Flexible or Direct?

Part 2 in a 3-Part Series
Presented by Intralox

Part 2: Evaluating
Your Package Handling System Design

Key tools and processes for evaluating line layout design options considering capital cost, operations, maintenance, and production capability

In Part One of our "Flexible or Direct?" series, we defined the main differences between "End-of-Line (Direct)" and "Integrated (Shared Asset)" Palletizing systems. The next step is to conduct a formal evaluation of proposed layout designs. The decision criteria can be divided into four categories.

Capital Cost

The key drivers of capital cost include:

- **The quantity and capability of the palletizing systems**
- **The amount and complexity of the conveyance system**

These will determine the cost of the equipment, the amount of labor and materials, and other resources needed to install it including mechanical utilities, power distribution, controls, communications infrastructure hardware, and building modifications.

Additionally, the engineering effort required to design and program the systems, and the on-site labor needed to start-up and commission them must be included in the capital cost estimate.

Often a flexible, integrated system has a lower palletizing system equipment cost by including fewer, higher utilization palletizers, but a higher equipment and engineering cost for the conveyance system that requires more accumulation and merging, sorting, or switching equipment.

	Line Item	Supplier	Cost per unit	Unit	Units Required	Base Cost	Spare Parts	Freight	Install Insurance	Taxes	Contingency	Total Cost	Comments
Equipment													
	Roller/Belt Transport Conveyor	CONVEYOR OEM	$375	ft	832	$240,750	$9,630	$10,000		$18,056	$24,075	$302,511	Includes OEM engineering/PM costs
	Zero Back Pressure Roller Accumulation Conveyor	CONVEYOR OEM	$500	ft	300	$150,000	$6,000			$11,250	$15,000	$182,250	Includes OEM engineering/PM costs
	Brake-Motor Belts - 12 ft Single Motor	CONVEYOR OEM	$10,000	#	6	$60,000	$2,400			$4,500	$6,000	$72,900	Switch infeeds
	Brake-Motor Belts - 6 ft Dual Motor	CONVEYOR OEM	$10,000	#	11	$110,000				$8,250	$11,000	$129,250	VPM infeeds
	Curves	CONVEYOR OEM	$11,000	#	4	$44,000	$1,760			$3,300	$4,400	$53,460	
	Case Turners	CONVEYOR OEM	$19,000	#	3	$49,000				$3,375	$4,500	$52,875	Outfeed of spirals before VPMs
	Virtual Pocket Merge 1	intralox	$95,000	#	1	$55,000	$2,200	$3,000		$4,125	$5,500	$69,825	"FX" long $400 Passive On
	Virtual Pocket Merge 2	intralox	$50,000	#	1	$50,000				$3,750	$5,000	$58,750	"FX" long $400 Passive On
	6-Station DARB Sorter 1	intralox	$85,000	#	1	$85,000	$3,400			$6,375	$8,500	$103,275	X-station DARB Sorter
	5-Station DARB Sorter 2	intralox	$75,000	#	1	$75,000				$5,625	$7,500	$88,125	Y-station DARB Sorter
	ST200 2-3 Switch	intralox	$80,000	#	2	$160,000	$6,400			$12,000	$16,000	$194,400	Transline connector switches
	Passive-Off Transfer	intralox	$11,000	#	4	$44,000	$1,760			$3,300	$4,400	$53,460	
	Conveyor Structural Steel - Base	MECHANICAL SUBCONTRACTOR	$200	ft	1204	$240,800			$4,816		$24,080	$269,696	Assumes no major reinforcements of roof
	Conveyor Air Piping - 2" Main Header	MECHANICAL SUBCONTRACTOR	$80	ft	375	$30,000			$210		$1,050	$11,760	Assumes black pipe or cheapest material
	Conveyor Air Piping - 3/8" Drops	MECHANICAL SUBCONTRACTOR	$175	#	16	$2,800			$56		$280	$3,136	Assumes black pipe or cheapest material
	Conveyor Control Hardware (Scanners, PEs, et al)	INTEGRATOR	$71,800		1	$71,800	$2,873	$850			$7,380	$82,733	Allowance of $272 per motor plus Y scanners
	Control Panels & Power Distribution Hardware	INTEGRATOR	$232,000		1	$232,000	$8,880				$23,200	$259,080	Assumes 48X motors total (panels and disconnects)
	Ethernet & Communication Hardware	INTEGRATOR	$70,000		1	$70,000	$2,800				$7,000	$79,800	Assumes Y line switches and fiber
Installation & Start-Up													
	Electrical Installation - Materials	ELECTRICAL SUBCONTRACTOR	$85	ft	860	$84,570			$1,686		$16,864	$102,870	Conduit, wire, etc
	Electrical Installation - Labor	ELECTRICAL SUBCONTRACTOR	$290	ft	860	$248,000			$4,960		$49,600	$302,560	
	Mechanical Installation - Materials	MECHANICAL SUBCONTRACTOR	$19	ft	1204	$20,068			$400		$4,007	$24,417	Connective hardware, whicles
	Mechanical Installation - Labor	MECHANICAL SUBCONTRACTOR	$300	ft	1204	$366,800			$5,386		$73,360	$375,496	
	Construction Management	INTEGRATOR	$40,000	weeks	6	$40,000			$800		$8,000	$48,800	Man-weeks, includes expenses
	Conveyor Startup Support	CONVEYOR OEM	$12,000	weeks	2	$24,000					$4,800	$28,800	Man-weeks, includes expenses

