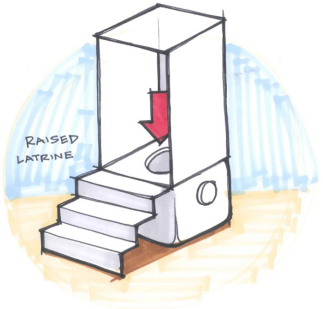
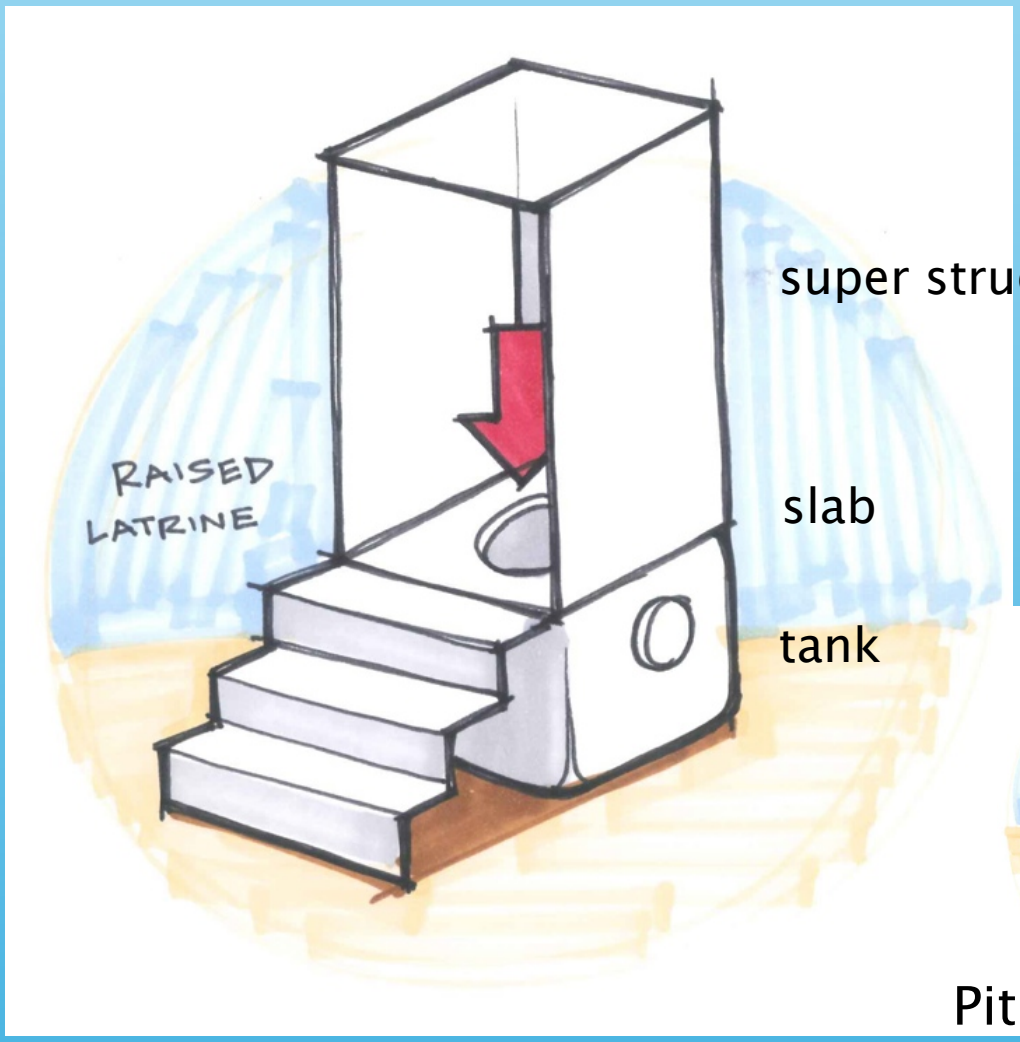


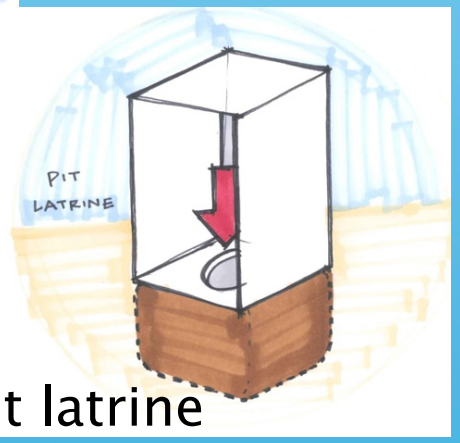
Inspiration for productdevelopment; Raised latrines

June 13th 2012

Aldus bouwinnovatie
eigenwijze ingenieurs I inventieve adviseurs

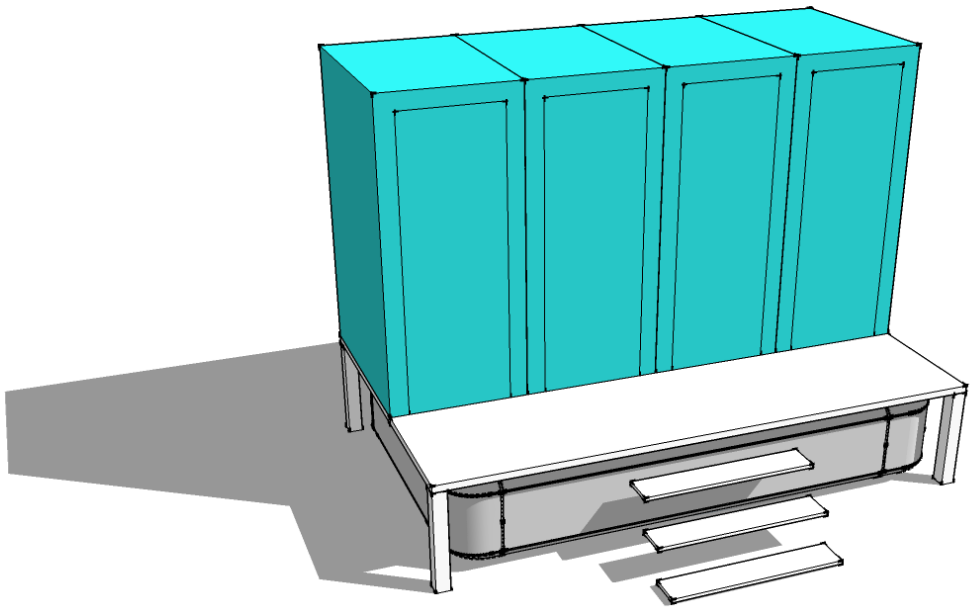
Raised latrine





Pit latrine

Raised latrine - kit



1 kit = block of 4 toilets ?

