

# INTRAMURAL BUILDING ADDITION AND RENOVATION PHASE I

Penn State Architectural Engineering Senior Capstone Project

Gonzalo Lay | Construction Option

Advisor: Ray Sowers



## PROJECT INFORMATION

### BUILDING INFORMATION

**Scope:** Renovation of existing building's mechanical, electrical and fire suppression systems and addition of a new, 48,000 SF facility to meet student demands for recreation.

**Size:** 48,000 SF | 148,565 SF Total

**Stories:** 1 w/ Mezzanine and Basement

**Construction Dates:** February 2013 - March 2014

**Delivery Method:** CM at Risk

**Project Costs:** \$26.1 M GMP

### CONSTRUCTION INFORMATION

**Construction Dates:** February 2013 - March 2014

**Delivery Method:** CM at Risk

**Project Costs:** \$26.1 M

**Contract Type:** Guaranteed Maximum Price

**Structure:** Steel Frame

The main focus was to accelerate the project's schedule and quality through the use of prefabrication and offsite construction, as well as reducing construction costs while promoting safer jobsite and higher end product.

### PROJECT TEAM MEMBERS

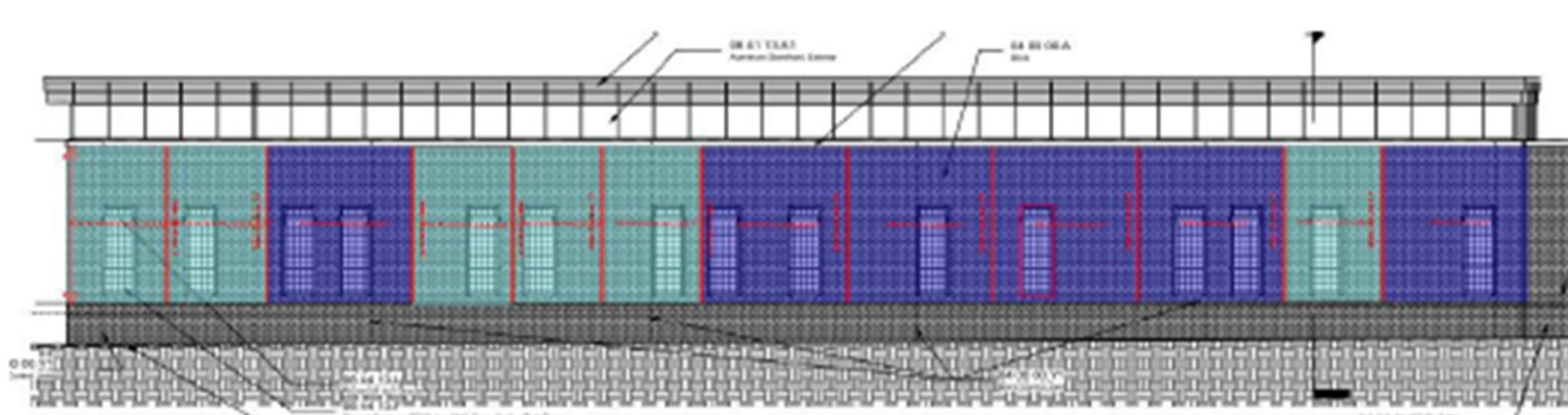
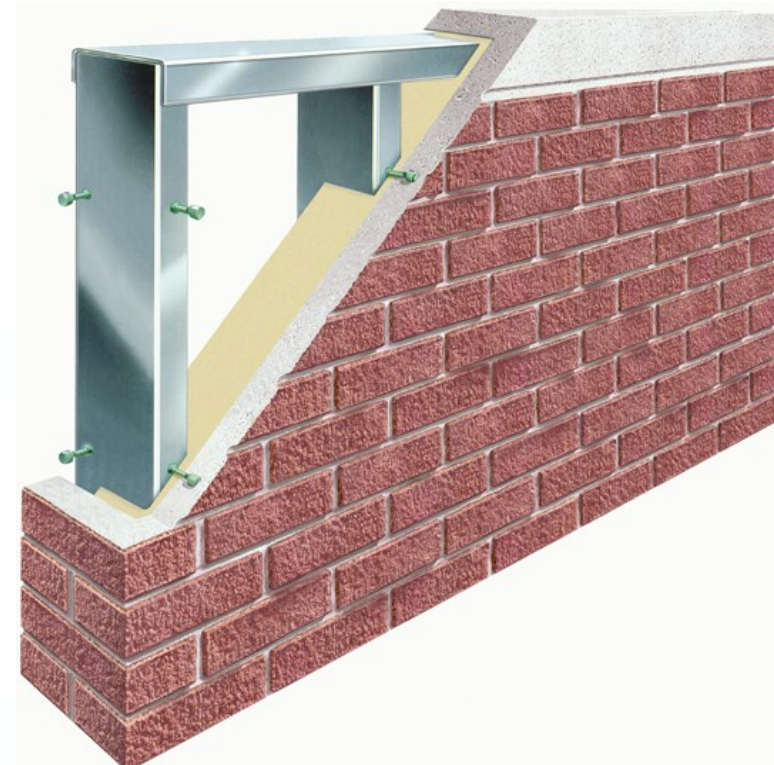


