

Executive Summary

The Reinsurance Group of America's (RGA) Global Headquarters is located in Chesterfield, Missouri. The complex consists of two, five story office towers framed in steel with glass curtain wall façades and a two story, partially underground parking garage of post-tensioned reinforced concrete with a limestone panel façade. The lateral system consists of steel concentric braced frames in the office towers which change to reinforced concrete shear walls in the parking garage. Four of the five stories of the office towers are cantilevered over the first floor by five feet on three of the four sides and by forty feet on the fourth side. Housing a Fortune 500 company, the complex is meant to represent RGA's local and global presence and is designed for a LEED Silver Core and Shell Certification.

Purpose and Scope

The purpose of this report is to present in detail the analysis and design outcomes of the green roof garden amenity area addition on each steel office tower. This report contains an overview of the as built project's characteristics and structure and moves into detailed redesign calculations, considerations and comparisons for the green roof addition. Finally, supplemental material such as technical information and detailed calculations are provided in appendices. The investigation's scope is limited to the South Office Tower and parking garage structure below it due to time constraints.

First, the green roof garden breadth study is presented where the design outcome and considerations are discussed. Considerations included planting selection, code requirements, system selection, ASTM standards, public access, and aesthetics. Next, a structural depth study was performed on the gravity and lateral system using the structural considerations and revised weights of the green roof addition. The gravity cantilever truss system affected by this change was analyzed and redesigned for new loading and deflection limits. The roof system was redesigned as a composite steel system and the roof framing was redesigned considering composite action. After studying the gravity system, the lateral system was changed from conventional braced frames to buckling-restrained braced frames and designed. ETABS models were created for the roof system, the three gravity trusses, and the lateral system of the office structure to assist in the calculations. Finally, a construction breadth study was conducted in which a cost analysis and schedule analysis for each project option and their outcomes were compared to determine the additional cost and time the green roof garden will add to the project.

The results of this report show that adding a green roof garden is feasible for this project and the most critical factor in the decision for the owner is the additional project cost. Although adding a green roof will add almost two months to the schedule of each office tower, none of those activities lay on the critical path since construction on both towers overlap. The outcome of the lateral analysis showed that buckling-restrained brace frames can work for this project, but they are not the best choice over conventional braced frames. This is because the higher green roof mass required the highest yield strength available and almost the highest steel core area manufactured. Overall, the result of this investigation concludes that a green roof garden is feasible and that the lateral system should remain conventional braced frames.