



The Blight of Frozen Thinking

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Abstract

The majority of structural engineers believe what the codes tell them and become code jockeys. When this extends to senior levels (as it must without serious early intervention) the dangers are serious. The author's sees good evidence that frozen thinking blights many parts of the industry. It is driven by an environment in which growth and profit dominates and large companies often deliver the minimum accepted by the client. The paper presents some examples of frozen thinking in different areas of work, with an emphasis on UK experience but with worldwide examples.

Keywords: analysis, confidence, modelling, mentoring, thought.

1 Introduction

I am an old man. I am 17 years into my third career (consultant) having spent 6 years building bridges and 23 teaching and researching. Most of my work is on masonry bridges. They are testing subjects, ill understood by most and much more complex than they appear. Much of the work on them is done by more-or-less raw graduates who have been taught nothing about arches at university and who receive precious little guidance when they start. I talk to many of them as users of my program. They take learning where they can and follow codes slavishly. But the codes are largely, demonstrably, wrong.

Let's consider just one example. All the "rules" for bridge assessment set about reducing the behaviour to two dimensions because there was no hope of doing calculations beyond that. An effective strip was defined. The early model assumed that live load was distributed through the fill. A 1.5m strip of arch is assumed to be mobilised without any fill.

The ~~strength~~ stiffness of an arch is in membrane behaviour not bending. The live load thrust

gathers under the load and spreads as it flows towards the abutments, the flow modified by the stiffness of arch and abutment. Complex? I said so didn't I.

When the railways started analysing arches they created their own distribution through rail, sleeper and fill, but not arch. Not invented here, we say.

Full scale testing assumed that 2D was the limit of understanding - full width line loads. The edges of bridges have thick walls to contain the fill. The loading system bridged on to the walls and became part of the tested structure. Then codes were re-drafted asking that analyses produce the same "answers" as the tests.

2 Real Behaviour

For at least thirty years, and possibly more, bridges have been failing, not destroyed, but damaged beyond repair in ways that are not predictable by current thinking. The codes are not fit for purpose.