STINGER (SHELBY TUBE) SAMPLER

The high cost of conventionally drilled borings in deepwater limits the number of borings that can be drilled, the number of soil samples that can be collected, and the areal coverage for a given project. To remediate the situation, TDI-Brooks has developed and is now offering an innovative and cost-effective tool called the ***Stinger Sampler***. The basic idea behind the deepwater ***Stinger Sampler*** system is to “transport” a Shelby tube down through the seabed to acquire geotechnical-quality core samples down to depths of 20 to 40 m BML, thus nicely complementing the 0-20m continuous JPC soil samples (**Figure 26**).

The economic benefits of quickly acquiring from a modest-cost vessel several high-quality geotechnical soil samples are readily apparent, in that the ***Stinger Sampler*** allows more high-quality data to be acquired for a given budget, and affords more areal coverage compared to the amount of data obtainable from a single, more expensive conventional soil boring. Thus, the ***Stinger Sampler*** helps reduce the overall risks associated with foundation design and installation planning.

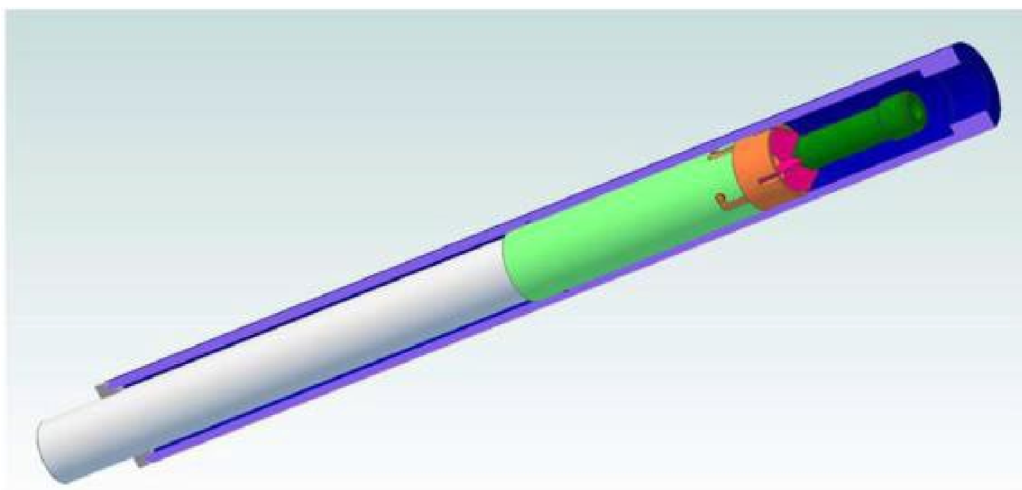

Figure 26) Schematic Illustration Of The TDI-Brooks *Stinger Sampler*

The ***Stinger Sampler*** system consists of various hardware assemblies designed to be fastened together into a working tool that can be safely deployed to the seabed. The deployed tool is comprised of the weight-head assembly, the USBL transponder canister, the barrel assembly, the push rod assembly, the Shelby tube sampling system, the push control module, and the trigger system, as further described below.

- The weight-head assembly is made up of a core head with an inserted flange-barrel and coupling with which to attach 10-ft long barrel sections. The weight of the core head can be adjusted by adding or removing lead ingots.
- A USBL transponder is placed into a canister mounted inside the weight-head for monitoring the deployed tool’s lateral position and depth.
- The barrel set can be assembled to a pre-determined length of up to 21 m.
- The trigger assembly is made up of the trigger arm, pendant clamp, trigger weight, trigger wire, and trigger wire connecting system.
- The push rod assembly can push the Shelby tube sampling system to 20 m more into the soil, down to 40 m BML. The depth reached by the push is controllable so that a sample can be acquired from two or more depths in the formation with subsequent drops

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The ***Stinger Sampler*** operational process is essentially identical to that of the well-proven CPT- Stinger, with the ***Stinger Sampler*** tool deployed using the same existing TDI-Brooks CPT-Stinger safe deployment system.

By simply replacing the PCPT cone of the already mobilized TDI-Brooks CPT-Stinger tool with a Shelby tube soil sampling system, the field crew can quickly and safely convert from PCPT acquisition to soil sampling mode. Same-site CPT data and 3-inch diameter, 2 to 3-ft long Shelby tube samples, each acquired down to as deep as 40 m, can be performed at a rate of several drops per day, as the conversion is safe, quick, and simple. Such samples can also be acquired at any client-specified depth, if a particular formation seen on a sub-bottom profile is desired.

The Shelby tube sampling system is installed at the end of the CPT-Stinger rod in place of the PCPT cone, deployed and triggered near the seabed with the well-proven TDI-Brooks free-fall tool insertion process, and allowed to ballistically insert itself 20 m down into the soil just like a CPT-Stinger.

During ballistic insertion, no soil fills the Shelby tube as it remains protected inside its housing. Once fully embedded 21 m deep into the soil, the reaction force of 22,000+ lb is available to push the Shelby tube sampling system deeper into the formation (exactly like the PCPT cone of the CPT-Stinger) at a push rate of about 2 cm/sec. During this "static" push, soil flows through the Shelby tube and out its top-vents. When the tool push reaches its stop at the pre-set depth, the soil from that depth inside the Shelby tube is captured by valve closure and retained during retrieval in a materially undisturbed state.

