ARCBS Collaborative Studio

Mississippi State University

Concrete Collaborations

Architecture and Building Construction Science Problem-Solving with Precast Concrete

ARC 3546 ARCHITECTURAL DESIGN III-B_**BCS 3126** Building Construction Studio IV

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ABSTRACT

The College of Architecture, Art + Design at Mississippi State University has three undergraduate collaborative opportunities for our students, one specifically addressing the professional relationship between architects and constructors. The partnership between the School of Architecture and the Building Construction Science Program was initially created to address tectonic issues and to teach the students how to work together to better prepare them for careers in which their fields regularly collaborate. Over the past four years the 3rd Year Collaborative Studio has evolved to include ideas such as BIM and project delivery methods and the students are organized into project teams to create a design solution considering both architectural ideas and construction techniques.

More recently, the 3rd Year Collaborative Studio has developed a working relationship with the professional architecture community through the AIA Mississippi Chapter with professionals attending student presentations of the collaborative work. Additionally, the studio also began to introduce students to precast concrete through a $100,000 grant awarded by the PCI Foundation in 2019. The students were familiarized with precast concrete in an earlier lecture course and were given even more detail through lectures from PCI Gulf South, a digital tour of the Jackson Precast facilities, and online presentations by US Formliner. Once the students had that information they worked in teams to propose solutions to address the needs of a client using precast concrete. The Structures II lecture course was also connected to the 3rd Year Collaborative Studio to explore precast concrete in both that course and the studio. Then the students worked together on an architectural design, construction cost estimating and scheduling, and then presented their work throughout the semester to reviewers including local professional architects, representatives of PCI, Jackson Precast, the client, and faculty from the School of Architecture and the Building Construction Science Program.

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COURSE INFORMATION

The 3rd Year Collaborative Studio builds on information from ARC 3713 Assemblages and coordinates with ARC 3914/BCS 3914 Structures II.

DATES COURSE OFFERED & NUMBER OF STUDENTS

Spring 2022 - 43 ARC students/32 BCS students
Spring 2021 - 39 ARC students/27 BCS students
Spring 2020 - 41 ARC students/40 BCS students
Spring 2019 - 40 ARC students/32 BCS students
Spring 2018 - 32 ARC students/29 BCS students
Spring 2017 - 35 ARC students/16 BCS students
Spring 2016 - 24 ARC students/11 BCS students
Spring 2015 - 28 ARC students/13 BCS students
Spring 2014 - 28 ARC students/18 BCS students
Spring 2013 - 36 ARC students/22 BCS students

ADDITIONAL FACULTY INVOLVED IN THIS STUDIO

Spring 2022: NONE
Spring 2021: Hans Herrmann
Spring 2020: Cindy Walls
Spring 2019: Christopher Hunter
Spring 2018: Fred Esenwein
Spring 2013-2018: Emily McGlohn
Spring 2017: David Beatty
Spring 2013-2016: Tom Leathem

GOALS AND OBJECTIVES

- Students will learn the basic factors associated with effective collaboration
- Students will learn the importance of individual versus group work in a collaborative environment
- Students will build an understanding of the relationship with and values held by their building industry partners
- Students will learn construction budget estimating and scheduling
- Students will learn the importance of Building Information Modeling and Integrated Practice as a means to foster the above listed goals and objectives

ARCHBCS Collaborative Studio

Mississippi State University

COURSE INFORMATION

The 3rd Year Collaborative Studio builds on information from ARC 3713 Assemblages and coordinates with ARC 3914/BCS 3914 Structures II.

COURSES IMPACTED

ARC 3546 Architectural Design III-B
(Spring semesters)
The development of building design as a synthesis of environmental concerns, behavioral responses, functional requirements, and technical systems. Studies using small and intermediate scale projects in this design studio where architecture students work collaboratively with construction students.

ARC 3914 Architectural Structures II/BCS 3914 Structures II (Spring semesters)
Design and analysis of structural elements as part of frames and other structural systems in this lecture and lab course that teaches both architecture and construction students in one section.

BCS 3126 Building Construction Studio 4
(Spring semesters)
In-depth evaluation of the principles and applications of construction productivity, estimating and bidding procedures, cost alternatives, scheduling, sequencing, budgeting and project cashflow management in this studio where construction students work collaboratively with architecture students.

ARC 3713 Assemblages
(Fall semesters)
Fabrication and construction are explored in the relationship between nature of materials and methods of assembly in this lecture and lab combination course.

