Design Manual
NR/GN/CIV/200/11

Parking & Mobility at Stations

Image 0.1
Hamburg Mobility Hub and
Switch MaaS app

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Disclaimer

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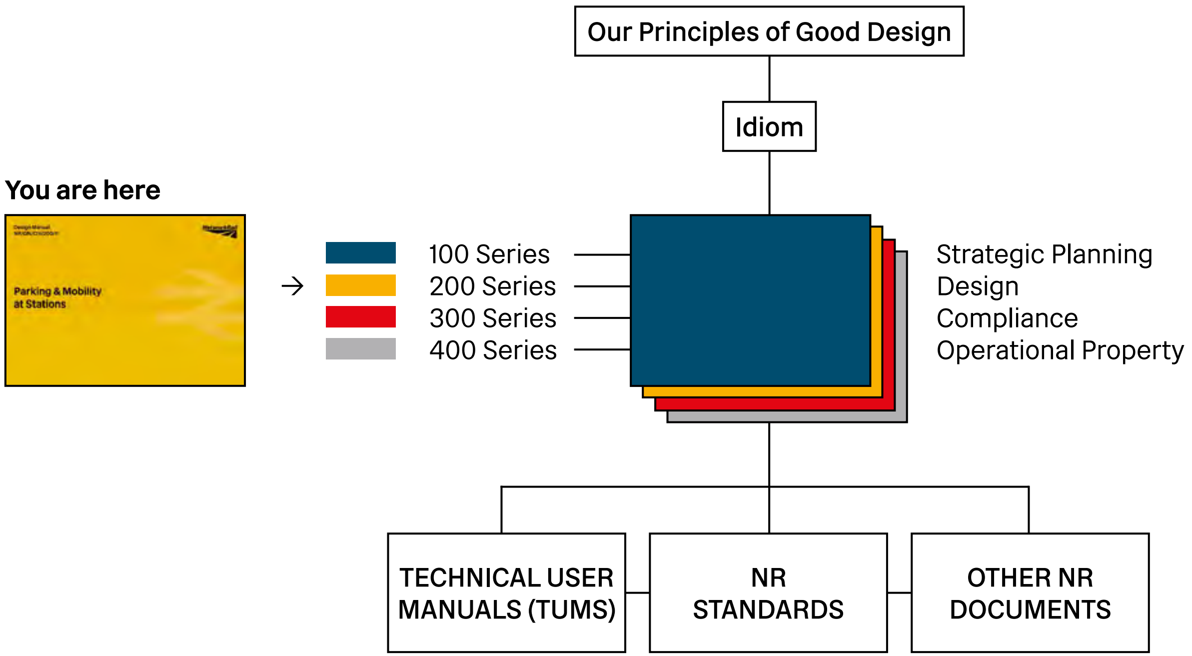
Parking & Mobility at Stations

The Parking & Mobility at Stations Design Manual provides guidance for parking and mobility planning at stations and establishes Network Rail's vision for the future integration and use of emerging technologies and new mobility services.

How to use the guidance

The Network Rail Document Suite



References to other documents

- Code of Practice Guidance
- National Standard
- Network Rail document
- European Standard

Example:

Standards Reference

Technical Specification for Interoperability: Accessibility for Persons with Reduced Mobility (2014)
TSI PRM

Design of an accessible and inclusive built environment — Code of Practice (2018)
BS 8300

This guidance has a Network Rail standards Green status, and the contents do not require a variation order.

A full list of relevant documents, and other guidance suite documents is contained in the appendices.

Image 0.2
Utrecht Central Station Bike Park
for 12,500 bikes

Contents

Parking & Mobility at Stations

Introduction

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1.1 Introduction

1.1.1 Purpose

The Parking and Mobility at Stations Design Manual has been prepared in anticipation of changes to how people will access railway stations over the coming decade. It presents good practice in the design of station parking and mobility facilities to inform the development of new schemes and for upgrades to existing Network Rail sites in order to achieve maximum customer satisfaction.

The remit for this document is an ambitious one, looking to provide guidance for parking and mobility planning and design in and around stations that will still be relevant by the end of the current decade when sales of new diesel and petrol vehicles are due to be banned in the UK.

The guidance is written to inform current projects and it looks to the future, to innovations and trends that could influence parking facility design. It should be considered as a living document to be reviewed and updated as the need arises.

1.1.2 Scope

The Parking and Mobility at Stations Design Manual provides guidance for parking and mobility planning in and around stations establishing the vision for the future integration and use of emerging mobility technologies and services.

The guidance is based on best practice, benchmarking, available published advice and research, and standards and specifications where they currently exist. The guidance refers to a range of Network Rail and external standards that can help users with their projects.

The intended audience for the Parking and Mobility at Stations Design Manual are project design and delivery teams including:

→ Asset owner-maintainer

→ Contractors/project delivery

→ Designers and architects

→ Local Authorities

→ Developers

→ Engineers

→ Project managers

→ Project sponsors

→ Network Rail Property

→ ACOPOA

→ Station managers/ Stations team

→ Public and private transport operators and service providers

→ Funders

→ Others involved in designing car parks and mobility planning in and around stations for Network Rail

Passengers and the General Public should also be encouraged to access this document and share its ambitions.

1.1.3 Relationship of this document to other Network Rail design guidance

The Network Rail Design Guidance is a suite of documents that interconnect and relate to each other. The Parking and Mobility at Stations Design Manual overlaps with several other Network Rail guidance documents. The Station Design Guidance and Masterplanning at Stations as part of the 100 series (blue) will often come before or inform a project initially before the 200 (gold) series is considered.

Other guidance documents in the 200 series provide additional guidance for specific topics such as Public Realm, Third Party Funded Railway Car Parks and Station Facilities & Amenities. This guidance signposts the other relevant documents where appropriate. Documents in the 300 series (red) provide additional information.

1.1.2 How the guidance has been developed

The guidance has been developed and informed by a comprehensive evidence review of historic and emerging Network Rail guidance, design guidance created for other infrastructure bodies and Local and National Government design guidance examples (a full list can be found in Appendix B). While this guidance provides information relevant to inform current projects, it also looks to the future, to new mobility innovations and trends.

Figure 1.1
Relationship of the Parking and Mobility at Stations Design Guide to other Network Rail Guidance Documents

1.2 Guiding principles

1.2.1 Network Rail principles of good design

Network Rail's commitment to good design is captured in the 'Our Principles of Good Design' document. This sets out the ten key principles shown on the right.

This guidance follows these principles and processes and links these to six design considerations that should steer the design process for railway station parking and mobility facilities.

The six design considerations are described in **Section 3.1**.

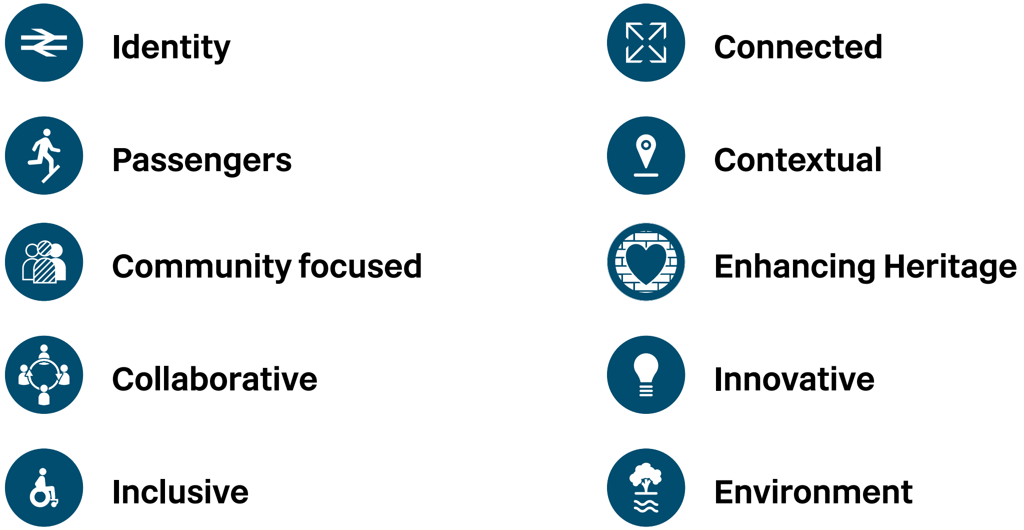

Figure 1.2
Network Rail principles of good design

NR Guidance Suite Reference

Our Principles of Good Design
Network Rail

Image 1.1 HEAT (Hamburg Electric Autonomous Transportation) autonomous, accessible minibus

2

Parking and Mobility

Mobility Trends

2.0.1 Transport and travel trends

Peoples' travel patterns, preferences and behaviours are changing with this transformation expected to continue over the coming decade accelerated by advances in technology that have potential to improve transport and mobility services, reduce costs, and revolutionise business models.

The drivers of these transformations can broadly be categorised within the following themes: demographic and social, economic, environmental, political and technological. These drivers of change are not mutually exclusive: they are working both independently and together to transform the rail sector and life more generally.

There has also been a slow decline in commuting over the last twenty years or so with potential explanations for this including (aside from working from home) employees working fewer days a week, an increase in employment without a usual place of work, and an increase in part time work. People who work flexible hours or work on a freelance basis, make nearly a quarter fewer commuting trips than those working regular office hours, confirming that changes in working patterns is at least one of the explanations for the observed fall in commuting travel.

The COVID-19 pandemic resulted in much greater numbers of people adopting such agile working practices with many employees transitioning to home working. However, despite the impact of the pandemic, the UK Transport Vision 2050 predicts an increase in the use of most travel modes alongside a push for travel reduction and a trend towards alternative forms of mobility.

Travel mode shifts are expected with walking and cycling predicted to grow along with the use of electric bicycles. In its 'Gear Change' vision for cycling, the Department for Transport states that it would like to see half of all journeys in towns and cities being cycled or walked by 2030. The Government also supports the cycle rail fund - created to improve cycle facilities at railway stations (see Section 3.2 for more information on provision for cycling and walking).

The DfT's Future of Mobility: Urban Strategy, identifies the following six key changes driven by the trends:

- **Automation**: autonomy could make road vehicles smarter, create opportunities for new services such as last-mile delivery by drone and deliver fully autonomous urban transport
- **Cleaner transport**: the move to net zero by 2050 will require a complete shift from fossil fuels to sustainably produced electricity, hydrogen and other alternatives
- **New business models**: advances in technology and new government policies could transform business models and lead to bundling of services, better use of resources and customisation
- **New transport modes**: emergence of new mobility modes and services
- **Data & Connectivity**: improved communicators and data connectivity could create opportunities for greater efficiency, new services for travellers, and new business products and amenities
- **Changing attitudes**: rise of the shared economy and changing travel needs accelerated by the COVID-19 pandemic

2.0.2 New mobility trends

New mobility technologies and services are disrupting the transport sector at a faster pace than ever, with their rapid adoption changing the ways people and goods move around our cities and towns. Navigating these changes effectively will maximise the potential benefits of safer, more efficient and more personalised services and minimise risks such as increased congestion and inequality.

The UK Government's "The Future of Mobility" report assesses the whole transport system and how it could change up to 2040 driven by the implications of current trends. It builds four plausible future worlds to help decision makers think about the future. This is complemented by the government's "Future of mobility: urban strategy" report which sets out its approach to working with innovators, companies, local authorities and other stakeholders to realise the benefits of new urban mobility technologies.

Provision of parking and mobility facilities is linked to broader patterns of mobility depending on how people and goods move around - and those patterns are being transformed with the rise of emerging services and technologies and the resulting changes to user behaviours and needs. At the same time, parking facility providers have an opportunity to significantly improve the customer experience and gain understanding of how facilities are being used, potentially enabling smarter use of space. For example, use of cameras and sensors can offer real-time space availability and updates on maintenance needs supporting more efficient operations.

Several of these new mobility trends, powered by or influenced by emerging technologies and services, have applications across both passenger and freight transport and could impact the design of and access to, railway station parking and mobility facilities.

Section 2 of the Parking & Mobility at Stations guideline provides an overview of the following existing and emerging services and technologies and their expected impact on mobility and parking in stations:

- Shared mobility
- Mobility Hubs
- Mobility as a Service (MaaS)
- Smart Parking Systems
- Kerbside Management
- Electric Vehicle Infrastructure
- CAVs and Autonomous Valet Parking
- Freight and Logistics
- Advanced Aerial Mobility

It is acknowledged that mobility technologies are constantly evolving and this manual represents the latest development as of March 2022

Each of these services/technologies is supported by case studies in Appendix A.

References and Resources

Transport Vision 2050: investing in the future of mobility
UK Research and Innovation
Future of mobility: urban strategy
Department for Transport
Gear Change: A bold vision for cycling and walking
Department for Transport

Image 2.1
Shared Micromobility
(UK e-scooter trial)

2.1.1 Shared mobility

Shared mobility refers to transport services shared amongst users. It includes shared vehicle services such as bike share and car clubs, and shared rides such as lift share or on demand transport such as Digital Demand Responsive Transport (DDRT). Shared mobility services offer a range of flexible, on-demand services that complement existing public transport and taxis.

This section is focused on relatively new and evolving shared mobility services including:

- → Shared micromobility (shared bike/e-bike and e-scooter)
- → DDRT
- → 2+ car share/lift share
- → Car clubs

Provision of shared mobility requires partnership working with private operators of shared services, such as bike share (including e-bikes), e-scooter share (subject to legalisation), DDRT and car clubs services.

Growth of shared mobility services is expected to reduce the demand for private car access to railway stations and the quantity of car parking required.

2.1.2 Shared micromobility

Shared micromobility is broadly defined as shared access to bikes/e-bikes, scooters, e-scooters or other light/low-speed modes. It is anticipated that a variety of new vehicle types and designs will emerge in the future. In their shared form, micromobility schemes have brought flexibility, choice and more sustainable travel options to people in many cities, but not without challenges regarding use of public space, engagement with city authorities and concerns regarding safety.

There are various operational shared micromobility models including: self-service on-street vehicles either with or without docking stations; railways station hubs; loans; folding bike lockers; workplace pool bikes; and peer to peer sharing. Operational models and spatial requirements are described in Section 3 of this guideline.

Bike share has been shown to facilitate the use of public transport by offering a last mile solution, with the CoMoUK Bike Share User Survey 2019 reporting that 35% respondents use bike share in conjunction with the train.

E-scooters are low speed two-wheeled vehicles powered by a small electric motor, designed for a single standing rider. Shared e-scooters schemes have been widely adopted in different countries including in Europe, North America, Latin America, Asia.

Current UK regulations were introduced prior to the development and introduction of e-scooters and do not allow for the use of e-scooters on either the road or pavement. E-scooters fall within the legal definition of a 'motor vehicle' and must conform to the same laws. The Road Traffic Act 1988 sets out the legal definition of a 'motor vehicle'.

In 2019 the UK Government announced the biggest regulatory review in a generation to explore regulation around new transport modes including e-scooters in the 'Future of Mobility: Urban Strategy' policy paper. As part of this review the DfT is undertaking a consultation for evidence on micromobility vehicles including e-scooters.

To support a 'green' restart of local travel and help mitigate reduced public transport capacity, DfT has launched trials of shared e-scooters in various locations in the UK. During the trials, e-scooters will continue to be classed as motor vehicles, meaning requirements to have insurance and the correct type of driving licence will continue to apply. In the future, following the trials, DfT may look to amend the law to treat e-scooters more like electrically assisted pedal cycles (e-bikes), which are not treated as 'motor vehicles' in law.

At the time of writing, there have been reported incidents of private e-scooters catching fires. TfL's review found that incidents with e-scooters had been caused by "defective lithium-ion batteries which ruptured without warning" and "led to fires that caused toxic smoke to be released". As a result, TfL banned e-scooters from all London public transport pending further review.

Bike/e-bike rental/hire at rail stations offers a last mile travel mode. Bikes are usually accessed via staff, for example as part of a community bike hire scheme. Some offer back-to-base hires while others can be returned to different locations, in both cases the pricing model encourages full day hire.

Image 2.2 Loch Ness Community Transport Hub

Image 2.3 Shared micromobility on-street parking bay, London

2.1.3 Digital demand responsive transport (DDRT)

Traditional Demand Responsive Services (DRT) such as door-to-door and dial-a-ride schemes have been available in the UK since 1960s, typically focusing on a specific user group such as the elderly or people with mobility impairments. The development of digital booking and scheduling platforms accessible via smartphones has enabled DRT to evolve into Digital Demand Responsive Transport, offering on-demand services to the general public.

DDRT is a user-oriented form of transport characterised by flexible routes and smaller vehicles, with routes and/or schedules that respond to user demand, rather than using a fixed route or timetable. DDRT operations are determined by the requirements of its users. Typically, this involves users booking a service through a mobile app or online, with the system dynamically planning the optimal routing to pick-up users and take them to their required destinations. DDRT offers the flexibility and convenience of a taxi with the cost-effective, shared characteristics of a bus.

DDRT trials and pilots are underway. These include services operating as alternatives to fixed routes during off-peak hours; on-demand services for remote neighbourhoods; or as a replacement for under performing fixed routes. Some have been successfully implemented e.g. Via in Milton Keynes, while others ceased operations for various reasons, e.g. Citymapper Ride in London, Ford Chariot worldwide and Slide in Bristol. Insights gained from these trials demonstrate that every location is unique, and that DDRT services have to be designed to serve the specific needs of a local area.

The principal DDRT design considerations include:

→ Designated pick-up and drop-off space should be provided for DDRT services, clearly visible from and in close proximity to the station entrance/ exit and marked for the use of DDRT services

→ In rural and semi-urban areas with infrequent bus services, pick-up and drop-off areas for DDRT could be shared with traditional buses (in agreement with the local authority and bus operators)

→ Bay design should include sufficient space to accommodate wheelchair ramps

→ Service and operator information should be displayed in the context of other available public and private transport modes

→ Digital integration with other modes such as rail, traditional buses and other shared mobility modes should be provided, e.g. through MaaS

Image 2.4 Via Van DDRT Service, Milton Keynes

2.1.4 2+ car share and lift share

2+ car share is also known as lift share, carpool and 2+ ride share. Services involve sharing trips offered by drivers in their private vehicles. People share rides formally through established digital platforms, or informally through networks in neighbourhoods, communities and workplaces. Such collaborative tools and networks make it easier for passengers to find the appropriate rides and for the driver to not only share, but also increase the number of riders they can pick-up and drop-off in their vehicles along the route of that trip. Apps typically offer cost sharing for fuel and may be integrated with smart parking systems (see Section 2.1) to provide users with verified access to priority parking space allocation.

Principal 2+ car share design considerations include:

- → Prioritised designated 2+ car share bays should be located close to station entrances/exits
- → Bays should be visible and clearly marked
- → Use of bays should be enforced and linked with smart parking systems
- → Prioritised car share bays should be considered at stations with high levels of commuter parking
- → At stations with limited parking, priority should be given to space for sustainable transport modes over private cars

Image 2.5
2+ Car Share Parking Bay

2.1.5 Car clubs

A car club refers to vehicles that can be accessed and used by multiple people at different times, facilitated by a self-service booking system. A car club is distinct to 2+ car sharing or lift share which relates to the use of a single private vehicle by multiple people travelling together.

The principle of car clubs is simple: individuals use shared vehicles on an as-needed basis and gain the benefits of access to a range of conveniently located vehicles without the costs and constraints of ownership. By doing so, the shared vehicles can be utilised by multiple users for multiple trips. Car clubs differ from car rental as vehicles are booked through self-service apps, are located close to where people live or work and are available for any time and duration – including short periods of use. Car club users tend to use public transport more frequently with 22% of car club members using rail once a week, compared with 8% of the general population. There are various car club business models including:

- **Traditional or back-to-base**: customers collect and return a vehicle to the same dedicated parking space (on- or off-street)
- **One-way**: customers can pick up a vehicle at one location within a pre-defined zone and drop it off at a different location within the same zone using approved parking spaces (often resident permit or pay and display bays)
- **Peer-to-peer**: allows people with underused vehicles or small businesses to offer vehicles for rent

The different models are closely bound with geographic context and target market. The most common car clubs currently available at stations are the traditional or back-to-base model.

The types of vehicles offered by car clubs vary, with the majority offering a diverse fleet, ranging from urban to light commercial vehicles. Companies are starting to incorporate electric vehicles and it is expected that car clubs will eventually become fully electric.

Car club design considerations include:

- Designated parking bays for car club vehicles should be located in station car parks where demand is anticipated from users and operators
- Locate car club bays in areas with good visibility and where possible, integrated with Mobility Hubs to increase car club awareness
- Increase car club visibility through signage and marking of car club vehicle parking areas to act as an advert for the club and contribute to its success
- Provide CCTV coverage of bays, integrated with wider station security systems
- Include the official DfT 'Car club permit holders only' logo on signage alongside information and contact details of the car club operator
- Provide line markings with the wording "Car club vehicles only" or "Car club only" to the outer edge of the bay and consider use of a distinguishing surface colour in the bay
- Provide clearly signed electric vehicle charging infrastructure at designated bays for EV car clubs
- Provide for effective enforcement of parking rules

Image 2.6
Marked Enterprise Car Club bay with operator details
Image 2.7: (inset) official DfT signage

Image 2.8
Jelbi Mobility Hub, Berlin

2.2.1 Mobility Hubs

Mobility Hubs are identifiable, safe and accessible spaces where public, shared and active travel modes are co-located alongside improvements to public realm and enhanced community facilities where relevant.

The key characteristics that define a place as a Mobility Hub are:

→ **Co-location** of public and shared mobility modes

→ The **redesign of places** to reduce private car space and improve the surrounding public realm

→ **Signage** that identifies the place as mobility hub and ideally provides digital travel information

Image 2.9 from the CoMoUK Mobility Hub Guidance illustrates some of the most commonly used Mobility Hub components.

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Components of mobility hubs

A1: Mobility components: Public Transport

A2: Mobility components: Non - public transport

B: Mobility related components

C: Non-mobility & Urban realm improvement

C: NON-MOBILITY & URBAN REALM IMPROVEMENT

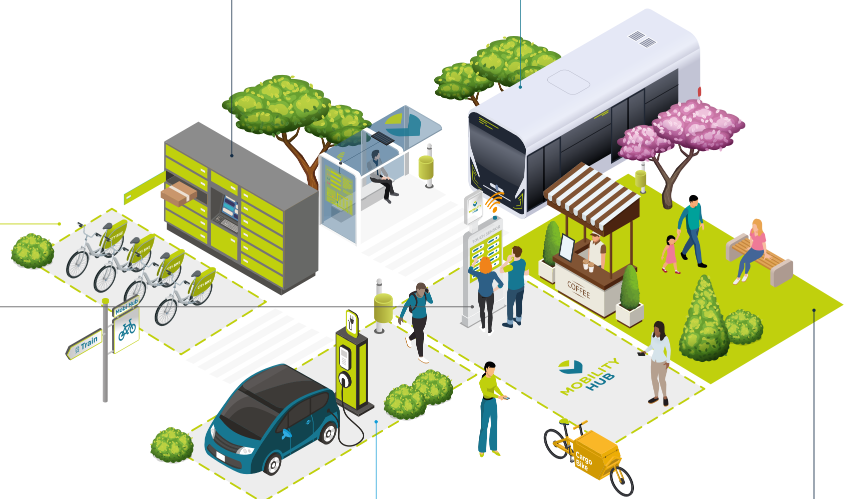
- Package delivery lockers
- Mini fitness or play area
- Café and Co-working space
- Outdoor water fountain

A1: MOBILITY COMPONENTS - PUBLIC TRANSPORT MODES & OTHER PICK UP /DROP OFF:

- Bus
- Tram
- Rail
- Demand responsive mini-buses (all one points)
- Ride hailing, (shared) taxis

A2: MOBILITY COMPONENT: SHARED MOBILITY

- Car share: back to base, one way, electric.
- Bike share: back to base, one way, electric.
- Cargo bike share, cargo bike logistics store
- Other future micro-mobility options e.g. e-scooters, moped share
- Ride sharing



Branded pillar

Mobility hubs require a prominent sign or pillar with a common brand to make them visible to the public. The inclusion of a digital elements in a pillar can provide:

- Access to a local transport website for information on services
- A journey planning service for multi-modal trips
- A way finding option for local walking and cycling trips
- Registration and ticketing
- Customer services.

B: MOBILITY RELATED COMPONENTS

- EV car charging
- Bike parking, (Standard, covered, restricted access, EV charging)
- Bike repair, pumps
- Digital pillar, (transport info, ticketing, way finding, walk distances, local services
- Child car seats, bike seats & trailers
- Community concierge parcel last mile delivery

C: NON-MOBILITY & URBAN REALM IMPROVEMENT

- Improved public realm, safer crossings, step free access, road repairs, adjustments for disabilities.
- Waiting area space, covered, seating, planting, artwork, kiosks for coffee etc.
- Wi-Fi, phone charging

Image 2.9
Potential mobility hub components from CoMoUK's Mobility Hub Guidelines

2.2.2 Benefits of Mobility Hubs

Mobility Hubs bring a range of benefits including:

- Supporting modal shift from private cars contributing to reduced congestion and carbon emissions and improved air quality
- Encouraging multi-modal trips and improving connectivity between different transport modes including public and shared transport
- Improving access for poorly connected, disadvantaged communities to health services and employment
- Raising the profile and visibility of the range of shared and sustainable travel modes enabling more sustainable travel and behaviour change
- Creating a new community focal point by converting land currently dominated by private parking to green space, recreational facilities, waiting areas and additional facilities
- Managing "street clutter" from free floating micro-mobility bike share or e-scooter services, and providing a home for EV charge points

CoMoUK has developed Mobility Hub assessment criteria and provides formal accreditation to a bronze, silver or gold standard.

2.2.3 Mobility Hub planning

Mobility Hubs vary in size and components, with each hub tailored to local needs and mobility objectives. For example, a city centre railway station hub may include physical space for public transport, on-demand services and bike share, whereas a hub in a local transport interchange may provide for fewer vehicles but support access to more flexible, local travel options such as micromobility.

The type of a Mobility Hub in any given environment, should consider type of space, local geographic and demographic factors, current and future demand for hub services and exiting facilities/transport modes in the area.

When planning Mobility Hubs the following elements should be considered:

- **Mobility Hub components:** Mobility Hubs components should be selected based on the local context, mobility needs and challenges
- **Spatial context:** Mobility Hubs should be spatially organised to encourage visibility and access to the available services with easy transfer between modes and connections to surrounding destinations
- **Visibility and accessibility:** Mobility Hubs should be visible and easily accessible by all user types
- **Flexibility and scalability:** Mobility Hubs should be modular to accommodate future growth and new services/components embracing and encouraging innovation
- **Safety**: Mobility Hubs should become a safe place for everybody encouraging the use of available services and facilities
- **Community appeal:** Mobility Hub design should contribute to an improved sense of place and a quality public realm
- **Branding and signage:** Mobility Hubs should have clear branding and provide information for ease of use
- **Digital integration:** Mobility Hubs are digital enablers of MaaS and offer a practical opportunity to pilot MaaS applications (see Section 2.6)

2.2.4 Mobility Hubs at railways stations

Mobility Hubs can be added to existing stations or included in the design of new stations. For example, the Swiss Federal Railways announced plans to transform their railway stations into Mobility Hubs. In the UK, various local authorities are planning to implement Mobility Hubs with one implemented in 2021 by London Borough of Redbridge and another launched by BP in London.

2.2.5 Mobility Hub deployment

Mobility Hub planning and implementation typically follows a four stage process.

Stage 1 Planning	Feasibility, scoping and business case development Governance arrangements Funding application
Stage 2 Initiation	Procurement (if required) Design development Stakeholder engagement
Stage 3 Implementation	Procurement Construction and installation works Marketing and promotion
Stage 4 Operations	Operations and maintenance Data collection and analysis Monitoring and evaluation

Table 2.1 Mobility hub implementation process

The principal factors influencing Mobility Hub planning and deployment in urban, suburban and rural locations are described in the following examples.

Mobility Hubs at urban stations

Location: Berlin, Germany

Services: moped share, shared e-scooters, bike share, information pillar, car club, EV charging, public transport.

Mobility Hubs at stations in urban areas would ideally offer the widest range of services and facilities including shared mobility parking bays (bikes, e-bikes, e-cargo bikes, e-scooters), cycle parking, car club bay, with infrastructure integrated within the station environment.

The hub would support use of sustainable transport modes over private car, taxis and PHVs.

Space may be limited with priority given to sustainable, efficient modes supporting first / last mile trips.

Image 2.10 Jelbi stations developed by BVG, Berlin

Mobility Hubs at suburban/local stations

Location: to be confirmed, West Midlands, UK

Services: e-scooter share, bike share, enterprise kiosk, digital pillar, parklet with planting and seating, DDRT, public transport.

Mobility Hubs at suburban or local stations offer commuting links including first / last mile connectivity with a focus on shared micromobility.

Opportunity to include car club vehicles should be considered if space allows.

Relatively small and constrained footprint.

Image 2.11 TfWM Mobility Hub prototype in the West Midlands, UK

Mobility Hubs at rural/semi-rural stations

Location: Bremen, Germany

Services: public transport, walk and cycle infrastructure, 2+ car share, car club, information pillar.

Focus on services linking residents in surrounding settlements to a railway station.

Prioritised 2+ car share parking bays.

Secure cycle parking and parcel lockers.

Modest offer of shared low impact mobility based on the user numbers, e.g. a car club run by the local community to raise awareness and stimulate behaviour change.

Potential to provide co-working spaces for local community.

Image 2.12 Mobil.punkt Mobility Hub, Bremen, Germany

2.2.6 Stakeholder engagement

The success of Mobility Hubs requires significant involvement of key stakeholders at all phases, from planning through to implementation and evaluation, primarily in helping to identify suitable locations and to confirm that services are customised to the needs of users.

This is necessary to balance the areas of greatest demand (to have the greatest potential for commercial success) with those with the greatest need (where public subsidy is likely to be necessary).

Planning of Mobility Hubs should be incorporated into local, regional and national land use policies to confirm space can be allocated, incorporated within Local Transport Plans and be considered as a core component of Station Travel Plans (see Section 3.1).

NR Guidance Suite Reference

Environment and Social Minimum Requirements
NR/L2/ENV/015
Diversity Impact Assessments (DIAs)

References and Resources

Mobility Hubs Guidance
Mobility Hubs Toolkit
CoMoUK
Guidance on the Implementation of Station Travel Plans
RDG / Rail Safety and Standards Board (RSSB)

Image 2.13
MaaS multimodal travel platform

2.3 Mobility as a Service (MaaS)

2.3.1 Mobility as a Service (MaaS)

As an emerging concept, there are many competing definitions and claims about how best to deliver MaaS as a component of the new mobility market.

The MaaS Alliance defines MaaS as the integration of transportation services into a single mobility service, that is accessible on-demand. The MaaS Lab defines MaaS as: "a user-centric, intelligent mobility management and distribution system, in which an integrator brings together offerings of multiple mobility service providers and provides end-users access to them through a digital interface, allowing them to seamlessly plan and pay for mobility" .

The key functions commonly agreed as components of MaaS include the following:

→ Integrated booking, payment and journey planner functions that allow users to purchase tickets with payment options ranging from daily and monthly passes to Pay-As-You-Go (PAYG) and subscription-based services offering mobility fare bundles

→ Provision of real-time information and live service and journey plan updates from transport and service operators.

→ Organisation and consolidation of ticketing information across a range of journey types

→ A user-centred service catering for individual preferences, travel habits and mobility needs, e.g. wheelchair access

→ Incorporation of mobility incentives that nudge users towards certain mode or route choices with the purpose of spreading peak congestion and reducing reliance on a particular mode, e.g. active travel incentives focused on user uptake of the most sustainable modes of travel – cycling and walking – for health and environmental benefits

2.3.2 Implications on stations access and parking

→ Reciprocal agreements between railway operators and MaaS operators and platforms should be established to facilitate data sharing on parking and rail use to support a seamless passenger experience

→ Parking and railway operators should also receive the data from MaaS operators

→ MaaS could support multimodal journeys and last mile travel from railway stations through digital integration of services and operators in one platform

Image 2.14
Yumuv MaaS app, by Swiss Federal Railways.
See Case Study in Appendix A

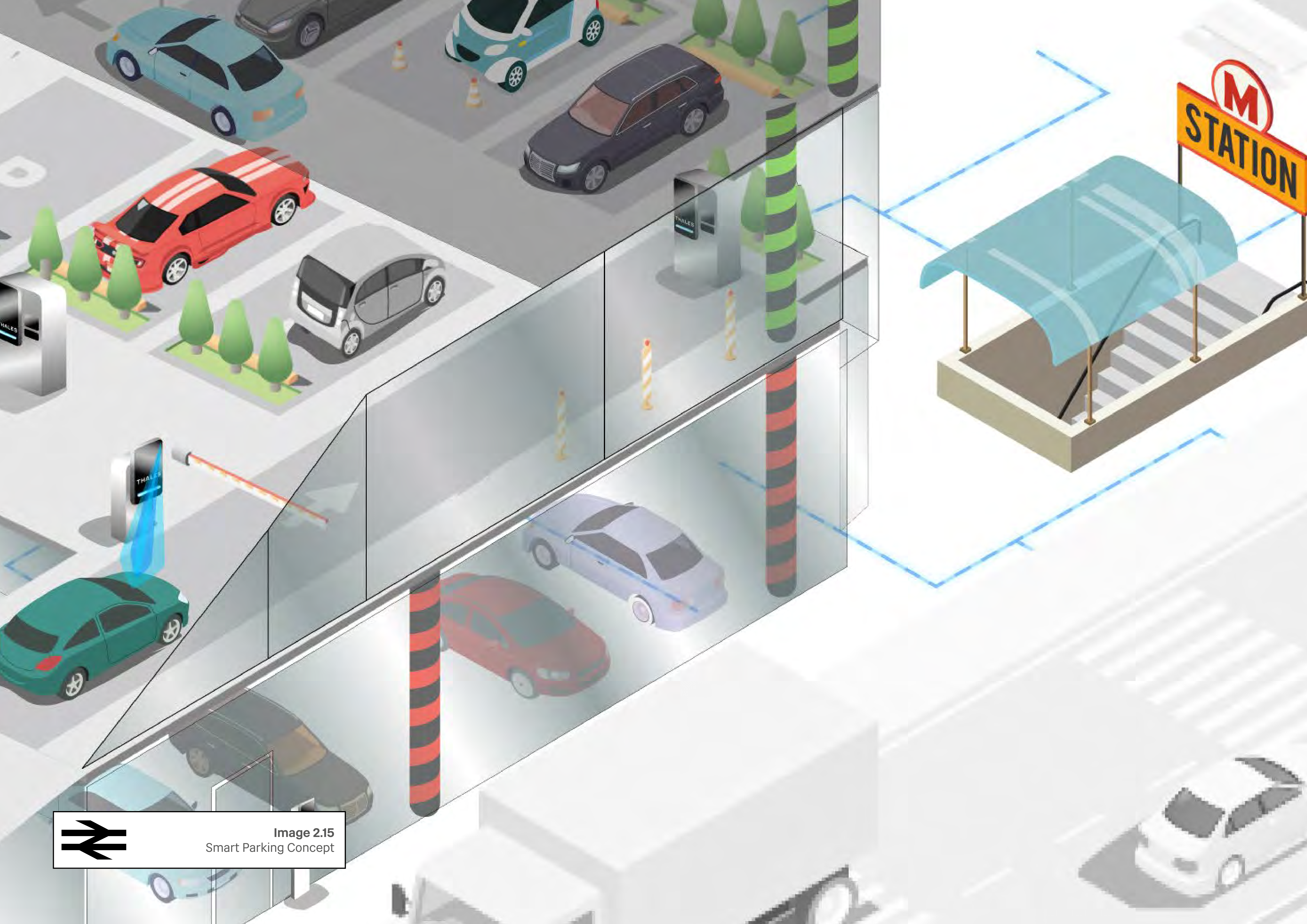


Image 2.15
Smart Parking Concept

2.4 Smart Parking Systems

2.4.1 Smart parking systems

Smart parking systems include Internet of Things (IoT) platforms and/or cloud-based systems that utilise sensors/cameras and detection technology for provision of real-time data on parking availability.

They combine a variety of technologies, most typically Automatic Number Plate Recognition (ANPR) at car park entrances and sensors located in car and/or cycle parking bays to provide real time data and information about usage. Sensors are linked with data systems to provide locations of available parking spaces to facility users. Sensor types range from in-ground and surface-mount to overhead indicator vehicle detection with some companies installing sensors on lampposts or, alternatively, buildings. The use of these sensors is likely to continue to grow, specifically in urban areas where parking space is limited.

Smart parking technologies allow customers to book available spaces for a designated time period and, in some cases, can identify free spaces on nearby streets or other parking facilities in the area. Data on bookings and empty spaces can be displayed via on-street signage to advise on space availability. For parking facility operators, ANPR and sensors can supply valuable information on length of stay and occupancy, allowing for better understanding and management of useage. Smart parking also supports more effective enforcement.

2.4.2 Smart cycle parking systems

In the places of high demand, smart cycle parking systems can be introduced to monitor cycle hubs occupancy and improve user experience. For example, the Hague Central Station in the Netherlands has a capacity of almost 8000 bikes with a detection system operational in the bicycle parking facility close to the station. Utrecht Cycle Hub also utilises sensors and detection system with a smart phone app available to users. In the UK, the London Borough of Waltham Forest, has installed sensors in their cycle hubs to provide real-time data on capacity, which is reported live to users (see case study in Appendix A).

