

business issues

ACHIEVING SUCCESS ONE MISTAKE AT A TIME

BY MICHAEL HOWELL, SE, PE

The best engineers
are the ones that make mistakes—
and learn from them.

I USED TO BELIEVE that good engineers never made mistakes.

I have since learned that good engineers have just learned to never make the same mistakes twice. This has become apparent to me in the decade or so I've been doing this (yes, I am an engineer). I know some would look at my experience and say, "That's a long time," while others would suggest that I've only just started this journey. But one thing that's certain is that I've made a lot of decisions during my stint as an engineer. Most were good ones, but I've had some bad ones in there too. Each one has taught me something, but the bad ones seem to do it in a way I am less likely to forget. One of those "bad" lessons has stuck with me since my first week on the job.

Right into the Deep End

My story begins right after I graduated from college in 2005. I went to the University of Pittsburgh and was blessed to receive a job offer from American Bridge Company. On my first day, I was told I would be relocating to Washington, D.C., to work on the Woodrow Wilson Bridge project—the ten-lane, \$200 million bascule portion of the much larger \$2.5 billion beltway project. After spending a few days at the home office familiarizing myself with the project, buying my first pair of real work boots and packing my clothes and an old TV in the back of a truck, I was off to our nation's capital for my first taste of "real work."

It is every kid's fantasy (who likes construction) to be on a site like the one I was greeted with as I walked toward the project trailer that first morning. The cranes were tall, the steel was big and the equipment was loud. The sound of rolling machinery and the pounding of the ironworkers' "beaters" clanking

against the steel was the perfect soundtrack to the landscape. The words "awestruck" and "overwhelmed" don't begin to capture everything I was feeling as I craned my neck to take it all in.

The only thing that could have elevated my spirits more that first day was the news I heard from one of the project managers. The Discovery Channel would be visiting the project that very same week to film the show *Extreme Engineering*. If being on a construction site like this one was every kid's fantasy, then being on a show like *Extreme Engineering* was certainly every engineer's!

The episode would be centered on what was being referred to as the "heavy lift." Essentially, the heavy lift comprised the center portion of half of the outer loop (about three lanes of traffic). The assembly being lifted was a monstrous 100-ft-long × 50-ft-wide mixture of steel floor beams, stringers and cross-bracing all supported inside the nearly 15-ft-tall custom plate girders that served as the main load bearing elements for the span. At just shy of 500 tons, there was no denying that this was a serious operation well deserving of the nearly yearlong preparation that went into developing a plan to lift and fabricate it.

The plan for the lift entailed picking the piece at its four corners using strand jacks. The assembly would need to be lifted off of its resting place from a barge below and set into place within a fraction of an inch. An engineer and several ironworkers would man each of the corner strand jacks. It was the ironworker's job to work the jack while the engineer would measure each stroke and report it back to the chief engineer for analysis. The goal was to lift the assembly nearly level because too much tilt in any direction might have caused the jacks to seize. And since the jacks could only move in one direction, having one seize midway through the operation could spell disaster.

I remember that everyone arrived early that morning, most of us long before the sun had even started to creep over the horizon. Electricity seemed to be coursing through the air as we fastened our harnesses and grabbed our hardhats. In small groups, hushed conversations over steaming cups of coffee tended towards the fact that there was no "Plan B" should this fail. The only feasible method to get this piece into place was the operation we were about to undertake. We didn't have a crane on-site that could lift it; the only barge big enough to support it would need to depart the site shortly after we started, and the channel had to be open for national security reasons by that afternoon.



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It would not be dramatic to say that this was a high-pressure moment for everyone involved. The size, manpower and physical constraints of the lift were enough to put everyone on edge. The presence of a TV crew and the many VIPs from both DOTs (who were also there to observe the first time both shores would be linked on the new structure) only added to it. For a fresh-faced, green engineer in his first week in the real world, it was rather intimidating. My hands were shaking so badly that I was having trouble climbing the ladder to the platform.

