Developments in Structural Adhesives
Introduction

• Characteristics required for a Structural adhesive
  - Durable for the lifetime of the timber structures (min 50 years)
  - Adhesive must not creep
  - Bonding mechanism stronger than the wood
  - Must comply with AS/NZS4364:2010
Types of exterior Structural Adhesives

- Phenol Resorcinol Formaldehyde (PRF)
- Polyurethane (PUR or PU)
- Aqueous Polymeric Emulsions (API or EPI)
- Semi-exterior
- Melamine Urea Formaldehyde (MUF)
Phenolic Resorcinol Formaldehyde

**Pros**
- Very durable and strong
- Fairly easy to work with excellent pot life (e.g., 1 1/2 hour pot life in many cases)
- Can be expensive
- Can be cured at ambient temperature
- Very forgiving
- Excellent track record for performance in the field
- Good Shelf life 12-18 months (at least)

**Cons**
- Can be slow to cure without addition of extra heat (approx 4 hours at ambient temperature)
- Formaldehyde based (carcinogenic)
- If housekeeping not maintained can be very dirty and messy
Polyurethane

- **Pros**
  - Durable and strong
  - Easy to work with and is in a single pot so no mixing
  - Upfront cost of glue can be expensive (however uses ½ spread rate of PRF)
  - Can be cured at ambient temperature by using moisture in the wood
  - Little to no waste of glue or waste water
  - Cure times can be VERY fast

- **Cons**
  - Needs very tight manufacturing conditions to ensure good bonding
  - Some PUR’s are high foaming which can cause adhesion to press beds
  - Requires separating agents and cleaning agents
  - 6 month shelf life
API/EPI

• **Pros**
  • Bonds are semi-structural and strong in interior and semi-exterior situations
  • Cost is reasonable
  • Works of some timber species that other adhesives can not bond

• **Cons**
  • Not well accepted
  • Is susceptible to creep
  • Has pot life issues and is a two part mix, which requires automated equipment
  • Shelf life 3 months
Melamine Urea Formaldehyde

**Pros**
- Durable and strong in semi exterior conditions
- Fairly easy to work with even though it needs a hardener added thus requires mixing
- Cost is very reasonable

**Cons**
- Requires heat to cure
- Needs an acidic hardener
- Needs very tight manufacturing conditions to ensure good bonding
- Can have problems with formaldehyde smells
- Shelf life 3 months
PVAc (Structural and Exterior?) - NO

• Pros
  • Durable and strong in interior and sometimes wet situations
  • Can be cured at ambient temperatures
  • Good track record for performance
  • With Aluminium Chloride added can make water resistant
  • Very cheap

• Cons
  • Does not pass cyclic wet/dry testing
  • Creeps
Where do they sit with the standards testing

- Shear Test
  - MUF did not survive freeze, dry boil test
- Delamination Test
  - PRF, PU, MUF and EPI all passed
- Creep Test
  - EPI failed