

# Test Tube Material

- Thin walled cold rolled 1010 steel tubes

- 2 x 2 x 1/8 x 12 in.
- **Weld operation**
- 23 Volts, 130 Amps
- Mild Steel #ER-705-3
- 0.035 in diameter
- Gas coverage = 75% argon,  
25%Co<sub>2</sub>

Flow rate = 30 cfm

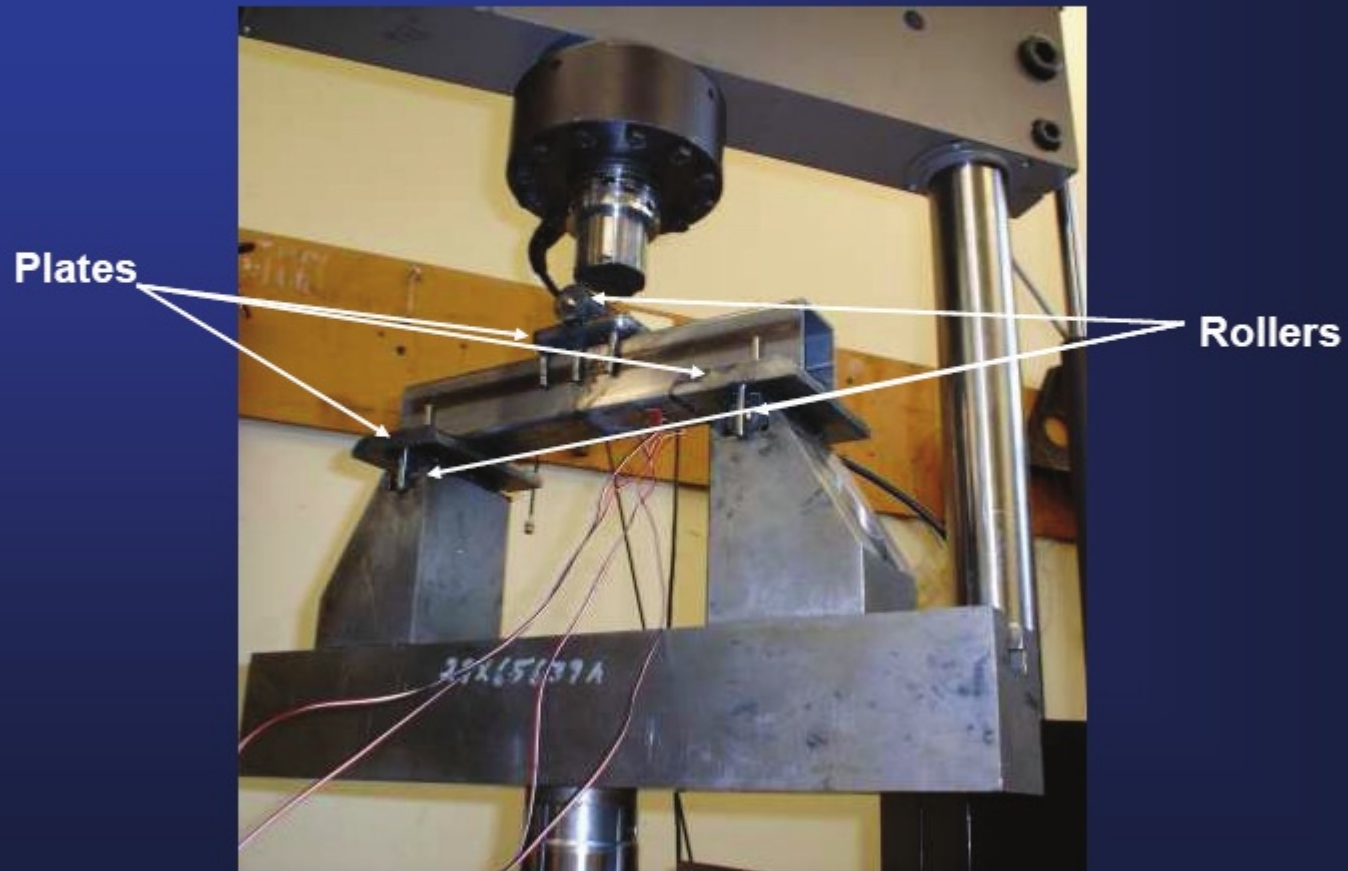


- Peening processes

- Shot peening
  - CW14 cut wire conditioned
  - Peened with 8A intensity to 100% coverage
  - Shot peening included weld and 1/2 in to either side of the weld
- Laser Peening
  - intensity = 8 GW/cm<sup>2</sup>
  - pulse duration = 18 ns
  - two peening layers

