NOV 2021

City-Wide Electric Vehicle Charging Strategy

Birmingham City Council

1 Executive Summary

Introduction

In June 2019, Birmingham City Council declared a climate emergency and set an ambition for the city to become net-zero by 2030 or as soon as possible after that date as a 'just transition' allows.

Transport currently accounts for around a third of CO_2 emissions in Birmingham, over 95% of which is from road transport.[1] To reduce, and eventually eliminate emissions from transport, it is necessary to both reduce vehicle usage and ownership, and shift remaining vehicles to electric vehicles (EVs).

To enable the uptake of electric vehicles, **a comprehensive public EV charging network across Birmingham will be needed**. This network must be accessible to all of Birmingham's residents and serve the needs of all key user groups within the city, including taxis (hackney carriages and private hire vehicles), car clubs, commercial fleets, and residents without off-street parking.

The Council has already taken steps to begin expanding the public charging network in Birmingham. The Council have procured ESB Energy as an EV Charge Point Network Development Partner and have secured funding from the Office for Zero Emission Vehicles (OZEV)[2] to deliver a backbone of 394 fast and rapid charge points by 2022, as the first phase of our 12 year strategy. This document sets out our strategy to grow the public charging network beyond this first phase and aims to answer the questions of:

- **How much** EV charging infrastructure will be needed by 2030?
- **Where** should this infrastructure be deployed?
- **What timeframe** should this infrastructure be deployed over?

1.1 Core Principles

The core principles underpinning the development and delivery of the city-wide charging strategy are to provide a network that:

- Follows the best practice approach for choice of technology
- Aligns with consumer preferences and current deployment trends
- Aligns with wider aims within the council, including reducing reliance on private cars and encouraging modal shift (changes in travel away from private cars and towards public transport, walking and cycling)
- Is accessible and equitable for all

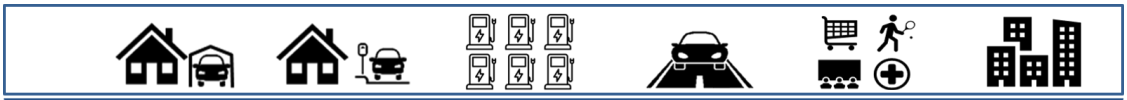
To meet the needs of all EV user groups, the network will provide a combination of different charging types at strategically selected sites. This includes Electric Vehicle Charge Point (EVCP) deployment along major routes, for in-trip charging, at destinations, and in residential areas (highlighted charging types in Figure 1.1).

Based on the core principles set out above, **rapid charging – preferably in hubs – is the priority approach for residential charging in Birmingham, supported by EV charge**

[1] UK National Statistics: UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2018 https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2018 *accessed April 2021.*

[2] Formerly Office for Low Emission Vehicles (OLEV)

points on the Highway, within public car parks and on public land. Innovative technology for residential on-street charging (e.g. using lamp posts, kerbstone or embedded charge points) will be deployed as an alternative where locally accessible fast and rapid charging is not viable. The focus on rapid charging hubs is aligned with best practice in other UK cities, research into consumer preferences and economic considerations.



Charging type	Home charging	Residential charging		En-route charging	Destination charging	Workplace charging
		On-street	Charging hubs			
Use case	Charging at home in a private driveway / garage / allocated space	Charging at public on-street EVCP close to driver's house	Charging at public EVCPs in the drivers local areas.	Charging along major arterial routes or main roads in urban areas.	Charging in car parks at the end of an outward journey. "Top up" charging model.	Charging while parked at workplace.
Key user groups	Residents with off-street parking	Residents without off-street parking	Residents without off-street parking, taxis, car clubs etc.	All residents, visitors, commuters and commercial vehicles.		Employees (particularly those without off-street parking)
Typical charging speed	Slow, 3-7kW	Slow to fast 3-22kW	7-150kW but more likely to be 50-150kW	Rapid to ultrarapid (50-350kW)	Slow to fast 3-22kW with some sectors moving towards rapid	Slow, 7kW
Led by	Residents/building owners	Council	Council or private sector			Private sector (unless for council employees)

Not council led – not a focus of this strategy | Main focus of strategy

Figure 1.1 Overview of charging types considered in this strategy

1.2 Birmingham's Charging Needs

We have carried out detailed modelling to estimate the scale of infrastructure required to meet Birmingham's EV charging needs. This modelling takes into account EV uptake among Birmingham's vehicles and their associated charging demand, as well as charging behaviour and required technology type.

The number of charge points required to meet charging demand depends heavily on the type of charging technologies installed and the extent of change in travel behaviour away from private cars towards sustainable modes such as walking, cycling and public transport (modal shift) achieved in Birmingham. To meet our target of net zero by 2030, significant modal shift will be needed alongside the switch to EVs. Previous modelling for the Council has shown that car use needs to reduce by 40% compared to 2018 levels to achieve our climate targets. If we achieve this level of modal shift, **at least 3,630 public charge points** (*ca.* 1,600 chargers) will be needed across Birmingham, with residential charging predominantly met by fast and rapid charging hubs.

However, the size of infrastructure is highly dependent on market need and the number of charge points required could reach over 5,000 if, for example, more residential charging must be met with on-street charging or the level of modal shift achieved is much lower (for example, in-line with a 2050 target). If modal shift is not achieved and car use grows in line with historic trends, the number of charge points required could be greatly in excess of 5,000.

The range of EVCP numbers that the Council is planning for is illustrated in Figure 1.2. This includes deployment by the Council as well as by the private sector and regional stakeholders; however, the share provided by the private sector could go beyond these numbers. The Council will continue to monitor market development and we will adjust our plans as the market develops.

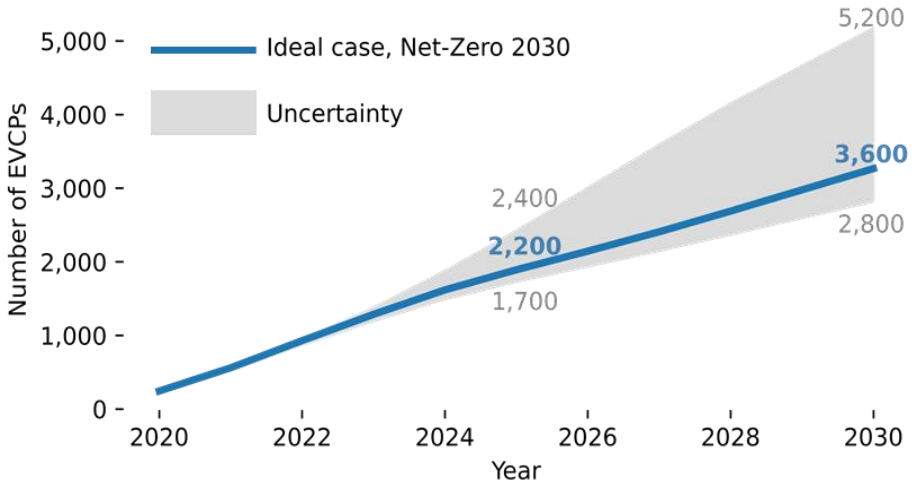


Figure 1.2 Projected number of public EVCPs needed in Birmingham reflecting the ideal case in which Birmingham meets net zero by 2030 (blue line) and the range of uncertainty that the Council must plan and monitor for.

1.3 Deployment Approach

Geographic Deployment Strategy

A crucial consideration for deploying rapid charging, particularly while EV uptake is in its early stages, is aggregating demand across user groups and charging types. This ensures that the charge points are highly used to meet market needs.

We have prioritised areas of the city for rapid hub deployment based on indicators of high charging demand for key use cases:

- **Hackney carriage and private hire vehicle charging:** based on number of taxi ranks in an area
- **Residents without off-street parking:** based on the share of cars and vans in an area that have low access to off-street parking
- **En-route charging:** based on car and van traffic levels on major roads
- **Destination charging:** based on the number of amenities in an area (e.g. supermarkets, cafes, hotels, shopping centres, leisure facilities etc) and number of trips ending in an area

Early deployment of rapid charging (to 2025) will focus on locations in the city centre and some satellite areas where these use cases overlap and demand is expected to be most concentrated (Figure 1.3). **Medium term deployment** (2025-2030) will **expand the network to ensure comprehensive coverage across the city**, including hard-to-reach areas.

Rapid hub charging will be prioritised in all suitable areas. Where areas are considered unsuitable for rapid hubs (e.g. where demand is not high enough or where space or grid constraints limit deployment), we will prioritise innovative solutions for on-street charging.

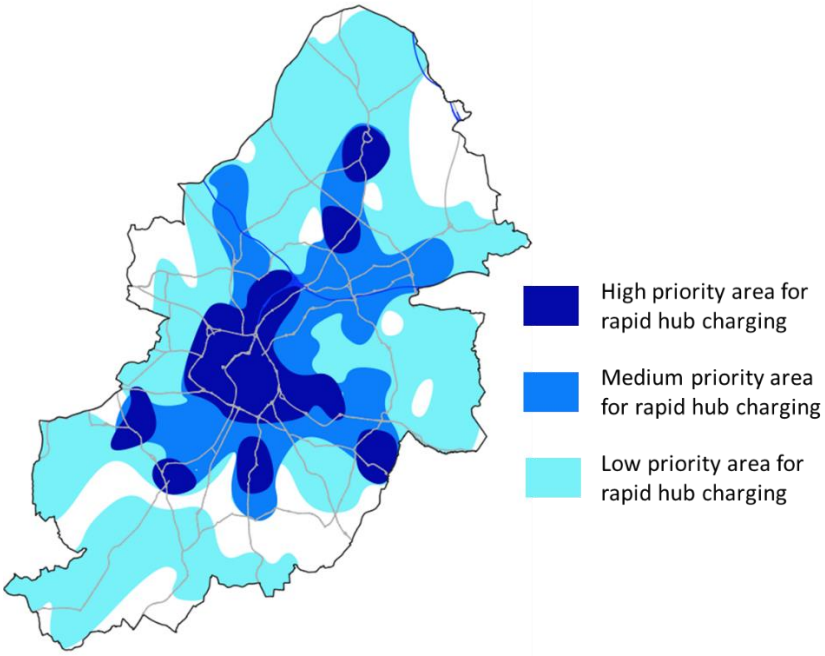


Figure 1.3 Priority areas for deployment of rapid hub charging in Birmingham based on aggregated demand from all sources.

EV Charging Delivery

The Council will take a leading role in developing Birmingham's EV charging infrastructure, alongside our appointed EV Charge Point Network Development Partner and associated stakeholders. Council-led deployment will play a larger role in the early stages of deployment to stimulate the market and enable the required step change towards EV uptake. Public sites, such as public car parks, green parks and Council-owned land, will continue to be developed for EV deployment, since they enable the Council to ensure that:

- standards for full public accessibility are met
- priority user groups are catered for
- there is a comprehensive spread of charge points across the city, including in hard-to-reach areas

In the short term, deployment may be focused on public sites to stimulate the market before shifting towards a greater mix of public and private sites. In the long term, deployment will be increasingly weighted to private sites as the market grows and EV uptake increases.

In addition to directly supporting delivery, there are a range of supporting activities we will take to facilitate deployment. These include:

- **Engaging with the private sector** to communicate the volume of infrastructure that will be required, to give confidence in the future EV landscape in Birmingham and to encourage deployment.
- **Developing systems to identify clusters of demand** and prioritise charging deployment in these areas.
- **Working with local commercial fleets** to enable us to identify and prioritise deployment in areas that support the early transition of these fleets to EVs.

- **Reviewing our regulations, policies and processes** to address barriers to deployment for charge point operators.

Working with Wider Stakeholders

While this strategy outlines the Council's approach to EVCP deployment, the 3,600-5,200 total charge points projected to be needed in Birmingham by 2030 includes those deployed by the Council alongside those deployed by the private sector and other regional stakeholders. We will work with all relevant stakeholders to align plans and to encourage growth in Birmingham.

1.4 EV Charging Delivery Roadmap

Our deployment strategy and key activities to support our charging vision are summarised in the roadmap in Figure 1.4.

While this roadmap gives high-level, indicative timelines for delivery of the City-Wide network, in practice the precise rollout trajectory will depend on market trends and growth. We will work to ensure that the deployment approach is adaptable to continue to drive the EV transition and meet the needs of all users in Birmingham.

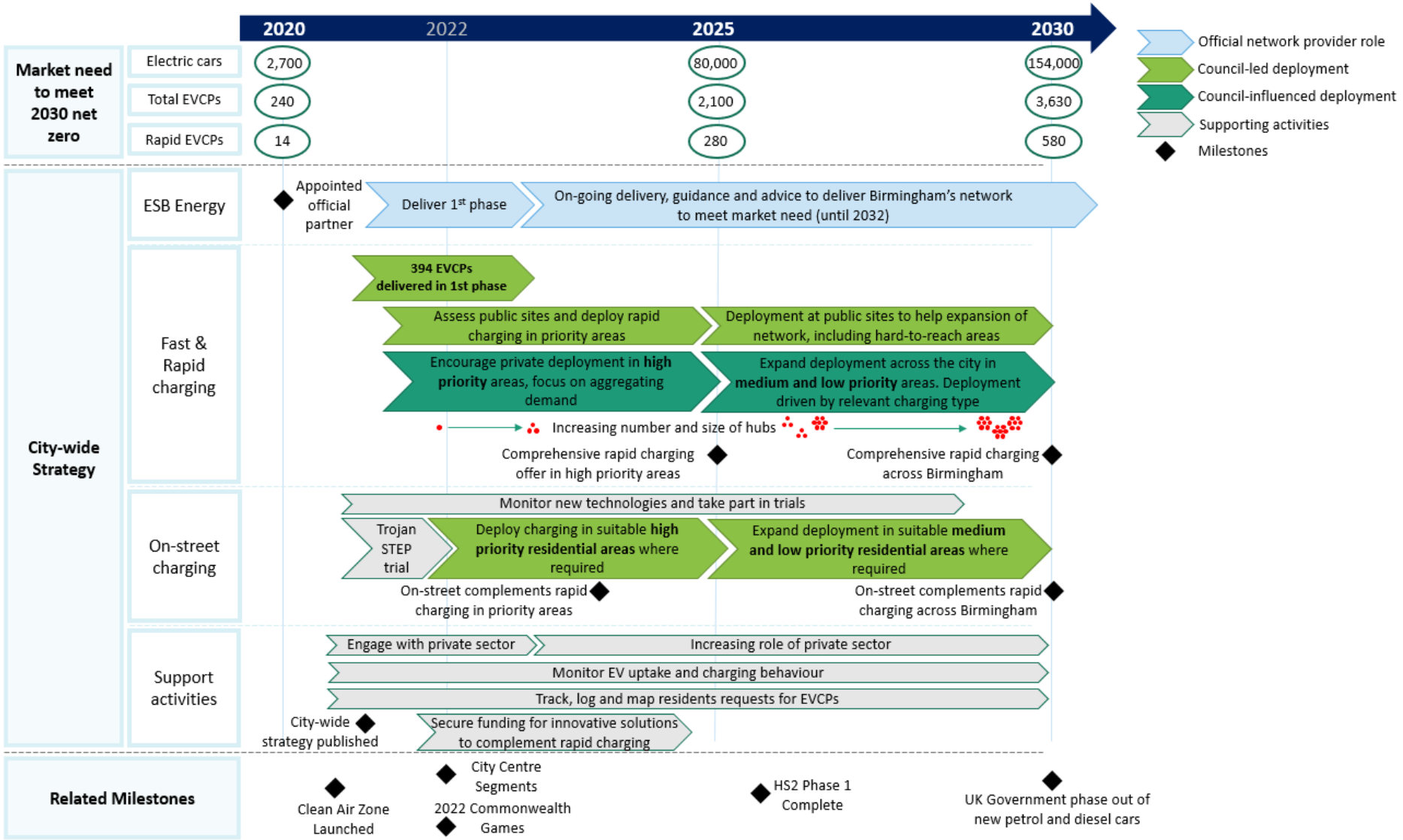


Figure 1.4 Roadmap for expanding charging infrastructure across Birmingham

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Acknowledgements

We gratefully acknowledge input from the following organisations:

- Transport for West Midlands and ESB Energy: whose input has helped to shape this strategy.
- Western Power Distribution: for invaluable input in early site assessments for Phase 1 of our charging strategy
- British Gas: for providing information about their fleet and electrification plans for inclusion in our plans.

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Glossary

Acronyms

BCC	Birmingham City Council
BEV	Battery Electric Vehicle
CAZ	Clean Air Zone
CCC	Committee on Climate Change
DfT	Department for Transport
EV	Electric Vehicle
EVCP	Electric Vehicle Charge Point
ICE	Internal Combustion Engine
kW	kilowatt
MSOA	Middle Layer Super Output Layer
PHEV	Plug-in Hybrid Electric Vehicle
PHV	Private Hire Vehicle
TfWM	Transport for West Midlands
vkm	Vehicle kilometres

Definitions

EV – the term electric vehicle is used to refer to vehicles that use electric motors for propulsion; for the purposes of this strategy, we primarily use the term electric vehicle to refer to plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs); these are vehicles which must plug in to charge points to recharge the battery that powers their electric motion.

EV charger – standalone charging device, which can have multiple EV charging connectors

Electric vehicle charge point (EVCP) – individual charging connectors / plugs attached to an EV charger, which can charge different EVs simultaneously

EV Charging Speeds

- Slow charging: 3-5 kW
- Fast charging: 7-22 kW
- Rapid charging: 50-99 kW
- Ultra-rapid charging: 100 kW+

2 Background and Context

Key messages

- Reducing the use of cars and vans and transitioning to electric vehicles is central to reducing greenhouse gas emissions in Birmingham and across the UK
- To drive electric vehicle uptake, a comprehensive charging strategy is required that accounts for future demand and is integrated with other initiatives within the city.
- In partnership with ESB, as the procured EV Charge Point Network Delivery Partner, Birmingham City Council has already initiated the first component of our strategy to increase the number of fast and rapid charge points in Birmingham.
- The city-wide strategy considers the next phase of deployment and will take into account demand from vehicles within the city and those that travel in from surrounding areas out to 2030.
- The city-wide EV charging strategy must align with other mobility related schemes within the Birmingham region, for instance charge points should not be installed in areas intended for pedestrianisation.