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COLLABORATIVE ASSIGNMENTS - EXPLORING PRECAST CONCRETE

GOALS AND OBJECTIVES

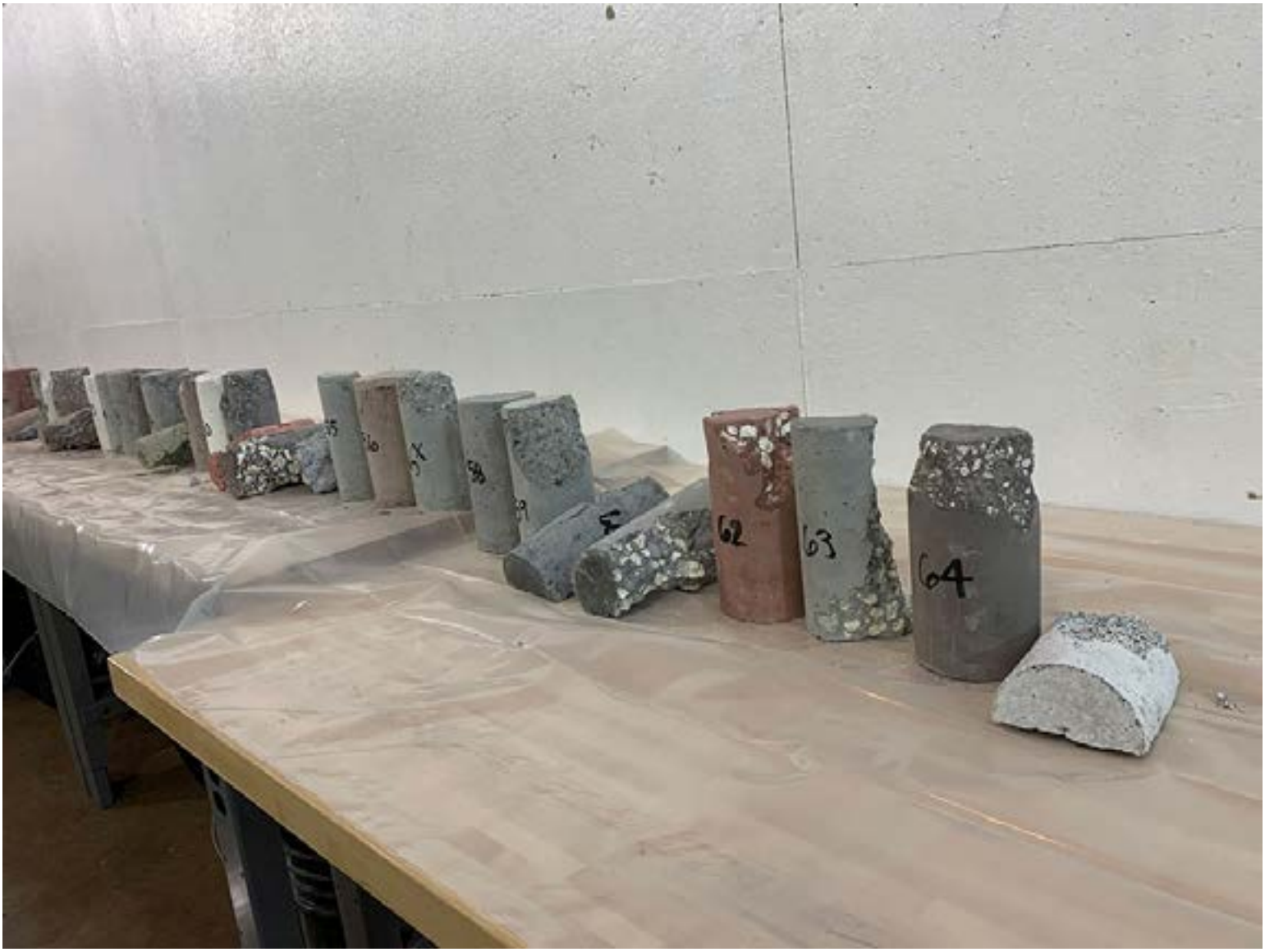
Goal: To learn about the impact of concrete mix design such as cement types, aggregates, admixtures, and formwork on material qualities

Objectives:

- To create and test a variety of concrete mix designs
- To create and test a variety of concrete formwork materials, shapes, and textures
- To take lessons learned and create a final report on the impact of knowledge gained on the architectural design process

PROJECT SYNOPSIS

To take the information gathered in Structures II to inform the conceptual design of an architectural precast concrete panel that will be used to influence and develop a building addition for the Cadence Building.



