Rethinking Your Reslotting Strategy:

Optimal Slotting Benefits from Slot Maintenance Performed In Sync with Distribution Center Dynamics


Executive Summary

Optimal slotting benefits from slot maintenance performed in sync with distribution center dynamics. Cost effective slot maintenance frequency depends greatly on the dynamics of the warehousing environment under consideration. Constraints within the distribution center and factors external to the facility impact reslotting frequency and timing decisions. Influences or ‘destabilizing events’ such as product volume and mix changes, seasonal demands and promotions create periods of instability within the warehousing environment.

Opportunistic responses to such destabilizing events allow for reslotting that increases picking efficiency. Identifying inflection points and reslotting at the appropriate time using underutilized labor at standard rates minimizes costs and improves payback cycles. Once a slotting strategy has been determined and resultant rules established, slotting technology can be employed to achieve a reslotting strategy that minimizes costs and optimizes efficiency according to the predetermined warehousing objectives.
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1.0 Introduction
How often slot maintenance is performed depends on product stability within the four walls of the distribution center environment. Realistically, of course, slotting is a dynamic function responsive to the changing influence of actions and activity outside of the four walls such as promotions, seasonal activity, shifts in products and change in stock-keeping unit (SKU) breakdowns. How to best respond to these changing levels of product and product mix requires more than technology alone. Before technology can be effective, strategic slotting objectives must be defined taking into account optimization within the four walls with purview over what is happening outside of the four walls. A slotting tool can then be used to calculate and recommend moves in order to optimize according to the rules defined by the aforementioned strategic goals. Slot maintenance frequency follows these parameters as a function of a given distribution center (DC) or warehouse’s stability and provides insight as to slot maintenance timing.

2.0 Slot Maintenance Timing
Appropriate timing of slot maintenance can contribute to a globally optimized cost benefit equation providing the balance between optimizing product placement inside the four walls and expending resources to maintain that optimal slotting. Determining optimal timing and frequency of slot maintenance goes a step beyond simple optimized product placement and yields improved globally optimal solutions. To define appropriate slot maintenance frequency requires first understanding the stability of the environment in which the slotting is taking place.

2.1 Distribution Center Stability
The frequency of pickline slot maintenance, referred to as ‘reslots,’ is a question often asked and rarely clearly answered. Many factors play into the trade-off between efficient slotting (producing a lower cost per pick) and inefficient slotting (resulting in a higher cost per pick.) In a relatively stable (i.e. lower SKU turnover) environment, such as a dry grocery facility, minor reslotting activities may occur far less often than minor reslotting activities in a less stable environment, such as a general merchandise facility.
Differences between stable and less stable environments include factors such as numbers of:

- New item introductions
- Item deletions
- Seasonal items
- Seasons
- Promotional items
- Promotions
- Product grouping/sequencing considerations

### 2.2 Destabilizing Events in the DC

In a stable environment there is time between ‘destabilizing’ events to actually benefit from minor reslotting. If the reslot moves are made, the distribution center enjoys the benefits of reduced selection/replenishment costs associated with the moves, and then a ‘destabilizing’ event like a seasonal period or promotion occurs, which undermines the value of the reslot moves. This chain reaction causes another round of reslot moves to be made until the next ‘destabilizing’ event occurs, such as the end of the seasonal period or promotion that created the need for the reslot moves in the first place.

Another issue to consider in choosing how often to perform reslots is, clearly, the payback associated with making the moves. If the number of items to move is small, then the cost of moves may be, but is not necessarily, small. In some cases, costs are actually prohibitive, especially in a full facility where there are few empty slots. Additionally, if the benefit of making the moves must be gained in a short timeframe then there may not be a payback in the allotted time. Finally, the number of moves required to free up the correct locations for reslots may be large, typically seen when the facility has few empty slots. It is difficult to justify making these moves unless the benefit is attainable for an extended period of time. Justification is more easily achieved in a stable environment.
environment, which has more certainty, and yields calculations that make reslot decisions easier.

