Key considerations when building multistory distribution centers

GROENEWOUT
Member of EPG

CLAUDIUS PRINSENLAAN 132A
4818 CP BREDA
THE NETHERLANDS

T +31 (0)76 - 533 04 40
MAIL@GROENEWOUT.COM
WWW.GROENEWOUT.COM

In the Netherlands, work is currently underway on the construction of several multistory distribution centers allowing trucks to be loaded and unloaded on two levels. But what exactly is a multistory distribution center? And what are the key considerations when building one? Dirk Becks shares his insights.

The Netherlands is a densely populated country, so it is no surprise that the question of multistory distribution centers is a recurring topic. So far, however, this has not led to the large-scale construction of distribution centers with two or more floors. Having said that, the situation slowly seems to be changing. In fact, due to the national discussion on spatial planning in the context of ever-more unsightly logistics hubs appearing, plus the rapidly rising price of land, the issue now seems more relevant than ever.

The country already has a few multistory distribution centers, the best-known and possibly the oldest example of which is probably the Jumbo distribution center in a prominent location alongside the A12 motorway in Woerden. Trucks can load and unload on both the ground floor and the first floor. There is a logical explanation for this: it is a distribution center (DC) for both fresh and frozen products. To reduce energy costs by minimizing the loss of cold air, it made sense to keep the exterior of the building as small as possible by designing it in a cuboid shape. Docks have been created on two levels so that the trucks can load and unload as close as possible to this compact cube.

Under construction or development

This DC will not be a rarity for much longer, as several more multistory distribution centers are currently under construction or development in the Netherlands. The most striking example is the Amsterdam Logistic Cityhub, where both trucks and delivery vans can be loaded and unloaded on two levels. One remarkable feature of the Cityhub is the dual-level parking deck being built between the two logistics levels. At the Provada property trade fair, real estate developer Goodman announced plans to develop two urban logistics distribution centers (in Amsterdam and Utrecht). In large cities, multistory buildings are an effective way of creating sufficient logistics space on expensive land close to urban centers or of combining logistics with other functions.

De Jong Verpakking, a cardboard packaging firm located in De Lier, is working on a new building where all logistics activities, including loading and unloading, will take place on the upper floor, while the lower floor is reserved for production activities.

In Venlo, logistics service provider DSV is building a two-story distribution center covering a total of 43,000 square meters. The scarcity of land suitable for this type of development will have been one of the main reasons that De Jong and DSV opted for multistory buildings. De Jong's new facility is centrally located for its customer base in the Westland region, an area that is already bursting at the seams with greenhouses, while DSV plans to further expand its campus by making maximum use of the last remaining plot at Greenport Venlo.

Optimal use of space

What all these distribution centers clearly have in common is that trucks and/or delivery vans can dock on more than one level. But is this the right way to define a multistory distribution center? Moving beyond this, the Netherlands actually has many more multistory distribution centers. The fulfillment centers run by large e-commerce companies are good examples. From the outside, they look like standard distribution centers, but on the inside they have large concrete floors on one or more levels. Goods are received on the ground-floor level, and sorted, assembled and packed on the upper levels.

Mechanized storage systems, such as pallet or shuttle systems (up to heights of 30 meters) have input and output stations on multiple levels. Surely these are also examples of multistory facilities, aren't they? This approach makes it possible to optimize a site by creating a higher storage density per square meter. And what about all the other distribution centers in which mezzanine floors create additional space for order picking from shelves or flow racks? All these examples make optimal use of the available space – just like the Amsterdam Logistic Cityhub, Goodman, De Jong Verpakking and DSV. Therefore, rather than saying 'multistory construction', it would be better to call it 'land use optimization'.

Weighing up the costs

Whether or not a multistory distribution center is an interesting option for optimizing land use depends to some extent on cost. The more robust construction requirements for the load-bearing floors and ramps mean that construction costs are significantly higher for multistory buildings. But if land prices continue to rise as they have done in recent years, it will eventually become more profitable to start building upwards.

The logistics costs are another essential cost component to consider. A multistory distribution center involves additional investment for the internal transport equipment required on all levels. Furthermore, it may be necessary to transport goods vertically, and vertical transport is usually more expensive than horizontal transport. This factor does not play a role at the Amsterdam Logistic Cityhub, because in effect it is a multi-tenant building for various users, each operating separately on their particular level.

Opportunities for multistory construction

The number of multistory distribution centers is set to increase in the years ahead. Land for logistics purposes will become increasingly scarce and expensive in the Netherlands, especially now that a majority of the Dutch House of Representatives wants to limit the construction of new distribution centers. Although no construction freeze has been announced as yet, politicians are keen to take measures to prevent the construction of large distribution centers in what they see as unsuitable locations. As a result, real estate developers and users are under pressure to make even better use of the available space.

Multistory construction is particularly beneficial for city hubs like the one in Amsterdam. Large sites are rare and expensive near urban centers, yet distribution centers are needed in these locations so that small-scale zero-emission vehicles can deliver to city-center shops, offices, restaurants and consumers. Goodman is one firm that has already proved this to be possible. In Paris, this developer has built a four-story distribution center on the banks of the Seine. Meanwhile, with 22 floors, the Goodman Interlink in Hong Kong is the tallest logistics facility in the world. It is only a matter of time before distribution centers also dominate the Dutch skyline.

Load-bearing floors vs mezzanine floors

At Groenewout, we define a multistory distribution center as a building that has at least one additional load-bearing floor throughout. This is often a concrete floor which – for the structural engineers among us – consists of hollow-core slabs with a compression layer, usually on a main support structure made of steel. These floors can bear a serious amount of weight, which means that it is possible to add an extra story with pallet racks and heavier internal transport equipment or to conduct loading and unloading activities.

Another way to make efficient use of a site is to install a mezzanine floor to create multiple levels with shelving and flow racking, or an additional floor for value-added logistics (VAL) activities. Such floors can be made of pressed metal panels (C-Dur panels) laid on beams attached to the uprights of the racking or specially constructed on cold-formed steel profiles.

Loads and columns

One of the key differences between load-bearing and mezzanine floors is the amount of weight that is involved. A load-bearing floor is strong enough to support a conventional logistics operation or the weight of trucks driving over it. In contrast, the maximum load for a mezzanine floor is often 5 or 6 kilonewtons per square meter. This means that they can support an assembly conveyor or the weight of order-picking carts moving around, but not the weight of heavy internal transport equipment.

The second important difference concerns span. A span of ten to fifteen meters is possible for a load-bearing floor, but this is limited to five, or at the very most six, meters in the case of a mezzanine floor. A mezzanine floor must therefore be supported by a much larger number of columns, many of which must also be braced. These columns are usually arranged in a grid of 4×6 or 5×5 meters. This limits the options for the use of the space below the mezzanine floor. An area with shelf racking or manufacturing operations can often fit in well, but the columns will get in the way of a cross-dock operation.

Vertical transport

There are a number of additional matters to consider when designing and building a multi-story distribution center, such as fire safety and escape routes for people working on the upper floors. Another specific item that needs attention is vertical transport. Moving goods internally between two floors will require lifts or conveyors. But where should these be installed, and how much vertical transport capacity is required? If the second level is also to be used for loading and unloading trucks, a ramp will be required – but this will take up a relatively large amount of space. In other words: a two-story distribution center does not automatically mean twice as many effective square meters of usable space.

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For questions please contact Dirk Becks at +31 76 533 04 40.