



# **ELECTRIC VEHICLE CHARGING INFRASTRUCTURE TRANSITION ROADMAP**

**Amendment B:  
Micro-Mobility, E-Bike and Cargo Bike Analysis**

**ARUP**

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# SUMMARY

Electric bikes (e-bikes) have a role to play in the transition to a more sustainable, safe, healthy and economical transport system. This amendment to the City of Adelaide's (CoA) *EV Charging Infrastructure Transition Roadmap* (the Roadmap) explores some of the mechanisms through which CoA can influence increased e-bike uptake.

The term "electric vehicles" (EVs) is commonly used to refer to electric cars. However, EVs can include a wide range of vehicles - from larger EV varieties including electric trucks, buses, vans, and cars to smaller "micro-mobility" vehicles including electric bikes, cargo bikes, and scooters.

This amendment focuses primarily on e-bikes, with consideration for the broader electric micro-mobility category that they belong to.

The barriers for e-bike adoption much more closely reflect the barriers to bike adoption than adoption of other types of EVs (including electric cars). For example, while range anxiety is a significant barrier for individuals looking to purchase an electric car, bikes (and e-bikes) are primarily affected by safety barriers. Case studies are included in this report as a reference.

Specific analysis for electric cargo bikes shows high potential for uptake, but barriers mirror those for 'normal' bikes and e-bikes.

This amendment explores options and opportunities for providing e-bike charging within CoA, including in UPark facilities.



# CONTEXT

E-bikes have a role to play in mode shift and electric vehicle transition, as globally e-bikes are contributing to a greater reduction in oil consumption than other types of EVs.

## ROLE OF E-BIKES IN THE EV TRANSITION

While EVs have lower emissions than internal combustion engine (ICE) vehicles, local and international benchmarks support a longer-term shift to alternative modes of transport.

E-bikes only take a fraction of the power, resources, and space required to manufacture and own an EV, making them a highly effective mode for decarbonisation and improving a city's overall liveability.

### Congestion

EVs occupy the same road space requirements as ICE vehicles. Substituting even a small number of car trips with bike and e-bike trips can lead to an impactful congestion reduction<sup>6</sup>.

### Infrastructure

EVs continue to require a significant amount of the city's space to be devoted to carriageway and parking compared with other active transport modes (including bikes and e-bikes).

A higher share of bikes and e-bikes could allow some of this space to be repurposed for other uses; for example outdoor dining, green space, footpaths, or cycle lanes.

### Health and safety

EVs pose similar or greater safety risks to vulnerable road users compared to ICE vehicles.

Investing in active transport (including e-bike riding) can create positive health benefits from increased physical fitness<sup>7,8,9,10</sup> and reduce road fatalities<sup>11</sup>.

## GLOBAL AND LOCAL TRENDS

The popularity of e-bikes has exploded in recent years.

- Worldwide, electric two- and three-wheeled devices are reducing oil consumption by over a million barrels per day – more than double that of electric cars<sup>1</sup>.
- 2 million e-bikes were sold in Germany in 2021 alone<sup>2</sup> (2% of the population).
- E-bike sales in Australia grew 730% from 2017 to 2021<sup>3</sup>. One retailer reported a 92% increase in e-bike sales in SA from 2019 – 2021<sup>4</sup>.
- From 2019 to 2023, the share of e-bike trips recorded on the exercise app Strava grew sixfold in Greater Adelaide (from 0.4% to 2.8%)<sup>5</sup>.



<sup>1</sup> *Electric Vehicle Outlook 2022* - BloombergNEF, 2022

<sup>2</sup> *Visualization and bibliometric analysis of e-bike studies: A systematic literature review (1976-2023)* - J Zhou, Z Li, S Dong, J Sun, & Y Zhang, 2023

<sup>3</sup> *Australia's EV strategy misses the turnoff for faster climate action* - Bicycle Network, 2023

<sup>4</sup> *Electric bike sales increase in SA as commuters and families climb aboard* - C Peddie / The Advertiser, 2021

<sup>5</sup> This report includes aggregated and de-identified data from Strava Metro.

<sup>6</sup> *E-Bike Subsidy for Australians* - Institute for Sensible Transport / WeRide, 2021

<sup>7</sup> *E-bikes Toward Inclusive Mobility: A Literature Review of Perceptions, Concerns, and Barriers* - K Lee, & IN Sener, 2023

<sup>8</sup> *Extending life on the bike: Electric bike use by older Australians* - M Johnson, & G Rose, 2015

<sup>9</sup> *The impact of e-cycling on travel behaviour: A scoping review* - JE Bourne, AR Cooper, FJ Kinnear, C England, S Leary, & A Page - 2020

<sup>10</sup> *Health impact assessment of active transportation: A systematic review* - N Mueller, D Rojas-Rueda, T Cole-Hunter, A de Nazelle, E Dons, R Gerike, T Götschi, L I Panis, S Kahlmeier, & M Nieuwenhuijsen, 2015

<sup>11</sup> *Why cities with high bicycling rates are safer for all road users* - WE Marshall, & NN Ferenchak, 2019



# ABOUT E-BIKES

E-bikes are part of a large and continually-growing number of electric mobility devices, which come in a range of different forms for different users and use cases.

## THE 'TYPICAL' E-BIKE

Many e-bikes look like a normal bike - only they have a battery and an electric motor that will assist the rider up to a speed of 25km/h.

E-bikes allow riders to choose to cycle for more types of trips - whether that's riding further, on more challenging terrain, or with more cargo (e.g. groceries).

E-bikes tend to start at around \$800 (depending on range, quality, and other factors), and have a range of 30-70km (varying for example with battery size, terrain, and power level).



## ELECTRIC CARGO BIKES

Cargo bikes unlock a wide range of possibilities for transporting people and goods sustainably.

Businesses are increasingly using cargo bikes to replace vans - including in Adelaide, where they're used (for example) to deliver food, or service electric scooters.

There are many different sizes and configurations of cargo bikes, ranging from the size of a regular bike to not much smaller than a small van.



## E-SCOOTERS AND ELECTRIC PERSONAL TRANSPORTERS

There are many other forms of e-mobility devices gaining popularity worldwide. E-scooters, e-skateboards, and other devices share similarities with e-bikes. They tend to benefit from infrastructure aimed at e-bikes and can help contribute to the overall electric vehicle transition by providing low-cost zero-emission transport options to fulfil a wide range of users' needs (pending legislation to allow their private use in South Australia).



Image: [City of Adelaide](#)

## ELECTRIC MOBILITY AIDS

Electric mobility plays an important role for many people's independence and accessibility - for example electric mobility scooters, electric wheelchairs, or adaptive e-bikes. Support for charging electric mobility aids is outside of the scope of this document. CoA is committed to investing in infrastructure that helps people to move around and navigate the city, including promoting inclusion of people with disability.



Image: [Zoos SA](#)

# INFLUENCING E-BIKE UPTAKE

*Key actions to increase the share of e-bikes  
in the city's transport mix*

# INFLUENCING DEMAND

Approximately 30% of the CoA<sup>1</sup> is currently dedicated to vehicle infrastructure by area – reinforcing vehicles as the mode of choice for most visitors to the city. This is true of most Australian cities, which have largely been designed to optimise car travel.

