PROMISE OF PUBLIC-PRIVATE PARTNERSHIPS
2018 IECA Annual Conference and Expo Focuses on Trending Industry Topics

Opening Keynote: Post-wildfire Remediation on Federal Lands

Penny Luehring, USDA Forest Service Burned Area Emergency Response (BAER) Program Leader, will provide an overview of the effects of wildfires on natural resources and describe the post-fire emergency response program implemented by the Forest Service and other federal land management agencies. Typical emergency response actions and treatment examples will be discussed along with examples of longer-term post fire remediation needs and costs.

Featured Workshop: “Solar Developments Don’t Cause Land Disturbance”; BMP’s for Solar Facility Construction in the North East | Feb 12
Take a look at the pros and cons of solar developments as they relate to site compliance and stormwater pollution.

Featured Case Study: The Green Rush: Marijuana Cultivation Impacts and Opportunities in Northern California’s ‘Emerald Triangle’ | Feb 12
Learn the trends, impacts, and opportunities for stormwater professionals as they pertain to California’s newly legalized marijuana cultivation industry.

Featured Fireside Chat: Five Feet High and Rising...A Panel Discussion on Climate Change, Flooding and Impacts to the Stormwater Industry | Feb 12
Actively discuss the impacts of climate change and stormwater runoff. Learn about industry challenges and strategies to implement into your job sites.

Featured Field Tour: Middle Harbor Redevelopment Project | Feb 14
Visit the world’s greenest container shipping terminal – nearly all electric and zero emissions. The facility handles twice as much cargo, while dramatically cutting air pollution.

Register Before January 15 to Save $200 at www.IECA.org/Annual18.
Delivering infrastructure through public-private partnerships (P3s) is gaining ground, but it's far from the norm, and might never be — story on page 16. Design by Donovan Brigham

ON THE RISE
14 Awards, promotions, and new hires

MANAGEMENT FILES
16 The promise of public-private partnerships
22 2018 Insurance market outlook

CHANNELS
SOFTWARE + TECH
26 Precise maps for driverless cars
28 Data transition for a BIM-to-FM process
30 Autodesk University 2017

STRUCTURES + BUILDINGS
36 Aloft breathes new life into a landmark building
37 Buildings of the future: Rethink the bottom line
38 Assessing regional earthquake risk and hazards in the age of exascale
40 Skyscraper Top 10

WATER + STORMWATER
44 Wastewater management tools
46 Low-profile stormwater detention
49 Performance of pipe with recycled HDPE resin
50 Smart sewers

ENVIRONMENT + SUSTAINABILITY
52 Sustainable mobility
54 Environmental market growth
55 Land loss crisis

TRANSPORTATION
57 ARTBA forecasts modest growth for 2018 transportation construction
58 Infrastructure priorities
59 Highways designed for safety

UAV + SURVEYING
60 Cloud-based perspective

CONTINUING EDUCATION
61 Managing engineering firm licenses

DEPARTMENTS
7 Civil + Structural Engineer Online
11 Events
64 Specify
65 Reader Index
66 Benchmarks

COLUMNS
06 From the Publisher: 2018 resolutions
By Mark Zweig
08 Engineering Our Future: Get out of the weeds
By Chad Clinehens, P.E.
10 Engineering Front Line: One exciting Monday meeting
By H. Kit Miyamoto, Ph.D., S.E.
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FROM THE PUBLISHER

THE NEW YEAR is almost here as I write this, and for most of us it is a time of self-reflection and thoughts about how we can do things better or improve ourselves in the year ahead. As civil and structural engineering leaders, there’s a lot to be said for looking and acting the part if you want to be recognized as such. Here are some examples:

Attire — Dress appropriately. That varies by client or work environment. If everyone else is wearing jeans and golf shirts, you should not wear a suit. Conversely, if your clients and peers always wear suits and dress formally and you only wear jeans, that may not be right. Ditto with ties. Don’t show up wearing a tie to an office where none of the male employees do so. And women, cocktail dresses are never appropriate for work. “Appropriate” is the word when it comes to dress.

Email — Return them promptly, and with no spelling errors. Your employees need to have the idea that if someone responds to their request, they should say, “Thank you.” An email response should not get dead air. And use “we” versus “I” in most cases. We all work for organizations that have more than one person — at least most of us do. That’s one of my pet peeves.

Office space — Keep it clean. Keep the lights on. Keep the bathrooms and kitchens clean. Keep the trashcans from overflowing. Keep the magazines in the lobby fresh. Don’t let stuff pile up on the reception counter. Don’t let your conference room turn into a lunch room. Have some art on the walls. Keep the place well-painted. It shows pride in the workplace. Don’t let anyone make their individual work space a dump.

Music — If you have music playing in the building, make it appropriate. Rap, heavy metal — No. Loud anything is not good. And letting everyone wear headphones and not interact with others isn’t good either.

Entertaining/interviewing — Most of your clients (if you work in consulting) or potential employment candidates for any organization really don’t want to go to Burger King or even Applebee’s. Take them somewhere nice, or somewhere local in flavor with some character.

Education — It’s important for you to keep learning about your profession so you don’t become obsolete. In addition to mandatory continuing education to maintain your registration, you also need to stay well-informed. Be sure to read and stay up with developments in your field. Start with reading Civil + Structural Engineer magazine every month from cover-to-cover!

Any other hints on looking and seeming more like a leader and professional that you want to share with your fellow readers? Send them to me at mzweig@zweiggroup.com. And meanwhile, enjoy our January issue of Civil + Structural Engineer magazine!

MARK C. ZWEIG
mzweig@zweiggroup.com

2018 RESOLUTIONS
IMPROVING LEADERSHIP ROLES AND PROFESSIONAL APPEARANCES.
Civil + Structural Engineer provides news and articles online to supplement content in this print issue. Visit csengineermag.com daily for the latest news and check out the following articles posted online with the January 2018 issue:

**PROJECT PROFITABILITY: ROLES OF A PROJECT MANAGER**
BY HOWARD BIRNBERG, ASSOCIATION FOR PROJECT MANAGERS

A successful project manager must have excellent communication skills. Project decision-making requires leaders who can communicate information to others to allow for effective implementation. One commentator noted not long ago that as the technology to communicate has improved, our ability to communicate has become more ineffectual.

Fundamental to a project manager’s success is an effective decision-making system. Lines of communication must be clear. A project manager’s authority must be commensurate with his/her responsibility. Needed information must be accessible and timely. Individuals must be clear about their role within an organization.

Read the entire article at [http://tinyurl.com/projectprofit-jan18](http://tinyurl.com/projectprofit-jan18).

**DIVERSIONS: GOLD RUSH**
BY ANDY SCIARABBA, P.E., T.G. MILLER, P.C., ENGINEERS AND SURVEYORS

Time for a new year’s resolution. My resolution is to bring more value to my clients. To achieve this I need a goal. No, scratch that. I need a Gold — the Goal of Gold. Our clients want it. They expect it. They “value” it. They covet it. But they can’t always have it. And when they can’t have it, we are expected to pull back, lower the standards, and reduce expectations. We have to “value engineer” it.

Value engineering always rears its ugly head at that pivotal moment when the “well has run dry,” the “cup is half empty,” and the client is ready to “sell the farm.” It seems to happen more and more these days and never at a good time. It invariably comes about when the design is about to wrap up, right before the project has to “hit the streets” and “get into the ground.” Sometimes it happens after the project is in the ground.

Where did the term value engineering come from anyway? And who made it up?

Read the entire article at [http://tinyurl.com/diversions-jan18](http://tinyurl.com/diversions-jan18).
ONE OF THE KEYS to career advancement is to work yourself out of your current job. In order to do that, you have to train someone else to do what you do and clear your own way to do bigger things.

However, the problem for many technical professionals right now is that workloads are at historic highs in many AEC firms. That, combined with the tightest labor market we have seen in decades, is making an ideal career advancement environment very difficult to foster. As such, many engineers are over their heads in projects, offering little time to train, develop, and advance themselves or others.

Another tragic and latent side effect is that heavy project loads are eliminating time to focus on the future of the firm. Whether it be time to develop new business, expand operations, or simply work on improving internal processes, these critical activities are not getting done in many firms. Everybody is off in the weeds right now and nobody has their head up looking beyond the field and to what is coming ahead.

If there is any way you can get yourself out of the weeds and help your firm with any of the critical business activities mentioned above, there could be huge rewards for you. I would prioritize pushing work down as far as you can in your team. Put more work and responsibility on junior team members and then reward those who respond positively.

Our employee surveys show that there are a lot of younger staff in AEC firms looking for the opportunity to step up. The problem with senior engineers is that they often see pushing work down as risky and possibly causing more time and effort than if they simply do it themselves. However, that mindset keeps us on a never-ending hamster wheel. We have to trust people more, offer opportunity to prove themselves, and then advance — in both pay and position — those who perform. This is the only way you will get out of the weeds!

CHAD CLINEHENS, P.E., is Zweig Group’s president and CEO. Contact him at cclinehens@zweiggroup.com.
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OUR COMPANY is currently working through a budget process for the new year. John, a principal, stands up in the midst of a meeting and says, “Kit, I don’t agree with the direction of this strategy.”

It is a dull Monday morning, but his statement really gets people going. The air in the room suddenly shifts.

“Budgeting is an important process,” he says. “Define the backlog, weighted proposal, and expense. But it’s BS if we see such a huge ‘gap’ between the revenue target and expected revenue. We need some major business development actions and solid project management to make this work and to be profitable. As any engineering company, we operate in seven to eight months of backlog. We need to think deeper to understand what’s really going on.”

John adds relentlessly, “How can we fill the gap — by what? How much can we grow and how? How can we increase profitability?”

You may think he is rude. No, that’s how we roll. We challenge each other. He is challenging the status quo and how all of us can be accountable. It is coming from a good place.

Our CFO, Mike, counters somewhat calmly, “Essentially, our budget process is only as good as what we decide to do and act on it throughout the year.”

Michele, our operations director says, “Yeah, right. Our company is spread out all over the place and this makes it even more challenging. Eight offices in the U.S. and 10 international locations. How are we going to keep everyone going in one direction? Everyone has different ideas and backgrounds.”

I step in to point out, “The budget is only as good as the business plan behind it. Each business unit must have a business plan, regardless of size. The budget gives us numerical goals that need to be achievable. Then we need to have major strategies to achieve the goal, such as marketing, training, and a project-management process. Then we need to have action plans to achieve these strategies. This has components of ‘what, by whom, when.’ The plan should be simple enough that it can be almost memorized, but comprehensive enough to make each of us accountable for the actions we put in place. This is the essence of a business plan.”

I add: “I think what really helps us is that our mission — Make the world a safer, better place — unites us in the direction all of us want to go.”

JT, a long-time principal says, “You know what? I know we will be successful. We can debate with no holds barred. It seems a simple thing, but this is so critical. In this process, we can really flesh out important things, go deeper, and gain commitment from each other. This can only be accomplished if we understand and care about each other.”

I really like what’s going on in this Monday morning meeting.

Note: This is a fictional account based on a somewhat true story.
THE INTERNATIONAL EROSION CONTROL ASSOCIATION (IECA) will hold its 2018 Annual Conference and Expo — formerly the IECA Environmental Connection Conference — Feb. 11-14, 2018, at the Long Beach Convention Center, Long Beach, Calif. More than 100 education sessions, including preconference half-day and full-day courses, fireside chats, and new Expo Hall training, provide training and professional development for the expected 1,800-plus attendees from the global erosion and sediment control and stormwater industry. The Expo Hall features more than 130 exhibitors.

In addition to the preconference courses, education sessions are organized into 10 tracks, including Erosion and Sediment Control; MS4 Management; Stormwater Management; Wetland, Stream Bank, and Shoreline Restoration; among others.

Featured industry roundtables include the following:
- Perimeter Controls: They May Not Be Effective, But At Least They Are Expensive — Discussions will revolve around types of perimeter controls, design guidance, application, in-field performance, typical failure modes, maintenance requirements, and innovations.
- Enforcement Support Group — An opportunity for the enforcement community to ask peers how they got to their biggest accomplishments and how to avoid embarrassing failures.

Western Region Featured Sessions include:
- Floodplain, Floods & Restoration in California’s Sacramento Valley
- After Drought, California’s Eternal Water Struggles
- Construction Industry Cost of Compliance with the CA CGP for Stormwater Discharges, 2010-2017
- California’s Secretary for Natural Resources (invited speaker)

Featured Fireside Chats include:
- Stream Restoration — New Challenges, Opportunities & Trends

Field trips
Two field tours will be available during the conference. The first is a walking tour of the New Long Beach Civic Center. This building will be in the construction BMP phase during the tour. The tour will address construction BMPs as well as management of stormwater post-construction. The $520 million, design-build-finance-operate-maintain civic center will replace the old city hall and provide efficient new offices for the Port of Long Beach, a new city library, a retail marketplace, and public park.

The second field tour visits the $1.3 billion Middle Harbor Redevelopment Project, which is creating the world’s greenest container shipping terminal featuring nearly all electric and zero emissions. Using advanced technologies, the new facility will handle twice as much cargo as the two terminals it replaces, while dramatically cutting air pollution. The modernized wharf can handle the world’s largest ships and will strengthen the port’s competitiveness and the local economy.

Construction began in 2011 and is expected to take about eight years. The first of two phases opened in 2016. Orient Overseas Container Line, a major Hong Kong-based shipping line, agreed in 2012 to a 40-year lease to operate the new terminal through its subsidiary Long Beach Container Terminal. To date the Middle Harbor project has moved more than 5 million cubic yards of material as part of both the cut and fill.

Keynotes
In an opening keynote session, Post-Wildfire Remediation on Federal
Lands, Penny Luehring, USDA Forest Service Burned Area Emergency Response (BAER) program leader, will provide an overview of the effects of wildfires on natural resources and describe the BAER program implemented by the Forest Service and other federal land management agencies. Loss of vegetation and fire-induced water-repellent soils can trigger increased runoff that cause erosion, flooding, or debris flows many miles downstream of the fire. Typical emergency response actions and treatment examples will be described along with examples of longer-term post-fire remediation needs and costs.

The closing keynote speaker, Andrew Wright, will provide an “inside the Beltway” perspective on the environmental agenda of the Trump Administration and Congress. He will explain the current political climate and what it means to attendees, their businesses, and their bottom line. Wright is an attorney with more than 30 years of experience in Washington, D.C., as a senior congressional staffer, association executive, and lobbyist.

More information and registration is available at https://www.eventscribe.com/2018/IECA.

Information provided by the International Erosion Control Association (www.ieca.org).

**EVENTS**

**JANUARY 2018**

**TRANSPORTATION RESEARCH BOARD 97TH ANNUAL MEETING**
**JAN. 7-11 — WASHINGTON, D.C.**
Program covers all transportation modes, with more than 5,000 presentations in more than 800 sessions and workshops, addressing topics of interest to policy makers, administrators, practitioners, researchers, and representatives of government, industry, and academic institutions. www.trb.org/AnnualMeeting/AnnualMeeting.aspx

**IDENTIFICATION OF WETLAND PLANTS IN WINTER**
**JAN. 22-23 — BASKING RIDGE, N.J.**
Combines classroom and field training to increase attendees’ wetland expertise by learning to identify vegetation during the winter months by examining criteria such as bark, twigs, and other leafless characteristics. www.cpe.rutgers.edu/courses/current/eh0205ca.html

**FEBRUARY 2018**

**INTERNATIONAL LI DAR MAPPING FORUM**
**FEB. 5-7 — DENVER**
Technical conference and exhibition showcasing the latest airborne, terrestrial, and underwater LiDAR as well as emerging remote-sensing and data-collection tools and technologies. www.lidarmap.org

**IECA ANNUAL CONFERENCE**
**FEB. 11-14 — LONG BEACH, CALIF.**
International Erosion Control Association’s annual conference and exhibition brings together engineers, contractors, regulators, and providers of erosion control and stormwater management products and services. www.ieca.org/ieca/ieca%20Events/2018_annual_conference.aspx

**GROUTING FUNDAMENTALS AND CURRENT PRACTICE**
**FEB. 12-16 — AUSTIN, TEXAS**
39th Annual Short Course covers pressure grouting as a method to improve geotechnical properties of soils and rock masses, with special focus on mechanisms, theories, and practical applications of grouting to ground densification and strengthening, permeability reduction, and groundwater cutoffs. http://executive.engr.utexas.edu/epd/grouting18.php

**PCI CONVENTION & NATIONAL BRIDGE CONFERENCE**
**FEB. 20-24 — DENVER**
Precast/prestressed concrete industry event offering committee meetings, education sessions, and peer-reviewed paper presentations. The event is held in partnership with The Precast Show. www.pci.org/convention

**EXCELLENCE IN PROJECT MANAGEMENT**
**FEB. 21 — SAN ANTONIO, TEXAS**
**JULY. 18 — BOSTON**
**OCT. 17 — SALT LAKE CITY**
Tutorial and case study workshop sessions present critical areas every project manager should know from the perspective of architecture, engineering, and environmental consulting firms. http://zweiggroup.com/seminars/excellence-in-project-management

**REAL MARKETING AND BRANDING FOR AEC FIRMS**
**FEB. 22 — SEATTLE**
**JUNE 21 — MIAMI**
Designed to bring clarity and distinction between marketing and sales, this course will aid all levels of staff to understand how to market the firm and build the brand in their respective roles. https://zweiggroup.com/seminars/real-marketing-and-branding-for-aec-firms

