Reducing Waste Material and Increasing Productivity by Butt Splicing - *R. Joseph Gotshall, MTorres*

Thesis:

Zero-Speed Splicing Technology can be utilized to reduce waste when splicing from one roll to another of raw material.

Presentation Summary:

Zero-tail, butt-splicing can be utilized to speed up converting lines while greatly reducing or eliminating the waste of valuable raw materials. This technology has been applied to materials ranging from paper & paper board to tissue, towel, film, nonwovens & flexible packaging substrates.

Perfect butt-splicing can be achieved at high speeds by utilizing a festoon system, precisely controlling tension and having exact coordination with the unwind stands through automation. This technological advancement was made possible through control systems and the integration of a high-capacity festoon system allowing a perfect butt-splice to be performed at 0-speed while the production line continues to function at maximum velocity. In other words the joining of the two webs, the terminating web and the leading edge of the new roll, are actually sealed together using an adhesive tape while the webs are being held perfectly still. Yet the production line continues along at high speed utilizing the paper stored in the festoon to supply the line with material.

Points to be demonstrated in this presentation:

1) A line with a fully integrated 0-Speed splicer can run consistently at 2,625 fpm. = 800 mpm without posing any interruption to the production line.
2) A single operator can manage the preparation and loading of rolls due to automated loading and unloading assistance. Loading sequence can take between 3 and 4 minutes for a standard operator under normal conditions.
3) When a perfect butt splice passes through the line, the sheet walks less than 1/16-inch causing no noticeable disruption to the production process and producing minimal to no waste.
4) The splice can be set up as a perfect butt splice, eliminating the entire tail so that the film curtain is not disturbed when the splice passes through the line. The result: No paper is thrown away while the film curtain is re-establishing itself.
5) Many lines operating with post treaters (flame or corona) require that the treater be disengaged when the splice comes through, wasting paper in the process. A butt splice eliminates the need to disengage the treater therefore increasing production, reducing waste and eliminating manual labor tasks.
6) By applying a piece of standard masking tape to the leading edge of the paper during the butt splice setup, the splice is actually sealed when it passes through the machine.

Since there is no raw paper edge exposed at the laminator, the possibility of the edge sticking in the laminator is reduced.

7) Teflon tape which is used in creating the Butt Splice, lasts at least 50% longer since:
   a) The splice is sealed
   b) There is no tail
   c) The sheet walk is so minimal.
8) Most extrusion coating line operators report that sheet breaks typically occur during a splice, for various reasons:
   a) The splice itself can fail
   b) The sheet may walk, causing wrap up on the pressure roll
   c) The added caliper of the tail may break the Teflon tape, etc.
   d) The sheet walks and causes the slitters to plug up
   e) The sheet delaminates, pocket is formed that bursts the sheet
   f) The sheet sticks to the chill roll when the splice goes through, causing a wrap up
   g) The sheet walks and the overhang wraps a pressure roll when the tail is too long and causes a break.

   For all of the reasons listed in the above bullets, a line equipped with a Butt-splicer will operate with fewer sheet breaks.

9) An integrated unwind and Butt-splicing system can automate many of the functions that now must be performed manually on most backstands. For example,
   a) Once the splice is complete, the core is automatically removed and deposited into a bin for reuse.
   b) If an operator triggers a manual splice and a large amount of paper is left on the core (i.e., a butt roll), the system recognizes the situation and compensates accordingly, depositing the butt roll on the loading table and then kicking it off.
   c) The system automatically chucks up the roll, centers it, and then rotates into the correct position for the splice position. A single operator can unload a core, load a new parent and prepare a splice in under 3.5 minutes.
   d) Splice preparation is extremely simple, requiring no special technique or finesse on the part of the operator.

A splice and preparation will be shown in video during the presentation.

10) As a result of the automatic functions, a single person can process rolls at a shorter turn-up time than 2 people on most existing backstands. As experience shows, a single person can keep up while running 8 minute and shorter turn-up's, hour after hour. Operations running a typical flying splicer will realize significant personnel savings with the Torres system.
11) The automated features also provide the following benefits:
   a) Out of round rolls: Since the splice is completed at zero speed, an out of round roll does not compromise the splicing efficiency (although the operator does need to check and ensure that the sheet is taut between the new roll and the splicer)
   b) Offset cores: The system places the new roll in register relative to the running roll by measuring the position of the side of the new roll. Splicing onto a roll with an

offset core does not cause the sheet to walk when the splice goes through the machine.

