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Bicycle Parking Facilities: Updating the Austroads Guide to Traffic Management

Bicycle Parking Facilities: Updating the Austroads Guide to Traffic Management

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Abstract

This report provides recommended content for inclusion in the Austroads *Guide to Traffic Management Part 11: Parking*.

This content guides the design of bicycle parking facilities and helps identify appropriate provisions of bicycle parking and end-of-trip facilities.

Providing bicycle parking in accordance with the principles outlined in this report, can encourage bicycle use and the more efficient use high-value urban space.

Keywords

Bicycle parking, end-of-trip facilities, layout, design, provision, access

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About Austroads

Austroads is the peak organisation of Australasian road transport and traffic agencies.

Austroads' purpose is to support our member organisations to deliver an improved Australasian road transport network. To succeed in this task, we undertake leading-edge road and transport research which underpins our input to policy development and published guidance on the design, construction and management of the road network and its associated infrastructure.

Austroads provides a collective approach that delivers value for money, encourages shared knowledge and drives consistency for road users.

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- Roads and Maritime Services New South Wales
- Roads Corporation Victoria
- Queensland Department of Transport and Main Roads
- Main Roads Western Australia
- Department of Planning, Transport and Infrastructure South Australia
- Department of State Growth Tasmania
- Department of Transport Northern Territory
- Transport Canberra and City Services Directorate, Australian Capital Territory
- Australian Government Department of Infrastructure and Regional
- Australian Local Government Association
- New Zealand Transport Agency.

Summary

In the same way that the availability and usability of car parking is an important requirement for motor vehicle use, the availability and usability of bicycle parking is critical to the viability of the bicycle as a mode of transport. By providing bicycle parking in accordance with the principles outlined in this report, bicycle use can be encouraged and high-value urban space can be utilised more efficiently.

The report includes a literature review of the 2015 Australian Bicycle Parking Standard AS2980.3, the Austroads Research Report *Bicycle Parking Facilities: Guidelines for Design and Installation* (Austroads 2016) and other bicycle parking guides and policy documents in an effort to provide recommended material for inclusion in the Austroads *Guide to Traffic Management Part 11: Parking*.

This report provides the:

- key benefits of installing bicycle parking
- key principles to creating high quality and attractive bicycle parking facilities
- main bicycle parking facility types
- main bicycle parking types
- dimensions of typical bicycle types
- recommended approach to identifying an appropriate rate of provision for bicycle parking spaces
- recommended rates of provision for end-of-trip facilities such as showers, lockers and change facilities
- design considerations in accessing on and off-street bicycle parking facilities
- design considerations and key dimensional layout requirements of on and off-street bicycle parking facilities.

This report should be read in conjunction with the Australian Standard *AS 2890.3: 2015 Parking facilities - Bicycle parking* which provides more detailed information on certain aspects of bicycle parking such as the geometric spacing that is required to provide adequate clearance for access to bicycles during the parking process.

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1. Introduction / Purpose

Bicycle parking is a critical component in developing infrastructure to support bicycle use.

1.1 Overview

More and more people are choosing to use the bicycle as a general means of transport. Interest is particularly strong over short trips and in areas where competing modes of transport are expensive, congested, inefficient and/or unreliable. This increase in bicycle use increases the demand for bicycle parking and related end-of-trip facilities. When executed well, bicycle parking investment not only meets current demand, but can also stimulate an increase in cycling use.

When such an increase in bicycle use is supported at a given development, it helps reduce the need for car parking facilities, which typically require more space per user, so incur a higher cost on developments. More broadly, bicycle use is a more space efficient travel mode than private motor car use, so its encouragement is considered to form a valid and potential significant component of the transport task our cities need to provide their community members.

This report provides information that assists in identifying what provision of bicycle parking and end-of-trip facilities is appropriate for developments, as well as how they should be designed and accessed. The report provides recommendations and principles that should be followed to encourage people to cycle regularly.

The report includes a literature review of the 2015 Australian Bicycle Parking Standard AS2980.3, the report *Bicycle Parking Facilities: Guidelines for Design and Installation* (Austroads 2016) and other bicycle parking guides and policy documents in an effort to provide recommended material for inclusion in the Austroads *Guide to Traffic Management Part 11: Parking*.

In this regard, an outline of the bicycle parking material included in *Bicycle Parking Facilities: Guidelines for Design and Installation* against the new AS2890.3:2015 and current *Guide to Traffic Management Part 11: Parking* (Austroads 2008) is provided in Table 1.1.

Table 1.1: Cross reference to the Austroads Guide to Traffic Management Part 11 and AS2890.3:2015

Research Report Topics	Austroads Guide to Traffic Management Part 11	AS2890.3:2015
Benefits	-	-
Key Principles	-	-
Facility Types	C9.2	1.5
User Types	-	1.4
Bicycle Types	-	2 & A
Parking Rates	C2.2	-
On-Street	7.8.5	2.6 & B
Off-Street	6.8.5 & C9.1	2.6 & B

2. Benefits of Providing Bicycle Parking

Bicycle parking provides a number of benefits to users, building owners and managers, as well as the community more broadly. While the provision of bicycle parking requires some planning and investment, it is typically less expensive and more space efficient per user than equivalent car parking facilities.

2.1 Improved Accessibility

Providing good quality bicycle parking that is accessible by a wide type of users helps encourage more people to cycle to a destination, and thus makes it more accessible. This can be highly beneficial in areas where public transport provision is poor, car parking is scarce and/or traffic congestion exists.

Even where other forms of transport are available, cycling is often a cheap, efficient and convenient form of transport, so can have a competitive advantage over other modes, at least over short distances if suitable facilities are provided.

It is well understood that those who currently cycle in our cities are those who are keen and confident. This current user group is only a small proportion of the number of people who may be interested in cycling if suitable facilities were available. This includes end-of-trip facilities, such as through the provision of horizontal parking racks (not all being vertical racks where they need to lift their bicycle up), low grade access ramps, and separate male and female changing rooms.

For further understanding of the natural variation in an individual's comprehension of whether cycling is a viable form of transport, reference can be made to the four main groupings within the general community (Geller 2010).

2.2 Space Efficiency

Bicycle parking is vastly more space efficient than car parking, particularly when typical car occupancy rates of around 1.1 people per vehicle is taken into account. Simply, you can fit a number of bicycle parking spaces within a single car space. Also, car parking requires significantly more circulation space, making the overall car parking area quite large and rigid. On the other hand, bicycle parking has relatively small circulation space and can even be provided in places that would otherwise be unusable for other transport purposes.

Through a reduction in the amount of car parking that is required, bicycle parking can result in large savings, particularly where land values are high. Even where this is not the case, the construction costs associated with car parking are significant, especially where multi-level facilities are required. Any car parking that is able to be replaced with more space efficient bicycle parking means more space for the core purpose of the building, i.e. more lettable retail space or higher residential yield.

As an example of the space efficiency difference, at-grade car parking facilities typically require in the order of 32 to 35sqm per car space (as indicated in Section 3.3 of the Austroads *Guide to Traffic Management Part 11: Parking*). Yet a bicycle parking facility with horizontal racks, require in the order of 2.0 to 2.5sqm per bicycle space.

2.3 Increase in Trade

As bicycle parking is more efficient, an increased number of people are able to access a commercial use, which enables greater economic benefits, in terms of greater visitation and trade. Even where this is a result of the removal of car parking, as long as some of the bicycle parking is used, it provides better returns to local business for a given area.

This has been shown to be the case through various studies (Lee and March 2007). The results of one of these studies for a shopping centre in Lygon Street Carlton found that changing one car space to a facility for six bicycles generated 3.6 times more expenditure in local businesses.

2.4 Capital Growth

As bicycle use increases, buildings with high quality bicycle parking facilities will likely attract high value tenants that are willing to pay a premium to provide their staff with a workplace that meets their needs. The same could well be expected with residential developments, with those connected by high quality bicycle facilities increasing in value (Raje and Saffrey. "The Value of Cycling"). The result is that for a relatively small investment in bicycle facilities, property rental yields and capital growth can be maximised.

This is reflected in the many buildings within the CBD's of our major cities in Australia retrospectively installing bicycle parking and end of trip facilities to help ensure they maintain their market positions.

Improved capital growth can also be achieved through Green Star accreditation¹, which attracts tenants who aim to meet sustainability goals. In order for an office building to secure the available Green Star points awarded for bicycle parking and end-of-trip facilities, they are required to provide bicycle parking spaces for at least 5.0% of the regular building occupants if less than 100 regular occupants in the building.

While these benefits can be achieved through retrofitting, designing bicycle parking as an integral part of a building or place, rather than as an afterthought, provides the best opportunity to achieve a value for money outcome.

2.5 Environmental Sustainability

The transport sector is a major contributor to greenhouse emissions each year. Moreover, some 60% of all road based emissions come from cars in Australia, and the number of cars on our roads is increasing (BITRE 2009).

Increasing cycling through the provision of bicycle parking delivers environmental benefits by reducing the number of trips taken by motor vehicles. In addition to being a benefit to the community, it is also relevant to businesses or organisations which have sustainability or corporate social responsibility goals. As a tangible and visible sign of commitment to these goals, bicycle parking can be an effective and cost efficient way of achieving goodwill for the organisation's brand.

2.6 Health Benefits

Cycling is also an effective way to improve health outcomes, as increased physical activity reduces the risk of conditions such as heart disease and obesity, which are significant social and economic burdens on the community. The health benefits of cycling can deliver direct benefits to employers, through reduced absenteeism, as well as improved alertness and performance.

¹ <http://new.gbca.org.au/green-star/>

2.7 Encourage Liveability

Encouraging cycling makes streets more attractive, by decreasing traffic congestion, reducing the noise and pollution associated with cars. In addition, it activates streets and improves passive surveillance, creating more livable and engaged communities.

These approaches to the planning and design of our urban environments is being considered by many of the major health and well-being bodies, including the Heart Foundation, who have published various documents to help guide associated practitioners, including the following:

- *Creating Healthy Neighbourhoods* (Heart Foundation 2011)
- *Streets for People Compendium* (Heart Foundation 2012)
- *Blueprint for an Active Australia* (Heart Foundation 2014)

2.8 Other Benefits

Cycling delivers a range of other benefits to users, such as enjoyment, well-being, fitness, travel cost savings and greater convenience. Encouraging or facilitating cycling through the provision of quality bicycle parking can make places more attractive for a modest investment, delivering benefits to developers, building owners, landlords, employers, and businesses.

3. User Considerations

Different types of bicycle parking are required depending on who the users are and what they are doing. This has implications for the location, security level and design of the parking facility. In many situations there will be a need to provide a mixture of bicycle parking facilities to match the mixture of users accessing the given destination.

