

Tilt-Up Overview with MD Case Studies (It's Not Just for Warehouses!)

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Disclaimer



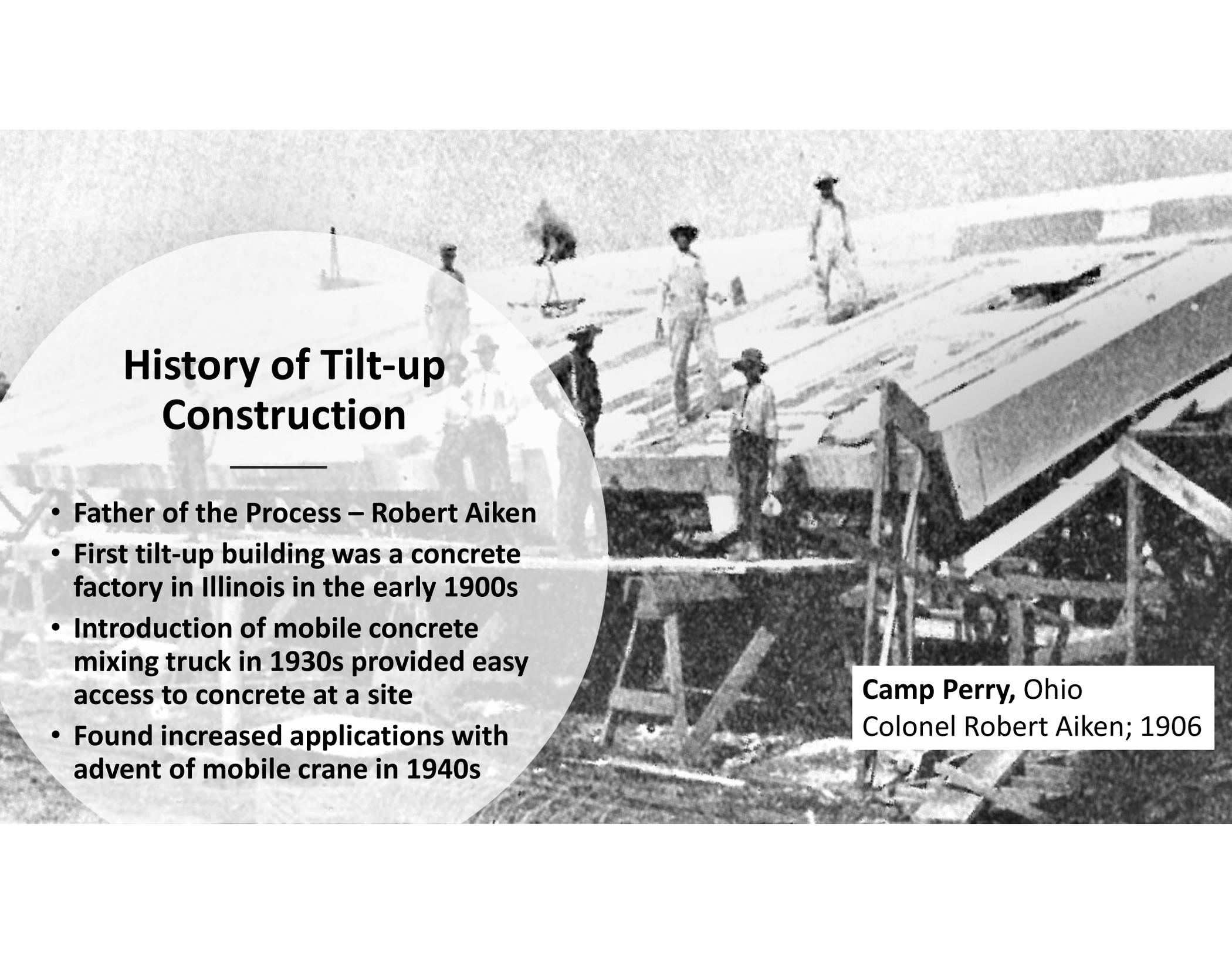
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Learning Objectives/Goals

- Brief History/Background
- Design Aspects
- Construction Sequence
- Maryland Project Case Studies
- Architectural Versatility
- Design Assistance & References



A historical black and white photograph showing a construction site. Several workers in hard hats and work clothes are standing on a large, sloping concrete structure that appears to be part of a building's roof or a large wall. The structure is supported by a complex wooden scaffolding system. The background shows a clear sky and some distant structures.

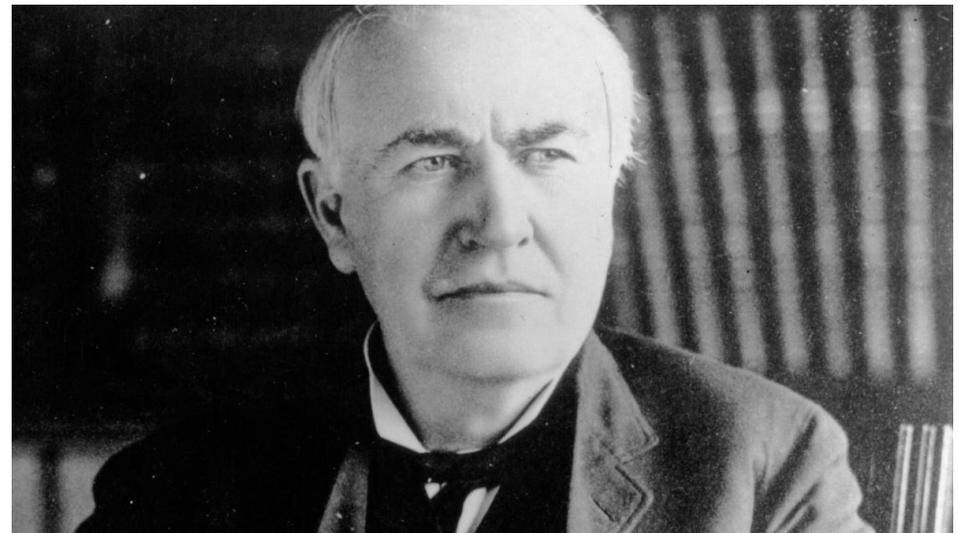
History of Tilt-up Construction

- **Father of the Process – Robert Aiken**
- **First tilt-up building was a concrete factory in Illinois in the early 1900s**
- **Introduction of mobile concrete mixing truck in 1930s provided easy access to concrete at a site**
- **Found increased applications with advent of mobile crane in 1940s**

Camp Perry, Ohio
Colonel Robert Aiken; 1906

Thomas Edison recognized the advantages of tilt wall construction.

“Tilt-up construction eliminates the costly, cumbersome practice of erecting two wooden walls to get one concrete wall.”



❖ Tilt Wall Concrete Buildings

- **Modern Definition: “a construction technique for casting concrete elements in a horizontal position at the job site and then tilting them to their final position in a structure”**



Tilt-Up Walls – Simplistically, a 2-Step Process



1. Form and cast panel on slab



2. Lift "Tilt" panel to final position

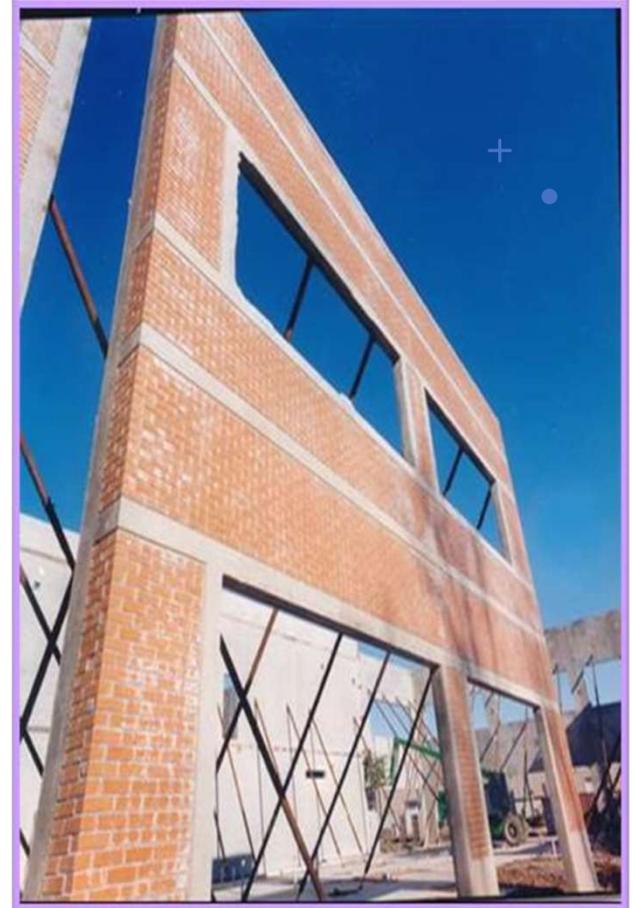
Tilt-Up Wall Design Considerations

- Panel Size (height by width)
- Panel Thickness (include insulation – sandwich application?)
- Panel Openings (overhead/pedestrian doors, windows, etc.)
- Panel Logistics (layout for construction and lifting)
- Design Loads (dead, live, snow, wind, seismic, combinations)