Raised latrine

Research into latrine requirements;

New technology inspiration;

* Structure alternatives
* Tanks
* Combined structures
* Integrated solutions

Challenges & discussion points;

Research into latrine requirements

Problem:

There is no acceptable (kit) solution available to be deployed in all emergency situations

Goal:

To establish an unambiguous set of requirements for new raised latrine kits:

1. General consensus
2. Feasible solution for all emergency situations

Research into latrine requirements

Method:

1. Evaluating current solutions
2. Response to concept requirements
3. Search for new inspiration
4. Reaching consensus in workshop

Research into latrine requirements

Evaluation of current solutions, based on experience reports

System type	Configuration Reservoir	Product or category	Affordability Product Costs	Affordability Lifecycle Costs	Ability of local manufacturing	Desludging	Volume of reservoir	Operability	Safety, Health and Cleaning	Speed of deployment	Vector reduction	Odour reduction	Environmental aspects	Limited use of Resources	Life cycle
	Weighting factor →		2.	2.	1.	1.	2.	2.	2.	3.	3.	3.	3.	2.	1.
SINGLE LATRINE	Underground reservoir	Single pit latrine	++	+	++	-	+	-	-	-	- -	- -	- -	+	0
		Vip latrine	+	+	++	-	+	-	-	-	+	+	- -	+	0
		Borehole latrine	+	+	++	- -	- -	+	+	-	+	+	- -	+	-
		Aqua-Privy	++	+	++	0	+	-	+	-	0	0	- -	- -	0
		Latrine with septic tank	0	-	-	+	+	-	+	-	+	++	+	+	+
	Double underground reservoir	Alternating Twin pit latrine	+	+	+	+	+	+	+	-	-	-	+	+	+
		Fossa alterna													
	Surface reservoir	Packet latrine (pee poo bag)	+	+	0	N.A.	- -	++	+	+ +	+ +	+ +	+	0	N.A.
		Portaloo (chemical toilet)	- -	-	- -	+	0	+	+	+ +	++	+	-	0	+
		Bucket latrine	+	+	+			-	-	++				+	
		Pour-flush latrine + septic tank	-	-	- -	+	+	-	0	-	+	+	+	+-	
		ECO-SAN without Urine Diversion	+	+	+	-	0	-	0		+	+	+ +	+	
		Raised composting latrine/Arborloo	-	+	+		0		+		+	+	+ +	0	
		Humanure toilet	+				0								
	Double surface reservoir (Urine Diversion)	ECO-SAN with Urine Diversion	-		+		+			+			+ +		
		UDDT	+	+	+ +		+		+	+	+	+	+	+	
		Double vault toilet	+	+			+		+	+	+	+	+ +		
		Portaloo with Urine Diversion								+					
		UD toilet drums								+					
	No reservoir	Overhung latrine	+	+	+	N.A.	N.A.	0	- -	+	+	+	- -	+	+
MULTI LATRINE	Underground reservoir	Deep trench latrine	+	+	+	+	+	+	++		0	- -	- -	+	
		Shallow trench latrine	+	+	+	+	+	+						+	
		Shallow family latrine	+	+	+	+	+	+							
	Surface reservoir (raised latrine)	?													

Research into latrine requirements

Evaluation of current solutions: portaloo

-/- high product and lifecycle costs

+/+ high speed of deployment and good health and safety

System type	Configuration Reservoir	Product or category	Affordability Product Costs	Affordability Lifecycle Costs	Ability of local manufacturing	Desludging	Volume of reservoir	Operability	Safety, Health and Cleaning	Speed of deployment	Vector reduction	Odour reduction	Environmental aspects	Limited use of Resources	Life cycle
	Weighting factor →		2.	2.	1.	1.	2.	2.	2.	3.	3.	3.	3.	2.	1.
SINGLE LATRINE	Underground reservoir	Single pit latrine	++	+	++	-	+	-	-	-	-	-	-	+	0
		Vip latrine	+	+	++	-	+	-	-	-	+	+	-	+	0
		Borehole latrine	+	+	++	- -	- -	+	+	-	+	+	-	+	-
		Aqua-Privy	++	+	++	0	+	-	+	-	0	0	-	-	0
		Latrine with septic tank	0	-	-	+	+	-	+	-	+	++	+	+	+
	Double underground reservoir	Alternating Twin pit latrine	+	+	+	+	+	+	+	-	-	-	+	+	+
		Fossa alterna													
	Surface reservoir	Packet latrine (pee poo bag)	+	+	0	N.A.	- -	++	+	+ +	+ +	+ +	+	0	N.A.
		Portaloo (chemical toilet)	- -	-	- -	+	0	+	+	+ +	++	+	-	0	+
		Bucket latrine	+	+	+					++				+	
		Pour-flush latrine + septic tank	-	-	- -	+	+	-	0	-	+	+	+	+-	
		ECO-SAN without Urine Diversion	+								+	+	+ +	+	
		Raised composting latrine/Arborloo	-								+	+	+ +	0	
		Humanure toilet	+												
	Double surface reservoir (Urine Diversion)	ECO-SAN with Urine Diversion	-										+ +		
		UDDT	+								+	+	+	+	
		Double vault toilet	+								+	+	+ +		
		Portaloo with Urine Diversion													
		UD toilet drums													
	No reservoir	Overhung latrine	+								+	+	- -	+	+
MULTI LATRINE	Underground reservoir	Deep trench latrine	+								0	- -	- -	+	
		Shallow trench latrine	+											+	
		Shallow family latrine	+	+	+	+	+	+							
	Surface reservoir (raised latrine)	?													

