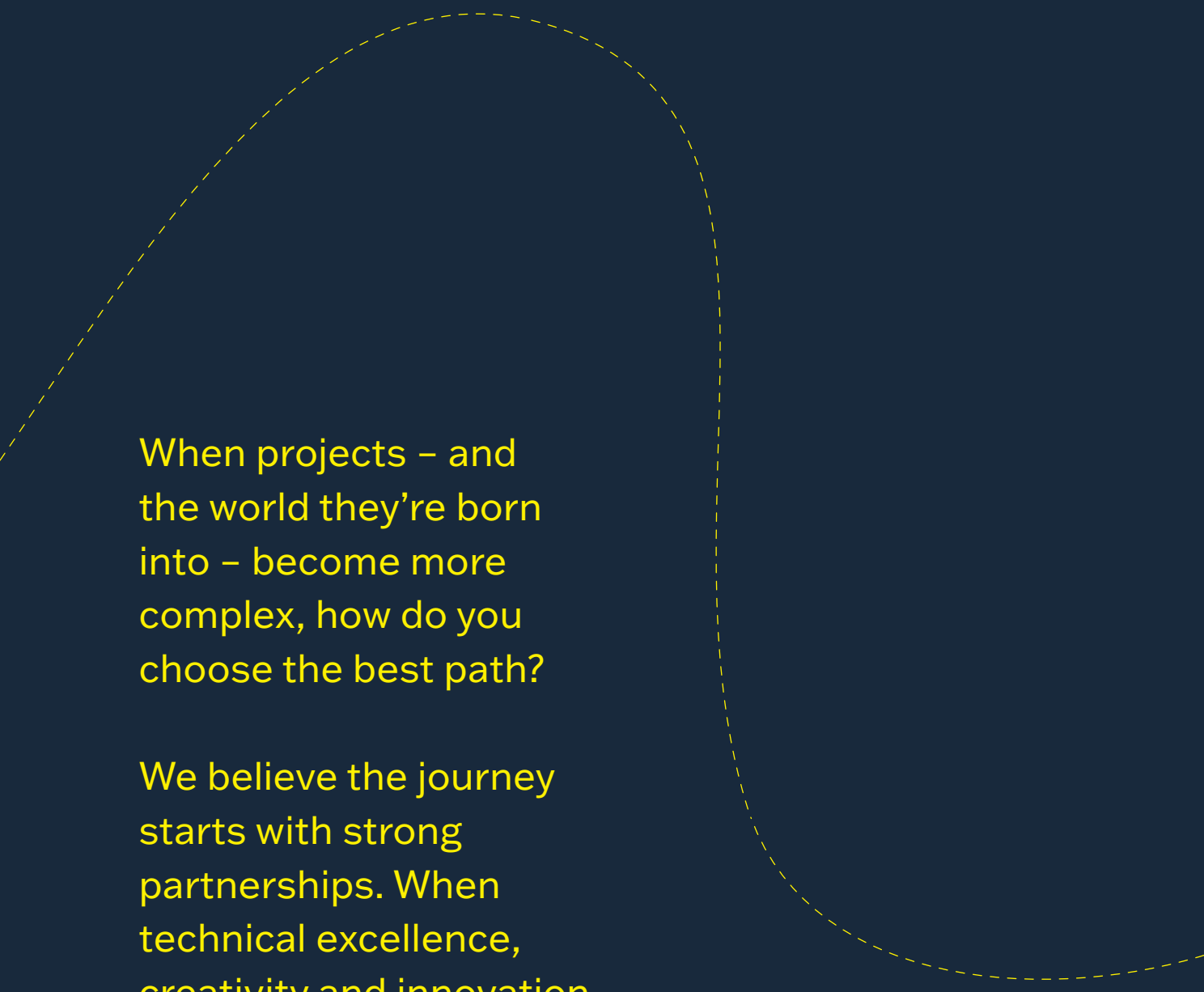


The Best Path

Thornton Tomasetti

ANNUAL REVIEW 2023/2024



When projects – and the world they're born into – become more complex, how do you choose the best path?

We believe the journey starts with strong partnerships. When technical excellence, creativity and innovation merge with true collaboration, there's no problem we can't solve together.

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**Members of our
Citadel headquarters
team collaborate
across disciplines.**

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Finding the Best Path

In solving complex problems for our clients, we have always merged analytical and creative thinking. We combine the logical processes of theory, math and science with art, ingenuity and imagination. These qualities, together with strong collaboration, are ever more essential in a world of interconnected problems, competing priorities and expanding frontiers.

Climate change is a major driver of increased complexity in our work. We have been challenged to reduce the impact of our projects on the environment and make them more resilient in a warming world. What we call “climate action” has become a central task of project teams. Embodied and operational carbon are now embedded into design thinking, with interoperable parametric modeling and artificial intelligence helping us assess the carbon impact of alternative materials, processes and supply chains. We continue to push innovative systems, such as mass timber, literally to new heights. In all our partnerships, we strive to make a positive impact – reducing our carbon footprint while increasing our carbon handprint.

Climate action extends beyond physical building systems. Our support of circular economic principles means minimizing the impact of new construction and intelligently reusing existing structures to reduce cost, time and carbon impact. Our efforts to enhance resilience and sustainability extend to the energy supply itself, which is undergoing a rapid transformation to renewable, low-carbon sources, creating opportunities to reposition legacy energy infrastructure.

We are passionate about building better communities, and not just through the impact of our projects. A better Thornton Tomasetti community springs from people pursuing their passions – from mentoring the next generation to expanding our culture of inclusive leadership and belonging.

Navigating all this complexity requires a holistic view, which can be found only through collaboration with project partners. There is no one path to solving complex problems. But there is a best path, forged through curiosity, innovative thinking and the relentless pursuit of new possibilities.

Tom Scarangelo
Executive Chairman

Pete DiMaggio
Co-CEO

Mike Squarzi
Co-CEO



THINKING HOLISTICALLY TO REDUCE EMBODIED CARBON

Carbon Cutter

PARTNERS

TP BENNETT, MACE, CO—RE
WITH IVANHOÉ CAMBRIDGE

In February 2024, the City of London's lowest-embodied-carbon (EC) building topped out in the city's finance and insurance center. The 350,000-square-foot Stonecutter, a mixed-use office and commercial development, aims for net-zero carbon by cutting EC in several ways.

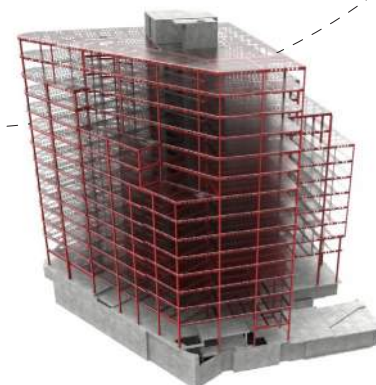
To avoid the need for temporary works and excavation – and archaeological risk – the new basement lies within the volume of the old one. This approach reused existing piles and sidestepped the need for excavation, but required a lightweight structure. Our long-span design doubles the floor area of the previous building while maintaining the same weight and enlarges the bays by 250%. Avoiding groundworks also accelerated construction, providing significant cost savings while supporting a low-EC approach and circular-economy principles.

To further reduce Stonecutter's carbon footprint, we decarbonized our

structural materials specifications. For example, we replaced 60% of cement with slag in concrete where curing time wouldn't slow the construction program – 45% of the total used. And for another 9% of the project's concrete we used at least 50% slag. We selected steel sections produced by electric arc furnace (EAF), which emits about one-third the carbon of blast-furnace production. Altogether, our approach yielded an EC footprint of 550 kgCO₂e/m², which places it in the City of London's "aspirational" class. The 13-story building is also targeting BREEAM Excellent and WELL Gold standards.

"WE ENCOURAGED COLLABORATION WITH OUR PROJECT TEAMS TO STIMULATE NEW THINKING AND RESEARCH. AS DEMONSTRATED WITH THORNTON TOMASETTI AND THE WIDER TEAM, THIS WAS ESSENTIAL TO ACHIEVE THE ASPIRATIONAL SUSTAINABILITY TARGETS FOR STONECUTTER."

—ALEX THORPE, CO—RE



73% of rolled steel is EAF sourced

70% of piles retained and reused

A broad approach to embodied-carbon reduction drove Stonecutter to the lowest levels so far for the City of London.

CO—RE Senior Development Manager Alex Thorpe (second from left) with Thornton Tomasetti team members Sabina De Jesus, Eddie Jump and Duncan Cox.

CLIMATE ACTION IN ACTION

Going Against the Flow

PARTNER: NEW YORK HALL OF SCIENCE

When the remnants of Hurricane Ida hit New York City in September 2021, torrential rains flooded the [New York Hall of Science \(NYSCI\) in Queens](#). While making extensive repairs, the organization called in our resilience specialists to prevent it from happening again.

Our team, led by Senior Associate Aditya Bhagath, started with climate-hazard and stormwater assessments. A hydrological analysis – which revealed that the entire neighborhood drains toward NYSCI's front door – informed short-term measures, like

Senior Associate Aditya Bhagath inspects the semipermanent flood-barrier system.

relocating the primary entrance, that would protect NYSCI while other solutions were developed. The predicted water volume also guided our design of a semipermanent flood-barrier system.

NYSCI is considering long-term measures, such as landscaping to divert floodwaters, permanent exterior flood barriers and flood-proofing for operations-critical rooms. These strategies factor in scientific data forecasting increasingly severe weather events fueled by climate change.

The current flood-barrier system had its first real test during a downpour in April 2023. It kept the water out, and NYSCI stayed dry.



Growing Energy Independence

PARTNERS: ITPENERGISED, THE JAMES HUTTON INSTITUTE, WATER TO WATER

Can a working farm become 100% self-reliant? We're helping answer that question at Northeast Scotland's [Hydro-Glen](#) demonstration project. On-site wind and solar electricity generation with battery storage can meet part of the energy demand. Hydrogen production (using electrolysis), combined with fuel cell technology, will provide the rest. Together, they'll power all the farm's



COURTESY THE JAMES HUTTON INSTITUTE

The Glensaugh farm's transformation into HydroGlen will show how the agriculture sector can help Scotland become a net-zero greenhouse-gas emitter by 2045.

operations, including electric and hydrogen-fueled vehicles.

