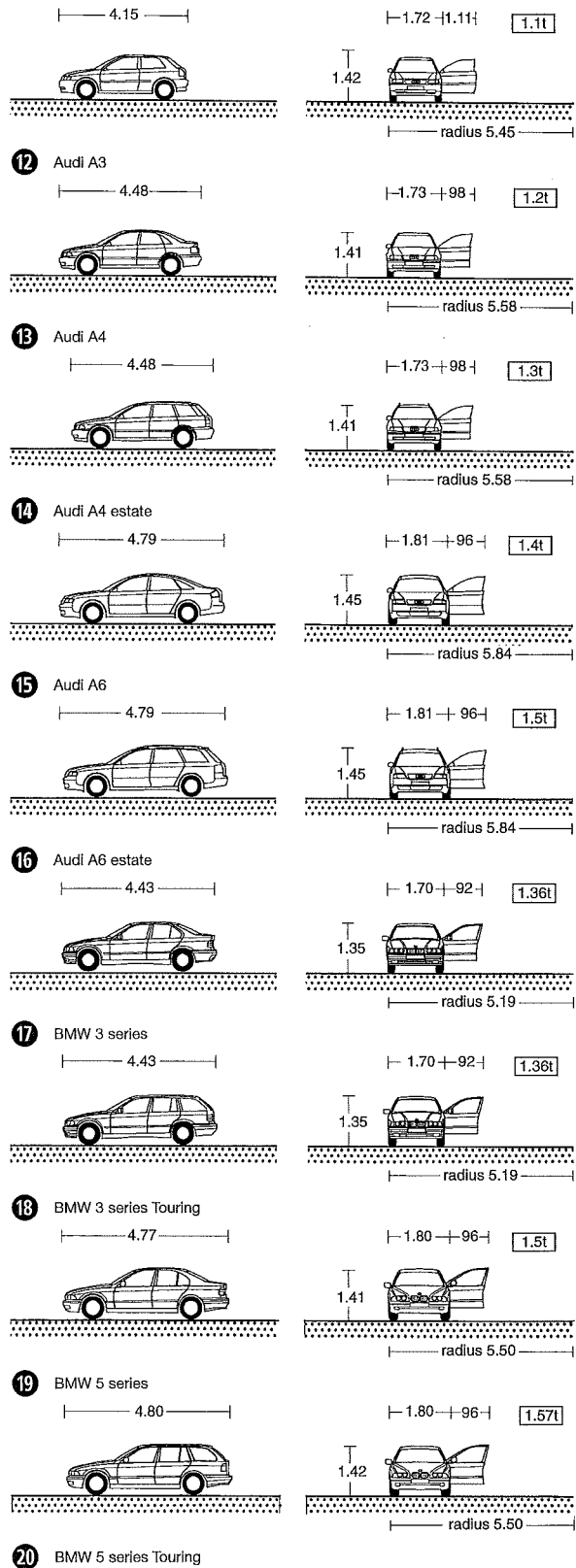
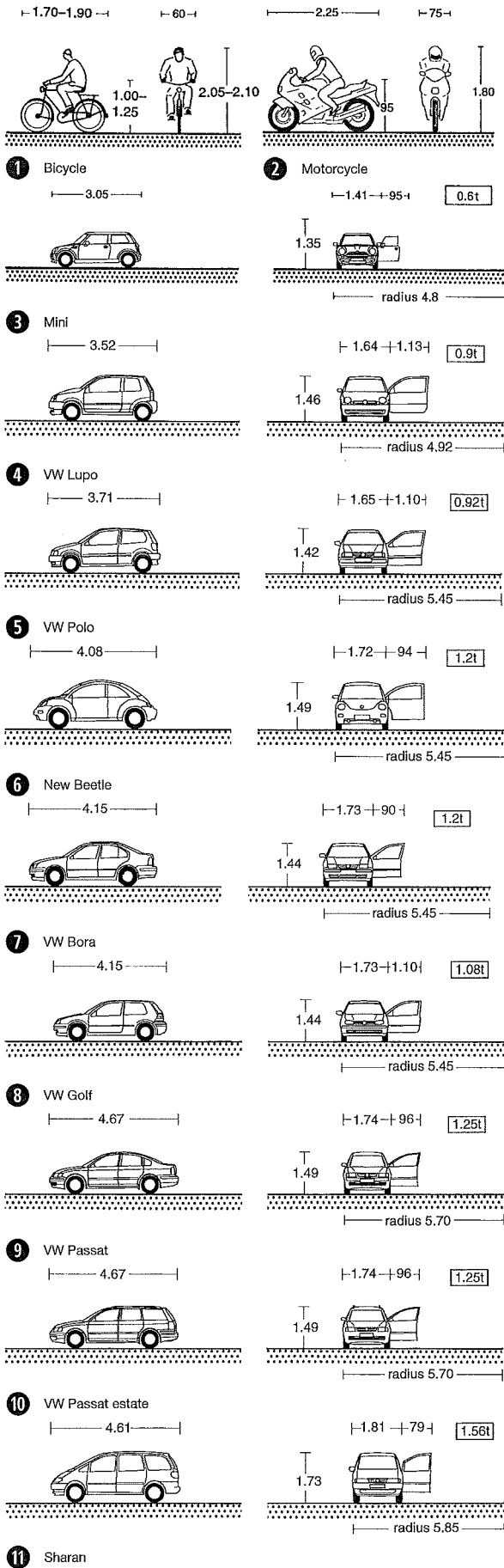


# PARKING FACILITIES

Vehicles – Cars

Dimensions, turning circles and weights of typical vehicles regarding space requirements and regulations for garages, parking spaces, and access and exit driveways.

