Crossdocking as a Supply Chain Strategy

By reducing reliance on inventory buffers and expediting customer orders, crossdocking promotes a flow-through supply-chain pipeline.

Ray Kulwiec

Crossdocking as a distribution tactic is not new. However, its use continues to grow with the popularity of just-in-time (JIT) methods, and as supply chain concepts such as collaboration take hold, and sophisticated information technologies proliferate.[1] Crossdocking is primarily a warehousing practice, but in order for it to be efficient and successful, there has to be close coordination and continuous, high-quality information flow among manufacturer, distributor, and customer levels.

In Brief

Author Ray Kulwiec explores crossdocking as a means to improve supply chain performance. The article describes the Owens Corning approach to crossdocking, along with Sears and Wal-Mart activities. Readers will also find counsel on "when crossdocking does – and doesn't – apply."

What it is: A broad definition of crossdocking is the transfer of goods and materials from an inbound carrier to an outbound carrier, without goods or products actually entering the warehouse or being put away into storage. Thus, the products "cross the docks" from the receiving dock area to the shipping dock area. Reality is a bit more complicated than this broad definition, since there are several versions of crossdocking, as described in the accompanying box, "Common Types of Crossdocking." And it is clear that the shipper, typically the manufacturer, carries a high degree of responsibility for making crossdocking at its customer (distributor) facilities successful.

Crossdocking can provide significant inventory savings. In its purest form, there is no storage. Therefore, there is no routing to storage areas, no subsequent retrieval from storage racks, and no re-routing back to dock areas. Both the costs of holding inventory and the costs of handling the inventory are eliminated or drastically reduced. In addition, crossdocking

Common Types of Crossdocking

Several types of crossdocking can be practiced, as follows:

Full pallet load operation: This simplest, and usually least costly, version involves receiving an incoming load that is marked and separated by outgoing orders. The pallet loads are simply sorted and re-routed into outgoing trucks having different destinations.[11] A classic example can be found in a less-than-truckload (LTL) truck terminal, where products never touch the floor, but move directly from one truck to another.

Case-load order makeup: In this version merchandise arrives at the dock sorted and marked by stock-keeping units (SKUs). However, the goods must be segregated by customer order, generally requiring that pallet loads be broken down. Cases may then be re-palletized and the new loads delivered to appropriate outbound vehicles.

Hybrid crossdocking: In some cases materials in storage at the warehouse are blended in with incoming materials, and these newly completed palletized orders are then routed to outbound trucks. Likewise, some of the incoming goods may be routed to temporary storage in the warehouse instead of all being crossdocked. (See Figure 5.)

Opportunistic crossdocking: "Hot" items, such as late-arriving products on back order, are often crossdocked rather than being placed in inventory and order-picked. Such goods may be crossdocked directly upon receipt, or combined with items from storage. The operation can be vital in enhancing customer service.

Truck/rail consolidation: Products may sometimes come in by both truck and rail, and need to be consolidated in order to complete customer orders. Here the goods are combined and sorted for shipment within 24 to 48 hours. A related tactic is pool-car forwarding. Here, goods are picked up by truck and transferred to a rail boxcar at the shipping origin point. Then, at the rail destination, the goods are unloaded and transferred back into trucks for final delivery.

Short-term storage: Promotional or seasonal merchandise, or awkward, bulky items, may be stored temporarily off-site, or in a yard trailer, until just before shipment, when they are moved to the cross-docking area. This approach works well for a space-limited warehouse, or where warehouse handling may be extremely tedious and time-consuming.

provides improved customer service by expediting customer deliveries.

Owens Corning's Approach

Most warehouses can crossdock at least a portion of their incoming materials. Owens Corning, based in Toledo, OH, reports a range from a small percentage to 40 percent to 50 percent, depending on the location. This manufacturer practices "opportunistic" crossdocking, as well as direct loading of outbound shipments from the production line. Opportunistic crossdocking takes "hot" items such as back-ordered or late-arriving goods and moves them directly to outbound shipping areas instead of moving them first to storage and putaway. Even if some of the needed goods are in inventory, crossdocking of the arriving items is performed to save time and expedite orders. In some cases the "hot" items are combined with products coming directly off the production line to make up outbound orders.