12) Waste Reduction: The integrated Butt splicer reduces waste because less paper is left on the core than with the standard backstands. Even at speeds in excess of 800 mpm, the Torres Butt Splicer can be configured to strip the core - leave no paper on the core after each splice.
13) The Torres splicer produces a butt splice by joining the two webs at zero speed while the line speed remains high and constant thanks to the integrated festoon system. This creates a more reliable and exact splice and then sends it through the line under more controlled situation. This eliminates all of the above issues, so that the line can run much more reliably at higher speeds.
14) For years, extrusion managers have insisted the way to run the extruders efficiently is to send the largest possible basestock roll to the extruders, based on two assumptions:
    a) The larger the basestock roll, the fewer splices the extruder will have to make in a given 24 hour period. The fewer the splices, the fewer opportunities for missed splices and shutting the line down.
    b) The smaller the diameter the shorter the turn up time.
    c) At some mills, the labor contract states that at a certain threshold (for example, turn up times equal to 15 minutes or less) the manager is required to put a second person at the backstand to assist. Both of these issues can be eliminated by automating the process.
    d) So, the Torres would allow 58- or 60-inch diameter basestock rolls to run efficiently, instead of the usual 72 - 76-inch diameter. Why is this important? The standard 76-inch diameter basestock roll produces 1.6 finished sets per basestock roll. The uneven number of finished sets to basestock roll means that the winder is constantly stopping to make butt splices. On the higher calipers the line speed is usually limited by the winder. The winder crew just cannot keep up with the line and so the extruder has to be slowed down. If the extruders coated 58-inch diameter rolls and then double stacked them at the reel, the double stacked reel could be quickly run off with no butt splicing
    e) Another benefit: The quality of the butt splice is such that it would not have to be cut out at the winder, only marked. It can be a tremendous benefit and time savings measure to winder crews, and results in fewer line speed reductions on the extruder on the higher caliper runs.

Butt-splicing allows the two webs to be joined perfectly together with no overlap and therefore no caliper variation. Since many converting lines (extrusion, coating, laminating, and some printing processes) are greatly disturbed by caliper variations these processes may have to be disengaged during splicing on traditional flying splice units and material must be discarded rather than being included in the final product. These processes can take significant time to be reengaged and then reach equilibrium again costing significant loss in production, materials and labor time. The 0-speed splicing technology being discussed in this presentation causes no disruption to the web and therefore saves both

production time and materials while allowing the operator to focus on other necessary tasks.

Since the terminating web can be held perfectly still during splicing in the application of 0-speed splicing technology, it is cut precisely leaving no tail or other excess material that can interrupt the converting line. In 0-speed splicing the two webs are joined perfectly and sealed allowing many production lines to sell the splice and all the material around it to their customer, therefore avoiding the costly and time consuming step of cutting out the splice and rejecting some length of material. Again operators can be focused on other more important tasks necessary while monitoring the production line.

While standard high-speed production lines can suffer wild tension swings and waste valuable raw-materials using traditional flying splice units, the MTorres 0-speed splicing system allows the splicing sequence to be performed accurately in a virtual vacuum while the converting production line continues to perform at high speed with zero tension disruptions. Most steps can be fully automated removing any chance for human error and reducing the potential for work place accidents.

Benefits of 0-speed splicing include: Improved Tension Control, Reduced Materials Loss, Increased Production Output, and the Elimination of Missed or Inaccurate Splices. This integrated and automated system can be utilized to reduce the manual labor required for loading and preparing splices at the unwinds and move operators further outside the “line of fire” of more dangerous tasks.

