

# The Architectural Development of Dutch Parking Garages

A critical review on the embedding in the urban environment

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## Preface

As a child, I regularly visited the centre of Eindhoven by car with my parents. Every time, the car was parked in the same parking garage. This building got my interest more and more due to the way we needed to descend towards the exit. The parking garage consisted of a double helix, and for a long time I wondered how this system worked. The car park, named Mathildelaan was the beginning of my fascination for parking garages.



*Figure 2: double spiral of Q-park Mathildelaan, Eindhoven*

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## 1. Introduction

8.9 million vehicles were registered in the Netherlands in 2023, which is an increase of 1,0 percent a year earlier. Compared to 2019, the number of cars increased with 5,6 percent (CBS, 2023a). These numbers show that the use of vehicles is still growing, despite the encouragement to travel with public transport or by bicycle.

Another research done by CBS (2023b) shows that vehicles are still the most popular way of transportation. 42 percent of all transportations in the Netherlands were made by car, followed by 28 percent by bicycle and 22 percent by walking. Nowadays, considering the numbers shown above, every two Dutch residents should own a car. This makes that vehicles are still an attractive way of transportation (Louter & Van Savooyen, 2005).

However, in spatial terms, the car is a demanding mode of transport. The small capacity, the limited daily use and the number of parking spots that are needed on different locations; at home, at work and other locations makes a vehicle a space-consuming object. Especially in cities, the number of cars effects the liveability, because they are prevailing on the streets. To reduce on-street parking, the development of parking garages represents an important role. And because the number of vehicles in the Netherlands is still growing, the amount of car parks will increase. Parking garages are starting to get a more prior place in the urban environment.

The emphasis on car parks was used to be on creating a functional and cost-effective building. However, in recent years there has been a noticeable shift by urban planners and architects. A parking garage is also part of the urban fabric and needs to get more design attention. A car parking building does not need to be only used for the storage of vehicles, they can be combined with other functions.

This paper will focus on the architectural development of Dutch parking garages. A literature review will form the base for the case studies, in which six Dutch car parks will be investigated on their architectural influence. The following research question will be answered: *How has the architectural development of Dutch parking garages contributed to their embedding in the urban environment?*

## **2. Methodology**

This paper is based on exploratory research. An attempt has been made to investigate the architectural development of Dutch parking garages based on a literature review and several case studies of parking garages that have been the last twenty years. The knowledge of this paper was obtained through literature reviews and its sources including Google Scholar, Elsevier, TU Delft Repository and the TU Delft library. Initially, the following search terms were used: development of parking garages – parking garage design – parking garage layout.

These search terms have led to a number of articles and books about parking garages in general, but also about realised car parks in the Netherlands and abroad. This information has been used for the theory part of this paper. The outcomes of this theoretical framework have contributed to analysing the case studies for the second part of this paper. For each project, the following aspects will be mentioned: urban integration, types of garage-flooring, types of parking spots, entrances & exits and building construction. However, the main focus will be on the architectural embedding in the surroundings; the aspect on which the case studies are selected.

### 3. Theory

The theory part consists of the existing literature and research that has been conducted about parking garages. First, the origin and functional aspect of a car park will be described followed by the development of parking garages during the twentieth century. Thereafter the research objective is mentioned and several design aspects affecting the architecture of parking garages are described.

#### 3.1 Development of Dutch parking garages

##### 3.1.1 Origin and function

Due to the increase in automobile traffic around the 1920s and 1930s, problems appeared for Dutch cities. An expansion in space for trams, buses, bicycles and pedestrians was made impossible, due to the number of parked cars. An example is shown in figure 3. A solution had to be found; the car needed to be parked in specially designated squares or in constructed parking lots (Louter & Van Savooyen, 2005).

Car showrooms formed an important development for the creation of multi-storey parking buildings. Showrooms were a place to show new cars to the public. Moreover, it was also the place to come back when the vehicle needed service or repair. To accommodate all the cars in one building, a new building type was developed: the multi-storey garage. The introduction of reinforced concrete made it possible to build this type of building. The first few years, parking garages were combined with a showroom and workshop.

*Figure 3: Amsterdam, Het Rokin occupied with cars in 1937*

### 3.1.2 Evolution during the twentieth century

The first parking garage in the Netherlands, designed by architect J. Greve, is located in The Hague and was opened in 1930. Around four-hundred cars could be stored spread over three different floors. The construction was made from concrete, while the facade consisted of brickwork and steel windows (Vrolijk, n.d.). According to Duits (2019) the design of the Torengarage (figure 4 and 5) could be mentioned as revolutionary. The building was more than just a place for storing cars, also a car wash and a repair place were part of the building. But moreover, a special place was created for drivers to wait for their customers. During the 1930s the ability for having a car was only reserved for the rich people.

From the 1960s the use of vehicles was no longer limited by rich people. More and more Dutch citizens were able to buy a car, which led to an increase in the daily use of cars. This caused the demand for having more parking spaces. While families moved outside the city, large companies just moved towards the city. Due to the scarcity of parking lots in the city, companies implemented a parking garage into their office and so created a multifunctional building (Louter & Van Savooyen, 2005).



Figure 4: The Hague, exterior of the Torengarage in 1930



Figure 5: The Hague, interior of the Torengarage in 1930

However, the beginning of the Modernism has led to the design of monofunctional (parking) buildings. The Modernism time was known for its functional and minimalism architecture (Rowe, 2011). Parking garages were no longer combined with commercial space or a showroom. As a result, the environment of car parks had a dead and desolate character. Everywhere across the country 'concrete bunkers' were risen. A car park shown in figure 6, located in the Bijlmer, is a classic example of a parking garage from the Modernism period. But also, the Europarking in Amsterdam (figure 7) is a typical example of a Modernist car parking building.

Around the 1990s a transition was made about the importance of car parking buildings as part of the urban area. The focus was again on creating a compact and multifunctional city centre. To make the city more attractive for citizens and companies, a balance should be found between accessibility and quality of life (Louter & Van Savooyen, 2005). To achieve this aim, people started to be realising that architectural quality and the design of public spaces were important keys for creating a well-functioning city. The architectural aspect of car parks became more important, and more attention has been given to these buildings the last two decades.

### 3.2 Research objective

This paper has been set up to delve into the architectural aspect of parking garages in the Netherlands. As mentioned before, the last two decades there has been paid more attention to the design of parking garages. The objective of this research is to show different car parking buildings which make a contribution to the urban environment. Different design aspects are mentioned in the case studies that influenced the architecture of the parking garage.

Figure 6: Bijlmer Amsterdam, Modernist car parking building



Figure 7: Amsterdam, sketch of the Europarking



### 3.3 Design aspects for a parking garage

#### 3.3.1 Urban integration

Car parks can be built in the urban environment in different ways. The most important distinction is an underground or above-ground parking building. An underground garage can be defined as two different building typologies, namely an integral or a detached parking garage (Irmscher et al., 2013). The first possibility includes a combination of functions. For example, a residential building with a car park underneath the building.

