



MALAWI PERI-URBAN SANITATION PROJECT REPORT

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ACRONYMS

bVIP	Blair Ventilated Improved Pit
iDE	International Development Enterprises
JMP	Joint Monitoring Program
MDHS	Malawian Demographic and Health Survey
MOU	Memorandum of Understanding
NGO	Nongovernmental Organization
SHOPS	Strengthening Health Outcomes through the Private Sector
UNICEF	United Nations Children’s Fund
USAID	United States Agency for International Development
VIP	Ventilated Improved Pit
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

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EXECUTIVE SUMMARY

In 2013, the United States Agency for International Development (USAID) in Malawi tasked the Strengthening Health Outcomes through the Private Sector (SHOPS) project with engaging with the private sector to improve the poor sanitation conditions in peri-urban areas of Malawi. An increasing population density in these areas continues to stress the sanitation infrastructure, which is comprised of mainly shared and traditional latrines. A SHOPS sanitation market assessment in late 2013 identified the cost of currently marketed improved latrines as a major barrier to the transition from unimproved to improved latrines.

To encourage residents of peri-urban areas to transition from shared and traditional latrines and increase the market segment for improved latrines, SHOPS initiated an activity, the Malawi Peri-Urban Sanitation project, which aimed to introduce a more affordable improved latrine. The activity began with a global review of transitional sanitation products to learn from other projects around the world. Masons, NGO staff, university faculty, and local government representatives were then brought together to explore new design strategies using human-centered design and participatory approaches. The resulting design prototype was piloted in the peri-urban areas of Lilongwe and Blantyre, and project staff collected valuable feedback from households and sanitation experts. Using the feedback, project staff modified the design of the prototype latrine and formulated a strategy to promote the latrine.

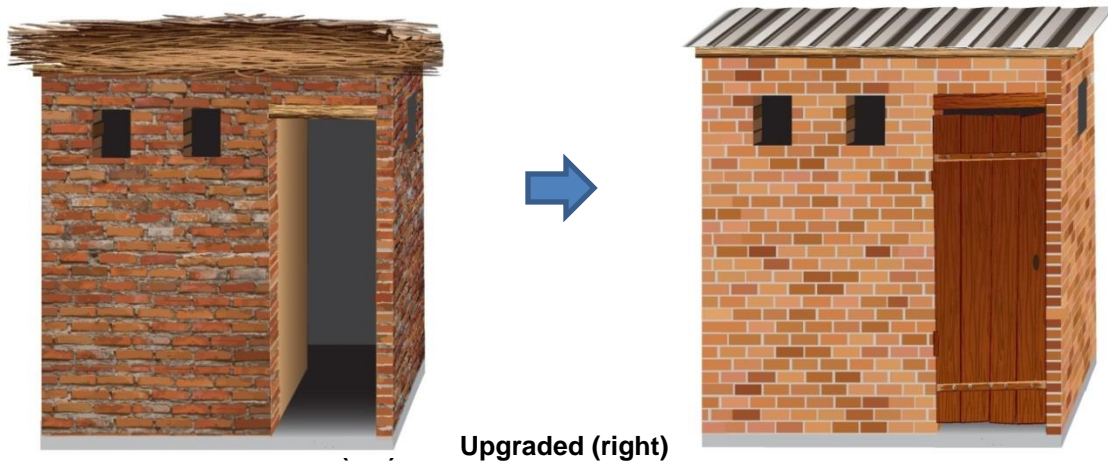
Project Objective

To facilitate the transition from shared and traditional latrines to improved latrines in peri-urban areas by designing a transitional latrine that can be supplied by private sector sanitation businesses.



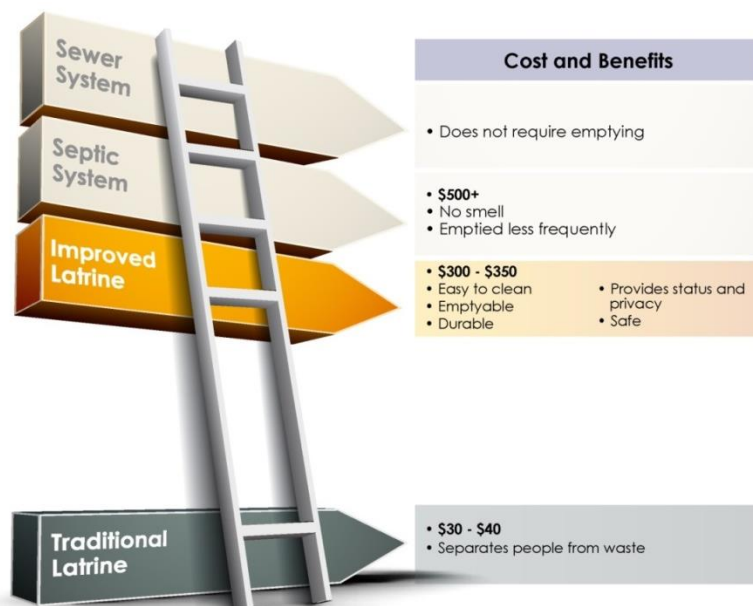
Transitioning from an unimproved latrine to a transitional improved latrine

In order to reduce the cost of the already low-cost improved latrines on the market, the sanitation project strategy moved from developing a standardized model to a modular one. Its critical design elements and construction guidelines allow masons to tailor the design of the latrine to the household's specific requirements and available resources. To further reduce the upfront cost of the latrine, the design also is upgradeable, enabling the household with limited resources to start with a basic improved latrine and, as they are able to pay, to later upgrade the structure in terms of durability, privacy, and status. This approach focuses on creating a durable substructure (i.e. pit, pit lining, and slab) with a superstructure that can be improved over time.



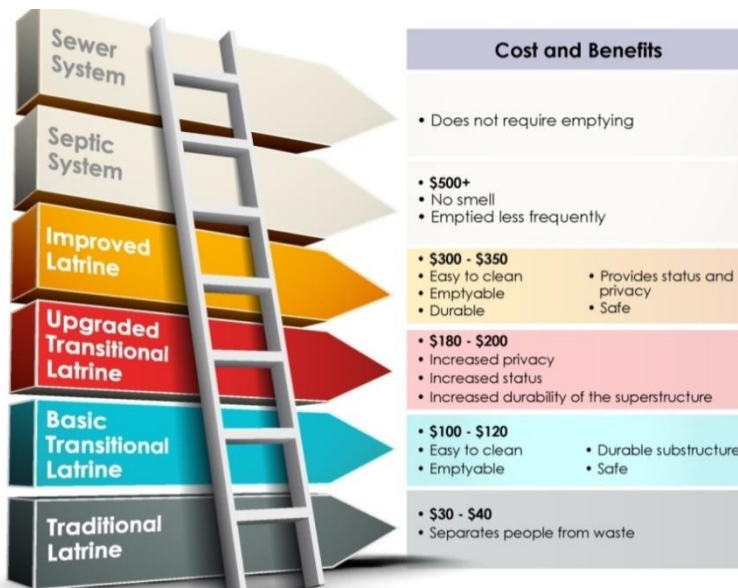
The current peri-urban sanitation facilities can be summarized with a “sanitation ladder.” The cost difference between traditional latrines and improved latrines in the peri-urban areas of Malawi is significant and makes it difficult for households to improve their sanitation facilities. Figure 1 illustrates the current rungs of the peri-urban sanitation ladder in Malawi and it demonstrates the gap in latrine costs.

Figure 1: Current Sanitation Ladder in Peri-Urban Malawi



With adequate marketing and mason training, the transitional latrine design has the potential to increase the market segment of improved latrine customers – that is, to move households up the “sanitation ladder” from traditional to improved latrines. It enables households to upgrade the latrine over time by creating additional rungs on the ladder.

Figure 2: Peri-urban Sanitation Ladder with the Transitional Latrine Rungs



Recommendations

This activity – from initial assessment through the design, prototyping, review, and final modifications of the low-cost transitional latrine – is now at the marketing stage. Based on lessons learned, SHOPS staff recommend the following marketing approach.

- 1) Market the minimal list of materials to highlight the design’s low cost.** Due to the variability of material prices over time, it is not possible to advertise a fixed cost of the transitional designed latrine. Marketing instead should communicate the affordability of the latrine by providing the list of materials required for a basic transitional latrine.
- 2) Market the benefits of the transitional latrine as compared to traditional latrines.** Homeowners and landlords expressed their dissatisfaction with traditional latrines in terms of durability, safety, and convenience. The transitional latrine is designed and should be marketed to replace traditional latrines, not to compete with other more expensive improved latrines.
- 3) Market the design as a service of skilled masons.** As households typically provide the construction materials and hire a mason to build latrines, the transitional latrine design is viewed as a service that the mason provides to the household. From this perspective, marketing messages should focus on the benefits of hiring a mason, rather than hiring day laborers.
- 4) Use community meetings and print materials to link potential customers with skilled masons.** Masons should present their services as beneficial to the health of the community via the traditional leaders who are influential in their communities. Print materials with the mass media messages should be distributed by masons trained in the transitional design.
- 5) Provide hands-on transitional latrine design training to peri-urban masons.** To make the design available, additional masons should be trained to build transitional latrines and to understand the rationale behind the critical design elements and the construction guidelines.

1. INTRODUCTION

Urban growth and specifically growth in unplanned, peri-urban areas is accelerating in Malawi. The 2010 Malawi Demographic and Health Survey (MDHS) found that the annual urban population growth rate in Malawi is among the highest in Africa, at 4.7 percent in 2008 (National Statistical Office and ICF Macro 2011). UN Habitat reported that, as of 2008, 64 percent of urban residents in Malawi lived in unplanned settlements and slums (UN Habitat 2012). This rapid urbanization in peri-urban areas poses a major challenge to government at all levels in fulfilling their commitments to provide basic urban services.



Satellite image of Ndirande, Blantyre, Malawi showing the density of housing in peri-urban areas (© Google Earth)

According to the 2010 MDHS, over 91 percent of households in Malawi lack access to an improved sanitation facility, defined as 1) a facility connected to a public sewer or septic system or a pit latrine with a slab, which isolates wastes, and 2) a facility used only by members of one household. In urban areas, 79 percent of households lack such access – nearly 62 percent of households use unimproved latrines and 16 percent use shared latrines (National Statistical Office and ICF Macro 2011). Improving the facilities poses a particular challenge because the majority of these households are located in unplanned, peri-urban areas where population density and lack of space make it extremely difficult to install a public sewer system or septic systems. Traditional, unimproved pit latrines, which when filled are covered and moved to a new location, continue to reduce the land available for sanitation facilities.

The lack of improved sanitation services has a direct impact on the health of people living within peri-urban areas. The contamination of water resources, soil, and food by human excreta is a major cause of diarrhea, the second biggest killer of children in developing countries (World Health Organization (WHO) 2008). The loss of earnings due to illness among the working-age population and those they care for also reinforces a perpetual state of poverty. Improving access to sanitation is a critical step toward reducing the impact of these diseases and creating a physical environment that enhances safety, dignity, and self-esteem. Safety issues are particularly important for women and children, who risk sexual harassment and assault when defecating at night and in distant areas (WHO 2008). Traditional latrines, which are prone to collapse due to the lack of a pit lining and weakly constructed slab, also pose a risk for latrine users.

