2010

Fourth Year Collaboratory 2010

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CAL POLY

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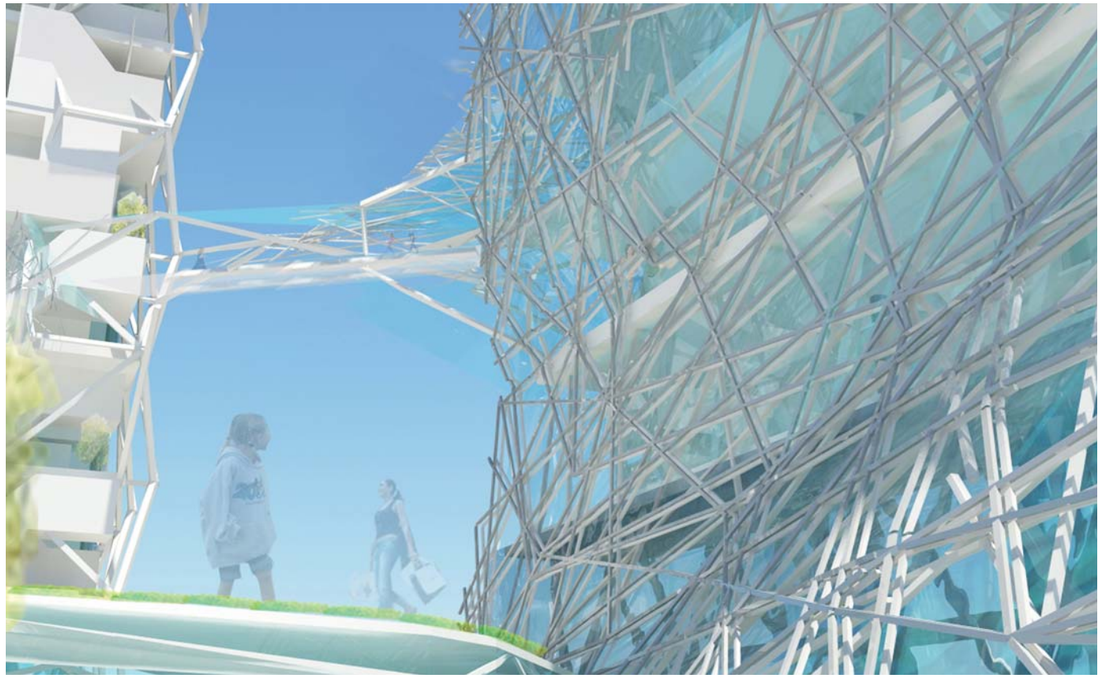

Fowler
Dong
Doerfler
Cabrinha

architecture ARCHITECTURAL ENGINEERING

2007 – 2010 Design Collaboratory

College of Architecture and Environmental Design
Cal Poly, San Luis Obispo, CA

CAL POLY

The Architecture Department is one of five departments that comprise the College of Architecture & Environmental Design.
The other departments are:

Architectural Engineering
City & Regional Planning
Construction Management
Landscape Architecture

AeD PRESS

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introduction

FOUR faculty, THREE iterations, TWO departments, and ONE objective: Design Collaboratory.

To emphasize the quality of the work presented in this collection seems self-evident for two reasons. First, because the work partakes in today's iconography of an architectural production that remains suggestive of urban places –a utopia of superstructures that has become reality in many of our contemporary metropolises. Second, even at a glance the reader will discover projects whose content is about more than rudimentary concepts. The resulting work demands careful consideration to understand what lies beyond and beneath the extraordinary imagery. In the projects there is a comprehensiveness, an exhibition of process, a clarity of intent, and a legitimacy of ideas that is sufficient to convince us that these projects convey something fundamentally different.

The true road map to understanding the projects lies in the students' reflective essays. These essays are a testimony to the rich potential of a collaborative approach to design issues and offer insight into the students' certitudes. They are also a testimony to the experience of collaboration and the hope that this is the beginning of a long journey in which teamwork is the antidote to the solitary artisan. I hope that you will reflect on the works they have presented, for the projects, and the entire experience of the collaborative efforts.

The students and faculty have my sincere gratitude for the richness of the experience they have shared with us. My thanks also go to Kenneth Rodrigues, principal of Kenneth Rodrigues & Partners, Inc, for naming the first interdisciplinary studio at his alma mater. We are indebted to him as he paved the way for sustained collaborative excellence.

Henri T. de Hahn
Department Head, Architecture

Design Collaboratory

Since the 2007/2008 academic year, this interdisciplinary design studio called the Design Collaboratory has been co-taught by four faculty members building upon the successful 46-year multi-disciplinary experience of this academic institution cultivating innovative models of practice through an integrated architecture and architectural engineering design studio. This team of professors, with over 40 years of collective cross disciplinary collaborative experience, and students from Architecture and Architectural Engineering Departments participate in a 20-week design studio.

The Design Collaboratory provides for an intensive two-quarter course sequence designed to familiarize undergraduate students with practiced based knowledge and application for how interdisciplinary teams can work together to design buildings. All discipline students have a seat at the building design table and therefore students learn the fundamental principles for negotiation and building systems integration. Students are provided a unique opportunity, not provided anywhere else in the curriculum, where they are all fully engaged in the studio design project that is enhanced by the support and collaboration with leading practitioners in the field.

This interdisciplinary team approach to building design has all disciplines involved from the inception of the building design project. Innovative uses of steel, integration of structure and design, and energy efficient cladding systems, are emphasized in this comprehensive design studio. The DC's collaborative practitioner partners are internationally recognized architecture and engineering firms, and the educational division of a major software company. Interdisciplinary student teams address complex structural/cladding systems, environmental issues, and use advanced digital technology tools, while simulating innovative collaborative practice strategies based on workflows demonstrated by leading design and engineering firms.

This Collaboratory model expands the role of the practitioner in the academic design studio by having leading firms sponsor workshops, lectures and critiques across the disciplines to reformulate the methodology for integrating a practitioner's workflow strategies into a studio project.

The five major Collaboratory activities are:
1. Practitioner Lectures/Workshops
2. Practitioner Reviews and Discussions in a Selected Practitioner's Office
3. Advanced Technology Training By Software Company and Practitioners
4. Digital and Physical Prototyping of Project Cladding System

Design Collaboratory Project Goals —

- To challenge or transform the preconceptions about the boundaries between academia and practice;
- For firms to strengthen students' preparedness for practice;
- To provide opportunities for practitioners to teach, mentor and recruit;
- For students to learn from and in a practice environment.

Design Collaboratory Learning Objectives —

- That students recognize that innovative structural and cladding systems, environmental issues and building siting and building constructability knowledge is not distinct from design knowledge;
- That students develop a "rules of thumb" working knowledge of core building design topics such as structural and cladding systems design, building siting and constructability, and LEED issues can be synthesized into their design studio project;
- That students learn to conceptualize buildings not as discrete objects that ONLY RELATE to their particular discipline, but rather as an assemblage of systems and elements that are connected to and interact with the larger world;
- That students are able to understand building design from the perspective of other disciplines involved for inFORMing and inspiring the development of building project;
- That students' learn to develop leadership and partnering skills over the course of the studio that will be used as future professionals.

Professor Jim Doerfler, AIA
Associate Professor Kevin Dong, SE, CE
Assistant Professor Mark Cabrinha, PhD, RA
Professor Thomas Fowler IV, AIA, NCARB

Thanks to Ken Rodriguez, of Kenneth Rodrigues & Partners, Inc., for supporting the development of this interdisciplinary design studio publication. The following companies have also supported the Design Collaboratory through involvement in student reviews, providing seminars/workshops (in person and via Webinars) in how they approach design projects in practice along with providing examples of the fi rm's workfl ow strategies for integrating technology into the development of the project. Autodesk has provided training and support for REVIT building information modeling (BIM) and Ecotect environmental analysis software.

www.krparchitects.com
Kenneth Rodrigues & Partners, Inc.

Buro Happold
www.burohappold.com
David Herd, Partner

WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS
www.wje.com
Paul Kovach, Senior Associate and
Ian Chin, Vice President /Principal

Autodesk
usa.autodesk.com
Nancy Clark Brown, AEC Education Solutions Specialist

www.schroederiron.com
Neel Aldridge, Production Manager

www.rntarchitects.com
Ralph Roesling, Partner

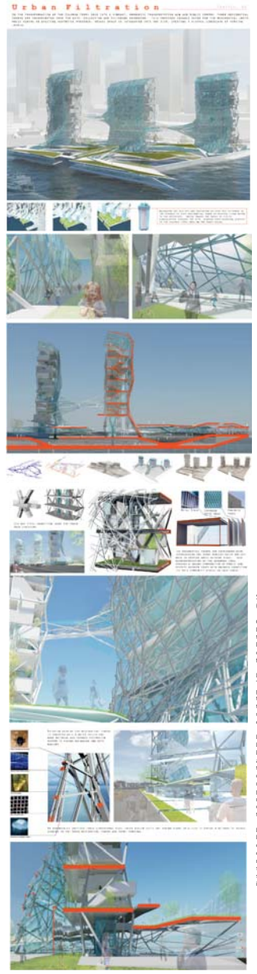
morphosis ARCHITECTS
www.morphosis.com
Kim Groves, Managing Partner

ARUP
www.arup.com
Bruce Danziger, Associate Principle and Aime Nulman, Associate

Student Project #1 (Selected) — Urban Filtration - Seattle, Washington's Coleman Ferry Dock Housing + Retail

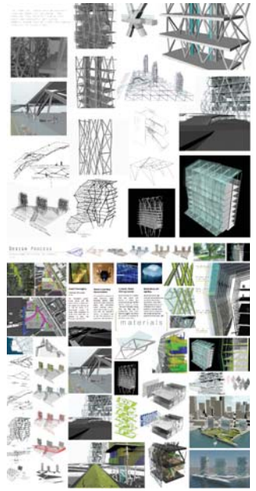
Architecture Concept:

Seattle's weather forecast frequently includes rain, and the Coleman Ferry Dock's location at a low point in the city's topography means the site receives run-off from the entire downtown area and surrounding parts of the city. Water also traces the paths of human circulation through the site, which flows from downtown Seattle to the Puget Sound. Both rainwater and run-off are collected on site and filtered through screens of each residential tower to provide clean water to the residents. The playful articulation of the ground plane provides retail space and protected access to the ferry terminals as well as a park-like setting for residents and visitors alike. This multiuse project aims to create a sense of community through a balance of housing, greenery, and retail space while speaking of Seattle's intimate connection between people and water.



Structure/Skin Concept:

An organically inspired three-dimensional steel truss system lifts the ground plane in slices to expose a network of retail leading to the three residential towers and ferry terminal. The playful landscape of articulated green roofs serve to provide protection from the rain, light to the lower parking level, and an extensive park as a new community social space. Using the varying planes of the roof and realistic beam spans, a system of triangulation was developed to determine the truss form. This system appears organic because of the constantly changing variables of span and roof location but is in fact rationally derived. A similar system, though scaled down, is used in the residential screens. The screen structure is designed not only to support the glass and ceramic filtering system, but also some of the lateral forces experienced by the towers. A steel mega structure in a canted diamond pattern spans four floors and establishes points that were used to derive the screen structure patterns. Open braced frame cores faced with glass provide lateral stability and elevator access to the modules. Peeling up and out from the ground is a water filtration screen that cleans storm and rainwater flowing into the site and delivers fresh water to the apartments contained in the residential towers. The runoff is first screened of debris and collected at the base of the towers where it is stored in large, exposed tanks before being pumped up through the elevator cores to the top of the towers. As the dirty water runs through the ceramic panels that are cut to mimic the steel screen structure that supports it, microscopic particles are filtered out by the ceramic's pores and by the time the water reaches the first floor of the towers it is clean. Here the water flows through a break in the screen to trickle down as a water wall into a collection area at the base of the residential towers.



Selected Reflective Comments From Architecture and Architectural (Structural) Engineering Interdisciplinary Team:

Collaboration:
I felt that as a team, my group came up with a much richer design, strengthened by the ARCE team's input to create something new and innovative in my school career: a group project that has transformed my own thinking and helped me to continue to develop my design skills and critical thinking. Group interdisciplinary project involvement is a skill that is important to learn for the architecture field while still in school.

Design Process:
The initial design charrette was a huge leap for our team, and the success of the first charrette propelled our team forward into developing sketches of our screen filtration idea, organic structural system, research in developing a materials system for the screens and the set-up of the vertical suburbia. In winter quarter, Rachel and I worked very closely, dividing the work between us, and meeting every few days to update the combined digital file, go over ideas, and updating each other on new design developments.

I worked a lot in my sketchbook drawing ideas for the design, and then once my colleagues and I had discussed them, we would implement it digitally. Initially we had the work divided up between the towers and the retail; I worked in Rhino drawing up the landscape, parking level, and retail structure (which was extensively revised over time) while my colleagues worked on the structure for the residential towers and the screens. Later on, I also became involved in digitally drawing the screens, creating details, developing the patterns, and applying it to the master model. I also worked extensively on the modular apartments, coming up with floor plans, modeling them in Rhino, and modifying them as necessary. As far as digital modeling, my colleague focused primarily on modifying the mega structure for the towers, placing the completed apartment modules, and modifying the final used screens I had drawn to create a more three dimensional structure.

Learning:
I was interested in this studio particularly because of the interdisciplinary aspect, but also because I had yet to enter a competition and wanted the experience before fifth year since it would enable me to sharpen my presentation skills. 1) I feel I have made huge strides in my communication and presentation skills, 2) I have also reinforced both design theory and developed a sense of structural understanding that I can use to better inform my projects and thus make them stronger, 3) I have learned that miscommunication is possible despite valiant efforts to prevent it.

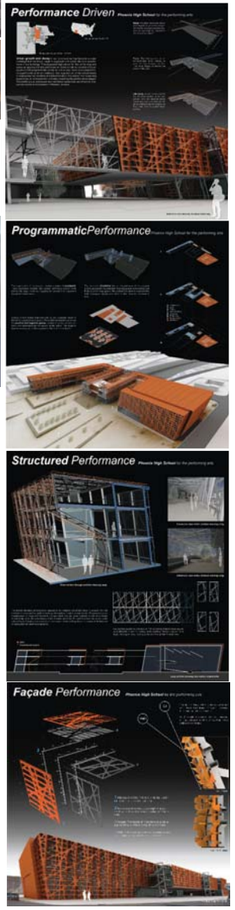
Lectures / Workshops (Selected)

Student Project # 2 (Selected) — Performance Driven - Phoenix, Arizona's Deck Park High School for the Performing Arts

Architecture Concept:

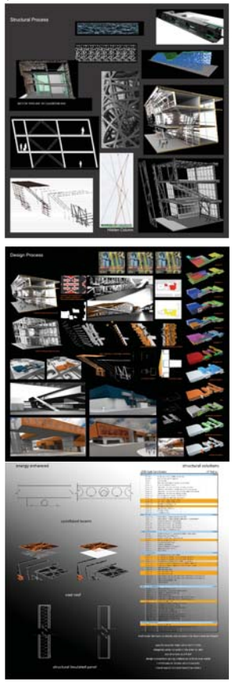
The site is Deck Park, just north of downtown Phoenix, Arizona and next to the Phoenix Central Library located in the art district of the city. The site is situated above Freeway 10 and can be seen when driving on the freeway. Considering that Phoenix has extreme climatic conditions, it is preferable that the building would be passively cooled and heated to reduce the use of mechanical systems and thus, reduce the impact on the environment. The site is currently not in much use. With the introduction of a High School for the Performing Arts on this site, we will bring a sense of community back to the city. By developing this area that otherwise would be neglected, we can avoid the development of green lands and help preserve the natural environment.

Performance can be a presentation of an artistic work to an audience or the effectiveness in which something functions, operates, or behaves. Why can't it be both? This High School for the Performing Arts is not only meant for performances, but also is a performance in of itself. The building is meant to house the transition of performing students that attend the school to learn, rehearse, and ultimately perform. This idea became the basis for the programmatic organization of the school. The transition the students go through in school becomes their circulation path on the site that flows from private to public as the students learn, rehearse, and perform for the community.



Structure/Skin Concept:

The primary structure, although at first glance, appears as a chaotic web of steel members, consists of a series of standardized panels of steel tubes. Each panel is made up of a hot-dim cross member and infill elements that are added for additional support as well as complexity. The structure's redundancy allows the members to be smaller and it helps minimize the need for lateral support. The structural panels inform the skin and create certain openings in their intersection and overlapping in order to control sunlight. The skin itself consists of a series of louvers, or fins, that are oriented either vertically or horizontally depending on the solar orientation. The skin is attached to the primary structure through a series of smaller members that are placed across the primary structure. The building's south and north walls tilt down towards the south at 10 degrees in order to prevent direct summer and solstice sunlight from the south and to maximize the amount of indirect north light that comes into the classrooms and lab spaces.



Selected Reflective Comments From Architecture, Architectural (Structural) Engineering and Construction Management Interdisciplinary Team:

The top three things that I learned in this studio experience include working efficiently with a group, the application of structural concepts in the design process, and the benefits of using (advanced digital) technology for the development and presentation of a project. Some of the things that contributed to this learning experience include the involvement of professors, the field trips to the site and related projects and the involvement of professionals in our design process.

By working in this interdisciplinary group I feel that we all greatly learned from each other. We were able to put aside our differences and work together as a team to achieve our project goals. Working with the Architectural Engineers and the Construction Management Students helped us develop our structure and understanding of constructability issues so that we all were content with the project outcomes. I think this experience is unique here at this institution and I feel other majors should also collaborate with different disciplines. This is something that will benefit us in the future when we get into the workforce and have to work with many different fields of study.

Participating Professionals
The participation of the different range of professionals greatly assisted our group to further develop our project. In person reviews with Practitioners were probably the best due to the ease of communication of our concepts and ideas. Through their critiques and suggestions we were able to make changes and take into consideration issues that we would of never have thought of. I feel that the web was beneficial… Web Conferencing is a great tool… Visiting the actual firms was probably one of the best experiences that I enjoyed about this class.

2010 NCARB Prize Winner:
California Polytechnic State University, San Luis Obispo
College of Architecture and Environmental Design
"Design Collaboratory (DC)"

Jury comments: "Students were provided the opportunity to fully engage in a studio design project that was enhanced by the support and collaboration of leading architect practitioners. Students from all disciplines participated in the building design to learn the fundamental principals of negotiation and building systems integration. Practitioners interacted with students during lectures, design critiques, and technology training. The jury noted that the project recognized that integration of architecture education and practice leads to more informed and better outcomes and showed ways architects lead teams of professionals to common goals."

Thomas Fowler IV, AIA, NCARB
Professor – Architecture

Thomas Fowler, IV received his Masters of Architecture in Theory and Design from Cornell University in 1995 and his Bachelor of Architecture from New York Institute of Technology/ Old Westbury in 1984. Thomas has over 15 years of practice experience working for architectural firms in New York City and Washington DC and over 20 years of teaching experience.

Thomas' teaching responsibilities include third and fourth year design and building technology courses, working with a range of four and fifth year independent study students and directing his award winning digital media facility founded in 1997, called the Collaborative Integrative-Interdisciplinary Digital-Design Studio (CIDS). Over 1,500 students (700 from architecture, plus 800 from other disciplines) have participated in over 80 interdisciplinary projects since the founding of CIDS in 1997. These collaborations have involved over 11 disciplines on campus, and have brought together a range of industry professionals and clients. Thomas has published widely his work with students in the studio. Thomas has also served as paper referee for numerous conferences, journals, and has published a range of papers on his design studio teaching methods and interdisciplinary project activities. He has published an essay on teaching titled, "A Teacher's View", in Becoming an Architect, Lee Waldrep editor, Wiley 2006 (second edition with updated essay released for 2009).

During his career Thomas has received numerous awards in recognition of his teaching, research activities, and his student's design studio work. A selected sampling of these awards includes: ACSA's 2010 Creative Achievement Award, the 2009 American Institute of Architects (AIA) Education Honor Awards for the Integrated Project Studio (IPG) taught in collaboration with full time Lecturer Barry Williams, the 2008 AIA Education Award for CIDS, the College of Architecture and Environmental Design 2007 Wesley Award for Teaching Excellence, Architecture Department's 2005 Faculty Teaching Award, the 1997 Young Faculty Teaching Award from the ACSA/AIAS, and was selected for the 1994 Young Architects Competition, Progressive Architecture.

Kevin Dong, SE, CE
Associate Professor - Architectural Engineer

Kevin Dong has a Masters of Engineering in Civil Engineering, University of California, Berkeley in 1988, a Masters of Science in Civil Engineering, University of California, Berkeley in 1987, and a Bachelor of Science in Architectural Engineering, California Polytechnic State University in 1986. He is licensed as a Civil Engineer and Structural Engineer in the State of California. Prior to beginning his teaching career at Cal Poly, Kevin practiced holistic design with Ove Arup & Partners (ARUP) for 13 years, starting as an Arup Fellow in London and then moving to the San Francisco office. During his tenure with ARUP he worked on numerous projects nationally and internationally that required collaboration and integration of all disciplines from design inception through construction and occupancy.

Kevin's teaching responsibilities range from 2nd year technology classes through graduate structural systems and seismic engineering courses. Additionally, he has been teaching a collaborative design studio for the past five years. In a movement to help non-engineering majors better understand the link between structure, design, and construction; he helped reconfigure the technology sequence for architecture and construction management majors. Kevin is also responsible for integrating Building Information Modeling (BIM) into the architectural engineering core curriculum. His latest curricular achievements include leading the development of a new graduate degree program in Architectural Engineering, re-instituting the departmental advisory council, and establishing internships for continuing graduate students. He is currently the department assistant head and graduate program coordinator/director.

During his tenure at Cal Poly he has received teaching awards and grants for his collaborative work with Cal Poly and Iowa State University faculty. The list of honors include the 2009 College of Architecture and Environmental Design Wesley Award for Teaching Excellence, 2008 ASEE Best Presentation Award for "Connecting Architecture and Structures", ARUP Foundation Grant for the "Collaborative Design Studio" with Professors Cabrinha, Doerfler, and Fowler, the BIM Experience Award from Autodesk, in collaboration with James Doerfler, for work in creating interdisciplinary classes, and Instructionally Related Activity funding for the Collaborative Design Studio: ACSA/AISC Steel Competition

James Doerfler, AIA
Professor – Architecture

James Doerfler received a bachelor of the arts degree in art history from the University of Hartford and a master of architecture degree from Syracuse University. Prior to joining the faculty at Cal Poly James taught at the University of Technology, Sydney from 1998 to 2005. While at UTS, James was course director of the bachelor of the arts in architecture degree.

James' teaching responsibilities include third and fourth year design and building technology courses, as well as a number of electives exploring issues of prefabrication and digital production. At both Cal Poly and UTS, James revised the building technology core classes to reflect current international practice. He is currently developing interdisciplinary classes and studios for architecture, architectural engineering and construction management students. His work and research focuses on connecting conceptual design to digital fabrication methods using digital tools to supplement the design process. James has lectured in the United States and Australia on the topics of museums, prefabrication, digital culture and media, and sustainability.
James has had over twenty years of international practice experience. He has worked with Raphael Vinoly, Richard Gluckman and Fox & Fowle in New York City and PTW in Sydney, and his own practice in New York and Sydney. His projects have included work in the United States, China, Spain, Switzerland and Australia. James is a registered architect in New York and New South Wales, Australia. He has participated in a number of interdisciplinary and artist collaborations with diverse projects including the design of the Perth City Foreshore with artist Dennis Ashbaugh and "Agrippa: Book of the Dead" with author William Gibson and Dennis Ashbaugh.

Mark Cabrinha, PhD, RA
Assistant Professor - Architecture

Mark Cabrinha received his PhD in Architecture and Informatics from Rensselaer Polytechnic Institute in 2010, his Master's of Architecture from the University of Illinois at Chicago in 2001, and his Bachelor of Architecture from California Polytechnic State University, San Luis Obispo in 1995 with a minor in philosophy. He is a registered architect in the state of Illinois practicing in Chicago for over seven years as a project designer and project architect for OWP/P Architects. His professional experience focused on educational environments such as the award winning A.E. Stevenson High School in which he was project architect. He began teaching full-time at Cal Poly, SLO in 2002 teaching across all year levels with focus on design, practice, and digital media and fabrication. Over the last six years, Mark's research has focused on the impact of technology on design culture through the lens of digital fabrication through his teaching at Cal Poly, RPI, the University of Oregon, and at Ball State through the Institute for Digital Fabrication. His dissertation, (In)Forming: the affordances of digital fabrication in architectural education, focuses on the image of practice projected from within design education through a disciplinary cultural shift in the form of architectural practice afforded through digital fabrication. For this dissertation he was awarded the Architectural Research Centers Consortium (ARCC) King Medal for Excellence in Architectural and Environmental Design Research.

"This experience gave me the opportunity to explore fields and programs that I would not normally be exposed to. Through interactions with architects and engineers, I had a glimpse of issues and solutions that a real consultant (and contractor) would face." *-Construction Management Student*

"Working with architects forced me out of my comfort zone. They pushed me into the realm of a nontraditional structural steel design and the project only benefited. This collaborative class is one of the best educational experiences I have had while in school." *- Engineering Student*

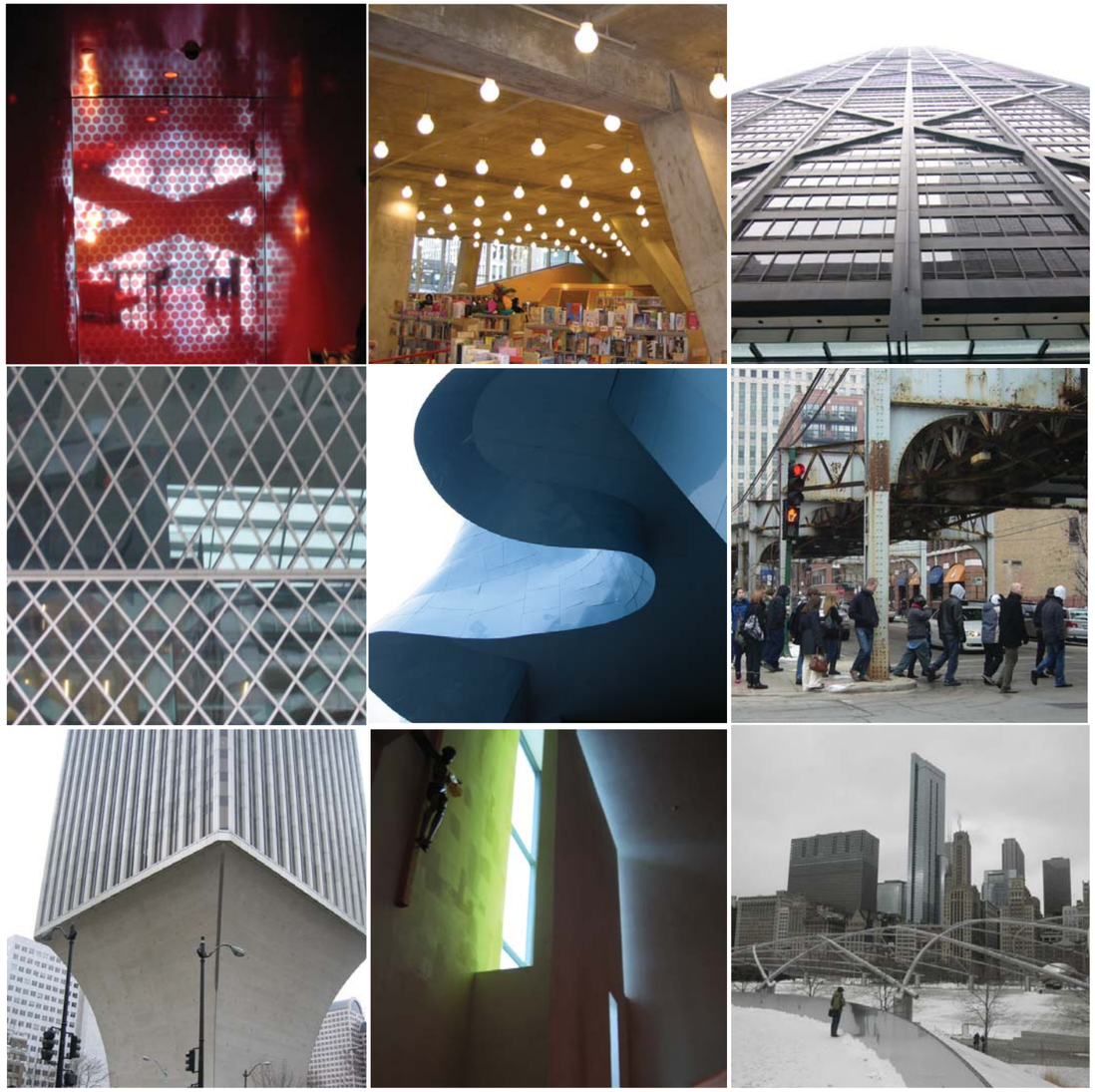
"Working with multiple disciplines for this design project was a great experience. It allowed multiple perspectives in the design as well as some compromises that had to be made as a group. It was a great team environment that gave us a realistic approach to a steel design project. Having to do the presentation at a firm with different professionals makes you realize the importance of the project." *-Architecture Student*

Typical Schedule
Winter

Week	date	project	assignment	Lecture
1	January 6	Interdisciplinary Project Intro:	Project 1	Introduction to class
	January 8	Interdisciplinary Project presentation	Project 1	
2	January 13	Competition Introduction Intro: Site and Program Student interests	Project 2: Precedents + Teamwork	
	January 15	Competition Discussion with Teams	Conceptual Project framework -Precedent Preliminary Teamwork	Buro Happold Lecture Matthew Melnyck
3	January 20	CHARRETTE 1 Block Model	FULL TEAMS PARTICIPATE	
	January 22	Desk crits	LEED Day	LEED workshop Mike Montoya
4	January 27	CHARRETTE 2	FULL TEAMS PARTICIPATE	
	January 29	Student presentations PRECEDENTS	Precedents due Structural analysis	
5	February 3	Desk crits		Ralph Roesling
	February 5	PIN UP 4- 6pm Workshop with guest		Buro Happold workshop environment/performance David Herd
	February 6	Phoenix Trip		
6	February 10	Phoenix Trip		
	February 12	Desk crits		
7	February 17	Desk crits		
	February 19	Student presentations TEAMWORK	Final Teamwork due: Base Drawing site Base Drawing context Zoning etc Environmental data Unit layouts	
8	February 24	Desk crits		
	February 26	Desk crits		Buro Happold lecture/workshop on structure
	February 27	Desk crits		CAED Advisory Council visit
9	March 3	Desk crits		
	March 5	REVIEW 2-4		
10	March 10	Desk crits		
	March 12	Desk Crits		
	March 14	TURN IN WORK - SLEEP REQUIRED		
Finals Week	March 16-18	Presentation at Buro Happold in Los Angeles	Trip to Los Angeles	Guests Kim Hodges, Kevin Genik, Ralph Roesling

Typical Schedule
Spring

Week	date	project	assignment	Lecture	NA
1	March 31	Academic Holiday			
	April 2				
2	April 7				
	April 9				JD
3	April 14				
	April 16	FINAL PRESENTATION FULL MOCK-UP		Buro Happold jury	
4	April 21	production			
	April 23	production			
5	April 28	production			
	April 30	production			
6	May 5	production			
	May 6	PROJECT DUE DIGITAL COPY SENT			
	May 7	No class			
7	May 12	Cladding Mock-Up: 1 ½" scale Physical Model Detail + Large scale Digital Model Print Out			
	May 14	Cladding Mock-Up Production			
8	May 19	Cladding Mock-Up Production			
	May 21	Cladding Mock-Up Production		David Herd Web Critique of In Progress Cladding MockUps	
9	May 26	Cladding Mock-Up Production			
	May 28	Cladding Mock-Up Production			
10	June 2	Cladding Mock-Up Production			
	June 4	Cladding Mock-Up Presentation & Review			
Finals Week	June 8	Exit Interviews with Teams			




FIELD TRIPS

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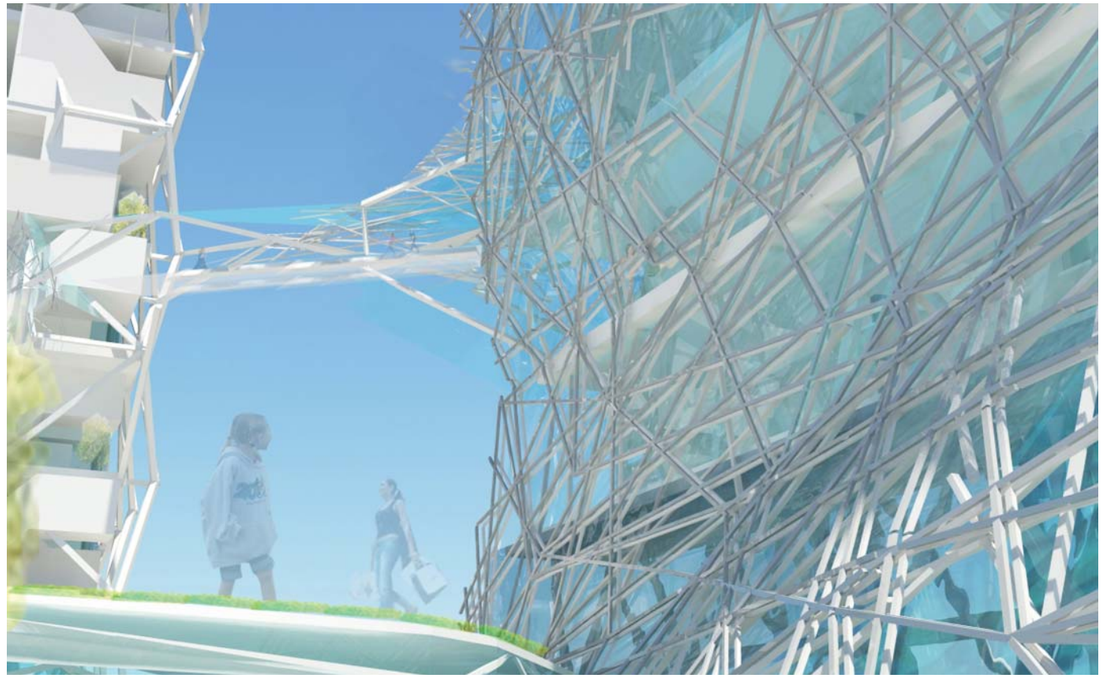


2007/2008 mixed-use tower

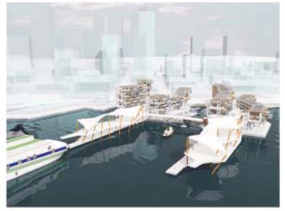
The site for the project is located in
Seattle, WA on the waterfront.

2007/2008

team01

urban PREFABric

Bonnie Miller
Collin Sprenkle
Andrea Gadioma
Marissa Nolasco
Danny Ramos

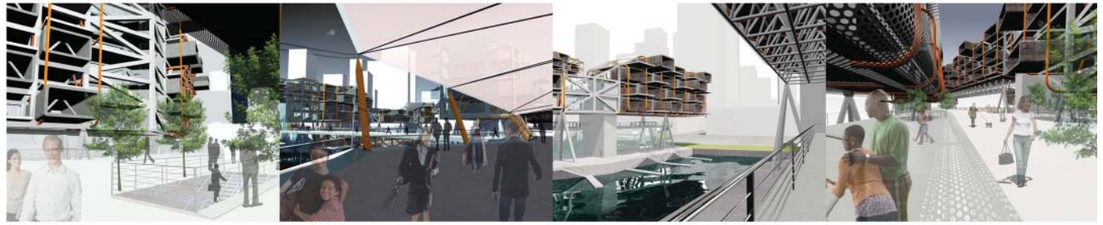


urban PRE-FABric

colman dock
seattle, washington

The "urban fabric" of Seattle, Washington is most prevalent at Colman Dock, where the public flows constantly, each individual pursuing their own agenda. The concept for this project is a coalescence of a dense urban population manifested into a hub of transport and dwelling. The marriage of the permanent and transient population on our site symbolizes this interweaving of the urban fabric. The site is composed of implied alleys and "finger-like" tube structures with residential pre-fab units above and commercial spaces below. The pedestrian alleys penetrate the water's edge as they transform into the two ferry terminals that accommodate the traveling public.

Presentation Board 01



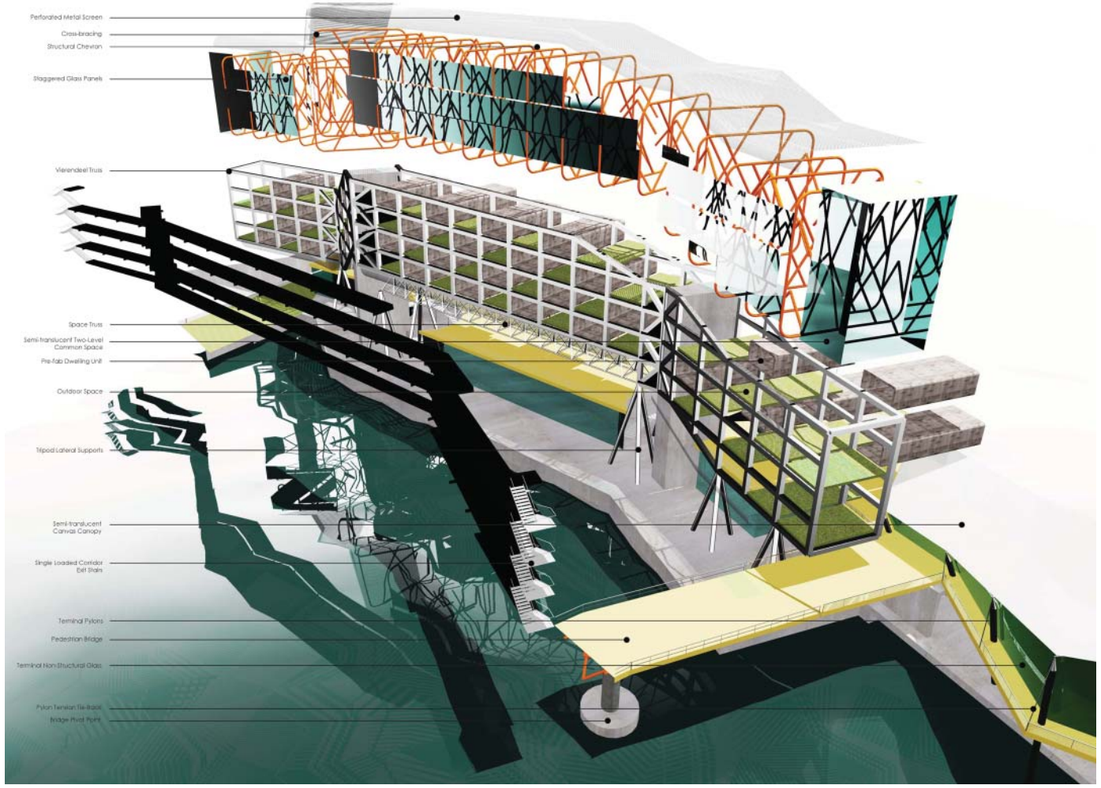
view from alley | view from terminal | view from above commercial space | view from alley between residential

Presentation Board 02

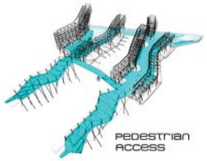
north elevation

north section

The continuous bracing between the residential bays have been altered to give the illusion of continuity, yet are welded to beams at each story; this allows the braces to laterally support the structure in one of the principle axes. The chevron bracing is located at every other bay in the north and south façade of the buildings. This arrangement creates a triangulated shape throughout the frame. By triangulating the frames it stiffens and reduces deflections in the structure and transforms shear and bending forces into axial forces. The frame now behaves like a truss. The chevrons also serve as the lateral force resisting elements for the principle axis. The tripod-like columns at each building provide lateral support for the base of the building while also carrying the gravity forces from the structure above, down to the ground. A space truss located under the building provides additional stiffness to the building but is a secondary structure in necessity. The pre-fab units, once connected to the frame, act as a diaphragm to support the finger structure as a whole.

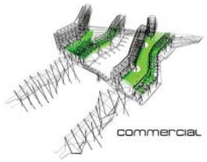


Presentation Board 03



pedestrian access

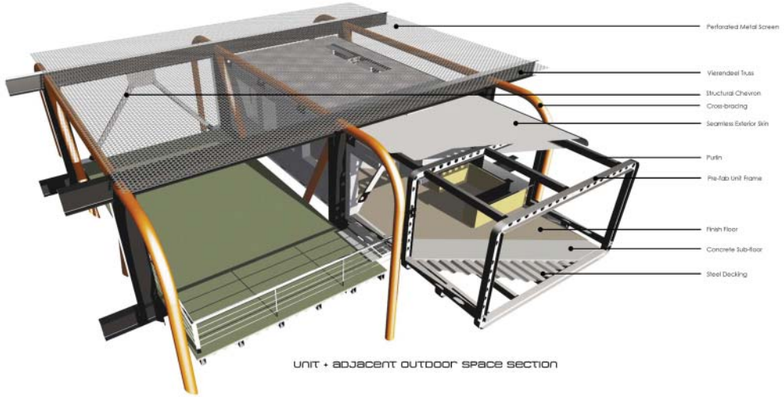
vehicular access



commercial

dwelling units

terminal

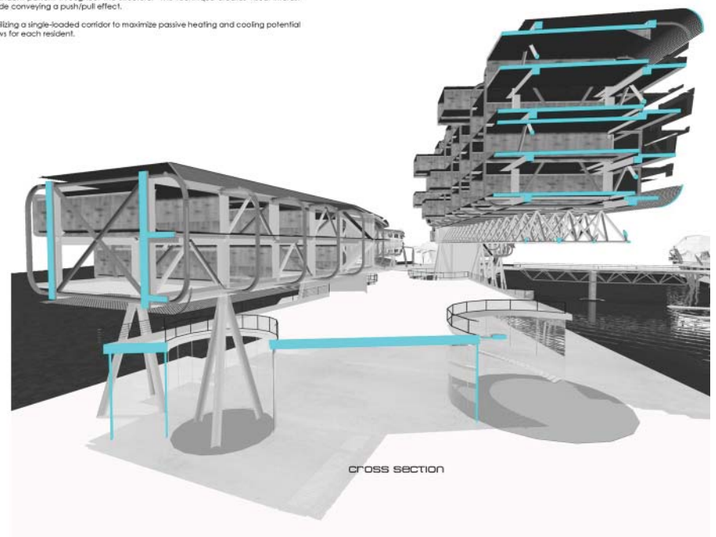


unit + adjacent outdoor space section

The Pre-fabricated units take advantage of the vierendeel truss design by their checkerboard placement. By positioning the units in a checkerboard fashion, any doubling of walls, floors or ceilings is avoided. Actually, the checkerboard placement allows for an adjoining outdoor space for each unit and adequate cross-ventilation throughout the residential units.

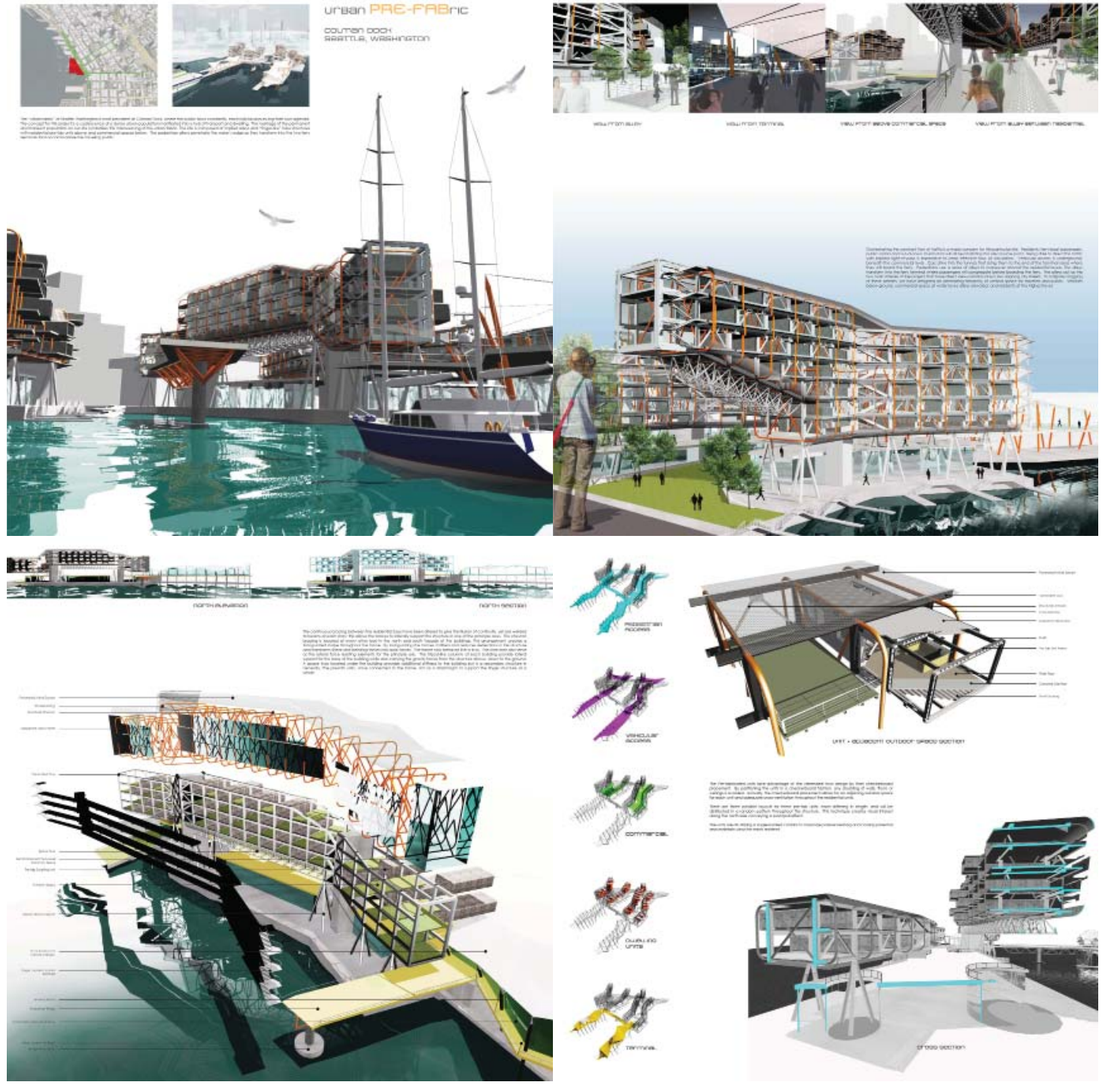
There are three possible layouts for these pre-fab units, each differing in length, and will be distributed in a random pattern throughout the structure. This technique creates visual interest along the north side conveying a push/pull effect.

The units are all utilizing a single-loaded corridor to maximize passive heating and cooling potential and maintain views for each resident.



cross section

Presentation Board 04



urban PRE-FABric

The concept for this project is a coalescence of a dense urban population manifested into a hub of transport and dwelling. The marriage of the permanent and transient population on our site symbolizes the interweaving of this urban fabric.

Project Location:
Colman Dock - Seattle, Washington

Concept Explanation:
This particular site is pivotal to Seattle's population. It is where the human chaos of the city meets the tranquility of the ocean front, a nexus for people coming and going on every manner of business. From weekday warriors to football and baseball fans, thousands of Seattleites traverse this ground every day. From a historical perspective, the site sits on the corner where Seattle as a whole made the transition from post industrial cityscape to modern metropolis. Colman Dock lies at the exact point where the grid of the old city to the south meets and merges with the lines of the new. Our design problem, to create a mixed use residential and commercial project on the site of the existing dock while redesigning the ferry terminal, adds two new threads to this already complex urban fabric. Our design was driven by the need to make sense of seemingly discordant elements and make them sing, all the while emphasizing modern sustainable principles and prefabricated elements. By synthesizing temporal aspects and tectonic forms with the confluent streams of traffic on the site, we hope to create an architectural aggregate of Seattle.

Four finger-like structures, recalling the wharves of the old industrial waterfront, reach out over the water, floating on tripod piers. These piers penetrate the commercial space below, creating light wells and green space. On the roof of the commercial spaces, are the alleys, submerged between these structures to provide pedestrian circulation and access to the ferry terminals. They provide an intermediate circulation space between commercial, residential, and ferry uses. Aligned with the city streets, these arteries also provide a strong visual connection to the city. In plan their orientation shifts, sharing the lines of the old city grid as well as the new. The two alleys are connected by park space along the street front, and a pedestrian bridge on the water side. The pedestrian bridge pivots at its center to allow residents with maritime tendencies to access the harbor at the project's center. Sail boats are a mainstay of Seattle culture, and this "third alley" would give residents the opportunity for private anchorage.

Ecology and economy were major concerns when designing the residential units. We designed them as pre-fabricated steel pods which can be inserted into the skeletal structure of the buildings after site construction is complete. Building the units en masse of site saves considerable time and money. The checkerboard distribution of the dwellings within the structural frame not only improves passive ventilation and natural light, but allows the unique opportunity for each resident to have a private outdoor space adjoined to their housing unit. Overall, this system will save money, time, and energy while improving quality of life in an urban setting.

Precedence_Case Studies

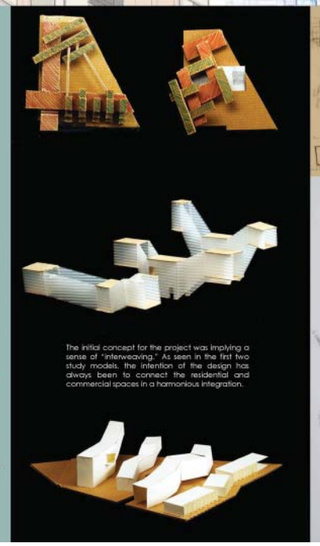
Alley 24

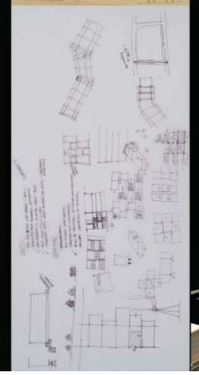
_Two alleys divide site into quarters
creating a highly active intersection
_Creating zones
_Paneled facade studies

West 8_Borneo-Sporenburg

_High density/ low rise
_Create a colorful urban context
_30-50% voids
_System of streets and alleys for vehicular
and pedestrian access to site

Early Form Generation

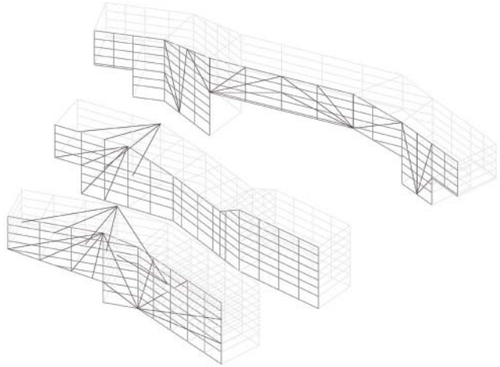




Design Development Model

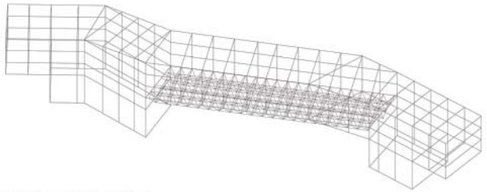
Structural Designs

Previous Design

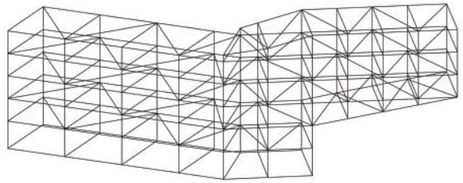


Current Structure

"Big-Span" Truss

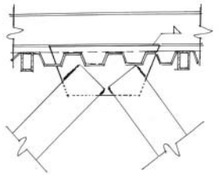


Cantilever Bracing

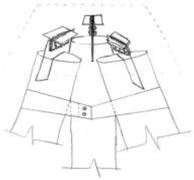


Detail Sketches

Pick-point connection



Tri-pod connection



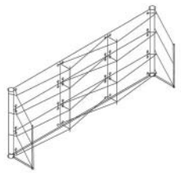
Models

Vierendeel Truss Structure

Tensile Terminal

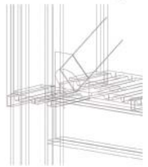
Detail Drawings

Screens



Unit Connection

Unit Bracing



Andrea Gadioma
What I got most from working on this project is that I fully understand the phrase 'stop designing and start producing.' I think that since we usually work within a ten-week period we tend to design until the very last minute, leaving an unfinished looking project in the end. By having a two-quarter system with this course, it made it easier to know when to stop designing, which allowed us to produce something that fully explains our project.

What I also got from this course is a better sense of the engineer's perspective. By working with ARCE students, I got a better grasp of communicating ideas in a way for someone outside of architecture to understand, as well as learning ARCE terminology in order to understand them better. What was also helpful was the LA field trip, when we visited different engineering firms.

Lastly, this is my first time participating in a design competition. Even though I know our team put a lot of thought and effort in our design, in the end it depends on the boards we send without us being there to explain it. This process definitely reinforces the idea to let the graphics do all the "talking."

What I liked most about this course is that it spanned two quarters. I liked how we were able to go at a less rushed pace and still develop the design further. I think that since the scope of our project was huge, (i.e., designing housing, commercial space, and a terminal) it is possible to expand the course to a full year project (assuming the competition design objective is available by Fall Quarter). I also feel that having a good space to work in would contribute to productivity.

Bonnie Miller
The top three things I have learned from this studio are:

1. How to think about all aspects of a project and how that effects the design
2. How to work with other people with different ideas
3. How to graphically present a project so that it can be understood without you there to defend it.

I think that this class was the catalyst to all of my learning. I really enjoyed how it felt similar to an independent studio, but we had a lot of reviews to get plenty of helpful feedback. Also, being in a group with different ideas and expectations really allows you to understand the project differently which is a major benefit of collaboration. In addition, being able to go to the site and experience it was very helpful and inspiring.

A few things that I expected to learn were digital rendering skills and the new laser cutter. I really wanted to learn a new digital rendering program during this studio, but since no one in my group was very skilled in that department, another team member took that on, while I contributed the best way I know how, and that is through physical modeling.

One thing that I was able to learn through the interdisciplinary team configuration was how to think about a design with structure in mind. When designing our project, many things had to change due to the fact that it was required to make the project structurally sound. I learned a lot about the structural possibilities of a building and how to be creative with the structure. I do not think it would have been possible to learn such lessons in an individual or even discipline-specific team.

I feel that the two quarter design studio really contributed to my learning and enabled me to immerse myself in the possibilities of this project. This studio has completely prepared me for 5th Year as well as later on in my career when I know I will have to collaborate again. This was a very successful and helpful class and totally enhanced my education.

Collin Sprenkle
The winter and spring quarters spent in the interdisciplinary design studio were, without a doubt, my two most valuable quarters so far at Cal Poly. Not only were they mightily challenging for various reasons, they were educational and informative as well. I developed my digital modeling and rendering skills, worked in a design team for the first time, worked with architectural engineering students for the first time, entered an international design competition for the first time, and basically did independent study for the first time, all on one project. All in two quarters. Needless to say, it was tough, but well worth it.

Starting in winter quarter, I had absolutely no knowledge or skills with digital modeling and rendering software. I decided to learn by doing, so I took on the role of digital designer for my group from day one. I am proud to say that by the end of spring quarter my digital skills have gone from nonexistent to top of the line. There is no better way to learn something than to just dive in and get your hands dirty.

This project was also my introduction to working with a design team. This seemingly easy task (share the work loads, right?) turned out to be probably the most challenging aspect of the project. Instead of having complete autonomy over all design decisions, we were forced to communicate our ideas to our teammates in a clear and understandable way in order to win them over. While this seemed to slow the design process early on and cause a lot of frustration for everyone, in the end it really helped to refine and sharpen our ideas, to create a simpler, more elegant, more lucid project. I don't think that our design would have been as good if any one of us had been working alone.

Another new variable for me to contend with during this studio was the presence of ARCE students as part of our design team. Their influence on the project was invaluable. They added an element of realism and concreteness to our project that would not have been possible without them. Though it was often a trial to convince and cajole and compromise our way to our design goals, it was a very rewarding experience. Learning to speak their trade language and attempting to find common ground in structural scheme and design was satisfying on so many levels. Again, it produced the necessity to pare down our project and crystallize our most important ideas. If a certain aspect of our design was not worth the trouble of convincing our engineers to adopt, then it didn't deserve to be in the project.

The fact that our design project was to be entered in an international competition put an edge to the studio environment that I had never felt before. To have to perform on that stage as well as the standard critiques and reviews was extraordinary. Representing our school at that level lent us a desire to perform unlike any other; it was always in the background, urging us on.

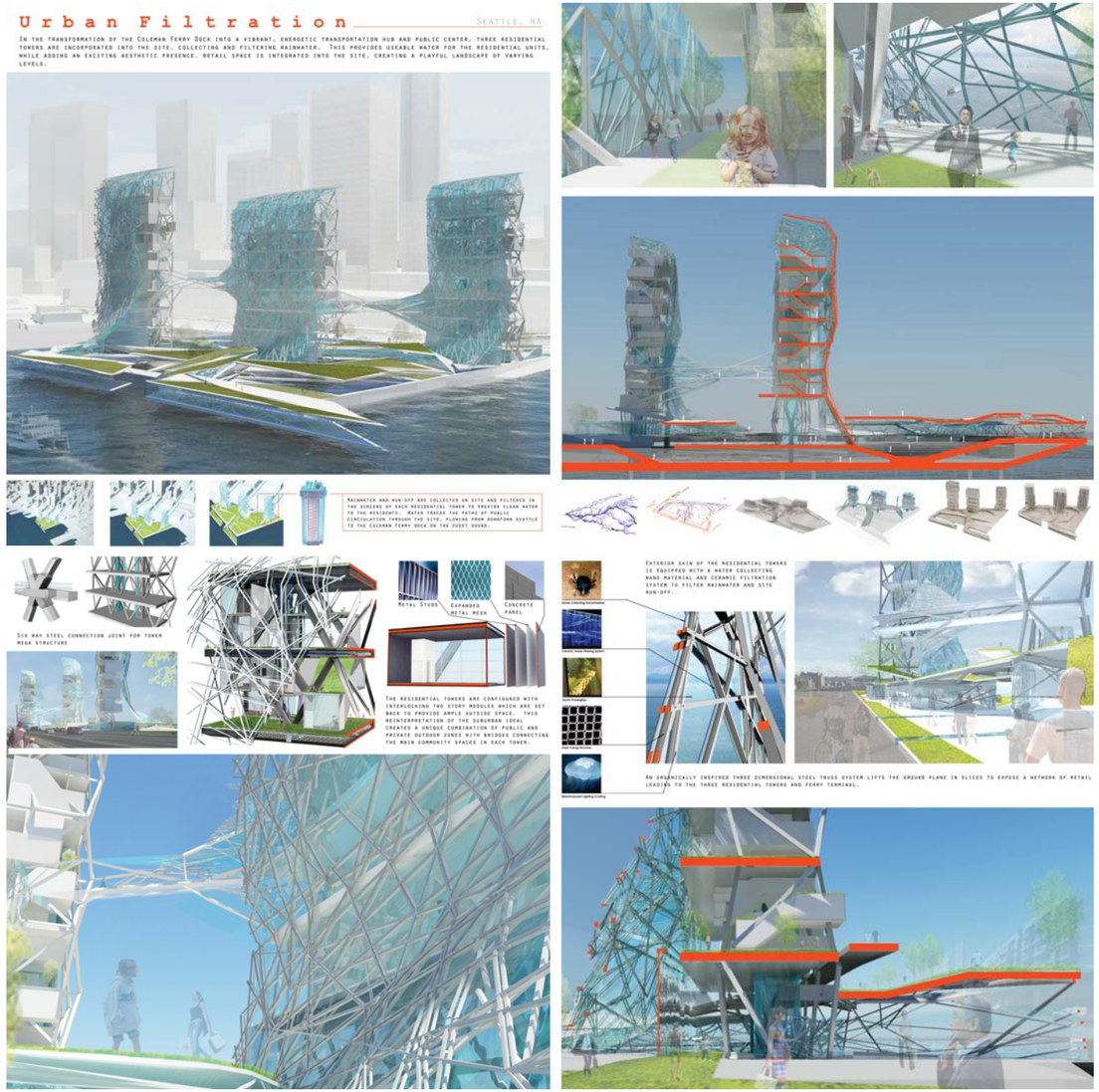
2007/2008

Honorable Mention,
2008-2009 ASCA/AISC
Steel Design Student Competion

team02

urban filtration

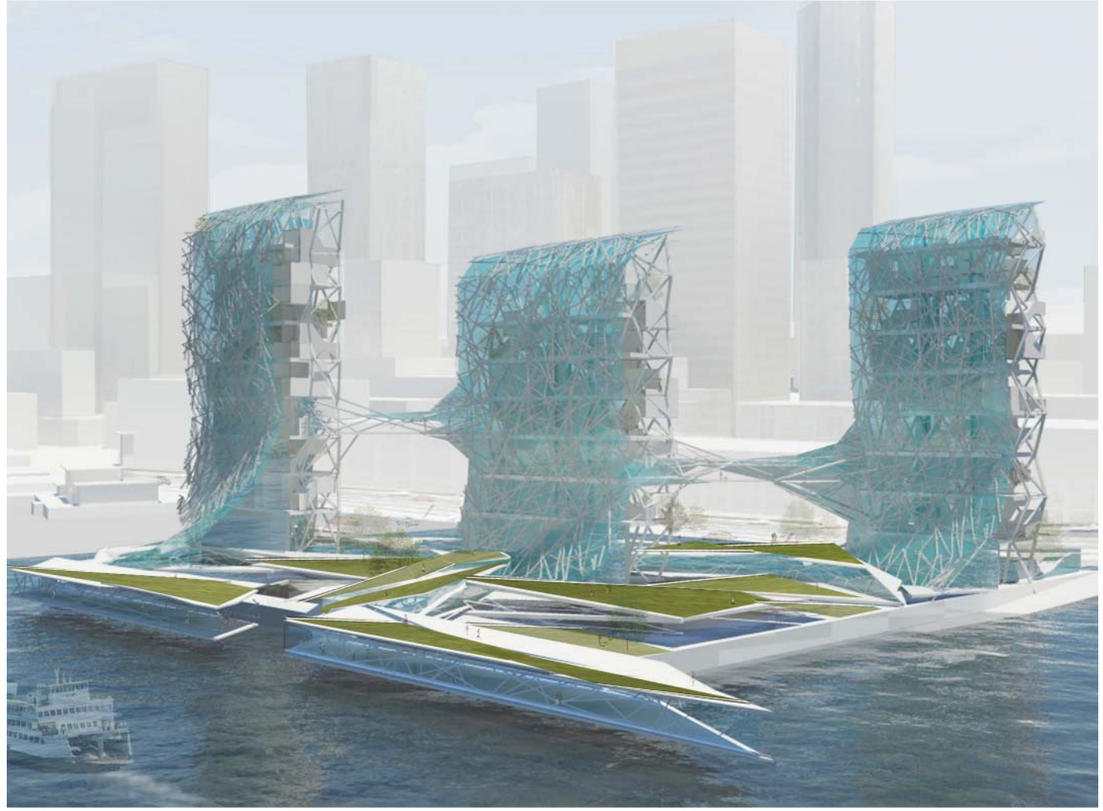
Megan West
Rachel Glabe
Caitlin Potter
Leigh Guggemos

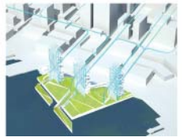


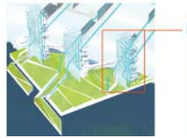
Urban Filtration

Seattle, WA

In the transformation of the Coleman Ferry Dock into a vibrant, energetic transportation hub and public center, three residential towers are incorporated into the site, collecting and filtering rainwater. This provides useable water for the residential units, while adding an exciting aesthetic presence. Retail space is integrated into the site, creating a playful landscape of varying levels.

