PHOTO: BOB HOFFMAN

Upgrading a Cable Railing

Coastal conditions call for extra steps to fight corrosion

by Steve Sherritt

With 12 months of sunshine and plenty of coastline builds, southern California is an amazing place to be a deck builder. Here, our San Diego–based company specializes in composite and hardwood hillside and rooftop decks. To maximize the ocean views, we usually install stainless steel cable railings on our decks, but these views often come with a price: harsh exposure to salt and UV rays. This environment can challenge even the toughest deck and railing materials to survive.

We started installing cable railings in 2003 and have found them to be a wonderful, low-maintenance choice for coastal decks, as long as they're built with quality materials and installed properly. When railings are installed improperly, however, the results can be disappointing and, at times, downright dangerous. On more than a few deck-remodeling jobs, we've found railings with slacked cables and corroded parts. In most cases, these issues—which are unfortunately common at the beach, where quality should come first—have been caused by installation errors.

A recent upgrade of a cable railing during a deck-remodeling project in La Jolla provides a good case study. The deck and railing itself were less than a year old, so some of what we found was quite surprising considering the deck's short lifespan. But like many cable railing systems that we've encountered, this one wasn't designed and engineered to withstand lateral and tension loads or to meet building codes designed to keep users safe. And this particular property is located only a couple of blocks from the beach, where materials are exposed to corrosive salt air.

Cable Railings Need Strong Posts

Even experienced contractors often underestimate how much tension is actually applied to the posts in a cable-style railing. One of the biggest design flaws on this project was the use of undersized, 1½-inch thin-walled square stainless steel tube for the upright posts, which were fitted with small stainless steel pegs welded to the post tops for a standoff aesthetic. A thin piece of stainless flat bar connected the tops of all the post members and supported a thin ipe top rail. Under the cable tension, the pegs bent badly, allowing the ipe top rail to droop and warp. The cables then slackened because the flat bar and ¾-inch-by-3-inch ipe cap rail weren't rigid enough to provide lateral stability or tension resistance (**Figure 1**).

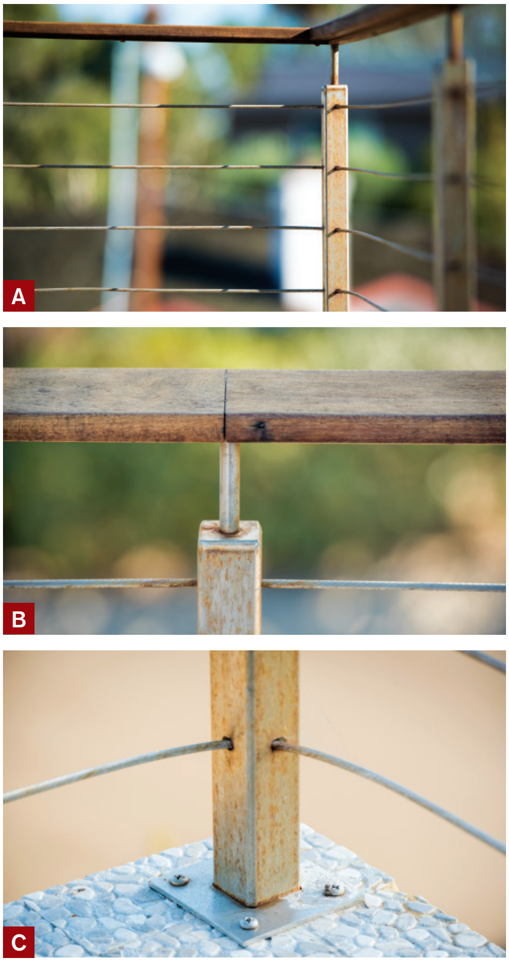

Figure 1. Though less than a year old, the existing T304 stainless steel railing was starting to corrode because of its proximity to the beach (A). The posts and top rail assembly were undersized (B). The base plates were also undersized, and fastened to the deck with screws, some of which had sheared off (C).

