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Adhesive Design Considerations

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LOCTITE®

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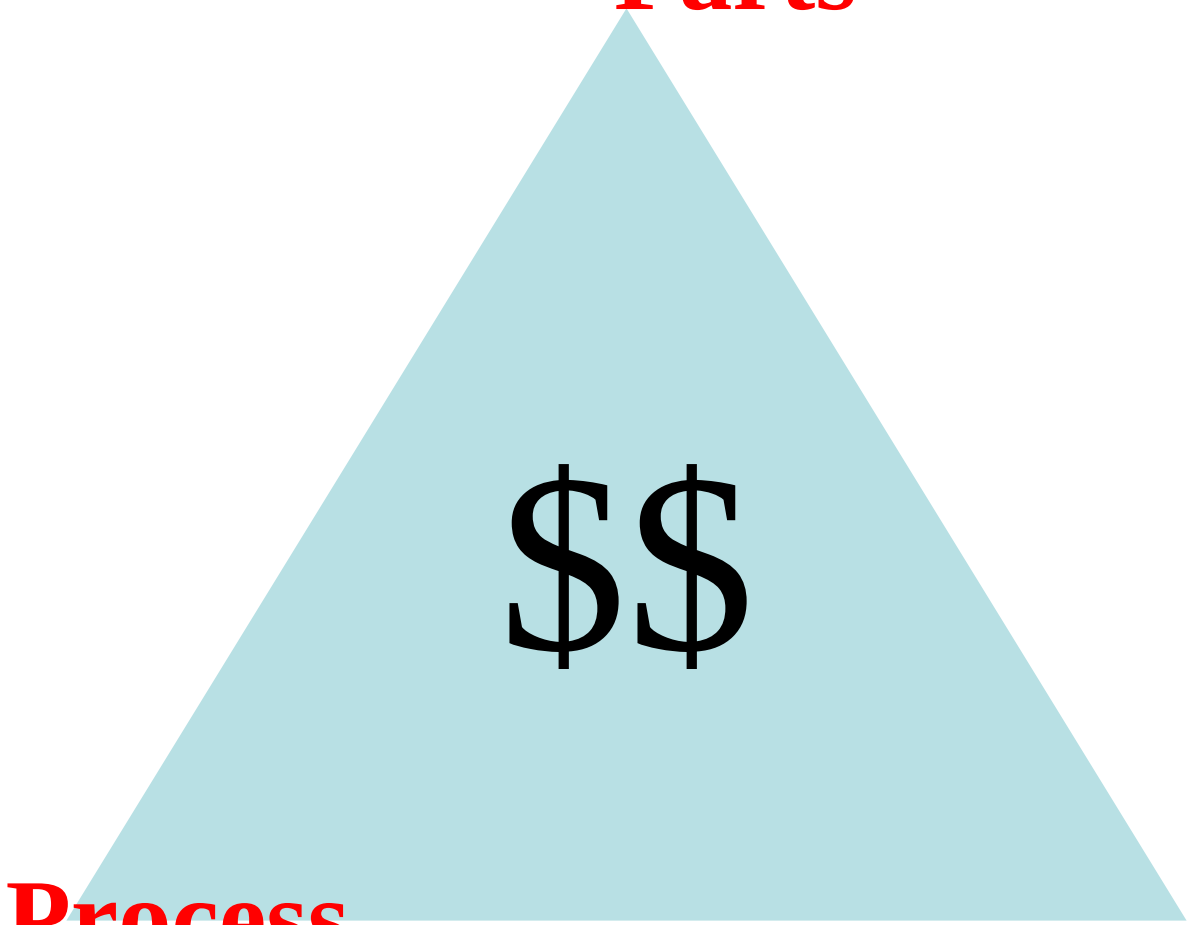
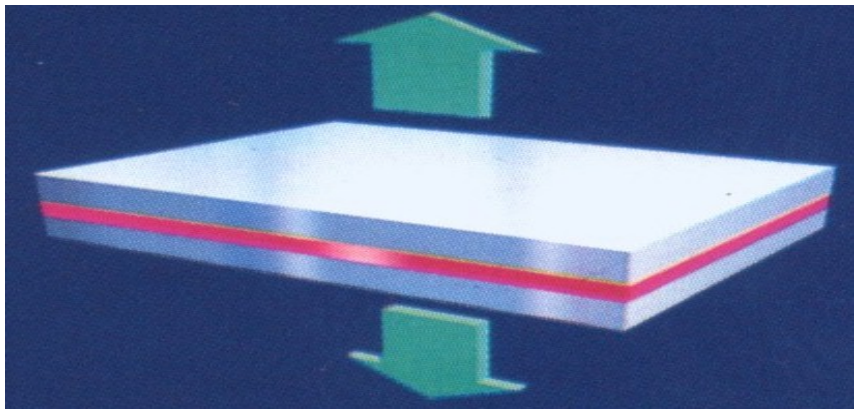
Agenda

