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PORTABLE SANITATION PLANNING OF KAMPUNG SURYATMAJAN FOR EMERGENCY NEEDS

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ABSTRACT

Indonesia is a country located in the Pacific Ring of Fire, surrounded by many mountainous plates and islands that allow for unforeseen disasters. Sanitation is an important aspect in maintaining public health, especially during emergencies such as natural disasters, pandemics, or migration. In rural areas or villages that are vulnerable to these conditions, sanitation issues tend to be a major problem that affects the quality of life of the community. Suryatmajan Village is located in an area prone to natural disasters and emergencies, thus requiring sanitation solutions that are efficient and easy to implement in an urgent situation. This design method uses a mixed method consisting of qualitative and quantitative methods. Environmentally friendly selection and design of portable sanitation can be realized by using recycled materials and biological waste treatment technology, which will reduce the environmental impact of using portable toilets. The dimensions of portable toilets refer to local ergonomic standards, using modular materials and dimensions to maintain the quality, comfort, or hygiene of portable toilets. Suryatmajan Village, a tourist village, is known for its mural paintings on the walls of the houses. To maintain and harmonize the portable toilet with the identity, the appearance of the viusal becomes very important by displaying the character of Javanese people from men's blankon and women's bun. Overall, the design of an effective portable toilet for emergency needs should prioritize comfort, cleanliness, efficient use of space, and environmentally friendly and it would be better if it has harmony with local identity to strengthen the impression of harmony.

Keywords: *Sanitation, design, visual art, universal, sustainable*

1. PREFACE

Background

Sanitation is an aspect of maintaining people’s health, more importantly for an emergency use like natural disaster, pandemic, or migration. In Indonesia, particularly in rural areas or villages that’s susceptible to those conditions, sanitation problems tend to be a huge issue that affect the local people's quality of life quality. Suryatmajan Village is located in areas prone to natural disasters and emergencies, requiring efficiency and easy-to-implement in urgent situations for sanitation solutions.

Sanitation is an effort to prevent disease that focuses on improving the health of the human environment (Dewi, 2022). In the application of sanitation, there’re aspects that need to be paid attention to in order to guarantee the health of users, so that sanitation requires effectiveness in using the portable sanitation to maintain cleanliness. Sanitation aims to prevent the spread of disease and protect human health from dangers caused by dirty and unhealthy (Tjirowati, 2023). There are many cases where infectious diseases occur due to the uncleanliness of public sanitation used by other individuals. Examples of such cases include shigellosis infection or known as severe diarrhea that causes stomach cramps; staphylococcus which causes boils or skin infections; Escherichia coli or E. Coli which causes diarrhea, stomach cramps, stomach disorders, nausea, and vomiting, as well as many more infectious disease and various ways of transmission.

In addition, this portable sanitation solution can also support faster post-disaster recovery efforts, because it can help facilitate self-cleaning, waste management and provide clean water in limited conditions. Therefore, the design of portable sanitation in Suryatmajan Village is expected to be an innovative solution that can increase community resilience to crises and support environmental sustainability.

Toilets are sanitation facilities for defecating and urinating, washing hands and faces (Widyanti, 2020). As a type of sanitation, this toilet is often used specifically, unlike bathrooms which have more functions and provide bathtubs or showers for bathing. Generally, toilets can be found in various public facilities such as tourist attractions, outlets, malls, commercial buildings, offices, public transportation: buses or trains, etc. In these categories, toilets are divided into public and special, public toilets are toilets that are in the form of larger-sized room and cannot be moved, while special toilets or portable toilets are limited-sized room and are easy to move anywhere (Smith et al., 2019; O'Connor, 2021; Taylor et al., 2020).

Blangkon and sanggul as symbols of Javanese culture have important relevance in the context of Suryatmajan Village, which is one of the villages in Yogyakarta with strong social and cultural characteristics (EPA, 2017). Although this village is known to be more associated with urban and modern life, the roots of Javanese culture are still strongly felt in the daily lives of its people (Huang et al., 2022).

Suryatmajan Village, like many villages in Yogyakarta, reflects an effort to maintain tradition amidst urban development (Thompson et al., 2020). Javanese blangkon and sanggul can be seen as symbols representing the identity of the Suryatmajan community which is rooted in traditional values, such as wisdom, order, and simplicity (Martinez et al., 2023). In the midst of the dynamics of fast city life, the people of this village still maintain Javanese cultural values in various aspects of life, from social interaction to traditional celebrations.

