

INFRASTRUCTURE/ **PARKING****BICYCLE PARKING AND STORAGE SOLUTIONS****Overview**

Dispersed, small bicycle parking systems, such as inverted U-stands, allow cyclists to park and attach their bicycle for short periods and near their destination. More elaborate secured storage facilities, such as lockers or supervised storage, allow cyclists to store their bicycle safely for longer periods, at slightly larger distances to their destination. Available products range from inexpensive small parking devices to automated systems and supervision.

Background and Objectives*Function*

Bicycle parking systems (racks, stands) and storage facilities (lockers, cycle centers) are a range of facilities allowing cyclists to park their bicycles safely, conveniently and in an orderly way. As such they contribute to a well-organized public space and increase the attractiveness of cycling.

Scope

Bicycles can be parked anywhere, leaning against a wall or attached to a post or a railing.

However, **with large numbers of bicycles**, the situation becomes messy and confused. This is no longer practical and safe for cyclists, and it turns into a physical and visual nuisance in public space. This in turn may discourage bicycle use and turn opinion against cyclists.

Wherever a **concentration of parked bicycles** is present, expected or desired, these need to be accommodated with **well-organized, convenient and safe public bicycle parking facilities**. This in itself will encourage the use of cycling.

- For **short-term** bicycle parking, reserved **on-street spaces** should be provided, dispersed over streets and squares. These should be equipped with appropriate **parking systems** to support the bicycle and secure it.
- For **longer-term** parking and increased **protection against theft, protected storage facilities** should be provided, such as lockers and supervised cycle centers. These can range from small individual lockers to vast cycle stations.

For more information on neighbourhood storage facilities, reserved to local residents, see the fact sheet on BICYCLE PARKING IN RESIDENTIAL AREAS.

For more information on planning quantity, type and location of parking facilities, see the fact sheet on BICYCLE PARKING IN THE CITY CENTRE.

For more information on bicycle parking at public transport stops and stations, see the fact sheet on CYCLING FACILITIES AT INTERCHANGES.

Implementation*Definition*

Public bicycle parking facilities includes two types of provision.

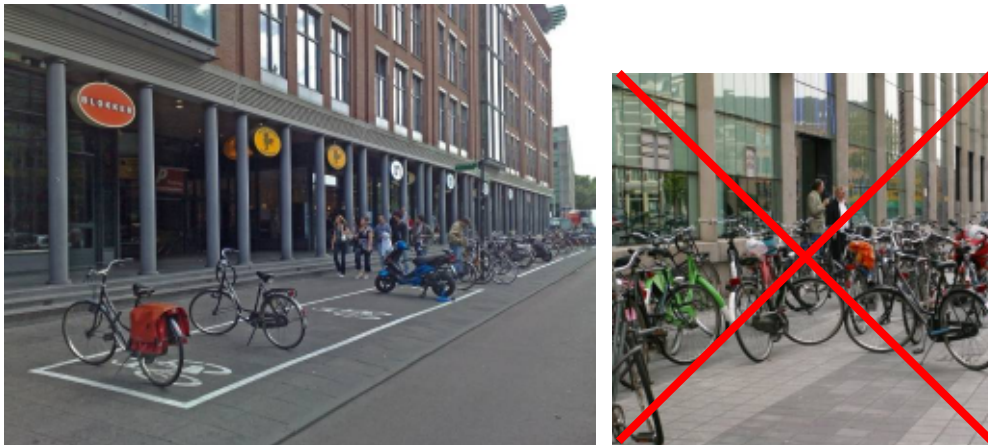
- **Bicycle parking systems** are **structures** that support a standing bicycle. These include various types of racks and stands, for a single bicycle or for several, with an integrated bolt locking system or not. They allow cyclists to **park a bicycle**.

- **Bicycle storage facilities** are protected **spaces** for storing a bicycle. These include individual and collective lockers, as well as cycle centers. They may be supervised or not, automated or not, free or paying. In the larger ones, bicycles will be stored in parking systems. They allow cyclists to **store a bicycle**.