An above-ground parking building can be characterized by three different categories, especially a detached garage, a garage above an external function or a garage as ground level of a larger building (Irmscher et al., 2013). In addition, a mechanical parking garage can be both built as underground or above-ground garage. This typology is known for its different way of use.

For an above-ground car park it is important to think about the surroundings when designing a new car park. The building is part of the urban environment and should be considered the same as an office building or residential building (Louter & Van Savooyen, 2005). The role for the architect is to design a parking building which suits the urban environment.

#### 3.3.2 Entrances & exits

Each parking garage should have two different entrances and exits, one for vehicles and one for pedestrians. According to Irmscher et al. (2013) the entrance for cars should be recognisable from a traffic-functional point of view, and in addition, the building's architecture should create a clear entrance of the car parking building.

Two possibilities can be distinguished: independent access and combined access (Louter & Van Savooyen, 2005). The first possibility is designed in the urban area as seen in figure 8. A cut-out has been made in the urban area for creating a slope leading to the underground parking garage. The second possibility is designed as part of a building, an example is showed in figure 9. This type of access can be both lead to an underground or an above-ground parking garage.

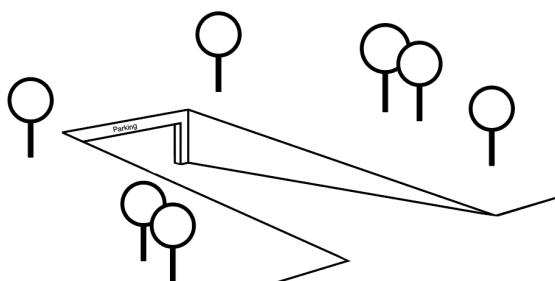


Figure 8: Sketch of an independent entrance/exit

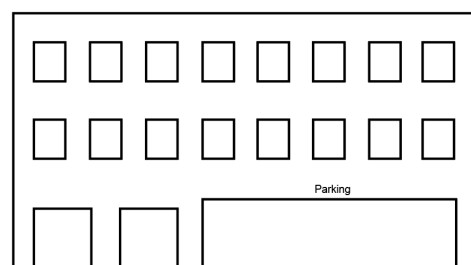


Figure 9: Sketch of a combined entrance/exit

### 3.3.3 Types of parking spots

A distinction in parking spots can be made by looking at what angle they are placed. The common angles are thirty, forty-five, sixty and ninety degrees. Parking lots that are placed perpendicular to the direction of the road are known as most efficient. However, the vehicles need complex manoeuvres which can cause small accidents and moreover, the traffic flow in the parking garage will get worsened (Madhuri et al., 2013). According to the ESPA, parking spots should be designed under an angle of at least 75 percent for the most optimal use to park a car. Parking spaces which have an angle between 76 and 90 percent are considered as not functional, due to the amount of stabbing that is necessary.

### 3.3.4 Types of garage-flooring

The different levels in a parking garage force the vehicular traffic into two flows; inbound and outbound traffic, which are preferably separated to avoid conflicts. Both ways of transportation need to go from one level to another. This way of transportation depends on the type of flooring. Three main types are known: plain, split-level and a ramp. Variations and combinations between the three types are possible.

Firstly, plain floors are most efficient for larger parking garages with limited space availability (Louter & Van Savooyen, 2005). The levels are connected with indoor or outdoor slopes and spirals. Straight slopes along the elevation give the garage a well-organised lay-out and ensure a better orientation for the motorist. Slopes as a helix are less efficient in terms of space. However, the vehicle flows will be more efficient because it is not necessary to cross the entire level before going to the next level (Irmischer et al., 2013).

The second type of flooring is a split-level. The characteristic element of a split-level garage are the parking floors that differentiate only half a level (Louter & Van Savooyen, 2005). As a result, the ramps are relatively shorter than the ramps for plain flooring garages. Split-level garages are most likely to be built above ground level, due to the wasted space between the roof and the ground which is only half a level.

The third and last type of flooring is a ramp principle which is simultaneously used as parking area and for transportation. The ramps can be designed as a circle or square shape and because the slope is also used for parking spots it is an optimal way of exploitation (Irmischer et al., 2013).

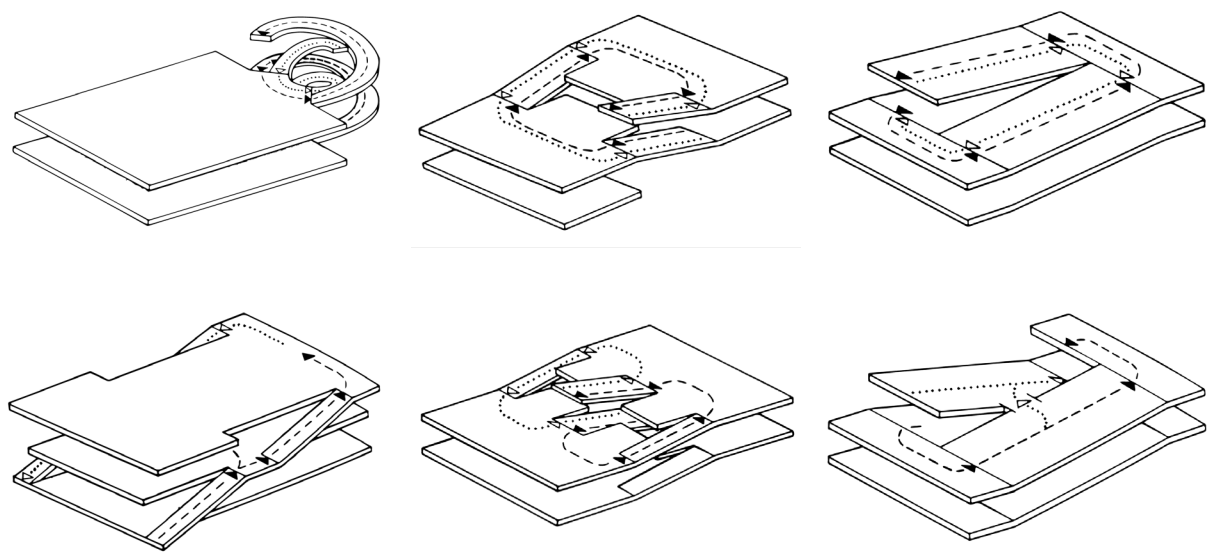


Figure 10: Different typologies of flooring; left: plain flooring, middle: split-level flooring, right: ramp flooring

## 4. Results

The second part of this paper will show six different parking garages that have recently been built in the Netherlands that follow the new movement of parking garages to be part of the urban environment. These projects have been selected because of their architectural impact, each project with a different approach. These case studies show the importance of designing a parking garage to be part of the surroundings.