Figure 2. The replacement posts were fabricated from T316 marine-grade stainless steel 2-inch tube with a powder-coat finish (A). Solid $1\frac{1}{2}$-inch-by-$\frac{3}{8}$-inch flat bar was used for the intermediate posts (B). The posts have hefty 4-inch-by-5-inch base plates, which were fastened to the deck framing with 4-inch-long, $\frac{3}{8}$-inch-diameter lag screws (C).

When I first inspected the railing, I was able to shake it back and forth with little effort, and I was certain I could break it free from the deck if I tried hard enough. That's because the posts were fitted with small, $2\frac{1}{2}$-inch square base plates that were attached to the deck with screws instead of lag bolts, providing a poor connection to the deck surface and little in the way of lateral support. When we removed the existing railings, we found that many of the screws had sheared off.

While the railing frame was built with stainless steel, a material that should last 30 years on the coast, the wrong grade was used to fabricate it. According to the owners, corrosion began almost immediately upon completion of the deck construction. No protective coating had been applied to the post members, and the railings had never been cleaned or oiled. When we inspected the railing, all the posts, cables, and fasteners exhibited some degree of corrosion.

Standard T304 stainless steel posts should be fine in noncoastal areas (though lately I have noticed quality problems with some imported stainless steel components and fittings). But for extra protection from the coastal elements, we typically recommend T316 marine-grade stainless steel posts with a powder-coated finish, an upgrade that adds between 5% and 10% to the materials cost of the project.

An engineered system. The railing on this project was supplied by San Diego Cable Railings (sandiegocablerailings.com), a local vendor that also provides cable railing systems to contractors nationwide. SDCR offers quite a few post options in terms of appearance, but most

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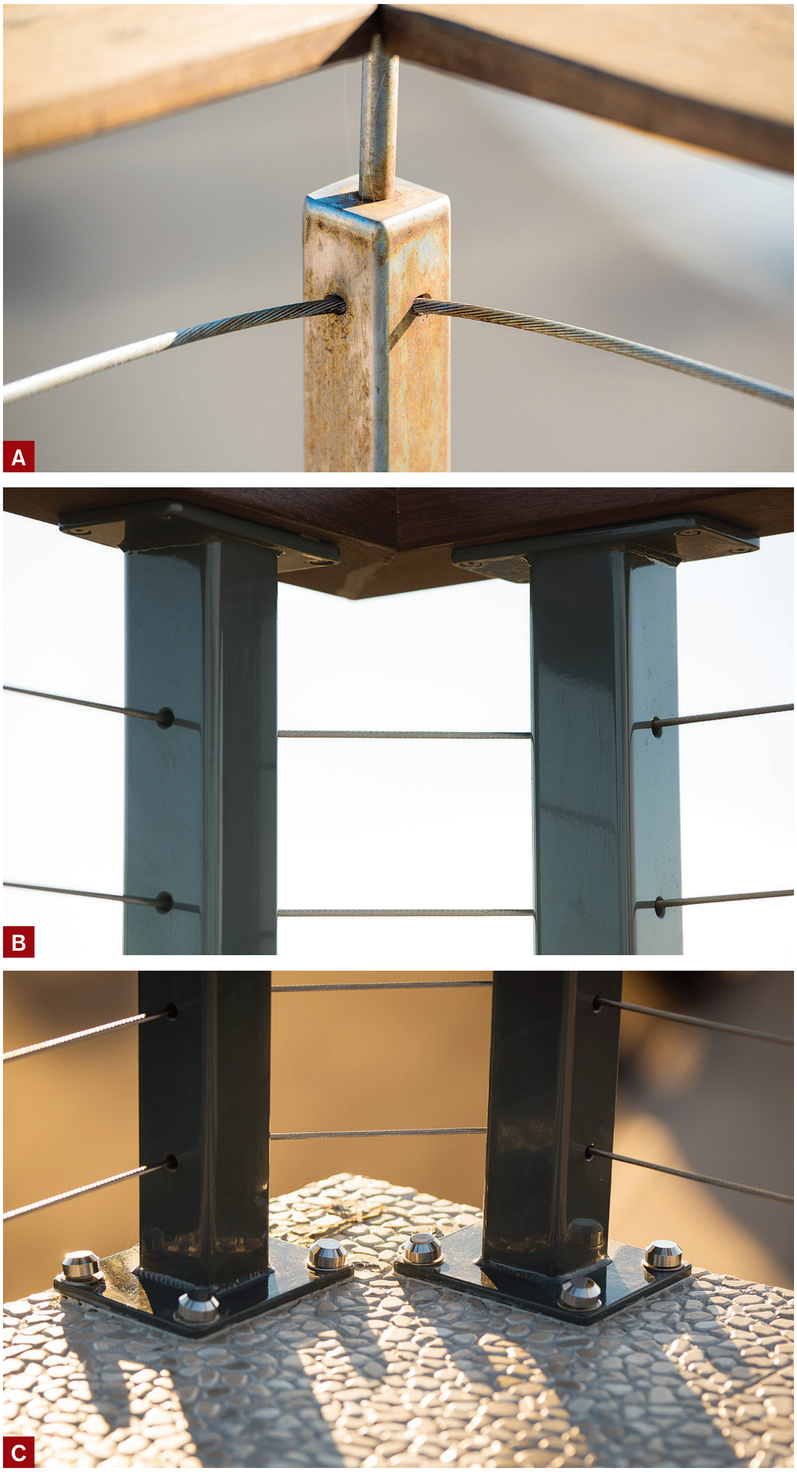

