furnish residential interiors temporarily and permanently. Furniture is one of the essential items in people's daily life. Furniture is composed of four factors: material, structure, appearance, and

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function. The structure is the backbone and is the basis of the implementation of functions. These four factors are related to each other and restrict each other. Because furniture is to satisfy people certain material demands and use purpose and design and make, accordingly furniture still has the element of material and exterior form respect. Outdoor public seats are public facilities that are widely used in cities, are widely distributed, and are in close contact with people. With their unique features, they are spread all over the streets and alleys of the city. As one of the elements of urban space, outdoor public seats have become an indispensable part of urban public facilities. They are closely related to the daily life of the public. Based on realizing their own functions, they reflect the characteristics and style of a city and reflect the citizens' quality of life.

A bench is a long seat on which multiple people can sit at the same time. Some benches are typically made of wood, but may also be made of metal, stone, or synthetic materials. Many benches have arms and backrests; some have no backrest and can be sat on from either side. The openness and robustness of squares often make them the centre of city events and social nodes. Squares are physical voids that offer breathing space amid the buildings (Zakariya *et al.*, 2014). Not only that, but public spaces are also creating essential opportunities for social interactions. “Public spaces are platforms where people can be a part of the public realm” (Zakariya *et al.*, 2014).

Weather-resistant outdoor furniture varies greatly depending on the region in which the property is located, as environmental factors cause your furniture needs to be built for. First and foremost, water. Whether you live on the coast, in the prairies, or in the mountains, any outdoor furniture left outside is likely to meet water at some point during the season, whether it's in the form of rain, snow, humidity, or morning dew, so this is one of the first considerations to address when looking for durable patio furniture. Bench selection and design should consider weather effects such as sunlight, expansion and contraction, wind stress, moisture, and in some cases, salt spray and frost. The best designs usually incorporate strong, simple shapes, native materials, and natural finishes, generally in black, greys, and earth tones, accented with bright colours (Almandrawy, 2016).

Nowadays, most outdoor furniture is designed with a monotonous and not comfortable design. Some of the outdoor benches did not consider whether the weather will affect the durability of the bench. Benches and seating are not just objects; they are mirrors of our social behavior. The ways people interact with seating can reflect their personalities, their sense of belonging and security in public spaces, and their openness to other people. To look closely at how people, use something as simple as a bench is to shed light on the ways that we interact; the intricacies of how humans share spaces, even when it is time to sit down for a rest. Outdoor furniture also needs to have an identity or trend, by focused on creating lifestyle also needs to have an identity or trend, focused on creating a lifestyle based on clarity, creativity, innovation, and most importantly reliability and comfort (Mulyono and Thamrin, 2017).

Weather will cause the outdoor furniture damaged especially country with extreme climate events like tropical country. With prolonged water exposure, humidity and sunlight exposure, unsealed wood furniture can warp and become damaged. In addition, steel and iron furniture also can rusty. Outdoor furniture that does not completely dry or is prone to stand water can support mold or mildew growth. Malaysia has a tropical climate with mean annual temperature is 25.4 °C. Rainfall distribution also remains high year-round, with mean annual precipitation of 3,085.5 millimeters (mm). In Malaysia, there are two monsoon seasons: The Southwest Monsoon (April-September) and the Northeast Monsoon (October-March). Malaysia receives about six hours of direct sunlight per day, with cloud cover most likely during the afternoon/evening. Weather is the main factor will affect the durability of outdoor furniture such as wind stress, expansion and contraction, sunlight, moisture, and in some cases, cold weather (Pezshkpoor, 2020).

Therefore, be against the weather, the choice of materials depends on the context and limitations of the design. The bench can be made of timber slats and an iron pack. Iron benches are a popular material

choice because they are versatile, have a high strength-to-weight ratio, and can be shaped to fit almost any design aesthetic. It is long-lasting, corrosion- and impact-resistant, and requires no maintenance. It is also less expensive in terms of life-cycle cost than all other materials and is fully recyclable. (Almandrawy, 2016). Thence, this study purposes a weather-resistance bench to address the previously mentioned issue.

