integration

What is integration?
How does it work?
Why is it important?

Thornton Tomasetti

2015/2016
Annual Report
Thornton Tomasetti provides engineering design, investigation and analysis services to clients worldwide on projects of every size and level of complexity.

We are a 100 percent employee-held organization of engineers, architects, and sustainability and support professionals collaborating from offices across North America and in Asia-Pacific, Europe, Latin America and the Middle East. We focus on providing a diverse suite of integrated services and leading innovation in our industry to ensure the continued success of our clients.

integration

[in-ti-grey-shuhn] noun, from Latin integratio

1) the act of uniting different things, of bringing together smaller components into a single system

2) the process by which the different parts of an organism or organization are made a functional whole

3) the operation of finding a function whose differential is known, of solving a differential equation

4) the quality of being in harmony with the environment
Executive Message

“When our conversation about coming together turned serious, the tipping point was our discovery that we share core values and a long-term goal: to be the leader of change and innovation in our industry.”
— Tom Scarangello
Chairman & CEO

Integration has long been critical to fulfilling our business goals. For our diversified practices to meet an ever-wider range of client needs, they must be seamlessly interconnected. Our collaborative approach aims to integrate project teams to improve both process and final results. By finding new connections between “adjacent possibilities”—a big part of this endeavor.

In the past year, we undertook a tangible kind of integration: On Sept. 7, 2015, we announced our merger with Weidlinger Associates. The result is a firm that provides clients with deeper and broader engineering and design expertise in more places. It’s fair to say the deal was in the works for decades. We knew each other as honorable competitors and as colleagues, often working in adjacent markets and sometimes on different parts of the same project. Our founders respected each other and shared a sense of duty to educate young people about engineering. Charlie Thornton established the ACE Mentor program, and Mario Salvadori of Weidlinger founded the Salvadori Center, see page 18. Early in his career, when Richard Tomasetti considered job offers, he took only two seriously—one from Lev Zetlin, who founded what became Thornton Tomasetti, and the other from Paul Weidlinger.

Our similarities help us clear the most common hurdle in mergers: cultural mismatch. When our conversation about coming together turned serious, the tipping point was our discovery that we share core values and a long-term goal: to be the leader of change and innovation in our industry. During our tour of more than 30 offices, when the three of us introduced the merger to our people face-to-face, we discovered a common chemistry. Our cultures have differences, but in the most fundamental ways, they are a natural fit. Importantly, we found widespread agreement that our goal in coming together was not to get bigger, but to get deeper and broader. We’re motivated to be the best in all we do, with each of our 10 integrated practices serving as a center of excellence. Our present challenge is to successfully integrate our project, technical and operations teams. To do this, we are following two guiding principles:

First, we recognize that no two firms are identical. To build a better firm, we need to acknowledge that there is no “Thornton Tomasetti way” or “Weidlinger way.” We’re taking the best from each and shaping it into our new way. So we will celebrate our differences, and that will elevate the state of our practices and our work.

Second, we believe that what makes a great project team is also what makes a great firm. For decades, our best project teams have followed the American Institute of Architects’ nine principles of integrated project delivery (see above). Just as we strive to uphold these principles in every project (including, of course, IPO projects; see pages 12–17), we also use them to guide all our integration efforts—from revamping our financial systems and network security to unifying our modeling software practices and project teams.

The IPO principles also give rise to an integrated approach that serves a larger purpose. Strong teams build strong firms, which make a stronger industry. We believe that making these principles standard will benefit everyone in our industry and move us all closer to that big goal of being leaders of change and innovation.

Principles of Integrated Project Delivery

Mutual Respect and Trust: Team members rely on collaboration and teamwork to support the best interests of the project.

Mutual Benefit and Reward: Compensation rewards behavior that’s best for the project. Early involvement is recognized and rewarded.

Organization and Leadership: Team members commit to common goals and values. Leadership is assigned to the team member most capable in that specific work or service.

Collaborative Innovation: A free exchange of ideas among team members promotes creative decision-making. Ideas are judged on their merits, not the role or status of their originator.

Early Involvement: Early involvement improves decision-making. Diverse knowledge has greater value if it is employed earlier.

Early Goal Definition: Project goals are developed early and are agreed upon and respected by all team members.

Intensified Planning: Increased effort in planning drives efficiency and savings by streamlining and shortening the construction effort.

Open Communication: Direct and honest communication focuses energy on quick identification and resolution of problems, rather than liability.