Figure 3. Besides being undersized, the original, single-corner posts required a sharp bend in the cable, which prevented proper tensioning (A). The author prefers double corner posts, which offer a more gradual bend for the cable and a more secure corner attachment for the ipe top rail (B). The posts are equidistant and located a minimum of 4 inches from their centers to the corner, which creates a soft, 45-degree cable bend at each post (C).

importantly, the railing posts and connection details are engineered to sustain cable tension and resist lateral loads. Having an engineering report in hand makes the permitting process much easier and is a huge bonus during inspections.

SDCR railing posts come pre-drilled and pre-finished, complete with hardware and fasteners, step-by-step installation instructions, blocking recommendations, and tech support. It typically takes about three weeks lead time from the time the rails are ordered to the time that they are shipped.

The new railing consists of T316 stainless steel 2-inch square posts and $1\frac{1}{2}$-inch-by-$\frac{3}{8}$-inch stainless steel flat-bar intermediate posts (**Figure 2**). We used the heavier, 2-inch posts at the ends and at the corners and alternated the sleeker, flat-bar posts between in order to expand the viewing windows. The maximum spacing—4 feet on-center—we used for the railing posts is a common requirement for cable railing.

The 2-inch square posts have welded 4-inch-by-5-inch base plates, which we fastened to the deck framing with four 4-inch by $\frac{3}{8}$-inch-diameter stainless steel lag bolts per post. Post installation is simple, thanks to the large base plates and the fact that the bolt holes are located farther away from the vertical post. This makes it easy to drill pilot holes with the posts in place, and then drive the lag bolts in with a small impact driver. The resulting rail system feels sturdy and extremely rigid, even before being connected together with the top rail.

Double corner posts. The fabricators of the original railing used single posts at the corners. To do this, they had to drill holes on two walls of the corner posts and run the cable through the posts at a 45-degree angle. But architectural braid 1x19 stainless cable is considered semi-rigid and cannot bend or move at a tight angle inside a small, $1\frac{1}{2}$-inch square tube. As a result, the cables

Figure 4. By upgrading from a $\frac{3}{4}$-inch-thick to a full-2x4 ipe top rail, the author was able to eliminate the metal subrail typically used with aluminum and lighter-gauge stainless steel rail systems.

