Room for a City

Cars are a natural part of the city's heartbeat, and many people are dependent on having personal vehicles. However, cars also take up space in the city that could be used for other purposes to improve the lives of the people who live and work there.

In the past almost-10 years, Aarhus, the second largest city in Denmark, has transformed its inner harbor area—close to the historical center of the city, the cathedral, and the Aarhus River—into a city space full of life and activity, a new link between the center of the city and the harbor.

An important element in this project is that cars and the old, open car parks on the waterfront were moved to make room for three new waterfront spaces on staggered levels, unfolding down to the water at the harbor. The new spaces are multi-functional and have room for large-scale concerts and everyday activities such as soccer. From these spaces, people can enjoy views of the harbor and the sea—views framed by two

With a capacity of up to 1,000 cars, Dokk1 Parking in Aarhus, Denmark, is the largest fully automated parking system in Europe and an example for big-city parking of the future.

By Peter Fangel Poulsen

to Come to Life

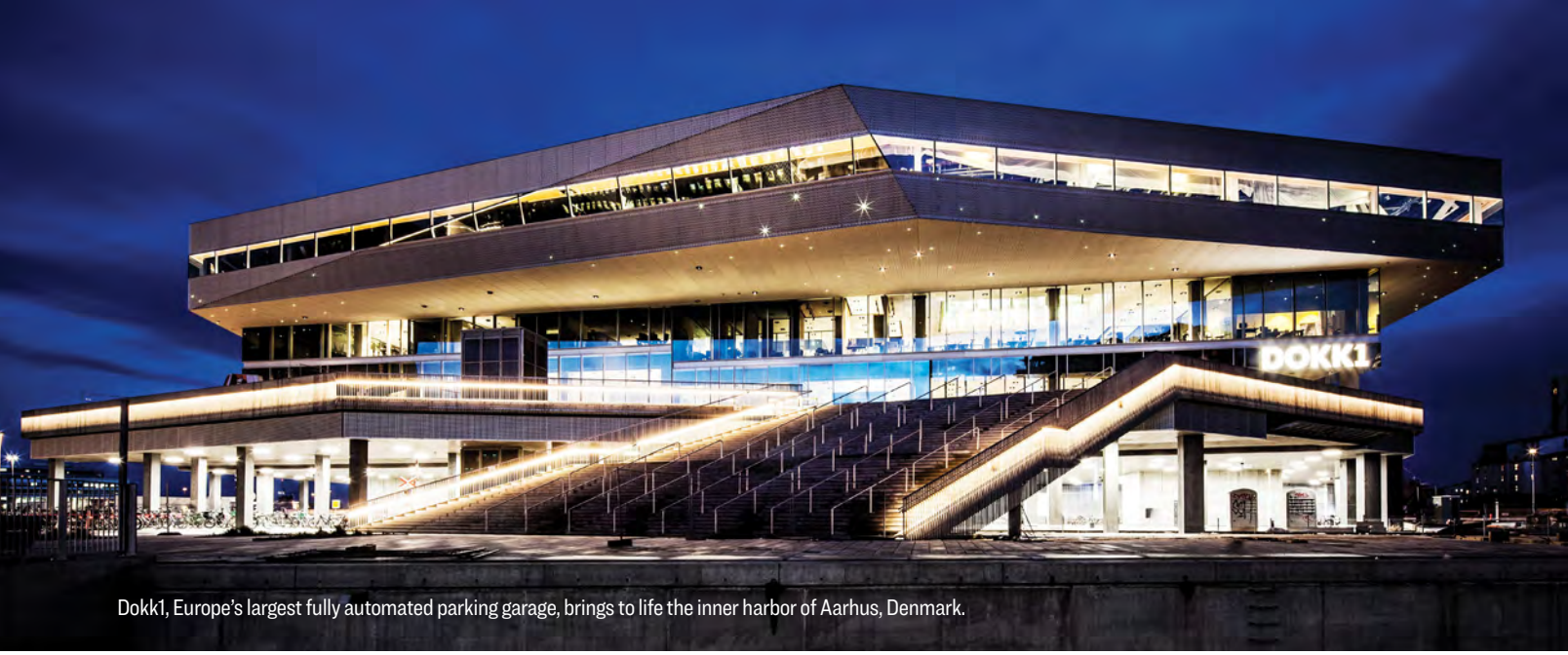
very striking new buildings: Navitas and Dokk1. Here, you will find room for all recreational aspects of city life in a setting that links the various elements together, including the city's past.