BCS Collaborative Studio

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PROFESSIONAL, EDUCATIONAL, AND INDUSTRY PARTNERSHIPS

The 3rd Year Collaborative Studio has had a variety of professional, educational, and industry partnerships over the years. Beginning with a sponsorship with the Brick Industry Association in 2013 the collaborative studio has built up to partnerships with the AIA Mississippi Chapter to engage with regional architects, as well as industry partners through the PCI Foundation Grant. Educational partnerships include the collaboration between the School of Architecture and the Building Construction Science Program, as well as consultation with the Civil Engineering Department at Mississippi State University.

AIA Mississippi

PCI Gulf South
A Chapter of the Precast/Prestressed Concrete Institute

Tindall
ENGINEERED TO SERVE

JACKSON PRECAST

gcp applied technologies®

US FORM LINER
POWERED BY RECKLI

ARCHITECTURAL POLYMERS®

M2
M2 SOLUTIONS

MISSISSIPPI STATE UNIVERSITY
SCHOOL OF ARCHITECTURE

MISSISSIPPI STATE UNIVERSITY
BUILDING CONSTRUCTION SCIENCE PROGRAM

MISSISSIPPI STATE UNIVERSITY
COLLEGE OF ARCHITECTURE, ART AND DESIGN

MISSISSIPPI STATE UNIVERSITY
JAMES WORTH BAGLEY
COLLEGE OF ENGINEERING

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Photo from Google Street View

INNOVATION HUB PARKING GARAGE_ Faculty: Ryan Ashford, Mohsen Garshasby, Alexis Gregory, Hans Herrmann, Briar Jones

This collaborative studio project in Spring 2021 explored the architectural and construction aspects of using precast concrete for the design of a building addition to the old Cadence Building in downtown Starkville, MS that has become the new Innovation Hub for the Mississippi State University Research and Technology Corporation.

The building addition was a parking garage with street-level retail spaces to enhance the walkability and retail options in downtown Starkville. Materials presented were for the architectural design aspects of the precast structural system, the architecture precast cladding system, and how they integrate into the existing historic building. The construction aspects presented were the creation and installation of the custom architectural precast cladding system, the project budget, and scheduling.

Regional architects participated in the student presentations as reviewers of the student work and earned AIA CEU HSW credits for their involvement.

ASSIGNMENTS AND EXPLORATIONS

Students began with the Project Delivery Theater assignment, as with other past 3rd Year Collaborative Studios. Then they moved into a new assignment to explore precast concrete that started in Spring 2021. This assignment worked with concrete mix design, concrete cylider testing, and ending with concrete disk design and testing.

The next assignment was to explore the context of the project site and the project in relation to both the architectural and construction aspects of the project. This assignment was created in Spring 2019 and was used for the 3rd Year Collaborative Studios ever since. This assignment included research into:

- Local and Historic Context
- Code Requirements and Preservation Guidelines
- Project Precedents and Site Analysis
- Building the Existing Building in Revit

These research topics were divided up and assigned to either ARC or BCS students in the studio based on their prior knowledge from previous courses, as well as what they needed to learn about their future roles in a collaborative team.

The remaining assignments on Schematic Design and Design Development divided up the various deliverables as well. For example:

<u>ARC Responsibilities</u>

- Drawings (Plans, Elevations, Building Sections, Structural Axons, Wall Sections, and Perspectives)
- Virtual Reality Fly-Through Video in Enscape or Lumion

<u>BCS Responsibilities</u>

- Material samples, product cut sheets, pricing for low, medium & high materials
- Outline specification
- Cost estimate for low, medium & high options
- Construction schedule
- Construction site plan(s)(BCS)