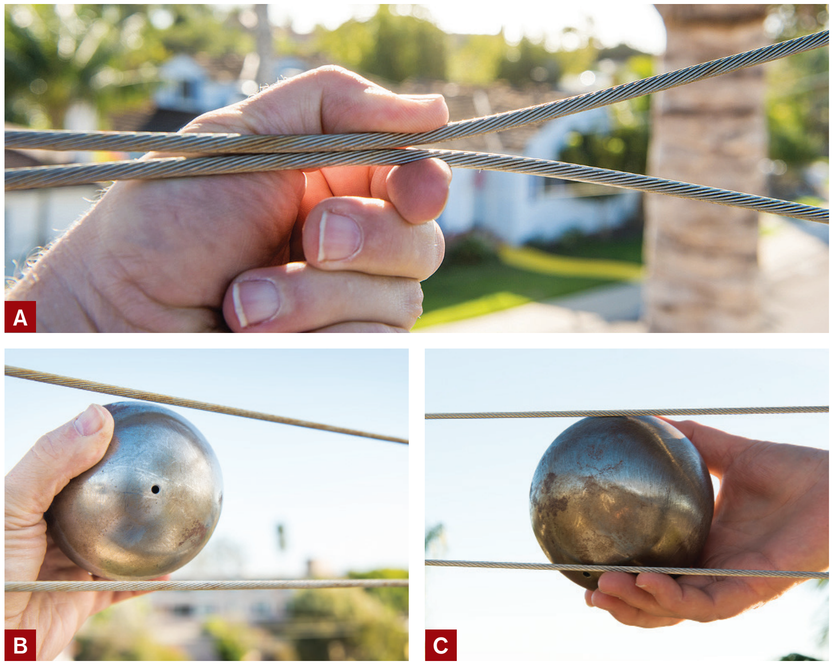

Figure 5. The $\frac{3}{16}$-inch-diameter cables in the original railing had become slack (A), but failed the 4-inch sphere test even when properly tensioned because they were installed 4 inches o.c. (B). For residential decks, the author usually installs $\frac{1}{8}$-inch-diameter cable 3 inches o.c., which easily meets code requirements (C).

became bound at the corner posts, making tensioning impossible and creating extreme tension loads on the corners. Binding at the corners likely contributed to the broken fasteners and standoffs, due to the overloading of certain points on the railings.

We replaced the deck's single corner posts with two posts at each corner (**Figure 3**). Using double corner posts makes it easier to install continuous runs of cable without any binding and offers a cost benefit to clients because it eliminates a number of cable fittings. And mitering top rails at the corners is much easier with two posts because each railing member has its own mounting plate.

Clients sometimes have concerns about the aesthetics, since cable-railing customers often want as few railing members as possible. Usually I can persuade them that slacked cables or shaky railings will be much less attractive than a two-post corner. Unless a designer or engineer specifies otherwise, we always recommend the use of two posts to turn a corner with cable.

Ipe Top Rail

Because our clients were fond of the hardwood look of the original $\frac{3}{4}$-inch-thick ipe top rail, we beefed it up by using stronger, 2x4 stock, which won't warp under tension. The ipe top rail is directly attached to the welded post plate connections via four $1\frac{1}{4}$-inch by #10 SS screws with countersunk heads. Because of the strength of the ipe, there was no need for the continuous steel reinforcing subrail often used with aluminum railings (**Figure 4**).

For solid corners with wood and hardwood top railings, we like to reinforce the joints with biscuits and either TiteBond III waterproof glue (when time permits) or a quick-setting epoxy (if we're in a hurry). When the cables are under tension, they pull inward at the corners; the biscuits prevent any slipping at the joint.

Installing the Cable

The cables used on the original railing were spaced 4 inches apart. This, of course, doesn't allow for any cable deflection, and so the railing couldn't satisfy the building code. Even had we been able to properly tension the cables, they still wouldn't have been able to prevent a 4-inch ball from passing between them. To allow for deflection, we always install cables so that they are spaced no more than 3 inches apart (**Figure 5**).

