

NUTS AND BOLTS

THE ENGINEER CORNER

How Much Weight Can Your Boating Ramp Handle?

by Jeff Smith, P.E., Sr. Engineer

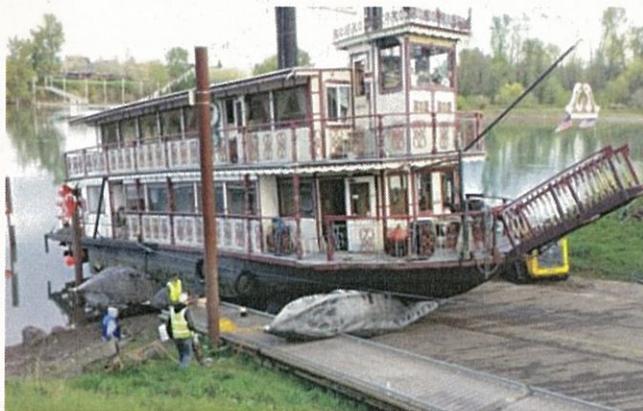
What is the function of a boat ramp? The obvious answer is to launch and retrieve boats. Most people consider a boat to be no larger than what could be easily trailered with a pickup, which is usually 26-feet or smaller. In fact, 95-percent of all boats in the United States are trailered and are 26-feet in length or smaller. Oregon and National Boating Facility Design Standards both use this boat size as the typical recreational trailered boat.

The Marine Board receives occasional requests to use a boat ramp for "non-conventional" purposes. Some recent examples include launch and retrieval of a 100-ton passenger vessel; 75-ton pleasure craft; 35-ton fire boat; loading large spools of electrical cable onto a barge; and offloading 100-ton electrical turbines.

Some boating facility owners will contact the Marine Board to determine if such uses are appropriate, feasible or even allowable. It should be noted that Facility Grant and Maintenance Assistance Grant agreements prohibit commercial use of a facility. But what about incidental or occasional use, such as the examples listed above? These occurrences need to be evaluated

on a case-by-case basis. The Marine Board is concerned about potential damage to boat ramps due to the heavy loads imposed by those types of activities and the down time for recreational boaters to launch.

Our current boat ramp design is intended to handle typical



recreational boating demands and consists of geotextile fabric over graded ground, followed by 12-inches of compacted crushed rock and a 6-inch reinforced concrete slab. It's really nothing more than a slab-on-grade that works very well for the intended use. But even a slab-on-grade has its limits. It's easy to imagine what a heavy load would do to the concrete if it were only an inch or two thick. And even though 6-inches of concrete may seem thick it is still subjected to variable stresses.

But just how much loading can a typical boat ramp handle? To

answer that question we had our boat ramp design analyzed for a maximum working load limit. This is the loading at which we're confident that no damage will occur to a properly maintained boat ramp. Beyond this limit the potential for damage can increase significantly.

To analyze the ramp for load capacity a few assumptions have to be made. First, the strength of the soil that the ramp rests on can vary significantly. But in all cases, the soil is at some point subjected to complete saturation (i.e. when the ramp is underwater). For analysis purposes, the structural code's minimum soil bearing pressure

of 1500 psf (pounds per square foot) were used. Secondly, the compressive strength of the concrete was limited to 4000 psi. Thirdly, the contact area between the tire and ramp was limited to 12 inches by 12 inches (1 square foot). And lastly, heavy loads would be expected to be distributed over multiple axles (in this case two).

There were two conditions to analyze: punching shear and bending stress. Punching shear is the force (weight) it would take to cause the concrete to crack completely through its thickness and fail vertically (like punching a



requirements stated earlier so loading capacity may vary.

For those non-conventional ramp uses, the analysis

provides us with a tool to help determine if the ramp can withstand the anticipated loading without damage. For example, if a vessel and trailer weighs 48 tons (96,000 lbs.) it would require at least 16 tires to adequately distribute the weight. The Marine Board does not encourage the use of public boating facilities for non-conventional purposes.

However, we are willing to help you ask the right questions to protect recreational boater investment, determine the amount of bonds and/or insurance that should be required to protect against damage, find alternative locations, and make informed decisions.

Please let us know when you receive requests for these types of activities so we can work with you to protect public recreational boating access by avoiding temporary closures, damage repairs and ultimately loss of use for the recreational boater.

If you have more questions about the structural integrity of a concrete ramp, call Jeff Smith P.E., 503-378-2607 or email jeff.smith@state.or.us.

hole through a wall). Since concrete is very strong when fully supported, reinforced and compressed, it can withstand a significant amount of weight before failing in this fashion. Bending is another story and is usually the loading scenario that dictates the capacity of the design. Concrete is a rigid material that does not like to bend without cracking. The steel reinforcement will hold the concrete together but with enough applied loading, even the steel will bend, resulting in a wavy slab.

The final analysis indicates that a safe working load limit is 6000 lbs. per tire. In other words, a boat on a trailer could weigh up to 24,000 lbs. assuming the trailer is a tandem axle (4 tires). In reality any boat/trailer combination that weighs this much would have additional axles and tires. Furthermore, the trailer tire carrying capacity is usually no more 3500-4000 lbs. so it's easy to see that a typical boat ramp is designed for recreational boats up to 26-feet in length. Bear in mind that this analysis applies to the standard Marine Board design. Older boat ramps may not be designed to the minimum

Board Meeting News

The Board approved a grant, subject to budget approval, to OYCC in the amount of \$40,000. This will provide funding to employ 23 young people in four different counties improving boating facilities.

Legislation Update

Passage of a transportation package continues to be uncertain. The focus of the Marine Board continues to be on maintaining funding for services at the current level. Should the funding fall short, boating facilities grants and law enforcement contracts will be impacted.