Thornton Tomasetti

trust+respect+collaboration
+enterprise+innovation+
expertise+confidence
+knowledge+candor+
understanding+fun+creativity

ANNUAL REPORT 2011/2012

Thornton Tomasetti provides engineering design, investigation and analysis services to clients worldwide on projects of every size and level of complexity. Our six integrated practices (page 32) address the full life cycle of structures. Founded in 1956, today Thornton Tomasetti is a 600-person organization of engineers and architects collaborating from offices across the United States and in Asia-Pacific, Europe and the Middle East.

...building relationships

CONTENTS

Glance through this report and you might notice something unusual.

The largest images in this report are not of our projects: they're portraits – photos of our people with some of the clients we serve. That's because in every project we undertake, success depends as much on relationship excellence as technical excellence. The trust, mutual respect and camaraderie that underpin productive relationships make everything else possible.

Good relationships with clients are an extension of good relationships within a firm. This comes from the top at Thornton Tomasetti: our employee-shareholders maintain a deep commitment to the firm and to each other, with an average tenure of 15 years. Sharing our institutional and industry knowledge enables us to streamline our decision-making: when you have worked with someone for 15 years or more, it's easy to cut to the chase.

Thornton Tomasetti places a high priority on building strong relationships throughout our organization. For our young, high-potential professionals, for example, we offer mobile and borderless careers, in which they can move between offices, practices and countries. This enables them to cultivate relationships that will last a lifetime, experience different cultures, develop new skills and, most importantly, go as far as their talent and ambition will take them.

We also encourage our people to reach out beyond the cubicle in many ways. We value their initiative in supporting charities, mentoring underprivileged students, teaching in local schools or at the university level and taking time off to travel or study. Through the relationships they build in these activities, they enrich themselves and in doing so, they enrich our firm by bringing more to every project team they join. Our professionals have won recognition across the industry and an increasing number of awards because of these activities, and we are proud of them for contributing above and beyond project work.

The power of building relationships drives our growth. At the end of 2007, we entered the "Great Recession" with 16 offices. Today we have 26 offices, 11 outside North America and 15 within. Virtually all of our offices and practices have been built on the foundation of relationships cultivated over the 50-plus years we have been in business. As we expand our worldwide presence – from assessing earthquake damage in New Zealand to designing iconic, record-setting structures in Saudi Arabia – our relationships will continue to drive the growth of our business.

The rewards of relationships, however, are more than knowing whom to call and making the connections that lead to challenging and rewarding work. What is most exciting is the growth of high-quality relationships that enhance the collaborative process on all kinds of projects – whether it is a new design or retrofit, a forensic investigation, a construction support plan or a sustainability assessment. The words on the cover of this report are an attempt to capture what makes a relationship great. But we know the whole is more than the sum of its parts. Every great relationship is a unique bond that happens one-on-one and could never be captured completely in words.

In our flatter and rapidly changing world, success increasingly depends on strong collaborations – within our firm and with the entire project team. Everyone in our firm looks forward to making those relationships as strong, true and resilient as the buildings we jointly imagine and create.

Tom Scarangello
Chairman and CEO

Bob DeScenza
President

building relationships

One measure of project success is how much an innovative, elegant and enduring building design enriches a community.

Another measure is how well the project team overcomes challenges – and delivers the project on time and on budget.

But often overlooked in the project narrative is what made it all possible: *the moment when the project team clicks.* When this happens, the project takes flight and success unfolds with a kind of inevitability. What's required to make this happen?

The words on the cover of this report are all necessary ingredients for success. When those pieces come together the team creates a united understanding of *where we're going*, *what matters* and *how we solve problems*. In the passion of the project, life-long bonds are formed. We're energized by jointly building something bigger and better than ourselves: a structure, and new relationships. This is how we love to work.

This report highlights some of the relationships we enjoyed this year and some examples of what we aspire to achieve in all our work.

REACHING NEW HEIGHTS

KINGDOM TOWER

Jeddah, Saudi Arabia

Owner: Jeddah Economic Company
Architect: Adrian Smith + Gordon Gill Architecture

Designing the structure for a tower taller than any built before is both a privilege and a challenge. The architect chose Thornton Tomasetti for the +1,000-meter building based on his previous work with senior principal Bob Sinn and on the firm's history of designing supertall structures. Our team united this expertise with a pragmatic approach to design and construction technology to create a unique structure for Kingdom Tower.

When Adrian Smith conceived the form of the tower, inspired by the folded fronds of a sprouting desert plant, he was confident its shape would perform well under wind loads. We then worked closely with him to refine the details. Using advanced computational modeling software, we developed a highly efficient structural system that would provide the best performance within the parameters set by both the architect and the owner. Extensive wind tunnel testing confirmed our approach and pointed the way toward the optimal design for the tower.

The tower's form allows for an elegant and constructible structural system. With no massing set-backs, neither column transfers nor outriggers are required – all structural components can be continuous. This permits the use of an all-concrete system that avoids complex steel components and takes advantage of the region's concrete-dominated construction practices. All walls at each floor are connected to one another and to the core, so that every piece of vertical and inclined concrete contributes to the building's lateral-load resisting system. This structural system makes efficient use of material and involves readily available construction techniques and concrete strengths, all of which will speed construction and reduce costs.

LEFT: Adrian Smith and Bob Sinn were colleagues at another firm for 23 years, where they worked together designing skyscrapers, including the tallest reinforced concrete building in the United States and the preliminary design for a 2,000-foot tower in Chicago. Lessons learned from these experiences were applied to the design of Kingdom Tower, which improves upon conventional structural solutions for supertall buildings.

