THE TRADEOFFS: FINISHERS AND CONVERTERS ENCOUNTER SPEED

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SPOTLIGHT ON WINDERS, CALENDERS/SUPERCALENDERS SHEETING/FINISHING, AND WAREHOUSING/SHIPPING

IN THE CONTINUING SERIES OF TAPPI JOURNAL *Technology Spotlights, this article is dedicated to paper machine speed as it affects finishing and converting operations. The contributors to this roundtable represent several TAPPI Sustaining Member companies specializing in finishing and converting operations. Questions were posed to stretch their imaginations to look into the future of increased paper machine speed as it affects their equipment specialty. The questions relate to winding, calendering, sheeting and finishing, and warehousing and shipping.*

The "what if" scenario of paper machine speeds in the zone of 10,000-12,000 ft/min garnered responses citing opportunities and complications that stretch process and design considerations of existing equipment. The experts provide practical technical insights as they expand the discussion to include considerations beyond speed.

Contributors are listed under their equipment specialty.



One crew can operate two of these high speed-fully, automated multistation winders.

WINDERS

Respondents include: ***Black Clawson Converting Machinery LLC***: R. Duane Smith, product manager, unwind/winding/slitting systems; ***Beloit Lenox***: Rudi Deeg, marketing manager, Don Gangemi, product development manager, and Bob Lucas, senior scientist; ***Valmet***: Michael J. Daul, product manager-winders, and Jon Boulton, production manager (Atlas Group).

TAPPI JOURNAL: ***Are winders a critical limit to paper machine speeds? Since winders must be faster than the machine, can current designs be upgraded, or will new designs be needed?***

Beloit: Winders may critically limit the paper machine's speed if they are unable to keep up with production. Not only is the winder as critical to the productivity of the paper machine as any other contributing element in the process, it also defines the final quality of the mill's product. If the best sheet on the reel is wound into poor-looking and poor-running rolls, all the quality effort upstream in the process is irrelevant.

If the paper machine's speed were to double immediately, taking into consideration today's existing and developing technologies, multiple winders are the only solution. Not only two per paper machine, but—depending on the grade and the winder—possibly three, as it proves enormously expensive to shut down a paper machine producing a reel every 20 to 30 min or so. Experience in the mill shows that if you put the crew under pressure with reels accumulating in the aisle, quality suffers because there is no time to make adjustments for web variations or to slow down to "nurse" problematic paper off the reel to the wind-up.

Having experienced winders producing up to 10,000 ft/min for a number of years, we suspect that the optimal production speed of today's winders is below 10,000

ft/min, rather than above. Some paper mills in Europe and North America recognized this years ago and put two winders behind one high-speed paper machine, or three behind two paper machines, to provide and ensure consistent roll quality.

The new designs of two-drum winders running 12,000+ft/min will look drastically different from today's winders. First, they will be designed to eliminate machine vibration and prevent roll bouncing. Second, the winder designs will have the ability to optimize the winding geometry as the roll diameter increases. Third, the winding systems will be automated to provide the much sought after one-man operation. Beloit has recently introduced a winder concept in the BelWind VG™, which is well on its way to realizing these goals.

Prevention of air entrainment at these high speeds, particularly with non-porous grades, will present a challenge, and very possibly become one of the limiting factors to increasing speed. With more persistent air films adhering to the surface of the web, the entire web-conveying technology stands to be redesigned, particularly in the attempt to stabilize webs traveling under light conveying tensions.

Along the same line will be the ability to remove the trim effectively. Air conveying will become less efficient and considerably louder than present government standards allow.

The only slitting system suited to the projected speeds would be the old standby mechanical shear slitting. However, knife diameters, larger than those used today, will be needed to accommodate mechanical and electrical drive limitations, as well as maintain life expectancy.

Black Clawson: The quest for higher paper machine production speeds poses challenges to different parts of the papermaking process depending upon the grade produced. On some grades, speed is limited in the formation process, while in other grades, speed may be challenged during the pressing or the drying process. The critical link in achieving faster machine speeds in the production of lightweight publication grades is found in the slitter/winder operation. These grades are now produced at speeds up to 5000 ft/min, and 6000 ft/min production speeds are on the horizon. However, to meet the challenges presented by these speeds, the maximum winder speed is only one consideration. Special attention must be paid to the nonwinding functions of the slitter winder operation. These nonwinding functions include the wound roll set change time, the reel change time, the slitter change time, and the control setup for different winding parameters change time.