Research into latrine requirements

Evaluation of current solutions: twin pit latrine

-/- low speed of deployment and low vector reduction

+/+ low product and life cycle costs

System type	Configuration Reservoir	Product or category	Affordability Product Costs	Affordability Lifecycle Costs	Ability of local manufacturing	Desludging	Volume of reservoir	Operability	Safety, Health and Cleaning	Speed of deployment	Vector reduction	Odour reduction	Environmental aspects	Limited use of Resources	Life cycle
	Weighting factor →		2.	2.	1.	1.	2.	2.	2.	3.	3.	3.	3.	2.	1.
SINGLE LATRINE	Underground reservoir	Single pit latrine	++	+	++	-	+	-	-	-	+	+	-	+	0
		Vip latrine	+	+	++	-	+	-	-	-	+	+	-	+	0
		Borehole latrine	+	+	++	--	--	+	+	-	+	+	-	+	-
		Aqua-Privy	++	+	++	0	+	-	+	-	0	0	-	-	0
		Latrine with septic tank	0	-	-	+	+	-	+	-	+	++	+	+	+
	Double underground reservoir	Alternating Twin pit latrine	+	+	+	+	+	+	+	-	-	-	+	+	+
		Fossa alterna													
	Surface reservoir	Packet latrine (pee poo bag)	+	+	0	N.A.	--	++	+	+ +	+ +	+ +	+	0	N.A.
		Portaloo (chemical toilet)	--	-	--								+	0	+
		Bucket latrine	+	+	+									+	
		Pour-flush latrine + septic tank	-	-	--								+	+-	
		ECO-SAN without Urine Diversion	+	+	+								+ +	+	
		Raised composting latrine/Arborloo	-	+	+								+ +	0	
		Humanure toilet	+												
	Double surface reservoir (Urine Diversion)	ECO-SAN with Urine Diversion	-		+								+ +		
		UDDT	+	+	+ +								+	+	
		Double vault toilet	+	+									+ +		
		Portaloo with Urine Diversion													
		UD toilet drums													
	No reservoir	Overhung latrine	+	+	+								-	+	+
MULTI LATRINE	Underground reservoir	Deep trench latrine	+	+	+								-	+	
		Shallow trench latrine	+	+	+	+	+	+						+	
		Shallow family latrine	+	+	+	+	+	+							
	Surface reservoir (raised latrine)	?													

Research into latrine requirements

Conclusions:

1. None of the products performs sufficiently on all aspects

2. Some criteria are negatively correlated

3. High volume tanks are more cost efficient

4. Highly prefabricated solutions are fast and relatively safe

5. Peepoo concept has relative good overall score

Responses to concept requirements

Conclusion 1

Ideal product

* no weight,
* no transport volume,
* max tank volume,
* easy to clean,
* at no costs

Responses to concept requirements

Conclusion 2

Consensus regarding priorities of requirements:

1. low transport volume 2. privacy 3. vector reduction

Some specifications are not quantified:

e.g. tank volume, nr. of users, nr. of latrines per kit, max weight of kit

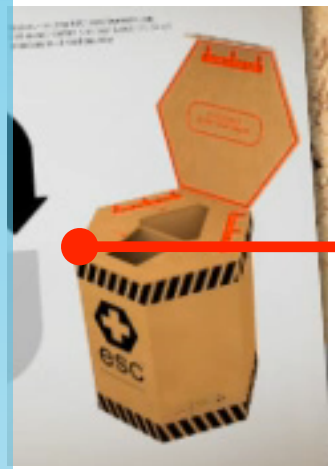
Negative correlated specifications lead to challenging requirements:

e.g. high tank volume versus small kit dimensions and low weight

Responses to concept requirements

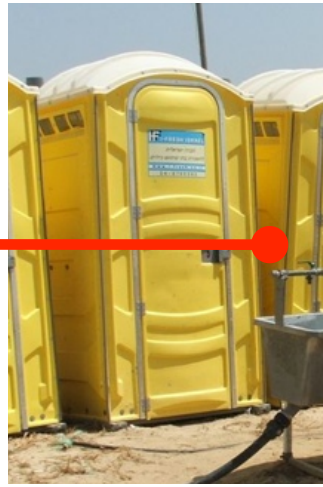
Conclusion 3

No consensus on ideal product on the scale between ESC box (or peepoo bag) versus Portaloo scenario



?

X



Responses to concept requirements

Conclusion 4

- Application of local materials: no dependency allowed
- Urine diversion: not favorable due to technical and operational risks
- Slab compatibility: choose specific range of compatibility
- Recycling: not favorable due to operational risk
- Tank structure: rather assembled or foldable then fixed
- Basic configuration: with add-ons such as toilet seat, compost facility, hand wash unit, adaptations for disabled/ children

New technology inspiration;

Structure alternatives

New materials;

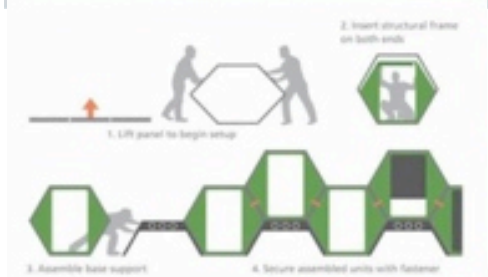
* textiles, plastics
* cardboard
* combinations (tank and structure)

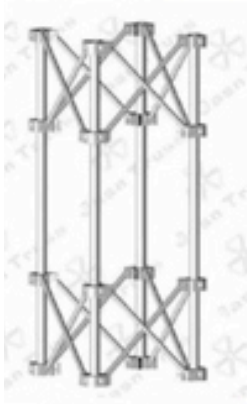
Structure alternatives

New combinations;

Structure alternatives

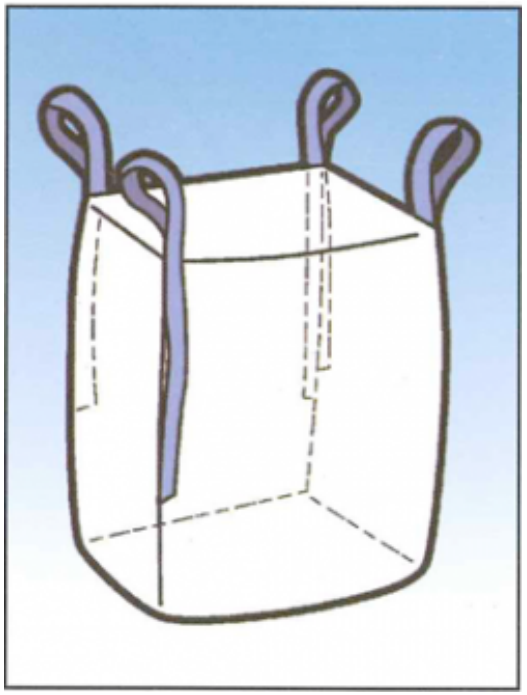
Foldable frames;





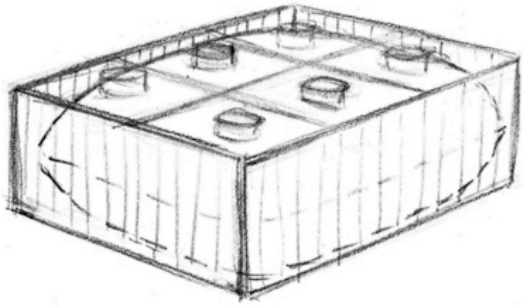
Tank alternatives

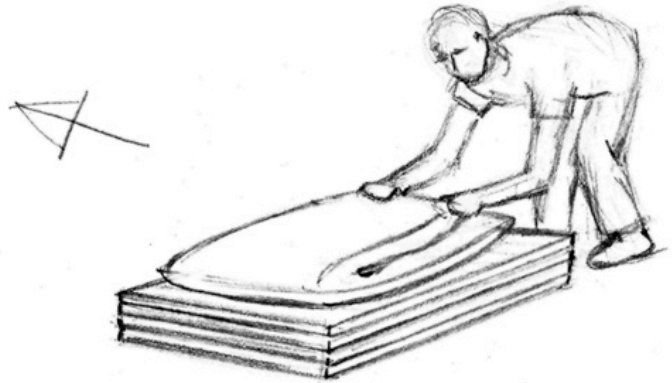
Reinforced bags;