2.1 Climate Emergency and Birmingham's Ambition

Following the UK government's commitment to reducing greenhouse gas (GHG) emissions to net zero by 2050,[3] local and regional authorities across the UK, including in the West Midlands, have strengthened their climate ambitions. In June 2019, Birmingham City Council declared a climate emergency and set an ambition for the city to become net-zero by 2030 or as soon as possible after that date as a 'just transition' allows.

Transport currently accounts for around a third of CO_2 emissions in Birmingham, over 95% of which is from road transport.[4] Of road transport emissions, 70% is from car use.[5] The UK Climate Change Committee's advice to Government[6,7] sets out several measures to reduce, and eventually eliminate emissions from transport through:

- **Reducing car miles** travelled through avoiding travel (e.g. working from home) and switching from private cars to walking, cycling, and shared and public transport
- **Transitioning remaining cars and vans to electric vehicles (EVs)[8]** alongside measures to reduce freight emissions.

The Council is already supporting EV uptake through purchase grants for ultra-low emissions hackney carriage and private hire vehicles as part of the Clean Air Zone mitigation measures.[9] Alongside direct incentives, a critical supporting step is to develop **a comprehensive public EV charging network.** While not delivering carbon reductions directly, widespread deployment of public charging infrastructure is a necessary requirement for enabling the uptake of electric

[3] The Climate Change Act 2008 (2050 Target Amendment) Order 2019
[4] UK National Statistics: UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2018 https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2018 *accessed April 2021.*
[5] Analysis of sub-national road transport fuel statistics, 2019
[6] Net Zero – The UK's contribution to stopping global warming (2019) Climate Change Committee
[7] The Sixth Carbon Budget (2020) Climate Change Committee
[8] vehicles that use electric motors for propulsion; for the purposes of this strategy, we primarily use the term electric vehicle to refer to vehicles which must plug in to charge points to power their electric motion, including plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs).
[9] https://www.brumbreathes.co.uk/homepage/7/financial-incentives

vehicles and preparing for the UK's planned 2030 phase out of petrol/diesel cars and vans. The public network must be accessible to all of Birmingham's residents and serve the needs of all key user groups within the city.

This document sets out Birmingham City Council's strategy to grow the public EV charging network across the city. Our strategy is based on detailed modelling of future EV charging

needs and aims to answer the following key questions:

- **How much** EV charging infrastructure will be needed by 2030 to support our wider carbon reduction ambitions, alongside modal shift and EV uptake?
- **Where** should this infrastructure be deployed?
- **What timeframe** should this infrastructure be deployed over?

2.2 EV Charging in Birmingham

2.2.1 Introduction to electric vehicle charging

EV charge points are broadly categorised by their power rating, which determines how fast vehicles can be charged. There are four broad categories:

Type	Power rating	Typical charge time
Slow	3-5 kW	11-17 h
Fast	7-22 kW	2-4 h
Rapid	50-99 kW	40 min
Ultra-rapid	100 kW+	10-20 min

Slow charge points are typical of home charging and on-street solutions such as lamppost chargers, whereas rapid and ultra-rapid charge points are increasingly deployed at destinations and en-route locations, such as service stations and car parks.

The power rating of the charger determines the maximum power that can be delivered by the charge point. The actual power delivered to a vehicle that plugs into a charge point depends on both the power rating of the charge point and the charging capability of the vehicle. For example, an electric car that is only capable of charging at 50 kW can plug into a 100 kW charge point, but the actual power delivered will be 50 kW or below.

An increasing number of battery electric cars released onto the market can charge at 50 kW or more, but none can handle very high power ratings yet (e.g. 350 kW). Rolling out an increasing share of higher power chargers as Birmingham's network develops will future-proof the network for future technology developments but will not impact accessibility for existing vehicles (see also section 3.1).

2.2.2 Current EV Charging Infrastructure

There are currently over 140 chargers in Birmingham (approximately 240 charge points).[10] Charge points are most densely clustered around the city centre (see map in Figure 2.1), with some chargers along major routes. Over two-thirds are fast chargers (7 kW and 22 kW; Figure 2.1) while just over a fifth are rapid or ultrarapid (50-150kW+).

[10] Data from Open Charge Map (https://map.openchargemap.io/#/search) and inspection of Zapmap (https://www.zap-map.com/live/) from March 2021. Charge point estimate based on 2 charge points per charger for 7kW and 22 kW chargers and 1 charge point per charger for rapid and ultra rapid chargers.

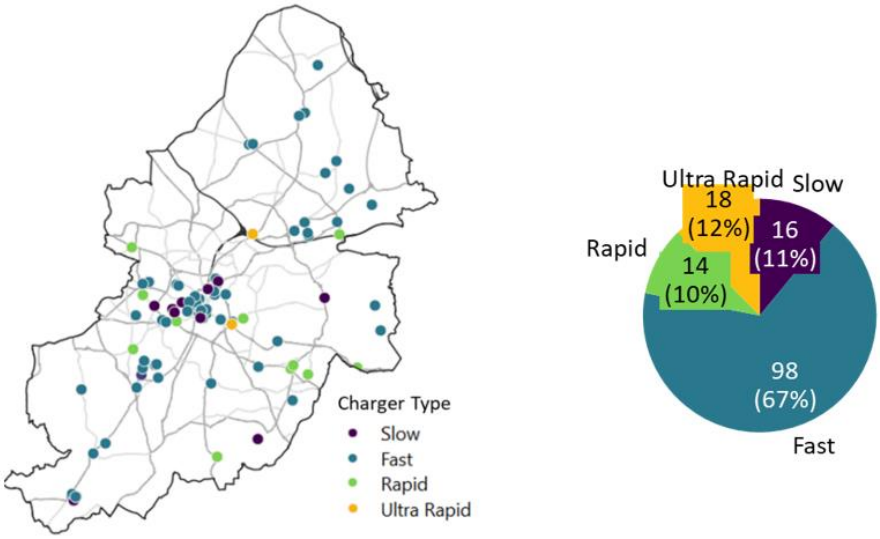


Figure 2.1: Distribution of EV charge points in Birmingham, as of March 2021.[5]

2.2.3 Phase 1 of 12-year EV Charge Point Strategy

Birmingham City Council's first step in expanding EV charging was securing £2.92m funding from the Office for Zero Emission Vehicles (OZEV)[11] Taxi Infrastructure Scheme to deploy fast and rapid charging. In 2020, we appointed ESB Energy as our procured EV Charge Point Network Development Partner (see box on page 7) and have worked with consultancy Element Energy to develop a strategy for this first phase of public fast and rapid charge points (Figure 2.2). Phase 1 of the strategy began in 2020 and will add 197 fast and rapid chargers (394 charge points) to Birmingham's network by 2022 (see accompanying Appendix). While this planned network prioritises demand from hackney carriages and private hire vehicles, a core aim is to enable wider public access.

[11] Formerly Office for Low Emission Vehicles, OLEV

First phase – Fast & rapid public infrastructure

- 394 fast and rapid connectors (97 fast chargers and 100 rapid chargers with two connectors each) to be deployed by September 2022 as part of the public charging infrastructure
- Aimed at hackney carriage and private hire vehicles due to their high number of miles travelled and to accommodate their uptake in the Clean Air Zone
- Focus primarily on charging at destinations and along busy routes
- The charge points will be deployed on a combination of publicly owned sites (on-street and car parks) and privately owned sites
- ESB Energy will install, own, maintain and operate the EVCPs
- Although aimed at hackney carriages and private hire vehicles, the charge points will be universally accessible, and supported 24/7, 365 days a year

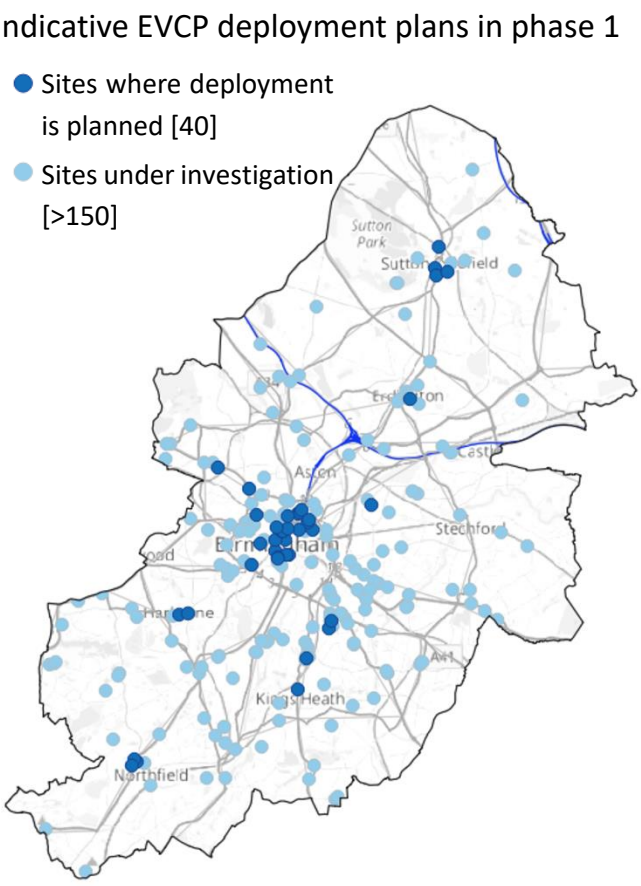


Figure 2.2 Overview of the first phase of Birmingham's public charging Strategy[12]

ESB Energy is a leading charge point provider, that maintains a network of over 3,000 charge points across the UK and Ireland. They were appointed the official EV Charge Point Network Development Partner for Birmingham in 2020 and will provide on-going support to the Council to develop the network in Birmingham until 2032. The charge points in Birmingham will be supplied with 100% renewable energy to support emissions reduction ambitions.

2.2.4 Phase 2 of the 12-year strategy

Phase 2 of the **city-wide strategy** represents EV charge point deployment beyond 2022 and will cover expansion of Birmingham's network out to 2032, as laid out in Figure 2.3. The strategy has a wider focus than the first phase and covers all key user groups, including residents without off-street parking, car clubs, and commercial fleets.

The city-wide strategy must deliver a future network that is user friendly, cost-effective, and future proofed. To achieve this, it must complement the current EV charging infrastructure, address current barriers to EV uptake, and align with both best practice technology choices and changes in the way people travel.

[12] Map © Crown copyright and database rights 2020 OS 100021326

Key strategic aims of the strategy are to:

- **Deliver a network that serves the needs of all vehicles** registered in and travelling in Birmingham that rely on a public network
- **Deliver a fully publicly accessible network** that is universally accessible, supported 24/7 over 365 days per annum across the city and to all users
- **Encourage uptake of EVs** by providing a comprehensive network and increasing public confidence that their charging needs will be met through a clear, transparent strategy
- **Future proof the network** by:
    - Avoiding locking-in private car ownership and prioritising options that are most suited to sustainable transport modes
    - Following the charging market and technology development and adapting as required
    - Being proactive in the trial of innovations, in particular to minimise impact on the electricity networks.

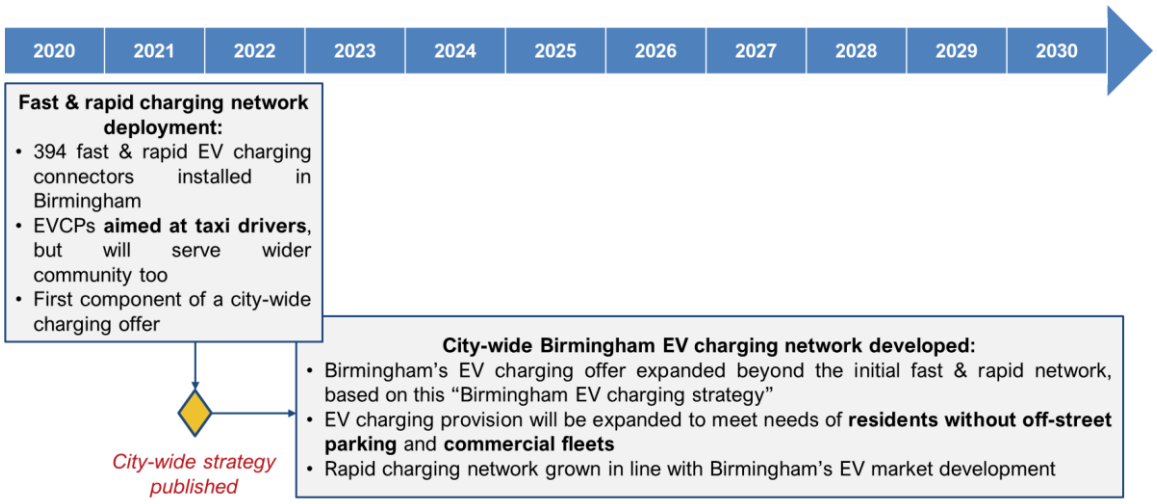


Figure 2.3: Timeline of Birmingham's EV charging strategies.

2.3 Alignment with Wider Mobility and Development Plans

Birmingham's city-wide EV charging strategy has been developed to align with other ongoing and upcoming mobility-related schemes within Birmingham. This alignment will ensure that the network fully considers the future needs of all users while avoiding potential wasted investment, such as putting charge points in areas that are targeted for pedestrianisation.

Current mobility schemes share three significant aims which the city-wide EV charging strategy must consider:

- **Reducing local emissions and improving air quality** by driving uptake of zero-emission vehicles.
- **Reducing total emissions by reducing car miles travelled** and private car ownership.
- **Reducing city centre traffic** by understanding charging needs across the city and identifying priority areas to avoid encouraging city centre travel for charging needs.

An overview of relevant wider mobility schemes in Birmingham is provided in Table 2.1 along with an indication of how those schemes may influence the deployment of EV charging infrastructure.

Table 2.1: Wider mobility schemes in Birmingham that may have an impact on EV charging demand and infrastructure rollout.

Document / Initiative	Key Features	Considerations for EV charging infrastructure
Birmingham Transport Plan	– Plan to 2031 that aims to guide investment in local transport in a way that reduces car dependency and delivers public transport improvements – Includes plans for pedestrianising city centre areas and reclaiming land currently used for parking – Builds on principles and policies set out in Birmingham Connected	Impacts suitable EV charging areas
City Centre Segments	– Plan to divide the city within the ring road into 6 segments, aiming to tackle local traffic within the city centre – Will prevent through access for private vehicles between segments – Will deliver improved access for walking, cycling and public transport	Impact on accessibility of charging areas
Clean Air Zone	– Active from June 2021, to improve air quality in the city centre – Drivers of the most polluting vehicles will have to pay to enter the zone – Hackney carriage and private hire vehicles drivers are encouraged to switch to EVs through provision of grants	Vehicles travelling into the CAZ should be supported to go beyond diesel Euro 6/VI through the provision of EV charging. Travel patterns may change as a result of the CAZ, impacting traffic volume and locations with highest traffic flow.
Public Realm Improvements	– Comprehensive programme for pedestrianisation of city centre areas, using the Commonwealth Games as an opportunity to showcase Birmingham	Impacts suitable EV charging areas
Commonwealth Games 2022	– The Games are expected to bring an upswing in public transport use – EVs may be favoured in the Commonwealth Games fleet	May create new convenient/high demand charging areas
Other major city developments e.g. HS2	– Multiple programmes with aims to increase the capacity of the public transport network and open up access to Birmingham's commercial centre to wider residential areas – Will create new shared and public transport hubs, including station access, and taxi drop off areas	May create new convenient/high demand charging areas

2.3.1 Modal shift

Switching to electric vehicles alone will not meet our ambitions for Birmingham to be net-zero by 2030 or as soon after as possible. Due to the slow turnover of cars and somewhat limited supply of electric vehicles, especially in the 2020s, there will still be many petrol and diesel cars on the road by 2030. This means that there will still be emissions from fossil-fuelled cars in 2030. Figure 2.4 shows the reduction in emissions from cars if the Government's ambition for no new petrol and diesel vehicle sales by 2030 is achieved. This rollout reduces emissions by close to 50% in 2030 compared to 2020 levels. To close the gap to zero, car usage (measured in vehicle kilometres travelled) will also need to be reduced, through avoiding travel and 'modal shift' – changes in travel behaviour away from private vehicles towards more sustainable forms of transport. Previous modelling for the Council has shown that a reduction in car use of 40% compared to 2018 levels is required to meet Birmingham's climate ambitions (see also Section 4.2.2).

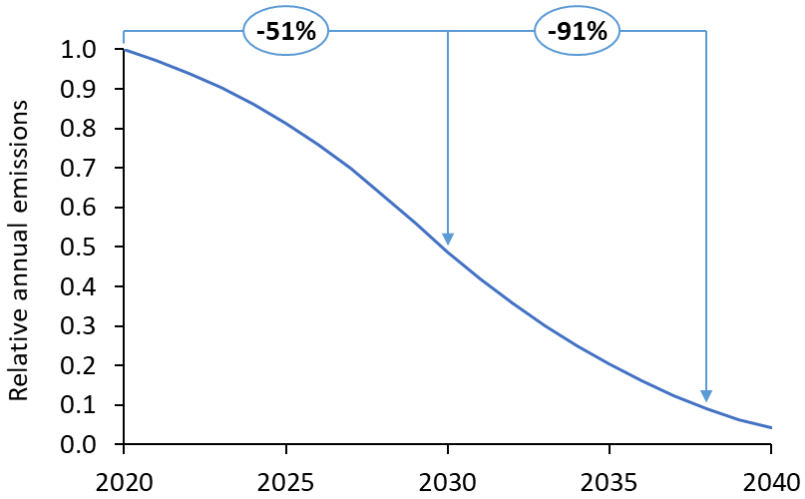


Figure 2.4: Impact on emissions from technology change alone: change in CO_2 emissions from all cars and vans as new petrol and diesel vehicles are phased out from sales in 2030.

