Suffolk County Fire Academy

Medium Level Structural Collapse Concepts

Session 2

Suffolk County Fire Academy

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Session Overview
Session 2

- Structural Shoring Concepts
  - Types (Interior Continued)
  - Types (Exterior)
  - Cribbing
  - Sloped Floor Shore
- Shoring Size-up
- Test
- Hands-on Stations.

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Session Objectives
Session 2

- Identify Components of Interior and Exterior Emergency Shoring Using Lumber and Alternative Shoring Systems
- Understand the Construction and Use of Cribbing
- Describe the Considerations Involved With Shoring Size-up
- Demonstrate The Use of Tools and Equipment To Build Emergency Shoring.

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Structural Shoring Concepts Types (Interior Continued)

4

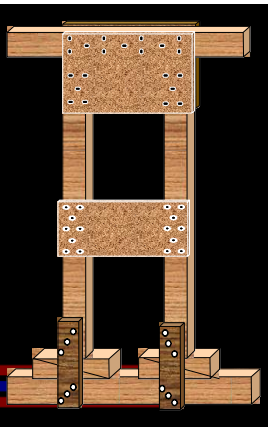
Structural Shoring Concepts Double "T" Shore

- Used when more stability or support is required
- Prefabricated and walked into position
- Maximum 36" header
- Posts can be 18" or 24" apart
- Top/Mid gusset plates are 12" x 24" – ¾" ply
- Upwards of twice the strength of a single T shore
- Shore height less than 6' use top gusset only.

5

3' Header With 6" Overhang of 2 Posts

12"x24" Gusset At Top and Mid-point



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Padding

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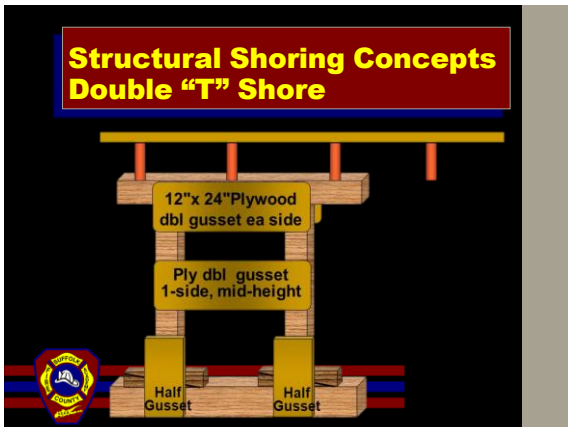
Structural Shoring Concepts
Double "T" Shore
12"x 24"Plywood
dbl gusset ea side
Ply dbl gusset
1-side, mid-height
Half
Gusset
Half
Gusset

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Structural Shoring Concepts
Double "T" Shore

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Structural Shoring Concepts Vertical Shore

- 90% of the shores we will build
- Re-support unstable floors or roofs
- Posts placed under floor beams
- Mid-point bracing required if post is higher than 9'.

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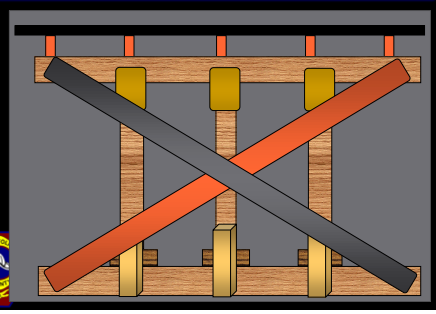
Structural Shoring Concepts Vertical "Dead" Shore



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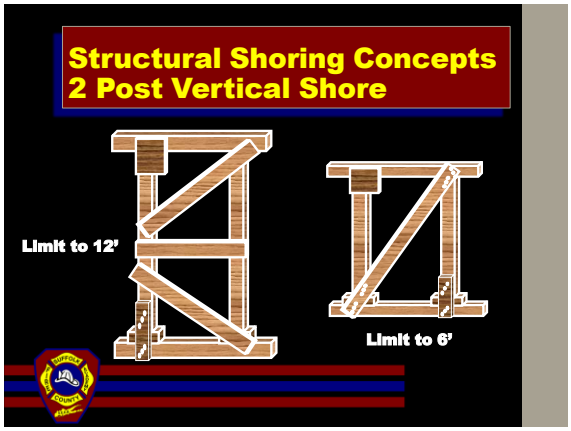
Structural Shoring Concepts Vertical "Dead" Shore

12


Structural Shoring Concepts
2 Post Vertical Shore
Limit to 12'
Limit to 6'

13


Structural Shoring Concepts
2 Post Vertical Shore
Padding

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Structural Shoring Concepts
Laced Post Shore
· The strongest and most stable shore we can construct
· Can be utilized as a safe haven area when necessary
· 4x4's and 6x6's
· Midpoint bracing at 4'
· 5' maximum spacing.