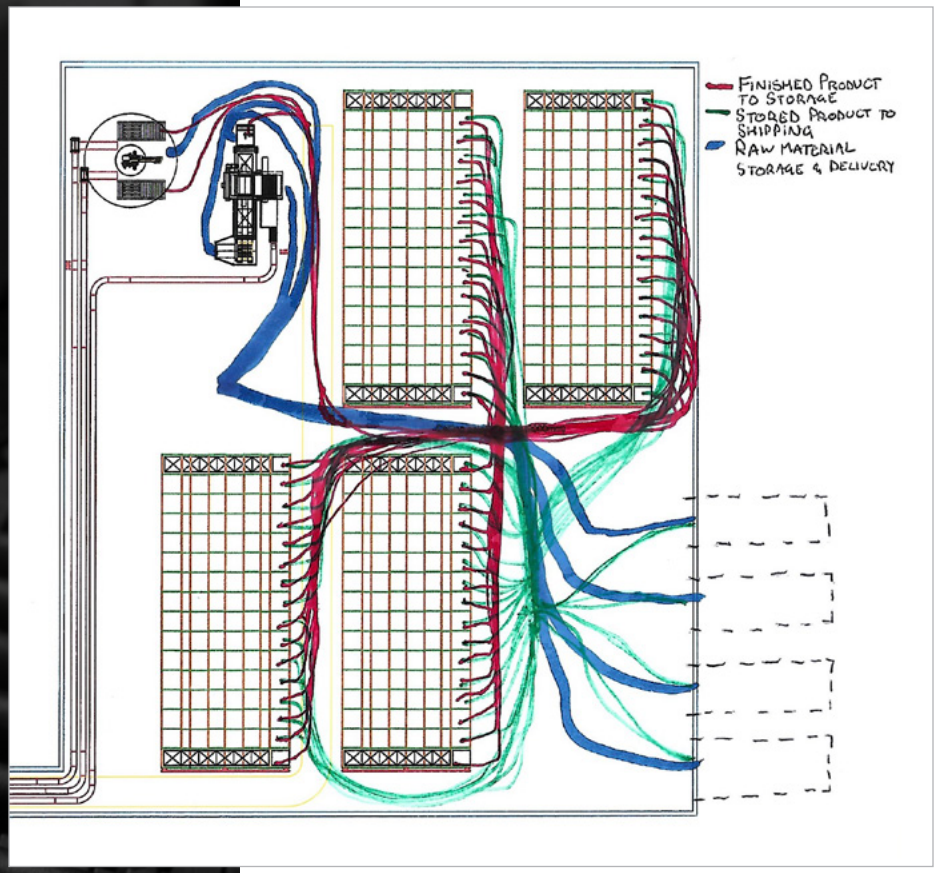
A detailed, capital cost spreadsheet is a useful way to compare designs and ensure all project scope components are covered.

Operations

When considering the operational impact of each design, the critical factors are the number of personnel and resources required to support the equipment, and the effort needed to manage day-to-day production scheduling as well as any major downtime events.

The personnel required to operate the system depends on:

- **The number of machines**
- **The physical distance between them**
- **How often an operator must interact with a machine**



A "spaghetti diagram"—created by drawing the paths operators take to complete their tasks directly on the package handling system layouts—can be used to determine the amount of distance covered and time required.

Operations

Management of the day-to-day production schedule will depend on the system production capability.

Are all lines designed to be capable of independently running any product?

OR

Does the system's design support a production schedule in which a limited number of lines can run their fastest-producing or most difficult-to-handle products at a single time?

In the latter case, be sure to:

- **Develop a process for coordination among schedulers to ensure planned production doesn't exceed system capacity**
- **Create contingency plans—and budget funds for their execution—to support critical sales orders in a major downtime event**

The added flexibility of a shared asset system allows schedulers to prioritize production from lines in the system whenever a palletizer has a major downtime event, effectively serving as part of the facility's risk mitigation plan.

The utilization of floorspace is another critical component to the operations analysis. With larger systems, keep in mind the opportunity cost of the footprint they occupy. In evaluating different layout designs, consider the potential costs of renting or building additional warehouse space that may be needed down the line.

