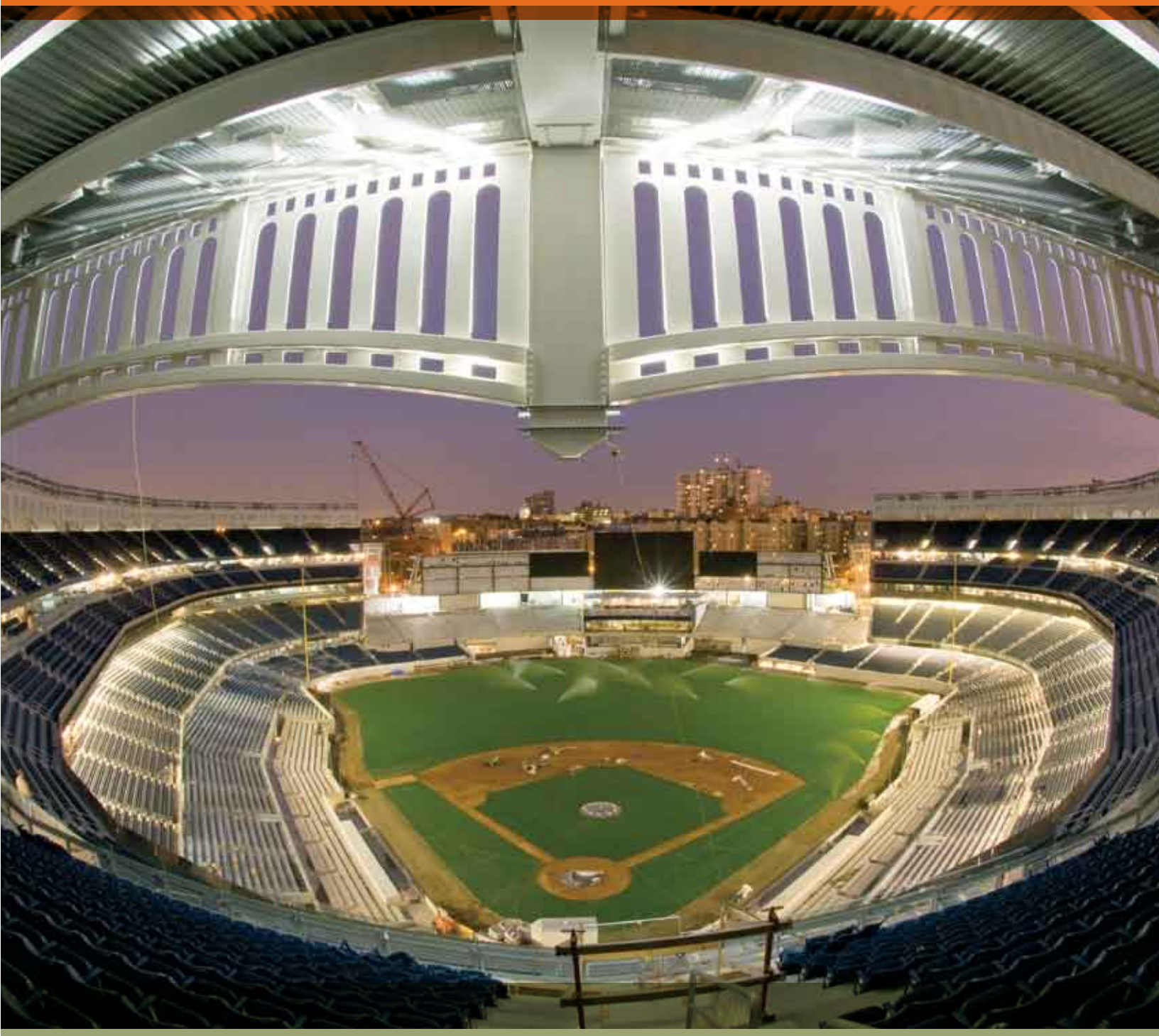
Thornton Tomasetti

Building Solutions



Annual Report **2008**

Thornton Tomasetti provides building engineering services to clients worldwide on projects of all sizes and complexity, from the tallest towers and the longest spans, to innovative building systems and materials. Our three complementary practices in Building Structure, Building Skin and Building Performance serve the entire building life cycle for a wide range of clients including architects, building owners, developers, building managers and others who serve the construction industry.

Our 650 engineers, architects and support professionals are committed to creating the best solutions through our technical ingenuity, our pursuit of excellence, and anticipating client needs.

Services

Building Structure
- Buildings
- Supertall Buildings
- Long-Span Structures
- Special Structures
- Specialty Analysis
- Project Delivery

Building Skin
- Building Skin
- Specialty Skin Analysis
- Skin Systems
- Special Skin Structures
- Innovative Skin Materials
- Skin Sustainability

Building Performance
- Forensics
- Emergency Response
- Building Envelope
- Building Assessment & Renovation
- Historic Preservation
- Seismic Assessment & Rehabilitation
- Property Loss Consulting
- Sustainability

Sectors
- Aviation & Transportation
- Commercial
- Cultural & Institutional
- Education
- Healthcare
- Hospitality & Gaming
- Mixed Use
- Residential
- Special Structures
- Sports & Entertainment

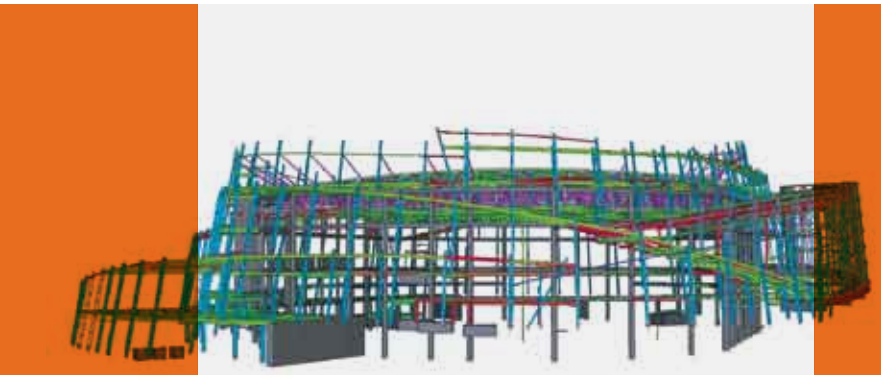
Offices

Abu Dhabi, United Arab Emirates
Chicago, Illinois
Dallas, Texas
Dubai, United Arab Emirates
Fort Lauderdale, Florida
Hong Kong, China
Irvine, California
Kansas City, Missouri
London, United Kingdom
Los Angeles, California
Moscow, Russia
Newark, New Jersey
New Haven, Connecticut
New York, New York
Oakland, California
Philadelphia, Pennsylvania
San Francisco, California
Shanghai, China
Washington, D.C.

Cover: The trademark frieze at the new Yankee Stadium plays a structural as well as an aesthetic role, serving as the end girder for the canopy. The stadium opens in May 2009. Chris Linder Photo.

Back cover: A modern approach to the historic Yankee Stadium frieze, shown in a Tekla Structures building information model developed collaboratively by Thornton Tomasetti and fabricator Canam Steel Corp.

Facing page: Top, the Bank of Oklahoma Center, designed by Pelli Clarke Pelli, in model (left) and as built (see page 14). Bottom, the Thornton Tomasetti Los Angeles team.



Gayle Babcock
Architectural Imageworks, LLC

Chris Kaharek

Dan Cuoco, president & chief executive officer, and Tom Scarangello, chairman.

Chairman's Message

Thomas Z. Scarangello, P.E.

Our vision statement – *Always reinvent how buildings are imagined – and built* – expresses the ideas central to our firm's culture since our founding more than 50 years ago.

We are never satisfied with the status quo. We always strive to innovate.

Our work is not done until our ideas are transformed into reality. We imagine – and we build.

We continue to execute our business plan in line with our vision, adding and expanding services to better serve our clients and contribute innovations to our industry.

Our Building Skin Practice works at the dynamic intersection of architecture and engineering, beyond traditional systems and materials. With the inventive application of traditional and new materials, we are helping our clients create pioneering and cost-effective building skin designs (see Chelsea Modern, pages 10–11).

From building skin to building structure, the drive for sustainable building design and construction continues to grow – and with it so has our employees' commitment to sustainable practices. With more than 100 LEED (Leadership in Energy and Environmental Design) accredited professionals by year end, our firm accounts for more than 10% of the world's structural engineering LEED accredited professionals. Our growing "green team" is already helping our colleagues and clients think and build green for a more sustainable environment (see page 31).