**AEC BUSINESS DEVELOPMENT TRAINING**
**FEB. 23 — SEATTLE**
**JUNE 22 — MIAMI**
Specifically developed to help design and technical professionals become more comfortable dealing with clients and promoting the firm and its services. http://zweiggroup.com/seminars/aec-business-development-training
**4th Residential Building Design & Construction Conference**  
**Feb. 28-Mar. 1 — State College, PA.**
Forum for researchers, architects, engineers, other design professionals, product manufacturers, builders, developers, and code officials to discuss challenges to sustainable, energy efficient, healthy, environmentally friendly, natural hazard resistant, and affordable residential construction.  
www.phrc.psu.edu/conferences/residential-building-design-and-construction-conference/4th-RBDCC.aspx

**March 2018**

**Design-Build for Water/Wastewater**  
**Mar. 19-21 — Portland, Ore.**
Event for design-build owners and practitioners in the water industry co-hosted by the Design-Build Institute of America, the American Water Works Association, the Water Environment Federation, and the Water Design-Build Council.  
https://www.dbia.org/Conferences/water/Pages/default.aspx

**Design-Build in Transportation**  
**Mar. 21-23 — Portland, Ore.**
Nearly 1,000 public and private owners, design-build practitioners, and exhibitors address the growing nationwide role of design-build project delivery.  
https://www.dbia.org/Conferences/transportation/Pages/default.aspx

**April 2018**

**Complete Streets Conference**  
**Apr. 3-4 — Nashville, Tenn.**
Under the theme, Intersections: Creating Culturally Complete Streets, attendees will learn practical ways to integrate arts and culture to create streets that not only are safe for everyone, but also better reflect the unique character of their communities.  
https://smartgrowthamerica.org/program/intersections-creating-culturally-complete-streets

**Structural Design Topics in Wood Construction**  
**Apr. 16-18 — Blacksburg, VA.**
This course offers a range of topics related to the structural design of wood-frame buildings as well as design measures that can enhance the in-service performance of structural elements.  
www.cpe.vt.edu/sdtwc/index.html

**The Principals Academy**  
**Apr. 26-27 — Napa Valley, Calif.**  
**June 7-8 — Aspen, Colo.**  
**July 19-20 — Montreal, Quebec**
Two-day, intensive course in all aspects of managing a professional service firm, including business planning, marketing/business development, accounting, financial management, project management, leadership, mergers and acquisitions, ownership transition planning, and recruitment and retention.  
https://zweiggroup.com/seminars/the-principals-academy

**May 2018**

**Leadership Skills for AEC Professionals**  
**May 2-3 — Boston**  
**Nov. 14-15 — San Francisco**
Specifically developed to provide design and technical professionals with the skills to become more competent leaders, including strategies and techniques that will help them grow personally and professionally.  
https://zweiggroup.com/seminars/leadership-skills-for-aec-professionals

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**Check online at cengineermag.com/event-directory/ for events later in 2018. Send information about upcoming conferences, seminars, and exhibitions relevant to civil and structural engineering to Bob Drake at bdrake@zweiggroup.com.**
AWARDS, PROMOTIONS, AND NEW HIRE

Seeking to increase its profile in the Americas, BMT appointed Stephen Vaughn, P.E., as regional manager for the Americas. Vaughn has 17 years of experience working on critical infrastructure projects.

Keast & Hood promoted three engineers, formerly associates, to principal: John R. Davis, P.E.; Denise L. Richards, P.E.; and Craig D. Swift, S.E., LEED AP. Davis, has managed some of the firm’s most sensitive historic building and new construction projects. Richards was recognized as a Philadelphia Business Journal 40 Under 40 professional in 2015 and manages some of the firm’s largest and most complex work. A seismic design expert with diverse structural engineering background, Swift leads the firm’s Virginia and southeastern U.S. work.

Douglas Fell, P.E., joined Walker Consultants as a senior restoration consultant. Fell will direct Walker’s Emergency Response Services, assisting clients with damaged structures across the United States.

Deborah Alaimo Lawlor, FAICP, PP, discipline leader of Planning Services at Maser Consulting P.A., was named president-elect of the American Institute of Certified Planners.

Jamie Brueggeman, P.E., joined CALYX Engineers and Consultants’ Building Structures Group as senior project manager in its Cary, N.C., headquarters.

RETTEW announced three new employees. Joe Anderson, working in RETTEW’s Pittsburgh office, is a project technician in the subsurface utility engineering group. Cathy Bihlman is a senior surveyor in RETTEW’s surveying group, based in Ohio. Bihlman completes residential and commercial boundary surveys, surface and underground mine surveys and permitting, construction surveys, and ALTA surveys. Brian O’Neill is a senior civil engineer in RETTEW’s civil municipal group in the firm’s Mechanicsburg, Pa. office. With more than 24 years of civil and environmental engineering experience, his areas of expertise include stormwater systems, subdivision reviews, water distribution and treatment systems, and road and street maintenance.

Ware Malcomb promoted Ted Swan, P.E., LEED AP, to director, Civil Engineering in the firm’s Denver-based civil engineering practice. In this position, Swan manages both commercial and multifamily projects.

Darryl Daniel, PMP, joined Burns as a senior project manager in its newly established Houston location. He is an experienced Airport Information Technology and Systems professional. Burns also announced that Derek Brown joined its Railroad & Transit team as senior project manager.

Jeff Layne, J.D., joined Kleinfelder as national service leader for Gas Transmission & Distribution. He has more than 25 years of energy market experience involving engineering, operations, safety, business development, commercial transactions, and regulatory compliance. Kleinfelder also added Caroline Brabrook, P.E., to the West Division as the Seattle area manager. She has 21 years of experience in transportation design, construction, management, and business development.

Jeff Scarborough joined Freese and Nichols, Inc. as an account director in its Houston office. In this role, Scarborough will leverage 20 years of business development expertise to help expand the firm’s capabilities to support federal and state agencies.

Gannett Fleming named Giuseppe (Joe) Tulumello, AIA, LEED Green Associate, leader of its Northeast Region Facilities Business Line. His nearly 20 years of experience spans complex, multidisciplined facilities projects. Steven Bowser, P.E., a former Navy civil engineer with nearly 25 years of experience, joined Gannett Fleming as a federal market program manager. He will focus on developing and maintaining relationships with the Naval Facilities Engineering Command, the Department of Defense, and other federal agencies. Luis Casado, P.E., was named director of Gannett Fleming’s Water Business Line. Casado will continue to hold the positions of southeast region director and senior vice president. Laurie Matkowski was named Gannett Fleming’s director of connected and automated vehicle capabilities to support federal and state agencies.

Gannett Fleming named Kevin Switala, GISP, to the position of chief technology officer.
The Principals Academy is Zweig Group's flagship training program encompassing all aspects of managing a professional AEC service firm. It's the most impactful two days you can spend learning about principal leadership, financial management, recruiting, marketing, business development, and project management.

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- Business Planning
- Marketing/Business Development
- Accounting
- Financial Management
- Project Management
- Leadership
- Mergers & Acquisitions
- Ownership Transition Planning
- Recruitment and Retention

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THE PROMISE OF PUBLIC-PRIVATE PARTNERSHIPS

Delivering infrastructure through P3s is gaining ground, but in a fractured U.S. market with no federal standard, it’s far from the norm, and might never be.

By Richard Massey
“A lot of times if there is no champion pushing for it, it might not go anywhere,” Herberghs said. “It’s a new way of doing things and you have to explain it.”

There are, however, issues at the federal level, where much of the “seed money” for P3 projects comes from in the form of low-interest debt. Early in his presidency, Trump had said he wanted to fund $1 trillion in upgrades. In May, a framework was issued in which the federal government would pledge $200 billion over 10 years as incentives for another $800 billion in spending by state and local governments and the private sector. In effect, the ideal environment for P3s.

But in September, Trump, speaking to lawmakers, apparently reversed course, putting the infrastructure framework into question. A glimmer of hope for P3 advocates, meanwhile, came in August when U.S. Transportation Secretary Elaine Chao, a Trump appointee, appeared at the groundbreaking for the 16-mile light rail Purple Line in suburban D.C. The federal government pledged $900 million to the project, which has as private equity partners the super firms of Flour, Meridiam, and Star America.

Still, the national infrastructure program appears to be stuck in neutral, with lawmakers focused on health care and tax reform, not roads and bridges. Add to that the series of brushfire controversies involving Trump, partisan gridlock on Capitol Hill, and a simmering investigation into Russian meddling in the 2016 election, and the forecast looks cloudy for P3s.

“I fear infrastructure is taking a back seat,” Herberghs said. “We’re reading the tea leaves.”

Geoffrey Yarema
Founder, Nossaman’s Infrastructure Practice Group

If infrastructure is taking a back seat, it’s at least still in the car. And there are plenty of influential people who want to see P3s considered whenever projects are proposed. One such person is Geoffrey Yarema, founder of Nossaman’s Infrastructure Practice Group. An acknowledged thought leader for innovative procurement, contracting, and financing structures for large transportation projects, he is known for his work with state departments of transportation, as well as regional and local agencies. Yarema has often provided expert testimony before Congress.

In addition to his work across the United States, Yarema counts 16 years representing the Texas Department of Transportation through more than $59 billion in transportation improvements. Perhaps it’s no surprise that Texas is one of the nation’s leaders in P3s, with many projects operational or under construction, and with an advanced, centralized state bureaucracy.

Yarema, an attorney, spoke with Civil + Structural Engineer and shared his thoughts on P3 and its role in the ongoing struggle to repair and expand the nation’s infrastructure.
Unsolicited proposals receive undue priority over established public projects. An unsolicited proposal into a state’s project pipeline could lead to the perception that competition, and a lack of transparency, which could lead to allegations of abuse. Inserting including proposal quality, constrained resources for adequate review, a lack of input. However, managing and responding to unsolicited proposals can lead to pitfalls, inserting proposals often extending for 30 to 50 years.

Unsolicited proposals not only reduce changes at a late stage but also increase transparency. (separate from legislative approvals) and stakeholder input is a successful practice that allows for robust public deliberation and participation through early agency approvals (separate from legislative approvals) and stakeholder input is a successful practice that allows for robust public deliberation and participation through early agency approvals.

Unsolicited proposals can trigger significant private-sector force, reaching out to influential parties and to the public to drum up support for a project. Political champions act as a rallying force, reaching out to influential parties and to the public to drum up support for a project. Political champions act as a rallying force, reaching out to influential parties and to the public to drum up support for a project.

Unsolicited proposals
Allowing unsolicited proposals for new projects can lead to pitfalls, inserting proposals often extending for 30 to 50 years. An important talking point for Yarema centers on the business model. Delivery of most publicly owned infrastructure in the United States, Yarema said, is based on a system that hasn’t changed in decades — pay for infrastructure with bonds and/or taxes with the owner breaking a project up into many scopes and awarding contracts to the lowest bidder.

The result, for larger and more complicated projects, is owner retention of interface and other significant risks that can be the foundation for significant claims and change orders. With the overwhelming majority of infrastructure in the United States delivered under the standard model, the conventional thinking is, “If it ain’t broke, don’t fix it.”

But with P3, there are many tools in the toolbox, and for owners there are opportunities to deliver increasingly complex projects by transferring to contractors project risks they can control better at commercially reasonable prices, all while creating a defined schedule for long-term asset management and life cycle costs — an expense that often exceeds a project’s initial capital outlay.

With state and local governments across the country looking at pressing needs throughout the gamut of infrastructure — road, rail, water, and air — now is the time to consider additional delivery models.

“Agencies should look at methods they may not have used before,” Yarema said. “Let’s not default to standard methods without analytically comparing them to modern business practices. Analytics now even drive how baseball players are positioned on defense. Why shouldn’t they drive how state and local governments deliver their most important capital investments?”

For Yarema, the use of alternative delivery should at least be on the table every time an owner plans to spend significant taxpayer dollars on a complex public works project with the potential for private-sector innovation. Based on the outcome an owner wants, maybe a P3 is the right tool, maybe it isn’t. But at least put P3 in the conversation, Yarema said.

While P3 has been around in the United States for about 30 years, the industry itself has yet to mature here. But at least one prominent infrastructure firm is expecting that to change.
In October, Louis Berger, a global professional services corporation, announced the appointment of Leif Dormsjo as senior vice president for infrastructure asset management. The former District of Columbia Department of Transportation director, Dormsjo brings to the firm nearly 20 years of experience in the transportation industry. Before joining Louis Berger, the Harvard-educated Dormsjo was associated with such marquee projects as the D.C. Streetcar project and the Purple Line in Maryland.

In an interview with Civil + Structural Engineer, he discussed Louis Berger’s growing role in the P3 industry, and the P3 industry in general.

Louis Berger has been involved with P3s for a while, primarily as an advisor on the front end, providing analytics, design-build, revenue analysis, and traffic forecasts. While the firm will continue to provide those services, Dormsjo’s hire signals an expansion into the P3 universe. The firm will now undertake direct operation of assets and will expand from highways and toll roads into transit, aviation, and maritime.

“We want to deepen our involvement on the operations side of the business,” Dormsjo said.

A major P3 the firm is now involved in is the once-troubled SH 130 in central Texas, a 41-mile highway linking Georgetown and San Antonio. The toll road went bankrupt when revenue did not meet projections, and emerged from Chapter 11 with new ownership, Strategic Value Partners. The firm hired Louis Berger to operate and maintain the roadway.

While SH 130 had its problems, it is still representative of what Louis Berger and Dormsjo see on the long-term horizon — a healthy secondary market in maturing infrastructure assets. As the original investors in P3s — infrastructure and construction companies — cycle out of the assets, new kinds of owners — pension funds and insurance companies — cycle in.

“We find that market intriguing,” Dormsjo said. “We see that transition into long-term life cycle management as an opportunity to be helpful.”

Here’s how it works.

A P3 is built, and the original investors manage the asset through the high-risk period, say for the first seven to 10 years when the reward is also high. When, in Dormsjo’s words, the asset is “de-risked,” the
original owners sell to a different breed of buyer, those looking for a more stable asset.

“The profile, from a risk perspective, changes,” Dormsjo said. “It’s the maturation of the asset.”

As a preview of what Dormsjo expects to happen in the United States, one must look no further than Canada, a country with perhaps the most well-defined P3 industry in the world. SNC-Lavalin, the largest engineering firm in Canada, announced this summer that it had agreed to sell five assets for about $208 million to BBGI, a Luxembourg-based investment company.

Even as the secondary market in domestic P3s begins to take shape, the foundation of the P3 industry in the United States will remain on uneven ground for a long time to come. With no federal standard, each state that has P3 legislation has its own law. As a result, companies looking to do business in P3s must navigate a labyrinth of obstacles, including legal, political, and labor, from state to state.

“The market is very fractured,” Dormsjo said. “You have many pipelines. It injects a whole bunch of risk in going after projects.”

A good example of how state and local politics can affect P3s happened in Colorado in 2014 when Gov. John Hickenlooper had to pass an executive order adopting more P3 transparency measures — but only after vetoing a previous proposal that would have been so restrictive, it would have imposed “unworkable substantive limitations on future P3 transactions.” The legislative uproar was sparked by the state’s first P3, U.S. 36 in metro Denver.

A big litmus test for P3 is likely to take shape this year, and beyond, in Nashville, one of the most explosive markets in the country. Nashville Mayor Megan Barry has proposed a $5.2 billion transit and infrastructure plan. Facing a huge upturn in population and subsequent congestion, Nashville is looking for as much as 26 miles of light rail, a tunnel under downtown for the transit lines, and rapid bus routes.

Voters are supposed to head to the polls in May to either approve or reject increases in the city’s sales tax, hotel-motel tax, car rental tax, and the business and excise tax, revenue sources that would fund the historic program. Last year, Tennessee lawmakers passed P3 legislation, albeit with restrictions. Under Tennessee law, P3s cannot be used for...
highways, bridges, and tunnels, but transit programs, like the one being proposed in Nashville, are authorized.

Sean Braisted, a spokesman for Mayor Barry’s office, had this to say about possible delivery methods, when and if the project moves forward: “Metro has developed our program at this stage without a definitive determination as to the ultimate delivery model. Metro will examine traditional design-bid-build and we will also entertain alternate delivery models to include the possibility of a P3 if it would result in faster or less expensive delivery, while managing the long-term risk of the city and keeping the best interests of our workers and residents in mind.”

Before Nashville arrives at the question of whether to use P3, however, it must first push past the age-old obstacle that has dogged public works for years — the unpopularity of new and increased taxes.

Zachary Jones, an infrastructure attorney with Nashville-based Stites & Harbison PLLC, said the political hurdle will be difficult to surmount. As proposed, the increased taxes would be implemented in Nashville and Davidson County, but not in the surrounding area. For many constituents, that might be too much to swallow — paying for something that lots of other people get to use.

“This is the potential problem on the horizon,” Jones said. “That’s what will be politically difficult.”

There is already opposition to Mayor Barry’s proposal. And then there’s the additional issue of what projects would be good for P3 and which ones wouldn’t — when and if the taxes are passed. Tennessee is brand new to P3 and has a law that, in Jones’ opinion, is “not the model of clarity.”

Though Jones was speaking of Tennessee, he could have been talking about multiple other states across the country when, referring to the P3 bureaucracy in Nashville, he said, “There’s no real infrastructure to get from Point A to Point B.”

