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OPPORTUNITY

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From the Editor's Desk

In this newsletter, our regular contributor, Derek Viner, writes about "Murphy and the Theory of Perfect People". We have provided an update about the development of the RES online resource known as the Risk Engineering Body of Knowledge 'REBOK'. Also, save the date for the Integrated Project Engineering Congress conference proposed for 26-28 May 2021 in Brisbane. We have also included a brief article that Kevin Foster wrote for the RES national newsletter in February 1994. It is interesting to compare what we were discussing then with what we are discussing now!

We hope you enjoy the newsletter. Please send articles of around 600 words for the next edition and also any comments you may have about current risk engineering issues where you work, live or visit. In the next issue we are particularly keen to include articles about managing risks for engineering projects and operations during the Covid-19 crisis. Case studies would be great! You can send your submissions to the joint editors Kevin Foster kevinjfoster@bigpond.com and Bronwyn Brookman Smith bronwyn@riskconsult.com.au

Kevin

REBOK

The Risk Engineering Body of Knowledge (REBOK) is a living and continuously developing project that relies on members of the community to ensure it grows. The aim of the REBOK is to capture and communicate the core concepts, skills and practices that are generally accepted and known within the field of risk engineering.

Membership of this online community is free and open to the public. To participate in discussions and be notified of upcoming activities please register at https://rebok.engineersaustralia.org.au/ .

RES is a Technical Society of Engineers Australia.

For Engineers Australia members, please remember to nominate your membership of RES when you renew your membership. NB: Non EA members can also join RES.

RISK ENGINEERING SOCIETY

Technical Information

The ubiquitous material of concrete is everywhere we look.

Improving the world through better use of concrete

Viewed through the lenses of the 17 UN Sustainable Development Goals, it is clear that, whilst it provides humanity with many benefits, these benefits come at a cost to the sustainability of our planet.

RES's Gareth Byatt has provided access to this article on our use of concrete, the impact is has, and what we can all do to help ensure the materials used in concrete production, and out consumption of this material, is done in a more sustainable way.

https://irp-cdn.multiscreensite.com/8bbcaf75/files/uploaded/190805_MRS-1_concrete.pdf

An Article From the 1994 Risk Engineering Society National Newsletter is Reprinted Below:

The Challenger Disaster, Bush Fires and a National Risk Council – by Kevin Foster

Dr Alan Jarman from the University of Canberra was the guest speaker at a recent ACT Chapter meeting. Alan spoke of the Challenger (Space Shuttle) disaster and the implications for managing high technology projects. It was chilling to hear from Alan that the engineers were aware of the high risks associated with launching the shuttle in cold temperatures but failed to convince the decision-makers that the launch should be delayed. Alan raised four key aspects to this disaster.

Firstly, there was considerable complexity in terms of the organisation design (including policy makers, project managers, contractors) with low levels of certainty despite design comprehensiveness and detailed calculations.

Secondly, organisational cybernetics were dynamic with many networks and communication feedback loops. However the communication was inadequate and contributed to the risk management failure.

Thirdly, in terms of crisis management there were pre-disaster plans, an immediate response, and a synergy amongst participants in the crisis management operation.

Fourthly post-disaster, there were a number of dilemmas. These included disbelief by engineers that the management had gone ahead with the launch despite the risks and yet denial by the management that they understood the risks. There were contributions to the subsequent inquiry by engineers but alleged cover-ups by management. Management was rewarded for managing a complex task and engineers were punished for failing to convince management of the risks. Engineers learned a lot about the need to improve risk communication but lost a lot of credibility.

Anyone wishing to study this disaster in greater depth should start by reading a paper written by Alan Jarman and Alex Kouzmin. It is entitled "Decision Pathways From Crisis - A Contingency-theory Simulation Heuristic for the Challenger Shuttle Disaster (1983-1988)" , in Contemporary Crises - Law, Crime and Social Policy, Volume 14, no 4 December 1990, ISSN 0378-1100, pp. 399-433.

Dr Jarman's analysis of the Challenger disaster is very valuable to us all. In the political fallout from the 1994 NSW bush fires, one can see similar patterns emerging. Managing forests is a complex business with many competing interests (loggers, conservationists, bush fire control brigades, and the public). The communications between all of these groups could be quite poor. Pre-disaster management plans by the bush fire brigades may have been good but prevention strategies might have been better. We are just starting the dilemma phase and no doubt there will be a lot of finger pointing. Time will tell who is labelled the villains. However there is no doubting that the fire fighters are the heroes of the day.