Short-term parking systems

Cyclists first and foremost need to be able to **park bicycles**. Parking means leaving the bicycle behind for a short time, **2 h or less**. They will want to park as near as possible to their destination, typically **less than 50 m**. Research in major UK city centres illustrates this: asked why they parked in a particular location, 86% of cyclists said because it was close to destination (only 16% security); it also showed that 75% of cyclists park for less than two hours within 50 m of their destination¹. This demand needs to be met with a **dispersed offer of small parking facilities**, at short distance intervals.

The simplest way is to **allocate reserved bicycle parking space**, without installing a parking system. This can be done by simple marking, by different surface materials or using street furniture. This in itself will already incite cyclists to park there. The advantage is that space is left free for other uses, for instance in town squares. However, it is only suitable for bicycles that have their own kickstand and fitted lock. Even then, the bicycle is not attached to a fixed object and risks falling over or being stolen or vandalized.



Reserved bicycle parking space, with only markings, and the clutter it avoids (Amsterdam, NL)

It is recommended to provide a **fixed structure that supports the bicycle and to which it can be attached**. This can take the form of a stand, for a single bike or one on each side, or of a rack, for multiple bicycles in a row.

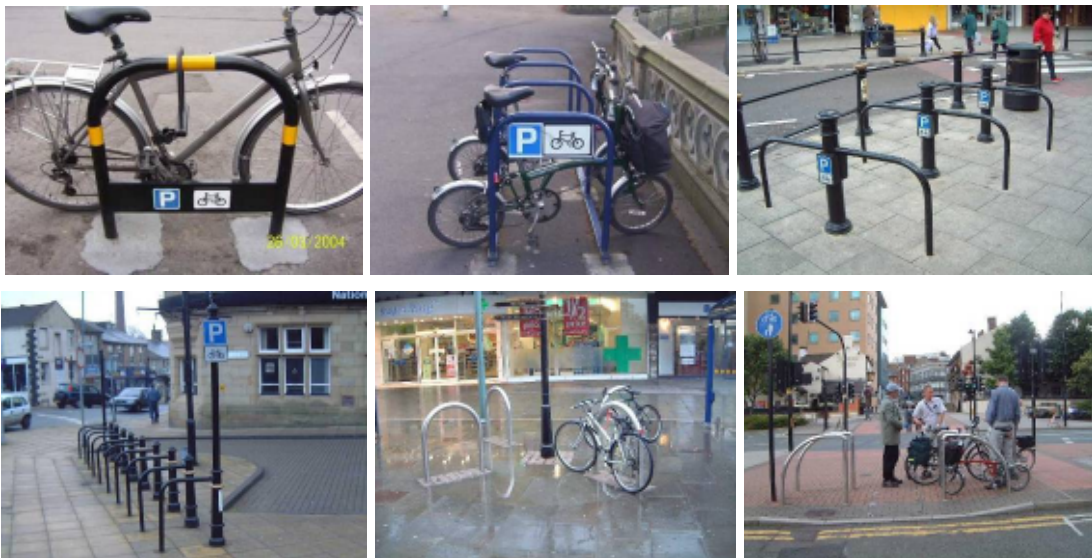
A wide range of products is available on the market, but not all are equally good value. The following criteria should be considered in **assessing product quality**.

- Does it provide **stability**? A bicycle with 10 kg of luggage in a side bag should be able to stand up without damage to the bicycle.
- Does it **protect against theft**? It should be possible to secure both the frame and the front wheel. If only a wheel can be attached, thieves may detach the wheel. If the bicycle only has a fitted lock, not attached to the parking system, thieves may just lift the bike and break the lock later.
- Is it **compatible** with many types of different bikes? Many preformed systems to accommodate the fork or the front wheel may not fit children's bicycles, racing bicycles or the increasingly popular folding bicycles. Suspension systems are not suitable for longer bicycles. Specific solutions may be considered in some situations, such as special provision for children's bicycles at schools.

¹ DfT, 1997: *Traffic Advisory Leaflet 7/97 – Supply and demand for cycle parking* (results of surveys and field observation in Leicester, Nottingham and Southampton).

- Is it **practical**? The system should be easy to use, self-explanatory and require minimum effort. Sophisticated anti-theft devices may be confusingly difficult to operate. Any system that requires lifting the bike will be less used.
- Is it **robust**? The system should be solidly fixed to the ground or wall, weather proof and vandal-resistant. Small parts often provide leverage for destruction. Systems with built-in locks, risk malfunctioning or being damaged by vandals.
- Is it **easy to maintain**? The system should not attract litter and be easy to clean, even when fully occupied.

