A Structural Engineer's Manifesto for Growth

Part 1

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

This is the first 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. Additional parts will appear in future issues of STRUCTURE®. I realize that some of what I say will come across as too simplistic or perhaps even misleading. It is meant to be read as a coherent whole, not piecemeal. My intent is not to provoke; it is to seek truth, to be clear, to translate what I do as an engineer, as an educator, and as a citizen and human being. In 20 years, I suspect that this is all going to sound pretty straightforward and bland. Finally, this manifesto will always be a work in progress – just like engineering.

1: Understand Structural Engineering Itself

In order to grow, we need to understand who we are (see "What Is Structural Engineering Exactly?" in the February 2011 issue of STRUCTURE).

2: Embrace the Process

Let the design process push and pull you constantly. It is healthy. Design is nonlinear. It goes backward as much as forward, and it curves around on itself. That is okay. If you have issues with that, this may not be the best profession for you–although there are engineers that successfully do only computer modeling or code research, so there is still hope.

3: Listen

Be a better listener and collaborator. Architects (and other clients) will make you a better engineer, but you have to listen.

4: Become a Lifelong Learner

Not because it is a goal, but because you want to maximize your well-being now. Engineering, like the good life, requires lifelong learning. Ask stupid questions often and pursue answers. Stupid questions are really smart. *Who am I? What is engineering? What is a weld, really? How can something turn from a liquid to a solid within a liquid (concrete underwater)? How come I don't add that tension force I calculated to the pretension already within the bolt shank from tightening?* If you are constantly thinking about these types of questions, you are in great shape.

5: Take Risks

Designing big things requires risk-taking. Design of new and unique solutions to problems involves even more risk. Because engineering requires ingenuity, it requires risk. Be daring. We need to continue to be leaders in design and construction, and we need to take more active roles in pushing our projects forward, not getting pushed. As Lord Kelvin put it:

> *"It's no trick to get the answers when you have all the data. The trick is to get the answers when you only have half the data and half that is wrong and you don't know which half."*

In popular terminology, scientific applications or procedural calculations are about the "known knowns." Design is much more about the "known unknowns." Embracing this means embracing risk.

6: Accept Imperfection

If there is no perfect solution, it follows that all solutions are imperfect. In other words, there is always a better solution than the one that you just submitted for construction. Every design has many compromises, such as code requirements, construction skill, material limitations, conservativeness on new construction techniques, possible errors of design, bad decisions early, etc. Get accustomed to that and own it. All designs are fallible. All designs can be improved. Guess what, the design that you submitted last week has numerous problems or design compromises, and that is okay. Learn and do better next time. Hopefully, you did not just lose a client; but that will happen, too. Take your imperfect project to a lower state of imperfection next time.

7: Forget About Goals

Structural engineering is a process without a goal. Design constraints are not goals, they are ways to make decisions and move the project forward in the present. Engineering is an evolution from a concept to a built project. Let the final product be unknown during the design process.

Understanding that design is inherently goalless is good for you. Design is means-driven, not ends-driven. It is about the present, not the future. Ask yourself often, "What am I doing right now? How am I improving the project now? Am I increasing my well-being, that of my team, and that of the project?" Engineering is about taking action to improve the quality of the object using experience-based judgment. If you have an end product first, that is less effective than if you live and work honestly in the present. When you take meaningful steps in the present, the next day the project will evolve to a higher level. This repeats itself day after day. The end product (building/structure) simply becomes. Let it become. Nurture the process. Be patient.

The goal of achieving this or that building is useless. How could something unknown obligate us? I would submit that even known goals are useless; they are not only obvious, they are superfluous. Goals themselves are always good things for the person who has them, so I am not debating whether this or that goal is a worthy pursuit. Yearning for the vast and endless sea is fine as a goal, but the more immediate task is building the boat. Focus on the boat, not the sea. Let the design process produce the next evolution of the concept instead of trying to pin it down beforehand. Try to design the boat by asking what materials are available first, and keep proceeding. The built project, the boat itself in its final state, should not be known until it is done. Let the boat become, hop on board, and then the sea can be reached.▪

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