In forest management there are clearly many risk related issues that need to be coordinated under a single risk management strategy.

Perhaps the time is right to pursue the creation of a 'National Risk Council' (as suggested by John Wayland). Such a body, not unlike the National Quality Council, could have a positive impact on [training and] the way risks are managed in this country.

(*ed. This article from 1994 still seems very relevant in 2020!*)

Standards Update

RES has representation on a number of Australian Standard Committees. The following is a summary of some of the activity being undertaken recently. Draft standards available for public comment can be found at https://sapc.standards.org.au/sapc/public/listOpenCommentingPublication.action .

Standards Australia Committee OB-007 Risk Management (EA/RES Rep: Jason Wagstaffe)

AS/NZS 5050 Business Continuity – Managing disruption-related risk has been revised with input from the OB-007. The new standard will be a companion to AS/ISO 31000:2018, providing guidance on dealing with disruption-related risk, with a focus on high uncertainty and high complexity contexts, situations where more traditional methods struggle.

Standards Australia Committee SF-041 Safety of Machinery (EA/RES Rep: Roger Lim)

Various ISO/IEC/EN Standards have been adopted.

Standards Australia Committee MB-025 Societal Security and Resilience (EA/RES Rep: Dr Kevin Foster)

- HB188 Physical Protective Security Treatment for Buildings: Public comments have been received, amendments currently underway.
- AS 4811 Workforce screening. Work is progressing on a revision.

Various International standards are proposed for revision or development including:

- ISO/CD 22329 Security and resilience – Emergency management – Guidelines for use of social media in emergencies
- ISO/DIS 22300 (ed 3) Security and resilience – Vocabulary
- ISO/FDIS 22313 (Ed 2) Security and resilience – Business continuity management systems – Guidance on the use of ISO 22301
- ISO/FDIS 22396 – Community resilience – Guidelines for information exchange between organizations
- Reserved 22350 Security and resilience – Emergency management – Framework

REBOK Update

A number of webinars have been held as part of the REBOK including:

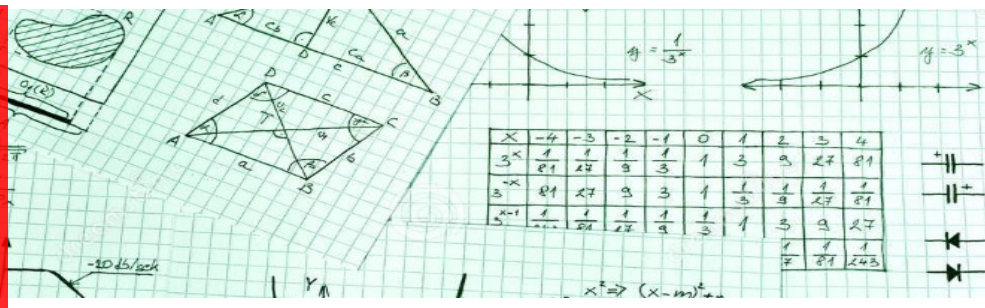
- Risk Management and COVID-19: How can REBOK help?
- Coronavirus—Lessons in Risk, Resilience & Complex Systems
- Australian Capital Projects—Risk Management, Project Controls and COVID-19

Access to these, and previously recorded webinars, is available at https://rebok.engineersaustralia.org.au/webinar_records.html/

Upcoming sessions include:

- ISO 31000—2018 revision, redundant or relevant to your organisation
- Introduction to the Resilience Potentials

Safety Valve 3



Murphy and the Theory of Perfect People

The enduring nature of Murphy's reputation is fascinating in its own right. I rather like the idea that the essence of risk engineering can be expressed by a household name. Whether what we know as his law is in fact to be attributed to Edward Murphy[1] is beside the point - that is the name people know it by, so let's go with the flow rather than argue aetiology. Edward's son Robert recalled his father saying of another person something to the effect of "if there's more than one way to do a job, and one of those ways will result in disaster, then he will do it that way."[2]

Wikipedia (ibid) includes statements of a related nature being made as early as 1866:

- Mathematician Augustus De Morgan wrote on June 23, 1866: *"The first experiment already illustrates a truth of the theory, well confirmed by practice, what-ever can happen will happen if we make trials enough."*
- "… a report by Alfred Holt at an 1877 meeting of an engineering society. *It is found that anything that can go wrong at sea generally does go wrong sooner or later, so it is not to be wondered that owners prefer the safe to the scientific .... Sufficient stress can hardly be laid on the advantages of simplicity. The human factor cannot be safely neglected in planning machinery. If attention is to be obtained, the engine must be such that the engineer will be disposed to attend to it.* "

The common factor is found in the words "if we make trials enough" and "sooner or later". Murphy seemed to be blighted by a person who could be relied on to make it sooner, not later. Risk engineers understand they all refer respectively to Exposure and Error Probability.