RIGHT: When completed, Kingdom Tower will set a new height record. Thornton Tomasetti has designed structures for a number of the world's 10 tallest buildings, including the Petronas Towers, Taipei 101 and the nearly complete Shanghai Tower.

SUSTAINING RELATIONSHIPS

When we decided to expand our green building services in 2012, we teamed up with Gunnar Hubbard and Fore Solutions, his Portland, Maine based sustainability firm. In addition to adding capabilities to our portfolio, the acquisition reinforced existing relationships with mutual clients. Thornton Tomasetti had already worked with FXFOWLE on 11 Times Square and the New York Times Building. Gunnar's history with FXFOWLE stretches from 1996 – when he provided environmental consulting for 4 Times Square, an early example of green skyscraper design – to the present: in 2011 he led concept and schematic design-phase sustainability consulting for the Museum of the Built Environment.

Creating a high-performance, environmentally sustainable building in the desert requires innovative approaches. Applying sustainability programming, a newly developed technique, we helped the design team arrange space types to maximize the potential for natural ventilation, views, daylighting and energy performance. For example, spaces that need strict climate control, like galleries and archives, are clustered to increase MEP efficiency, while spaces with more flexible tolerances are located where greater temperature fluctuations may occur.

The project team focused on pushing the boundaries of sustainable practices and low-energy design in pursuit of a high-performance building. Among the proposed solutions were an east-facing clerestory that makes use of natural light, a light shaft that illuminates underground parking and filtered natural ventilation that takes advantage of cooler night air. Sustainability services also included climate analysis, biomimicry concepts, natural ventilation studies, daylighting studies, and materials research.

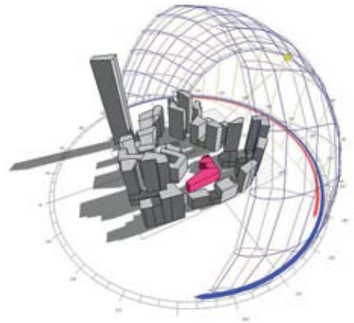
MUSEUM OF THE BUILT ENVIRONMENT

Riyadh, Saudi Arabia

Owner: Rayadah Investment Company
Architect: FXFOWLE

OPPOSITE PAGE: Thornton Tomasetti principal Gunnar Hubbard and FXFOWLE senior partner Sylvia Smith have known each other for more than 20 years. They have collaborated at a number of organizations during their careers, including co-teaching classes at Ball State University and the Yestermorrow Design/Build School in the mid-90s. Their long-standing mutual respect has fostered a wider set of relationships within the architecture firm, including that with the international group, which designed the Museum of the Built Environment. (right)

BELOW: We analyzed direct sunlight and shade at the site to assess photovoltaic panel potential and to evaluate façade exposure and its impact on cooling loads. This diagram depicts the site at noon on the winter solstice, December 21.



Courtesy FXFOWLE

PROJECT TEAM SCORES A GOAL

An aggressive schedule for the new home of Major League Soccer's Kansas City Wizards – just 22 months from kick-off to opening day – demanded extraordinary performance by the design team. Luckily, we had worked with Populous on a number of sports projects, among them ultra-fast-track stadiums. Based on that experience, we were confident the challenging schedule could be met – and met in style. Collaborating closely with the architect and contractor, we produced a structural design that supported the owner's aesthetic goals and was tailored to speed construction.

The park's signature feature is a translucent canopy that cantilevers up to 95 feet, covering all seating sections and allowing sunlight onto the grass field. Using glass would require dense sub-framing to support its weight, an expensive option that would also create too much shade, so the project team turned to lightweight, high-strength polycarbonate glazing. We worked intensively with the architect and construction team to define mullions and supporting structure with sufficient strength in a slender profile.

Our engineers employed a number of strategies to accelerate construction. We hosted weekly meetings with the construction team and steel fabricator to review the 3D Revit model, and we split the framing design into sequenced steel packages that coordinated with mill roll dates and the contractor's erection plan. We provided fully designed and detailed connections for fabrication to speed the RFI and submittals review process. Our construction support experience made it second nature to design the structure with construction sequencing and excavation strategies in mind. This expertise contributed to a constructible design that helped the project team complete the stadium on time for opening day.

LIVESTRONG SPORTING PARK

Kansas City, Kansas

Owner: Sporting Club of Kansas City
Architect: Populous
Contractor: Turner Construction

Andrew Lack / Thornton Tomasetti

OPPOSITE: Clear and open communication between the project's engineer, architect and contractor was key to meeting the tight schedule. Art Hortua, Brad Albers and Brandon Valdez talked together about the project almost every day for nearly two years.

collaboration +

Luke Nisley
Thornton Tomasetti

Laura DeBonis
Gensler

CREATIVE STEEL DESIGN WINS VOTE OF CONFIDENCE

DEFENSE HEALTH HEADQUARTERS

Falls Church, Virginia

Owner: GBA Associates Limited Partnership
Architect: Gensler
Contractor: James G. Davis Construction Corp.

The mission: to complete a fast-track renovation of a 650,000-square-foot office complex in time to meet the U.S. government tenant's Congressionally-mandated occupancy date. Federal guidelines for seismic design and progressive collapse resistance called for significant structural modifications to the three interconnected low-rise office buildings. Budget and schedule constraints required innovative structural designs for the improvements.

Our engineers took advantage of existing lateral-load resisting capacity in the building's structure and then added a series of steel frames with braces installed at angles that could be "tuned" to provide the precise level of additional stiffness needed to satisfy seismic codes. This design was faster to implement and less expensive than completely replacing the lateral systems.

