



# Overcoming Direct Push Refusal

If you regularly use direct push technology (DPT) for high-resolution site characterization (HRSC) efforts, there is a very good chance you've experienced DPT refusal. Although frustrating, there are often solutions to overcoming refusal and completing data collection for your conceptual site model (CSM). Every DPT refusal scenario is different, which is why environmental consultants must understand the different types of refusals, options for overcoming them and when to consider hybrid drilling options.

## TYPES OF DPT REFUSAL

There are four common types of DPT refusal: tip resistance, sleeve friction, operator error and subsurface heterogeneity.

The first, tip resistance, may indicate distinct unconsolidated deposits overlying bedrock. You won't be able to advance the DPT tools without destroying them. Another form of tip resistance occurs when cobbles are imbricated near the surface — and you can't get past those either.

Sleeve friction involves interaction with cohesive soils, which can grab the outside of the tool and limit its depth penetration.

The last DPT refusal scenarios can be caused by either operator error or subsurface heterogeneities. In either case, you'll notice that when pushing the drill head, there's very little in the way of penetration. If the probe gets off course in the first 5 to 10 feet, it will follow that course until you lose the ability to advance the tool. If you attempt to continue, you will most likely snap it off.

## OPTIONS FOR OVERCOMING REFUSAL

Refusal means you've hit a roadblock, but it does not necessarily mean you need to give up on DPT. The first option may seem obvious: move locations. It is surprising how frequently this simple change makes all the difference. In cases of operator error or subsurface heterogeneity, when the probe begins to veer off course, moving



Contractors can overcome DPT refusal, but solutions can introduce safety concerns that may not have been previously planned for. Source: Cascade Environmental photos

your drill location even a short distance can give you a better start to the hole to try again. For obvious reasons, this is the most cost-effective solution to DPT refusal and is often successful.

The second potential solution is to select a larger DPT unit. If you initially used a small DPT rig, now is the time to bring out one of the big guys. Depending on the nature and depth of the resistance, sometimes a little extra power is all it takes. This needs to be managed though. Sometimes the bigger hammer ends up with many bent nails.

The third option to consider is hybrid drilling. This option takes considerably more pre-planning than the others, as the team must determine how holes will be advanced, how rigs will be switched on and

off, etc. Due to the multiple rigs and crews on site, these are expensive field events. They really must be orchestrated in advance to ensure there is no overspend and that adequate safety measures are in place. The most common DPT hybrid drilling combinations are with hollow-stem auger (HSA), sonic and rotary drilling methods.

## HYBRID DRILLING OPTIONS

When it becomes clear that DPT is unable to advance to the termination depth, the first option should be utilizing accessories on the machine that is already on site. For example, the majority of Geoprobe 6610 series and higher have rotary options available. HSA, fluid rotary, air rotary and casing advancement methods are all compatible with these

rigs, and can be used with direct sensing tools. On the downside, you are typically limited to depths of around 100 feet (though, I would note that significantly greater depths have been achieved).

Sonic is another hybrid option worth considering. When combining sonic with DPT, we run the sonic rig to advance casing and collect soil cores, then drop the direct sensing probes into that casing. This is the most dependable casing advancement method available, because very little can stop sonic drill advancement. Another benefit is sonic's extreme versatility, with multiple platforms available from a mini to full-size truck mount. However, this approach definitely requires field strategy to plan for the borehole sequences and change management as you move on.

Rotary is a useful technology to combine with DPT, as it is often successful to extreme depths — we've achieved depths greater than 600 feet using mud rotary casing advancement with WaterlooAPS. Depending on the formations present, rotary can be the most suitable hybrid option for DPT refusal, but it often requires retrofitting a rotary rig with Geoprobe hammers for implementation.

### OTHER TECHNIQUES

There are cases of refusal that might require using other techniques altogether, such as the sonic vertical groundwater profiler. With this, the sonic casing advances as normal, but then the soil core barrel is removed and the rods are fitted with the profiler tip. The profiler tip is advanced ahead of the casing to collect a discrete undisturbed sample.

Another technique utilizes the packer isolation sampler, which works in a similar way. After sonic advancement and soil core removal, the packer assembly is lowered into the casing, which is pulled back to ex-

pose the screen interval. The packer is then inflated, and groundwater can be purged and collected from the interval.