3.1 User Types

The most common user types and recommended facilities are outlined below:

- **Customers and visitors** typically only require short-term (less than three hours) parking with a higher level of proximity and convenient access to their destination. This type of parking is likely to be provided within the road reserve or within publicly accessible areas on private property with no specific access control. As such, they are ideally located in areas with high foot traffic and passive surveillance (particularly in retail areas). However, increased levels of security are able to be achieved through the provision of lighting and CCTV cameras.
- **Employees** at workplaces typically require all-day parking (8-10 hours) with high levels of security, as they are often located in areas of low activity and passive surveillance. This may take the form of a secure room or structure, such as a parking cage, and often includes access to shower and change room facilities.
- Appropriate **resident** parking facilities generally depended on the dwelling type. Properties with lock-up garages allow for bicycles to be stored against the wall or using domestic bicycle parking products (e.g. more space efficient systems that don't require the ability to lock the bicycle can be used). Multi-dwelling developments, such as apartment buildings, typically include shared car parking areas, in which bicycle parking can be provided. At a minimum, bicycle racks to which bicycles can be locked must be provided. However, as these parking facilities are not completely secure, it may be desirable to provide bicycle lockers, cages or other secure areas only accessible by residents.
- **Public transport users**, particularly those interchanging to rail or accessing a bus interchange, are also likely to make use of bicycle parking, as this increases the catchment of the public transport services and reduces the need to drive and park a car proximate to the stops. As these users typically require longer term or all day parking, the security requirements are again similar to that of workplaces, although facilities are likely to be located outdoors. Undercover parking cages can meet both security and weather protection needs. Bicycle lockers can also provide a suitable level of security, but they tend to have lower utilisation, as shared use of the facilities is not possible.
- **Students** at educational facilities typically require medium to long-term parking (4-8 hours), the security requirements are again similar to that of workplaces, although facilities are likely to be located outdoors.

3.2 Bicycle Types

Regardless of the facility type to be provided, consideration should be given to the dimensions and other attributes of the bicycles anticipated to be accommodated. The dimensions of bicycles must be considered in the design of the facility to allow adequate space for bicycles to be easily parked, without risking damage to bicycles, blocking access, or causing hazards. In addition, some bicycle types may have limited manoeuvrability (requiring more room for access) or greater weight (making them unsuitable for vertical bicycle racks).

Even within the scope of various standard types of bicycles, there is some variability in dimensions. Table 3.1 shows dimensions for common types of bicycles, taken from the *Design manual for bicycle traffic* (CROW 2007) by Dutch infrastructure, traffic, transport and public space organisation CROW.

Table 3.1: Standard bicycle types

Bicycle Type	Height (mm)	Length (mm)	Width (mm)
Adult touring bicycle	1000-1200	1800-1950	500-600
Adult racing bicycle	1000-1200	1700-1900	450-600
Mountain bicycle / All-terrain bicycle	950-1100	1700-1900	600-650
Children's bicycle	800-1000	1500-1700	500-550

Source: CROW 2007

Moreover, Appendix A of AS 2890.3:2015 shows dimensions and other features of a wider range of bicycle types, of which a few examples not covered above are reproduced in Table 3.2.

Table 3.2: Extended list of bicycle types

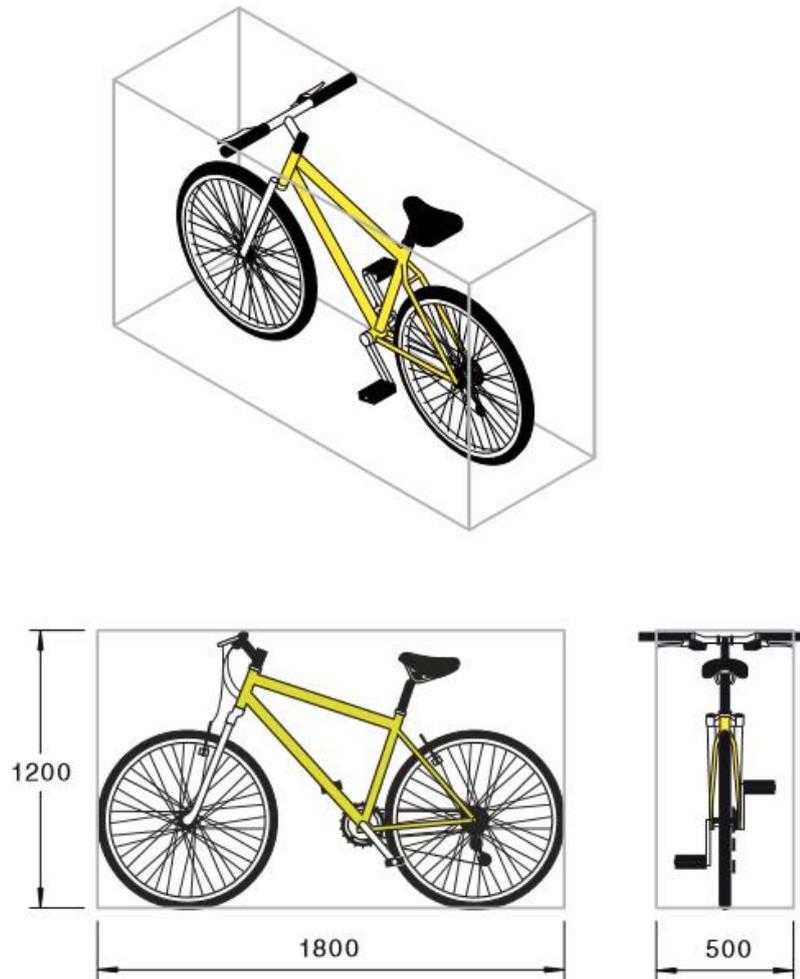
Bicycle Type	Height (mm)	Length (mm)	Width (mm)	Other Features
Child's bicycle	600-900	1500	500	Small size, lower top tube
Tandem	1200	2750	600	Length, reduced manoeuvrability
Recumbent bicycle	1300	2000	750-1000	Length, width, reduced manoeuvrability
Cargo bicycle	1300	2550	650	Length, height, reduced manoeuvrability, weight
Bicycle and child trailer	1200	3000	800	Length, width, height, reduced manoeuvrability, weight
Bicycle with child seat	1400	1800	600	Height

Source: AS 2890.3:2015

While a wide range of bicycle types exist, a "typical" bicycle envelope can be used to cater for the vast majority of bicycles. On the above basis, the bicycle parking envelope for a standard bicycle is considered to be 1200mm high, 1800mm long and 600mm wide. Although the width of a bicycle is based on their handlebars, and if the bicycle parking type can suitably off-set the handle bars, a reduced width between bicycle parking spaces can be achieved. The parking spaces should still be sufficient to enable users to easily reach around the bicycle to lock and unlock them. As such a desired minimum of 500mm spacing where the handlebars is off-set is considered acceptable.

This resulting bicycle envelope is consistent with Figure 2.1 in AS 2890.3:2015, which is reproduced in Figure 3.1 below.

Figure 3.1: Bicycle Spacing Envelope



Notes:

- 1 The dimensions of the envelope are equivalent to those of a standard bicycle.
- 2 The bicycle spacing envelope does not apply to bicycle lockers or radially arranged vertical bicycle parking (Figures B1 and B8).
- 3 Handlebars will protrude beyond the envelope.

Source: Figure 2.1 AS 2890.3:2015

Using this parking envelope as a starting point, the vast majority of bicycles will be catered for. However, it should be recognised that there are other types of bicycles for which this parking will not be suitable, and where demands for other bicycle types can be reasonably expected, they should be provided for. For example, bicycles may be larger than the typical envelope (i.e. at a place where deliveries by cargo bicycle are expected), may be too heavy to practicably lift onto vertical racks, or may have low top tubes making it difficult to secure them to racks.

4. Facility Considerations

There are a number of requirements that are applicable to the provision of any bicycle parking facilities. In order to deliver maximum benefit, bicycle parking must be attractive and useful, regardless of the type of parking provided. Unless this is the case, it will remain under-utilised and represent poor value for money.

4.1 Facility Types

Bicycle parking facility types are typically grouped based on the level of security they provide. The level of security generally varies across the level of access control and passive surveillance. The highest level of security is not always desired or expected to encourage the highest number of users, especially if they are only wanting to stay for a short period of time. Rather, they need to be matched with the user and trip types they are supporting.

The current AS 2890.3:2015 defines three levels of security for bicycle parking facilities, which are summarised in Table 4.1.

Table 4.1: Bicycle parking security levels

Security Level	Style	Suitability
A	Bicycle Locker	Long-term parking that includes overnight storage.
B	Bicycle Cage	Day parking for staff, students and public transport users. Some overnight parking in residential buildings.
C	Bicycle Rack	Short-term parking such as visitor or customer parking.

Source: AS 2890.3:2015

4.1.1 Bicycle Lockers (Security Level A)

Bicycle parking facilities with Security Level A typically consist of lockers with high security locking mechanisms used to store a single bicycle. Such facilities are used at locations with low passive surveillance and where the bicycles are parked for an extended period of time, including:

- apartment complexes
- holiday apartments where bicycles are stored long-term.

While bicycle lockers provide the highest level of security, there are a number of disadvantages compared to bicycle cages, including the following:

- high construction cost per unit
- high maintenance and administration costs
- large footprint per unit
- lockers only serve one person and are not available to others when that person is not using the locker
- lockers are sometimes used to store private belongings other than bicycles
- it is difficult to assess the usage of lockers.

4.1.2 Bicycle Cages (Security Level B)

These facilities typically consist of a secure room, cage, or other structure where multiple users park their bicycles. They often incorporate security features, such as self-closing and self-locking gates that require security access devices (e.g. keys, codes, swipe cards) for entry.

They are generally used to support commuter use, so bicycles are typically parked in the facilities during the day. Examples of where such facilities are used include:

- by various State Transport Authorities in Australia at major transport hubs, especially train stations
- as part of staff parking facilities provided by private developments
- as part of staff and/or student parking provided at educational developments.

Such facilities are suitable for locations that require a higher level of security than a public bicycle rail, but where the expense and size of individual bicycle lockers is not warranted.

4.1.3 Bicycle Racks (Security Level C)

These facilities typically consist of a bicycle parking space where the user is able to secure the bicycle frame and both wheels onto a bicycle parking device (e.g. bicycle racks). They are typically used for short-term parking (e.g. at retail destinations), and located in public and highly accessible locations.

It is noted that there are many rack types on the market. However, care should be taken that they achieve the following:

- able to secure the bicycle frame and both wheels
- spacing between and accessing the racks is consistent with the dimensional requirements set out in the current AS 2890.3:2015
- rack is durable, rigid and suitable fixed / mounted.

