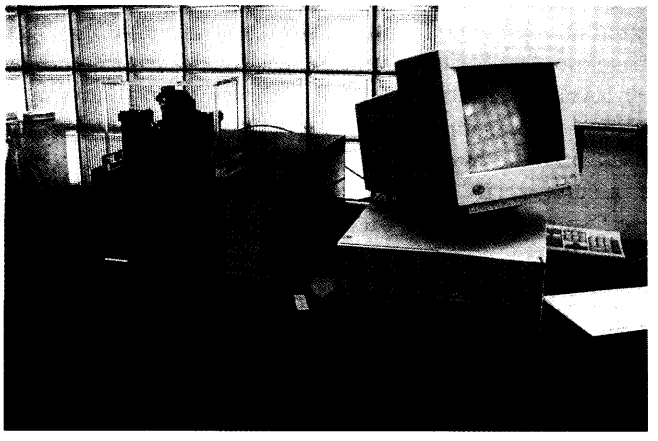
FIBER STRENGTH TESTING SAVES MILLIONS IN DOWNTIME AND MATERIALS FOR SAPPI FINE PAPER

A Michigan paper mill saved millions of dollars per year by implementing a testing system that helped lower fiber quality variation, reducing downtime and providing material cost savings. The Muskegon Business System of Sappi Fine Paper North America was previously losing up to three hours per day in wet end breaks on paper machines. Concern over strength loss made it necessary to keep pulp mill brightness to 88, requiring the addition of titanium dioxide on the papermaking side, and caused plant management to search for more accurate fiber process control methods. Management implemented a zero-short span tensile test at several different process stages that helped to reduce strength variation, thereby reducing wet end breaks significantly. The reduction in strength variation made it possible for the pulp mill to increase brightness two points, allowing for substitution of lower-cost pigments for titanium dioxide. Another advantage of this objective strength measurement was to provide a common language between pulp and paper personnel. Having this common language for papermaking quality helped promote mill-wide cooperation.



The Z-Span tester hooked up to the support computer.

Sappi produces 5 million tons of paper and more than 3 million tons of pulp annually. The Muskegon Business System produces #1, #2 and #3 products on two paper machines; the average basis weight of the papers produced is 158.5 lb per 3300 sq. ft. The pulp mill runs kraft cooking process and processes hardwood only. From the digester, the pulp goes to a four-stage bleaching process. Both paper machines have online coating systems.

In the past, the Muskegon mill monitored viscosity, residual alkali, and sulphidity every two hours and also made frequent measurements of kappa, brightness, and dirt. Even with this level of testing, pulp mill management was not confident they were predicting the papermaking quality of the pulp in terms of runnability, formation, and in machine strength requirements. Strength variation led to frequent wet end breaks on the paper machines. The difficulty in controlling strength also made it necessary to use premium materials in a number of cases. In an effort to avoid wet end breaks, the pulp mill maintained brightness at 88, so it had to use relatively costly titanium dioxide in the papermaking process to achieve brightness, gloss, and print properties. In addition, the strategy was to keep softwood content high to compensate for situations when hardwood quality was not good enough.

The indirect measurements used in the past provided fair performance when monitoring a consistent process but would, they thought, be unreliable after a major process change. Managers began searching for a more direct method of repeatably measuring the component strength properties of pulp and stock. Based on a recommendation from a sister plant, they purchased the Z-Span 3000 turn-key strength testing system from Pulmac Instruments International, which automates the process of sample preparation, sheet forming and strength testing. It includes a dewatering device that squeezes variable consistency pulp to a nominally 30% solids content cake in 5 minutes. A fluffer transforms dewater cake pulp into fluff pulp in 10 seconds. A pulp scale measures out to 2 grams of fluff pulp. A mixer and mixing jugs are provided to slurry and swell fluff pulp in another 5 minutes. A dilution jug is provided to dilute and slurry pulps to the sheet former. The automated sheet former forms 6 air-dry test sheets in 5 minutes. A paper scale is provided to determine moisture-free basis weight of test sheets. The operator then puts the sample in the jaws of the tester, which pulls the fiber apart and measures of the force exerted. The tester can perform 24 wet, dry, zero, or short span tensile tests on three test sheets in less than 5 minutes.

"From the beginning, the Z-Span provided fast, repeatable results and was able to identify process changes from the digestor all the way to the paper machine area," said Lynn Berry, quality manager for the Muskegon Business System. "The ability to accurately measure fiber strength made it possible to rapidly determine the impact of process variables on pulp quality. Using the device, we were able to isolate certain variables, such as sulphidity, blow temperature and chip blend as key indicators for pulp quality. This made it pos-

sible to focus on process improvements with a major impact on fiber strength. Engineers worked on improving temperature control and chemical balance in the digester. They changed the inputs for some chemicals in the bleach plant to get more efficiency and less degradation. The tester is very sensitive to any process changes, so it immediately provided feedback on the results of each process change. The tester also is used as a diagnostic tool in the refiner area for fiber cutting, quality of refiner plates, and life of refiner plates. During the first few months we generated enough data throughout the pulp mill to provide baseline data for each unit process and understand their overall variability. The tester is extremely sensitive to any process change, and so provided immediate feedback on whether strength increased or decreased. Test results verify the fiber strength of incoming purchased soft wood kraft pulp (SWK) and post-consumer wastes (PCW).

"The net result," Berry said, "was that we gained a greater understanding of the effect of process variables on fiber strength and were able to make positive changes in that substantially reduced to the variability in the process. One of the most important testing sites was the couch trim sample that comes off the wet end end. We determined how this value varies in response to changes in individual fiber stream. For us, the broke or internal waste content was the most critical. We set a target value for the inherent or wet zero value of the couch trim and, whenever that number falls below the limit, we reduce broke content to move it back up. In the end, this process substantially increased the process window under which fiber strength requirements were maintained. With ongoing credible feedback from the Z-Span testing system, we were able to increase wet zero values for bleached stock by 10% while reducing standard deviation from 6.5% to 3.2%. This provided a substantially larger process window for the refining operations that take place just prior to going into the paper machine. This reduced downtime caused by wet end breaks.

"As the pulp mill successfully reduced the variation in fiber quality being sent to the two paper machines, two initiatives were made possible," Berry continued. "Both the pulp and paper groups worked together in a project to reduce the costly requirement to add titanium dioxide. The pulp mill was able to increase brightness two points to 90, allowing the paper side to totally substitute wet end calcium carbinate for titanium dioxide. Before having the strength data, the pulp side would have been fearful that strength loss when increasing brightness would not have been an acceptable compromise for the paper machines. The substitution of calcium carbonate for titanium dioxide resulted in significant cost savings. In another initiative, a team from one of the paper machines was able to reduce by 10% the amount of softwood in a grade without compromising the strength specification. The previous strategy was to keep softwood content high to accommodate instances when hardwood quality was not good enough. With a more stable hardwood and credible data to track pulp strength, this safety margin was no longer needed."

Prior to installing the new strength testing system, the mill measured viscosity, sulphidity, and active alkali every two hours round-the-clock. As confidence in the strength testing numbers provided by the Z-Span testing system increased, viscosity testing was dropped in favor of the Z-Span and a consensus emerged in response to a cost-cutting initiative that composite testing only was required. Engineers and production supervisors, as well as papermachine personnel, agreed that if the z-span numbers are in line, then the whole pulp mill is running well. "The new fiber strength testing system has had a dramatic impact on our ability to supply consistent pulp quality to the paper machines," Berry concluded. "Being able to directly measure this important variable to a high level of accuracy has made it possible to substantially increase process windows, resulting in substantial cost reductions."

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