



## Weld Fatigue – Deere Tube Example

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April-2003

# Weld Life Estimate

- Two methods were employed
  - Historical method – International Truck and Engine, Truck Division
  - Structural Stress approach developed by the Weld Joint Industry Program at Battelle Labs



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# Historical Method

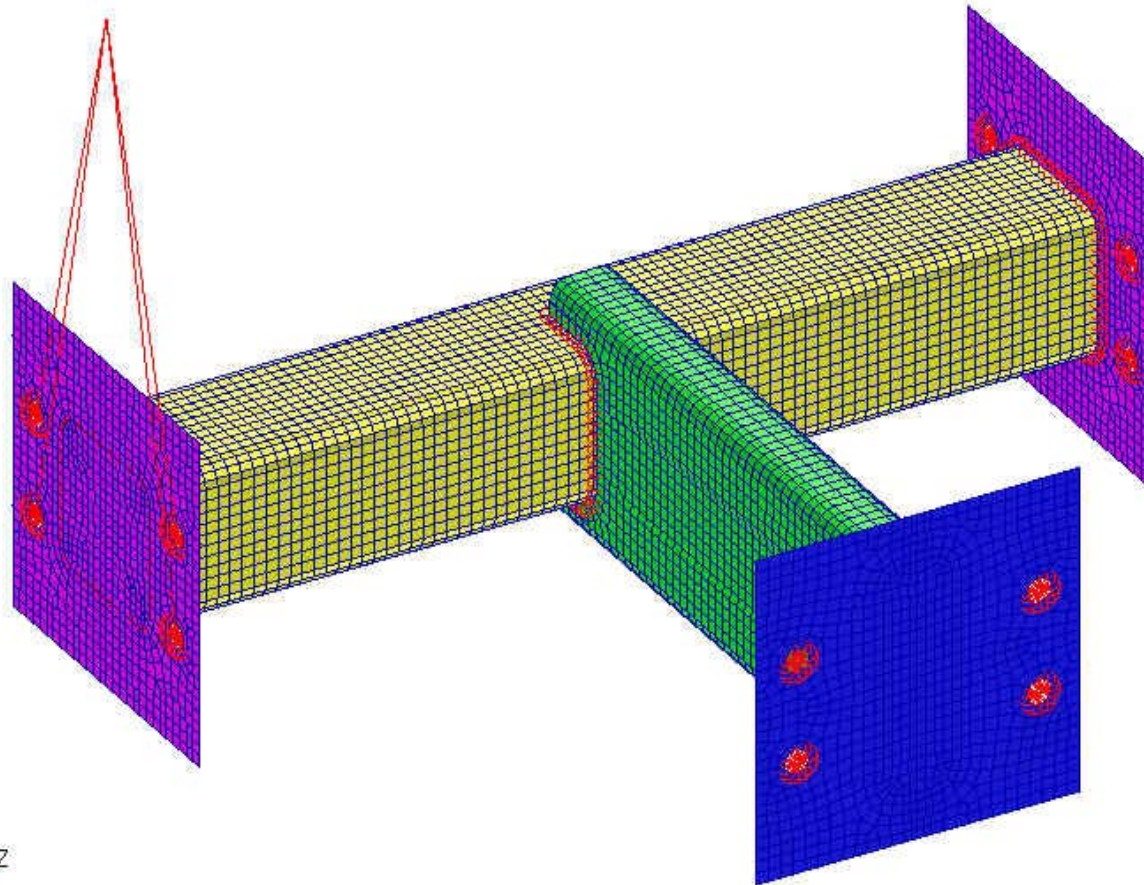
- Weld is modeled as a rigid (RBE2)
- Stress at base elements
- Non-averaged centroidal value
- $K_f$  is historically based
- Method is known to be growing more conservative over time (mesh density increases)



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## Historical Method - Model