All six projects will be analysed shortly on the following aspects: architecture & urban design, entrances & exits, type of flooring, type of parking spots and the building construction. These aspects are chosen because they are all part of the design process of a car park. The following six projects have been used for the case study:

1. Parking garage Insulindeplein, Rotterdam
2. Parking garage Meander Medisch Centrum, Amersfoort
3. Parking garage Kustwerk, Katwijk aan Zee
4. Parking garage Katwolderplein, Zwolle
5. Parking garage Lammermarkt, Leiden
6. Parking garage Zwijsen, Tilburg

#### 4.1 Parking garage Insulindeplein

<i>Location:</i>	Rotterdam
<i>Capacity:</i>	140
<i>Opening year:</i>	2010
<i>Client:</i>	Ontwikkelbedrijf Rotterdam
<i>Architect:</i>	Paul de Ruijter Architects
<i>Contractor:</i>	Ballast Nedam

The parking garage located at the Insulindeplein can be considered as a special one, because of the fully automatic car park. There is no need for ramps and roads inside the garage which saves space and allows up to a third more parked cars. An automated machine will place the vehicles in the right position. In addition, there is no need for a security guard, not permanently ventilation and lighting are necessary and damage to the parked vehicles is minimised (Bunschoten, 2023). However, it is an expensive way of parking and sensitive to software errors because all movement is done by an automated parking system.

The parking garage features two different accesses and a waiting area. Upon arrival, the motorist places the vehicle on a lift platform on ground level. Thereafter, the vehicle will be scanned if it is parked properly, and if there is no one inside the vehicle anymore. Then, the car lift delivers the vehicle to the automated parking system and places it in a parking lot. In the waiting room or via Internet, the car can be summoned and follows the reverse path where the lift reverses the car to make sure the motorist can drive the car forward out of the entrance/exit.

The only visible aspects at this garage are two entrances/exits and a waiting room. These elements are combined into one volume designed by Paul de Ruijter Architects. To create social safety, the design consists of a minimalistic volume made from glass. The glass facade is printed with silver light-reflecting vertical stripes. The reflective stripes ensure that the building is transparent from the inside without heating up due to solar radiation. From the outside, the building does not seem to be the entrance of a parking garage (Paul de Ruijter Architects, n.d.). The building is only used for residents living in the neighbourhood.



Figure 11: Exterior of the car parking building; glass volume with two entrances/exits and a waiting room



Figure 12: Interior of the parking garage with automated parking system



Figure 13: Exterior of the parking garage with one of the two entrances/exits

## 4.2 Parking garage Meander Medisch Centrum

<b>Location:</b>	Amersfoort
<b>Capacity:</b>	830 parking spots (expansion possible to 1070 parking spots)
<b>Opening year:</b>	2013
<b>Client:</b>	Meander Medisch Centrum
<b>Architect:</b>	Atelier Pro Architecten
<b>Contractor:</b>	Ballast Nedam

The multistorey car park which belongs to the Meander Medisch Centrum is specially designed for the employees and is located near the main hospital building. Atelier Pro is responsible for the design of this new car parking building. The design could be both described as functional and flexible. In addition, attention has been paid to integrating the facade with the surrounding nature (Atelier PRO, n.d.).

To make a connection with the landscape, logs have been added to the buildings' facade. The stumps of oaken trees are placed vertically and were originally located on the building site, but had to make way for the parking garage (Atelier PRO, n.d.). This reuse of trees is both sustainable and improves the embedding in the landscape environment. Wild vine, hедера and wisteria are growing around the logs and will cover the façade in future.

The structure of the building is built following the ModuPark®-concept, a system which is developed by Ballast Nedam Parking in cooperation with Oostingh Staalbouw and Grontmij Parkconsult. Characterised by the quick realisation and its flexibility. A modular construction made of prefabricated concrete double T slabs of 16 x 2.5 metres containing a grid of five metre. As a result, there is a possibility to park cars without the need of pillars (Stichting Zinkinfo Benelux, n.d.).

The floor principle of this car parking building can be categorised as split-level and consists of four levels, which can be expanded with two extra levels. The centre of the building has made place for a corridor that allows light to come in, but moreover, an open and friendly atmosphere is obtained. The traffic flow is separated between inbound and outbound traffic to gain a fast and safety circulation. The inbound traffic will follow the outer circle, while the outgoing traffic can follow the inner circle around the central corridor (see figure 17). A disadvantage of this layout are the few parking spots that have been placed in the wrong direction according to the traffic flow. Cars need to enter these spots by reverse parking.

The pedestrian accesses are not integrated into the building, but they are added to the outside. The main entrance, implemented with an elevator, is located on the south corner. In addition, three more emergency exits have been designed to the car parking as a spiral to minimise the volume and appearance.

Figure 14: Exterior of the parking building with the recycled stumps surrounded by wild vine, hедера and wisteria



Figure 15 & 16: Left; buildings' facade including natural elements, right; central corridor providing natural light and better atmosphere

Figure 17: Floorplan of the parking garage with the surrounding nature.



### 4.3 Parking garage Kustwerk

**Location:** Katwijk aan Zee  
**Capacity:** 663 parking spots  
**Opening year:** 2015  
**Client:** Rijnland Water Board and the Municipality of Katwijk  
**Architect:** Royal HaskoningDHV and OKRA landscape architects  
**Contractor:** Ballast Nedam and Rohde Nielsen

Katwijk aan Zee is a well-known Dutch seaside town. Since 2015 a new parking garage has been developed to allow more parked vehicles for summer days. This car parking building is more than just a place for storing cars, it is part of a complete masterplan to improve the quality of the dunes and the connection between the centre and coast. In 2016, the project has won the 'BNA best building of the year 2016' and a year later, it has received the IPI Award of Excellence awarded by the International Parking Institute (IPI). This shows the success of the masterplan (ZJA Architecten, n.d.).

The underground parking garage has been fully integrated into the dune landscape, which has been done for the first time in the Netherlands. To ensure that Katwijk aan Zee will be protected against the rising water level in the future, the dune landscape has been made one hundred metres wider. This allowed space for a 500-metre-long underground car parking behind a new created underground dyke.

