



CONCRETE TILT-UP CONSTRUCTION FOR SUSTAINABLE WORLD

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Overview



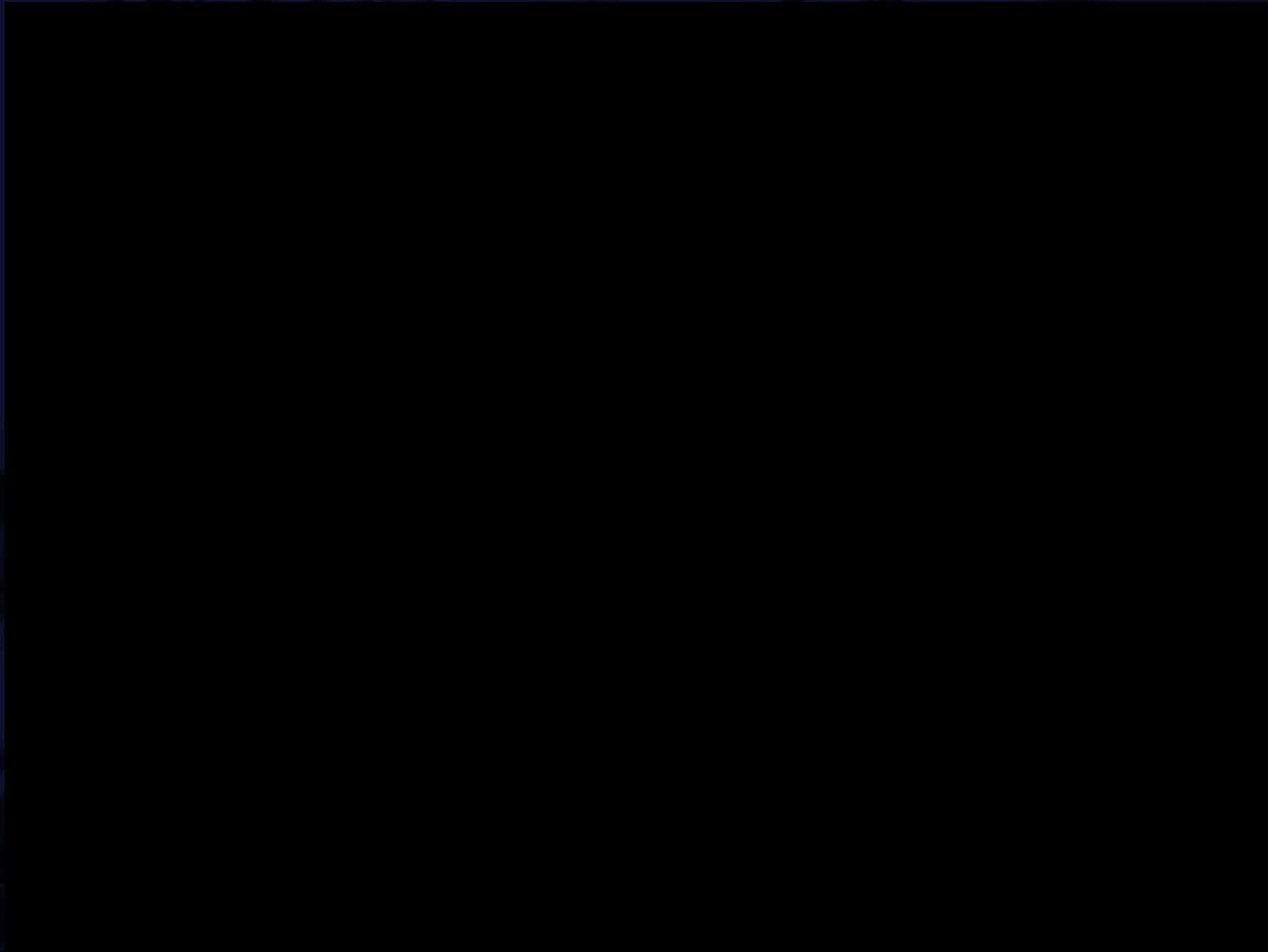
- What is concrete tilt-up?
- What are the disadvantage & advantages of tilt-up?
- How can tilt-up construction be used to achieve LEED points and USGBC certification?
- How else is tilt-up green/sustainable?

