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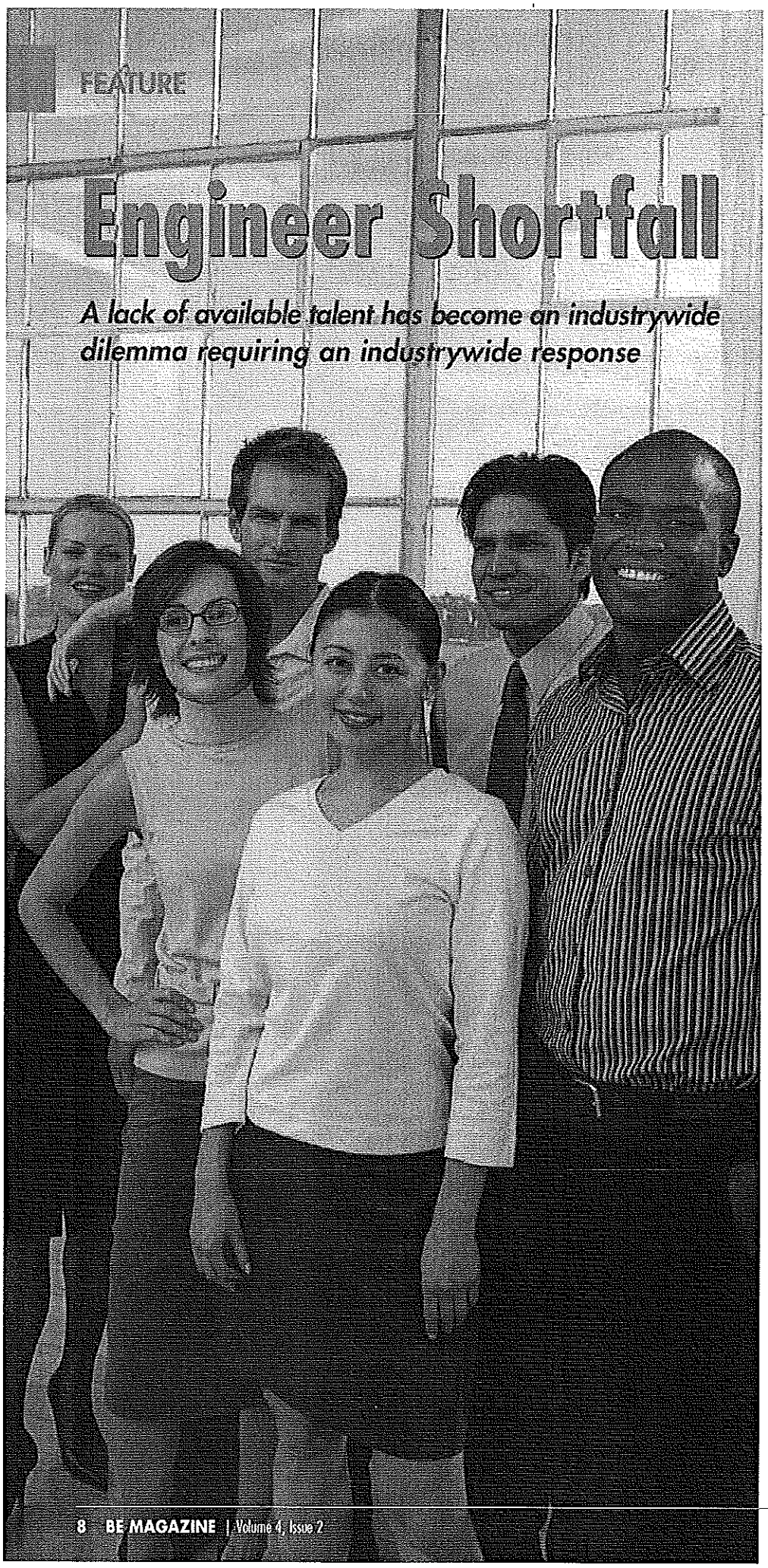
FEATURE

Engineer Shortfall

A lack of available talent has become an industrywide dilemma requiring an industrywide response



Jim Parsons, Maureen Conley, and Alan D. Crockett
American Council of Engineering Companies

For engineering firms that specialize in the built environment, these should be the best of times. With sustained growth of the nation's economy, a huge infusion of federal transportation funds, large-scale private-sector development, and a host of communities now eager to upgrade aging infrastructure systems, firms of all sizes are aggressively working to take advantage of a robust market.