According to Logistics Systems Development Team Leader Barry Burnham, crossdocking at Owens Corning occurs primarily at multi-purpose warehouses co-located with the company's production facilities. They serve retail and wholesale facilities, and other distribution warehouses.

The company moves large, bulky materials such as fiberglass insulation, pallets of glass reinforcements, and vinyl siding. Efficiency of material movement is a major concern. By reducing the number of "touches" applied to materials, the company has experienced substantial reductions in labor, product damage, and cycle time. Burnham states that crossdocking is performed exclusively for palletized or otherwise unitized loads. Turns for most crossdocked items average 25 to 50 per year.[2] Primarily they are finished goods. Crossdocking is not applied to materials coming off the production line that have curing or quality testing requirements.

Translation of the Acronyms

Crossdocking is an important element in a synchronized supply chain. In turn, supply chain management today relies on the use of various information technologies and techniques whose acronyms have become an "alphabet soup." Brief explanations of the acronyms are provided:

ASN	*Advance ship notice.* An electronic notification that a product is due, before it is received
ERP	*Enterprise resources planning*
LTL	*Less-than-truckload quantity for shipment*
OMS	*Order management system.* A cross between planning and execution software. OMS performs order entry, inventory management, order processing, and customer service. It prepares the shipping and delivery execution program, which is then transferred to a warehouse management system.
POS	*Point of sale*
RFDC	*Radio frequency data communication*
SCM	*Supply chain management.* The process of optimizing the flow of materials and products from the supplier's supplier to the customer's customer.
TMS	*Transportation management system.* An execution software system that plans freight movement, oversees freight rating, selects the route and carrier, and manages freight bills and payments.
VMI	*Vendor managed inventory.* A process in which the vendor assumes responsibility for replenishing the customer's stock as needed.
WMS	*Warehouse management system.* An execution system that manages the operations or a warehouse or distribution center, including receiving, crossdocking, putaway, inventory control, order picking, replenishment, packing, and shipping.
YMS	*Yard management system.* An execution system that manages yard operations, including receipt of carriers, dock scheduling and spotting, and operator activities relating to receiving and shipping.

In many locations, received items are combined with goods carried to the dock area in ware carts. Picking is done from the carts to make up outbound loads that also contain received materials. This "compromise" solution provides flexibility and saves on transportation and handling to and from traditional storage areas in the warehouse.

At Owens Corning, various levels of information systems support crossdocking as well as other warehouse operations. They include enterprise resource planning (ERP) software, warehouse management systems (WMS), yard management systems (YMS), radio-frequency data communication (RFDC), and bar coding. Line loading from production has been practiced for several years. Opportunistic crossdocking has been mostly implemented as the WMS and YMS software systems have been deployed.

A Supply Chain Issue

Crossdocking today is a supply-chain issue, requiring collaboration among members of the chain. In fact, says Toronto-based management and logistics consultant Dave Luton, crossdocking in an era of

minimal inventories is the element that links the supply and demand sides of the chain.[3] Luton notes that market forces are continuously increasing pressure on supply chain management (SCM) performance, with requirements for 1) increased throughput with lower inventories, 2) more product lines with lower operational costs, and 3) more value-added services provided to customers.

In the past, says Luton, the traditional SCM model relied on the use of inventory buffers at strategic points within the supply chain to alleviate the uncertainty between supply and demand (see Figure 1). Note that in this example the supply and demand chains are de-coupled, and inventory buffers are used to provide a connecting link. Today, however, the objective is to synchronize the supply and demand chains (Figure 2) to provide flow-through operation made possible by crossdocking. In this model, the chains are coupled, and crossdocking replaces inventory buffering as the linking mechanism.

Obviously supply-chain reliability is critical when operating with minimal inventory buffers. (If product does not arrive from the supplier on time, there is little contingency in the inventory buffers.) Therefore, information sharing is crucial.