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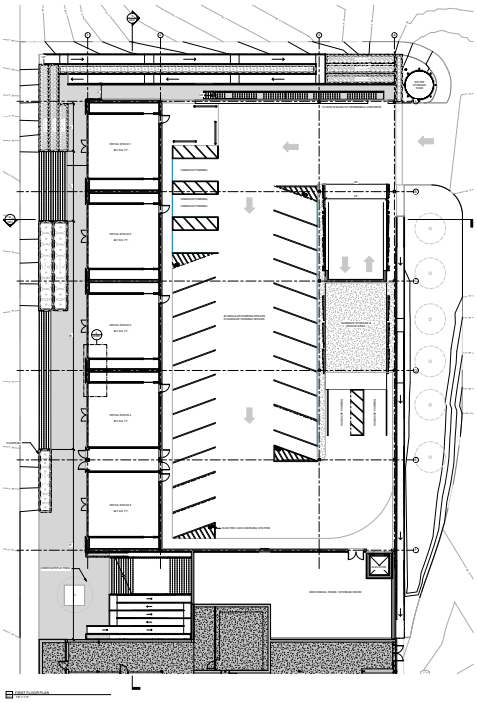
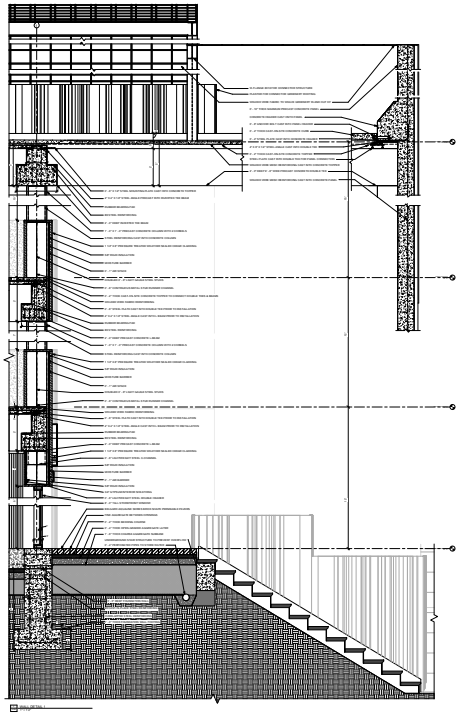
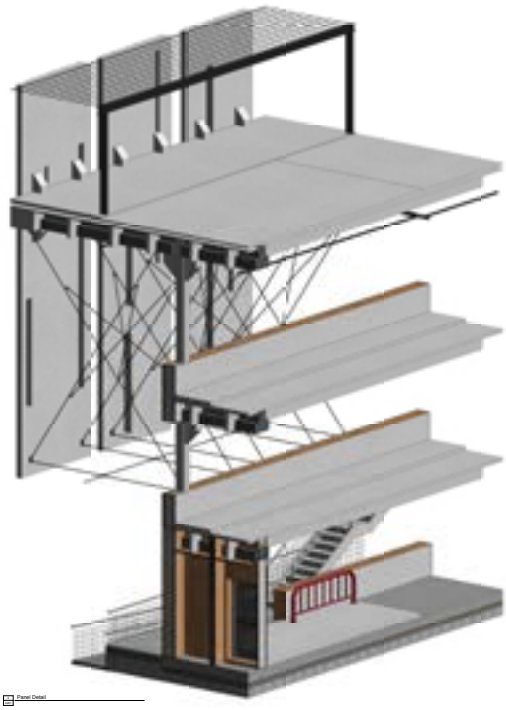
INNOVATION HUB PARKING GARAGE_ Students: Hunter Allen, Travis Bryant, Jane Kent, Hamner McCrory

Faculty: Ryan Asford, Mohsen Garshasby, Alexis Gregory







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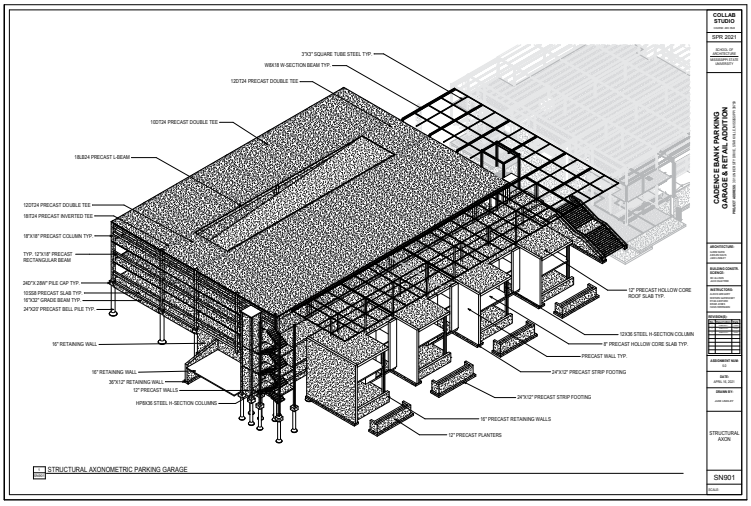
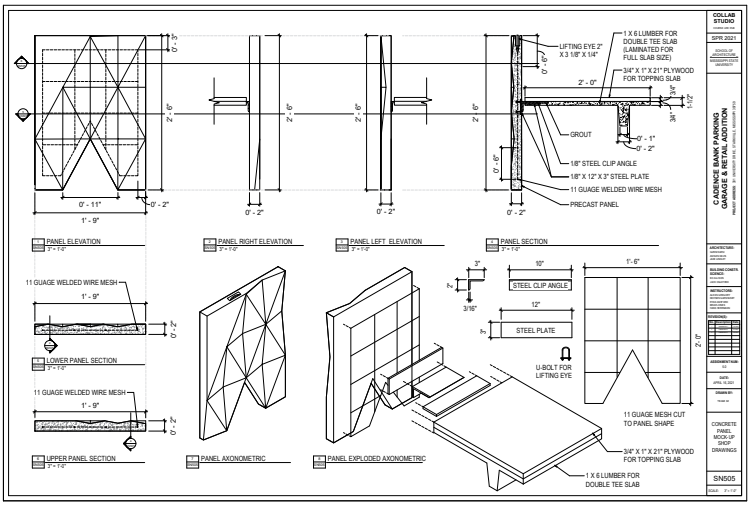
INNOVATION HUB PARKING GARAGE_ Students: Bo Allison, Ashlen Davis, Gizem Karsi, Jake Lindley, Jack Ogletree_Faculty: Ryan Asford, Mohsen Garshasby, Alexis Gregory





