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AISC Live Webinars

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AISC Live Webinars

Course Description

The Structural Stability Game Show!
September 25, 2020

This webinar will feature a panel of engineers and academics, who will present their views on the root cause of three structural collapse case studies. The audience will then be given an opportunity to vote on which cause was most likely. Finally, the moderator will reveal and explain the true nature of the collapse.



AISC Live Webinars

Learning Objectives

- Identify sources of instability for several structural configurations.
- Describe methods for how to approach stability analysis computationally and experimentally.
- Show how the structural factor of safety can be significantly impacted if one neglects considering stability.
- Explain the importance of communication during the design and construction of a project with case studies.



The Structural Stability Game Show!



Cliff D. Bishop
Exponent



Patricia Clayton
UT Austin



Larry Griffis
Walter P. Moore



John D. Hooper
Magnusson Klemencic



Ron Ziemian
Bucknell University

SteelDay
Everywhere

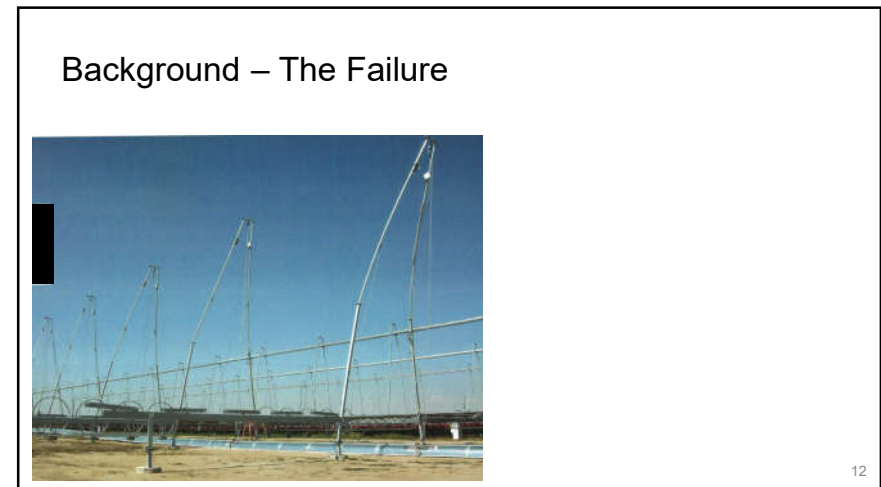
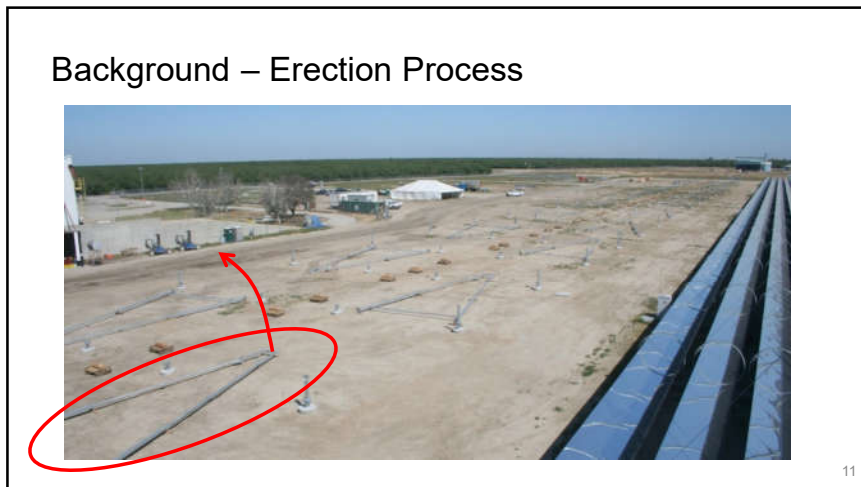
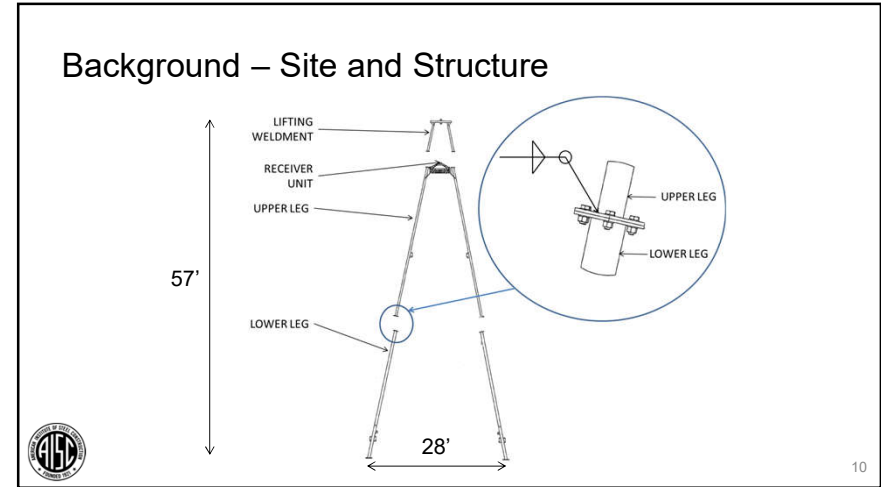
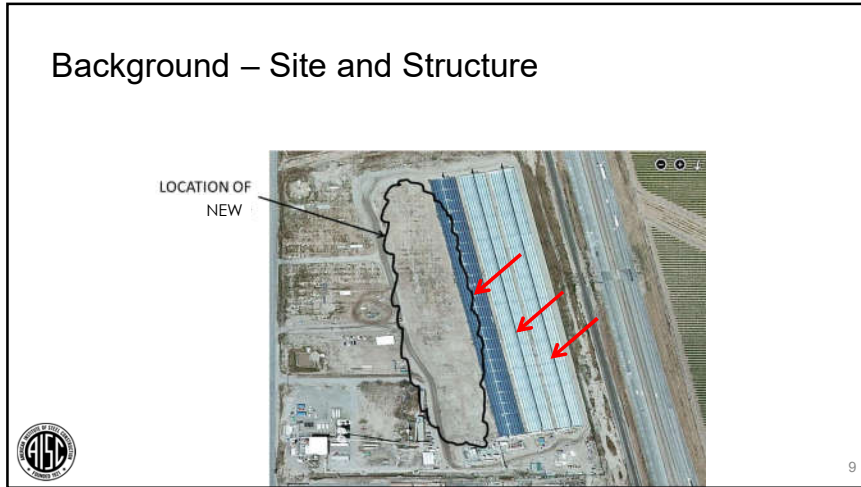
September 25, 2020
aisc.org/steelday