4.2 Design Principles

4.2.1 Proximate

Parking should ideally be located a short distance from the users' destination. In terms of specific recommendations around what distance bicycle parking facilities should be located to the users' destination, the following examples are provided:

- Sydney City Development Control Plan (2012) requires bicycle parking to be provided on the uppermost basement level
- Australian Standard for Bicycle Parking (AS 2890.3:2015) recommends that facilities should be located within one level of street access points
- the Cycling Aspects of Austroads Guide (2014) nominate that bicycle parking facilities should be located within 100m from the destination
- in Denmark (Crow 2007), the aim is to provide the facility within 30m.

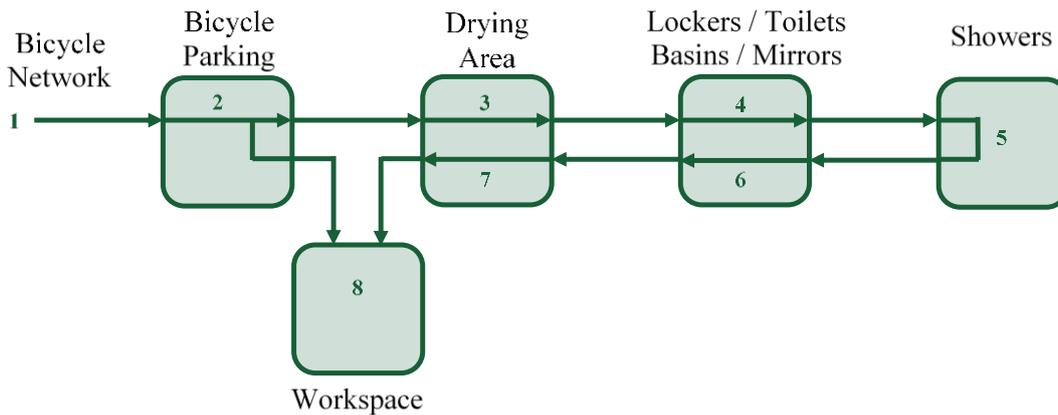
The proximity of bicycle parking to lockers and end-of-trip facilities is similarly important to ensure that their uses are integrated and accessible.

4.2.2 Intuitive

Bicycle parking facilities must be intuitive to users. This means it must be situated in such a way that users can park their bicycle, shower, change, store their apparel and continue moving towards the destination within a short walking distance, and in reverse as they egress.

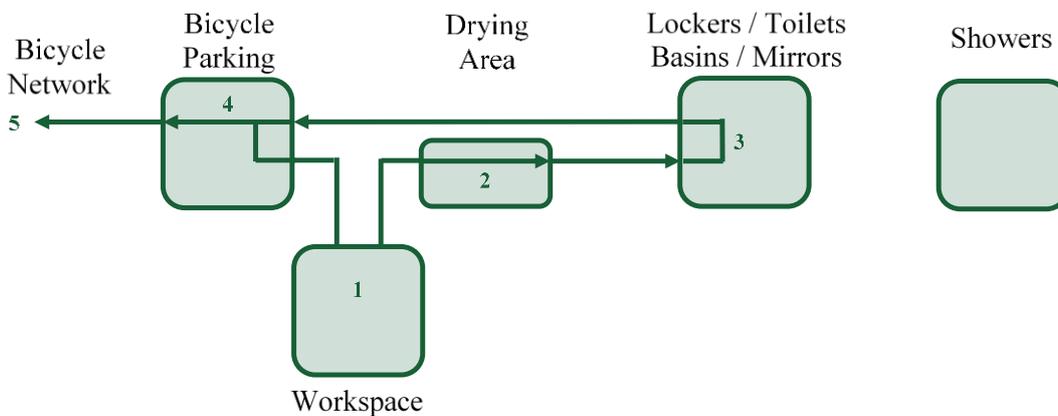
The associated ingress and egress workflows recommended for bicycle parking facilities is illustrated in Figure 4.1 and Figure 4.2.

Figure 4.1: Example workflow for arriving at work



Source: *Bicycle Parking Facilities: Guidelines for Design and Installation (Austroads 2016)*

Figure 4.2: Example workflow for leaving work



Source: *Bicycle Parking Facilities: Guidelines for Design and Installation (Austroads 2016)*

4.2.3 Visibility

Bicycle parking should be highly visible, as this will ensure that it is easy to find, which helps promote the facility. This can be achieved firstly through being located in a prominent location, but also through clear signage and wayfinding. Visibility also contributes to user safety and comfort through increasing passive surveillance. Where the facility is not highly visible from a public area, other measures such as good lighting and CCTV cameras may be beneficial in making the facility feel safe and thus used.

4.2.4 Security

Protecting parked bicycles from damage and theft is important in providing users with the peace of mind they need to be able to use the facility. Importantly, while a bicycle rail may provide a fixture for securing the frame and wheels, it does not protect the bicycle from vandalism or the theft of attached bicycle components. The level of security, and therefore the type of facility required, will depend on the trip purpose. In this regard, the following guidance is provided:

- Long term users such as residents or staff typically require a secure bicycle locker or bicycle rail within a secure enclosure.
- Short term users such as shoppers or visitors require a conveniently located bicycle rail, potentially within the road reserve, and with good passive surveillance, and preferably protected from the elements.

Regardless of user category, the Australian Standard for Bicycle Parking (AS 2890.3:2015) recommends that both wheels are able to be secured to the chosen bicycle rail.

4.2.5 Facility Access Management

For bicycle parking enclosures, a swipe card or duplicate key is often used to manage access. In some instances, building management may issue access to the same number of persons as there are bicycle parking spaces. However, on any given day it may be unlikely that all parking spaces are utilised, particularly in larger installations. In instances such as these where resources are not pooled, this may inhibit the ability for some casual users to gain access to them. Further, in applications such as residential developments, rather than linking individual bicycle parking spaces to a land title, there may be merit in providing 'decoupled' or 'unbundled' parking which can be purchased or leased separately from the dwelling, enabling a more efficient utilisation of the asset.

4.2.6 Amenity and Usability

Different types of facilities vary in the level of 'user friendliness'. For instance, racks that are mounted in a location that requires users to move a vehicle or navigate obstacles will result in a large degree of inconvenience for many users, and may only be suitable for use in private garages. Similarly, wall-mounted racks that support the bicycle in a vertical position may be difficult to use for some persons.

It is noted that AS 2890.3:2015 includes a requirement for 20% of all spaces to be ground level or horizontal type racks to ensure equitable access. There is potential that other amenity and usability considerations may well need to be met depending on who is expected to access the facilities, such as for cargo and recumbent bicycles.

4.2.7 Other End-of-trip Facilities

End-of-trip facilities can include showers, lockers, drying rooms, ironing facilities and bicycle service/repair toolkits. These items can be just as important as a bicycle parking space itself, as they make cycling a more attractive and feasible transport mode as well as being used by pedestrians and those who exercise before, during or after work.

One consideration often overlooked is the management of towels and used apparel which may need drying out. This is an important consideration which can significantly deteriorate the quality of a bicycle parking facility if insufficient amenities are provided, as it decreases general hygiene and perceptions of cleanliness.

4.2.8 Easy to Maintain

To deliver best value for money, facilities must be designed to minimise maintenance costs. Even where this involves a higher initial outlay, the overall cost of providing the facility over its lifetime should be aimed for. Facilities should be designed to be resistant to vandalism, rust, wear, and so forth. They should also minimise the need for cleaning, such as ensuring dirt, leaves, etc. do not accumulate. Facilities that are poorly maintained through being visibly dirty or damaged are less likely to be used.

5. Parking Provision

5.1 Why it is Important to get it Right

It is important to determine the number of bicycle spaces to prevent under or over-supply. Providing an adequate number of spaces from the outset is usually the most cost effective approach, as retrofitting later may be more expensive. However, as long as the potential to retrofit bicycle parking is planned for, such as by allowing for potential expansion of the initial facility or identifying locations for additional facilities, it may be an appropriate option to stage their implementation to avoid a poor investment through over-supply.

5.2 Statutory Requirements

Within many municipalities throughout Australia, statutory requirements for bicycle parking already exist as part of new developments. They are often minimum requirements that are applied across the municipalities. Some more targeted localised rates have been developed, but given their historic nature and limited consideration of site context (i.e. ability to access a given location by bicycle), they are considered to only provide a minimum level of bicycle parking provision.

It is recommended that increased consideration of the level of bicycle accessibility (existing and proposed) for an area be undertaken in identifying a suitable number of bicycle parking spaces. Also, if an increased level of bicycle parking spaces is considered appropriate for a given area, then proportionate reductions in the level of car parking should also be considered.

5.3 Mode Split Targets

The level of bicycle parking should be consistent with the bicycle mode split being targeted for an area. Depending on the user types, bicycle mode split target for a given area are able to be determined through the following methods:

- Review of historic ABS Method of Journey to Work and Austroads National Cycling Participation Survey data to identify the current trend in bicycle use, which can then be extrapolated from the most recent ABS data or more area specific survey data.
- Review relevant local and state government strategies and policies that identify the existing and future mode split targets or level of change (i.e. reductions in private car use).
- For at least residential land uses, identify the level of bicycle ownership through ABS data and/or surveys and apply this to the average level of occupancy per dwelling type.

What is also important in setting bicycle mode split targets is the time horizon that is being contemplated. Most buildings have a useful life of 50 to 100 years, and while current trends are not expected to be applied over such time horizons, it is expected that 10 to 20 years would be appropriate in determining the level of bicycle parking that will be ultimately required.

5.4 Location Based Targets

In lieu of determining bicycle mode split targets through the approach set out in Section 5.3, a 'location based' approach may be applied, reflecting the likely level of development density/activity and ability for uptake of cycling. In this regard, the following three broad level urban environments have been identified, and the associated recommended bicycle mode split targets provided:

- **CBD / Principal Activity Centres = 30% bicycle mode split target**
This rate reflects the high propensity for these urban environments to attract bicycle use, as they are major trip attractors and employment generators.
- **Town Centres / Major Activity Centres = 20% bicycle mode split target**
This rate reflects the moderate propensity for these urban environments to attract bicycle use, especially for local and short trips.
- **Other Urban = 10% bicycle mode split target**
This rate is considered to be a reasonable starting point for general urban environments.

5.5 Bicycle Parking Rates

Bicycle parking rates for a number of common land use types have been determined using the following process:

- identifying the peak number of people that are likely or permitted to be accommodated within the associate land use
- applying empirical data associated with the likely split between short and long-stay users for each land use type
- identifying the rate of bicycle parking provision for a generic 10% bicycle mode share, which should be factored up based on the bicycle mode split target being adopted for the area (i.e. if a 30% bicycle mode split target is being adopted, then factor up by 3.0).

Each of these above steps is outlined below.

5.5.1 Peak Population Densities

Peak population densities vary significantly, and where possible development specific population densities should be identified. However, in lieu of site specific information there are number of available data basis, including the following that can be used to identify what current population densities exist for various land use types:

- ABS data
- Census of Land Use and Employment (CLUE) data for capital cities.