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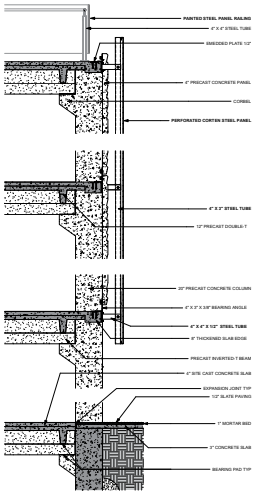
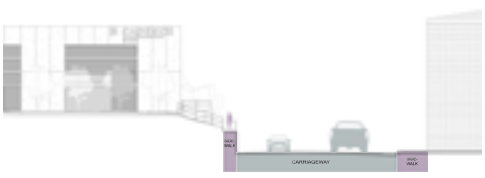
INNOVATION HUB PARKING GARAGE_ Students: C.J. Childers, Conner Griffin, Noah Heflin, Luke Murray

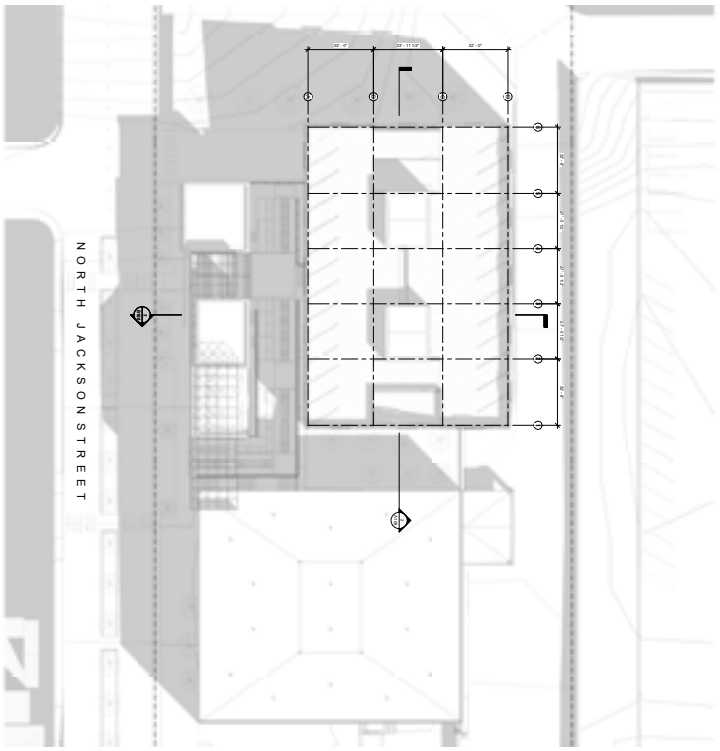
Faculty: Ryan Asford, Hans Herrmann, Briar Jones



NORTH JACKSON STREET DESIGN STREET SECTION



NORTH JACKSON STREET EXISTING STREET SECTION



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CLIMATE POSITIVE CONCRETE HOUSING_ Faculty: Ryan Ashford, Mohsen Garshasby, Alexis Gregory, Briar Jones, John Poros

The project is the development of a Habitat for Humanity house that can be repeated on an existing site owned by the Starkville Area Habitat for Humanity. The studio is composed of 16 teams with 2 BCS students and 2-3 ARC students. As part of the PCI Foundation Studio each team developed a design for a three-bedroom house meeting all the Habitat for Humanity requirements using precast concrete as the primary architectural cladding material. Each team developed three different house designs and three different construction systems for the house exterior walls as part of Schematic Design, then narrowed down to one house design and one construction system for the final presentation. The exterior wall designs are to take into account durability, tornado resistance, structural loading, thermal performance, cost, assembly by non-professional labor, time, and aesthetics using precast concrete.

