Curtain Wall Thermal Gradient Detail

Mechanical Breadth

Problem

The curtain wall system was chosen so that the structure could use expansive floor plans, use a smaller foot print for a larger amount of square footage (high-rise construction), and have the possibility to change the specific floor arrangements as the University felt necessary. With the growing popularity of the concept of green design, considerations for thermal efficiency should be taken into consideration with buildings using extensive amounts of glazing on their facades. Was the glazing system chosen the best for efficiency? See detail of Enlarged Plan @ University Floor Exterior Wall on next page.

Goal

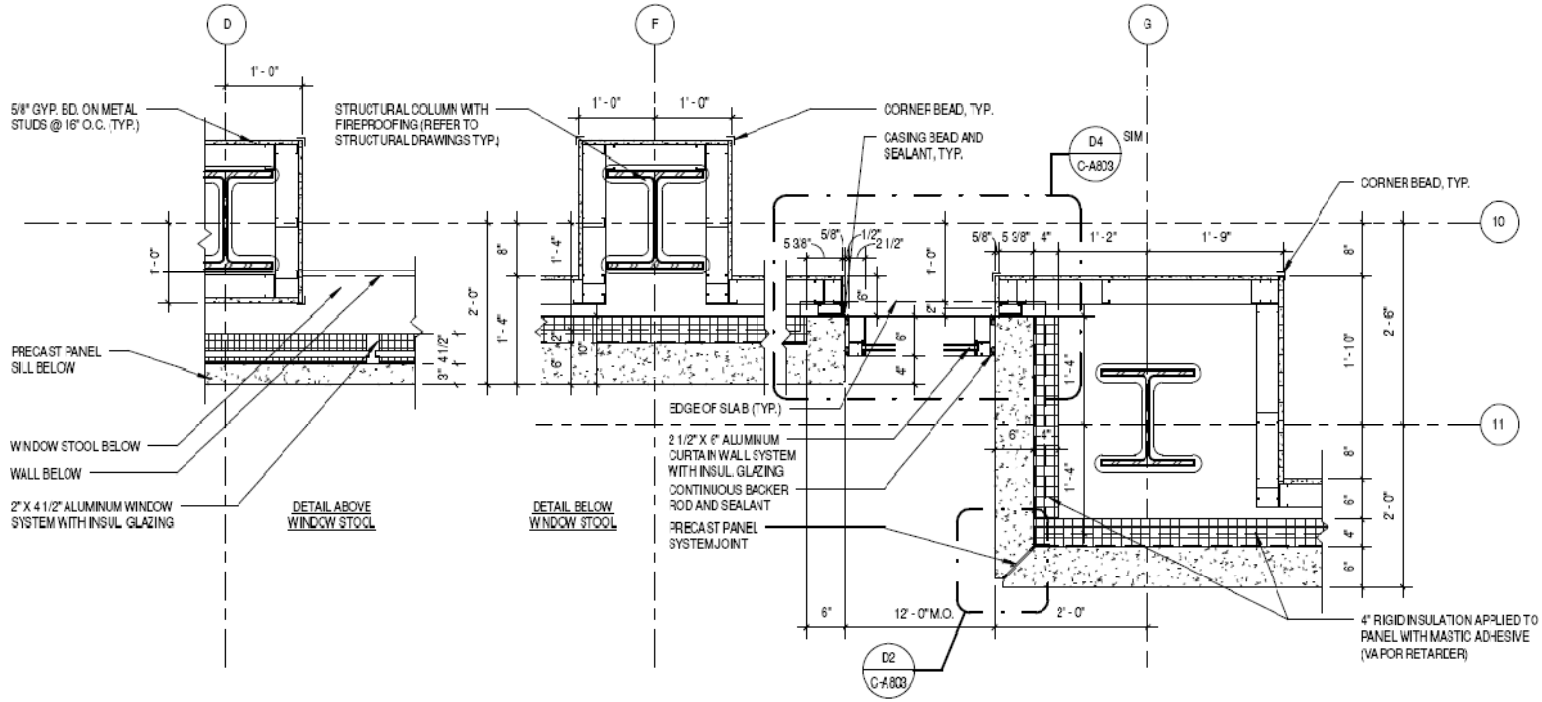
The goal for the analysis will be to determine if the glazing system in place is the best for efficiency. An alternative type of glazing will be chosen and compared to the current system. Value engineering analysis, especially life cycle analysis will be studied. Lead time for both the current and alternate glazing systems of the curtain wall will be taken into consideration with a study of schedule reduction time and possible schedule acceleration. This analysis will be the mechanical breadth study of the thesis.

