

Tilt-Up 101  
Part 3: Construction Hour – Building with Tilt-Up

Presented by the Tilt-Up Concrete Association  
www.tilt-up.org

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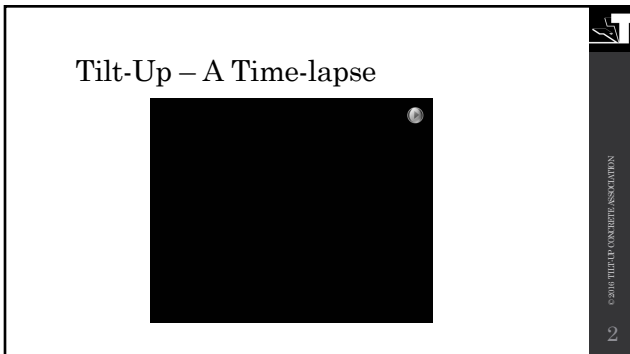
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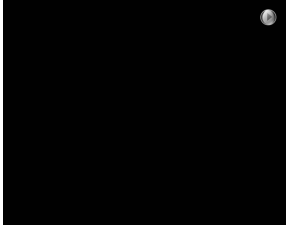
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Tilt-Up – A Time-lapse



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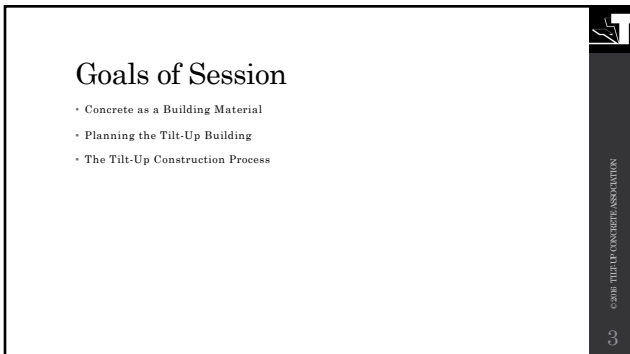
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Goals of Session

- Concrete as a Building Material
- Planning the Tilt-Up Building
- The Tilt-Up Construction Process

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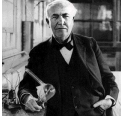
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## What is Tilt-Up



- A construction method which eliminates the cumbersome practice of constructing two wood walls to get one concrete wall.
- Thomas A Edison, 1909

### Modern Definition

- The process of casting walls or other concrete elements on site, lifting and placing them in their final location in a structure.



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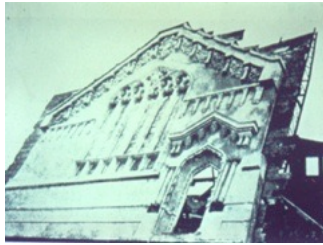
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## History of Tilt-Up



Tilt-Table Circa 1909



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## Evolution of Tilt-Up

Ready-Mix Concrete



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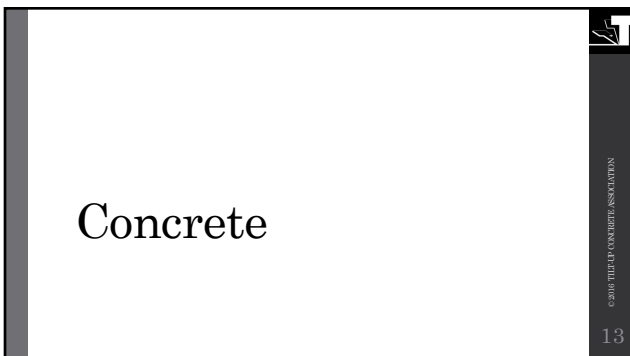
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### Concrete Constituents



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### Mix Proportioning

Mix Design/Mix Proportioning for Specific Properties by Concrete Properties

	Cement	Water	Air	Fine agg.	Coarse agg.
Mix 1	15%	18%	8%	28%	31%
Mix 2	7%	14%	4%	24%	51%
Mix 3	15%	21%	3%	30%	31%
Mix 4	7%	16%	1%	25%	51%

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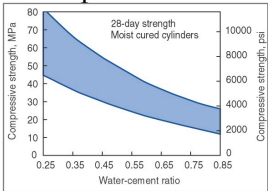
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### Concrete Properties



- W/C Ratio Effect on Strength
- Low W/C Ratio = Better Concrete

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## Impact of Adding Water

Increase beyond  $w/cm$ ...