Valmet: On some existing paper machines, particularly newsprint, where the mill has only one winder and considerations such as building layout make it difficult to add a second winder, then the winder becomes the paper machine's critical limit. In much of the world, mills have already accepted the use of two winders for one high speed paper machine, or three winders for two paper machines.

In the case of existing paper machines and winders, where newer technologies to increase both speed and efficiency are incorporated, the winder becomes the bottleneck. If the existing winder is of a modern design, upgrades may further increase capacity. This capacity increase, in some cases, can be automation of manual tasks; but most of these winders already have automatic set change, auto-positioning slitters, etc. Today, we are seeing capacity increases by means of control automation-increasing the winder efficiency.

For new paper machines, it is becoming accepted in North America to purchase two winders. With two winders and the paper machine speeds of current deliveries, winder capacity is not a critical issue.

New winder features, including both task automation and control automation, allow a single winder crew (or even a smaller crew), to efficiently and safely operate two automated winders. The newest winder designs over the past few years have successfully combined the automation/capacity features and increased winding process capabilities.

With new automation technology on the horizon, it is only a matter of time before a market for these features and final designs is established. At this point, capacity gains through automation and efficiency are modest without quantum leaps in running speed. Two fully automated winders (i.e., the operator oversees the operation while the winder runs continuously until either a web break or out of parent reels) of the near future, running at 8000-9000 ft/min will adequately support the production of a 12,000 ft/min paper machine running at 95% efficiency.

From a converting viewpoint, we are asked to produce high speed center winders for pressure sensitive grades and customer stock size rolls directly at the source. This is to cope with the increasing machine speeds and advanced coating technology.

TAPPI JOURNAL: ***Are current tension controls and sensors adequate for winding at 12,000+ ft/min? What changes might be required?***

Beloit: The web control systems at present, with 8500-10,000 ft/min, are only marginally satisfactory and need to be radically improved for the speeds considered here.



This converting winder features a console with integrated graphical user interface (GUI) diagnostics to control the tension, nip load and torque.



New multinip technology, when used in an on-line application, approachs supercalender finish while keeping pace with the latest papermachines.

In addition, the wound-in-tension in the reel must be reflected in the torque, nip and tension operating parameters in the winding process.

Controlling the enormous masses and inertias of the considerably larger and faster rotating equipment will be a daunting task. An unwind regenerative motor designed for accelerating and decelerating 60+ ton reels will also have to control 2 pli +/- 0.1 pli in all running conditions, with perfect inertia compensation. It is not obvious just where the line is, but if the time it takes to tune and retune a new drive is any indication, we are fighting these limits right now.

The visco-elasticity of the paper puts a cap on how fast we are able to wind and control the correct wound-in-strain in a roll structure that supports the roll over its entire life, i.e. winding, transportation, storage, and finally, running faultlessly in the printing press with the residual tensions left in the roll.

Black Clawson: The drive controls must be efficiently accurate and responsive to allow high acceleration and deceleration rates under constant tension control. Even the present 8000 ft/min winder with all the automation of the nonwinding function and most sophisticated drive control systems will be challenged to meet the higher product speeds of the paper machine. These highly automated winders still require that the slitter winder speed be a minimum of 1-1/2 times the paper machine speed.

Valmet: With intelligent digital control principles and sensors, it is possible to run the winder at very high speed with adequate tension control. Limitations will be in winding process and web control. Web profiles need to continue to improve, web defects must be reduced, and reel structure optimized.

Within our converting division we are producing a tension control system, which operates in conjunction with load cells or with our dancer tension control system. This is tried and tested up to 8200 m/min.

TAPPI JOURNAL: ***What must change in the winder and slitter operations to handle a paper machine putting out twice as much paper per day?***

Beloit: To optimize the operation, a number of things can be done using current technology, providing the decision has been made to add a second winder. This winder should already be specified to go as fast as proven and available technology will allow. Examples of such optimization include the following:

- Increase reel spool diameter, enlarge unwinds and drive capacities to accommodate larger reels, which is one of the most effective time-saving measures. It is extremely important that the reel be kept round and concentric on its way to the winder, to avoid limiting the winder's running speed.
- Consider automatic splicing at the unwind, particularly if unable to enlarge the reel's diameter.
- Provide adequate manpower and facilities to help safely expedite clean-ups after breaks, which, to begin with, may be more frequent and severe at these elevated speeds.
- Automate core preparation and injection.
- Automate threading.
- Review and optimize splicing at both the unwind and rewind.
- Review and optimize reel and spool handling at the unwind.

