The Importance of Sanitation and Hygiene Practices in Improving Water Quality and Standards of Living in Developing Nations

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S.W.A.N. is an initiative started by Professor Massoud Pirbazari of the University of Southern California focusing on the improvement of drinking water quality for citizens of developing countries. SWAN's goal is to provide comprehensive and visually based information so that people, at the household level, can treat their water, and in turn, improve their health and well-being.

THIS SITE IS UNDER CONSTRUCTION.

All material included in this presentation have been adapted from sources* listed on the final slide.

** We would like to thank those whose work has been pivotal in the creation of this site.*

(See Reference Page for Sources)

To the Visitor,

Your comments and suggestions are appreciated. Please direct your thoughts to Peter Grasso at pgrasso@usc.edu

Thank you.

Sanitation and Hygiene Practices

- This slide presentation will:
  - Express and highlight the importance of sanitation and hygiene practices in improving water quality and the standard of living in developing nations.
  - Explore the advantages and disadvantages of various common latrine designs.
  - Provide plans for the construction of a biodigester latrine.
- The information below is for the benefit of rural communities in developing nations.

Global Sanitation and Hygiene Issues

- 2.6 billion people (40% of world's population) lack access to improved sanitation services.
- Unhygienic habits and poor or nonexistent sanitation facilities greatly increase susceptibility to diarrhea, cholera, typhoid and a number of parasitic infections.
- In total, 2.2 million deaths annually arise due to inadequate sanitation practices, a lack of safe drinking water, and poor hygiene in developing nations .

The Roles of Sanitation and Hygiene in Improving the Standard of Living

- Sanitation and Hygiene play major roles in the prevention of illness, for example:
  - A 2004 study estimates that poor quality water, sanitation, and hygiene habits account for 5.7 per cent of world wide disease burden.
  - Approximately 81 million years of healthy life are lost each year most of which could be eliminated with simple improvements in the areas of water supply, sanitation services, and hygiene practices.
- Illness prevention through simple sanitation services and hygiene practices is a cheaper alternative to illness treatment.
  - Illness prevention also reduces the number school and work days missed within a community which in turn helps increase societal productivity.

Sanitation and Hygiene Categorization

- Sanitation entails:
  - Human excreta management, disposal and re-use
  - Solid waste (refuse) management
  - Management of hazardous wastes
- Hygiene entails:
  - Effective personal hygiene
  - Safe handling and treatment of food
  - Safe water storage

Causes and Transmission Routes of Enviornmental-related Illnesses

Refuse

Standing water

Vectors
(e.g. mosquitoes)

Poor, overcrowded housing

Vectors
(e.g. flies, fleas, mice, rats)

(Flea)

(Fly)

Malaria
Filariasis

Tuberculosis

Typhus
Chagas' Diease

Diarrhoea
Roundworm

Flies

Food

Vectors

Bilharzia

Dirty Hands
(If not washed after defecation)

Cholera
Diarrhoea
Guineaworm

Contaminated water

Cryptos-
poridiosis
Hepatitis A

Soil

Animals
(e.g. cattle, sheep, pigs)

(if eaten undercooked)

Tapeworm

Open defecation

Bare feet

Hookworm

Diarrheal Diseases

- Diarrheal diseases are a major problem in developing nations and proper sanitation and hygiene techniques can drastically reduce susceptibility to diarrheal diseases.
  - Diarrheal diseases directly kill 2 million children a year and are a contributing factor to 18 million other deaths a year.
  - Diarrheal related illnesses are the second greatest cause of mortality and morbidity in children under five years old (17-21%).
  - 85-90% of diarrheal illnesses in developing countries can be attributed to inadequate sanitation, poor hygiene practices, and unsafe water usage.

Hand Washing's Role in Preventing Disease

- Hand washing is essential to decreasing incidence of illness; according to a 2008 study, hand washing after defecation has been shown to reduce episodes of diarrhea by 30%.
- Washing your hands helps remove any bacteria and parasites present.
- To ensure that one's hands have been effectively washed one must consider five key criteria :
  1. Length of wash
  2. Use of a Scrubbing agent
  3. Frequency of wash
  4. Method of drying
  5. Quantity of water used

Hand Washing

Five Key Criteria to Clean Hands

1. Length of wash
   - Hands should be scrubbed for at least 20 seconds
2. Use of a Scrubbing Agent
   - The use of a scrubbing agent is an essential part of hand washing. If access to soap is limited, ash can be used as a suitable alternative.
     - Studies have shown that the use of a scrubbing agent reduces the risk of diarrhea in the general population by 42-44%
3. Frequency
   - Hands should be washed multiple times a day including before preparing food, eating, and feeding a child, and after using a toilet, caring for an ill family member, and changing a diaper
4. Method of Drying
   - Hands should either be air-dried or dried with a clean cloth

Hand Washing

Five Key Criteria to Clean Hands Continued

5. Quantity of water used

- Should be between 1 and 2 liters
  - Studies have shown a significant decrease in hand coliform counts of individuals who used 2 liters of water while washing their hands compared to individuals who used 0.5 liters.
- If the quantity of fresh water is limited, use of a “tippy-tap” can help conserve water.
  - A “tippy-tap” is a simple and cost effective water saving device that minimizes excess water waste while one washes there hands.

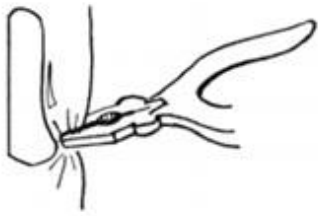
Tippy Tap Construction

1. Select a plastic container that has a handle and can hold around 5 liters.
2. Heat the base of the handle with a candle until the plastic is soft without melting it.
3. When the plastic is soft, pinch the base of the handle closed with a pair of pliers and let it cool. Make sure that no water can get through the pinch-closed base.

1.

2.

3.



Tippy Tap Construction (continued)

4. With a hot nail, make a 2mm hole just above the pinch-closed base of the handle.
5. With a plastic or twine net, suspend the bottle from a metal support. Let one piece of plastic hand down to suspend the soap from.
6. Make a hole in the center of soap. Suspend the soap with a string through the hole and place a metal or plastic cover above the soap to protect it from sun and rain.

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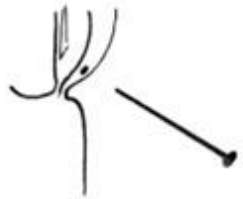
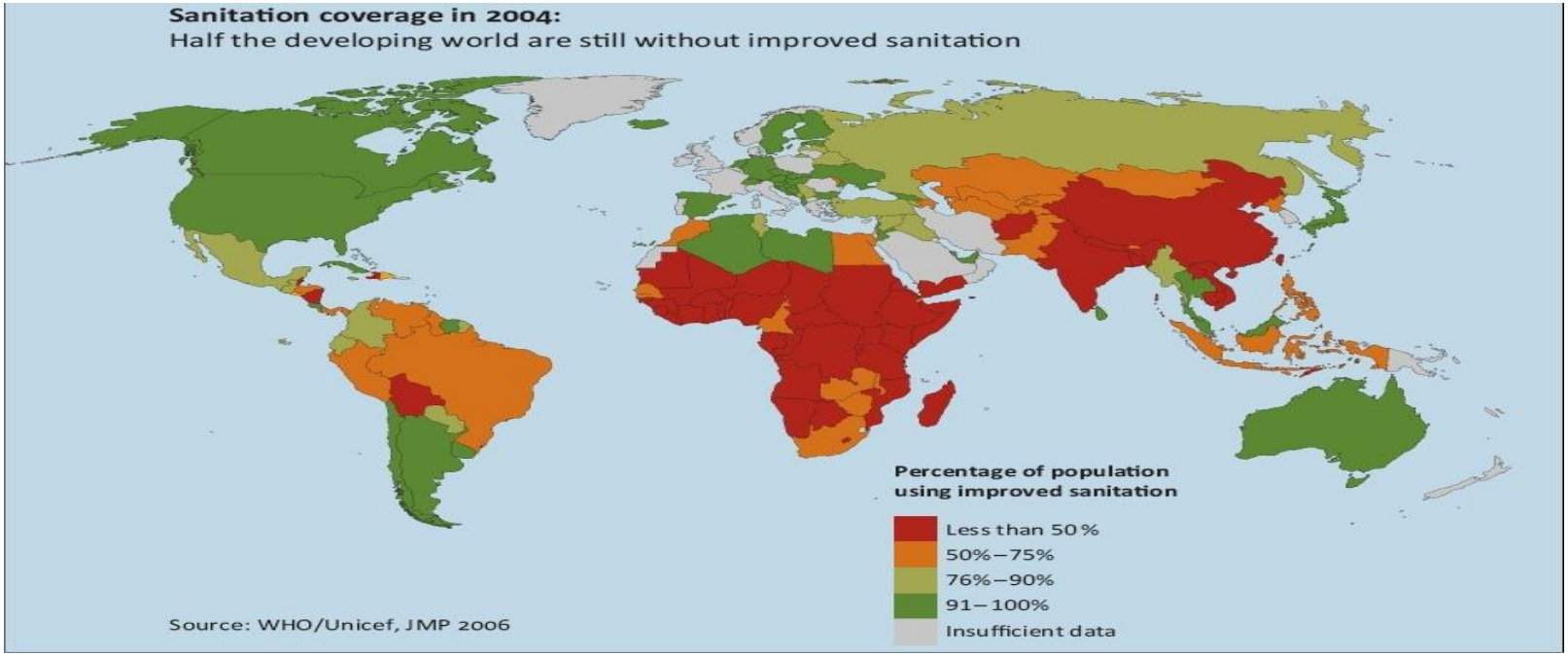


5.

6.

Ways to Impact Future Hygiene and Sanitation Practices

- Three major ways to increase future hygiene and sanitation practices
  - Public education
  - Implementation of Hygiene and Sanitation practices in schools
  - Empowerment of women to leadership positions



Hygiene and Sanitation Education

- Hygiene education should take place on all community levels
  - Schools, clinics, market-places, community meanings, and places of worship
- Picture based pamphlets for the illiterate
- It is important to start hygiene education at schools because habits that people adopt as children have a tendency to stay with them for life

Sanitation and Hygiene in School

- School is a good place to promote hygiene and sanitation practices and therefore teachers must be effective advocates of sanitation practices.
- Promotion hand washing in school reduces diarrheal episodes.
- Adequate school latrine design plays an important role in keeping students in school while advocating sanitation practices.
  - One latrine should be used by no more then 30 student
  - Bathrooms should be gender specific
  - 1 in 10 African school-aged girls do not attend during menstruation and consequently short absences compound over time and negatively impacts a girl's learning abilities
  - School girls drop out rate increases due to a lack of private and clean sanitation facilities.

Importance of Gender Equality

- In a number of cultures it is the woman's duty to fetch water.
- In most developing countries rural women produce 60-80 % of food.
  - Being in charge of food production and water retrieval these women deal with hygiene and sanitation on a daily basis.
- Convenient access to drinking water reduced time spent collecting water by women and young girls by 50 to 90 per cent.
- Water rights often tied to land ownership. Women own less than 2 per cent of the world's private land.
- Women are not allowed to own land in Burkina Faso, Cameroon, and Zimbabwe.