- Lowers strength
- Increases permeability
- Decreases resistance to weathering
- Poorer bond between concrete and reinforcement
- Increases shrinkage and cracking
- Greater volume change from wetting and drying

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## Blended Cements

- Fly Ash & other pozzolans
- Silica fume
- Ground granulated blast-furnace slag
- Hydrated lime
- Replace part of cement
- Slight alteration properties
- Improves "greenness" of concrete



Mineral Admixtures as Described by ASTM C595

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## Admixtures: Improving Concrete

- Retarder - slows cure (good in hot weather)
- Air entrainment - durability & workability
- Water-reducers (MRWR) - reduce  $w/cm$  & increase slump
- Superplasticizers (HRWR) - creates increased flowability
- Accelerators - early-age strength gain
- Coloring - aesthetics
- Others - corrosion inhibitors, shrinkage reducers



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### Concrete Needs...



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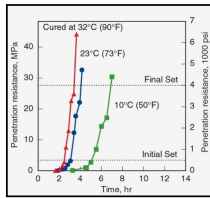
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### Concrete Curing



- Higher Temp = Faster Curing
- Protect Fresh Concrete Below 40 Degrees F until 1000 psi

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### Cold Weather Concrete



- Protect Subgrade
- Casting Window
- Protect until 500 psi
- Adjustment to working conditions
- Awareness of material
- Freezing/Frozen Impact

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### Hot Weather Concrete

- Cast During Evening Hours
- Cold Water/Ice
- Accelerators
- Protect After Casting
- Sun & Wind



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### Concrete Curing



- Water Needed for Hydration
- Wet Curing (Burlap/Misting)
- Curing Compounds

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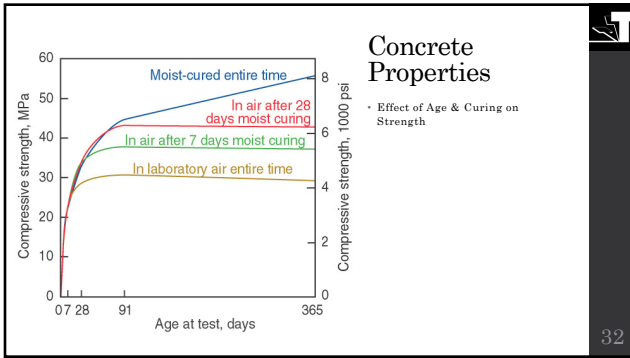
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### Measuring Strength

- Cylinders measure compressive strength
- Comp. Strength x 10% = Flex. Strength
- Beam Test Important for Lifting (Modulus of Rupture)
- Cast from wall mix
- Store on site in conditions similar to wall
- Lift Strength Specified in Panel Book
- 3 Specimens per Run

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### The Tilt-Up Site

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**Planning: The Site**

- Topography
- Access to Perimeter
- Overhead and Underground Utilities/Obstructions
- Material Storage/Staging
- Special Permits
- Noise/Dust Abatement

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**Planning: Panel Layout Efficiency**

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**Alternative Casting: Slabs**

- Casting Beds (Waste Slab)
  - Thickness 2"-3"
  - Finish: Match Floor
  - Unreinforced
  - Multiple Uses
  - Adjacent for Crane Efficiency

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**Alternative Casting: Stacking**

- Stacked Casting
  - Up To 5-6 High
  - Same Size or Smaller Panels on Top
  - Plan Lifting Order

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**Construction of a Tilt-Up Building**

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**Site Preparation**

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## Foundation Systems

- Foundation Systems
  - Spread (Continuous) Footings
  - Foundation Walls
  - Deep Foundations
- Panel Weight Can Be 75% of Footing Load

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## Foundations/Floor Slab

- Footings Typically 1"-2" Below Bottom of Panel
- Adjust Height with Shim Packs
- Preset Bearing with Grout Pads

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## Base Preparation

- Slab Compaction to Minimum 90%
- Place Slab As Soon As Possible
- Use Non-Expansive Granular Fill – Capillary Break
- Confirm Capacity with Geotechnical Engineer
- Slab Only As Good As the Sub-base

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**Placement of the Floor Slab**  
 Must take place as soon as possible to protect compaction of sub-base and keep frost from the ground.