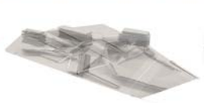


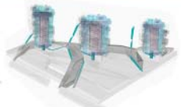




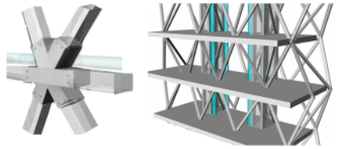
Rainwater and run-off are collected on site and filtered in the screens of each residential tower to provide clean water to the residents. Water traces the paths of public circiulation through the site, flowing from downtown Seattle to the Coleman Ferry dock on the Puget Sound.

Presentation Board 01

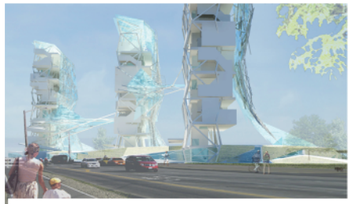


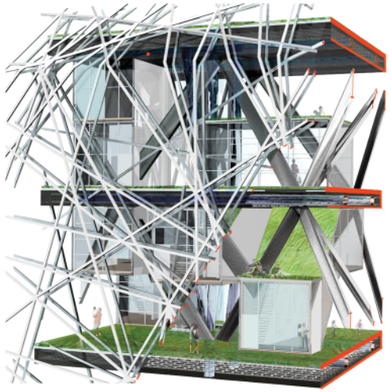


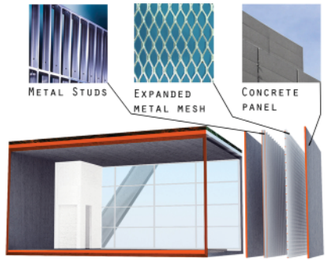
Presentation Board 02



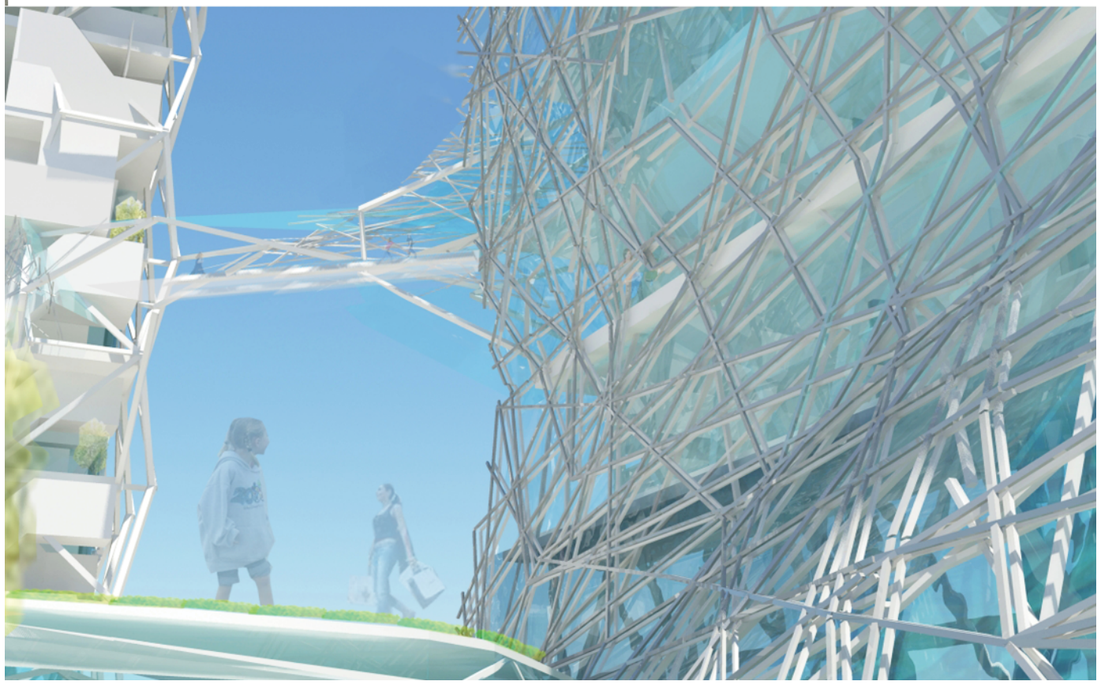
Six way steel connection joint for tower mega structure







The residential towers are configured with interlocking two story modules which are set back to provide ample outside space. This reinterpretation of the suburban ideal creates a unique combination of public and private outdoor zones with bridges connecting the main community spaces in each tower.



Presentation Board 03

Water Collecting Nanomaterial

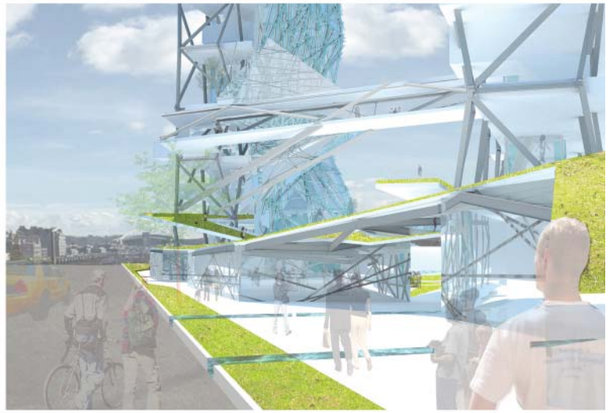
Ceramic Water Filtering System

Xsunx Powerglass

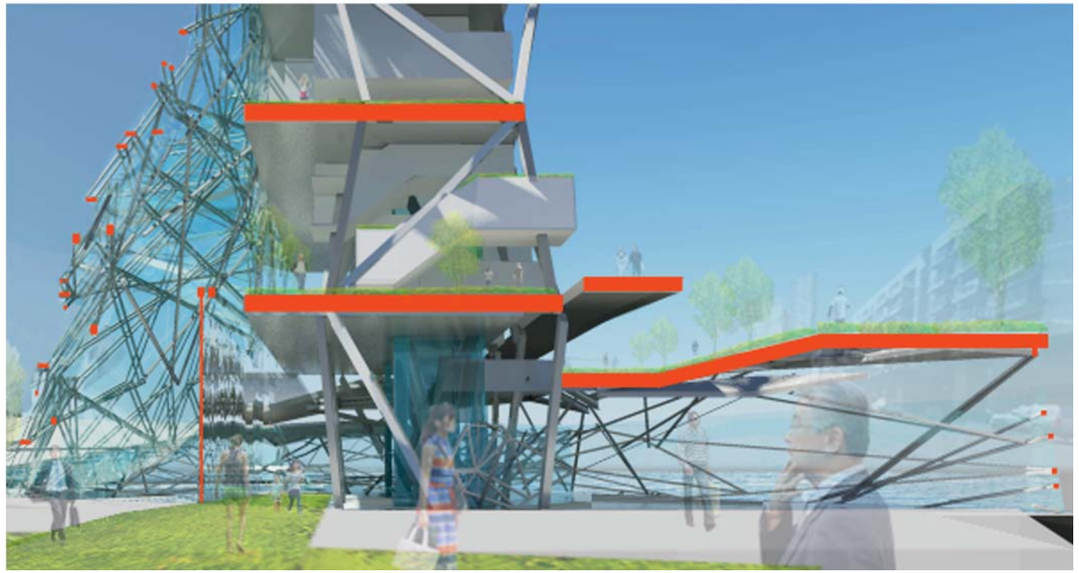
Steel Tubing Structure

Bioluminescent Lighting Coating

Exterior skin of the residential towers is equipped with a water collecting nano material and ceramic filtration system to filter rainwater and site run-off.



An organically inspired three dimensional steel truss system lifts the ground plane in slices to expose a network of retail leading to the three residential towers and ferry terminal.



Presentation Board 04

Urban Filtration

Site:
The site is located in Seattle, Washington on the Colman Dock waterfront. Here on Pier 52, commuters and visitors travel via Washington State ferries from Bainbridge Island and Bremerton to arrive in downtown Seattle.

Concept:
Seattle's weather forecast frequently includes rain, and the Coleman Ferry Dock's location at a low point in the city's topography means the site receives run-off from the entire downtown area and surrounding parts of the city. Water also traces the paths of human circulation through the site which flows from downtown Seattle to the Puget Sound. Both rainwater and run-off are collected on site and filtered through the screens of each residential tower to provide clean water to the residents. The playful articulation of the ground plane provides retail space and protected access to the ferry terminals as well as a park-like setting for residents and visitors alike. This multiuse project aims to create a sense of community through a balance of housing, greenery, and retail space while speaking of Seattle's intimate connection between people and water.

Program Configuration:
In order to maintain and encourage the current flow of pedestrian traffic, the retail arms trace the movement of water onto the site through the placement of two major entries at the intersection of Columbia and Marion streets with Alaskan Way that borders the eastern edge of the site. Each of the three towers is sited between these major paths of circulation and raised above the retail on canted structural columns to provide privacy. Parking is located underground and the ferry building now juts out into the water on its own private jetty to accommodate commuters without disturbing the residences. Along the main retail arm that runs through the site to the water's edge to provide a covered thruway to the ferry dock, there is a sheltered amphitheater space for community events in the park.

Circulation/Public and Private Areas:
Since the program includes a combination of residential and retail spaces on site, differentiation between public and private areas was crucial to allow the inhabitants privacy from the busy ferry terminal and retail located below the residential units. In a reinterpretation of the suburban ideal, two story interlocking modules are offset from the edge of slab to provide private outdoor spaces. Since not all households are the same, three different sized modules that range from a one bedroom unit for individuals or couples to a three bedroom unit for families are configured within the residential towers. These three modules are arranged to create various sized green spaces that occasionally punctuate the entire width of the tower and are organized both as private spaces for individual modules and larger community spaces that are connected between towers via pedestrian bridges.

Skin / structure:
An organically inspired three dimensional steel truss system lifts the ground plane in slices to expose a network of retail leading to the three residential towers and ferry terminal. The playful landscape of articulated green roofs serves to provide protection from the rain, light to the lower parking level, and an extensive park as a new community social space. Using the varying planes of the roof and realistic beam spans, a system of triangulation was developed to determine the truss form. This system appears organic because of the constantly changing variables of span and roof location but is in fact rationally derived.

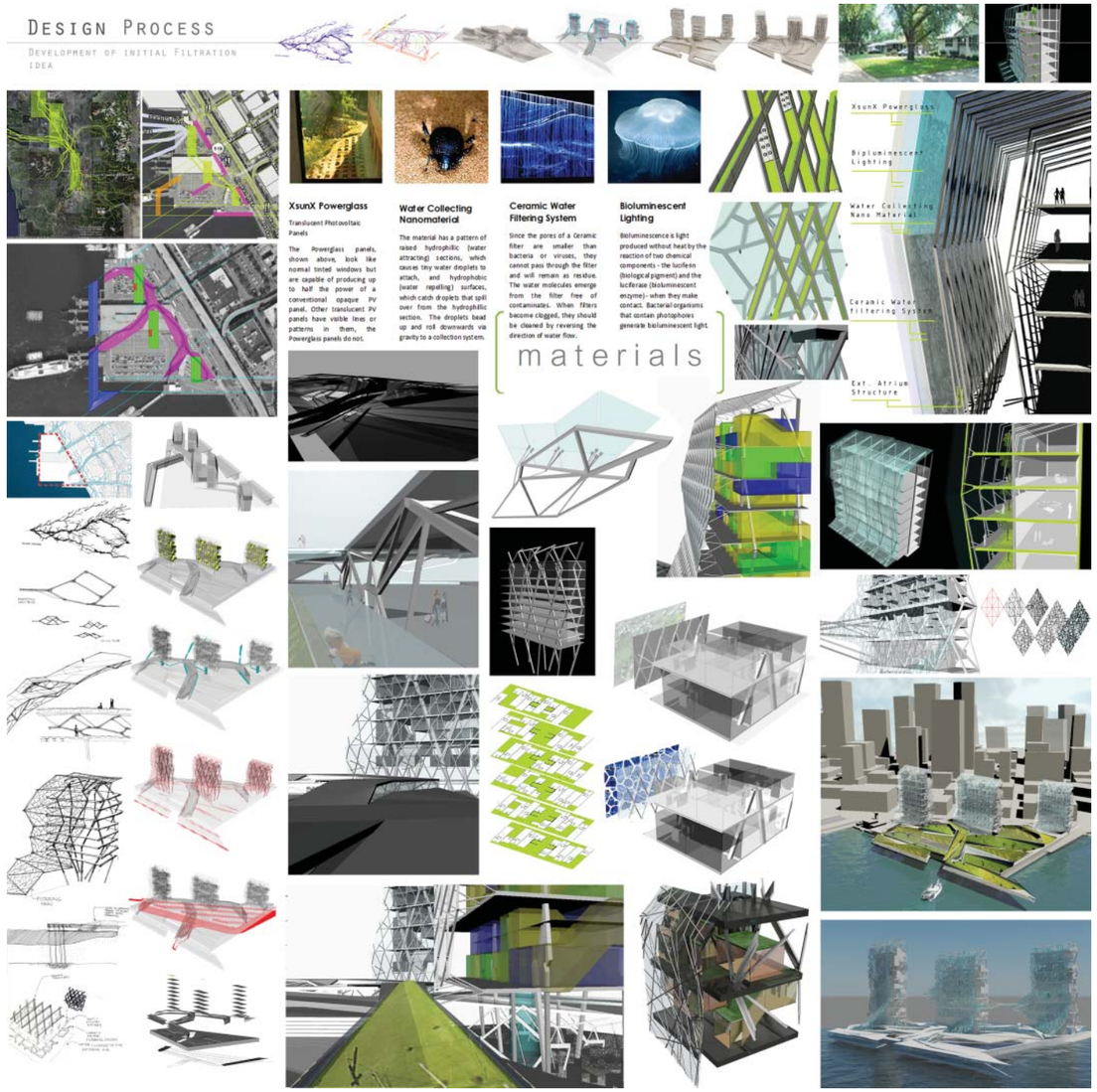
A similar system, though scaled down, is used in the residential screens. The screen structure is designed not only to support the glass and ceramic filtering system, but also some of the lateral forces experienced by the towers. A steel mega structure in a canted diamond pattern spans four floors and establishes points that were used to derive the screen structure patterns. Open braced frame cores faced with glass provide lateral stability and elevator access to the modules. Peeling up and out from the ground is a water filtration screen that cleans storm and rainwater flowing into the site and delivers fresh water to the apartments contained in the residential towers.

The runoff is first screened of debris and collected at the base of the towers where it is stored in large, exposed tanks before being pumped up through the elevator cores to the top of the towers. As the dirty water runs through the ceramic panels that are cut to mimic the steel screen structure that supports it, microscopic particles are filtered out by the ceramic pores and by the time the water reaches the first floor of the towers it is clean. Here the water flows through a break in the screen to trickle down as a water wall into a collection area at the base of the residential towers. The clean water is then stored in tanks before being pumped up along the cores once more and distributed to individual apartments via pipes imbedded in the slabs.

A system of five materials is employed to filter the water. The first layer, located on the outermost portion of the screen, is the water-collecting nanomaterial coating. Inspired by a desert beetle, a pattern of alternating raised hydrophilic (water attracting) sections, which cause tiny water droplets to attach, and hydrophobic (water repelling) surfaces, which catch droplets that spill over from the hydrophilic section is used to attract condensation in the air onto the screens to be filtered. Second, a ceramic layer uses the material's natural microscopic pores to prevent the passage of bacteria or viruses while water molecules emerge from the filter free of contaminates. The third layer is made up of Powerglass panels, glass that is imbedded with translucent photovoltaic cells without visible lines or patterns to generate electricity for the site. The glass also protects the structural steel layer, which is constructed as a truss system similar to the retail structure, from the corrosive effects of water. The last material is a bioluminescent coating applied to the structural steel facing the residential units to provide a diffuse glow during overcast weather and at night. The various screen layers are held together with a simple bolt system that runs through the ceramic, glass and steel at each major intersection of the panels.

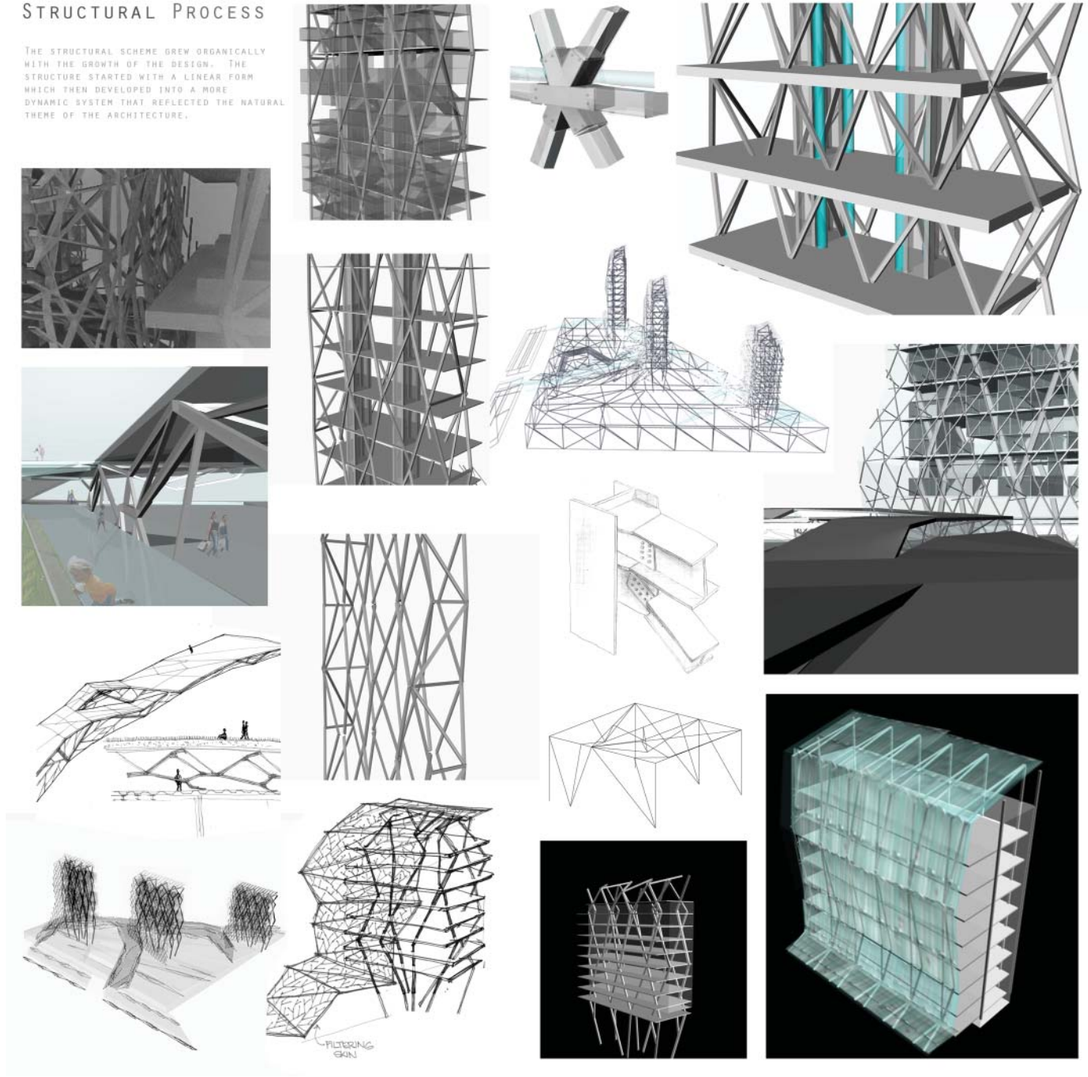
Design Process

Development of initial Filtration idea



Structural Process

The structural scheme grew organically with the growth of the design. The structure started with a linear form which then developed into a more dynamic system that reflected the natural theme of the architecture.



Megan K. West
I was interested in this studio particularly because of the interdisciplinary aspect, but also because I had yet to enter a competition and wanted the experience before fifth year since it would enable me to sharpen my presentation skills.

Top Three Things Learned:
1. I feel I have made huge strides in my communication and presentation skills.

2. I have also reinforced design theory and developed a sense of structural understanding that I can use to better inform my projects and thus make them stronger.

3. I have learned that miscommunication is possible despite valiant efforts to prevent it.

I'm not sure that I did expect anything more from studio that I did not make some strides toward. This studio allowed me to push myself in a new direction, to integrate structural aspects into the design process and thus better inform the final design.

For the steel competition studio I used my knowledge of hand drawing for early concept sketches, moving into Rhino and 3D Studio Max to model and render the final images for submittal. While this is the typical way I approach design, in this interdisciplinary studio I also had the opportunity to incorporate the ideas and knowledge of our ARCE team members into the project. This in turn helped to inform the design and was reflected in a much stronger overall design concept reinforced by many aspects of the project.

I thought the field trips were enormously helpful, so much so that I definitely think it is worth working out a time in the quarter that works for everyone since this year we had conflicts with other projects being due during the field trips. In the future I think it would be helpful to have more meetings where the architects and architectural engineering members sat in on each other's meetings. I know I attended a few ARCE meetings that Leigh and Caitlin had with Kevin in spring quarter after asking if it would be appropriate, and it allowed me the opportunity to see and hear specifically what they were working on for the structure. This enabled me to give them relevant information in a timelier manner as well as hear Kevin's suggestions and comments.

I truly enjoyed this course and this project, especially the multidisciplinary aspect. I really feel it has strengthened my design theory and I look forward to exploring this multidisciplinary theme in future work.

2007/2008

team03

coleman transitions

Ryan Ahmadi
Danniel Kang
Chris Nikkel
Tobias Yuen

Ryan Ahmadi

The first major thing that I learned from this studio experience was an improved proficiency with digital tools. I used Rhinoceros 4.0 extensively for digital modeling and used V-Ray and Flamingo for rendering. A second thing I learned was how to develop effective teamwork with people from different backgrounds and disciplines. This was always a challenge because the team had to collectively agree and many design decisions throughout the process. Thirdly, I developed my skills in designing and developing comprehensive architectural solutions, including realistic and rational structural systems alongside the architectural design. The nature of the steel competition interdisciplinary project had a huge contribution to these specific areas of learning. Inherently, it involved teamwork and collaborative processes. This was at times very challenging, but I think a lot can be learned through challenging situations and projects. Working in teams also allowed us to strengthen and challenge each other. We shared our knowledge with each other and everyone benefited. Prior to taking the course, I expected to learn how to how to use the CNC and laser cutter. I was hoping that I would learn how to produce a clean-cut model from the digital model. Unfortunately, we never really got the opportunity to use the machinery. Other than this, I feel like I was able to learn everything else that I expected to learn from this studio. I learned a lot about team coordination through working on this interdisciplinary team. For example, as soon as we updated or changed that structural scheme, we had to inform the architectural engineering students promptly so that they could work out rough calculations and stress analysis to see if what we wanted to do would work. Though this was challenging at times, it was very good to experience because I know that architects encounter these situations daily in practice.

Secondly, I was challenged and grew in my communication of the structural concepts and details of my project. In discipline specific projects, sometimes students can get away from not having thoroughly developed and expressed structural systems. But in this studio, both students and professors of both disciplines challenged every design decision made. I also learned how to coordinate all the digital models and drawings between all the teammates in our group. This was a challenge because we had different people working on different parts of the model, so we had to maintain a level of organization in order to make sure that everything fit together in the end.

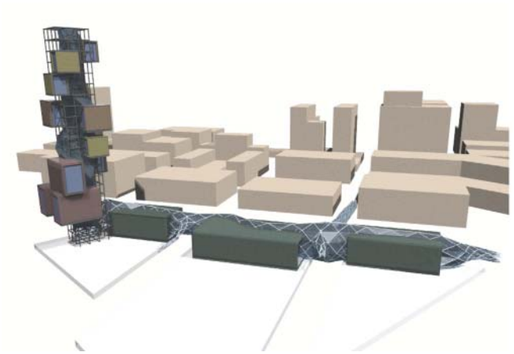
I really enjoyed the integration of the two field trips with this design studio. The first to the site location in Seattle, WA was really exciting and beneficial. Just spending time with the professors as we visited different architectural landmarks and visiting various architecture firms was a great learning experience, not to mention a lot of fun as well. The highlight of the L.A. field trip definitely was visiting the Marmol Radziner Prefab factory. That was a really engaging and informative place to experience. I appreciated the Professor Doerfler's work in putting both field trips together and it was very helpful to have the department help defray the costs of these trips as well. To improve this course in the future, I would recommend that the ARCE students take the course for more units. Also, working in teams with other architecture students is rewarding but also challenging. I think that if we would have been challenged to make some big decisions earlier in our design development, we would have been able to develop our project better. One last improvement would be to take both field trips during the first quarter so that the second quarter can be fully devoted to the competition presentation submittals. The L.A. trip was great, but I feel like it would have been more beneficial for our project earlier on in the studio.

Pier 52: coleman transitions [the new mixed-use project at Coleman Docks]

live + work + shop + travel

seattle, wa

Coleman Docks in Seattle, WA is currently the site of the main ferry terminal for Seattle with surrounding islands on the Puget Sound. Strategically located between downtown Seattle, numerious new residential high-rises, and entertainment venues such as Qwest Field and Safeco Park, Coleman Docks are the center of daily activity and constant activity.



SILODAM - MVRDV

This project was interesting to us because of how the architect used the architecture to create neighborhood-like environments. Inside, different circulation cores access specific different programmatic areas and residential neighborhoods.

WOZOCO - MVRDV

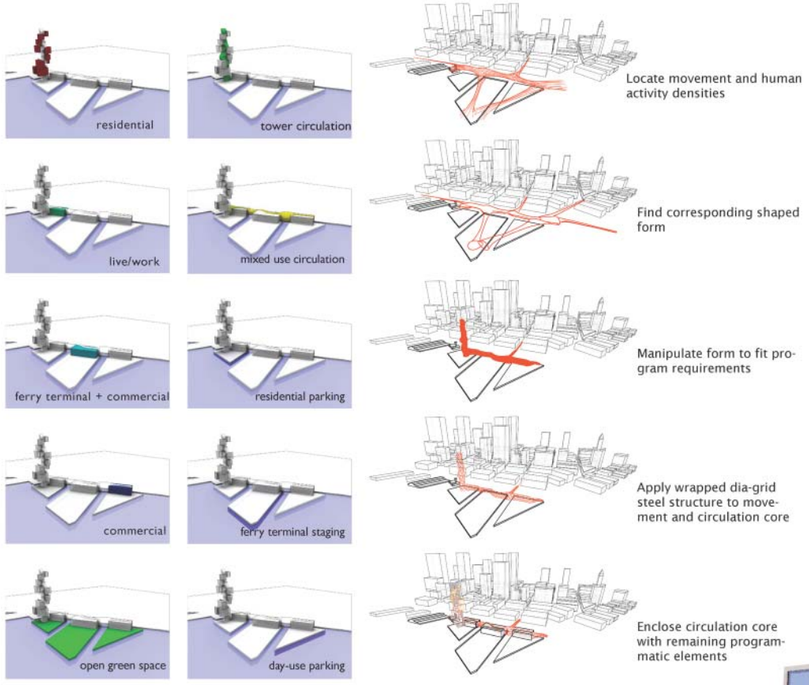
The architect employed a unique use of cantilevers in WOZOCO to respond to the present design challenges of the site. The building footprint was restricted, but more residential units were achieved through massive cantilevers. The aesthetics and structural design of this project were particularly intersting to us in relation to our project.

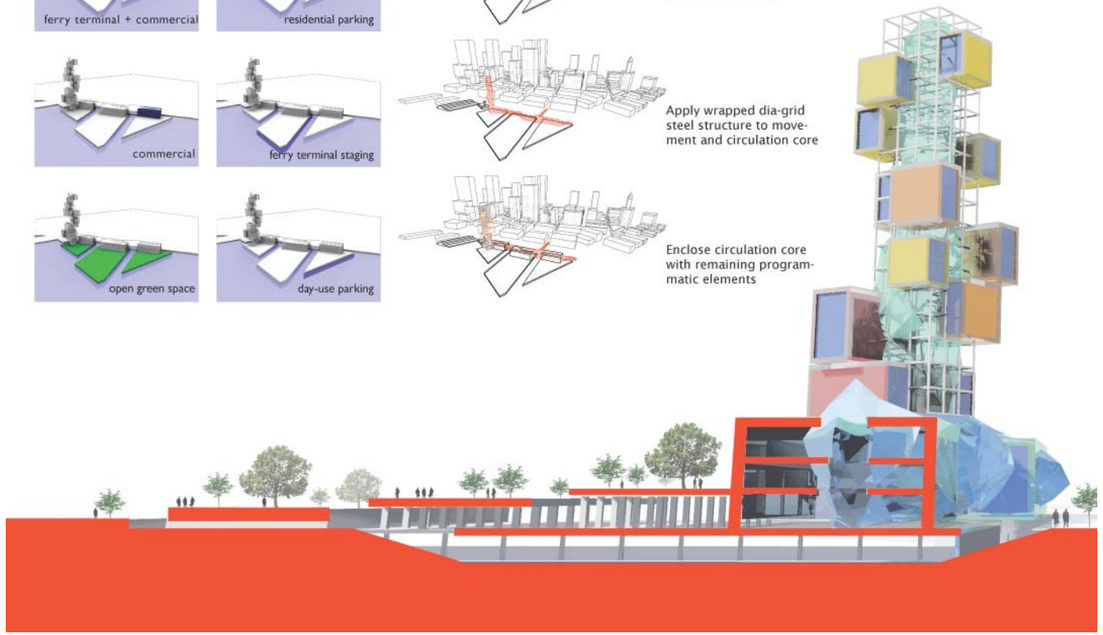
BRITISH MUSEUM-FOSTER+PARTNERS

The innovative structural design precedent of this project served as another inspiration for our project as we addressed ways to enclose large spatial areas while still maintaining a sense of lightness and transparency.

Presentation Board 01

site + project development

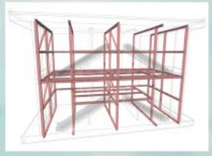


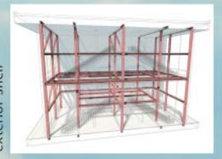


Presentation Board 02

residential tower


primary structure


seconary structure

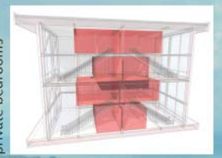

exterior shell

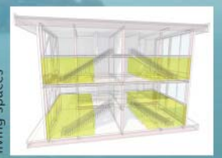

floor/ceiling

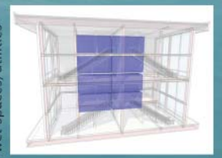

exterior skin


circulation

Each residential 'community' contains four units which are cantilevered off the central circulationcore of the tower by means of a primary braced steel structure (typical 3 bedroom unit *at left*). The wet spaces are located in the part of the unit that is absorbed into the tower core. This designates the connection of mechanical, electrical, and plumbing services from the tower core to each of residences. This structural system helps articulate the desired sense of lightness and transparency that the project goals envisioned.

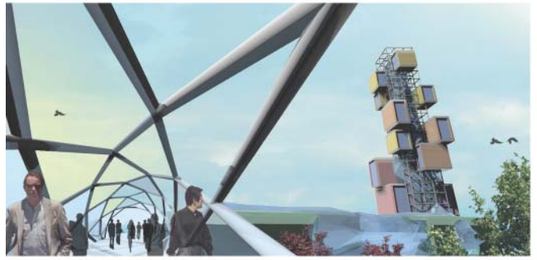

private bedrooms

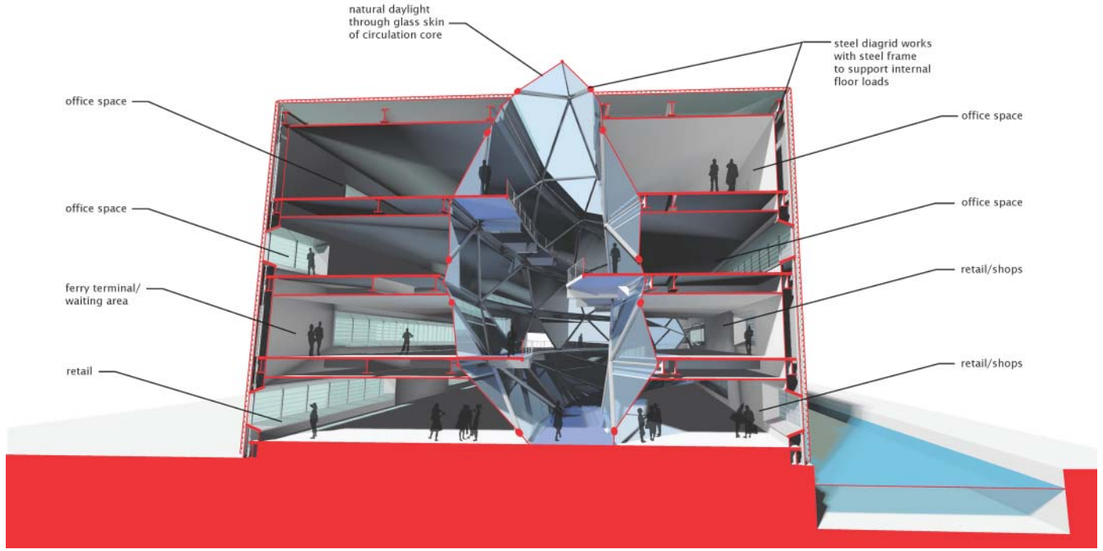

living spaces


wet spaces/utilities

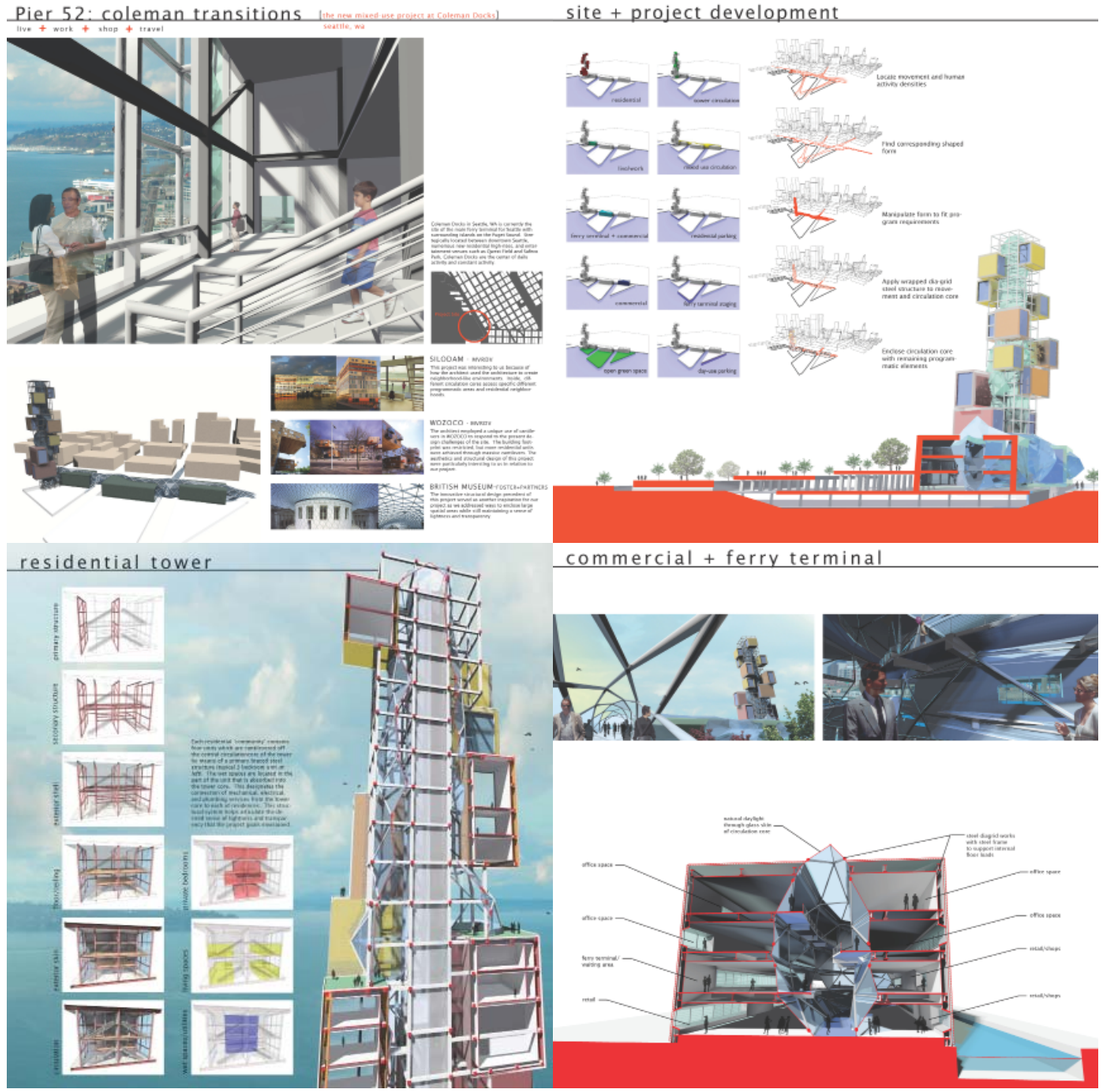
Presentation Board 03

commercial + ferry terminal





Presentation Board 04



Presentation Board Summary

coleman transitions
live + work + shop + travel

Coleman Docks in Seattle , WA is currently the site of the main ferry terminal for Seattle with the surrounding islands on the Puget Sound. Strategically located between Downtown Seattle, numerous new residential high-rises, and entertainment venues such as Qwest Field and Safeco Park, Coleman Docks are the center of daily activity and constant activity.

The existing site and terminal are extremely passive. They sit by and act as nothing more than a covered waiting area for commuters and ticket booth for the ferry. As an extension of the City of Seattle's waterfront rejuvenation plan, the resulting mixed use development is actively engaging the movements and flows through and around the site. More commercial spaces have been brought to the site to compliment not only the ferry, but the proposed transitional housing units located towards the northern portion of the site.

The commercial center is located along the street front of the site and with its twisting central circulation space creates a dramatically celebrated transition between the grounded city and ferry transportation. This transition is also accentuated by a new oceanic extension along the street that follows the City's guidelines for shoreline and wildlife rejuvenation.

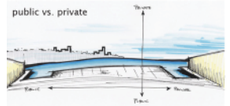
The housing complex is located adjacent to these flows and provides as much privacy as is possible when living near a busy transportation hub. The units have been arranged in elevated neighborhoods. Each neighborhood is comprised of four similar units, either 1, 2, or 3 bedrooms, and has its own outdoor yards for the tenants. An extension of the twisting circulation space has climbed towards the top of the tower and houses another dramatic transition, that from the public circulation to the front doorstep of the individual units. It acts as a front porch in the sky.
This transitional space runs through the site and is characterized by its twisting, diamond like structural form. This continuous space collects pedestrians at each entrance to the site, flows through the new commercial spaces, and provides an indoor waiting area for those who choose not to peruse through the shops. This space terminates with a cantilevered bridge to the ferries. In the morning the main concern is providing adequate circulation space for the explosion of commuters exiting the ferry. Later in the day enough area has been provided to accommodate the nearly 1,500 daily commuters.

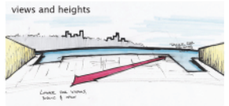
The ferries now pull into the site, engaging the newly created outdoor parks rather than amplifying the boundary between water and land. These paths for the ferry are an extension of the roads of downtown of Seattle. This creates an infrastructural extension of the city into the sound and also allows for those within the city to see the ferries as they approach.

The final transition articulated on the site is that from horizontal to vertical. Our reacts to this transition by formalizing the transition form compression (the tower) to tension (commercial). Within one continuous space, an individual can see the compressive forces of the tower translate into a system designed to accommodate the tensile forces of the circulatory cantilevers. This is an illustration of the tensile forces that pull individuals from the site and toward different locations within the city.

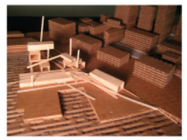
architectural design process

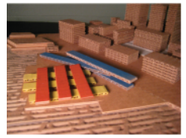
initial sketches/studies

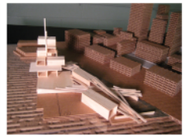


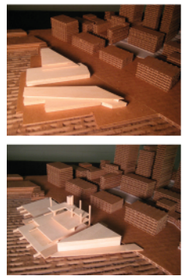


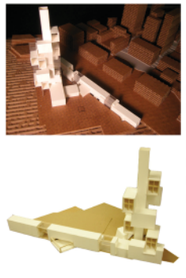
programming + form [models]:

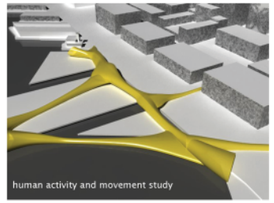


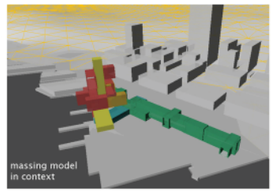






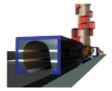


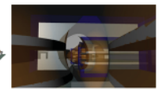


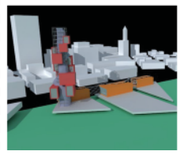


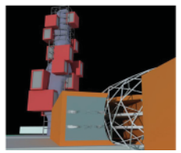
commercial [models]

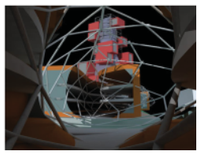
early and middle stages of development for the commercial spaces and curculation structure.





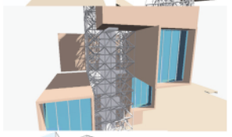


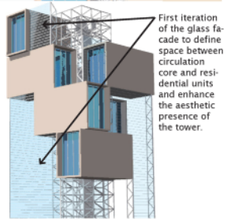


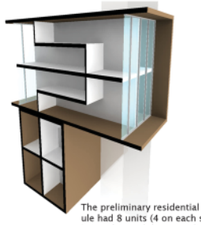


residential tower [models]

scheme #1

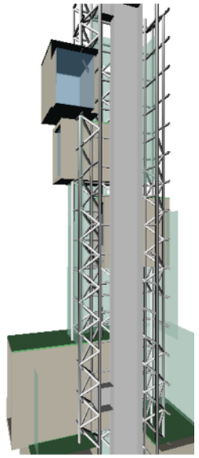




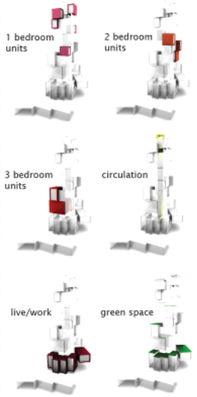


The preliminary residential module had 8 units (4 on each side). Later, the module was reduced to a total of 4 residential units.

scheme #2

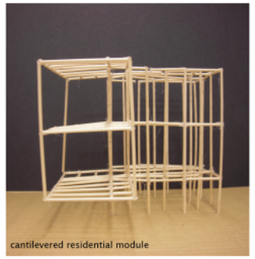


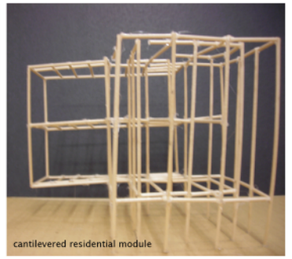
tower program models

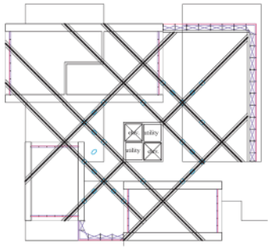


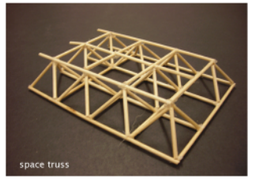
architectural engineering process

tower structure [physical models]:





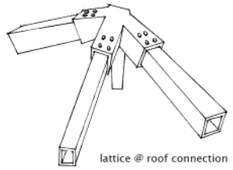


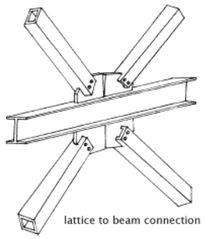


left: an early iteration of a possible floor framing plan that would allow support for cantilevered residential modules. this scheme was realigned with the utility core to be more efficient and consistant with the aesthetic of the tower.

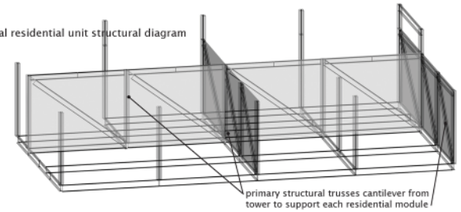
left: early in the design process, the idea of a space truss was incorporated as being both the structural core of the tower and a way to define an interstitial space between core and residence. in the end, a braced fram was adopted because it accomplished the same effect in a more efficient way and allowed for more interstitial space because it requires less diagonal members.

structural details

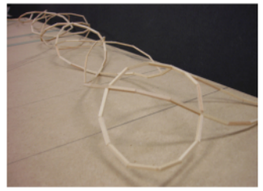


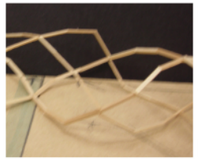


final residential unit structural diagram



commercial structure [physical models]:

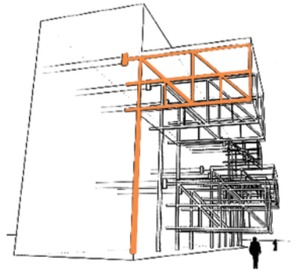


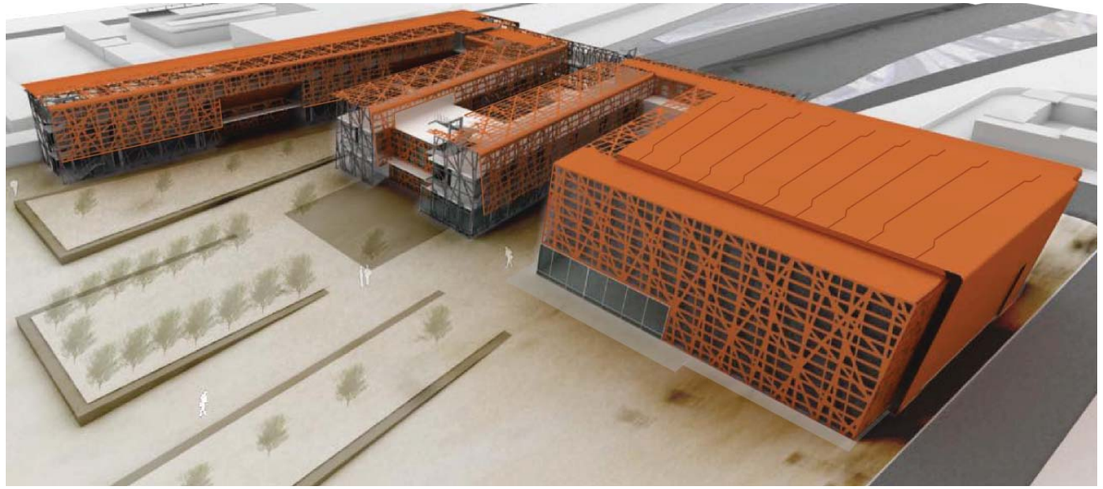


for the development of the commercial structure, a spiral system of linear members was first explored. after more iterations and refinement, the structure was ultimately composed in a more rational manner: the form of the commercial circulation was cut into semi-regularly spaced sections. each section was divided into 12 nodes. structural lmembers zig-zag between adjacent sections alternating between every other node. the result is a diamond like amorphic steel structure.

case study: wozoco - mvrdv

precendent study and analysis of a project that cantilevers large masses using structural backspans and braced frame systems.





2008/2009 elementary school

The site for the project is located in the
Phoenix, AZ downtown deck park area of town.

team01

Desert Canyon

Mimi Le
Martin Cortez
Jorge Garcia
Oscar Nino
Ryan Ouimette
Christine Zipperer

I was first interested in ARCE when I visited my uncle's home because it looked so different every couple of years. It was a great learning experience to work with a team of architects and come up with the structural system for the building. It had been a challenged to see the building take many different shape before it was settled to one particular outline.

Mimi Le
Livermore, CA

I am a 4th year ARCE student at Cal Poly, originally from Gonzales, California, with an interest in high profile steel and concrete structures. I am also interested in designing to achieve an economic and efficient structure that meets its purpose and accentuates the architecture.

Martin Cortez
Gonzales, CA

When I am not busy with architecture, I like to spend my free time running, swimming and biking. I also spend summers as an intern working at Anderson Brulé Architects. From the beginning, we tried to recognize each other's strengths. Be it concept, program, or design; I feel that each person's strength as a designer is reflected in the project.

Jorge Garcia
San Jose, CA

I enjoy going to the movies, the beach, and concerts. On the weekends I drive back home to spend time with my girlfriend. Design is always a never ending task, and when I look back to where we started I realize how much the design has evolved. I learned how important it is to work simultaneously on structural issues to make sure everything works.

Oscar Niño
Guadalajara, MX

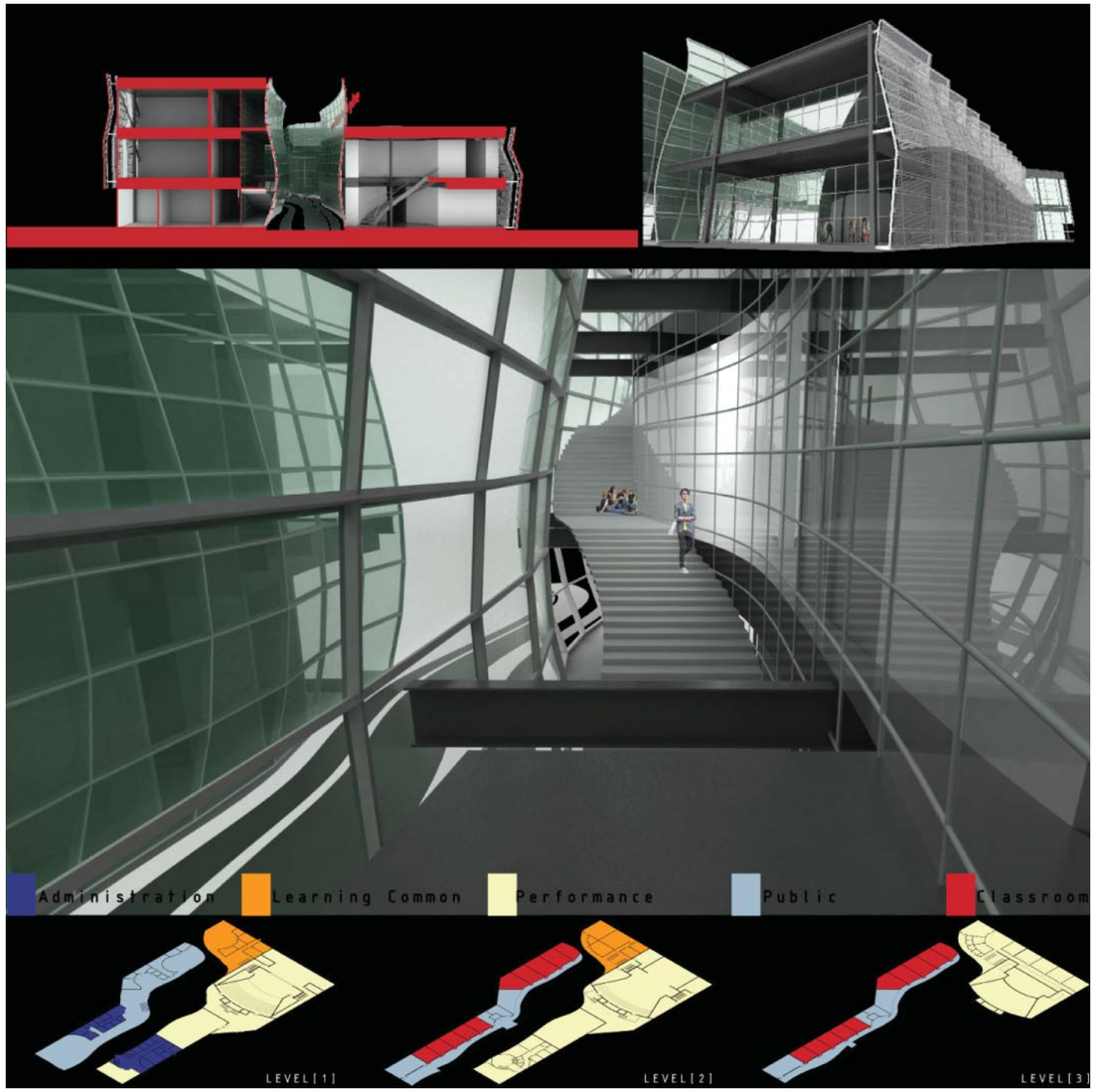
Cal Poly Architecture has opened my eyes to the current and future endeavors of the architecture field. From parametric tools and digital fabrication processes, to scripting with algorithms,I am starting to discover the endless design possibilities at our fingertips. Leveraging the computational abilities of the computer has become a focus of my study.

Ryan Ouimette
Arroyo Grande, CA

I was born and raised in San Luis Obispo county and I enjoy spending my free time with friends and family. I have enjoyed working in an interdisciplinary group because so often in the studio environment you forget to address structural aspects of a project. Working with our ARCE counterparts we have been able to develop a more cohesive design.

