

ARIC HEFFELFINGER FORDHAM PLACE BRONX, NY STRUCTURAL OPTION ADVISOR - DR. HANAGAN



1. Executive Summary

The lateral system at Fordham Place consists of concentrically braced chevron frames. In the North – South direction, there are four bents in which contain chevron frames as opposed to three in the East-West direction. However, the frames are placed so that their center of rigidity is very close to the geometric center of the building, eliminating almost all shear caused by eccentricity. Frames in which the bracing is located range from 22' to 28' wide and 12' to 15' high. All chevron bracing members are HSS 12 x 12 x 1/5" and are considered to adequately resist all lateral loads. The assumption was made to analyze these members to resist only lateral loads, no gravity loads. This is a safe assumption because as the gravity loads try to get transferred into the bracing members, they will be redistributed into the girder.

Bracing members were spot checked to assure they did not deflect too much and were strong enough resist lateral loads. This was done by modeling each frame in SAP 2000 and applying a 1 Kip unit force on the frame to determine the stiffness of each frame. Relative stiffness' were then found so that distribution of lateral forces could be done based on the stiffness of each frame. All load cases were considered, however since only lateral loads were being transferred into the bracing members, the controlling term was 1.6W. Once the proportion of the lateral force was determined for the selected frame to spot check, the frame was analyzed just as a simple truss. The Manual of Steel Construction, LRFD 3rd Edition, was used to determine the axial capacity of a HSS 12 x 12 x 1/5. This value was then compared to the critical force in the bracing members and was determined to be adequate. Drift of the same frame was determined using SAP2000, and was determined to be approximately 95% of the allowable drift accepted within the industry. Because the actual drift is so close to the acceptable drift, it is obvious the lateral resisting system at Fordham Place was design with the controlling factor being wind. Usually a building of 15 stories will not be controlled by drift, but due to architectural features limiting the building to only three locations where braced frames can be placed; it minimized the ability for the building to reduce drift. As an engineer, it is our job to find a viable design regardless of architectural restraints, and it was done very well with Fordham Place.