Green hydrogen – with its capacity for energy-dense compressed storage – is a clean and affordable replacement for hydrocarbons in gas turbines, boilers and combustion engines. Our applied science team provided hydrogen and hazard management expertise, working closely with our project partners to develop the design of HydroGlen's hydrogen system.

The Power of Safety

PARTNER: WOODSIDE ENERGY

Our energy-industry experts supported Woodside Energy in the safe [removal of a riser turret mooring \(RTM\)](#) offshore of Western Australia. The 2,500-metric-ton RTM previously connected the Nganhurra floating production storage and off-loading facility (FPSO) to risers carrying oil for processing. After decommissioning the FPSO, Woodside began plans to remove the RTM.

Removal activities required a regulator-approved safety case to be in place. For nine months, Vice President Joanne Tarleton spent part of each week in Woodside's offices, working side-by-side with their team to examine the planned removal

activities, evaluate potential risk to workers, implement appropriate controls as necessary and ensure proper documentation of safety-related decisions.

Joanne also conducted workshops with project team members, including Heerema Marine Contractors, the operators of the heavy-lift vessel that would be used for the work. The goal was to learn about their operating procedures – especially those relating to transferring workers between the vessel and the RTM – and identify all potential hazards. “We brought together all the information and all the people and got input from the workforce, project team and operators,” says Joanne, “and all of this was incorporated into the final safety case.”

The heavy-lift DCV Aegir raises the 83-meter-long Nganhurra RTM in October 2023.



© WOODSIDE ENERGY LTD.

The Long Decarbonization Game

PARTNER
ALLOY

A revitalization of Brooklyn's Boerum Hill neighborhood paved the way for the [Alloy Block, Downtown](#), a mixed-use redevelopment that includes Brooklyn's first all-electric residential tower. We're providing architect/developer Alloy with sustainability consulting services for the ambitious project.

Plans for the residential tower, called 505 State Street, were based on three goals: to foster a connection to place, improve energy efficiency and design for future decarbonization.

"Through the development process, we redefined the future of responsible building in Brooklyn," says Jeffrey Sullivan, vice president of architecture at Alloy. "This was achieved through extensive collaboration among Alloy, Thornton Tomasetti's sustainability team, city agencies and the local community."

"Because we were aiming for an innovative approach, the entire project team came together from

the start," says Thornton Tomasetti Vice President Jose Rodriguez. We knew going in that electric heating technology was not yet commercially viable. We also knew electricity service to the area relied heavily on generation from natural gas, which produces greenhouse gas emissions and other pollutants. But ConEd had committed to building a zero-carbon electric grid by 2040, which let us look several moves ahead.

We focused first on reducing the building's energy loads, then on electrifying its systems to eliminate on-site fossil fuel usage. We modeled the impacts of thousands of inputs – including simulated façade-performance values, infiltration rates and ventilation-recovery effectiveness – to find the combination of variables that yielded the lowest heating load. Our process turned conventional energy modeling on its head by choosing an output aligned with our performance goals and working backwards to identify inputs to hit the target.

Jeffrey Sullivan (center) of Alloy and Thornton Tomasetti's Lisa Bolle and Jose Rodriguez at the Khalil Gibran International Academy construction site. The school, the first in New York to be designed to Passive House standards, is part of the Alloy Block redevelopment.

"WE WORKED WITH ALLOY, CON EDISON, THE NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY, AND FAÇADE AND MEP PARTNERS TO UNDERSTAND WHAT WAS POSSIBLE AND WHAT MEASURES WE COULD EVALUATE FOR FUTURE IMPLEMENTATION."

—JOSE RODRIGUEZ
THORNTON TOMASETTI

PREPARING TODAY FOR TOMORROW'S CLEAN ENERGY

COURTESY ALLOY DEVELOPMENT



The Rise of Embodied Carbon

The [Carbon Leadership Forum \(CLF\)](#) pursues a zero-embodied-carbon built environment through research, education and advocacy and by fostering collaboration. We convened a group of CLF leaders and members to discuss the past, present and future of understanding, measuring and reducing embodied carbon (EC) in buildings and infrastructure.



AMY HATTAN
CORPORATE RESPONSIBILITY OFFICER AND EC COMMUNITY OF PRACTICE CO-LEADER, THORNTON TOMASETTI; FORMER BOARD MEMBER, CLF

KATE: The CLF began with a small group of people who were excited about understanding embodied carbon. Early work focused on advancing standards for reporting. Over time, we started conducting research on data and methods and empowering more people to act by founding regional hubs. We've also moved into engaging more explicitly with policy.

AMY: I got involved with the CLF when Thornton Tomasetti joined in 2012, and what I'm seeing now is the perfect storm. All the vectors are pointing toward change. There has been growing global attention to how EC affects climate change, and more owners and developers asking for EC reduction.



CHRIS ERICKSON
CEO AND CO-FOUNDER, CLIMATE EARTH; FOUNDING MEMBER, CLF

AMANDA: It used to just be about the energy buildings consumed. But the building sector is the largest consumer of industrial materials by mass. You see policy starting to pay attention as the relationship between industrial decarbonization and EC in buildings becomes clearer.

CHRIS: In the U.S., commercial interest in EC is enormous. It's become a buying criterion, so



KATE SIMONEN
PROFESSOR OF ARCHITECTURE, UNIVERSITY OF WASHINGTON; FOUNDING DIRECTOR, CLF

material producers are going from trying to be "good" to having millions of dollars at stake. In Europe, it's more regulatory-driven, but it's coming like a steamroller, slowly but on a massive scale.

KATE: I'm very proud of the CLF's role in the Structural Engineers 2050 Challenge (SE2050). Thornton Tomasetti and Arup were tracking EC on projects, so they worked together with the CLF to figure out how more designers could do it consistently. It was a breakthrough moment for the CLF to issue the challenge in 2019 and then bring it to the American Society of Civil Engineers' Structural Engineering Institute group to adopt and implement. Today SE2050 has 140 firms – it's just stunning.

AMANDA: I'm seeing so much innovation, spurred by a demand for improvement. I work a lot with concrete procurement, and there are so many interesting new materials. And EC is frequently synergistic with issues like material toxicity; something lower in EC is often also healthier.



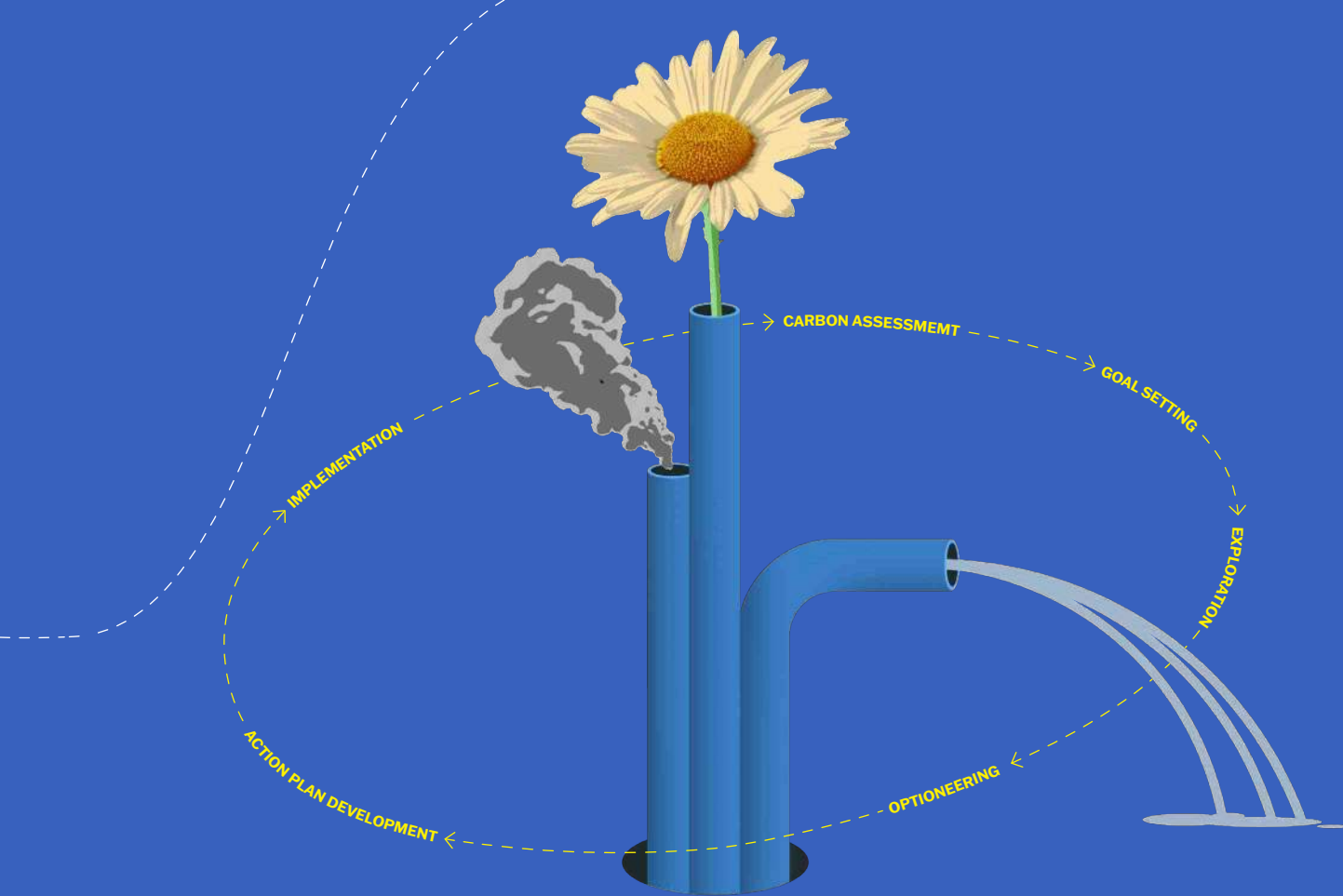
AMANDA KAMINSKY
DIRECTOR, SUSTAINABLE CONSTRUCTION, AMERICAS, LENDLEASE; ADVISORY BOARD MEMBER, CLF

AMY: A shift in focus is beginning, from carbon footprint to carbon handprint. From just trying to reduce the harm we do to taking actions that are net-positive. How can we use our ingenuity and innovation to help make these transformations happen?

