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Risk-Based Thinking and Knowledge in Engineering Organizations

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Abstract

Against the personal background of working in computational research, in design and in quality management, personal views on uncertainties, on human error and learning are presented. They refer to ground-breaking work from ETH Zurich in the 1970s and expand on the Swiss approach to a holistic quality management in the construction sector, which may seem "old-fashioned" in today's price-driven market. Organizational dispositions, both on company level and within professional societies are addressed. In the context of risk and knowledge management, the revised FIDIC/EFCA guide on quality management (ISO 9001:2015) is briefly presented.

Keywords: computational mechanics, engineering careers, collaboration, partnering, dependability, human error, organizational learning, building culture, ISO 9001

1 Introduction

Some structures, like dams and tunnels, are designed for a life expectancy of 100 years, others are rendered useless before by the fast progress of society and technology. Take, for example, the famous *Railway Postal Hall* in Munich by U. Finsterwalder & H. Bomhard (Fig. 1), closed down 30 years after opening, when the transport of parcels by train became uneconomical [1].

Figure 1. A derelict engineering landmark of 1966, once spanning 15 busy railway tracks

Quite a few structures show premature decay, such as post-tensioned bridges designed in the 1960s, at a time when de-icing salts were not imagined. As Christian Menn confessed in his lecture in 1982, he would never design again with as little concrete cover as in his beautiful arch bridges. His *Felsenau Viaduct* in Berne, for instance, is impossible to widen now by an additional lane, because the sophisticated design by plasticity theory (with interaction of normal and shear stresses in webs) utilized the capacity of the hollow box section to the full.

So we can proudly look back on to a rich history of structural engineering, with impressive outdated design methods – from graphical statics, via iterative solution methods (e.g. *Cross* and *Kany*), matrix analysis and finite difference methods –, various theories of load bearing behaviour and stability [2] as well as bold building technology. Yet, our students and we ourselves as practicing engineers find less and less time to explore and to exploit this wealth of knowledge due to economic pressure.

Are we condemned to undergo a vicious cycle of "lean → mean → ignorant"?

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