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For Design Professionals

# Engineering on the Margin: Practical Considerations for Avoiding Litigation

## By Robert B. Zelms and Paul Mittelstadt

Every engineering engagement carries a cost consideration. Owners and architects weigh the value of proposed features of a system to be engineered and make decisions about whether the final design will include or omit those features. Most engineered projects reach some middle ground—not every house needs a large window wall where a picture window will suffice. Trouble arises, however, where engineers are retained to provide a system that works, but just barely. Most, if not all engineers are capable of designing a system that will constantly and reliably work on the edge of failure, however not every contractor will install the system perfectly and few end-users will use the system perfectly. Where the system has been designed marginally, any flaw in installation, load calculations provided by third parties, or end-user error will cause the system to fail.

While this failure is typically not the engineer's fault, the engineer and his insurance coverage make a convenient target for the astute plaintiff's attorney.

**In this Issue:**



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## Cases in Point

### The HVAC Engineer

Two recent cases come to mind where engineers were set with the task of creating a marginally engineered system which ultimately embroiled the engineer (and his insurers) in protracted litigation.

In the first case, an engineer was retained to design an HVAC system for an optical surgery center in Arizona. Prior to the engineer's engagement, the ownership group and the architect had decided to utilize a marginal cooling system. Upon being retained, the engineer was informed that cost was a major factor for the project. Following the direction of the ownership and the architect, the engineer designed a system that met American Society of Heating, Refrigerating and Air-Conditioning Engineers ("ASHRAE") standards for a surgical suite, i.e., that the system could maintain a temperature between 68 and 75 degrees and 30% to 60% relative humidity 99.4% of the time.

The HVAC engineer designed a custom cooling system integrating the heat load calculations provided by a third-party. The system was installed by several contractors and the controls were designed by yet another party.

Shortly after the system was installed, the surgeons began to complain that the suites were too hot, too humid, that their glasses fogged up, and that the system just plain failed to work on occasion. The engineer worked with the ownership and the architect to find the problem. Several items of defective installation were discovered and the controls were not designed to utilize the system in the way that was intended by the engineer. In a typical HVAC engineering scenario, the system would have been at least slightly over-designed and these minor installation and control issues would not have resulted in the failure of the system, but in this case there was no room for error.

Ultimately, the surgeons have never been happy with the performance of the system—they feel the room is too warm and their glasses still fog up. The surgeons have been presented with evidence that the room maintains a temperature and humidity within ASHRAE standards and have been shown that if they would tape the top of their surgical masks their glasses will not fog up. Despite being objectively shown that the system works, the ownership elected to remove the entire HVAC system and replace it with a heavy-duty system that cools much more efficiently—a system that could have easily been designed by the original engineer if he had been given some leeway. The ownership is now suing the engineer on a professional negligence theory for which his insurer is providing a defense and potential indemnity.

### The Structural Engineer

In the second case, an engineering firm was retained by the manufacturer of solar farm panel supports in a long-term contract to review the design of the supports. These supports are not complicated contraptions; they are essentially a post stuck in the ground with a tray on top that holds a large solar panel. If you have ever driven along an interstate in the southern United States you have probably seen them. Unusually, the structural engineer had reviewed approximately 100 different designs for these supports over the years; the design kept changing over and over again. The reason the supports kept getting re-engineered was that they were marginally designed. The company that sold the supports wasn't paid per support, it was paid per mega-watt hour produced by the solar panels on top of the supports. With this compensation structure, the company had a massive incentive to build the supports as cheaply as possible without them falling down.

The structural engineer's job was to take the design created by the support company, verify their calculations, and stamp the drawings for the state in which the supports would be installed. One iteration of the design came to the structural engineer missing calculations for a small piece of metal that connected the post to the tray. The connector was shown on the drawing, but there were no specifications for its design and no calculations for its expected load. The structural engineer confirmed that all of the present calculations were correct and sealed the drawings.

Some months later, five of the connectors failed due to unknown influence. By this time, the design had been used at 16 solar farms—over 65,000 of the connectors had been installed, each holding up an expensive solar panel. Upon inspection of the failed connectors, it was determined that they were under-engineered. The support company elected to replace all 65,000+ connectors and to sue the structural engineer for indemnity. The structural engineer's insurer is providing a defense but the support company will not accept any settlement short of 100 cents-on-the-dollar for the cost to replace every single connector.

## The Importance of Input

These two cases carry hallmarks of ligation that arises from marginal engineering. In a typical engineering engagement, the engineer will at least be consulted during the design development phase. However, in marginal engineering engagements, often the engineer is set with a very delineated task from the outset: the engineer is expected to create a system that just barely meets the demands of the owner and/or architect. As you can see, designing a system that just barely works in theory often fails to work in reality. Of course, this is no fault of the engineer. The defendant engineer typically can produce the calculations performed in creating the system which can be independently reviewed by an expert and determined to be correct. When the marginally engineered system is installed and operated perfectly, the simple math proves that the system works as designed.

To avoid costly and time consuming lawsuits, it is important that engineers insert themselves into the design process to the extent possible. In both of the above cases, if the engineers had given their input to the owners and architects, they may have avoided becoming defendants.

At a minimum, if an engineer expresses (preferably in writing) that a marginally designed system must be installed and operated perfectly, that statement by the engineer can become "Exhibit 1" in a dispositive motion in the event that the system ultimately fails. Obviously, the goal of the engineer should be to competently advise her client about the pitfalls of marginal engineering and the benefits of leaving some room for error in a design. However, even if the client does not heed this advice, the simple provision of the advice may dissuade plaintiffs' attorneys from pursuing the engineer in the face of their clients' blatant disregard of the engineer's well-founded opinion.

## Calling Out Unreasonable Expectations

Engineers can also be instrumental in the cost-benefit analysis performed by owners when they determine the level of engineering necessary for a particular system. Oftentimes, owners look only at the up-front cost of the system and its purported benefits should the system be installed and operated perfectly. The engineer can educate the owner about the potential costs (repair, downtime, lost business opportunities, etc.) that often follow when a system is marginally designed. By informing the client about these sometimes-hidden costs at the outset, the client may be more likely to choose a system that is more robustly designed and has a lesser chance of failure.

## Winning but Losing

From an engineering perspective, there is nothing wrong with a marginally engineered system. If all goes according to plan, a marginally engineered system is the most efficient and cost effective option available to the engineer's client. However, from a risk-management perspective, marginal systems are problematic even where the engineer performs his job flawlessly.

There are two inherent problems with a suit against an engineer even where the engineer is blameless.

First, a typical suit against an engineer states a cause of action for professional negligence. Under this cause of action, attorneys' fees are not available. So, even where defense counsel may obtain a dismissal or summary judgment, the defense costs are not recoverable. Compounding this problem is that testimony regarding the engineer's standard of care must be provided by an expert and engineering experts do not come cheap. Again, these costs are not recoverable.

Second, engineering problems are complicated. A plaintiff's attorney can paint a narrative for a jury that makes the engineer look culpable even where he is not; the plaintiff's theme is as simple as "the engineer was retained to design a system that works and this system does not work." A jury full of non-engineers can easily understand this narrative. The defense narrative is considerably more complicated. It relies upon mathematical calculations, technical installation instructions, proving that the end-user was using the system incorrectly, and ultimately rests on the technical testimony of an engineering expert.

Given these problems, even where an engineer designs a perfect system on the margin, she becomes a target for litigation and, even if the case is "won" in court, the engineer and her insurers still lose.

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