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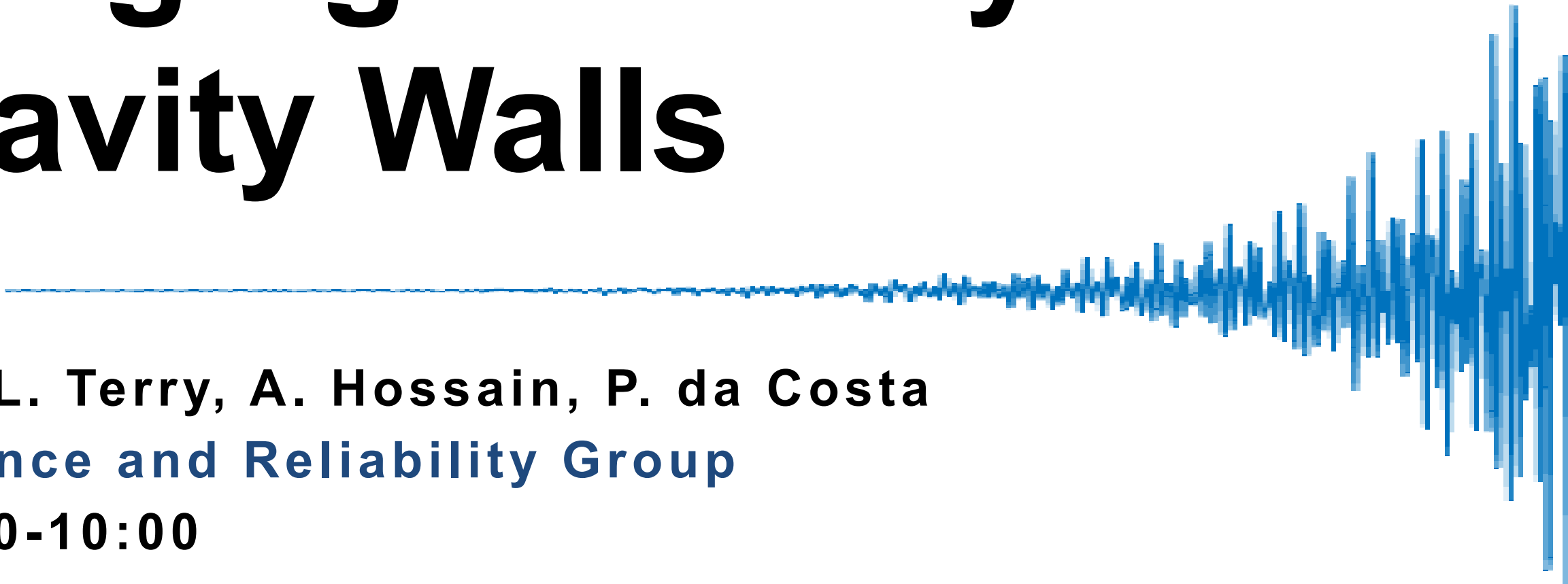
A Method for Estimating Resilience of Aging Masonry Veneer and Cavity Walls

Igor Chaves, M. Masia, C. Lam, L. Terry, A. Hossain, P. da Costa
Critical Infrastructure Performance and Reliability Group

Date: Fri 21st Nov Time: 9:40-10:00

Research Advances Paper ID: 2

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Royal Newcastle Hospital
(est. 1817)

(Inc. JHH 2007)

(photo 1980's)

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Medical Superintendent

Chris McCaffrey

“It was widely believed that
patients recovered quicker
due to the fact that the salt air
killed the bugs”





Arc Apartments (est. 2018)

© www.thinkbrick.com.au

Architect: Koichi Takada

Construction Innovation Award

Steel lintel support masonry units



Battersea Power Station (est. 1933)

© www.batterseapowerstation.com.uk

(photo 2020's)

Designed: Leonardo Pearce,
Engineer and Chief

Biggest Brick Building in Europe
(Residential & Shopping Centre)

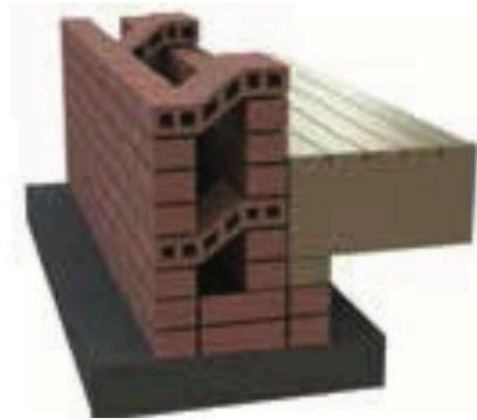


(2017) Brisbane Times, Coorparoo QLD
12-year-old, 8m tall wall collapse
during Villanova College School holidays.

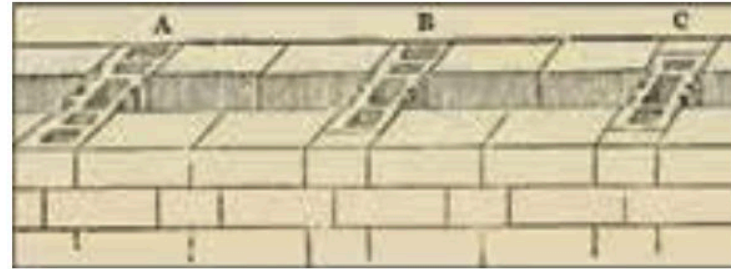


(2023) NBC News, Davenport, Iowa
3 killed in
116-year-old, 6-storey
west wall collapse.