Historically, investments in sanitation have lagged behind other investments in public health infrastructure such as piped water or clinical health infrastructure such as health centers and hospitals. Recently there has been an increasing trend of investments in urban sanitation in Malawi. Led by UNICEF, the European Investment Bank, the Gates Foundation, and the World Bank's Water and Sanitation Program, and in coordination with the Ministry of Water Development and Irrigation and city water boards and city councils, the emphasis of current sanitation programming is a subsidy-free approach, which addresses the supply and demand of sanitation through the private sector. The private sector approach is thought to be more scalable and sustainable, as it does not rely on continuous government or donor funding. Programs such as Community Led Total Sanitation have worked with communities to identify unhygienic practices and have used shame and peer pressure to create the demand for improved sanitation. Sanitation marketing programs have been creating an increasing supply of sanitation products and services by training private sector masons and entrepreneurs in sanitation businesses (Armand 2013). These programs have had to overcome the discontinuation of subsidies, lack of business skills, and the view that sanitation is not a profitable business.

These programs have made steady albeit slow progress: over the past five years, thousands of new and improved latrines have been built in peri-urban areas. These improved latrines have further promoted improved sanitation and the growth of pit emptying services, as neighboring households come to know the benefits of these products and services. However, the construction of these products has been slower than hoped and so program targets for the number of improved latrines constructed have not been met and programs continue to search for ways to expand sanitation coverage. Program staff have observed that there is a disconnect between what the majority of households can afford and the cost at which masons and entrepreneurs built improved latrines (Armand 2013). The improved latrines being promoted are in the range of \$300 to \$350 while the unimproved latrines used by the majority of people cost around \$35, which makes the improved latrine nearly ten times more expensive than the unimproved latrine. Masons, entrepreneurs, NGO implementers, and potential consumers agree that cost is a significant barrier to improved sanitation facilities in peri-urban areas.

The WHO and UNICEF Joint Monitoring Program for Water Supply and Sanitation (JMP) illustrates this cost barrier in terms of a “sanitation ladder” (Figure 3). Households move up the ladder by making additional investments in their sanitation facilities.

In Malawi, the JMP’s step from unimproved to improved latrine is too high (i.e., costs too much) for most households to make at one time and it has hampered their ability to move up the sanitation ladder. Creating incremental rungs on the ladder that correspond to the cash flow of the homeowner or landlord is essential to improving sanitation (Figure 4). Sanitation program staff and sanitation businesses in Malawi have recognized this and efforts are underway to reduce the cost of improved latrines.

Notably, UNICEF has reduced the cost of improved latrines in rural areas with a new construction approach and masons in the sanitation business have been constructing a variety of low-cost, improved latrines to fill in the gap.

Figure 3: The JMP Sanitation Ladder

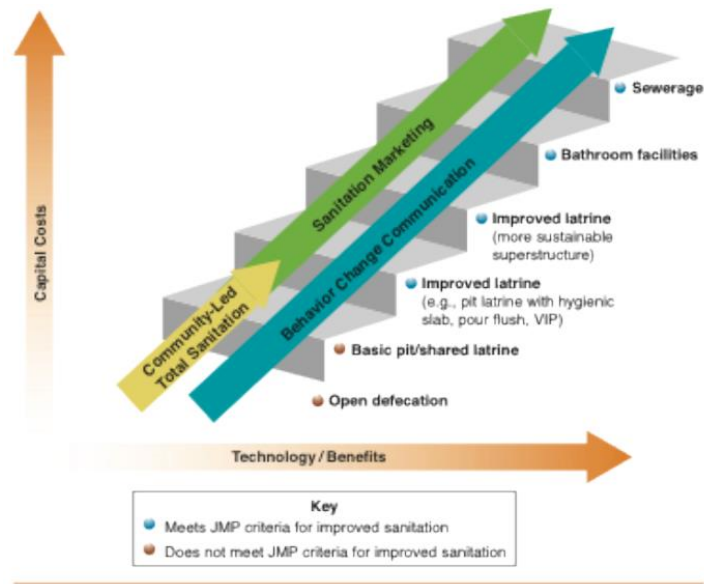
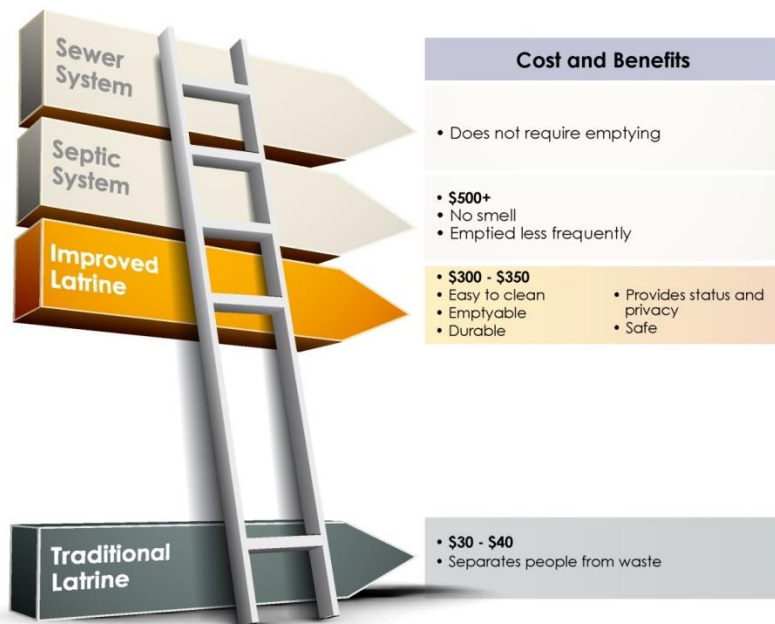


Figure 4: The Current Sanitation Ladder in Peri-Urban Malawi



2. THE PERI-URBAN SANITATION PROJECT

This chapter describes how the Strengthening Health Outcomes through the Private Sector (SHOPS) project, funded by the United States Agency for International Development (USAID) and led by Abt Associates, is engaging with the private sector to improve the poor sanitation conditions in peri-urban areas of Malawi through the Peri-Urban Sanitation project.

2.1 OBJECTIVE

The ultimate goal of SHOPS is to improve sanitation conditions in peri-urban areas of Malawi. More immediately, its objective is to accelerate the slow transition from unimproved to improved latrines in these areas through the promotion of private sector sanitation products and services. This SHOPS-led Peri-Urban Sanitation project moves toward that objective.

SHOPS' work in the field began in late 2013, with a Sanitation Market Assessment that looked at the current best practices in sanitation in Malawi as well as barriers to progress. The Peri-Urban Sanitation project grew out of that assessment and used its findings as a starting point. The most salient findings were that there is some movement in peri-urban areas toward the adoption of improved latrines and many stakeholders consider the cost of improved latrines to be a major barrier in the transition from unimproved to improved latrines. Private sector sanitation businesses have been established and are selling low-cost products that their supporters have endorsed, but construction is slow primarily because of the cost of materials and labor required to construct improved pit latrines.

Therefore, the Peri-Urban Sanitation project aimed to facilitate the transition from unimproved to improved latrines by creating a transitional latrine design with input from a range of private and public sector actors involved in sanitation. Rather than replacing the currently promoted improved latrines, the transitional latrine would be designed to capture more of the market segment currently using traditional latrines.

2.2 PROJECT DESIGN

The Peri-Urban Sanitation project was organized into five steps, with each step building off the preceding one. The first step was to expand upon the Sanitation Marketing Assessment by conducting a *global review* of transitional sanitation products in order to learn from current best practices in sanitation both within Malawi and globally and applying those practices to the country's peri-urban areas. Second the project held a *design workshop* that drew together private and public sector participants such as masons, entrepreneurs, NGO staff, university faculty, and local government representatives who reviewed local and global approaches, identified obstacles, and designed prototype solutions to the challenges. The project supported 10 participating masons in *building prototype latrines* in the peri-urban areas where they live and work and then sought *feedback* from the households' pilot testing the prototypes as well as

neighboring households; from the masons and other sanitation experts who participated in the design workshop; and from others who work in sanitation. Based on the feedback, the project then conducted a *design modification* to optimize the benefits and attractiveness of the latrine and minimize the cost for the household, while maximizing the ease of construction and marketing for the masons.

STEP 1: Global review of transitional sanitation products

The first step of the sanitation project was to review the global literature and speak with sanitation experts to identify potential solutions that could be adapted to the situation in Malawi. Design and promotion ideas were collected from published articles, project websites, and a visit to Malawi's most populous peri-urban areas in Lilongwe and Blantyre, where project staff interviewed residents, NGO staff, university faculty, and local government representatives.

The review found that, as the lack of improved sanitation facilities is a long-standing problem, a large number of solutions to the problem have been explored. Organizations in Southeast Asia, such as International Development Enterprises (iDE), conduct community gatherings where community sales agents create demand and sanitation providers sell modular pour flush latrines to interested households (www.ideorg.org). In peri-urban areas in Kenya, a company called Sanergy promotes communal latrines for which a small user fee is charged and the income allows for regular cleaning and emptying to occur (www.sanergy.org). In Malawi's neighbor Zimbabwe, the government has endorsed upgradeable latrines that help rural households transition from traditional unimproved latrines to improved ones (Morgan 2011). In Malawi, UNICEF conducted a participatory design of lower-cost latrines that has introduced a new pit lining method, which greatly reduces the risk of pit collapse without the need for cement, which is difficult to acquire and expensive (Cole 2013). These efforts have identified a number of key design elements for a marketable and durable improved latrine; they also underline the need for local solutions that take into account the users' needs, desires, and ability to pay if a project is to be successful.

STEP 2: Design workshop

The second step was to tap into local knowledge and context. To do this, the project held a design workshop for 29 sanitation stakeholders from a variety of backgrounds – masons, entrepreneurs, NGO staff, university faculty, and local government representatives. The workshop format drew heavily from IDEO's Human Centered Design approach (2013) and more generally from participatory design methods. It provided a space for innovation by bringing together the wide range of talented individuals and giving them the time and resources to consider new ways to design a latrine. Project staff facilitated and gave structure to the group as they explored their current knowledge of latrines, learned new design concepts, created prototypes, and evaluated the prototypes in terms of desirability, feasibility, and viability.

Framing the design challenge

To focus the workshop, the group first framed their own design challenge: “Create a sanitation product or service that is appropriate for peri-urban households and expands the current coverage of improved sanitation products or services.” As the workshop progressed, the project staff continued to refer to the design challenge to keep the participants in line with the challenge.

Examining existing knowledge

The participants then shared their knowledge of construction methods, latrine features, common latrine concerns, methods to market and sell latrines, the sanitation needs and wants of peri-urban households, and the ideal features of peri-urban latrines. This was done first in small groups and then in a plenary session, in which project staff expanded on areas with examples from other regions and projects to introduce new design concepts. All of the concepts were written or drawn onto colored paper and posted on a large wall so that the group could keep them in mind moving forward.



Masons, NGO staff, university faculty, and local government representatives discuss what is already known about improved latrines for peri-urban areas.

Synthesizing knowledge into opportunities

The group then searched the existing knowledge and design concepts for new opportunities for latrine design. The concepts were then organized to allow the participants to visualize them: the most promising ideas were moved to a separate wall and grouped by topic into key design elements (top, yellow paper), construction methods or techniques (blue paper), and promotional strategies (right side, yellow paper).