2. Research Methodology

In this work, the methods described by Lim and Selimin (2023) and Kor and Selimin (2019) was utilised. A questionnaire is a quantitative instrument consisting of a series of questions for the purpose of gathering information from respondents. To acquire the design criteria of the weather-resistant bench inspired by YOUNG badminton logo, the researcher collected the primary data using a questionnaire. Google Form was utilized to distribute the questionnaire to at least 50 individuals aged 18 and above in Taman Rekreasi Tasik Y, Batu Pahat, Johor. In this research, the questionnaire consists of two sections which are Section A for demographic information, and Section B is about the opinion of respondents and design criteria. The data collect from the questionnaire will be used as design criteria for the weather-resistant bench inspired by YOUNG badminton logo.

2.1 Visual Research

Visual research aids in the brainstorming of ideas for the weather-resistance bench design based on the precise design criteria derived from collected data. It aids the researcher in determining the design direction for this study. It interprets the image using artistic mediums. Video, photography, sketches, drawings, and paintings are examples of artistic mediums. In this research, the resource of visual research will be obtained from a webpage, articles, and any other possible sources. The selection for the visual research involves the way the bench is inspired by the YOUNG badminton logo, the design shape of the bench, and the dimension of the bench. The visual research will be focused on the bench with natural colour, the bench with armrest and backrest, and the materials of the bench. The set of visual research elements is helping to identify the design criteria and direction for this research.

2.2 Thumbnail Sketches

Thumbnail sketches are small, and random drawings of an idea but suitable for bench design. Thumbnail is an important preparatory step in drawing those aids in visualizing the simple design concept and ideas of the weather-resistance bench. Weather-resistance bench concepts were sketched in 3D on A3 paper for this study. There have 30 thumbnails or more will generated in this study. The thumbnail will focus on the perspective view of the bench. The thumbnails will be constructed using one or two design criteria obtained from the questionnaire.

2.3 Ideation

Ideation is a process of generating and visualizing ideas of the mind through sketching. Ideation can convey the design ideas of the bench with different shapes, criteria, and materials by sketching. In this research will focus on the YOUNG badminton logo concept the generate many ideas for an outdoor bench based on the design criteria and sketched thumbnails. In this research, the ideation for a bench will be sketched in 3D form. There are 5 ideations that will be made in this stage and the potential designs will be used in the idea development.

2.4 Idea Development

The process of developing ideas by modifying them with the collected design criteria is known as idea development. Based on the ideation sketches, the idea development stage will provide additional design specifics. In the idea development phase, an isometric view, side view, and front view with some

details will be sketched to provide a better understanding of the bench's design. Furthermore, the elements of the YOUNG badminton logo were infused into the design at this stage through the enhancement of the bench sketches with some explanation of important features. In this stage, two ideas were chosen to be developed further. Two idea developments were generated and improved from the chosen ideation by considering the functions, appearance, and materials in detailing the important part of each sketch.

2.5 Final Design

A design survey must be conducted prior to finalizing the design to determine the final design. In this study, three ideas from idea development sketches will be chosen as pre-final designs and displayed in the design survey after the render and information are stated. In isometric view, colour, and texture, the pre-final design will perform well. The sketch will display the message and employ mode on how the bench is created and functions. These sketches also include notes to illustrate and mark the concept. The image is presented with design and information for voting; the design with the most votes will be considered as the final design and manufactured as a prototype.

2.6 Mock-up Development

A mock-up is a scale replica of a design that is used for demonstrating, evaluating, and other reasons. Mock-ups provide a realistic view of a design and assist the researcher in gathering user input on the outdoor bench. Mock-ups can also assist in revealing a problem that is not readily apparent on paper. Following the release of the final design, the researcher must create a 1:6 scale mock-up based on the dimensions of the final design. Cardboard is the material that will be utilized to make the mock-up. White glue and A4 paper The PVC foam board will be cut into multiple pieces of the proper size for this study, and all the components will be assembled with white glue.