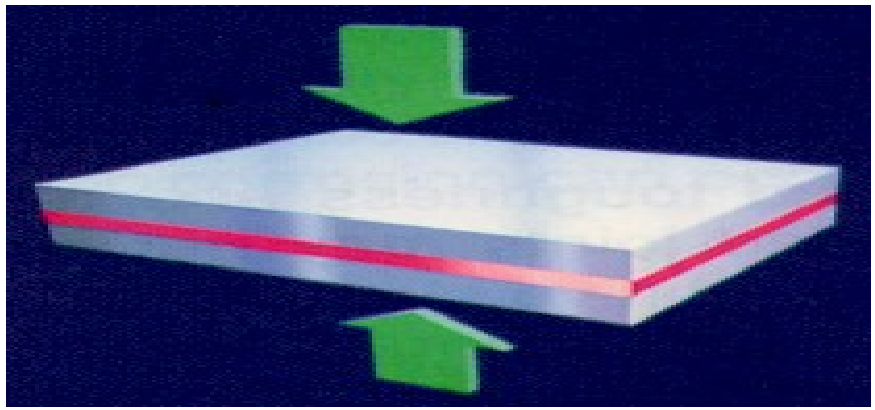
- The Three “P‘s“
- Types of Force
- Width vs. Overlap
- Effect of Gap
- Adhesive Selection Questions



