

Appropriate Toilets for Developing Countries

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Technically, “latrine” is the word used for any non-water toilet. However, latrine is considered a “dirty word” in some places, so it’s better to call what you are building a toilet.

2 billion people don’t have a toilet. What do they do?

- Go outside. Some common areas used for these purpose are fields used to grow crops or rivers. Sometimes there is an established area that acts as a community toilet.
- Use a “bucket toilet” inside the house and then dump it somewhere.
- Use a neighbor’s toilet when they can.
- Use a plastic bag or container and then dispose of it in a trash heap.

Why do people still not have adequate sanitation?

It’s not totally a lack of money. Many governments and NGOs have spent lots of money building toilets for the poor.

As many as half of the toilets built do not get used. Why?

- If you are used to going outside in the open air, a smelly toilet is not an enticing option.
- Some technologies are hard to maintain, and will fail when there’s no money/expertise for maintenance.
- The toilet starts to smell and the neighbors start to complain.
- Some toilets have usage requirements that are difficult for people to understand or follow.
- Toilets are vandalized or are not used due to conflicts in the community.
- The type of toilet is unusual and people are uncomfortable using it.
- In some places going out to relieve yourself is a social ritual.
- If a toilet is better than the house someone lives in, he might tear down your toilet and use the materials to improve his house.
- The pit/vault/septic tank fills up and there’s no way to empty it.
- Outdoor toilets are seen to be inferior to flush toilets, so people would rather not have the physical evidence of using an outdoor toilet near their house.

- Toilets can be dark and scary places. Some people may be afraid of their children falling in toilets, criminals hiding in them, or women leaving the house to use them.

As you can see, this is a long list, and it is only a partial list of problems that may arise. The general idea here is that **sanitation projects are not simply a matter of building toilets**. You could build great toilets, using the best technology, and they still could lay around useless once you've gone. Getting people to use the facilities and change their behaviors is not something that happens overnight, and takes a long and concerted effort in a community.

Types of toilets

Dry:

- Pit toilet
- Ventilated improved pit (VIP) toilet (“improved” is code for “has a vent pipe”)
- Ventilated improved double pit (VIDP) toilet: (dehydrating system)
 - sealed or unsealed
 - passive dehydrating or active composting
- Composting toilet

Waterborne:

- Soakaway pit
- Septic tank
- Hookup to a central sewage plant.

Waterborne toilets can be “pour flush” (you throw a bucket of water down them to flush) or mechanical flush

Design factors of the basic toilet

1. Which basic type of toilet best suits the community?

- **Waterborne or dry? (partly cultural, part technical)**
 - Are people washers (waterborne better) or wipers (dry is probably the best option)?
 - What's the site like? Where is the nearest water source? How high is the water table? (Water intrusion would be a problem if the toilet is designed to be dry.)
 - What are the soil conditions like? (Loose soils make for unstable pits. You may need a casing for the pit.)
 - How much room is there around people's homes?
 - How much money does the community have/can they get from donors? Are there people trained to maintain complicated systems?

The only situations in which you would encourage a water-based solution would be if people use water to clean themselves after using the toilet, or in a more developed community that has the money and expertise to maintain a water-based solution and is opposed to traditional pit latrines.

- **Are you going to actively compost the waste, or passively dehydrate it? (mainly technical, partly cultural)**
 - What is the climate like?

- What's the attitude toward human waste? Do people use waste for fertilizer? Would they be open to using composted human waste?
- What do people grow in the area?
- What diseases are endemic in the area? What is health risk be if people handle waste improperly?
- How are the vaults going to be emptied? Who is going to empty them?

Passive dehydrating systems are somewhat harder to maintain than regular pit toilets, but are environmentally better, and often (but not always) less smelly. Composting toilets are the hardest to maintain, but provide valuable compost and have the potential to be very odor-free.

