Warehouse of the Future

Efficient use of land and space

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Colophon

Warehouse of the Future
Efficient use of land and space (part 2)

Authors
René Geujen - Next Level Development
Radboud olde Scheper - Riverland Supply Chain Consultancy
Raymond Tukker - TICM
Eric Hereijgers - St. Onge Company
Annemieke de Leeuw - Hogeschool Rotterdam

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TICM
Next Level Developing next level logistics property
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Foreword

In the past 4 years, we have supervised a number of projects by students at companies in collaboration with Rotterdam University of Applied Sciences. Due to the open-mindedness of the students and therefore creative/innovative approach to bottlenecks, this has provided interesting insights into how to deal with logistics in the future. What we have particularly noticed, however, is the fact that we (logistics consultants, real estate companies and logistics parties), together with (local) governments, are not able to give a clear vision of how we see logistics in the Netherlands in the future.

That is why we have come up with the idea to give a (practical) impetus for that vision:

> *The Warehouse of the Future. The starting point of the Warehouse of the Future is that it makes a positive contribution to the requirements of sustainability, well-being and efficiency for the user, taking into account the increasing complexity as a result of scarcity, regulations and social transformation.*

The white papers outline the range of possibilities that exist in the various sub-facets, with which the 'warehouse of the future' can be designed. The purpose of the whitepapers is to provide the various stakeholders with practical ideas and tools to work with and, where necessary, to provoke discussion/ exchange of ideas. We realize that no overarching blueprint or 'Grand Design' is described here. Although the whitepapers are written from a Dutch perspective, we believe elements can be used internationally as well.

It is more important to us that we stop looking at each other or trapping each other because of outdated concepts or regulations. The Future is always different from what we think, in any case not what it is today: so, get moving and take steps for that future.

Happy reading.
Annemieke, Eric, Raymond, René and Radboud.

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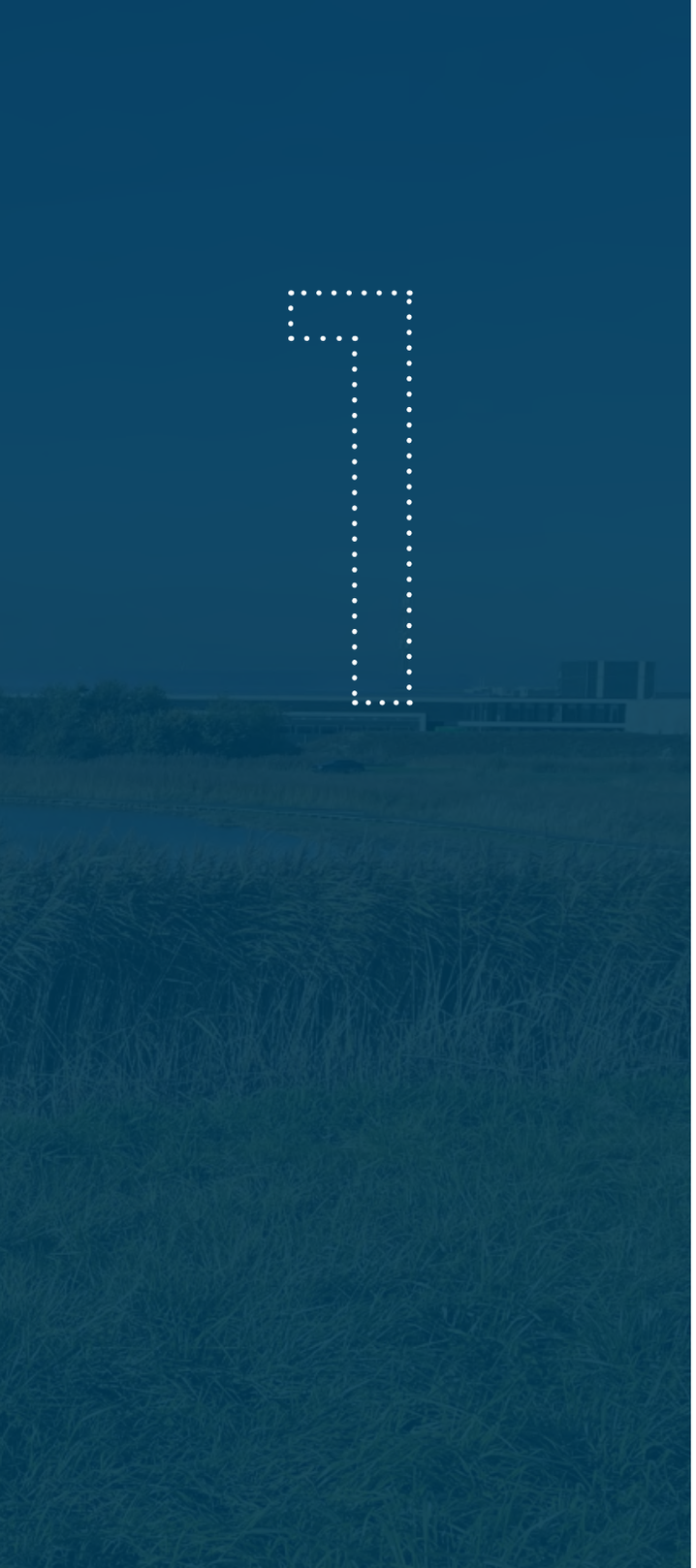


Introduction

Space is at a premium. And yet, in urban areas, and beyond, almost exclusively single-level distribution centers are built. In doing so, the Netherlands is missing out on opportunities. By combining logistics functions, building multi-layered and smart automation, available space is optimally used, and energy is saved. These warehouses of the future also offer countless other advantages.
In three white papers, the most important facets of the Warehouse of the Future are examined. Part 2: Building, configuration, and efficient use of space.

