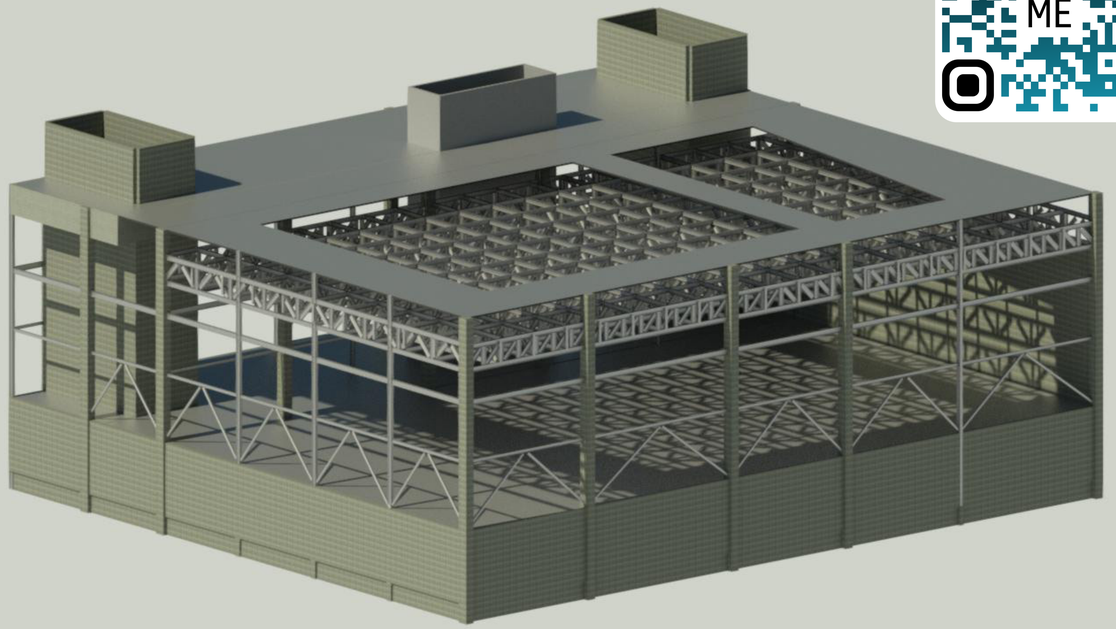
Creating Spaces for Life: Designing with Safety & Stability in Mind

UCI CEE Structural Engineering Senior Design
Project Manager | Jackie Yoo | Winter 2023 | Group S2
Project Engineers | Deena Salama | Dajian Liu | Christian Haastrup
Industry Advisor | Daniel Wang | LPA Design Studios
Faculty Advisor | Professor Mo Li | UC Irvine Winter 23

Introducing the **Aquatics & Recreation Center (ARC)** in Stanton, CA* - a cutting-edge project spanning 17,000 square feet that responds to the needs of the community and reflects their culture. This impressive facility boasts a range of amenities, including a double pool rooftop deck and an intervarsity gym at ground level. What's more, the ARC is constructed atop a subterranean parking garage, designed to accommodate foundation loads with ease.

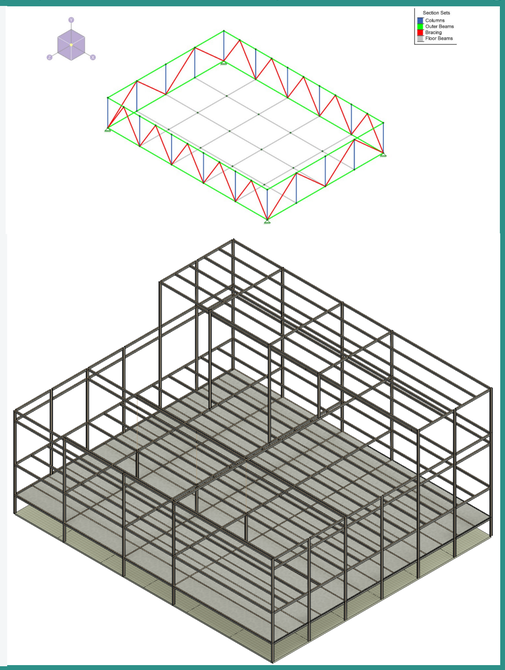
The ARC's stunning interior is designed around an atrium layout providing panoramic views of the gym floor from offices and activity rooms at intermediate levels between the rooftop deck and gym floor. The Olympic-sized and recreational pools are located above a column-free atrium, supported by a state-of-the-art mega-truss system that ensures optimal stability and safety.