Objectives



- By the end of this presentation, you will be able to:
 - Understand the product, processes, and performance of tilt-up construction
 - Apply tilt-up construction to help achieve or achieve LEED points
 - Identify how tilt-up construction is green/sustainable beyond LEED

Concrete Tilt-Up: Product, Process, & Performance



Disadvantages of Tilt-Up



- It can be dangerous if the proper precautions are taken
- Tilt-Up is cost prohibitive for small project
 - High cost to obtain proper safety equipment
- Panels are engineered before work begins making changes difficult, i.e.
 - relocate openings, change panel sizes before pouring
 - Altering (cutting in a door) panels after tilted in place if the change was not considered during the design phase

Advantages of Tilt-Up - Safety



- No vertical formwork or scaffolding
- Slab provides safer working surface
- Shorter project cycle – less opportunity for accidents



Advantages of Tilt-Up - Time



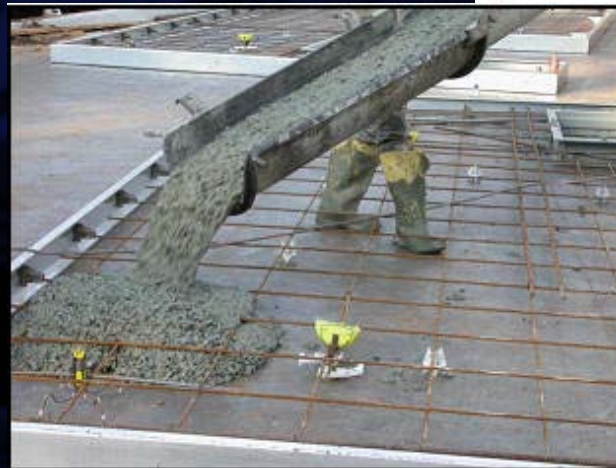
- Fast Track Delivery
 - Design-build
 - Assembly line prefabrication
 - Quicker shell construction allows trades to start sooner
 - Earlier occupancy



Advantages of Tilt-Up - Cost



- In-place material are
 - Cost competitive
 - Readily available
 - Provide costs stability
- Positive cash flow



Advantages of Tilt-Up - Cost



- Low Operating Cost
 - Less Heating and Cooling
 - Thermal mass of the concrete
 - Insulated sandwich panels
- Low Maintenance Cost
 - Exterior can be left unpainted, or
 - If painted only needs repaint every 5-10 years
 - Easy to clean
- Low Insurance Premiums



Advantages of Tilt-Up - Quality



- Durability
 - Can withstand earthquakes, intense winds, and hail storms
 - Several tilt-up panels built during the 40's and earlier show little sign of age and are still in service
 - Panels make it difficult for the smallest rodents, insects, or even the most determined humans to get through



Walls standing after an earthquake



Walls standing after a tornado

Advantages of Tilt-Up - Quality



- Architectural Aesthetics
 - Concrete coloring admixtures
 - Textured paints
 - Form-liners
 - Rustication or reveal strips
 - In-lay brick
 - Exposed aggregate
 - Ribbon window treatment



Industrial Buildings



Retail/Commercial



Office



The Greening Curve: Tilt-Up for Schools



Bay Meadows
Elementary –
Orlando, FL



Cary Christian School – Cary, NC.

Tilt-Up for Schools



Rutledge Elementary School – Austin, TX

Tilt-Up for Schools



Vista Ridge High School – Cedar Park, TX

Tilt-Up for Schools



Villages Charter High School – The Villages, FL

Tilt-Up for Schools



Wiley Middle School – Austin, TX

Tilt-Up and LEED™



LEED is the U.S. Green Building Council's (USGBC) certification program and the nationally accepted benchmark for the design, construction and operation of high performance buildings.