Zachary Jones
Infrastructure attorney, Stites & Harbison PLLC

Zachary Jones is director of newsletters and special publications at Zweig Group and editor of The Zweig Letter. He can be reached at rmassey@zwieiggroup.com.
For many companies, insurance is one of the largest costs. When you add up premiums for Property, General Liability, Auto, Workers’ Compensation, Employee Benefits, Life Insurance and other lines of coverage, it can often total 5 percent of revenues or more. And that is only the direct costs. If you factor in the indirect costs, this number can more than double.

Due to the magnitude of these costs, it is critical to understand not only how to manage them proactively, but also how to forecast your costs as you look ahead to your next fiscal year.

In the long run, the only way to lower the cost of risk is to lower the frequency and severity of claims that drive the premiums as well as the indirect costs. In the near and intermediate future, however, you will also be affected by the insurance marketplace. This article provides some perspective on where the insurance industry is today and how the industry’s current finances and underwriting objectives might affect your business in 2018.

The insurance industry today
Table 1 shows that from 2008 to 2012, the industry’s “Return on Average Net Worth” was poor. This was attributable to a lousy combined ratio and a low level of investment return (the majority of an insurance company’s portfolio is invested in debt obligations; they can only invest about 20 percent in equities).

The industry needs to attract capital (surplus) to continue to grow. In order to do that, it needs to earn 10 percent or more in returns. When returns deteriorate like they did from 2008 to 2012, underwriters try to get more rate (increase premiums). This is reflected in the rate increases illustrated in Figure 1.

In 2013, 2014, and 2015, the industry performed well, but not great. Insurers earned modest underwriting profits but decent overall returns. Rates in these years were flat and started trending down. This decrease in pricing adversely affected 2016 results. Insurance companies basically broke even on underwriting (combined ratio of 100.7 percent) and overall returns dropped from 8.4 percent to 6.2 percent — a 26 percent drop.

The first six months of 2017 continued the downward trend. The industry recently posted a $5.1 billion underwriting loss for the first six months of 2017 compared with a $2 billion loss in the same period last year. Net income year-over-year fell to $15.4 billion from $21.6 billion in 2016.

The industry will be further impacted by the devastating effects of the recent hurricanes. Hurricanes Harvey and Irma promise to be among the worst national disasters to ever hit mankind, second only to Katrina, and it is estimated that total damages could be as high as $100 billion.
Insured losses could range from $30 billion to $40 billion, although it is too early to have a precise amount. To put this in perspective, Katrina cost about $176 billion, of which $82 billion was insured.

Overall, the Property and Casualty insurance industry remains in pretty good shape and, although it does have its share of challenges, we are still projecting flat renewal rates with modest rate relief for preferred accounts. This, of course, will vary by line of coverage.

Allied Lines includes Property, General Liability, Auto, and Umbrella. With the exception of Auto premiums, these lines should stay relatively flat. That does not mean that underwriters will not seek modest rate increases — they will. However, in most cases, rate increases can be negotiated. Auto is the exception. Auto experience has deteriorated recently, and it is estimated that State Farm lost more than $7 billion on its auto book in 2016!

The deteriorating results are attributable to increased claims frequency (distracted driving) and increased severity. The increased severity is driven (no pun intended) by higher medical costs, which affect bodily injury claims and higher physical damage costs to repair damaged vehicles. The cost to fix a sensor- and camera-laden bumper today is a lot more than it cost to just replace the bumper 10 years ago. On top of that, it is estimated that more than 500,000 vehicles have been destroyed by Hurricane Harvey alone, and flood damage is not excluded on most auto policies.

**Professional Liability (Errors & Omissions) insurance**

The market for architects, engineers, lawyers, CPAs, and other professionals remains competitive, with a large number of companies competing for preferred accounts. Every policy written for this line is tailored by the insurance company providing the coverage. In addition to coverage, the type of risk management resources offered and the quality of the claims handling differs greatly between insurance companies. Moreover, some of the "opportunistic" new players in this market may not be around in five years. Insurance is not a commodity and it is imperative that coverage, risk management, and claims be considered in addition to price.

Like Allied Lines, preferred Professional Liability risk professions should be able to negotiate renewal terms that are flat to minus 5 percent from expiring rates. If you operate in what is considered a higher risk profession, such as geotechnical engineering, or attorneys specializing in class action cases, or if you have adverse loss experience, the market is much narrower. It is suggested that your terms be negotiated early and your program marketed, if necessary.

**Executive Risk**

Executive Risk includes Directors & Officers (D&O) Liability, Employment Practices Liability (EPL), and Fiduciary Liability. The headache from the last economic downturn appears to be waning and these lines of coverage are reasonably competitive. Every form is different and there are a number of new players who may not be around in five years. On average, we are expecting flat renewal terms with some opportunities for rate relief.

**Workers’ Compensation**

Workers’ Compensation experience in California has improved significantly since 2011 and rates on average have dropped 15 percent since the first half of 2015. The rate reductions are even more impressive when you look back to 2003 when the Average Charged Rate (ACR) was $6.29, as shown in Figure 2. Through the first six months of 2017, the ACR in California is $2.58 — nearly a 60 percent decrease! Since 2013, combined ratios for this line of coverage have been positive (under 100 percent) but losses are trending up and 2017 is likely to come in close to 100 percent. Despite this, rates have continued to trend downward. This, however, could change.

The Workers’ Compensation Insurance Rating Bureau (WCIRB) proposes Pure Premium Rates that are approved by the Insurance Commissioner. Every insurer then publishes its own rates. It is the average charged by all the insurers in the state that make up the Average Charged Rate.

The WCIRB submitted its Jan. 1, 2018, pure premium rate filing to the California Department of Insurance proposing advisory pure premium rates that average $1.96 per $100 of payroll. This is slightly less than the current recommended pure premium rate of $2.00. The proposed decrease follows five consecutive advisory pure premium rate decreases since early 2015 that have totaled more than 27 percent.

### Table 1: Insurance cycle, 2007-2016

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<tbody>
<tr>
<td>Net Written Premium</td>
<td>$440.60</td>
<td>$434.90</td>
<td>$418.40</td>
<td>$423.80</td>
<td>$438.0</td>
<td>$456.90</td>
<td>$477.7</td>
<td>$487.6</td>
<td>$505.8</td>
<td>$523.5</td>
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<tr>
<td>Combined Ratio</td>
<td>95.5</td>
<td>105</td>
<td>101</td>
<td>102.4</td>
<td>108.1</td>
<td>103.2</td>
<td>96.1</td>
<td>97.0</td>
<td>97.8</td>
<td>100.7</td>
</tr>
<tr>
<td>Investment Income</td>
<td>$55.1</td>
<td>$51.5</td>
<td>$47.1</td>
<td>$47.6</td>
<td>$49.1</td>
<td>$48.0</td>
<td>$47.4</td>
<td>$46.2</td>
<td>$47.2</td>
<td>$46.3</td>
</tr>
<tr>
<td>Operating Income</td>
<td>$73.4</td>
<td>$30.6</td>
<td>$45.0</td>
<td>$38.2</td>
<td>$15.4</td>
<td>$33.3</td>
<td>$64.3</td>
<td>$55.6</td>
<td>$57.3</td>
<td>$42.6</td>
</tr>
<tr>
<td>Policyholder Surplus</td>
<td>$517.90</td>
<td>$457.30</td>
<td>$511.50</td>
<td>$556.90</td>
<td>$553.70</td>
<td>$586.8</td>
<td>$653.3</td>
<td>$674.7</td>
<td>$673.7</td>
<td>$700.9</td>
</tr>
<tr>
<td>Return on Avg. Net Worth</td>
<td>10.9%</td>
<td>0.1%</td>
<td>5.0%</td>
<td>5.6%</td>
<td>3.0%</td>
<td>5.1%</td>
<td>10.3%</td>
<td>8.4%</td>
<td>8.4%</td>
<td>6.2%</td>
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</table>

*Source: Insurance Information Institute (iii.org)*
Our projection is that rates in 2018 will on average be flat to down 5 percent. However, rate changes will vary by classification and by insurance company.

Surety Bonding
In 2018, the Surety industry in the United States will continue to post further growth in overall premiums and below-average loss activity.

The total direct written premium for the calendar year end for 2016 was up to $5.88 billion from the prior 2015 year of $5.62 billion (a 4.5 percent increase). Impressively, at the same time, the surety industry loss ratio fell in 2016 to 15.5 percent from 18.3 percent the previous year. This high watermark for surety industry volume continued to increase through the second quarter of 2017 to $3.13 billion in revenues, with a 13.6 percent loss ratio (compared with $2.98 billion in revenues with an 18.4 percent loss ratio at the second quarter of 2016.)

Strong growth and profitability since 2005 have attracted an increased number of new sureties to the market, creating fierce competition for market share. During the last five years alone, startup front-line contract and/or commercial surety operations have included AmTrust, Axis, Ironshore, Freedom Specialty, Allied World, Berkshire Hathaway, QBE, Euler Hermes, Navigators, Crum & Forster, Patriot, Endurance, Everest, Sirius, Markel, and Argonaut. The number of reinsurance markets have almost doubled since 2008. Although underwriting standards are relatively stable, overall supply has outpaced demand. This fresh credit capacity will likely cause increased pressure to further relax and soften terms and conditions (i.e., capacity, rate, indemnity) throughout the surety market.

Slow and steady economic growth has extended the current building cycle to a sluggish pace. This has also lengthened the surety industry’s positive historical results. Continuing labor shortages, inflation, interest rate hikes, and other factors will likely further slow the economic engines in the coming years.

Wise contractors are now getting margins, building their balance sheets, and conserving for a rainy day. Contractors should begin positioning themselves for the impending shift ahead by retaining the best management team and labor talent; closely managing material, field, and overhead costs; and demanding acceptable margins to ensure long-term success.

Health Insurance
The Affordable Care Act (ACA) is still the law. A number of “repeal and replace” bills have failed to pass, so the law will continue to be enforced. We are still waiting on information about the Cadillac Tax and whether regulations will be implemented.

For 2018, the number of age bands is likely to change. Currently, for small groups (two to 99 employees), most insurance carriers have one rate for children under 20 years old. In 2018, insurance carriers will divide the 0-20 age group into seven bands: 0-14, 15, 16, 17, 18, 19, and 20. As a result, premiums for age 20 and below could see significant increases of 20 percent to 50 percent.

Rates for all “small” employers will be based on the employees’ and their dependents’ individual ages, plan design, and location of the company. For example, a family of five will pay for each family member based on each individual’s age and the plan they select. Some younger employees or families with one child may realize lower premiums. All of the small group plans have changed to conform with the law and most have higher deductibles and copays; therefore, employees will have to pay more when they use the services.

The actuaries at all the major insurance companies have determined
that, to stay in compliance with the ACA’s metallic tier guidelines, they must change plan benefits every year. The ACA guideline gave a percentage requirement for each tier — 90 percent = Platinum, 80 percent = Gold, 70 percent = Silver and 60 percent = Bronze. As costs increase, the value of the percentage changes and, therefore, the plan benefits change.

Using the Platinum Plan as an example, if the actuarial value of a plan this year was $1,000, then the Platinum Plan has to cover 90 percent ($900) and pass 10 percent ($100) to the plan member. In the second year, if the actuarial value goes up to $1,100, 10 percent ($110) can be passed to the plan member and the benefits will change. This will always be a moving target until the values are fixed or the law is changed.

The provider networks are still changing and are offering a lower number of choices for doctors and medical groups. The industry calls them skinny networks. Often, the price looks good, but your employees will have very few choices for doctors. Be sure to run a report to compare current providers to those associated with any programs you are considering. Insurance carriers continue to seek greater discounts from hospitals, medical groups, and doctors and are offering patient exclusivity in return. Some insurance carriers will allow skinny networks to be offered side-by-side with full networks, with the price and contribution being set by the employer to favor one or the other. In 2018, businesses will see an overall zero to 10 percent rate increase and benefit changes for “small” employers and 5 percent to 15 percent for “large” employers.

Captives, self-funding, and partially self-funded plans are becoming more popular and should be considered for companies with more than 50 employees. Industry trust plans for all size of employers could lower the overall cost and stabilize the benefits. Other ways to reduce costs include buying a Bronze Level Plan and supplementing it with cancer, hospital, accident and critical illness plans. Dental, life, vision, and disability continue to be popular benefits with employees.

**Conclusion**

The insurance industry remains in a solid financial position. Despite the costs of the hurricanes, rates on average should be consistent, if not trending down slightly. The industry, however, has a good memory and has not forgotten the mediocre returns experienced from 2008 to 2012. Most underwriters still want more rate but the industry’s capacity (as measured by surplus) continues to have a downward effect on pricing.

While the health of the insurance market will directly affect what you pay for insurance, a much more important element is your Risk Profile. When an underwriter considers your account, they will evaluate your overall operations, your human resources practices, safety culture, and overall safety practices, as well as your loss history.

A positive Risk Profile will result in substantially better pricing than a poor Risk Profile. This underscores the importance of proactively managing your cost of risk. The only way to lower your insurance premiums and the total cost of risk in the long run is to reduce the frequency and severity of the claims that drive this risk. While you cannot control the insurance marketplace, you can directly control your Risk Profile.

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Precise Maps for Driverless Cars

Sanborn Map Highlights HD Map Data Overlaying 3D Reality Mesh for Use in Autonomous Driving.

An Industry Leader in geospatial solutions and technology, The Sanborn Map Company, Inc. is helping to make self-driving cars a reality by creating high-definition (HD) Maps used by test-drive simulators for autonomous vehicles.

Sanborn partnered with auto manufacturers in a $100,000 project that demonstrated the precision of its purpose-built HD Maps. Using aerial oblique imagery of the target area in Santa Clara County, Calif., Sanborn generated a 3D reality mesh with Bentley’s ContextCapture Center software, then overlaid proprietary HD base map data that is accurate within an absolute range of 7 to 10 centimeters. Visualizing the high-precision HD Map in the context of a high-resolution 3D urban environment elicited auto company requests for repeat demos internally and with department of transportation regulatory authorities.

Bentley software allowed Sanborn to quickly create 3D reality meshes that would ordinarily take three modelers six months to complete. This capability made the technology more affordable, allowing Sanborn to provide exceptional value to clients.

Safe Test-Drive Environment

Major auto manufacturers are racing to release self-driving features that give their vehicles some autonomy in specific situations, such as braking to avoid imminent collision. To achieve the ultimate goal of a driverless vehicle, manufacturers need to demonstrate that their cars can safely operate in any situation. The RAND Corporation estimates that a driverless car would have to drive more than 11 billion miles to prove it is 20 percent safer than a human-driven car. A thousand test cars driving non-stop, 365 days a year would take 50 years to cover that many miles. Simulating the test drive in a virtual world would prove the point in a matter of hours. Using 3D reality models creates a realistic world for the virtual driverless car in the least amount of time.

“Self-driving cars are no longer a futuristic idea,” said Sharad V. Oberoi, Ph.D., director of IT and software engineering, with Sanborn Map. “Major auto manufacturers have already released, or are soon to release, self-driving features that give the car some ability to drive itself. Through the 3D mesh generated using ContextCapture Center, Sanborn’s Advanced Technology group has been able to showcase the quality of the HD Map data, including true-ground, absolute accuracy, to its partner automotive firms. Automating the production of city-sized 3D models with ContextCapture Center made the project much faster than previously possible.”

Founded in 1866 to produce fire insurance maps, Sanborn evolved with the changing market for imaging and mapping services and today is a first mover in the emerging market for HD Maps. Sanborn’s Advanced Technology group has developed proprietary HD mapping technology that creates standardized, high-precision 3D base maps for self-driving vehicle models and markets. The HD Maps contain more detailed information with true-ground, absolute accuracy than is available in conventional resources, such as GPS maps. Compared with current mapping systems that can locate a car’s position within 1 meter, HD Maps can position a vehicle within less than 10 centimeters.

Sanborn provides precise real-world context for HD Map data by creating 3D reality models of the environs, drawing upon its expertise in aerial oblique imagery, aerial LiDAR data, and mobile (driven) LiDAR data. For image processing, the map company uses ContextCapture Center, Bentley’s reality modeling software for 3D models of any scale. ContextCapture Center generates the 3D engineering-ready reality mesh that Sanborn’s HD Map data overlays to create the purpose-built, map-based data sets automotive makers need for their driverless car’s virtual worlds.

High Definition, Precision, Resolution

For the automakers’ project, Sanborn acquired aerial oblique imagery of the Silicon Valley area, including Santa Clara, Sunnyvale (Heritage District), Palo Alto, and surrounding locations, to construct a sizeable target area for mapping. The oblique imagery was acquired in a single, multi-pass flight plan using five digital cameras to collect four oblique views and one straight-down (nadir) view. These images were processed using Context Capture Center to quickly produce 3D mesh models of Santa Clara County’s complex urban environment. The software automatically aerotriangulated the images to identify the position and orientation of each image, then reconstructed the images as a highly accurate georeferenced 3D reality mesh.

The 3D reality mesh provided precise real-world context for Sanborn’s HD Maps. With many densely packed triangles, draped textures, and snap points, the 3D mesh created the fine details, sharp edges, and accurate geometry required by the automotive partners. The georeferencing made it possible to identify the precise locations that intersect with Sanborn’s HD Map data (collected in absolute XYZ space). The project team overlaid the 3D mesh data with Sanborn’s HD Map data to provide all the critical information a driverless vehicle needs to safely navigate roadways and intersections.