Alternatives tanks

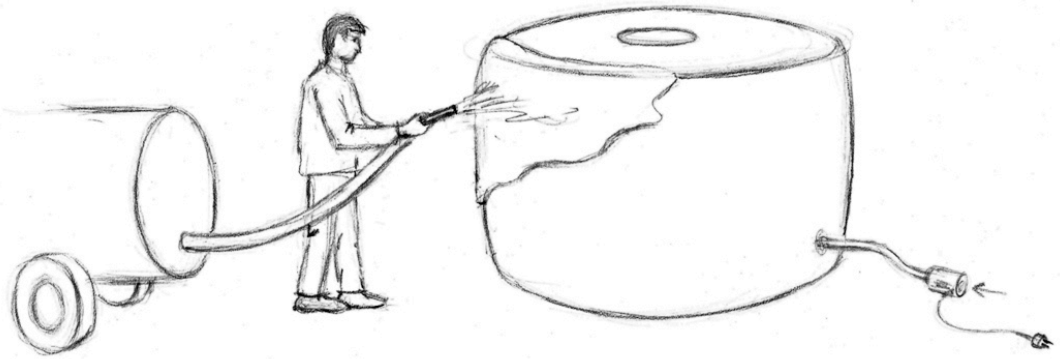
Flexible/foldable tanks;





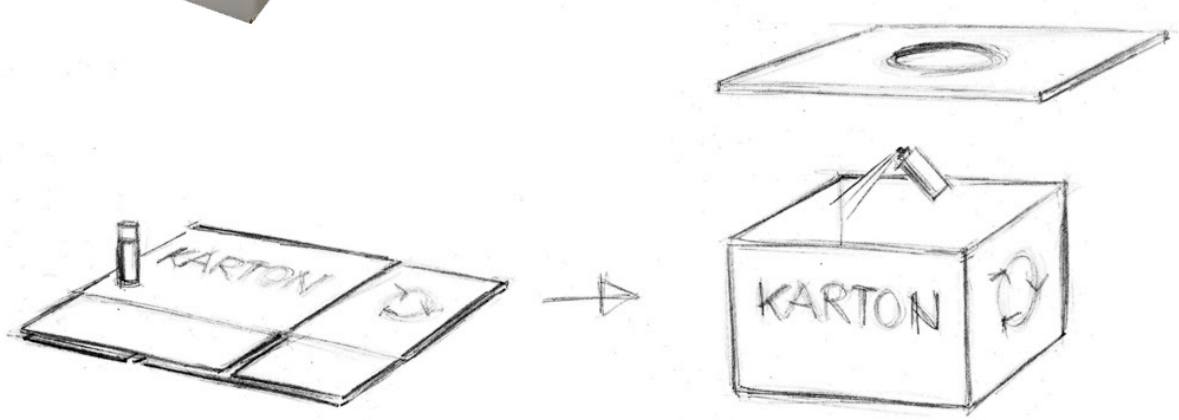
Alternatives tanks

Shotcrete tank on site production;



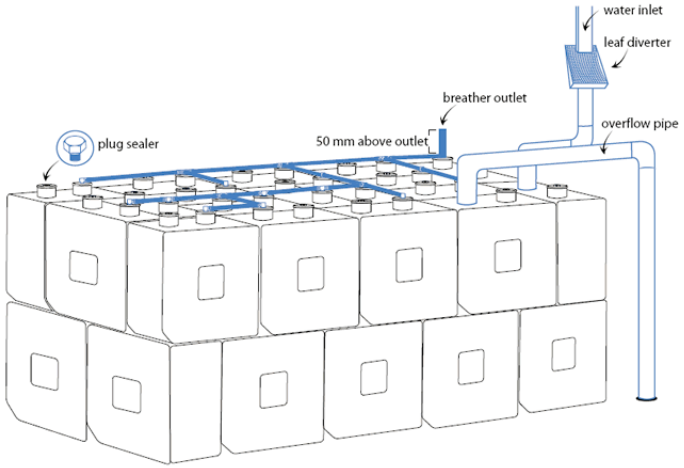
Alternatives tanks

Waterproof boxes (plastic/spray);



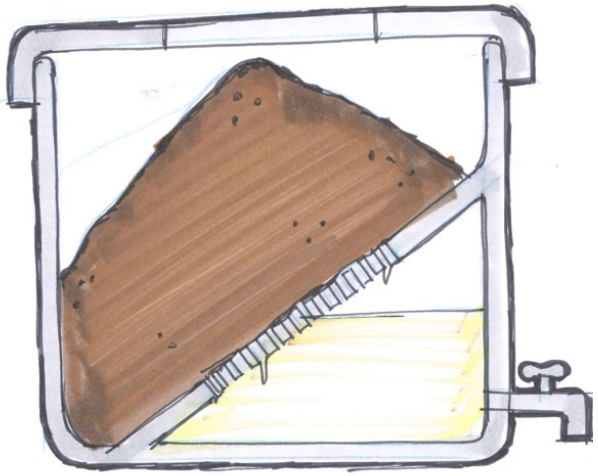
Alternatives tanks

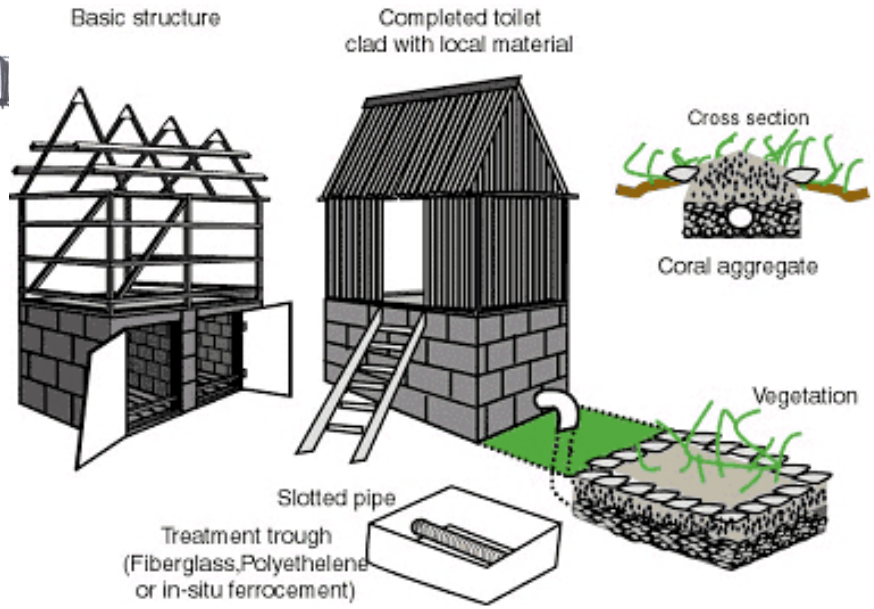
Modular tank systems;