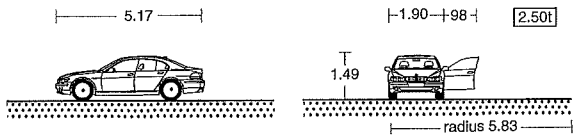


## Transport

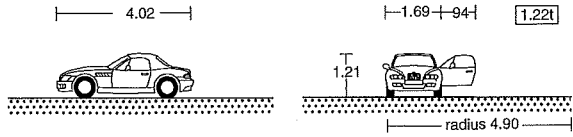
- PARKING FACILITIES
- Vehicles – cars
- Vehicles – turning
- Parking spaces
- Multi-storey car parks
- Ramps
- Multi-storey car park regulations
- Parking systems
- Vehicles – trucks
- Trucks – parking and turning
- Service areas
- Petrol stations
- Car wash

# PARKING FACILITIES

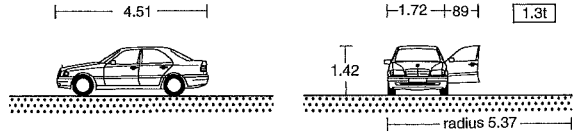
## Vehicles – Cars



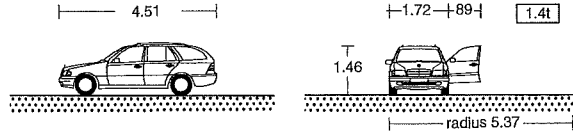
1 BMW 7 series



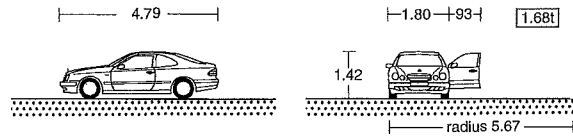
2 Z3 Roadster BMW



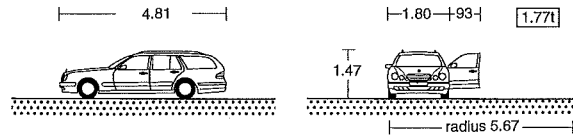
3 Mercedes C 180



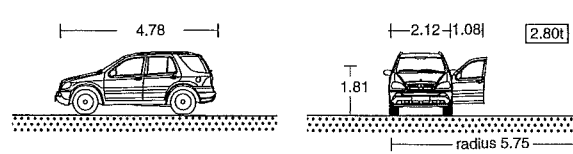
4 Mercedes C 180 estate



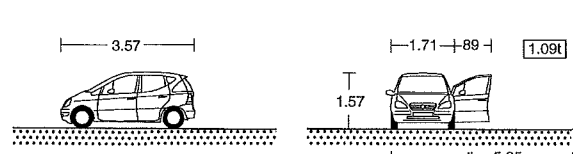
5 Mercedes E 430



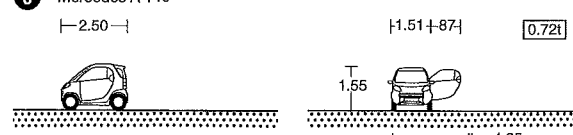
6 Mercedes E 430 estate



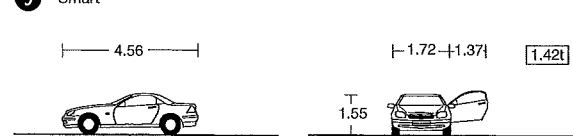
7 Mercedes M



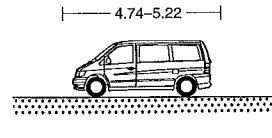
8 Mercedes A 140



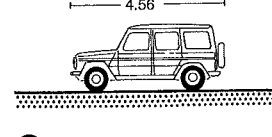
9 Smart



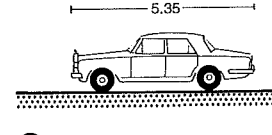
10 Mercedes CLK



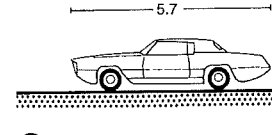
11 Mercedes Vito



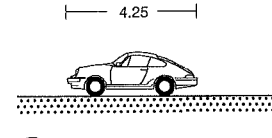
12 Mercedes station wagon, long, five-door



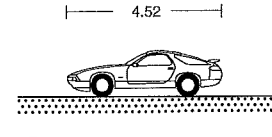
13 Rolls-Royce



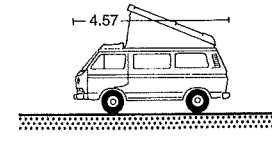
14 American car



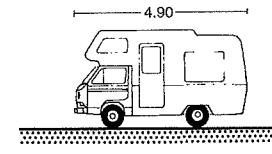
15 Porsche 911



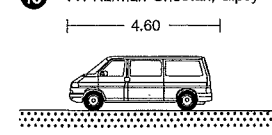
16 Porsche 928



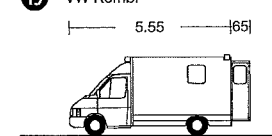
17 VW Joker



18 VW Karman-Cheetan, Gipsy



19 VW Kombi



20 Ambulance

### Transport

#### PARKING FACILITIES

- Vehicles – cars
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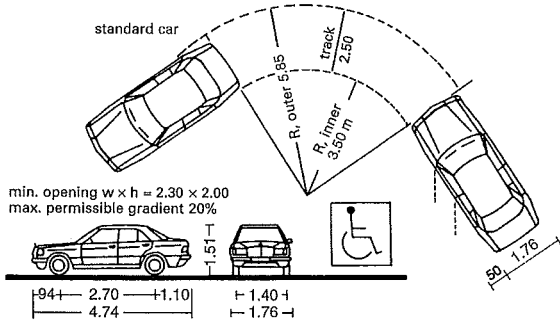
# PARKING FACILITIES

