Radial Dependence of Axial Load Cells

Alex Nathan Kahn (ankahn2@illinois.edu)
Professor Emeritus James W. Phillips

1) Background

- Industrial load cells measure compressive axial loads
- Asymmetric loading can impact localized strain at gages
- What is the effect of load geometry on output?

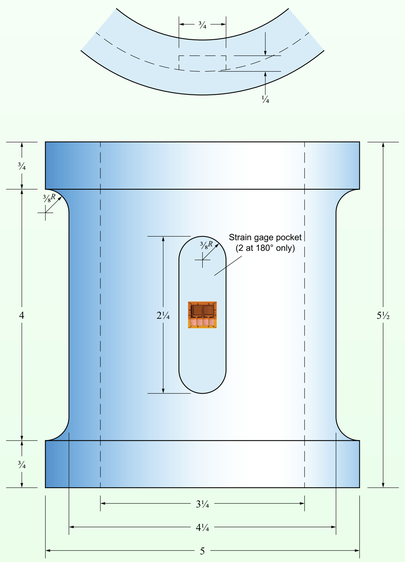

Figure 1: General load cell geometry and slot rosette position.
(Drawing courtesy of Prof. James W. Phillips.)

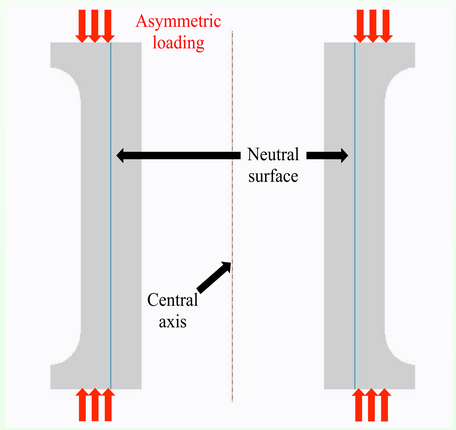

Figure 2: Neutral surface loading asymmetry.

2) Methods

- Two strain gage positions to study effect variation
- Load at various radial distances
- Automated contact ring manufacture

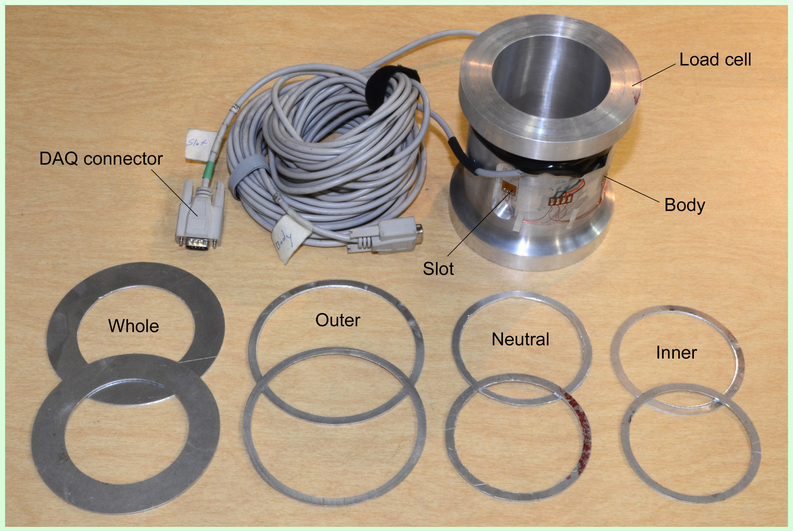

Figure 3: Load cell and metal rings.
(Photograph courtesy of Prof. James W. Phillips.)

3) Results

- Dramatic output variance, even for neutral surface gages
- Analytically predicted effects of asymmetric loading
- Implications for damage or death by faulty load cell readings