Maintenance

From a maintenance perspective, it's important to keep risk assessments in mind. Certain safety measures—such as barriers—can make equipment more difficult to access and maintain. In evaluating line layouts, consider the additional time and costs that such measures require so you can choose a design that balances safety with accessibility.

A virtual walkthrough of a proposed layout can identify all opportunities for personnel to interact with the equipment as well as the likelihood, and potential severity, of an injury occurring.

Besides risk assessments, other components of the maintenance evaluation include:

- **The amount and complexity of the equipment**
- **Annual costs to upkeep the system, including number of labor hours and cost of replacement parts required**

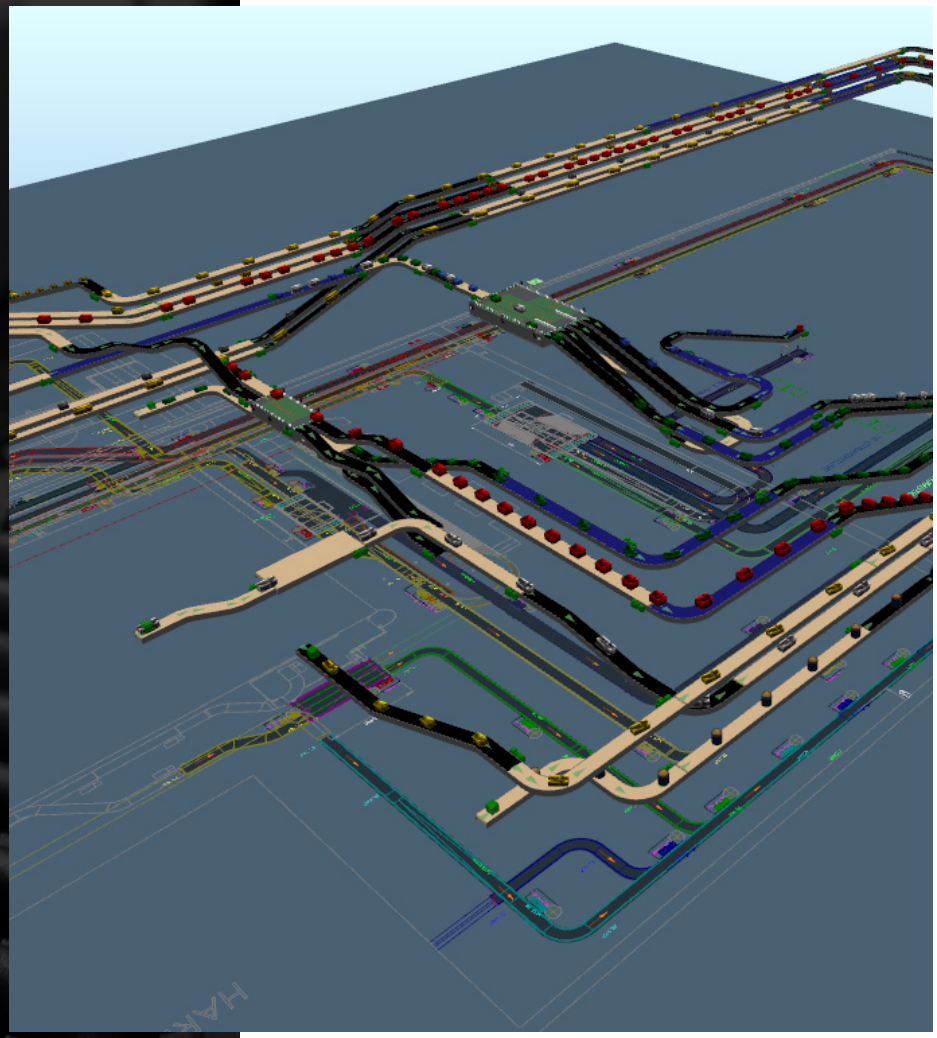
Thorough analysis of the preventive maintenance schedules and OEM-provided wear parts will inform whether additional personnel or a spare parts budget must be considered for any of the layout designs.

Production Capability

The volume output of each proposed system depends on several engineering design factors, such as:

- **Capacity of the palletizer and conveyance systems**
- **Amount of accumulation**
- **Ability to synchronize preventive maintenance with planned packaging line downtime**
- **Likelihood and impact of unplanned downtime events**

Volume output can be measured using tools such as an Overall Equipment Effectiveness (OEE)/Production Calculator or through dynamic, time-based simulation software. Both can process several inputs including mean-time-between-failure (MTBF), mean-time-to-repair (MTTR), max rate capability, and conveyance lengths, speeds, and accumulation amounts.



