

## Executive Summary

As part of the State University of New York (SUNY) Upstate Medical University's campus expansion, the SUNY Upstate Cancer Center will be a five story, seventy-two foot tall medical facility located in Syracuse, New York. A steel framing system supports the lightweight concrete and metal deck composite floor system, and lateral forces are resisted by ordinary steel braced frames. The structure sits atop concrete grade beams supported by drilled caissons.

The primary goal of this thesis was to redesign both the gravity and lateral structural systems of the Cancer Center, using reinforced concrete in place of structural steel, with the intentions of decreasing the cost of the structure. In addition, the building was also designed to resist disproportionate collapse in accordance with regulations set by the United State Department of Defense. Maintaining the progressive collapse theme, the building's site was redesigned to limit damage from exterior threats that could initiate a collapse. Carrying this ideology into the building envelope, the main façade of the Upstate Cancer Center was redesigned to accommodate effects from wind and blast pressures, impact of debris, and seismic movement. A heat transfer analysis was conducted to quantify the thermal performance of the new and redesigned glazing system

Building loads associated with the SUNY Upstate Cancer Center were determined in accordance with ASCE 7-10 and the New York State Building Code. Structural design for both the building's lateral and gravity force resisting systems was conducted using ACI 318-08. Progressive collapse design was conducted following protocol from the UFC 4-023-03. A two-way slab with concrete beams on all sides supported the gravity loads, while concrete moment frames resisted lateral loads acting on the building. Final design dimensions resulted in a 9 inch thick slab poured integrally with 22 inch wide by 24 inch deep typical support beams. Columns were chosen as square with dimensions of 24 inches by 24 inches. All perimeter beams were upsized to 22 inches by 28 inches deep and all perimeter columns on the first two stories above grade were upsized to 30 inches by 30 inches to meet progressive collapse requirements. The redesigned concrete structural system cost an estimated \$415,644 more than the original steel structural system.

Using the Site Security Design Guide provided by the United State's General Services Administration, the site of the SUNY Upstate Cancer Center was modified to reduce or eliminate the risk of building and structural damage associated with a vehicular impact or exterior explosion. Bollards, planters, trees, and benches were used to disrupt a direct path from the roadway to the building. A plaza was created to increase the standoff distance of the building and therefore dampen the effects of an explosion.

New glazing and a mullion support system were designed to meet the maximum wind pressures, pressure resulting from a 70 pound explosion, impacts from airborne debris, and glazing movement from seismic activity. In addition to choosing an assembly with a low thermal conductance, the new glazing unit was selected with a low-e coating to help reduce heat gain from solar radiation. Heat transfer analyses were conducted for both glazing systems under summer and winter conditions. The proposed alternative glazing unit provided less heat gain in the summer months, however; it caused undesirable heat loss in the winter months.