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# A Reliability Assessment of Railway Track Performance in Extreme Heatwave Events

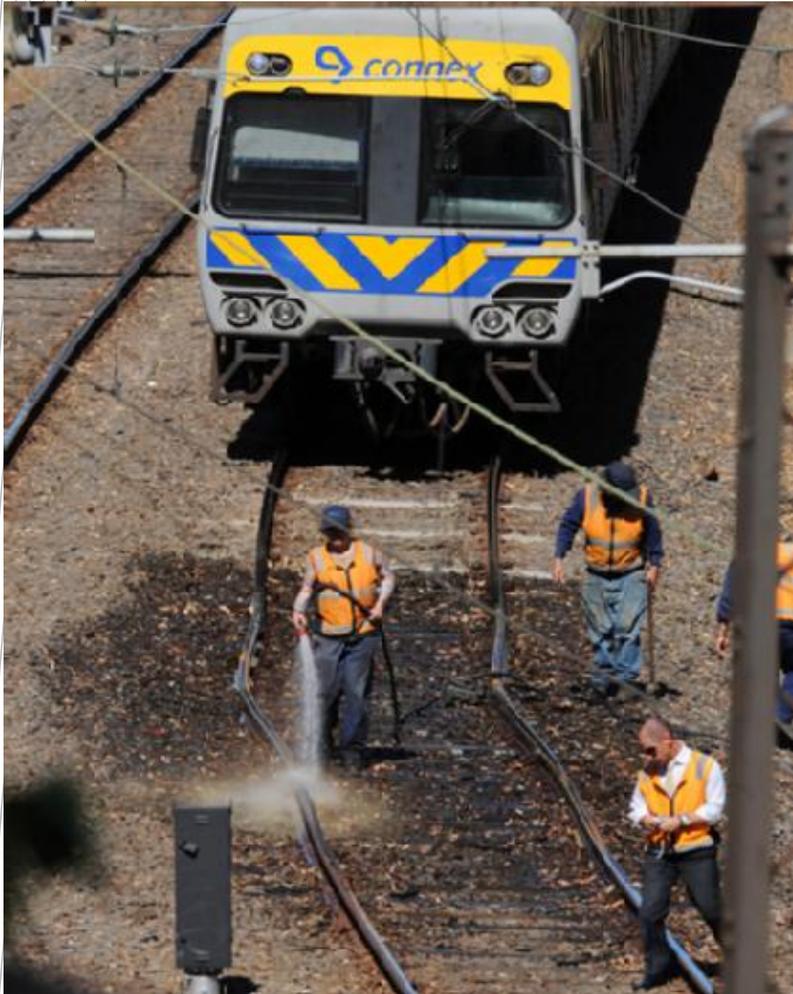
Climate Adaptation Flagship

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30 June 2010

National Research  
**FLAGSHIPS**  
Climate Adaptation



# Issues



Melbourne Rail Buckling - The Age, Jan 29, 2009

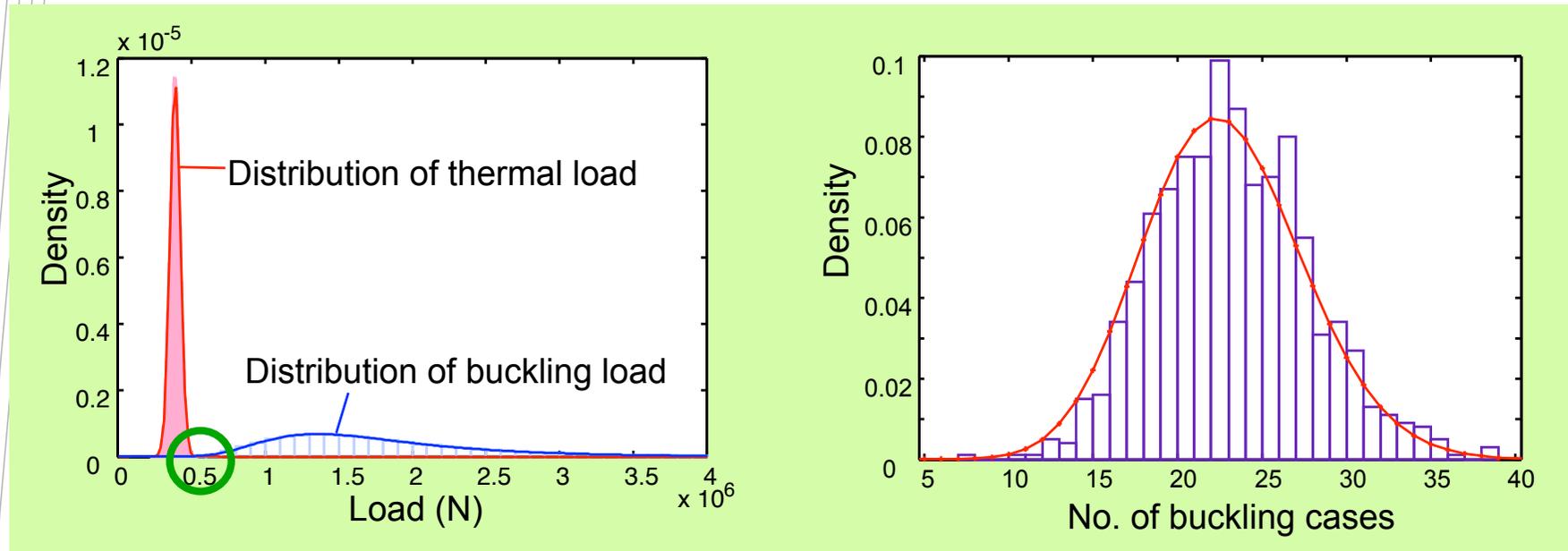
- Railway networks are essential infrastructure for Australian cities.
- Buckling of railway tracks due to extreme heatwaves caused severe service disruption of the networks - *observed in the heatwave of January 2009 in Melbourne*
- Climate change research indicates a future of *more frequent and more 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*

# Research Outline

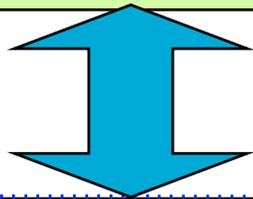
Our research aims at setting up a reliability analysis framework for railway track buckling failure under extreme heatwaves

- 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*

# Key Results



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



Buckling probability  $\sim 2 / 100,000$

**Observations:** Melbourne has 275km rail = 110,000 x 2.5-m rail segments  
Number of buckling segments observed in the Jan'09 heatwave is 2

# 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