Before considering the role of advanced information technologies, look at a simple and basic information technique — labeling. The easiest labeling scenario is when stretch-wrapped pallet loads travel intact to the ultimate destination. Since each case in the load does not have to be identified, only the pallet requires identification, on two faces if possible.[4] On the other hand, incoming pallet loads that have to be broken down will require labeling of individual cases or items, and the number of pieces to each consignee identified.

Crossdocking becomes more complicated when less-than-full-case situations are involved. Unpacking, picking, packing, and labeling obviously are more time consuming. Some distributors choose not to crossdock less-than-full-case deliveries.

Traditional Supply-Chain Model

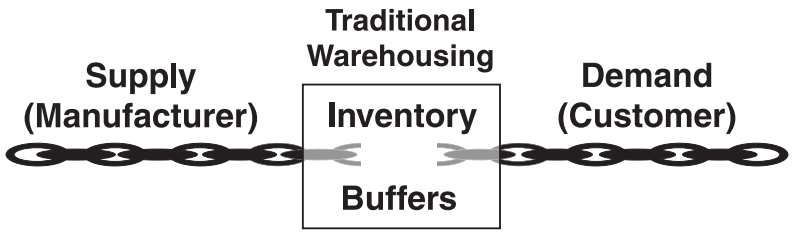

Figure 1. Traditional supply-chain-management model uses inventory buffers (traditional warehousing) to maintain product flow between disconnected supply (manufacturer) and demand (customer) chains.

Synchronized Supply-Chain Model

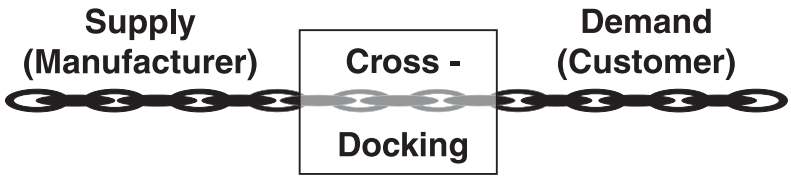

Figure 2. Supply and demand chains are coupled and synchronized by crossdocking, which replaces or greatly minimizes inventory buffers.

IT the Key

Information sharing and collaboration among trading partners are critical for successful crossdocking which, in turn, provides the means for supply-chain synchronization. At the supplier or manufacturer level, important information technologies (IT) include production scheduling, advance ship notices (ASNs), and transportation management systems (TMS). At the warehouse execution level where crossdocking is performed, warehouse management systems (WMS) perform daily planning and execution. This step involves an awareness of future orders, plus knowledge of the destination of an incoming item even before it is received. Also, yard man-

agement systems (YMS) may be involved. By providing visibility to all dock and yard storage locations, the YMS paves the way to better, advanced crossdocking planning. Finally, at the demand or customer level, point-of-sale (POS) software is an important tool, along with order management systems (OMS) and, in some instances, vendor-managed inventory (VMI) systems. Further information on these various systems is provided in the box, "Translation of the Acronyms."[5]

Crossdocking at Sears

Collaboration with trading partners is certain to be one of the next big areas for improvement and development, according to Lt. Gen. (ret.) Gus Pagonis (Figure 3), who is president of Sears Logistics Services, an in-house logistics/distribution provider for Sears, Roebuck & Co. Pagonis, who was the top U. S. Army officer in charge of all logistics and distribution during the Gulf War in 1991, is also a senior vice president for distribution at Sears, headquartered in Hoffman Estates, IL. He notes that collaborative forecasting in particular is critical for making crossdocking work properly.

Pagonis explains that with the broad array of products Sears handles, ranging from nuts and bolts to fashion items to refrigerators and lawn tractors, crossdocking must be programmed and monitored carefully. A major part of the process is correctly forecasting arrival of goods and the availability of space, time, and onsite materials needed to create outbound loads for same-day shipment to all the department stores in Sears' U.S. network. Not only diversity of products, but also their seasonality, affects when items are received, in what quantity, and whether or not crossdocking is appropriate. In the north, for example, patio furniture and lawn-care products are not likely to be shipped in late fall or early winter; snowblowers are. In warm climates on the other hand, demand continues for lawn equipment and lawn furniture virtually throughout the year.