CHRIS: You have to be optimistic. Fifteen years ago, the possibility that EC action could be where it is today would have been inconceivable. There were 10 people in the room. And look how far we've come. So imagine what could happen in 15 more years.



[THERE'S MORE!
READ THE FULL
CONVERSATION.](#)



Carbon Consulting: Action at Every Scale

Organizations of all types and sizes are seeking ways to reduce their carbon emissions. Whatever the objective – fulfilling corporate-responsibility targets or commitments, complying with regulations, gaining a competitive edge or minimizing climate-related risk – a comprehensive, customized action plan is essential to achieving ambitious goals.

We work with clients to develop and implement effective action plans for everything from a single facility to a campus, community or complete portfolio. By evaluating options holistically, rather than as individual parts, we can help make sense of complex issues and discover hidden opportunities in five broad categories:

Energy Supply. Reducing greenhouse gas (GHG) emissions and

climate-change risk by optimizing energy supply, including renewables, internal and external generation, energy storage and other resources.

Energy Resilience. Minimizing the risk of outages and disruptions through strategic deployment of distributed energy resources and mitigation measures.

Energy Optimization. Pursuing net-zero emissions through strategic deployment of all available technological solutions, efficiency improvements and use-reduction strategies.

Embodied Carbon. Decreasing GHG emissions from the construction of facilities by using low-embodied-carbon materials, designing long-lasting structures and supporting the reuse of facilities.

Operational Resilience. Mitigating risks from climate and earth hazards to reduce impacts from projected changes due to flooding, wind, winter weather, wildfires and other extreme natural events.

We partner with organizations to understand their unique needs. Our process starts with a comprehensive carbon assessment to establish a baseline. Next we set goals and establish metrics and then explore available decarbonization and resilience pathways across all emissions scopes and quantify their effectiveness. Next comes selection of the best strategies for the organization and the highest return on investment. Then we collaboratively establish targets, timelines and action plans. Finally, we monitor results – and look for ways to make additional improvements.



COURTESY HARTSHORNE PLUNKARD ARCHITECTURE

The design's embodied carbon came in 15% below that of a concrete structure designed to Passive House standards.

Milwaukee Tall(er)

PARTNERS: HPA, THE NEUTRAL PROJECT, C.D. SMITH

The Edison is on track to become the world's tallest timber building in 2027, when the residential project tops out at 375 feet.

To achieve this record, the project employed several innovations – many based on what we learned designing Ascent (currently the tallest, about a mile away). We used our Advanced Timber Delivery process, delivering our structural design model to the fabricator. And we worked with the contractor to develop a hybrid system that encases all connections in concrete to enhance constructability and fire protection. “We sat with the contractor and asked: ‘What’s easiest for you?’” says Associate Principal Jordan Komp, leader of our structural design team. “‘How do we want to build it? Do the logistics work for you?’ Everything was on the table so we could innovate fast.”

Timber Blazes a Trail

PARTNERS: TURNER, BROOKFIELD PROPERTIES, SOM, FRIENDS OF THE HIGH LINE, EMPIRE STATE DEVELOPMENT

In Manhattan's fast-evolving Far West Side, a new public pathway links the High Line with the Manhattan West development and the Moynihan Train Hall. Comprising the weathering-steel Woodland Bridge and the glulam-truss Timber Bridge, the [High Line-Moynihan](#) connector has made this part of the city more walkable.

The Timber Bridge demanded bespoke solutions. “As part of the design-build team, we worked with the architect and contractors to develop nearly flush timber joints,” says Mike Bauer, a Thornton Tomasetti principal, who led our team. “We had to conceal connections and ensure they perform well for a 75-year life in a harsh environment.” The key to success was full collaboration of the design team, fabricator, contractor and stakeholders.



THORNTON TOMASETTI/BESS ADLER

Mike Bauer of Thornton Tomasetti with Adam Bukberg of Turner Construction, Diana Zakem of Brookfield Properties, Terence Cho of Empire State Development, and Patrick Hazari of Friends of the High Line.



KRISTON JAE BETHHEL

Christina Chu-Garcia of Thornton Tomasetti with Ruchika Modi, principal, PAU, at the Hobson College site.

Hybrid Design for Sustainability

PARTNERS: PAU, PRINCETON UNIVERSITY

A commitment to sustainability, a central tenet of Princeton University's residential college construction program, informed the design of the new 510-unit [Hobson College residence hall](#). The design mitigates embodied carbon (EC) by engaging part of an existing building that might otherwise have been demolished, salvages site paving, reuses old-growth lumber and employs mass timber and other low-EC materials.

“Eli Gottlieb, Christina Chu-Garcia, Andrew Altamirano and Vishwadeep Deo are not only some of our closest collaborators and thought partners, but also our sounding boards and allies,” says Ruchika Modi, a principal at design architect PAU. “This camaraderie was instrumental in fostering the ingenuity and thoughtfulness that went into the design of Hobson College – one that elegantly achieves the university's ambitious sustainability, operations and aesthetic aspirations.”

Timber Sets Record at Southstone Yards

PARTNERS: DUDA|PAINE, GENSLER, CROW HOLDINGS, PURDY-MCGUIRE

The country's largest timber office building, at 235,000 square feet, is rising in an old rail yard north of Dallas. The main challenge at [Southstone Yards](#) was fitting seven stories within the allowable height. A late change in the timber supplier required our structural team to redesign for the new manufacturer's specs. And squeezing MEP services under the glulam beams added another layer of complexity. Collaboration with the architecture and MEP teams allowed us to modify our design to accommodate an advanced MERV 15 filtration system.



Our life-cycle analysis showed that the timber design reduced the building's embodied carbon by 34%, compared to a baseline all-concrete structure.

Strong Connections Make a Timber Gathering Place

PARTNERS: STUDIO GANG, MEMPHIS RIVER PARKS PARTNERSHIP, TIMBERLAB, MONTGOMERY MARTIN CONTRACTORS, GRINDER FABRICATING & ERECTION, TITAN STEEL

The reinvigoration of a public space along the Memphis, Tennessee, waterfront culminated in the September 2023 opening of the newly transformed 30-acre [Tom Lee Park](#). We provided structural engineering services for three components, notably the signature steel-and-timber Sunset Canopy. Studio Gang tasked us with detailing concealed connections for large loads, a harsh environment and constructability. "Timber isn't like steel," says Nate Sosin, associate principal and project lead. "There is a developing market of proprietary connectors, not a well-defined kit of parts. We had continuous discussions with the architect, contractor and fabricator to find solutions that met everyone's needs."

The centerpiece of the \$61 million project is the steel and wood canopy, comprising 150 glulam members with concealed connections, designed for harsh conditions.

THORNTON TOMASETTI



High Embodied Values, Low Embodied Carbon

PARTNERS

GENSLER, BINDERHOLZ, WHITING-TURNER, MGAC

When Under Armour (UA) started planning a new building on their Baltimore, Maryland, campus, they wanted it to reflect their commitment to optimizing performance and acting sustainably. We helped architect Gensler to embody these values in the design of [Teammate Building 2 \(TMB2\)](#), UA's new global headquarters. The 280,000-square-foot office building is being constructed almost entirely of mass timber – an eco-conscious choice that cuts the structure's embodied carbon (EC) and imparts an appealing aesthetic to its interior spaces. Our structural design also supports a rainwater capture system, a green roof and a canopy carrying photovoltaic panels to help the new headquarters achieve net-zero-energy operations.

During the first phase of design, we collaborated with Gensler to develop structural schemes for mass timber,

concrete and steel to uncover the pros and cons of each. We calculated quantity estimates for all three and used [Beacon](#) – the EC-tracking Revit plug-in we developed – to assess the EC impacts of all three materials. These details helped UA evaluate the options and make a fully informed decision to choose timber.

When Austrian mass-timber supplier binderholz was selected, we engaged with their team on the design of structural components. Switching from imperial to metric measurements was just one part of it. Collaborating closely, we evolved our design to accommodate their proprietary connections and adjust member sizes to match their fabrication practices. “Mass timber hasn’t standardized yet,” says Thornton Tomasetti Associate and Lead Engineer Doug Schweizer, “so conforming our structural details to their preferences was much more cost-effective than specifying custom shapes. And at the same time, we could make sure the final design didn’t stray from Gensler’s vision.”



MASS TIMBER HAS
50%
LESS EMBODIED
CARBON THAN
CONCRETE AND
65%
LESS THAN STEEL

“THERE’S STILL A MASSIVE
LEARNING CURVE WHEN
IT COMES TO EFFECTIVELY
CONSTRUCTING MASS
TIMBER PROJECTS OF THIS
SCALE. WORKING WITH
TRUSTED PARTNERS ALLOWS
FOR A SMOOTH PROCESS
TO ENSURE WE DELIVER ON
THE CLIENT’S VISION AND
DESIRED EXPERIENCE.”

–JJ RIVERS, GENSLER

Doug Schweizer of Thornton Tomasetti and JJ Rivers, principal and studio director at Gensler, at TMB2. In addition to its EC benefits, mass timber also sped construction and drastically reduced the need for interior finishes.

SHOWING THE VALUE OF MASS TIMBER



INTEGRATED SERVICES SHORTEN THE PATH



Multidisciplinary in Miami

PARTNER: FOSTER + PARTNERS

Sometimes internal partnerships are a key benefit to forging the best path to project success. When we perform multiple services on a single project, we're able to offer holistic thinking and superior coordination that are value multipliers. This is especially true for the new Citadel headquarters, a supertall building under design in Miami, Florida. We're providing structural design, protective design and security consulting, sustainability and resilience, and waterproofing services.

