

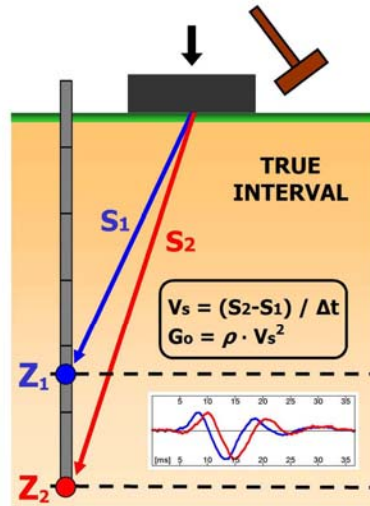
Performing a 400-foot deep Seismic Dilatometer Sounding

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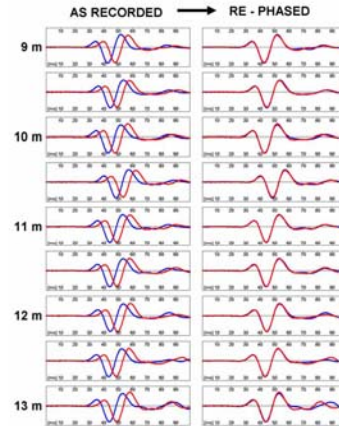
DMT Project Requirements

- Perform DMT at 1 foot depth intervals to 400 feet
 - We convinced the client to perform tests at 20-cm intervals (5 tests per rod) because it would not take much more time to do so and 50% more information would be acquired
- Perform true-interval seismic tests at 1-m depth intervals until shear wave attenuated
- Perform pore pressure dissipation tests
- Obtain “C” readings below the water table

SEISMIC DILATOMETER



SDMT at FUCINO (June 2004)



Direct Push Method

- Impossible to successfully perform to full depth
- Cemented sand layers would cause penetration refusal
- Sounding would be too inclined from vertical
- Would develop high rod friction

Wire-line DMT probe

- A relatively quick method to perform DMT from a drill rig and good for deep soundings
- Not developed for seismic, dissipation test or “C” readings, which were part of the project specifications



DMT Method Used

- Started by performing seismic DMT with direct push rig with 20-ton thrust capacity
 - Used track rig with screw anchors
- Direct push with 20 tons had refusal in a cemented sand layer at 14.0 m
- Removed the rods and DMT probe from the hole and moved out of the way

In-Situ Track Rig with Anchors



Mud Rotary Drilling

- GeoServices Corporation crew setup over the sounding and used mud rotary drilling to drill through the cemented layer
- To keep the hole and drill bit from wandering out of plumb, their bottom 5-foot rod had four steel strips (5/8 inch square stock and 3-foot long) welded to it 90° apart

DMT Torpedo Method

- Changed testing method to the torpedo method
- Dilatometer blade and seismic module were screwed onto a 10-foot long AW rod
 - Used rubber centralizers to try to prevent AW rods from bending
 - We could perform DMT up to the AW rod length
 - We tried longer sections of AW rod (more efficient), but occasionally bent the AW rods
 - Client did not want to pay for bent rods
 - Sacrificed some efficiency to save our money

DMT Torpedo



DMT Torpedo Method (cont.)

- DMT cable was threaded through the AW rod and then exited to outside of the rods
- Used an adapter to NWJ rods
- GeoServices lowered the DMT torpedo and NWJ rods to the bottom of the hole
 - Used 20 foot sections of NWJ rods and a 5-foot long NWJ rod with welded 5/8 square stock (centralizer rod) between the 20-foot sections
 - DMT cable was taped to the outside of the NWJ rods at 10-foot intervals
- At the top of the NWJ rods, an adapter was used to channel the cable back into AW rods

Centralizer



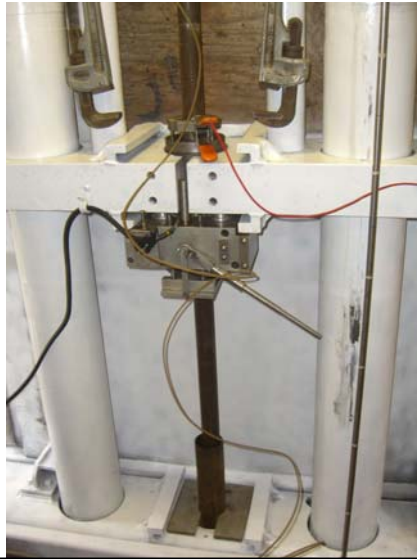
DMT Torpedo Method (cont.)

- GeoServices moved their CME-75 drill rig off of the hole
- Moved In-Situ track rig back exactly over the hole
- Camera was placed inside the hole in the track rig
- Monitor with a cross-hairs was watched as track rig was repositioned over the hole

DMT Torpedo Method (cont.)

- AW rods had the same diameter as the In-Situ direct push rods
- Existing In-situ clamp worked with the AW rods
- Threaded DMT cable through the AW rods
- Lowered BX-casing (3-inch OD) over AW rods to provide lateral support
- Pushed DMT to test depths (20-cm intervals) and performed test

In-Situ Direct Push Clamp



DMT Control Unit and Auxiliary 100 Bar Gauge

Some pressure readings were higher than the standard 60 bar gauge—added a 100 bar gauge



Drilling Equipment

- Selecting the drill rig with the necessary accessories was critical to successful project
 - High capacity Gardner –Denver piston pump
 - 3 different speed/capacity winches
 - Hydraulic Break-out Wrench/Rod Clamp
 - Footing
- Extensive maintenance was performed on drill rig including rebuilding of pumps prior to mobilization

GeoServices CME-75 Drill Rig



Additional Drilling Efficiencies

- Used a three person crew that had combined 70 years of experience
- Used a large mud pit lined with plastic
- Circulated the drilling mud through a desander to keep mud clean
- Used steel saw horses to hold their NWJ rods in 20-foot sections

Mud Pit



NWJ Rods Kept on Steel Saw Horses



Additional Drilling Efficiencies (cont.)

- Used 4 hoisting plugs so that they could simply clip the winch line on rod and were never waiting for the rod to be hoisted
- Used three winch cables
 - 100 feet of rod could be hoisted with light duty but fast winch
 - 100 to 200 feet of rod could be hoisted with the medium duty winch
 - 200 to 400 feet of rod had to be hoisted with the heavy duty but slower winch

Additional Drilling Efficiencies (cont.)

- GeoServices' driller, Ronald Stidham, knew which winch to use when
- At 400 feet, the GeoServices' crew was able to trip either in or out of the hole in about 45 minutes
- Used a reel to keep DMT cable from getting tangled

DMT Cable Reel



Satisfying Conclusions

- Significant planning for a complicated project made the project go smoothly in the field
- Selecting the most suitable equipment enabled the project to be successfully completed
- Working with an experienced driller and crew eliminated many field frustrations