Analysis Techniques

1. Architectural drawings will be studied and analyzed relating to curtain wall of building project, specifically glazing system.
2. An alternative glazing system will be chosen.
3. Calculations of thermal gradients and R-values will be performed.
4. If necessary, a second alternative glazing system will be chosen and analyzed again for thermal gradients and R-values.
5. Life cycle cost analysis will be performed to see if the current or alternative glazing system is the better one for thermal efficiency.

Expected Results

The expected results for the analysis study of the glazing system will be to see if thermal efficiency and life cycle analysis was taken into consideration when choosing the specific glazing material on the Harrisburg University Academic Center. The alternative system is anticipated to be the better one for thermal efficiency.



C1 Enlarged Plan @ University Floor Exterior Wall

3/4" = 1'-0"

Pre-cast Concrete vs. Structural Steel

Structural Breadth

Problem

The Harrisburg University Academic Center is a high-rise building in the city of Harrisburg. The current structural system consists of steel girders, beams, and columns; precast concrete wall panels; and composite slab on metal deck. During the beginning of the erection of the steel structure for the Academic Center, there were a number of schedule delays including the need to reposition the tower crane on site. As discussed above, the structural system currently in place has a long lead time for the fabrication of the steel members. To relieve site congestion because of the project's location, pre-fabrication would be an alternative to casting of concrete on site. With the use of pre-cast interior wall panels and curtain wall system, the use of a precast concrete structure seems as though it would have been a better choice for the Academic Center.

Below is the steel staging located on Market Street. Part of the street is blocked off for pedestrian and vehicular safety, as well as for more space on site. Would the use of a pre-cast concrete structural system affect traffic on one of the main roads through the city as the use and staging of steel?

Steel Staging on Market Street

Goal

The goal for the analysis will be to determine if the structural system in use currently is the best choice for the area, site, project, and budget. The steel framing will be analyzed with the current pre-cast interior partition walls and curtain wall panels. It will be compared to a pre-cast concrete structure since most of the structural elements are pre-cast currently. Considerations of a pre-cast concrete structure would include staging for the pre-cast concrete, lead time for the pre-cast concrete, integration with mechanical, electrical, and plumbing systems. Continuing, studying the costs of each system, plenum heights allowed, spanning distances, and green building design will be analyzed. With the integration of the existing pre-cast concrete wall panels, there could be a reduction or acceleration of the schedule if a structural pre-cast system was in place. However, in order to implement such a change in design, considerations for this modification to the structure would have to have occurred during the design phase of the project. The conclusions of this research will be to allow for similar projects to see the advantages of this system as well as the Harrisburg University of Science and Technology to have a better understanding of the current and alternative structural systems in place for further development of future buildings. This analysis will act as the structural breadth for the proposed thesis.

Analysis Techniques

1. Structural drawings will be studied and analyzed relating to current structural system, specifically typical bay system of floors 5-15.
2. A typical bay redesign will be done using pre-cast concrete.
3. Calculations tributary areas and loads for both current and alternative structural system will be performed.
4. Plenum heights will be calculated for the alternative system to see if there is proper space for MEP systems.
5. A schedule analysis will be conducted to see if the structural system erection can be accelerated or erection time reduced.

Expected Results

The expected results for the analysis study of the structural system will be to see if the use of a pre-cast concrete structure has schedule reduction time benefits. In addition, the feasibility of the alternative system relating to plenum space, site coordination, and cost will be taken into consideration when analyzing the structural system of the Harrisburg University Academic Center. The alternative system is anticipated to be a better choice for the particular project analyzed.