A preliminary study on epoxy glued-in rod for MASSLAM®

Degree programme : Bachelor of Science in Holztechnik
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Industrial partner : Australian Sustainable Hardwoods, Heyfield, Australia

Australian Sustainable Hardwoods is a fast expanding sawmill and hardwood glulam factory in Australia. To expand the glulam production capabilities beyond the current 4000m3 per annum, new and more efficient connections are needed.

Glued-in rods (GiR) as connections for timber elements are not new anymore, with the first reported uses dating back around the late seventies. However, due to their complexity and bonded nature, still no general formula to calculated their resistance has been agreed on, but lots of studies propose empirical models based on testing. By reviewing them and other specific papers, a base knowledge has been gathered for ASH. The studied aspects are:

- Fire and temperature effects
- Moisture, load duration effects and creep behaviour
- Adhesive types
- Geometry and group effects
- Bonding defects

To allow ASH to use GiR in production, a small testing campain was carried out using three different metric threaded rod sizes (M12, M16, M20), three different embedment lenghts (5d, 10d, 15d) and two different adhesives. After the initial tests, only one adhesive was further tested, the Würth WIT-PE-1000 (2K-epoxy mortar designed for concrete anchoring). Tests were done with the ML45 glulam grade, the highest strength group pruduced by ASH ($f_{m,k}$= 45 N/mm²) The variability seen across all samples tested was low, at 9%. With the results, an empirical model was developed (based on the Ferwood® model) and adjusted. It follows the testing results with a confidence higher than 95%. The confidence with embedments longer than 15d is unknown, but doesn't matter as it already exceed the design capacity of a standard 8.8 grade threaded rod.
For ASH to use GiR as a common connection, further testing is absolutely needed, to understand shear resistance, long-term connection / adhesive behaviour (moisture, delamination), and high ambient temperature impacts (strength loss starts at around 50°C depending on the adhesive).

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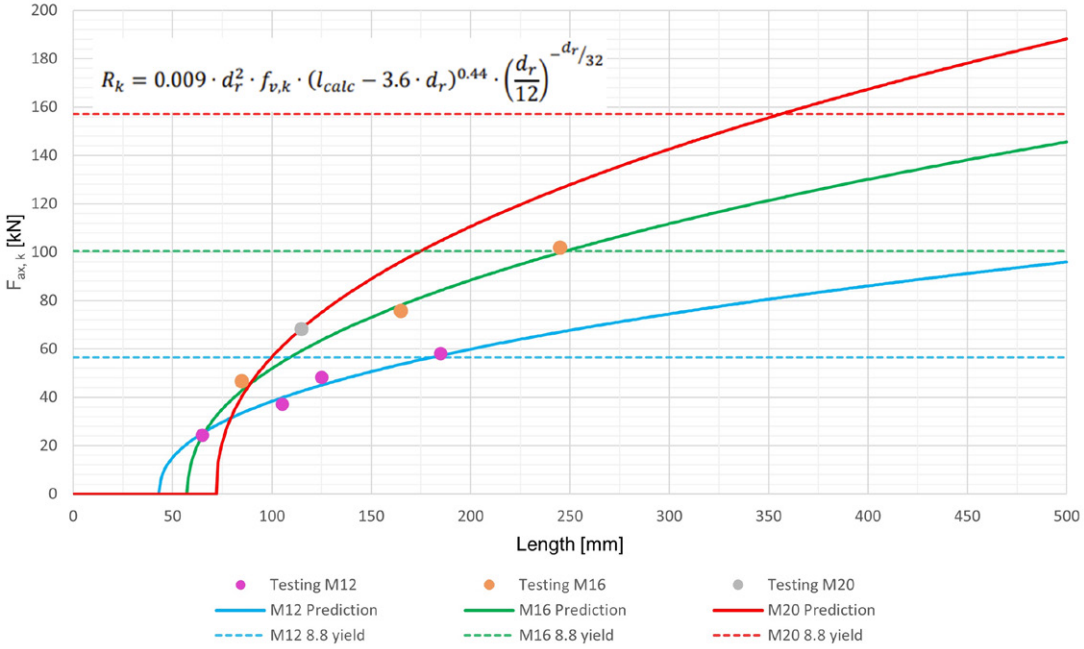

Developped model with test data (test points are characteristic values, at 80% of the average test results)