

Benchmarks for Structural Fire Modelling

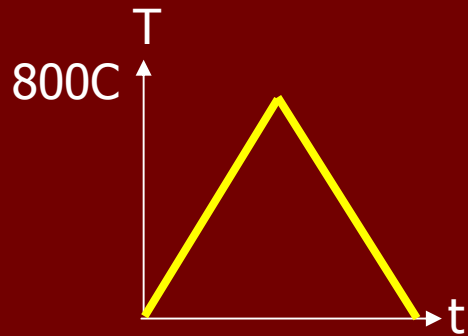
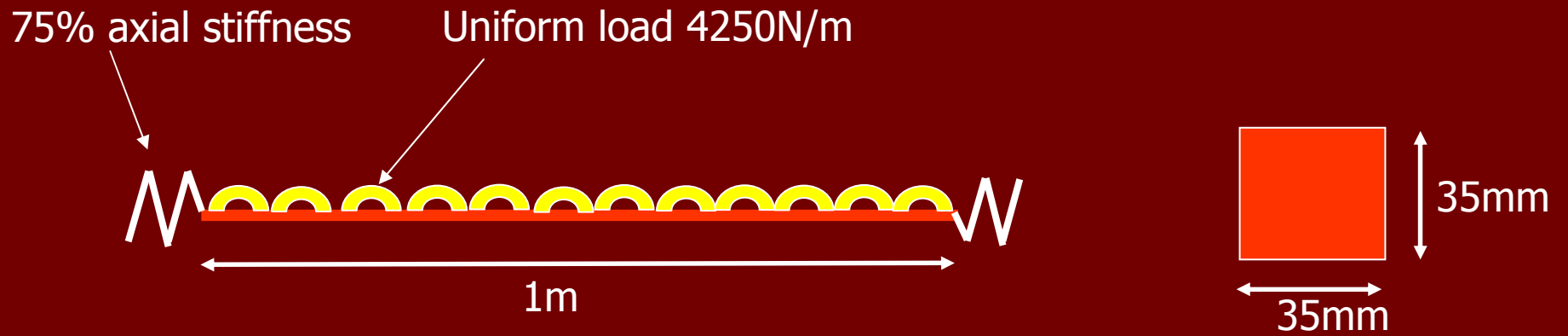
Dr M Gillie

(with thanks to Dr Z Huang for the Vulcan predictions)

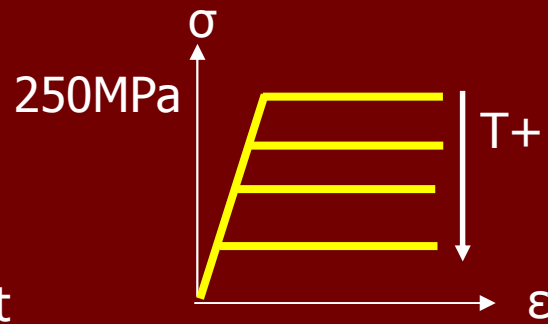


Gillie M. (2009) Analysis of heated structures: Nature and modelling benchmarks
Fire Safety Journal, In Press, <http://dx.doi.org/10.1016/j.firesaf.2009.01.003>

