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Support For Muslim Friendly Tourist Destinations in Makassar by Designing Ergonomics Based Ablution Places Using Approach of an Anthropometric

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A R T I C L E I N F O

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A B S T R A C T

The ablution place is one of the places that is always used as an initial means of prayer. From the results of the discussion, it is known that there are several design sizes that have been changed such as the height of the faucet from 100 cm to 136 cm, the width of the gutter from 20 cm to 25 cm and the addition of a shelf with a height of 120 cm to 163 cm to be used to put songkok and other items. Soap height from 110 cm to 140 cm. In addition, the addition of anti-slip rubber carpet on the floor along the ablution place is needed to provide safety so as not to slip due to slippery floors and the addition of a 35 cm high footrest from the 95 % PL percentile to make it easier to wash your feet and be safe and comfortable during ablution.Second, anti-slip floor surfaces to prevent slipping accidents, which often occur in wet areas. Third, the provision of physical supports such as handrails to assist users who need extra help, such as the elderly or those with limited mobility. By designing an ergonomic ablution place, it will enrich the literature in ergonomic design studies and also a commitment to improving the quality of life and spirituality of mosque worshipers, so that Muslim-friendly tourist destination facilities in halal tourism will be more attractive to visit

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INTRODUCTION

Ablution is one of the most important acts of worship in Islam, serving not only as physical but also spiritual preparation before performing prayers or other acts of worship. According to Islamic teachings, ablution involves the cleansing of certain parts of the body with water, which includes the face, hands up to the elbows, head, and feet up to the ankles, as described in Surah Al-Maidah verse 6. This process begins with a strong intention, followed by sequential and orderly cleansing, which essentially prepares the individual to communicate with the Almighty in a state of purity.

Ergonomics is the process of designing or arranging workplaces, products and systems so that they fit the people who use them. Most people have heard of ergonomics and think it is something to do with seating or with the design of car controls and instruments – and it is… but it is so much more. Ergonomics applies to the design of anything that involves people – workspaces, sports and leisure, health and safety. According to Ted Dohrmann CPE (2023) a Managing Director, Certified Professional Ergonomist, ergonomics is Ergonomics is the process of designing or arranging workplaces, products and systems so that they fit the people who use them. Most people have heard of ergonomics and think it is something to do with seating or with the design of car controls and instruments – and it is… but it is so much more. Ergonomics applies to the design of anything that involves people – workspaces, sports and leisure, health and safety. In the context of ablutions, the application of ergonomics is crucial as ablutions are frequently used and important areas in daily religious practice. This study identified that many ablution facilities in Indonesia, including the Masjid of Cheng Hoo Tun Razak Masjid in Gowa, were designed without regard to physical differences between individuals using the facilities. This often results in incorrect postures during ablution, such as bending too deeply or reaching an inappropriate height, which not only causes discomfort but also increases the risk of injury. Anthropometry, a branch of ergonomics that focuses on measuring the dimensions of the human body, can provide very useful data for designing more ergonomic ablution stations. This study uses anthropometric measurements that include height, arm length, and horizontal hand height of users. This data was then used to redesign the ablution station so that it can accommodate the physical variations of users, with the aim of reducing the risk of injury and increasing comfort. The proposed design includes adjustments to the height of the water taps and physical supports such as handrails to assist users in maintaining balance, particularly when washing the feet.

In addition, this study also suggests the use of non-slip materials on the floor of the ablution area to prevent slipping, which is one of the main causes of accidents in ablution stations. It was also recommended that the distance between each ablution station be widened, to avoid unwanted physical contact or water splashes between users, which could disrupt the ablution process. One other important aspect raised in this research is the need to design ablution stations that not only focus on safety and ergonomics, but also on user privacy. This is particularly relevant in large Masjids or in public places where privacy and comfort are important considerations for users. The goal to be achieved from

this research is to design an ergonomic ablution place in order to reduce the risk of accidents or hazards for users in ablution.

