A Reliability Assessment of Railway Track Performance in Extreme Heatwave Events

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Issues

- Railway networks are essential infrastructure for Australian cities.
- Buckling of railway tracks due to extreme heatwaves caused severe service disruption of the networks - observed in the heatwave of January 2009 in Melbourne
- Climate change research indicates a future of more frequent and more intense extreme heatwaves in Australia
- Assessment of heatwave hazard to the rail track buckling failure is needed for future planning and management of railway network services
Our research aims at setting up a reliability analysis framework for railway track buckling failure under extreme heatwaves.

- **Research Outline**
  - A science-based method - Monte-Carlo simulation
  - Consideration of uncertainties – Gaussian distribution modelling for:
    - effective buckling length
    - buckling mode
    - rail temperature at the time of installation
    - rail temperature during heatwaves
  - Matching results to observations - Melbourne railway buckling in Jan’09
    - A proof of concept
    - Validation
Observations: Melbourne has 275 km rail = 110,000 x 2.5-m rail segments
Number of buckling segments observed in the Jan’09 heatwave is 2

Science-base simulation: Out of 1 million 2.5-m rail segments, number of buckling cases is 23 in average

Buckling probability ~ 2 / 100,000
Outcomes (Impacts)

- Demonstrated a science-based approach for reliability/risk assessment for railway track buckling failures in heatwaves.

- Opportunities - the assessment can be developed into a framework to assist railway authorities to plan and manage railway network services.

- Identified the need for reviewing the design and construction of railway tracks for adaptation to changing climate through:
  - New materials, less-sensitive to changes of temperature
  - Review and revise rail construction procedure, where rails are laid at its ‘neutral temperature’, to cope with increasing average and wider variation of temperature in changing climate
  - Review and improve rail performance by improved construction configurations / designs
  - Re-emphasizing the importance of proper maintenance for railway tracks