Hidden beneath the euphoria of a burgeoning clientele, however, is the reality of empty desks, overburdened staff, and hastily implemented personnel decisions, all the result of firms not being able to find enough qualified candidates to keep pace with market demand. This, despite industry data that shows more than 70,000 engineering degrees are earned each year in the United States.

Although engineering firms still are meeting deadlines and delivering high-quality services to their clients, many practitioners confirm that there is an actual shortage of qualified engineers, and the shortage is becoming more and more of a hindrance to daily operations and firm success. "It is the single most important factor restricting our growth as a firm," Thomas Crump, a principal at WWC Engineering in Sheridan, Wyoming, succinctly puts it.

"We definitely see a shortage of engineers, and it has been this way for a while," says Jim Blake, vice president at Hunt Valley, Maryland-based KCI Technologies, a 900-employee firm with 20 offices in nine states. "We see it in the competition with other firms for the talent coming out of school, which has become absolutely fierce at times. But where we really see it is when we need the more seasoned and experienced talent, those with 10 to 15 years of experience. They are becoming extremely hard to find."

"We're busy, which is good," adds James DiVito, vice president of human resources for Haley & Aldrich in Boston, Massachusetts. "We would just like to have

more staff to help us do the work. The faster we fill our job openings, the better it is for our company, our clients, and staff members already on board."

Ron Drnevich, CEO of Gannett Fleming, which has offices in 22 states and in Canada, says the dearth of engineering talent is being felt industrywide. "There absolutely is a shortage," he says. "The number of our open job requisitions is testament to that fact. The economy is booming, and everybody I talk to in the industry is busy, yet everyone is having difficulty finding talent."

For Gannett Fleming, the shortage has been particularly painful in one specific job specialty: "The lack of crucial project management candidates is one place where we are feeling the shortage," Drnevich says. "The interface on every project is the project manager. We need experienced people who can do the work and get to the work. Technology has been a big help in the information sharing, but we still need that main experience on the job. And that's where we're feeling it the most."

Not just the United States

The shortage of engineers is not just a U.S. dilemma. Germany, with a reputation of engineering excellence built on the legacies of Gottlieb Daimler, Carl Benz, and Carl Wilhelm Siemens, is down about 18,000 engineers, according to Antje Lienert of the German Association of Engineers.

In Australia, the pool of available engineering talent has been strained, according to a recent Monash (Melbourne) University study, because of a current building boom of infrastructure and utilities to serve the needs of a rapidly expanding urban population.

And in Singapore, one of the major hubs in the Asian-Pacific region, the finding and keeping of qualified engineers has become a major concern. "The real worry in Singapore is the same as what's happening in the United States and United Kingdom," says Andrew Smith, manufacturing director for Shell Eastern Petroleum.

As U.S. advertisements for entry- and mid-level positions often go unanswered, and the availability of foreign-born engineers, long an alternate source of engineering expertise, has been sharply curtailed since 9/11, firms are being forced to seek new alternatives to handle recruitment.

"We've definitely found that there's a shortage," says John Cook, director of human resources for H.W. Lochner, a Chicago, Illinois-based transportation engineering firm with 400 employees in 26 offices nationwide. "As a result, we look very hard at candidates from foreign countries, even though there are not many H1-B visas to go around. We're also considering a more aggressive college recruiting program."

KCI's Blake notes: "We've got openings all the time. But the climate has almost put us in a situation where when we find good talent, we just hire them, regardless of whether there is an existing position that fits them or not."

"Years ago, we would just place a requisition with a recruiter and someone would quickly be selected," says Gannett Fleming's Drnevich. "The climate today has forced our company to develop specific strategies just on how we go about recruiting."

The reasons why

Industry practitioners say a combination of factors has contributed to the reduced pool of engineering talent. They point to a less-than-adequate number of high-school students choosing to pursue engineering degrees and how more and more engineering graduates opt for other and more lucrative positions outside of the profession.

Another problem is that the availability of H1-B visas, which are set aside for foreign workers including skilled engineers with a bachelor's degree or equivalent experience and training, has been limited since 9/11, and there is a significant backlog of applications as a consequence.

American Council of Engineering Companies (ACEC) Government Affairs Vice President Steve Hall says to help alleviate this problem, ACEC is supporting a provision in the Senate-passed immigration reform bill (S. 2611) that will significantly increase the number of H1-B visas. The bill would increase available H1-B visas from the current level of 65,000 per year to 115,000. "While Congress was unlikely to complete work on this legislation in 2006, the need for more H1-Bs is critical, and the ACEC and its business community allies will continue to push for passage early in 2007," Hall says.