2.7 Technical Drawing

A technical drawing is a drawing that conveys technical information or demonstrates how something is built. The goal of technical drawing is to produce a precise result using ineffective procedures. The researcher used AutoCAD software to create a full-scale technical drawing of the outdoor bench. The outdoor bench's technical drawing will be shown in an orthographic view that includes the following views: (i.) top view, (ii.) side view, and (iii.) front view. In addition, the design will be displayed in isometric and perspective views at this point. The centimeter (cm) is the unit of measurement for the technical drawing of the outdoor bench, and all drawings will be printed on A3 paper.

2.8 Prototype Fabrication

A prototype is a working model or original sample of a final product that evolves from the final design. The prototype is intended to provide a strong visualization of the design and is used to assess the design to improve end-user satisfaction. Users' responses will aid researchers in gathering input on the YOUNG Badminton Logo-inspired outdoor bench. So, in the future, researchers can make substantial changes to the product to improve its quality and fulfil as many consumer requirements as feasible. The material utilized to make the prototype in this study will be determined by the data received from the questionnaire and the appropriateness of materials for the final design.

3. Results and Discussion

3.1 Questionnaire Analysis

In this study, the results had been collected from a sample size of 50 respondents. After collecting data, the researcher analyzed the data by using google form. Thus, this survey will conduct in two

section which are Section A: demographic information and Section B: design criteria of weather resistant bench. For survey study, the survey has been done at Taman Rekreasi Tasik Y, Batu Pahat Johor. Table 1 shows a summary of the questionnaire result. This study found that weather-resistance bench is the preferred design concept which is durability, ergonomically dimension, and rustic. Most of the respondents prefer in the natural colour, combination more than one material and has armrest and backrest to develop.

Table 1: Summary of the questionnaire

Section	Percentage (%)	Description
Demographic	50.0	Male respondent
	49.0	18-30 years old
	56.0	Chinses
	43.0	Degree
	100.0	Single
Design criteria	60.0	Go to the parks weekly
	100.0	Has used the public park bench
	66.0	2 persons seats
	100.0	Bench should follow ergonomically dimension
	60.0	Do aerobic exercise in the park
	60.0	Prefer durability
	44.0	Current issue of the bench is corroded
	100.0	Bench should be weather resistance
	50.0	The most common type of weather-damaged public park bench is rust
	78.0	Prefer natural colour
	52.0	Prefer combination more than one material
	62.0	Prefer has armrest and backrest

3.2 Visual Research

The visual research is processed by using the data collected in the questionnaire. It clearly clarifies and visualizes the design direction for the weather-resistant inspired by YOUNG badminton logo. There are a total of 3 pieces of visual research product (Figure 1), and it can be categorized as bench with natural colour, bench has armrest and backrest, and bench with combination material more than 1.

3.3 Thumbnail and Ideation

In this study, some ideas were sketched as thumbnails presented in Figure 2. All thumbnails were sketched in 3D perspective view with different design criteria based on the data collected from questionnaire and visual research. Thumbnails marked with red box as in Figure 2 were selected for further development in the next process known as ideation. The selection was made based on the results of collected from respondents as aforementioned. Afterwards, six ideations will be selected from thumbnail which are making with red box (Figure 2) as illustrated in Figure 3.

The ideation was sketched in 3D view. For ideation 1, this sketch of design shape was very simple, addition the backrest for more comfortable, and material used are wood and steel. Second, for the ideation 2, this sketch was made based on combination table and bench. The material for ideation 2 will used wood and steel. Third, the ideation 3 shows the classic design of the bench, its addition armrest and backrest for more comfortable and it will make from steel and wood. Next, the ideation 4 is presented the design based on the concrete furniture. It will make from concrete material, has armrest and backrest and it for two-person seats. Furthermore, the ideation 5 design based on modern style and made based on wood and steel, backrest and two-person seats. Lastly, the ideation 6 sketch was made

based on the YOUNG badminton logo on the side view. The bench will use the wood and steel for this design product, backrest and bicycle park.