While walking, cycling and public transport should take a leading role in taking the place of private car use, future transport systems must provide a range of options to fully meet users travel needs. As such, shared transport such as car clubs, car sharing, and hackney carriages and private hire vehicles have a role to play, and their electrification must be supported.

The Council is currently developing targets for the extent of modal shift ambition and these will be informed by ongoing developments at Transport for West Midlands (TfWM) level. In this strategy, we take into account the impact of different potential levels of modal shift but will remain flexible to ongoing plans.

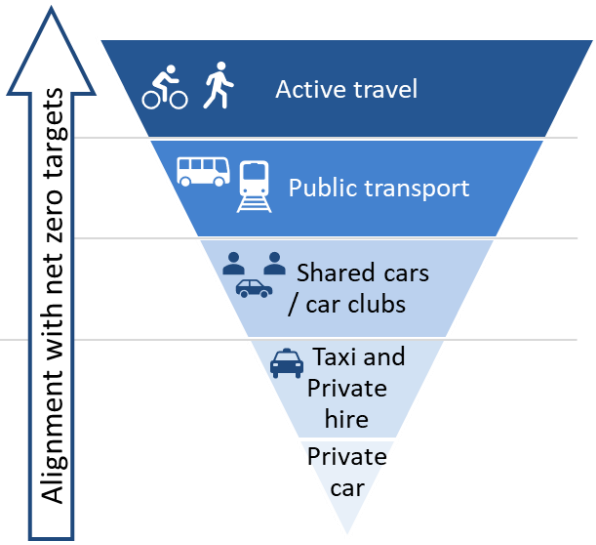


Figure 2.5: Compatibility of various modes of transport with net-zero targets.

2.4 Scope of the EV Charging Strategy

2.4.1 Timeline

The focus of the city-wide EV charging strategy is for a publicly accessible network that considers EV uptake and subsequent demand out to 2030. We will aim to deploy EV charging infrastructure at least a year ahead of projected EV demand in order to accelerate and promote EV uptake.

2.4.2 Vehicles

The city-wide EV charging strategy will cover charging demand from a range of vehicles shown in Table 2.2 including cars, hackney carriages, private hire vehicles, mopeds and motorcycles, and commercial light goods vehicles. The strategy does not cover demand from buses, heavy goods vehicles (HGVs) or e-scooters and e-bikes, as set out in Table 2.2, given either the low current market availability for EVs for these vehicle types (see projected uptake in Technical Appendix, Section 6.1) or the more vehicle-specific charging requirements of these vehicles.

Table 2.2: Vehicle types within the scope of the EV charging strategy.

	✓ In scope		X Out of scope
Private and shared vehicles (including car clubs)  	• **Private vehicle charging will be split between public network and home charging, whereas shared cars will rely on public network. Dedicated charge points in car club bays are out of scope of the Council's strategy.** • **Demand will increase with EV uptake.**	**Buses** 	• **Majority of charging expected to be done at the depot - not public demand** • **Strategy acknowledges TfWM strategy on opportunity charging**
Taxis: hackney carriages and private hire vehicles 	• **High mileage vehicles therefore ideally suited to EV transition.** • **Taxis require fast turnaround times while charging during shifts.**	**e-bikes and e-scooters** 	• **Privately owned will be charged at home / workplace** • **Public models will have minimal energy demand and their uptake / location is currently uncertain**
Commercial light goods vehicles 	• **Some larger fleets will be depot based (out of scope)** • **Vehicles kept at users homes will have charging needs more similar to a high-milage private car.**	**Heavy Goods Vehicles** 	• **Electric truck deployment will only be in early phases by 2030** • **Public charging demand in timeline proposed will therefore be very limited**

2.4.3 Charging types

To meet the full range of EV user groups, the network will provide a combination of different charging types at strategically selected sites. This includes EVCP deployment along major routes, for in-trip charging, at destinations, and in residential areas. One of the key challenges associated with the transition to EVs is providing access for residents without access to home charging (i.e. those without garages, driveways or car parks in shared accommodation). To achieve the level of transport emissions reduction required over the coming decade and beyond, it will be crucial to make owning and using an EV a viable option for this demographic.

2.4.4 Key User Groups

The city-wide EV charging strategy targets five key user groups:

- Hackney carriages
- Private hire vehicles (PHVs)
- Car clubs
- Light commercial vehicles (vans)
- Residents without off-street parking.

These user groups were chosen to represent the main demand requirements and charging behaviours within Birmingham. Table 2.3 gives an overview of each user group showing the factors that are likely to affect charging demand in Birmingham.

Table 2.3: Key user groups prioritised in the city-wide EV charging strategy.

Target user group for the strategy	Aligned with modal shift ambition	High mileage, and associated high share of carbon emissions	High EV charging demand	Home-based vehicles	Depot-based vehicles
Hackney carriages*	✓	✓	✓	✓	
Private hire vehicles*	✓	✓	✓	✓	
Car clubs	✓	✓	✓	✓	
Commercial vehicles		✓	✓	✓	✓
Residents without off-street parking				✓	

* Priority group for fast & rapid network

3 Core Principles of Birmingham's EV Charging Strategy

Key messages

- The priority residential charging strategy for the Birmingham City area will be rapid charging hubs with on-street charge points deployed in a limited number of areas.
- The focus on rapid charging hubs is aligned with best practice in other UK cities, research into consumer preferences and economic considerations.
- The use of rapid charging hubs is also aligned with BCC's modal shift ambitions to reduce the miles travelled by private car shifting instead to walking, cycling and public transport.

The core principles underpinning the development and delivery of the city-wide charging strategy are to provide a network that:

- Follows the best practice approach for choice of technology
- Aligns with consumer preferences and current deployment trends
- Aligns with wider aims within the council, including modal shift
- Is accessible for all

3.1 Technology approach

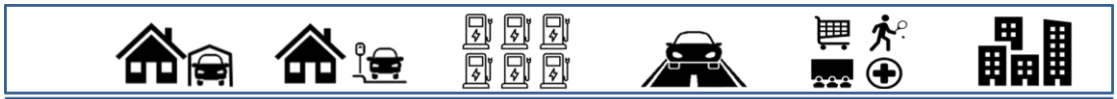
The charging market can be broadly split into four main charging types according to their location (detailed in Figure 3.1) covering:

- **Residential:** charging at or close to homes
- **En-route:** located along major routes for charging away from home
- **Destination:** in car parks for charging at the end of journeys
- **Workplace:** provided for employees at workplaces

In practice, charge point locations often straddle multiple charging types. For example, a rapid charging hub installed in a car park within a residential area will meet both destination and residential charging needs. A key consideration when developing the deployment approach will be to aggregate demand across user groups to maximise utilisation.

The most appropriate charger type for any given location depends on the level of charging demand at that location and the typical charging behaviour of users. Broadly, different charging speeds are appropriate for different locations:

- **Slow chargers (3-5 kW)** are suitable for vehicles that are parked for long periods of time, such as overnight charging at home, at a depot or, in some cases, on a residential street
- **Fast chargers (7-22 kW)** are suitable for cases where a vehicle may be left for several hours, such as at a destination or workplace
- **Rapid and ultra-rapid chargers (50-350 kW)** are required where a vehicle needs to charge quickly, with charging time more similar to traditional refuelling of a petrol or diesel car; these are particularly suited to en-route charging but are appropriate across many charging types.



Charging type	Home charging	Residential charging		En-route charging	Destination charging	Workplace charging
		On-street	Charging hubs			
Use case	Charging at home in a private driveway / garage / allocated space, typically overnight	Charging at public on-street EVCP close to driver's house, typically overnight	Charging at public EVCPs in the drivers local areas. In the rapid hub case, quick turnaround means a similar model to petrol refuelling.	Charging along major arterial routes or main roads in urban areas. Quick turnaround times.	Charging in car parks at the end of an outward journey. "Top up" charging model.	Charging while parked at workplace. Predictable + long dwell times. Not strictly public charging.
EVs per EVCP	1 EV per EVCP	Small number of EVs per EVCP	Many EVs per EVCP			Small number of EVs per EVCP
Key user groups	Residents with off-street parking	Residents without off-street parking	Residents without off-street parking, taxis, car clubs etc.	All residents, visitors, commuters and commercial vehicles.		Employees (particularly those without off-street parking)
Typical location	Driveway, garage, private residents car park	Along residential pavements	Along urban roads, public car parks, forecourts, dedicated development on public land	Service station / petrol forecourts plus other sites near main roads including hotels, retail parks etc.	Range of car park types e.g. public car parks, supermarkets, shopping centre	Employee car park
Typical charging speed	Slow, 3-7kW	Slow to fast 3-22kW	7-150kW but more likely to be 50-150kW (rapid and ultrarapid)	Rapid to ultrarapid (50-350kW)	Slow to fast 3-22kW with some sectors moving towards rapid	Slow, 7kW
Led by	Residents/building owners	**Council**	**Council or private sector**			Private sector (unless for council employees)

Not council led – not a focus of this strategy | Main focus of strategy

Figure 3.1 Overview of charging types considered in this strategy.

For the case of residents without access to off-street parking, there are two charging options to complement destination charging (compared in Table 3.1 and Table 3.2):

- **Slow on-street charging** – provides residents with slow overnight charging close to their house; for example, at lampposts or at kerbside
- **Hub charging** – provides quick and accessible charging at central locations within a local area, similar to taking a car to a petrol station. These can be fast or rapid, but a benefit of rapid hubs in residential locations is that they will also support other user groups such as hackney carriages, private hire vehicles and car clubs.

Each option has strengths and weaknesses, as set out in Table 3.2.The key takeaway from the comparison in Table 3.2, and the view taken in this strategy, is that **rapid hub charging is the best solution for providing charging for residents in Birmingham**. This means that rapid charging will be preferred where it is technically and commercially viable**. Slow on-street charging will only be deployed in suitable areas where rapid charging is not feasible.**

Rapid charging hubs can take many forms. These range from dedicated developments solely used for charging (similar to a fuelling station), to hubs containing multiple EVCPs in a car park (e.g. at a supermarket), and more recently large developments with 30 or more charge points located with cafes and shops at service station-style sites.

The number of EVCPs per hub also varies, with car park hubs in the UK typically having around 6 EVCPs. Early in Birmingham's deployment strategy, it is likely that hubs will have a small number of EVCPs (2-4) and may be located on-street. However, in the mid-long term as the market develops, larger hubs on dedicated sites are expected to be the preferred option.

This view is based on the current market, but the charging market is rapidly changing. The city-wide strategy will need to be flexible in adapting to the market need and new technologies as they develop. By focussing on rapid hubs initially, this allows for innovative on-street charging technologies to be incorporated later in the deployment strategy, once functional and reliable options have been identified.

Table 3.1: Comparison of key characteristics of rapid-hub and on-street charging

Characteristic	Rapid hub charging	On-street charging
Description	Multiple rapid chargers deployed together in areas of high demand	Slow chargers deployed in residential areas, generally used for overnight charging.
Power rating	50 kW and above	3-22 kW
Typical charging times (depends on battery size)	Full charge would require 1-2 hours but typical charge is ca. 30 mins, to 80% state of charge	Full charge would be 10-20 hours, overnight will take most vehicles from 30% to 100% charge

Table 3.2 Comparison of strengths and weaknesses of rapid-hub and on-street charging

Consideration	Rapid hub charging	On-street charging
Supporting the behaviour change needed to reduce private cars	Ideally suited to taxis and car clubs	Chargers outside homes makes private car ownership attractive, and could slow down a move away from private car use
Alignment with sustainable user groups (hackney carriages, private hire vehicles, car clubs)	Ideally suited to hackney carriages, private hire vehicles and car clubs	Less suitable for hackney carriages, private hire vehicles and car clubs that require quick charging turnaround times
Current business case	Attractive on high demand sites	Very challenging – typically fully funded through Government schemes
Future business case	Future business case is attractive - shorter payback and significant returns	Business case will improve as EV uptake grows but will be unable to match rapid charging for return on investment
Cost effectiveness	Many EVs are served by each charger, overall costs are lower than for equivalent on-street provision	Few EVs are served per charger, overall cost is higher than equivalent rapid charging provision
Avoidance of street clutter	Limited number of hubs installed away from residential streets	Charge points add to street clutter and infrastructure must be installed along pavements on residential streets
Technology maturity and improvement	Technology is mature and fully commercial. Charging is getting faster and the market is growing	Innovative solutions are being developed and trialled but there is no dominant technology yet – unclear which solution will “win”
Siting challenges	Space for hubs required in areas that are often already busy and with limited space – car parks mitigate this to a certain extent	Requires additions to street and can create competition between EV and non-EV, plus not all streets are suitable
Current cost of charging tariff to drivers	Rapid charging is typically more expensive than slow on-street charging although it still provides cost savings vs petrol	Slow charging is typically lower cost and overnight charging can access cheap electricity

positive neutral negative

3.2 Alignment with Latest Deployment Trends

3.2.1 UK trends

Birmingham's focus on rapid charging is in line with UK wide deployment trends (Figure 3.2) that show a growing number of fast and rapid chargers being deployed. The rapid charging market has seen significant growth in the last couple of years, with the majority of rapid EVCPs deployed in the UK being installed in 2019/2020.

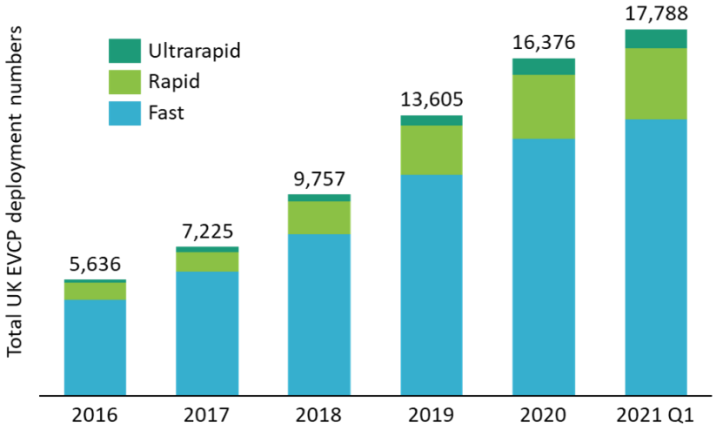


Figure 3.2: UK annual deployment figures for fast, rapid and ultra-rapid EV charge points.[13]

There is also a trend towards deployment of EVCPs in hubs, where multiple chargers are installed at the same location. Over a quarter of the UK's rapid and ultrarapid chargers have been deployed in a set of three or more with nearly 20% having been deployed in hubs of five of more.[14] Additionally, more than half of ultrarapid chargers deployed in hubs of five or more. These deployments are part of a growing trend towards hub charging favoured in areas of high demand where fast charging and charger availability are important to customers.

The focus on rapid hubs is generally in line with consumer preferences. Research has found that public opinion of charging infrastructure is more heavily influenced by charging speeds than spatial coverage.[15] The latest Energy Systems Catapult research showed that residents without off-street parking would prefer quick turnaround hub charging compared to slow on-street or slow hub charging.[16]

[13] ZapMap: EV Charging Stats 2021 https://www.zap-map.com/statistics/#points *accessed April 2021*
[14] Based on data from Open Charge Map (https://map.openchargemap.io/#/search
[15] J. Globisch, P. Plötz, E. Dütschke, M. Wietschel, "*Consumer preferences for public charging infrastructure for electric vehicles",* Transport Policy, **2019**
[16] *Electric Vehicles: What will persuade the 30% of households without off-street parking to adopt electric vehicles?* Energy Systems Catapult (2021)

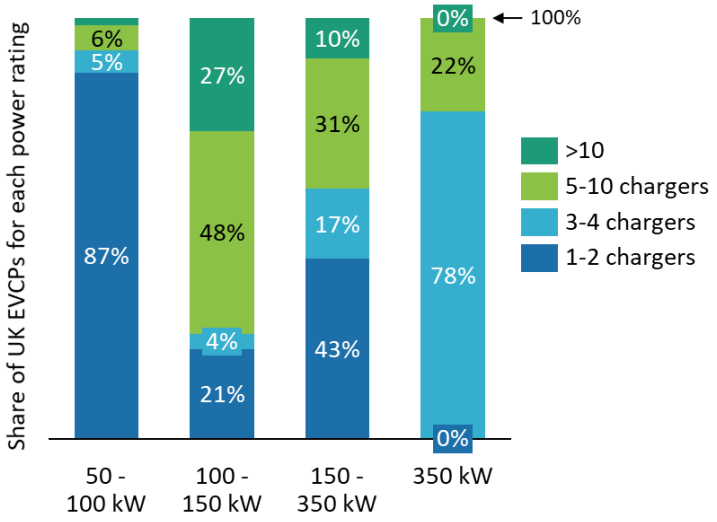


Figure 3.3: Annual UK EVCP deployment split according to hub size.[17]

3.2.2 Best Practice of Other UK Cities

The preference for rapid hub charging over on-street charging is also reflected in the approach being taken by other large UK cities, an overview of which is given in Table 3.3. London, Dundee and Nottingham are now focussing on rapid hub deployment aimed at all user types (i.e. hackney carriages, private hire vehicles, car clubs etc.) while on-street charging only forms a central focus of smaller, more residential cities such as Oxford.

[17] Open Charge Map https://openchargemap.org/site *accessed April 2021*

Table 3.3: Overview of EVCP deployment strategies in other UK cities.