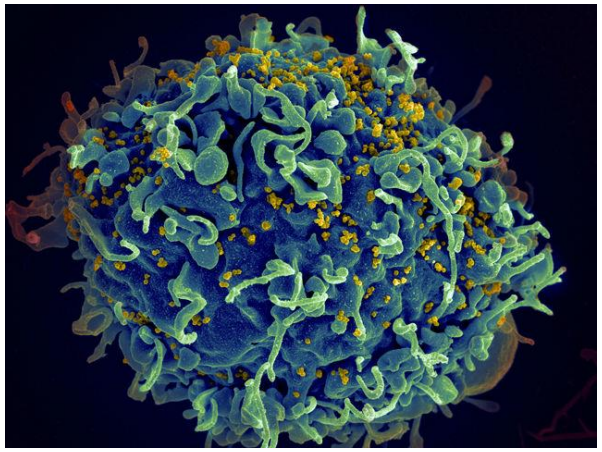
Importance of Gender Equality

- In most third world countries women are in charge of sanitation, health, and household water supply.
- In these societies there is a disproportionate amount of men in positions of leadership.
- In order to gain awareness and advocacy for global water and sanitation agenda, women need to gain more leadership positions.

Ethiopian women transporting water

Water Sanitation and HIV/AIDS

- Around 34 Million people have HIV/AIDS
- People living with HIV/AIDS (PLWHA) are more prone to common disease and illnesses
  - 90% experience Diarrhea symptoms
  - Diarrhea reduces the effectiveness of medicines and the bodies intake of essential nutrients
- Due to the frequent illness PLWHA have reduced mobility, making it harder for them to collect water
  - PLWHA need 20-80 liters of water a day
    - Much of this water is needed for sanitizing the living space of the patient.
- Family members should help properly dispose of the patients excreta.
- Bedbound patients
  - A commode or bedpan should be nearby so that excreta can be managed properly
  - Plastic sheets should line the bed



T-Cell Infected by HIV

Stigma Associated with HIV/AIDS

- PLWHA and their families face many types of discrimination from other members of community.
- Many families are reluctant to adopt water saving techniques and technologies such as tippy taps for fear of being suspected as HIV positive.
- Reducing the stigma associated with HIV/AIDS will aid the promotion sanitation and hygiene.
- Education plays a major role in reducing the stigma associated with HIV

Picture of a “Tippy Tap” in use

Sanitation-Excreta Disposal

- 1.2 billion people still practice open defecation
- Proper excreta disposal is an integral part of curbing disease transmission
  - Excreta should be disposed of away from sources of fresh water
  - Excreta can be collected and used as fertilizer
- Safe handling and proper disposal of excreta can reduce the risk of diarrhoeal disease by 30% or more

Hygienic Latrine design

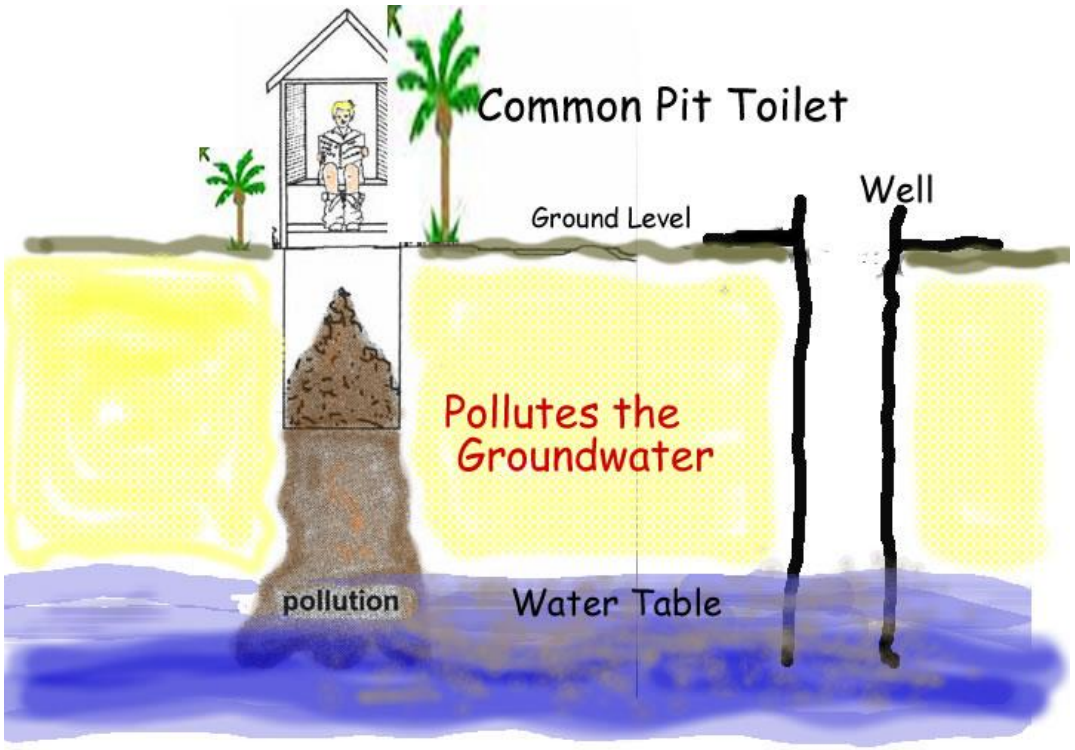
- Hygienic latrine design plays a major role in reducing the transmission of bacteria and viruses.
- Latrines should be wide enough to fit two people.
  - This allows for one to help an ill family member or friend.
- They should be designed to allow for natural light and ventilation
- A squat pole should also be included to help the elderly and sick
- Soap or ash should be located nearby so that the occupant can wash his or her hands.
- The latrine should be in an enclosed area to keep vectors out.
- A vent pipe will allow for fumes to escape the latrine.
  - A fly screen should be attached to the vent pipe's opening to stop flies from entering the latrine.
- A seat cover can help reduce odor when the latrine is not in use.

Latrine Types

- Pit Latrine
  - Simple latrine with a super structure and a pit for human excreta retention. The walls of the pit may be lined.
- Ventilated Improved Pit Latrine (VIP latrine)
  - Advance pit latrine with a lined pit. VIP latrines reduce odor and control vector populations
- Ecological Sanitation (eco-san)
  - A urine diverting latrine that composts feces
- Biodigester Latrine
  - A latrine that creates biogas usable for cooking and composts waste

Pit Latrine

- A pit latrine is often just a dug out hole with a super structure over the top
- The hole is generally not lined and the waste created can easily pollute the ground water



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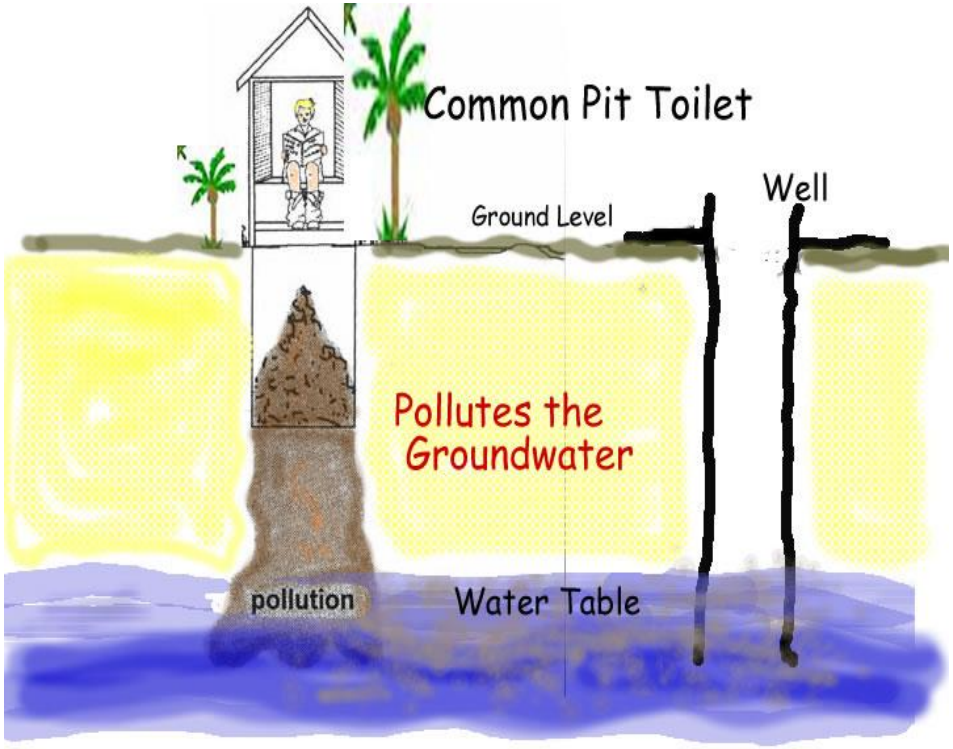
Pit Latrine Pros and Cons

- Advantages
  - Cheap and quick to build
- Disadvantages
  - Easily pollutes ground water
  - Little to no protection from vectors
  - No ventilation or odor control



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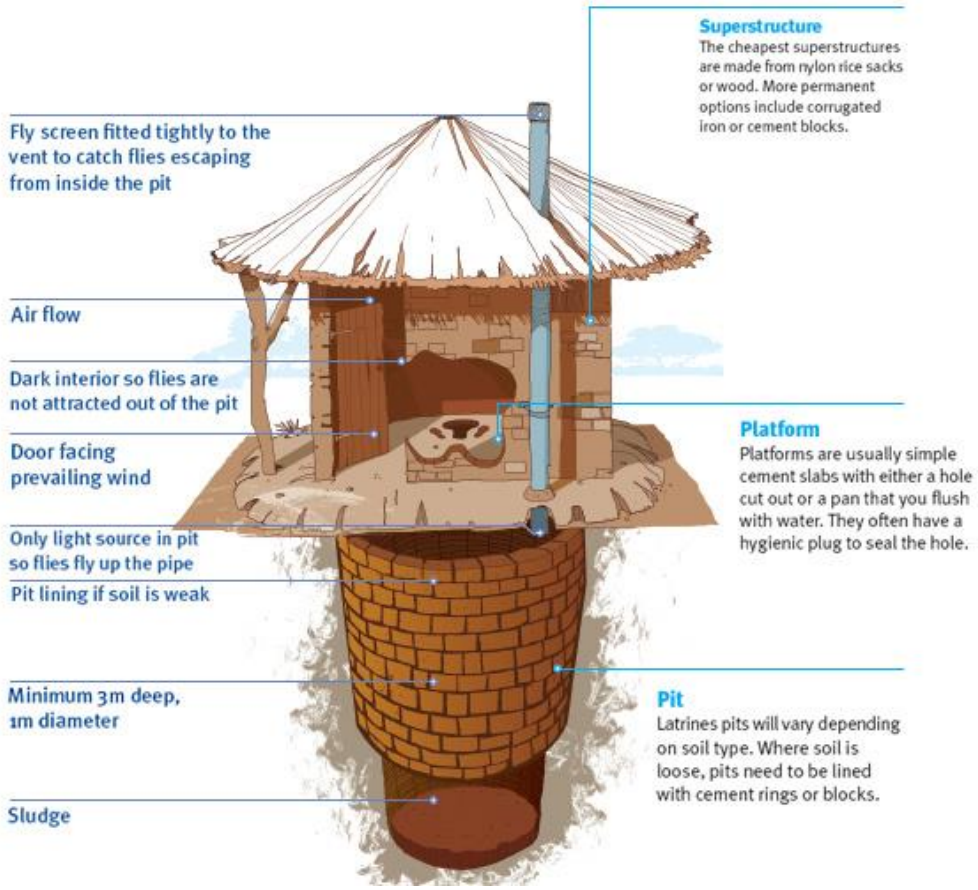
Ventilated Improved Pit (VIP) Latrine

- A VIP Latrine is designed to reduce the number of flies within the latrine and to disperse the odor.
  - Both of these tasks are done via the use of a vent which connected to the pit itself.
  - The vent being the only source of light within the latrine, attracts the flies, effectively trapping them within the pipe until they die.



