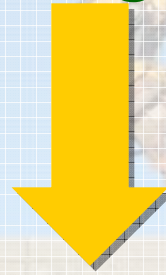


# Bridge Construction Loads and Evaluation

Michael J. Garlich, S.E., P.E.  
Collins Engineers, Inc.



## **I-35W Bridge Failure**



**FHWA TA 5140.28—Construction Loads on Bridges**

**But not a new issue!**







# Questions for Construction Load Analysis

- What are the loads?
- What is the condition of the existing structure?
- Who prepares the structure analyses?
- To what criteria is the bridge compared?
- How is the actual load controlled?





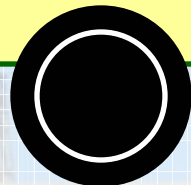
# Loads

- Traffic on adjacent lanes
- Materials
- Construction equipment
- Construction operations

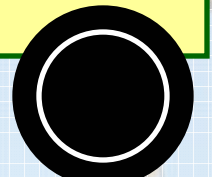
# AASHTO HS20-44



8,000



32,000



32,000



14 ft

Varies

14 ft min. - 30 ft max.



# Volvo A400



42,262

54,120

54,120

14 ft 7 in.

6 ft 6 in.



# CAT 740



53,528

52,062

50,585

13 ft 10 in.

6 ft 3 in.

# CAT 621G (Scraper)



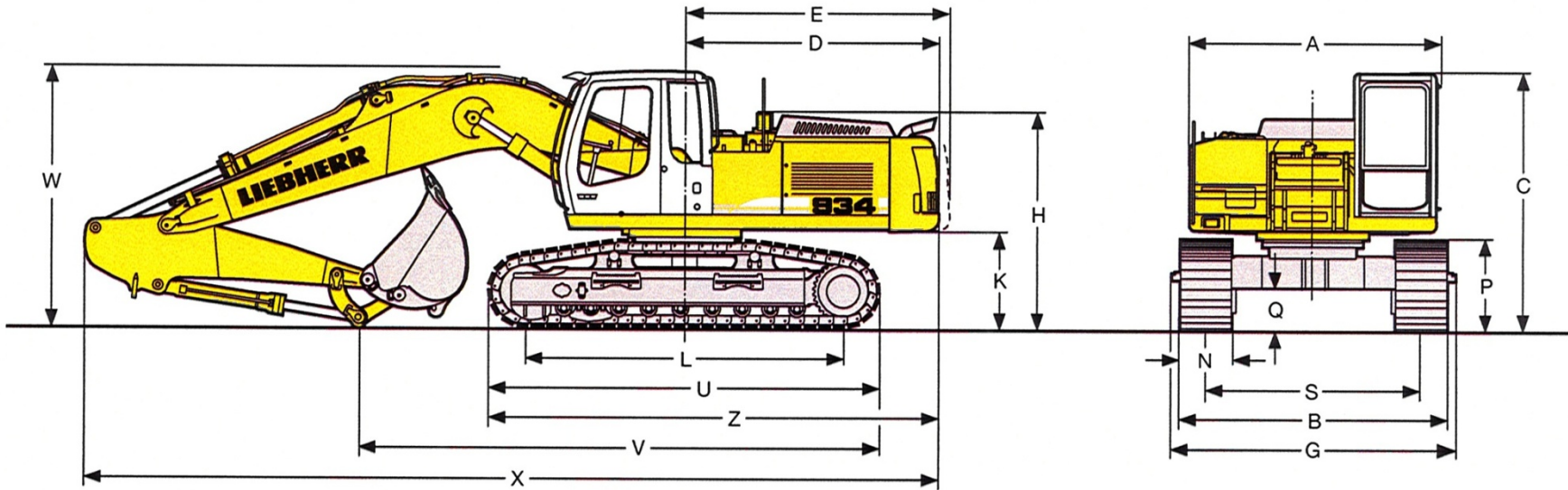
67,092

59,497

25 ft 4 in.



# Dimensions



	<b>HD-S</b>	mm	<b>HD-SL</b>	mm	<b>S-HD</b>	mm		<b>HD-S</b>	mm	<b>HD-SL</b>	mm	<b>S-HD</b>	mm
A		3050		3050		3050	Q		493		493		537
C		3125		3125		3175	U		4720		4720		4900
D		3145		3145		3145	S		2400		2600		2400
E		3145		3145		3145	N	500 600 750	500 600 750	500 600 750	500 600 750	500 600 750	500 600 750
H		2650		2650		2700	B	2998 3000 3150	3198 3200 3350	2998 3000 3150	2998 3000 3150	2998 3000 3150	2998 3000 3150
K		1160		1160		1210	G	3195 3195 3195	3395 3395 3395	3195 3195 3195	3195 3195 3195	3195 3195 3195	3195 3195 3195
L		3848		3848		4000	Z		5510		5510		5615
P		1016		1016		1120							