3.0 Reslot Frequency Decisions
Frequent reslot moves can lead to moving product repeatedly because of the dynamic nature of certain warehouse environments. A near-term benefit from the moves may be negated by the need to move items again in a short timeframe due to demand fluctuations. Constant movement based on changing demand aggravates an already difficult slotting situation. Luckily, advanced computerized slotting systems have the capacity to minimize the occurrence of items being slotted more than once in a short timeframe.

4.0 Reslot Benefit Analysis
So how does one balance the benefits of reslots against their costs? In a stable environment, an easy approach dictates that minor reslot moves are only made based on the availability of ‘free’ labor. Free labor here is referred to as workers who have completed their assigned tasks and are available to either ‘sweep the floor’ or move product. These workers are designated as free or available and are assigned to make reslot moves. Large-scale reslots may require additional labor.

4.1 Slotting Rules as Factors
Selecting the best moves for the allotted labor would be a capability of a good slotting system. Additionally, slotting new items may require that a rule be applied, such as slotting new items to the best empty locations, where best empty location is determined based on grouping or sequencing rules and item/slot profiling rules. Of course, where strict adherence to grouping is required, then it should be acceptable to make several product moves in order to free up slots that allow new items to be grouped correctly. Upon the arrival of the next season or promotional period, a more extensive reslot would most likely be necessary. A good slotting tool would not only identify and reslot the seasonal items but also ‘fix’ other mis-slotted items, including new items, in the process.
4.2 Logical Reslotting

One of the issues that muddies the reslot frequency decision is a basic property of slotting. Certain slot types and slot locations are required to properly profile and sequence items in a pickline. The more empty slots available, the more likely an item can be assigned to the appropriate slot in a cost effective manner. When considering a reslot, we can theoretically create logically empty slots. Logically empty slots are created by logically (not physically) removing all mis-slotted items from their locations and putting them ‘on the floor.’

In general, the more items we reslot at one time, the better the probability of lower reslot costs. By making many moves at one time, the likelihood of a positive payback is improved.

A larger number of empty slots available (logical empties plus physical empties), increases the probability that an empty slot is available into which, each item can be correctly slotted. In turn the cost to move the item to the correct empty slot is lower than if we considered the physically empty slots independently.

Figures 1.0 and 2.0 illustrate the logical slotting point under two scenarios. In both scenarios, slotting occurs based on case density, from highest to lowest. As a new item is slotted, the result eventually abides by the decreasing case density sequence.

In the first scenario, no empty slots allow new item, G, to be slotted while maintaining the density sequence. New item, G, must be slotted to the best empty slot, here labeled, Slot 5. The sequence is then fixed by physically placing item C on the floor such that item G can be moved to the (density sequenced) appropriate slot 3. Finally, item C is moved to slot 5. In this scenario, four total moves are required.
Figure 1.0  Physical Reslot of New Item to Best Empty

In Figure 2.0, the second scenario ‘logically’ removes mis-slotted item C from slot 3, so now both items C and G must be slotted. Item C moves directly into slot 5, and item G moves directly into slot 3. In this scenario, only two physical moves are required.

Figure 2.0  Logical Reslot with Minimal Moves
5.0 Efficiency Gains Based On Reslotting Frequency

Efficiency gains associated with reslotting are the next consideration with respect to the frequency decision. A simple ‘saw tooth’ graph represents slotting efficiency over time based on various reslotting strategies. In both figures 3.1 and 3.2, the x-axis depicts time, (for this example) in months. The y-axis represents pickline efficiency; for this example, consider efficiency in terms of optimal space utilization, shortest pick path and product grouping.

5.1 Comparative Time-based Reslotting Examples

Figure 3.1 depicts efficiency drops over time, perhaps due to SKU proliferation and demand fluctuations. A reslot occurs after one month and brings efficiency back up, as items are re-profiled and re-sequenced based on their new characteristics (dimensions, weight, movement, groupings, etc.). The efficiency gain is equal to the blue shaded area. The second graph, Figure 3.2, depicts the same scenario, except that the reslot is completed after two months. Similarly, the efficiency gain is equal to the blue shaded area.

