Effect of Bond Thickness on Tensile Shear Strength of Impact Resistant Structural Adhesives
(MatSE 493W ~ Spring 2016)

Overview
Currently, General Motors (GM) utilizes a single part, heat cured structural adhesive in the assembly of an automotive BIW. The material is dispensed between metal stampings, and is then heat cured through the painting process. For repair of these joints, GM has two different two-part, room temperature cured adhesives. The project is to develop a comparison of the heat cured (Henkel Teroson EP 50889) and two room temperature cured adhesives (Lord Fusor 2098 & 3M 07333) for lap-shear tests. Additionally, bond-line thickness (gap between panels) variation and substrate variation (stamped steel and stamped aluminum) needs to be considered.

Objectives
- Verify testing reproducibility with GM by comparing their Henkel strength vs. bond-line thickness results to the results obtained by the Penn State GM Learning Factory team
- Compare the tensile strength of two different repair adhesives (Lord Fusor 2098 & 3M 07333) with SOP, 1mm and 2 mm bond-line thickness

Approach
- Created 3 identical assembly stages in order to standardize the fabrication of samples
- Followed ASTM D1002-10 for fabrication and testing of samples
- Used the Bretschneider's formula to calculate unaccounted adhesive area on samples

Outcomes
- Lord Fusor and 3M adhesives experience a 12% and 33% strength decrease respectively over an approximately 2 mm increase in bond thickness
- Lord Fusor and 3M adhesives have strengths above the 10 MPa cut off (ASTM classifying them a “structural adhesive”)
- Percent cohesive failure followed the same trend as lap shear strength and drop off with an increase in bond-line thickness.