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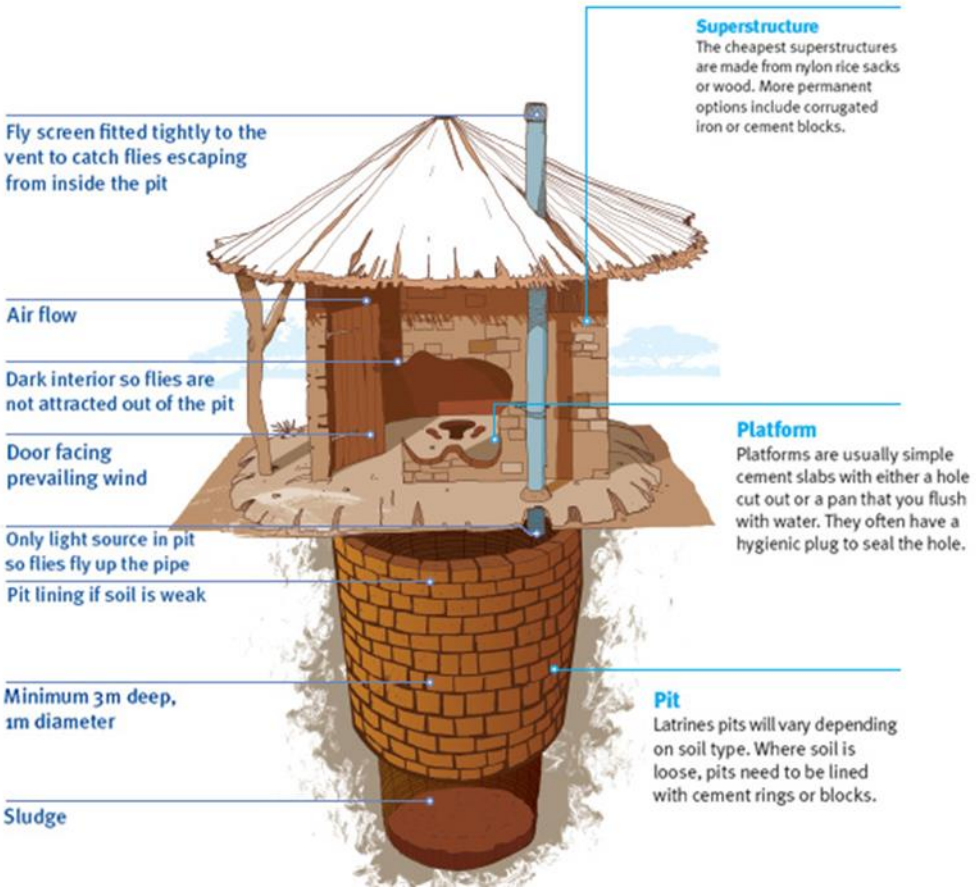
VIP Latrine Pros and Cons

- Advantages
  - Cheap
  - Controls vector populations
  - The pit is lined with bricks to better control ground water pollution
  - Reduces odor
- Disadvantages
  - Still has a chance of polluting ground water



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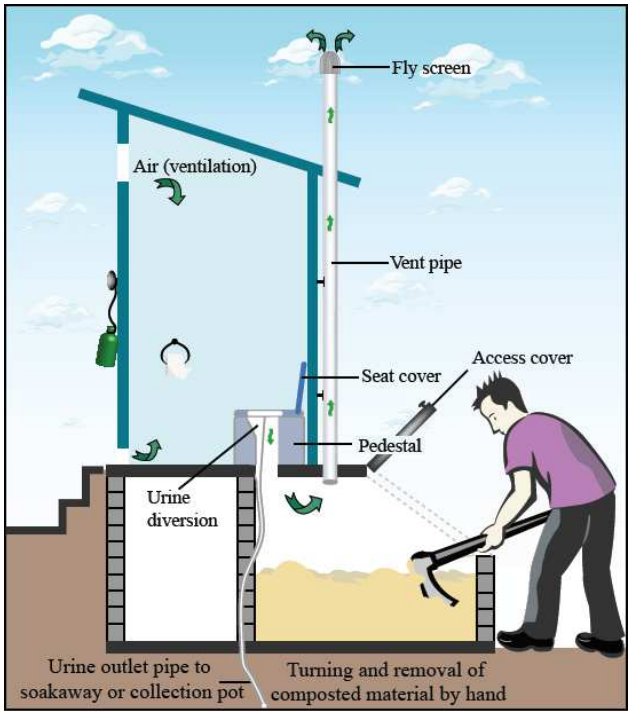
Ecological Sanitation (EcoSan)

- EcoSan Toilets collect human excreta while separating urine and feces
- To prevent ground water contamination human feces are separated from the soil by concrete floor
- Feces can be composted and eventually recycled as fertilizers for fields.
  - The nutrients within the waste can be used to help fertilize fields



http://www.ecosanres.org/pdf_files/Ecological_Sanitation.pdf

EcoSan Pros and Cons

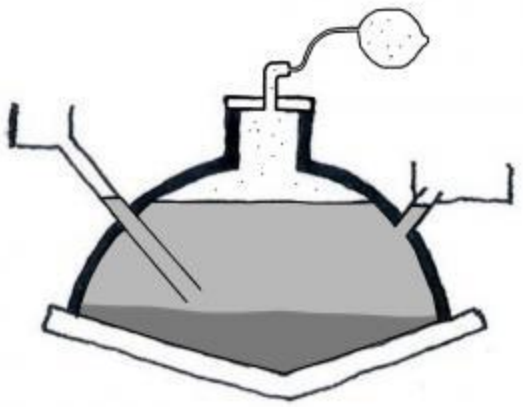
- Advantages
  - Human waste products are utilized as fertilizer
  - Little to no potential for ground water pollution
  - Reduces Odor
- Disadvantages
  - More expensive than pit latrines
  - Requires occasional maintenance
  - Urine tank has to be emptied weekly

EcoSan Toilet in Rural Kenya

http://www.ecosanres.org/pdf_files/Ecological_Sanitation.pdf

Biodigester Latrines

- Biodigester latrines are similiar to ecological sanitation latrines, they convert ‘waste’ into useful products
  - The major difference is that urine and feces are mixed into a slurry that undergoes a series of anaerobic reactions resulting in the production of biogas
  - Biogas can then be used as a fuel for cooking or lighting homes



Example of a simple biodigester

Biodigester Latrine

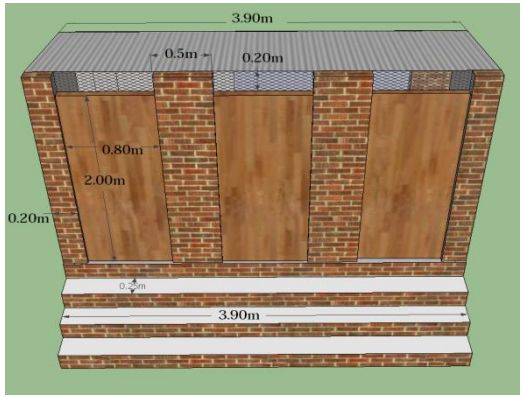
- A biodigester latrine converts fecal matter into biogas through a series of anaerobic reactions
- This gas can then be used as an energy source; the gas can help power homes and cook meals
- This type of latrine is more expensive up front but ends up turning what is usually seen as waste into useful products like fertilizer and gas power.
- 1 kilogram of human fecal matter can produce between 0.020 and 0.028 m^3 of biogas
  - A latrine designed for the use of 180 people will generate between 328 and 460 m^3 of biogas a year.

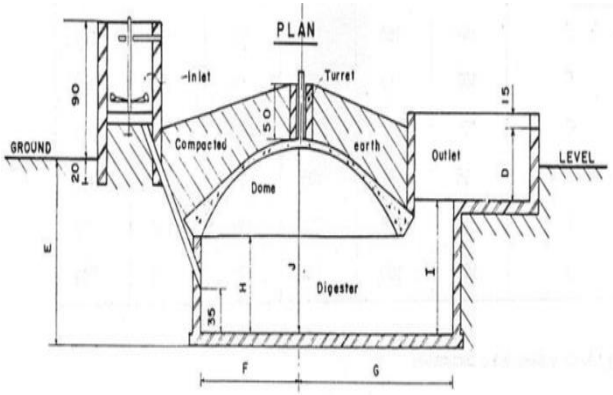
Compound	%
Methane	55-70
Carbon dioxide	30-50
Nitrogen	0-15
Hydrogen Sulfide	0-3
Hydrogen	0-3

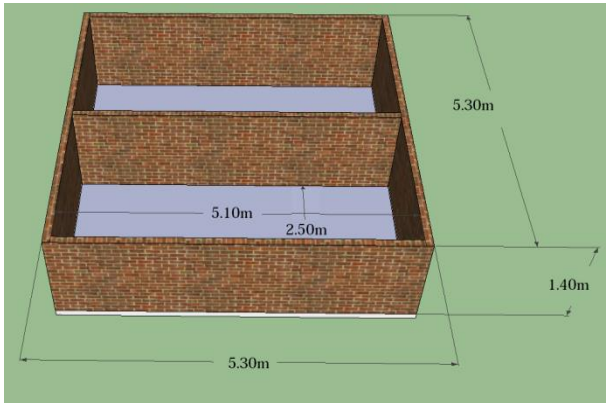
Composition of Biogas

Biodigester Design

- The following slides will detail the proper construction of a biodigester latrine, starting first with a brief overview of the latrine itself
- There are three main parts to the biodigester latrine (as shown below)







- Latrine Superstructure
- Biodigester
- Composing Pits

Biodigester Latrine Basics

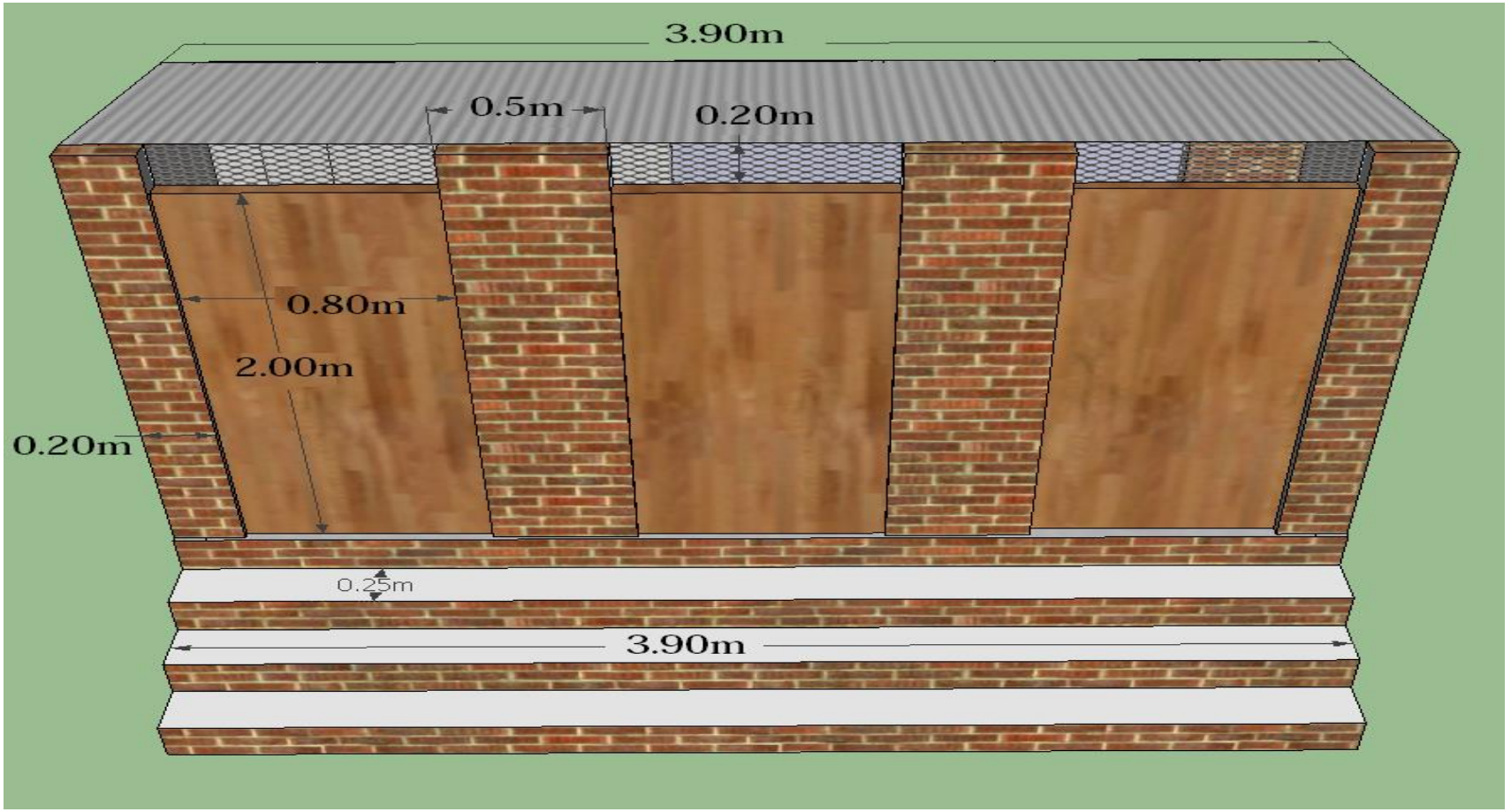
- The biodigester latrine designed herein is for the use of approximately 180 people
  - The latrine superstructure is where people will go to the bathrooms and will not physically be connected to the biodigester
  - Excreta will then be transferred to the Biodigester where it will reside for 35 days while biogas is produced
  - The waste will then flow into the composting pits where it will be stored until it is safe to use as fertilizer