Combining services offers more than the simplicity of "one-stop shopping." It also creates opportunities for synergies that

Thornton Tomasetti team members from five disciplines and four offices meet to share information and coordinate efforts. Clockwise from center: Jose Rodriguez, Claudine Williams, Barbara Gao, Peggy Van Eepoel, JJ Tobolski, Carolina Simoes and John Peronto.

could go undiscovered if separate consultants were used. Resilience and protective design offer examples: "Multihazard risk assessment and design give us a chance to look for combined solutions," says Peggy Van Eepoel, Washington, D.C., office director and protective design and security project lead. "A resilience feature like hydraulically deployable flood barriers can also provide an extra layer of security at building entrances to mitigate a civil disturbance threat."



Delivering a Community Vision

PARTNERS: STUDIO GANG, LENDLEASE, DDC/PARKS DEPARTMENT, WSP, ATELIER TEN

Construction is underway on the [Shirley Chisholm Recreation Center](#) – named for America's first black woman congressperson, who was elected in 1968. Echoing Chisholm's championing of women and minorities, the East Flatbush community advocated for a new recreation center that provides fitness facilities, an indoor pool, and learning and media centers.

Our scope for the design-build project encompasses structural, façade, civil and geotechnical engineering. A key challenge was the inclusion of long-span timber elements in the natatorium.

After performing extensive analysis, we worked with the timber engineer



COURTESY STUDIO GANG © NEW YORK CITY DEPARTMENT OF DESIGN AND CONSTRUCTION

The Shirley Chisholm Recreation Center in Brooklyn, New York, is due to open in 2025.

and fabricator, contractor, architect and MEP designer to specify and document the durability of timber in the high-humidity setting. Another challenge – a last-minute change to state regulations – required a swift redesign of stormwater drainage systems to meet the ambitious schedule.

Tight collaboration between the structural and façade teams also yielded multiple cost-effective options. “Design-build projects have a reputation for focusing on time and cost,” says Tanya de Hoog, our project lead. “We made the extra effort to get the most from our integrated approach and achieve the design quality the community asked for and deserves.”

All Power to the Energy Transformation

Collaboration between our forensics and applied science experts is helping safely demolish coal-fired power plants to make way for greener energy production in California, Georgia, Illinois, Kentucky, North Carolina and Ohio.

Our applied science team develops high-fidelity engineering simulations of explosions and explosive felling, dust cloud dispersion and vibration. A deep understanding of why structures fail helps our forensics specialists effectively analyze them, plan controlled destruction – by explosive felling or mechanical deconstruction – and prevent accidental collapse.

Combined, these skill sets provide an unmatched ability to manage safety and mitigate risk during the demolition of outdated power plants.

We partner with utilities, helping plant owners develop RFP (request for proposal) specifications that include robust safety and risk-management provisions or performing peer reviews of demolition plans. We also team with demolition contractors to determine the best approach for each project and devise means and methods. “When a contractor brings us in during the pre-bid phase, it shows that they’re proactive about managing risk,” says Vice President Mahesh Bailakanavar. “And that can set a really positive tone with the utilities.”

We’re working with B&B Wrecking and Excavating on demolition of the 1960s-era coal W. H. Sammis Power Plant in Stratton, Ohio.



THORNTON TOMASETTI / GUILLERMO MONTERO

Buffalo Modern

PARTNERS

OMA, COOPER ROBERTSON, GILBANE, ARC
BUILDING PARTNERS, ZUBATKIN, GEORGE
WHEELER, PH.D.

“With so many scopes of work happening simultaneously, close collaboration with Thornton Tomasetti meant that our work often intertwined with theirs,” says Jason Cadorette, senior associate at Cooper Robertson, architect of record for the [Buffalo AKG Art Museum redevelopment](#) in New York. “We worked extremely well together, respecting each other’s boundaries but always willing to help when the lines got blurred.”

The museum – a national landmark and an important repository for modern and contemporary art – underwent a multimillion-dollar renovation and expansion in 2023. The campus, established in 1905, now boasts three primary exhibition spaces. The most recent addition, the Gundlach Building, connects via the new John J. Albright Bridge to the original neoclassical Wilmers Building. Farther south lies the Knox Building, constructed in 1962. Its formerly open-air courtyard, *Town Hall*, is now enclosed by a glass-and-mirror canopy called [Common Sky](#) – conceived by artist Ólafur Elíasson and architect Sebastian Behmann of Studio Other Spaces – for which we performed structural and façade engineering.

Throughout the redevelopment, our multidisciplinary professionals worked as a unified team with project stakeholders, performing multiple tasks, including façade engineering, condition assessment, restoration, roofing and waterproofing.

To obtain approval for our restoration plan, we participated with OMA in a hearing before the New York State Historic Preservation Office to demonstrate that the project would follow the Secretary of the Interior’s Standards for the Treatment of Historic Properties. We worked with architects OMA and Cooper Robertson to revitalize the Wilmers Building, restoring stonework, cleaning the marble façade to reveal its original white color, and designing a roof replacement that restored the ornate copper cresting that encircled it.

The Gundlach Building opened in August, adding 91,000 square feet to the museum’s exhibition and programming space. Its standout feature is the “veil,” a custom glass-and-steel diagrid that encloses the building. We worked closely with the architects and façade contractors to select materials and develop details for the veil that were suited to the climate and fulfilled the design intent while regulating light, heat and condensation. We also collaborated with the design team and façade contractors to select, detail and test the new marble cladding. The stone-selection process, led by OMA, along with careful detailing, ensured the closest aesthetic match among the marble slabs.





BRINGING THE PIECES TOGETHER

**"COLLABORATION WAS
ESSENTIAL TO ACHIEVING
OUR SHARED VISION - TO
COMPLEMENT THE HISTORIC
STONE FAÇADES AND PAY
TRIBUTE TO DELAWARE
PARK AND THE BUFFALO
COMMUNITY."**

-LAWRENCE SIU, OMA



**Jason Cadorette of
Cooper Robertson;
Efe Karanci, Michael
Palmisciano and Silverio
Patrizi of Thornton
Tomasetti; and Lawrence
Siu of OMA.**

Thornton Tomasetti Gives Back

Our program nurtures our people's passion for community service, encourages personal growth and promotes lasting relationships. Through our charitable initiatives, the firm and our staff support the next generation of professionals, strengthen the communities where we live and work, and help people in disadvantaged regions of the world.

In 2023, we donated \$525,486 to charities and educational organizations and paid employees for 3,036 hours of volunteer work. We initiated an ongoing program to match employee contributions to the Red Cross disaster relief campaign, raising \$20,680 in the first year.

And we continued to provide support to the [ACE Mentor Program](#), the Lee Petrella and Daniel A. Cuoco Memorial Scholarships, and the [Thornton Tomasetti Foundation](#).

This year, Thornton Tomasetti Gives Back funded 1,398 hours of "employees' choice" community service and 1,238 for coaching high school students through the ACE Mentor Program. Since the 2018 start of our partnership with Bridges to Prosperity, our employees have helped construct four bridges. The projects, in isolated areas of Panama and Rwanda, enable safe access to economic opportunity for more than 10,000 people.

The Path to Carbon Neutrality

Milestones in Our Journey

2012

- Established sustainability practice
- Initiated green champions program
- Conducted first emissions inventory

2013

- Began publishing annual sustainability report
- Established green office certification policy

2014

- Set goal of carbon neutrality by 2030
- Offset all air-travel emissions annually

2015

- Joined U.S. EPA Green Power Partnership
- Offices began purchasing green power at the local level

Our Carbon Footprint

In pursuit of our goal of carbon-neutral business operations by 2030, our target is a 5% reduction in absolute CO₂e emissions (from 2018 baseline levels) each year. To achieve this, we're reducing carbon emissions wherever possible and purchasing

offsets to cover the rest. We accomplish reductions by designing or moving into high-performance offices, purchasing renewable energy and reducing air-travel emissions. We're now in our ninth year of offsetting all our air travel.

In 2023, our absolute emissions declined by 3.4% despite a 10% growth in our workforce. Per capita emissions continued to drop, with reductions of 12% from 2022 levels and 53% from the 2018 baseline. And for the first time, we purchased Renewable



3,000+

company-paid community
service hours in 2023

55%

increase in volunteerism
since 2022

Over \$2 million

in charitable giving since 2018

42%

increase in charitable
contributions since 2022

Schoolchildren in Nyagisumo, Rwanda, with the 2023 Bridges to Prosperity team.

THORNTON TOMASETTI/FRANK FANG

35%

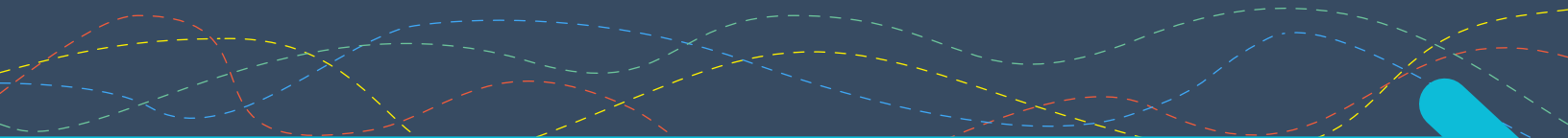
decrease in
absolute emissions
since 2018

2.05

MT CO₂e average per
capita emissions in 2023

42%

offices using
green power



2020	2022	2023	2024
<ul style="list-style-type: none">Established environmental policy	<ul style="list-style-type: none">Conceived our Climate Action initiative, deepening our commitment to sustainable operations, decarbonization and resilience services	<ul style="list-style-type: none">First year reporting in reference to Global Reporting InitiativeFinalized climate-action planPurchased 100% green power for all U.S. offices	<ul style="list-style-type: none">Verified emissions inventory internallyCommitted to the Science Based Targets initiative (SBTi)

Energy Certificates for green power for all U.S. offices.