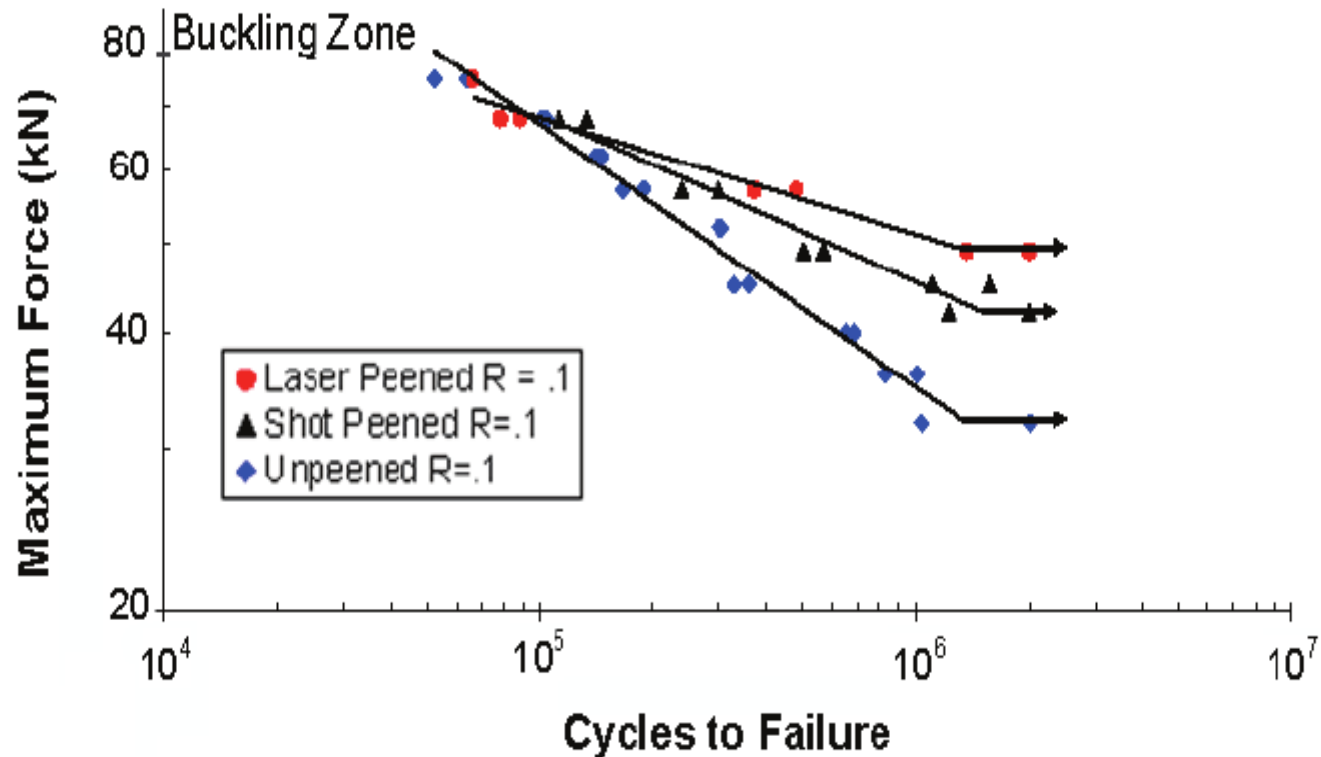


# Test set-up



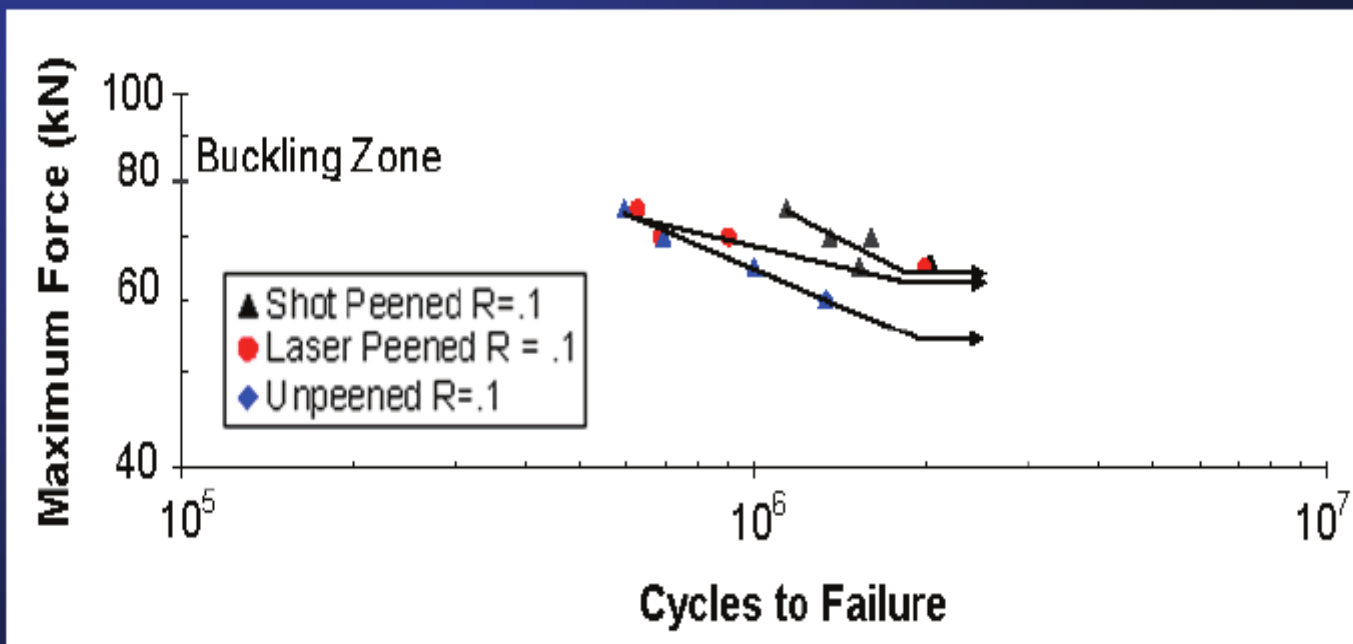
# Constant Amplitude Test Results

## R = 0.1

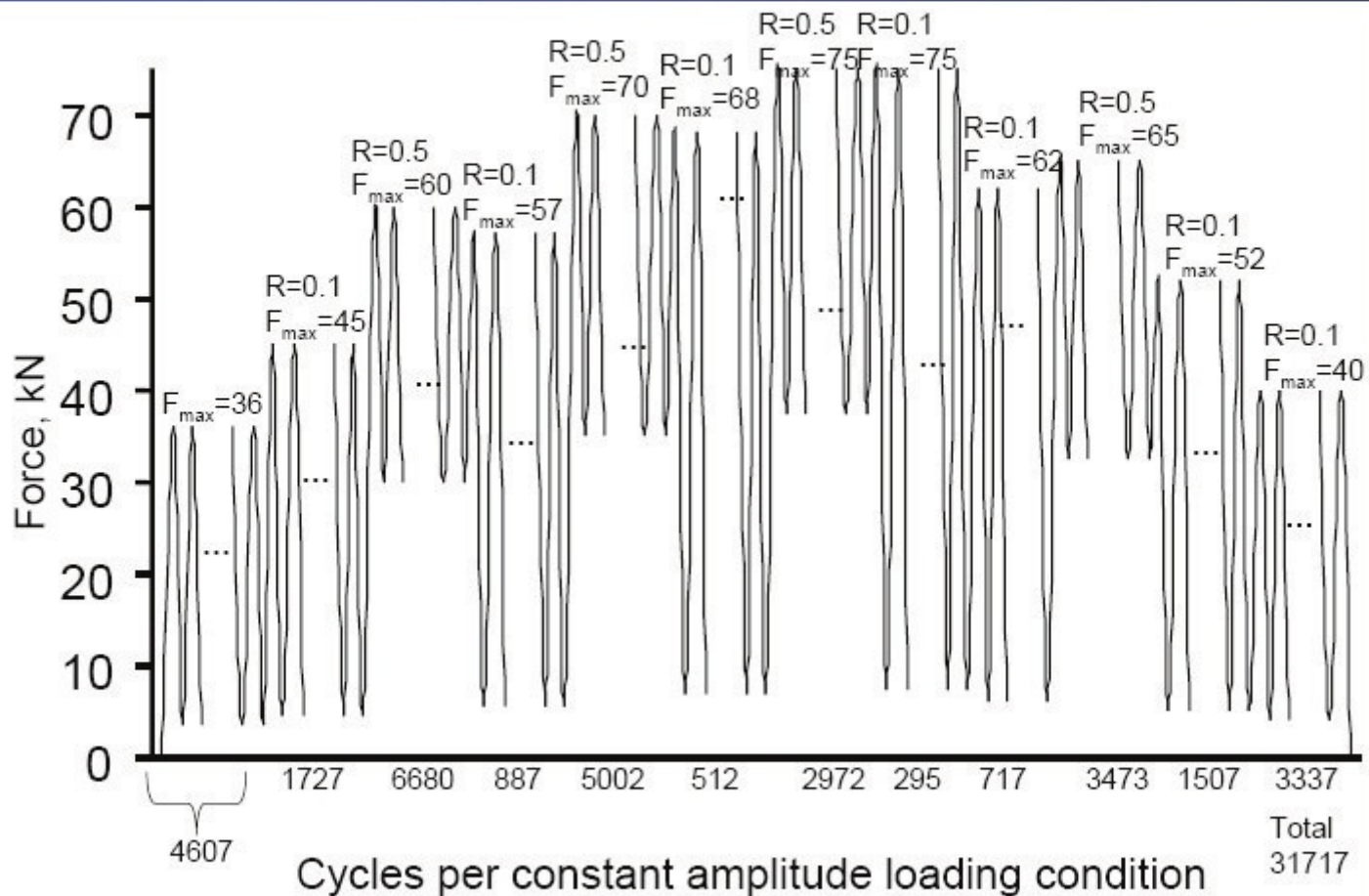


# Constant Amplitude Test Results

## R = 