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**Floor Slab**

- The Building Floor Slab
- Most Common Casting Surface
- Hard Trowelled Finish Recommended
- Most Panels Cast Face Down
- Use a Low Water-Cement Ratio
- 5" Recommended Thickness

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**Floor Slab Loading**

- Crane Tire Load
- Outrigger Loading
- Brace Loading
  - Punching
  - Uplift/Sliding

**Who is Responsible?**




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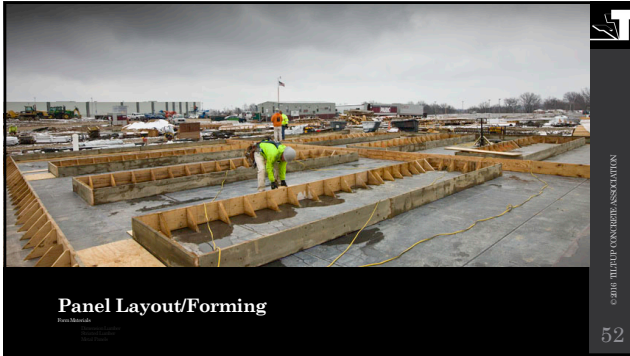
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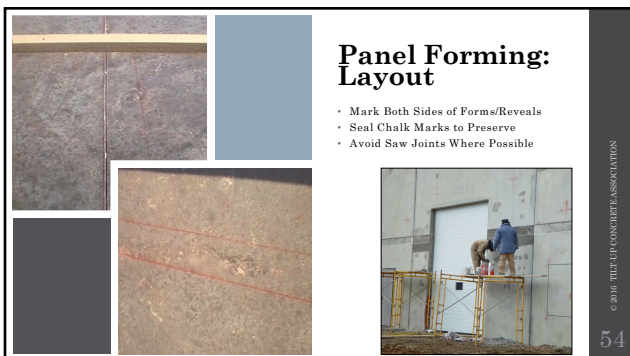
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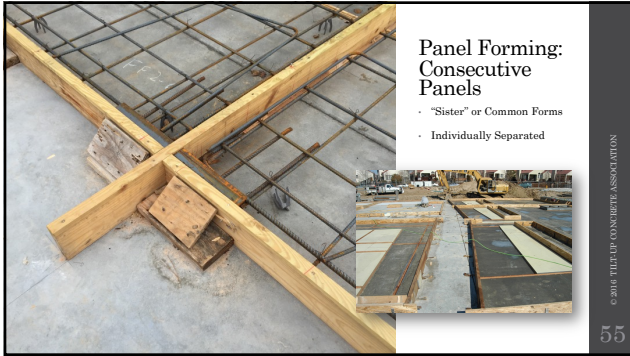
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**Panel Forming:  
Consecutive  
Panels**

- "Sister" or Common Forms
- Individually Separated

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**Panel Forming:  
Support**

- Most Common Panel Thickness: 5-1/2" to 9-1/4"
- Bracing Methods
  - Dimensional Lumber
  - Metal Brackets
  - Glue-Down Systems
- Attachment Decisions
  - Will the owner accept holes or patches?
  - Will the adhesive withstand the elements?

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**Panel Forming:  
Detailing**

- Chamfer Strips (22.5 or 45 deg.)
- Fabricate in Shop
  - White Pine, Poplar,
- Manufactured
  - Polystyrene, Plastic
- Mechanically-fastened or Adhesive
- Chamfer Edges to Avoid Corner Damage

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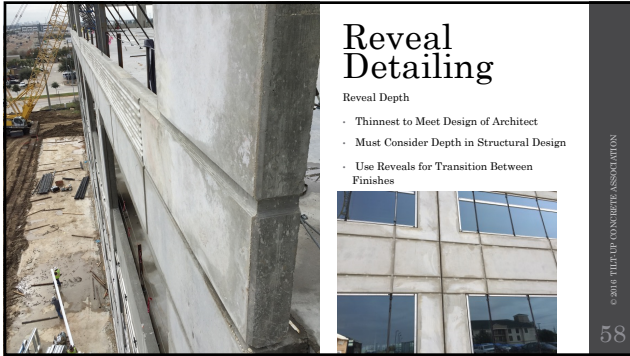
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**Reveal Detailing**