Encouraging mode shift to bikes (of any kind) seeks to change people’s existing travel behaviours, and address barriers to bike ridership, particularly perceptions of safety<sup>2</sup>.

E-bikes address barriers that may typically limit bike uptake associated with distance and difficult terrain, but barriers remain that limit mode shift to bikes, e-bikes, e-scooters, and cargo bikes.

## NETWORK SAFETY

Network safety is one of the biggest barriers to adoption of both bikes and e-bikes<sup>3,4,5</sup>; particularly in Australia, where most adults do not feel safe riding on roads around vehicle traffic<sup>6</sup>. People’s thresholds for cycling safety vary by age and gender, leading to discrepancies among those who cycle<sup>14,15</sup>.

A safe and well-connected cycling network is one of the highest-impact ways to increase cycling uptake. This includes providing physical separation from cars, reducing vehicle speeds, and quality of paths and lighting<sup>11,12</sup>.

Many of these infrastructure interventions also benefit those using electric mobility aids. For example, in some areas separated cycling infrastructure is open to people using electric mobility aids<sup>7</sup>. Limiting obstructions and widening paths are also important for improving accessibility for users of these devices<sup>8,9</sup>.

## COMFORT AND EFFORT

Weather, distance, hills, and physical effort can all contribute to people making the choice not to ride<sup>2,3</sup>. E-bikes reduce the physical effort required to ride and can reduce such barriers<sup>3,5</sup>.

## STORAGE AND CONVENIENCE

Bikes (and e-bikes) benefit from destination parking facilities at end of trip. These facilities occupy a small footprint compared with motor vehicles, and can be close to destinations or inside buildings. Security for bike parking can be a concern for e-bike riders<sup>5</sup>.

## COST

E-bikes range in cost from approximately \$800. Some jurisdictions are incentivising uptake through rebates, including the City of Holdfast Bay (offering rebates of \$200 for e-bikes and \$300 for e-cargo bikes<sup>10</sup>), and CoA.

## CASE STUDIES

The following case studies demonstrate how jurisdictions across the globe have invested in measures to increase demand, technology and facilities to increase the share of e-bikes in their city’s transport mix.

<sup>1</sup> Excludes parklands. Based on OpenStreetMap and CoA road network data.

<sup>2</sup> *Barriers and enablers of bike riding for transport and recreational purposes in Australia* - L Pearson, B Gabbe, S Reeder, & B Beck - 2023

<sup>3</sup> *The impact of e-cycling on travel behaviour: A scoping review* - JE Bourne, AR Cooper, FJ Kinnear, C England, S Leary, & A Page - 2020

<sup>4</sup> *E-bikes Toward Inclusive Mobility: A Literature Review of Perceptions, Concerns, and Barriers* - K Lee, & IN Sener, 2023

<sup>5</sup> *E-bike Experience: Survey Study of Australian E-Bike Users* - T Washington, K Heesch, & A Ng, 2020

<sup>6</sup> *The Australian cycling and e-scooter economy in 2022* - Ernst & Young Australia / WeRide, 2023

<sup>7</sup> *Urban Design Guidelines for Victoria: 2.3 Pedestrian and bicycle paths* - Victoria Department of Transport and Planning, n.d.

<sup>8</sup> *Being mobile: electric mobility-scooters and their use by older people* - E May, R Garrett, & A Ballantyne, 2010

<sup>9</sup> *Inclusive and Safe Mobility Needs of Senior Citizens: Implications for Age-Friendly Cities and Communities* - AJ Bokolo, 2023

<sup>10</sup> *Green Living Rebates* - City of Holdfast Bay, 2024

<sup>11</sup> *Cycling, Health and Safety* - OECD / International Transport Forum, 2013

<sup>12</sup> *Summary of Design Principles for Good Bicycle Infrastructure* - Bicycle NSW, 2020

<sup>13</sup> *Designing for All Ages & Abilities: Contextual Guidance for High-Comfort Bicycle Facilities* - National Association of City Transportation Officials, 2017

<sup>14</sup> *Gender, Safety and Bike-Riding: Data Insights Report* - Z Condliffe, L Tsuchida, J Tang, J Clinch, A Kostecki, & G Cullen / She’s a Crowd, 2022

<sup>15</sup> *Does More Cycling Mean More Diversity in Cycling?* - R Aldred, J Woodcock, & A Goodman, 2016

# CASE STUDIES AMSTERDAM

Bikes account for  
**32%**  
of all journeys

E-bikes account for  
**50%**  
of new bike purchases

## CYCLING NETWORK

Amsterdam is well known as being a bike-friendly city, having:

- Low speed limits on more than 80% of streets
- A vast, interconnected, safe cycling network including separated cycle paths and car-free areas
- High-quality public transport, which is well-integrated with cycling network and parking infrastructure.

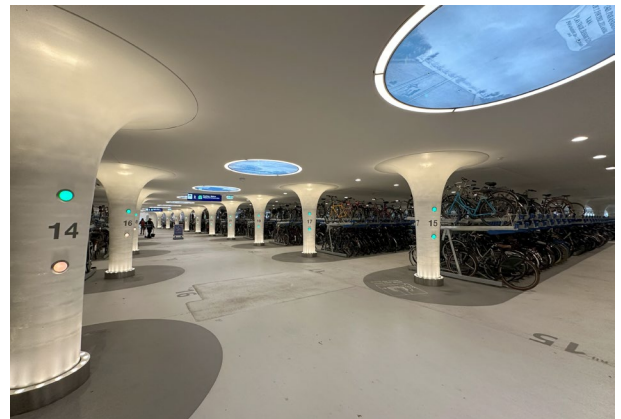


## E-BIKE CHARGING

Amsterdam has large parking garages that cater for thousands of bikes - often co-located with public transport to allow multi-modal trips, and often with attendants and other security measures to minimise theft.

Some of these have e-bike charging facilities, for example battery charging lockers. However, charging tends to be only a small fraction of overall parking capacity, and charging provisions weren't included in Amsterdam's newest 7,000-bike garage.

Amsterdam has very few on-street or destination e-bike charging facilities, with no active municipal or government programs to deliver facilities as of 2023.



*Secure parking facility for 7,000 bikes at Amsterdam Central train station. This facility accommodates cargo bikes and share bikes but does not have charging facilities.*

## LESSONS FROM AMSTERDAM

Amsterdam's infrastructure, particularly network and parking facilities, makes cycling an appealing option for bike and e-bike riders. The Amsterdam case study indicates that e-bike use is not dependent on available e-bike charging infrastructure.



# CASE STUDIES DENVER

Mode share target:  
**15%**  
by 2030

Since 2018,  
**+255km**  
of new bikeways installed

## CYCLING NETWORK

Denver has strong commitments to increase cycling mode share, and a key part of this involves ensuring all households have access to safe, comfortable bikeways.

Denver has installed 255km of new bikeways since 2018, many of which include physical separation from vehicle traffic.