We continue to embrace the potential for creativity and efficiency that Building Information Modeling (BIM) offers. In 2002, when Thornton Tomasetti began to utilize BIM, our challenge was interoperability between software platforms. Having overcome that hurdle by developing our own in-house suite of translators, and with all of our new projects now designed with BIM, we continue to push the technology. We now not only incorporate models into our delivery process, we also regularly make them the deliverable for a host of downstream users to further enhance a project's efficiency and economy.

Our firm has a long tradition of strategic planning, and at the end of 2008 we began Vision 2014, our latest round of five-year planning in which we look beyond the horizon to anticipate the evolving needs of our clients. This strategic plan is currently under development, and if our firm's history is any indicator, Vision 2014 will soon become our road map to the future.

Meanwhile, navigating today's market requires close attention to the here and now. Yet, at the same time, subscribing to the notion that a crisis is a terrible thing to waste, we also know it presents opportunities for the long term. Looking beyond the significant challenges of the moment, we look forward to the continued support of our colleagues and clients and welcome the road ahead.

President & Chief Executive Officer's Message

Daniel A. Cuoco, P.E.

Our growing geographic reach and greater integration of diverse services enabled us to finish a challenging year in a strong position to help our clients maximize the value of their engineering investments.

Along with challenges come opportunities, and we must recognize the importance of building for strategic growth, not only in good times but also through economic downturns. This will enable us to emerge in a much stronger position when the economy starts to rebound, and is consistent with our firm's long-term strategic goals.

In September 2008 we opened an office in San Francisco, and in February 2009 we completed the acquisition of DASSE Design, bringing our California presence to four offices and nearly 100 people. San Francisco is now our center of excellence for performance-based design, with a strong and growing expertise in the education, healthcare and government sectors.

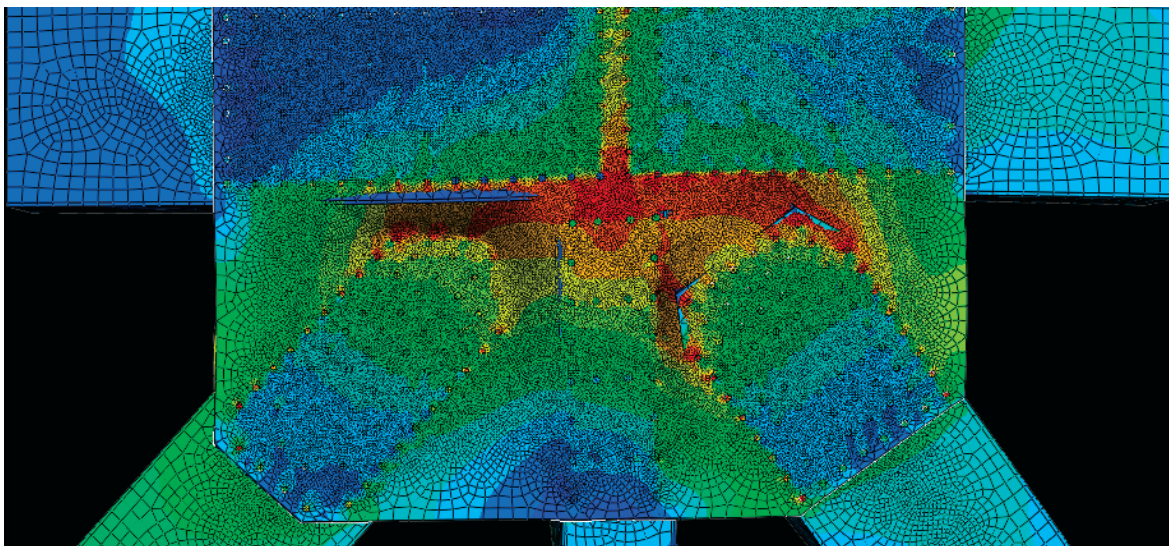
With nearly one-third of our work this year coming from outside of the United States, we also opened two offices in the Middle East, and expanded our work in Asia, with a focus on China, South Korea and India. We broke ground on the tallest buildings in China and South Korea: Shanghai Tower, at 632 meters and 151 Incheon Tower, at 601 meters (see pages 8–9 and 12–13). At year end, we had more than 20 active projects in the Middle East, notable among them the headquarters of the first zero-energy city, Masdar, in Abu Dhabi (see pages 26–27).

In the United States, one of our more prominent projects is the new Yankee Stadium (shown on the cover of this report and on pages 6–7), which will be ready for opening day of the 2009 baseball season.

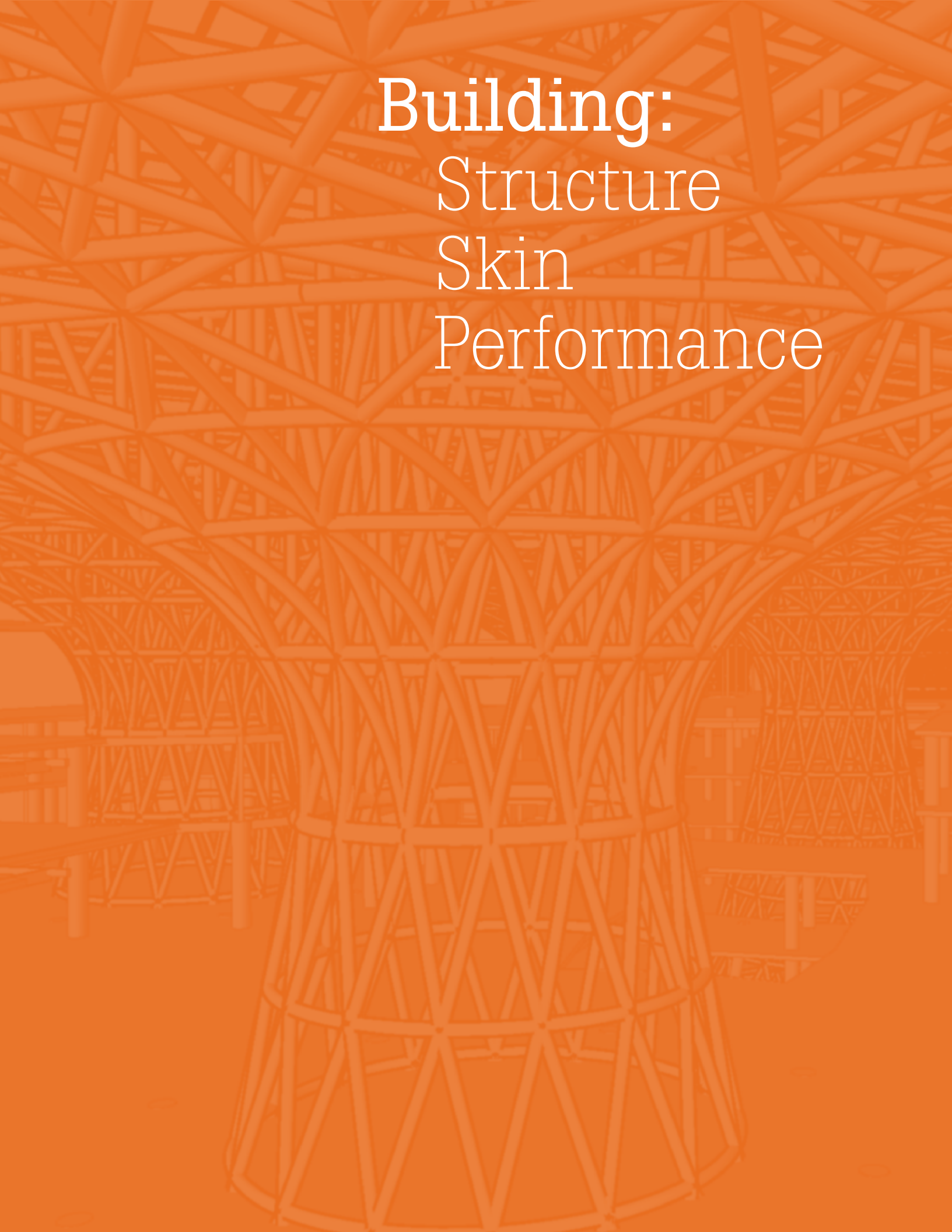
The market downturn that began in early 2008 is defining a new business reality for 2009, and probably beyond. As in previous downturns, we are prepared to serve clients with a full suite of services for the entire building life cycle, from new designs to renovations and rehabilitations of existing buildings.