Consumer behaviour is constantly changing. And that has an impact on logistics chains and shopping malls, inside and outside the cities. In addition, the population of the Netherlands continues to grow. Combined with the government's desire to build fewer (large) distribution centers, the increasing distribution volume in the future must largely be absorbed within the existing distribution infrastructure.
Add to this the lack of available personnel, a development that is expected to continue in the coming years due to the increasing ageing of the population, it is clear a fresh look at distribution capacity is needed. In collaboration with, among others, the Top Sector Logistics and the Rotterdam University of Applied Sciences, René Geujen (Next Level Development), Radboud olde Scheper (Riverland Supply Chain Consultancy), Raymond Tukker (TICM) and Eric Hereijgers (St. Onge Company) provide this different view in a series of white papers..

The starting point for the vision is that it should make a positive contribution looking at sustainability, well-being and efficiency, of course taking into account the increasing complexity as a result of scarcity, regulations and social transformation.

Leading in this are:

- scarcity (personnel, space, energy, etc.);
- clustering of functions;
- flexibility;
- innovation;
- social relevance and acceptance;
- no sacred cows are spared and
- concrete steps (now and not in 10 to 20 years).

That is why we looked at better, sustainable use of space, better use of operational hours, the possibilities of energy transition, robotization and mechanization, and a sustainable use of materials.

This vision is laid down in three white papers - under the umbrella title 'Warehouse of the Future'. The triptych outlines the palette of possibilities to shape the warehouse of the future. Part 2 focuses on the building in its surroundings, its connection to logistics ecosystems, the building configuration and the consequences for efficient use of space.

Principles and conclusion’s part 1

In part 1 of this triptych, it was already established that the space utilization of current, traditional warehouses is (very) low. In fact, often only less than 10 percent of the warehouse volume is filled with goods. The remaining space is lost to aisles, maneuvering space and workspace. In addition, the site may only be 60 to 70 percent built-up, which means that valuable space is lost for loading docks or parking spaces.

A higher storage density and a reduced space requirement are increasingly necessary.

With new, more mechanized storage and order picking systems and a logical design of processes, both the square meters and the cubic meters in the warehouse are better utilized. And there are more benefits. Because (driving) distances are smaller, energy consumption decreases. Fewer or no batteries are also needed because the new systems are connected directly to the energy grid. The remaining work can also be carried out more ergonomically. And heating and lighting can be limited to those places where employees are active.


Traditional warehouse

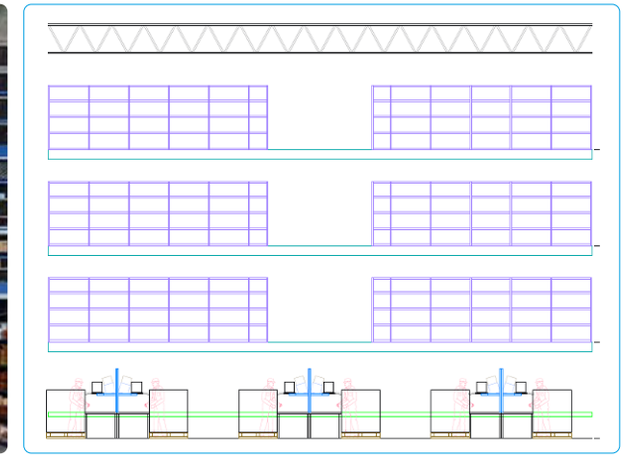
'Building block explosion'

Multi-layered DC (source: logistiek.nl)

In addition to a better internal layout, the spatial integration of warehouses plays a role. Available land is scarce, which puts pressure on the use of space for logistics operations. Whereas in recent years there has been a 'building block explosion" in the Netherlands, the use of space must be limited as much as possible in the future.
The space that is available can be better utilized, for example by using the height (within a building) and combining logistics functions in one compact, multifunctional building.
By deliberately assigning warehouse functions to different (height) levels, and by merging functions and companies, very compact and efficient logistics processes are created, requiring significantly less floor space, and using less energy to move (more) goods.
Technically, it is possible to build warehouses with 2, 3, or 4 concrete or system floors; with a variety of free heights of up to 12 meters. Such an 'accumulation of functions' should become the rule rather than the exception. If more use is then made of vertical transport systems, the height is optimally utilized.

A smart stacking of functions opens new doors, for example for cold stores, where cooling and keeping the temperature at the right temperature requires an enormous amount of energy. Compact buildings, with a good insulation shell, offer enormous savings potential. For example, the refrigerated and/or freezer compartment can be (partly) realized underground, with other logistical functions above it. After all, the ground temperature is lower and more constant. In addition, the bottom has an insulating effect and the fridge and freezer compartment is not heated by the sun.
With the help of vertical transport, the refrigerated products can be transported from the underground warehouse to the loading dock and loaded into the refrigerated compartment of the truck, and then delivered to the customer together with the non-refrigerated products.
In addition to the energy savings and logistical advantages, such a smart stacking of functions requires less land. The extra investment for (partially) underground construction will pay for itself through the lower land price and lower energy costs.

Smart stacking is not limited to new construction. Many modern logistics systems, such as Autonomous Mobile Robots (AMRs) for storage cabinets and sorting installations, only require a limited headroom. Three meters is often enough. By using mezzanine floors, multiple storage and working areas are created on top of each other. Especially in existing warehouses.



To date, buildings are often no higher than two or three floors. However, there is no reason not to go higher and, for example, to realize up to eight floors above each other. Thanks to vertical conveyor systems, the height is automatically bridged. Examples include continuous lifts, spiral conveyors - with or without built-in sorting units - 'traditional lifts' for transporting AMRs from one floor to another, or pallet conveyors with automated pallet lifts for the vertical transport of pallets, roll containers and order picking trolleys.