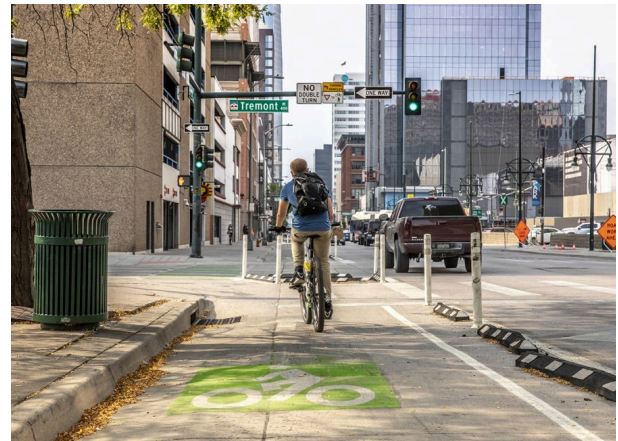
## E-BIKE SUBSIDIES

From 2022, Denver has offered various e-bike rebates, with higher amounts offered to residents purchasing cargo bikes or those below certain income thresholds (see table B.1).

Denver's subsidy also includes a provision for people with a disability who cannot use a standard e-bike. Eligible applicants can access a higher rebate to purchase a specialised adaptive e-bike designed to meet their individual needs.

Denver's subsidy exists in the form of vouchers, which can be applied for online (at a first-come, first-served basis) and are redeemed at participating bike stores at the time of purchase.

A study<sup>1</sup> found that 71% of surveyed recipients used ICE vehicles less often, and that bikes replaced 3.4 round-trips per week.



Recently-installed separated bike lane in Denver  
Image: [HDR Inc](#)

Table B.1: Denver e-bike rebate amounts<sup>3</sup> (USD)

Income tier	Low income	Moderate income
Base incentive amount	\$1,100	\$500
Equipment incentive	+\$100	+\$100
Cargo bike incentive	+\$300	+\$300
Adaptive e-bike incentive	+\$250	+\$250

## E-BIKE CHARGING

Denver have not implemented e-bike charging infrastructure as part of their target to increase e-bike uptake.

## LESSONS FROM DENVER

Denver has made strong commitments to improving bike mode share, but charging has not been a part of this. Denver's e-bike subsidies have increased the number of people with bikes, which has led to further support for the increased roll-out of safe bike infrastructure<sup>2</sup>.

<sup>1</sup> *Denver's 2022 Ebike Incentive Program: Results and Recommendations* - City and County of Denver, PeopleForBikes, Bicycle Colorado, Ride Report, & Rocky Mountain Institute, 2023

<sup>2</sup> *How E-Bike Rebates Will Make Cycling Safer* - D Zipper / Bloomberg, 2023

<sup>3</sup> *Community Access to Electric Bicycles Rebate Program* - State of Colorado Energy Office, 2024

# CASE STUDIES TASMANIA

Hobart cycling share:  
**7%**  
(2x that of Greater Adelaide)

In 2023:  
**\$1.2m**  
allocated to e-mobility incentives

## CYCLING NETWORK

Tasmania's bike infrastructure is currently very similar to Adelaide, in that cycling is predominantly on-road.

Hobart is expanding their safe cycling network, with new separated cycle lanes installed in 2023 as part of the *Greater Hobart Commuter Cycling Network Plan*<sup>1</sup>. Hobart's aims<sup>2</sup> include providing a safe and convenient network that comprises of:

- Low speed limits (30km/h) on local streets
- Physically protected bike lanes
- Off-road cycleways.

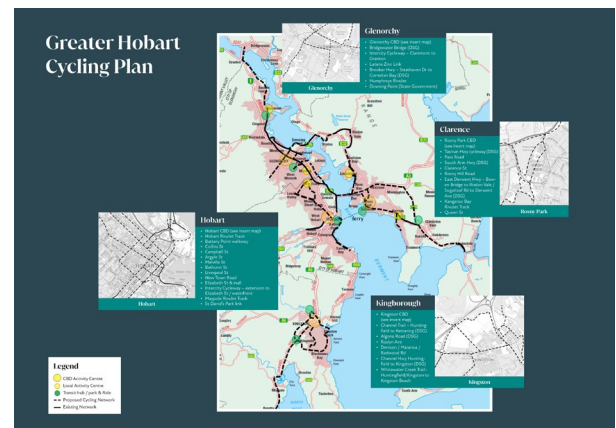
## E-BIKE CHARGING

In 2023, a trial of public e-bike charging infrastructure began in Hobart<sup>3</sup>. The city is recording data of its usage to determine the impact and benefit of the trial.

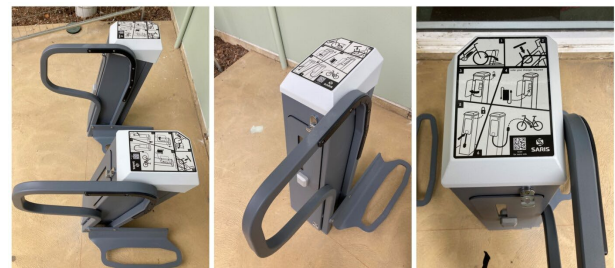
## E-BIKE SUBSIDIES

From November 2023, the Tasmanian Government has been offering rebates for purchasing e-mobility vehicles<sup>4</sup>:

- \$250 for e-scooters and e-skateboards
- \$500 for e-bikes
- \$1,000 for electric cargo bikes.



Extract from the *Greater Hobart Cycling Plan*



Public e-bike charger in Hobart  
Image: *Bicycle Network*

## LESSONS FROM TASMANIA

Tasmania has shown leadership in pioneering e-bike incentives in Australia, and is trialling e-bike charging infrastructure.

<sup>1</sup> *City of Hobart pedals forward with separated cycle lanes* - City of Hobart, 2023

<sup>2</sup> *Greater Hobart Cycling Plan* - Tasmanian Government Department of State Growth, 2021

<sup>3</sup> *e-Mobility Rebate 2023* - Tasmanian Government Department of State Growth, 2023

<sup>4</sup> *New chargers to keep Hobart on the move* - City of Hobart, 2023

# CASE STUDIES SUMMARY

## PARIS

### *Rapid adoption following infrastructure investment*

In 2020, bikes accounted for just 5.4% of trips in Paris. Following significant investment in cycling infrastructure, and implementation of low-emissions zones and widespread 30km/h speed limits, Paris has seen a rapid increase in cycling, surpassing vehicle traffic counts during peak hours in 2023.



## OSLO

### *Measurable benefits from e-bike subsidies*

A 2016 Oslo City Council e-bike subsidy led to recipients increasing their cycling mode share by 17 percent points compared to a control group<sup>1</sup>.



## SUMMARY

Of the jurisdictions reviewed that are seeking to increase the share of bikes or e-bikes in their city's transport mix, charging is generally a minor consideration. While offering public e-bike can benefit some e-bike riders, it does not address the primary barrier to e-bike adoption, safe cycling infrastructure.