LITERATURE REVIEW

The Masjid functions as a place of worship for Muslims which plays an important role in the advancement of Islamic civilization. The multifunctional role of the Masjid has been demonstrated throughout history. Masjids function as centers of education, research, military, other social and economic functions. The multifunctionality of the Masjid has also been shown by the Prophet Muhammad SAW in advancing and taking care of all the interests of the people, both economic, political, social, educational, military, and so on. Improving the quality of the Masjid is progress and quality for worshipers and the surrounding community. The Masjid as an asset needs to be maintained and even developed into a pilot project. The number of Masjids in Indonesia is estimated to be around 800,000, making it the largest in the world. As Indonesia is home to a predominantly Muslim population. Masjids have savings funds that are used for various Masjid purposes, including construction and other operational costs, as is well known. Masjids serve as an economic option for people in need. In addition, Indonesia is home to the largest number of Masjids in the world. This shows the potential of Masjids as a solution for individuals facing the impact of the economic crisis. The presence of the Masjid is a sign of hope for the creation of civilization and the majesty of Islam. When the functions of the Masjid are carried out in accordance with the example of the Prophet Muhammad, the unity and prosperity of the people will be easily achieved. The Masjid serves as a location to not only develop. Islam teaches its followers to maintain health in any case, both physical and mental health. One example is by doing ablution. Wudhu according to the language means clean, beautiful and good. According to the Sharia, wudhu is washing, flowing and cleaning using water on every part of the members of wudhu to eliminate small impurity (Akrom, 2010).

Definition of Ablution Room

The ablution room is a place used to purify yourself with ablution. There are two kinds of ablution rooms, namely standing ablution rooms and sitting ablution rooms. According to Purnomo (2013), the design of ablution places with a sitting position is relatively few in Indonesia and the ablution place has not paid attention to ergonomic aspects in its design. Meanwhile, according to Anies in Suparwoko (2010), doing activities in a sitting position is better than standing because when sitting the legs do not receive the burden of the body where the body is charged to the seat.

Standing Ablution Room

Quoted from Suparwoko (2016), for standing ablutions, the height of the faucet is in the range of 80-109 cm. The distance between faucets ranges from 80-100 cm. The ablution place has a footrest with a 30-degree slope that can facilitate users in ablution.