This past year, for example, one of our fastest growing services was our property loss consulting business, which provided rapid response for property damage assessment in Texas following Hurricane Ike and kept our clients on a fast track to damage recovery (see pages 16–17). To meet the growing demand for such services, we began embedding Building Performance expertise in each of our offices, a process we will complete in 2009.

By the end of 2008, the timing and pace of economic recovery remained uncertain. We will continue to combine our innovative spirit with technical pragmatism to extract costs from every project and help our clients achieve their goals despite the challenging economy.



▲ *Representing our three practice areas are, from top: The sweeping structures of the Indianapolis Airport Terminal; a building skin design in steel and glass for the cap of Federation Tower in Moscow, which will be the tallest building in Europe; and a finite-element model of stress distribution at a gusset plate of the Interstate 35 bridge, which collapsed into the Mississippi River in 2007 (red denotes high stress; blue is low stress).*



Building:
Structure
Skin
Performance

A New House for Ruth

Bronx, New York

After playing at the House that Ruth Built for 85 years, in 2009 the New York Yankees will move across the street to a new stadium that revives many of the design themes that were stripped from the original during its 1974 renovation. The new stadium will include signature design features such as a 500-foot-wide scoreboard/video board with cantilevered end bays, and a suite level and upper deck seating that cantilever 50 feet beyond the main level concourse, creating unobstructed views.

A leading engineering challenge was the requirement for highly detailed, aesthetic connections, including the design of the trademark frieze, which also plays a structural role as the front girder of the canopy. Developing the project in a Tekla model enhanced the design review of these and other important exposed structural elements, and accelerated the mill order. "The part I'm proudest of is the design team's attention to detailing," said Mike Squarzini, Thornton Tomasetti's project manager. "The thought process from the very beginning of the project combined structural requirements and the highest level of aesthetics. It's a pleasure to be part of a project team where the result is an elegant structure both technically and visually."

Owner: New York Yankees
Architect: HOK Sport + Venue + Event
Development Manager: Tishman Speyer Properties
Construction Services: Turner Construction
Completion Date: 2009
Total Area: 1,250,000 SF
Seating Capacity: 54,000; 55 luxury suites

Thornton Tomasetti Engineer Jesse Chrismer, right, with Steve McFadden, senior foreman, Intricate Construction Inc., near the Great Hall, the stadium's main entrance. ▶

Chris Linder

▲ *The trademark frieze recalls the vibrant history of Yankee Stadium, and creates a new identity for a new century.*

▲ *Advanced modeling (left) produced jointly by Thornton Tomasetti and Canam, enables visualization of the stadium's aesthetic and also helps speed the design, fabrication and construction.*

Shanghai Tower

Shanghai, China

Ground was broken in November for the tallest building in China: the 632-meter Shanghai Tower, in the heart of Shanghai's Luijiazui financial district in the Pu Dong section of the city. Thornton Tomasetti engineered a simple, safe and cost-effective structural system that enables a creative architectural form. The exterior of the tower is a gently twisting triangle that tapers with height, and which drapes around an inner concrete structure comprising nine cylinders, stacked one atop another. We developed an efficient design of super-columns with outrigger trusses that also support the twisting-form curtain wall. The outrigger trusses, located on the mechanical floors, and super columns derive stiffness from the concrete inner building, comprising an effective system for resisting wind and seismic loads.

Sustainability is a major factor in the tower's design. Key features include inner glass skin technology to reduce energy consumption, landscaped atria to improve air quality, and the use of renewable and recyclable locally sourced materials.

Client: Shanghai Tower & Construction Co., Ltd.

Architect: Gensler; Architectural Design and Research Institute of Tongji University

Total Area: 380,000 m^2

Height: 632 meters (2,073 feet)

Completion Date: 2014

Ryan Pile

▲ *Balloons and banners are set up for the November 28 groundbreaking ceremony for Shanghai Tower, the tallest building in China. Drilling rigs, ready to begin work on the piles, are in place on the left.*

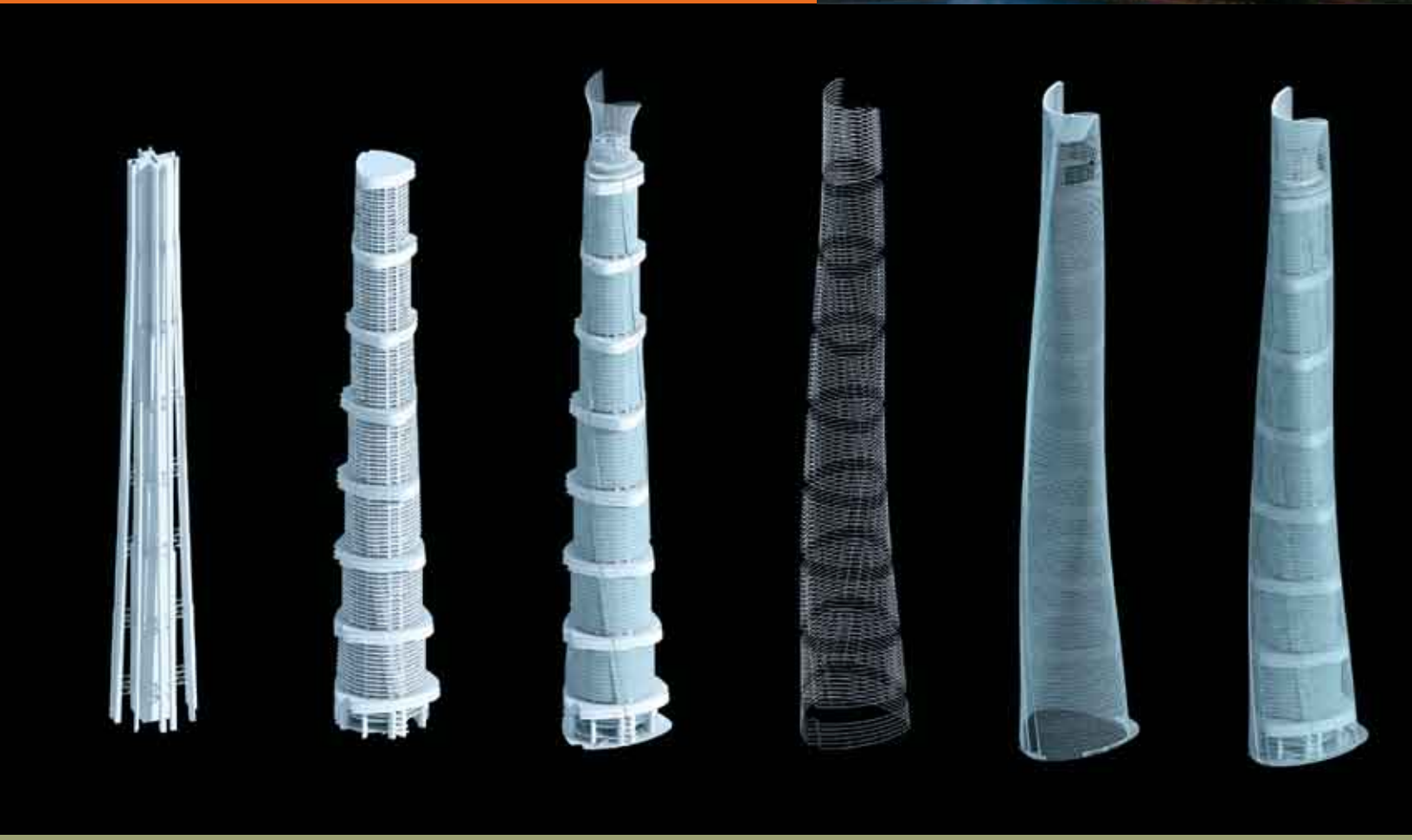
Ray Yu

▲ *Managing Principal Dennis Poon, left, with David Gensler, executive director of Gensler, at the contract signing ceremony in June.*

▶ *Located in a public park in the Pu Dong district, Shanghai Tower will house class-A office space, a boutique hotel and retail and cultural venues.*

▼ *The tower is organized internally as a series of cylindrical buildings stacked one atop another. These internal buildings are enclosed by the inner layer of the double-skin façade. The space between the two façades, at the juncture between each of the internal, vertically stacked buildings, creates the space for atrium sky gardens.*

Renderings courtesy Gensler



Chelsea Modern

New York, New York

Chelsea Modern is an award-winning 12-story, 47-unit condominium that reflects the artistic sensibilities of the Chelsea arts district and makes a unique statement. It is the successful manifestation of good design combined with functionality, grace and utility. The developer, Madison Equities, has realized its vision for design elegance in a high-quality residential building.