Tables / Illustrations:

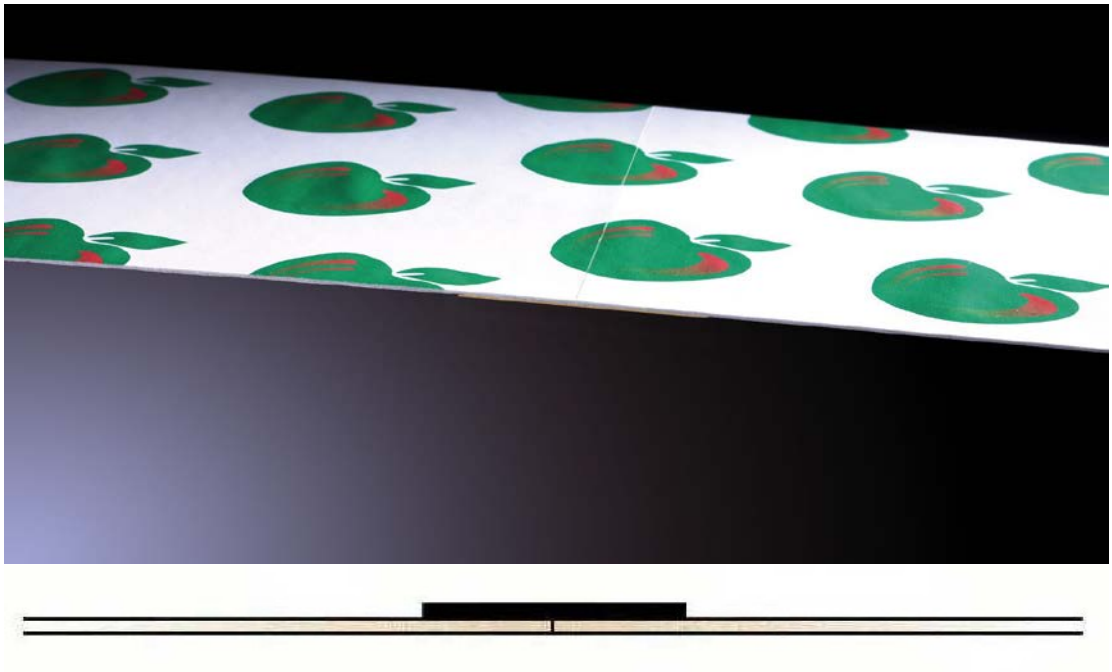

Figure 1 – Example of a perfect Butt Splice – this photograph shows that printing was performed on the material after the splice took place with no disruption to the process.

The lower drawing is a side depiction of the splice which demonstrates that the two webs are sealed together perfectly through the use of a single piece of adhesive tape (seen here in black).

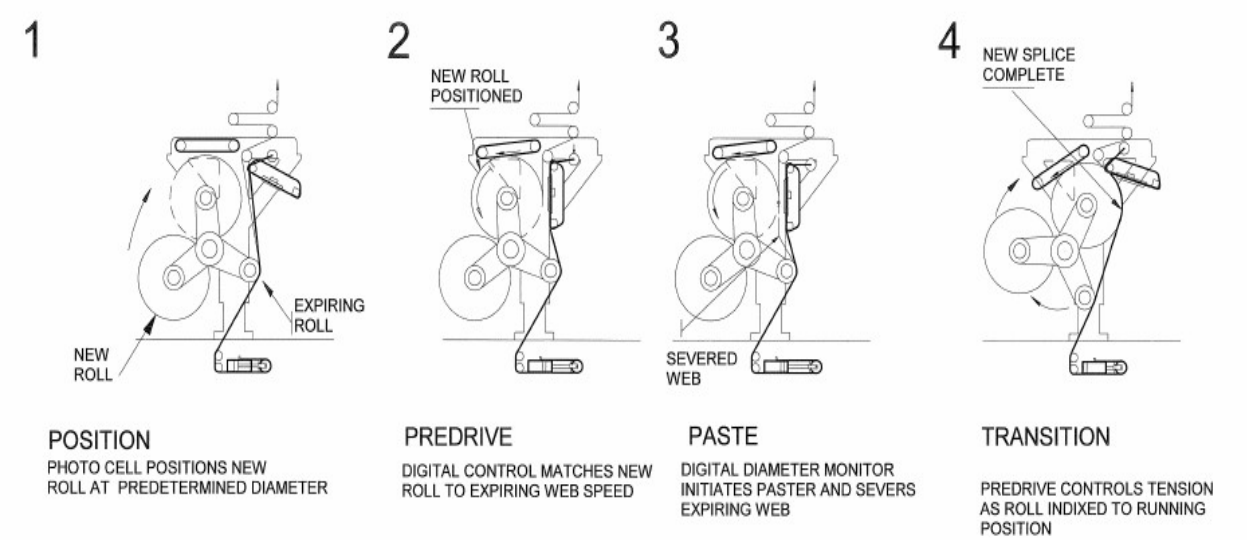

Figure 2 – Example of a Flying Splice – This drawing depicts a traditional flying-splice turret and breaks down the steps necessary to complete a splice