Several points of attention

In part 1 of this series, it was discussed that warehouse processes, mechanization and robotization have an impact on the Warehouse of the Future. Modern systems are flexible to fit in and scalable. They offer the possibility to grow along with volumes and are often easy to move to other warehouses. Furthermore, they can be easily integrated into manual processes. However, other aspects also play a role, such as use of space and sustainability.

Camouflage: fitting in the environment (Detailresult Bleiswijk)

Rhenus

Use of space and 'Building blocks explosion'

In a small country like the Netherlands, competition for scarce available space is fierce. Housing, agriculture, recreation, and nature, water, and business; Everyone is fishing in the same pond. We need to be more inventive with the available space. And that is a big task for many companies. Whereas in the past large plots were often bought, which were used very extensively, the Warehouse of the Future has to make the switch. Many older industries, to which many of those large lots have been spent, are suitable for transformation. Auction sites for instance are disappearing and making way for urban logistics.
The discussion about the 'building blocks explosion' of our country mainly focuses on the size and appearance of warehouses and distribution centers. For the appearance of the 'building block aka box' and the impact on the environment, several solutions, whether or not combined, are possible.

Design

For example, buildings can be architecturally upgraded to increase attractiveness. Examples include Rhenus Logistics' New Logic III distribution center in Tilburg, nicknamed 'The Tube', and Levi Strauss & Co's new European distribution center in Dorsten, Germany. No matter how beautiful the design is, there must of course be an eye for functionality and flexibility.

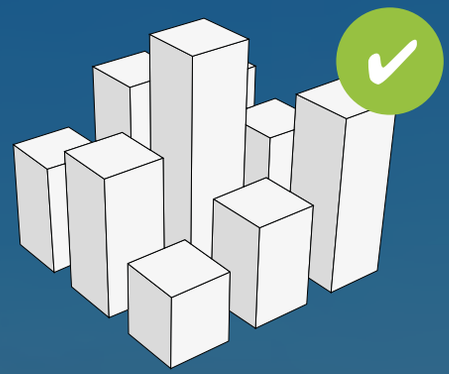
Camouflage

By adapting the colors of a warehouse to the environment, the massiveness is hidden from view.

Fitting of a building in the environment

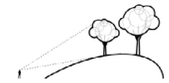
When a clear separation is made in the (re)development of industrial sites and the transition to adjacent areas for example by means of green buffers or noise barriers, large buildings are hidden from view.

Multiple functions can also be added to the same building block, such as living in urban areas, generating energy, and transforming the building into logistics hubs.