Sears operates ten appliance distribution centers (DCs) in the United States, along with seven large, general merchandise warehouse distribution centers. Store replenishment and sales event needs are met through crossdocking of vendor-supplied goods, through the seven general merchandise DCs to the stores. Crossdocking is performed at virtually all DCs, but the extent to which it is performed varies by the product category, or "channel." Thus, for the channel comprising appliances and other "hard-line" goods, about 60-70 percent of incoming products are crossdocked, and 50-60 percent for other lines. Bar coding is used extensively in all networks, and radio-frequency data communication (RFDC) capability exists in all locations. Sears is investigating applicability of radio-frequency identification (RFID) technology in its systems.

Typically the DCs receive truckloads of merchandise from vendors, generally in the form of pallet loads or large units (such as

Figure 3. Lt. Gen. (ret.) Gus Pagonis, president of Sears Logistics Services, an in-house logistics/distribution provider for Sears, Roebuck & Co.

refrigerators or stoves). When necessary, pallet loads are broken down to the case level, and outgoing loads assembled and shipped out to stores the same day, whenever possible. Given the magnitude of SKUs handled by Sears, cycle times are very important for getting the right products to the right stores on time. Smaller items, in less than full-case quantities, are not crossdocked, but directed to storage and putaway for subsequent order processing. Some of these items may be products such as tools, which are assembled into packs that customers will readily take home from stores.

Sears has been practicing programmed crossdocking for about ten years. All partners in the chain — suppliers, distribution centers, and retail stores — have benefited from the significant inventory savings. Inventory benefits have included not only the values of inventories that had to be held in the past, but also the savings in warehouse space and costs of handling and storage in the warehouse. The savings are best illustrated by the fact that additional DCs have not been built to support new formats and increased unit disbursements.

When Crossdocking Does — and Doesn't – Apply

Consultant Dave Luton identifies the following types of products as generally being suitable for crossdocking:

- Back-ordered items
- Seasonal (or promotional) merchandise
- High-volume products in steady demand
- High-value products
- Products having short leadtimes.

On the other hand, Luton points to the following products as not generally being suitable for crossdocking:

- Bulky, awkward items that are difficult to handle
- Items arriving before seasonal promotions begin
- Slow-moving, low-value products
- Items purchased in large bulk quantities
- Products having long leadtimes (including overseas shipments).

Crossdocking is practiced in a diversity of industries. The grocery industry is a natural, because it typifies a closed-loop system, involving daily deliveries from suppliers, and regular deliveries to a fixed set of customers. Surprises are usually uncommon. Parcel delivery companies also are practitioners, although at the case or package level. Typically voice data, bar coding, and RF systems are used in such operations. Various manufacturing industries, automotive parts distribution, and, as we have seen, retailing, are other strong application areas for crossdocking.

In discount retailing, Wal-Mart has been identified as the king of crossdocking. In fact, industry sources have pointed to crossdocking as one of the major factors accounting for the company's rise to preeminence in its field. Wal-Mart reportedly delivers about 85 percent of its merchandise using crossdocking operations. Suppliers are part of the process. Using a private satellite communications system, Wal-Mart transmits point-of-sale (POS) information to suppliers, to keep them informed about sales activities and trends.[6] Suppliers (manufacturers) are instructed to pack orders so they can be readily crossdocked at Wal-Mart's DCs. Thus, some suppliers are now picking orders of mixed SKUs (stock-keeping units) that are packed for individual stores. When they arrive at a Wal-Mart DC, they do not go into inventory storage, but keep moving and, whenever possible, are processed out the same day.[7] In any case, such merchandise stays in the warehouse for less than 48 hours. From the supplier's point of view, greater effort is required in packing for crossdocking. On the other hand, the practice results in better customer service by getting goods to stores faster and helping to keep shelves filled.