Combined with Sanborn’s HD Maps, which are accurate within an absolute range of 7 to 10 centimeters, the high-resolution 3D mesh provided a meticulously detailed inventory of physical assets for the roadways, such as lane markings and dividers, road edges and shoulders, and traffic signals and signage. Inclusion of surrounding buildings, generated by ContextCapture Center and enhanced using Descartes, produced a city-sized reality model for a more genuine driving experience. Together, the HD Maps and 3D mesh were integrated into virtual
reality simulation tools for testing autonomous vehicles. Using the FBX (Filmbox) format made the process seamless.

**Testing the testing grounds**
The HD mapping technology allowed Sanborn to create data sets for multiple environments and levels of complexity in the autonomous driving tests, including freeway, complex urban, and complex parking. For some sections of the city, Sanborn’s geospatial developers loaded the 3D mesh into a web interface, so the automotive partners could see the quality of the 3D reality view. Sanborn also developed web-based analytics that the partners could use to review and discuss vector and point data superimposed on the 3D reality mesh. Within the 3D viewing interface, it was possible to precisely measure distances, volumes, surface areas, and other parameters. These capabilities create an accurate virtual reality, showcasing the driverless car in various road conditions.

Showcasing the complex HD Maps in a 3D urban setting provided context for high-precision features such as road lanes and traffic signs and signals, as well as surrounding buildings. The project highlighted the level of road intelligence that could be achieved in a 3D reality model. As they explore the virtual landscape for autonomous driving tests, several automotive partners are using Sanborn’s 3D demonstrations internally, as well as in meetings with department of transportation regulatory personnel.

By making a modest investment of time and resources, Sanborn showcased HD Maps for autonomous driving and received positive responses from the participating automakers. With a premier collection of oblique imagery, Sanborn is poised to expand its HD Maps offering for autonomous vehicles, which have a promising future.

Among the much-touted benefits, self-driving cars promise less stress for drivers, more mobility for non-drivers, and less congestion and fewer accidents on roadways. Given the opportunities, Sanborn’s proprietary technology could fuel a lucrative market.

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Information provided by Bentley Systems Incorporated (www.bentley.com).
DATA TRANSITION FOR A BIM-TO-FM PROCESS

DENVER INTERNATIONAL AIRPORT FILLS THE GAP BETWEEN COLLECTING INFORMATION AND POPULATING THE ASSET MANAGEMENT SYSTEM.

By George Broadbent and George Wright

ASSET MANAGEMENT — or facilities management (FM) — has both a strategic and tactical component to it, with both being vital to any long-term program success. The technical component boils down to two main areas. The first centers on where the information is coming from; the second evaluates how the system will be used to support asset/work order management. However, there’s a fundamental component in between these two areas that’s often overlooked. This is the area of the region we call a data transition period.

Denver International Airport’s (DIA) administration recognized that data transition was a critical component to its long-term success and began taking steps to fill the gap between the collection of information and population of the asset management system.

The first look at this process became the need to develop a Single Source of Truth, which is where information would be centrally stored and used to feed all other systems. However, there’s a fundamental component in between these two areas that’s often overlooked. This is the area of the region we call a data transition period.

About three years ago, DIA moved away from the central repository model for the information toward a shared communication between systems, known as a Federated Model for Information Management.

Any information management plan that is developed needs to understand what the source and the destination is for the information as well as the Extract Transform and Load (ETL) process for that data. It’s only by ensuring the process is consistent and reliable that you can ensure the data is also consistent and reliable.

In a Federated Model for Information Management, the individual systems that are responsible for the data to maintain their system keep data outside that system. It is sent through a trusted connection. The ETL process moves the information from one system to the Target system. At the Target system, processes are put in place to maintain and upkeep the data. Then the data can be returned to the store system based on information that’s updated from the Target. This bi-directional flow of information was appealing to DIA, which would not have to maintain a third database for storing information.

Microdesk ModelStream was the product selected to help build the Federated Model for Information Management. ModelStream allows the information to be mapped between the source and the destination system. In DIA’s case, the source was a BIM model and the destination was the IBM Maximo system. This mapping extracts information, transforms it, and loads it into the Maximo system.

The Maximo system information is constantly being updated with new equipment and information. This information can then go back into the BIM model using ModelStream’s functions. This process allows each group to continue to update and maintain the data as needed based on their jobs. ModelStream handles the ETL process of moving information from one system to the other on an as-needed basis so the BIM process can be updated through the normal established workflow. The two systems are tied together through this mapping but they are not dependent on each other.

As the BIM models evolve and standards are developed for data being captured within those models, the mapping file is updated to show where the information needs to go into the Target system. There is a profile for each set of existing models using a different data standard. These don’t need to be updated to the new standard but can continue to
use their existing map of information to push and pull information into the Maximo system.

The process that developed at DIA and other infrastructure locations allows this approach to be used by MEP and structural engineers. The approach has been proven to be useful in fixed structural assets such as bridges and is being extended to tunnel infrastructure.

Impact on owners
From the owner’s perspective, the construction process contains rich data sets that are needed in operations and maintenance. Unfortunately, the traditional methods of data delivery require additional time and money to get the information into the hands of the operations and maintenance staff. This time has been measured as somewhere between six and 18 months to process the close-out packages, extract the data, and convert the data to something a computerized maintenance management system (CMMS) can use.

This process using ModelStream greatly reduces the time to data delivery for operations and maintenance.

Asset management impacts
“Day One” operational support is the holy grail of facility maintenance and operations, where at the end of major construction, the assets and related data and reference documents are loaded into an asset management system. On this first day of operations and maintenance, all relevant information about the assets is made available to facility staff. ModelStream allows the industry to get one step closer to Day One operations by streamlining the data transfer process from a unified as-built model into an operations and maintenance CMMS.

In addition, operations staff can view the 3D model information and all related data while inside Maximo through the introduction of a Model Viewer Tab. This Model Viewer Tab allows the facility technician to see where the asset is located and what equipment is around the asset. The Autodesk Forge platform is used to display the 3D models without a need to have Autodesk Revit installed. The Autodesk Forge Platform is a browser-based system for viewing 2D and 3D drawings.

Implementation challenges
As with any data management system, complexities of implementation always come up. In this case, the challenges revolved around ensuring the Maximo system for the development staging and production environments were of similar Rev levels for data consistency across each platform for populating assets. All information updates were handled through the specifications or classifications in Maximo and then through an automation process.

The main technical issues were Maximo patch level differences among the environments and network/firewall that had to be worked through. The firewall issues were mainly getting its exceptions from the hosted Maximo environment to the Forge platform.

As a part of a separate effort, DIA realized the BIM process had to be modified to add placeholders for the data they were looking to collect and eventually transfer to Maximo. Even though the data didn’t exist yet, the placeholders allowed for the creation of the mapping files. All the additional parameters were created at the instance level in the models to allow for individual values (as opposed to global values that are placed at the family level). This provided support for using the model as a facility model.

DIA wanted to have Maximo auto number the assets, but also be able to see what a particular element in Revit was linked to in Maximo. To accomplish this, we set up an inbound (Maximo to Revit) mapping that brings the value for the “assetnum” field back into the Revit model after it is loaded in Maximo to give full visibility.

Conclusion
What this and other projects like this have shown is that BIM does have a role within operations and maintenance. The Single Source of Truth model may not currently exist, but there is a role for a federated data model with BIM as the primary source of information. What is left for the facility maintenance and operations industry to figure out is if the 3D model itself has a useful role in operations and maintenance.

The 3D model allows the facility staff to view and examine the work area prior to going into the field. Future integrations of technology will allow the 3D model to be used in the field for the “behind-the-wall” view. However, for the industry to get there, a robust BIM workflow must be in place to ensure the data is consistent and reliable.

Technical requirements
Revit 2015-2018:
• ModelStream plugin for communication with Maximo

Maximo 7.5 or newer:
• Installation of components to the IBM WebSphere platform for communication with Maximo
• Valid Maximo account for publishing asset data

Autodesk Forge platform:
• No subscription required; provided under the ModelStream license

GEORGE BROADBENT is the director of asset management for Microdesk (www.microdesk.com). He has more than 25 years of experience in the areas of asset management electronic content management (ECM), system architecture, and vital records planning and management and is a leader in the design and implementation of asset management systems using IBM’s Maximo and ECM systems.

GEORGE WRIGHT is the vice president, western region for Microdesk. He is an enterprise-level architecture, engineering, construction, and operations technology specialist with expert knowledge in transitioning public and private organizations and government agencies to the latest planning, design, construction, and operations and maintenance software and methodologies including BIM and virtual design and construction, and has nearly 20 years of civil and survey engineering experience.
The 25th annual Autodesk University, held mid-November 2017 in Las Vegas, offered Autodesk software users an opportunity to attend hands-on classes; view peers’ work in architecture, engineering, construction, and other applications; and discover new products from Autodesk and its partners. Following are a few highlights of particular interest to civil and structural engineers.

Autodesk and Esri to collaborate

Autodesk and Esri announced the start of a new relationship to build a bridge between BIM and GIS mapping technologies. The companies said they plan to enable a broad range of industries to gain better context by visualizing data of the man-made world, the environment, citizens, and the networks that weave it all together.

“It is important to consider the needs of future generations during the design and building of projects today,” said Jack Dangermond, president of Esri. “The benefits of partnering with Autodesk will include securing sustainable resources for the growing population, a responsible human footprint on our natural environment, better use of our planet’s resources, and more resilient cities.”

Autodesk and Esri plan to work together to better integrate their respective technologies, allowing industry professionals to synthesize information from both BIM and GIS to enable a more connected infrastructure. Benefits are expected to include reductions in permitting through improved stakeholder engagement, more sustainable and resilient design through enhanced project insight, and reduced risk via improved end-to-end flow of materials, resource availability, and scheduling during construction.

For infrastructure owners around the world, both public and private, enabling BIM and GIS mapping software to more seamlessly work together will optimize their ability to plan, design, build, and operate infrastructure assets, saving precious time and money, the companies said. Improving the integration of Esri and Autodesk software has the potential to dramatically decrease workflow times.

“Partnering with Esri is intended to combine the power of BIM and GIS mapping, which will enable our shared customers to build anything, anywhere,” said Andrew Anagnost, CEO, Autodesk. “Our goals are to provide industry and city planners the ability to design in the context of the real world. This will allow communities to build more connected, resilient cities, and infrastructure with a focused eye on sustainability.”

Autodesk and Esri plan to work together to better integrate their respective technologies, allowing industry professionals to synthesize information from both BIM and GIS to enable a more connected infrastructure. Benefits are expected to include reductions in permitting through improved stakeholder engagement, more sustainable and resilient design through enhanced project insight, and reduced risk via improved end-to-end flow of materials, resource availability, and scheduling during construction.

Learn more about the collaboration between Autodesk and Esri at www.autodesk.com/solutions/bim/hub/autodesk-esri.
The next generation of BIM 360, built on the Autodesk Forge platform, supports informed decision-making throughout the construction project life cycle by centralizing all project data in a single place.

**Next-gen BIM 360**

Autodesk previewed its next generation BIM 360 platform, a seamless cloud service connecting the entire construction project life cycle. Autodesk also launched the Connect and Construct Exchange, a new BIM 360 integration partner program designed to bring third-party software applications and data into the BIM 360 construction workflow. The Connect and Construct Exchange launched with more than 50 inaugural BIM 360 integrators.

The next generation of BIM 360, built on the Autodesk Forge platform, supports informed decision-making throughout the construction project life cycle by centralizing all project data in a single place. Autodesk Forge is a connected developer cloud platform that enables customers and partners to create customized, scalable solutions for engineering, construction, and manufacturing challenges.

BIM 360 connects project stakeholders and workflows at all stages of the building life cycle — from design to construction to operations, from the field to the office and back. BIM 360 removes the uncertainty that plagues construction projects of all sizes by pairing its project management tools and database with machine learning analytics and insights. The result is closer collaboration among project teams, greater transparency about changes, and improved data continuity that translates into increased profitability, according to Autodesk.

"With the confusion of an ever-increasing number of construction apps across the industry, the option to manage all project data in a single cloud platform results in more predictable building project outcomes," Anagnost said.

The new BIM 360 platform is a result of collaboration between Autodesk and 500 construction professionals from 100 organizations who informed the company’s software development process. Autodesk BIM 360 solutions presently house almost 4 million models, and BIM 360 customers have logged approximately 200 million field observations.

BIM 360 connects fragmented workflows across preconstruction, execution, fabrication, installation, and facility management. Autodesk said its new Connect and Construct Exchange adds value for each of these phases of construction with an inaugural group of more than 50 BIM 360 integration partners, of which more than 40 are now available on the exchange. The exchange’s goals are to showcase, catalogue, and generate awareness for all applications and integrations to the next-generation BIM 360 platform so customers and partners have a broad choice of solutions to enhance and extend their workflow to better meet their unique construction needs.

**2017 AEC Excellence Awards winners**

Autodesk revealed the 2017 AEC Excellence Awards winners. The competition recognizes global projects that embrace connected BIM technologies and sustainable design in the AEC industry. This year’s
competition received 145 submissions representing more than 30 countries.

The 2017 AEC Excellence Awards were co-sponsored this year by Autodesk, HP, Construction Dive, and Smart Cities Dive. The independent panel of judges selected the winning projects in the categories of Sustainability, Infrastructure, Building, and Construction.

Geotectura, Axelrod-Grobman Architects, NCA, and Assa Aharoni Consulting Engineers won the first place award in the Sustainability category for The Porter School of Environmental Studies at Tel Aviv University. The 4,000-square-meter building is the first of its kind in Israel, achieving both LEED Platinum certification (92 points) and 5 stars in the Israeli Green Code 5281.

Tianjin Architecture Design Institute claimed the second place award in the Sustainability category for the Jie Fang Nan Lu Community Culture and Sports Center. The Jie Fang Nan Lu Community Culture and Sports Center is designed to operate as a net-zero building, obtaining both LEED Platinum and China’s Three Star certifications.

The third place award in the Sustainability category went to Magnolia Quality Development Corporation Limited for WHIZDOM 101 Bangkok. Magnolia Quality Development Corporation is transforming an urban, 17-acre plot into a sustainable, smart city model with a fully integrated, digital, mixed-use development with both commercial space and residential towers.

In the Infrastructure category, the first place award was presented to Foster + Partners, FR-EE for Nuevo Aeropuerto Internacional de la Ciudad de Mexico (NAICM). At 470,000 square meters, NAICM will be one of the world’s largest airports. Its flowing form is inspired by flight, but its primary design focus is the passenger experience. The terminal is almost 1.5 kilometers long with a single, continuous grid shell with an innovative roof and fixed boarding bridges in one enclosure.

LiRo Group won the second place award in the Infrastructure category for East Side Access in New York City. The Metropolitan Transportation Authority’s East Side Access, one of the largest infrastructure projects in the United States, will connect trains from Long Island and Queens to the east side of Manhattan. This includes an eight city-block-
long concourse and multiple train platforms 150 feet beneath Grand Central Station, as well as major renovations of Harold Interlocking, the busiest railway junction in the country.

Third place in the Infrastructure category went to Norconsult AS for Arna-Bergen, Ulriken Tunnel. The Arna-Bergen, Ulriken Tunnel is the first use of a tunnel boring machine in Norway. When the new parallel tunnel is finished, double tracks will run between Arna and Bergen, providing more frequent departures between the cities and updated stations to accommodate the new trains.

In the Building category, Dubai Future Foundation, Killa Design, BuroHappold Engineering, BAM Higgs & Hill, and Transgulf received the first place award for the Museum of the Future. Located adjacent to Emirates Towers in Dubai, the $136 million, 30,000-square-meter iconic building will have an instantly recognizable distorted torus shape, epitomized by its futuristic stainless-steel façade with illuminated glazed Arabic calligraphy.

Second place in the Building category went to Tianjin Architecture Design Institute for the Hohhot City Saihan District National Fitness Center Project. The project in Inner Mongolia is being designed and constructed to encourage participation in China’s 2016-2020 National Fitness Plan. With a site consisting of 91,437 square meters and a total construction area of 33,000 square meters, the building is divided into two zones that include a multi-functional gymnasium with 5,000 seats for sports events and fitness facilities.

Dubai Expo 2020 Bureau won third place in the Building category for Expo 2020 Dubai. Between its opening day on Oct. 20, 2020 and its close on April 10, 2021, the $6.8 billion Expo 2020 Dubai will bring together 180 countries, each with its own pavilion, and the capacity to welcome as many as 270,000 visitors per day. The enclosed area of the expo will occupy 2 million square meters with the remaining 2.4 million square meters for amenities and facilities.

In the Construction category, China Construction Eighth Engineering Division Corp. Ltd. won the first place award for the Tianjin Chow Tai Fook Financial Center Project. Expected for completion in the fall of 2019, Tianjin Chow Tai Fook Financial Center will be a striking
new landmark with integrated business and commercial space, luxury apartments, and a five-star hotel. It has a 390,000-square-meter total construction area, constituting a four-story basement, a five-story podium, and a 103-story tower, reaching a total height of 530 meters.

Second place in the Construction category went to China Construction Third Engineering Bureau Group Co., Ltd. for China Zun Tower. Set to become the tallest structure in the city of Beijing, and in an area prone to 8.0 seismic intensity, CITIC Group’s new $3.5 billion China Zun Tower — with a gross floor area of 43.7 million square meters — will reach 528 meters with 108 floors and seven floors underground.