Key to many of these efforts is providing an environment that allows cycling to be a competitive and appealing transport choice - by being safe, connected, and convenient. Best practice includes:

- Lower speed limits (e.g. 30km/h); or
- Providing separated cycling infrastructure; or
- Removing cars from selected active transport routes.

<sup>1</sup> *The effects of a subvention scheme for e-bikes on mode share and active mobility* - HB Sundfør, & A Fyhri, 2022



# SHARED MICRO-MOBILITY

## ABOUT SHARED MICRO-MOBILITY

Shared micro-mobility schemes provide the public with short-term paid access to shared bikes, e-bikes, or e-scooters distributed throughout a city.

## ROLES OF SHARED MICRO-MOBILITY

Shared electric micro-mobility options fulfil thousands of trips in Adelaide each day, replacing trips that may otherwise have been fulfilled by an ICE vehicle. The data shared electric micro-mobility vehicles collect can also be used as a proxy for e-bike usage, helping to prioritise and target infrastructure upgrades.

## Shifting travel demand away from vehicles

Shared e-scooters and e-bikes make it easy for riders to sign up and experience e-mobility without requiring a significant upfront investment.

Shared electric micro-mobility can complement public transport by enabling more types of journeys, and can fulfil e-mobility needs for those who don't have access to their own e-scooter or e-bike, or prefer not to store devices.

## Data

Shared micro-mobility are internet-connected and collect detailed usage data.

CoA has access to this data through an anonymised and aggregated reporting platform providing detailed insights into how shared micro-mobility is used in CoA. This can be used to help identify where improvements could be made to networks and infrastructure to make active transport safer and more appealing.

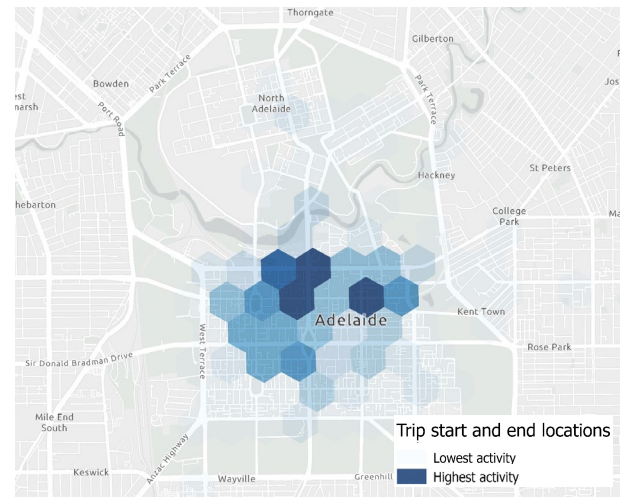
## SHARED MICRO-MOBILITY IN ADELAIDE

CoA was one of the first Australian cities to introduce shared electric micro-mobility schemes, with e-scooter trials operating since 2019 and e-bikes introduced in 2021.

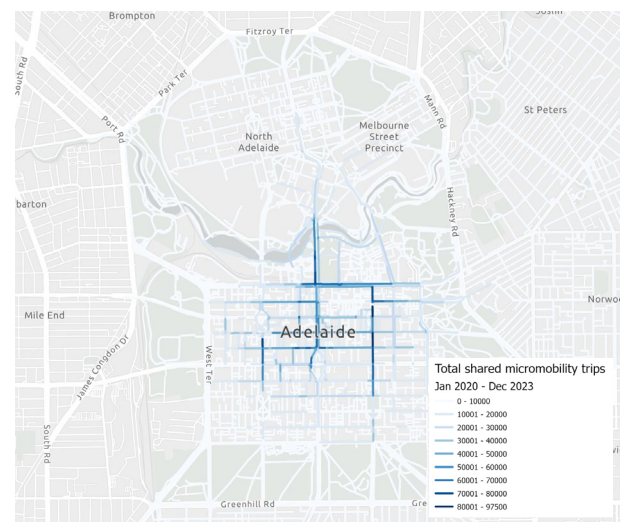
### Key facts and figures

In Adelaide from 2020 to 2023<sup>1</sup> shared e-scooters and e-bikes saw:

- 2,874,200 trips taken
- 1,262 vehicles available (average)
- 4.2 million kilometres travelled
- 1.8 trips per vehicle per day (average)
- Peak of 8,900 trips/day



Shared micro-mobility trip start and end activity  
Jan 2020 - Dec 2023



Routes travelled on shared micro-mobility<sup>1</sup>  
Jan 2020 - Dec 2023

<sup>1</sup> Ride Report Global Micromobility Index

# **ELECTRIC CARGO BIKES AND COMMERCIAL VEHICLES**

# ABOUT CARGO BIKES

## ABOUT CARGO BIKES

Cargo bikes, electric cargo bikes, and similar small electric delivery vehicles have significant potential to change the way goods are moved around cities - whether for personal or commercial use.

This amendment uses the term “cargo bikes” to cover the wide range of vehicles in this category. This includes both electric and non-electric cargo bikes as most cargo bikes currently sold are electric, and challenges and opportunities are generally common across the category, regardless of motive power source<sup>1,3</sup>.

For personal use, cargo bikes are often considered more of a “car replacement” than standard bikes and e-bikes due to their ability to carry children, groceries, and other cargo.

For commercial use, cargo bikes can be a cost-effective alternative to utility vehicles or vans, particularly in built-up areas with high levels of traffic congestion.

In both cases, cargo bikes can be seen to extend the benefits of e-bikes to cover a wider range of trip purposes - being more cost-effective, environmentally-friendly, and city-friendly than their ICE vehicle or EV equivalents.

## GLOBAL TRENDS

Internationally, the benefits of cargo bikes are starting to be realised - with European cargo bike sales rising 65% in 2021, and over 100,000 cargo bikes sold in 2020 in Germany alone<sup>2</sup>.



Cargobike Archetypes icons by Eric Poscher from [Noun Project](#) (CC BY 3.0)

<sup>1</sup> [Electric cargo cycles - A comprehensive review](#) - S Narayanan, & C Antoniou, 2022

<sup>2</sup> [How fleets of cargo delivery bikes are making the last mile greener](#) - R Gizauskas / HERE, 2022

<sup>3</sup> [Cargo bike growth exploding](#) - Bicycle Network, 2020

## CARGO BIKE ARCHETYPES

Cargo bikes come in a wide range of different forms to meet different needs. Some common typologies are summarised below.



### Standard Frame E-Bikes

The assistance provided by e-bikes makes them an option for transporting goods (with a luggage rack and pannier bags), or children (with a carrier).



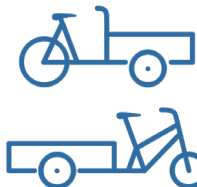
### Longtails

The extended “tail” of this class of cargo bike allows them to be small, while still providing high capacity for personal items, commercial goods, or a passenger.



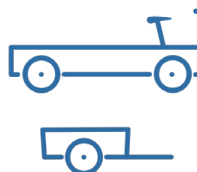
### Long Diamonds and Long Johns

Often referred to as “Dutch-style” cargo bikes, these bikes offer an efficient balance between size and cargo capacity. They can often be found carrying commercial goods for delivery, or for personal use (including carrying children).



