Mechanized Percussion Well Drilling

Jar, Bit Attachments, and Testing Team
Dan Eckman, Althea Mavros, Greg Shirk

Introduction
The goal of the Mechanized Percussion Well Drilling project is to develop an engine powered system that reduces the labor required to manually drill wells, while retaining portability and low capital investment. Percussive well drilling technology is currently used by our client in Burkina Faso, West Africa, to drill wells that provide access to water during the dry season for agricultural purposes.

During the spring semester the team worked to improve the current technology by designing a mast superstructure, equipment to drive and pull casing, drill bit attachments, and by testing our current system.

Testing Team
Throughout the spring of 2016, the Testing Team spent many hours outside on the lawn of the Bittner Dorm, right outside the project space in Frey, testing different methods of drilling. We continually looked for different variables that effected the overall progress of drilling as well as wear on the structure.

During the semester we made a short instructional video showing the overall process of drilling for testing. After watching this video, a new team member, or anyone who would need to, would be able to drill for testing fairly knowledgeably. While testing, we also looked to find and resolve problem areas on the old rig that needed to be resolved in the rig being developed by the rest of the team.

Jar
During the fall of 2015 there was a need to redesign the jar due to issues that came up in testing. The purpose of the jar is to create enough upward force on the drill bit loop to free the drill bit if it gets stuck in the hole. For the new jar we wanted to design it in such a way that it would not disconnect during drilling, to prevent the drill bits or bailer from being lost down the hole. We also wanted to make the jar easily removable so that we could switch between drill bits and bailer quickly.

Drill Bit Attachments
During the spring of 2016 the team felt there was a need to reduce the number of drill bits and still be able to drill through different types of soils efficiently. In order to do this we designed drill bit attachments called Chisooks, which bolt onto the rock bit to improve drilling in sand and clay. We wanted to design them in such a way that they would dig into the ground and break up the clay instead of packing it down, which the drill bits are currently doing.

Our Team
Front: Amanda Lager, Katie Moyer, Dan Eckman, Althea Mavros, Damaris Gelman, John Hannon
Back: Luke Betteridge (Student Project Manager), Joseph Longenecker (Project Manager), Greg Shirk, Calvin Dammin, Tyler Collier, David Wilson

Clients
Matt Walsh with Open Door Development, SIM
Matt Walsh was the first Collaboratory Manager. He is now a missionary with SIM in Burkina Faso, West Africa.

Open Door Development
ODD is an SIM community development ministry based in Mahadaga, Burkina Faso. Their mission is to share the gospel by equipping the local church for community service and by ministering to human needs. ODD was officially founded by Dale Johnson and Matt Walsh, in 2012.

Drilling through rock with a Drill Bit Attachment

Conclusions
- Testing Team
  - Goal: To test the drilling rig, optimize drilling variables, and create an instructional video.
  - Progress: The instructional video was created. We discovered that rock in the drilling variable that governs progress in PA soil, and also that higher drop heights are more effective when dealing with rock.
  - Future Goals: We plan to make continued depth progress and simulate drilling in an aquifer.

- Drill Bit Attachments
  - Goal: To design a bit attachments that efficiently drill through sand and clay soils.
  - Progress: Chisooks were designed manufactured and tested. Problems arose during testing.
  - Future Goals: Make improvements to Chisooks, possibly redesign them to prevent bending under force.

Acknowledgements
- Project Advisor: Joseph Longenecker jblongen@gmail.com
- Research Mentors: Dr. Tesfayohannes Yacob, Dr. Thomas Soerens, Tony Beers, Brendon Earl
- Consulting Engineers: John Meyer, Dyke Burki, Tony Beers, Dr. Brian Swartz, Dr. Tim Van Dyke

- Future Goals: Fix drill bit loops to further use the jar in drilling.