Alternatively, Table D1.13 of the Building Code of Australia (2010) sets out rates to identify the maximum number of people permitted for various land use types.

5.5.2 Short vs Long-Stay Splits

With most land uses there are short and long-stay users accessing them. The associated ratios between short and long-stay users various by land use. There are fairly well established ratios for car parking based on empirical data, which are also reflected through statutory requirements and in various car parking provision guides. Application of these empirically based ratios for car parking are considered to be appropriate for bicycle parking as well.

This approach has already generally been applied to many of the existing statutory bicycle parking requirements, such as those within Table 1 to Clause 52.34 of the Victorian Planning Provisions.

5.5.3 Generic 10% Bicycle Parking Rates

A 10% bicycle mode share is considered to be a reasonable starting point to accommodate the likely demand generated by land uses in an urban location. As such, and based on the above process, Table 5.1 has been prepared to indicate what a 10% bicycle mode share rate of provision equates to for the most common land uses. However, where high bicycle mode splits are expected, those indicated in the table below should be factored up based on the specific mode split targets being aimed for, and associated bicycle parking demand calculations rounded up, to help ensure a suitable level of bicycle parking provision is provided.

Table 5.1: Bicycle parking provision rates

Land Use	Description	Peak Population Density	10% Mode Share Rate	
			Short-Stay ¹	Long-Stay ¹
Dwelling	Dwelling	-	0.02 spaces per dwelling ²	Should be based on average bicycle ownership levels per dwelling type
Office	Office	20sqm GFA per employee ³	0.05 spaces per 100sqm GFA	0.45 spaces per 100sqm GFA
Shop	Shop	20sqm NFA per person ⁴	0.4 spaces per 100sqm NFA	0.1 spaces per 100sqm NFA
	Department Store	27sqm NFA per person ⁴	0.30 spaces per 100sqm NFA	0.07 spaces per 100sqm NFA
	Supermarket	14sqm NFA per person ⁴	0.57 spaces per 100sqm NFA	0.14 spaces per 100sqm NFA
Retail	Bulky Goods Retail	27sqm NFA per person ⁴	0.30 spaces per 100sqm NFA	0.07 spaces per 100sqm NFA
Education	Primary	-	-	0.3 spaces per student and staff ⁵
	Secondary	-	-	0.3 spaces per student and staff ⁵
	Tertiary	-	-	0.3 per student and staff ⁵
Accommodation	Hotel	-	-	0.1 space per staff
	Motel	-	-	0.1 space per staff
	Serviced Apartments	-	-	0.1 space per staff
Places of Assembly	Gallery, Museum, Library	-	0.1 space per visitor	0.1 space per staff
	Sports Facility	-	0.1 space per visitor	0.1 space per staff
	Community Centre	-	0.1 space per visitor	0.1 space per staff
Food and Drink Premises	Restaurant	-	0.1 spaces per seat	0.1 spaces per staff
	Take-Away Food	-	0.1 spaces per seat	0.1 spaces per staff

Land Use	Description	Peak Population Density	10% Mode Share Rate	
			Short-Stay ¹	Long-Stay ¹
Health Services	Hospital	-	0.1 spaces per patient (max on site at one time)	0.1 spaces per staff
	Health Facility	-	0.1 spaces per patient (max on site at one time)	0.1 spaces per staff
Industry	Industry	50sqm NFA per person ⁶	0.02 spaces per 100sqm NFA	0.18 spaces per 100sqm NFA

¹ Short and long-stay splits of 10:90 for office and industry, and 80:20 for shop and retail applied

² Short-stay rate based on Table 1 to Clause 52.34 of the Victorian Planning Provisions, unless otherwise advised

³ Based on the average employee density rate for offices in the City of Melbourne (CLUE data, 2015)

⁴ Based on comparative differences between the Victorian Planning Provision car parking rates to office

⁵ A 30% bicycle mode share parking rate has been indicated as it is considered to be a reasonable starting point

⁶ Based on the maximum rates permitted under the Building Code of Australian (2010)

5.6 End-of-Trip Facilities

The provision of bicycle parking facilities at destinations provides the fundamental requirements to support bicycle trips. In many instances, the provision of quality, fit-for-purpose bicycle parking may be all that is required (e.g. for short-stay visitor parking and parking for shopping trips). However, for commuters, additional facilities are required to ensure that they are adequately catered for. This includes the provision of appropriate change room facilities, showers and personal storage space (lockers) to store clothing and towels. As noted earlier, the management and treatment of towels in end-of-trip facilities can have a significant impact on the attractiveness and amenity afforded by the facilities.

The provision of showers and change facilities in workplaces reduces the barriers to cycling and contributes towards making cycling a viable alternative to car trips. In order to achieve substantial change in user travel behaviour choices, it is necessary to equip workplaces with clean, safe and comfortable showers, lockers and changing facilities. These facilities are not exclusive to cyclists, but also offer benefits and incentives to other people who walk or exercise regularly.

The recommended rates for shower and change facilities to be applied to employee (long-term non-residential land use) demands are outlined in Table 5.2.

Table 5.2: End of trip facility provision rates

Number of Showers	Change Rooms ¹
One shower for the first five bicycle spaces or part thereof, plus an additional shower for each 10 bicycle parking spaces thereafter	One change room or direct access to a communal change room per shower

¹ The change room may be a combined shower/change room.

Note: In instances where more than one shower/change facility is required, there must be provision for separate male and female facilities. This is a requirement of the ACT Bicycle Parking General Code, 2008.

It is also noted that the shower and change room requirements leveraged off the number of bicycle parking spaces may not accommodate the needs of other users, such as those who exercise before, during or after work.

6. Design of Bicycle Parking

The design of bicycle parking spaces is the component of the facilities that allows the bicycle to be held in place and securely locked. There are many systems available but not all are compliant with standards or fulfil user requirements.

6.1 On-Street

6.1.1 Access

Access to on-street bicycle parking facilities should be as direct as possible from connecting bicycle facilities and minimise the need to mix with pedestrians, especially within high pedestrian areas like strip shopping centres. Moreover, it can be difficult and potentially unsafe for cyclists to stop on the road and lift their bicycle up over the kerb to access on-street parking facilities. As such, consideration should be given to how cyclists can easily and safely connect between the adjacent bicycle facilities and the bicycle parking facilities. Use of dedicated pram ramps and clear areas between kerbside parking are recommended.

6.1.2 Layout

On-street bicycle parking facilities should at a minimum be designed in accordance with the relevant planning standards, codes and policies acting in the associated jurisdiction. However, they should also satisfy the following general requirements:

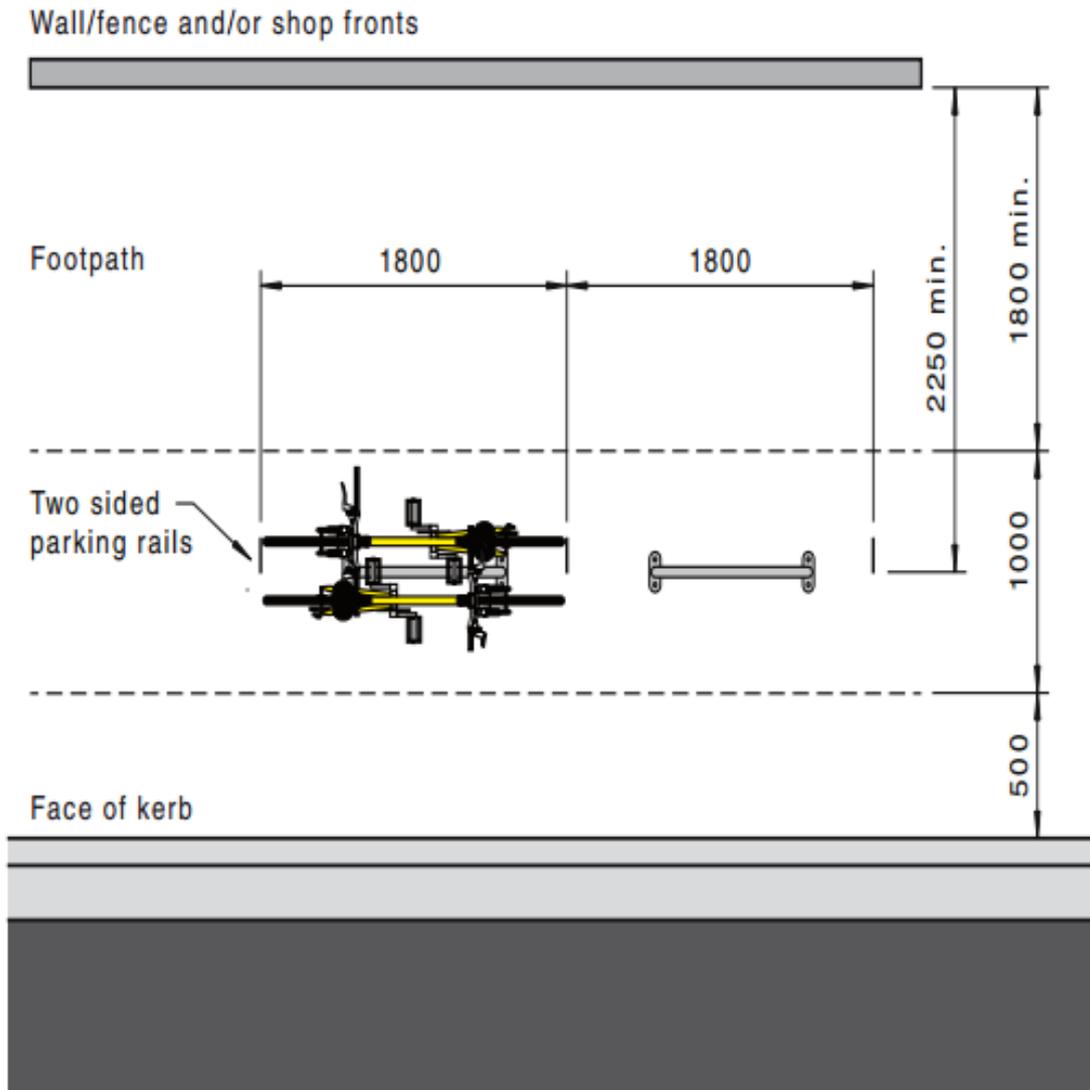
- enable wheels and frame to be locked to the device without damaging the bicycle
- be of a horizontal type of bicycle parking device
- be placed in view of staff, customers and/or passers-by
- be located away from, and potentially physically separated from, pedestrian paths
- ensure there is sufficient available width for the adjacent pedestrian traffic volumes
- be easily accessible from the adjacent bicycle facilities and not damage or be obstructed by parked cars
- be clear of manoeuvring vehicles and opening car doors
- be as close to the users' ultimate destination
- be well lit throughout the day and night
- be protected from the weather (rain, wind and sun)
- be attractive and consistent with the surrounding streetscape
- be appropriately signed, both at and on approach to the parking facilities (wayfinding)
- be well maintained, and kept free from graffiti and vandalism: considering of the required reoccurring costs of maintenance should be included in relevant budgets.