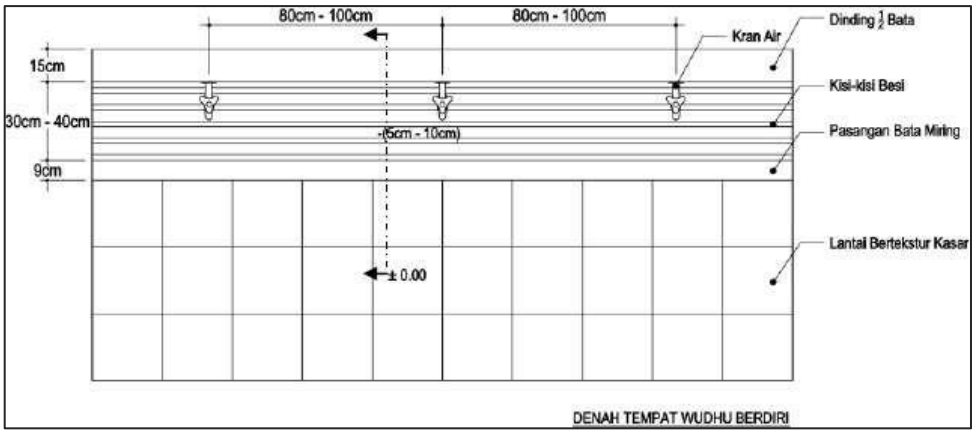

Figure 1. Plan of the Standing Ablution Room

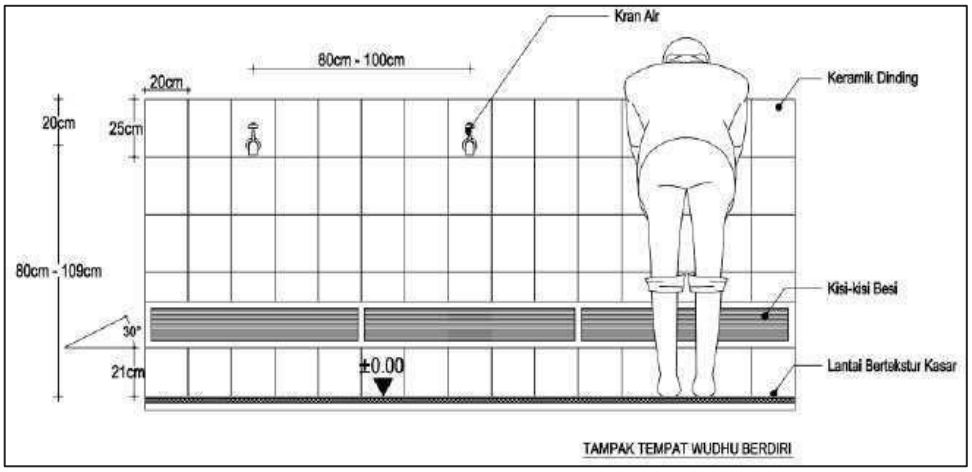

Figure 2. Standing Ablution Place

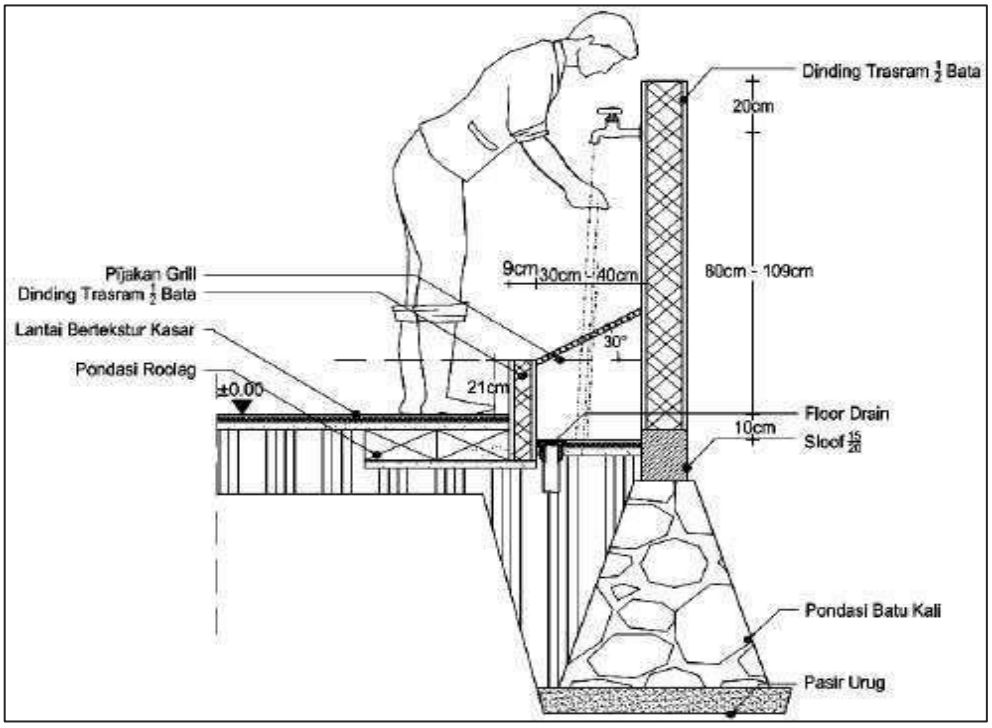

Figure 3. Standing Ablution Place

Ergonomics

The study of the interaction between humans and machines and the factors that affect their interaction. With the aim of improving system performance by improving human interaction with machines (Bridger, 2003). However, the study of ergonomics extends not only to the interaction with machines, but also to the workspace and design of public facilities. Basically, the conditions and dimensions of humans are different, this is what causes design making to refer to and according to the user, this term is often known as fit to man. For this reason, data on the size of the human body is very important in design science. Anthropometry is a study of the dimensions of the human body, where the application of this data is intended for handling design and workspace problems. One of the studies of public facility design is worship facilities such as prayer rooms, toilets and ablutions. The design of toilets and ablution rooms in public facilities such as offices, shops, entertainment facilities, recreation, hotels, restaurants and Masjid buildings, most of which have not accommodated the need for 'unclean-free' and aurat privacy (Budiono & Anggraeni, 2017). In addition, the design of the ablution place must accommodate the needs of its users, for example the availability of shelves, hangers, to the dimensions of the ablution place such as the distance of the faucet, the height of the faucet and so on to make users more comfortable. Several studies have discussed the design of ablution places, including Qurtubi & Purnomo (2015) which discusses the design of a sitting ablution place with the calculation of anthropometric data of its users to make it much more suitable when used. In addition, there are also several studies on the arrangement of standing ablutions which are much more space-saving and simple because there is no need for a seat bench. Research conducted by Suparwoko (2016) produced a standardized design of ablutions for women and men. But for this research, the design of the ablution place to be made is based on the calculation of percentiles from anthropometric data. Anthropometry is a branch of science that deals with body measurement: especially with the measurement of body size, shape, strength and work capacity. This statement is supported by the origin of the word anthropometry which comes from Greece and consists of two words, namely "anthropos" which means human and "metron" which means to measure, anthropometric data is used in ergonomics to measure the physical dimensions of workspace, equipment, furniture and clothing to avoid physical mismatches between the dimensions of equipment and products and their users. According to Stevenson (1989) and Nurmianto (1991), anthropometry is a collection of data related to the physical characteristics of the human body (size and shape) along with the application of these data for handling design or design problems. This science is widely used as a consideration in the design of products and a work system that requires human interaction. Anthropometry can analyze, evaluate and standardize the range that allows most types and postures of diverse human bodies to be able to carry out their activities easily with simple movements. In general, humans differ in terms of body shape and size. Differences even occur within the same group according to gene characteristics. The difference between one population and

another is due to factors that affect body dimensions including: Age, gender, ethnicity, body position, thickness of clothing, disability, pregnancy.