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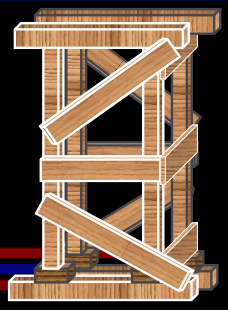
Structural Shoring Concepts Laced Post Shore



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Structural Shoring Concepts Laced Post Shore

17

Structural Shoring Concepts Laced Post Shore Testing

- Approx. height – 12'
- Built to FOG specs.
  - 12" gussets
  - 2x4 wedges
  - 4x4 posts
- Design load – 32,000 lbs.
  - Initial test load – 38,000 lbs.
  - No discernable stress!

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Structural Shoring Concepts Laced Post Shore Testing

- Failure @ 90,000 lbs.
- Torsional action
- Posts buckled at knots
- Still sound after failure.

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Structural Shoring Concepts Horizontal Wall Shore

- Used to stabilize passageways
- 2 – 3 support struts
- Weight of debris will determine size and number of struts required.

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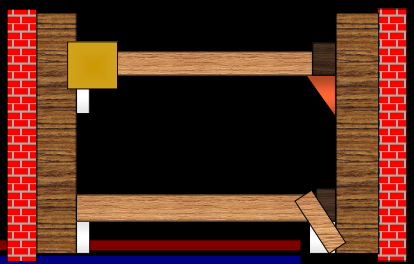
Structural Shoring Concepts Horizontal Wall Shore



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Structural Shoring Concepts
Horizontal Wall Shore

22


Structural Shoring Concepts
Horizontal Wall Shore

23


Structural Shoring Concepts
Horizontal Wall Shore

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Structural Shoring Concepts Door Shore

- Re-support entrance
- Support wall breach
- 1" thickness for every foot of header length.

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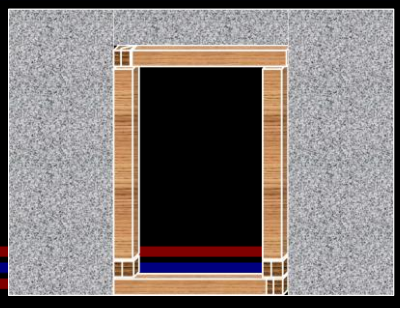
Structural Shoring Concepts Door Shore



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Structural Shoring Concepts Door Shore

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Structural Shoring Concepts Door Shore

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Structural Shoring Concepts Window Shore

- Stabilize window opening
- Support damaged header
- 1" thickness for every foot of header opening.

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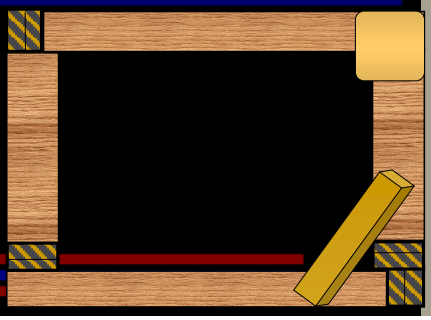
Structural Shoring Concepts Window Shore



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Structural Shoring Concepts
Window Shore

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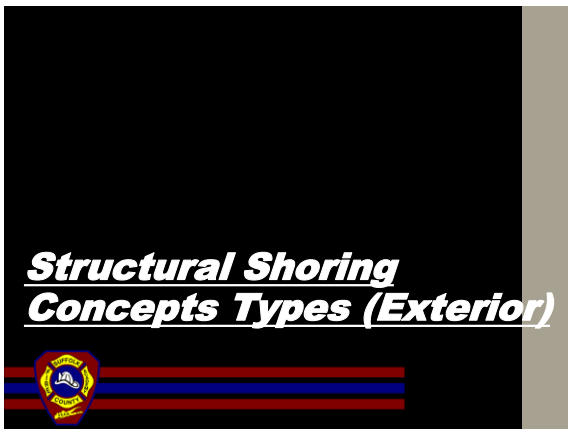
Structural Shoring Concepts
Window Shore
RESCUE
TECHNICIAN
INSTRUCTOR

32


Structural Shoring
Concepts Types (Exterior)

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Structural Shoring Concepts Raker Shore

- Bracing walls that are cracked or leaning away from the building
- Placed *eight foot* on center in most cases
- Must always be laterally braced
- Built away from dangerous wall and carried into place
- The raker capacity must be 2% of the weight of the wall in question.