The ambitious façade of the Chelsea Modern is the building's signature: the complexity of the articulating curtain wall called for exacting design, detailing and construction. To help meet these demands, Thornton Tomasetti provided curtain wall consulting services including roofing, waterproofing, field testing and observation during construction of the exterior wall.

Awards

CNBC 2008 America's Property Awards
- Best Apartment New York
- Best High-rise Development New York
- Best High-rise Architecture U.S.A.
- Best High-rise Architecture Americas

Society of American Registered Architects 2006 Design Award of Honor

AIA 2005 Award for Excellence in Architecture

Courtesy Audrey Matlock Architect

▲ *Windows that project from the façade presented a special engineering challenge. A scissor device was tested to ensure that it allowed the100-pound-plus windows to be easily opened and closed. This may be the first use in New York of such "pop-out" windows.*

▼ *Thornton Tomasetti Senior Associate Elizabeth Lyons and Field Engineering Manager Sharath Babu, with architect Audrey Matlock.*

Developer: Madison Equities, LLC
Architect: Audrey Matlock Architect
Total Area: 100,000 SF
Completion: 2008

Courtesy Audrey Matlock Architect

▲ *The façade of undulating bands of cobalt blue and clear glass is animated by windows that project from the façade face. A glass block sidewalk provides natural light to the basement gallery.*

151 Incheon Tower

Incheon, South Korea

When it rises 601 meters above land reclaimed from the Yellow Sea, the 151 Incheon Tower will be the tallest building in South Korea. The building splits at the 44th floor into two interconnected trapezoidal sections to create a distinctive silhouette.

The tower's sharp edges are an important aspect of the architect's aesthetic vision, but at the upper levels this shape intensifies wind loads caused by vortex shedding. Thornton Tomasetti's structural team worked closely with the architect and a wind tunnel consultant to develop a form that is both structurally efficient and consistent with the design vision: a series of open slots on four corners. The four-level-high openings create an alternative path for wind, improving aerodynamic performance while enhancing the structure's visual appeal.

Our engineers combined a talent for teamwork with technical expertise to create an innovative solution that delivered multiple benefits for the entire project team.

Owners: Portman Holdings, Samsung, Hyundai and SYM-Associates

Design Consultant: John Portman & Associates, Inc.

Architect of Record: MSAE

Total Area: 608,796 m^2 (6.5 million SF)

Height: 601 meters (2,000 feet)

Completion: 2014

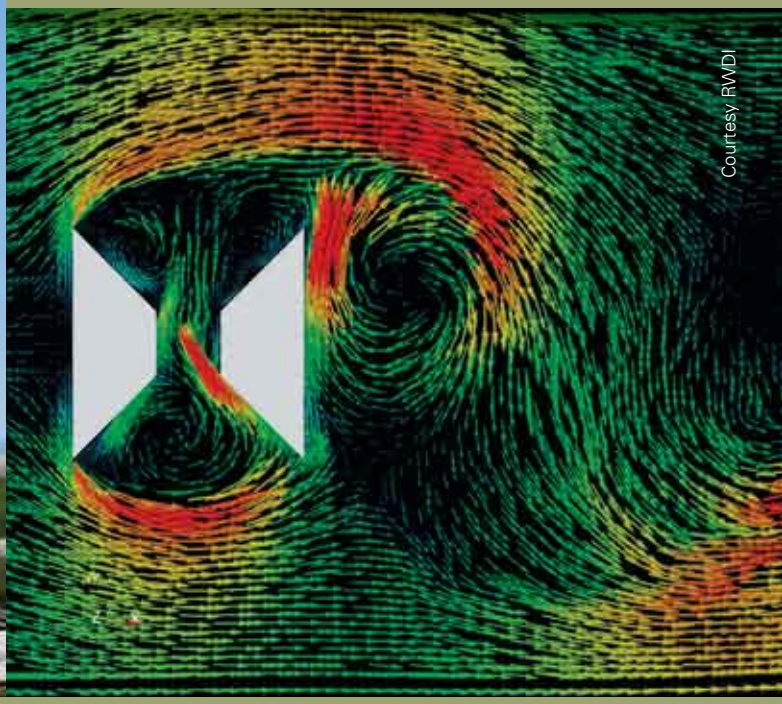
Ed Lederman

▲ *Managing Principal Dennis Poon brings to the project his extensive experience designing supertall buildings throughout Asia.*

Courtesy John Portman & Associates, Inc.

▲ *Senior Project Engineer Cori Kwitkin, right, with Principal Hi Sun Choi, whose engineering experience in South Korea enhances collaboration between Korean and U.S. project team members.*

▼ *Computer simulations by our wind tunnel consultant, RWDI, show wind flow around the tower. Blue denotes low wind speed and red denotes accelerated flow. Shedding of vortices – shown between and downwind of the towers – can induce vibrations and magnify wind load. To mitigate these effects and enhance occupant comfort, we worked with RWDI to design slots at the tower corners, which significantly reduce vortex strength and coherence.*



Courtesy RWDI

▲ *The 151 Incheon Tower will include 30 floors of office space, a 10-level hotel, observation decks, and 95 floors of residential and condominium units. The structure consists of a concrete core and super-columns connected by mega-outriggers. The two halves of the tower are tied together by a trio of pedestrian bridges containing steel truss outriggers to create greater resistance to wind and seismic forces.*

Bank of Oklahoma Center

Tulsa, Oklahoma

In 2004, the City of Tulsa was looking for more than an arena: they also wanted a defining architectural landmark. Design architect Pelli Clarke Pelli responded with a dynamic vision of sweeping arcs and layered angles.

The innovative design concept is based on a series of cones, with walls that slope and curve and six roof sections set at varying angles. The irregular intersection of the cones and roof elements creates a complex and challenging geometry.

Our design team applied Tekla Structures, a just-released Building Information Modeling (BIM) software package. A 3-D representation of the arena's structure offered clear project visualization and defined the complex interactions between elements. Building Information Modeling also provided technical answers, said Senior Associate Darren Hartman. "We used the model to quickly solve complicated detailing areas such as roofing transitions."

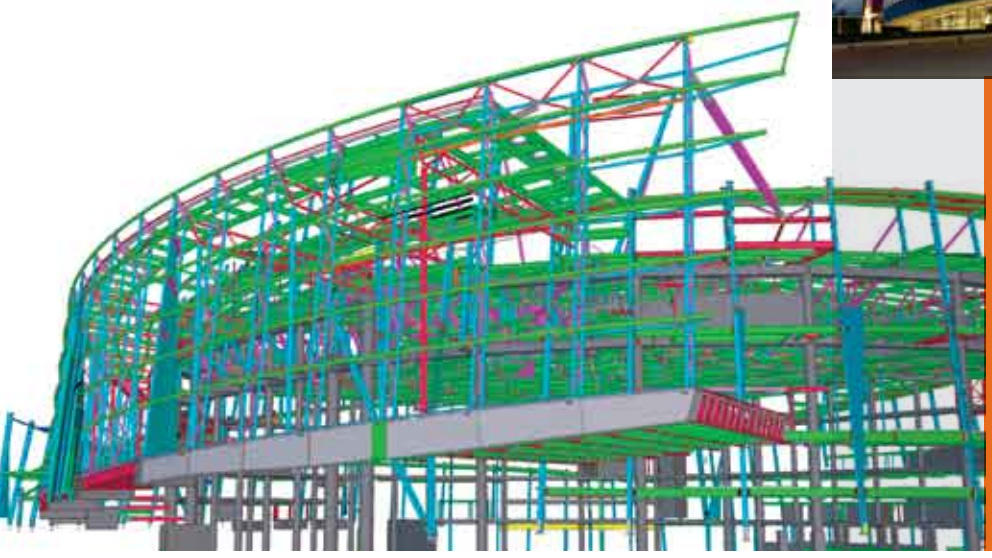
Our early adoption of this new design tool convinced other team members to implement Tekla as well. The entire project benefited from the expedited design and detailing, enhanced coordination and constructability, and increased accuracy in material cost estimating made possible by BIM.

