Internal Project Information Note 33/08 - Extended summary

Trial of acoustic hammer tool for moisture content measurement in roundwood

To achieve woodfuel market confidence and development, it is imperative that woodfuel is supplied to users at the correct moisture content (MC) for their burning appliance. Assessing the MC of roundwood can be difficult and this has created a demand from suppliers for a practical, quick and reliable method to determine the MC in roundwood. This could provide valuable decision support information for example to choose the appropriate time for processing or to assign a monetary value to the woodfuel.

Acoustic hammer tools are traditionally used to assess timber quality. Initial investigations carried out by Forest Research in 2007 investigated the relationship between speed (velocity) of sound waves in experimental conditions. The project summarised below was a continuation of this work.

Protocol

- The tool tested was an HM200 Director acoustic tool
- Three trial sites were selected to provide a range of climatic conditions (Rumster, Well Cleuch and Huddisford, see map below).
- Sitka spruce was the species studied as the main commercially grown coniferous species in Great Britain
- On each site

- 4 stacks of 10 m^3 roundwood in 3 m lengths were built on bearers (end diameters ranged from 8.2 cm to 37.5 cm)

- 60 control billets were laid on bearers near the stacks

- At week 0, 4, 8 and 16 at each trial site:

- hammer readings were taken from the same 18 pre-identified billets within the stacks

- hammer readings were taken from 12 random control billets, which were then removed and destroyed for oven dried MC assessment

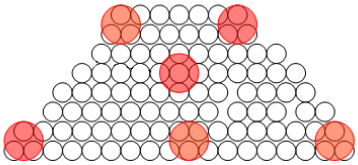
- At week 32 at each trial site:

- hammer readings were taken from the 18 pre-identified billets within the stacks, the stacks were then taken apart and the 18 billets removed and destroyed for oven dried MC assessment

- hammer readings were taken from the remaining 12 random control billets, which were then removed and destroyed for oven dried MC assessment

Location of trial sites

Stack of roundwood on bearers



location of 18 billets in stacks
(6 x 3 billets)

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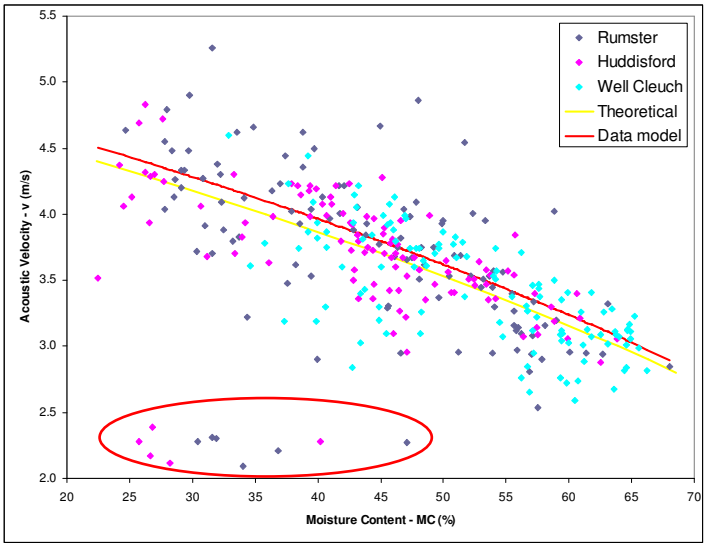
Results

- A robust correlation can be established between the sound velocity v recorded by the hammer and the moisture content measured in the roundwood MC (see below indicated the red curve). The relationship can be described as $MC = 100 – 3.816v^2$



Acoustic velocity plotted against MC

- It is important to note that the robust regression identified approximately 5% of points as outliers (data unrepresentative of the overall sample, circled in red above). This implies that any future protocol for collecting velocity measurements and subsequent moisture content estimates:

- should not rely on a single velocity reading, and

- that values of less than 2.5 m/s for v should be treated with caution.

- The acoustic hammer proved easy and robust to use

- The cost of the tool is relatively high (indicative retail price at the time of the trial c.£5,000) which makes it more likely to be suitable for large scale applications and/or large businesses

- The potential application for 'typical' lower grade woodfuel products (potentially smaller diameter, poor shape, knots, decay) would need to be confirmed.

The work summarised here is part of an ongoing programme of research funded by the Forestry Commission aimed at improving the efficiency with which fuel is produced from sustainably managed forests in the UK. For further information on this project and related work:

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