Anthropometry Data

There are two categories in anthropometry related to the position of the body in the way of measurement, namely: Measurement of body structure / static dimensions (structural body dimension) and measurement of functional / dynamic dimensions (functional body dimension). The design process which is a common stage of design techniques is known as NIDA (NEED, IDEA, DECISION, and ACTION). This means that the first stage of a designer establishes and identifies needs (need) in connection with the tool or product that must be designed. Then proceed with the development of ideas that will give birth to various alternatives to meet these needs. An assessment and analysis of existing alternatives is carried out, so that the designer will be able to decide (decision) on the best alternative. And in the end, a manufacturing process (action) is carried out. The results of the design made are required to provide convenience and comfort for the user. Therefore, the design that will be made must pay attention to human factors as the wearer. These human factors are studied in ergonomics (anthropometry, biomechanics, physiology, etc.). Some things that need to be considered in making a design in addition to human factors, among others: technical analysis (many related to durability, strength, hardness and so on.), economic analysis (related to the comparison of costs to be incurred and the benefits to be obtained), legalization analysis (related to legal aspects and the applicable legal order and from copyright), marketing analysis (related to product distribution channels / design results so that they can reach consumers), and value analysis.

METHODS

This research design aims to create an ergonomic ablution site design using calculations using anthropometric data which can later be used as a proposal for improving facilities to create a safe and comfortable ablution area for users. In research using quantitative data, this research design aims to create an ergonomic ablution place design using calculations using anthropometric data which can later be used as a proposal for improving facilities to create a safe and comfortable ablution place for its users. Secondary data is data obtained directly or indirectly from the object of the research location which is additional data but supports the course of the research. The data collection method used in this research is observation carried out by measuring the congregation at the mosque. Also with interviews, this can be done by asking questions directly or using a google form. Data processing uses the percentile concept to calculate the size of the proposed design. The proposed design is depicted in a 3-dimensional design using Sketchup software. The data collected were body height (TB), arm length (PL), elbow to fingertip distance (SJ), knee height (TL), horizontal hand height (TH), ankle height (MK) which were measured using anthropometric tools. in centimeters (cm) attached in the attachment chapter. Data calculations were carried out with the 5th, 50th and 95th percentiles.

Data Processing Method

Then the data is processed using the percentile concept to calculate the size of the proposed design with the help of SPSS statistical software. The proposed design is depicted in a 3-dimensional design using sketchup software. The data collected are data on height (TB), arm length (PL), elbow distance to fingertips (SJ), hip width (LP), horizontal hand height (TH), ankle height (MK) measured by anthropometric tools in centimeters (cm) which are attached in the appendix chapter. Data calculations are carried out with percentiles 5, 50, 90 and 95. The data that has been processed with the concept of Percentile and SPSS statistical software is then discussed and analysed.

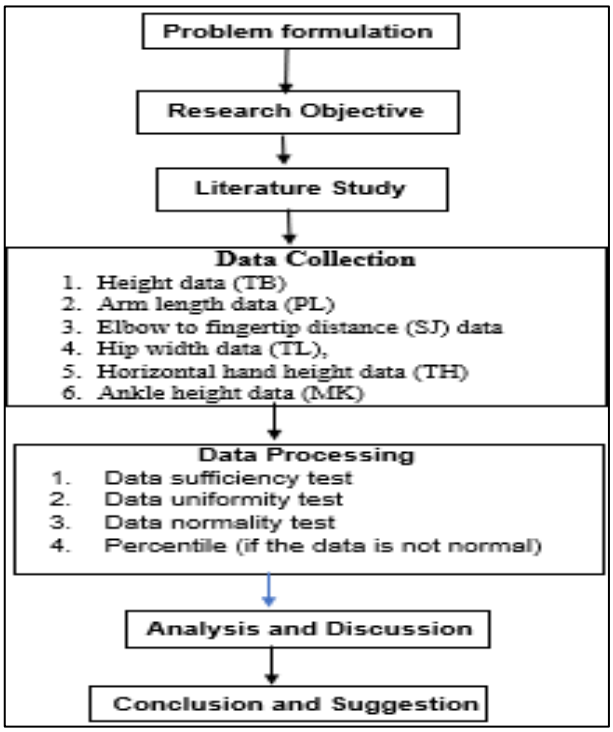

Figure 4. Research Flow Chart

RESULTS

Data from questionnaires, data from 30 respondents who were asked whether they had experienced interference or injury during ablution, 23.33% of respondents answered that they had experienced interference or injury during ablution.