Reveal Depth

- Thinnest to Meet Design of Architect
- Must Consider Depth in Structural Design
- Use Reveals for Transition Between Finishes

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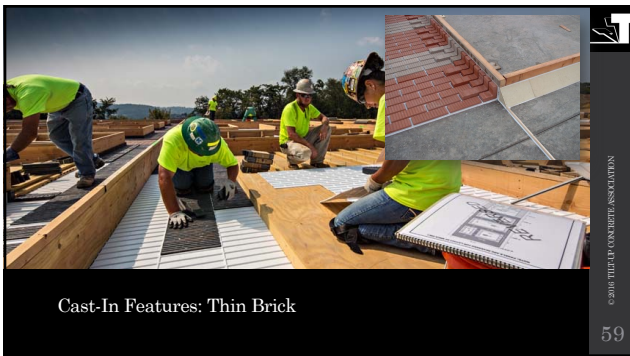
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**Cast-In Features: Thin Brick**

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**Shaped Panel Forming:**

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### Preparing to Cast

- Clean All Surfaces of Debris
- Apply Bond Breaker Prior to Installation of Reinforcement
  - Always Follow Manufacturer's Recommendation
  - Prevent Sticking
  - 2 Coats @ Right Angles
  - Field Check Curing Compound/Bond Breaker Compatibility
  - Water Beads Mean Coating is Effective
  - Some Materials Serve as Curing Compound & Bondbreaker



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### Panel Reinforcement

*You must remove reinforcement if it is necessary to reapply bond breaker - ACI*

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### Panel Reinforcement

- Types of Reinforcement
  - Welded Mats
  - Rigid Wire Mesh

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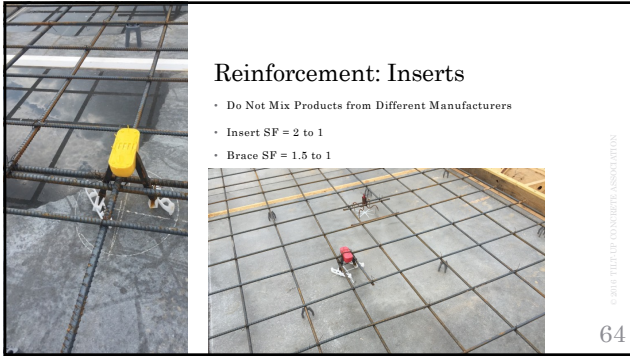
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**Reinforcement: Inserts**

- Do Not Mix Products from Different Manufacturers
- Insert SF = 2 to 1
- Brace SF = 1.5 to 1

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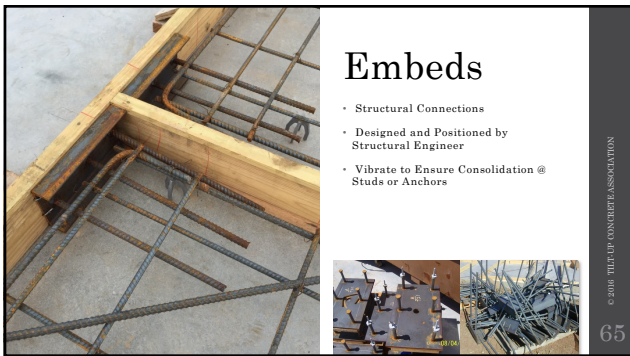
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**Embeds**

- Structural Connections
- Designed and Positioned by Structural Engineer
- Vibrate to Ensure Consolidation @ Studs or Anchors

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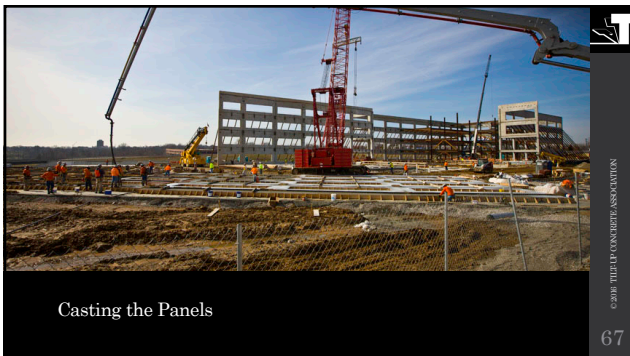
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**Casting the Panels**

