

EMERGING TRENDS IMPACTING COMMERCIAL PLUMBING PROJECTS AND ENGINEERS



In the growing shadow of a global pandemic, no emerging trends article can be written without acknowledging these are not normal times. As of May, 67% of construction firms reported a project cancellation or delay since the start of the outbreak in early March, according to a survey of 800 firms by the Associated General Contractors of America (AGC).¹ The crisis has redefined business as usual for all aspects of a project, from professional engineers to manufacturers, contractors, and distributors.

As PEs, you've had to expand your building information modeling, cost estimation, project management, construction administration, commissioning and code expertise to include new skills, like mastering Zoom video conference calls from a quarantined home office and factoring in local health mandates when scheduling projects. And while at this writing no one knows when the pandemic will end, experts do agree on one thing - the lasting effect

of COVID-19 on all aspects of the commercial construction business will be felt for years to come.

McKinsey & Company recently reported the multiyear trend toward densification and open-plan office layouts may reverse sharply. They forecast that public-health officials may amend building codes to limit the risk of future pandemics, potentially affecting standards for HVAC and plumbing systems, square footage per person, and the amount of enclosed space.²

Deloitte expands on this new normal theme for commercial real estate owners by stating the demands and services as people return to spaces where they work, shop, or stay will need to evolve. "Companies should consider more real-time analyses of changing user preferences, prepare to adapt designs, and (re)develop space and tenant engagement strategies."³

Yet adapting to new challenges is part of the DNA of Professional Engineers

who daily shoulder the responsibility to protect the public health, safety, and welfare. Each man and woman are uniquely qualified to address many of the problems our society will face in the wake of the COVID-19 pandemic.

We offer up the following emerging trends to consider in this journey:

- 1** Increased Labor Shortages
- 2** Tighter Deadlines and Greater Project Complexity
- 3** Collaboration in Problem Solving Drives Innovative Solutions

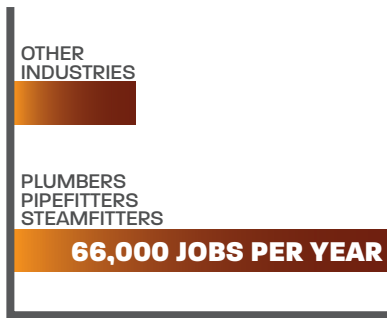
¹ Associated General Contractors of America Survey, May 8, 2020

² McKinsey & Company article: Commercial Real Estate Must Do More Than Merely Adapt to Coronavirus, April 9, 2020

³ Deloitte article: COVID-19 Implications for Commercial Real Estate, Preparing for the "Next Normal," May 1, 2020

TREND 1

THE LABOR SHORTAGE OF EXPERIENCED WORKERS



JOB GROWTH



PLUMBERS RETIRING IN THE NEXT 10 YEARS



According to the U.S. Bureau of Labor Statistics, there will be more than 66,000 projected openings for plumbers, pipefitters and steamfitters each year between 2020 and 2030, a growth rate nearly three times faster than other industries and occupations.⁴

However, a look behind these encouraging numbers uncovers two challenges for design engineers. The first is that 75% of experienced plumbers are hanging up their tools in the next 10 years due to retirement. Secondly, the industry is already struggling to find young people to consider plumbing as a career.

“Every year, more talent retires and with that knowledge loss we have less skilled people doing the work” says Warren Rosenbrook, Plumbing Technical Director | Senior Associate, Henderson Engineers. “I’d like every young person to understand that if you become a plumber, you’ll get paid throughout your apprenticeship and journeyman period, and one day be in a position to run your own business.”

“Contractors are struggling to find people to turn a wrench,” adds Nick Manning, President, PRIER Products, Inc. “We hear of projects being pushed out a year or more because of the lack of available manpower during install.”