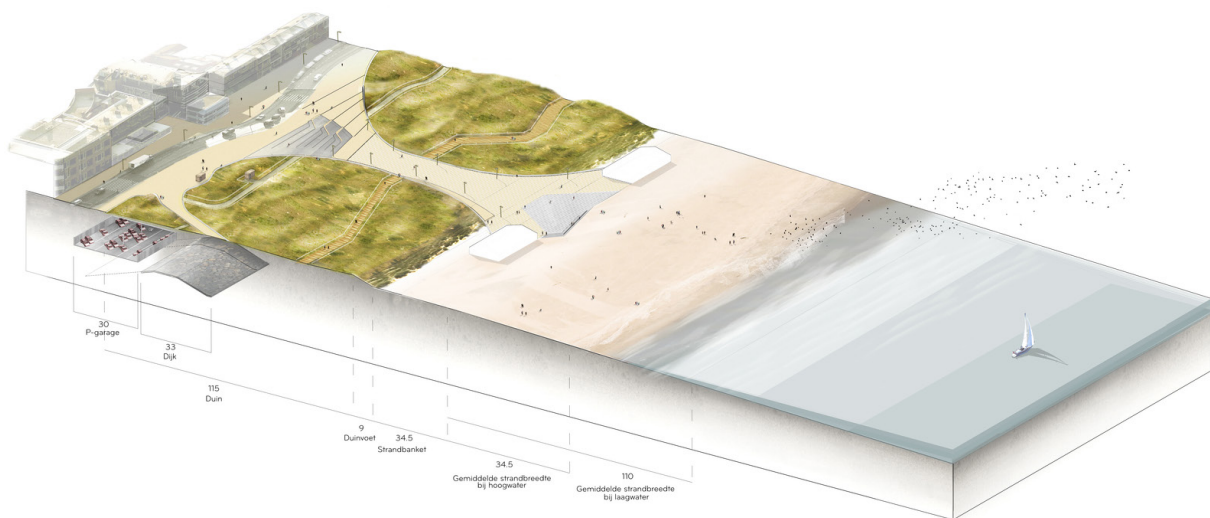


Figure 18: Three-dimensional section of the masterplan

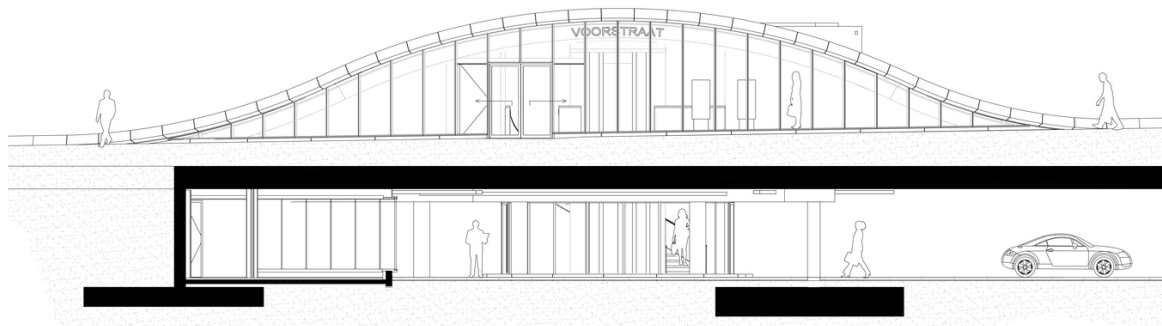


Figure 19: Section in which the connection between the parking area and the pedestrian entrance is shown

The iconic aspect of this parking garage is the integration into the landscape. The pedestrian entrances and exits are embedded in the natural dune environment. The pedestrian accesses, five in total, are designed as curved glass openings spread through the dunes which are showed in figure 20. This allows direct access to the paths that both lead to the centre and the coast. The section in figure 19 presents the connection between the pedestrian entrance and the car parking area. Another characteristic of these glass elements is the natural light that enters the underground parking space which contributes to the orientation of the customers.

The access to the parking garage for vehicles is located on both ends of the longitudinal building for an optimal flow of traffic. A ramp situated in the dune landscape creates the connection between the entrance of the car parking building and the main street. The parking deck itself consists of only one level with a dimension of thirty metres wide by 500 metres long (Visser, 2015). To create a workable traffic flow inside the building, a roundabout is made around each pedestrian entrance to give the possibility for car drivers to turn around if necessary. Due to the location near the coast, it was not possible to design a parking building with more than one level. A one level car park is an optimal use in terms of parking spots and accessibility. The parking spaces in this garage are designed with an angle of 75 degrees, which is according to the ESPA a suitable angle.



Figure 20: Relation between the pedestrian entrance and the boulevard



Figure 21 & 22: Left; interior of the car park allowing natural light, right; emergency exit located in the dunes

#### 4.4 Parking garage Katwolderplein

**Location:** Zwolle  
**Capacity:** 710 parking spots  
**Opening year:** 2016  
**Client:** Municipality of Zwolle  
**Architect:** DOK Architecten  
**Contractor:** Royal BAM Group

The design for this parking garage is inspired by the caravanserai, a place along the Silk Road where travellers stayed overnight, traded and horses were stabled. According to DOK Architecten, the Katwolderplein is a place where inner-city functions converge; dwellings, a cinema and a car parking building were realised. The district is the first moment for meetings between people, visitors to the city centre and the residents in the area. The parking garage contributes to these moments and therefore interprets the role of a caravanserai. These buildings merge into the city through their architecture, something which is not known in the Dutch inner-cities. However, it should be implemented, DOK Architecten mentioned, because Katwolderplein is a place where lots of functions come together and asked for a natural transition between the small scale of the housing development and the large building volume of the cinema (Hoek, n.d.).

