

## PHILOSOPHY OF IGS VANE CORRECTION FACTORS – POLICY AND CALCULATIONS

### 1 Friction Offset

There is a small amount of friction in any system. In IGS' vane shear testing system friction comes from two sources:

- a) Rod Friction – We minimise this by “hanging” the rods from a small roller thrust bearing at the top of the system. The rods spin very freely in the bearing and thus friction is relatively low – as low as we can reasonably make it. This friction source depends to large extent on the weight of rods hanging from the bearing – ie on the test depth.
- b) Friction in the rotation drive and torque measuring system. This is tiny, probably negligible, but is taken into account by the following method.

We quantify the total friction in the system by running dummy tests with just rods hanging inside the casing. The dummy tests have been run at varying depths and the relationship shown for Friction Offset in the attached graph has been rationalised.

### 2 Correction For Rod in Soil

The vane, of whatever dimensions, is pushed out into the soil below the casing by a 16mm diameter steel rod. This short length of 16mm rod attracts a small amount of torque from the rotation system that is detected by the torque measurement device and thus must be accounted for in calculation of shear strength. If ignored this will lead to non-conservative “upper bound” estimates of soil shear strength.

IGS has undertaken trials that show that there is no absolute certainty in correcting for this small amount of torque taken up by rotating the 16mm rod in the soil. In some trials the torque measured was consistent with peak strength, in others residual strength, and in others “maybe somewhere between”.

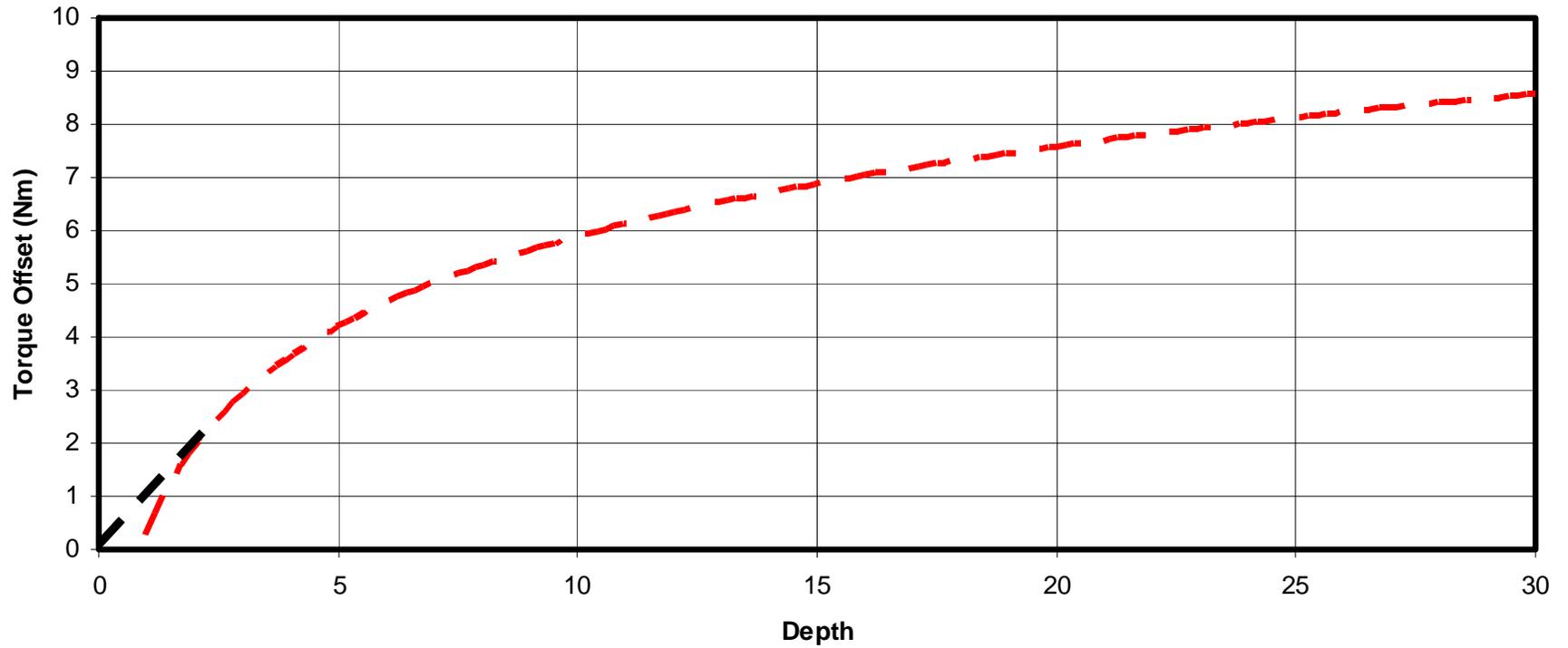
As an error in this correction, no matter how small, will lead to a non-conservative shear strength measurement, IGS has adopted a policy of, unless directed otherwise by a client, assuming that the average shear stress over the small connecting rod is the same as the average shear stress on the vane, at all times. At least this cannot reasonably lead to a non-conservative outcome. This is done simply by adjusting the “Vane Factor” based on slightly increased area, ie including the area of the 16mm extension rod.

The calculation involved is simple, described in summary below:

- The torque required to turn a 1:2 ratio vane with no rod is  $S_u \times (7\pi D^3)/6$ .  
This evolves to uncorrected Vane Factors of (a) 75mm vane = 0.647, (b) 50mm vane = 2.180.
- The torque required to turn a 1:2 ratio vane with a 200mm long 16mm diameter rod is  $S_u \times [(7\pi D^3)/6 + (\pi \times 16 \times 200 \times 8)]$   
This evolves to corrected Vane Factors of (a) 75mm vane = 0.615 – 5% correction, (b) 50mm vane = 1.860 – 15% correction.

**SHOULD ANY CLIENT PREFER US TO TAKE A DIFFERENT APPROACH TO THIS CORRECTION, IGS WILL BE HAPPY TO COMPLY**

## Vane Shear Torque Offsets



**New Vane Factors (allowing for 200mm rod)**

**50 x 100 mm vane = 1.860**

**75 x 150 mm vane = 0.615**