

Customer Case:
**Smart roll flow at APRIL Fine
Paper mill in Xinhui China**

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12/2012

APRIL Fine Paper (Guangdong) Co. Ltd, which is part of Asia Pacific Resources International Limited (APRIL), started new fine paper machine at its Xinhui plant July 2012. The annual production capacity of this new 8.65 m wide production line will be 450.000 tons. Connected to this new line was started also a new converting plant with shipping facilities both to rolls and pallets.

Between these main processes is fitted fully automated Intermediate Roll Storage (IRS), which purpose is to offer unmanned flexible sorting buffer between the main production processes. This breaks mill's production to freely and individually optimized main processes (Figure 1). Here, like with APRIL's other mill in Kerinci Indonesia, the selected solution was again Pesmel's TransRoll® rack storage system.

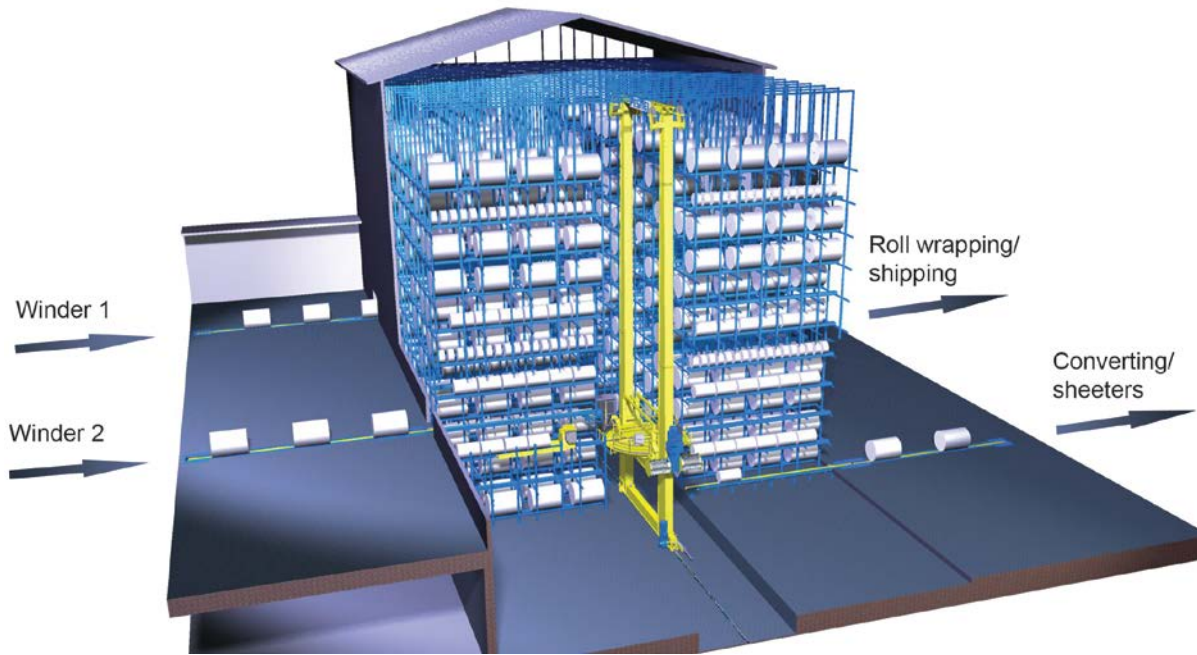


Figure 1, Fully automated Intermediate Roll Storage (IRS) offers unmanned flexible sorting buffer between the main production processes. This breaks mill's production to freely and individually optimized main processes with simple straight forward conveyor lines.

