SONIC DRILLING "An Efficient Way to Drill"





A Brief History of Sonic Drilling

- The concept of sonic drilling technology was born approximately 100 years ago by Romanian civil engineer George Constantinesco.
 - In 1930, Romanian engineer, Dr. Ion Basgan continued Constantinesco's methods and applied sonic vibrations to the drill pipe string of a conventional drill rig which resulted in increased drill depth and speed.
 - American inventor, Albert Bodine, continued research in the 1940's through the Drilling Research Institute.
- In the early 1970's Hawker-Siddeley, a British aerospace company, assigned the next generation of research to one of its Canadian offices.
- In the 1980's Ray Roussy continued work on the Sonic technology resulting in a number of patents and the successful method of what we use today.

WHAT IS SONIC DRILLING?

- A soil penetration technique that fluidizes porous materials.
- The sonic head contains mechanisms that allow the rotation and oscillation of the drill stem, which causes a high frequency force to be superimposed on the drill stem. The drill stem/drill bit physically vibrate up and down in addition to being pushed down and rotated.
- By using a sonic head, drill casing and rods are brought to a vibration frequency of 100-200 Hz, which is within the range of human hearing.
- These waves are transmitted through the drill string to the end of the casing and reflected, causing the casing to stretch and thin, and to shorten and thicken 100-200 times per second.
- This intense vibration causes a very thin layer of soil directly around the drill rods to fluidize. The fluidized soil zone extends a maximum of 5 millimeters from the rod. The soil in the influenced area behaves like a fluid, which dramatically reduces the friction between the drill rod and the surrounding soil, allowing very rapid penetration.
- The same friction reduction applies to the inner surface of the soil sampling tool, and enables collection of very long sample cores (up to four meters).
- The movement of the eccentric weights brings the casing into a purely vertical vibration. With low pull-down or pull-up force, the casing can be driven and retrieved.

What Is A Sonic Drilling Head?

- Not a new concept
- Basics
 - Counter Rotating Eccentrics
 - Direct coupled to rod string
 - Isolated from the drill rig



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Applications for Sonic Drilling

• Soil Boring Installation/Sampling







Applications For Sonic Drilling

• Monitor, Air Sparge, & Recovery Well Installation

• Single, Nested, Clustered, Double/Triple Cased



Applications For Sonic Drilling

- Abandonment of Wells
 - Overdrilling of Wells
 - Fully grouting to well depths inside casing
- Injection Points
 - Permanent or Temporary Cased
 - Angle Drilling
- Water Well
 - Soil Sample to Verify Screen Interval (300 to 500 foot efficiency range)

Applications For Sonic Drilling

- Geotechnical Investigations
 - Split Spoon and Shelby Tube
 - Equipped with Automatic Hammer





Applications For Sonic Drilling

Aggregate Explorations



Applications For Sonic Drilling

- Geothermal
 - Installation of Geothermal Loops





Angle Sonic Drilling Capabilities



Offshore Drilling Capabilities



Sonic Work Footprint



SONIC & SAFETY

- Pinch Points
- Automated Controls
- Automatic Rod Handling
- Less Physical Contact
- Break out jaws tighten and loosen pipe joints
 - Reduces the amount of hand injuries
- Less Labor Intensive
 - Less spoils to shovel and contain
 - Pipe is moved and loaded using a skid steer
 - Tooling

Advantages of Sonic Drilling

- Provides longer, larger, better continuous core samples for observation/logging
- Reduction in time spent drilling vs Hollow stem auger, wet rotary techniques
- **Reduces the possibility of cross contamination**
- Provides cleaner and more effective wells by building wells inside the casing and elimination of heaving sands/collapse of borehole
- Use of telescoping method instead of setting permanent surface casings reduces costs
- **Reduces the drill cuttings by 50-70%**
- **Reduces disposal costs of drill cuttings on environmental projects**
- **Fully cased holes for installation of Geothermal loops**

Advantages of Sonic Drilling

- Reduced decontamination time and well development time
- Various Applications
- Although the technology is expensive, the reduction of drill time and reduced spoil disposal generally make this technology cost competitive with other drilling technologies.
- Use of ATV units allow access to remote locations

Disadvantages of Sonic Drilling

- **Expensive start up and maintenance cost.**
- Requires a water source for most sites.
- Limited use on setting permanent surface casing.
- Requires a relatively large work footprint.
- Reduction in soil cuttings return may require soil sampling for water well installation.
- Replacement of sonic rig parts may not be readily available.
- **Drill casing failure.**

How does Sonic Drilling compare to Direct Push?

































