Ground Condition and Preparation for Mobile Cranes

Host: Mike Parnell
President/CEO, ITI
ASME B30 Vice Chair (Cranes & Rigging)
ASME P30 Chair (Lift Planning)

Guest Speaker: Klaus Meissner
Director of Product Integrity
Terex Cranes
- Convenor of CEN TC147 WG11 (EN13000)
- President FEM Mobile cranes

The views expressed in this presentation are that of ITI and are not necessarily the views of the ASME or any of its committees.
WHO WE ARE

A world leader in crane and rigging training and consulting.

We Rig It Right!
We Serve a Variety of Industries

- Aerospace
- Chemicals
- Construction
- DOD
- DOE
- Electric Utility
- Hydro
- Manufacturing
- Maritime
- Mining
- Nuclear
- Oil & Gas
- Pulp & Paper
- Railroad
- Shipbuilding
- Wind Energy
The World's Greatest Organizations Trust ITI's Expertise with their Crane & Rigging Operations
SHOWCASE WEBINAR SERIES

Past Presentations:
• 10 Audit Points for Your Crane and Rigging Operations: An HSE Perspective
• Tackling the Challenges of Training Site Supervisors, Lift Directors, and other Leaders
• 4 Major Lifting Considerations in Power Gen Environments
• Rigging and Sling Failures: Case Studies and Solutions
• How to Manage a Crane Accident
• Automation - Equipment Inspection and Asset Management
• 10 Points of Lift Plan Development
• 9 Questions You Must Ask When Selecting a Crane and Rigging Training Provider

Today's Presentation:
Terex Presents: Ground Condition and Preparation for Mobile Cranes

WEBINAR TRAINING COURSES

Coming in 2014
• Lift Director and Site Supervisor
• Critical Lift Planning
• Rigging Gear Inspection for Supervisors
• Advanced Rigging: Load Distribution and Center of Gravity
• Advanced Rigging: Multi-Crane Lifts and Load Turns
Mr. Parnell has a wealth of knowledge regarding cranes, rigging, and lifting activities throughout a variety of industries.

- 30+ years learning about wire rope, rigging, load handling, and lifting activities.
- Vice Chair of the ASME B30 Main Committee which sets the standards in the US for cranes and rigging
- Chair of the ASME P30 Main Committee which sets the standards for lift planning.

ASME standards are also adopted by many countries around the world.

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Klaus Meissner – About your Guest Speaker

• Director of Product Integrity, Terex Cranes
• 25+ year experience in the crane industry
• Expert for mobile crane approval appointed by the German Health and Safety Authority
• Convenor of the working group developing EN13000 – the European Safety Standard for mobile cranes
• President of the product group for mobile cranes within FEM – the European Manufacturers Association of Material Handling, Lifting and Storage Equipment

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Ground Condition and Preparation for Mobile Cranes

November 2013
Typical Incidents
- Loading too high, ground gives way
- Crane tips over during travel on site

Background
- Load distribution
- Ground gives way, shear failure
- Centre of gravity at height

Prevention
- Load distribution, cribbing, mats

Ground Condition and Preparation for Mobile Cranes

Content
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Content

**Typical Incidents**
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Ground Condition and Preparation for Mobile Cranes

Typical Incidents
Ground Condition and Preparation for Mobile Cranes

Typical Incidents
Ground Condition and Preparation for Mobile Cranes

Typical Incidents
Outside Influences
(acting on the "system crane")

Pure Physics
(the same for all sites and equipment)
Ground Condition and Preparation for Mobile Cranes