The Latrine Superstructure

- The first major part of the biodigester latrine is the latrine superstructure.
  - The biodigester latrine will have two identical rectangular superstructures each with three toilets inside.
    - Two 50 L plastic drums will be positioned below each latrine (one for urine, the other for feces)
  - It is important to have two superstructures so that each gender can have their own latrines.
  - These superstructures will have urine diverting capabilities in order to optimize biogas production

50L plastic drum

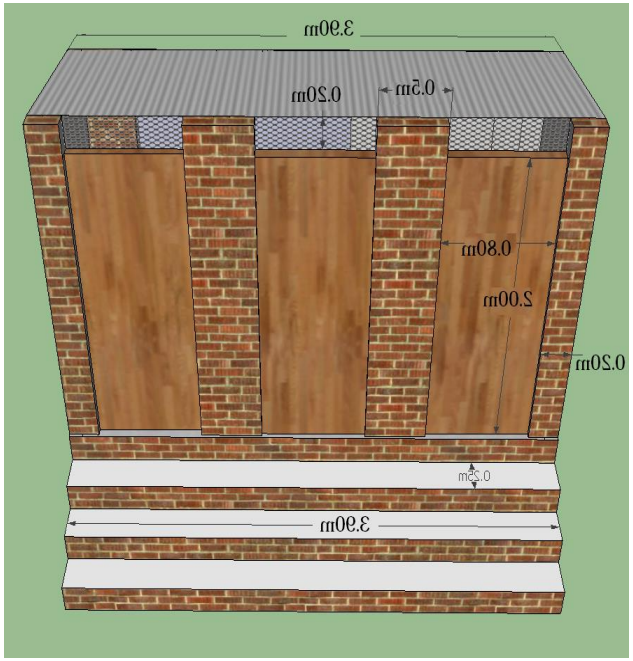
Front View of Latrine Superstructure



Front View of Latrine Superstructure

Latrine Superstructure Construction Tasks

- Task 1: Cover slab construction
  - Step 1. Construction of Urine Diversion and Latrine Hole molds
  - Step 2. Position and Cast Cover slabs
- Task 2: Latrine Superstructure Foundation
  - Step 1. Excavate and Cast Foundation
- Task 3: Superstructure Floor Construction
  - Step 1. Lay initial layer of bricks
  - Step 2. Brick and mortar to a height of 0.7 m



Latrine Superstructure Construction Tasks (Continued)

- Task 4: Cover Slab placement
- Task 5: Superstructure Wall Construction
  - Step 1. Brick and mortar all walls to a height of 2.8m
  - Step 2. Brick and mortar front walls an additional 0.2m
  - Step 3. Brick an mortar side walls to create an even slope from back to front wall
- Task 6: Superstructure Stairs Construction
- Task 7: Superstructure Roof Construction
  - Step 1. Install roof
  - Step 2. Install doors
  - Step 3. Install Fly Screens above doors

Materials for Latrine Super Structure

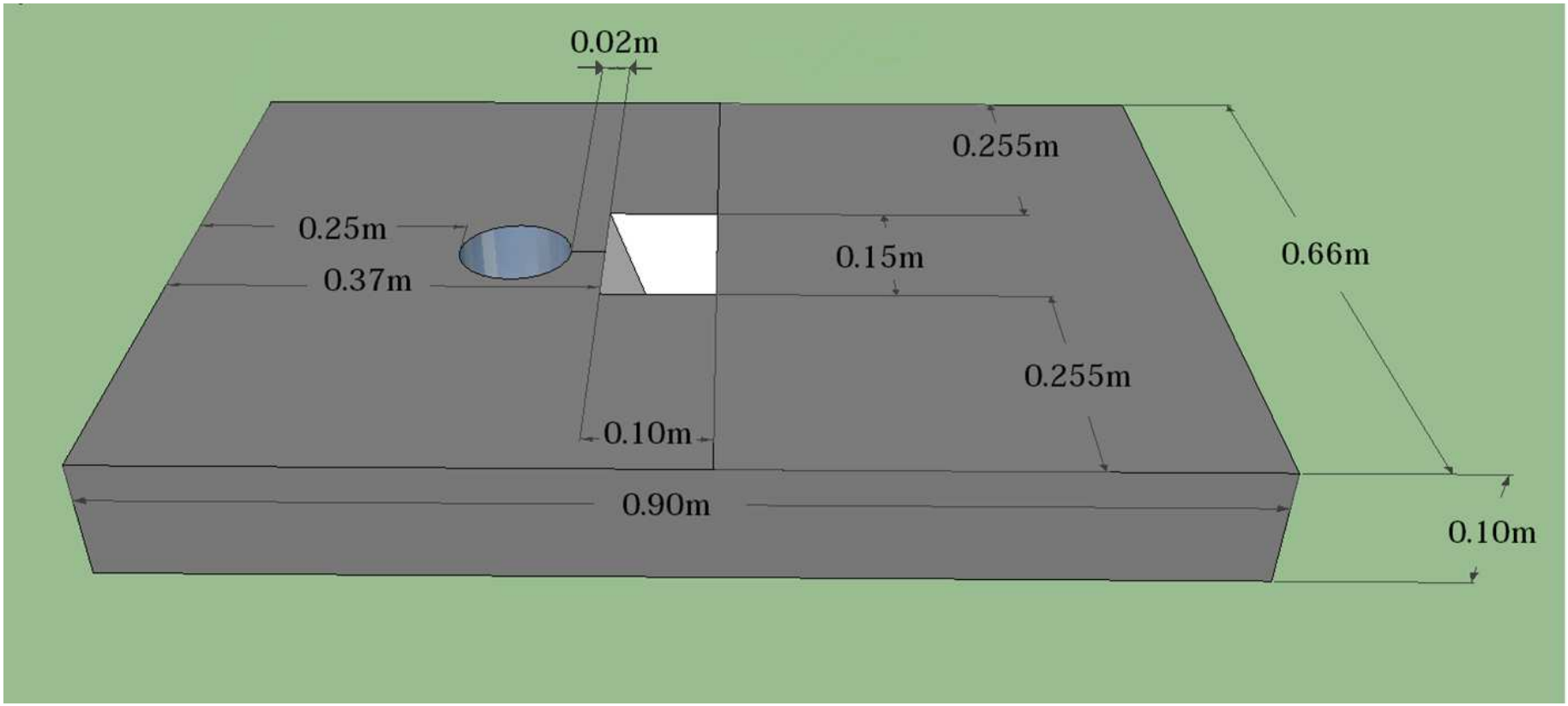
Building materials necessary for the latrine superstructures include:

Material	Quantity
Bricks* for two super structures	~4300
Concrete	1.5 cubic meters
Tin Sheet (2)	Each 3.9 by 1.4 meters
Doors (6)	Each 2.0 by 0.80 meters
Fly Screens (6)	Each 0.20 by 0.80 meters
50 L Plastic Cans	12

*Brick size for the latrine super structure and composting pits of this project will be 0.23 by 0.11 by 0.07 meters (Length X Width X Depth) with .008 meters or mortar in between bricks

Task 1: Latrine Cover Slab

- The first task in construction of a latrine superstructure is the building the latrine cover slab.

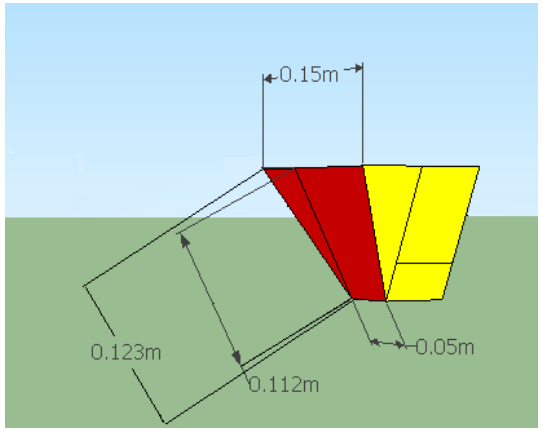


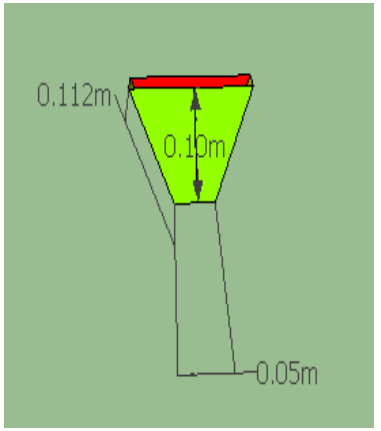
Schematic of a completed Latrine Cover Slab

Task 1: Latrine Cover Slab Construction

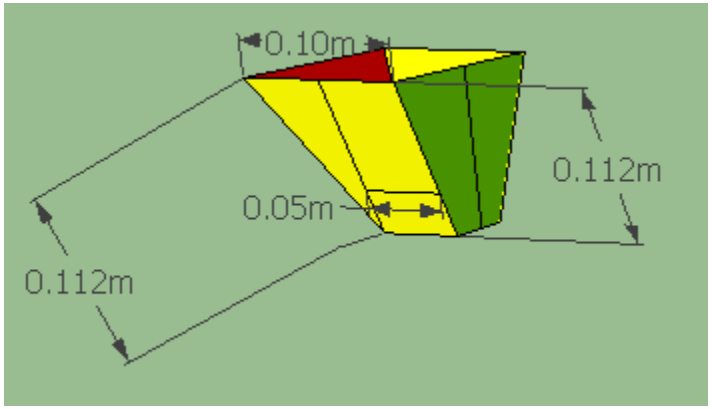
Step 1: Building a Urine Diverting Mold

- First
  - Cut a piece of wood into an equilateral trapezoid with a height of 0.10 m and bases of 0.05 and 0.15 meters (The green piece)
    - This piece will go directly up right