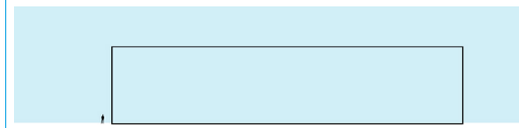
Example right positioning

Example wrong positioning

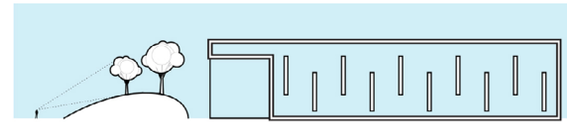


Blending in

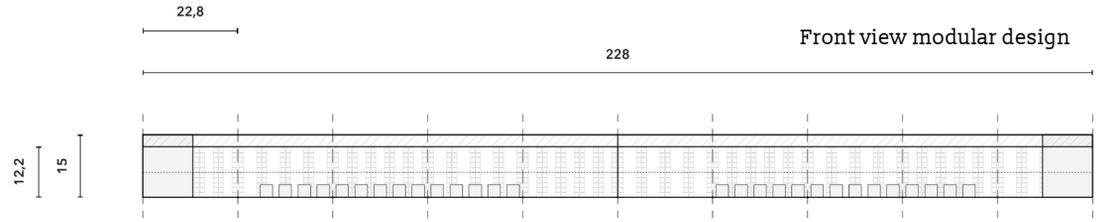
Architecture



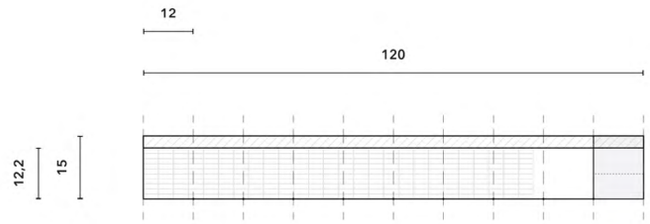
Camouflage



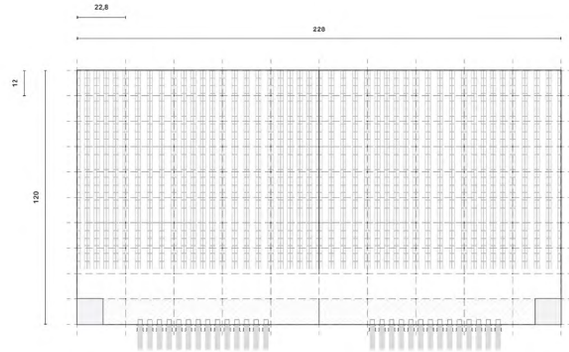
Combine



Front view modular design



Side view
modular design



Top view
modular design

Shopping

Sustainability, CO_2 reduction and energy savings

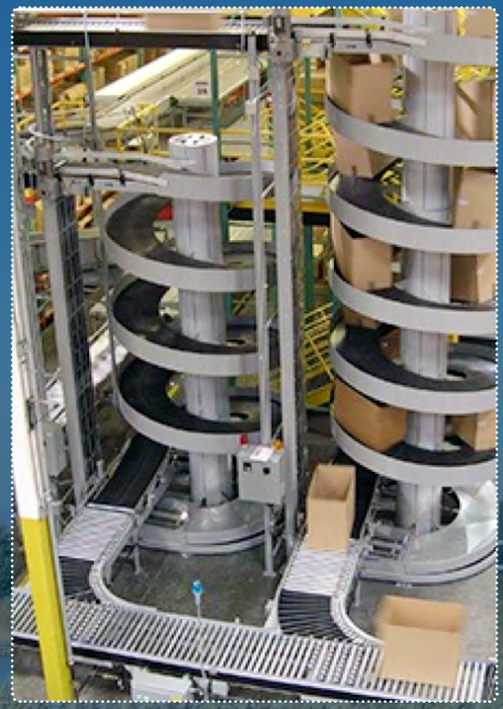
Logistics must be more sustainable; everyone is now aware of that. This means, among other things, reducing CO_2 emissions and saving energy. The largest CO_2 footprint of logistics chains is not in the building, but in the transport movements. Logically, the location of a building does have an influence on this. Good consultation between the sector and policymakers about the positioning of logistics functions is therefore necessary.
An average household buys a cubic meter of groceries every month. These goods must be transported to residential areas. This requires a logical location for urban distribution, close to residential areas. From this point of view, national distribution should be better allocated close to motorways and multimodal hubs. While for production logistics and value-added services, areas where production, energy, qualified personnel, and knowledge are present are the most logical location.

Especially in urban areas, the accumulation of logistical functions, as described earlier, can offer a solution. In the past, the construction of terraced houses and later apartment buildings ensured that sufficient living space became available on the scarcely available land. Stacking logistics functions at logical logistics locations follows the same line of thought. For example, the knife cuts both ways if cross dock and urban distribution are provided on the ground floor, distribution activities are carried out on a second layer and energy production, or possibly greenhouses or light industrial functions, are planned on the roof. A different way of thinking is necessary. It is important that a robust structure is chosen and that functions are complementary to each other.
The main risk is that dependencies arise that undermine the economic model of one of the functions, or cause risks in terms of insurance or safety.

What do these things mean for a building?

For the Warehouse of the Future, the aim is to create a basic building, modular and with as much connected building mass as possible. This increases rental flexibility. Parties can easily switch on and off units that have become available. And users can collaborate more easily, share processes more efficiently and exchange goods with internal transport. Moreover, buildings are occupied sustainably, and such a basic building promotes cooperation. By creating more combined building mass, fewer building materials and installations are also needed. After all, it is possible to build smarter and more efficiently, with a sustainable use of space.

DC under construction with column structure



Vertical transport of goods via multi-levels/ layers - Apollo

Modular construction also results in flexibility. Processes are interchangeable and easier to adapt. Material handling solutions can be standardized, and system suppliers can more easily devise and adapt systems accordingly. This also makes the reuse of systems more attractive, for example.
In the (re)development of logistics buildings, as indicated earlier, more attention must be paid to vertical transport. For example, via separate driveways to the different floors, or via elevator shafts at each unit to be able to use the upper floors.

Modular building design in units

Basic modular buildings are needed in different sizes so that they can accommodate businesses of different sizes and provide sufficient flexibility and scalability over the life cycle of businesses.

Modular units

Market research shows that the life-cycle resilience of a business park increases if the units form a mix of modular spaces of varying sizes - of approximately 7,500 m^2, 10,000 m^2, 15,000 m^2 and 20,000 m^2 - that can be used in a connected manner.
At many industrial parks, an area is set up based on a 'stamp sheet logic', after which various stamps are offered in a chained manner. Within the city, the scaling is of course smaller and concerns units from 1,000 m2 to about 5,000 m^2; due to the smaller stock positions (boxes instead of pallets).

Optimal building depth

Until now, the most universal and most efficient logistics building often required an ideal depth of a 100 to 140 meters. However, this approach is a consequence of the idea that it is more advantageous to have all activities on ground level. However, by using the height of a building, spaces are used much better and more sustainable solutions are possible. For an optimal building of the future, the building depth is a maximum of twice the height.

Columns grid

The current ideal grid size within a building is often in sections of 22.8 x 12 meters, with a tessellation of 22.8 meters (or a residual size of 17.1 meters) on the front façade and 12 meters on the side wall. This provides the most optimal set-up both for the logistical set-up and from a structural point of view. However, this is no longer the case for multi-level buildings and stacking functions.

Loading dock

Passage height

To enable efficient processes, buildings/units must be connected to each other at set locations - for example at the level of the dispatch zone - via passageways of at least five meters high. These passageways allow the exchange of equipment and goods between the different units. The height is often also maintained as a clear height under a mezzanine, so that moveable equipment can also move there. It is also wise to provide (internal) transport corridors; both horizontally and vertically.

Loading/unloading docks

Five loading/unloading docks fit in a 22.8 m grid. As standard, one dock per 1,000 m^2 of warehouse is often calculated. An outdated line of thought. It's more important to assess how many times a dock can be used per day. As a result of the current process design, docks are often only used for a few hours a day. A better distribution of loading and unloading activities throughout the day, for example by sharing docks with multiple users, can mean that fewer docks are sufficient.

Office Projection

The office space in logistics buildings often depends on the set-up and organizational structure of the users, with three main groups: functional, shared service and head office. The office projection ranges from 3% to 12% of the warehouse projection.
Flexibility is also desirable in the basic set-up. By basically using about 3% office projection and extending it on the mezzanine, if necessary, over projection is prevented.

Building/Site Functions

Available land in the Netherlands is becoming increasingly scarce. Consideration should be given to combining functions within one building: especially at distribution centers. Stacking functions offers a solution. Distribution centers often cover a large surface area and therefore also have large roofs. All kinds of functions can be added to these roofs.