Christine Zipperer
Templeton, CA

Presentation Board 01



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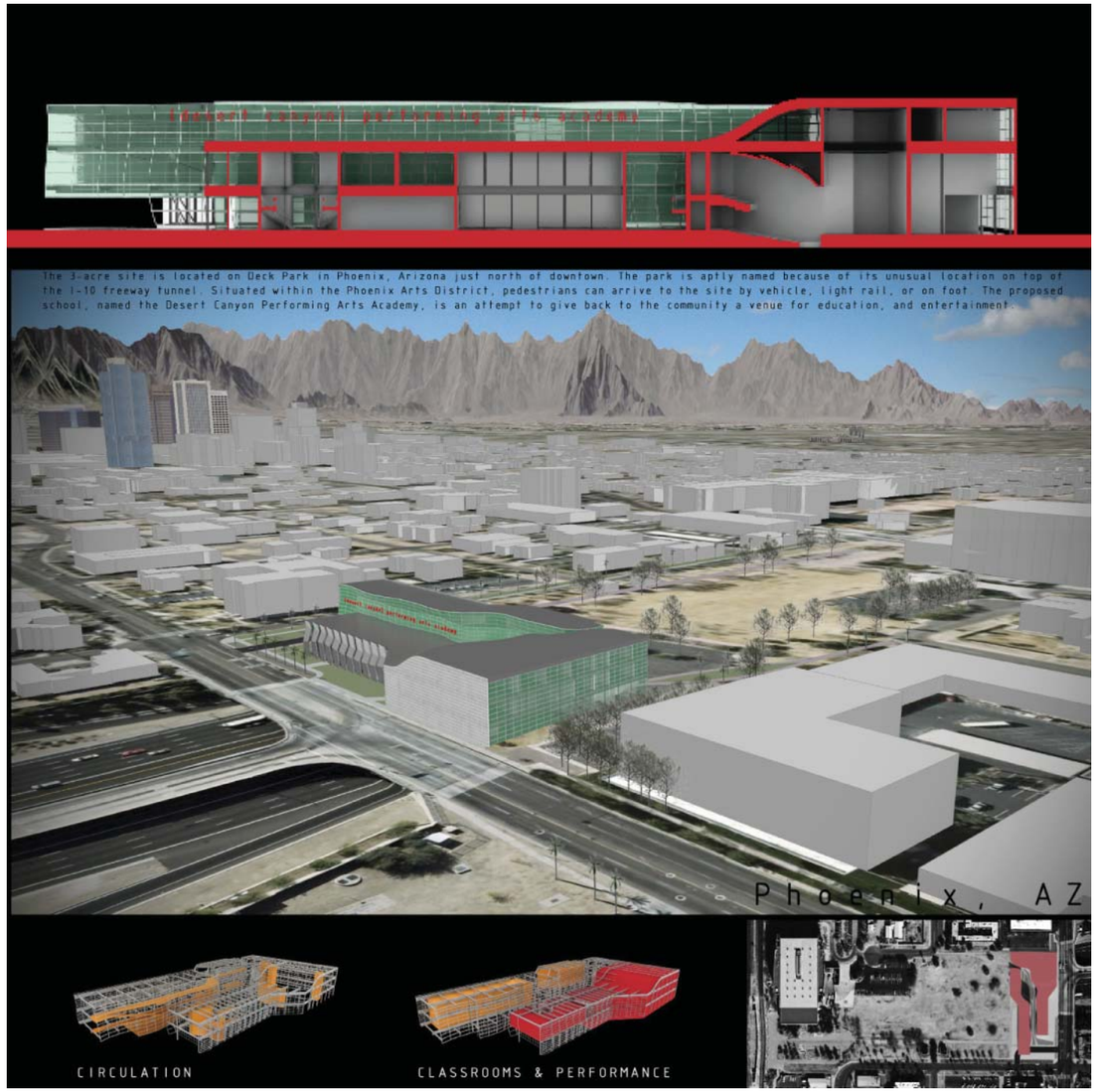

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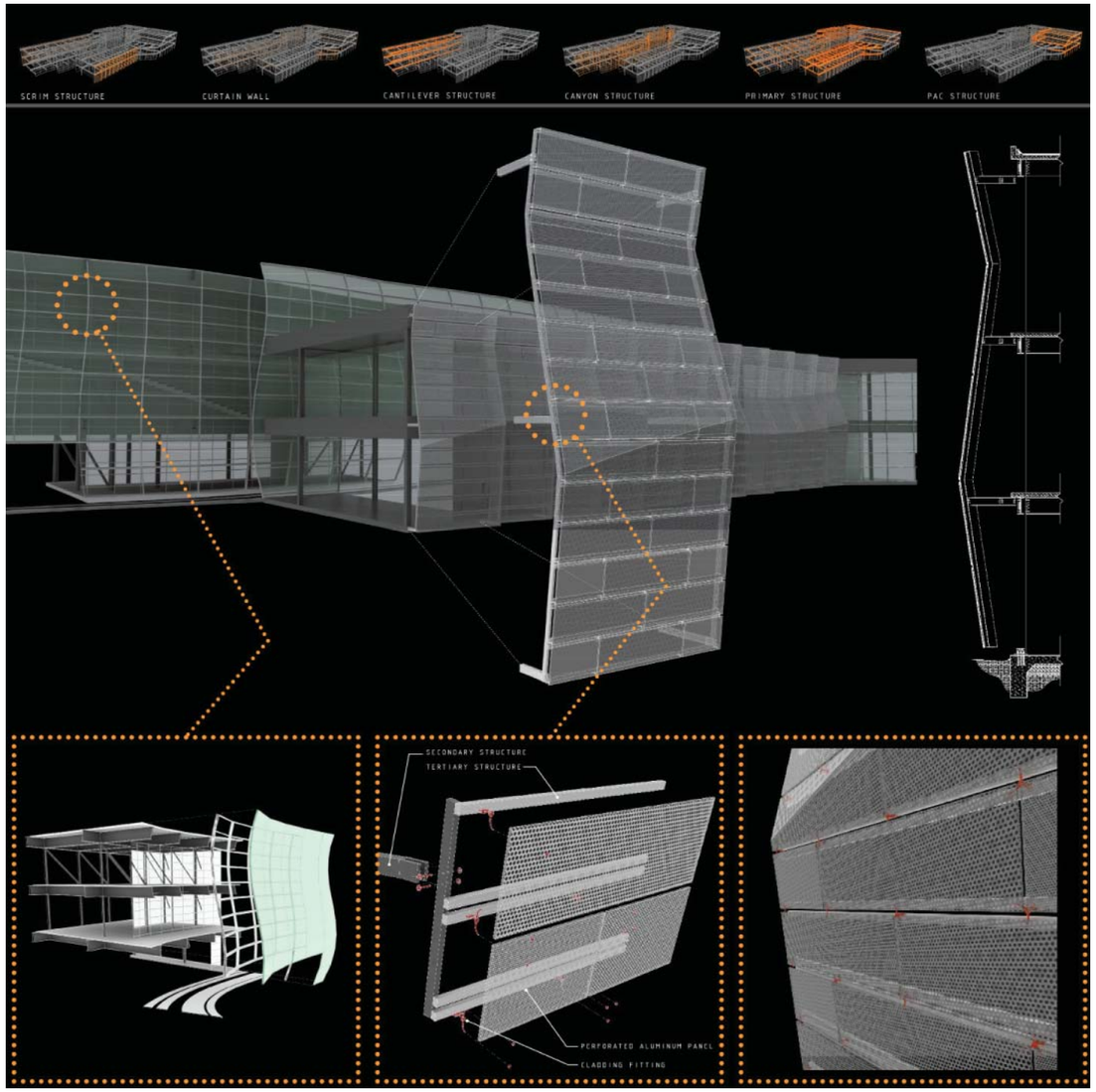

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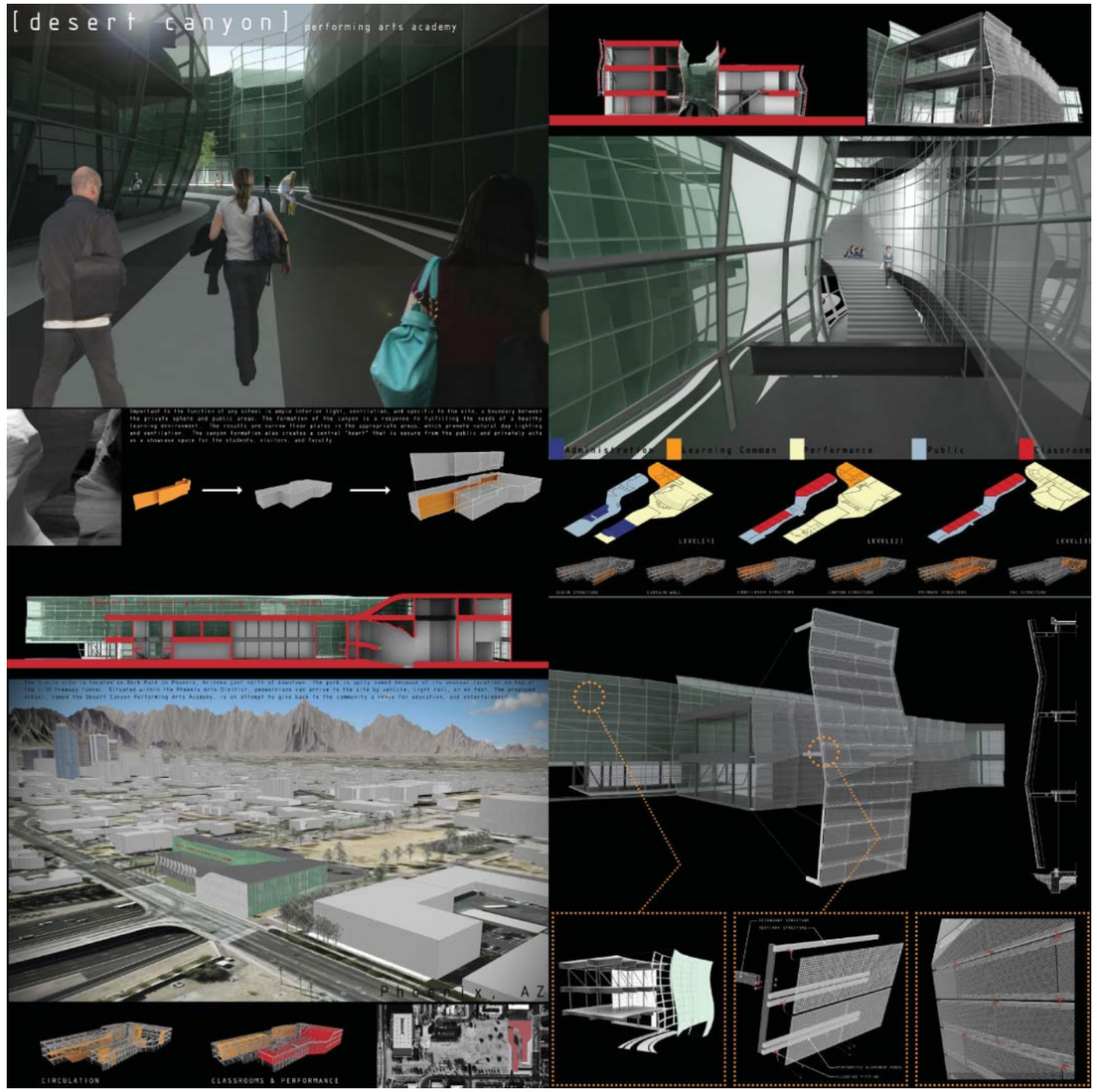


Desert Canyon

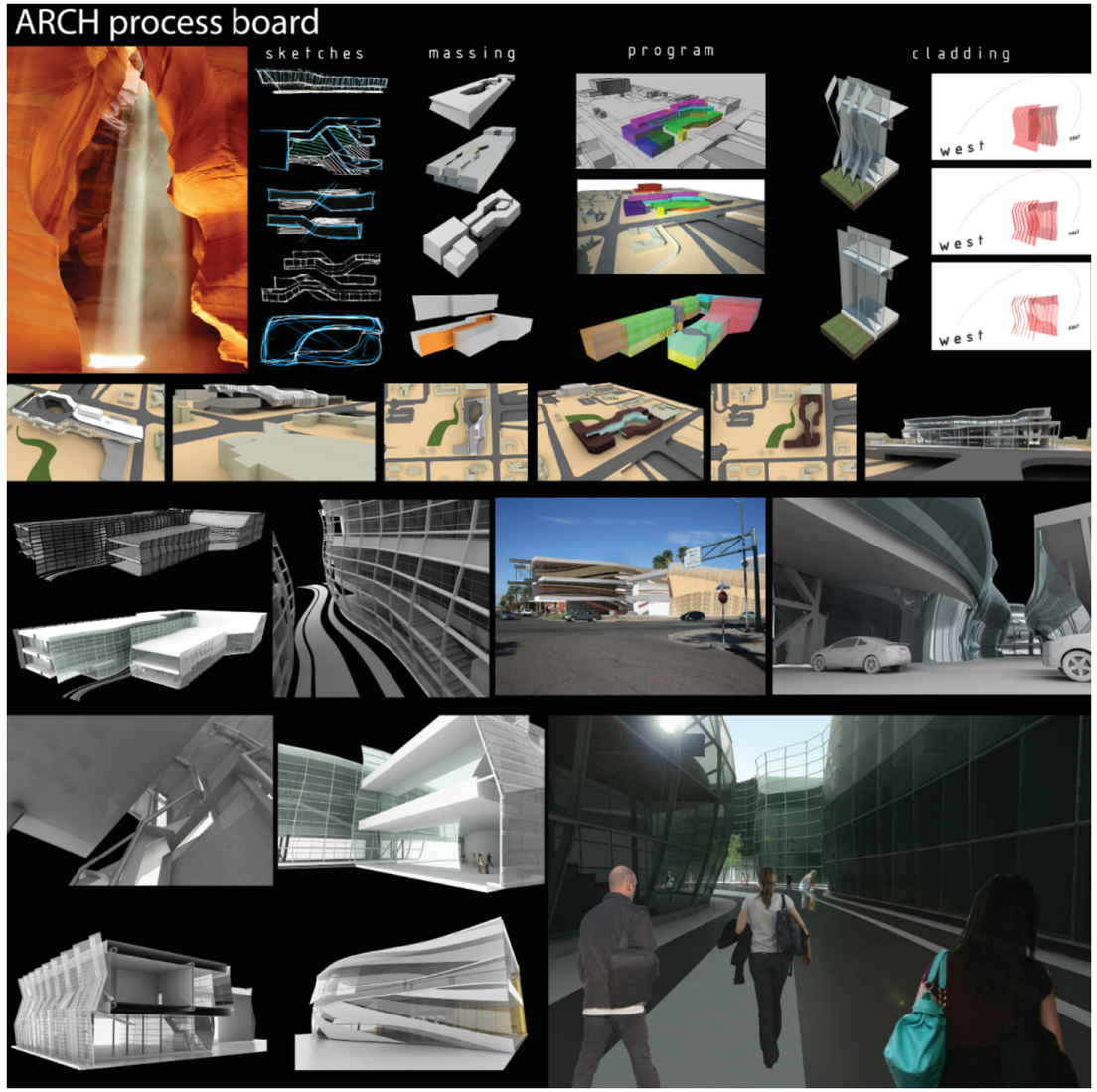
Phoenix is well-known for its natural wonder, the Grand Canyon. Every year visitors go to experience the enormous presence the canyon has in the desert. As a new icon for the city of Phoenix, the design of the high school is driven by the iconic value inherited in nature's wonder. Along with the conceptual relatedness to the desert, the canyon concept also provides for an easy integration of essential criteria for the form and function of a high school. Important to the function of any school is adequate light in the interior, ample ventilation, and specific to the site at Deck Park, a boundary between the private sphere and public areas. Each layer of the canyon is formed from narrow floor plates, which maximize the use of natural daylighting that is essential of a healthy building and learning environment. Ventilation in desert climates is most important during months with high temperatures. The orientation of the canyon utilizes the direction of the southwesterly wind with the west façade of the building directly exposed to the natural air while the canyon opens itself up to receive the trespass of wind to the eastern façade. Successful schools also provide a sense of "heart" where students can gather and feel a sense of arrival at school. The canyon formation creates a central "heart" that is secure from the public and privately acts as a showcase space for the students, visitors, and faculty. This High School for the Performing Arts aims for community connectivity by functioning as a center for education and a stage for entertainment while being responsive to the harsh Arizona desert sun.

Program configuration:
In order to give back to the community and become a presence on Deck Park, the decision was made to site the school along the North-South access parallel to East Moreland Blvd. This location also provides for an iconic view of the school from both the I-10 freeway and anywhere within the surrounding park area. To further support community connectivity, the Performing Arts Center is on the most public corner of North 3rd Street and East Moreland Blvd. The educational facilities of the school are connected to the performance spaces of the school by the canyon, which carves out the spaces of the school and collides into the PAC, forming a fissure that programmatically becomes the main lobby. The drop-off area is located to the south, which occurs on axis with the canyon, bringing students and theater goers into the fissure further amplifying the presence of the concept of a desert canyon.

Circulation and expanded zones:
Continuing the idea of the canyon as the "heart" of the school, circulation within the school was designed to connect students to the canyon. Locating the school circulation along the interior maintains a consistent view into the canyon for students throughout their school day. Along the circulation paths, long corridors are broken up with "expanded zones" programmed to compliment adjacent educational spaces and student needs. Four circulation towers are thoughtfully located to provide for convenient movement throughout the school, with one tower providing a direct connection between the school and the lobby of the Performing Arts Center. To connect the school and the canyon to the park, a grand circulation stair is designed along the west side of the school with a view of the park, canyon, and the I-10 freeway. The scale of the space is intended to support the stair as a social space where students will stop to talk with fellow students during their school day.

Skin + Structure:
Phoenix is a city known for its extreme temperature swings. Further increasing the effects of the desert climate is the North-South orientation of the school. The harsh climate which can reach a temperature over 110-degrees, presents a challenge to design a building that is responsive to the desert sun. This challenge will be to create habitable space that is day-lit, ventilated, and thermally comfortable for its users. The solution to designing in the desert is largely dependent on the building's cladding system. The chosen design of the cladding system plays off of the canyon concept.

The secondary structure, the cladding system, is connected to the primary structure through cantilever beams extending up to 8-feet long moment connections. The main structure itself is the typical post-and-beam system along with braced-frames to resist the lateral system produced by the governing wind loads of Phoenix, Arizona. The majority of the interior structure is hidden from view, except for the structural members supporting the hanging stairways throughout the buildings and the suspended curved walkway located next to the atrium. The main auditorium and the library are framed using open-web joists. To help with thermal massing in the desert climate, a 3" lightweight concrete filled over 18 gage metal deck is exposed on all floor levels.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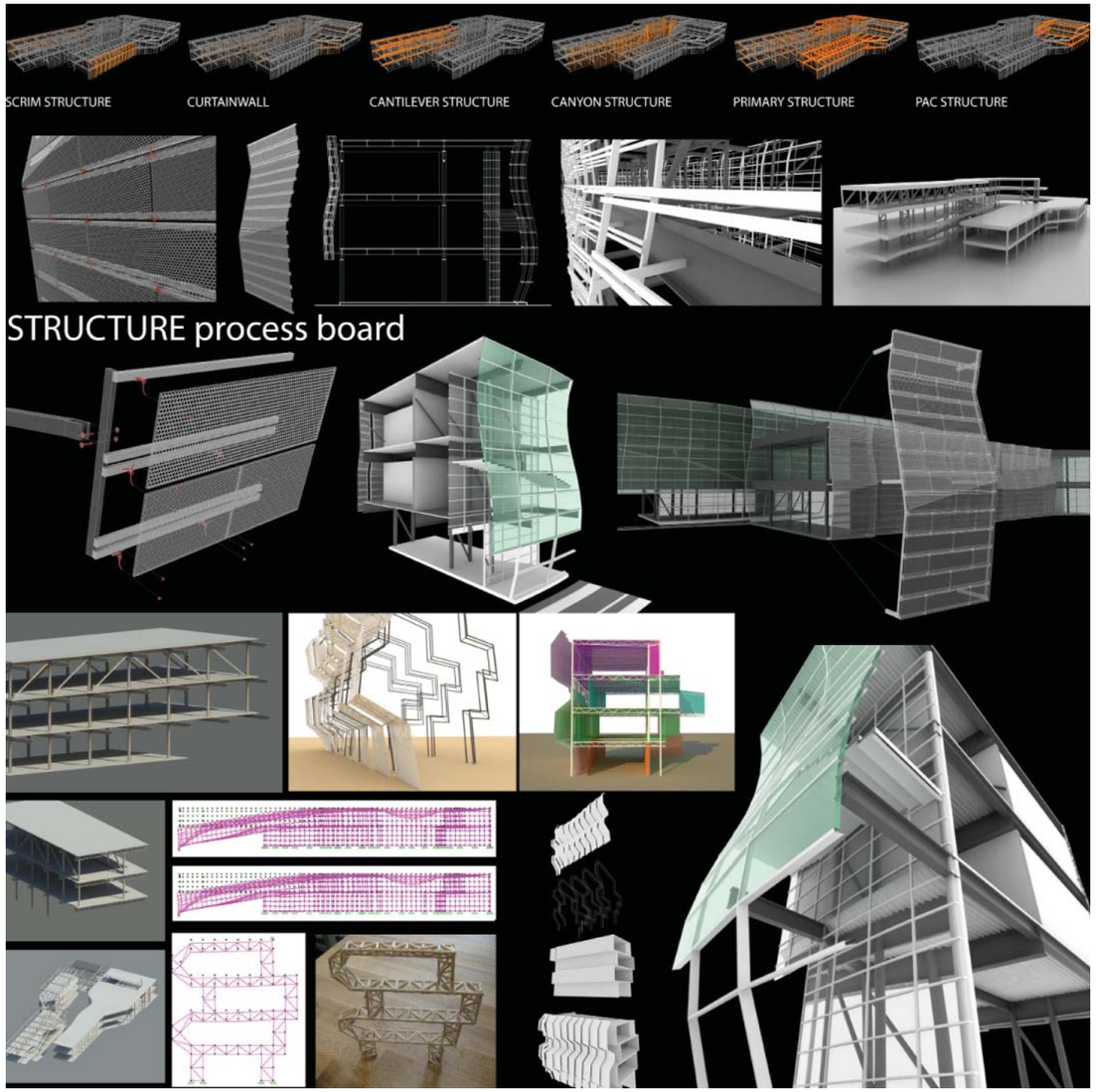

SCRIM STRUCTURE
CURTAINWALL
CANTILEVER STRUCTURE
CANYON STRUCTURE
PRIMARY STRUCTURE
PAC STRUCTURE
STRUCTURE process board

Ryan Ouimette
I learned:

1. When you work in a group you rarely get stuck on what the next move should be. The collective minds of a group contribute to this.
2. Having the structure figured out makes the project much stronger and for me that was important because in the past I thought of structure last. Having the ARCEs in the group was a big factor and talking to the instructors helped us to figure it out.
3. I learned that reviews can be very constructive. Instead of feeling like you have to defend your project, I learned that you can just be honest in what you haven't figured out and can ask the reviewers what they think would be a good solution.

The advantages of the interdisciplinary studio are:
1. You learn how important it is to be on the same page as the engineers and that requires a large about of communication and discussion.
2. You learn that there are real constraints on the project and that not everything is possible.
3. You learn that engineering students are very different that architecture students.

I think teaming up with Buro Happold was one of the best things about the studio. To see and hear professionals in the building field was very helpful. I think consulting with architects as well as engineers would be interesting as well.

Oscar Nino
What I learned from this studio experience was how to be able to analyze the building structurally and I think that working with architectural engineering students helped to better understand how important the structure is in a building. I also learned how the structure affects the design and the aesthetics of the building and I think that having Matt and David from Buro Happold was a great advantage to the success of the project. Finally, I learned how important collaboration is between the two disciplines to make the project work.

What I learned from this interdisciplinary team that I think would have not learned in only working with a single discipline is how important is to correlate the structure and the design to make the project work. This project has been the only one in which I had actually analyzed the structure in depth and know how it works.

I think that the participation of Matt and David from Buro Happold helped us a lot because they both gave us good insight that only made our project better. It also helped making some important decisions on issues we were struggling with. I think that the in-person reviews worked well because there was always questions we had and they always had good feedback that helped in the development of our project.

Christine Zipperer
The top three things I learned from this studio experience were:

1. How to Renderfarm: through our close-knit studio environment, everyone is really open to sharing what he or she learns along the way. Whether it is a new model material/strategy, 3D model troubleshooting, or the best discovery of the quarter, RENDERFARMING!!! This is going to be a very valuable asset next year.

2. REVIT: I now have a basic understanding of Revit. Although I was unable to get as familiar with the program as I would have liked, I learned enough to be get familiar on my own. Everyone in my group brought different skills/ knowledge to the table, and it was through this that I was able to get my introduction to Revit.

3. Digital Fabrication: This studio was my introduction to the capabilities and process to use the digital fabrication lab. I was fortunate to have a TA on my team, because I was able to become very familiar with what we are able to do, and how to set up our files. I look forward to using the CNC and laser cutter next year.

Three things I expected to learn but did not:

1. I was hoping and expected to learn more about structural engineering. So often in our normal studios, we don't address the structural system of our projects. I was excited to be working with ARCEs because I wanted to get a better understanding of how to analyze and design structure, at least the basics that an architecture student could benefit from. I think that the problem was the difference in priorities. It seemed that this studio was not as important a class (most notably in the first quarter when they should have been more involved in the design), for the ARCEs and the architecture students therefore were designing the structure on our own. I would suggest that the ARCEs students are given more units for the class in the first quarter rather than the second quarter.

2. I have some knowledge of 3D modeling, but I was hoping on getting a lot better these last two quarters. We had a very strong 3D modeler on our team, and it the most sense to have him in the driver seat. Although I did gain something from watching him, I would have liked to be able to do more modeling myself. But, with deadlines, and speed in which we needed things to get done, I had to get my own duties done.

3. Not necessarily something I wish I would've learned (because I can't think of anymore) but I wish that my group had done more to concentrate on the sustainability of our project. It was always a thought that we intended on getting back to, but in reality it should have been developed along side with the design. So, if we could go back and do the project again, I would push to have a more sustainable approach to our project.

There were many components of the course that contributed to my learning. I could not see this class being as successful without the 2-quarter structure. It works out really well to have the first quarter more focused on finalizing design, with the second quarter more for production. The collaboration with Buro Happold was extremely beneficial to my learning. It was very generous of them to take such an interest in our projects and to make the trip to visit us. To improve the course, I would have fewer reviews. We were trying to get stuff done, but whenever there is a review, we have to stop working in order to produce something for the review. It makes it difficult to keep the designing going when we have to halt for the review. The other part of the structure that I think may need to change is the number of students per group. As I stated earlier, it was hard to find stuff to do at times, and I felt that I was unable to contribute as much as I would have liked because other members of the team did not need any assistance. I think the teams would function better if they were smaller. A better structure may be 3 architecture students with 1 ARCE, or 2 of each, depending on the number/type of students enrolled. `

team02

Aeolian Processes

Ryan Nearman
Chris Disibio
Kristen Linn
Loren Galarza
Myron Merced
Christina Ward

Ryan Nearman
Boise, Idaho

As a 4th year architecture student, the most interesting part of this project has been designing along side of the architectural engineers. While the level of detail that we were able to design into was great practice, bouncing ideas off students with completely different perspectives proved to be a beneficial part of the design process.

Kirsten Linn
Colorado Springs, Colorado

A 4th year Architecture Student, I felt the addition of Architectural Engineers to the team provided a great opportunity to consider design from an applied perspective. The most imperative decisions we made in the formation of this project was the concept theory, the appearance and function of the skin, as well as the incorporation of the building into the landscape.

Myron Merced
Jersey City, New Jersey

A 4th year Architecture Major at Cal Poly, San Luis Obispo, when he's not working in the studio making models and renderings, he's in a dance studio teaching dancers on the side. As an aspiring architect and dancer, he hopes that one day his work (in both fields) can inspire people to find the very best in themselves.

Chris Disibio
Redwood City, California

4th year ARCH student, I am a transfer student from Cuesta community college and am minoring in Construction Management. Have worked in construction since age 12 and believes it will be benefirial in my architectural career. This project has taught me the value of communication, and the difficulies and a new appreciation for collaborative work.

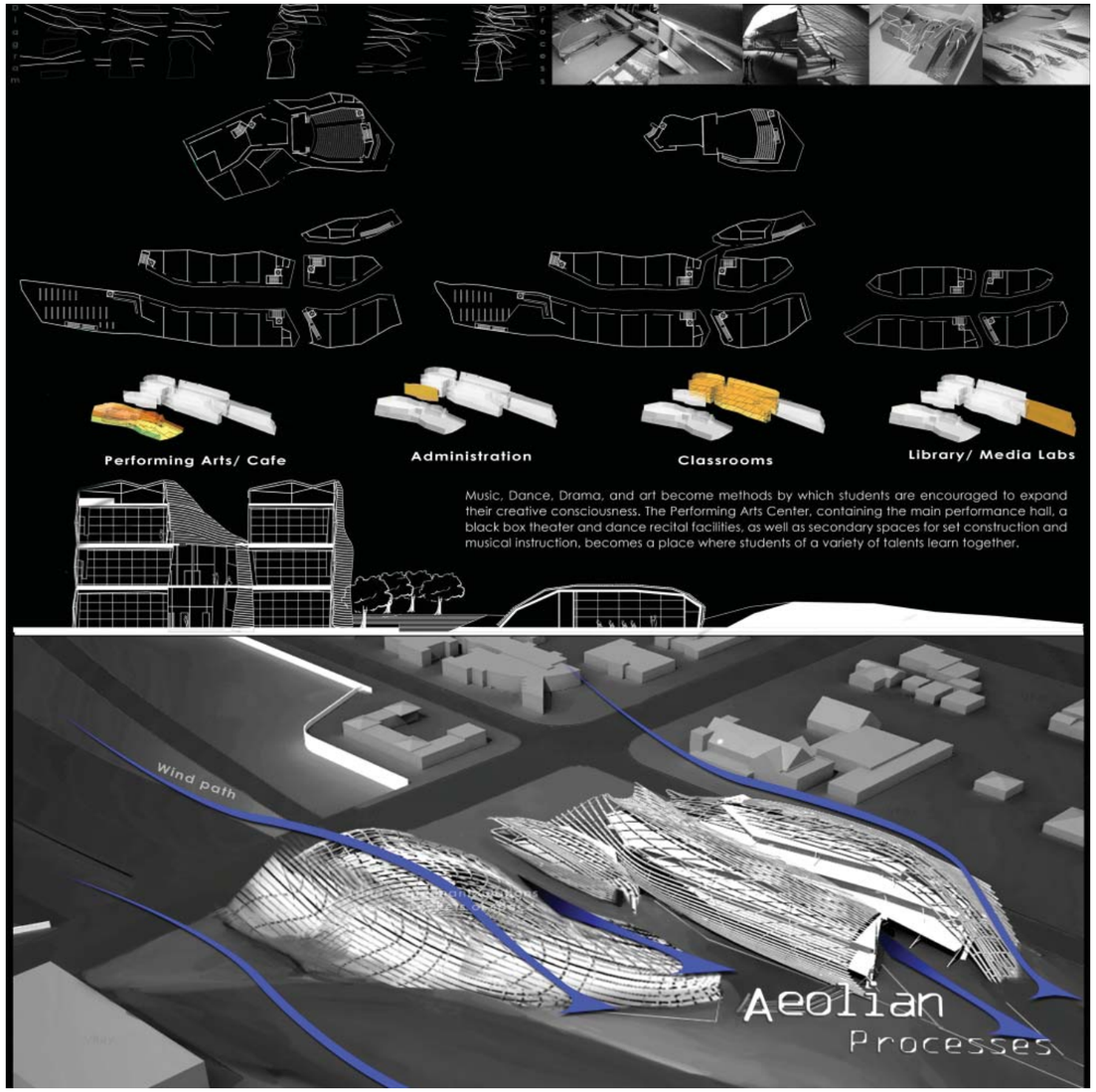
Loren Galarza
El Centro, California

4th year ARCE, born in El Centro, CA, but presides in Salinas. I have a twin brother (also goes to Cal Poly), yet have never tried to trick anyone. I believe computers are a great aid for documentation of drawings and such, but know that sketching is an invaluable tool.

Christina Ward
Los Angeles, California

5th year ARCE, and a California native. I enjoy travel and spending time with family. I am graduating in June and am looking forward to life after college.

Presentation Board 01



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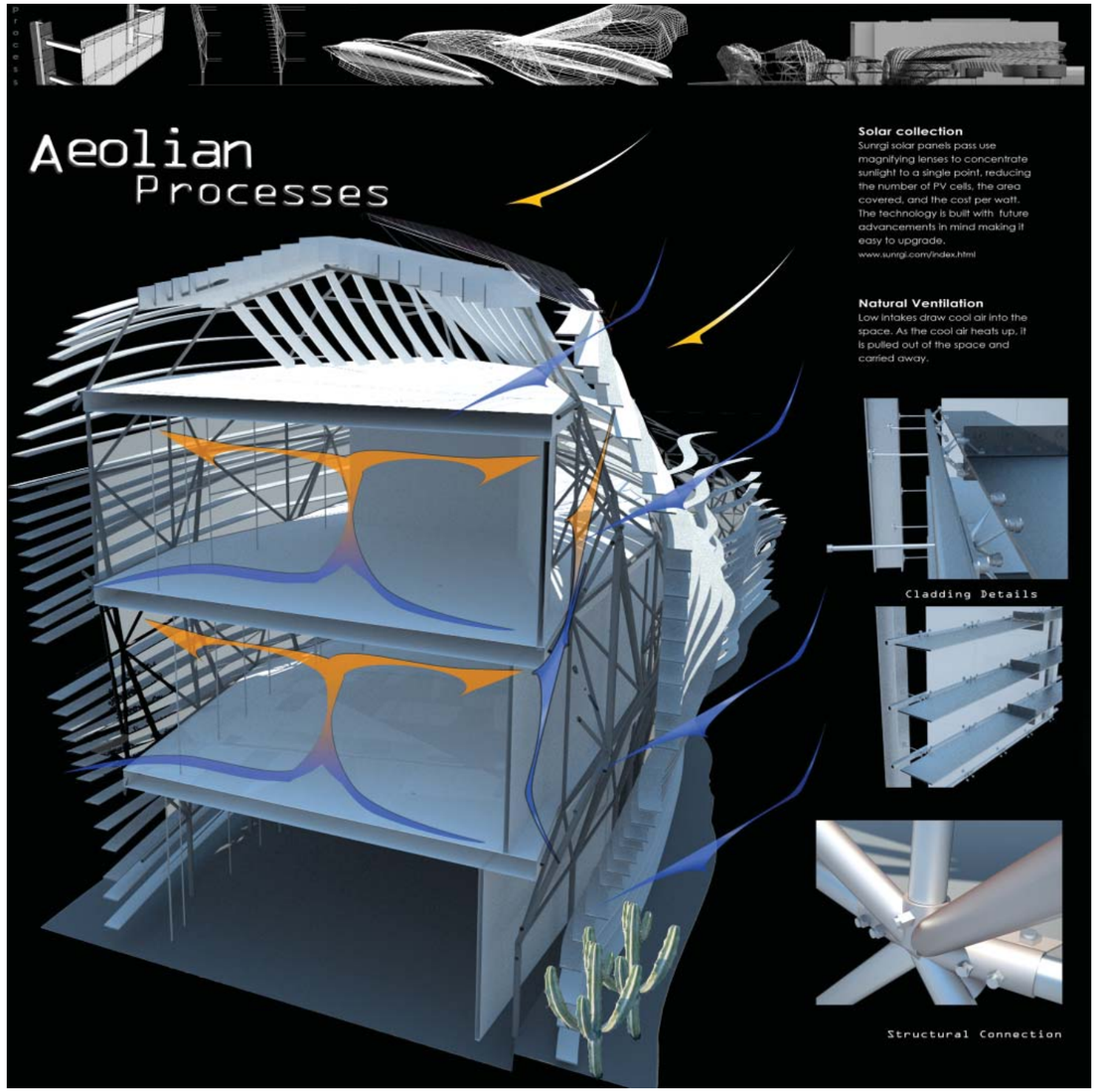

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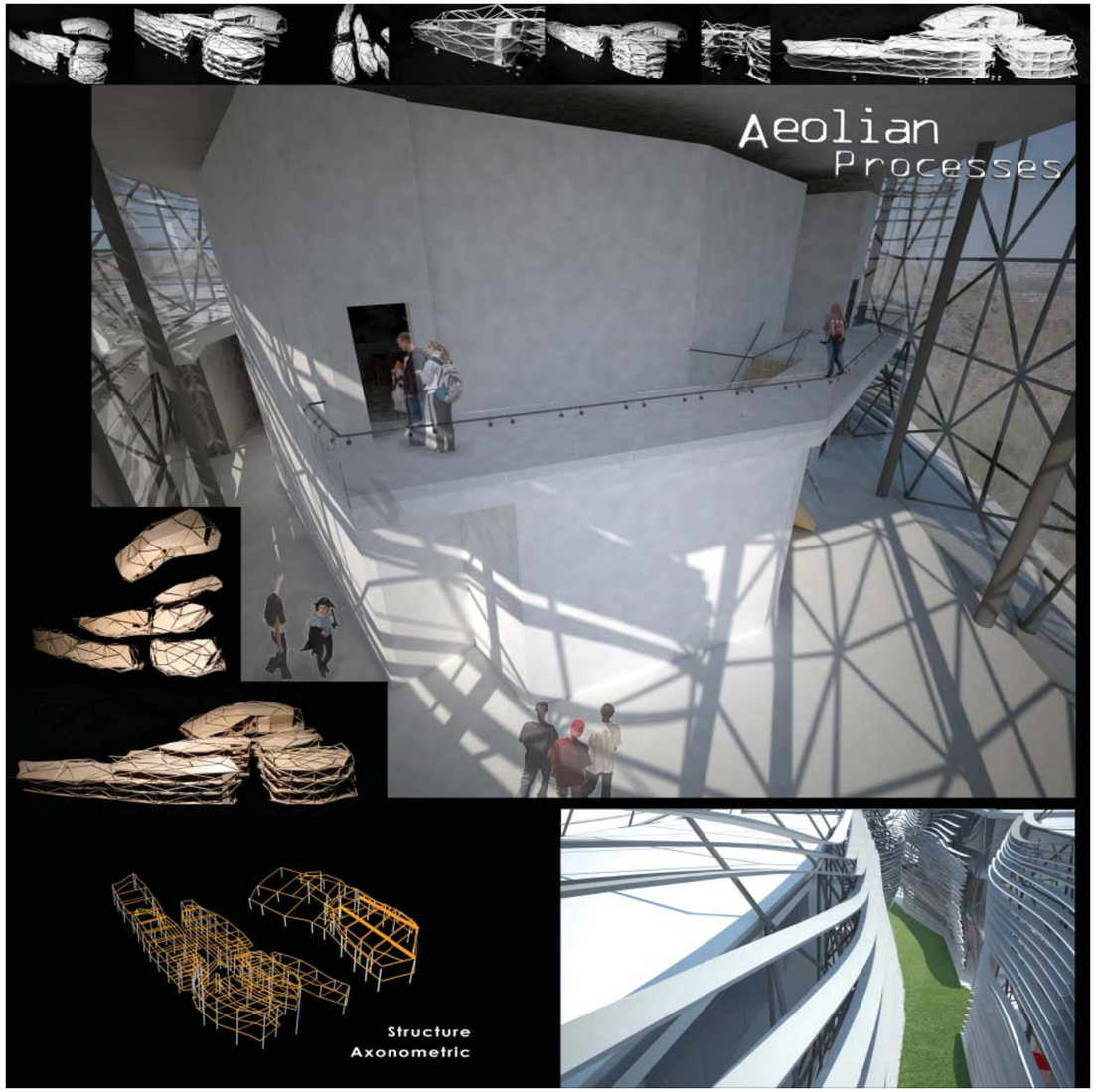

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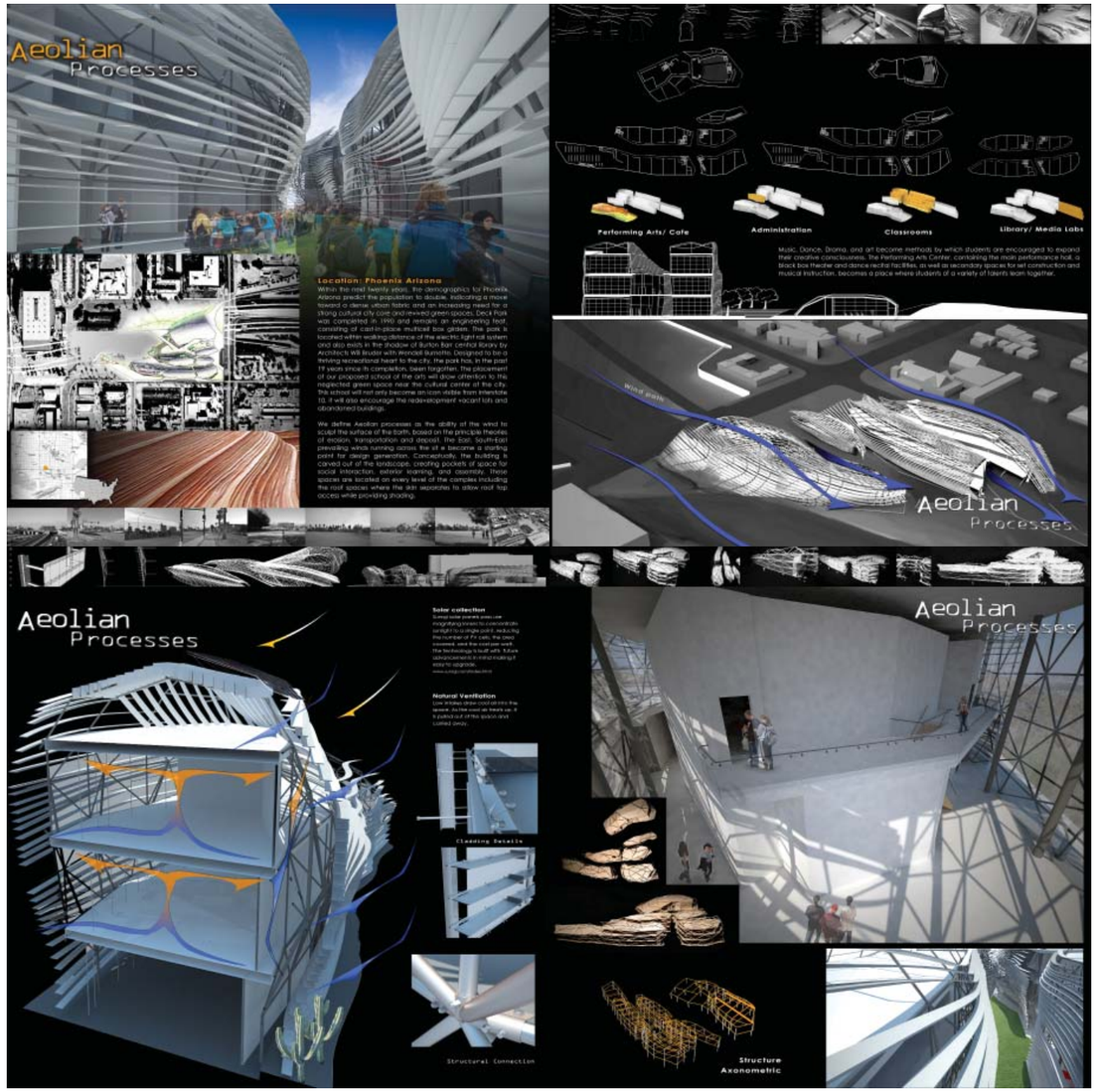


Presentation Board Summary

Aeolian Processes

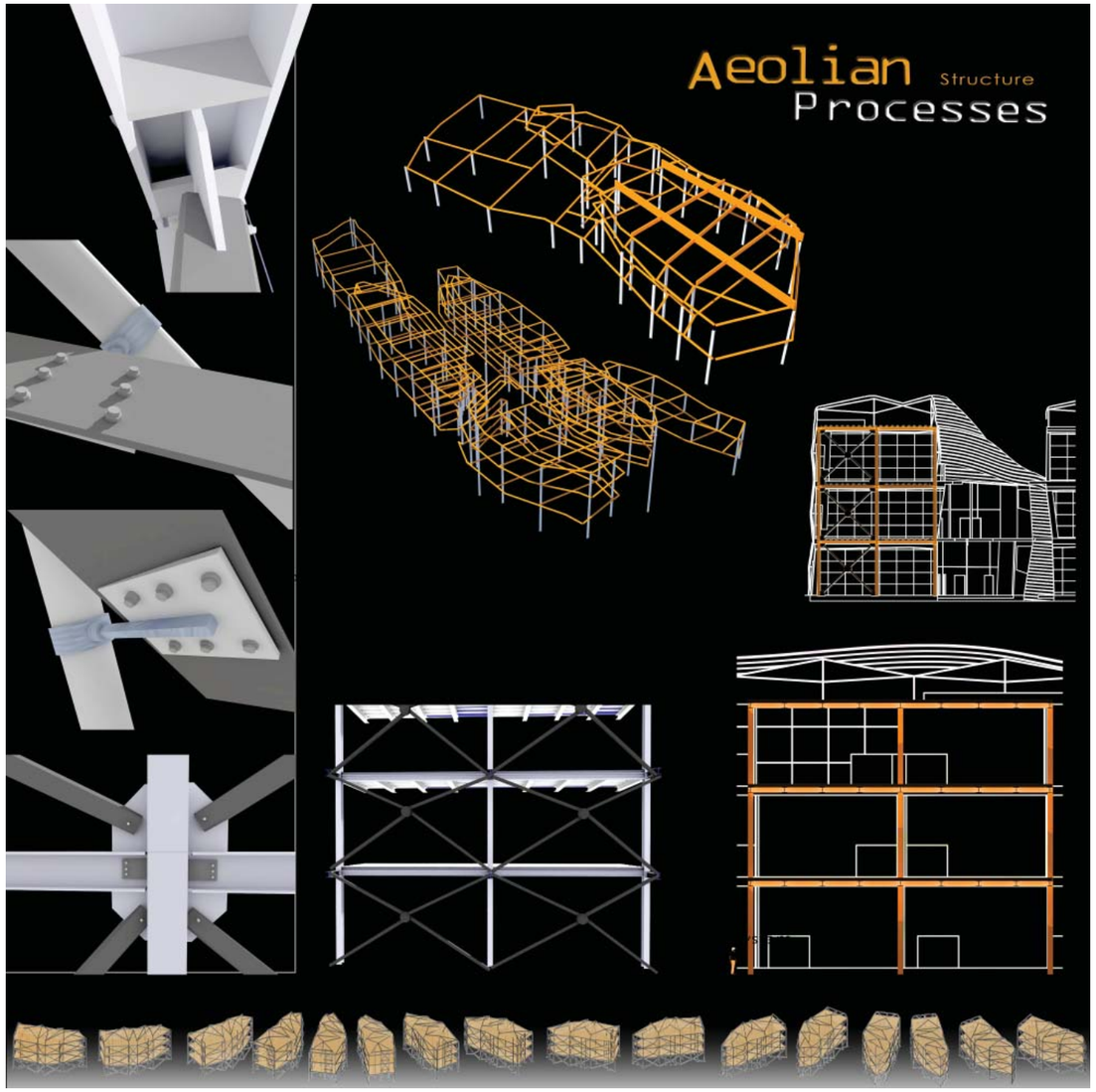
Within the next twenty years, the demographics for Phoenix Arizona predict the population to double, indicating a move toward a dense urban fabric and an increasing need for a strong cultural city core and revived green spaces. Deck Park was completed in 1990 and remains an engineering feat, consisting of cast-in-place multi-cell box girders under which ten lanes of traffic speed. The park is located within walking distance of the electric light rail system and also exists in the shadow of Burton Barr central library by Architects Will Bruder with Wendell Burnette. Designed to be a thriving recreational heart to the city, the park has, in the past 19 years since its completion, been forgotten. The placement of our proposed school of the arts will draw attention to this neglected green space near the cultural center of the city. This school will not only become an icon visible from interstate 10, it will also encourage the redevelopment vacant lots and abandoned buildings.

We define Aeolian processes as the ability of the wind to sculpt the surface of the Earth, based on the principle theories of erosion, transportation and deposit. The East, South-East prevailing winds running across the site became a starting point for design generation. Conceptually, the building is carved out of the landscape, creating pockets of space for social interaction, exterior learning, and assembly. These spaces are located on every level of the complex including the roof spaces which is where the skin separates enough to allow roof top access while providing shading.

This school of the performing arts provides students with the opportunity to experience a variety of art forms and come to appreciate multiple cultures. Music, dance, and drama, and art become methods by which students are encouraged to expand their creative consciousness. The Performing Arts Center, containing the main performance hall, a black box theater and dance recital facilities, as well as secondary spaces for set construction and musical instruction, becomes a place where students of a variety of talents learn together.

Our proposal includes a variety of classroom spaces that are designed for flexibility. The incorporation of technology into the classrooms and the placement of media labs interspersed throughout the class blocks promote learning on a global scale. The proposed school will not only perform sustainably, it will become a tool of sustainable instruction. Roof top gardens and cool roof systems reduce heat loads minimizing the use of HVAC systems. Building run off is channeled by the louvered skin and treated in a grey water system that then distributes the water to irrigate the landscape. Given the minimal annual rainfall, we propose limiting plant selections to those with attributes promoting the efficient use of water. Energy consumption is supplemented with solar collection systems.

Process



Ryan Nearman
One thing that I learned from this studio experience is that it is hard to keep motivated for the same project for two straight quarters. Perhaps this is a result of the group problems I encountered but in general, keeping focus was tough. These are the points when individual group members should rise up to spur the group forward towards completion and that lacked in our group. The second thing I learned was that sustainable buildings in Arizona are difficult to design. With such a harsh climate it took much more thought to make each environmental design effective. Traveling there helped in this education as well. The final thing I learned was an appreciation for input outside of architecture. When we would have engineering critics I would try to fully implement their opinions into the design. Architecture can get a bit stuffy and repetitive and any beneficial input from others outside of architecture is greatly appreciated.

First off, the ARCE students, Loren and Christina, were awesome. From what I hear and saw they were the most productive ARCEs and I loved what they had to say. If this is the experience of working with arces from here on out I will be ecstatic. We had a great relationship of being able to discuss what would and wouldn't work in terms of architectural and structural design openly and bluntly. And they were happy to work with us to achieve the design vocabulary that we wanted. The thing that I wouldn't have been able to learn without them is that 'crazy forms' can be achieved just by tweaking the way one thinks. I was thinking about how we could cant the columns, when in reality, all that was needed was to shift the plates and have a regular structure. This made it easy on both parties. It also forced me to see how ARCEs see things and to take that into consideration when describing our design ideas. I had to be more concrete which is definitely not a bad thing.

Bringing in professionals was by far the most important experience that took place in this studio. Not only were they forward thinking in terms of design ideas, but they knew what it took to get things built. This information helped us to realize our designs in a more realistic light. If possible I would keep bringing in as many professionals as possible because it was something I had never experienced before, and something that enriched the class more than anything I had ever seen. One thing that could've been improved in terms of the interaction with professionals is explaining the project before hand. I felt that there was a lot of repetition of the description of each project such that at the end of the two quarters I didn't know who knew what about our project, and I became tired of explaining it.

Chrstina Ward
Over that past two quarters the greatest lesson that I learned from our studio is that success depends as much on the quality of workplace relationships as it does on how effectively we perform our tasks. The studio time was invaluable in regards to the time spent working side by side with architects. The studio room that we had and the collocation of our work stations made many tasks easy to perform. Despite our close-quarters, forming sound working relationships proved to be difficult for my team. This is in part due to a lack of commitment of a couple of individuals but can also be attributed to a failure in communication. I think that some exercises in effective communication skills might have helped my team's approach to working with one another. We never developed an understanding that our goal was the same. This might also in part be due to the fact that our goal was not clearly outlined. We were all aware that we wanted to develop a winning design for the competition but we did not establish benchmarks for reaching that goal. I think that it may fall on the instructors to enlighten future classes on this fact since without any prior experience on a design team such a thing is hard to foresee. Also, it may help to designate a team leader. Personally, I would have been felt more obligation to be in touch if I were in a management position or if I was referring to someone in a management position.

Overall, my experience with the Collaborative Design Studio was educational. I learned important lessons about developing a project and building working relationships. Participating in the ASCA/AISC Steel Design Student Competition with Cal Poly architects was revealing of the quality of education we all receive here and the opportunities we were provided by being part of the College of Architecture and Environmental Design.

Kirsten Linn
During this quarter, I learned the value of a committed team. Team commitment was, rather than through strength, learned through a festering wound. I see this as an invaluable lesson for future team work.
The incorporation of engineering into the project has been an interest of mine since this fall when I had the opportunity to ground my project in a dollar value. This opportunity to see a building of eccentric character be designed to be buildable was a great pleasure. Through this experience, I learned some practical applications of engineering that cannot be gleaned through the less interactive architecture engineering classes required for architects.

As for skin development, I admit this to be a weakness of mine. In the past I have not had much experience with a secondary skin system, as I have not yet had the opportunity to do such a large scale project. The detailing of the system was helpful and enlightening. The input from professionals in this matter gave me a direction for investigations in the future.
In the interdisciplinary team, I learned that it is beneficial not to approach those outside of your profession as if they are trying to reduce or impede your own. Although we never had this problem, I felt that the absence of such an issue was a pleasant contrast to what I have heard in the past from practiced professionals and cal poly professors. The experience was delightful and educational.

Overall, my experience with the Collaborative Design Studio was educational. I learned important lessons about developing a project and building working relationships. Participating in the ASCA/AISC Steel Design Student Competition with Cal Poly architects was revealing of the quality of education we all receive here and the opportunities we are provided by being part of the College of Architecture and Environmental Design.

I found the invitation and input of our guests from Buro Happold as well as others to be very insightful. They offered their years of experience toward the completion of the project and gave us insight into what was functioning in our projects and what still required attention. Although the web conference is a convenience measure, the software in use seemed to cause difficulties. It would have been interesting and potentially beneficial to the teams if students were able to set up such web conferences on their own when they encountered specific difficulties, but overall the web conferences were an interesting resource.
As for the personal reviews and class visits by these professionals, I found this to be my preferred interaction method. Communication was clear and their advice seemed more constructive when they could view the project in its entirety.

Matt Moran
Aramis Arciga
Idolina Benavides
Christopher Brazell
Paulina Mendoza
David Carmona
Jacleen Webber

team03

Performance Driven

Group work was a challenging experience due to a lot of different ideas floating around between multiple members and disciplines. The experience proved to be a rewarding one as it prepared us for the real world and allowed us to be come closer as friends. I am very proud of everyone and the results of our efforts. I would do this again without question.

Matt Moran
Westminster, CA

Collaboration between architects and engineers allowed our group to generate an interesting and feasible solution for a realistic project. Personally, it allowed me to improve my skills and expand my knowledge by learning from my teammates.

Idolina Benavides
Baytown, TX

Working in a team made the design process easier since there were five other people with interesting and creative ideas. Also, having an entire quarter to work only on the design allowed us to have a more complete project in the end. it was an extremely valuable experience since I was able to learn new skills from my teammates.

Paulina Mendoza
El Centro, CA

Working with multiple disciplines for this design project was a great experience. It allowed multiple perspectives in the design as well as some compromises that had to be made as a group. It was a great team environment that gave us a realistic approach to a steel design project.

Aramis Arciga
Santa Ana, CA

This design competition was an interesting exploration of the different design phases of a project while working with different disciplines. These experences will be directly reflected by improving my communication in future projects.

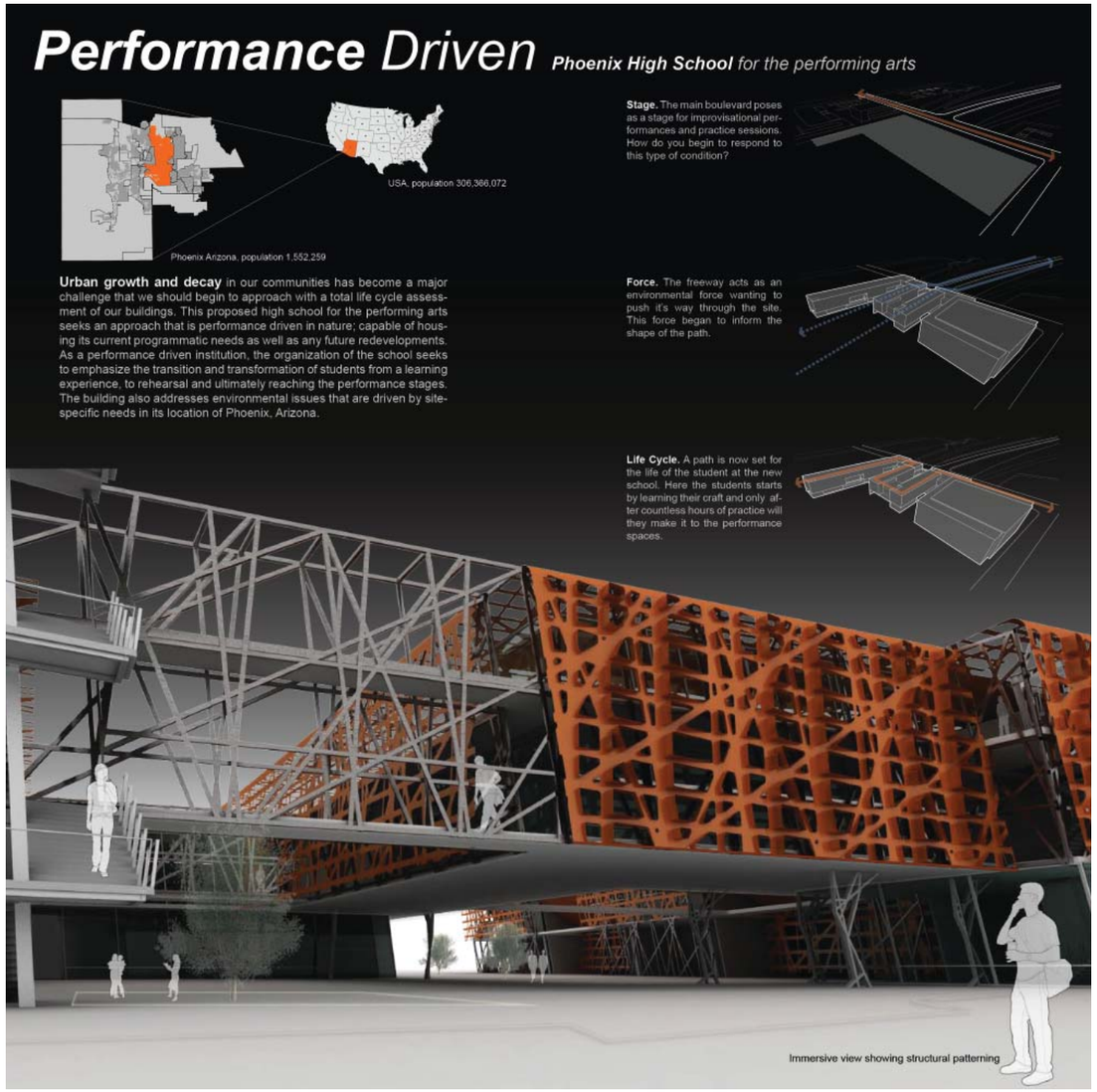
Christopher Brazell
Santa Rosa, CA

Working with architects forced me out of my comfort zone. They pushed me into the realm of untraditional steel design and the project only benefited. This collaborative class is one of the best educational experiences I have had while in school.

David Carmona
Agoura Hills, CA

Architectural engineering at Cal Poly seemed to be the perfect combination of the delicacy of architecture and the rough lifestyle of construction.This experience gave me the opportunity to explore fields and programs that I would not normally be exposed to. Through interactions with architects and engineers, I had a glimpse of issues and solutions that a real consultant would face.

Jacleen Webber
Vacaville, CA



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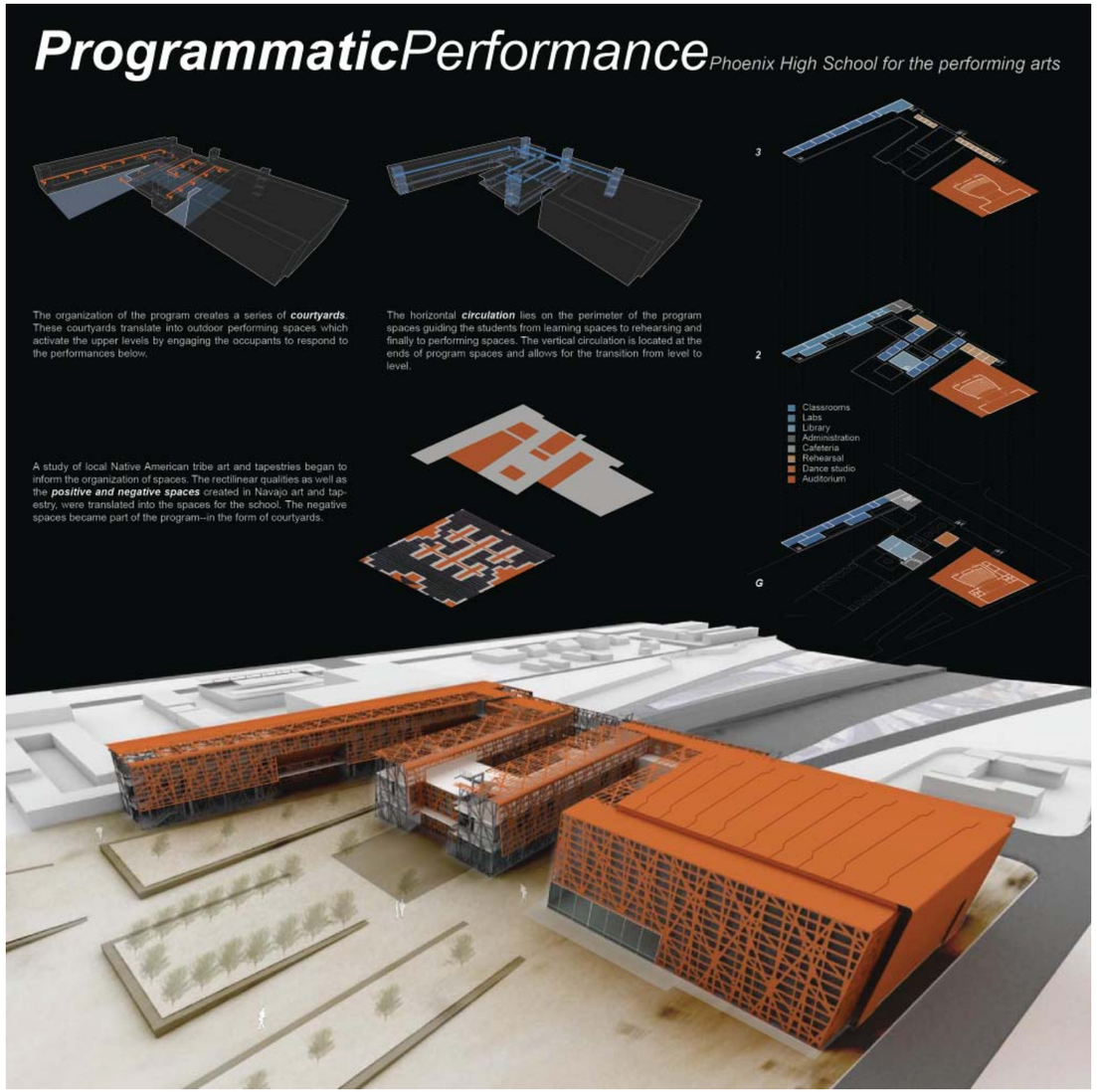
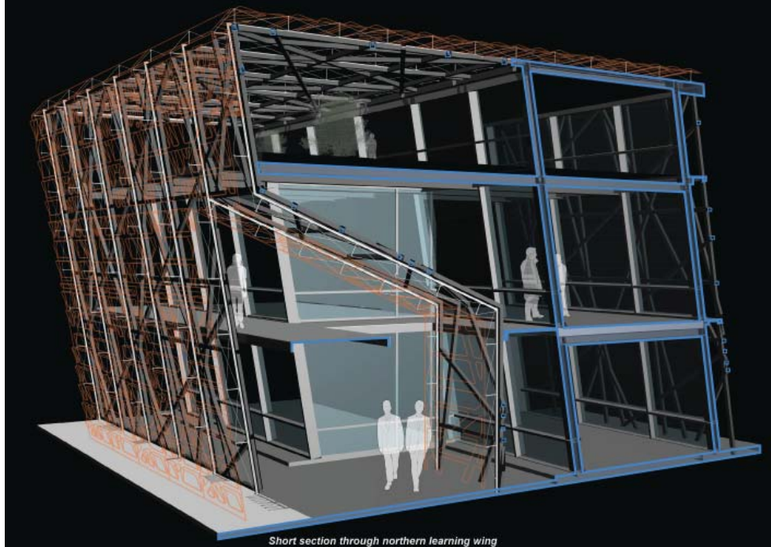


Presentation Board 02

Structured Performance **Phoenix High School** *for the performing arts*

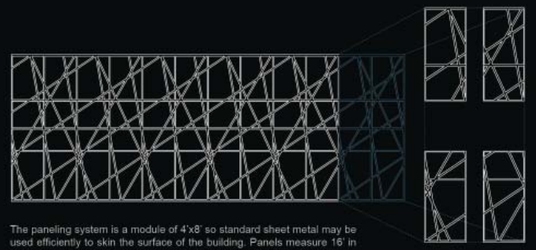


Short section through northern learning wing

Immersive view within northern learning wing

Immersive view within northern learning wing

The primary structure, at first glance, appears to be a chaotic web of tube steel. In actuality, the web consists of a standardized pattern made up of a system of only 4 unique panels. The panels are pre-manufactured in-house and trucked to the site where they are joined together on-site with a series of bolted slip joints. The redundancy of the structure allows for the system to take lateral and gravitational loads. Situating the structure on the exterior of the building allows for spaces to be free and re-arrangable for future developments.



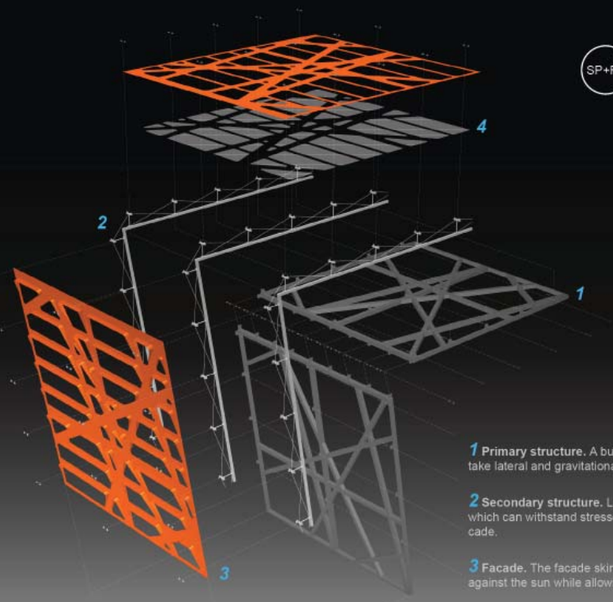
The paneling system is a module of 4'x8' so standard sheet metal may be used efficiently to skin the surface of the building. Panels measure 16' in length allowing for easy trucking to the site through the Phoenix area.

