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A new innovation for lining pit latrines in collapsing formations

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A new innovation for lining pit latrines in collapsing formations

Chaungo Barasa, Kenya

I N DADAAB REFUGEE camps, North Eastern Kenya, a new innovation is replacing the conventional materials such as masonry, metal, wood or rubber used for lining pit latrines in collapsing formations. This is the sandbag liner, known simply as "*birkaroon*" or '*better than steel*' in Somali language. The technique was innovated by a member [1] of the Water and Environmental Sanitation (Watesan) team of the Refugee Assistance Project (RAP) in May 1999. RAP provides essential relief services to 125,000 refugees, and is CARE-Kenya's largest programme in the country.

Low – cost technology

Birkaroons are fast phasing out the empty oil drum liners previously used by CARE. At the end of June 2000, eight hundred *birkaroons* had been installed in one of the three Dadaab camps called Hagadera (UNHCR registered population 44,750 in June), making a saving of USD 20,570 in lining costs alone, and USD 82,290 in lieu of annual replacement costs of drum liners - savings are injected into income generation activities for refugee women and youth.

The soil formation in 75% of Hagadera camp settlement comprises shifting sand from surface up-to a depth of 2.5 –3m, and pits must be lined. The target is 3000 latrines within 2 years, to realize a latrine: user ratio of 1: 15. Birkaroon costs 50% cheaper than a drum-lined latrine to install and the annual maintenance cost is negligible (a drum - lined pit latrine used by an average household of six costs USD 50 to line in Dadaab and has to be replaced at least twice in a year at a n additional cost of $100. An average *birkaroon* fills after 2 years, with negligible or no annual maintenance costs required in between. A masonry - lined latrine costs slightly more than a drum - lined one per unit metre). Besides its very low-cost nature, the birkaroon is environment - friendly, utilizes the local resource (sand scooped from the pit and filled into empty gunny sacs) and is sustainable .....majority of households do line their own. The soil-bagging concept may be replicated anywhere in the world, in varied unstable soil types. (See picture).

A Sandbag latrine under construction : Hagadera, Kenya

Origin of birkaroon: the concept of waste as a resource for income generation.

The *sandbag* latrin*e* is one among several innovations born by the RAP Watesan sector following the broadening of its programming scope in 1999 to promote environment-friendly sanitation practices. As is common in many peri-urban and urban centres in Africa, solid waste management in the sprawling Dadaab camps previously entailed basic collection and dumping. The effect on the environment after nine years of refugee occupation was beginning to show: polythene bags and other non biodegradable waste littered the streets and open yards; more than 20,000 drums lay buried in the refugee villages or blocks in Hagadera camp. Above all, the sanitation budget, just like the case of several other relief programmes of this nature, continued to dwindle, eroding per capita coverage of available sanitary services in the process. In Hagadera for example, the latrine: user ratio had declined from 1: 16 in 1996 to 1: 20 by mid-1999.

The drive was therefore towards more environment – friendly and sustainable sanitation practices. For meaningful *sustainability* of a community project, two crucial factors are essential: One, the beneficiaries should bear significant responsibility for installation, and pay for all operation and maintenance costs of the service. Secondly, the service should have an in- built mechanism for generating income so that households are not hard-pressed to meet O&M costs by having to dispose their meager assets. (This is a major cause for failure of community based projects in Kenya and many other African countries).

Whereas community participation in latrine construction and other water supply and S*anigiene* activities and tasks was already active in RAP since 1997 through the CSM (community self- management) framework, Income generation in Watesan was in-existent. It was in the search for more innovative solutions to the challenge of sustainability that the CARE staff, who had just returned from a regional Water and Sanitation conference in Lusaka, Zambia, stumbled on the idea of birkaroon one evening.

The new sector strategy has since shifted significantly to encompass reuse and recycling of waste to generate income, while mopping up the environment. Waste, as Steven A. Esrey writes, does not exist in nature, "*only in our minds. Waste is nothing more than a resource in the wrong place. It is not waste that we should dispose of, rather the concept of waste. All that we consider to be waste, is a food for another process*"[2]. Yes, majority of the refugee women and youth in Dadaab no longer look down upon all waste as an abominable nuisance, rather as valuable resource. For example, the shifting sand they scoop away from the pit latrines is no longer *spoil*, it is the lining itself; the *paper bag* (as the polythene tube is commonly known in Kenya) is no longer rubbish that one discards after use, for three kilos of it earns one USD 0.3 (the polythene is woven into very

durable mats known as *polymats* , which are sold for use as latrine superstructure screens)

Construction features of the birkaroon.

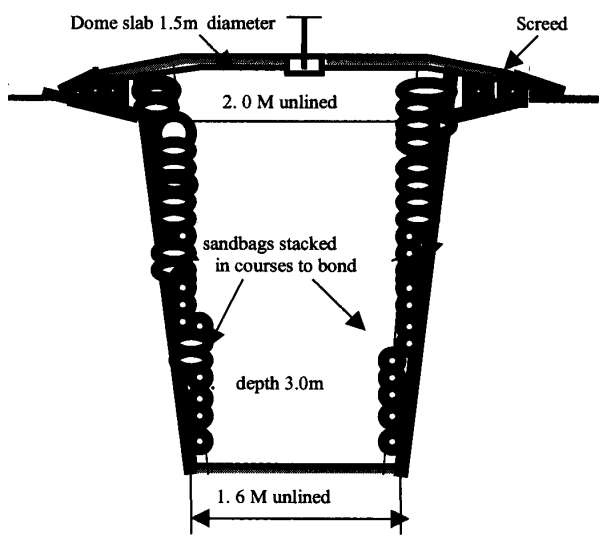
Key features of the latrine are:

- **Shape:** The pit is like a cone with a cut apex at the bottom…what in mensuration is called a frustum. (In its loose state, sand when heaped stabilizes in the shape of a cone) . Average top width before lining is 2.0m (1. 2m after lining with sandbags). Bottom width before and after lining is 1.6 m and 0.8m respectively. Maximum depth ever reached so far is 3.0 m. Deeper levels have not been tried.
- **Lining**: The lining material comprises sand spoil from the pit filled in 50kg size gunny sacs and tucked in. The sandbags are then stacked flat in courses, around the circumference of the frustum, with an overlap of about 2cm. The top course is staggered to avoid straight joints, just like the bond in a masonry wall. This results in a well *bonded,* stable structure supported by its own weight. A ladder may be used to lower in the sandbags from outside. The top most course should protrude about 0.2 m above the rim of the pit, to provide for settling.
- **Slab**: The top course is rammed level and covered with a layer of sand. A concrete dome slab 1.5m diameter is laid in place and a circumferential screed of 1:3 applied. The screed should extend out ward to cover and protect the sandbag rim.
- **Sedimentary process:** It is suspected that under the intense heat generated once the latrine is in use, the sack falls off after some time, leaving caked blocks of sand. However, the actual sedimentary process taking place has not yet been studied. Out of 800 latrines constructed, none has collapsed or caved in so far, and it is now proven that they can survive rain.
- **Labour** : Digging and lining the pit is labour intensive. It takes 3 men three days to dig and line one pit. Hired labour charges range between USD 4 – 7 for lining. Eighty(80) sandbags are required to line a pit 3 m deep. The weight aspect was a major handicap to the advance of the technology during the first three to five months, with many people citing it as a key disadvantage. But with sustained awareness creation, and after the initial latrines had survived their first rain season, the demand for birkaroon short drastically from 50 monthly in August 1999 to 150 a month in June 2000.
- **Key advantages** of the *birkaroon* are its low cost compared to masonry and steel lining, its durability, and its environment- friendliness. It has also recorded low odour and larval activity ratings.

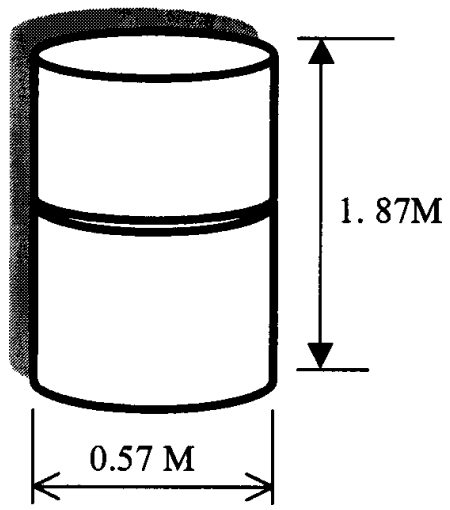
Further research

This is an entirely new technique in latrine lining. Studies on the most recent works [3] in the area of low - cost water and sanitation reveal that it has not been documented before. Therefore, more detailed research has to be undertaken. The department is already working on a research proposal to WEDC, Loughborough University. Among some of the areas to be studied would include:

- The nature of the sedimentary or *caking* process which seems to harden the sand into cohesive blocks which remain stable and intact as the sac wrapping tears and falls off.
- The maximum depth to which the sandbags can be stacked without collapsing or bursting.



Birkaroon lining with concrete dome slab



Oil drum lining without dome slab

Table 1. Comparison: Birkaroon versus drum lining

DRUM LINER	BIRKAROON
1. Environmental hazard – *leaching, tetanus, injuries, permanent "graves",*	1. Environment friendly
2. "Imported" resource … 90% of drums sourced from the city, Nairobi 450 km away…no benefits to refugees and locals.	2. Sand is local resource, and at least 30% of sacs sourced locally (WFP)…proceeds go to Refugees (school girl-child programme).
3. Life-span 3 – 4 months then must be replaced.	3. Life-span 2 years.
4. Minimum 2 empty oil drums required.	4. 80 gunny sacs of 50kg capacity.
5. Cost of lining one pit is USD 50 .Total lined latrine needs for Hagadera 2500 a year. Replacement needs 1600 latrines a year.	5. cost of lining USD 25
6. Budget of USD 41,140 can replace 410 latrines a year (only 26% of needs)	6. Total latrine needs for Hagadera 2500 a year. Does not require replacement until 2 years.
7. Total Water & sanitation budget capita is USD 4.7 Lining budget per capita alone is USD 8.6	7. Budget of USD 41,140 can do 1645 new sandbag latrines a year, much more than the replacement needs.
8. Lined pit still unstable and caves in from the -top. Susceptible to large colonies of larva and hinders larva control by use of chemicals/bacteria medium	8. Watesan budget percapita is USD 4.7 Lining budget per capita is USD 4.0
	9. Lined pit is stable against collapse and caving.
	10. Responds well to larva control measures.
	• Takes 3 men 3 days to dig and line the pit. Often, the family seeks help from neighbours.(-ve)

- Testing of the technique in swamp , black cotton and other different soil conditions.
- The theory behind the relatively low larval activity and odours.
- Seepage and filling rates.
- Effect of different types of anal cleaning material…water, paper, vegetation etc.
- Publication of technical paper series.
- Patenting and dissemination of the technology into current water and sanitation literature for applications elsewhere.
- Load impact
- Further improvements.

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