To improve progressive collapse resistance, a new steel structure was threaded into the buildings in line with existing concrete columns. Full-height square steel tubes were inserted through the roof and floors below. These new columns support individual floors and carry loads up to a rooftop transfer beam. This minimally invasive approach didn't require façade removal, making it faster and easier to construct than more conventional systems employing column-jacketing and perimeter transfer girders.

A close working relationship with the architect, built over a history of successful collaboration, allowed our engineers to explore unconventional solutions to the project's design challenges. The contractor, brought on early in a design assist role, then "virtually constructed" the project by combining building information models from all disciplines. The use of creative approaches and innovative technology allowed the project team to get the complicated design just right before putting boots on the ground – and to deliver the project on schedule.

Courtesy James G. Davis Construction Corp.

RIGHT: Building information model showing new steel inserted into the existing structure. The project won the 2011 Award for Best Use of BIM on a renovation project from the Associated General Contractors of Metropolitan Washington, D.C.

AHEAD OF THE CURVE

PALAZZO LOMBARDIA

Milan, Italy

Owner: Regione Lombardia
Architect: Pei Cobb Freed & Partners
Developer and Construction Manager: Infrastrutture Lombarde S.p.A.
General Contractor: Consorzio Torre (Impresa Leader: Impregilo S.p.A.)

The new headquarters of the Lombardy Regional Government consists of a bifurcated 43-story tower that emerges as a fragmentary vertical extension of sinuous intersecting strands of nine-story office space that comprise the main body of the building. The civic complex also features rooftop gardens, open-air public plazas between the buildings, and a large piazza enclosed by an innovative roof structure. We performed structural design through design development. The project was then turned over to the local design-build contractor who substituted precast elements for cast in situ elements to accelerate the schedule.

The curving shape of the low-rise buildings made coordination between form and function more complicated than in a structure with conventional geometry. Our engineers met early on with the architect to work out the column grids in a brainstorming session, where all the pieces came together in a "eureka" moment: the team found the solution that optimized structural efficiency and supported architectural priorities. The team's willingness to openly share ideas resulted in a timely solution to a complex design challenge.

The piazza at the heart of the complex is topped by a curving diagrid of steel tubes supporting a transparent membrane of ETFE pillows. Because it connects to four separate buildings, each of which could move independently during a seismic event, the roof needed to be able to withstand simultaneous movement in different directions. We employed parametric modeling to identify the best balance between appearance and performance and developed a two-fold approach. Some portions of the roof rest on slide bearings while others are supported on posts hinged at top and bottom, allowing the boundary connections to move freely. We used innovative tools to apply simple techniques to a complex problem, creating a unique, project-specific solution.

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LEFT: The piazza and roof enclosure. Completed in 2011, the Palazzo Lombardia received an Excellence in Structural Engineering Award from the National Council of Structural Engineers Association.

EARTHQUAKE RECOVERY IN NEW ZEALAND

RYDGES HOTEL

Christchurch, New Zealand

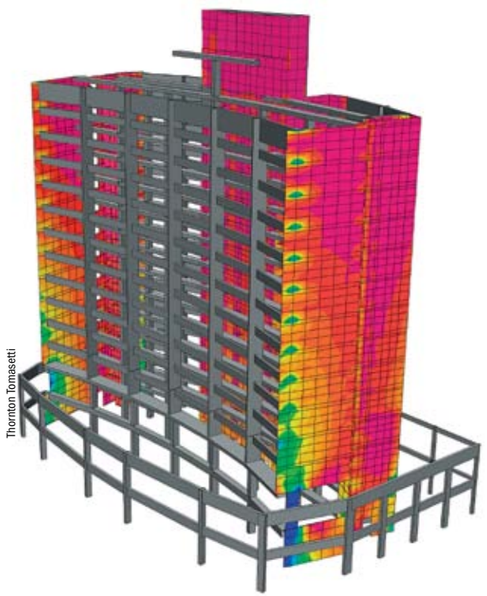
Client: Hawkins Construction
Owner: Emmons Developments

New Zealand's February 22, 2011 earthquake, at magnitude 6.3, was the country's worst natural disaster in 80 years, effectively shutting down the Christchurch central business district for more than a year. The earthquake and subsequent seismic events – some larger than magnitude 6 – resulted in the demolition of more than 600 structures.

The Rydges Hotel, a 14-story structure built in 1972, fared better than most. It suffered a localized roof collapse, and beams in the two-story podium required shoring. But how much other hidden structural damage might have occurred?

To answer this question, we worked alongside Hawkins Construction to determine the scope and nature of damage, develop repairs and evaluate upgrades where appropriate to meet modern codes.

We began with a qualitative field survey, and then developed an ETABS model of the building frame to conduct a detailed analysis of key areas where major structural damage would have been most likely. We also determined the building's expected earthquake performance relative to current code. We found that the building could be saved and when repaired will be in line with the recently updated earthquake guidelines. Rehabilitation work began in early 2012, with the staged reopening of the hotel expected in 2013.



Thornton Tomasetti

LEFT: An ETABS model of the Rydges Hotel showing axial stress at the concrete shear walls from one of many earthquake load cases considered in the analysis of the structure. Blue denotes high axial stress and pink low.

OPPOSITE PAGE: Cory Sanders, Hawkins Construction project manager, with Cliff Brade, Thornton Tomasetti project engineer, at the Rydges Hotel, Christchurch, New Zealand. Following a series of earthquakes, finishes were stripped off, exposing the concrete frame and ceiling. Repairs will include partial demolition and reconstruction of these frames to address damage and differential settlement.

global relationships

Where did we work in 2011/2012?

All over the world, on five continents and beyond, drawing on our knowledge of more than two dozen languages and bringing a global perspective to every local project.