2. What kind of “options” does the community want for its toilet?

- **Seat** (totally cultural)
 - Do people like to sit or squat?
- **Urine separation** (mainly technical, partially cultural)
 - What to do with the urine after separating it
 - Separate soakaway pit: remember urine can eat away at concrete over time.
 - Save for fertilizer: will people use it?
 - How to separate urine
 - Behavior – put a separate urinal within or outside the toilet
 - urine-separating seat
 - mesh toilet bottom or sloped toilet bottom leading to a pipe
- **Type and size of vault** (technical)
 - Underground vs. aboveground vault?
 - Does the area flood? Is the soil unstable, or solid rock? Is there more solar heat to “cook” the compost aboveground?
 - How big should the vault/vaults be?
 - How many people will use the toilet?
 - How long is it supposed to last?
 - Sealed vs. unsealed vault
 - Will groundwater contamination be a problem?
 - Where are water sources relative to the toilet?
 - Is it possible to re-site the toilet if there's a conflict?
 - If it's unsealed there's potential for an “Arborloo” (plant a tree on top of the pit after it becomes full; mobile superstructure moved to new pit.)
 - What will the vaults be made of?
 - What's available? What are soil conditions like?
 - Possibilities: plastic water drums, block, stone (unsealed)
 - How to open the vault
 - Put a door on the vaults of an aboveground latrine
 - Make the slab removable to empty an underground pit.
- **Ventilation** (technical)
 - Vent pipe: How big? Made out of what?
 - Possibilities: PVC pipe (expensive), cinder block, bamboo, pieces of plastic.

- How to keep out bugs: If the superstructure is dark then the only light the flies can see is at the top of the vent pipe and they fly towards the light and are captured by the screen.
- Which way does the wind blow? Keep smells away from houses, neighbors, especially shops or outdoor kitchens.

Ventilation (both pipe and siting) is particularly crucial to pleasantness of your toilet, and therefore to the success of any project.

- **Superstructure** (mainly cultural)
 - What are local buildings like? Have a local mason design this part.
 - Is this a permanent structure or a temporary, emergency one?
 - How can you incorporate the ventilation and bug-killing schemes?
- **Slab** (technical)
 - What weight will it bear?
 - What are the vaults made out of?
 - Are soil conditions stable?
 - How can you make sure it doesn't hold standing water?

Best practices

Most of the design elements of a toilet should be chosen based on the specific situation of each site. However, there are some best practices that you should be aware of:

Vent Pipe: Should be at least 2" in diameter, straight (no elbow), and extend at least 18 inches above the top of the superstructure. For maximum airflow, the pipe should start level with the bottom of the slab so that no smelly air can get trapped between the part of the pipe that is extended and the bottom of the slab. Many practitioners have lately been increasing the diameter of the vent pipe to up to 6 inches. A larger vent pipe will usually have larger airflow, which will make the superstructure maximally odor free. However, in my experience, having a vent pipe this size can lead to smells outside of the latrine when there's a quick change of wind direction. Smells outside of the latrine can often be more problematic than inside because outside smells affect neighbors who may not be getting the benefit of having the latrine.

Flyscreen: It is critical that the vent pipe have a fly screen tightly sealed to the top. If the latrine is dark, flies will be attracted to the sunlight coming through the pipe, and fly up to the top. If the flyscreen is attached, they can't get out and die up there. If a flyscreen is not in place, they get out and land on the kids.

Slab: Should be at least 3" thick, reinforced concrete. Many slabs are not reinforced because the area they cover is very small and it is not considered necessary, but because of high usage I have seen many un-reinforced slabs cave in over time.

Vault Size: There is no absolute best practice for this, but for sealed latrines, one rule of thumb is 0.8 m³ per person per year. Unsealed pit latrines should be at least 5 ft deep and are usually 6 to 8 feet deep. Of course, always overestimate! In areas like schools or other public areas, sealed vaults may not be the best solution because they may fill at an unpredictable rate.

Siting: There are usually local building regulations. If you are in an urban area, even in an informal community, look at these and attempt to follow them as much as possible – you don't want a local official to have a good excuse to tear down a latrine because it isn't within code!

A word about concrete: there are many differing standards for the use of concrete – how long it should cure, what type of aggregate you should use, etc. This will depend a lot on climate and local practices. Get a local mason to help you, and follow local practices – local builders know what they are doing.