Awards

National Award Winner (projects greater than $75 million), AISC 2009 IDEAS² Structural Steel Building Awards Program

Owner: City of Tulsa
Design Architect: Pelli Clarke Pelli Architects
Architect of Record: Matrix Odell
Total Area: 600,000 SF
Completion: 2008

Gayle Babcock Architectural Imageworks, LLC

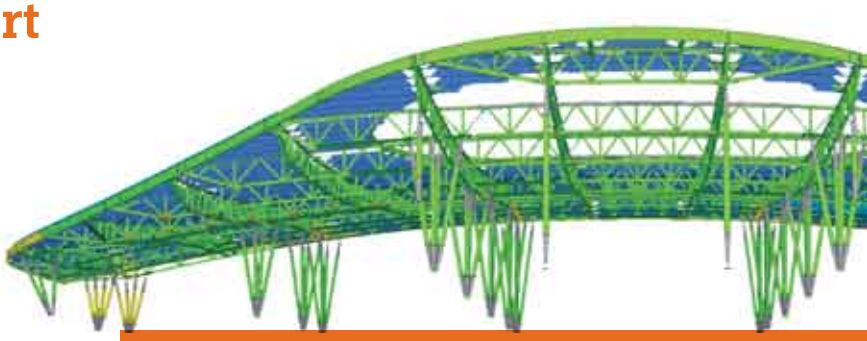


▲ We performed construction sequencing analysis to plan an efficient installation strategy for glass on the BOK Center's 450-foot "Icon Wall" that wraps around the arena. Steel support elements were preloaded to prevent cracking from dead load deflection during glass installation.

◀ Borne on a large box-beam cantilever, the wall terminates in an 80-foot glass and steel projection.

New Indianapolis Airport

Indianapolis, Indiana



▲ *A preliminary Tekla model of the Midfield Terminal roof. Thornton Tomasetti partnered with local structural engineering firm FRP, turning over the analysis model and an advanced steel design at the conclusion of the design development phase. Close collaboration continued through construction, with our team assisting with reviews of all roof shop drawings.*

When the City of Indianapolis replaced its outdated airport, officials wanted a flexible, forward-thinking facility that could grow into a major aviation hub. After a lengthy planning process, the New Indianapolis Airport emerged as a stunning example of synergy between architecture and structure, form and function.

A key element is the 320,000-SF roof that soars above the terminal, curving in two directions. Its structure essentially is the architecture: Thornton Tomasetti's engineers framed the roof with tubular steel trusses supported on steel "trees" that bear the load of four columns with the spatial effect of only one. The resulting column-free expanses "provide maximum flexibility for changing demands in capacity, technology and security," said David McLean, the project manager.

The roof also advances the airport's sustainability goals. It channels rainwater for building operations and shades the truss-and-glass curtain walls, letting in natural light while minimizing heat gain. Light wells and skylights, including a 200-foot circular porthole above a central plaza, further reduce energy required for illumination. The column trees embody efficient material use while providing an organic, aesthetic appeal.

Owner: Indianapolis Airport Authority
Design Architect: Hellmuth, Obata + Kassabaum
Total Area: 1.2 million SF
Completion: 2008

▲ *The 120-foot clear spans of the terminal roof (above left) are framed by trusses in two directions. Vice President Dave McLean and Senior Project Engineer Lee Ishida (above right) near a "tree," which consists of four tapering steel tubes. Pin-connections at top and bottom, which avoid putting bending moment into base plates or trusses, simplify design, speed assembly and provide aesthetic benefits.*

The Eye of Ike

Hurricane damage assessment, Texas Gulf Coast

Hurricane Ike had just churned into the Gulf of Mexico on September 10 when Scott Nacheman, from our Chicago office, boarded a plane for Houston. He was among the first on the ground with a Federal Emergency Management Agency response team, conducting search and rescue and stabilizing damaged structures. A week later, after the third-most damaging storm in U.S. history, a team of 25 people from nine Thornton Tomasetti offices converged on Houston to help clients quickly assess damage to their properties and develop remediation plans.

The work spanned the Gulf Coast region, where entire communities were wiped away by wind and storm surge, and more than a dozen commercial, medical, hospitality, manufacturing, and sports and entertainment facilities in the Houston area, where there was minimal structural damage.

"Much of our work leveraged our integrated practices in Building Structure, Building Skin and Building Performance," said Charlie Meade, who oversaw the property loss consulting work. "Our combination of skills on the ground enabled us to move fast and help our clients get back in business as quickly and efficiently as possible."

◀ *Some of the field crew on the property loss consulting team; clockwise from top left, Lance Parker, Scott Nacheman, Maria Karamanou, Andrew Lack, Eric Wheeler, Mark Andrews and Sam Cooper.*

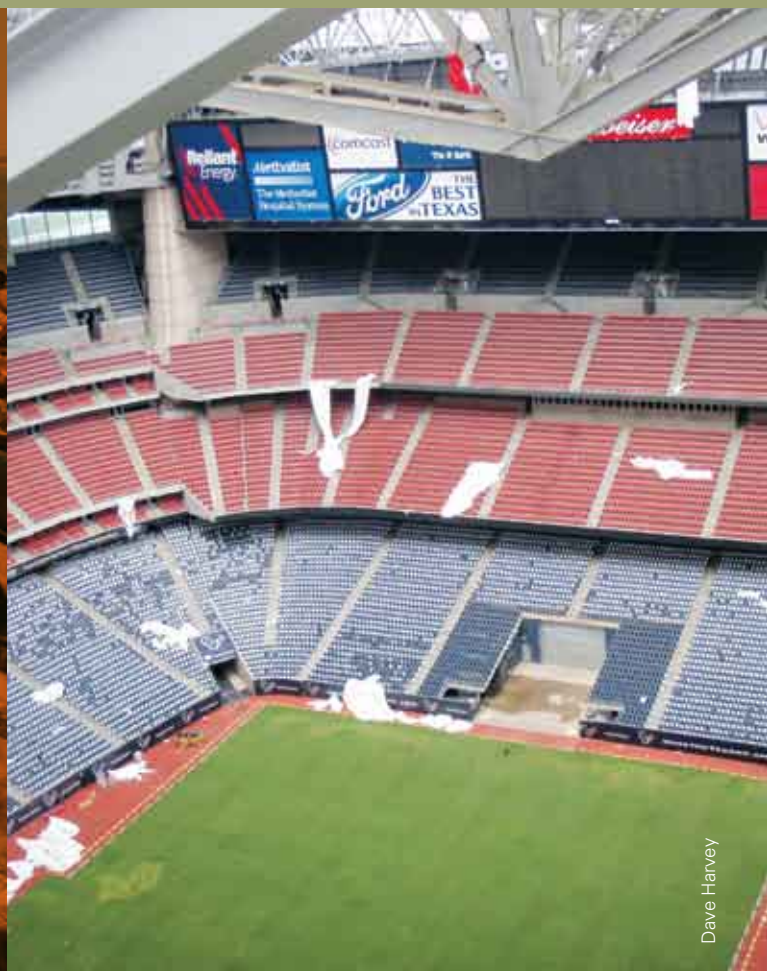
▶ *Andrew Lack assesses damage at an oilfield services depot in Port Arthur, Texas, which was hard-hit.*

Chris Pinto

▲ *Scott Nacheman, 200-plus feet above the field at Reliant Stadium in Houston, observing the condition of the fabric roof near mid-span.*

▼ *Remnants of the fabric roof were scattered on the field and bleachers.*

Sam Cooper



Dave Harvey

MGM Mirage CityCenter

Las Vegas, Nevada

On the Las Vegas Strip, where the rule is "bigger, better, faster," the 20-million square foot MGM Mirage CityCenter entertainment complex is the new leader. A large team of Thornton Tomasetti engineers performed structural design for the tallest hotel tower in the city, with a convention center, casino, theater, bridge and central plant serving the entire complex.

Structural systems vary to suit building functions and to accommodate "the Vegas way:" continual changes before, during and after construction to ensure that guests have the freshest, most engaging experience possible. Convention center steel long-span trusses bridge stacked column-free spaces and cantilever to hang a signature glass façade 500 feet long and 70 feet high. Hotel tower prestressed concrete floors are shaped as intersecting arcs to create wings of differing heights, served by three separate elevator cores. This provides optimal guest access and required complex testing and analysis to control wings and cores that tend to move differently during wind and seismic events.

