Electric Vehicle Charging Infrastructure Strategy

Working Paper 4- Forecasting

TRANSPORT FOR THE South East ARCADIS

Transport for the South East (TfSE) Electric Vehicle Charging Infrastructure Strategy

Working Paper 4 – Forecasting

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Acronyms and Abbreviations

Acronym	Description
BAU	Business As Usual
BEV	Battery Electric Vehicle
CCC	Climate Change Committee
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DNO	Distribution Network Operator
EV	Electric Vehicle
EVCI	Electric Vehicle Charging Infrastructure
EVCP	Electric Vehicle Charging Point
GHG	Greenhouse Gases
HEV	Hybrid Electric Vehicles
ICE	Internal Combustion Engine
kW	Kilowatt
kWh	Kilowatt Hour
LGV	Light Goods Vehicle
MVA	Mega Volt Amp
NCR	National Chargepoint Registry
N_2O	Nitrous Oxide
PHEV	Plug-in Hybrid Electric Vehicle
PIV	Plug-in Vehicle
SERTM2	South East Regional Transport Model 2
SSEN	Scottish and Southern Electricity Networks
TfSE	Transport for the South East
UKPN	UK Power Networks
ULEV	Ultra Low Emission Vehicle

Executive Summary

Introduction
This working paper has been commissioned by Transport for the South East (TfSE) to establish the forecasting context for the levels of electric vehicle (EV) uptake, electric vehicle charging point (EVCP) provision and grid capacity across the TfSE study area.

This working paper comprises of five sections:

- EV Forecasting
- EVCP Forecasting
- Future Grid Analysis
- Identification of Suitable Locations
- Summary and Conclusions

EV Forecasting
EV forecasting analysis was undertaken for the years 2025 and 2030. Two forecast vehicle growth scenarios were applied to DfT vehicle registration data:

- a mathematical linear extrapolation of growth in EV uptake and
- a 2% National Highways steady growth factor application.

The following EV uptake projections were applied to total vehicles forecasted for 2025 and 2030 (utilising DfT's Road to Zero uptake scenarios):

Forecast Year	Uptake Scenarios (% of total vehicles registered that are EVs)		
	Low (Business as Usual)	Medium (Good Practice)	High (Exemplar)
2025	15%	20%	30%
2030	40%	50%	70%

The results show that by 2025, there will be between 638,000 and 1,348,000 EVs registered in the TfSE area. By 2030, this will increase to between 1,752,000 and 3,474,000. EVs will cover between 12.3 and 25.9 million miles in 2025, rising to between 33.7 and 66.8 million miles per day in 2030. Assuming these EVs have replaced diesel and petrol fuelled vehicles, this would save up to 10.47 million tonnes of CO2e emissions in 2030, of which 79,000 tonnes can be attributed to N2O savings.

EVCP Forecasting
Regional EV projections, trip purpose data, EV specifications, and charging behaviour statistics were translated into future demand for specific EVCP types based on typical use cases.

The three use cases used for this analysis are presented below:

- On-street residential (for those charging overnight).
- Public town centre (for those carrying out general domestic trips such as shopping).
- Destination rapid (for a visitor trip to and within the TfSE area).

The forecasted range of EVCPs within the TfSE area (low and high scenarios) are listed below:

- Residential (7kW) EVCPs: Between 5,600 - 11,900 by 2025, and 11,600 - 22,900 by 2030.
- Public (22kW) EVCPs: Between 480 – 1,010 by 2025, and 990 - 1,960 by 2030.
- Destination (50kW) EVCPs: Between 1,030 – 2,060 by 2025, and 2,060 – 3,600 by 2030.

Future Grid Analysis
A Red Amber Green (RAG) assessment of 455 primary substations was used to analyse the impact of projected 2025 EV uptake on the power grid across the TfSE area. This will identify any future upgrades which may be required by the Distribution Network Operator (DNO). The analysis showed that 312 substations (69%) in the region were rated 'Red' or 'Amber' and will require grid capacity upgrades to cater for the expected EV uptake by 2025. Regions requiring upgrades include: southern West Sussex, western Hampshire, southern Hampshire, northern East Sussex, western Berkshire, northern Isle of Wight

Identification of Suitable Locations

Optimal locations for EVCI installation were selected using geospatial analysis. The following parameters were used to assess geospatial suitability for new EVCPs across the TfSE area:

- existing EVCP.
- power availability.
- accessibility via car and public transport.
- surrounding land use.
- flood risk.

A bespoke web application was developed, displaying a suitability analysis heat map with optimal sites highlighted in green and suboptimal in red, to guide future planning of EVCPs across the TfSE area.

Summary and Conclusions

This working paper provides a strong evidence base to inform TfSE's EV Charging Infrastructure Strategy by establishing future EV adoption figures based on different uptake scenarios. The next stage will be to build upon this research and evidence base to:

- gain further understanding of the extent to which private and public fleet vehicles will affect public EVCI and depot-based demand on the grid (which will be carried out within working paper 5).
- ensure the overall strategy and action plan align with the findings of this working paper.
- help provide local transport authorities with an evidence base to develop their own EVCI strategies and provide sufficient EVCI.