A Stable Relationship



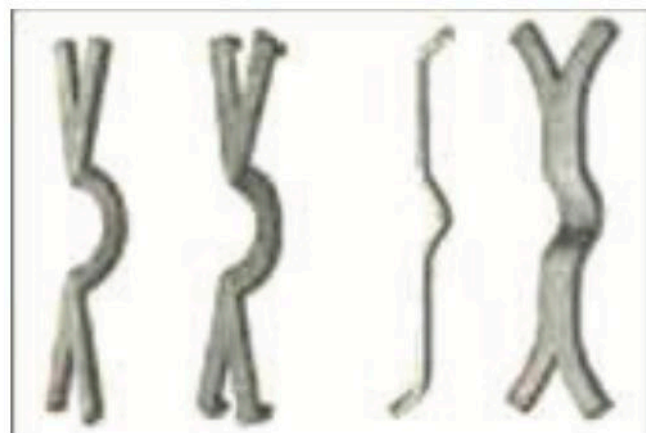
(a) Bent clay header bricks



(b) Extruded clay header bricks (Gwilt, 1888)

Figure 2 – Early details of header bricks used to tie the two cavity layers together

Early Details of Header bricks used to tie the two cavity layers together



(a) Cast iron (left 2) and wrought iron (right 2) ties (reproduced from Hamilton, 1958)



