Safe Working Platforms for Specialty Equipment
Working Platforms - The Problem

Every year, piling rigs, rotary piling rigs, and cranes fall over or are subject to near misses due to inadequately prepared or maintained site surfaces – all such incidents involve potential fatalities or serious injury to operators, ground crews, and typically cause extensive damage to equipment.
What is a “Working Platform”?

A working platform is the foundation for a piling rig or crane that may weigh anywhere from 5 tons to 200+ tons and all the ancillary equipment that may be used on the platform to service the rig.

Modern piling equipment is becoming increasingly heavy, often with higher centers of gravity, to cater for the demand for deeper and larger diameter foundations to take higher load capacities, combined with the need for more environmentally friendly installation techniques.
Foundation Drilling Equipment Evolution

Late 1950’s truck mounted drills to today’s sophisticated machines
Drill Rig Stability

The closer the rig’s center of gravity is to the tipping axis, the less stable the rig becomes.
Drill Rig Stability

Stable uniform pressure distribution

Stable trapezoidal pressure distribution

Unstable triangular pressure distribution
Drill Rig Stability

Drill Rig Stability-Bearing Pressures Vary with Rotation about Pin
Drill Rig Stability

The red arrows represent the force of gravity on the drill rig.

When tramming down a slope, the weight is further away from the tipping axis, which increases the risk of an overturn.
It should be everyone’s aim to minimize accidents on construction sites and to prevent any injuries to personnel and the possible long term implications of such injuries.

Delays to projects caused by accidents to skilled operators and the downtime while equipment is being repaired are likely to be extensive.
As in many other industries experienced operators are limited and new operators are often being trained “on the job” – exposure to adverse conditions can inevitably lead to problems. To effectively train a skilled operative takes several years – not days.

The lead time for equipment, accessories and spare parts from overseas is often considerable. For example most European and USA manufacturers are currently quoting up to 12 months for supply of new equipment!
There is sometimes a lack of understanding with project supervisory staff regarding the importance of preparing a safe working platform capable of supporting the equipment to be used, and whose responsibility it is to design, prepare and maintain such a platform throughout the course of the project.

There is also sometimes a lack of appreciation at site management & supervisory level of the effects of excavating through a working platform (for underground pipes, conduit, sumps, etc.) and the need for engineered replacement of any material that is disturbed during such excavation.
The Effect of Poor Working Platforms

Let us look at the effects of some poor working platforms on piling rigs or mobile cranes.
Working Platforms

You must have a level, stable work platform to operate from. . . period
Crawler Crane rig being mobilized on poorly prepared platform
Pile driving rig sinking due to poorly compacted platform
Working too close to the edge . . .
CFA rig overturned across commuter rail lines
Ground Conditions
Piling Rigs

This is an example of a well constructed and maintained working platform – in this case for a dedicated drill rig to operate from.
Ground Conditions

Most often, the deep foundation contractor is one of the first to arrive to a jobsite. Typically, the site needs some improvement.

If underground utilities, vaults, poor soil conditions are not identified before we get onsite, or dealt with once we arrive, bad things can happen to cranes.
Ground Conditions – Mobile Cranes

Improper method to determine if there is a septic tank under the rig.
Ground Conditions
– Mobile Cranes

A proper, pre-constructed and maintained, working platform – one designed for the working ground pressure loads of this crane, would most likely have prevented this accident.
Ground Conditions – Mobile Cranes

Proper use of crane mats to enhance poor ground support

Improper use of crane mats
Ground Conditions – Mobile Cranes

Will a concrete slab act a “safe” working platform?

Best to check the loading restrictions before crane set-up.
Ground Conditions
Piling Rigs

Note that the ends of the crawlers are just barley off the steel support plate.
Ground Conditions
Piling Rigs

Two innocent people, simply driving by the jobsite at the time, lost their lives in this overturn accident.
Rig operator suffered a broken leg.

A quote from the site investigators:
“Our initial investigations found that the crane was operating on weak soil piled on top of a monsoon drain.”
Safety

How close are your employees working to the equipment when drilling operations take place?

