Pickdelso

Picking and delivery solutions

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Unit size

A box is one example of a repository intended for products. A repository is generally a space that has a certain unit size and can be reserved for products. In order to serve a customer in a delivery service or in a Click & Collect service at least one repository must be reserved for the customer's order. Let us analyse why a small unit size saves space. Most repositories are relatively large, such as 70 or 100 l. For example, the volume of a box may be 70 l and the volume of a locker may be 100 l.

Sometimes the volume of the products ordered by a customer exceeds 100 litres. Therefore, even a 100 l locker is not large enough for every order. Pickdelso's Takeout wall is a new type locker system which does not have this limitation, because a customer gets as many lockers as the customer needs that time. In Takeout wall the volume of a locker is one unit, two units, three units etc., i.e. the volume is a multiple of units. In Takeout wall a) the volume of a locker is a multiple of units and b) the locker system includes lockers whose volume is one unit. It is important to obey the both rules a) and b) to save space and to make the locker system compact.

In Takeout wall and in Shopping bag cart the unit size is quite small, because it is about 20 l. The small unit size increases the system's capacity compared to the other locker systems and the other delivery services. To explain this, let us consider a picking and delivery system in which a repository is 70 l, i.e. three 23 litre bags can be placed in a repository. If an order includes only one bag of products, a single repository remains 66% useless space. If the order includes two bags of products, the single repository remains 33% useless space, i.e. waste space.
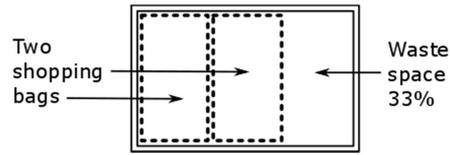
Two shopping bags →→ Waste space 33%

Figure 1: Box is viewed in this waste space example from a bird's perspective.

The following table (Table 1) discloses the amount in litres and the percent of the waste space when a 70 l box is reserved for a single order.

Volume of order	Boxes Count	Litres	Waste space Litres	percent
10	1	70	60	86
20	1	70	50	71
30	1	70	40	57
40	1	70	30	43
50	1	70	20	29
60	1	70	10	14
70	1	70	0	0
80	2	140	60	43
90	2	140	50	36
100	2	140	40	29
110	2	140	30	21
120	2	140	20	14
130	2	140	10	7
140	2	140	0	0

Table 1: Waste space with 70 l boxes and order sizes 10 – 140 l.

The amount of the waste space can be substantially reduced by using a smaller unit size when order volumes are low, such as 140 l or less.

A size of a shopping bag, such a 20 l plastic bag, is an appropriate unit size for consumer customers. Generally speaking, a shopping bag (a tote) is made of plastic, paper, cardboard, or fabric, and it has handles for carrying it.

The following table (Table 2) discloses the amount in litres and the percent of the waste space when a 20 l bag and approximately as large repository for the bag are reserved for a single order.

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Volume   |      Bags       |   Waste space
of order | Count | Litres | Litres | percent
---------------------------------------------
   10       1       20       10        50
   20       1       20        0         0
   30       2       40       10        25
   40       2       40        0         0
   50       3       60       10        17
   60       3       60        0         0
   70       4       80       10        12
   80       4       80        0         0
   90       5      100       10        10
  100       5      100        0         0
  110       6      120       10         8
  120       6      120        0         0
  130       7      140       10         7
  140       7      140        0         0
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Table 2: Waste space with 20 l bags and order sizes 10 – 140 l.

An order may include such products which fill precisely one (70 l) box but the probability of this kind of order is quite low. When there is no order statistics available, we may assume that each volume of order 10 l, 20 l,…, 130 l, or 140 l has the same probability (a uniform distribution).

According to Table 1, the average percent for the waste space is the sum of the percent values (86, 71, 57, 43, 29, 14, 0, 43, 36, 19, 21, 14, 7, and 0) divided by a number of the percent values (14). *Thus, the waste space average is 32% when using 70 l boxes in the picking and delivery of products. Correspondingly, according to Table 2 the waste space is on average only 9% when using 20 l bags which are placed into approximately as large repositories.*

The 70 l box is, however, an appropriate unit size for enterprise clients assuming that their orders usually include several boxes of products.

The following table (Table 3) discloses the waste space percent values when using 70 l boxes and the volumes of orders vary from 35 l to 490 l.

Volume of order	Boxes Count	Boxes Litres	Waste space Litres	Waste space percent
35	1	70	35	50
70	1	70	0	0
105	2	140	35	25
140	2	140	0	0
175	3	210	35	17
210	3	210	0	0
245	4	280	35	12
280	4	280	0	0
315	5	350	35	10
350	5	350	0	0
385	6	420	35	8
420	6	420	0	0
455	7	490	35	7
490	7	490	0	0

Table 3: Waste space with 70 l boxes and order sizes 35 – 490 l.

Now, according to Table 3, the waste space is on average 9% when using 70 l box. A conclusion is that 20 l bag saves the storage space, compared to 70 l box, when order sizes are at most 140 l, which is a relevant assumption relating to consumer orders. When the order sizes are larger than 140 l, the 70 l box is an appropriate unit size for the order reservations.

The reason for reserving a plurality of repositories for the same order is to save the storage capacity. It is possible to serve simultaneously a greater number of orders/customers when the storage capacity can be divided among a greater number of orders/customers.

When order sizes are at most 140 l an appropriate unit size is about 20 l. Thus, a repository to be used in the system should have such measures that it can receive and support a shopping bag whose volume is the unit size, i.e. about 20 l.