City (population)	Early deployment	Total EVCPs (Jan 2021)[18]	Current situation	Focus going forward
London (9 million)	Started early with slow on-street charging	6,150	50% of chargers are **slow** but there is also a high portion of **rapid**	Focus on **rapid hubs** aimed at range of users
Nottingham (330,000)	Fast and rapid	140	Majority of devices are **fast** with another third **rapid**	Focus on **rapid hubs** aimed at range of users
Oxford (150,000)	On-street focused on residents	100	Majority of devices are **fast** but with a third **slow** due to focus on on-street charging	Likely to deploy **on-street** lamppost chargers alongside plans for rapid points via the Energy Superhub
Dundee (150,000)	Rapid charge points focused on taxis	110	Almost all public charge points are **fast or rapid** with rapid making up nearly 30% of points	Focus on **rapid hubs** aimed at range of users

3.3 Alignment with Wider Aims

3.3.1 Modal shift and mobility schemes

Both the siting of charging infrastructure in the Birmingham region and overall deployment approach should align with wider modal shift plans: **the city-wide EV charging strategy must support sustainable transport modes and must not lock in behaviours that encourage private car ownership**.

Although the city-wide EV charging strategy will provide charging infrastructure for both private and public vehicles, the **prioritisation of rapid chargers over slow, on-street chargers is in line with the Council's aim to encourage modal shift**. Providing residents with overnight charge points outside their homes is expected to encourage private vehicle use and ownership more than the "charge and go" model of rapid hubs. Conversely, this charge-and-go model is

[18] UK Department for Transport: Electric vehicle charging devices by local authority, http://maps.dft.gov.uk/ev-charging-map/ *published January 2021, accessed April 2021*

ideally suited to the charging requirements of more sustainable forms of car use, such as car clubs, hackney carriages and private hire vehicles.

To maximise modal shift benefits, the strategy should also be designed to support other schemes that aim to reduce vehicle mileage and energy consumption such as cycling, pedestrianisation and low/zero-emission buses and other public transport.

3.3.2 Equity and accessibility for all

It is fundamental that the city-wide EV charging strategy delivers a network that is accessible to all users in Birmingham. Some of the potential accessibility considerations are addressed in Table 3.4.

Table 3.4: Equity and accessibility considerations for the city-wide EV charging strategy.

Factor	Barriers to accessibility	Key considerations for EV charging strategy
Geographic	Charge points currently do not cover enough of the Birmingham area to make public charging accessible to all residents	Ensure good spatial coverage according to need, including solutions for hard-to-reach areas
Households without off-street parking	Without their own driveway, many residents do not have easy access to EV charging.	The city-wide EV strategy aims to remove access to off-street parking as a barrier to EV ownership by prioritising the development of accessible rapid hub charging.
Technology	Some charge points can only be used by subscribers to a specific company or scheme and require an app to be downloaded, relying on all users having access to smartphones.	Charging infrastructure should be available to use by all members of the public with pay-as-you-go functionality (i.e. not solely on subscription services), made easy to pay for (i.e. contactless payments rather than relying on the use of a smartphone) and using a single payment metric such as pence per kilowatt hour (kWh) similar to pence per litre for petrol.[19]
Disability	There are a number of disability considerations: ○ Appropriate height for disabled users ○ Accessibility of area around charge point ○ Trip hazards	Design charging bays according to best practice guidelines to enable access for disabled users wherever possible (see blue box, next page). Prioritise technologies and innovative solutions that have actively considered accessibility for disabled people with mobility or dexterity impairments.
Price of charging	Cost of charging at public chargers can be up to 6 times more expensive than charging at home. Consumers with Agile EV tariffs can pay as low as 5p/kWh for charging overnight (Octopus electric vehicles)	Prioritise development of flexible charging tariffs for those who charge overnight. Engage with government on subsidising public infrastructure for those without a driveway.
	Placing EVCPs in existing on-street bays that currently have parking fee charges creates an accessibility barrier compared to locations without parking fee charges.	Implementation of a consistent approach for on-street EV charge point use, that aligns with an EV 'Charge and go' approach, and removes any parking fee charges in existing bays. See also section 5.2.2.

[19] These considerations align with proposals in a UK Government on "The consumer experience at public chargepoints" – the findings from this consultation should be used to establish best practice with regards to accessibility. https://www.gov.uk/government/consultations/the-consumer-experience-at-public-electric-vehicle-chargepoints/the-consumer-experience-at-public-chargepoints *accessed April 2021.*

2021

Ensuring accessibility for disabled users:

The specific design considerations for each charging site will be determined by the EVCP type and location; however, ensuring that each chargepoint is designed in a way that considers all those using the space around the EVCP as well as the EVCP itself is critical to accessibility of our future network**.** In designing our EVCP infrastructure, we will adhere to best practice principles; for example, those outlined in London's electric vehicle charge point installation guidance[20] and Government's upcoming accessibility standards, expected in 2022.[21]

Key considerations for disabled access include minimum parking bay length, width and space between bays to ensure adequate space, kerb height, and chargepoints being of a height suitable for wheelchair users. While it will not always be possible to adapt all bays to ensure adequate space (e.g. in bays not previously designed for disabled access in off-street car parks), we will ensure that access is provided in sufficient bays to meet the needs of Birmingham's disabled residents and visitors.

3.4 Summary

- Rapid charging is better aligned with BCC's modal shift ambitions to move away from private car ownership as it is ideally suited to car clubs, hackney carriages and private hire vehicles.
- A focus on rapid hubs is in line with consumer preferences and deployment trends, including strategies of other large UK cities
- Despite the above, some areas may still be more suited to on-street slow to fast charging where there is not sufficient demand (or space) for rapid hubs.

[20] https://lruc.content.tfl.gov.uk/london-electric-vehicle-charge-point-installation-guidance-december-2019.pdf

[21] https://www.gov.uk/government/news/uk-government-partners-with-disability-charity-to-set-standards-for-electric-vehicle-chargepoints

4 Estimating Birmingham's Charging Needs

Key messages

- The number of charge points required to meet charging demand depends heavily on the type of charging technologies installed and the extent of modal shift achieved in Birmingham.
- If we achieve the level of modal shift that is compatible with our target of net zero by 2030, at least 3,630 public charge points will be needed across Birmingham, with residential charging predominantly met by fast and rapid charging hubs.
- However, the size of infrastructure is highly dependent on market need and could reach in excess of 5,000 if, for example, more residential charging must be met with on-street charging or modal shift is not achieved.
- The Council will continue to monitor market development and we will adjust our plans as the market develops.

4.1 Approach

The core aim of this City-Wide Strategy is to deliver a comprehensive public charging network that drives EV uptake and meets the needs of all users within Birmingham over the next ten years and beyond. The scale of infrastructure required will depend on market development, which will be influenced by three main factors outlined in Table 4.1.[22]

Table 4.1 Main factors impacting size of charging infrastructure needed by 2030

Factor	Impact on EVCP Requirements
Rate of electric vehicle uptake	The faster the uptake of EVs, the earlier charging infrastructure is required to meet demand and therefore the higher the rate of installation.
Extent of modal shift	The higher the reliance on private (electric) cars is, the higher the charging demand will be, leading to more charge points required. The Council's ambition to move away from private vehicle use towards walking, cycling and public transport will affect the demand on the EV charging network.
Number of cars in challenging areas that need on-street solutions	Charging at on-street chargers is slower than at rapid hubs, meaning that fewer electric vehicles are served per charging point. As such, the higher the need for on-street charging, the more charge points will be needed to cater for the total charging demand. As set out in Section 2, the Council's strategy is to prioritise rapid hubs and use on-street charging only in challenging areas where rapid hubs are not suitable. However, the share of rapid vs on-street charging will be determined by the share of demand that falls into these challenging areas.

[22] Additional factors include improvements in battery technology that mean more charging is carried out at home than at public EVCPs, and the extent of workplace charging which would decrease dependency on public EVCPs.

To estimate the likely number of public EVCPs that the Council will need to plan for in Birmingham, detailed modelling has been carried out to reflect a range of market conditions as defined by these main factors. This modelling is based on stock and charging behaviour of cars, vans, motorcycles, hackney carriages and private hire vehicles within Birmingham, covering the scope outlined in Figure 4.1.

While this city-wide strategy focuses solely on development of the public charging network (residential, en-route and destination charging, Figure 4.1), home and workplace charging also have an important role to play in meeting the charging needs of vehicles in Birmingham. These charging types are not the focus of this strategy (see also Figure 3.1) but their rollout does have an impact on the public network. For example, if workplace charging becomes widespread, demand on the public charging network would be lower and less public infrastructure would be needed. Therefore, the impact of home and workplace charging was accounted for in the modelling to ensure public charging infrastructure is suitably scaled to meet Birmingham's charging demand.

Full details of the modelling are given in the Technical Appendix.

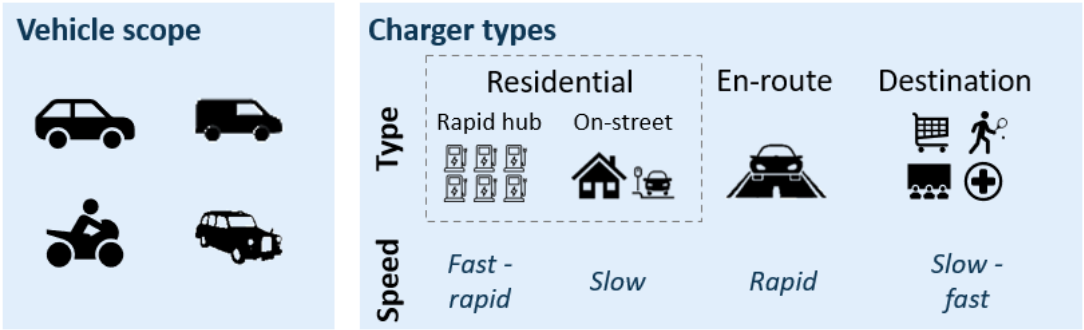


Figure 4.1 Recap of scope of city-wide strategy in terms of vehicles and charging types

4.2 Birmingham's EVCP requirements

4.2.1 Core assumptions

Rate of EV uptake: The rate of EV uptake is largely outside of the Council's control. In this strategy, we have assumed that EV uptake is consistent with the Government's ambition to phase out the sale of purely petrol and diesel cars and vans by 2030. This is an ambitious target set at national level that requires sales of EVs to increase from less than 10% in 2020 to 100% in 2030. While a public charging network can encourage EV uptake, reaching this sales share relies on people choosing to switch to EVs, enough EVs being available for people to buy, and likely enforcement of the ambition at national level.

Share of charging needed at public sites: The majority (79%) of cars and vans in Birmingham have access to off-street parking and will be able to charge at home. As such, they will not rely solely on the public charging network and most of their charging will be done at home.[23] However, while homeowners with access to off-street parking are overrepresented among early adopters, this will necessarily change as more people switch to electric vehicles. As such, as the market grows, a growing share of the total charging demand will fall on the public network.

Rapid vs on-street residential demand: While the Council will prioritise fast and rapid hubs to meet residential charging demand, we recognise that not all areas will be suitable for rapid hubs

[23] 75% of charging is typically carried out at home; Source: *Electric Vehicle Charging Behaviour Study (2019) Element Energy for National Grid ESO*

and those in challenging areas[24] will need alternative, innovative solutions. We have based our projections for EVCPs on close to 80% of cars and vans without off-street access being within areas suitable for rapid hubs; however, we have explored the impact of higher reliance on on-street parking in Section 4.2.2.

Deployment trajectory: To prevent the provision of public charging points being a barrier to EV uptake, annual EVCP deployment targets have been set a year ahead of projected demand. By staying ahead of demand, the public charging network across Birmingham can be a driver for EV uptake within the city.

4.2.2 EVCP projections

Impact of modal shift

Historically, the number of vehicles registered in Birmingham has grown with population. With Birmingham's population set to reach 1.25 million by 2031,[25] without behaviour change, this could lead to close to 800,000 cars in Birmingham. This increase in car ownership is incompatible with both Birmingham's and the UK's national climate ambitions.

Birmingham has set a target of reaching net zero by 2030 or as soon as possible after and, as set out in Section 2.3, this cannot be achieved only through switching to EVs. The Council commissioned modelling in 2019 using the SCATTER tool which showed that meeting the 2030 target requires a reduction in car use of 40% by 2030 compared to 2018 levels, among other measures. This is equivalent to someone who only uses their car for commuting, changing to work from home for 2 days a week instead of travelling 5 days a week.

If we meet our target, there would be over 170,000 EVs in Birmingham by 2030, of which, over 153,000 would be cars (compared to 2,700 EVs today[26]). To meet the charging demand from these vehicles, there would need to be 3,630 public charge points (*ca.* 1,600 chargers), with 1,375 on-street residential charge points and close to 450 rapid residential hubs (Table 4.2).

We recognise that our targets are ambitious and must plan for the case where progress is slower. As a minimum, Birmingham must achieve modal shift that is compatible with the national target of net zero by 2050. To meet this target, the Climate Change Committee's 6th Carbon Budget requires a much less ambitious reduction in car use of 1.3% by 2030.

If Birmingham only achieves the CCC's level of modal shift, there would be close to 230,000 EVs in the city by 2030, of which, over 210,000 would be cars. To meet the charging demand from these vehicles, there would need to be over 5,000 public charge points, with close to 1,900 on-street residential charge points and over 600 rapid residential hubs (Table 4.2).

If modal shift is not achieved and car usage grows in line with historic trends, the number of charge points required could be greatly in excess of 5,000.

[24] Where there is not sufficient demand or space for rapid hub charging
[25] Birmingham Transport Plan 2031 (2020)
[26] Department for Transport Vehicle Licensing statistics (2020) VEH0132b

Table 4.2: Number of EVCPs of each type required as a result of two different modal shift ambitions relating to different net-zero targets

Scenario	Year	Residential	Residential	En-route	Destination	Total
		Rapid	On-street			
Net zero **2030**	2025	191	642	93	1,176	**2,102**
Net zero **2030**	2030	454	1,375	124	1,675	**3,629**
Net-Zero **2050**	2025	215	734	106	1,370	**2,425**
Net-Zero **2050**	2030	609	1,886	176	2,508	**5,179**

Impact of share of on-street charging

Different types of chargers operate at different power ratings and therefore take different lengths of time to charge a car (see also Section 2.2). This variation in charging time means that faster chargers can charge many more vehicles per day and fewer chargers are needed to accommodate the total charging demand for all vehicles. On-street chargers, which are generally slow chargers, serve around four EVs per charge point while rapid hubs serve around 70 EVs per charge point (illustrated in Figure 4.2). Therefore, the number of charge points that will be required depends heavily on how Birmingham's EV charging demand is split across technology types.

As set out in Section 4.1, the split of on-street and rapid solutions will depend on the distribution of cars and vans reliant on public charging across those areas that are suitable for rapid charging and those that are challenging for rapid hubs.

If only 60% of electric cars and vans without off-street parking are in areas suitable for rapid hubs, this will increase the number of public charge points required to meet the net zero 2030 target to 4,940 (Table 4.3). Of this 4,940, over 2,900 will be on-street. Conversely, if more areas of Birmingham are suitable for rapid hubs, the total number of public charge points needed to meet the 2030 target could drop to 2,820 (Table 4.3).

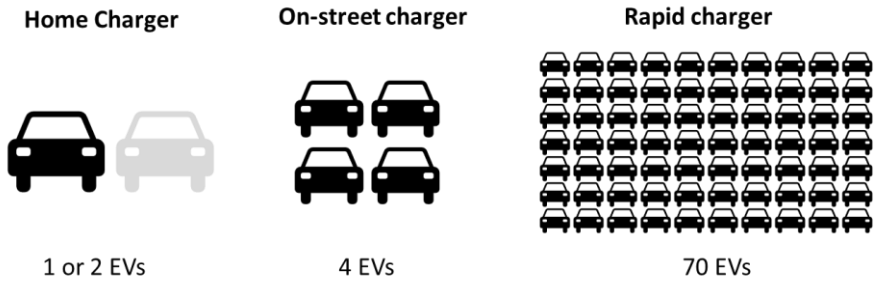
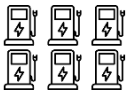


Figure 4.2: Illustration of the number of electric vehicles served by each kind of charge point

Table 4.3: Number of EVCPs of each type required depending on suitability of areas for rapid hub charging.

	Residential	Residential	En-route	Destination	Total
Share of cars and vans parked on-street in areas suitable for rapid hubs	Rapid 	On-street 			
60%	332	2,915	124	1,567	**4,938**
80%	454	1,375	124	1,675	**3,629**
95%	531	423	124	1,741	**2,819**

4.2.3 Summary of Birmingham's approach

The Council's strategy is to deliver a public charging network that meets market need. While the public charging network will encourage EV uptake and sustainable transport measures will support modal shift, these measures alone will not guarantee the transition to a sustainable transport system; the Council is reliant on action at national and regional level, as well as by local businesses and residents.

We will continue to strive to meet our target of net zero by 2030 or as soon thereafter as a just transition allows, and, in our ideal case, we will aim to achieve 3,630 charge points in the city by 2030 (Figure 4.3). However, as set out above, there are a number of uncertainties that impact the number of charge points required, and we will continue to monitor market development to ensure that infrastructure is being deployed where it is needed and to continue to build on best practice. This monitoring will include:

- EV uptake among key user groups, including hackney carriages, private hire vehicles, residents, commercial fleets and car clubs, as well as visitors to the city
- Vehicle stock and usage trends as indicators of modal shift
- Progress in the number of charge points installed and geographic coverage
- Available data on charging behaviour and consumer preferences – more data will become available as EV uptake increases (both nationally and within Birmingham itself)
- Technology progress that may impact charging behaviours or infrastructure requirements – for example, in innovative charging solutions for challenging areas, and EV technology

Maintaining an awareness of these factors will allow us to be agile in our approach to EV charging infrastructure, and to create a city-wide charging infrastructure that continues to align with the public's needs.