Park

The roof of a distribution center is ideal for parking cars and trucks. This saves a lot of space and is already being used at various locations.

Solar panels and battery storage Lidl Venlo

Battery storage

Proper housing of labor immigrants close to warehouses (Ruijgrok Tower Aalsmeer)

Solar panels and energy distribution

Roofs of distribution centers also offer a lot of space to install solar panels. The panels can generate the energy used in the DC. However, if the entire roof is covered with panels, more energy is generated than the DC needs. In that case, the generated energy can also be passed on to the neighborhood. Energy generated during the day can also be stored and used at times when the sun is not shining.

Multi-layer DC

Of course, it is also possible to stack distribution centers. This is already being done successfully in other countries, such as the ATL Logistics Center in Hong Kong.
By building multi-level distribution centers, the available space is used much more efficiently. From a logistical point of view, however, this poses a major challenge. Moreover, it depends on the environment whether such a multi-layer DC can be built. If there are already several tall buildings in the area, a multi-level DC blends in with the environment. If, on the other hand, there is a lot of low-rise buildings, a multi-level DC is much more noticeable.
In the Netherlands, work is now also underway on a multi-layer DCs. Palazzo Groep, for example, made a design for DSV in Venlo. Goodman also has two developments: in Utrecht and in Rotterdam.

Homes

A distribution center often employs employees from all over Europe and beyond. Those employees need housing. This living space could also be realized on the roof of a DC. However, this also has disadvantages. Stacking and mixing functions can lead to conflicts of interest or over-dependence. If living space is integrated into a logistics function, there is no clear separation between home and work, which can be detrimental to the employee. In addition, there is a risk of excessive dependence between employer and employee in the private sphere. This can lead to an unhealthy balance.

Agriculture

The roof of a DC can also be used for urban agriculture, agriculture, or greenhouses. After all, the large surface area offers enough space to grow crops. Distribution centers are often built in locations where there is also a lot of agriculture. By moving that agriculture to the roofs of the DCs, less land is lost that can also be used for agriculture. In the case of mixing functions, it must be carefully considered whether the right functions are being integrated and whether this will not lead to an undesirable mixing of functions in the future.

Recreation

In urban areas and other locations where space is limited, recreational functions can also be added to a DC. Think, for example, of sports fields or a park. This has already been achieved at IKEA in Utrecht; There are sports fields on the roof. For a DC, however, adding recreational functions can be a disadvantage. For example, a recreational function leads to a lot of extra traffic. This must therefore be considered in the design.

IKEA sports field on the roof

Behavioral change is indispensable

It is clear that stacking, mixing and landscaping of distribution centers offer a solution to the increasing lack of space and the 'building blocks explosion' of the Netherlands, also called Increased Product Housing (IPH) by the students of the Rotterdam University of Applied Sciences. These solutions seem simple, but they often involve high investments.

For example, function stacking is a good solution to make better use of the scarce space. Parking on the roof, or above the loading pit of a DC, or covering the roof with solar panels results in a better utilization of the square meters. Adding housing, recreation, or sports facilities, on the other hand, has less potential. After all, the Warehouse of the Future is ultimately located on a business park. Safety remains important and it is not desirable that there is a lot of crowds in places where many large and heavy trucks drive.

Traffic jam with trucks and passenger cars

In addition, landscaping requires high investments and is not at the top of companies' list of priorities. As long as the need is not recognized, many companies will not make extra money available for this. It is therefore important to make the landscaping of new buildings more important when releasing new permits. Area and project developers must also work together to properly shape the integration into the landscape in the long term. In this way, the Warehouse of the Future is better accepted and better integrated into the environment. In addition, sustainable solutions can be implemented in this way.

Clustering warehouses

A second solution to 'building blocks explosion' of the Netherlands is to cluster logistics buildings, so that the warehouses are not built throughout the country and central logistics hotspots are created. This solution is very focused on the long term. And it is utopian to think that companies that have chosen a particular location from a historical perspective or from an optimal logistical center of gravity will relocate their activities without having an effect on employment or the quality of business operations.

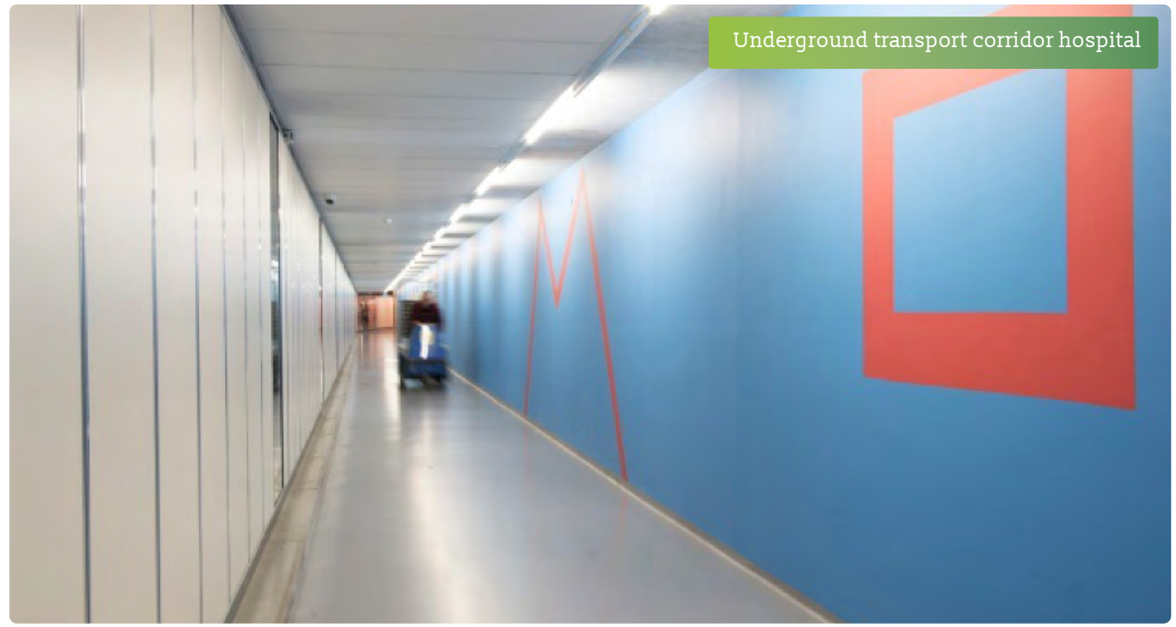
Centralizing warehouses also leads to larger transport distances and extra handling. After all, in order to continue to supply the entire country as efficiently as possible, more decentralized warehouses will be needed. Centralizing warehouses can also lead to extreme congestion on the road and congestion of the road network.
In addition, there is a lot of extra passenger traffic to and from the logistics hotspots and people are on the road longer. Expanding public transport options at logistics hotspots, or collective company transport on business parks, can offer a solution. Also, for safety.
Just designating a location is certainly not enough. A balanced spread of activities is important here. As well as bringing together parties that can work together horizontally and vertically in the logistics chains and create value.