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Structural Shoring Concepts Raker Shore

DEGREE	PITCH	LENGTH
45°	12/12	x17
60°	12/7	x14

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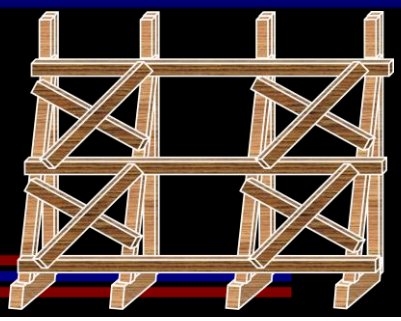
Structural Shoring Concepts Raker Shore



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Structural Shoring Concepts Raker Shore

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Structural Shoring Concepts Solid Sole Raker

- Raker shore of choice
- Generally erected at 45° angle
- Can be used on solid surface or soil
- Prefabricate and walk into position.

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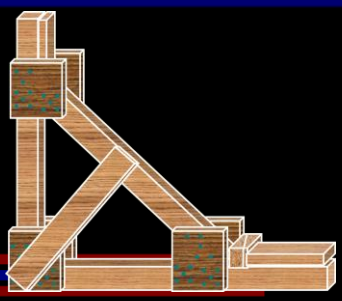
Structural Shoring Concepts Solid Sole Raker



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Structural Shoring Concepts Solid Sole Raker

40

Structural Shoring Concepts Solid Sole Raker

41

Structural Shoring Concepts Raker Test

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Structural Shoring Concepts Raker Test

43

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Structural Shoring Concepts Split Sole Raker

- Raker of second choice
- Used mainly in soil conditions
- Can be utilized where debris is blocking the base of the wall
- Partially preassembled.

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Structural Shoring Concepts
Split Sole Raker

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Structural Shoring Concepts
Split Sole Raker

47


Structural Shoring Concepts
Split Sole Raker
Ground

48

Structural Shoring Concepts Split Sole Raker

49

Structural Shoring Concepts Flying Raker

- A safety raker shore
- Must be anchored to the wall
- *Not a permanent system!*
- Can be reused.

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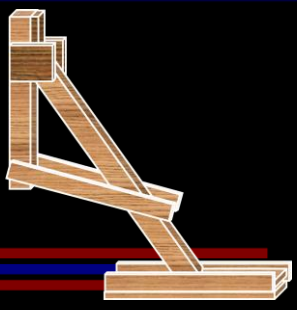
Structural Shoring Concepts Flying Raker



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Structural Shoring Concepts Flying Raker

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Structural Shoring Concepts Flying Shore

- Erected between two structures or large walls
- Generally no larger than 25 feet
- Can be erected multi-story.

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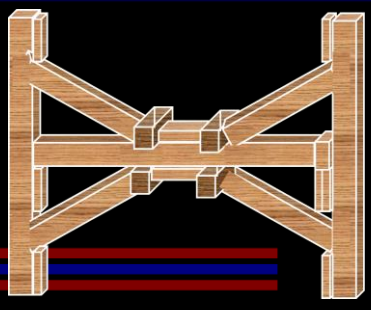
Structural Shoring Concepts Flying Shore



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Structural Shoring Concepts Flying Shore

55

Structural Shoring Concepts Types (Cribbing)

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Structural Shoring Concepts Cribbing

- Floor loads:
  - Contents can weigh upwards of 25 – 35 lbs per cubic foot
  - Collapsed debris ≈ 125 lbs. per cubic foot.

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Structural Shoring Concepts Cribbing

- Rules of thumb:
  - Overlap width of material
  - 3x height to the width
  - > 3', consider other shoring methods.