## Vehicles – Turning

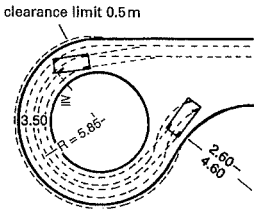
The type, size and design of a place where vehicles can turn depend on the particular use of an area, the vehicles and the urban planning function. It is difficult to make generally valid recommendations for the selection of the correct turning place. The requirements of the fire services and refuse disposal trucks have to be considered in turning place decisions. Some authorities responsible for waste disposal decline to remove rubbish from dead-end streets where refuse disposal trucks can only perform a three-point turn or have to drive backwards for considerable distances.

Turning places can be formed as hammerheads → ④ – ⑤, turning circles or turning loops → ⑥ – ⑧. Hammerheads demand manoeuvres such as three-point turns, so turning circles and loops are preferable as they allow trucks to turn in one swing.

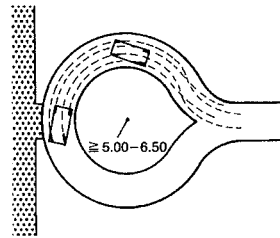
Turning places should for practical reasons be laid out asymmetrically to the left → ⑥ – ⑧. The perimeter of turning places should allow sufficient space without fixed objects being endangered by the overhanging parts of vehicles. The centre of turning loops can be planted → ⑧. Hammerhead turning places → ④ are only suitable for cars. They are not necessary where the road is more than 6 m wide, which can also include garage forecourts or footpath crossings.



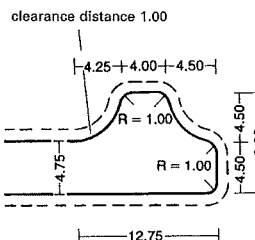
① Standard car



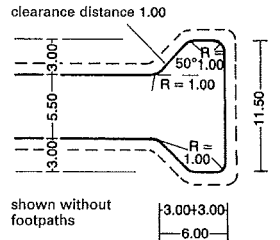
② Turning circle of a car



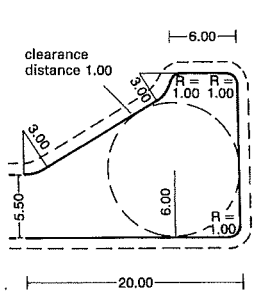
③ Entrance drive, car turning circle radius  $\geq 5-6.50$  m



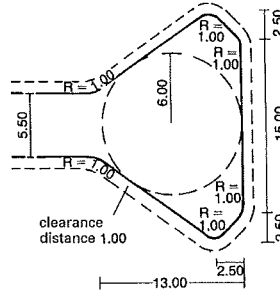
④ Hammerhead turning place for cars



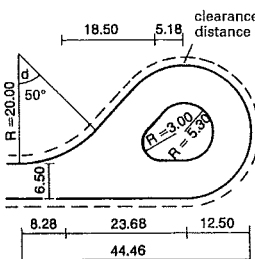
⑤ Hammerhead turning place for cars and HGVs up to 8 m length (refuse collection vehicle, fire engine, HGV 6 t)



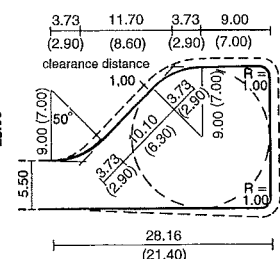
⑥ Turning place for HGVs up to 10 m and 22 t (3-axle refuse collection vehicle)



⑦ Variant of ⑥



⑧ Turning loop for HGVs with trailer and articulated buses



⑨ Turning circle for 2-axle refuse collection vehicle (r = 9) or for vans (r = 7), values in brackets

Type of vehicle	External dimensions						External turning circle radius [m]
	Length [m]	Wheelbase [m]	Overhang length [m]		Width [m]	Height [m]	
Bicycle	1.90				0.60	1.00	
Moped	1.80				0.60	1.00	
Motorcycle	2.20				0.70	1.00	
Car	4.74	2.70	0.94	1.10	1.76	1.51	5.85
HGVs:							
Van/campervan	6.89	3.95	0.96	1.98	2.17	2.70	7.35
HGV (2 axles)	9.46	5.20	1.40	2.86	2.29	3.80	9.77
HGV (3 axles) <sup>1)</sup>	10.10	5.30 <sup>1)</sup>	1.48	3.32	2.50 <sup>4)</sup>	3.80	10.05
HGVs with trailer:	18.71						
Towing vehicle (3 axles) <sup>1)</sup>	9.70	5.28 <sup>1)</sup>	1.50	2.92	2.50 <sup>4)</sup>	4.00	10.30
Trailer (2 axles)	7.45	4.84	1.35 <sup>3)</sup>	1.26	2.50	4.00	10.30
Articulated HGVs:	16.50						
Tractor unit (2 axles)	6.08	3.80	1.43	0.85	2.50 <sup>4)</sup>	4.00	7.90
Semi-trailer (3 axles) <sup>1)</sup>	13.61	7.75 <sup>1)</sup>	1.81	4.25	2.50	4.00	7.90
Buses:							
Coach, bus	12.00	5.80	2.85	3.35	2.50 <sup>4)</sup>	3.70 <sup>5)</sup>	10.50
Coach, bus <sup>2)</sup>	13.70	6.35 <sup>2)</sup>	2.87	4.48	2.50 <sup>4)</sup>	3.70 <sup>5)</sup>	11.25
Coach, bus <sup>2)</sup>	14.95	6.95 <sup>2)</sup>	3.10	4.90	2.50 <sup>4)</sup>	3.70 <sup>5)</sup>	11.95
Articulated bus	18.75	5.98/5.99	2.65	3.37	2.50 <sup>4)</sup>	2.95	11.80
Refuse collection vehicles:							
2 axles (2 Mt)	9.03	4.60	1.35	3.08	2.50 <sup>4)</sup>	3.55	9.40
3 axles (3 Mt)	9.90	4.77 <sup>1)</sup>	1.53	3.60	2.50 <sup>4)</sup>	3.55	10.25
3 axles (3 MtN) <sup>2)</sup>	9.95	3.90	1.35	4.70	2.50 <sup>4)</sup>	3.55	8.60
Highest values permitted in Germany:							
HGV	12.00						
Trailer	12.00				2.55 <sup>4)5)</sup>	4.00 <sup>6)</sup>	12.50
HGV with trailer	18.75						
Articulated HGV	16.50						
Articulated bus	18.00						

