1.) EXECUTIVE SUMMARY

The following report investigates the General Office Building and describes the solution to a proposed scenario. The goal for this report was to strengthen existing structural analysis skills by exploring a new and unique area of structural analysis. As part of this hypothetical situation, the new occupant required the building to resist progressive collapse and terrorist attack. This report describes the analysis conducted and the conclusions made.

The General Office Building is located in the greater Washington D.C. area. The primary use of the building is offices. The existing floor structure is comprised of two-way concrete flat slab with drop panels. Shear wall cores resist the lateral loads in the existing design.

The existing structure was first redesigned using composite steel members and a moment frame lateral system. Computer programs and hand calculations were used to design this new system to standard code requirements, which include live, dead, wind, and seismic loads. Wind drift limitations were found to control the lateral system analysis. Modifications were made to the existing layout, when reasonable, which produced a more efficient design. This steel design was considered the base structural system, to which later redesigns were compared.

The Department of Defense's antiterrorism design guide, entitled Unified Facilities Criteria, was used as the basis for much of the second redesign. Three structural design methods were used to strengthen the base steel design against terrorist attacks. The Tie Force Method resulted in additional slab reinforcing. The Alternative Path Method was conducted at two locations and increased the exterior frame sizes. The computer analysis was verified using simplified non-linear hand calculations. The Enhanced Local Resistance Method reinforced the perimeter column against brittle failure. To ensure the moment connections were capable of the increased loading, a typical moment connection was designed. Masters level courses were used in this connection design and it was concluded that a sufficient connection could be constructed.

The architectural impacts of the structural alterations were investigated, along with the necessary site plan alterations. The south atrium, in particular, was investigated. Structural cables, which were designed to carry the blast loadings, were added to the space and investigated aesthetically and functionally. The existing site plan was also redesigned to accommodate a 100 foot standoff distance.

The cost and schedule of the proposed redesigns were investigated in a construction management breadth. Only the superstructure was examined. The base steel redesign was found to be more expensive, but faster to construction. When progressive collapse was added to the design requirements the cost and schedule both increased modestly.