Another problem with the old rail system was that the diameter of the cables was $\frac{3}{16}$ inch, rather than the slightly lighter gauge, $\frac{1}{8}$-inch-diameter cable most often used on residential projects. Larger cable has less stretch and flexibility than $\frac{1}{8}$-inch cable and requires a more

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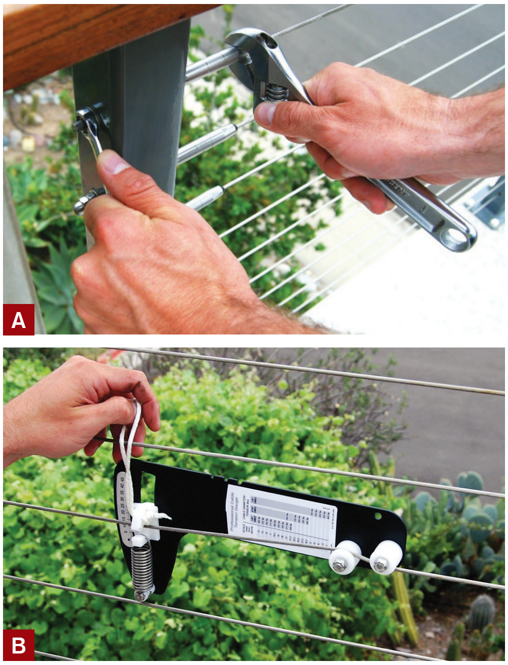

Figure 6. When tightening fittings, the author makes sure to allow enough adjustability so that the tension on the cable can be increased later (A). A tension gauge is used to indicate when the cable is tight enough, typically at 150 to 200 lb. of tension (B).

Figure 7. Routine cleaning and maintenance with a penetrating oil finish is needed to keep the ipe top rail looking good in a marine environment.

rigid frame to achieve proper tension. Meanwhile, the undersized post members in this railing frame weren't even adequately sized for 1/8-inch-diameter cable.

The 1/8-inch T316 stainless cable that we installed had factory-swaged threaded studs at the end of each section. We provide SDCR with the exact dimensions of the deck (this can be done with either a line drawing or a photograph) and it precuts the sections, allowing about a foot of extra cable per section to make it easier to pull it through the railings. Once the section is in place, either a swaged or—our preference—a swageless terminal is installed on the other end.

Most field-installed cable fittings these days are swageless, where the cut cable is inserted into a fitting that works like a finger lock. In our experience, many installers bottom out the fittings during the initial installation and tensioning, so that there isn't enough adjustability for someone to return and tune up the cables later on. Having sufficient—but not too much—"take up" to achieve proper cable tension is key. Typically, we find that cable installed with 150 to 200 lb. of tension will satisfy most inspectors (**Figure 6**).

Finishing Up

On completion of any cable railing installation, we always thoroughly clean the cables and post materials with a high-quality stainless steel cleaner that contains a bit of oil. We also recommend periodic cleaning, which offers extra protection from the elements and keeps the railings looking new.

When installing fittings, we apply a touch of anti-seize grease to the threads to prevent any binding of the tensioning nuts. Lubrication is especially important for coastal cable railings to prevent salt intrusion between the threads.

For finishing ipe, we prefer to use Penofin's hardwood penetrating oil finish (**Figure 7**). We've found that if the wood is kept clean, penetrating oil products can be added as needed (sometimes one to three times a year). Different levels of exposure will require different application rates, but it is a nice brush-on-and-wipe-off product with good longevity.

Typically, four to six weeks after we complete a railing, we return to check the tension and the connections. This allows for material shrinkage and acclimatization in our warm, dry climate. Steel and ipe systems like this don't usually show much tension loss, though wood-framed railings may require multiple tension sessions. ❖

Steve Sherritt is the president of SD Independent Construction, a deck and railing specialist in San Diego, Calif. Prior to that, he was an owner and founder of San Diego Cable Railings.