The 2010 National Engineering Survey

The roles of engineers are changing; but some things never change.

Amara Rozgus, Editor in Chief, and Rhonda McGee, Affinity Research Solutions

08/09/2010

In April 2010, *Consulting-Specifying Engineer* (CSE) conducted a comprehensive survey on a large sample of its total circulation of more than 40,000 engineers. The National Engineering Survey (NES) addressed the status, needs, and opinions of mechanical, electrical, plumbing, and fire protection engineers on a range of issues.

The NES was conducted via e-mail to a random sample of subscribers to CSE. Results were automatically tabulated and a number of verbatim (write-in) responses were tallied for quantitative insights, such as how many engineers responded with the same or similar answers to unaided questions. The sidebar, Survey Sample and Respondents, summarizes the sample sizes and return rates for the studies.

This article summarizes key findings from the NES. In particular, it describes the issues and challenges faced by engineers on the job, and their opinions about emerging tools and products.

Challenges to the profession

In the survey, the research team asked engineers to rank the most important challenges they face in engineering design on a scale of 1 to 4, with 4 being extremely important. Table 1 shows the top four issues (ranked by mean), topping out with energy efficiency.

	Extremely important			**Not important**	
	(4)	**(3)**	**(2)**	**(1)**	**Mean**
Energy efficiency	49%	43%	7%	1%	3.39
Inadequate budgets for good design	39%	49%	11%	1%	3.26
Speed of project delivery	38%	51%	10%	1%	3.26
Codes and standards changing frequently	38%	45%	16%	2%	3.19

Table 1: The top four issues challenging engineers, based on a list of issues presented as possible answers.

These four were not surprising, given the economic and regulatory conditions of 2007 to 2009 and their impacts on building owners. Faced with energy spikes in 2007 and 2008 and the recession beginning in 2008, owners found it difficult to set reliable utility budgets and obtain financing for capital projects. This led to projects being bid, but not started, and then suddenly restarted when financing came through, and, because the demand for completion built up during the delayed starts, project completions were being rushed. Meanwhile, codes and standards under continuous maintenance, such as ASHRAE 90.1 and 62.1, and federal and state energy and emissions regulations kept up their inexorable pace of change irrespective of economic conditions.

What was surprising, however, was that when asked about payback periods for retrofit projects involving energy and water system replacements or equipment retrofits, a 2-year payback was still acceptable for all system types (controls, HVAC, plumbing, electrical/power, and lighting), as shown in Figure 2. CSE has been hearing for years that the 2-year payback is dead; that owners are demanding paybacks of 6 months or less for upgrade projects to go through. The results show that requirements for paybacks of 6 months to 1 year are about as acceptable as paybacks of more than 5 years.

Regarding sources of contracts for engineering projects, there remains a diversity of contract types in the market and engineering firms have broad portfolios of project funding (Figure 3). Engineering firms are as likely to work on projects directly for an owner as for an architect for a plan-and-spec project led by an architectural firm, but a large number of projects are sourced from a general contractor. The results also show that energy service companies (ESCOs), such as Trane, Schneider, and Johnson Controls, tend to perform most of their engineering services in-house.

And what types of questions are owners, in particular, asking engineers? Figure 4 shows the top five questions, with codes/standards unsurprisingly at the top. Engineers have traditionally been charged with compliance, and this hasn't changed. However, energy efficiency as the second top answer, and within the precision of the survey for the top spot, reinforces the earlier question about energy being the top design challenge.

Tools and resources

The tools that engineers use reflect many issues that engineers face on the job; in fact, tools themselves are often a significant issue when they are changing, such as with the introduction of BIM. In the NES, CSE asked respondents to identify the types of software they are using; the results are shown in Figure 5. The top three categories of software are generally associated with conventional engineering practice. The bottom three are associated with green design and the most current design practice.

It's difficult to guess why, for example, when energy efficiency is the No. 1 challenge for all respondents, only half of engineers responding to the software question have energy modeling or simulation software. Also, it is evident that BIM software, while very much a hot-button issue, is not being used widely by the engineers who responded to this survey. Based on write-in comments (“verbatims”) from some respondents, there is concern that BIM requires costly investments that it could drive smaller engineering firms out of business.

Overall, looking at the software results, it would seem that engineering firms are due for new investments in software and training, especially in BIM and energy modeling.

Engineering tools also include handheld instruments. Given the emergence of commissioning and retrocommissioning as an engineering service (as shown in the 2009 MEP Giants survey and in Figure 4), CSE sought some indication of how many engineers are using different types of commissioning tools. Figure 6 shows that instruments for electrical detection ranked highest, probably because voltage, ohms, current, and continuity are used for mechanical, electrical, lighting, and even plumbing systems. Next in popularity are data loggers and sensors. There were a surprisingly high number of engineers using light meters and noise and vibration meters. Last are meters detecting fluid properties, which was, in hindsight, a poorly worded choice. We should have broken out ambient and HVAC system properties such as temperature, relative humidity, pressure, and flow. Chances are that had we done so, this family of instruments would have scored higher.

Technology solutions

Earlier, we asked about issues that challenge engineers and questions that owners ask. Technologies can be viewed as solutions that engineers bring to bear in answering questions.