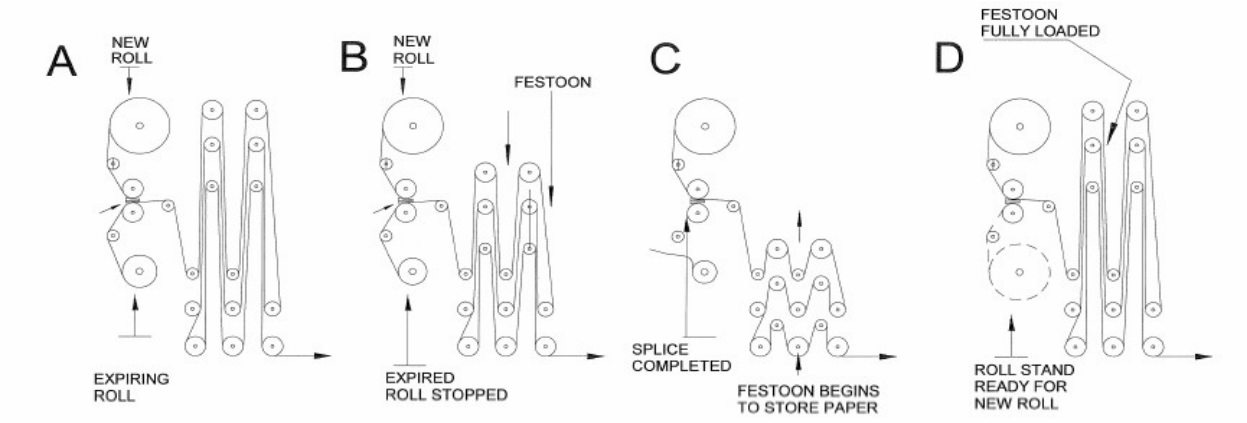

Figure 3 – Example of an MTorres 0-Speed Splice – The drawings depict a 0-speed splice system and breaks down the steps necessary to complete a splice

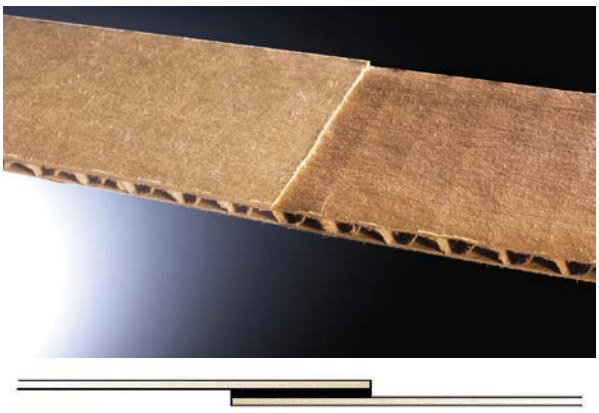

Figure 4 – Overlap Splice without a tail - this photograph shows an alternate type of splice that can be created on the 0-speed splicing equipment.

The lower drawing is a side depiction of the splice which demonstrates that the two webs are sealed together perfectly through the use of a single piece of double sided adhesive tape (seen here in black). The two webs are overlapped in this example as desired for the production line.