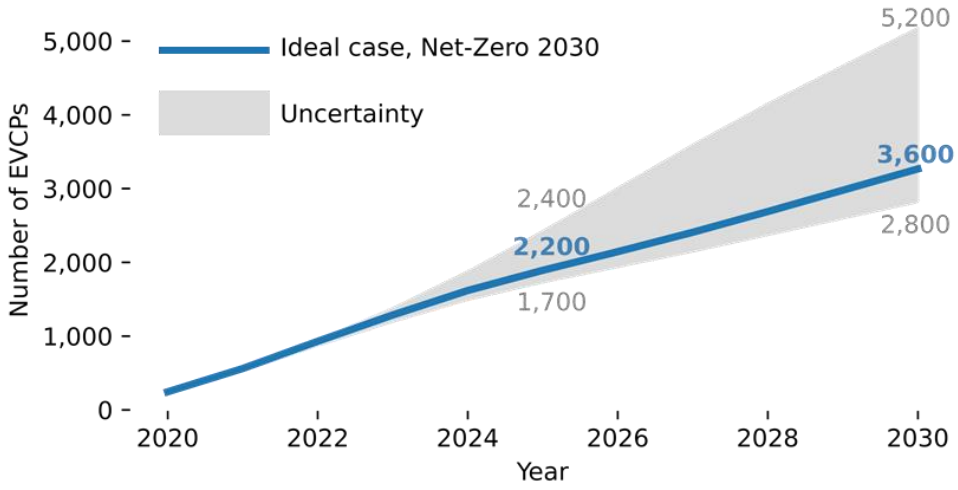


Figure 4.3: Projected number of public EVCPs needed in Birmingham reflecting the ideal case in which Birmingham meets net zero by 2030 (blue line) and the range of uncertainty that the Council must plan and monitor for

5 EV Charging Infrastructure: Deployment Approach

Summary

- We have prioritised areas of the city for EV charge point deployment based on indicators of high charging demand whilst taking into account future plans for traffic management and pedestrianisation.
- Early deployment (to 2025) will focus on locations in the city centre and some satellite areas where demand is expected to be most concentrated.
- Medium term deployment (2025-2030) will expand the network to ensure comprehensive coverage across the city, including hard-to-reach areas.
- The Council will play a key role in early deployment and will work with the private sector in partnership with our official charge point provider to ensure comprehensive network coverage.

This strategy considers deployment out to 2030 and has defined target areas for charging in the short term (out to 2025) and medium term (2025 to 2030). Short-term priorities will focus on areas of highest demand that cater for a range of charging types such as residential charging, demand from hackney carriages and private hire vehicles, destination charging etc. The medium-term priority areas will cover a larger area and deployment in these areas will be informed by lessons learned and trends observed in the early deployment phases.

To deliver a city-wide EV charging strategy capable of delivering the infrastructure required and that is in line with Birmingham City Council's wider aims for the city, the following will be taken into consideration:

- **Charging infrastructure siting will be demand-led** and where possible aim to aggregate demand across user groups, with a particular focus on vehicle types that align with longer term modal shift ambitions such as e-taxis and car clubs.
- **EVCP deployment will leverage a range of location types** in order to develop a comprehensive charging network in a timely manner, including private and publicly owned sites.
- **Charging infrastructure will align with wider mobility schemes in the region** so that it supports modal shift and the decarbonisation of Birmingham's transport system.

5.1 Geographic Deployment Strategy

To identify priority areas for deploying charging infrastructure, we have used geospatial analysis to build up a picture of potential charging demand across Birmingham. This is based on a range of relevant datasets describing travel patterns and local characteristics related to charging from key sources of demand.

As set out in Section 2, the primary focus for EV charging in Birmingham will be rapid charging, preferably deployed in hubs. A crucial consideration for deploying rapid charging, particularly while EV uptake is in its early stages, is aggregating demand across user groups and charging types. This ensures that the charge points are highly used to meet market needs. For example, putting rapid chargers in car parks in targeted locations may serve residential demand as well as destination charging, therefore meeting the needs of residents, car clubs and visitors to Birmingham. Prioritising areas where several user groups are catered for means that the Birmingham's EV charging strategy:

- Is able to cater for all types of charging demand
- Has a clear short-term focus with target areas to begin deployment

- Ensures early deployment where there is the best business case
- Allows the council and the market to understand charging demand and behaviours in high priority areas before deploying to medium priority areas.

The maps shown in this section of the strategy broadly identify the areas with highest potential demand from four key sources of charging demand:

- **Taxis including hackney carriages and private hire vehicles:** high mileage and early EV uptake
- **Residents without off-street parking**: residents who will be reliant on public charging infrastructure
- **En-route charging:** charging during journeys, most akin to the current petrol station refuelling behaviour
- **Destination charging:** charging while parked at a destination such as supermarkets, shopping centres, parks, leisure facilities etc.

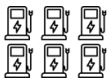
The overall deployment strategy brings together demand from all of these major sources to identify areas where these demands overlap and therefore where rapid hub charging is most suitable.

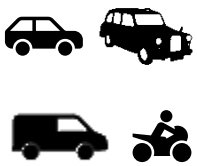
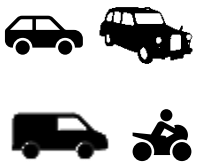
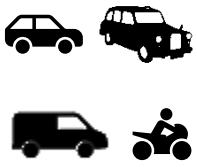
5.1.1 Rapid Charging Suitability Assessment

Although rapid charging hubs are the primary focus for Birmingham's charging infrastructure, rapid hubs are not suitable in all areas.

To assess suitability, several metrics were analysed as shown in Table 5.1. These metrics have been shown to be key indicators of high EVCP utilisation, and therefore provide an indication of where future demand for rapid EV charging is likely to be highest.

Table 5.1: The metrics below were analysed to identify areas of Birmingham that are likely to have the highest demand for public EV charging.

Metric	Reason for assessment	Most relevant user groups	Relevant charging types
Taxis ranks	Taxi ranks indicate areas with high taxi operation and analysis has proven that proximity to taxi ranks drives EVCP utilisation		 *Rapid hub*
Off-street parking	Areas with a low availability of off-street parking will be more reliant on public charging infrastructure, as fewer residents can charge at home	 	 *Residential on-street or rapid hub*

Metric	Reason for assessment	Most relevant user groups	Relevant charging types
Traffic flow	Routes with high traffic flows will develop higher en-route charging demand as EV uptake grows, due to the overall throughout of vehicles		 *En-route*
Trip data	Areas in which a large number of vehicle trips end (i.e. places where people are travelling to) have high demand for destination charging.		 *Destination*
Amenities	Analysis of real-world charging data shows that a high number of nearby amenities attracts EV drivers to EVCPs and drives utilisation		 *Destination*

5.1.2 Recommended Infrastructure

Priority areas for EV charge point deployment have been identified for each of the metrics outlined in Table 5.1. The maps in this section illustrate the high and medium priority areas for each metric individually. The aggregated demand from all sources is then shown in Figure 5.2.

Taxi demand

Taxis, both hackney carriages and private hire vehicles, are a key user group for early deployment of fast and rapid charge points, partly because they drive many more miles annually than the average private car leading to higher charging demands. Taxi demand is closely linked to taxi rank locations, and the distribution of taxi ranks in Birmingham is shown Figure 5.1(a). Taxi demand tends to be more localised around the city centre than other demand types, in the area covered by the Clean Air Zone. As taxi use is particularly concentrated within the Clean Air Zone, supporting the taxi fleet in the transition to electric vehicles is key to improving air quality in the city centre.

Residents Without Off-Street Parking

Residents without off-street parking are generally unable to charge at home and therefore much more reliant on the public charging network. Modelling carried out by Element Energy has indicated that around 75% of car-owning households in Birmingham have access to off-street parking (60% of all households). This leaves around 66,000 car-owning households within Birmingham without access to off-street parking. Figure 5.1(b) shows the areas of Birmingham with the highest reliance on on-street parking. As would be expected in a major city, areas with a high reliance on on-street parking are found densely around the city centre with a low reliance in the areas to the north of the city and a more varied pattern in the south.

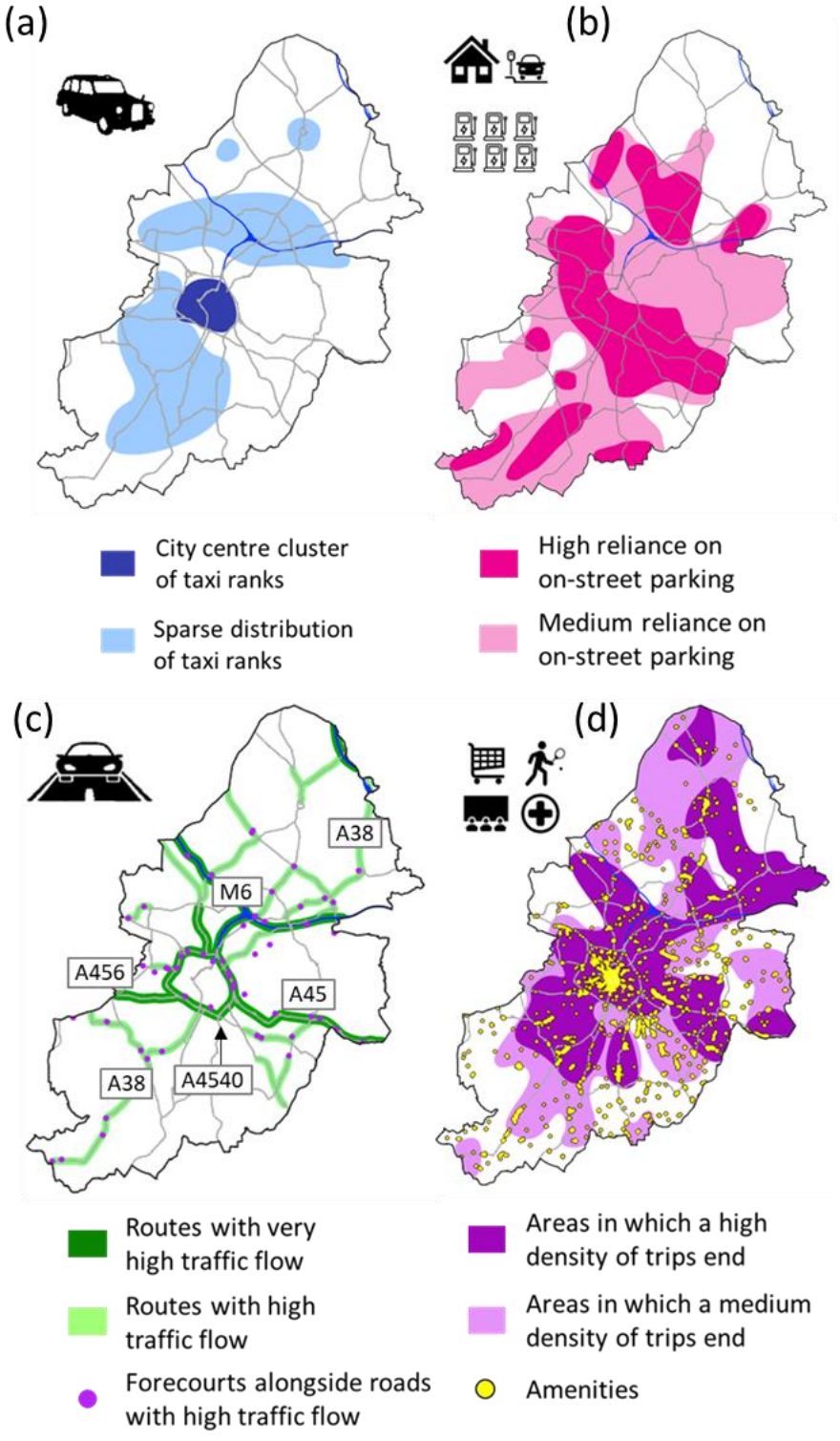


Figure 5.1 Geospatial analysis of potential charging demand across Birmingham: (a) Spread of taxi ranks across Birmingham indicating areas of demand for EV charging from taxis, (b) Areas with high or medium reliance on on-street parking leading to demand from residents for local EV charging infrastructure, (c) Roads in Birmingham with the highest car and van traffic flows leading to demand for en-route charging, (d) Areas with a high and medium density of trips ending in them, leading to demand for destination charging.

Rapid En-Route Charging

Rapid en-route charging is most similar to the current model of service stations or refuelling stations, generally found along main roads. En-route charging demand is naturally highest on large, busy roads where there is the highest traffic flow. Figure 5.1(c) shows the roads in Birmingham with the highest annual average daily traffic flow of cars and vans that would therefore be most suitable for en-route charging options.[27] Figure 5.1(c) also highlights forecourts that are found along these busy routes as obvious candidates for deployment of en-route charging.

The highest priority routes for en-route charging are those with the highest traffic flows in Birmingham, covering the M6 motorway, the A4540 ring road around the city centre, the A456 to the west and the A45 to the east of the city centre. The medium priority routes cover the rest of the main arterial routes into the city centre, including the A38 from the South.

Although the A4400 through the city centre is currently a very high traffic flow road, it has been excluded from en-route charging priorities in line with Birmingham City' Council's plans to reduce through traffic in the city centre. These plans aim to split the city centre into segments and limit through traffic, which will have a major impact on traffic flow on this section of road and could lead to stranded assets if infrastructure was deployed based on historic levels of traffic flow.

The introduction of the CAZ as well as changes to travel due to COVID-19 may also impact travel patterns across Birmingham. It is not currently clear what the long-term impacts of either COVID-19 or the CAZ will be; however, we will continue to monitor changes in traffic to ensure EVCP deployment follows the market need.

Destination Charging

Destination charging can be a useful source of "top up" charging or alternative charging for drivers unable to install an EVCP at home. The location and popularity of areas as destinations has been used to identify priority areas for destination charging, shown in Figure 5.1(d). This is based on the areas of Birmingham with the highest number of trips ending in them, in other words, the areas that drivers are most likely to be travelling to.[28] As would be expected, the areas with clusters of amenities (such as supermarkets, fast food outlets etc.) are associated with a large number of vehicle trips. Having rapid charging hubs close to these clusters of amenities makes charging infrastructure convenient for drivers as they can incorporate charging into their trip. Clusters of amenities are often served by large car parks which are suitable locations for EVCPs.

Overall Priority Areas for rapid charging

Priority areas from the four demand types given above were combined to establish the overall priority areas for rapid charging in Birmingham, shown in Figure 5.2.

[27] Source: UK Department for Transport Road Traffic Statistics, which gives annual average daily flow data (AADF) for traffic flow along major roads in the UK. Data from 2019.

[28] The numbers used for the map were based on the total number of non-home based trips (i.e. not starting or finishing at home) per Middle Layer Super Output Area (MSOA) divided by the area of the MSOA to account for the fact that some MSOAs are much bigger than others in terms of area.

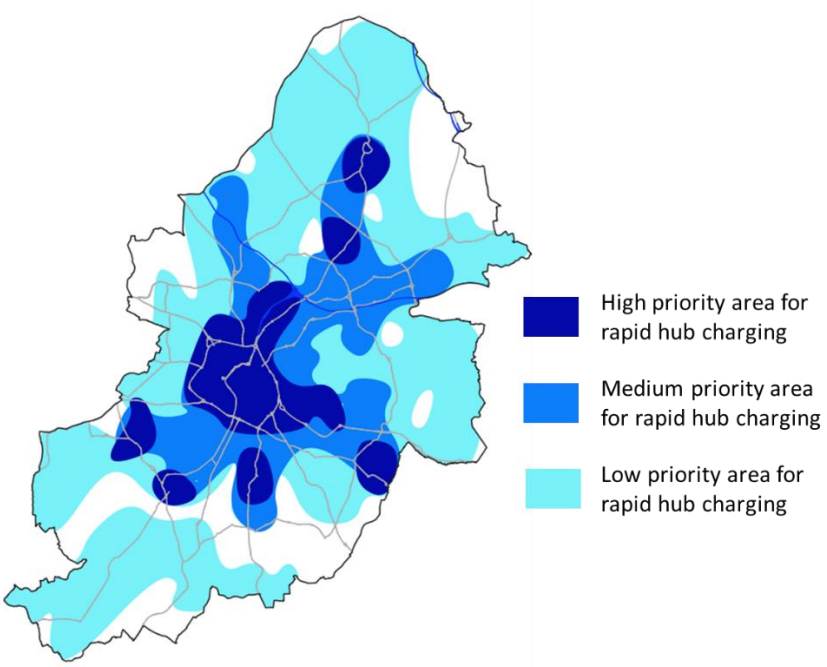


Figure 5.2: Priority areas for deployment of rapid hub charging in Birmingham based on aggregated demand from all sources.

Deployment across these areas will be divided across two main timeframes:

- **Short-term (to 2025)**: deployment will focus on finding sites within the highest priority areas (darkest blue in Figure 5.2) that serve multiple user groups and charging types; these include the city centre and some satellite areas, typically with clusters of amenities.
- **Medium-term (2025-2030):** deployment will expand to include sites within medium and low priority areas that radiate out from the city centre. While aggregating demand will remain a priority, these areas may serve a smaller range of charging types and therefore site selection will be informed by potential demand for each relevant charging type (e.g. residential charging will be informed by the priority areas in Figure 5.2(b), en-route charging by routes in Figure Figure 5.2(c)).

Although these areas have been highlighted as priority candidates, specific locations within these areas will be subject to a detailed feasibility assessment before the appropriate charging solution is decided and deployed. We will continue to engage with key user groups (see also Section 5.2.2) to identify clusters of demand and will remain flexible in our assignment of priority. For example, where clusters of demand occur in areas identified as low priority in Figure 5.2, these sites will be moved up in priority.

Areas that are not highlighted in Figure 5.2 are where on-street charging is more likely to be suitable where charging infrastructure is required. This may change over time as charging behaviour and consumer preferences become clearer.