In view of these requirements, it is not surprising that **the inverted U-shaped bar is widely recommended**. The height is between 0.7 m and 0.8 m. The bicycle frame leans against it and the frame and a wheel can be attached with a single lock. It is easy to use and suitable for all types of bicycle. It's a simple, low-tech and robust design that makes it easy to install and difficult to vandalize. It is inexpensive and requires minimal maintenance. An extra horizontal bar is useful to support smaller bicycles. Moreover, any number of them can be simply aligned and provided with a roof for covering. It also allows for design variations to fit in with street furniture.



Inverted U-shaped bar stands, with design variations (UK – image source: Cycling England)

For the same reasons, **low front-wheel grips should be avoided**. These can be slots in concrete, or wheel grips attached to a wall or incorporated in racks. They do not give enough stability, so that bicycles may fall over and be damaged, also on purpose by vandals. They also do not allow the frame to be secured. Finally, racks attract leaves and litter and need more maintenance. However, in Denmark, front-wheel wedge-shaped grips are widely used and recommended, on condition that the grips are sufficiently wide and mounted at the same height as the wheel. But they still have the disadvantage that the frame cannot be secured, so they are not recommended where theft is a major concern.



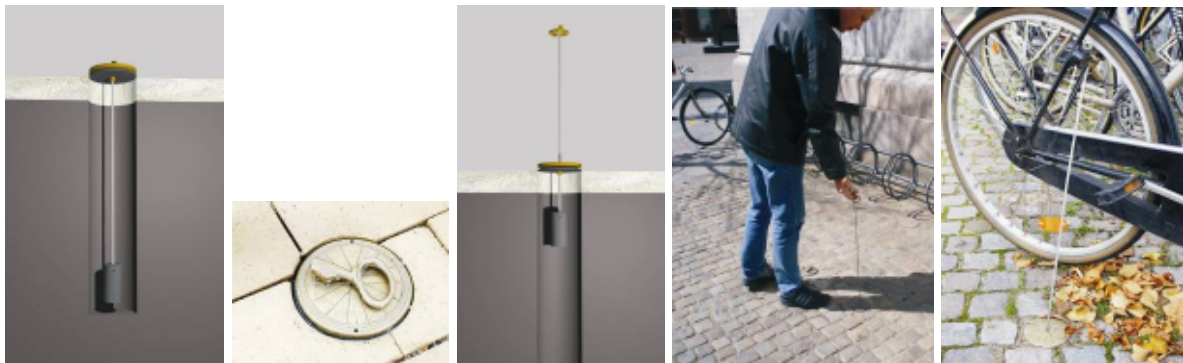
Horizontal front-wheel grips are TO BE AVOIDED (image source: T. Asperges)



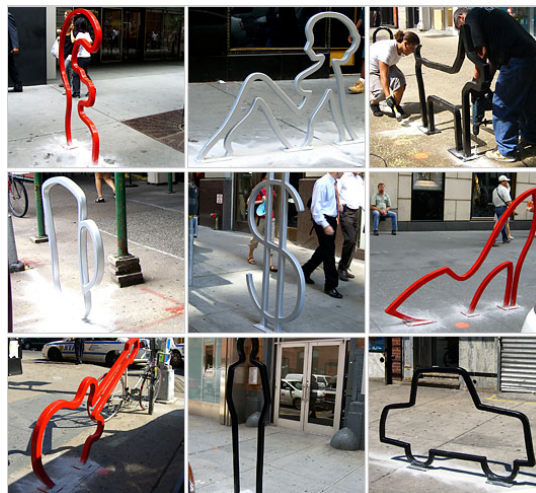
Vertical front-wheel grips, common in Denmark (image source: P. Celis – 2008, *Bicycle Parking Manua*, DK)

Bicycle systems allow for **innovative and arty design**. They may become striking objects in public space. The basic quality criteria should, however, always be respected.