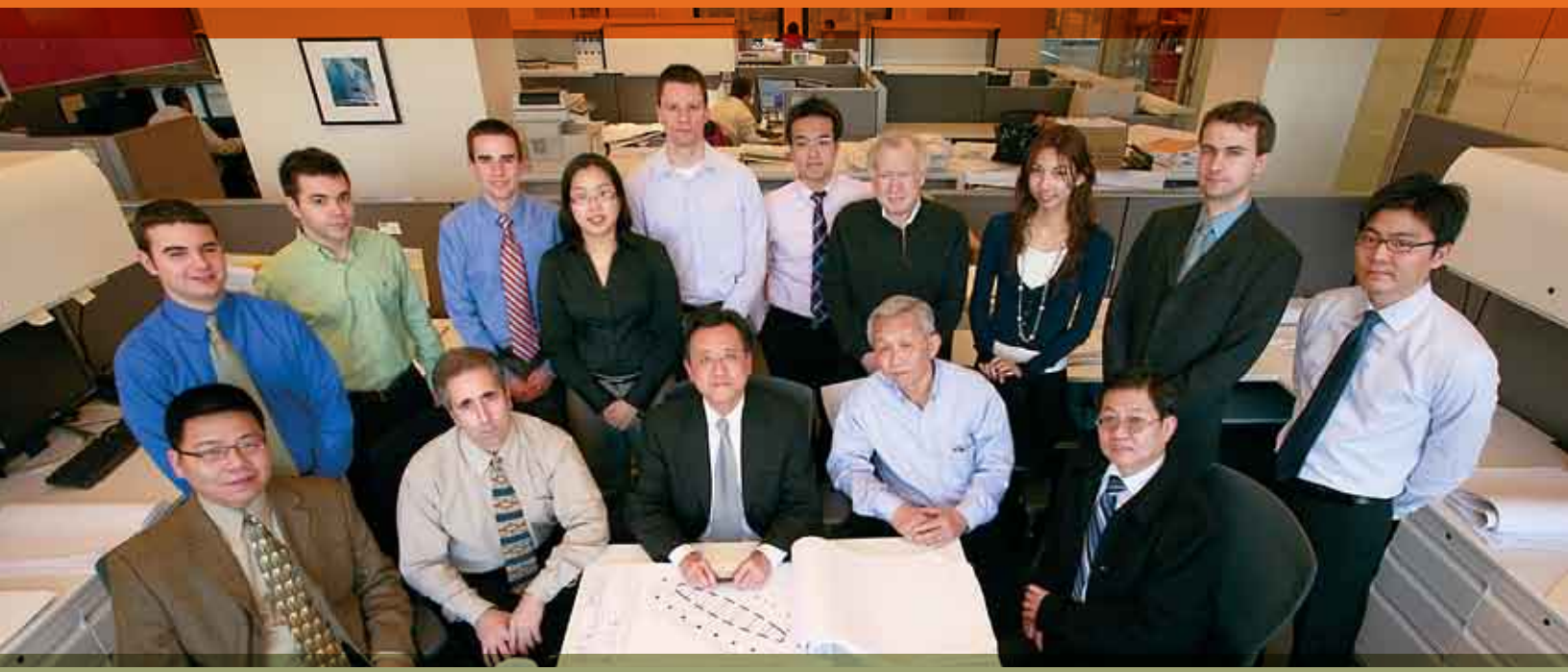
Developer: MGM Mirage and Dubai World joint venture
Executive Architect: Gensler
Architect of Record (Block A): HKS
Design Architect (Block A): Pelli Clarke Pelli
Total Area: 20 million SF; Block A: 5.6 million SF
Completion: 2009

Courtesy Pelli Clarke Pelli Architects

▲ *Vice President Kim Lin and the Dallas design team.*

◀ *The Aria Hotel and Casino (in rendering at left and photo above right) has post-tensioned concrete floors arranged as crossing arcs rising to different wing heights to create a beautiful form, and three separate concrete cores for optimal guest access.*

▼ *The New York design team flanking team leaders seated at the table; from left, Senior Associate Paul Fu, Vice President Steve Pacitto, Managing Principal Dennis Poon, Senior Vice President Udom Hungspruke, and Principal Dr. Ling-En Hsiao.*



1–5 Kingsway

London, United Kingdom

In the heart of London's West End is a sweeping neoclassical building that is being redeveloped and upgraded, but keeping its majestic façade. It's a long-planned 100,000 square-foot rebuild at 1-5 Kingsway to convert the historic landmark into a modern mixed-use development consisting of offices, retail, and residential accommodation.

"Our task is to design a modern structure that aligns with the existing façade," said Tanya de Hoog, co-director of the Thornton Tomasetti London office. An ultra-thin post-tensioned slab design maximizes floor-to-ceiling height, and allows for the passage of services within a restricted ceiling void without significantly adjusting existing floor levels. The design also allows for the addition of two new floors.

The prime location of this historic building means the development has attracted keen interest, particularly from city planners. "It's a pleasure to have the developer involved as an active member of the team who is motivated to create a high-quality, sustainable, and flexible development," said Les Postawa, co-director of the London office. Part of the design strategy is to embrace environmental aspects wherever possible, resulting in reduced energy consumption and carbon emissions, and a minimized environmental footprint.

Owner: UKI (Kingsway) Ltd.
Architect: Sidell Gibson Architects
Main Contractor: ISG
Total Area: 100,000 SF
Completion: 2011

▲ *Senior Engineer Lee Earl helped develop the design that mates a new structure to the existing façade.*

Lee Earl

▲ *Temporary bracing supports the 100-year-old façade of 1-5 Kingsway to allow for demolition to the single basement level.*

The historic façade of 1-5 Kingsway was preserved while the building behind was torn down and rebuilt, with floor spacing matching the existing window heights. The design work is in support of obtaining an "excellent" rating from the Building Research Establishment Environmental Assessment Method (BREEAM). ▶

Crane Collapse Emergency Response

New York, New York

Thornton Tomasetti teams were on site within hours of two tragic crane collapses this year in New York City, stabilizing the scene, planning steps to reopen buildings and streets, and determining the cause of failure.

A collapse on 51st Street in March caused seven fatalities when equipment used to stabilize the crane fell and knocked out tie-backs that anchored the crane tower to the building. In a rapid chain reaction, the 200-foot tower fell against a building across the street, and catapulted the crane cab and the payload on the crane hook blocks away. Eighteen nearby buildings were evacuated. Another crane collapse in May on 91st Street resulted in two fatalities when a weld in a repaired turntable failed, toppling the cab from a height of 12 stories.

In both accidents, our engineers were on the scene 24/7. "We evaluate what is stable, what needs to be stabilized, and develop a plan to remove debris," said Gary Panariello, senior principal. "We try to get everything back to normal as fast as possible – then we focus on the forensics."

▶ *When a crane fell on 51st Street in New York, it crashed into a building across the street, and falling debris damaged buildings a block-and-a-half away.*


Jimmy Lau


Jimmy Lau

◀▲ *Remains of the crane and cab on 91st Street. Part of our work was to stabilize the scene for the fastest possible clean-up.*

▼ *Damage from a crane collapse on 91st Street in New York (left), and (right), with the column we designed to stabilize the damaged area.*


Sam Cooper


Sam Cooper

Soyak Center

Istanbul, Turkey

The Soyak Corporation's new office towers will add a dramatic silhouette to Istanbul's skyline: a 160-meter tower of asymmetrical sloping surfaces. The structure's design process is as distinctive as its appearance – it is the city's first building to use performance-based design (PBD).

In PBD, we use powerful computer programs to determine a structure's realistic behavior in earthquakes and compare that to predetermined performance criteria. "This method allows us to go beyond prescriptive code rules that were developed for low-rise structures," said Associate Steve Szycher. "Tall buildings don't act the same way."

Our Building Performance team has extensive experience in non-linear computer modeling and time-history analysis required by PBD. "We apply the same tools used in our forensic investigations to design structures," said Principal John Abruzzo. "It's a great example of how our different practice areas support each other."

Using PBD on "regular" buildings is a new approach; applying its principles to the unusual shape and complex geometry of Soyak Center is extraordinary. "PBD helps us realize daring architectural visions without compromising safety," said Managing Principal Aine Brazil.