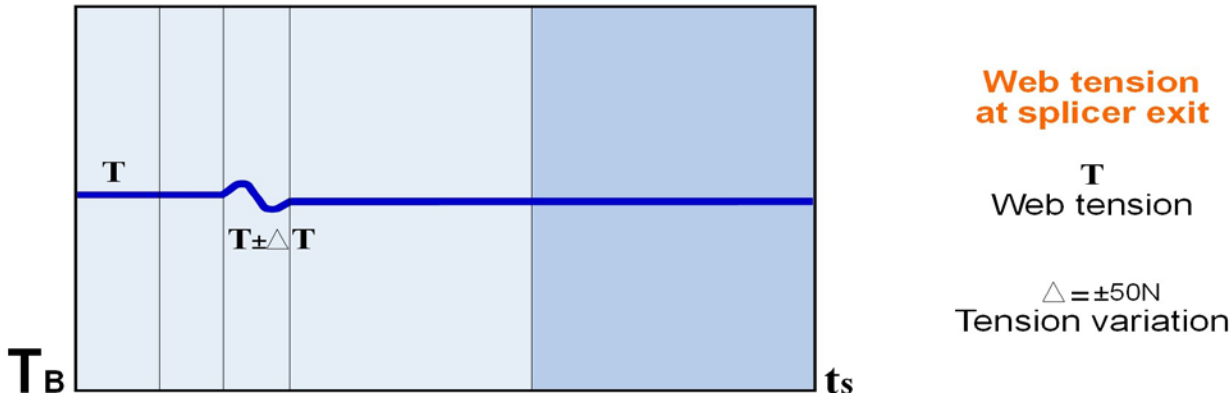

Figure 5 – Web tension at splicer exit – this graph represents a web tension variation of + or – 50 Newtons as the web leaves the splicer.

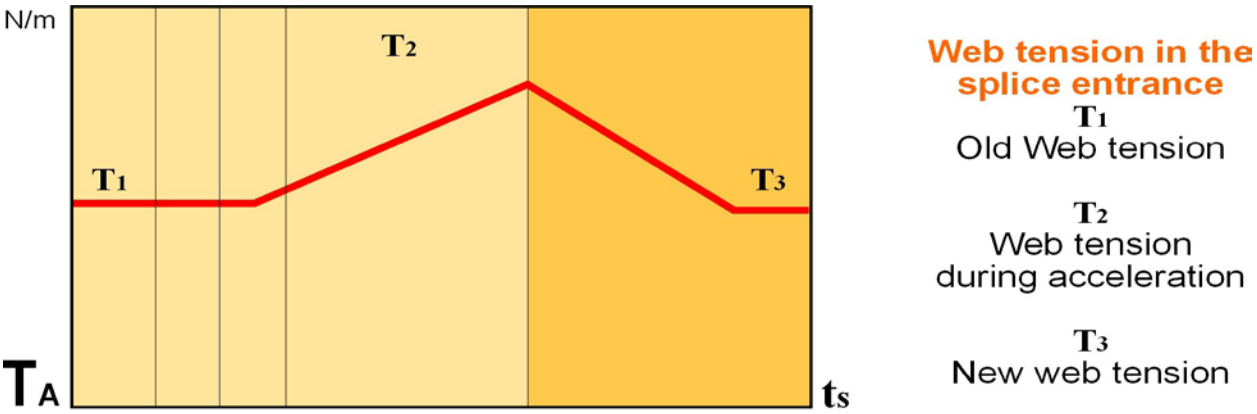

Figure 6 - Web tension at splicer entrance – this graph represents a web tension variation as the web enters the splicer.

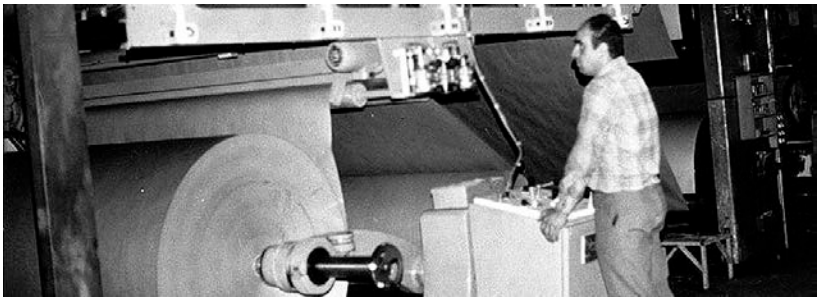

Figure 7 – MTorres splicer circa 1975 in use at a corrugated facility – this photograph shows the base equipment has not changed dramatically over the last 35+ years. The technology is proven and has been field tested on substrates as heavy as gypsum board and as light as TAD tissue paper.