Skin
Conditioned space

Long section showing skin+space relationship

Presentation Board 03

Façade Performance **Phoenix High School** *for the performing arts*

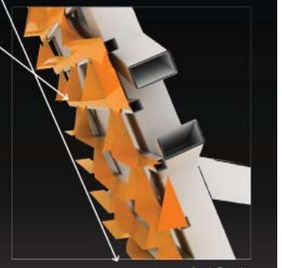


SU

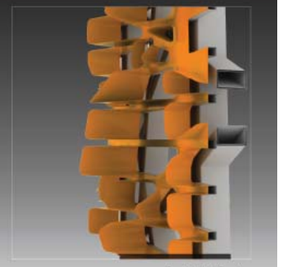
SP+FA

The skin is designed to prevent direct sun within the hottest times of the year - between the spring and fall equinoxes.

South facade treatments receive a horizontal louvered system while the east and west ends receive vertical.



South Facade



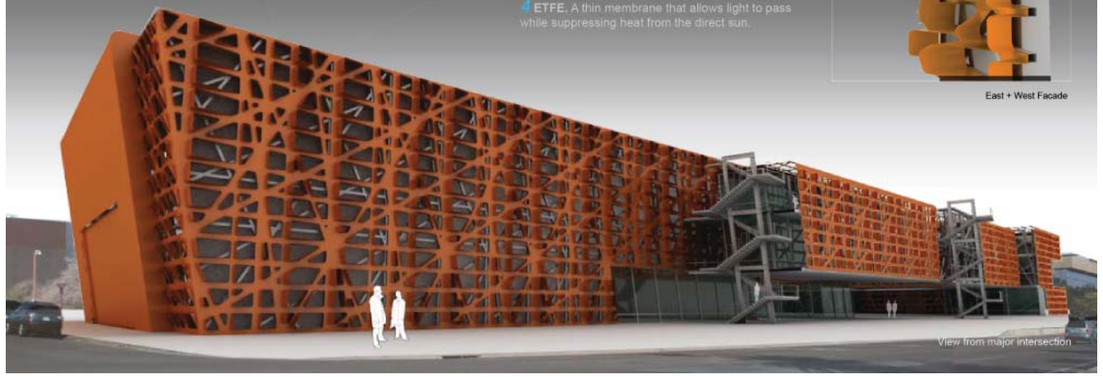
East + West Facade

1 Primary structure. A building skin designed to take lateral and gravitational loads.

2 Secondary structure. Lightweight structure which can withstand stresses developed in the facade.

3 Facade. The facade skin functions as a barrier against the sun while allowing air to flow freely.

4 ETFE. A thin membrane that allows light to pass while suppressing heat from the direct sun.



View from major intersection

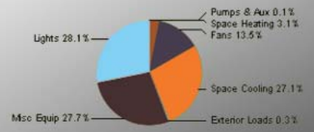
Presentation Board 04

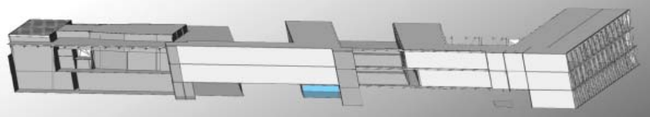
energy enhanced

model management

Estimated Energy & Cost Summary

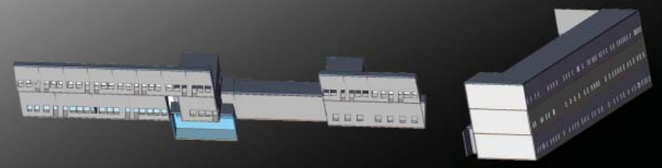
Annual Energy Cost	$73,631
Lifecycle* Cost	$1,002,858
Annual CO_2 Emissions	
Electric†	424.7 tons
Onsite Fuel	79.5 tons
Large SUV Equivalent	45.8 Large SUV's
Annual Energy	
Electric	662,689 kWh
Fuel	13,711 Therms
Annual Peak Electric Demand	346.8 kW
Lifecycle* Energy	
Electric	19,880,682 kWh
Fuel	411,315 Therms





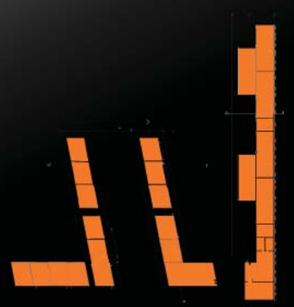
initial model

mid-quarter model

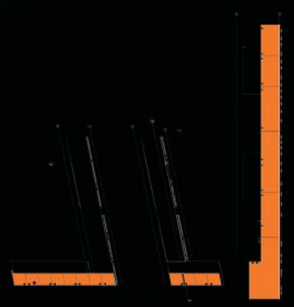


final model

first floor plan



second floor plan

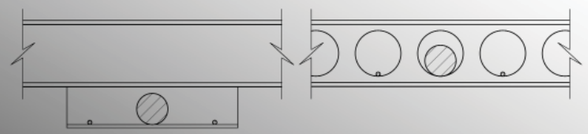


third floor plan

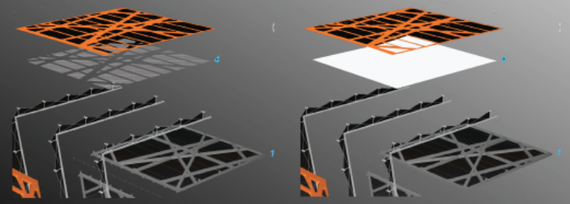
LEED Presentation Board 05

energy enhanced

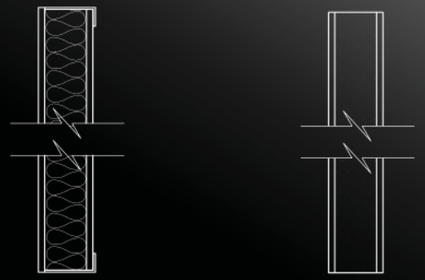
structural solutions



castellated beams



cool roof



structural insulated panel

LEED Gold Certification		47 Points
Sustainable Sites		8 Points
Prereq 1	Construction Activity Pollution Prevention	
Prereq 2	Environmental Site Assessment	
Credit 1	Site Selection	
Credit 2	Development Density & Community Connectivity	1
Credit 3	Brownfield Redevelopment	
Credit 4.1	Alternative Transportation: Public Transportation Access	1
Credit 4.2	Alternative Transportation: Bicycle Storage & Changing Rooms	1
Credit 4.3	Alternative Transportation: Low Emitting & Fuel Efficient Vehicles	
Credit 4.4	Alternative Transportation: Parking Capacity	1
Credit 5.1	Site Development: Protect or Restore Habitat	
Credit 5.2	Site Development: Maximize Open Space	
Credit 6.1	Stormwater Design: Quantity Control	
Credit 6.2	Stormwater Design: Quality Control	1
Credit 7.1	Heat Island Effect: Non-Roof	
Credit 7.2	Heat Island Effect: Roof	1
Credit 8	Light Pollution Reduction	1
Credit 9	Site Master Plan	
Credit 10	Joint Use Facilities	1
Water Efficiency		5 Points
Credit 1.1	Water Efficient Landscaping: Reduce by 50%	1
Credit 1.2	Water Efficient Landscaping: No Potable Water Use or Irrigation	
Credit 2	Innovative Wastewater Technologies	
Credit 3.1	Water Use Reduction: 20% Reduction	1
Credit 3.2	Water Use Reduction: 30% Reduction	1
Credit 3.3	Water Use Reduction: 40% Reduction	1
Credit 4	Process Water Use Reduction: 20%	1
Energy and Atmosphere		8 Points
Prereq 1	Fundamental Commissioning of the Building Energy System	
Prereq 2	Minimum Energy Performance	
Prereq 3	Fundamental Refrigerant Management	
Credit 1	Optimize Energy Performance	5
Credit 2	On-Site Renewable Energy	1
Credit 3	Enhance Commissioning	
Credit 4	Enhance Refrigerant Management	1
Credit 5	Measurement & Verification	1
Credit 6	Green Power	
Materials & Resources		7 Points
Prereq 1	Storage & Collection of Recyclables	
Credit 1.1	Building Reuse: Maintain 75% of Existing Walls & Floors	
Credit 1.2	Building Reuse: Maintain 95% of Existing Walls & Floors	
Credit 1.3	Building Reuse: Maintain 50% of Interior Non-Structural	
Credit 2.1	Construction Waste Management: Diver 50% From Disposal	1
Credit 2.2	Construction Waste Management: Divert 75% From Disposal	1
Credit 3.1	Materials Reuse: 5%	
Credit 3.2	Materials Reuse: 10%	
Credit 4.1	Recycled Content: 10%	1
Credit 4.2	Recycled Content: 20%	1
Credit 5.1	Regional Materials: 10% Extracted, Processed & Manufactured Regionally	
Credit 5.2	Regional Materials: 20% Extracted, Processed & Manufactured Regionally	1
Credit 6	Rapidly Renewable Materials	1
Credit 7	Certified Wood	1
Indoor Environmental Quality		15 Points
Prereq 1	Minimum IAQ Performance	
Prereq 2	Environmental Tobacco Smoke (ETS) Control	
Credit 1	Outdoor Air Delivery Monitoring	
Credit 2	Increased Ventilation	1
Credit 3.1	Construction IAQ Management Plan: During Construction	1
Credit 3.2	Construction IAQ Management Plan: Before Occupancy	1
Credit 4	Low-Emitting Materials	1
Credit 5	Indoor Chemical & Pollutant Source Control	1
Credit 6.1	Controllability of Systems: Lighting	1
Credit 6.2	Controllability of Systems: Thermal Comfort	1
Credit 7.1	Thermal Comfort: Design	1
Credit 7.2	Thermal Comfort: Verification	1
Credit 8.1	Daylight & Views: Daylight 75% of Spaces	1
Credit 8.2	Daylight & Views: Views for 90% of Spaces	1
Credit 9	Enhanced Acoustical Performance	1
Credit 10	Mold Prevention	1
Innovation & Design Process		4 Points
Credit 1	Innovation in Design	1
Credit 1 Opt.	Low Impact Cleanings and Maintenance: Equipment Policy	1
Credit 2	LEED Accredited Professional	1
Credit 3	The School as a Teaching Tool	

Additional Methods to Structurally Improve the Environmental Impact

specify recycled material content in CDs

integrate water collection into exterior skin

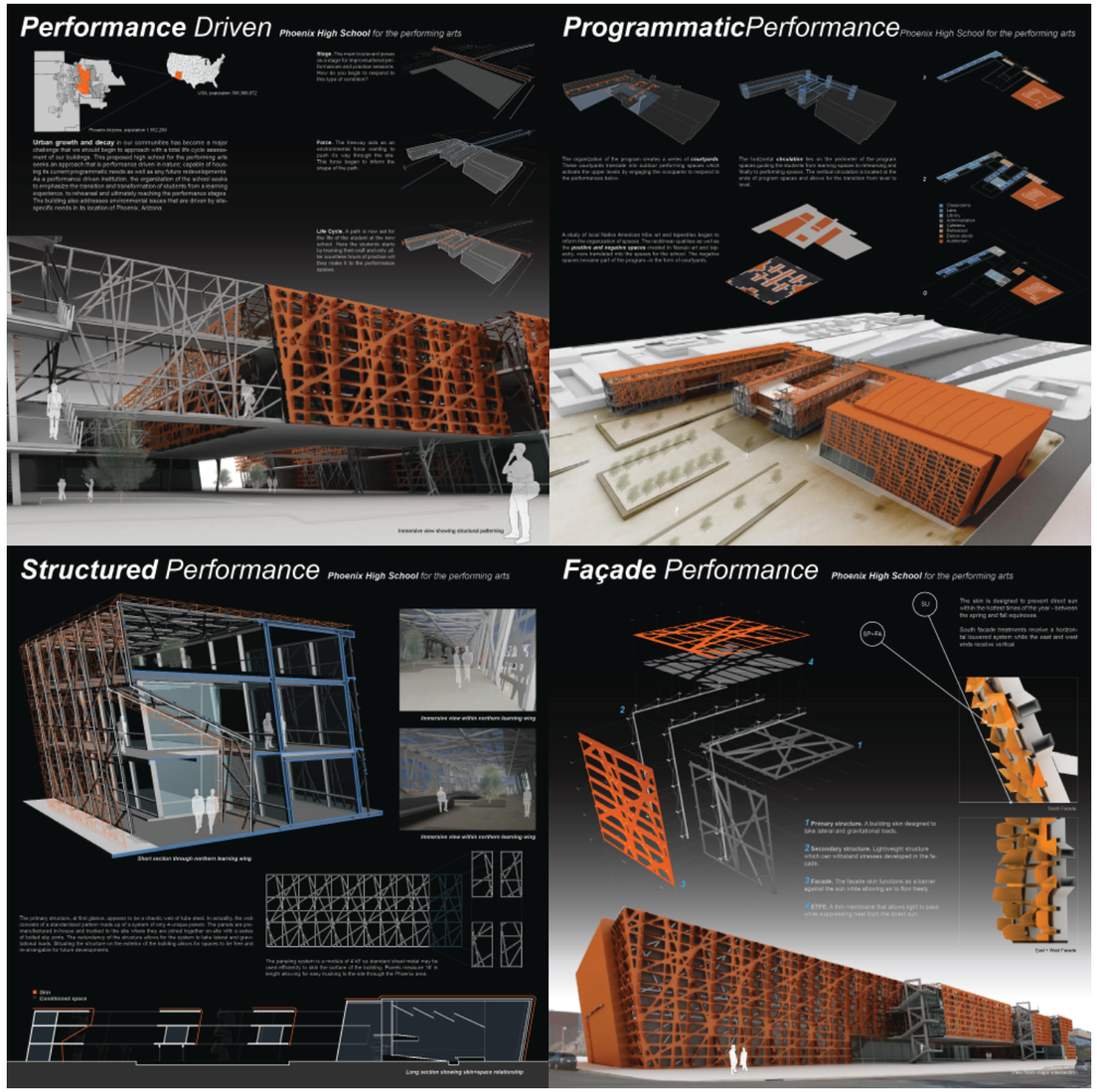
use structure as a finish

design connections giving preference to bolts over welds

limit breaks in structural components

create typical cuts and repetitive details

LEED Presentation Board 06



Performance Driven

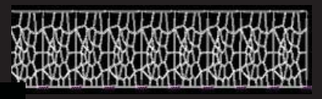
Performance:
Performance can be a presentation of an artistic work to an audience or the effectiveness in which something functions, operates, or behaves. Why can't it be both? This High School for the Performing Arts is not only meant for performances, but also is a performance in it of itself. The building is meant to house the transition of performing students that attend the school to learn, rehearse, and ultimately perform. This idea became the basis for the programmatic organization of the school. The transition the students go through in school becomes the circulation path on the site that flows from private to public as the students learn, rehearse, and perform for the community.

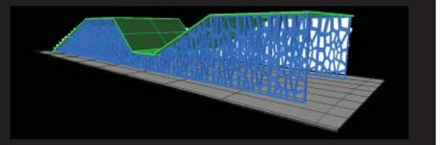
Site:
The site is Deck Park, just north of downtown Phoenix, Arizona and next to the Phoenix Central Library located in the art district of the city. The site is situated above Freeway 10 and can be seen when driving on the freeway. Considering that Phoenix has extreme climatic conditions, it is preferable that the building would be passively cooled and heated to reduce the use of mechanical systems and thus, reduce the impact on the environment. The site is currently not in much use. With the introduction of a High School for the Performing Arts on this site, we will bring a sense of community back to the city. By developing this area that otherwise would be neglected, we can avoid the development of green lands and help preserve the natural
environment.

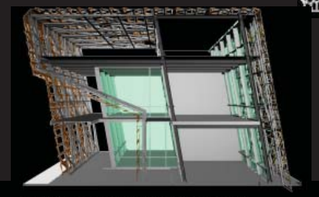
Organization:
After studying the art and tapestry of the Navajo, a Native American group of the area, we observed the qualities of the positive and negative spaces created by their forms. With this, we allowed the programmatic spaces to be strategically arranged so that the negative spaces created become a part of the program. The result is a series of courtyards that are the focus and heart of the school and also help connect the Performing Arts Center, the school, and the park. The program of the building consists of learning, rehearsing, and performing spaces with support spaces for each of them. By creating a gradient from learning to performing, spaces are organized in a sense that allows the horizontal and vertical circulation to guide the occupants to where they need to be.

Skin + Structure:
The primary structure, although at first glance, appears as a chaotic web of steel members, consists of a series of standardized panels of steel tubes. Each panel is made up of a hidden cross member and infill elements that are added for additional support as well as complexity. The structure's redundancy allows the members to be smaller and it helps minimize the need for lateral support. The structure panels inform the skin and create certain openings in their intersection and overlapping in order to control sunlight. The skin itself consists of a series of louvers, or fins, that are oriented either vertically or horizontally depending on the orientation. The skin is attached to the primary structure through a series of smaller members that are placed across the primary structure. The building's south and north walls tilt down towards the south at 10 degrees in order to prevent direct summer and solstice sunlight from the south and to maximize the amount of indirect north light that come into the classrooms and lab spaces.

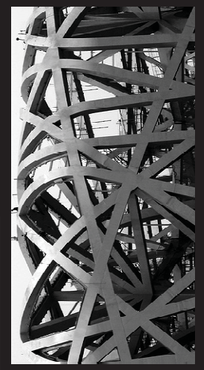
Structural Process

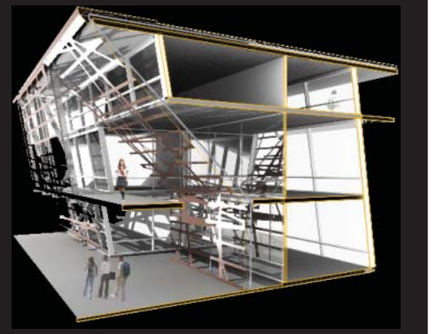


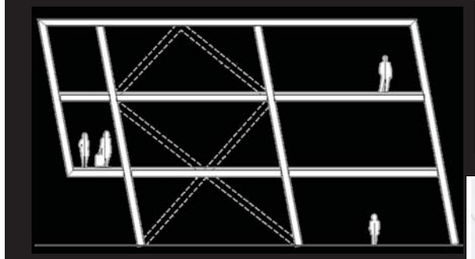


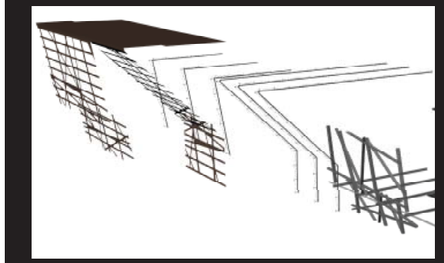


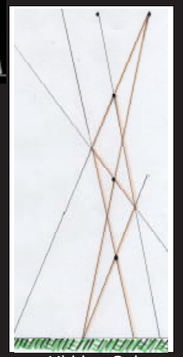
SECTION THROUGH THE CLASSROOM BAR



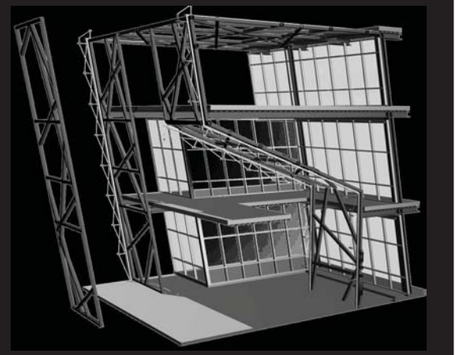




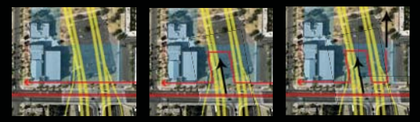




Hidden Column

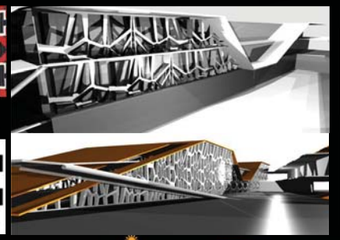


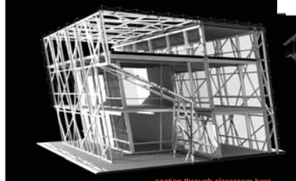
Design Process



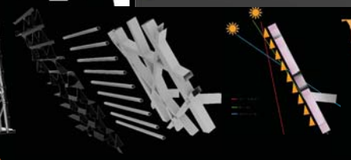
section through classroom bars

navajo art and tapestry positive + negative qualities informed the spatial relationships.





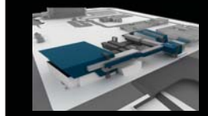
section through classroom bars

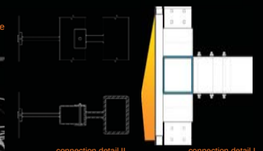


skin + primary + secondary structure

south-facing condition

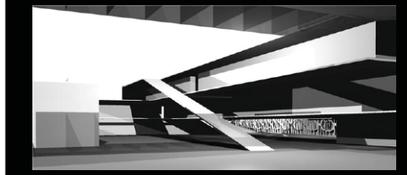
east/ west-facing condition

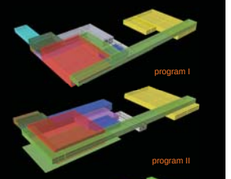




connection detail II

connection detail I





program I

program II

program III

program IV

program V

program VI

program VII

courtyard spaces

skin

horizontal circulation I

horizontal circulation II

vertical circulation

plans

David Carmona
As an ARCE, the interaction of professionals was an unexpected and appreciated addition to this project. I enjoyed the experience because it was the first time I had a member of industry actively change/interact/critique my school work. This was possibly because of the models the architects created – visually critiquing is far easier then critiquing structural calculations (but this only occurred at the much later stages of the project). Although the interactions were an interesting experience, I feel that their recommendations towards development were very limiting for structural engineers but beneficial towards the architectural design (same argument, structure was only discussed when visible on the boards). In person reviews are far more influential on the design. Talking in person with an individual removes the uncertainties, hesitations, and confusions of a web conference. However, fishbowl reviews are somewhat of a waste of time. The review is beneficial but since everyone is waiting at the bowl, the entire day is wasted just sitting there instead of working on our project. Overall, I think the interaction was well set up.

Aramis Arciga
The top three things that I learned in this studio experience include working efficiently with a group, the application of structural concepts in the design process, and the benefits of using technology for the development and presentation of a project. Some of the things that contributed to this learning experience include the involvement of professors, the field trips to the site and related projects and the involvement of professionals in our design process. Three things that I expected from this experience and did not learn include the CM aspect of the project, the different means to reduce costs more effectively and the involvement of other fields. By working in this interdisciplinary group I feel that we all greatly learned from each other. We were able to put aside our differences and work together as a team to achieve our project goals. Working with the Architectural Engineers helped us develop our structure so that both the architects and the engineers were content with the outcomes. I think this experience is unique here at Cal Poly and I feel other majors should also collaborate with different disciplines. This is something that will benefit us in the future when we get into the workforce and have to work with many different fields of study.

The participation of the different range of professionals greatly assisted our group to further develop our project. In person reviews were probably the best due to the ease of communication of our concepts and ideas. Through their critiques and suggestions we were able to make changes and take into consideration issues that we would of never have thought of. I feel that the web conferencing was beneficial but it often took to much time and made it difficult to communicate through the system. Web conferencing is a great tool but just needs a little bit more work to communicate easier. Visiting the actual firms was probably one of the best experiences that I enjoyed about this class. Having to do the presentation at a firm with different professionals makes you realize the importance of the project.

Christopher Brazell
I enjoyed the opportunity to collaborate with the different disciplines. I learned how much information is necessary to convey the idea and what details are important. Communication regarding structures is usually dumbed down when talking to a layman but the topic can, to a degree, be more effectively communicated to someone in an associated field with more complexity. The degree that that topic is discussed was an experience in communication, even when both parties have a background in the topic there is a time when the information is no longer pertinent or is too complex.

It was helpful getting little pushes and direction to move on when a project is ever evolving. There were times when an evolution may only mean moving a column rather than even added one, subtracting one or changing tributary areas. The uncertainty of these changes created a possibility of wasting time on unused calculations. The changes were rarely large enough to merit this apprehension.

The project expanded my abilities to work in groups and communicate effectively. As cumbersome as the many presentations were, they were beneficial to learning to communicate about a project where the reviewers do not already have an intimate knowledge of it. I learned that conveying details as they relate to the project as a whole is a more complex task then I had anticipated.

Paulina Mendoza
From this studio experience I learned what it takes to design a school and an auditorium, I learned using digital tools more, and I also learned how to work with architectural engineers. Before this studio, I had never designed a school and an auditorium. Because the school was a Performing Arts School, I learned of the different and special considerations that must be taken into account. The field trips that we took to Phoenix and Los Angeles also helped me understand the way a school and auditorium must be organized. Before this class, I knew how to use digital programs but thanks to the help of my teammates, I learned new tricks and I also know how to use them better. I had never worked with architectural engineers before and I feel that after this class, I am more prepared to work with other architectural engineers in the future. I expected to learn more about designing innovative structures, maybe learning more about how to design a sustainable school, and I also expected to learn how to use the laser cutter and the CNC router. Since the beginning of the class, one of the things I wanted to experiment with was with an innovative structure. I feel that our architectural engineers weren't as adventurous as I wished they should have been. I also feel that since we had in our team a student who was LEED Certified, I would have learned more about sustainability. Since we never had time to sit for a long period of time and discuss the sustainable aspects that our school could have, I didn't really learn much about it. I also expected that from taking this class that I would learn how to use the laser cutter and the CNC router. Since our team had a student who had a lot of knowledge using both machines, he was always in charge of the tasks that required using them. I wished I would have asked him more questions about how to use them and that I would have been more involved with this. I think that to improve the learning for future studios, it would have been very beneficial to have the resources to build our detail models with real materials. Also, I think it would have been very beneficial to have learned about the building process. Since the beginning we were told that construction management students were going to join our teams but it never happened. This would have helped us learn the construction process.

From being in an interdisciplinary team, I learned how to interact and communicate with architectural engineers. If I would have only been in a team with architects or by myself, I would have not learned what the expectations of architectural engineers are or how they think.

Matt Moran
I came into this studio with the preconceived idea that I was better off working alone. My goal for the studio was to test this idea and try to prove it wrong. My learning experience came in the collaborative process of the team and learning new skills that will benefit me in real world situations. Working with the ARCE students gave me an insight to structure and structural engineers I have not been exposed to. Also, being able to see a project through in its entirety will benefit me greatly when working on my own thesis project next year. I now know what is possible and what I am capable of.

I learned how to develop a façade, which is functional and structural. Working with the ARCEs made me realize that façades have to have a structural aspect to them or a structural aspect they are dependent on. Façades are no longer just 'pretty,' but now functional.

In person reviews are definitely the most helpful type of professional participation. Web conferencing had to be the most disappointing type. I think the assistance and presence of professionals brings the best out of everybody; in the sense that they don't want to look bad in front of a possible future employer. Web conferencing didn't seem to work correctly and felt rushed. Either the professional is busy, the set-up experiences technical problems, or the professional at times seem pre-occupied with other things in the office.

team04

Interlacing and Transformation

Neel Desai
Reid Nystrom
Alessandro Ortiz
Shani Sparks
Angel Chan
Torrey Dickinson

Neel Desai
Glendora, CA

During the design process the team encouraged each other to identified comparable and conflicting issues, concerns and interested which reflected the direction in design. Though there were many obstacles in the road, we eventually came together to produce a design worth being proud of and a concept to possibly further develop.

Reid Nystrom
Rescue, CA

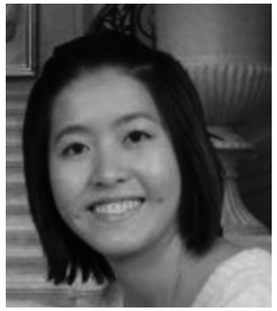
One integral design process fed by four totally different design styles; our open design forum allowed many ideas to be brought to table by each designer. Deeper into the design each member was able to settle into their areas of expertise, streamlining our process and strengthening our design.

Alessandro Ortiz
Santa Barbara, CA

Our initial parti model was praised, we were told not to mess it up, and then we stalled for some time before progressing the design further. It was a difficult situation.

Shani Sparks
San Diego, CA

Learning how to work with three other architects, and two engineers made it an interesting design process. We all had the same goal, but very different working styles, which made it difficult in the beginning. Once we knew each other strengths and interests the project was able to come together.



Angel Chan
Sacramento, CA

It was a fascinating experience working with architects. I learned a lot about their job and what they expect from me as well.

Torrey Dickinson
Buena Park, CA

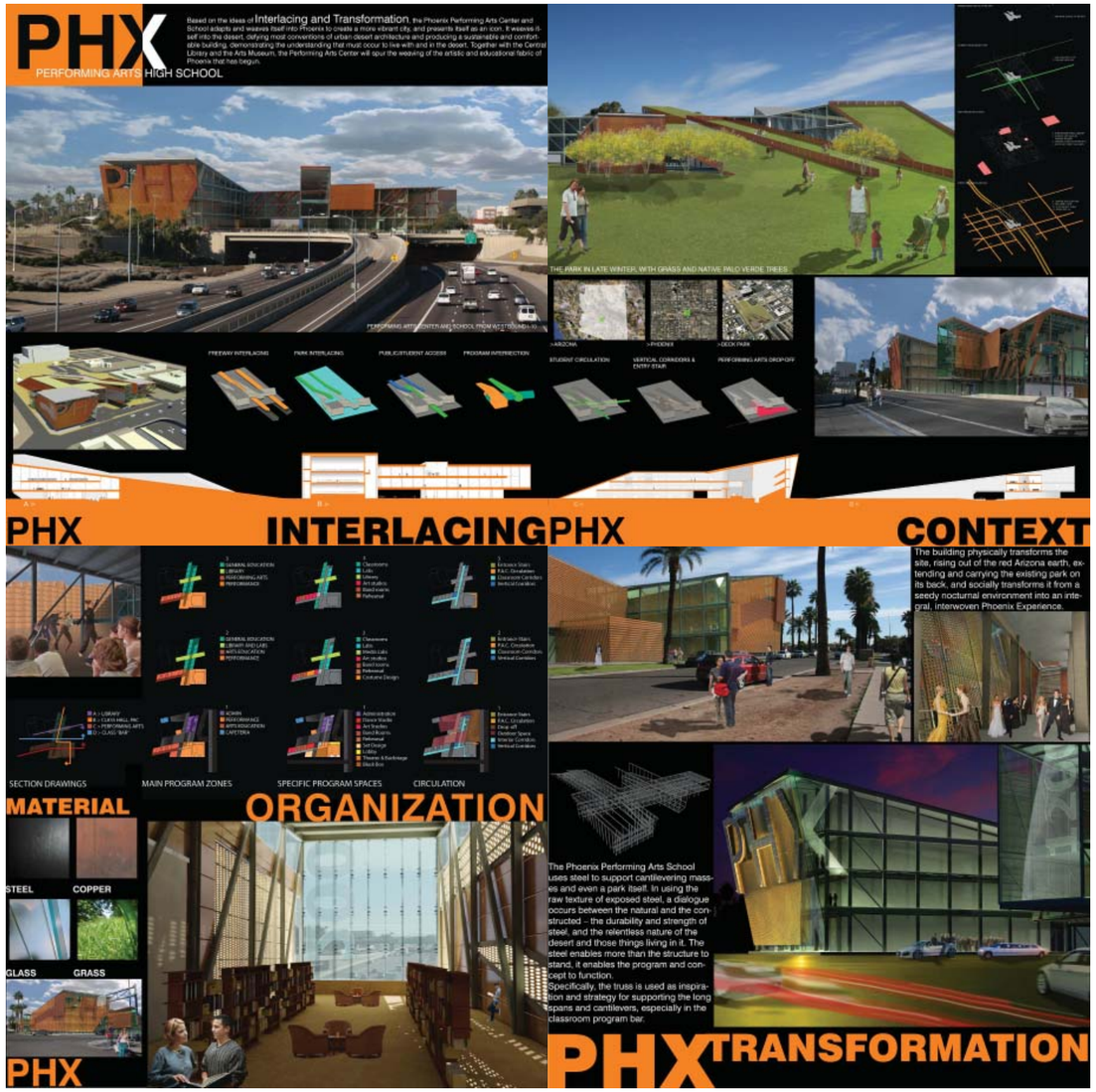
The structural design goal was to implement a system that complimented and enhanced the architectural concept of the high school. A strong and directional truss system was used to bring out the strength and dominance of the lines and bars of the classroom program. An interweaving floor framing system was used to establish the interlacing goal of the high school design.

Presentation Board 01

Presentation Board 02

Presentation Board 03

Presentation Board 04



Presentation Board Summary

Interlacing and Transformation in Phoenix

Using the ideas of Interlacing and Transformation, the Phoenix Performing Arts Center and High School adapts to its site without being submissive, transforms the social environment to benefit the people of Phoenix, Arizona and works to weave the building into the desert climate.

The building physically transforms the site, rising out of the red Arizona earth, extending and carrying the existing public park on its back, and socially transforms it from a seedy nocturnal environment into an integral, interwoven part of the Phoenix arts scene, with the nearby midtown attractions of the Art Museum and the smaller galleries in the Roosevelt St. neighborhood. The Performing Arts Center is in a prime position, and will be the brightest point of the nighttime art walk, spurring the interlacing of the artistic and educational fabric of Phoenix. It will bolster the connection of downtown and midtown Phoenix, a connection facilitated and encouraged by the development of a mass transit rail line.

The building weaves itself into Phoenix, creating a more vibrant city, presenting itself as an icon visible from the I-10 freeway. It weaves itself into the desert, defying most conventions of urban desert architecture, producing a sustainable and comfortable building, demonstrating the understanding that must occur for man to exist with the desert – even a harsh climate can be ruined by thoughtless construction.

The Phoenix Performing Arts School uses steel to support cantilevering masses and even a park itself. In using the raw texture of exposed steel, a dialogue occurs between the natural and the constructed – the durability and strength of steel, and the relentless nature of the desert and those things living in it. The steel enables more than the structure to stand, it enables the program and concept to function.

The education at the school will encourage art, music, and performance, with studios and band rooms, as well as private rehearsal rooms. A two-story bar of classrooms and laboratories runs north-south, connecting with the performance wing, ensuring a well-rounded education. The entry stairs lead up to the library and media labs, opening to a profound view of the west, beyond the freeway.

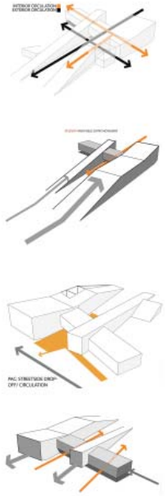
There is a sunken plaza between the park and the education bar, encouraging impromptu class activities and performances. Beneath the library and the entrance stairs is an outdoor stage, shaded from the sun, but open to the breeze. The plaza continues toward the cafeteria underneath a shade structure, drawing students into the plaza during their breaks. The park on the roof is an extension of the classroom and allows students to connect to the local environment.

Within the Performing Arts Center are a 600 seat theater with orchestra pit, a black box for smaller performances, and a dance studio. To encourage students to become involved in all the aspects of the performing arts, there will be costume and set design studios. Every student of the Phoenix Performing Arts School will have the opportunity to take part in productions that will be a focus of Phoenix nightlife.

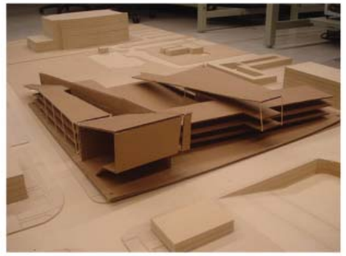
DESIGN PROCESS

[INTERLACING]

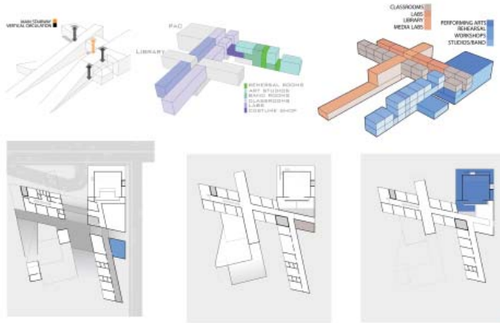
CONCEPT

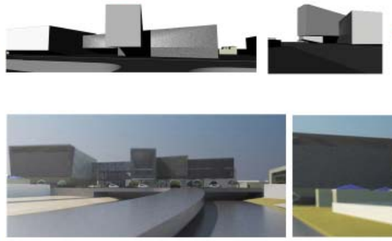


PHYSICAL MODELS

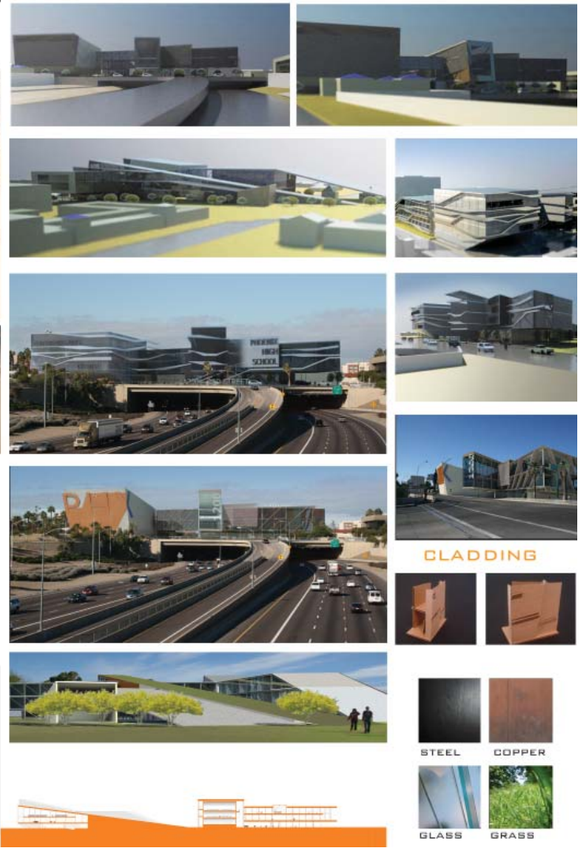


PROGRAM





DIGITAL MODEL

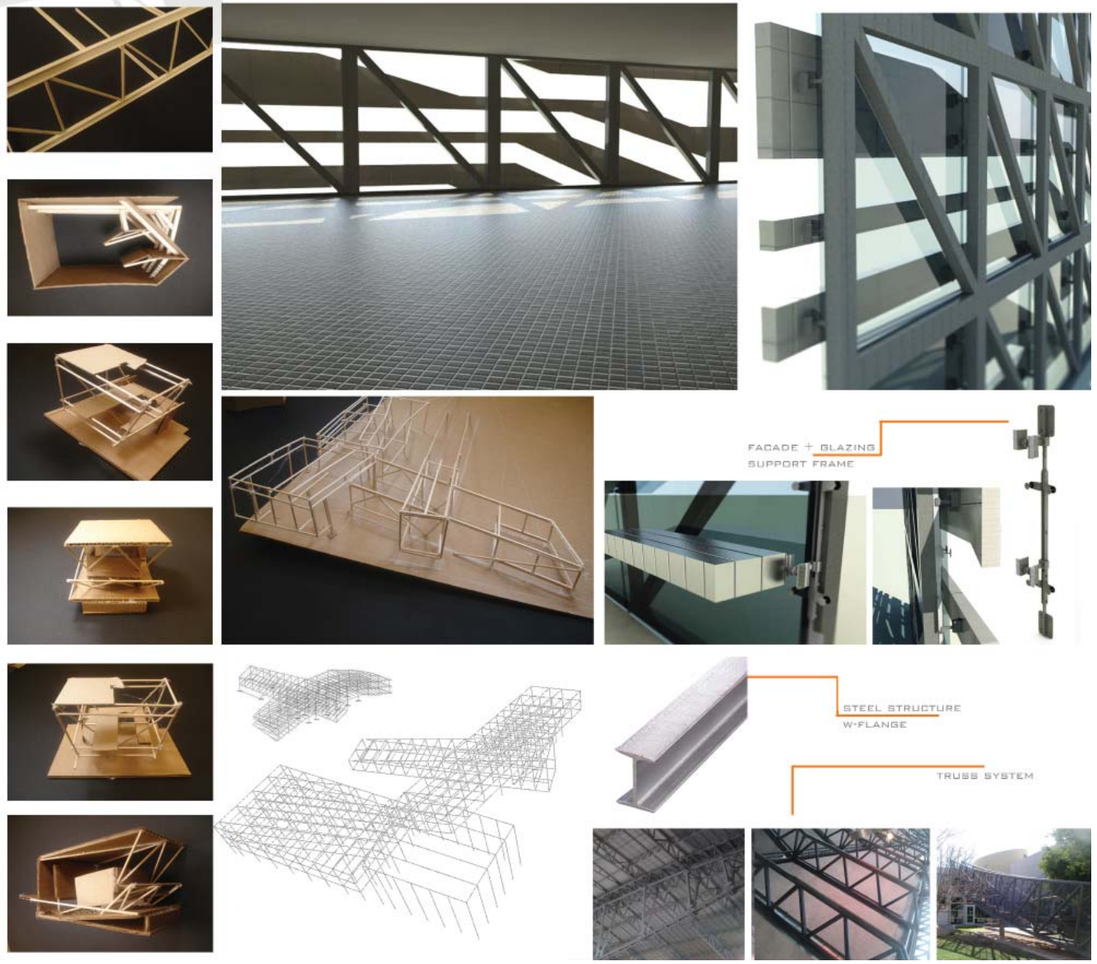


CLADDING

STEEL COPPER

GLASS GRASS

STRUCTURE PROCESS

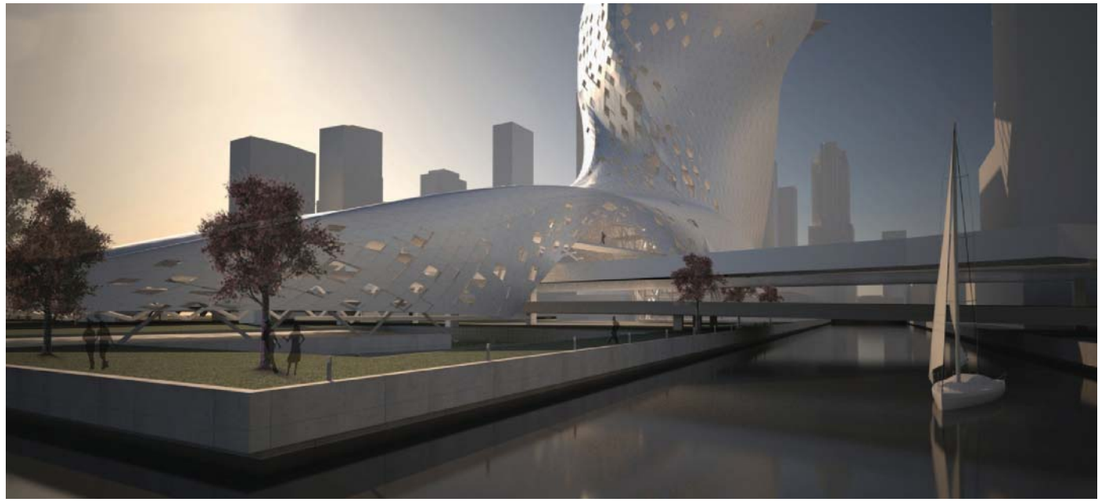


Neel Desai

As I enter the last few years of my stint at Cal Poly I wanted to leave with all the fundamental resources Cal Poly Architecture has to offer. I entered the interdisciplinary studio with high anticipations considering, not only do we get to work with architecture engineering students but also receive the expertise of four of Cal Poly's most highly respected professors. I left the studio with skills needed to work with people/students within the field of architecture as well as obtaining three very distinct philosophies of design from Thomas Fowler, Mark Cabrinha, James Doerfler, and Kevin Dong. My winter and spring quarter of 2009 in my opinion, was far more educational than an opportunity to study aboard and of course more importantly, cheaper.

We spent a lot of times within our groups designing and then translated the information into a structural system, constantly verifying with engineering students. This allowed the team to substantiate whether or not a concept was conceivable. Personally this process was very beneficial to my designing process which forced me to constantly reflect how a scheme/concept car be built. This was further reinforced with the visits made by Buro Happold. Each team participated in private consultations with actual engineers. Web conferences were made available, where each team presented design processes on the days the engineers weren't able to make it to Cal Poly. The idea of an environment that forces us as students to constantly deliberate with architecture students, engineering students and professional has better prepared me to face the professional world.

Throughout the two quarters spent on the project, we were always been pushed by our professors to excel and try new and different strategies. One of those strategies was an actual site visit to Phoenix, Arizona which was one of the most beneficial educational tools delivered. We all spend a five days exploring the city of Phoenix to help us understand the context of our project.
Not every team is going to be perfect and of course there were moments of failure among us. I believe this was an aspect I am grateful I went through. I was made aware of how to deal with five other personalities which at times were conflicting. These conflicting ideas and thoughts will become present within the professional world and I have been better prepared due to this. Where we failed as a team as well as succeeded, was where I was able to learn the most.



2009/2010 Re-Ligare Institute

The site for the project is located in Chicago, IL,
on the waterfront.

team01

urban fluidity

Laura Mendoza
Pete Austin
Marina Bourderonnet
Walt Busch
Justin Schwaiger

Laura Mendoza
El Centro, CA

As a 4th year Architecture student, I had never had the opportunity of working in a group. Having a twin sister who took this studio the year before, seeing how great her experience was and how much she learned, was what convinced me to take this studio. This studio proved to be more challenging than I imagined.

Walt Busch
Seattle, WA

Pete Austin
Lodi, CA

Justin Schwaiger
Newbury Park, CA

I enrolled at Cal Poly as a construction management major, and switched to architectural engineering two years later. I am excited about entering the structural engineering profession after I get my master's degree because I love architecture, structures, and the art of designing both with their context in mind.

Marina Bourderonnet
Paris, FR

French exchange student at Cal Poly for a year. After a year of arts formation, I have studied architecture for 4 years now. I'm also really passionate about photography and digital technologies. I try to combine all my passions together to express me as much as possible.

Urban Fluidity

MIND AND BODY

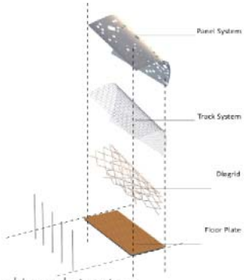
Chicago Mixed Use High-rise

SOLID AND LIQUID

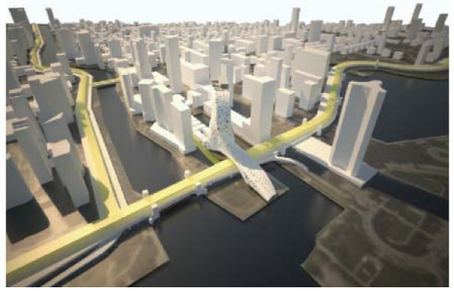
Steel is a material usually used in its rigid solid form. The goal of this project is to not only emphasize steel's rigid quality, but also its fluidity. Steel's fluidity is used to express a more natural movement and connection to nature. Where the project connects to the city, steel's rigidity is emphasized.

We rarely get a chance to experience steel in its multiple states. The rigidity of steel allows for higher, stronger and lighter structures. Consequently, our perception of steel is shaped by the state at which we experience it, solid. Once steel is cast, it permanently replicates whatever molded it becoming locked into a static existence. But steel at one time must be a liquid because if not it wouldn't be able to be cast and extruded into columns, beams or girders.

Mind and body are dependent on each other to work properly. The human body is rendered useless without mind, while mind can not act without the physical body. Steel's equivalent of this dependancy is solid and liquid; we're dependent on steel's liquid quality. At the same time we're dependent on its rigid strength.



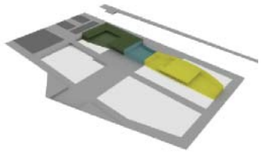
skin and structure



CONTINUOUS LANDSCAPE

Partition of the building

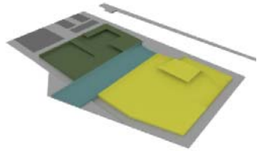
- lobby
- exhibition
- school



Partition of the site

use the partition of the building to subdivide the site in different areas.

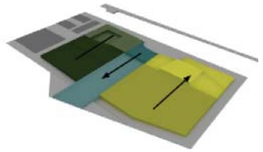
- public area
- cultural space
- education



Continuity of spaces

space can continue from the inside to the outside or from the inside to the inside.

- urban plaza
- art gallery
- recreation park



Presentation Board 01

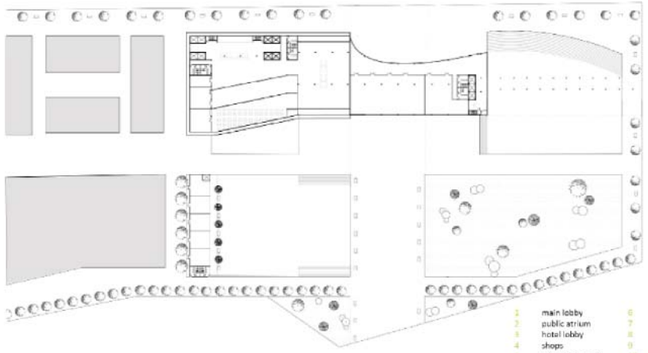
Fourth floor

Twenty-first floor

Fifth floor

Twenty-fourth floor

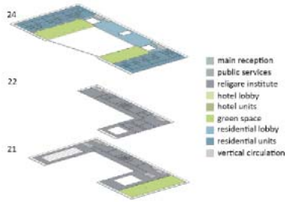
Ground plan

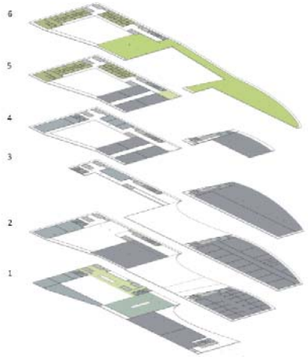


STATIC AND DYNAMIC

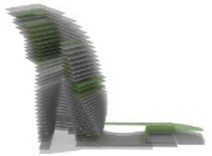
Starting at the uper section of the tower, there is a gradation from public to private. The upper section being private residence to the lower extension at the park being the public institute. The gesture of the building is suggesting the activity within. The more rigid vertical tower portion has strict guidelines on how activities function, while the lower looser extension promotes more interaction.

PROGRAMMATIC REPARTITION

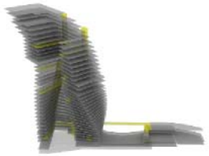




BUILDING COMPOSITION

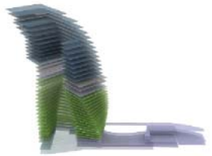


green space



circulation

atrium

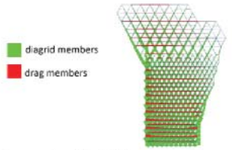


program

Presentation Board 02

FRAMING ELEVATION

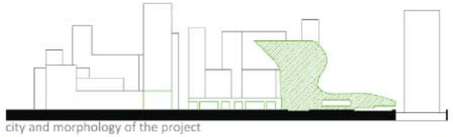
MEMBER FORCES



Forces experienced by diagrid members and drag members during wind and gravity loading.
Diagrid system distributes forces equally, relieving stress concentrations.


inside view from the coffee

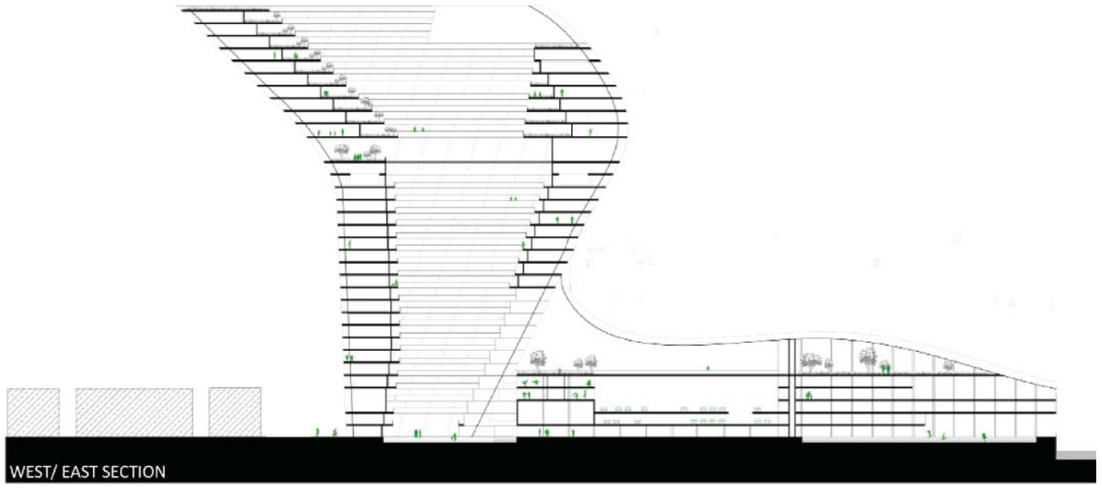

atrium


city and morphology of the project

ARCHITECTURAL EXPERIENCES

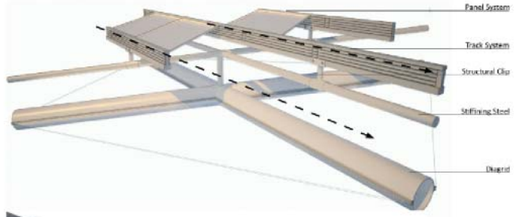
The atrium is the main organizing element within the tower. All the floor planes wrap around the atrium, creating a void that connects every space within the tower. This allows people to experience the true size and scale of the tower. The open atrium also allows for a level of transparency between interior activities and exterior activities. Facing the south, it allows for heating in the winter, lighting year round and the potential to ventilate the entire building.

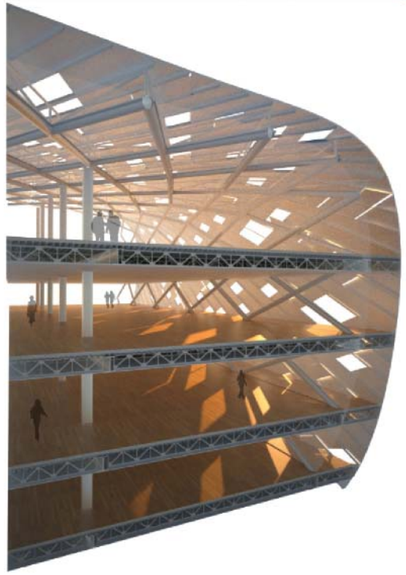

inside view from the offices


WEST/ EAST SECTION

Presentation Board 03

CONNECTION ROOF DIAGRID AND TRACK



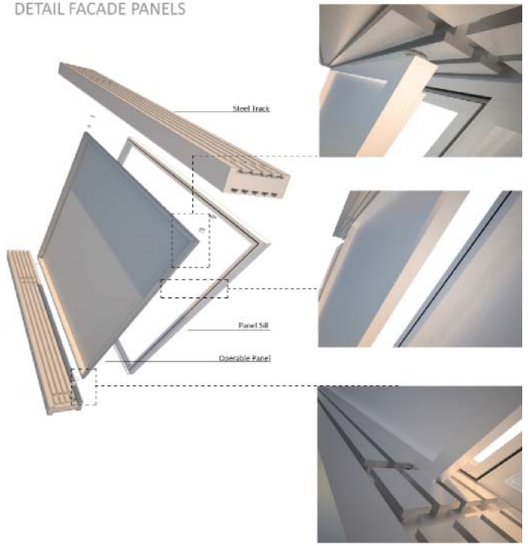


TO ENGAGE THE INDIVIDUAL

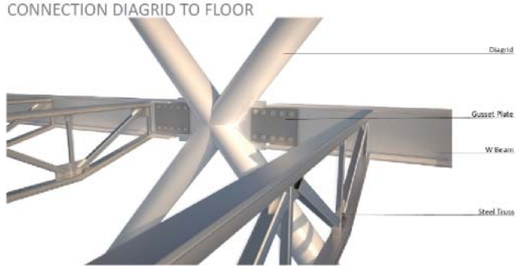
A rigid system of steel can also be fluid . The ability to interact with a sliding facade creates potential for change. As panels are moved throughout the day, the building takes on a more fluid or malleable characteristic. This fluidity is related to activities within the tower with respect to the time of day. During the day, there will be a gradation from open to closed; starting at the top with the residential to the bottom at the institute. Inversely at night, the institute will be closed and the residential will become open. The shift of mostly open to closed moves from top to bottom from day to night.

As people slide panels to adapt the space to desired needs, they have an impact on the overall idea of the building. Connecting an individual act to the greater society.

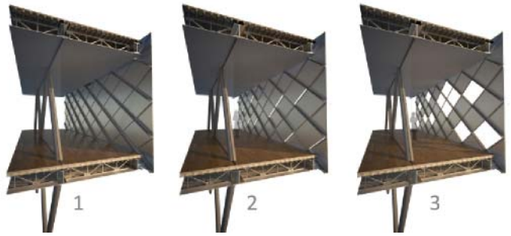
DETAIL FACADE PANELS



CONNECTION DIAGRID TO FLOOR



FACADE CONFIGURATION



Presentation Board 04

Presentation Board Summary

URBAN FLUIDITY

The main concept of this project follows the idea of how an element can change its state and be simultaneously unique and multiple.

SOLID AND LIQUID
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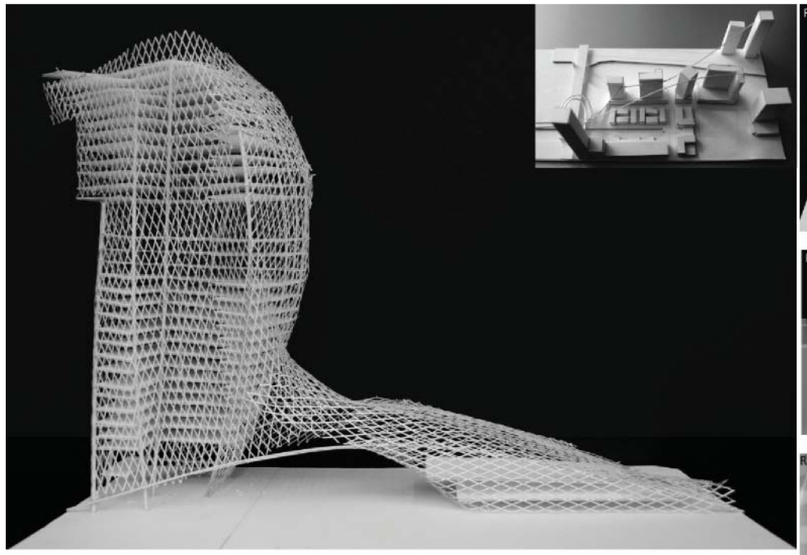
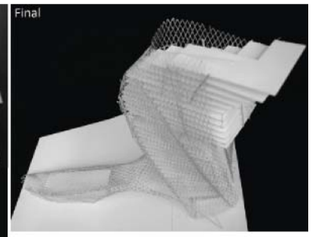
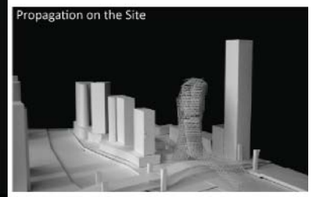
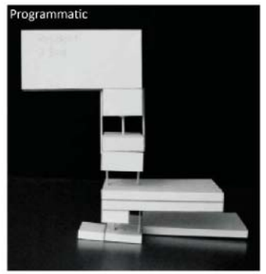
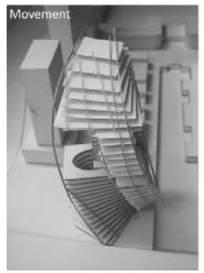
ARCHITECTURAL PROCESS



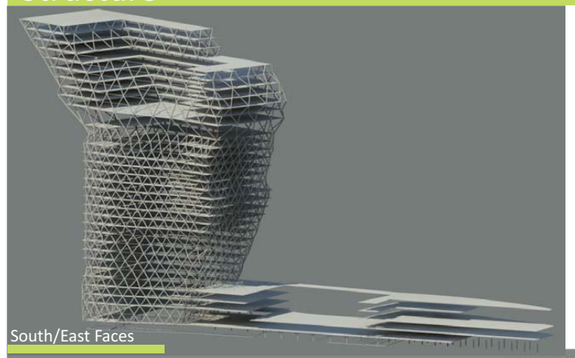


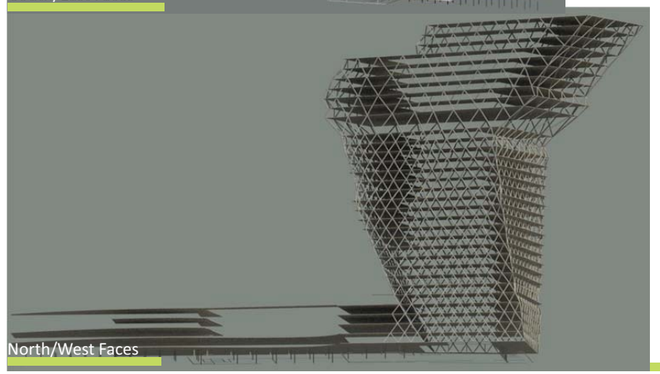


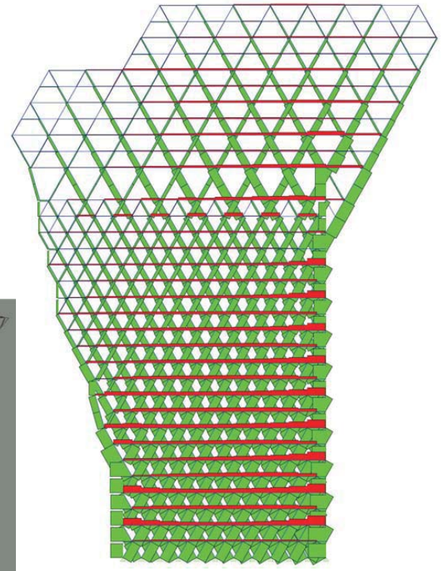




Structure







Wind and Gravity Axial
Force Diagram

Laura Mendoza
The interdisciplinary design studio has taught me how challenging and stressful it is to work on an actual competition and in a group. Working with structural engineers for the first time has taught me to better interact and communicate with people in a different discipline. It has also given me a glimpse of how real life work will be like. The unique part of this experience has definitely been working with a team of four people, who have their own unique skills and ideas, and getting to know them. The most helpful moments throughout this experience were when we all worked as a group, the much needed critiques, and visiting the actual site of our project.