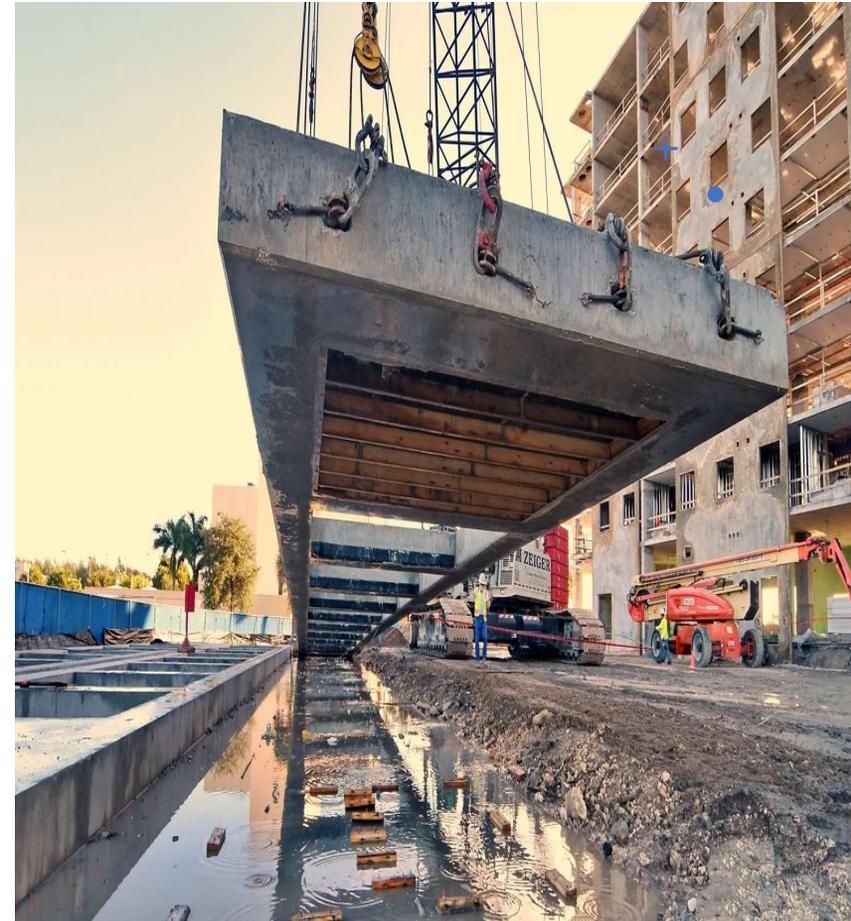
Tilt-Up Wall Design Considerations

- Design Software (connections, levels, deflections, temperature/shrinkage, lifting stresses, etc.)
- Reinforcing steel sizes and layout, including for openings and lifting
- Temporary Bracing during panel installation
- Interior Structural Framework design and connections to panels
- Foundation system and connections for panels
- Exterior finish (reveals, patterns, textures, colors)



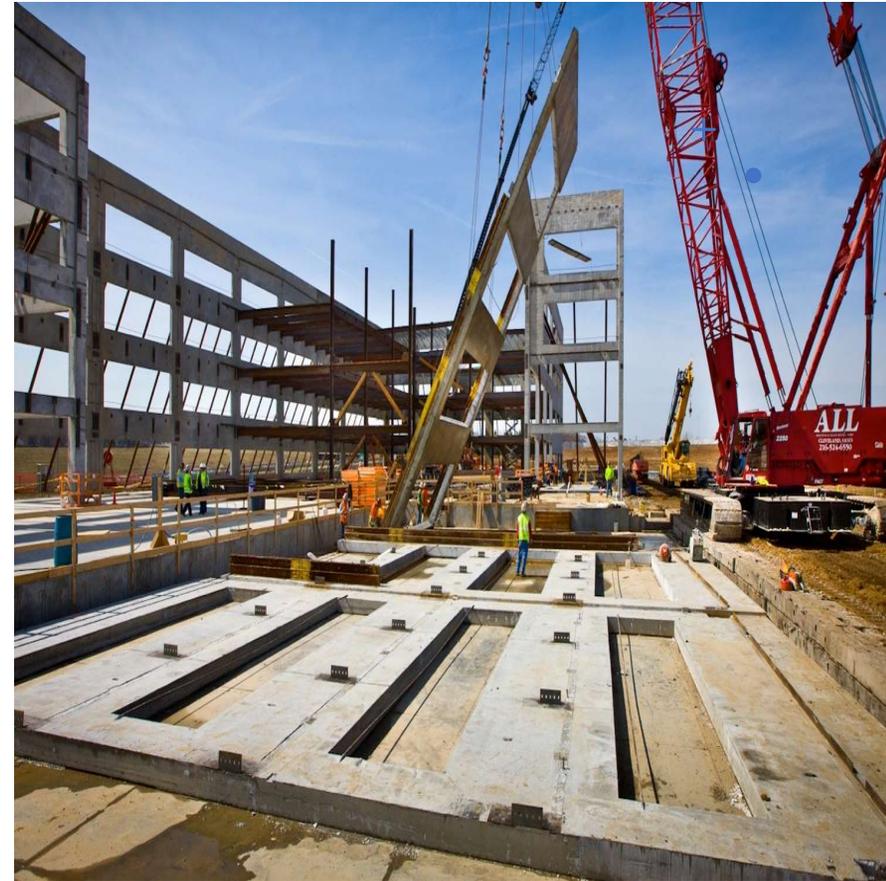
Tilt-Up Wall Construction

- Casting slab flatness/levelness and finish
 - Casting surface is MOST important contributor to the quality of the finish of the panels
- Suitable bond breaker compatible with curing compound
- Accurate panel drawings/layout with all details clearly delineated, including openings
- Coordination of forms with reveals/formliners; chamfered edges; caulk/seal joints
- Reinforcing steel layout using supporting chairs; embeds, supplemental bars, and lifting inserts

