THANK YOU! Breakfast Sponsor



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CRANE, RIGGING & LIFTING COMMITTEE



CHAIRPERSON: DAVID WOLF, LYONDELLBASELL

Committee Mission Statement

To promote safe and effective crane, rigging, and lifting industry-related activities in the refining, petrochemical, oil and gas, and construction industries in the Gulf Coast, greater Houston Texas area.



BUSINESS ROUNDTABLE OFFICERS

VICE CHAIR: BILLY EVERETT, FAGIOLI





VICE CHAIR: DOUG WRIGHT, BARNHART CRANE, AND RIGGING

ANTI-TRUST GUIDELINES FOR CONDUCTING MEETINGS

IBR appreciates your willingness to be an important part of this organization and the services provided to our industry.

The following guidelines shall be followed in conducting meetings of IBR. This is not an exhaustive list of every possible subject to be avoided; in the event you have doubts about the propriety of any matter to be discussed in a meeting, our legal counsel is available for consultation. Generally, the anti-trust laws proscribe unlawful combinations or agreements. Sometimes "agreements" may be inferred from conduct. IBR wants to avoid even the appearance of impropriety, and this is the spirit of these guidelines.

- Do not discuss the prices of goods or services of any particular company(s).
- Do not disparage the goods or services of any particular company(s)
- Do not recommend the selection of any particular company as a supplier or customer
- Do not urge or counsel that participating companies engage in any concerted activity to accomplish any unlawful purpose, i.e., boycotting any company or coercing a company to take some desired action.
- Do not discuss matters which may be trade secrets or confidential to any company, i.e. don't engage in "off the record" comments or state matters "not to be repeated out of this room".
- Do not propose secret or "rump" sessions after the official meeting is adjourned to discuss matters which cannot lawfully be discussed at the official meeting.
- Do not recommend or sponsor the gathering of statistical data, the publishing of standards, or doing joint research without advance written approval of the Operating Committee of IBR.
- Industry Business Roundtable's purpose is to educate participating companies, so every company represented will be better informed and can make its own individual decisions. IBR members are not required to adopt the IBR recommendations or policies.

Thank you in advance for adhering to these guidelines.



Emergency Exits and Restrooms



Pledge of Allegiance

I pledge allegiance to the flag of the United States of America and to the Republic, for which it stands. One Nation, under God, Indivisible, With Liberty and justice for all.

\star

Texas Pledge

Honor the Texas Flag; I pledge allegiance to thee, Texas, one state under God, one and indivisible.

New Attendee Introductions







Safety Council Reports













OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION

Welcome







Welcome to Lifting Load Effects on Elevated Structures!

February 13, 2024 | Pasadena, TX



Heavy Lift, Rigging & Transport Solutions Construction Engineers & Consultants NDE, Reality Capture & Mapping

NO LIMITS. NO COMPROMISE. **







Session Agenda...

- Housekeeping / Quick Intro to Me
- Brief Intro to Dearborn
- What we will & won't talk about today
- Common elevated structures we (LHE) encounter
- Language of loads & some physics
- Case studies & project examples
- Questions & Answers





Housekeeping... ► Q&A during the presentation...







Who is this guy?

- ➤ 40+ years in the Industry
- ➤ 30+ years leading Dearborn
- ➤ "Born in the business..."
- ≻ LU 597 Pipefitter / BSCE
- ➢ ASME P30 Committee Member
- SC&RA Allied Industries Committee
- > ACRP Member
- > NAMA Board of Directors & Tech Committee







Dearborn Overview...

- 70-year old specialized engineering & consultancy second & third generation leadership
- Chicago based operating nationally & heading to Houston / Gulf Coast

Primary Service Offerings

- Heavy Lift, Rigging & Heavy Transport Engineering
- "Construction Engineers"
- As-Is Documentation (*Reality* Captured[™])
- "Mud on our Boots"





NO LIMITS. NO COMPROMISE. "

What we're going to cover...

<u>GENERAL</u> overview of <u>certain</u> LHE generated loads and reaction forces on elevated <u>concrete</u> structures...

You can break a lot of laws, but not the laws of physics...

High complexity and nuance to LHE loads on structures...







What we're <u>NOT</u> going to cover...

"Static" and "special" LHE generated loads...

