

Problem Statement and Solution Overview

Problem Statement

The largest, most visible architectural and structural component of the Athletic Center is its perimeter diagrid system. It is arguably the most unique aspect of the building, and presented quite a challenge to both the architect and the structural engineer. Though the diagrid was certainly a sound and acceptable choice for the cost, schedule, architectural, and other constraints given to the structural team, it was not the only available solution to the design parameters of the project. In fact, three main issues were identified which are potential drawbacks to the current design. They are presented below:

- 1) The perimeter diagrid lateral system is much heavier than a typical gravity-only perimeter system. Material costs are relatively high.
- 2) Welded connections at each diagrid node are time and labor intensive. Labor costs are relatively high.
- 3) Very little of the usable window viewing height is glazed. Views of the football stadium and surrounding buildings are limited and unusual.

These three issues alone represent significant disadvantages to the Athletic Center's budget and performance. They have warranted further investigation into alternative solutions to the perimeter lateral system. As a result, research concentrated on identifying all potential weaknesses in the diagrid system, proposing viable options to those weaknesses, and ultimately determining which option, if any, is most appropriate.

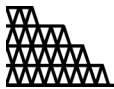
Solution Overview

Structural Redesign

The Athletic Center's unusual perimeter lateral structural system did not lead to a standard, "cut and dry" solution to the design requirements. It was unlikely that any one option would perform optimally in all performance considerations. Therefore, three distinct Solution Areas labeled I, II, and III have been investigated and evaluated. Each area varied in its degree of deviation from the original design.

- I) Keep the perimeter lateral system in the current diagrid configuration while changing the material of its members
- II) Keep the perimeter lateral system while modifying its architectural (and hence structural) geometry
- III) Move the lateral system from the perimeter to within the building, changing the envelope to a curtain wall

Solution Area I addressed issues 1 and 2 from the problem statement. Changing the material or detailing of the diagrid impacted both the material and labor costs associated with its construction. Solution Areas II and III also addressed the cost concerns of issues 1 and 2; however, because of their potential to drastically change the structural design of the building they impacted issue 3 as well.

**Daylighting Study**

All of the proposed options for the perimeter lateral system affected the building's enclosure properties, including the amount and position of glazing required. In addressing the third issue from the problem statement, it was a natural extension of the structural research to perform a qualitative daylighting study. The study considered several factors for potential daylighted private office spaces along the western side of the Athletic Center. These factors were developed into a curtain wall façade intended to work with the redesigned structural system. The results from this study were integrated into the overall final considerations and recommendations.

Construction Study

Naturally, changes to the structure and architecture of the perimeter lateral system had a substantial impact on several construction issues. A construction management study of two of these issues, erection sequencing and site layout, helped determine whether the proposed system alternatives were feasible.