RISSB
RAIL INDUSTRY SAFETY AND STANDARDS BOARD

FASTRACK

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INSIDE THIS ISSUE – WHAT IS SHAPING THE RAIL INDUSTRY TODAY AND INTO THE FUTURE

P1 Weighing the Cost of Australia’s Largest Source of Rail Safety Risk

P3 Plant & People Interaction on Rail Construction Projects

P4 Inadvertent contact between rail and other metallic objects

P5 ECOpact - Green Concrete Solution

P6 Composite Sleepers – Keeping plastic waste out of landfill

P7 Sanding System

Weighing the Cost of Australia’s Largest Source of Rail Safety Risk

If you ask most Australians what the highest source of risk on Australia’s railways is, you’d likely get an answer pointing to collisions, quite possibly in relation to level crossings, or perhaps to collisions with track workers. This is understandable, given that for most people, the places they are likely to think about rail safety risk are when traversing level crossings, or when viewing the track workers they pass on their commute.

However, the correct answer, when looking at rail safety risk on Australian railways, is that suicides are by far the highest contributor to rail safety risk. According to the latest version of the RISSB Australian Rail Risk Model[1], suicides account for approximately two thirds of Australian rail safety risk (measured in FWI[2]/year). Note the red section representing suicides in the below sunburst chart of the contribution of various sources of risk across the Australian rail network (sourced from ARRM 5.0).

Historically, when making decisions around capital expenditure on new and upgraded infrastructure, even where that infrastructure is designed to improve safety outcomes, safety-related analysis would typically exclude suicides when considering rail safety risk. Despite industry initiatives such as Rail R U OK? Day in addressing mental health within the rail industry, suicides by members of the public on rail infrastructure are often seen as something largely outside the control of rail transport operators, and it can be easy to fall into to the line of thinking that a lesser duty of care may be owed to a person intentionally endangering themselves.

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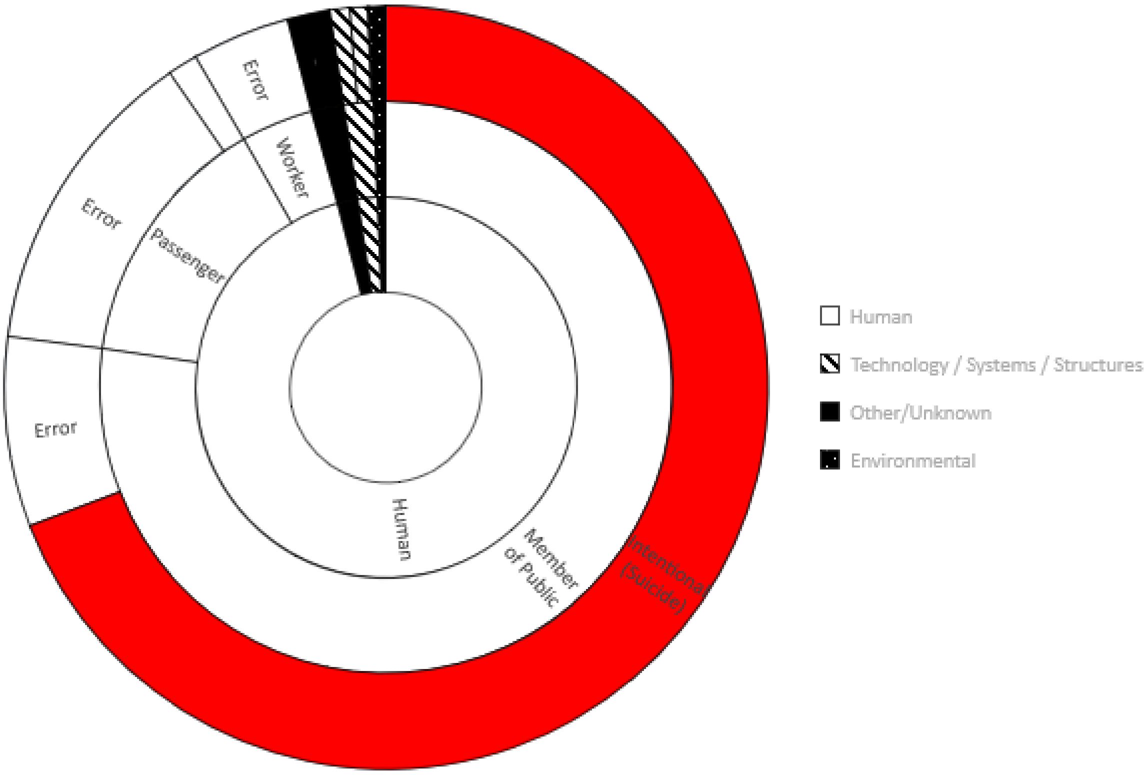
[1] https://arrm.org.au/