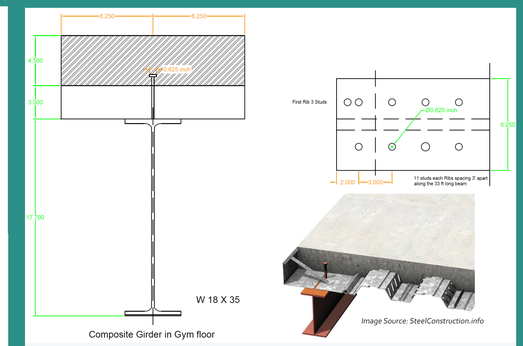
At the heart of the ARC's design is a deep understanding of the community it serves. The facility has been thoughtfully crafted to reflect the culture and unique needs of Stanton residents, providing a welcoming and inclusive space for everyone. Whether you're a seasoned athlete or just looking to try something new, the ARC has something for you.



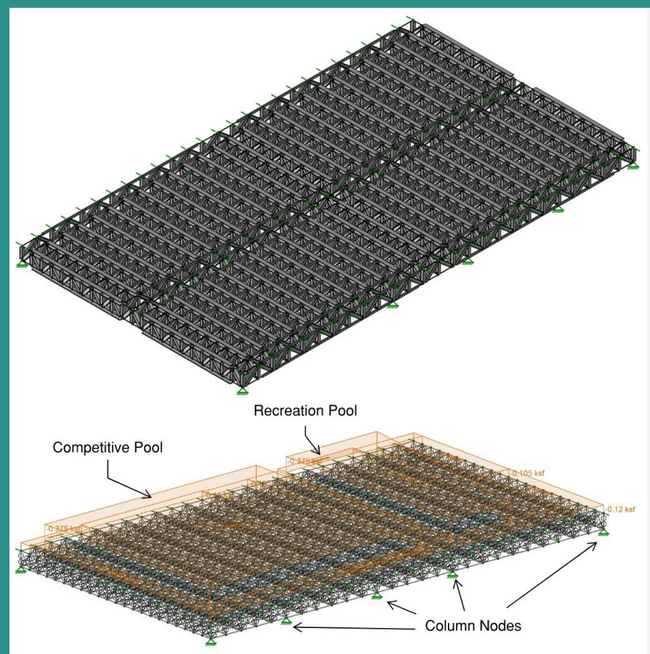
*For site selection purposes, soil & fault analysis, as well as demographic research were conducted on three potential project locations. Stanton, CA was selected upon review of acquired

Since the gym floor of the structure is an open-space area, research was conducted about various bracing systems to strengthen the floor directly below the rooftop pools which carries the brunt of the load, so bracing systems were analyzed for how they can best carry these loads. After conducting this research, shear wall was the recommended system for this structure.





The gym floor utilizes Composite Decking, which is a popular construction technology in the industry today. Our composite beams consist of a 3.5-inch deep 4ksi normal weight concrete section and a W18 X 35 section steel with eleven 5/8 inch diameter studs along the 33 ft beam. By combining these two sections, the composite beams provide increased strength, stiffness, and load-carrying capacity compared to single material beams.



Ten columns are placed within the building to support loads sustained by the rooftop, indoor basketball gym, and parking garage. Given the construction set drawings, we arranged column locations in areas that optimized space, material costs, and aesthetic appearance. Structural elements on the roof account for load factors used to find the force transferred to the columns. Moment demand was calculated using W36x160 steel columns.

MILESTONES

01 PRELIMINARY DESIGN
- Site determination
- Challenges & goals identified
- Subterranean garage layout
- Case study: truss beams

02 STRUCTURAL ANALYSIS
- Load Calculations
  - Dead & Live Loads
- Gravity Systems
- Composite Deckings
- Roof Support Mega Truss

03 TEST & REFINE
- Building models in RISA
- Run simulations
- Assess failure modes
- Modify design
- REPEAT

04 MODEL IN BIM SOFTWARE
- Design base model in Revit
- Assess ease-of-use & functionality

05 NEXT STEPS
- Seismic Design
- Shearwall Analysis
- Analysis of Connection Areas
- Finalize Structural+Architectural models, all floor plans
- Foundation Design
- Other Design Considerations (per code provisions)

06 BEYOND STRUCTURES
- Sustainability & Economy
  - Alternative material choices
- Sensitivity Analysis
  - Concrete vs. Steel
  - CO_2 Emissions
- GWP - Global Warming Potential
- Projected Construction Costs
- Landscaping & Aesthetics