Findings from Piloting Gulper in India

INTRODUCTION TO THE GULPER

Gulper is a human-powered faecal sludge removal device for on-site sanitation systems (OSS) such as pits and septic tanks, that is operated through a simple, direct lift mechanism. There are two types of gulpers commonly used: Gulper 1 for liquid sludge and Gulper 2 ('Rammer') for both thick and liquid sludge. In this study, Rammer was tested.

The Rammer (Gulper 2) is a direct lift pump which has an outer PVC casing that slides vertically, forcing sludge into the pump. The external rods allow unimpeded passage of sludge out of the pit. A flexible hose pipe should be connected to the outlet and a 'donkey tail' lever arm is included to facilitate pumping.

BACKGROUND

Desludging devices are needed in India to eradicate manual scavenging and empty OSS in areas inaccessible by vacuum trucks. The 'Rammer' is particularly suitable for thick sludge, and is designed to minimize contact of sludge with operators, spillage and drudgery during operation. The gulper can be carried down narrow alleyways to empty latrines. The sludge from the OSS is emptied to a container which is then transferred to the vehicle to be taken to the disposal location.

There have not been any known systematic efforts to test the gulper for its suitability in Indian conditions. CDD Society imported Gulper 2 'Rammer' from Uganda with the following aims :

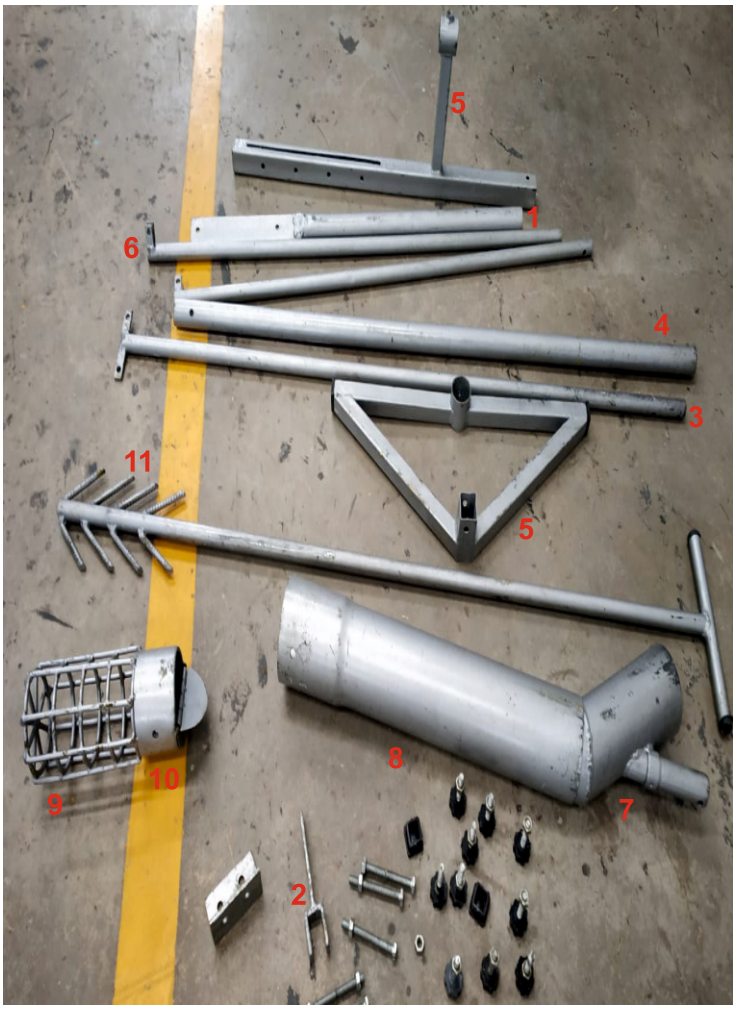
- To test the suitability of the Rammer for Indian sludge conditions
- Understand the performance efficiency of Rammer operations
- Understand the ergonomics of the system in operation

The Rammer was tested between August and October 2019.