Open here to see a representative overview.

1. HILTON HOTEL HURRICANE RISK ASSESSMENT
Hawaii

Review of multiple hotel properties for potential losses.

2. RESORT LITIGATION SUPPORT
Squaw Valley, California

Investigation and expert witness services in litigation regarding construction defects at a residential resort property.

3. SAN JOSE CITY COLLEGE MULTIDISCIPLINARY ARTS COMPLEX
San Jose, California

Structural services for a 45,000-square-foot arts education center delivered under a design-build contract.

4. PHIPPS MANSION
Denver, Colorado

Structural analysis and design to renovate a 1930s mansion to accommodate modern building services.

5. UNIVERSITY OF NEVADA, LAS VEGAS STUDENT CENTER
Las Vegas, Nevada

Structural evaluation of an existing sports complex for code compliance and recommendations for a retrofitting scheme.

6. POST-EARTHQUAKE FACILITY INVESTIGATIONS
Mexicali, Mexico

Review of previously performed damage assessments of three facilities for accuracy and appropriate recommendations, on behalf of the insurer.

7. DEVON ENERGY CENTER
Oklahoma City, Oklahoma

Structural design for a 50-story corporate headquarters building.

8. BLOCK 21, W HOTEL AND RESIDENCES
Austin, Texas

Structural design for a 35-story tower with 200 condominium units and a 250-room hotel.

9. LOUISIANA SUPERDOME ENHANCEMENTS
New Orleans, Louisiana

Structural services and connection design for renovations to a professional sports stadium.

10. JOHNSON COUNTY CRIME LAB
Overland Park, Kansas

Steel connection design for a new forensic science facility.

11. DEPAUL UNIVERSITY THEATER SCHOOL BUILDING
Chicago, Illinois

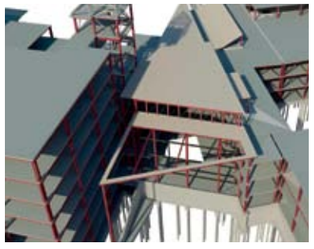
Structural design for a 169,000-square-foot building with two theaters, classrooms, and offices.

12. LAMBEAU FIELD REDEVELOPMENT
Green Bay, Wisconsin

Structural design integrating advanced delivery services, including connection design and a connected Tekla steel model. We are also providing full-time site representation services for the expansion of the existing stadium.

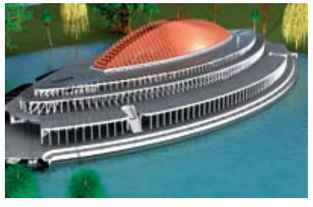
13. MARTIN ARMY COMMUNITY HOSPITAL
Fort Benning, Georgia

Structural services for a design-build contract to deliver a 745,000-square-foot healthcare facility.



14. UNIVERSITY OF SOUTH FLORIDA POLYTECHNIC, SCIENCE AND TECHNOLOGY BUILDING
Lakeland, Florida

Structural design for a two-story academic building that features an elliptical footprint and an arched steel and glass cupola with an operable steel sunshade.



15. HEINZ FIELD
Pittsburgh, Pennsylvania

Structural condition assessment of an existing stadium and design for repairs.

16. MARTIN LUTHER KING, JR. NATIONAL MEMORIAL
Washington, D.C.

Structural design for a new memorial on the National Mall.

17. BARCLAYS CENTER
Brooklyn, New York

Structural design and Revit/Tekla modeling services for a 750,000-square-foot basketball/hockey and multipurpose event arena.

18. WEST 57
New York, New York

Structural design for a residential tower with a sloping triangular shape that will give each of its 600 units a view of the nearby Hudson River.

19. BAHA MAR RESORT
New Providence, Bahamas

Structural design for a $3.5 billion beachfront resort development with four separate hotels.

20. CARTAGENA REFINERY DIVERSION CHANNEL
Cartagena, Colombia

Condition assessment of a 1.6-kilometer concrete-lined channel following flooding at the site.

