



A Structural Engineer's Manifesto for Growth

Part 4

By Erik Nelson, P.E., S.E.

This is the fourth and final installment of what I am calling my manifesto, which presents some of my thoughts about our profession and how we can grow as individual designers. For steps 1-17, please see Parts 1-3 in the April, May and June issues of STRUCTURE®.

18: Throw Away Your Alarm Clock

The most important part of my day as an engineer is lying in bed for about 20 minutes or so after slowly and naturally waking up from sleep. Not only do I lay out my work day, I literally solve engineering problems in my head. I can view the entire project, rotate it in my mind, find problems with the design, prioritize where I need to focus, and improve the design. I can think better because part of my subconscious is still present consciously; it has not yet scurried to the back of my brain. I am grateful for projects that last more than one day because I will be able to sort them out in the morning. Try not to finish deadlines at 7 p.m., finish them at 7 a.m. the next day. In Gordon Glegg's *The Design of Design*, we find the following:

History tells us that artists in various fields from music to mathematics, their key inspiration came suddenly and unexpectedly and never when they were working at it... Concentration and then relaxation is the common pattern behind most creative thinking.

So, make sure that you have time for reflection (not "working") and it will be the best work you did that day.

19: Succeed in Reducing Idiocy

Robert Pirsig complained about a bad motorcycle mechanic when writing *Zen and the Art of Motorcycle Maintenance*. After dropping off his bike at a shop, the mechanic immediately misdiagnosed the problem. He started pounding the engine head with a chisel, breaking off two of the cooling fins. This made the problem worse. Pirsig later thought to himself:

Why did they butcher it so? They sat down to do a job and they performed like chimpanzees. Nothing personal in it ... they were uninformed. They were like spectators. You had the feeling they had

just wandered in there themselves and somebody had handed them a wrench. There was no identification with the job. No saying "I am a mechanic."

What Pirsig is suggesting is that this guy was not a mechanic, he was an idiot. We have among us plenty of idiots, too; plenty of spectators who follow procedures or are slaves to the status quo, non-thinkers. But engineers, like mechanics, are not spectators. Engineers actively engage projects to reveal solutions to problems or yield new ideas. Matthew Crawford, in the terrific book *Shop Class Is Soulcraft*, describes the difference between an expert mechanic and an idiot:

The forensic perceptual expertise of the engine builder is active in the sense that he knows what he is looking for. But with the idiot we see the result of a premature conceit of knowledge.

An engineer, like a master mechanic, is self-reflective and constantly aware of the possibility of making a mistake. Before taking a hammer to the problem, the engineer reflects and asks questions regarding the design solution; questions such as, "Is this the best solution of all the possibilities?" or "Am I correct in assuming that this can be treated this way?" Since problems in engineering are rarely simple or straightforward, it takes a high level of self-reflection, teamwork, and attentiveness. Since our mistakes live as long as we do, it also takes great deal of humility. The best of us recognize that these mistakes are lifelong reminders that we are at times idiots, too, just like everyone else. So we need to succeed in reducing idiocy by being attentive and by participating actively in every project.

20: Worry is OK

Worrying about your design will make you better. You will be better able to prioritize which parts of the project need more attention. James Gordon, in his book *Structures*, writes:

When you have got as far as working drawings, if the structure you propose to have made is an important one, the next thing to do, and a very right and proper

thing, is to worry about it like blazes. . . it is confidence that causes accidents and worry that prevents them.

21: Draw 1 to 1 Scale

Drawing on a one-to-one scale will help you make a better design decision on a particular component of a project. Try drawing a 6x6 wood post on paper with the joist hanger, or 4x4x5/16 steel framing angle with bolts to scale. See if the bolts will fit and get into the code on bolt length (shank, threads, tension control bolt tips, etc.).

22: Buy Samples of Typical Structural Components

Go to the nearest hardware store and buy stuff to have in your office while you design on the computer. Having the material in your hand is the best way to proportion members later on the computer. Visit my blog for some recommendations of samples (rebar, CMU, wood, etc.). Display these proudly in the office for all engineers to see. These real components are vital to being able to make informed structural design decisions.

23: Build Physical Models

The computer will never replace the importance of a physical model out of cardboard, balsa wood, paper, glue, etc. Architects build these all the time; we should, too.

Conclusion

As I stated at the very beginning, this manifesto will always be a work in progress. There will be more ideas on how to grow as individual designers and as engineering communities. My blog (www.structuresworkshop.com/blog) contains more clarification and images for each of the steps. Please visit and provide feedback so that I can improve them, or provide new suggestions of what I can add.■

Erik Anders Nelson, P.E., S.E. (ean@structuresworkshop.com), is owner of Structures Workshop, Inc. in Providence, RI. He teaches one class per semester at the Rhode Island School of Design and Massachusetts Institute of Technology.

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