This is simple enough, but underlying this is the elephant in the room: Holt's "the human factor" and Murphy's "if there's more than one way…he will do it that way". The idea of the perfect person has a history that predates these sources. It goes back to the influence of the legal system in the industrial revolution, something of which I will write in a future article. If you think the idea is not relevant today, consider these cases.

Case 1—In the late 1970s, a coach taking skiers to Falls Creek ski fields (Vic) from the valley beneath, stopped to negotiate its way past another coach coming down the mountain. The sealed surface was narrow. The descending bus had no room to move further to the left, because of the mountain. The only room for movement, was that for the bus ascending the mountain. The driver did what he could to make room for the descending bus. The shoulder of the road subsided, as the wheels got to the steep hillside, the bus tilted to the point where it rolled, eventually coming to rest some distance down the hill.

Windows shattered, people were thrown out and chaos reigned. By evening some injured had yet to be treated. It is the nature of Risk that one may be absolutely certain this was not the first time that drivers had experienced this problem. Almost certainly it occurred every day of the ski season.

The response of those on the bus (a month or two later), heard by me first hand, was an annoyance with the driver because he had moved too far to the left (is that a value judgement I hear or a statement of the obvious?) and hence 'caused the accident'. I don't know whether he was prosecuted. I understand (unconfirmed) that subsequent to this, changes were made to the road (perhaps increased width, edge barriers and the like).

Case 2—On the 5th of June 2007 a truck collided with a train on the Kerang (Vic) level crossing[3], killing 11 people and injuring others. A 1995 crash at the same site had resulted in a fatality and there had been "a number of near misses in the months leading up to the 2007 accident". I have a first hand report from a railway labourer, that the maintenance crews were aware of the design problem (the road approached the rail at an angle and they had observed some 'near misses' when working there). They told their supervisor, but he appeared unimpressed and my informant thought it unlikely that he would pass on the information to his manager.

This apparent lack of attention is mentioned in the Age newspaper[4]. "*… calls for a major inquiry … seemingly forever from engineering experts and people who have lost loved ones in similar circumstances, have mostly gone unheeded*". In the same report is an example of the theory of perfect people in practice: "*Transport Minister Lynne Kosky made clear when visiting the crash site yesterday that a big part of the Government's response would be a renewed focus on driver behaviour*." In other words, the crossing would work well is only people behaved as intended or expected.

On this occasion the driver of the truck was acquitted of all criminal charges by a Supreme Court jury[5]. Subsequent changes to the crossing included improvements to warnings to drivers and a programme at level crossings to improve line of sight problems[6].

1. Wikipedia entry suggests a number of sources for the idea.
2. https://en.wikipedia.org/wiki/Murphy%27s_law, sighted 09/05/2020
3. https://en.wikipedia.org/wiki/Kerang_train_accident, sighted 12/05/2020
4. https://www.theage.com.au/technology/accident-waiting-to-happen-20070609-ge5394.html sighted 30/5/2020
5. https://www.bendigoadvertiser.com.au/story/1853860/upgrade-victorias-level-crossing-infrastructure-says-coroner-in-kerang-rail-disaster-inquest-finding/ sighted 30/05/2020
6. Rail Safety Investigation Report No. 2007/09, Office of the Chief Investigator, Transport and Martine Safety investigations

Safety Valve 3 cont.

Case 3—On 22nd February 2016 a motor coach from Ballarat hit the low (3m clearance) Montague Street overpass bridge in South Melbourne,[7] peeling back the roof and injuring a number of passengers. The driver was later prosecuted and jailed for over 5 years but a year later his conviction was overturned. I can only presume that at the time of the original prosecution, what it is popularly called the outrage factor influenced the legal process and later, with the passage of time, the legal system was no longer influenced by this. At the time of the Occurrence[8], it was the 226th time the bridge had been hit! There is even an unofficial website counting the hits[9]. I recommend visiting this Wikipedia site. It is both amusing and depressing but it contains a unique collection of data that makes meaningful risk estimation entirely feasible.

