



Building a car park is a science, especially when it's not your average multi-storey structure. **David Calthorpe** explains what happens when the only way is up

#### ABOUT the AUTHOR:

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# Reach for the sky

There's a lot to be said for choosing to build an automated parking system (APS) car park. It offers the potential to park in normally inaccessible spaces, puts twice as many cars in the same space, reduces construction times by up to 30 per cent, and increases the environmental rating of the facility.

In building an APS structure, forget the normal restrictions involved in conventional structures, but remember there are some important steps in the design process, including an understanding of what the customer wants, which a reputable provider will need before offering advice or a cost:

#### 1 Number of parking spaces and location

- A map of the surrounding area should be available, clearly indicating site boundaries, entrance/exit points and road configuration around the installation

- The ground available should be indicated and defined for area and shape

- Traffic studies should be taken

#### 2 Layout concept information

- Above ground or below ground

- Stand-alone or integrated in a building

- Maximum height allowed at the site

- Any special architectural requirements

#### 3 Performance

- How many cars per hour are moving in and out of the car park at peak times

- Maximum emptying time requirements

#### 4 Parking lobbies

- The number and position of the entry/exit lobbies has an important influence on system performance and redundancy – ideally they should be as close to the centre of the side profile of the building as possible

#### 5 Users

- Parking use: public and/or long term users

- Commercial application of parking: entertainment (cinema, theatre), sport arena, retail, universities, hospitals, offices, residential (share)

#### Performance criteria

The client/designer must decide what level of performance is required from the system. Typically the benchmarks are the time required to empty the car park and the average time to retrieve a single vehicle.

Guidance is available as to what typical system performance is required for different application under the German VDI standards, which is a good starting point as seen here. 

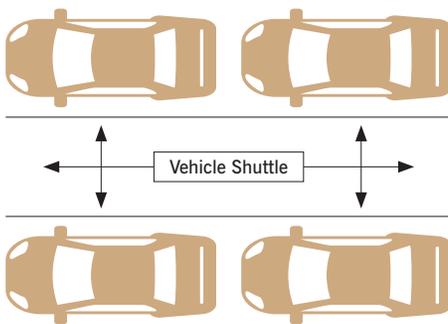
Automatic parking VDI category	Emptying time requirement
Entertainment	0.8 to 1.0 hours
Retail	1.0 to 1.8 hours
College and hospital	1.8 to 3.0 hours
Residential	2.0 to 3.9 hours

### Configuration options

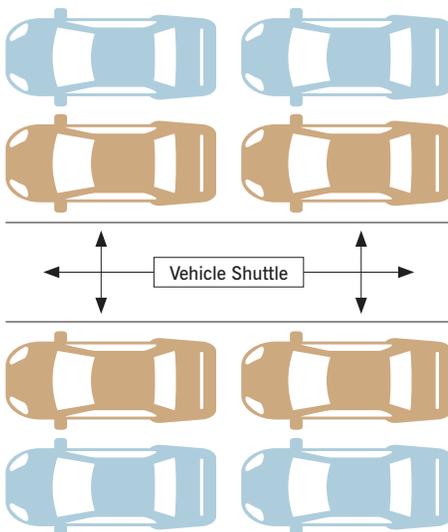
One of the many unique advantages of automated parking systems is that the normally high parking density can be increased even more by changing the parking configuration.

This is because APS systems offer the ability to double park cars. As the cars are transported by an electro-mechanical system at high speed, cars can quickly be both double parked and retrieved with the minimum of delay.

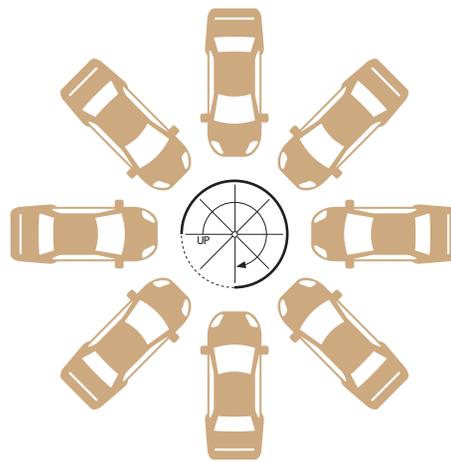
For example, sketched below is a typical standard configuration:



Now consider the same example if double parking is used, as below:



It can be seen that the parking density increases. Consider the options of a tower configuration (or shaft, if below ground) as illustrated.



### Building construction requirements

The majority of systems are installed on a steel framework, which may form the final building load-bearing structure or may be within a concrete structure, above or below ground (normally where the parking is a part of a mixed development).

Whatever the construction type, some critical elements particular to APS installations that need to be taken into account would include the following:

#### 1 Foundations

Typically the steel frame would be ST37

### As the cars are transported by an electro-mechanical system at high speed, cars can be quickly double parked and retrieved with the minimum of delay

(S235 Rj2) and the loading per automated parking space typically from 4.1 tons up to 4.8 tons incl. vehicle.

A typical 172 spaces over 10 floors would require a foundation thickness of 250mm, concrete plate (C30) and have a minimum load capacity of 30 Newton/mm sq.

#### 2 Steel structure (frame and levels)

All building projects consist of a series of construction phases. APS installations using steel frames require special consideration.

Careful co-ordination between the main contractor, the general steelwork contractor and the APS provider is essential to ensure an efficient overall construction plan.

#### 3 External walls/cladding/roof

Where the steel frame APS structure is within an overall concrete building/frame this is not an issue, but where the car parking is a dedicated steel structure, the frame will require cladding.

It is presumed that wind loading and so

on, would be pre calculated and agreed with all interested parties before finalisation of the APS frame design.

#### 4 Ventilation

As the public do not enter the car parking area, and the vehicle engines are not running when being parked, there is no need for normal venting.

#### 5 Smoke extract/control

These requirements are no more onerous than those for conventional parking solutions. Guidance should be taken from building control officers, the fire authorities and local authorities, as would be normal practice.

Designers should consider the guidance of BS7346-7 for smoke clearance.

#### 6 Lighting installation

Because the public do not enter the parking area, there is no requirement for any normal lighting provision there.

#### 7 Fire suppression systems

Our recommendation is that the basic requirements of the German APS standard VDI 4466 are used as a minimum as follows:

'As there is no personnel traffic in automatic parking systems, there are no requirements in terms of emergency exits.

This also applies to the formation of smoke breaks. Fire breaks must, however, be provided.

An automatic sprinkler system must be provided for the effective fire protection of an automatic parking system with more than 20 parking spaces.'

#### 8 Means of escape

Because the public do not enter the parking area, there are no issues around means of escape, greatly simplifying the fire strategy for the facility. However, requirements for a safe means of escape for maintenance workers within the parking area should be taken into account in the final design solution.

In conclusion, the design and construction requirements for an APS are far simpler than those for conventional parking systems, mainly due to public access being dramatically reduced and smaller building size. 