Next year, we'll set science-based reduction targets for our Scope 2 and 3 emissions, per SBTi guidelines. We'll further inspire reductions in energy consumption by upgrading our

data-management and visualization technologies. While our carbon footprint calculations are based on emissions from our internal operations, we've long been measuring the embodied carbon in the projects we design, in line with industry practice.



READ THE FULL
CORPORATE
RESPONSIBILITY
REPORT.

BUILDING ENDURING COMMUNITIES

Surfside Insights

On June 24, 2021, Champlain Towers South, a 12-story beachfront condominium in Surfside, Florida, partially collapsed, killing 98 people and injuring 11 others. To determine what caused the collapse, our forensics team reviewed the building design and performed linear and nonlinear analyses to simulate various collapse sequences.

[Our investigation](#) revealed that some of the building's columns were too small and that its column-to-slab connections were insufficient to prevent punching shear (a failure that occurs when a flat slab detaches from a column, in which the column appears to "punch" through the slab). These findings explained how the collapse progressed through most of the structure.

After the collapse, Florida enacted a statewide law requiring milestone inspections for buildings of certain types, sizes and locations. "We're committed

to safety," says Senior Associate Lauren Millman, "so we're educating owners, property managers and insurers about the new legislation and helping them fulfill its requirements." To nurture transparency and long-term relationships in the communities we serve, we've also developed a web-based hub to help monitor their buildings' health; remind them of necessary maintenance, repairs and inspections; and enable them to track their assets. One of our goals for the website – and the publication of our findings – is to inspire stakeholders to be more proactive about building safety.



[LEARN MORE
ABOUT INSIGHT AT
TT. OUR BUILDING
INFORMATION HUB.](#)

A rendering shows punching shear as it occurred at the site.



THORNTON TOMASETTI/LORENZO SANJUAN

Installation of the new deck.

Revitalized Bridge Speeds Connections

PARTNERS: NYC DOT, HABERLE STEEL, GPI, AMERICAN BRIDGE

Rehabilitation of the Ed Koch Queensboro Bridge concludes this year with a durable [new upper-level roadway deck](#) that will extend the life of the bridge for years to come. To support the new roadway, our specialists designed a customized-welded, open-rib orthotropic deck with a waterproof overlay. The open-rib design, which is uncommon in the U.S., uses less steel than other options. This lowers embodied carbon and reduces the load carried by the bridge's 115-year-old steel trusses.

As with all rehabilitation projects for aging, complex structures, designing new systems to fit within legacy components required unique detailing. Our designers used custom finite-element software to create 10 rib configurations with varying panel depth and length.

The project also adds dedicated pedestrian and cyclist lanes that will more safely convey people between Queens and Manhattan.

Banking on a Vibrant Neighborhood

PARTNERS: FUBON HOLDING GROUP, RENZO PIANO BUILDING WORKSHOP

The [Fubon Xinyi A25 development](#) doesn't just add an iconic tower to the Taipei business district. It welcomes the surrounding community as well. Visitors can tour the contemporary art museum or browse in the retail pavilion, while the public garden provides shade trees and a neighborhood park for nearby residents. Our façade engineers collaborated with the designers and the owner to develop an innovative double-skin façade that reduces the buildings' energy consumption well beyond the minimum Taiwanese code requirements. The design incorporated more ambitious targets than are typical in the region, and the building ultimately achieved best-in-class thermal and solar performance levels.



© HSIANGYUN MAI

The Fubon Xinyi A25 project includes three buildings – a commercial tower, an art museum, and a retail and services pavilion.



JASON O'REAR

Google Tower Block 185 stretches 36 stories into the Texas sky.

Smooth Sailing in Texas

PARTNERS: TRAMMELL CROW COMPANY, PELLI CLARKE & PARTNERS, STG DESIGN

[Google's new Texas headquarters](#)

embraces Austin's outdoors spirit with a sail-like shape and landscaped terraces, while the ground floor provides dining and retail with an open lobby leading to the Second Street shopping and entertainment district. Our structural engineers worked with the project team to ensure that the LEED-Platinum tower fit seamlessly into its tight footprint on the Colorado River. We also collaborated on a plan to minimize pandemic delays by ordering equipment in advance and staging it off-site to meet tight delivery windows. Despite the uncertainty caused by COVID, the project was delivered ahead of schedule.

Nick Pawlowksi of
HMBS, Mary Williams
of Thornton Tomasetti,
Gopi Swaminathan
of Corgan, and Rob
Stadler of LeJeune at the
module assembly site.

MOVING ATLANTA INTO THE FUTURE

Teamwork Takes Off

PARTNERS

CORGAN, GOODE VAN SLYKE
ARCHITECTURE, HMBS (A JOINT VENTURE
OF HOLDER CONSTRUCTION, C.D. MOODY
CONSTRUCTION, BRYSON CONSTRUCTORS
AND SOVEREIGN CONSTRUCTION AND
DEVELOPMENT), LEJEUNE STEEL COMPANY

At just 60 feet wide, Concourse D is Hartsfield-Jackson Atlanta International Airport's narrowest. It was designed for regional planes of the 1980s, but today's larger jets make the concourse uncomfortably crowded. Work is underway to [expand Concourse D](#) to increase capacity and greatly improve the passenger experience.

An ingenious system that [uses modular construction and careful phasing](#) will minimize disruption. A series of 25-foot-wide modules will be built on a nearby site and moved by night to abut the east side of the concourse. Then work will make a "U-turn" to add a five-foot extension to the boarding level on the concourse's west side. This will be built in sections that extend over the existing structure and connect to the modules opposite. Finally, the old roof will be dismantled, interiors finished and temporary walls removed section-by-section. This method assures that only eight gates need to be taken out of service at a time.

Our structural designers worked seamlessly with our construction engineers, who were hired by steel fabricator LeJeune to provide Advanced Project Delivery™ (APD) services. The teams collaborated to deliver a fully connected 3D model from which the fabricator could produce shop drawings and digital information for fabrication equipment.

Building the modules off-site and moving them adds extra considerations to the structural design and detailing. Says Swapnil Deshpande, an associate principal and our APD lead, "We had to think about temporary forces and bracing at the assembly site, as well as the configuration and permanent forces after installation. The connections had to work for both."

An important tool for managing these intricacies is a weekly "rally call" that "brings us all together for proactive coordination," says Mary Williams, vice president and structural project manager. "We can resolve questions on the fly and head off problems in the field."



**"ON A PROJECT AS
COMPLEX AS THIS,
EXCEPTIONAL
TEAMWORK ISN'T
A PLUS, IT'S A
NECESSITY."**

—MARY WILLIAMS
THORNTON TOMASETTI



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In this annual review,
we aspire to bring
you content that is
interesting and useful.

**Did we succeed?
Let us know by taking
a five-question survey.**

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INNOVATIVE METHODS

Sustainable Façades Get Greener

PARTNERS: HENNING LARSEN,
INNOVATION GLASS

At the 2023 Architectural Ceramic Assemblies Workshop in Buffalo, New York, our façade engineers were part of a team that [developed a prototype](#) for a curtain-wall-supported green screen-wall system that promotes moss growth on terra cotta. Moss has many eco-friendly properties, such as exceptional carbon-sequestration, water-retention and air-filtration capabilities, and it readily adapts to varying ecosystems. And root-free moss requires less maintenance than green walls that use other plants.

The terra-cotta-and-moss screen wall is supported by a backup curtain wall that allows building occupants to view the moss as growth spreads to the back of the panels.

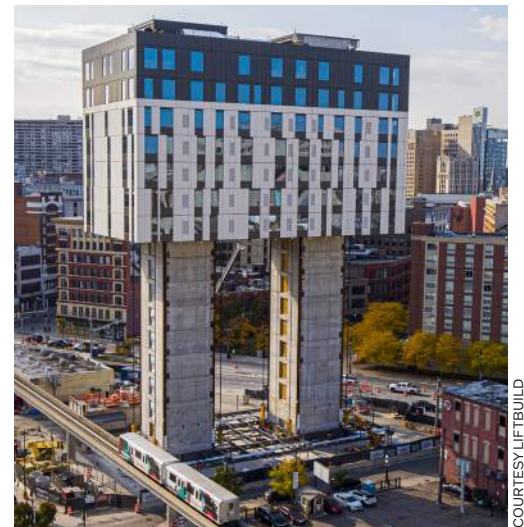


THORNTON TOMASETTI/JOSEPHINE STODDARD

Detroit Gets a Lift

PARTNER: LIFTBUILD

Exchange, a 16-story mixed-use residential tower in Detroit's Greektown district, represents the first implementation of LIFTbuild® technology, which takes an innovative Vertical ManufacturingSM approach to construction. LIFTbuild has reimaged the top-down method originally pioneered by Thornton Tomasetti Founding Principal Charlie Thornton (p. 42) in the 1970s. It reverses the construction process by using strand jacks to raise a building's completed upper floors to their final elevations before the lower ones are constructed. Because most of the construction, including curtain-wall installation, is completed at grade, each floor is fully enclosed at its lifted position, which improves safety by eliminating the need for exterior fall protection. At Exchange, collaboration among contractors, designers and fabricators improved the construction process even as the floors were being raised.



COURTESY LIFTBUILD

LIFTbuild is up to 30% faster and less costly than conventional construction methods.

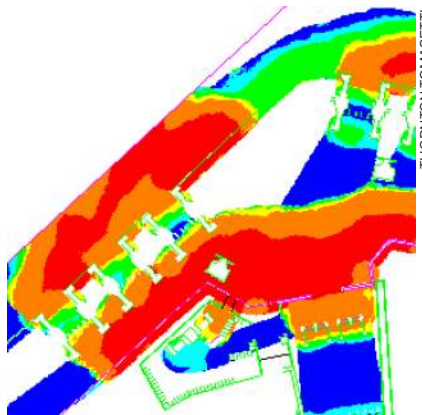


THORNTON TOMASETTI

Detailed concrete modeling has safety and insurance applications for all types of buildings and infrastructure.