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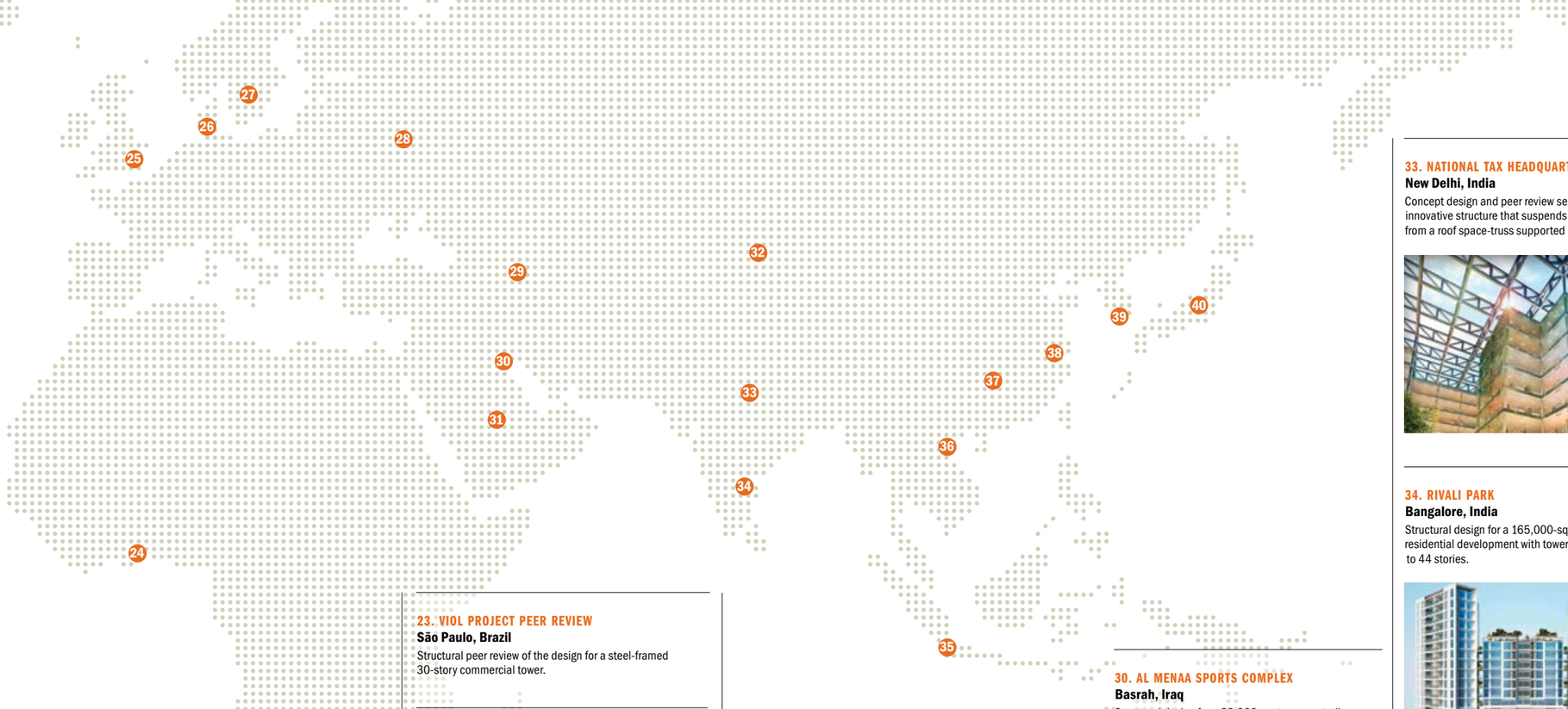


23. VIOL PROJECT PEER REVIEW
São Paulo, Brazil

Structural peer review of the design for a steel-framed 30-story commercial tower.

24. GHANA RIDGE HOSPITAL
Accra, Republic of Ghana

Structural design for a new 450-bed hospital.

21. PUCARA HYDROELECTRIC PLANT
Tungurahua Province, Ecuador

Condition assessment of a five-kilometer concrete-lined tunnel that sustained damage from a landslide.

22. CAP STEEL MILL
Concepción, Chile

Damage assessment of industrial structures, one of a number of investigations we performed in Chile following an earthquake with a magnitude of 8.8.

25. WEMBLEY NATIONAL STADIUM LITIGATION SUPPORT SERVICES
London, United Kingdom

Technical evaluation including creation of 3D analysis models to support expert witness testimony related to a delay claim.

26. UN CITY
Copenhagen, Denmark

LEED consulting for a new office building.

27. VASAKRONAN PROPERTIES
Sweden

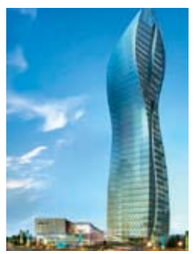
LEED consulting to certify a real estate client's portfolio of existing buildings in the Stockholm and Gothenburg areas.

28. VTB ARENA PARK
Moscow, Russia

Structural and building skin design to reconstruct an existing stadium into a world-class sports complex with a soccer stadium, basketball/hockey arena, restaurants, retail space and parking.

29. SOCAR TOWER
Baku, Azerbaijan

Structural design for a 38-story tower featuring a curving flame-shaped form.



30. AL MENAA SPORTS COMPLEX
Basrah, Iraq

Structural design for a 30,000-seat soccer stadium.

31. KING ABDULLAH FINANCIAL DISTRICT, CHILDREN'S INTERACTIVE MUSEUM
Riyadh, Saudi Arabia

Structural design and façade engineering for a museum with five connected structures, a form inspired by tree houses.

32. HOTEL REVIEW
Almaty, Kazakhstan

Structural peer review of the design for a 37-story hotel tower.

33. NATIONAL TAX HEADQUARTERS BUILDING
New Delhi, India

Concept design and peer review services for an innovative structure that suspends the building's floors from a roof space-truss supported by concrete cores.

34. RIVALI PARK
Bangalore, India

Structural design for a 165,000-square-meter residential development with towers ranging from seven to 44 stories.

35. SIGNATURE TOWER
Jakarta, Indonesia

Structural design for a 111-story tower with hotel, residential, office, retail and parking facilities.

36. HANOI CITY COMPLEX
Hanoi, Vietnam

Structural auditing and value engineering services for a 65-story mixed-use tower.

37. WUHAN GREENLAND CENTER
Wuhan, China

Structural design and building skin services for a 119-story tower, slated to be the world's fourth-tallest.

38. HONGQIAO SOHO
Shanghai, China

Building skin design for a sinuously-shaped mixed-use project.

39. ZENITH TOWERS
Busan, South Korea

Structural design for a recently completed three-tower residential development.

40. 2011 TOHOKU EARTHQUAKE RESPONSE
Tokyo, Japan

Life safety inspections of commercial properties to assess damage and determine if the facilities were safe for re-occupancy.

DESIGNING DEEP SPACE

Epic Systems Corporation, one of the country's top suppliers of healthcare information systems, is a company of software programmers. Epic's approach to growth meant finding ways for teams of engineers to collaborate in an informal, welcoming environment. The architectural mandate called for structures that harmonize with the rolling Wisconsin fields of its 811-acre campus.