Throughout the timeframe of this strategy, additional demand centres may appear within Birmingham as a result of new infrastructure, such as HS2, or new developments, such as new housing developments or shopping centres. The strategy will remain flexible to developments to ensure future demand is met.

5.1.3 On-street Charging Approach

As set out in Section 2, on-street charging will primarily be used to extend the public charging network to areas where either:

- demand is not high enough to warrant the deployment of more expensive rapid chargers
- or local restrictions limit other deployment options, such as lack of space or grid constraints that are too costly to overcome.

The need for on-street charging will be minimised as far as possible by prioritising rapid charging wherever feasible. Where on-street chargers are identified as the most viable option for a given area, the Council's focus will be on the deployment of innovative chargers that minimise additional street furniture.

Early deployment will focus on high priority areas within Figure 4 1(b) that are not otherwise catered for by rapid charging. This approach will aim to supplement the developing rapid charging network and offer full coverage in these high priority areas. Medium-term deployment will expand coverage to suitable candidate areas in the medium and low priority residential areas, with the aim of providing a fully comprehensive network that is accessible to all.

Where on-street charging is installed, innovative, low-profile and low street-clutter devices, currently under trial, will be preferred over mature technologies such as lamppost charging. The Council is an official partner in a government-funded trial of the Trojan Charger and will continue to seek to participate in suitable future trials to ensure the latest and most effective solutions are deployed in Birmingham.

5.1.4 Catering for changing demand across the city

Our aim is for Birmingham's EV strategy to be aligned with wider schemes within the city: both long-term city development plans and major events held within the city.

Birmingham is an international city, regularly hosting large-scale events that bring an influx of visitors to the city. These events include high-profile, one-off events like the Commonwealth Games and more regular, often annual events such as conferences and sporting events. To ensure Birmingham's EV charging infrastructure can support such events, infrastructure will be strategically deployed in places that can cater for these demand surges and local, year-round demand.

Some of the major schemes with which the city-wide EV strategy must align are those focussed on the city centre, such as the Clean Air Zone (CAZ) and the City Centre Segments. Both schemes aim to reduce traffic in the city centre air with the CAZ adopted specifically to improve air quality in the area. It is hoped that vehicles travelling into the CAZ will be encouraged to go beyond diesel Euro 6/VI through the provision of EV charging, and by provision of grants for taxi fleets. The proposals for the City Centre Segments will need to be considered in relation to deployment of EV charging infrastructure within the city centre. It is important that EV charging infrastructure is not cut off from major local sources of demand that it has been set up to serve, such as major roads or housing developments.

Major city infrastructure developments and redevelopments, such as HS2 and Birmingham Connected, will have a significant impact on demand for and suitability of EV charging infrastructure across Birmingham. Key examples include plans for the pedestrianisation of areas within the city centre which will eliminate demand for vehicle charging in these areas, and areas identified for regeneration that are likely to involve changes to road layouts and accessibility. Other schemes that promote walking, cycling and public transport that, although aiming to reduce

vehicle travel overall, may create centres of local demand where commuters drive to Park & Ride sites (or similar) and shift to another mode of transport to move around the city.

5.2 EV Charging Delivery

5.2.1 Deployment Approach

The Council will take a leading role in developing Birmingham's EV charging infrastructure, alongside our appointed EV Charge Point Network Development Partner and associated stakeholders. As set out in Sections 2 and 3, our focus is to first develop a fast and rapid charging backbone (first phase of deployment) then deploy residential rapid hubs and work to expand access in challenging areas.

Council-led deployment will play a larger role in the early stages of deployment to stimulate the market and enable the required step change towards EV uptake. Public sites, such as public car parks, green parks and Council-owned land, are strong candidates for early deployment, since they enable the Council to ensure that:

- standards for full public accessibility are met
- priority user groups are catered for
- there is a comprehensive spread of charge points across the city, including in hard-to-reach areas

However, as the network grows, EVCP deployment will need to leverage a range of location types and the role of private sector stakeholders will become increasingly important. While public sites will continue to be developed to support the wider network, the Council will work to encourage increasing deployment at private sites as private car parks, destination car parks (e.g. supermarkets, shopping centres, hotels, leisure facilities etc.), and en-route refuelling station forecourts.

Figure 5.3 shows locations of five types of potential sites for EVCP deployment in Birmingham (see also Section 4.2.3 for Park & Ride sites). In addition to those shown, potential off-street sites include privately owned car parks, hotels, sports grounds, hospitals, transport hubs and more. From Figure 5.3, it is clear that there is a good spread of potential sites available in Birmingham to cover all areas of the city and to suit all types of EV charging demand including those likely to be targeted by the private sector.

In the short term, deployment may be focused on public sites to stimulate the market before shifting towards a greater mix of public and private sites. In the long term, deployment will be increasingly weighted to private sites as the market grows and EV uptake increases.

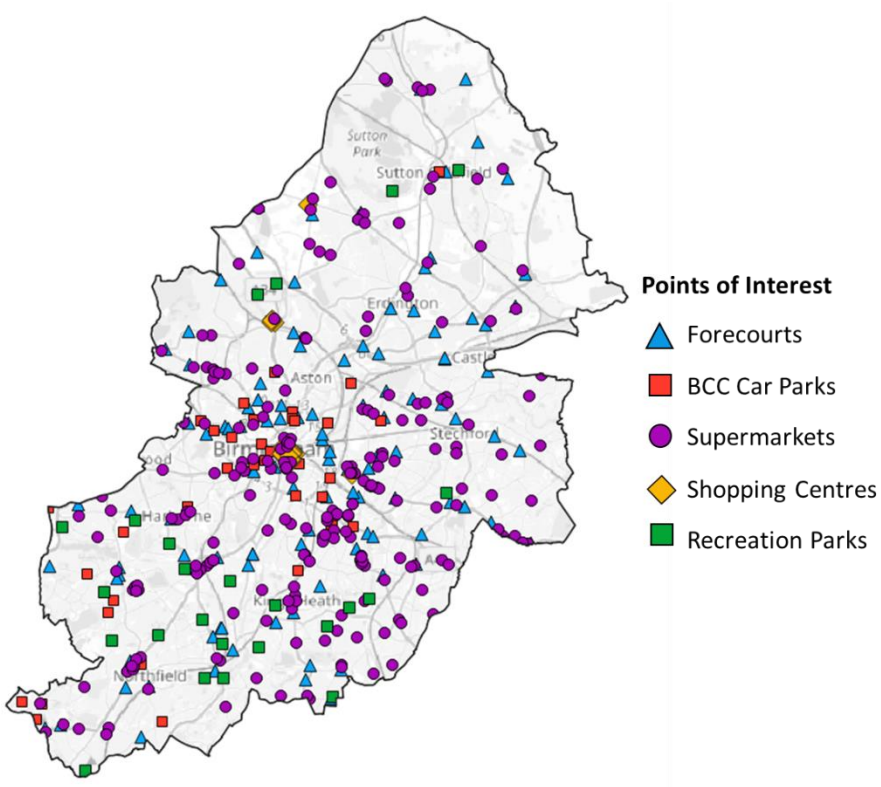


Figure 5.3 Distribution of selected potential sites for charge point deployment (car parks, supermarkets, and refuelling forecourts) across Birmingham.

5.2.2 Facilitating the Rollout of EV Charge Point Infrastructure

There are several ways that the Council will facilitate rollout of the EV charging network, and the precise business model and level of public support will vary across sites. We will continue to leverage our ongoing relationship with ESB Energy, our official charge point network delivery partner, to support development of rapid charge points beyond the first phase of rollout.

In addition to directly supporting delivery, there are a range of supporting activities we will take to facilitate deployment. These include:

- **Engaging with the private sector** to communicate the volume of infrastructure that will be required, to give confidence in the future EV landscape in Birmingham and to encourage deployment. This could involve identification of ideal sites or areas or by supporting organisations in accessing public funding (see information box for details of recently announced Government funding streams). Many organisations already have plans for EV charging at their sites (see section 5.2.3) and we will seek to support this uptake in Birmingham.
- **Developing systems** to identify clusters of demand and prioritise charging deployment in these areas, covering residents and commercial fleets.
- **Working with commercial fleet operators and representative fleet organisations such as the FTA (Fleet Transport Association)** to enable us to identify and prioritise deployment in areas that support the early transition of these fleets to EVs. For example, we are collaborating with British Gas (see local engineer fleet case study below) to identify areas where British Gas engineers will be reliant on public infrastructure and might be suitable for early rapid charging deployment.

- **Adopting a clear approach to parking charges** that encourages 'charge and go' usage patterns at charge points within the city centre. Specifically, where EVCPs are to be deployed at strategic sites along the Highway in which parking charges currently apply, only rapid EVCPs will be installed at these locations. Charging will be permitted at these sites for up to 1 hour (with no return) with no parking fee applied, in line with the approach of neighbouring authorities. At Highway locations where parking charges do not currently apply, both fast and rapid EVCPs will be deployed, and no additional parking charges or time limits will be imposed. Off the Highway, such as in public car parks, normal parking charges will apply. This approach ensures that charging patterns across Birmingham's future network align with our modal shift ambitions and wider aims to reduce congestion within the city centre, as well as ensuring equality of access across all charge points.
- **Reviewing our regulations, processes and policies for solutions to address barriers to charge point deployment for charge point operators**, such as planning restrictions on footprint of sites under development and constraints such as Conservation Area requirements.
- **Developing supplementary planning policies that support charge point deployment** in new and change-of-use developments through setting minimum standards for residential and destination EVCP provision. We will seek to encourage EVCP provision that supports multiple users, and the wider public network, wherever possible.
- **Continuing to work with Western Power Distribution** to support assessment of potential sites and address grid constraints

Government Infrastructure Grants announced in 2021:

Rapid Charging Fund: A total of £950m in funding has been announced for rapid charge points at A road and Motorway sites along the strategic road network. The fund will invest in locations where upgrading connections to install rapid charge points is prohibitively expensive and uncommercial. The fund will be open to applicants at approximately 400 Strategic Road Network sites and will support the deployment of approx. 6,000 ultra-rapid charge points (150 – 350kW capable) by 2035. Fund is likely to open for applicants in early 2022.

Local EV Infrastructure Fund: A total of 90m in funding has been allocated to support the roll out of large on-street charging projects and rapid charging hubs across England. The funding will be focused in regions where there is a market failure. The funding scope will be published in 2022.

British Gas operate the third largest fleet of light goods vehicles in the UK with around 9,000 vans and 1,000 cars on the road. They have committed to electrifying the entire fleet by 2025, with a third fully electric by 2022.

More than 100 British Gas drivers live in Birmingham with a further 130 serving Birmingham from surrounding areas. Of the drivers living within Birmingham, our analysis shows that close to a third live in areas with high reliance on on-street parking. Drivers all take their vans home overnight and those without home-charging will be reliant on the public network.

The Council are collaborating with British Gas in identifying how the public network can support early deployment of EVs in their fleet while also serving other user groups.

5.2.3 Working with wider stakeholders

While this strategy outlines the Council's approach to EVCP deployment, the 3,600-5,200 total charge points projected to be needed in Birmingham by 2030 includes those deployed by the Council alongside those deployed by the private sector and other regional stakeholders. We will work with wider stakeholders to both encourage deployment and to guide our own deployment approach.

Private sector

It is expected that en-route and destination charging will make up at least 50% of EVCP deployments in Birmingham, and a significant portion will be installed at private sites such as supermarkets, private car parks and petrol forecourts. This is the case in other cities; for example, in London, over 50% of new rapid EV sites installed in 2020 were on private land, and this share appears to be increasing.

Many national organisations already have plans for EVCP deployment and we will work with them to encourage growth in Birmingham. Table 5.2 provides and an overview of general deployment plans within sectors while Table 5.3, Table 5.4, and Table 5.5 provide more detailed information on the plans of individual organisations.

Deployment of EVCPs at public destinations will not be the sole remit of large national organisations with multiple car parks across the city such as those listed in Table 5.2. The Council and ESB will also seek to engage with independent businesses and forecourts to understand how such sites can support the wider public charging infrastructure.

Table 5.2: Overview of deployment plans within private sectors.

Supermarkets	Eight large chains have published charge point deployment plans or have significant deployment to date, representing approx. 90 sites in Birmingham.
Hotels	Five large hotel chains have published charge point deployment plans or have significant deployment to date, representing at least 22 sites in Birmingham.
Fuel Stations	There are a total of 75 fuel forecourts in Birmingham, the largest companies and their EVCP deployment plans are listed in Table 5.5. 12 fuel forecourts in Birmingham are operated by supermarkets whose plans are listed under these supermarkets.

Table 5.3: EVCP deployment plans for supermarkets with sites in Birmingham. Sources are provided in Table 6.8 in the Appendix.

Company	Target	Sites in Birmingham
TESCO	A target of 2,500 charge points in 600 stores by 2020 (unclear if reached). This represents 75% (796 stores) of Tesco's large (non-convenience) stores.	14 (inc 2 Extra and 6 Express)
ALDI	Target to deploy 140 charge point between 2020 – 2023 at their stores. Every new store will also have at least one EVCP with plans for 50 stores to open each year until 2025	16
Morrisons	50 charge points were deployed in 2019, with a further 50 planned in 2020.	7
LIDL	350 UK stores by 2022	11
M&S	Trail started August 2020 with 3 charge points installed at 1 store	6
Sainsbury's	No target announced but deployments underway	10 (including 2 local)
ASDA	No target announced but deployments underway	8
co op	No target announced but deployments underway	19

Table 5.4 EVCP deployment plans for hotel organisations with sites in Birmingham. Sources are provided in Table 6.9 in the Appendix

Company	Target	Sites in Birmingham
Premier Inn	600 charge points across 300 hotels	8
ACCOR HOTELS	No target announced but deployments underway	5 (Ibis and Novotel)
AA	All 4000 of their UK hotels offered a charge point	unclear
Best Western	All 270 hotels in UK with at least one, and increasing	1
IHG	UK wide plan of 20-30 new charge points per month	8 (Holiday Inn & Crowne Plaza)

Table 5.5 EVCP deployment plans for fuel suppliers with forecourts in Birmingham. Sources are provided in Table 6.10 in the Appendix

Company	Target	Sites in Birmingham
Shell	Aim to have 1-2 charge points in each of their 500 petrol stations	6
TOTAL	Extensive deployment plans in the UK but not clear target on the number deployed at Total's forecourts	unclear
bp	bp aims to double their number of public charge points in the UK and plans to deploy an increasing number of 150kW charge points at their forecourts.	8
mfg motor fuel group (JET, Esso, bp, TEXACO, MURCO)	40 charging hubs with 200 chargers are being developed in 2021, From 2022 MFG plans to develop 50 charging hubs each year. With 2,800 150kW charge points deployed across 500 sites by 2031	23 (4 Jet, 7 Esso, 12 Texaco)

Transport for West Midlands

Transport for West Midlands (TfWM) are in the process of developing a strategy for rollout of EV charging at their Park and Ride (P&R) sites. While these charge points will primarily target long-stay users – including commuters and leisure trip users – that charge during the day, suitability for residents, commercial fleets, hackney carriages and private hire vehicles,, and en-route users are also factors in prioritising sites for deployment. Modelling for TfWM estimates that 850 slow (7kW) charge points and 41 rapid (50kW) charge points could be deployed at P&R sites across the West Midlands, of which around 200 slow chargers and 10 rapid chargers could be deployed across 13 sites in Birmingham (Figure 5.4).

The Council, alongside ESB Energy, are working with TfWM to align and incorporate these sites into Birmingham's wider rollout plans. Where P&R sites are assessed to be strong opportunities to deliver fast and rapid charging, either as part of the first phase or wider deployment, we will work with TfWM to accelerate delivery at these sites.

Figure 5.4 Locations of TfWM Park and Ride sites across Birmingham

5.3 EV Charging Delivery Roadmap

Our deployment strategy and key activities to support our charging vision are summarised in the roadmap in Figure 5.5.

While this roadmap gives high-level, indicative timelines for delivery of the City-Wide network, in practice the precise rollout trajectory will depend on market trends and growth as well as available funding. We will work to ensure that the deployment approach is adaptable to continue to drive the EV transition and meet the needs of all users in Birmingham.