In terms of examples of suitable on-street bicycle parking layouts, reference is made to AS2890.3:2015, which indicates recommended minimum parallel and angled arrangements, as reproduced in Figure 6.1 and Figure 6.2 respectively.

Most notably, the recommended parking layouts indicate that bicycle devices mounted parallel to the kerb should be located approximately 1.0m from the kerb line. This is sufficient to place the devices outside the car door opening areas, but additional width should be provided to try and place a locked bicycle to the device outside the 1.0m from the kerb line to be clear of an open car door, or bicycles should be prevented from parking on the road-side of the device.

Where no kerbside parking exists, parking devices should be located at least 600mm from the face of kerb in low speed environments (60km/h or less), and at least 1.0m in higher speed environments (>60km/h). Again, ideally consideration is given to what off-set a locked bicycle to the device will have to moving vehicles.

Figure 6.1: Parallel On-Street Bicycle Parking Layout

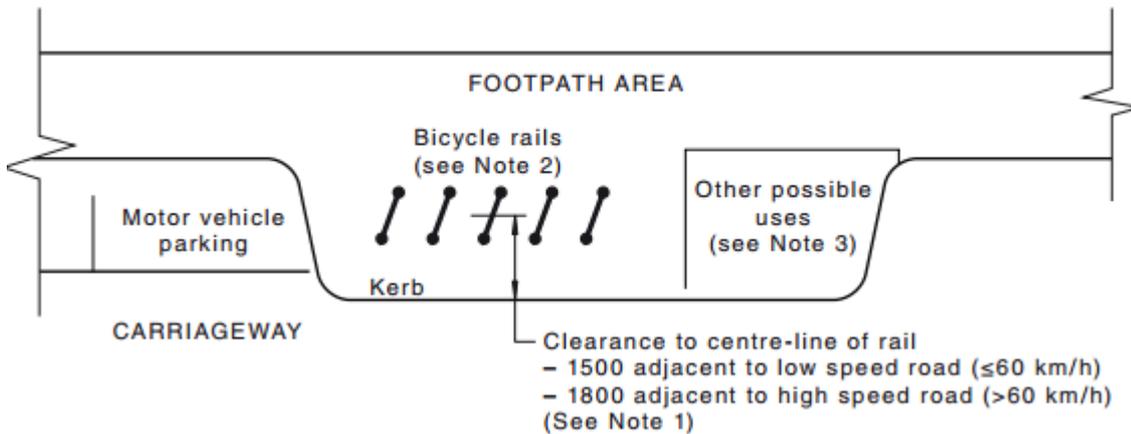


Notes:

- 1 The figure shows recommended clearances for parallel to kerb parking. Bicycle spacing envelope placement closer to the kerb than the 500 mm recommended should carry a warning that they are for single-sided use only and should be considered carefully and audited by an accredited road safety auditor.
- 2 Bicycle parking adjacent to roads where the speed limit is greater than 60km/h should be protected by a pedestrian barrier.
- 3 Clearance from a parked bicycle to the wall should be a minimum of 1800 mm.

Source: Figure 2.3 of AS 2890.3:2015

Figure 6.2: Angled On-Street Bicycle Parking Layout



Notes:

- 1 Clearances are based on minimum requirements specified in Clause 2.5.1 of AS 2890.3:2015, plus an allowance for the length or width of a bicycle.
- 2 For spacing of rails, see Clause 2.2 of AS 2890.3:2015.
- 3 Other possible uses include pedestrian crossing approach and landscaping.

Source: Figure B4 of AS 2890.3:2015

6.2 Off-Street

6.2.1 Access

Access to off-street bicycle parking facilities should be as direct as possible from connecting bicycle facilities and minimise the need to mix with other vehicles and pedestrians accessing and within the off-street parking facilities.

Bicycle parking design guides indicate riders should be able to ride within 30m of the bicycle parking facilities (CROW 2007), so off-road bicycle path width and grades should be applied over these lengths, such as those outlined in *Cycling Aspects of Austroads Guides* (Austroads 2014).

AS 2890.3:2015 recommends bicycle path widths of 1.5m for one-way and 2.5m for two-way bicycle access ways to off-street parking facilities. Determining when a one-way or two-way access way is required will depend on the length of the access way and number of bicycle parking spaces it is servicing. As with off-street car parking, a reasonable guide would be that a one-way cycle access way is sufficient for up to 30m in length and/or 30 bicycle parking spaces. Longer and/or more bicycle parking spaces being serviced by a one-way cycle access way would be considered to result in an unacceptable number of conflicts between users.

Gradients along bicycle access ways are also critical. AS 2890.3:2015 recommend grades of no steeper than 1:12, except over short distances (i.e. typical ramp between car parking levels). Also, at access control points, such as swipe card readers, a grade no steeper than 1:20 should be provided, so riders can operate the access control comfortably while astride their bicycle.

6.2.2 Layout

Off-street bicycle parking facilities should at a minimum be designed in accordance with the relevant planning standards, codes and policies acting in the associated jurisdiction. It is also noted that there are many off-street bicycle parking devices on the market. However, they should also satisfy the following general requirements:

- enable wheels and frame to be locked to the device without damaging the bicycle
- 20% of bicycle parking racks in any bicycle parking facility should be on the ground (horizontal) for those not strong enough to lift their bicycles
- be spaced so that at least the typical bicycle dimensions of 1200mm high, 1800mm long and 600mm wide is accommodated. However, reductions in the width and length can be achieved where the handlebars and wheels are off-set, as indicated in Figure 2.2, Figure B5 and Figure B7 in AS 2890.3:2015
- be placed in view of staff, security and/or passers-by, or be well lit with CCTV cameras
- be easily accessible and not damaged or be obstructed by parked cars
- be clear of manoeuvring vehicles and opening car doors
- be well lit throughout the day and night
- be protected from the weather (rain, wind and sun)
- be attractive and consistent with the surrounding streetscape
- be appropriately signed, both at and on approach to the parking facilities (wayfinding)
- be well maintained, and kept free from graffiti and vandalism: consideration of the required reoccurring costs of maintenance should be included in relevant budgets.

References

- ACT 2008, *Bicycle Parking General Code*, ACT Planning and Land Authority, Canberra, ACT
- Austroads 2008, *Guide to Traffic Management Part 11: Parking*, AGTM11-08, Austroads, Sydney, NSW.
- Austroads 2013, *Australian Cycling Participation 2013*, AP-C91-13, Austroads, Sydney, NSW.
- Austroads 2014, *Cycling Aspects of Austroads Guides*, AP-G88-14, Austroads, Sydney, NSW.
- Austroads 2015, *Australian Cycling Participation 2015*, AP-C91-15, Austroads, Sydney, NSW.
- Austroads 2016, *Bicycle Parking Facilities: Guidelines for Design and Installation*, AP-R527-16, Austroads, Sydney, NSW.
- BITRE 2009, *Greenhouse Gas Emissions from Australian Transport: Projections to 2020*, Department of Infrastructure, Transport, Regional Development and Local Government Canberra, ACT
- Building Code of Australia 2010, *Table D1.13, Person Per Area According to Use*
- City of Melbourne 2015, *Census of Land Use and Employment (CLUE)*
[<https://data.melbourne.vic.gov.au/clue>]
- City of Sydney 2012, *Sydney Development Control Plan 2012*, City of Sydney, Sydney, NSW
- CROW 2007, *Design manual for bicycle traffic*, CROW, Ede, The Netherlands
- Geller, R 2010, *Four Types of Cyclists*, Portland Bureau of Transportation, Portland, Oregon, USA
- Heart Foundation 2011, *Creating Healthy Neighbourhoods*, National Heart Foundation of Australia
- Heart Foundation 2012, *Streets for People: Compendium for South Australian Practice*, South Australian Active Living Coalition, Government of South Australia
- Heart Foundation 2014, *Blueprint for an Active Australia*, 2nd edn. Melbourne: National Heart Foundation of Australia
- Lee, A. and March, A. 2007 *What is the economic contribution of cyclists compared to car drivers in inner Melbourne's shopping strips?* Unpublished Master of Urban Planning Thesis, University of Melbourne
- Rajé, Fiona, and Saffrey, Andrew *"The Value of Cycling"*, Department for Transport, UK
- Victorian Planning Provisions Clause 52.34 2004 *Bicycle Facilities*, Department of Environment, Land, Water and Planning [<http://planning-schemes.delwp.vic.gov.au/schemes/vpps>]
- Australian Standards**
- AS 2890.3: *Parking facilities - Bicycle parking*

Appendix A Summary for Inclusion in Austroads Guide to Traffic Management

Part 11: Parking

A.1 Benefits of Providing Bicycle Parking

Bicycle parking provides a number of benefits to users, building owners and managers, as well as the community more broadly. While its provision requires some planning and investment, it is typically less expensive and more space efficient per user than car based road space and parking facilities.

Some of the benefits are outlined below.

A.1.1 Improved Accessibility

Providing good quality bicycle parking that is accessible by a wide type of users helps encourage more people to cycle to a destination, and thus makes it more accessible. This can be highly beneficial in areas where public transport provision is poor, car parking is scarce and/or traffic congestion exists.

Even where other forms of transport are available, cycling is often a cheap, efficient and convenient form of transport, so can have a competitive advantage over other modes, at least over short distances if suitably facilities are provided.

A.1.2 Space Efficiency

Bicycle parking is vastly more space efficient than car parking, particularly when typical car occupancy is taken into account. Simply, you can fit a number of bicycle parking spaces within a single car space. Also, car parking requires significantly more circulation space, making the overall car parking area quite large and rigid. On the other hand, bicycle parking has relatively small circulation space and can even be provided in places that would otherwise be unusable for other transport uses.

Through reducing the amount of car parking that is required, bicycle parking can result in large savings, particularly where land values are high. Even where this is not the case, the construction costs associated with car parking are significant, especially where multi-level facilities are required. Any car parking that is able to be replaced with more efficient bicycle parking means more space for the core purpose of the building, i.e. more lettable retail space or higher residential yield.

A.1.3 Increase in Trade

As bicycle parking is more efficient, an increased number of people are able to access a commercial use, which enables greater economic benefits, in terms of greater visitation and trade. Even where this is a result of the removal of car parking, as long as some of the bicycle parking is used, it provides better returns to local business for a given area.

A.1.4 Capital Growth

Buildings with quality bicycle parking can result in higher values and capital growth. This can occur through attracting high-value tenants to commercial buildings who seek to attract talented staff through providing accessible workplaces, or through making residential developments competitive in terms of providing greater transport options.