The Deep Space Auditorium, the newest addition to the growing campus, is a fan-shaped structure that will seat approximately 14,300. Sited within an excavated hillside, the building will feature an 80-foot concrete tied-back wall and a fully landscaped green roof supported by 25-foot-deep trusses across a span of 275 feet.

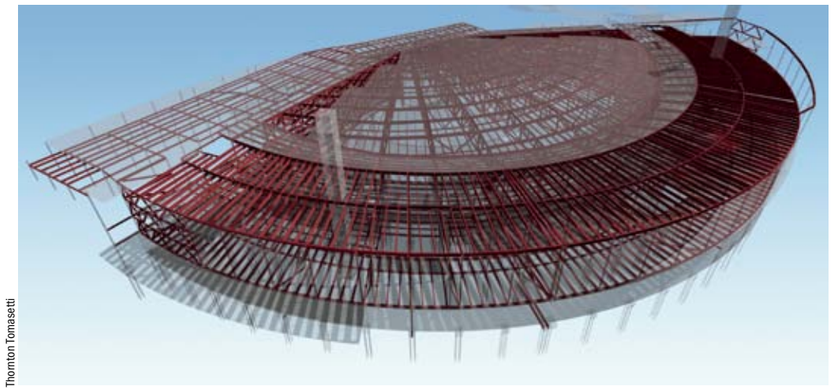
We are providing structural design services and integrated building skin and construction support services for the project. This unique suite of services includes consulting on building envelope systems, development of a fully detailed Tekla model, and erection engineering and design for a 4,700-ton roof lift. Our Information Technology team developed a cloud server platform to facilitate real-time design collaboration between our project staff, the detailers and the steel fabricator in the generation of a model to be used for directing steel fabrication.

One of the project's most challenging components is its long-span roof. Unique load considerations, including the weight of soil and gravel at depths of up to 16 inches, and erection issues had a strong influence on the design of the roof structure. To ensure an efficient structure and limit potential conflicts during construction, Thornton Tomasetti is consulting on the erection process. The roof trusses are being specifically designed to accommodate the erection of the structure on the ground and the subsequent strand jacking of the entire roof into position.

DEEP SPACE AUDITORIUM

Verona, Wisconsin

Owner/Client: Epic Systems Corporation
Client/Architect: Cuningham Group Architecture, P.A.
Contractor: J.P. Cullen & Sons, Inc.



Thornton Tomasetti

LEFT: Revit model of the fan-shaped auditorium, which will seat 14,300. It is cut into a hillside and is overlain by a green roof.

A CROWN IN THE QUEEN CITY

GREAT AMERICAN TOWER AT QUEEN CITY SQUARE

Cincinnati, Ohio

Owner: Port of Greater Cincinnati Development Authority
Architect: HOK

The Great American Tower at Queen City Square became Cincinnati's tallest building on July 13, 2011, with the placement of a steel tiara atop the 41-story tower. The building's architect, Gyo Obata of HOK, designed the building to include a top inspired by the tiara worn by Diana, Princess of Wales. Flipping through books, Obata was inspired by a picture of Diana wearing a crown. "That's perfect. Here we have the crown of the building, and the nickname for Cincinnati is Queen City," said HOK's Joe Robertson remarking to Obata when he first saw the picture.

The 400-ton tiara comprises 15 steel tubes arching 158 feet horizontally. The elliptical form went through many design and steel configuration iterations, with the goal of finding the proper balance between aesthetic and financial requirements. The color and lighting of the tiara were important considerations, since the tower has already become a visible icon for the city.

Thornton Tomasetti provided structural design services through construction administration to HOK for the 1.6-million-square-foot tower and tiara structure. We also provided geometric evaluation and final structural analysis with value engineering, connection design and a 3D Tekla model, as well as steel shop drawings to Owen Steel Company. Our work on the tiara received an award of merit from the Structural Engineers Association of Illinois for "the advancement of the state of the art of structural engineering." The building was awarded LEED Gold-CS Certification by the U.S. Green Building Council.

Rick Mayer

ABOVE: The tubular arch of the tiara, illuminated at night, is defining a new skyline for Cincinnati.

SAVING THE CAPITOL DOME

CAPITOL DOME
Washington, D.C.
Associate Architect: Hoffmann Architects

After 150 years, the world's largest cast iron dome atop the U.S. Capitol Building in Washington, D.C., is ready for major restoration. Leaks in the dome 20 years ago damaged the Capitol Building and paintings in the rotunda which have since been repaired. But it was clear that more than a patch would be required to repair the dome and extend its life.

For more than a decade, we have had the honor of helping prepare a plan for the preservation of the dome. Between 1997 and 2001, we performed a finite element structural analysis to determine the potential loading points for construction staging to safely access the exterior, interior and interstitial space for the removal of lead paint.

In 2011, we updated the structural analysis, and designed scaffolding that will provide access to the dome exterior while limiting the visual impact on the city skyline. This phase of the rehab is anticipated to begin in 2013 and, we hope, will help extend the dome's life for the next 150 years and beyond.

RIGHT: Richard Kadlubowski of Hoffmann Architects (facing camera) and Joelle Nelson of Thornton Tomasetti inspect the dome interior.

LEFT: 3ds Max Design model of structure and skin of Capitol dome, based on the original drawings.