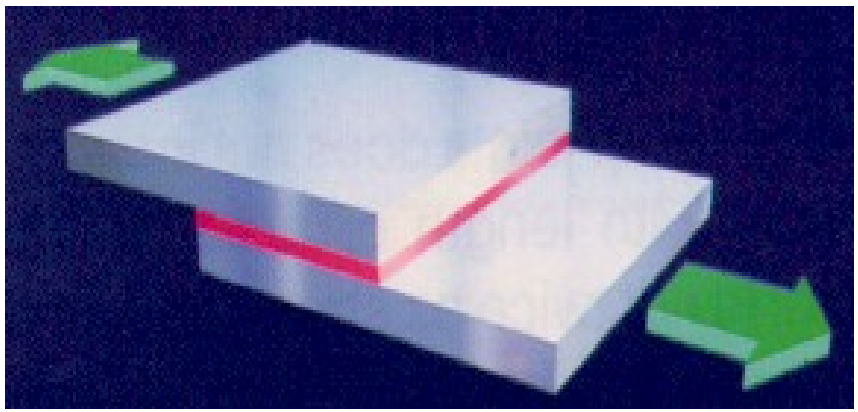
Type of Forces



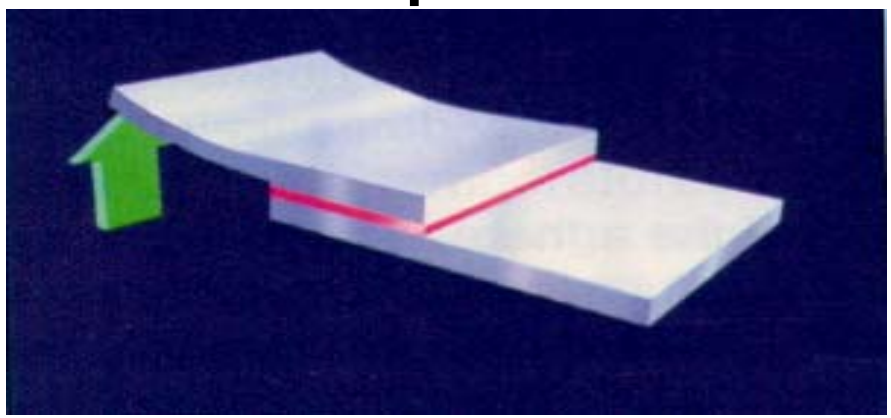
Tensile



Compressive

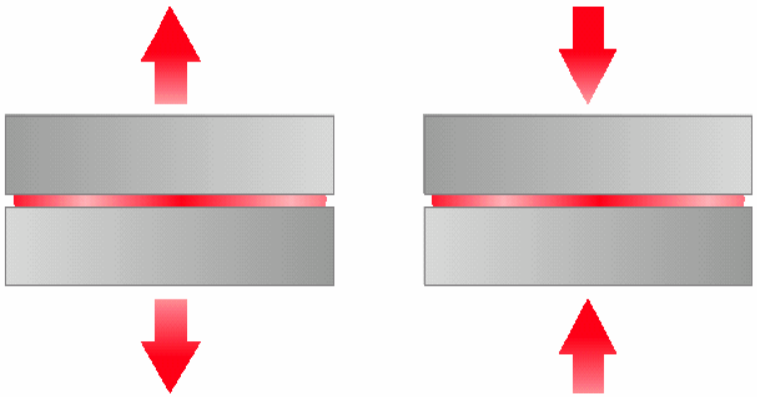


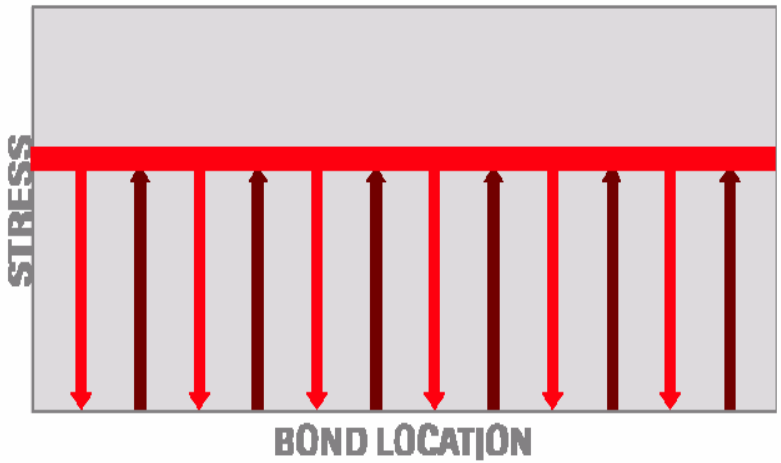
Shear



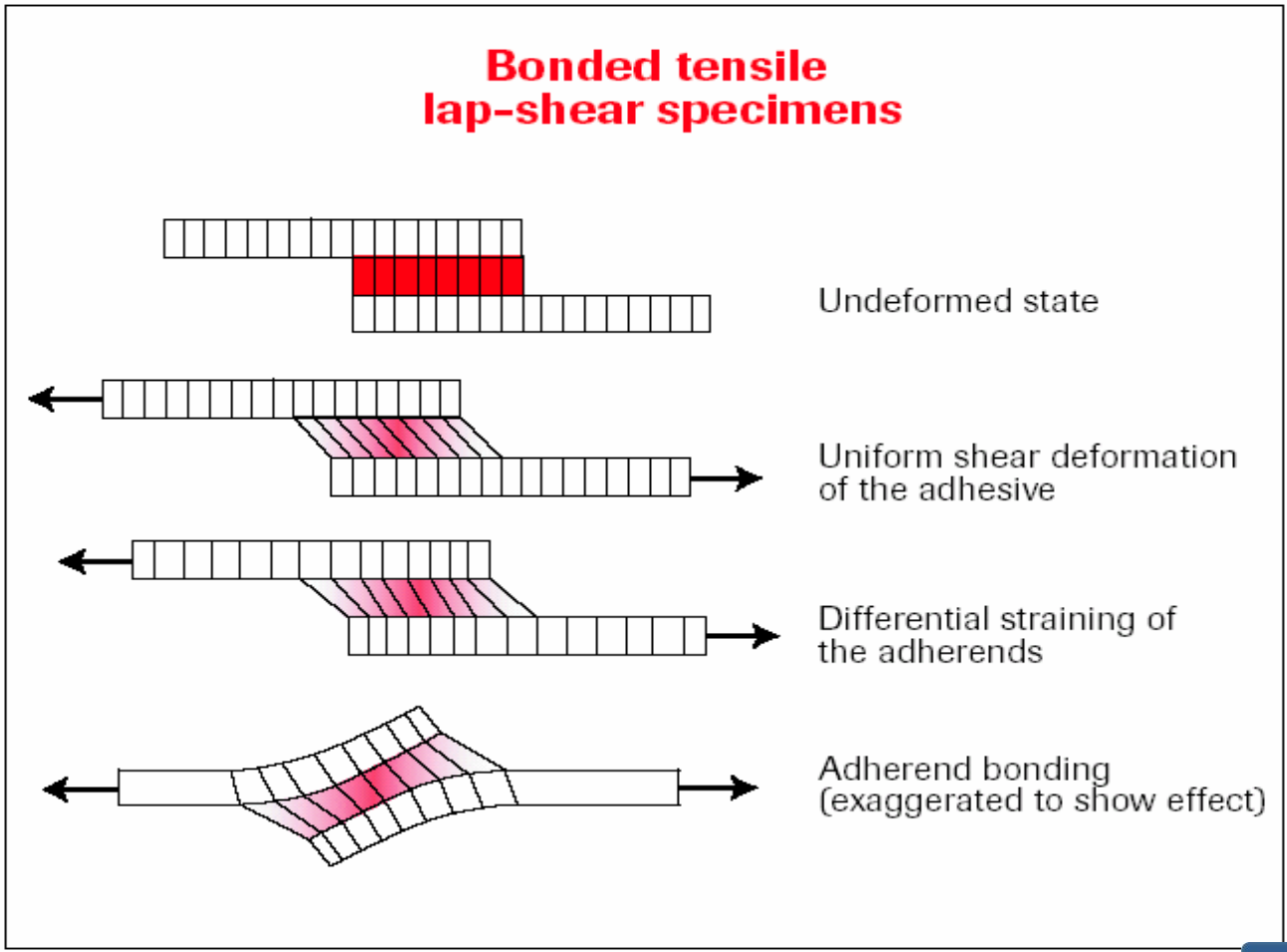
