cross sections

Magazine for the Structural Engineers Association of New York
2015 VOLUME 20 NO. 2

THE AWARDS ISSUE

THE 2015 EXCELLENCE IN STRUCTURAL ENGINEERING WINNERS

STRUCTURAL ENGINEERS ASSOCIATION
SEA
NEW YORK

cross sections
2015 VOLUME 20 NO. 2

SEAoNY
536 LaGuardia Place
New York, NY 10012

www.seaony.org

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President’s Message

Eli Gottleib, PE

This spring we are celebrating the accomplishments of our members with our annual awards. It is an optimistic time for engineering as we see new bold and exciting projects coming to our city. With new infrastructure projects expanding the boundaries and opportunities of the city including parks and trains we are seeing new towers and developments rising throughout from Queens to the west side.

SEAoNY and its members are playing a key role in helping to move the art of engineering forward through our leadership and participation in development of many of the projects as well as assisting in development of the new codes and construction methods in our City. The Department of Buildings has recently begun an effort to develop and update the code to address existing buildings, which many of our members will assist in. SEAoNYs Codes and Standards Committee efforts to identify and document the knowledge of our membership regarding existing structures is visible in the members section of our website in the Gray Areas Survey and the technical papers on historic NYC construction materials, and we are working with the DOB to leverage this effort as part of the code development.

I hope you will join me in commending our winners and we look forward to the new projects and events that 2015 -2016 will bring us.

Regards,
Eli

Editor’s Message

Justin Den Herder, PE

Dear Readers,

It’s wonderful to put together the Awards issue with such an exciting combination and diversity of projects. This represents some of the most astounding structural engineering being performed in the world! Thanks for all of your submissions and your efforts.

We hope that you enjoy this issue and will consider contributing to the SEAoNY Publications Committee. With the industry operating at such a voracious pace, we know that there are great article ideas and topics at your fingertips. Please take a moment to consider sharing your lessons learned, your technical development, your project management tips and tricks... any of these topics could make for an article that would benefit our readership.

Don’t hesitate to reach out to us via email us at publications@seaony.org with your ideas. We’d love to see your name next to an article in our upcoming issues.

Best,
Justin

engineer & contractor:

making design a reality

Should the design EOR be the special inspector for rebar placement?

Another construction executive told of several episodes where his concrete crew had framed and placed rebar for a floor and were just about to pour (or had begun the pour, or even were done with the pour), only to suddenly receive a sketch of a change from the design team. What can the contractor do in that situation? Certainly his crew will do their best to accommodate the change while keeping the pour schedule, but what if there are questions? What if the contractor or the inspector are not clear about the change since it bypasses the usual shop drawing process? What if the sketch calls for new rebar sizes that are not available at the site, but other rebar sizes are available and could be used if only the engineer could review the adjustment?

Separately, several engineers in the discussion group told of visiting construction sites and seeing blatantly wrong rebar placement, while the inspector had given no indication of non-conformance and would have allowed the concrete pour to go forward. Engineers also told of receiving non-conformance reports from the inspector well after the work was done, with no indication of if the rebar placement had been corrected prior to the pour. And so on.

Some firms who act as design engineer of record offer their services for special inspection, other firms do not, for various reasons. Other inspections besides rebar placement, really, are different from this discussion: assessing concrete core strength requires a lab and needs to be tested after the fact anyway, and steel welding and bolting are necessarily inspected after the members in question are erected. But rebar placement inspection is unique: You see it right before the concrete is placed, you cannot see it after the concrete is placed without substantial difficulty (destructive or non-destructive probes), and it is obviously essential to the structure. A developer representative pointed out that if the concrete structure is not right, it costs him a terrible amount of money to fix it after the fact.

Could these unique aspects to rebar placement and its inspection be solved by the EOR acting as the special inspector for rebar placement? Proponents of the idea say yes. But clearly the idea is not a magic bullet. Traditional third party inspectors as well as EORs operate with an experienced licensed manager overseeing subordinate staff, and inevitably some personnel are less experienced, especially for the humble task of repetitive field observation: Last-minute crises and on-the-fly questions may still be beyond the young engineer on site, requiring a call to the office. And does that logic not simply illustrate that the inspector needs to be responsible and communicative, no matter what party they are? It is an interesting debate.

On April 30th SEAoNY held its annual President's Breakfast event, this year titled "Making a Design a Reality – The working relationship between engineers and contractors". Your correspondent was among the 40 attendees, who gathered in four different discussion groups in four successive 20-minute sessions with each of the four pairs of moderators. Each pair of moderators hosted a table, while attendees rotated through each table during the event; each attendee's table order was randomly assigned, meaning that every discussion group round had a different combination of people.

Roughly speaking, the "topics" to be discussed at each of the four tables were:

A) special inspections,
B) delegated design of steel connections,
C) dealing with existing conditions discovered during construction
D) contractors and engineers learning from each other.

The full list of moderators and their long qualifications can be found at www.seaony.org.

Many intriguing topics came up in the discussions, but two specifically caught the interest of your correspondent:

Should steel shop drawings be completed (during the CD phase) before the steel subcontract is bid?

A construction executive lamented the extensive project delays caused by steel shop drawing production and review, especially on large projects with complex steel connections. He proposed a process whereby a steel detailer, working for the construction manager, begins the production of steel shop drawings based on 100% Design Development documents, with the goal of being completed at the same time as 100% Construction Documents and ready then for the steel bid.

