The testing and resulting implementation of a new fir strength has been shown to improve manufacturing processes all round. **Ruth Stanaway, Weyerhaeuser Company**

Fir strength improvement

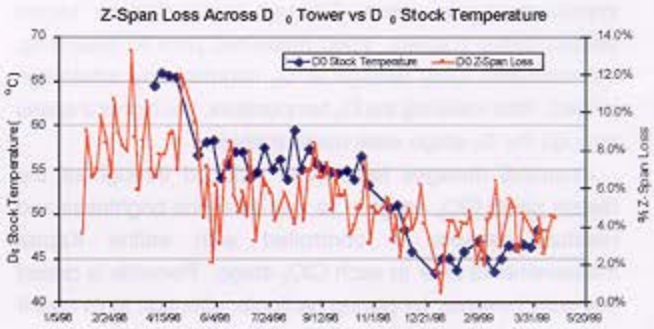
THE WEYERHAEUSER COMPANY'S 1200 TONNE-PER-DAY (TPD) KRAFT mill was started up in 1995. It consists of a continuous digester, oxygen delignification reactor and three-stage (D-Ep-D) bleach plant. The fibreline produces pulp for three paper-machine product lines: bleached paperboard, fine paper and newsprint. Newsprint is a new customer, which came with the start-up of the new mill. Kraft is used in certain newsprint grades to enhance tear and tensile strength of the newsprint sheet. Kraft pulp strength is critical at the newsprint machine because the amount in the sheet can be reduced as kraft pulp strength is improved.

The newsprint business has stringent strength requirements of kraft pulp. Wet zero-span (z span) tensile testing has been used to optimise pulp strength. The Weyerhaeuser Company's kraft mill produces pulp for newsprint, bleached paperboard, and fine paper machines. Prior to the implementation of process improvements, tear strength was as much as 15 per cent below the target for the newsprint sector. However, since optimisation, tear strength has consistently been 5 per cent above that target. In response to kraft strength improvements, the kraft content of newsprint sheets was reduced by about 4 per cent while simultaneously maintaining newsprint sheet strength. Machine runnability and sheet properties on other product lines have also improved with the improved kraft strength.

Testing pulp strength for newsprint

A pulp-strength benchmark was chosen based on historical PFI data from the previous supplier of kraft to the newsprint machine. The newsprint business uses five-ply tear at 5km breaking length as their kraft-strength parameter. This point was chosen so as to be near the peak of the tear versus tensile curve. Five-ply tear gives a better definition of this peak than single-ply.

Prior to installation of the new fiberline, viscosity testing was used to monitor pulp strength for the bleached-paperboard and fine-paper machines. However, viscosity inadequately predicts pulp strength in the range needed for newsprint and the mill does not have the facilities to do PFI testing. PFI testing carried out off-site indicated that the tear versus tensile strength of the pulp from the new fiberline did not match the benchmark of the previous supplier. It was clear that a tool for monitoring pulp strength at the mill was required.



The reduction in z-span drop through lower stock temperature.

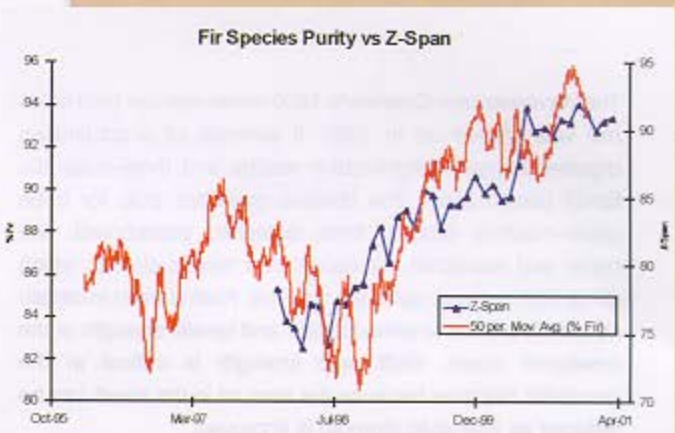
A Z span 3000 was chosen to measure wet zero-span tensile tests in real time. The Z span 3000 is an automated strength-testing system that allows operators to measure the zero- and short-span tensile strength of a sample in about 25 minutes. The system consists of a beater, an automated hand-sheet maker that produces six test sheets per sample, and a tester to measure fibre strength. Z-span testing on the final bleached pulp is used for pulp disposition for newsprint and the data it produces correlates well with a five-ply tear at 5km breaking length.

Improvements and advances identified

D_0 tower retention time is between two and a half and three hours at typical production rates. Prior to optimisation the stock temperature in the D_0 tower was 65°C. The temperature was lowered to 43°C during that stage to slow the reaction of the ClO_2 with the stock. The system was designed to heat the stock in the D_0 stage. Initially the stock temperature was lowered, by using cold water for dilution, prior to the D_0 tower. But, in order to make the change more practical and enable a sustainably low temperature during summer conditions, the fiberline hot-water system was revised. These revisions enabled the usage optimisation of the hot water produced by the powerhouse and digester and sustained a lower stock temperature. With the lower stock temperature, the z-span drop across D_0 tower was reduced from 8 to 3 per cent of z span of the stock entering the D_0 stage.