Technology: Specifying technologies up front maximizes functionality, generality and interoperability. Open and interoperable data exchanges are essential.
Lately, we’ve had integration on the brain. When Thornton Tomasetti and Weidlinger merged, we thought deeply about how to fuse the two firms into a better business – one that can deliver a higher level of service to our clients.

As we looked back over the past year, integration emerged as a recurring theme in many of our pursuits: in the way we perform our work, in our operations and in the products and services we invent. It’s there in how our people come together to seek new connections between ideas, solve challenging problems and make lasting contributions.

What is integration? How does it work? Why is it important? Explore these questions in this report.
Industry Leaders on Integration

What is integration? How does it drive value and innovation? How will it affect the future of the AEC industry? We convened a group of experts from across the industry to share their thoughts.

Participants

Andrew Burdick, AIA, LEED AP
Associate Partner, Ennead Architects
Director, Ennead Lab

Vishaan Chakrabarti, AIA
Founder, Partnership for Architecture and Urbanism
Associate Professor, Columbia University Graduate School of Architecture, Planning and Preservation

Raymond Daddazio, Ph.D., PE, SECB
(moderator)
Co-President, Thornton Tomasetti

Joseph A. Ienuso
Senior Vice President, Northwell Health

Cyrus Izzo, PE
Co-President, Syska Hennessy Group, Inc.

Meghan McDermott, AIA
Partner, Robert A. M. Stern Architects

Charles Murphy
Senior Vice President
Turner Construction Company

Characteristics of Integration

Cyrus: Whether it’s at the project level or integrating firms, I think the true measure of integration should be the outcome, as a multiple of the sum of the parts. It boils down to comprehensive communication.

Andrew: The whole point of integration is to magnify opportunity, not simply add it together. Whether it’s a business or personal transaction or collaborative design process, it’s all about having access to the correct information early in the process so that we don’t spin our wheels making decisions based on inaccurate or incomplete information.

Charlie: To me, it’s the humanizing, the cultural change. It could be with a firm or a project. But if you don’t take the time on the human side, changing behavior, breaking down the silos, then you’ve just made a bigger structure that may not create the synergies you’re looking for.

Vishaan: We must not mistake integration for “pea soup.” When an owner brings together a group of talented individuals, they’re looking for that talent to assert themselves. A huge part of the idea of integration is that it is not just a path to bland compromise, but a way of surfacing the sort of key vision differences that occur on a good team.

Making Integration Happen

Charlie: There is a hierarchy in the industry, with the owner at the top and the workman at the bottom. But who has to come up with the best idea to fix something on a project? Often it’s the workman in the field. Who’s often the person we’re least likely to ask? The workman in the field. So we’re making a cultural shift, asking the person who is doing the work, “What can we do better?”

Meghan: When we interview for a project, we take the time to educate our clients on the process – suggesting, for example, how they might organize their design team. We’re bringing in a variety of perspectives, asking their consultants questions to bring them along. It’s not just our clients on the process – suggesting, for example, how they might organize their design team. We’re bringing in a variety of perspectives, asking their consultants questions to bring them along.

Joseph: There is a lesson here for all of us – owners, architects, engineers, builders – everybody involved in our industry: Integration is not going to come because it’s contractual. Integration requires a willingness to collaborate in creative problem-solving.

Vishaan: We used to think we needed really big entities to solve really big problems. For a skyscraper, you went to three or four firms around the world. That was it. Now I see short lists that are mind-bending in their range. And it’s because of the ability to integrate in terms of team formation. With an executive architect who is there from the first meeting, there’s no baton to pass. Now small, agile firms or individuals are tied to very large, very competent firms. Together, they can do things in ways that were basically unthinkable 10 or 20 years ago.

Ray: One of the great things about the merger of Thornton Tomasetti and Weidlinger is that it’s opened up a whole universe for the staff. During a recent event in our office, I overhear a younger engineer talking about this, saying, “Where before I could work with just my Navy clients, now I’m talking to sustainability people and working with renewal people. If they need software, I can write it.” It’s great.

What Lies Ahead

Meghan: The way that architects, contractors, and engineers are educated today is very different from 20 years ago. Today’s young professionals work in multidisciplinary teams while still in school, so they enter the workforce accustomed to collaboration and sold on its benefits. It will be interesting to see how that filters up from the next generation to permeate our work process.

Joseph: For integration to succeed, our respective processes must evolve. From the way we structure teams to our contract forms, we must work collaboratively on efficient and creative alternatives.