### Trikes

Trikes have a larger footprint but provide more customisability, especially for commercial use.



### Others

Small electric delivery vehicles can take many other forms - for example motorised bike trailers, or larger vehicles that resemble a small van.



# INFLUENCING DEMAND

In general, the actions required to increase cargo bike uptake overlap significantly with the actions required to increase bike and e-bike adoption.

## PERSONAL CARGO BIKES

Cargo bikes can be a car replacement for a broader range of trips - including shopping, running errands, and transporting children.

International research<sup>2</sup> indicates that cargo bike adoption is limited by many of the same factors that limit bike and e-bike adoption - particularly the safety and quality of cycling infrastructure.

In an effort to increase uptake, cargo bike subsidies are offered by some central, regional, and local authorities in Europe<sup>2</sup>, and are included in a recent incentive offered by the Tasmanian Government.

Some other mechanisms that can be found internationally for aiding cargo bike adoption include:

- Providing larger parking spaces for cargo bikes (e.g. in the Netherlands)
- Shared cargo bike services (e.g. in Netherlands, Belgium, France, and Germany) to make cargo bikes available to those who only need to use one occasionally.



Longtail cargo bike in Adelaide

## COMMERCIAL CARGO BIKES

Cargo bikes are becoming increasingly popular for last-mile logistics, especially in higher-density urban areas. In addition to environmental benefits, a cargo bike's compact size can support more time- and cost-efficient deliveries of smaller consignments than larger vehicles such as cars or vans.

Cargo bikes are particularly competitive in areas with aggressive measures and policies to promote cycling over vehicle traffic. A study in Brussels<sup>3</sup> estimated a delivery cost of €0.10/parcel when using cargo bikes, compared to €1.10/parcel for a petrol van or €1.05/parcel for an electric van. This commercial advantage has led to electric cargo bikes being adopted by prominent delivery and logistics companies globally.

As with personal cargo bikes, support and incentives for businesses can be found in some areas. For example:

- In Belgium, a municipal-supported cooperative<sup>4</sup> was created to provide businesses with free cargo bike advice and training, and cargo bike sales and maintenance.
- Some European countries and local authorities incentivise cargo bikes for commercial use through subsidies or tax incentives.



Long John cargo bike used commercially in Adelaide

<sup>1</sup> *How fleets of cargo delivery bikes are making the last mile greener* - R Gizauskas / HERE, 2022

<sup>2</sup> *Electric cargo bikes in urban areas: A new mobility option for private transportation* - D Carracedo / H Mostofi, 2022

<sup>3</sup> *Data-driven Evaluation of Cargo Bike Delivery Performance in Brussels* - Kale AI, 2023

<sup>4</sup> Urbike

# CARGO BIKES IN ADELAIDE

The number of cargo bikes that can be seen on Adelaide streets is growing. There is increasing interest in cargo bikes from local residents and businesses. Commercially, cargo bikes are in use in CoA as a replacement for vehicles.

## COMMUNITY GROUPS

The community Facebook group *Adelaide Cargo Bikes* has amassed over 825 members since its creation four years ago, and has been growing rapidly with an average of 25 new members per month since October 2022.

The community organisation *Kidical Mass Adelaide* holds an annual demonstration event to support safer cycling networks and infrastructure, especially with children in mind. A wide range of cargo bikes can be found at these events.



Image: *Kidical Mass Adelaide*

## PASSENGER TRANSPORT AND WASTE

EcoCaddy formerly provided passenger transport, tours, and a zero-emission organic waste collection service in Adelaide. EcoCaddy used electric trikes, some of which had trailers attached for additional cargo capacity. This service is no longer operating.

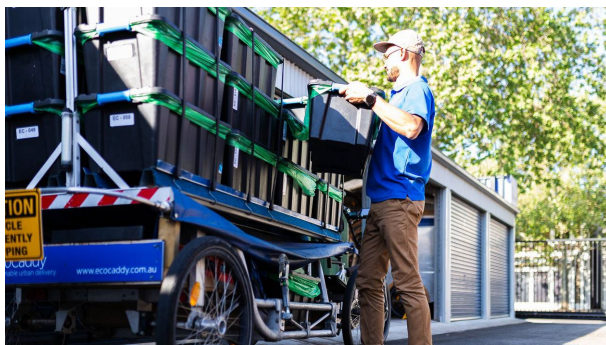


Image: *The Advertiser*

## COMMERCIAL OPERATIONS

Beam use an electric cargo bike to service their Adelaide-based fleet of e-scooters – particularly for transporting batteries and helmets. Being able to use bike lanes in the Adelaide CBD allows Beam to move more efficiently around the city than a van would otherwise allow.

Beam has indicated that an expanded safe cycling network would allow them to expand e-bike operations – more so than public e-bike charging or parking infrastructure.



## DELIVERIES

Australia Post operates over 5,000 electric delivery vehicles across the country. These vehicles have lower speeds than the ICE motorbikes previously used by Australia Post, but are more efficient overall, carrying up to 100 parcels and 1200 letters<sup>1</sup>.



Image: *Australia Post*

<sup>1</sup> *Here's how Australia's largest electric delivery fleet is changing the way you receive parcels* – N Clark / Australia Post, 2023



# CARGO BIKES GLOBALLY

Cargo bikes are being used commercially across Europe and the US by small businesses through to multinationals. They are used to transport a range of goods and equipment and are a particularly effective and competitive travel mode for avoiding congestion or vehicle restrictions.

## COURIERS

Cargo bikes have been adopted by large companies for deliveries worldwide. For example, courier company UPS uses electric cargo bikes to deliver parcels in over 30 cities including Dublin, Paris, Copenhagen, Stockholm, Amsterdam<sup>1</sup>.

Collectively, DHL and Amazon have employed thousands of cargo bikes to replace delivery trucks<sup>2</sup>, enabling these companies to continue to navigate areas with vehicle restrictions, including London<sup>3</sup>.



UPS delivery cargo bike in Cambridge<sup>1</sup>

## SMALL BUSINESSES

Throughout Europe, cargo bikes can be found serving a range of transport needs for small businesses.

Cargo bikes can be found delivering groceries<sup>6</sup>, flowers<sup>4</sup>, pharmaceuticals<sup>6</sup>, and many more items.

In addition to deliveries, cargo bikes are also often used to transport equipment and materials, allowing a variety of small businesses to provide more sustainable services to their community. Cargo bikes can be found being used to provide laundry and dry-cleaning, medical assistance, plumbing, gardening<sup>6</sup>, and construction services<sup>7</sup>.



Cargo bike used for wine delivery in Amsterdam

## LOCAL GOVERNMENTS

Some London councils have begun incorporating cargo bikes into their operations. Cargo bikes have been used by library teams, to access and maintain green spaces, for neighbourhood safety, and for community engagement<sup>4</sup>.

In Australia, the City of Melbourne uses a fleet of cargo bikes to maintain bins and collect organic waste in some areas – replacing over 30,000 heavy vehicle movements within the City<sup>5</sup>.