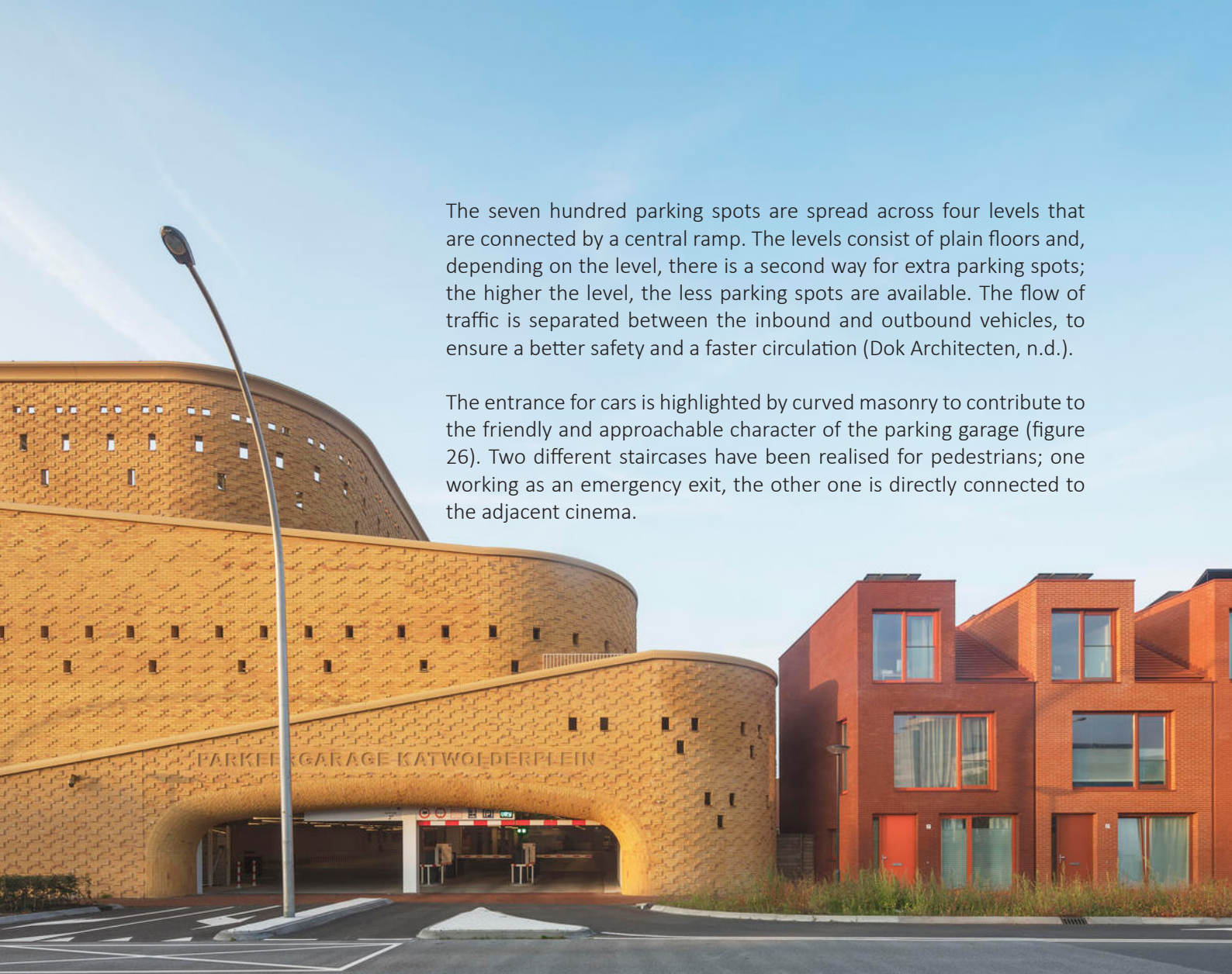


Figure 23 & 24: Left; Silk Road, right; sketch of a typical caravanserai along the Silk Road

The buildings' elevation takes a key role to achieve this ambition. The curved shape and the brickwork facade give the car park a friendly and approachable appearance. Detailed masonry is incorporated in five patterns that are delicately opened from a solid base upwards. Together with flowing lines a welcoming building has been realised (Hoek, n.d.). Figure 25 shows the parking garage creating the transition from private dwellings to the public cinema by means of layering. In addition, attention has been paid to integrate nature in the building by accommodating nesting and hiding places for swallows and bats (Architectenweb, 2018).



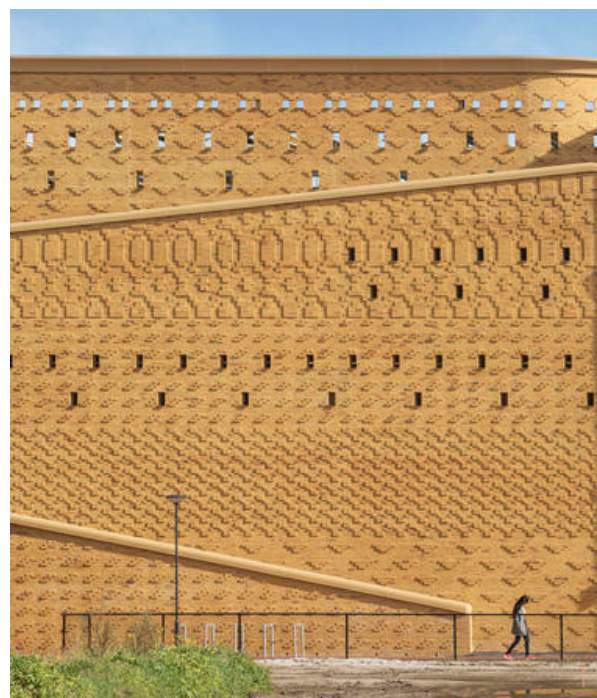
Figure 25: Elevation showing the transition between the residential area and cinema



The seven hundred parking spots are spread across four levels that are connected by a central ramp. The levels consist of plain floors and, depending on the level, there is a second way for extra parking spots; the higher the level, the less parking spots are available. The flow of traffic is separated between the inbound and outbound vehicles, to ensure a better safety and a faster circulation (Dok Architecten, n.d.).

The entrance for cars is highlighted by curved masonry to contribute to the friendly and approachable character of the parking garage (figure 26). Two different staircases have been realised for pedestrians; one working as an emergency exit, the other one is directly connected to the adjacent cinema.

*Figure 26: Main entrance of the parking building highlighted by curved masonry*



*Figure 27 & 28: Left; detailed photo of the curved entrance, right; different patterns of masonry on the facade*

#### 4.5 Parking garage Lammermarkt

**Location:** Leiden  
**Capacity:** 525 parking spots  
**Opening year:** 2017  
**Client:** Municipality of Leiden  
**Architect:** JHK Architects  
**Contractor:** DuraVermeer – BESIX

Located in the old centre of Leiden below the Lammermarkt, JHK Architects designed a new underground multistorey car park which is the deepest underground car park of Western Europe. The 22-metre-deep building is constructed as a cylindrical shape to minimize the volume and the inconvenience for the surrounding buildings. Due to the circular typology, all floors are spatially connected around an atrium (figure 29). Which emphasizes the spatiality of the building and provides social safety.



Figure 29: Section showing the depth of the car park with the central atrium

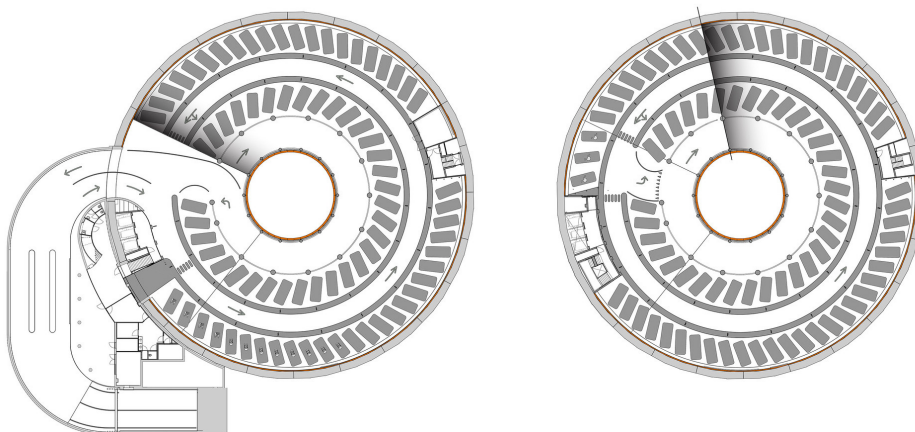


Figure 30: Floorplans showing the traffic flow in the garage

Attention has been paid in the design to show the history of Leiden. Each century, visitors descend or climb by one level in which important moments from that century are shown. Moreover, several artworks have been added to the walls of the parking garage to show Leiden's history.