Peel

Stress Distribution:
Tensile and Compressive Forces



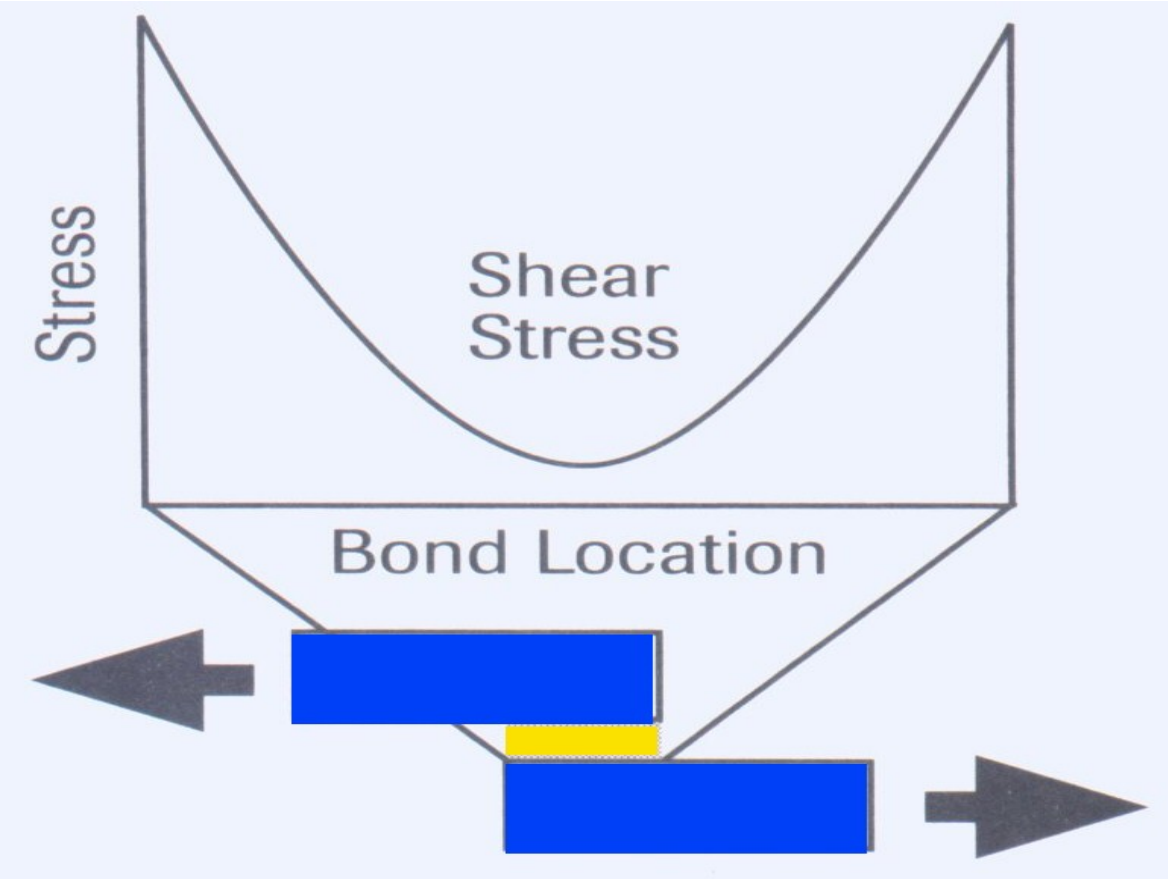


Stress Distribution:
Shear Forces



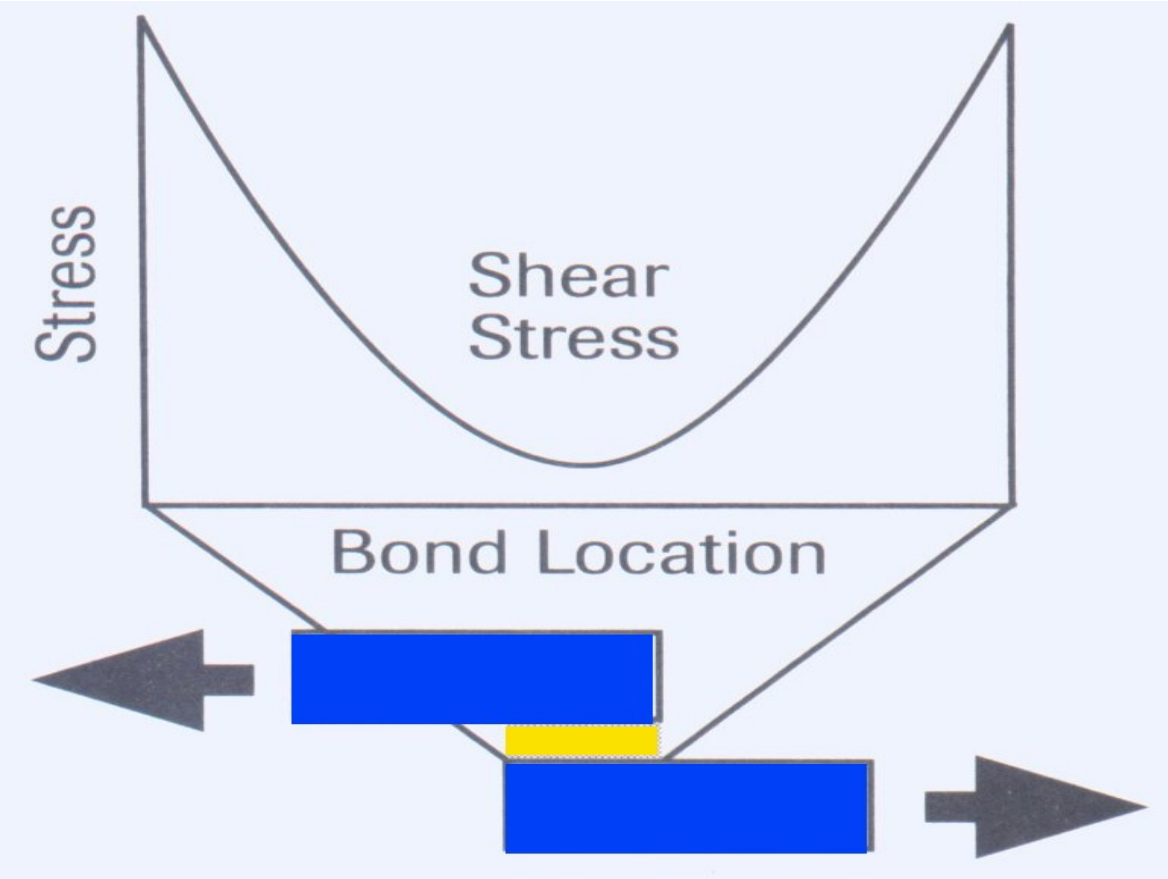
Stress Distribution: *Shear Forces*