Cyrus: The future of integration requires top talent – not just top technical talent but great communicators, folks who are really invested in, and excited about, creating a wonderful work environment. As an industry, we have such competition for talent. I’m curious who we are losing to the tech companies that are offering higher total compensation packages.

Vishaan: I’m optimistic, because I believe this generation is very motivated by mission. When I started my company, I didn’t have much to put on my website, so I posted a mission statement. The following day I had more than 100 portfolios in my email. These people are driven by the mission. The companies that succeed will be the ones that have a clear sense of mission.

For more of the conversation, go to ThorntonTomasetti.com/integration.
Weidlinger + Thornton Tomasetti

Weidlinger and Thornton Tomasetti united in 2015 to create a hybrid that is not simply bigger, but stronger, smarter and more effective than either firm alone.

What motivated the merger? Four important factors:

Talent: Uniting the two firms’ talented and highly respected people creates a single, even stronger team.

Service: We now have 10 complementary practices that allow us to provide an increasingly broad range of integrated services. We can say yes to our clients more often.

Reach: A larger geographical footprint allows us to work more closely with more clients and respond faster to events requiring forensic or property loss consulting services.

Innovation: Each of the firms had a drive for innovation and had established a structure to foster it. Uniting the firms augments our ability to deliver innovation to clients and drive it in our industry.

Joining two firms is about more than services and locations; cultural compatibility is equally important. While no two company cultures are identical, the many matches in the DNA of Thornton Tomasetti and Weidlinger made a successful combination possible. Common to both firms are a long-standing entrepreneurial spirit and many values: We attract and retain great people by challenging them to grow; we have a passion for innovation and excellence in delivery; and we look beyond the obvious to seek solutions to complex problems. The founders of both firms – from Lev Zetlin to Paul Weidlinger, Mel Baron, Mario Salvadori and Matthys Levy – also established enduring contributions to the future of the AEC community (see below).

But our DNAs have enough differences to beget fresh features when they recombine. How will the new Thornton Tomasetti change and grow? Keep watching to find out!

A Shared Passion for Educating and Inspiring the Next Generation

Thornton Tomasetti played a leading role in establishing the ACE Mentor program (www.acementor.org), which recruits volunteers from architecture, construction and engineering firms across the United States to teach high-school students about the industry. ACE inspires young men and women to pursue careers in design and construction and provides scholarships to support students in obtaining higher education required.

Weidlinger was instrumental in founding the Salvadori Center (www.salvadori.org), which uses buildings, bridges and parks to engage New York City elementary- and middle-school students in science, math and technology. Through in-school and after-school programs, students engage in hands-on, collaborative projects that provide them with the tools they will need for careers in the AEC industry and beyond.

A unique suite of integrated practices affords us an unparalleled ability to help our clients plan, design, build, maintain and renew structures of every kind, throughout their life cycles.

Structural Engineering

We collaborate with architects, building owners and builders to design elegant solutions for projects of all types, sizes and levels of complexity.

Weidlinger Protective Design

As a recognized leader in physical security analysis, advice and design, we collaborate with team members to achieve appropriate solutions that uphold each project’s aesthetic, functional and budgetary goals.

Façade Engineering

Our façade consulting services include materials research, specialty analyses, detailed design, engineering and construction support, and glass and façade failure investigations.

Weidlinger Transportation

We provide multidisciplinary engineering expertise — in structural, civil and geotechnical engineering — for new and existing bridges and other transportation infrastructure.

Construction Engineering

We help designers, developers, contractors, fabricators and erectors move efficiently from concept to completion with integrated design and fabrication modeling, connection design, erection engineering, crane engineering, field engineering and site representation services.

Sustainability

We collaborate with clients and project partners to integrate an array of customized green solutions into building planning, design, construction and operation.

Weidlinger Applied Science

We undertake research, development and design to engineer practical solutions that manage risks to life and structures in military and civilian buildings, infrastructure, industrial facilities and vehicles.

Forensics

We provide attorneys, property managers, building owners, contractors/manufacturers and design professionals with a wide range of engineering and architectural forensic services.

Property Loss Consulting

Our architects, structural engineers and MEP experts help insurance clients analyze pre- and post-loss risks, damage, and property claims arising from natural or man-made perils.

