EXECUTIVE SUMMARY:

Building Description

The Silver Spring Gateway is a mixed-use high rise development including 14,080 square feet of retail space, 100,215 square feet of parking, 395,439 square feet of residential space, and a 1,000 square feet roof top swimming pool. The building envelope consists of brick cavity walls and aluminum Centria storefront curtain walls. The main structural system consists of two-way flat plate post-tensioned slabs supported by 176 reinforced concrete columns without a typical bay grid. Every column transfers its load into transfer beams or directly into caissons carrying the load to the bedrock below. The lateral loads are resisted by three twelve inches thick reinforced concrete shear walls in the East-West direction and concrete moment frames in the North-South direction. The Silver Spring Gateway also contains a steel truss bridge spanning thirty-six feet over the garage entrance to connect the two portions of the residential space.

Structural Proposal

For the purposes of this thesis, JBG, hypothetically, acquired a lot in downtown Washington D.C. JBG will petition to alter the C-3-C zone to a C-4 zone to gain twenty to forty more feet in building height thus matching the surrounding buildings. Altogether, this site can accommodate the same architectural layout as the Silver Spring Gateway; however, due to the high profile aspect of the clientele, such as foreign diplomats and national delegates, and proximity to government buildings, the structural design may need altered to resist possible terrorist attacks. First, the locations exuding the most vulnerability to an attack need determined, such as, parking garage, entrance tunnel, exterior façade, etc. Since the current design lends well to several unique scenarios, the structural elements within the existing system will be analyzed per each scenario and redesigned, if necessary, to mitigate the effects of an explosion and to prevent a progressive collapse in case a localized failure occurs.

Breadth Proposal

Site and Landscape Architecture: The site design will need redesigned to prevent the attack scenarios, discussed within the structural study, as much as possible. The new site is larger than the existing site; therefore, more plaza area and landscaping can be accomplished to the accent the building. These designs must keep the tenants safe and comfortable.

Façade Redesign: In addition, the façade may need further attention due to possible historic guidelines and to resisting a street side explosion. The façade change requires focus on blast resistance, architectural and historic concerns, and thermal and moisture protection. Any fenestration changes may also affect mechanical loads and day lighting effects.

Results

Since the explosive weight utilized in an attack is arbitrary and difficult to predict with certainty, the main premise of this thesis is to compromise certain structural members and design to mitigate a progressive collapse. The design methods for alleviating progressive collapse mechanisms are defined in *ASCE 7-05* as a Direct Method (load redistribution) and an Indirect Method (catenary action through tie forces). The existing structure under both methods failed the criteria set by the General Services Administration (GSA) and the Department of Defense (DoD). First, structure was redesigned to pass the criteria, then the cost was analyzed to determine that the Indirect Method is the most efficient and economical method for this building.

In addition to redesigning the structure to withstand abnormal loads from terrorist attacks, the site architecture layout was updated to increase security through passive countermeasures such as bollards,

public and private spaces to increase the stand-off range, crash rated planters, and perimeter walls. The site access points were reconfigured to limit the number of entrances and incorporate guard houses.

With the stand-off range being over 100 feet, a street side blast has a small effect on the façade glazing which currently is specified as the most optimal choice for blast resistance. With most of the new developments in the area utilizing the same materials for façade wall assemblies, the existing materials also did not need to be redesigned for local considerations; however, the wall assemblies did need to add a vapor barrier to eliminate the potential for condensation and biological growth within the framing and insulation.

Overall, this thesis shows that the building of a residential high rise for foreign dignitaries and domestic diplomats would be relatively feasible especially with a large site. It is recommended that JBG pursue this development in the near future.