The entrance of the car park can be categorized as an independent access. At ground level an out cut has been made to create a ramp to the entrance of the parking garage whereafter the visitors enter the spiral. Figure 30 is showing the principle of the car entrance. For pedestrians, there has been made a separate glass pavilion on ground level to enter or exit the parking garage (figure 31). Through the curved and five-metre-high glass facade, the city of Leiden and mill De Valk will appear when the visitors exit the car parking building via an open staircase. Due to the small volume of the garage, only one main pedestrian access is needed in combination with an emergency exit.

The cylindrical ramp is divided in two different traffic flows: descending traffic on the outside and climbing traffic on the inside. The descending flow of traffic is combined with parking spots; visitors will automatically drive across a free parking lot which will cause less congestion. On each level, there is a possibility for cars to cross towards the rising spiral.

The construction of this parking garage needed to be as little nuisance as possible because of the location in the heart of Leiden. To minimise the inconvenience, several building technics have been applied: low-vibration pressing of sheet piling, drilling of anchors and installation of concrete diaphragm walls. Those 1.2-metre-thick diaphragm walls are thirty metres deep. With a diameter of about sixty metres, a total of over 60,000 cubic metres of soil have been excavated.

A pipeline was placed over a length of five kilometres through the Leiden canals. The soil was transported through this pipe to a soil depot outside the city where the sand could be reused. This has saved over 2,500 truck trips back and forth through the Leiden city centre.



Figure 31: Exterior of the pedestrian entrance with the famous mill in the background

#### 4.6 Parking garage Zwijsen

<b>Location:</b>	Tilburg
<b>Capacity:</b>	730 parking spots
<b>Opening year:</b>	2022
<b>Client:</b>	Municipality of Tilburg and EZ Park
<b>Architect:</b>	Vissers & Roelands Architecten
<b>Contractor:</b>	Van de Ven Bouw & Ontwikkeling BV

Parking garage Zwijsen is located next to the central station of Tilburg in the urban area called Spoorzone. This neighbourhood is undergoing a transition into a working and liveable area considering the industrial history. Part of this transition is a new car parking which should answer the need for parking spaces. The parking garage, with a length of 230 meters and a height of 18 meters, is mainly working as a noise barrier for the residential area behind. The car parking building separates the railway from the new developed neighbourhood (Vissers & Roelands, n.d.).

The Municipality asked for a building as small as possible to allow more space for residential buildings in future (Van der Vliet, 2023). Therefore, both ends of the parking garage are designed with a circular shaped slope; one for inbound traffic, and one for the outbound traffic. A straight way with parking spots connects both spirals as shown in figure 32. Both ways of traffic come together at the main entrance of the building. For pedestrians, two accesses are designed on the north side of the parking garage and provides access to a square with leads to the central station.