In order to realize the idea of removing cars from the surface, Realdania By & Byg developed a fully automated underground parking system that has made a huge contribution to the area's transformation. The new garage is the largest automated parking facility in Europe, with room for almost 1,000 cars on three underground levels beneath Dokk1.

The firm wanted to provide an innovative example of the future of big-city parking and came up with a parking solution that will set new standards of parking comfort by rethinking the process from the user angle, and which, by the rational use of space, will make more room for the life of the city.

Safe and Easy Parking

Users no longer need to drive through the murky, twisty underground car parks of times past, instead delivering their car in a transfer cabin at street level and

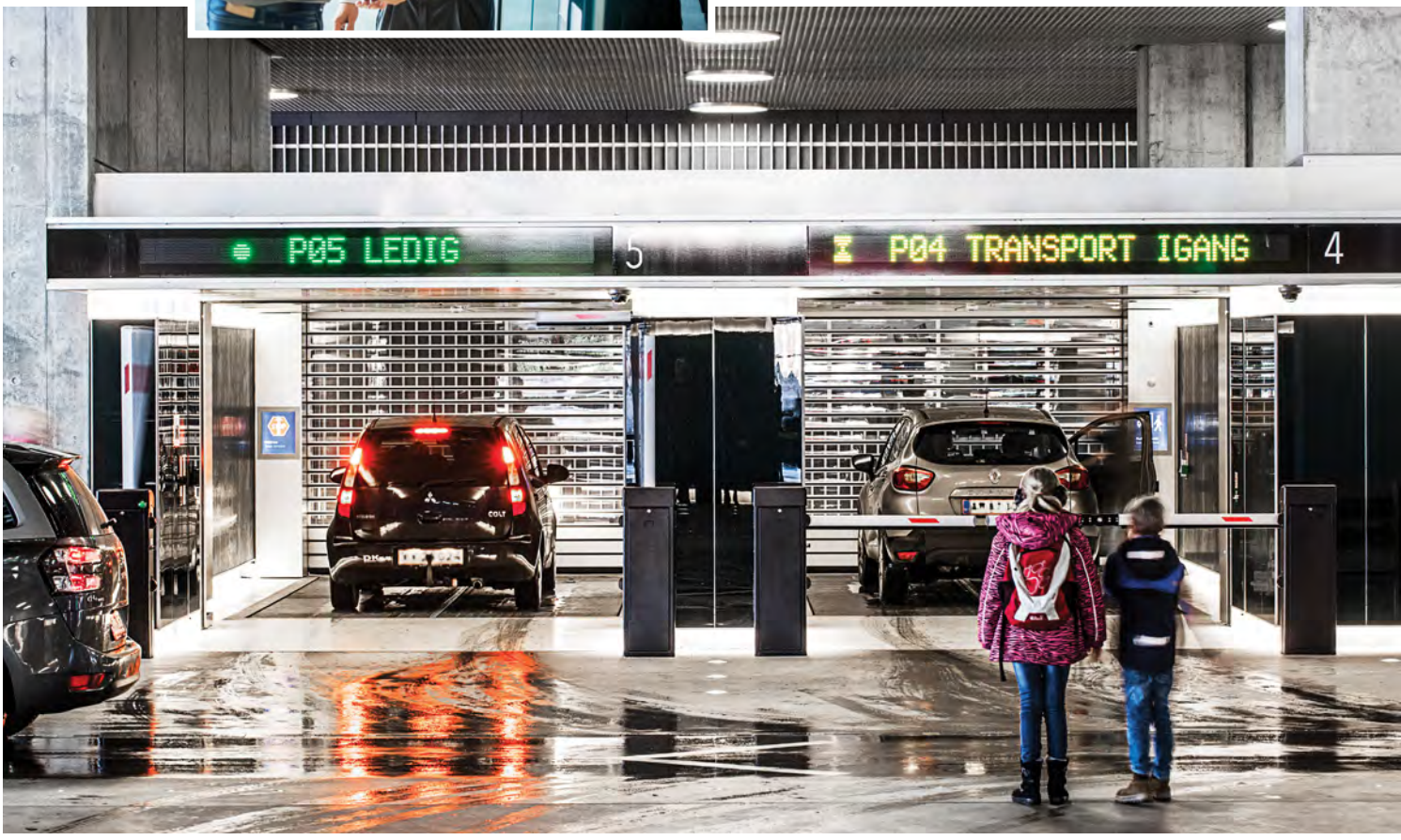


Dokk1, Europe's largest fully automated parking garage, brings to life the inner harbor of Aarhus, Denmark.

