

Build With Strength

Indiana
University
Selects Concrete
to Meet Carbon
Reduction Goals
Longy
Longiture Vice Producting
Structures and Sustainability
Structures and Sustainability

NRMCA'S 2023 Concrete
Innovation Award finalist

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# **Ferguson International Center**

IU's Hub for International Engagement

40,000 square-foot, four story building

IU's Climate Action Plan - carbon neutrality by 2040

Utility Grid

Infrastructure

Renewables

Behavior

Financing

Implementation

Substantially reduced project cost & Carbon footprint



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### **Ferguson International Center**

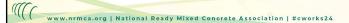


Owner:

Indiana University

Location:

Bloomington, Indiana





# **Design and Construction Team**



Architectural Firm:

Thomas Phifer & Partners

Structural Firm:

American Structurepoint

General Contractor:

Weddle Bros. Building Group



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# **Project Schedule**



Foundation Start:

June 2021

Concrete Top Out:

January 2022

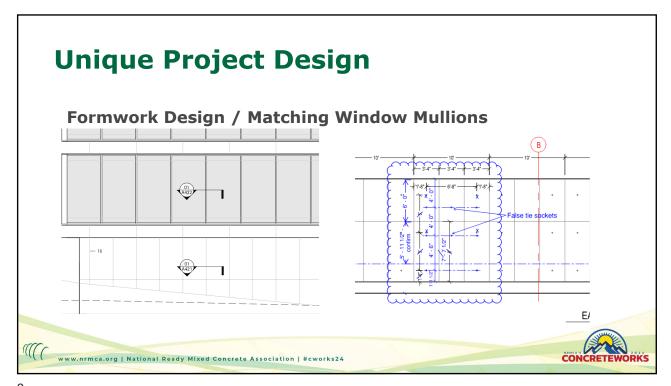
Substantial Completion:

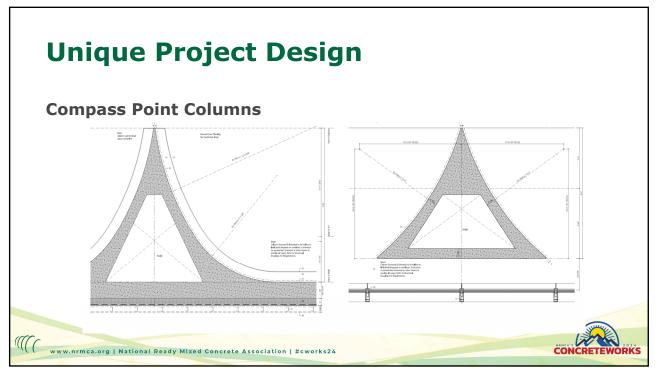
December 2022



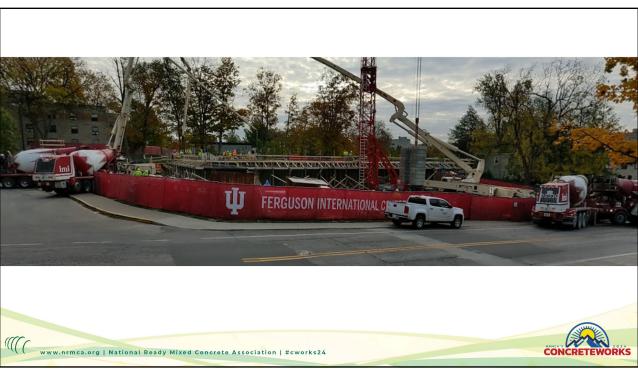












# **Design Challenges**

#### Color:

- Prescriptive white cement, white aggregate, white color
  - 4000 psi Architectural walls
  - 6000 psi Post tensioned Exposed cantilever beams
  - · Both to match in color

### Strength:

• PT Decks 3000 psi to stress tendons

### **Hot & Cold Weather:**

- Maturity Testing
  - · Heated under the decks in cold weather to maintain early strength gain





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### **Concrete Mix Designs**

### **Architectural Walls:**

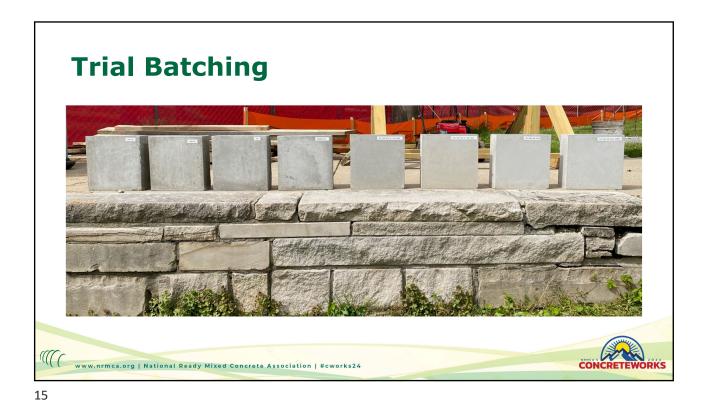
- Used 5000 psi design and added strength enhancing admixture to achieve 6000 psi  $\,$
- 658 Cementitious w/ 22% Slag
- Air entrainment, High-Range Water Reducer, Shrinkage Reducing Admixture, Waterproofing Admixture, strength enhancing admixture
- Controlled w/c ratio for color consistency