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### Casting the Panels

- Concrete Placement
  - Direct Chute
  - Concrete Pump/Conveyor
  - Bucket
- Break Initial Surge
- Drop on Prior Placed Concrete
- Begin vibrating immediately
- Fill to designed lift thickness

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### Concrete Placement

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### Concrete Placement

- Finished surface normal as interior of space
- Stack-cast requires finish to match casting slab
- Protect for time/temperature/humidity

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## Insulation Systems

- Sandwich Panels



- Edge to Edge Insulation
- Eliminate Thermal Bridges
- Non-Conductive Connections

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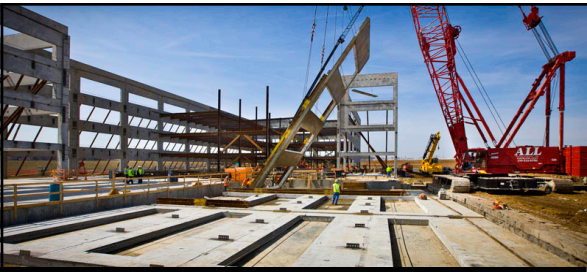
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## Erection

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## Erection Day: “Day of Reckoning!”

- CONSIDERATIONS
  - Safety
  - Slab Loads
  - Crane Selection
  - Lifting Location
  - Sequence
  - Safety!!

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### Safety Meeting

- Only the rigging foreman should signal crane operator
- Discuss erection sequence
- Never be under a panel while it is being tilted
- Have crew sign check list at conclusion of safety meeting
- Stay clear of area if not involved in the lifting



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### Site Stability



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### Prior to Lifting: Rigging Crew

- Locate lifting and bracing inserts
- Uncover and clean out
- Test and attach clutches and braces

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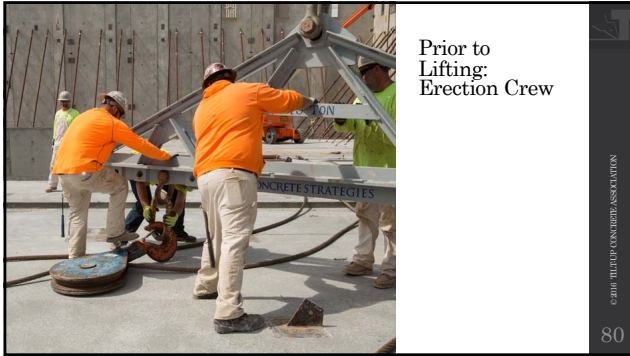
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Prior to Lifting: Erection Crew

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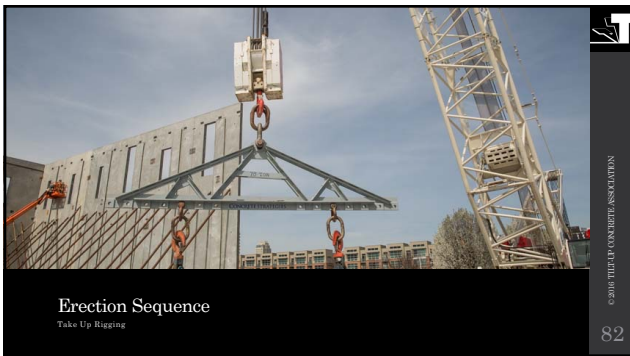
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Erection Sequence  
Take Up Rigging

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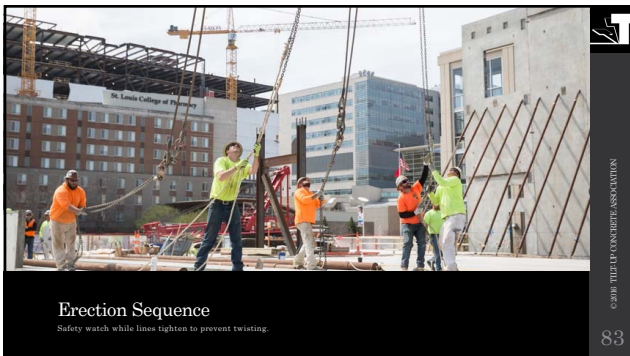
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Erection Sequence  
Safety watch while lines tighten to prevent twisting.