The feasibility of clustering warehouses therefore seems very far away and may not even be realistic. What is certainly an option, however, is to centralize decentralized distribution centers in villages and towns, so that DCs do not arise everywhere in different places in and around residential areas.

Behavioral change is indispensable

One of the most important changes needed is a different mindset, from governments, the business community and other stakeholders. A vision is needed on clustering, and particularly on collaboration opportunities and opportunities to stimulate additional value creation in these clusters. That vision can also help to set requirements for companies that want to establish themselves somewhere else as today.
Densification is difficult to achieve if there is no market pressure. The government must therefore create scarcity. Stricter laws and regulations are also needed, including clear requirements for new buildings. This can fuel the urgency among the business community.

The party that takes the lead must create a clear vision. A vision that forces all parties to think about aspects such as location, synergy, energy transition and sustainability.
By connecting buildings via (underground) transport corridors - as in some hospitals - goods can also be moved more easily to other buildings, such as those of carriers. As a result, the total space required is smaller and transport by road is reduced.

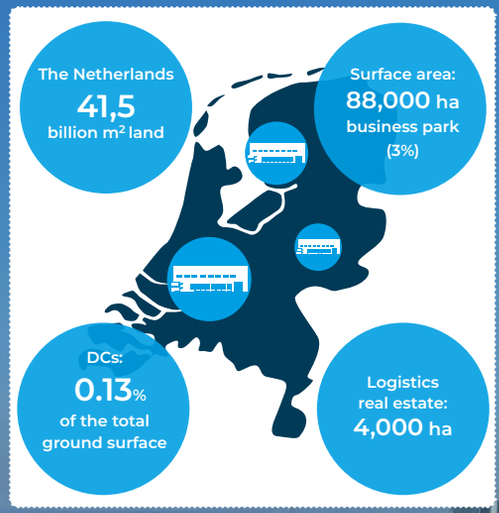


Underground transport corridor hospital

From ‘Building Blocks explosion’ to Increased Product Housing

More and more distribution centers are being built in the Netherlands. And that will only increase in the future. These halls look like blocks and weigh heavily on the Dutch landscape. Moreover, the distribution centers are often built on greenfield locations, which often makes them stand out even more in the landscape. Local stakeholders are often opposed to the construction of these distribution centers, which often lead to multiple annoyances in the immediate vicinity. Nevertheless, the DCs are necessary, partly because of the growing economy and increasing online trade in the Netherlands. In this chapter, the subject of ‘Building Blocks explosion’ is explored in more depth. Possible solutions are also discussed, with a critical eye on the current solutions.

The challenge lies mainly in solving the visual aspect of the buildings in the landscape, the cause of the need for logistics real estate is however directly linked to changing consumer behaviors. After all, the function of logistics is related to the behavior of consumers. This was once again evident with the trend change from offline to online buying goods, and the impact of Covid, which accelerate the growth even more.



DC boxes

The whole discussion about the 'building blocks explosion' of the Netherlands has a positive and a negative side. On the positive side, the issue is (finally) being considered. On the negative side, the shape and size of the buildings predominate in the discussion. Perhaps figures will help guide the discussion:

The Netherlands is 41.5 billion m² in size. A net 88,000 ha (gross 125,000 ha) of land has been allocated to business parks. This means that 3% of the surface area of the Netherlands is used as a business park, of which 4,000 ha is logistics real estate (approx. 6,000 ha of land use). Distribution centers therefore cover about 0.13% of the total area. Three-quarters of the DCs in the Netherlands are used for national distribution. The remaining 25% have an international function. These DCs are also useful as exports account for a third of GDP in the Netherlands and 2.5 million full-time jobs (figures from Statistics Netherlands). Slightly more than half of this volume consists of re-exports, representing a turnover of 260 billion euros and an added value of 45 billion euros.

'Building Blocks explosion'

The term 'Building Block explosion (or verdozing in Dutch)' is used for landscapes where more and more large, rectangular buildings have been erected over the years. Distribution centers and large warehouses that are also getting bigger and bigger. These 'boxes' are located around large cities, but also in the countryside.
The primary interest in the design is not a nice-looking building, but the most efficient use of space. However, the integration and the experience of the building is becoming increasingly important, especially if the buildings are placed in high-profile locations or close to inhabited areas. Moreover, the construction of a warehouse is relatively simple and not too expensive. The buildings are often erected at a rapid pace. In a short period of time, the number of 'boxes' increases fast. Often at the expense of large areas of landscape and with dissatisfied local residents and a lot of nuisances as a result.