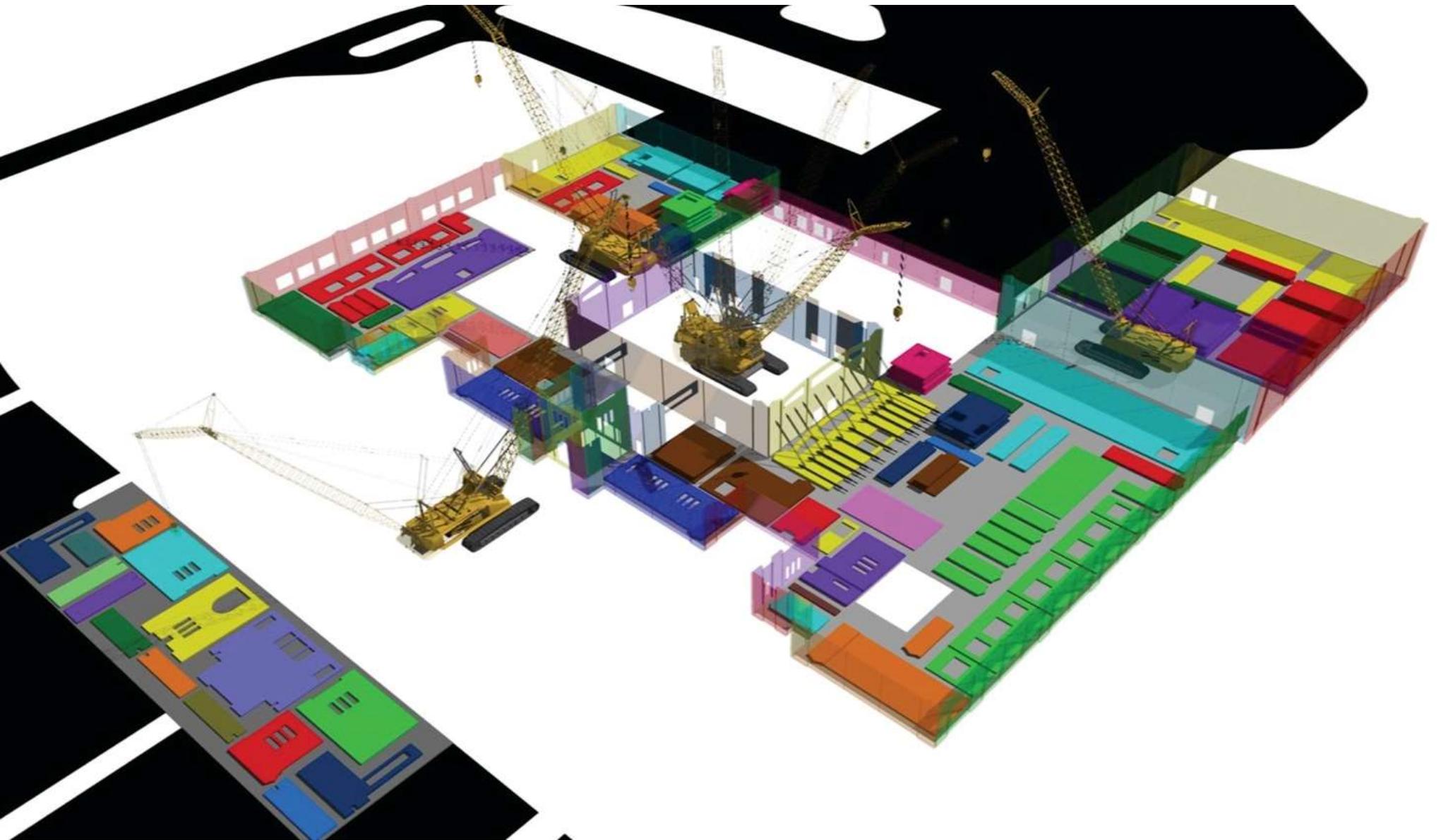


Tilt-Up Wall Construction

- Appropriate concrete mix (early strength and sustainable, but limit use of fly ash)
- Crane path for lifting and setting panels
- Adequate equipment for temporary bracing during install operations
- Sequencing of interior structural frame installation for removal of bracing









An Overview of the Tilt-Up Construction Process



SUBGRADE FOR SLAB IS GRADED AND COMPACTED



**“CASTING” SLAB IS FINISHED LEVEL AND FLAT -
BOND BREAKER THEN APPLIED TO SURFACE**



**WALL PANELS ARE FORMED AND CAST
ON THE BUILDING SLAB AND OR
NEARBY RECYCLABLE CASTING SLABS**



FORMS TYPICALLY USE 2x LUMBER WITH KICKERS TO FORM THE PANEL EDGES

**ITEMS TO BE CAST INTO THE WALL
(REINFORCEMENT, EMBEDDED LIFT
PLATES, REVEAL STRIPS, ETC) ARE
PLACED PRIOR TO PLACING CONCRETE.**



