



Members of Boise Paper's J1 paper machine team for the recent cost reduction project include (l-r): Mike Sexton, process control leader; Bryan Heid, process control engineer; Willie Robinson, J1 crew leader; Jerry Yarbrough, technical services representative; Marty Parker, technology resources manager; Tim Schultz, winder operator; Rick Wittmann, product development engineer; and Earl Martin, day shift supervisor.

Paper Machine Cost Savings Project Nets Half Million Dollar Return

Project at Boise Paper Solutions' Jackson, Alabama mill focuses on shorter grade change times and reduced dryer section steam consumption on J1 paper machine.

**By Ken Patrick,
Editorial Director**

Employee ingenuity and dedication have paid off again at Boise Paper Solutions' Jackson, Ala., mill. Following an optimization project in 2002 that improved sheet quality on the mill's 39-year-old J1 paper machine (see article in March 2003 PaperAge), the J1 optimization team recently completed a cost reduction program that is yielding an annualized \$582,171,000 payback.

As with the earlier quality improvement effort, no new investments were needed to achieve cost savings of the current project, which was completed in March 2004. Operations during the past year have verified the project's success, showing that new or improved procedures and process changes implemented by the team have significantly improved throughput and efficiency of the J1 machine, which is now setting production records at levels that have not been seen before, since it was put into service during the mid-1960s.

The current cost savings project focused on reducing grade change times and steam usage on J1 machine, which performs about 132 grade changes per quarter, involving some 40-50 different grades. The mix of production includes a variety of 100% recycled cut size papers, forms bond, lightweight opaques, and occasionally some offset papers. When the project was launched, some book papers were being made on J1, but none are currently produced on this machine.

The quality improvement/optimization project of 2002 used a statistical optimization method known as MVT (Multiple Variable Testing), while the current cost reduction project employed the Six Sigma process, now an industry standard method used to identify, track, and control performance “defects” in a process. When a process is “centered” with Six Sigma, a customer’s specifications are six standard deviations away from the mean. Today, most organizations operate between two and four sigma.

Working through the Alabama Technology Network at Auburn University, the Six Sigma project at Jackson was chosen as Project of the Year by the University Economic Development Assn. (UEDA), with the award being presented at the association’s most recent annual meeting in Orlando. This was the first Six Sigma award within the Boise group, Marty Parker, technology resources manager and certified Six Sigma Black Belt at the Jackson mill, points out.

Training and Planning

Parker explains that a grant from the State of Alabama allowed the mill to send three employees to “black belt” training for the Six Sigma process and four to “green belt training.” The cost reduction project aimed at shortening grade change times and cutting steam consumption was one of those chosen by the process area “coming out of that training,” he adds.

The next step after assembling the team (comprised of 50% hourly employees) was to define the scope, goals, and objectives of the project. A detailed flow chart or map of the grade change process was put together and a failure mode and effects analysis (FMEA) was conducted to determine those items to be addressed. Data was then collected to identify the KPIVs (key process input variables) and KPOVs (key process output variables). Control charts were developed to ascertain stability of the process.

“It wasn’t possible to work on all of the grades,” Parker explains. “So pareto charts were used to identify the top 10,



J1 PAPER MACHINE

The J1 paper machine at Boise Paper Solutions’ mill in Jackson, Ala., is a Valley/Allis Chalmers fourdrinier unit with a trim width of 215 in. It runs at a maximum speed of around 2,300 fpm. J1 has been upgraded during the past decade with the addition of a suction roll in the press section along with other upgrades (mainly by Metso) that included replacement of the head-box and conversion to a two-roll calendar stack. More recently, it also received a new winder.

The newer, twin-wire J3 paper machine at the Jackson mill produces cutsize copy papers. The Jackson complex also includes a recycle plant, a converting facility, and a sawmill operation.

Headquartered in Boise, Id., parent company Boise Cascade LLC currently operates five paper mills. In addition to Jackson, the company’s mills are located at International Falls, Minn. (business papers), St. Helens, Ore. (printing papers/market pulp), Wallula, Wash. (white paper, packaging grades/market pulp), and Deridder, Louisiana (liner board and newsprint). In addition, Boise has two converting plants, five corrugated container plants, and six regional service centers (distribution) in the U.S.

based mainly on tonnages. But we also looked at the time factor because some of the grades maybe weren't high tonnage but difficulties in the grade change involving color, etc., required considerable time to get on grade." Results from the 10 selected grades would be replicated for the remaining 40 or so grades produced on the machine.

