Rolling Chocks May Give Comfort—But Not Stability

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To paraphrase *Introduction to Naval Architecture*, it has been the ship designer's unhappy lot through the centuries to try to devise ways of damping the objectionable roll of vessels in a seaway.

Modern technology has provided a range of roll-damping options, including active and passive ballast tanks and gyro-activated fins, but most fishing vessels still rely on one of three traditional, passive, low-tech roll-stabilizing systems.

Steadying sails have long been used on motorized fishing vessels all over the world. "Flopperstoppers" or paravane stabilizers, familiar to most West Coast fishermen, work well underway and fairly well at anchor, but are noisy, difficult, and sometimes dangerous to handle, and may be impractical around nets or lines in the water.

Bilge keels, or "rolling chocks," the long, rigid fins that protrude from the chines of most ships and larger fishing vessels, are increasingly being designed or retrofitted onto smaller vessels. Effectiveness varies, depending on design and hull type; but a growing number of owners are specifying them on the understanding that they can make a significant improvement in a boat's comfort level.

How much improvement? It's hard to quantify. Little controlled testing of bilge keel effectiveness has been done, and results have not been published outside specialized engineering journals. I surveyed designers and builders on both coasts and none could refer me to published performance data. Some naval architects don't believe they are very effective at all, or cite roll magnitude reduction of only 10%, but other designers and builders report reduction of 30% to 50%. Some boatyards are doing a brisk business retrofitting bilge keels for owners who have observed improved characteristics on other vessels.

Success seems to depend on at least three factors: the characteristics of the hull, the size of the keels, and their exact positioning.

Bilge keels work primarily by absorbing roll energy through the viscous-eddy effect. As a boat rolls, the chine area swings in a large arc, passing quickly through a volume of water. The bilge keel interrupts that flow of water around the chine, and a low-pressure eddy behind the fin absorbs energy of motion. The damping effect is velocity-sensitive, like a shock absorber; the faster the boat tries to roll, the stronger the damping effect. Hard-chine boats and others with high initial stability benefit less from bilge keels than do round or soft chine hulls, because the harshness of the hard chine edge creates its own turbulence and damping effect.

Obviously, the greater the total area of the keels the more roll resistance they provide. They can be made fairly long—half the length of the boat or more, depending on the curve of the hull. However, they should extend forward only to the point where they start converging due the curve of the bow; any more and they would add drag when underway. Besides, they would be ineffective if they were to come out of the water when the boat pitches.

Commonly they are only eight inches or so in width to avoid extending beyond the "envelope" of the hull, where they could be damaged by a trailer, carriage, or at the dock. If the keel is positioned down at the turn of the bilge, and is placed perpendicular to the surface of the hull at that point, it can be made longer without extending far enough to attract damage. Some yards put bilge keels as wide as 16 to 18 inches on a 60-foot hull.

The trick is to place the keels such that they are within the water flow streamlines of the hull so they produce minimal drag. This can be a problem if the boat operates over a wide range of speeds, as do most semi-displacement hulls, because the streamlines change with speed. Some engineers place rolling chocks high on the chines to produce a little lift, and they claim they work best when underway. But the more widely held view seems to be that they should be positioned lower and at a 45° downward angle, which precludes any lift effect. If correctly positioned they work quite well at anchor, and even better underway.

There is a drag penalty for chocks, and it's there whether you need the roll control or not. But the increase in fuel consumption is estimated at less than 10%.

How to position them in the streamline? Well, you can pay a naval architect a couple grand to study the hull and draw up a set of plans, or you can eyeball it. Most people, including some successful boatyards, just eyeball it.

The fins should taper at both ends (rather than start and end with sharp corners) and should have a rounded or flat outer edge rather than a knife edge, to avoid damage to and by fishing gear and other obstacles in the water. On metal boats the keels are essentially just metal plate edge-welded to a sacrificial doubler plate welded to the hull, with pipe or half-round welded to the outer edge for safety and rigidity, and possibly with a few braces or stiffeners. On fiberglass hulls, the yard can use a molded piece, shaped in cross section like a V, which is laminated to the outside of the hull.

The layup is about five inches wide at the base, tapering to two inches at the outer edge. Or, a foam board mandrel can be glued to the hull, which is then encased and laminated to the hull with multiple layers of matt, cloth, and resin. Some yards that use hollow molded pieces fill the interior with liquid resin, which hardens and provides a stiffer, stronger fin.

The keels should be attached only to the exterior surface of the hull, not through-bolted, so that they will collapse or shear off without opening the hull if they hit something.

Because bilge keels or rolling chocks reduce the roll amplitude, it's tempting to think that they increase vessel stability. Not true. They make a boat more comfortable, but not safer. If your boat seems excessively tender, chocks could make it more sea-kindly, but you should spring for a stability test to ensure that it won't some day roll all the way over. ❖