CONCRETE IS PLACED AND VIBRATED

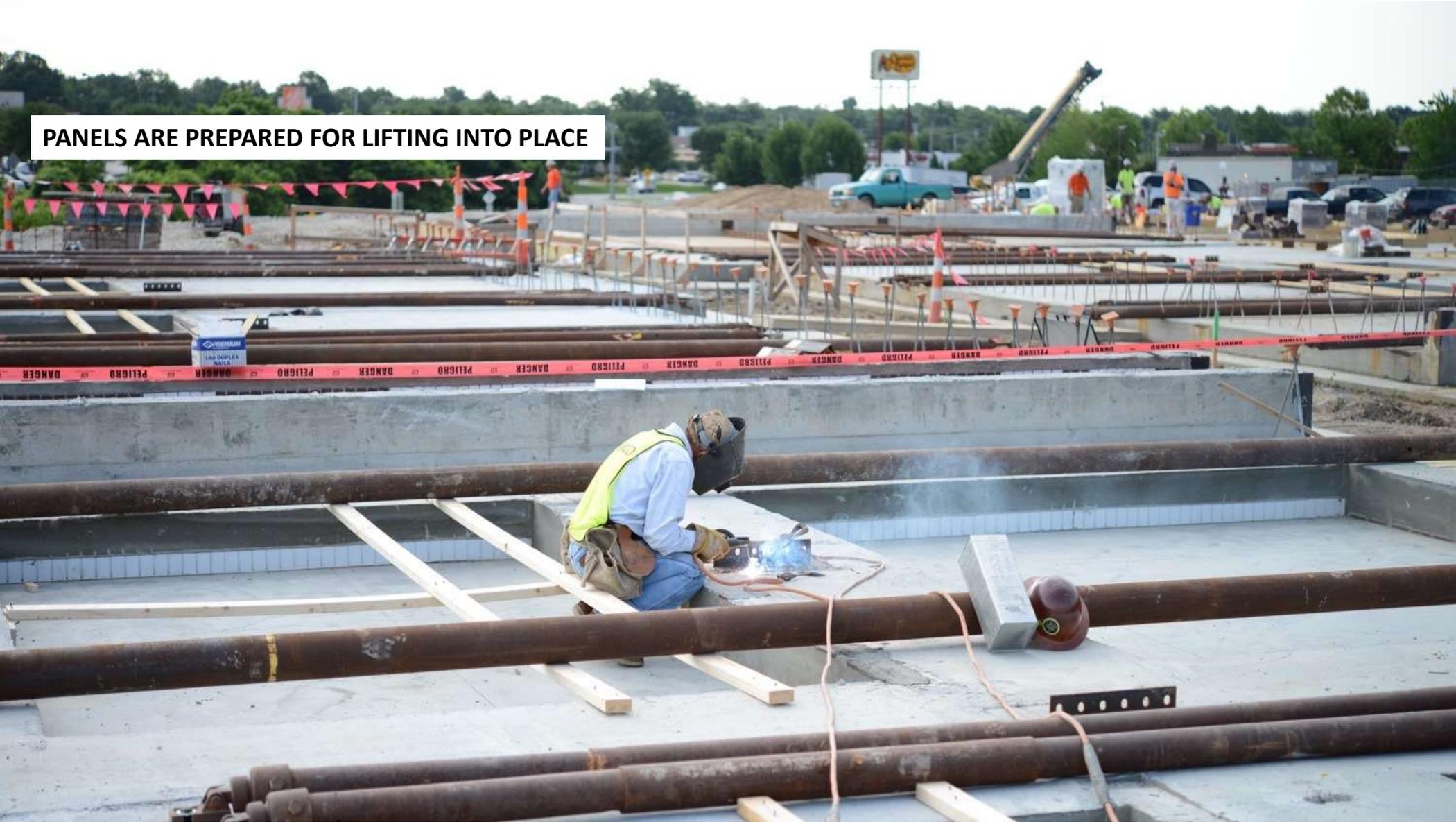




**PANELS ARE FINISHED, CURED,
AND ALLOWED TO REACH A
SPECIFIED STRENGTH**

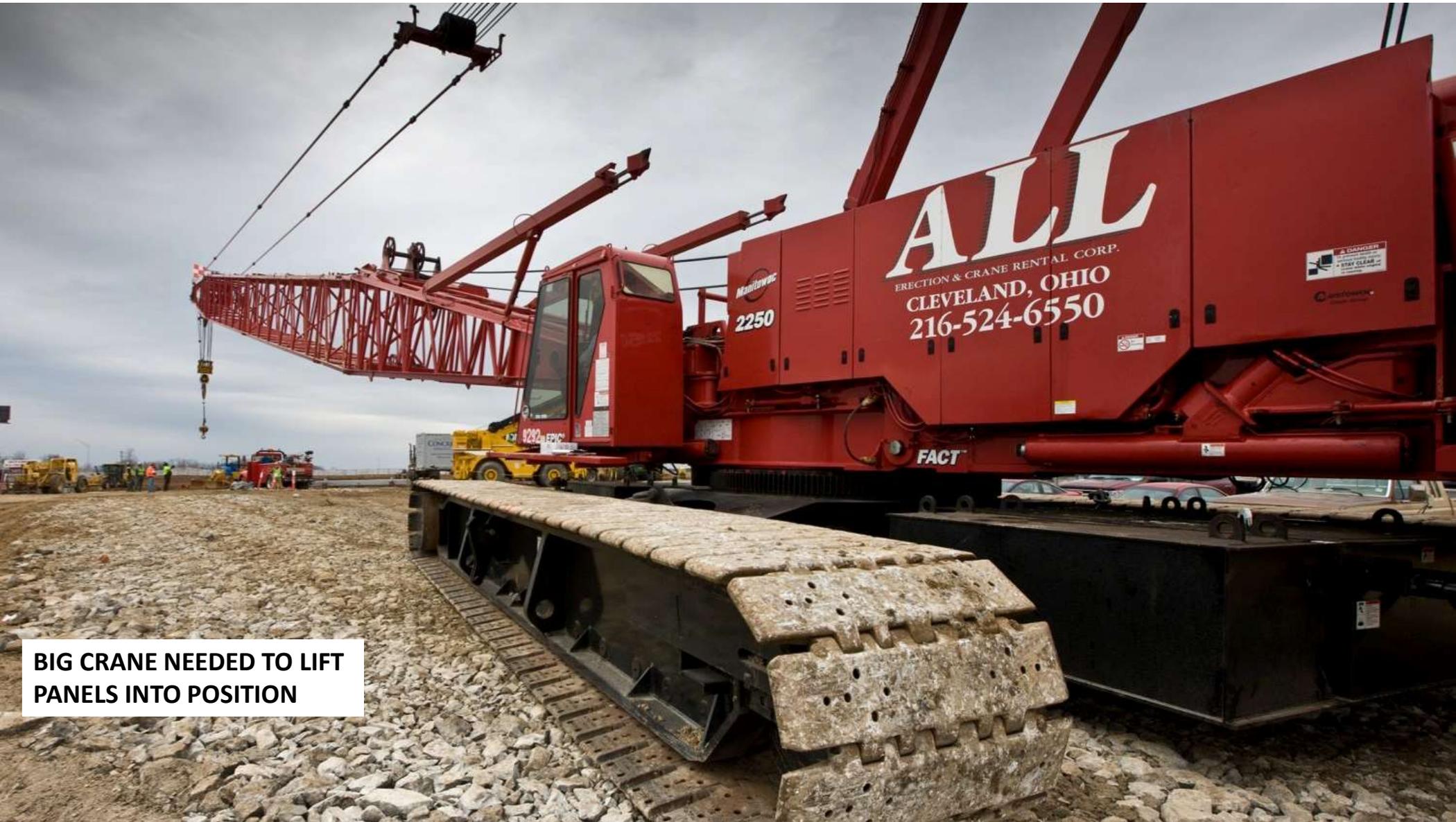


PANELS ARE PREPARED FOR LIFTING INTO PLACE



Lift Day – SAFE, Well Organized, and Executed Sequence





**BIG CRANE NEEDED TO LIFT
PANELS INTO POSITION**



A SERIES OF CABLES ARE CONNECTED TO LIFTING INSERTS THAT WERE CAST INTO THE PANEL.

A CRANE LIFTS THE PANEL FROM THE SLAB





**POSITIONING THE PANEL
ON THE FOUNDATION**

A photograph of a construction site. In the foreground, a large, vertical steel beam is being used as a support for a concrete panel. A worker in a yellow hoodie and blue jeans is leaning against the beam, while another worker in an orange shirt and white pants is working on the panel. A third worker in a yellow vest and blue jeans is standing to the right, looking up. In the background, a red excavator is visible, and a concrete mixer truck is parked. The ground is dirt and gravel, with various tools and equipment scattered around.