Wait a minute…. Aren't shop drawings supposed to be made off of the final, or nearly final, construction documents? Wouldn't the proposed process be confusing and risky if the design (structural, architectural, or program) changes at all during the CD phase, which always happens to some degree? The construction exec asserted that even with this risk of some rework, the time saved over the whole project is well worth it because all too often he has seen projects get stuck in the mud on one or another issue with the detailing and engineering review of complex steel connections. Plus this process would provide "early warning" for adjustments to the structural design for improved fabrication efficiency, e.g. bumping up columns sizes to avoid expensive stiffeners and doubler plates.

But wait another minute…. If the steel shop drawings are done by a party separate from the steel subcontractor who will actually do the job, wouldn't this be dictating fabrication and erection processes that some steel subs might not prefer, over others that they are more comfortable with? For instance, if the "early" steel detailer shows all-bolted angle shear connections but some steel subs prefer using welded knife plates, couldn't this make the steel bid inefficient? The construction exec argued that even with that risk, the time and cost saved is worth it, and ultimately the CM is responsible for "owning" the steel package anyway, and in that context the proposed process still streamlines the steel workflow and price.

The idea is intriguing. While not quite "design-build" or "integrated project delivery" per se, it suggests a process more collaborative, less linear, more messy in the schedule, potentially less wasteful in the long run, than the "traditional" design-bid-build paradigm. Is it the future of steel? The public sector and legally-focused focused clients will surely have a difficult time getting on board with it. But it perhaps reflects the less linear, more messy way that design and construction – and communication and work in general – occur in this generation than in previous ones.

EYTAN SOLOMON, PE
ROBERT SILMAN ASSOCIATES

the last building standing

The Dickey 1809 Townhouse at 67 Greenwich Street

After 1800, dwellings filled Greenwich St. in a building boom; however, the Dickey House is the only one remaining.

Local shipper Robert Dickey traveled the world procuring goods and transporting them on his own merchant ships. He was one of the richest citizens in New York in 1800. In 1809, he bought a 40-foot wide lot at 67 Greenwich St. that the City Corporation's Common Council had ceded in 1797. After 1811, the City grid established 20-foot wide lots, therefore the Dickey House materialized on a double-lot, originally about 70 feet deep and through to Church St. Dickey commissioned construction for a moderately heavy timber townhouse, with plaster and lath over wood studs, and a thin, two-wythe thick, un-reinforced masonry (URM) solid-unit brick exterior. [See Fig. 2]

Dickey's office, stable, privy and water cistern were in the backyard (facing today's Church St.). Animals freely roamed the streets, including ubiquitous pigs that ate the household scraps and garbage. It was a highly respectable street until after 1850, after which time the neighborhood declined, with the buildings functioning as shops and rooming houses.

In 1940, all of the 1800-1820 Federal Style 3½ story houses, running along Greenwich Street from the Battery to Rector Street, except No. 67, were demolished for the construction of the Brooklyn Battery Tunnel (two 31-foot diameter tubes lined with cast iron, 1950, Ole Singstad). First, however, realizing that at least one house in the area was designed by Andrew Jackson Davis, and that many other dwellings were constructed adhering to Asher Benjamin's contemporary carpentry "Pattern" books, the WPA and HABS arrived en scène to record the significant Federal style neighborhood houses.

The Dickey house was possibly built by Robinson, Moore, & Smith, who were active at the time in the neighborhood constructing nearly identical houses. The elliptical bay in the rear façade is significant; it is the City's last extant example of the once popular, post-revolutionary feature. [See Fig. 3]

TIMBER & MASONRY

The original structure was 3½ stories with high basement, four-bays wide "three-quarter house" (with the entrance off center), with dormers in its gabled, heavy slate-covered roof. Some timber-framing members appear to have been adze-hewn; others were cut with a straight saw.

The masonry exterior is of locally hand made soft bricks laid in Flemish bond with queen closers, using compatible lime mortar, and set above a brownstone base and water table. Some of the brownstone was edge-set, resulting in water infiltration and subsequent freeze-thaw cycles; a mechanism which ruptures the bedding planes, resulting in spalling. There are 12 inch by 12 inch original brick piers in the cellar, supplemented by two later eras of concrete masonry units (CMU) construction, built as long piers near the old brick piers. A significant finding was the uncovering of 1809 hand made CMU early prototypes at the SW corner, full of tiny seashells, cinders, and brick crumbs. CMU evolved after 1830, but were not in wide use until after c. 1900.

The gable roof of slate and timber framing was replaced with a light metal sloped-roof in 1872, when the structure was raised to four stories; with a common bond, machine-made brick installed above the new fourth floor. Architect Detlef Lienau designed the add on, which overloaded the already weak masonry wall elements. Cracking in wall components below the fourth floor had developed before this time, as demonstrated by the fact that many collapsing areas in the wall were repaired with the same common bond brick and mortar in 1872. In addition, two elevated trams were constructed at this time, on Greenwich St. and on Church St., which transferred loads and vibrations to adjacent dwellings along the track.

THE STRUCTURE

The still-active stability problems in the façade-masonry walls persisted over the centuries. They are seen in the inelastic deformations in the coupled wall of pier and spandrel components.

