Helical Screw Pile Moorings

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Who am I?

- Lecturer in Navigation and Maritime Science at Plymouth University
- We operate Calstock Boatyard – including a fundus containing 54 moorings.
- We operate Tradewind Marine – workboats and helical screw pile mooring systems.
- But principally a grotty yachty, who doesn’t want to pay enough for a mooring, hates parting with money, but if my mooring falls to pieces or hops off down wind and tide will be the first to be yelling about liabilities.....so I have some sympathy with a number of my customers who also fit this annoying profile......
Perspective – my problem.

Moored boats sitting on blocks.

Concrete with poor specific gravity in water - some with an uplift capacity of only 55% of their dry weight.

A lack of production control – I had no idea what the moorings in my fundus consisted of.

Anecdotal non data driven assumptions on mooring capacity (not such a bad thing – never deny experience) – but would be good to properly codify.
Perspective – Engineered, finessed solution

Calculated uplift capacity.

Production control.

Ease of planned maintenance.

Driven by empirical data.

Positional accuracy – no chance of movement.

No heavy machinery requirement (I can fit 30 moorings and the deployment equipment in the back of a transit)

Cost neutral alternative to traditional methodologies.
Perspective – Engineered, finessed solution

Necessity.
Affordability.
Security.
Safety.

....................I’ve yet to mention the environment.
The helical screw

Hoyt and Clemence (1989) and A B Chance produced a simple and elegant relationship that relates the ultimate capacity of the pile (Qu) to the final installation torque (T).

The final installation torque is defined as the torque measured over the last one meter of installation depth.

\[ Q_u = K_1 \times T \]

Rather usefully Hoyt and Clements / AB CHance work was based on uplift / tension capacities, rather than compression. Although they are generally regarded as comparable. Their empirical testing was based on 91 trial installations.
The helical screw - $Q_u = K_t \times T$

“This equation has been proven to be a very reliable predictor of pile/anchor capacity, especially for piles with a shaft diameter less than 150mm”. (ABC Anchors)

A Torque Factor ($K_t$) of 30 for piles less than 150mm shaft diameter has proven a reliable constant in numerous empirical tests....although this can vary depending on substrate.
....so what does this mean.

If I see a torque reading for the final three revolutions of the torque driver of 3kNm...we can calculate an uplift capacity of....

9,177.45 kg
The last two moorings in Cawsand Bay....

2.2 kNm over the final three revolutions therefore uplift capacity of 6730.13 kg
...so what size boat can we put on that....

Work continues....

Wind coefficients

Wave coefficients

Effect of current (slip of a boat)

Data collection – remote load cell recorders on a variety of vessel types
Thankyou....

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