During deployment, as the tool nears the seabed during its water column descent, the winch payout speed is slowed and preparations are made for USBL position logging during the instant of release. As the weight is released from the trigger arm, the trigger arm begins to rise with respect to the tool. When the trigger arm has risen through its full travel, the tool is released to free-fall down into the seabed. At this trigger point, the Shelby tube sampling system in its housing will be one or two feet above the seabed.

At the moment of release, the payout of the winch is stopped, thus fixing the length of main-rope out. The pendant will help stop the tool's weight-head so that it barely protrudes from the seabed. After this insertion, the Shelby tube sampling system will be extended from perhaps 21 m starting depth to as much as 20 m deeper into the formation. The rate of penetration is controlled at 2 cm/sec, so up to 15 minutes are allowed for this phase. When the rod push stops, the soil residing in the Shelby tube is a high quality sample from that stop-depth. Once the push is completed, a slow pullout on the winch is begun to immediately close a valve at the top of the Shelby tube, and then to extract the extended push rod and the barrel set from the soil. While still vertical at the sea surface, the push rod automatically retracts back into the barrel, and the tool is then retrieved to the deck. **Figure 27** shows a schematic of the valve that closes at the onset of tool extraction after its stops pushing deep in the soil.

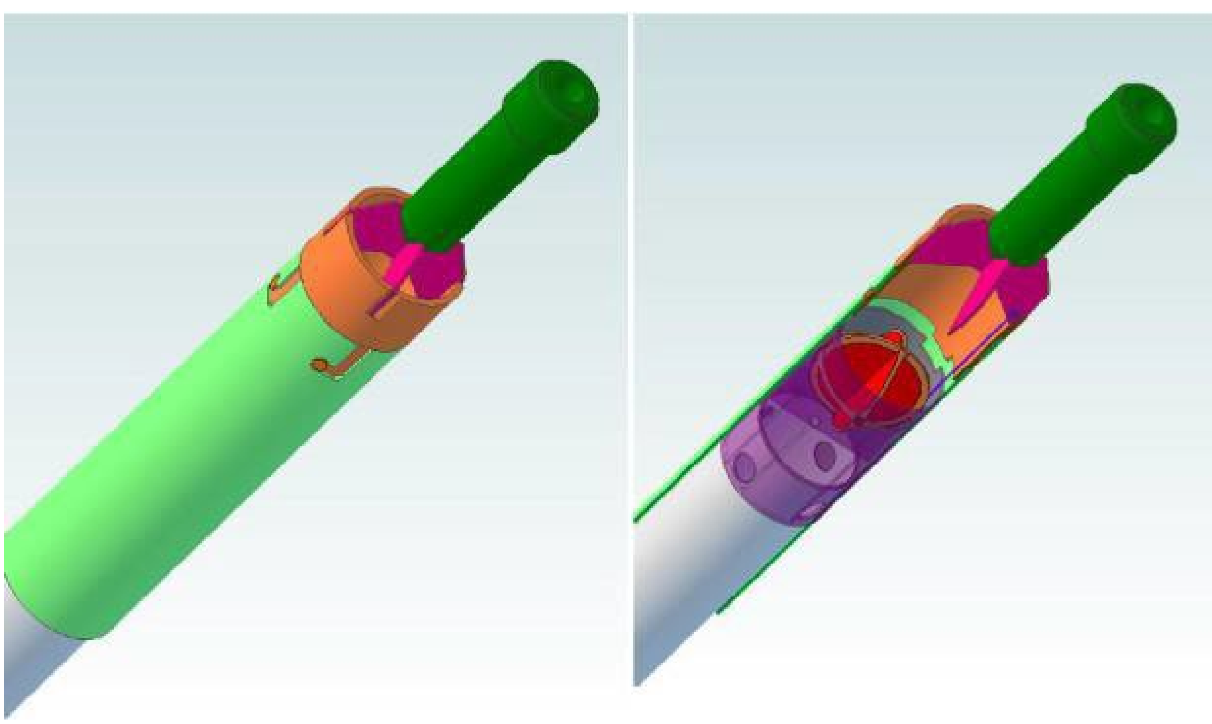

Figure 27) Valve At The Top Of The Stinger Sampler Shelby Tube

After the tool is on deck, the Shelby tube sampling system is removed from the end of the push rod and brought into the lab for processing. The tool's data logger is connected to a laptop computer, and then the raw data file generated from the tool's ballistic insertion is opened for processing the ballistic insertion data into acceleration, velocity, and depth profiles. In this manner, a very accurate and reliable measure is derived of freefall distance in the water and insertion distance in the soil, in an identical fashion as for the CPT-Stinger. **Figure 28** is a photograph of a tool just having acquired an undisturbed soil sample from 40 m depth.

Figure 28) Photo Of The Stinger Sampler Shelby Tube With A Soil Sample From 40 M Depth