WHITE PAPER

UNDERSTANDING THE NEW CONTEXT OF RISK IN STRUCTURAL ENGINEERING: BIM AND AI

GRANT ROE, BE(HONS) MENGSC MBA MIEAUST CPENG NER

CRC
COSTIN ROE CONSULTING
CIVIL & STRUCTURAL ENGINEERS

P: +61 2 9251 7699
F: +61 29241 3731
E: mail@costinroe.com.au
W: costinroe.com.au

CONTENTS

ABSTRACT

Understanding the new context of risk in structural engineering: BIM and AI.

Throughout the global engineering profession, there is an ongoing academic discussion about the need to contextualise risk for society in an increasingly complex and interconnected world. Structural engineers, as experts in risk associated with the built environment, are more often relied upon to explain the contemporary concept of risk to clients, partners, and associates.

AUTHOR

Grant Roe is the Managing Director of Costin Roe Consulting, a civil and structural engineering design firm based in Sydney. Grant Roe has a Masters degree in Engineering and Masters degree in Business Administration. Grant joined Costin Structural in 1990, becoming an Associate in 1995, Partner in 1999, Director of the renamed Costin Roe Consulting in 2001, and Managing Director in 2016.

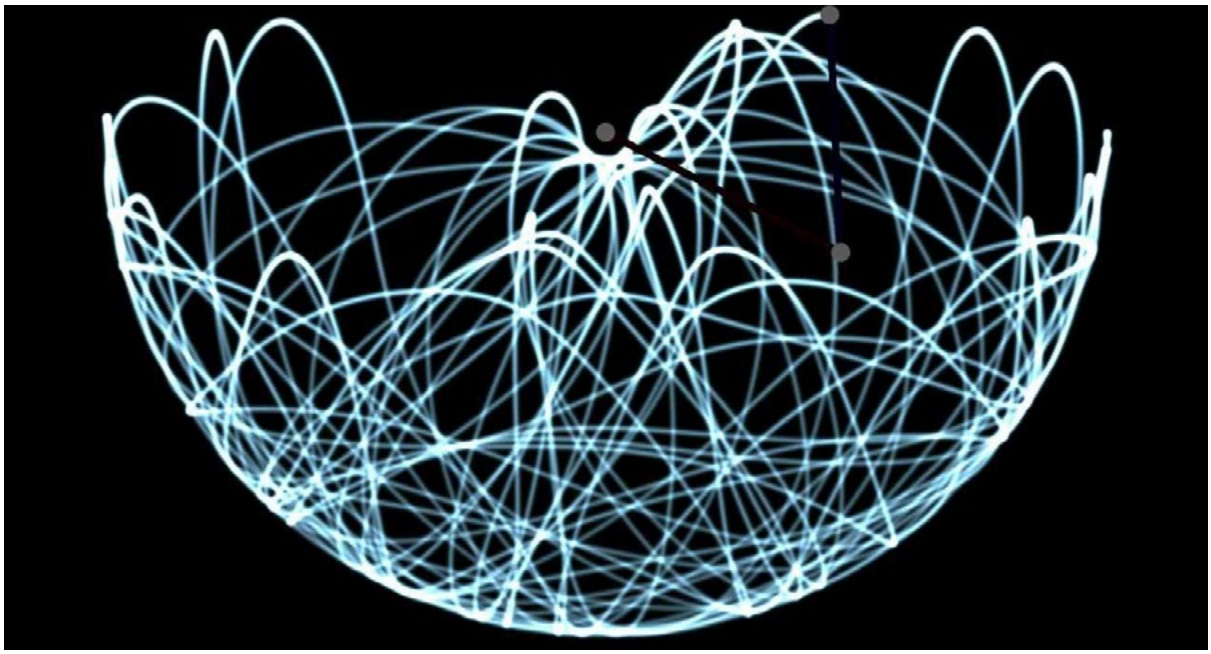
Since joining Costin Roe Consulting, Grant has worked on many significant commercial, industrial and residential projects. He is a specialist in the industrial sector and has worked on large scale industrial projects in Europe, Asia and Australia. Recently, Grant has become closely involved in the rapidly evolving logistics and fulfilment sector and has been instrumental in smoothly implementing the interface requirements between sophisticated automation systems and buildings. Grant has a keen interest in risk and structural reliability, particularly the general perception of risk and expectations at a societal level.