[2] FWI – fatalities and weighted injuries – is a measure used to compare risks with differing consequence severities. 1 FWI is equal to 1 fatality or 10 serious injuries or 200 minor injuries.

Australian Rail Industry Sources of Risk (FWI/yr)



However, given the sizable contribution of suicides to overall rail safety risk, there is significant scope for the industry to reduce overall rail safety risk by selecting infrastructure that assists in suicide prevention, such as:

- Platform screen doors;
- Barriers/throw screens on bridges;
- CCTV monitoring;
- Signage; and
- Help/call points

Generally, the above infrastructure (excluding mental health related signage) would be considered for inclusion in a project design for reasons unrelated to suicide prevention. However, if engineers were to consider the impact of this infrastructure in reducing suicide risk as part of the cost-benefit analysis, investment in such infrastructure options is likely to become significantly more attractive.

One common argument against such an approach is that preventing suicides at one location through the introduction of measures such as platform screen doors, fencing, or barriers will only result in those self-harm events happening in a different location. However, studies suggest that suicide attempts are not necessarily coupled with location/means – that is, people prevented from committing suicide at one location/by one means will not necessarily try again at another location[3].

For organisations participating in the RISSB ARRM, the data it provides can be leveraged to assist in preparing business cases for capital projects that include consideration of suicide risk reduction. Guidance on weighing the cost of controls against a benefit in terms of risk reduction is available from ONRSR in their paper on ensuring safety SFAIRP[4].

If we, as an industry, commit to considering the potential benefits of suicide prevention that can flow from our infrastructure decisions we have the capacity to make a significant difference not only in preserving the lives of vulnerable members of the public, but also in reducing the impact of suspected and attempted suicides on the mental health of our rail traffic crew, network control, emergency response, and incident investigation teams.

[3] Sources for uncoupling of suicide with location/means: Richard H. Seiden Ph.D. M.P.H., Where Are They Now? A Follow-up Study of Suicide Attempters from the Golden Gate Bridge, Suicide and Life-Threatening Behaviour 1978, 8(4), pp. 203-216; Kreitman N. The coal gas story. United Kingdom suicide rates, 1960-71. Br J Prev Soc Med. 1976 Jun;30(2):86-93

[4] https://www.onrsr.com.au/__data/assets/pdf_file/0009/2412/Guideline-Meaning-of-Duty-to-Ensure-Safety-SFAIRP.pdf

Plant & People Interaction on Rail Construction Projects

In recent times, the Rail Industry has seen a significant increase in incidents involving plant and people.
Plant & people interaction is a major cause of workplace death and injury in the Australian workplaces.

Operating and working in and around plant is a high-risk activity and control measures should always be in place to reduce or eliminate the need for interaction.

It can be difficult to implement a standard set of controls measures when working around mobile plant. Controls can vary greatly depending on the location of works, the task and the mobile plant itself.

Examples of some control measures are:

- Competency
- Communication
- Pre-Job Start Brief
- Exclusion Zones
- Spotters / Look Out
- Inspections

It is important we are fully aware of the hazards associated with mobile plant and its' operating limitations.

Every task that is performed should have an associated JSEA or SWMS. These documents will contain specific hazards associated with the task and interaction with the mobile plant.

During the Pre-Job Start Brief, hazards associated with mobile plant must be identified and adequate controls discussed, agreed upon and implemented prior to commencement.

It is important to discuss and evaluate suitable control measures during the Pre-Job Start Brief using the hierarchy of controls (Eliminate, Substitute, Isolate, Engineering, Administrative, PPE) and decide which is the safest and most practical to implement.

