Helical Strakes: Fin Alignment

A fundamental issue for helical strakes, which consist of fins that are placed on a tubular in a helical fashion, is the need to align the fins of adjacent strake sections. This note presents data illustrating that the performance impact of fin misalignment is generally quite small.

Helical strakes typically consist of three fins on a cross section (called "triple-start") that wrap helically around the surface of a cylinder. Since helical strakes are made of short sections, for all but the smallest diameters, each fin makes only a fraction of a wrap around the shell circumference. Some manufacturers require that the fins on adjacent helical strakes line up so that the fins are near-continuous along the length of the cylinder.

To accurately understand and model the effects of helical strake fin alignment, VIV Solutions team members performed VIV tests of a long tubular in sheared flow at prototype Reynolds numbers with mode numbers greater than 15. The nearly 100-foot long pipe section was towed in a circular basin around a center pivot point, therefore allowing the outer portion to experience the highest flow speeds (mimicking stronger ocean currents near the top of the water column).

Two biaxial accelerometers were scientifically placed at the anti-node locations near the inner and outer ends of the pipe to measure peak vibrations. Acceleration data points incorporate both displacement and frequency information, hence they most closely represent the fatigue-inducing bending stresses associated with VIV.

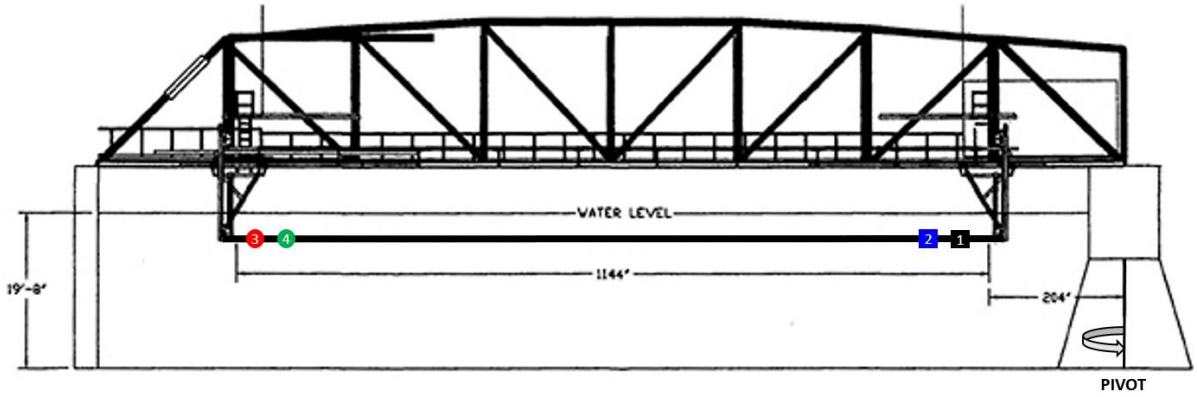

Figure 1 – Rotating Arm Diagram

The figure below shows the acceleration results for the bare cylinder (without helical strakes present). Accelerometers 1 and 2 measured the peak accelerations near the inner end while accelerometers 3 and 4 measured the peak accelerometers near the outer end. The results indicate that as the Reynolds number (which was proportional to the current speed) increased, the accelerations increased almost linearly. Nearly the same level of vibration was observed at both ends of the test cylinder, revealing that there was a fairly low level of damping affecting the vibration.

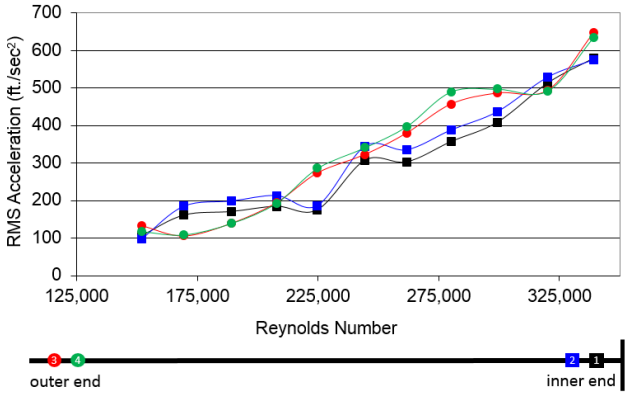

Figure 2 – Bare Pipe Accelerations

In practice, most helical strakes are made in short segments about 5-6 feet in length. Usually it is quite simple to line up adjacent strake sections by visually checking the fin alignment from one strake body to the next; however, there are some instances when lining up adjacent sections may be problematic, such as when the strakes are interrupted by connectors, anodes, or other appurtenances. To examine the importance of fin alignment, an experiment was performed with strake fins glued to the outer 40% of the test cylinder in three different arrangements:

- Condition A - The fins were attached in 15" sections and staggered 60 degrees apart with the worst misalignment possible such that the next strake section started exactly halfway in between the previous strake section (equivalent to a 6D offset, where D is the diameter of the test cylinder);
- Condition B - The fins were attached in 30" sections and 60 degrees apart (essentially a strake that was twice as long as Condition A); and
- Condition C – The fins were attached in a continuous helix.

The photograph below is a close-up of a 15" staggered strake section at maximum misalignment (Condition A). When scaled to larger size, this is equivalent to a 3-ft. strake section on a 12" diameter pipe.

Figure 3 – Intentionally Misaligned Strakes

The figure on the following page presents the results from this experiment using results from an outer end accelerometer (where the vibration is the largest).

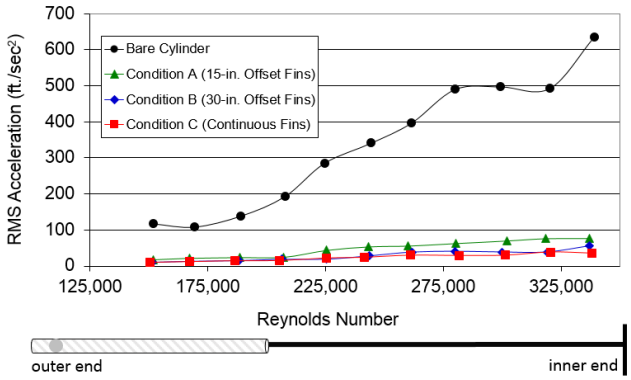

Figure 4 – Straked Pipe Accelerations

While the intentional fin misalignment produced a small degradation in the strake performance, all three alignment configurations were very effective at suppressing VIV. In fact, Condition B (30" offset which is equivalent to a 6-ft. long strake section on a 12" diameter pipe), provided suppression almost exactly equal to that of Condition C with the continuous fin configuration. This was somewhat surprising since the intentional misalignment was so severe. These results illustrate that, while fin alignment is desirable, it may often be unnecessary. This is especially important if installation time is a factor, especially in terms of the cost associated with offshore operations.

VIV Solutions' helical strake products are well tested and field proven for over two decades. VIV Solutions standard helical strakes have been used on scores of tubulars and have provided reliable performance with a very high suppression efficiency. VIV Solutions can customize the helical strake geometry to optimize the strake drag and suppression efficiency per the customer's requirements.

Contact Information:

Julie Dehne
Director of Business Development
http://www.vivsolutions.com
713-581-2481