It can also occur through helping to achieve Green Star accreditation, which is associated with greater capital growth. While these benefits can be achieved through retrofitting, designing bicycle parking as an integral part of a building or place, rather than as an afterthought, provides the best opportunity to achieve a value for money outcome.

A.1.5 Environmental Sustainability

Increasing cycling through provision of bicycle parking delivers environmental benefits through reducing the number of trips taken by motor vehicles. In addition to being a benefit to the community, it is also relevant to businesses or organisations which have sustainability or corporate social responsibility goals. As a tangible and visible sign of commitment to these goals, bicycle parking can be an effective and cost efficient way of achieving goodwill for the organisation's brand.

A.1.6 Health Benefits

Cycling is also an effective way to improve health outcomes, as increased physical activity reduces the risk of conditions such as heart disease and obesity, which are significant social and economic burdens on the community. The health benefits of cycling can deliver direct benefits to employers, through reduced absenteeism, as well as improved alertness and performance.

A.1.7 Encouraging Liveability

Encouraging cycling makes streets more attractive, by decreasing traffic congestion, reducing the noise and pollution associated with cars. In addition, it activates streets and improves passive surveillance, creating more liveable and engaged communities.

A.1.8 Other User Benefits

Cycling delivers a range of other benefits to users, such as enjoyment, well-being, fitness, cost savings and greater convenience. Encouraging or facilitating cycling through the provision of quality bicycle parking can make places more attractive for a modest investment, delivering benefits to developers, building owners, landlords, employers, and businesses.

A.2 User Considerations

Different types of bicycle parking are required depending on who the users are and what they are doing. This has implications for the location, security level and design of the parking facility. In many situations there will be a need to provide a mixture of bicycle parking facilities to match the mixture of users accessing the given destination.

A.2.1 User Types

The recommended facilities for the most common user types are outlined below:

- **Customers and visitors** typically only require short-term (less than three hours) parking with a higher level of proximity and convenient access to their destination. This type of parking is likely to be provided within the road reserve or within publicly accessible areas on private property with no specific access control to them. As such, they are ideally located in areas with high foot traffic and passive surveillance (particularly in retail areas). However, increased levels of security are able to be achieved through the provision of lighting and CCTV cameras.

- **Employees** at workplaces typically require all-day parking (8-10 hours) with high levels of security, as they are often located in areas of low activity and passive surveillance. This may take the form of a secure room or structure, such as a parking cage, and often includes access to shower and change room facilities.
- Appropriate **resident** parking facilities generally depended on the type dwelling. Properties with lock-up garages allow for bicycles to be stored against the wall or using domestic bicycle parking products (e.g. more space efficient systems that don't require the ability to lock the bicycle can be used). Multi-dwelling developments, such as apartment buildings, typically include shared car parking areas, in which bicycle parking can be provided. At a minimum, bicycle racks to which bicycles can be locked must be provided. However, as these parking facilities are not completely secure, it may be desirable to provide bicycle lockers, cages or other secure areas only accessible by residents.
- **Public transport users**, particularly those interchanging to rail or accessing a bus interchange, are also likely to make use of bicycle parking, as this increases the catchment of the public transport services and reduces the need to drive and park a car proximate to the stops. As these users typically require longer term or all day parking, the security requirements are again similar to that of workplaces, although facilities are likely to be located outdoors. Undercover parking cages can meet both security and weather protection needs. Bicycle lockers can also provide a suitable level of security, but they tend to have lower utilisation, as shared use of the facilities is not possible.
- **Students** at educational facilities typically require medium to long-term parking (4-8 hours), the security requirements are again similar to that of workplaces, although facilities are likely to be located outdoors.

A.2.2 Bicycle Types

Regardless of the facility type to be provided, consideration should be given to the dimensions and other attributes of the bicycles anticipated to be accommodated. The dimensions of bicycles must be considered in the design of the facility to allow adequate space for bicycles to be easily parked, without risking damage to bicycles, blocking access, or causing hazards. In addition, some bicycle types may have limited manoeuvrability (requiring more room for access) or greater weight (making them unsuitable for vertical bicycle racks).

Even within the scope of various standard types of bicycles, there is some variability in dimensions. The table below shows dimensions for common types of bicycles, taken from the *Design manual for bicycle traffic* (CROW, 2007).

Table A 1: Standard bicycle types

Bicycle Type	Height (mm)	Length (mm)	Width (mm)
Adult touring bicycle	1000-1200	1800-1950	500-600
Adult racing bicycle	1000-1200	1700-1900	450-600
Mountain bicycle / All-terrain bicycle	950-1100	1700-1900	600-650
Children's bicycle	800-1000	1500-1700	500-550

Source: CROW 2007

Moreover, Appendix A of AS 2890.3:2015 shows dimensions and other features of a wider range of bicycle types, of which a few examples not covered above are reproduced in the table below.

Table A 2: Extended list of bicycle types

Bicycle Type	Height (mm)	Length (mm)	Width (mm)	Other Features
Child's bicycle	600-900	1500	500	Small size, lower top tube
Tandem	1200	2750	600	Length, reduced manoeuvrability
Recumbent bicycle	1300	2000	750-1000	Length, width, reduced manoeuvrability
Cargo bicycle	1300	2550	650	Length, height, reduced manoeuvrability, weight
Bicycle and child trailer	1200	3000	800	Length, width, height, reduced manoeuvrability, weight
Bicycle with child seat	1400	1800	600	Height

Source: AS 2890.3:2015

While a wide range of bicycle types exist, a “typical” bicycle envelope can be used to cater for the vast majority of bicycles. On the above basis, the bicycle parking envelope for a standard bicycle is considered to be 1200mm high, 1800mm long and 600mm wide. Although the width of a bicycle is based on their handlebars, and if the bicycle parking type can suitably off-set the handle bars, a reduced width between bicycle parking spaces can be achieved. The parking spaces should still be sufficient to enable users to easily reach around the bicycle to lock and unlock them. As such a desired minimum of 500mm spacing where the handlebars is off-set is considered acceptable.

Using this parking envelope as a starting point, the vast majority of bicycles will be catered for. However, it should be recognised that there are other types of bicycles for which this parking will not be suitable, and where demands for other bicycle types can be reasonably expected, they should be provided for. For example, bicycles may be larger than the typical envelope (i.e. at a place where deliveries by cargo bicycle are expected), may be too heavy to practicably lift onto vertical racks, or may have low top tubes making it difficult to secure them to racks.

A.3 Facility Considerations

There are a number of requirements that are applicable to the provision of any bicycle parking facilities. In order to deliver maximum benefit, bicycle parking must be attractive and useful, regardless of the type of parking provided. Unless this is the case, it will remain under-utilised and represent poor value for money.

A.3.1 Facility Types

Bicycle parking facility types are typically grouped based on the level of security they provide. The level of security generally varies across the level of access control and passive surveillance. The highest level of security is not always desired or expected to encourage the highest number of users, especially if they are only wanting to stay for a short period of time. Rather, they need to be matched with the user and trip types they are supporting.

The current AS 2890.3:2015 defines three levels of security for bicycle parking facilities, which are summarised as follows:

- **Security Level A:** These facilities typically consist of lockers with high security locking mechanisms used to store a single bicycle. Such facilities are used at locations with low passive surveillance and where the bicycles are parked for an extended period of time. While bicycle lockers provide the highest level of security, they tend to be more expensive, less space-efficient, and require more management than other forms of bicycle parking.

- **Security Level B:** These facilities typically consist of a secure room, cage, or other structure where multiple users park their bicycles. They often incorporate security features such as self-closing and self-locking gates that require security access devices (e.g. keys, codes, swipe cards) for entry. They are generally used to support commuter use, so bicycles are typically parked in the facilities during the day. Such facilities are suitable for locations that require a higher level of security than a public bicycle rail, but where the expense and size of individual bicycle lockers is not warranted.
- **Security Level C:** These facilities typically consist of a bicycle parking space where the user is able to secure the bicycle frame and both wheels onto a bicycle parking device (e.g. bicycle racks). They are typically used for short-term parking (e.g. at retail destinations), and located in public and highly accessible locations.

A.3.2 Design Principles

The following are some key design principles that are central to creating high quality and attractive bicycle parking to users:

- **Proximate:** Parking should ideally be located a short distance from the users' destination. For example, the Sydney City Development Control Plan requires bicycle parking to be provided on the uppermost basement level, whilst the Australian Standard for Bicycle Parking (AS 2890.3:2015) recommends that facilities should be located within one level of street access points. The Austroads Guide and international guidelines nominate that bicycle parking facilities should be located within 100m from the destination. In Denmark, the aim is to provide the facility within 30m. The proximity of bicycle parking to lockers and end-of-trip facilities is similarly important to ensure that their uses are integrated and accessible.
- **Intuitive:** Bicycle parking facilities must be intuitive to users. This means it must be situated in such a way that users can park their bicycle, shower, change, store their apparel and continue moving towards the destination within a short walking distance, and in reverse as they egress.
- **Visibility:** Bicycle parking should be highly visible, as this will ensure that it is easy to find, which helps promote the facility. This can be achieved firstly through being located in a prominent location, but also through clear signage and wayfinding. Visibility also contributes to user safety and comfort through increasing passive surveillance. Where the facility is not highly visible from a public area, other measures such as good lighting and CCTV cameras may be beneficial in making the facility feel safe and thus used.
- **Security:** Protecting parked bicycles from damage and theft is important in providing users with the peace of mind they need to be able to use the facility. Importantly, while a bicycle rail may provide a fixture for securing the frame and wheels, it does not protect the bicycle from vandalism or the theft of attached bicycle components. The level of security, and therefore the type of facility required, will depend on the trip purpose. Long term users such as residents or staff typically require a secure bicycle locker or bicycle rail within a secure enclosure. Short term users such as shoppers or visitors require a conveniently located bicycle rail, potentially within the road reserve, and with good passive surveillance, and preferably protected from the elements.
- **Facility Access Management:** For bicycle parking enclosures, a swipe card or duplicate key is often used to manage access. In some instances, building management may issue access to the same number of persons as there are bicycle parking spaces. However, on any given day it may be unlikely that all parking spaces are utilised, particularly in larger installations. In instances such as these where resources are not pooled, this may inhibit the ability for some casual users to gain access to them. Further, in applications such as residential developments, rather than linking individual bicycle parking spaces to a land title, there may be merit in providing 'decoupled' or 'unbundled' parking which can be purchased or leased separately from the dwelling, enabling a more efficient use of the asset.
- **Amenity and Usability:** Different types of facilities vary in the level of 'user friendliness'. For instance, racks that are mounted in a location that requires users to move a vehicle or navigate obstacles will result in a large degree of inconvenience for many users, and may only be suitable for use in private garages. Similarly, wall-mounted racks that support the bicycle in a vertical position may be difficult to use for some persons. AS2890.3:2015 includes a requirement for 20% of all spaces to be ground level to ensure equitable access.