Blangkon, a woman bun which symbolizes the responsibility and identity of Javanese men and women, can be a symbol of the spirit of mutual cooperation and strong social ties in Suryatmajan Village, where its residents are known to have a high sense of togetherness. Meanwhile, the Javanese moustache, which symbolizes courage and authority, reflects the character of the people who are persistent and firm in facing challenges (Martinez et al., 2023), including in maintaining the sustainability of their village environment, as well as maintaining cleanliness and comfort in emergencies, such as when facing sanitation problems Green et al., 2018).

Thus, the blangkon and mustache are not only cultural elements that characterize the appearance of Javanese men, but also symbols of the character and collective identity that are still maintained and preserved by the people of Suryatmajan Village.

Aesthetically, the use of traditional motifs often found on blankon, such as batik or Javanese carvings, provides a strong local touch to the design of portable toilets (Wahyuni, 2019). This makes the toilet not only a sanitation facility, but also an element that reflects local culture, creating a more intimate and harmonious impression with the environment (Prasetyo, 2021). In terms of materials, like blankon which are made from natural materials, portable toilets can be designed with environmentally friendly materials such as bamboo or local woos (Putra, 2020). This not only supports environmental sustainability but also encourages the use of resources available around the village, making it more economical and sustainable (Santoso, 2022). In addition, the inspiration from blankon as a flexible and easy-to-use head covering is reflected in

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the design of the modular and easy-to-move toilet structure. This design allows portable toilets to be quickly dismantled and reassembled as needed, providing a practical solution in emergency situations (Santoso, 2022). This overall design makes portable toilets more in line with the character of the village, environmentally friendly, and have high cultural value (Wahyuni, 2019).

The meaning of the blankon is closely related to the Javanese philosophy of life which teaches simplicity, politeness, and respect for ancestors (Sujatmiko, 2017). The shape and way of wearing the neatly arranged blankon reflects harmony in the life of Javanese society (Puti, 2015). The use of blankon on various occasions also often indicates a person's social status and position in society (Wibowo, 2018).

Problem formulation

From the backgrounds above, there are problems that need to be solved, such as:

1. How to design a portable toilet that is comfortable and hygienic for its users while considering the limited space and facilities inside?
2. How to provide an effective ventilation system in a portable toilet to prevent odor and increase user comfort?
3. How to design a portable toilet that is easy to move but remains stable and safe when used in various environmental conditions including extreme weather conditions or uneven terrains?
4. What are the solutions to overcome the problem of clean water availability and waste management in portable toilets, especially over long periods of use?
5. How to design an environmentally friendly portable toilet, including in terms of using recyclable materials or having minimal impact on the environment?
6. How to ensure that the price of the portable toilet design remains affordable while still meeting the standards of comfort, cleanliness, and user safety?

Planning purpose

From the backgrounds above, these are the goals that are aiming to give solutions and solve the problems, such as:

1. Giving the effectivity of installation speed, operation and relocation as needed.
2. Reducing the risk of disease spread, avoid contamination of water resources and provide comfort and safety for residents during emergency periods.
3. Designing a comfortable and hygienic portable toilet with limited space and facilities inside including ventilation system to prevent odor and increasing comfort.
4. Make a portable toilet that’s easy to move while it remains stable and safe when in extreme weather conditions or uneven terrains.
5. Overcome the problem of clean water availability and waste management over long periods of use and use eco-friendly materials that would minimalize the damage for the environment.
6. Ensuring that the price remains affordable while still meeting the standards of comfort, cleanliness, and user safety.

Theoretical study

Distribution and the future of polyethylene microplastics released by portable toilet manufactures into the wetland and lake. Microplastics are ubiquitous pollutants and have been found in all environments. Some of the results studied come from the depths of the ocean, freshwater algae, remote mountain snow, animals, plants, and human cells. Microplastics come from domestic, industrial, and commercial wastewater.

