Distribution Center MANAGEMENT

Managing people, materials and costs in the warehouse and DC

Facility Management

Looking for a more efficient warehouse layout? Maybe the Flying V, fishbone, or chevron are for you

Nearly every warehouse in the world is laid out in a basic grid. Picking aisles are straight and parallel, and cross aisles run straight and perpendicular to the picking aisles.

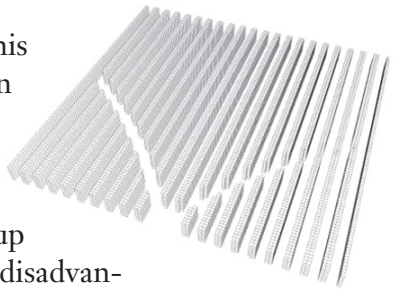
But this layout — Auburn University researcher Kevin Gue calls it "your grandfather's warehouse" — might not be the most efficient way to arrange a DC.

"Why does this middle aisle have to be straight?" Gue asks.

"It doesn't."

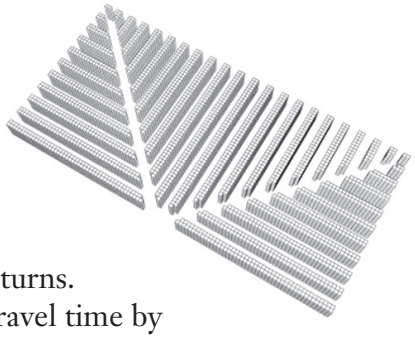
Gue and the University of Arkansas's Russ Meller have teamed up to question the assumptions behind the traditional warehouse layout, and they've found that modifying the layouts can cut travel times by as much as 20 percent.

Among the layouts the researchers have looked at:

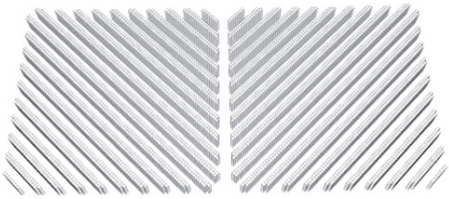


The Flying V. In this layout, picking aisles run parallel, but the cross aisle is shaped like a V, with the point of the V at the main pick-up and drop-off spot. One disadvantage is that forklift drivers must make a hard turn to get into the aisles below the V. This design cuts travel times by 10 percent.

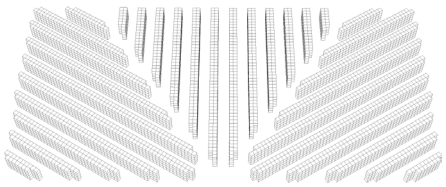
The fishbone. In this modification of the Flying V, the aisles atop the V run north and south, while the aisles below the V go east and west. This offers the advantage of softening turns to a 45-degree angle and increasing the speed at which lift truck operators can maneuver through the turns. The fishbone can cut travel time by 20 percent.



The chevron. In this design, the cross aisle runs north and south, and picking aisles shoot out at 45-degree angles in a V-shape. Chevron aisles are nearly as efficient as fishbone aisles, and they offer an advantage — multiple entry points to the picking space.



The leaf. This layout includes a V-shaped cross aisle. Aisles above the V go north and south, while aisles below the V run diagonally. This layout works for very large warehouses, but space is a trade-off.



In all four examples, the idea is to eliminate unproductive travel and shorten the distance from Point A to Point B. Less

travel can translate to lower labor costs and faster throughput.

Despite the intriguing potential of these alternate layouts, the concept has been slow to gain traction. Gue and Meller first presented their research about the Flying V and the fishbone at a Material Handling Industry Association conference in 2006.

Gue knows of only a handful of DCs that have put the theory into practice since then, and only one, generator-maker Generac, has been willing to publicly discuss its use of the concept.

Fishbone works well for full-pallet moves

Generac introduced the fishbone at its warehouse in Whitewater, WI. That DC stores electrical generators and transfer switches that are shipped to customers around the country.

"Most of our moves are full-pallet moves," says Brian Randleman, Generac's logistics manager. "I need to get that lift truck back to the staging area as quickly as possible, and that's what this layout does."

