executive summary

This thesis focuses on a scenario change in which the client requests a contemporary space with exposed ceilings. To solve this, the structural system is changed to composite cellular beams and custom Vierendeel trusses for the gravity system and concentrically braced frames as the lateral system. The breadth studies redesigned the façade and mechanical layout. Through the year of analysis and redesign, the proposed system is found to be suitable for the new scenario.

struc

Using cellular beams is an appropriate way to address the proposal's scenario, allowing for an open ceiling with a modern industrial feel while still being aesthetically pleasing. The lateral change to concentrically braced frames (in both directions) continues this feel throughout the building while providing a stiffer solution to the lateral framing. This decreases the story drift and is capable of resisting the lateral forces with fewer frames than in the original design. Plastic analysis confirmed the RAM Structural System's cellular beam selection and showed that the gravity loading was not the controlling factor.

arch

The façade is redesigned to better house the braced frames and reflect the contemporary style of the building. This combines aesthetic appeal and thermal benefits of using a panel system for the envelope enclosure. This system uses a rigid insulation with increased thermal properties which significantly improves the envelope's R-value for both the brick skin and the metal panel skin. Aesthetically, the addition of curtain walls and spandrel glass improve the façade's generated interest while maintaining the architectural footprint of the original design.

mech

In accommodating the height restriction set by the IBC, the mechanical ductwork is laid out completely within the structural cells. An increase in the number of VAV boxes allows for a more customized temperature range throughout the office spaces, increasing occupant comfort levels.

In addressing the structural, mechanical, and architectural needs of the proposed scenario, the redesign is able to adequately address each design challenge.