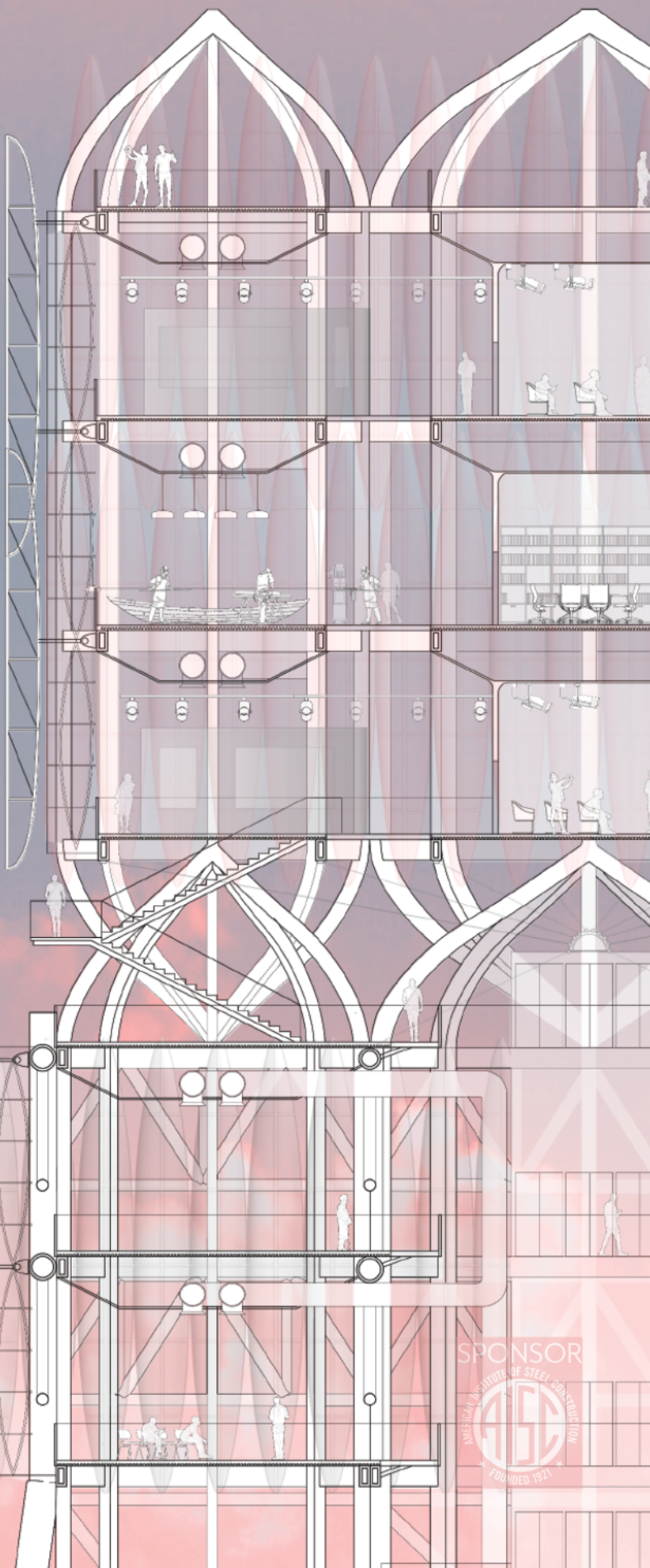
STEEL DESIGN

2024 STUDENT COMPETITION



STUDIO GUIDE

SPONSOR

SUPPLEMENTAL STUDIO GUIDE

Why has the American Institute of Steel Construction sponsored this competition since 2000?
One of AISC's primary objectives is education. A major component of what AISC does is to support students and professional architects to have the ability to integrate structure and architecture in a meaningful way. There are unique opportunities with structural steel to develop inspiring concepts, integrate innovation, communicate values, and protect people through resilience and with efficient technical strength. AISC's role builds on the publication of the foundational Steel Manual, or "steel Bible"; educational interaction is ongoing with AISC throughout an architect's career, and it can begin with the steel competition.

AISC
The American Institute of Steel Construction is a non-partisan, not-for-profit technical institute and trade association established in 1921 to serve the structural steel design community and construction industry in the United States. Since its establishment, AISC has conducted numerous activities with a scrupulous sense of public responsibility. For this reason, and because of the high caliber of its staff, the Institute enjoys a close working relationship with architects, engineers, code officials and educators who recognize its professional status in the fields of specification writing, structural research, design development and performance standards. Membership to AISC is free to university faculty and full-time students. Information can be found at Free Membership.