Human activities have indirectly produced many synthetic and semi-synthetic microfibers that enter wastewater and pollute surface water and other environments. Over time, microplastics will fragment into small pieces and become granules. So that microplastics are not harmful and damaging to the environment, it is better if they are processed into a product that is useful for humans, for example, making this microplastic into polyethylene. Polyethylene is a material that can be used to produce portable toilets, so that they can be used by people who need them, and do not become waste that damages the environment and is in vain.

Portable toilet: What is it and how does it work?

Portable toilets are a type of toilet that can be moved as needed. Portable toilets are very practical and are a favorite of campers, festival goers, and construction workers. The components of a portable toilet consist of a toilet seat, a holding tank, a flushing mechanism, and a pressure system. In a portable toilet, there is a hidden water tank inside.

There are also chemicals that function to decompose feces. The tank consists of clean water and a feces disposal tank. So that clean water can be used to clean the toilet. The use of biocides can prevent bacteria from growing in waste and can reduce unpleasant odors and allow for multiple use and then cleaning so that not every use has to be cleaned immediately. In addition to biocides, detergents can also clean the toilet. The stored waste is under the toilet and contains chemicals that decompose waste.

Analysis and research on design sample of urban mobile toilet

Urban portable public toilets get their name from their mobility, and their advantages are obvious as opposed to the traditional fixed toilets. The mobile public toilets are light in shape and structure, and can be freely matched with colors, and are applicable to tourist attractions, commercial streets, stations, docks, city squares, large construction sites and other public places with dense population. At present, for solving the problem of going to WC, many areas often build new or rebuilt toilets, replanning, or even spend a huge amount of money to build luxurious toilets, which waste a lot of social resources at the same time, but also fail to effectively solve the problems of people's livelihood.

As an important part of urban public facilities, the mobile toilets should be vigorously promoted. From the perspective of user experience, this paper discusses four new design cases of mobile toilets, hoping to provide effective reference to the sanitation industry. Today, the public do not need luxurious public toilets, but only need to increase the design and development of the portable public toilets when necessary, to meet people's needs and also improve the image of urban civilization.

2. RESEARCH METHOD

This design method uses a mixed method consisting of qualitative and quantitative methods. Since this design requires the help of literature data from other sources, the data will be associated with design considerations that can provide solutions to the problems faced when designing. The solution can be explained in the form of sentences or in the form of numbers.

Because this design requires the help of literature data from other literature sources, the data is linked to design considerations that can provide solutions to problems encountered while designing. The solution can be described as an explanation in the form of sentences, or in numerical form. To be described in point form: (a) Taking data from journals and research publication books in search media; (b) Analyzing the relation between literature data and

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portable toilet design materials; (c) Formulating problems that need to be considered when designing portable toilets; (d) Determining the purpose of designing portable toilets; (d) Comparing the results of literature data both in sentences and numerically to be described in the results and discussion; (e) Formulating solutions in the form of tables and images according to the data in the results and discussion; (f) Drawing conclusions and designing according to the research in this writing.

3. RESULT AND DISCUSSION

Designing a comfortable and hygienic portable toilet, especially in an emergency like in Suryatmajan Village, requires attention to space and facility limitations (Smith et al., 2019). The average size of a portable toilet for emergency use is around 1.2 meters x 1.2 meters with a height of around 2 meters. These dimensions provide enough space for users to move comfortably (O'Connor, 2021). To ensure cleanliness, the interior material of the portable toilet must be easy to clean and durable, such as antimicrobial plastic that can reduce the spread of bacteria by up to 80%. Good design also includes separating clean and dirty areas, which can reduce the risk of cross-contamination (Taylot et al., 2020).

Effective ventilation is essential to prevent odor and improve user comfort. A study by the Environmental Protection Agency (EPA) showed that good cross-ventilation can reduce humidity and odor by up to 50% in a confined space (EPA, 2017). In a portable toilet, ventilation can be achieved with a ventilation size of around 10% of the total wall surface area to allow fresh air to enter and polluted air to exit (Huang et al., 2022). To improve the ventilation system, solar-powered fans or exhaust systems can be used, which can reduce odor by up to 70%[8], based on test results under various conditions. The calculation of ventilation based on the area of the room is 1.44 m2 x 10% = 0.144 m2.

