ENTRY FORM

DVASE
2010 Excellence in Structural Engineering Awards Program

PROJECT CATEGORY (check one):

New Building under $30M		Other Structures Under $10M	
New Building over $100M	X	Other Structures Over $10M	
New Building $30M - $100M		Free Style	

Approximate construction cost of facility submitted:	$442M
Entry Fee:	**FREE**
Name of Project:	University Medical Center at Princeton
Location of Project:	Plainsboro, NJ
Date construction was completed (M/Y):	CD's Issued Jan 2009
Structural Design Firm:	O'Donnell & Naccarato
Affiliation:	**All entries must be submitted by DVASE member firms or members.**
Architect:	HOK/RMJM Joint Venture
General Contractor:	Turner Construction

Company Logo (insert .jpg in box below)

Provide a concise project description in the following box (one page maximum).

O'Donnell & Naccarato was tasked with developing the structural design for a replacement hospital for the University Medical Center at Princeton. Working with joint venture architects HOK and RMJM, the new hospital, scheduled to open in 2011, is a 7 story, 638,000 square foot steel framed structure. The project includes a new 7 story curved patient tower, a new 3 level Diagnostic and Testing (D&T) wing, a new 2 level Central Utility Plant (CUP)and renovations and links to an existing 2 story office building. The building is also designed to accommodate 4 future floors on the bed tower with a soft story that is 20 feet high above the current roof to maintain mechanical systems though the future expansion.

The structural design generally utilized a composite steel framed structure. However the architectural design and geometry called for orthogonally identical patient rooms in a curved bed tower. To accommodate this requirement the building used a geometry where each column line, instead of being radial from a common work point, was set by striking different tangent lines from a 400-foot circle outside of the 700 foot inside radius of the building. This made every column and in-turn every connection different in layout and rotation. To accommodate this geometric difficulty and to ensure proper coordination and spatial consistency, we utilized BIM for the structure documentation. Numerous meetings with the steel fabricator to work out the connection design and import of the BIM model into the structural steel detailing software allowed by the design team directly transfer the geometry and contribute flawless fabrication.

Lateral systems for the building included a combination of switch-back braced frames and curved moment frames with top and bottom plated connections at the bed tower, standard type 2 moment frames at the D&T, WWG and 'diagonal-bracing at the CUP. The curved and geometrically complex nature of the bed tower also significantly affected the design of bracing and moment connection. Braced frames for the tower were very slender because of the limited ability of the program to accommodate large frames. To provide adequate stiffness, uplift resistance, and limit concrete foundation costs we designed, rock anchors we designed at the braced frame locations.

The placement of the expansion joints presented a structural challenge. With little other choice, a joint runs through the two-story front atrium area, causing design considerations for deflection compatibility and stiffness of the atrium. Other challenges included a sloping site with full story of retaining across the building, a 12 foot cantilevered entrance canopy with options for full glass roofing, depressions in every patient room for walk-in European-style showers, two different soil bearing capacities, significant vibration criteria at the D&T and a full-building curved and cantilevered roof trellis that is through-bolted through a specially designed roof slab because of architectural incompatibility with the column grids.

The existing building provided structural challenges based on the existing footing locations, the change in use from an office building, façade deficiencies, and heavy equipment placed on the existing roof structure. Major underpinning, including soil nailing, was designed and new mechanical roof support, screen-walls and façade restoration. Extensive investigation and analysis of the existing building structure was required for the use change.

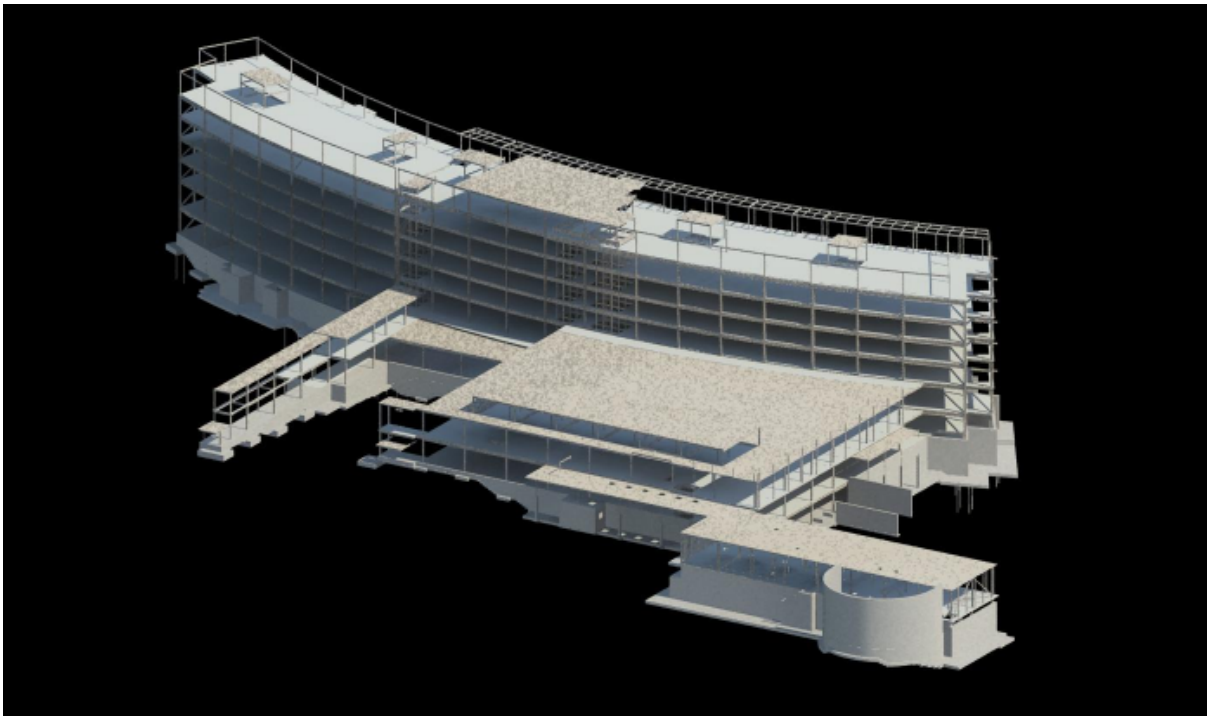
In the end, Princeton Health is thrilled with its new state-of-the art hospital to serve its New Jersey clients.

Please attach your photos as previously described in the call for entries document and insert captions for the photos in the following boxes.

Photo

1:

Photo



2:

Photo

3:

Photo

4:

By signing, signatory agrees to the following and represents that he or she is authorized to sign for the structural design firm of record:

*All entries become the property of DVASE and will not be returned. DVASE / NCSEA are hereby granted the right to use or publish entries and accompanying materials in **STRUCTURE** magazine or other publications. In addition, a royalty-free license is granted to DVASE / NCSEA to use any copyrighted material submitted.*

Submitted by:

Print name: **Dennis Mordan**	**Signature:**	**Date:** **4/20/2010**
Submitting Firm:	**O'Donnell & Naccarato**	
Mailing address:	**111 S. Independence Mall East, Suite 950** **Philadelphia, PA 19106**	
Telephone: **215-925-3788**	**Fax:** **215-627-1051**	**Email:** **dmordan@o-n.com**