Sustainability of Steel
Using steel is a highly sustainable option. The production of raw US structural steel involves in upwards of 93% recycled content, keeping your old cars and appliances out of landfills. At the end of a building's life, 98% of all structural steel is recycled into new steel products, with no loss of its physical properties. As such, structural steel isn't just recycled but "multi-cycled," as it can be recycled over and over and over again. It is truly a cradle-to-cradle material, and few materials can claim that.
Steel Sustainability

The US steel industry has high transparency through its mills' environmental product declarations (EPDs) that cover all phases from product extraction to mill gate. AISC develops environmental product declarations (EPDs) of fabricated hot-rolled structural sections, fabricated steel plates, and fabricated hollow structural sections (HSS) that cover all phases from product extraction to construction through the end of life. At the building's end of life, steel is scrapped and processed with no loss of quality. In fact, a steel building is less likely to become scrap in the first place. Steel buildings have considerable strength and flexibility of function over their lifetime. If occupancy or loading changes, steel frames are more readily adjusted. Steel, if desired by the architect, can be graceful, nimble, and minimal in its bulk both in plan and section, and it integrates easily with other systems and materials.

Fabricators are reducing their carbon footprint by reducing electricity use, and they are continually upgrading to renewable sources of energy. It not only saves money, but architects and engineers who specify steel, as well as owners, can require a lower carbon footprint of their materials by requiring and comparing EPDs, so the most sustainable US structural steel producers have a competitive edge in a market increasingly concerned with life cycle assessment. Architects, engineers, and owners who use steel support lower embodied carbon.

RESOURCES
A goal of all ACSA competitions is to make students aware that research is a fundamental element of any design solution. Students are encouraged to research material properties and methods of steel construction, as well as precedent projects that demonstrate innovative use of structural steel.

Steel Video Resources

- Architecturally Exposed Structural Steel (Steel Video Resources) – VIDEO
- What is AESS (Steel Video Resources) – VIDEO
- Steel Coatings & Protection (Steel Video Resources) – VIDEO
- Steel Connections (Steel Video Resources) – VIDEO
- Custom Steel (Steel Video Resources) – VIDEO
- Tension: Force Differentiated Structural Steel Design (Steel Video Resources) – VIDEO
- Span: Exploiting the Tensile Strength of Steel (Steel Video Resources) – VIDEO
- What is AESS – VIDEO
- Steel Coatings & Protection – VIDEO
- Steel Connections – RESOURCES

Steel Design References

- AISC website: www.aisc.org
- *Modern Steel Construction*: This authoritative monthly magazine is made available online free of charge. This magazine covers the use of fabricated structural steel in the variety of structural types. It presents information on the newest and most advanced applications of structural steel in a wide range of structures. Issues of Modern Steel Construction (1996 – Present) are available online. Visit Modern Steel Construction to view them.
- Steel Connections – RESOURCES
- Terri Meyer Boake. Understanding Steel Design: An Architectural Design Manual. (Birkhäuser 2013)
- John Fernandez. Material Architecture. (Spon Press, 2006)
- Victoria Bell and Patrick Rand. Materials for Design 2. (Princeton Architectural Press, 2014)
- Shulitz, Habermann, Sobek. Steel Construction Manual. (Birkhäuser Basel 2000)
- Annette LeCuyer. Steel and Beyond. (Birkhäuser Basel 2003)
- Sutherland Lyall. Remarkable Structure: Engineering Today's Innovative Buildings. (Princeton Architectural Press, 2002)

Innovation Center / Museum / Multiuse References

- David L Lawrence Convention Center, Pittsburgh, PA, Rafael Vinoly Architects, PC, New York, NY, Architectural Record, 2004 May, pg.154-159, Modern Steel Construction, 2004, July, pg. 30-35
- Seattle Public Library, Seattle, Washington, Office for Metropolitan Architecture/LMN Architects, Architecture, 2004, July, pg. 39-47, Civil Engineering, 2003, March, pg. 64-67.,
  Modern Steel Construction, May 2005. pp 48-49
- Boston Convention and Exhibition Center, HNTB Architecture, New York, NY, Rafael Vinoly Architects, New York, NY, Primary Group, Boston, MA, Modern Steel Construction, 2005, pg. 24-26
- Issues of Modern Steel Construction (1996 – Present) are available online.
  Visit: https://www.aisc.org/modernsteel/ website to view them.