The detection system generally works with optical sensors which are mounted on the ceiling, wall or on a mast when the system is used outdoors. Signposts and green/red LED lighting indicate free spots to cyclists. The optical sensors can be supported by software that analyses occupancy of the bicycle racks.

2.4.2 Implications for station parking

Ease and efficiency of parking significantly influences a commuter's journey choice, especially for time critical journeys. Smart parking technologies allow customers to find or book a parking space in advance, adding peace of mind and saving time finding a space in the station parking facility.

Monitoring of parking operations provides accurate data on demand and use and can inform decisions on future redevelopment or optimisation and the changing demands for accommodating electric vehicles, shared vehicles, cycling and micromobility.

Data share and security

To facilitate effective parking facility management, operators should confirm that all the parking data from smart parking systems on Network Rail land is made available to existing parking platforms, journey planners and MaaS platforms. The data should be stored securely in accordance with GDPR requirements.

The data collected should comply with the Alliance for Parking Data Standards (APDS) specifications (Future ISO TS 5206-1) so that the data can be exported simply and easily from parking facility systems and made available to customers in real time.

Digital payments

Smart parking systems can remove the need for traditional payment methods for users, leading to a more efficient parking experience. Adoption of MaaS technology (see Section 2.6), will open the opportunity for users to reserve and pay for their parking and rail ticket though a single mobile app, with the app directing users to a reserved bay at the station parking facility.

Enforcement
Sensors in parking spaces alongside cameras and other equipment could enable the identification of vehicle or cycles that have parked and not paid, allowing on-site staff to efficiently enforce fines and reduce lost revenues. Smart Parking systems could also confirm that only those with the proper permit can book Blue Badge bays, allowing operators to issue fines for those who park incorrectly.

New technologies
Enhanced sensor technology is currently in development and will improve the capture of parking occupancy data. For example, in Berlin, Siemens is trialling a new radar-based system where a single street light mounted sensor can monitor up to six spaces.

The principal design considerations related to Smart Parking Systems are:

- Smart parking systems are made up of interchangeable components that can fully integrate parking, guidance, payment and analytics providing ease of access for customer payments and minimising the need for payment systems at the point of parking
- Project sponsors should consider the latest models/technologies offered on the market alongside improved sensor locations, e.g. in-ground vs on lamp columns
- Sensors and cameras should be robust, weather-proof and vandal-proof
- Where placed outdoors, sensors/detectors should be installed to minimise any risk of functionality being impeded by weather conditions, and/or damage caused when cars move over them
- Smart parking systems should be integrated with digital signage systems to allow for advance information on-street and better direction of users within parking facilities

Image 2.16
Smart parking sensors installed at Longbridge Station

2.5 Kerbside Management

2.5.1 Kerbside management

Sensor technology creates the opportunity for more efficient management of kerb space, as well as pricing, that is actively responsive to real-time demand. Kerbside management is a strategic and holistic approach for an effective use of a part of the street and road space. It includes management of space adjacent to the kerb according to time of day and demand of different uses or users.

Kerbside management relies on the implementation of smart parking technologies such as sensors, cameras or detections systems, and allows for flexible use of street and road space, adapting to changing demand and functional need by day/hour and facilitating peak hour traffic. Dynamic pricing throughout the day can be used to optimise kerbside operations and access to and from stations.

Kerbside management technology can encourage parking during off-peak hours and support initiatives such as Low Emission Zones (LEZs) and road user charging. It can also allow for centralised management of shared micromobility parking zones, Digital Demand Responsive Transport and CAVs, in future balancing provision of kerb space for different vehicle types with the aim of managing kerbside congestion.

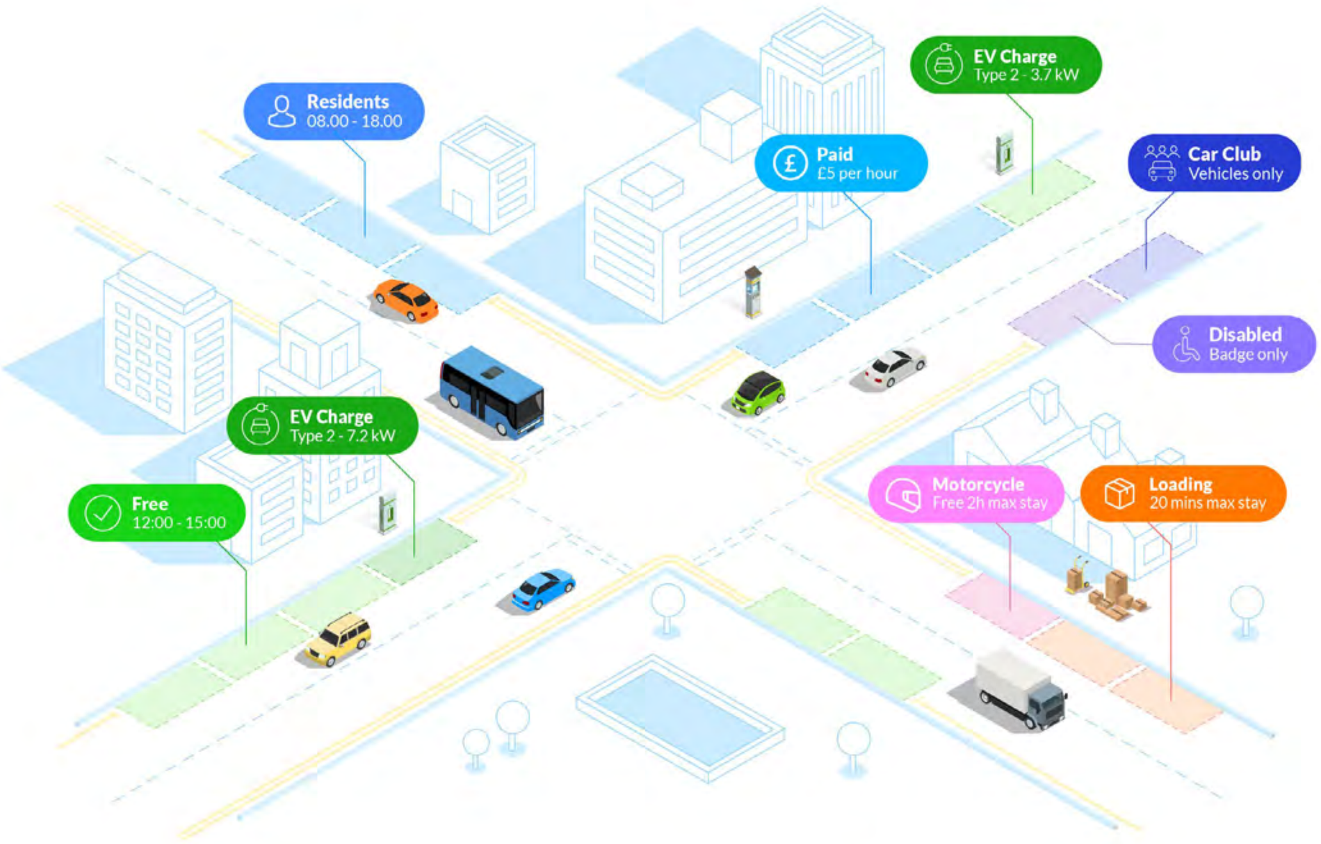


Image 2.17
Illustrated application of kerbside management showing dynamic, timed use of bays for multiple user types

Effectively designed and implemented kerbside management requires consideration of multiple use cases including, but not limited to, the following:

- Footpath users (pedestrians, wheelchair users)
- Loading and unloading zones for deliveries and servicing
- Public transport stops and interchanges
- Parking:
  - cars (including EVs and CAVs in future)
  - shared micromobility
  - motorcycles
- Kiss & Ride zones
- Taxi ranks
- Pick up and drop off zones:
  - PHVs
  - DRT
- Mobility Hubs

2.5.2 Implications for station parking

Kerb space around the station will increasingly require management, particularly where available space is limited, e.g. in urban areas to facilitate convenient access to the station for passengers via multiple transport modes and seamless access for freight and/or goods while maintaining a safe environment. For example, in Dublin, a flexible use of kerb space was trialled by a courier firm UPS working with Dublin City Council: parking bays were converted into a 'mini distribution centre', where a large UPS van drops off parcels every morning which are then transferred to cargo bikes for delivery to the city centre.

Station asset owners/operators should review opportunities to manage demand for the surrounding kerb space including automated charging, dynamic space designation, micro transactions for ultra-short-stay parking (such as taxis and private hire vehicles); and dynamic pricing for short-stay parking, in collaboration with local authorities.

With the vehicle fleet transitioning to CAVs and shared vehicles, kerbside management could enable flexible use of space for stations located in urban environments, including defined pick-up/drop-off zones in areas surrounding stations and rapid and efficient enforcement of unauthorised use of bays.

When designing flexible kerb space, the following factors should be considered:

- Establish local access priorities to guide decisions on space allocation for different users/uses
- Allocate road and kerb space in accordance with agreed user priorities promoting active and sustainable transport modes over private car use - kerb space hierarchies can help guide the allocation of parking and drop-off space
- Acknowledge that the balance of user needs varies by time of day, day of week and/or season, with flexibility in design and management that enables variation of space allocation over time
- Improve public realm and liveability through design to provide a safe environment for all users, considering accessibility and emergency access
- Use traditional and digital signage to indicate space availability and changing use cases during the day, e.g. parking permissions, vehicle types
- Provide clear and visible marking of the kerb and road space, confirming that digital signs and road markings are correctly operating and are fully visible at all times
- Gradually reallocate existing on-street parking space to high priority users, starting with trials of temporary facilities such as parklets or micromobility bays
- Integrate with digital apps to enable booking and payment for kerb side use
- Make data on provision and availability of kerb space available to MaaS operators, station managers and other data aggregators

2.6 Electric Vehicle Charging Infrastructure

2.6.1 Electric vehicle charging infrastructure

The UK EV market is growing rapidly: between 2019-2020 it experienced a growth of 66% in EV registrations with over 300,000 pure-electric cars on the UK roads at the end of May 2021. The key drivers for buying an EV in the UK are the cheaper running costs, tax reduction and reduction of carbon emissions. The key barriers for buying an EV in the UK include range concerns, purchase price and access to and availability of the charging infrastructure.

The Transport Decarbonisation Plan set the Government's approach to decarbonising the UK's highest-emitting sectors covering all domestic forms of transport including road, rail, shipping, and flights. The plan features headline commitments to ban the sale of new diesel and petrol heavy goods vehicles (HGVs) and buses and for the government's own fleet of cars and vans to transition to electric vehicles (EVs) by 2027 instead of 2030. The Government pledged to move 25% of its car fleet to ultra-low emissions by December 2022 as an interim step.

There are several types of charging for electric vehicles, each requiring different hardware, infrastructure, and adaptor types. Charging can be split into three main categories of power output: rapid (including ultra-rapid), fast and slow (not recommended for commercial installations, such as at railway stations). In the UK Type 2 is the dominant standard connector type for fast and slow charging. Type 1 is slowly being phased out, and most owners of a Type 1 car carry charging leads that are Type 1 to Type 2 compatible. CCS and CHAdeMo are the two main standards for rapid charging.

Induction/Wireless charging
Induction/Wireless charging removes the need for a connecting cable. The system relies on resonant magnetic induction to transfer energy between a pad on the ground to another pad positioned on the underfloor of the vehicle. At present, the majority of induction charging systems are static as opposed to dynamic (in-motion) and are best suited for defined fleet applications due to the need for pad locations (on vehicle and/or road surface) to be tailored specifically to meet the vehicle models in operation. To date, a number of pilots across Europe (including a trial in Nottingham railway station taxi rank) are underway with taxi and bus fleets. A summary of EV charger types is presented in Table 2.2.

Chargepoint speed	Chargepoint Power	Current	Amps	Connector Type	Typical Usage Location	Charging time	
						40kWh Battery (Nissan LEAF)	90kWh Battery (I-PACE)
Slow	3.7 kW	230v AC	13-16A single phase	Type 1 or 2	Home On-street	14 hrs	30 hrs
Fast	7kW	230v AC	32A single phase	Type 1 or 2	Home On-street Destination	6 hrs	13 hrs
	11-22kW	AC	32A three-phase	Type 1 or 2	Home Destination	6 hrs	13 hrs
Rapid	50kW	400-500vDC	100-125A	CCS or CHAdeMO	Destination Journey Charging / Motorway Service Areas	40 mins [i]	90mins [ii]
Ultra-Rapid	150kW	150-920v DC		CCS or CHAdeMO	Journey Charging / Motorway Service Areas	40mins [iii]	45mins [iv]
	350kW	150-920v DC	500A	CCS	Journey Charging / Motorway Service Areas	N/A	45mins

The notes below relate to the time it takes to charge the vehicles battery capacity from 0-80% (charge rate drops off beyond 80% when DC charging).
i Based upon 0-80%
ii Based upon 0-80%
iii Based upon 0-80% at 100kW – restricted by capability of vehicle
iv Based upon 0-80% at 100kW – restricted by vehicle capability

Table 2.2
EV charger types

References and Resources

Network Rail EV charging infrastructure report
Mitie Energy

2.6.2 Provision

The current Network Rail's commitment to the Secretary of State for Transport is to achieve 10% provision of EV charging stations at existing railways station car parks. However it should be noted that an update in 2022 to the Building Regulations (PART 9B Infrastructure for the charging of electric vehicles) requires that 10% of spaces should have electric vehicle charge points and that cable routes should be provided for 20% of the remaining parking spaces.

The number of EV chargers should be determined by the current and future energy demand. Station car park projects should include passive provision to enable additional EV spaces to be implemented more quickly and cost effectively. In new car parks, enabling infrastructure such as feeder pillars, switches, earth electrodes and concealed ducting for charger cable runs, should be installed in a minimum of one fifth of the total number of remaining parking spaces. This provides the flexibility to increase provision quickly as required and reduce long-term costs and engineering work as demand grows.

Demand for EV charging spaces is not linear. It will not be necessary to electrify whole car parks. An EV driver has a far greater choice on how they get energy into their vehicle (including at home) than an internal combustion engine driver who can only go to a petrol station. Increased vehicle range and battery capacity will also play a role in a user's need and choice to charge at a railway station car park.

User type	Requirements
Long stay railway station car park users	Charging speed is not especially important, as long as vehicles can receive enough charge before their driver returns. Recommendation that minimum speed provided is 22kW
Destination / Journey charging	Many railway stations are close to other traffic generators. The station operator may take measures to discourage non-railway users from parking at the station. However, if spare parking capacity is available EV charging could provide an alternative revenue stream for the station. If other destinations struggle to facilitate demand for EV charging, railway stations could help to meet that demand with fast/rapid chargers provided at station car parks.
Taxis and private hire	For taxis, it is beneficial to have rapid charging infrastructure close to the key transport hubs (for example, at Gateway stations - See Section 4). Rapid charging infrastructure is most useful when installed as part of a hub with six or more charge points in the same place.
Drop off/pick up and short stay/kiss & ride (private vehicles)	As with the other short stay groups, some access to rapid charging could be useful, but this will depend on many local factors including the size of the station catchment area and may therefore be difficult to quantify.
Buses	Potential for buses to charge at station but would require separate infrastructure and likely to require a high powered (350kW+) pantograph system. Potential bus charging developments should be discussed with relevant highway authority and/or bus operating companies early in planning.
Car clubs	Car clubs would benefit from having dedicated charging bays at the station.

Table 2.3
User types and EV charging requirements

Source: Electric Vehicles: Future-proofing Railway Station Car Parks, Catapult report What is the Future for Public EV Charging points at Railway Stations? (catapult.org.uk)

Holders of blue badges and users of mobility scooters and powered wheelchairs will also require EV charging infrastructure. Due to the relatively small number of disabled bays available, all should have access to EV chargers. Given the existing spatial requirements for disabled bays, these may only require minimal adjustment to accommodate charging stations.

2.6.3 Speed of charging

The specification of the charging station required will depend on the identified user that will be accessing the station on a regular basis. The minimum charging speed required in station car parks is 7kW. However, to support future flexibility and ongoing improvements in vehicle charging speeds, installation of 22kW AC charging stations is

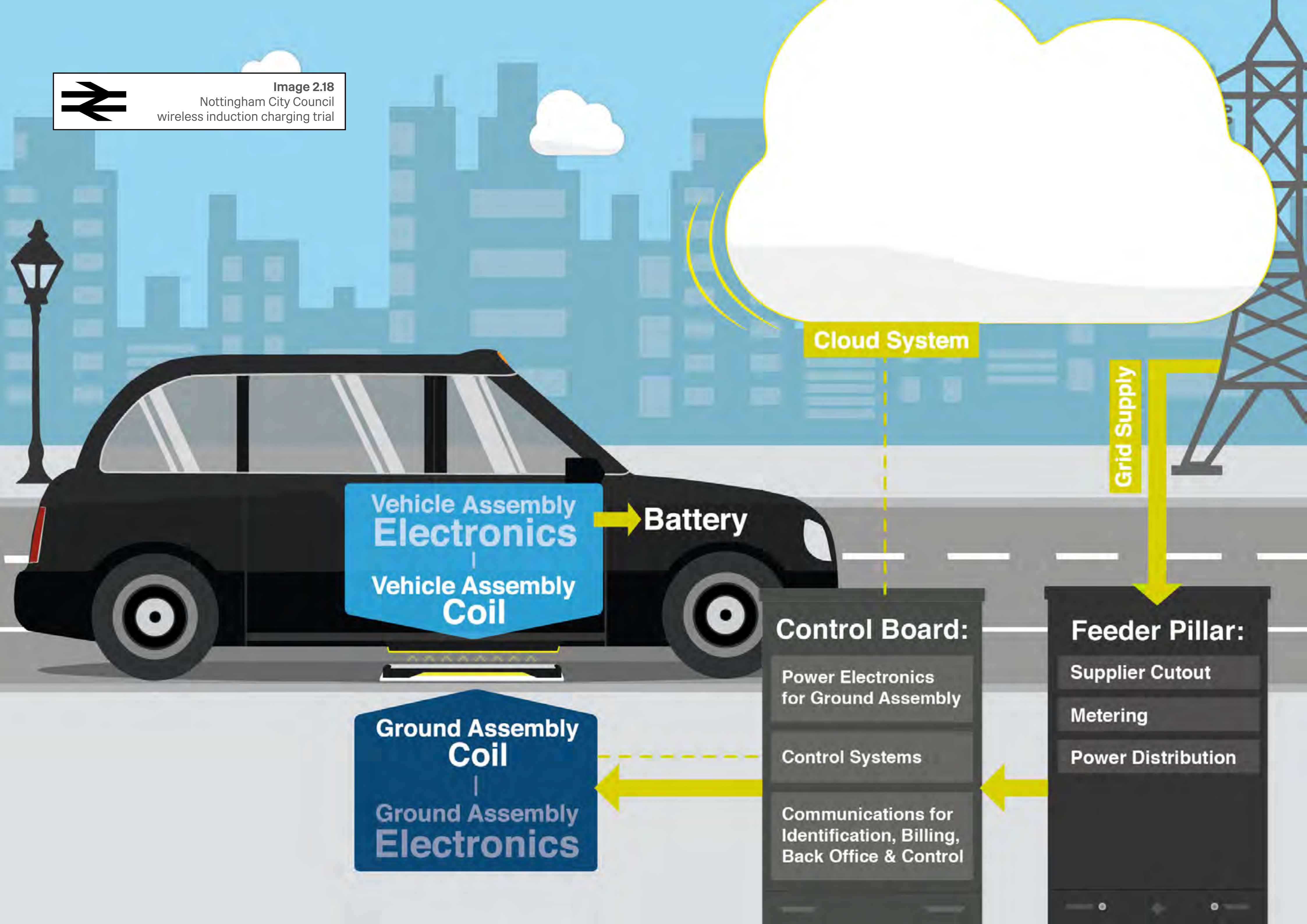


Image 2.18
Nottingham City Council wireless induction charging trial

recommended to offer the flexibility to future proof provision and manage the power loads between multiple charging vehicles (average AC charging speed 7-11kW, with some premiums Original Equipment Manufacturers (OEMs) already offering 22kW).

As most station car parks tend to be long-term stays, fast (22kW) chargers could serve the majority of users. However, some locations such as Parkway stations, taking advantage of their location often in close proximity to highways and motorways, could also include rapid charging stations to provide EV drivers with a quick charge to continue their journey and stations located in urban areas could provide rapid chargers for taxis and private hire vehicles. A summary of user types/ charger requirements is presented in Table 2.3.

2.6.4 Grid capacity

Many existing Network Rail parking facilities are unlikely to have the grid capacity necessary to support additional EV charging infrastructure. A new connection or grid reinforcement actions would therefore be required if insufficient power is available at the intended charger point installation location.

Planning in advance is key - if a transformer needs to be upgraded it may be better to oversize it at the specification stage as the costs are not linear, i.e. a double sized transformer may not be twice the price.

Use of on-site battery storage should also be considered (sized by additional capacity required and space permitting) to support the availability of power from the grid. Power can be drawn from the grid off-peak and stored for usage at peak times or times of high demand. Coupled with on-site renewables, such as solar panels, a site battery could become a valuable building asset Battery storage systems can also support multiple services in addition to price arbitrage such as ancillary services, network services (i.e. deferring reinforcement costs to the electrical network) and providing renewable back up or emergency supply.

2.6.5 Load management

Load management combined with smart charging is often deployed in large scale installations. Its purpose is to control and distribute the available power between the active chargers on site. The system can reduce or increase charge (balance the load and vehicle demand requirements) to the vehicles at different points in the day to enable all vehicles to get the charge they need during the term of their stay.

Load management for railway station car parks should be considered as a minimum, and a smart charging system utilised on all potential developments as it provides greater flexibility and the potential to reduce infrastructure costs, e.g. 22kW supply shared between 2 and 4 chargers using load management.

2.6.6 Chargepoint software considerations

Open Charge Point Protocol (OCPP)
OCPP is considered as the standard for charging infrastructure interoperability among most charging equipment manufacturers, charging operators, software and systems providers. The communication protocol provides flexibility for infrastructure operators to be Electric Vehicle Supply Equipment (EVSE) agnostic and is a proven way to improve cost and minimize the risk of infrastructure investments becoming stranded. In an emerging market sector, where the market is still developing, this flexibility is both advantageous to the end consumer and also to the operator in the event of a supplier ceasing to trade.

ISO 15118
ISO 15118 – is an international standard for bi-directional digital communications between electric vehicles and the charging station. ISO 15118 defines a Vehicle to Grid (V2G) communication interface for bi-directional charging/discharging of electric vehicles. Often referred to as “Plug and Charge” the technology is considered a key enabler in simplifying the process allowing EV drivers the ability to simply plug the chargepoint into the car, charge the vehicle and then drive away when finished. Full payment and process to enable the charge is certified between the vehicle and the chargepoint management system. ISO 15118 is also the communication protocol used in distributing the available power

and shifting charging loads and adjusting energy consumption in support of providing an optimal response to demand from the system or network.

2.6.7 Potential business models for operations

Offering EV charging can generate a small amount of revenue for the car park owner. This depends on the cost to charge but also how it is administered. It is not usual for long stay charging to be free of charge with the user just paying the car parking fee. In the event that charging price is not included, the cost to charge will need to be competitive in order for the user to consider it.

Revenue can also be collected by providing rapid charging services to commercial operators of taxis, PHVs, car clubs and delivery vehicles. Stations such as parkways, which are located in close proximity to highways, could serve as rapid charge hubs for drivers to top up.

Users are paying for convenience and the requirement is driven by a need, so pricing could be more flexible but still competitive. Additional consideration should be given to the potential ancillary services at the station that may benefit from these users such as cafés and retail outlets.

Station car parks that serve the commuter market have the potential to provide vehicle to grid energy transfer, which could provide additional benefits and income to car park operators. However, this technology is still in development and, while it is possible, the majority of vehicles do not yet have the capability to perform bi-directional charging.

Further information on potential models is included in the Network Rail EV charging infrastructure report.

2.6.8 Implications for station parking

The provision and type of EV infrastructure at railway stations needs to be considered for existing and new build car parks. EV charging stations and the enabling infrastructure should be included at the design and planning phase for any new build car parks.

Project sponsors should assess requirements of each station on case-by-case basis considering as a minimum the following factors:

- → Existing and predicted demand for EV charging infrastructure in the area (active versus passive provision)
- → Policies and strategies adopted by a local authority including any planning requirements that need to be met
- → Site suitability
- → Type and amount of charging required – user case analysis

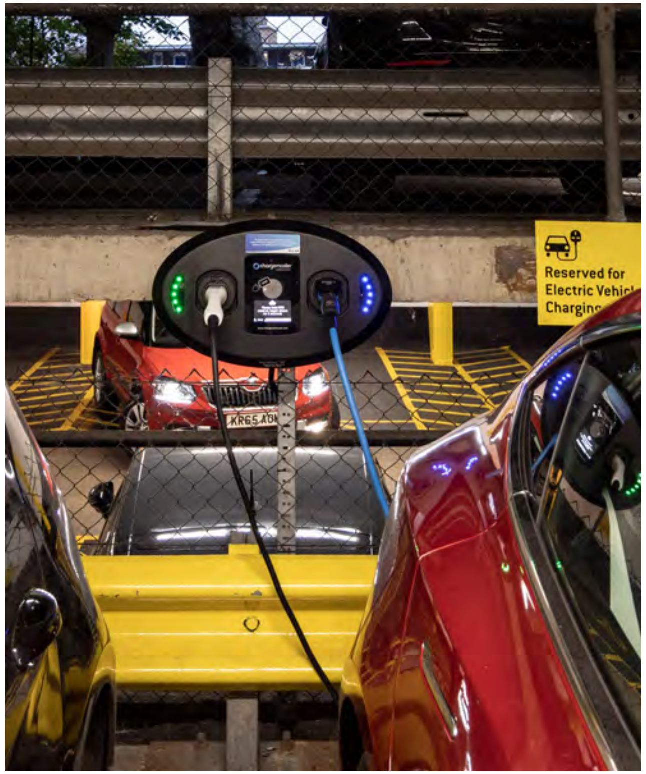


Image 2.19 Wall mounted EV charge point

- → Available grid capacity and additional requirements
- → Required location and layout of charging stations on site (see Section 3.2.12)

Image 2.20
Automated Valet Parking
Trial in Detroit, U.S.

2.7 CAVs and Automated Valet Parking

2.7.1 Connected autonomous vehicles (CAVs)

A Connected Autonomous Vehicle (CAV) uses data collected and received from its sensors and the environment to inform navigational decision making. There are five levels of automation starting from driver assistance (level 1) to full automation (level 5) where no driver attention is needed. Many car manufacturers have set goals to have fully autonomous vehicles operational by the end of the decade, although the scale of operations is currently uncertain.

When combined with the emergence of Mobility as a Service (MaaS), railway stations could become a seamless transfer point as part of a multi-modal journey. A shared CAV service hosted on-site could provide passengers with instant onward transport to any local destination.

2.7.2 Automated valet parking (AVP)

Automated valet parking (AVP) enables a driver to leave their car in a designated drop-off zone at the car park and continue their journey on foot, wheelchair or other mode while the car autonomously finds a parking space, parks and then returns to a designated pick-up location at the owner's request.

AVP is currently being refined in various trials around the world where parking facilities have the required specialised equipment installed.

0 No Automation	1 Driver Assistance	2 Partial Automation	3 Conditional Automation	4 High Automation	5 Full Automation
Zero autonomy; the driver performs all driving tasks.	The vehicle is controlled by the driver, but some driving assist features may be included in the vehicle design.	The vehicle has combined automated functions, such as acceleration and steering, but the driver should remain engaged with the driving task and monitor the environment at all times.	The driver is a necessity, but is not required to monitor the environment. The driver should be ready to take control of the vehicle at all times with notice.	The vehicle is capable of performing all driving functions under certain conditions. The driver may have the option to control the vehicle.	The vehicle is capable of performing all driving functions under all conditions. The driver may have the option to control the vehicle.

Table 2.4 Levels of Automation as designated by the society of automotive engineers.

2.7.3 Implications for station parking

Railway stations are well placed to become a home location for CAV fleets and the ability to assimilate this technology into station environment is likely to become increasingly relevant. CAV implications should be considered in relation to existing car park upgrades and the design of new stations.

The effect of CAVs on parking will depend on the adopted ownership model, public policy and demand:

→ Private CAVs could reduce the number of required parking spaces with vehicles either returning to their home base or being used for trips by other household members

→ Shared CAVs could also reduce the need for parking, however, these services may result in an increased need for holding locations for vehicles that are either not in use, charging or waiting for passengers at peak times. A CAV service may also facilitate more shared rides resulting in a higher-than-average vehicle occupancy

It is likely that a mixture of private and shared CAVs will need to be accommodated, each with various uses and implications for space planning and infrastructure with the need for designated loading and unloading zones. In the future, a railway station car park may hold a fleet of CAVs for public transport.

2.7 CAVs and Autonomous Valet Parking

CAV vehicles and fleets are expected to be fully electric in future and provision for EV charging infrastructure should be included in car park planning (see Sections 2.2 and 3.1.14 for detailed information on EV charging infrastructure).

Initially, there is likely to be a mixed approach where autonomous vehicles operate and park alongside traditional vehicles, so space allocation should be flexible. Existing car park structures can be adapted to accept both kinds of vehicles, and new designs should begin to integrate necessary infrastructure (such as AVP drop-off zones). Additional information on application of AVP could be found in the Third Party Funded Railway Car Parks Design Manual,

While AVP is unlikely to be widespread until at least 2030, manufacturers have promised AVP-ready cars by 2023 and it is anticipated that AVP could become one of the first autonomous technologies more widely available. AVP readiness should therefore be considered for railway station car park upgrades or new station projects.

CAVs have potential to become one of the most accessible forms of transport, able to transport individuals from across demographics, including those with loss of mobility and/or ability to drive themselves.

The following factors should be considered in car park design to support implementation of AVP and CAVs:

- → ISO standards for autonomous parking systems have been drafted that set minimum requirements for AVP facilities. These should be followed where car park operators plan to implement AVP
- → AVP requires a drop-off and pick-up zone close to the parking facility entrance with convenient passenger access to the station
- → Formal pick-up and drop-off zones for CAV fleet / private CAVs will be required close to station entrances
- → Pick-up and drop-off zones should be designed to accommodate vehicles with a larger opening than a traditional car and the ability to kneel or extend a ramp for wheelchair users
- → Dedicated areas for AVP parking could be located furthest from the car park entrance or a dedicated site could be built remote from the station
- → Payment systems should support the use of CAV fleets including pre-booking of a parking space and remote payments (see Section 2.1)
- → 5G connectivity and a digital map of the car park would be required
- → Parking spaces markings, road signs and directional information should be consistent with conventional highway signage
- → Implement kerbside management (see Section 2.4) to manage demand and any potential conflicts

NR Guidance Suite Reference

Third Party Funded Railway Car Parks Design Manual
NR/GN/CIV/200/12

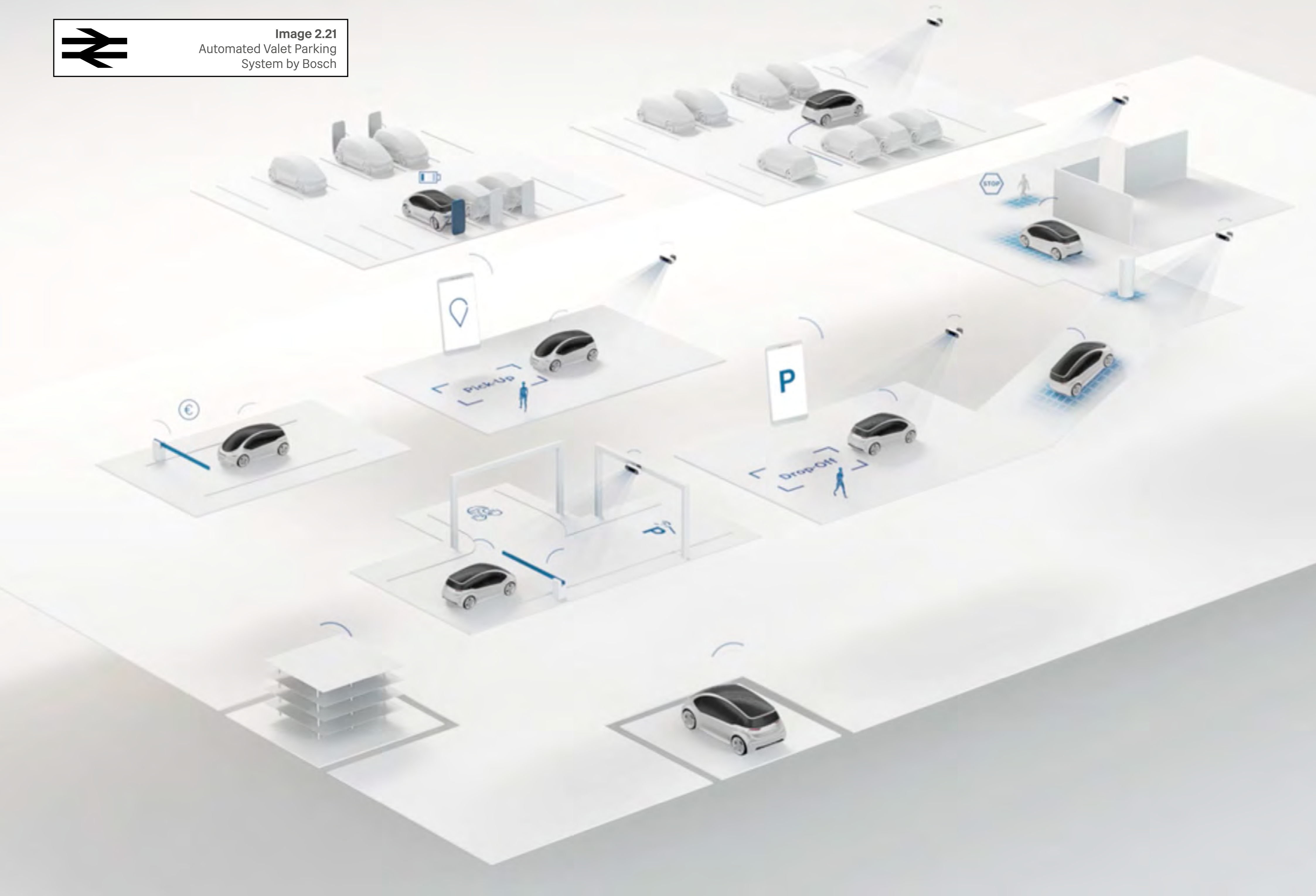


Image 2.21
Automated Valet Parking
System by Bosch

2.8 Freight and Logistics

2.8.1 Freight and logistics

Between 2010 and 2020, the proportion of internet sales (online shopping) as a percentage of total retail sales grew from less than 10% to more than 25% with ONS data from the first quarter of 2021 showing online shopping accounting for 35% of all UK retail spend. This represents a transformation both in the way that we shop, but also in the way that people receive shopping.

The clean and efficient delivery of parcels is an increasing challenge in cities and urban areas. While the initial stage of a delivery to a consumer – typically from a national distribution centre to a regional distribution centre – is a fine-tuned process, the final stage (also known as the 'last mile') – from the intermediate hub to the consumer's address – can be the most complex part of the journey.

2.8.2 Last mile freight

Last mile freight relates to the movement of goods between a distribution hub and destination. Last mile freight involves handling small/medium size goods, transported over short distances using sustainable modes such as: on foot, cycle, cargo cycle or electric / low emission vehicles. Last mile freight usually takes place in urban centres, though examples of operations in suburban and rural areas are evident.

2.8.3 Micro-consolidation and e-cargo

The expansion of e-commerce has contributed to a significant growth in demand for freight in urban areas. This has led to a growth in development of micro-consolidation centres that facilitate responsible last mile deliveries. Micro-consolidation centres typically serve small size areas close to an end delivery point, handle small and lightweight goods and are used for vehicle dispatch for last mile deliveries to consumers in residential and commercial properties. The centres often operate from car parks, basements of large office blocks and shopping centres and can also be used to return goods from consumers to online retailers.

Cycle freight operating from micro-consolidation centres (involving cycles, cargo cycles or electric cycles) can be the fastest, cleanest and most efficient option for transporting goods in cities. These vehicles are zero emission at point of use, quiet and can be ridden on cycle routes which means that the riders can take short cuts through areas restricted for general traffic to gain a competitive advantage.

The biggest challenge to wider implementation of micro-consolidation is the availability of premises that are cost effective and geographically suitable with many logistic centres having relocated from city centres due to high rents and urban redevelopment. Underutilised railway station car parks and other available land/premises can be adapted to operate as micro-consolidation centres facilitating sustainable last-mile freight.

Design considerations for freight and logistics include:

→ Consider development opportunities for micro-consolidation centres at station car parks serving as hubs for last mile deliveries

→ Micro-consolidation centres require access to storage space, efficient mobility connections including onward road networks and cycle routes, and a supply of easily accessible e-mobility charging stations for e-cargo vehicles

→ Consider opportunities to provide parcel lockers at stations

→ Parcel locker locations should be accessible both by users as well as delivery vans/other freight vehicles

→ Provide parcel locker locations with power and communications services and CCTV camera coverage

Image 2.22
E-bike last mile delivery operating from Zedify's Hornsey hub

Image: 2.23
Royal Mail Drone Delivery Pilot

2.9 Advanced Aerial Mobility

2.9.1 Aerial mobility

The Air mobility sector is developing fast with new types of aerial vehicles being tested and operated worldwide including unmanned aerial vehicles and vertical take-off and landing vehicles serving as air taxis and delivering cargo. Vehicles are planned to be powered by renewable and green energy sources and capable of Vertical Take-Off and Landing (VTOL) or Short Take-Off and Landing (STOL). To start with, vehicles will be piloted with plans to gradually move to fully autonomous flights as technology allows.

