# The New DC: The Atrium at 300 New Jersey Avenue

*By Azer Kehnemui, D. Sc., P.E., Hakan Onel P.E., S.E. and Rupa M. Patel*

*Smislova, Kehnemui and Associates, P.A. received an Outstanding Project Award for the 300 New Jersey Avenue project in the 2010 NCSEA Annual Excellence in Structural Engineering awards program (Category – New Buildings $10M to $30M)*

Veiled in the shadow of the U.S. Capitol, the atrium at 300 New Jersey Avenue displays one of the most contemporary integrations of architectural vision and engineering creativity in Washington, DC. The expansive, full-height atrium was designed and constructed as part of a new, 10-story concrete office building and six-story below grade parking garage. It is the first commercial office building to be designed and built in the United States by the world renowned architectural firm, Rogers Stirk Harbour + Partners (formerly the Richard Rogers Partnership), who collaborated with Smislova, Kehnemui and Associates, P.A. (SK&A), the structural engineer of record and HKS Architects, the project architect and architect of record, to create one of the most unique structures in the Washington, DC metropolitan area. Hakan Onel, P.E., S.E., an associate at SK&A, led the structural design of the atrium and Tolga Cubukcu, now retired, was responsible for the office building portion of the project. Azer Kehnemui, D.Sc., P.E., principal and co-founder of SK&A, served as the principal in charge of the entire project, leading both design teams and coordinating efforts between the engineers, architects, and owner.

The LEED GOLD certified 270,000 SF office building is constructed adjacent to an existing historic 1935 office building and its 1953 addition. The atrium is the project's most notable feature and serves as the common convergence space between the three buildings–blending past and present in a three-dimensional cascade of glass and steel. Linked by the canopy of a skylight and a full-height hanging glass facade in front, the buildings come together in a series of glass walkways and platforms that extend out from the main "tree" structure in the center of the space. Supporting the skylight is a complex, bright yellow boomerang truss that extends the length of the atrium and is punctuated at each end with two lattice columns that, at first glance, appear to be sculptures placed for aesthetic appeal.

The luminous glass curtain wall at the entrance of the atrium falls about one hundred feet from cantilevered beams at the top floor of the building. Steel cables extend from the top level of the structure to support the hanging wall against vertical and lateral forces. Lateral movement is also restricted by horizontal kipper trusses at each level, and springs at the bottom of the wall and at the attachment to the existing building prevent loads from being transferred to the glazing system below the curtain wall and to the existing building.

The boomerang truss, seemingly hovering over the length of the atrium, is offset from the supporting tree structure with tie-back rods that help support it at mid-span. The truss has a tapered triangular section with circular chord and web members. The depth of the truss tapers from eight feet to zero at the ends. A noteworthy feature of the support system for the truss is the tension rods that support it and its stair platforms. These tie rods are pre-tensioned so that they remain tensioned during all phases of construction and provide initial camber to the steel truss. The two steel lattice columns supporting the truss at each end are constructed of steel HSS pipe sections in compression and pre-tensioned cables with roller pins at each outrigger to allow for zero loss in pre-tensioning friction. Structural redundancy in the columns has been provided using double cables at each of the three lines of cables around the main pipe section.

The skylight covering the atrium is composed of ladder frames that were assembled off-site and transported to the project site. The frames are constructed of steel channels and HSS tube steel sections that were field bolted together on-site to create the framework that supports the glass panels of the skylight.

The atrium tree is the primary structural steel moment frame tower that supports the skylight, the boomerang truss, and the elevator shaft and platforms. The 18-inch diameter steel HSS round columns that make up the tree structure's vertical members had to be filled with concrete and designed as composite columns in order to carry the high axial loads. The elevator support cage and transparent elevator shaft are constructed with elevator

sheave beams supported on a dedicated steel cage system, which itself is supported on atrium tree beams and the main truss at the top. The guide rails are laterally supported by slender steel forks attached to the tree beam members. The stair treads are Z-shaped bent plate sections that were specifically designed to provide lateral stiffness to the stair frame. Steel bridges extend from the main atrium tree structure, spanning each level between the two historic buildings and the new contemporary structure. The bridges are framed with stiff kink post truss structures with slender members and walking platforms composed of multilayer laminated glass panels.

Residents and tourists alike are now witness to a timeless vision of engineering and architectural ingenuity that punctuates a sleepy morning commute or casual stroll through Capitol Hill. This part futuristic, part whimsical atrium structure is a welcome contrast to the stern, conservative personality of the traditional DC skyline, introducing a truly spectacular integration of art and ability.▪

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