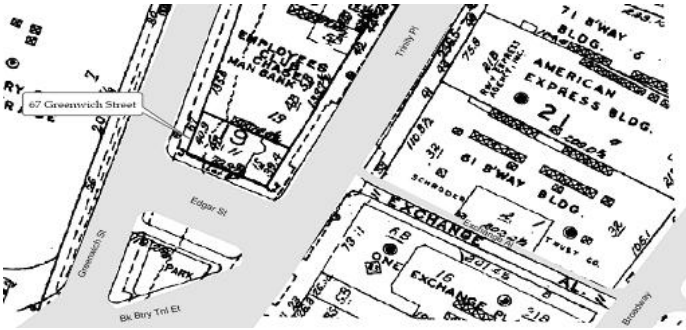

FIGURE 1

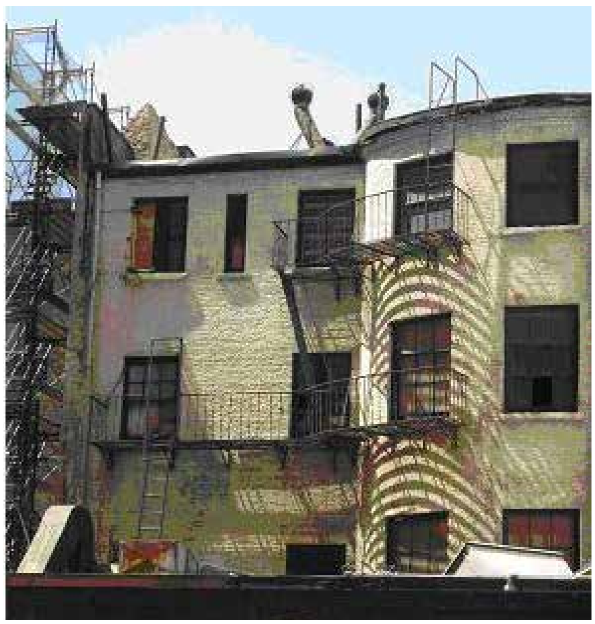

FIGURE 3

FIGURE 2

Figure 4 exhibits diagonal stair-step cracking and separation of units (top of Fig. 4), spandrel joint sliding with through unit cracking (center of Fig. 4, and displacement and joint sliding of bricks in the spandrel below. (bottom of Fig. 4). The column piers and the weaker spandrel components each are moving differently. There is an inadequate number of wall ties.

The Dickey House was "book ended" at the 1940 demolition, meaning that No. 67 lost the lateral force resistance provided by the former large adjacent structure at No. 65. However, the demolition crew in 1940 left the early 19th century, eight-inch thick north gable end /party wall of No. 65 - - with its soft brick interior side exposed. This was attached to the Dickey House only by a thin stucco covering. Due to areas of missing stucco over the last decade, it could be seen that the wall had missing bricks, missing mortar, continuous vertical un-toothed joints, stacked bricks, partially washed away mortar, and odd sized bricks laid out in a slipshod manner and out of plane. Areas of a stronger modern mortar were applied c. 1940 for repairs in scattered areas of the gable end; the hard mortar is not properly sacrificial to soft brick, and this caused some bricks to spall.

A developer recently bought the defunct adjacent Syms site, together with No. 67 Greenwich St., which was New York City landmarked in 2006 and in dilapidated condition. Future plans are unknown: However, the Dickey House facades are being stabilized as per its landmark protected status.

(Continued on Page 8)

Fig. 1. The Dickey 1809 Townhouse at 67 Greenwich St. and Edgar Street, Manhattan's Shortest Street. To visit this and three nearby 1798 structures at 94-98 Greenwich St., take the 1, 9 or N, R to Rector Street and walk south half a block.
MAP: SANBORN MAP. MANHATTAN LAND BOOK, BLOCK 19, LOT 11, NYC. PLATE TWO. 2004-5

Fig. 2. 67 Greenwich St. Fifty Years Ago in Better Days. Front (West) façade. URM exterior of 1809 locally hand made painted brick, laid in a Flemish bond and with a brownstone base, surrounds a modified timber frame. The sloped metal roof replaced the original slate-covered gable roof in an 1872 fourth floor add on. There is long term front & SW-corner settlement of the foundation: Note the façade tilting forward a few inches out of vertical plane. Three vertical anchor bands secure ties tensioned into the wood floor joists, which run parallel to the 40-foot wide front façade.
PHOTO: BAYLEY. NYC LPC 1965

Fig. 3. Dickey House Back Façade, 1809. The City's last extant Federal era elliptical rear bay. An adjacent five to six story apartment house at No. 65 Greenwich St. was demolished in 1940, but its early-mid 19th century interior-exterior gable-end party wall was left in place, unconnected to Dickey House except for a partial chimney and a ½ -inch thick stucco application. Note separated and bulging end wall (left), and adjacent weak spandrel condition with joint sliding, vertical cracking, and through-sill cracking (upper left window); much the same as on the front façade.
Gable end wall and chimney demolished and rebuilt, 2014.
PHOTO: A. OVIATT-LAWRENCE 2013

FIGURE 5

Fig. 4. Detail of SW Corner Front Façade. Flemish bond, coupled wall of piers and spandrels. Evidence of inelastic deformation. Weak spandrel components evidenced by: heavy cracking above and below windows; sill through-cracks; collapsing stone lintels; out of plane bricks; and masonry-unit joint sliding conditions. Additional contributing issues were vibrations from two steam-powered locomotives pulling elevated trams operating proximal to both front and back of the property after 1872.
PHOTO DETAIL: FORSTER, NYC LPC. C. 2005.

Fig. 5 West side of Greenwich St., looking south from house No. 28. The elevated tram (1872-1940s) transmitted cyclical vibrations into the structural materials and foundations of the adjacent houses. Photo taken just before demolition of the area in 1940 for the Brooklyn Battery Tunnel.
PHOTO: HABS (HISTORIC AMERICAN BUILDING SURVEY, WWW LOC GOV. HABS NY, 31-NEYO,54. S. MIXON, PHOTOGRAPHER. 1940.

