The World Health Organization (WHO) currently estimates that only 45 percent of rural Africans have access to basic sanitation services. Although pit latrines provide a low cost option for rural areas, their performance proves difficult in conditions of soil collapse.

Problems:
- Soil collapses when latrine is not lined in some sandy soils
- People are afraid to use pit latrines
- This fear leads to open defecation
- Open defecation leads to health hazards
- Expensive to line hole with current liners and thus limited adoption of latrines in such areas.

In response to this challenge, students and faculty in the Collaboratory at Messiah College are working on the Affordable Sanitation Project.

**Goals:**
- Stabilize the hole using designed liners
- Cost-effective design
- Use local materials for sustainable liners
- Reduce open defecation
- Removable liner

**Our Solution:** Stabilize pit latrines with a cost effective liner

**Current Solution Designs**

**Ferro-cement Liner:**
Design: A rebar cage wrapped in two layers of chicken wire and then covered in a thin layer of concrete (1-2 in. thick).

Advantages:
- Locally available materials
- Extremely strong
- Fairly cost effective - approx. $150/m³

Disadvantages:
- Labor and time intensive
- Non-removable

**Fabric Liner:**
Design: A rebar cage wrapped in a single layer of chicken wire and then covered by a strong fabric.

Advantages:
- Locally available materials
- Cost effective -at most $100/m³
- Easy to construct
- Lightweight

Disadvantages:
- Non-removable
- Fabric deflects slightly

**Removable Design - Fiberglass**

**Testing**
- First Stage, November 2015: Feasibility Check
  - Tested removability and deflection of panels
- Second Stage, April 2016: Detailed Testing
  - Focused more on procedure for insertion and removal
  - Precisely measured deflection and removal force
  - Verified performance of a new removal process

**Analysis of Test Results**
- Large deflection in panels
- Takes approx. 1100 lbs. to remove panels

**Advantages of Design**
- Removable
- Strong, flexible panels - supported hole from collapse
- Lightweight

**Disadvantages of Design**
- 18% volume reduction due to deflection
- Expensive - approx. $510/m³ for materials

**Future Work**
- May 2016: Site Trip to Ghana
  - Conduct field assessment to better understand the problem
  - Document local availability and cost of liner construction materials
  - Test current solutions in affected areas
  - Identify additional problems to increasing sanitation coverage
- Fall 2016 - Spring 2017
  - Based on feedback and test results from Ghana, improve latrine design
  - Build permanent testing facility
  - Finalize chosen design specifications
  - Write builders manual

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