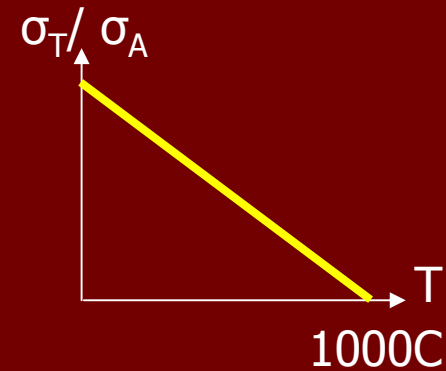
Benchmark 1



Heating



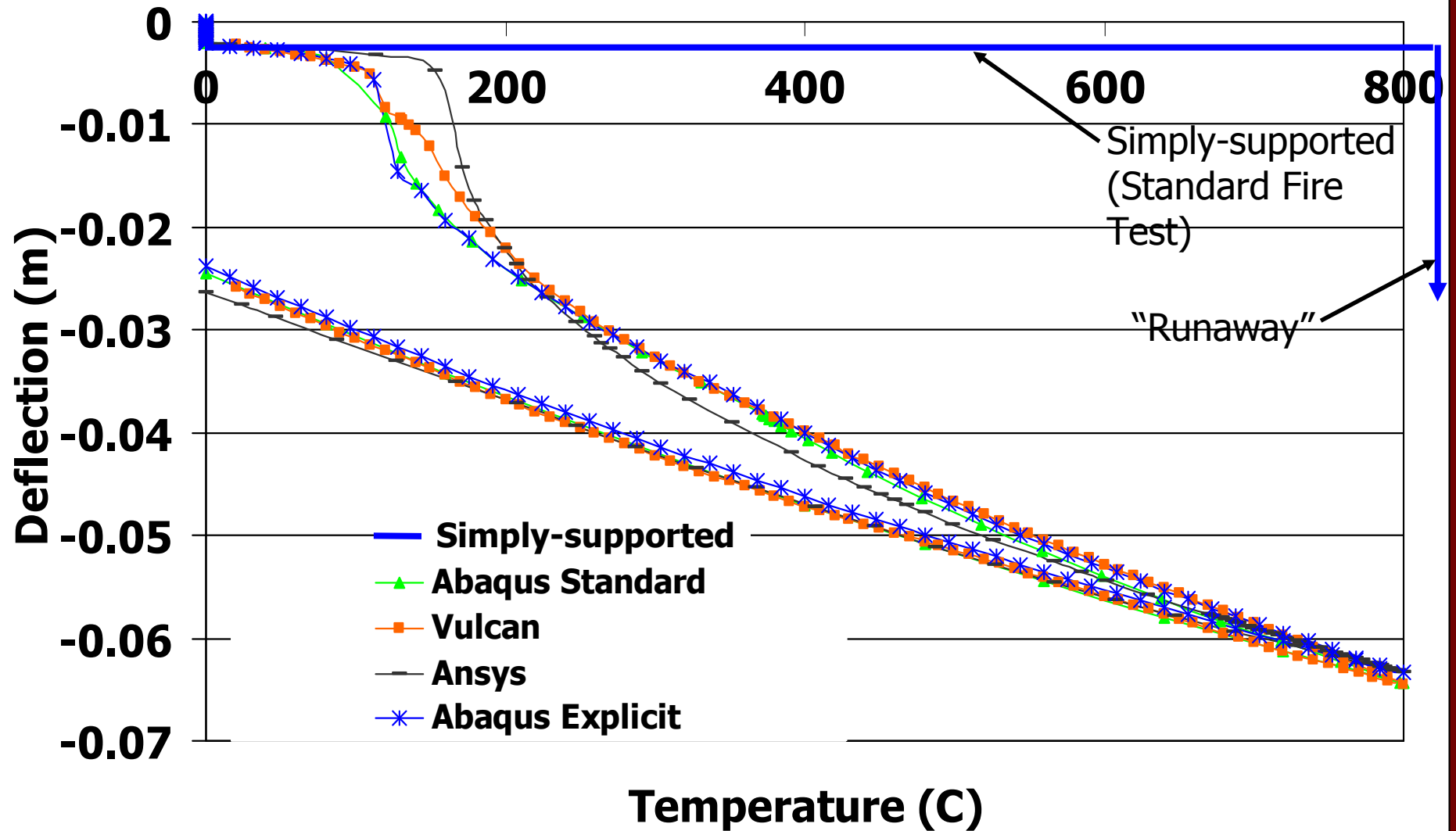
Elastic-plastic material



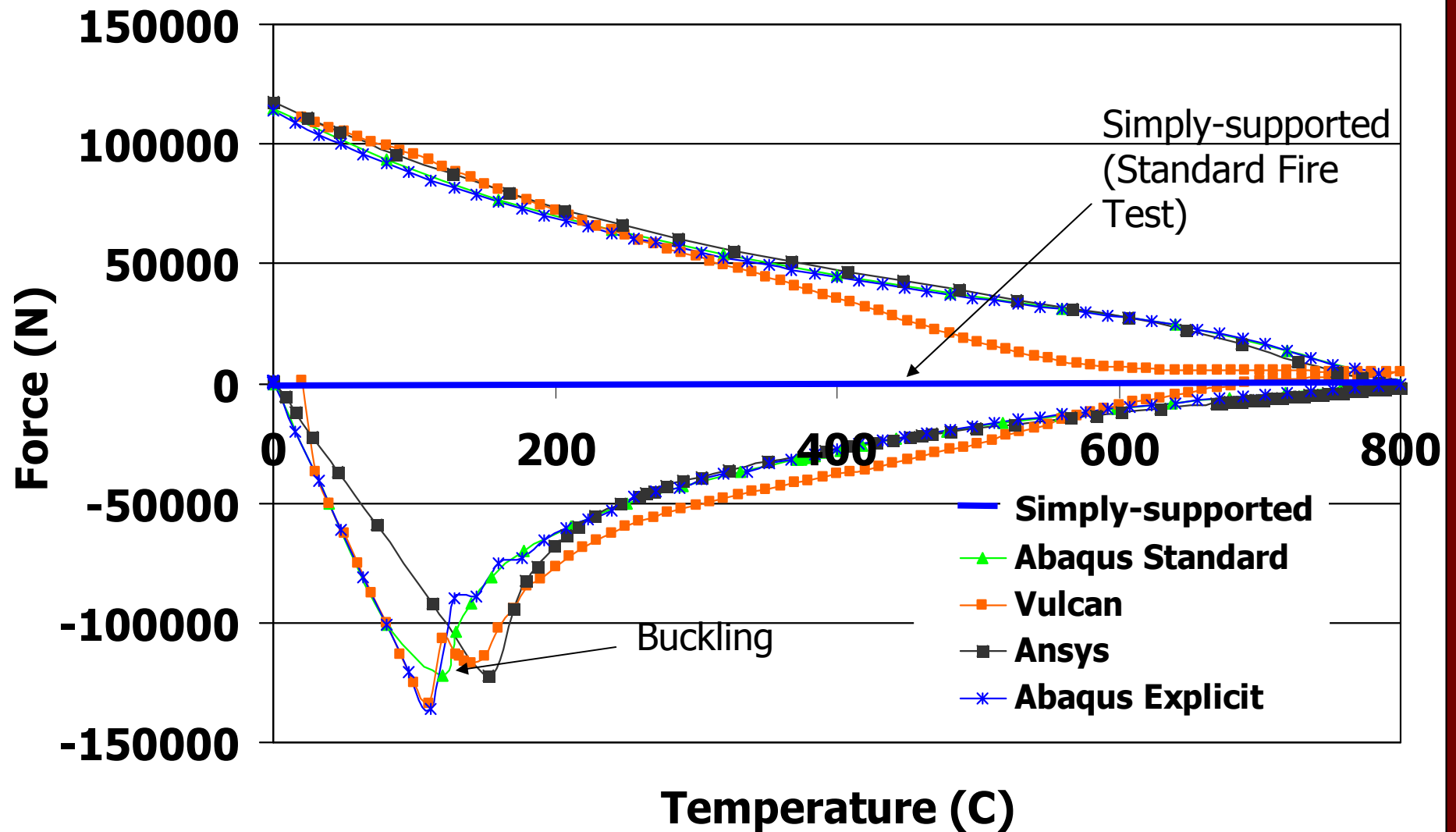
Purpose of Benchmark 1

- Model not “real” but...
- ... shows complex phenomena captured
 - Non-linear material behaviour
 - Temperature dependent
 - Plastic
 - Thermal expansion
 - Non-linear geometric behaviour
 - Boundary conditions important
- Can be used for demonstrating
 - software capability
 - Appropriate modelling techniques