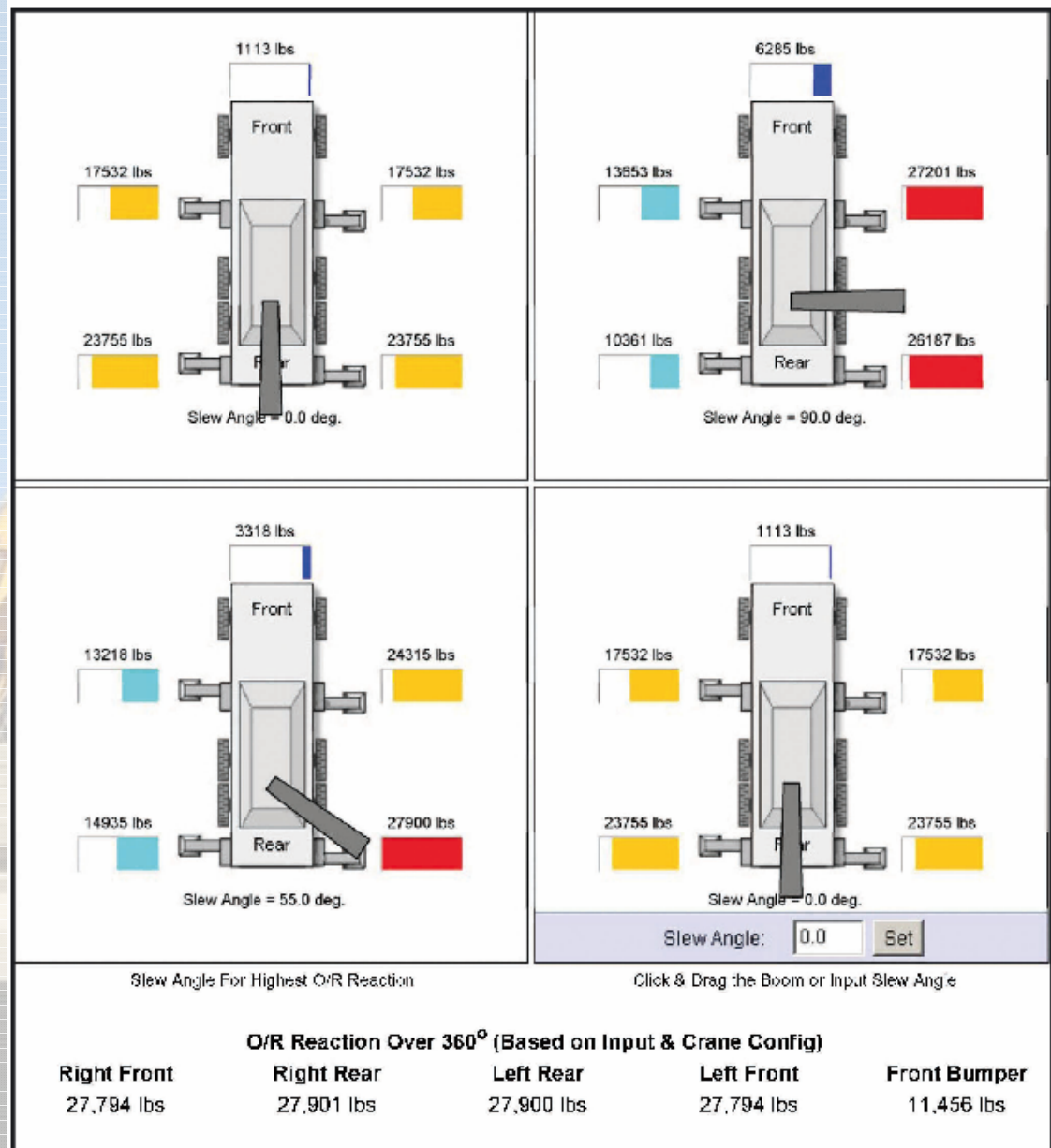
# Outrigger Crane



Western Bridge Engineers Seminar 2009



# Representative outrigger loads for 40-ton capacity truck-mounted crane







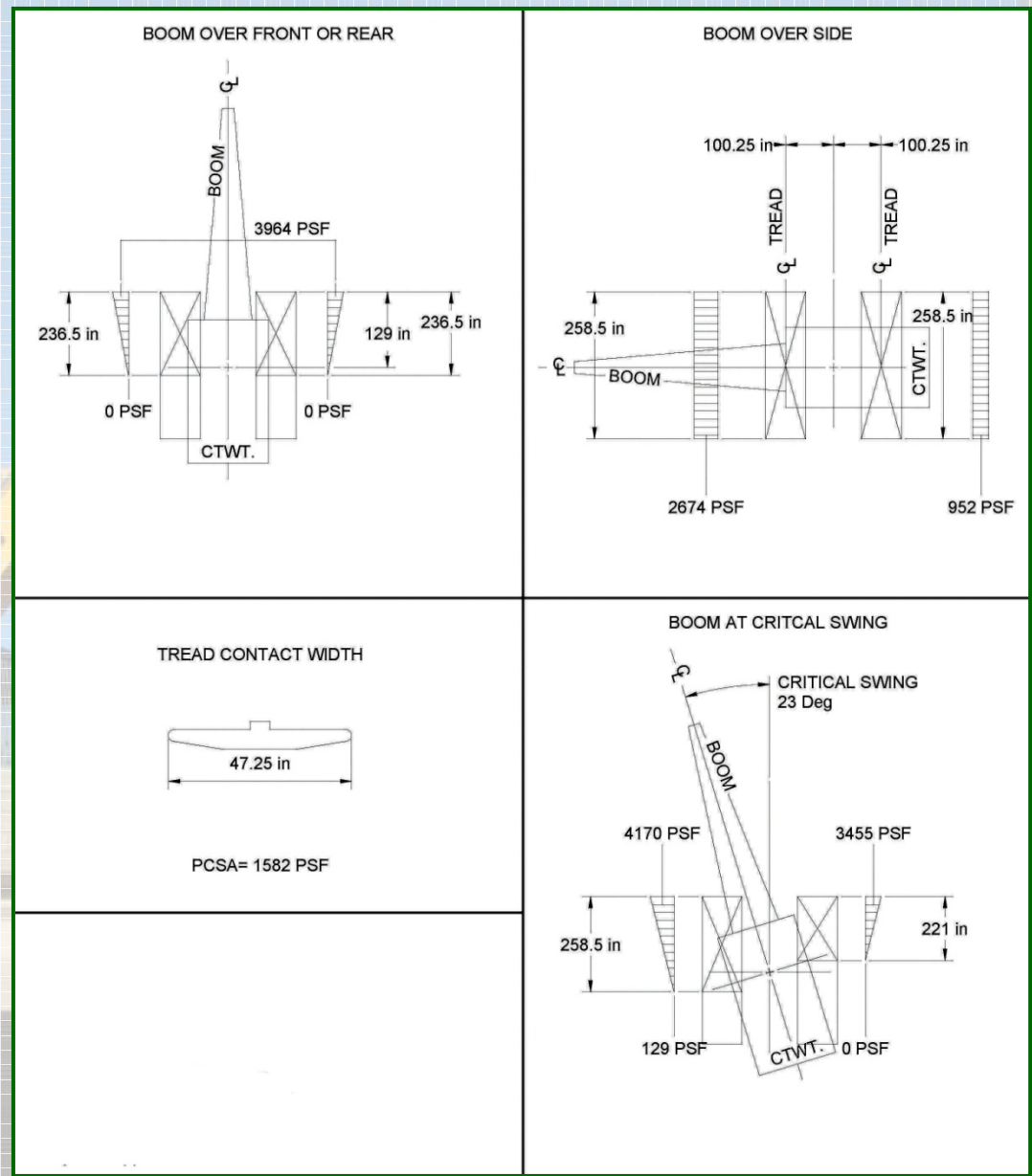


# Crawler/Track Crane (being assembled)



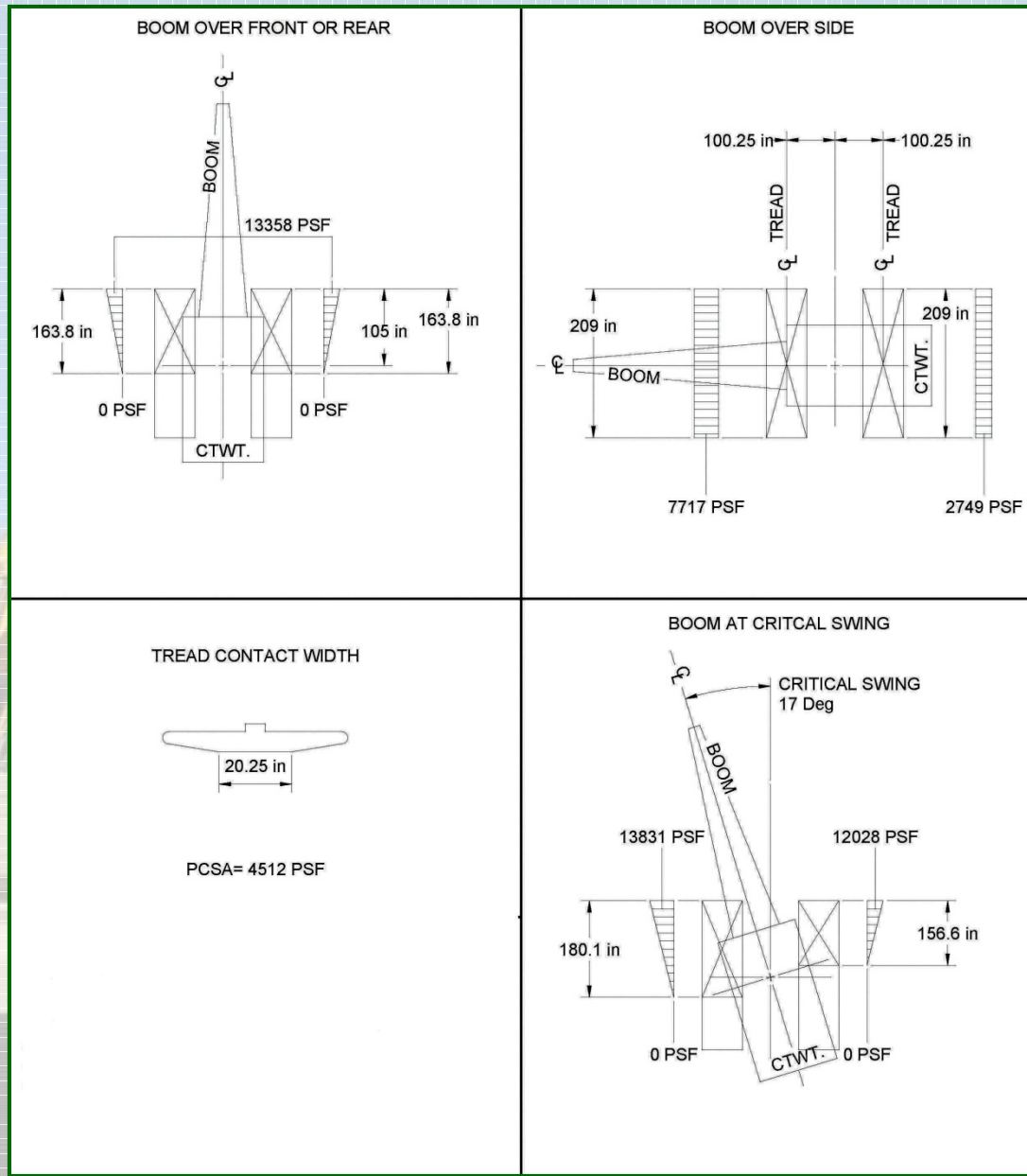


# Track pressures for a large crawler crane sitting on a soft surface





# Track pressures for a large crawler crane sitting on a hard surface



# Equipment Load Issues

The background of the slide is a photograph of a construction site. A large yellow excavator is positioned on a concrete bridge structure, with its arm extended. The bridge is under construction, and the sky is clear and blue. The entire slide is framed by a yellow border with a grid pattern.

- Location/movement
- Impact effects
  - Vehicles
  - Cranes
- Cranes
  - Pick
  - Radius
  - Rigging