## PREFABRICATION OF BUILDING ENCLOSURE

**Goal:** Match the existing brick and curtain wall systems with offsite prefabricated panels with same or equal performances and architectural features, to accelerate construction schedule and reduce costs

**Manufacturers Selected:** SlenderWall by Easi Set and Kawneer 1600 SS PreGlazed

SlenderWall - Lightweight panel with structural framing within the design. Comes in variety of finishes.



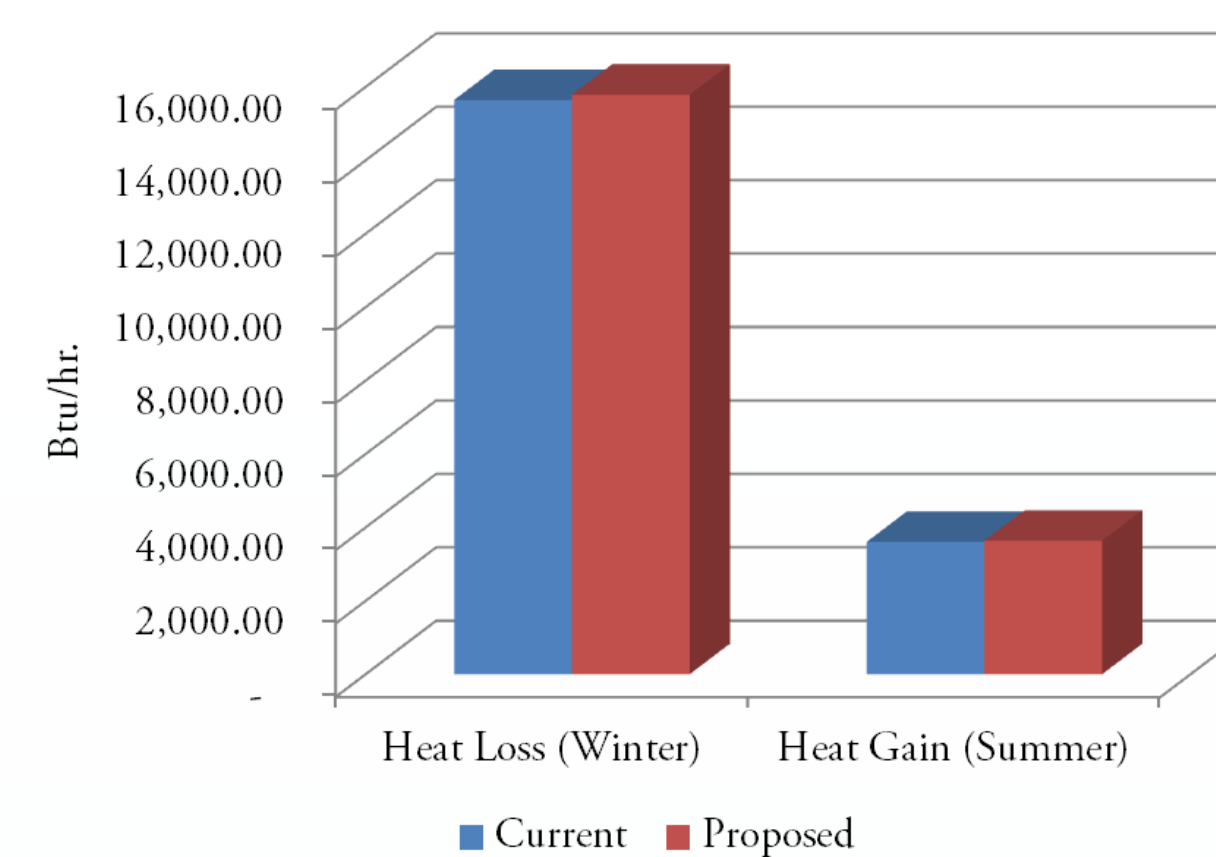
**Brick Panel Evaluation:** Meet architectural features and have same or better thermal performance.