In the past five years, the number of square meters of warehouse space in the Netherlands has grown from 25 million to 43 million. The demand for 'large boxes' is growing, and these are realized mainly on large land plots. The scale of the land use is partly caused by restrictions imposed by the government. For example, regarding the maximum building height, the maximum use of built-up land, the time during which goods may be loaded or unloaded (for instance no activities during night hours).

Discouraged by rules

Due to zoning plan restrictions, which are often outdated and do not meet an optimal need for space (building contours, height restrictions, building percentage), available space is currently not used optimally. In fact, more space is needed than would be optimally necessary. In this respect, the government stimulates the continuous need for and growth of business parks.

The term 'Building Blocks explosion' has a mainly negative connotation and encourages prejudice. As a result, a substantive discussion on the subject becomes difficult. This is a pity as there are aspects that can provide a structural solution.
Firstly, it is important to look at how buildings can be better integrated into their environment, for example through spatial planning, camouflage, or architecture. Secondly, the use of space of the building itself, also known as Increased Product Housing (IPH), can be examined. Students from the Rotterdam University of Applied Sciences have taken up this IPH to increase the awareness of companies of the possibilities of making better use of available space.

Stakeholders Increased Product Housing

IPH has several stakeholders, each of whom has their own interests and requirements (see table).

Stakeholders	Interests	Demand
Municipality	Employment, income, activity	Satisfied residents, sufficient activity, the right balance between nature and living
Residents	Preservation of views and nature	No disturbance, clean environment, good views and plenty of nature
Developers	Positive business case, suitable location	General building, suitable for multiple businesses, low cost, convenient location
Businesses	Quick move into the property, convenient location, fit to purpose	Low costs, sufficient employment
Job seekers	Possibility to work in the area	Easy-to-reach, pleasant workplaces
Government	Activity, the right coordination of living and working, growing economy, sustainability	Satisfaction among both residents and businesses, centralization of activities, control of space constraints in the country

Vacancy in the city centre

As can be seen in the table, interests and requirements can vary largely. Research indicates that no clear leadership is being taken in solving the problem of 'Building Blocks explosion'. To break through the negative image, collective cooperation is crucial.

Spatial economic consultancy firm Stec Groep and architectural and engineering firm DENC have jointly explored the possibilities of how the logistics sector (developers, investors, logistics service providers and shippers), together with national and regional governments, can better meet the criticism of the high demand for space in recent years. The research report provides insights into possible solutions.

The location of distribution centers is another critical issue. For our community, a green environment has a lot of value. A widely accepted Warehouse of the Future must therefore carefully be integrated into that environment.
The traffic flows resulting from the distribution centers also lead to social criticism. Many people experience it as unsafe when the number of traffic movements increases. A distribution center with a favorable traffic influx is important for determining the location (Aarnoudse, 2022).

The main disadvantages of 'Building Blocks explosion' are described as follows:

1. Disappearance of natural landscape
2. Congestion of the road network
3. Reducing the enjoyment of living
4. Pollution of the environment

These topics are especially important for residents in the vicinity of large distribution centers and the impact on the living environment must be considered. On the other hand, consumer behavior is the driving force behind the transformation of the living environment. Government, businesses, and area developers must respond to the effects of this transformation, which have an impact on the entire living environment. This means that a contraction in retail real estate, a further growth in online shopping and an infrastructure that delivers goods to consumers as sustainably as possible must be considered.

Generic building requirements now and in the future

Sustainability

The Netherlands must comply with the Paris climate agreement. Logistics in the Netherlands can and must play a major role in this with new, sustainable distribution centers. The Rhenus DC in Tilburg is an example of this. Until 2018, this was the most sustainable distribution center in the world, measured according to the BREEAM certification; with a score of 99.48%, assessed on integral sustainability.

Sustainable distribution center

Energy scan business hall


Flat multimodel transport/switch


Public transport for employees on business park

With the current development in the field of sustainability and energy transition, we are able to build the most sustainable distribution centers in the world in the Netherlands. More IPH will lead to a further sustainability of logistics in our country. The main trends in this context are the reduction of CO_2 emissions and the improvement of energy efficiency. In addition, the infrastructure is important, and we should look at the best possible connectivity; on the one hand for the (multimodal) transport of the goods and on the other hand for the employees, for example through good public transport connections. In short: A sustainable ecosystem is needed.

Energy

For many companies, it is unclear what the energy they used is used for. This must be mapped out quickly and properly for new construction and renovation. Is heating necessary for the process? Or can (extra) insulation saves on energy (costs)? And what about light? Is artificial light needed everywhere, or is daylight sufficient (in parts of the building)? New opportunities due to the energy transition also deserve attention, such as the charging of internal transport equipment or trucks using solar energy. There are numerous solutions to reduce the CO_2 footprint, in the short and longer term:

Short term

- Insulation (relatively cheap and pays back for itself quickly).
- Applying renewable fuel units (HBEs) for electricity and hydrogen.
- Smart switches and thermostats based on occupancy and/or staff attendance.
- Electric charging stations (electrify choice of internal and external means of transport).

Hydrogyn gas

Long term

- Collective heat pumps in suitable warehouses.
- Solar panel implementation.
- Batteries (self-storage energy for companies).
- Subsidy Scheme for Cooperative Energy Generation (SCE).
- Switching from fossil fuels (or electricity) to the use of hydrogen gas for means of transport.

