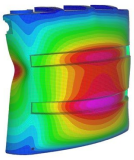


David Beneke Consulting

Finite Element Analysis for Engineering

FAILURE ANALYSIS OF NESTED LIPPED C BOX SECTION
Non-Linear Static Analysis

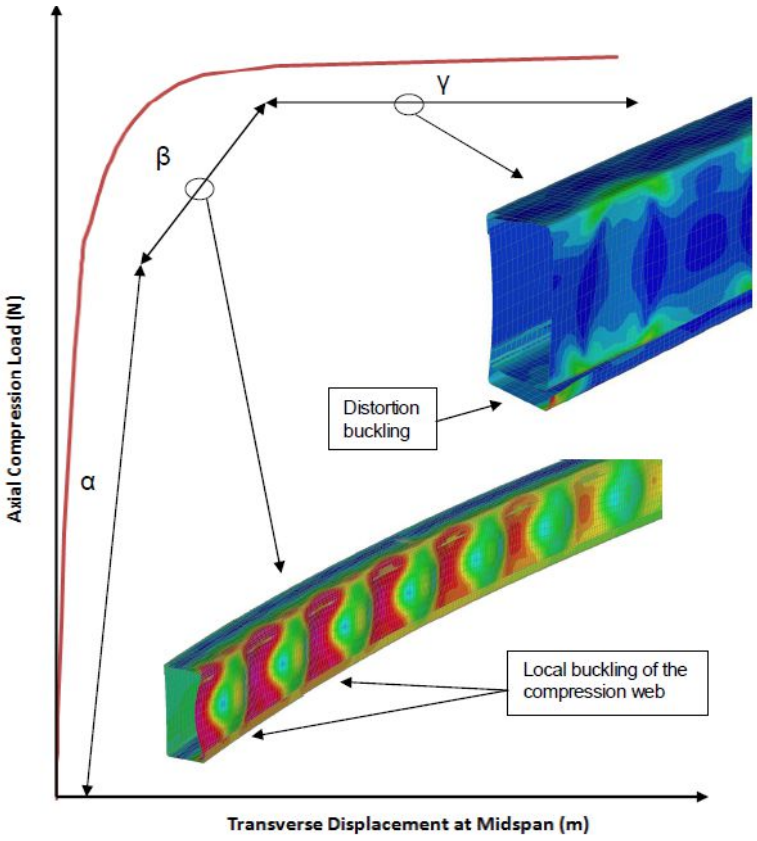
Date:	November 2016
Client:	D W Knox & Partners

Project Description:

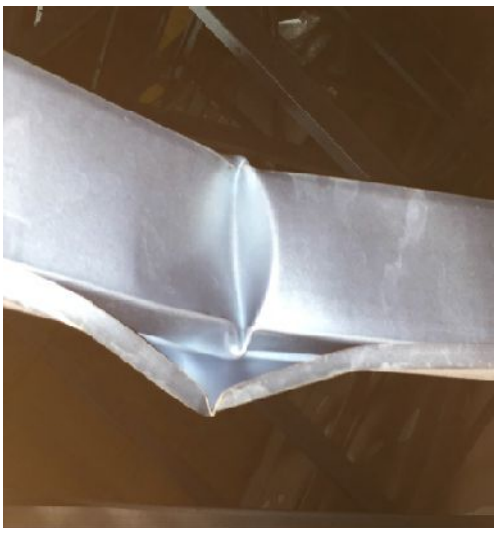
David Beneke Consulting was commissioned by D W Knox partners to investigate the on site failure of a box section compression member fabricated from two Lipped C sections fastened together. The FEA model of the nested lipped C box section consisted of each lipped C member being simulated using 2D plate/shell elements. The M6 fasteners used to bind the adjacent flanges of each lipped C member were simulated using 1 D line elements in conjunction "spider" arrays of stiff 1D line elements at the corresponding fastener holes. 1D compression only contact elements were used to simulate the contact interface between the adjacent flanges.

The analysis undertaken on the FEA model was non-linear incorporating geometric and boundary contact non-linearity. material properties were linear elastic. Various effective lengths were investigated within the analyses conducted.

Our initial work focused on eccentric compression loads. Based on this initial work it was established that the derived capacity of the member were similar to that for the original design. However when one considered the eccentric end connection of the member which introduced minor axis bending moments into the member, the capacity dropped significantly. Multiple buckling modes were encountered with the final distortion buckling mode matching that observed on site.



Axial load versus mid-span displacement characteristic of the nested lipped C box member under axial compression loads with eccentric end connection.



Actual on-site distortion buckling failure

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