While popular in the 1960s and ’70s, vocationally based career and technical education (CTE) programs started a slow decline in schools by the ’80s. Various reform movements,

inspired by A Nation at Risk – the landmark 1983 report that called out U.S. schools for poor performance – pushed for more students to take courses preparing them for college and white-collar jobs. By 1998, only 8% of students concentrated in vocational training, down from nearly one-third of high school students in 1982.⁵

In recent years, school systems have revived and modernized their CTE programs to meet the growing needs for skilled workers. According to a 2017 Brookings Institution report, in 2015 alone, 39 states created 125 new laws, policies, or regulations concerning CTE, some of which involved the allocation of state funding.⁶

Just last August, the U.S. Department of Labor awarded nearly \$1.5 million in grant funding to recruit, train, and retain women in quality apprenticeship programs like those in the plumbing industry. The Women in Apprenticeship and Nontraditional Occupations (WANTO) Grant Program is to help increase the number of women who pursue a career in a skilled trade. The percentage of women plumbers is estimated at only 2.5% nationwide.⁷ Demand is increasing for engineers



⁴ U.S. Bureau of Labor Statistics, 2020 - www.bls.gov

⁵ George Lucas Educational Foundation article, “Modernizing Career and Technical Education” by Andrew Simmons, December 2018.

⁶ Brookings Institute report, “What We Know About Career and Technical Education in High School” by Brian Jacob, October 2017.

⁷ U.S. Bureau of Labor Statistics

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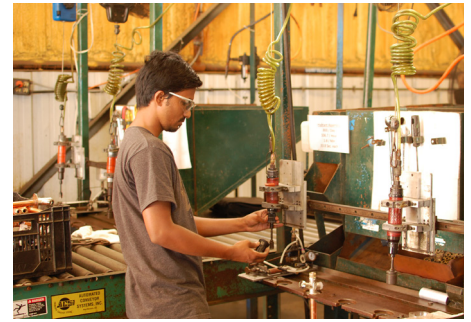
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and related technical fields while companies are struggling to find enough talent to fill available engineering positions. According to a recent survey, 82% of executives reported a shortage of qualified technical candidates, with 35% saying mechanical engineering jobs are the most difficult to fill.⁸

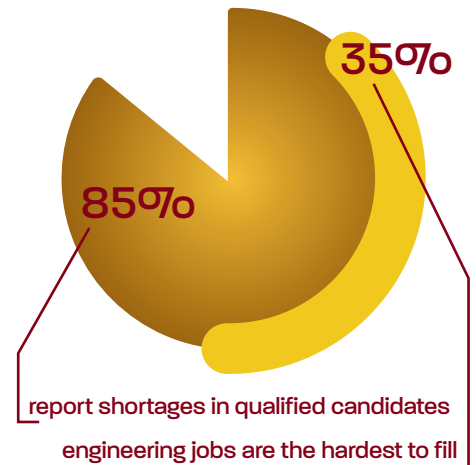
Several factors contribute to this talent shortage, including an overall shortage of young students pursuing science, technology, engineering, and mathematics (STEM) education; a lack of awareness of the MEP engineering option and its vital importance in our daily lives; heightened recruitment competition with popular consumer brands such as Amazon, Google, and Apple; and more restrictive immigration policies.

Industrial manufacturers and engineering firms are also stepping up to meet the talent challenge. PRIER Products partners with Cristo Rey Kansas City, a college prep high school for culturally diverse students with economic need. The unique program offers an innovative corporate work-study platform to young men and women. “We offset tuition costs and provide internships opportunities while students are in high school,” says Manning. “A growth strategy of our business is finding people with an acumen for problem-solving, and we’re willing to apprentice anyone who shows an interest in that area.”

The emergence of the coronavirus in an industry already plagued by labor shortages is sure to have an impact on construction projects in the near term, whether by illness or shelter-in-place government lockdowns. However, the greater concern facing owners, engineering firms, and contractors is the number



**WHAT COMPANY
EXECUTIVES SAY:**



of skilled plumbers and engineers that will need to be recruited and trained in the next 10 years. A concerted effort to communicate to young people the many benefits of these career paths is essential.

“Fostering awareness by exposing middle and high school students through site visits and encouraging employee mentoring opportunities is needed to inspire today’s youth,” Rosenbrook says. “The beauty of our industry is we have viable career options for those considering a four-year college degree or a meaningful trade.”