**USE OF "STRONGBACK" STEEL BEAM
TO ASSIST IN SUPPORT DURING LIFT**

POSITIONING THE PANEL ON THE FOUNDATION

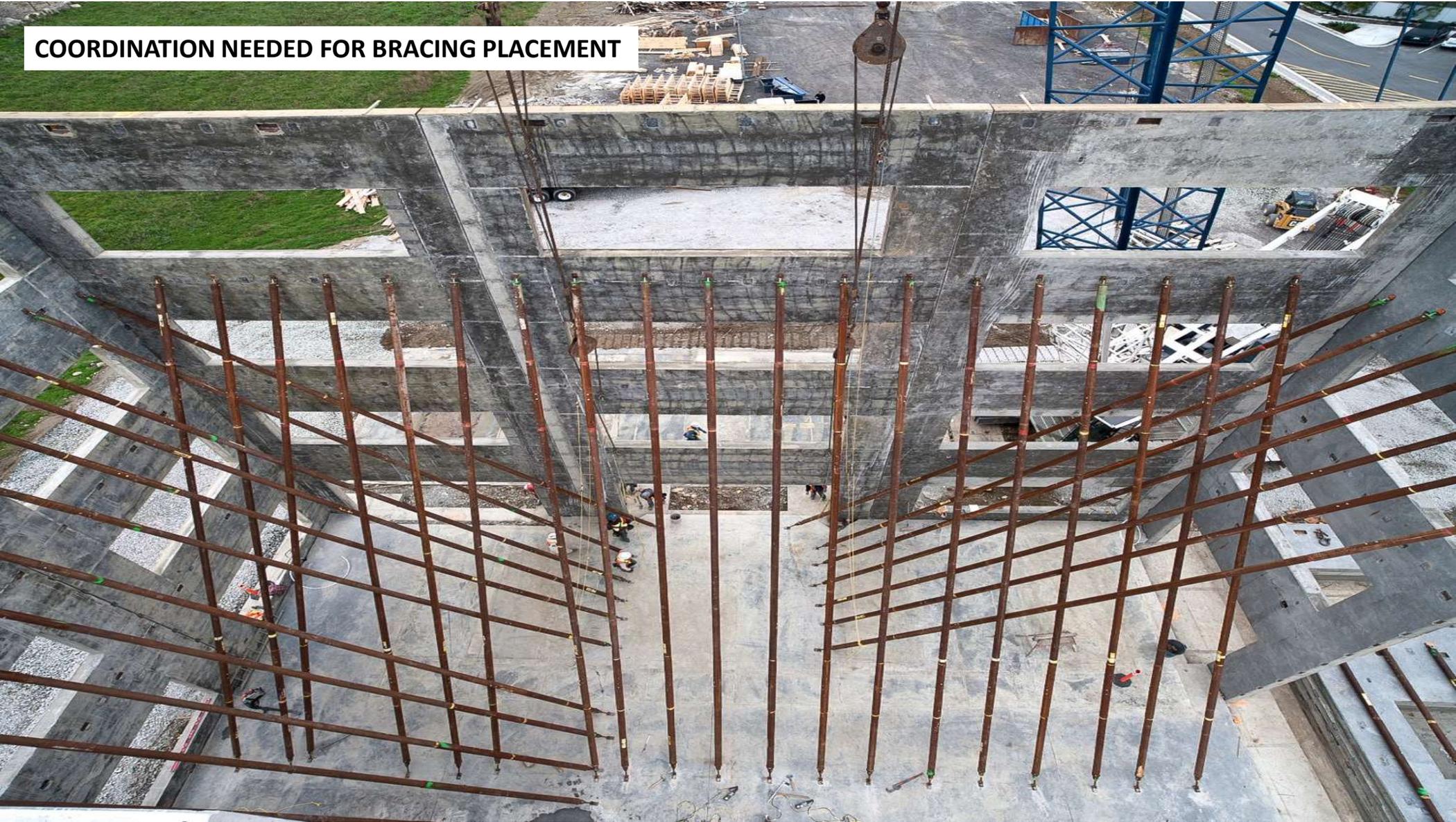


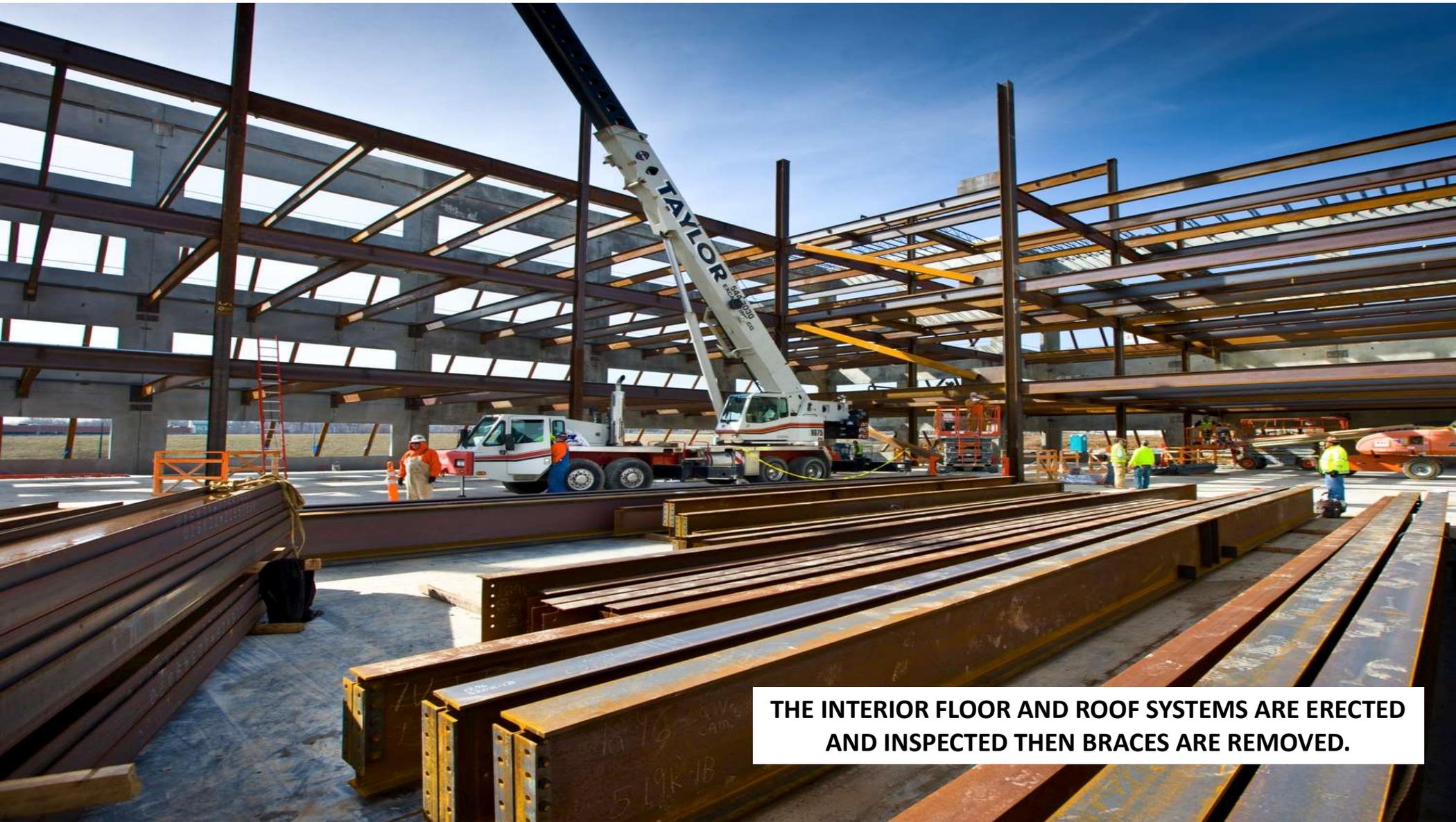
**INSTALLING TEMPORARY
INTERIOR BRACING TO
HOLD PANELS IN PLACE**



EXTERIOR BRACING FOR TEMPORARY SUPPORT

COORDINATION NEEDED FOR BRACING PLACEMENT





THE INTERIOR FLOOR AND ROOF SYSTEMS ARE ERECTED AND INSPECTED THEN BRACES ARE REMOVED.



**ANY NESSESARY REPAIRS OR
ADJUSTMENTS ARE MADE TO PANELS**

Tilt-up Facts (from Tilt-Up Concrete Association)

- ❖ Tallest Panel is 111 feet-9 inches for FIU Student Housing facility in Jupiter, FL
- ❖ Heaviest Panel is 1,252,111 pounds for JAG East Phase I Building I in Aurora, CO
- ❖ Widest Panel is 89 feet-0 inches for York Preparatory High School in Rock Hill, SC
- ❖ Widest Spandrel Panel is 125 feet-0 inches for Scottsdale Airplane Hanger in Scottsdale, AZ
- ❖ Largest Panel (area) is 65,535 square feet for The Trade Group Headquarters, Grapevine, TX
- ❖ Tallest Cantilever Wall (from top of foundation) is 84 feet-6 inches for Fau Innovation Village Apartments in Boca Raton, FL



**FIU STUDENT HOUSING,
JUPITER, FL - 2016**

111'-9" TALLEST PANEL



**YORK PREPARATORY
HIGH SCHOOL
ROCK HILL, SC - 2013**

89' WIDE PANEL

5-Story Tilt-Up Office Building
Millersville, MD
St. John Properties







CAN "STACK" PANELS TO ACHIEVE GREATER HEIGHTS





LEASE 410-788-0100 ST. JOHN PROPERTIES

 **ST. JOHN**
PROPERTIES

Canton Crossing, Phase I
Baltimore, MD
72,200 SF of Panels

Canton Crossing, Phase I

Baltimore, MD



CHESAPEAKE
CONTRACTING GROUP

2020 Tilt-Up Achievement Award



Canton Crossing II
Baltimore
Single-story, 85,000 SF,
73 panels, wood texture
form liner and thin-lay
brick veneer