Ideations 2, 4, 5, and 6 were chosen for further development in idea development process, because they are potential design which can lead to the adoption of the YOUNG badminton logo concept.



Figure 1: Visual research

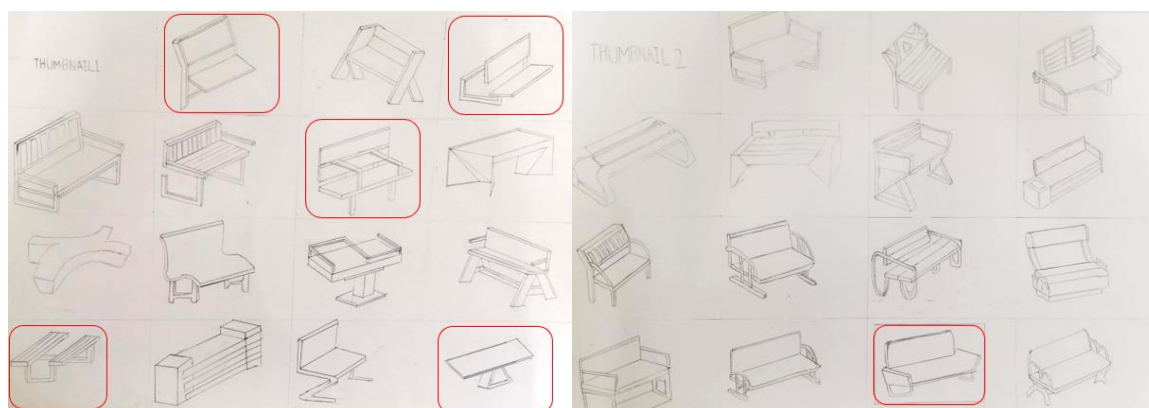


Figure 2: Thumbnails

3.4 Idea Development

The idea developed in this study has illustrated the detail of the design and its criteria. During the idea development process, it will sketch the improvement with some changes to provide a better understanding of the design. Table 2 contains additional information about each idea development. All idea developments in this study were used as final design candidates in the final design survey. This is primarily done to ensure that the final design candidate is included in the final design survey. This is done primarily to ensure that the final design for this study serves the preferences of potential users, even though all designs met the main design criteria obtained previously. In the idea development, 3 idea development were created and Figure 5 shows the idea development sketches. In this process, the

bench shape was implemented into the ergonomic design by adjusting the angle of backrest about 75 degrees. The bench improved on a modern design inspired by the YOUNG badminton logo.