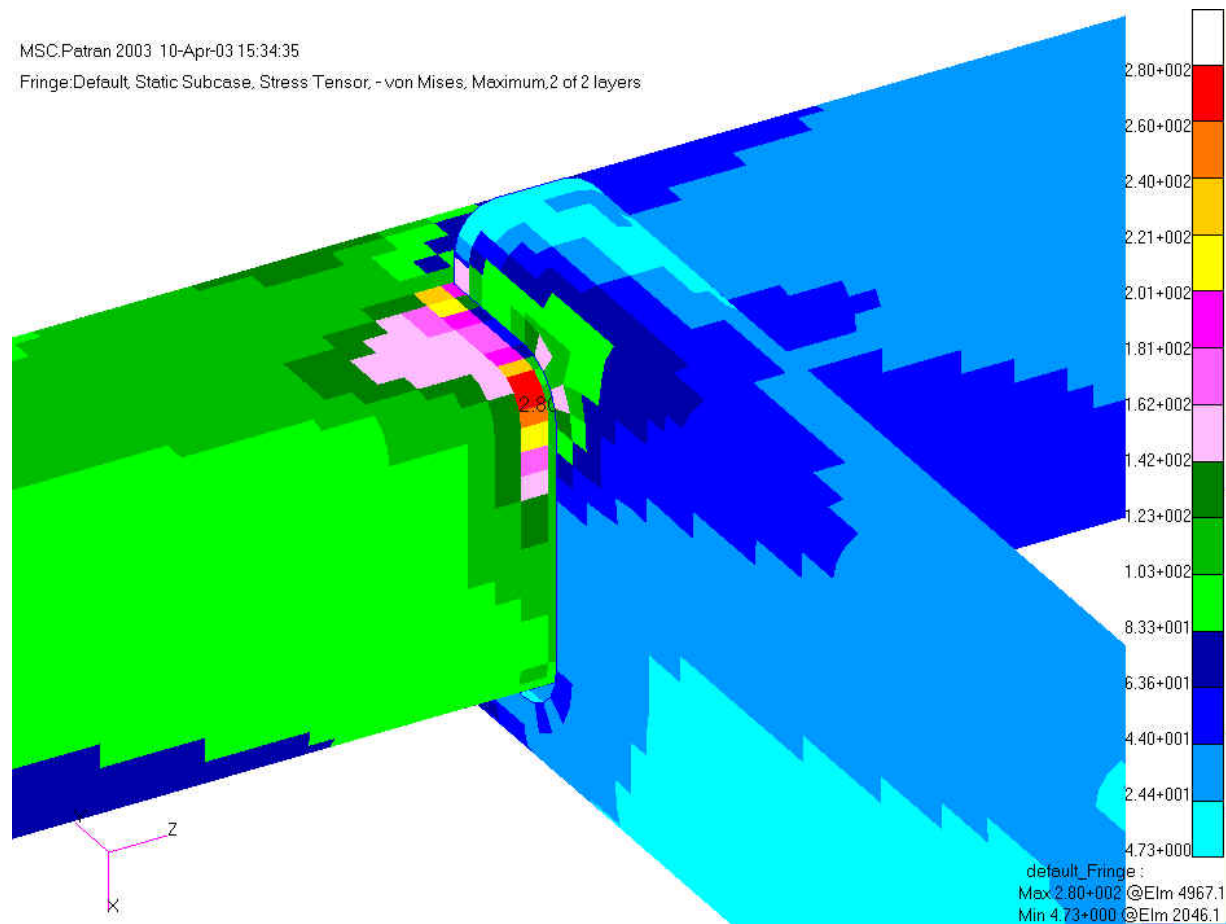
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## Historical Method - Stress

MSC.Patran 2003 10-Apr-03 15:34:35

Fringe:Default, Static Subcase, Stress Tensor, -von Mises, Maximum,2 of 2 layers





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# Historical Method - Results