- Automate set change.
- Dedicate a winder, if at all possible, to wind jumbo rolls exclusively, in order to lower set change related downtime.
- Paper quality will be, to a large part, a contributor to the success of high-speed papermaking. The most overt paper problems that can slow down the winder are caliper or basis weight variations in both cross-machine and machine direction. It is the harmonic content in the machine direction, manifested in barring, which contributes to vibration problems in the paper machine, as well as encouraging multiple modes of vibration in the winding operation. The papermaker should put great emphasis on minimizing both of these phenomena.

It goes without saying that today's paper mill, facing a sudden onslaught doubled production, would stop almost within minutes, as none of the existing roll handling systems are able to manage this kind of production.

Black Clawson: To meet the future higher paper machine production speeds, new approaches must be taken. One of these new approaches eliminates the off machine slitter winder operation.The new advance technology machine winders need to incorporate the ability to slit and wind shippable quality rolls right on the process line. Customers' small core requirements presently limit the inline slitting process. New advancements in winding technology are being worked on to allow winding large diameter slit on small diameter cores inline with the process. In my opinion, the development of this inline slitting and winding equipment that will make shippable quality rolls on the customers' required core sizes is the most effective way of meeting the challenges presented by the higher paper machine production speeds of the future.

Valmet: With today's winder designs—depending on paper grade and roll size—it is possible to follow a paper machine speed of 7200-9200 ft/min (2200-2800 m/min) using two of our most efficient winders.

The fastest newsprint machines are now over 5300 ft/min (1600 m/min). If this were to double (some day) with current winder offerings, three winders would be needed.Two winders would produce only modest gains.

Winder technology is always improving. By the time paper machines run at twice their current speed, we will have equivalent winder technology for two winders to support them. For example, through a capacity calculation for a high speed newsprint paper machine, we determine that two fully automated winders running at 8000 ft/min will support a 12,000 ft/min newsprint paper machine. Most of this automation technology is currently available. It's just a matter of time for market requirement and acceptance.

In the future, expect winder speed to increase somewhat, but speed is not the most critical factor.Winder run time and efficiency is more important. Improvements in winder automation will continue, but the capacity gains over today are on a downward sloping curve. Web breaks and defects are the capacity limiting factors of the future that need to be addressed.These not only require improvements to the winder, but also emphasize the importance of web quality reaching the winder.

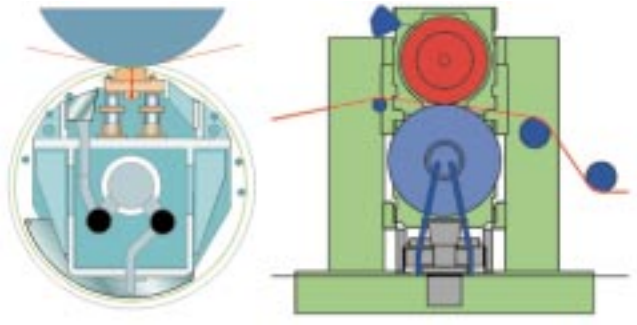
Another factor is wound roll diameter.We need to see a substantial increase in the smallest roll diameters that mills ship. Roll diameter must increase well beyond the current 50 in. standard. Rolls of 58-60 in. and larger diameter on printing grades can already be produced with the latest winder technology.

With the same capacity calculations we used in the previous example, one fully automated winder at 8000 ft/min could support a newsprint machine running at 5840 ft/min if the winder made 50 in. diameter rolls. But if the wound roll size were increased to 60 in., the newsprint machine could run at 6175 ft/min comfortably—an increase of 6% in paper machine speed. A fully automated winder will include the following capabilities:

- Reel spool handling and changing
- Full width web threading
- Automated core handling
- Tail fastening to cores and of the finished wound roll
- Back splicing with butt joint device (commercial quality)
- Trim change
- Set change

And then, of course, you could always buy an extra rewinder!!

The same is true with converting winders. The set change and roll handling time are the governing factors. As a machine builder we have been forced to increase winder automation, rather than winder speeds and are now able to offer some of the most sophisticated fully automatic winders available, including the use of robotic roll transfer. Always wanting to avoid the one factor that kills all productivity calculations—downtime.



The shoe calender concept (left) is based on the well known shoe press roll, but in a new setting on the papermachine (right) will provide smoother finish at higher speeds.



The full weight relief achieved with separate relieving cylinders for each roll allows advanced multinip calenders to achieve the same surface characteristics at higher speeds.

CALENDER/SUPER CALENDER

Respondents include: ***Kusters Beloit LLC***: Mark Sorenson, director of operations; ***Valmet***: Jim Berceau, technical manager, Rex Robertson, production manager-calenders and Martti Tuomisto, business manager.