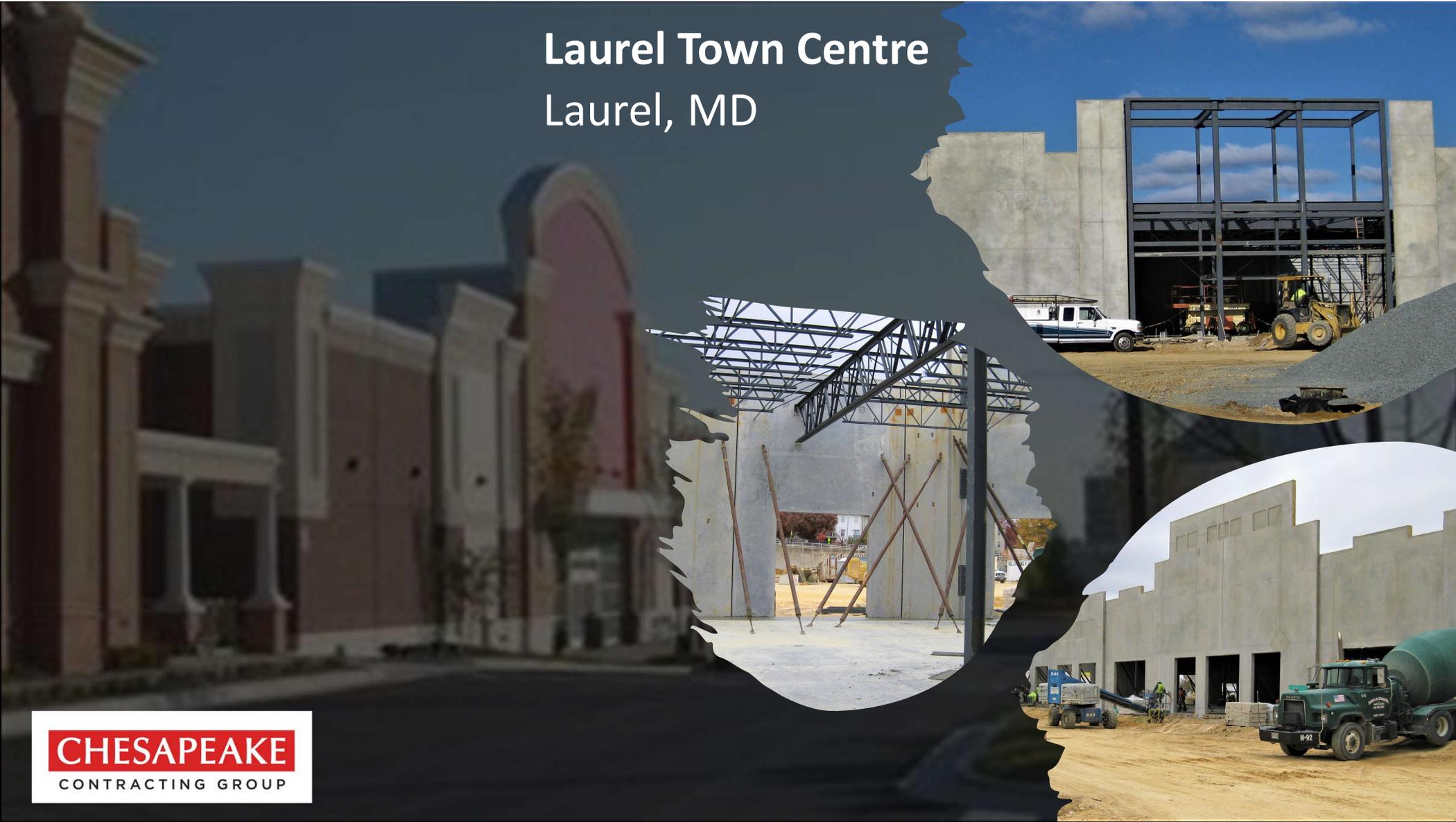
CHESAPEAKE
CONTRACTING GROUP



Foundry Row - Baltimore, MD
2018 Tilt-Up Achievement Award

CHESAPEAKE
CONTRACTING GROUP

Laurel Town Centre Laurel, MD



CHESAPEAKE
CONTRACTING GROUP



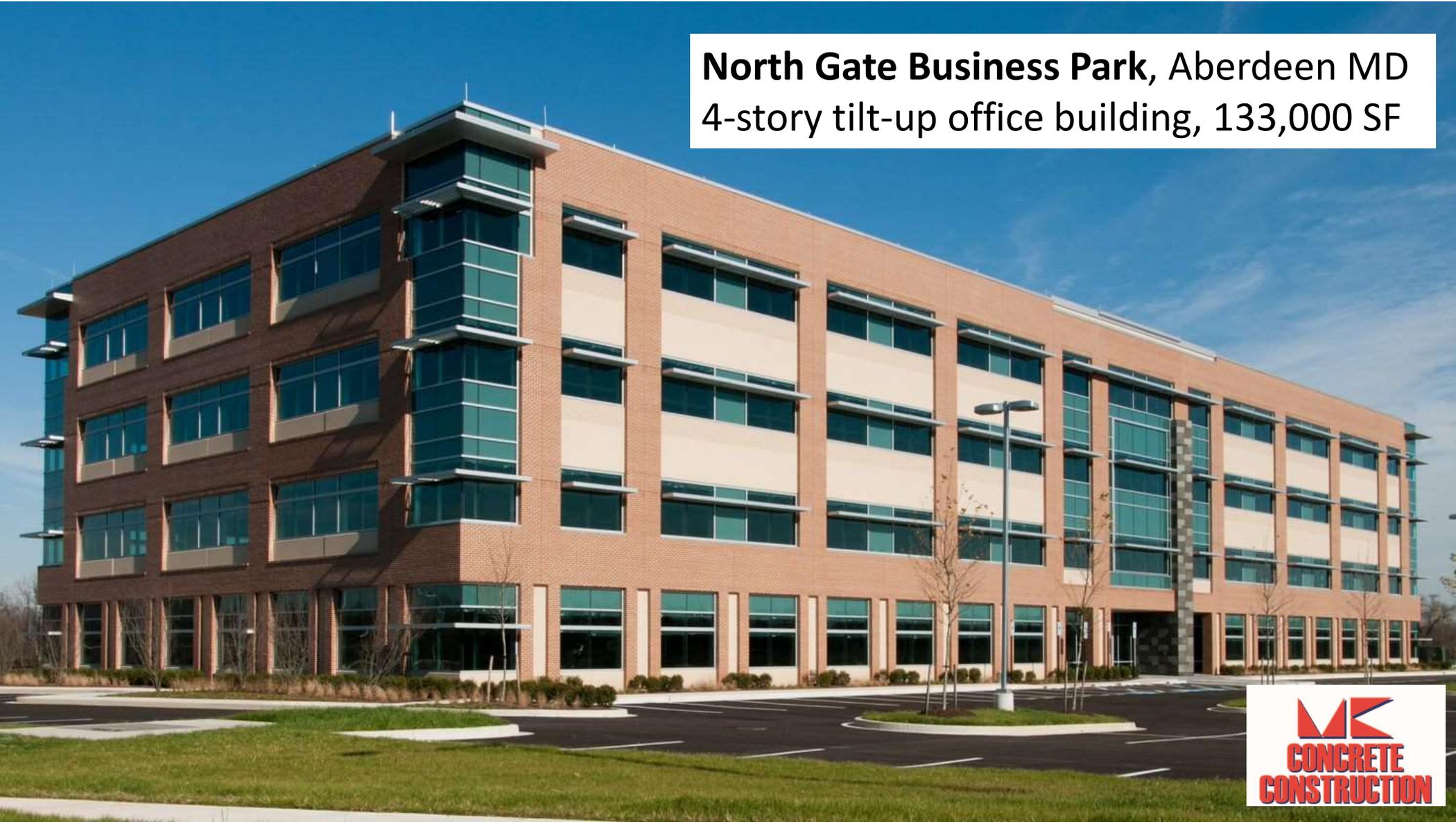
Advanced Technology Research Facility,
Frederick, MD
5 separate tilt-up, 3-story buildings,
330,000 SF



Progress Labs Facility, Frederick, MD
2-story, lab/manufacturing facility -70,000 SF



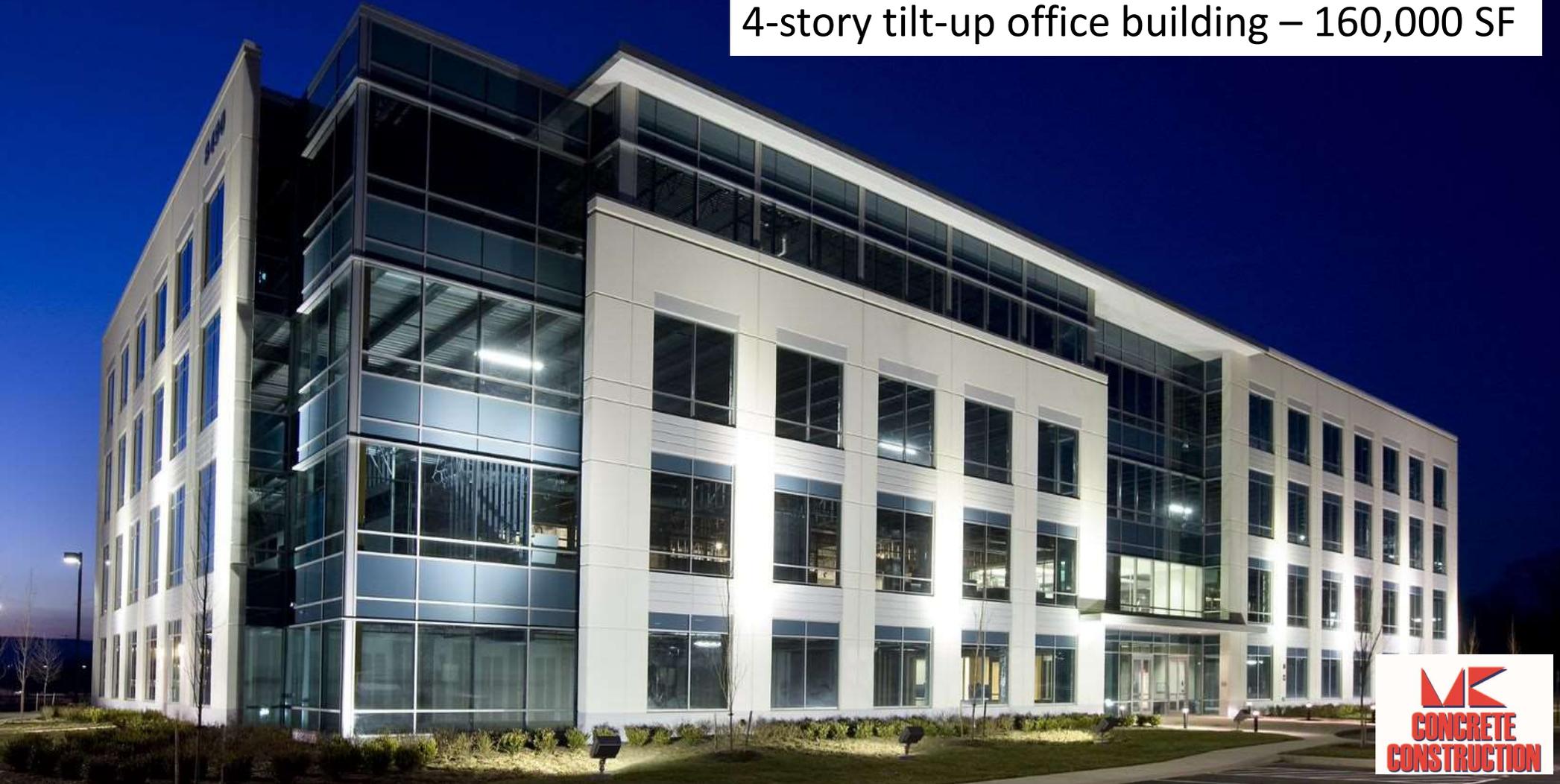
North Gate Business Park, Aberdeen MD
4-story tilt-up office building, 133,000 SF