Alternatives tanks

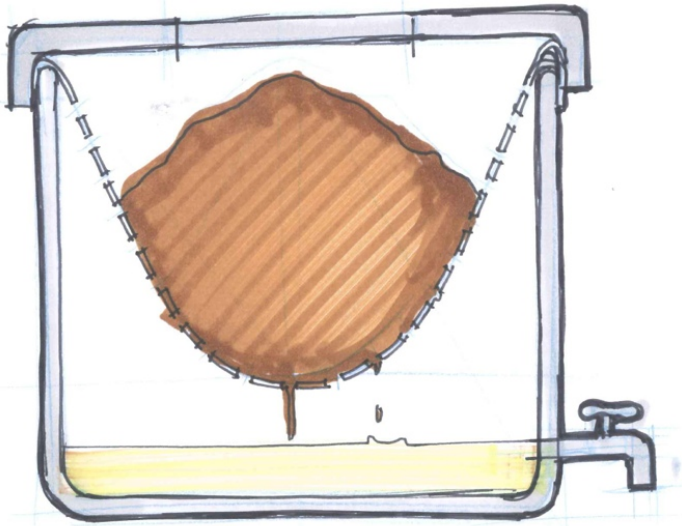
Diversion tank with permeable sub-compartment;





Alternatives tanks

Diversion tank with permeable sub-compartment;

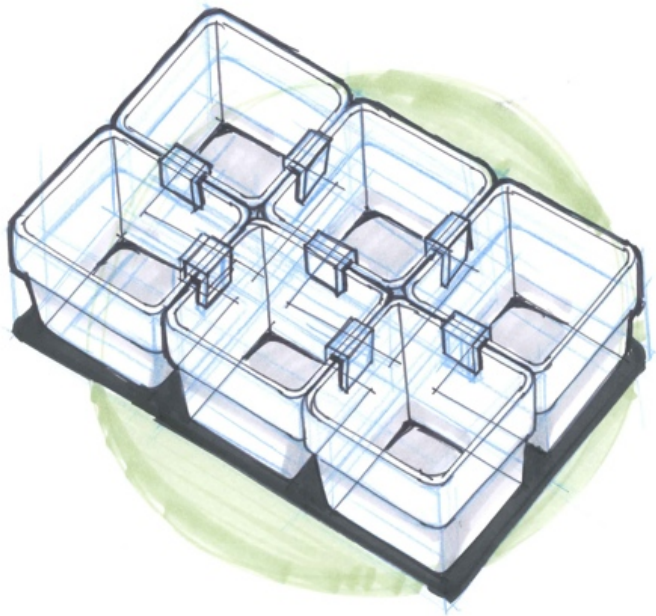


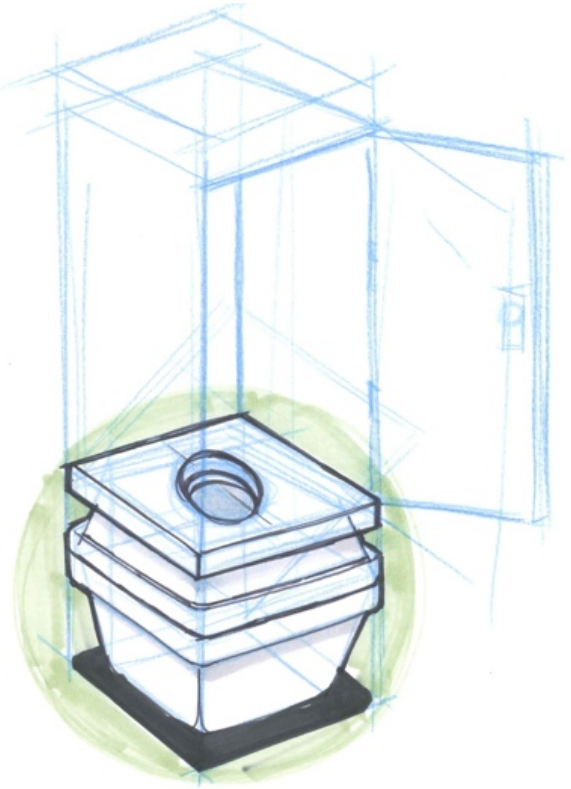
Alternatives tanks

Individual degradable bag system;

Alternatives tanks

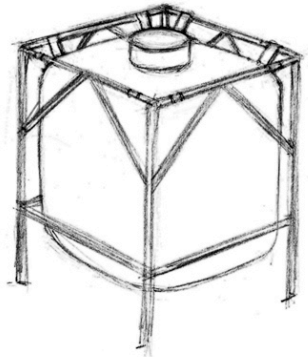
Stackable tank systems;