FIGURE 4

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ALICE OVIATT-LAWRENCE
PRESERVATION ENTERPRISES

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2015 SEAoNY EXCELLENCE IN STRUCTURAL ENGINEERING

AWARD WINNERS

The Structural Engineers Association of New York (SEAoNY) Excellence in Structural Engineering Awards serves to recognize creative achievement and innovation in structural engineering. Modeled after the National Council of Structural Engineering Associations (NCSEA) Awards, the program annually highlights some of the best examples of structural engineering ingenuity by firms in New York.

For the 2015 Awards, projects must have been sufficiently completed between January 1, 2012 and December 31, 2014 such that they clearly show the basic design of the structural system. Firms were asked to provide narratives, photos, and plans or sketches to convey the complexities and innovations of their design. Judged by past SEAoNY presidents and honorary members, themselves structural engineers and leaders in the industry, scores were awarded based on: creativity and complexity of design; innovative application of materials or techniques; ingenuity of design for efficient use of labor and materials; sustainability of structure; and exceeding client/owner needs and expectations.

Awards finalists and winners were recognized on the SEAoNY Annual Boat Cruise on July 1st, 2015, with each being represented by a project display board and, of course, their engineers. The SEAoNY Awards provide a great opportunity for engineers to learn more about the work of their peers and to share in their engineering achievements. In past years, several SEAoNY Awards winners have gone on to win NCSEA Awards as well. This year's winners are sure to be no exception.

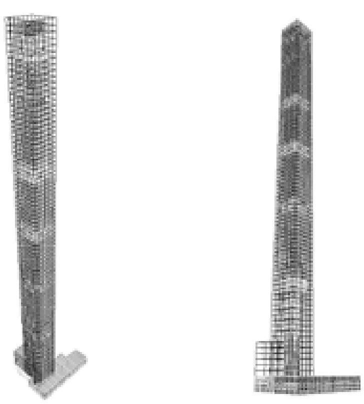
Judges

***Brian Albert Falconer** has been a principal at Severud Associates since 2007, is a past-president of SEAoNY, and is on various technical and standard committees locally and nationally. He is a licensed Professional and Structural Engineer. His projects include note-worthy museums, athletic facilities, academic buildings, research facilities, medical complexes, transportation facilities, and commercial, residential, and retail developments.*

***John Hill** is an architect, author, editor, blogger, and tour guide based in New York. He is Editor in Chief of the World-Architects.com Daily News/eMagazine. His first book, Guide to Contemporary New York City Architecture, was published by W.W. Norton in 2011, and he is writing his second book, on contemporary architecture in Chicago.*

***Caroline Weiss** is an associate principal at Weidlinger Associates where she manages high-design public healthcare and aviation-related projects such as Memorial Sloan-Kettering Cancer Center and CUNY Hunter College. Her experience includes historic preservation and restoration, and building design. She holds an MS degree in structural engineering from the University of Pennsylvania and a BS degree in civil engineering from Tufts University.*

***Karl Rubenacker** is a partner at Gilsanz Murray Steficek and a past president of SEAoNY. His diverse project portfolio includes new construction and restoration on both the east and west coasts.*

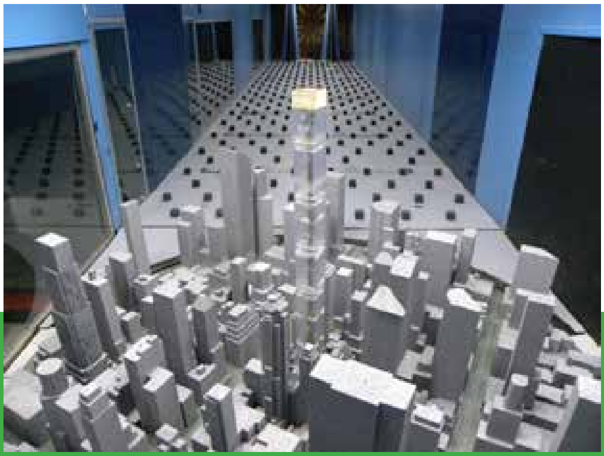


NEW BUILDINGS

432 Park Ave

WSP

Location: Manhattan, NY
Architect: Raphael Vinoly Architects, SCLE Architects
General Contractor: Lend Lease



432 Park is a luxury super-tall residential and commercial tower located at 56th Street and Park Avenue.

At a height of 1,397ft, 432 Park is currently the tallest residential structure in the Western Hemisphere. Careful consideration was made to ensure acceptable levels of occupant perception of dynamic motion and movement of the building. Double levels of open floors helped reduce wind effects; in addition a 1300 ton mass tuned damper was added.