This took the team through the "M" stage of the Six Sigma DMAIC (define, measure, analyze, improve, and control) approach. Various statistical methodologies were used in the analysis stage, and box plots were constructed for each of the mill's four production shifts as a baseline for measuring improvement. Root causes were identified and numerous types of graphical analyses were used in communicating the changes and/or improvement to the department and management.

Part of the control stage involved sharing best practices across all shifts so that operations as a whole was included. "This sharing was a critical part of the project. It played a very important role in our success," Parker emphasizes.

Reducing Grade Change Times

Figure 1 is a Pareto Chart showing average grade change times and number of grade changes for the top 10 grades used in the project. The objective in reducing grade change times was to reduce the amount of off-spec or "twilight" production. "But throughout the project, we made sure no quality parameters were degraded in any fashion, and we were very successful in that regard," Parker says.

Several factors were involved in shortening the grade change times. Willie Robinson, J1 crew leader, points to

changes in procedures for controlling dyes and additives. We established some ballpark figures with additives for certain grades and that information was passed on to other shifts. Every time, then, we were able to reduce the time a little more, just by that information alone."

Earl Martin, J-1 Superintendent, adds that "we also improved our preparations in getting ready for a grade change. We looked closely at how we were setup for a grade change and made some needed adjustments. Having everything ready to go into the system just when we needed it helped knock a lot of time off the process. As the different shifts did these sorts of things and passed the data on, all shifts were soon doing it the same way."

Tim Schultz, winder operator, explains that "we set up what could be called a recipe sheet for each grade. The various shifts then ran to these parameters using their own individual operating techniques, e.g., how they built a reel, how they controlled steam at the backtender station, etc. We then combined results based on these different approaches and picked out those that worked the best in regard to what we were trying to accomplish.

We would progressively narrow parameters as we did runs on each grade. So we kept fine tuning until we got to the best times."

Parker adds that process mapping, sequencing of grades, and sharing the evolving "recipe" sheet information across all four shifts "allowed us to work to the same sheet of music, so to speak. Behind the scenes, the shifts were doing FMEA analyses to find failures and determine what were the most

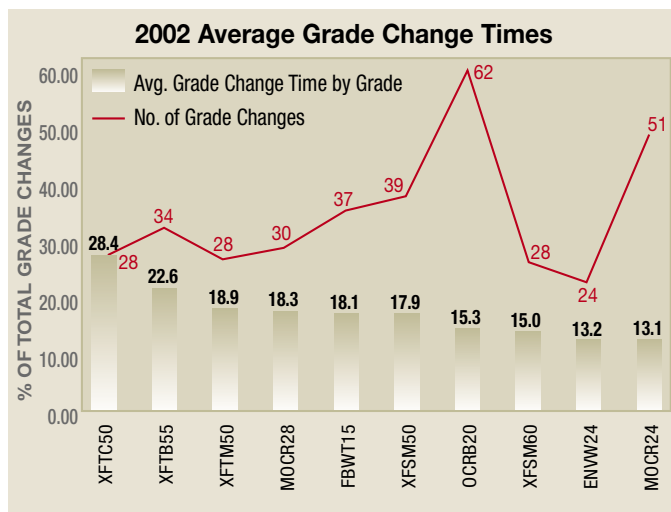


Figure 1. Pareto chart of average grade change times on J1 paper machine's top 10 grades prior to launching the change time reduction project.

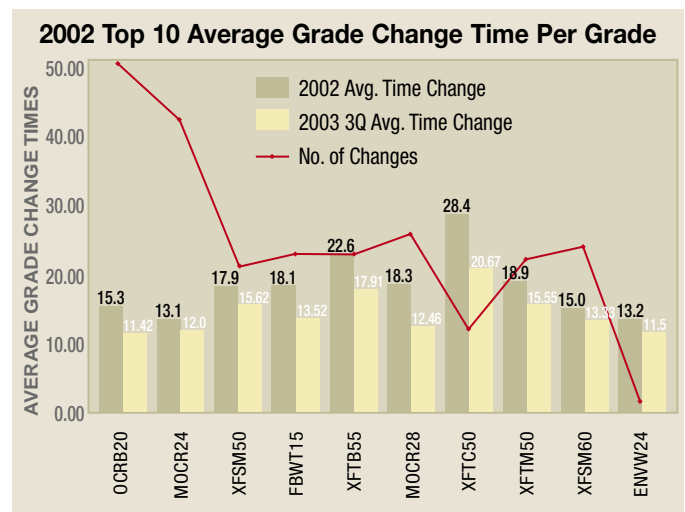


Figure 2. Pareto chart of 2002 grade change times versus third quarter (year-to-date) 2003 after the change time reduction project had been underway for about a year.