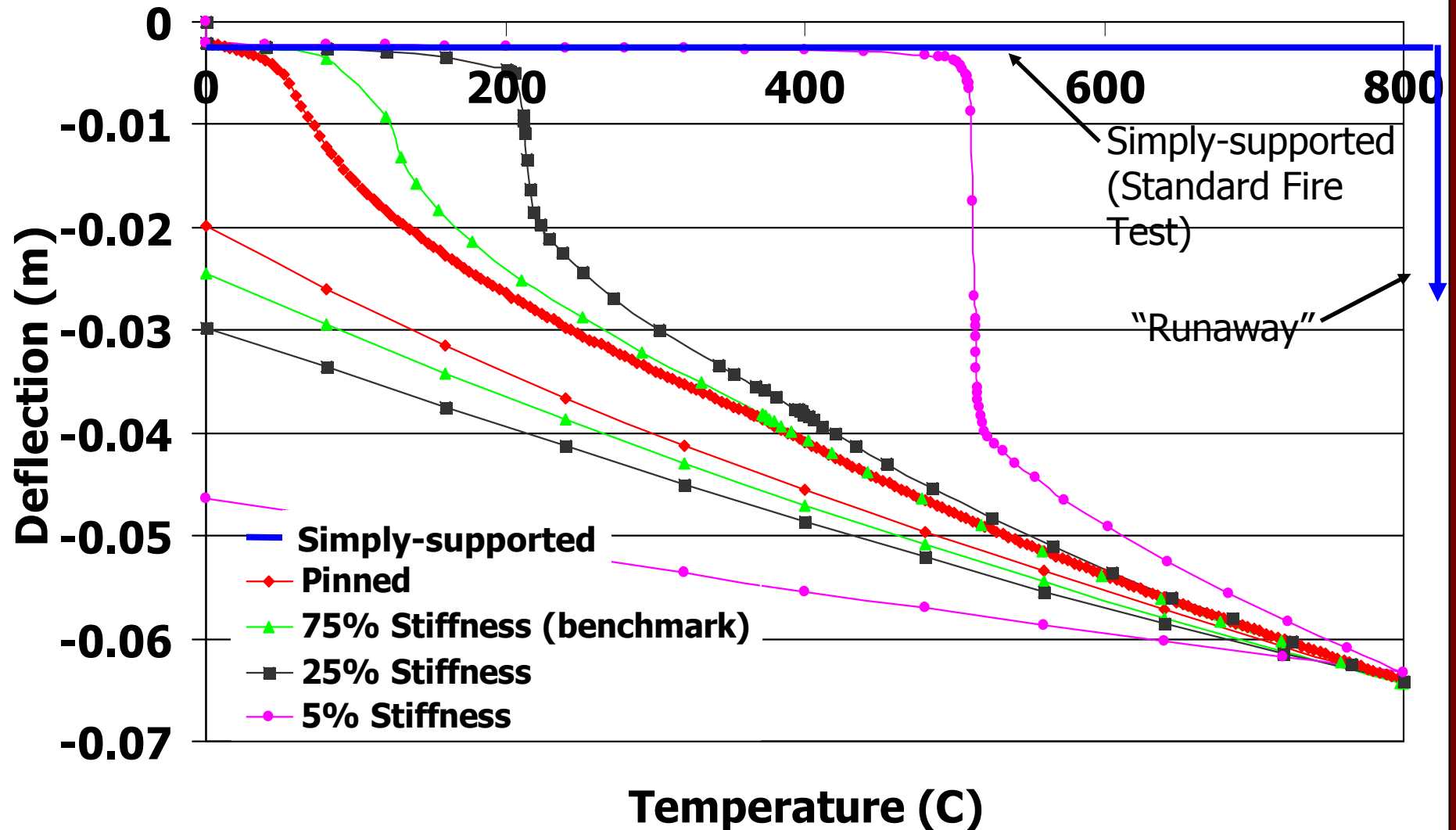
Benchmark 1 - Deflections



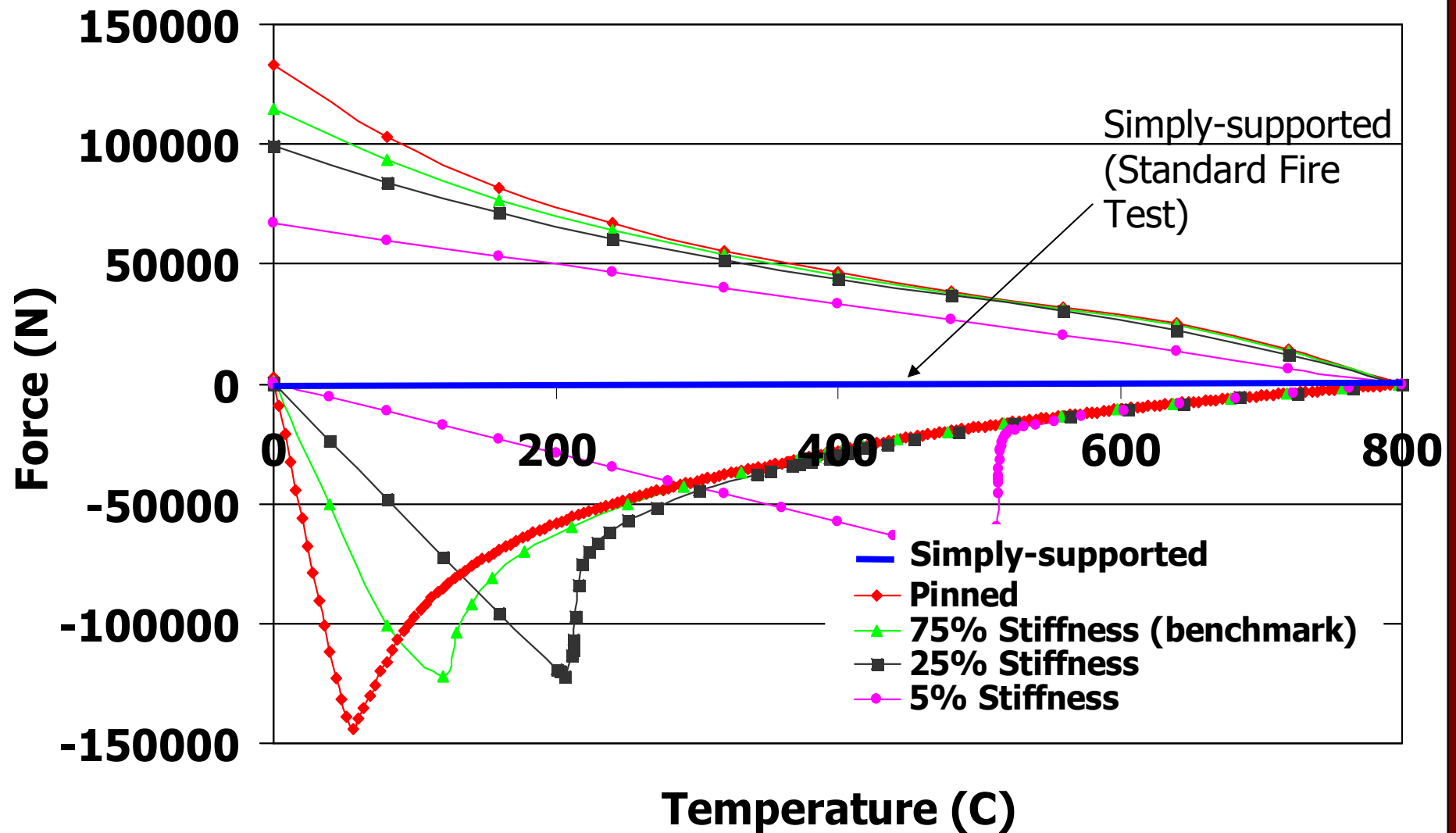
Benchmark 1 - Axial Force