- **Other end-of-trip Facilities:** End-of-trip facilities can include showers, lockers, drying rooms, ironing facilities and bicycle service/repair toolkits. These items can be just as important as a bicycle parking space itself, as they make cycling a more attractive and feasible transport mode as well as being used by pedestrians and those who exercise before, during or after work. One consideration often overlooked is the management of towels and used apparel which may need drying out. This is an important consideration which can significantly deteriorate the quality of a bicycle parking facility if insufficient amenities are provided, as it decreases general hygiene and perceptions of cleanliness.
- **Easy to maintain:** To deliver best value for money, facilities must be designed to minimise maintenance costs. Even where this involves a higher initial outlay, the overall cost of providing the facility over its lifetime should be aimed for. Facilities should be designed to be resistant to vandalism, rust, wear, and so forth. They should also minimise the need for cleaning, such as ensuring dirt, leaves, etc. do not accumulate. Facilities that are poorly maintained and are visibly dirty or damaged are less likely to be used.

A.4 Number of Spaces

A.4.1 Why it's Important to get it Right

It is important to determine the number of bicycle spaces to prevent under or over-supply. Providing an adequate number of spaces from the outset is usually the most cost effective approach, as retrofitting later may be more expensive. However, as long as the potential to retrofit bicycle parking is planned for, such as by allowing for potential expansion of the initial facility or identifying locations for additional facilities, it may be an appropriate option to stage their implementation to avoid a poor investment through over-supply.

A.4.2 Statutory Requirements

Within many municipalities throughout Australia there are already statutory requirements for bicycle parking as part of new developments. They are often minimum requirements that are applied across the municipalities. Some more targeted localised rates have been developed, but given their historic nature and limited consideration of site context (i.e. ability to access a given location by bicycle), they are considered to only provide a minimum level of bicycle parking.

It is recommended that increased consideration of the level of bicycle accessibility (existing and proposed) for an area be undertaken in identifying a suitable number of bicycle parking spaces. Also, if an increased level of bicycle parking spaces is considered appropriate for a given area, then proportionate reductions in the level of car parking should also be considered.

A.4.3 Mode Split Targets

The quantity of bicycle parking should be consistent with the bicycle mode split being targeted for an area. Depending on the user types, bicycle mode split targets for a given area are able to be determined using the following methods:

- Review of the historic ABS Journey-to-Work and National Cycling Participation Survey data to identify the current trend in bicycle use, which can then be extrapolated from the most recent ABS data or more area specific survey data.
- Review relevant local and state government strategies and policies that identify the existing and future mode split targets or level of change (i.e. reductions in private car use)
- For residential land uses, identify the level of bicycle ownership through ABS data and/or surveys and apply this to the average level of occupancy per dwelling type.

What is also important in setting bicycle mode split targets is the time horizon that is being contemplated. Most buildings have a useful life of 50 to 100 years, and while current trends are not expected to be applied over such time horizons, it is expected that 10 to 20 years would be appropriate in determining the level of bicycle parking that will be ultimately required.

A.4.4 Location Based Targets

In lieu of determining bicycle mode split targets through the approach set out above, a 'location based' approach could be applied, that reflects the likely level of development density / activity and ability for uptake of cycling. In this regard, the following three broad level urban environments have been identified, and the associated recommended bicycle mode split targets provided:

- **CBD / Principal Activity Centres = 30% bicycle mode split target**
This rate reflects the high propensity for these urban environments to attract bicycle use, as they are major trip attractors and employment generators.
- **Town Centres / Major Activity Centres = 20% bicycle mode split target**
This rate reflects the moderate propensity for these urban environments to attract bicycle use, especially for local and short trips.
- **Other Urban = 10% bicycle mode split target**
This rate is considered to be a reasonable starting point for general urban environments.

A.4.5 Bicycle Parking Rates

Bicycle parking rates for a number of common land use types as presented in the table below were determined using the following process:

- identifying the peak number of people that are likely or permitted to be accommodated within the associate land use
- applying empirical data associated with the likely split between short and long term users for each land use type
- identifying the rate of bicycle parking provision for a generic 10% bicycle mode share, which should be factored up based on the bicycle mode split target being adopted for the area (i.e. if a 30% bicycle mode split target is being adopted, then factor up by 3.0).

A 10% bicycle mode share parking rate is considered to be a reasonable starting point to accommodate the likely demand generated by land uses in an urban location. However, they should be factored up based on the specific mode split targets being aimed for (as outlined above), and associated bicycle parking demand calculations rounded up, to help ensure a suitable level of bicycle parking provision is provided.

Table A 3: Bicycle parking provision rates

Land Use	Description	Peak Population Density	10% Mode Share Rate	
			Short-Stay	Long-Stay
Dwelling	Dwelling	-	0.02 spaces per dwelling	Should be based on average bicycle ownership levels per dwelling type
Office	Office	20sqm GFA per employee ¹	0.05 spaces per 100sqm GFA	0.45 spaces per 100sqm GFA
Shop	Shop	20sqm NFA per person ²	0.05 spaces per 100sqm NFA	0.45 spaces per 100sqm NFA
	Department Store	27sqm NFA per person ²	0.30 spaces per 100sqm NFA	0.07 spaces per 100sqm NFA
	Supermarket	14sqm NFA per person ²	0.57 spaces per 100sqm NFA	0.14 spaces per 100sqm NFA
Retail	Bulky Goods Retail	27sqm NFA per person ²	0.30 spaces per 100sqm NFA	0.07 spaces per 100sqm NFA
Education	Primary	-	-	0.3 spaces per student and staff ⁴
	Secondary	-	-	0.3 spaces per student and staff ⁴
	Tertiary	-	-	0.3 space per student and staff ⁴
Accommodation	Hotel	-	-	0.1 space per staff
	Motel	-	-	0.1 space per staff
	Serviced Apartments	-	-	0.1 space per staff
Place of Assembly	Gallery, Museum, Library	-	0.1 space per visitor	0.1 space per staff
	Sports Facilities	-	0.1 space per visitor	0.1 space per staff
	Community Centres	-	0.1 space per visitor	0.1 space per staff
Food and Drink Premises	Restaurant	-	0.1 spaces per seat	0.1 spaces per staff
	Take-Away Food	-	0.1 spaces per seat	0.1 spaces per staff
Health Services	Hospital	-	0.1 spaces per patient (max on site at one time)	0.1 spaces per staff
	Health Facility	-	0.1 spaces per patient (max on site at one time)	0.1 spaces per staff
Industry	Industry	50sqm NFA per person ³	0.02 spaces per 100sqm NFA	0.18 spaces per 100sqm NFA

¹ Based on the average employee density rate for offices in the City of Melbourne (CLUE data, 2015)

² Based on the maximum rates permitted under the Building Code of Australian (2010)

³ A 30% bicycle mode share parking rate has been applied

A.4.6 End-of-Trip Facilities

The provision of bicycle parking facilities at destinations provides the fundamental requirements to support bicycle trips. In many instances, the provision of quality, fit-for-purpose bicycle parking may be all that is required (e.g. for short-stay visitor parking and parking for shopping trips). However, for commuters, additional facilities are required to ensure that they are adequately catered for. This includes the provision of appropriate change room facilities, showers and personal storage space (lockers) to store clothing and towels. As noted earlier, the management and treatment of towels in end-of-trip facilities can have a significant impact on the attractiveness and amenity afforded by the facilities.

The provision of showers and change facilities in workplaces reduces the barriers to cycling and contributes towards making cycling a viable alternative to car trips. In order to achieve substantial change in user travel behaviour choices, it is necessary to equip workplaces with clean, safe and comfortable showers, lockers and changing facilities. These facilities are not exclusive to cyclists, but also offer benefits and incentives to other people who walk or exercise regularly.

The recommended rates for shower and change facilities to be applied to employee (long-term non-residential land use) demands are outlined in the table below.

Table A 4: End of trip facility provision rates

Number of Showers	Change Rooms ¹
One shower for the first five bicycle spaces or part thereof, plus an additional shower for each 10 bicycle parking spaces thereafter	One change room or direct access to a communal change room per shower

¹ The change room may be a combined shower/change room.

Note: In instances where more than one shower/change facility is required, there must be provision for separate male and female facilities. This is a requirement of the ACT Bicycle Parking General Code, 2008.

It is also noted that the shower and change room requirements leveraged off the number of bicycle parking spaces may not accommodate the needs of other users, such as those who exercise before, during or after work.

A.5 Design of Bicycle Parking

A.5.1 On-Street

Access

Access to on-street bicycle parking facilities should be as direct as possible from connecting bicycle facilities. The design should minimise the need to mix with pedestrians, especially within high pedestrian areas like strip shopping centres. The design should provide safe and direct access from the road network to bicycle parking as it can be difficult and potentially unsafe for cyclists to stop on the road and lift their bicycle up over the kerb to access on-street parking facilities. Use of dedicated pram ramps and clear areas between kerbside parking are recommended.

Layout

On-street bicycle parking facilities should at a minimum be designed in accordance with the relevant planning standards, codes and policies acting in the associated jurisdiction. However, they should also satisfy the following general requirements:

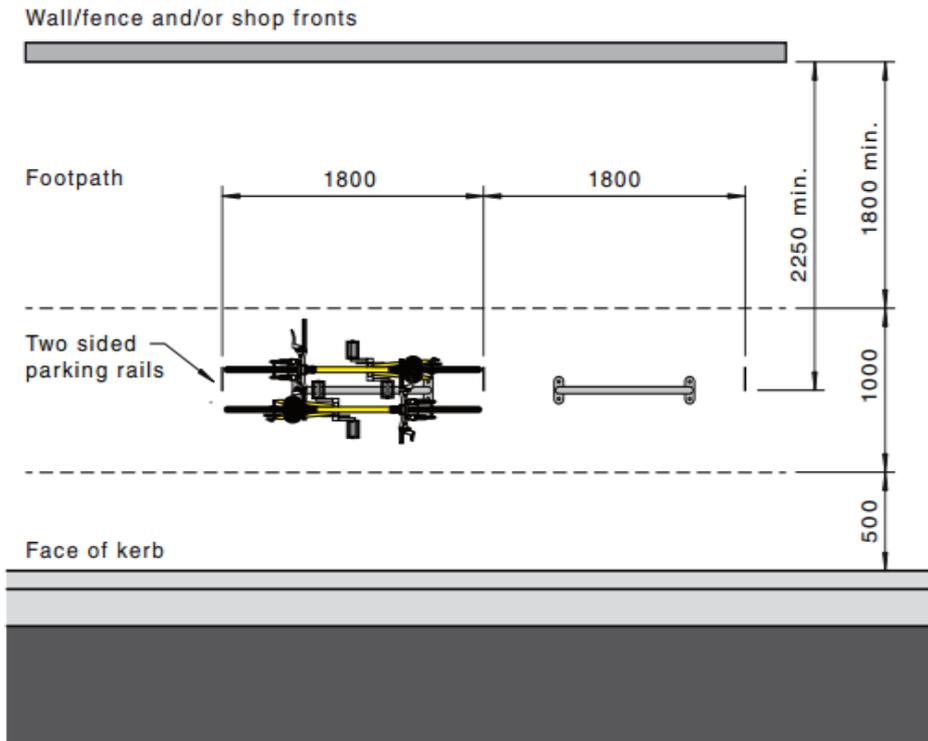
- enable wheels and frame to be locked to the device without damaging the bicycle
- be of a horizontal type of bicycle parking device
- be placed in view of staff, customers and/or passers-by
- be located away from, and potentially physically separated from, pedestrian paths
- ensure there is sufficient available width for the adjacent pedestrian traffic volumes
- be easily accessible from the adjacent bicycle facilities and not damage or be obstructed by parked cars
- be clear of manoeuvring vehicles and opening car doors
- be as close to the users' ultimate destination
- be well lit throughout the day and night
- be protected from the weather (rain, wind and sun)
- be attractive and consistent with the surrounding streetscape
- be appropriately signed, both at and on approach to the parking facilities (wayfinding)
- be well maintained, and kept free from graffiti and vandalism: considering of the required reoccurring costs of maintenance should be included in relevant budgets.