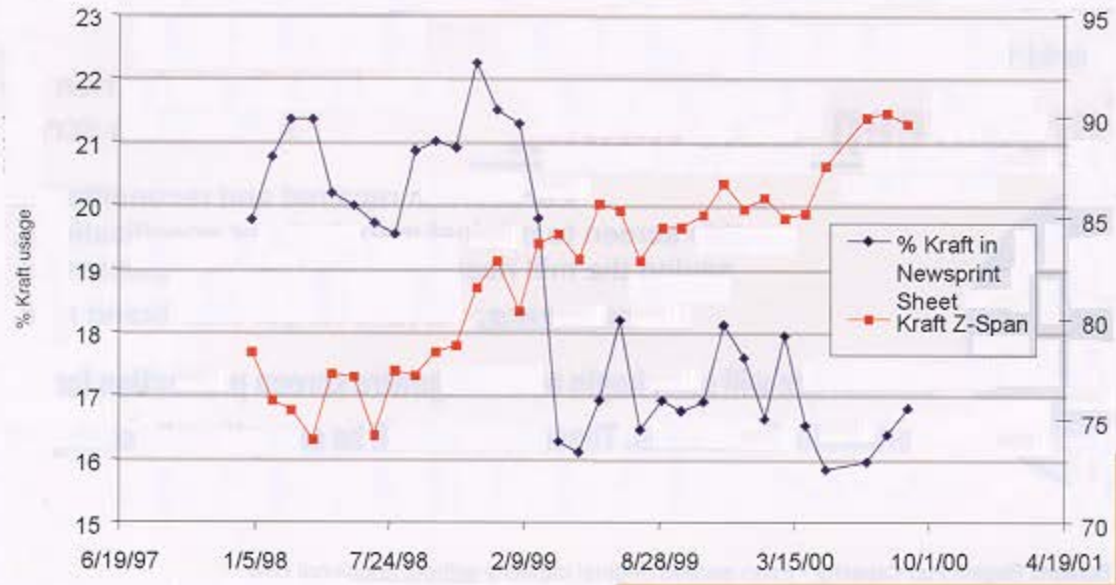
Z span was further improved by cooking to a higher kappa target at the digester. This was attempted early on and no improvement was noted. Although higher-digester kappa yielded better z spans, when measured prior to bleaching, the increased ClO_2 dosage at D_0 negated any advantage gained. After lowering the D_0 temperature, the higher z spans through the D_0 stage were maintainable.

Chemical dosages have been reduced throughout the bleach plant. ClO_2 addition as well as in-line brightness and residual sensors is controlled with online Kappa measurements prior to each ClO_2 stage. Peroxide is dosed manually however, by paying particular attention to its use, it was possible to reduce peroxide usage by over 50 per cent. Temperature targets at the E_p and D_1 stages were also lowered and additional pH sensors were installed to better control E_p and D_1 stage pH at the optimum targets. The impact on pulp strength of each of these improvements was monitored with z-span testing throughout the process.



A comparison of fir species purity and that of z span.

During this time, a separate, lower-brightness fir grade for newsprint was created. A switch from the newsprint grade by turning off the ClO_2 to the final bleach stage was made. The final stage is used simply as a wash stage. An on-line brightness analyser enabled accurate tracking and isolation of the lower brightness pulp.



Per cent of kraft usage in newsprint sheet versus kraft z-span

As a result, the newsprint grade has better met the newsprint machines' need for brightness and opacity at lower cost. It also made a slight improvement to z span. However, since the optimisation of pH, ClO_2 dosage and temperature, the ClO_2 at the D_1 stage has only had a slightly negative impact on z span. Hence product lines that use higher-brightness pulp grades have enjoyed similar strength-improvement benefits to newsprint.

Species contamination of the fir chips has a negative impact on tear strength as well as z span. Improved automation at chip-handling facilities has resulted in significantly reduced levels of contamination. The improved species uniformity has been another factor in improved z-span and tear strength in fir pulp

In addition to fir grades, Weyerhaeuser also runs a hemlock/pine mix and a hardwood grade.

Manufacturing processes improve all round

The optimisation of Weyerhaeuser Company processes has resulted in a 50 per cent increase in wet z-span tensile. Z span has been a useful tool in providing rapid feedback for individual process optimisation steps. Five-ply tear at 5km breaking length has shown a similar improvement. As a result of the improved strength of the kraft pulp made for newsprint, the kraft portion of the newsprint sheet has been reduced and replaced with lower-cost fibre. Newsprint sheet-strength properties were unaffected by this change.

Although its bleach plant optimisation work was to improve pulp strength for the newsprint grade, product lines have also benefited. Paper runnability on its fine paper machines has improved in conjunction with pulp-strength improvements. The company's bleached-paperboard machine has been able to meet board stiffness requirements at lower basis weights. Although other changes elsewhere in the process have contributed to these improvements,the pulp strength is credited as having had a major impact. ∎

Author

Ruth Stanaway obtained a BSc in chemical engineering from the University of Maine, USA.

She has worked for Weyerhaeuser Company for 21 years. Her current role is bleach plant/pulp quality process owner.