⁸ Deloitte and SEMI 2019 Survey reference: <https://semiengineering.com/engineering-talent-shortage-now-top-risk-factor/>

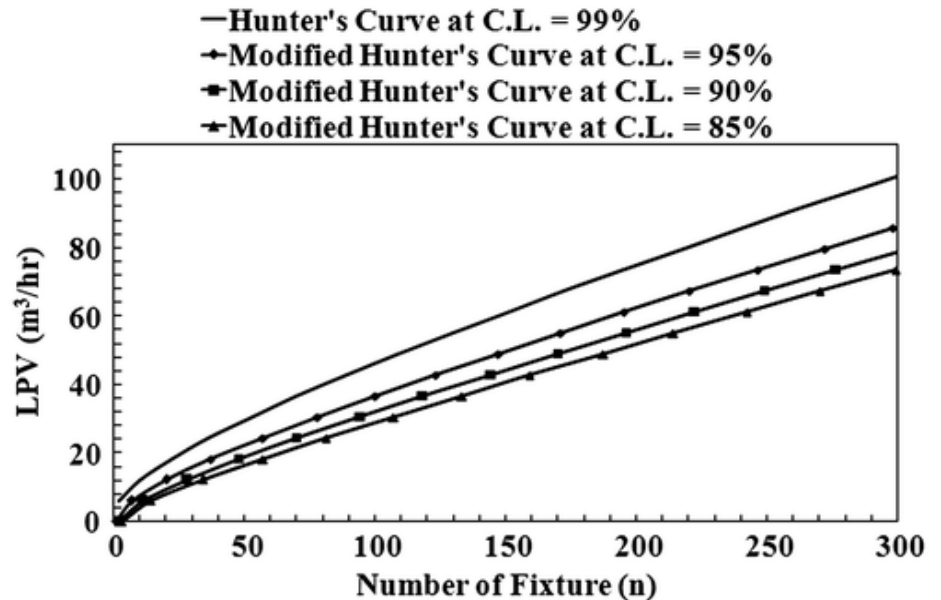
TREND 2

TIGHTER DEADLINES AND GREATER PROJECT COMPLEXITY

The rise of technology has had its positives and negatives in developing viable plumbing system solutions for engineers. On the positive, building information technology (BIM) has given users an intelligent 3D model-based process to manage buildings and infrastructure, providing efficiency gains to enable prefabrication of parts. The advent of 3D printing has also given manufacturers faster product-to-market strategies by getting a tangible concept into the hands of an engineer for feedback. And during the COVID-19 pandemic, technology has proven valuable in keeping projects on track even when managed from afar.

However, technology enhancements have driven unrealistic scheduling expectations as well. “Everybody wants things done faster and faster because we have all of this technology to speed things up,” says Rosenbrook. “Designing plumbing systems is as much an art as a science, and I spend much of each day solving unique project challenges technology alone can’t solve.”

One recent project for Henderson Engineers involved lowering the basement floor in a building by three feet. A nearby creek raised concerns about groundwater infiltration.



Budget constraints did not allow for a hydrologist recommendation. Henderson Engineers determined the gallons per foot drain solution and designed the sump pump, piping, and variable frequency drives for the underground foundation system.

“We determined the maximum GPF and wrote a system spec guide to ensure it would be installed to meet local codes,” adds Rosenbrook.

Challenges for larger projects, such as stadiums, are not addressed in the technology design options available to plumbing and mechanical engineers.

Consider the legendary Hunter’s Curve. Created by Roy B. Hunter in 1940 for the U.S. Department of Commerce, Hunter’s Curve remains the most widely used method for approximating peak demand loadings on a building’s water distribution system and forms the basis for model plumbing codes (e.g. The International Plumbing Code, The Uniform Plumbing Code and ASHRAE guide).

The beauty of Hunter’s Curve is its simplicity. Hunter created calculations based on banks of toilets and their flow rates and did the same for lavatories. Because each fixture had a different



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flow rate, Hunter converted it into a common value called fixture units and placed those units into his Hunter's Curve, which calculated the occurrence of a maximum usage event – for example, the 99th percentile probability that multiple toilets would be flushed simultaneously.

Engineers have discovered Hunter's Curve is sometimes too conservative and could lead to an oversizing supply and waste lines if taken literally. Other projects where large crowds congregate, such as stadiums and arenas, might demand flow rates that could exceed those determined by Hunter's Curve due to water usage peaks during breaks such as halftime and intermissions. Concessions may need to be made due to introductions of WaterSense faucets and fixtures, LEED building requirements, and the Home Energy Rating System as plumbing fixtures utilize less water than they did 80 years ago.