(b) Typical cavity wall cross-section showing metal ties

Typical metal ties and typical cavity wall cross-section



(2015) Dizhur, D., Ingham, J., et.al
Struct. Eng. Soc. Of NZ Journal, Vol 28 (1) 13 pages.
Historical Study of URM Earthquake Performance

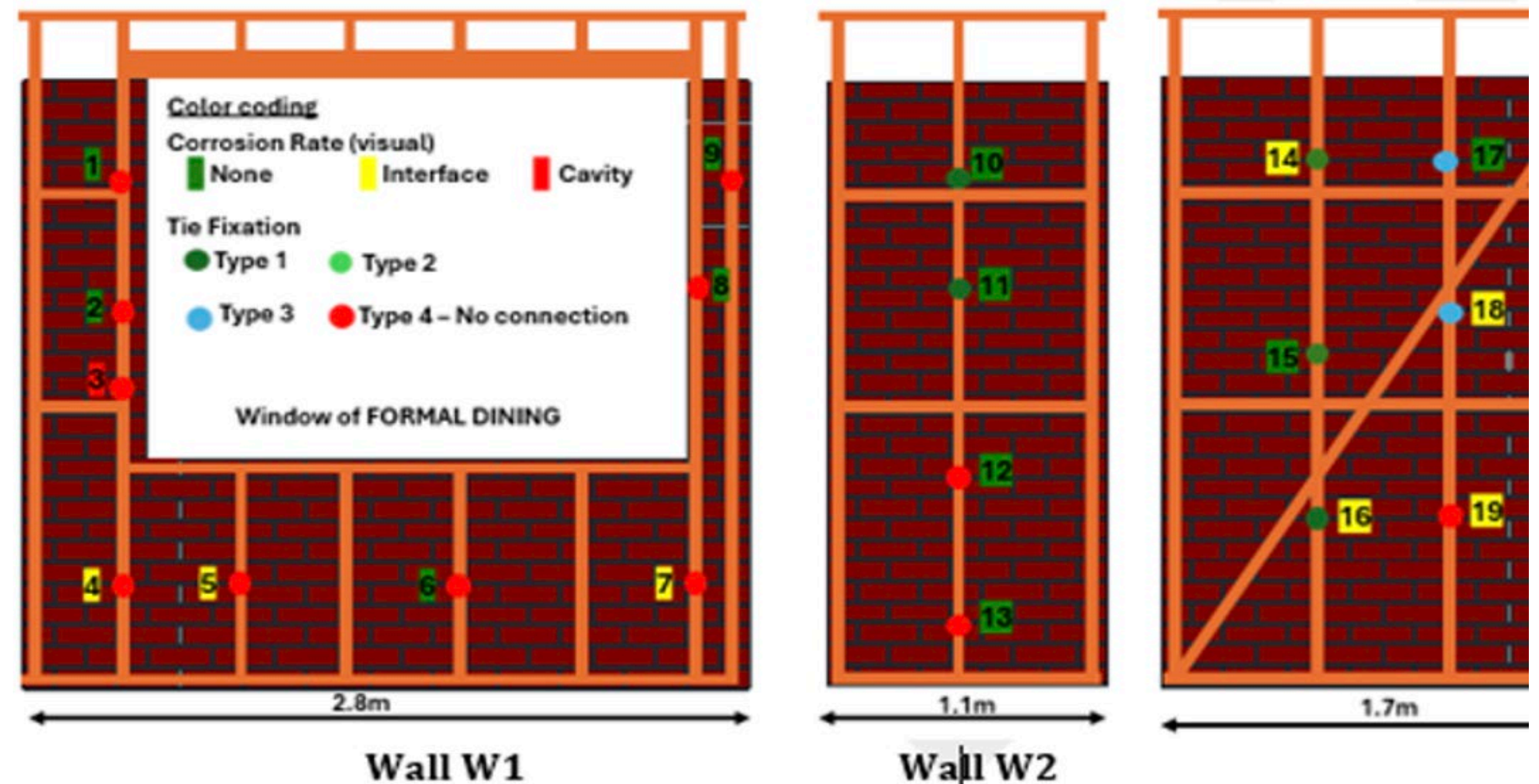
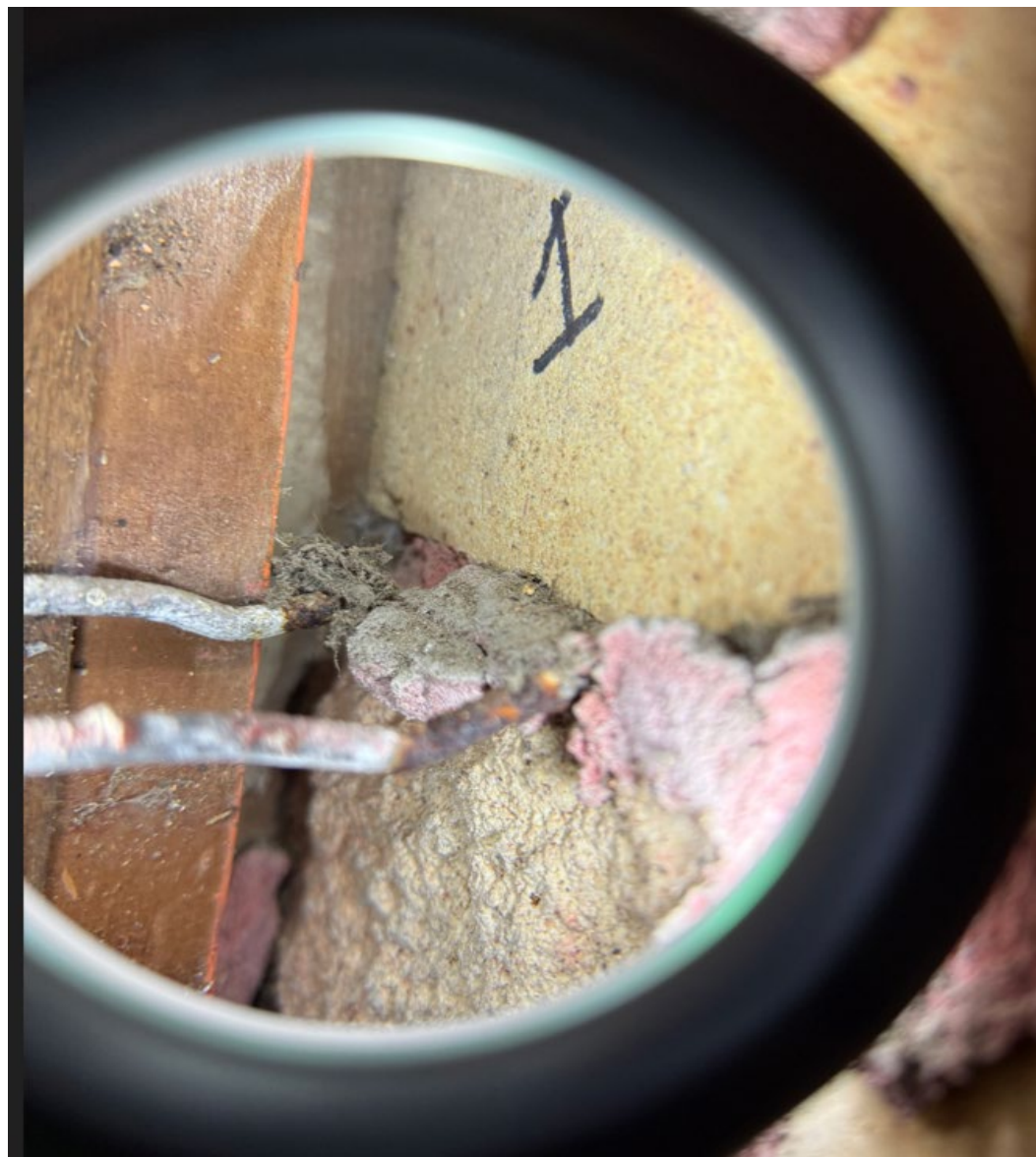
Down-Under Contributions