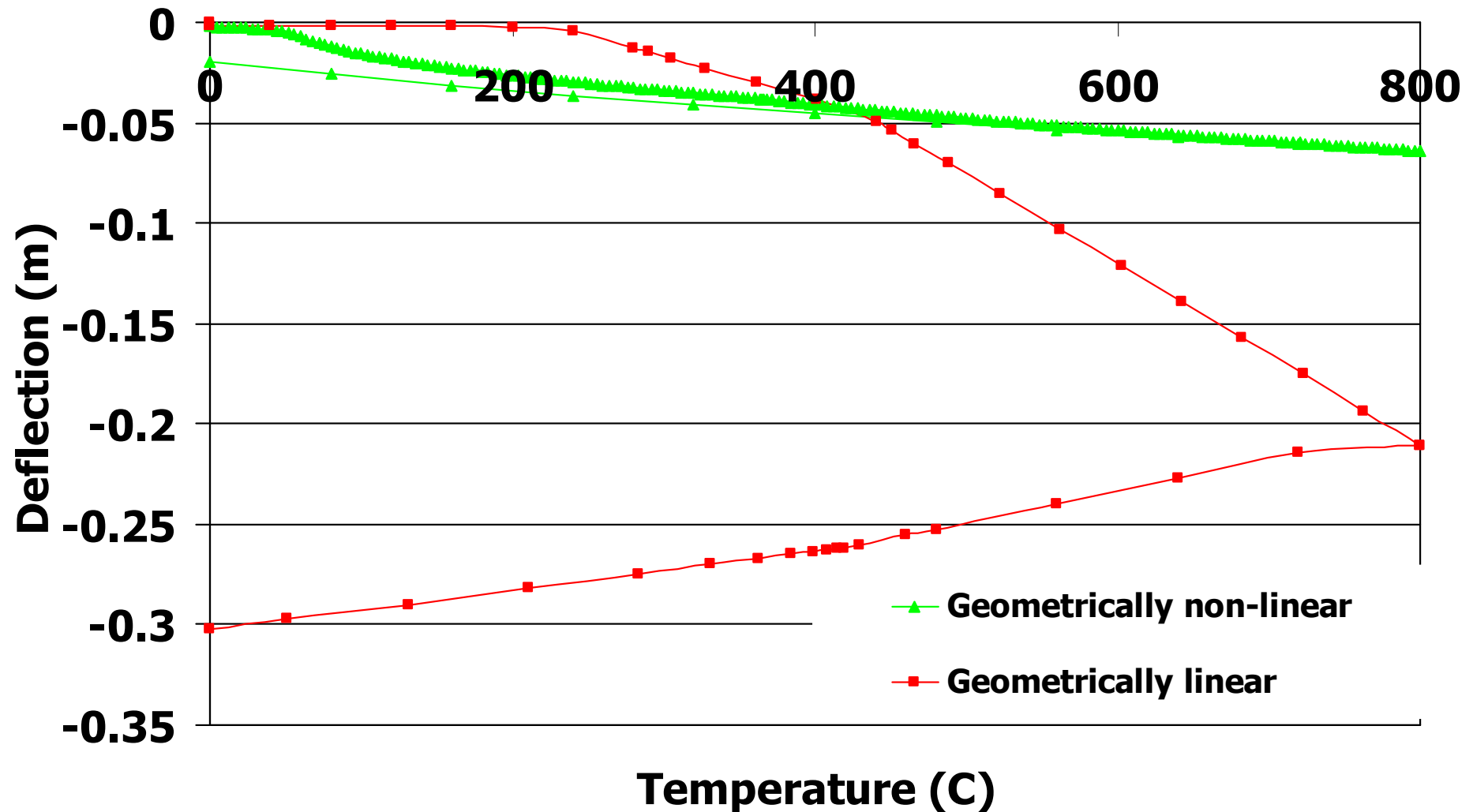
Effect of BCs on Deflections



Effect of BCs on Axial Force



Effect of Non-linear Geometry on Deflections



Aside – Cardington Tests