Q: Where is stress most concentrated? Least concentrated?



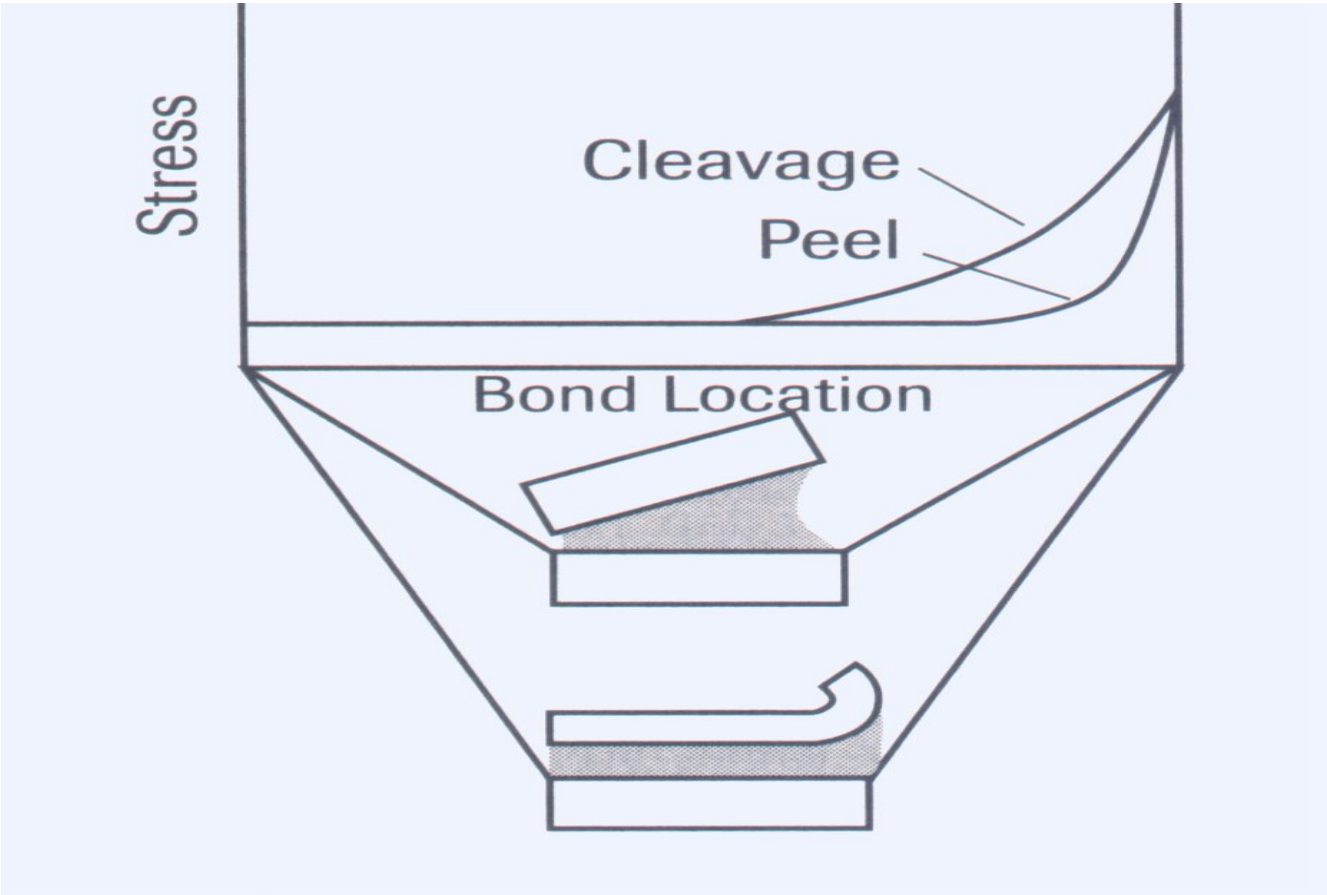
Stress Distribution: *Shear Forces*

A: Stress is higher at each end, but it is still spread across the entire bond area (length and widthwise)