TAPPI JOURNAL: ***Are calenders in their present form capable of speeds of 10,000-12,000 ft/min?***

Beloit: Calenders, or any other rotating pieces of equipment, are fundamentally capable of operating at these high speeds. However, to meet final sheet quality requirements, the process variables of calendering, which include time, moisture, temperature and nip intensity, will need to change.

Valmet: The answer is "yes, in principle" but there are many technical challenges. Machine runnability at these speeds will be the key issue, which would favor as few nips as possible and some straight-through sheet runs. However, calendered paper finishing requirements require more nips, or a more intense nip effect, as the speed increases.

If we look at current on-line soft calenders, theoretically the designs support high speed use with appropriate dimensioning. There are three major areas that will require changes/development: threading, heating, and roll diameters. These are covered in the answer to the next question.

On-line multi-nip calenders can be run at high speeds, with the same development areas required in soft calenders, relating to polymer covered roll diameters, etc.

Off-line calenders are not currently capable of running at the 14,000 ft/min necessary as a batch process supporting a 12,000 ft/min continuous process. However, you shouldn't have to. For a paper machine running at 12,000 ft/min at 95 % efficiency, you would only need two off-line advanced multi-nip calenders running (well within their current capabilities) at 6700 ft/min at 85% efficiency using unwind (UW) and wind-up (WU) autosplicing. Autosplicing is currently being used at splicing speeds in excess of 1200 ft/min. The off-machine coater also has these speed requirements, and we are developing new methods of high speed splicing such as gap splicing, etc.

TAPPI JOURNAL: ***If not, what are the limitations and what needs to be done to overcome those limitations?***

Beloit: The technology to run calenders at these speeds is physically possible. The limitations of the current configurations are based primarily around sheet handling and energy usage. To overcome these limitations and meet these speeds, sheet handling needs to be completely automated and open draws must be minimized. In addition, the cost of power would be a concern. Because power input is not linear with the increase in speed, but rather a function of the speed squared, a machine running twice as fast would consume four times the energy with today's technology. Developments in this area will overcome such limitations to make these speeds possible.

Valmet: With the increasing speed, the heating capacity becomes critical. Also, polymer roll covers face new challenges as the loading needs to be increased while the nip cycles get more frequent.

An interesting development for some grades, such as fine papers and newsprint, is the shoe calender. As the shoe has a constant width, the nip dwell time is controlled independently of the nip pressure, providing an opportunity to reach the required paper finish and structural characteristics at higher speeds.

In the on-line (soft or multinip) calender case, the difficulties fall into three categories: high-speed on-line threading, adequate heating of the paper and protection of the polymer roll covers.

We could dispense with high-speed threading by using the same magic that would allow the paper machine to run at 12,000 ft/min. However, we are currently looking at some alternatives for high speed threading involving belts that show great promise for upcoming deliveries of fast paper machines.

The second development area would involve heating the paper to achieve the same smoothness and gloss at a doubled speed. Since the paper dwell time in the nip is half as long, the heating would need to be roughly twice as high/effective. The most obvious methods would involve either more efficient peripheral drilling, although modern thermo rolls are already quite efficient, and higher/more efficient heating transmitted to the heated rolls. The shoe or belt calender, with their extended nips, might also be able to address this issue.

Thirdly, polymer rolls have certain properties that must be respected. They will need cooling time during each revolution. Also, after being compressed in the nip, they need to expand to their full size before being compressed again. This would be possible with substantially larger diameter rolls. To get the same amount of "cooling off" time for the polymer roll at twice the speed, the circumference (and therefore the diameter) would need to be doubled. Again, this would "magically" not be a problem, because the cranes, investment costs, spares cost, etc. necessary for these large diameter rolls would have already been accepted and undertaken for the same type of rolls that would be necessary in a 12,000 ft/min paper machine.

Examples of other challenging areas to overcome, both on the paper machine and the calender, include roll critical speeds, bearing lubrication and life, doctoring at very high cycles per minute, dealing with the aerodynamics of high speed threading, break detection and wrap prevention, tension and draw control, etc.

In the off-line case, the speed of existing supercalenders can be increased by upgrading to multinip technology, such as: full weight relief for each roll to maximize calendering potential in all nips, polymer roll covers to reduce downtime for roll changes, steam heated intermediate rolls for high temperatures, driven rider roll, and full (UW and WU) autosplicing.