In each of these cases it is possible to see a reliance on (by the road designers) and assumption (by the legal system) of 'proper' behaviour of the road user. It's an assumption that *perfect people* are normal, the corollary of which is that imperfect people are abnormal. There's an expectation that in the event of a crash, the courts will tend to find the person involved abnormal and therefore negligent and in so doing uncover the fact, not noticed prior to this even by their employer, that some anomalous people are, in fact, not perfect. Really? Is this a surprise? I would argue the opposite - that imperfect people are normal and perfect people are a figment of our collective imagination.

These cases are just three that come to mind. I'd ask you to consider how many alternative cases from around the world could have been used to illustrate the point I wish to make. I know, for instance, that buses rolling down mountain sides are not at all uncommon. Search the WWW for yourself.

Each of these cases concerns road design, but the problem they illustrate is not confined to road design. In our profession, road design is the province of civil engineers. Do we therefore blame them for this? I don't think we should, not only because I have long-standing dislike of 'blame' but also because we, as engineers, work within a very complex social and organisational system. Blaming engineers would overly simplify our understanding of the influences that lead to situations such as each of these.

As an illustration of these complex system interactions, the reason for the Montague Road bridge clearance being as little as it is are explained in the Wikipedia entry (ibid). After construction (1914) flooding of the road under the bridge was a problem (let's assume capable of engineering prediction and maybe also control) such that it became unusable by pedestrians. In 1934 the responsible council solved that problem by the engineering solution of raising the level of the road surface by two feet, thereby creating the current abnormally low clearance of three metres. The fact of the low clearance is announced to road users by "prominent signage".

There's a further problem in that the bridge then carried trains (and now a light rail track) and the bridge itself could be damaged by impact with possible adverse effect on these services.

A risk-literate engineer would consider the possible failure Mechanisms of this strategy, the driver :

- Does not know the height of their vehicle;
- Does not see the sign owing to attending to traffic conditions;
- Knows about the bridge but is distracted - their attention is elsewhere (phone call, crying baby, anxiety about a personal problem etc. etc.).

The probability of any one of these is influenced, for example, by the possibilities that a driver is entirely new to the area and has never seen a bridge of non standard clearance before and that a driver is unaccustomed to driving high and wide vehicles, etc.

Looked at objectively, rather than bureaucratically (we put a sign up) or legally (it's easy to blame a driver), we would see that the potential for a bridge strike with serious consequences is self-evident to the responsible party and so it is therefore only a matter of probability, in other words a matter of *when* rather than *if* (recall Exposure - *"if we make trials enough"*). It is clearly not in the death and taxes category. The probability is that expected of human error in this situation: otherwise normal traffic and drivers operating in routine mode. For drivers familiar with this low clearance, it would also be a routine task. Enquiries would reasonably consider what proportion of traffic in general is tall vehicles? What proportion of these or their drivers are from outside this area?

A little investigation illuminates the problem - the risk factors that influence probability and consequence values. The answer will be somewhere in the range of expected error. I'd tentatively put it in the range of 10-2 to 10-4 [unaware approaches to the bridge per vehicle]. However, not all of these will hit the bridge as at the last moment there is the possibility of recognition, the 'goodness me' moment and effective braking. It is only when all this fails that we have a collision. The collision in the case of the coach was spectacular and so reached the newspapers.

7. https://en.wikipedia.org/wiki/Montague_Street_Bridge sighted 12/05/2020
8. https://www.thecourier.com.au/story/5867810/gold-bus-bridge-strikes-again-as-truck-gets-wedged/ sighted 12/05/2020
9. https://howmanydayssincemontaguestreetbridgehasbeenhit.com/ sighted 25/05/2020

Safety Valve 3 cont.

Ignoring the reality of the situation created all those years ago and the possible increase in vehicle heights and traffic volumes (Exposure) in the intervening time, the simple reaction is to plod through the legal process of prosecution (dangerous or reckless driving perhaps?), judgement, appeal etc. News readers will announce that the police are investigating the cause of the accident and the unspoken sub text is that we can then all rest easily because this will be found and removed.