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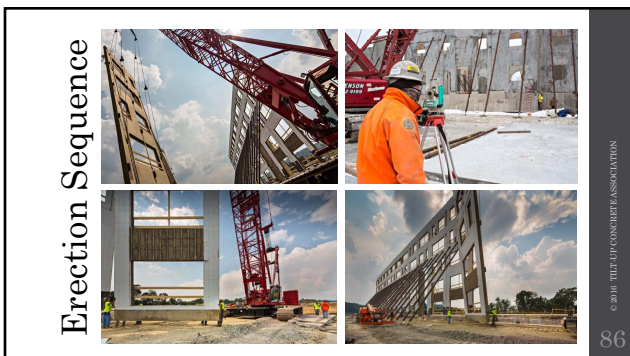
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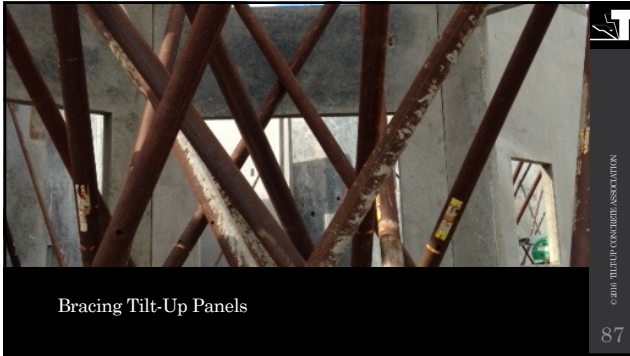
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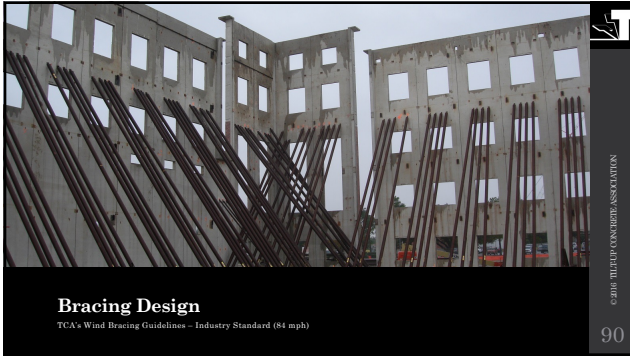
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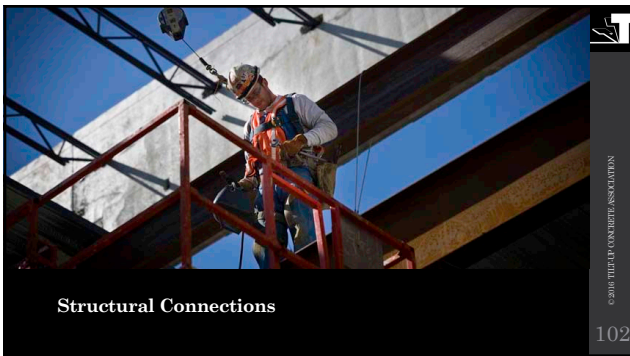
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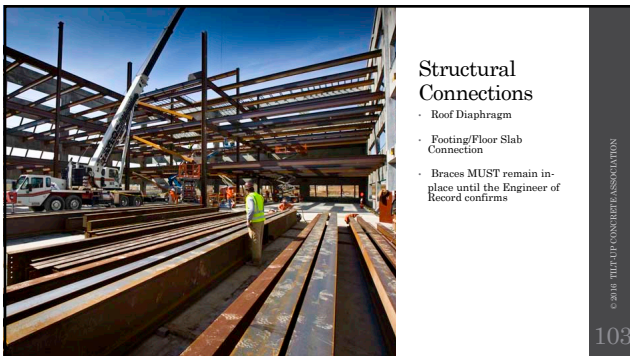
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### Structural Connections: Base