Innovate UK published its UK Transport Vision 2050 which sets out what the UK transport system may look like in 2050 and outlines the likely steps along the way to achieving this. The vision states that AAM is forecast to be worth US$510 billion by 2040 and there will be 76,000 operational drones by 2030. It highlights that AAM would first be adopted for freight delivery and remote inspections, with passenger-carrying services expected to be adopted by 2030.

2.9.2 Passenger travel by air

The first commercial services are expected to be expensive, however, as the technology becomes more widespread, the price of air travel is expected to decrease.

Aerial vehicles require a dedicated space to land and take off in the form of a vertiport, which could become a part of transport network. Vertiports could be integrated with multi-use facilities serving various transport modes and acting as hubs with renewable energy, data, and public facilities such as waiting and recreational areas. Urban-Air Port was awarded £1.2 million in 2021 through the Future Flight Challenge to develop an airport for autonomous aerial mobility in Coventry.

2.9.3 Cargo deliveries by air

Unmanned aerial vehicles (e.g. drones) have the potential to support last mile deliveries. For example, A trial for delivering NHS medical supplies to the Isle of Wight was funded by the Department for Transport as part of Solent Transport's Future Transport Zone (FTZ). Private sector companies such as Amazon, Alibaba, UPS and DHL are also testing different ways in which drones could fulfil product deliveries (see case studies in Appendix A)

Design considerations for AAM include:

- → Aerial mobility integration with stations would require dedicated space (e.g. vertiport) at or near selected station sites to allow aerial vehicles to take off and land with clear access rules and safety considerations
- → Locations for vertiports should be considered, with Gateway stations (see Section 4: Station scenarios) representing a high level of demand for passenger travel and deliveries, while vertiport at Rural stations could support connectivity with remote areas
- → Integration of vertiports into the station and connectivity with other transport modes should be considered alongside EV infrastructure requirements for vehicle refuelling

Image 2.24
Air One, Urban-Air Port Pilot, West Midlands

References and Resources

Transport Vision 2050: investing in the future of mobility
UK Research and Innovation
Future of mobility: urban strategy
Department for Transport

3

Parking & Mobility

Parking & Mobility Facility Environments

Image 3.1
Network Rail Hub Station

3.1.1 Spatial planning process

This section outlines the spatial planning process in relation to station parking and mobility. The process considers parking and mobility as part of a station specific vision acknowledging the role of the station in relation to its local context.

Station specific vision

Each station will have different needs for parking and mobility, varying by station type (see Section 5: Station scenarios) and site context. Establishing a station specific vision sets overarching principles tailored to specific conditions. Station parking and mobility projects may be standalone initiatives or form part of wider initiatives such as a public realm scheme or station masterplan, which will establish a vision within which parking and mobility should be considered. The vision helps define and steer a project from start to finish and provides a constant reference point. It guides what needs to be achieved for an individual station in terms of spatial planning.

Planning process

The process of spatial planning supports the principles set in the vision. It should be informed by analysis and stakeholder involvement to help define requirements, and then shape the planning and design response. The diagram below illustrates the typical stages of a station parking project.

A review of the local authority development plan and Local Transport Plan is essential as is engaging with the Local Transport Plan (LTP) and CIL development processes to confirm that station access needs and opportunities are considered.

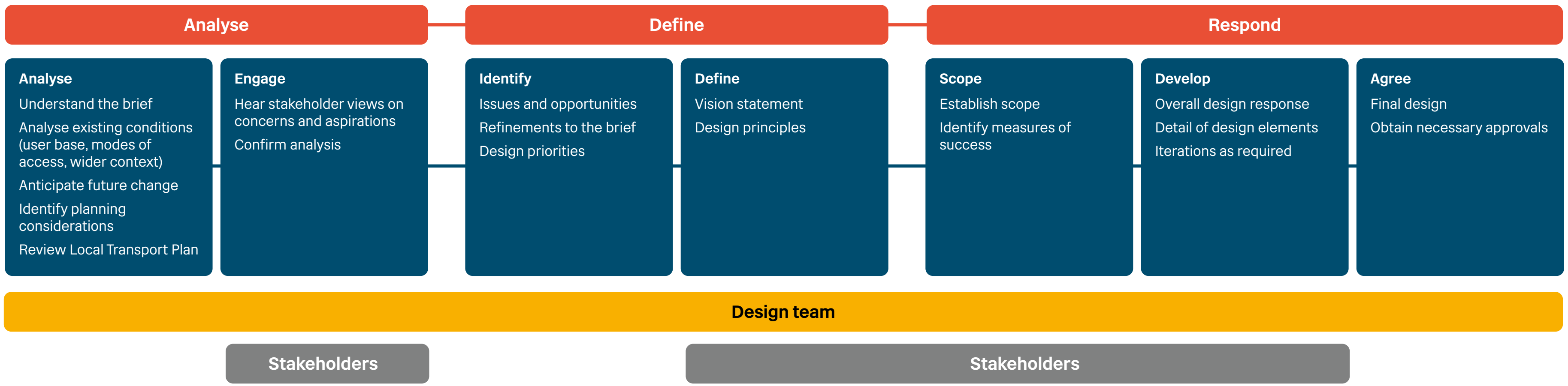


Figure 3.1 Parking and mobility at stations planning process

3.1.2 Design considerations

For parking and mobility at stations, six design considerations have been established that link back to our guiding principles. These considerations should steer the design process in the case of railway station parking and mobility facilities and allow designers to respond to the ways in which mobility may be redefined in a low carbon economy.

These are summarised on the following page with further detail on their application set out in the Public Realm Design Guidance for Stations.

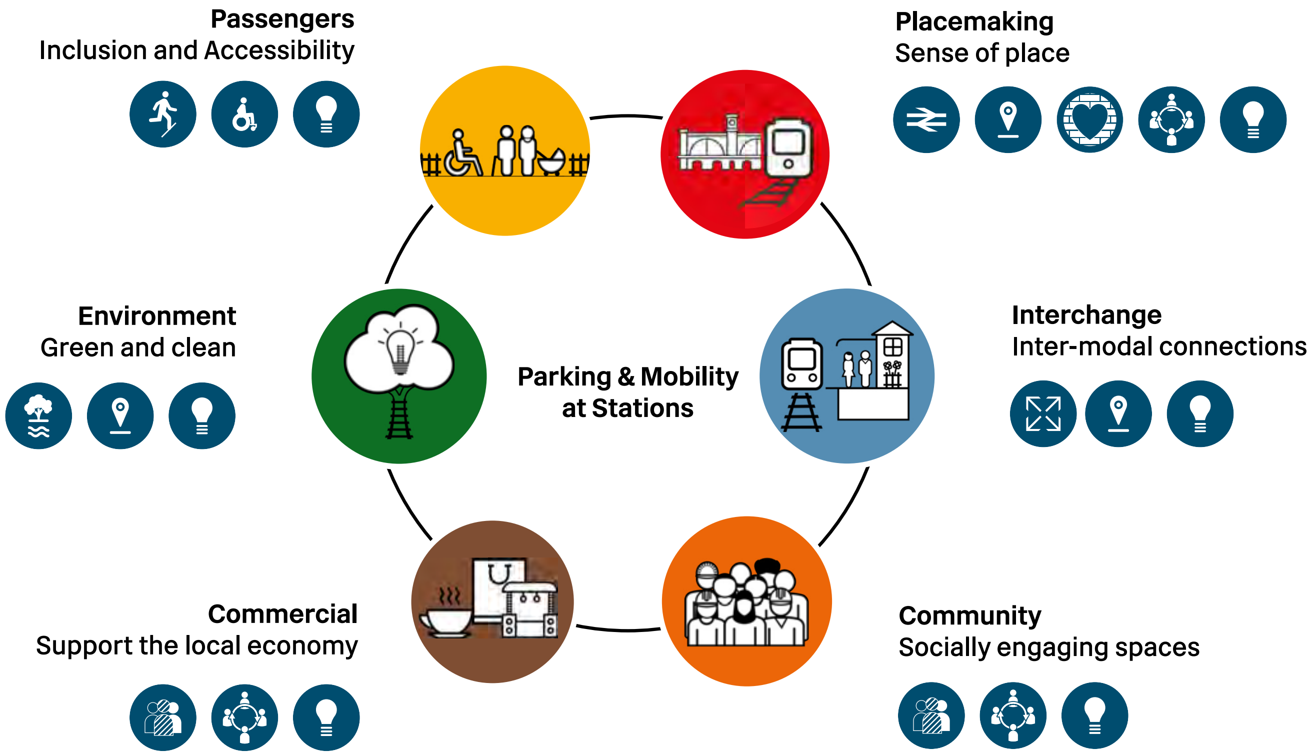


Figure 3.2 Design considerations

NR Guidance Suite Reference

Public Realm Design Guidance for Stations
NR/GN/CIV/200/10

Parking & Mobility Facility Environments
3.1 Spatial Planning Process

Passengers: inclusion and accessibility
Network Rail should be seen as an exemplar organisation in terms of fully accessible parking & mobility facilities that consider all user groups and encourage diversity and inclusion.

Environment - green and clean
Network Rail is committed to reducing carbon emissions and minimising the consumption of natural resources. With an ambition to achieve net zero carbon emissions by 2050 (and 2045 in Scotland) and deliver continual improvements to air quality so that our passengers, neighbours, and employees breathe healthier air. Good parking & mobility facility design considers sustainability from the outset for the entire lifespan of the asset. These facilities should help people make green choices through good planning and design.

Interchange: inter-modal connections
The full railway customer journey relies on interaction with various modes of transport. The provision of parking and mobility facilities appropriate to local needs is a key element in enabling sustainable first/last mile mode choice - providing for seamless transfer and a positive passenger experience.

Placemaking: sense of place
Station parking and mobility facilities should contribute to and enhance local identity - representing and reflecting the character and quality of the place to promote ownership and provide a high quality experience for the user.

Community: socially engaging spaces
Station parking and mobility facilities can offer an important resource to the communities they serve. The greatest benefits of these assets can be realised when multiple points of view are considered in order to build a successful place that can contribute positively to local community life.

Commercial: support the local economy
Station parking and mobility facilities offer opportunities for commercial activity both in the design and construction of the asset and during its ongoing life. These facilities can contribute to the local economy and at the same time provide revenue streams for Network Rail.

3.1.3 Site context

Network Rail seeks to continually enhance and improve the quality of our estate, creating a coherent identity, while supporting the contribution of our assets towards their local context and situation.

Every railway station is the product of its local context, function, and national requirements. The station scenarios described in Section 4 cover many core functional aspects of station parking and mobility. These should be considered alongside other aspects of local context, including:

- → **Local place identity and character** of the neighbourhood around the station, including landscape, townscape, land uses, and urban structure
- → **Heritage value of the station and surrounding area** including Conservation Areas, statutory and local listings, and historical development of adjacent sites and wider neighbourhood
- → Contribution to **net zero carbon** and **whole-life sustainability** goals of wider estate and similar within local community, including minimising energy usage, conserving / lowering embodied energy, and environmental footprint of design components
- → **Architectural and design influences** derived from the station itself and adjacent sites
- → **Planning requirements** including any specific restrictions or designations stipulated by the planning authority
- → **Nearby development** whether in planning or future pipeline that may have a bearing on design, construction, or operation of the station
- → Local **movement network and access** to the station and adjacent sites
- → Local **transport policy and plans** that may impact on travel mode choice including road user charging, shared mobility initiatives, infrastructure improvements and travel behaviour change initiatives
- → **Environmental designations** such as flood risk, air quality, contamination risks, and other environmental considerations
- → **Socio-demographic context** of the various communities within a place, considering residents, workers and visitors
- → **Views of the local community, potential stakeholders,** and **partners** on station and relationship to context
- → Potential contribution to **National Design Guide** characteristics of a well-designed place as well as **NR Principles of Good Design**

Consideration of these aspects as part of spatial planning will help parking and mobility projects contribute positively to the wider rail estate as well as the local area and its community.

NR Guidance Suite Reference

Planning practice guidance for beautiful, enduring and successful places
National Design Guide

Our Principles of Good Design
Network Rail

Public Realm Design Guidance for Stations
NR/GN/CIV/200/10

Network Rail Station Masterplanning Guidance
NR/GN/CIV/100/07

3.1.4 Stakeholder engagement

When developing station parking and mobility projects, a wide range of stakeholders should be approached and engaged. The key objectives of the stakeholder engagement include:

→ Confirm that the vision and objectives for each project align with national, regional and local visions and objectives

→ Build consensus and support from local stakeholders for the project

→ Collect feedback from transport operators (both public and private), other service providers such as EV charging providers, technology providers and local community

→ Assess operational and maintenance requirements and procurement routes

Stakeholder contributions should be fed into the development of a project through mutually beneficial ideas. The process should be transparent and be recorded to demonstrate compliance. Determining the type, role and scope of stakeholder involvement at project outset is important to define when and how stakeholders will interact with the design process.

Image 3.2
Stakeholder workshop

3.1.5 Key stakeholders

When considering parking and mobility at stations, think beyond the usual users of stations to those who may find the experience more difficult or may use stations in different ways. This might include disabled people, young children or people who come in just to use the facilities. By thinking more broadly about facility users, a more inclusive brief can be created.

Think about each stakeholders role in the project, at what point they may want to engage in the process and how they might be involved. There are many different ways to engage people from online surveys, to design workshops and simple walkabouts that might help to identify challenges and opportunities.

Think about people's journeys – ask them to explain their journey from home to destination or merely walking through the area. What modes do they use and why? What could be improved to make their journey more convenient, comfortable or accessible?

The following key stakeholders should be consulted throughout the planning, design and construction phases of a new/refurbished parking facilities and development of station access:

- Local Authority Planning Department
- Local Authority Highways & Transportation Department
- English /Welsh/Scottish Heritage
- Local City/County action groups
- Rail Passenger Committees
- Health & Safety Executive (HMRI)
- Office of Rail Regulator
- Local and National Accessibility Groups (Inclusion & Access consultants (NRAC), NR BEAP or other Accessibility groups).
- Network Rail Disabled Policy Unit
- Environment Agency
- Fire Brigade/Authority (Civil Defence Authority)
- Counter Terrorism/security team
- British Transport Police
- Cycling groups, taxi drivers, passengers, residents
- Property site owner, e.g. Network Rail Property, private developer
- Affected neighbours, e.g. catering, retail, other railway operators on/adjacent to site, private residents
- Public and private transport and services operators
- Local Authority Police
- CoMoUK
- All TOC's operating at the relevant station (including passenger, freight and infrequent users such as maintenance)

NR Guidance Suite Reference

Environment and Social Minimum Requirements
NR/L2/ENV/015
Diversity Impact Assessments (DIAs)

3.1.6 Station travel plans

Station Travel Plans are a tool designed to improve connectivity to and from a rail station, setting out a package of behavioural, operational and infrastructure measures to promote and facilitate effective access, with a focus on sustainable modes such as walking, cycling and public transport. Importantly, they also perform a much wider role in recognising the importance of a rail station in driving forward sustainable economic and community development, particularly in areas where there is forecast growth in the residential, employment and visitor markets.

Station Travel Plans provide a mechanism through which the activities of public and private stakeholders can be brought together to achieve these and other common goals, including:

→ Increasing passenger satisfaction

→ Delivering sustainable growth in rail patronage

→ Supporting local and strategic plans for growth and economic development

→ Adding value to work already carried out by community groups

→ Contributing to wider objectives around health, social equality and sustainable development

However stakeholders are engaged, the process should be transparent and be recorded as a key part of the design process to demonstrate the approach.

3.1.7 Access to the station

Beyond the railway boundary, local highway authorities (LHAs) are responsible for routes to and from the station. Working in partnership with the LHA and the local transport authority could open up new funding opportunities for improvements on routes to the station as well as improvements to parking facilities at the station itself.

These opportunities include devolved capital funds, as well as development generated funding through the Community Infrastructure Levy (CIL) and Section 106 agreements.

References and Resources

Guidance on the Implementation of Station Travel Plans
RDG / Rail Safety and Standards Board (RSSB)

3.2.1 Public realm

The term public realm refers to the ‘space between buildings’ which is freely and publicly accessible including streets, squares, forecourts, parks and open spaces. This is primarily comprised of public land although it can also include publicly accessible privately owned and managed land. Network Rail should be seen as an exemplar organisation in terms of fully accessible public realm that considers all user groups and encourages diversity and inclusion. All passengers should feel safe and welcome. For Network Rail, public realm includes the forecourt, as well as areas within stations such as concourses and platforms.

The most successful stations balance ease of movement and access with a series of activity zones that enable people to meet, interact and operate the station. Getting the balance right is an important step in delivering an inclusive and safe station environment. Public realm design should consider how to make places attractive, active, responsive to context, and inviting for people to visit, spend time in and move through. Providing functional, safe, and attractive public realm helps support use of facilities and amenities within the station environment. Great public realm design can also contribute to a positive experience for users of parking and mobility facilities, supporting convenient use, access, and interchange.

Achieving this requires an understanding of the different types of movement taking place at stations. Pedestrian, cycling and vehicular flows, the capacity

Image 3.3 King’s Cross station pick-up/drop-off zone and HVM security bollards

of each, the interactions between them, any level changes and access points for servicing and emergencies. The 'end to end journey' experience should be designed as well as other movement patterns within the station public realm to create safe, accessible and inclusive movement routes.

Key routes should be identified, and a hierarchy established in order to prioritise movement types within the available space. In the design of movement zones, consideration should be given to provide for future flexibility both in terms of capacity and also to accommodate changing modes of transportation and requirements such as shared micromobility and mobility hubs, buses, digital demand responsive transit (DDRT), taxi and trams.

Public realm design is covered in detail in our Public Realm Design Guide which should be the main point of reference for specific design considerations. The guide describes movement and activity zones at stations and the relationship of these zones to the hierarchy of movement. It also includes a Public Realm Considerations Tool that describes a way of recording responses to the public realm and prioritising requirements. The balance of these considerations for a specific station should inform the station vision and drive all design decisions.

This Guide focuses on the public realm elements most relevant to provision of parking and mobility facilities at stations.

Image 3.4 Bath Spa station forecourt public realm

NR Guidance Suite Reference

Public Realm Design Guidance for Stations
NR/GN/CIV/200/10

3.2.2 Multi-modal integration

Efficient connection between transport modes and services is a core function of stations. Design of connections should balance local modal and functional priorities, using safe, direct routes that minimise conflict with other passengers or vehicles. Not only does this minimise passenger journey times, but it also facilitates efficient connections that allow passengers to make their onward journey as easily and as logically as possible.

Design for effective modal integration requires:

→ Engagement with local authorities and operators of local transport services to ensure spatial provision meets with current and future needs

→ Sufficient capacity to deal with different conditions at different times based on a detailed understanding of the likely future demand for movement between each mode at different times of day

→ Prioritised access by feeder modes such as walk, cycle, taxi, bus and shared mobility to meet with passenger and operational needs aiming to minimise delays due to extended waiting times for connecting services and avoid unnecessary dwell times for operational vehicles

Image 3.5 Solihull Station Consultation Stage concept

→ Provision of efficient passenger connections that are short and direct with minimal level changes (although it may sometimes be necessary to direct or sign to longer routes for crowd control reasons):
- locate connection points to allow for convenient, accessible and safe access to and from the station - under cover where possible
- locations should not conflict with other station operations
- routes should be safe and secure, avoiding road crossings or other vehicle routes wherever possible

→ Provision of legible routes to and from inter-modal connections with coordinated wayfinding and signing integrated with station layouts (see Section 3.3)

→ Design of lighting strategies for inter-modal routes that meet with minimum requirements and integrate with third party lighting systems where routes extend beyond station thresholds

→ Design of inter-modal connections should align with appropriate relevant local authority guidelines and standards

3.2.3 Pedestrian access and circulation

Every rail trip begins and ends as a pedestrian trip, whether interchanging with other modes or accessing the station via the surrounding street network. Thinking about pedestrian requirements is a fundamental part of planning and designing for station parking and mobility.

- Routes for pedestrian movement include footways, footpaths, and delineated routes in car parks. These should be dimensioned to comfortably accommodate volume of people predicted to use them, allowing for levels of demand at different times of the day, days of the week, times of the year, and any special events that may influence volumes
- Design routes to provide convenient access for all users, thinking about people with specific mobility requirements, as well as being comfortable for all ages and abilities
- Key accessible design considerations include step-free access routes through the station and connecting into the neighbourhood, gradients of routes, and various design details to activate or indicate crossings and potential hazards (see Inclusive Design in Stations)
- Align pedestrian routes to desire lines between key facilities within the station environment, making these routes as direct as possible
- Locate social activity spaces to be visible but off, or adjacent to, main movement routes
- Maintain clear sightlines along pedestrian routes connecting with public transport, cycle facilities, micromobility hubs and parking facilities to promote intuitive wayfinding and avoid reliance on wayfinding signage
- Consider routes to and from the station as well as within the public realm recognising wider pedestrian connections and desire lines such as crossing points and local connections; high footfall generators such as retail streets, event destinations, work places and residences
- Plan sufficient space to allow for people to pause at decision points such as building entrances, where routes meet and where they interact with equipment, furniture or similar - with spaces sized to likely demand
- Locate crossings aligned to desire lines and as close as possible to places pedestrians may wish to access, such as bus stops or taxi ranks while clearly separating or demarcating pedestrian routes from vehicular space to provide comfortable space for pedestrians and reduce risk of collisions
- Crossing types include formal crossings (e.g. zebras or pedestrian-activated signal crossings) and informal crossings (e.g. marked with different surface material or with pair of dropped kerbs) - the crossing type used depends on pedestrian demand, vehicular volumes and geometry
- Small level changes can often be resolved with appropriate grades as part of public realm design, however ramps and steps may be required, for which specific design dimensions and gradients apply
- Surfaces should be firm, durable, slip resistant, without undulation. They should also be consistent in material treatment along their length for continuity, supporting ease of navigation and comfort
- Tactile paving materials are required to aid people with visual impairments in terms of navigation; providing directional information and warning of hazards
- Minimum required route width is 1.5m, with passing places of 1.8 x 2.0m in sight of one another, but a consistent minimum width of 1.8m is preferable
- Pedestrian movements during an emergency situation should be clearly planned and designed with rendezvous points, evacuation routes and fire escapes

NR Guidance Suite Reference

Inclusive Design in Stations
NR/GN/CIV/300/04

3.2.4 Cycle access

Cycling to stations as part of the door-to-door journey is a growing trend. Cycling provides for sustainable access to the rail network and, aside from walking, consistently offers the most reliable journey times. Cycling is often fastest for short journeys and avoids the need to wait for a taxi or other connecting mode. Average cycle distances to stations range between 2-3 miles, however with the emergence of e-bikes distances are expected to expand and that change taken into account when planning cycle facilities.

Supporting the growth in cycling to or from stations requires a significant increase in cycle parking that is safe, secure, direct, comfortable, coherent, and attractive. The Government is committed to delivering this through the Cycle Rail programme.

Stations increasingly have dedicated cycle hubs providing a large number of secure and enclosed cycle parking spaces often with ancillary functions. For instance, the Cycle Hub at Kingston Station has capacity for 400 cycles and includes amenities such as information, cycle repair and maintenance, cycle hire and a cafe rest stop - and is connected to the wider cycle network through a new pedestrian and cycle bridge and linear park.

Cycle access and facilities should be planned for in relation to wider bicycle networks as well as to circulation routes and location of facilities within a station environment, considering both regular cycle commuters and leisure cyclists.

→ Integrate cycle routes to/from stations into the wider network through consultation with local authorities and other relevant stakeholders

→ Identify cycle access and movement routes within the station environment that are as direct as possible between arrival point and cycle parking facilities or to enable passengers with cycles to connect with trains

→ Cycle routes should be step free and accessible for all ages and abilities with a maximum extended gradient of 5% and maximum short distance gradient of 15% where site conditions dictate

→ Where gradient change is absolutely necessary, ramps or lifts should be included to provide convenient and direct connections to key destinations and station facilities

→ Routes should be free from barriers that prevent access by adapted cycles (minimum unobstructed width 1.5m) unless a specific security requirement

→ Routes should have clear sightlines for cyclists to clearly see and be seen by other station or road users

→ Routes should preferably be segregated and, where this is not possible, be well-designed to connect though the site to enable safe and efficient access

→ Cycle routes should be comfortable to use, with even and well-drained surfaces

Good Cycle Design Outcomes
Safety Good infrastructure should help to make cycling safer and address negative perceptions about safety, particularly when it comes to moving through junctions.
Directness Routes should be logical and continuous, without unnecessary obstacles, delays and diversions, and planned holistically as part of a networks.
Comfort Riding surfaces for cycling, and transitions from one area to another, should be fit for purpose, smooth, well constructed and well maintained.
Coherence Infrastructure should be legible, intuitive, consistent, joined-up and inclusive. It should be usable and understandable by all users.
Attractiveness Cycle parking should help deliver public spaces that are well designed and finished and help create places people want to use.
Adaptability Cycling infrastructure should be designed to accommodate users of all types of cycle and an increasing numbers of users over time.

Table 3.1: Good cycle route design outcomes

Image 3.6
Segregated cycle/pedestrian connection to Kingston Station cycle hub with capacity for 400 bikes

3.2.5 Cycle parking

Cycle parking design should be fit for purpose, inclusive and secure. It should be located on cycle desire lines near to the station entrance and be well connected to surrounding highway and cycle infrastructure. Cycle parking design should follow these basic principles:

- **Fit-for-purpose:** meet the current and future demands with a mixture of open and covered stands and secure facilities to accommodate both short-stay and long-stay uses considering the need to accommodate micromobility modes and electric cycles
- **Inclusive:** Cycle parking should be accessible and accommodate all types and sizes of cycle and electrically assisted cycle, hand-cranked cycles, tricycles, tandems and cycles adapted for use by disabled people defined as Pedal Cycles or Electrically Assisted Pedal Cycles within the Highways Act. Cycle parking racks or stands should be provided to cater for all and set out to allow ease of access. Approach routes to cycle parking area should be step-free and the aisles and cycle parking equipment should offer sufficient space for easy access. It is not expected that every piece of cycle parking equipment will be accessible to all forms of cycle, but designers should integrate some provision for larger cycles into the cycle parking offer (i.e. not just bicycles).
- **Secure:** Cycle parking facilities should be provided in secured spaces (e.g. for long-stay stands in lockers/shelters) or in visible and well-lit places (e.g. for short-stay stands on-street) with good natural surveillance from activity or passers-by
- **Well located:** cycle parking should be convenient, accessible, as close as possible (and no more than 50m) to the station entrance and preferably sheltered without compromising other movement needs
- **Easy to find:** Cycle parking facilities should be clearly and consistently signed with distances and locations to/from surrounding origins/destinations

3.2.6 Quality, quantity and mix of cycle parking

Quantity and mix at stations needs careful consideration as this could encourage more people, and a more diverse range of people to choose cycling as a mode of transport. The quantity provided should meet with typical current peak demand and allow for a surplus to accommodate future growth. Growth can be predicted by monitoring patterns of demand over time and taking into account local factors that generate greater use such as new developments, improvements to cycle infrastructure or rail services.

Guidance for the minimum quantity of cycle parking at a range of types of location is published in LTN 1-20. This guidance should be

Image 3.7
Non-standard bays, lockers and cycle tools, Kingston Station Hub

the starting point for consideration of the scale of provision as demand will vary according to local circumstances. The Cycle Rail Working Group Standard provides further detail on cycle parking requirements and includes a methodology to evaluate future demand for cycle parking at stations - also described in Section 4 of this Guide).

3.2.7 Short-stay parking requirements

Sheffield stands

Sensibly spaced Sheffield stands are the most user-friendly form of cycle parking and are accessible to virtually all types of cycles. When placed in the public realm, consideration should be given to their impact on pedestrian movement and circulation. For example, on footways they should be located in the furniture zone adjacent to the kerb where items such as lighting columns and signposts would be found - or to the rear of footways where there is space adjacent to walls or landscaped areas out of the pedestrian circulation zone.

Where Sheffield-type cycle stands and other types of single layout racks are used within a secure parking facility, they should be placed 600mm clear of vertical structure and 1.0m to 1.2m apart to allow cyclists to access their bicycles and attach a lock. Building Regulations should be followed to determine clear head height.

To cater for all bicycle types (adapted cycles, tricycles, and cargo bikes) some Sheffield stands should be provided with a clear spacing of 1.5m and where possible a length of 2.0m. These should be provided in the most accessible parts of large cycle parking hubs so they can also be used by disabled people with adapted bikes. Signage should be installed to inform other cyclists where certain stands are reserved for users of non-standard or adapted cycles.

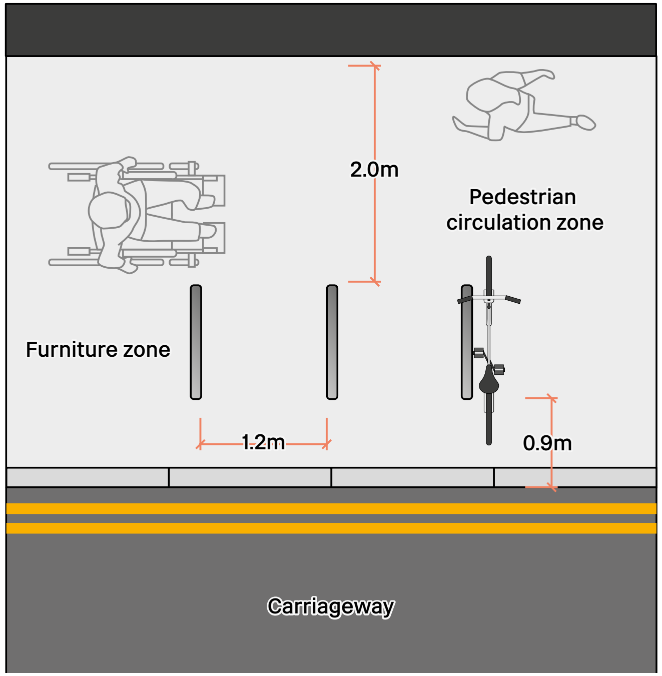


Figure 3.3 Sheffield stands set out at 90°

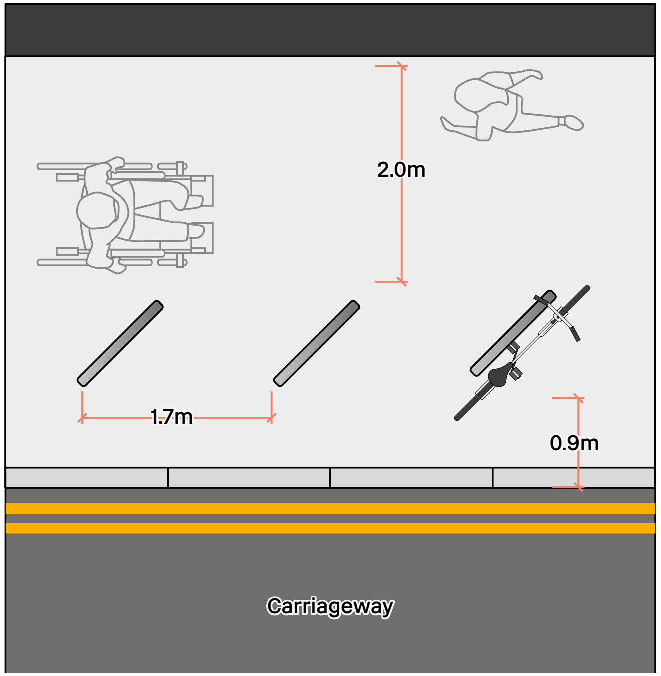


Figure 3.4 Sheffield stands set out at 45°

Consideration also needs to be given to whether cycle parking can be sheltered from the elements. Cycle parking at stations will often be for longer-term use, so returning to your cycle at the end of the day and finding it covered in rainwater is likely to deter some users, particularly if they are concerned about the longer time weathering impacts of leaving their cycles open to the elements. As such, cycle parking at stations should be sheltered where possible.

The following design parameters should be followed to achieve well set-out cycle parking in the public realm:

→ Stands should be placed so that the clearance between the kerb edge and any cycle parked on any stand is at least 450mm to the carriageway or cycle track

→ A minimum of 2m clear width should be retained for pedestrian movement

→ A minimum spacing between stands of 1000mm should be provided – with 1200mm preferred

→ Cycle stands should be set out at either 45 or 90 degrees to the kerb or cycle track

→ The visual impact of cycle stands can be reduced if they are placed between other items of street furniture, especially tree planting, within an organised street furniture zone on footways

→ At least 600mm clearance should be given between a stand and any another object higher than the kerb face

→ At least one stand in any group should be placed to allow for a larger cycle to be parked – this is usually a matter of leaving enough clear space at the end of the run

Image 3.8
Sheffield stands set out at 90° to the kerb opposite London Bridge station

3.2.8 Long stay cycle parking design requirements

One of the primary concerns for long stay cycle parking is security. Users will trade some convenience for additional security such as CCTV coverage, shelter from weather and secure access. To achieve these qualities, cycle parking needs to be efficient and accessible. Standard dimensions for cycle parking design are shown in Figure 3.5. Detailed design of secure cycle parking facilities should consider site specific architectural and structural features which can impact the overall layout. Consideration should also be given to the provision of amenities such as cycle workshop will free tools and a space to carry out repairs.

Two-tier racks

Two-tier racks are the most common cycle parking solution at stations in the UK. These racks offer high density of parking and have a smaller footprint than 'single tier' solutions, such as Sheffield stands. Two tier racks should include measures to secure the wheels and frame.

Two-tier racks can, however, be difficult to use if they are not hydraulic power assisted and may be off-putting (or inaccessible) to those with heavier cycles, electric bikes, or non-standard designs. As such, any two-tier racks should be supplemented with Sheffield stands .

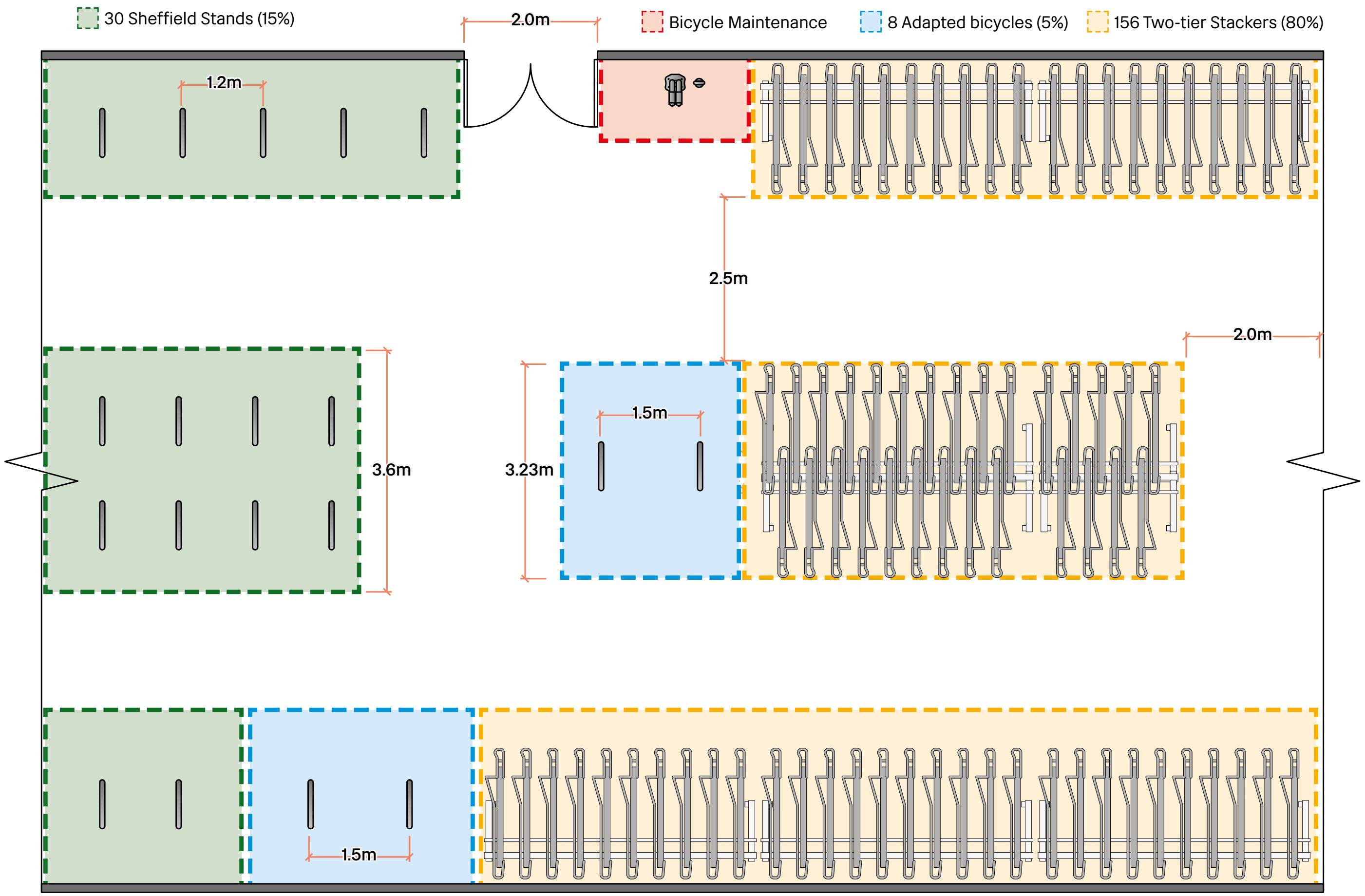


Figure 3.5 Typical secure cycle hub set out arrangement

The following design parameters should be followed to achieve well set-out cycle parking hubs:

- A minimum aisle width of 2.5m between stands and beyond the lowered frame is required to allow cycles to be turned and loaded. This could be reduced based on manufacturer specifications and consideration of peak usage
- Two-tier racks require a minimum clear head height of 2.7m. This includes for overhead fixtures and fittings such as lights and wayfinding signs
- Cycle hubs should have step-free access, wide doorways and spacious corridors
- Accessing the cycle parking area should involve passing through no more than two sets of doors, with a recommended minimum external door width of 2.0m
- External doors to cycle parking facilities require a minimum width of 2m
- Cycle lifts require a minimum door opening of 1m.
- Wheel ramps should be provided where cyclists are required to use steps to access cycle parking

Image 3.9
Mix of Sheffield stands and two-tier racks in Kingston cycle hub

References and Resources

Cycle Infrastructure Design
LTN 1/20
Standards for Public Cycle Parking
Cycle Rail Group

References and Resources

Cycle-Rail Toolkit 2
Rail Delivery Group
London Cycle Design Standards
Transport for London

Image 3.10
Mobility Hub with e-scooter and e-moped hire, and micromobility parking, Berlin

3.2.9 Shared micromobility spatial needs

A shared micromobility scheme can be operated as a system where vehicles can be hired or returned to fixed docking stations, designated micromobility parking bays and/or any location within an operating area.

