Terri Meyer Boake, BES, BArch, MArch, LEED AP
Professor School of Architecture University of Waterloo
email: tboake@uwaterloo.ca

Tokyo International Forum - Rafael Vignoly

Arch 570: Architecturally Exposed Structural Steel Design

Fall 2020: Course Home Page

course outline

last updated September 9, 2020 12:39 PM

Territorial Acknowledgement

We acknowledge that the School of Architecture is located on the traditional territory of the Neutral, Anishinaabeg and Haudenosaunee peoples. The University is situated on the Haldimand Tract, the land promised to the Six Nations that includes 10 kilometres on each side of the Grand River. (see references here: https://uwaterloo.ca/engineering/about/territorial-acknowledgement)

Course Description:

THIS COURSE IS ALL ABOUT DESIGN, NOT CALCULATIONS. LEARNING OUTCOMES INCLUDE AN INCREASE IN YOUR ABILITY TO UNDERSTAND HOW STRUCTURES WORK, AND DETAIL THE SAME. PORTFOLIO WORTHY DESIGN PROJECTS.

Using an international database of case studies this course examines in detail the architectural design, specification, fabrication and construction process for Architecturally Exposed Structural Steel (AESS). It references the standards that were developed by the Canadian Institute of Steel Construction. Lectures will address topics including, the AESS Category Approach, fabrication standards and practices, project communication, tensile structures, diagrid structures, curved steel, castings, pedestrian bridges, steel with glazing, steel with timber. The work of the term will use current steel based competitions to explore detailed design application of the material.

The term's knowledge will focus on DESIGN PROJECTS that requires the students to design and detail architecturally exposed structural steel systems, connections and buildings.

Students will
· keep a detailed sketchbook of examples and details addressed in class (notes to be submitted weekly)

· prepare a weekly sketch of a steel detail

· in teams of 2 (masters) or (undergrad) students, complete the **CISC Design Competition**

The overall intention is to provide you with a high level appreciation of steel structural systems and an adeptness for detailing that is appropriate to the specific project and building type. The work of the term is intended to provide you with some signficant pieces for your portfolio.

The course reflects the research of my book on **Architecturally Exposed Structural Steel** published by Birkhauser in January 2015.

This is being designed as a synchronous course. The lectures will fit within the 3 hour slot on Friday afternoons. They will be delivered on WebEx, recorded and uploaded for those who cannot attend in person. I am given to understand that when Webex processes the video it adds closed captioning as well as generates a transcript. This takes time (5 hours or so), and I will endeavour to make the link available as quickly as possible.

Course Time Zone

All dates and times communicated in the document are expressed in Eastern Time (Local time in Waterloo Ontario, Canada). From September 8 – October 24 2020 times are indicated in Eastern Daylight Time (EDT, UTC—4:00) and from October 25 – December 31 2020, times are indicated in Eastern Standard Time (EST, UTC—5:00)

A major graded element this term will be your sketchbook - much like we did in Building Construction in first year. The major effort with the switch to online learning is actually motivating yourself to attend the lecture and pay attention. The taking of hand notes will help you in this process as well as encourage you to keep pace with the work and not fall behind. These will be evaluated on a weekly basis - so simple cell phone shots uploaded to the LEARN Dropbox will suffice. They are due prior to the next synchronous class.

The weekly sketch will be submitted to a Trello board so that there is some sense of the class sharing their work. Again this is due before the next synchronous class. Also submitted to LEARN for grading.

The major term project will be the CISC Competition which entails the design of an urban market building with a focus on the creation of an amazing canopy structure. I am excited to inform you that they have increased the prize money this year! First prize is now $8,000! Second is $4,000 and third is $2,000. There will be honorable mentions as well. This class is well positioned to win this competition as this course that you are taking is the most comprehensive one on architectural steel detailing in the world. And I am not kidding.

Learning Outcomes:

In spite of the required switch to online learning, there are some clear things that you should be able to do or know by the end of this course.

1. Understand the workings of the CISC method of specifying AESS - the category and characteristics system.

2. Understand the critical role of detailing as it plays into the design, fabrication and erection of steel.

3. Understand the role of the architect in the process, particularly in the selection of detail and splice types as they factor into overall buildability and construction safety.