Marguerite Pinto/Thornton Tomasetti

TORNADO RECOVERY IN MISSOURI

LAMBERT–ST. LOUIS AIRPORT RECOVERY

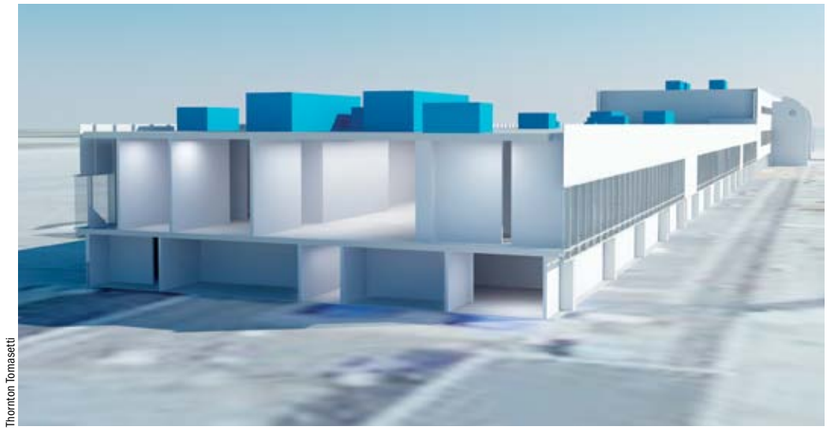
St. Louis, Missouri

Client: NHI General Adjusters and Lexington Insurance Co.
Construction Consultant: J.S. Held, Inc.

The St. Louis area's most powerful tornado in 44 years tore through the airport on April 22, 2011, shattering glass, ripping off roofs, and tossing a 10-ton air conditioning unit onto the concourse. The storm included hail, reported at up to three-quarters of an inch in diameter. The National Weather Service estimated the storm peaked at EF-4, the second-highest category on the Enhanced Fujita Scale, with winds of up to 200 mph. The tornado was estimated to be an EF-2 (up to 135 mph) when it struck the airport. Thanks to early warning, people escaped quickly to shelters and there were no fatalities. But a significant portion of the airport sustained some level of damage.

We were on the scene within 48 hours to determine what needed to be repaired or replaced and to help the airport return to full operation as quickly as possible. Because of the diverse nature of the damage, we engaged all facets of our multidisciplinary team: mechanical, electrical, plumbing, fire protection, building skin, and architectural and structural services. We also evaluated options to enable the structure, built between 1955 and 1965, to meet current building code requirements and to meet security and blast protection standards implemented since the terminal was built. Hardesty & Hanover, our strategic partner on bridge engineering, joined the project team for jet bridge inspections.

Through our efforts, along with those of other consultants, including NHI General Adjusters and construction consultant J.S. Held, the airport was reopened, fully operational, in spring of 2012.



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LEFT: A slice of an interactive 3D forensic information model of the airport terminal, used to evaluate damage, store field and analytical data and develop a recovery plan.

RAPID DEVELOPMENT OF A COMPLEX BUILDING SKIN SYSTEM

TENCENT HEADQUARTERS

Shenzhen, China

Owner: Tencent Holdings, Ltd.
Architect: NBBJ / Tongji LDI

Tencent, the world's third-largest Internet company, is designing a new twin-tower headquarters to be located in Hi-tech Park in the Nanshan District of Shenzhen. Thornton Tomasetti is providing building skin consulting services to the architect.

Although the design calls for 15 skin systems – extensive unitized curtain walls, a number of long-span glass walls, ETFE pneumatic cushion atria and two cable-net walls – we helped take the project from concept design to design development in only seven months.

A notable architectural feature is the sawtooth-shaped box panels that cover the façade, and extend outwards by up to 1.5 meters from the building structure. They create a textured aesthetic and support sustainability objectives by providing self-shading to reduce energy consumption during the hot summer. Using Rhino and structural analysis software, we met the challenge of designing box frames that are easy to fabricate, assemble, hoist and install. In addition, we developed the design to handle water and wind loads of a typhoon zone.

Courtesy NBBJ

RIGHT: Extensive use of modeling programs allowed the team to develop 15 skin systems for the Tencent Headquarters in just seven months.

THORNTON TOMASETTI FOUNDATION

www.ThorntonTomasettiFoundation.org

Thornton Tomasetti Foundation Mission

Fund fellowships, scholarships and internships for undergraduate students, and those planning to pursue graduate studies in building engineering, design or technology.

Provide financial support for individuals and organizations pursuing philanthropic activities related to building engineering, design or technology.

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In 2011, the Thornton Tomasetti Foundation distributed $96,000 in financial support for scholarships, charitable design projects and other efforts in support of its mission. Since its inception in 2008, it has distributed $306,000 in grants and scholarships to 15 organizations. Most notably, at the end of the year the Foundation set up a national scholarship, three awards of $10,000 each, to support students interested in the integration of architecture and engineering who are pursuing master's degrees in structural engineering.

Highlights of commitments during the year include:

- A grant of $25,000 to support two Engineers Without Borders projects undertaken by EWB chapters at the University of Maryland College Park and Princeton University. The Maryland chapter is designing and building a bridge in Addis Alem, Ethiopia, to provide 30,000 people with safe access to markets during the rainy season. The Princeton chapter is building a school library in Ashaiman in the greater Accra Region of Ghana.
- Continued support of the Master of Engineering in Structural Engineering program at Lehigh University. As a founding sponsor, the Foundation has provided $60,000 since 2008 for this program, which supports scholars in need of financial assistance. We have also served on the program's executive advisory board.
- A grant of $15,000 to the Global Orphan project, in collaboration with 360 Architecture, to support design and construction of an orphanage and school in Haiti, with an A/E educational component.
- Support for the Planning Land Use with Students (PLUS) program of the Lamont-Doherty Earth Observatory of Columbia University's Earth Institute for its ongoing work educating students about land use planning and sustainability.
- Scholarships awarded to NYU/Poly students James Walsh and Zain Ahmad. Since the merger of New York University with the Polytechnic Institute, the Foundation has provided $45,000 in scholarships to encourage cross-fertilization of the arts and sciences with engineering.