The current operating systems can be broadly classified into the following two categories:

→ Micromobility station based systems including:
  - Physical docking stations
  - Hub based systems with light infrastructure
  - Systems with geofencing and marked parking bays

→ Free floating micromobility schemes

Physical docking stations

Vehicles are parked in fixed docking stations (with spaces for bikes/e-scooters varying in number but typically no fewer than 10 and up to around 50). Docking stations are placed in key locations around a town/city at regular intervals for convenience. The docking station may include a terminal to release the vehicle or the technology may also be located on the vehicles and accessed via an app. Vehicles should be docked at the docking stations to end a hire.

Hub based systems with light infrastructure

Hub based stations have physical infrastructure such as racks in parking locations, where vehicles should be parked. The stations are relatively easy to implement as they only require installation of vehicles stands. Operators may require that vehicles are locked to the racks.

Image 3.11 Shared e-scooters with physical docking stations in Milton Keynes

Image 3.12 Micromobility bays with light infrastructure in Watford

Systems with geofencing and marked parking bays

Users can pick up a bike/e-bike/e-scooter from a designated parking bay and end their trip returning it to another designated parking bay, which may have painted markings and signage. Geofencing is often used to confirm that the vehicles are parked in designated bays avoiding clutter on footways or carriageways.

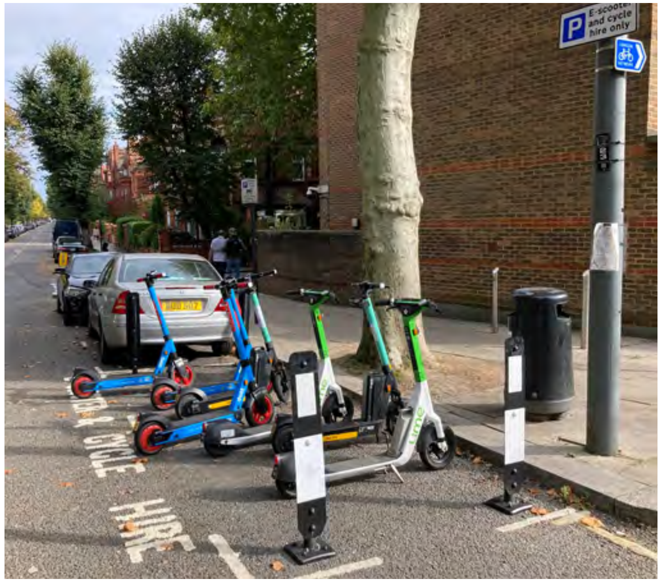


Image 3.13 Designated shared micromobility parking bays in Islington, London

Free-floating micromobility schemes

In free-floating schemes, vehicles can be parked anywhere within the operating area, often with recommendations on where not to park for safety reason.

Operation of free floating schemes is not recommended at busy locations such as railway stations

Image 3.14 Free floating micromobility

Image 3.15 Shared e-bike with charging dock, Penarth Station, Wales.

The following design considerations should be taken into account when planning for shared micromobility.

- Shared micromobility parking bays should be located in visible locations on desire lines in close proximity to rail stations entrances/exits without impacting negatively on other access and circulation needs
- Size of shared micromobility parking bays will vary relative to local demand
- Parking locations should provide for ease of access by redistribution vehicles, e.g. vans, e-vans or e-cargo bikes
- Docked stations may require provision of power and communication infrastructure
- Where e-bikes are available passive power provision for potential future expansion should be accommodated
- Parking locations should allow for efficient integration within the existing street space and may be located on the carriageway (replacing a car parking space) where there is sufficient space
- In areas with high demand for parking and high car parking stress, a network of smaller parking bays could be implemented
- A minimum 2m clearance should be allocated from any road junctions

Micromobility system	Infrastructure requirements	Considerations
Station based systems		
Physical docking stations	Use of fixed docking stations with/without payment systems	→ Power and comms (terminal based technology systems) → Space allocation → Power for charging if e-bikes/e-scooters are offered → TRO (if on carriageway)
Hub-based systems with light infrastructure	Use of vehicles stands (including options with the locks attached to them or the vehicles)	→ Space allocation → TRO (if on carriageway)
Geofenced and marked parking bays	Allocation of space for designated parking bays	→ Space allocation → TRO (if on carriageway) → Parking bay marking and signage
Free floating system		
No designated parking locations	Vehicles can be parked anywhere within the operating area.	→ Potential for clutter and obstacles for pedestrians in high footfall areas → Operation of free floating schemes is not recommended at busy locations such as railway stations

Table 3.2 Shared micromobility considerations

- Shared micromobility parking bays should be marked by appropriate signs affixed to posts or lamp posts adjacent to the bays
- Shared micromobility information should be included within public transport information materials and integrated within public transport journey planners
- Shared micromobility scheme agreements should include data sharing agreements for incorporation within local MaaS systems
- Consideration should be given to incorporation of Car Club bays close by in agreement with local operators

3.2.10 Taxis and passenger pick-up/drop-off zones

Taxis and on-demand services including Digital Demand Responsive Transport (DDRT) enable short trips to be made efficiently, often when time is at a premium. These zones are important for commuters getting a lift to the station, family members with luggage, the business community, families with children, tourists, shoppers and leisure visitors. Taxis and on-demand transport modes also provide door-to-door services for disabled and mobility-impaired passengers.

Well located passenger pick-up/drop-off zones (PPUDO) support efficient transfer between connecting modes and rail services and provide reassurance that passengers can safely alight close to the station entrance and that drivers have a clearly signposted place to pull in without obstructing other users or parking illegally. Where space allows, taxi ranks should offer a sufficient number of bays relative to the size of the station and expected footfall.

Image 3.16 Taxi pick-up zone with managed queueing area, CCTV, a taxi pooling area, Paddington Station.

Location

- → PPUDO zones should be sited in safe, accessible, well lit, and well signed locations that are close to the main station entrance with near side loading and direct, visible and accessible connections to the main station concourse and ticketing facilities
- → PPUDO zones should have clearly marked crossing points with dropped kerb or raised road design
- → Kerbside bays should be provided for mobility-impaired passengers close to the station entrance
- → For stations that aren't level to the road, PPUDO zones should be located close to lifts to cater to mobility impaired visitors including those with heavy luggage or pushchairs
- → Adjacent footways should accommodate wheelchair ramps with sufficient space for manoeuvring of wheelchairs when boarding
- → PPUDO zones should be designed so that the flow of vehicles is clearly understood as well as being expeditious to local traffic flow
- → Locations and function of these zones should be clearly identified by prescribed road markings and additional signage
- → Where space permits, private car and taxi/on-demand movements should be segregated, with taxi, DDRT and community transport facilities located to minimise conflict with core public transport operations and pedestrian movements but remain convenient for those with mobility impairments

- Walk routes should minimise conflict with traffic, particularly where roads need to be crossed. Ideally, facilities should be located so there are no roads between them and station entrances.
- Kerbside management technology should be considered for larger facilities with multiple PPUDO zones to facilitate dynamic bay allocation with bays numbered for ease of identification.

Security

- Where PPUDO zones fall within the station boundaries, they are required to be covered by CCTV/ Video Surveillance Systems (VSS) and can be included as part of security checks. In some stations there may be dedicated security in place at certain times of the day to help reduce anti-social behaviour
- PPUDO zones are reviewed as part of the local risk vulnerability review (LRVR). This should help ascertain if there is a need for protection barriers or bollards to be installed to facilitate safe operation

Amenities

- PPUDO zones should have a dedicated waiting space with a clearly marked queuing system in larger stations to allow for efficient operation in busy times
- Waiting areas should be covered to offer comfort to visitors using the facility in bad weather, as well as being well-lit for those travelling at night
- PPUDO zones should feature seats of inclusive design, access to luggage trolleys, customer information screens showing arrivals and departures, and customer help points to give passengers access to assistance and information if required

Wayfinding

- Signage indicating the location of PPUDO zones should be clear and easy to follow, in compliance with Network Rail's Wayfinding Design Guidance (NR/GN/CIV/300/01) and the UK highway signage standards
- Within queueing areas, the start point and direction of the queue system should be clearly identified
- For PPUDO zones with low service levels, signage should provide a telephone number or website to call for a taxi with information available in an accessible form
- Signage leading to PPUDO facilities should be provided on platforms, at regular points on concourses, at exits, and at the facility itself to identify PPUDO queue areas

Staff

- Taxi ranks are generally unstaffed, although station staff should always be aware of the needs of passengers departing and arriving at the station
- At times of high demand, such as during major events or disruption, there should be a member of staff present to help manage the queue and enable an efficient flow of people. If this is not possible, staff should check queueing as regularly as they are able to

Image 3.17 Covered taxi rank waiting area and sign, London Bridge Station

3.2.11 Bus and tram

Station layouts should facilitate direct, easy and unobstructed access to/from onward public transport connections such as bus or tram stops, PPUDO zones and Mobility Hubs. Physical constraints related to the wider built environment and the proximity of station entrances/ exits to these facilities can limit the effectiveness of modal integration. The spatial arrangement of these modes in the wider station environment requires careful consideration to facilitate ease of access, and ultimately a positive passenger experience.

- Inter-modal priorities should be defined in agreement with the local authority to inform the proximity of bus/tram and shared mobility facilities in relation to station entrances without putting pedestrians or cyclists at risk
- Wherever possible stops should be visible from the station entrance/exit and vice versa to facilitate intuitive transfer movements and minimise the need for additional signage
- Passenger waiting areas should be sized to provide sufficient space for anticipated peak time demand
- Bus stop layout and design should be consistent with the requirements set out in TfL's Accessible Bus Stop Design Guidance
- Design the public realm to help simplify interchange, allowing easy and unobstructed access between station buildings, bus and tram stops and Mobility Hubs
- Street furniture locations should not impede passenger boarding and alighting, or obstruct sight lines to/from stops or hubs
- Stops should be sited to minimise walking distance for interchange with other services and make sure drivers and passengers are clearly visible to each other
- Stop location and design should promote natural surveillance and incorporate adequate lighting for personal security of staff and passengers
- Where stops are not immediately outside the station, connecting routes to/from the station should be clearly signed (see Section 3.3)
- Bus/ tram information should be incorporated within station exit signing, with detailed information about routes and services provided at an appropriate place in the station and at stops/hubs
- Where feasible, dedicated toilets for bus drivers and staff should be provided at bus layover stands

References and Resources

Accessible Bus Stop Design Guidance
Transport for London

3.2.12 Car parking

Car park design should be based on as much relevant information as possible to inform a layout that has suitable access and internal circulation. Before starting a car park design it is necessary to determine the total required number of car parking spaces, or to confirm the extent of the site allocated for car parking. The total number of spaces required or achieved within the available site will then influence the car park circulation and access to and from the car park for vehicles and pedestrians (see Section 4).

Opportunities for future development, changes to demand, the need to accommodate cycling and new mobility technologies should also be confirmed at the outset as these may influence the setting out, shape and function of the car park. Design can commence once the size of the car park has been determined.

Car park layouts in this guide update those contained in Design of Car Parks for Railway Stations & Depots (NR/L3/CIV/160 - currently withdrawn but may be updated at a future date) and are based on a standard set of dimensions as set out in Figures 3.6-3.9:

- → This guidance recommends a standard car parking space of 2.5m wide x 4.8m length - this is larger than DfT guidance to accommodate larger modern cars and a standard EV charge point
- → The Accessible Railway Stations Code of Practice details the layout of accessible spaces which require a minimum of 2.4m width x 4.8m length.

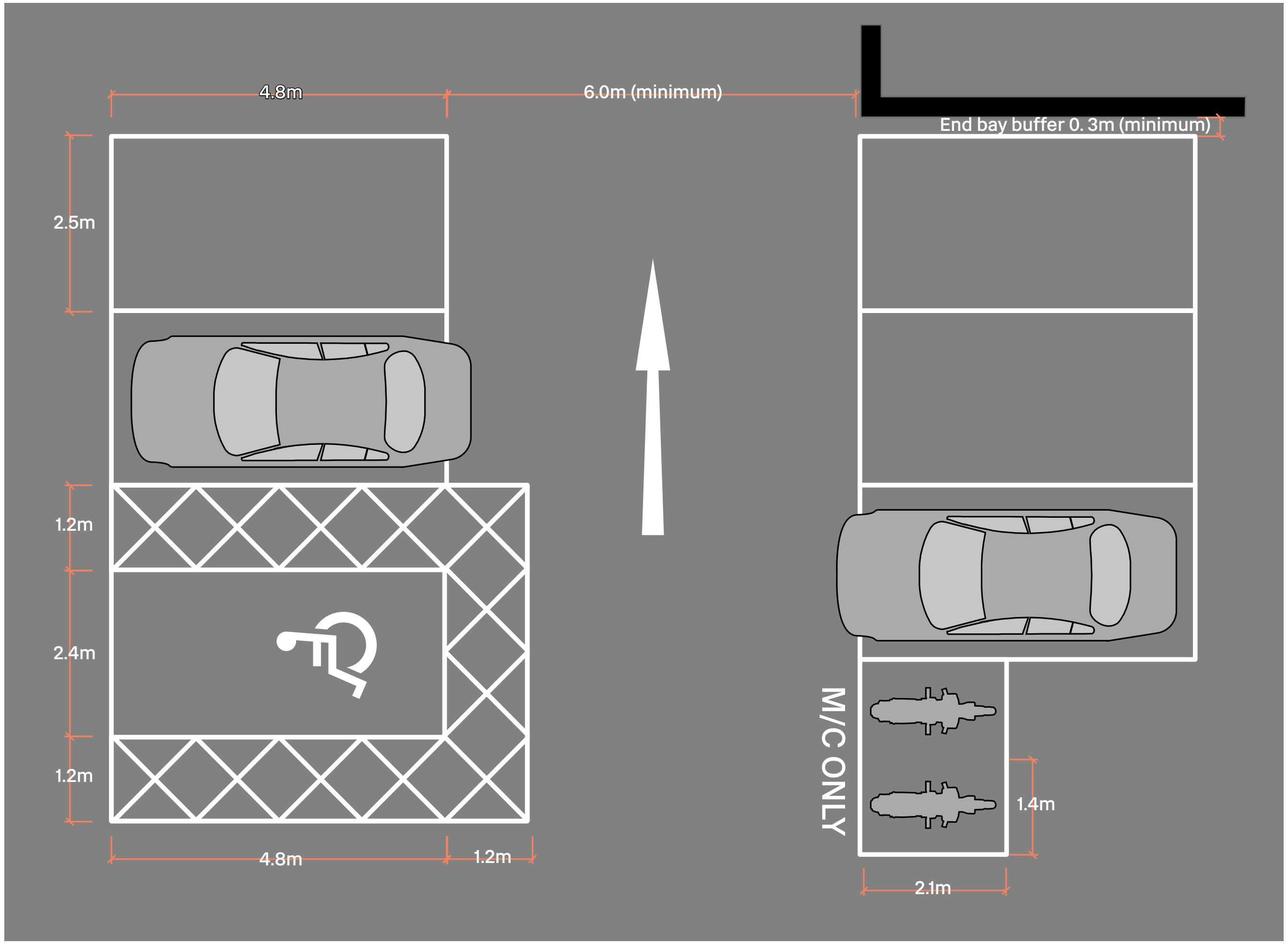


Figure 3.6 Standard car park layout dimensions

- Accessible bays also require 1.2m clear access zones (also known as transition zones) on both sides of each space and a 1.2m safety zone between the space and the vehicle aisle
- Motorcycle parking space 1.4m wide, 2.1m length and generally not marked out for individual vehicles, allowing for a flexible and efficient use of limited space
- Motorcycle bays should avoid soft surfaces such as tarmac as it will not support the weight of a motorcycle or scooter, Secure anchor points should be installed to prevent attack using implements such as hammers or power operated tools
- The anchor points should be able to resist hand or portable-powered tools and high enough to be readily visible and secure
- Widths of end bays should be increased where these are adjacent to walls or vehicle barriers. The increase will be subject to the edge detail form, but an additional side clearance of min. 300mm is recommended from the bay marking to the edge detail
- Where applicable the minimum recommended clear headroom for vehicles is 2.20m, with a desirable clear head height of 2.6m
- Aisle width (preferably one-way) 6m absolute minimum, based on 90° parking
- In areas of high volume two-way vehicle flows, consider 7.0m wide aisles/lanes - typically near car park entrance/exit where max. flow occurs

3.2.13 Electric vehicle charge points

Car park layouts and design should provide sufficient space to accommodate EV charge points. EV charge point positioning should consider:

- Parking space with standard EV charge point of 2.5m wide x 4.8m depth with additional line marking symbol to indicate EV bay
- Bay with rapid EV charge point 2.5m wide with 1.2m buffer and bollard protection, 4.8m depth with additional line marking symbol to indicate EV bay
- Position EV charging stations at the kerb in the closet proximity to the EV parking bay to avoid creating potential trip hazards by cables for pedestrians
- Designs should accommodate the additional spatial requirements of EV spaces to allow for trailing cables and consider charging flap positions as these may be located to the front or rear of vehicles and vary by manufacturer
- Wall-mounted unit installations should not impede pedestrian circulation with pavements remaining accessible to all users, including disabled people
- Enabling infrastructure such as feeder pillars, switches, earth electrodes and concealed ducting for charger cable runs for passive EV provision should be installed at the time of construction
- Spaces should be clearly marked and identified as EV only (see DfT signage standards)
- EV charge bays should include facilities suitable for those with disabilities and children, with adequate sizing, dropped kerbs, tactile paving, and avoidance of potential trip hazards
- Protective bollards should be installed to protect against accidental damage or impact from vehicles
- Cluster EV bays (see Figures 3.7 and 3.9) to:
  - optimise where power and cabling goes
  - reduce need to search for an alternative EV bay if the charger is not working
  - optimise duct runs and layouts for control cabinets and charge posts
- Maximise the use of EV charging stations:
  - charge points should not be located at corners of the car park
  - place chargers along the short edge of parking spaces
  - position charge points to support two EVs as a minimum
  - provide ease of access/ingress to charge points by EVs

Car club parking bays should take the same layout dimensions as provided in the rest of the car park. Additional signs and line markings will be provided with guidance taken from the Car Club provider. Car Club Bays should be EV ready.

Advantages	Disadvantages
Many fast charging stations have the ability to be wall mounted, saving floor space in locations where parking bays cannot be extended.	Placement of charger realistically only supports charging 2 vehicles
Ideal for retrofit installations, the wiring can be housed in enclosed ducting channels that can be fixed to the wall – less expensive	
Less likely to be hit by a vehicle on wall mounted station	

Table 3.3: Pros and cons of boundary wall charge point installations

Advantages	Disadvantages
Ability to serve a greater number of bays from a single installation point	Retrofit locations will require invasive civil works into the car park surface in order to install – more expensive
Highly visible to EV and Non EV users	Higher chance of accidental vehicle impact damage
Greater flexibility with ingress and access to charging spot and positioning vehicle in relation to charging outlet	Greater risk of trip hazard with trailing cables between vehicles

Table 3.4: Pros and cons of central reservation charge point installations

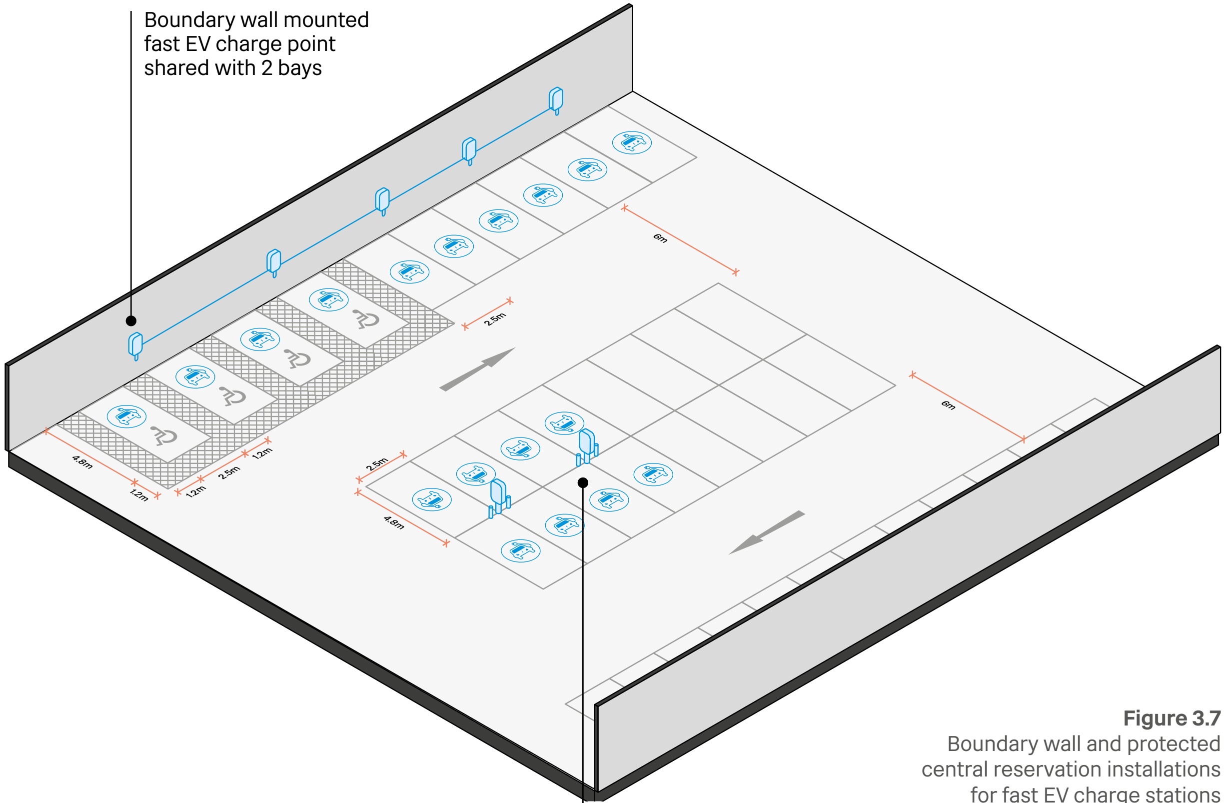


Figure 3.7
Boundary wall and protected central reservation installations for fast EV charge stations

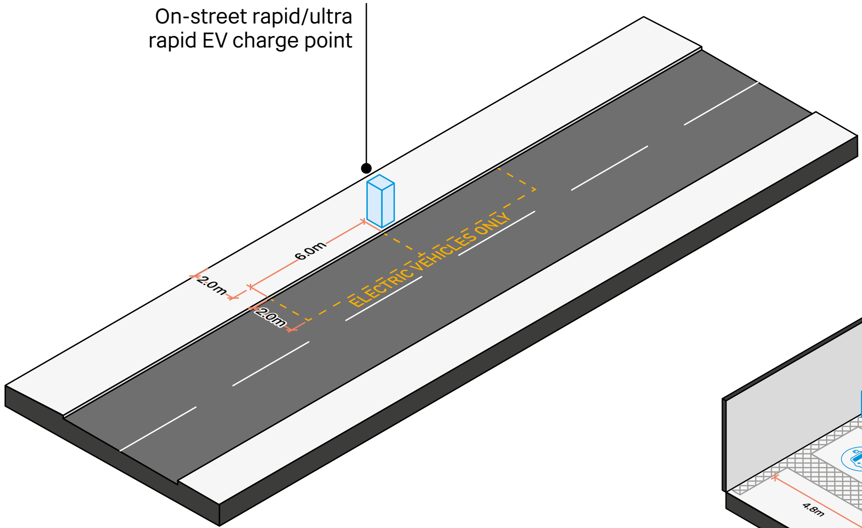


Figure 3.8
On street protected rapid/ultra rapid charger bay layout

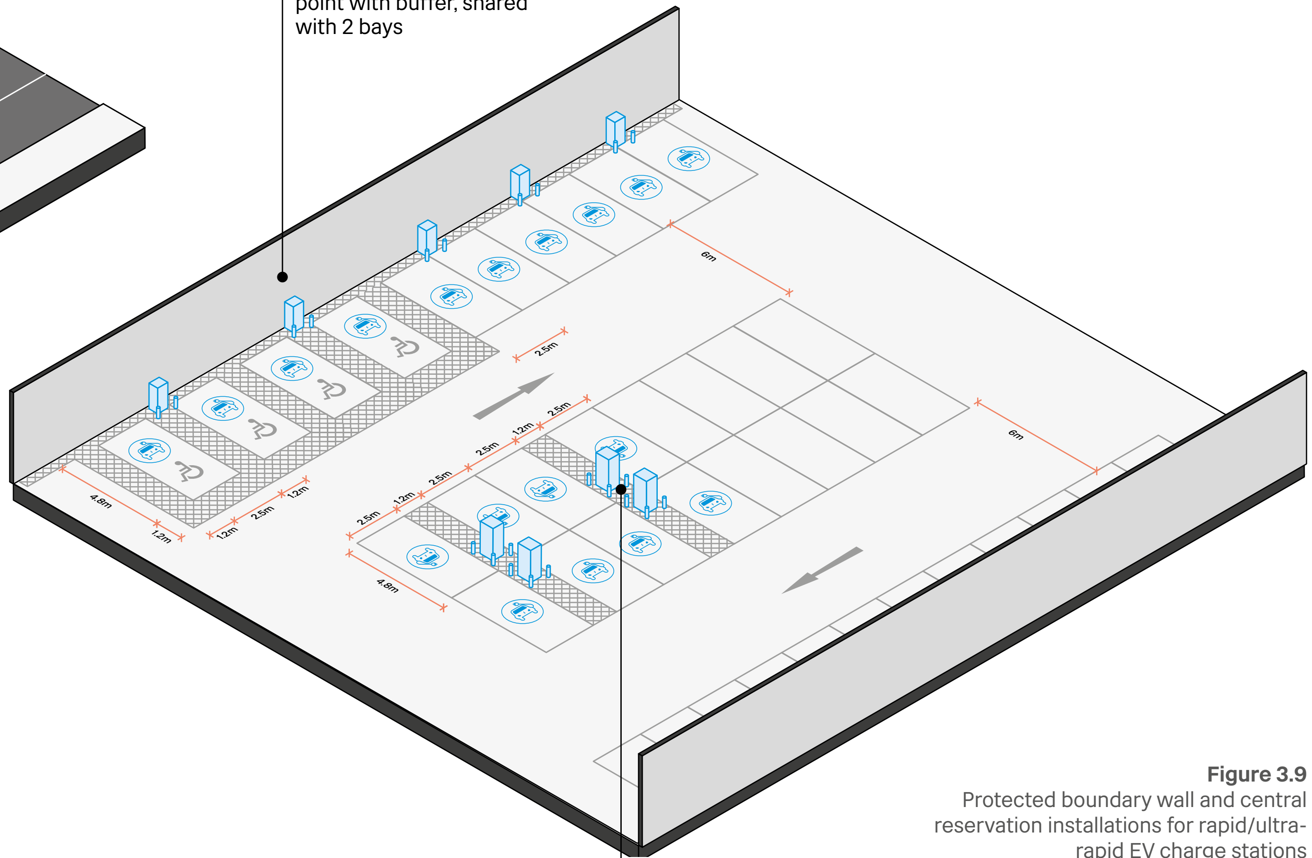


Figure 3.9
Protected boundary wall and central reservation installations for rapid/ultra-rapid EV charge stations

Other parking arrangements based on different parking angles may be considered in spatially constrained car parks. Table 3.5 provides recommended aisle and bin width, where the bin width is the overall kerb to kerb dimension for two car parking spaces and the access aisle. This type of parking limits the circulation of the car park to one-way only and could complicate the provision of EV charge points.

Where ramped access to a car park is necessary, the maximum recommended ramp gradient is 1:10 with a transition length required if ramps are steeper than 1:10 or the floor is laid to a fall of 1:60 or greater away from the ramp. The transition length should be at least 3.00m and its gradient half the gradient of the ramp.

3.2.14 Vehicle entrance & exit

Access control systems may include “raised arm” parking barriers or barrier-free access control using Automatic Number Plate Recognition (ANPR). Access control can support prioritisation of car parking for rail users at stations where there is likely to be demand to park in the station car park by users of neighbouring destinations such as shops, workplaces and other destinations. Setting charges that discourage short stays in the station car park would also deter non-rail users.

An ANPR system should be provided to cover all entry and exit lanes and interface with the car park management system to provide full functionality. Car park management systems should use ANPR

Parking Angle	**Preferred Aisle width (m)**	**Bay width (m)**	**Preferred bin width** bay length 4.80m
90°	6.95 (two-way)	All	16.55
90°	6.00 (one-way)	All	15.60
60°	4.20	2.30 2.40 2.50	14.85 14.95 15.05
45°	3.60	2.30 2.40 2.50	13.65 13.80 13.95

Table 3.5: Recommended aisle and bin widths

to associate each vehicle with a right to park (e.g. a parking payment or pass), enabling revenue control and enforcement where required.

“Free flow” barrier-less systems are becoming the norm for car parks where customers are likely to be mostly or exclusively rail users. A car park that is for mixed use may require entry and exit lanes to be barrier controlled, allowing access/ egress for paying customers, and protecting revenue by denying entry/ exit to non-payers.

Rising arm barriers require an entry and exit control device linked via intercoms to centrally managed parking controls. Barriers can also be helpful, even without a ticketing function, where management of the rate of entry/ exit and vehicle speed control is required.

ANPR can be used with barriers to restrict access to pre-booked vehicles. Where ANPR is in use the control device may not be required by drivers unless they need to talk to parking management.

Entry and exit ticket machines should be easy to reach without requiring a driver to open the car door. In some instances, existing ticketing systems may be required to be retained but space and containment for services should be allowed for future changes to vehicle entry and exit points.

Where vehicle access is located close to local highways PPUDO zones or ranking should be set back to prevent queues developing on the local network. Clear signing and wayfinding should indicate where vehicles are required to go, being mindful of pedestrian and cycle routes.

Rising arm barriers are provided to performance criteria as specified in BS 6571. The rising arm barrier should have a fracture plate or be mounted on a clutch system such that it can be broken off or pushed up in an emergency. The lower edge of the arm should be cushioned to minimise damage if the arm descends on a pedestrian.

Lane widths at barriers should be no wider than 2.35m to avoid standoff situations where motorists are unable to reach the ticket or card reader without leaving their vehicle. Left turns onto barriers should be avoided for the same reason unless the control barrier is set back from the turn. To avoid roll-back situations, gradients at barriers should be as flat as possible and preferably no steeper than one in 30 (3.3%).

The number of barriers required at entrances/exits will depend on the expected peak hour traffic flows. The typical working capacity of a single ticket operated barrier is approximately 350 vehicles per hour. Automatic number plate recognition capacity is higher at approximately 500 vehicles per hour. Where there is no rising arm barrier, ANPR or similar, free-flowing systems are used with an increase in exit capacity, possibly up to 800 vehicles per hour.

References and Resources

The Code of Practice Design Standards for Accessible Railway Stations
Department for Transport
Network Rail EV charging infrastructure report
Mitie Energy
Design of an accessible and inclusive built environment
BS8300-1:2018 / BS8300-2:2018
Car Park Designers' Handbook
ICE
Station Car Parking Good Practice Guide
Rail Delivery Group

Image 3.18
Fast EV charge points installed in Worcester Parkway Station car park

Image 3.19
Accessible parking spaces and marked pedestrian route

3.3 Accessibility and Inclusivity

3.3.1 Inclusive design compliance

Designers should confirm that parking facilities are accessible to all. This goes beyond simply providing accessible parking spaces for adapted cycles or Blue Badge holders. It extends into making the end-to-end experience accessible for users with a wide range of disabilities, covering matters such as pedestrian routes and ticketing equipment. Accessible facilities can benefit all customers, including those who are frail, have luggage, women passengers travelling alone, or passengers travelling with children.

Designs should comply with the DfT Code of Practice, BS 8300 and the Equality Act 2010. The Code of Practice Design Standards for Accessible Railway Stations includes detailed requirements for accessible parking and should be the first reference point for accessible design. A National Technical Specification Notice (NTSN) is in force as from January 2021 and applies to all new work, upgrades or renewal in relation to provision for PRMs (Persons with Reduced Mobility).

This section of the Guide draws out some key issues arising from the Code of Practice, and also describes the Disabled Parking Accreditation scheme. A Disability Impact Assessment should take place as soon as possible in the design process and be updated at every GRIP (Governance for Network Rail Investment Projects) design work stage.

3.3.2 Disabled cyclists, drivers and passengers

Designs should consider the needs of all disabled cyclists, car drivers and passengers across the age spectrum, and not just those restricted to a wheelchair. Disabled passengers can be driven to the station by non-disabled companions.

When considering the needs of disabled people (including those with hidden disabilities) a Diversity Impact Assessment (see Inclusive Design in Stations NR/GN/CIV/300/04) should be drafted at the earliest design stage with the following range of disabilities taken into account:

- → Physical impairment including limited mobility, such as of the head and neck, as well as impaired coordination of upper or lower limbs
- → Physical reactions to noxious materials and stimuli
- → Sensory impairment — such as sight or hearing impairment, which can reduce perception situations
- → Neurodiversity — which makes comprehension of routine situations more difficult or requires the consistent use of hazard or warning signals
- → Limitations to speech or language comprehension or communication capability

3.3.3 Number of accessible spaces

The Code of Practice sets a 5% minimum provision of accessible (Blue Badge) parking spaces for customers. The same figure is recommended for accessible cycle parking spaces.

However, in some limited cases, particularly larger car parks, actual demand for Blue Badge spaces does not approach this level, even at the busiest times. In some of these instances, standard parking spaces are regularly full, which means the balance between the two types of space may not be correct. This situation can also generate potential for abuse of Blue Badge spaces by non-badge holders. This is recognised as an issue by Disabled Motoring UK.

For projects that evidence an over provision of Blue Badge spaces, it is possible to apply to DfT or Transport Scotland for variation from the 5% standard. Strong numeric evidence is required to justify a lower figure. This could involve a daily occupancy count (at the busiest period each day) over a number of months and supporting user surveys. Where a variation is considered necessary, DfT or Transport Scotland should be consulted at the outset to agree the level of evidence they will require prior to carrying out counts or other monitoring.

The Disabled Parking Accreditation (DPA) scheme recognises off-street parking facilities that are accessible to disabled people. It is an initiative by Disabled Motoring UK (DMUK) and managed by the British Parking Association (BPA). Like ParkMark, the BPA's Safer Parking Scheme, it is a useful "kitemark" of quality and Investors should consider this initiative.

Parking provisions for the disabled should be in accordance with the Accessible Train and Station Design for Disabled People: A Code of Practice and BS 8300: Design of buildings and their approaches to meet the needs of Disabled People Code of Practice. Wherever practicable, parking for disabled people should be provided as close as possible to the shortest step-free access to the station, often these spaces may be in surface parking locations. Assessment of the best location for spaces for disabled people should consider the characteristics of each individual parking facility. Consideration

Blue Badge and adapted cycle parking bays should be clearly signed, with disabled car parking bays marked by the International Symbol on the car park surface. Signs should also be provided at driver's eye level.

Parking spaces and disabled taxi pick-up/drop-off bays for disabled car drivers and passengers should be located as close as possible to the station entrance with near side drop off and safe, direct, step-free access to the station.

Image 3.20
Accessible parking bay

NR Guidance Suite Reference

Inclusive Design Manual
NR/GN/CIV/300/04

References and Resources

Design of an accessible and inclusive built environment
BS 8300
Equality Act 2010
Inclusive Mobility A Guide to Best Practice on Access to Pedestrian and Transport Infrastructure
Department for Transport
Design Standards for Accessible Railway Stations
Department for Transport Code of Practice

3.4 Lighting

3.4.1 Parking and mobility facility lighting

Lighting quality plays a central role in creating safe and pleasant environments for customers, staff and other users. Lighting that is appropriate to location and function will result in increased safety, legibility, accessibility, security, ambience and, therefore, public satisfaction. Carefully planned lighting will improve wayfinding and make orientation intuitive; contributing to the design of parking facilities and their immediate context that are easy to use and navigate. Where possible, daylighting should be prioritised over artificial lighting.