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Video 1

LET'S MAKE SOME EXPERIMENTS
Ground Condition and Preparation for Mobile Cranes

Background load distribution

Top View on Crawler car Body, Crawlers turned to better indicate Shape

Symbol indicates Centre of Gravity

Symbols indicate Ground Pressure under Crawler

Symmetrical Loading

Symmetrical Loading to the Front

Non-Symmetrical Loading
## Type of Soil/Description

<table>
<thead>
<tr>
<th>Max. Allowable Bearing values (presumptive) in tons/sq.ft.</th>
<th>Max. Allowable Bearing values (presumptive) in psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Rock</td>
<td>100</td>
</tr>
<tr>
<td>Soft Rock</td>
<td>12</td>
</tr>
<tr>
<td>Very compact sandy gravel</td>
<td>10</td>
</tr>
<tr>
<td>Loose fine sand or firm inorganic silt</td>
<td>1,5</td>
</tr>
</tbody>
</table>

## Crane Cap.  Weight  Crawler Length  Crawler Width  Contact Surface  Theor. min. Ground Loading (crane w/o load and balanced)  Typical Ground Loading w. Load

<table>
<thead>
<tr>
<th>600t</th>
<th>400t</th>
<th>10m</th>
<th>1,3m</th>
<th>26m²</th>
<th>15,4t/m²</th>
<th>30…&gt;100 t/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>660tons</td>
<td>440tons</td>
<td>32ft</td>
<td>4.3ft</td>
<td>275sq.ft</td>
<td>1,6tons/sq.ft.</td>
<td>3.1…&gt;10.4 tons/sq.ft.</td>
</tr>
</tbody>
</table>
Ground Condition and Preparation for Mobile Cranes

Background load distribution
Video 2

LET'S MAKE SOME EXPERIMENTS
Very often the shear failure develops non-symmetric as the load starts tilting.
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Background, shear failure

Angle of Repose
Ground Condition and Preparation for Mobile Cranes
Travel with load, exceeding load bearing capacity of ground
Ground Condition and Preparation for Mobile Cranes
Rescuing a truck, exceeding load bearing capacity of ground
Ground Condition and Preparation for Mobile Cranes Travel on site with load
Ground Condition and Preparation for Mobile Cranes
Travel with load, exceeding load bearing capacity of ground
Ground Condition and Preparation for Mobile Cranes
Travel with load, exceeding load bearing capacity of ground
Ground Condition and Preparation for Mobile Cranes
Travel with load, partially erected crane
Ground Condition and Preparation for Mobile Cranes
Travel with load, partially erected crane
Ground Condition and Preparation for Mobile Cranes
Travel with load, partially erected crane
Ground Condition and Preparation for Mobile Cranes
Travel with load, partially erected crane, consequence
Ground Condition and Preparation for Mobile Cranes
Travel with load, partially erected crane, consequence

Where is the Centre of Gravity?
Ground Condition and Preparation for Mobile Cranes
Travel with load, partially erected crane, consequence

Where is the Tipping Line?

Suspension Base

Wheel Base
Ground Condition and Preparation for Mobile Cranes
Travel with load, partially erected crane, consequence
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Travel with load, partially erected crane, consequence
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General

Plan

Act

Do

Check

**PLAN:** Develop a Plan

**DO:** Act according to Plan

**CHECK:** Are Conditions as per Plan

**ACT:** Take Action if needed
Ground Condition and Preparation for Mobile Cranes
Preparation of the hard stand

- Establish the loads action on the ground
  - Consult manufacturer's documentation
  - Use calculation tools

- Investigate the ground
  - Load bearing capacity?
  - Hidden cavities?

- Prepare the ground and level it

- Use appropriate cribbing/mats
  - Cribbing may fail if the load is not spread over the full area of the mat
  - Cribbing/mats may fail if the ground crushes or extensive settling appears
  - Cribbing/mats may fail when the mat bends
  - Cribbing/mats may fail by horizontal splitting
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Travel with load, preparation of builder’s roads

Axle load ≤ 12 t Width = 5.0 m
Axle load > 12 t Width = 7.0 m

How are the Roads you are using?

B
Up to 12 t axle load ≥ 1.0 m
Over 12 t axle load ≥ 2.0 m

A

α ≤ 30° width soft soil; A = 2 × T
α ≤ 45° width firm soil; A = T

Slope angle and dimensioning a builders’ road

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Thank you for your attention.

work safely.