Hossain, M.A., et.al (2025) Assessment of a 60-year-old building near lakeside, NSW, C&P2025, paper 11.

Hossain, M.A., et.al (2024) Evolution of corrosion considerations in the AS3700 masonry standards, C&P2024, paper 24.

(1963) 1st Block-Masonry Stand. → (1977) Corrosion resistant metal ties → (1988) Exposure Classes, SS304

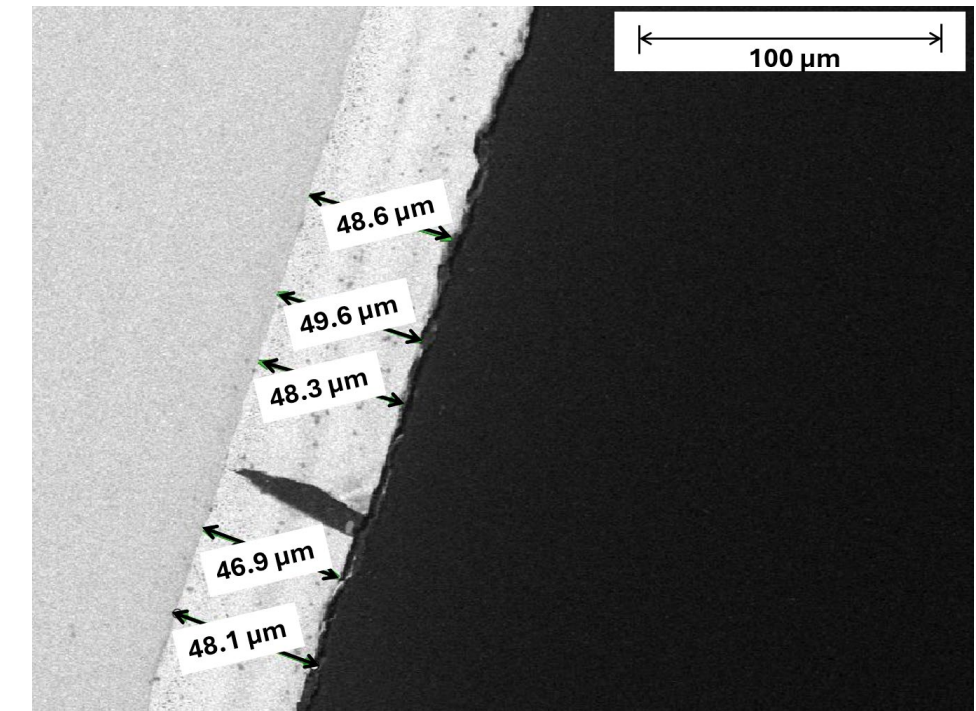
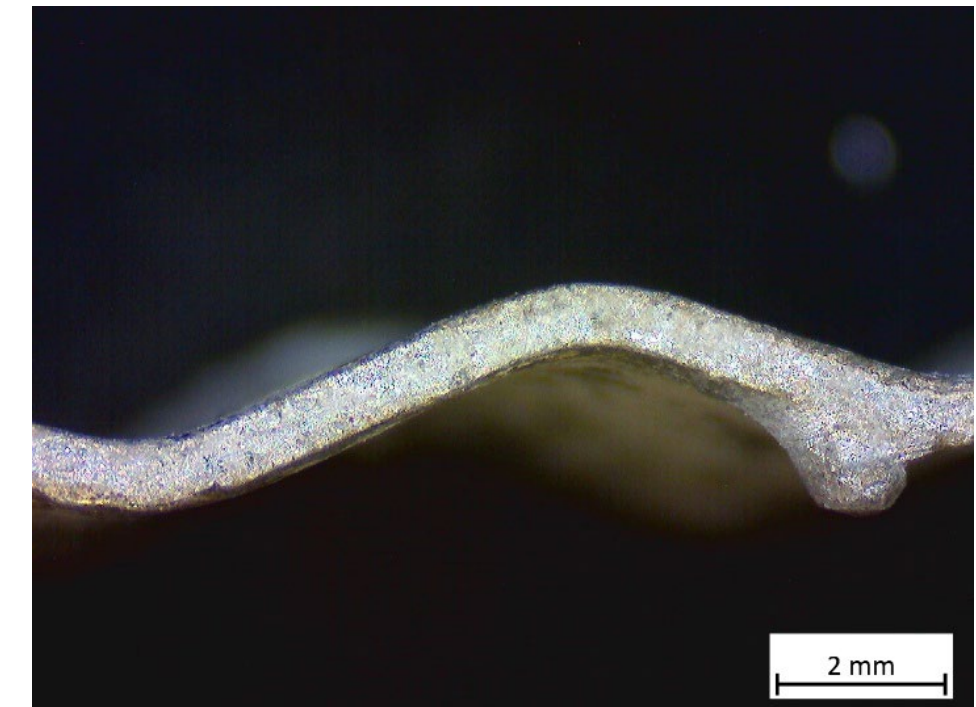
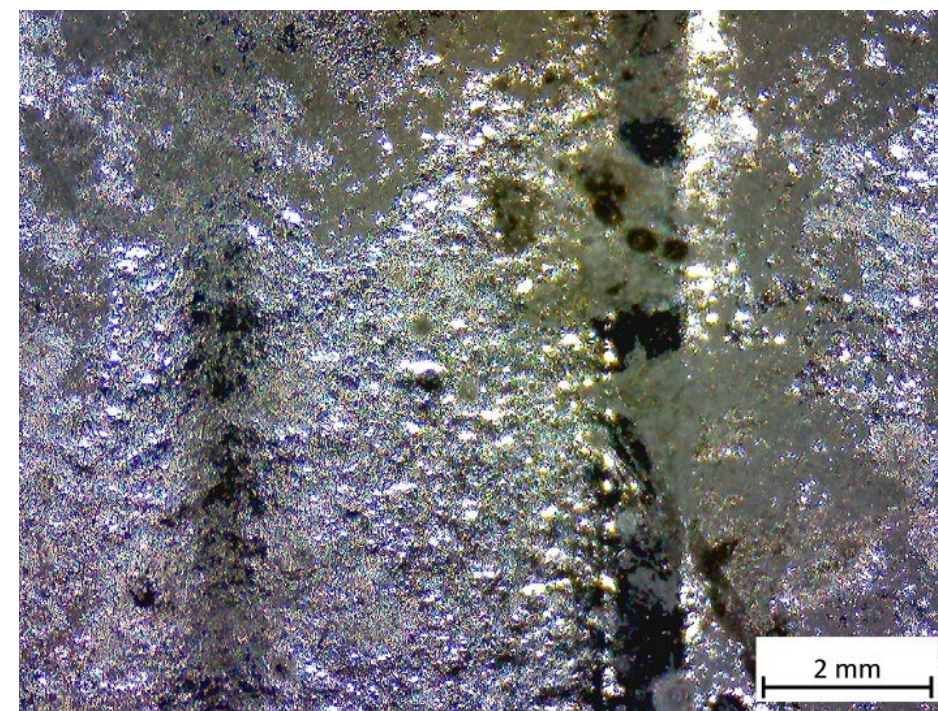
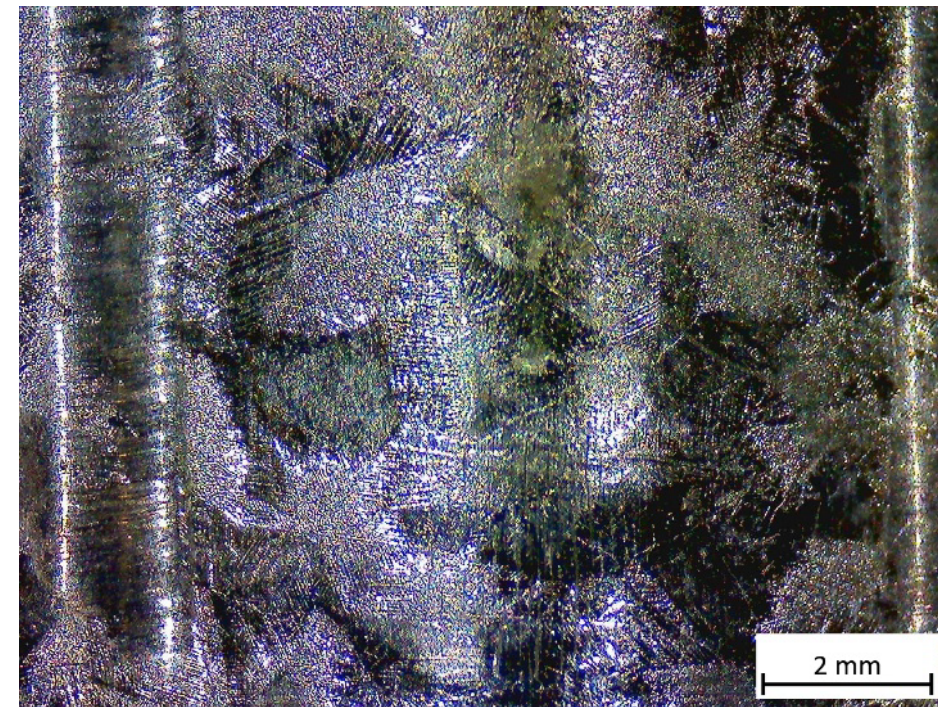
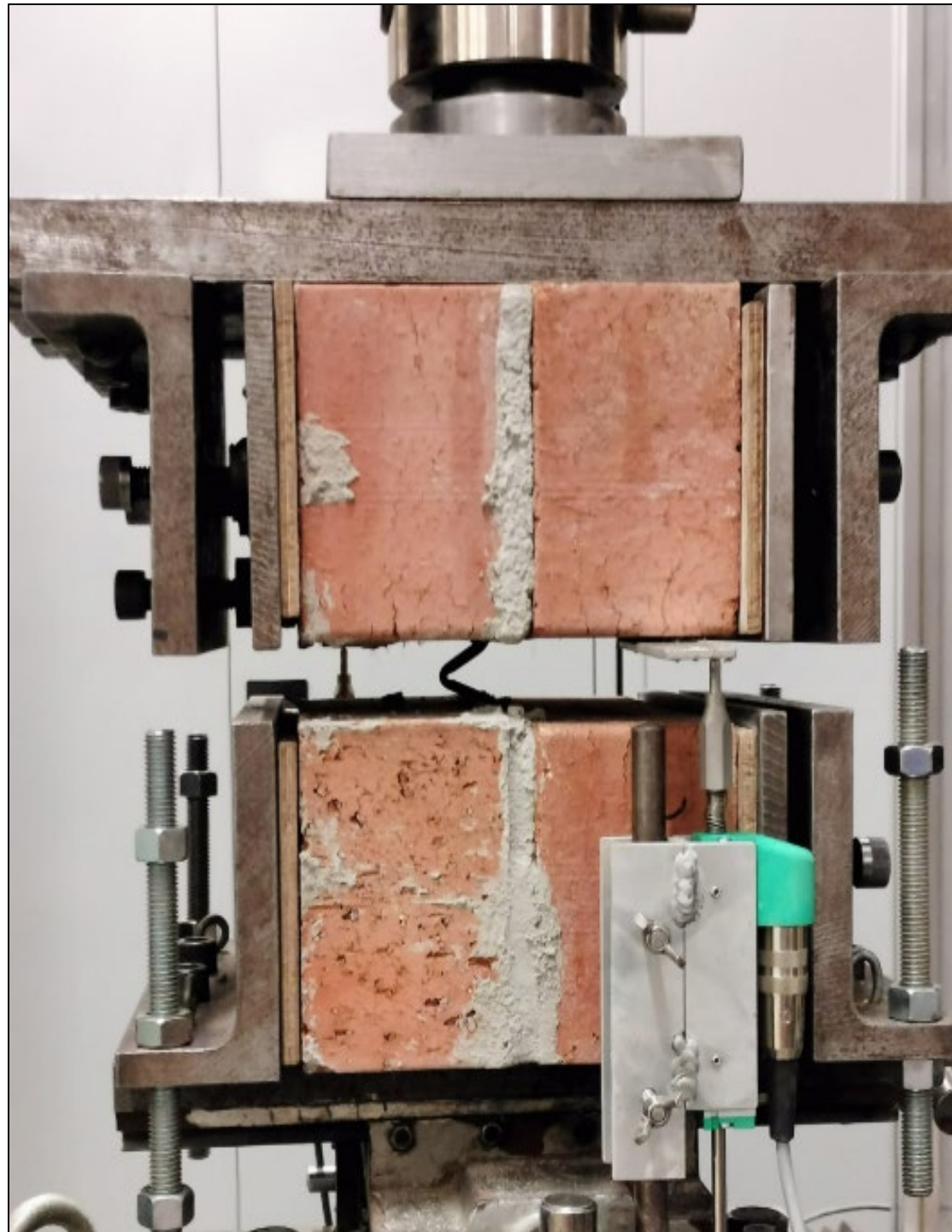


