



## Application Summary Sheet 14

**Title:** GRP timber connections

**Target Audience:** Structural Engineers, Architects

**Keywords:** Bonded-in rods, glulam, LVL (laminated veneer lumber), timber connections.

### Overview of application / summary:

Both bonded-in and un-bonded rods are an effective and attractive solution for timber to timber connections in structures. Such hidden connections are more aesthetically pleasing than the alternative of exposed plates and bolting. The use of Glue Laminated Timber (glulam) and Laminated Veneer Lumber (LVL) as a structural element, primarily for its visual appeal, has often been let down by the indelicate use of steel angle and suchlike for the connections.

Pultruded FRP rods offer a lightweight, corrosion resistant and elastically compatible alternative to steel rods. The performance of bonded-in FRP rods can be superior due to better resin bonding and ductility. FRP bonded-in rods may act as secondary reinforcement and also reduce stress concentrations which would otherwise cause the formation of fractures in the timber.

### Impact of Application

#### **Financial:**

Marginally more expensive than steel, although GRP offers technical advantages.

#### **Environmental:**

Alternative to steel, although low volumes of material are used.

#### **Social:**

Hidden connections in timber structures can be aesthetically pleasing.

#### **Engineering:**

High strength, good ductility.

Corrosion resistant.

Excellent bond characteristics with resin

Rods easier to prepare for bonding than steel, requiring only sanding and cleaning with solvent.

Prepared by BRE and Trend 2000 Ltd (Partners in Innovation Project)

For further information please consult the project website:

[www.polymercomposites.co.uk](http://www.polymercomposites.co.uk)

## **Robustness:**

Authoritative research with component testing

## **Where to get further information**

### **Research:**

#### **Non-metallic, adhesiveless joints for timber structures**

Drake R D, Ansell M P, Mettem C J, Bainbridge R J. (1999)  
CIB W18/32-7-11, Graz, Austria.

Review: The paper examines the use of GRP pultruded dowels for connections in medium and large scale LVL timber structures and presents the results of test results and finite element analysis on moment resisting joints. Failure loads for GRP dowel joints were found to be marginally higher than corresponding steel connections, with failure occurring in the dowel and LVL rather than in the LVL alone (i.e. the GRP connection is more ductile, avoiding stress concentration in the timber).

also:

#### **Evaluation of joints in timber structures using pultruded GRP dowels and implications for Eurocode 5-based design**

Drake, R.D., Ansell, M.P.  
The Structural Engineer, June 2000.

#### **Evaluation of material combinations for bonded in rods to achieve improved timber connections**

Mettem et al. (1999)  
CIB W18/32-7-13 Graz, Austria.

#### **Bonded-in Pultrusions for Moment-Resisting Timber Connections**

Harvey K., et al. (2000)  
CIB W18/33-7-11 Delft

### **On products:**

Rotafix Ltd  
[www.rotafix.co.uk](http://www.rotafix.co.uk)