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### Grouting

Grout as Soon as Panel is Set and Adjusted

- Flowable Grout
- Dry Pack

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### Cleaning

- Clean From Bottom Up
- Rinse From Top Down
- Power Wash Common
- Cleaning Agent (TSP) & Water
- Bond Breaker Neutralization
- Paint >50 degrees & pH 7-10

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## Repairs

- Grinding
- Rubbing Stone
- Sacking
- As much as possible while panel is still horizontal

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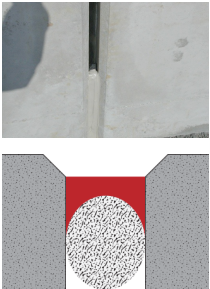
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## Caulking

- Clean with Wire Brush, Power Wash or Sandblast
- Remove All Bond breaker
- Failure Mode: Lack of Adhesion
- Sealant Depth = 1/2 Joint Width
- Caulking Materials
- Polyurethanes
- Polysulfides
- Silicon
- Fire-Rated Joints Possible



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## Completed Shell

- Most common finish is painted (textured)
- Natural (unfinished) increasingly popular
- Sand-blast
- Acid Etch
- Polished
- Stained

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**Mock-Up Panels**  
**Insure Expectations Meet Reality**

- One Panel for Each Finish Type (or Multiple per Panel)
- 4' x 8' Minimum Size
- Replicate Job Conditions (include slab joint)



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**TCA Guideline Specifications**  
 Finish Grade Based on Viewing Distance of Visible Defects

**THE TILT-UP CONCRETE ASSOCIATION'S GUIDELINE SPECIFICATIONS**  
 in  
 Standard 3-part CSI Format

- Grade A: Architectural – 10'-25'
- Grade B: Standard >25' Viewing
- Grade C - Utility

The guidelines are intended for the use of professional personnel concerned to establish the objectives of inspection and to assist actual responsibility for the application of the standard. It is necessary to address the application of the standard to the specific conditions of the project. The professional using the guidelines is solely responsible for the application of the standard to the specific conditions of the project. The Tilt-Up Concrete Association makes no representation, warranty or guarantee in connection with the guidelines, and assumes no liability for any loss or damage resulting from the use of the guidelines. The Tilt-Up Concrete Association is an umbrella organization to meet the needs of producers, manufacturers or suppliers in properly train, train, and equip their employees or others, and to comply with applicable federal, state or local regulations or laws.

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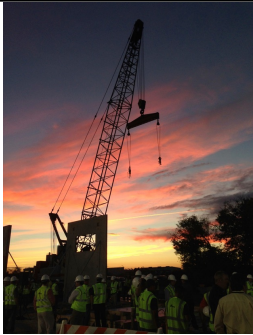
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**Learn More**

- TCA
- Events
- Web Site
  - ([www.tilt-up.org](http://www.tilt-up.org))
- Publications
- Network
- Manufacturers



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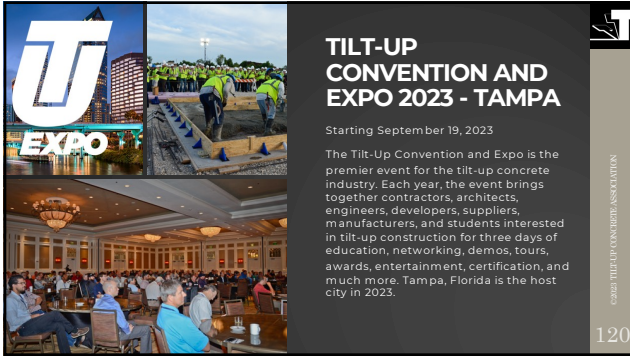
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**TILT-UP CONVENTION AND EXPO 2023 - TAMPA**

Starting September 19, 2023

The Tilt-Up Convention and Expo is the premier event for the tilt-up concrete industry. Each year, the event brings together contractors, architects, engineers, developers, suppliers, manufacturers, and students interested in tilt-up construction for three days of education, networking, demos, tours, awards, entertainment, certification, and much more. Tampa, Florida is the host city in 2023.

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**Thank You!**

This concludes the Continuing Education Program.

**Any Questions?**

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