A creative example is the bicycle key developed in Odense. This is an elegant locking device than is sunk into the ground when not used. The cyclist pulls up an eyelet that can be attached to the bicycle's lock. The eyelet is attaché to a wire and a weight that pulls it down when released. The advantage is that it takes up no space and can be used with all kinds of bikes. The disadvantage is that it does not support the bicycle: in Odense it complements a front-wheel bicycle rack.



The Odense bicycle key



Bicycle stands as design objects, but still solid, robust and secure (David Byrne, New York)

Long-term storage facilities

Cyclists also need to **store their bicycles**. Storing means leaving your bicycle inside an access-restricted and covered facility. Cyclists will feel this need for **longer-term parking**, which may be from an hour upwards, to a whole day, all night or several days. The UK research already mentioned notes that 77% people on commuting, business or education trips who were not prepared to leave their bicycle behind for more than two hours were concerned about theft or vandalism, but only 55% of people on shorter shopping or leisure trips².

This demand can be served by a range of **secure storage facilities**: individual lockers, collective lockers and supervised cycle storage centres.

Individual bicycle lockers

Individual bicycle lockers are used in situations calling for protection against bicycle theft and vandalism, but where the demand is too low to create a supervised storage facility (e.g. small railway stations, park & bikes near city centers).

- Lockers in public places are usually **privately rented** for periods from a day to a year. The user is identified and receives a unique key. Users pay a **premium price for the added value** of security and a reserved space. Lockers also allow users to store accessories safely, such as helmet, pumps, special clothing etc. Locking options vary, from keys, padlocks, smart-cards and number key-pads. The disadvantage is that storage space is not efficiently used, since they remain empty for part of the time.
- Lockers can also be used more flexibly on a **first-come-first-served** basis. They can be free: users bring their own lock or insert a coin they retrieve afterwards. This easily leads to abuse: lockers are used to store other things or monopolized. Alternatively, users pay short term rent and receive a key or an access code. Recently, **electronic lockers** have made their appearance, in which users have a smart card and book a locker in advance.
- Individual lockers are mostly **mobile** and can be moved to other locations. On the other hand, they are **bulky** and consume much more space than parking outside lockers. This means they are also more difficult to integrate physically and aesthetically into public space. They may also require some form of **supervision** and maintenance, possible control by CCTV.
- Lockers can be **managed** by public authorities, a public transport company, a parking agency or a private provider.
- The **price** of a basic individual locker lies around 1000 €.



Individual lockers at Brugge (BE)



Individual lockers at Dutch railway stations – NS Fiets

² DfT, 1997: *Traffic Advisory Leaflet 7/97 – Supply and demand for cycle parking* (results of surveys and field observation in Leicester, Nottingham and Southampton).



Commercial e-locker provider in the San Francisco Bay Area.
Users buy a smart card, which allows them to open lockers and use them at an hourly rate.

Collective bicycle lockers

A **collective bicycle locker** can contain a number of bicycles. Each user pays rent and has a key.

- The most important advantage of the collective locker is that it takes up considerably **less space** for the same number of bicycles than individual lockers.
- Users need to know and **trust** each other. Neighbourhood bicycle storage is mostly organized this way, as an indoor storage space shared by a number of local residents.
- One user can be designated as **supervisor** and contact person for the managing organization, for instance in exchange for a reduced rent.
- Collective lockers can also be installed **on the street**. One example is the 'bicycle drum' which is often used in urban neighborhoods (in The Netherlands) where there is not enough space to park bicycles off-street. The cost of a bicycle drum parking 10 bicycles is around 5.000 €.



A bicycle drum



Carousel cycle locker: bicycles are on hand-rotated platform that moves your bicycle in front of the single-door entrance
(Sweden, see clip on www.plugin.se)

Supervised bicycle storage facilities

A **supervised bicycle storage facility** can be considered in almost any city centre and main station. The following conditions should be met.

- The destination attracts large number of cyclists.
- A considerable share of the cyclists wants to park their bicycle for a period of more than one hour.
- The risk of theft in the area is relatively high.

Some further recommendations.