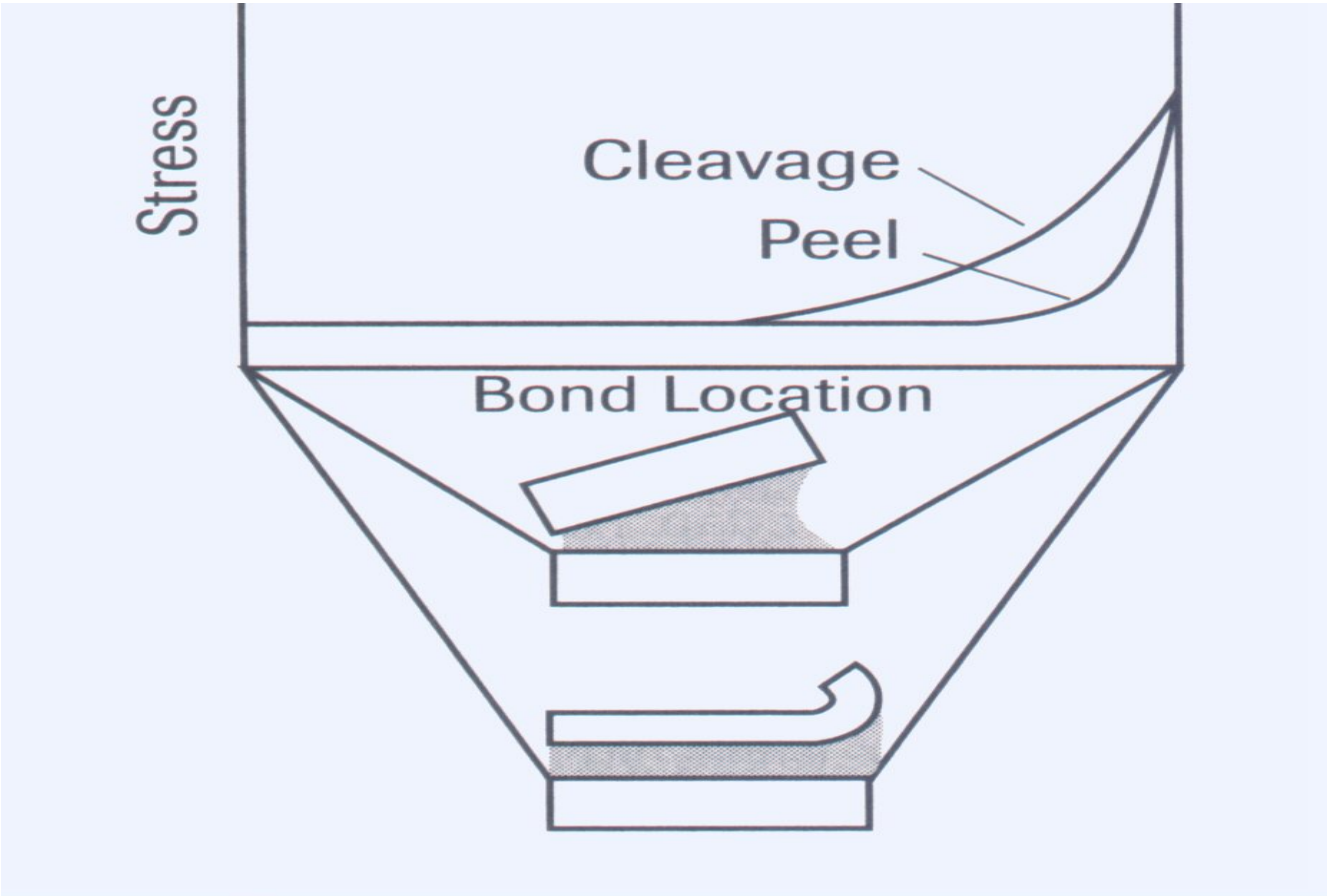
Stress Distribution:
Peel and Cleavage Forces

Q: Where is stress most concentrated?



Stress Distribution:
Peel and Cleavage Forces

A: Stress is concentrated at ONE end of the bond width (the length of overlap doesn't matter!)

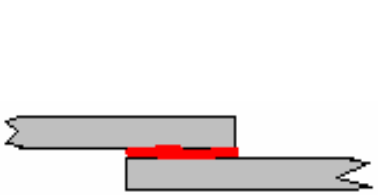


What Have We Learned?