**Results:**

Costs Savings of \$75,000

Accelerate Building Envelope Schedule by 12 days

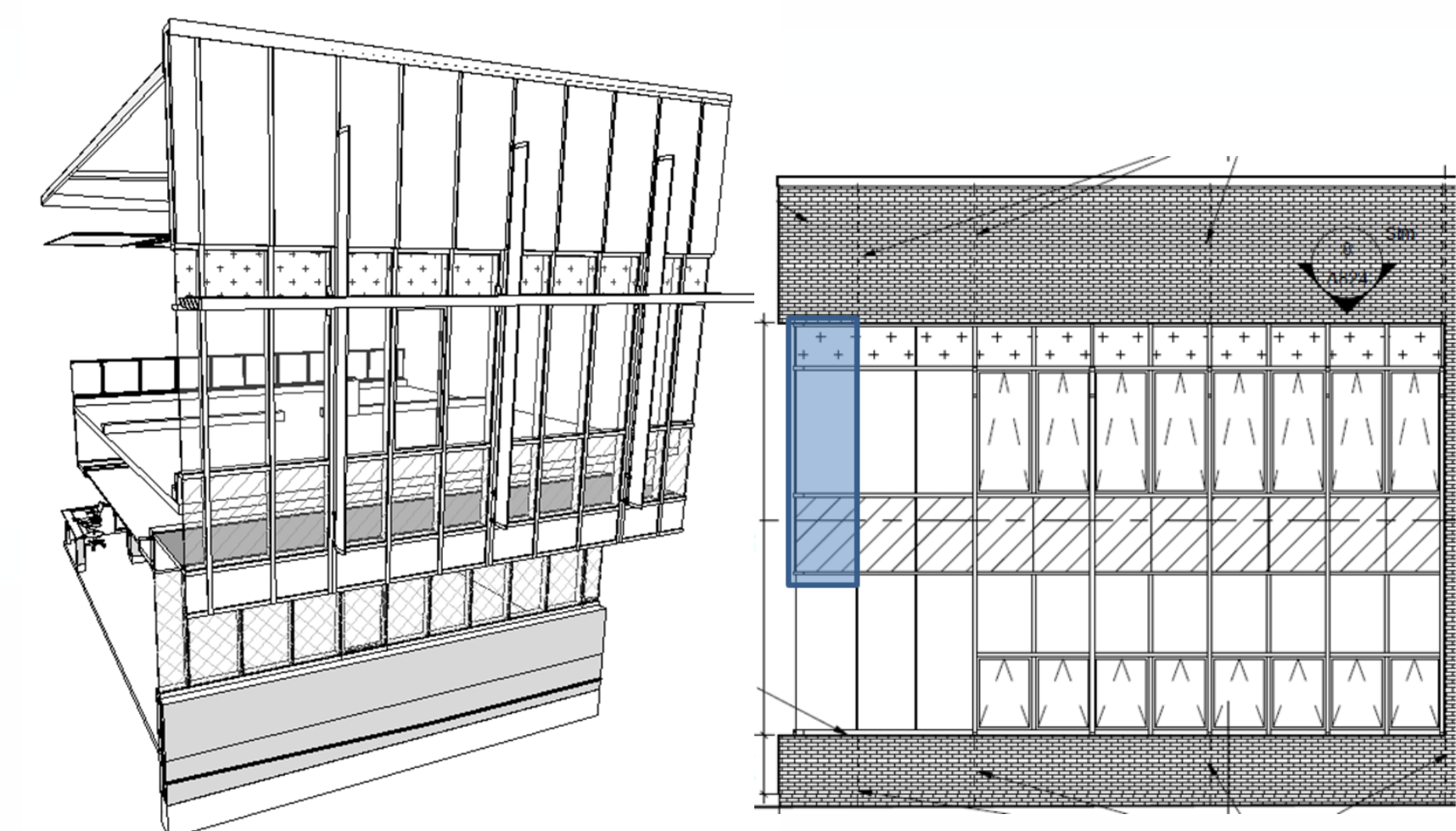
Small difference in cooling and heating loads