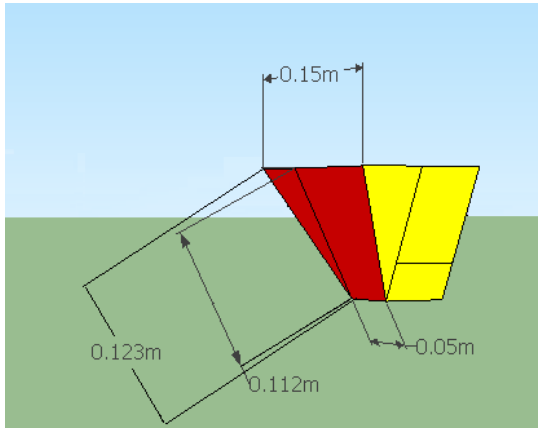
- Second:
  - Cut separate pieces of wood into two equal-sized right trapezoids with a height of 0.11 m and bases of 0.05 and 0.10 meters (the yellow pieces).
    - These will be fitted to the first pieces slants

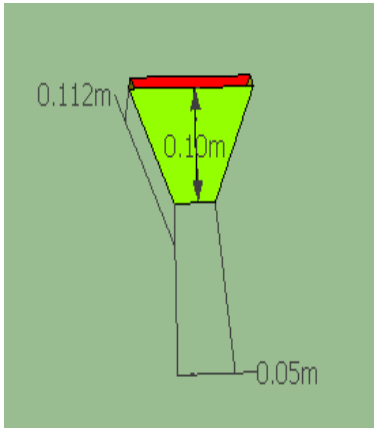


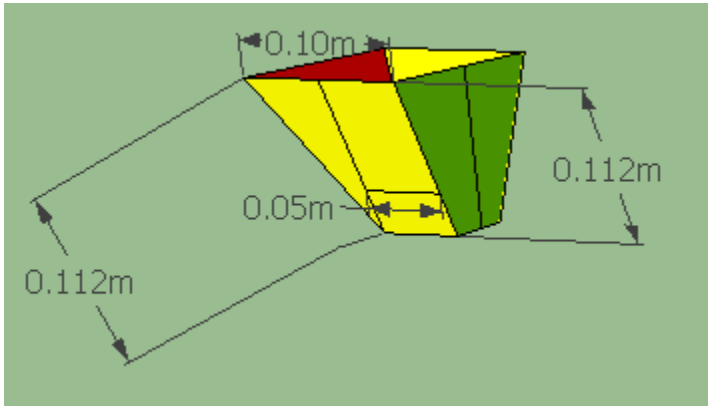
Task 1: Latrine Cover Slab Construction

Step 1: Building a Urine Diverting Mold (Continued)

- Third:
  - Cut and fit an equilateral trapezoid into the remaining It will have a height of 0.112 m and bases of 0.05 and 0.15 meters
  - Once all four pieces are put into place they should be secured together
- Fourth:
  - A cylinder with height of 0.1 m and radius of 0.05 m must also be constructed
- Fifth:
  - Construct 5 more Urine Diverting and latrine hole molds



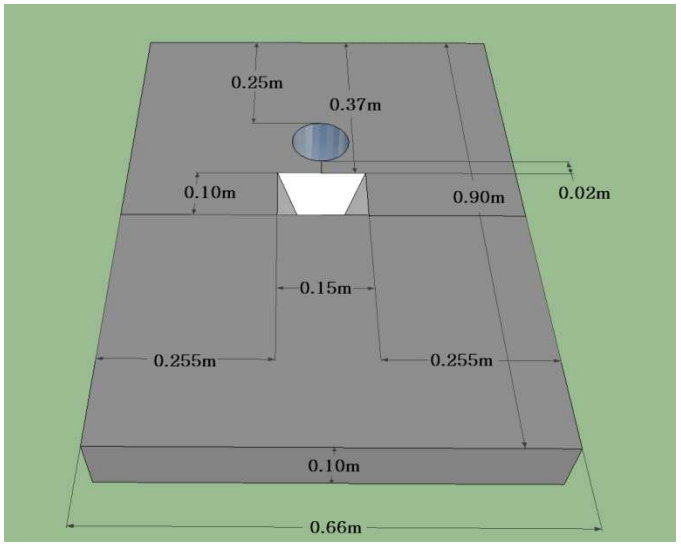


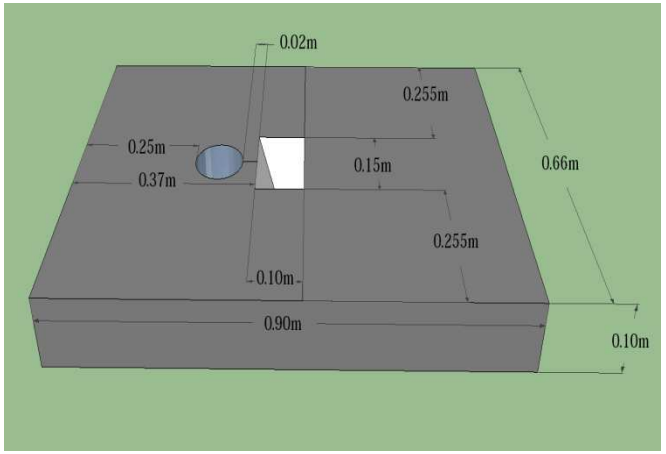


Task 1: Latrine Cover Slab Construction

Step 2: Position and Cast Cover Slabs

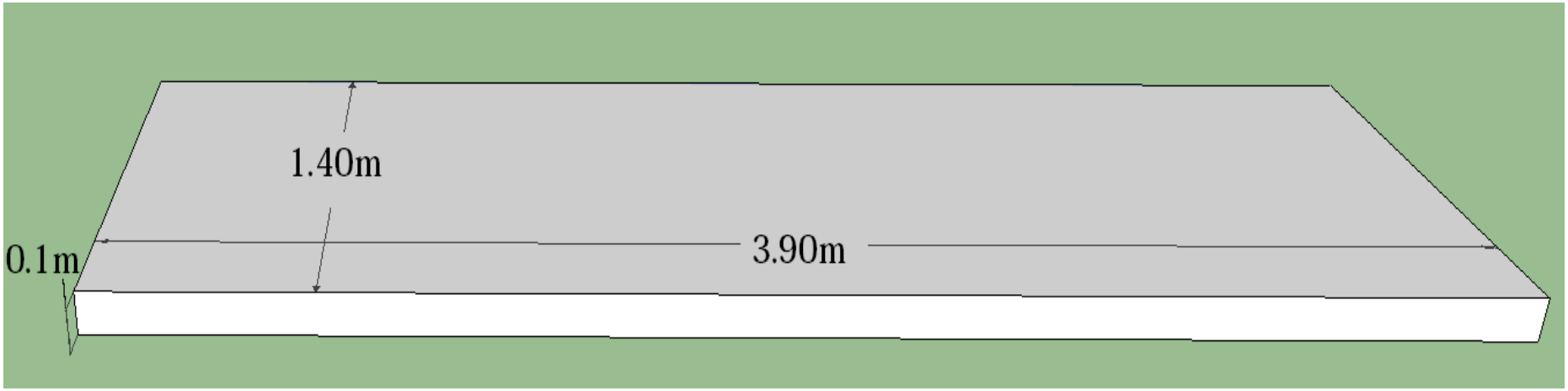
- First:
  - Excavate six holes with dimensions of 0.66 by 0.90 meters to a depth of 0. 1 meter
- Second:
  - Align the urine diverting and latrine hole molds
    - The cylinder's origin should be located on the midline of the 0.66 m dimension, 0.29 meters away from the edge.
    - The urine diverting mold should be lined up directly with the cylinder 0.02 meters further from the end
- Third
  - After the molds are put into place within the hole, the concrete should be poured





Task 2: Latrine Superstructure Foundation

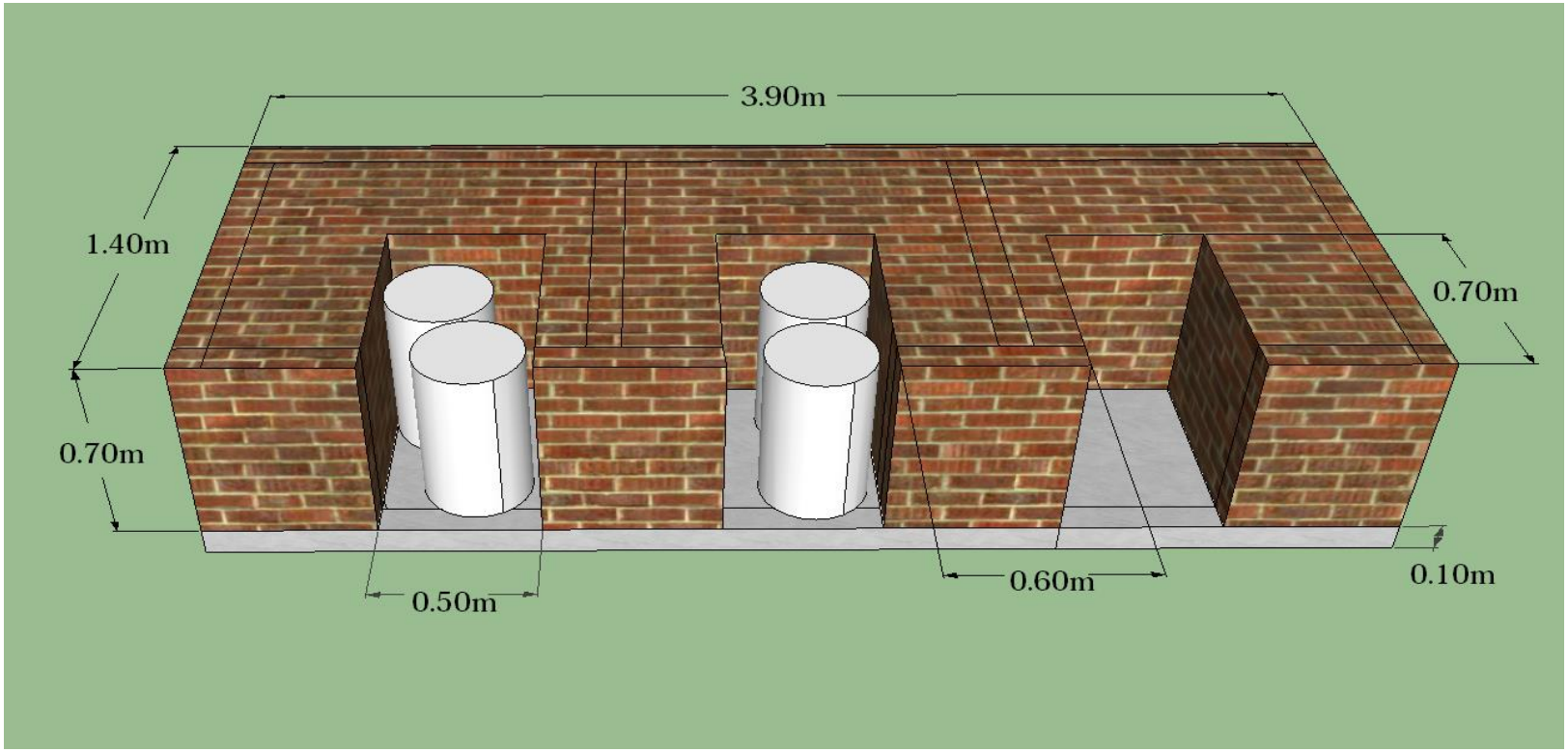
- After the cover slabs are completed the foundations for each superstructure should be poured
- First:
  - Excavate (2) 3.90 by 1.40 meter holes to a depth of 0.10 meters
- Second:
  - Fill the hole with concrete