Credit Categories



- Sustainable Sites (14 Possible Points; One Prerequisite)
- Water Efficiency (5 Possible Points; No Prerequisites)
- Energy and Atmosphere (17 Possible Points; Three Prerequisites)
- Materials and Resources (13 Possible Points; One Prerequisite)
- Indoor Environmental Quality (15 Possible Points; Two Prerequisites)
- Innovative & Design Process (5 Possible Points)

Tilt-Up and LEED™



- Several LEED™ certified buildings ranging from Certified to Platinum
- Located throughout the country
- Dozens more are registered and are under construction



Certified: 26-32 Pts



Silver: 33-38 Pts



Gold: 39-51 Pts



Platinum: >52 Pts

Inland Empire Utilities Agency



- LEED™ Platinum certification
- 8” thick concrete tilt-up walls with R-11 insulation on interior surface.
- Why it was chosen:
 - Simplicity
 - Regional Material
 - Recyclability and recycled material
 - Thermal mass properties (offset peak heat/cooling loads)
 - Most economical building envelope



Chino, CA

ARCH: Austin Research Center for the Homeless



- LEED™ Silver certification
- 45% Fly-ash concrete mixture
- Why it was chosen:
 - Recyclability and recycled material
 - Thermal mass properties (offset peak heat/cooling loads)
 - Large opening for daylighting and views
 - The “stack-cast tilt-frame” reduced the amount of finished materials and formwork used
 - Exposed concrete finish is very durable
 - Regional Materials



LEED™ Points Achieved with Tilt-Up



- Materials & Resources
 - Credits 1.1 and 1.2 – Building Reuse
 - Credits 2.1 and 2.2 – Construction Waste Management*
 - Credits 4.1 and 4.2 – Recycled Content*
 - Credits 5.1 and 5.2 – Regional Materials*
 - Credit 7 – Certified Wood*
- * 1 additional point can be achieved for exception performance
- Indoor Environmental Quality
 - Credit 4.1 – Low-Emitting Materials
- Up to 12 Points can be earned

MR Credit 1 – Building Reuse



- 3 Points Possible – 2 with Tilt-up
- Extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings.
 - MR Credit 1.1 – Maintain 75% of Existing Walls, Floors & Roof
 - MR Credit 1.2 – Maintain 95% of Existing Walls, Floors & Roof

Concrete Tilt-Up Building Reuse



- Panels can be reused in the new building
- Panels can maintain a complete shell of a building for a second use
- Panels can be relocated to another job site and commissioned into a different building



MR Credit 2 – Construction Waste Management

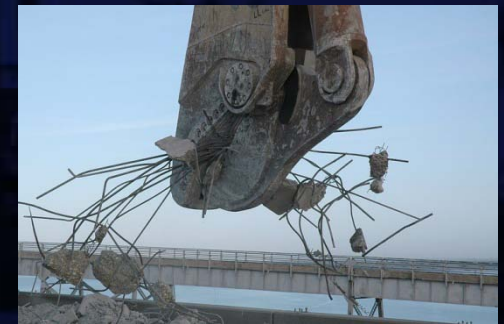


- 3 Points Possible
- Recycle and/or salvage non-hazardous construction and demolition.
 - MR Credit 2.1 – Construction Waste Management (Divert 50% from Disposal)
 - MR Credit 2.2 – Construction Waste Management (Divert 75% from Disposal)
 - Exemplary Performance for diverting 95% or greater from disposal may earn Innovation in Design point (ID1.1 – 1.4)

Concrete Tilt-Up & Construction Waste Management



- Demolition of Tilt-Up Panels
 - Aggregate
 - Reinforcing bar and/or weld-wire steel
 - Steel embeds