Renewal

We assist owners and managers of existing structures with envelope, structural and MEP assessments, feasibility studies, peer reviews, and design for repairs, renovations and alterations.
Building Communities, Building Business

Every business struggles to share knowledge and best practices – among departments, locations and generations – to increase efficiency and quality. But “smashing silos” gets even harder when you merge two long-established firms. One way we are working to overcome these barriers is by launching a Communities of Practice program.

While informal groups have always gathered in person or virtually to discuss technical issues, the Communities of Practice initiative provides official sanction and establishes ground rules through a constitution. Communities will still be self-selecting, grassroots groups of employees, but now they’ll formally elect leaders and establish goals, outcomes or end products that benefit the firm and help to improve project outcomes. The communities will link people with a passion for a topic to others throughout Thornton Tomasetti and enable creative ideas and best practices to surface to a wider audience.

The program’s mission isn’t limited to knowledge management, however. Says Carol Post, a principal working to launch the initiative: “In the end, it’s also about creating communities within the staff. Building stronger relationships among employees will make our business better.”

White Paper at Light Speed

Last September, Project Engineer Brett Benowitz came across an intriguing request for information from the U.S. Department of Energy’s Building Technology Office. It sought information on R&I advances in diagnostic technologies for building envelope infiltration that could reduce costs or improve building performance.

Realizing the newly combined firm had the necessary expertise, Brett reached out to find the right people to collaborate with him on the response. It took less than 24 hours to form a team drawn from our CORE studio and the Sustainability, Renewal and Weidlinger Applied Science practices, and to begin work. Less than two weeks later, the team completed a white paper proposing thermographic diagnostics, using drones equipped with infrared cameras to perform thermal imaging. The DOE will use the information for strategic planning.

Combined Expertise Gives Station Square New Life

Soon after the ink was dry on the merger agreement, staff from the two firms jointly pursued a project to renew a historic square in Forest Hills, New York. The combination of historic-preservation expertise and civil and traffic engineering know-how was a winning one. The project will restore the busy, century-old square by reconstructing the worn and uneven red brick pavement, stabilizing the subbase and improving drainage.

Structural and Façade Engineering Practices Gain Strength from Weidlinger Protective Design

Before merging, Thornton Tomasetti and Weidlinger often found themselves on the same design teams, with Weidlinger as the protective design consultant and Thornton Tomasetti as the structural or façade engineer. Only five months after the merger, clients already recognize the advantages of combining these services. We’ve been awarded four projects on which we’re doing both structural and protective design, and three that combine façade engineering and protective design. Many other integrated teams are pursuing projects in the proposal stage.

Geotechnical Engineers Add Depth to Property Loss Consulting Capabilities

The merger added geotechnical engineers to Thornton Tomasetti’s roster, giving the Property Loss Consulting practice an opportunity to better serve insurance-industry clients. When we were retained to assess the safety and durability of a shopping mall built atop an old mine that was in the process of collapsing, we augmented our structural engineering capabilities with in-house geotechnical expertise. Integrating these disciplines under one roof sped our response and allowed us to provide coordinated information to our client.
The Rx for IPD

Thornton Tomasetti is part of the integrated project delivery team that is working on an expansion of the NorthBay Medical Center in Fairfield, California. During a meeting in January 2016, we asked team members about their experiences and opinions of the IPD process.

The AIA defines IPD as “a project delivery method that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication and construction.”

Most people in the industry are familiar with IPD’s basic principles (see page 3), but what’s most important to making it work?

Bryan: Having the right people involved, who are willing to learn and to understand other disciplines. It only works if we break down the silos and everyone takes responsibility for the whole project. And if you don’t have an integrated, committed and active owner, IPD doesn’t work.

David: The contract has a financial incentive that’s intended to put everyone on the same side of the table. But that incentive alone doesn’t always result in the desired behaviors if people don’t fully buy into the process. But if you get the right team, you could even eliminate the financial incentive and the desired behavior will still happen.

Theresa: The full involvement of the owner is key. I’ve done a lot of design-build, and the difference really is having them at the table.

Heidi: The team is an investment. You have to leverage the experience, the human capital. You’re not going to find your stride by starting with one team, learning the hard way, then using a different team for the next project.

What are the benefits of the IPD process?

Joelyn: Everybody on the team knows what’s going on with the entire project. So we’re all responsible for identifying and maintaining the budgets. We’re all accountable.

Theresa: Exactly. There’s a feeling of obligation to your team. You don’t just put your part on paper and then throw it over the fence for someone else to price it.

