





Dr. Franca Trubiano

# ARCH 631 D<sup>3</sup> Detail + Data + Delivery

Research, analysis, and integrated technologies for AEC project delivery

Contact information

Dr. Franca Trubiano

**Teaching Fellows** 

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Lectures

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Wednesday 10.15 am – 11.45 am Claire Fagen Hall AUD, Ann L. Roy Auditorium Guest lectures will be delivered virtually.

## **COURSE DESCRIPTION:**

Field:

This course is focused on advanced subjects in the project delivery of buildings: subjects inclusive of **Building Organically with Carbon Responsive Materials and Details**, **Resiliency and Fossil Fuel Free Building Systems Integration**, **Construction Robotics and Advanced Prefabrication**, and **Artificial Intelligence**, **Digital Delivery**, **and Building Simulations**. Students study complex, integrated, and sustainably determined buildings seeking their systems based, technological, and labor-based innovations.

Method:

Students engage in advanced research methods and forensic analysis of artifacts associated with the material detailing, fabrication, data-scaping, virtualizing, simulating, and workflow planning of building projects. Students also organize the collection of firsthand/primary source information by interviewing members of the project delivery team. Identifying how, why, and to what end products and practices are deployed in the construction of innovative projects is the goal.

Sources:

Using research publications, construction documentation, building information models, fabrication shop drawings, construction site photos, analytical models (structure, energy, sun, wind, materials), and data created for and by the construction process, **students analyze**, **report-on**, **and critically evaluate important technological innovations** in the delivery of building projects in the AEC (Architecture, Engineering, and Construction) industry.

Agency:

Cultivating critical decision-making skills in service to the means and methods of building delivery remains an essential aspect of the architect's work. Having advanced knowledge of project delivery material technologies, systems, and digital interfaces facilitates the translation of one's design ideas into building; it also encourages a more ethical response to their use. D° Detail + Data + Delivery asks students to critically assess the responsibility that we have as architects to define, use, and deploy technology in the building of our projects.

#### **COURSE OBJECTIVES:**

- Acquire knowledge and information associated with the detailed design development, construction documentation, material prototyping, fabrication, and project delivery portions of the architectural practice.
- Conduct **forensic research and rigorous analyses** of building projects, fabrication technologies, material processes, data structures, software, delivery sequencing, and construction management workflows.
- Deploy networking strategies for harvesting primary sources related to selected construction projects
- Scheduling, organizing, conducting, and transcribing a first-person interview with a project delivery team member in the A, E, or C, for the purposes of finding primary source information.
- Gain exposure to a variety of built/constructed examples of innovative, yet complex, project delivery workflows, via presentations by invited guests.

#### **COURSE METHODS**

Lectures:	Franca Trubiano Lecture Intro	o will lecture on the following subjects: Innovation, not Invention Collaborative Design and the Composite Mind, Walter Gropius and Ove Arup Workflows in Project Delivery
	Lecture 1.0	Building Organically with Carbon Responsive Materials and Details
	Lecture 2.0	Resiliency and Fossil Fuel Free Building Systems Integration
	Lecture 3.0	Construction Robotics and Advanced Prefabrication
	Lecture 4.0	Artificial Intelligence, Digital Delivery, and Building Simulations

## **Invited Guest Presentations**

Students will be introduced to advanced topics in project delivery offered by invited speakers in material research, façade engineering, pre-fabrication, and architectural detailing. Students prepare questions for our guests. See details below.

## **STUDENT DELIVERABLES**

## (submitted via Canvas and Penn BOX)

1. Readings and Responses

Students will complete (3) reading responses to the subjects covered in the classes' designated readings. Students are expected to offer critical observations and pose rigorous questions that demonstrate their advanced apprehension and comprehension of subjects discussed.

2. Questions for our Guests

In advance of [3] guest presentations, students will review content offered by guest presenters and prepare [2] questions for each guest presentation. Students are expected to identify critical ideas in their questions that challenge the content.

## 3. TEAM Research and Analysis, Report and Paper

This course deliverable produced by students working in teams of (3), analyzes an exceptional case study in building technology and project delivery. Students focus on how designs are translated during the Detailed Design, Construction Documentation and Fabrication phase of the project. Project details are collected and harvested from our collective professional connections with student teams encouraged to make early connections with professionals involved in the project's execution. An extensive Research Report in the form of a written and diagrammed paper describes and discusses the project's givens and the **team's research question**. The student will use mapping, data collection, modeling, simulation-analysis, and fabrication evidence to demonstrate their claims about the project, including its assets, values and possibly its drawbacks. Exceptional reports will be recommended for publication.

Research questions may be inspired by the content delivered during the instructor lectures or guest lectures. Student teams may also identify their own research topics as particular to chosen projects. In all cases, teams review their research topics with their designated Teaching Fellow.