Latrine Superstructure Foundation

Task 3: Latrine Superstructure Floor Construction

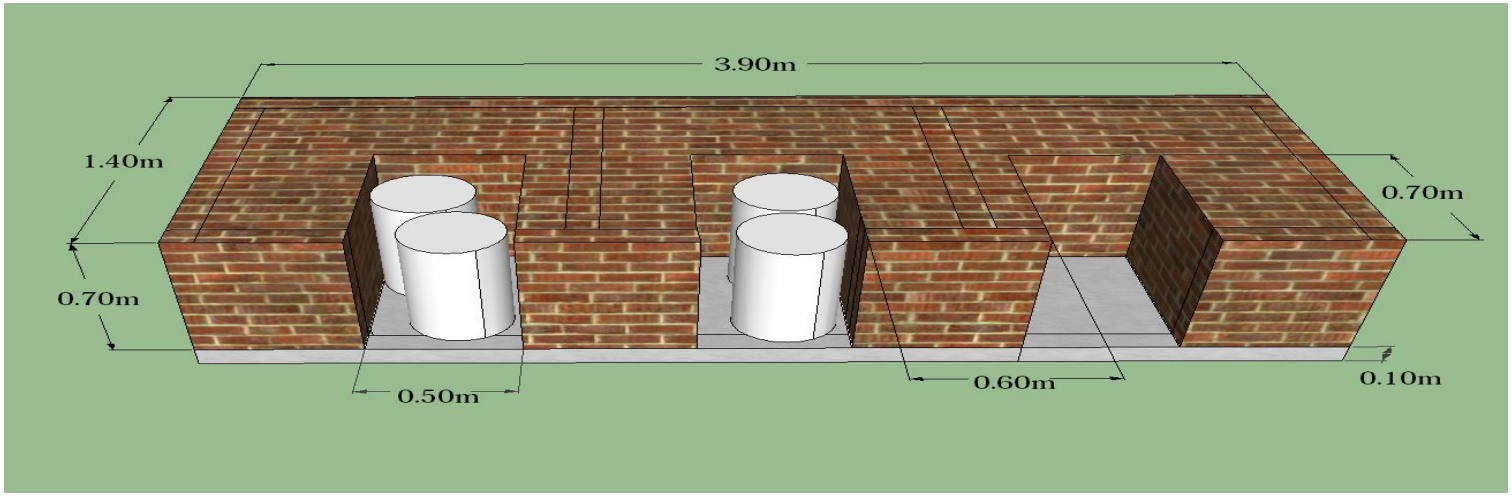
- After the foundation has settled construction of the superstructure with bricks and mortar should begin.



Schematic of the floor of the latrine superstructure (backside view)

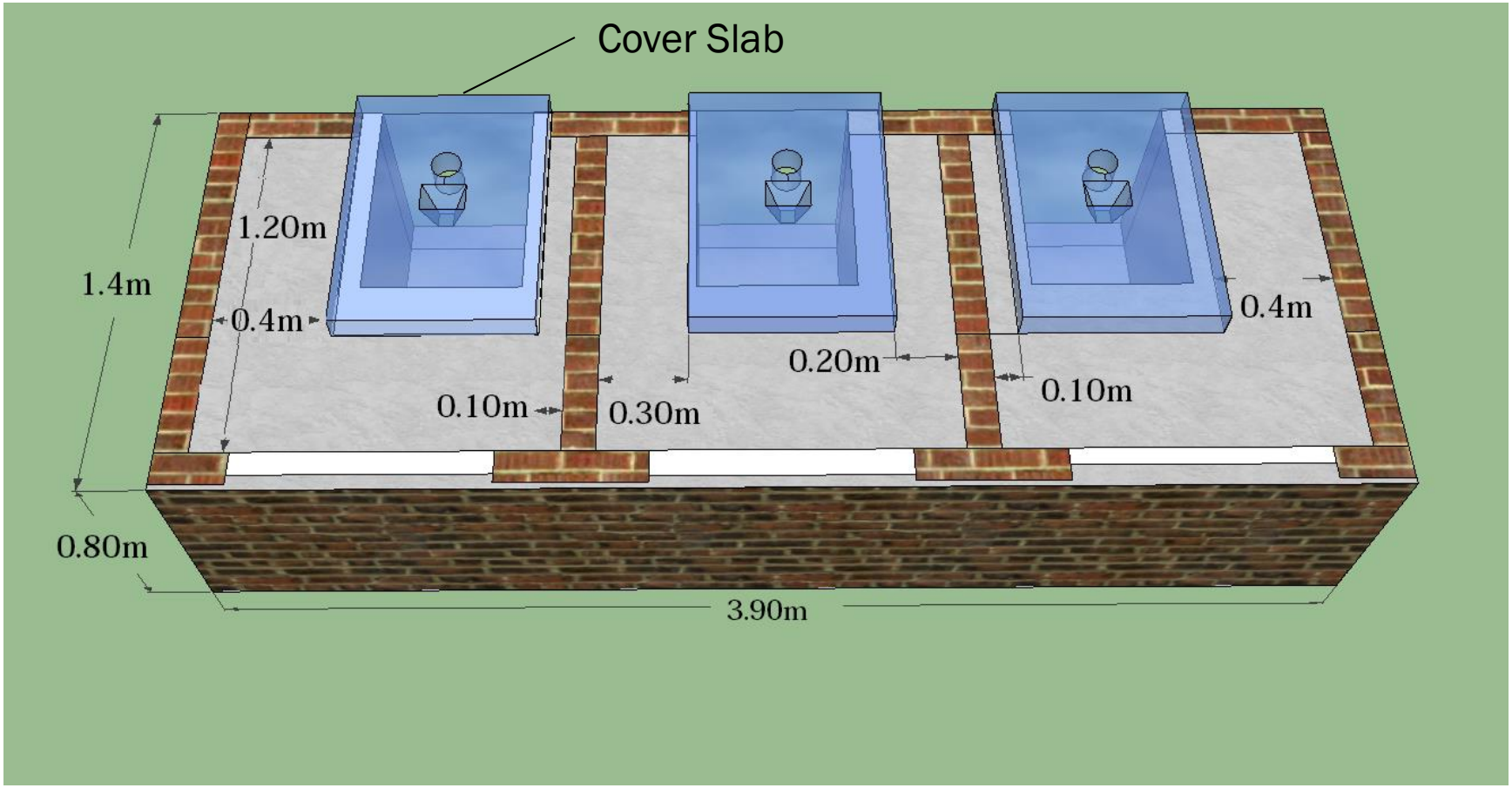
Task 3: Latrine Superstructure Floor Construction (Continued)

- Step 1:
  - Lay down initial layer of bricks leaving three 0.50 by 0.70 m rectangular spaces free of bricks
    - This three rectangular spaces should be separated by 0.6 meters of brick on either side.
- Step 2:
  - Build up the initial layer of bricks to a height of 0.70 m



Task 4: Cover Slab Placement

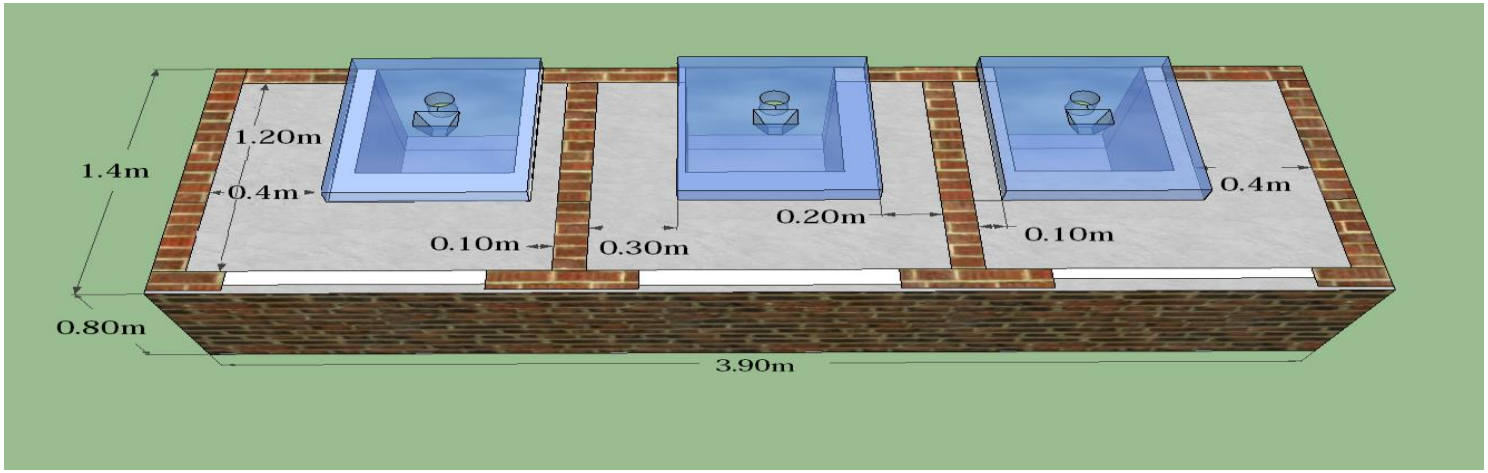
After bricks have been layered to a height of 0.7 m, cover slab placement can take place



Superstructure's floors with Cover Slabs

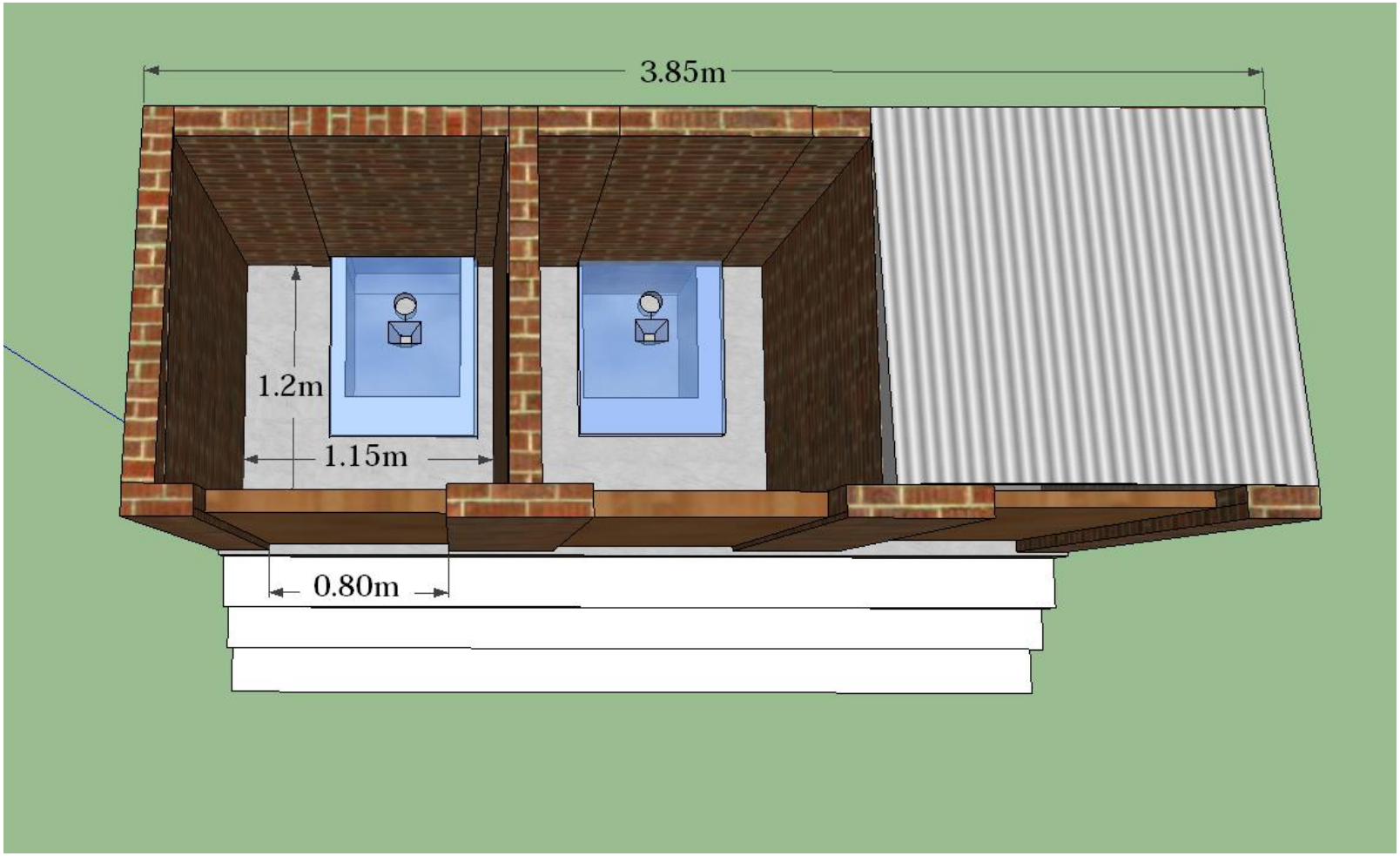
Task 4: Cover Slab Placement (Continued)