For all that was riding on this, the lift started with little fanfare. Just a command across the radio to take up the slack, and then we were off. In 18-in. increments, the 500-ton monolith of steel began to rise from the waters of the Potomac River. For the next eight hours, it would be up to each engineer to make sure everything was going according to plan from our tiny perch above each corner.

Growing Concern

Almost immediately though, we had a problem. The measurements on the jack I was monitoring were slightly off from the other three—not by much, just fractions of an inch. But after a few hours and countless lifts, those minor discrepancies were beginning to add up to the point we were starting to get concerned. As the piece inched closer and closer, the chance that it may not fit into its spot was becoming a very real, and very frightening, possibility.

The problem grew to the point that the legendary ironworker superintendent, Ugo Del Costello (known as “Hokey”), began to take an interest and approached my platform to see what was happening. Hokey was a salty, iron-jawed, no-nonsense guy that often reminded me of Sam Elliot’s character (Sgt. Major Plumley) from the movie *We Were Soldiers*. By the time I would leave the project a year-and-a-half later, I had so much respect for Hokey though that I would have probably climbed the bridge balanced on my fingertips rather than risk disappointing him. But at the time, he scared the living daylights out of me.

Hokey looked over my shoulder and in a moment had identified the problem. The next minute brought forth a string of mostly incoherent, but nonetheless colorful, adjectives about what exactly he felt they taught us “college kids.” During this tirade, I was able to pick out the phrase that would forever stick with me: “He’s holding the tape backwards.” What he was referring to, and what I would soon learn, was that the “engineer stick rulers” we were using to record our measurements actually had two sides. The front side showed $\frac{1}{16}$ -in. increments while the backside $\frac{1}{10}$ -in. increments for surveying. While the other engineers were reading the front side, I was reading the back side and calling my measurements out as though they were quarters of an inch. When your tolerance is a fraction of an inch and you are taking measurements over and over again, even this seemingly small difference can add up to a real problem.

Once we figured out my error, the rest of the lift proceeded without incident. The piece landed exactly where we predicted it would, the ironworkers finished bolting it in place and everyone shared a collective sigh of relief as we climbed down from

our platforms. In the end, the show captured beautifully the intensity of the whole operation and even included a cameo shot of yours truly holding the now famous stick ruler up to the jack (although it must have been filmed *after* I corrected myself because I’m clearly holding it in the right way in the clip).

Lessons Learned

I have thought about this day a lot though over the course of my career. Occasionally, I remember being on the Discovery Channel and even sometimes I think about Hokey. But what has struck with me through every project since then are the two lessons I learned that morning.

First, education is a beautiful thing. I have always loved learning (so much so that I even married a teacher). As engineers, I think we take a lot of pride in our education. I always believed that education would provide me with the answers I needed for the challenges I would face in the real world. But I wouldn’t have learned in a 100 years of education what I needed to know that day. Yes, we need education to do our jobs. But we also need to step outside of what we can read and study to learn by observing our surroundings. For a structural engineer like myself, that means seeing my designs not just through the lens of statics, physics or geometry but also as something that must get built by real people using real tools and methods. Oftentimes, we need to open our eyes and realize that all of answers we have learned in our education are useless unless we first ask the right question.

Second, details matter. I couldn’t appreciate it then, being so new, but I have an idea now of just how big of a process that lift (and that whole project) was. I think of the thousands of decisions that had to be made right in the months and years leading up to this effort by the hundreds of people involved in it before me. And yet, the tiniest decision—which side of the tape the lowest engineer on the project should read—could have undone them all. Since then, I take pride in my ability to pick up on the details. The “what” is great, but if you don’t also know the “how, why, where, when and who” that go along with it, then you don’t really understand the problem. In every project since, I’ve strived to find the details that have eluded me on the last one, always pursuing that perfect project with every *i* dotted and *t* crossed. Because details matter in our business.

For a long time, I didn’t tell this story. Maybe I didn’t want to believe it was OK for an engineer to make a mistake. After all, we are paid to give solutions. But what I’ve learned since is that good engineers aren’t immune to making mistakes; they are just smart enough to own them and do their best to never make the same ones again. ■