#### PT Decks:

- Interior non-air entrained mixture with 20% Class F fly ash
- Exterior air entrained mixture with 22% slag
  - -Same mix used in architectural concrete
  - -Both mixes poured simultaneously







### **Trial Batching**

### Color:

- · 35+ Trial batches
  - Switched from OPC to PLC (1L)
  - Optimized cement content for Architectural Concrete for color
  - · Optimized Slag Replacement for color
  - Optimized w/c ratio to finalize color
  - Admixture efficiencies (water reducers, air entrainment)
  - Mixer Truck test batches
  - Test slabs at plant

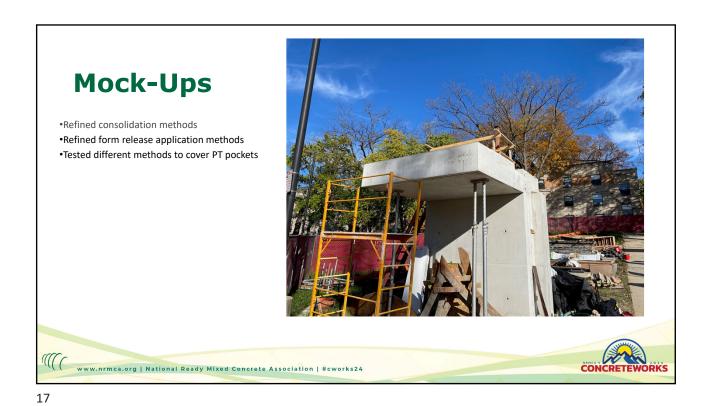
### Strength:

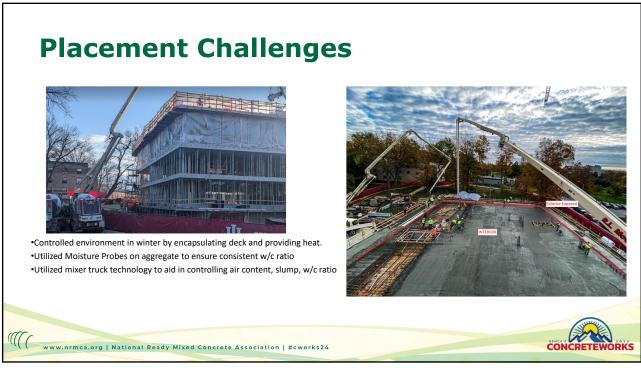
- Maturity
  - Established Maturity Curves for Architectural Concrete
  - Established Maturity Curves for Interior PT Concrete
    - Avoided pre-mature stressing of tendons in winter conditions

Round 1
(OPC) 564 & (OPC) 564 + SRA
(OPC) 752 & (OPC) 752 + SRA
Round 2
OPC & PLC
Round 3
PLC 752 40% Slag 0.41 w/c ratio
PLC 752 40% Slag 0.44 w/c ratio
Round 4
PLC 658 30-40-50% Slag
Round 5
PLC 658 15%-22%-25% Slag
Round 6
PLC 658 25% Slag 0.41-0.44-0.47 w/c ratio



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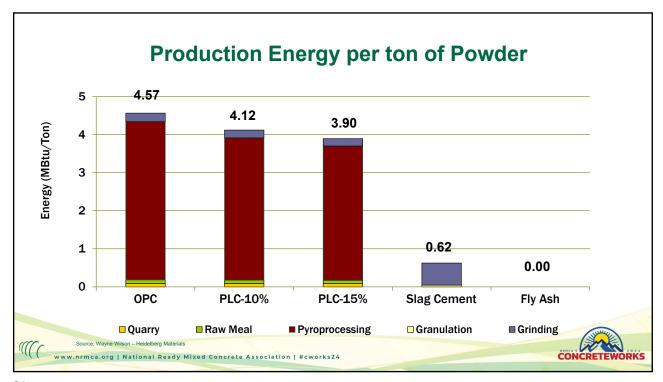