Experimental

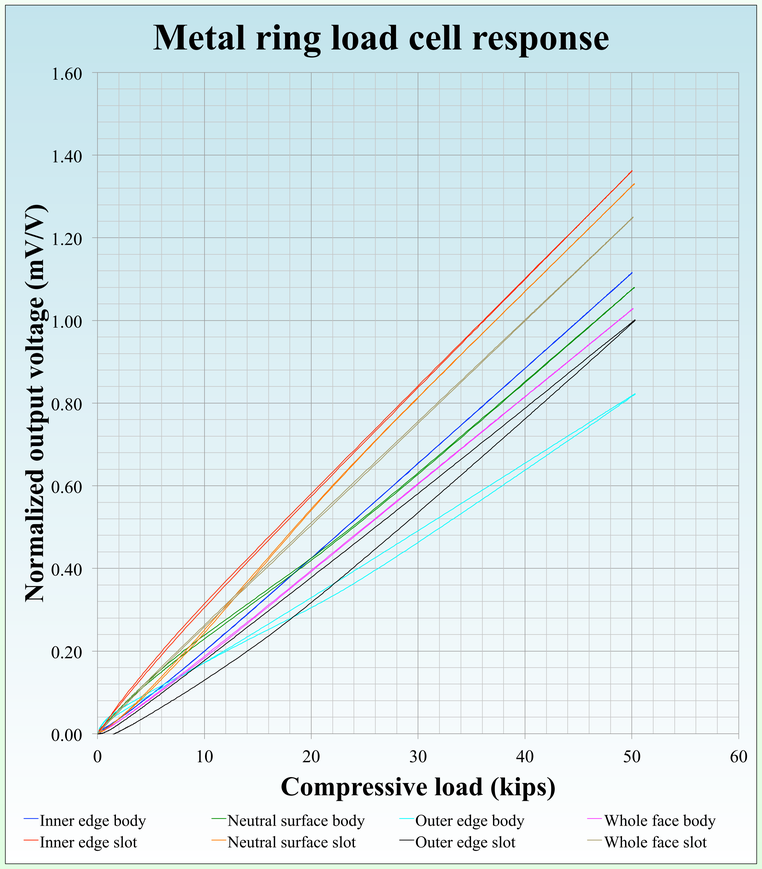

Figure 4: Metal ring load cell response.

Theoretical

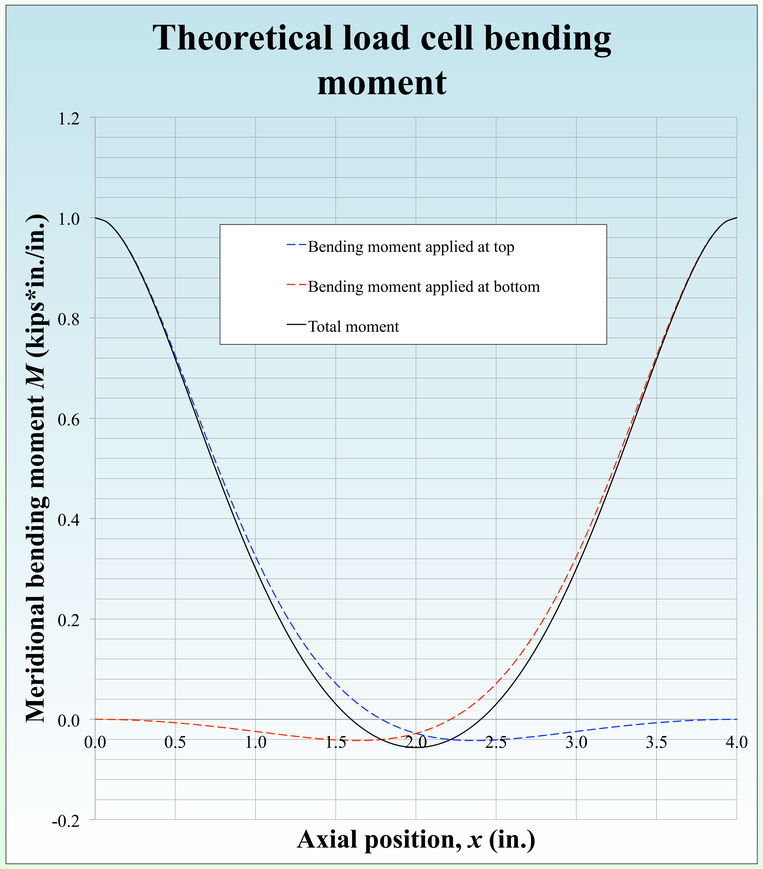

Figure 5: Theoretical load cell bending moment.
(Adapted from a spreadsheet provided by Prof. James W. Phillips.)

4) Credit

- Talbot crane bay testing with Professor Phillips
- Bay staff: Lee Booher, Steve Mathine, Greg Milner
- CNC manufacturing: Josh Kim

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Figure 6: Metallic ring testing. From left to right: Alex Nathan Kahn, Professor Emeritus James W. Phillips.
(Photograph courtesy of Prof. James W. Phillips.)