Cracking the Code on Concrete

Nondestructive testing of concrete can detect voids, honeycombing and delamination. But because cracking in reinforced concrete is usually harmless, its potential to cause substantive damage is often overlooked. To understand how cracks form – and how they spread – we’re modeling concrete at unprecedented levels of detail, looking at ways to augment the capabilities of existing software and supplementing it with in-house tools. This expertise enables us to detect potentially dangerous cracks, identify the detriment associated with them and design effective reinforcement or replacement measures.



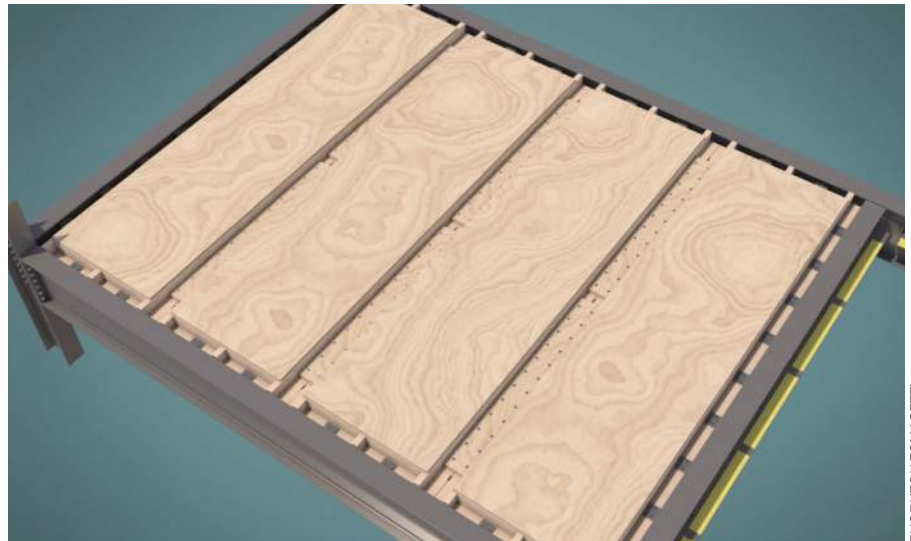
THORNTON TOMASETTI

Simulations can reveal where bottlenecks might cause overcrowding or other unsafe conditions (in red).

Think Inside the GreenBox

Conventional floor cassettes (prefabricated floor panels) are low-carbon, but because their fire, acoustic and vibration performance is limited, they’re used primarily in smaller buildings. Our patented [GreenBox™ system](#) is just as efficient – and it’s robust enough to use in large residential and commercial buildings. Constructed of wood and recycled

materials, GreenBox is beautiful and lightweight and can cut the embodied carbon in a building’s floors and frames by up to 40%, compared to concrete or cross-laminated timber flooring. And it’s easier to install. With an innovative filling that provides superior insulation, vibration damping and up to two hours of fire protection, GreenBox equals or exceeds the performance of other floor systems.



THORNTON TOMASETTI

GreenBox works for large bays and long spans in both residential and commercial buildings.

Ahead of the Crowd

Studying crowd movement patterns – how crowds respond to physical spaces and how behavior can change under varying conditions – is critical for the architects, city planners, event managers and emergency service providers who design and operate public venues. We couple commercial software with cutting-edge in-house tools to predict how buildings might perform during normal use, large-scale events,

or emergencies such as fires or active-shooter attacks. Then we offer practical solutions to enhance crowd flow and emergency response. By integrating our expertise in structural engineering, operational security and protective design with advanced [crowd dynamics and safety modeling](#), we help clients make informed choices that make their facilities work better for everyone.

THE NEXT STEP IN ED&I

Equity, Diversity and Inclusion (ED&I) Officer Vandana Juneja (center) with Women@TT leaders Allison Partridge and Samantha Eng.

Challenges & Opportunities

The past year has seen the environment for ED&I (or DEI) become more challenging. Judicial rulings, legislation and a growing number of legal disputes are causing some companies and institutions to pull back on ED&I efforts. Yet it's been proven that diverse and inclusive organizations are more creative and successful and better to work for. That's why we're expanding on our long-established initiative to cement ED&I into our culture, policies and practices.

We hired Vandana Juneja as the firm's ED&I officer in October 2023. Her mission? To strengthen our ED&I programs, track and accelerate progress, and advance our goal of becoming a place where all our people can bring their authentic selves to work.

Milestones

[Happy 10th Birthday, Women@TT!](#)

Founded in 2013 by then-Managing Principal Aine Brazil, Women@TT was our first employee network group (ENG). It was guided by the pursuit of gender equity and dedicated to promoting awareness, providing support, and driving firm culture. In the intervening decade, the ENG has chalked up a panoply of accomplishments, including establishing mentoring programs and leadership activities to support the advancement of women. It has grown to include 25 chapters and is now accessible to over 94% of employees.

ENG Highlights



MULTICULTURAL
Employee Network Group

We collaborated with industry partners to explore identity, recognize leaders and celebrate culture with cosponsored events for Asian American and Pacific Islander Heritage Month and Hispanic Heritage Month.



LGBTQIA+
Employee Network Group

Continuing our emphasis on visibility in the workplace, we marked National Coming Out Day by holding a discussion with Leslie McMurray of the



The Path Forward

In 2023, we enlisted Catalyst, a global consultancy focused on gender equity and workplace inclusion, to help us measure the success of our ED&I engagement to date. An all-staff survey, coupled with in-depth interviews, provided insight into what we're doing right – and where we need to do better. This data helped us define our priorities for 2024:

Perform an ED&I Audit. Understand how our policies, programs and practices affect ED&I.

Enrich Our ENG Community. Expand programming and engagement to deepen our sense of community.

Elevate Our Learning Journey. Refresh on-demand resources, conduct inclusive leadership workshops for all levels of

management, and expand training on understanding and mitigating unconscious bias.

Enhance Inclusive Career Growth. Hold listening sessions to learn about and cultivate effective pathways to advancement for all.

Foster Community Through Courageous Conversations. Create more opportunities for coming together to share our stories, communicate authentically and listen to one another.

Map the Future. Build a plan for ED&I efforts to align with the firm's next five-year (2025–2029) strategic plan.

Dallas Resource Center, "Bringing Your Whole Self to Work."

**Women
@TT**

WOMEN'S
Employee Network Group

In celebration of International Women's Day 2023, women leaders from

our Chicago, San Francisco and Washington, D.C., offices presented our fourth leadership panel, examining the impact of trusting relationships on women's career development.

31%
are women

38%
in the U.S. are from nonwhite ethnic and racial backgrounds

95%
would recommend the firm as a great place to work

90%
agree that we're an inclusive workplace

"OUR STRATEGIC ED&I PRIORITIES STAND ON A SOLID FOUNDATION BUILT THROUGH THE COMMITMENT OF OUR ENGS AND OUR LEADERS. BY CONNECTING HEADS, HEARTS AND HANDS, WE'RE CREATING AN INCLUSIVE CULTURE WHERE EVERYONE CAN BE THEIR AUTHENTIC SELVES AND THRIVE."


–VANDANA JUNEJA

“ON DAY ONE WE ASKED EACH TEAM MEMBER, ‘WHAT DOES A SUCCESSFUL PROJECT LOOK LIKE TO YOU?’ WHILE EVERYONE HAD A SLIGHTLY DIFFERENT ANSWER, IN THE END, A SUCCESSFUL PROJECT ULTIMATELY LOOKED THE SAME TO ALL OF US.”

—JULI KAWAHATA, CALIFORNIA DGS

MASTERING EFFECTIVE COMMUNICATION





Brian Kenworthy of ZGF, Katie Hansan Post of Thornton Tomasetti and John Petty of Hensel Phelps at RBOC in Sacramento, California. The development, which consists of four mid-rise buildings, will soon house state employees.

Together Apart

PARTNERS

HENSEL PHELPS, ZGF, CALIFORNIA
DEPARTMENT OF GENERAL SERVICES (DGS)

When the design-build contract for the 1.25-million-square-foot [Richards Boulevard Office Complex \(RBOC\)](#) was awarded in February 2020, the team had planned on using a “big room” approach. Then COVID shut everything down in March. In spite of this, all members were committed to maintaining that sense of being one big team.

They leaned hard on remote working technologies, and “by keeping communication

channels open and strong and by building strong relationships, we were able to get together and solve a lot of issues quickly,” says Brian Kenworthy, design principal at architect ZGF. Our structural engineers have a decades-long history of working with both Hensel Phelps and ZGF, and those established relationships proved to be particularly beneficial for this project.

Close collaboration allowed us to develop early steel-fabrication packages – providing flexible details that enabled the design to continue while allowing for long-lead steel procurement and pandemic-related supply chain issues. This strategy let steel erection begin just a year after notice to proceed, helping meet a tight schedule. And all challenges were handled as a

team. “There was never a point where people were pointing fingers,” says Associate Katie Hansan Post. “We said, ‘Here’s our problem. Let’s get together and find what works.’”

As with any project, it’s not always easy. “Sometimes issues come up and we need to have difficult conversations,” says John Petty, operations manager at Hensel Phelps, “but we’re a good team – we can deal with those things and celebrate the wins and keep those relationships strong.”



THORNTON TOMASETTI / BRIAN MACRAE



Well, Designed

PARTNERS: SRG PARTNERSHIP, CLARK|ABBOTT JOINT VENTURE

When the [University of Washington Medical Center's Center for Behavioral Health and Learning \(CBHL\)](#) opens in Seattle in 2024, it will add 150 much-needed inpatient psychiatric beds. It will also set new standards for patient-centered care and for training the next generation of behavioral-health providers – goals that are embedded into the building's design.

Our structural engineers worked with the design-build team on a SidePlate® perimeter moment frame, a lateral system that leaves room for open interior spaces. This arrangement provides maximum flexibility, lets in abundant daylight and allows for larger-than-usual treatment areas to accommodate teaching.