It usually takes 5 to 10 years for these solutions to be cost-effective. The payback period also differs per solution. For example, the switch from fossil fuels to electrically powered vehicles is made fairly quickly but does not necessarily have to be profitable quickly. In short: the possible solutions vary from company to company and from situation to situation. The current company-specific situation and any restrictions that may or may not have been imposed by the government also play a role in this.

Greenpoint pump station

Hydrogen application

It is certain that sufficient action can already be taken in regard to facility management and the use of buildings to better use square meters and cubic meters. Often even more than expected:

Existing buildings

- Does everything make sense? Is there room to be gained in height through (structural) adjustments?
- What is the maximum load-bearing capacity of floor(s) and roof?
- Do you need to take extra security/safety measures?
- Do permits allow optimization of building use?
- Which systems can be implemented without major modifications?

Re-use and renovation of building

- Does everything make sense? Is there room to be gained in height through (structural) adjustments?
- What is the maximum load-bearing capacity of floor(s) and roof?
- Can the functions within the building be rearranged?
- Is there material that can be reused?
- Can the building be (partially) enlarged, for example in height?
- Do permits allow optimization of building use?
- Which systems and installations can be implemented in the renovated building? And what (building) adjustments are needed for this?

For new construction, it goes without saying that the Warehouse of the Future is multipurpose and modular, meets the aforementioned (sustainability) requirements and that a maximum possible projection of surface area and height is sought.

Requirements for (business) sites

Functions in the supply chains are changing. There will be more small-scale warehouse functions, for local and regional delivery. No longer one large warehouse, centrally located in the country, but ten smaller warehouses, closer to the customers. And with smart planning function, so that despite the longer delivery times, the entire range is still offered. Logically, these other supply chains place different demands on the warehouse function for goods delivered in the region. Compact bulk flows to local centers are created. Business parks then contain more small-scale warehouses. These can also be located closer to residential areas, so that employees live closer to work. Separate access roads for commuting on the one hand and the supply and removal of goods on the other hand could also be considered.

Digital scheduling function

HACCP pest control

Type of users

The market demand has different target groups. On the one hand, they are businesses that are already active in the region and want to grow. This group can be very diverse and usually needs 7,500 m² to 60,000 m². On the other hand, there are companies that have the desire to establish themselves in the region. The latter group consists mostly of online-related (e-commerce) companies, with a space requirement that varies from 30,000 m² to 80,000 m² - built on a a large plot. In order to be able to cover all types of demand, it is important to connect the built masses as much as possible.

But the danger of a monoculture is always lurking. This can lead to excessive economic dependence. Municipalities should therefore take a good look at which companies they want in their municipality. How can these companies reinforce each other? And to what extent should a municipality look for new companies that add value to the ecosystem?

Outside area

Preferably, the sites are separately fenced off for each building block. This enables companies to set up an appropriate security shell. For food companies, for example, this is necessary because of HACCP guidelines. This also allows pest control to be better organized. For e-commerce companies, the security of the premises is of greater importance.
Individual access to the buildings and flows in and around the building should also be separated as much as possible. For the public area, two-way roads - with possibly a ring road - are desirable. These ensure an optimal distribution to and from the main access and keep transport movements in the area as short as possible. Furthermore, a good, low traffic connecting route for slow traffic, for example with bicycle suggestion lanes, is needed.

Parking above dock

Parking

At the Warehouse of the Future, parking is done on site as much as possible. In the context of optimal, double use of space, it is desirable that passenger cars are parked above the docks. In addition to an efficient and improved use of space, this offers the advantage that traffic flows are separated and offices on the first floor are accessible on the ground floor. It is also wise to provide separate parking facilities for trucks. This can partly be done on private property, but buffer places in the area are also recommended.

At the same time, we can look at limiting the need for parking, for example by using public and semi-public transport. In Japan, as well as in Istanbul, private transport networks have already been set up to transport employees to and from work. The services are used by several companies and are specifically aimed at the arrival and departure of employees at the right times.

Public space

Various aspects are important for the design of public space:

- Good road infrastructure - to reach businesses and ensure a smooth flow of traffic in the area.
- Green framing of the site - to hide buildings from view and ensure a qualitative transition in the area.
- Good integration of the transition to the nature reserve.
- Future-proof infrastructure (lighting, data, etc.).
- Multimodal transport - to combine freight flows.
  An example is Switzerland, where the government requires 50% of all freight movements to take place by rail. In the Netherlands, this can be done by expanding (or revitalizing) the railways, and more use can also be made of inland waterways.

Optional program

The company premises can be made more inclusive by adding features that bring added value to the companies and their employees. Examples include charging stations, a workshop for trucks/trailers, pick-up points, sports facilities, accommodation options, catering facilities, etc.

About the authors

René Geujen
Director Plan Development with Next Level and expert in the field of Logistic Real Estate.
Next Level Development o renegeujen@next-level.eu

Radboud olde Scheper
Supply Chain Management Consultant with Riverland Supply Chain Consultancy and expert in the field of logistic strategy.
Riverland Supply Chain Consultancy o radboud@riverland-scm.com

Eric Hereijgers
Logistic consultant warehousing & automation with St. Onge Company and expert in the field of design, detailing and realizing logistic solutions for warehosues and distribution centers.
St. Onge Company o ehereijgers@stonge.com

Raymond Tukker
Logistic consultant and interim manager warehousing & automation with TICM and expert in realizing complex mechanization- and robotization projects.
TICM o r.tukker@ticm.nl

Annemieke de Leeuw
Lecturer at Hogeschool Rotterdam, where she connects business and education.
Hogeschool Rotterdam o a.de.leeuw@hr.nl

Warehouse of the Future

This is part 2 of our white paper series: Warehouse of the Future

- Optimal use of square and cubic metres (Part 1)
- Efficient use of land and space (Part 2)
- Business park and logistics ecosystems of the future (Part 3)

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