- Peak stress (linear FEA) = 280 Mpa
- $R = -1$  7,500 cycles
- $R = 0$  429,000 cycles



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# Structural Stress Method

Reasons International is pursuing this

- Mesh insensitive
- Can distinguish between one-sided and two sided welds, as well as weld ends

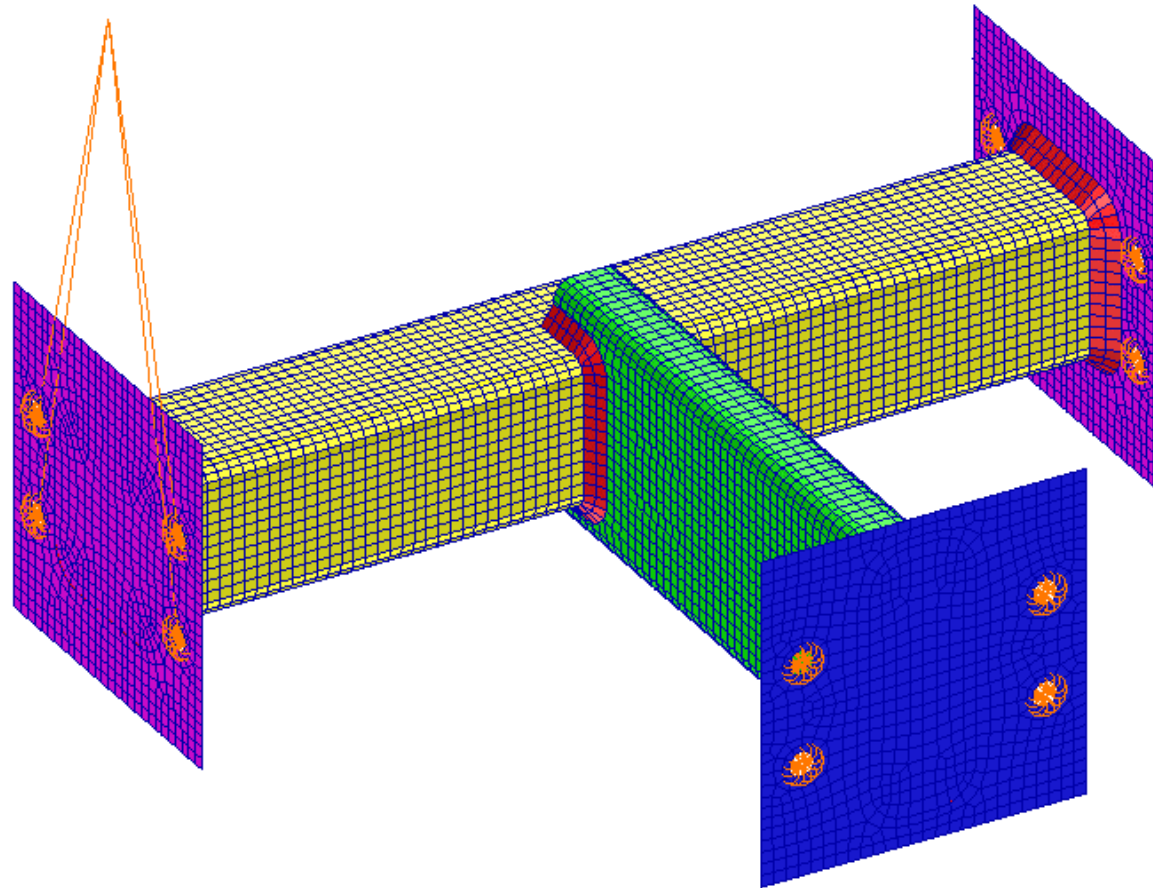


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# Structural Stress - Model

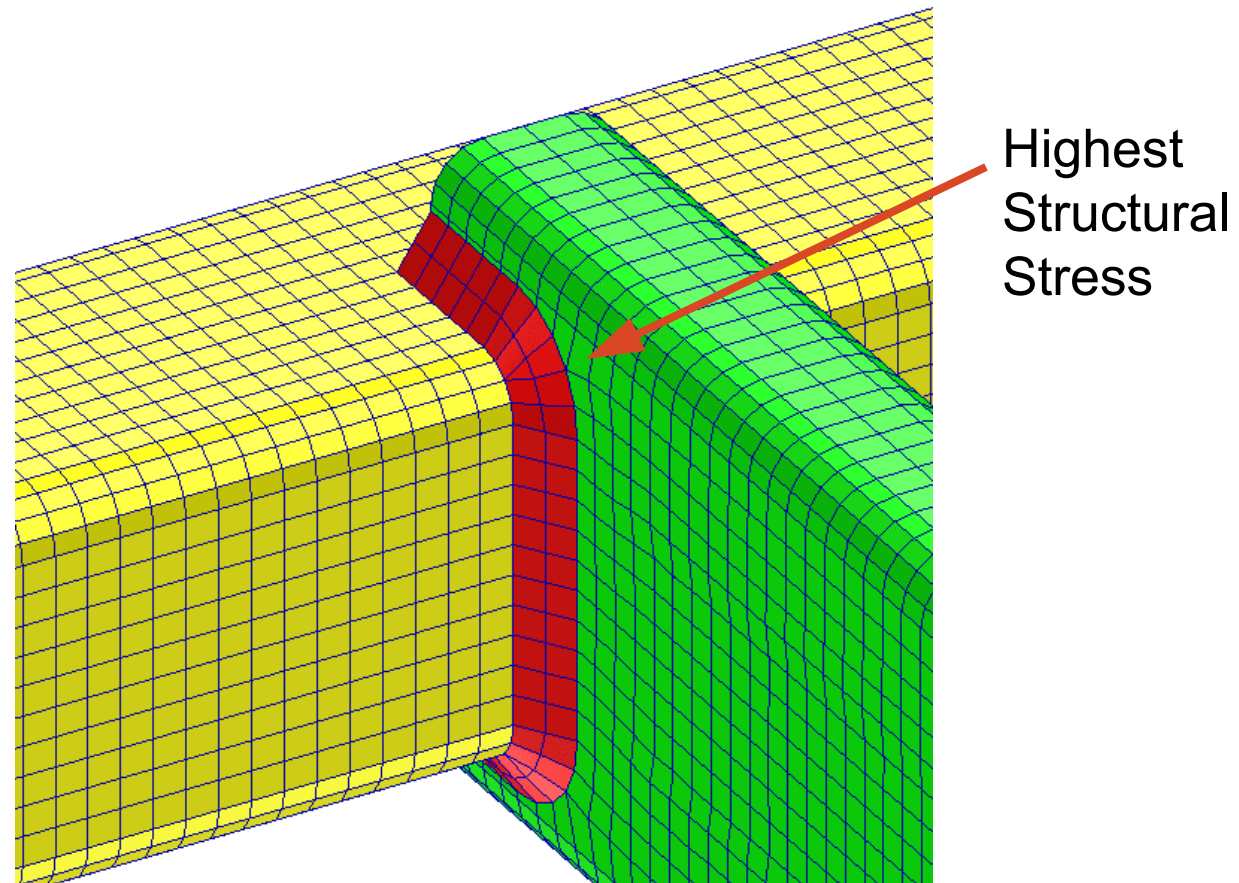




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# Structural Stress - Results