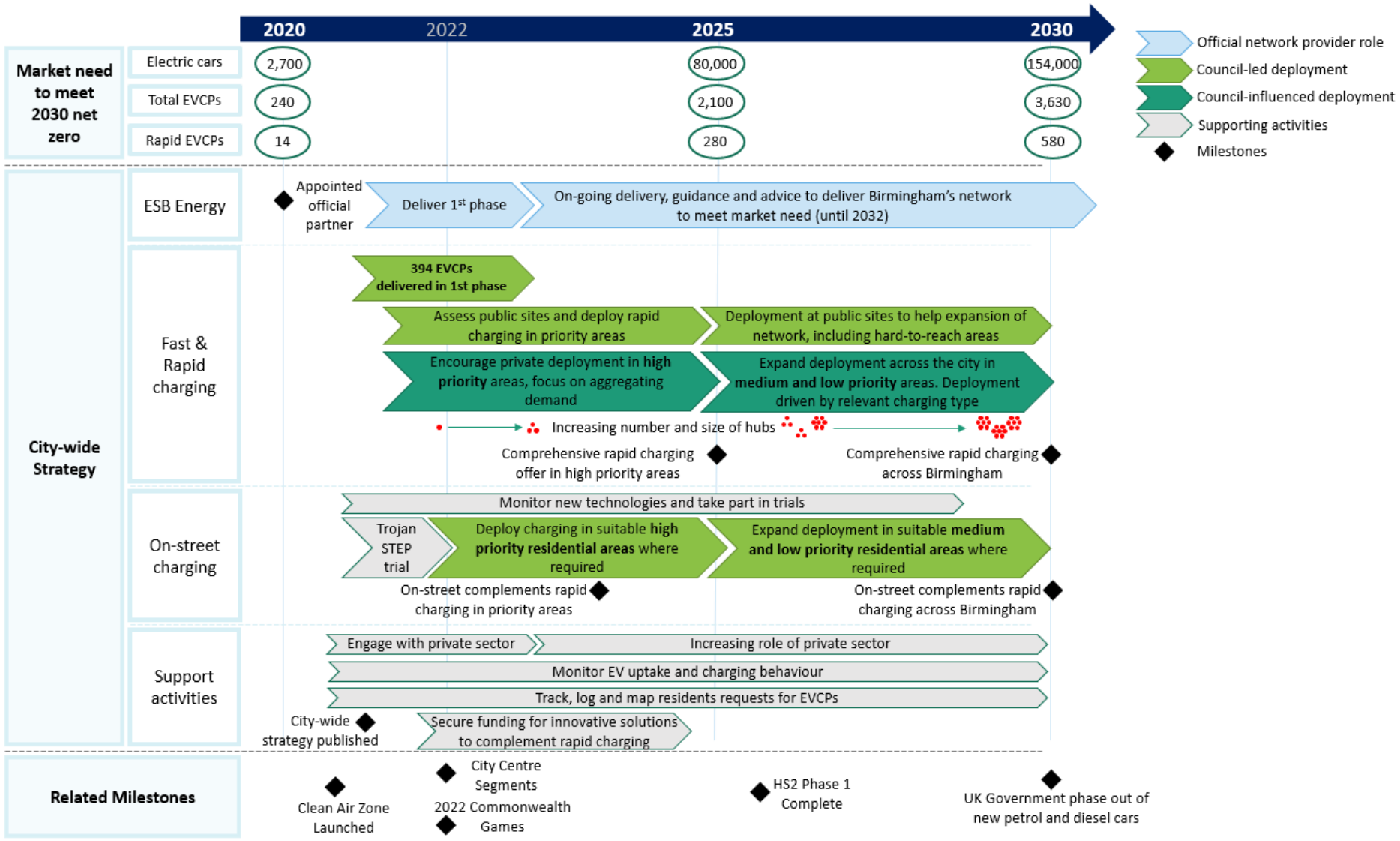


Figure 5.5 Roadmap for expanding charging infrastructure across Birmingham

6 Technical Appendix

6.1 Projected Uptake of Low Emission Buses and HGVs

Charging demand from buses and heavy goods vehicles (HGVs) have not been included in the analysis for this city-wide EV charging strategy for two main reasons:

1. Bus and HGV charging is expected to occur across a mix of depot-based and public infrastructure, with widespread public infrastructure likely developing later than at-depot.
2. Battery-powered bus and HGV availability and uptake is some way behind that of light vehicles and the percentage of stock transitioning to EVs over the timeframe of this strategy is expected to be relatively low.

Projected uptake of zero emissions vehicles (both battery electric and H_2 fuel cell) buses and HGVs are shown in Figure 6.1 and Figure 6.2. For both, the split between battery electric and fuel cell vehicles will depend on fuel cost and technology development. These projections were produced by Element Energy for the GB Gas Distribution Network Operators and National Grid,[29] and assume that all vehicles will have zero tailpipe emissions by 2050. To achieve this, sales of internal combustion engine (ICE) HGVs must end by 2040 to ensure the last models sold are off the road by 2050. The last sale of ICE buses is projected to occur before this, around 2035, due to the greater availability of zero emission models today and the total cost of ownership advantage of these buses compared to conventional vehicles. Although the UK Government is consulting on targets for ending the sale of heavy-duty ICE vehicles, policy is not currently in place to support this pace of uptake.

The increased power requirements for charging large vehicles (5-10 times higher than for cars and vans) means that buses and HGVs will rely on dedicated charging infrastructure rather than using the same public infrastructure deployed for cars and vans. Initially, bus fleets will rely largely on depots for charging but, as the electric bus fleet grows, there may be an increased reliance on en-route 'opportunity' charging, such as at route ends or at multiple sites along a route. Although a large share of HGV refuelling will occur at-depot, HGVs will rely more on public infrastructure than buses due to their duty cycles. As the market develops, a comprehensive, national public charging network will be vital for enabling long-haul HGVs to switch to zero emissions alternatives.

[29] Element Energy 'The Future Role of Gas in Transport' http://www.element-energy.co.uk/wordpress/wp-content/uploads/2021/04/20210325-CADENT_HYDROGEN_TRANSPORT_REPORT.pdf *published March 2021*

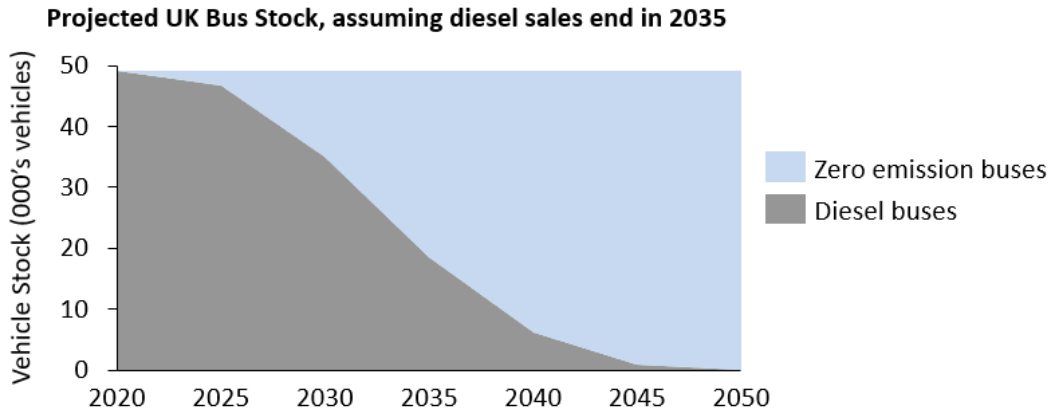


Figure 6.1: Projected bus stock in the UK split by broad powertrain.

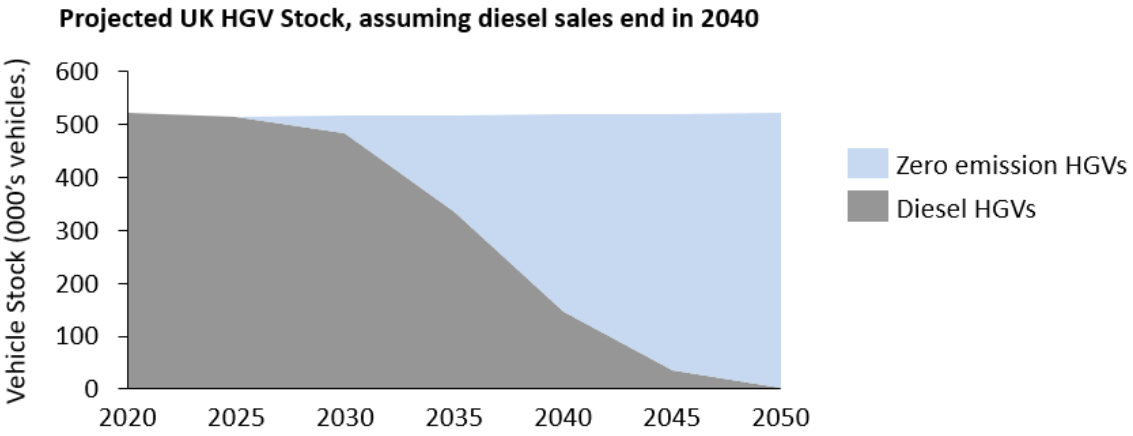


Figure 6.2: Projected HGV stock in the UK split by broad powertrain.

6.2 Modelling EV Uptake and Charging Demand

6.2.1 Model overview

The diagram shown in Figure 6.3 gives an overview of the modelling approach underpinning the projected EV charging demand within the city-wide EV charging strategy. Briefly, detailed stock modelling was carried out to project the number of EVs registered in Birmingham over the next decade and the number of kilometres travelled by those vehicles. The inputs for this section of the modelling were based on annual EV sales, turnover rates of vehicle stock and changes expected in vehicle kilometres travelled (vkm). The EV stock and total charging demand was then used to project EVCP requirements based on various scenarios for charging behaviour i.e. changing the ratio of rapid vs on-street chargers.

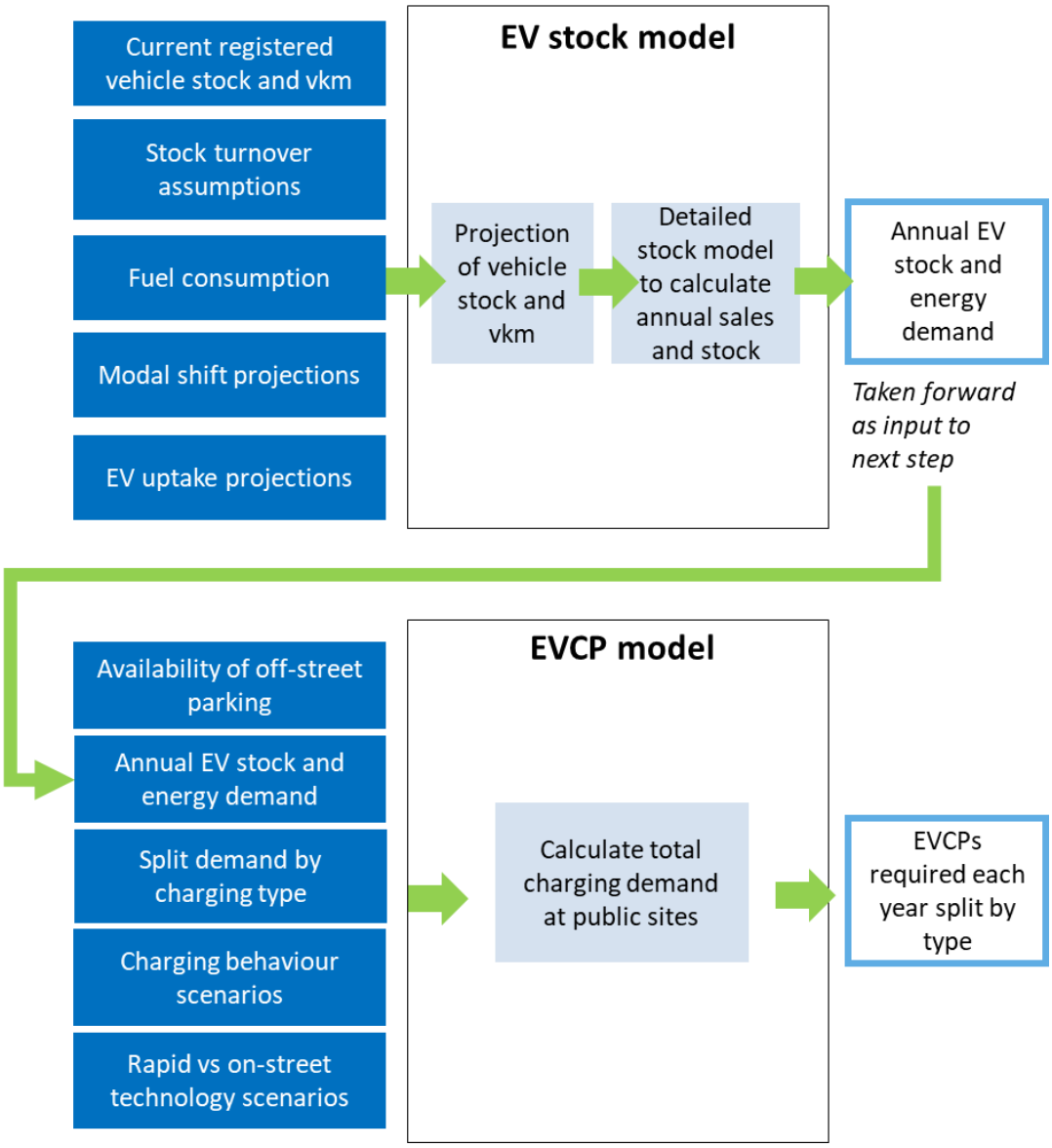


Figure 6.3: Diagram of the modelling process underpinning the city-wide EV charging strategy showing the input data, modelling steps and model outputs.

6.2.2 Vehicle stock and demand modelling

Core inputs and assumptions

Input parameter	Source and description
Current registered vehicle stock	Department for Transport statistics covering cars, vans (VEH0105) and motorcycles (VEH0122) Department for Transport statistics Hackney Carriage and private hire vehicle stock from Birmingham City Council licensing data
Current vehicle kilometres travelled	Department for Transport statistics covering cars, vans, motorcycles (TRA02) Department for Transport statistics Hackney Carriage and PHV calculated based on observed annual mileage (450 miles per week) from an Element Energy study for Birmingham City Council. For simplicity of modelling, Hackney Carriages and Private Hire Vehicles were modelled as one group (Taxis); however, it is acknowledged that these two groups have different duty cycles and different charging requirements in practice.
Fuel consumption	Fuel consumption is predicted by Element Energy's in-house Cost and Performance model (updated for DfT in 2020), which accounts for expected improvements in vehicle technology out to 2050.
EV uptake projections	Element Energy in-house ECCo model; a consumer choice model which takes into account policy and consumer preferences to forecast likely annual sales share, in use by DfT.
Modal shift projections	Based on SCATTER scenarios for Birmingham City Council and from the Committee on Climate Change's Sixth Carbon Budget for the UK Government

Modal shift scenarios

The impact of behaviour change from demand reduction and modal shift was represented by reductions in annual vehicle kilometres travelled (vkm). Table 6.1 and Table 6.2 show the modal shift required to meet each net-zero target for the vehicle types modelled. Although car clubs and shared cars were not explicitly modelled, the shift to shared vehicles is implicit within the change in car vkm.

Table 6.1: Adjustments to the annual vehicle kilometres travelled (vkm) as a result of modal shift ambitions under the 2030 net-zero compatible scenario.

Vehicle Type	Change in vkm compared to 2020	Source
Car	-26% (-40% relative to 2018)[30]	SCATTER modelling for Birmingham City Council (2019)
Van	+7% (-2.3% relative to 2018)	SCATTER modelling for Birmingham City Council (2019)
Motorcycle	-26% (-40% relative to 2018)	Assumed to be in line with car travel
Taxi	0%	Assumption

Table 6.2 Adjustments to the annual vehicle kilometres travelled (vkm) as a result of modal shift ambitions under the 2050 net-zero compatible scenario.

Vehicle type	Change in vkm compared to 2020	Source
Car	-1.3%	CCC Sixth Carbon Budget, Balanced Scenario
Van	+1.8%	CCC Sixth Carbon Budget, Balanced Scenario
Motorcycle	-1.3%	Assumed to be in line with car travel
Taxi	0%	Assumption

EV uptake projections

Cars and vans: EV uptake projections for cars and vans are based on expected sales out to 2030 under a scenario in line with the UK Government's planned phase out of new cars and vans. EV uptake is calculated using predicted EV sales from Element Energy's consumer choice EV uptake model, ECCo. This model accounts for expected policy interventions and improvements to EV and charging technology to predict how EV sales and stock change each year from the present day to 2050.

[30] SCATTER modelling projected vehicle usage decreases relative to 2018 data; however, these have been adjusted to account for reduced travel in 2020 due to the COVID-19 pandemic. It should be noted that as of Q1 2021, UK motor traffic levels have returned to pre-COVID levels.

Motorcycles: A lower ambition scenario was used, compatible with net zero by 2050 and based on scenarios used in net zero pathways for London.[31] This reflects the lower ambition of current national policy for motorcycles compared to cars and vans.

Taxis (Hackney Carriages and PHVs): Taxi EV uptake was assumed to be in line with cars. This is a highly ambitious projection and will likely require strong policy support to achieve.

The expected EV share of new vehicle sales are shown in Table 6.3.

Table 6.3: Share of EVs in new vehicle sales in 2025 and 2030.

	2025	2025	2030	2030
Vehicle type	**BEV**	**PHEV**	**BEV**	**PHEV**
Car	64.2%	15.3%	86.3%	13.0%
Van	**19.1%**	**0.3%**	**88.2%**	**6.7%**
Taxi (Hackney Carriage and PHV)	64.2%	15.3%	86.3%	13.0%
Motorcycles	16.1%	0.0%	65.0%	0.0%

It should be noted that in the modelling, sales of cars and vans do not reach exactly 100%. This is because the stock model assumes a small uptake of hydrogen fuel cell electric vehicles. In 2030 plug-in cars actually make up 99% of sales but, for simplicity, this is referred to as 100%

To calculate the total number of EVs in Birmingham, the share of new sales that are EVs was applied to the total number of new cars added to Birmingham's fleet each year, and scrappage assumptions were applied to the total stock to represent stock turnover. The modal shift scenarios considered in this strategy result in a different number of total vehicles registered in Birmingham out to 2030 and therefore a different number of EVs. Figure 6.4 and Figure 6.5 show the projected number of EVs out to 2030 in the net-zero 2030 compatible scenario and the net-zero 2050 compatible scenario.

[31] *Zero Carbon London: a 1.5°C Compatible Plan* (2018) Greater London Authority

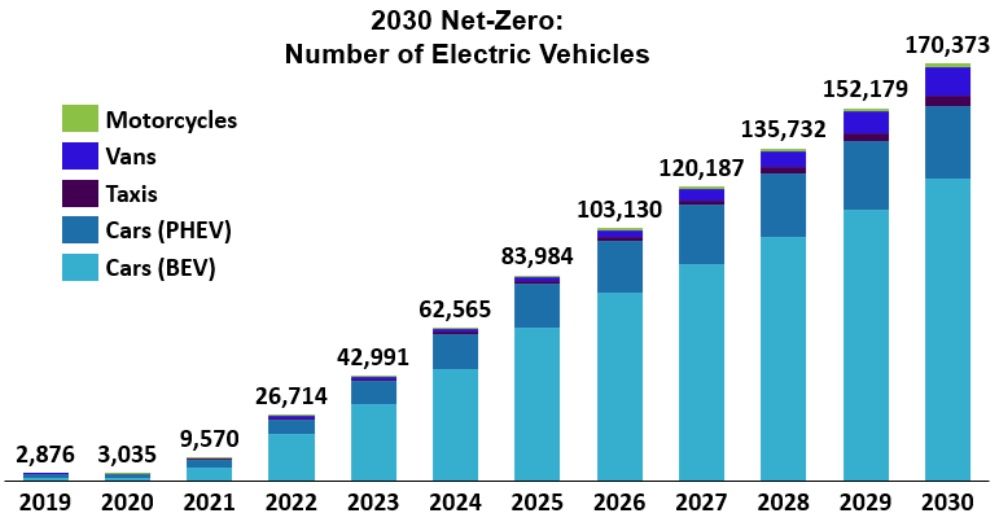


Figure 6.4: Projected EV numbers out to 2030 in the net-zero 2030 compatible scenario.