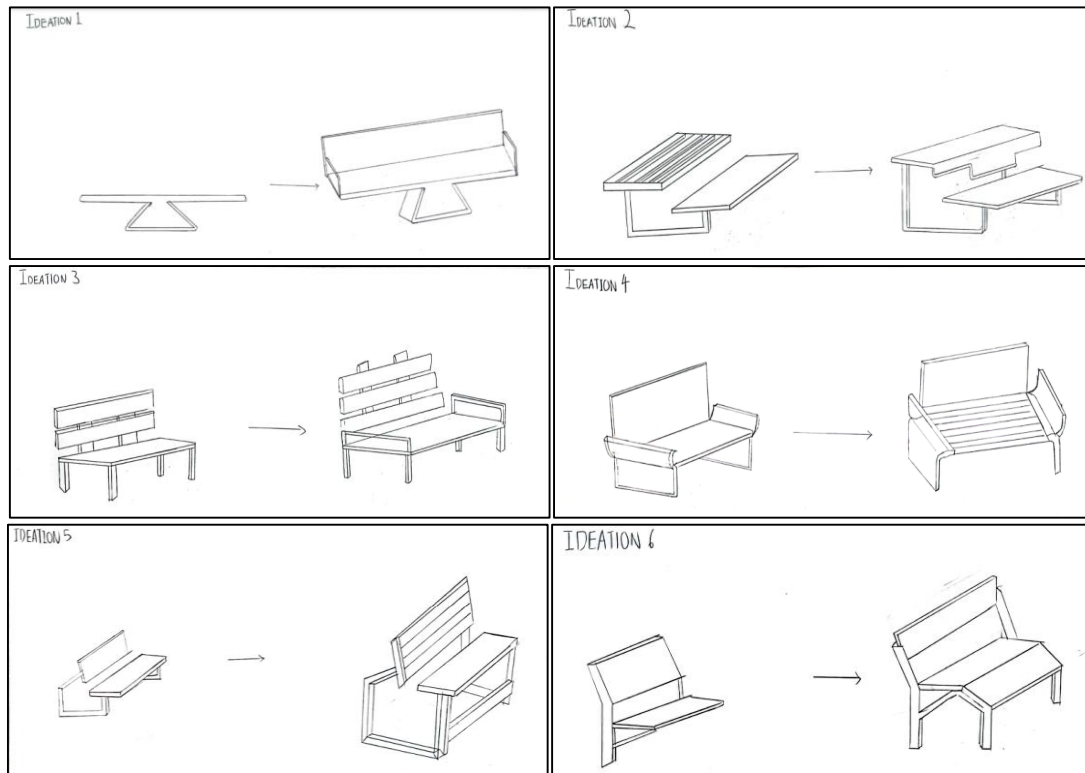


Figure 3: Ideation

Table 2: Summary on the design description of idea development

Idea development	Design description
Idea development 1	<ul style="list-style-type: none"> - Has armrest and backrest - Has footrest - Design shape based on YOUNG badminton logo - Natural colour - Material combination with steel and wood - Comfortable design
Idea development 2	<ul style="list-style-type: none"> - Has armrest and backrest - Design modern - Natural colour - Material combination with steel and wood - Comfortable design
Idea development 3	<ul style="list-style-type: none"> - Has backrest - Has tabletop - Material combination with steel and wood - Natural colour
Idea development 4	<ul style="list-style-type: none"> - Has backrest and armrest - Combination material with steel and wood - Natural colour - Comfortable design - Design inspired by YOUNG badminton logo