Below: A robotic system makes it easy and quick for drivers to drop their cars off for parking and be on their way.

identifying themselves at a terminal. This only takes a minute and then the system takes over. When the car has been delivered, a hoist moves it down to the desired level, and it is guided to its bay by a transfer vehicle specially designed for this facility.

The delivery area offers views over the harbor and inward toward the city. Good lighting and subdued acoustics make parking the car a pleasant experience. On returning, it usually takes two minutes to retrieve a car from its underground bay and have it delivered in



one of the transfer cabins; it's turned out to be a short time in which to stand and admire the qualities of the place.

Use of Space

The new automated parking system under Dokk1 is the result of several years of development involving the municipality of Aarhus, Realdania By & Byg, and German partner Lödige Industries. A system was developed that moves cars around faster than other automated parking systems have to date.

Other parking systems employ pallets on which the cars are placed and moved around, but the Dokk1 system works differently. Lödige designed a small, self-propelled unit called a shifter that slides in under the car and gets a grip under each tire, enabling the car to be moved without the use of pallets.

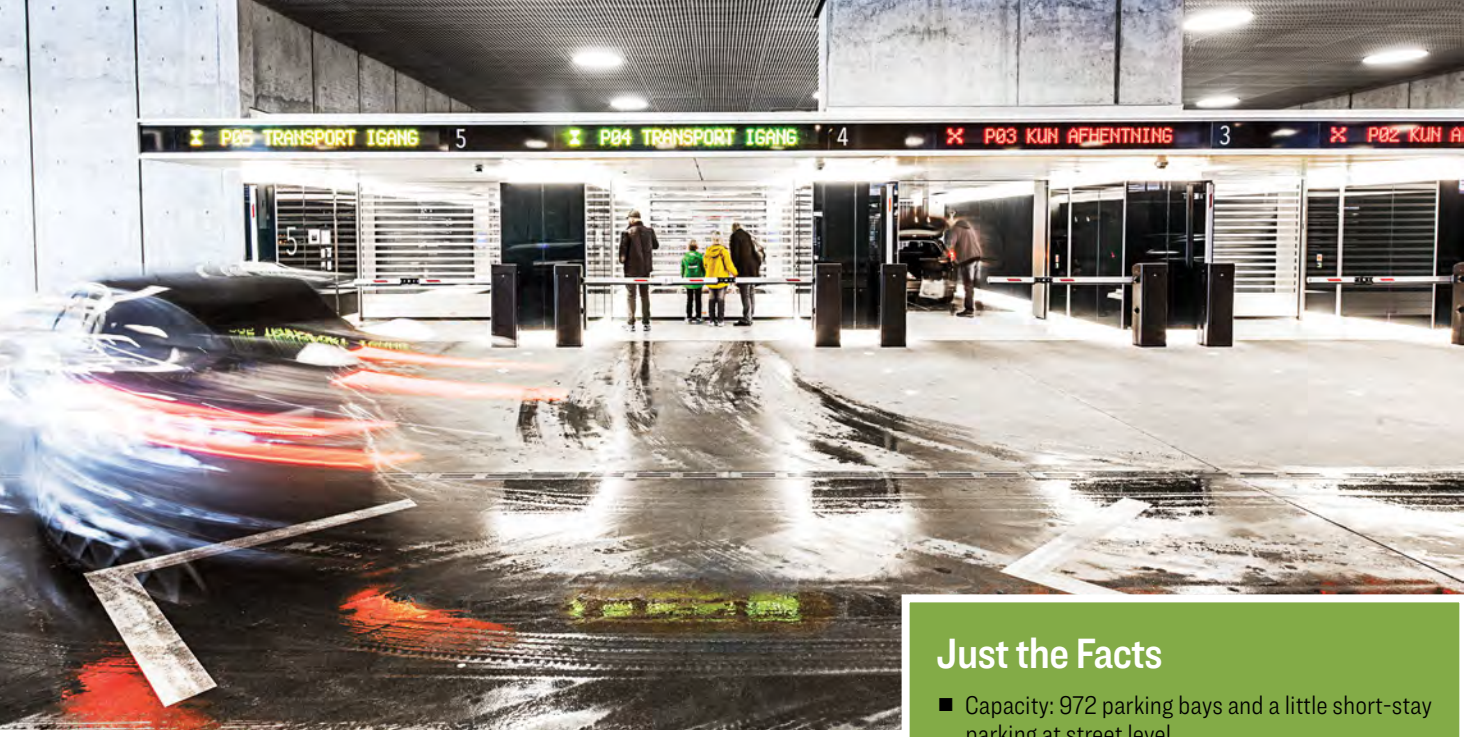
When the car has been moved, the shifter can immediately move on to the next task so the only thing taking up space in the parking bay is the car itself. The fact that no pallet is needed is a real space saver. The shifter is only 8.6 centimeters (about 3.25 inches) high, so it can get in under most cars. The shifter technology means that cars can quickly be moved around within the system and less parking space is needed.