Cargo bike used by the City of Melbourne<sup>5</sup>

<sup>1</sup> *UPS pilot aims to sustainably deliver parcels via e-assisted cycles in Cambridge* - UPS, 2022

<sup>2</sup> *These electric cargo trailers are designed to replace delivery trucks and slash emissions* - A Peters, 2022

<sup>3</sup> *Amazon launches first fleet of e-cargo bikes in the UK* - Amazon UK, 2022

<sup>4</sup> *Fully Charged Business Case Studies* - Fully Charged, 2024

<sup>5</sup> *Case study: Cleaner streets in more ways than one* - Good Cycles, 2024

<sup>6</sup> *About us - Les Boite à Vélo* - Les Boite à Vélo, 2024

<sup>7</sup> *FM Conway introduces new e-cargo bikes to cut carbon emissions in London*, FM Conway, 2020



# SUMMARY

Cargo bikes can take many forms and are used for a range of purposes. For individuals, their carrying capacity can allow them to replace more ICE vehicle or EV trips than a standard bike might. For commercial use, they are being used for a wide range of purposes in Adelaide and internationally, particularly where driving is disincentivised.

Subsidies, facilities, and other supporting measures can help to promote cargo bikes among individuals or small businesses. This can include:

- Rebates or other monetary incentives for purchase (including CoA)
- Support and advice for procurement and operation
- Larger parking facilities.

Charging infrastructure was not prominent in research as a barrier or enabler to cargo bike adoption.

Ultimately, cargo bikes are most appealing and competitive when a city's cycling network and infrastructure is safe, high-quality, and efficient. This applies to both personal and commercial use.



Dedicated cargo bike parking space in Amsterdam, Netherlands

**CHOISIR SON VÉLO-CARGO**

Guide pratique pour identifier le vélo-cargo le plus adapté à son activité professionnelle

urbiE CAIRGO BIKE EU UIA

"Choosing Your Cargo Bike" - a guide produced by the Belgian municipal-owned Urbike to support businesses interested in adopting e-bikes.

# CHARGING E-BIKES

*Charging patterns, technology,  
and solutions*

# CHARGING TECHNOLOGY AND BEHAVIOUR

## TECHNOLOGY AND STANDARDS

E-bikes have a much lower power requirement than electric cars (the type of EV they are most likely to replace), with as little as 10% of the consumption per kilometre, and 1% of the required battery capacity. This means that while larger EVs (including electric cars, vans, or trucks) often require expensive and wide-spread fast charging infrastructure, e-bikes tend to be charged via a standard power point - making them convenient and cost-effective to adopt.

E-bikes currently use a range of different charging standards depending on the manufacturer - with different connectors, voltages, and power requirements. This makes it difficult to provide a "one size fits all" public charging solution to suit a range of e-bikes.

Most e-bikes allow batteries to be detached from the bike, making it easier to charge in a smaller space such as an office, apartment, or locker - but this isn't the case for all models.

## CHARGING SAFETY

E-bike chargers tend not to be designed for charging in wet conditions. As a result, public charging infrastructure should only be provided in dry locations.

Charging any lithium battery can pose a fire risk - and this applies to e-bike batteries too. In Australia, e-bikes must comply with AS 15194, which includes design and testing requirements for battery safety.

Fire risk has been particularly problematic in overseas jurisdictions that previously did not have requirements for batteries to meet safety standards. For example, New York City implemented new rules for the sale of e-bikes in 2023<sup>1</sup>, and the city is also piloting outdoor storage and charging facilities, with a focus on fire safety<sup>2</sup>.

## TYPICAL CHARGING PATTERNS

### Personal e-bikes

E-bike batteries generally have sufficient capacity for everyday personal use, so it's common for e-bikes (and cargo bikes) to primarily be charged at home.

Where destination charging exists, this tends to require owners to bring their own charger due to the wide range of incompatible charging standards across vehicle models.

Range anxiety is commonly cited as a barrier to e-bike adoption, though to a lesser extent than infrastructure safety and quality<sup>4,5</sup>. Destination charging can help to alleviate range anxiety, but one study found that destination charging is much less likely to be utilised if riders are charged a fee<sup>3</sup>.

### Commercial e-bikes

Commercial e-bikes (including cargo bikes) tend to be charged on-premises. For larger-scale operations with many batteries being charged simultaneously, some businesses may install extensive charging infrastructure with thermal monitoring systems for safety.

## CHARGING SECURITY

E-bikes tend to be more expensive than their non-electric counterparts, which exacerbates the finance consequence of theft.

Secure parking will be increasingly important for promoting cycling in the city, and any public charging solution will need to consider security as a prerequisite.

<sup>1</sup> *How New York Plans to Regulate E-Bikes in the Wake of Deadly Fires* - W Hu / The New York Times, 2023

<sup>2</sup> *Mayor Adams Announces Plan to Combat Lithium-Ion Battery Fires, Promote Safe Electric Micromobility Usage* - City of New York, 2023

<sup>3</sup> *E-Bike Charging Infrastructure in the Workplace - Should Employers Provide It?* - D Kohlrantz, & T Kuhnimhof, 2023

<sup>4</sup> *E-bikes Toward Inclusive Mobility: A Literature Review of Perceptions, Concerns, and Barriers* - K Lee, & IN Sener, 2023

<sup>5</sup> *The impact of e-cycling on travel behaviour: A scoping review* - JE Bourne, AR Cooper, P Kelly, FJ Kinnear, C England, S Leary, & A Page, 2020



# PUBLIC CHARGING INFRASTRUCTURE

Due to the power requirements for charging an e-bike being low, public charging solutions can be relatively small and versatile. However, different e-bikes having a range of different charging standards means that users are usually required to provide their own charging cable. For public charging to be a viable option for e-bike riders, secure parking needs to be provided for both the e-bike and the charging cable.

This section provides a high-level comparison of some of the public e-bike charging infrastructure options currently available.

## STANDALONE CHARGING POINTS

The minimum infrastructure that would enable e-bike charging is technically a standard power point. Some solutions exist to provide a weatherproof power point on a post or similar to provide a public charging option.

### Benefits

Minimal footprint is required for this category as they can be installed where existing bike rails are located. For example, a power point for charging could be provided on a post in a public space, or on a wall in a bike cage.

### Disadvantages

Potential benefits can be reduced if the charger can't be secured, if there's a risk of bike theft, or if the location is exposed to wet weather.

## CHARGING RACKS

There are a number of commercially-available bike parking racks which include charging provisions.

Commercial products often have a locked section to secure the user's charging equipment.

### Benefits

These can provide more security for users' charging equipment compared to standalone charging points. Minimal footprint is required, as they can be installed where existing bike rails are provided.

### Disadvantages

These experience similar weather and security disadvantages to standalone charging points.



Image: Entwurfreich Team



Image: Saris Infrastructure

# PUBLIC CHARGING INFRASTRUCTURE CONTINUED

## BATTERY CHARGING LOCKERS

Battery charging lockers provide a secure solution for e-bike batteries and their charging equipment.