Belinda: We’re usually very focused on our little pieces of a project, but here we’ve had access to all the consultants, so we better understand what’s driving budget and design decisions. The opportunity to collaborate so widely has been the biggest benefit for me.

David: It makes your job a thousand times easier when you trust that people aren’t looking to assign blame. At one point or another, we’ve all spent time carefully crafting emails to make sure we’re “covered” in case there’s an issue later. It’s such a relief to be able to drop that. You can just say, “You know what? I messed up.” The team owns the mistake together. Then you fix it, and the team moves on. You focus on the work, not all that other stuff.

Rebecca: This group doesn’t scoff if the electrical engineer says something about what’s going on with another system. Everybody comments as a group, not just in discipline silos, so I’m constantly learning their perspective on my systems. And getting the contractor feedback in real time on pricing and constructability has been very beneficial.

(continued inside the flap)
Stephanie: On the contractor’s side, I’m better equipped to do my job after being involved in the design and understanding all the history. We’re making better decisions in the field because of that.

Theresa: We’ve seen that in reduced RFIs. We can tell you’ve got that knowledge out there.

Stephanie: And RFIs are getting turned around fast – sometimes within an hour.

Rebecca: This group gets along great. But the real test is when there are difficult problems. Once, when we couldn’t get a decision made on a particular element, the owner told us to get it done – and not with a smile. So we got it together and got it done. And then we moved past it. Nobody held a grudge, and there were no hard feelings.

How do you select the right people for IPD teams?

Heidi: We interview a lot of firms, but it really has to do with individual relationships. We look to people we’ve worked well with before to help us find other solid team members. Personalities are so important to the success of IPD; it’s a risk to bring on people who don’t get too far out ahead when the real design work should begin.

Lisa: We’re getting intelligence by talking to each other, so we’re all able to understand each other’s processes better over time.

What aspects of the process were most challenging?

Heidi: The most difficult thing was figuring out pull planning – learning how to combine the approach from the contractor’s point of view and the designers’ point of view, and moving forward with a plan.

Gary: I usually come on board after the design is already fixed. But there are a lot of small changes that can make a project better. We’re paralleling the design effort with full fabrication drawings, so if something comes up, I can ask a question, make the change, and keep moving forward.

Greg: Normally, we’re handed a set of drawings and think, “Why did they do that?” Knowing why the design is the way it is – the motivating factors – is interesting. It’s never what I would have imagined.

David: It’s hard. You ask questions, but the answers aren’t what you’re really after. You’re looking for how the team works together to get the answers.

Bryan: So many of us think winning work is all about professional competence. But most people unconsciously assess whether or not they can trust you, or can work with you; competence comes after those things. When selecting a team, I’d pick a B+ player with the right attitude over an A+ player with the wrong attitude.

What is the value of having the whole team on board early on, especially for the disciplines that typically come in later?

Bryan: Early input from many team members prevents a particular vision from getting too deeply set without an understanding of all the consequences.

John: It’s good to get everybody committed at the beginning, but then you need careful planning to orchestrate when early input is needed versus when real design work should begin.

Gary: That’s a balancing act, so you don’t get too far out ahead when the design is still in a state of flux.

Lisa: We’re getting intelligence by talking to each other, so we’re all able to understand each other’s processes better over time.

Nikki: I need to coordinate with the structural and electrical disciplines on IT design. Too often, I don’t have much communication with them. But here, we’ve coordinated so much early on that we’re comfortable with each other. It makes it easy to solve issues that come up.

Belinda: Usually, the interior designer is brought in last. But we like helping to inform the budgets, for instance, instead of just having to work with decisions that were made before we got involved.

Rebecca: And on the electrical side, having interiors decisions made earlier meant we didn’t have to redesign things like we often do.

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Co-locating team members is critical to putting the principles of IPD into successful practice. Working together in a dedicated space, known as a “big room,” erases boundaries between firms; team members start to feel – and behave – like co-workers. Physical proximity also promotes coordination and problem-solving.

The NorthBay team’s co-location space is a house near the job site. The rooms have been converted to work spaces, while the garage serves as the conference room. The team fondly calls it their “Big House.”

Not all team members are there full-time, but everyone comes together for regular all-day working sessions. Spending so much time together in the Big House has inspired more than good teamwork; it has also built solid friendships.

Bryan: I think you just defined your and Heidi’s biggest challenge in this whole process.

Heidi: It’s not easy. If it were easy, everyone would do it.