- **Maximize...**
  - **Tension, Shear & Compression**

- **Minimize…**
  - **Peel and Cleavage**

Joint Area - Width vs. Overlap



Side view

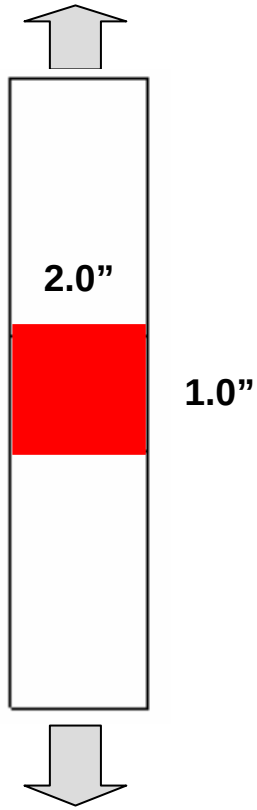


Photo A

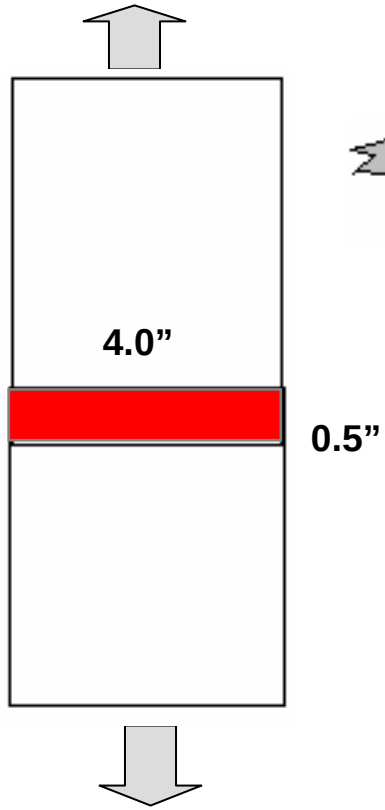
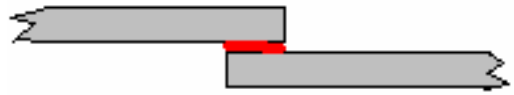


Photo B



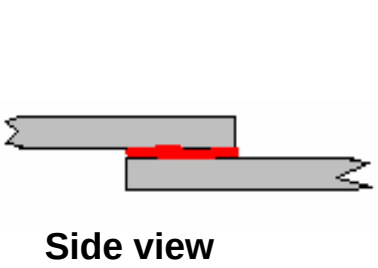
Side view

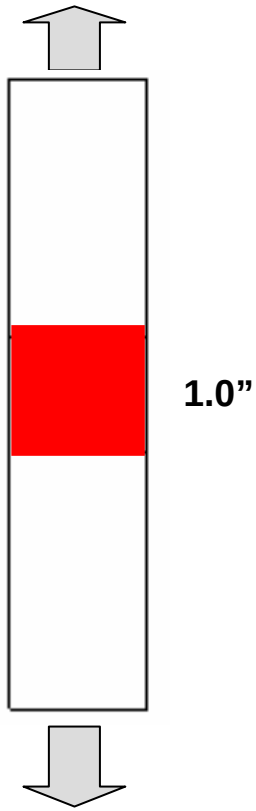
Bond Area = 1 sq in

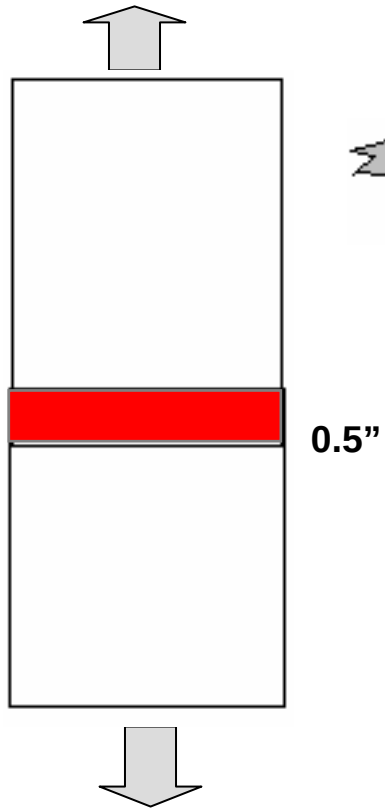
FORCE = Shear

Q: Which joint can handle a higher load? Why?