The Challenge

From the start it was clear, that an effective centralized Intermediate Roll Storage (IRS) was needed for Xinhui operations. It was needed to ensure free and well controlled material flow between the state-of-the-art paper production line, converting plant and direct hot load shipping. So that the demanded world class efficiency could be achieved with justified investment and operational costs. Without effective IRS solution the production line will easily be bottlenecked by relatively small and low cost parts. In that sense the roll handling systems in mills are like referees in ball games - at best they are not noticed at all, but the absence of control and order is noticed for sure. In Xinhui plant the IRS dimensioning parameters where set as follows:

- Storing and buffering capacity for PM's 14 days production.
- Combined handling capacity in and out 320 rolls/h. (e.g. 160 rolls in and 160 rolls out).
- Fully automated, real time production assorting for the converting and shipping operations.
- Zero tolerance for roll damages with wrapped or unwrapped rolls which sizes:
 - Diameters 800 - 1800 mm
 - Widths 400 - 2200 mm
 - Mass 200 - 5800 kg
- Secured Warehouse Management System (WMS) that effectively sorts, buffers and distributes the production, and which offers easy graphical user inter phase both for the storage inventory and man machine interface.

Alternative solutions

The clamp truck operated IRS was eliminated in early stages of the feasibility study. Imagine that clamp truck army and that space needed to sort and handle manually this kind of production line. If you somehow manage to do it for one line, how about possible future lines at the same site? With all needed shifts, truck maintenance shops and huge floor space where to lose the individual rolls. Well, if you need to compete in open markets and your owners demands profitable operations, the clamp truck operated solution is easily moved aside.

The next generation solution after clamp trucks has been the overhead crane storages with advanced WMS systems, which so far have been the synonym for automated storages in paper mills. These systems have served quite well with limited roll handling and sorting needs. But they demand quite large roll handling systems to serve the cranes optimally, and quality high ceiling buildings with accurately leveled floors. The multi roll clamps that have been brought in to replace the vacuum grippers with their limited handling capabilities have been the latest developments to enhance the competitiveness of the crane systems. The fire safety has always been the limiting factor with this concept.

The third generation solution has been brought in from hard competed converting and general material handling markets.

The high-rise AS/RS (Automated Storage and Retrieval System) rack storage solutions presents nowadays competitive solutions also for paper mills roll handling needs. Likewise with overhead crane solutions it offers advanced WMS solution for the automation and control, but also unparalleled simplicity with needed conveyor systems and especially unmatched handling and sorting capabilities. These rack storages can be fitted in existing buildings, or they can be build as rack supported building (Figure 2), where the wall and roof cladding is attached directly to the rack structure. Rack storages have clearly the smallest footprint compared to other alternatives, due to the most effective space utilization.



Figure 8, Rack storages can be fitted in existing buildings, new buildings made for it or rack structures can be covered with wall and roof elements (rack supported building).

Pesmel's unique TransRoll technology represents the fourth generation solution for paper mills and converting plants buffering and storing needs (Figure 3). It's deep channel technology has been developed especially for the paper industries needs from the traditional AS/RS systems.



Figure 3, TransRoll stacker crane sorting rolls at APRIL Fine Paper's Xinhui mill.

Selected Pesmel TransRoll® system

In the APRIL Xinhui case one of the biggest advantages of the selected rack concept was the simplified mill layout that it offered. At the machine floor level straight conveyor lines directly from the winder decks to the IRS intake sorting (Figure 4). And same way at downstairs straight and plain conveyor lines out to sheeters and roll shipping. It was easy to locate the 32m wide and 30 m height storage building middle of the main processes, and set up multiple entries and out takes along the long side to handle the required 320 r/h roll handling capacity (in 160 and out 160 rolls per hour).

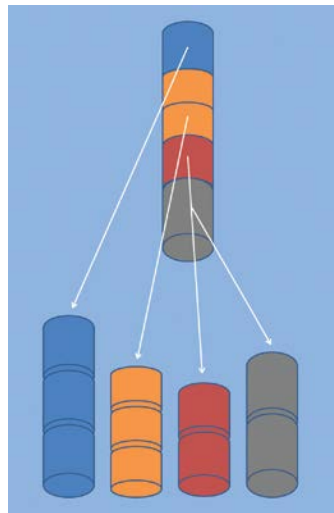


Figure 4, The incoming roll stream is sorted by the TR- vehicle, which enables effective multi roll handling.