**Curtain Wall Results:**

Acceleration of enclosure schedule by 29 days

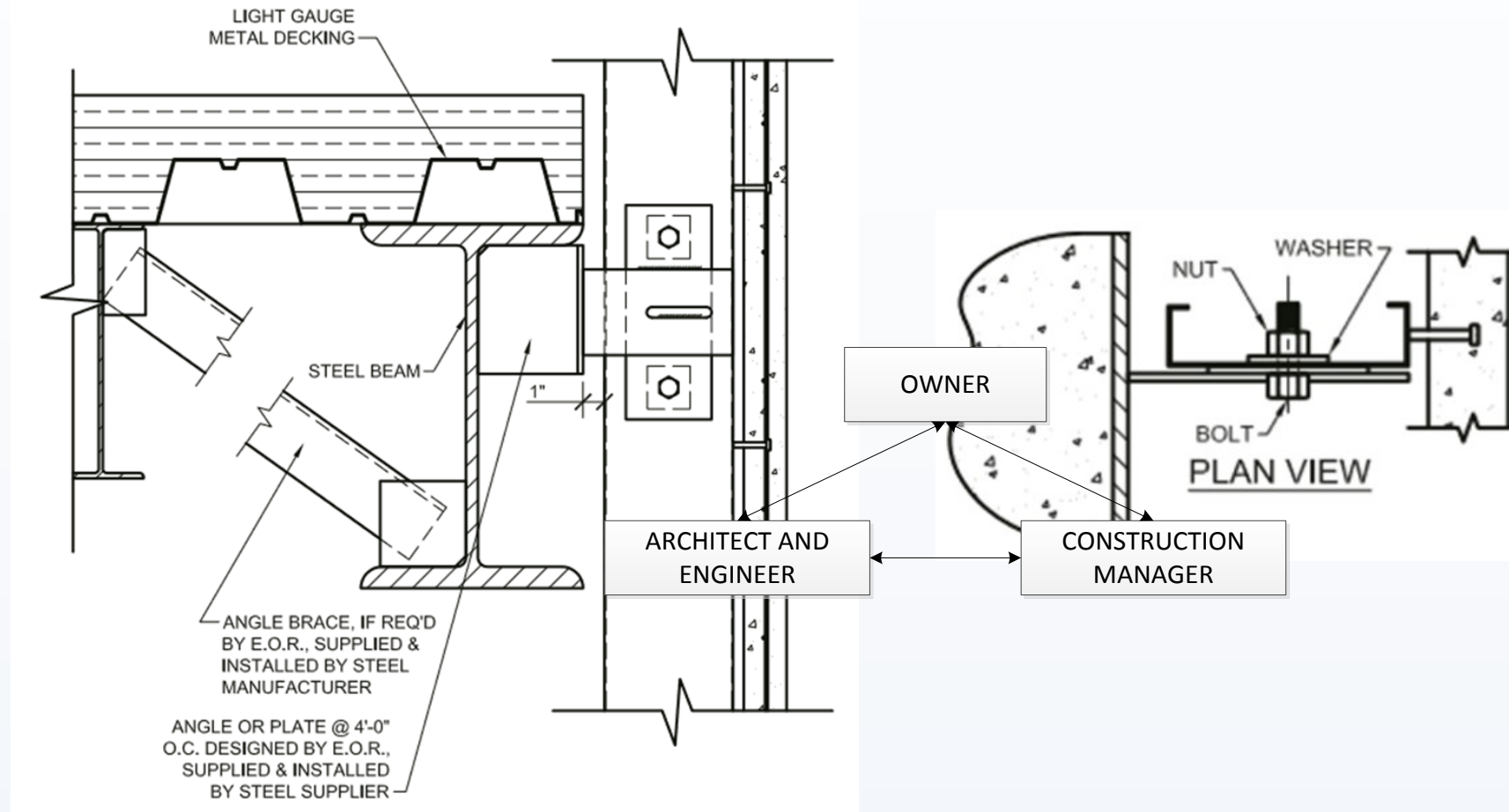
\$190,000 added costs to project



## PREFABRICATION STRUCTURAL EFFECTS

**Goal:** Evaluate the feasibility of altering the exterior structural framing columns and beams from the new loading generated by the proposed SlenderWall panels.

**Approach:** Resized structural columns and beams through calculations and checked the beam deflection. Also looked at the different types of panel connections to the building.