Safe practice for operators

- Relevant competencies for plant operations
- Plant pre-start checks
- Adequate communications in place
- Familiarisation of work area – environmental surrounding including ground condition
- Visually locate workers to ensure path is clear
- If vision is impacted cease all plant operation
- Have a spotter in place

Safe practices for spotters

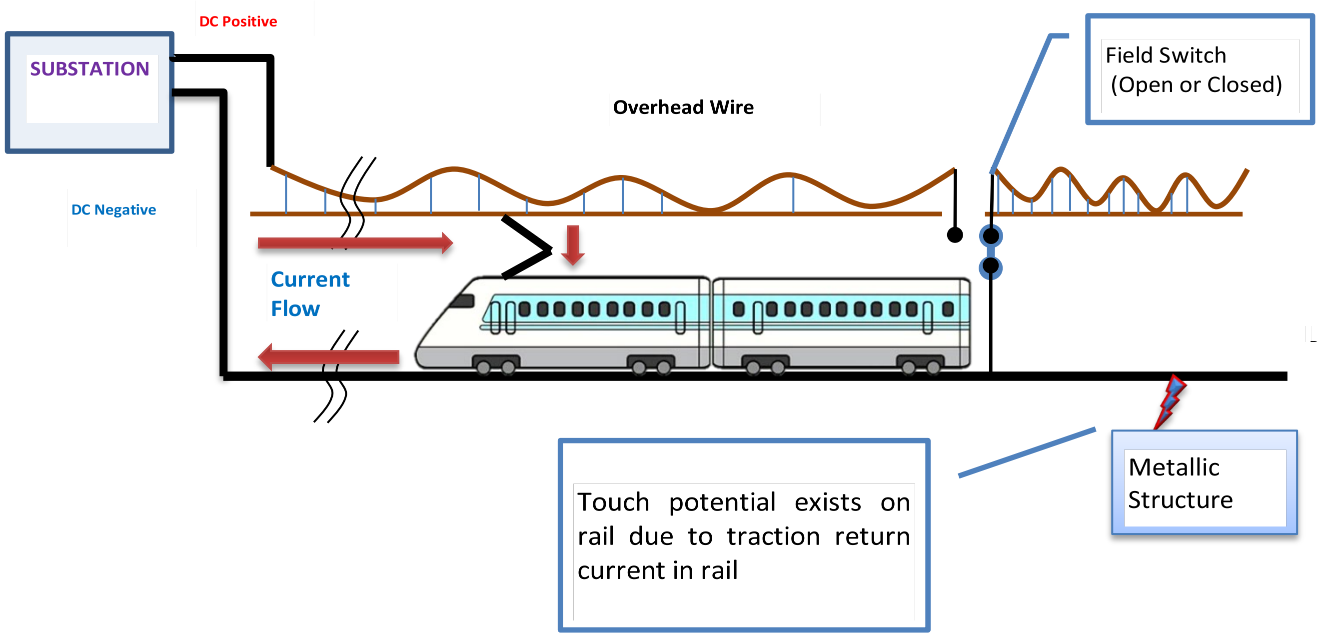
- A spotter uses hand, light signals or verbal communication to guide a driver while in operation.
- Before any operation, the operator and spotter should:
- Ensure communication method is adequate, established and agreed upon
- Pre plan the movements and delineate the area if possible
- Discuss where the blind spots are for the vehicle/plant
- Make sure the spotter has a clear understanding of how much space is required for a turning/reversing vehicle and ensure an exclusion zone is in place.

Inadvertent contact between rail and other metallic objects

Incidents involving persons, tools or materials having contact with rail and nearby metallic structures has resulted in electric shock, exposure to electric arcs, and damage to the assets even when the 1500V DC OHW has been isolated. There is a potential voltage difference of up to 100VDC at any one time between rail and earth.

A circuit formed between your body, adjacent infrastructure, rail or a rail-mounted vehicle may result in a serious electric shock. In addition, creating a direct metal-to-metal contact can result in significant electrical current flowing and, if broken, a hazardous arc may result. This current is not limited by protection devices and the resulting arc may cause serious injury or damage to the infrastructure.

A sectioned electrical isolation may not prevent the traction return currents in the rail because the rail is continuous over many electrical sub sections, including crossovers making the ability to isolate traction return currents difficult.



