Introduction

- Factors that drive the wood industries use of adhesives
- Structural gluing and the need for certainty
  - Evolutionary not revolutionary
- Global trends in adhesive technology over the years
- The current status of adhesive use globally
- Recent developments in adhesive technology
- Summary
Factors Driving Adhesive Change

- Environmental concerns about existing products
- Products that are easier to use
- Products that offer an economic advantage
- Market driven requirements
- A new product or process requiring a new adhesive

Environmental Reasons for Change

- Usually based on concerns about the chemicals involved
  - Formaldehyde
  - Isocyanates / polyurethanes
  - Organic Solvents
    - cleaning / hardeners / resin formulations
  - Adhesives that enable reduced energy use during the manufacturing process
    - Lower temperature curing
    - Fast curing
    - Adhesives that will bond green / higher m/c timber
- Adhesives made from renewable resources
Ease of Application

- Adhesives that do not require hardener (Water is the hardener)
  - Single pot / one component systems
  - Require special application equipment / release agents
- Suitability of adhesive for in-line mixing
  - Allows processes to become highly automated
- Use of specialised application equipment
  - Separate application
  - Ribbon spreaders
- Systems that allow for a fast start up and shut down

Economics

- Lower cost of adhesive / m3 of products
- Less energy to dry timber and cure adhesive
- Reduced glued timber inventory
- Initial set up costs
- On going costs
- Adhesive disposal
Market Requirements

- Wood coloured glue line
- Durability of adhesive and end product
- Compliance to standards
- Fire resistance
- Low VOC’s emitted from final product
- Short delivery times

Fact

“If you always do what you have always done, you will always get what you have always got.”

But

Gluing, especially structural gluing, requires a high degree of certainty

- We need to ensure new adhesives are fit for purpose
- We need to act responsibly as cost of failure is high

Change should be evolutionary not revolutionary
Structural Adhesives

• Historically structural adhesives were always RF and PRF resins
  - RF / PRF are the “Rolls Royce” of Structural Adhesives due to their:
    - Excellent creep and fire resistance
    - Durability > 50 years in exterior conditions
    - Resistance to most common chemicals
    - Excellent strength properties
    - Ability to cure at room temperature
    - Neutral pH at cure - no wood damage

• From 1960’s onwards...
  - MF, MUF and UF resins gained acceptance
    - In conditions where full exterior durability not required

• During the 1990’s...
  - Emergence of polyurethane one and two component systems
    - API/EPI
    - In conditions where full exterior durability not required
    - For small dimension products only
The situation now....

European Structural Market Share by Adhesive Type

- MUF/MF: 85%
- PRF: 5%
- EPI/PUR: 10%

North American Structural Fingerjointing Market Share by Adhesive Type

- MF: 92.00%
- RF: 5.00%
- MF Powder: 2.00%
The situation now....

North American Glulam Market Share by Adhesive Type

- PRF: 77.04%
- HM MF: 16.86%
- RF: 6.10%

The situation now....

Glulam production in North America, 1999-2005

Notes: f = forecast. Conversion factor: 650 board feet per cubic metre.

The situation now....

North American I Beam Market Share by Adhesive Type

- EPI: 45.89%
- PRF: 11.68%
- PUR: 4.62%
- Other: 37.80%

The situation now....

I-beam production in North America, 1999-2005

Notes: F = forecast. Conversion factor: 1,2802 linear feet per metre.
Why is MUF usage increasing?

• MUF typically gives a lower adhesive cost / m3
• Clear or natural wood coloured glue line
• Formulations exist that meet EN301/AS4364:1996 Type 1 Requirements
• Ease of use
• Good creep and fire resistance
• Low formaldehyde and VOC levels in both the workplace and the final product

What is new with PRF Technology?

• Replacement of powder and slurry hardeners
  • Formaldehyde Free hardener technologies available from Hexion
• Very fast setting systems, both at room temperature and under conventional and RF heating
• Variable setting speed options are available
What is new with MF / MUF Technology?

- Advanced glue application technologies give similar advantages to a one component system
  - Ribbon spreaders
  - Separate application of resin and hardener
- Fast curing systems, both at room and high temperatures

What is new with API / PUR technology?

- Certified Structural API’s and PUR’s are available
  - Standards specify spread weights required
- Single component PUR’s – require no mixing
### The future in Structural Adhesives

- MUF will remain / grow as a major player
- RF / PRF will always be used in high risk applications
- Formaldehyde free hardeners will replace conventional hardeners in PRF systems
- PUR will gain small market share – only where fire risk is low
- API will become used for more small dimension beams and I-beams

### Non-Structural Adhesives

- Historically key adhesives have been PVA, UF, MUF and casein
- Now there are other options available:
  - PUR
  - API
The situation now....

North American Door Market Share by Adhesive Type

- PVA: 94.94%
- PVA/PURHM: 2.96%
- Casein: 2.10%

The situation now....

North American FJ Stud Market Share by Adhesive Type

- PVA: 84%
- EPI: 6%
- PUR: 6%
- MF: 3%
- PRF: 1%
The situation now....

North American Flooring Market Share by Adhesive Type

- UF: 40%
- PVA: 7%
- PUR: 8%
- UF/MUF: 45%

The future in Non-Structural Adhesives

- PVAc will remain a major adhesive type
- One pot D4 PVAc will become norm
- New adhesives based on materials like soy flour will be seen
- MUF, UF and PUR will be used in specific applications or where customers also produce structural products
Summary

- Globally there are clear drivers of change in the wood industry relating to adhesives
  - Although not all regions are driven equally on all issues

- Structural gluing requires a high degree of certainty
  - Changes must be evolutionary not revolutionary

- Across key structural properties RF / PRF continue to give the best performance

- New adhesive systems meet specialised needs

- In non-structural applications a key drive is for productivity so cure speed has become a dominant technical factor