### Benefits

Lockers can provide additional security for batteries (which can be a large part of an e-bike's cost) and charging cables.

For existing bike parking areas, these allow a high density of charging infrastructure to be rolled out with minimal footprint and infrastructure.

Some lockers can provide fire resistance and are being used in some areas as a safe alternative to apartment or at-home charging (particularly where e-bike battery safety is less regulated).

### Disadvantages

Most, but not all e-bikes have removable batteries - so not all will benefit from this solution.



Image: [Kinetic Parking Solutions](#)

## BIKE LOCKERS

Bike lockers provide a secure solution for bikes (an individual bike or a small group of bikes) and can be fitted with power to provide a charging option.

### Benefits

Bike lockers can provide enhanced security for bikes and charging cables, making it a particularly appealing option in areas that do not have access to secure bike parking. For example, in an off-street car park which does not yet have a bike cage, or on-street within an existing parking space.

For outdoor charging, bike lockers have the benefit of providing weather resistance.

### Disadvantages

This is more expensive than traditional bike parking options.

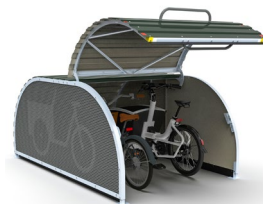


Image: [Cyclehoop](#)



Image: [Bikeeep](#)

## RECOMMENDATIONS

Battery charging lockers are an option for public e-bike charging, particularly in UPark facilities that have secure bike parking options. This would allow charging facilities to be provided to users of the existing infrastructure, while minimising the electrical works required.

In UPark's premium offering (cages for individual bikes), charging could be provided by adding a power point given that the bike and charger are locked securely regardless.

In other locations (such as on-street), standalone charging points or charging racks are not recommended due to issues with bike security and weatherproofing. In these locations, bike lockers could be considered to offer secure parking and e-bike charging simultaneously.

# FACILITIES

*Analysis of current UPark bike  
parking facilities*



# UPARK BIKE FACILITY ANALYSIS

## CITY OF ADELAIDE'S BIKE PARKING

UPark sites provide an opportunity to help enable e-bike adoption by offering secure bike parking and charging options within existing CoA assets.

This section focuses on the paid bike parking products at UPark sites.

### Free bike parking

CoA currently has a high number of free-to-use bike hoops and racks throughout the city; including at most UPark sites.

### Paid bike parking

Some UPark sites offer secure, paid bike parking options including:

- Bike cages: an enclosed steel bike cage shared among riders, potentially with small individual lockers for personal items
- Bike boxes: an individual enclosed box for one bike.

Paid bike parking at UPark sites is unlikely to be a convenient option for the bulk of trips as users can generally park close to their destination at no cost.

With access to the secure options being billed monthly, the product is more appealing to customers who use the facility regularly rather than visitors.

## SITE VISITS

Site visits of three UPark sites (Topham Mall, Rundle Street, and Wyatt Street) were undertaken during business hours on a weekday to understand the opportunities for enhancing UPark's bike parking for e-bike owners.

The following details some potential opportunities for enhancing the secure bike parking offering at UPark facilities.

Most of the identified opportunities have the potential to make the product more appealing to owners of all bikes; not just e-bikes.

### Current utilisation

Although the site visits only provide one data point, it was observed:

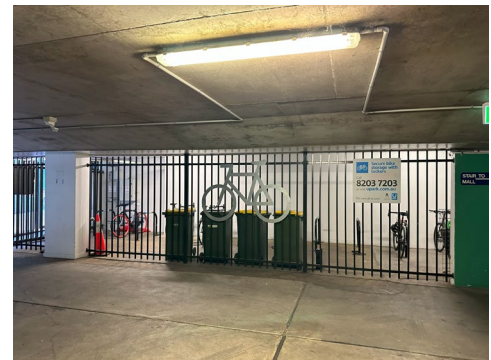
- There was excess bike parking capacity in bike cages, highlighting an opportunity to improve, focus marketing, or raise awareness of the product to acquire more users.
- A relatively high proportion of parked bikes were electric - indicating that secure parking is valued by e-bike owners, and charging does not necessarily need to be provided for parking to be useful for e-bikes.



Rundle Street UPark



Wyatt Street UPark



Topham Mall UPark

# UPARK BIKE FACILITY ANALYSIS

A summary of the strengths and potential opportunities for the three UPark locations visited are included in the table below.

Category	Observations	Strengths & Opportunities
<b>Safety &amp; security</b>	All: Bike cages provide additional security for bikes over rack-only options	Secure bike storage provides security and weather protection, which are both pre-requisites for charging infrastructure.
	Wyatt Street and Rundle Street: Lockers for personal items are provided	Lockers are a useful feature for storing helmets, equipment, personal items, or even e-bike batteries. Investigate adding lockers to the Topham Mall bike cage.
	Rundle Street and Topham Mall: Obscured or isolated locations	Relocating bike cages to be in more prominent locations could help to increase passive surveillance and public awareness.
<b>Amenity</b>	All: Varied lighting quality across bike cages	Investigating lighting upgrades could enhance users' perceptions of personal safety and overall experience. This may include going beyond requirements of standards and considering factors such as contrast and quality of light.
	All: Single entry/exit points	Including more than one entry/exit point could contribute to increased perception of safety and equitable access.
<b>Information &amp; membership</b>	All: The UPark website indicates which UPark facilities have bike parking options.	The UPark website could be updated to provide more details about the available services, including photos.
	All: Access is granted via a monthly charge. Users sign-up via phone call.	Investigating casual access and web-based sign-up options may allow the bike facilities to be more heavily utilised by a larger customer base.
<b>Electrification</b>	All: Access to power	The access to power at each site could (subject to further investigation) enable charging to be provided with relatively small infrastructure works.
		Lockers with battery charging capability could provide charging facilities for e-bikes with minimal infrastructure works.
<b>Access</b>	Wyatt Street and Rundle Street: Bike cages are accessed through car entry and exit driveways	Providing pedestrian paths for accessing bike cages could improve perceptions of safety and user comfort.
	All: The bike cages visited appeared to have sufficient space for cargo bikes	Designating some space for larger cargo bikes could allow these facilities to support increased adoption of cargo bikes for personal use.

# RECOMMENDATIONS



# ACTIONS TO INFLUENCE E-BIKE UPTAKE

Recommendations to increase the uptake of e-bikes can be summarised into six main themes, that cover actions and best practise for the network, parking and charging facilities, as well as incentives and subsidies.

## SAFE CYCLING INFRASTRUCTURE & NETWORK

Create a low-stress cycling network by implementing:

- Cycling infrastructure that is physically separated from vehicle traffic
- Reduced speed limits (e.g. 30km/h)
- Areas with restricted vehicle traffic.