In the NES, we sought to gain insights into what technologies engineers were finding to have a large impact on their jobs. We asked this question unaided, meaning the respondents had to type in the answer rather than choose from a list provided. Some engineers responded with technologies representing design solutions; others answered with technologies representing tools used to design systems (Table 2).

Technologies	**Number of write-in responses**
LED lighting and lighting controls	94
Alternative energy	50
LEED and green technology or regulations	41
BIM	39
Energy efficiency	38
Internet/wireless systems/Web-based controls	30
Automation	24
Water conservation	10

Table 2: Survey respondents note these technologies as having the biggest impact on jobs.

The fact that four of the top five write-in answers concern energy efficiency or sustainability reinforces that energy is a top challenge for engineers.

Specification

The NES asked in-depth questions about how engineers are involved with system and product specification, and about their relationship with vendors. Among the key findings are those that relate to the degree to which engineers consider lifecycle issues such as reliability, maintainability, and costs.

As mentioned earlier, tight budgets are a major challenge among engineers. However, when designing and specifying systems, product cost ranked lower than expected as a specification criteria in several questions. When asked, while completing specifications, what types of information they rely on equipment vendors to provide, less than half of the engineers we polled checked maintainability and reliability.

When asked what product information they seek when performing product research, less than half checked price, reliability, and maintenance. Warranty, availability, and environmental impact data scored even lower (Figure 8). The low ranking of total systems capability could point to future integration, compatibility, or flexibility problems. Even the catch-all phrase, "equipment quality data," ranked low at 34%.

And, when asked to identify the three most important factors leading them to select one supplier over another, price, maintainability, and reliability placed in the middle tier of engineers' choices. Longer term criteria, such as lifecycle cost and warranty advantage, were ranked third to last and last, respectively (Figure 9).

Conclusion

The National Engineering Survey presents a comprehensive look at the role of engineers in today's building-construction environment. Apparent in the results is that engineers face many challenges, some of which are traditional, while others represent conflicts with traditional engineering practice.

On the one hand, they have to satisfy continually changing codes and standards and the traditional mandate that systems have to be well designed and accurately specified. Just doing this amount of work is becoming harder due to shrinking budgets and tightening schedules, especially in the current economic circumstances. To look more deeply into issues beyond initial construction, i.e., lifecycle issues, which are not codified, seems to be beyond the scope of their contractual requirements.

The results show that lifecycle issues such as environmental performance, reliability, maintainability, and lifecycle cost, if important to the owner, will have to be clearly articulated in engineering contracts, and backed up with the fees necessary to support the time needed for engineers to fulfill them with confidence.

The results also show that commissioning and retrocommissioning are ensconced as services that engineering firms provide and that owners increasingly seek.

The NES asked many more questions, and in future issues of CSE we will bring the answers to these questions to light.

Rozgus is editor in chief of CSE. McGee was research director at Reed Business Information, which published this magazine previously. She is now president of Affinity Research Solutions.

Research context

At the time the research was done, the commercial (nonresidential building) construction market dropped from $445 billion in 2008 to a forecast of $320 billion in 2010 (Haughey, 2010). The growth rate, which had been not only positive but also accelerating in 2005, 2006, and 2007, showed a hard deceleration in 2008 and recession in 2009 and 2010 (Figure 1). A slight increase was being projected in May 2010 for 2011, with construction returning to roughly 2006 levels.

During the deceleration of 2008 and recession of 2009 and 2010, thousands of engineers were laid off and many offices closed or reduced to bare-bones staffing. In 2010, the largest year-to-year drop anticipated, engineering firms saw markets thought to be safe havens in 2009 (based on the *Consulting-Specifying Engineer* 2010 MEP Giants survey)—health care, education, and government facilities—fall off due to cuts in federal stimulus and defense-facility spending and the drying up of state and municipal projects that had been approved and budgeted before the recession.

Additionally, technologies are continuing to evolve, as are codes and standards. And, finally, other construction constituencies and stakeholders, including owners, architects, contractors, and vendors, were under the same crushing economic hardships and the same enabling information and Internet technology developments.

It was in this milieu that this magazine conducted the National Engineering Survey summarized in this article.

References:

Personal e-mail exchange with James Haughey, chief economist, Reed Construction Data, April 10, 2010.

"MEP Giants 2010 Report," *Consulting-Specifying Engineer,* August 2010. Available at www.csemag.com/giants.

Survey sample and respondents

The National Engineering Survey was conducted in March 2010. More than 13,000 surveys were sent via e-mail to a sample of *Consulting-Specifying Engineer'*s circulation of more than 40,000 engineers. Of these, 1,249 surveys were completed, resulting in a margin of error of +/- 3.0% at the 95% confidence level. This means that if the entire population responded, results would fall within +/- 3.0% 95 times out of 100.

Because *Consulting-Specifying Engineer* is a national publication that covers mechanical, electrical, plumbing, and fire protection systems, its circulation database enabled the staff to poll a wide range of engineering disciplines (Figure 10) throughout the United States. Among the respondents, 56% are registered professional engineers, and among those who are not, 66% are working toward their professional engineer license.