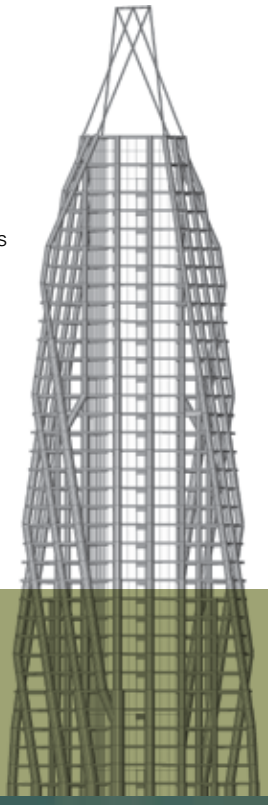
Owner: Soyak Corporation

Architect of Record: Pei Cobb Freed & Partners

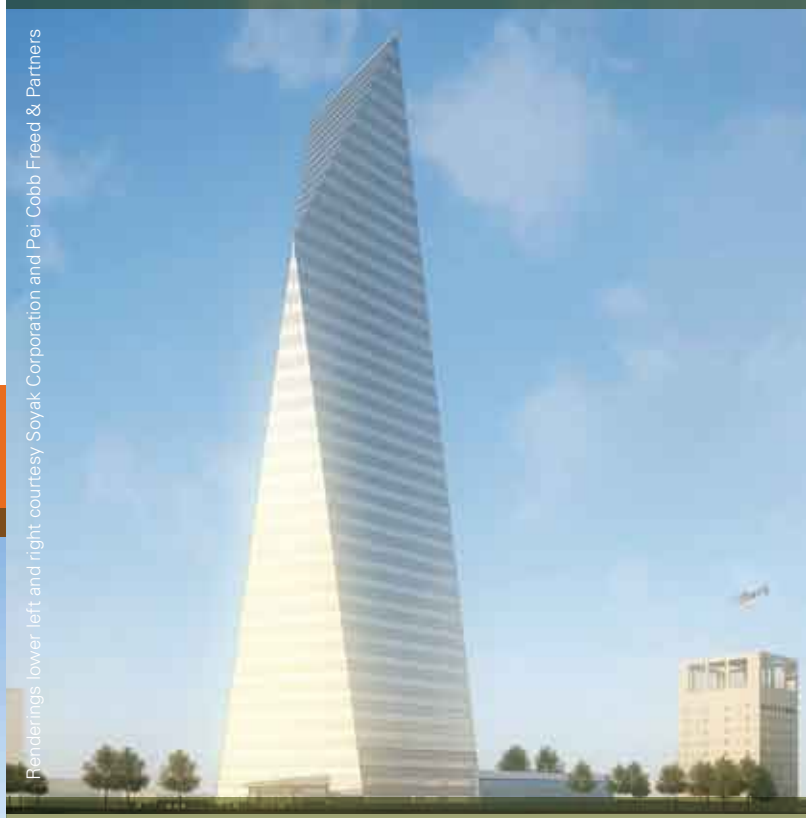
Total Area, Entire Complex: 100,000 m² (1.1 million SF) including parking, technical and mechanical areas, winter gardens and interior courtyards.

Tower Height: 160 meters (525 feet)

Completion: 2012



▶ *The architect's vision of a faceted façade dictated the use of sloping and merging columns to create slanting surfaces of varying shapes. Revit models like this facilitate more efficient solutions to such complex engineering challenges.*



Renderings lower left and right courtesy Soyak Corporation and Pei Cobb Freed & Partners

▲ *The focal point of the Soyak Center is a 35-story tower, crowned by a glass-enclosed roof garden 28 meters tall. The tower sits atop an eight-level, mostly underground horizontal component with open courtyards. The complex includes a neighboring 52-meter tower topped by a helipad.*

▼ *This early architectural rendering shows how the tower's unique configuration of sloping surfaces causes its appearance to shift when viewed from different angles.*

Presbyterian Hospital of Dallas

Dallas, Texas

Set in the midst of six existing healthcare buildings, the Acute Care Expansion provides 459,700 SF of new patient rooms and clinical and diagnostic facilities.

Engineering a large structure on a complicated site is always demanding, but hospitals present additional challenges. The Acute Care Expansion will house diverse functions, with floor layouts governed by clinical necessity – not the convenience of the design team. The building must also adapt to changing technology and care delivery models.

Thornton Tomasetti's extensive portfolio of hospital design projects allows our experienced engineers to ask the right questions, providing solutions to problems the owner may not anticipate. "Determining probable paths-of-travel for future equipment change-outs allows us to design affected corridors to handle increased loads. This eliminates the need for temporary shoring later," said Thornton Tomasetti project manager Patricia Coleman. To provide our healthcare clients with the best value, technical skill is not enough: we also understand how hospitals work.

Courtesy HKS Inc.

Owner: Texas Health Resources
Architect of Record: HKS Inc.
Total Area: 459,700 SF new construction; 104,800 SF renovation
Completion: 2011

▲ *The Acute Care Expansion project also includes new bridges and tunnels connecting to other facilities and a 104,800-SF renovation. Foundation designs were complicated by the presence of existing tunnels beneath the footprint of the new building, all of which had to remain operational throughout construction.*

◀ *Making a site visit during curtain wall installation are, from left, Project Engineer Okie Setiawan, Senior Engineer Clifford Brade, Senior Project Engineer Senad Ovcina, and CAD Modeler Joe Crumpley. The Dallas team collaborated with our Kansas City team on the design of the east sky-bridge.*

Masdar Headquarters

Abu Dhabi, U.A.E.

What better place than in the extreme heat and humidity of the Persian Gulf to prove the viability of a net-positive energy development?

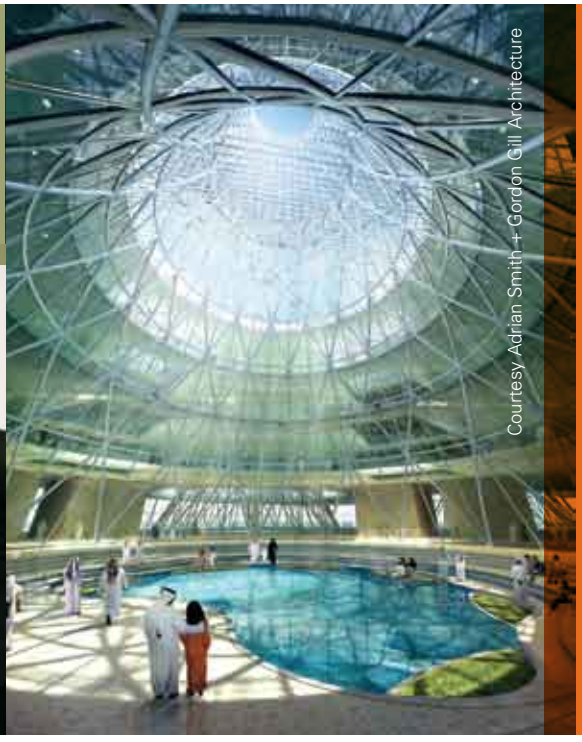
To achieve Masdar's ambitious vision, standard "green" design strategies fall short; the complex needs to generate more electricity than it uses. The striking solution for the energy program's centerpiece is a 7,500-ton trellis of hollow steel tubing carrying a seven-acre field of photovoltaic cells. It is supported by 11 large cones that double as chimneys that allow hot air to escape. "The 'cone and trellis' system is an architectural/structural/MEP engine for sustainability," said Thornton Tomasetti Senior Vice President Bob Sinn.

Calculating the project's total embodied carbon footprint involves scrutinizing every ounce of building material. Designers faced the challenge of identifying the best balance of functionality and sustainability. Intensive collaboration during detailed initial studies was key to successfully navigating these trade-offs to get the right mix. Solid relationships among team members fostered a level of trust and mutual respect that allowed each to bring their priorities to the table, weigh all options, and agree on solutions that will make one of the world's greenest structures a reality.

Owner: Masdar, Abu Dhabi Future Energy Company
Architect of Record: Adrian Smith + Gordon Gill Architecture
Total Area: 968,000 SF
Completion: 2011

▶ *The interior of a support cone creates outdoor space – an oasis within a modern office building.*

▼ *Regular collaboration keeps the project on track. Our engineers Suzanne Provanzana, Wincy Law and Bob Sinn (first, fourth and sixth from left) meet with the Smith + Gill team, from left, Jorge Soler, Leslie Ventsch and Ying Liu.*



Courtesy Adrian Smith + Gordon Gill Architecture

Courtesy Adrian Smith + Gordon Gill Architecture

▲ *The Headquarters project, with two office buildings nestled beneath an undulating trellis, is a major component of Masdar City, a zero-carbon community planned for a population of 50,000. The trellis shades the complex below from the desert sun, reducing cooling requirements.*

▼ *Our Building Information Model view of the wind tunnels connecting to the trellis. The project is being produced in Revit, a dynamic tool that speeds the design of this "hyper-fast-track" project. Foundations are under construction while designs for the complex are being completed.*

Evolving Project Provides a Healthy Challenge

Philadelphia, Pennsylvania

Construction is underway on the Fisher Translational Research Center (FTRC) at the University of Pennsylvania, the third phase of the Center for Advanced Medicine master plan. The complex aligns medical research and laboratory discoveries with advanced medical therapy. The building sits atop the phase-two construction, a facility for cutting-edge proton therapy cancer treatment.

Prior to the conception of the FTRC, the substructure of the proton center was designed to support a 13-story clinical tower. As foundation construction progressed, the tower design evolved into a 15-story research tower, requiring a redesign of the substructure without affecting the schedule.