Wells Fargo Home Mortgage Headquarters, Frederick, MD
3-story tilt-up office building, 310,000 SF



Riverside Five, Frederick, MD
4-story tilt-up office building – 160,000 SF



Advantages of Tilt-up Construction (working horizontally)

- ✓ Design – uses standard concrete wall methods and codes
- ✓ Lower construction costs – less volatility in materials prices
- ✓ Size – faster erection, less joints - greater efficiency
- ✓ Speed - Faster erection allows other trades to start early; less project carrying costs
- ✓ Limited on-site storage – smaller sites to allow construction
- ✓ Formwork – only edge forms needed for horizontal placement; variety of shapes possible
- ✓ Precision – focus on quality of panels and placement



Advantages of Tilt-up Construction (working horizontally)

- ✓ Sustainable – use low carbon concrete mixes with PLC
- ✓ Construction in extreme temperatures – weather is less of an issue
- ✓ Safety – smaller crews on the ground
- ✓ Aesthetics – architectural versatility/opportunities/different shapes/finishes
- ✓ Durability – resistance to damage from man-made or natural disasters
- ✓ Fire Safety – Reduced Insurance Premiums (no fires during construction)



Benefits of Concrete Construction

- ✓ Lower construction costs – greater return on investment
- ✓ Fast construction schedule – early occupancy; less carrying cost
- ✓ Safety – resistance to man-made and natural disasters
- ✓ Aesthetics – architectural versatility/opportunities
- ✓ Durability – resilient structure in natural disasters
- ✓ Fire Resistance – safety and protection for tenants
- ✓ Thermal Mass/Sound Attenuation – comfort for occupants
- ✓ Resistance to Mold/Rodent/Insect Infestations – peace of mind



Benefits of Concrete Construction

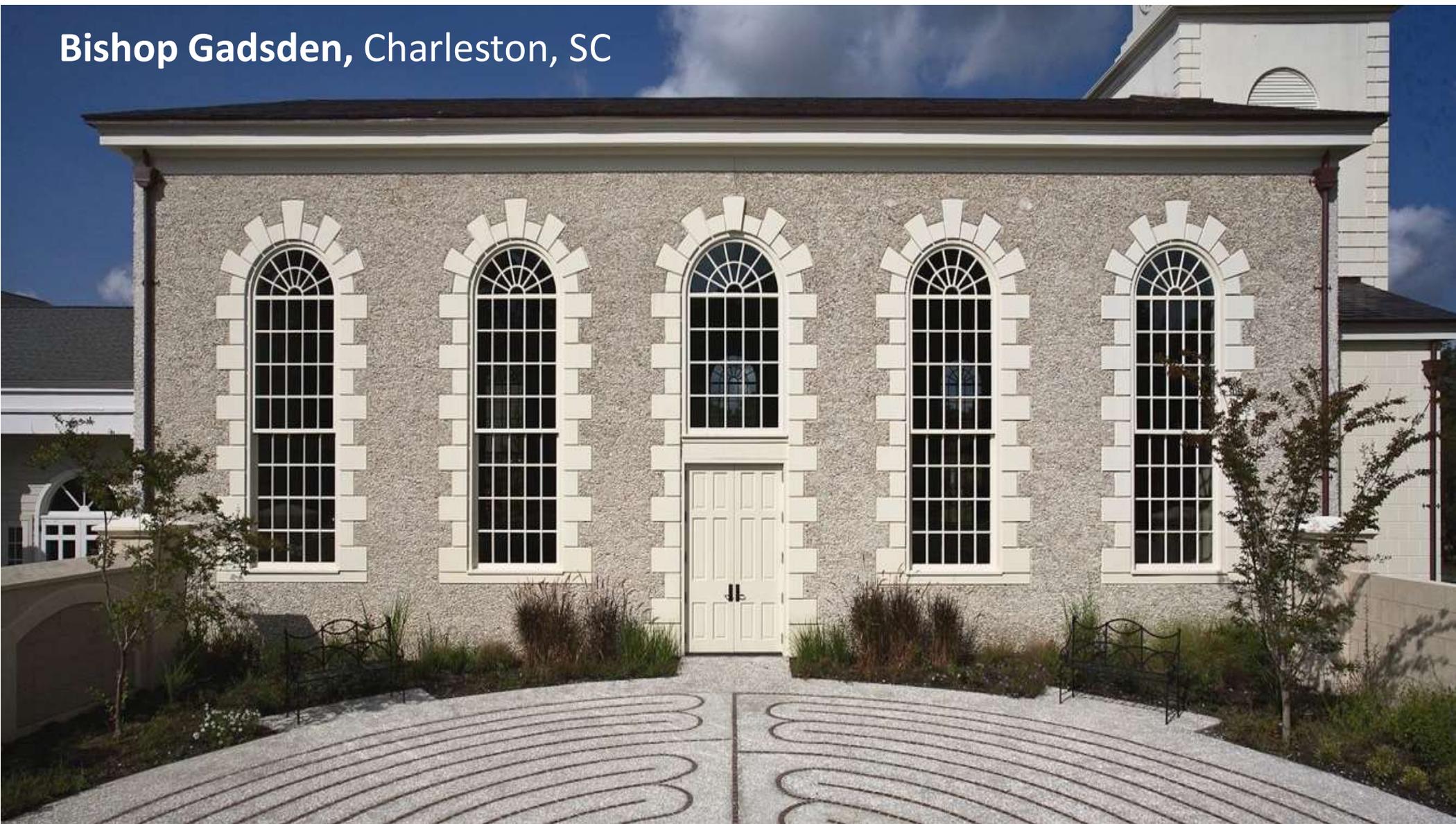
- ✓ Low Maintenance – minimal costs for years; keeps rates low
- ✓ No Shrinkage of Frame – minimal cosmetic repairs/callbacks
- ✓ Repairs and Expandability – minimal damage
- ✓ Security – impenetrable walls/occupant safety
- ✓ Reduced Insurance Premiums – durability of walls; fire resistance; resiliency
- ✓ Reduced Operating Costs – lower rental rates; occupant retention, greater return on investment
- ✓ Sustainable – use low carbon concrete; potential for carbonation from exposed surfaces