![Figure 3.1 Monthly Reslots](image1)

![Figure 3.2 Bi-monthly Reslots](image2)
5.2 Comparative Efficiency Gains
If we compare the efficiency gains between the two graphs in Figures 3.1 and 3.2, it appears that reslotting every month provides four times the benefit of reslotting every other month. Bi-monthly reslotting results in the loss of additional efficiency from months two to three and months four to five rather than the recapture of efficiency that occurs when a monthly reslot is performed. These example and their results are based on the assumption that the rate of efficiency reduction is constant (a straight line) and the labor rate for performing reslots is constant. However, if we also consider that the cost per item/reslot is reduced as the number of items being reslotted is increased, then we may favor the second graph, as the cost per item/reslot would likely be lower. How much lower is based on the point at which the reslot would require overtime pay rates and beyond. The conclusion of the cost/benefit analysis of each scenario is unclear unless each variable can be specifically designated and pinpointed in time.

5.3 Non-linear Efficiency Rate Reduction
In reality, though, the rate of efficiency reduction is not linear. The reduction in efficiency drops at a lesser rate immediately following a reslot, then gets steeper as the reslot rules continue to be violated, then flattens as the reslot rules are not distinguishable. The graph in Figure 4.0 illustrates this concept.

![Non-linear Efficiency Reduction](image)

**Figure 4.0 Non-linear Efficiency Reduction**
5.4 Efficiency Fall-Off Modeled by the Logistics Curve

Figure 4.0 illustrates the fall-off of efficiency over time using the ‘logistics curve’. The logistics curve - there are many of them, in fact, but all have the same basic structure - is a well-known model for the degrading of ‘order’ (good slotting) into ‘chaos’ (bad slotting), which is exactly what happens as efficient slotting erodes over time as items and velocity profiles change, etc.

As shown in the logistics curve in Figure 4.0, efficiency drops at a lower rate just after a reslot. The benefit of reslotting again at that point in time is reduced, as the gain in efficiency is small relative to the gain in efficiency further down the curve.

5.5 Reslotting at the Inflection Point

The optimal time to reslot as illustrated in Figure 4.0 is at the inflection point, where efficiency can be maximized, assuming no additional gains (due to more slotting flexibility) or losses (due to need for overtime) in cost per item/reslot. In graphical terms, we get the biggest efficiency increase (shaded area) through a reslot at the inflection point. Consider a curve fit to calculate the time increment at which the inflection point occurs. Actual inflection point calculations serve as a topic for future discussion.

6.0 Timing the Reslot with Cost Considerations

The fact that the rate of efficiency reduction is not linear not only supports the concept that waiting longer generates a lower cost per item/reslot but also increases the value of waiting. The steeper portion of the efficiency curve lies further out in time, suggesting that a higher efficiency gain can be achieved at that point further in time. However, the benefit of waiting for the higher efficiency gain must be weighed against the cost per
item/reslot in the scenario where overtime hours are required. Timing of the reslot is impacted by cost factors and the extended environment or ‘universe’ under consideration.

### 6.1 Cost Factors
A discussion regarding the cost to perform a reslot is warranted. As the number of items to be moved increases, the cost per item to perform a reslot is reduced. Again, the reason for this is that mis-slotted items will provide homes for other mis-slotted items in the move process, eliminating the need to make additional moves to free up slots. The problem is that if one waits too long, overtime costs come into play. From that point forward, the same cost reduction concepts apply although the global cost will be higher. Even in an overtime situation, the overtime cost will not have a major impact on the cost/benefit of performing the reslot, as the product is moved once and then selected from that more efficient location many, many times. The graph in Figure 5.0 below illustrates the reslot cost concept.

![Figure 5.0 Reslot Costs Over Time](image-url)
6.2 Slot Frequency as a Factor of Cost Universe

Frequency of slot maintenance also depends on the ‘universe’ being considered. For example, the warehouse that delivers to retail and family groups product to minimize retail stocking labor costs, must consider the impact on labor at the retail location when deciding how often to reslot. The ‘global’ rate of efficiency reduction, including labor efficiency at retail, will drop more steeply, as family group mis-slots in the pickline may cause significantly higher labor requirements (for sortation and stocking) at retail. If the ‘global’ rate of efficiency reduction is steeper, the reslot of mis-slotted items at an earlier point on the efficiency curve could be justified leading to more reslots with fewer mis-slotted items. In contrast, the warehouse whose ‘universe’ lies within its four walls has a more straightforward decision-making environment, concentrating on reducing overall distribution center costs without regard to activities outside the four walls. “Within the four walls” costs of reslots under various reslotting frequency scenarios are easier to calculate and compare.