0.5



# Variable Amplitude Test: 12 Level Spectrum

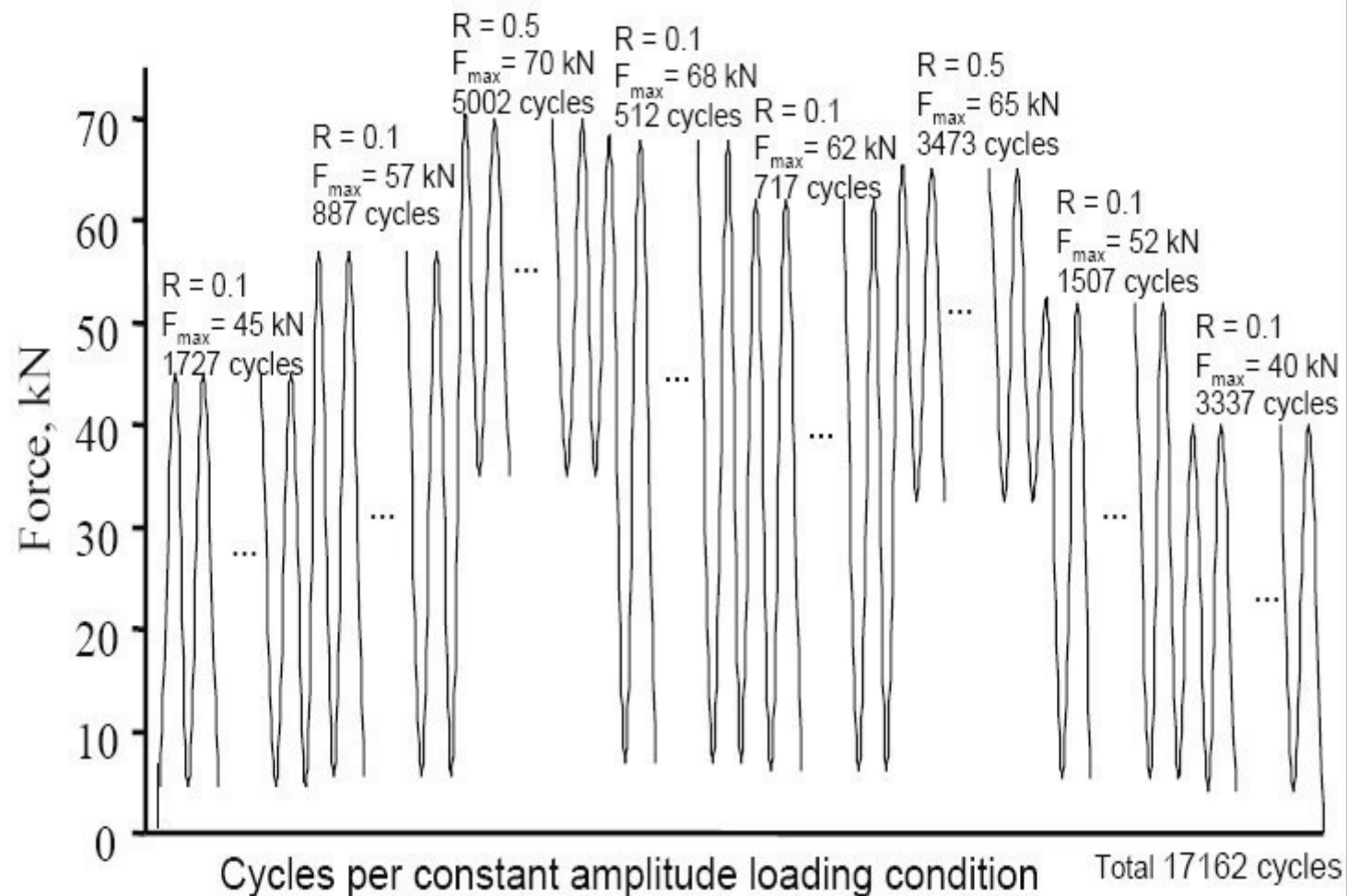


# Variable Amplitude Test Results

## 12 Level Spectrum Variable Amplitude Tests

Surface Treatment	Blocks Completed	Average Blocks Completed	Average Cycles Completed	Average Fatigue Life Increase
As welded	19.6	17.6	556 936	
As welded	15.5			
Shot peened	27.5	20.7	655 645	
Shot peened	17.6			18%
Shot peened	16.9			
Laser peened	19.7	18.8	594 369	7%
Laser peened	17.8			