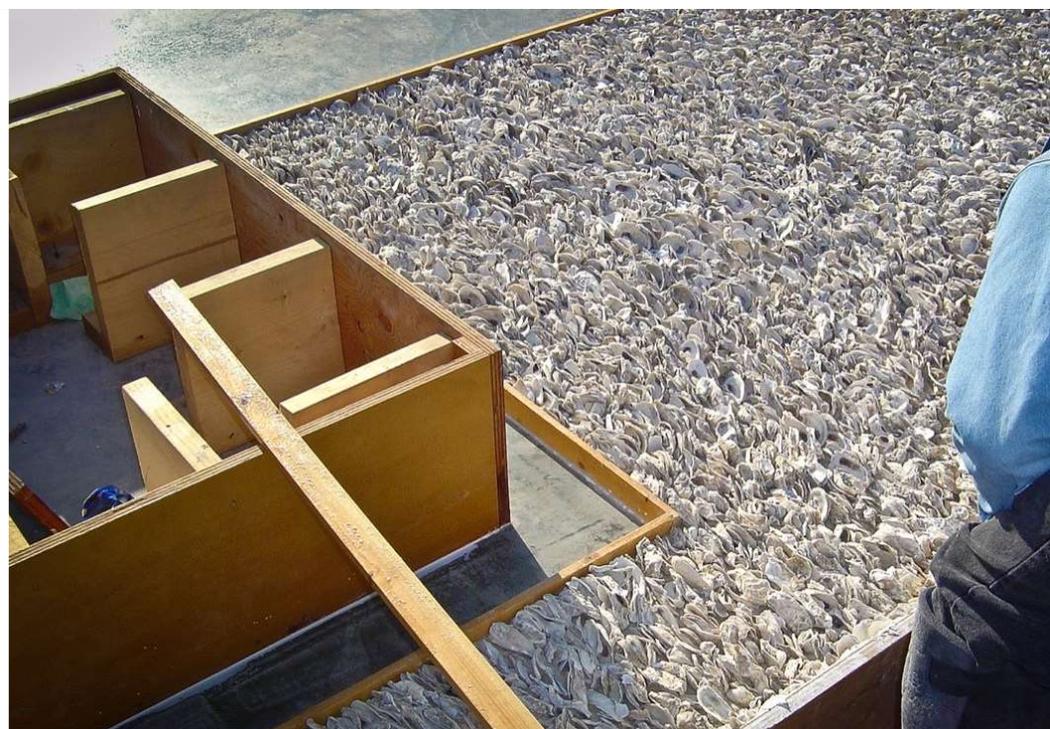
St. Mark Coptic Orthodox Church, Chicago, IL





Bishop Gadsden, Charleston, SC

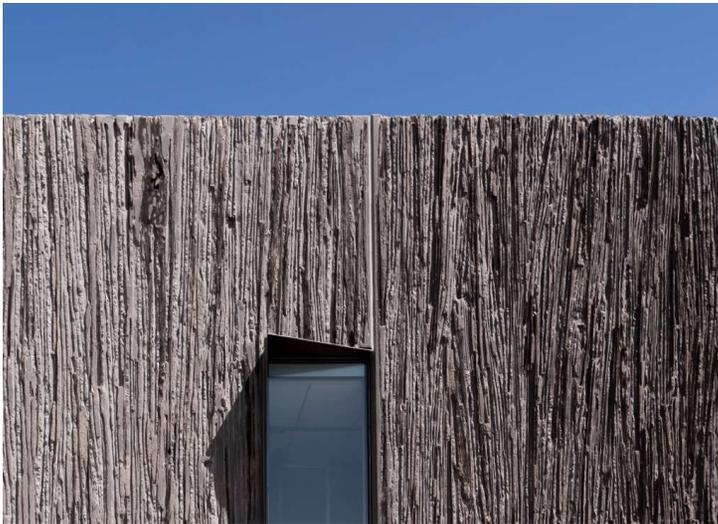
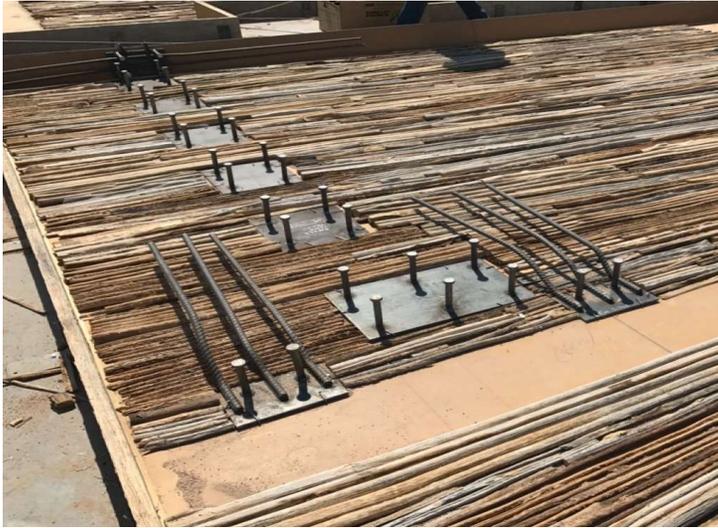




Bishop Gadsden
Charleston, SC



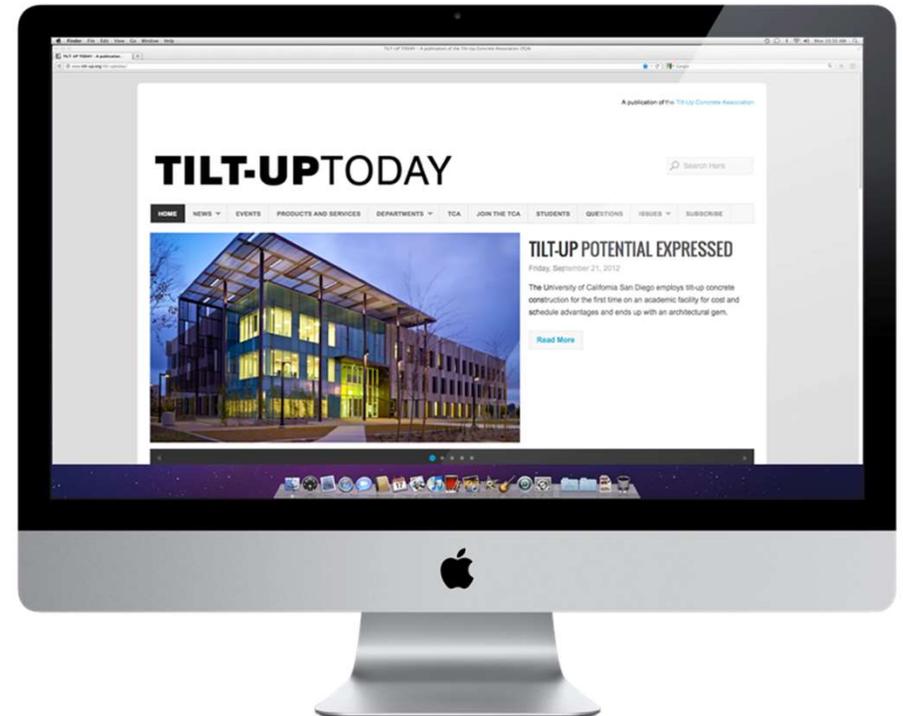
Muscatatuck Urban Training Complex, Butlerville, IN



Cloud Song Center Scottsdale, AZ

TILT-UP RESOURCES

www.tilt-up.org





www.buildwithstrength.com

BUILD WITH STRENGTH

www.buildwithstrength.com/design-center

- Structural system recommendations
- Cost comparisons
- Specification review
- Design/construction team collaboration

www.buildwithstrength.com/education

- ✓ Achieving Resilience with ICF Construction
- ✓ Concrete Innovations
- ✓ Economical Design of Insulating Concrete Forms
- ✓ Specifying Sustainable Concrete



CONCRETE RESOURCES

Maryland Ready Mix Concrete Association - MRMCA
(marylandconcrete.com)

Portland Cement Association - PCA (cement.org)

American Concrete Institute - ACI (concrete.org)

National Ready Mixed Concrete Association (nrmca.org)

American Society of Concrete Contractors (asconline.org)

Questions?

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marylandconcrete.com