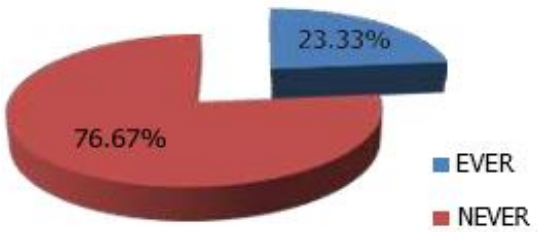

Figure 5. Diagram of the Percentage of Respondents Who Have Experienced Disorders or Injuries during Ablution

The respondents who answered that they had experienced interference or injury during ablution 33.33% (3 out of 9 respondents) were over 40 years old, 20% (3 out of 25 respondents) were between 20-40 years old and 16.67% (1 out of 6 respondents) under the age of 20 years. Injuries or disturbances during ablution include disturbances or injuries that are directly experienced by respondents when going to ablution, during ablution and after ablution.

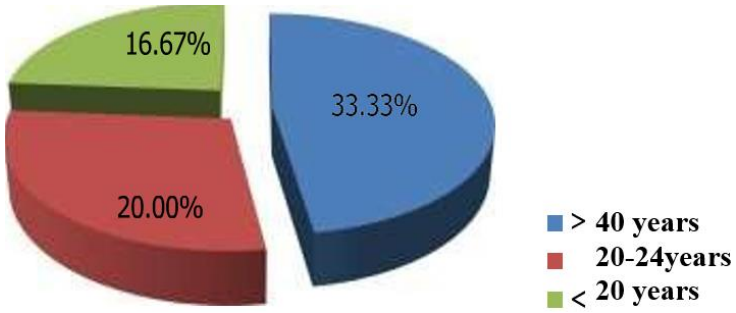

Figure 6. Percentage of Age of Ablution Users

Injuries experienced by respondents included pain in the waist 28.57%, bumped legs 14.29%, fell or slipped 42.86% and interference (complaints) with the size of the ablution place is narrow 14.29%.

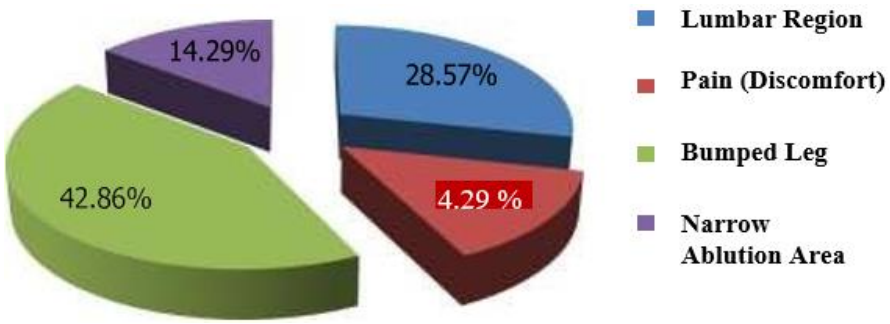

Figure 7. Percentage of Ablution Disorders or Injuries

For public ablution places, we usually find them in all Muslim places of worship (Masjids and mushalla). This is indeed a necessity because this ablution place is related to the implementation of worship, namely as a place to perform ablution activities before praying. However, not all ablution places are comfortable to use in their functions, both in terms of position before ablution, during ablution and after ablution. The dimensions used to design ergonois ablution places are height data (TB) as a measure for the height of the goods rack, arm length (PL) as a measure of the distance between taps, elbow distance with fingertips (SJ) as a measure of the width of the tap gutter, knee height (TL) as a measure of footrest height, horizontal hand height (TH) as a measure of tap height, ankle height (MK) is used as the height of the gutter barrier, which is measured by anthropometric tools in centimeters (cm).

Anthropometric Data

The data collected are height (TB), arm length (PL), elbow to fingertip distance (SJ), knee height (TL), horizontal hand height (TH), ankle height (MK) measured with anthropometric tools in centimeters (cm). See to table 2.