Feature lighting should be considered where appropriate to enhance sense of place – and the experience of space and art – and to add enjoyment to the experience of the station. Design criteria for lighting parking facilities are described in BS 5489-1:2020, BS EN 13201 and BS EN 12461- 1/-2. These documents should be referred to where additional detail is required (also see Clauses 5.1.4 to 5.1.8 of this document).

- A task-based lighting strategy should be developed for functional areas, such as ticket machines, information displays and barriers, to deliver light where and when it is needed without over lighting.
- Lighting consistency should be maintained throughout by lighting all surfaces to improve visibility, visual comfort and adaptation and to prevent dark corners and potential vandalism
- Particular care is required when planning lighting for areas where pedestrian and vehicle routes intersect as vehicle headlights may cause glare for pedestrians. Lighting for these areas should be sufficient to enable pedestrians to move safely and to be seen by drivers
- Calculation of glare index and lux levels should be provided together with details of luminaires and columns for approval
- At pay kiosks and ticket machines, lighting levels should be sufficient to enable facility users to read instructions and use payment devices
- Lighting in pedestrian areas should follow the recommendations of the relevant UK standards
- To allow people to leave and return to the parking facility, lighting levels should enable them to clearly see and be seen.
- Any pedestrian areas that will be regularly used by staff should be considered as part of the workplace and lit appropriately
- Transition zones should be identified to facilitate adaptation between natural and electric lighting and between areas with significantly different light levels
- Consider using intelligent lighting systems to reduce power consumption, i.e. lighting that is time-based or uses sensors to determine appropriate use

Image 3.21 Cycle access route lighting, Kingston.

References and Resources

Light and Lighting
BS EN 13201
Indoor and Outdoor Lighting Best Practice
BS EN 12461- 1 / -2
Design of road lighting - Lighting of roads and public amenity areas
BS 5489-1:2020
Institute of Lighting Professionals (ILP) Guidance
Note 1 for the reduction of obtrusive light

Image 3.22 Integrated lighting between the station area and-party systems. Utrecht central Station

3.4.2 Integration with third-party lighting

External lighting should be designed according to a facility's local context, with light levels appropriate to the facility's lighting zone, including reasonable use of outdoor lighting for night-time safety, security, productivity, enjoyment and commerce while not impacting negatively on neighbouring communities.

Lighting requirements vary according to context e.g. ranging from protected wildlife corridors to high-intensity commercial and industrial districts. A coordinated lighting strategy should be developed between Network Rail, local authorities, third party-owned lighting systems and ecologists with the common goals of:

→ Increasing visibility, safety and sense of security
→ Minimising light pollution
→ Identifying hazards
→ Avoiding energy waste
→ Minimising visual clutter
→ Creating a positive customer experience
→ Considering impact on wildlife

Luminaires should be specified to confirm light spilt across site boundaries complies with the Institute of Lighting Professionals (ILP) Guidance Note 1 for the reduction of obtrusive light 2021.

3.5 Wayfinding and Information

3.5.1 Wayfinding overview

Wayfinding describes how people find their way around an environment. It is a spatial problem solving process in which orienting decisions are made. These decisions are influenced by a number of factors including the information available, personal knowledge, ability and environmental factors.

Information to aid wayfinding can be provided across a range of media including signs, printed material, public announcements and staff/customer interface; as well as through the physical design of station environments and facilities and the materials, finishes, lighting and public art within them.

The philosophy underpinning wayfinding and signage at railway stations should be that of clarity, consistency and coherence in order to guide people through stations in a steady, convenient and safe manner helping to confirm station users have a positive, stress-free experience. This philosophy supports a well-planned and well laid out station, and is integral to its design.

A signing system comprises directional and locational signs. For it to be successful, the terminology, design and fixing of these signs should be consistent.

Signing to meet fire and safety regulations is also required to warn of dangers and to inform people of emergency procedures. These are known as Statutory signs and it is essential that an appropriate sign is used in each instance.

Network Rail wayfinding standards and guidance should be followed for new and updated pedestrian wayfinding and signage within Network Rail managed stations. Vehicular signage should, where possible, align with highway signage, as detailed in Traffic Signs Manual and the Traffic Sign Regulations and General Directions. The following customer information should be provided in relation to station parking facilities:

- → Directional signage between station parking (including cycle parking) and surrounding destinations and inter-modal facilities
- → Parking space availability signs on the surrounding highway network
- → Function of parking spaces, e.g. Disabled, EV charging, 2+ Car Share, Car Club
- → How to pay and location of pay booths
- → Availability of services at the station
- → Assistance staff/help points
- → Real time information on train and other connecting services

Wayfinding principles
Consistent and predictable placement Signs placement and mounting heights should be predictable with destinations signed consistently from first mention on a sign to arrival at the destination.
Appropriate spacing between signs Signage should stand out from its environment. A predictable rhythm of signage should be established in order to set expectations for the traveller.
Clear sight lines for signs Signs should be placed perpendicular to the main movement flow to allow the user to identify the relevant information quickly and intuitively.
Clean layout Sign content and design should follow Network Rail's content hierarchy and standards for layouts, letter heights, line spacing, colour palette and should read as a system to give the passenger confidence in the accuracy of the information.

Table 3.6 Network Rail wayfinding principles

NR Guidance Suite Reference

NR Wayfinding Design Guidance
NR/GN/CIV/300/01

3.5.2 External signage

An external signage strategy serves to promote efficient access to and egress from parking facilities for all users including pedestrians, cyclists and car drivers. Signs should advise, direct, be predictable, easily understood and easily recognisable. Even when travelling at low speeds in a station forecourt or parking area the driver's workload can be relatively high and an abundance of signs only serves to confuse, whereas too few directional signs can create a sense of unease.

To maintain a user's understanding, each sign should, where possible, be the same as those found on the highway, and detailed in Traffic Signs Manual and the Traffic Sign Regulations and General Directions. This is an important consideration for new and emerging mobility services such as connected and autonomous vehicles that will recognise standard highway signs, but potentially not bespoke signs.

To reduce sign clutter the use of road markings (line markings) should supplement vertical signs and replicate the markings found on the highway. Traffic Signs Manual Chapter 3 Regulatory Signs provides guidance on the design of common highway vehicle control applications such as Give Way and Stop junction markings.

Traffic Signs Manual Chapter 5 provides details on size and application of other commonly used road marking around parking facilities and station access routes including lane indication arrows and elongated text.

External signage and wayfinding should include:

→ Directional signage for vehicles on approaches to the parking facilities – including to Mobility Hubs, secure cycle parking and pick up/set-down areas (in negotiation with the local highway authority)

→ Directional signage for pedestrians and cyclists to facility entrances

→ Use of Variable Message Signs or similar to provide advance warning of parking space availability to users approaching from the surrounding network and options of alternative parking locations where parking facilities are full

→ Illuminated gateway signs at parking facility entrances for vehicles and other users including pedestrians and cyclists

→ Entry lane layout and information to inform users of parking facility operations such as charges and opening hours

Directional arrows coupled with "EXIT" signs should be installed to support users exiting the parking facility.

Image 3.23 On-street car park space availability display

3.5.3 Internal signage and markings

Directional signage and road markings within parking facilities should be clear, consistent, unambiguous and easy to read. Parking bay markings should be clear and include designation of cycle, motorcycle, micromobility, disabled, EV, 2+ Car Club, Car Share and special use bays.

The Share-North project has developed a suite of icons to represent shared mobility and its main forms for use on signage, Mobility Hubs, websites and information packages. The icons are free for sharing and are available in from the Share-north website or the Noun Project.

Internal wayfinding and signage should include:

→ Entry signs should be readable by those requiring use of the facility, clearly showing:
  - daily opening hours
  - scale of tariffs
  - height restrictions
  - operator terms and conditions

→ Pedestrian route signs between facility entrances/exits and other station facilities and amenities that comply with Network Rail Wayfinding Design Guidance

→ Signage to clearly demarcate vehicle, cycle and pedestrian routes

→ Signage to direct pedestrians efficiently towards vertical circulation and discourage them from using vehicle ramps

→ Wayfinding clearly identifying direction of travel, including signage to identify vacant spaces at the facility entrance, which can reduce abortive travel within the parking facilities

→ Signage that clearly indicates the location of disabled parking areas and bays for other specialist uses, e.g. electric vehicles

→ Surface marking for vehicle movements should be consistent with standard highway signs and include:
  - directional arrows and other horizontal markings including stop signs
  - parking bays
  - pedestrian and (where required) cycle routes, crossings and aisles

→ Floor levels clearly delineated for all users with the use of coloured signage and wall colours to cores and super-graphics visible from all parking areas and within stair and lift lobbies

→ Customer Information Systems to inform customers of train arrivals and departures

→ Local orientation maps at pedestrian exits

References and Resources

Traffic Signs Manual
Department for Transport
Traffic Sign Regulations and General Directions
Department for Transport
Shared mobility icons
https://share-north.eu/resources/

Image 3.24
Customer wayfinding, CIS signed trolley point and seating at Paddington Station PPUDO zone

3.5.4 Wayfinding for special use facilities

Blue Badge parking bay

Blue Badge bays should be clearly marked with horizontal and vertical signage including the International Symbol on the car park surface.

Signs should be provided at driver's eye level.

Routes to Blue Badge bays should be clearly signposted from car park entrances.

Passenger pick-up/drop-off zones

Passenger pick-up/drop-off bays should be clearly identified with road markings and vertical signage adjacent to the bays and with surface marking to define the extent of the allocated space.

Taxi and shared mobility information including operator details and how to access the system should be included at bays and within public transport information materials.

In large facilities with multiple pick-up/set-down zones, bays should be numbered for ease of identification.

Car clubs and 2+ car share

2+ car share bays should be visible and clearly marked.

Car Club bays should be identified through line markings with the wording "Car club vehicles only" or "Car club only" to the outer edge of the bay with use of a distinguishing surface colour considered in the bay.

Electric vehicle charging infrastructure for EV car clubs should be clearly signed at designated bays.

Contact details of the car club operators should be included at the bays.

Image 3.25 Disabled bay with bay colour and international symbol

Image 3.26 PPUDO zone horizontal signage

Image 3.27 Car Club bay with contact details and DfT approved sign

Mobility Hubs

Mobility Hubs should have distinct branding and information for ease of use including digital totems.

Hubs should be clearly identified and signed from surrounding routes and within the station concourse.

At large hubs with cycle parking, wayfinding and zoning of the parking area should be considered to assist with users finding their bicycles.

Kerbside management and CAVs

Traditional and digital signage should be used to indicate space availability and changing use cases during the day, e.g. parking permissions, vehicle types.

Clear and visible marking of the kerb and road space.

Confirm that the electronic signs and road markings are correctly operating and are fully visible at all times.

Parking spaces markings, road signs and directional information should be consistent with conventional highway signage.

Electric vehicle bays

EV bay locations should be clearly signed from parking facility entrances.

Supporting horizontal and vertical signage should be installed at the bays to confirm their use as charging spaces, e.g. use of coloured surfacing, an EV symbol and signage stating, for example ‘Electric Vehicle Only’.

Signage should still be visible when an EV is parked in the bay.

Signage should advise that bays are only used when EVs are in need of charging to avoid misuse.

Image 3.28 Mobility Hub with branded information totem

Image 3.29 Geofenced on-street micromobility parking zone

Image 3.30 EV bay sign with horizontal and vertical signage

3.6 Car Park Management Systems

3.6.1 Car park management

Approaches to railway parking management vary according to the location and the entity responsible for managing the stations. For example, on the core commuter routes into London, beyond the Greater London boundary, station car parking is generally managed by rail operators and there is a relatively high level of car parking management, often funded through parking charges. In metropolitan areas outside of London such as Mayoral Combined Authority areas, parking is often provided free of charge as part of policies to encourage travel by rail, and the level of management and enforcement of rail station car parking is lower.

Charged car parking with high levels of enforcement is most likely to happen at commuter stations located in dense areas such as town centres where operators are responsible for the station management.

These variables result in different user experiences with the following common issues that can be addressed through implementation of parking management systems at railway stations to deliver an improved customer experience:

- Drivers seeking to park at station are seldom able to find out whether there is a space available prior to parking. This can increase the stress of making a journey by car and rail and reduce the confidence in the ability to make a car-rail journey. This is especially problematic where rail services are less frequent and missing a train due to difficulties in parking brings a greater risk of extending the journey time, or potentially resulting in the user choosing to drive all the way instead of continuing the journey by rail
- For new or occasional users of railway car parks, there can be uncertainty about the arrangements for car parking at stations, whether parking is charged and can be pre-booked, and the processes that are in place for payment
- Payment methods vary between pay and display, pay-on-exit, pay-by-phone/app and payment at a kiosk on entry. The different payment methods may require a user to bring cash, to download an app and set up a payment account or to pay by phone all of which may not be clear until arrival at the car park adding stress and delay. The point at which a user is seeking to park at a station prior to catching a train is often time-pressured requiring simple, efficient and easy to understand processes for payment
- At many stations, car parking spaces are fully occupied before the end of the morning peak and remain full until late in the afternoon, precluding use of railway station car parking for off-peak users. For those arriving towards the end of the morning peak or at off-peak times, the inability to guarantee a space at the station car park may prevent them from travelling by rail and/or create overspill parking in areas adjacent to the station

3.6.2 Design considerations

Parking management systems (including CCTV, intercom, ANPR cameras and sensors) should control all access and payment operations for customers and allow the car park to be operated remotely from an operator's call centre.

- ANPR systems should be provided to cover all entry and exit lanes and interface with the car park management system to provide full functionality (see Section 3.2.13)
- Prior to making their journey, users should be able to find out all the information they need about car parking at the station from the relevant websites (National Rail, rail operator, Local Transport Authority) and through National Rail Enquiries
- Provide users with the ability to pay for car parking prior to their journey or allow a grace period shortly after parking (for example allowing users to pay via an app whilst waiting on the platform or on the train) to remove the requirement for users to interact with payment processes during a potentially stressful and time-pressured part of their journey

- Where required, ticket machines and payment station locations should reflect the payment method, and the day-to-day operation and management of the car park. Payment stations should be highly visible, and be located in prominent and convenient positions, preferably adjacent to all main access/exits from parking areas and levels as well as on the return route from the station to the car park
- Consideration should be given to the provision of additional payment stations on key routes to the car park to deal with any short-term increase in demand or equipment failure
- Reduce the burden of cash collection by prioritising cashless payment for car parking, allowing users to pay at terminals using contactless cards/mobile phones, pay by phone or online payment. Where terminals are installed, they should be energy efficient and provide a receipt for payment on request
- Parking management systems should allow the manager of the car park to have readily available data on parking occupancy patterns, which may inform pricing strategies and future decisions about allocation of space within car parks for other uses
- The parking management system should interface with third party systems (including credit card payment processing, other payment systems such as mobile phone payment, accounting systems, and any other systems that would be reasonably required by an operator) using interfaces based on appropriate standards (e.g. APDS or Open Charge Point Interface (OCPI) for EV charging)
- Live information about car park occupancy/space availability provided by access to control systems or other occupancy monitoring systems should be made available for users to view. Providing an API allows occupancy data to be shown by apps, websites, in-car systems or dynamic on-street signage
- Control access to the car park where there may be demand from non-rail users through the use of “raised arm” parking barriers or barrier-free access control using ANPR.
- Payment machine functions (coin and card facilities, intercom buttons) should be accessible to those in a wheelchair, instructions and screens should be accessible to those with vision impairments. If the car park is barriered, then the car park barrier ticket machines should be accessible to wheelchair users

3.6.3 Car park operations and maintenance

Staffing costs can be minimised, but not eliminated, by the use of Smart Parking Systems, however even if these systems are implemented, staff will still be required to deal with:

- Maintenance
- Cash handling
- Car park ticket replenishment
- Customer help including mobility assistance
- Monitoring the car park control system
- Occasional equipment errors or failures

System installation
There should be coordinated installation of all service elements such as light fittings, CCTV cameras, payment stations, and digital signage to minimise clutter and the impact on the quality of the car park environment.

Image 3.31
HVM at London King's cross through an arrangement of seating and bollards that contribute to a positive passenger experience

3.7.1 Safety and security

Design of railway station parking and mobility facilities and connections to and from surrounding areas including station buildings should be and feel safe for users. Consideration of safety and security should be applied at the initial stages of a project informed by the guidance contained in the DfT Security in the Design of Stations, 2018 to embed design decisions that can enhance safety and security from the outset rather than as an afterthought.

The location of security features, visibility and natural surveillance should all be incorporated into the spatial response.

- → Plan and design spaces based on an understanding of demand, desire lines and circulation patterns to enable people to move freely, comfortably and without conflicts
- → Provide convenient, accessible, legible, obstacle free, well-lit and clearly signposted connections and crossing points between parking and mobility facilities and station buildings
- → Enhance permeability and connections to remove hidden corners and confirm an appropriate maintenance programme is in place
- → Locate waiting areas and information boards in well-lit sites with good natural surveillance or within view of staff locations
- → Waiting areas and connecting routes should be sized to accommodate predicted demand, covered and with even illumination
- → Locate seating and other features to encourage movement and social interaction and confirm that facilities such as retail units, seating and help points are not positioned in isolated locations
- → Encourage lively station frontages and consider the use of suitable materials such as glass frontages to enhance visibility
- → Design lighting systems to make spaces feel safe and secure
- → Design environments with high levels of natural surveillance to encourage people to observe the spaces around them
- → Where possible, rationalise road and junction design around stations to minimise crossing distances and provide additional footway space based upon pedestrian comfort analysis
- → Create a clear definition between public and private spaces, introducing where possible active uses around public spaces that will provide natural surveillance
- → Engage with the local community to achieve safe walking/cycling routes in surrounding areas

Statutory Requirements

Station facilities should be designed to be fully compliant with National Railways Security Programme (NRSP) and all Statutory and Network Rail fire, safety and security requirements, including:

- → An appropriate means of escape
- → Emergency lighting with fail-safe power
- → Fire alarms and smoke detection
- → Signage and fire-fighting equipment
- → A station evacuation plan

References and Resources

Security In the Design Of Stations (SIDOS), 2018
Department for Transport

Fire safety in the design, management and use of rail infrastructure,
BS 9992

Traffic Sign Regulations and General Directions
Department for Transport

National Railways Security Programme
Department for Transport

CCTV monitoring provides numerous benefits, including the recording of criminal activity and crowd management in stations. Used overtly, it can also act as a deterrent to crime and reduce fear of crime in stations, on-street and in vehicles.

- → Consider discrete placement of cameras within the design whilst remaining noticeable and allowing for clear, uninterrupted views of all public areas
- → Use visible crime prevention elements, such as posting information on security cameras and providing ample and accessible telephones and passenger help points. This will provide the user with a feeling of safety and allow for maximum surveillance.
- → CCTV cameras should be integrated with parking management systems incorporating off-site monitoring and linked to the ANPR system, at strategic locations such as parking facility entry and exit, cycle and micromobility parking areas, pay machines, EV and disabled parking bays

3.7.2 Hostile vehicle mitigation

Many stations, particularly those that are centrally located may demand a heightened approach to security through counter-terrorism measures. The visual effect of Hostile Vehicle Mitigation (HVM) can be minimised through design and often integrated into street furniture.

- → Provide sensitive mitigation of vehicular impacts through measures engineered to resist vehicles including setbacks and bollards, planters, incursion barriers and street furniture, and suitably resistant structures and cladding
- → Facilities and spaces in and around stations should be designed to discourage crime throughout the day and night. Crime and the fear of crime can be greatly reduced by removing isolated areas and confirming locations are well lit and visible to others
- → Engage with transport authorities and agencies to coordinate surveillance and activities in adjoining areas
- → Designs should aim to optimise the balance between designing out crime and meeting the wider design principles set out in this document and Network Rail's wider suite of guidance

3.7.3 Secure by design

Station parking and mobility facility design should consider public security against a range of different threats, both man-made and natural. All stations face a certain level of risk associated with various threats be they the result of natural events, such as flooding and accidents, or through malicious practices. The risk of malicious practices should be reduced through the design process. Stations all face a certain level of risk but developing an appropriate secure and sensitive design helps to mitigate the potential loss of life, property or function.

- → Consult with Network Rail's Security Advisors and other crime prevention specialists such as the British Transport Police, TRANSEC or the National Rail Crime Prevention Unit as early as possible in the scheme's design. This will confirm that factors such as lighting, clear lines of sight and CCTV are included in the context of existing crime factors in the vicinity
- → Identify the range of threats to the station through a Threat and Vulnerability Risk Assessment considering threats to both operators and users
- → Consider the need for resilience to climate change and extreme weather conditions
- → Design to minimise the opportunity for the discreet placement of devices

Image 3.32 HVM outside Arsenal Stadium using steel reinforced letters to create a community focal point

3.8 Ancillary uses

3.8.1 Ancillary, added-value and community uses

There are various facilities that may already be incorporated within or adjacent to station parking environments or where design activities may present an opportunity to provide these as part of efforts to improve passenger amenity.

Such items may include:

→ Retail units that face and are accessed via the public realm

→ Permanent freestanding kiosks, such as for passenger information or small-scale retail

→ Food carts or pop up markets, which may be mobile but need a designated space

→ Parcel lockers and similar style delivery collection points (see Section 2.8)

→ Other special elements that are managed by or for the local community facilities such as noticeboards, heritage signage, play features and community gardens

Relationships to existing facilities or potential for additional facilities should be considered when undertaking planning for parking and mobility facilities and spaces. Specific design considerations will vary according to the location, but key aspects include:

→ The need to provide access to the facility for third parties (e.g. retailer or community group), potentially outside of station operating hours

→ Any special management or operational considerations, as well as general servicing requirements for deliveries and refuse collections

→ Supply of power and water for kiosks and carts, and water for community gardens

→ In the case of kiosks and food carts, there may be a need for additional storage space within the station area

Image 3.33 Pop-up food market activates King's Cross Station forecourt public realm

4

Parking & Mobility

Station Scenarios

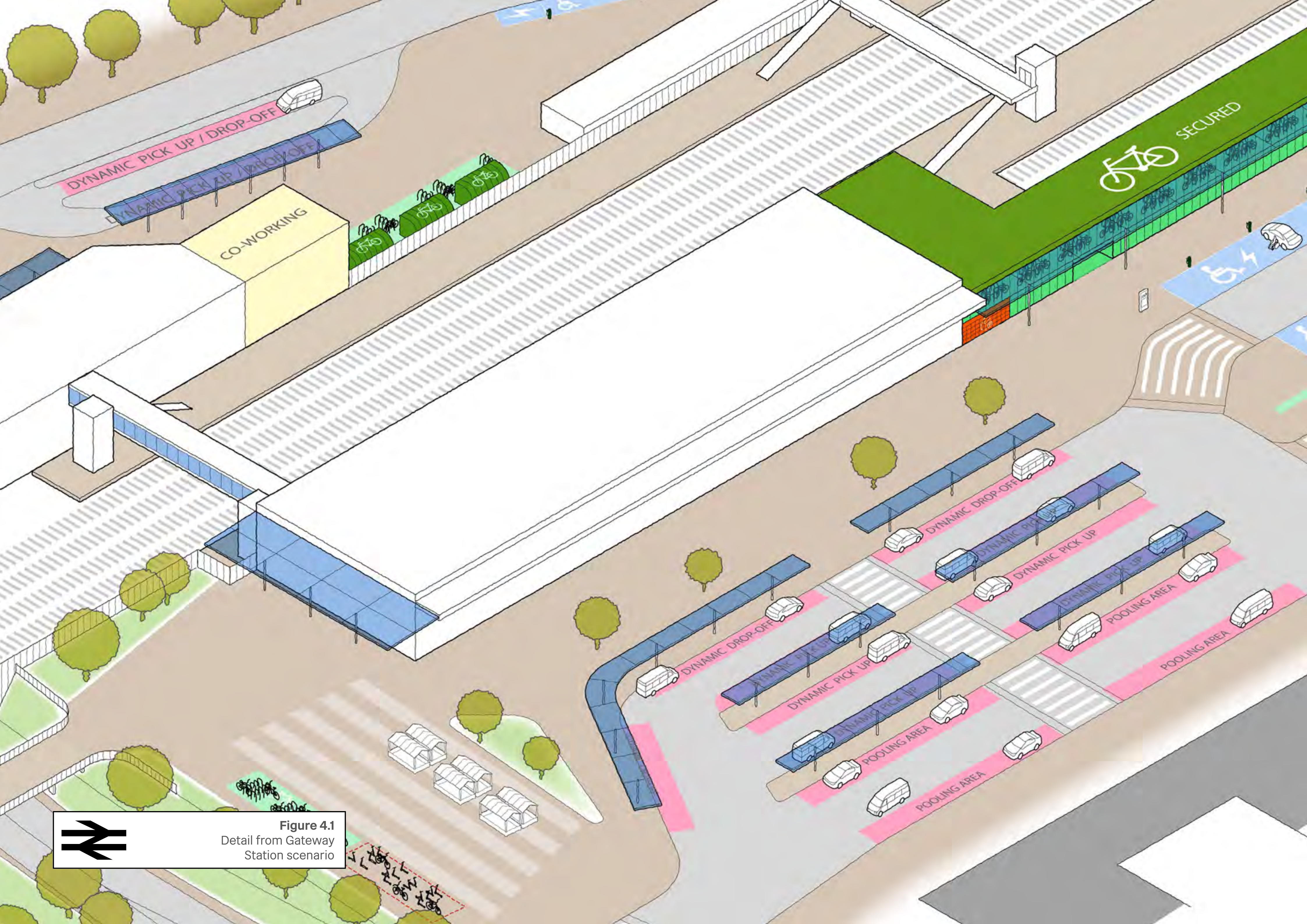


Figure 4.1
Detail from Gateway
Station scenario

4.1 Station context

4.1.1 Station context

Six representative station scenarios are presented within this section to illustrate how parking and mobility at stations with different urban and mobility characteristics may change over the coming decade influenced by new mobility technologies and evolving trends. These station models broadly represent the range of parking and access scenarios present at UK stations.

In applying these models to station projects, the factors described on this page should be considered. These acknowledge that, while many stations share some physical attributes, it is their context – be it spatial, socio-demographic, or political – that will ultimately influence how they are likely to evolve in the future.

User base

Determine the station's current user base and how that may change in the future:

- → Review current, historic and forecast passenger numbers, including the split of passengers arriving, exiting and interchanging at the station
- → Review current, historic and forecast catchment resident and workforce population
- → Review type and mix of passengers, based on travel frequency, purpose and distance

Existing or proposed modes of access

Review how access to the station may change in the future including impacts of local planning and transport policy, and policy objectives within Local Transport Plans:

- → Current access mode share
- → Presence and size of car parking facilities
- → Presence and size of cycle parking facilities
- → Presence and size of taxi and demand responsive transport facilities
- → Presence of shared mobility facilities including micromobility
- → Public transport accessibility, including coverage, service frequency and hours of operation

Future change to station access

Evaluate how the identified changes to station access may impact on the need for and provision of parking and mobility facilities:

- → Location of the station in relation to key origin and destination points
- → Space availability, including space that could be converted from one use to another
- → Availability of non-rail station uses, such as retail outlets serving local population, over site development (existing or proposed), shared workspaces or the desire to transform the station into a focal space for the local community
- → Existing or emerging policy considerations, including policies in relation to modal shift, new mobility, and/or mode prioritisation, e.g. area based car-use restrictions/charging schemes, changes to car parking standards, emergence of new mobility services

4.1.2 Parking capacity assessment

Each station location is unique with specific local usage patterns and transport policy that need to be considered when evaluating the number of spaces required at station parking facilities. This section describes approaches to estimate demand for cycle and parking facilities at stations taking account of current and future demand and supply estimates.

4.1.3 Cycle parking capacity assessment

Guidance for the minimum quantity of cycle parking at public transport interchanges, including railway stations, is published in LTN 1-20. The current recommended minimum for National Rail stations is 1 space for every 200 passengers however demand will vary according to local circumstances so LTN 1/20 should be the starting point when considering cycle parking demand assessment.

The quantity and mix of cycle parking provided should meet typical current peak demand and allow for a surplus to accommodate future growth. Growth can be predicted by monitoring patterns of demand over time and taking into account local factors that generate greater use such as new developments or improvements to the rail service. Spare capacity should always be provided to cater for growth and turnover. The effect of new infrastructure should also be factored into any decisions about planned reserve capacity of cycle parking facilities.

A proportion of the cycle parking should be accessible to larger types of cycle including electrically assisted cycles, hand-cranked cycles, tricycles, tandems adapted cycles and cargo bikes. A minimum of one accessible space should be provided at every cycle parking facility. As with car parking, 5% of cycle parking capacity should be accessible to all.

A cycle parking assessment typically includes the following activities:

- → Review of data gathered for Local Cycling and Walking Infrastructure Plans and other planning documents
- → Review finding of Diversity Impact Assessment and station Travel Plan surveys
- → Regular surveys of the numbers of cycles parked and locations being used
- → Monitoring cycle parking occupancy: regular counts of cycle parking facilities can help to establish patterns of use and trends over time. Once the cycle parking occupancy regularly breaches 70% this can trigger the provision of additional capacity to confirm that there is always a space to meet demand
- → Monitoring informal cycle parking activity: when counting parked cycles and occupancy of stands, it is also important to note how many cycles are parked informally (i.e. away from cycle parking stands) to get a true picture of the total demand. In some cases informal parking may also occur if the formal parking stands are located in an insecure or inconvenient location, and may therefore be indicative of the preferred location
- → Engagement with businesses and organisations to understand how customer and visitor patterns vary across the day, week or year
- → Engagement with local cycling representative groups to understand existing problem locations – either where absence of parking is an issue, or where there are ongoing security concerns. Police liaison may also be helpful regarding the latter
- → Engagement with local pedestrian and accessibility groups to understand where fly-parking presents an obstruction or hazard
- → Review of existing trip generators and the ability to access them easily by cycle – locations more easily accessible by cycle may justify an increased level of provision of cycle parking
- → Introduction of temporary cycle parking stands as a trial measure and monitoring use

Several other considerations can help inform cycle demand estimation.

Cycling Catchment: The DfT Cycling to Stations Report suggest that around 75% of journeys to stations are less than 2.5 miles (4-5km). Other data such as the National Travel Survey also suggests that the majority of everyday cycle journeys fall within this range. The density of development within this radius of the station will have an impact on demand.

Proportion of Season Ticket Holders: Regular commuters are likely to be making short journeys to/from local stations and are therefore a potential 'near market' for cycling. Stations with a high proportion of season ticket holders are therefore likely to have greatest demand for cycle parking.

Access Mode Data: Where available, data on mode of travel used to access the station is indicative of cycle parking demand, such as the National Rail Passenger Survey, surveys by station/train operators and surveys by local transport authorities. Caution is required due to sample size as most surveys are not large-scale.

Propensity to Cycle Tool: The Propensity to Cycle Tool (https://www.pct.bike/) offers a simple way to look at local travel patterns based on Census Journey to Work data which is fed into a GIS based application. The tool also provides a 'scenario planning' facility that can help illustrate the magnitude of increase in various potential scenarios. All of the data and software in the PCT is open source, enabling it to be customised with additional local information, such as planned new development.

References and Resources

LTN 1/20 Cycle Infrastructure Design
Department for Transport
Standards for Public Cycle Parking
Cycle Rail Working Group

Image 4.1
Secure cycle hub and lockers, Waltham Forest

4.1.3 Car parking demand assessment

When planning car parks it is helpful to consider a target maximum occupancy. Usual values are 95% for commuter or other long-stay parking, and 90% for short-stay parking. Above these figures, the car park should be considered as full, and intervention may be required to confirm that customers have a reasonable certainty of finding a space.

Establishing a 'trigger' occupancy level for responding to demand growth will help anticipate potential supply issues. Typical triggers are 75- 85% occupancy, depending on anticipated growth rates. Consideration should be given to mitigation strategies when car parks are at or close to the trigger occupancy level. These measures may include provision of additional spaces, but in the first instance should review opportunities to better manage use of the existing supply, particularly through promoting alternative modes, developing Station Travel Plans and use of pricing strategies and smart parking technologies to optimise use of the existing space.

The scope of a car park assessment typically includes the following activities:

- → Review of existing public and private sector parking provision at the station and in the immediate local area (including parking locations, numbers of spaces, long/short stay, occupancy, arrival and departure traffic profiles, patterns of use including peak hours, historic car park entry/exit flows (if available)
- → Review of local public transport provision
- → Review finding of Diversity Impact Assessment and station Travel Plan surveys
- → Review of station catchment area data to help identify future passenger demand, drive distances and potential for modal shift
- → Review of relevant transport planning policies and parking standards to identify the context for planning of future car park provision
- → Review of planned developments within the station catchment area
- → Forecast of how demand for car parking will change considering changes to car ownership levels and car parking provision at the origin (considering nearby developments (current and future), future housing growth and other relevant information

Inputs to the assessment could include the need to review and identify:

- → Car park usage surveys (for existing stations car parks)
- → Current and future car parking provision and its type in the immediate local area
- → Under/over provision, and opportunities to change provision and management of car parks, including site disposal and acquisition recommendations, rail passenger trends, opportunities to change car park operations to accommodate future demand, e.g. pricing strategies, charges, permits, and promotions
- → Type of journeys railway users are undertaking to/from the station
- → Passenger forecasts
- → Historic and forecast mode shares in the area including access modes to the rail station, sources may include the National Rail Passenger Survey, surveys by station/train operators and surveys by local transport authorities. Caution is required due to sample size as many surveys are not large-scale
- → Station catchment area data to help identify future passenger demand, drive distances and potential for modal shift

- → Components of car park revenue (short-stay users, season ticket holders)
- → Bicycles, motorcycles and micromobility demand
- → Current and planned provision of shared modes including car clubs and micromobility
- → Available land for the development
- → Local strategic development plans and community requirements in the context of existing or new railway stations

Any review of car parking provision should follow the DfT guidance on modelling demand for car parking at various locations: TAG UNIT M5.1 Modelling Parking and Park and Ride.

Recommended taxi/DDRT provision for the station models is described in Table 4.1.

Representative station type	PPUDO requirements
Gateway station (no/minimal parking)	Primary feeder ranks should provide for 30 to 50 vehicles. Total feeder rank length should provide a 15 minute reservoir of vehicles at full peak demand. Secondary ranks should provide additional space as required subject to capacity of road network.
Gateway station (with parking)	Primary feeder ranks should provide for 20-30 vehicles. Total feeder rank length should provide a 15-minute reservoir of taxis at full peak demand.
Minor Gateways	Primary feeder ranks should provide for 10-15 vehicles. Total feeder rank length should provide a 15-minute reservoir of taxis at full peak demand.
Suburban station (no parking)	Provide for one or more marked set down/pick-up bays where space is available.
Local / rural station (with parking)	Consideration of formal taxi rank or private hire facilities with near side drop off provided for.
Parkway station	Primary feeder ranks should provide for local demand and include for a 15-minute reservoir of vehicles at full peak demand. Ranks should be of a multi bay arrangement with dynamic bay allocation and kerbside management.

Table 4.1 Passenger pick-up/drop-off requirements

NR Guidance Suite Reference

Diversity Impact Assessments (DIAs)

References and Resources

Guidance on the Implementation of Station Travel Plans
RDG / Rail Safety and Standards Board (RSSB)

Modelling Parking and Park and Ride
TAG UNIT M5.1

Standards for Public Cycle Parking
Cycle Rail Working Group

4.2.1 Representative station models

Six representative station models are presented over the following pages. These demonstrate the potential impacts of mobility trends described below across station types.

Smart parking technologies
Smart parking can help manage parking more efficiently and optimise use of available capacity by allowing customers to find and book parking spaces quicker and by providing accurate demand data, supporting planning, enforcement and operations.

Kerbside management
Kerbside management could become an important feature at stations where multiple motorised modes – private cars for kiss & ride, taxis, private hire vehicles, flexible journey car clubs and service vehicles – will interact. Kerbside management could support efficient management and operations of restricted space.

Shared micromobility
Shared micromobility could become increasingly important at stations that have sufficient catchment population to support them. These solutions could provide an alternative first/last mile travel mode for those travelling further afield reducing the need for a private vehicle at either end of the journey. If not commercially viable, such schemes can be introduced if subsidised by local authorities.

Digital Demand Responsive Transport (DDRT)
DDRT services could appear at stations with a larger catchment but limited public transport or shared mobility services. DDRT would help in-fill gaps in transport provision improving station accessibility and supporting mode shift from private cars to shared transport.

Mobility Hubs
Important for local and medium sized stations, the inclusion of Mobility Hubs can simplify access to, and use of, shared mobility modes including DDRT and micromobility, with related facilities such as parcel delivery lockers, enterprise space and seating. Mobility Hubs in rural areas could support remote connectivity and provide additional services such as co-working spaces.

Connected Autonomous Vehicles (CAVs)
CAVs are expected to have the most impact on those stations that will see the continued use of private cars, determined either by purpose or distance to the station. Autonomous Valet Parking is expected to emerge first helping to optimise available parking capacity.

Logistics and freight
First/last mile freight relates to the movement of goods between a distribution hub and an origin/destination. Micro-consolidation centres could be developed at station car parks serving as hubs for last and first mile deliveries. Station car parks also provide an ideal location for parcel lockers, with passengers and other station users collecting their deliveries on the way home.