Down-Under Contributions



Terry, L., et.al (2025) Investigation of galvanized coating weight and thickness, C&P2025, paper 15.

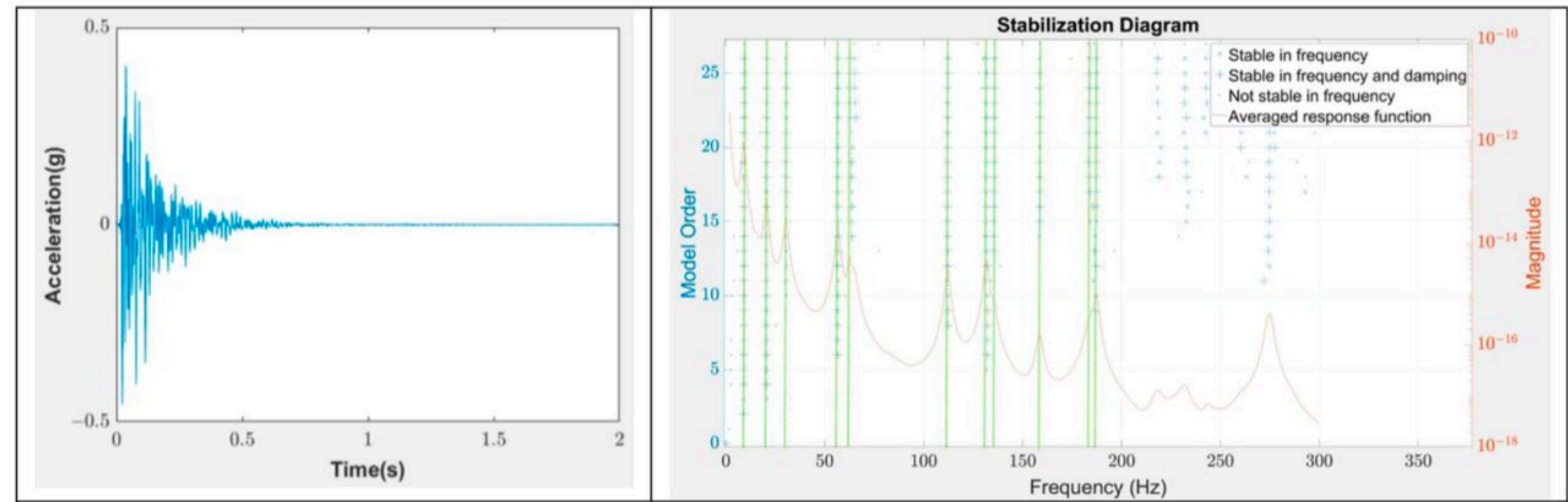
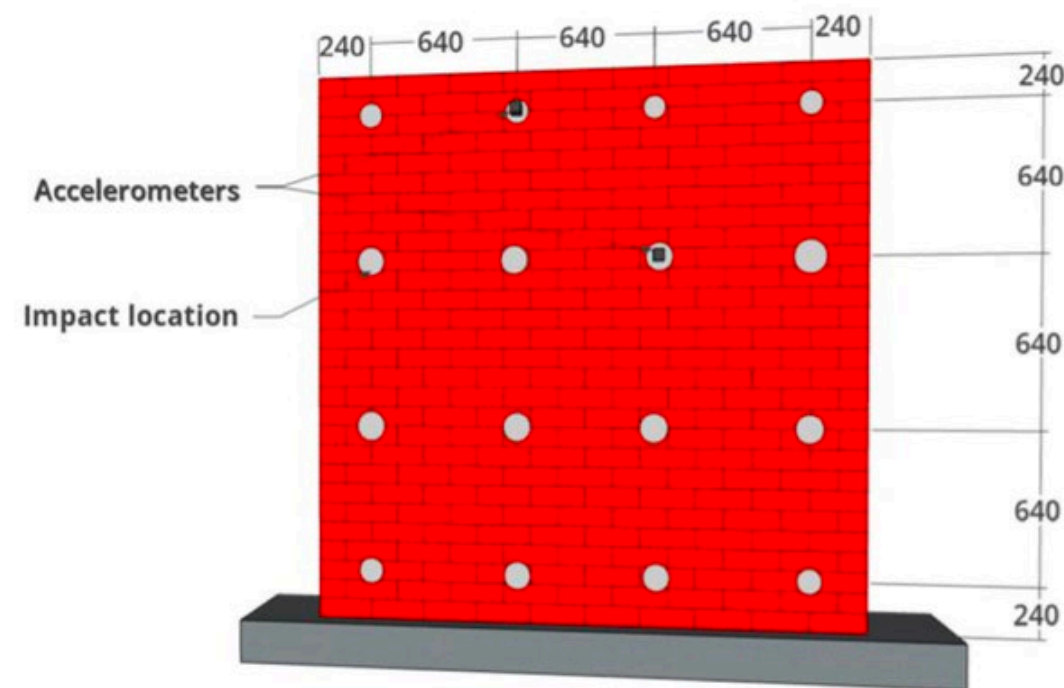
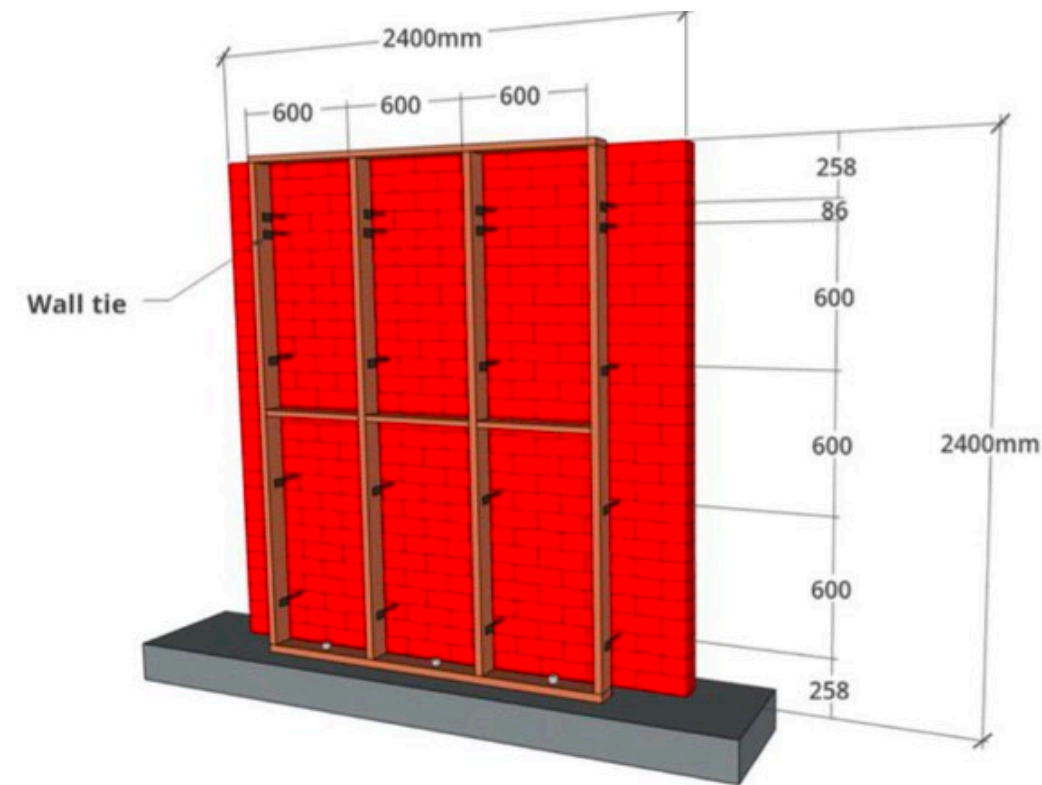
Terry, L., et.al (2025) The impact of corrosion on strength of wall ties, Australian Journal of Structural Engineering.