“As an engineer on big projects, such as stadiums, we can see projects where Hunter's Curve is off by as much as 50% from what we end up designing,” says Rosenbrook. “We have to schedule time to adapt our designs as we can't rely on our current modeling system.”

For niche manufacturers such as PRIER, the challenges with technology are different. It starts with the advent of 3D modeling itself. While many parts designers embraced one 3D solution for designing parts, cars, planes and other items, architects went a different direction for buildings and infrastructure. The result was two systems that could not communicate with each other.

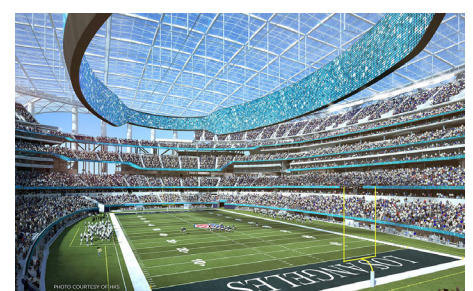
Parts manufacturers must either spend tens of thousands of dollars annually on software licensing or outsource to a third-party to convert the design files to a usable format. “Creating design files for commercial hydrants is a necessary cost of doing business, both in dollars and time,” says Scott Brady, Research and Development Manager, PRIER. “We continually provide Revit files and product information to engineers. We've also listed our products in MasterSpec to make it easier for engineering firms to spec our products in their design.”

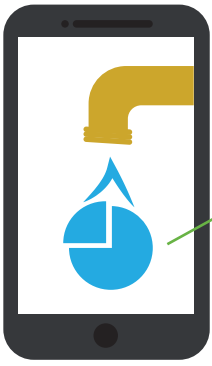
The timeless adage of measure twice, cut once is always top of mind, however, eventually the scheduling leads to project installation. As detailed earlier, the shortage of skilled labor can quickly throw a project off schedule. And often the time pressures accelerate as the completion deadline gets closer. For design engineers responsible for a project, special effort is made to minimize any added complications for commercial plumbers.

“The days of disassembly and reassembly, of having time to put shims in to make the final install look right, are gone,” says Rosenbrook. “We spec more and more products that not only have to perform to high standards, but also require a minimal amount of labor to install.”

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“We’re seeing a huge growth in our variable-use products being spec’d by project engineers,” adds Manning. “The ability for commercial plumbers to adjust-to-fit our hydrants can cut installation time in half.”

Another key time saver for commercial plumbers is the increased use of installation videos by manufacturers.

If a question comes up, even an apprentice plumber can pull out a phone and watch a short, 5-minute how-to video and get a job done right the first time. According to an article on elearningindustry.com, mobile devices are the ideal devices to deliver micro-learning modules to millennials and can be used both for formal training and performance support.⁹ Today, millennials represent nearly half of the workforce, a figure that will grow to 75% of plumbers by 2025.¹⁰

“Today’s younger plumbers learn from their phones,” says Manning. “Our installation videos get the information out there in the field when and where they need it.”

However, changing the mindset on construction methods is not always embraced. Innovation requires new methods and techniques that challenge the status quo. A new part may be spec’d and appear to cost more at the onset but provide savings in labor costs and speed of installation to more than offset the premium charged. A new approach and thought process are required to reach new levels of efficiency without compromising performance requirements or the standard of care.

TREND 3

COLLABORATION IN PROBLEM SOLVING DRIVES INNOVATIVE SOLUTIONS

Henry Ford once said, “Coming together is a beginning, staying together is progress, and working together is success.” More than a century later, these words still ring true when solving complex commercial plumbing challenges.

Effective team collaboration should be established as soon as possible in the planning and design process to maximize the probability of a project’s success. In the early design phase, a core design team is assembled to articulate and define the client’s project and evaluate the project’s feasibility regarding space

use, constraints, and budget. Beyond capturing the building owner’s goals, the architect must incorporate many additional parameters into the developing program. Other project participants, such as plumbing design engineers and parts manufacturers, are often consulted for their input as the design develops. And when new parts are developed, collaboration with contractors enables manufacturers an opportunity for new designs, field trials, and feedback for improvements before final release.