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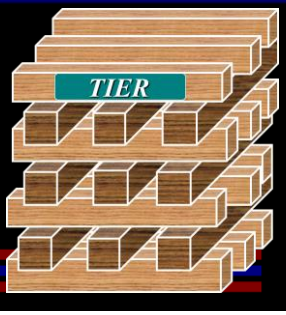
Structural Shoring Concepts Cribbing



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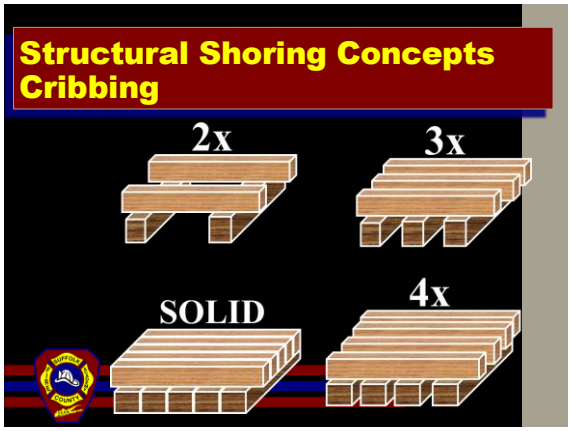
Structural Shoring Concepts Cribbing

60


Structural Shoring Concepts
Cribbing
2x
3x
SOLID
4x

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Structural Shoring Concepts
Cribbing Contact Points
6000 lbs. Per Contact Point
24,000 lbs.
54,000 lbs.

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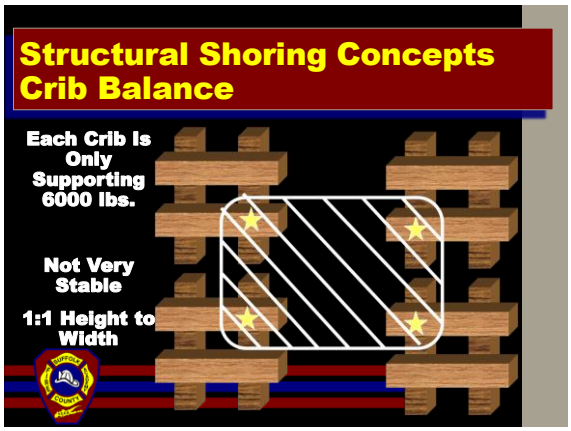
Structural Shoring Concepts
Cribbing Contact Points
Objects Must Have Full Bearing With Crib Contact Points

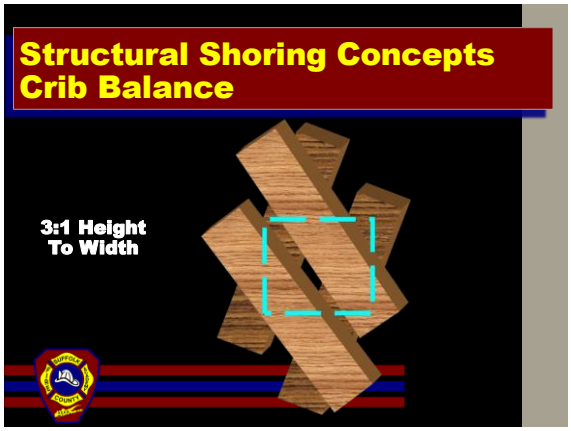
63


Structural Shoring Concepts
Cribbing Contact Points
Objects Must Have Full Bearing With Crib Contact Points

64


Structural Shoring Concepts
Crib Balance
Each Crib Is Only Supporting 6000 lbs.
Not Very Stable
1:1 Height to Width

65


Structural Shoring Concepts
Crib Balance
3:1 Height To Width

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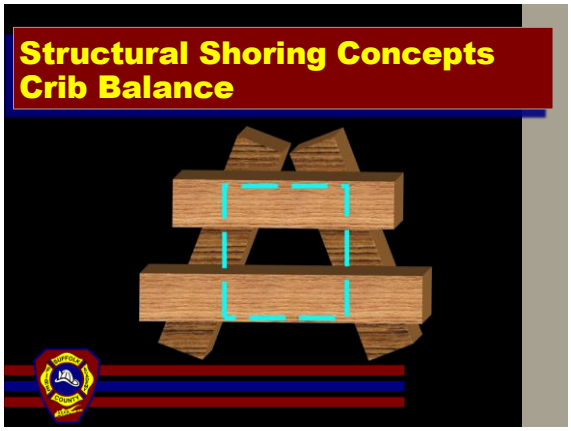
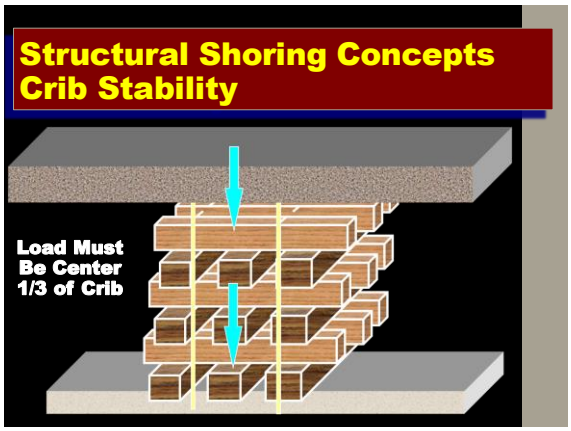

