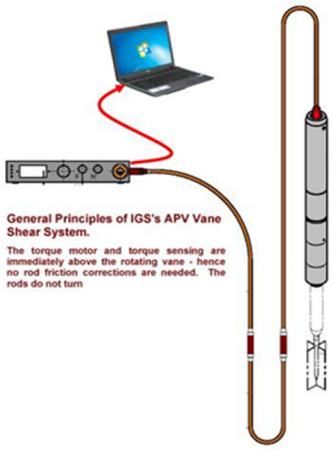
EXPLANATION SHEET DIRECT-PUSH VANE SHEAR

23 February 2021

IGS undertakes Vane Shear Testing by direct-push methods. We have two systems:

- We have two more-or-less conventional, though sophisticated, Vane Shear devices from Geomil in Holland, where the vane is rotated via rods encased in a protective casing to minimise rod friction. Torque is measured by a load cell built into the rotation motor at the top of the rod and casing system. The whole process is driven by a PLC processor to control rotation speed precisely. Torque and rotation angle are auto-logged on a computer. Rod friction (torque loss) is measured by a 12º slip joint so that it can be deducted from the total torque - this is the "classic textbook" Vane Shear system that most geotechnical engineers are familiar with.
- We also have two new state-of-the-art devices from A P Vandenberg in Holland, where the torque motor and measurement transducer is at the bottom of the rods, just above the vane. This eliminates the need for a slip joint or any other form of rod friction correction, as there is no rod friction; it's great; it's nice to use; it's very factual. We prefer to use these on jobs with very soft conditions where friction corrections can "swamp" the vane torque readings, making outcomes less reliable.



On both systems IGS undertakes our own in-house vane torque-cell calibrations. We don't know any others in Australia who do this. We think it's "interesting" that many geo-people habitually use un-calibrated vane testing systems to "correlate" CPT test data. The adjacent photo shows our in-house vane shear calibration set-up.

Re the testing process, AS, ASTM and ISO standards say (my words) to:

(i) slowly (6° per minute) rotate to beyond peak strength; then

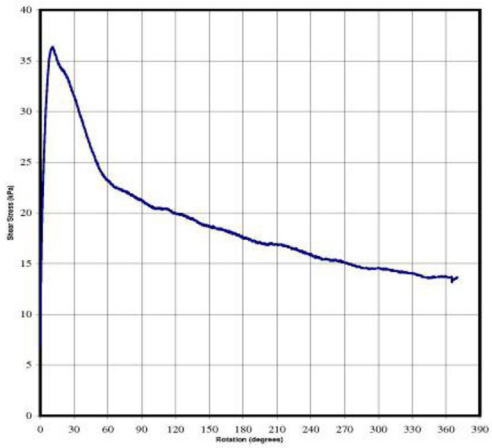
(ii) rapidly rotate several times; then

(iii) continue at the same slow speed until a "uniform residual value" is reached.

At IGS we have seen hundreds, maybe thousands, of vane tests. We observe very often that if the standards are followed, nothing close to a "uniform residual value" evolves. Values typically rise after the fast rotations then bounce or jag up &down; seldom is a nice uniform residual achieved.

Others may differ, but we sense that it's the speed changes that cause this. Others may differ again, but we think the only reason for the rapid rotations specified in the standards is to try/perceive to save time and hence save $.

At IGS we have made many recent tests by simply continuing the vane rotations at a single constant speed until a nice steady "uniform residual value" is reached or approached. This seems to work very much better than following the standards - see the adjacent example plot.



As can be seen on the adjacent test plot, by following the above method, the data makes sense - a peak is passed - a residual is achieved or approached, and frankly it really doesn't take any (or much) more time overall. It normally takes about 360º of total rotation to achieve this or to asymptote to it. Note that a properly done Vane Shear Test takes 40-60 minutes to complete, by whatever method.

As our client, it's your choice of course, every time, but our experience indicates that the above is a better way to make a vane shear test. Since late 2014, when we first alerted clients, IGS has made this our default Vane Shear Test method unless instructed otherwise by our client. So far very few clients have requested we revert to the standards.