- Locate the facility **max. 500 m** from the destination it is meant to serve.
- Use available **location opportunities**. A large-scale cycle centre can be a prestigious new construction. But it can also be set up outdoors in public space, preferably covered: this is often more visible, more easily accessible and less expensive. Mobile supervised storage can be set up at events, with bicycle systems cordoned off with temporary fences.
- Consider making it **free**. This has the strongest impact on cycle theft reduction and overall bicycle use.
- Choose a **familiar** location. A cycle in or near a town centre or a landmark building will more easily be absorbed in cyclists' minds.
- Make it **easily accessible**. Ground level is to be preferred. Underground storage should be accessible via inclines and carefully designed: wide entrances, lighting.
- Assure **social safety**. Make sure the entrances are visible and at places with sufficient social control.

Supervision and automation

Access management and supervision can be organized by staff personnel or partly or fully automated.

- Supervision by **personnel** is generally appreciated by users. They have someone to turn to in case of problems and perceived safety increases. However, staffing is costly and normally only feasible for limited periods, typically from 8:00 h to 18:00 h. This restricts usage of the facility outside peak times.
- Staff is often supported by **partially automated** supervision. Camera supervision (CCTV) and electronic access systems allow reducing the number of personnel and exploitation costs.
- This technology now allows access and supervision to be **unmanned and fully automated**, doing away with all need for staffing. This allows 24-hour operation. In those cases special care should be taken to assure social safety: play music at all times, let in daylight and provide views to the streets outside, integrate 24-hour functions nearby, such as a snack bar. If the facility is perceived as unsafe, it will not be used.



Unmanned and fully automated storage facilities at Dutch railway stations – NS Fiets

A recent development is the appearance of **fully automated on-street storage systems**.

- The **principle** is that bicycles are delivered – against payment – to a facility which then automatically parks the bicycle underground.
- The **benefit** is that they operate on a 24h basis and are safe for the bicycle and for the cyclist. In principle, this type of parking facility safeguards 100% against theft and vandalism. Often there is also room for your helmet and jacket. At the same time, these systems are accessed at street level, and can be established in highly visible locations with good lighting at night.
- The **disadvantage** is the time needed to get your bicycle back at ground level. It doesn't take more than 35 seconds for any system to retrieve your bicycle, but at rush hours or train arrivals you may have to stand in line. Therefore, the number of bicycles should be limited, from 50 to 100.



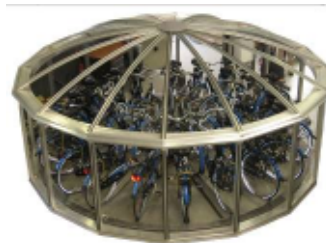
Bike Tree: 12 bicycles are hung on their front wheel. 30% of space is saved.



Biceberg: fully automated underground bicycle parking in the form of a horizontal giant mill. It can be delivered in modules from 23, 46, 69 or 92 bicycles. In Spain different types are working. www.biceberg.es



Bicycle mill in Nieuw-Vennep in The Netherlands: underground parking for 200 bicycles, in the form of a giant mill, 3m above ground, 9 m below. www.fietsmolen.nl



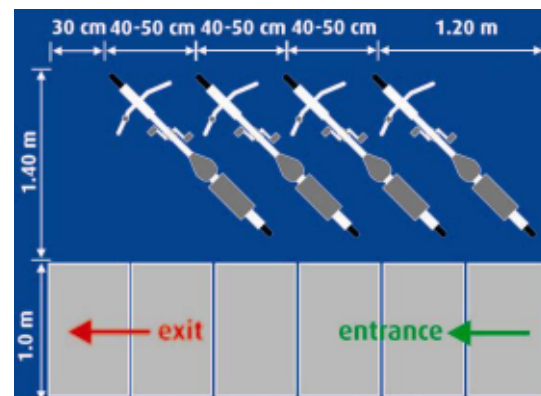
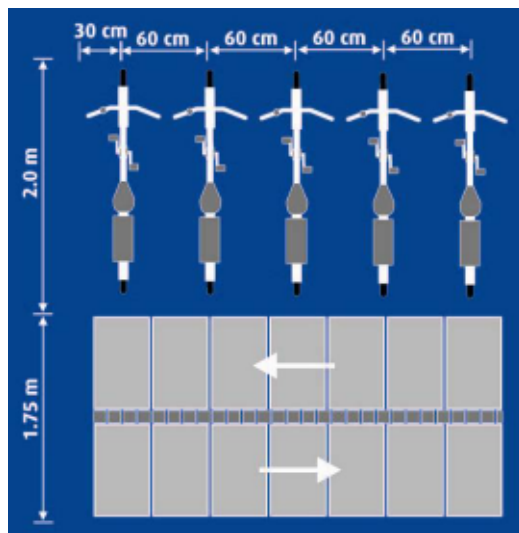
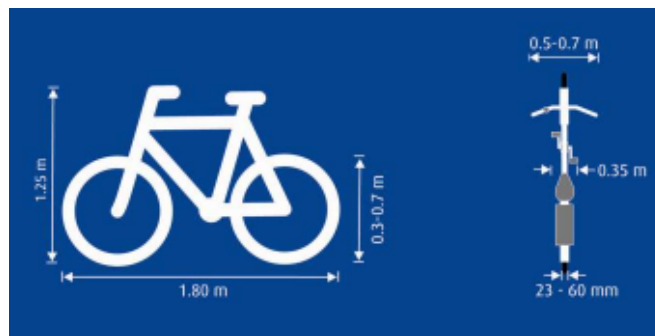
Velominck and Velospace system. www.Velominck.nl