- Step 1:
  - Line up cover slabs so that the 0.9m sides are flush with the back wall
  - The cover slabs should be placed so that they rest on equally on both sides of the hole
- Step 2:
  - Cover slabs should then be mortared into place and construction of the super structure walls can then begin



Task 5: Latrine Superstructure Wall Construction

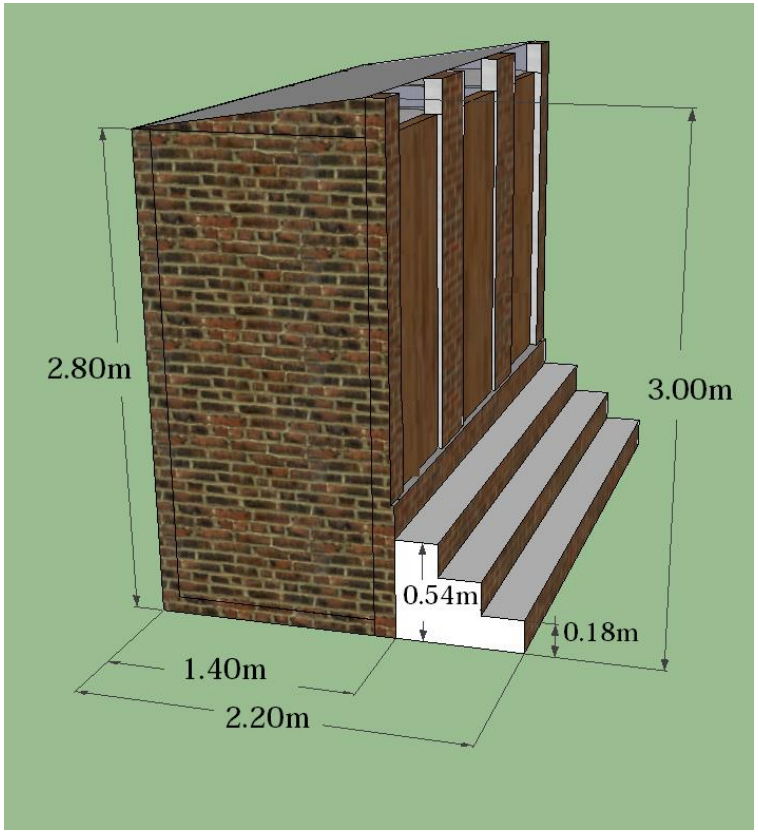
The next step in building the superstructure is wall construction



Schematic of latrine superstructure (overhead view)

Task 5: Latrine Superstructure Wall Construction (Continued)

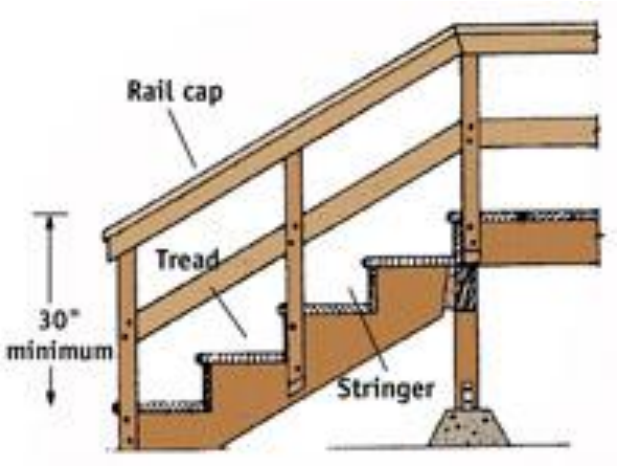
- First:
  - Brick and mortar all walls an additional height of 2.1m to reach a height of 2.8m
- Second:
  - Brick and mortar the front walls an additional 0.2m to reach a total height of 3.0 m
- Third:
  - Mortar and Brick the four side walls what ever additional height is needed to maintain and even slope from the back to the front of the roof.



Side View of the Latrine Super Structure

Task 6. Superstructure Stair Construction

- Stairs should be built leading to all three doorways.
- Stairs should reach a height of 0.70 meters. Each step should 0.18 meters high, giving you a total of 4 stairs.

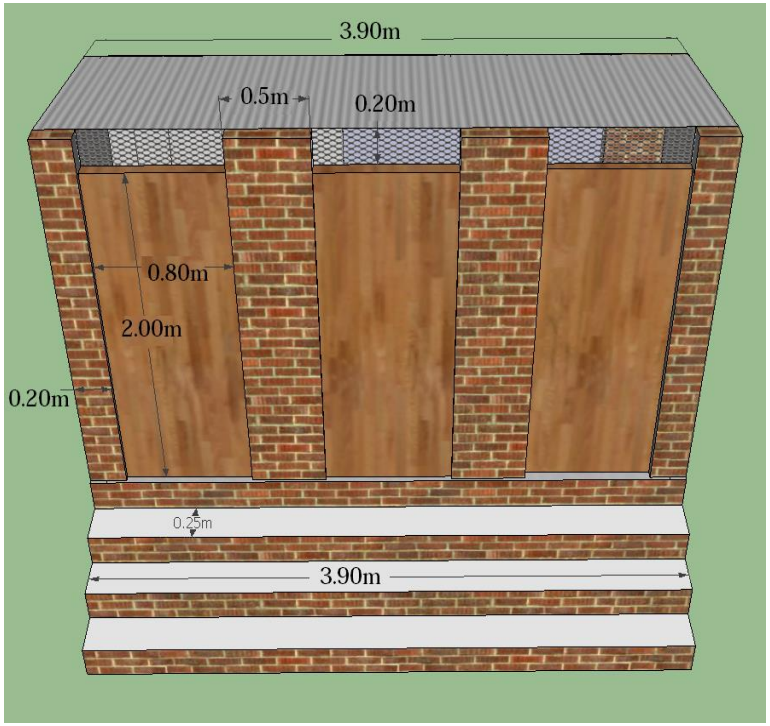


Note: more information on stair construction can be found on the following websites.

http://howto.millardlumber.com/ostairs/outdoorstairs.htm
http://www.doityourself.com/stry/h2buildoutdoorstairs#b

Task 7: Latrine Superstructure Roof Construction

- First
  - Position and secure a corrugated tin roof sheet on top of each super structure (1.5 by 3.9 m)
- Second:
  - Install 0.8 by 2.0 m doors in the doorways
- Third:
  - Install 0.2 by 0.8 m mesh fly screens above each door.
    - This will prevent vectors from entering while reducing odor and letting in light



Biodigester Design Basics

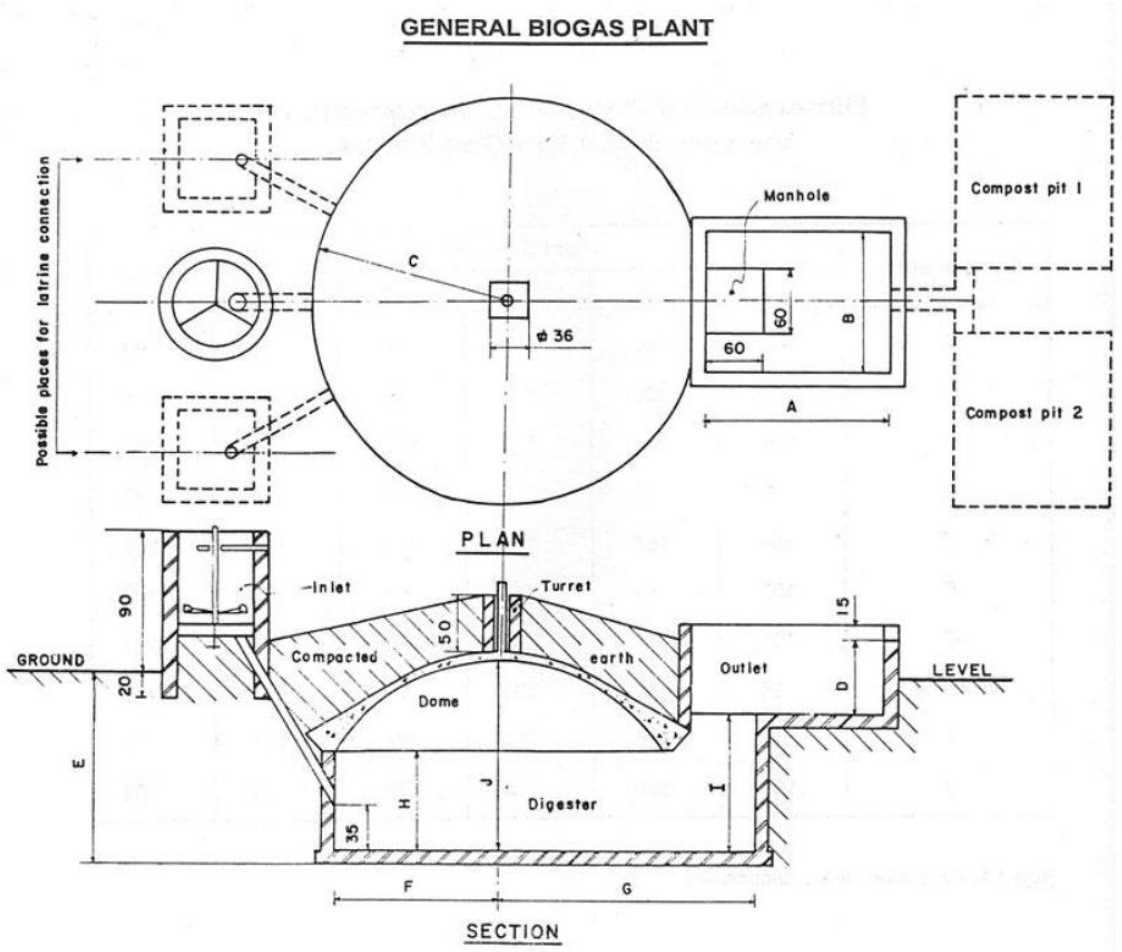
- The biodigester presented herein has a retention time of 35 days.
- It is 8 cubic meters and can handle the waste of 180 people.
- It is important to keep a steady flow of waste going into the Biodigester so the latrine superstructures should be emptied daily into the biodigester's inlet mixer.
  - A one to one volume ratio of fecal matter to urine should be put into the mixer to create the optimal slurry for biogas production.
  - After the human excreta is put into to the inlet mixer and thoroughly mixed any left over urine should be stored for eventual use as fertilizer in fields.
  - The 50 liter drums should then be rinsed and replaced into the latrine super structure.