## SECURE PARKING

Secure parking is a prerequisite for any public charging facility. Opportunities to improve secure parking throughout the city include:

- Improving secure bike parking facilities at select UPark locations, with a specific focus on e-bikes and cargo bikes
- Providing long-term secure bike parking in new locations, including near the Adelaide Railway Station, which could enable more multi-modal journeys
- Providing casual secure bike parking for shorter-term use cases including dining and events - for example near East End or Adelaide Oval
- Providing secure parking on-street by converting car parking space to bike parking using bike lockers
- Considering parking for larger bikes, including cargo bikes

Ideally, secure bike parking should be located in convenient, prominent locations with high levels of passive surveillance.

## PUBLIC CHARGING FACILITIES

Battery charging lockers provide an effective solution for charging at UParks where secure bike parking already exists. For other locations such as on-street, charging provisions could be provided as part of a secure parking upgrade.

## WORKPLACE & APARTMENT CHARGING

Encouraging businesses and strata corporations to install e-bike charging for their employees, residents, or visitors can help to maintain this advantage while meeting many users' charging needs.

In locations that have high interest but lack space for on-premises bike facilities, CoA could consider providing secure on-street parking by replacing some car parking spaces with bike lockers.

## SUBSIDIES AND INCENTIVES

CoA has decided to implement incentives for e-bikes. Incentives should be monitored for uptake and effectiveness.

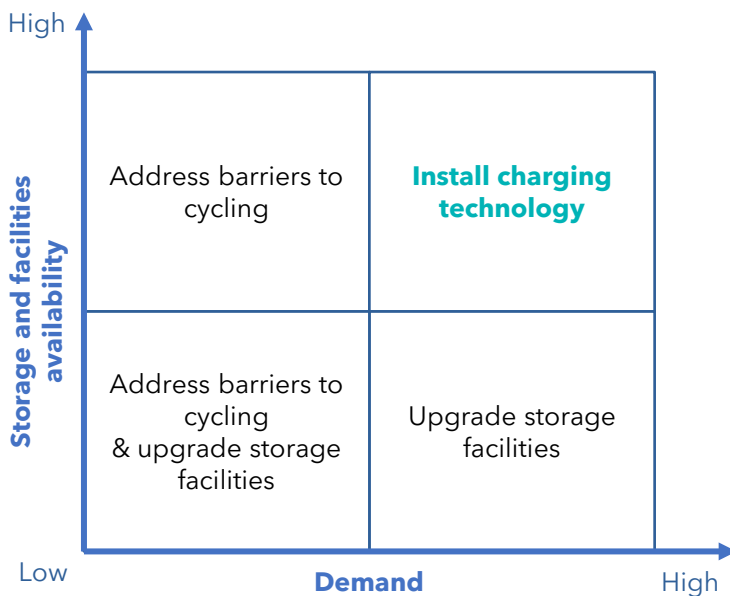
# CHARGING INFRASTRUCTURE PRIORITISATION

## PRIORITISATION FRAMEWORK

Short-term e-bike charging pilot projects would be most impactful where bike parking demand is already high, and secure bike parking facilities already exists.

Areas without secure bike parking will need storage facility upgrades before charging is implemented.

Areas with little cycling demand or connectivity with the broader network likely need network upgrades before charging infrastructure will be warranted. Integrated transport planning should continue to consider where cycling infrastructure can be upgraded to encourage more people onto e-bikes.



## EVALUATING DEMAND

There is currently limited data about cycling demands in Adelaide. However, some data sources exist that can help to infer the demand spatially.

### Cycling network

The safety and quality of cycling routes is one of the most important factors in influencing e-bike uptake. The Bike Direct network provides an overview of routes based on how “quiet” they are, indicating broadly which areas of the city are more and less friendly towards bikes (and hence e-bikes).

### Shared micro-mobility data

The detailed usage data afforded by shared micro-mobility is one of the most detailed datasets currently available about where e-mobility is used most in the city at present.

## EVALUATING STORAGE & FACILITIES

### Existing UPark facilities

Some UPark facilities already provide secure bike storage. Being a prerequisite for e-bike charging infrastructure, this significantly reduces the upgrades required to provide a charging offering.

Other UPark locations present longer-term opportunities for upgrades to bike storage facilities - upgrades which can benefit all bike riders, regardless of electrification.

### Gaps in UPark coverage

Some areas with high cycling demand do not overlap with UPark locations.

Some areas with high demand (for example Adelaide Railway Station or Adelaide Oval) have space limitations or are not owned by CoA. Providing secure parking in these locations might require more influence from the Council.

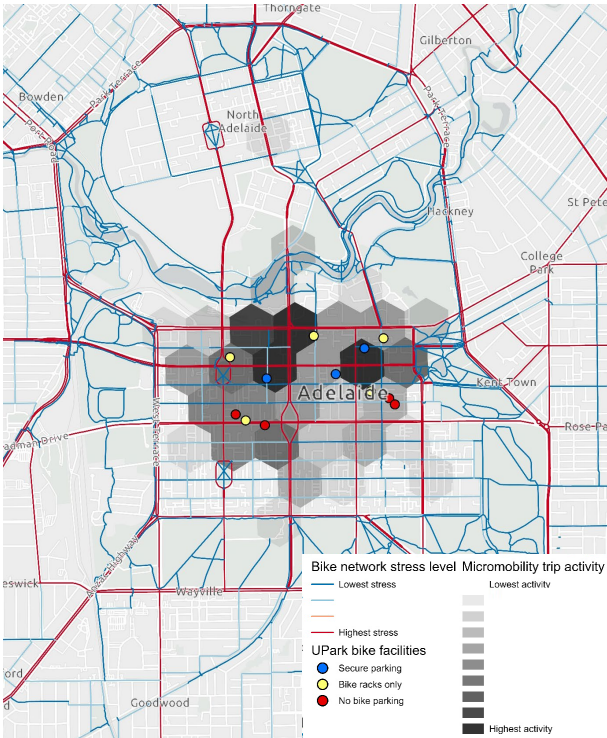
There may also be demand for secure on-street parking solutions, particularly near residential areas or businesses without off-street alternatives. Identifying these areas will require more investigation, and feedback from residents and businesses.

# CHARGING INFRASTRUCTURE PRIORITY LOCATIONS

## UPARK AND OFF-STREET PARKING

Demand indicators and existing UPark bike facilities are overlaid on the map below.

Using the prioritisation framework, interventions for key locations are shown in the table to the right.



UPark location	Network Demand	Storage & Facilities	Intervention
Rundle Street	High	High	Investigate e-bike chargers
Topham Mall	High	High	Investigate e-bike chargers
Adelaide Railway Station & Festival Plaza	High	No existing UPark	Work with State Government to upgrade storage facilities
Central Markets & Grote Street	High	Low	Investigate upgrades to storage facilities
Gawler Place	High	Low	Investigate upgrades to storage facilities
Light Square	Moderate	Low	Address barriers to cycling & investigate upgrades to storage facilities
Wyatt Street	Low	High	Address barriers to cycling
Frome Street	Moderate	Low	Address barriers to cycling & investigate upgrades to storage facilities

## ON-STREET PARKING

On-street secure bike parking (for example bike lockers) could be beneficial to some residents and businesses – particularly those without off-street alternatives.

CoA should work with residents and businesses to identify and understand the demands for secure on-street parking, and where this could potentially be trialled.