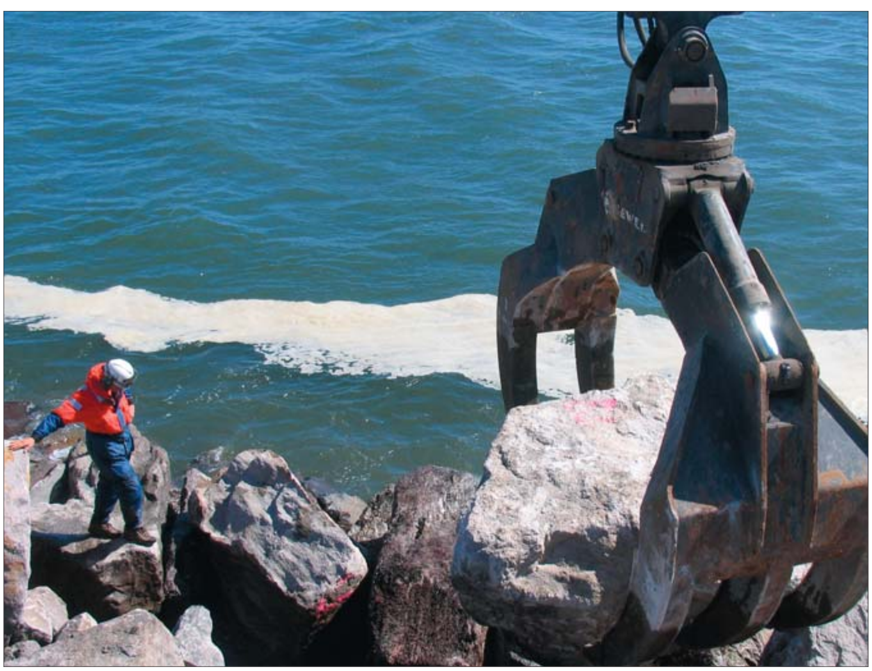
Huge Boulders Require Delicate Placement

Non-traditional approaches expedite Columbia River jetty repair

With almost alarming frequency, nature's fury is played out in daily headlines: a tsunami in southeast Asia, Gulf Coast hurricanes, a devastating earthquake in northern Pakistan, and so on. While not making national headlines, that fury is also being felt on a daily basis on the Washington-Oregon border as massive waves pound—and are damaging—jetty walls at the mouth of the Columbia River. Left unchecked, the damaged jetties would allow the inflow of tremendous volumes of sand into the heavily-traveled channel, impacting shipping routes and upsetting import-export traffic from as far away as South Dakota. Faced with this scenario, the Portland District of the U. S. Army Corps of Engineers has contracted with Tapani Underground, Inc. (www.tapaniunderground.com) to make the repairs necessary to ensure uninterrupted shipping through the channel for decades to come. Tapani has responded with a game plan that calls for movement and placement of nearly 71,000 tons of material, innovative repair approaches, and equally innovative equipment—including a Hitachi EX1200 (www.hitachiconstruction.com) excavator with a Jewell Attachments (www.jewellattachments.com) front end and massive 146-in. grapple—to bring it to bear.

To appreciate the importance of the Columbia River jetties, one has to understand that the channel's problematic nature has been on the radar of the Army Corps since the early 1880s and was first addressed via construction of a stone jetty on the channel's south side in 1884. That structure—currently 6.7 miles long—took ten years to complete at the cost of about $2 million. Effective, more substantial channel depths were sought, so a $5-million, 2.5-mile long north side jetty was added in 1914. Constructed of nearly 12 million tons of boulders, those two structures have been in place since that time and have undergone periodic major repairs, the latest in 1983. According to Nick Massie, Tapani Project Manager, continued degradation of both jetties has made the current project necessary.



Standing at the water's edge, spotters communicate with the excavator operator, telling him where to place the huge boulders.

"Both jetties have taken a pounding over the years," he says. "There are, however, several sections of each structure that the Army Corps identified as being in danger of breaching and those are the areas we are concentrating on at this time as part of the MCR Jetty Interim Repair Project. Not surprisingly, they are in the area where wave activity is generally at its hardest: within the first 8,500 feet from shore."