Air mobility
Aerial vehicles would require a dedicated space to land and take off in the form of a vertiport, which could become a part of transport network. Vertiports could be integrated with multi-use facilities serving various transport modes and acting as hubs with renewable energy, data, and public facilities such as waiting and recreational areas.

	1. Gateway (no parking)	2. Gateway (with parking)	3. Minor Gateway	4. Suburban	5. Local / Rural	6. Single Purpose / Parkways
Key Characteristics	Principal station located in the urban core of major cities	Principal station located in or close to the urban core of cities	Located close to the centre of medium/large towns	Located within mid to high density urban areas with mix of residential, commercial and industrial land uses	Located at fringes of small towns and may serve multiple surrounding settlements	Frequently located adjacent to suburban retail parks or airports
	Trip origin and destination station	Trip origin and destination station	Trip origin and destination station	Trip origin station	Trip origin station but in some cases may also be a tourist destination	Trip origin station
	All rail service types	All rail service types	Commuter and local rail services	Commuter and local rail services	Commuter and local rail services	Mainline, commuter and local rail services
	Comprehensive public transport connections	Comprehensive public transport connections	Reasonable public transport services – dependent on location/geography	Accessible by walk, bike and local public transport (level of service may vary)	Often with limited public transport connections and may not be convenient or easily accessible by walk/bike	Often with limited public transport connections and may not be convenient or easily accessible by walk/bike
	Good cycling connectivity	Good cycling connectivity	Typically convenient for cycling	Cycle parking medium to low (varies by context/geography)	Cycle parking medium to low (varies by context/geography)	Limited cycle provision
	Limited of car parking and low car mode share	Medium to high car parking aligned to local demand	Medium car parking with some reliance on external (third-party) parking facilities	Limited if any, car parking, with limited space for expansion	Medium to high car parking aligned to local demand	High-capacity car parking
	Low car access mode share	Medium to high car access mode share	Medium car access mode share	Low car access mode share	Medium to high car access mode share	High car access mode share
	Medium to high use of taxi and kiss & ride	Medium to high use of taxi and kiss & ride	Medium taxi and kiss & ride	Medium use of kiss & ride, low use of taxi	Medium use of kiss & ride, low use of taxi	Medium taxi and kiss & ride
	Mix of users and uses including for non-travel purposes, e.g. commercial/ retail/F&B	Mix of users and uses including for non-travel purposes, e.g. commercial/ retail/F&B	Mix of users with high proportion of commuters	Majority of users are commuters - off-peak demand varies by station	Users vary by day/time of year – from commuters to tourists dependent on geography	High proportion of commuter generated demand

Table 4.2 Representative station models

4.2.2 Network Rail example hub station

Small- to medium-sized stations constitute ~80% of all those on Britain's railway and the current 2,000+ stations range from small halts in rural locations to medium-sized stations in suburban settings.

Our new hub station provides an adaptable solution that can respond to site specific conditions and contexts to enable the efficient design and delivery of facilities at sites already occupied by a small to medium-sized railway station, as well as at new build sites not yet served by an existing facility.

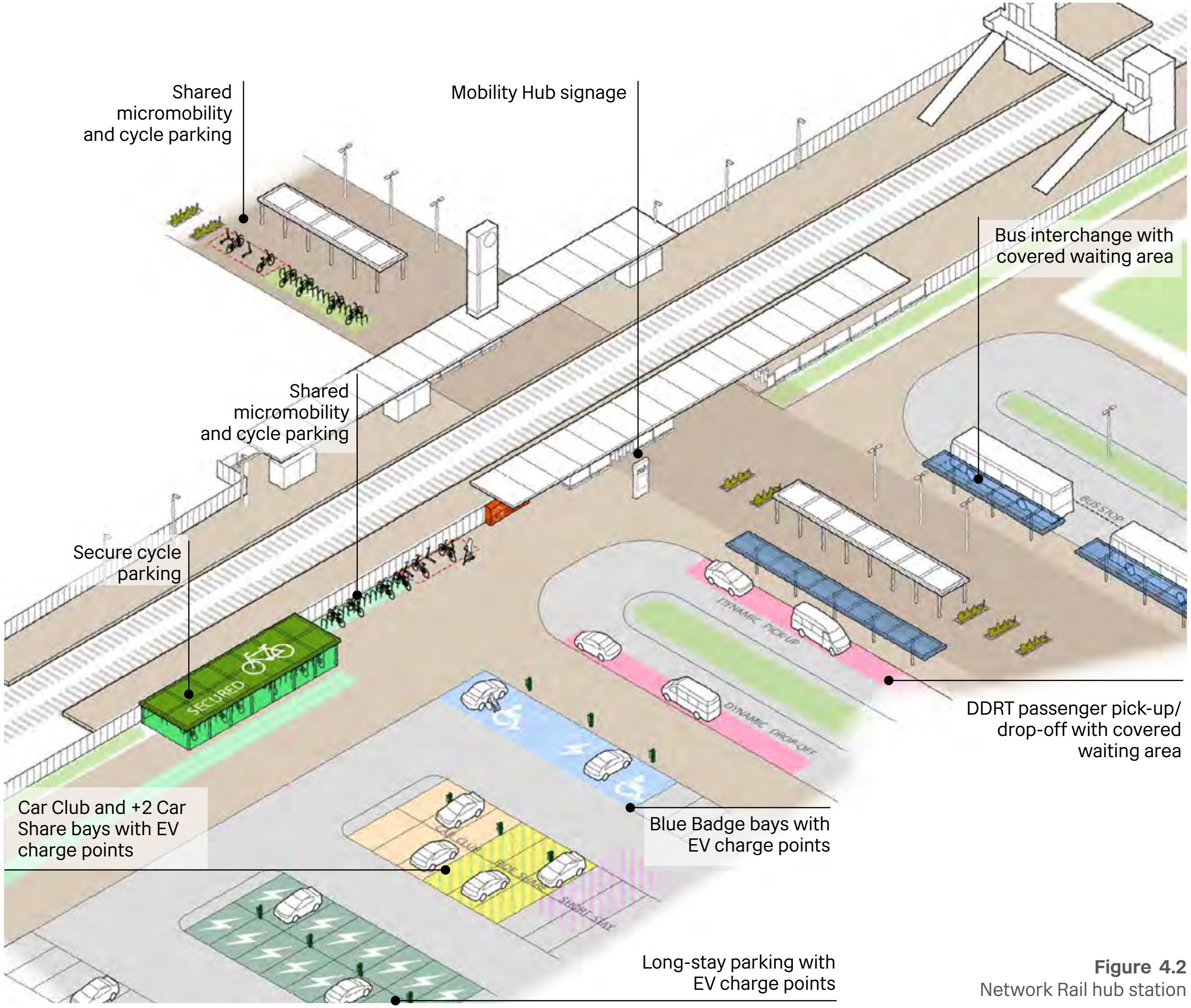


Figure 4.2
Network Rail hub station

4.2.3 Gateway (no/minimal parking)

Gateway stations are located in the urban core of major cities. They have a large resident, worker and visitor user base comprised of passengers and non-rail users accessing a range of services.

Gateways with low parking are typically located in areas with restricted space and limited possibility for expansion. These spatial constraints may result in the conversion of available car parking to other uses such as cycling storage, Mobility Hubs or commercial space.

Current modes of access/egress

- → Gateways typically have good access on foot or by cycle (often with sizeable cycle storage), by public transport and by taxi/private hire (PHV)
- → Car parks may be present but these are very small and the proportion of users accessing the station by car is low
- → Shared mobility schemes such as shared bike/e-scooter and car clubs are already available at Gateway stations with sufficient catchment population to support them

Future state

- → Heavily influenced by the typically constrained urban context
- → Reduced car parking as travel behaviours and access modes change over the short to medium term – with spaces re-purposed or retrofitted to suit more efficient, shared and active modes, e.g. cycle parking or Mobility Hubs may take over some of the space currently dedicated to private cars
- → Taxis will continue to be popular and PHV provision could increase with more managed pick-up/set-down zones required
- → Focus on access/egress by sustainable travel modes (active travel, public transport, shared mobility) supported by evolving policies encouraging a modal shift away from cars
- → Improvements to pedestrian and cycle access, including enhanced connecting routes
- → Growth in availability and type of cycle storage and provision for shared mobility aligned to local policy and demand
- → Inclusion of Mobility Hubs to simplify access to, and use of, shared mobility modes, with related facilities such as parcel delivery lockers, enterprise space or seating
- → Application of smart parking technologies / kerbside management to advise users of available parking options and manage efficient use of external kerb space for time-based deliveries, PHV pick-up/set-down and other services

4.2.4 Gateway (with parking)

Gateway stations with parking are located in urban centres or close to the centre edge of medium to large cities. With a substantial resident, worker and visitor user base, these stations cater to a diverse range of users, often serving a large catchment area.

These Gateway stations typically have medium to large car parks with sufficient space to serve both station users and those visiting sites close to the station, often occupying a significant proportion of the station footprint.

Current modes of access/egress

→ Co-existence of all modes of access – most stations support those accessing the station on foot or by cycle (often with a sizeable cycle store available), by public transport, by taxi/PHV and by private car

→ Shared mobility schemes such as shared bike/e-scooter and car clubs are already available at Gateway stations with sufficient catchment population to support them

Future state

→ Future demand for car parking is expected to evolve in response to changes in travel patterns, available access modes and local policies:

- Some Gateways are located in built up areas with limited urban space and challenges such as high level of congestion and poor air quality. Policy makers may seek to discourage car travel through measures such as LEZs and road user charges which may lead to re-purposing of car parks space to encourage a shift to more sustainable modes
- The opposite may be true for other Gateway stations – particularly stations with large scale, often purpose-built, car parking but less central locations and consequently more limited walk, cycle and public transport options. At such stations, social pressure may contribute towards keeping or even expanding facilities dedicated to private car users. Therefore, these stations may require a staged approach to car park conversion – in the intermediate term, as the bulk of car parking remains in use, some of that existing car parking could accommodate emerging services such as on-demand transport; and in the future, CAVs or aerial mobility

→ Focus on growing sustainable transport modes (active travel, public transport, shared mobility)

→ Improvements to pedestrian and cycle access, including enhanced connecting routes

→ Growth in mix and availability of cycle storage including secure cycle storage for e-bikes

→ Inclusion of Mobility Hubs to simplify access to, and use of, shared mobility modes, with related facilities such as parcel delivery lockers, enterprise space or seating

→ Appropriate space planning, with active travel access given priority and support

→ Enhanced PHV provision with more/ larger pick-up/set-down zones

→ Application of smart parking technologies / kerbside management to advise users of available parking options and manage efficient use of external kerb space for time-based deliveries, PHV pick-up/set-down and other services

Figure 4.3
Gateway station current situation
(loosely informed by Oxford Station)

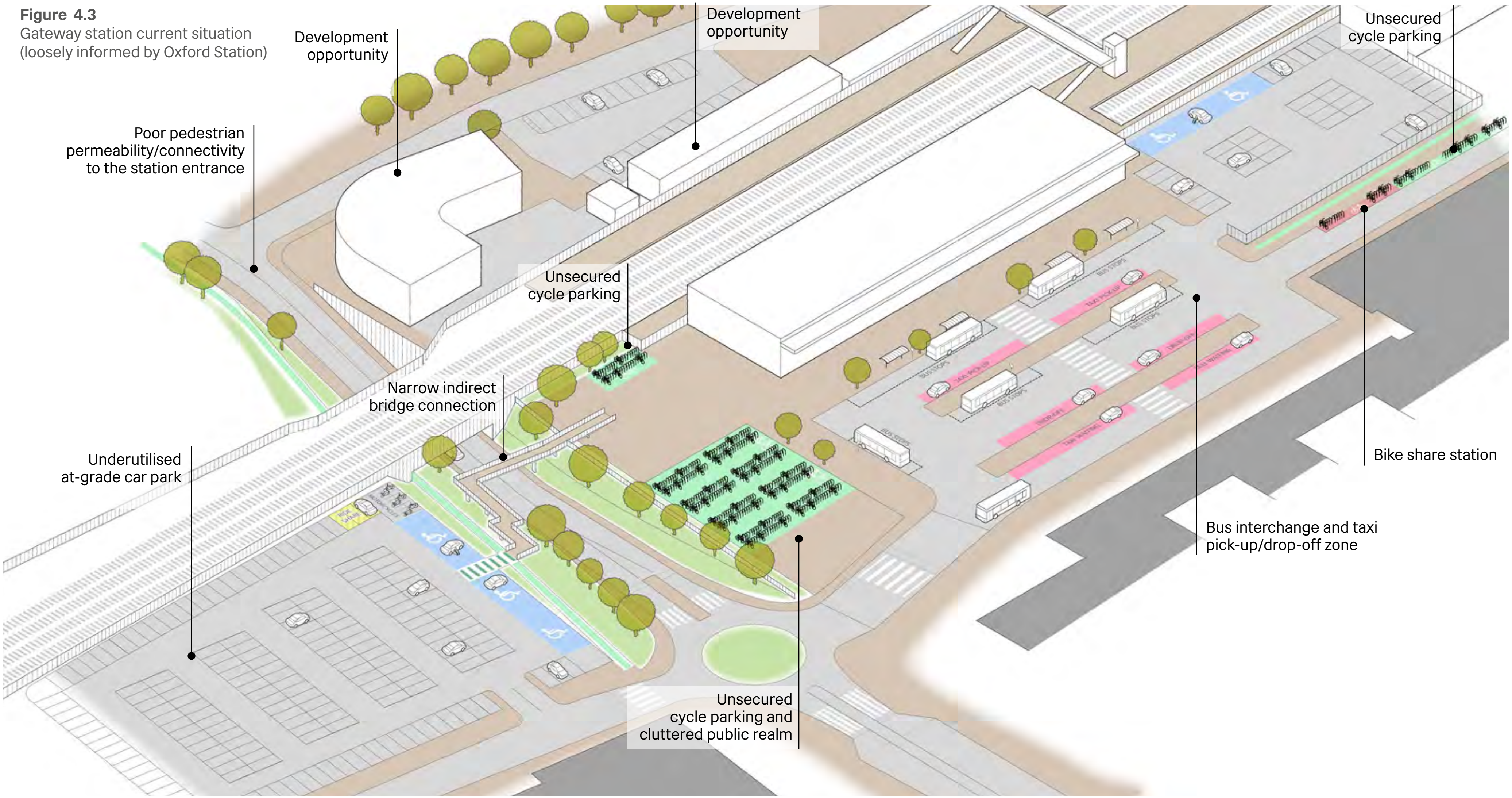
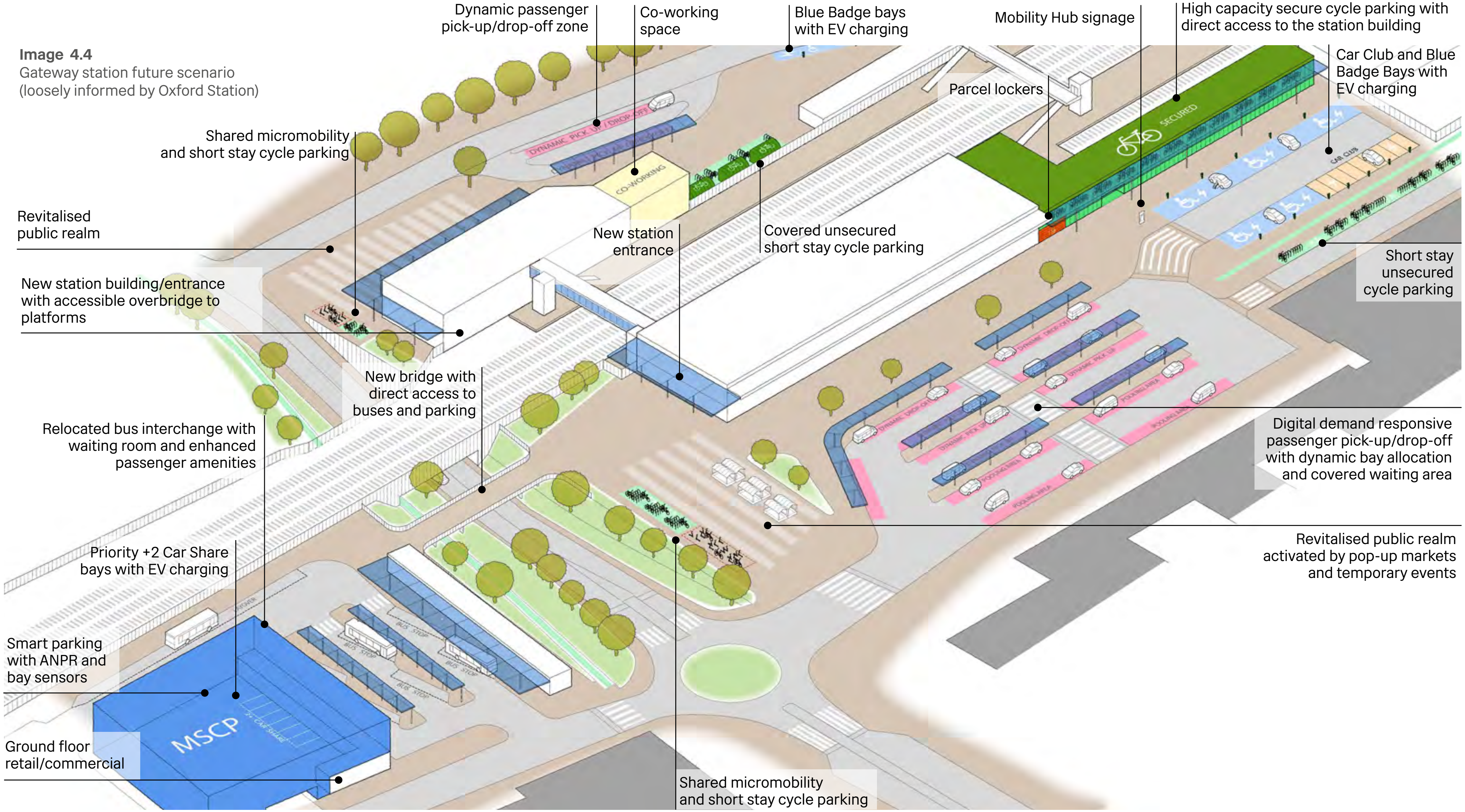


Image 4.4
Gateway station future scenario
(loosely informed by Oxford Station)



4.2.5 Minor gateway

Minor Gateway stations are located in smaller towns being both journey origin and destination stations. Minor Gateway stations are typically at the edge of centre/urban fringe and their smaller catchment area is likely to result in a large proportion of users being located within a relatively short distance.

Car parking at Minor Gateways, while medium or small in size, is typically aligned to local demand and may serve both railway users and people visiting areas close to the station. In instances where the car park is insufficient to support local demand, third-party neighbouring parking facilities or local streets may be exploited.

Current modes of access/egress

→ Given the edge of centre/urban fringe location, greater priority is typically placed on access by either car, taxi/PHV or public transport, with a local population catchment able to walk

→ While some may cycle to the station the availability of cycle facilities is typically limited and may not actively encourage cycle use

→ In some locations, limited public transport frequency and operational hours could discourage users or even exclude public transport as a viable mode at certain times

Future state

→ The smaller scale of these urban areas may support a move away from the car towards more sustainable options, particularly walking and cycling with these modes prioritised, especially in areas where a limited catchment population is insufficient to support delivery of comprehensive public transport services

→ Potential growth in demand responsive services such as micro-transit/DDRT to in-fill gaps in public transport provision - requiring dedicated facilities for passenger pick-up/drop-off

→ Improvements to pedestrian and cycle access, including enhanced connecting routes, which should be convenient and prioritised over private vehicle access

→ Growth in mix and availability of cycle storage including secure cycle storage

→ Shared micromobility schemes are likely to be less commercially viable due to limited passenger and visitor numbers but could be implemented if supported by a local authority

→ Car clubs with allocated designated car club bays could be provided in certain locations – particularly in stations with high visitor/tourist numbers

→ Application of smart parking technologies / kerbside management to advise users of available parking options and manage efficient use of external kerb space for time-based deliveries, PHV pick-up/set-down and other services

→ At stations with limited surrounding space available, conversion of car parking space may be required to accommodate the needs of other modes

Figure 4.5
Minor Gateway station current situation
(loosely informed by Poole Station)

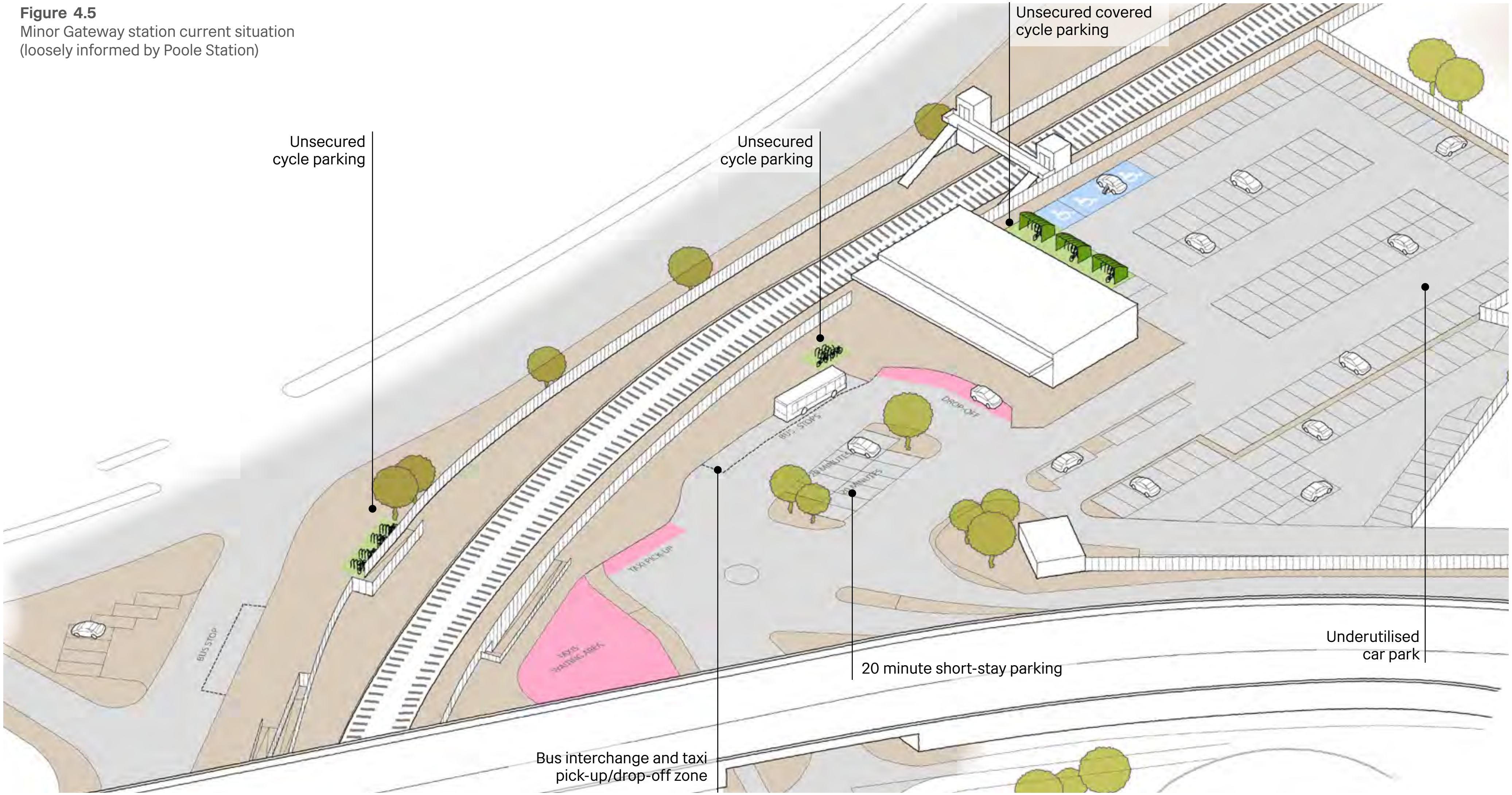
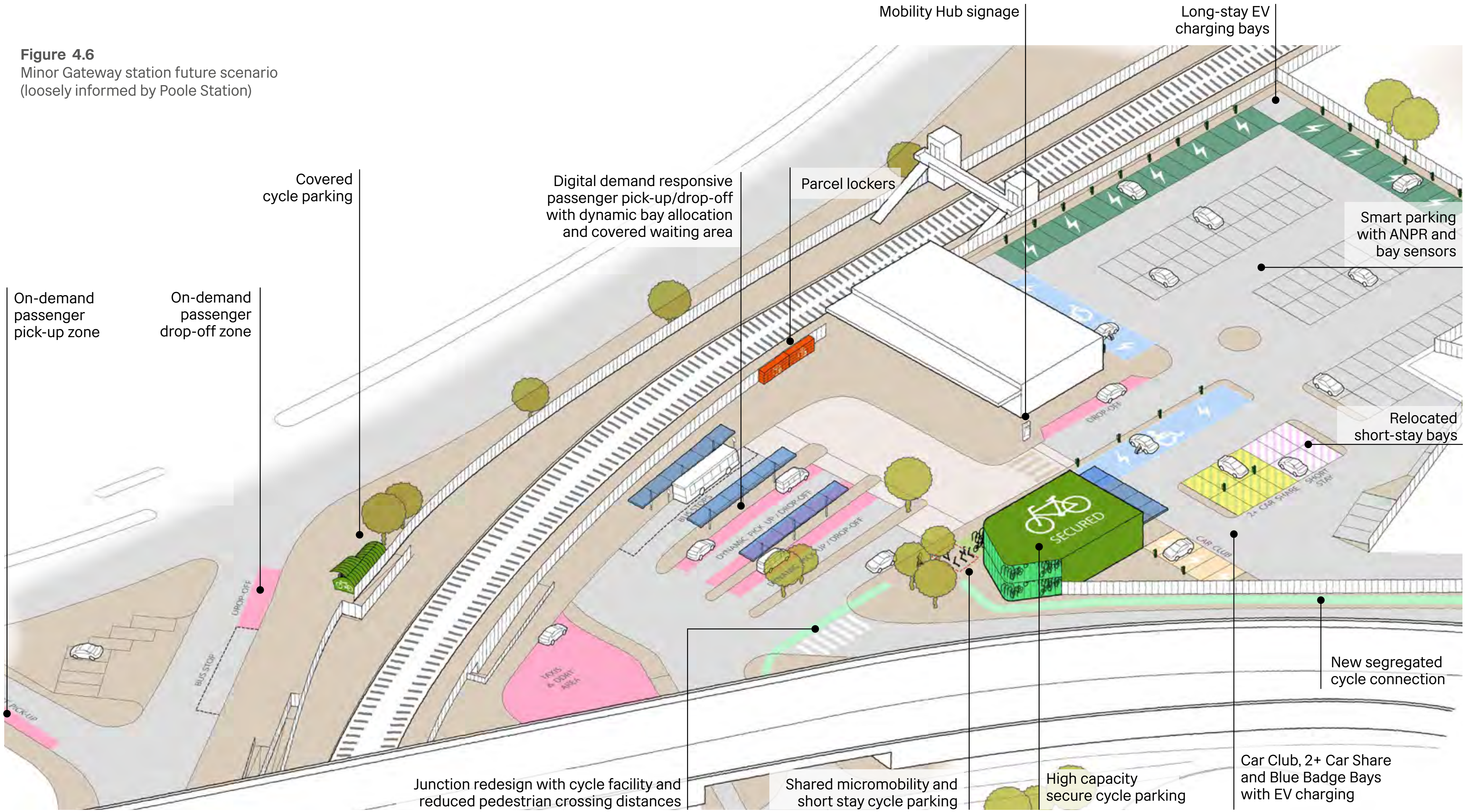


Figure 4.6
Minor Gateway station future scenario
(loosely informed by Poole Station)



4.2.6 Suburban station

Suburban stations are located in between the urban core edge and the urban fringe in predominantly residential areas. Stations experience high peak hour demand focused on outbound trips in the morning peak and inward trips in the late afternoon. Some local (urban) stations may also be surrounded by commercial or industrial land uses which should be taken into account when planning parking and mobility facilities.

Although Suburban Stations typically have a pronounced peak hour demand they also cater to non-commuter traffic through the day with a relatively small catchment population.

The Suburban Station footprint is typically limited, not extending far beyond the station threshold, and the built-up urban context limits their ability to provide much infrastructure to support car access. If present, local (urban) station car parks are typically very small with good walk and cycle connectivity.

Current modes of access/egress

→ Key modes of access include walking, public transport and cycling (if cycle parking facilities are available)

→ Dependent on their proximity to the urban core, onward rail services from Suburban Stations may compete with bikes and buses, rather than cars, particularly in cities where car use is less attractive due to congestion, limited/expensive parking/road user charging

Future state

→ At these stations, rail services are faced with competition from cycling or taking the bus for the whole journey, interchange times from these modes should therefore be minimised with convenient and reliable connections

→ Suburban Stations should be able to accommodate existing and predicted customer demand providing a mix of cycle parking options and space for micromobility (if present)

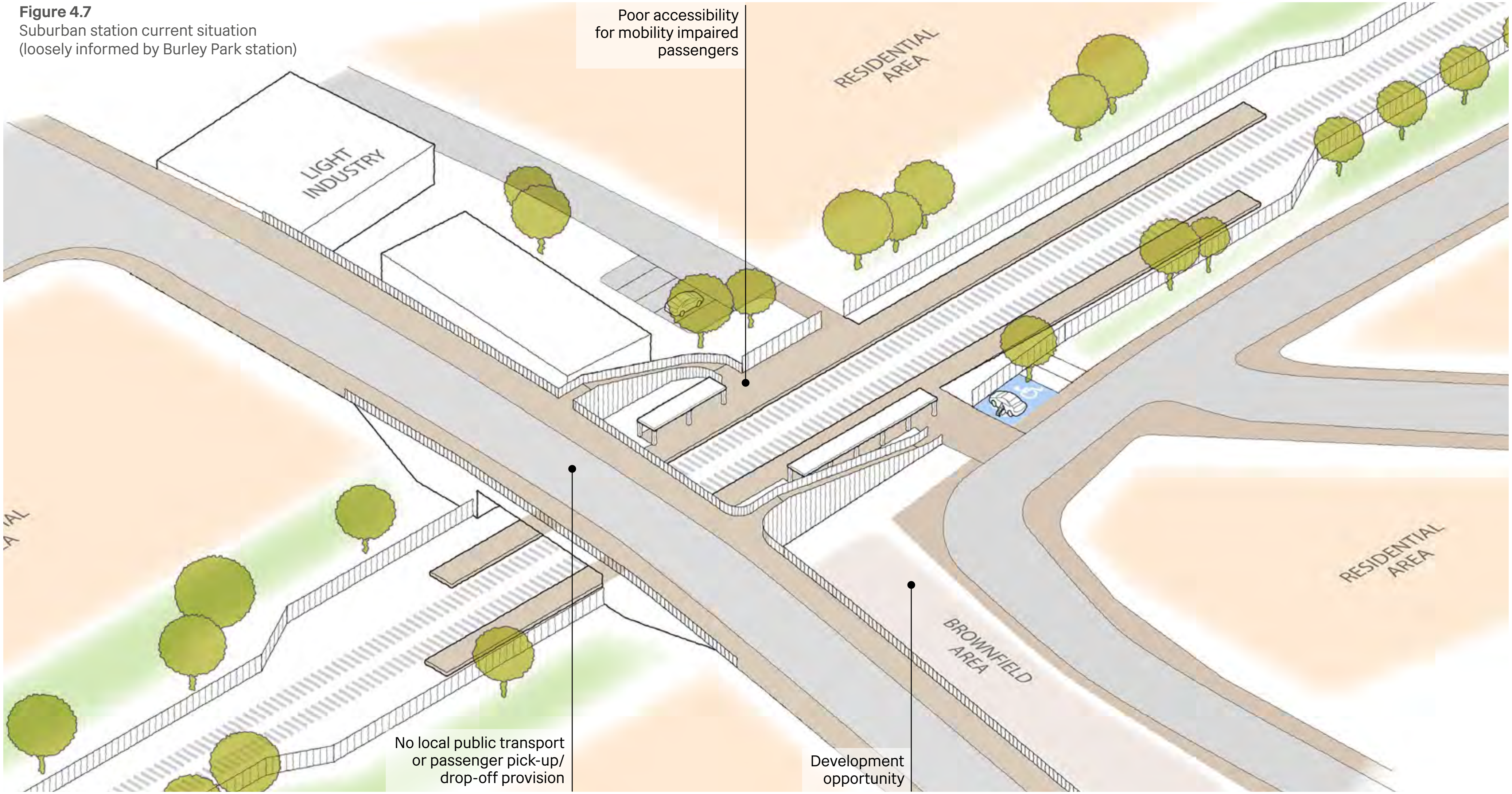
→ In settings where the station catchment extends beyond a short walk, cycle parking spaces should be provided to encourage active travel from further afield

→ Kerb management could become an important feature of Suburban station forecourts as the available space which would need to be shared by multiple motorised modes – private cars for kiss & ride, taxis, private hire vehicles, flexible journey car clubs and service vehicles – all require more efficient management of nearby kerb space

→ The physical constraints of Suburban Stations means that if parking is available, it may need to be converted to accommodate other sustainable transport modes. This could include converting long-stay commuter car parking to managed pick up and set-down zones, taxi ranks, secure cycle parking and car club parking

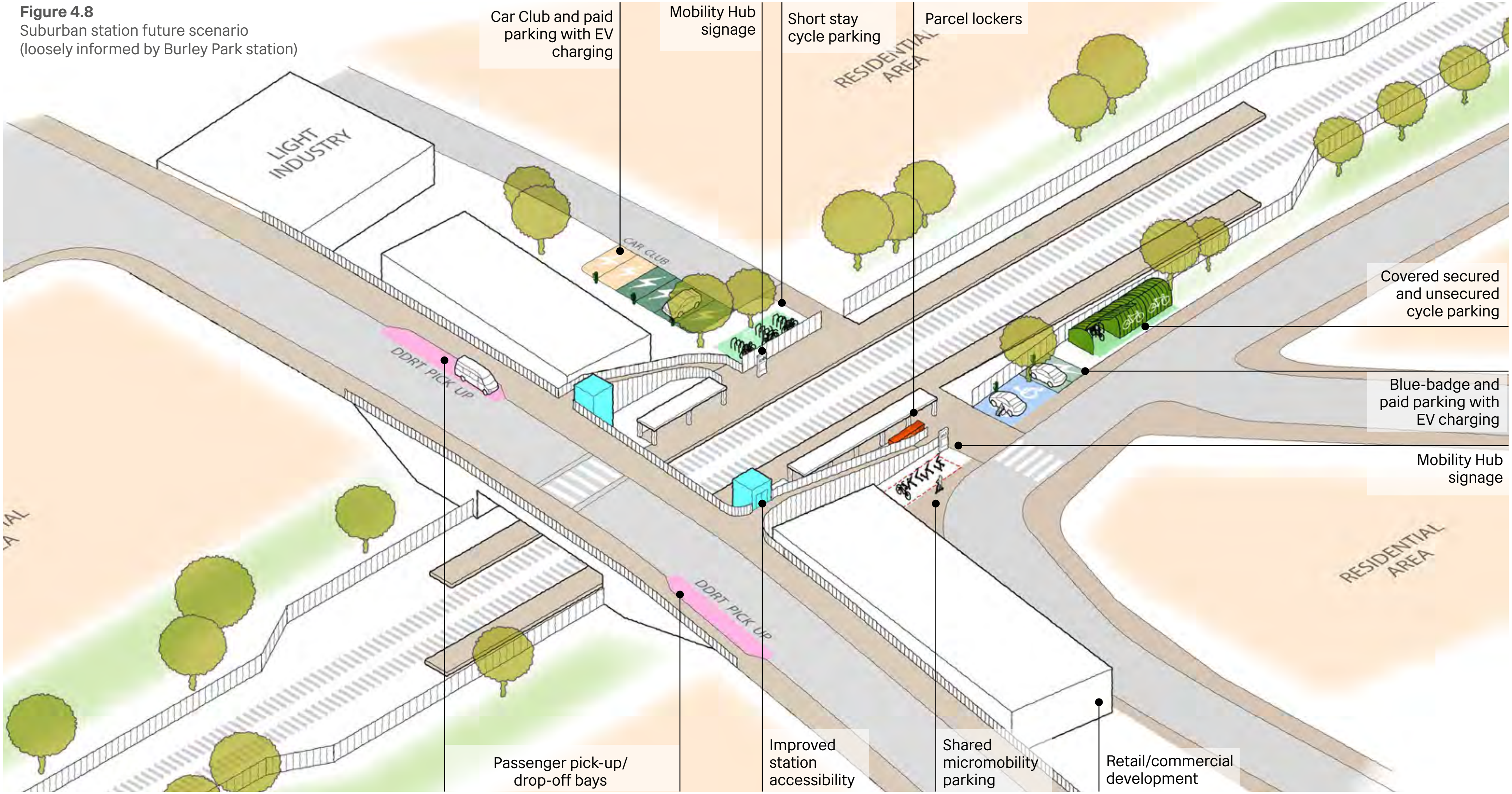
→ Provision for cycle storage could be prioritised even where there are space constraints, through conversion of car parking or use of platforms/other station land where available

Figure 4.7
Suburban station current situation
(loosely informed by Burley Park station)



4.2 Representative Station Models

Figure 4.8
Suburban station future scenario
(loosely informed by Burley Park station)



4.2.7 Local/semi-rural

Serving towns or villages, and often multiple settlements, these stations are frequently located at the edge of towns or in-between populated areas. Catering to a dispersed population, often connected only by local roads with limited public transport, passengers at these stations rely on either walking, cycling or driving, with the latter often being the default.

