Drill Bits

MAGAZINE OF THE NATIONAL DRILLING ASSOCIATION

SPRING 2013

Environmental Drilling in Maine

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Findlay, OH
Permit No. 163

DRILL BITS **SPRING 2013**
THE OFFICIAL MAGAZINE OF THE NATIONAL DRILLING ASSOCIATION

Drill Bits magazine is published by the National Drilling Association. Members of the National Drilling Association receive complimentary copies as part of their membership benefits.

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FEATURES

IN EVERY ISSUE

About the Cover

The Summit Geoengineerng Services drilling crew braved the frigid Main winter to obtain environmental samples. See article on page 8.

Sample Collection Comparison for Environmental Drilling

This article summarizes sampling recovery observations between the uses of 2-inch diameter direct push soil liners, 2-inch diameter geotechnical SPT split-spoon samplers (split spoons), and use of 3.5-inch diameter direct push tooling with a concrete punch sample collection. The project consists of an environmental remediation site located in southern Maine. Soil explorations were performed to evaluate the presence of PCB's with soils containing mixtures of sand-silt (fill) with occasional gravel and cobbles mixed with brick and concrete debris. Groundwater was not present within the explorations performed.

An initial investigation was performed by another direct push rig with 2.5-inch diameter casing and 2-inch diameter soil liners 5 feet in length. A total of 16 explorations were performed to an average depth of 10 feet below ground surface (bgs). Occasional refusal depth less than 10 feet bgs was encountered within concrete rubble and/or cobbles. Sample recovery averaged 12 inches and ranged from 6 to 18 inches per 5-foot sample interval. The 2-inch direct push tooling resulted in an average sample recovery of approximately 20 percent. Due to the limited data obtained during the initial investigation, alternative methods were considered to efficiently obtain better sample recovery for the subsurface site investigation.

The following investigation was performed by SUMMIT GEOENGINEERING SERVICES with an AMS PowerProbe™ direct push rig using a 140 lb auto-drop hammer and 2-inch outside-diameter geotechnical California-modified SPT split-spoons with 6-inch waste barrel extensions. Recovery using SPT split spoons obtained an average recovery of 18 inches and ranged from 12 to 24 inches per 2-foot sample interval. The 2-inch SPT split spoons resulted in an average sample recovery of approximately 75 percent. A total of 23 explorations were performed using SPT split spoon sampling to a depth of 10 to 17 feet bgs. While the SPT split spoons were obtaining better sample recovery, damage to split-spoon tips and occasional refusal on brick, concrete, or other debris still limited penetration depth.

A change in exploration method was made to switch to an AMS 3.5-inch diameter concrete punch 22-inches in length with 3.5-inch diameter direct push casing to obtain continuous samples at 2-foot intervals. A total of 13 explorations were performed to a depth of approximately 12 to 16 feet bgs using the large diameter direct push casing with concrete punch sampling. The method worked efficiently as the boreholes remained open and the samples remained collected within the concrete punch upon retrieval. Sample recovery ranged from 20 to 24 inches averaging approximately 90 percent. Some of the samples contained almost 24 inches of brick rubble fill which earlier would have resulting in SPT refusal or plugging of the 2-inch diameter direct push liners. The sample size collected was significantly larger at over 3 inches in diameter. This method enabled the collection of samples beneath buried foundations and samples to test the concrete and brick debris for PCB's.

In summary, it was observed that the 5-foot length of the 2-inch direct push liners would limit sample collection due to potential plugging from gravel or pushing of debris such as brick, concrete, cobbles, or large gravel during advancement. The use of an auto-drop hammer with geotechnical SPT split spoons did improve

sample recovery however was still limited where performed in dense rubble resulting in damaged spoon tips or penetration refusal. The use of the concrete punch with direct push casing permitted percussion/cutting of the rubble debris and collection or the sample within the punch upon advancement. The concrete punch method resulted in much greater sampling recovery and size for the rubble fill and improved exploration advancement depth through dense layers which earlier would have resulting in exploration refusal.

Use of a concrete punch with direct push tooling may be considered useful for the following exploration conditions:

Collection of larger diameter soil samples within fills containing rubble fill such as brick, concrete, small cobbles and/or large gravel or similar for geotechnical and/or environmental exploration work to relatively shallow depths above groundwater and/or above

caving or heaving soil conditions.

Collection of large diameter samples beneath concrete or bituminous pavement sections, particularly for the collection of laboratory gradation analysis, min/maximum density testing, California bearing ratio, or similar tests where larger sample sizes are required.

Surface sampling through frost, pavement, or similar dense strata and/or advancement through a dense substrate layer for subsequent performance of conventional direct push or geotechnical SPT boring exploration work.

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