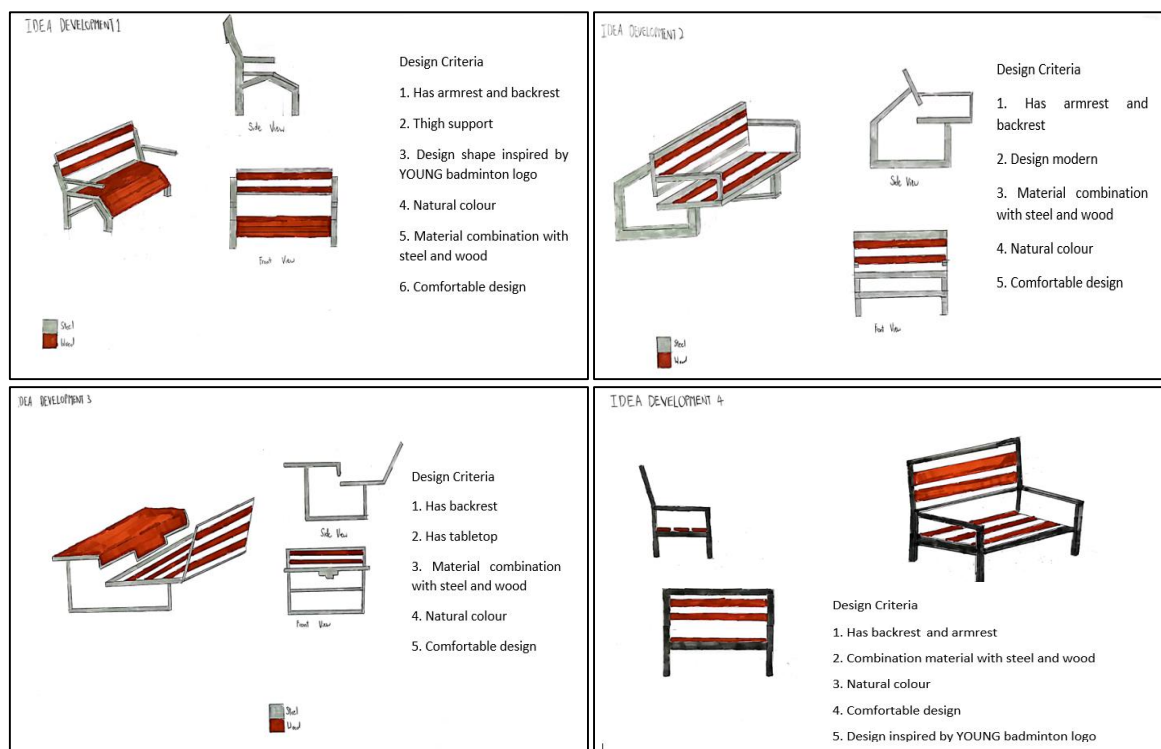


Figure 4: Idea development

3.5 Final Design

In this stage, the selection of the most potential idea development as final design. A design survey is conducted via Google Form to identify the final design of weather-resistance bench inspired by the YOUNG badminton logo. The number of respondents is same as the previous design criteria survey which is 50 respondents. The final design survey consists of two section which is Section A (demographic information) and Section B (final design selection of weather-resistance of bench inspired by the YOUNG badminton logo). The summary of the final design survey is tabulated in Table 3.

Table 3: Summary of final design selection

Element	Percentages (%)	Description
Demographic	52	Male respondent
	50	18-30 years old
Design selection	62	Select Design 4
	38	Satisfied with its design

In this research, pre- final design 4 will become the candidate for the final design. Pre-final design 1 which is idea development 3 had met the respondent’s preference. The bench height is 110 cm where the bench width 58 cm and the length are 168 cm. Apparently, most of its dimension fulfil dimensions of the bench industry. The bench seat will extend because it can become multifunctional for the users parking their bicycle or become one more seat. In the other hand, the material and finishing will be chosen which are wood and steel to prevent the weather for its durability become strong. The jointing of the steel was using welding jointing and the jointing of the wood is use fastener mechanical. Not only that, but the finishing of the steel was coating the blue colour. The wood was chosen chengal wood and it was the most suitable material to make a weather- resistance outdoor furniture can prevent weathering so the coating of wood will choose shellac and lacquer only to make the seat become smoothing so the user can sit more comfortably. The final design for the bench inspired by the YOUNG badminton logo will show in Figure 5.



Figure 5: Final design of weather-resistance bench inspired by YOUNG badminton logo

3.6 Mock-up Development

In this research, the mock-up of bench inspired by YOUNG badminton logo is made of several tools and equipment which including ruler, scissor, sanding utility knife, pen, bamboo chopstick, hot-glue gun, cylinder pine wood and spray paint. The mock-up was made at the scale of 1:8 as presented in Figure 6. The steps to develop is using pen and ruler to draw the structure of the bench on the bamboo chopstick. Then, using the utility knife to cut the part of the bench. Next, use the hot glue gun to join the part according to final design sketch. After that, use the sanding paper to let the part of backrest and armrest become round corner. Lastly, use the spray paint to fill up the colour of the bench and let it dry. The researcher then determined the feasibility and any improvements that could be made with the mock-up.



Figure 6: Mock-up of weather-resistance bench inspired by YOUNG badminton logo

3.7 Technical Drawing

The technical drawing for the bench was sketch by using AutoCAD software with full dimension in mm. The technical drawing is defined as an overview for illustrating how the bench is constructed in suitable techniques. They were presented in the forms of 2-dimensional (2D) and 3-dimensional (3D), as presented in Figure 7.