Case 1: Solar power support structure

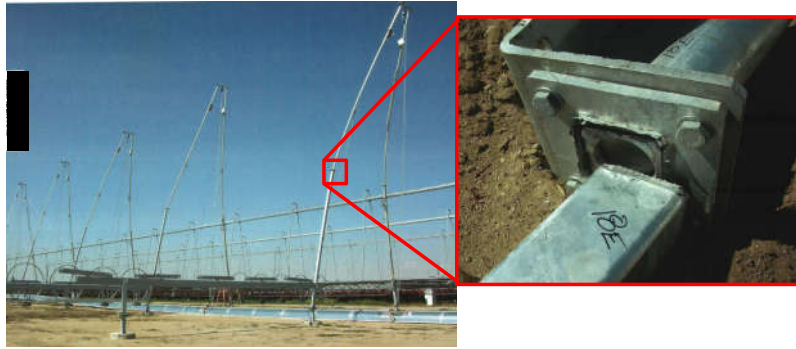


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Background – The Failure



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Contestants' discussion of root cause



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Contestants' discussion of root cause

A. Weld failure



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Contestants' discussion of root cause

A. Weld failure




B. Inadequate design





16




Contestants' discussion of root cause

A. Weld failure 


B. Inadequate design 


C. Poor construction sequencing 





17


Contestants' discussion of root cause

A. Weld failure 

B. Inadequate design 


C. Poor construction sequencing 


D. Extreme weather 





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What was the root cause?


A. Weld failure 

B. Inadequate design 

C. Poor construction sequencing 


D. Extreme weather 


**Time
to
Vote!**





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What was the root cause?


A. Weld failure 

B. Inadequate design 

C. Poor construction sequencing 

D. Extreme weather 

**Select
your
answer!**



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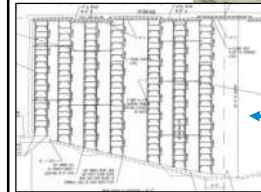
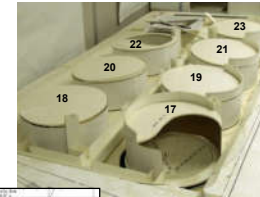


Case 2: Dome scaffolding collapse



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Background



- Project required construction of 7 digester tanks
- Tanks were numbered from 17 to 23
- Dimensions
 - 125-ft diameter concrete tank
 - 50-ft tall
 - 1-ft thick wall and slab
- Base of tanks slopes down towards center
- Aluminum falsework used to support formwork and deck pour

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Background



At the Time of the Accident:

- Tanks 17 and 18 had already been constructed; roof decks poured without incident
- Tank 19 was ready for concrete deck pour
- Tanks 20 and 21 had the falsework almost fully installed

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Background




At the Time of the Accident:

- Concrete roof was being placed in Tank 19, moving south to north
- A little over half of the concrete had been placed