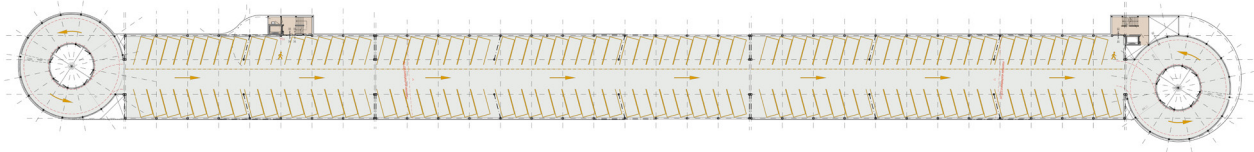


Figure 32: Floorplan of the parking garage with two spirals

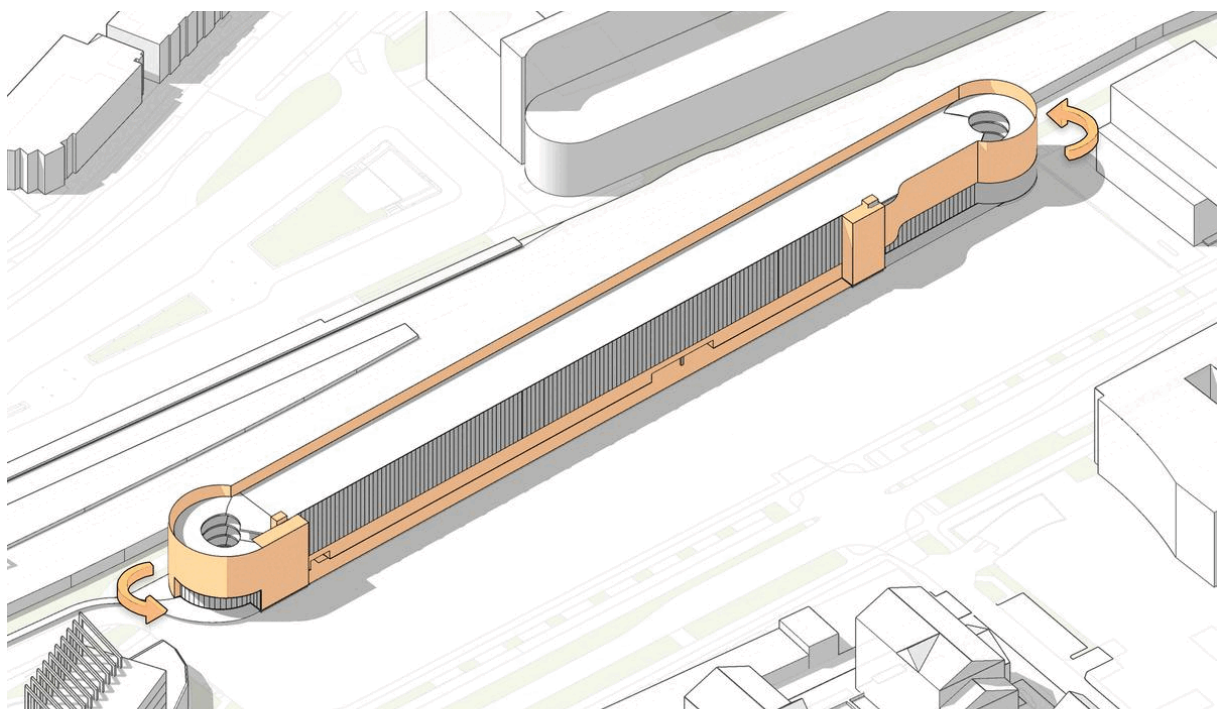


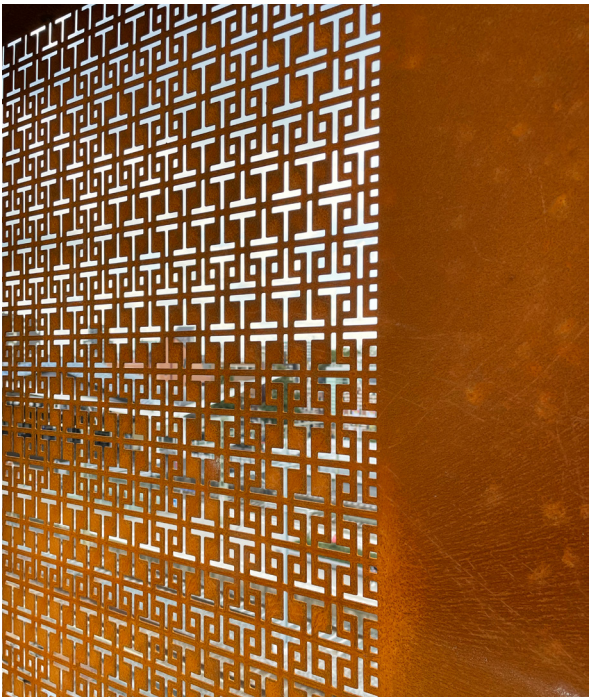
Figure 33: Three-dimensional drawing showing the building mainly operated as noise barrier

An important aspect for the design was referring to the history of this industrial area. Corten steel facade elements should give the building a certain reference to the past. Corten steel is, according to *Visser & Roelands*, a material with a transient nature. It cannot be considered as old steel, but as a natural product. Therefore, it gives a solid look that suits the Spoorzone. In addition, it is also reminiscent of the material a railway track is made of (*Van der Vliet, 2023*). The railway side of the building is performed in Corten steel facade elements with a unique perforation. This perforation is formed by the letter T, both referring to the name of the city and the abstract cross-section of a railway track. The other facade, located on the north side, is designed with a semi-transparent curtain wall to allow more daylight and give the building a more friendly character.

To emphasize the industrial character, the construction is made from galvanised steel and concrete floors. From the inside, the construction is made visible, which gives the car park a more industrialised character. Moreover, due to the construction method with dry bolting and prefabricated elements, the building is completely modular and demountable.



*Figure 34: Relation between the new parking garage and the old NS workspace*



*Figure 35 & 36: Left; detailed photo of the perforated Corten steel panels, right; north facade performed with semi transparent glass*

## 5. Conclusion

In this paper research has been done to what extent the architectural development of Dutch parking garages has contributed to their embedding in the urban environment. The main directive was to show the evolution of car parking buildings and their focus on fitting with the surroundings.

Research has shown a significant shift in the importance of designing a multistorey car park. During the Modernism mainly functional and minimalism architecture was used for these buildings. Parking garages were no longer combined with commercial space or a showroom which increased a desolate character around them. 'Concrete bunkers' were built everywhere across the country.

However, since the twenty-first century more attention has been paid to the design of parking garages. They become part of the urban environment because these buildings cannot be avoided. This shift is reflected in the various case studies in this paper. Different possibilities are shown to embed in the urban environment: car park Kustwerk is fully integrated into the dune landscape while car park Katwolderplein is used for the transition between the residential neighbourhood and public buildings. Car park Zwijsen is designed with the reference to the old industrial and railway area.

These examples show the importance for a well-designed parking garage which fits the surrounding area. Despite these buildings are only used for storing vehicles, they cannot be ignored or removed. Therefore, it is necessary to pay attention on how to be integrating these buildings with the environment. Following research on this topic can be done by examining the different design possibilities for integration in more detail. Another topic could be more specific on the financial aspects of designing a parking garage; why is it, for example, nowadays profitable to design and build a parking garage which is designed from an architectural point of view?

## References

### *Theory*

Centraal Bureau voor de Statistiek. (2023a). Hoeveel personenauto's zijn er in Nederland? Centraal Bureau Voor de Statistiek. Available at: <https://www.cbs.nl/nl-nl/visualisaties/verkeer-en-vervoer/vervoermiddelen-en-infrastructuur/personenautos> (accessed on 21 February 2024)

Centraal Bureau voor de Statistiek. 2023b). Hoeveel reizen inwoners van Nederland en hoe? Centraal Bureau Voor de Statistiek. Available at: <https://www.cbs.nl/nl-nl/visualisaties/verkeer-en-vervoer/personen/hoeveel-reizen-inwoners-van-nederland-en-hoe-> (accessed on 21 February 2024)

Duits, H. (2019). Parkeren voor heeren- Haags Gemeentearchief. Haags Gemeentearchief. Available at: <https://haagsgemeentearchief.nl/ontdek-de-stad/verhalen-van-de-stad/parkeren-voor-heeren> (accessed on 14 March 2024)

European Parking Association. (z.d.). The European Standard Parking Award (ESPA Off-Street). <https://www.europeanparking.eu/en/awards/espas-off-street/> (accessed on 22 February 2024)

Irmscher, H., Kosarev, I., & Schiefenhövel, A. (2013). Handbuch und Planungshilfe, Parkhäuser und Tiefgaragen. DOM Publ.

Louter, F., & Van Savooyen, E. (2005). Parkeren op niveau: De parkeergarage als ontwerp opgave (1st edition). Twynstra Gudde.

Madhuri K., Rathi, D., Patel, V. (2013) Different types of Parking Spaces and Multiple Level Car Parking, Available at: <http://www.engineeringcivil.com/different-types-of-parking-spaces-and-multiple-level-car-parking.html> (accessed 7 March 2024)

Rowe, H. A. (2011). The rise and fall of modernist architecture. *Inquiries Journal*, 3(04).