In terms of examples of suitable on-street bicycle parking layouts, reference is made to AS2890.3:2015, which indicates recommended minimum parallel and angled arrangements, as reproduced in Figure A 1 and Figure A 2 respectively.

Most notably, the recommended parking layouts indicate that bicycle parking devices mounted parallel to the kerb should be located approximately 1.0m from the kerb line. This is sufficient to place the devices outside the car door opening areas, but additional width should be provided to ensure that a bicycle locked to the kerb side of the device remains clear of an open car door. Alternatively, bicycles could be prevented from parking on the road-side of the device.

Where no kerbside parking exists, parking devices should be located at least 600mm from the face of kerb in low speed environments (60km/h or less), and at least 1.0m in higher speed environments (>60km/h). Again, ideally consideration is given to what off-set a locked bicycle to the device will have to moving vehicles.

Figure A 3: Parallel On-Street Bicycle Parking Layout

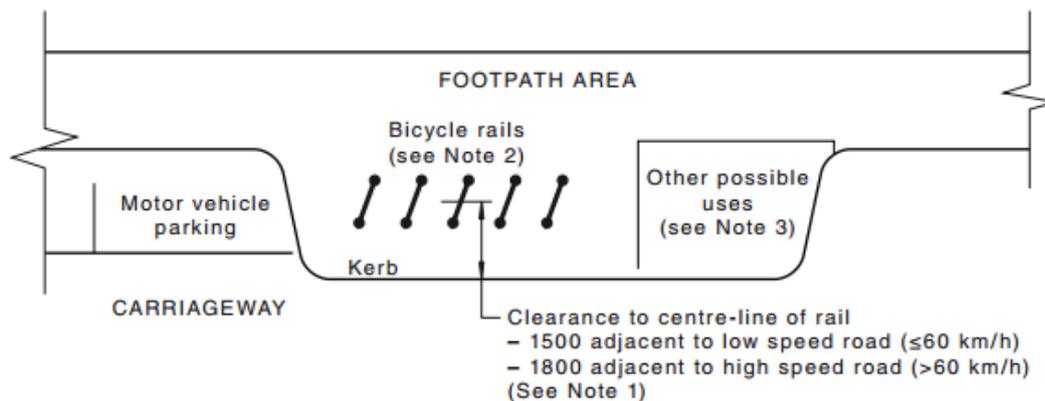


Notes:

- 1 The Figure shows recommended clearances for parallel to kerb parking. Bicycle spacing envelope placement closer to the kerb than the 500 mm recommended should carry a warning that they are for single-sided use only and should be considered carefully and audited by an accredited road safety auditor.
- 2 Bicycle parking adjacent to roads where the speed limit is greater than 60km/h should be protected by a pedestrian barrier.
- 3 Clearance from a parked bicycle to the wall should be a minimum of 1800mm.

Source: Figure 2.3 of AS 2890.3:2015

Figure A 4: Angled On-Street Bicycle Parking Layout



Notes:

- 1 Clearances are based on minimum requirements specified in Clause 2.5.1 of AS 2890.3:2015, plus an allowance for the length or width of a bicycle.
- 2 For spacing of rails, see Clause 2.2 of AS 2890.3:2015.
- 3 Other possible uses include pedestrian crossing approach and landscaping.

Source: Figure B4 of AS 2890.3:2015

A.5.2 Off-Street

Access

Access to off-street bicycle parking facilities should be as direct as possible from connecting bicycle facilities and minimise the need to mix with other vehicles and pedestrians accessing and within the off-street parking facilities.

Bicycle parking design guides indicate riders should be able to ride within 30m of the bicycle parking facilities (CROW 2007), so off-road bicycle path width and grades should be applied over these lengths, such as those outlined in *Cycling Aspects of Austroads Guides* (Austroads 2014).

AS 2890.3:2015 recommends bicycle path widths of 1.5m for one-way and 2.5m for two-way bicycle access ways to off-street parking facilities. Determining when a one-way or two-way access way is required is dependent on the length of the access way and the number of bicycle parking spaces it is servicing. As with off-street car parking, a reasonable guide is that a one-way cycle access way is sufficient for up to 30m in length and/or 30 bicycle parking spaces. Bicycle parking facilities with longer access ways and/or more bicycle parking spaces should provide an access way that is suitable for two-way bicycle movements.

Gradients along bicycle access ways are also critical. AS 2890.3:2015 recommends grades of no steeper than 1:12, except over short distances (i.e. typical ramp between car parking levels). Also, at access control points, such as swipe card readers, a grade no steeper than 1:20 should be provided, so that riders can operate the access control comfortably while astride their bicycle.

Layout

Off-street bicycle parking facilities should be designed in accordance with the relevant planning standards, codes and policies acting in the associated jurisdiction. It is also noted that there are many off-street bicycle parking devices on the market. However, they should also satisfy the following general requirements:

- enable wheels and frame to be locked to the device without damaging the bicycle
- ensure that 20% of the bicycle parking racks in any facility are ground (horizontal) racks for those not strong enough to lift their bicycles into vertical racks.
- provide racks that are spaced so that at least the typical bicycle dimensions of 1200mm high, 1800mm long and 600mm wide is accommodated. However, reductions in the width and length can be achieved where the handlebars and wheels are off-set, as indicated in Figure 2.2, Figure B5 and Figure B7 in AS 2890.3:2015
- be placed in view of staff, security and/or passers-by, or be well lit with CCTV cameras
- be easily accessible and not damaged or be obstructed by parked cars
- be clear of manoeuvring vehicles and opening car doors
- be well lit throughout the day and night
- be protected from the weather (rain, wind and sun)
- be attractive and consistent with the surrounding streetscape
- be appropriately signed, both at and on approach to the parking facilities (wayfinding)
- be well maintained, and kept free from graffiti and vandalism: consideration of the required reoccurring costs of maintenance should be included in relevant budgets.
- be as close to the users' ultimate destination, with supporting end-of-trip facilities located and sequenced so that users arrive, park, shower and change on their ingress movement, and in reverse as they egress. This should accommodate people who shower and change, as well as those who don't, as illustrated in Figure A 3 and Figure A 4.

Figure A 5: Example workflow for arriving at work

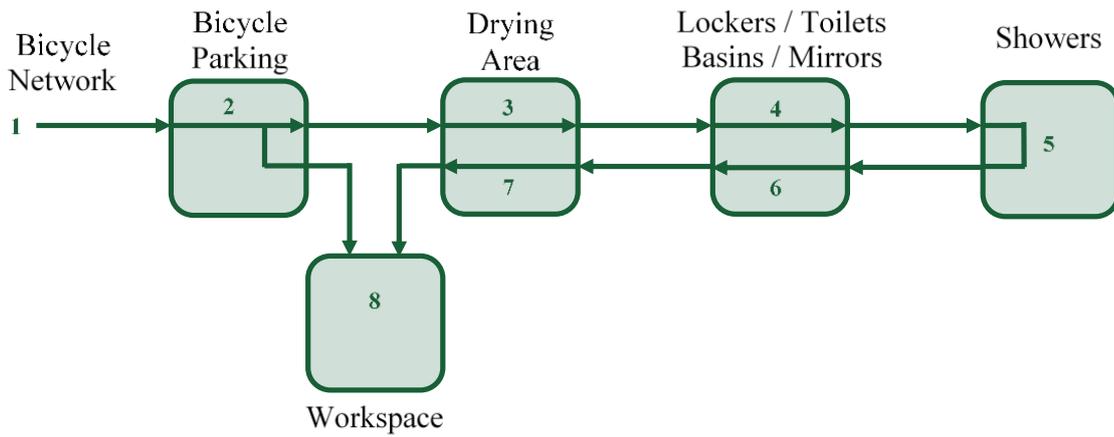
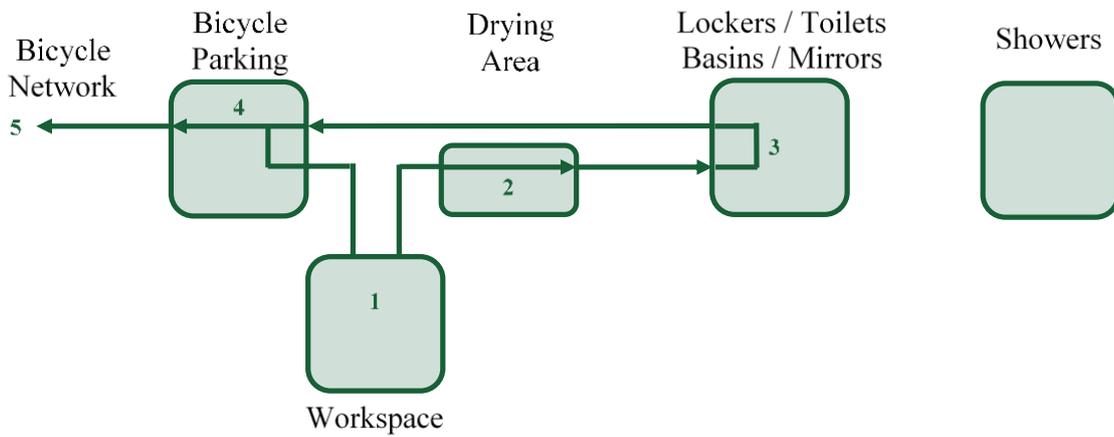


Figure A 6: Example workflow for leaving work





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