Rigging for Safety—Equipment

In this column I'm going to talk about rigging – the process of lifting and moving monuments using slings, hoists, spreader bars, and other equipment. It's important for those actually using mechanical lifting devices to be aware of OSHA's New Crane Standard requirements for riggers (§1926.1404 and § 1926.1425: http://www.osha.gov/Publications/cranes-qualified-rigger-factsheet.pdf).

A good selection of equipment is critical. Remember that marble typically weighs about 170 pounds per cubic foot and a short ton is 2,000 pounds. Understand that the rated load is usually based on static or moderately dynamic lifting/pulling operations where a load is being applied uniformly in a straight-line pull. Sudden changes in load, up or down, can constitute a hazardous shock load and should always be avoided.

In terms of slings, chains and wire ropes are generally too unforgiving to use with monuments, leaving us with nylon and polyester slings. Both can be found as flat eye and eye (also known as a Type 3 or FEE sling) and endless (Type 5 or EN). Besides differences in chemical resistance, the big difference is elongation under loads. Nylon can stretch up to 10% of its initial length; in contrast, polyester stretches only about 3%. Nylon slings are not as soft or flexible as those made of polyester. The polyester slings are made up of a series of polyester fiber strands, all contained inside a polyester sleeve. The rope strands are the load-bearing components; the sleeve simply shields the strands from cuts and abrasion. These slings often require the use of wear pads to prevent cuts and abrasion damage.

There are "special" stone-handling slings made by some companies that are abrasion resistant with built-in wear pads. They're nice, but not necessary. They also tend to be wide and this can sometimes create problems. You can purchase slip-over wear pads or you can create your own if you can find a source of decommissioned canvass fire hose. Cut into appropriate length sections and slipped over slings, fire hose makes a good—and inexpensive—wear pad.

Nylon slings come in a variety of lengths (generally 3-12 feet), widths (2-12 inches) and plies (1-4). These (and the type of hitch) determine the rated capacities. Polyester slings also come in a variety of lengths and rated capacities. Slings have identification tags permanently sewn into them to identify the manufacturer, length and rated capacity. These tags should never be removed. Most slings also have inner warning yarns to show when a sling is cut or damaged. Slings should meet or exceed the requirements of OSHA and ASME B30.9.

Generally you'll want to purchase slings in pairs. They are relatively inexpensive, so you're also well served by acquiring three or four sets.

Slings should always be inspected prior to use. The inspection typically begins by laying out the strap and examining all sides and surfaces for evidence of cuts, holes, tears, snags or abrasion. If the core or warning yarn is visible, it must be removed from service. When a sling is damaged and removed from service, it should be cut into short pieces to prevent unauthorized use.

An assortment of screw pin anchor shackles is also essential to combine slings or attach them to lifting devices (such as a backhoe bucket). While it is essential that you never exceed the rated capacity, often it is more important that you select shackles based on their size. We rarely use a shackle smaller than ¾" (with a rated capacity of 6½ tons) and a 1" (with a capacity of 10 tons) is good to have. Screw pin shackles also can be used for applications involving side-loading.

The actual lifting device can range from a crane to a backhoe to an A-frame gantry to a tripod. For the latter, a chain hoist will be needed. These are manual (i.e., non-electric devices) that may be either a lever or hand chain type. The former is raised or lowered using a lever; the latter uses a hand chain. Both provide accurate positioning, although the lever type can be used in any position, while hand chain types can only be used

Straps are attached to the backhoe bucket using a 1" shackle.

vertically. Lever type hoists are often more expensive, but they often have low pull requirements, making them easier to operate than hand chain hoists.

When selecting a hoist be sure to determine the maximum capacity (that is the heaviest monument you plan on – and will be able to – lift), the standard lift height, the pounds of pull necessary to lift a full load 1 foot, and the weight of the hoist. Check to make certain that the hoist complies with OSHA, ANSI/ASME B30.16 and HST-2 standards. Many "imported" hoists, especially those you find on E-bay and other such sites, do not. These hoists may be inexpensive, but are they worth your life?

If lifting a ledger, a useful device is a spreader beam. These are essentially I-beams with two safety swivel hooks on either end. Some are designed for low headroom; others provide four pick points.

Gantries are either steel (very heavy and tough to move around) or aluminum (a little easier to move, but limited in height and lifting capacity). Aluminum gantries are generally rated either 1 or 2 tons with heights of no more than about 12 feet. The travel distance (or length of the I-beam) is generally 6 and 10 feet. That doesn't provide a lot of movement room if you're dealing with a ledger. Remember, no one should ever work under a suspended load. While gantries may have wheels, they are of little use in a cemetery and moving a gantry with a suspended load creates a dynamic (rather than static) load.

If you are planning to use a gantry, you'll need either a hoist trolley or a beam clamp (although there are some combination hoists and trolleys). The former is designed to run along the gantry I-beam using wheels and support the hoist. Since the width of I-beams varies, most have a manual screw mechanism to adjust the width of the trolley. A correct fit is essential in order to support the rated load. These trolleys are generally pushed by hand, although there are some that are hand geared.

Selection should take into consideration not only the rated capacity, but also how much headroom you have. If you're using a 12-foot gantry to lift a 10-foot obelisk and the hoist itself is 1-foot, you may require a low headroom trolley. Beam clamps, as the name implies, clamp onto the I-beam. The hoist cannot be moved along the I-beam as it can with a trolley. These devices must also meet or exceed ANSI/ASME B30.16 specifications.

Tripods are perhaps more commonly used than gantries, although tripods are limited to lifting more or less straight up and down. They, too, may be either steel or aluminum and are generally rated for only 1 or 2 tons. They require the use of a hoist, although a trolley is not necessary. Thus, their costs tend to be more affordable.

There are a few additional tools that deal with setting, although they are not usually considered normal rigging. For example, there is the roller pry bar, also known as the Johnson Bar, J-bar, lever handle dolly or roller crowbar. This is useful in adjusting die on base markers after initial setting and are generally rated to 2.5 tons. Some stone companies, such as Granite City, have a variation of this tool called the Stone Pro Monument Setting System. Another setting tool is the Monumental Lifting Device, capable of clamping down on stones between 3 and 15" in width and weighing up to 2,500 pounds. This tool is especially great in lifting monuments that are difficult to rig using straps.

The next column will expand on rigging to include how to develop a basic rigging plan, types of hitches, looking at the center of gravity and safe operating practices.

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Two straps are used in a basket hitch to transfer the obelisk to the base. Note the 3" straps, each with an orange identification tag that lists the rated capacity of the straps under different conditions.