Current modes of access/egress

- → Spatial constraints are typically lower at Local/Rural stations, with these models often having a relatively high car mode share, typically supported by the provision of a medium/large car park
- → For stations located near town or village centres walking or cycling may be a valid mode of access.
- → Low catchment population, travel distance, frequently limited cycle facilities and limited public transport contribute to a low level of cycling and public transport mode share
- → Users unable to drive are frequently reliant on others for kiss & ride or may use taxis or demand responsive transport to access the station

Future state

With these constraints in mind, there are two options for how Local/semi-rural stations could evolve – one where access by private car remains the default, the other where access by car diminishes in favour to sustainable transport options. Regardless of the option chosen, access by private vehicle is unlikely to be fully replaced.

- → The first pathway preserves the status quo, as it assumes that in the short-term station car parks could either remain or expand, catering to population and passenger volume changes. It is likely for a car to remain the dominant option to access the station, with a growth in electric vehicles and traditional cars becoming CAVs in future. Secure, high-quality cycle parking should be introduced to encourage bicycle use where viable. Digital Demand Responsive Transport may emerge to in-fill gaps in public transport provision requiring passenger pick-up/drop-off zones
- → The alternative pathway may see a gradual shift towards more sustainable modes of transport, particularly in areas where priority is given to walking, cycling and public transport, including on demand services. This may occur through reallocation of space currently dedicated to cars and may be further supported by a policy emphasis on sustainable travel
- → As Local/semi-rural stations have a wide but low-density catchment area, shared micromobility schemes and car clubs may not be commercially viable, although could be introduced if subsidised by local authorities

Regardless of the pathway a Local/semi-rural station might take, parking and mobility infrastructure should be reviewed and updated to support a shift towards greater accessibility and sustainability. This should be achieved through installation of EV charging points and managed passenger pick-up/drop-off spaces, reorganisation of the station and station context to prioritise pedestrian and cyclist access and provision of sufficient cycle parking to accommodate future demand.

Figure 4.9
Local/semi-rural station current situation
(loosely informed by Princes Risborough station)

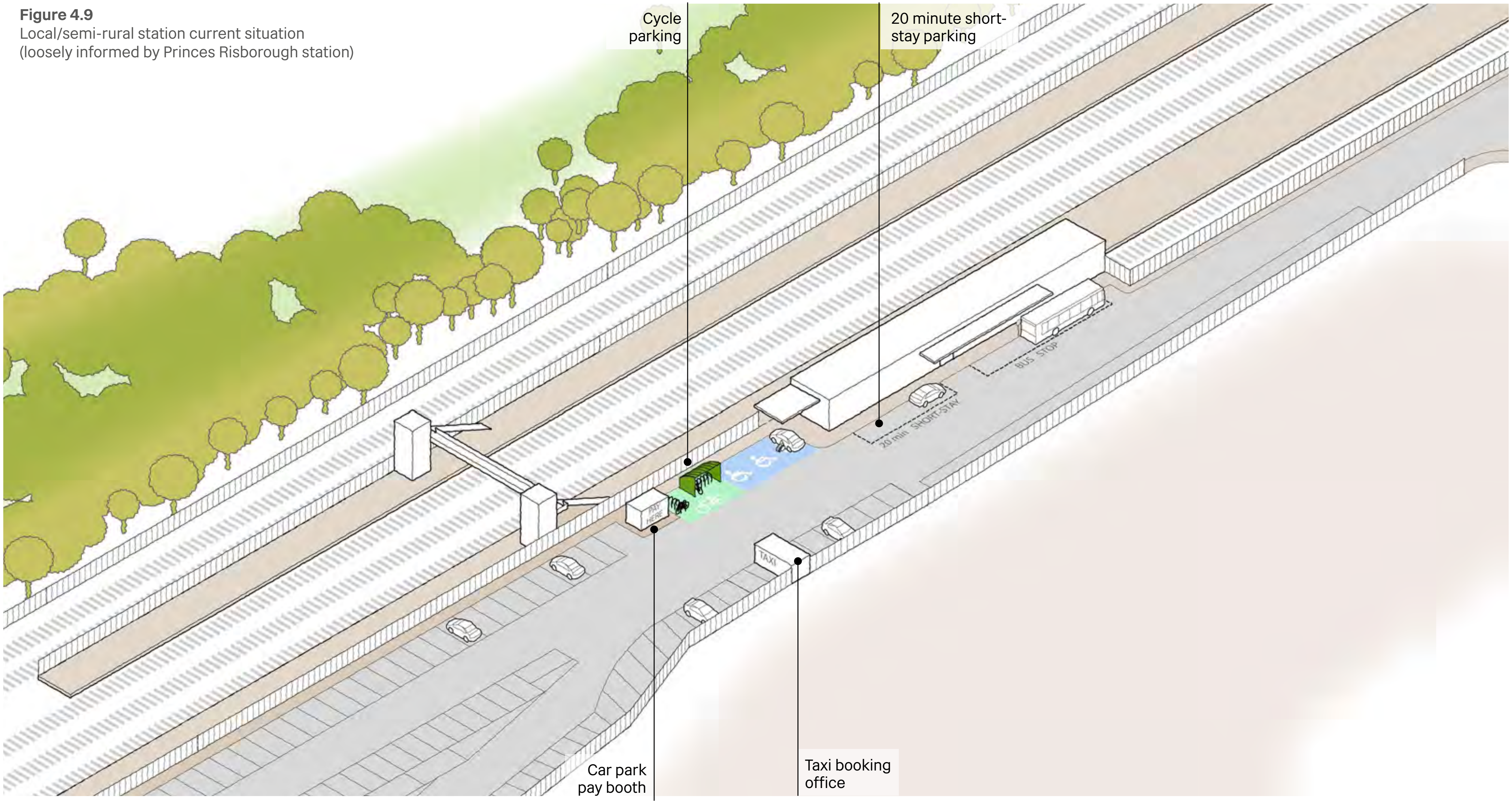
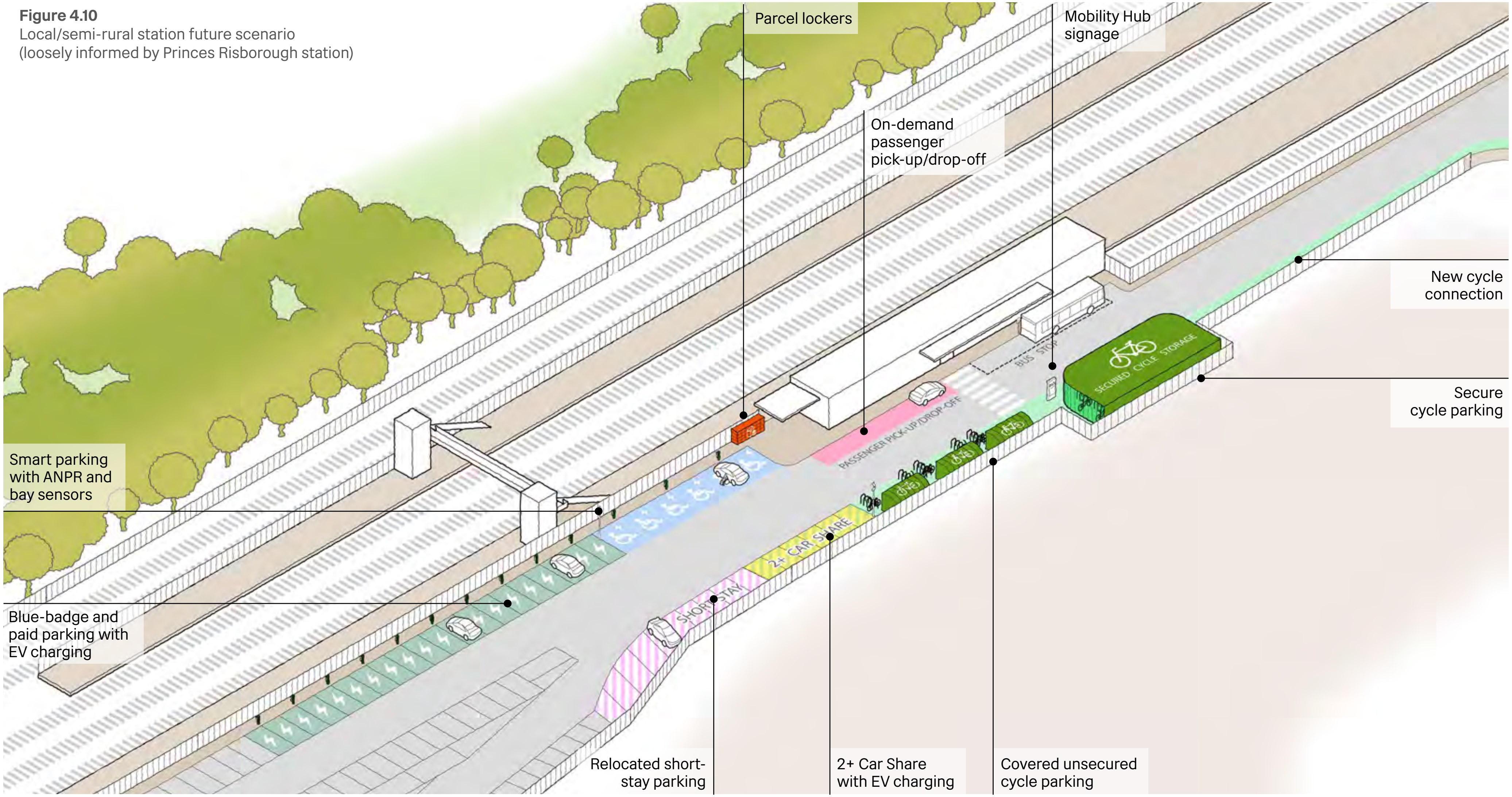


Figure 4.10
Local/semi-rural station future scenario
(loosely informed by Princes Risborough station)



4.2.8 Single purpose/Parkways

Single purpose/parkways are purpose-built stations or stations retrofitted to serve a particular local destination/function. Examples include parkway stations, airport stations or stations serving major trip generators such as retail parks.

Although these stations need to be considered on a case-by-case basis, they are frequently located in car-dominated areas and include a large, dedicated car park. In some instances, such as airports, the car park may form part of the station but does not only serve station users.

Current modes of access/egress

→ Often dominated by private car by design or necessity

→ Pedestrian and cycle access could be challenging as a consequence of stations being located off major highways and away from urban settlements

Future state

→ Private car is likely to remain the main mode of access, regardless of whether provision of other transport options is improved

→ A large catchment area and often inconvenient station location discourages access by sustainable transport modes which limits opportunities to grow walking and cycling access

→ Opportunities to create direct, safe and pleasant pedestrian and cycle routes to the stations should be explored and, if provided, stations will require appropriate secure cycle parking facilities

→ These stations will need to accommodate a rising number of passenger pick-up/drop-offs and emerging transport models such as 2+ car share and car clubs

→ Due to the co-location of multiple 'local destinations' – park & ride facilities, airports, retail outlets in addition to the station itself – visitors may use the station facilities without travelling to or from the station. As such, the future requirements of the station may be dependent upon neighbouring uses and should be developed in close collaboration with relevant stakeholders

→ A specific station purpose should be considered when new services and facilities are introduced accounting for each station's requirements on case-by-case basis

4.3 Station Summary

	1. Gateway (no parking)	2. Gateway (with parking)	3. Minor Gateway	4. Urban	5. Local / Rural	6. Single Purpose / Parkways
Existing Modes						
Car	●	●●●	●●●		●●●	●●●●
Taxi/Shared/PHV	●●●	●●●	●	●	●●	●●
Kiss & Ride	●	●●	●●	●	●●	●●
Bus/Light Rail	●●●●	●●●	●●	●●	●●	●
Cycling	●●	●●●	●●	●	●●	●
Walking	●●●●	●●●	●●●	●●●●	●●	●
Emerging Modes						
Shared Micromobility	Typically Offered	Occasionally Offered	Rarely Offered	Occasionally Offered	N/A	N/A
Car Clubs	Provided at some stations in urban and semi-urban areas alongside subsidy schemes in a few semi-rural locations					

Table 4.3 Current state
Summary of the importance/prevalence of existing modes of access/egress to each representative station model.

	1. Gateway (no parking)	2. Gateway (with parking)	3. Minor Gateway	4. Urban	5. Local / Rural	6. Single Purpose / Parkways
Shared Micromobility	High	High	Medium	Medium - High	Low	Low
Mobility Hubs	Low-Medium	High	Medium - High	Medium	Medium - High	Low
CAVs	Low	Low	Medium	Low	High	High
Demand Responsive Transport (DRT)	Low	Low	Low-Medium	Low	Medium	Low-Medium
Smart Parking Technologies	Medium	Medium - High	Medium - High	Low	Low-Medium	High
Kerb Management	Medium	High	Medium - High	High	Low	Low
Air Mobility	Medium	Low	N/A	N/A	N/A	Medium
Logistics and Freight Solutions	Medium - High	High	Medium	Low	Medium	Low-Medium

Table 4.4 Future state
Summary of the potential impact and importance that new mobility services and technologies may have on representative station models.

Image 4.2
Kingston Station high capacity cycle hub

5

Parking & Mobility

Common Design Elements

5.1.1 Power and data infrastructure

New mobility technologies will require additional power and data cabling infrastructure. Planning and integration of this infrastructure from the outset of projects will minimise downstream costs and disruption, minimise clutter and reduce risk of accidents.

- → Installation of all service elements such as light fittings, CCTV cameras, payment stations, and digital signage should be coordinated to minimise clutter and the impact on the quality of the parking facility environment
- → EV charging stations and the enabling infrastructure such as feeder pillars, switches, earth electrodes and concealed ducting for charger cable runs, should be included at the design and planning phase for any new build car parks and installed at the time of construction
- → Wall-mounted unit installations should not impede pedestrian circulation with pavements remaining accessible to all users, including disabled people
- → Containment systems should not only support the cables in-situ, but also to make ongoing management of cables as easy as possible and provide separation and isolation of power and data cabling

5.1.2 Materials and surfaces

Parking and mobility facilities comprise a kit of parts of common design elements. Each of these should be tailored to the context and locality of a station while maintaining a consistent national identity where appropriate.

Typical public realm elements and the design considerations related to them are described in detail in Public Realm Design Guidance for Stations which should be referred to in conjunction with this guideline. These include:

- → Hard landscaping such as surface materials, kerbs, tactile paving
- → Level changes such as steps, ramps, retaining walls
- → Drainage features such as grates, channels, tree pits, rain gardens
- → Soft landscaping and biodiversity such as planted areas, trees, biodiversity enhancement, community involvement
- → Wayfinding such as totems, map panels and fingerposts
- → Street furniture such as seating, boundary treatments
- → External lighting including lighting columns and feature lighting

Key considerations in relation to station parking and mobility are summarised here,

Surfaces

Surfaces should be firm, durable, slip resistant, without undulation. They should also be consistent in material treatment along their length for continuity, supporting ease of navigation and comfort

- → Paving material should be relatively uniform in tone, avoiding strong contrasting patterns which can be perceived as steps or holes by the visually impaired
- → Surfaces should be even and avoid gaps, new cobbled surfaces are unlikely to be appropriate even in historic environments
- → Potential hazards such as level changes and steps should be indicated with tactile warning surfaces and visual indicators such as colour contrast step nosings
- → Tactile paving materials are required to aid navigation; providing directional information and warning of hazards for people with visual impairments
- → Visual contrast should be provided between pavements, walls and street furniture to help people with visual impairments to safely navigate external routes

Level changes

Many stations are not located on flat topography and the nature of a linear railway can result in significant level changes to reach the platforms or with interfaces in the surrounding area. Changes in level can cause problems for many people. Even a single step can prevent access for disabled people and can present a trip hazard.

→ Level changes should be designed out but where they cannot be avoided and graded routes are required, they should be designed to be as shallow as possible. Steep ramps are trip/slip hazards and often require excessive effort for some people to access independently

→ Significant changes in level (more than 2m) requires alternative step-free options, such as lifts. It is important that journeys by lift, graded route or by steps provide the same quality of experience with none of the alternative routes feeling secondary

→ Cycle routes should be step free and accessible for all ages and abilities with a maximum extended gradient of 5% and maximum short distance gradient of 15% where site conditions dictate

→ Where gradient change is absolutely necessary, ramps or lifts should be included to provide convenient and direct connections to key destinations and station facilities

Image 5.2
High quality, uncluttered public realm with consistent surface material, planting and street furniture product specification, Paddington Station.

Kerbs and edges

Kerbs and edges provide separation and visual definition between spaces. Often to separate transport types such as pedestrians and vehicles or a change in surface materials. Level or flush access is essential for the majority of wheelchair users and also important for cyclists and scooter users. Such access can be achieved either by dropped kerbs or raised road crossings.

- → Kerb and edges should be detailed to provide accessible, sustainable and inclusive environments for all
- → Kerbs should be detectable
- → Drop kerbs and flush edges should be used at all Zebra and controlled crossings, side roads and access points to parking facilities used by pedestrians. On longer side roads and residential roads dropped kerbs should, where possible, be provided every 100 metres to avoid the need for wheelchair users to make lengthy detours to cross the road giving due consideration to pedestrian desire lines
- → Kerbs and edges should be used in combination with surface materials choices to reinforce local identity and character
- → Heritage kerbs and edges should be retained and reused where possible
- → Kerbs and edges should be considered for potential trip hazards

Drainage

The approach to surface water management at stations should be to minimise, reduce and delay the flow of surface water directly to drains and water courses, to reduce the risk of flooding. This approach should consider:

- → The use of sustainable urban drainage systems and infiltration through permeable surfaces should be prioritised and should be considered at an early stage of the project
- → Establish if infiltration drainage is possible
- → Using appropriate technical advice sought from a drainage engineer
- → Reducing the amount of non-permeable surfaces used
- → The use of trees, planting and soft landscaping to reduce the flow of water
- → Design of cambers and falls of paving surfaces to direct water flows into the drainage system
- → Drainage features should be level with the surface in public areas, should not impact negatively on accessibility or create hazards
- → Consultation with water suppliers for any new connection arrangements to an existing sewer network
- → Sustainable urban drainage systems and attenuation systems (SuDS) elements should be fully integrated into station parking and mobility facility design where feasible. A combination of SuDS elements or a mix of SuDS components and traditional drainage is preferred over the use of all traditional urban drainage methods

References and Resources

Guidance on the Use of Tactile Paving Surfaces
Department for Transport 2021

NR Guidance Suite Reference

Planning practice guidance for beautiful, enduring and successful places
National Design Guide

Our Principles of Good Design
Network Rail

Public Realm Design Guidance for Stations
NR/GN/CIV/200/10

Network Rail Station Masterplanning Guidance
NR/GN/CIV/100/07

5.1.3 Street furniture

Street furniture animates the public realm, it adds character, identity and provides many functions. Successful public spaces consider every piece of street furniture and rationalise and creatively place pieces to achieve multiple aims.

Parking and mobility facilities at stations may include a range of street furniture elements, for example:

- → Dedicated space and equipment for bike and e-scooter parking
- → Charging infrastructure for electric vehicles, e-scooters, and e-bikes
- → Parking infrastructure such as barriers, sensors and payment machines
- → Cycle equipment including lockers, stands, pumps, and maintenance equipment
- → Infrastructure for onward public transport services such as bus, tram, taxi or DDRT
- → Mobility Hubs
- → Parcel lockers
- → Managed kerb space for taxi and PHV pick-up/drop-off
- → Managed kerb space for deliveries and servicing vehicles
- → Information boards including digital signage

There is no 'one solution fits all' for street furniture within stations. Variation and bespoke solutions may be the best option for some stations whereas a standard off the shelf solution may work better in another. The chosen approach should reflect a station's context for spatial considerations of layout and performance specification.

The impact of poorly placed or excessive street furniture can create a cluttered environment resulting in obstructions, reduced legibility and a blighted character.

The aim is to provide high quality, beautiful, robust and maintainable street furniture that complements the surrounding area using 'the right product in the right place, done right'.

Further detail on street furniture is provided in Public Realm Design Guidance for Stations.

Image 5.1 South Woodford Mobility Hub and parklet.

NR Guidance Suite Reference

Public Realm Design Guidance for Stations
NR/GN/CIV/200/10

5.1.4 Lighting and Emergency Lighting

Lighting to parking and mobility facilities should provide sufficient illumination for vehicles and pedestrians to move around safely, security and for CCTV to be effective with emphasis being given to barriers and ticket machines and where installed stairs and lift lobbies.

Design calculations for new installations should conform to current standards. Calculation of glare index and lux levels should be provided together with details of luminaires and columns for approval with particular consideration given to task lighting of isolated areas, car park barriers, information displays and pay and display machines. Design should take account of signal sighting, where relevant.

Lighting design criteria and average lighting levels for parking facilities are described in BS 5489-1:2020, BS EN 13201 and BS EN 12461- 1/-2.

5.1.5 Lighting Columns

Exterior lighting should, where possible, be undertaken from the perimeter of the facility, with the use of raise and lower columns, orientated to drop into the perimeter area, i.e. access for maintenance should not be blocked by obstructions. Where this is not possible lighting may be undertaken from island sites, again using raise and lower columns orientated to drop onto the island such that access for maintenance will not interfere with parking. Where columns are mounted in the parking area protection against vehicular damage should be provided.

One lowering device should be provided for each type of column. Where more than one type of lowering column is provided each column type should be colour coded to the appropriate lowering device. All columns should be clearly labelled and referenced within Operating and Maintenance instructions.

On open parking areas and access roads, lighting columns should be either medium or heavy duty hot dipped galvanised steel root mounted raise and lower type installed in such a manner that all maintenance can be undertaken within a safe working area without obstructing traffic flow or use of parking spaces. Particular consideration should be given to clearance to live and return conductors when the car park is adjacent to an electrified line.

Raising and lowering system can be by use of spring/hydraulic equipment (preferred) or hand/powered winch and should be standard throughout a station. A hard level surface should be provided at the base of the column with sufficient space for operation of the raise and lowering equipment and at the column head when lowered for maintenance. Allowance should be made for this clearance when vehicle barrier hoops are installed.

The height of columns should be dictated by the layout of the parking and mobility facility and the need to manage any light pollution that may affect surrounding properties.

Columns should be cabled using 3 core XLPE/SWA/LSF cables, 3rd core being used as CPC in addition to the armouring, terminating at a fused cut out, fused at 6A, with final connection to the luminaire using 2.5mm OHLS multicore flex. Steel wired armouring of cables should not be used as a CPC. All raise and lower columns should be fitted with an earthing braid bridging the hinge. Where the lines are electrified then a 16mm CPC should be used to all columns.

If the columns are to be painted in corporate colours they should either be delivered already painted/powder coated in the correct colour or primed with etching primer ready to be painted on site.

5.1.6 Luminaires

Luminaires should utilise the most cost effective control gear in terms of energy usage, effects on lamp life and capital costs. Control gear should be power factor corrected to 0.95 or better. HID control gear should be fitted with thermal cut-outs or timed igniters. Control gear used with fluorescent lamps should be capable of starting the lamps at an ambient temperature down to -10oC.

Luminaires should provide sufficient illumination to enable safe use by both the public and staff during the hours of darkness and low light conditions, be suitable for the railway environment and be simple to maintain given the limited time available for access and the proximity of the general public and moving vehicles. Enclosed luminaires should be used for parking facility lighting, with a minimum rating of IP54 to ensure minimal build-up of internal dirt. IP65 or better is preferred. Luminaires generally should have a 'white light' aspect unless they are required to match existing luminaires. All luminaires should conform to the BS EN 60598-1 and be CE marked

Luminaires should normally be mounted on columns and be post top mounted or on extension arms, with double arm brackets being used where appropriate.

A minimum of 2 No circuits should be used (different phases where possible) with luminaires being connected alternately to separate circuits so that in the event of a circuit or phase failing alternate luminaires should remain lit. Lighting levels should conform to CIBSE lighting guide or Network Rail Standards and that which achieves Secured Car Park status, whichever is the most onerous, and should take account of the deterioration in lighting level over time in order to retain minimum lighting levels.

Luminaire positioning should not conflict CCTV cameras or layout, or with signalling either by obstruction, being mistaken for a signal, overpowering a signal or by reflection or refraction.

5.17 Lighting Control

Parking facility and access route lighting should be controlled by use of dusk to dawn photocell and time clock. The photocell should operate the car park luminaires when the natural light reaches a predetermined level and the time clock should ensure that the lights only operate between a predetermined time before the first train arrives and a predetermined time after the last train departs.

On some stations it may be necessary to leave a number of luminaires permanently lit during the hours of darkness for security purposes and this should be qualified with the TOC and Network Rail.

5.18 Emergency Lighting

Provision of emergency lighting is subject to risk assessment and is not normally required to open parking facilities. Where it is required it should conform to BS5266 Part 1 and Network Rail Standards to show direction of escape and to illuminate exit routes, plant rooms and electrical switch-rooms and cupboards.

External emergency luminaires should be installed to illuminate exits where parking and mobility facilities have no other exterior lighting and hazards exist. Consideration should be given to the use of a central battery system for emergency lighting in place of the integral units where cost and maintenance of a large installation would make such an installation more cost effective. If a central battery system is used then appropriate fire rated cable should be used for connection.

References and Resources

Light and Lighting
BS EN 13201
Indoor and Outdoor Lighting Best Practice
BS EN 12461- 1 / -2
Luminaires - General requirements and tests
BS EN 60598-1:2015+A1:2018
Design of road lighting - Lighting of roads and public amenity areas
BS 5489-1:2020
Institute of Lighting Professionals (ILP) Guidance
Note 1 for the reduction of obtrusive light

5.2.1 Whole Life Cycle Emissions Assessment

Material selection and sourcing have significant effects on the long-term environmental impact of new or upgraded parking and mobility facilities. All phases of a material's effective life should be considered when sourcing materials, including energy and resource consumption required for extraction, production, transportation and maintenance and evaluation of alternatives in terms of cost and environmental impact.

Consideration of a parking and mobility facility's whole life costs means accounting for the net present value of all monetary costs (design and procurement; construction methods and sourcing; operations, maintenance and management; disposal and renewal) as well as accounting for its commercial, social and environmental value over its full life-cycle. Planning and design of parking and mobility facilities should aim to minimise operational costs and consumption of natural resources over the life of the facility through design innovation, component standardisation and facility optimisation.

→ Projects should adopt a whole asset life cycle emissions approach that considers all phases of a facility's life, from design and procurement through operation and end-of-life salvage.

→ Materials should always be fit for purpose and meet with all health and safety requirements.

→ Where possible, specify materials that minimise the embodied energy, carbon and water used in the manufacturing process

→ Give preference to rapidly renewable materials where applicable

→ Use materials that are responsibly extracted or harvested

→ Prioritize post-consumer, recycled materials when railway station-specific requirements that include longevity, durability and low maintenance are met

→ Reuse or salvage materials where applicable and possible

→ Select materials and finishes that are vandal- and graffiti-resistant, and difficult to deface, damage or remove

→ Materials should not be selected with complicated repair, removal and disposal requirements

→ Materials with potential negative environmental impacts should not be used

→ The balance between durability, functionality and quality of design will vary depending on the situation but should take account of the needs and priorities of all parking and mobility facility users

→ Structures, finishes and elements such as doors may need to achieve specific ratings for fire integrity and fire insulation when forming fire compartments. This should be defined by the project Fire Engineer as part of the Fire Strategy

→ Materials should be non-combustible where possible. Refer to fire regulations and guidance for detailed requirements

The following frameworks can be used to guide responsible sourcing:

→ BS 8902 - Responsible sourcing sector certification schemes for construction products - Specification (from BSI)

→ BES 6001 - Framework Standard for the Responsible Sourcing of Construction Products (from BRE)

More details on whole life cycle emissions asset evaluation and Network Rail's commitment to being a Net Zero Carbon organisation by 2050 are covered in our Climate Action Design Manual.

NR L2 ENV 015 sets out Network Rail's minimum requirements for the management of environment and social risks and opportunities during design and/or construction activities.

5.2.2 Adaptability and resilience

Parking and mobility facility design should be dynamic, with the flexibility to enable spaces to adapt over time. Station sponsors and operators should consider long-term requirements, anticipating the need for change, to minimise the cost of any future resizing or reconfiguration. Expansion, enhancement and/or redevelopment of parking and mobility facilities may be driven by one or more factors, including capacity constraints, new vehicle types, new technologies and regeneration of surrounding areas.

Provision for adaptation should be adequate but not excessive and should seek to minimise any resource waste during design and construction.

5.2.3 Energy generation and consumption

On-site energy conservation/generation, responsibly sourced and manufactured materials and the use of sustainable energy sources provide long-term environmental benefits and can also provide cost-effective design solutions. It is necessary to understand the full sustainability equation when considering the application of micro-generation techniques and not just the energy generating abilities.

This includes consideration of passive heating and cooling strategies where applicable; use of intelligent control systems to optimise energy use, e.g. light sensors for infrequently used areas; provision of low-energy lighting to reduce energy consumption; and minimising energy waste through use of optimum wall and roof insulation, including consideration of green roofs.

5.2.4 Renewable energy sources

Taking advantage of renewable energy sources is an important component of reducing energy impacts. On-site renewable energy, such as the incorporation of photovoltaic in canopies, can be a source of energy cost savings and can also protect against the uncertainty of future energy costs and sources.

5.2.5 Reuse and disposal

The cost of raw materials and their disposal is both unpredictable and likely to increase in the future. Designers should consider opportunities to minimise waste and allow for a positive reuse of facility components at the end of a facility's life cycle.

NR Guidance Suite Reference

Climate Action Design Manual
NR/GN/CIV/100/04
Environmental and Social Minimum Requirements
NR/L2/ENV/015

References and Resources

Responsible sourcing sector certification schemes for construction products
BS 8902
Framework Standard for the Responsible Sourcing of Construction Products
BES 6001

Image 5.3
Blackfriars station has 4,400 PV panels installed on the station roof, providing over 1MW of renewable electricity that contributes up to 50% of the station's energy demands with the excess sold to the National Grid.

Case Studies

A

Approach

The case studies contained within this Appendix are listed below and have been selected to illustrate current and future mobility trends described in Section 2.

Mobility Hubs

- → Interreg North West Europe eHubs Project
- → Jelbi Stations
- → South Woodford Mobility Hub
- → Calderwood Mobility Hub
- → Street Moves

Shared Mobility

- → ArrivaClick DDRT
- → London E-scooter Trial
- → BTN Bikeshare

Passenger Pick-up/Drop-off

- → Stansted Airport ESDL

Electric Vehicles

- → Leeds Railway Station
- → UK Charging Hubs
- → London Rapid Charging Hub

MaaS

- → Yumuv: MaaS in Switzerland

Smart Parking

- → Longbridge Railway Station
- → AppyWay

Kerbside Management1

- → Smart Kerbside Project

CAVs

- → GATEway Project
- → LUTZ Pathfinder
- → Project Synergy

Autonomous Valet Parking

- → V-charge
- → Hamburg Airport

Last Mile Logistics and Freight Consolidation

- → Distripolis, Paris
- → Ovo Micro-Consolidation Centre: Geneva

Emerging Modes

- → Advanced Aerial Mobility
- → Deliveries by Drones, Royal Mail

Cycling

- → Kingston Cycle Hub
- → Utrecht Cycle Hub
- → Waltham Forest Cycle Hubs

Interreg North West Europe eHubs Project

Six European cities including Manchester, Arnhem-Nijmegen, Leuven and Amsterdam agreed to pilot electric Mobility Hubs (eHubs) to facilitate transition to electric and shared mobility between 2019 and 2022. The pilots are funded by the European Union, with total estimated budget of €8.86m. eHUBS are defined as on-street locations that bring together e-bikes, e-cargo bikes, e-scooters and/or e-cars.

The project aims to create 92 eHubs between 2019-2022 with more than 2,400 shared e-vehicles. Each hub may vary in size and components, and they can be located in major transport interchanges (such as stations) or residential areas. Different pilot city characteristics will be evaluated such as population size and density; morphology; number of private cars per household and current modal split to identify the optimal locations for implementation.

eHubs will offer a range of shared electric mobility options such as e-bikes, e-scooters, e-cars, e-cargo bikes, along with electric vehicle charging stations (with fast/rapid chargers), and parking/docking stations for e-micromobility vehicles.

The city of Amsterdam launched its first eHub in June 2019 and aims to create up to 20 hubs by 2022 to discourage use of private vehicles and make better use of on-street space otherwise used for parking.

Image A.1
Interreg North West Europe eHub

Jelbi Stations

Jelbi stations have been implemented across various locations in Berlin, Germany.

Jelbi stations bring multiple services together including car share, bike share, moped share, e-scooter share, EV charging and stops for taxis and on-demand shuttles. Vehicles can be booked through the Jelbi App, which is a MaaS platform implemented by Berliner Verkehrsbetriebe (BVG - the city's principal public transport operator). There are two types of Jelbi Hubs: Jelbi stations (larger hubs) and Jelbi points (small hubs for all vehicles with just two wheels). There are 11 Jelbi stations and 11 Jelbi points currently operating in Berlin . All of the stations have a consistent identity with a branded information pillar.

The Jelbi development is supported by BVG, and through partnerships with shared mobility operators and other stakeholders.

Image A.2
Jelbi Hub, Berlin

Mobility Hub Case Study 3
South Woodford Mobility Hub

The hub opened in 2021 and provides an electric car club bay with a charging point, cycle parking, a café, and an outdoor seating area with bar stools and coffee tables and planting.

CoMoUK provided accreditation for the hub to its Gold Award level. In achieving the Gold Award, the hub met six key CoMoUK assessment criteria. It provides co-location of public and shared mobility modes - being adjacent to South Woodford Underground Station; it re-purposes public space to remove car parking spaces, and it is clearly branded by signage as a Mobility Hub.

Image A.3
South Woodford Mobility Hub

Calderwood Mobility Hub

Stirling Developments developed a Mobility Hub in West Lothian, Scotland. The vision for the hub was primarily driven by the developer's need to meet climate objectives and promote sustainable transport. The development consists of residential buildings, business development units and community facilities. It is located 1 mile from Kirknewton station which provides good rail connectivity to Edinburgh, and the X27 express bus service runs through the site also providing strong connections to Edinburgh.

The hub offers the community access to sustainable transport modes including public transport and a car club. It offers a community car club with EV charging point, cycle parking, and two bus stops for buses.

Image A.4
Calderwood Mobility Hub, West Lothian

Mobility Hub Case Study 5
Street Moves

Street Moves is a project exploring the use of street furniture to meet ‘hyper-local’ needs of streets in Stockholm, Sweden, engaging directly with the public. The concept is based on the vision to create a ‘one minute city’ where residents have immediate access to things they need.

The project explores the use of modular, semi-permanent structures and incorporates amenities such as parking for active transport (e-scooters and bikes), green space, play spaces and seating with the modularity allowing usage to change or grow over time.

At railway stations, these kerbside hubs could operate as Mobility Hubs, providing waiting areas for onward transport, parking for shared mobility, charging for electric vehicles or to improve wellbeing through micro green space.

Images A.5, A.6, A.7
One-minute city conceptual layouts and hub prototype, Stockholm

ArrivaClick DDRT

ArrivaClick is a DDRT service that users can book, track and pay for through a mobile app. ArrivaClick offers a 'corner to corner' service, collecting and dropping off passengers within a couple of streets of their destination. This allows the service to pick up multiple passengers on route who are heading in the same direction, while keeping the service efficient.

The service was initially piloted in Sittingbourne in 2017 through to 2019, then in Liverpool from 2018 to 2020, and it is operating currently in Leicestershire and Watford.

Image A.8
Arriva Click DDRT

London E-scooter Trial

In June 2021 a 12-month shared e-scooter trial was launched in London by TfL and London Councils. Three operators (Dott, Tier, Lime) were selected to participate in the trial through a competitive tender. The use of e-scooters is controlled through strict parking rules, where users should park in designated zones.

The potential of e-scooters to provide last mile connectivity from the city's rail stations is high. Findings from a study by 6t and Momentum showed that 98% of Inner London and 78% of Outer London can be reached from a rail or tube station by a 10-minute e-scooter journey.

Post-trial, if shared e-scooters are legalised in the UK, their provision at train stations could provide a convenient service for rail users and will require allocation of space for managing parking at stations.

Image A.9
Shared micromobility parking zone, Camden, London

BTN Bikeshare

Brighton's bike sharing scheme, BTN Bike Share, has been operating successfully since late 2017. In that time, the scheme has gained funding to expand with further bikes and hubs with coverage across the Brighton and Hove authority.

The service requires users to park at, or near to, dedicated parking stations, with a small fee of £2 for parking elsewhere. The success of the scheme has been realised due to the low cost of hire and the density of provision throughout the city. Providing bikes at key locations, such as transport interchanges, places of work and points of interest caters to a variety of trip uses and improves accessibility for both residents and tourists. It is important to provide space for bike share schemes at stations to facilitate first/last mile trips.

Image A.10
BTN Bikeshare, Brighton & Hove

Stansted Airport ESDL

The Express Set-down and Pick-up lane (ESDL) at Stansted Airport extends across the front of the main terminal building. Its purpose is to provide a short stay set-down and pick-up close to the main terminal entrance.

Charges are applied per minute to discourage cars from dwelling.

The project addressed issues with cars queuing from the set-down to the main road during peak times, causing congestion and delays on the wider highway network.

The queues were a consequence of cars not making full use of the set-down and pick-up area due to a lack of clear road markings and supporting signs at the entrance to the ESDL.

