



Structural Innovation: A Dissection of Confidence

Mark Sarkisian, Neville Mathias

Skidmore, Owings & Merrill LLP, San Francisco, CA, USA

Contact: Neville.mathias@som.com

Abstract

What does it take to have the confidence to implement a new idea, process, or method—to innovate—in the field of structural engineering? This question is examined by the authors using their experience as practicing engineers in a firm that has always prided itself on trying to bring innovation to all it does. Examples from recent projects implemented in China are cited.

Keywords: Creativity; Innovation; China; Expert-Panel-Review; Non-Linear Analysis; Testing.

1 Introduction

Structural engineering is a specialization within the field of civil engineering, one of the two oldest branches of engineering—the other being military engineering—and is dedicated to the design and construction of civilian works. Based on the application of physics, primarily mechanics, the field can arguably be said to have changed very little over time in comparison to the many new branches of engineering—electrical engineering, electronics, and computer science to name a few—that have sprung up as science and technology have advanced over time. One can look at castles, cathedrals, bridges, canals and other civil works from bygone ages and recognize in them principles and techniques of design and construction not too far removed from those still in use today. The field has a reputation for being conservative that is not entirely unjustified.

There are good reasons for this. Civil engineering projects have typically been large in scale, based on simple / intuitively appreciable principles of physics, been validated by physical trial and error, and employed large numbers workers. Costing large sums of money, these projects were usually commissioned by wealthy and powerful sponsors. Responsibility for cost control, life safety and

speedy execution undoubtedly drove those responsible for the design and construction of civil works and their oversight to be conservative and utilize familiar and reliable locally available materials and construction techniques.

Yet change did come. Innovations took place, slow though their pace may have been, spurred by the development of new materials, computational techniques, construction methodologies, and last, but not the least but very likely the most, the aspirations of the human spirit. Romanesque architecture, for instance, gave way to Gothic architecture which in turn was supplanted by Renaissance architecture and so on, each style requiring concomitant structural innovations.

The confidence to innovate, the authors hold, sprang from the confluence of the intellectual / devotional / political spirit of the times, the open minded support of project sponsors, and the spirit of curiosity, daring and rigour of the engineers, builders, and project overseers. While radical change and innovation has occurred periodically, incremental innovation can be said to have occurred constantly, whenever engineers, builders and project sponsors with the right mix of attitudes and abilities came together.