Any final thoughts?

Joelyn: We’ve come so far. It’s fantastic that this team is transforming the neighborhood with a modern design that reflects the advanced medicine we’re bringing.

Theresa: It makes everybody in the room a better designer to listen to the conversations about other disciplines. I’ve learned so much about things I normally never knew about in a regular project.

David: Many of the relationships on this team have grown into personal relationships. That’s a special dynamic that can’t be created just because the contract requires it. Most project teams never reach that level of connection.

Gary: I have never been a part of such a dynamic team. I’ve been doing this for over three decades, and I’ve never seen this level of collaboration.

Lisa: I’ve been doing IPD for six years now, and I don’t think I want to go back to the other way.

Bryan: We all have buildings we’ve worked on that we’re proud of when we drive by. But with this project, we’re also going to be proud of how we got there.
Accelerating Engineering Technology with TTWiiN

The merger between Thornton Tomasetti and Weidlinger did more than increase our size and range of services – it also amplified our ability to develop innovative technology.

Both firms have long supported the development of new tools and techniques to solve engineering problems and improve project processes. Our merger agreement includes the formation of a new company, called TTWiiN, to focus the development of these products and processes and provide a commercial platform for them. TTWiiN launched in 2016 with an initial slate of six products; a number of them highlight different aspects of integration. For more information on TTWiiN and its products, visit www.TTWiiN.com.

PZFlex: Faster Finite Element Modeling

PZFlex® is a multi-application virtual simulation software package that, when integrated early in a product design project, can lower costs and speed development. See page 22 for details.

Spectacles Suite: Integrating Paper, Models and People

Our CORE studio developed a suite of web-based tools to enhance project team collaboration. Spectacles helps users to easily view and share 3D models. Plug-ins for Grasshopper and Revit allow lightweight visualization models to be created, uploaded and updated in their native authoring applications, and plugins for Tekla, SAP, ETABS and Dynamo are coming soon. Models can be viewed and queried on mobile phones, tablets and desktops using a web browser. DocQR integrates web-based models with paper drawings and specifications; QR codes on the sheets point to the applicable model. And VRX enables user interaction with Spectacles-hosted models in a virtual reality environment, using a smartphone and a Google Cardboard. VRX also allows a “host” user to guide multiple “guest” users through a model, making the program a potent tool for team interaction and coordination.

Vibration Solutions: A New Kind of Tuned Mass Damper

NASA recently invented a new way to reduce dangerous vibrations on a newly designed rocket. The fluid structure coupling device works by calibrating the way liquids and structures interact, an effect that has myriad applications here on Earth. Thornton Tomasetti licensed the FSC technology and set about adapting it for use in buildings and bridges. The result is the Fluid Harmonic Damper, a less expensive, easier to install, more flexible and more effective alternative to traditional tuned mass dampers.

The new damper combines a water-filled length of pipe with NASA’s FSC device, which allows easy and extremely precise tuning of the water’s behavior. This means less mass – about one third of the weight – is needed for effective function compared to traditional solid or liquid-tank dampers. Because of this, an FHD can be supported by a lighter and less expensive structure; it takes up less space; it can be retrofitted in response to changes in a structure over time; and it can be installed in existing buildings that have vibration-related problems without the need to upgrade the structure to support a large additional load.

The FHD gets its first commercial test in 2016: it will be installed in a Brooklyn building in the spring.

WAimat Suite: High-Fidelity Material Modeling

WAimat Suite is a trio of powerful, interrelated software tools that facilitates advanced material modeling and brings new functionality to the most widely used finite-element programs. WAimat’s modules – WAdam for fracture prediction, and WAfire for simulation of structures exposed to fire – integrate seamlessly into popular software packages like Abaqus and LS-DYNA. The suite also includes WAimc®, a stand-alone tool that generates model parameters for the modules using experimentally determined material properties.

With WAimat, engineers and researchers can calibrate the properties of structural metals and simulate the effects of various loads on large-scale structures. No other product offers comparable high-fidelity material-failure modeling capabilities.

As a Simulia Software Partner, WAimat Suite is being integrated into the commercial giant’s marketing of its industry-leading Abaqus software. Livermore Software Technology Corporation, developer of LS-DYNA, has also agreed to promote and support WAimat Suite as an add-on to its popular finite-element application. Visit www.waimat.com to learn more.