# Project Specific Equipment



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# Evaluation of Load Effects

- Who conducts?
  - Contractor
  - Consultant
- Actual bridge configuration
- Base on bridge condition
- Designer to visit site

# Load Distribution

- Non-standard configurations
- Dead load may be predominate
- Placement
- Effects of mats, plates, etc.



# Capacity Limits

- AASHTO Standard Specification
- Operation load
- Permit load

# Bridge in Good Condition

- Compare moments, shears, and reactions due to construction loads and compare them to the minimum bridge design capacity values for the standard AASHTO loading
- Treat moments, shears, and reactions, as Operating loads using load factors from the AASHTO Manual for Condition Evaluation of Bridges
- Local effects of equipment or materials loads may govern member/bridge capacity
- Where bridge members are being replaced or decks are removed, remaining members should be checked to assure that their stability is not adversely affected by temporary conditions



# Bridge with Reduced Available Member Capacity

- Capacity analysis based on actual member properties in accordance with the AASHTO Manual for Condition Evaluation of Bridges, treating the construction load as an operating load
- Use of materials samples with properties established from laboratory testing may be advantageous since test values are often higher than the required minimum values given in specifications

# Controlling Load Effects

- Member strengthening
- Full or partial shoring of bridge
- Use of load distribution system
- Load placement limits delineated on the bridge
- Alternate construction sequence or equipment











# Submittals

- Layout sketches
- Equipment data
- Construction sequence
- Load computations
- Remedial works

# Field Follow-Up

- Verify conformance with plan
- Bridge inspection report upon completion



Questions?