Brainstorming solutions

The participants then returned to their small groups to identify sanitation solutions. They selected construction methods to build a latrine that met the design challenge. The small groups drew designs, and priced the designs based on their own experience and a price list provided by project staff. Again, they presented their solutions in a plenary session. The whole group then voted for their preferred prototype according to its desirability, feasibility, and viability, where desirability was defined as meeting the household's needs and wants, feasibility as the ability to actually build the latrine as designed, and viability as the ability to make a profit from the product. Participants cast their votes for several designs that contained design elements they thought would be best to move forward into the next round of building a prototype.



Organization of concepts



A small group presents their new design to all workshop participants.

The workshop succeeded in establishing a creative atmosphere with the participants formulating new approaches to sanitation. Project staff closed the workshop by summarizing the solutions and creating a latrine design—including the popular components from the voting—that could move on to the next step of piloting.

STEP 3: Pilot of the prototype latrine

The piloting of the prototype latrine allowed for the design assumptions to be tested, and for the households to interact with a real rather than abstract latrine so that they would be able to provide feedback based on actual use of the new design. It also gave exposure to the new design, promoting the new model to other sanitation providers and supporters such as local and international NGOs and the local government.

The fourteen masons who had helped develop the prototype in the design workshop were invited to build the latrines that would be tested in the pilot. Project staff traveled to the areas where these masons worked to select households for the pilot. Households were purposively selected for participation in the pilot on the basis of their income level and their housing characteristics. Some premises were occupied by a single family; others housed multiple families, with the additional families renting rooms from a landlord whose family resided on the premise. Their current sanitation facilities and their aspirations were gleaned in the pilot pre-selection survey (see Annex C).

All of the ten households selected to participate in the pilot had traditional latrines. As seen in the photographs below, the traditional latrine on the left, built with unburnt bricks and mud mortar, is collapsing because it lacks a roof to protect its walls from the rain. The traditional latrine on the right, with only a maize sack covering the entrance, offers little privacy. Branches like the ones that form its floor (see lower right corner of photograph) are often eaten by termites, causing the floor to collapse under the weight of the user.



Traditional latrines belonging to households selected for the pilot.

Once the households were selected, a Memorandum of Understanding (MOU) was signed between the project, the homeowner, and the mason. The MOU stated the aims of the project and the responsibilities of each partner to the MOU (see Annex A). The project provided funds to the masons to purchase the materials for the latrine in phases and at each phase project staff inspected the construction to ensure that the construction met the specifications of the MOU.

The MOU and the design document (see Annex B) shared with the masons and households allowed for the masons to adapt the prototype design to the household needs, the available space, and locally available resources. As a result, latrine design varied by mason, specific household site, and peri-urban location. These design variations made by the masons and the households were viewed as valuable initial feedback.



A homeowner stands in front of her newly constructed transitional latrine.

STEP 4: Household and sanitation expert feedback

After the latrines were built, the project staff conducted a second survey, to obtain household feedback on the latrines. (See interview guide in Annex D.) Homeowners, tenants, and neighbors were interviewed and asked a range of questions regarding their perceptions of the constructed latrines. Their feedback is presented in Section 4 of this report.

Project staff also interviewed the participating masons to obtain their feedback. (See interview guide in Annex E.) The ten masons who built the prototype latrines were asked about their masonry experience, their business status, and their perspective on the design of the prototype latrine. Their feedback is presented in Chapter 4.



Sanitation experts making a learning visit to a prototype latrine.

In line with the participatory format of the design workshop, the project also called back the masons, NGO staff, university faculty, and local government representatives to participate in learning visits to the constructed latrines. The objectives of the visits were to 1)

share how the design was executed, 2) receive their expert feedback on the final product, and 3) discuss how best to promote this new type of latrine in peri-urban Malawi. Separate visits were made in Lilongwe and Blantyre and representatives from Mzuzu University attended the Lilongwe visit. Their feedback is presented in Chapter 4 of this report.

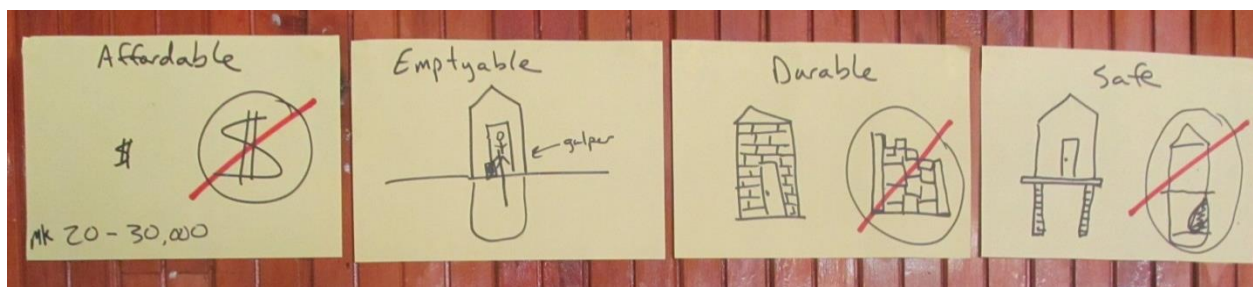
STEP 5: Design modification

The real-world experience gained by building the prototype latrine by different masons in households in different peri-urban locations of two cities provided a wealth of feedback on the prototype's design. Project staff completed inspections of the latrines once the pit lining and slab were complete and again once the superstructure was complete. The inspections documented the exact dimensions of the latrines, the amount of material and labor used during the construction, and the costs for both materials and labor. This information combined with the sources of feedback previously described provided the basis for making modifications to the latrine design. Several important design modifications were made using this information and they are described in Chapter 4 of this report. The data collected also provided insight into the ways that the new design could be marketed to peri-urban households.

3. TRANSITIONAL LATRINE DESIGN

Making an already low-cost product cost even less expensive without sacrificing the elements that make it better – in this case, an improved latrine that is also affordable and attractive – requires innovation. In the design workshop, participants first identified cost, safety, and durability as the design elements that are important to households. They later added the ability to empty the latrine, which is important from a public health perspective.

It should be noted that “durability” includes several factors that influence a household’s decision to build an improved latrine. Looks are important, as households consider a latrine made with cement and burnt bricks as attractive as well as strong. Workshop participants also included privacy as another influencing factor; the latrine’s superstructure of the latrine should provide privacy to the user.



Participants listed the four critical design elements: affordable, ability to empty, durable, and safe.

At the workshop, each small group contributed designs that would work in different scenarios. Participants struggled to create an affordable design that could meet the other criteria. They recognized that households usually provide the materials for a latrine and hire someone else – a mason in the case of an improved latrine or unskilled day laborer in the case of a traditional latrine – to do the construction. Materials chosen are those that are most affordable, materials that the household already owns or can purchase nearby, as truck transport can increase the cost dramatically.

In the end, to create a prototype that could be built across peri-urban areas in Lilongwe and Blantyre, the project staff decided to move from a standardized latrine design to an approach that would be more adaptable to individual households and locales; thus, they developed a set of guidelines to govern the construction process of each component of the latrine.

3.1 MODULAR DESIGN

A modular design strategy breaks the latrine down into its component parts (i.e., pit, pit lining, slab and housing). The substructure comprises the pit, pit lining, and slab; the housing – walls, windows, roof, and entryway or door – constitutes the superstructure. No single type of component can satisfy all critical design elements in every case. Take for example the slab. The slab needs to be affordable, durable, and safe. Metal reinforcement bars make a slab durable and safe, but in some areas, they are prohibitively expensive; however, a skilled mason will know how to make a domed slab that uses slightly more cement and sand but does not require the costly metal reinforcement bars, and in this way satisfies the various critical design elements. In areas where low-cost used or scrap metal reinforcement bars are available, the mason can build a flat, reinforced slab to satisfy the same critical design elements. In short, the mason must consider the household needs, desires, and resources and the environment where the latrine will be built to select the appropriate components for the latrine.

This makes it essential for the masons to understand the reasoning behind each of the components of the latrine. As was seen in the pilot, when masons do not clearly understand the reasoning behind each component they can make modifications

that compromise one or more of the critical design elements. In the design document that initially emerged from the design workshop, the project staff provided construction steps and sketches of the design of each component. The project staff made several visits to each construction site to discuss with masons and homeowners the extent of the degree of flexibility in design that would meet local space constraints and households preferences, and still meet the essential design elements that produce an improved latrine. With the experience of the pilot and the feedback from sanitation experts, project staff refined the design of each component and developed a list of construction guidelines to be used to train new masons that both describe the components and explain the rationale behind them (See section 4.3).



The transitional latrine includes a pit that is lined down to 1.5 meters to facilitate emptying.

3.2 UPGRADEABLE DESIGN

The second strategy followed by the design guidelines was to build a basic latrine that can be upgraded over time as household finances permit. This approach is already used to build new houses in Malawi. The upgradeable latrine design strategy calls for an initial investment large enough to pay for a basic functional improved latrine, essentially a durable substructure (again, the pit, pit lining, and slab) and a superstructure that can be upgraded in terms of durability, privacy, comfort, and dignity.

Four main upgrades were built into the initial design. 1) The walls are made with burnt bricks and mud mortar, which later can be upgraded with cement pointing.¹ This reduces the amount of cement needed for mortaring and delays the cost without having to rebuild the wall. 2) The initial entryway is “G” shaped, with the inner wall made of a reed mat that can be upgraded by removing the mat and installing a doorframe and door in the opening of the outer brick wall. 3) The initial roof is made from grass and bamboo, and upgraded to iron sheets. 4) The floor around the slab is backfilled with crushed brick, then upgraded to a cement slab.



The basic latrine (left) and upgraded latrine (right).

As with the modular design strategy, the upgradeable strategy needs to be discussed with the household. Not all of the upgrades listed above have to be put off. For example, the household might have iron sheets available – either new or used – and so can immediately install a durable roof. Similarly, the household may opt for a door to be able to control the usage of the latrine if it is located in a high traffic area, such as near a school or church.

¹ Cement pointing is a process whereby masons fill the space in between the bricks of an existing wall with cement mortar after scraping away the outermost existing mortar.

3.3 COST

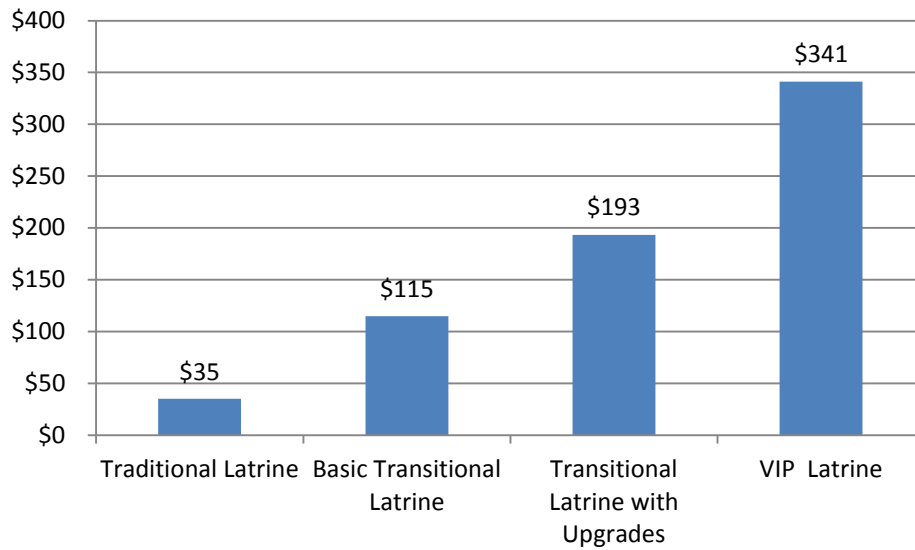
Together, the modular and upgradeable design strategies assist the mason and household in designing an improved latrine that meets the critical design elements while minimizing cost. Table 1 compares the building materials and average prices of the transitional latrine in its basic and upgraded forms to a standardized VIP latrine.