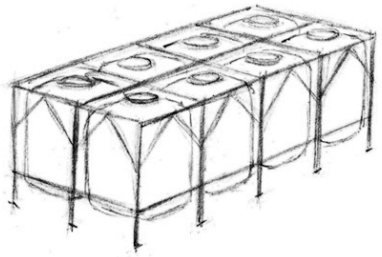




Combined structures

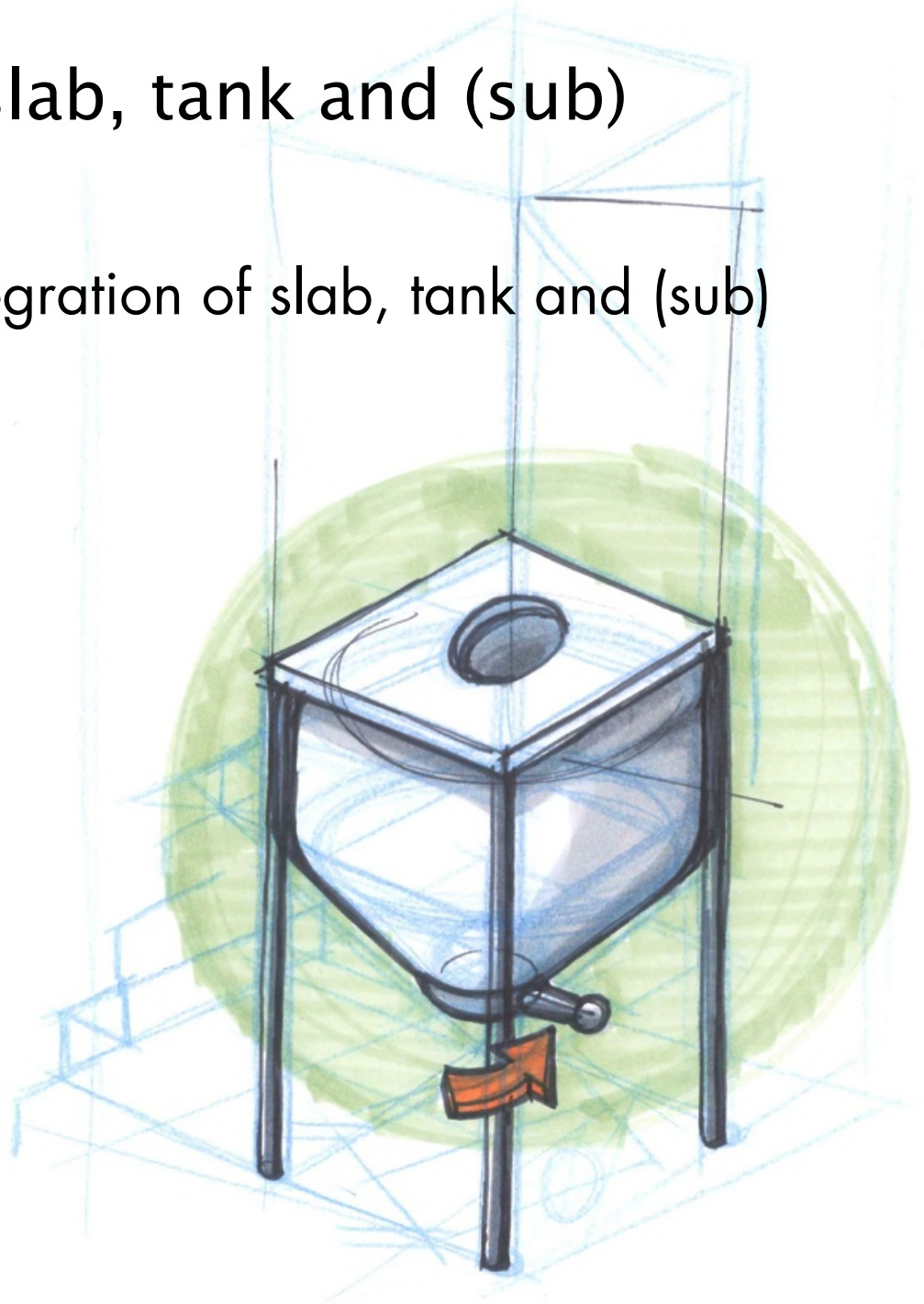
Integration of tank and (sub)structure;





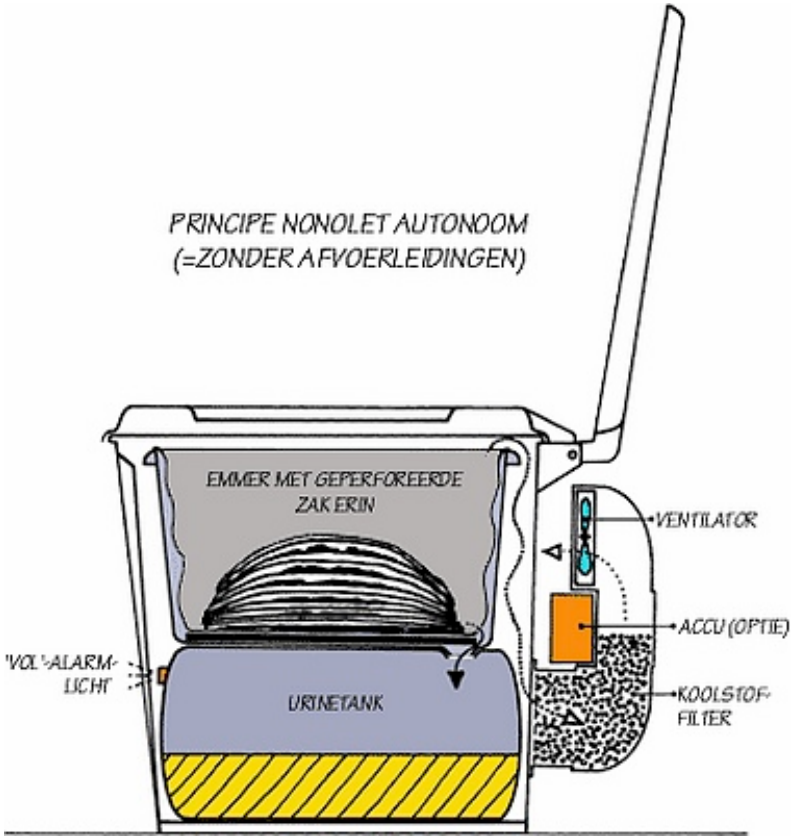
Combined slab, tank and (sub) structure

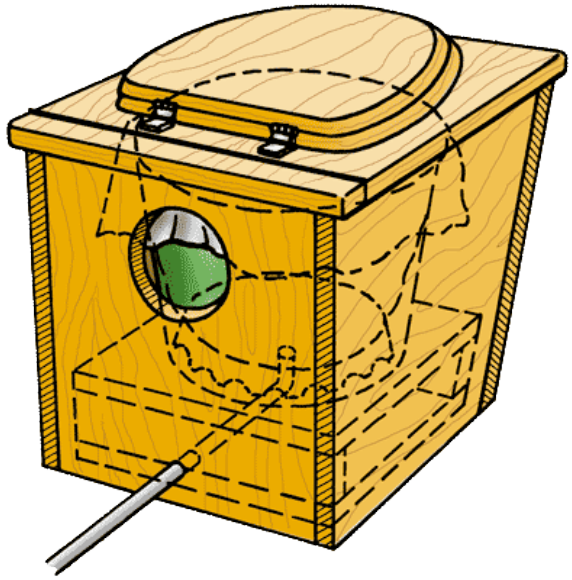
Waste-silo, integration of slab, tank and (sub) structure;