Joint Area - Width vs. Overlap







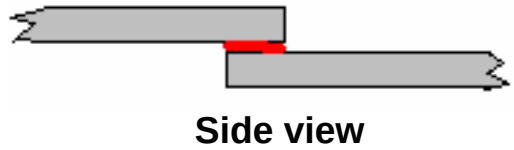


Photo A

Bond Area = 1 sq in

Photo B

FORCE = Shear

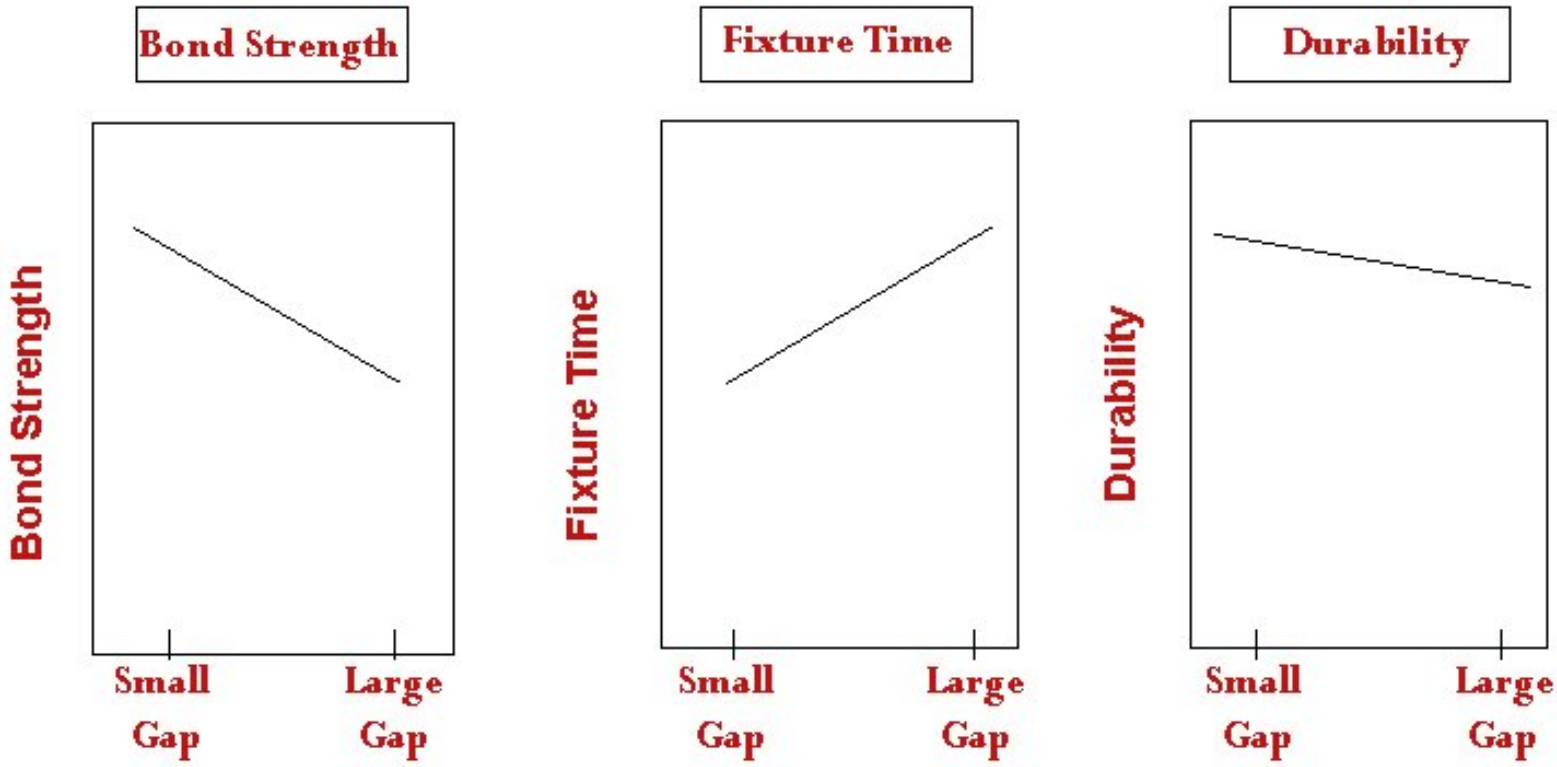
A: Wider is better than overlap (Photo B is better)

What Have We Learned?

- **Joint Overlap**
  - **Wider is Better**

Joint Design

Effect of Gap / Thickness



- Smaller GAPS exhibit HIGHER strength and FASTER fixture.
- Smaller Gaps are also more DURABLE for long term performance.

IMPORTANT: Thicker gaps (that offer some degree of flexibility) are sometimes required to compensate for dimensional changes and exerted STRESSES due to thermal expansion, impact or vibration, etc.

What Have We Learned?

- **Gap: What's Better?**
  - **Smaller**

ADHESIVE SELECTION:
Question #1

What are the Substrates?

- If at least one surface is NOT Metal, then forget Anaerobics (all others OK)
- If plastic, try to avoid Anaerobics, Silicones & Epoxies
- If glass, forget CA's and Anaerobics
- If rubber, forget Acrylics, avoid Hot Melts & Epoxies
- If wood, avoid Silicones & Urethanes
- Unless 1 surface is transparent, Light Cure will NOT work

- Try to avoid POLYOLEFINS! Your options will be limited!

ADHESIVE SELECTION:

Question #2

What is the Joint Design Geometry?

- If it WILL NOT hold w/o adhesive, then forget Anaerobics
- If need High Strength, avoid Hot Melts & Silicones
- If need High Durability, avoid CA's
- If need High Flexibility, use Hot Melts, Silicones, Urethanes, or 2part Acrylics
- If only some Flexibility needed, try Epoxies, and Acrylics
- Unless 1 surface is transparent, Light Cure will NOT work

ADHESIVE SELECTION:
Question #3

What is the Service Environment?

- If Temp > 200°F, avoid CA's
- If Temp > 250°F, avoid Hot Melts & Urethanes
- If Temp > 300°F, avoid Epoxy & Acrylics
- If Temp > 400°F, try Silicones ONLY

REFER to the Technical Data Sheet

- there are always exceptions to the rule!

Joint Design Guidelines

- **Maximize These Forces**
  - **Shear, Tension, & Compression**
- **Minimize These Forces**
  - **Peel, Cleavage**
- **Increase Bond Area**
  - **Wider is better (than Overlap)**
- **Minimize Thickness (Gap)**

For more information…

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