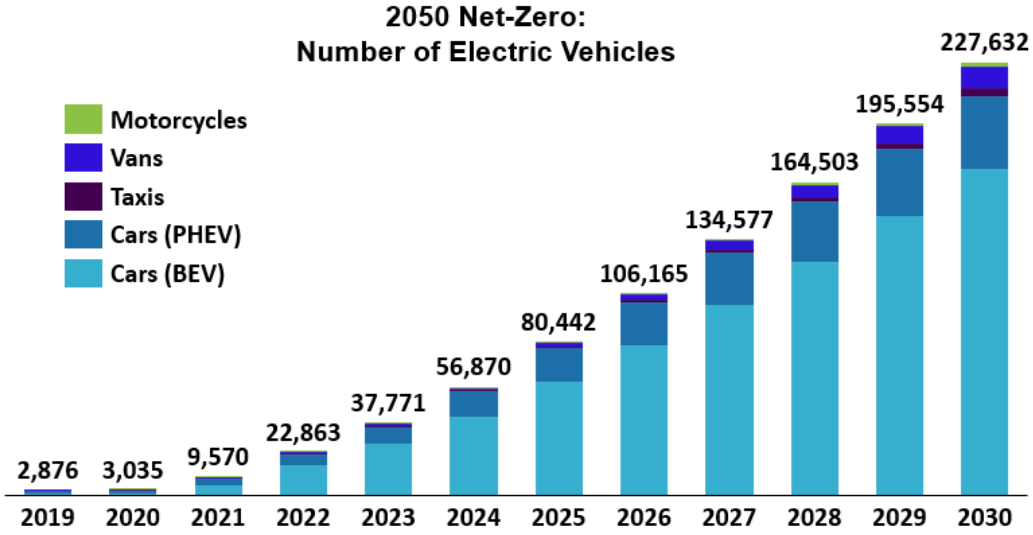


Figure 6.5: Projected EV numbers out to 2050 in the net-zero 2050 compatible scenario.

6.2.3 EVCP projections

Core inputs and assumptions

Charging behaviour is assigned based on findings from real-world EV charging behaviour trials.[32] The majority of a vehicle's charging needs have been found to be satisfied by residential charging (off-street or public charging depending on availability of off-street parking), with the remaining demand split across workplace, destination, and en-route charging. The splitting of charging demand across the various charging types that was used for this strategy are shown in Table 6.4. The charging demand that can be delivered by each

[32] *Electric Vehicle Charging Behaviour Study (2019) Element Energy for National Grid ESO*

EVCP is dependent on the power rating of the charge point; the assumptions on power ratings are given in Table 6.5.

Table 6.4: Values used for splitting of charging demand across charger types for BEVs and PHEVs.

BEV	Cars	Vans	Motorcycles	Taxis
Residential[33]	75%	95%	75%	75%
Work	10%	0%	10%	0%
Destination	5%	0%	5%	0%
Rapid en-route	10%	5%	10%	25%

PHEV	Cars	Vans	Motorcycles	Taxis
Residential	75%	95%	–	80%
Work	10%	0%	–	0%
Destination	15%	5%	–	20%
Rapid en-route	0%	0%	–	0%

Table 6.5: Assumptions used for average power drawn at charge points for each charger type.

Charger power / kW	2020	2030
Destination	**7**	**11**
Work	**7**	**11**
Rapid en-route	**100**	**150**
Residential on-street	**7**	**7**
Residential rapid	**50**	**50**

The number of cars with access to off-street parking was calculated using Element Energy's in house model for establishing dependency on on-street parking based on local building types.

The number of vehicles using each charge point is determined in different ways depending on the type of charge point being considered:

- Off-street residential charging: 1 charge point is assumed for each EV.

[33] Residential is assumed to be home charging for those with access to home charging and local (residential hub or on-street charging) for those reliant on on-street parking.

- On-street residential charging: a half-hourly charging demand profile for a peak demand day is used to assess the maximum level of charging demand required. Sufficient on-street residential chargers are assumed to be installed to meet this maximum demand level.
- All other public charging locations (workplace, destination, en-route): each charging type is assumed to be used only for a certain portion of the day. The energy transferred per charger each day is used to determine the number of chargers required to satisfy daily demand from EVs that charge in the area. Details of the assumption used in this strategy are provided in Table 6.6.

Table 6.6: Assumptions on charge point utilisation levels.

Charger type	2020	2030
Destination	20%	20%
Work	10%	10%
Rapid en-route	11%	25%

Impact of Technology Choice

To assess the impact of chosen charger technology on the number of EVCPs needed, three scenarios were considered, as detailed in Table 6.7. These scenarios were established using geospatial analysis in which each Middle Layer Super Output Area (MSOA)[34] in Birmingham was assessed and ranked based on a score for likely future charging demand (more detail provided in section 6.4). The MSOAs with the highest future demand were assigned as suitable for rapid hubs while the MSOAs with the lowest demand were deemed more suitable for on-street chargers. The demand score at which the suitability switched from rapid to on-street was varied to study the impact on the number of EVCPs required, the details of which are shown in Table 4.3 in the main body of the strategy.

Table 6.7: Share of total vehicles and vehicles without off-street parking in areas assigned to rapid hub charging based on the portion of MSOAs designated suitable for rapid hub charging.

Share of MSOAs assigned to rapid charging	Share of vehicles assigned to rapid MSOAs	Share of vehicles without off-street parking assigned to rapid MSOAs
50%	45%	60%
75%	70%	80%
90%	88%	94%

[34] Middle Layer Super Output Areas (MSOA) are geographic areas designed to improve the reporting of small area statistics in England and Wales; there are 133 MSOAs in Birmingham

EVCP projections

Figure 6.6 and Figure 6.7 show how the number of EVCPs of each type changes when the target date from net zero is moved from the 2050 UK-wide target to the Birmingham-specific 2030 target.

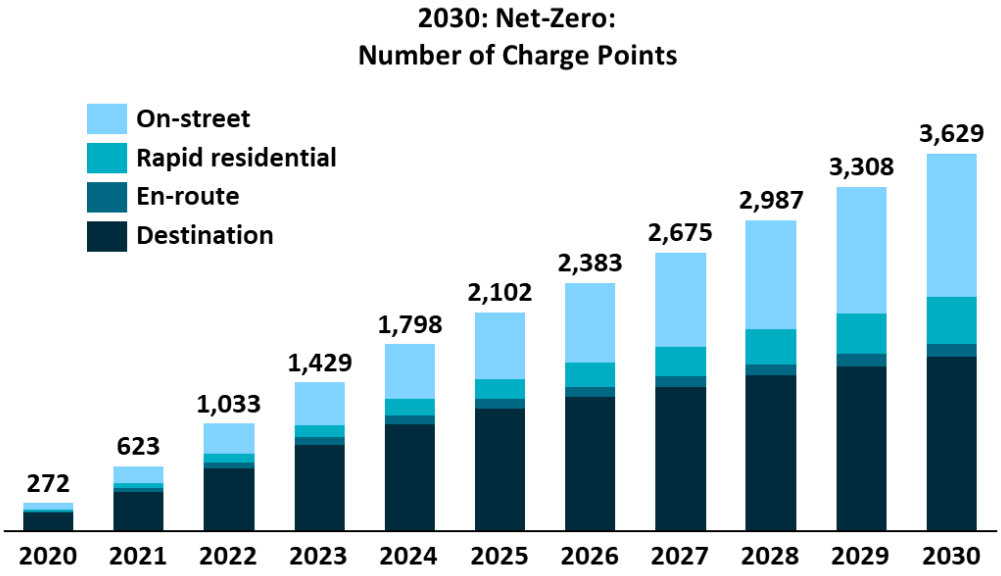


Figure 6.6: Number of EVCPs required for each year out to 2030 in the 2030 net-zero compatible scenario.

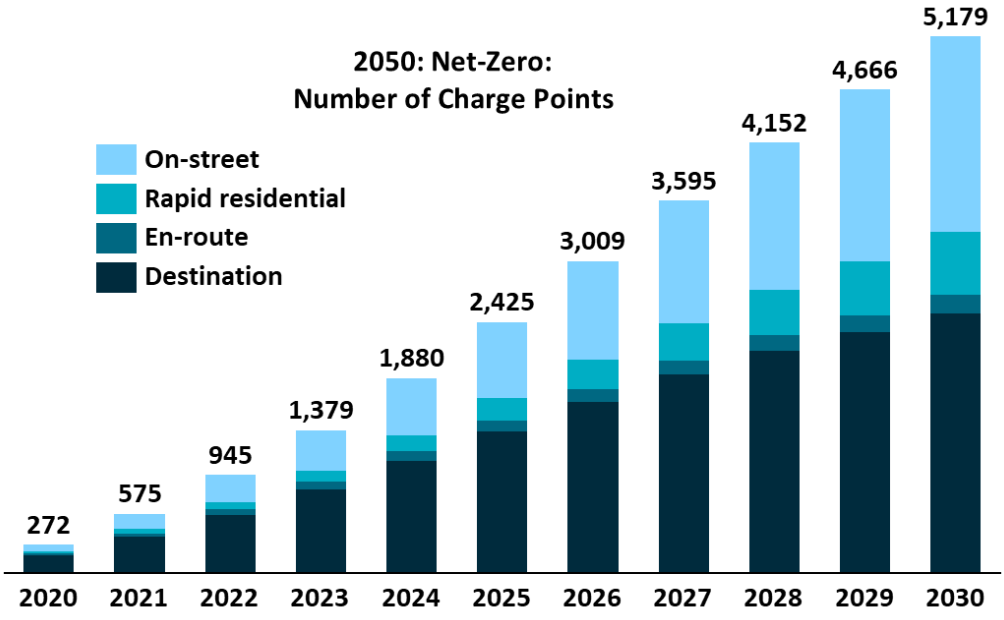


Figure 6.7: Number of EVCPs required for each year out to 2030 in the 2050 net-zero compatible scenario.

The number of EVCPs required in each of the scenarios shown in Figure 6.6 and Figure 6.7 follows a similar pattern to the EV uptake (as would be expected) where the 2030 scenario requires a more rapid roll-out of charging infrastructure. However, by 2024 more

infrastructure is required in the 2050 compatible scenario as modal shift has less of an impact on charging demand.

6.3 Mapping Data

Data	Source
TEMPro Trip End Data	The data used here is taken from the Trip End Model Presentation program (TEMPro) provides datasets for vehicle trips across the UK, which are approved by the Department for Transport and used widely for traffic modelling. Gov website- Trip End Model Presentation Program download
Reliance on On-Street Parking	Element Energy's off-street parking model was used to estimate the number of vehicles with access to off-street parking, with remaining vehicles being entirely reliant on on-street charging. The model is based on 2011 Census data on accommodation type broken down by number of cars and vans registered at each dwelling, and car and van ownership, at output area (OA) level.[35, 36] Estimates for the share of different household types with access to off-street parking were taken from a study conducted by the RAC Foundation[37] and used to determine the share of households and vehicles with access to off-street parking.
Traffic Flow	Traffic flow was taken from road traffic statistics published by the Department of Transport showing annual average daily flow data (AADF) for traffic flow along major roads in the UK. DFT- Road traffic bulk downloads
Amenities and Taxi Ranks	Data on the locations of amenities and taxi ranks are open source, retrieved from OpenStreetMap through GIS software.

6.4 Assessing suitability for rapid charging

To assess which areas of Birmingham will have the highest demand for EV charging, each MSOA in Birmingham was assessed on a number of metrics:

- Density of taxi ranks (number per km^2)
- Density of amenities (number per km^2)
- Highest traffic flow within MSOA
- Non-home based trips ending in MSOA, taken from TEMPro data (number per km^2)
- Reliance on on-street parking (number of cars and vans without access to off-street parking per km^2).

[35] ONS. *CT0876: Accommodation type (excluding caravans or other mobile or temporary structures) by car or van availability.* (2011)
https://www.ons.gov.uk/peoplepopulationandcommunity/housing/adhocs/009575ct08762011census
[36] Nomis. *KS404UK: Car or van availability*. (2014)
https://www.nomisweb.co.uk/census/2011/ks404uk
[37] Bates & Leibling. *Spaced Out – Perspectives on parking policy*. (2012)
https://www.racfoundation.org/research/mobility/spaced-out-perspectives-on-parking

The MSOAs were ranked, then assigned a score of 0-3 based on that ranking. An overall score based on combining the scores for each metric above was then assigned to each MSOA.

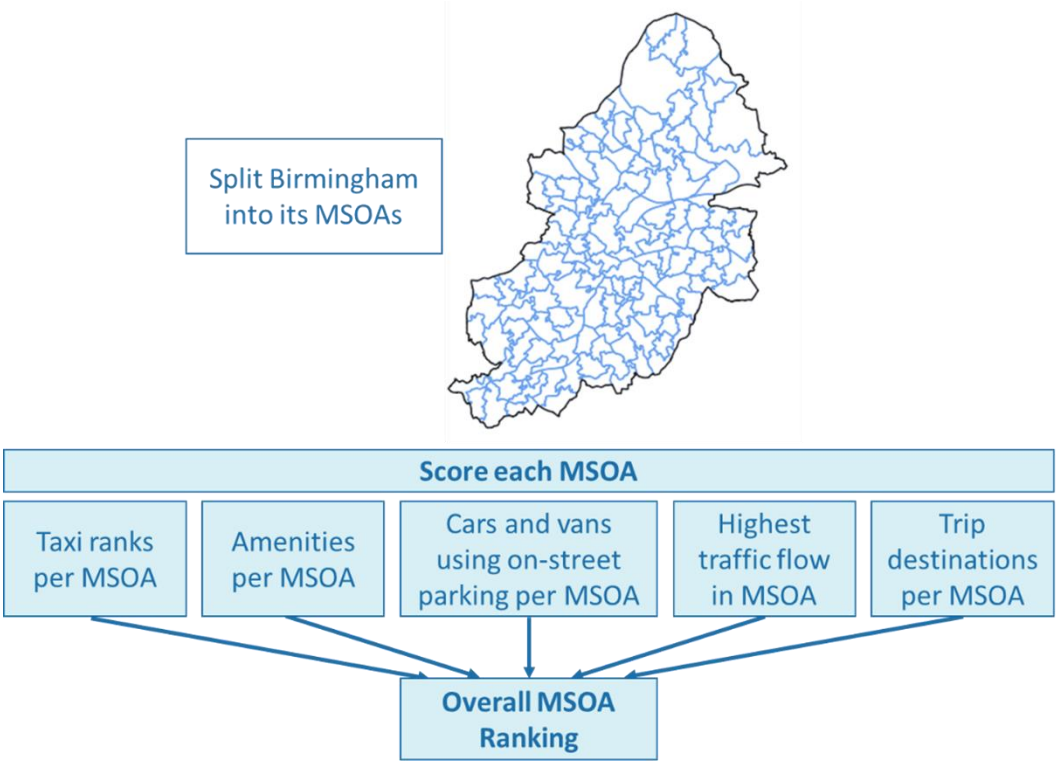


Figure 6.8: Illustration of MSOA scoring process.

The combined score was then used to rank MSOAs in order of likely future demand for EV charging. These rankings were then used to assign a portion of MSOAs as suitable for a focus on rapid hubs and the remaining MSOAs assigned as challenging areas likely to need on-street charging solutions. In general, the areas highlighted in the maps as high priority correspond to the top 25% highest scoring MSOAs, and medium priority to the top 50% highest scoring MSOAs.

The MSOA assignments function as an indicator for where is most (and least) likely to be suitable for rapid charging. The assumed suitability of an area may change over the coming years as a result of progress in charging technologies or emerging trends in customer charging behaviour.

6.5 Private Sector Deployment Targets

Table 6.8: Links to webpages detailing targets for supermarkets.

Company	Link
TESCO	https://www.volkswagen.co.uk/en/electric-and-hybrid/partnerships/tesco.html
ALDI	NewMotion and Aldi NewMotion and Aldi partner
Morrisons	Airqualitynews Morrisons unveils 'charge whilst you shop' rapid EV chargers
LIDL	Airqualitynews Lidl commits to installing 350 EV chargers by 2022
M&S	bp Pulse Chargemaster
ASDA co op Sainsbury's	Zap-Insights: Supermarket EV charge point numbers double in two years

Table 6.9 Links to webpages detailing targets for hotels

Company	Link
Premier Inn	Premier Inn electric chargers
ACCOR HOTELS	Novotel and Ibis Hotel electic vehicle charging points
AA	4,000 AA hotels and B&Bs offered EV charging points by Chargemaster
Best Western	Hotels with electric charging points
IHG	IHG offers EV drivers a warm welcome

Table 6.10 Links to webpages detailing targets for fuel suppliers

Company	Link
Shell	Shell charging network plans for the UK
TOTAL	Total partners with ChargePoint to develop UK EV infrastructure
bp	CMA MARKET STUDY INTO ELECTRIC VEHICLE CHARGING bp pulse charging map
mfg motor fuel group (JET, Esso, bp, Texaco, Murco)	mfg investment in chargers