I would describe this experience as difficult, but unique at the same time. Communication, understanding, and compromise are definitely important things to keep in mind in order to achieve a successful project. I describe this experience as difficult because many problems will arise along the way, but that's when you learn the most, through those difficult circumstances. You learn about problem solving as well as the people you're working with. This interdisciplinary design studio helps you gain valuable tools that you will surely apply in the future.

Pete Austin
The interdisciplinary studio was insightful in two main ways. It's a more realistic way of thinking about architecture and it exposes the benefits and disadvantages of team work. I learned early on in this studio that collaboration between engineers and architects is vital to running a successful project. Early collaboration prevents any major problems from accruing in the late stages of the project, which in turn eliminates any major changes to a project saving time and money for the architect, engineer and client. A sustained level of collaboration throughout the entire project allows architects and engineers to think creatively on how to solve problems. Architects and engineers each have a set of skills that the other ones doesn't creative solutions are achieved by combining these technical and abstract skills.

Team work has advantages and disadvantages. Working in a team allows many different people with individual skills to work more effectively. For example, some group members are good at plans and diagrams while others are good a rendering and presentation. Disadvantages are mostly personal - in a typical studio we work individually. We only have to rely on ourselves to finish a project efficiently and effectively. In a group setting we have to rely on others and I think for the architecture students that are not used to this it can become very stressful at time not having complete control over a project. But in the end, I realized not having complete control allows us the put our effort in one area and complete what you are working on better than you would have individually.

Marina Bourderonnet
I learned in this class to work in a big team (5 people), with American students (first time for me) and in collaboration with engineers. It was also the first competition I did and I really enjoyed that. This experience was unique because it was a two quarter studio working on the same project.

The particular experiences most helpful for my learning were when we had guests come for reviews, learning how to communicate clearly to people who are unfamiliar with the project. Their comments were helpful and they wanted to help us develop our ideas.

For the students who didn't take this class, I'll just tell them that it's a good experience, even if everything is not good all the time. I thought I would learn more about engineering and digital programs, but I learned more about team relationships. I think this experience was good preparation to what we'll probably have in our future professional lives.

Walt Busch
I think this senior project class has begun to prepare us for working in the industry. Our disciplines will have to work closely with one another, yet there are very few chances in the current curriculum. Learning to work from the creative side as well as the structural was difficult, especially with the design constantly changing in the beginning. It was interesting working on a project as large as ours, compared to the typical small structure in ARCE labs.

I enjoyed the class but had a difficult time getting used to the less structured architecture environment. It was difficult changing from a very concrete thought process regarding class work and assignments to a more fluid one.

Justin Schwaiger
The interdisciplinary design studio experience has given me a unique perspective of what real-life interdisciplinary design work will be like. I have learned valuable lessons including how to work on an ever-evolving project with a group of people who have differing opinions and work styles. It was challenging getting the project to move along in a productive direction on a daily basis, but we found that through extensive communication and deliberation about all possible divergent paths we could filter and select the best options.

I would hesitantly recommend this course to another student. I thoroughly enjoyed the Chicago trip where we got to see a new city, experience a new environment, and view the history of the skyscraper firsthand. However, the competition and project were at times very ambiguous concepts which were challenging and frustrating to work on. It was good to get the interdisciplinary experience, but I felt that my own time could have been better spent in another, more focused course.

Aziza Feriel Mestiri
Melissa McKinney
Jonas Houston
David Watkins
Kate Oroudjeva

team02

revitalization tower

Aziza Feriel Mestiri
Tunisia

As an exchange student from Paris, architecture at Cal Poly opened my knowledge through new experiences. This competition gave me the opportunity to explore fields and programs never used before. I started to discover the endless design possibilities at our fingertips. Interactions with architects and engineers gave us a real understanding of issues and solutions that we would face in the future.

Melissa McKinney
Ellenberg, WA

Senior ARCE student who is looking forward to Grad-school in Illinois.

Jonas Houston
Aspen, CO

The two-quarter process for the AISC steel competition has been invaluable. Senior ARCE student.

David Watkins
Santa Barabara, CA

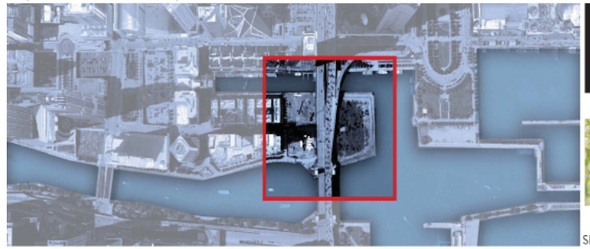
Since I was a kid, the various creative aspects involved with Architecture have always fascinated me. The processes behind architecture-related skills such as problem-solving, drawing, communicating, and visualizing seemed natural to me. The lifestyle I enjoyed while growing up in Santa Barbara also helped develop a deep respect for the environment which I have strived to present in every project.

Kate Oroudjeva
Serpuhov, Russia

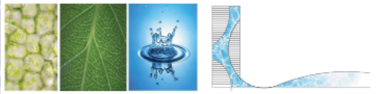
Fourth Year Architecture Student who really enjoys being at Cal Poly. Loves pets, drawing and being outside. Likes to learn about different cultures, and would like to travel to many different cities to see how people live. Sustainability is something that inspires me.

REVITALIZATION TOWER : context/concept

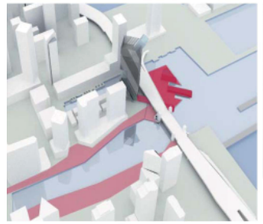
architects: Ekaterina Droudjeva/Ariza Feriel Mestiri/David Watkins
engineers: Melissa Mckinney/Jonas Houston



CATCHING THE WATER AND GIVING BACK TO THE CITY: The intent of this building is to celebrate the power of water, a element fo all of its many forms. Throughevery aspect of the human experience, the firm highlights and incorporates some of water numerous potentials, erosive, connecting, restrictive, and ultimately life sustaining. Throughout the site and building, water is refained, restored and redistributed. The building also performs the same process throughout its program, by collecting students, residents and guests alike, channeling them through various modes of health, where their minds and bodies can be restored in a number of fashions, and finally re-distributing them back to their lives, healthier and rejuvenated. In this sense, the building serves as a filter, not only for the water it remediates, but also for the people who inhabit it.



SITE: Chicago Streeterville



MARKET STREET: market/marina extension

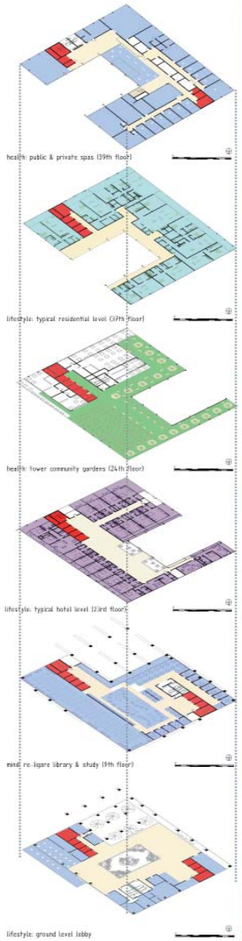
LAKE MICHIGAN: filtration system

RESCUE RETAIN REVITALIZE VISUAL CONTINUITY RELATION/INHABITING SITE SOUND TOUCHING TASTING MEDITATION INTAKE CLEANSING CIRCULATION SMELINGFORCE TRANSPARENCY CONGREGATION POTENTIAL OF EXTENSION FLUIDITY COLLECTION VIEW PATH POOL BATH FILTRATION TASTING CONNECTION

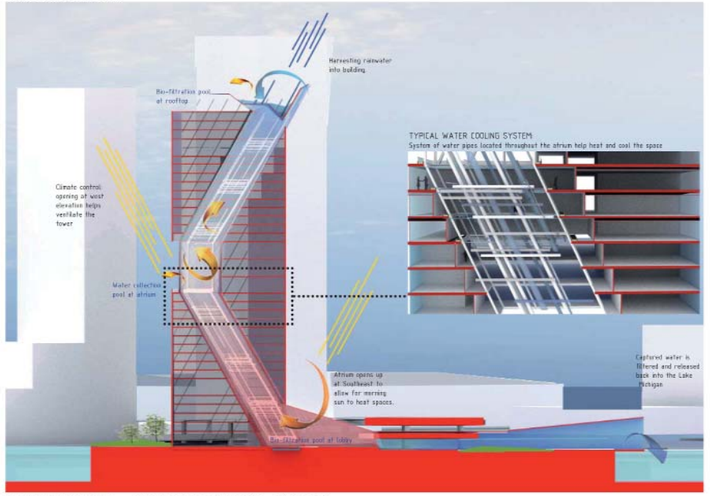
South facade and entrance

Presentation Board 01

Connection: water system/program



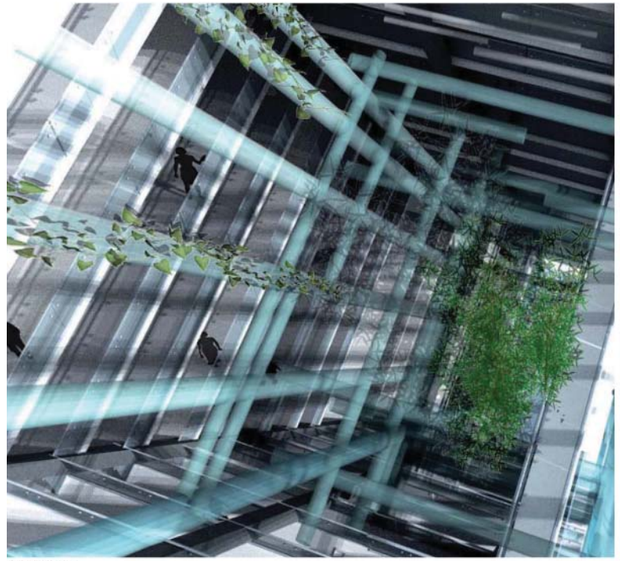
ATRIUM SECTION CENTRAL AREA



ENVIRONMENTAL: THERMAL CONTROL SYSTEM
Atrium serves as a vent stack , water filtration and cooling tower.

Presentation Board 02

Interaction: water and well being

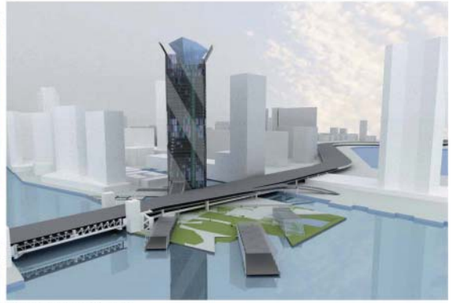


1. Atrium looking down

Shifting central atrium brings light and views into the heart of the building while maintaining a continuous vertical connection with inhabitants

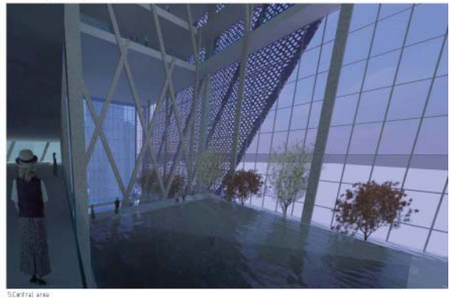
3. Re-connect: Re-ligare Library

Complimenting the steel bracing elements in the atrium are a corresponding series of water pipes, conveying the precious fluid throughout its process of rescue, revitalization, and reuse. Rainwater collected from the adjacent remediated park would be channeled back to the building for drinking and recreational uses, while the water retained by the building would be used for grey-water systems and redirected to the park landscape. The flow of water would be highly visible, with the bracing of the atrium relaying the exchange between building and site. As it emerges from the building, the structure of the atrium would translate from a vertical connector to an horizontal one, directing inhabitants towards the park



4. Northwest perspective: park and marina

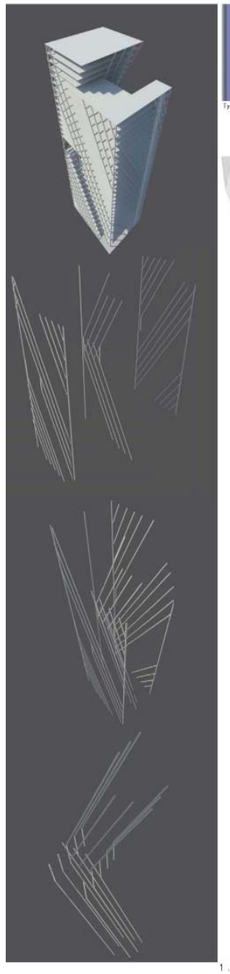
2. Cooling tower system of atrium



5. Central atrio

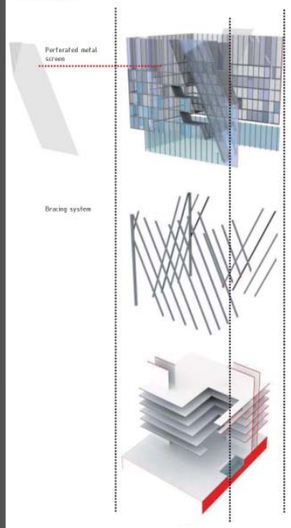
Presentation Board 03

Movement: structure/skin

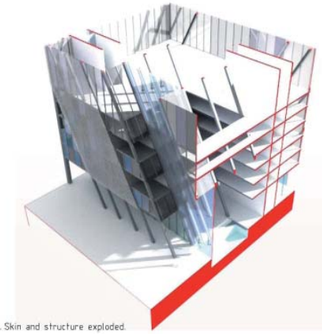


Typical glazing pattern

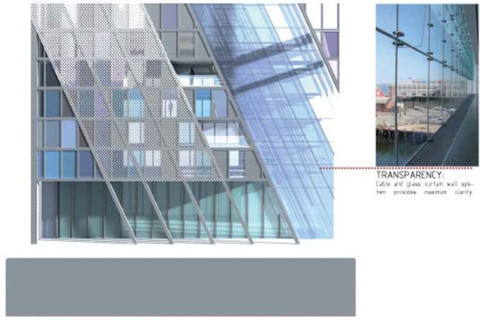
AN EMBRACE OF FORM AND FUNCTION Upon approach, the fluidity of the building is evident, with the overall axis being rotated off of the city grid. The exceptional qualities of steel are promoted in the various elements of the building. The interpretation of the grid into a rotation carries through the interior, where structural braces embrace a continuous, shifting central atrium. The atrium not only serves to carry the experience of the facade through to the inhabitants, but also provides a strong vertical relation between the multiple nodes of health located on various levels. The Cladding system reinforces the movement of the bracing system around the tower, while providing a degree of environmental control through a perforated metal screen that transforms into a system of photovoltaic panels along the rooftop. The colored curtain wall panels of the building facade creates an atmosphere of light similar to that of the surrounding waters.



2. Skin and structure detail.

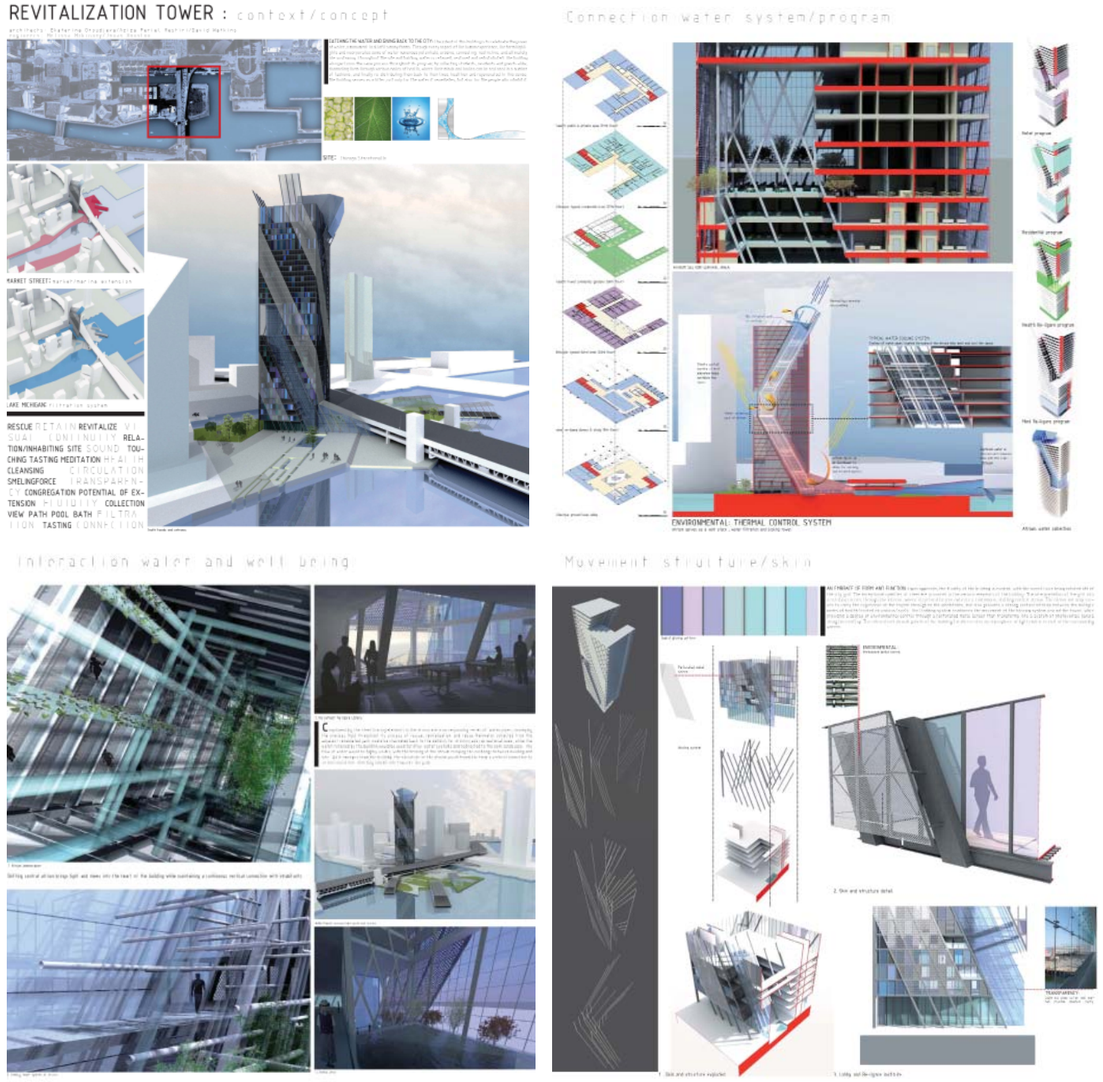


1. Skin and structure exploded.



3. Lobby and Re-ligare institute.

Presentation Board 04



Presentation Board Summary

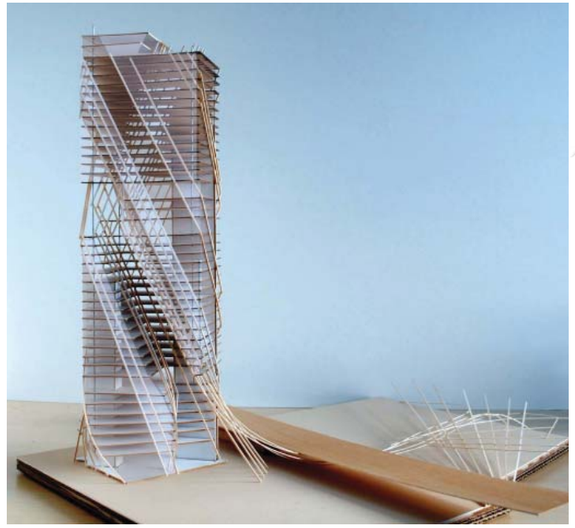
Revitalization Tower

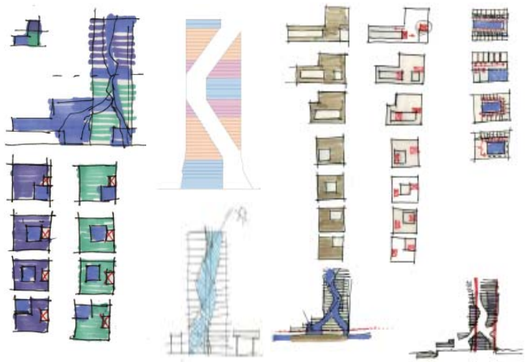
Chicago's unique history has always revolved around water, with it's rapid growth directly resulting from the city's mastery over this precious resource. The intent of this building is to celebrate the power of water, a monument to all of its many forms. Through every aspect of the human experience, the form highlights and incorporates some of water's numerous potentials; meditative, connecting, and ultimately life sustaining. Throughout the site and building, water is retained, restored and redistributed. The building also performs the same process throughout its program; by collecting students, residents and guests alike, channeling them through various nodes of health, where their minds and bodies can be restored in a number of fashions, and finally re-distributing them back to their lives, healthier and rejuvenated. In this sense, the building serves as a filter, not only for the water it remediates, but also for the people who inhabit it.

Upon approach, the fluidity of the building is evident, with the overall axis being rotated off of the city grid. The exceptional qualities of steel are promoted through various elements of the building. The embrace of the structural bracing around the form carries through into the interior, where a continuous, shifting central atrium connects all of the building's various programs. The atrium not only serves to carry the experience of the façade through to the inhabitants, but also provides a strong vertical relation between the multiple nodes of health located on various levels. Complimenting the steel bracing elements in the atrium are a corresponding series of water pipes, conveying the precious fluid throughout its process of rescue, revitalization, and reuse. The system of water pipes running continuously from top to bottom also serves as a cooling tower, helping maintain a constant climate throughout Chicago's extreme seasons. Rainwater collected from the adjacent remediated park would be channeled back to the building for drinking and recreational uses, while the water retained by the building would be used in internal grey-water systems as well as redirected back to the park landscape. The flow of water would be highly visible, with the bracing of the atrium relaying the exchange between building and site. As it emerges from the building, the structure of the atrium would translate from a vertical connector to a horizontal one, directing inhabitants toward the park under an illuminated glass form.

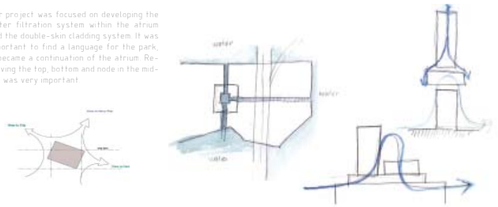
The new Re-Ligare tower captures the essence of what water can be; connecting, inviting, meditative, and nourishing. The unique location of the tower between multiple major waterways, as well "The Loop" will serve to remind the city's inhabitants of their commitment to preserving world's most valuable resource. As Chicago continues to establish its identity as America's green city, this monument will continually remind the city of its promise to preserving the well-being of its citizens and the environment.

Design Process





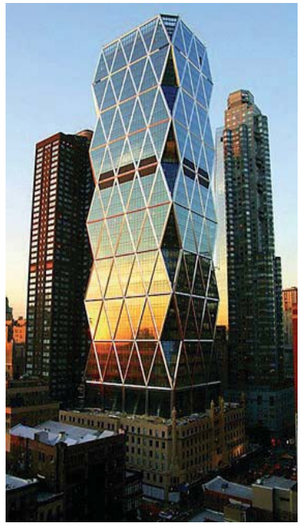
Our project was focused on developing the water filtration system within the atrium and the double-skin cladding system. It was important to find a language for the park, it became a continuation of the atrium. Resolving the top, bottom and node in the middle was very important.

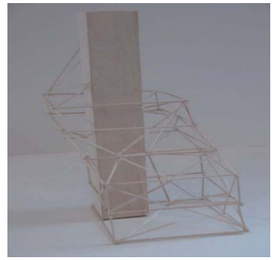


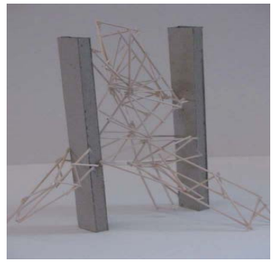
Structural Process

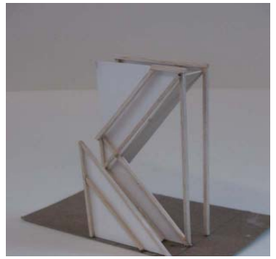
National Stadium (Taiwan)

Hearst Tower









Aziza Feriel Mestiri
What we learn doing an interdisciplinary studio competition is working efficiently with a group. Maybe the secret of a good coordination is to know each other and know what each is able to do well. And this is one of the hardest parts. The interaction between architects and engineers requires long discussions to understand the different disciplines. This experience gave us the opportunity to learn new programs and explore new possibilities of exploring a project, mostly the structure that we leave last as architecture students. We had the opportunity to learn Ecotec software, an innovative tool exploring the environmental aspect of our project.

The field trips that we took to Chicago and LA help us to understand better the issue of the site and the city. Meeting professionals regularly gave us other critics an occasion to make the project getting better.

Finally, doing this competition is a good experience to have professionally. People will know that you already worked in team with different disciplines like in real life, that you can work under pressure, you are flexible and able to do many different jobs within the architecture discipline, from buildings and conceptual models to presentations.

Kate Oroudjeva
I took this class in hopes of learning how to flesh-out a building in terms of skin, structure and floor plans. I was very curious about what working with ARCEs was going to be like. I knew that doing a large-scale building would be a unique design problem and this was a great opportunity to explore.

The most important thing I learned this quarter was that in a presentation it is really important not to just have good renderings, but to make sure that the presentation communicates the story of your concept. Developing diagrams and sections that read well was critical. As we developed the project as a group, we constantly had to make sure that we did not stray too far from original design intent. Everybody had his or her own ideas about where the project should go, and without almost constant communication it would have been impossible to create a building that looked complete. The numerous critiques along the way helped tremendously, and I am really glad that we had the chance to present at ARUP.

Overall, I learned what kind of tactics go into developing a large-scale structure, and I am better prepared for Senior Thesis. Working in a group thought me how to be more diplomatic about resolving issues positively within a working environment.

David Watkins
This integrated studio presented a unique opportunity to closely collaborate with engineers in developing a mid-level high rise design that was rationally planned and appropriately responded to the Chicago lakefront. The result of our group effort produced a building that not only functionally responded to the program specifics, but in doing so, provided a service back to the community by capturing, revitalizing, and releasing rainwater back to the water table.

Although much can be said of the overall experience of this particular studio, the point should not be lost that such collaborative projects are extremely beneficial to students from all disciplines. Students participating in these types of projects gain invaluable knowledge about communication, work-sharing, and team-building. By far the most valuable skill developed during this project was the ability to step back from a design perspective and view a design intent through the eyes of an engineer. While strong architectural design is intended to evoke emotion and a sense of place, efficient structural design is used to translate design intent into a realistic form. The two forms of thought must never be isolated from one another, but rather flow back and forth between one another until an impressive solution is developed.

Jonas Houston
For a structural engineer, being involved in the design of a super-tall building is an experience that is highly coveted. Although the competition was purely academic, the concepts behind the design of such an immense structure will be something that I will carry far into my career.

Also, working in conjunction with architects, I was exposed to problem solving in a different light. For most of my academia, I have gone about problem solving in a very distinct manner. My experience in this competition has left me with the capability to solve problems in a more creative way.

Melissa McKeenley
The opportunity to work on the AISC steel design competition allowed me to expand the type of projects I've worked with. Being able to not only design but to select the structural system was an entirely new experience. Integrating structure and architecture as a group effort highlighted numerous design issues as the two systems interacted.

Being teamed with architecture students gave me the chance to see how the two disciplines interact and communicate with each other. Also, seeing the evolution of our structure throughout the design process gave me an appreciation for the detailed components that go into the design of a structure of such magnitude.

team03

retreat to reconnect

Vivian Lai
Kevin Hicks
Janelle Wiens
Charis Wu
Baptiste Sulpicy

Vivian Lai
Santa Clara, CA

This collaborative design class allowed each of us to bring our individual strengths to create something of greater value, as well as teaching us how to cultivate learning and discussion from other perspectives. It was interesting to see how the architecture students began the design process and modify the design with each iteration.

Kevin Hicks
Santa Clarita, CA

Working with ARCE majors, and other ARCH majors has been a great challenge that has allowed me to think about a building in a different way. This interdisciplinary studio has opened the door to understanding structural systems more intuitively and from the view of engineers. This collaboration is one of the best experiences a Cal Poly student can have.

Janelle Wiens
San Jose, CA

Working on an interdisciplinary team was exciting and challenging. After starting with an abstract massing, our team learned to collaborate and created an elegant structure with a deeper narative. The process took a lot of communication and work, but it was worth it.

Charis Wu
Hayward, CA

Working on a collaborative design project from its conception was a new and exciting experience. It was very educational to see where the architectural design came from and how it developed, as well as the final product.

Baptiste Sulpicy
La Rochelle, France

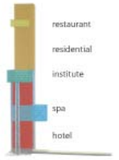
As an exchange student from France, working with a group of american students, both ARCH and ARCE was a really new experience. It was not easy everyday but I learned a lot about communication, both with my team and to outside reviewers. The layout process took more time that I was expecting but it allowed us to improve our boards.

RETREAT TO RECONNECT

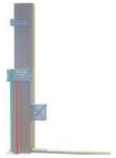
To retreat from the busyness of life and reconnect with the city by simply being.

Located along Lake Shore Drive in Chicago, the Re-Ligare Institute is retracted from the hectic city life to provide a space of reconnecting mind and body. Though different program elements are separated, circulation cores reconnect all aspects of the institute, spa, hotel, residential units and public spaces. Users reconnect with the city through public spaces, views and the influence of Mies Van der Rohe on the city and the building.

conceptual diagram

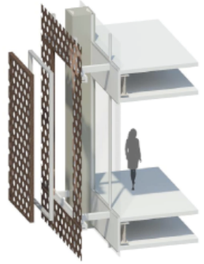


program elements

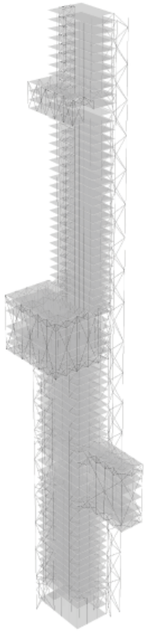


circulation cores

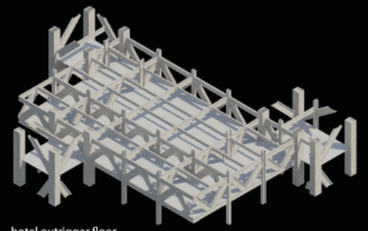
Presentation Board 01



Skin:
The major skin system consists of a double skin of interior glazing and exterior perforated metal. The exterior layer acts as a wind screen and prevents solar gain.

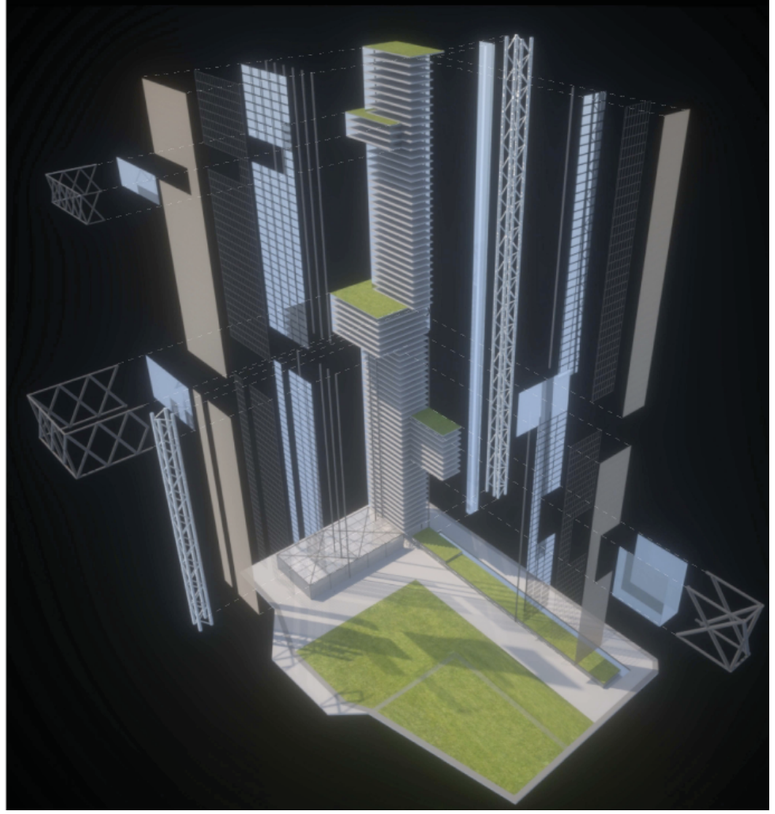


Structure:
The structural system consists of three braced frame cores and a number of moment frame systems, which are connected at six structural outrigger floors. These outrigger floors serve to stiffen the building against wind loads and redistribute gravity loads, minimizing the sizes of interior columns. This system creates an optimal open floor plan, leading to programmatic diversity within the tower.

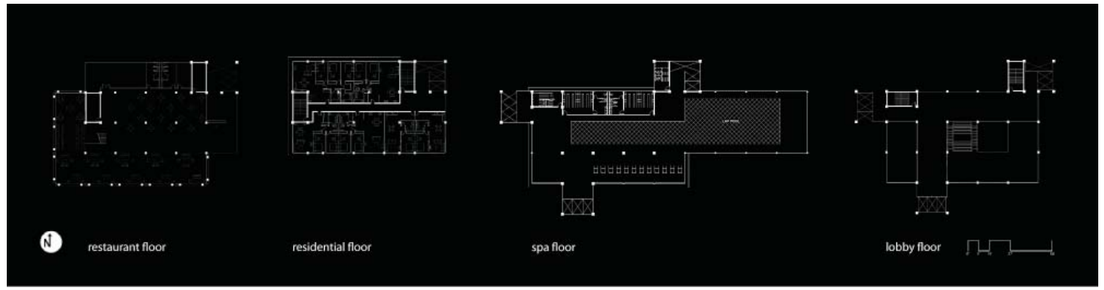


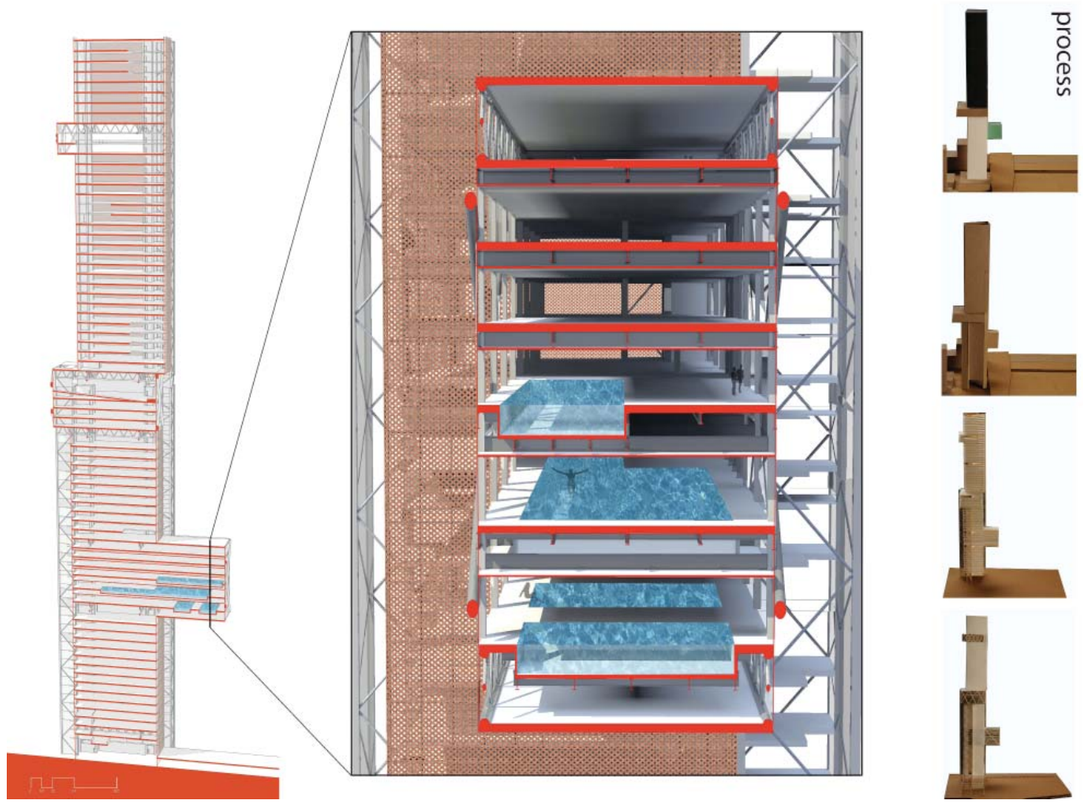
hotel outrigger floor

hotel framing plan



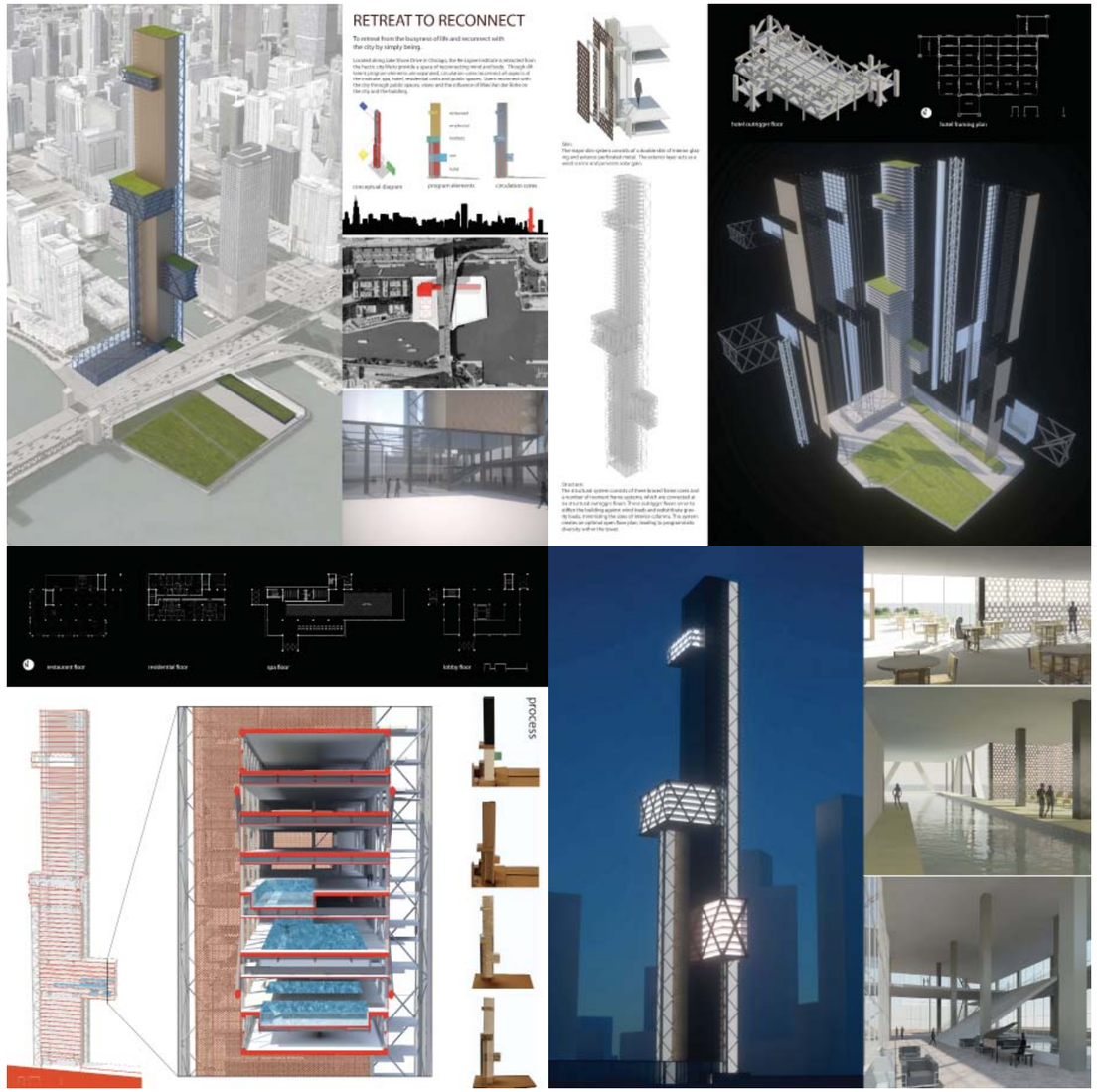
Presentation Board 02





Presentation Board 03

Presentation Board 04



Presentation Board Summary

Retreat to Reconnect

To retreat from the business of life and reconnect with the city by simply being.

Located along Lake Shore Drive in Chicago, IL, Retreat to Reconnect is retracted from the hectic city life to provide a space of reconnecting mind, body and soul. In order to maintain a healthy life, it is important to separate from stress and revitalize relationships to self, to others and to the environment.

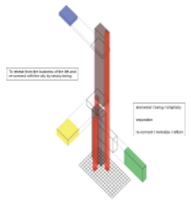
Following the desire for a simplified lifestyle, Retreat to Reconnect takes an elemental approach in dividing the program into separate massings. It is a mixed-use skyscraper that includes the Re-Ligare institute and spa, hotel, residential units, sky restaurant, winter garden, and gallery. Each program inhabits a different massing, and the structure shifts and separates to reveal the unique program spaces. Reconnection occurs in the cores of circulation, where people from all backgrounds and activities can interact. Social reconnection also occurs in program spaces that have more public interaction, such as the institute and spa, which protrude out from the main volumes of the building. These public spaces are also more open and transparent, focusing on the views of the city and Lake Michigan and include access to outdoor green space.

Retreat to Reconnect looks to Mies van der Rohe's precedents in Chicago for proportion. The two largest massings follow Mies' orthogonal proportions in plan. Looking to Mies' influence in Chicago and in the history of skyscrapers provided inspiration for an elegant massing with sensitivity to the city context. The impact of his public plazas is revealed in the winter garden and outdoor spaces. In addition, the expression of steel structure on the exterior is a contemporary play on Mies' innovative and leading use of steel.

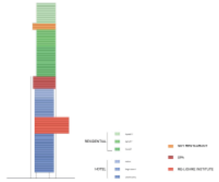
Using steel for this building allows the cores to have transparency, creating a visual verticality and a semblance of programmatic separation from the main elements while still being connected to them. It allows slender columns at the base, emphasizing the separation created by pulling the large massing up from the site. Steel also maximizes the potential of the program by creating a simple, clear structural system. The three brace frame cores, which are also used for circulation, carry much of the lateral load. Six outrigger floors connect brace frames and moment frames, creating a structure more resistant to the high wind loads of the Chicago lakefront.

Retreat to Reconnect responds to the need for separation from the stress of everyday life and a desire for a space to reconnect mind, body and soul. It provides a haven of simplicity and meditation in the midst of busy city life.

CONCEPT



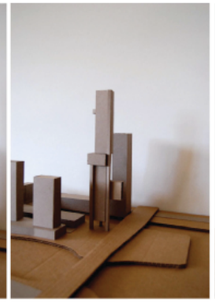
concept diagram

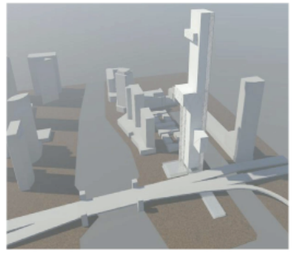


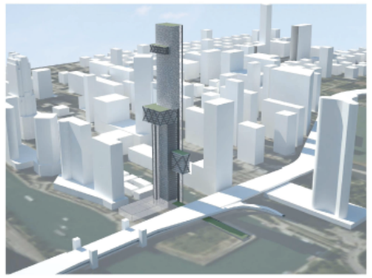
program diagram

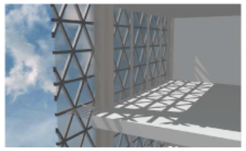
PRECEDENTS

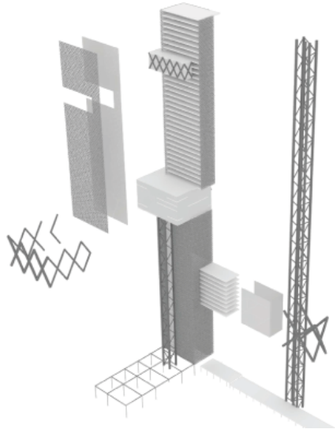
EVOLUTION

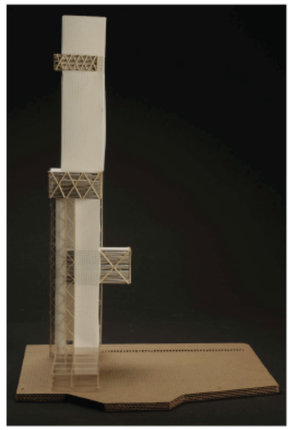




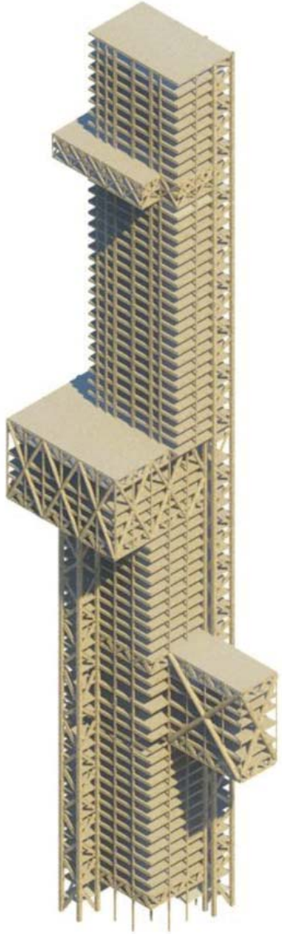


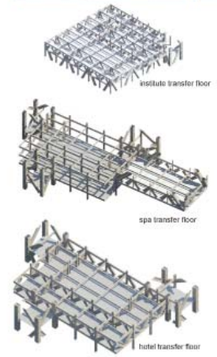


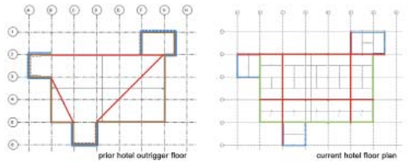


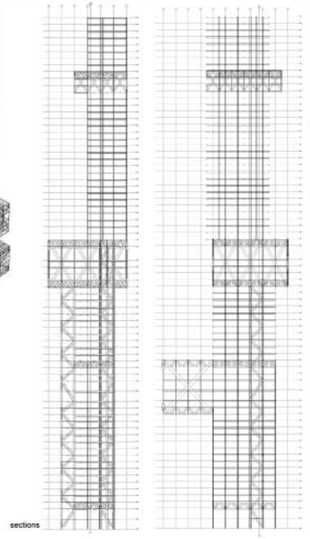


STRUCTURAL
RETREAT TO RECONNECT









Vivian Lai
This interdisciplinary class seemed intimidating and overwhelming at first. No longer do we ARCEs have the typical, pleasant two or three story box structure we're used to in the labs. The words "Collaborate or Die" on a dark image to re-iterate the professors' point seems like old propaganda at first, but the message sticks with you through out the quarter. You must work as a team to thrive. I think the most important discussion we had as a team was not a particular design issue, rather it was to have every member in the group buy into the project—take ownership and responsibility. The idea that this is not just one person's design being pushed forth and worked on, but that we all invest time and energy to make something even better and would be proud to have our names on. Yes, that initial conversation was uncomfortable and perhaps upsetting as well, but it set the foundation on which we could then move forward with confidence that we will work through obstacles together for the these two quarters. By working together, you begin to see how each member of the team adds value to the project.

From various interactions with the architects, you understand more of their perspective on the built environment, learn key terms in which to effectively communicate, and realize this project is indeed an iterative process. You can't just wait for the "final" architectural design and then proceed to work on the structure; both have to work simultaneously and must be self-motivated to stay on task. Time consuming tasks such as building physical models from basswood and rendering 3D computer images test your patience, but working together as a team makes you feel that your contribution is worthwhile. All in all, I think the class is a great opportunity to learn more things that are relevant to the development of future architects and engineers that one would otherwise not learn alone in a classroom of students in the same major.

Charis Wu
Taking this interdisciplinary class was a unique experience. It is unique in the work – no other class designs a high-rise in a non-seismic zone, which gave us a broader base of experience and showed us other design problems we don't face here in California. It is unique in the way it is taught – it is very self-guided, with teachers giving ideas and direction instead of assignments, which taught us to be self-motivated and seek out the next step of the process on our own. It is unique in the teams formed– it is interdisciplinary, so architects and engineers work together from the beginning, which taught us the importance of working as a team and communicating with other professionals who have a different vocabulary and perspective. It is unique in the depth of the work – the engineers and architects work together from the concept to the competition entry, creating a structure that works for both and teaching us to appreciate the work that the others do and contribute to it.

Working with architects gave me a much broader perspective on building design. I learned a lot about the environment, and how a building is not just an isolated building but it interacts with its environment. For the first time, I was able to see how architects fit their building to the surrounding buildings and environments, from the shape of the building to the cladding, and how the building reflects light and heat onto other structures. I was happy to find that there are architects – and many of them – that love structure and want to express it. The challenge then was to work together to create a visually pleasing and useful structure. Working together as a group was key to making this class easier and more fun. I learned that working well as a group enables tasks to be accomplished more efficiently, which also results in less work for everyone. If you work well as a group, you become friends and get along instead of fighting about ideas and details which makes working together pleasant.

Baptiste Sulpicy
During these two quarters, I learned a lot about communication, how to make everybody in the team understand your idea and how to be the most efficient in representing this idea. Also, having a good project is not the only important thing. You need to have a strong way to communicate it. We spend as much time working on the project as on the documents.

The very unique thing about this experience was working in a team, both with architects and architectural engineers for a steel competition. Working in a team isn't easy every day, but comparing our opinions made the project better and each decision is the result of discussion. I think the most important thing I learned came from the layout of our final boards. The design project is a process, as much as the layout.

Janelle Wiens
This interdisciplinary studio has been a challenging and growing experience. One of the challenges in this class is learning to work as a team across both disciplines. Working as a team requires knowing how to present your ideas, but also how to incorporate and encourage others' ideas. Sometimes it is important to be persistent with your own idea, but it is also necessary to compromise and build off of each others' ideas. It has been a challenge to collaborate and make our project a combination of each person's vision, but it has been a worthwhile and more meaningful project because of it.

Working with architectural engineering students has been another opportunity to grow as an architecture student. Collaborating with them made the design process a little more challenging as structure had to be a major factor in our early design phases. It was interesting to see the communication and flexibility that had to happen to progress the project both architecturally and structurally. I think this class was a valuable learning experience both for learning to work as a team and collaborating across disciplines.

Kevin Hicks
I have learned many things from the Interdisciplinary studio such as working with teammates in architecture and engineering. First of all, being able to work with engineers on a project opened my eyes to analyzing the field of structures in a building and being able to intuitively understand systems in architecture. Being able to see a building from the eyes of an engineer makes the process of working with engineers much easier.

Next, working in this Interdisciplinary studio with other architects was a great challenge that every architect student must experience before they graduate. The experience taught me more then I can imagine learning from other designers or teachers. There are definitely pros and cons with working in a group, but in the end, the overall educational experience will be able to be used in an architectural career or other real world experiences. Some of these experiences for me are learning to be patient, seeing the design develop from another perspective, collaborating with all types of people, and applying roles of leading and following.

team04

plate tectonics

JuanCarlos Fematt
Natassia Chane-law
Brittany Thornburg
William Wood
Josue Urrutia

JuanCarlos Fematt
Salinas, CA

As a 4th year architecture student, the highlight of this project was working in collaboration with architectural engineers. Being able to develop a detailed structural system was a first for me. Having both disciplines use BIM made the collaboration much more efficient.

William Wood
Fayetteville, NC

As a graduating senior, I feel that this class did a good job of exposing me to the climate of working in a professional office, both through visits to professional offices and through the interdisciplinary studio project itself.

Natassia Chane-law
Paris, France

I'm an exchange student from France. I was expecting to confront different ways of thinking, and I was not disappointed with that. We had to find ways to combine our ideas. I also learned how to give things up and accept other points of view. It's a good excerise - more about how to work in a team and use everyone's particular skills than to design a project.

Josue Urrutia
Los Angeles, CA

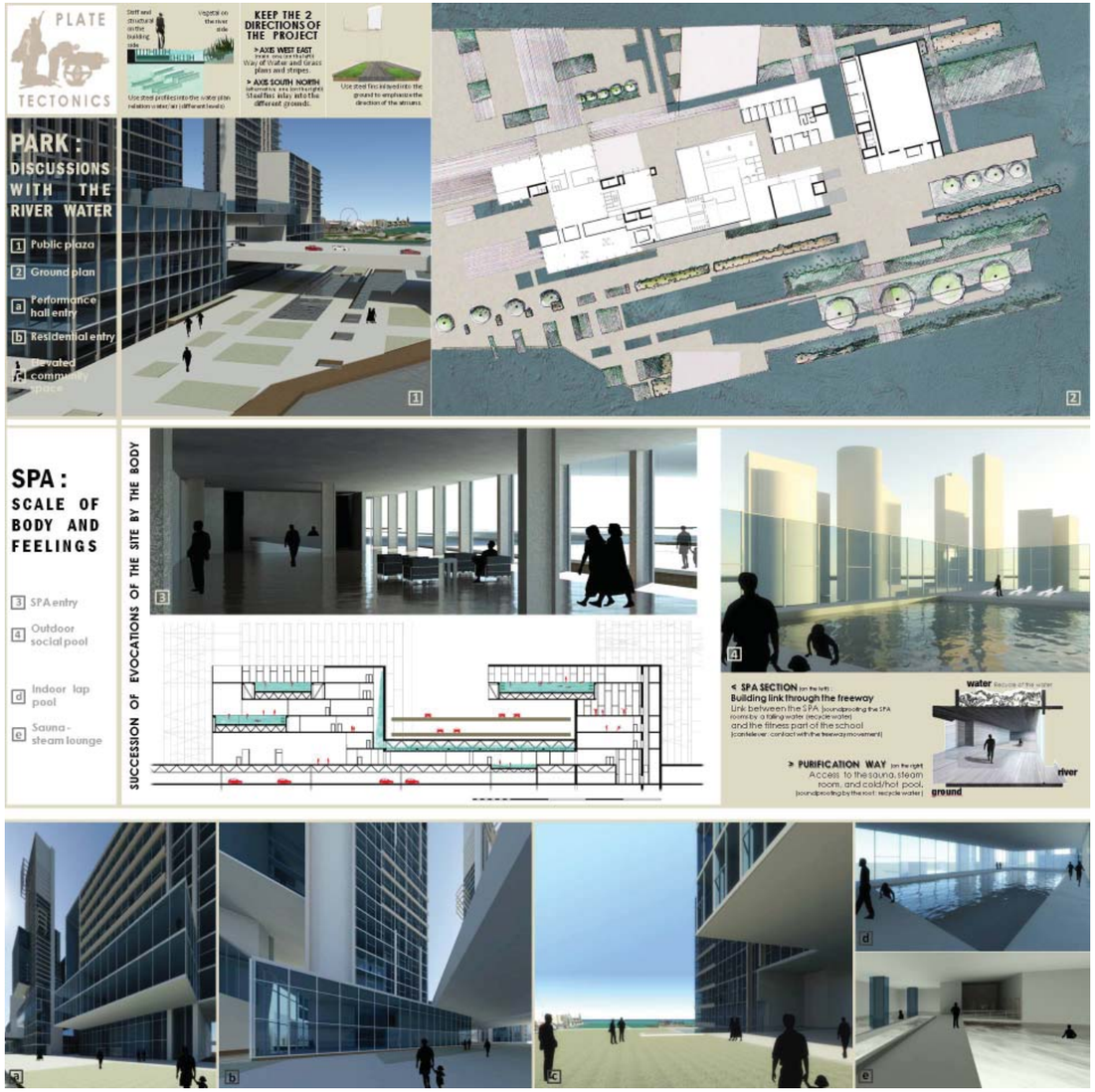
I really enjoyed exploring different concepts and applying them to a project of my own. At the same time, I learned to look at this project from an architectural point of view. The best part of this experience was collaborating with great people and accomplishing a great project.

Brittany Thornburg
Daejon City, South Korea

Having the opportunity to develop our project over two quarters was really great. We were able to create working floor plans, a feasible structural system and a detailed facade that really pulled the entire high-rise together. Without the collaboration between the two disciplines, this would have not been possible.

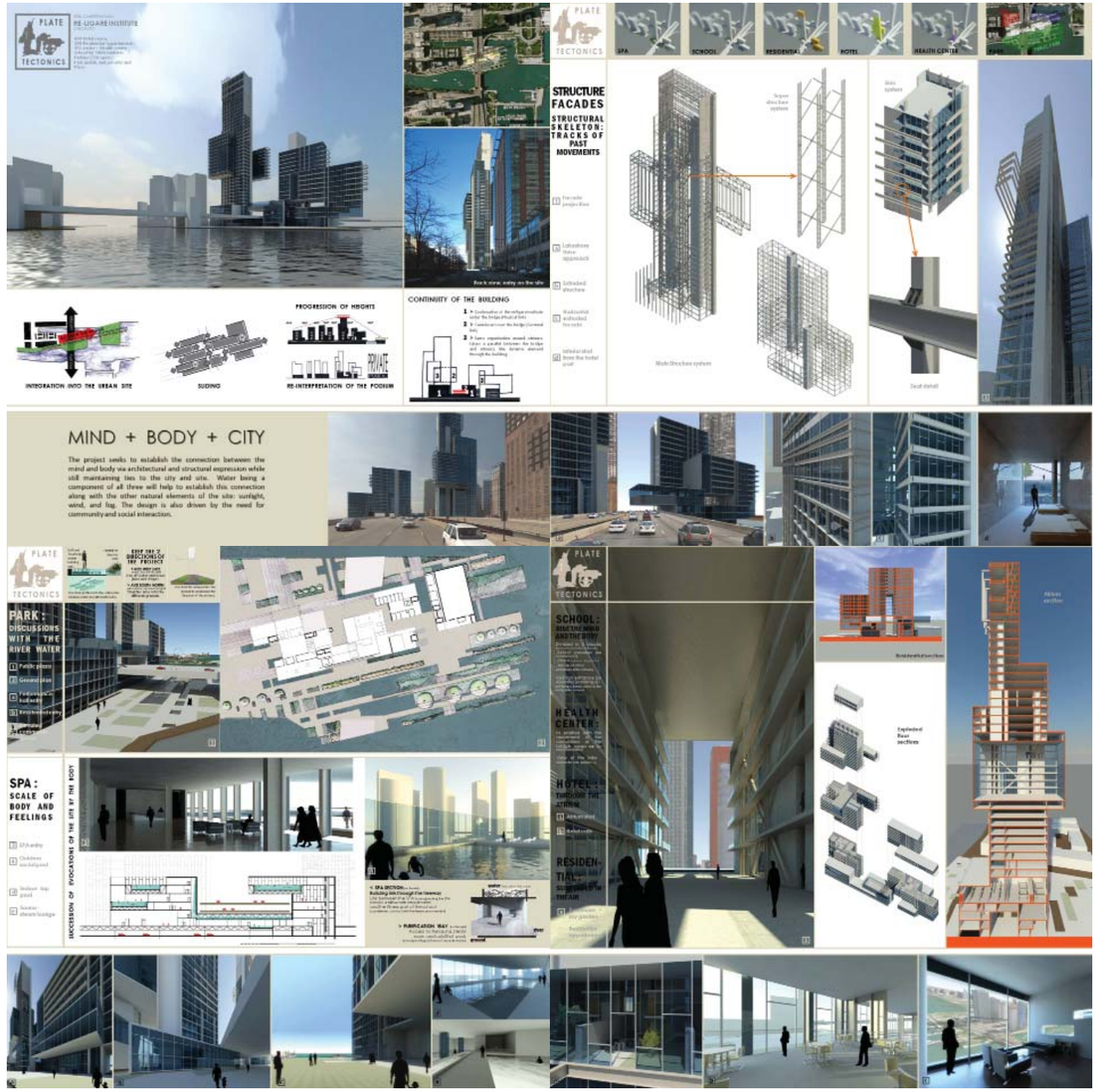
Presentation Board 01

Presentation Board 02



Presentation Board 03

Presentation Board 04



Presentation Board Summary

Plate Tectonics

Our project seeks to establish the connection between the mind and body via architectural and structural expression while still maintaining ties to the city and site. Water, being a component of all three, will help to establish this connection along with the other natural elements of the site: sunlight, wind, and fog. Our design is also driven by the need for community and social interaction.

The use of individual and community outdoor spaces will provide a chance to reconnect with the city and site. Apartment inhabitants will be given the chance to interact with one another. This is done through the community roof gardens and the double height social spaces. Each unit takes advantage of the city views, as well as optimal heating, cooling and lighting. This was achieved by orienting the long side of the buildings in the north-south direction. The building form was derived by keeping the rhythm of the existing building vernacular of Chicago. The lower levels consist of public program while above the program becomes more private. The continuation of the Re-ligare Institute under the bridge serves as a physical link while the cantilevers over the bridge serve as the gestural link.