TAPPI JOURNAL: ***Will supercalendering work at these high speeds? What are the challenges? Will it be possible to match the tension, friction, and heat necessary for supercalendering at 10,000-12,000 ft/min?***

Beloit: Supercalendering paper is a process dependent on the rate of change of loading on the sheet and time in which the sheet is exposed to an elevated temperature. A conventional supercalender is limited by filled roll technology. However, new technology in composite rolls and new technology in the multi-roll calender area, like the ProSoft™, will allow these high speeds given some configuration changes and the proper sizing of components. At these speeds, sizing of most components in the process will require modification to accommodate the process parameters needed to make a quality product. Our vision is that most calendering will be located on-line, but the economics may dictate another approach.



This mill uses only two off-line advanced multinip calenders to do the work of three traditional supercalenders following their world class LWC paper machine.

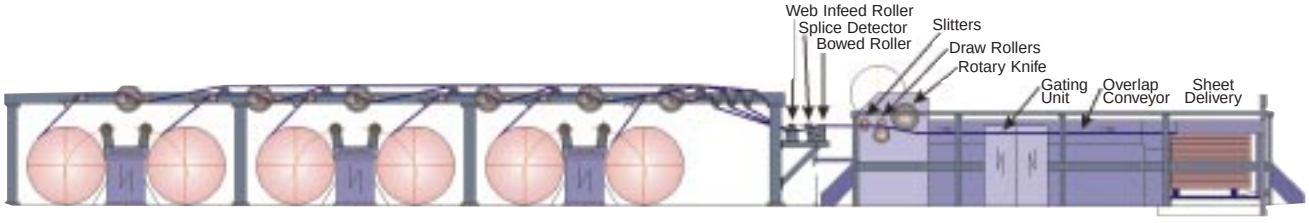
Valmet: Traditional supercalenders with cotton-filled rolls have no chance. But the new multinip calenders offer significantly higher speeds than before. The key element in achieving high quality and structure while running faster is through uniform nip loading via the stack. This means that the top nip is loaded at exactly the same load as the bottom nip.

Web handling, tension control and threading will be the main runnability concerns at high speeds. Rapid progress is being made in these areas. For example, the new LWC machine at Haindl's Augsburg mill in Germany will have a design speed of 6600 ft/min. The new machine will have an on-line, 8-roll multinip calender. We expect the speeds to increase step-by-step with every new machine order.

SHEETING/FINISHING

Respondents include: ***Marquip Inc.***: Charles Q. Treichel, vice president, Madison operations; ***Will-Pemco Inc.***: Alan Ambridge, senior vice president sales & marketing; ***Valmet***: Steven Brimble, production manager, sheeter sales (Atlas Group).

TAPPI JOURNAL: ***Can current sheeting/finishing operations handle the increased load with upgrades of current machines or will physical expansion and additional machines be the better option?***



This high speed sheeter can be equipped with unwind flying splices and automatic pallet changes to further increase capacity.

Marquip: In regard to operating speed, the current "state of the art" for board folio sheeters is about 1200 ft/min. But keep in mind that represents just one narrow set of operating parameters and has little to do with what happens in practice.

The average running speed of a sheeter in production is brought down by many factors including: 1) set-up time, 2) discharge cycle, 3) knife speed curve as related to sheet length, 4) deterioration of accuracy and quality at higher speeds, and 5) ability of the operator to keep up. It is not unusual to walk into a plant and see 1200 ft/min sheeters average less than 60% of this goal.

The technical improvements that separate high performance sheeters from the rest of the field have more to do with increasing the average speed than raising the maximum speed. I would not expect dramatic increases to the current maximum speeds in the near future.

The demand for new machines will be driven not only by production needs but also quality. Accuracy of the cutoff and trim in addition to minimizing dust are real demands created primarily by printing requirements. Inspection and elimination of defective sheets translates to less trips and higher output from presses. On top of this, management demands more accurate production tracking and reporting. Because of these factors, I would expect a continuous demand for replacement of obsolete technology.

Will-Pemco: Looking at the American fine paper industry, most machines in operation today are running the maximum grammage under the knife. So, the possibility of adding additional backstands per more webs does not appear to be practical. The alternative is to increase linear speeds. On cut-size equipment, however, the speed is governed not by paper handling but by the physics of the discharge and collating area. While we have been upgrading many cut-size sheeters to higher operating speeds, the concept of doubling the speed is beyond any possibilities. For cut size, the tendency has been to go wider as well as a little faster to achieve greater outputs. We are already manufacturing the world's first 15-pocket cut-size sheeter that will be installed and operating in Europe by the end of 1998.

For folio sheeting, today's machines operate with electronically driven cross-cutters and the cut off length is selected through the drive. There are mechanical limitations to the output speed of folio sheeters based on cut off length and the possibility of doubling those speeds or even making a significant increase are very remote indeed. To handle dramatically increased output on existing paper machines, for the foreseeable future, the only possibility is to add further sheeting and finishing capacity.