4. Be able to design a highly detailed architecturally exposed steel structure that is credible in its detailing, member selection and constructability.

Log-in to LEARN: **here**

	Schedule of Classes: Fridays 2 to 5pm - synchronous **Office Hours:** I will open the Webex room early and stay late after the synchronous lecture. Otherwise you can email me at any time.
1	*Course Introduction*

Sept 11	**HIGH TECH ARCHITECTURE:** A detailed look at the roots of the birth of exposed steel in the British High Tech movement. *ADDITIONAL REFERENCES:* Construction of Stanstead Airport by Foster Renault Distribution Centre by Foster Start your weekly steel detail sketch. One due each week before the beginning of the class starting due next Friday. Full page. Media of your choice. From life or from photo. Should present something interesting in terms of approach to connections. Image posted to our Trello board as well as submitted to the LEARN Dropbox.
2 Sept 18	**ARCHITECTURALLY EXPOSED STRUCTURAL STEEL:** The development and details of the new system created by CISC to clarify the design, construction and fabrication of AESS systems.
3 Sept 25	**APPLICATIONS IN AESS:** A look in more detail at several Canadian buildings using the CISC method of Categories and Characteristics. Topics will also address finishes and corrosion protection as these impact the detailing of an exposed structure.
4 Oct 2	**AESS CONNECTION DETAILING:** Perhaps the most important aspect and largest design feature to be explored and exploited.
5 Oct 9	**SPAN:** A look at different ways that we create long spans with structural systems. Types will include truss systems, spaceframes. Applications will include buildings and pedestrian bridges. whistler platform construction video
Oct 16	Reading week
6 Oct 23	**TENSILE STRUCTURES:** An examination of a range of applications of tension systems for building structures, canopies, roofs and pedestrian bridges.
7 Oct 30	**CASTINGS AND CURVES:** Castings of the 21st century are very different than the elaborate castings of the 19th century. A look at the application of modern cast steel via several case studies. Curved structures can be achieved via several means, all related to the scale of the building, budget and technical means available.
8 Nov 6	**STEEL AND GLAZING AND LATTICE SYSTEMS:** An examination of some of the newer cable type glazing systems to see how these work with AESS systems. The tolerances in glazing systems are even tighter than for finely detailed AESS structures, and these systems are often used together. info on ETFE, examples of fabric and ETFE systems
9 Nov 13	**DIAGRID STRUCTURES AND BRACING SYSTEMS:** My This lecture will look at many of the case studies covered in my book on Diagrid Structures in detail, along with the method of design established in the book. We will also look at the design of bracing systems for buildings that can also be architecturally expressed. A new Canadian designed system used post quake in Christchurch, New Zealand will be discussed. Bracing systems for tall buildings will be introduced.

10 Nov 20	**STEEL AND TIMBER SYSTEMS:** A look at some signficant projects that have used exposed steel and heavy timber or glulam. Steel and timber undergo very different thermal and moisture related movement, so this must be taken into account when detailing the systems.
11 Nov 27	**COMPOSITE STRUCTURAL SYSTEMS FOR TALL BUILDINGS:** This lecture will reflect some ongoing research I am doing with the Council on Tall Buildings and Urban Habitat to look at variations in the combinations of steel and concrete as composite systems. This material should feed well into the tall buildings competitions. **COMPETITIONS:** A review of previous winning competition schemes. A strategizing session to understand the perspective of the jury, role of the brief and to plan a strategy for winning!
Dec 21	Final Project Due to LEARN. 11:59pm

Reference Texts and other Materials:

These texts will be on reserve in Musagetes. We have at most 2 copies of each book so you are not to remove them from the library to your personal shelves for the term. They are all available on Amazon. If you were to purchase just one for the course, the AESS one would be the most directly related.

Understanding Steel Design: An Architectural Design Manual. by Terri Meyer Boake. Birkhauser 2012.

Diagrid Structures: Systems, Connections, Details. by Terri Meyer Boake. Birkhauser 2014.

Architecturally Exposed Structural Steel Design. by Terri Meyer Boake. Birkhauser 2015.