The students met twice during the semester with precast concrete industry partners for feedback and advice for the design of the precast concrete architectural cladding. Those partners included PCI Gulf South, Jackson Precast, and Tindall Precast. The students also helped construct a Habitat for Humanity house using their current designs and met with the Construction Supervisor, John Breazeale, to learn more about their clients. Each team also presented to a representative of the Starkville Area Habitat for Humanity and several precast concrete industry partners for the Schematic Design presentations.

The students are also submitting their projects to the ACSA (Association of Collegiate Schools of Architecture 2022 Habitat: Design Competition – Climate Positive Concrete Housing. The final deliverables required are:

- 1” = 50’-0” Site plan of entire development
- ¼” = 1’-0” Floor Plan with site
- ¼” = 1’-0” Exterior elevations (4 or more)
- ¼” = 1’-0” Interior elevations
- ¼” = 1’-0” Building sections (2 or more)
- Structural system diagrams (structural plans and axonometric showing all structural elements – footings, slab, exterior wall system, roof system)
- Interior perspectives (4 or more)
- Exterior perspectives (4 or more)
- ¾” = 1’-0” Typical Wall Section for each of the exterior wall proposals
- ¼” = 1’-0” Physical model of house on its site with relocatable elements such as porches, patios etc.
- Virtual reality of Revit model with three-minute fly though video using either Enscape or Lumion
- Final sheet of cladding elevation, axon, and detail drawings(as noted above in Part 1), materials list, budget estimate, and schedule for mock-up.
- Mock-up of exterior wall system
- Material samples, product cut sheets, pricing for low and medium materials
- Outline specification
- Cost estimates for low and medium options
- Construction schedule
- Assembly instructions/diagrams for the exterior wall system
- Construction logistics and site plan(s)

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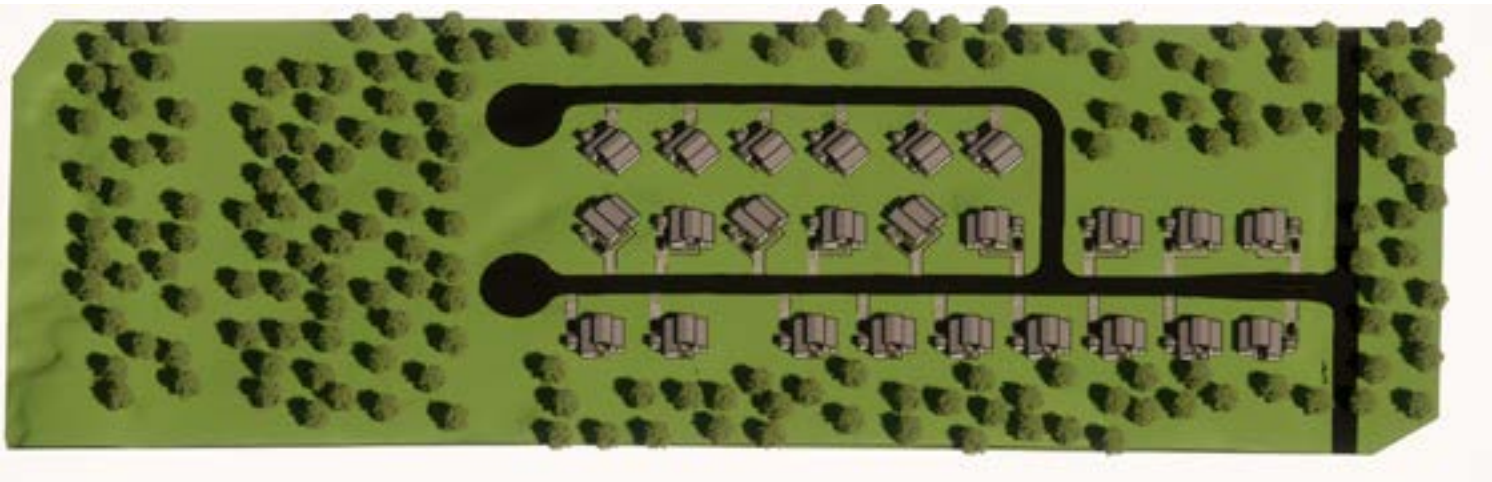
CLIMATE POSITIVE CONCRETE HOUSING_ Students: Jacob Bryson, Kobe Clouthier, Chapman Cooper, Elizabeth Gallagher, Elaine Otts