⑩ Basic vehicle data → p. 397-398

Type of road	Use of zone	Design vehicle	R (m)	Notes
access road to houses, residential road with little traffic	residential	car	6	- turning circle for cars - special provision for refuse collection vehicles (e.g. link road connection via lanes with limited traffic access)
residential road	predominantly residential	cars, 2-axle refuse collection vehicle	8	- turning circle for small buses and most refuse collection vehicles - possibility for all permissible vehicles to perform three-point turn
residential road	residential, also considerably commercial	car, waste disposal, 3-axle HGV, standard bus, articulated bus	10 11	- adequate turning circle for great majority of permissible HGVs - turning circle for newer buses
	predominantly commercial	lorry with trailer, articulated bus	12.5	- turning circle for articulated buses - adequate turning circle for all permissible HGVs

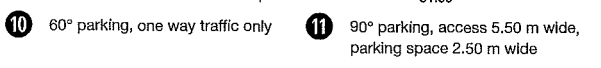
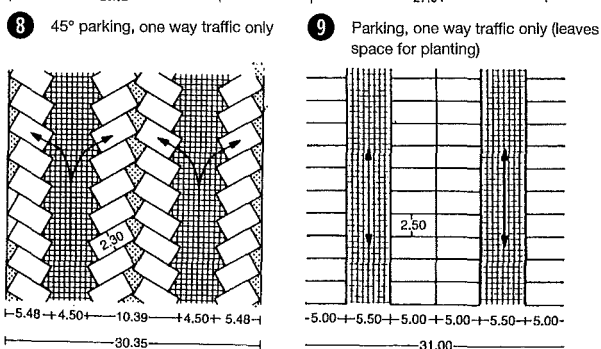
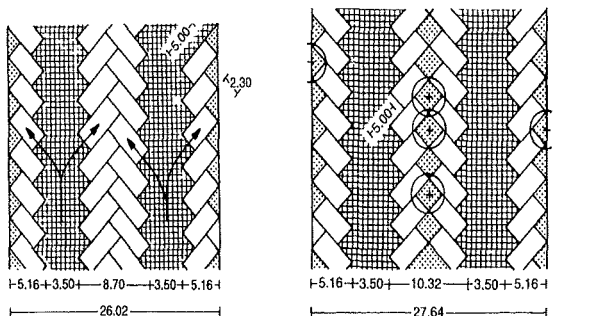
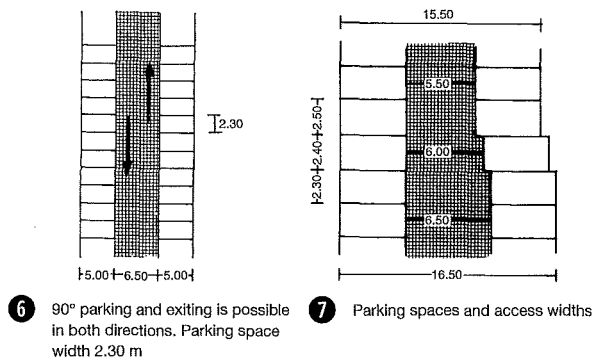
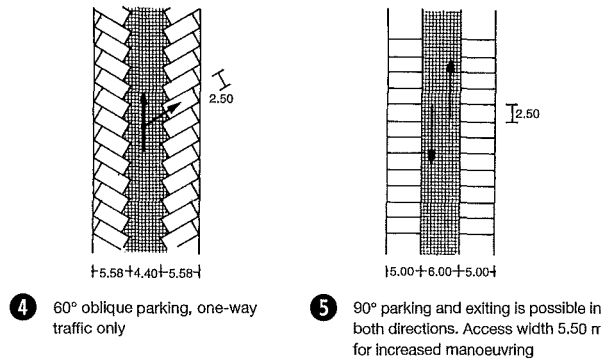
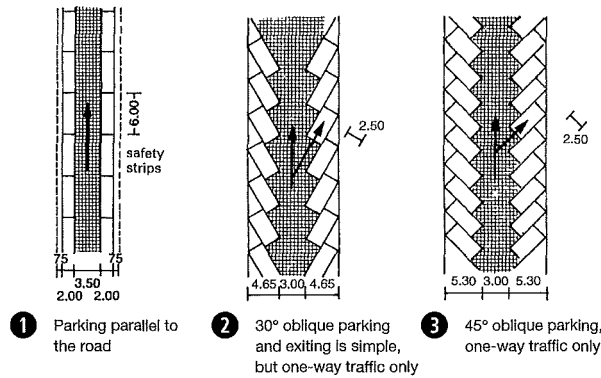
⑪ Recommendations for determination of external turning circle radius (R)



**PARKING FACILITIES**  
 Vehicles – cars  
 Vehicles – turning  
 Parking spaces  
 Multi-storey car parks  
 Ramps  
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 Car wash

# PARKING FACILITIES

## Parking Spaces



Parking spaces are usually outlined by 12–20 mm wide yellow or white painted lines. When parking is facing a wall, these lines are often painted at a height of up to 1 m for better visibility. Guide rails in the floor along the side have also proved popular for parking limits, and can be about 50–60 cm long, 20 cm wide and 10 cm high.