The graphs in Figures 6.1 and 6.2 depict scenarios presenting significant advantages regarding pickline efficiency and the cost to reslot.

![Figure 6.1 Efficiency Curve Within the DC](image1)
![Figure 6.2 Global Efficiency Inclusive of Retail Considerations](image2)
The question continues to go unanswered regarding the optimal timing of reslots. However, conclusions can be drawn from this discussion. The reslotting cost per item will, in general, be reduced as the number of mis-slotted items increases. Therefore, a general rule might be to wait as long as possible before reslotting during periods of relative DC stability.

7.0 Destabilizing Indicators for Reslotting
Destabilizing events, such as a seasonal period, will define correct times to reslot. Seasonal items create a situation where many items will be mis-slotted due to seasonal demand increases. Fortunately, seasons are well defined, and seasonal demand may be forecasted, enabling the warehouse to adapt to the seasonal requirements before the season arrives. Just prior to an upcoming season is exactly the right time for a reslot. Seasonal items may be moved to locations that better fit based on seasonal demand in order to reduce stockouts and minimize replenishments. Simultaneously, other non-seasonal items may be reslotted, and the ‘logical’ empty slots that are provided as potential new locations for seasonal items may minimize the work required to handle seasonal requirements.

7.1 Reslotting At the Conclusion of a Destabilizing Event
If reslots have been performed to handle seasonal movement, then at the end of the season reslots must be performed to handle the new ‘out-of-season’ demand for those seasonal items. The end of a season is the next logical point in time to reslot. The reason is that if an item is not re-profiled to a larger slot at the beginning of a season, there is a higher likelihood that the mistake will be identified either by a selector who regularly visits an empty pickslot (stock-out) or by a replenisher whose daily activity has increased at a significant rate. However, at end of season, seasonal product that has

Interestingly, the use of advanced slotting tools to handle end of season reslotting provides more space utilization benefit than using those tools to handle beginning of season slotting.
been profiled to a large pickslot will not be identified as easily. Selectors will simply not stock out, and replenishers will visit that slot less frequently. The result would be a slower moving item taking up valuable space in a large pickslot. These situations are identified by sophisticated slotting systems.

7.2 Additional Destabilizing/Restabilizing Events
If we are at the end of a seasonal period, and if the lowest cost per item/reslot occurs at the latest point in time, then the next best time for a reslot is at the beginning of the next season. The scenario presented is simplified; additional (de)stabilizing considerations include SKU proliferation, product demand growth factors and slotting strategy rules changes.

8.0 Conclusion
Determining how many items to move and how often is difficult. Presented here is one approach consisting of simple rules.

1. Use ‘free labor’ to perform slot maintenance tasks whenever possible. Minor slotting on a weekly basis keeps selection efficiency very high. With selection labor being the largest single warehouse expense, maximizing picking efficiency helps to keep the overall costs lower. While it may cost more per item reslotted, the overall cost-benefit may be more favorable.

2. Make the most moves possible in one batch using only standard labor costs.

3. Concentrate on the ‘worst’ slotted items at all times.

4. Avoid the use of overtime hours except to do larger reslots.

5. Reslot at least before and after seasonal periods.

The use of sophisticated slotting tools will aid in this endeavor providing cost calculations and payback savings for alternative slotting scenarios prior to initiating actual moves. Providing management with alternative scenario visibility enables
payback comparisons and allows for efficient labor planning. Interleaving available labor over time using a tool that provides discrete move chains by resource capability and availability supports continuous operational efficiency. Management with accessibility to these options can then best design a reslotting strategy tailored specifically to their dynamic environment and specific to achieve optimal slotting benefits.