

## Abstract

The purpose of this report is to complete a thorough analysis and redesign of the structural system of the SteelStacks Performing Arts Center (SSPAC) and compare these results to the existing building, evaluating this redesign. The SSPAC is a 64-foot, 4 story, 67,000 square foot arts and cultural center with a steel gravity system and a dual lateral system comprised of braced frames and shear walls.

This report culminates the work of a semester of research and redesign, at the end of which a scenario was created in which the architect wanted to explore cast-in-place concrete as an alternative design option. The new design was decided to include a fully concrete gravity and lateral system. Additionally, the floor system was evaluated and chosen between different systems, a reinforced one-way slab and beam system and a prestressed system.

The goal of this redesign is to evaluate the benefits of both the existing steel system and a reinforced concrete system through a comparison of the benefits and issues with each. This analysis necessitated considering benefits and disadvantages including the structural benefits to each system, flexibility in design, cost, and construction.

The proposed redesign and change in materials resulted in a need to evaluate the acoustic performances of these spaces. This acoustic breadth considered both floor systems and the impact of these materials on the sound transmission as well as the reverberation time within each space.

Results from this analysis led to the conclusion that concrete benefits the system in terms of the many cantilevers and framing configurations seen throughout the SSPAC, while steel is a continued benefit in other areas if the layout is kept the same. If concrete were to be implemented, the building would benefit from seeing some slight changes to layout and structural design.

Cost and construction were seen as more effective in steel. The considerations on acoustics and architecture resulted in successful adjustments to the concrete structure to create a more effective design. Acoustics in particular, were improved through the use of concrete, as it is naturally a better system for the required sound isolation and reverberation of the spaces in the SSPAC.