MR Credit 4 – Recycled Content



- 3 Points Possible
- Use material with recycled content based on costs of the total value of the material in the project
 - MR Credit 4.1 – Recycled Content, 10% (post-consumer + $\frac{1}{2}$ pre-consumer)
 - MR Credit 4.2 – Recycled Content, 20% (post-consumer + $\frac{1}{2}$ pre-consumer)
 - Exemplary Performance for 30 % or greater recycled content may earn Innovation in Design Point (ID1.1 – 1.4)

Recycled Content in Tilt-Up Panels



- Reinforcement Bar or welded-wire steel
- Steel embeds
- Bar supports
- Course aggregate
- Cement Grout (fly ash or blast-furnace slag)



Case Study: Stapleton Enterprise Park, Denver, CO

- 5,700 CY of concrete used in tilt-up panels
- 1,570 tons of recycled aggregate
- Equals 13.6% recycled content

MR Credit 5 – Regional Materials



- 3 Points Possible
- Use building materials or products that have been extracted, harvested or recovered, as well as manufactured, with 500 miles of the project site.
 - MR Credit 5.1 – Regional Materials, 10% Extracted, Processed & Manufactured
 - MR Credit 5.2 – Regional Materials, 20% Extracted, Processed & Manufactured
 - Exemplary Performance for 40 % or greater regional materials may earn Innovation in Design Point (ID1.1 – 1.4)

Regional Materials in Tilt-Up Panels



- Regional Materials
 - Aggregate
 - Sand
 - Portland cement
- Regional Manufacturing
 - Mixing Plant



MR Credit 7 – Certified Wood



- 2 Points Possible
- Use a minimum 50% of wood-based materials and products, which are Forest Stewardship Council's (FSC) certified
- Exemplary Performance for 95% or greater FSC-certified wood may earn Innovation in Design Point (ID1.1 – 1.4)

Certified Wood Used in Tilt-Up Construction



- Tilt-Up Panel forms
- Reveal Strips



EQ Credit 4.1 – Low-Emitting Materials (Adhesives & Sealants)



- 1 Point Possible
- All adhesives and sealants used on the interior of the building need to meet certain Volatile Organic Compound (VOC) levels.

Low-Emitting Materials in Tilt-Up



- Chemical Admixtures
- Sealant between Panels
- Concrete Bond Breaker
 - If stacking panels on top of each other consider breakers that emit low levels of VOC's.

