

## Executive Summary

The Corporate Headquarters, located in the Great Lakes Region of the United States, is a new five story office and retail space designed to serve as new home base for an established and successful US based company. The building will serve as a focal point for the south entrance of an existing retail park. The building's existing structural system is composed of W-shape steel beams, girders, and columns. The composite beams and girders, along with the concrete on metal floor deck, make up the building's gravity system. The Corporate Headquarters relies on eight braced frames as its lateral force resisting system. Within the building lies an open air courtyard featuring an intensive green roof garden.

### Purpose and Scope

The purpose of this report is to examine and investigate an alternate structural system for the Corporate Headquarters. Though the existing structural system was adequate to fit the building's needs, a scenario was developed in which the courtyard green roof's geometry and composition were changed in order to help increase office space and to aid in the design process. To accommodate this change, the building's gravity system was redesigned using long span steel joists and joist girders. The columns remained as w-shapes but were resized in accordance with the new loads.

The changes in the gravity system resulted in a lower total building weight, which required the building's seismic loads to be recalculated. Once these loads were determined, it was found that wind controls over seismic. The building's lateral system was redesigned with reinforced concrete shear walls taking the place of the existing steel moment frames. The new shear walls were placed in the same locations as the existing steel braced frames in order to maximize floor space and to maintain the integrity of the existing architectural design, which put walls on either side of the braces.

A green roof redesign was completed to help lower the dead loads on the building. The tree area was removed and the entire intensive green roof courtyard was redesigned with grass, garden, and patio areas. A focal garden was created in a shape symbolic to the building owners and it was filled with planters featuring native flowers.

Finally, the watertight enclosure of the main roof and courtyard levels were examined. New waterproofing membranes, application types, and water tests were researched in order to determine what would be the best fit for the courtyard green roof and the main roof level. First, a new drainage plan was created for the courtyard green roof, Membrane manufacturers were compared, assembly types were considered, and a system was found that best suits the needs of each level. Water tests were considered based on feasibility of the test, time to conduct the test, and appropriateness for the material.