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The failure

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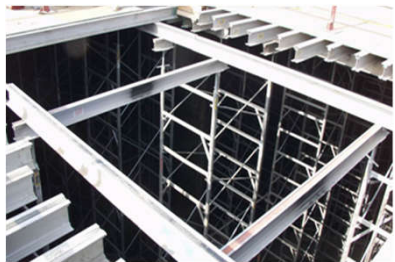
The Failure

- Falsework supporting the plywood in Tank 19 collapsed
- 29 persons on the roof deck
- 14 workers injured; 4 serious; **none** fatally injured
- Tanks 19, 20, and 21 were immediately put under Cal OSHA Order to Preserve, pending investigation

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Scaffold Layout

- Plywood formwork for concrete deck was supported on aluminum beams
- Layers of aluminum beams supported on aluminum shoring towers

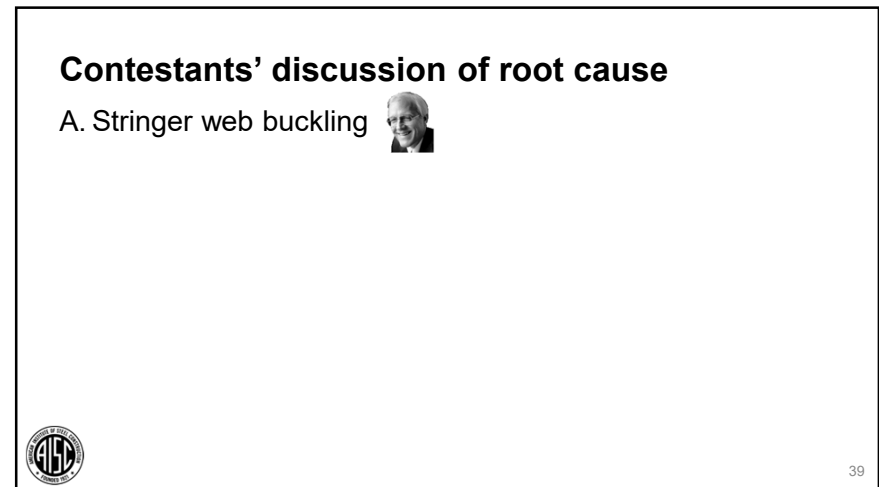
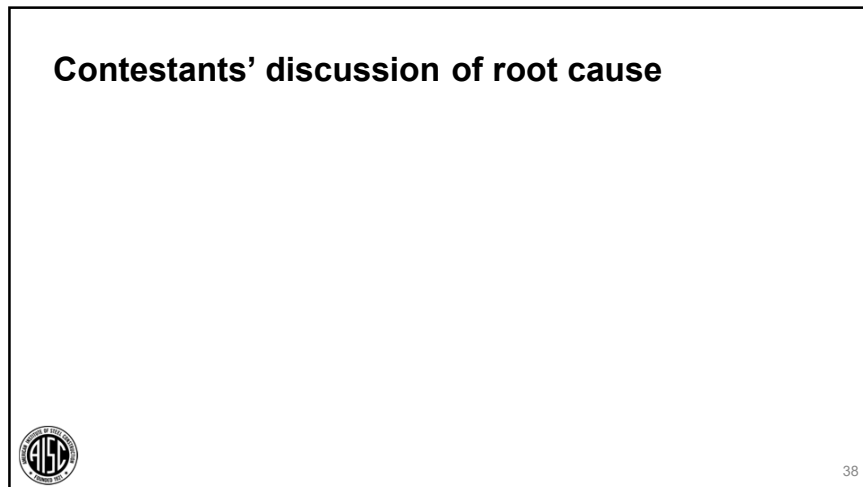
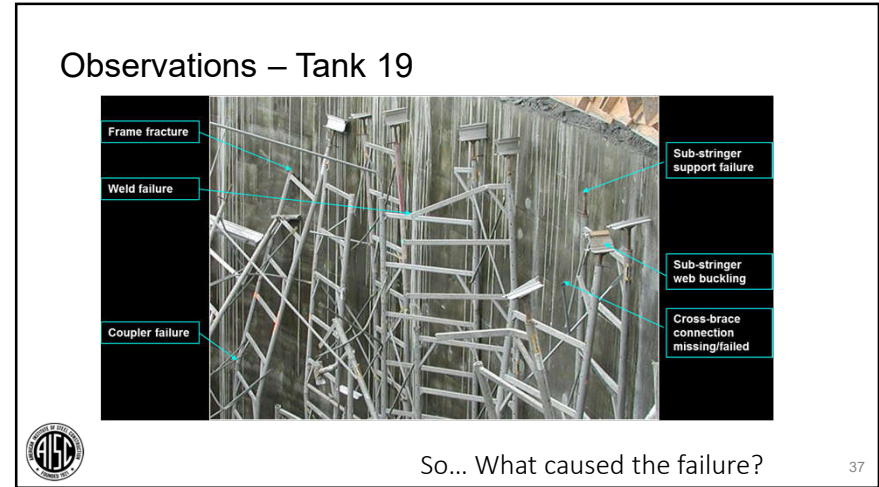
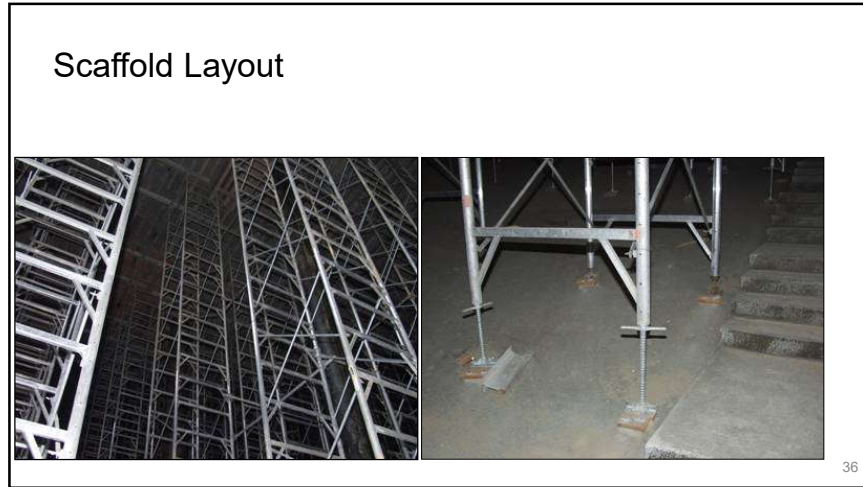
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Scaffold Layout