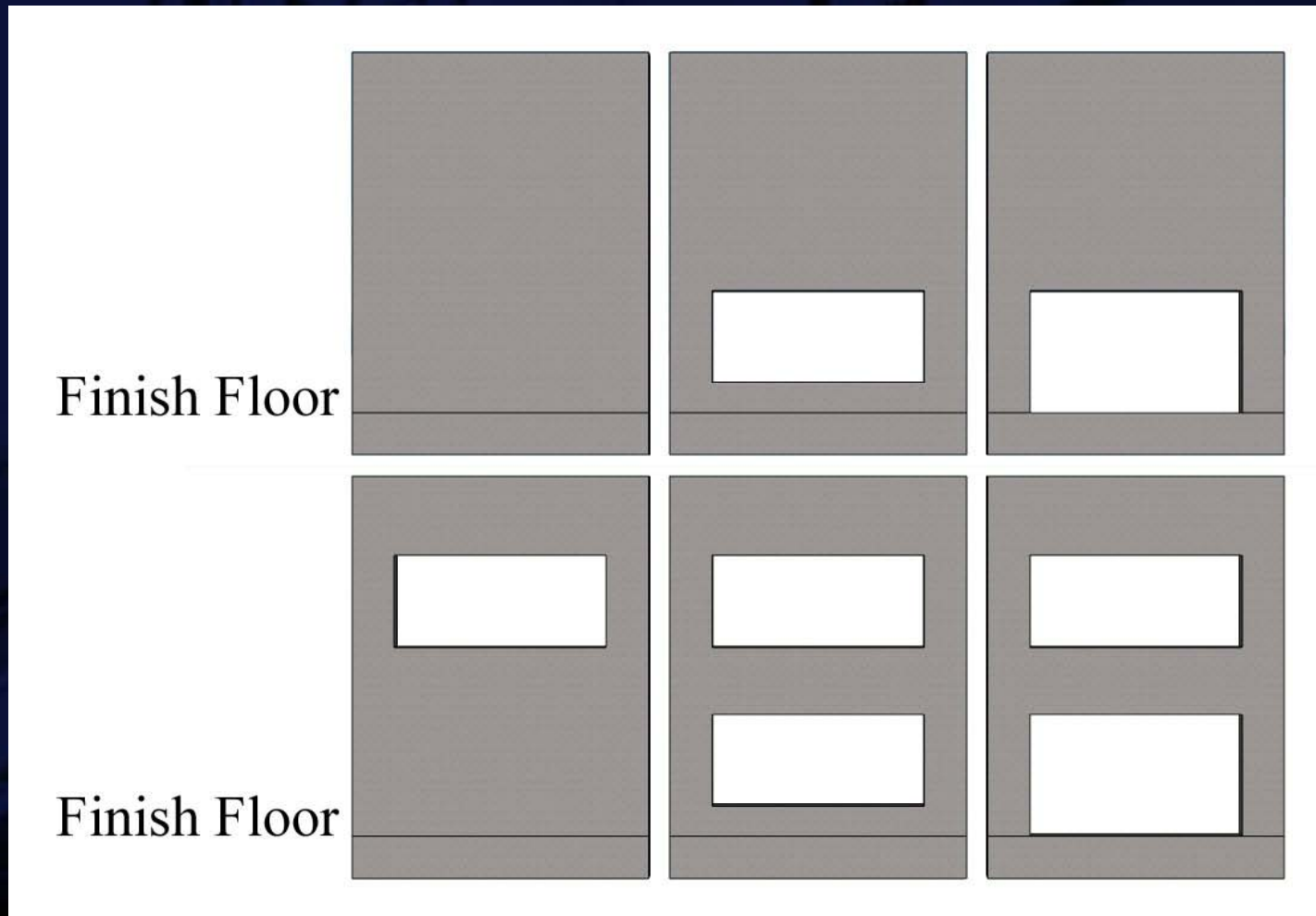


LEED™ Credits Achieved In Part by Tilt-Up Construction

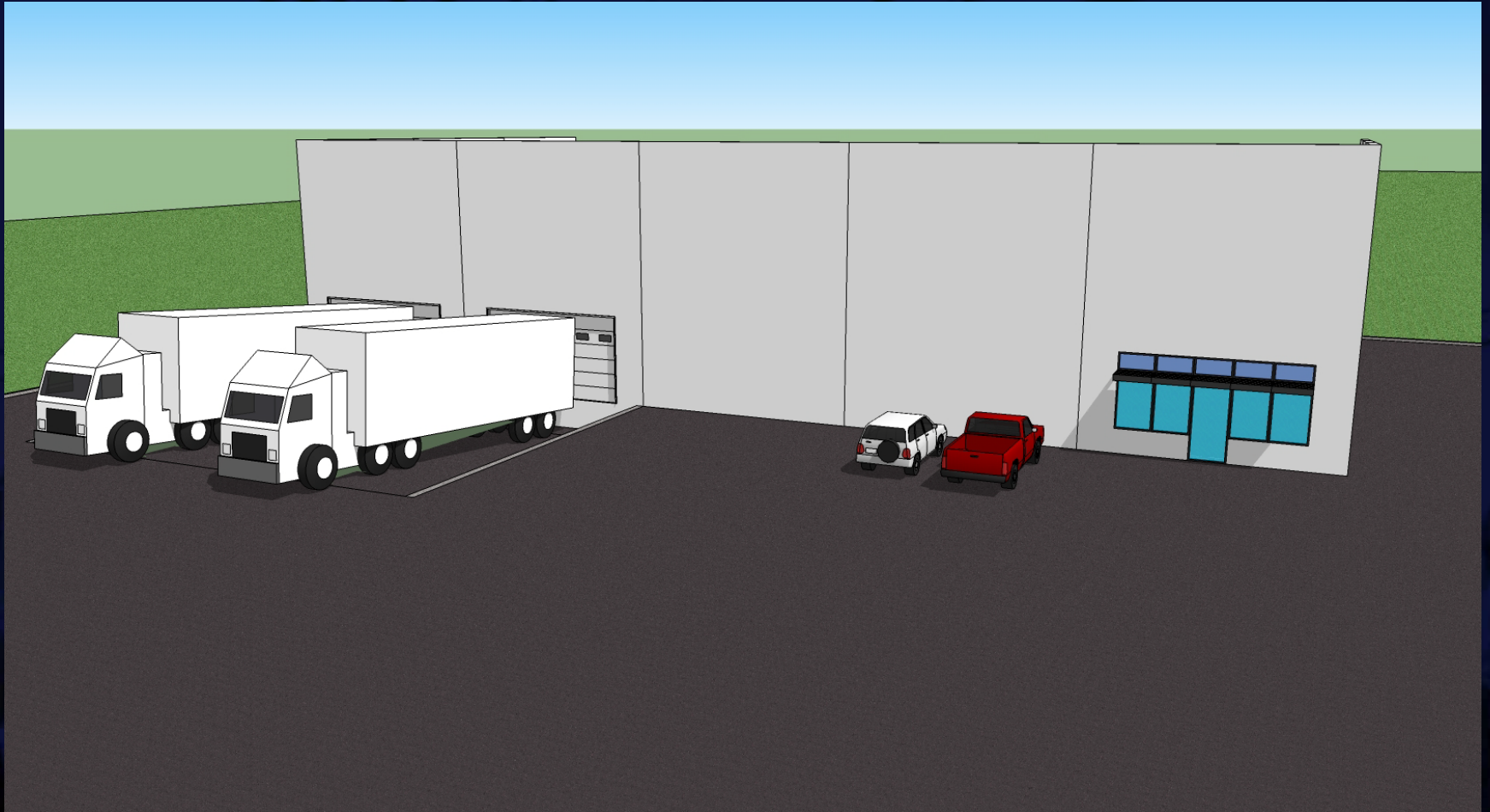


- SS Credit 5.1 – Site Development (Protect or Restore Habitat)
- EA Credit 1 – Optimize Energy Performance (1-10 points) ASHRAE 90.1-2004
- EQ Credit 7.1 – Thermal Comfort (Design) ASHRAE 55-2004
- EA 1 & EQ 7.1 credits look at the quality of the envelope of the building.
- Up to 12 points can be earned

Tilt-Up as a Sustainable Building Method



Owner A - Manufacturing



Owner A - Expansion



Owner B – Retail/Office



Embodied Energy



- Two forms of embodied energy
 - Initial embodied energy represents the energy consumed in the acquisition of raw materials, their processing, manufacturing, transportation to site, and construction.
 - Recurring embodied energy represents the energy consumed to maintain, repair, restore, refurbish or replace materials, components or systems during the life of the building.
- Concrete has a very low embodied energy over the life cycle of the building.

Extreme Tilt-Up



- Largest Building (Footprint): 2,029,554 Sq. Ft.
- Largest Building (Total Floor Area): 3,420,000 Sq. Ft.
- Most Wall Area (Including Windows): 1,400,000 Sq. Ft.
- Building with Most Panels: 1,310 Panels
- Project with Most Panels: 1,756 Panels
- Largest Tilt-Up Panel: 2,742 Sq. Ft.
- Tallest Tilt-Up Panel: 96'-9"
- Heaviest Tilt-Up Panel: 339,000 lbs.
- Widest Tilt-Up Panel: 74'-1/2"
- Largest Spandrel Panel: 125'-0"

Don't reinvent the wheel



- National Ready Mix Concrete Association
- Tilt-Up Concrete Association
- Portland Concrete Association
- Concrete Reinforcing Steel Institute
- American Society of Concrete Contractors
- U.S. Green Building Council

Thank you for you attention