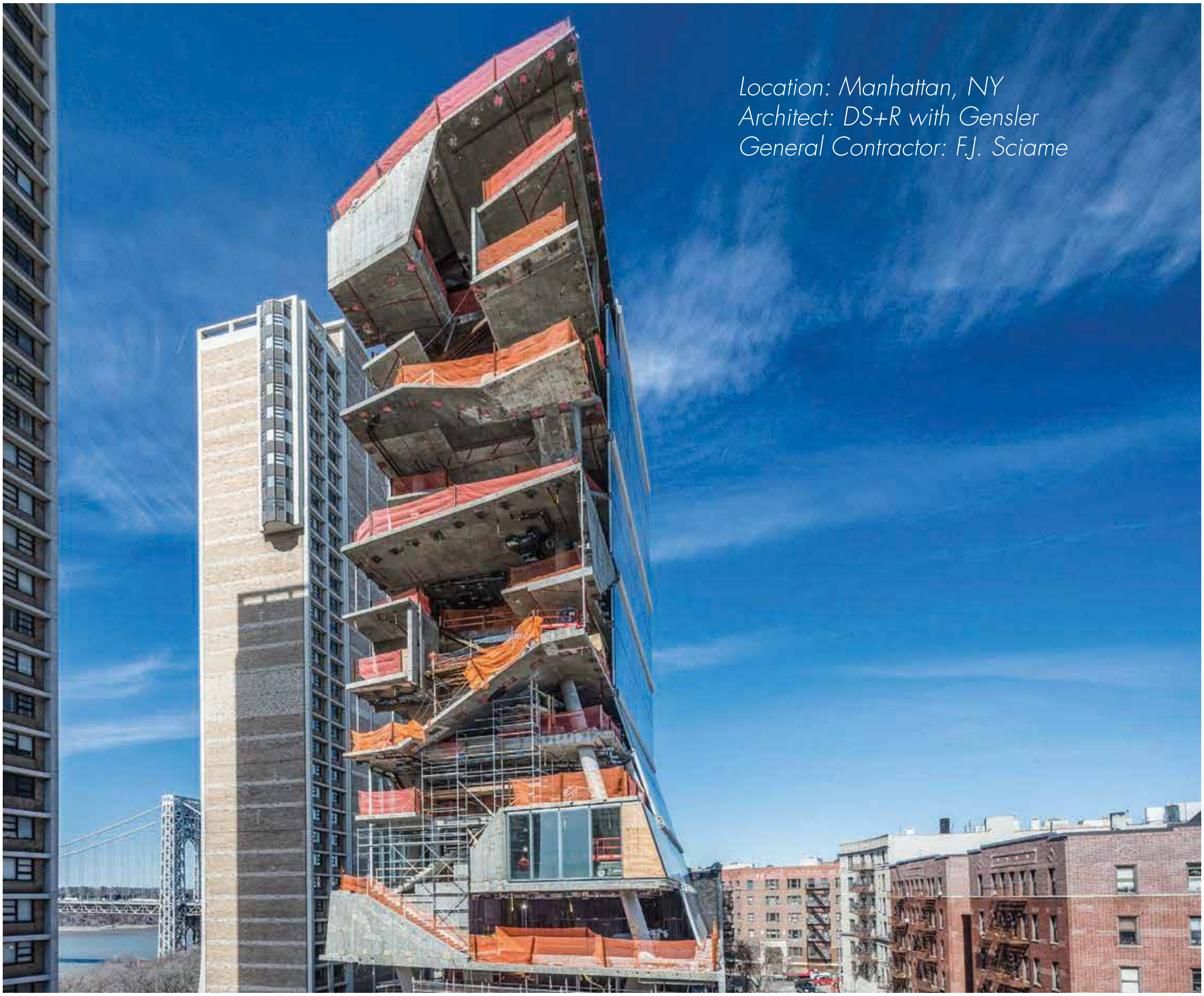
The structure is a reinforced cast-in-place concrete construction. The building is supported on exposed exterior white concrete columns and a central shear wall core.

Lateral stability, was achieved by connecting the exterior columns to the central core via outriggers at various mechanical levels.

NEW BUILDINGS

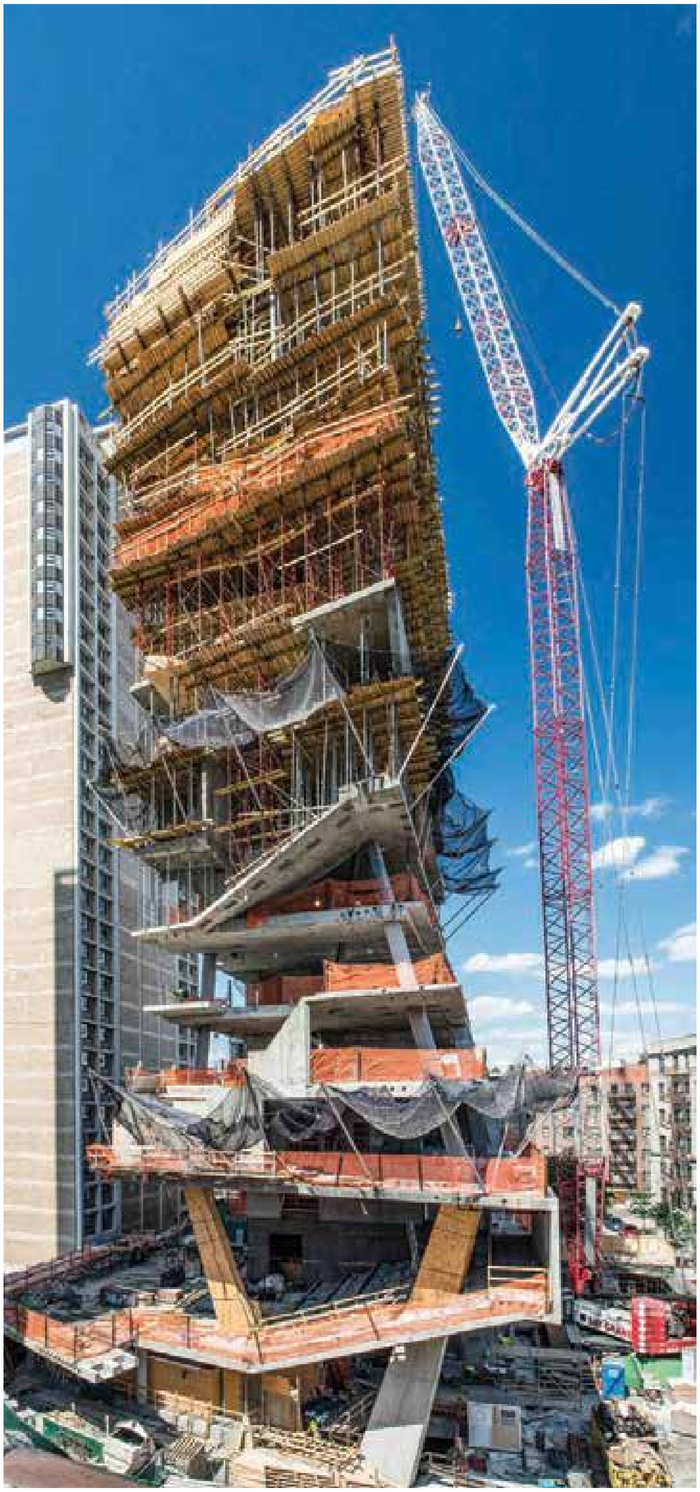
Columbia University Medical Center Graduate Education Building