Vrolijk, J. (n.d.) Haagse Tijden | De eerste parkeergarage. Available at: <https://www.haagsetijden.nl/tijdlijn/de-wereldoorlogen/de-eerste-parkeergarage> (accessed on 14 March 2024)

### *Case studies*

Architectenweb (2018). Parkeergarage Katwolderplein. Architectenweb. Available at: <https://architectenweb.nl/projecten/project.aspx?id=35241> (accessed 5 April 2024)

Atelier PRO. (n.d.) Parkeergarage Meander Medisch centrum, Amersfoort. Available at: <https://www.atelierpro.nl/nl/projects/78/parkeergebouw-meander-medisch-centrum> (accessed 3 April 2024)

Bunschoten, S. (2023). Zo werkt de nieuwe automatische parkeergarage onder de Vijzelgracht. Available at: AT5. <https://www.at5.nl/artikelen/222158/nieuwe-parkeergarage-onder-vijzelgracht-amsterdam> (accessed 9 April 2024)

Dok Architecten (n.d.). Parkeergarage Katwolderplein, Zwolle. Dok Architecten. Available at: <https://dokarchitecten.nl/project/parkeergarage-katwolderplein-zwolle> (accessed 5 April 2024)

Hoek, B. (n.d.). Parkeergarage Katwolderplein. Galleo. Available at: <https://www.galleo.co/project/parkeergarage-katwolderplein> (accessed 5 April 2024)

JHK Architecten. (n.d.). Parkeergarage Lammermarkt. JHK Architecten. Available at: <https://www.jhk.nl/NL/13883-lammermarkt.html> (accessed 26 March 2024)

Paul de Ruijter Architects (n.d.) Insulindeplein parkeergarage. Available at: <https://paulderuiter.nl/projects/insulinde-square-parking-garage> (accessed 9 April 2024)

Stichting Zinkinfo Benelux. (n.d.) Parkeergarage Meander Medisch Centrum. Available at: <https://www.zinkinfobenelux.com/projecten/parkeergarage+meander+medisch+centrum> (accessed 3 April 2024)

Van Der Vliet, R. (2023). Dit is waarom Parkeergarage Zwijsen “roestig” is- indebuurt Tilburg. Indebuurt Tilburg. Available at: <https://indebuurt.nl/tilburg/genieten-van/mysteries/mysterie-dit-is-waarom-parkeergarage-zwijsen-er-roestig-uitziet~181999/> (accessed 10 April 2024)

Visser, P. (2015). Kustwerk Katwijk. Architectuur.nl. Available at: <https://www.architectuur.nl/project/kustwerk-katwijk/> (accessed 26 March 2024)

Vissers & Roelands. (n.d.). Parkeergebouw Zwijsen. Vissers & Roelands Architecten. Available at: <https://www.vissersroelands.nl/projecten/1923/parkeergebouw-zwijsen> (accessed 10 April 2024)

ZJA Architecten. (n.d.). Parkeergarage Kustwerk Katwijk. Available at: <https://www.zja.nl/nl/KustwerkKatwijk> (accessed 26 March 2024)

## Image references

Fig 1. Europarking Amsterdam Marnixstraat. (2007). Available at: <https://www.flickr.com/photos/visbeek/430498419/> (accessed 3 April 2024)

Fig 2. Natris, A. (2017). Goeiemorgen, we worden kei dol in de parkeergarage! Available at: <https://indebuurt.nl/eindhoven/eindhovenaren/goeiemorgen-we-worden-keidol-parkeergarage~13783/> (accessed 26 March 2024)

Fig 3. Louter, F., & Van Savooyen, E. (2005). Parkeren op niveau: De parkeergarage als ontwerp opgave (1st edition). Twynstra Gudde.

Fig 4-5. Duits, H. (2023). De Torengarage: uniek in Nederland. Haags Gemeentearchief. Available at: <https://haagsgemeentearchief.nl/ontdek-de-stad/verhalen-van-de-stad/de-torengarage-uniek-in-nederland> (accessed 19 March 2024)

Fig 6. Bijlmermuseum. (n.d.). Garages; tot er geen garage over was. Bijlmermuseum. Available at: <https://bijlmermuseum.com/garages/> (accessed 4 April 2024)

Fig 7. ANP. (1969). Tekening van Parkeergarage Europarking, Marnixstraat 250. Archief Amsterdam. Available at: <https://archieff.amsterdam/beeldbank/detail/03490dd0-f11c-52bf-c69c-bba8ec88815d> (accessed 4 April 2024)

Fig 8-9. Own drawing

Fig 10. Louter, F., & Van Savooyen, E. (2005). Parkeren op niveau: De parkeergarage als ontwerp opgave (1st edition). Twynstra Gudde.

Fig 11-13. Paul de Ruijter Architects (n.d.) Insulindeplein parkeergarage. Available at: <https://paulderuiter.nl/projects/insulinde-square-parking-garage> (accessed 9 April 2024)

Fig 14-15. Atelier PRO. (n.d.) Parkeergarage Meander Medisch centrum, Amersfoort. Available at: <https://www.atelierpro.nl/nl/projects/78/parkeergebouw-meander-medisch-centrum> (accessed 3 April 2024)

Fig 16. Stichting Zinkinfo Benelux. (n.d.) Parkeergarage Meander Medisch Centrum. Available at: <https://www.zinkinfobenelux.com/projecten/parkeergarage+meander+medisch+centrum> (accessed 3 April 2024)

Fig 17. Atelier PRO. (n.d.) Parkeergarage Meander Medisch centrum, Amersfoort. Available at: <https://www.atelierpro.nl/nl/projects/78/parkeergebouw-meander-medisch-centrum> (accessed 3 April 2024)

Fig 18-19. Cardenas, D. (2022). Underground Parking Katwijk aan Zee / Royal HaskoningDHV. ArchDaily. Available at: <https://www.archdaily.com/791812/underground-parking-katwijk-aan-zee-royal-haskoningdhv> (accessed 26 March 2024)

Fig 20-21. ZJA Architecten. (n.d.). Parkeergarage Kustwerk Katwijk. Available at: <https://www.zja.nl/nl/KustwerkKatwijk> (accessed 26 March 2024)

Fig 22. Cardenas, D. (2022). Underground Parking Katwijk aan Zee / Royal HaskoningDHV. ArchDaily. Available at: <https://www.archdaily.com/791812/underground-parking-katwijk-aan-zee-royal-haskoningdhv> (accessed 26 March 2024)

Fig 23. Wikipedia. (n.d.) Silk Road. Wikipedia. Available at: [https://en.wikipedia.org/wiki/Silk\\_Road](https://en.wikipedia.org/wiki/Silk_Road) (accessed 9 April 2024)

Fig 24. Caravanserai in Tabriz. (n.d.). Galerie Ary Jan. Available at: <https://www.galeriearyjan.com/en/caravanserai-in-tabriz.htm> (accessed 9 April 2024)

Fig 25-28. Dok Architecten (n.d.). Parkeergarage Katwolderplein, Zwolle. Dok Architecten. Available at: <https://dokarchitecten.nl/project/parkeergarage-katwolderplein-zwolle> (accessed 5 April 2024)

Fig 29-31. JHK Architecten. (n.d.). Parkeergarage Lammermarkt. JHK Architecten. Available at: <https://www.jhk.nl/NL/13883-lammermarkt.html> (accessed 26 March 2024)

Fig 32-36. Vissers & Roelands. (n.d.). Parkeergebouw Zwijssen. Vissers & Roelands Architecten. Available at: <https://www.vissersroelands.nl/projecten/1923/parkeergebouw-zwijssen> (accessed 10 April 2024)