### **COURSE REQUIREMENTS**

- **O. Attendance** is compulsory during all Lectures and Invited Guest Presentations.
- 1. Readings and Responses (3) each posted to the Canvas Modules-Due Wednesdays at 7 am
- 2. Guest Presentation Questions [3] each set of questions posted to Canvas-Due Wednesdays at 7 am
- 3. TEAM Research and Analysis, Report and Paper

Teams work on their projects in increments throughout the semester, submitting their research findings in (4) segments

- PART 1 DEFINITION: Defining the Project and its Research Question
- PART 2 INVESTIGATION: Collecting the Evidence for determining the Project's Innovative Delivery
- PART 3 ANALYSIS: Describing and Analyzing the Evidence associated with the Project's Innovative Delivery
- PART 4 CRITIQUE: Final Submission that Evaluating the Evidence

As part of the research process, all teams will meet with their designated Teaching Assistant for 15 mins after each submission (of PARTS 1, 2, and 3) to receive oral and written feedback on their Research and Analysis Paper. Feedback is offered in writing after Part 4.

#### **COURSE TECHNOLOGY:**

CANVAS On-line interface that stores and guides all course content, delivered by Trubiano. See

ARCH6310 001 202230 D3 - Design, Data, Delivery.

This Canvas site will host ALL content being delivered and generated for the class. Consult this Canvas site for <u>weekly instructions organized under **MODULES**.</u>

PENN BOX On-line PENN server for collecting all research documentation in team specific folders, for

archival purposes. You will receive a personalized link to your TEAM Penn BOX folder.

### **GRADING:**

Class Participation - Attendance			
Reading and Responses (3)			
Guest Presentation Questions (3)			
TEAM Research and Analysis, Paper		<b>60</b> %	
PART 1 Project choice and research question	10 %		
PART 2 First submission: sources, data, contacts	10%		
PART 3 Draft submission: models, mapping, text	20%		
PART 4 Final Edited submission:	20%		

100%

Grading in this course will adhere to university guidelines as outlined in the student handbook. Grades will be given in relation to the student's ability to meet the course deadlines, deliverables, and course objectives. Letter grades are understood to mean the following, with + and – understood as qualifiers.

Total

A Excellent, B Good, C Marginal, F Fail. Grade point values are, A+&A=4.0, A=3.7, B+=3.3, B=3, B=2.7, C+=2.3, C=2.0, C=1.7, F=0. Numerical Values: A + 90 and more, A 85-90, A - 80-85, B + 75-80, B 70-75, B - 65-70, C + 60-65, C 55-60, F below 55

60%

Please Note: All students will be working in teams for their research projects: however, all Readings and Responses and Guest Presentation Questions will be graded independently. Hence, a student's work will be assessed both collectively and independently.

### Attendance Policy

Attendance at all classes is compulsory. Students are expected to attend the entire scheduled meeting time and are responsible for completing assignments and for knowing the material covered in class. One unexcused absence is allowed. More than one unexcused absence will result in one-half level reduction for each additional absence (e.g. after the second absence from the class the final course grade will be lowered from a B+ to a B, after the third absence from a B+ to B-, etc.).

### Code of Academic Integrity:

All students are responsible for upholding the Code of Academic Integrity as published in the University of Pennsylvania Penn BOOK - https://catalog.upenn.edu/pennbook/. **Students are expected to undertake independent and individual research and adopt all expected rules of citation.** Please ensure you consult the Code of Student conduct, https://catalog.upenn.edu/pennbook/code-of-student-conduct/ and the Code of Academic Integrity https://catalog.upenn.edu/pennbook/code-of-academic-integrity/, for all pertinent details.

Dr. Franca Trubiano

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**DETAILED CALENDAR:** (Subject to change to accommodate guest speakers)

**MODULE** 

WK1 August 31<sup>st</sup> Initial Syllabus Review

TA introductions, Syllabus Review, Canvas Site Review

What is Architectural Research?

A Tale of Two Towers

WK2 September 7<sup>th</sup> FT Lecture - Intro

Innovation, not Invention

Collaborative Design and the Composite Mind, Walter Gropius and Ove Arup

Workflows in Project Delivery

Final Project Selection by Teams, due

WK3 September 14<sup>th</sup> FT Lecture 1.0 - Building Organically with Carbon Responsive Materials/Details

Reading Response 1, due

WK4 September 21\* FT Lecture 2.0 - Resiliency and Fossil Fuel Free Building Systems Integration

Reading Response 2, due

WK5 September 28th FT Lecture 3.0 - Construction Robotics and Advanced Prefabrication

PART 1 Project choice and research question, due

WK6 October 5<sup>th</sup> NO LECTURE

Review of PART 1 DEFINITION, Meetings with Teaching Fellows (Team meetings)

WK7 October 12th Guest Lecture Gawon Shin, Senior Associate, SHOP

(Studio mid-terms) Mass Timber

Questions for Guest 1, due

WK8 October 19th Guest Lecture Keyan Rahimzadeh and Evan Levell, Front Inc.

Façade Engineering

PART 2 INVESTIGATION: Collecting the Evidence, due

WK9 October 26th FT Lecture 4.0 - Artificial Intelligence, Digital Delivery, and Building Simulations

Reading Response 3, due

WK10 November 2<sup>nd</sup> Guest Lecture, Bowen Qin, Archi\_Tectonics and Kelvin Wang, ZIAD

Questions for Guest 2, due

WK11 November 9th Guest Lectures, Dr. Anne Beim, Royal Danish Academy of Art.