Where vehicles are parked in lines facing walls or at the edge of the parking deck in a multi-storey car park, it is common practice to provide buffers, restraining bars or railings up to axle height to prevent cars from going over the edge. Where cars are parked face to face, transverse barriers about 10 cm high can be used to act as stops at the front. Overhang on vehicles must be taken into account → **15**. For lining up in front of a wall, a stop rail or rubber buffer will be sufficient → **15**.

Parking arrangement	Space requirement per place incl. access (m <sup>2</sup> )	No. places in 100 m <sup>2</sup> area	No. places on 100 m of road (one side only)
→ <b>1</b> 0° parallel to road. Difficult parking and exiting – good for narrow roads	22.5	4.4	17
→ <b>2</b> 30° oblique to road. Simple parking and exiting. Area busy	30.8 (27.6)	3.2 (3.6)	20 (21)
→ <b>3</b> 45° oblique to road. Good parking and exiting. Area per place relatively low. Normal type of layout	24 (21.7)	4.2 (4.6)	29 (31)
→ <b>4</b> 60° oblique to road. Relatively good parking and exiting. Area per place low. Frequently used layout	22.5 (20.5)	4.4 (4.9)	34 (37)
→ <b>5</b> and <b>6</b> 90° right angle to road. Low area per place. Considerable turning of vehicle necessary	20 (19.0)	5 (5.3)	40 (44)

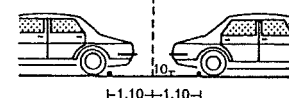
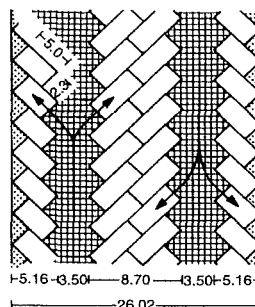
The given values are for a parking space 2.50 m wide.

The values in brackets (parking place width 2.30 m) should be used only in justified and exceptional cases.

### 12 Space requirements

Arrangement of garage parking spaces to the access. At an angle of:	Required access width (in m) for a garage parking space width of:		
	2.30	2.40	2.50
90°	6.50	6.00	5.50
75°	5.50	5.25	5.00
60°	4.50	4.25	4.00
45°	3.50	3.25	3.00
up to 30°	3.00	3.00	3.00

**13** Access width. (Parking space 2.50 m wide is standard. This value should if possible always be complied with in public areas)



## Transport

### PARKING FACILITIES

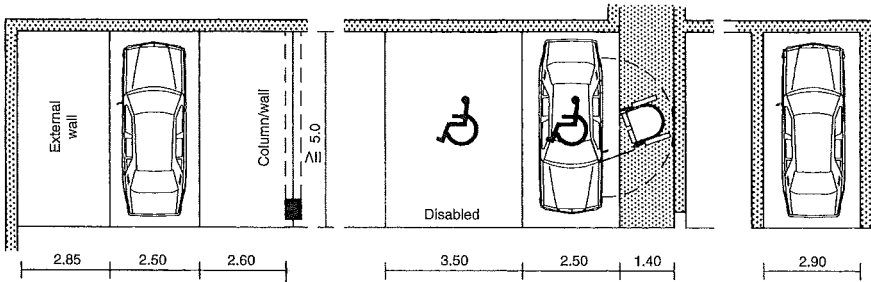
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# PARKING FACILITIES

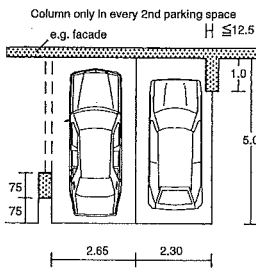
## Parking Spaces

If individual parking spaces are bordered by pillars, walls or columns, then the width of the parking space on the relevant side is increased by 0.10 m → ❶ – ❸. (This does not, however, apply to mechanical lifting platforms or automatic garages.) If parking spaces are bounded by a footpath, cycle way or separation strip on the facing side via a kerb, then the kerb will be used to estimate the border of the parking space → ❹ + ❸. The examples show how parking spaces can be integrated into their surroundings by design elements without impairing their function → ❺ – ❷.

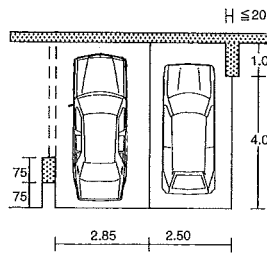
To increase open areas, parking spaces can be partly or completely lowered or provided with green roofs. The greening not only has design value but also provides shadow and improves the ecological situation (dust absorption) → ❷.