How many might be injured or killed if an overturn occurs?

What about other contractor employees or the public?
Productivity

If you cannot get your equipment onto the jobsite, let alone safely unload or load it, how will that impact your schedule?
Productivity

How productive will your rig be, if it is stuck in the work surface – over and over again?
Productivity

Generally speaking, you are more productive when the ready-mix truck can access the shafts for pouring.
Productivity

It is equally important that your mobile cranes and other support equipment, have a safe working platform to operate from . . .
Quality Control

Machine set up level

Mast is Plumb

Rig does not tip forward (sink into the platform) during tool removal or spin-off

This helps drill a straight, plumb shaft – every time!

One and done – no re-work required
Rebar Assembly and Transport

What if we must assemble the cage away from the drilled shaft? How do we transport it to the shaft... Safely?
Emergency Equipment Access
Fatal Impact

Employee **morale** suffers and has a negative impact on quality & productivity.

Public image and **reputation** – what kind of message does an unsafe company send out?
Ground Conditions – Mobile Cranes

1926.1402(b) - The equipment must not be assembled or used unless ground conditions are firm, drained, and graded to a sufficient extent so that, in conjunction (if necessary) with the use of supporting materials, the equipment manufacturer's specifications for adequate support and degree of level of the equipment are met. The requirement for the ground to be drained does not apply to marshes/wetlands.

1926.1402(c) - The controlling entity must:

1926.1402(c)(1) - Ensure that ground preparations necessary to meet the requirements in paragraph (b) of this section are provided.

1926.1402(c)(2) - Inform the user of the equipment and the operator of the location of hazards beneath the equipment set-up area (such as voids, tanks, utilities) if those hazards are identified in documents (such as site drawings, as-built drawings, and soil analyses) that are in the possession of the controlling entity (whether at the site or off-site) or the hazards are otherwise known to that controlling entity.
Ground Pressures for Mobile Cranes

This is a diagram from Link-Belt Crane. It is for a LS-108B Lattice Boom Crawler Crane. You must input:

• Boom Length
• Load Radius
• Weight of Load
• Counterweight

This program will actually show differing pressures as the crane swings around with the load.
Ground Conditions

A10.19-2017

4.4.1 The project constructor shall:

3) Ensure that pile driving equipment shall not be assembled or used unless the ground conditions on which they are moved or placed are firm, graded and, unless the work is being performed in marshes or wetlands, drained, to the extent that the use of supporting materials is adequate and the equipment manufacturer's specifications for adequate support and degree of level are met.
Ground Conditions

A10.23-2019

6.1 The project constructor shall:

6.1.2 Ensure that drilled shaft equipment not be assembled or used unless the ground conditions on which they are moved or placed are firm, drained (except for marshes/wetlands) and graded to a sufficient extent so that, in conjunction (if necessary) with the use of supporting materials, the equipment manufacturer's specifications for adequate support and degree of level of the equipment are met. This includes the associated ramps and access points for the duration of the drilled shaft installation process.

1) Supporting materials includes blocking, crane mats, steel plates, cribbing, marsh buggies (in marshes/wetlands), or similar supporting materials or devices.
The Deep Foundation Contractor must know the ground bearing pressures the drill rig will generate, in the configuration it is set up in.

This information may be supplied in the operator's manual or by calling the manufacturer. It is the DFC’s responsibility to know this information, and only work from a stable, level platform that will support the rig.
This capacity calculation applies to:
- Vertical operation only.
- Concrete supply pipe and leader access Better not attached.
- Leader extension 20.89 installed.
- Platform not attached to rotary drive.
- 2. Auxiliary winch on leader bar not attached.
- Kelly bar WC09B/230 max. 1/8/09住院 completely compressed to highest position.
- Top head guide installed.
- Kelly transmission BAT015 with attached frame and motion without pressure pipe.
- Weight of drilling tool max. 500LBS.
- The water loads for the different winches are only permitted individually and may not be combined.
- Load on auxiliary winch only with complete empty drilling tool.