PART 3 ANALYSIS: Describing and Analyzing the Evidence, due

WK12 November 16th GUEST Lecture, Dr. Stefanie Weidner, Director of Sustainability, Copenhagen,

Werner Sobek

Questions for Guest 3, due

WK13 November 23<sup>th</sup> NO class – due to Thanksgiving Week

WK14 November 30th Final Team Videos and discussion

WK15 December 7<sup>th</sup> Final Team Videos and discussion

December 20th PART 4 CRITIQUE: Final Submission that Evaluating the Evidence, due

## **INVITED PRESENTATIONS:**

October 12<sup>th</sup> Detailing Mass Timber, SHoP Projects in LA and Syracuse Gawon Shin, Senior Associate, SHOP, https://www.shoparc.com

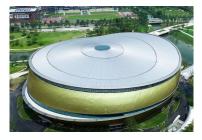


October 19<sup>th</sup> Design and Automation for Manufacture and Assembly: A Case Study of Scale and Complexity in the Delivery of High-Rise Building Envelopes
Keyan Rahimzadeh, Senior Associate, FRONT, www.frontinc.com/



November  $2^{\text{nd}}$  The management strategy of BIM application in Asia Games Stadium

Bowen Qin, Archi -Tectonics, www.archi-tectonics.com Kelvin Wang, BIM general consultant of ZIAD, http://en.ziad.cn



November 9<sup>th</sup> Building with Organic Materials - Thatch and Hemp

Dr. Anne Beim, Royal Danish Academy of Art



November 16th Resource Minimized Construction

Dr. Stefanie Weidner, Director of Sustainability, Copenhagen, Werner Sobek https://www.wernersobek.com



### **REQUIRED READINGS:**

- CANVAS Readings required topical readings will be posted to the respective MODULES for each WEEK. In addition -
- Franca Trubiano (2017) "Representing the Visible on Engineering the World: Ove Arup and the Philosophy of Total Design, Victoria and Albert Museum, London," *Technology Architecture + Design*, 1:1, 121-125, DOI: 10.1080/24751448.2017.1292807
- Franca Trubiano (2019) "Walter Gropius & Ove Arup: collaboration, 'total design' & the 'composite mind." *Proceedings of ICSA Conference*, Lisbon Portugal July 2020. (on Canvas)
- What is Architectural Research (posted to Canvas)
  - 1. Jeremy Till, "Architecture Research, Three Myths, One Method (2007).
  - 2. Richard Buday, "The Confused and Impoverished State of Architectural Research (2017), https://commonedge.org/the-confused-and-impoverished-state-of-architectural-research/
  - 3. Michael Mehaffy & Nikos Salingaros, "Designers Don't Get Science (And That's A Dangerous Thing)" (2013), https://www.archdaily.com/391794/designers-don-t-get-science-and-that-s-a-dangerous-thing
- Phillip Bernstein, Architecture Design Data: Practice Competency in the Era of Computation (2018, Birkhauser Verlag GmbH). E Book Central Book that can be downloaded from UPENN Library
- Jane Burry, Jenny Sabin, Bob Sheil, Marilena Skavara, Fabricate 2020, Making Resilient Architecture (UCL Press, 2020)
   JSTOR Open Access
- Richard Garber, BIM design: realising the creative potential of building information modelling, [Chichester, England: Wiley, 2014]. E Book Central Book that can be downloaded from UPENN Library
- Richard Garber, Workflows: expanding architecture's territory in the design and delivery of buildings (Oxford: John Wiley & Sons, 2017). Pertinent articles were downloaded from UPENN Library
- Randy Deutsch, Data-driven design and construction: 25 strategies for capturing, analyzing, and applying building data (Hoboken, New Jersey: Wiley, 2015). E Book Central Book that can be downloaded from UPENN Library
- Randy Deutsch, Convergence, The Redesign of Design, (Wiley, 2017). E- Book Central Book that can be downloaded from UPENN Library
- Scott Marble, Digital Workflows in Architecture: Design Assembly Industry (2012, Walter de Gruyter GmbH)
   E Book Central Book that can be downloaded from UPENN Library

## Additional Readings, recommended

- Yasha J. Grobman and Eran Neuman, *Performalism: Form and Performance in Digital Architecture* (2011, Taylor & Francis Group). E Book Central Book that can be downloaded from UPENN Library
- <u>Derek H. T. Walker</u> and <u>Steve Rowlinson</u>, <u>Routledge Handbook of Integrated Project Delivery</u> (Routledge, 2019)
   <a href="https://www-routledgehandbooks-com.proxy.library.upenn.edu/doi/10.1201/9781315185774-29">https://www-routledgehandbooks-com.proxy.library.upenn.edu/doi/10.1201/9781315185774-29</a>, Available on-Line
- Arup Materials Master Class Videos Follow this link for ARUP Materials Masterclass

This syllabus is dedicated to Prof. Lindsay Falck who taught an inspired version of this course for decades.

He continues to inspire our work today.

