PILE INSTALLATION & EXTRACTION OPERATIONS

Technical Q&A With Richard Marshall

The ANSI/ASSP A10.19-2017 Safety Requirements for Pile Installation and Extraction Operations standard establishes safety requirements for the installation and extraction of piles during construction and demolition operations. ASSP received a technical question about the standard and Richard Marshall, subgroup chair, provided his insight.

Richard Marshall
Richard Marshall, CHST, is director of safety, ADSC—The International Association of Foundation Drilling. He is chair and coauthor of ANSI/ASSP A10.19, Safety Requirements for Pile Driving and Extraction Operations; vice-chair and coauthor of ANSI/ASSP A10.23, Safety Requirements for Drilled Shafts, and chair and coauthor of ANSI/ASSP A10.30, Safety Requirements for the Installation of Ground Anchors and Micropiles (draft). He is a subject matter expert for the Northern Alberta Institute of Technology Foundation Drill Rig Operators training course and the ADSC/NCCCO Foundation Drill Rig Operator Certification Task Force. Marshall holds a B.S. in Occupational Safety and Health from Columbia Southern University. He is a member of ASSP's Southwestern Ohio Chapter and the Society's Construction Practice Specialty.

Question: My organization has a question on ASSP A10.19 Safety Requirements for Pile Installation and Extraction.

We found the standard to be comprehensive and helpful, but it does not address the use of load moment indicators (LMI) during pile driving and extraction operations. Does A10 have guidance on this issue and are there plans to address the issue in future updates of the standard?

The issue as we see it is the practice of disconnecting the LMI during pile driving. This is a common practice allowed by OSHA. We do not see a significant exposure with this as the weights of the hammer, leads and piles can be easily determined by calculation, name plates, manufacturer's literature, weighing and other factors.

Perhaps the overall concern is with pile extraction regardless of the extraction technique. We believe a technical issue is the additional and unknown extraction force over and above the weight of the pile and extraction hammer required to extract a pile itself. A rule of thumb for our organization when using a vibratory extraction hammer is that the extraction force should be approximately two to four times the combined weight of the pile and hammer (Warrington, 2011).

The technical concern is that without an LMI or a load indicating device, there is no way to know how much specific extraction force is being applied, so it is difficult to meet the standard, which states "At no time shall the crane's lifting capacity for the full working radius of the driving or extraction operation be exceeded." Not exceeding the crane's capacity during lifts is also an OSHA requirement and is also prohibited by all crane manufacturers. Common practice during pile extraction is to guess how much force is being applied (impossible) or to keep pulling until the crane starts to tip (dangerous).

Is there additional safety guidance on load monitoring during pile extraction? This appears to have been overlooked by OSHA. It may also help to have an idea of the scenario being addressed.

We have two cranes on our work site. We posed the question to one manufacturer whose response was that the use of an LMI or load weighing device was recommended, as that was the only way to know how much specific force was being applied during extraction.

The manufacturer directions indicate that the use of the crane requires the implementation of an LMI during pile driving and extraction.

The vibratory hammer we are using lists a maximum allowable pull, but there is no way to measure the pull without an LMI or load weighing device.

In addition to A10.19, U.S. Army Corps of Engineers has some guidance in its USACE EM385-1-1 document. However, this actually added some confusion since Section 16.R.15(b) says:

> When pulling piling, the crane shall be equipped with LMI devices (unless the load can be calculated and is within the load rating chart of the crane) and the booms shall not be raised more than 60° above the horizontal. (This requirement does not apply to vibrating-type pulling devices.)

We have heard one interpretation of this section saying that during pile extraction the force required can be estimated, but the actual force being applied is really unknown, so an LMI is required. Another interpretation is based on the last sentence, "This requirement does not apply to vibrating-type pulling devices."

This also leads to different interpretations: 1) the exemption applies to only the boom angle requirement; or 2) it applies to both the boom angle and LMI requirements. Any overall insight or guidance would be appreciated.

Marshall: I am pleased you find the standard "comprehensive and helpful." Thank you for your technical question, which is a good one. Here is my opinion on your inquiry.

An LMI system, one that is either an aftermarket add-on or one built into the crane from the manufacturer, is a key operational aid for safe crane operation. OSHA (2010a) provides a definition:

> Operational aids are devices that assist the operator in the safe operation of the crane by providing information or automatically taking control of a crane function. These include, but are not limited to, the devices listed in § 1926.1416 ("listed operational aids").