This image, generated using WAdam, shows the distribution of equivalent plastic strain (with blue denoting the lowest and red the highest) around a propagating crack in a simulation of a welded plate subjected to idealized ship grounding.
We strive to integrate sustainability into every aspect of the firm’s planning and operations. We believe it is crucial to our success as a company. We measure our degree of sustainability as a confluence of three intersecting dimensions – environment, society and economy, or “planet, people and profit.” We work to minimize our ecological footprint while helping others reduce the environmental impact of their buildings. We continue to find new ways to create a workplace that provides opportunities for professional development, education and training; a healthful and supportive environment; and ample opportunities to contribute to the communities where we work and live. Through these efforts to do good where we have influence, we seek to build an enduring and profitable organization.

Each year, we move closer to fulfilling our vision of becoming one of the most sustainable firms in the AEC world. In 2015, we were recognized for our efforts by City & State Reports (New York) and Engineering News-Record, which continues to rank Thornton Tomasetti among the top 20 in its annual Top 100 Green Design Firms list. Our commitment to integrating sustainability practices into our engineering designs – as one of the few engineering firms that tracks the embodied carbon of its projects – promotes carbon-neutral buildings as a key step toward achieving a sustainable built environment.

With eight of our office locations now either LEED Gold certified or registered for certification – and our continued support for green power and carbon offsets – we are on target to achieve carbon-neutral business operations by 2030. By working to fully integrate sustainability into every aspect of the company, we look toward a future in which Thornton Tomasetti will continue to thrive. To view our latest sustainability report, visit GreenReport.ThorntonTomasetti.com.

Corporate Sustainability Update
At Thornton Tomasetti, we view sustainability as a way of doing business, not as merely an enticing catchphrase.

During Thornton Tomasetti’s Sustainability Retreat, staff from across the country gathered in Maine to brainstorm approaches to integrating sustainability into engineering.

Top: Our sustainability solutions for the gut renovation of Cornell University’s Upson Hall provided exceptional energy savings and daylight autonomy, earning the project LEED Platinum certification.

Above: Employees in our Shanghai office were awarded wristband pedometers after winning Thornton Tomasetti’s Carbon Footprint Challenge.

Top: Our sustainability solutions for the gut renovation of Cornell University’s Upson Hall provided exceptional energy savings and daylight autonomy, earning the project LEED Platinum certification.

Above: Staff from our Portland office used their volunteer day benefit to build a rainwater catchment and a composting system for a local preschool.
PZFlex Drives Medical Innovation

Early integration of Thornton Tomasetti’s finite-element analysis software reduces costs and accelerates research.

Engineers and designers around the world rely on PZFlex and PZFlexCloud® – the most powerful FEA simulation software for piezoelectric and wave-propagation analysis. An important resource for ultrasonic imaging manufacturers, PZFlex rapidly executes the huge simulations required in ultrasound, enabling engineers to accurately predict the performance of a product or device much more quickly than with other approaches.

While PZFlex modeling can be introduced at any stage of development, integrating it early in the design process reduces the number of physical prototypes a designer must produce by as much as 90 percent, thereby reducing costs and accelerating development.

Originally developed by our Weidlinger Applied Science practice to model ultrasonic probes, PZFlex has been used to design and improve high-intensity focused ultrasound transducers that use heat to destroy tumors, fuel injectors that increase the efficiency of diesel engines, acoustic fingerprint scanners that serve as identification devices, and even ultrasonic toothbrushes.

Exciting innovations are occurring in medical diagnostic and therapeutic methods, with PZFlex driving the core research globally.

**Microbubbles: Better Chemotherapy Delivery**

Researchers at the University of Leeds, England, are integrating PZFlex into the investigation of new cancer treatments, modeling the use of tiny gas-filled microbubbles to deliver chemotherapy directly to the sites of tumors. There, antibodies in the bubbles make them congregate around the cancerous tissue. Ultrasound frequencies then cause the bubbles to burst and temporarily rupture the membranes of the targeted cells, allowing the drug to enter. This method promises to minimize toxicity and tissue damage, reduce costs and reach locations that were previously inaccessible. The university has developed the world’s first commercial microfluidic microbubble generator, bringing this treatment a step closer to becoming a reality.

**Sonotweezers and Sonic Screwdriver: Accurate Tools on a Minuscule Scale**

PZFlex was instrumental in the development of a device that uses ultrasound waves to manipulate microscopic objects. Created by the University of Bristol, England, the Sonotweezers prototype allows researchers to separate healthy cells from diseased ones or separate materials like anthrax from other substances. Researchers believe that by increasing the ultrasonic force and adding rotation, they will be able to produce a “sonic screwdriver” – reminiscent of the gadget used in the popular science fiction television series *Doctor Who* – that can be used for such tasks as the assembly of delicate electronic components.