Unlike with piled roll stacks, with the Trans Roll (TR) system there is no need to up-end and down-end rolls for the crane pick-up. Also it doesn't put any requirements on handled roll queue order, roll sizes or packing codes. Rolls are handled as they come on the lying position all the way from the entry pick-up to out delivery with TR- sorter vehicle's cradle, and in the storage rolls lay on their bellies on v- shaped storage channel beams (Figure 5, 6, 7).



Figure 5, Gentle multi roll handling by TransRoll channel vehicle at the Intermediate Roll Storage (IRS) in-feed.



Figure 6, TransRoll roll storage is fully automated enclosed area without lights. Only the stacker crane's lifting platform has spot lights for the on-board video cameras



Figure 7, TransRoll vehicle fetching rolls according the orders from the storage to be delivered forward to wrapping and shipping.

The base elements with high-bay, deep channel TransRoll® technology are:

- Rack storage with channel profiles, which stores the rolls on laying horizontal position.
- Stacker crane, normally one or two units.
- Channel TR- vehicle to move rolls or roll sets by its cradle.
- Computer controlled Warehouse Management System (WMS) for the inventory real time and reliable roll stream handling, with graphical man machine interface for the machine control.

There are motors only in the TR- vehicle and stacker crane, which technology resembles roughly vertically turned overhead crane (Figure 8).



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The fire safety is with rack storages at its own level compared to alternative concepts. And it has to be, when thousands of tons of paper is stored right in the center of your production plant. The water sprinkler system is built in the rack, which enables unique precision fire extinguishing with standard sprinkler nozzles. This can't be done in storages, where the sprinkler nozzles have to be installed high on the ceiling structures with distance to floor +15 meters.

Totally Integrated Warehouse Management System (WMS)

With the modern IRS systems the key element is effective sorting and buffering capabilities to ensure the free and optimized roll flow. With Pesimal's totally integrated WMS this is set up with open software and hardware environment, which is connected to Mill Information System (MIS). The sorting system sorts the rolls according sorting criteria originated from MIS and instructed by the WMS.

Although the storage can be run freely either in auto, semi-auto or manual mode, the best results are achieved by following the principles listed below:

- Rolls are sorted to the channels according sorting criteria.
- Rolls are sorted close to the preferred out-feed if the destination is known.
- Rolls are sorted close to the in-feed if the destination is unknown.
- The number of mixed channels (sorting criteria) is minimized.
- Some empty channels are needed for re-sorting.
- Hot load channels reserved near the out-feed conveyors.

The sorting criteria most time with the automation mode is FIFO (First In First Out, or in other words simply the oldest roll out first), but it can be freely adjusted as needed. The WMS user interface is mainly intended for process supervision and trouble shooting.

The totally integrated WMS here means combined Human Machine Interface (HMI) for the storage inventory PC and the machine control logistics (PLC). All normal roll flow and maintenance tasks are performed through one and same user-friendly client server. The main features are:

- To show the status of both the storage inventory and equipment.
- To update the storage inventory (add/modify/delete roll data from the database).
- To show stacker crane load orders.
- To maintain system parameters.
- To generate print reports.
- To browse event and alarm information.

Expectations met

The TransRoll® concept was selected after thorough evaluation process to suit best for the Xinhui mill needs. It offered the simplest mill layout with clearly less equipment with smallest footprint requirements compared to alternative solutions. It can handle rolls without limitations related to roll dimensions or packing variants. Rolls can be unwrapped, partially wrapped or fully wrapped, because rolls are handled all the time in horizontal position.

In APRIL Xinhui mill, like in APRIL's Kerinci mill, TransRoll® system has made the controlling of production easy, which results in higher productivity due to better overall process efficiency.