Steel Innovation and Workforce References
Workforce video: Ironworkers Local 5 outside of DC, state-of-the-art facility Their landing page is literally a video of folks training on their true-to-life mock-ups as well as shots of their welding booths, etc.
For manufacturing, Lincoln has several videos that might be helpful:

- Why Manufacturing: Lincoln Electric
- Lincoln Electric Virtual Factory - slower-moving
- Video Tour of Baker Industries, a Lincoln Electric Company - this video provides some specific dimensions and machinery descriptions that might be helpful. It also shows steel 3D printing.

For structural steel fabrication:

- Steel Fabrication: A Virtual, Detailed Tour of the Steel Fabrication Process -
- Conewago Manufacturing's Steel Fabrication Virtual Shop Tour - AISC Certified
- VIP Structural Steel Workshop Tour Bay 2 & 0, Bromley Christchurch

PERFORMANCE EVALUATION *(For Category I only. Not required for Category II.)*
The performance evaluation is new this year and required by the students entering Category I. Design performance accountability is an important aspect of today's architectural profession and education, and this new requirement is meant to encourage students to embed performance assessment into their design process. The competition is an opportunity for programs to consider how assessment can be integrated at their schools and ultimately share different approaches. What students measure or assess is flexible. Students could measure quantitative aspects or assess qualitative aspects of design, from sociological performance to technical or environmental performance. Below are some examples.

Sociological

- User behavior
  How do different people use the space? How have you analyzed that to assess, and perhaps influence, your design? How can you determine whether your design is successful if responding to how people use the spaces is a goal of yours in the project?
- Accommodation/response to needs of different user groups
  This might include the needs of trainees, instructors, researchers, fabricators, or managers etc. How do you assess whether your initial goals of accommodation were actually met?
- Inclusivity and/or accessibility
  Are you creating equally dignified experiences in your design for all users? Or did you make changes to create a more accessible entry? What does "more accessible" entail?

Technical

- Structural performance- member sizing
  Did you calculate the depth of your roof beam or trusses based on the forces and the span? Did you compare its performance to code minimums or adjust your spacing to get a more efficient or economical layout? A more dramatic effect?
- Efficiency of use of steel in the project
  One of steel's benefits is how it can integrate with other systems. Did you make adjustments to a steel member's depth or spacing to refine the integration with a facade or environmental system?
- Daylighting quantity and/or quality
  Some modeling plug-ins not only measure daylight quantity, but also daylight quality- does it cause glare or heat gain? Does that impact energy use?
- Energy Use Index or Embodied Carbon Index
  Modeling plug-ins are available to help measure both operational energy used during the time a building is occupied and embodied energy over a project's lifetime.
- Acoustics
  Did you measure the reverberation time of a space? Would it be comfortable for the users of the space and activities happening in the project? Some of these spaces might be loud- how might that be minimized and isolated?

Construction

- Project Cost or Schedule
  Did you study a steel system, member, or detail like SpeedCore, for example, that would shorten construction time or reduce cost?
- Life Safety
  Were you able to improve the life safety of your design?

Other

- Another aspect of design performance of your choice

Performance Evaluation Questions *(For Category I only. Not required for Category II.)* Upon submission, each student will answer a series of questions.

1. What category of performance did you measure or assess while developing your project?
    a) Society/Community
    b) Structural
    c) Environmental
    d) Life Safety
    e) Constructability

2. What standard or benchmark did you measure against?
    a) Architecture Industry or Profession Standards (Ex: LEED or Architecture 2030)
    b) Faculty or Studio Standards
    c) Code Standard (Ex: International Building Code, Local Code, ADA, Energy, Zoning, etc.)
    d) Self-Assessed Standards (established by research or surveys)
    e) None

3. How did your final design performance compare with your standards or benchmarks?
    a) Performed Much Better
    b) Performed Somewhat Better
    c) Performed Almost Equally
    d) Performed Somewhat Lower
    e) Performed Much Lower
    f) Some measurements were better, while some were lower

4. If your design performance was below the standards, did you redesign and measure or assess again?
    a) Not applicable, my/our design performance was equal to or better than the standards
    b) Yes, and performance improved.
    c) Yes, but performance did not improve.
    d) Yes, I/we redesigned, but it was difficult to run the same assessment.
    e) No, it was too difficult to run the same assessment.

*You could literally mean you, or user groups, a lab technician, a fabricator, an engineer, a contractor, etc. A defined aspect of the design should be substantiated by objective analysis or assessment.

Image Credit (background):
2022 Steel Design Students Competition Winner, 1st Place, Category II: Open
Project Title: Tomols
Student: Ron Patanavin
Faculty Sponsor: Thomas Fowler
Institution: California Polytechnic State University