Table 1: Cost Comparison of the Transitional and VIP Latrines

	VIP Latrine	Basic Transitional Latrine	Upgrades	Average Unit Cost	VIP Cost	Basic Transitional Latrine Cost	Upgrades Cost
STRUCTURE							
Cement (50 Kg Bags)	8	2	1	6,500	52,000	13,000	6,500
Bricks (8.5" x 4.5")	4000	1200	0	8	32,000	9,600	-
River Sand (wheel barrows)	40	8	4	300	12,000	2,400	1,200
Iron Bars 3mm (meters)	12	12	0	100	1,200	1,200	-
PVC Pipe 110mm (meters)	3	0	3	1,200	3,600	-	3,600
DOOR							
Wooden Door Frame	1	0	1	3,000	3,000	-	3,000
Wooden Door	1	0	1	5,000	5,000	-	5,000
Hinges (4")	2	0	2	500	1,000	-	1,000
Wood Screws (Kg)	0.25	0	0.25	500	125	-	125
Night Latch Lock	1	0	1	800	800	-	800
Bamboo or Grass Mat (Mkeka)	0	0.5	0	800	-	400	-
ROOF							
Iron Sheets	3	0	4	1,500	4,500	-	6,000
Timbers (2"x3") (meter)	9	6	0	200	1,800	1,200	-
4" Nails (Kg)	1	0	0	800	800	-	-
Roofing Nails (Kg)	1	0	1	800	800	-	800
Soft Wire	1	1	0	200	200	200	-
Bamboo (bundles)	0	1	0	800	-	800	-
Grass (bundles)	0	4	0	400	-	1,600	-
Plastic Sheeting	0	1	0	400	-	400	-
Tire Twine (Linya)	0	1	0	400	-	400	-
LABOR							
Mason Labor (days)	8	5	2	2,500	20,000	12,500	5,000
Pit-digging Labor (3m x 1.4m)	1	1	0	4,500	4,500	4,500	-
				Total (MK)	143,325	48,200	33,025
				Total (USD)	\$ 341	\$ 115	\$ 79

Though the list of materials and prices in Table 1 represent an average for each type of latrine, the cost difference between the two types of latrines is significant. Figure 5, below, compares the cost of the transitional latrine to both the traditional and VIP latrines. Here the basic and upgraded forms of the transitional latrine create additional, low-cost options for households between the traditional and VIP latrines.

Figure 5: Cost Comparison of the Traditional and VIP Latrines



As seen in Figure 5, the transitional latrines create additional steps or rungs which households can use to transition from traditional latrines to improved latrines. For each step the benefits and costs of the latrine increase. This provides the opportunity to progress slowly from traditional to improved latrines as household funds become available.

4. LESSONS LEARNED

The Human Centered Design approach emphasizes the importance of feedback and reflection in the design process. The project was designed to collect feedback and allow for the modification of the design. The feedback received from households and experts complemented each other. The households focused much of their feedback on the superstructure, while the sanitation experts paid equal attention to the substructure of the latrine. The following sections describe feedback in terms of the substructure and superstructure, and also present feedback on the modular and upgradeable design strategies.

4.1 SUBSTRUCTURE

Both the households and the experts agreed that the depth and width of the pit described in the design guidelines were appropriate for the latrine. Households thought that the pit would take 4-8 years to fill, giving them a good return on investment before they would need to pay for pit emptying services. From the experts' perspective, the pit was wide enough to be able to dig to three meters deep and line without problem. However the masons disliked the size of the slab needed to cover the pit. With the outside diameter of the pit lining at 1.4 meters, the masons built slabs at 1.5 meters to ensure the slab covered the pit completely and was also partially supported by the surrounding soil. The 1.5 meter slab required a substantial amount of material, making it more costly and heavy to move into place. The size of the slab also meant that the walls of the superstructure had to be built over the slab. Several masons had concerns about the weight of the walls stressing the slab. They recommended that the design be modified to reduce the size of the slab without decreasing the size of the pit significantly.

The other sanitation experts supported this opinion and suggested that the pit lining could be slightly corbelled to reduce the diameter of the slab and prevent the walls from being built directly on top of the slab. A project in Zimbabwe used a similar strategy to maximize the size of the pit while minimizing the size of the slab. The photographs below illustrate how the pit lining can be reduced in diameter by stepping each new level of brick inward by approximately 2cm per level and back filling the remaining outer space with soil.



**A pit lining from the Blair Ventilated Improved Pit (bVIP) latrine in Zimbabwe.
(Photo: Peter Morgan 2011)**

A second modification came from masons' observation on the design and cost of the slab. The important aspects of slabs are that they not break and can be easily cleaned. Several masons involved in the prototype construction were unfamiliar with building dome slabs. In some cases, these masons used additional cement to make the domed slab stronger, fearing that an unreinforced dome slab might break. This drove the cost up. Other masons switched to build flat reinforced slabs because they were familiar with this method and they were able to source the metal reinforcement bars at a low cost. The sanitation experts indicated that in their experience households preferred flat slabs because they are easier to clean. The requirement of a strong slab can be met by either a dome slab or a flat reinforced slab, so the deciding factors can be the mason's experience, the household's preference, and the cost of the reinforcement bars.



These photographs show a dome slab that is raised in the center (left) and a flat reinforced slab (right).

4.2 SUPERSTRUCTURE

The size and strength of the pit lining was very important to both the households and the sanitation experts. They deemed the substructure would last a long time (more than 10 years) and as such care should be taken to ensure that the superstructure also last the same amount of time. Their attention was first given to the walls, which were constructed with burnt bricks and mud mortar. All commended the use of burnt bricks due to their durability and status of burnt brick buildings in peri-urban communities. During the learning visits, the sanitation experts noted that some masons took more care to prepare an equal consistency in the mortar, spaced the bricks evenly, and finished the mud mortar by scraping it with a soft wire. These efforts resulted in a stronger wall that is more attractive to households and can be easily upgraded with cement pointing.



Different techniques are used to mortar walls. The left photograph shows a wall with unfinished mortar and the right shows a wall with finished mortar.

Several masons and sanitation experts also noted the need for a more substantial foundation for the superstructure to prevent settling of the walls, which could lead to cracks and even the collapse of the walls. Storm water runoff was also considered a threat to the integrity of the superstructure and in extreme cases it could also enter and flood the pit. To address these concerns, the design was modified to include a foundation consisting of three levels of bricks (two below ground level and one above) laid perpendicular to the walls and secured with cement mortar, which is more resistant to rain and uneven settling of the walls.



A latrine built with a foundation because the area chosen for the latrine was uneven and storm water could potentially affect the walls of the latrine.

Households and sanitation experts both commented on the windows as an important design element. The number and positioning of windows are important for adequate ventilation and for light to enter the superstructure, but this must be balanced with the need for privacy in densely populated areas. The households and experts agreed that a minimum of four windows, each 10cm by 20cm, is needed for adequate ventilation and light. Exact location of the windows needs to consider the flow of people around the latrine and nearby structures that can block light and air flow. Windows placed higher in the walls allow for more privacy.

The height of the latrine prototypes also varied. Reducing the height of the latrine can reduce the number of bricks required, the amount of time spent constructing the latrine, and therefore the cost. However, during the learning visits a sanitation expert noted that the pump used to empty improved pit latrines, known locally as the “Gulper,” is 2 meters tall and requires the same amount of space above the drop hole so that it can be positioned into the hole for emptying. Noting this requirement and acknowledging that the ability to be emptied is a critical design element, the height of the front wall of the latrine was recommended to be not less than 2.1 meters and the height of the back wall should not be less than 1.9 meters. These heights will ensure that the latrine can be emptied without disturbing the roof of the latrine.

Several masons constructed the front wall of the prototype latrines to span the top of the entryway. The masons indicated that this framed the area for the future door and increased the strength of the walls. The sanitation experts felt that this addition added stability to the walls without dramatically increasing the amount of materials used. Households expressed the importance of a durable superstructure, although they did not specifically mention whether they preferred the latrines with or without this modification. Several of the households did express an interest in adding a door within three months of construction, and if the connecting wall framed the size of the door, it would facilitate this upgrade.



These photographs show a variation in the front wall; on the right, the front wall connects to the side wall to frame the future door and add strength to the design.

4.3 MODULAR DESIGN

During the design workshop it became apparent that a standardized design would be more expensive than a design that allowed for the latrine to be tailored to the desires and available resources of the household. This posed problems from both design and promotion standpoints. Traditionally, blueprints or standardized sketches are used to share a design with masons and pictures are used to market a product to households. With a design that needs to be adapted to each household, masons and households would need to understand the critical design elements and the construction techniques that could satisfy them. Thus the project staff moved to construction guidelines to convey to households and masons each component of the latrine and the rationale behind the modular and upgradeable design strategies.

The construction guidelines that came out of the prototyping process include:

1. Use locally available materials when possible to obviate the need for transport and thus reduce the overall cost.
2. Consider the seasonal variation in prices of local materials when deciding when to build.
3. Dig a circular pit to maximize the volume of the pit and minimize the pit lining material required.
4. Dig a pit that will not fill up for at least four years to give the household time to upgrade the latrine before they need to empty it. To calculate the size of the pit, multiply the number of family members by 90 liters/year and then multiple by 4 years. The resulting number is the size of the pit required in liters. For example, a family of eight ($8 \times 90 \times 4 = 2880$ liters) will need a pit that is 2880 liters in volume. Then use the following formula to calculate the depth and width needed. $\text{Volume} = \text{Radius} \times \text{Radius} \times 3.14 \times \text{Depth} \times 1000$ (i.e., $2880 = (0.55\text{m} \times 0.55\text{m} \times 3.14 \times 3\text{m} \times 1000)$)
5. Use a single 4.5" burnt brick lining with cement mortar to a depth of 1.5 m to prevent the more unstable upper layers of soil from collapsing, especially during pit emptying down to 1.5m with the Gulper.
6. Corbell the pit lining to reduce the size of the cement slab to 1.2 m in diameter or less to reduce the cost and weight of the slab.
7. Use a strong cement slab to prevent collapse and make it easy to clean (i.e., a dome or flat reinforced slab).
8. Create a foundation for the walls with burnt bricks and cement mortar to protect the latrine from water damage and collapsing walls due to settling.
9. Build the superstructure with burnt bricks and mud mortar to create a good looking superstructure that can be later upgraded with cement pointing to last a long time.
10. Build the front wall of the latrine to be not less than 2.1 meters and the height of the back wall to be not less than 1.9 meters to ensure that the latrine can be emptied without disturbing the roof of the latrine.
11. Finish the mud mortar of the superstructure by scraping it with a soft wire to make the walls look nice and prepare them for cement pointing.
12. Build at least four windows in the superstructure to allow for light and ventilation, making the latrine more comfortable to users.
13. Consult with the household about the dimensions of the walls, the placement of windows and entry way, and roofing options to ensure privacy, comfort, and affordability.