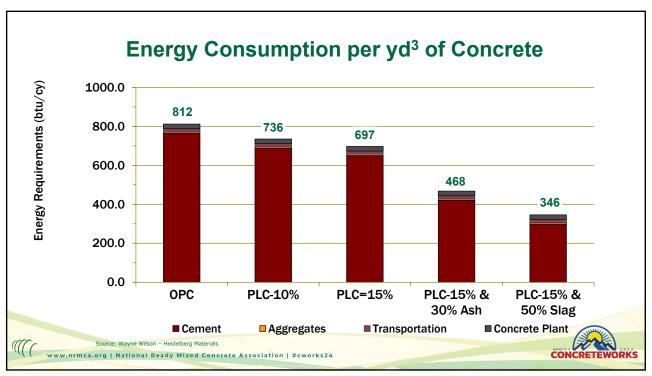


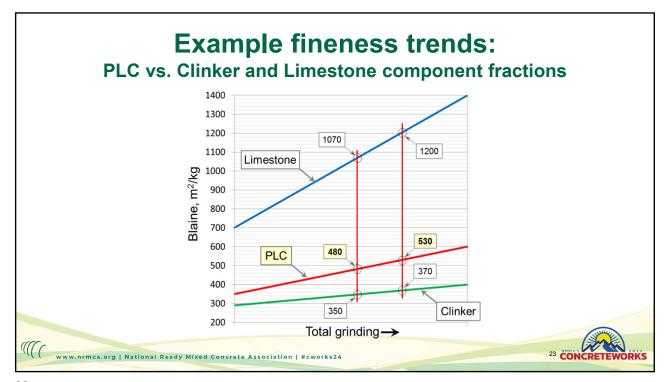


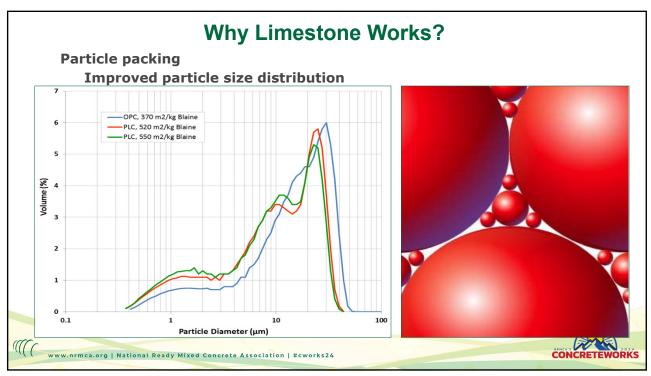
Past
Introduction of PLC
GWP - Type IL 1049 kg Co2e
(Type II 1093 kg Co2e)

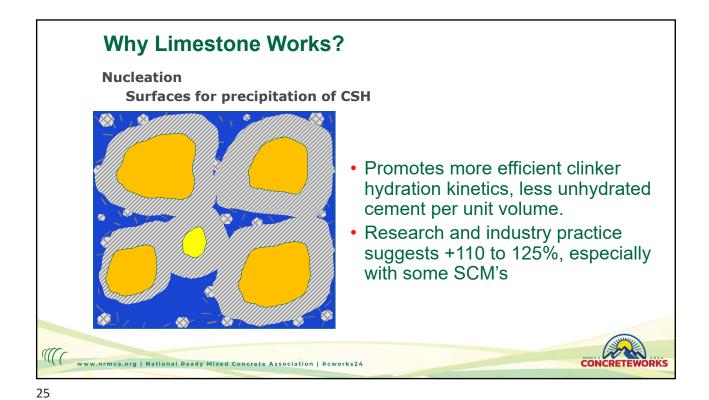
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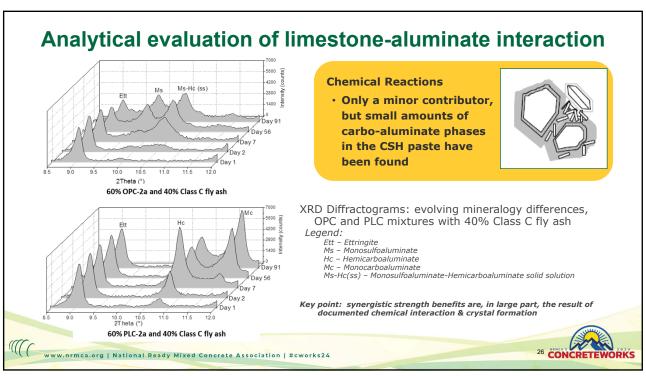


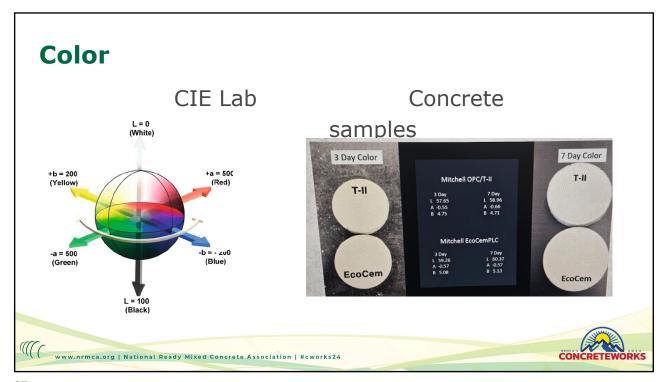












# Partnership and communication between all parties involved are crucial

- Material Suppliers
- GC
- Concrete Subcontractors
- Engineer
- Architect
- Owner



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