Biodigester Schematics

For an 8 cubic meter tank

	Length (m)
A	1.7
B	1.3
C	1.7
D	0.65
E	1.72
F	1.35
G	2.30
H	1.05
I	1.27
J	1.75

Construction of a 4 cubic meter biodigester



(See the above table for measurements)

Biodigester Construction Materials

Materials	Unit	Quantity	Materials	Unit	Quantity
Bricks	Piece	1700	Socket	Piece	3
Sand	Bag	80	Elbow	Piece	8
Gravel	Bag	40	Tee	Piece	2
Cement	Bag	16	Union	Piece	1
6mm rod	Meter	70	Nipple	Piece	4
Paint	Liter	1	Main gas valve	Piece	1
Vertical Mixer device	Piece	1	Water drain	Piece	1
Inlet pipe	Piece	2	Rubber hose	Meter	1
Dome gas pipe	Piece	1	Gas stove	Piece	1
GI pipe	Piece	12	Gas Lamp	Piece	1
Dome gas pipe	Piece	1	Teflon tape	Roll	2

Site Selection for Biodigester & Constrcution

- Digester should ideally be kept between 30-40 degrees Celsius so the biodigester should be built somewhere that is sunny
- Site proximity should be 10 meters or greater from groundwater wells and bodies of fresh water.
- Gas pipe length should be minimized to decrease cost and potential for leak
- Construction of the biodigester is a involved process, for detailed instructions visit the following website:

http://www.scribd.com/doc/65716095/2011-04-27-Afghan-Biogas-Construction-Manual-FINAL

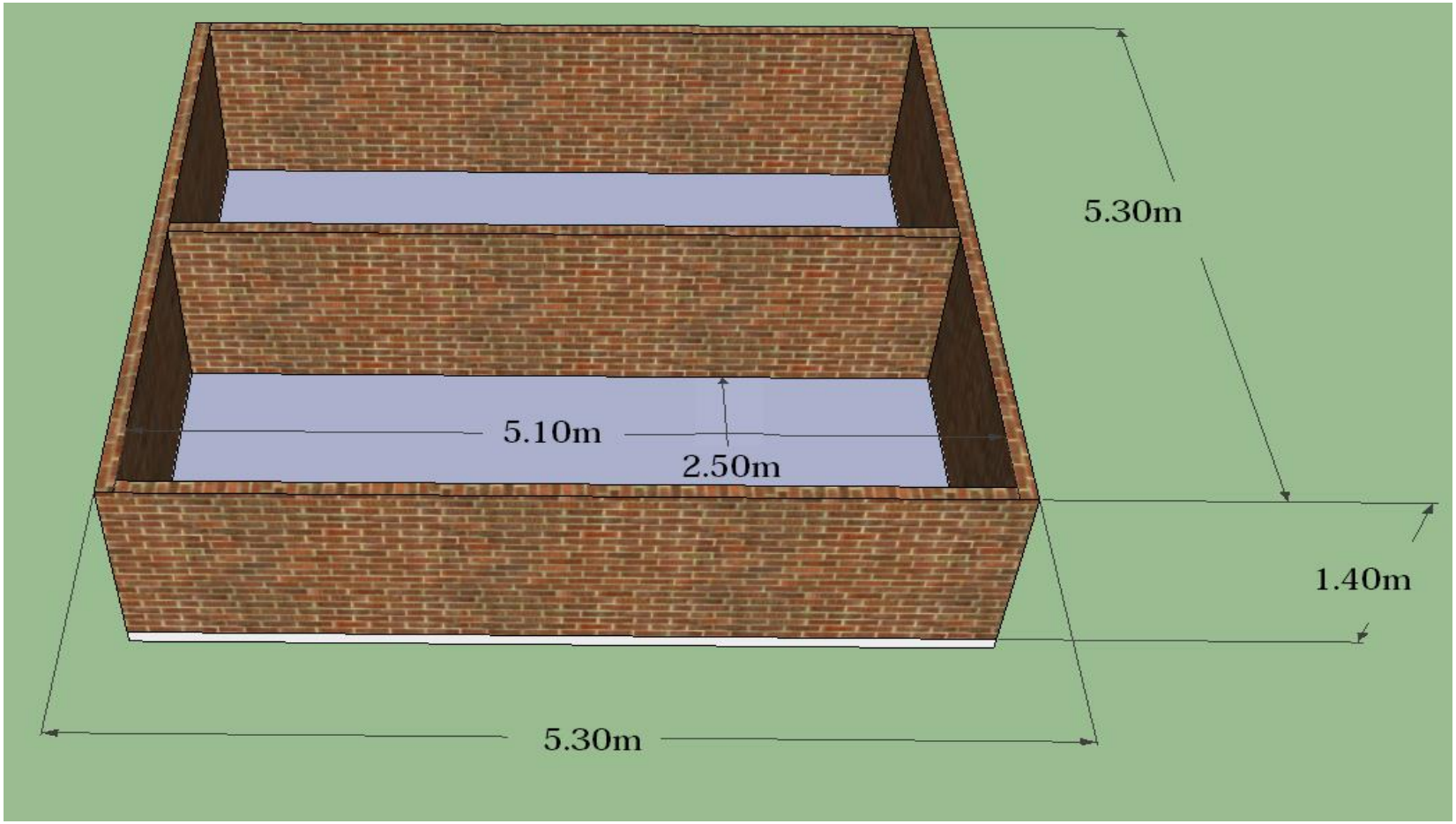
Inlet Mixing Well to Biodigester

- In order to obtain optimal gas production human excreta needs to be mixed into a slurry
- This can be done by building a vertical mixer at the opening to the biodigester.
- Construction information can be on the following website:

http://www.scribd.com/doc/65716095/2011-04-27-Afghan-Biogas-Construction-Manual-FINAL

Composting Pits

The final structure of a biodigester latrine is its composting pits



Schematics of the composting pits (side view)

Composting Pits

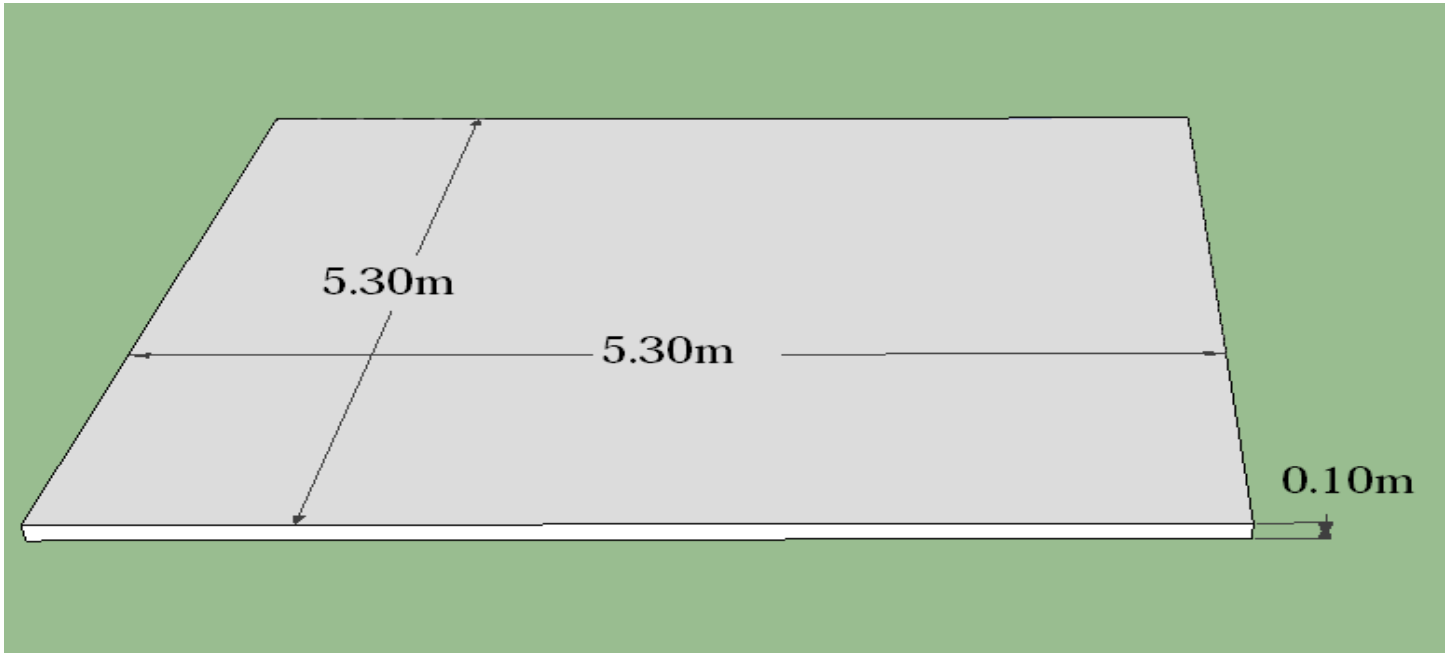
- Composting pits are storage sites for the waste product of biogas production.
- Two pits will be built side by side one meter away from the outlet of the Biodigester
  - The outlet of the biodigester should be one meter away from the middle of the 5.3 m composting pit wall. This is to ensure that the outlet waste makes it into both pits.
- Each pit will have a retention time of 6 months so that pathogens can be eliminated
- After six months the waste in the composting pits can be used as fertilizer

Material	Quantity
Bricks*	1950
Concrete	2.8 m^3

*Brick size for the latrine super structure and composting pits of this project will be 0.233 by 0.107 by 0.069 meters (Length X Width X Height) with .008 meters or mortar in between bricks

Task 1: Composting Pits Foundation

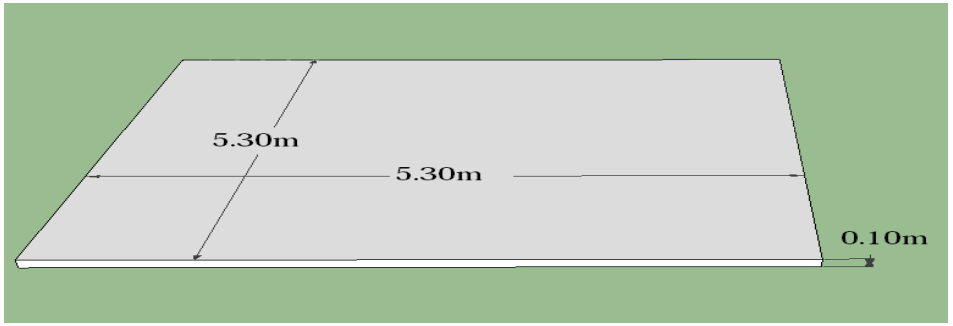
- First:
  - Excavate a 5.30 by 5.30 m square hole to a depth of 1.9 m
- Second:
  - Fill the bottom with a layer of concrete 0.1m thick



Composting pit foundation

Task 2: Composting Pit Walls Construction

- After the cement has solidified construction of the walls can begin.
- Step 1
  - Divide the foundation into two equal chambers separating the two with a line of bricks.
- Step 2:
  - Brick and mortar all walls including the wall diving the two chambers to a height of 1.4 m
- The remaining 0.4 meters of height will be to slope the pipe exiting the Biodigester to the inlet of the of the composting pits to ensure that the slurry can flow into the composting pits.
- Step 3
  - Construct a roof of the composting pit from available materials with dimensions of 5.3 by 5.3 meters



Summary

- Sanitation and hygiene practices are intimately tied to a population's standard of living and general well-being.
- Implementation of minor improvements to existing sanitation and hygiene practices can dramatically decrease a given population's susceptibility to debilitating illnesses.
- Upgrading current latrine technologies within rural communities will not only reduce illness susceptibility within a community, but can also provide a community with source of energy as well as a potential source of income.

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