

EXECUTIVE SUMMARY

Kingstowne Section 36A (KT36A) is a 200,000 SF mixed use building currently being constructed in Fairfax County Virginia. When completed, the lower half of the building will serve as a parking garage serving the office tenants of the upper half of the building. The parking garage levels utilize flat slab concrete construction while the office levels use a composite steel construction. A more thorough description of the existing structure can be found in the first half of this report.

The goal of this thesis was to use one type of structural system (reinforced concrete) throughout the height of the building, simplifying coordination of construction and hopefully reducing the cost of the overall structure. Once the office levels and roof level were designed for gravity and lateral loads, the structure was analyzed and designed to resist progressive collapse following guidelines adopted by the U.S. Department of Defense. According to the guidelines, a thorough design for progressive collapse also incorporates assessing elements outside of the building structure, including the surrounding site and exterior building façade. Following through with this, a site layout redesign was conducted to reduce the risk of events that could initiate progressive collapse. Finally, new glazing for the building would be sized to resist pressures caused by a specified explosive charge, with the goal of maintaining the thermal performance of the existing systems.

Design loads on KT36A were calculated in accordance with ASCE 7-10. From here, structural design for both the gravity and lateral systems was completed using ACI 318-11. A three-dimensional model of the building structure created in ETABS was also used to aid in the design of the lateral system. Once the structure was designed for gravity and lateral loads, a design for progressive collapse was conducted following UFC 4-023-03 and GSA guidelines for designing against progressive collapse. The resulting design consists of 8" thick slabs with drop panels of the same thickness at the columns, 24" wide X 28" deep edge beams spanning the E-W direction, 24" wide X 31" deep edge beams spanning the N-S direction, columns of varying size. Shear walls are all 12" thick and primarily reinforced with #4 @ 12" O.C. in each face for the vertical and horizontal reinforcement.

Using the United States General Services Administration (GSA) Site Security Design Guide, modifications to the site design layout were implemented to reduce the risk of building and structural damage associated with vehicular impact and exterior explosion. Structural bollards, hardened site furniture, large planters, and security booths were all applied to the site to reduce the possible associated risks.

New glazing for the parking levels and office levels and an aluminum frame support system were designed to withstand the maximum wind pressures and pressure resulting from 80 lbs of TNT exploding at a standoff distance of 35' away. Parking level glazing remained as an uninsulated system, but was increased in thickness to 5/8". Glazing for the office levels also required a thicker system, which remained an insulating glass unit (IGU). Heat transfer analyses were conducted for both the existing and newly designed IGU's. The results found that the new glazing allowed more heat gain in both the summer and winter. While this could be desired in the winter months, it is not desirable during the summer months.