Links to sites with specs for different types of latrines

Composting toilets:

<http://peacecorps.mtu.edu/erda/links.htm>

<http://peacecorps.mtu.edu/sj/Types.htm>

Excellent reference with detailed specs on different types of toilets:

http://www.who.int/docstore/water_sanitation_health/onsitesan/ch04.htm

Information in the context of the Ecological Sanitation movement, which is also trying to move the developed world toward more efficient sanitation practices:

<http://www.ecosanres.org/>

<http://www.gtz.de/ecosan/english>

Behavior and maintenance issues

Repairing the flyscreen: Even a small tear in the flyscreen on the vent pipe can cause a huge amount of insect invasion. This flyscreen material can be hard for people to get, so leave some extra on hand for after toilets are built.

Putting things down the hole: This is far and away the biggest maintenance issue. Children in particular seem to love to throw things down holes. Educating them about the new latrine is crucially important. A lot of garbage gets thrown into latrines that doesn't break down and fills up the pit way too early and collects water, causing smells. Explain to women that they cannot put sanitary napkins (unless they use all organic materials) or disposable diapers down the pit. It is also important that people understand that they can't let much water get in. This can be emphasized by calling it the "dry toilet" and reinforcing that first word.

Composting/dehydrating toilets are problematic in that they require people to throw in some organic material to facilitate drying/composting. Be careful how in how you explain this to people. It is often hard to get people to identify what is an organic material and what is not. In developing countries, people often throw their inorganic trash on the ground, and then rake everything up at the end of the day – and you don't want them to throw this in the toilet. Many people are used to throwing things like gasoline into traditional pit toilets to dry them out – this is disastrous for any sealed vault system.

Keeping the floor and seat clean: Encourage people to paint, polish, or lay down vinyl flooring (surprisingly cheap many places) so that surfaces are easier to clean. Wooden surfaces are particularly good breeders of germs.

Emptying vaults: Double vault systems are often built with the idea that the users will empty them when they fill, but people are often intimidated or disgusted by this task – even when the toilet doesn't smell, and then this step never gets done and the toilet never gets used. There is actually evidence that worldwide nearly half of VIDPs never get emptied. It is usually more realistic to have a particular person either inside or outside the community designated to do this for a fee.

Even though compost that comes out of a vault should be safe, it's not guaranteed to be totally pathogen free. It should be kept away from children, and people should be very careful about washing their hands after handling it

Public latrines: Public latrines are problematic because not everyone knows how to use it correctly. If you put up a sign about proper toilet behavior, remember that many people will not be able to read it.

HAND WASHING is the most crucial part of proper sanitation. Make sure people have an available water source and soap or ashes to wash their hands after using the toilet.

What to do if you have a smelly toilet

If you are in a community for a short period of time, some of the best interventions you can make are helping people to improve their existing toilets, or to help them realize how some of their behaviors might be causing any of the odor problems they are having.

The reason that most toilets are smelly is because their contents are wet. Keep this concept in mind when troubleshooting issues – it might be as simple as making sure people aren't cleaning the pit with water or encouraging them to urinate another place. And, after a really big rain, the thing just might smell for a while, and there's not much you can do about it.

Have the users pour ashes into the toilet: Ashes are one of the best odor controllers. This is usually fairly easy to do because in most developing countries, people cook on coal fires. Have them pour in a few cups at once, and then have them get into the habit of emptying their coal pot into the toilet every day. Sawdust is another good odor-absorber. If none of these is available, put in anything organic in that will absorb some of the moisture. Remember the "fine balance" issue above.

Add/Extend the vent pipe: Adding a vent pipe to an existing latrine with no ventilation can make an incredible difference in odor. For a toilet that already has a vent pipe, try attaching additional length of the vent pipe above the superstructure, to help carry odors further away – I have seen pipes extending up to seven feet above the roof. This can make a huge difference.

Paint it black: By painting the vent pipe or the vaults black or by adding a black metal panel, you can get a surprising increase in temperature that in the case of the vent pipe

will help suck air up the pipe, and in the case of the vaults will help speed the dehydration process.

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