The forward-focused facility has spacious private rooms and landscaped terraces designed for patient safety.

Members of the design-build team visit an outdoor terrace where patients will engage in therapy, recreation and exercise, one of many features creating a welcoming, noninstitutional atmosphere.

Dedicated spaces for telepsychiatry sessions will extend services to underserved communities. And the six-story CBHL is fully integrated into the medical center's Northwest campus. Two pedestrian bridges connect it to an adjacent hospital, and its first floor houses a cafeteria for staff, students and visitors.

Design and construction speed was crucial for the taxpayer-funded project. Washington State's critical need to expand behavioral health services was one reason. Another was the rapid rise in the cost of materials during the pandemic. Our construction engineers produced an advance steel package that locked in prices early and ensured timely delivery despite supply-chain challenges.

Stadium Roaring Into the Future

PARTNERS: POPULOUS, STAHL SHEAFFER ENGINEERING, A+F ENGINEERS, BARTON MALOW AECOM HUNT ALEXANDER JOINT VENTURE

Penn State's 64-year-old Beaver Stadium will soon embark on a major renovation that will prepare the storied venue to serve the Nittany Lions and their fans well into the future. The four-year, \$700 million project is being phased to allow the stadium to remain at full seating capacity for football and other events.

We're collaborating with several longtime partners on the design. Our history with architect Populous includes dozens of sports projects



H. MARK WEIDMAN PHOTOGRAPHY/ALAMY STOCK PHOTO

Beaver Stadium, in University Park, Pennsylvania, before the renovation.

over three decades. We're also sharing the structural design work with two associate structural engineers: local business Stahl Sheaffer and A+F Engineers, a woman-owned business we've worked with seamlessly for 20 years. These established working relationships streamline a design process that is complicated by the need for careful phasing of every aspect of the work, which will reconstruct most of the west side of the grandstand and include clubs, suites, accessibility improvements and upgraded amenities.

MORIYAMA TESHIMA ARCHITECTS



Building Quiet Into Big Timber

PARTNERS: MORIYAMA TESHIMA ARCHITECTS, ACTON OSTRY ARCHITECTS

Our acoustics team faced several challenges in designing quiet classrooms and public spaces at [Limberlost Place](#), the new home of the architecture school at George Brown College in Toronto, Ontario. The building's open design, mass-timber structure and generous air passages for convection-based ventilation meant that noise abatement required ingenuity and teamwork.

Starting at concept development, we collaborated with the architects

Use of mass timber in facilities such as the 10-story Limberlost is a key component in reducing the embodied carbon of the built environment.

to design sound-absorbing ceiling systems that reduce reverberation while harmonizing with the aesthetic vision. To limit footfall noise, we worked with the contractor to include a sound-insulating rubber layer between the cross-laminated-timber floor and the concrete overlay. And we partnered with the HVAC team to develop baffles in the large air-transfer passages to reduce intrusive noises from neighboring indoor spaces. Another creative solution? In-passage hot-water heating units that double as acoustic panels.

How Are We Thinking About Artificial Intelligence Today?

AI is quickly permeating engineering design and analysis. Just a year ago, [CORE lab](#), our R&D program, had only one project involving AI. This year, four of nine research projects incorporate it. Our industry is exploring four primary AI/ML (machine learning) applications:

Automation. We can replace repetitive tasks with automatic predictions based on preexisting solutions. Column spacing changes from 40 to 30 feet? No problem. Floor framing, column, slab and foundation dimensions recalculate instantly.

Iteration. What if we reduce the concrete core thickness by 15% and increase the steel column forces? AI can show how to optimize a design whether we change two or 200 variables – in any increments.

Foresight. What are the known and unknown unknowns? What building materials can address the challenges of constructability and low carbon footprint? AI can provide inspiration and link us with like-minded colleagues and collaborators.

Education. ML can extract knowledge from varied sources – including drawings, files, spreadsheets and emails. When we can quickly and easily organize and harvest data from them, we can accelerate trial-and-error learning.

By embracing this new kind of learning, companies with a culture of sharing information will leapfrog those that hoard data.



THORNTON TOMASETTI

Traditional modeling of HVAC system performance takes two weeks for buildings like this assisted-living facility in Scarborough, Maine. Our AI/ML approach produces a first model in seconds.

Next-Gen AI Energy Modeling

Today's energy modeling is a tedious process: chasing down myriad inputs, followed by weeks of modeling and analysis – only to arrive at an answer that is out-of-date because the design or procurement has moved on.

We're revolutionizing this process, using AI/ML to deliver instantaneous results. This research, led by Associate Principal Vamshi Gooje, involves training a model on thousands of projects, spanning 20 years, including open-source databases. This speed allows for immediate feedback, real-time collaboration and swift decision-making. While conventional modeling remains essential for addressing nuanced questions and compliance verification, our focus is on enhancing AI/ML model accuracy and forecasting operational carbon. It's a transformative approach, streamlining a once-lengthy process into a rapid, data-driven solution for the future.

AI & ML for Climate Prediction

Climate risk assessments that inform how the built environment might accommodate future weather rely heavily on climate-model predictions derived from historical trends and data. AI presents an exciting opportunity to explore new ways to model these conditions.

Using 70-year continuous

historical datasets recorded by the National Oceanic and Atmospheric Administration, we trained ML models to predict an hourly temperature dataset that can be used in building analytics to estimate monthly heating and cooling demand.

Incorporating additional information, like other data stations, dry and wet bulb temperatures, dew point and relative humidity, we

Optioneering Façade Embodied Carbon

Asked why he robbed banks, Willy Sutton reputedly replied, “Because that’s where the money is.”

Following Sutton’s law, engineers trim the largest sources of embodied carbon (EC) – the frame and concrete floors – but often overlook the significant carbon embodied in the façade.

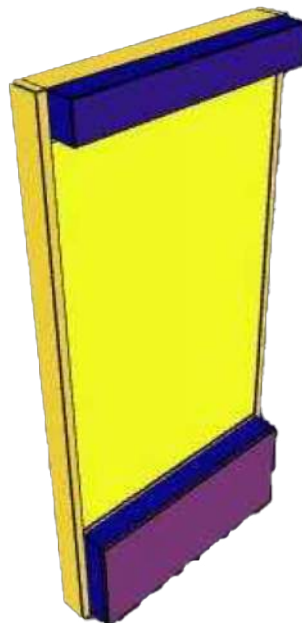
We’re developing a parametric tool to calculate the life-cycle EC of a façade panel based on its geometry and materials. Any design variable – such as bay dimensions and number of façade elements – can be modified to estimate its effect on EC.

Next, we’ll add more façade types and ensure accurate component data, which varies by fabricator. Then we’ll determine a correction factor, since at schematic design, the contractor might not have identified each material’s supplier. The goal is to provide the project team with a reasonable range of façade EC for a given design.

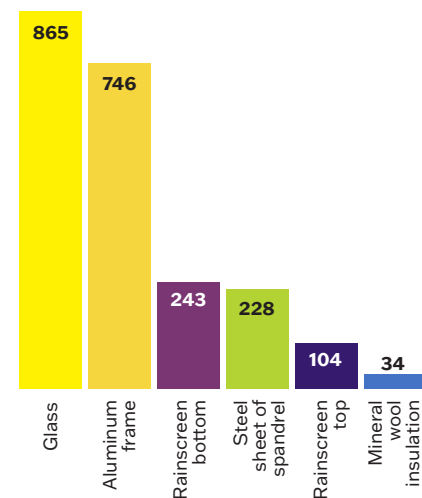
How we calculate façade embodied carbon: We start with multiple options for façade materials, using a Grasshopper-Rhino tool we built that extracts information from a materials spreadsheet. Then . . .



... we pick one option (fuchsia outline above) for direct parametric 3D visualization and . . .



... link it to our AI model to obtain an instant estimate of the carbon content of each façade component. Then we can adjust choices to minimize embodied carbon.



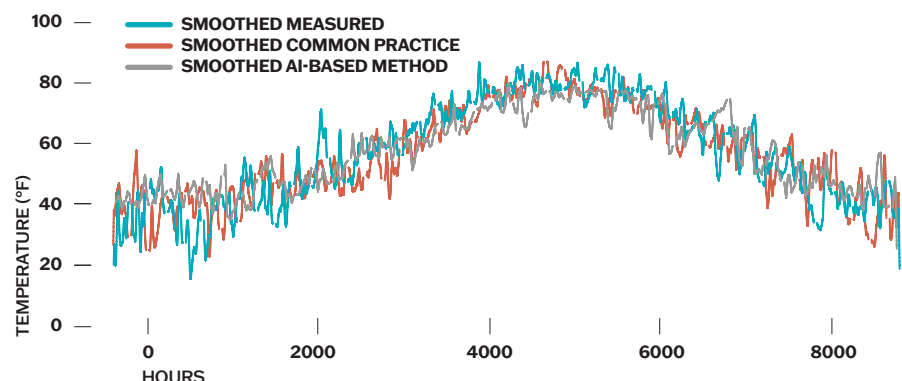
Product Stage (off-site emissions) (EC A13)

kgCO₂e per material

trained the model to predict hourly temperature data for 2020. The predicted and measured data track each other closely.

Our AI models, overall, produced less error than the common practice (University of Southampton’s CCWorldWeatherGen), which underpredicts heating demand and overpredicts cooling load. Further refinement of our approach should lead to improved building design and modeling of heating/cooling economics.

Measured Temperature vs. AI and Common-Practice Models
2020, Kennedy Airport



Making Thermal Networking Work

PARTNERS

HUDSON SQUARE PROPERTIES; COOKFOX ARCHITECTS; JAROS, BAUM & BOLLES

The retrofit of the historic [345 Hudson Street](#) office building adapts the Nordic idea of thermal networking to drastically reduce energy demand and carbon emissions. Heat recycling and sharing with nearby buildings cut energy demand by 30% and will reduce CO₂ emissions by 90% by 2040, when New York City's grid is scheduled to go all-electric.