Basic dimensions for bicycle parking

Design recommendations for parking spaces for standard adult bicycles.

- Provide a **depth of 2 m**, with a minimum of 1.8 m. The standard length of bicycles varies from 1.8 m to 2 m.
- Provide a **width of 0.65 m**. This is the centre-to-centre distance between bicycles needed to accommodate the standard width of handlebars, between 50 to 65 cm. Cyclists can then park easily, without getting handlebars entangled with the next bicycle. Below this distance, most probably only one in two spaces will be used. At a distance of more than 70 cm, an additional bicycle may park in between when supply is short.
- Provide a **free access path of 1.8 m**, for easy maneuvering. In large storage facilities, people need to be able to walk past each other wheeling their bicycles: the access path should 3 m to 3.5 m.
- Provide **wider space for specific needs**. At supermarkets or in shopping districts, the width must be increased to allow customers to load their bags easily. The same goes for facilities outside day-care centres and kindergartens, to allow parents to lift children easily in an out of the baby seat. If space is lacking, shoppers and parents will be forced to load or lift children in the access space, blocking other cyclists.

- Consider **compact high-low systems**. In these, bicycles are alternatively stacked on a slightly different level. This way, handlebars cannot get entangled, and the centre-to-centre width can be reduced to 4 m (min. 0.375 m). The level difference should be at least 0.25 m and the lifting height should not be more than 0.35 m.
- Consider **compact angled parking**. When bicycles are parked at a 45° angle, handlebars cannot get entangled. In addition, this reduces the depth and maneuvering space needed. The centre-to-centre distance can be reduced to 0.5 m (or even 0.4 m) and the depth to 1.4 m. The inconvenience is that parking space can only be accessed from one direction.
- Allow a standard space consumption of **1.8 m² per bicycle**. This includes the parking space itself (1.3 m²) and a shared access path for two rows (0.5 m² per bicycle). This can vary from around 1 m² for compact solutions up to 3 m² with a more comfortable width of 0.8 m.
- Only use **two-tier parking as a last resort**. Parking on two-tiers, one bike above another, significantly reduces space consumption, up to 50%. In very large parking facilities, this may be unavoidable to reduce the distance to be walked. However, lifting bikes requires a serious effort that many cyclists will try to avoid. The effort may be reduced by sinking the bottom tier slightly below ground level and by providing ramps for the upper tier, or by providing lifting mechanisms.



Space gained by a angled parking

Danish guidance on bicycle parking dimensions (slightly larger dimensions are recommended)



Two-tier parking system



...with sunken lower tier



... or extractable wheel gutters



High-low rack

Considerations

Strengths

Good-quality parking systems and storage facilities

- make parking and storing bicycles safer, more convenient and more orderly;
- include very cost-effective and little space-consuming products, such as the inverted U-shape stand
- include automated solutions, highly secure and reducing personnel costs

Weaknesses

Good-quality parking systems and storage facilities

- can take up considerable space, especially individual lockers
- can be quite expensive to install, or maintain or both, especially when personnel supervision is involved

Alternative options

With large numbers of bicycles, there is no alternative: no bicycle provision will result in cluttered space and most likely reduced bicycle use.