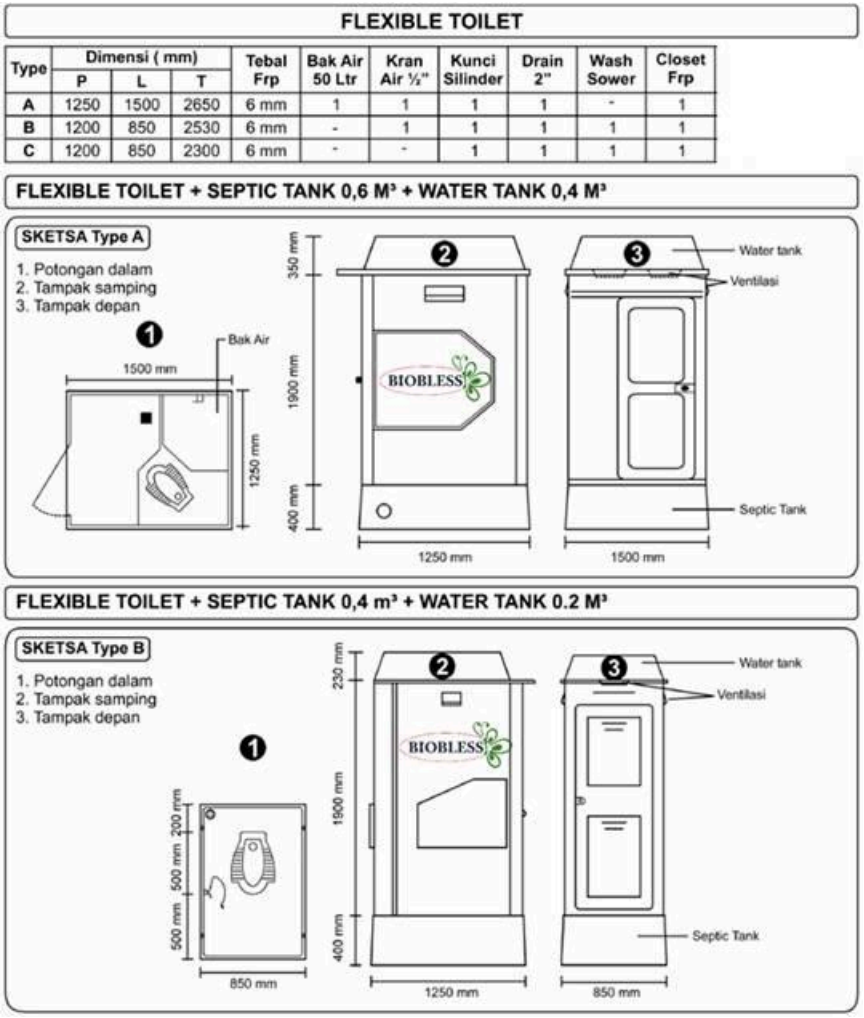
Portable toilet designs that are easy to move yet stable require a lightweight yet strong frame. The use of materials such as fiberglass or aluminum, which have higher strength per weight, can reduce the total weight of the toilet by up to 30% compared to traditional materials such as steel (Dewi, 2022). A locking or support system must be in place to accommodate varying ground contours. Studies show that 80% of accidents involving portable toilets occur due to instability or incompatibility with ground conditions, so stability must be ensured by the use of wheels and adjustable supports (Thompson et al., 2020).

The problem of clean water availability and waste management in portable toilets can be overcome by using a waterless or low-flush system. A dry toilet system can reduce water usage by up to 95%, while a low-flush toilet uses only 1.5 to 3 liters of water per flush, compared to 6 to 9 liters for a conventional toilet (Taylor et al., 2020). For waste management, the use of a holding tank with a capacity of 150 to 200 liters can be sufficient for use by around 50 to 100 people per day, depending on the frequency of use. Composting technology can also be used, converting waste into safe and useful compost, reducing waste by up to 90% (Martinez et al., 2023).

Eco-friendly design can be achieved by choosing recyclable materials, such as PET plastic or bamboo-based composites. The use of these materials can reduce the carbon footprint by up to 40% compared to conventional materials (Green et al., 2018). Additionally, the use of composting systems or other waste management technologies can significantly reduce environmental impact. In some locations, the use of renewable energy systems (such as solar

panels) for ventilation or lighting can reduce external energy consumption by up to 605 (Huang et al., 2022).