**Sonopill: Imaging from the Inside Out**

Scientists at the University of Dundee, Scotland, are employing PZFlex in their efforts to use capsule technology for minimally invasive gastrointestinal diagnosis and therapy. Once swallowed, the Sonopill broadcasts ultrasound images as it travels through the gastrointestinal tract, allowing doctors to see beyond the tract’s surface and into the tissue itself. For some patients, Sonopill could replace invasive endoscopy procedures. The university is also studying methods for controlling Sonopill’s movement through the body, and its potential for use in focused ultrasound surgery and targeted drug delivery.

Sonotweezers and Sonopill are shown on the right. PZFlex models, top to bottom: surface acoustic wave-based radio frequency filter; pressure field from a piezoelectric high-intensity focused ultrasound transducer; inspection of turbine blade, 3D steady-state flow field; nonlinear pulse in tissue, multiple phased array inspection of a rail.

We opened this report with three probing questions:

**What is integration?**

**How does it work?**

**Why is it important?**

Some answers emerged:

Integration is about bringing together diverse resources and perspectives to gain new insights and improve results.

Integration in the AEC industry combines people, ideas, practices and technologies to create new ways of working. Hierarchies flatten, teams become more effective, and new programs and processes open up fresh possibilities.

Integration ultimately results in better decisions faster.
Second Annual Purpose & Values Awards

Our purpose and values are the key distinguishing features of our firm. For the second year, we invited all employees – now 1,200 people in more than 35 offices – to nominate the colleagues they think best embody our purpose and values. The winners of last year’s awards narrowed the field to the finalists, and our board of directors approved the winners.

Purpose
We embrace challenges to make lasting contributions.

Value
We are passionate about what we do.

Value
We see opportunity where others focus on risk.

Many other deserving nominees from more than 20 offices received the recognition of their colleagues:

- Adam Kauc
- Chris Kahanek
- Mikel Czar
- Mark Coggin
- Turla Calvin
- Ben Kaan
- Kevin Jackson
- Hilary Goehert
- Chris Bresloff
- Trevor Bertin
- Robert DeScenza
- Kevin Legenza
- Elisa Malsch
- Melissa Wong

Top: The new suspended span over the Luribay River in Bolivia. Bottom: The Carroll College student chapter of Engineers Without Borders retrofitted this school in Guatemala.

Thornton Tomasetti Foundation

In 2015, the Thornton Tomasetti Foundation, an independent 501(c)(3) nonprofit organization, distributed $71,250 in scholarships and charitable contributions in support of its mission.

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Scholarship winners Denise Buzatu, Adam Jesberger and Zachary Caamano-Withall. The three engineering students, soon to be graduates of Princeton University, Penn State University, and the University of California, San Diego, respectively, each received $10,000 to pursue their master’s degrees.

Highlights of 2015 Commitments

- Engineers Without Borders: We provided $6,500 to the Carroll College student chapter for the seismic retrofit of a school in Guatemala. The Cal Poly chapter used a $3,500 award to construct a new, seismically sound elementary school in Nicaragua. And $1,250 went to the Kansas State University chapter to build a school in Joyab, Guatemala. The facility increases educational opportunities and serves as a gathering center for the community.

- Bridges to Prosperity: The University of Colorado Boulder chapter’s $10,000 award was used to build an 85-meter footbridge in Samaca, Bolivia, that provides safe and consistent access to schools, clinics and markets for more than 150 people per day.

- The Urban Assembly: We donated $10,000 to help provide education programs to underserved children in 21 New York City public theme schools.

- National Scholarship Awards: The foundation’s fourth annual scholarships went to Denise Buzatu, Adam Jesberger and Zachary Caamano-Withall. The three engineering students, soon to be graduates of Princeton University, Penn State University, and the University of California, San Diego, respectively, each received $10,000 to pursue their master’s degrees.

- We recently selected the first fellowship recipient. We’ll tell you about the resulting project next year.

www.ThorntonTomasettiFoundation.org

Since its inception in 2008, the foundation has distributed over $680,000, with 60 grants and scholarships going to more than 30 organizations. See more at www.ThorntonTomasettiFoundation.org.
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