As you mention, OSHA (2010b) addresses this type of operational aid and their use in this manner:

1926.1416(e)(4) Load weighing and similar devices.

1926.1416(e)(4)(i) Equipment (other than dericks and articulating cranes) manufactured after March 29, 2003, with a rated capacity over 6,000 pounds must have at least one of the following: load weighing device, load moment (or rated capacity) indicator, or load moment (or rated capacity) limiter. *Temporary alternative measures:* The weight of the load must be

determined from a source recognized by the industry (such as the load's manufacturer) or by a calculation method recognized by the industry (such as calculating a steel beam from measured dimensions and a known per foot weight). This information must be provided to the operator prior to the lift.

For additional reference, the USACE (2014) Safety Manual EM 385-1-1 mimics the current OSHA standards. These are found in Section 16, Load Handling Equipment.

As you point out, crane overload is a serious and potentially dangerous condition if not addressed correctly. Modern cranes are lighter in weight (for easier shipping and assembly/disassembly), yet still offer tremendous lifting capacity, but when overloaded, my view is they are typically more subject to structural failure rather than tip-over incidents. That said, having an LMI system is an important component/operational aid. Unfortunately, when performing duty cycle operations such as pile driving and extraction, the LMI system can be disrupted by the hoist lines bouncing or vibrating during piling operations. This may cause intermittent shutdown of some crane functions.

The OSHA standard requires the employer to know the weight of the load (i.e., hammer + pile + rigging + hoist line from tip to load). A safe working platform provided by the controlling entity capable of resisting the bearing pressures generated by the crane during extraction operations is also required for crane operations. Are we working from a floating platform? We must remember to derate the crane's lifting capacity according to the list and trim of the platform, and other manufacturer requirements.

You point out a reference source (Pile Buck) that "extraction force could be two to four times the combined weight of the pile and hammer." Information from Federation of Piling Specialists (2010) is another good resource.