Leslie E. Robertson Associates



Location: Manhattan, NY
Architect: DS+R with Gensler
General Contractor: F.J. Sciame

The Columbia University Medical and Graduate Education Building (CUMGEB) is a 100,000 sf, 15 story, state-of the-art educational facility. Designed by Diller, Scofidio, and Renfro (DS+R), with executive architect Gensler, the project's main feature is a southern facing "Study Cascade" that contains interconnected study and social spaces to encourage collaboration between students. Envisioned as a vertical campus of stacked neighborhoods, the CUMGEB brings a welcoming atmosphere to Columbia University's Washington Heights campus. The northern half of the building is organized for classrooms and administration space, in addition to a mid-tower mechanical space to accommodate the needs of the building's Anatomy Labs. Leslie E. Robertson Associates (LERA) provided structural engineering services. F.J. Sciame is the project's Construction Manager.



The Kimbell Art Museum Expansion is a free-standing, 89,000sf addition that includes: an East Pavilion with gallery and lobby space where the column-free structure is a combination of architecturally exposed concrete walls and 102ft glued-laminated timber beams with custom mental hardware supporting a glass roof. A new West Building (CIP concrete framing) that includes additional gallery space, an auditorium, and education rooms with a green roof that blends into the surrounding parkscape. Additionally, a basement underneath the full building site and a parking garage (long-span CIP concrete framing) below grade provides a connection between the new and existing buildings.

NEW BUILDINGS

Kimbell Art Museum

Guy Nordenson and Associates

Location: Fort Worth, TX
Architect: Renzo Piano Building Workshop, Kendall/Heaton Associates
General Contractor: The Beck Group