Programs such as Demo3D can be used to model a full system and determine production outputs through a time lapse simulation based on various inputs.

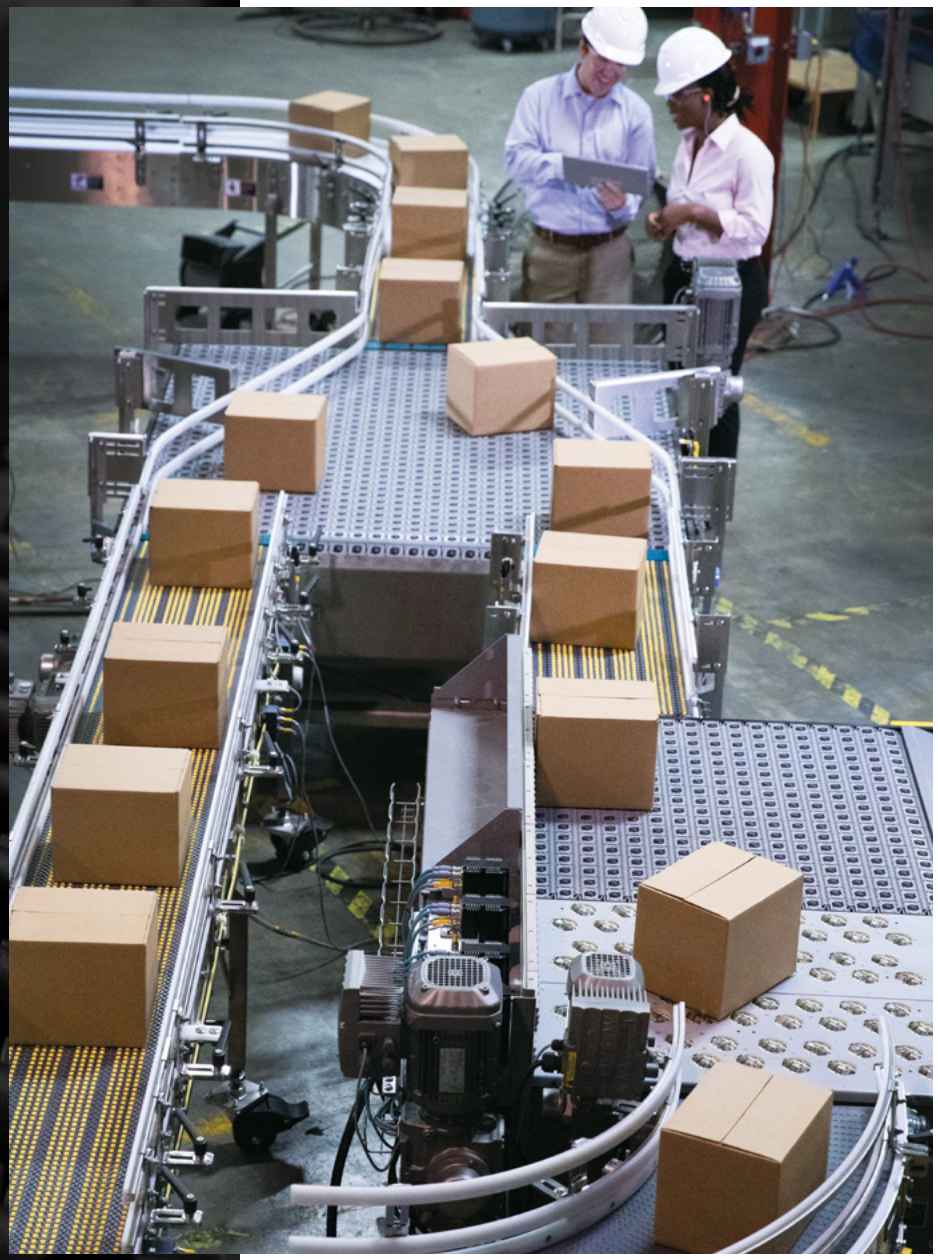
Production Capability

In evaluating production capability, consider each system within the contexts of sales volume, planned production time, and storage capacity.

The benefits of being able to output more volume can be evaluated in terms of:

- **Increased sales**
- **Decreased production hours/cost needed to meet sales targets**
- **Ability to provide additional inventory to mitigate production scheduling risks**

These benefits may offset some additional upfront or annual costs associated with larger, more flexible systems.



Evaluate the Options to Grow Smartly

A full evaluation consists of engineering analyses and exercises aimed at scoring how well each design satisfies the defined criteria for the project to be successful. Once complete, you'll be able to draw definitive conclusions about which type of line is the best choice for your expansion project.

Watch for Part 3 in our "Flexible or Direct?" series.

Intralox's global team of industry experts can help you navigate these decisions. From initial planning to post-project support, our specialists are available to assist with optimizing your line layout.

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