**Results:** Exterior Beams could be resized from W18x35 to W16x36.

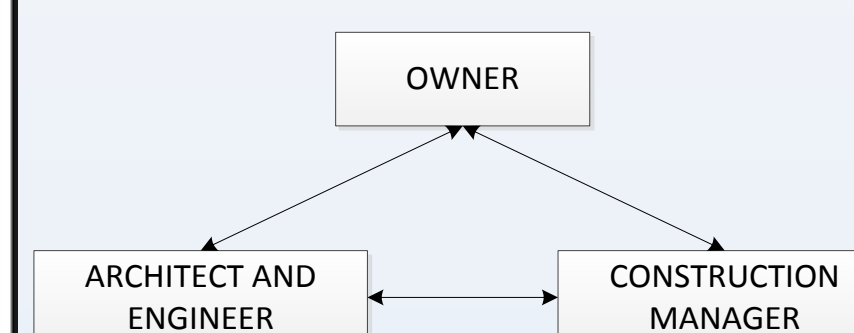
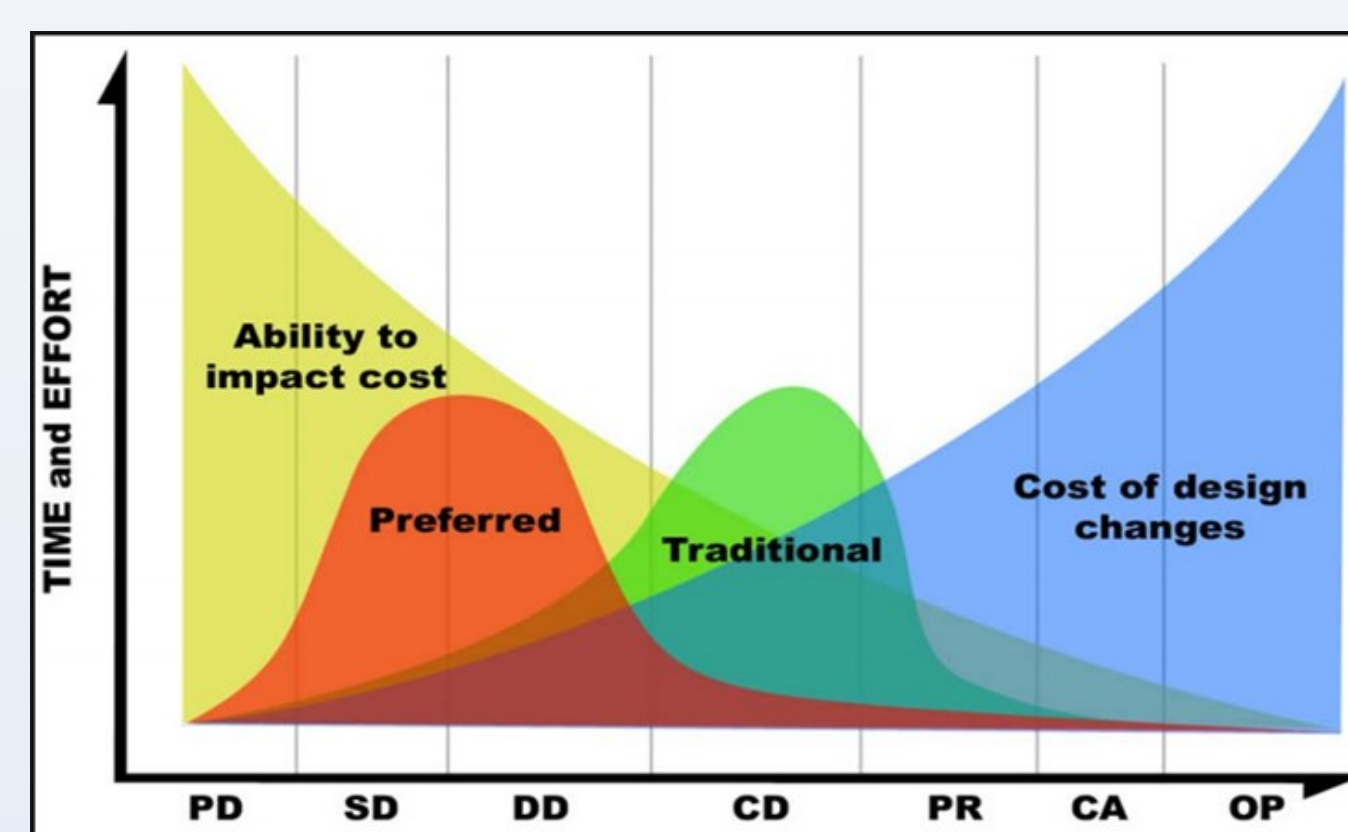
Not a cheaper alternative, since beam is not economical by AISC.