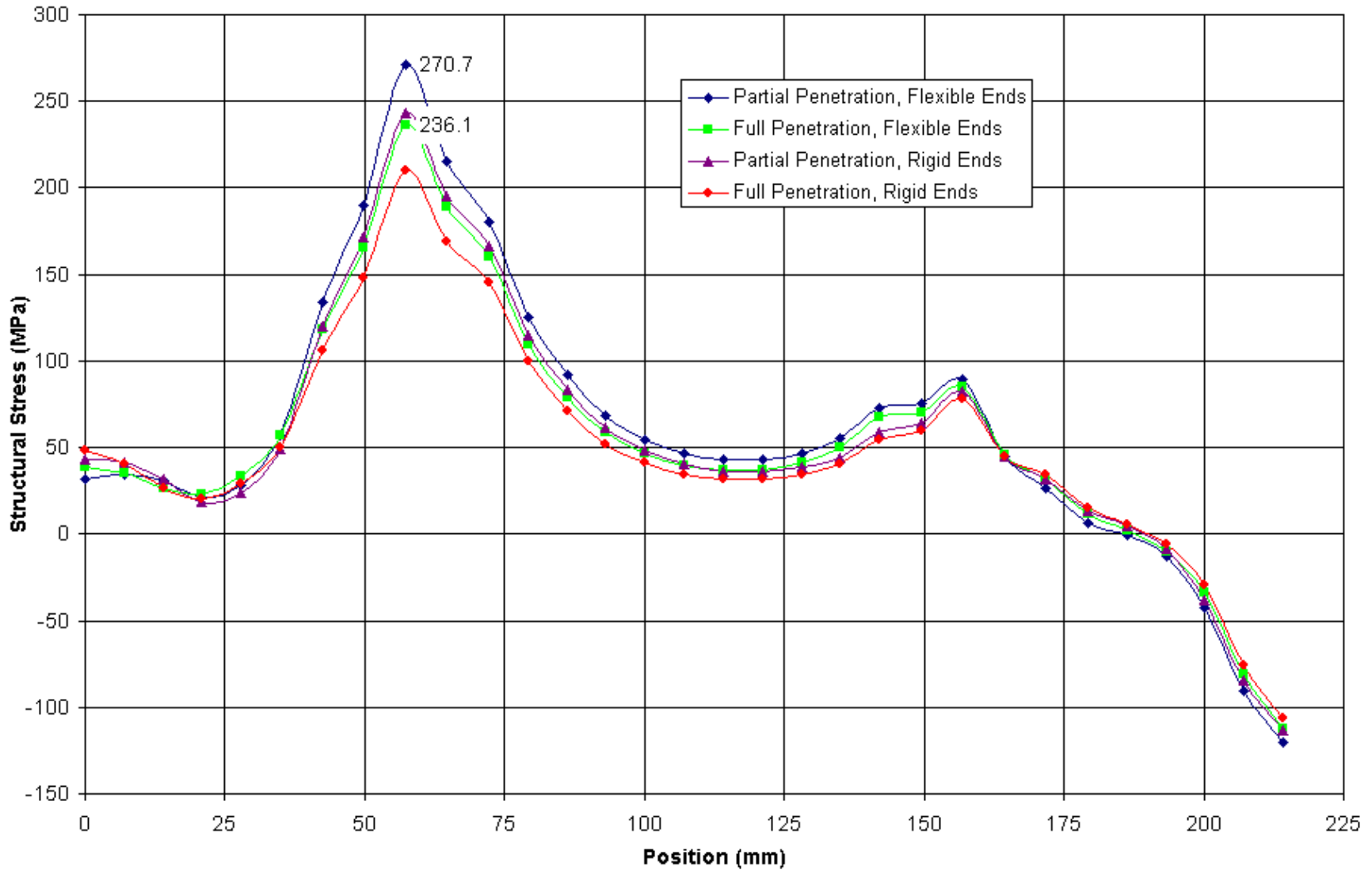




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Weld toe on 2x6

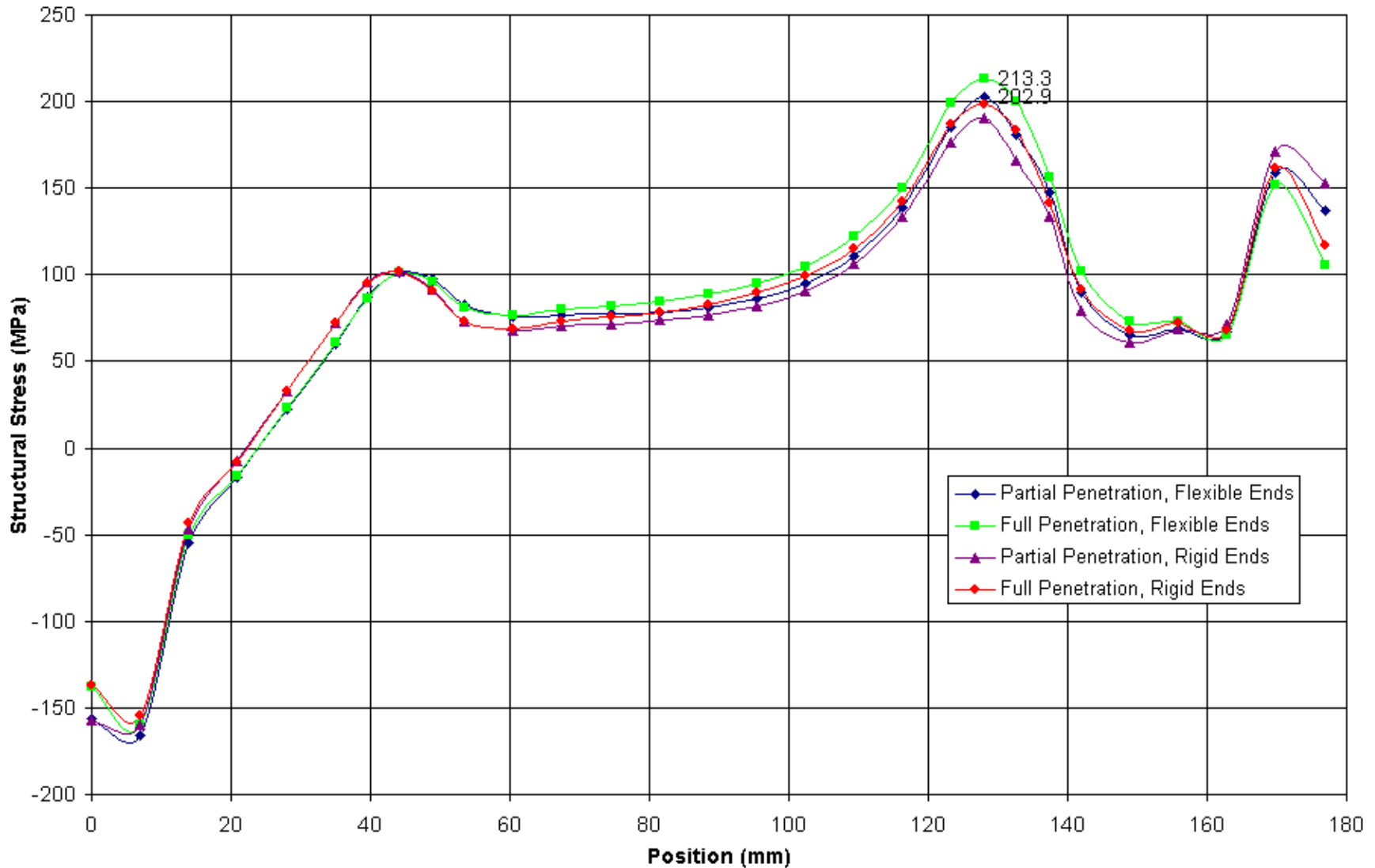




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Weld toe on 4x4





# Structural Stress - Results

Life Estimates based on Structural Stress

- Partial Penetration
  - R = -1      35,000 cycles
  - R = 0      241,000 cycles
- Full Penetration
  - R = -1      51,000 cycles
  - R = 0      353,000 cycles