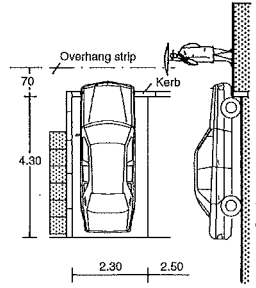
❶ If parking spaces are bordered by pillars or walls, then the width is increased



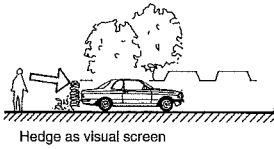
❷ Reductions are possible in private buildings



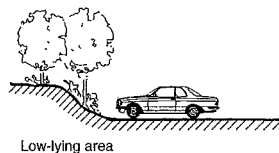
❸ Comfortable parking and exiting



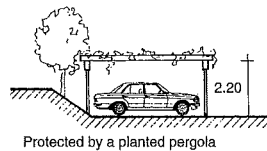
❹ With kerb border



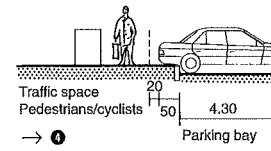
❺ Lowered parking space



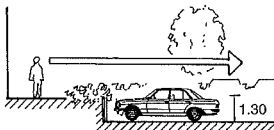
❻ Parking behind an earth wall



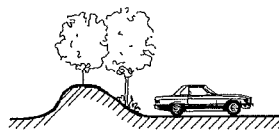
❼ With earth covering



❽ Block layout



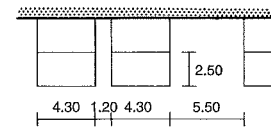
❾ Car park with planting



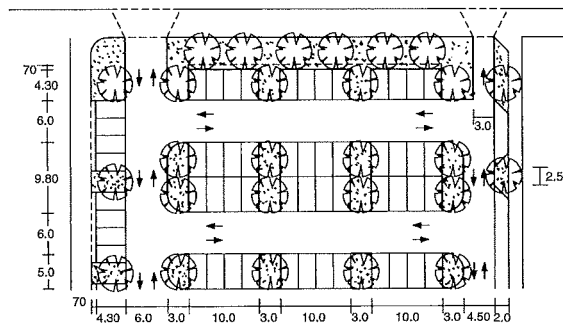
❿ Planting at right angles to the access passage



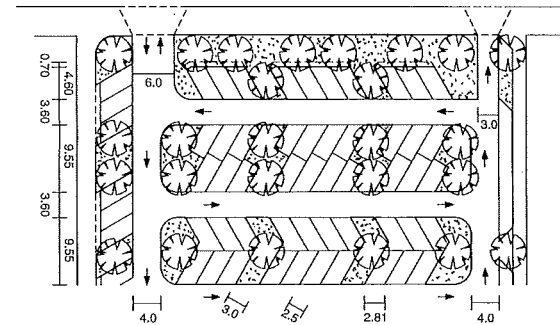
⓫ Lowered parking area → ❺ – ❻



⓬ Parking next to the road



⓭ Example: car park



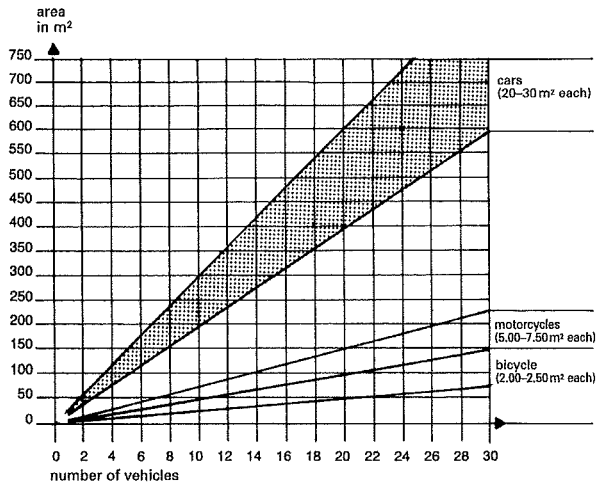
⓮ Variant: oblique layout in car park

## Transport

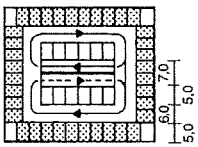
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# PARKING FACILITIES

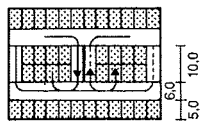
## Multi-storey Car Parks



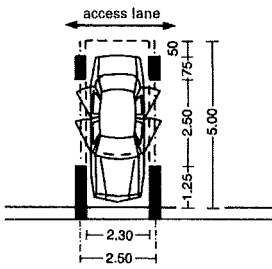
1 Space requirement of car parks including access areas → p. 390 12



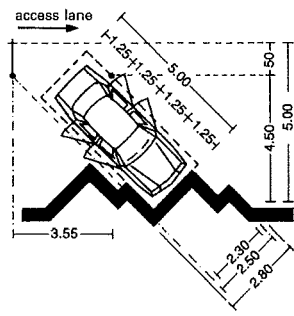
2 Longitudinal ramp, for exact dimensions see p. 390



3 Transverse ramp



4 Possible column arrangement for right-angled parking



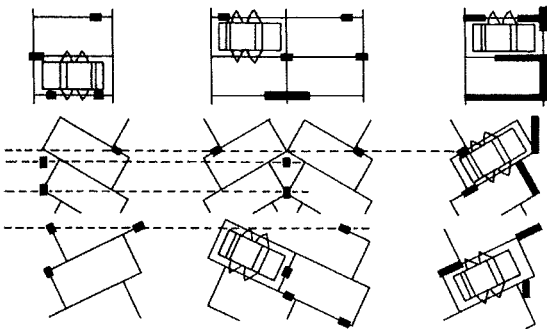
5 45° oblique parking

For multi-storey car parks the requirements for the layout of parking spaces and access are in principle the same as for open car parks. The Garage (multi-storey car park) Regulations require a minimum width for parking spaces of 2.30 m. The Research Company for Roads and Traffic (FGSV), however, recommends a minimum width of 2.50 m for all publicly accessible parking spaces on account of the increasing size of cars.