For Calculation results of body dimension percentile values, as below

Table 1. Calculation Results of Body Dimension Percentile Values (TB, PL, SJ, TL, TH, and MK)

No	Dimensions Body	P5	P50	P95
1	TB	150,93	163,15	175,24
2	PL	45,48	50,40	55,43
3	SJ	25,19	27,99	34,80
4	TL	25,30	28,95	35,33
5	TH	130,74	136,15	140,22
6	MK	20,33	24,84	27,10

Source: Data Processed (2023)

Table 2. Body Anthropoetry Data

No	TB	PL	SJ	TL	TH	MK
1	173	51	32	26	137	25
2	169	49	27	28	140	21
3	171	51	27	28	130	23
4	164	51	27	32	137	25
5	169	55	28	35	138	27
6	160	45	27	34	137	22
7	159	47	31	32	132	20
8	174	48	25	33	134	27
9	175	45	28	26	133	20
10	153	45	28	34	135	24
11	151	51	33	28	139	22
12	174	53	26	34	135	26
13	151	50	30	28	137	25
14	175	52	34	35	136	24
15	159	54	28	26	134	24
16	170	50	32	33	137	25
17	154	54	25	29	138	27
18	153	55	33	25	136	23
19	171	55	32	26	136	21
20	150	48	34	28	136	22
21	150	52	26	32	131	24
22	171	54	35	33	138	20
23	163	51	26	28	139	21
24	174	53	30	27	140	22
25	157	48	27	32	133	23
26	152	45	27	30	132	22
27	159	50	27	35	133	24
28	157	53	30	27	139	26
29	168	48	28	27	136	26
30	175	45	25	27	138	25

Source: Data Processed (2023)

From the calculations that have been carried out according to the formulas for P5, P50 and P95 for the dimensions of his body are recapitulated in Table 3.

Table 3. Determination of Tolerance and Final Product Size

Facility Design	Dimensions Used	Work Facility Dimensions	Percentile Selected	Reason	Size (Cm)
whudu Place	1 x width Whudu place	Width of the ablution basin	-	-	300
	1 x length of whudu place	Length of whudu place	-	-	1200
	(1 x TB height)-(shelf height)	Height of goods shelf	50	To determine the average height of the jamah to be made. So that people of different heights can reach and be comfortable when placing items	163
	1 x wall height	Height of whudu wall	-	-	400
	(1x length of handrail)/PL	The distance between taps	95	So that the ablution user is protected from the ablution faucet that is beside him.	55
	1 x elbow to fingertip length (SJ)	Width of gutter	5	So that the width of the gutter is not too wide with this size for standing position and distance enganbil faucet comfortably and perfectly	25

	Horizontal hand height /TH	Faucet height	50	So that the height of the faucet can be reached by each user safely and comfortably	136
	Ankle height / MK	Height of gutter barrier	5	In order to avoid splashing unclean from the gutter, a high barrier is needed that can protect users from unclean, and also for more ergonoimis, the height of the barrier with the height of the footrest is combined.	20
	1 x LUTH length / PL	Footrest height	95	So that the entire population can stand comfortably when doing pressure on the process of washing the feet	35

Source: Data Processed (2023)

After obtaining the right size for the role of the whudu place and given a tolerance for the size from Table 1. Next is the making of drawings of the size of the facility that has been determined previously. The images that will be made can be seen in Figure 8 through Figure 12.