Obayashi Corporation and ITOCHU Techno-Solutions Corporation received the third place award in the Construction category for the Mikusa tunnel on the Kinki Highway Kise Line. Surrounded by the sea, Japan is especially susceptible to the devastation of tsunamis. Since many areas are connected by a single road, there is a high risk of isolation during a disaster. A new highway was recently built to serve for additional transportation, which included construction of the 2,380-meter Mikusa tunnel.


Information provided by Autodesk (www.autodesk.com).
The St. Regis Aspen Resort is a perfect environment for this educational event. Ideally located at the base of Aspen Mountain, the resort is within walking distance to all of Aspen’s shops, restaurants and entertainment.

DISCOUNTED LODGING AVAILABLE UNTIL MAY 16, 2018

zweiggroup.com/tpa
On Aug. 31, 2017, the historic Liberty Title and Trust building in Philadelphia reopened its doors as the Aloft Philadelphia Downtown hotel after nearly 20 years of vacancy. First built in 1929, the Liberty Title and Trust building is the only structure along the corridor to survive the expansion of the Pennsylvania Convention Center. Today, the fully renovated bank building harkens back to Philadelphia’s rich architectural history, while offering all the luxury amenities of a modern hotel.

The 90-year-old building, originally designed by Philadelphia architectural firm Savery & Scheetz, has been transformed into a modern building while keeping its historic roots. Providing façade restoration and structural engineering services, The Harman Group worked closely with developers Realen Properties and HRI Properties and architects Blackney Hayes Architects to breathe new life into this historic property.

Early on, the team was determined to preserve the original aesthetic and authenticity of the old Liberty Title and Trust building while also giving it a more modern look. The Starwood Hotels and Resorts group, which owns the Aloft hotel, wanted to create a brand for millennials, but understood the historical importance of this iconic building. One of the most notable examples of this balance is seen immediately when stepping into the hotel’s main lobby, which features the original 30-foot-tall windows, plaster crown molding ceiling, and marble flooring with mosaic tiling. Neon and rolling electronic signs outlining the entrance to the elevators instantly reminds guests that this is a building for the modern traveler.

While undergoing renovations, The Harman Group ran into a few challenges. The major issues were the lack of architectural or structural drawings of the 181,000-square-foot building. Compounding this, existing finishes from the previous uses were in place and could not be demolished to allow a field survey of the existing structure prior to completion and issue of bid documents. The engineering team had to make its best educated guesses as to what the original design was, and essentially redesign elements of the new fit out from scratch as the renovation moved forward.

The lack of drawings and field survey information led to several unexpected discoveries as the renovation moved forward. During the initial
stages of renovation, for example, the engineering team discovered the foundation from a previous building. At another point, an old elevator for money cars was discovered where it was thought none existed. Most problematic was the lack of spandrel beams at the primary floor levels where public bathrooms were located half a floor up and down from the typical floors, forcing the structural engineers to work through multiple design revisions. The existing public bathrooms were required to be demolished to allow new floor construction at the main floor levels for the addition of accessible hotel rooms.

As the renovation progressed, however, the structural engineering and design teams were able to keep the historic character while adding modern touches. Each room is unique in its shape, ranging from 206 square feet to 423 square feet. Keeping the original bold and large windows of the building, each room has a welcoming and sweeping view of bustling Center City or the whole of Philadelphia. This allows every guest to have a different experience while all still enjoying gorgeous views of the City of Brotherly Love.

In addition, a three-story steel-frame addition to the Aloft hotel connects to the neighboring Pennsylvania Convention Center, allowing guests to walk between the two buildings without going outside. On the second level of this new addition is an outdoor space named “the Backyard,” where hotel guests can enjoy a drink from the WXYZ bar and the view of Philadelphia’s iconic City Hall.

**ALBERT MEYER, P.E.,** senior project engineer at The Harman Group (https://harmangroup.com), oversees all aspects of a project’s structural and foundation design. He has 25 years of experience in the structural design of residential, hospitality and gaming, and other projects.

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**BUILDINGS OF THE FUTURE: RETHINK THE BOTTOM LINE**

**LACK OF MEASUREMENT MODELS THAT ACCURATELY REFLECT ROI IS OFTEN THE BIGGEST HURDLE IN DESIGN, CONSTRUCTION, AND MAINTENANCE.**

A **REVOLUTION** in construction and maintenance of future buildings is not being adequately reflected in traditional return on investment (ROI) business cases, and according to a new report by global engineering and infrastructure advisory company Aurecon, this is blocking important forward-looking design innovations and significantly damaging the future value of major building investments.

The short-term focus on start-up and construction costs is denying investors and building owners access to the design innovations that increasingly are key to the construction of digitally smart, “intelligent” buildings that are able to use technology to dramatically improve operational efficiencies and employee productivity and reduce maintenance costs.

In a recent white paper released by Aurecon, “Buildings of the Future: Bottom-line benefits,” a new narrative around the ROI of intelligent buildings is explored to demonstrate the crippling effect that a short-term focus on start-up and construction costs often has on design innovation.

According to Aurecon, the property and construction industry is evolving dramatically as digital disruption, changed building practices, and the need to respond to climate change and reduce energy consumption impact the sector. Yet many building owners and investors are locked into relying on more traditional ROI metrics, designing for the short term while ignoring the importance of designing buildings for the longer term.

The company has called for a new ROI model that accounts for financial and non-financial benefits such as improving employee productivity and wellbeing, while maintaining design flexibility to plan for a rapidly changing future.

Aurecon’s experience highlights that while Buildings of the Future have marginally higher start-up costs (2 to 6 percent more expensive than traditional buildings) in the short term, they can deliver significant savings, with a good ROI being achieved quickly (six months to two years) if focus is given to heating, ventilation, air conditioning (HVAC), lighting, and some types of electrical loads, with a reduction in operating costs against traditional buildings of between 10 percent and 50 percent.

Their experience also points out reductions in maintenance costs of between 8 percent and 12 percent, increases in employee productivity of 10 percent, and the ability of landlords to charge 5 percent more for premium property rentals of these innovative new buildings.
“To provide a more accurate ROI analysis on Buildings of the Future, a 3D approach is needed — one which presents the elements of design as interconnected pieces of a living and dynamic puzzle,” said James Bennett, Aurecon’s managing director - Built Environment.

“Buildings of the Future must be designed to meet future expectations, while avoiding wasted space, inefficient designs, and inflexible stories. The paper explores why and how our thinking around ROI needs to evolve in line with this,” said Peter Greaves, Aurecon’s Buildings of the Future leader.

**Long-term thinking**

Aurecon calls for a ROI model that reflects the importance of designing buildings for the long term and looks at both the financial and non-financial benefits of intelligent buildings, such as improving employee productivity and wellbeing, while maintaining design flexibility to plan for a rapidly changing future.

Long-term thinking can help companies avoid potential disruption. The importance of designing for the longer term and for changing space requirements was never better illustrated than when well-known architect Norman Foster admitted that he had got it wrong with Apple’s Campus 2 and its massive underground carpark for 11,000 cars by not allowing for retrofitting into habitable spaces as garages become less important and transportation patterns evolve.

Legislation can also present significant disruption for those who don’t invest in the right tools and methodologies from the outset. For example, the European Commission is currently proposing a voluntary scheme for rating the “smart readiness” of buildings. The scheme, which is expected to be adopted by the end of 2019, will include development of a Smart Readiness Indicator (SRI), which will measure a building’s capacity to use information and communications technology and electronic systems to optimize operation and interact with the grid.

**The changing nature of construction**

“The changing nature of construction design and materials also plays an increasingly significant role in ROI. We are seeing an evolution in construction and maintenance with prefabricated construction, automated technology such as robotics to install it, and additive printing, which drives down short- and long-term costs,” Bennett said.

The ROI on a 3D printed building, for instance, is almost immediate, with its parts integrated into a digital model of the building that makes maintenance easy. Beyond construction and maintenance, these embedded digital parts also capture and monitor consumption and usage to optimize building performance over the long term.

**A holistic approach**

According to Aurecon, based on these non-financial factors, Buildings of the Future demand a more robust evaluation of their ROI.

Intelligent buildings are the quintessence of future-ready architecture, but their true value lies in innovation and a shared vision, which necessitates moving away from old, one-dimensional models of measuring ROI, to synergetic models that encourage and thrive on collaboration throughout the entire life cycle, starting at the design stage.

“For Buildings of the Future, idealistic future-focused models are necessary to measure value. Instead of spending too much time trying to demonstrate the financial ROI of intelligent buildings,” Greaves said, “We should rather be asking, ‘What will the cost be of not innovating?’”


Information provided by Aurecon (www.aurecongroup.com), a global engineering and infrastructure advisory company.

Currently, an interdisciplinary team of researchers from the Department of Energy’s (DOE’s) Lawrence Berkeley (Berkeley Lab) and Lawrence Livermore (LLNL) national laboratories, as well as the University of California at Davis, are building the first-ever end-to-end simulation code to precisely capture the geology and physics of regional earthquakes, and how the shaking impacts buildings. This work is part of the DOE’s Exascale Computing Project (ECP), which aims to maximize the benefits of exascale — future supercomputers that will be 50 times faster than our nation’s most powerful system today — for U.S. economic competitiveness, national security, and scientific discovery.

“Due to computing limitations, current geophysics simulations at the regional level typically resolve ground motions at 1-2 hertz (vibrations per second). Ultimately, we’d like to have motion estimates on the order of 5-10 hertz to accurately capture the dynamic response...
for a wide range of infrastructure,” said David McCallen, who leads an ECP-supported effort called High Performance, Multidisciplinary Simulations for Regional Scale Seismic Hazard and Risk Assessments. He’s also a guest scientist in Berkeley Lab’s Earth and Environmental Sciences Area.

One of the most important variables that affect earthquake damage to buildings is seismic wave frequency, or the rate at which an earthquake wave repeats each second. Buildings and structures respond differently to certain frequencies. Large structures like skyscrapers, bridges, and highway overpasses are sensitive to low frequency shaking, whereas smaller structures like homes are more likely to be damaged by high-frequency shaking, which ranges from 2 to 10 hertz and above. McCallen noted that simulations of high-frequency earthquakes are more computationally demanding and will require exascale computers.

In preparation for exascale, McCallen is working with Hans Johansen, a researcher in Berkeley Lab’s Computational Research Division, and others to update the existing SW4 code — which simulates seismic wave propagation — to take advantage of the latest supercomputers, like the National Energy Research Scientific Computing Center’s (NERSC’s) Cori system. This manycore system contains 68 processor cores per chip, nearly 10,000 nodes, and new types of memory. NERSC is a DOE Office of Science national user facility operated by Berkeley Lab. The SW4 code was developed by a team of researchers at LLNL, led by Anders Petersson, who is also involved in the exascale effort.

With recent updates to SW4, the collaboration successfully simulated a 6.5-magnitude earthquake on California’s Hayward Fault at 3 hertz on NERSC’s Cori supercomputer in about 12 hours with 2,048 Knights Landing nodes. This first-of-a-kind simulation also captured the impact of this ground movement on buildings within a 100-square-kilometer radius of the rupture, as well as 30 kilometers underground. With future exascale systems, the researchers hope to run the same model at 5-10 hertz resolution in approximately five hours or less.

“Ultimately, we’d like to get to a much larger domain, higher frequency resolution, and speed up our simulation time,” McCallen said. “We know that the manner in which a fault ruptures is an important factor in determining how buildings react to the shaking, and because we don’t know how the Hayward fault will rupture or the precise geology of the Bay Area, we need to run many simulations to explore different scenarios. Speeding up our simulations on exascale systems will allow us to do that.”

This work was published in a recent issue of Institute of Electrical and Electronics Engineers Computer Society’s Computers in Science and Engineering.

Predicting earthquakes: Past, present, and future
Historically, researchers have taken an empirical approach to estimating ground motions and how the shaking stresses structures. So to predict how an earthquake would affect infrastructure in the San Francisco region, researchers might look at a past event that was about the same size — it might even have happened somewhere else — and use those observations to predict ground motion in San Francisco. Then they’d...
The winner of the annual Emporis Skyscraper Award for the best new skyscraper of the year is a 34-story residential building, VIA 57 West in New York City. The winner was picked by an international panel of experts from a worldwide pool of more than 700 eligible skyscrapers that were completed in 2016 and are at least 100 meters tall. The award, given by Emporis, an international provider of building data, is being presented for the 17th time this year.

The pyramid-shaped winner, designed by Danish architects BIG-Bjarke Ingels Group, was recognized by the award jury for its fascinating and extraordinary shape, which breaks new ground in design. VIA 57 West is a hybrid between a European perimeter block and a classic American skyscraper.

To achieve this, the tool under development by the project team employs a discretization technique that divides the Earth into billions of zones. Each zone is characterized with a set of geologic properties. Then, simulations calculate the surface motion for each zone. With an accurate understanding of surface motion in a given zone, researchers also get more precise estimates for how a building will be affected by shaking.

The team’s most recent simulations at NERSC divided a 100-kilometer by 100-kilometer by 30-kilometer region into 60 billion zones. By simulating 30 kilometers beneath the rupture site, the team can capture how surface-layer geology affects ground movements and buildings.

Eventually, the researchers would like to get their models tuned up to do hazard assessments. As Pacific Gas & Electric begins to implement a very dense array of accelerometers into its SmartMeters — a system of sensors that collects electric and natural gas use data from homes and businesses to help customers understand and reduce their energy use — McCallen is working with the utility company about potentially using that data to get a more accurate understanding of how the ground is actually moving in different geologic regions.

He noted that the current seismic hazard assessment for Northern California identifies the Hayward Fault as the most likely to rupture with a magnitude 6.7 or greater event before 2044. Simulations of ground motions from large — magnitude 7.0 or greater — earthquakes require domains on the order of 100 to 500 kilometers and resolution on the order of about one to five meters, which translates into hundreds of billions of grid points. As the researchers aim to model even higher-frequency motions between 5-10 hertz, they will need denser computational grids and finer time-steps, which will drive up computational demands. The only way to ultimately achieve these simulations is to exploit exascale computing, McCallen said.

In addition to leading an ECP project, McCallen is also a Berkeley lab research affiliate and associate vice president at the University of California Office of the President.

This work was done with support from Exascale Computing Project, a collaborative effort between the DOE’s Office of Science and National Nuclear Security Agency. NERSC is a DOE Office of Science User Facility.

Information provided by Lawrence Berkeley National Laboratory (www.lbl.gov).
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<tr>
<td>1.</td>
<td>VIA 57 West</td>
<td>New York City</td>
<td>467</td>
<td>35</td>
<td>BIG -Bjarke Ingels Group, Schuman, Lichtenstein, Claman &amp; Efron</td>
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<td>25</td>
<td>Herzog &amp; de Meuron</td>
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<td>6.</td>
<td>56 Leonard Street</td>
<td>New York City</td>
<td>821</td>
<td>57</td>
<td>Herzog &amp; de Meuron, Costas Kondylis &amp; Partners LLP</td>
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<td>Guangzhou, China</td>
<td>1,739</td>
<td>111</td>
<td>Kohn Pedersen Fox Associates, DLN Architects &amp; Engineers, Guangzhou Design Institute</td>
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<td>The L Tower</td>
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<td>673</td>
<td>59</td>
<td>Studio Daniel Libeskind, Page + Steele / IBI Group Architects</td>
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<td>Sumitomo Fudosan Roppongi Grand Tower</td>
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<td>757</td>
<td>43</td>
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Table 1: Emporis Skyscraper Award Top 10
Oasia Hotel Downtown in Singapore features a red façade and 21 species of plants in 1,793 planter boxes. Photo: © K. Kopter WOHA Architects Pte. Ltd

At 804 feet, Torre Reforma is Mexico City’s tallest skyscraper and also the world’s tallest exposed concrete structure. Photo: ©Alfonso Merchand

“It’s impressive how the architect rethinks the whole idea of a skyscraper. The building is a fantastic addition to the New York skyline,” one jury member said.

Claiming the second place is Torre Reforma from Mexico City. With a height of 804 feet, it is Mexico City’s tallest skyscraper and also the world’s tallest exposed concrete structure. The jury specifically praised the intelligent environmental solution for a skyscraper. The building is composed of two exposed concrete walls and one main glass façade. The concrete walls protect the interior from direct sunlight and reduce the cooling load.

Mexico City is known for its high seismic activity. For this reason, Torre Reforma has a triangular footprint and, combined with the latest engineering knowledge, it is supposed to withstand heavy winds and earthquakes for the next 2,500 years.

In third place, the expert jury selected Oasia Hotel Downtown, in Singapore. The project stands out with a red façade and 21 species of plants in 1,793 planter boxes turning into an urban oasis. The building’s façade is overgrown with different vines to ensure it is always lush and resilient during different weather conditions. Moreover, the tower offers four open-sky gardens, which allows wind to pass through the building for good ventilation.

This year, buildings from Asia dominate the Top 10 of the Emporis Skyscraper Award (see Table 1). The winners’ list contains a total of five Asian projects. New York City, known as the world capital of high-rise architecture, wins the top award for the fourth time. The Sofitel in New York was the first building to receive the award in 2000.

Information provided by Germany-based Emporis (www.emporis.com), a provider of information about building and construction projects.
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WASTEWATER MANAGEMENT TOOLS

DECENTRALIZED COLLECTION, TREATMENT, AND DISPERAL

ADVANCES SOLVE COMMUNITY CHALLENGES.