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Drnevich cites an overall escalating national and even international need for engineering expertise as contributing to the shortage. "The economy is strong and there's a lot of attention now on infrastructure problems, security problems, and IT," he says. "You can't keep reducing load limits for that bridge, pretty soon you have to fix it. That's where we are today, and that increases demand on the profession."

"The number of students coming out of college and entering the profession is not keeping up with the demand we have," adds Judy Webster, human resources director for HDR, Inc. Those factors also help fuel concern that the imbalance of engineering supply and demand will only worsen in the future, especially as the nation's 78 million baby boomers and aging engineering professionals begin to retire, Webster says.

Recruitment challenges

While many causes have led to the shortage, experts agree on the primary key to the solution: increased recruitment of new and excited talent into the profession.

"Today's students want to make a difference in the world," says Timothy McKindles, vice president of human resources for the Wade-Trim Group. "Those who do go into infrastructure engineering often want to do something visible like a bridge. Roads and underground piping are just as important, of course, but are far less visible."

Duke University engineering professor Vivek Wadhwa believes that for U.S. students, the engineering professional may be well respected, but is considered less exciting than other professions. "The engineering profession is held in very high esteem in countries like India and China, and children are brought up to believe that the most successful people there are doctors or engineers," Wadhwa says. "It's not like that anymore in the United States."

William Knocke, head of the Department of Civil and Environmental Engineering at Virginia Tech, notes that because many middle-school and high-school teachers don't have a clear picture of what the profession is about, "they can't encourage it among their students." And as they learn more about the "real world," other aspects of engineering may not click with an idealistic young person's worldview.

Then there's the matter of money. Technically minded students can find lucrative career opportunities outside of engineering, even though a recent national survey shows strong salary ranges for entry-level engineers. "I am surprised that about 40 percent of our master's students want to become management consultants or investment bankers instead of engineers," Wadhwa says. "They believe that is where the money is."

Keeping engineering graduates in the profession also is challenged by the fact that an engineering background has been shown to lead to success in other professions, according to Christopher Swan, CEO of RSMR Global Resources. He cites a National Academy of Engineering survey showing that 22 percent of Fortune 200 CEOs have degrees in engineering. Swan says that their leadership success derives from "having the business mindset to complement technical and operations abilities."

Recruitment progress

There are, however, several signs that students may be receiving a more positive message about engineering. Virginia Tech's Knocke reports that enrollment in his department's undergraduate civil engineering program has increased by 50 percent during the past three years, reversing a downward trend that began in the mid-1990s. Although the evidence is admittedly anecdotal, Knocke adds that "interest in civil engineering is up at other schools as well."

He credits a special precareer fair targeted at Virginia Tech's freshman and sophomore engineering students for helping accentuate the profession's attributes. They also receive career advice and discuss internship opportunities. "Our surveys show that approximately half of the freshman engineering students enroll in a discipline other than the one they originally intended to follow," Knocke says. "So it's clear that, with the right approach, we can capture their interest and imagination."

There are no quick fixes to shoring up the supply of engineers, but industry officials agree that a multitargeted effort is needed. Suggestions range from encouraging engineering firms to offer on-site learning experiences for middle- and high-school teachers to sponsoring the development of engineering-related video games.

Universities need to demonstrate that engineering is not strictly a technical discipline, but that it also has important people-oriented aspects as well," says Hans Van Winkle, director of the Construction Institute in Austin, Texas. RSMR's Swan adds that the profession must provide competitive salary incentives. "Higher salaries will require higher fees, but they'll be more acceptable to clients if the firm brings greater value and creativity."

And no attempt to enhance the attractiveness of engineering will succeed without the involvement of those already in the workforce. "We tell engineering companies that if you want to hire students as seniors, you have to help get them in the pipeline as freshmen or earlier," Knocke says. "You can't just assume they'll be there."

Haley & Aldrich's DiVito agrees. "The sooner we can get involved with students, the better. It's like nurturing plants. They require the right amount of water and care to grow. Young people need the same kind of encouragement when it comes to exploring and choosing careers. It's absolutely critical to our industry that we do this."