Generac's layout includes racking in the middle section, between the diagonal aisles, and floor storage below the diagonals. There's also a horizontal cross aisle.

Generac installed mirrors at key intersections to help workers navigate the layout safely. In addition to improved material flow and reduced travel distances, Generac found that the layout lets forklift operators drive faster. Operators can navigate the 45-degree turns into the picking aisles more quickly than the 90-degree ones.

"He's probably going 80 to 90 percent of full speed, and he's doing it safely," Randleman says.

Randleman acknowledges that it's hard to say just how much efficiency the fishbone layout creates. Generac doesn't have another DC to compare this one to.

Before Generac built its DC with the fishbone layout, it shipped directly from its manufacturing facility. But Randleman has been happy with the results.

"It works extremely well," he says.

Generac was an ideal candidate for the fishbone concept, Gue says. The design works best for unit load facilities, where a picker has just one destination on each trip and picks up a full pallet or a large item.

Appliance warehouses and import operations can benefit from the fishbone design. But the fishbone isn't much good in DCs where a picker grabs eight or 10 small items from multiple locations in the same trip. The concept also makes little sense in what Gue calls the Raiders of the Lost Ark scenario, named for the final scene of the Indiana Jones movie, where a relic is deposited in a warehouse to gather dust for years.

"If people rarely go in there, you're getting very little savings," Gue says.

There's another caveat, too: The

For order-picking warehouses, multiple cross aisles can boost efficiency

The diagonal aisles of the Flying V, fishbone, and chevron work for unit-load distribution centers. But what if you run an order-picking warehouse where pickers make multiple stops for small items on each trip?

Keep the grid but add more cross aisles, says Kees Jan Roodbergen of the University of Groningen in the Netherlands. His research shows that additional cross aisles improve pickers' access to product.

"Layouts with just two cross aisles are very common, but actually are rarely the best choice with regards to operational efficiency," Roodbergen writes in a recent paper. "More cross aisles in between the front and back cross aisles should be added to increase the number of opportunities to change aisles."

Extra cross aisles reduce travel distances by giving pickers more routing options. A trade-off: The additional cross aisles take up space, so you might lose some storage density.

To help DCs decide how best to lay out their facilities, Roodbergen designed an online tool that's available at www.roodbergen.com/warehouse/index.php.

Contact: Kees Jan Roodbergen, University of Groningen, www.roodbergen.com, 31-503632360.

fishbone just doesn't allow for the same storage density as your grandfather's grid. The layout loses some pallet positions and decreases storage capacity by 5 percent to 10 percent, Gue says.

If you operate in a low-cost real estate market, or if you have some extra capacity in your facility, the fishbone might make sense. And if you're in a pricey market or your DC is bursting at the seams, maybe not.

"If you're building this in Manhattan, it's going to be a tough sell," Gue says. "You sacrifice the storage density a little bit for the potential of benefitting on the costs of travel in the warehouse."

The fishbone makes the most sense if you're building a new facility or moving into a DC that needs to be reconfigured anyway. But unbolting the racks in your DC and rearranging them into a fishbone would be costly and likely would eat into the labor savings from shorter travel times.

Because the fishbone is best-suited for specific types of DCs, Generac's case study is the rare example of a DC going to the unconventional layout.

Gue knows of another DC that adopted the fishbone. But because it was a construction material warehouse in Florida that changed its layout just before its business was eviscerated by the housing crash, it's hard to say how much efficiency it gained.

And the savings realized by any DC will depend on a variety of factors, such as whether pick-up and drop-off points are at the same place or on opposite sides of the warehouse.

"Every implementation is different," Gue says. "There's no cookie-cutter approach."

Contacts: Kevin Gue, Auburn University, kevin.gue@auburn.edu; Brian Randleman, Generac, 262-544-4811. DCM

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712 Main Street — Suite 187B, Boonton, NJ 07005-1450
Telephone: (973) 265-2300 • Fax: (973) 402-6056 • Email: info@DistributionGroup.com • Website: www.DistributionGroup.com

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