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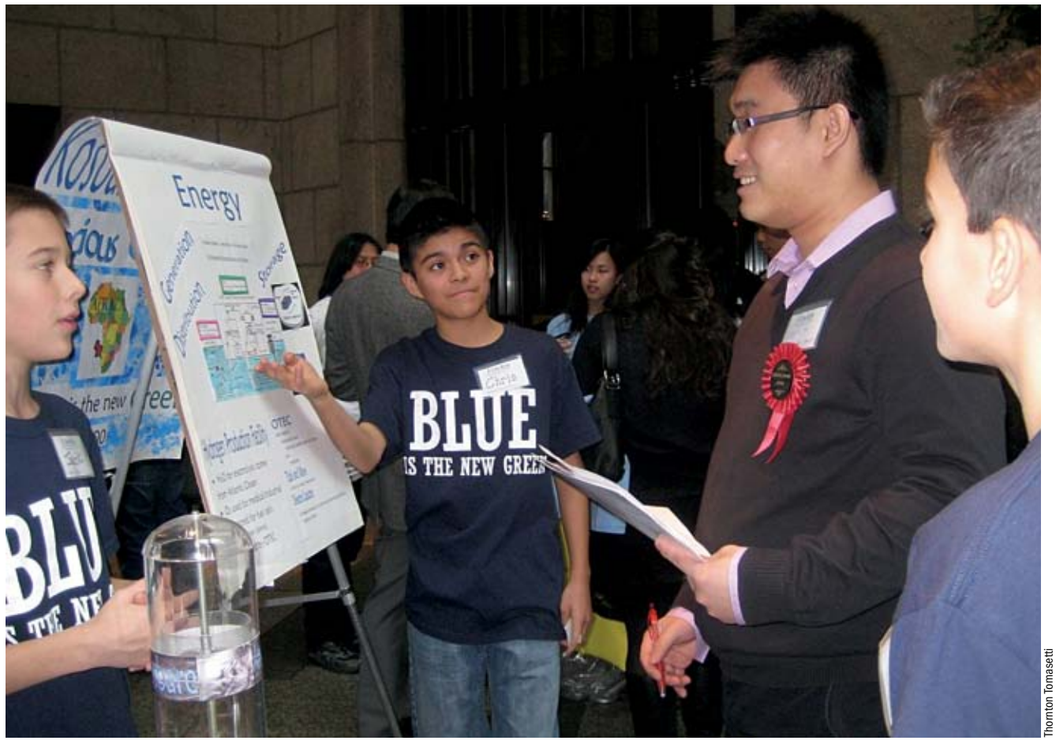
LEFT: The Thornton Tomasetti Foundation supported students in the University of Maryland EWB chapter, shown here, who are designing and constructing a bridge in Ethiopia.

BELOW: The Foundation sponsored this year's Future City Competition, in which middle school students compete in designing buildings for futuristic cities. Here, Thornton Tomasetti Engineer Edwin Yu, a judge in the competition, confers with the team from R.G. Reed Middle School, in Islip, N.Y. , which took first place in the New York metro region.



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OUR PRACTICES

BUILDING STRUCTURE We collaborate with architects, owners and builders to design elegant structural solutions that meet the demands of challenging projects of all types and sizes – new facilities as well as renovations and conversions. We focus on achieving the optimal balance among multiple objectives: form, function, schedule, sustainability, constructability and budget.

BUILDING PERFORMANCE Building owners and managers have ever-increasing expectations for high performance in moisture management, thermal comfort and noise control, as well as in meeting challenges such as sustainability, force protection, and pre-event and post-event evaluation. We recommend maintenance regimes, guide owners through expansions, adaptive reuses, rehabilitations and repairs, and provide expert witness representation.

BUILDING SKIN Our expertise in skin and structural systems extends from applications of innovative materials and point-supported and cable-supported glass, which can provide signature architectural statements, to budget-friendly conventional curtain walls. The creative use of new materials and techniques, combined with our pragmatic approach of unifying structure and skin, offers our clients valuable opportunities to achieve solutions that are both striking and sustainable.

PROPERTY LOSS CONSULTING We assist insurance companies, their representative attorneys and executive general adjusters in evaluating the scope and nature of losses related to natural and man-made events. We offer scope of damage determination; covered-loss assessment; cause and origin investigation; expert witness testimony; green claims consulting; and multihazard risk assessment.

CONSTRUCTION SUPPORT SERVICES We help developers, construction managers, fabricators, erectors, and general and specialty contractors to efficiently move a project from concept to delivery. We provide planning, analysis and logistics; evaluation of existing load capacity; engineering for shoring, stability and erection; and on-site field engineering. We develop and deliver steel, concrete and precast models, provide connection design, and create shop drawings. We also perform BIM coordination and documentation services and planning for design-build and integrated project delivery.

BUILDING SUSTAINABILITY We collaborate with clients seeking sustainable innovation in the design, construction and operation of high-performance green buildings. We use whole-systems thinking to strike the right balance between economic, social and environmental factors on each project. Our sustainability experts offer LEED consulting and administration; sustainable building strategies; energy and daylight modeling; owner's sustainability representation; education and training; and innovations in green building – integrated design practices that go well beyond the LEED rating system.

Russell Design NYC www.russelldesign.com
Portrait photography: Dan Bigelow, pages 2, 8 and 15; Ron Wu, pages 6 and 21; Steve Puppe, page 11; Robert Rathe, pages 12 and 24; Simon Waterhouse, page 17; Stefan Hester, pages 22 and 27; Ed Carreón, page 28.
Back cover image: 3ds Max Design model of the U.S. Capitol dome structure.

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