Physical and Financial Performance of Pit Emptying Technologies

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Mott MacDonal
How much profit can be made emptying pits?

1. How strong is the sludge? (Strength testing)
2. How well do pumps perform? (Pump testing)
3. How does the business work? (Financial model)
1. How strong is the sludge?

**Patna, Bihar, India – Pit 35**

- **Strength (Pa)**
- **Displacement (m)**

**S24P, W Bengal, India – Pit 07**

- **Strength (Pa)**
- **Displacement (m)**
2. How well do pumps perform?

Pump testing results

Average flow rate (ℓ/s) vs. Average sludge strength (Pa)

- Gulper 1
- Gulper 2
- Diaphragm
3. How does the business work?

Profit = Fee - Total Cost

Fee = Fixed fee + Variable fee < Willing to pay limit

Total Cost = Labour cost + Transport cost + Disposal cost + Hidden cost
How much profit can I make emptying pits?

![Graph showing profit per pit and depth of sludge.]

- Profit per pit:
  - 0 - 110 Pa: $5
  - 110 - 180 Pa: $5
  - 180 - 280 Pa: $10
  - 280 - 430 Pa: $10
  - 430 - 590 Pa: $15
  - 590+ Pa: $20

- Areas:
  - All areas, India
  - West Bengal
  - Muzaffarpur
  - Patna
  - Kampala, Uganda

- Depth of sludge (m):
  - 0 - 1.10
  - 1.10 - 1.80
  - 1.80 - 2.80
  - 2.80 - 4.30
  - 4.30 - 5.90
  - 5.90+ Pa
Profit breakdown by pit

Total depth (m)

Patna, Bihar
Muzaffarpur, Bihar
S24 Parganas, W Bengal

Profit per pit

Gulper 1
Gulper 2

Kampala, Uganda

590+ Pa
430 - 590Pa
280 - 430Pa
180 - 280Pa
110 - 180Pa
0 - 110Pa
0 - 0Pa
How can I increase my profit?

Limitations of Gulper 1

Limitations of Gulper 2

- Freeboard
- Emptiable Volume
- WTP
- Depth
- Strength
Which pump should I use?

Patna/Muzaffarpur, India | Kampala, Uganda

Depth of sludge (m) | Sludge strength (Pa)
Conclusion

• Testing sludge strength and pump performance can show how to increase profit for pit emptying

Next steps

• Test more pits – link to treatment and planning
• Test more pumps – mechanised, tankers
• Include more business model options
• Web tool to inform pump selection
Thank you!

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Mott MacDonal
2. How well do pumps perform?

Impact of debris on Gulper I performance.

- No debris
- Debris

-25%
-40%
-100%

Average Flow Rate (including blockages)

Shear Strength (Pa)
3. How does the business work?

\[
\text{Total Cost} = \text{Labour cost} + \text{Transport cost} + \text{Disposal cost} + \text{Hidden cost}
\]

- **Labour cost**: Time to:
  - Travel
  - Negotiate
  - Set up
  - Empty
  - Blockages
  - Transport
  - Dispose
  - Hourly wages

- **Transport cost**: Vehicle (hire) + Fuel cost

- **Disposal cost**: Flat charge + Fee per volume

- **Hidden cost**: Depreciation + Maintenance + Interest