Site Plan of Habitat for Humanity Neighborhood

View of Living Room

View of Dining Room and Kitchen

View of Living Room

View of Dining Room and Kitchen

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CLIMATE POSITIVE CONCRETE HOUSING_ Students: Anna Criswell, Patrick Haggerty, Francis Neal, Connor Speaks, Jeb Thomas

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CLIMATE POSITIVE CONCRETE HOUSING_ Students: Anna Criswell, Patrick Haggerty, Francis Neal, Connor Speaks, Jeb Thomas

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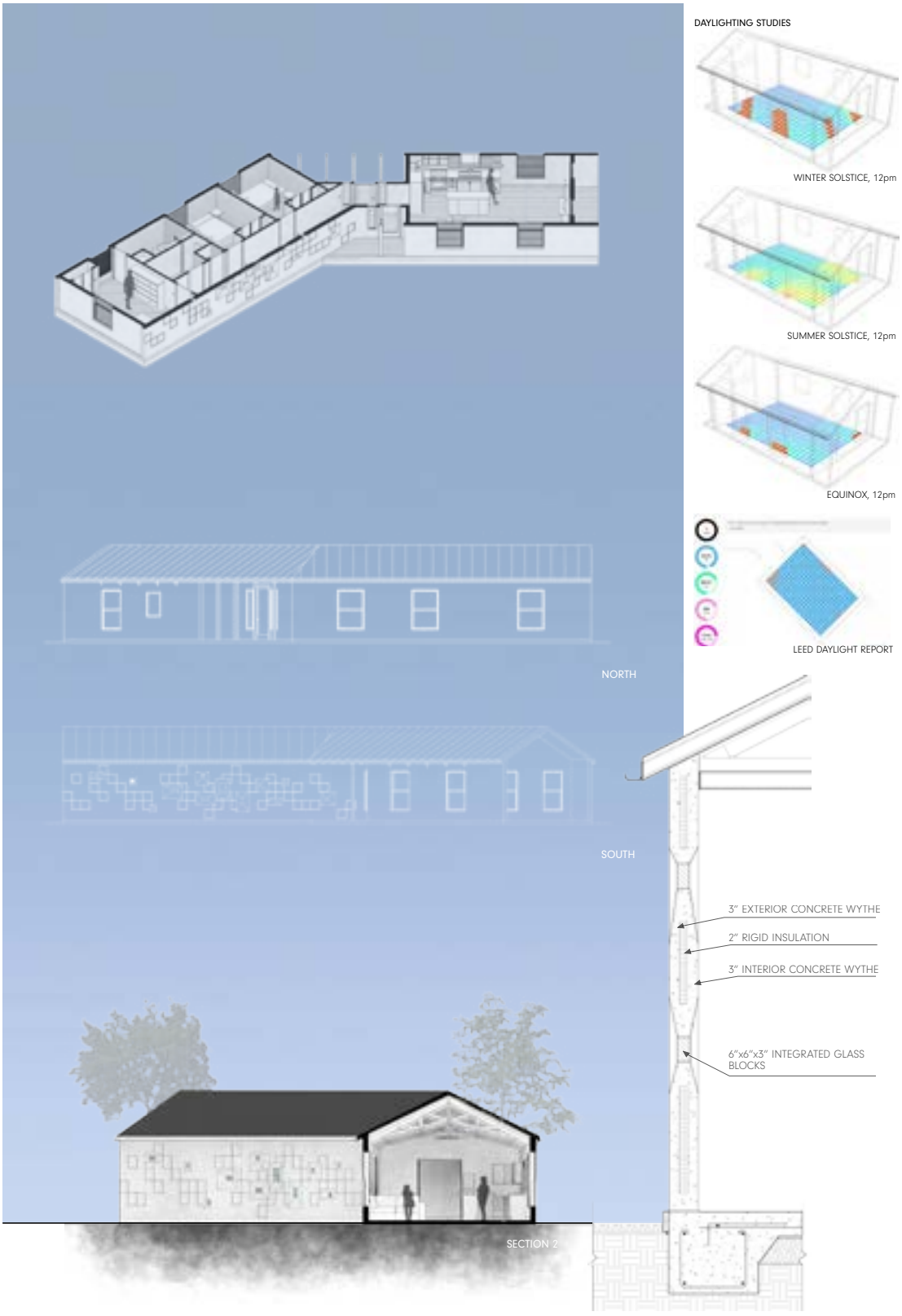

