The Designer's Corner

Brian M. Lee, P.E.

Designing a Fast-Pick Area for Cases or Individual Items

Part One

Do you operate a fast pick area for cases or individual items in your plant, warehouse or distribution center? Are you thinking about building one or adding to one that already exists? If the answer to either of these questions is *yes*, you might be interested to know that quite a bit of academic research has been conducted on the subject in the past few years. And, if you've got a computer and a good spreadsheet program, you can use it to help you get more out of the investment you've made or are preparing to make!

Some of the most interesting research published comes from two Georgia Tech professors: John Bartholdi and Steven Hackman. Their body of work is quite large and covers quite a few subjects, so I decided to break this particular topic out and review a good portion of it (minus the lengthy mathematical derivations) over the course of several articles (this being the first). By the way, if you're interested in some of the math, you can check out their website (warehouse-science.com) or drop me an e-mail (blee@asapauto.com) and I'll work through it with you.

Fast Pick Area Rationale

Why build a fast-pick area in the first place? While there are many reasons, and while those reasons may vary from site to site and from industry to industry, almost every decision to build a fast pick area is partially (and in some cases wholly) motivated by the need to reduce operating costs.

When you move product to a fast pick area, you substitute an expensive pick activity (travel to, search through and pick from a large shared storage area) with an inexpensive pick activity AND a restocking (or replenishment) activity. For any particular SKU in the fast pick area, the more you store, the less you restock, but the less space you make available for other SKU's (the conundrum). How much space should you allocate to each SKU to minimize the total costs associated with picking AND restocking products?

Let's start with the simplest case. Remember, we're dealing with cases and individual items (equations for pallets are more complex).

Assume you've already decided on the subset of SKU's you're planning to store in your fast pick area (i.e. the "what"). How do you decide what amount of space to allocate to each SKU (the "how much")? A lot of folks employ one of the following strategies:

Equal Space Allocation: Pretty basic. Simply allocate the same amount of space to each SKU. To solve, take the total volume (*V*) of your fast pick area and divide it by the number of SKU's (*n*).

Equal Time Allocation: A little more involved (but not much). Store an equal *time supply* of each SKU (e.g. a three week's supply of each SKU). You'll need a couple of pieces of data to solve this one (if you've got Warehouse Management Software, you've probably got it). For each SKU, you'll need to know a.) the total number of items sold, b.) the total number of items in a case or carton and c.) the size (volume) of the carton. From these, you can determine the rate of flow through your facility (volume per year or *f*). Each SKU is then given a fraction of the fast pick area volume that is equal to the ratio of its flow rate to the sum of the flow rates of all the SKU's.

Conventional Wisdom

I first believed a fast pick area loaded up with products using the Equal Time method would significantly reduce total replenishment costs when compared to one loaded up using the Equal Space method for the simple reason that the Space method is arbitrary. Turns out I was wrong. Not only are the total number of restocks the same under both methods, but the number of restocks are, in many instances, far from optimal!

From Bartholdi and Hackman:

If the number of restocks per year for SKU *i*= product flow rate per year (f_i) divided by the fast pick volume allocated to i (v_i), *then*

	Equal Space Method	**Equal Time Method**
Space reserved for SKU *i*	V/n	$\left(f_i / \sum_j f_j\right) V$
Restocks for SKU $i = f_i/v_i$	nf_i/V	$\sum_j f_j / V$
Total restocks	$n \sum_i f_i / V$	$n \sum_j f_j / V$

A Better Way

The aforementioned authors developed a mathematical model of the loading problem and from it, derived the following:

To minimize total restocks over all SKU's, each SKU i should be stored in the amount

$$v_i = \left(\sqrt{f_i} \Big/ \sum_{j=1}^{n} \sqrt{f_j} \right) V$$

How Much Better?

There are different ways to answer this; I felt the most interesting would be to test different sets of numbers (more palpable than a mathematical proof).

I opened up my spreadsheet program and dropped in a couple of sets of numbers. Here are the results:

		SKU's					Total
		A	B	C	D	E	
	Flow	40	35	30	15	5	
Equal Space	Allocations	0.20	0.20	0.20	0.20	0.20	
Method	Restocks	200	175	150	75	25	625
Equal Time	Allocations	0.32	0.28	0.24	0.12	0.04	
Method	Restocks	125	125	125	125	125	625
Optimal	Allocations	0.27	0.25	0.23	0.16	0.09	
Method	**Restocks**	151	141	131	92	53	**568**
					Percent Improvement		9.1%

		SKU's					Total
		A	B	C	D	E	
	Flow	20	15	10	5	1	
Equal Space	Allocations	0.20	0.20	0.20	0.20	0.20	
Method	Restocks	100	75	50	25	5	255
Equal Time	Allocations	0.16	0.12	0.08	0.04	0.01	
Method	Restocks	51	51	51	51	51	255
Optimal	Allocations	0.30	0.26	0.21	0.15	0.07	
Method	**Restocks**	66	57	47	33	15	**218**
					Percent Improvement		14.5%

		SKU's					Total
		A	B	C	D	E	
	Flow	20	10	3	2	1	
Equal Space	Allocations	0.20	0.20	0.20	0.20	0.20	
Method	Restocks	100	50	15	10	5	180
Equal Time	Allocations	0.16	0.08	0.02	0.02	0.01	
Method	Restocks	36	36	36	36	36	180
Optimal	Allocations	0.38	0.27	0.15	0.12	0.08	
Method	**Restocks**	53	37	20	17	12	**139**
					Percent Improvement		22.8%

More to follow next issue...