Clearly communicating these guidelines to the masons and households is crucial to the construction of a transitional latrine that meets all of the critical design elements.

4.4 UPGRADEABLE DESIGN

Cost was a major concern for the peri-urban sanitation project staff, masons, partners, and households. The project strived to balance the need for a safe latrine and household desires for an attractive and comfortable latrine. The upgradeable options enable this design to first satisfy the basic need for household safety and then be improved over time to meet their desires.

The most common upgrade among the prototype latrines was iron sheeting for the roof. Several households in Lilongwe and Blantyre opted for this upgrade during initial construction. Interestingly, several households had saved used iron sheets from previous structures and so had them available for their latrine. The second most common upgrade was the move from the “G” design to a door. Some households liked the temporary inner wall of the “G” design because it could be easily upgraded when they were able to purchase a door and doorframe. Three households made the upgrade to the door during initial construction. In all three cases, the size of the structure was reduced because the entryway was not required. By reducing the size of the structure, fewer bricks, timbers, and roofing materials were needed to complete the superstructure. For households paying for all of the construction materials, this adjustment in size helps to offset the cost of the door and doorframe.



The mason (pictured) reduced the dimensions of the latrine while adding a door during construction.

In addition to the planned upgrades, one mason added a vent pipe to the design and another included a hole for a future vent pipe in the slab. The Ventilated Improved Pit (VIP) latrine has been well marketed in peri-urban Malawi. This slight modification allows the household to upgrade to a vent pipe in the future, which should increase the comfort (lack of smell and flies) and the status of the latrine.

While difficult to see in this photograph, this slab was created with a hole for a vent pipe (within the dotted line), which could be added as an upgrade if desired.



The initial feedback on the transitional latrine design – and its cost – from the owners of the prototype latrines and their surrounding neighbors is very positive. The owners are happy to have an affordable latrine that they are confident will not collapse in the rainy season and that they will not need to replace every few years. Several households have discussed their plans to upgrade their latrines with doors, iron sheeting roofs, and cement pointing. Project staff also

report talking with neighbors who are surprised to hear how little their neighbor's transitional latrine cost, and several of the masons involved in the pilot have reported being contracted to build additional transitional latrines in the areas near the pilot prototypes.

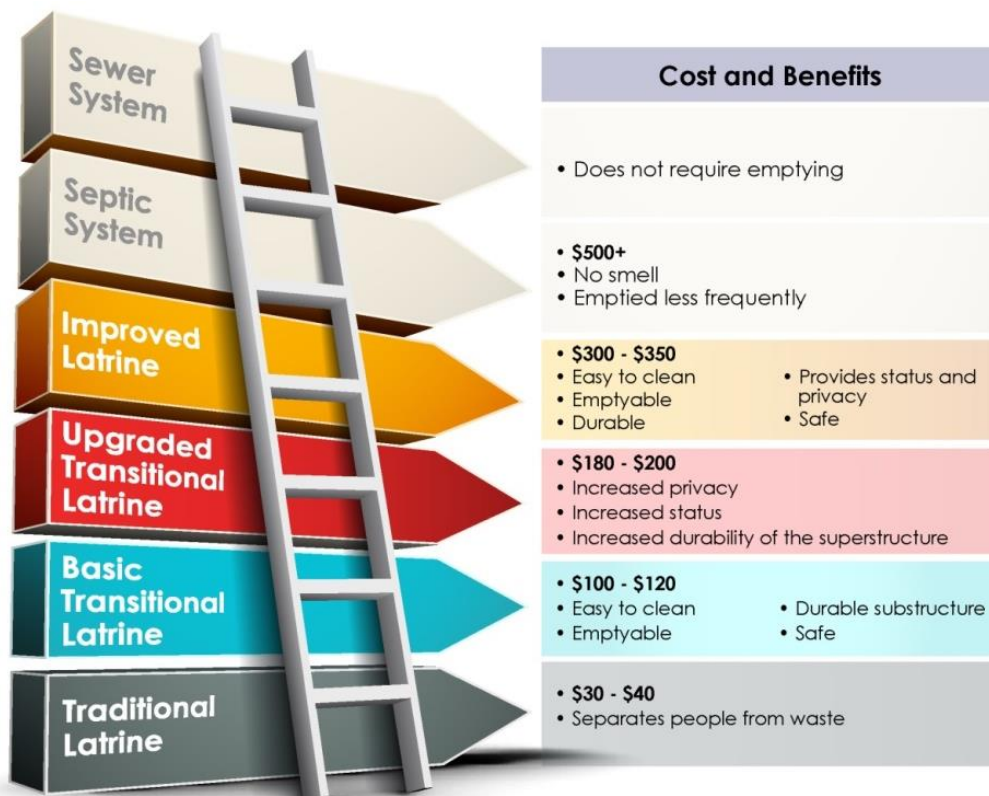
5. RECOMMENDATIONS

The project found that it is possible to build improved latrines well below the cost of currently marketed improved latrines. While it is not possible to create a standardized design for such a latrine, design strategies and construction guidelines can be used to custom design transitional latrines to meet the needs of their customers. Masons in the peri-urban areas of Lilongwe and Blantyre are already doing so. A human-centered design workshop enabled these masons to come together with support from SHOPS project staff, NGO staff, university faculty, and local government representatives to think critically about the sanitation needs and desires of peri-urban households and create a construction process that is capable of meeting their needs.

Each latrine must be designed keeping in mind the critical elements of affordability, ability to empty, durability, and safety; how the modular and upgradeable strategies can enable this; and the detailed construction guidelines presented in Section 4.3.

The results from the transitional latrine pilot indicate that the transitional design could add needed rungs to the peri-urban sanitation ladder. Figure 6 illustrates how the transitional designs would fit among the existing latrine designs that are currently available in peri-urban areas.

Figure 6: The Peri-urban Sanitation Ladder with the Transitional Latrine



The potential consumers indicates that the design creates a finished product that is desirable in

terms of function, looks, and cost. The viability (profitability) of the design as a service that masons provide to households wanting to transition from unimproved to improved also looks promising, as masons are continuing to build transitional latrines around the pilot areas.

5.1 MARKETING

The feedback received from both sanitation experts and households was useful for planning how the latrine design might best be marketed. The sanitation project will need to market the new design to potential consumers. It will also be necessary to do hands-on training for masons in the modular and upgradeable design strategies to ensure they can work with households to adapt the design to build durable and low-cost latrines. This section describes the project staff recommendations to move this latrine design onto the peri-urban market in Malawi.

1) Market the minimal list of materials to highlight the design's low cost.

Households have been exposed to improved latrine designs that require two or three times the materials that are needed for the transitional design. Marketing must dispel the assumption that this quantity, and cost, of materials is necessary. However, a specific price cannot be mentioned because of the fluctuating costs of materials and the flexibility in the current design. Instead, radio ads, community discussions, and marketing materials should list the materials needed and households can cost the materials themselves (including no-cost materials that they already possess).

2) Market the benefits of the transitional latrine as compared to traditional latrines.

The benefits of the transition from a traditional latrine to an improved latrine are another key marketing message. Homeowners and landlords expressed their dissatisfaction with traditional latrines in terms of durability, safety, and convenience. Pre-pilot interviews with households showed that households feel burdened by the need to rebuild a traditional latrine every few years. Households also expressed their concern that the latrine's mud floor, and in turn its walls, might collapse if termites eat through or rains wash away the branches supporting the floor. Households prefer to have a latrine that is well constructed and that will last for many years.

Households also expressed their desire for a latrine that offers privacy and can be locked while not in use. In densely populated peri-urban areas, traditional latrines that lack a door or a "G" shaped entrance offer little privacy. Unlockable traditional latrines often fill quickly as people in the community use the latrine without the permission of the owner. Households also mention that having an attractive, modern latrine is a source of pride, and this includes latrines that are constructed with burnt bricks, a cement floor, a door, and iron sheet roofing. Promoting the upgradeable design strategy as an affordable way of attaining these desired attributes would be a powerful marketing tool. The transitional latrine is designed and should be marketed as an affordable way to replace traditional latrines, not to compete with other more expensive improved latrines.

3) Market the design as a service of skilled masons.

As households typically provide the construction materials and hire a mason to build the latrine, the transitional latrine design is viewed as a service that the mason provides to the household. From this perspective, marketing messages should focus on the benefits of hiring a mason, rather than hiring day laborers, as improved latrines, the transitional latrine in particular, require a skilled mason. This distinction is important for the marketing of the modular and upgradeable design, as marketing messages will not be able to describe and price the custom latrines. The use of masons should also be linked to the latrine's durability and status.

4) Use community meetings and print materials to link potential customers with skilled masons.

Masons should present their services as beneficial to the health of the community via the traditional leaders who are influential in their communities. Community meetings called for by traditional leaders provide opportunities for the masons to reach homeowners and landlord who are using traditional latrines. Traditional leaders who have seen transitional latrines should support the masons in marketing the service to their communities. Print materials with the marketing messages should also be distributed by masons trained in the transitional design during these meetings. Print materials can clarify the design to households and connect the masons to households interested in the transitional design.

5) Provide hands-on transitional latrine design training to peri-urban masons.

To make the transitional latrine design service available, additional masons should be trained to build transitional latrines and to understand the rationale behind the critical design elements and the construction guidelines. It is essential to ensure that the masons understand the critical design elements and the construction guidelines, so that they are able to tailor the design to match the resources available and the desires of the household. Masons should be brought together to learn the design strategies of the transitional latrine from masons involved in the pilot and from project staff. They should participate in hands-on construction of the transitional latrine including building a corbelled pit lining, pouring dome and flat reinforced slabs, creating a foundation and wall plans, and building with mud mortar. As with the design workshop and the learning visits, these trainings should also involve NGO staff, university faculty, and local government representatives involved with current sanitation programs to foster integration and synergy. In this way, the transitional design could be viewed as another tool in their toolbox rather than a competing project with separate aims. The involvement of partners will also enable future trainings of masons in new project areas and masons entering into the sanitation business.

5.2 PROJECT EVALUATION

The evaluation of the latrine design has already begun. The prototypes were built for households that were selected on the basis of their socio-economic status and their potential to be a transitional latrine customer. Feedback from these households and their tenants and neighbors has been discussed. SHOPS project staff will continue to track their satisfaction to observe how their perceptions of the latrine change over time, and if they upgrade their latrine and for what reasons. These observations will be shared with the masons trained to build transitional latrines so that they can continue to modify their design strategies and guidelines to provide a better service. To evaluate the training of the masons and the marketing of the transitional latrine design, follow-up will be conducted with the masons to record their marketing activities and the percentage of their business that consist of transitional latrine and other improved latrine designs.

ANNEX A: MEMORANDUM OF UNDERSTANDING

MOU BETWEEN SHOPS, MASON AND HOME OWNER ON LATRINE PROTOTYPE CONSTRUCTION

IN PERI-URBAN MALAWI

This is an agreement between SHOPS Project, Mason namely _____, and the home owner namely _____, where the mason is agreeing to provide masonry technical task of constructing pit latrines on behalf of SHOPS Project at a designated place, and the Homeowner is willing to have this prototype latrine constructed within his/her premises. SHOPS will in return fund the activities, monitor construction work, provided construction design and pay for the labor cost among many responsibilities. The following are the detailed responsibility expected from the parties involved in this agreement.