Anatomy of a Jetty

Jetty walls of the type in place at the Columbia are constructed by placing a bed of rocks into the sand on the ocean floor. Larger boulders, called "core stones," are placed on top of this bed to form the main body of the jetty. Progressively larger boulders are added in layers to form the outer "armor" shell of the structure. The largest of the boulders (some weighing 30 tons to 40 tons each) are placed on the upper part of the structure and toward its seaward

To build a jetty of this type, smaller stones are first placed into a bed of sand, followed by larger core stones.

side where waves and currents are most powerful. Despite their massive weight, the ocean's force can still cause these stones to shift with seemingly little effort—it is this armor stone that Massie's crew is replacing. He says they've chosen to do things a bit differently, both to make best use of available technology and to expedite their efforts.

"Traditionally jetty work of this nature is done using a crane to place each of the boulders, which, according to the job's specs, can range in size from three tons to 20 tons. We proposed to the Corps of Engineers that we would do the placement using an excavator rather than a crane, feeling that an excavator was not only faster and more efficient, but also provided a much better capability for placement of the boulders. Initially, they were apprehensive, but we convinced them that this was the way to go, and we've been proving it with our progress."

At first glance, the repair aspect of the project would appear to be fairly straightforward: boulders are brought to the site, a loader takes each one out to the area being worked upon, and a 245,000-lb Hitachi excavator puts it in place.

"There's actually a lot more that goes into every placement than meets the eye," says Massie. "First of all there is the equipment itself. The EX1200 is fitted with a Jewell front end package that provides us with far greater lifting capacity and reach than any standard boom. That package consists of a 60-ft, two-piece material handling boom—a cambered main section, and a hooked stick for better below-grade reach. The advantage that design offers comes into play with almost every move we make. With a standard 19-ft boom we can pick a 20-ton payload; with our current design we can go 55 ft out, 25 ft down, and still easily pick and place a 15-ton stone."

While the additional reach is invaluable, actual boulder placement is accomplished using a Jewell 146-in. heavy-duty, free-hanging rock grapple. Massie says the positive grip and full 360-degree powered rotation afforded by the grapple, coupled with the down pressure of the base machine itself, is what gives the excavator the distinct advantage over other tools such as cranes.

"With the tools we have in place—including a GPS-driven system to accurately place each boulder within .03 in. of design specs—we can provide a higher quality product to the Army Corps and do it while maintaining a tighter schedule. In fact, in the past, with a crane, the top daily placement total was about 400 tons; the way we are set up now, we've done as much as 1,100 tons a day."

Buying Into Success

While Tapani has been working at an impressive clip, the logistics of the project have really presented the greatest challenges. As was the case with the original construction more than a century ago, finding material for the repair and the means to get that material to the site has been daunting. However, Tapani did what any self-respecting, proactive company would do in a similar situation: it formed its own trucking company and bought its own quarry.

"Supply and demand is the name of the game in this area and that dictates price. As a result, we've had 50 percent increases on some aggregate and, for us, that became unacceptable. So we purchased a quarry in Castle Rock, WA, which now supplies us and others in the area. Similarly, we addressed the issue of finding enough local trucks by starting our own trucking company. We've actually wanted to do this for a while; this job just made it feasible."

It's interesting to note that, despite all the technology brought to bear in the MCR project, Massie cites two individuals as perhaps the most critical element of the overall project.

"Anthony Hicks and Troy Johnson are the operator's spotters. Standing at the water's edge, they are in constant communication with the excavator operator, telling him via radio, what rock they need, which way to turn it, if it needs to be nudged into place, and so on. They are essentially creating a 3-D puzzle of interlocking boulders and, after all is said and done, they call the final shot. Their contribution can't be overstated."

The north jetty was completed in late fall, 2005 and work on the south wall will take place in 2006. GE

Fitting the excavator with a special front end package increased its lifting capacity.