This is why it is possible to park nearly 1,000 cars in an underground facility measuring 82 by 100 meters. Parking starts with the user parking the car in one of the transfer cabins at street level. The hoist then descends with the car to the appropriate level where the shifter goes into action. Two shifters are used to move a car—one for each set of wheels. The shifter moves in under the car, folds out to catch the tires, and moves the car to a large transfer vehicle. The transport vehicle moves the car and its shifters to an empty bay, where the shifters put it in place.

The car is centered in the hoist on the way down. An advanced weighing system using 16 weighing points determines the exact position of the wheels in the hoist. If the car is askew, four shifting plates—one for each wheel—align it properly as the hoist moves down. This ensures that the car is properly centered so the shifters can just glide in under it and move it on.

How Dokk1 Works

1. The car is driven into a parking cabin, which is also a hoist.
2. The hoist moves down to one of the three levels in the underground parking system.
3. The car is picked up by two small shifters—small transporters that slide in under the car and grip the tires.
4. The shifters move the car onto a large transfer vehicle.
5. The transfer vehicle moves the car to an empty parking bay.
6. The shifters move the car into the parking bay.
7. Four bays are wider to allow for better access.
8. Touch panels and terminal navigation were tested by several groups of users to make the system as user-friendly as possible.



Just the Facts

- Capacity: 972 parking bays and a little short-stay parking at street level.
- Size: 82 x 100 x 5 meters/270 x 328 x 17 feet.
- Levels: 3.
- Vehicles: Vehicles up to 2 meters/6.5 feet high, weight maximum 2.5 tons.
- Parking cabins: 20.
- Time to park a car: 40–60 seconds per vehicle.
- Retrieval time: 210 seconds maximum per car.
- Investment: 550 million DKK/$87.5 million.

Modern, Sustainable Parking

The automated parking facility under Dokk1 realizes a new vision of modern, sustainable parking using a minimum of space. In a traditional multi-story car park, drivers have to drive around the building to find a space. This is unnecessary in Dokk1 because the computer that manages the facility always knows where the empty spaces are. The facility has 20 transfer cabins so drivers will nearly always be able to deliver their car without waiting. If only one of the almost 1,000 places is free, a driver can get it right away.

This is also an advantage in terms of the general traffic situation in the city. Research has shown that up to 30 percent of car movement in the city center is made up by drivers looking for parking spaces. A large-capacity car park may considerably reduce this traffic.

Another advantage of moving the cars fully automatically is that it is possible to park cars much closer to each other, making room for 30 percent more cars than in a traditional multi-story car park. This makes good sense in a city like Aarhus, where there is considerable need for parking in the city center but where parking spaces are very limited in number and also expensive.

Comfort and Safety

One advantage of the parking system being underground is that there is a constant temperature of 15–16 degrees Celsius (about 59–60 degrees Farenheit), so drivers can retrieve a car that is not like a deep freezer in winter or an oven in summer. And as the human element has been removed from the parking process, garage-related dents and scratches are a thing of the past. Users also appreciate the fact that there is little chance of theft from a locked underground facility where there are only cars. The sense of safety is further being strengthened by the presence of guards in the facility 24/7. In addition, users are very pleased with all the technology that makes parking a simple, user-friendly experience and that frees up space for other activities in the city.

The system has been adopted by another project in Copenhagen, the capital of Denmark, named BLOX, which is a multifunctional house on the harbor front that will be home to the Danish Centre of Architecture and a hub for companies, researchers, and organizations working with architecture, design, construction, and digitization.

While the technology used in BLOX is the same, the capacity is approximately a third of the capacity in Dokk1.

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