SHOPS Responsibilities

1. Identify a household on which the proto type should be constructed in a peri-urban area.
2. Provide standards on how the construction should conform.
3. Make periodic payments for the construction material including labor fees as scheduled.
4. Monitor the construction to meet recommended standards as scheduled.
5. Conduct periodic in-depth interviews with home owners and their neighbors to get feedback on people's preferences, attitudes and needs regarding pit latrines.

Mason Responsibilities

1. Construct latrine prototypes at designated places, with adherence to the set and agreed latrine construction standards.
2. Receive funds from SHOPS representatives and procure building materials for latrine construction whilst consulting the home owner.
3. Be accountable to both SHOPS and the homeowner on the funds that shall be disbursed for latrine construction purposes.
4. Provide labor/source labor to dig a pit and construct both substructure as well superstructure.

Homeowner Responsibilities

1. Provide space for the prototype latrine to be constructed.

2. Work with the mason to identify and purchase building materials for the latrine.
3. Accept taking part in scheduled in-depth interviews that the SHOPS project will conduct periodically.
4. Supervise the construction process in terms of monitoring the supplies that are purchased and used to construct the latrine.
5. The home owners will be allowed to make upgrade for other things they deem necessary, provided they pay for the extra materials. These could be addition to existing feature such as adding the door to the superstructure etc.
6. Allow other people such as neighbors and those passing by to observe the latrine, answering questions from them if necessary.

Liability

1. Once construction develop a problem, SHOPS will provide funds for the construction to be re done, but will not pay for extra labor associated with the extra work.

Mason Signature_____ Date_____

SHOPS Project Representative Signature _____ Date_____

Homeowner Signature_____ Date_____

ANNEX B: DESIGN DOCUMENT

Latrine Pilot Design April-September 2014

Purpose of the Pilot

To test whether we can construct an improved latrine for under MK 35,000, which meets peri-urban requirements of durability and ability to empty and household desires of dignity, comfort, and privacy.

Methods

1. Households will be selected to receive pilot latrines by identifying households which are in the targeted market segment for this type of latrine (i.e. households that could afford to spend MK 35,000 on a latrine and could then upgrade the latrine over time).
2. The pilot aims to simulate the actual interactions between a household and mason (i.e. if the household has bricks that can be contributed to the latrine we will buy the bricks from them and deduct the purchase from the overall cost.)
3. The head of household will supervise the construction process in terms of monitoring the supplies that are purchased and used to construct the latrine.
4. SHOPS will work with the household and masons to form an agreement in the form of an MOU, so that all parties understand their level of contribution and responsibilities to the construction.
5. Masons will agree to follow the following construction steps in this document while constructing the latrine. They will review and approve of a bill of materials needed and the planned labor charges that are at or below MK 35,000 before beginning the construction of the latrine. Note: The costs listed in this document have come from the masons during the urban sanitation workshop. Actually costs may vary from those listed here.
6. SHOPS will make at least two inspection visits (1 once the pit lining and slab are complete, 2 once the housing is complete). Structures that are deemed to not meet standards will be demolished. SHOPS will pay for additional materials to rebuild, but will not pay for the additional labor required to rebuild the structure.
7. SHOPS will pay up to MK 35,000 for the construction including all materials and labor charges (including the transport of materials).
8. Households will be briefed on the design of the latrine and the upgrading steps that can be taken once the latrine is completed. If households would like to contribute funds or materials to the construction process to 1) add a door, 2) use more durable roofing materials 3) add cement pointing to the superstructure, or 4) plaster the inside of the latrine, they may do so. The household will be responsible for material and labor charges exceeding MK 35,000 for making these upgrades.
9. SHOPS will document for every latrine every material that is used and its cost and also who works on building the latrine and how much they are paid.
10. SHOPS will pay the masons in three installments. On signing the MOU, SHOPS will pay MK 20,000. On passing the inspection of the pit, pit lining and dome slab AND presenting the expense record, SHOPS will pay MK 10,000. On passing the final

inspection of the superstructure AND presenting the expense record, SHOPS will pay MK 5,000.

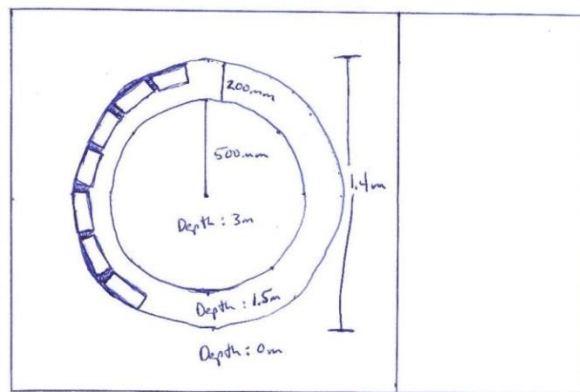
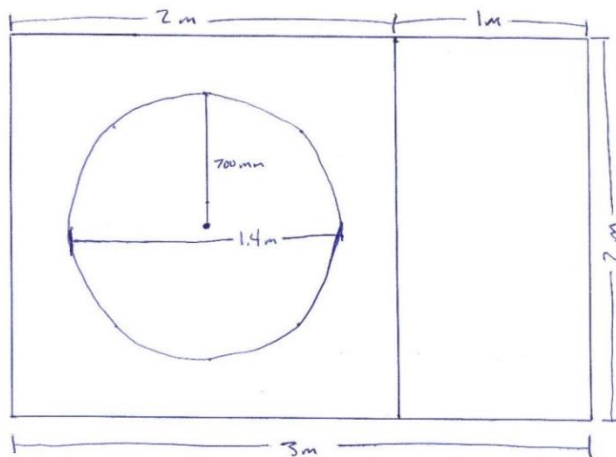
11. The household must agree to be interviewed by SHOPS before construction and immediately following construction.

Pit and Pit Lining

The pit and pit lining have been designed to create a strong pit lining that will prevent pit collapse and facilitate the emptying of the pit down to 1.5 meters, while minimizing the cost of construction.

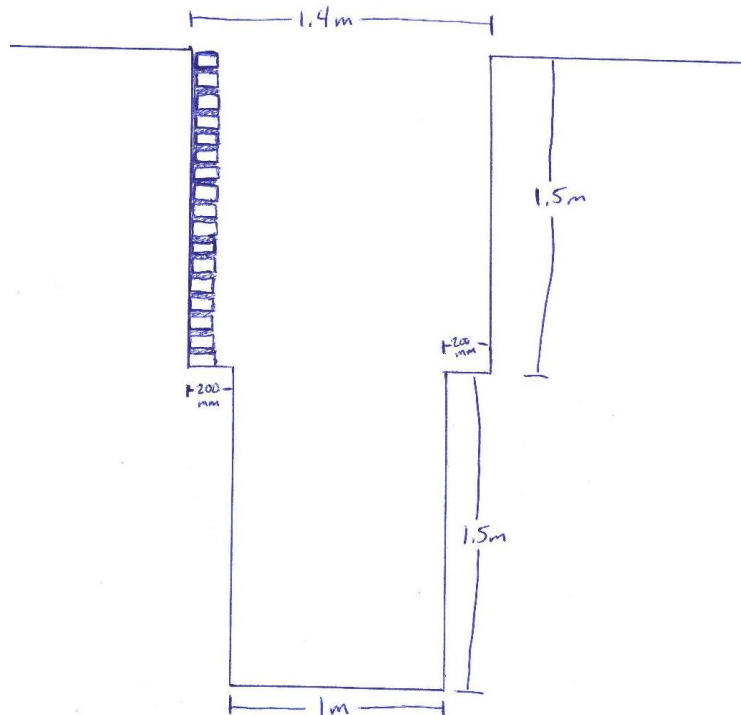
Construction Steps

1. Select an area that is at least 2m x 3m where the latrine can be build, in cooperation with the household owner.
 1. Consider access to the latrine for all household members.
 2. Consider the other uses of that space.
 3. Consider the way people move through the space.
 4. Consider the way the rains affect the area.
2. Divide the space into a 2m x 2m square and a 1m x 2m entrance way by marking the ground. (see figure)



3. Locate the center of the 2m x 2m square by measuring and mark the spot.

4. Use a piece of string to mark the ground with a circle which is 700mm from the center of the circle. (see figure)
 5. Dig down 1.5 meters within the circle. IMPORTANT- The sides of the pit should be smooth and vertical so that the brick lining is built uniformly and tight to the sides of the pit without becoming wavy.
 6. Once you have dug down to 1.5m create a smooth and flat bottom to the pit.
 7. Locate the center of the pit by measuring and mark the center.
 8. Use a string to draw a second circle that is 500mm from the center of the pit. (see figure)
 9. Dig down 1.5m further within this second circle (creating a shelf around the pit wall) (see figure).
1. NOTE: If the digger hits solid rock below a total depth of 2m, the pit can range between 2 to 3m deep. If digger hits solid rock before 2m consider moving the location of the latrine to a less rocky area.



10. Mix 4 wheel barrows of sand to 1 50 Kg bag of cement for the mortar.
11. Lay a thin layer of cement mortar on the shelf and lay the first row of bricks around the shelf as close to the pit wall as possible.
12. Continue adding layers of bricks with cement mortar to the ring of bricks keeping them in a tight circle and as close to the pit wall as possible.
13. On each level, create 3 small openings in the wall to allow liquids to drain from the pit. Make sure to stagger these openings in each row of bricks so the strength of the wall is uniform.
14. After every fifth row, backfill the space between the bricks and the pit wall tightly with soil removed from the hole.
15. Continue adding brick rows and backfilling until the bricks are level with the ground level.

List of materials for the pit lining

Item	Quantity	Unit Price	Total Price
Bricks	275-400 (depending on 8-5 size)		2500
River Sand	4 wheel barrows	400	1600
Cement	50 Kg Bag	6500	6500
		Total	MK 10,600

Masons and household members transport all materials. Materials need to be sourced locally to minimize transport costs.

Size Calculations:

Size of the Pit = $(1.5 \times 0.6 \times 0.6 \times 3.14) + (1.5 \times 0.5 \times 0.5 \times 3.14) = 1.6956 + 1.1775 = 2.8731$ m³ or 2873 lts

Initially pit will fill in 4 years with 8 users

Amount that can be emptied by the Gulper = 1695 lts

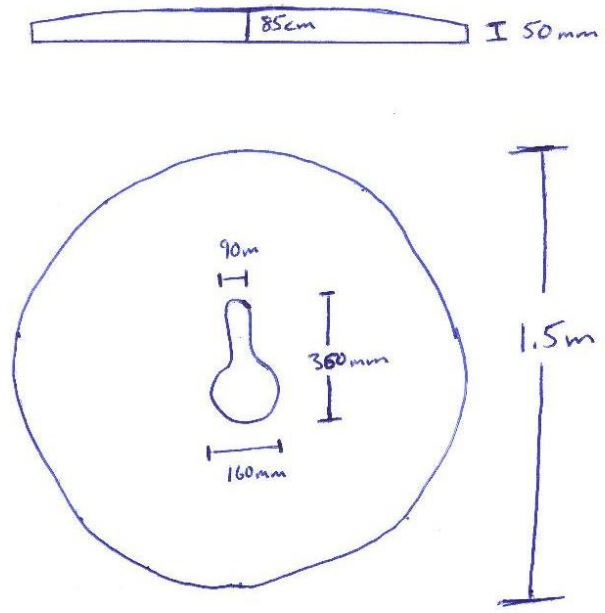
Time to fill after emptied by the Gulper with 8 users = 2 years and 4 months

Dome Slab

The slab design will be a domed slab. This existing technology has proven to be a low-cost method of creating a slab that is suitable for use with round pits which are lined with bricks. The dome slab for this latrine will be 1.5m in diameter to allow for a slight overlap of the brick pit lining.