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<thead>
<tr>
<th>Load Vertical</th>
<th>Rotary Position</th>
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<td>Right (°)</td>
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<tr>
<td>Support arm angle</td>
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<td>Radius</td>
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<td>Auxiliary winch (lbs)</td>
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<td>Kelly winch (lbs)</td>
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<td>Drill winch (lbs)</td>
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<td>Max. ground pressure (PSI) under flush with 3.06 base plates</td>
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<tr>
<td>Max. permitted load on auxiliary winch</td>
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<td>42.0</td>
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<tr>
<td>Max. permitted load on Kelly winch</td>
<td>52.0</td>
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Machine may only be moved under the following conditions:
- Drilling head and drill casing detached.
- Drilling tool emptied.
- Rotary drive and tool are in lowest possible position.
- No load on auxiliary winch.
- Support arm cylinder fully extended.
- Ground firm and level.
- Leader vertical.
- Max. travel speed with tool 2.5 mph, travel only permitted on firm ground or excavator support rails.
- Travel only permitted when upper margin of parallel to undermargin.
- No dynamic effects whatsoever permitted, travel with extreme caution and think one step ahead.
Fatal Accident in Toronto - 2011

In this terrifying accident, a young backhoe operator was killed when the large, heavy, high center of gravity drill rig trammed into a soft area of the site. The rig immediately went out of level and toppled over – without any means for the operator to stop it from happening.
156.3 Sections 156.4 and 156.5 apply when a drilling operation at a project uses a *rotary foundation drill rig* that can exert a ground pressure of 200 kilopascals or more under its tires, crawlers or outrigger pads in any configuration, including during its operational activities.
Working Platforms

156.4 (1) Before a drilling operation described in section 156.3 begins, a professional engineer shall,
(a) design a supporting surface for the drill rig in accordance with good engineering practice to adequately support the drill rig during all drilling and drill rig set-up activities;
(b) designate and design a path of travel for the drill rig to use on the project to ensure the path of travel safely supports the drill rig; and
(c) prepare a written report described in subsection (2). O. Reg. 345/15, s. 19.
Safe Working Platforms

The FPS (Federation of Piling Specialists) initiative in the UK:

- Development of managed process
- Setting out responsibilities
- Generated the “rig loading tool”
- Published platform calculation methods
- Verified construction and maintenance of the platform by certificate
Bearing Pressure Calculations

There are many methods you can use to calculate your equipment’s bearing pressures – it is strongly recommended that you work with a “friendly engineer” to ensure you are solving for the bearing pressures correctly.

It is also recommended that the Deep Foundation Contractor consult with their equipment manufacturer(s) and have them work through the FPS calculator or use their own methods to develop ground bearing pressures generated by their equipment.
FPS (Federation of Piling Specialists)

From a presentation by Derek Egan, B.Eng, Ph.D., C.Eng, FICE | Remedy Geotechnics Ltd.
SuperPile 2018
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SuperPile 2018
Use the Track Pressure Calculation Tool to input known information:

- **Rig Type**
- **Operation Mode** – CFA, Kelly Bar, Displacement
- **Machine Weights** -
- **Suspended Equipment** – Rotary, CFA, Kelly Bar, Displacement
- **Tool Weight**
- **Track Size**
- **Outrigger Pad Size**
- **Crowd System Forces**
Once the information is inputted by a trained, qualified person, the spreadsheet generates bearing pressures in various modes:

**Standing, Travelling, Handling, Penetrating, Extracting**
The Spreadsheet then generates a “Summary Page” which you can use to present to the “Controlling Entity” or “Project Constructor” so they may be able to design and construct a safe working platform for your equipment.
Safe Working Platforms

The FPS initiative had this effect:

• Drove Industry Change
• Improved safety for foundation piling rigs
• Gained universal acceptance in the UK
• Has a now proven track record

And so can the ADSC-IAFD, PDCA, and DFI Consensus Position . . .
Safe Working Platforms

The ADSC-IAFD, PDCA, and DFI Consensus Position is similar to the FPS initiative in that it ensures safe working platforms as an established policy lies in three areas:

- Recognition of the need for proper analysis and preparation of working platforms by controlling entities and acknowledgment of responsibility for such tasks
- Common use of appropriate contract language for prime contracts and subcontracts
- And for the present, informal enforcement through industry consensus.
Safe Working Platforms

That ongoing enforcement of OSHA standards for cranes (CFR 1926.1401 and 1926.1402 (all parts)) and adherence to existing ANSI Standards (A10.23-2014 for drilled shafts and A10.19-2017 for pile installation and extraction) will support and reinforce facilitation of safe working platform evaluation and implementation for all specialty construction equipment.
Safe Working Platforms

ADSC-IAFD, PDCA, and DFI anticipate that deep foundation contractors and their equipment suppliers will fully and readily present the real working loads, geometries, and operating conditions of their drilling equipment to allow for realistic assessments of working platform safety to be made.
Safe Working Platforms

ADSC-IAFD, PDCA, and DFI anticipate that the engineering design community will be aware of the importance of working platform safety and will incorporate appropriate data and general recommendations relative to construction-phase subgrade conditions into geotechnical reports and construction plans.
Risk Management = Lower Premiums

Risk prevention strategies can be very helpful in bringing down premium costs because decreasing the risks for equipment damage, loss of production, and employee injury.

Have a discussion with your insurance carrier to see if your adherence to the safe working platform protocols will lower your premiums . . .
The Responsibility

• The responsibility for the design, construction, maintenance and repair of a working platform should be taken by the organisation that has CONTINUOUS control of the project activities – NOT the piling contractor.

• The platform may continue to exist after the piling contractor has left the site and may be used by other trades, requiring maintenance and repair to continue beyond the end of the piling works. Even during the piling works other trades often operate from the same working platform as the piling contractor.

• The piling contractor is responsible for supplying details of the crane, piling equipment and support equipment to be used on the project including the bearing pressures, dimensions and working space required to operate safely.

• Both the Main Contractor and the Piling Contractor have responsibilities under the existing OSHA legislation in the state in which the work is taking place which will remain unchanged.
Working Platforms

This is the beginnings of a safe and productive working platform for a piling rig or mobile crane to operate from.
Safe Working Platforms for Specialty Equipment

• **Safety** – A safe site is easier to manage. There are fewer opportunities for working areas to be unsafe. The piling crews work safer. A reduction in the possibility of an accident will have a positive effect on your Workers Compensation statistics.

• **Quality** – by installing the pile correctly the first time, we save time and cost of unplanned rework and we can start to develop the ‘get it right first time’ theme.

• **Production** – if you have taken proactive steps to have a safe site producing a quality product you will achieve your production targets.

• **Risk of Failure** – The cost of a rig going over is incalculable. The list starts with accidents and injuries and possible fatalities, work being stopped, loss of equipment, employing lawyers, being sued, physical and mental stress for everyone involved, negative publicity, possible prison sentences.
Safe Working Platforms

We *can* make a difference – but we all must commit to doing so – for every job we do
ADSC / NCCCO Foundation Drill Rig Operator Certification

ADSC
The International Association of Foundation Drilling

NCCCO
National Commission for the Certification of Crane Operators (NCCCO)
At long last . . .

February 23, 2017—The National Commission for the Certification of Crane Operators (NCCCO) and ADSC – The International Association of Foundation Drilling have announced plans to jointly develop a certification program for operators of foundation drill rigs. The official announcement was made at ADSC’s Annual Meeting in La Quinta, CA, in February 2017.

Program rollout – December 19, 2018
Practical Exams
The Core Exam (Written or Computer Based) will have questions related to the following “Domains”:

DOMAIN 1: PROJECT SITE

DOMAIN 2: Assembly / Disassembly

DOMAIN 3: PRE-OPERATION

DOMAIN 4: OPERATION

DOMAIN 5: TECHNICAL KNOWLEDGE

DOMAIN 6: MANUFACTURERS’ STABILITY / RANGE CHARTS FOR AUXILIARY WINCH

Separate Specialty Exam for Anchor/Micropile Foundation Drill Rig
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