Overhead cranes, davits, etc. Tower cranes & self-erectors Maritime & port equipment Bull rigging & other loads Other specialized applications







Terminology – "Land of Confusion"







Load Handling Equipment (LHE)

ASME P30.1-2019 (Revision of ASME P30.1-2014)

Planning for Load Handling Activities

load handling equipment

(LHE): equipment used to move

а

load vertically or horizontally







Load Handling Equipment (LHE)







Elevated structures...

<u>el·e·vat·ed</u>

/'elə vādəd/

adjective 1. situated or placed higher than the surrounding area.

struc·ture

/'strak(t)SHar/

noun

1. the arrangement of and relations between the parts or elements of something complex.







Common elevated structures encountered by LHE...





Image courtesy of Equipment & Contracting



"Other" elevated structures...







When an assumed non-elevated location becomes "elevated...







Caveat for demolition work...











Terminology & Basic Physics...

► What's a "Load"?



/lōd/ noun

Force(s) applied to a structural element causing stress, deformation, and acceleration.

Definition of "Stress": Stress

/stres/ noun



Stress = force per unit area ... σ = F/A Consider stress as the intensity of force, or a measure of how concentrated a force is.



Basic Physics – Stresses...

► Tension:

<u>**Tension**</u> stress (or tensile stress) occurs when two forces pull on an object in opposite directions so as to stretch it and make it longer and thinner.



(A) TENSION

Compression:

<u>Compression</u> pushes or presses an object so as to make it shorter and thicker.



(B) COMPRESSION





Basic Physics – Stresses...



Shear:

Shear stress is two forces acting parallel to each other but in opposite directions so that one part of the object is moved or displaced relative to another part.



(D) SHEAR





Basic Physics – Stresses...



Reactive Force...

► Newton's 3rd Law:

- In every interaction there is a pair of forces acting on the two interacting-objects.
- Magnitude of $F_1 = F_2$
- The direction (vector) of F₁ is *opposite* of F₂
- "For every action there is an equal and opposite reaction"







What's a "kip"???



- A "US Customary" unit of <u>REACTIVE</u> <u>FORCE MEASUREMENT</u>
- Equals 1,000 pounds-force
- Ground Bearing Reaction Force (i.e., ground bearing pressure) is typically expressed in kips per square foot







What's a "kip"???

While it's also a gymnastics move...



A kip is <u>NOT</u> a unit of weight!!!!





Weight...

Weight:

- A measurement of gravity acting on a mass at the Earth's surface.
 - Expressed in pounds (or kilograms)
 - "Active force" single body / single force
 - <u>Mass</u> doesn't change, but weight is relative to gravitational force







Basic Load Types...

Lateral Loads*

* not discussing today









Vertical Load Categories...

Dead Load

- Always present ("persistent" or "static" load)
- Includes self-weight of the structure

Live Load

- Anything not "Dead"
- Can present a moving target







Live Load Examples...

Live Load Examples

- LHE, tools & equipment
- Staged building materials
- Personnel





Image courtesy of Iron Workers Local 1 - Chicago, IL



Other "Live" Loads - Environmental...

- "Environmental" loads
 - Snow & Ice

Rain







Live Load Types...













3rd Live Load Category – IMPACT!!!

Impact & Shock Loads

- **Shock** is a sudden acceleration or deceleration stimulus applied to a system.
- Impact is an extreme force or shock applied over a short time period.
- Can be catastrophic depends on relative velocities and masses involved.







"What? Me worry?"







So what can happen? Punch Through...







So what can happen? Deck Collapse...





Managing imposed structural loads...

- Risk mitigation…
- Step 1: Professionally assess the structure – will it take the load?
- Step 2: Professionally assess load mitigation options:
 - Load reduction
 - Load distribution
 - Structure augmentation
 - MOVE lift from somewhere else







LHE Load Distribution Case Study









Contractors Service, Inc.

Northwestern Memorial Hospital **Galter Pavilion (Chicago, IL)**



















LHE Load Support Case Study







A Service Logic Company

Chiller Replacement (Chicago, IL)





Lancaster Case Study

Project Overview...

- Replacement of (2) 18,000 lb rooftop chillers set at 255' AGL
- LTM 1400 (guyed) with 220,000 lb cwt bearing on elevated roadway above 4-story parking garage
 - <mark>Loads distributed</mark> to bottom slab <mark>via shoring</mark> towers (q_{max} = 169 kips)











Lancaster Case Study









Lancaster Case Study







Thanks for your kind attention!!!







Questions????













Next Meeting March 12, 2024

Innovation Through Collaboration!