By Allison Blodig, REHS

FOR COMMUNITIES with no access to centralized wastewater treatment, finding cost-effective and sustainable solutions for residential and commercial treatment and dispersal/disposal is a challenge. The need for high-level treatment strategies that address nitrogen reduction, watershed protection, and sensitive environments has catalyzed the design of advanced treatment systems to solve these issues. This is mostly due to the high cost of traditional centralized wastewater collection and treatment and the innovation with small-scale treatment systems.

To sustain the environment and community health, engineers, municipal health officials, and regulators are adding to their wastewater solutions tool chest the use of pre-engineered, decentralized treatment systems as well as incorporating nontraditional collection methods and soil dispersal for final disposal.

Where individual onsite septic systems are the norm, town officials have a host of traditional and advanced decentralized treatment system possibilities to protect local waterways and water supplies, upgrade outdated systems to reduce nitrogen loading, and improve overall wastewater management for the community. Because of the advances in collection, treatment, and dispersal, decentralized systems are no longer limited to small-flow systems and those in remote locations. Some decentralized communities are collecting and treating wastewater in excess of 3.75 million liters per day. It’s a boost to rural and growing communities that the wastewater technologies and solutions available for large-scale decentralized systems are now available for small-scale systems as well. Communities, homeowners, and developers can move ahead with projects without waiting for a sewer extension to reach their site or the treatment plant to be expanded.

Pre-engineered, decentralized treatment systems provide long-term treatment solutions at an affordable cost; however, they do require engineers and regulators to be comfortable with how these Alternative Onsite Wastewater Treatment Systems (AOWTS) have been designed and sized by the manufacturers. If they are accustomed to designing, engineering, and incorporating individual components to make up a centralized treatment system, this approach saves time and money that would normally go into the design/engineering phase of the treatment.

Engineers who are embracing these new options are finding they can easily be adapted to various site conditions and that these space-saving and flexible technologies do work well when applied appropriately, installed correctly, and maintained consistently. This flexibility can lend itself whether designing and installing individual AOWTS, several smaller-scale satellite AOWTS, or a single larger AWOTS to serve the needs of treating the wastewater in a development.

Successful nutrient removal

Although not always attributed to onsite septic systems, nitrogen can be a problem in coastal estuaries throughout the United States including Cape Cod, Long Island Sound, New Jersey, Delaware, Chesapeake Bay, and Puget Sound. While tides, currents, or fresh water naturally flush estuaries, nitrogen can accumulate in highly populated coastal areas or those with extensive agricultural runoff when the estuaries don’t flush adequately.

Nitrogen pollution issues have been catalyzing initiatives to develop new ways of treating wastewater at individual sites as well as community and municipal systems. AOWTS have been used successfully to replace or rehabilitate outdated onsite systems such as cesspools and eliminate surface discharge.

Finding less capital-intensive solutions that can extend the life and expand the capacity of existing centralized systems is also a high priority in many communities that have aging or undersized wastewater treatment plants but are open to smart sustainable development. AOWTS are often paired with a range of updated components and new disposal field products such as plastic chambers, geosynthetic aggregate bundles, and large, plastic septic tanks. This increases the opportunity to protect natural resources and public health at a cost that communities can afford.
Collection: STEP systems
Septic Tank Effluent Pump (STEP) collection systems can be a cost-saving alternative for many communities. In these cases, septic tanks, like the versatile yet tough plastic tanks mentioned above, are placed at each home or every couple of homes to retain solids onsite. The tanks have pumps that pressurize a small-diameter collection line that can be buried at a shallow depth, making them perfect for rocky or rolling terrain. These lines deliver settled wastewater to either an existing centralized facility or to single or multiple satellite treatment and disposal facility locations throughout the development. This eliminates the need for additional primary settling at the treatment locations.

Treatment: Secondary and tertiary
Many packaged treatment systems have proven performance in not only obtaining exceptional secondary effluent quality but also accomplishing nutrient removal and disinfection. Just about any treatment system technology available for large-scale plants is now available to develop small “plug and play” systems to meet even the most stringent effluent requirements. Activated sludge systems, trickling/media filters, Integrated Fixed Activated Sludge (IFAS), Moving Bed Bioreactors (MBBRs), and even Membrane Bioreactors (MBRs) have been scaled down for use in some of the toughest applications. A range of applications from schools with high incoming total nitrogen, to restaurants with very high biological oxygen demand (BOD), to even direct-discharge applications can be addressed with decentralized packaged systems.

Dispersal: Using the soil
One diminishing resource is groundwater. In some areas, sinkholes are swallowing up land and homes, but even worse, the elevation of large areas of land such as the San Joaquin River Valley in California fell in recent years due to groundwater depletion. Using soil dispersal as part of the overall design of a decentralized wastewater collection/treatment/distribution plan, groundwater is extracted, consumed, treated onsite, and returned close to its point of origin to recharge the aquifer. This is in sharp contrast to the centralized model, where treated wastewater is discharged to a river where it gets taken miles away from the origination point and is essentially a wasted resource.

STEP system example
Surgoinsville is a low-income community in northeastern Tennessee with a population of 1,800, no public sewer system, and limited economic development opportunities. Existing homes had failing or compromised subsurface sewage disposal systems and the current package plant was at the end of its useful life. With no previous wastewater infrastructure experience, Surgoinsville faced big challenges, including project funding. Grants or loans from the Rural Development Community Program, the Appalachian Regional Commission, the U.S. Environmental Protection Agency, and USDA Rural Development made the $4.5 million project possible.

Designed to serve 700 properties and installed on lots with existing homes, outbuildings, and landscaping, the low-pressure STEP sewer system currently serves 247 residences, two schools, and nine businesses. It delivers wastewater to the neighboring city’s wastewater plant via nine miles of low-pressure sanitary sewer collection lines, two pump stations, and individual STEP services utilizing Infiltrator IM-1060 plastic tanks. An excellent example of successfully incorporating decentralized design concepts into centralized infrastructure, Surgoinsville benefited from the best possible solution to its wastewater treatment challenges at a cost it could manage with the help of funding sources.

AOWTS example
In Suffolk County, N.Y., nitrogen from residential septic systems is a significant factor in the degradation of Long Island estuaries. When New York State listed portions of the Long Island Sound, Peconic Estuary, and South Shore Estuary as impaired water bodies, Suffolk County officials began a review to understand the source of the water supply pollution.

Seventy-four percent of Suffolk County utilizes onsite sewage disposal systems. Currently, the drainfield systems in Suffolk County consist of deep leaching pits, concrete rings, or leaching pools that can be installed as deep as 25 feet. A study revealed numerous pollution sources; however, nitrogen pollution from cesspools and septic systems was identified as the primary cause of water quality issues. Impacts include beach closures, toxic algae blooms, and shell fishing restrictions — all detrimental to resident health and tourism revenues.
Sewering was financially unfeasible so the Suffolk County Health Department began a “Reclaim Our Water Initiative” focused on reducing nitrogen by replacing existing septic systems with individual AOWTS. The initiative includes a demonstration program to pilot these advanced treatment technologies. In this public-private partnership, manufacturers donate the systems, including advanced treatment technologies and shallow dispersal drainfields, to the demonstration program. Tested and monitored by the county for six months, if the system meets the county “pass criteria” standard of a 50 percent reduction in nitrogen, it gains Provisional Use Approval. The county also upgraded its sanitary code to allow for the changes needed to incorporate these advanced technologies.

Conclusion
Decentralized systems offer many benefits for small residential or community applications and the best approach varies from case to case. Community leaders and residents need to define the community’s environmental challenges and anticipated growth in making the best wastewater treatment choice. Local codes, proximity to water bodies, and anticipated daily flows are additional key factors for individual, commercial, or community systems. In most cases, the decentralized approach can offer lower cost, high performance, and versatility when compared with a centralized option.

The National Onsite Wastewater Association (NOWRA), the largest wastewater organization in North America, is dedicated to providing resources to members and professionals wishing to incorporate decentralized treatment. Organization members include regulators, educators, engineers, and manufacturers of decentralized wastewater products and systems. NOWRA also has an extensive training program in place that is accessed via national or state affiliate shows. Find out more at www.nowra.org.

Another resource for wastewater engineers and designers is numerous state and university-based demonstration programs and test centers such as the Massachusetts Alternative Septic System Test Center (www.masstc.org) and the North Carolina Soil and Water Environmental Technology Center (http://soils.ces.ncsu.edu/training).

ALLISON BLODIG, Rehs, is a senior regulatory specialist at Infiltrator Water Technologies. She has more than 20 years of experience in designing, inspecting, and troubleshooting many types of decentralized systems. She can be contacted at ablodig@infiltratorwater.com.
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“The high water table was a problem as it provided very little room for stormwater to infiltrate back into the ground,” said Jon Shell, CULTEC’s regional sales manager. “In addition, the detention systems needed to be able to withstand light to moderate traffic loads.”

The sports fields where the systems were installed were not adjacent, so the project required two systems. One system used 414 Contactor Field Drain C-4HD chambers, which stand just 8.5 inches tall and are the lowest profile chambers on the U.S. construction market. They were covered by 6 inches of No. 57 stone, 2 inches of No. 8 stone, and 1.75 inches of artificial turf. The total storage area is slightly less than 16,300 square feet and provides a storage capacity of 11,243 cubic feet in a horizon of only 18.5 inches from bottom elevation to final grade.

“The engineer selected the C-4 chamber because of its shallow profile,” said Shane Harkey of Sports Construction Management. “I thought it was a good design. It met our specs and the low-profile chambers were hard to find. Their chambers were exactly what we needed for this project.”

The second system required the 12.5-inch-high Contactor 100 HD chambers. The system included 396 chambers, 6 inches of No. 57 stone, 2 inches of No. 8 stone, and 1.75 inches of artificial turf for an overall depth of 22.25 inches. The system provides 10,225 cubic feet of water storage within an area of 11,189 square feet.

McAdams, based in Durham, N.C., designed the stormwater management systems. East Coast Contracting of Wilmington, N.C., and Sports Construction Management of Lexington, N.C., placed the chambers and constructed the chamber beds.

Site contractor Joby Hawn, of East Coast Contracting, said it was essential to stockpile the pallets of chambers to make best use of the available space at the jobsite and optimize material handling. “I wanted to keep the chambers out of the way, which was important because this was a pretty tight jobsite,” Hawn said. “We were able to install about 50 chambers per hour with only two installers.”

One of the concerns was the amount of weight that could be put on top of the field, especially on the first system with the lower-profile chambers. “They wanted to make sure that these chambers were rated for traffic,” Hawn said. “Even though it’s a turf field, you’re better safe than sorry. It’s nice to have a traffic-rated chamber underneath an athletic field.”

The low-profile stormwater systems were completed in spring, and contractors completed construction of the fields during the summer, when students were off campus. When they returned in August, the fields were complete with pre-drawn lines for sports such as intramural football and soccer, and a nearby building was constructed to store sports equipment and provide security measures.

The new building also includes restrooms to accommodate players and spectators. Thanks to the new stormwater management system, the fields will be playable even if there are weather-related issues. In the past, games would be canceled due to rain because of safety and flooding concerns.

Other improvements at UNC-Wilmington included installation of artificial turf on the softball field along with a new video board and scoreboard, dugout replacement, increased seating capacity, and new press box. The university also built a new tennis stadium.

In the increasingly difficult competition to attract students, UNC-Wilmington has distinguished itself within the state and nation. Since Sartarelli came to the campus in 2015, the university has added 2,000 students. It has also boosted its SAT score average above 1,200 (the third best figure in the UNC system) and has the system’s highest number of undergraduate degrees conferred per 1,000 students. It also has developed partnerships with U.S. and international universities, and more than 40 small companies are incubating on campus, including eight companies that are exploring marine science.

More improvements are on the horizon for UNC-Wilmington, which sits just a few miles from the Atlantic Ocean. During the next five years, the school is seeking to invest nearly $200 million into campus improvements, including a $54 million, 105,000-square-foot science building and a $51 million expansion to Randall Library, which was last renovated in 1987.

For now, the school is still celebrating its outdoor improvements. At the opening ceremonies in August, student Katie Solinski told the student newspaper, The Seahawk, “My whole team was beyond excited about these new fields. (Field) hockey can now be played on grass or turf, but it’s a whole different level of play on a turf field. Before we had to travel to schools like Duke to play on a turf field, but now we have one in our own backyard.”

GINA CAROLAN is the chief operating officer and director of marketing for CULTEC (www.cultec.com).
VILLANOVA UNIVERSITY STUDY VALIDATES USE OF PIPE IN RAIL AND HIGHWAY APPLICATIONS.

Researchers at Villanova University recently completed a study of the performance of corrugated, high-density polyethylene (HDPE) pipe containing recycled HDPE resin in commuter rail installations, finding its performance to be indistinguishable from pipe made from virgin material. The three-year field and laboratory evaluation is an important step in validating the use of corrugated HDPE pipe manufactured with recycled materials for commuter railroad and highway applications. The study was funded cooperatively by the Southeastern Pennsylvania Transit Authority (SEPTA) and the National Cooperative Highway Research Program (NCHRP) Project 4-39.

“The railroad industry is reliant on drainage infrastructure materials that are sustainable and resilient and offer a long service life relative to the cyclical live loading conditions typical in these applications,” said study author Michael Pluimer, Ph.D., a pipe industry authority and PhD graduate from Villanova. “Since pipes manufactured with recycled materials can be more sustainable and cost effective than those manufactured with 100 percent virgin materials, it was important to compare the performance and durability of the pipes in these applications.”

In the study that commenced in October 2013, two 30-inch-diameter corrugated HDPE pipes manufactured by Advanced Drainage Systems, Inc. — one made with 100 percent virgin materials and one with 49 percent post-consumer recycled content — were installed underneath a SEPTA main commuter rail line near Doylestown, Pa., about 25 miles north of Philadelphia. Approximately 36 trains passed over the pipes daily for three years, after which a detailed analysis showed both pipes to be performing as designed with no noticeable differences between the two pipes.

Measured strains and deflections on both pipes were found to be minimal and well below industry recommendations. Based on the field measurements, a laboratory test was developed to assess the long-term performance of the pipes relative to fatigue and stress cracking via the slow crack growth (SCG) mechanism. Based on this testing, it was determined that both pipes — the one manufactured with virgin materials as well as the one with recycled materials — should have a service life in excess of 100 years.

“The transportation industry, just like many other areas, is seeking to incorporate more sustainable and cost-effective engineering materials and practices into their infrastructure systems,” said Tony Radoszewski, CAE, president of the Plastics Pipe Institute, Inc. (PPI). “This has prompted research into new products that can be manufactured with more sustainable materials, such as those incorporating recycled content. The incorporation of recycled materials into products used in transportation infrastructure offers both economic and environmental benefits.” PPI is the major North American trade association representing all segments of the plastic pipe industry.

“For more than 50 years, HDPE pipe has been known to stand up to tough environments including toxic waste and high pH levels,” said Daniel Currence, P.E., director of engineering for the Corrugated Plastic Pipe Division of PPI. “Its projected 100-year service life has been documented by independent studies and state and federal government agencies, including departments of transportation.

“HDPE pipe is favored by the railroad industry for its durability and environmental sustainability, ensuring the pipe will serve generations to come,” Currence said. “Strong, durable, lightweight, and flexible, this pipe requires significantly less energy to fabricate, transport, and install than metal or concrete alternatives. With superior resistance to corrosion and abrasion, plastic piping systems also supply long service life, excellent joint performance, and offer leak-free protection — all adding up to exceptional value. Additionally, pipe made from HDPE can be recycled into many products including pipe, which is exactly what was used and validated in this study.”

San Antonio Water System uses an expanded sewer monitoring system to decrease overflows.

Smart sewers

The San Antonio Water System is strategically deploying 200 SmartCover Systems real-time remote sensors to monitor troubled pipeline segments citywide.

A successful pilot program

For the San Antonio (Texas) Water System (SAWS) is expanding to encompass the nation’s widest deployment of smart infrastructure in sewer collection systems to lower operating costs by millions of dollars, reduce pressure on rates, and dramatically decrease the risk of sewer overflows.

SAWS is strategically deploying 200 SmartCover Systems (SCS) real-time remote sensors to keep a high-tech eye on troubled pipeline segments citywide. These units will join more than 300 current sensors used to monitor...
high-risk pipes, increasing the smart monitoring network to more than 500 sites.

This deployment is considered the largest of its kind by one of the largest and most innovative utilities in the country. The sensor network continuously monitors sewer flows and provides SAWS with the ability to “see” how its pipelines are faring. The SmartCover network includes a proprietary software platform that puts the right information at the right time at the fingertips of operators so they can make real-time actionable decisions, leading to saved money and extending the lifetime of pipes.

“Our system is like an EKG for the sewer,” said Greg Quist, CEO of SCS. “We combine real-time flow data with advanced analytics to give SAWS the ability to visualize the health of their pipelines and detect small trends that anticipate future problems. Our SmartClean program provides real-time condition assessment of the collection system and puts SAWS in the position of being proactive rather than reactive.”

Resulting data eliminates unnecessary maintenance and redundant cleaning previously scheduled to ensure sufficient flow capacity. Less cleaning reduces operational costs and demands, wear and tear on pipes, and less staff labor, all while maintaining 24/7 protection from overflows. In 2014 alone, the SAWS SmartCover system prevented more than 500 potential sewer system overflows at locations with a high risk due to the structural condition, grease, debris, or roots.