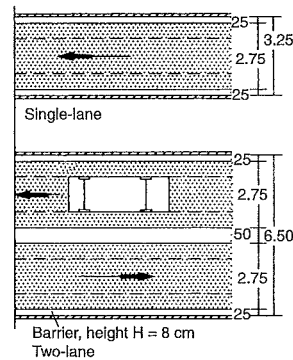
All structural elements (ceilings, walls, columns, reinforcements) of multi-storey car parks must be fire resistant. The recommended clear access height for car parks above and below the ground is 2.20 m. An addition of 25 cm is practical for the direction signage for cars and pedestrians, plus a further 5 cm for later resurfacing. This gives a total height of 2.50 m plus construction over the access ways, thus a storey height of 2.75–3.50 m, depending on the chosen method of construction. A relatively close spacing of columns can reduce building cost without impairing function if the construction height is carefully chosen → 2 – 3. Wide-spanning column-free constructions have 7–12% less column area on plan → 4.

Underground car parks result in considerably higher costs for construction and operation than those above ground.

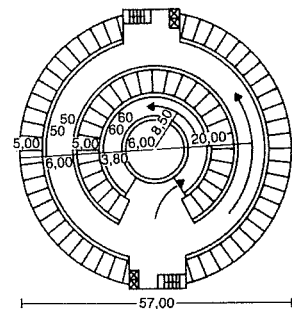
Uphill sections and ramps must be designed and built in line with the above → 6. Straight or spiral car park ramps are created by sloping the floor slab → p. 393, or forming spirals → 8, with vehicles both sides of the access way. The areas, including access areas, on which a certain number of vehicles can be parked can be determined for preliminary design from → 1. The examples → p. 393 and p. 394 show layouts of multi-storey car parks and ramp arrangements. Reinforced concrete construction (in in-situ concrete, pre-cast elements or a combined form) comply best with the fire-resistance requirements. Steel structures are normally designed as a main beam/secondary beam system and mostly have to be clad with concrete or fire protection boards, or sprayed, for fire resistance reasons. Car parks catering for passenger cars should be designed for a live loading of 3.5 kN/m² and the ramps for 5 kN/m² for design purposes, for greened roofs 10 kN/m².



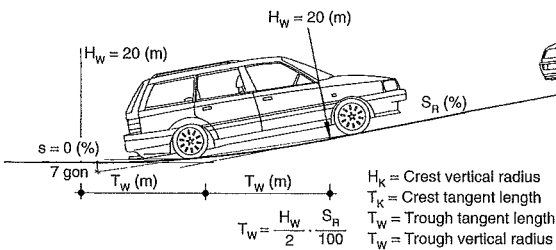
6 Possible column layouts



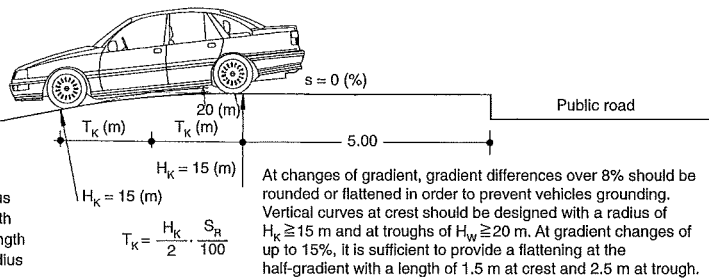
7 Minimum width of straight ramps



8 Spiral car park ramp



9 Ramps – changes of slope



At changes of gradient, gradient differences over 8% should be rounded or flattened in order to prevent vehicles grounding. Vertical curves at crest should be designed with a radius of  $H_k \geq 15$  m and at troughs of  $H_w \geq 20$  m. At gradient changes of up to 15%, it is sufficient to provide a flattening at the half-gradient with a length of 1.5 m at crest and 2.5 m at trough.

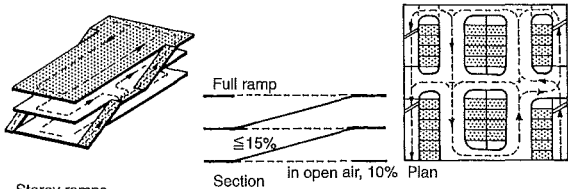
## Transport

### PARKING FACILITIES

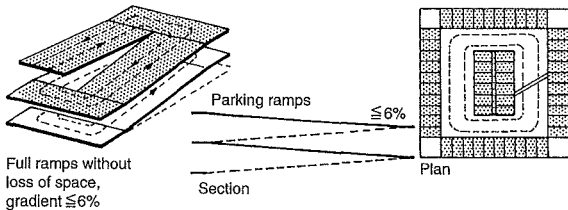
- Vehicles – cars
- Vehicles – turning
- Parking spaces
- Multi-storey car parks
- Ramps
- Multi-storey car park regulations
- Parking systems
- Vehicles – trucks
- Trucks – parking and turning
- Service areas
- Petrol stations
- Car wash