Complex Steel Structures: Non Orthogonal Geometries in Building with Steel. by Terri Meyer Boake. Birkhauser 2020.

Canadian Institute of Steel Construction Guide for Specifying AESS. by Terri Meyer Boake.
(download free PDF).

Here are some of my websites to assist with steel connection design:

Steel: Fun is in the Details
SSEF1/

Steel Image Gallery:
steel.html

AESS Facebook Page:
https://www.facebook.com/aess4u

Look at resources in the industry:
Canadian Institute of Steel Construction: http://www.cisc-icca.ca/
American Institute of Steel Construction: http://www.aisc.org/
Canadian Sheet Steel Building Institute: http://www.cssbi.ca/

Evaluation:

The final term grade will consist of an average of submitted work as follows.

Late Penalties:
The weekly sketch and copies of your class notes are due prior to the subsequent week's class. A 24 hour grace period will be allowed to account for time zones and internet related issues that may impact submission. After 24 hours a grade of zero will be assigned.

For the Final Project late penalties of 5% per day will be applied, following the 24 hour grace period. After 5 days of lateness a grade of zero will be applied.

SKETCHBOOK: You are required to keep a sketchbook/notebook for this class. Graded on the basis of neatness and completeness.
10 lectures @ 3% per lecture = 30%

WEEKLY SKETCHES: 30%: 10 sketches to be posted to Trello weekly. 3% each.

CISC Competition:
Three board submission as per their requirements. 40%

Avoidance of Academic Offenses

Fall 2020 COVID-19 Special Statement

Given the continuously evolving situation around COVID-19, students are to refer to the University of Waterloo's developing information resource page (https://uwaterloo.ca/coronavirus/) for up-to-date information on academic updates, health services, important dates, co-op, accommodation rules and other university level responses to COVID-19.

Mental Health Support

All of us need a support system. We encourage you to seek out mental health supports when they are needed. Please reach out to Campus Wellness (**https://uwaterloo.ca/campus-wellness/**) and Counselling Services (https://uwaterloo.ca/campus-wellness/counselling-services).

We understand that these circumstances can be troubling, and you may need to speak with someone for emotional support. Good2Talk (**https://good2talk.ca/**) is a post-secondary student helpline based in Ontario, Canada that is available to all students.

Equity, Diversity and Inclusion Commitment

At the School of Architecture, we are committed to foster and support equity, diversity and inclusion. We recognize however, that discrimination does occur, sometimes through an isolatedact, but also through practices and policies that must bechanged. If you experience discrimination,micro-aggression, orother forms of racism, sexism, discrimination against LGBTQ2S+, or disability, there are different pathways to reportthem:

A)If you feel comfortable bringing this up directly with the faculty, staff orstudent who has said or done something offensive, we invite you, or a friend,to speak directly with this person.People make mistakes and dealing them directly in the present may be the most effective means of addressing the issue.

B) youcanreach out to either the undergraduate (Donna WoolcottorMaya Przybylski), graduate office (Nicole Guenther,Lola Sheppard, orJane Hutton),or director (Anne Bordeleau).If you contact any of these people in confidence, they are bound to preserve your anonymity and follow up onyourreport.

C)Youmay also choose to report centrally to the Equity Office. The Equity Office can be reached by emailingequity@uwaterloo.ca. More information on the functions and services of the equity office can be found here:https://uwaterloo.ca/human-rights-equity-inclusion/about/equity-office.

Academic Integrity: To create and promote a culture of academic integrity, the behaviour of all members of the University of Waterloo is based on honesty, trust, fairness, respect and responsibility. [Check www.uwaterloo.ca/academicintegrity/for more information.]

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offenses and types of penalties, students should refer to Policy 71 - Student Discipline, http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm

Appeals: A student may appeal the finding and/or penalty in a decision made under Policy 70 - Student Petitions and Grievances (other than regarding a petition) or Policy 71 - Student Discipline if a ground for an appeal can be established. Read Policy 72 - Student Appeals, http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm

Note for students with disabilities: The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term. Once registered with OPD, please meet with me in confidence during my office hours to discuss your needs.

last updated September 9, 2020 12:39 PM