Construction Steps

1. Select an area that is at least 2m x 2m and flat.
2. Use a string that is 750mm long to draw a circle on the ground that is 1.5m in diameter.
3. Use bricks to create a round frame for the slab.
4. Line the area with plastic or paper lining.
5. Mix half a bag of cement (25 Kg) with 1 wheel barrow of sand and 1 wheel barrow of quarry stones.
6. Shovel the mix into the form and sculpt into the dome shape and cut in the keyhole.
7. Ask the household if they want raised foot marks or not. (Children and elderly may be better off without raised foot marks and the dome shape will carry liquids way from the standing area if someone misses the hole)
8. Allow the slab to cure and for SHOPS to inspect the pit lining and slab before moving the slab onto the lined pit.
9. Construct a drop hole cover with a handle using either wood or metal.



List of materials for Dome Slab

Item	Quantity	Unit Price	Total Price
River Sand	1 Wheel barrows	400	400
Stone	1 Wheel barrows	1000	1000
Cement	25 Kg	6500	3250
		Total	MK 4,650

Masons and household members transport all materials. Materials need to be sourced locally to minimize transport costs.

Latrine Housing (Superstructure)

The housing of the latrine will be a simple structure which can be upgraded over time as the household saves additional funds and prioritizes the latrine as an area for investment. Importantly, the wall materials used in the initial construction can be upgraded with cement pointing (outside) and plastering (inside), and do not need to be replaced when upgrading. This results in a lower overall cost and provides an initial product which more closely meets the demands of durability, dignity and privacy. Once the initial construction is completed by the mason, the homeowner can choose to upgrade the latrine in the following ways.

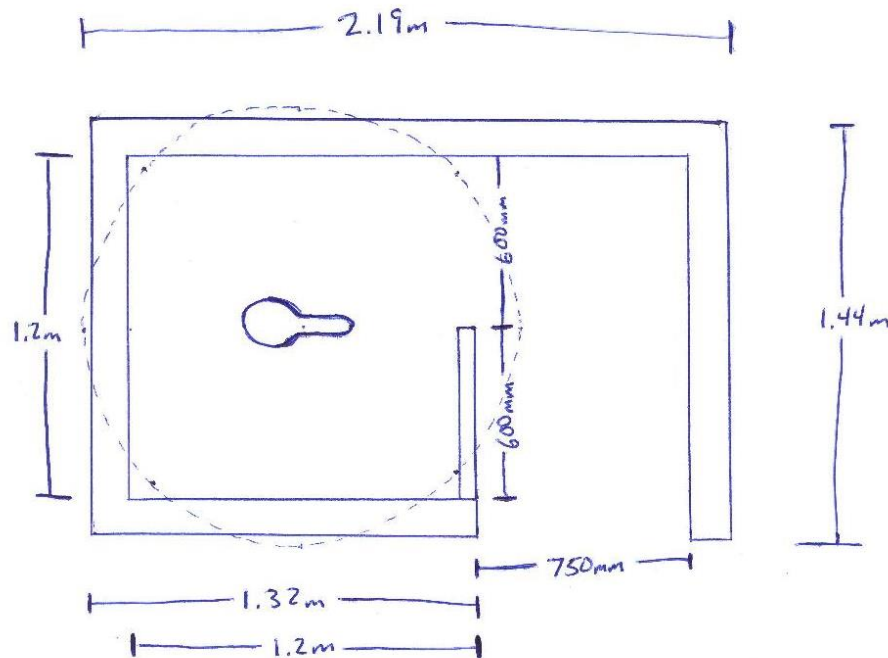
Latrine Upgrades

1. Replace the thatch roof with iron sheeting
2. Add a wooden door to the brick structure and remove the inner temporary wall
3. Apply cement pointing to the outside of the housing
4. Apply plaster or cement pointing inside of the housing
5. Cement the remaining floor space around the slab

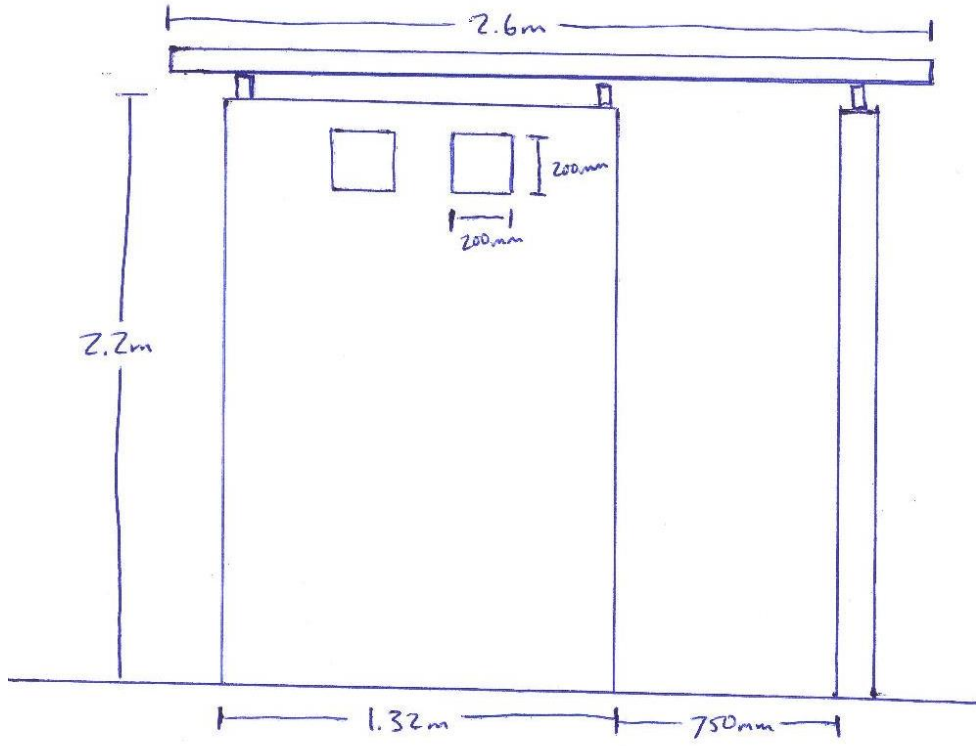
Construction Steps

1. Build a G-Design using burnt bricks and mud mortar for the outer walls (see figures) that can be upgraded by adding a door at a later date.
2. Create the walls with windows that allow for ventilation and light to enter. The total opening should be 0.5m squared (including the gaps between the walls and the roof). Discuss with the homeowner where the windows should be located and how large they should be.
3. Line floor with left over bricks where it is not the slab.
4. Create the inner wall of the G with a woven mat (mkeka) or similar material and hang it from the roof rafters.
5. Use grass and bamboo to create a thatched roof.

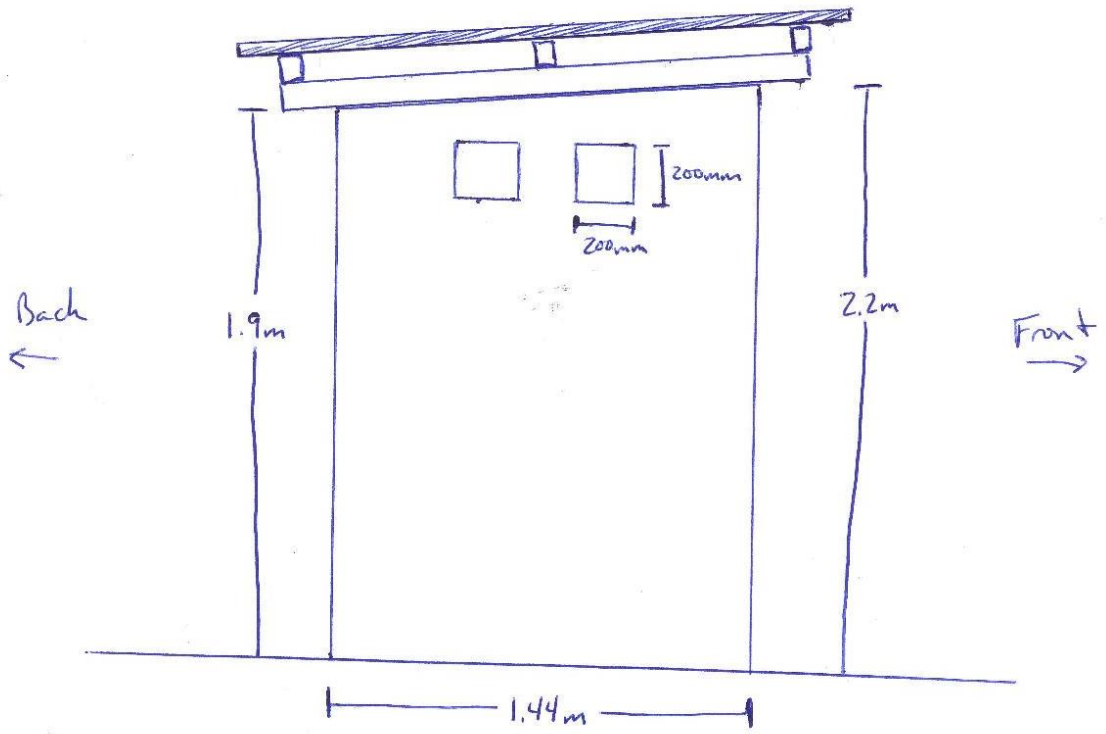
Floor Plan



Front View



Side View



List of materials for Housing

Item	Quantity	Unit Price	Total Price
Burnt bricks	550-800 (depending on size)	8-5	4400
Mud	8 Wheel barrows	0	0
Bamboo	1 bundle	800	800
Grass	4 bundles	400	1600
Plastic sheeting	1 sheet	550	550
Twine (Linya)	1 bunch	500	500
Total			MK 7,850

Masons and household members transport all materials. Materials need to be sourced locally to minimize transport costs.

List of all material and labor costs

Item	Quantity	Unit Price	Total Price
Burnt bricks	825-1200 (depending on size)	8-5	6900
River Sand	6 Wheel barrows	400	2400
Stone	1 Wheel barrows	1000	1000
Cement	75 Kg	6500	9750
Mud	8 Wheel barrows	0	0
Bamboo	1 bundle	800	800
Grass	4 bundles	400	1600
Plastic sheeting	1 sheet	550	550
Twine (Linya)	1 bunch	500	500
Labor			10000
Transport Labor			1500

Total

MK 35,000

TOTAL COST = MK 35,000

LABOR COSTS = MK 11,500

MATERIAL COSTS = MK 23,500

Note: The costs listed in this document have come from the masons during the urban sanitation workshop. Actually costs may vary from those listed here. It is the responsibility of all parties to discuss the costs of construction and determine how the latrine can be built on budget at MK 35,000 including all labor costs.

ANNEX C: PRE- CONSTRUCTION HOUSEHOLD INTERVIEW GUIDE

Latrine Pilot Interview Guide

BEFORE CONSTRUCTION

Instructions for the interviewer:

Household selection-

The household should be in the market segment we are targeting with the low-cost latrine, i.e. medium income within the peri-urban areas. They should be able to spend MK 35,000 on an improved latrine after saving for a few months.