With regard to packaging equipment, the vast majority of cut-size sheeters are already equipped with twin packaging lines and with both lines in operation, the packaging equipment is capable of handling the existing output of the sheeters with a reasonable margin for safety. It can therefore be seen that the packaging equipment is not a limiting factor on a cut-size production line.

In order to handle higher speeds and certainly to operate the wider cut-size and folio sheeters, it is essential that roll quality is at the highest level. This is in regard to both profile and rewinding consistency. There are many ways that existing production lines do not achieve their full potential and among these are:

- Rolls of uneven meterage, poor runnability by bad winding, creasing etc.
- Mechanical downtime due to lack of maintenance or insufficient spare parts
- Narrow reeels caused by machine deckle and edge damage
- Size and spec changes caused by inaccurate production planning or sales pressure of quick delivery
- Backstand under utilization caused by damaged reels, small orders and poor planning
- Low sheeter running speeds caused by poor maintenance or product quality.

Where these factors are eliminated, improved output is possible. It would be unrealistic to suggest that even in the worst cases, improvements of greater than 20% would be possible.



Accurately controlled, repeatable cuts at high speed frequently requires a new sheeter rather than a rebuild.



Cradle stops and a turntable with cushion and a short pitch steel slat conveyor change the roll orientation requiring a minimum of space & equipment.

Valmet: Sheeters can undergo limited upgrades provided the basic design is sound. Most upgrades involve main drive or cutting head replacement. Apart from these areas, very few reputable companies offer upgrade services due to the cost of "one-off" engineering, and the potential for start-up problems. Generally speaking, new machines offer far better return on investment as prices for capital goods are currently very competitive.

Roll finishing systems are always affected by a major paper machine rebuild. The following paragraphs review two different scenarios—an upgrade for more production of the same grade or a change in grade:

More production

More production of the same grade often means increased roll count, which in turn can result in bottlenecks in the roll handling, wrapping, warehousing and shipping areas. (Warehousing and shipping solutions are covered later.)

In some cases, the paper machine upgrade can include a second winder to keep up with the rebuilt paper machine—integrating the new winder may be challenging and often involves a reel cart in addition to roll handling (conveyor) equipment. Interfacing the roll flow from a second winder into the rest of the roll handling system should take place using the proper principles of roll handling such as avoiding excessive amounts of rolling (especially backwards), kick-offs and cushionings of the unwrapped roll.

The components in the existing roll handling and wrapping chain need to be thoroughly analyzed for the increased roll flow. Conveyors can be sped up where needed. Winder discharge areas can be furnished with segmented deck stops and set cushion stops to increase efficiency and operator safety.

One way to safely keep up in the wrapping area is to increase automation. Automatic head inserters and labeling may be added to an existing system. Often, however, it is just not feasible to rebuild an old wrapping line, due to its age and base technology or due to the down time required for installation of the rebuild—a new one rather than an additional roll wrapper is the choice. Justifying a new roll wrapper is often difficult. From the management point of view, one roll wrapping facility—the centralized concept—is the preferred way to go. Two separate facilities are too labor intensive. The automation and central finishing concept is also applicable to board grades, even in grades that don't require wrapping. (There are several recent examples at linerboard mills where the finishing processes have been relocated into one central area for better capacity, safety and operating economy.)

Grade change

Take an example from newsprint to value-added grades such as SC or LWC: Wound roll density changes drastically from newsprint to SC or LWC—the increase in density can be more than 60%! Offset rolls are roughly the same size as newsprint rolls, so there will be no size issues, only a roll weight capacity check for all roll handling and wrapping equipment. If the grade spectrum extends to rotogravure grades, the changes are likely to be more extreme since rotogravure presses require very wide rolls. Today, there is one 136 in. wide rotogravure press, with two more on order in North America; specifications for new rotogravure grade roll handling lines are for 150 in. wide rolls weighing 8 tons! This effectively means a total replacement of the existing roll handling and wrapping system. Heavy rolls require special handling techniques. New equipment was developed for better handling of these large and fragile rolls; new smooth cushioned roll stops, cradle stops and short pitch steel slat conveyors now exist, which have proven to be beneficial concepts for just about any paper grade.





A clamp truck with turning attachment (left) illustrates a basic roll handling approach, while the sorting deck (right) with five lanes exemplifies the state-of-the-art in grouping rolls for efficient clamp truck handling.