SAWS leadership and vision was recognized by AccelerateH2O, the Texas-based organization focused on bringing innovative practices, novel technologies, and water utilities together. “We presented SAWS with the annual Innovator of the Year Award to highlight its early adoption of innovative solutions,” said Richard Seline, executive director of AccelerateH2O. “We encourage unique approaches and seek solutions such as SmartClean to demonstrate their capabilities in real-world settings. SAWS and SCS exemplify successful collaborations and partnerships necessary for solving urgent challenges through the internet of things, data analytics, and instrumentation that transforms operations and reduces costs for ratepayers.”

Information provided by SmartCover Systems (https://smartcoversystems.com).

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IN 2014 ALONE, THE SAWS SMARTCOVER SYSTEM PREVENTED MORE THAN 500 POTENTIAL SEWER SYSTEM OVERFLOWS AT LOCATIONS WITH A HIGH RISK DUE TO THE STRUCTURAL CONDITION, GREASE, DEBRIS, OR ROOTS.
New York City ranks No. 1 among 23 North American cities for overall sustainability of its urban transportation systems, according to the first Arcadis Sustainable Cities Mobility Index (see Figure 1). However, no city in the United States or Canada makes it into the top 20 cities ranked in the global index. New York City, sitting in 23rd place globally, is the most sustainable city for transportation in the United States and Canada, buoyed by an efficient, expansive, and heavily used metro system operating around the clock.

This index, one of the most comprehensive sustainable transit studies ever conducted, is an indicative ranking of sustainable urban transportation practices across 100 of the world’s leading cities. It looks at more than 20 elements of mobility that are essential to a city’s competitive advantage, economic vitality, and overall sustainability. The study was conducted for Arcadis by the London-based Centre for Economics and Business Research (Cebr).

Exploring the three pillars of sustainability — People (social), Planet (environmental), and Profit (economic) — the study measures financial investments and infrastructure improvements to urban transportation systems, including access to multiple transit modes, active commuting, bicycle infrastructure, commuting travel time, affordability of public transit, digital mapping and payment capabilities, air and emissions pollution, internet connectivity, and more.

The People sub-index rates safety (traffic fatalities), access to transport services, share of trips taken by public transport, rider connectivity, digitization of the transport system, upkeep of the transport system, uptake of active commuting, airport passengers, hours of metro accessibility, and wheelchair access. These indicators can broadly be thought of as capturing “quality of life” for a city’s commuters and visitors.

The Planet sub-index ranks cities on greenhouse gas emissions, congestion and delays, efforts to lower transport emissions, bicycle infrastructure, air pollution, provision of green space, and electric vehicle incentives. These indicators can be broadly thought of as “green factors.”

The Profit sub-index examines commuting travel time in a city, transport revenues as a share of expenses, public finance commitment, affordability of public transport, system utilization, and efficiency of road networks. These indicators can broadly be thought of as capturing “economic health.”

North America’s car dependency
Overall, North American cities rank low compared with equivalent European or Asian cities due to the car-centric culture that exists today. Many U.S. cities lack an extensive transit network because of years of reduced public investment.

According to Arcadis, to improve future mobility, bold actions need to happen soon. North American cities will have to overcome the negative public perception of public transit and alternative modes of transportation by incentivizing usage and working with companies and developers to encourage ridership. Using technology such as apps, smartcards, and other communication systems is also critical to the adoption of public transit by streamlining the user experience and making commutes convenient. Further, cities should work collaboratively with counties,
The GEOWEB® 3D Cellular Confinement System (CCS) is recognized by many states as a Low Impact Development (LID), Best Management Practice (BMP) permeable pavement solution and economical alternative to porous asphalt or concrete. Factors to consider in the design of grass and aggregate CCS permeable pavements include stormwater infiltration and storage, load reinforcement, tolerance to traffic frequency, and aesthetics.

DESIGN CONSIDERATIONS
The specific CCS design is dependent upon an evaluation of the CBR value of the subgrade soil below the system in conjunction with the weight and frequency of the anticipated traffic loading. Whether for restoration or new construction, the balance of any design issues relative to the interaction of the runoff with the subgrade shall be determined by the permitting agency and the design engineer as with any other porous pavement solution.

Presto Geosystems, the GEOWEB CCS manufacturer, offers a porous pavement tool with inputs for loading requirements, infill type, and subgrade strength—and returns recommendations for base depth, and values for runoff coefficient, and water volume storage.

FOR GRASS PAVEMENTS
The 3D confinement structure with a 70/30 mixture of aggregate and topsoil creates a stable, load-bearing surface that is highly permeable. The pavement layer infiltrates stormwater, greatly reducing runoff from the area of application.

A free-draining, coarse aggregate base designed below the pavement layer facilitates runoff storage and natural infiltration. Vegetated CCS pavements are suitable for occasional use traffic areas—overflow parking, road shoulders, firelanes and maintenance roads to utilities. The stable CCS pavement limits surface erosion and sediment loss.

FOR AGGREGATE PAVEMENTS
The 3D CCS system acts as a structural container for open-graded aggregate (low fines)—the aggregate locks up within the textured/ perforated CCS cell walls and prevents the stone from rutting.

Aggregate CCS systems can function as onsite stormwater ‘basins’, storing water in the aggregate voids for eventual natural infiltration. An aggregate base is designed below the CCS layer, providing support for loads and additional temporary storage for rain events. Aggregate CCS pavements are suitable for normal traffic—parking areas, unpaved gravel roadways, and industrial yards.
state departments of transportation, transit agencies, businesses, and investors to implement sustainable mobility solutions.

“A city is most sustainable when it is most attractive for people to live, work, and invest,” said Arcadis President of Infrastructure Wassim Selman. “While some North American cities enjoy well-funded and comprehensive transit systems, most rely heavily on private vehicles and lack developed public transit options. We need to be bold in implementing non-traditional approaches and leveraging technology to meet the mobility needs of our communities today and into the future.”

**North American study highlights**

North American cities are generally challenged in Planet factors such as measurements of greenhouse gas emissions — especially in Houston, Pittsburgh, Chicago, and Atlanta. With exception of New York City, North America is car-dominated with a strikingly low percentage of trips taken by public transit and a small share of commuters cycling or walking to work.

For instance, Atlanta, Tampa, and Dallas can boost their rankings by further encouraging bicycle use and expanding bike lanes compared with other international cities. Meanwhile, the most car-dependent U.S. cities include Indianapolis, New Orleans, Dallas, and Houston, which have a low percentage of public transit journeys made per capita and sit in the bottom 10 globally in this category.

The number of traffic fatalities across North America trends higher than its global counterparts, with only Toronto making it into the index’s 20 safest cities. Meanwhile, Miami, Tampa, New Orleans, Houston, Dallas, and Indianapolis rank in the bottom 20 for high volumes of road fatalities, which are indicative of an ineffective roadway network.

Los Angeles ranks lowest in North America for congestion and delays, but the city is addressing this challenge by investing in metro rail projects. For People factors, Boston, Denver, and Detroit all rank near the bottom in providing internet connectivity on public transportation. However, U.S. and Canadian cities are increasingly offering transit apps to improve the public transit user experience.

On the bright side, North American cities generally score better compared with most global cities for offering incentives to stimulate adoption of electric vehicles and making public transit generally affordable.

On Profit factors, Chicago and New York lead the world when it comes to offering citizens a 24/7 metro service. New York City also has one of the highest shares of trips taken by public transit, and San Francisco ranked first for having the most bus and metro stops per square kilometer in the U.S., an important factor in delivering a more sustainable mobility system across a metro area.


Information provided by Arcadis (www.arcadis.com).

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**ENVIRONMENTAL MARKET GROWTH**

**Environmental Consulting Services Market** is expected to grow to $37 billion by 2020.

**Environmental Consulting Services** are growing at 4.5 percent year-on-year, according to a report from The Business Research Company (TBRC) — Environmental Consulting Services Market Global Report 2017. These services are gaining traction among both multinational companies and small and medium businesses as awareness of the impact of e-waste on the environment increases, TBRC said. E-waste, the fastest-growing waste stream, is hazardous and expensive to treat in an environmentally sound manner. Up to 2016, the market of environmental consulting services grew at the rate of 3.8 percent, but this has accelerated.

The Asian region was the biggest market for environmental consulting services in 2017, making up about 40 percent of the whole market. The Americas is the second largest market, accounting for 33 percent of the global total. Asia will remain the biggest market and will also grow fastest; almost 7 percent year-on-year growth has accelerated by 2 percent. Two other regions where the market will grow substantially are Oceania and the Middle East and Africa. Growth in the American and European markets is expected to slow.

The global market for environmental consulting services is expected to grow from $33 billion in 2017 to $37 billion in 2020 (see Figure 1). The main reasons behind this increased growth are investments in smart cities to promote sustainable living, global collaboration for environmental protection, and new technologies in environment and waste management. Through the next decade, smart cities will host numerous climate-sustainable solutions for industries such as energy, technology, and manufacturing.

Companies will strive to deliver innovative approaches to manage complex projects to build high-risk infrastructure, while protecting public health, preserving the environment, and restoring natural resources. In
National and local conservation groups working together to address Louisiana’s severe land loss crisis released a report, Restoring the Mississippi River Delta: A Recommended List of Coastal Restoration Projects and Programs, outlining 17 priority projects for restoring the Mississippi River Delta and coastal Louisiana.

Restore the Mississippi River Delta — a coalition comprised of Environmental Defense Fund, the National Wildlife Federation, National Audubon Society, Lake Pontchartrain Basin Foundation, and the Coalition to Restore Coastal Louisiana — jointly authored the report, which outlines a suite of restoration projects that, if prioritized for implementation, would build and maintain land across Louisiana’s nationally significant coast.

The coalition’s priority restoration projects — all components of the 2017 Louisiana Coastal Master Plan approved unanimously by Louisiana’s legislature earlier this year — were selected from the more than 100 master plan projects for their ability to deliver the greatest impact if implemented quickly. The project recommendations include sediment diversions, freshwater diversions, marsh creation, barrier island and headland restoration, ridge restoration, hydrologic restoration, and oyster reef restoration (see Figure 1).

The recommendations come at a critical time for Louisiana, which is losing a football field of land every 100 minutes. Without action, the state could lose an additional 2,250 square miles of land over the next 50 years. Meanwhile, funds from the BP oil spill settlement, the Gulf of Mexico Energy Security Act, and other funding sources are flowing to the state for coastal restoration. These resources make it possible to implement large-scale restoration projects across the coast protecting communities from St. Bernard to the Texas line, nationally significant industries and natural resources, and world class habitats and landscapes.
“Our coast has been vanishing for decades, and studies on the best way to correct the problem have been completed for nearly as long — now is the time for decisive and efficient action,” said Natalie Peyronnin, director of science policy for Mississippi River Delta restoration at Environmental Defense Fund. “State-of-the-art science backs each of these 17 recommended projects, which will work together to set us up for further success and land gains down the road.”

“Louisiana faces very real threats — sea level rise compounded by subsidence, combined with the continued tragic waste of the Mississippi River’s sediment,” said David Muth, director of Gulf Restoration with the National Wildlife Federation. “Our challenges are great, but our current opportunity is even greater. We can use the substantial funding the state is poised to receive and the immense public and political support for the projects we are recommending in this report to protect and maintain as much of the coast as possible.”

“As we wrap up one of the most active hurricane seasons in recent memory, we know that Louisiana has no time to lose when it comes to strengthening the coast and protecting vulnerable coastal communities,” said John Lopez, director of the Coastal Sustainability Program at Lake Pontchartrain Basin Foundation. “Sea level rise projections and extreme weather impacts will only worsen. Louisiana’s people, wildlife, and economies are counting on swift and strategic progress on restoration to deliver maximum benefits and best returns on our investments.”

“In this race against time, Louisiana must use the most precious and powerful resource at its disposal — the Mississippi River and its land-building sediment,” said Kimberly Davis Reyher, executive director of the Coalition to Restore Coastal Louisiana. “If Louisiana hopes to maintain a sustainable coast in the face of sea level rise and subsidence, sediment diversions must be advanced quickly to capture this precious resource that flows past our wetlands every day.”

“Louisiana’s Coastal Protection and Restoration Authority should be commended for the significant and real progress it has made over the previous decade, particularly in restoring barrier islands,” said Cynthia Duet, deputy director of Audubon Louisiana. “There is no greater issue facing Louisiana than the ongoing disappearance of our land. We stand ready to work with state and federal agencies, elected officials, community members and other stakeholders to advocate for these important projects and expedite their implementation.”

Read the full report, Restoring the Mississippi River Delta: A Recommended List of Coastal Restoration Projects and Programs, at http://mississippiriverdelta.org/priorityprojects.

Information provided by the Environmental Defense Fund (www.edf.org).

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The U.S. transportation infrastructure market is anticipated to rebound slightly next year, following a 2.8 percent drop in 2017, according to the American Road & Transportation Builders Association’s (ARTBA’s) economic forecast released Nov. 30. Total domestic transportation construction and related-market activity is forecast to reach $255 billion in 2018, a year-on-year increase of 3.2 percent after adjusting for project costs and inflation. The 2017 market performance is expected to come in at $247.1 billion.

The 2017 market drop was largely driven by the overall national decline in state and local highway and bridge spending, which is expected to be down 6.4 percent and 7.7 percent, respectively.

ARTBA Chief Economist Alison Premo Black, Ph.D., shared the findings in her multimodal forecast during a webinar for analysts, investors, transportation construction market executives, and public officials.

Although the overall U.S. transportation infrastructure market will see modest growth in 2018, the situation will likely vary significantly by state and region, according to Black. The market is forecast to grow in 20 states and Washington, D.C., and slow in 23 states, with the remaining seven expected to be relatively flat.

The largest growth is anticipated in California, Florida, Hawaii, New York, Virginia, and Washington. The association anticipates a slowdown in new work in Arizona, Colorado, Delaware, Maryland, Nevada, and Oklahoma. The Minnesota, New Jersey, Ohio, Texas, and Iowa markets are anticipated to be steady.

Federal highway funding of state DOT programs provided by the 2015 FAST Act will continue to show inflationary growth in 2018, providing a degree of market stability in every state.

Black noted that although there have been significant increases in state and local revenues for transportation purposes in a number of states during the last several years, some of that revenue is dedicated to debt reduction or has been delayed from reaching the transportation market due to state budget issues. These factors, combined with receding state markets due to completion of bond programs or declining or inflation-eroded state revenues, continue to cause a drag on the overall U.S. transportation infrastructure market.

The bright spots in the market continue to be airport terminals; public transit; Class 1 railroads; and private driveway, street, and parking lot construction associated with residential and commercial developments.

Black’s forecast includes the following findings:

**Public and private highway, street and related construction** — The real value of public highway, street, and related work by state DOTs and local governments — the largest market sector — is expected to increase a modest 2.4 percent in 2018 to $58.1 billion after falling 6.4 percent to $56.8 billion in 2017. Six highway-related public-private partnership (P3) projects came to financial close in 2017, totaling more than $7.5 billion in investment. Work on private highways, bridges, parking lots, and driveways will increase from $62.4 billion in 2017 to $63.3 billion in 2018, and will continue to grow in the next five years.

**Bridges and tunnels** — With some major projects, such as the New NY Bridge and Ohio River Bridge reaching conclusion, the pace of bridge work has slowed. The public bridge and tunnel construction market is expected to increase slightly in 2018 to $31.3 billion. Work in 2017 is expected to be $30.5 billion, down from $33.1 billion in 2016.

**Railroad, subway, and light rail** — Public transit and rail construction is expected to grow from $20.3 billion in 2017 to $21.3 billion in 2018, a 4.6 percent increase. Subway and light rail investment is expected to reach a new record level, increasing from $7.7 billion in 2017 to $8 billion in 2018.

**Airport terminals and runways** — Airport terminal and related work, including structures such as parking garages, hangars, air freight terminals, and traffic towers, is expected to increase from $11.7 billion in 2017 to $13.4 billion, a 14 percent increase. Runway work, which has been down the last few years, is forecast to increase from $3.6 billion in 2017 to $4.1 billion in 2018.

**Ports and waterways** — The value of port and waterway investment is expected to remain flat at the $1.8 billion level. Construction activity in 2017 was down from $2 billion in 2016 and $2.4 billion in 2015.

ARTBA’s full 2018 forecast can be purchased at [www.artbastore.org](http://www.artbastore.org).

Information provided by the American Road & Transportation Builders Association ([www.artba.org](http://www.artba.org)).
Transportation and water infrastructure funding and finance in the United States are not nearly as dire as some believe, but a national consensus on infrastructure priorities, accompanied by targeted spending and selected policy changes, is needed, according to a new RAND Corporation study.

While much of the nation’s transportation and water infrastructure is adequately maintained, a 2.5 percent to 3 percent annual spending increase above the total of more than $235 billion now spent annually by local, state, and federal agencies on transportation and water infrastructure largely would eliminate existing maintenance backlogs by 2030, according to researchers.

For more transformational change, a national consensus on capital spending priorities is needed to target regional and national-scale opportunities to meet 21st century needs, while accounting for different priorities across regions and between urban and rural areas, according to the study.

State and local governments already shoulder most of the burden of building and maintaining infrastructure such as roads, highways, bridges, water and sewage treatment, stormwater systems, airports, and ports. The RAND study says such infrastructure projects need federal support through tax advantaged financing, efficiency improvements in regulatory processes, and research and development.

“Spreading federal dollars around to fund short-term, ‘shovel-ready’ projects without a sense of national purpose or priority will not get the nation where it needs to be,” said Debra Knopman, lead author of the report and a principal researcher at RAND, a nonprofit research organization. “The federal government should focus on maintaining and modernizing vital federal infrastructure and on targeting nationally significant projects that are beyond the capacity of individual states and cities.”