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CLIMATE POSITIVE CONCRETE HOUSING_ Students: Du'Juan Brown, Michael Chew, Tanner Madison, Mary Stafford Shurden, Colby Stalcup

HABITAT FOR HUMANITY
TEAM 12

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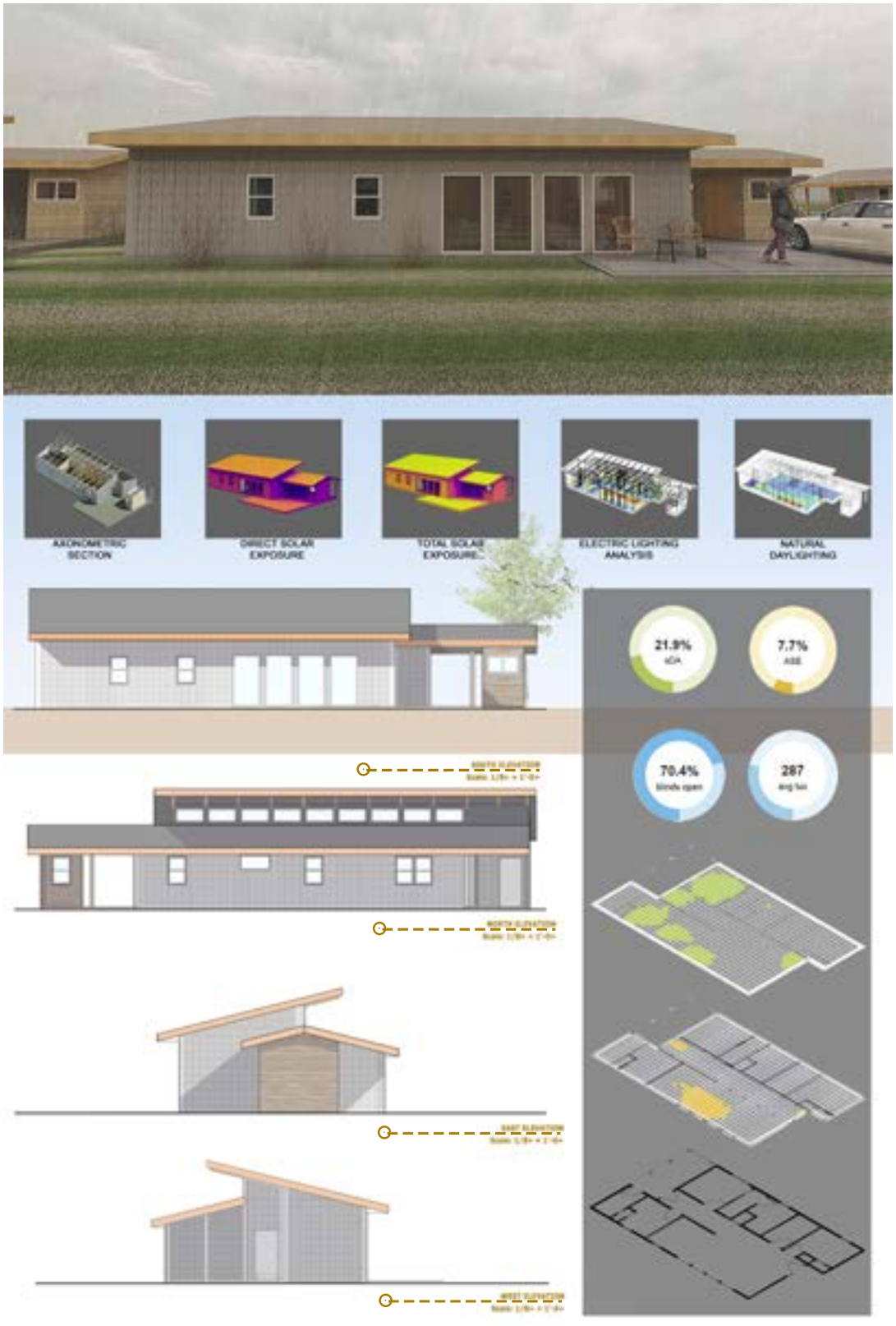

20 slides is a lot...

When you just finished a crazy semester...

Sorry for all of the reading you had to do!

THANK YOU!