A new layout that encouraged drivers to use the full length of set down lanes and improve the speed in which cars could manoeuvre into and out of the parking spaces was designed to resolve the queuing and improve throughput.

The following measures were implemented:

- → Length of parking bays increased to avoid the need for cars to reverse into previously tight spaces. Parking bays measure 6m x 2.25m with a 2m clear space between each bay to improve entry/exit manoeuvrability.
- → Revised line marking to push vehicles along the ESDL and utilise all available space in front of the terminal.
- → Signs were deployed at the entrance to the EDSL to advise drivers to utilise both available lanes and direct to Blue Badge parking.
- → Additional pedestrian routes and a clearly defined 1.2m wide pedestrian aisle were provided within the roadway to keep people moving away from the ESDL.

These measures improved driver understanding of vehicle flow, improved throughput by up to 25% during peak times, reduced congestion on the surrounding highway and maintained safe movement of pedestrians.

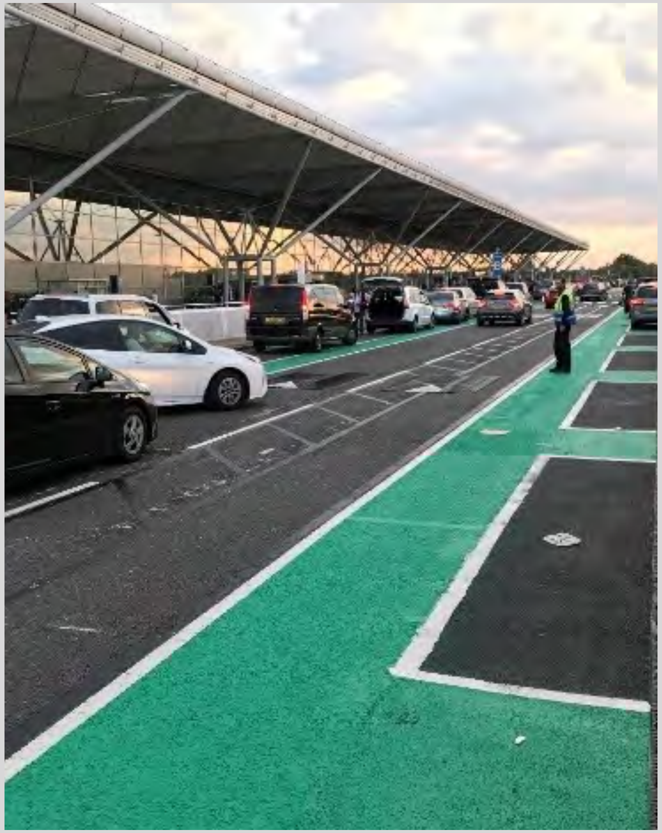


Image A.11
Stansted express set-down/pick-up lanes

Leeds Railway Station

In June 2021 a multi-story car park at Leeds station re-opened with 56 electric vehicle charging points available among the 307 pre-bookable spaces. The fast (22 Kw per connection) type 2 chargers are powered by guaranteed renewable energy. The charging service is free to those who have paid to use the long stay car park.

Network Rail has committed to installing electric vehicle charging points across 10% of car parking spaces at their managed car parks by March 2024.

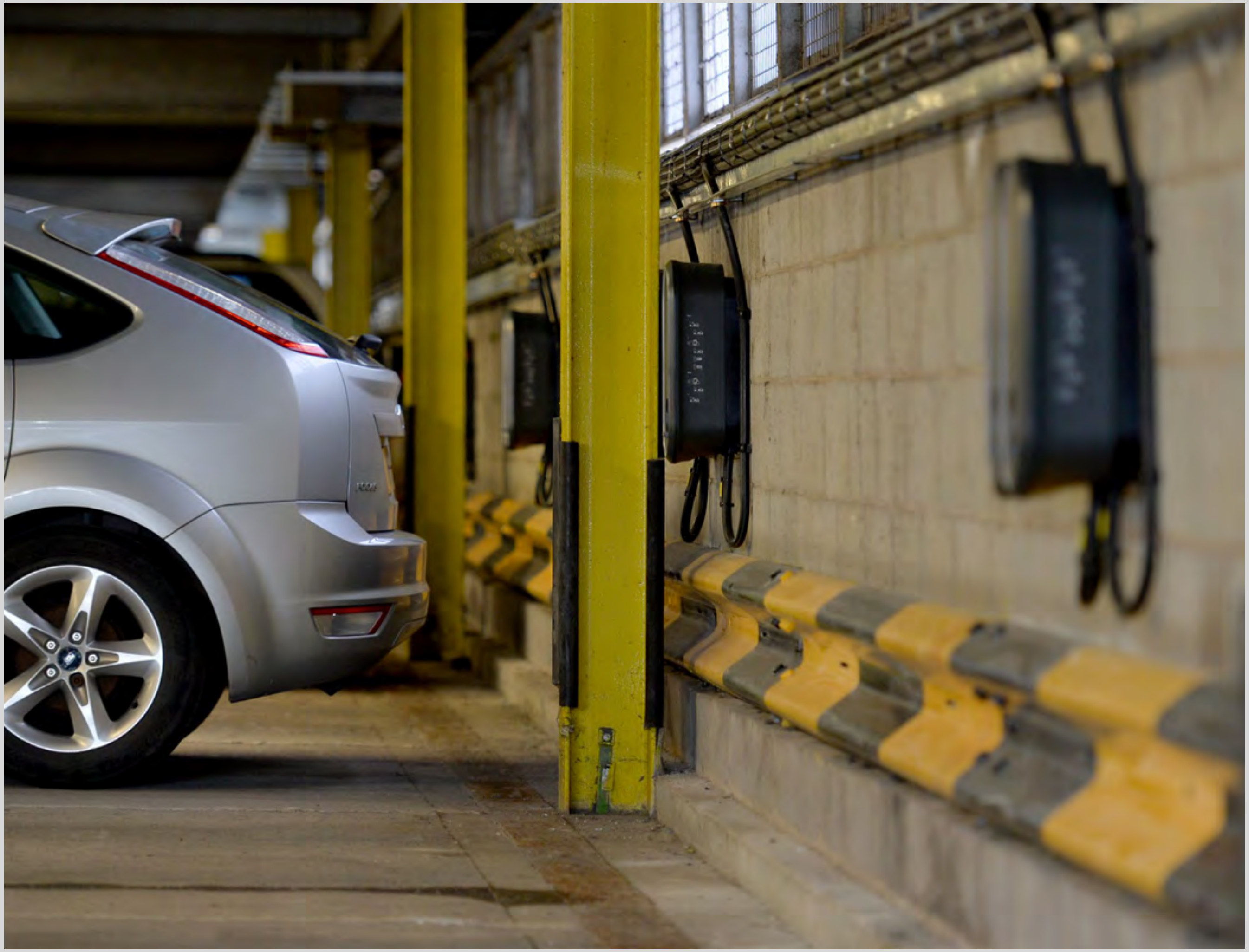


Image A.12
Leeds Station, boundary wall mounted fast EV charge points

UK Charging Hubs

As part of a wide-ranging station improvement programme being undertaken by Govia Thameslink Railway, with 27 and 26 charge points opened in Hatfield and Norton respectively.

These charging hubs were delivered to support the growing demand for EV charging infrastructure from railway car park customers, with 230 stations across the county set to receive similar chargers. As part of the project, 12 charging points have also been installed at Haywards Heath station.

A high number of chargers has been implemented at each location to future proof the network as EV ownership level grows. The stations also plan to trial different pricing and access models.

Image A.13
Hatfield station EV charging bays

London Rapid Charging Hub

London's first rapid charging hub with six chargers opened at Stratford International Station car park in a partnership between Transport for London and Osprey. The hub is the first of five to be opened across London in coming years.

Osprey is subsidising the charging so that drivers pay for charging only and not for the parking space. The 50kW chargers are provided with connectors fitting all cars on the market. The chargers are accessible to all EV drivers with the tap of a contactless bank card and no registration or membership is required.

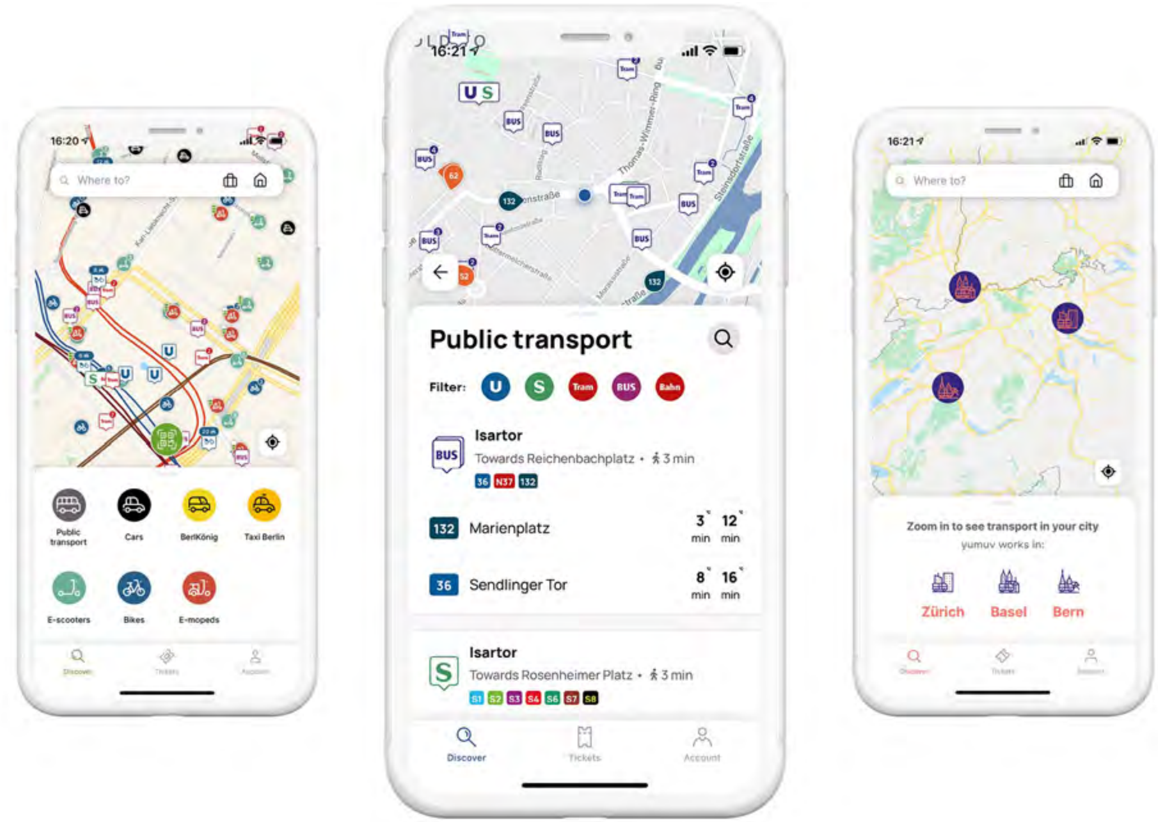
Image A.14
Stratford International Rapid EV charging hub

Yumuv: MaaS in Switzerland

Yumuv is a mobile app owned by Swiss Federal Railways (SBB CFF FFS), public transport operators in Zurich (VBZ), Basel (BVB), and Bern (BERNMOBIL) which is powered by Trafi.

It aims to integrate public transport and shared mobility services in several Swiss cities in a single app. It currently includes bus, tram, e-bikes, e-scooters and car sharing.

Yumuv offers various ticket bundles including free minutes and discounts. It has been indicated that in less than two months of operations, yumuv was downloaded by almost 1,000 individuals.



https://www.trafi.com/yumuv-mobility-as-a-service/

Image A.15
Yumuv MaaS app

Longbridge Railway Station

Longbridge railway station, working with Smart Parking, installed parking sensors and devices in the disabled and Save-a-Space bays in 2018 in the station car park. Save-a-Space was a service allowing drivers to reserve and pay for a parking space before leaving the house via an app. The smart parking sensors installed sent the real-time occupancy information to the SmartCloud.

The data collected by the sensors was used by Transport for West Midlands to understand bay usage, gather real-time information on car park activity and better understand parking patterns to inform their future planning. The use of technology also improved user experience and allowed for improved enforcement.

Image A.16
Longbridge Station smart parking bay sensors

Smart Parking Case Study 2

AppyWay

In January 2019, AppyWay launched over 2,000 smart parking sensors across Harrogate and worked to consolidate digitised parking data, parking sensors, parking payments, ANPR barriers and linear pricing into a single solution for the Councils. AppyWay is a kerbside management and smart parking company based in the UK.

The mobile app provides users with real-time availability of parking spaces across Harrogate town centre and ability to pay for parking use. The sensor technology means parking sessions automatically end when the vehicle is driven away. Users were able to use pay-per-minute sessions, which resulted in longer stays (an average of 10 minutes extra for on-street and 50 minutes extra for off-street locations).

Implemented smart parking technology and solutions provide better data collection and real time information, which could support local authorities with management of parking assets.

Image A.17
AppyWay, smart parking app

Smart Kerbside Project

A six-month pilot of smart kerbside management took place in downtown Las Vegas through a public-private partnership initiative.

Two digital kiosks were installed covering six parking spaces that utilise video analytics and smart parking technology to better manage pick up and drop off zones for taxis and PHVs. Traffic is monitored and any parking violations are immediately reported to the city. The system utilised cloud processing of traffic and pedestrian information to monitor traffic flow. The company plans to display test advertising on the screens for local businesses.

Similar technology can be used at kerbside at stations to facilitate a continuous traffic flow, safe loading and display information about onward journeys or nearby amenities.

Image A.18
City of Las Vegas/ Cox Media Smart Curbside Management Corridor

GATEway Project

The GATEway project began in November 2016 as a proof of concept for autonomous vehicles. Among various demonstrations, a fleet of four driverless pods were deployed to shuttle people along a dedicated route through Greenwich. The project gathered positive feedback from the public, with 92% of riders feeling safe during the experience.

In advance of road-ready CAVs, pods like these could be carrying passengers from city centres to out-of-town train stations along set routes, improving links to difficult to reach railway connections.

As well as trialling driverless pods as pubic transport, the study also looked into Automated Valet Parking. Participants of the trials were able to experience AVP first hand, driving vehicles around a predefined route before activating automated parking. The participants experienced both the sending the car to park and summoning the vehicle for a return journey. Overall response was positive, 89% of participants indicating partial to full trust of the system. Those who distrusted the system were worried about the loss of control. However, the project found most were keen to see this technology available as a stepping stone to autonomous journeys.

Image A.20
GATEway project autonomous pod

CAV Case Study 2

LUTZ Pathfinder

As a demonstration of CAV technology, the LUTZ pathfinder project in Milton Keynes, people were drive people around Station Square and surrounding underpasses in a two-seater CAV.

The demonstration led into a larger project ‘UK Autodrive’ which explored three facets of autonomous vehicles:

- **Cars**: focusing on developing and trialling CAVs.
- **Pods**: developing and trialling electric CAVs as a last mile mode of transport.
- **Cities**: Exploring how cities can facilitate and benefit from automated transport systems.

Image A.21
LUTZ CAV pilot, Milton Keynes

Project Synergy

Operated by Transport for Greater Manchester, Project Synergy is a proof of concept for autonomous transport operating between Manchester Airport and Stockport railway station, with road legal cars trialling autonomous driving along the A555 in early 2021. The trial successfully demonstrated the use and benefits of Vehicle to Everything (V2X) and Signal Phase and Timing (SPaT) technology. The goals include tackling transport challenges such as accessibility, mobility, traffic congestion and air pollution; contributing to achieving Manchester's carbon neutrality targets and exploring Mobility as a Service technologies.

Three PODs are planned on-site at the airport to connect the facility's hotels, car parks and airport terminals in a circular route. Project GATEway previously trialled similar pods in Greenwich in 2016, with a positive user perception (92% of riders felt safe in the vehicle). The pods covered 2,000 miles in various conditions without experiencing any safety incident. These types of vehicles, as well as providing on-site transport, could carry passengers from city centres to out-of-town train stations along set routes, improving links to difficult to reach railway connections.

Image A.21
Project Synergy CAV trial pod, Manchester

V-charge

V-charge (Valet Charge) is a Volkswagen study into Automated Valet Parking, where cars park and charge by themselves.

In this concept, a driver would park their car in a 'valet zone' at a car park, activating the parking process via an app with the vehicle then parking itself. If the vehicle requires charging, it can park over an inductive charging spot, moving to a regular space when charged to make way for another vehicle. The owner then uses the app to recall the car to the pick-up area where and is charged for the length of stay/charging. This approach creates an efficient use of parking space and allows for a faster and easier parking experience.

Volkswagen in 2015, working with six international partners, created a car capable of self-parking with existing technology. The car is provided with a digital map of the layout on acceptance of the parking request and can then use its local sensors to check if a space is free and navigate into it. The sensors are able to detect obstructions and pedestrians, meaning that this technology can operate in a mixed environment of autonomous and non-autonomous vehicles.

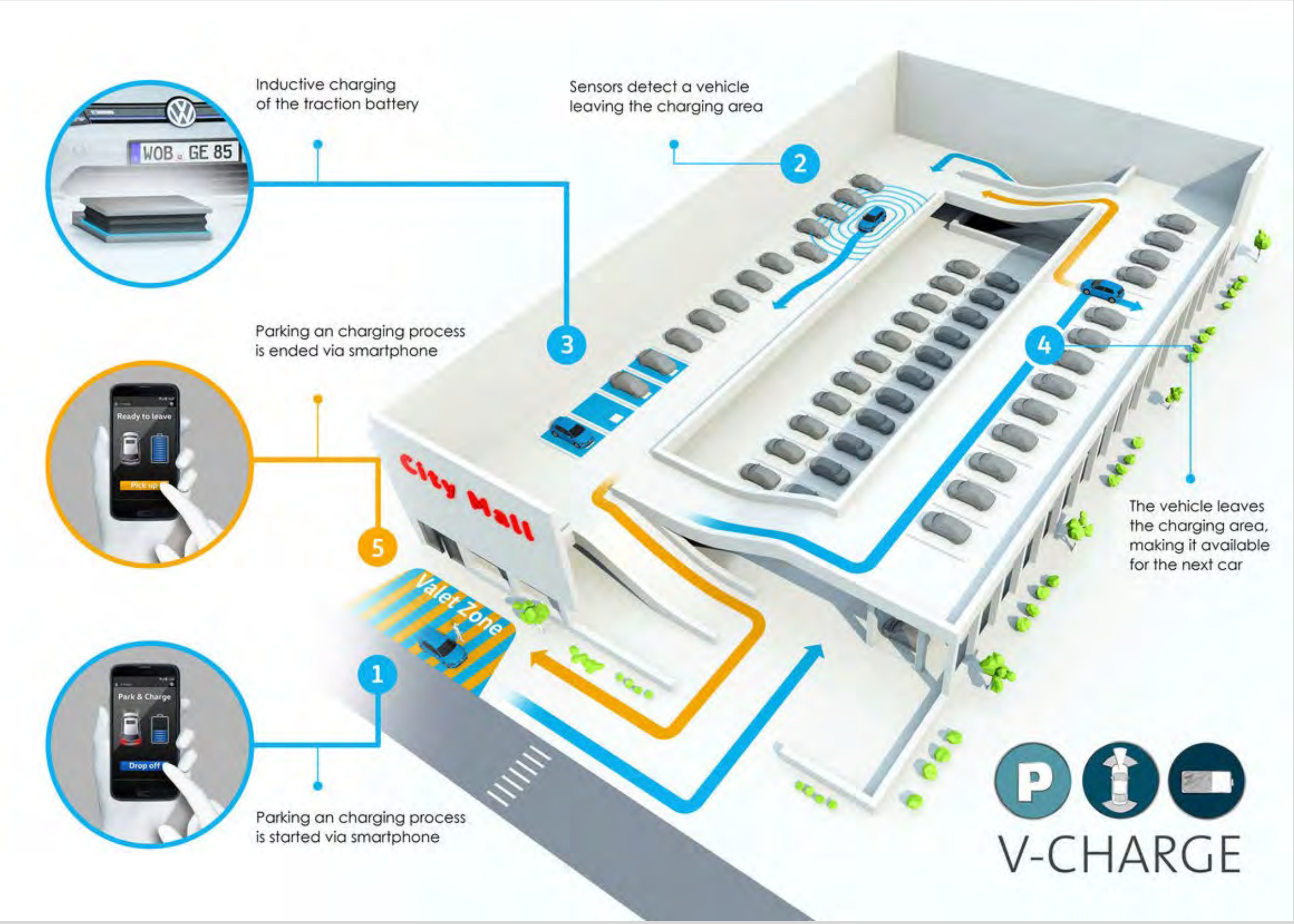


Image A.22
V-charge, Autonomous Valet Parking

AVP Case Study 2
Hamburg Airport

Volkswagen tested the implementation of AVP in real conditions at Hamburg Airport in 2018. Drivers could pre-book a space and leave their car at the car park entrance, a short two-minute walk from airport check-in.

The system required markers placed around the car park to assist the car in navigation. The concept also involved parcels and dry cleaning delivered directly into the car boot. The driver can recall the car through an app, which also calculates the parking fee allowing for fast payment. Train station car parks should expect to see the adoption of similar AVP systems, as well as convenience services such as the parcel drop-off.

The aim of the project is to make parking as practical and fast as possible for onward travel, reducing stress, a goal also be shared by railway station car parks. Reducing time spent searching for a space allows travellers to reclaim time and reduce their mileage. Volkswagen has also been using the streets of Hamburg to test their fully autonomous cars and trucks amongst other projects.

Image A.23
Volkswagen AVP trial, Hamburg Airport

Distripolis, Paris

In an effort to replace standard diesel trucks, GEODIS -a road transport operator- tested micro-consolidation centres and e-cargo bikes in a large-scale trial in France. The scheme operates through the use of the GEODIS networks whereby freight is collected from a large outer Paris depot by trucks. Eight micro-consolidation centres within the city receive the freight from the outer depot throughout the day. The last-mile delivery is completed using zero emission e-cargo bikes.

GEODIS previously performed its urban freight deliveries with conventional diesel trucks and vans; however, Distripolis has allowed the firm to substitute its diesel fleet with clean delivery vehicles optimising last mile delivery.

Paris is the first city where the Distripolis concept has been implemented with a vision to transfer the concept to 30 cities in France and wider major European cities.

Since the scheme became operational there has been a 364-tonne reduction in CO_2 and an annual reduction of 1,747 tonnes of CO_2 equating to a total 85% reduction in CO_2 emissions. Additionally, GEODIS vehicle noise levels have reduced by 20%.

Image A.24
GEODIS Distripolis micro-consolidation centre, Paris

Ovo Micro-Consolidation Centre: Geneva

Ovo is a Geneva based company which aims to improve the energy and economic efficiency of urban parcels and goods transport by providing environmentally friendly vehicles and optimising delivery routes using intelligent software and micro-consolidation centres. This is facilitated through the use of e-cargo bikes to complete last mile deliveries.

The micro-consolidation centres are located within the city belt and are strategically placed to provide access to the main roads so there is city-wide coverage to enable efficient management of goods.

Image A.25
OVO micro-consolidation project, Geneva

Advanced Aerial Mobility

Urban-Air Port was awarded £1.2 million through the Future Flight Challenge to develop a vertiport for autonomous aerial mobility in Coventry. The project, due to start in late 2021, will be a testing ground for vertical take-off and landing vehicles.

If serving VTOL vehicles only, an Urban Airport can be 60% smaller than a traditional heliport. A number of potential uses will be examined during the trial such as autonomous delivery drones and air taxis. The site will allow for testing of integration of new forms of mobility with city infrastructure. The vertiports could be positioned close to or at the major railway stations.

The design presents a domed shape featuring a landing pad on the roof and facilities such as waiting areas, aerial vehicles storage or parcel consolidation beneath. It also features drop off and pick up zones.

Image A.26
Visual representation of the Air-One site with a Hyundai eVTOL, Coventry

Deliveries by Drones, Royal Mail

In October 2021, Royal Mail started a two-week drone delivery trial on a remote Scottish island between Kirkwall and North Ronaldsay, capable of carrying up to 100kg of parcels delivered to 70 residents. The trial is intended to evaluate the potential to connect remote isolated island communities and reduce carbon emissions. The trial links to the broader Sustainable Aviation Test Environment (SATE) project based at Kirkwall airport and uses innovative and efficient technologies to support and expand connectivity within remote isolated communities.

In May 2021, Royal Mail trialled the use of drones to send PPE, the COVID-19 test kits and other items of mail from the UK mainland to the Scilly Isles, a 70-mile journey. Royal Mail was the first parcel carrier in the UK to deliver mail to a UK island using autonomous flight/drone delivery. The month-long UK government funded trial, used a drone designed to deliver to remote locations and fly through poor weather conditions while carrying 100kg of mail, which equates to a typical delivery round.

Based on the outcomes of the trials, Royal Mail will consider whether to introduce drone technology to support deliveries on a wider scale, particularly in more remote parts of the country.

Image A.27
Royal Mail drone delivery service trial

Kingston Cycle Hub

As part of the London Mayor's mini-Holland programme, Go Cycle Kingston re-establishes a strong green connection from the station forecourt to the riverfront and transforms the derelict landscape adjacent to the rail tracks into an attractive and usable public amenity for people walking and cycling.

The project consists of a trio of new interventions, including, a station plaza, cycle hub and new cycle/pedestrian bridge. These are united by new crossings at the station forecourt and a newly landscaped green route to the riverside.

The cycle storage hub is adjacent to the station and has three-storey storage capacity for 398 bicycles. The upper levels provide secure and convenient cycle storage throughout the day. The ground floor includes a coffee shop and community event space, and a new cycle workshop will offer free tools and a space to carry out repairs. Cargo bikes and cycle rental are also planned to encourage cycling, while reducing vehicle congestion and pollution.

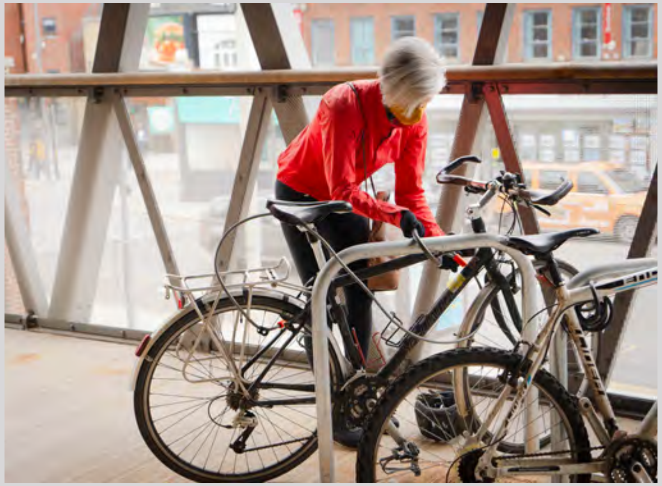


Image A.28, A.29, A.30
Kingston Station cycle hub and segregated cycle route to the Thames

Cycling Case Study 2
Utrecht Cycle Hub

Utrecht Cycle Hub in the Netherlands is the largest bicycle hub in the world with over 12,500 bike parking spaces. The hub has three floors: the lower and upper floors for "day-parkers" and the ground floor for riders with subscriptions. Use of the facility is free for the first 24hrs and then incurs a charge of €1.25 (£1.13) a day thereafter. Users can enter and leave on both sides and the continuous cycle path through the facility operates a one-way system with a speed limit. The Cycle Hub is open 24/7 with the city of Utrecht employing around 40 people to operate it.

The main facilities and services offered include:

- → Easy check-in /check-out controls (OV chip card – 'OV-chipkaart') with a smartphone app
- → Digital signs to direct cyclists to free spaces
- → Optical sensors that transmit information on space occupancy
- → Spaces for non-standard bikes including cargo bikes
- → Onsite bike repair facilities
- → Staff, e.g. wardens monitoring cycle parking to confirm that bicycles are removed after 28 days

The facility was financed by the Prorail (~ 60%), the city of Utrecht (~20%) and the Ministry of Transport (~20%) with additional contributions from Nederlandse Spoorwegen (rail passenger management co.) and the European Union via the CEF (Connecting Europe Facility).

Image A.31, A.32, A.33
Utrecht cycle hub

Cycling Case Study 3
Waltham Forest Cycle Hubs

Waltham Forest implemented are eight cycle hubs with over 500 cycle parking spaces between them. These hubs are primarily located at railway and underground stations; however, some serve both town centre and railway users.

All hubs have strong seasonal variation with much higher usage throughout the summer months. There are 850 members registered to use the scheme, with 550 cycle parking spaces available for use, however many of these members are inactive, and either never use the scheme, or use it sparingly.

The graph shows daily cycle hub entries for each of the locations within Waltham Forest presented as a percentage of the overall capacity of each hub.

The hubs are not intended for long-term storage of bicycles, staff therefore should attend to “garaged bikes”. This is managed by carrying out checks for signs of usage with bikes that appear abandoned tagged with a notice of removal. If they are not moved by the given date, the bike is removed and donated to charity.

Hubs have had Abel sensors installed to provide real-time data on capacity, which is reported live to users.

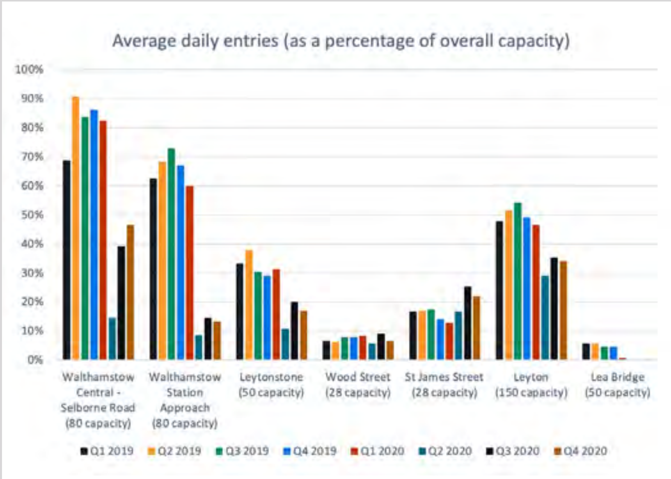


Image A.34, A.35, A.36
Waltham Forest cycle hubs and useage graph

Document References

B

Parking & Mobility
Definitions
Relevant Standards and Guidance
Image Credits

Definitions

AAM
Advanced Aerial Mobility

AC
Alternating Current

ANPR
Automatic Number Plate Recognition

APDS
Alliance for Parking Data Standards

ATOC
Association of Train Operating Companies

AVP
Autonomous Valet Parking

BPA
British Parking Association

BRE
Building Research Establishment

BSI
British Standards

CAV
Connected and Autonomous Vehicle

CCTV
Closed-circuit television

CIL
Community Infrastructure Levy

DC
Direct Current

DDRT
Digital Demand Responsive Transport

DfT
Department for Transport

DMUK
Disabled Motoring UK

DPA
Disabled Parking Accreditation

DRT
Demand Responsive Transport

ESDL
Express Set-down and Pick-up lane

EV
Electric Vehicle

EVSE
Electric Vehicle Supply Equipment

eVTOL
Electric Vertical Take-Off and Landing

FTZ
Future Transport Zone

GRIP
Governance for Network Rail Investment Projects

HGV
Heavy Goods Vehicle

HMRI
Her Majesty's Railway Inspectorate

HVM
Hostile vehicle mitigation

ICE
Internal combustion engine

ILP
Institute of Lighting Professionals

kW
Kilowatt

LEZ
Low Emission Zone

LHA
Local Highways Authority

LRVR
Local Risk Vulnerability Review

LTP
Local Transport Plan

MaaS
Mobility as a Service

MSA
Motorway service area

MW
Megawatt

NR
Network Rail

NTSN
A National Technical Specification Notice

OCPP
Open Charge Point Protocol

OEM
Original Equipment Manufacturer

PAYG
Pay As You Go

RDG
Rail Delivery Group

PHV
Private Vehicle Hire

PPUDO
Pick-up/drop-off zones

PRM
Person with Reduced Mobility

PV
Photovoltaic

RSSB
Rail Safety and Standards Board

SATE
Sustainable Aviation Test Environment

SPaT
Signal Phase and Timing

STOL
Short Take-Off and Landing

STP
Station Travel Plan

TfL
Transport for London

TOC
Train Operating Company

TRO
Traffic Regulation Order

UK
United Kingdom

V2G
Vehicle to Grid

V2X
Vehicle to Everything

VSS
Video Surveillance Systems

VTOL
Vertical Take-Off and Landing

Relevant Standards and Guidance

A wide range of Network Rail and industry-wide documents and guidance notes were used in compiling this Guide. Below is a list of the most relevant standards and guidance documents referenced within this Guide. These documents are drawn from a range of sources and have been used in the development of this Guide. The list is not intended to be exhaustive but provide the user of this Guide with a sound basis.

Relevant Network Rail Standards and Guidance

- Our principles of good design (January 2020)
- Station Design Manual (NR/GN/CIV/100/02)
- Climate Action Design Manual (NR/GN/CIV/100/04)
- Station Masterplanning Guidance (NR/GN/CIV/100/07)
- Public Realm Design Guidance for Stations (NR/GN/CIV/200/10)
- Third Party Funded Railway Car Parks Design Manual (NR/GN/CIV/200/12)
- Wayfinding Design Guidance (NR/GN/CIV/300/01)
- Inclusive Design Manual (NR/GN/CIV/300/04)
- Design of Car Parks for Railway Stations & Depots (withdrawn) (NR/L3/CIV/160)
- Standard Specification for New and Upgraded Lifts (NR/L2/CIV/193)
- Standard Specification for New and Upgraded Escalators (NR/L2/CIV/196)
- Environment and Social Minimum Requirements NR/L2/ENV/015
- Environmental Strategy 2020 – 2050
- National Design Guide: Planning practice guidance for beautiful, enduring and successful places (2021)
- The Sustainability Requirements for Network Rail Buildings, Asset Management Services Guidance, August 2013
- Buildings and Architecture Strategy 2021
- Network Rail EV charging infrastructure, Mitie Energy (2021)

British Standards

- BS 9999:2017 Fire safety in the design, management and use of buildings. Code of practice
- BS 9992:2020 Fire safety in the design, management and use of rail infrastructure, Code of Practice
- BS 5489-1 Code of Practice for the Design of Road Lighting Part 1: Lighting of Roads and Public Amenity Areas.
- BS 5266-1 Emergency Lighting Part 1: Code of Practice for the Emergency Lighting of Premises
- BS ISO 21931-1:2010, Sustainability in building construction, framework for methods of assessment of the environmental performance of construction works
- BS 8300 - Design of an accessible and inclusive built environment
- BS 8902 - Responsible sourcing sector certification schemes for construction products - Specification (from BSI).
- BS EN 13201 Light and Lighting
- BS EN 12461- 1 Indoor Lighting Best Practice
- BS EN 12461- 2 Outdoor Lighting Best Practice

- BS EN 60598-1:2015+A1:2018 Luminaires - General requirements and tests
- BES 6001 - Framework Standard for the Responsible Sourcing of Construction Products
- BS 6571 -Vehicle Parking Control Equipment

External Guidance Reference

- Guidance on the Implementation of Station Travel Plans 2013 (ATOC/RSSB)
- GIGN7520 Iss 1: Guidance note on Lighting of Railway Premises GI/GN7520 Lighting in Railway Premises
- GC/RT5212 Railway Clearances
- Wayfinding at Stations Good Practice Guide, RSSB 2006
- BS 9999, Fire safety in the Design, Management and Use of Buildings
- BS 9992, Fire Safety in the Design, Management and Use of Rail Infrastructure
- Inclusive Mobility, Department for Transport, 2021
- Guidance on the Use of Tactile Paving Surfaces, Department for Transport, 2021
- LTN 1/20 Cycle Infrastructure Design, Department for Transport, 2020
- Cycle-Rail Toolkit 2, Rail Delivery Group, 2016
- Standards for Public Cycle Parking, Cycle Rail Group, 2021
- London Cycle Design Standards, Transport for London, 2014
- Station Car Parking Good Practice Guide, Rail Delivery Group, 2018
- Inclusive Mobility A Guide to Best Practice on Access to Pedestrian and Transport Infrastructure, Department for Transport
- Accessible Bus Stop Design Guidance, Transport for London
- Design recommendations for multi-storey and underground car parks (Fourth edition), IStructE
- Car Park Designers' Handbook, ICE
- Motorcycle Parking at Railway stations, ATOC 2014
- DfT Code of Practice - Design Standards for Accessible Railway Stations
- Department for Transport, National Technical Specification Notice (NTSN), Persons with Reduced Mobility (PRM) Jan 2021 (replaces the EU standard PRM TSI)
- Department for Transport, Security in the Design of Stations (SIDOS) Guide, 2018
- Department for Transport: Traffic Signs Manual and the Traffic Sign Regulations and General Directions
- Equality Act (2010)
- Institute of Lighting Professionals (ILP) Guidance Note 1 for the reduction of obtrusive light
- TAG UNIT M5.1 Modelling Parking and Park and Ride
- The Alliance for Parking Data Standards (APDS) specifications (Future ISO TS 5206-1)
- ISO 15118 – is an international standard for bi-directional digital communications between electric vehicles and the charging station

Other references and resources

- Transport Vision 2050: investing in the future of mobility, UK Research and Innovation
- Future of Mobility: urban strategy, Department for Transport
- Mobility Hubs Guidance, CoMoUK
- Mobility Hubs Toolkit, CoMoUK

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