

How to Move Massive Structures Using Hydraulics

By Jeff Spira

Moving massive structures, in the hundreds or thousands of tons range, special methods need to be employed. Specially designed and built hydraulic systems are capable of achieving some amazing results using three techniques, each suitable for different applications. Which to use, depends on a number of factors, but is best illustrated by examining some applications and how those problems were solved.

When offshore drilling rig jackets are built, they're often built on their sides and then dragged onto a barge for transport out to sea where they are positioned, shoved off the barge to float, then gradually flooded as they're tugged into position to settle on their pre-cast sub sea bases. Skidding a huge structure up to 25,000 tons to load it on a barge required the use of re-positionable hydraulic jacks. Most often the structure is just dragged along a row of wide flange steel I-beams.

The hydraulic jacks are positioned by either a latching mechanism engaging a hole in the beam of a gripper mechanism that uses hydraulic pressure to clamp on the beam flanges. One or more jacks can then exert their massive push forces on the structure to move it ahead some distance, usually on the order of 4 feet (1 meter.) Once the jacks are fully extended, the gripper disengages or the advancing load relaxed in the case of a latch, so that the jack can then retract and draw the gripper or latch ahead to re-position itself for another push. This inchworm sequence: clamp, push, unclamp, advance is repeated until the structure is moved the desired distance.

The same method, using wide flanged beams as skidding surface, is used to move drill towers about on offshore drilling rigs. In shipyards where ships are built in sections, this

method can be used to marry sections together, accurately positioning them to be welded together.

An interesting variation on this technique is used on structures that require many movements, such as the Denver Mile High Stadium east stands. A 16 story tall, 5000 ton section was moved back and forth 165 feet to reposition the section to account for the different sizes and shapes of baseball and football fields. In this case the grippers and jacks were permanently attached to mounts in the ground,, while the wide flange jacking beams were attached to the moving structure. The entire structure was floated on water bearings to reduce the friction and allow it to be moved with minimal effort. This was so successful that a restriction on wind speed had to be imposed to prevent the structure from blowing away when floated on the film of water.

Another technique for moving massive loads has been applied in shipyards to move up to 12,000 ton ships about in the yard. A wheeled train with hydraulic jacks is rolled under the blocked up ship, and the ship lifted using the on-board jacks. A hydraulic gripper and jack system can then be used on the rails to inch-worm the ship along the rail tracks. Instead of gripping on a wide flanged beam, the hydraulic clamp actually grips on a standard train rail, so that off-the-shelf commercially produced rail and track can be employed.

When contemplating moving massive structures, it is prudent to think through the moving method before the civil engineering is done so that accommodations can be made to design the site to best accommodate the function. A number of innovative hydraulic solutions are possible, when faced with this daunting task.

Jeff Spira is a mechanical engineering consultant and runs Spira Engineering at <http://www.spiraengineering.com> specializing not only in design and engineering, but also in tooling, design, process design and quality system consulting. He has been acted as project engineer for a number of hydraulic systems used to move massive structures.

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