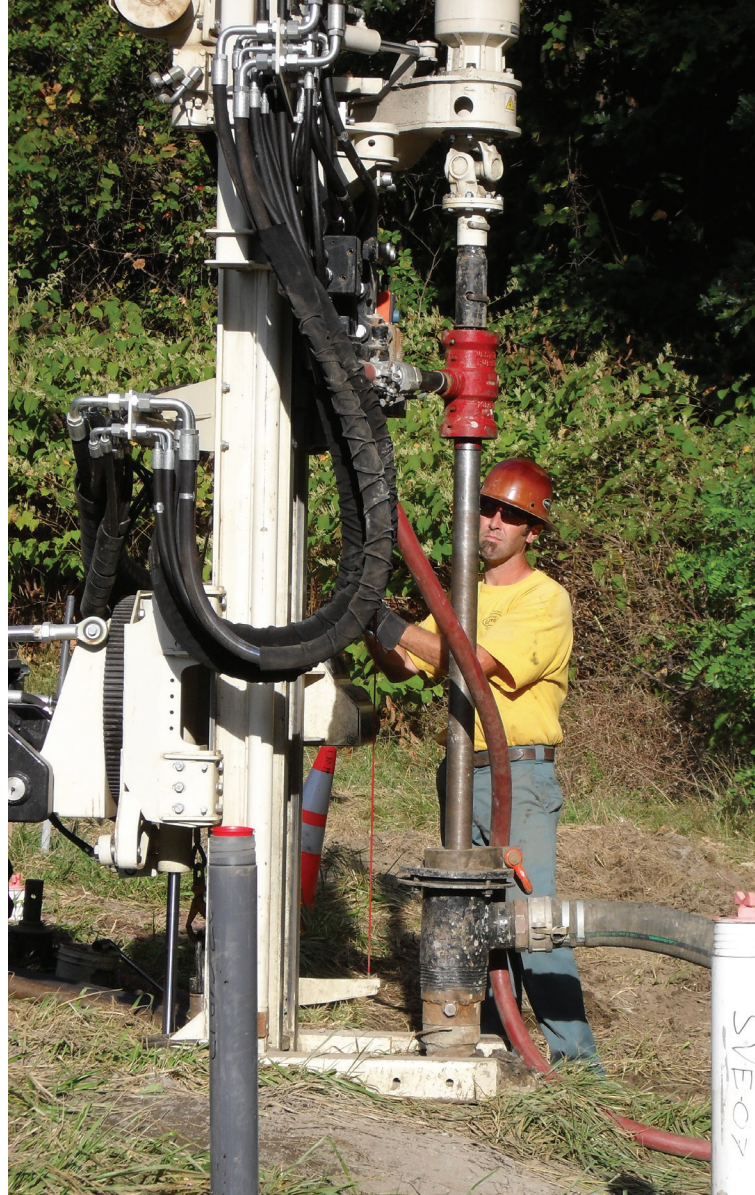
### SAFETY CONCERNS

DPT refusal scenarios can be overcome, but those solutions introduce safety concerns that may not have been previously planned for. Some of the more common scenarios include, but are not limited to:

- Multiple crews on-site with their equipment, all working on the same borehole.
- Tripping in and out of 100 or more feet of drill rod.
- Hazards typically involved with subsurface exploration, multiplied by the number of drilling techniques utilized onsite.

A robust safety program provides a great baseline for managing these hazards. At Cascade, our CORE Corporate Safety Program ensures crews complete projects with strict adherence to health and safety guidelines, including job-specific JSAs, daily tailgate meetings and project management oversight. The impact of these efforts cannot be overstated.

Additionally, a safe and efficient site requires coordination — management strategy is safety strategy. A strategic meeting to map out plans for the site should include a review of existing data, a definition of method(s) and applicability, and how the strategy will shift if conditions change.



Refusals are roadblocks, but they may just require contractors to change their tactics to advance.

In a recent webinar poll, 92 percent of participants said they've experienced DPT refusal — meaning this is a very common challenge. Luckily, refusal can be overcome if you know what methods, tools and techniques are available, and when they should be employed. **ND**

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