The intent of the project is to demonstrate horizontality with the building form. This is achieved by guiding the view up the building and out to the waters edge. By allowing for water to come into the site and having the site push into the water, the visitors are being guided to the waters edge. The bridge is being utilized as a site element; we are allowing it to break through the site and are taking advantage of this by replicating the gesture and forming the atriums.

The structural design team had several objectives when designing the structure of the project. First, to maximize the stability of the structure while minimizing the structure's impact on the views from the building. Secondly, the design of the structure needed to reflect the horizontality of the overall project. Lastly, the structure had to minimize the lateral drift of the building due to wind.

In order to maximize the structural stability and still keep the structure from impacting the sight lines out of the building, a series of trusses were used. The layout of these trusses allowed the floors between them to be kept free of lateral structure elements.

The trusses also served a second purpose. By emphasizing the long horizontal trusses on the exterior of the buildings, the concept of horizontal movement that the project embodies was further emphasized.

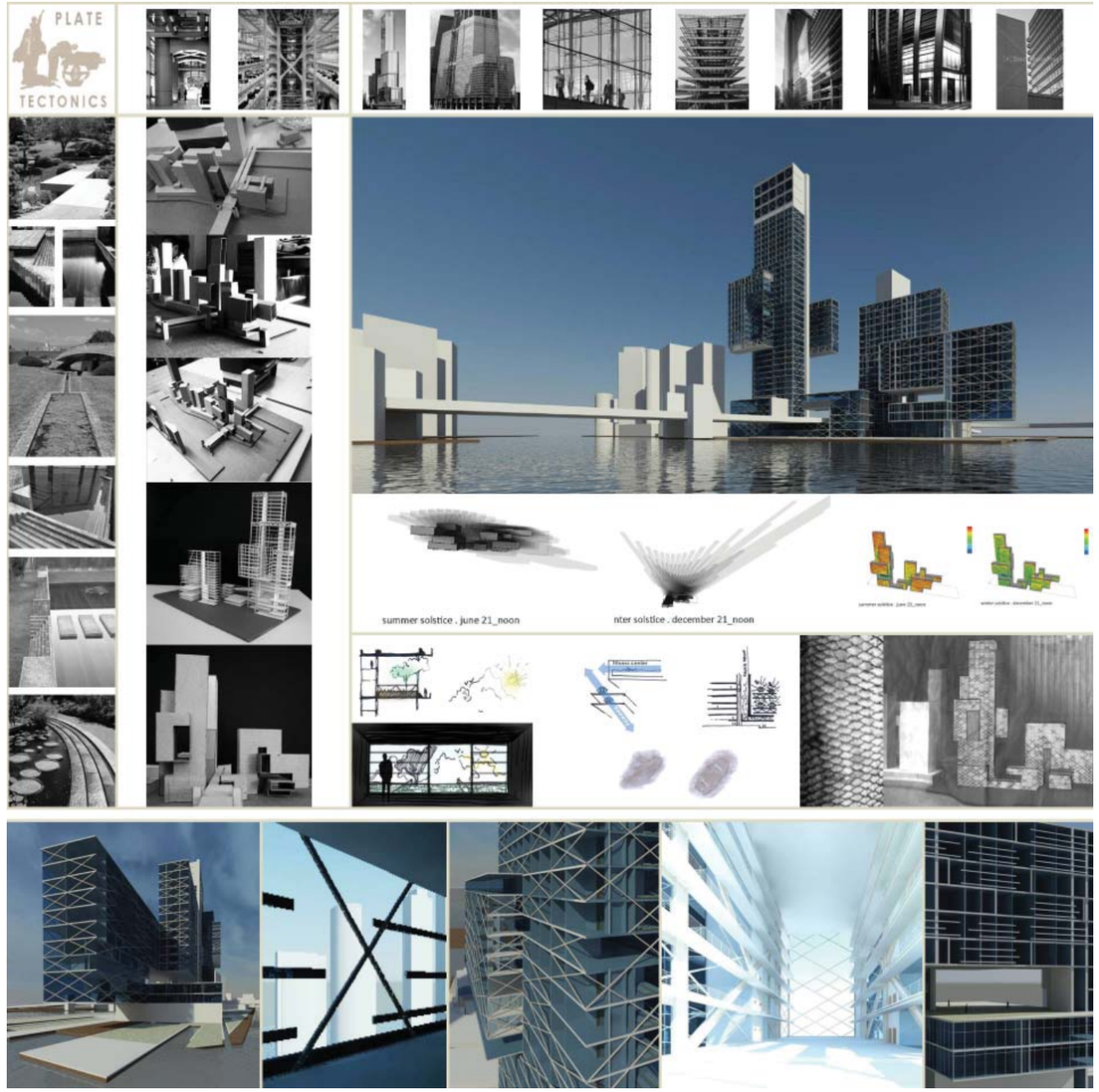


PLATE
TECTONICS
summer solstice . june 21_noon
nter solstice . december 21_noon


PLATE
TECTONICS
Structural Design Process

JuanCarlos Fematt
In taking this interdisciplinary studio I have learned a lot about myself and how it is to work with another discipline. Working with engineers was a great experience, their in-depth analysis on structural systems played a big role on the appearance of the building. We were always exchanging ideas and concepts that helped push the project forward. The team found that the key to good team work was the weekly meetings. These meetings helped each discipline ask specific questions and get answers.

Everything that I learned from this studio will help shape how I work in the future. The ability to communicate with a team and express my ideas is what I will take with me. I can now see the importance of integrating a structural system into my projects. Merging the architecture and the structure forms a strong cohesive completed work of architecture.

This studio taught me that it's important to be on the same page as your engineer, this is accomplished by communicating and discussing ideas. Engineering students think differently than architecture students, making it difficult at times to agree. Lastly, through the engineers I learned that there are restrictions and constraints making some things difficult to achieve, nonetheless achievable.

William Wood
Overall, this lab was a very good learning experience. We learned about the difficulties and the requirements of working as an interdisciplinary team. The two best highlights of the class were the trips to tour professional firms, and carrying a large scale project from inception to final iteration. Some of the skills that this class honed were the ability to work as a group, presentation skills, and time management; particularly as it pertains to planning over a long period of time.

The class exposed students to a microcosm of the professional environment outside of school, and as such was a worthwhile experience. I would absolutely recommend it to any design student.

Josue Urrutia
These past two quarters of class have been perhaps the best I've ever had the pleasure of spending. The scope of this particular collaborative design class is a unique and wonderful opportunity for someone in my major. Starting with the experience of traveling to another city (Chicago), and exploring the site and the city, the atmosphere and the culture, the journey was an adventure. Reflecting on the past few months, it is amazing to think about our group as we first explored the project parameters, developed a program, to working day in and day out and contributing different ideas, and then, watching our ideas take life and flourish. I feel like, more than anything, I learned to think outside the box. This project challenged me with concepts outside my realm of comfort, and allowed me to explore many different ideas within my discipline in order to provide the client with alternatives.

Perhaps most interesting of all was working with and developing a relationship with our architecture student group members. I feel like I learned a lot from the architects and learned what the design approach was from the architectural perspective. At the same time, I was able to give them insight into the point of view of a structural engineer. I believe that very central to our success as a group was our ability to communicate with each other as friends, as well as teammates. This perhaps the best thing I could walk away with, is the ability to work with a team, successfully, to accomplish a common goal. I don't think a class can come any closer to simulating a real world environment than this. The experience was incredible, and I'm glad I could partake.

Brittany Thornburg
This class was a great experience in real world application. Being a two quarter studio class, there was a lot more room for the growth and development of the project. In turn, the expected scope of the project was broadened. We were able to create working floor plans for over thirty stories, make some preliminary decisions on interior materials, develop the site, create an effective structural system and fully detail the facade.

The site visit to Chicago as well as the various firm visits both in Chicago and LA were also very helpful in gaining knowledge about the profession and what it takes to get there and what happens once you make it. We made a lot of contacts that will definitely come in handy within the coming years.

It was insightful working with the engineers right from the get-go. They could let us know early on if they needed to place a column or other structural element within our plans so that we could work around them and vice versa. Melding the design process with the engineering process was a bit difficult at first but once we established what the other needed, the process became much smoother.

Overall, this class really showcased the value of teamwork. To succeed, you need to go in with an open mind and be able to negotiate well with others. COMMUNICATION IS THE KEY TO YOUR SUCCESS! If you're not happy with the way something is going, your teammates will never know if you don't tell them. Learning to do that is something that I will definitely take away from this project and I am sure will come in handy for many years to come.

This class was a wonderful opportunity and I highly recommend it to anyone who is interested.

Natassia Chane-Law
I'm an architecture exchange student from France. I took this class to have the opportunity to work with American students in architecture and also in structural engineering. I was expecting to learn a different ways of thinking. I was not disappointed with that. We had to find a way to combine our ideas. I also learned how to accept other points of view. It's a good exercise more about how to work in a team than to make a project, and how to use the particular skills of each individual.

Working with engineering students was pretty interesting. They were not here to design the structure alone but they helped us to understand what goes into the design of the structure. In France, steel construction is not the main way to build, so it was a good exercise about how create a project that is developed around the steel structure aspect.

I probably will describe this class as hard but a complete experience. The challenge was more about relationships, it's a group experience, since we had to work together by ourselves, to call into question what we did and what we thought. It's not really a class where the teacher comes and corrects the project for each group. You have to use all the available skills of the group to develop and keep the project in an evolutionary process and it's not easy. From my perspective, another important benefit to this class is that I made new friends!

team05

rhythmic interaction

Jamie Jones
Naoko Miyamoto
Adriana Savannah
Carl Fosholt

I am a 5th year ARCE graduating this June. I grew up in Shasta, CA. In my spare time I enjoy coaching gymnastic and special Olympic gymnastics.

Jamie Jones
Shasta, CA

What I learned most from this studio was how to make one project out of multiple ideas. I also learned about myself from working in a group. I am glad that I took this studio and got to work with my group mates. Thank you :) I am so ready for summer break!!

Naoko Miyamoto
Kyoto, Japan

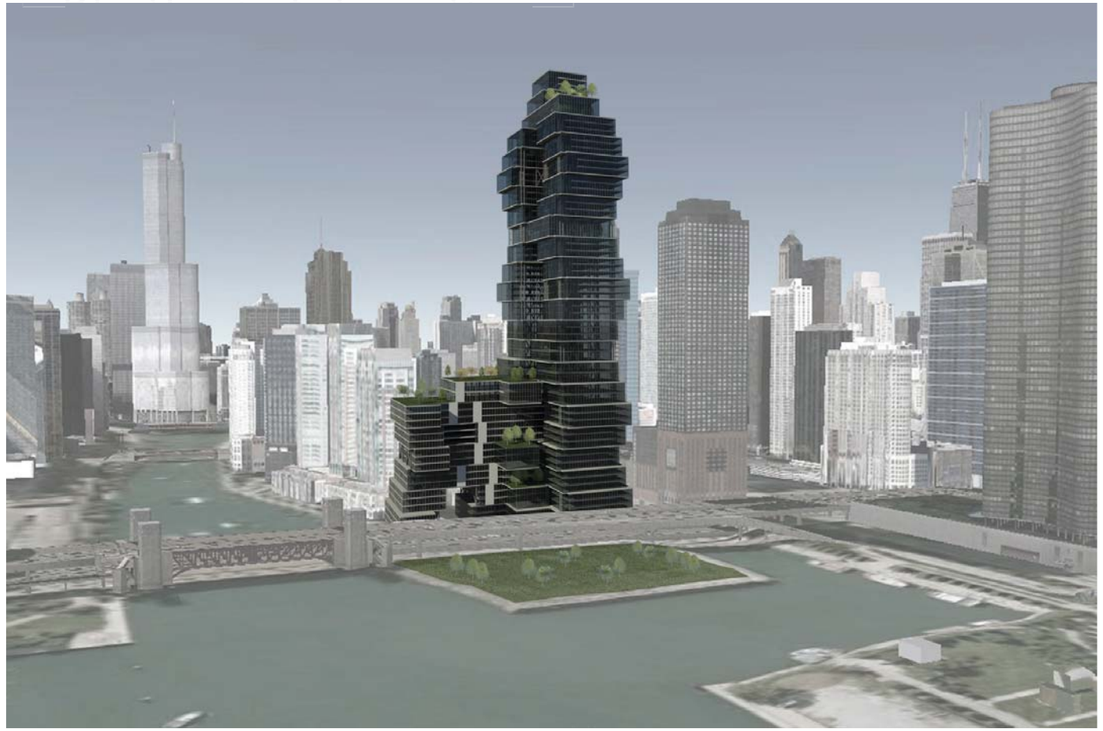
I find successful architecture one that can effectively integrate structure and form as an aesthetically and innovative design solution. This studio was educational and helpful for future endeavors. The interdisciplinary collaboration and group atmosphere allowed for many different strengths to shine and create a unique final product.

Adriana Savannah
Renton, WA

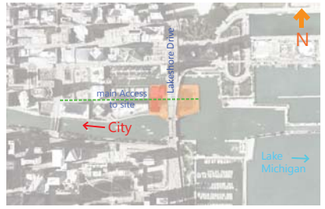
I am a 5th year ARCE student hoping to work as a structural design consultant. This interdisciplinary collaborative design studio has given me the valuable experience of working with architecture students to create an innovative building with emphasized structure.

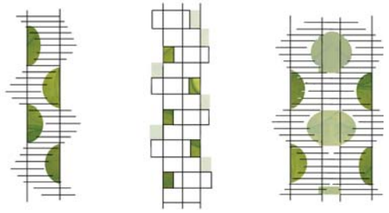
Carl Fosholt
Denver, CO

Rhythmic Interaction _ Reconnecting Mind + Body



Chicago





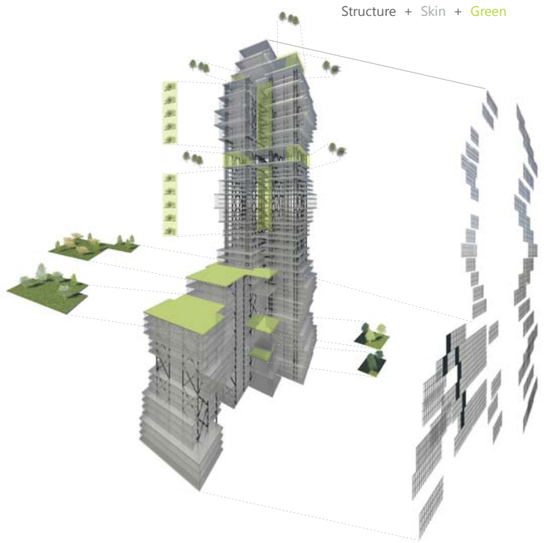
Interaction Shift Reconnect

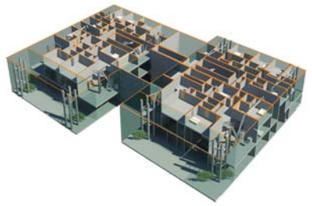
Presentation Board 01

Enclosed Terrace _ South Side

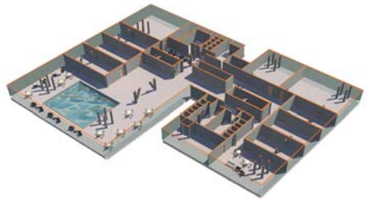
Green Space _ Southern Roof Top

Presentation Board 02

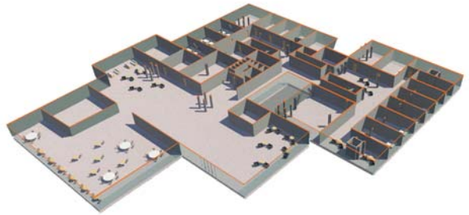




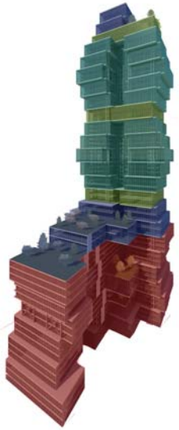
Residential _ Typical Box



Re-Ligare Institute _ 23rd Floor

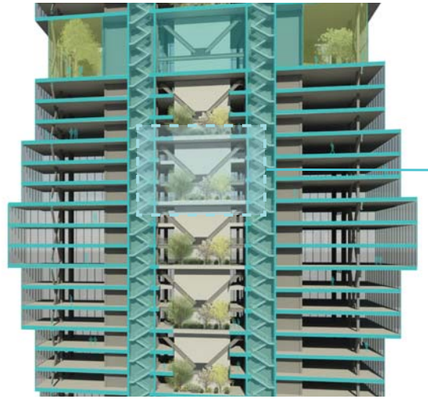


Hotel _ Ground Floor



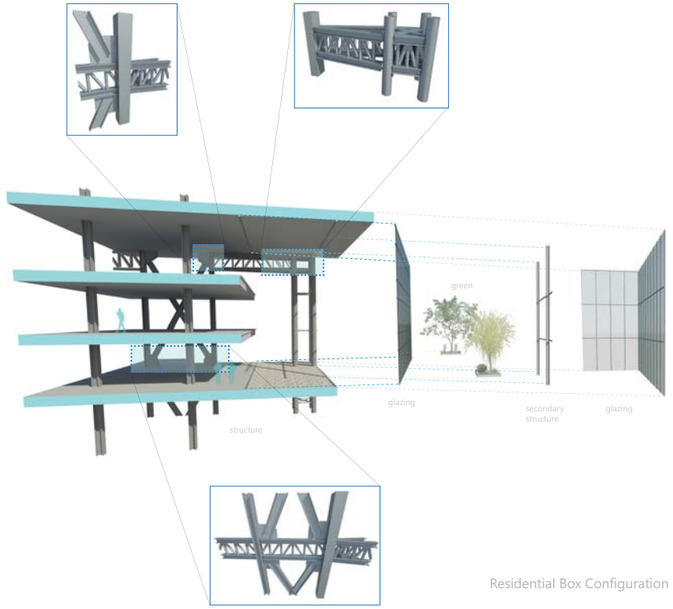
SPA / INSTITUTE
MECHANICAL / GREEN
RESIDENTIAL
HOTEL

Presentation Board 03



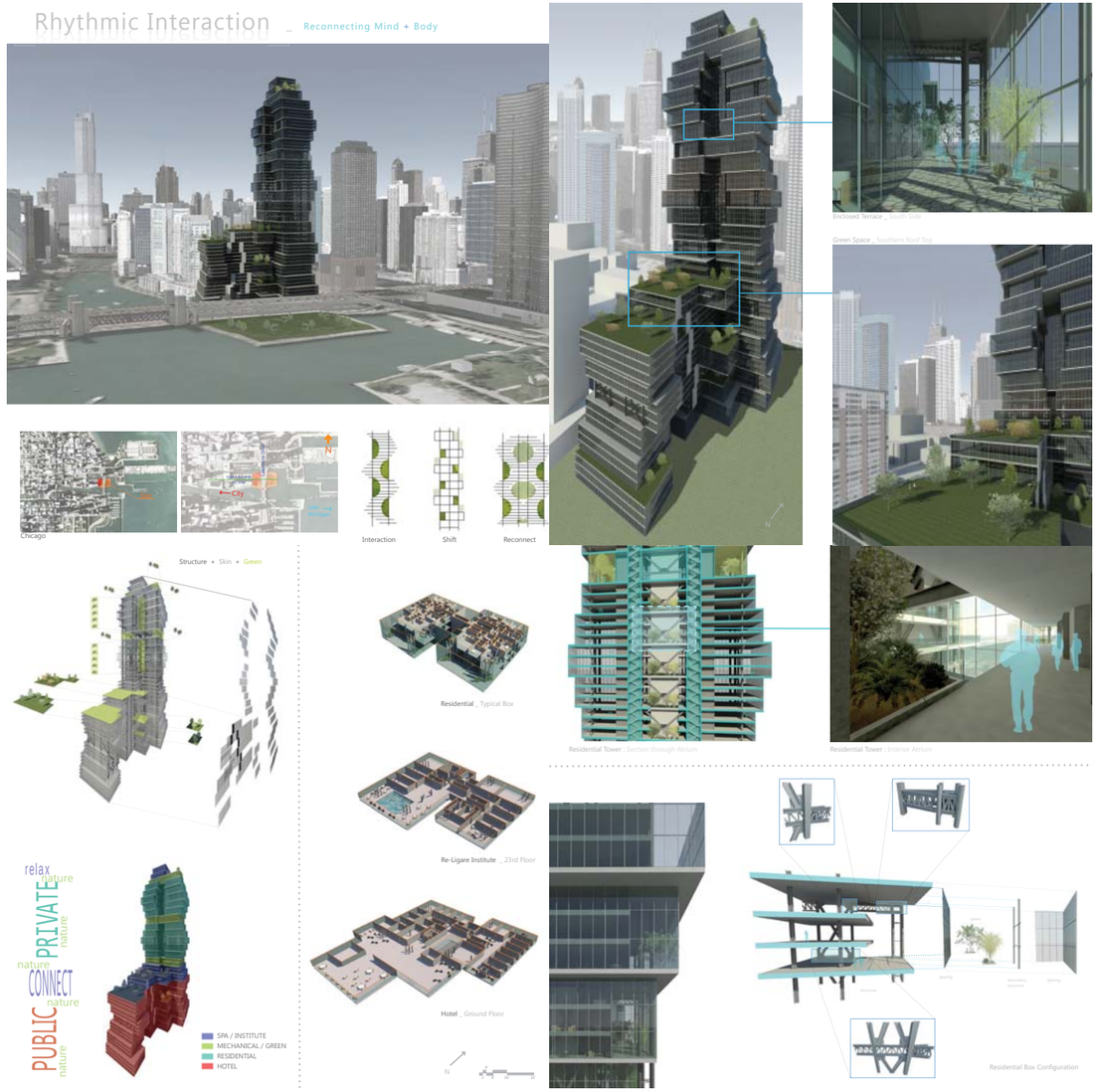
Residential Tower : Section through Atrium

Residential Tower : Interior Atrium



Residential Box Configuration

Presentation Board 04

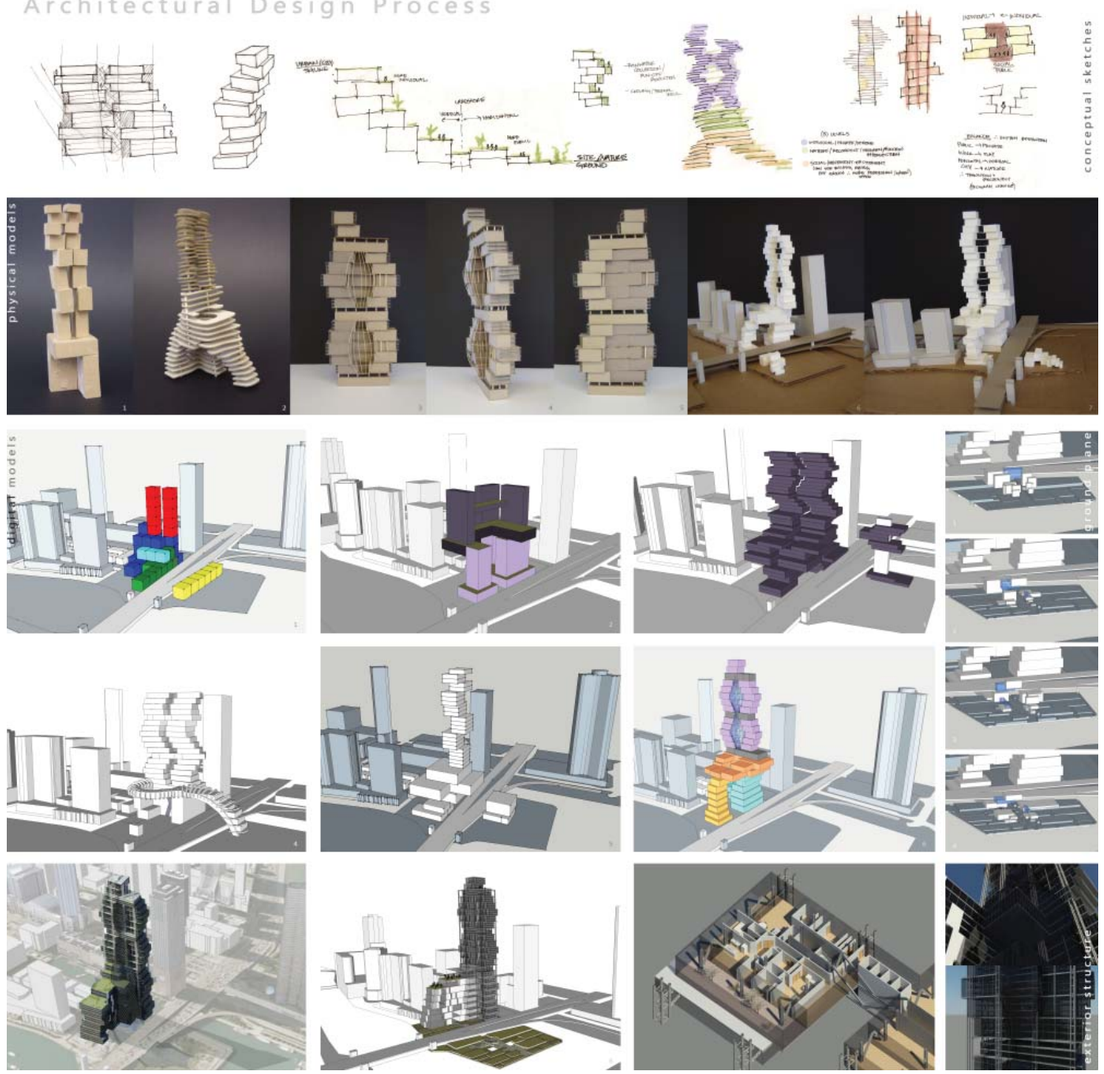


Presentation Board Summary

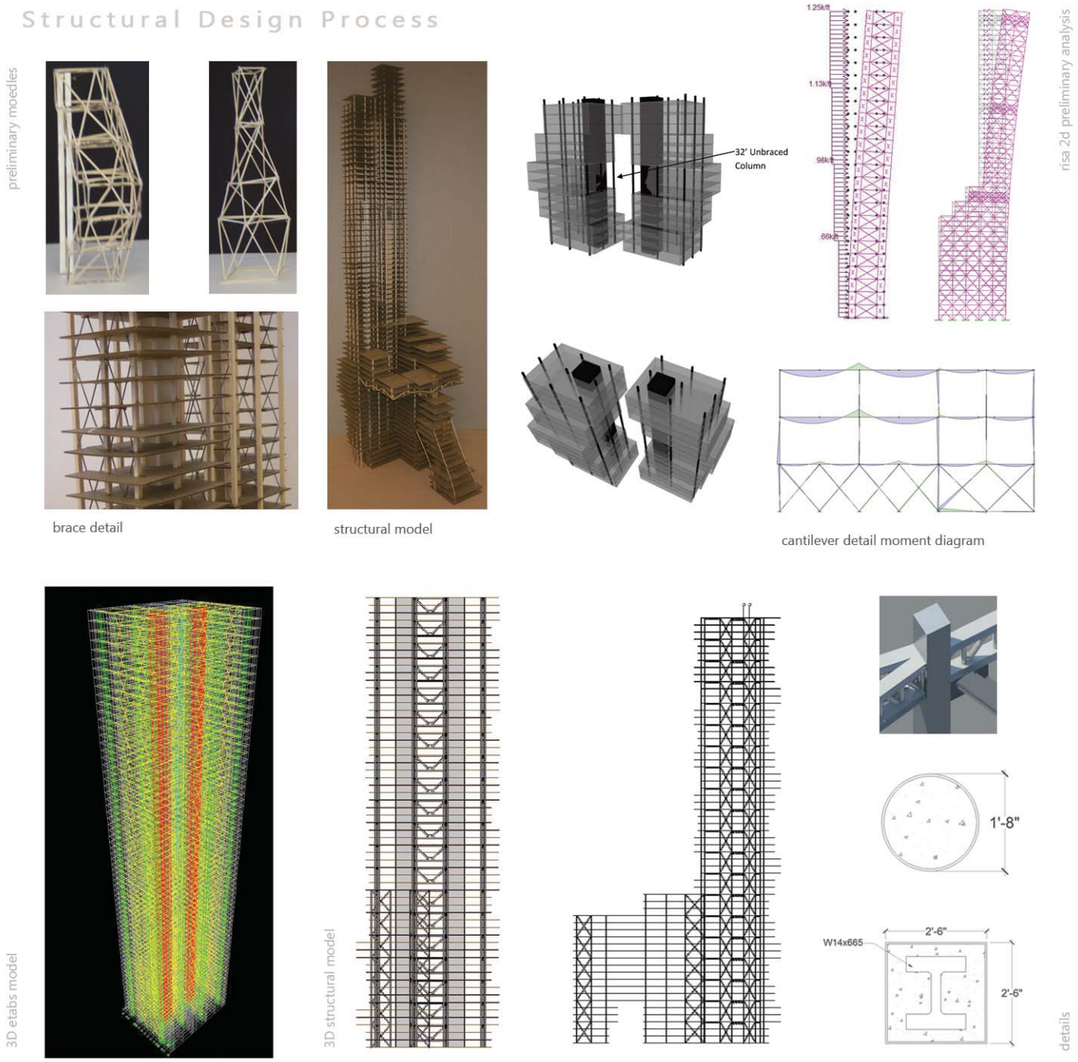
Rhythmic Interaction

The tower design is inspired by individuals trying to reconnect their mind and body among all of the everyday challenges [social + individual; work + play; city + nature; horizontal + vertical] and provides numerous spaces to exercise their efforts and remain true to themselves. The overall form provides spaces for social interactions of individuals who are interested in balancing social and individual connections. The tower contains box-shaped elements that are pushed and pulled depending on program and the possible interactions created between them. This pushing and pulling of the boxes starts at the ground plane as being random and larger gestures. This is the more social program of the building which is dedicated to the outdoor space and hotel where large groups may gather. As you move up the tower there is less erratic movement, large elevated green space, and a 'break' in the rhythm of the tower's shifting boxes. This is the where the tower and its users reconnect with others, themselves, and nature. This intersection is where the Re-Ligare Institute is located, as well as a fitness center for the entire tower. The fitness center is available to hotel, institute, and residences and is the only portion of the tower where all programs converge. Continuing up the tower, the shifting boxes become more in-sync and have a rhythmic quality to them. The tower opens up to allow for a continual vertical connection between levels and intertwines all the way up to the top. This is the more individual (private) portion of the tower where the atrium provides each residential level with outdoor spaces while re-connecting inhabitants to the city with panoramic views of the Chicago and Lake Michigan. The tower terminates into the spa where the highest point of the tower is for relaxation and rejuvenation. The upper portion of the tower allows you to see the boxes shifting away from the structural system, making it more apparent that it is not being confined by structure but interacting with it. As the boxes shift away from the structure, the structure is still keeping the tower grounded. As the towers split apart there are two large atrums that give the tower a communal quality and allow for nature to creep up the tower and flourish the interior. The entire south face of the tower contains an enclosed terrace for the residences. This allows for a more intimate interaction while still having the option of privacy. The main structure also reveals itself at the atrium to provide a continuous vertical connection, while showcasing the unique steel structure. The southern terraces and atrium vegetation not only reveal the structural system but help with Chicago's severe weather and creates an enjoyable buffer between the sometimes harsh environment of the site.

Architectural Design Process



Structural Design Process



Jamie Jones
Even though our group started with five members and ended with four, we each learned valuable lessons about what it means to collaborate that we can take with us into our futures. Collaboration in the beginning was difficult. As engineers, we wanted to let the architects do the design and we would just put in some braces and shear walls because that was what we were used to, but we quickly learned it doesn't work that way in this setting. Each of us had to figure out our roles in the group quickly to ensure nothing that needed to get done was lost in translation. I think one of the biggest things I've learned how important it is to provide numbers. Everyone wants to know "how big", "how deep", or "how long" a specific piece to the puzzle is, and it is important to know how to do "back of the napkin" calculations to give an estimate of size.

Architectural issues arose that we had never thought about before this class. We never realized how important a cladding system was, or the way a structure cast shadows on surrounding buildings and areas. It was very interesting and informative to realize which issues were important to the architects and which were not. All in all, this class gave us valuable insights we can take with us into our careers. It is important to be able to talk with people in an understanding environment or tensions arise and the project as a whole suffers. We also learned what it really means to be part of a group and what it is like when someone doesn't pull their weight or do what they had promised. This was a great experience in group and collaborative work.

Naoko Miyamoto
What was different about this studio from others was that each group was made of architecture and engineering students. I had not thought about structural systems from the very beginning along with architectural design, so it helped me think of our project as an actual building, seeing design problems more realistically. At the beginning, it was hard to work on architectural and structural aspects at the same time because engineers could not come up with structural systems when there was no form; architects couldn't come up with a form when structural systems and sizes were not provided. We all learned quickly what we have to provide to each other to make things work.

What I learned most from this studio is how to make one project out of multiple ideas. We all have different ideas, and ways of working, so decision-making was the hardest part of this studio. I have worked in a group before at work with a lead architect, but in this class everybody was at the same level, so communication and understating each other became more important as design progressed. I understood from the beginning that we all have different backgrounds and different ways of approaching the project, but every time somebody had ideas which I had never thought of, I was surprised and impressed that we all think and feel differently. I learned to see problems from different angles and to approach them differently through working in the group. It was hard to unify everything into one building, but there is more thought in the building than my previous projects.

Carl Fosholt
The most important thing I learned from the interdisciplinary collaborative design studio was the significance of keeping an open dialogue. When brainstorming ideas as a group, the most destructive thing one could do was to say, "No" or "That doesn't work." This would kill the dialogue and bring the design process to a sudden stop. If the response was more along the lines of "I see what you mean, but could we try this..." then the dialogue would remain open and the design process could continue. I found that this tactic was essential especially in the early stages of development. I also learned how helpful 3-dimensional models and comprehensive drawings can be. It is so hard to convey what one sees in their mind with words, and it can be nearly impossible for other people to understand what that person has in mind. When our group would meet to discuss massing designs, I would try to explain an idea that I had that seemed crystal clear in my head, but when I tried to explain it, my colleagues couldn't understand what I meant. After building a quick study model, they were able to see what I had in mind and could work with my idea.

The most unique part of this experience was being able to share the design process with other disciplines. It was very interesting to juggle the balance between architecture and structural design while at the same time trying to splice them together and make them work as one. I really enjoyed solving the design problems from two different outlooks. On one hand, I wanted to make sure the structure was adequate, simple enough for me to design, and innovative. On the other hand, I wanted the structure to be complex and a driving force in the aesthetic of the building. This is when the collaboration with the architecture students was so crucial. I had a hard time manifesting my ideas for exposed, aesthetic structure with any relation to the building itself. It was really great to get input on scaling, spacing, form, etc. from my colleagues. This experience with teamwork is also a very valuable asset that will be very important later in my career when I will be working with a whole team of designers.

Adriana Savannah
This interdisciplinary studio was a great experience and a change of pace from other studios. The unique part about this studio was being able to work closely with the structural engineers and to get their input from such an early stage in the development process. The biggest lesson for me was communication amongst team members and to know how important everyone's role on the team is. Although communication between architecture students and structural students was difficult at first, we learned what was important on both sides and learned to understand one another. The structural students helped put our major design decisions into perspective, which was key for an 800 foot tall tower and is very unique to this studio.

A major factor in working on a group project is to have everyone on the same page about the end goal or vision of the project, architecture and structural students alike, in order for the project to be successful and have something everyone can be proud of. The main thing that I enjoyed was collaborating to get the ideal structural system and form to satisfy the group's vision and to have others bring up ideas you may not have been able to come up with on your own. Working in groups can be challenging at times but to have many different ideas and input into one project makes the project far more interesting and gives it depth that many other studios don't allow time for. To be able to work in a group is something that you will definitely take with you in the future and will give you an advantage in your future working environment.

Thomas Einspahr
George Foreman
Dago Delarosa
Kalen Turner

team06

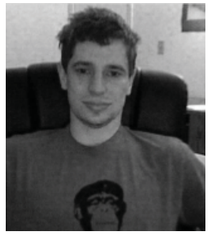
pulling structure_ skin and bone

Thomas Einspahr

While combining the four ideas of structure and architecture can be difficult, the benefits outweigh the struggles. The interdisciplinary interactions result in a design process which reveals new opportunities to all of the fields within environmental design.

George Foreman

The most interesting part of the past two quarters was coming together initially on the blank slate when it was nothing but the raw ideas of four people and the development of those ideas into the material object.

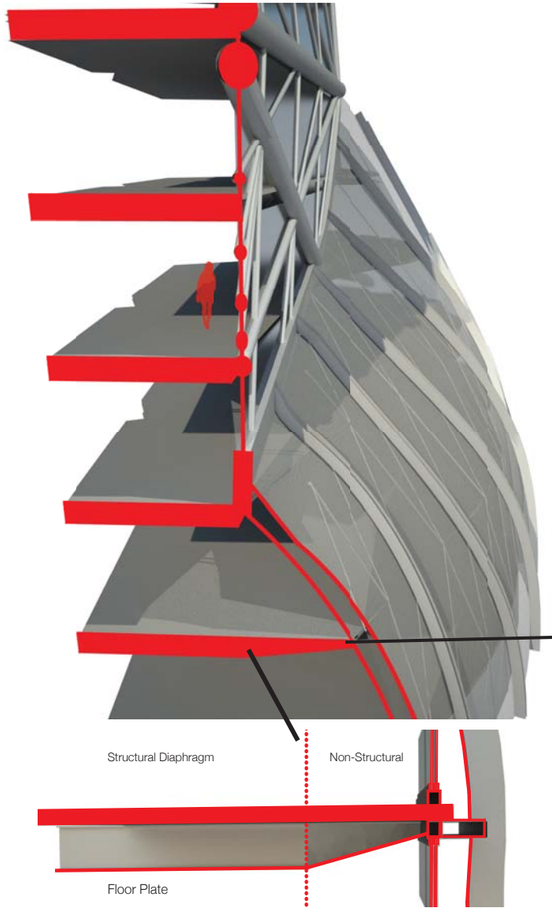


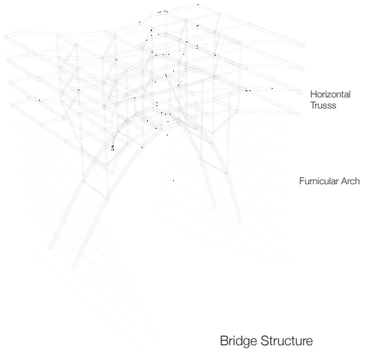
Kalen Turner

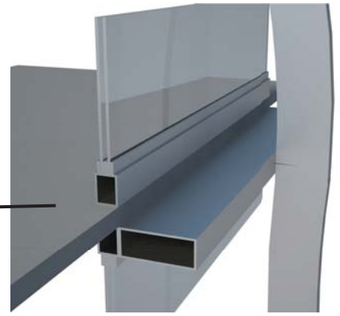
Going from Architecture to Architectural Engineering I have learned that Architects and ArcEs look at problems differently and react to situation with completely different points of view. An architect looks at it from a spacal perspective while the AcrE wants to know how to make it stand up. When you combine the two you get a conflict but in the end something special.

Dago De La Rosa

After switching from architecture to architectural engineering, I do not have any regrets. I admire both good architecture and think of engineering as an art. Irregular and tall structures interest me because they make me think in different innovative and exciting ways.



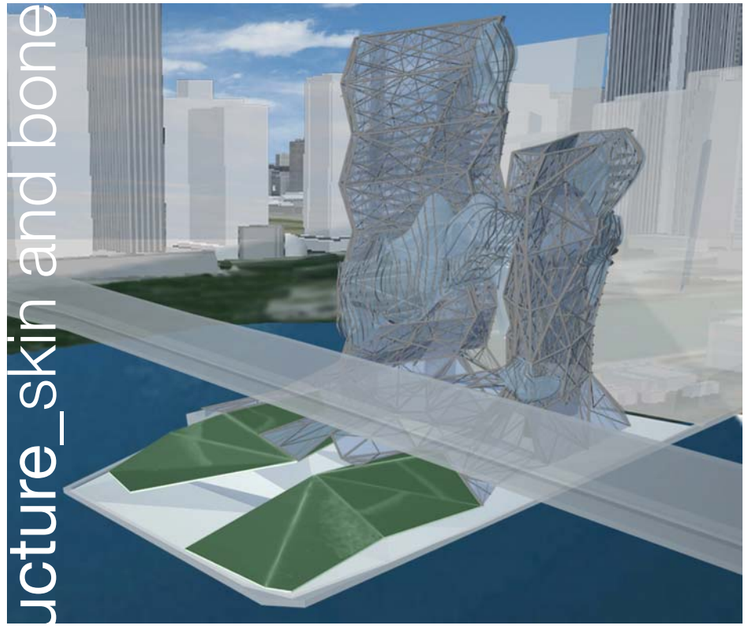


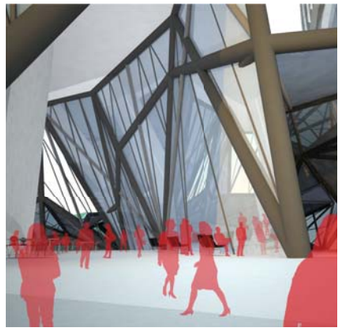


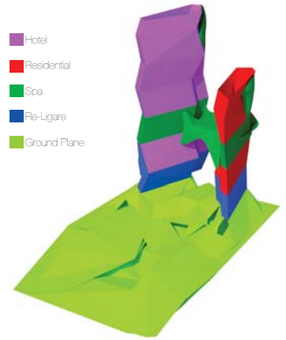
The project is conceptualized as the public skin being pulled from a structural diagrid. This gesture encourages the intermingling of public and private elements creating greater human interaction within the program witn public indentified as growths emerging from private diagrid. The diagrid then hits ground creating a new type urban space inspired by the urban layers of the city of Chicago.

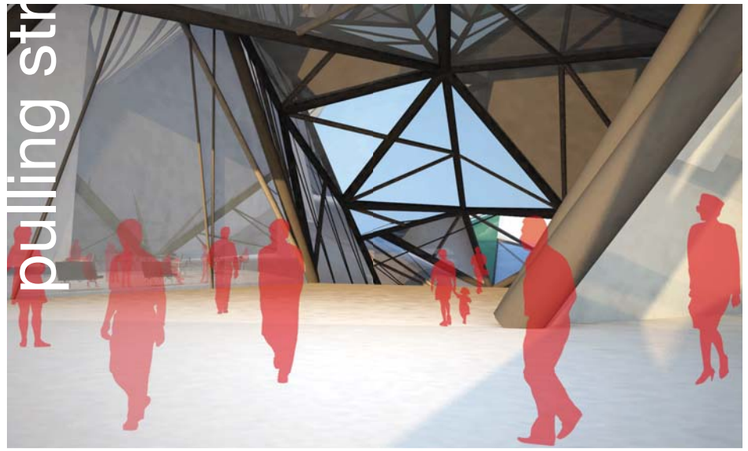
pulling structure_skin and bone

Presentation Board 01



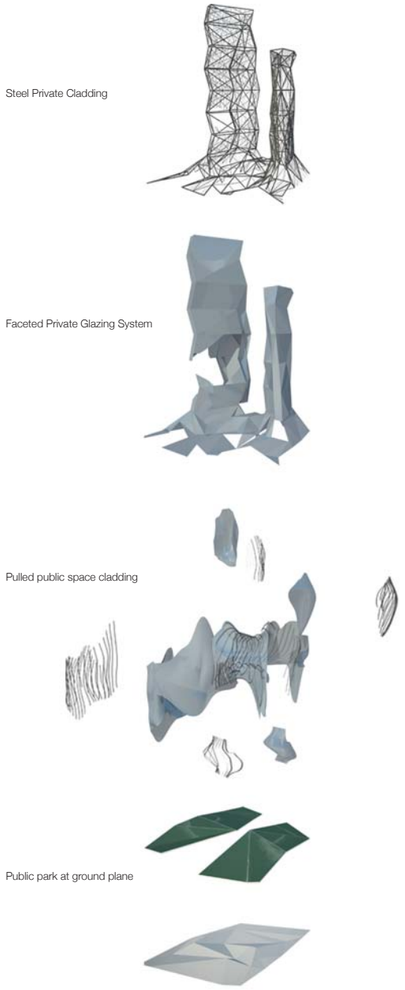


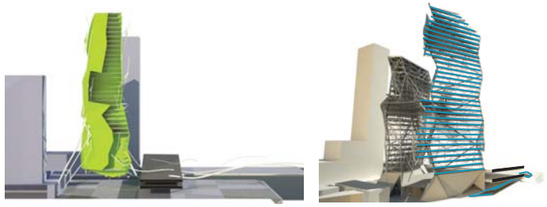


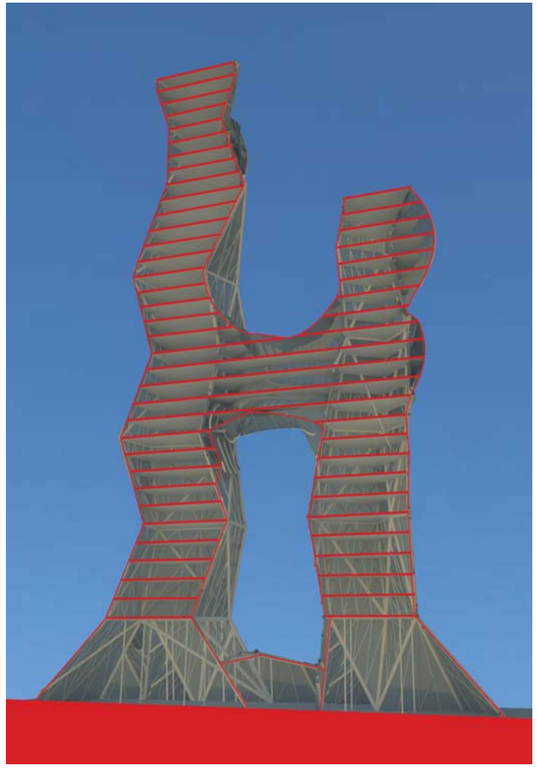


Presentation Board 02

pulling structure_skin and bone

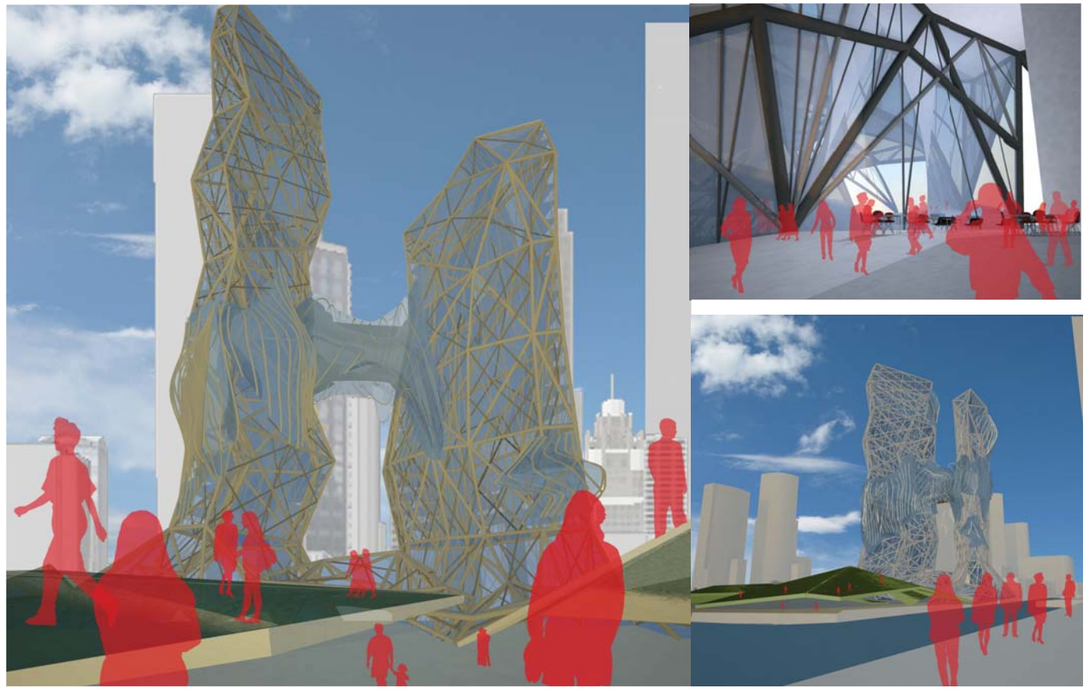


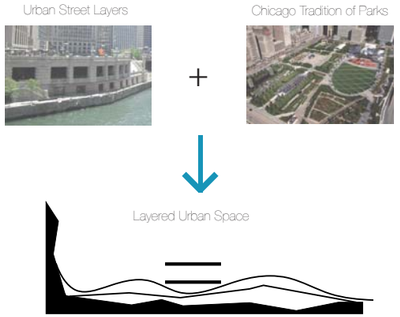


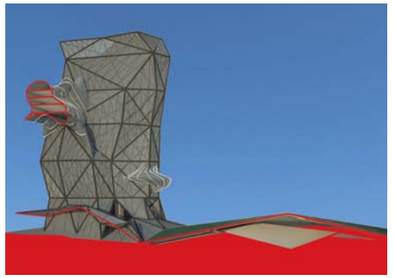


Presentation Board 03

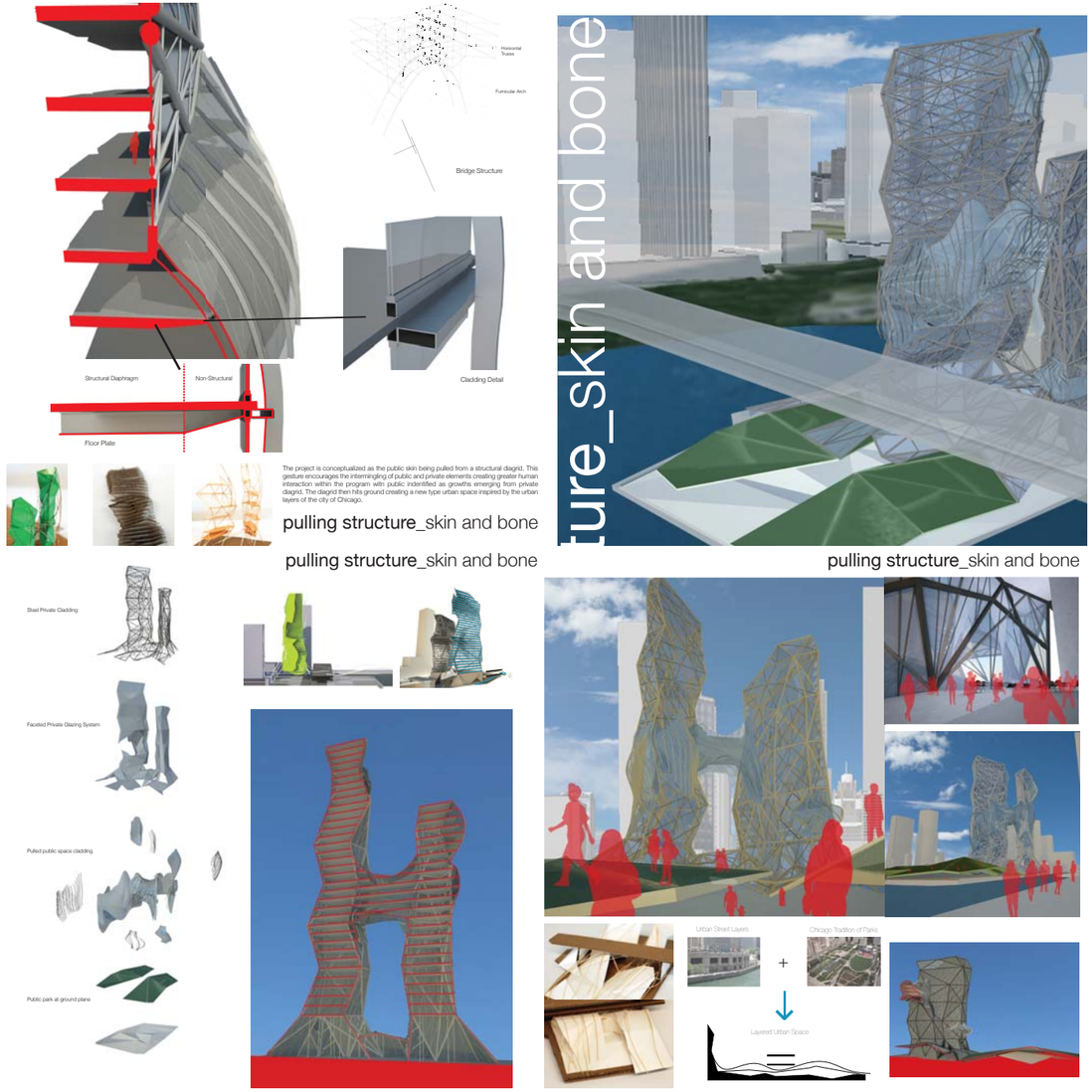
pulling structure_skin and bone







Presentation Board 04



Presentation Board Summary

pulling structure_ skin and bone

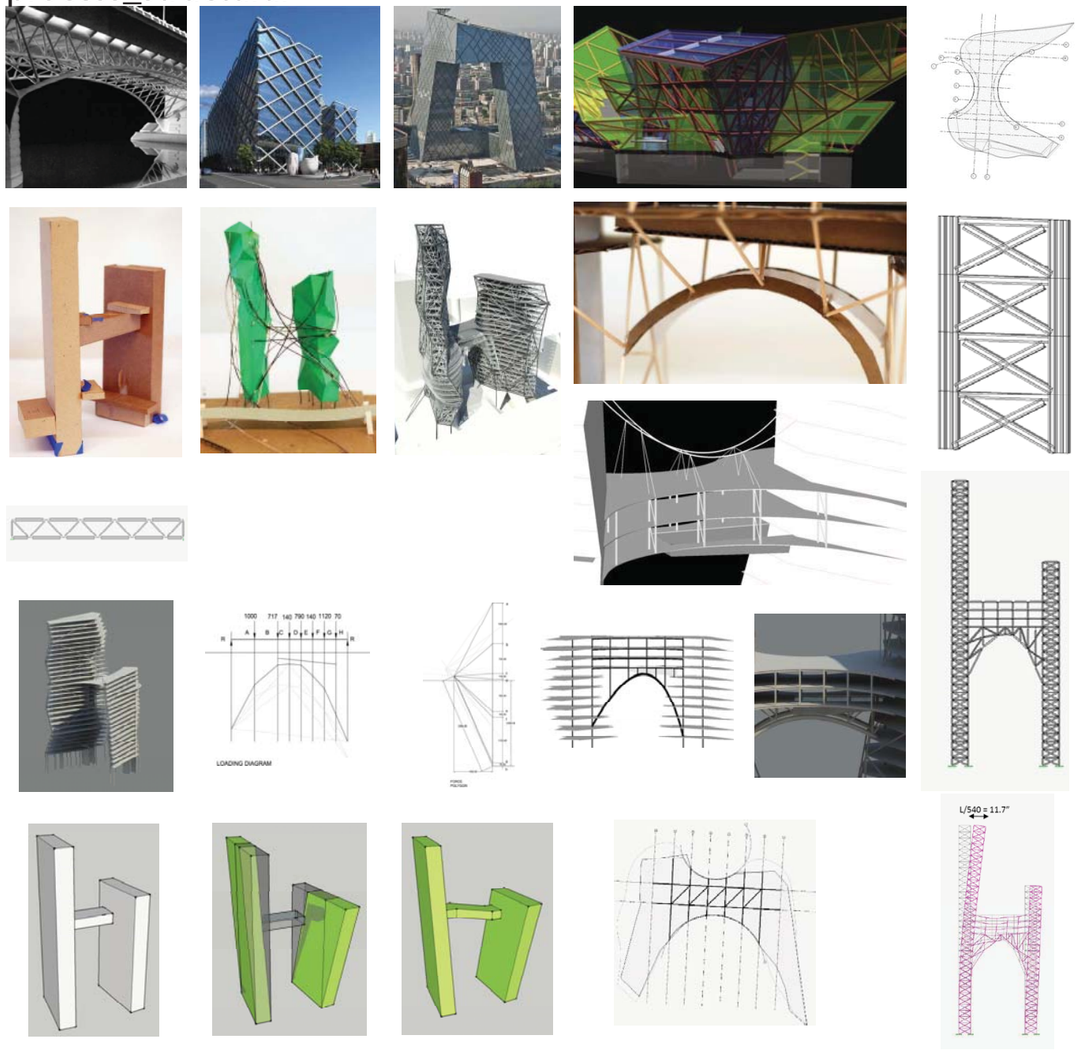
The project is conceptualized as the public areas being pulled from a structural diagrid, which acts as the private areas. This gesture encourages the intermingling of public and private elements, creating greater human interaction within the program with public areas identified as growths emerging from the private diagrid. The diagrid then hits ground creating a new type urban space inspired by the urban layers of the city of Chicago. We contributed a park to allow for a taller building height that emerges from the base of the tower. The park is a combination of the tradition of parks found in the Burnham plan and the urban layers found within the city, i.e. Wacker Drive where there are three layers of streets.

The public space is cantilevered from the structural diagrid and is composed of a double screen metal mesh in order to appear more singular in its fluidity. The floor plates fin to indicate that the floor is no longer load bearing. By using this choice of material, the public space will not appear to be attached on, but appear to be an intermediate state in the public and private areas. This is also used to accommodate the program and allow uses to identify the separation of public and private. The diagrid is the main volume of the towers. It houses the hotel and the residencies. Opposed to making a singular tower, two were created to move people through out the structures and utilize the public space that lies in between. The private diagrid is formally rigid, similar to the programs which it contains. When the diagrid hits the ground, it forms the faceted ground plane, extending itself out toward the Chicago River. The structure of the diagrid lowers in density and becomes a growth out of the ground. There is a green roof attached to the ground plane so that maximum usability is obtained through out the structure.

Gravity loads from the bridge, which includes the pool, are transferred to the cores of the towers through a constant force arch. This allows the bridge to have an open plan. Lateral loads in the north and south direction are resisted by the special core that has shear walls with two columns on each end to increase the stiffness. The buildings are slender in this direction so the bridge diaphragms will be used as struts to transfer some of the lateral loads to the other building. The bridge decks have horizontal trusses that help to accommodate the separate drifts from the two buildings. The diagrids at the east and west ends of the towers will also help to reduce torsion in the towers.

process_architectural

process_structural



Thomas Einspahr
Coming in the studio I was looking more at the design focus in the class than perhaps a focus on working within a group. I looked at design as a very individual process. One of main things I learned in my experience working with structural engineers is the most complex design solution is not necessarily the best. Originally our design had a diagrid structure which was random and complex. Through working in the group we came up with a design solution which was not as complex as the original.

One of the most rewarding aspects was the design work we put into the bridge between the two towers. The bridge functioned as a testing ground for us to push the envelope both in terms of structure and design. In developing the design we pushed ideas working between structure and architecture. On the other hand, the design began to show the limitations of going back and forth between Rhino and Revit. Design elements developed in Rhino were not easily transitioned into a Revit environment. I think working in this interdisciplinary environment really opened the way I think about structure and design as a whole.

George Luis Foreman
The interdisciplinary studio provided opportunity to work with architectural engineers. It was interesting to see how much the design changed when they got their hands on it (column dimensions and additional loading requirements) and how they can incorporate structural design into the aesthetics of what the architects have done. The richest experience was the challenge over the bridge, where numerous proposals and solutions from the ARCE students were addressed but came together to determine which solution matched the design concepts.

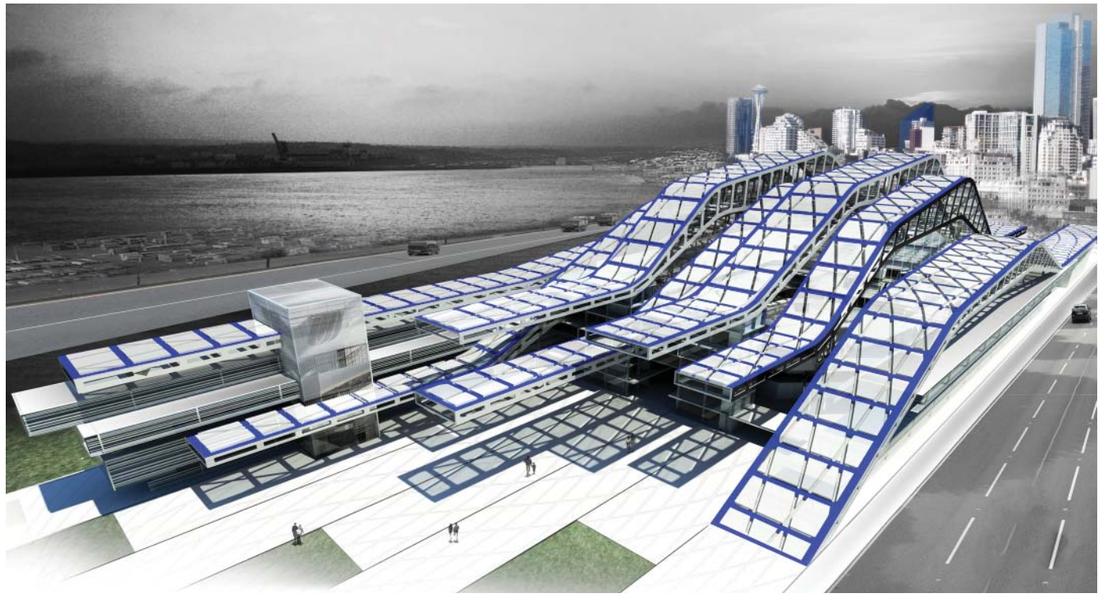
My recommendation for this class would be to come in open-minded and be able to work well with others so that ideas can be fostered rather than stagnated through stubbornness over personal design philosophies. If you are working alone in developing new ideas, you should keep the group informed of what you're experimenting with and be ready to explain the sucesses and failures.