Figure 1
Toilet Portable Biobless, as a Reference for the Design of Portable Toilets in Suryatmajan Village



Finally, to ensure that the price of the portable toilet design remains affordable while meeting standards of comfort, hygiene and safety, the use of common but strong and durable materials is essential. The use of recycled materials or cheaper materials that still meet safety and comfort standards can reduce production costs by up to 20%. Additionally, modular designs that allow for separate maintenance and replacement of components can help reduce long-term costs, making portable toilets more affordable without sacrificing quality.

Blankon and sanggul Jogja is the most common type of blankon and sanggul is often worn by Javanese men and women, both in formal and informal events. Its shape tends to be round and made of cloth with more neutral colors, this blankon is often worn in various traditional events as mentioned in Javanese Society. Likewise, the bun commonly used by Javanese women in daily life and traditional events indicates the authority and beauty of Javanese women, using a black arch as a symbol of identity and philosophical meaning of a smart woman. The image of Blankon and sanggul Jogja shown as in Figure 2 below.

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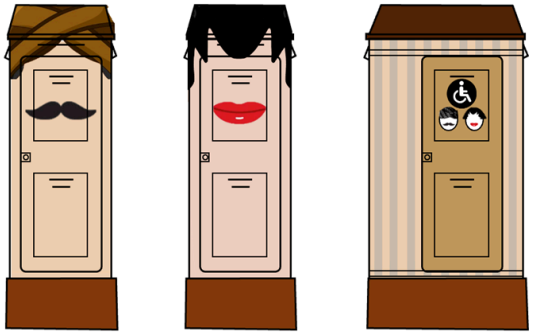
Figure 2
Mood Board Design Image for Portable Male's Toilet, Woman Toilet and Male's and Woman Disabled Toilet

Suryatmajan Village, a tourist village, is known for its mural paintings on the walls of the houses. To maintain and harmonize the portable toilet with the identity, the appearance of the viusal becomes very important by displaying the character of Javanese people from men's blankon and women's bun.

Overall, the design of an effective portable toilet for emergency needs should prioritize comfort, cleanliness, efficient use of space, and environmentally friendly and it would be better if it has harmony with local identity to strengthen the impression of harmony. The following is the development of a portable toilet design that represents Javanese local identity and adapts to the character of Suryatmajan village as seen in Figure 3.

Figure 3
Front Elevation of Portable Toilet with Local Identity Mural Design for Male's Toilet, Woman Toilet and Male's and Woman Disabled Toilet



4. CONCLUSIONS AND RECOMMENDATIONS

From the discussion results, it can be concluded that designing a comfortable and hygienic portable toilet for emergency situations, such as in Suryatmajan Village, must consider several important aspects. An effective ventilation system is key to reducing unpleasant odors and maintaining user comfort. Natural ventilation, such as air holes or small gaps, can be combined with an exhaust fan driven by an emergency energy source to increase air circulation. The use of natural odor absorbing materials, such as activated charcoal or zeolite, can also help reduce odors.

The selection of waterproof and easy-to-clean materials is essential to maintain cleanliness and avoid dirt buildup. An efficient design with lightweight yet strong materials, such as high-strength plastic or composites, as well as a stabilizer system that can adapt to the terrain, will ensure the stability and safety of the portable toilet. An efficient waste treatment system, either through chemicals or environmentally friendly technology, is also needed to manage waste properly, while reducing the need to empty the tank frequently.

Environmentally friendly design can be realized by using recycled materials and biological waste treatment technology, which will reduce the environmental impact of using portable toilets. To keep the price affordable, optimizing modular materials and technology for mass production is a solution that can reduce costs without sacrificing quality, comfort, or cleanliness of portable toilets. Overall, an effective portable toilet design for emergency needs must prioritize comfort, cleanliness, efficient use of space, and be environmentally friendly and affordable.

To maintain and harmonize the portable toilet with the identity, the appearance of the viusal becomes very important by displaying the character of Javanese people from men's blankon and women's bun. Overall, the design of an effective portable toilet for emergency needs should prioritize comfort, cleanliness, efficient use of space, and environmentally friendly and it would be better if it has harmony with local identity to strengthen the impression of harmony.

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