All personnel working in the rail corridor need to be aware of their surroundings to ensure inadvertent contact with metallic earthed objects and rail does not occur. Examples of metallic earthed objects are scaffolding, elevated work platforms, galvanised steel troughing, station structures including awnings, handrails, platforms, poles supporting lighting, CCTV, or communication equipment, fences, bridges, buildings, handrails, electrically powered tools.

Effective controls that can reduce the risk of touch potential electric shocks include, ensuring separation between yourself and earth and rail using rubber mats, fiberglass scaffolding, wooden planks, battery operated tools and finally correct use of PPE by ensuring sleeves are rolled down and gloves are worn.

ECOpact - Green Concrete Solution

Our industry has pledged to achieve net zero emissions, to achieve a green living means creating sustainable solutions supported through data and science. Green concrete is just the beginning of reducing CO2 emissions against equivalent general ready-mix concrete without cement substitutions.

Why is it important to create sustainable alternatives to conventional concrete?

The construction industry has a dramatic effect on climate change due to concrete being the second most used material on earth, after water. As an industry, we are directly tasked with finding lower carbon solutions to minimize our impact footprint.

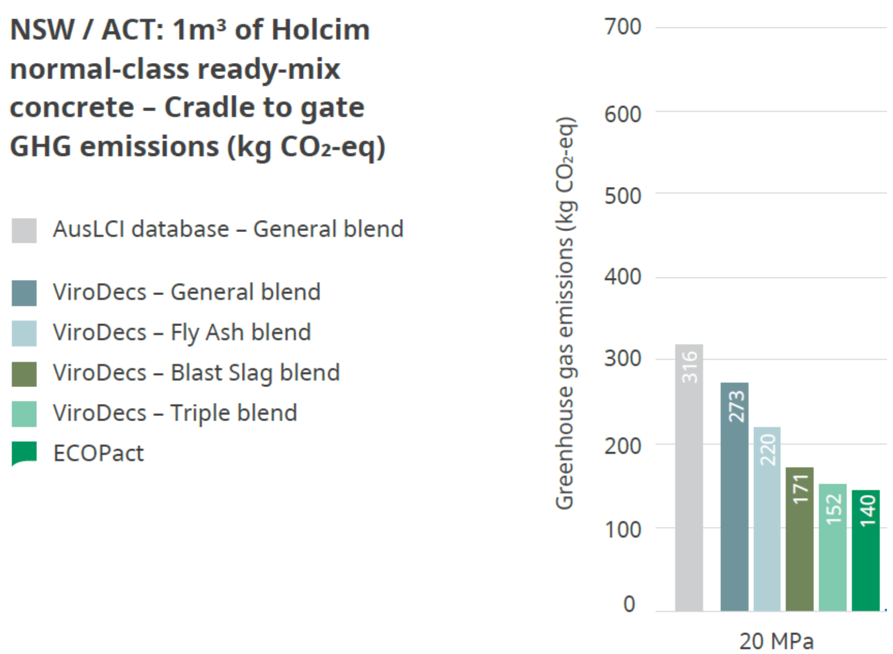
Ecopact is a Carbon Concrete currently approved and utilised on TfNSW substation projects for Kerbs, Gutters, Light Posts, Footh paths, conduit launch plinths and Road pavements. It is readily available in a variety of strength classes and meets AS1379 Australian standards. The usage and application methodology is handled the same as conventional concrete.

With ECOpact, carbon intensity can be reduced by 30-60% by replacing standard cement with alternate material types, this includes utilising industrial by-products produced in other production lines like Fly ash, blast furnace slag and silica fume.

To put things into perspective, constructing the Harbour Bridge using ECOpact would have the equivalent carbon reduction of 15,000 personal car usage over the span of a year!

What shall this product enable for our future? :

- Maintainable strength product and quality adhering to industry standards
- Available for a range of strength and mixes
- Infrastructure Sustainability Council accredited
- Economically viable compared to conventional concrete
- Achieve and embodied 30-60% carbon reduction without carbon offsetting



We are currently exploring further areas of application where ECOpact concrete range has potential to be applied across B83 and B80 structural components: foundations, columns, beams to walk and driveways. Additional testing shall be conducted on specific concrete mixtures to verify material long term performance.