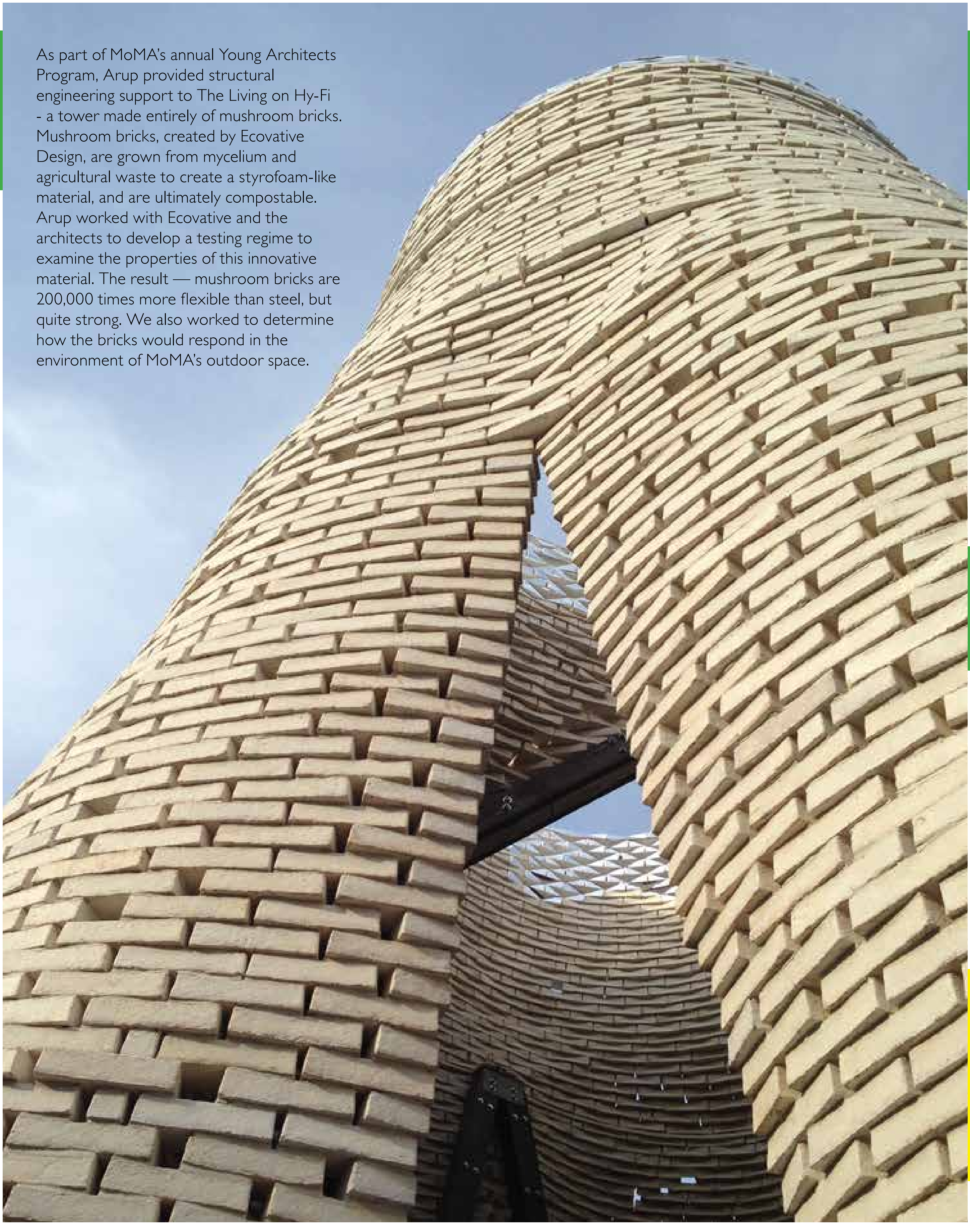
SPECIAL AWARD FOR OUTSTANDING CONTRIBUTION TO PUBLIC SAFETY

Wood Bowstring Truss Initiative

New York City Department of Buildings
Forensic Engineering Unit

Location: Bronx, NY

The New York City Department of Buildings ensures the safe and lawful use of buildings. As a part of our mission, we monitor developing trends in potential hazards in the city. One of these trends is failures of buildings with wood bowstring truss roofs. With performance, engineering and material science issues, these are not typical building stock. The Department is at the forefront of understanding of these risky structures. By working closely with the property owners, many of these buildings have consequently been demolished, shored, or repaired, thus ensuring public safety.

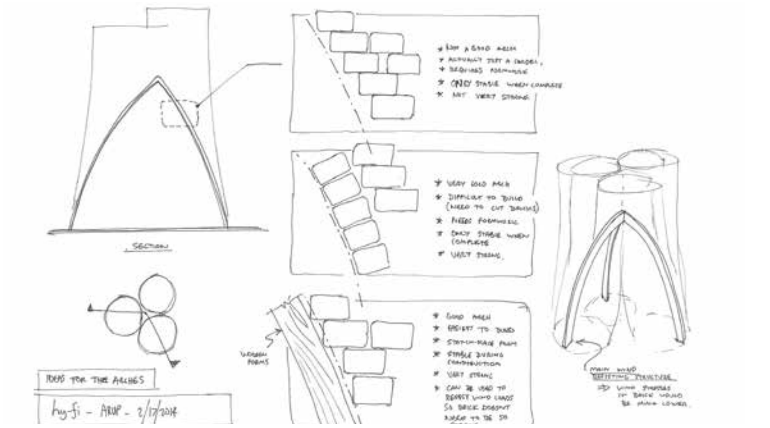


As part of MoMA's annual Young Architects Program, Arup provided structural engineering support to The Living on Hy-Fi - a tower made entirely of mushroom bricks. Mushroom bricks, created by Ecovative Design, are grown from mycelium and agricultural waste to create a styrofoam-like material, and are ultimately compostable. Arup worked with Ecovative and the architects to develop a testing regime to examine the properties of this innovative material. The result — mushroom bricks are 200,000 times more flexible than steel, but quite strong. We also worked to determine how the bricks would respond in the environment of MoMA's outdoor space.

OTHER STRUCTURES

Hy-Fi

Arup



Location: Queens, NY
Architect: The Living (David Benjamin)
Builders: Graduate Students from Columbia University