Examples include re-engineering connections among regional highway and rail lines, port-rail-highway junctions, airport modernization, major dam repairs, and infrastructure on military installations, in national parks, and other publicly managed recreational areas.

Federal assistance can be through direct spending or through the tax code. If it wanted to ensure that state and local governments have reliable and sustained access to capital from a broad class of investors, Congress could preserve the federal tax exemption on interest earned from municipal bonds for at least the next decade, reinstate taxable Build America Bonds, and experiment with other financing alternatives that keep capital flowing to local and state infrastructure investment, including investment through public-private partnerships.

RAND researchers also offered other policy options for Congress that could be used to help the federal government — working with state and local governments and the private sector — to renew and modernize the nation’s infrastructure. Among these options, RAND researchers listed major investments in the renewal of the nation’s most-critical aging and new infrastructure, incorporating advanced technologies to support newer construction methods, more-durable and sustainable materials, and sensor technologies that might benefit infrastructure maintenance.

In addition, federal capital funding could include requirements to make projects resilient to natural disasters and climate change in order to reduce future spending on disaster assistance.


Information provided by RAND Corporation (www.rand.org).
New Brigham Young University (BYU) research commissioned by the Federal Highway Administration (FHWA) shows a number of highway features that make accidents less likely. Among them are some that are intuitive — minimal hills and curves, paved right shoulders, and concrete-barrier medians. But one finding was less expected: Lower speed limits were associated with higher rates of accidents.

“I think the speed limit was the shocker,” said statistics professor Matt Heaton, who coauthored the study, recently published in Statistical Modelling. “We found that the lower speed limits, the 60 to 65 [mph] zones, were the higher-risk areas.”

Heaton pointed to Utah’s I-15 as an example of a well-constructed, lower-crash-risk freeway: There aren’t high curvatures, the medians are well separated, and there’s a wide left shoulder outside of the HOV lane. On the flip side, he pointed to Colorado’s I-70 with its grass shoulders, rolling terrain, and high curves going into mountainous areas as a more risky freeway.

In exploring Washington’s hotspots that remained even after controlling for such variables, the BYU team found segments that likely had high levels of driver distraction. One such hotspot, on Washington’s I-5, has a clear view of Seattle’s Space Needle. Another was near a ski resort, which had “lots of things to look at besides the road,” Heaton said.

Heaton and Gibson both emphasized that hotspot finding shows that driver distraction comes from more than just cell-phone use. Unfortunately, said Heaton, “you can’t just obstruct the view of what’s around you or control what’s off the freeway.” But, he added, engineers can “do other things to decrease the risk in these areas. You can control how the freeway is constructed to try to bring the risk down.”

David Banks, a Duke University statistics professor, called Heaton “one of the leaders” in his field of study (spatial process modeling), and noted that his combined-analysis methodology is “more powerful than either of them separately.”

With information from their Washington study, Gibson is hopeful that other highway administrations could implement similar models using their own local data. “They could make changes to roadway construction for increased safety, as well as study the identified hotspots further to try to discover, and potentially fix, the other factors associated with the high risk,” she said.

Information provided by Brigham Young University (www.byu.edu).
Nearmap, a location content provider specializing in high-resolution aerial maps, released new forms of location content — Nearmap Panorama and Nearmap Oblique — available through a new MapBrowser interface. Nearmap has long provided vertical imagery (also known as orthorectified imagery) covering about 70 percent of the U.S. population.

Nearmap Panorama enables users to view perspective maps in all cardinal directions for small or large areas in uninterrupted fashion. Users do not need to jump from one image to another and, in the process, lose context. According to the company, they can easily navigate, pan, and zoom across any size geography; quickly analyze perspective maps; and make faster decisions that impact government and commercial operations — all within an instantly accessible, 100 percent cloud-based environment.

"Nearmap Panorama is delivered via our new, highly intuitive MapBrowser interface, enabling users to effortlessly visualize and navigate across regions or local areas in an uninterrupted way," said Patrick Quigley, senior vice president and general manager for Nearmap North America. “Our users can inspect aerial location content faster than ever before using Nearmap Panorama. Consistent with past location content, Nearmap Panorama is delivered in high-resolution, 3-inch GSD.”

Nearmap Obliques enable users to interactively inspect and measure the height of features, such as buildings and terrain, from all cardinal directions. Nearmap Oblique images are also accessed through the new MapBrowser.

"Our customers need location content aligned with their requirements," said Natasha Ridley, product manager for MapBrowser. “For example, with Nearmap Oblique images, government organizations conducting property appraisal can accurately value property using measurement and detailed, tilt-angled perspectives. At the same time, commercial organizations interested in engineering and construction can quickly select a north, south, east, or west orientation, measure heights of buildings, and better plan changes.”

Users working within MapBrowser can switch from Nearmap Vertical to Nearmap Panorama or Nearmap Oblique location content. “We’ve added new features that our customers are going to be very excited about,” Ridley said. “For example, now users can export our imagery with measurements added. The saved image provides the whole picture, which is very useful in proposal development and communicating specific aspects of the aerial maps essential in planning and operations.”

“These enhancements represent a major step forward in both our location content and delivery capabilities. There’s also more on the way,” said Robert Carroll, vice president of 3D commercial and government for Nearmap. “This imagery is produced by our patented HyperCamera2 technology, enabling us to continue to proactively survey the U.S. urban areas including 50 percent of the population with obliques while also producing high-resolution 3D content. Our plan is to extend our leadership position by introducing Nearmap 3D, combining ‘off-the-shelf’ digital surface models (DSM), textured 3D mesh, and 3D point clouds in the near future.”

Information provided by Nearmap (https://go.nearmap.com).
Managing Engineering Firm Licenses

Understand requirements in each state and how they dovetail with your operations.

By Jerri-Lynn Wier

There are three layers of state licensing that impact engineering firms — secretary of state (SOS) registrations, professional engineer licenses, and engineering firm licenses. Because each state has different requirements, managing firm licensing can feel like a moving target, one designed to trip you up, tie your staff in knots, and eat away at your bottom line. But it doesn’t need to be that way. By understanding the requirements in each state and how they dovetail with your operations, your firm can turn licensing into a source of competitive and financial gain.

This article provides an overview of state requirements with a focus on areas that frequently cause problems for large and growing firms, such as registering in new states, gaining board approvals, having the right staff in place, corporate structure and ownership considerations, naming concerns, and the order in which everything needs to be accomplished. It concludes with tips for managing licenses across multiple jurisdictions to help firms realize the bottom-line benefits of proactive license management.

Register with the state
To begin operations in a new state, firms need to register with the SOS to gain authority to transact business, among other requirements (www.harborcompliance.com/landing-pages/understanding-business-licensing). In 37 states (www.harborcompliance.com/information/engineering-license), firms must also apply to the state board of engineers for a firm license. States that don’t require engineering firm licenses include Colorado, Hawaii, Iowa, Maine, New Mexico, Oregon, Utah, and Vermont, plus the District of Columbia.

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To begin operations in a new state, firms need to register with the SOS to gain authority to transact business, among other requirements (www.harborcompliance.com/landing-pages/understanding-business-licensing). In 37 states (www.harborcompliance.com/information/engineering-license), firms must also apply to the state board of engineers for a firm license. States that don’t require engineering firm licenses include Colorado, Hawaii, Iowa, Maine, New Mexico, Oregon, Utah, and Vermont, plus the District of Columbia.
Five additional states impose requirements other than licensing such as registration, name approval, or other records to be filed. In California, for example, firms must file an Organization Record following precise specifications and register every engineering branch office under ownership of a licensed engineer, a process that can wind up being every bit as complex as a state license. In Tennessee, firms must file a disclosure showing that a Tennessee-licensed engineer oversees services. In Michigan, firms must receive board approval, while Pennsylvania firms must do so only if their names include “engineer” or “engineering.” In Massachusetts, firms may need to file a regulatory board certificate with the SOS before forming a professional entity. In all, 42 states impose some license or registration requirement on engineering firms.

Order of operations
Each professional board has unique requirements and a set process for licensure. In some states, including Idaho, New Hampshire, New York, North Carolina, and Rhode Island, firms must receive board approval before registering with the SOS, while in most states, the order is reversed. For this reason, it’s important to review SOS and board requirements together before beginning any applications to prevent delays or rejected filings.

Engineer in responsible charge
In all 50 states, a firm must have a licensed engineer on staff. Where firm licenses are required, the firm must appoint a licensed engineer in responsible charge for all services provided by the firm. In some states, if the firm has branch offices, those must be registered as well, and some may require an engineer in responsible charge for each branch location.

It is easy to forget that the firm license is always dependent on the underlying individual licenses. If a responsible engineer leaves the firm, the firm must notify the engineering board within a specified time frame and appoint a replacement. Failure to do so may lead to a lapsed license and loss of your right to work in the state. Since individual licenses are usually filed under the engineer’s home address, you may need to notify the board whenever an engineer in charge moves.

Corporate structure
Requirements also vary based on firm structure. For example, in Vermont, engineering firms wishing to incorporate must be formed as professional corporations (PCs) or professional limited liability companies (PLLCs), while in New Jersey, foreign engineering firms are not permitted to form PCs. Because these requirements are “all over the map,” it’s important to examine them in detail whenever you are contemplating moving into a new state.

In some states, you may need to amend your articles of incorporation or create board resolutions to secure a license. Looking for these entity-level requirements will help avoid surprises down the road.

Ownership and management
Many states impose management or ownership requirements on engineering firms. In Georgia, for example, all stockholders in a PC as well
as one board member and the president must be a licensed engineer. In some cases, the requirements include engineers licensed in any state; others can be satisfied only by in-state licensees. For example, in New York, all partners must be licensed in New York State.

Because of these requirements, firms frequently find that they must adjust their ownership or management structure or even form a new entity when entering a new state, as many engineering firms are not owned solely by licensed professionals.

**Name requirements**

In some states, referring to a licensed profession in the firm’s name carries specific requirements. As previously noted, Pennsylvania firms must register if their names include some form of “engineer;” in New York, you may be required to file a fictitious name if your name omits such a reference. In some states, the name requirements depend on the number of licensed engineers in your firm.

Requirements also center on names of individual practitioners. In North Carolina, for example, individuals whose names are included in the firm name must be licensed within North Carolina. Once again, it pays to review SOS and state board requirements in detail before beginning any filings in a new state.

**Application fees and processing times**

Firm license fees range from $0 in Georgia and California to $600 in Alaska. The most common filing fee is $100; the average is $135.

Like individual engineering licenses, most firm licenses are approved at monthly or quarterly board meetings, so timing depends on the board’s meeting schedule. Turnaround typically ranges from four to eight weeks, but it can take much longer. In New York, for example, approval usually takes from three to five months.

**Updates**

If a firm changes its name or address, it must notify the engineering board and fill out a new certificate of authorization or change form, depending on the state. Many firms don’t realize that before doing so, they must change their name with the SOS. Interestingly, in some states this requires prior approval of the engineering board!

In addition, most licenses must be renewed every one to two years. If your firm has been disciplined by any state licensing board, this must usually be disclosed in initial applications and renewals.

**Competitive abilities**

Because it takes time to prepare a filing, and approvals depend on board meeting schedules, it’s critical to plan ahead for licensing when considering growth opportunities and to make sure your applications are accurate the first time. One missing item can mean a rejection, which means waiting again for the next board meeting. It is frustrating for a firm’s sales team to identify a major opportunity in a new state only to miss the bidding window because of a delayed or rejected license application. Sometimes firms will take the risk and bid anyway. This can have disastrous consequences because penalties for missing or lapsed licenses are substantial.

Individual and firm licenses elevate the engineering profession, uphold standards, and protect the public. By embracing the strategic value of licensing and implementing a sound management plan, firms can turn an unpredictable source of aggravation and expense into a solid investment that pays dividends long into the future.

**TIPS FOR SUCCESSFUL LICENSE MANAGEMENT**

To maintain licenses across your enterprise and keep pace with growth opportunities, firms should take the following steps:

1. Use appropriate software to track all individual and firm licenses and renewal dates throughout your entire operation.

2. Set up automated reminders of renewal dates and other important deadlines.

3. Include licensing as an early step in your sales and growth plans.

4. Examine secretary of state and licensing board requirements side-by-side before beginning any applications.

5. Pay special attention to requirements concerning firm name, structure, branch locations, ownership, management, and individual engineer licenses.

6. Create a system to notify the license board immediately whenever key licensed individuals leave the firm or change addresses, possibly directly through payroll.

7. Include a means to notify the board if your firm changes its name or address or opens new branch offices.
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Smith-Midland Corporation is producing four sound wall projects in Loudoun County, Va. The 48,000-square-foot Route 606 job will be manufactured using SoftSound sound-absorptive precast technology. The faces of the panels will be imprinted with a dogwood flower pattern using form liners. SoftSound is a proprietary material molded and compressed to meet the desired technical and aesthetic requirements. It combines specialized mineralized wood-chip aggregate using cement as a binder in a specific and exacting manufacturing process. Once installed, SoftSound surpasses other products for sound absorption, durability, strength, and moldability, according to the manufacturer.

Simpson Strong-Tie said its new SET-3G high-strength anchoring adhesive is formulated to yield superior performance in threaded rod anchor and rebar dowel installations. The two-component, one-to-one-ratio, epoxy-based anchoring adhesive formula dispenses in a uniform gray color to match surrounding concrete surfaces, and can be installed in downward, horizontal, vertical, and overhead orientations. SET-3G adhesive is designed for dry or water-saturated use conditions with temperatures anywhere between -40°F (-40°C) and 176°F (80°C). It is tested in accordance with ICC-ES Acceptance Criteria for Adhesive Anchors in Concrete Elements (AC308) and ACI 355.4 for use in cracked and uncracked normal-weight and lightweight concrete.

The National Electrical Manufacturers Association (NEMA), using guidance and data from the Plastics Pipe Institute, Inc. (PPI), released an update to the NEMA Standards Publication TC 7-2016, Smooth-Wall Coilable Electrical Polyethylene Conduit. The document supersedes NEMA Publication TC 7-2005. The standard covers several wall types of high-density polyethylene (HDPE) conduit used to provide a protective raceway for electrical and communication cables buried underground or encased in concrete. Benefits, according to the PPI, include availability in long lengths without joints, high strength, flexibility, proven reliability, and installation toughness.
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Dodge Data & Analytics’ 2018 Dodge Construction Outlook predicts that total U.S. construction starts will climb 3 percent to $765 billion. By major sector, gains are predicted for residential building, up 4 percent; and nonresidential building, up 2 percent; while nonbuilding construction stabilizes after two years of decline.

“The U.S. construction industry has moved into a mature stage of expansion,” said Robert Murray, chief economist for Dodge Data & Analytics. “After rising 11 percent to 13 percent per year from 2012 through 2015, total construction starts advanced a more subdued 5 percent in 2016. Total construction starts in 2017 are estimated to climb 4 percent to $746 billion.

“For 2018, there are several positive factors which suggest that the construction expansion has further room to proceed,” Murray said. “The U.S. economy next year is anticipated to see moderate job growth. Long-term interest rates may see some upward movement but not substantially. While market fundamentals for commercial real estate won’t be quite as strong as this year, funding support for construction will continue to come from state and local bond measures. Two areas of uncertainty relate to whether tax reform and a federal infrastructure program get passed, with their potential to lift investment.”

Single family housing is expected to rise 9 percent in dollars, corresponding to a 7 percent increase in units to 850,000 (Dodge basis). Continued employment growth has eased some of the caution shown by potential homebuyers, while older Millennials in their 30s are helping to lift demand for single family housing. A modest boost will also come from rebuilding efforts in Texas and Florida after Hurricanes Harvey and Irma.

Multifamily housing will retreat 8 percent in dollars and 11 percent in units to 425,000 (Dodge basis). This project type appears to have peaked in 2016, helped by widespread growth across major metropolitan markets. That strength has begun to wane in 2017, given slight deterioration in market fundamentals (rent growth, occupancies) and a more cautious bank lending stance.

Commercial building will increase 2 percent, following a 3 percent gain in 2017, and continuing to decelerate after the sharp 21 percent hike in 2016. Office construction should see further growth in 2018, helped by broad development efforts in downtown markets, and warehouse construction is supported by greater demand arising from e-commerce. However, store construction will remain weak, and hotel construction will continue to pull back from its 2016 peak.

Institutional building will advance 3 percent, maintaining its upward track after this year’s 14 percent jump. Educational facilities should see more substantial growth next year, lifted by the passage of recent school construction bond measures. The robust volume of transportation terminal projects in 2017 may not be repeated in 2018, but activity should stay at a high level.

Manufacturing plant construction will recede 1 percent in dollar terms, after surging 27 percent this year due to the start of several massive petrochemical projects. Next year should still see moderate growth for manufacturing plants in square footage terms.

Public works construction will improve 3 percent, slightly more than the 1 percent growth in 2017. Highways and bridges should be helped as federal funding rises to the levels called for by the FAST Act, while the environmental categories will partly reflect reconstruction efforts related to Hurricanes Harvey and Irma. Additional benefit may come from the infrastructure program proposed by the Trump Administration, should it achieve passage in some form.

Electric utilities and gas plants will drop 13 percent, falling for the third year in a row after the exceptional amount reported in 2015. Power plant construction starts will ease back as new generating capacity comes on line.


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