Structural System Description

Gravity System

The floor framing system consists of typical steel composite wide flange beams with composite metal decking supporting one-way slab diaphragms. Most connections are shear only, though some elements framing into full height columns near the atrium are designed with moment connections to support atrium walkways. The layout is irregular due to the highly curved shape of the building; however, the N-S direction spacing is typically 9' o.c. within 27' bays. A representative above-grade framing plan is shown in Figure 6.

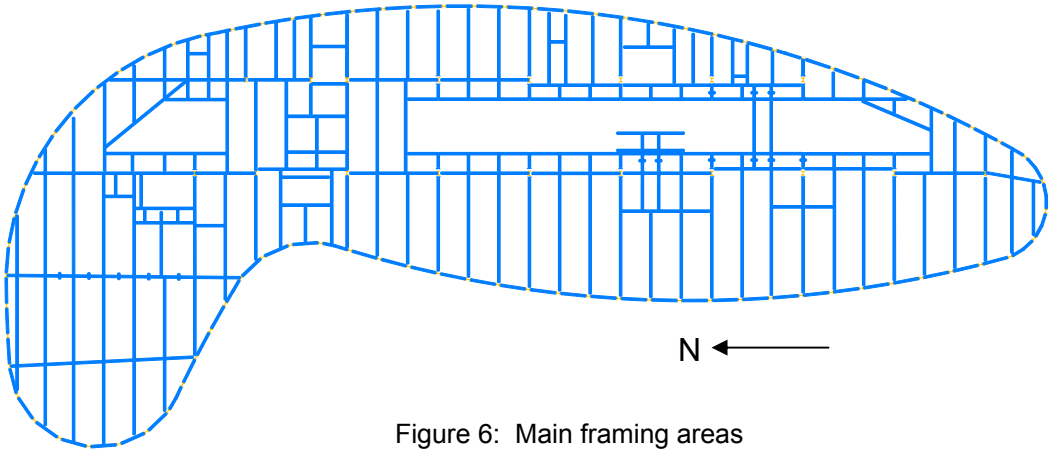

Figure 6: Main framing areas

Lateral System

Diagrid and Diaphragms

The above-grade enclosure of the Athletic Center is a triangulated, curved perimeter frame system called a diagrid. The diagrid acts as a rigid shell, and for structural purposes can be considered a very thin, deep beam. It is composed of wide flange rolled sections welded or bolted for full restraint. The steel is covered with precast concrete cladding to produce a monolithic appearance. Between the beams are triangular window glazings. A rendering of a typical diagrid connection is shown in Figure 7. The above-grade diaphragms are 6.5" reinforced concrete slabs on metal deck, supported by steel framing. There are numerous slab openings, including the main atrium and several elevator and stair shafts.

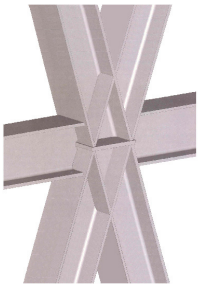

Figure 7: Diagrid connection

Braced Frames

There are four types of braced frames. Two of them, labeled BF2 and BF3, are light braced frames around the atrium staircase. They both span from Level 100 to Level 400 (ground floor) and provide lateral support for the staircase only. The other two, labeled BF1 and BF4, are heavy braced frames to resist lateral movement for the entire building. Two BF1s brace against E-W deflection around an elevator shaft in the northern half of the building, while the lone BF4 braces against East-West deflection in the southern half. Frame elevations are shown below in Figure 8.

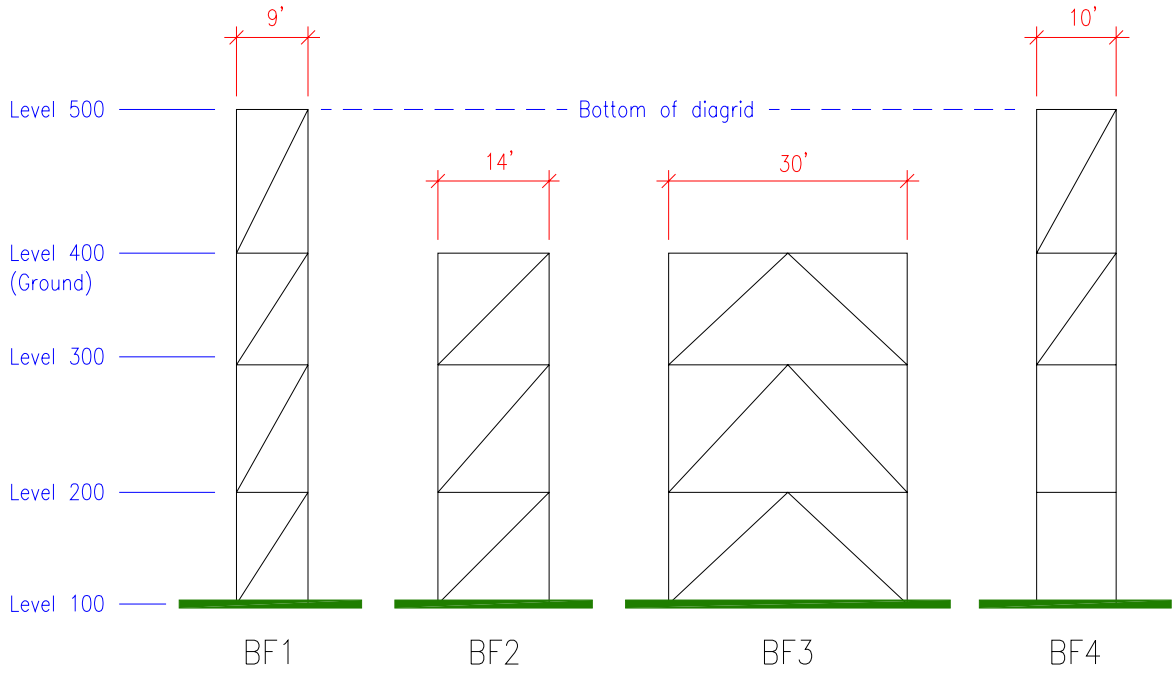

Figure 8: Braced Frame Elevations

Columns

There are two kinds of columns found in the Athletic Center. Within the perimeter of the building are two rows of full height vertical columns, supporting the floor and partition gravity loads of the interior bays. Between Levels 300 and 500 are large "V" columns which are rigidly connected to both the diagrid and the substructure. Though their primary function is to carry gravity load from the diagrid, they also play a significant role in the transfer of lateral forces from the bottom of the diagrid to ground level. They are made of either heavy wide flange rolled shapes or built-up boxes, and sit on single below-grade columns. A rendering of a V column is shown in Figure 9.

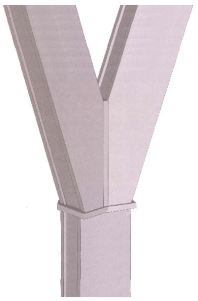

Figure 9: V column

Foundation

The foundation utilizes a combination of spread footings and drilled piers, set into gray shale. Reinforced concrete shear walls below grade serve as the retaining walls as well and are typically 1'6" thick. They are rectangular in plan and therefore do not carry the loading from the curved above-grade floors. They do, however, work with the below-grade diaphragms to resist shear forces. There are 16 threadbar anchor rods embedded in the foundation walls to resist shear. As in the upper floors, the foundation diaphragms are 6.5" reinforced concrete slabs on metal deck.