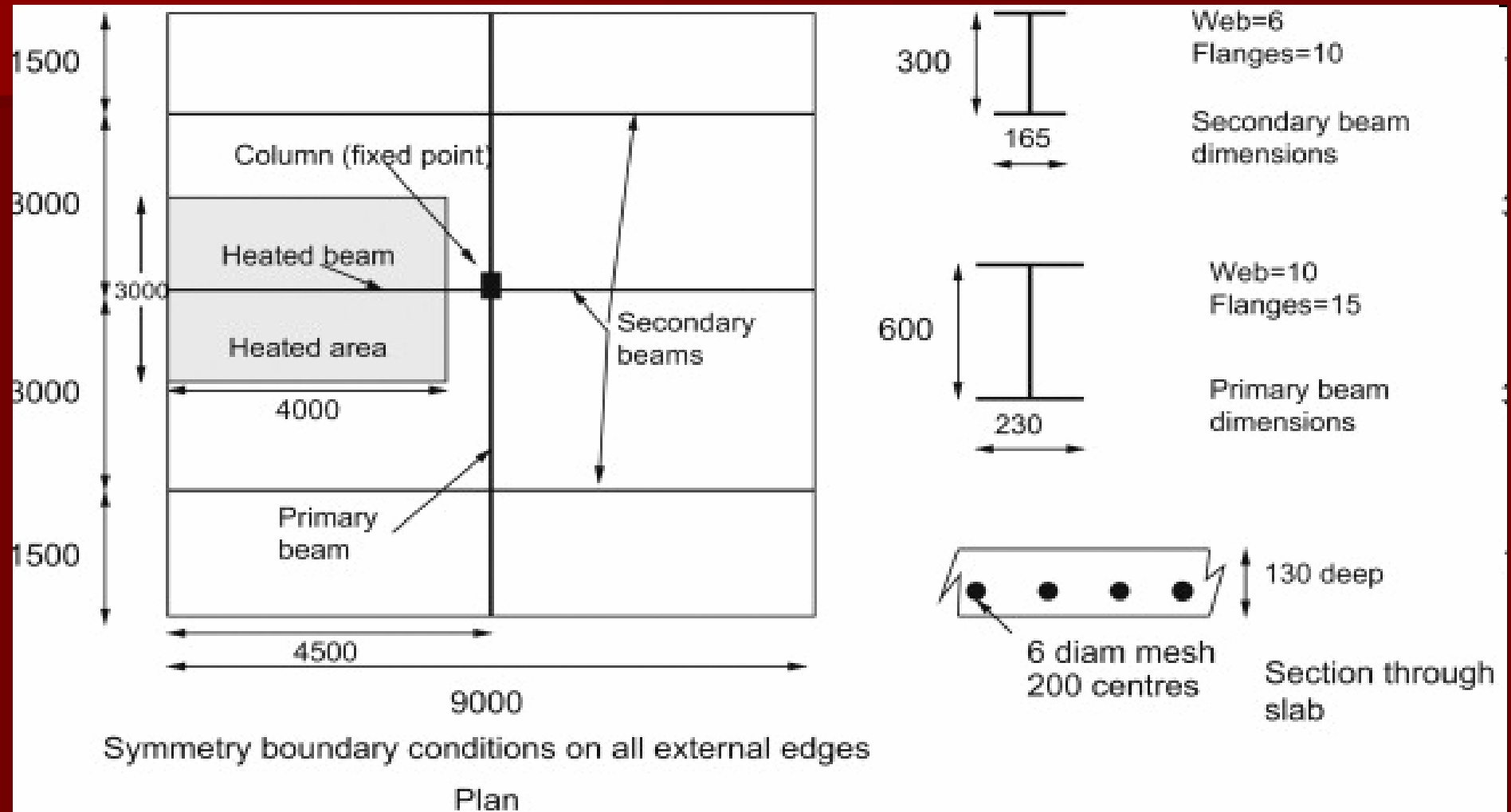
Aside - Cardington Test 1



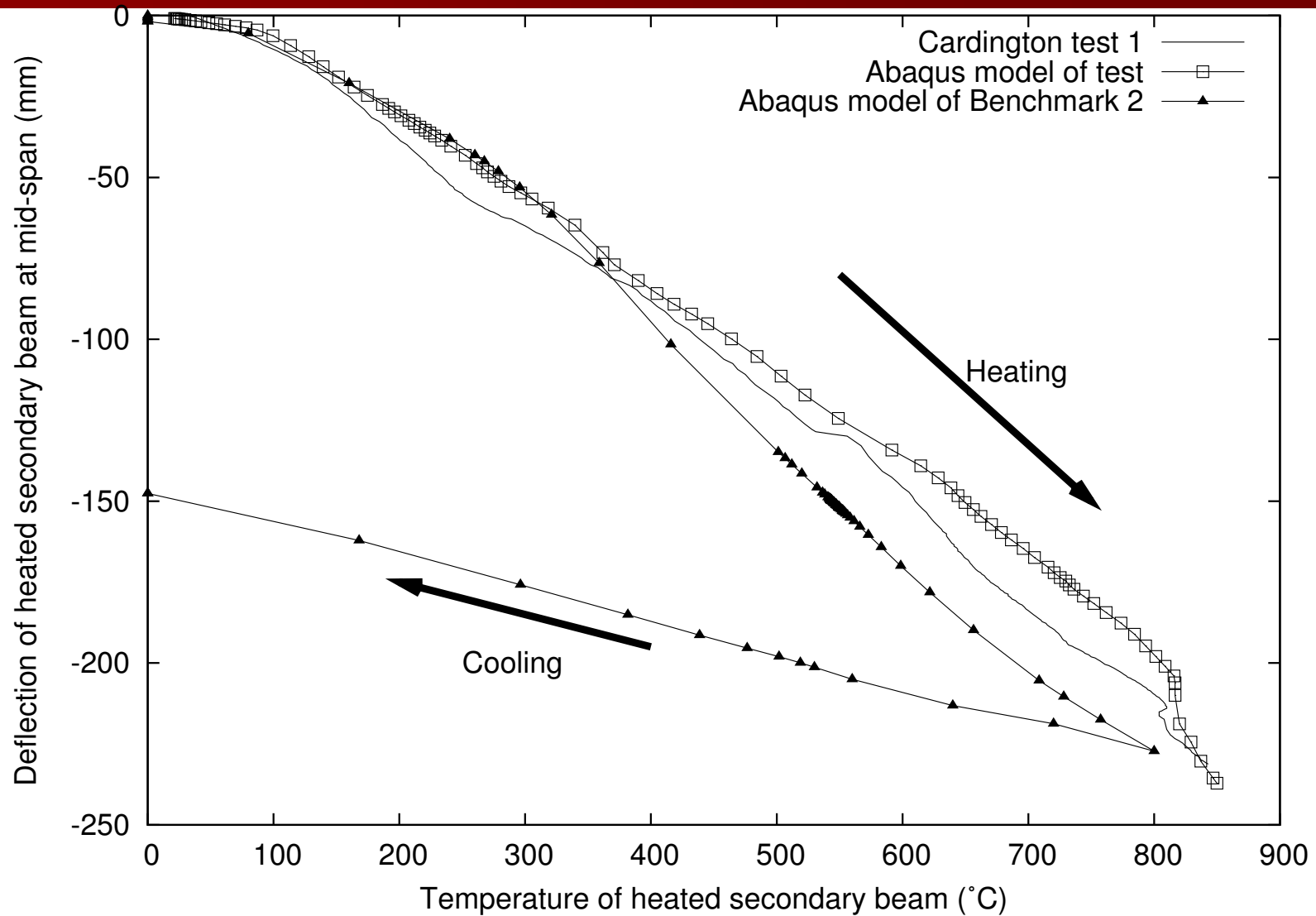
Benchmark 2

- Real structure
- Based on Cardington test 1
 - Carefully conducted test on real structure (v. rare)
 - Has been extensively modelled
 - Experimental data available
- Simplified so
 - Precisely defined
 - Practical to model
- As challenging as many larger structures

Benchmark 2



Benchmark 2 Deflections



Benchmark 2 Axial Force