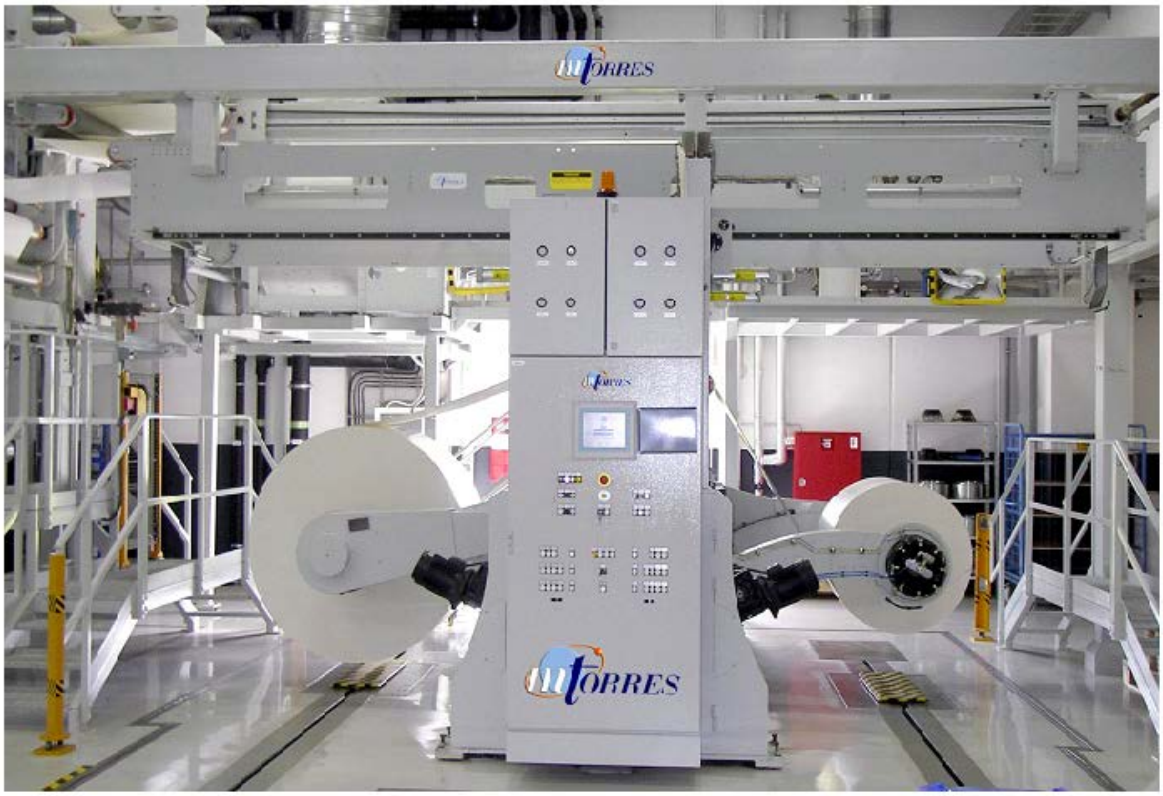

Figure 7 – MTorres Floor Pickup splicer circa 2010 - this photograph will be used to show the base equipment as compared with Figure 6 has not changed dramatically over the last 35+ years.

Figure 8 – MTorres turret splicer circa 2010 - this photograph will be used to show the differences when compare Figure 7 the Floor Pickup design.

Results and Conclusions:

0-speed splicing can be applied to numerous unique substrates and many different processes. When utilized 0-speed splicing can reduce material waste, increase production speeds, minimize unnecessary tension changes, and reduce operator workload. 0-speed splicing offers the highest performing solution for extrusion, coating, laminating, and printing applications. If the production line operates at high speeds 0-speed splicing is the highest performing solution. Heavy weight or light-weight materials perform better on 0-speed splicing equipment.

Listed below are a few disadvantages of the traditional flying splice and a few advantages of the MTorres 0-speed splicing design.

Disadvantages of flying splice design

- Lower reliability – leaves room for operator error
- Splicer requires adhesive & the tail is inconsistent so it can cause problems

- Complex splice preparation
- Not available for higher speeds
- Unsteady Web Tension control during the Splicing
- It's not possible to finish the Parent Roll

Advantages of 0-speed splicing design

- Almost 100% splice reliability even new when rolls are out of round
- Increased productivity
- Programmable, automatic, simple, easy, & rapid splice preparation
- Applicable to a large range of speeds and paper grades
- Maximum performance and reliability at higher speeds
- Less paper waste because less paper is left on the core:
    - Smaller adhesive tape consumption
    - Profitability increased
- Ability to RUN-OFF the core. Leave NO PAPER on the core after each splice