Integrated solutions

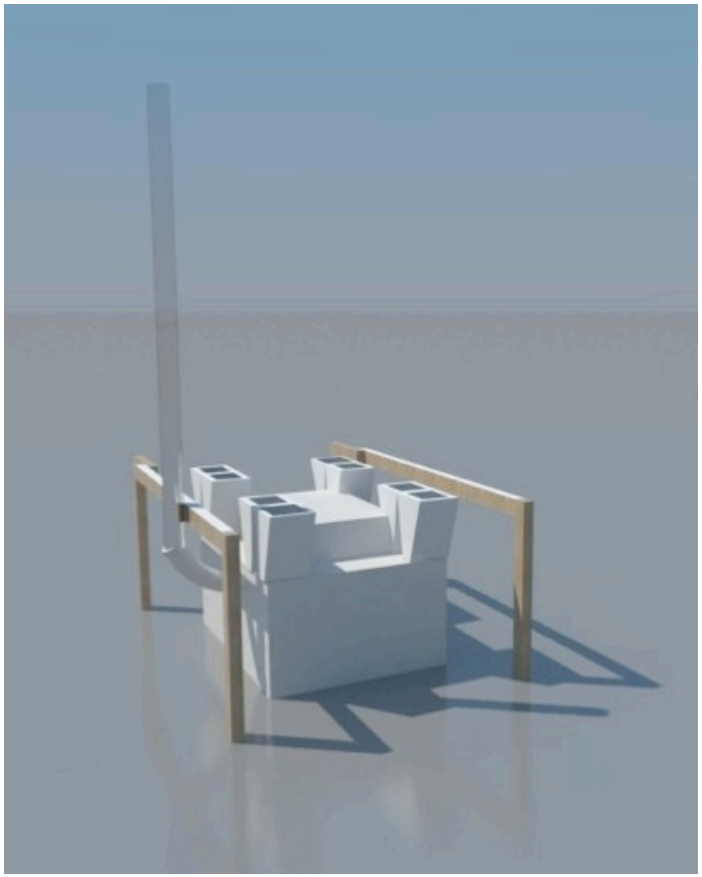
Nonolet toilets;

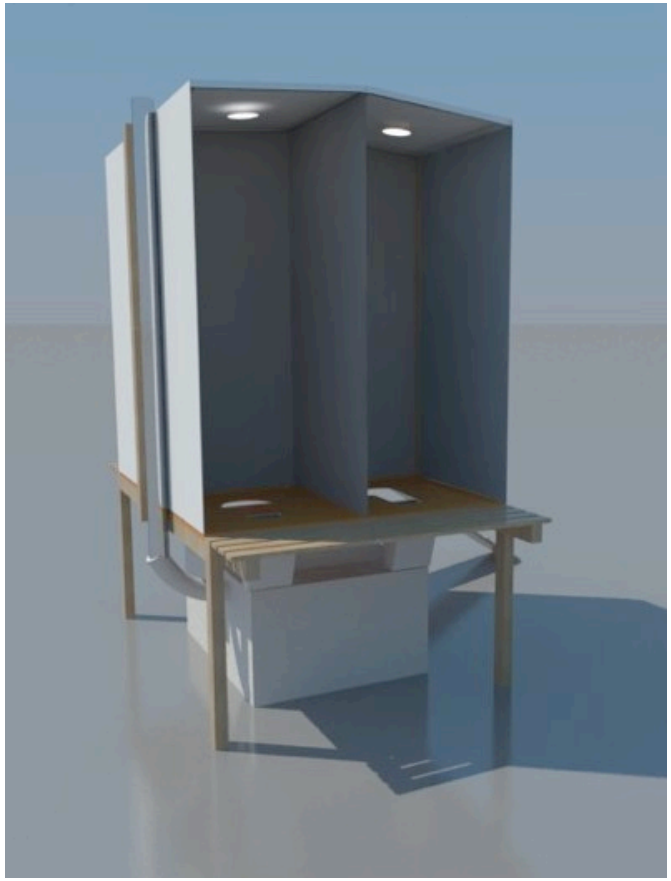




Integrated solutions

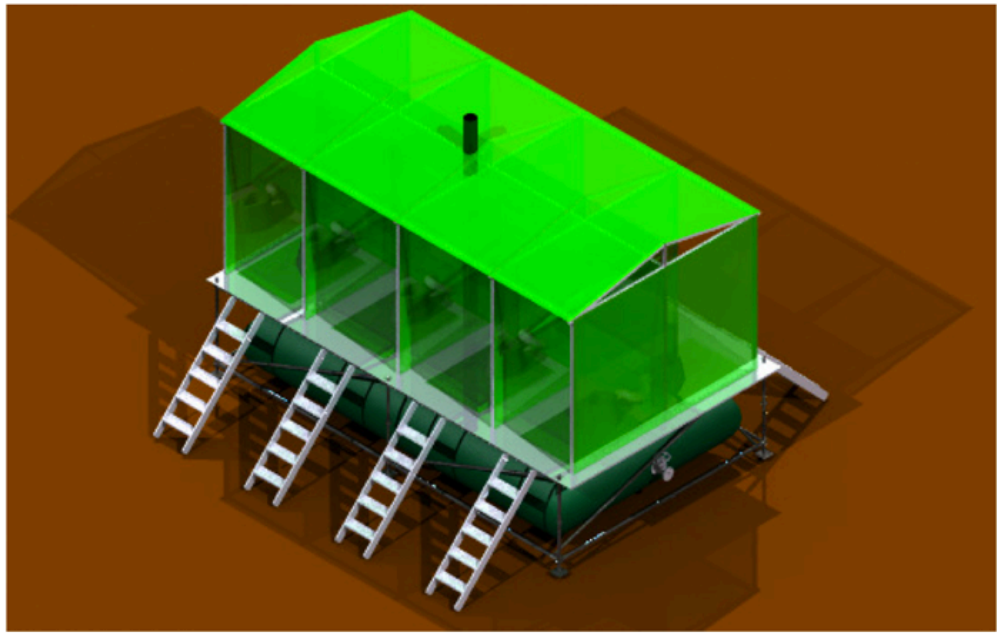
Toilet cluster: Industrial Design UT Twente;

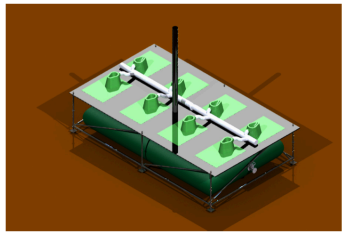


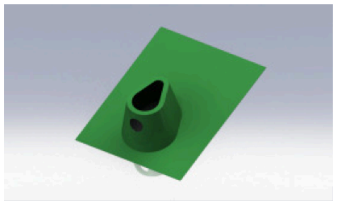


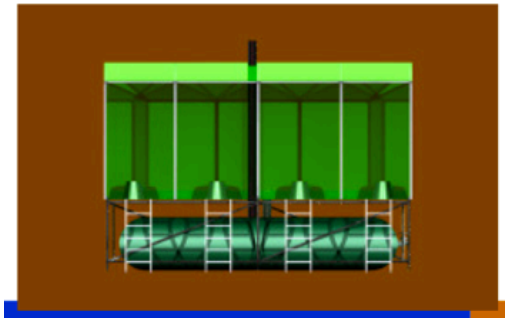
Integrated solutions

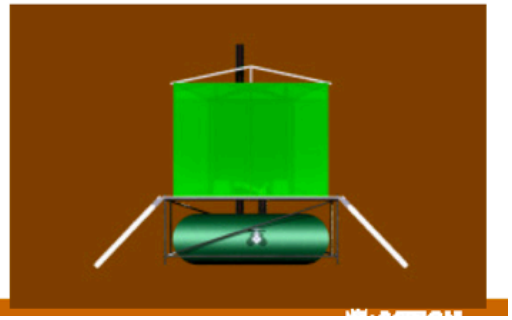
Toilet cluster: Universidad de Alcalá;