Our multidisciplinary team led several aspects of the retrofit, including a new lobby connection to the adjacent building and elevator machine room structural repair and relocation. We also conducted forensic evaluation of the structure and façade, augmenting manual façade inspections with AI-driven T2D2 drone surveys to identify needed repairs or replacements. And we wired the building and the one next door to monitor vibration.

Yasser Khalifa of Thornton Tomasetti, Gavin Ennis of Hines, Kyle Dew of Thornton Tomasetti and Anthony Magliozzi of Hines on-site.





SYNCHRONIZING MOVING PARTS

“BUILDING A COHESIVE TEAM THAT COULD COORDINATE BETWEEN THE DIFFERENT PROJECTS HAS BEEN CRITICAL TO ENSURE SUCCESS.”

—BENJAMIN RODNEY, HINES



To enable heat sharing between buildings and floors and make room for high-efficiency MEP equipment, our structural renewal specialists designed extensive renovations – including lowering the ground floor and adding a penthouse level.

“Overlapping schedules and multiple design and construction teams running simultaneously, sometimes in adjacent areas, required intensive coordination,” says Yasser Khalifa, Thornton Tomasetti vice president and project manager. “Daily briefings and coordination within and between all teams made for steady progress and quick resolution of issues.”

The result? When completed this year, 345 Hudson will become one of New York’s most sustainable buildings and, says Benjamin Rodney, vice president with Hines (a partner of Hudson Square Properties), “It will showcase how ingenious design and engineering can help convert brown assets (buildings with excessive energy and carbon impacts) into green assets that are ready to take advantage of an all-electric, low-carbon energy future.”

2024 PURPOSE & VALUES AWARDS

Our annual Purpose and Values Awards recognize employees who exemplify exceptional support and collaboration with clients, partners and colleagues. This year's winners were chosen from among nominations submitted by co-workers across 17 offices.

PURPOSE:

We Embrace Challenges to Make Lasting Contributions



Brian Shen
Principal and Office Director
San Francisco

"The San Francisco office has the most amazing culture, thanks to Brian. His efforts to build the staff into a strong, cohesive group and make sure every person feels respected, listened to, and like an important member of the team can serve as a blueprint for other offices throughout the firm. The office reflects our core values and purpose and has its own local flavor."
–Theresa Curtis and Gary Panariello



Emily Kunkel
Vice President
Chicago

"There are few challenges facing the world that are bigger than climate change. Emily has applied her background in carbon capture and storage to promote our capabilities in that area, as well as in Thornton Tomasetti's broader climate-action agenda. She's driving development and promotion of our hydrogen knowledge and modeling capabilities, working on alternative energy and championing our embodied-carbon expertise."
–Pawel Woelke

VALUE:

We Are Passionate About What We Do



Megan McEveley
Senior Engineer
Perth

"Megan and the Women@TT Europe chapter coordinators have been instrumental in instigating a seismic shift in how our office approaches menopause and other female-specific challenges, which, for many, were previously uncomfortable topics. Megan, who recently relocated from the U.K. to Australia, helped destigmatize these women's health issues by setting up an awareness session to encourage open dialogue about them. This led to further discussions on mental health and well-being challenges for all our staff."
–Andrew Nelson, John Evans and Saffron Wyse

VALUE:

We Are Passionate About What We Do



Michael Bauer

Principal
New York

"Michael's passion for his work has made an impact across the firm. He serves as the liaison between the Structural Engineering practice and CORE studio and is a driving force behind many of our most mature in-house software tools, including TTColumn, TTVibration, Skipper and our emerging Shear Wall Automation Platform (SWAP)."

—Scott Lomax and Scott Schneider

VALUE:

We See Opportunity Where Others Focus on Risk



Pawel Woelke

Senior Principal and Applied
Science Co-Practice Leader
New York

"Pawel is leading the charge to explore challenging areas of decarbonization (nuclear, carbon capture, hydrogen, batteries) that were once unfamiliar to many at Thornton Tomasetti, educating himself and others on the topic and connecting with as many practices as possible. He has engaged people, both inside and outside the firm, to explore new opportunities and identify an entirely new area of services."

—Emily Kunkel

VALUE:

We Look Beyond the Obvious to Solve the Real Problem



Jessica McCoy

Senior Project Engineer
Fort Lauderdale

"Jess realizes that while technical solutions are a big part of our job, a bigger challenge is often managing clients' expectations. Whether the challenge is technical or client management, she listens to the client's needs and concerns, investigates the problem from various angles, and develops creative and appropriate solutions to the real problems."

—Michelle Olender

VALUE:

We Challenge People to Grow



Jason Albright

Senior Associate
San Francisco

"Jake is a leader by every definition of the word. He's a mentor, manager, advocate and coach, and he's successful in each role. We've seen firsthand how he nurtures his team, using positive and constructive feedback to help them develop and grow. We're consistently impressed by his insight and how he approaches situations with thought, respect and intention."

—Rupa Patel, Samantha Eng and Theresa Curtis

CELEBRATING THE IDEAS THAT DRIVE US

Investing in the Future of Engineering

The [Thornton Tomasetti Foundation \(TTF\)](#) is an independent 501(c)(3) organization that helps students prepare for careers in building engineering, design and technology by funding scholarships and fellowships for undergraduate and graduate students. TTF also supports initiatives that help communities around the world by providing financial assistance to individuals and organizations pursuing activities in building engineering, design or technology.



COURTESY CHARITY: WATER

In Cambodia, families build their own biosand filter and keep it at their home for daily use.

Delivering Clean Water

We donated \$10,000 to nonprofit organization [charity: water](#) to fund household biosand filters to more than 400 people in Cambodia, where nearly five million people lack access to clean water. The easily maintained filters remove pathogens by filtering water through a biological film, coarse sand, fine sand and gravel.

ADVOCATING FOR COMMUNITIES, STUDENTS & TECHNOLOGY

SURE Program

The Summer Undergraduate Research Experience (SURE) at Columbia University was established to increase diversity in science and engineering by providing a unique summer research experience for students from historically underrepresented and minority backgrounds. This year our \$15,000 donation sponsored Marylyn Carrillo, a first-generation Latina student at UCLA and second-generation immigrant, who studied how advanced traffic-mapping techniques can provide insight into the variables that determine which areas are crash-prone, laying the foundation for better traffic-safety strategies.



COURTESY COLUMBIA UNIVERSITY

Marylyn Carrillo participated in the 10-week summer program at Columbia University that introduces talented undergraduate students to STEM research.

Grants & Scholarships

Since its inception in 2008, TTF has distributed \$1.85 million in grants and scholarships. In 2023, the foundation granted

\$204,638

in scholarships and charitable contributions, including

\$45,000

to six college students through its national scholarship program and student innovation and technical literacy fellowships.

The foundation supports philanthropic organizations and individuals working in building design, technology and engineering.

Support in 2023 went to

- **Build Change**
- **Columbia University**
- **Community Impact Nepal**
- **The Cooper Union's Summer STEM Program**
- **Engineers for a Sustainable World**
- **Engineers in Action Bridge Builder Boot Camp**
- **Engineers in Action Capstone Program**
- **GeoHazards International**
- **International Society for Urban Health**
- **The Urban Assembly**
- **West End Secondary School**

INNOVATION & INVESTMENT



THORNTON TOMASETTI/ BESS ADLER

Representing the founding firms of AEC Angels are Ray Daddazio, Thornton Tomasetti; Cyrus Izzo, Syska Hennessy; and Robert Leon and James Donaghy, STO Building Group. Founders also include Bill and Chris Sharples and Gregg Pasquarelli of SHoP Architects, and Tom Scarangelo, Mike Squarzi and Grant McCullagh of Thornton Tomasetti.

OnScale

The OnScale acquisition by ANSYS has concluded. Our virtual simulation problem solver is now a cornerstone of ANSYS's expanding platform.

PUMPKIN™ Mounts

After a multiyear partnership with Taylor Devices, TTWiiN LLC sold the company to TD in January 2024. Now part of TD's strategic platform, the product's successful exit will benefit the broader market.

Hummingbird

Resolution of patent ownership in Hummingbird's favor positions the company to capitalize on current projects in Taiwan and London and the growing modular construction sector.

KONSTRU

Launch of our partnership with Autodesk positions KONSTRU to leverage and expand its current client base.

ShapeDiver

After a successful entry into the built-environment sector, ShapeDiver continues to increase paid and total users, enterprise clients and revenue streams.

T2D2

In an increasingly positive legislative environment, T2D2 continues to expand its public/private client base with projects such as the Empire State Building while advancing significant product development.

AEC Angels

Recent additions to the AEC Angels portfolio include CALMFLOOR® and AquaTrace Global. We also added TestFit and SKEMA, new leaders in the application of AI/ML, to the planning and design phase.

TTWiiN Investment Partners

We continue to monitor our investments in our various technology funds, such as MetaProp, Building Ventures, Shadow Ventures and Parkway Ventures, plus AEC Angels, which collectively cover more than 85 start-ups.

TT Tech Ecosystem

We established alliances with Suffolk Technologies' BOOST Program, BuiltWorlds, Impulse Partners and many other like-minded AEC tech industry leaders by serving as speakers, panelists, judges and advisors.





In Memoriam

Charles H. Thornton
Co-Founding Principal
1940–2023

→ “Engineering, at its core, is about shaping the future. It is through our collective effort that we have the power to create structures that not only stand tall but also stand as reminders of human ingenuity.”

A Life of Elegant Solutions: A Memoir
Charles H. Thornton



Thornton Tomasetti

Acoustics, Noise &
Vibration

Aviation

Biomechanics & Life
Sciences

Commercial

Construction Engineering

Critical Facilities

Cultural & Community

Decarbonization

Defense

Education

Energy

Façades

Forensics & Investigations

Government

Healthcare

Hospitality & Gaming

Insurance

Laboratory & Research

Protective Design &
Security

Residential

Resilience

Restoration & Renewal

Special Structures

Sports & Public Assembly

Structural Design

Sustainability

Tall & Supertall Buildings

Transportation &

Infrastructure

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