Structural Shoring Concepts
Crib Balance

67


Structural Shoring Concepts
Crib Stability
Load Must
Be Center
1/3 of Crib

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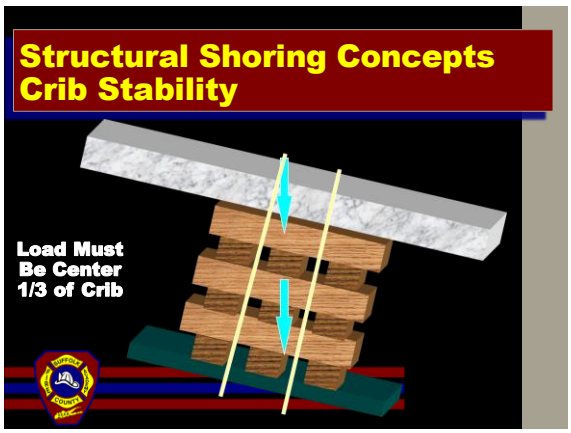
Structural Shoring Concepts
Crib Stability
Load Must
Be Center
1/3 of Crib

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Structural Shoring Concepts
Crib Level

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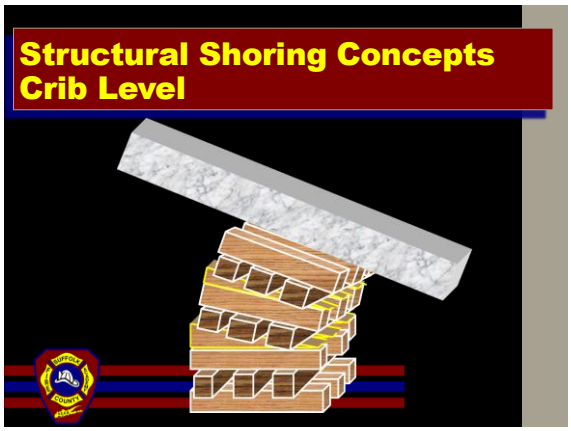
Structural Shoring Concepts
Crib Level

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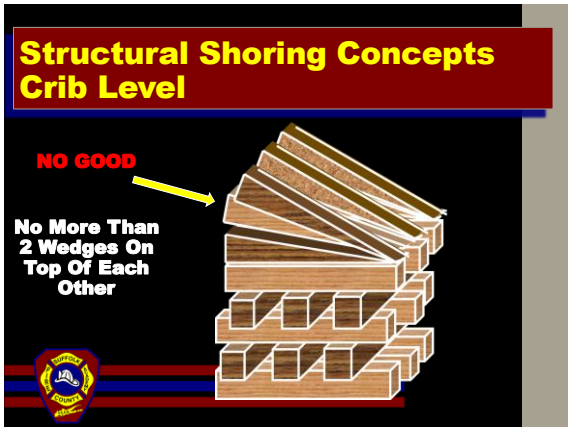
Structural Shoring Concepts
Crib Level

72


Structural Shoring Concepts
Crib Level
NO GOOD
No More Than
2 Wedges On
Top Of Each
Other

73


Structural Shoring Concepts
Crib Level
OK

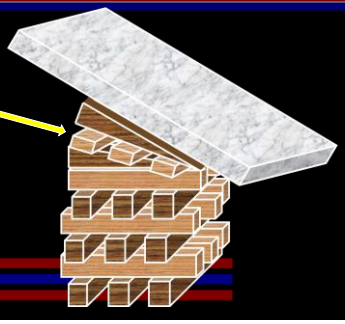
74


Structural Shoring Concepts
Crib Level
BETTER

75

Structural Shoring Concepts Crib Level

Use 2x4's If Necessary



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Structural Shoring Concepts Cribbing Test

- 4x4
- 4' cribbing length
- Approx. 8' 6" height
- Design Load:
  - 24,000 lbs.
  - 6,000 lbs./contact point
- Initial Test Load:
  - 28,000 lbs.

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Structural Shoring Concepts Cribbing Test

- As load increased, crib continued to "squash"
- Note cupping and splitting
- Noise accompanied compression.

