Starving Packer

Engineers at a large consumer packaging company believe they have an intractable code problem with a laner. Both internal and external programming teams have attempted to change the code to the laner, but to no avail: No PLC code debug can fix the unbalanced lane problem or stop the shutdowns to the upstream cartoner.

Is the laner the problem or are more drastic changes needed further up the line?

Introduction

Unbalanced lanes at a downstream packer are causing big problems for a large packaging line. The photo eye is getting tripped, shutting down the upstream cartoner, but the packer is starved. Plant engineers have been focused on the code for the laner and have sent waves of programmers to fix the problem.

Nothing seems to work.

Is the laner the problem or are logic changes needed further up the line? Engineers look at four possible scenarios to solve the riddle:

- Change PLC code for laner
- Add buffer after laner
- Add buffer before laner
- Change slug size

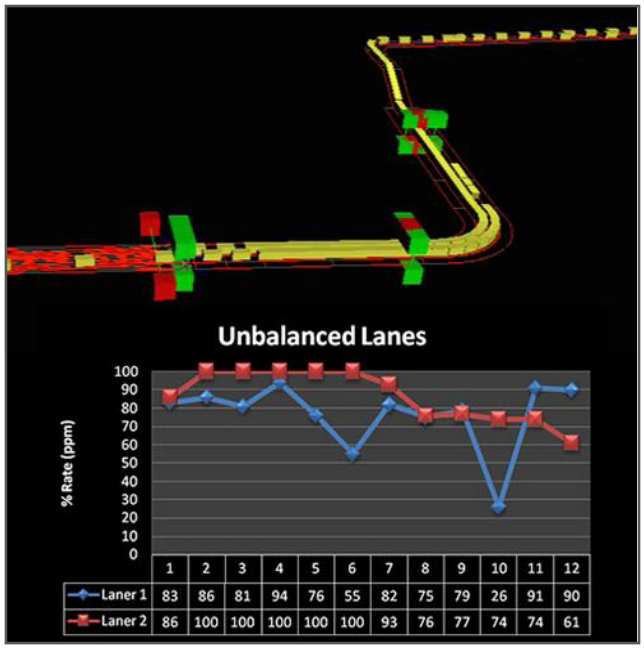
Off-Balance

Plant engineers are looking to resolve a 20% loss in throughput. Infeed from upstream unit operations are running at a consistent rate, but averages continue to languish at around 80%. So, where is the problem?

Plant engineers have long suspected logic problems to the laner and, over several months, they have brought in different teams to reprogram the laner.

Still, the unbalanced lanes problem persists.

A team from Haskell is called in. The new team works with plant engineers to develop several scenarios to simulate and emulate variables and their effect on the line.



	1	2	3	4	5	6	7	8	9	10	11	12
Laner 1	83	86	81	94	76	55	82	75	79	26	91	90
Laner 2	86	100	100	100	100	100	93	76	77	74	74	61

Bug Hunt

The team hasn't given up on the possibility that the logic in the laner is the culprit. The team creates an emulation of the line used to test and debug programming in the line's Programmable Logic Controller (PLC). The working packaging line is modeled in a real-time environment and sends a series of variables to the laner. However, only negligible improvements are seen.

The team starts to think logic changes may be needed further up the line.

Among the options tried was adding buffer after the laner. However, there was nothing to fill up. Engineers were already starving the case packer so adding a buffer would provide no benefit.

Another option considered was changing slug lengths – varying lengths between each lane.

Because emulation allows for the recreation of a three-dimensional model of the line and to define package dimensions of the product and production variables such as motor, speed, sensor placements, and control device logic to resolve problems in the line design or

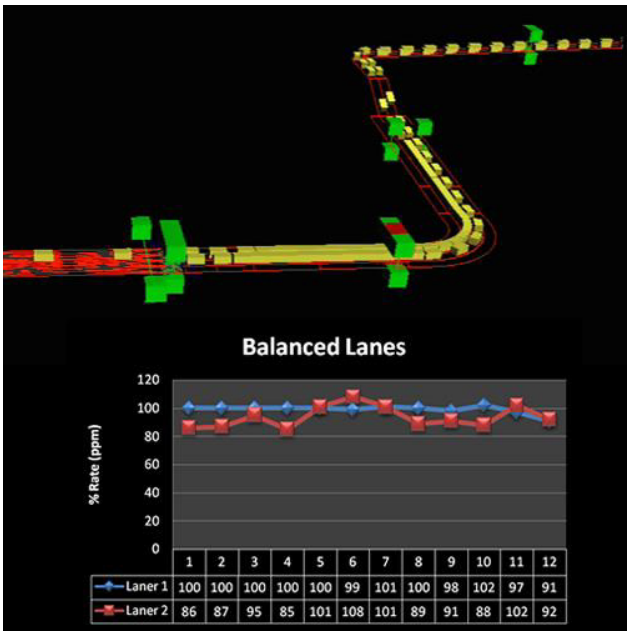
programming, changing slug lengths can be done relatively easily. Such an attempt would typically yield dramatic data changes. While the team realized some benefit after making all of these changes, it wasn't enough to balance line operations.

The Eyes Have It

The photo eye is getting tripped, shutting down the upstream cartoner. What if the model could emulate moving the photo eye upstream? Moving the photo eye would mimic adding buffer upstream. Obviously, moving a photo eye is not very involved or expensive. However, physical limitations of the conveyor layout would require more significant mechanical and electrical changes to allow the accumulation of product upstream. Because emulation can demonstrate the effect of product design variables on the working line, system changes can be created and tested without impacting the actual system, or incurring the cost of a physical change.

The team decides to emulate adding buffer before the laner by moving a photo eye upstream in the model.

This change provided significant improvements to the line: **a 16% jump in average throughput of the laner** – and no shutdowns of the cartoner.



Conclusion

Confirming that additional buffer would smooth out operations of the line, the team now had a solution to implement. Again, physical limitations to the existing layout would require significant funding and time to allow the additional buffer. But there was a sound justification for the project.