Vibration-Based Method



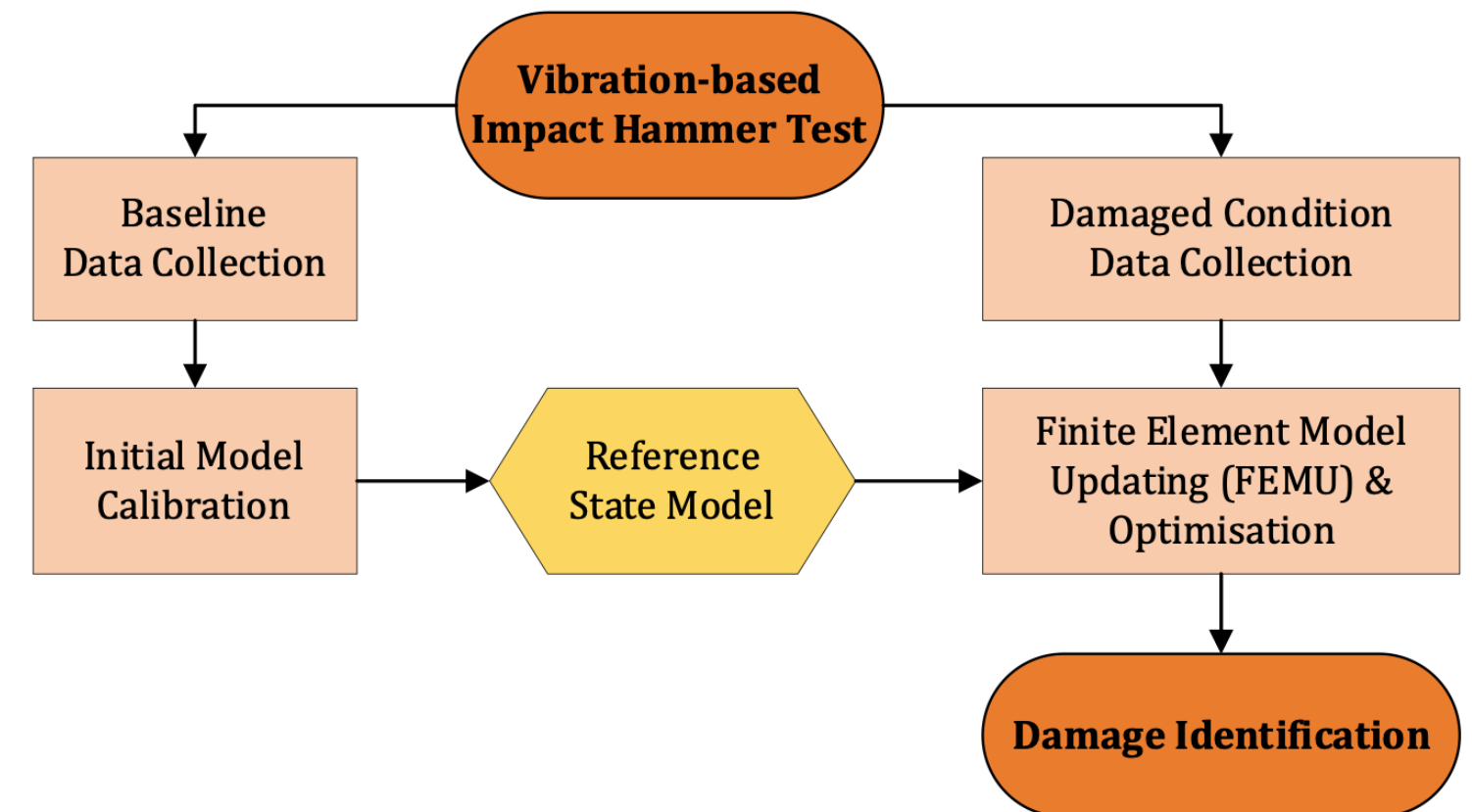
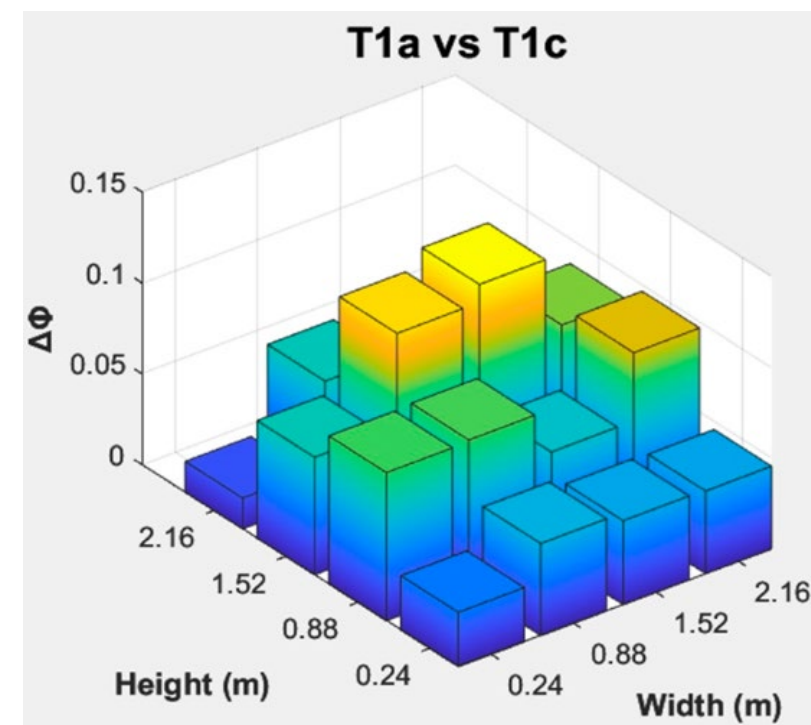
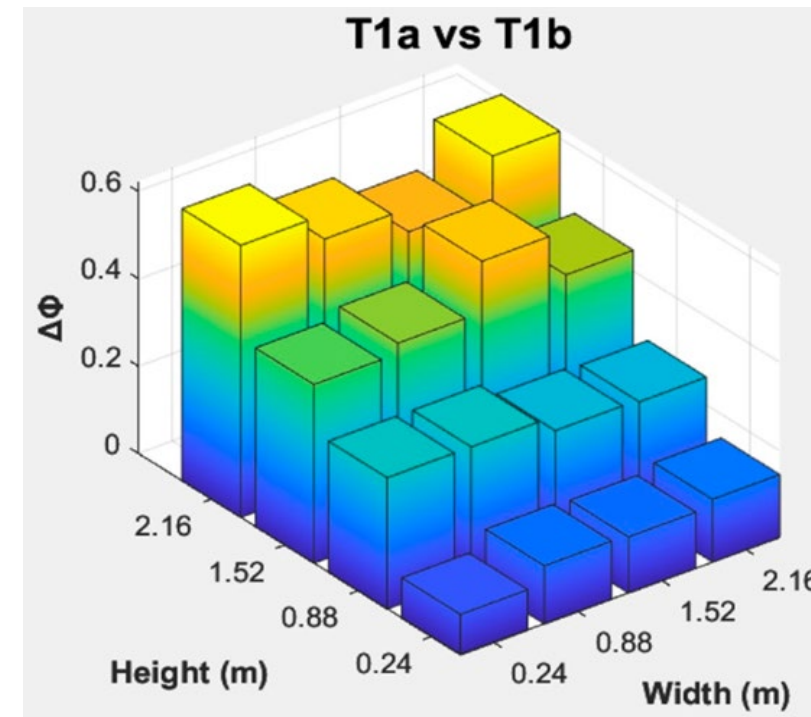
Lam, C.Y., et.al (2025) Identification of wall tie deterioration using FEA updating model, 15th CMS, paper 72.
Lam, C.Y., et.al (2025) Assessing wall tie deterioration through vibration-based methods, buildings 15:1226



1. Obtain Frequency Responses
 2. Re-Capture and note decrease in frequency responses
 3. Compute the absolute mode shape differences
(5th order Butterworth low-pass filter – 350 Hz cutoff, only first few modes are of interest for masonry)
- * Trialing use of non-contact measurement systems

Vibration-Based Method

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Concluding Remarks

- The proposed method **can non-destructively detect vulnerability** of masonry veneer and cavity brick wall collapse due to corrosion of stability wall ties.
- The method can also numerically provide **qualitative and quantitative estimation of remaining wall stability**, which in turn can be **used for timely remediation strategies** or further numerical structural analysis.
- Application of the contact **method is still restricted**. Ideal for isolated panels, ground walls or where access can be safely gained by scaffolding or abseiling.
- The method is still unable to provide quantitative estimation of individual wall tie corrosion section losses.

Acknowledgement



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Australian Research Council





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