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Structural Shoring Concepts Cribbing Test

- No failure
- Continued compression
- Note – greater cupping and splitting near base
- Composite vs. wood

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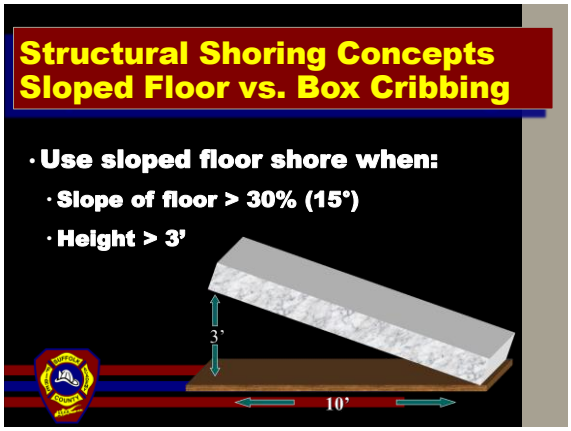
Structural Shoring Concepts Cribbing Strength

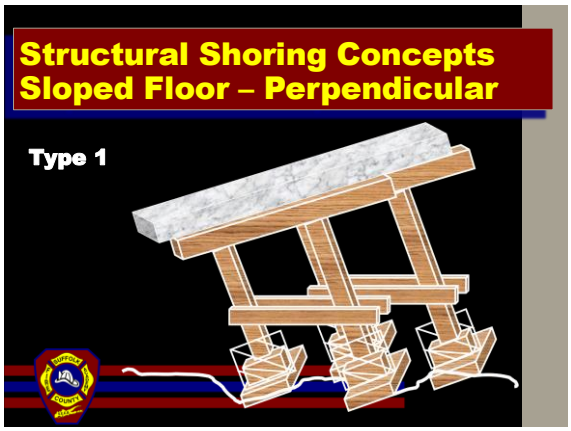
80

Structural Shoring Concepts Types (Sloped Floor Shore)

81


Structural Shoring Concepts
Sloped Floor vs. Box Cribbing
· Use sloped floor shore when:
· Slope of floor > 30% (15°)
· Height > 3'
3'
10'

82


Structural Shoring Concepts
Sloped Floor – Perpendicular
Type 1

83


Structural Shoring Concepts
Sloped Floor – Perpendicular
Type 2

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Structural Shoring Concepts Sloped Floor – Perpendicular

85

Shoring Size-up

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Shoring Size-up Considerations

- Missing structural items
- Structural fire damage
- Age of structure
- Condition of structure
- Six-sided approach.

87

Shoring Size-up Considerations

88

Shoring Size-up Considerations

- Walls out of plumb
- Strained structural items
- Construction type
- Beam connections
- Door and window access / condition.

89

Shoring Size-up Considerations

90

Shoring Size-up Considerations

- Sagging floors / roofs
- Columns out of plumb
- Framed or unframed
- Access to the structure
- Bulging / cracked walls.

91

Shoring Size-up Considerations

92

Shoring Size-up Considerations

- Separating walls
- Potential for vibration
- Unprotected steel beams
- Trusses
- Void access
- Bearing wall stability.

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Shoring Size-up Considerations

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Shoring Size-up Weights of Materials

- Steel – 490 lbs. / ft^3
- Wood – 35-50 lbs. / ft^3
- Concrete – 150 lbs. / ft^3
- Masonry – 125 lbs. / ft^3
- Conc./Msry. Rubble – 120 lbs. / ft^3
- Furniture – 10-20 lbs. / ft^2

95

Shoring Size-up Weights of Materials

- Steel Deck/Coonc. Fill – 50 lbs. / ft^2
- 8" Concrete Reinforced Block – 60 lbs. / ft^2
- Curtain Walls – 10-15 lbs. / ft^2
- Wood/Metal Stud Walls – 10-15 lbs. / ft^2
- Concrete Floors – 90-150 lbs. / ft^2.

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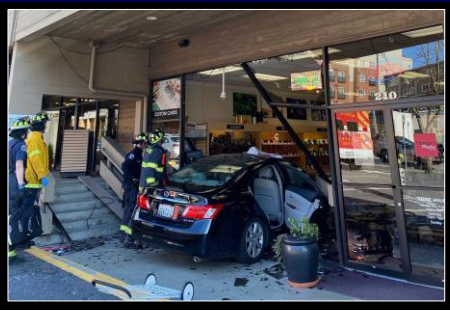
Size It Up

97

Size It Up



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Questions?

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