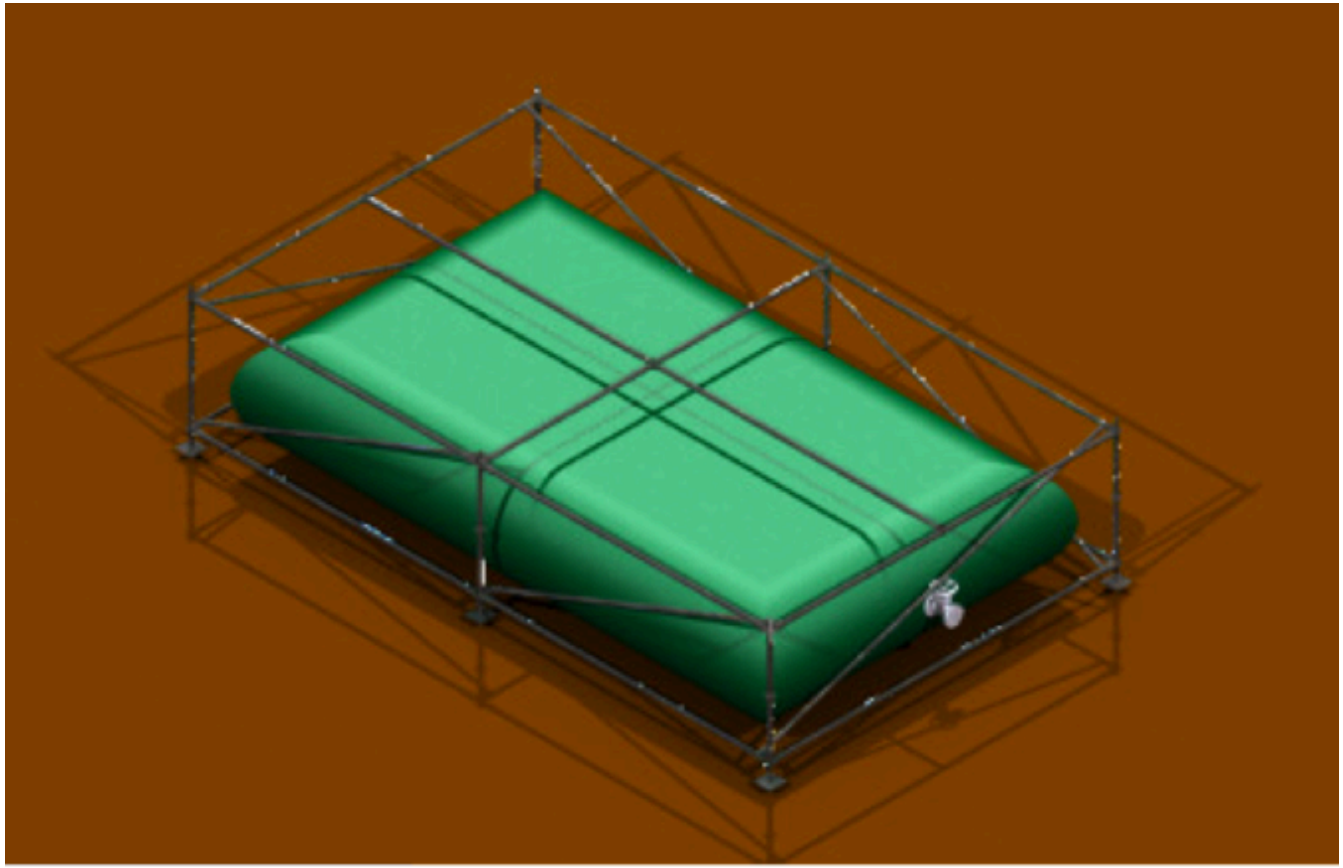






Integrated solutions

Toilet cluster: Universidad de Alcalá;



Challenges & discussion

Challenges

- Big tank volume related to small transportation kit
- Big tank size related to small structure spans
- Minimum required desludging time of 4 weeks
- High number of users related to cleanness and safety
- Light weight materials related to low cost product
- Ease of desludging
- Tank solution which is suitable for both raised and pit latrines

Discussion points

- Can use of water solve some essential problems?
- Can urine diversion solve some essential problems?
- Can self-responsibility for collection of sludge be managed properly?
- How could gravitational desludging work best with raised latrines?

Hygiene risks associated with diverted urine are mainly a result of contamination by faeces, IHE report -Elisabeth v. Münch.

Group sessions

Group session:

All participants divided in 7 groups

Each group receives a short briefing and emergency context scenario

Group assignment:

1. Decide with your group what raised latrine solution is best suited in your given context. Draw how it would work! 20 minutes

2. Evaluate the criteria stated in your group briefing:

* Quantify and specify all 8 specifications
* Add 3 most relevant specifications missing

40 minutes

Requirements to be discussed:

F1. Tranportability: the emergency kit should not exceed the following dimension (Xl*Xw*Xh) (possibly flat packed or foldable and be able to fit on standard euro pallet to allwo ease of transportation.

F2. Product should be lightweight and potential different parts of the cluster kit should not exceed X kg.

G1. Fast and straightforward setup and installation (one cluster of latrines can be assembled and operational within X hours)

E1. 1 Raised latrine should be able to accommodate between X to X people for a minimum period of 4 weeks before desludging. The minimum tank dimensions should be: Xl*Xw*Xh

Requirements to be discussed:

F3. The emergency kit should be designed in such as way that they can be transported by common pick-up vehicles (e.g. Toyota Landcruiser pick-up model) or fit on the standard size of Euro pallets. One kit (cluster of latrines) contains a maximum of X latrines.

H11. The product should provide privacy to the different target groups.

H8. The product (especially the floor) should be easy to clean.

H15.The product should allow compatibility with commonly used product parts (i.e. slabs) without leading to gaps or structural weaknesses.