Households should have:

1. Compound or premise without a brick wall.
2. A house made of burnt bricks but not recently painted (within two years).
3. The house may also be built with unburnt bricks that are plastered.
4. A roof made from iron sheets
5. A shared latrine with a neighboring household or a traditional latrine (unlined pit and/or earth slab) on their premise.

Interview protocol-

1. Interview should take place before you tell them we are building improved latrines.
2. Household selection will also be made based on income and access to improved latrine responses in the interview. Not all individuals interviewed will receive a latrine.
3. Interview should be conducted with the owner of the compound/premise.
4. Interview will take place within the premise.
5. Interview will be recorded.
6. Interviewer will be taking notes.
7. Interview should take less than one hour.

Introduction-

My name is Ernest Mlenga. I am working with the SHOPS Project to promote sanitation in peri-urban areas. Our purpose in the sanitation project is to promote the construction of low-cost improved pit latrines.

As part of the learning process, we are interacting with households to get their perspective on sanitation.

I would like to ask you some few questions. The answers you will give will be used only for our sanitation work and will be helpful to you and other in peri-urban areas.

The interview will take less than an hour.

Do you accept to take part in this interview?

Household Questions- (estimate time 15 min)

1. What is your name?
2. How many people in total stay in this compound?
Probe: number of adult women, adult men and number of children
3. Do you rent rooms out to other people?
4. If so, how many households do you rent to and how many people are in these households? (i.e. 2 households—3 people / 4 people)
5. How long have you lived at this premise?
6. What type of work do you do?
Probe: If a business, what kind of business?
7. Do you have multiple sources of income?
Probe: If yes, what are they? (i.e. farming income, piecemeal labor, owning small shop or business, renting rooms)
8. What is your highest level of education?
9. Who makes household purchasing decisions?
Probe: Does your spouse or extended family influence purchasing decisions?

Latrine questions- (estimate time 45 min)

It is important to have good hygiene around the house...

10. How do you make sure that your house is hygienic?
Probe: Which is the most important? Which is the second, third, fourth most important?

People have many different opinions on what a good latrine should look like...

11. What does a good latrine look like to you?

Probe: What type of wall material, roof, door, floor and windows does it have?

Probe: How big should the housing be? How large should the pit be?

Probe: Would it have a vent pipe, a seat, or a drop hole cover?

Probe: How much would this good latrine cost to build?

Now let's talk about your latrine.

12. Tell me about your latrine. What is it like?

Probe: What type of wall material, roof, door, floor and windows does it have?

Probe: How many years has it been in use?

Probe: How big is it? How large is the pit?

Probe: Does it have a vent pipe, a seat, or a drop hole cover?

Probe: Is it a shared one or does your household use it alone?

Probe: How much did it cost to build?

Probe: What do you like about this latrine?

Probe: What do you dislike about this latrine?

13. What improvements would you like to make to your latrine?

14. What is currently preventing you from making such improvements?

Probe: Besides money, are there other things that are a higher priority? List them.

There are so many ways people learn about latrines...

15. What sources have you heard about latrines from?

Probe: Have you heard radio messages, been visited by door-to-door campaigns or sanitation promoters or participated in community functions?

Probe: Are there some local NGO's who are promoting latrines? If yes, what are they saying about latrines?

16. Have you heard about pit emptying services? If yes, what did you hear?

Probe: Do you know how much it costs to empty a pit?

ANNEX D: POST- CONSTRUCTION HOUSEHOLD INTERVIEW GUIDE

Latrine Pilot Interview Guide

AFTER CONSTRUCTION

Instructions for the interviewer:

Household selection-

1. All households which latrines were built will be interviewed (10)
2. If multiple households use the latrine (i.e. tenants), all households will be interviewed
3. If the latrine is only used by one household, a neighboring household will also be interviewed.
4. A minimum of 20 household interviews will be conducted in this way.

Interview protocol-

5. Interview should be conducted with the head of the household.
6. Interview will take place within the premise.
7. When neighbors are interviewed, they should first be showed the latrine and the size and structure of the pit and pit lining should be explained to them. The interview can begin after they have had time to inspect the latrine and ask questions about it.
8. Interview will be recorded.
9. Interviewer will be taking notes.
10. Interview should take less than one hour.

Introduction-

My name is Ernest Mlenga. I am working with the SHOPS Project to promote sanitation in peri-urban areas. Our purpose in the sanitation project is to promote the construction of low-cost improved pit latrines.

As part of the learning process, we are interacting with households to get their perspective on sanitation.

I would like to ask you some few questions. The answers you will give will be used only for our sanitation work and will be helpful to you and other in peri-urban areas.

The interview will take less than an hour.

Do you accept to take part in this interview?

Household Questions- (estimate time 15 min)

11. What is your name? (after recording their name skip to **Latrine Questions** if they were interviewed in the first round)
12. How long have you lived at this premise?
13. What type of work do you do?
Probe: If a business, what kind of business?
14. Do you have multiple sources of income?
Probe: If yes, what are they? (i.e. farming income, piecemeal labor, owning small shop or business, renting rooms)
15. What is your highest level of education?
16. Who makes household purchasing decisions? (Home Improvements)
Probe: Does your spouse or extended family influence purchasing decisions?

Latrine questions- (estimate time 45 min)

If you are interviewing a neighbor, skip to the next section.

Households that use the latrine

17. What do you think of your new latrine?
Probe: What do you like about it?
Probe: What do you dislike about it?
Probe: Is anything missing from the design?
18. Is there enough light entering the latrine during the day?
19. Do you think it is safe to use? Why?
Probe: Do you think it will collapse? Ask about the pit and the walls separately?
20. How old do your children need to be before they start using the latrine?
21. Do you think it is going to be comfortable to use this latrine?
Probe: If no? How would you make this latrine more comfortable?
22. Does it feel private to use?
Probe: How would you make it more private?
Do you think you need a door on a latrine? Why/why not?

Probe: if yes is it for privacy or security?

23. When visitors come, are you comfortable to allow them to use this latrine?
24. Are you planning to make any changes/Upgrades to the latrine in 3 months?

Probe: Would you consider cement pointing, iron sheets addition, adding a door, plastering the walls etc.?

25. When the walls, start to wear or fall apart, would you use cement pointing to reinforce or tear the wall down and rebuild with mud mortar?
26. When the roof start to leak, would you replace with iron sheets or same grass?
27. Would you recommend this type of latrine to others? Why?
28. If you had to come up with a name for this type of latrine, what would it be? What would you call this latrine type?
29. How would you convince a neighbor or friend to buy this type of latrine?

Probe: Cost and feature such as strong pit, slab, and amount.

30. How long do you think it will take to fill?
31. Do you know someone that can empty it?
32. How much do you think it will cost to empty it?

Neighboring households that do not regularly use the new latrine

33. What do you think of this type of latrine?

Probe: What do you like about it?

Probe: What do you dislike about it?

Probe: Is anything missing from the design?

34. Do you think it is safe to use?

Probe: Do you think it will collapse?

Probe: Do you think it will control the level of flies?

35. How old do your children need to be before they start using the latrine?
36. Do you think it would be comfortable to use this latrine?

Probe: How would you make this latrine more comfortable?

37. Does it feel private to use?

Probe: How would you make it more private?

38. Do you think you need a door on a latrine? Why/why not?

Probe: if yes is it for privacy or security?

39. If visitors come, would you be comfortable to allow them to use this latrine?

The latrine we are referring to (newly built) has a strong pit design which is lined with cement and burnt bricks. It also has very strong slab. However, the super structure is basic, almost made like many superstructures in the community. This super structure will last longer surely, but some improvement/upgrades that could be made to the basic house will make the super structure last even longer. These improvements could be adding iron sheets, cement pointing, or a door, and plastering the walls.

40. Would you make any changes/upgrades to the latrine? Explain.

41. When the walls, start to wear or fall apart, would you use cement pointing to reinforce or tear the wall down and rebuild with mud mortar?

42. When the roof starts leaking, would you replace it with new grass and paper or replace it with iron sheets?

43. Would you recommend this type of latrine to others?

44. If you had to come up with a name for this type of latrine, what would it be?

45. How would you convince a neighbor or friend to buy this type of latrine?

Probe: Costs features (Lined pit, Slab, Depth).

46. How long do you think it will take to fill?

47. Do you know someone that can empty it?

48. How much do you think it will cost to empty it?

ANNEX E: MASON INTERVIEW GUIDE

Latrine Pilot Interview Guide

MASON

Instructions for the interviewer:

Mason selection-

1. All masons who built latrines will be interviewed

Interview protocol-

2. Interview will take place at the latrine they constructed.
3. The head of household will not be present for the interview.
4. Interview will be recorded.
5. Interviewer will be taking notes.
6. Interview should take less than one hour.

Introduction-

My name is Ernest Mlenga. I am working with the SHOPS Project to promote sanitation in peri-urban areas. Our purpose in the sanitation project is to promote the construction of low-cost improved pit latrines.

As part of the learning process, we are interviewing the masons who built latrines for the project.

I would like to ask you some few questions. The answers you will give will be used only for our sanitation work and will be helpful to you and other in the sanitation business.

The interview will take less than an hour.

Do you accept to take part in this interview?

Mason Questions- (estimate time 15 min)

7. What is your name?
8. How long have you been working as a mason?
9. How long have you been building latrines?
10. How many latrines have you built or assisted in building in the last year?
11. Currently, what percent of your livelihood (or business income) comes from building latrines? Or latrines related activities?

12. What types of latrines have you built in the past?

13. What is your highest level of education?

Probe: Have you had formal mason training or did you learn as an apprentice?

Latrine questions- (estimate time 45 min)

14. What do you think of this new type of latrine?

Probe: What do you like about it?

Probe: What do you dislike about it?

15. Is anything missing from the design?

16. How could this latrine design be improved without increasing the costs too much?

17. Is the pit size the right size? If no, what dimensions would be better? And why?

18. Which is the better shape: a round pit or a square pit?

19. Is the brick lining well designed?

Probe: Is it too strong or too weak?

Probe: Is there any way to reduce the cost of the pit or the pit lining?

Probe: Is there any way you could use less cement in the mix without an increase in risk of collapse?

20. Is there any way we could improve the slab or reduce its cost?

21. How much would cement pointing cost?

22. When the walls show wear, would you recommend cement pointing or rebuilding the walls with mud mortar?

23. Is the superstructure designed well?

Probe: Is there enough ventilation and light entering the latrine?

Probe: Will the superstructure last for 10 years or more?

24. Is there a better low-cost way to make the roof?

25. Is there a better low-cost way to make the entrance?

26. If you had to come up with a name for this type of latrine, what would it be?

27. Do you think people will be willing to pay for this latrine if it costs MK 40,000?

Probe: If not, how much would people be willing to pay?

28. What are the advantages/disadvantages of this latrine compared to the VIP?

29. How much did labor cost for the latrine (your own labor plus hired labor)? How much did you earn in labor from this latrine (your charges)? How much could you earn when building a VIP?

30. Knowing the features of VIP, and this latrine, do you think demand for this latrine will be high given the low costs compared to VIP?

31. How would you convince more customers to buy this type of latrine?

Probe: Would you use any of the following: radio, community meeting, door-to-door sales agent, endorsement by local authority, dramas/theater shows, brochures, posters, demonstrations, or visits to an example latrine?

32. How long do you think it will take to fill?

33. How much would you or a nearby pit emptier charge to empty it?

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