Crossdocking has helped Wal-Mart achieve significant reductions in inventory and safety stocks, and therefore in the cost of holding inventory. It has also helped the company achieve purchasing economies by dealing in full truckload quantities. The result has been a significant reduction in the cost of sales.[6] The company's logistics practices have helped to keep prices down,

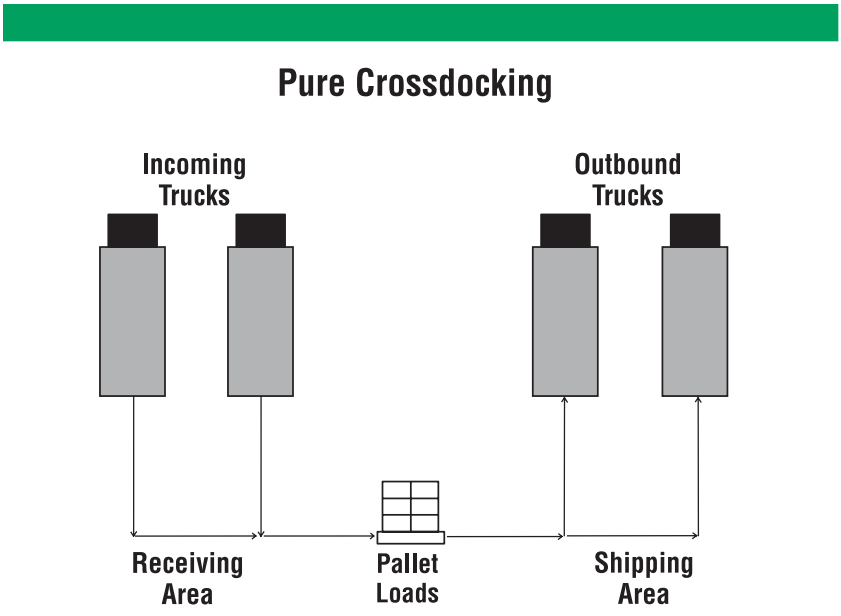

Figure 4. In the simplest form of crossdocking, pallet loads from incoming trucks are routed directly to outgoing trucks, for shipment to various destinations such as retail stores. It is usually good practice to keep receiving and shipping docks close to each other, preferably on the same side of the building. Or, in some cases, a long, narrow building permits easy crossover even if docks are on opposite sides.