Structural engineers, as experts in risk associated with the built environment, are more often relied upon to explain the contemporary concept of risk to clients, partners, and associates.

In the 2016 article, '***Structural reliability and risk-informed decision-making by property owners***', Grant Roe referred to ISO 2394 in explaining the management of risk as a balance between event probability and commercial feasibility. Construction costs rise in proportion to the degree of risk mitigation. It is therefore not practical to extend mitigation measures to meet the consequences of every conceivable possibility.

Engineers rely on deep knowledge and numerous tools, calculations, and codes to make structural determinations and recommendations. In Australia, as in many nations, buildings tend to be 'over-engineered' in that the basic loadbearing and resistance qualities of buildings must be many times greater than necessary to withstand whatever could be reasonably predicted to occur across the building's entire lifespan. Accordingly, people in Australia can be given high confidence in the structural reliability of buildings whether residential, commercial, civic, or industrial.

Still, anywhere in the world, events of remote probability will occasionally occur. The freak hail-and-ice storm which swept through the Eastern Creek area of Sydney on Anzac Day in 2015, causing several warehouses to collapse, has been cited as an example of a relatively improbable event that occurred. This is where insurance plays a continuing role in structure-related risk management, with the insurer making their own expert calculations on exposure to risk and setting premiums accordingly.



The double-rod pendulum animation is one of the simplest dynamical representations of chaos.

THE 'INTERNET OF THINGS' (INTERCONNECTIVITY) AND RISK

The 4th Industrial Revolution (Industry 4.0) – beyond computers and automation towards cyber-physical systems/AI (artificial intelligence) – impacts all levels of society and industry. Buildings are made 'intelligent' from the design engineering in BIM through to completion, occupancy, and ongoing utility. Building documentation can be managed in a live digital environment, with sensors and other indicators effectively feeding real-time building performance intelligence back into the building. The greatest challenge in engineering today remains the management of human knowledge. We're constantly capturing more expert professional knowledge, from engineers themselves, into the clusters of data that comprise the growing wealth of structural intelligence.

With the huge amount of information on building performance being continually updated and analysed, along with information about associated impacts and environmental happenings ('big data'), there is further reassurance of structural reliability for the greater community. The connectivity and immediate accessibility of information in Industry 4.0 mean that building codes, regulations, and practices will be updated more rapidly in the future if required in response to evident change. These responsive adjustments could swing both ways, over time, in that while engineering requirements may be increased to mitigate emerging risk, there may also be instances where engineering requirements could be reduced, such as if the probability of a specific type of risk is diminished by the emerging volume and detail of information about the risk factor.

In the meantime, while some element of risk is always a fact of Life, it's reassuring to keep in proper perspective the risks generally associated with structural engineering and building construction. According to a recent article in 'The Structural Engineer', an authoritative international magazine for professional engineers, the risk of death from structural failure is about the same as the risk of being struck and killed by lightning. It does happen, but rarely and unpredictably.

REFERENCES

- https://www.istructe.org/thestructuralengineer – article by Professor Richard Clegg and Simon Pitchers
- https://www.costinroe.com.au/structural-reliability-and-risk – structural engineering commentary citing Grant Roe BE(Hons) MEngSc MBA MIEAust CPEng NER
- https://en.wikipedia.org/wiki/Chaos_theory – chaos theory explanation

mail@costinroe.com.au

SYDNEY

Level 4, 8 Windmill Street, Millers Point, NSW, 2000

PO Box N419, Sydney, NSW, 1220

02 9251 7699

NEWCASTLE

Shop 2, 173-179 Pacific Highway, Charlestown, NSW, 2290

02 4946 2061

BRISBANE

Level 19, 10 Eagle Street, Brisbane, QLD, 4000

07 3121 3040

MELBOURNE

Suite 103, 517 Flinders Lane, Melbourne, VIC, 3000

03 9100 1772

WOLLONGONG

Suite 1 Ground Floor
Enterprise 1
Innovations Campus
Squires Way
North Wollongong NSW 2500

02 4258 3645