Composite Sleepers – Keeping plastic waste out of landfill

In 2018/2019, plastic consumption in Australia was over 3.5 million tons, while just 13% of that was recycled. Australia sends 84% of plastic waste to landfill each year where it can take up to 1000 years to break down.

Composite sleepers are an emerging technology within the rail industry which can help to tackle plastic waste. Various local and international manufacturers have developed sleepers made from recycled plastic content, as a substitue for traditional timber or concrete sleepers.

In Australia, Integrated Recyling have developed the Duratrack sleeper which is made from a mix of flexible and rigid plastics including agricultural film, polystyrene, pipes, drums, and bottles. Duratrack sleepers are manufactured locally with recycled plastic materials making up 85% of each sleeper.

A composition of polymers and additives are used on the formulation of recycled plastic sleepers to achieve the necessary properties and performance requirements such as density, hardness, tensile strength and flexural modulus.

It is estimated that for every kilometre of track constructed with Duratrack sleepers, 54T of plastic is diverted from landfill. The sleepers are fire, rot, and UV resistant with a design life of 50 years, comparable to that of a concrete sleeper, and significantly longer than timber sleepers which require replacement every 10-20 years.

Duratrack sleepers are approved for use by a number of authorities across Australia including MTM, Queensland Rail, V/Line and ARTC. To date, the sleepers have been trialled in a number of applications including;

- Wyndham Vale Stabling Yard (V/Line)
- Richmond Station Platform 3 (MTM)
- Helidon-Gatton mainline (QR)

Some authorities currently limit application of composite sleepers to low-speed environments or lower track classes. This is partly due to the low flexural strength of recycled plastic sleepers compared to concrete sleepers, and concern over the performance of a low mass sleeper under higher axle loads.

Cost is another barrier to the wholesale adoption of composite sleepers, costing roughly 3.5 times that of a conventional concrete sleeper.

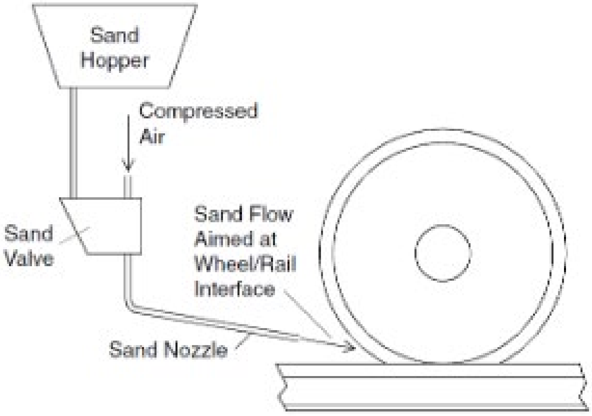
Ultimately, success of current and future trials has the potential to broaden the application of composite sleepers. Despite higher costs, an increased focus on sustainability and circular economy within the rail industry is likely to see an increased uptake in the use of this emerging technology.

Sanding System

Wet leaves are notorious: by covering rails in the fall, they dramatically reduce the level of adhesion between wheel and rail. The main adhesion enhancer used on railway networks worldwide is sand. Sanding is used in train operations to improve adhesion in both braking and traction.

In braking it is used to ensure that the train stops in as short a distance as possible. It usually occurs automatically when the train driver selects emergency braking. Sanding in traction, however, is a manual process. The train driver must determine when to apply the sand and how long the application should last.

The sand is supplied from a hopper (Sand Box) mounted under the train, usually with drying function to keep the sand run freely. Compressed air (controlled by the Brake Control Unit) is used to blow the sand out of a nozzle attached to the bogie and directed at the wheel–rail contact region (see following figure). In most systems the sand is blown at a constant flow rate, but some can provide a variable flow rate. There is a certain sand type (quality & mix) requirement for the sand to ensure the adhesion and control.



While sanding is effective and easy to use, it can potentially cause complex and costly problems relating to both rolling stock and track infrastructure. Sand application has been shown to increase wear rates of both wheel and rail materials by up to an order of magnitude. Braking sand scattered at a low speed can cause an isolating effect between the wheel and the rail in the case of individually driven traction vehicles. The application of sanding system requires particular attention.

Source: Handbook of Railway Vehicle Dynamics, Picture, Knorr-Bremse

Thanks for reading

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