The final design included expanded upper level floor-plates and incorporation of an auditorium between the first and third floors. Keeping the evolving building compatible with phase-one and substructure construction required inventive engineering. "We investigated several solutions and performed rigorous analyses to accommodate the new design," said Umakant Vadnere, Thornton Tomasetti project manager. The structural team's intimate knowledge of the master plan was the right prescription for cost-effective solutions that kept the fast-track project on schedule.

Project: Fisher Translational Research Center

Owner: University of Pennsylvania Health System and Penn School of Medicine

Total Area: 500,000 SF

Completion: 2010

Architect of Record: Rafael Viñoly Architects PC

Courtesy Rafael Viñoly Architects PC

▲ *"The thrilling part was coordinating a dynamic design while identifying and resolving impacts on the fast-track construction," said David Fusco (above left), Thornton Tomasetti senior engineer, shown here with, from left, Thornton Tomasetti Associate Umakant Vadnere, James Herr, project director for Rafael Viñoly Architects, and Ed Hanzel, senior project engineer with L.F. Driscoll Co.*

◀ *To integrate with the already-completed phase-one construction, the FTRC lower level floor-plates had to match a column grid 30 feet square, while the upper floors required a larger grid for laboratory space. The transition is achieved through a series of 15-foot-deep steel transfer trusses within a level-five mechanical space. The auditorium is supported by a hanging truss and a cantilevered plate-girder system to create a large column-free area.*

People

Advancing Careers with Advanced Degrees

The growing complexity of engineering drives more young engineers to pursue advanced degrees, and this year eight of our engineers juggled the demands of simultaneous work and studies. How do they do it?

"It helps to plan your schedule and have a flexible manager," said Senior Project Engineer Jeannie Pfeiffer, who travels once a week from the Chicago office to her evening structural engineering class at the Milwaukee School of Engineering. In Washington, D.C., Engineer Lisa Chong schedules overtime work around exam week for her classes at George Washington University.

Our reimbursement policy for tuition and fees, helps, too. Other master's candidates this year who took advantage of the reimbursement include Benjamin Isham, Vladmir Kotlyarov, Timothy Lynch, Luis Valderrutten, Courtney Zeolla and Caitlin Kevins.

Helping Students Get Ahead

Anthony Massari wanted to give his students at New Jersey Institute of Technology (NJIT) a leg up in their bid for a fifth consecutive regional title leading to the 2009 National Student Steel Bridge Competition. So the Thornton Tomasetti engineer and adjunct professor brought his class to our Newark office and taught them to use industry-standard software, the Structural Analysis Program (SAP), to design a bridge to be judged for its strength, lightness, deflection, and assembly time.

For Massari, the profession is all about learning, fostered at Thornton Tomasetti through collaboration with colleagues. "I may know something the guy next to me doesn't know," Massari said. "We share ideas, and together we solve problems. The earlier aspiring engineers learn that, the better for everyone, and for the profession."

Supporting MS Research

Jason Jeffries' mom was diagnosed with multiple sclerosis when he was in elementary school. Just as she's confronted the challenge of MS for two decades, Jeffries accepted the challenge of the 181-mile charity ride for Bike MS: Kansas City 2008.

On his two-day ride to central Missouri and back, Jeffries raised nearly $1,000 from individual donors,

◀ *Senior Project Engineer Jeannie Pfeiffer takes evening classes in engineering at the Milwaukee School of Engineering. "More education is the best way to advance your career," she said.*

▼ *Anthony Massari (center) in our Newark office with New Jersey Institute of Technology engineering students, from left, Keith Corkery, Giancarlo Fricano and Kenneth Gilbertson. Massari conducted a tutorial for the students on the use of the Structural Analysis Program (SAP), which engineers use to design structures.*

Hertzler Awuy

including many colleagues at work. More than $1 million was raised by 1,800 cyclists participating in the ride.

Long-distance cycling requires hours of training, discipline and commitment. Still, Jeffries thinks his contributions are modest. What does his mom think of his efforts? "She thinks it's awesome," he said.

LEEDers in Green Building

With two days left before our year-end deadline, our 100th employee was certified by the U.S. Green Building Council as a Leadership in Energy and Environmental Design (LEED) accredited professional (AP), meeting our firm's goal for new LEEDers in 2008. Anita Asokan, an architectural designer in our New York office, passed the exam on December 29. By year end, Thornton Tomasetti accounted for an estimated 13% of LEED accredited structural engineers worldwide.

Increasing the number of accredited employees supports an increased focus on sustainability. "Greening the built environment through our service offerings is the ultimate objective," said Wolfgang Werner, who, with Adam Cone and Paulina Calderon, led the team that pushed for 100 LEED APs.

We are also greening our own operations. One effort is the pursuit of LEED gold certification for commercial interiors for our Chicago office, which relocated in the winter. Supporting the complex certification process are regionally purchased materials and furniture, and the location of the office near public transportation.

ACE Grows in the Midwest

The Architecture, Construction and Engineering (ACE) Mentoring program saw expanded activity in our Midwest offices this year.

The North Kansas City School team, mentored by engineers in our Kansas City office, placed third in a national competition for their design of a community center. "Their careful consideration of site location, sustainability concepts, and architectural design put them over the top," said Mike Lancey, senior engineer in our Kansas City office and ACE chapter executive director.

The Chicago ACE chapter boasted participation from a record 37 schools, and Senior Engineer and ACE associate board member Geoff Dauksas was impressed by the eagerness of 150 workers from 22 firms, including 15 of our own employees, to serve as mentors.

More ▶

Shannon Jeffries

◀ *Jason Jeffries, right, raised nearly $1,000 in support of multiple sclerosis research in his 181-mile ride with friend Andy Kasper, left.*

▲ *In our Chicago office, the number of LEED Accredited Professionals in 2008 exceeded 30. The bid for LEED certification of the new office, which relocated in early 2009, is being led by Engineer Matt Huizinga (eighth from left, middle row) and Senior Engineer Rachel Michelin (not present for photo). At press time, the firm has 115 LEED APs.*

Personal experiences motivate mentors. Suzanne Provanzana, senior project engineer in Chicago, said she would have benefited from a program like ACE. "When I entered college, I didn't know what a structural engineer was," she said. "ACE gives kids today a definite advantage."

Thornton Tomasetti Foundation Awards Student Scholarships

The Thornton Tomasetti Foundation, a nonprofit organization funding education of students aspiring to careers in building design, this year awarded its initial round of $35,000 in grants to four students.

Elizabeth Bava received $15,000 to support her Master of Engineering studies at Lehigh University in Bethlehem, Pa. Another $15,000 went to an exchange program between New York University (NYU) and Polytechnic Institute. Welkinson Robert, a civil engineering major at the Polytechnic Institute, will take courses at NYU's College of Arts and Sciences, and NYU's Matthew Bouton, a senior in the Urban Architecture and Studies Program, will enroll in Polytechnic courses. Gar Yan Yeung, a former intern at our New York office, received $5,000 upon graduation from the Urban Assembly School of Design and Construction.

"The Foundation takes our outreach to the next level," said Joel Weinstein, Foundation vice chairman. "It gives back not only to the design professional community, but also to the building industry as a whole."

Copenhagen, Concrete, and Danish Cuisine

The partnership between Thornton Tomasetti and Danish engineering firm Leif Hansen includes an exchange program, in which employees from both firms switch places for several months to learn a new culture and engineering methods.

Joe Shields, senior engineer in our Chicago office, was the fifth employee selected for a six-month exchange to Copenhagen. His skills and service record, along with a winning essay and strong recommendation, secured his spot.

On a Copenhagen project with a cast-in-place concrete parking structure, Shields was charged with explaining applicable sections of the European Building Code to colleagues more accustomed to using Denmark's own building code.

The exchange program was worth it for Shields. He believes he's prepared to take on other European projects and recommends the program to flexible employees. "If you like to eat fish – you're set," he said.

Harper Essenfeld

▶ *During his exchange to Denmark, Senior Engineer Joe Shields learned Danish engineering – and culture, here at 16th century Egeskov Castle, in Funen.*

▲ *ACE mentors Geoff Dauksas, left, and Lina Chiu, an ACE mentor with Gensler, with Gerardo Alvarez, a junior at North-Grand High School in Chicago.*

▶ *Thornton Tomasetti Foundation award students, from left, Elizabeth Bava, Welkinson Robert, Matthew Bouton and Gar Yan Yeung.*

Thornton Tomasetti

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