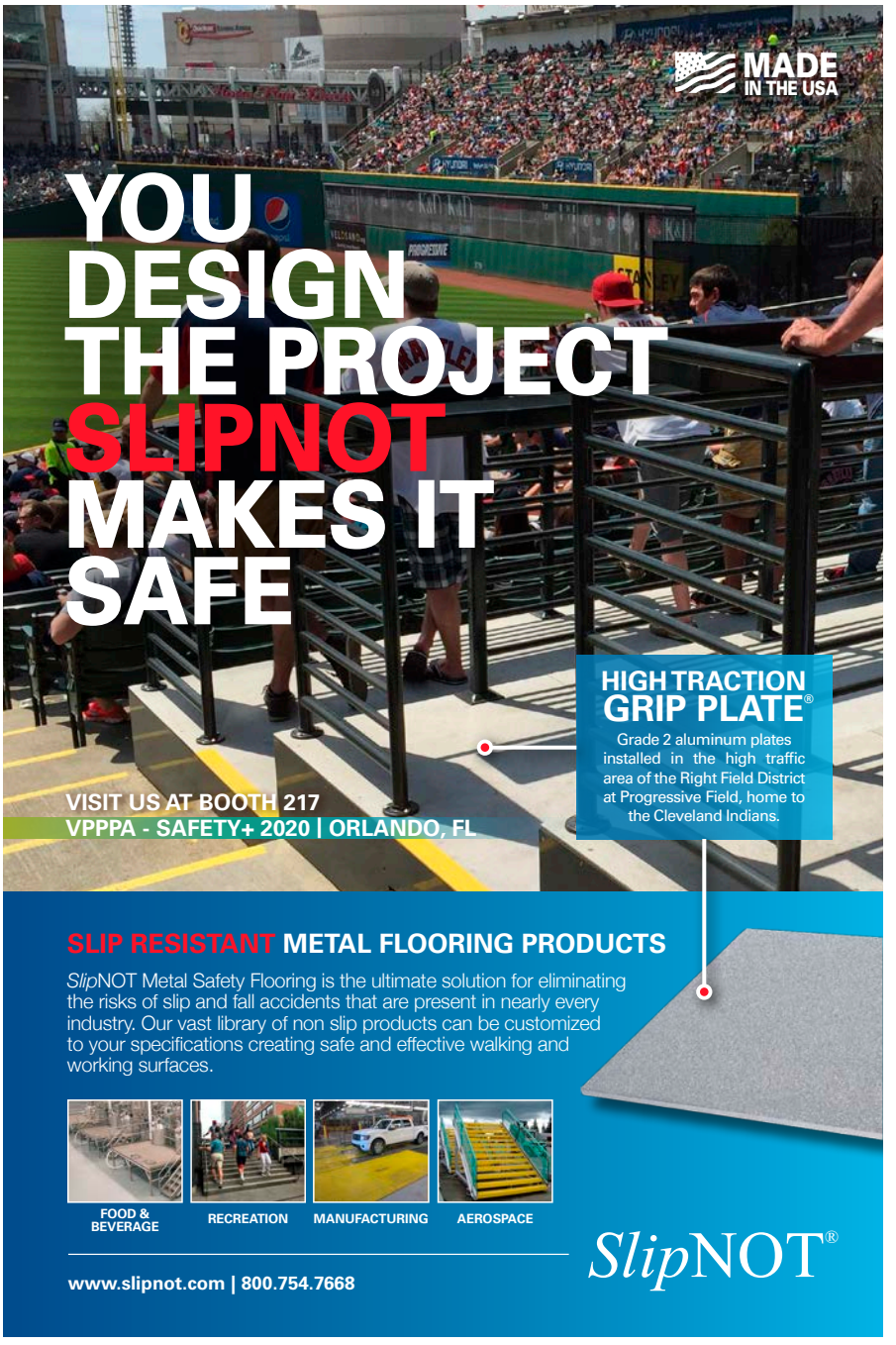
Armed with this information, the piling contractor can determine weights, and the operator will know if the crane will be operated within the load chart capacities in the configuration the machine is set up in. Remember, the LMI system is an operational aid; it does not run the crane, the person in the seat does. The employer must ensure that the operator is educated and certified to safely operate the type of crane the person is assigned. Then, the employer must train the operator to safely and correctly operate the crane assigned, and to perform the task required (i.e., extract piling). Finally, the employer is required to evaluate the operator to ensure that s/he is capable of operating the type of crane and performing the assigned task to the employer's requirements.

ANSI/ASSP A10.19 has this paragraph:

21.4 When piles are extracted with a vibratory or impact pile hammer suspended from a crane:

1) The piling contractor shall follow the crane manufacturer's required procedures for this operation. At no time shall the crane's lifting capacity for the full working radius of the driving or extraction operation be exceeded.

An important point of this section is the first sentence: "The piling contractor shall follow the crane



manufacturers required procedures, for this operation." As crane technology has improved and cranes have become more sophisticated, some manufacturers forbid the use of a vibratory hammer, as they can cause disruption to the LMI and ATB (anti-two block) systems and possible damage to the machine. Some require the use of a vibration damper when using a vibratory hammer. Additionally, an employer would be foolish to arbitrarily disconnect or defeat an LMI system without first conversing with the crane manufacturer to best determine a possible alternative, or how to temporarily disengage the system correctly.

So A10.19 addresses your concern, but perhaps not in as much detail as you were looking for. Since there are so many options that a piling contractor can use to safely drive and or extract piling, this standard cannot address them all. Instead, the standard places the burden on the piling contractor to follow the manufacturer's procedures for both crane and hammer operations. It is true that piling operations may not be specifically addressed in a given crane's operators manual, but the contractor must then call or write the manufacturer for this information. A contractor familiar with what their cranes can do and, more importantly, what they cannot do is a sound basis for safe, productive and high-quality work.

I cannot give an interpretation of EM-385 or the Army Corps' view of this issue. A number of ANSI/ASSP A10 standards are referenced in the current version of EM-385, but A10.19 is not included since the 2017 revision was approved after the latest edition of the EM-385 manual.

Your information and views are interesting, and your comments will be presented to the A10.19 subgroup during the next revision of the standard. Our goal is to enhance future synergy with A10.19, OSHA and other regulatory materials such as those published by Army Corps of Engineers. **PSJ**

Disclaimer
These comments are from Richard Marshall, not the A10 committee itself. Interpretations are processed and approved by the full committee.

References

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