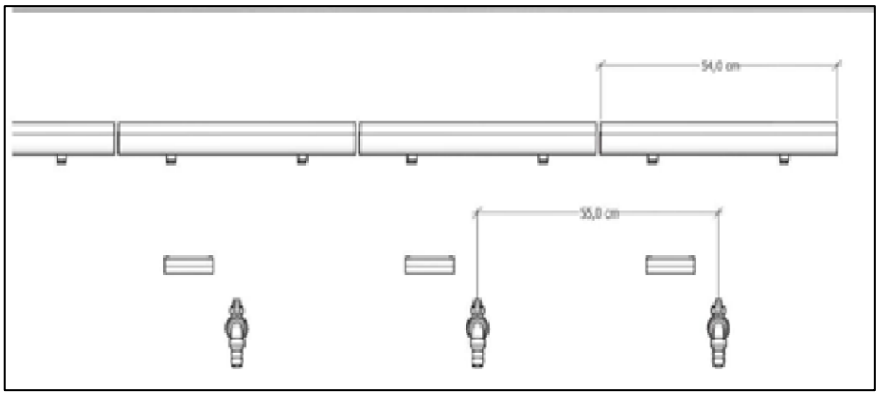

Figure 8. Faucet, Soap Dish and Item Holder View

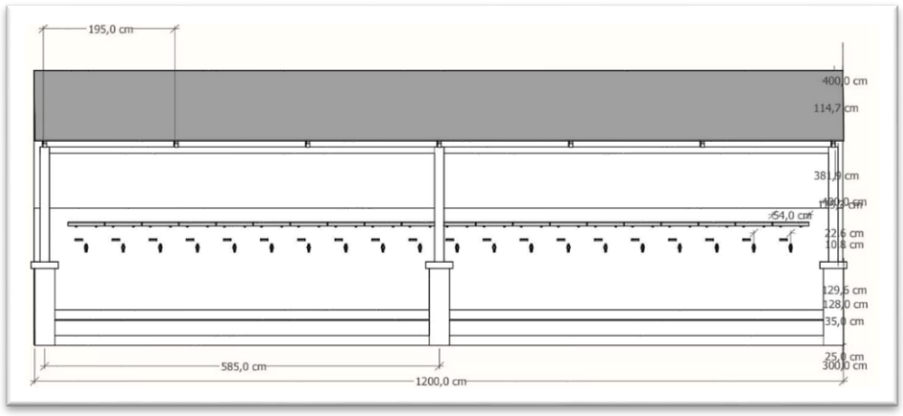

Figure 9. Front View of the Ablution Area

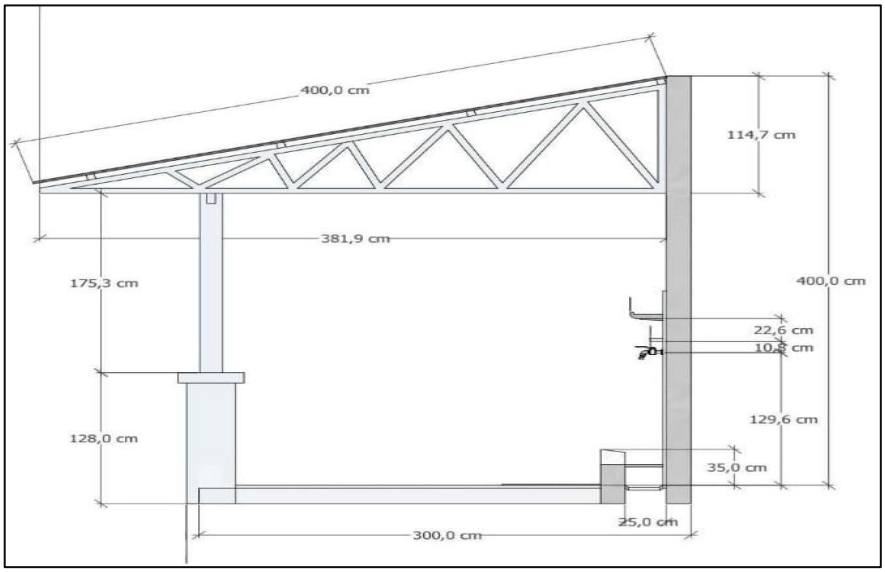

Figure 10. Side View

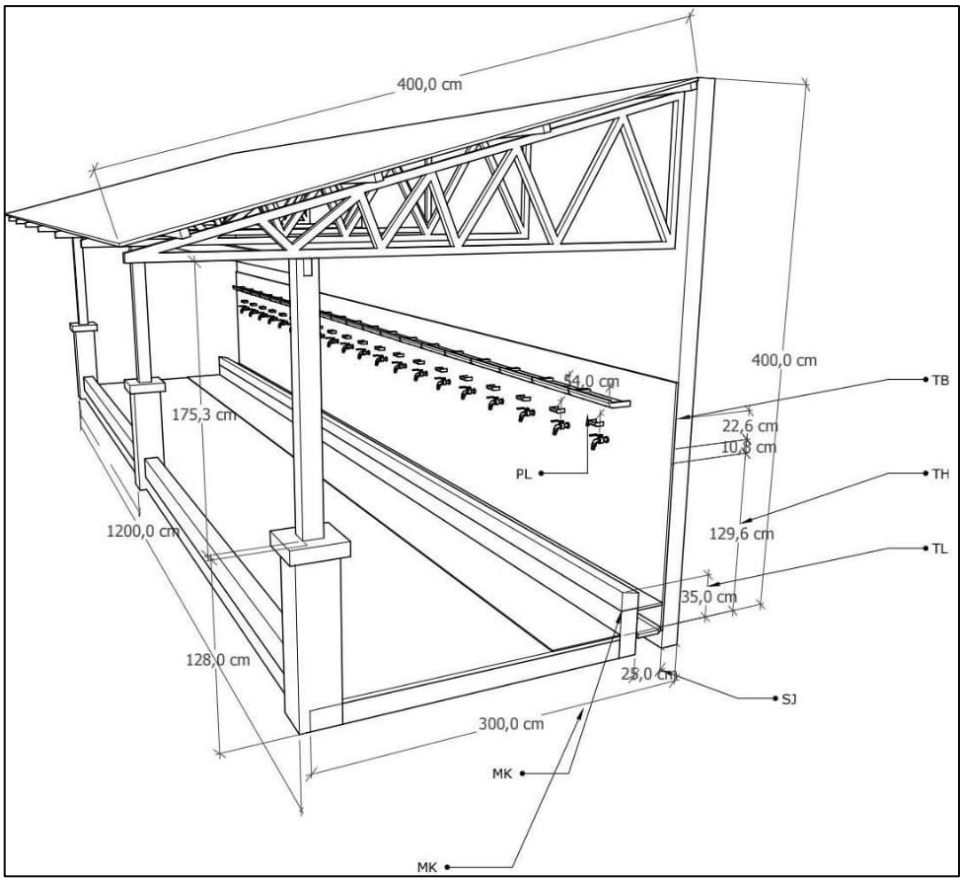

Figure 11. Design of the Proposed Whudu Place

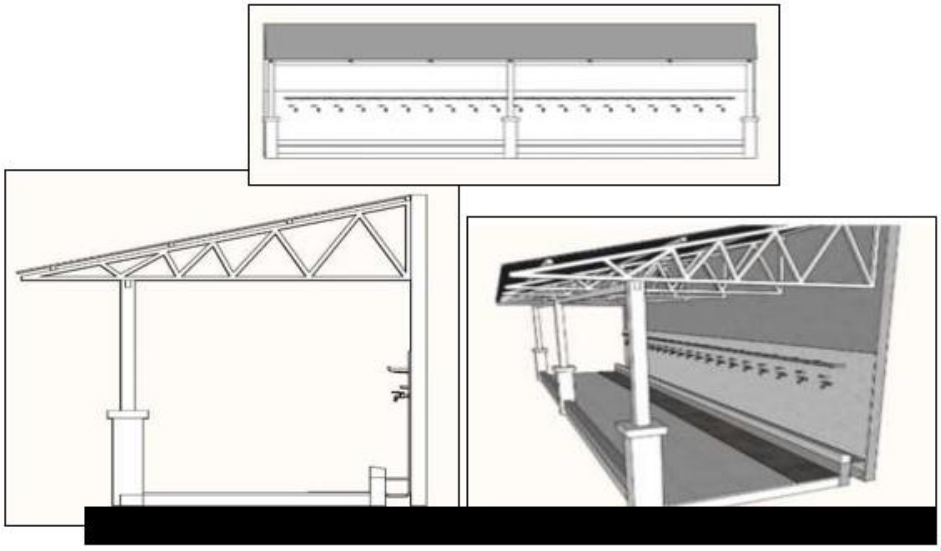

Figure 12. Layout of the Proposed Ergonomic Whudu Design

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

From the results of the discussion above, it is known that there are several design sizes that have been changed such as the height of the tap from 100 cm to 136 cm, the width of the gutter from 20 cm to 25 cm and the addition of a shelf with a height of 120 to 163 cm to be used to put songkok or others, the height of the soap from 110 cm to 140 cm. In addition, the addition of an anti-slip rubber carpet on the floor along the ablution place is needed to provide security so as not to be slippery and avoid slipping due to the slippery floor of the ablution place, and the addition of a 35 cm high footrest from the 95th percentile of PL to make it easier to wash your feet and be safe and comfortable during ablution. With these proposed changes, it is hoped that it can make the ablution place at Masjid of Masjid of Cheng Hoo Tun Razak much more comfortable and safe in accordance with ergonomic principles.

Recomendation

The suggestions in this study are the addition of facilities such as shelves, anti-slip rubber carpets along the ablution area, and maintaining the cleanliness of the ablution area to keep it safe and comfortable. In addition, suggestions for further research are for the elderly and disabled users of the ablution area and the addition of anthropometric data on visitors. Due to the difficulty of obtaining these data, the discussion and calculation of anthropometric data in this study are limited to the results of existing data collection where the age range is only 17-50 years.

FURTHER STUDY

This research still has related limitations, so it is necessary to carry out further research on the topic of Designing Ergonomics-Based Ablution Places Using Anthropometric Approaches to Support Muslim-Friendly Tourist Destinations in order to perfect this research and increase insight for readers.

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