Marty Parker

important things we needed to address. They weren't just passing on irrelevant information."

The project goal was to reduce average grade change times by 25%, or about 3.8 min for non-book grades (15.3 min down to 11.48 min) and 5.5 minutes for book grades. The project achieved an overall 19% reduc-

tion, cutting grade change times for non-book grades that J1 currently produces by an average of almost 3 min. "The 25% was a very ambitious goal, and achieving 19% was quite an accomplishment," Parker says.

Figure 2 compares average grade change times for the top 10 grades in 2002 before the project was launched versus those through the third quarter of 2003. The project was completed in early 2004 and has now been in full, on-going operation for approximately one year.

"The cost reduction project was wrapped up in March 2004, but it's on-going. We are still improving some of the procedures and enhancing the process wherever we can."

—Marty Parker, technology resources manager

The grade change part of the project resulted in an annualized \$88,000 savings. The portion of the project involving reduction of steam to dryer cans on the machine resulted in a \$494,171.00 savings, bringing the total to \$582,171.00, as reported above. The project goal, or total potential annualized cost savings, was \$664,000.00.

Steam Reduction

An integral part of reducing the grade change times, Bryan Heid, process control engineer, explains that the steam savings portion of the project involved modifying—"actually overhauling"—internals of the program that executes the mill's auto grade change process.

"We carefully reviewed the grade change control model and found that it was lacking in several places. Working with our gauging service supplier, IKON, we basically rebuilt the entire model so that steam is delivered more consistently. We looked at a lot of dynamic data—response times, lags, mois-

ture, swings, etc., and based on those data we were able to correlate a medium point for moving the valves a little faster at the base regulatory (our DCS), which made delivery to the dryer cans quicker, getting us on grade much faster. This dropped our overall steam demands at the same time.

"So we made two basic process changes—to the base regulatory system (how the steam valves move) and the supervisory control system (auto grade change) based on dynamic values coming into the gauges," Heid continues. "We also found some innovative ways to adapt controls to technology already existing at the mill to more effectively trim our overall steam consumption."

A "cultural shift" of sorts was also involved, Heid notes. Most operators are accustomed to doing whatever they need to do to get on grade as soon as possible, he says. "In this case they had to become more hands-off, to wait and watch the system. Of course, if the system got too far 'off course,' they knew to knock it out of automatic and do what was necessary manually."

Parker adds that "basically we changed the system to be more robust in regard to when steam comes into the dryers based on the grade—to make it more optimum. The idea is to be sure we have less steam when we don't need it or increased steam when it's more appropriate. This way, instead of having a steep transition, we have more of a level, linear approach."

The project target for temperature reductions (steam consumption) was also 25%. The achieved improvement was 23.25%, which Parker again emphasizes was a very ambitious target and a highly significant accomplishment.

The Power of Teamwork

As Jerry Yarbrough, technical services representative, puts it, "the success of this project and others at this mill is due in large part to the workers who serve on the teams. The J1 process improvement team is made up of half salaried and half hourly personnel. But we really don't consider whether we're salaried or hourly. We're just some guys on a team trying to do a job, trying to make improvements by working together."

"The cost reduction project on J1 didn't involve rocket science. People get so caught up in daily routines that they sometimes lose perspective. All we did was back up and look at the big picture. It was really a matter of changing some basic things that, when you look at it as a whole, you



Jerry Yarbrough

realize should have been changed all along. One simple change might not fix a problem, but a combination of several will come together as a web and generally produce solutions,” Yarbrough says.

Robinson emphasizes that “communications is the whole nine yards. The key to this project was

weeding out variations in what we do, and then passing that information along to the next shift. It’s important not to keep things locked down,” he says. “They have to be shared with co-workers.”

Rick Wittmann, product development engineer, agrees with the importance of communications, adding that it is the No. 1 factor in creating teamwork. “Working together, we all have a common goal which, in turn, becomes the focal point for a group.”

According to Mike Sexton, process control leader, the outstanding cooperation between departments and shifts not only allowed critical information to be shared, but provided forums for misunderstandings and frustration to be worked

“In the past, if you knew how to do something well, people came to you for information and help. This made you a very important person. Knowledge was power. Today, that power is being shared among everyone at this mill”

—Jerry Yarbrough, technical services representative.

out. “There were a few meetings involving some heated discussion about certain things not working right, etc. We were able to work through those difficulties and get to the heart of our real problems by working together. Once all of the data were on the table, we made progress.”

One other key factor behind the successful cost reduction project on J1 was support by company management, Schultz says. “Any time you take on a project of this size that involves money and machine runnability, you have to have the support of top management all the way through. At Jackson, we had that.” ■

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