The requirement to wrap wide rolls has resulted in a new overlap style roll wrapping method whereby narrower, more available wrapper stock can be used to wrap rolls, without the need to subject them to excessive turning at the wrapping station. Overlap wrapping combined with a continuous heat sealing wrapping process gives a compact wrapping line with superior package quality and strength. Wrapper stock for the continuous heat sealing process is one side polyethylene coated liner. This type of wrapper is recyclable for use as a source material for a core board furnish.

Roll labeling set up may also change to reflect the different market of the new grade. Use of special preprinted wrapper stock, or end band stock to distinguish the new grade from the competitions' products, are often used in conjunction with a grade change.

TAPPI JOURNAL: ***What changes might be needed to handle both speed demands and grade/quality demands from customers as they adapt new technology?***

Valmet: With respect to sheeters, in our opinion, speed is a factor but output is much more important. That may sound strange, but we have found that speed is rarely the key factor governing output, except in mills with extremely large single set-up order tonnages. The secret is to keep the machine running with automatic pallet changes, and in some cases flying splice unwinds. The time required to change sizes must also be minimized. There will always be mills looking for the traditional "upper cutter," however we feel the growth area will be in the quick change, highly flexible and efficient market area. That is where our development is heading.

Regarding roll finishing, adaptation of zero defects quality policies have also had an impact on how the rolls are wrapped and the wrapping materials used.

A change in grade, for example rotogravure, will generate an increase in roll size—and bring changes in the entire chain all the way to the end user. This requires upgrading the existing roll handling system and logistics to handle the heavier roll loads. Techniques such as clamp attachments and rail cars may be necessary. This is covered in more detail in the Warehouse/Shipping section.

WAREHOUSE/SHIPPING

Respondent: ***Valmet:*** Jukka Linnonmaa business manager

TAPPI JOURNAL: ***If production of paper doubled, could most modern warehouses handle the load?***

Valmet: The warehousing and shipping area and the operations there are rarely ready for doubling production.

TAPPI JOURNAL: ***If not, what changes would need to be made to improve the situation?***

Valmet: There are several ways to improve roll handling in the warehouse and shipping areas, all depend on the starting point. Both space and the equipment concepts should be considered. There are still a large number of mills where the roll handling system brings each roll to the warehouse/shipping area on its bilge to a kick-off point where the roll is ejected onto the floor. A clamp truck with a turning clamp attachment is used to pick up the roll. After pick-up, the roll is turned upright by the clamp mechanism and delivered to the warehouse or shipping. The floor pick-up method is both inefficient and tends to damage the roll. A very popular rebuild item is a label orientor, upender and storage conveyor. Now the rolls are presented to the clamp truck driver in a per-

fect manner, resulting in faster operation and less damage to the end product.

The next upgrade is a sorting and grouping system where the roll flow is automatically sorted and grouped/stacked into clamp truck loads belonging to the same customer order. This can be combined with twin roll clamp attachments whereby a clamp truck can carry 6 rolls (a "six pack") at a time—we are talking about major improvements in capacity and safety!

There are different sorting systems available: pairing pockets, sorting ramps, automatic storage and retrieval systems for different needs, capabilities, cost and degrees of sophistication. Automatic truck loading for all or part of the roll production is a possibility at some mills. A system with less clamp truck handling is always better for end product quality.

TAPPI JOURNAL: ***What changes might be needed in current loading facilities, both for rail and truck, to keep pace with production increases?***

Valmet: Automatic roll sorting and grouping as mentioned above are part of the solution. Large clamp truck(s) with twin clamp attachments are used for the heavy transportation to the staging area(s) near the box cars or trucks being loaded. Smaller more maneuverable clamp trucks are used for the actual loading operation at the loading docks. A system such as this reduces the total amount of truck traffic in the warehouse and improves safety.



Black pre-printed end bands in the top end of the roll both enhance the appearance and help the clamp truck driver to distinguish individual rolls, adding to roll handling safety.

A roll tracking system with truck-mounted terminals and laser guns or equivalent is an essential part of an efficient shipping/warehousing operation assuring that the correct rolls go to each customer. In addition, a few European papermakers are using automatic semi-truck loading systems to gain more efficiency from logistics. This is a very effective option for minimizing clamp truck handling in coastal paper mills.

A FEW WORDS FROM THE SUPPLIERS OF ACCESSORY EQUIPMENT

Kevin Rolfe, North American sales manager of Core Link Inc. states that mismatched sets and off-spec cores are notorious causes of delay at the winders. For the newer mills, doubling winder speeds can cause a demand for as many as 8000-9000 cores per day. This means increasing attention to the quality, accuracy and efficiency of core preparation systems, delivery and storage methods, and handling—particularly loading. Speeds at the levels being considered will require a new generation of automated equipment and higher levels of reliability in the core room, along with greater cooperation between core prep systems manufacturers and winder builders.