Some project owners are implementing collaborative contracts upfront to stop

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⁹ Elearningindustry.com article: “5 Winning Reasons for Adopting Mobile Learning,” May 2018.

¹⁰ U.S. Bureau of Labor Statistics



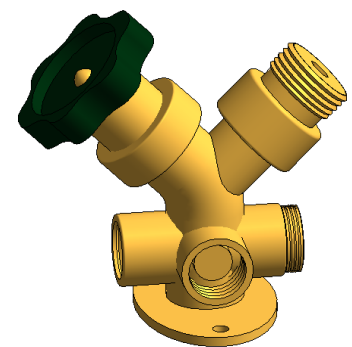
the status quo of adversarial contracting practices where parties rush through fixed-price negotiations, leading to understated timelines, long delays, and massive budget overruns. Successes have been realized in other capital-intensive industries, such as oil & gas and healthcare, where a move to collaborative contracting has delivered a 15% to 20% improvement in cost and schedule performance compared with traditional contracts.¹¹

However, most collaborative efforts in today's commercial construction business start the old-fashioned way – trusted relationships and conversations.

“At the 2018 ASPE Convention, we met with several design engineers to learn about the challenges of plumbing in large parking structures and warehouses,” says Manning. “One recurring theme involved existing exposed pipe angle sill faucets.”

The challenge was tying into a supply line while securing the valve to the building. The water inlet was on the back of the valve, which demanded plumbers to concoct an elaborate and somewhat unsightly solution of bolt u-channels, elbows, and extra piping to complete the job. After dialoguing with additional engineers and contractors, PRIER began concepting solutions that led to a patent-pending design that has inlets on the top and bottom of the valve allowing for flexibility during installation and the ability to manifold numerous valves together as typically found in a large parking garage.

The new P-156 valve can be easily secured to the building and tied directly into the supply line, saving extra installation steps and material costs, while presenting a more finished look.



¹¹ McKinsey & Company article – “Collaborative Contracting: Moving from Pilot to Start-up,” January 2020.

“Our firm met with PRIER at ASPE to collaborate on challenges and discuss potential solutions,” says Rosenbrook. “The result of those conversations resulted in new ideas. We recently spec’d the new P-156 valve for a major airport project.”

Collaboration at its best brings together the creative ideas of all design professionals and blends these with the practicality of the contractor and other team members. The idea is to not only push the envelope on aesthetics, but also, to integrate practicality, constructability, and budget into the design from the beginning.

“We’re already getting ideas on additional functionality for the P-156 from engineers and contractors,” says

Brady. “Being a good listener is what collaboration is all about.”

Plumbing and mechanical engineers are in a unique position to drive a more collaborative build environment. “We’re sandwiched between architects and contractors,” says Rosenbrook. “Our opportunity to influence the players around us gives us a unique seat at the table for changing the industry and making the construction process better.”

These trends of future labor shortages, tighter deadlines, increasingly complex projects, and problem-solving through collaboration are worth considering for companies engaged in the design and installation of commercial plumbing projects. By establishing a

partnership mindset when approaching a design or installation challenge, more innovative solutions will be developed, and more projects will be completed on time and on budget.

“We’ve found that our most successful plumbing products all have three things in common,” says Manning. “They allow the engineer to design better, the distributor to require less inventory needs, and the contractor to save time in installation.”



ABOUT



Henderson Engineers

Henderson Engineers is leading the field and changing the industry by combining engineering knowledge with in-the-field expertise to provide a single-source solution for any project or building need. Team members embrace creativity and flexibility and create opportunities for a diverse mix of employees that understand success is based on the relationship between individuals. Since being founded by Fran Henderson in 1970, Henderson has embraced the work hard, play hard, give back philosophy by mixing the rules with imagination and finishing the day knowing not only was the job done, it was done right.



PRIER Products, Inc.

PRIER builds plumbing products with a purpose. PRIER’s patented commercial designs offer the best flow rates in the industry, install in half the time and include a watertight seal to protect facilities. All hydrants are designed to last the life of the plumbing system. Established in 1881 as a brass foundry by a German emigrant Anton Prier, PRIER manufactures residential, commercial and ground hydrants, angle sill faucets, plumbing brass, drainage products and specialty valves at its Kansas City production campus in Missouri. The company is best known for inventing one of the first self-closing faucets.