My point, in drawing attention to these three cases, is to use them as a springboard for questioning what the role of the RES could perhaps be in promoting a wider community understanding of the realities of risk and the need for its management. I think the wider community here includes the engineering profession in general, those who are not part of this society. Of course it also includes, in the context of these three cases, local government, the police and the legal system. The tragedy at Kerang draws attention to the needs of organisations to make use of the information that is present within them ("near miss") but largely unrecognised, in other words management of risk practices as whole.

My experience as a practitioner in this field over some 40 years is that if it is possible to name one major obstacle to improved management of risk it is simply this - not understanding the subject of risk. Many times I despaired of making progress in my client organisation, so deeply ingrained and immovable was the unhelpful preconceptions of everyone about what 'safety' or even 'risk' was. These preconceptions were expressed practically in the role and activities of the safety department, which I regret to say were very often ineffectual. More recently (in my timescale at least) they have given rise to the parallel activities of the risk department. Picture an organisation in which in head office there is a risk management department and in the real world of operations there is a safety department. And picture these two departments operating without reference to one another and basing their work on two entirely different concepts. It's the stuff of comic opera. Reality is stranger than fiction.

Furthermore, in organisations employing professions with a science base (engineers, geologists, chemists etc.) there was, in my experience, almost always a conceptual gulf separating these professions from the risk or safety people. Especially, I mostly found in the case of engineers, the politely unexpressed desire to have no involvement at all with the safety/risk people was easy to sense. The reason, I feel sure, is that the latter were seen to be akin to snake oil salesmen - all evangelism, no substance/science. I well remember attending a talk by the chief safety person from a well known major technology company from the USA, who was visiting Australia. He said that he took every opportunity to spend a few uninterrupted seconds with the senior engineers who ran the company to promote what he did and the values he represented. His favourite place was the lift, as his audience was captive there. How very depressing, but also how illuminating and illustrative of the gulf of which I write.

That was over a decade ago and times change. With the overwhelming attention given to safety and risk assessment by legislation, I have more recent experiences to indicate that similar senior engineers now believe that there must be something in what the safety department think, given the legislative promotion and perhaps they should rely on them and their methods for guidance. The last occasion I became aware of this was after a disaster of biblical proportions involving a particular engineer's profession. He shook his head and told me he and his colleagues all over the world felt they had been let down by the safety people.

I am picking up here on a point I made in Safety Valve 2 - "*This means risk engineering is something all designers should do and our role as professed risk engineers is to both promote the science and application of the subject and assist designers ourselves.*" I believe the task of promotion is actually greater than attending to the needs of designers, it applies to science-based professions in general as well as to managers, accountants and even lawyers. My experience with the legal profession is that they find the concept of risk and uncertainty hard to understand, coming as they do from the position of the perfect and reasonable person and the adversarial system that is the basis of legal practice.

To do this, we need a jointly held strong scientific foundation for our theory, our terminology, our thinking process and hence what we talk about and how. We need to spend time on this and hold scientific meetings (just as physicists do), seminars and conferences on this topic alone. When we have developed a sound and shared knowledge base, we can confidently move outwards and provide others with the concepts and vocabulary to make sense of their own profession wherever uncertainty is to be found. This is everywhere other than death and taxes, so the task is worth doing. If we don't do this, who will stop the history of the world being punctuated by disasters of biblical proportions?

Derek Viner

Save the Date—IPEC

Save the Date—Conference 2021

The Risk Engineering Society is teaming up with The College of Leadership and Management and kindred societies: AMC, SESA and ACES to deliver the Brisbane RISK 2021 conference within the INTEGRATED PROJECT ENGINEERING CONGRESS (IPEC).

This is a new opportunity orchestrated to help RES members learn more about trends in RISK Engineering practices and the applications in other fields Engineering from around the world.

An obligation of our RES mission is to promote and disseminate Risk Engineering practices for the wider good both within the engineering community and society at large. It is anticipated that by collaborating with our colleagues in this way RES will increase the penetration of the understanding of RISK into the world wide community.

Please save the date for this exciting upcoming congress – to be launched soon!

RES National Committee

Geoff Hurst (President)

David Cox (Treasurer and QLD)

Pedram Daneshmand (Deputy President and NSW)

Subhash Dang (ACT)

Timothy Rigby (Victoria)

Kevin Foster (WA)

Andrew Dakin (EA) provides advice to the committee