Dago De La Rosa
This class was much different than any other course I had taken in architectural engineering because I got to travel out of the state and because it was the class with the least amount of calculations I have ever done. It challenged me to think in totally different ways about how structures can be designed. The toughest part of this class was not working with very creative and innovative architects but getting the team to work together and to follow a set schedule.

The most helpful experiences from this class were communicating ideas to peers and also to non-engineers. Presenting to non-engineers was a great experience because I had to think of how to communicate ideas in a way that they would understand what I was trying to present. This is similar to the real world where, as an engineer, I will have to communicate with architects, owners, and building officials.

Kalen Turner
I went into this class with pretty high expectations. I thought I would enjoy working with architecture students and fellow engineers. Unfortunately for me, I found that I was disappointed with what I got out of this class, but please don't take this as a norm for the rest of the students. I feel my experience was clouded by events outside of the class giving me a skewed view. Things I did like were being able to go to a site and actually have a sense of purpose for the project. In most ArcE or Architecture classes, it seems to me, you are given a project but don't have a clear purpose of what the point is, since it all seems so non-realistic. Not in this class. In this class we went to the site, we were given a program and from the very start we understood the purpose and why we were involved in the project.

Things I would advise you to look out for if you decide to take this class are: architects take time in their creative process and try to listen to your engineers. Architects, I know you have a bunch of great ideas, but just remember it has to stand up, and in order to make it stand the engineers might have to do things that aren't always how you pictured structural systems working in your mind. To you engineers, when the architecture student gives you some crazy idea, don't immediately say it's not going to work, take a deep breath and say instead that you will look into it. Then go back to the architects with a viable solution making it clear what will be necessary for making it work.



2010/2011 sports arena complex

The site for the project is located in Seattle, WA at the conclusion of the Waterfront Redevelopment Promenade

team01

synergy

Sophia Freund
Jennifer Ton
Oscar Gutierrez
Garrett Sweeden
Kristine Morales

Sophia Freund
Camarillo, CA

I do not regret switching from architectural engineering to architecture. Even though they are different disciplines, they greatly depend on each other to create a livable work of art. This process started with two disciplinary backgrounds but ended as one team, one idea, and one goal.

Oscar Gutierrez
Cocula, Jalisco

Structure is my favorite part of architecture, especially when it defines the aesthetics of a space. It is great to have a class where the collaboration with other disciplines further enhanced these structurally expressive spaces. Seeing everyone strive for the same goal, with different perspectives, was very insightful.

Kristine Morales

After a separation from our architect counterparts for the bulk of our collegiate career, being reunited as a design partner with architects was a great experience. It was amazing seeing a common respect from everyone for form, function, and statics.

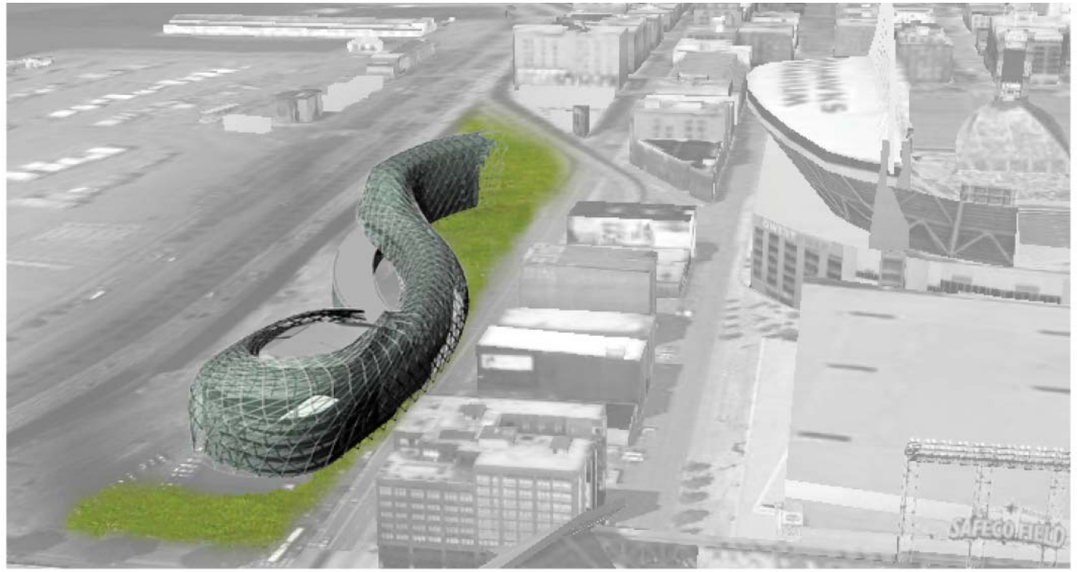
First and foremost this class was a great learning experience - having structure and architecture simultaneously guide a project was a definite challenge, but breaking through differences in software literacy as well as translating between architectural and structural vocabulary was rewarding in every sense.

Jennifer Ton
San Jose, CA

More collaboration among various disciplines to understand the needs of design and build entities at the beginning of a project is the future of the building industry. The interdisciplinary studio allows an opportunity for the design team consisting of architects and engineers to share their concerns and to efficiently design a project holistically instead of inefficiently as an afterthought.

Garrett Sweeden
Tulare, CA

I have always viewed “structure” and “architecture” as the same, rather than opposing systems. This studio was very interesting because I was able to learn how structural engineers approach complex building projects differently than architects, but in the end, the result was so much better than one or the other could produce.



SYNERGY

Fig. 1

Waterfront site in the context of the Seattle network

Fig. 2

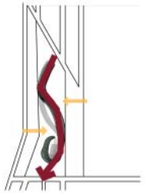
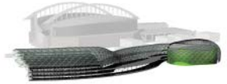


Diagram showing form generation in response to pedestrian flow and east-west connection

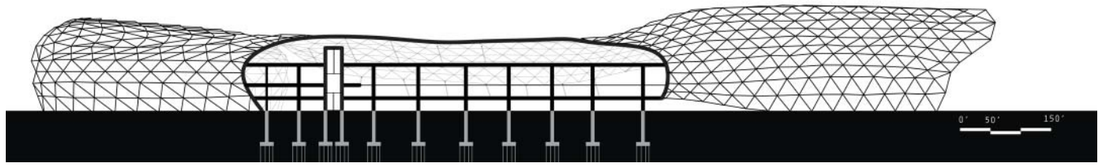
The linearity of the design emphasizes the long, narrow nature of the site. To serve as three destinations that intertwine together, the hotel and the arena are strung together by retail developments. The form of the project is derived from the flow of pedestrians to and through this site, and also allows people to access the waterfront development easily. The undulating, steel skin covers the program to ensure usability during all seasons. The use of steel contributed to the perceived lightness and flowing nature of the canopy, visually guiding the pedestrians along an experiential path.

Hotel program

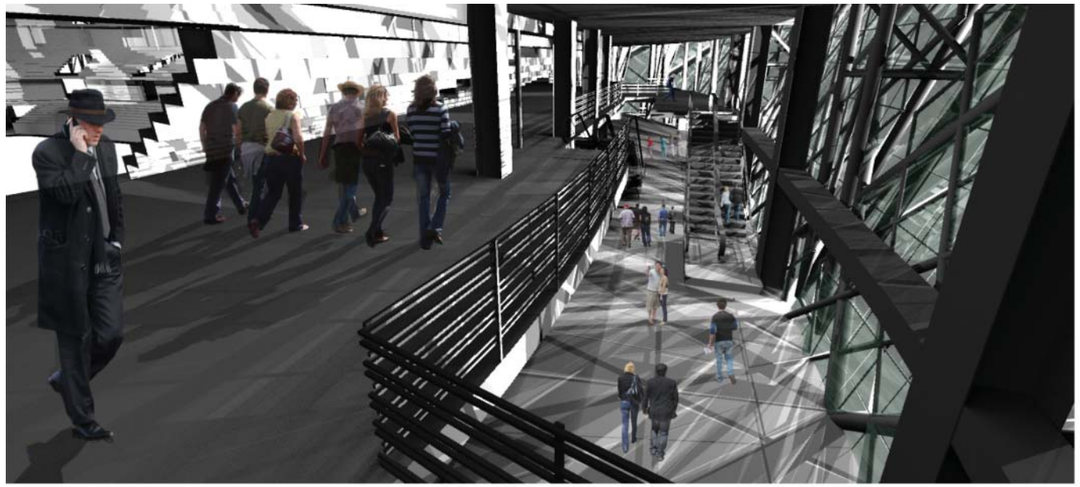
Retail program

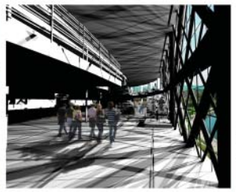


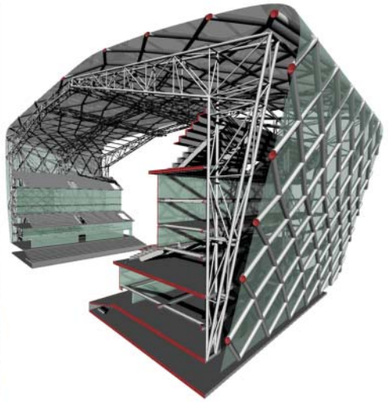
Stadium program



Presentation Board 01







The three-tiered arena sits 19,000 spectators. Box seats are situated on the third level, which is a completely private floor. This allows VIP customers the ability to maintain a level of privacy at such sporting events.

A compression ring ties all of the trusses together at a height of 150'. The properties found in steel minimized the number of trusses needed to span the arena. In the end, 13 trusses, spaced at 45', surround the arena. The trusses also support the diagrid skin that sweeps around the arena, starting at a height of 90' and gradually elevating up to 150' to meet the retail program.

The arena's skin is opaque except for strategically placed transparent panels where day lighting is needed, such as main circulation paths. The layering of both structural systems creates a dynamic environment for fans to enjoy.

Presentation Board 02

Fig. 4

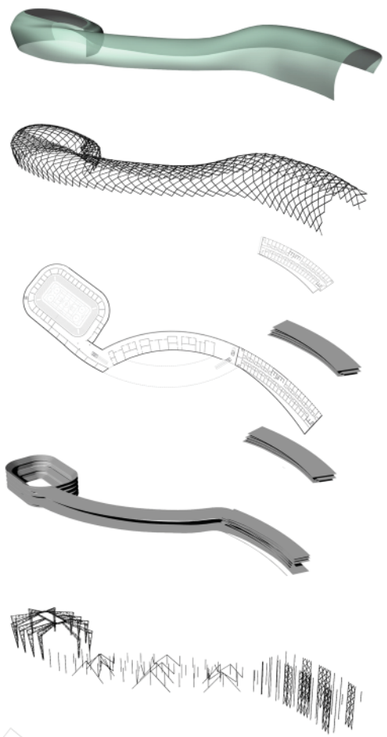


Fig. 5

Fig. 4

The continuity of form was able to be achieved through the use of steel as a structural material. The form gently sweeps across the length of the site, encompassing the hotel, retail and arena programming. This allowed for a unified project, one that integrated structure and architectural form

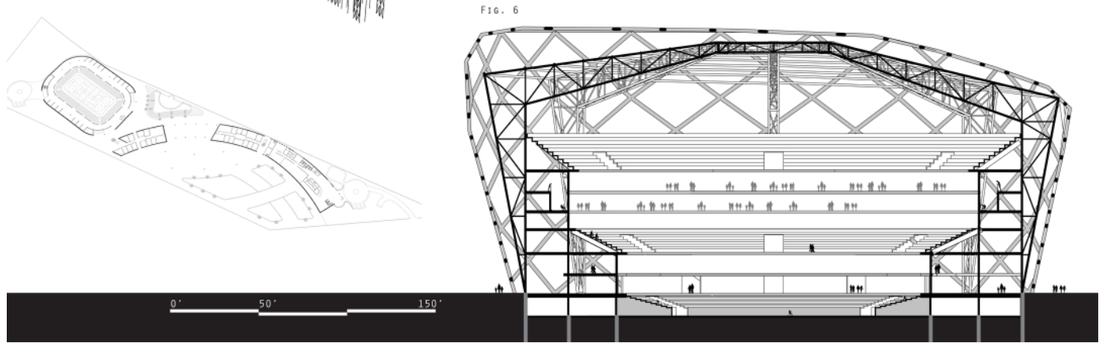
Fig. 5

Steel is used in a variety of places in order to maximize their efficiency. The steel diagrid acheives spans that allow for aesthetic lightness. The trusses and seating supports also benefit from the use of steel by maximizing efficiency while minimizing materials needed.

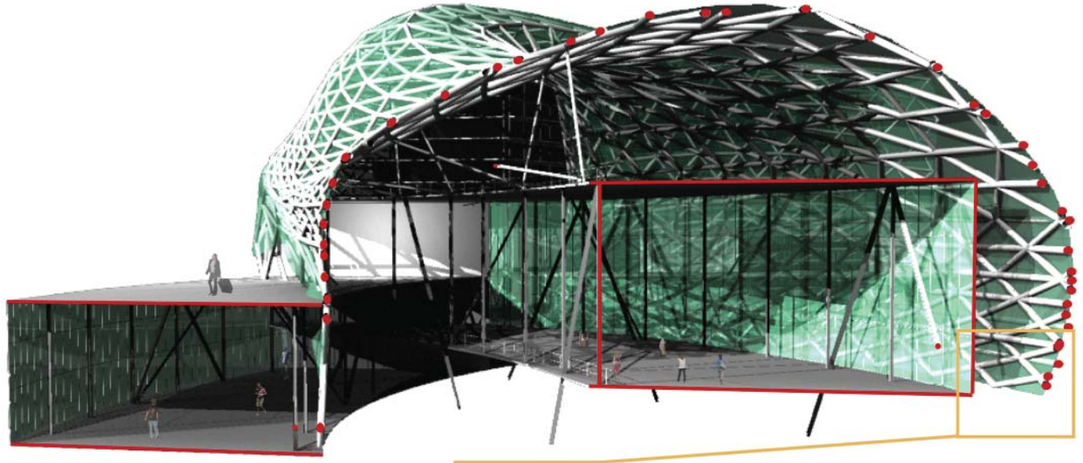
Fig. 6

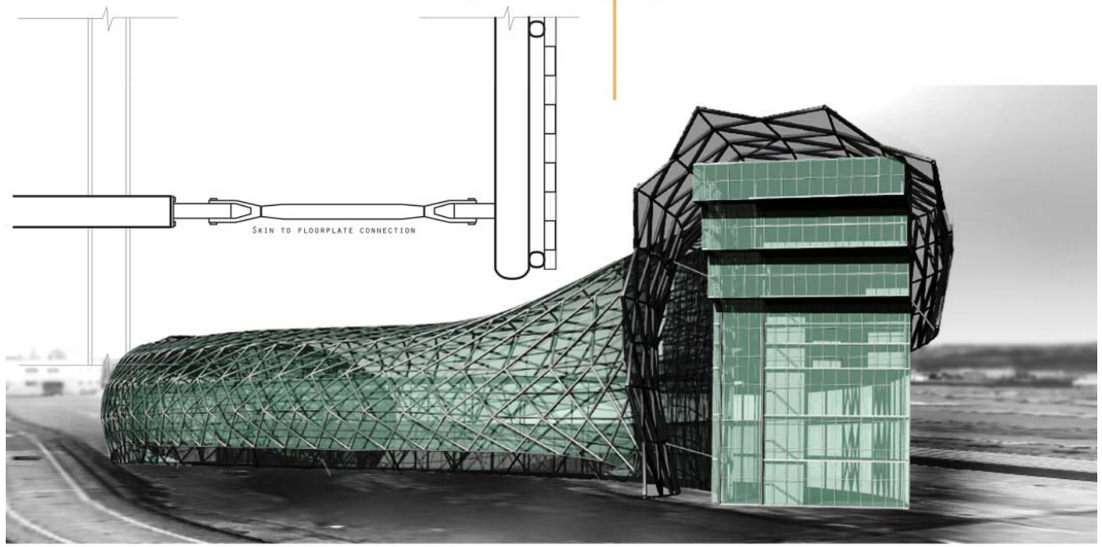
The diagrid that clads the arena on all sides, is supported by the 3D space-trusses. The skin is attached to the angled sides of the trusses, creating a volume that is experienced on all the concourse levels. This allows for a more pronounced relationship with the structure and the volumes it creates.

Fig. 6

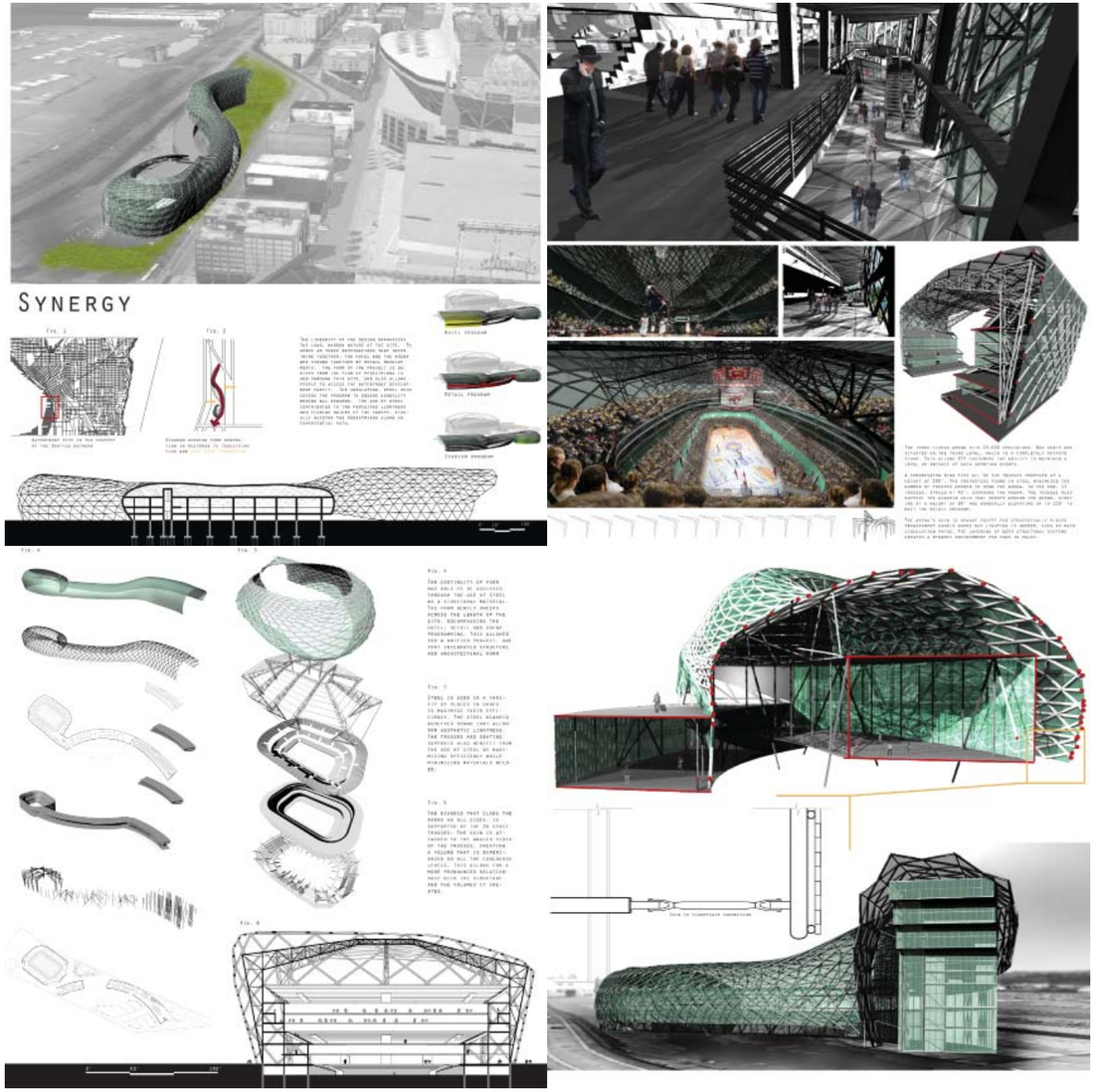


Presentation Board 03





Presentation Board 04



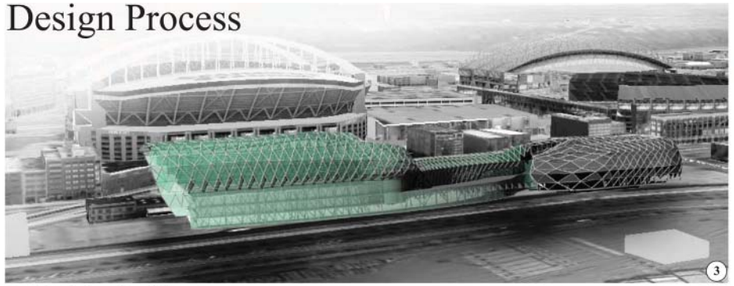
Synergy

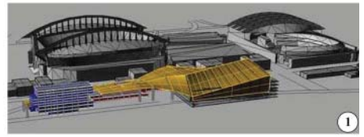
Seattle plans to redevelop its waterfront by rethinking how it connects back to the city, this unique situation allowed for this idea to influence the project's design. Sitting at the southernmost end of the proposed waterfront redevelopment, the project is designed to serve as an icon for not only the waterfront, but for Seattle as well. The program, consisting of a hotel, retail space, and a sports arena, is unified by a diagrid skin that drapes over it. The continuity of form was able to be achieved through the use of steel as a structural material. The form gently sweeps across the length of the site, encompassing the hotel, retail and arena programming. This allows for a unified project, one that integrates structure and architectural form. This creates unique opportunities allowing the different programs to interact with the skin in different ways. The skin not only provides a unifying flow and protection from Seattle's 300 days of rain, it also serves as a directional guide for visitors.

The circulation throughout the site takes advantage of existing pedestrian flow. The north end, where most of the pedestrian traffic comes from, welcomes the stream of people by subtly curving around them, creating a welcoming environment. A strong East to West connection is achieved through the site by elevating the ground plane of the retail programming. This allows for the waterfront of Seattle to connect back with the city. The undulations of the ground plane provide aesthetic appeal for visitors, as well as mimic the unique topography of the Olympic Sculpture Park at the north end of the Seattle Waterfront Redevelopment.

The diagrid skin sweeps around the three distinct programs, unifying them under one roof. The arena is wrapped by the skin that fluidly connects it to the retail and hotel on the north end of the site. The diagrid that clads the arena on all sides is supported by 3d space-trusses. The skin is attached to the angled sides of the trusses, creating a volume that is experienced on all the concourse levels. This allows for a more pronounced relationship with the structure and the volumes it creates. In the retail space, the skin flows over and around a void created by two curving floor plates creating a 150' atrium. The skin continues to the hotel where it creates an atrium for the main lobby as it sweeps up and over it. Structurally, the complex is composed of three buildings separated by seismic joints, located on the divisions of the programming. The hotel is framed with cross bracing to carry the diagrid theme of the skin. In the retail space, the diagrid skin provides longitudinal lateral bracing. The retail programming is longitudinally supported by a special concentric braced frame, and both branches are supported transversely by special concentric braced frames. At the stadium, the skin is completely structural, providing the lateral support of the roof and concourse.

Design Process

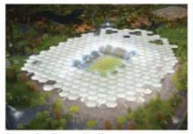




Precedent Study and Inspiritions

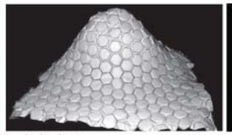
YAS Hotel - Abu Dhabi

Aquatic Center - Zaha Hadid



Burse Stadium - Stadiumconcept

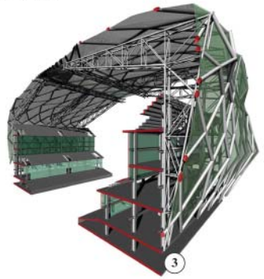
Inspirational - Rain Drop

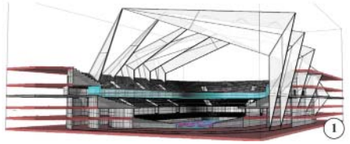


Inspirational - Movement

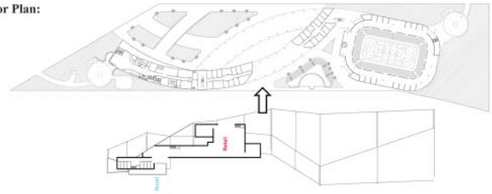
Inspirational - Curves

Stadium Section:

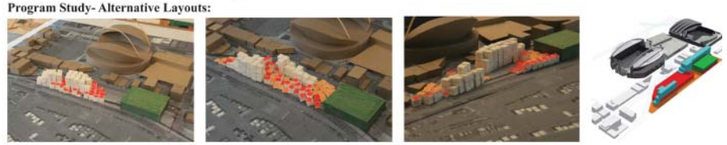




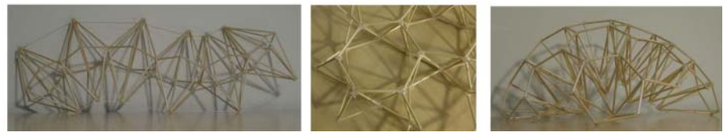
Ground Floor Plan:



Program Study- Alternative Layouts:



Structure Modular Study:



ARCE Process

Rachel Sophia Freund
Coming into studio the first day I assumed we would get into groups where each discipline does their own work before integrating studies at the end. I am happy to say that my assumption was completely wrong. This was truly a team effort throughout the entire project. I believe it really helped our group when we approached this Interdisciplinary Building Design Team experience not as different disciplines but rather as one team motivated to reach a goal. By doing so, I learned a lot about each discipline. Having the experience of working with other disciplines will defiantly help me in the future. It gave me a sense of what to expect when I work in the design field.

Oscar Alejandro Gutierrez
Since I had never taken an interdisciplinary studio, I remember feeling anxious about how the final project would turn out. Luckily, my doubts were gone once the quarter was underway. Working with different disciplines helped me realize that architecture is not just about how a building looks - the true beauty lies in the integral relationship of all of the building systems. Working together, from the initial design concept until the very end, was definitely my favorite part of the course. I am glad to have had this exposure to a different form of thinking about architecture, one that I will carry with me throughout my career.

Kristine Morales
I'd wanted to take this class for over a year before I actually took it. Coming in, I expected a systems -based approach to structure, and less nitty gritty calculations. Anndd…. It happened. The best part of this class was the interaction with architects, getting a feel of what we wanted the project to be and how to make it more. I feel that, especially in our group, we had a great open channel of communication between all the designers involved.

However, there was a language barrier and an indecisiveness for structure and architecture. Our group struggled mid quarter with whether design should be structure driven or architecture driven, when it could've been looked at holistically rather than from one side. It was a disconnect of language and software literacy, but this communication challenge was also the best experience. It was a great learning experience as both engineers and architects acquired the vocabulary and logic of the other side.

Garrett Sweeden
Day one brought me many uncertainties because I had no idea of what to expect. I had heard both positive and negative things about the studio, but I knew that I wanted to take it for the experience. Reflecting back on the project and, more importantly, the process, I can say that I am very fortunate to have taken this studio.

The most valuable aspect of the studio's collaborative nature was coming together around a blank slate, each of us carrying our own biases of what architecture and structure actually mean, and hashing through those biases to learn how to communicate well outside our comfort range. Our group gelled really well, and there was never a shortage of ideas bouncing around. Working for 20 weeks towards a common goal helped me realize that it doesn't have to be architects vs. ARCE's, but rather when the two disciplines come together, the sum of the whole will always be greater than the sum of the two parts.

Jennifer Ton
I have enjoyed the opportunity to work with architects and engineers. The steel design competition was a great way to integrate the design team and utilize our collective genius through co-location instead of working with limited views in solitude. Working in groups takes a lot of communication efforts as well as organization, open mindedness, flexibility, and patience. The extra time is definitely worthwhile when the whole team can come up with a collaborative design that addresses everyone's concerns.

As an engineer, one aspect of the course I really appreciate is getting involved in the design. In traditional architectural engineering design labs or in design-bid-build procurement, the architectural drawings are usually just given to us to develop a structural system. On the other hand, the steel design competition gave us a chance to influence the design whether it was structural or environmental. Our class trip to Seattle gave me the opportunity to step outside my engineering role by understanding the environment of our project and thinking about the people our complex would accommodate.

I have really come to appreciate the design and production process that architects work incredibly hard to do. I hope the architects have come to respect our engineering design and production process as well. The design team can become incredibly powerful when we can utilize methods to align our processes. For example, establishing a grid for the project made both the architect's and engineer's jobs easier. Ultimately, I will take these learning experiences to realize what I can do better in the future to achieve architectural and engineering goals more effectively.

team02

draped//escape

Myles Parr
Ross Klein
Catherine Lam
Steven Ni
Baptise Rouit

Myles Parr
San Diego, CA

Architecture and structure should not be separated into two extremes. Without the combination of both, there can be no form. This class epitomizes this combination where structure and architecture must work elegantly and efficiently together.

Catherine Lam
San Francisco, CA

The best part about design is seeing a finished product knowing that the design was not tangible to begin with. Seeing the product of two disciplines emphasizes the two integral parts to the design.

Steven Ni
San Marino, CA

I've always been interested in structure and the physics of objects. In the past I've been spending too much time in Rhino and designing in a vacuum without giving too much thought to structure. I'm glad to have been able to take this studio where I can combine structure with architecture and work with engineers to come up with a solution that will be agreeable to all parties.

Ross Klein
Chatsworth, CA

This course has given me a much greater appreciation for the work that both architects and engineers do to create the work around us. As an engineer, I was fascinated to learn about the process that architects take to realize their vision and have a newly found respect for the work that they do. By combining the inventive aspects of architects with the ingenuity of engineers, both are able to come together to create something far better than either could have individually.

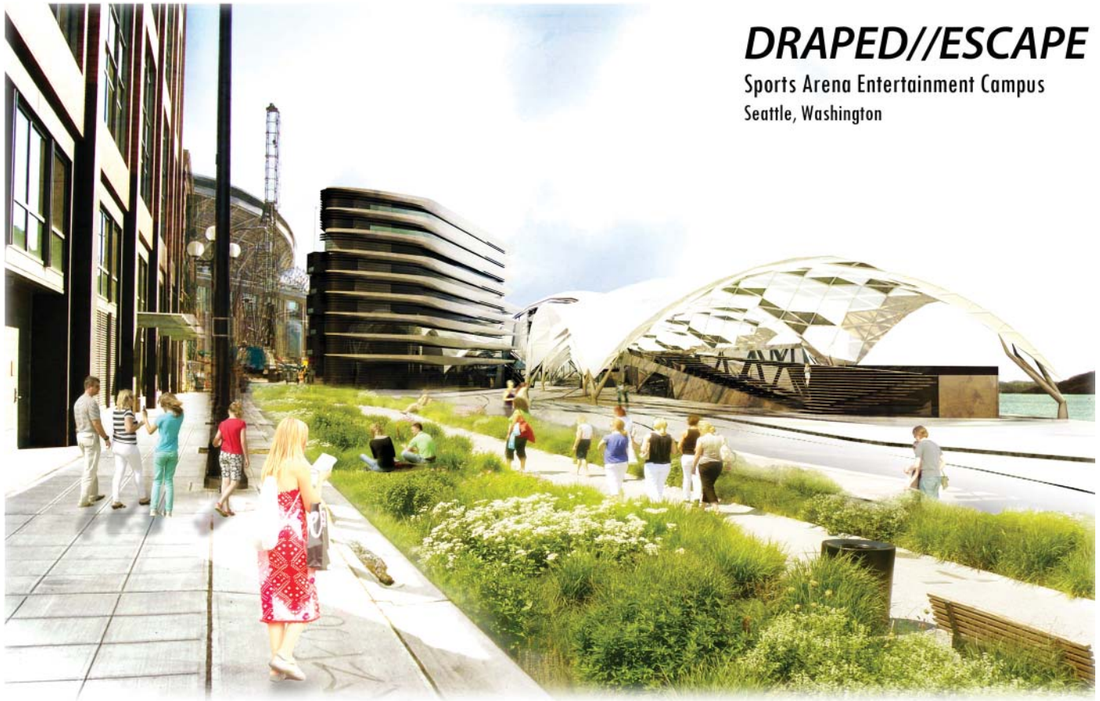
Baptise Rouit
Paris, FR

I was born in Paris and start my Architecture studies four years ago after spending one year in an Art school. Since I've started Architecture I've been enjoying this studies by the wide overview of the world it brings me. I like traveling and from a roundtrip around Asia to my exchange program in California it allows me to live and understand a completely different way of life. I enjoy raising new question and consider ideas far from my culture.

DRAPED//ESCAPE

Sports Arena Entertainment Campus

Seattle, Washington



DRAPED//ESCAPE *is conceptualized as an inverted arena, turning the public into the spectacle, and placing the program off to the side, creating a situation where the pedestrian public is the focus of attention. This is an extension of bringing the experience of the sports arena to the site and act as a unifying catalyst for social interaction for the diverse population of Seattle. This broad pedestrian boulevard is envisioned as an open park/program space and allows for maximum flexibility regardles of the weather or time of the year. The large, steel, gridshell canopy is formally derived by draping or hanging a cloth by points to find its most optimal form in tension, which when flipped creates the most optimal form in compression. The program is developed into three different areas where each one offers a different spatial experience provided by the expressive structural approaches. The main public spaces of the hotel and retail program allow users to be part of the energy and the excitement of the campus and the future of Seattle's sports teams. DRAPED//ESCAPE provides a year round, pedestrian friendly plaza that increases Seattle's walkability and sustainability.*

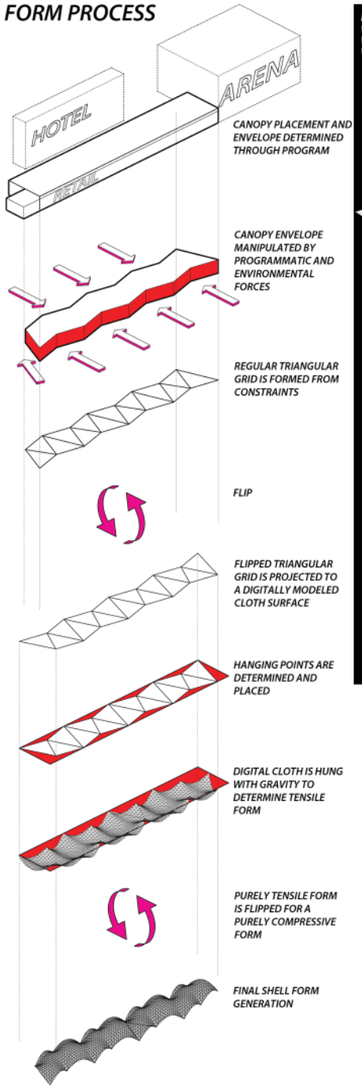
Presentation Board 01

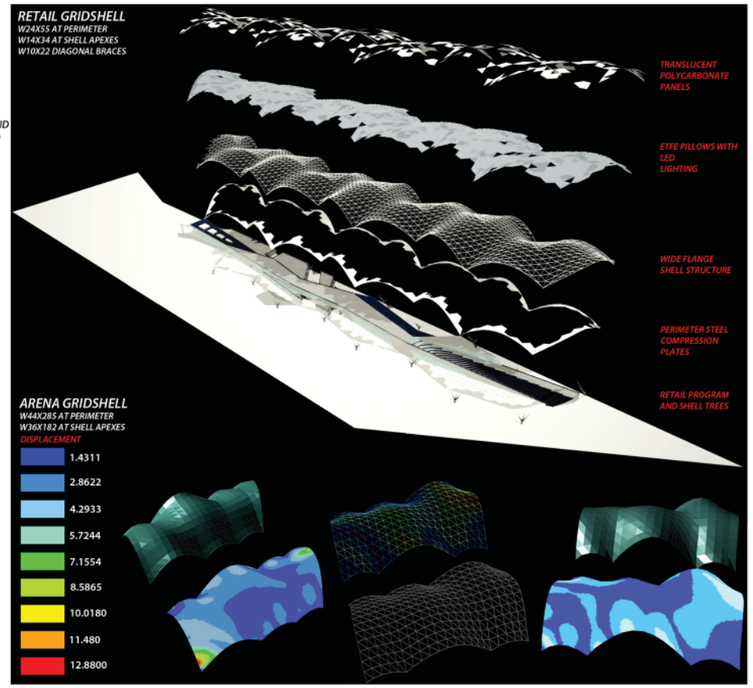
Extensive site analysis was done to determine the major components of the program: hotel, retail, and sports arena. Each program component is placed in its optimal position in regards to vehicular (both private and public) traffic, pedestrian alternative transportation traffic, and to current and projected habitation and zoningtrends. A pedestrian promenade is located longitudinally down the site at a N-S axis flanked by the hotel and the retail with the new sports arena placed at the southernmost part of the site. This program placement creates a pedestrian boulevard that encourages pedestrian movement to the site rather than driving to a parking garage and then to the arena/retail/hotel. This pedestrian boulevard is shielded from Seattle's inclement weather with a steel and ETFE canopy that allows this pedestrian boulevard to be in use and active year round regardless of weather.

Presentation Board 02

Presentation Board 03

FORM PROCESS





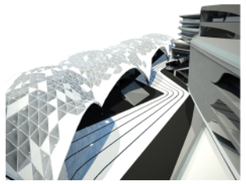
GRIDSHELL CONNECTION

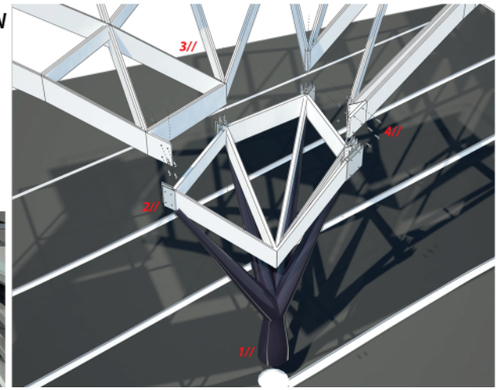
1// PREFABRICATED TREE COLUMN DESIGNED TO OVERCOME MOMENT FORCE OF RAISED SHELL CANOPY

2// PREFRABRICATED CORNER JOINT OF SHELL SHOP WELDED TO 1//

3// PANELIZED STEEL SHELL SYSTEM, ATTACHED IN FIELD TO 2// & 1//.

4// CUSTOM PREFAB BRACKET CONNECTION TO ATTACH 3// & 2// IN FIELD.





Presentation Board 04

Presentation Board Summary

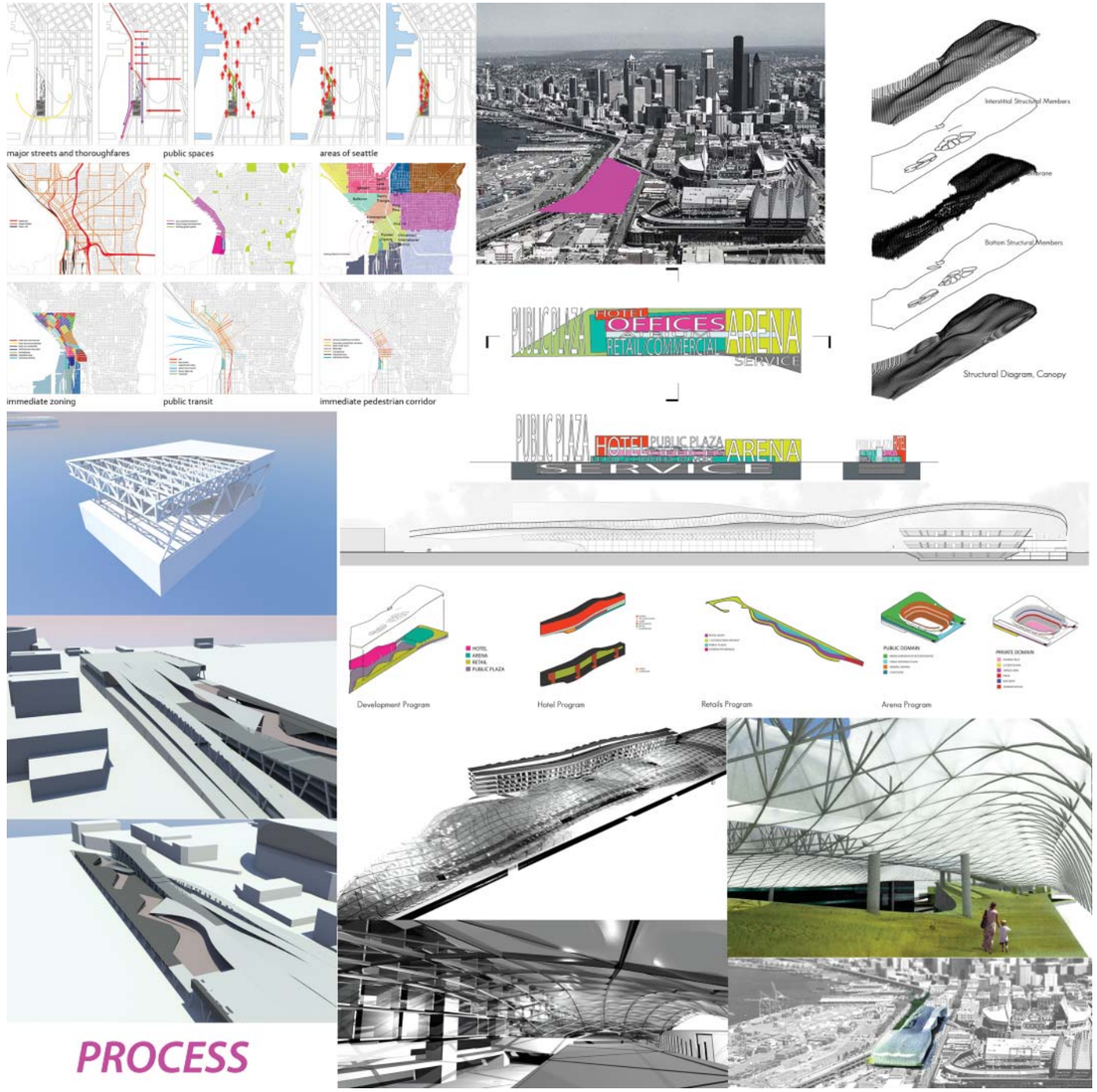
draped//escape

In Seattle, Washington, the city is putting its efforts into reconnecting its city center back to the waterfront. From the regional scale, the waterfront is a portal to Seattle's diverse culture, thriving economy, as well as waterborne transportation. The waterfront's attractiveness provides a great opportunity to continue development at its southern end in which it links the core of the city to its industrial area. The site of the project is located right on this borderline where there are rarely any public spaces around and pedestrian access dramatically tapers off. The proposed site is expected to receive large amounts of pedestrian traffic coming from the northern end, through the dense city core, along this waterfront and to the entertainment campus. Pedestrian traffic is also expected from the East where the other two sports stadiums and heavy rail line reside. A light rail from the south is proposed to run immediately west of our site, allowing those from other neighboring cities to visit and be a part of this Seattle experience.

This entertainment campus will include a hotel, a large retail program, an arena, and a large open air public plaza which allows people to congregate regardless of the weather.

The project is conceptualized as an inverted arena, turning the public into the spectacle, and to place the program off to the side, creating a situation where the public is the focus of attention. This is an extension of bringing the experience of the sports arena to the site and act as a unifying catalyst for social interaction for the diverse population of Seattle. This broad pedestrian boulevard is envisioned as an open park/program space and allows for maximum flexibility. Every part of the project allows for interactions between users of the different programs. The program is developed into three different areas where each one offers a different spatial experience provided by the expressive structural approaches. The different structural approaches are designed to accommodate each separate function while always relating back to the main arena space. The main public spaces of the hotel and retail program allow users to be part of the energy and the excitement of the arena with the future NBA/NHL teams.

The steel structure that encloses the arena is a gridshell canopy which was derived from a series of inverted catenaries, allowing for a shallow structural section. Aside from creating intriguing columns and flowing, organic curves, the gridshell's use of form as structure and structure as form, allows for a very lightweight and efficient environmental barrier, offering the public protection from rain, snow, and insolation. Steel is chosen as the prime material for gridshell construction given Seattle's rainfall. A timber structure is only predicted to last for 5-10 years depending on the level of treatment. A combination of steel, ETFE pillows, and Tensotherm panels creates a very lightweight roof structure that not only protects the public from inclement weather but also allows for a robust, sustainable, structure capable of easily handling severe snow, water, and earthquake loads.



STRUCTURAL PROCESS

PRECEDENTS

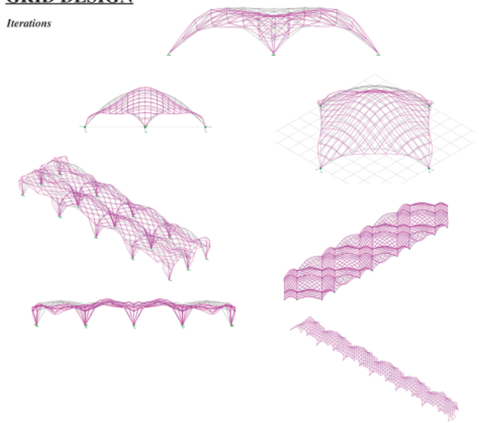
Milan Trade Fair

Kogod Courtyard - Smithsonian

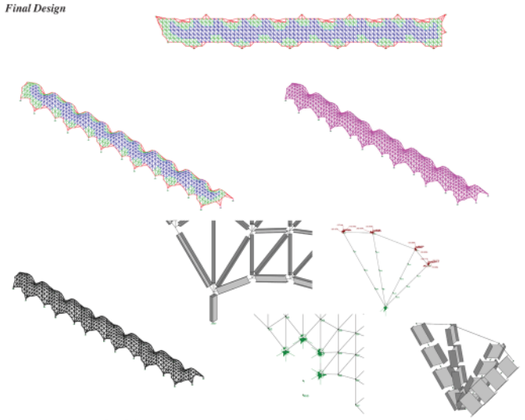
Chiddingstone Castle

GRID DESIGN

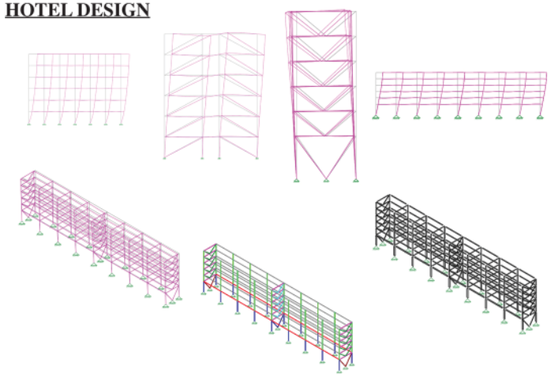
Iterations



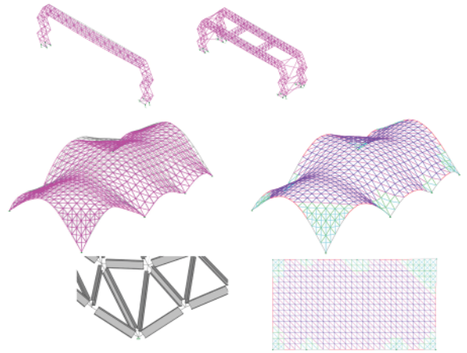
Final Design



HOTEL DESIGN



ARENA DESIGN



Ross Klein
Coming into this course, I really had no idea of what to expect. Not having taken an architecture class since freshmen year, I felt a little intimidated sitting side by side with individuals who had been studying the art of giving life to a form for four years. Then, as we began to delve into the project, all of these feelings began to subside. I soon realized that architects and engineers are not all that different in how they approach problems, only in how they go about solving them.

This course has taught me that it is important to be open to new ideas and to value another person's insights. By working together we were able to arrive at an elegant solution that is both structurally efficient and aesthetically pleasing. I feel that this class not only allowed me to learn more about the world of architecture, but that it also allowed me to share my passion for engineering with my teammates.

Probably the most rewarding part of this course is that it taught me that I have the capacity to reach beyond my comfort zone. In our engineering labs, we typically only learn how engineering applies to a regular building, in other words, a box. This class has shown me how to take those basic principles and apply them to a problem which I have never encountered before.

Catherine Lam
This studio experience was definitely different from my previous studio experiences. The program given was definitely a challenge. The collaboration between the two disciplines definitely helped me better understand how the structure works within architecture. With the structural reasoning, it makes the project more realistic. Having the architectural engineers as "consultants" really helps with understanding the structural system because they are there to answer questions and make things more efficient. Being able to sit down and have discussion with the engineers helps with the design process.

It has been a long two quarters but it is definitely an experience that shouldn't be missed. This studio was one of the few chances where an ARCH can sit down with an ARCE to work something out before stepping out into the work field.

Steven Ni
While I did hear some negative comments regarding this class prior to enrolling; such as the ARCEs only receiving 2 units of credit so they don't care at all, and the engineers not understanding anything outside their engineering domain, I was quite intent on taking this studio given the high level quality of work that usually comes out of it. Although I did find quite a few of the things I heard to be sort of true, it was really a great experience overall despite any mishaps. Despite the frustrations, the indifference, and the long sleepless nights, we ended up coming together at the very end to come up with a project that was collaborative and representative of both architecture and engineering. Though a few egos were bruised and angry words were muttered along the way, I wouldn't have had it any other way. I learned a lot, working with ARCEs and my fellow ARCHs, both in terms of architecture and engineering.

Myles Parr
It is too bad both curriculums do not offer more classes like this combined studio. I believe architecture students need to know more about structural engineering difficulties and engineering students need to know more about architectural process and design. This class allows for some of that exploration and study between disciplines to take place and grow.

But it is not to be ignored that this class benefits your own field of study as well. Speaking as an engineer, this class challenges your ability to adapt and think though problems that are uncomfortable. Being able to think outside the box, literally, cannot be understated.

Baptise Rouit
I choose this two quarter studio to work as a team with American people in order to learn from them. I learned a lot from this studio, first by working with engineers but also about the importance of being able to comunicate. Sometimes ideas or concepts are not obvious for people far from our studies or just far from our brain. The different field trips and the connections we had with the professional world were really helpful to understand more about the reality of the project. It was also great just to have an overview of how an office works and how you deal while working as a team. I made good friends with my team and this experience will be helpfull for a long time in my professional work.

team03

inter_locked

Branden Dong
Ian Tomitch
Ryan Nevius
Thomas Shorey
Kevin Towers

Branden Dong
San Luis Obispo, CA

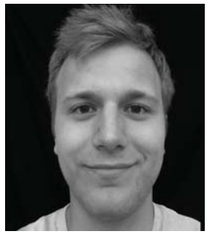
The epitome of absolute architecture structural design captures the scope of this integrated studio. Visiting design firms and participating in professional reviews only enhances the overall experience.

Ryan Nevius
Lake Isabella, CA

As someone who has always been interested in structure and the role it plays in design, I am grateful to have been exposed to the concepts in this studio. Interdisciplinary collaboration results in a design that is innovative structurally and architecturally. Using structure as a design tool rather than an afterthought reveals new opportunities for architects and engineers to work together toward a more advanced output.

Thomas Shorey
Galt, CA`

This interdisciplinary studio has been a learning experience on steroids. We visited many top name architecture and engineering firms, had various desk crits and reviews with practicing professionals and worked in design teams which combined architectural engineers with architects. Resulting in a challenging and fulfilling course.

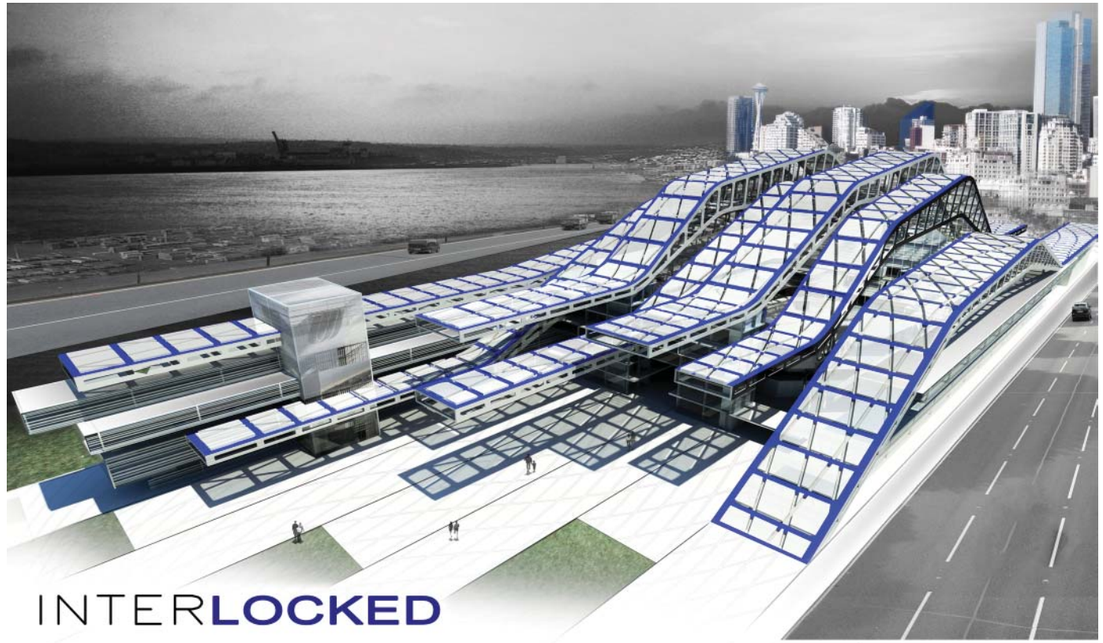


Ian Tomitch

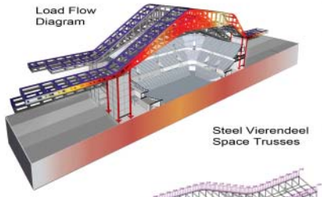
The 4th Year Interdisciplinary Design studio was the most relevant studio I have ever had in terms of preparation for real world architecture. I always felt like there was a live link to the professional world through regular interaction with professionals. Seeing their work, having to present our work to them, and receiving their input on a regular basis helped push our own work to a professional quality and standard. Ultimately, this helped us really focus in on our final submittals for the Steel Competition and gave us a product we could be satisfied with in the long run.

Kevin Towers

The initial thought going into this class was that the ARCHs would want one thing and the ARCEs would want the complete opposite. However after spending two quarters with the group, it really became one big design from the ideas of all five of us. There was no longer a real distinction between architect and engineer.

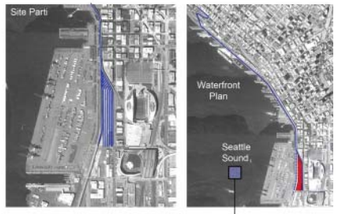


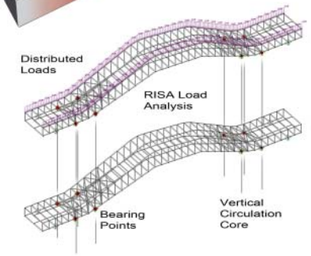
INTERLOCKED



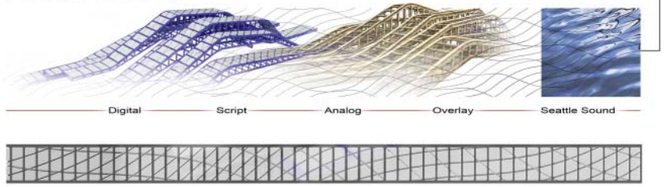
Site / Concept:

The project consists of a new multi-use sports arena, integrated with hotel and retail space for the City of Seattle, Washington. It is located on a long, narrow site that measures approximately 1100 feet by 350 feet. Like its neighboring stadium and ballpark, Seattle's interLOCKED Arena was designed as a part of an overall urban design program to tie a major entertainment venue into the activation of the district around it. But unlike either of these efforts, which serve a single entertainment purpose, interLOCKED is thoroughly contemporary in its imagery, programmatic interaction, cladding system, and elegant use of steel. With a complicated building program and a long, narrow site, design considerations cover many topics. Design cues for the structure, cladding, and overall form were taken from the action of the Seattle Sound waterfront nearby, as well as the natural flow of activity on the site as it relates to the city's waterfront plan. Interlocked arena seats 16,000 to 18,000 for sporting events, but with the interlocking building program, these seats will be used year-round due to other events such as concerts and corporate conferences.



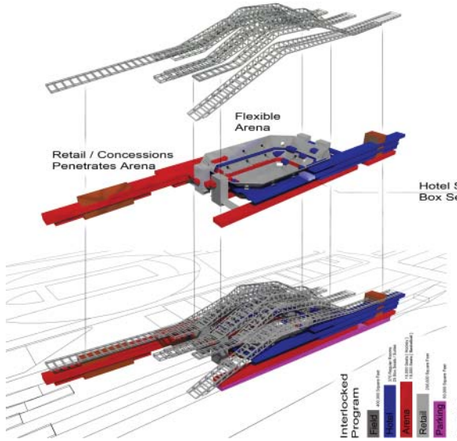


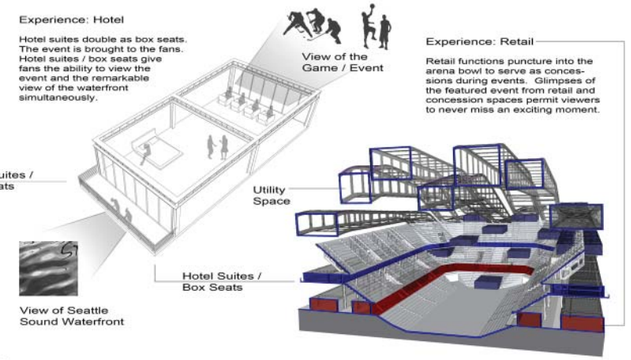
Form Process:



Design cues for the structure, cladding, and overall form were taken from the action of the Seattle Sound waterfront nearby, as well as the natural flow of activity on the site as it relates to the city's waterfront plan. The design process included multiple sketches, analog, and digital iterations before the desired aesthetic was achieved.