First set of trials

PARTS OF GULPER

Gulper after assembly



Gulper before assembly

LEGEND

1.Donkey tail handle
2.Crank for donkey tail
3.Internal Bar sub-assembly
4.Fixed strut
5.Donkey tail foot stool
6.External rods
7.Fixed cylinder
8.Raising cylinder
9.Cage
10.Butterfly valve of cage
11.The rammer rod
12.Separately attached hosepipe

SPECIFICATIONS

- **Height:** 3.4 metres (1.1 metres above ground and 2.3 metres below ground, measured with the foot stool as the reference)
- **Breath:** 0.7 metres at the foot stool
- **Weight as received:** 23 kg (approx.)

PROCUREMENT DETAILS

- Equipment cost: USD 590
- Total Cost (Inclusive of Tax &
- Transportation): USD 1669
- Manufacturing lead time: 3 weeks

FIRST SET OF TRAILS

The first set of trials were carried out in wastewater tanks at CDD office. The following issues were identified:

- Too much time and effort was required; it took over 3 minutes of emptying to extract 5 litres of water.
- The non-return butterfly valve (see Legend 10) did not work
- Leakages were observed from the fixed and rising cylinders.
- There was unintended contact between fixed strut and internal bar sub-assembly leading to friction.
- The foot stool was wobbly leading to difficulty in operation.

RECTIFICATION AFTER FIRST SET OF TRIALS

Placing springs and plastic bush for improving the ramming action and reducing the friction. The first spring was placed on the inner bar assembly. The second spring was placed in between the top portion of donkey tail handle and donkey tail foot stool. The plastic bush was placed in between the fixed strut and the internal bar to avoid the friction.

The entire cage was replaced with plastic foot valve

A rubber bush was fixed around the fixed cylinder to seal leakages

A stand was used for the stability to the equipment

Position of the changes in installed gulper

POST RECTIFICATION IN-HOUSE TRIALS

Post Rectification In-house trials

After the above rectifications, the time and effort required reduced considerably; the operator could empty twenty five liters in three minutes. Thereafter, field trials were conducted with the rectified equipment.

FIELD TRIALS POST-RECTIFICATION

An old household pit (0.91 m diameter and 2.2 m depth) was identified in Kengeri (Bangalore) for the field trial. The pit was about ten years old and had never been emptied. It was connected to a pour-flush toilet used by a four person household.

The sludge consistency was inspected using the rammer rod. As the sludge was very thick, about 100 liters of water was added to it for achieving necessary viscosity. The sludge was stirred using the rammer rod.

As the mouth of the pit was wide, a stand was placed over the pit to hold the gulper in position. Multiple attempts were made to bring out the sludge from the pit. However, sludge could not be pumped out.

The gulper was pulled out and it was found that the butterfly valve got stuck due to presence of solid waste like plastic and sanitary napkins. The waste was removed, and repeated attempts were made to empty the sludge. The same problem persisted and sludge couldn't be emptied.

Opening the Pit

Thick sludge

Estimating Sludge Viscosity

Adding water to the sludge

Test in progress

Foot valve choked

Solid waste in containment units blocking gulper operations

KEY LEARNINGS

- Desludging equipment in the Indian context should be able to handle solid waste. At the same time, it is necessary to sensitise people to not dispose solid waste in toilets.
- Even after rectification, the emptying rate still remained very low. It would take a person around three hours to empty one cubic metre of sludge. As the OSS in India are often huge (3-12 cubic metre), use of this technology will involve exorbitant time making the rammer economically unviable.
- The time and effort to operate the gulper is significant. At least three people are required to work on the equipment at once; a person each holding down the foot stool, holding the collection unit and doing the ramming action. The ramming action requires intense human physical efforts and a person cannot ram for more than 3-5 minutes. Reducing the weight of the equipment and increasing its emptying efficiency may reduce the labour required and make it easier to use.

Survey No.205 (Opp. Beedi Workers Colony),
Kommaghatta Road, Bandemath Kengeri Satellite Town
Bangalore 560 060, Karnataka, India.

+91 80 28486700

bangalore@cddindia.org