# PARKING FACILITIES

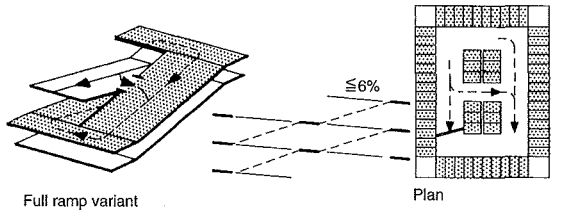
## Ramps



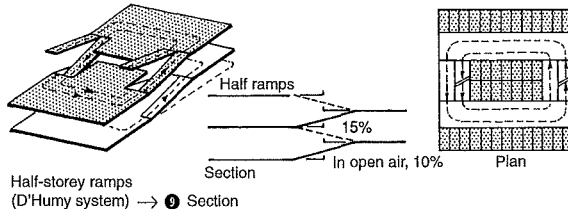
Storey ramps



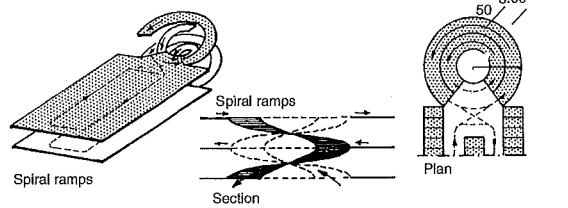
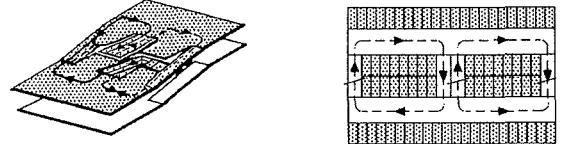
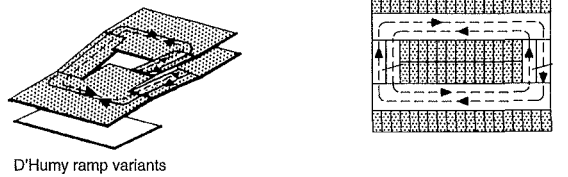
Full ramps without loss of space, gradient  $\leq 6\%$



Full ramp variant

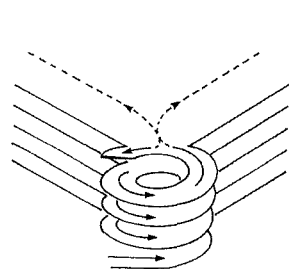


Half-storey ramps (D'Humy system) → ① Section

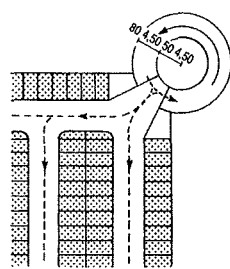


Spiral ramps

① Ramp systems



② Separate spiral ramp towers at the corners of the building



③ Schematic plan → ②

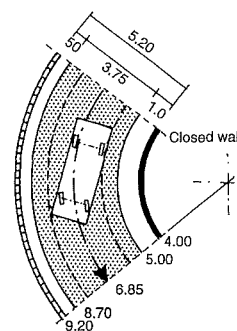
There are various systems of ramps to overcome height differences and to access the various storeys of multi-storey car parks. The gradient of ramps should not exceed 15%, for small car parks 20%. Between public roads and ramps with more than 5° gradient, there must be a horizontal run of  $\geq 5$  m length, or in the case of ramps for cars the run should be  $\geq 3$  m long, with ramps at up to 10% gradient. Possible arrangements of ramps can be divided into four groups:

**Straight, parallel and continuous multi-storey ramps** with intermediate landing, access and exit opposite → ①.

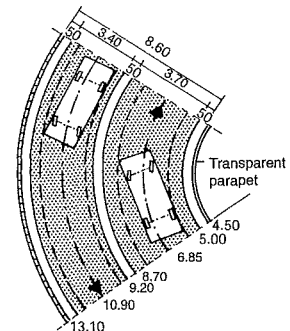
**Sloping floor levels (no-loss full ramp system).** The entire area with parking spaces is on a slope, a space-saving system. Slope  $\geq 6\%$ .

**Half-storey offset levels (D'Humy ramps).** Parking spaces are on half-storeys and the height difference is overcome by short ramps. This is a space-saving system but not very smooth to drive around and therefore only intended for smaller car parks → ①, ⑥ and ⑧.

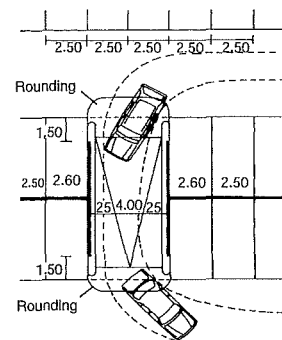
**Spiral ramps.** This system is relatively expensive yet has poor visibility, and the circular form leads to residual areas, which are hard to exploit → ① – ⑤. The spiral ramps must have a transverse gradient of  $\geq 3\%$ . The radius of the inner road edge is  $\geq 5$  m. In large multi-storey car parks, ramps also used by pedestrians must have a  $\geq 80$  cm wide raised pavement, unless routes for pedestrians are provided elsewhere.



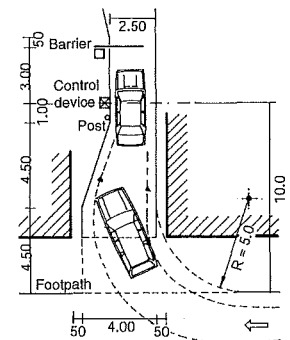
④ Minimum ramp widths



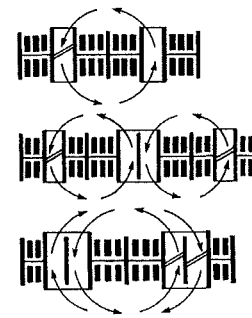
⑤ Minimum ramp widths in curve with minimum radius



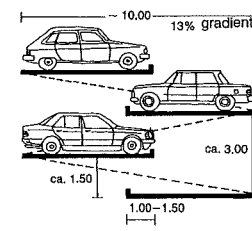
⑥ Half-ramp with one-way traffic



⑦ Access control



⑧ Basic forms of D'Humy ramps. Ramps with 13–15% gradient



⑨ Dovetailing of half-storeys → ⑧

## Transport

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