- Top and bottom of the towers had screwjacks for adjustable extension
- Many of the towers also had 12-inch or 16-inch long sub-stringers at the top

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Contestants' discussion of root cause


- A. Stringer web buckling 
- B. Screwjack extensions 



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Contestants' discussion of root cause


- A. Stringer web buckling 
- B. Screwjack extensions 
- C. Inadequate bracing 



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Contestants' discussion of root cause

- A. Stringer web buckling 
- B. Screwjack extensions 
- C. Inadequate bracing 
- D. Too much concrete 




42

What was the root cause?

- A. Stringer web buckling 
- B. Screwjack extensions 
- C. Inadequate bracing 
- D. Too much concrete 





**Time
to
Vote!**




43



What was the root cause?


- A. Stringer web buckling 
- B. Screwjack extensions 
- C. Inadequate bracing 
- D. Too much concrete 

**Select
your
answer!**



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Case 3: Building roof collapse



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Background



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The Failure



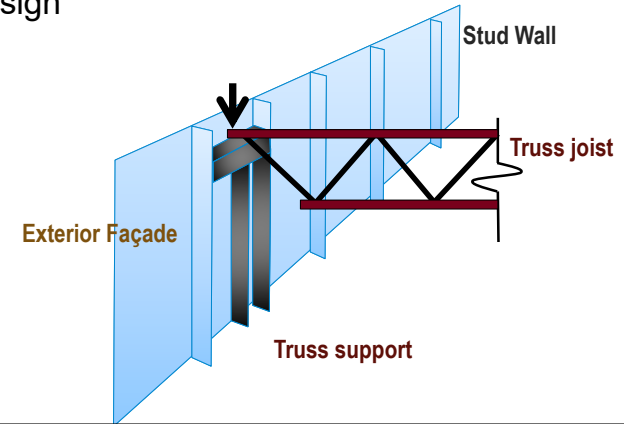
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The Failure



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Design



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As-Built



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The Failure



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Contestants' discussion of root cause



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Contestants' discussion of root cause

A. Freak storm (overload)



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Contestants' discussion of root cause

A. Freak storm (overload)



B. Missing support (improper construction)



65

Contestants' discussion of root cause

A. Freak storm (overload)



B. Missing support (improper construction)







C. Local member effects




66







Contestants' discussion of root cause

- A. Freak storm (overload) 
- B. Missing support (improper construction) 
- C. Local member effects 
- D. Improper design 




67

What was the root cause?





- A. Freak storm (overload) 
- B. Missing support (improper construction) 
- C. Local member effects 
- D. Improper design 

**Time
to
Vote!**




68

What was the root cause?

- A. Freak storm (overload) 
- B. Missing support (improper construction) 
- C. Local member effects 
- D. Improper design 

**Select
your
answer!**





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“For since the fabric of the universe is most perfect, and is the work of a most wise Creator, nothing whatsoever takes place in the universe in which some relation of maximum and minimum does not appear.”

Leonhard Euler in *Lineas Curvas (Elastic Curves)*, 1744

Thank you for your participation!



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