# Variable Amplitude Test: 8 Level Spectrum



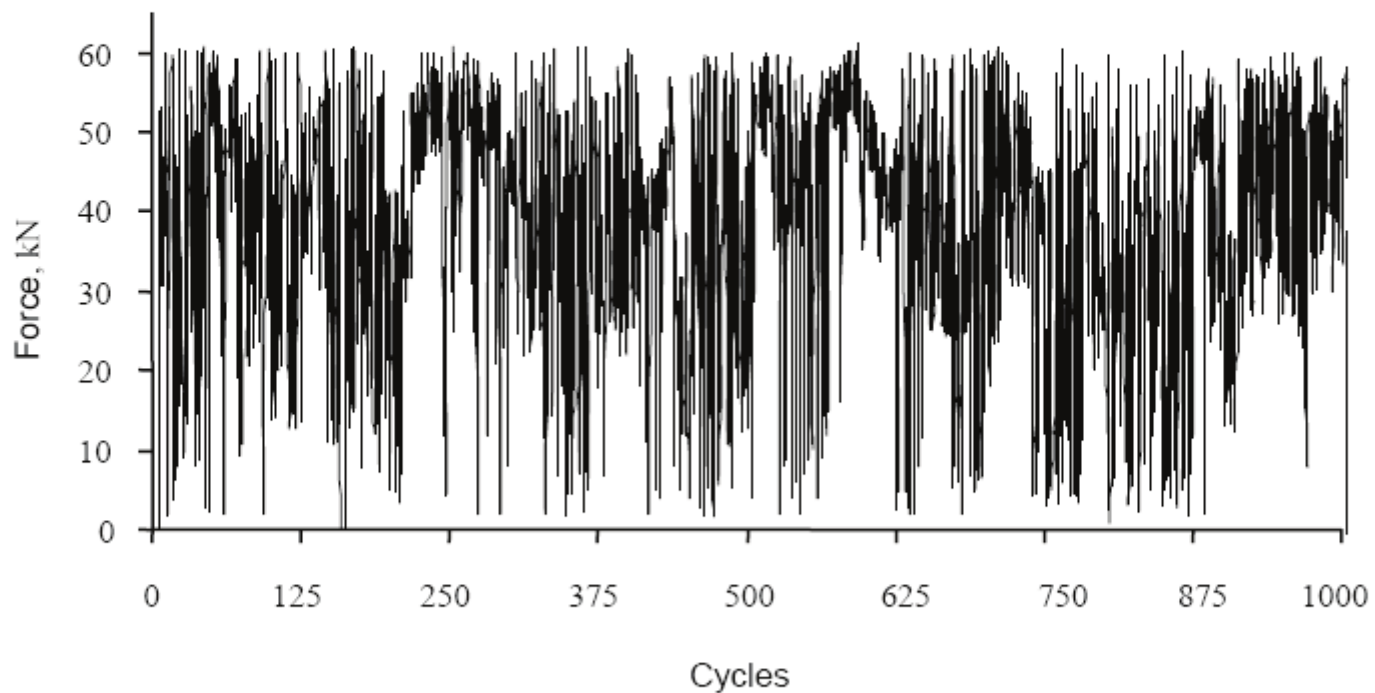
# Variable Amplitude Test Results

## 8 Level Spectrum Variable Amplitude Tests

Surface Treatment	Blocks Completed	Average Blocks Completed	Average Cycles Completed	Average Fatigue Life Increase
As welded	25.1	24.5	419 900	
As welded	23.8			
Shot peened	37.3	31.2	548 132	27%
Shot peened	32.1			
Shot peened	26.4			
Laser peened	29.3	28.3	484 555	11%
Laser peened	27.2			



# Variable Amplitude Test: Random Spectrum

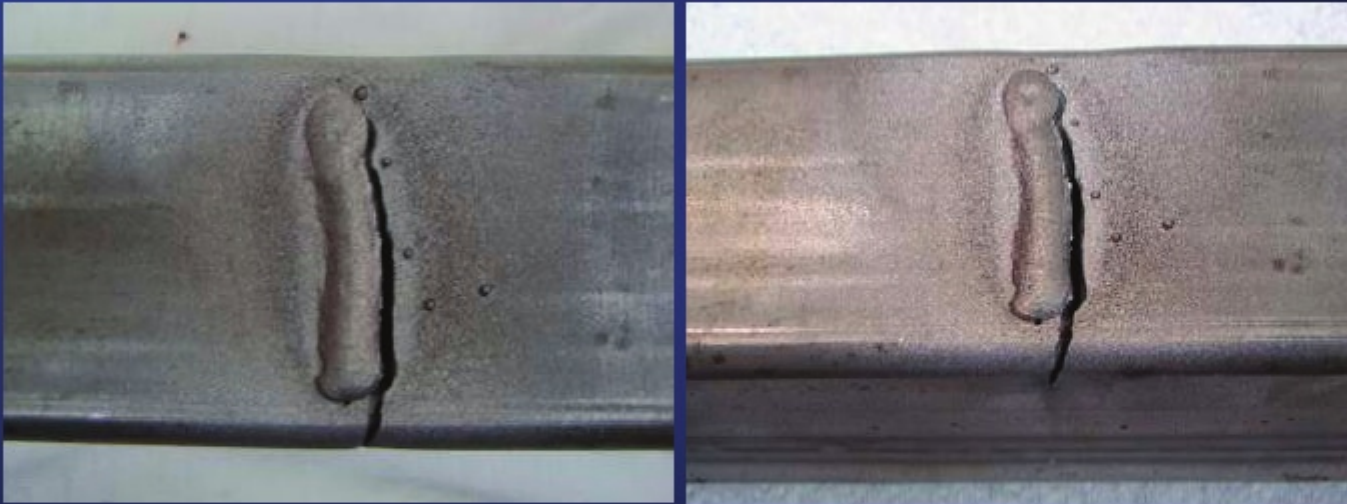


# Variable Amplitude Test Results

## Random Generated Spectrum Variable Amplitude Test

Surface Treatment	Blocks Completed	Cycles Completed	Fatigue Life Increase
As welded	716	716 270	
Shot peened	674	674 349	-9%
Laser peened	805	805 704	13%

# Crack Appearance



Shot peened specimen, 12 level variable amplitude test, completed 27.5 blocks

## Conclusions

- \* Significant effect of shot peening in constant amplitude loading
- \* Effects of shot peening under variable amplitude loading are insignificant
- \* Where next? (Stephens)