FORENSIC ANALYSIS / RENOVATION / RETROFIT / REHABILITATION OF STRUCTURES

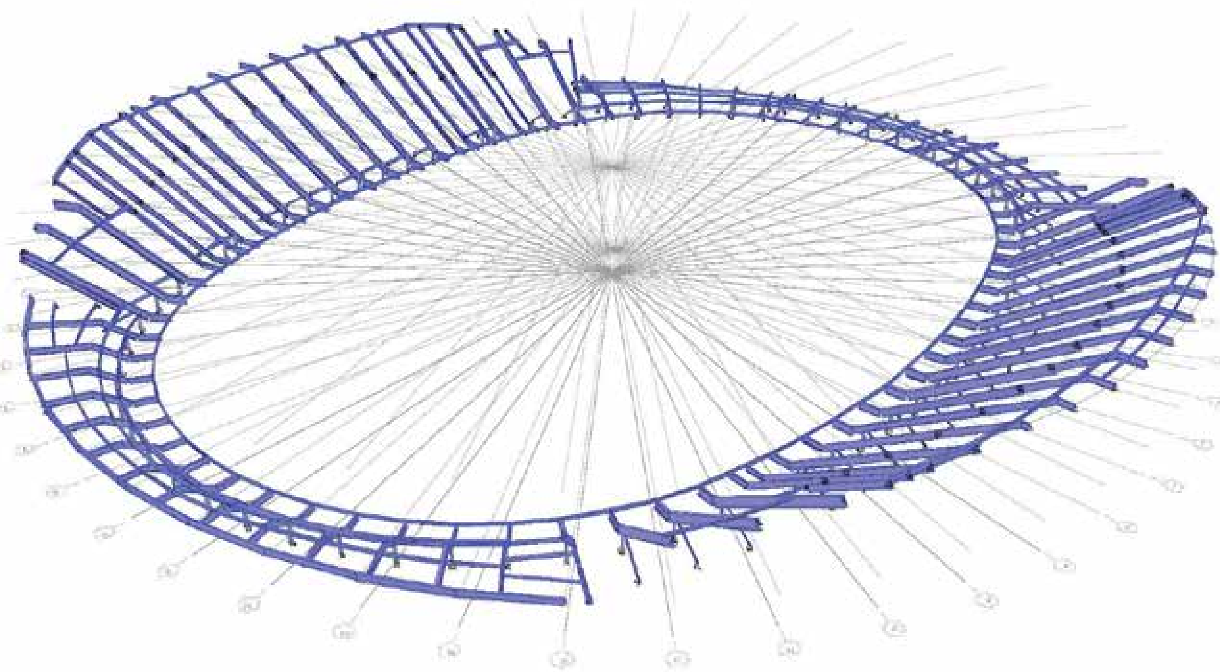
Madison Square Garden V

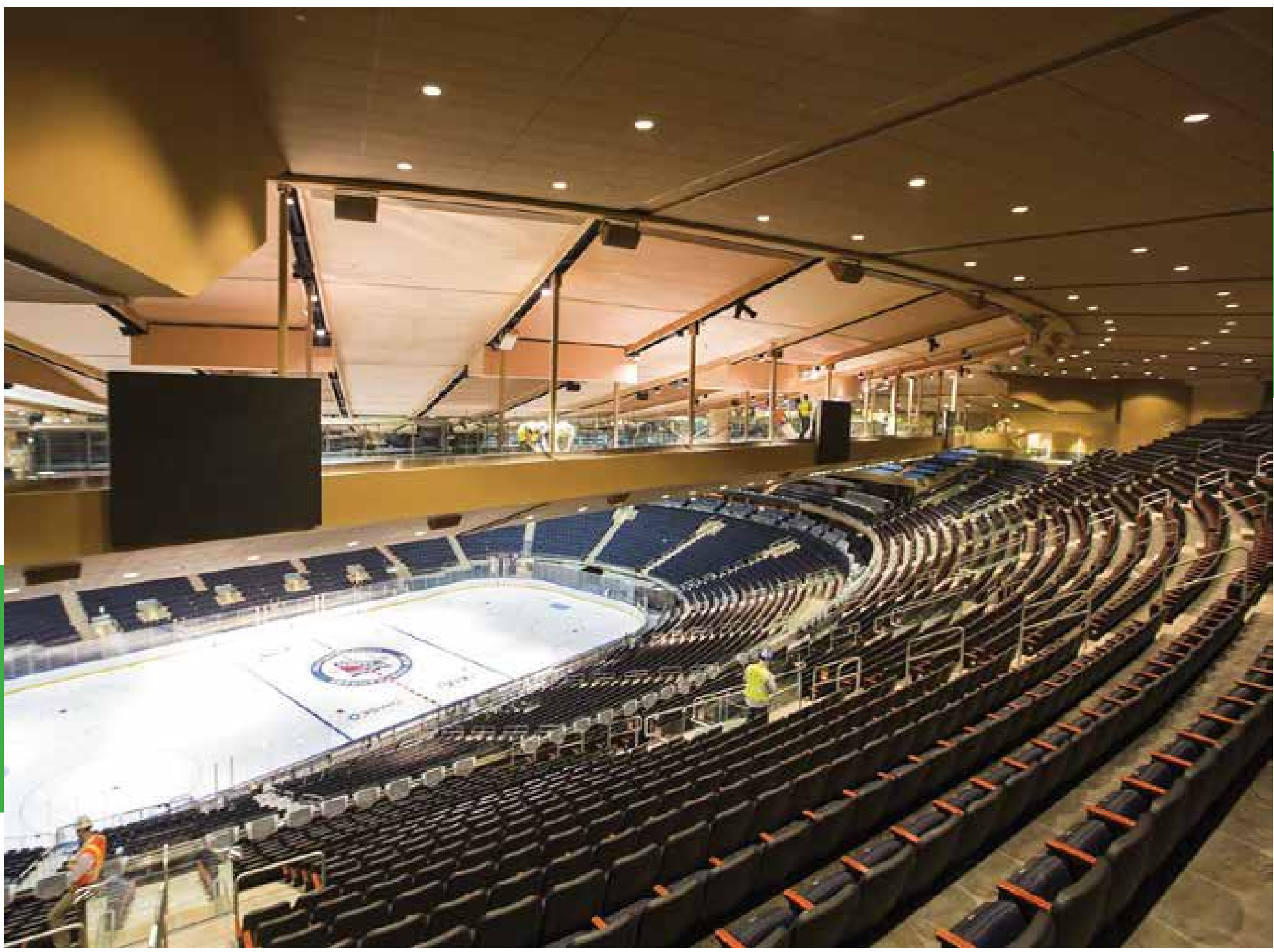
Severud Associates

Location: Manhattan, NY
Architect: Brisbin Brook Beynon Architects
General Contractor: Turner Construction

Madison Square Garden officially completed its ambitious 985,000 square foot transformation in October, 2013. The project, which broke ground in June, 2010, involved the reconstruction of a new arena within MSG's historic circular shell.

The project included demolition, raising and reconstruction of the entire upper bowl seating structure, raising of the north and south arena roof structures, two 280 foot long sky bridges, the expansion and re-structuring of the 7th Avenue entrance, three levels of structural expansion on the 7th Avenue side for new concessions concourses, a one-tier expansion of the existing west-side hung suites, new lower bowl luxury suites (in-filled beneath the newly raised upper-bowl seating structure), court side "bunker" suites, external threat mitigation, new MEP and A/V systems, the installation of 50 new escalators, dressing rooms, and countless concessions outlets.





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