Untapped resources

Many in engineering circles believe that while progress is being made, more steps are necessary to increase the ethnic and gender diversity in the engineering profession. The results, they say, can play a major role in eliminating the shortage of engineers.

Statistics show that more women and minorities are indeed receiving science and engineering degrees today than in the past, according to the 2006 Science and Engineering Indicators report by the National Science Foundation. Results also show the number of engineering degrees earned by African Americans, Hispanics, and Native Americans combined grew from 9 percent to 16 percent of all degrees earned between 1983 and 2002.

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The proportions of women, African Americans, and Hispanics employed in science and engineering (S&E) occupations also have continued to grow over time, but are still much less than their proportions of population. According to the National Science Foundation:

- Women accounted for 12 percent of those in S&E occupations in 1980 and 25 percent in 2000. However, the growth in representation between 1990 and 2000 was only three percentage points.
- African Americans in S&E occupations increased from 2.6 percent in 1980 to 6.9 percent in 2000, while the representation of Hispanics increased from 2 percent to 3.2 percent.

Perceptions, specifically images displayed in the media and popular culture, also are obstacles to attracting more women and minorities, says Jude Garzolini, president of the Society of Women Engineers (SWE). Unlike medicine, law, and even crime scene forensics, engineering has not been glamorized by television, she says. The popular image of an engineer working alone in front of a computer does not accurately represent the "wide range of interests, disciplines, lifestyles, and industries of today's engineers," Garzolini adds.

"To attract the next generation of women and minorities, the appeal has to be through quality of life," she notes, while crediting the desire to "make a difference" as driving an increasing number of women into the biomedical and environmental engineering professions.

Jorge Corzo, president of Corzo Castella Carballo Thompson Salman in Orlando, Florida, believes the obstacles go to the root of the education system and a culture that offers more distraction than incentive to excel at school. He believes the solution lies in helping schools produce more kids interested in the benefits of engineering. To that end, Corzo urges firms to develop partnerships with individual schools—providing young children with positive role models who can plant the seed early that an engineering degree is an attractive career strategy.

Both the SWE and the National Society of Black Engineers (NSBE) offer such partnering programs. SWE has a program called "Wow! That's Engineering?" that introduces young girls to a variety of engineering achievements. And NSBE has a summer camp program that targets about 1,000 middle- and high-school students and spreads the word about engineering careers. NSBE plans to significantly expand the program in the future.

Gary May, head of Georgia Tech's Electrical and Computer Engineering Department and an advisor to NSBE, emphasizes the need for more diversity among faculty. He developed a program to attract undergraduates, including those from historically black colleges, into Georgia Tech's doctorate programs. Since 1998, the program has produced 167 minority Ph.D.s in engineering and science. A significant percentage of those have entered academia.

Carl Mack, NSBE's executive director, confirmed the need for more faculty diversity, saying he didn't have a single African American engineering professor, something he believes hurts retention. "To see someone excel academically in a very demanding discipline like engineering can only inspire students," he says.

William Wulf, president of the National Academy of Engineering, believes that a more diverse profession will provide additional benefits over increasing numbers in the talent pool. He says a more diverse project team will simply "engineer better because it has a larger set of life experiences from which to draw. By contrast, every time we approach an engineering problem with a 'pale male' team, we are doing it with one hand tied behind our back."

Long-term impact

Practitioners and industry observers agree, if not addressed, the dilemma of the engineer shortage today will have a significant impact on the profession in the future. "The inability to apply resources makes it more difficult to get projects done, which causes prices to go up," says Van Winkle of the Construction Industry Institute. "Higher costs to owners mean that projects that may have been barely viable economically become even less feasible. And some projects simply won't get done."

Drnevich says that increased salaries may become a by-product of the shortage. "We as a profession had our backs against the wall like this regarding a shortage in the late 1990s, and that resulted in significant salary escalation for engineers, which I believe would be a good thing."

And HDR's Webster cautions that the impact can become even more dire for individual company success and overall industry competitiveness. "With the pending retirement of baby boomers, it is imperative that the industry takes a strong look at what is needed to maintain an adequate influx of young talent into the profession," she says. "If not, then there will come a time when we are not going to be able to meet the needs of our clients. And that's the bottom line."

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This article was originally published in Engineering Inc., the official publication of the American Council of Engineering Companies (ACEC), November/December 2006, and can be found on the ACEC's Web site, **www.acec.org**. *Copyright 2006 American Council of Engineering Companies. All rights reserved. Reprinted by permission.*