Executive Summary

Purpose

The Monongalia General Hospital has recently completed the Hazel Ruby McQuain Tower; an expansion to the existing hospital. The new expansion to the Hospital will provide more patient rooms, intensive care units, the emergency department, imaging department, central sterile supply, a pharmacy, as well as a medical records department. Located in Morgantown, West Virginia, a part of the Pittsburgh Tri-State region and the largest city in North-Central West Virginia, located conveniently within the city and close to the West Virginia University, the Monongalia General Hospital is a well integrated health care facility servicing not only North-Central West Virginia but also Southwestern Pennsylvania. With this in mind, and for the purpose of this thesis, the Hospital has hypothetically decided to research and integrate higher levels of structural safety against blast and progressive collapse, should the unspeakable happen.

Building Description

The Monongalia General Hospital is a 405,994 square feet hospital located in Morgantown, West Virginia. The building project includes a 280,000 square feet addition as well as a 60,000 square feet renovation to the existing structure. The building envelope is a brick façade tied to structural concrete walls with openings for punch windows and curtain wall systems. Aluminum curtain wall systems can be seen all around the Hospital, oriented around lobbies and other major openings on plan. The system consists of insulated tempered spandrel glass framed by aluminum mullions which is tied into the concrete structural system. The main structural system of the Hospital consists of two-way flat slab supported by columns that follow a typical grid and edge beams located in the perimeter of each floor. The loads carried by the columns are transferred to the foundations. The lateral loads are resisted by twelve shear walls of varying height and width located in various portions of the building.

Methodology and Schedule of Tasks

In order to analyze blast and progressive collapse events; multiple scenarios, properties, loads, and characteristics need to be researched. The following is a tentative list of tasks required to complete the thesis by April 2009:

- Study of blast and collapse characteristics
- Study of structural members' response
- Determination of scenarios
- Modeling and analysis
- Structural analysis and redesign
- Checking the validity of redesign
- Conclusion and analysis of redesign
- Written and oral presentation of findings

Breadth Topics

This proposal will cover the breadth topics to be covered in the thesis. Architecture and Construction Management disciplines will be studied and analyzed as supplemental research for the Structural depth topic.

For the interest and purpose of the thesis; as mentioned earlier, attacks to hospitals can cause catastrophic events: lives can be lost and significant monetary damages are inevitable. To ensure that such events do not occur, the Monongalia General Hospital has decided to research and integrate higher levels of structural safety against blast and progressive collapse due to accidents or attacks (Depth Topic). Within the initial stages of the research, various locations within the Hospital which may be vulnerable to attacks must be determined and analyzed. Through this analysis, the responsible structural members will be located, analyzed, and if required, redesigned to mitigate the effects of attacks and progressive collapse. Structural members such as beams and columns will be hypothetically loaded to resist blast loads, and removed from the rest of the structure as a part of the analysis, and then neighboring members will be designed accordingly to provide enough strength to carry the loads forfeited by the failed members.

Upon an intermediate completion of the research, architectural consideration must be given a high priority as to not hinder the current floor plan from losing its efficient layout, although one must keep in mind that enhancements to the structural system will inevitably cause such issues to arise. The current architectural layout of the Hospital is a simple grid layout with bays spanning 27 feet in each direction floor heights of 11 feet 6 inches, this allows for an open and flexible layout for the various spaces required. However, should any redesign call for say, deeper members, smaller bay sizes, and use of more columns; the architectural layout will require significant attention. Much of the walls in the hospital are partition walls and to be able to protect the patients, doctors, as well as visitors in the event of a blast, an alternative partitioning wall or an entirely new wall system must be designed. This will call for thick walls which may inevitably decrease the effective square footage in each of the spaces in the hospital. This breadth topic will directly be related to the second breadth topic which will follow.

Cost must also be considered and studied in the event of a redesign—should there be issues as such, alternate materials and/or construction methods must also be considered. This too is closely related to the depth topic, stronger members could require a change of material or increasing the member size, in such events cost could be a major issue. As of September 2008, the project volume was estimated to be over $67,000,000 and still rising. In order to reflect the existing monetary issue, yet still making the hospital resistant to blast and progressive collapse, much attention needs to be paid, and a possible alternative must be planned out. Also, possible schedule changes must be accounted for in the event of a redesign, factors such as use of different materials and/or construction methods can be major influences.