Mark Fortin, president of Double E Company, Inc., the engineering firm that introduced carbon fiber composites talked about the roll shafts and rolls: We have certainly noticed a major shift, especially among the big companies and OEMs, to "higher speed" machinery. The need to increase machine throughput (i.e., speed, width, and roll size, etc.) presents significant challenges to shafts and rolls. Wider spans and higher rotational speeds create "critical speed" problems that must be addressed with stiffer, lower mass, lower inertia shafts and rolls. In the majority of cases, it will be physically impossible to achieve the required performance without the use of composites.

In addition, these shafts and rollers will need to be larger in diameter, straighter, better balanced as well as far lower mass than conventional shafts and chucks designed for lower speeds. In many cases the application will also dictate that the expanding shaft be mechanical instead of air inflated to provide the necessary concentricity to achieve rated critical speeds.

Another critical part of the machine "system" whether winding, calendering, or sheeting when trying to achieve much higher speeds will be the strength, stiffness, rotating inertia, straightness and the mass of the core the material is wound on. Conventional paper cores will exhibit crushing under increased roll weights, tear-out during fast accelerations and decelerations, and will offer no additional stiffness to the rotating system. To achieve very high critical speeds and avoid the loss of entire rolls due to increasing incidence of speed related core failures, cores will need to be chosen for their stiffness to mass properties.

The design of brakes and drives will also be crucial to the success of higher speed machinery. With larger rolls and higher speeds, the dissipation of heat from conventional friction brakes will become a major problem and expense.

Frank Lang of International Knife and Saw, Inc. spoke about issues from a supplier's point of view: Although there are machines in the industry achieving such speeds today, the question would be, if a mill has a machine running at 5000-6000 ft/min., what would happen if you doubled the speed. Several issues need to be looked at, such as:

- Can the present machine, (the frame) handle such a modification?
- Is the machine in a stable physical location?
- What is the cost of modification vs. new?

Most machines that have been modified for increased speeds, have been modified for a 25%-30% increase.

The cutting tools also need to be evaluated. If the present tooling lasts 10 days before changing, what will happen when winder speed is increased. the tooling life will still cut the same amount of total feet, but it will only last 5-7 days. The other point to consider regarding tools is the tolerances. They will have to be manufactured with a tighter tolerance than before. Any loose tolerance or nonconformance on a cutting tool may result in increased changes and premature knife failure.

From a supplier point of view, there are options available to mills wanting to increase productivity. Circular and straight knives (slitter & sheeters), come in a variety of tool steels to perform better. Winders in excess of 8000 ft/min, usually use powdered metal top slitters and inlaid carbide bottom bands. If machines exceed 14,000 or 18,000 ft/min, new technology will have to be researched by vendors to supply superior cutting tools which will last longer than the tools of today.

Today's technology is more than sufficient for present winders which run at speeds of 10,000-12,000 ft/min. We have the knowledge to make improvements. This is where the mill plays an important role, as do the original equipment manufacturers of the winders. R&D dollars need to be spent now to meet the challenges of the new millenium.

MAN OVER MACHINE: THE CHAMPION STORY

Crews at Champion's Pensacola, FL, mill are claiming a world record for cutting rolls of paper into sheets. During June, employees who operate the mill's #3 cut size line processed an average of 367 tons/day of paper into letter-sized sheets. That's 146,8000 reams/day or 4.4 million reams during June, to be used around the world in copiers and laser printers.

"Our Pensacola organization once again has been recognized for producing world-class results through excellent performance and teamwork," said Doug Owenby, vice president/operations manager. "We're proud of everyone involved in setting this new standard."

The record was verified and recorded by E. C. H. Will, the manufacturer of the sheeting equipment. It replaces the previous record of 359 tons/day set on similar equipment by the Boise Cascade mill in Jackson, AL, in August 1997.

The sheeter on which the record was set is not new. In fact, it is 10 years old. "But our crews were able to make it do what brand new equipment at other mills hasn't been able to do," said Larry Andrews, converting operations coordinator.

"It just proves what we've said all along," added Dave Gorman, cut size system leader. "It's people—not equipment—who make the difference. Any company can buy equipment; it's employees who provide the competitive advantage."

Champion International Corp. is an integrated forest products company with operations in the United States, Brazil, and Canada. Champion produces coated and uncoated papers and market pulp.

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All photographs in this article were provided by Valmet Corp.