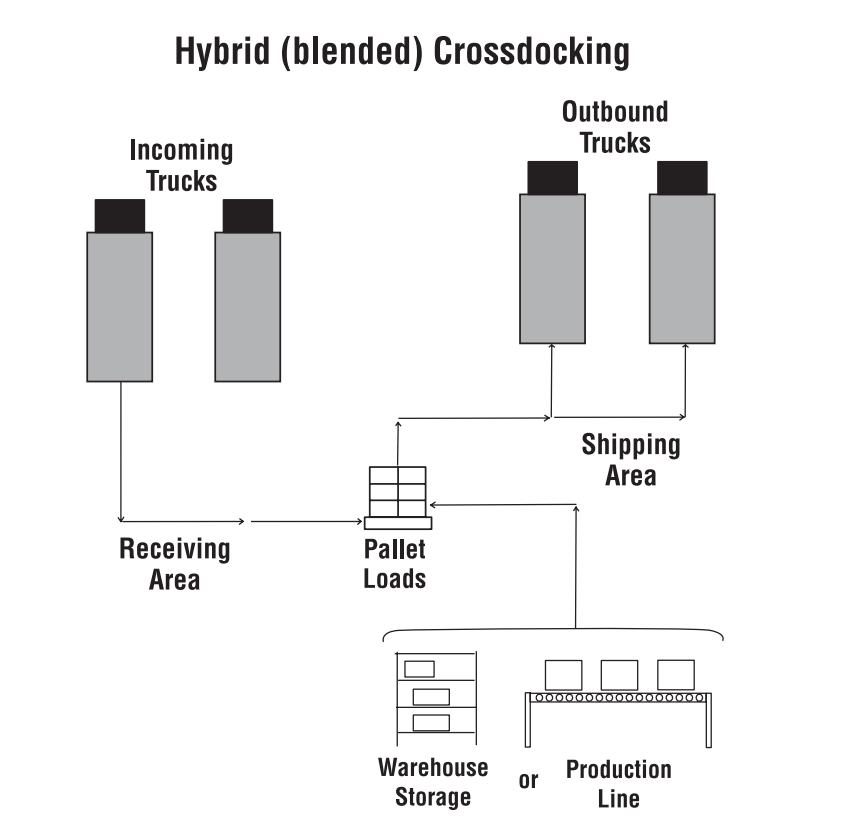

Figure 5. Incoming materials are blended with items coming from onsite storage to complete outbound loads. If the warehouse is co-located with a manufacturing facility, items coming off the production line may be sent directly to pallet make-up to be blended with items coming off arriving trucks. In some instances, some incoming materials may also be routed to storage instead of all being crossdocked immediately.

thereby benefiting the ultimate customer.

Technology is an important part of Wal-Mart's logistics processes, and this fact was highlighted in the company's recent mandate that suppliers provide radio-frequency identification (RFID) tags on pallets and cartons they ship to the company, by January 2005.[8] The use of RFID is expected to improve efficiency and speed of receiving operations, including crossdocking.

Bar coding, used widely today, requires a line-of-sight scan, typically made by an employee using a hand-held scanner. Because RFID does not require line-of-sight scanning, less labor is required. Further, a good deal of time may be spent positioning the goods so bar code labels are in a line for line-of-sight for reading. With RFID, cases can be stacked without considering label orientation.

A bar code scanner typically scans one bar code at a time. An RF reader, on the other hand, can read multiple tags. Besides speed, accuracy can also be improved. RFID can track inventory without relying on an operator doing a scan (a source of error can occur if the operator performs an inventory move without performing the necessary scan).[9]

A Compromise Approach

Pure crossdocking (Figure 4) does not always work. While it has been a major tool for helping to reduce costly inventory holding and for expediting orders, it has not been a total replacement for storage. Late changes in customer orders, canceled orders, incomplete production runs, shippers running out of stock, outbound vehicles not filled to economic capacity, and a host of other circumstances may make crossdocking a questionable alternative to storage at times, even with the best of information technologies at work. A compromise approach, which some have called "pause in transit," provides some degree of storage to supplement crossdocking operations.[10]

The compromise scenario designs for crossdocking, but also provides for a certain amount of storage. The storage may be

in outdoor trailers, or within the warehouse but close to the shipping area. Racks may be provided near dock doors to facilitate quick retrieval of items that were not immediately crossdocked. Some of these approaches may be more properly termed staging rather than storage, because of their short-term duration. The compromise staging/storage/crossdocking approach may also help the manufacturer maintain economic production volumes while still fulfilling the needs of partners down the line in the supply chain.

It has been said that the best warehousing is no warehousing at all. Obviously that sentiment is impractical, but crossdocking in its various forms can provide alternatives to the utopian dream. When properly executed and monitored, it can serve as a tool for synchronizing the supply chain, and for producing significant space, labor, and inventory savings.[12]

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Footnotes

1. Westburgh, Jesse T., "Cross Docking in the Warehouse — an Operator's View," Ackerman Warehousing Forum, August, 1995, The Ackerman Co., Columbus, OH.

2. Inventory turns can vary widely depending on industry and application. Annual turns of 80-100 are not uncommon in automotive assembly. In less-than-truckload (LTL) terminals, they can be twice a day or over 500 per year.

3. Luton, David, and Bard Critoph, "Warehouse Design for Supply Chain Synchronization," 2003 Supply Chain & Logistics Canada (SCL) Annual Conference & Tradeshow, Canadian Association of Supply Chain & Logistics Management.

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5. "Logistics Execution Systems: A Guide to Understanding and Procuring LES," Logistics Execution Systems Association, Charlotte, NC, 2002, http://www.mhia.org/LESA

6. "Solutions: Cases," University of South Carolina, Computer Science & Engineering, http://www.cse.sc.edu/~zavalagu/MGSC798ESCcases.htm

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