**Cost implications:** \$800 + effect on column beam connections

## INTEGRATED PROJECT DELIVERY IMPLEMENTATION

**Goal:** To reduce design discrepancies throughout the project by increasing the collaboration and coordination efforts by implementing IPD-like delivery method.

**Approach:** Investigated the pros and cons of the delivery method through literature and projects, to understand how it works and success criteria.

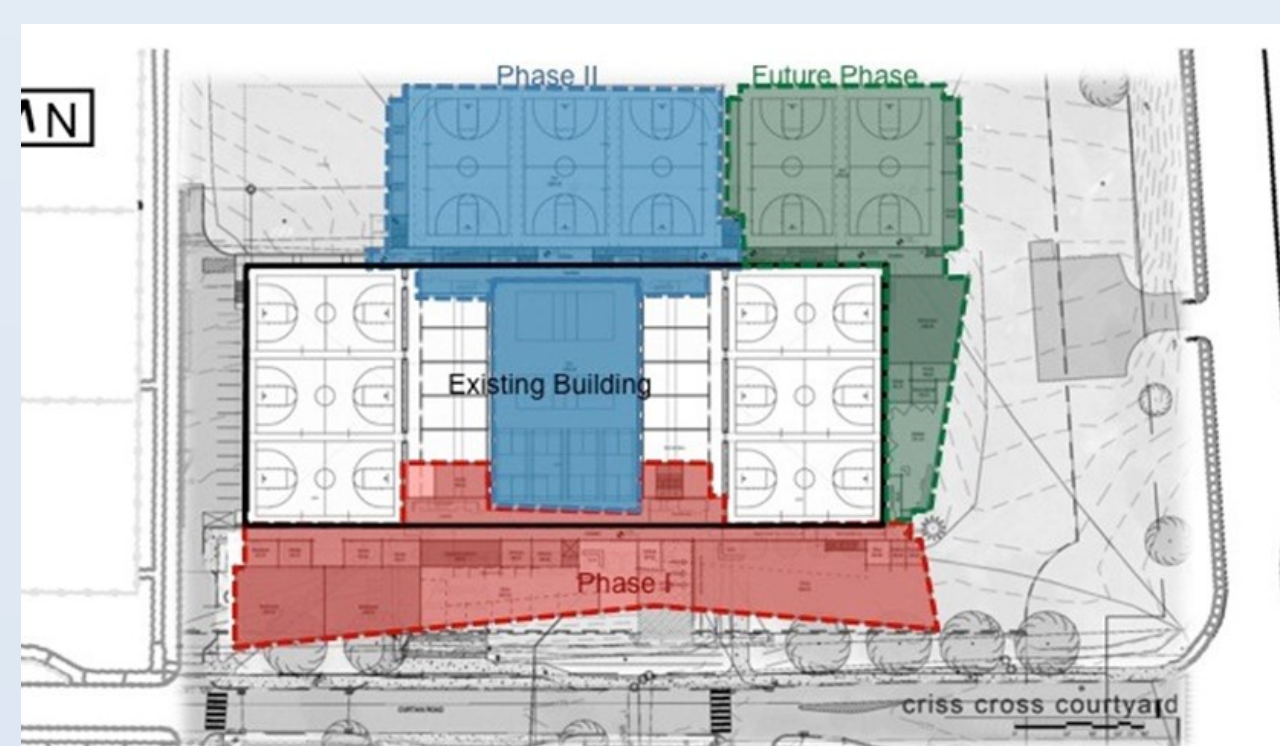


**Results:** By implementing early involvement of key project members and enforcing daily interaction will ultimately decrease the chances of creating both design and project discrepancies. This way, project schedule, quality and costs will be more controlled for owner benefit.

## OCCUPIED vs. VACANT RENOVATION

**Goal:** To evaluate the decision of renovating and constructing the project while fully occupied and operational, and analyze the effects on the building occupants.

**Approach:** Investigated the advantages of vacant construction, while evaluating the key concerns of a occupied building, and a study on noise and productivity.



**Results:** Vacant renovation offers the opportunity of easier planning, coordination larger scope of work, but it requires funding to be available.

Building occupants can be easily distracted throughout phases such as demolition, therefore construction standards must be followed.