Presentation Board 01

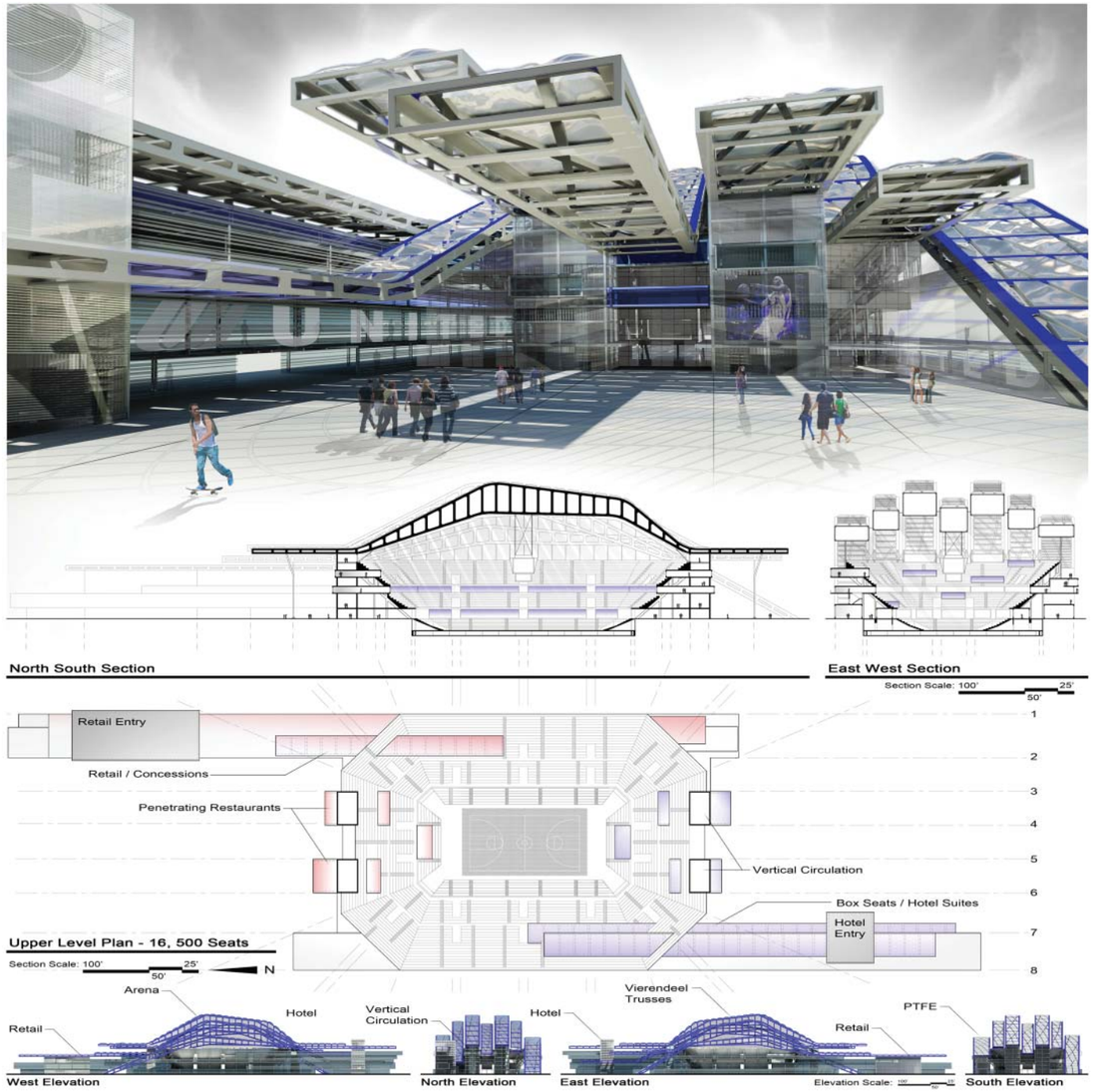




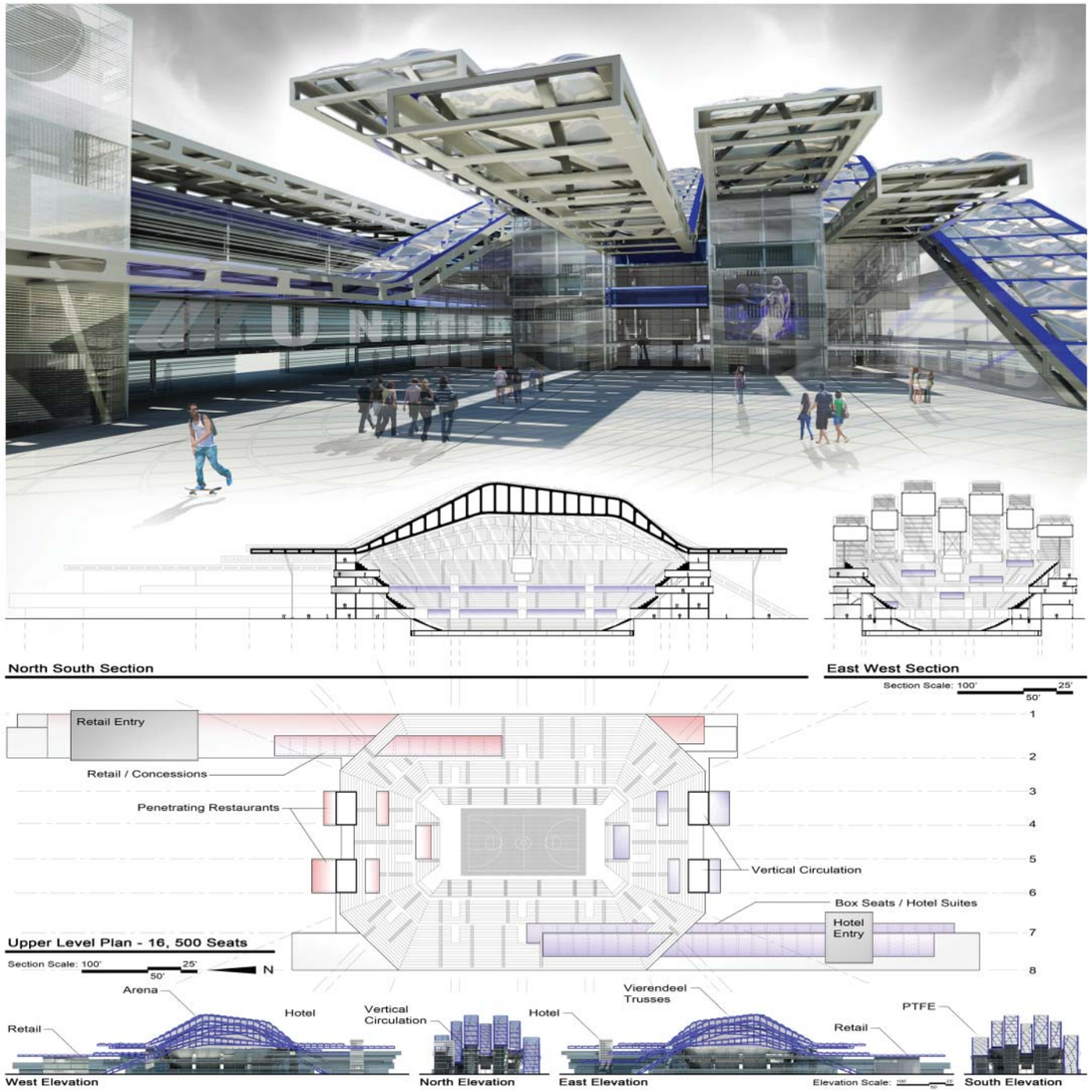
Program:

As its name suggests, interLOCKED Arena exhibits a space in which retail, arena, and hotel functions can coexist as one unified entity. Hotel suites double as box seats and retail functions puncture into the arena bowl to serve as concessions during events. In a sense, the game is literally being brought to the fans. Glimpses of the featured event from retail and concession spaces permit viewers to never miss an exciting moment, while the hotel suites / box seats give fans the ability to view the event and the remarkable waterfront simultaneously.

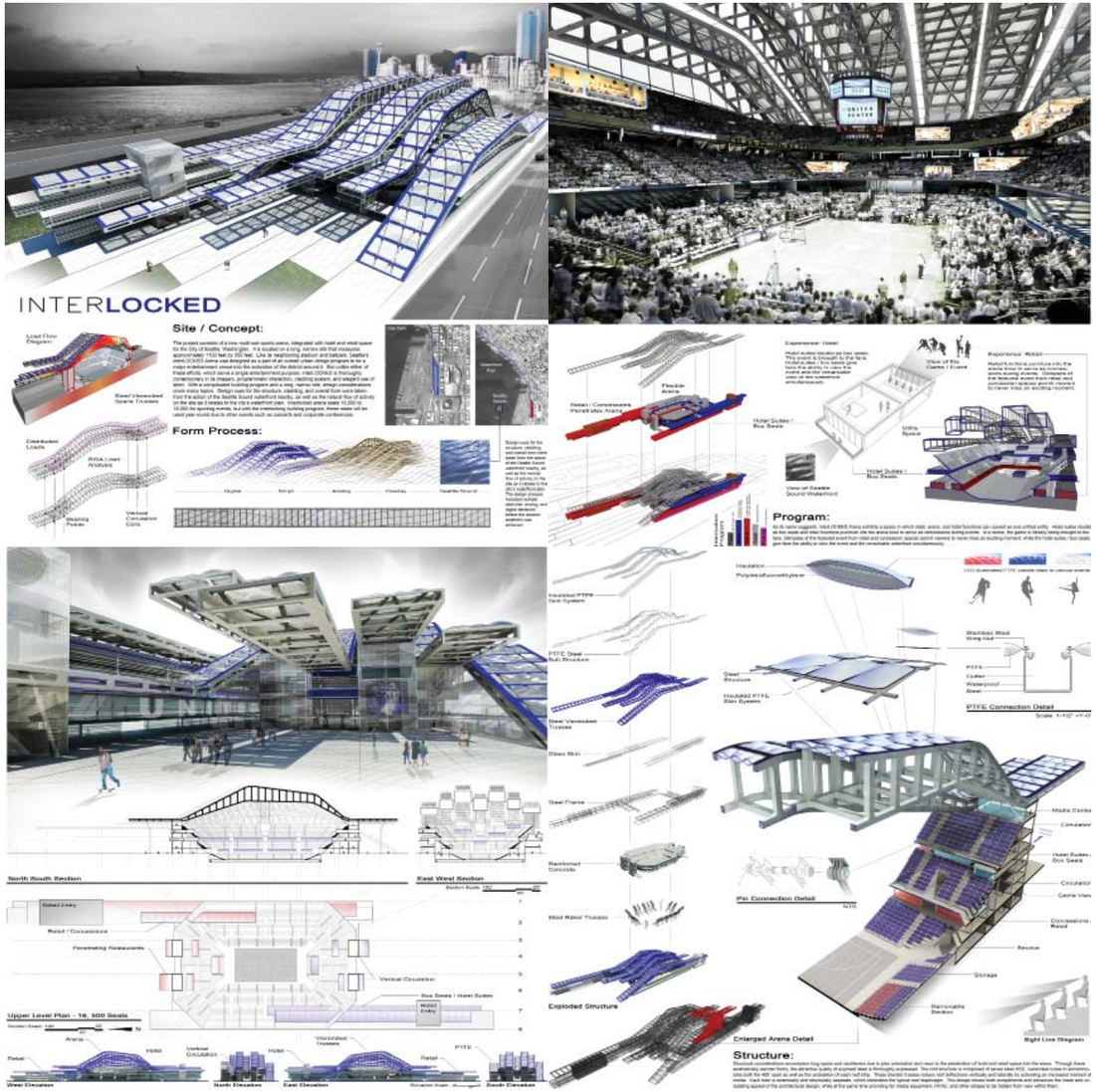
Presentation Board 02



Presentation Board 03



Presentation Board 04



Presentation Board Summary

interLOCKED

Like its neighboring stadium and ballpark, Seattle's interLOCKED Arena was designed as a part of an overall urban design program to tie a major entertainment venue into the activation of the district around it. But unlike either of these efforts, which serve a single entertainment purpose, interLOCKED is thoroughly contemporary in its imagery, programmatic interaction, cladding system, and elegant use of steel.

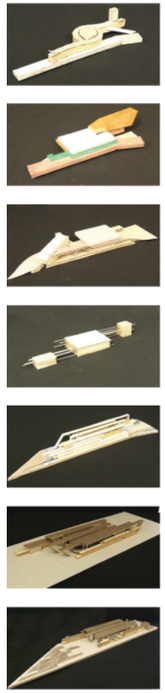
With a complicated building program and a long, narrow site, design considerations cover many topics. Design cues for the structure, cladding, and overall form were taken from the action of the Seattle Sound waterfront nearby, as well as the natural flow of activity on the site as it relates to the city's waterfront plan.

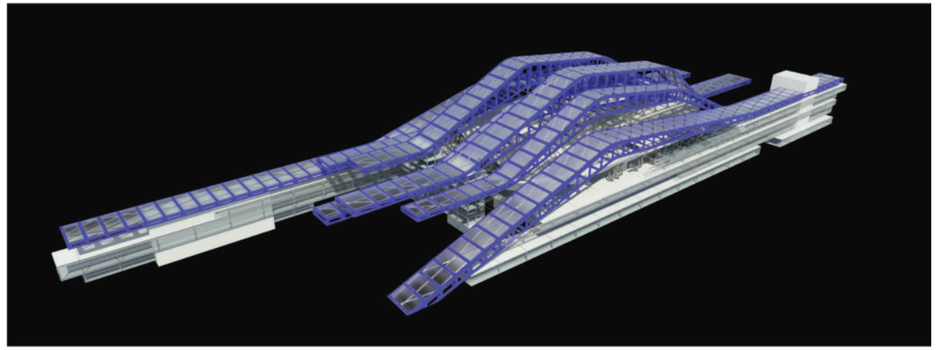
As its name suggests, interLOCKED Arena exhibits a space in which retail, arena, and hotel functions can coexist as one unified entity. Hotel suites double as box seats and retail functions puncture into the arena bowl to serve as concessions during events. In a sense, the game is literally being brought to the fans. Glimpses of the featured event from retail and concession spaces permit viewers to never miss an exciting moment, while the hotel suites / box seats give fans the ability to view the event and the remarkable waterfront simultaneously.

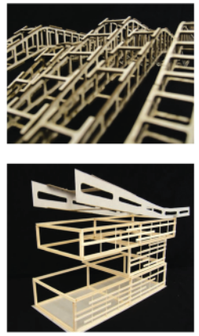
Structural considerations encompass long spans and cantilevers due to plan orientation and react to the penetration of hotel and retail space into the arena. Through these aesthetically slender forms, the attractive quality of exposed steel is thoroughly expressed. The roof structure is composed of seven steel HSS, vierendeel tubes to accommodate both the 400' span as well as the undulation of each roof strip. These slender trusses reduce roof deflections vertically and laterally by activating an increased moment of inertia compared to that of traditional two-dimensional trusses. Each tube is seismically and structurally separate, which eliminates the typical roof diaphragm. This design choice both compliments and preserves the linear and undulating appeal of the architectural design, while at the same time providing for media equipment, HVAC, and other utilizes to be hidden from view within them.

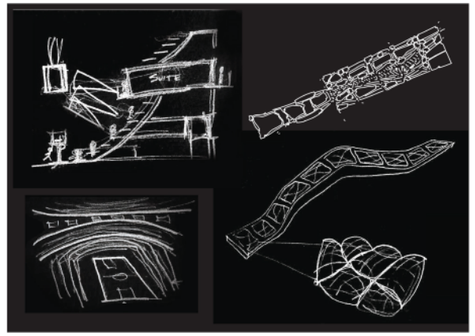
The majority of the arena's unwanted heat is regulated through passive means. The perforating quality of the program elements inherently maximizes cross ventilation along the prevailing wind direction. In addition, insulated Polytetrafluoroethylene (PTFE) panels located at the top of each vierendeel truss not only reinforce the undulating form of the roof but also allow for precise regulation of heat and natural light energy entering the arena space. During the evening, these PTFE panels are illuminated by LED lights which change color depending on the event that is taking place.

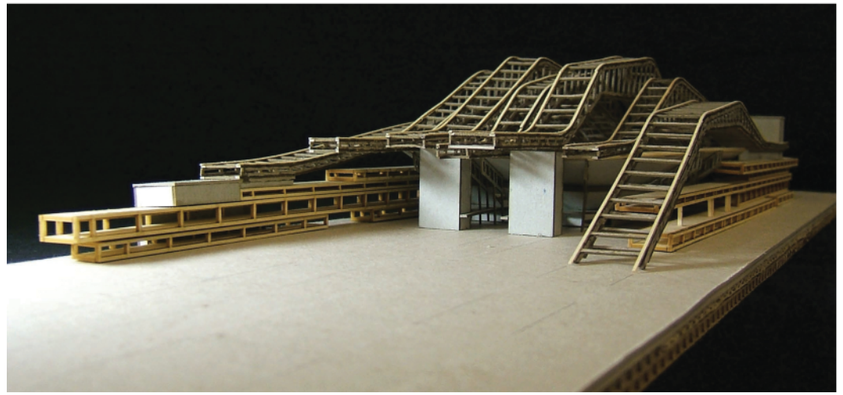
Whether fans are attending a basketball game, hockey match, or concert, interLOCKED Arena's attractive, slender steel structure, innovative programmatic arrangement, and alluring cladding system is sure to turn some heads and provide an experience its inhabitants will never forget.





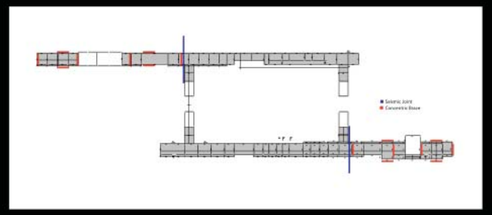


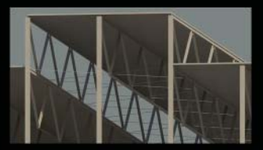




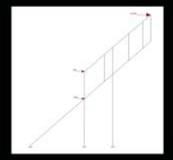
PROCESS:
The genesis of our concept came from sketching the integration of box seat with hotel suite. These sketches gave birth to the idea of interlocking. Our models show the evolution of our explorations in the realm of interconnection. The breakthrough in the project came when we exchanged the flat roof canopy for a dynamically expressive roof. Prior to the change, we had achieved an interlocking of program under a flat, static roof; the change of roof brought an interlocking of the interlocked program with its surroundings by creating a dynamic movement through the site that reaches out to the surrounding city fabric.

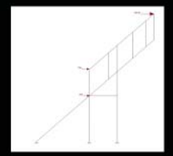
Structural Process

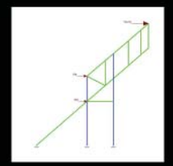




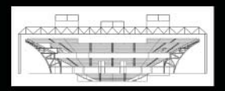
Structural Framing

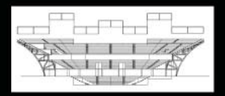


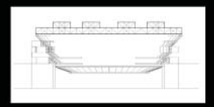


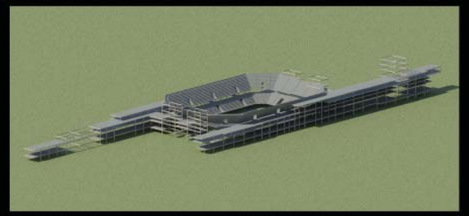


Preliminary Ideas

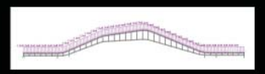


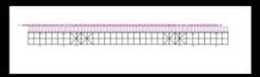




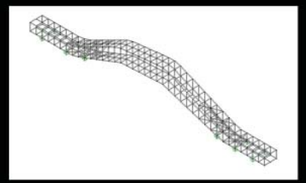


2D RISA Analysis

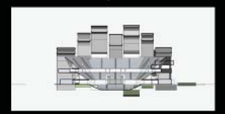




RISA Analysis



Final Concept



Branden Dong
Going into this interdisciplinary design studio, I thought I knew what to expect because I had already participated in an interdisciplinary building envelopes design studio. This turned out to be a very premature notion and perception. The interdisciplinary studio required exponentially more collaboration and work between disciplines, but with it, came the reward of seeing the final product: a truly innovative, integrated design of a hotel, retail and arena space where architecture and structure complete one another.

I was lucky enough to be teamed up with great architecture students, who were open-minded toward structure. Our group worked well together, because we all shared the same common goal and were willing to communicate constantly in order to reach it. I felt that the overall experience of the studio was inspiring and eye-opening, making me look forward to future interdisciplinary work.

Ryan Nevius
When the time came to decide whether or not I wanted to enroll in this studio, I have to admit I was a little hesitant. Past reviews of the course included many negative remarks about lazy, narrow-minded engineers with tunnel vision, and it sounded like the “integration” of multiple disciplines would be more of a hindrance than advantageous. These statements couldn’t be farther from the truth. Although some teams encountered conflict, overall it became apparent that open-minded engineers do exist and can contribute valuable information and suggestions throughout every stage of the design process. Interdisciplinary collaboration is now something that I will actively seek in the future. As a result of this group effort, our project became more exciting both structurally and architecturally, and exceeded all expectations I had when the course began.

Thomas Shorey
Previous architectural design studios focused on architectural decisions regarding experience and aesthetics. However, this interdisciplinary studio combined architects and engineers into teams which encouraged us to consider structure, performance, aesthetics and experience with equal consideration. This course also exposed us to many different practicing professionals who challenged us to think about the constructability and documentation of our projects. Our team design is the result of a compromise that took place over the past two quarters between five distinct team members who belong to two distinct disciplines: resulting in a project that is not only spatial and exciting but also structurally rational.

Ian Tomich
The 4th Year Interdisciplinary Design studio provided an excellent transition into 5th year for me. To help start the process of thinking about my senior project, I viewed the steel competition as a practice version of the senior project. I felt that, eventually, I would have to produce a professional quality visual presentation of my senior project, so why not treat the professional quality of our steel competition submittal as practice?
The structure of the class was very relevant to the real world as well. I always felt like there was a live link to the professional world through regular interaction with professionals. Seeing their work, having to present our work to them, and receiving their input on a regular basis, helped push our own work to a professional quality and standard. Ultimately, this helped us really focus in on our final submittals for the Steel Competition and gave us a product we could be satisfied with in the long run.

Kevin Towers
The interdisciplinary studio these last two quarters allowed me to experience a unique class that only a few get to participate in. The dynamic between the architects and the architectural engineers was fun to observe and I enjoyed watching the different creative minds coming together to invent unique and innovative projects. After taking all of the structural design labs it was a nice change of pace to think on a more broad scale in order to scheme a structure that you wouldn’t normally get to do as a student at Cal Poly.
This class provided the opportunity to interact with another discipline in the industry and begin to understand how each one works together. It also allowed us to visit a number of firms in Washington to see a different side of design. I will be able to take the skills that I have learned from this class and apply them when I get out into the industry. I truly enjoyed the experience from the last two quarters and recommend this class to future students.

team04

waterfront arena & commons

Kevin Chen
Alexander Nash
Zane Kime
Alex Zimmerman

Kevin Chen
Campbell, CA

I've always been interested in architecture, but am supremely glad I, at the last minute, on a whim, decided to pursue a degree in architectural engineering instead. My ultimate dream is still to save the world through structural engineering, while bartending on the side and maybe leading a rock band. We'll see.

Zane Kime
Penryn, CA

I love design, and this class gave me a great opportunity to do just that. I plan and hope to practice architecture and structural engineering in very creative and innovative ways during my career. Eventually I want to own an efficient and purposeful design firm that employs people from different building disciplines, practices Integrated Project Delivery, and which excels at producing the most sustainable and ecologically integrated buildings while still remaining totally in line with the wishes of the client.

Alexander Nash
Brea, CA

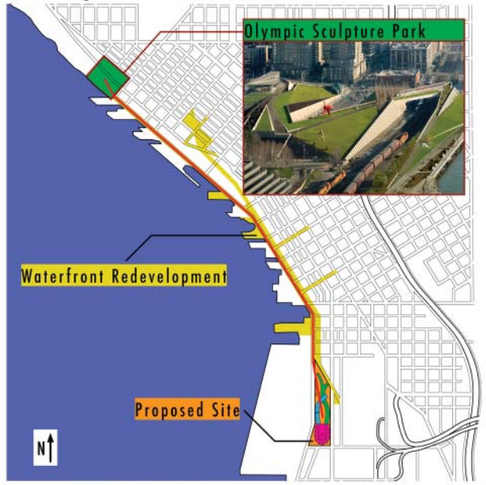
This experience led to a much more interesting and in depth project than what I am normally used to in architecture. I like the engineering aspect of buildings and this project allowed me to understand how architecture and engineering can interact and benefit each other.

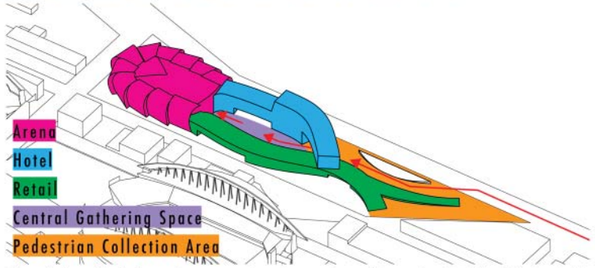
Alexander Zimmerman

2010/2011

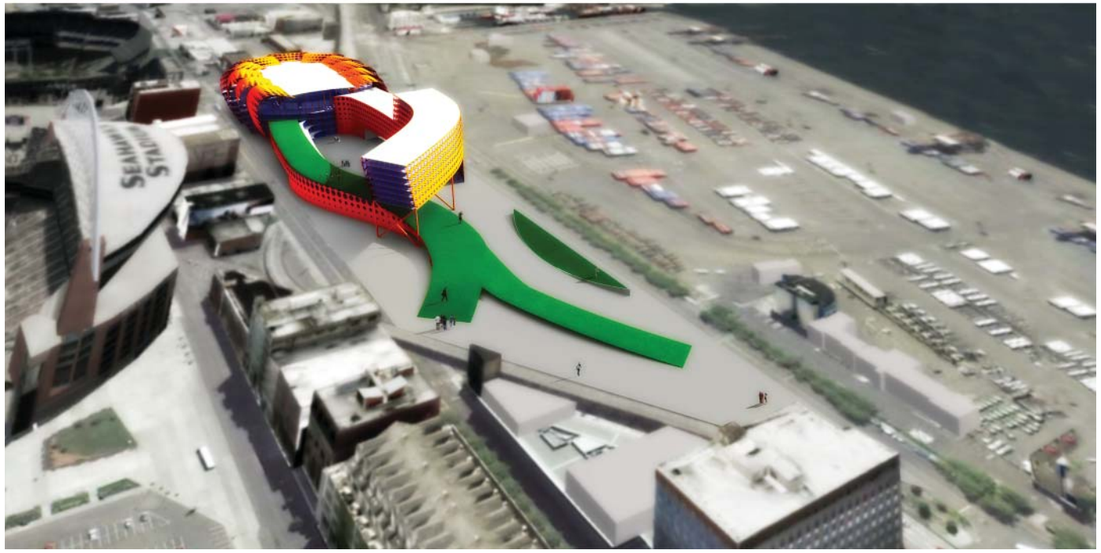
Waterfront Arena & Commons

Concluding Seattle's Promenade





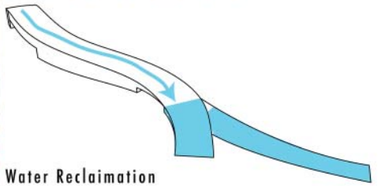
The project consists of four major program elements: arena, hotel, retail, and park. The hotel and retail elements are configured in a linear fashion that reach out into the northern end of the site forming a boundary with a wide opening, welcoming pedestrians in. These two elements cross over to define a central congregation space, outside of the main arena entrance. The retail portion is terraced out into the central space to provide sight lines for people on all different levels to see each other and interact. The roof of the retail is a green roof that slopes down to the ground allowing people to use it as an elevated park, which also participates in the terraced experience. The opposing side of the site is bounded by the hotel, which employs a gradation of window sizes that are determined by the cost of the hotel rooms. Several of the hotel's suites are integrated into the arena at the box seat level, having both a clear view of the court and of Puget Sound. The decision was made to push the concourses and vertical circulation to the outside wall of the arena so that with the use of windows, the patrons of the arena would activate the façade by merely circulating through the building.



Presentation Board 01

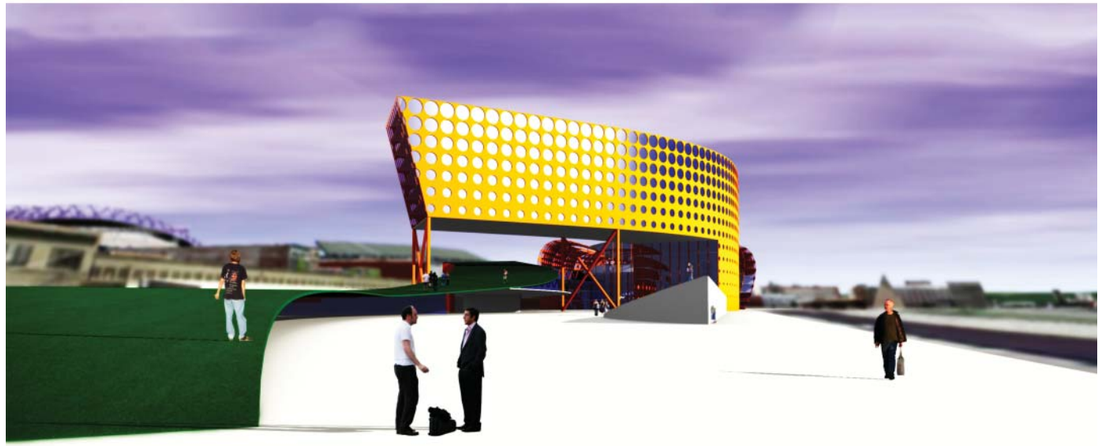
Waterfront Arena & Commons

Concluding Seattle's Promenade



Water Reclaimation

The green roof aims to collect the abundant rainfall that Seattle experiences over the year. Instead of letting that water runoff it will be stored in the portions of the building that are too short for human occupation. This water can be used for recharging aquifers, gray water, or irrigation for the green space. This is a very effective of utilizing the local climate and natural resources as opposed to trying to harvest sunlight or wind power.

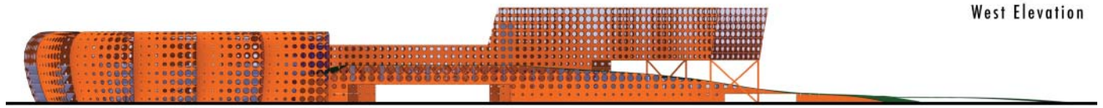


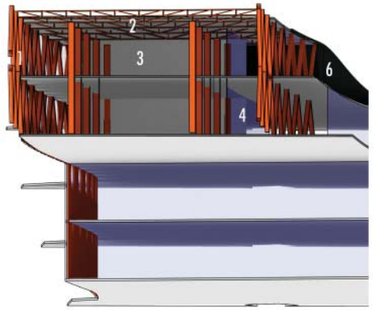
Presentation Board 02

Waterfront Arena & Commons

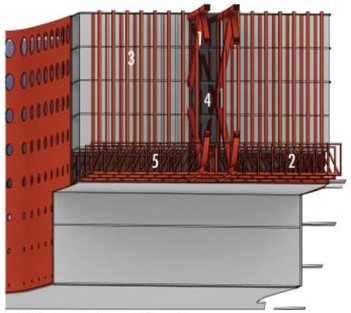
Concluding Seattle's Promenade

West Elevation





Retail Long Span Structure



Hotel Long Span Structure

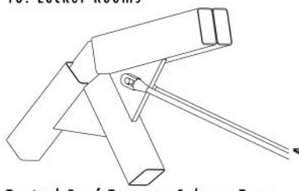
1. Main Longitudinal Structure
2. Transverse Trusses
3. Columns supporting slabs
4. Horizontal Circulation
5. HVAC Floor
6. Green Roof

Presentation Board 03

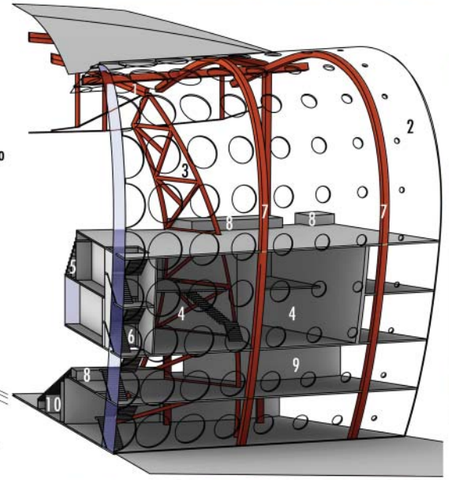
Waterfront Arena & Commons

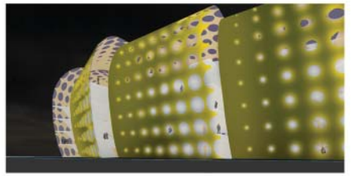
Concluding Seattle's Promenade

1. Funicular Roof Truss
2. Steel Plate Shear Wall Skin
3. Roof Supporting Truss
4. Hotel Game Viewing Suite
5. Hallway Leading to Hotel
6. Vertical Stadium Circulation
7. Columns Continuously Welded to Shear Walls
8. Concessions
9. Bathrooms
10. Locker Rooms

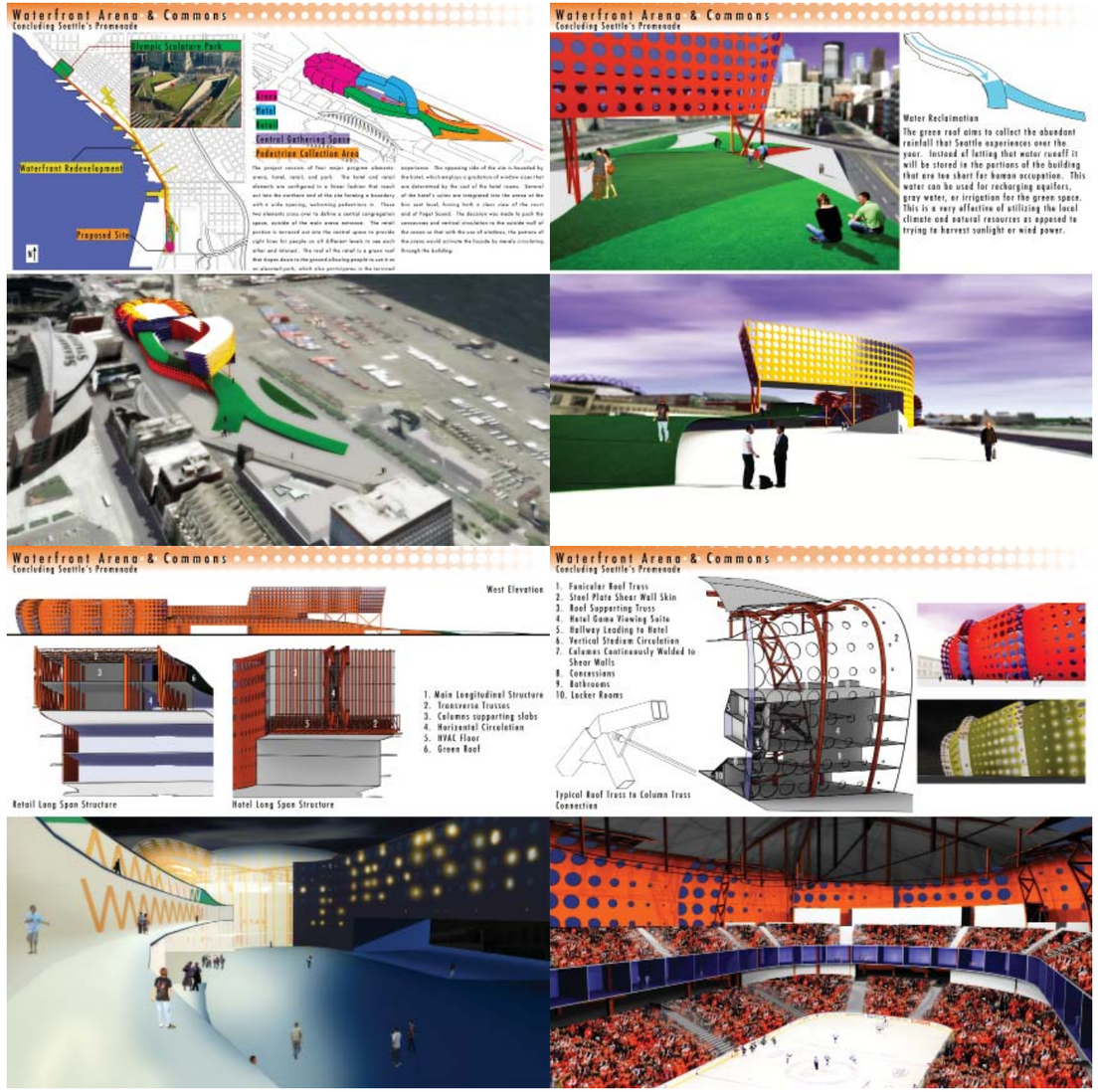


Typical Roof Truss to Column Truss Connection





Presentation Board 04



Waterfront Arena & Commons: Concluding Seattle's Promenade

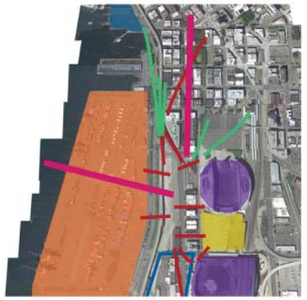
This project seeks to form a conclusion to the southern end of Seattle's new waterfront redevelopment by giving back to the people a public space to relax and socialize in. Seattle is a very walk-able city and the new waterfront's long promenade, geared toward predominantly pedestrian traffic, showcases that unique attribute of this urban environment. With that in mind, this arena complex was designed to collect people arriving on foot from the North end of the site and offer them a recreational area. The design takes cues from the very successful Olympic Sculpture Park, which resides at the north end of the waterfront, such as having grassy expanses available to the public and elevated viewpoints out into the city.

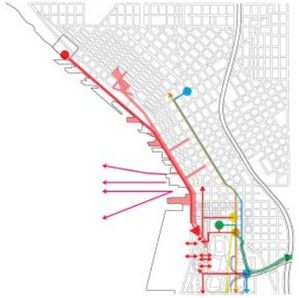
The project consists of four major program elements: arena, hotel, retail, and park. The hotel and retail elements are configured in a linear fashion that reach out into the northern end of the site forming a boundary with a wide opening, welcoming pedestrians in. These two elements cross over to define a central congregation space, outside of the main arena entrance. The retail portion is terraced out into the central space to provide sight lines for people on all different levels to see each other and interact. The roof of the retail is a green roof that slopes down to the ground allowing people to use it as an elevated park, which also participates in the terraced experience. The opposing side of the site is bounded by the hotel, which employs a gradation of window sizes that are determined by the cost of the hotel rooms. Several of the hotel's suites are integrated into the arena at the box seat level, having both a clear view of the court and of Puget Sound. The decision was made to push the concourses and vertical circulation to the outside wall of the arena so that with the use of windows, the patrons of the arena would activate the façade by merely circulating through the building.

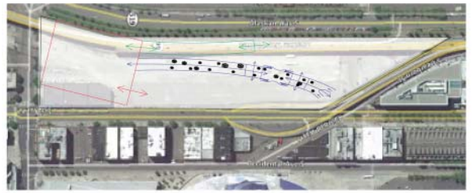
The project provided a variety of opportunities for innovative use of structural steel. The hotel's floating form over the green roof at the entrance of the site makes a bold statement about the capabilities of steel. The spans under the retail and hotel open up the site for East-West circulation while making a structurally impressive passage. These perforations are accomplished by having two major cross-braced trusses span the longitudinal direction, with minor trusses supporting the building in the transverse direction. The roof of the arena is a lightweight funicular structure, allowing for efficient use of steel. The lateral force resisting system for the arena is steel plate shear walls, which also function as the structure for the skin. These are welded to the framing of the arena to provide structural stiffness.

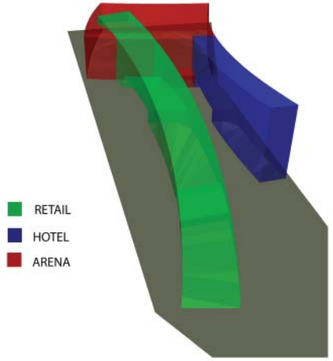
Waterfront Arena & Commons

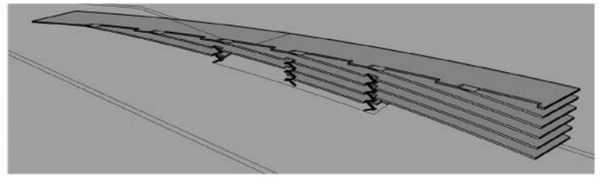
Concluding Seattle's Promenade

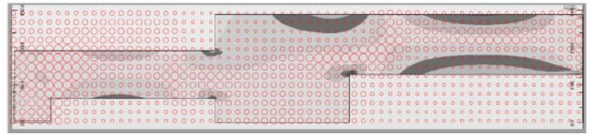


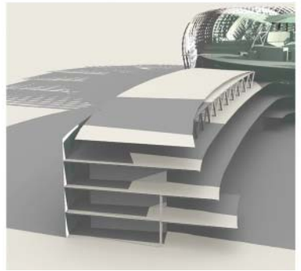












Waterfront Arena & Commons

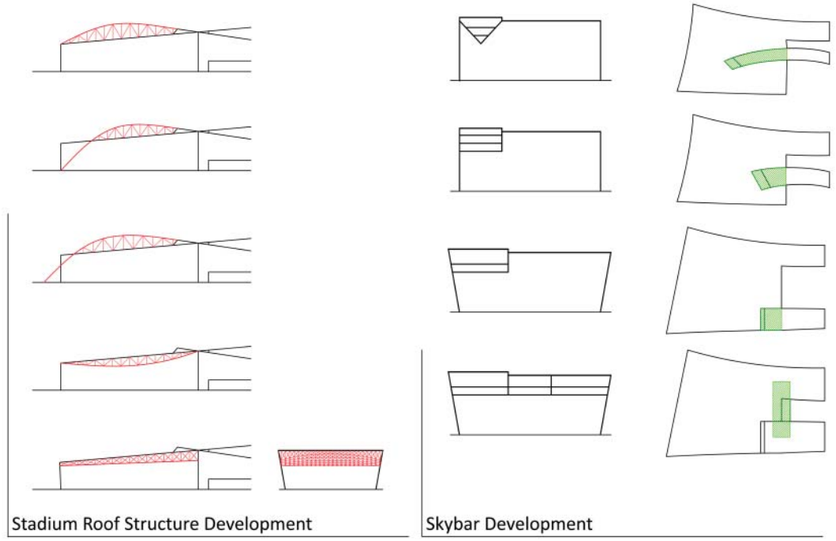
Concluding Seattle's Promenade

precedents

John Hancock Center | Chicago, IL

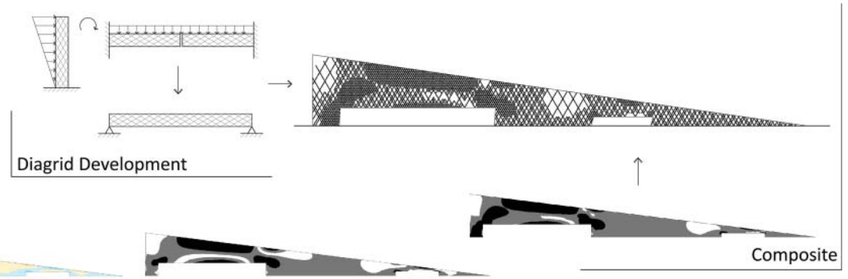
30 St Mary Axe | London, UK

CCTV Headquarters | Beijing, China



Stadium Roof Structure Development

Skybar Development



Diagrid Development

Composite

Normal Stress

Shear Stress

Kevin Chen
I had anticipated an active environment in which the architects and engineers would constantly bounce ideas off each other, ultimately resulting in this golden, fully developed design. But instead what I experienced in my own group and witnessed in others was the complete separation of architecture and structure on many fronts. Sure, the architects in our group were involved in the structural design, and the engineers provided some insight into the architecture, but for the most part, the two remained separate.

What I observed the most, however, was the very clear lack of communication among the professors and between the professors and the students. In the early days of the studio, when the architecture professors would joke and remind the architects that engineers don't like waiting until the last minute to start a project, I took that, as it was intended, as an indictment of the architects' work habits. However, as the quarters progressed, I saw that this last-minute attitude was more characteristic of the professors than it was of the architects. From all this, I have learned to tread the ice very carefully, delegating the work equally among everyone according to their ability, but fully preparing to do it myself if it came to that.

Zane Kime
I was personally very excited to work on this project with the architects because I was initially considering applying to Cal Poly as an architect instead of as an architectural engineer. I am very happy with the path I that I chose but I still yearned to learn and practice design more often in my engineering courses. That is why this course was so enjoyable for me.

The course was an excellent way to learn about interdisciplinary design and collaboration. The teachers are extraordinarily knowledgeable and helpful although they could have been a little more organized and clear in their administrative communications. Taking trips to the actual site that we were designing as well as other similarly designed sites was an amazing experience. Talking with many of the elite design professionals in both the fields of architecture and structural engineering and having them critique our team's projects was a nerve wracking yet fantastically enriching encounter that very few students get to experience.

I am very grateful to the teachers and my fellow classmates for making the course so rewarding. The course itself and even my own group had its problems but the positives far outweighed the negatives in my opinion. I have no doubts that I have come out of the class a much better designer and engineer.

Alexander Nash
This class was the first time I have worked with engineers, and in a group this big, on an architecture project. Both of these aspects offered challenges and rewards. I started the class focusing on the project, but I quickly realized that the group aspect was where I would get the most out of the class. Learning how to get four or five people on the same page, working toward a common goal was quite difficult, but the work we produced was much better. I also can say that everyone in the group needs to want to collaborate and without that, the group becomes unproductive. I would say that after this class I could see why people would avoid the challenge of collaboration, but I would say that the risks outweigh the rewards.

Alex Zimmerman
The first day of this class was rather intimidating because I was unclear on the collaborative nature this class has to offer. Our group had a shaky start due to our lack of teamwork, but eventually we got past many of our difficulties and were able to produce some exceptional ideas. My favorite part of working with other disciplines was rationalizing all of our different suggestions and ideas into a form that is both elegant and functional. Reflecting back, I can say that I've learned a lot from this class as both an architect and a member of a team.

team05

seattle sports complex

Kimberly Bowen
Nicholas Ochoa
Jean-Luc D'Arbeau
Ema Shahinian
Ryan Martin

Kimberly Bowen

Be willing, stay motivated, and do not be afraid to try new things. This interdisciplinary studio is the perfect opportunity to use your imagination and develop new skills. Architects and engineers have different thought processes, but great things happen when they work together. Listen to others, but commit to your ideas.

Jean-Luc D'Arbeau

When architecture and engineering function separately neither is truly functioning. Every architect should be an engineer and every engineer should be an architect. That is when truly great ideas are brought to life.

Ryan Marlin
Lompoc, CA

To me, architecture and structure has always been the same thing. They play such a pivotal relationship that without one there could not be the other. Working with structural engineers gave me the opportunity to take myself out of my comfort zone and allowed me to blur the boundary between 'architect' and 'engineer'. In the end, the result was much better than anything one discipline could produce on its' own.

Nicholas Ochoa

Architecture involves the creativity of imagining the unbuilt , the intelligence to implement the design, and the ability to discover the unknown. It is something unlike any other discipline. Every day I am in awe, and have found something that truly has the potential to be revolutionary.

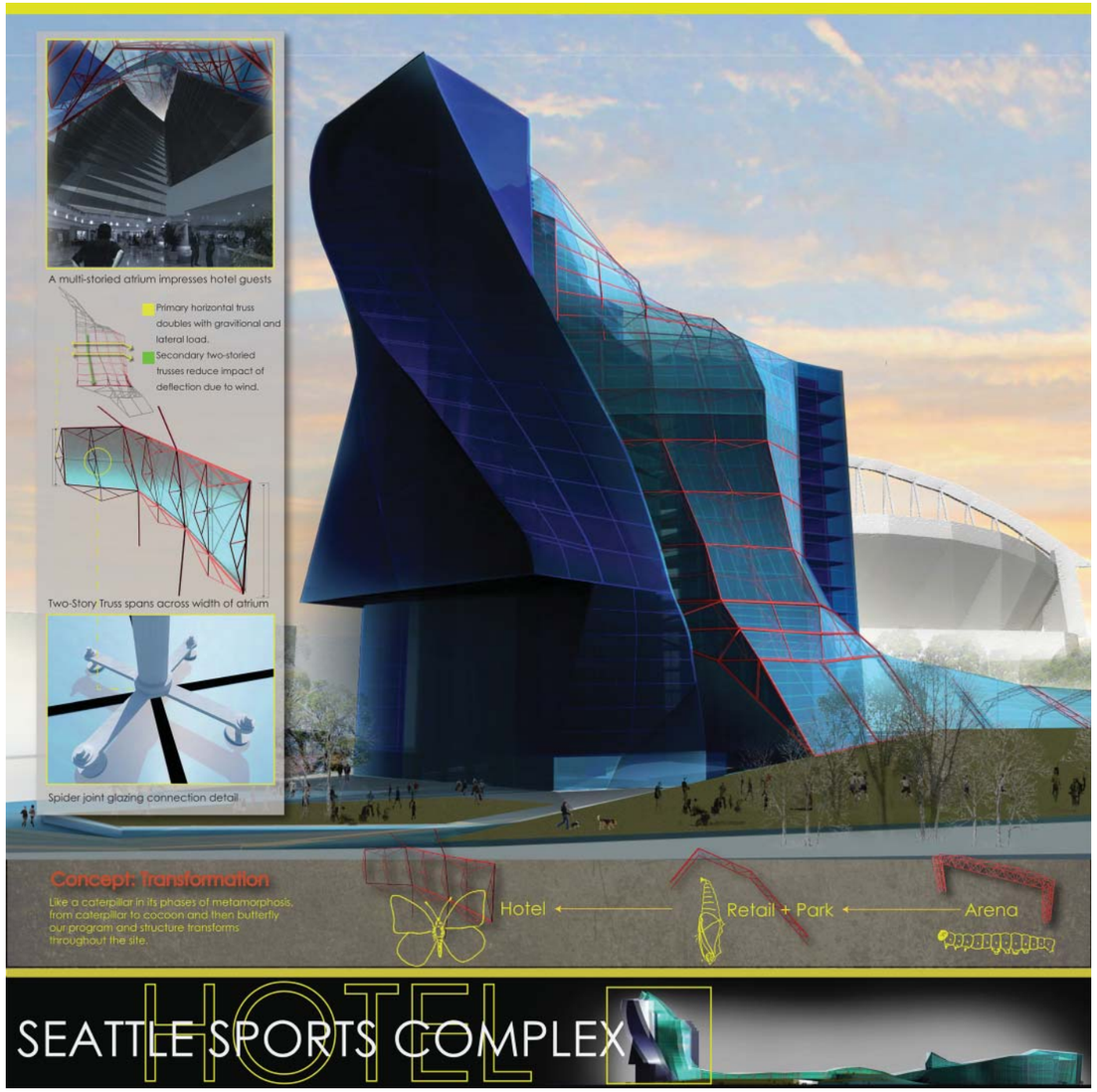
Ema Shahinian
Fresno, CA

We are Armenian, but my dad is from Lebanon and my mom is from Kuwait. My dad works at the Getty Museum as a security officer and my mom is a programmer. I worked on construction documents for a mental hospital this summer during my internship at HKS in Los Angeles. In 10 years I hope to see myself licensed and with a family on the beach.

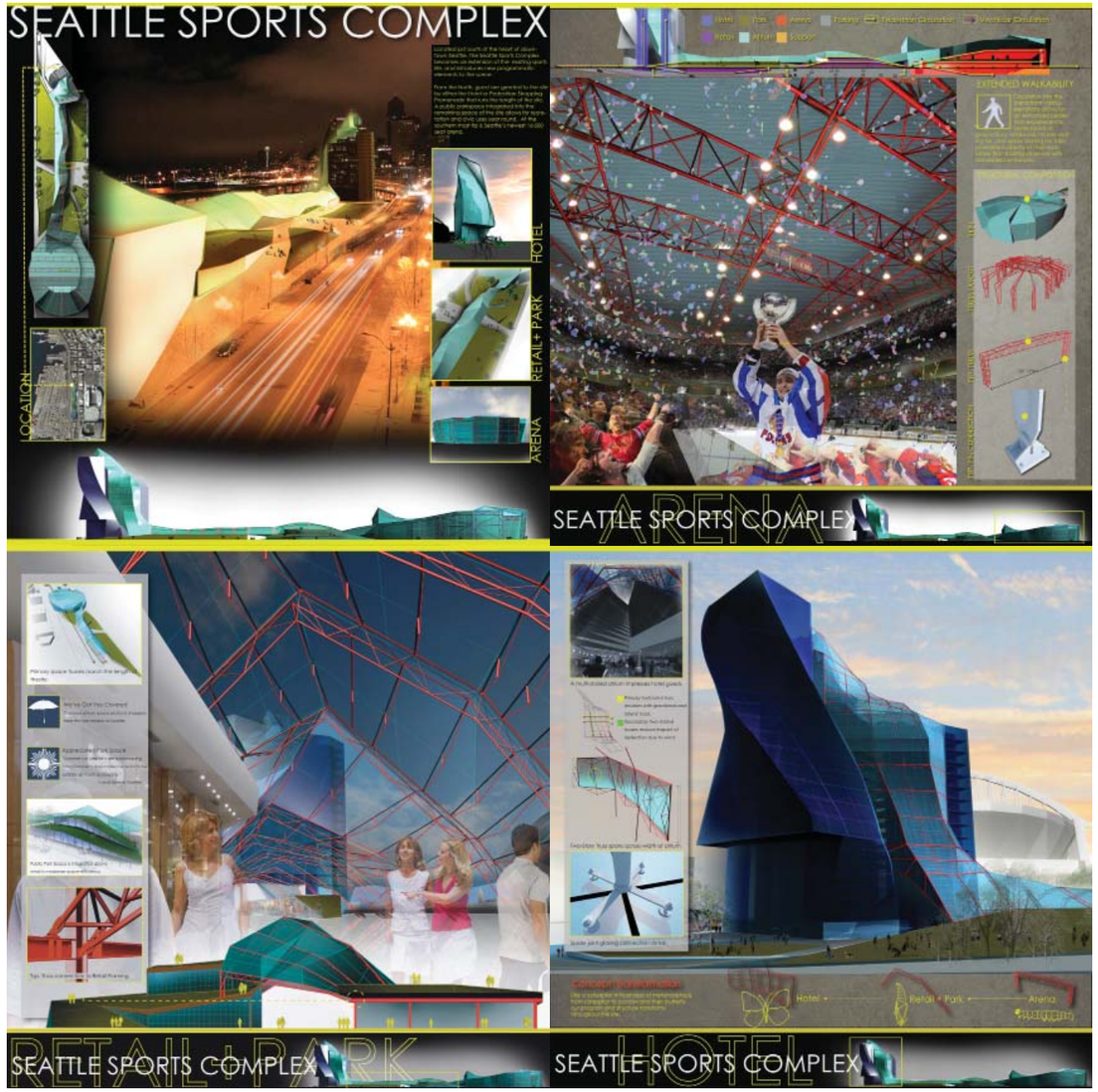
Presentation Board 01

Presentation Board 02

Presentation Board 03



Presentation Board 04



Presentation Board Summary

Seattle Sports Complex

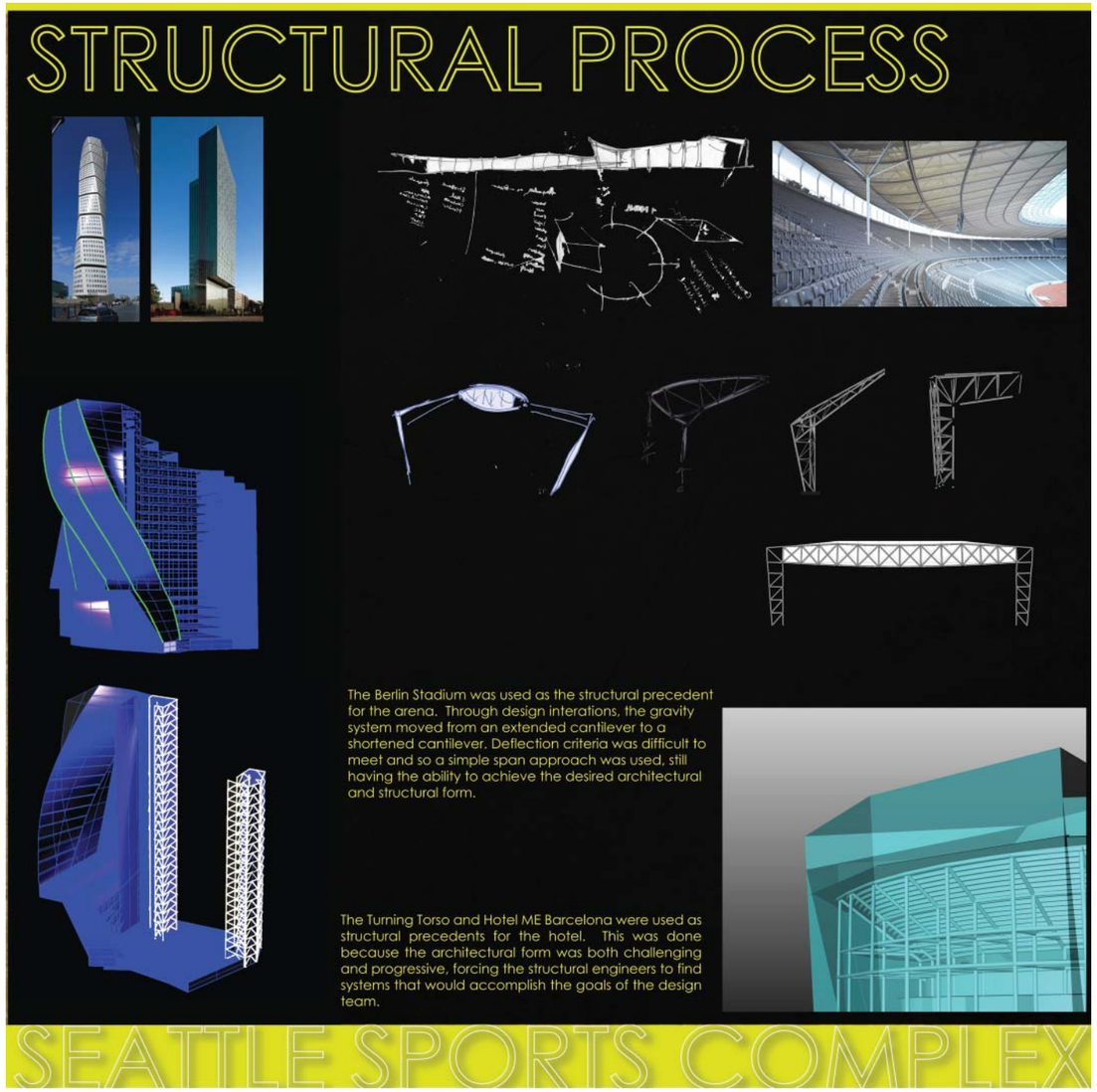
The city of Seattle has many places for congregation, relaxation, and entertainment such as Pioneer Square, Pike's Place market, and the few parks that are dispersed throughout the city. Now you can visit the Seattle Sports Complex and enjoy all of those amenities at the same time. The site, which is located at the southern end of the city and adjacent to Qwest and SafeCo Fields, becomes an extension of the Seattle waterfront and acts together with the Olympic Sculpture Park, located at the northern end of the city, to designate the newly redesigned waterfront experience. The continuation of the waterfront into the site includes high end retail, a five star hotel, and a new sports arena for basketball and hockey. Through the integration of green spaces and communal spaces the site becomes a hub of activity in that region of the city providing the visitors with opportunity to enjoy the park space during the summer and still stay protected from the elements by the continual canopy/atrium throughout the year.

The goal of the project was to highlight the walkability of the Seattle cityscape. In doing that each level of the project is capable of being reached without the use of conventional elevation circulation. Essentially, one could walk from the northern tip of the site all the way to the upper seats of the arena without stairs, escalators, or elevators. To immerse visitors in the context of the site, the ground plan was manipulated to bring visitors down into 'underground' retail and up over storefronts allowing occupants to enter the arena and multiple levels, adding to the complexity of space and manipulation of the' zero level' elevation.

As said before the canopy/atrium is the critical driving force of circulation, program and form generation throughout the site. It is meant to be treated as the main circulation spine and can be clearly and easily understood by all visitors to the site. It transforms fluidly from the atrium enclosing the arena to the canopy that protects and delineates the retail sector, and finishes through the hotel, gesturing to the north to indicate a connection with downtown Seattle.

The aesthetic quality of the atrium comes purely from the steel trusses that span the site transversely. They become the continual architectural element throughout the site that ties the separate programmatic pieces together. In doing this it allowed us to signify the journey of walking the site the the evolution of truss design. We tied this opportunity to the concept of the evolving Caterpillar. Starting in the arena, the trusses are designed inspired by the long fat body of the Caterpillar, giving the space a sense of heaviness, weighing the visitor down and centering their concentration to the playing floor. Moving into the retail sector, the trusses become lighter and begin to resemble the hanging cocoon. In the hotel, the trusses take on a new design, one that captures the upward soaring movement of the Butterfly in the air.


PROGRAM
ARENA
HOTEL
RETAIL
PUBLIC
UNIQUE ARCH
WALKABILITY
YEAR-ROUND
PUBLIC PARK
Concept: Transformation
Like a caterpillar in its phases of metamorphosis, from caterpillar to cocoon and then butterfly
Hotel
Retail + Park
Arena
TRANSFORMATION
ARCHITECTURE
PROCESS


STRUCTURAL PROCESS
The Berlin Stadium was used as the structural precedent for the arena. Through design interations, the gravity system moved from an extended cantilever to a shortened cantilever. Deflection criteria was difficult to meet and so a simple span approach was used, still having the ability to achieve the desired architectural and structural form.
The Turning Torso and Hotel ME Barcelona were used as structural precedents for the hotel. This was done because the architectural form was both challenging and progressive, forcing the structural engineers to find systems that would accomplish the goals of the design team.
SEATTLE SPORTS COMPLEX

Kimberly Bowen
This collaborative studio was a great experience – I took much more away from it than I had anticipated. It is quite impressive how quickly one can adjust to new ideas, techniques, and skills while further developing existing ones. Working in a team highlights each member's abilities and encourages everyone to improve.

Throughout the two quarters, it was interesting working between different computer programs; I learned how to create a structural analysis model from an architectural mass model. This reinforced the importance of coordination between ARCEs and ARCHs – both are crucial for the other's design.

The most rewarding outcome from this studio was learning how to approach a project from the very beginning. Floor plans, story heights, and structural systems are not provided, so it is entirely up to the team to figure things out and create an innovative design together. I appreciate the global perspective of form and function, both structurally and architecturally.

JeanLuc D'Abreau
This course required the most communication for any class I've taken in my time at Cal Poly, including taking Public Speaking. Whether it was communication via phone, in person with words, or through drawings and sketches, relaying information to not only the other structural engineer on my team, but the architects as well, proved challenging at times, but ultimately very rewarding. I was not certain what to expect coming into the class; the only expectation I truly had was that I would be working with architects on a collaborative project. Ultimately, it turned into much more than that. Experiencing design, both structural and architectural, in a new way allowed me to think me conceptually about structure, particularly on a global scale, rather than on an element by element basis. The trips, especially the one to Seattle, showed me what it looked like when architecture and structure functioned well together, i.e., the Seattle Public Library, and what it looked like when the they did not. When everything is taken into account, this was an amazing course and one that I enjoyed greatly. It was more work than I anticipated but the knowledge and skills that I gained are invaluable.

Ryan Marlin
I have had an interdisciplinary studio before, but there it felt to me that the only collaboration was between to the two architecture students on the team. Coming into this class I had hoped that that would change, and I am glad that it did. Working together with my group, we lost the conventional definition of who was 'supposed' to do what, and worked truly collaboratively to reach our goal. My favorite part of the class was sitting down with the engineers, coming up with designs and working out solutions to problems that came up. Working together with engineers gave me a new perspective on design that I will take with me the rest of my career.

Nicholas Ochoa
The discipline of Architecture requires the collaboration and communication amongst various other disciplines in order to successfully design and build a project. This course offered the opportunity and experience to learn about the working styles and ethics of both fellow Architecture colleagues as well as Engineering individuals. Leaving this class with an insight of the above mentioned will be an invaluable asset that I will carry with me for a life time to come.
In addition to advancing my presentation and designing techniques, this course was beneficial in the sense that it allowed me to continue the development of thought from a structural standpoint. Integrating a realistic structural plan both on a global and local scale has inspired me to move into the notion of projects that move beyond elementary course work learned in school. Ultimately this mindset will aid into my transition of "real-world real-life" projects after college.