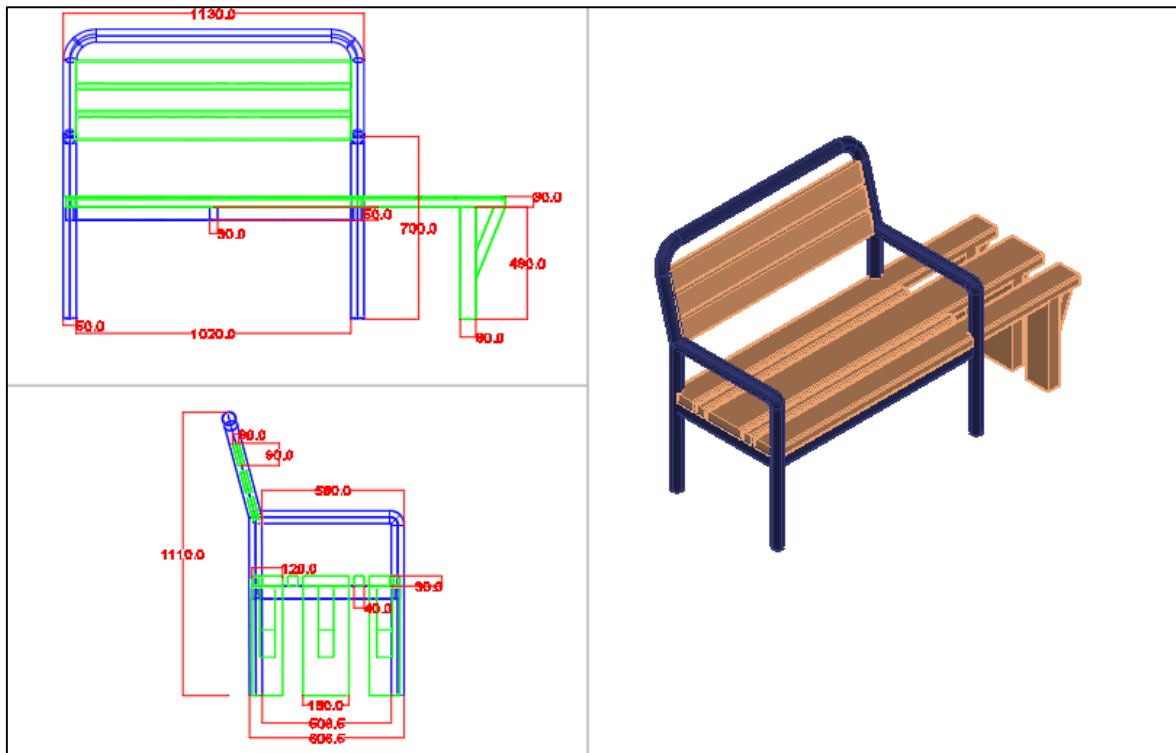


Figure 7: Technical drawing of weather-resistance bench inspired by YOUNG badminton logo

3.8 Prototype Fabrication

Next, the prototype was made of chengal wood and steel as the main material and finished with shellac and lacquer to enhance the bench's appearance (Figure 9). Originally, the main material is stainless steel, but the manufacturer gives the suggestion to use mild steel because it cheaper and use coating as finishing to protect the weather. The prototype has a backrest, armrest, and bicycle parking features as shown in Figure 8.



Figure 9: Prototype of bench inspired by YOUNG badminton logo

4. Conclusion

In conclusion, the three objectives of this study have been achieved with success. In this study, a weather-resistant bench inspired by the YOUNG badminton logo was designed by identifying design criteria through questionnaires distributed to respondents visit in Taman Rekreasi Y, Batu Pahat, Johor. The main criterion in this studies includes bench made of weather-resistant materials, with armrests and

backrests, and bicycle park to give comfort and multifunctional uses to visitor with a modern style design, and natural colour. These criteria served as a guideline during the design process. In this study total of 30 thumbnails, 6 ideations, and 4 idea development sketches were produced. The final design for this study was chosen as Idea Development 4 though final design survey, idea development 4 was selected as the final design due to its attractive, innovative design and ergonomic backrest angle. The bench prototype is made from mild steel and chengal wood. An attractive weather-resistance bench inspired by the YOUNG badminton logo is made in this study can satisfy visitor needs the design was made of combination material between mild steel and wood, comfortable design, natural color, and design YOUNG badminton logo (appearance) as the inspiration. The purposed design able to resistant to weather problems such as exposure to water, moisture, and sunlight while in this design brings new features such as bicycle park.

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