1 Introduction

1.1.1 This working paper has been commissioned by Transport for the South East (TfSE) to establish the forecasting context for the levels of electric vehicle (EV) uptake, electric vehicle charging point (EVCP) provision and grid capacity across the TfSE study area.

1.1.2 There are several challenges to forecasting the levels of EV uptake, EVCP provision and grid capacity due to uncertainty of future EV uptake and the EVCP market. The current EV market is ever evolving with new, more efficient, and technologically improved models being released every year. It is acknowledged that 'specific predictions of the future mix and number of EVCPs are inherently uncertain in 2023 due to rapid developments in battery and charging technology, and because consumer preferences about where and when they would like to charge are still emerging'[1].

1.1.3 This working paper provides analysis of Battery Electric Vehicle (BEV) and Plug-in Hybrid Electric Vehicle (PHEV) uptake at a sub-national transport body and local transport authority level for the forecast years 2025 and 2030. From this analysis, the environmental impact is calculated through the average carbon dioxide (CO_2) and nitrous oxide (N_2O) savings, in tonnes per year, as a result of the shift from miles driven by internal combustion engine (ICE) vehicles to miles driven by EVs.

1.1.4 The next stage of analysis forecasts the future demand of EVCPs, based on overall vehicle trip lengths extracted from the regional transport model and from visitor data. Using these findings, estimates are made of the number of EVCPs required across the area to support future EV usage. These estimates are presented as ranges using different scenarios to ensure the uncertainty around future trends in the EV and EVCP market are captured.

1.1.5 A grid capacity assessment establishes the available headroom capacity across the TfSE area. Priority locations for electric vehicle charging infrastructure (EVCI) are identified, with optimal sites selected following a suitability assessment using a Geographic Information System (GIS).

1.1.6 This working paper comprises of five sections:

- EV Forecasting
- EVCP Forecasting
- Future Grid Analysis
- Identification of Suitable Locations
- Summary and Conclusions

1.1.7 Where applicable, the working paper references the relevant Appendices to supplement the evidence base.

[1] HM Government 2022 – Taking Charge: The Electric Vehicle Infrastructure Strategy https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1065576/taking-charge-the-electric-vehicle-infrastructure-strategy.pdf

2 EV Forecasting

2.1 Overview

2.1.1 This section describes the development of the three uptake scenarios used in the forecasting process, and a comparison against EV uptake scenarios from other reputable organisations. Using the baseline data presented within working paper 3, this section also provides an overview of the bespoke model developed to forecast future EV uptake in the TfSE area and the assumptions that feed into the model.

2.1.2 Data has been acquired through National Highways' South East Regional Transport Model 2 (SERTM2) on the current number, length, and purpose of car and van trips within the TfSE area. DfT registration data has been used to determine the total vehicles registered and two growth projections have been used to calculate the total number of vehicles in 2025 and 2030. This is described further in Sections 2.3 and 2.5.

2.1.3 The results show the number of forecasted EVs in 2025 and 2030 based on the three uptake scenarios and two growth projections. Using this information, environmental impacts of each scenario have been calculated, including the forecasted reduction in emissions of CO_2e and N_2O for each scenario.

2.2 Scenario Development

2.2.1 To align with industry projections, the analysis has drawn on EV uptake values to 2030 published in the DfT's Road to Zero (2018) report[2]. It should be noted, there is a level of uncertainty with all EV and EVCI forecasts and modelling given the fast-moving environment. The forecasting assumptions made in this section are comparative with those for other industry projections. This includes the DfT's "Transitioning to zero emission cars and vans: 2035 delivery plan" (2022) guidance document which introduced a ban on the sale of new ICE vehicles by 2030, indicating that 100% of all new vehicle sales should be EV in 2030.

2.2.2 Following a review of published research across the private and public sector (see Table 1 below for current EV/ULEV projections), this strategy uses the Road to Zero EV uptake scenario values. These provide an extensive range of possible total EV registrations in 2025 and 2030.

Table 1 - Desktop Research on EV/ULEV Projections

Source	Year	Low %	Medium %	High %	Comment
Road to Zero % (2018)	2025	**15%**	**20%**	**30%**	Cars - ULEV (new car sales) - approx. %
	2030	**40%**	**50%**	**70%**	
Transitioning to Zero Emission (2022)	2025	25%	34%	42%	Cars - ULEV (new car sales) - approx. %
	2030	60%	80%	100%	
	2025	8%	18%	28%	Vans - ULEV (new car
	2030	38%	70%	100%	

[2] HM Government, DfT: The Road to Zero (2018). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/739460/road-to-zero.pdf

Source	Year	Low %	Medium %	High %	Comment
					sales) - approx. %
CCC – Briefing Document – The UK's Transition to Electric Vehicles (2020)[3]	2032		55%		Passenger Vehicles and Vans
	2050		100%		
CCC – The Sixth Carbon Budget Surface Transport (2020)[4]	2030	27%	-	37%	% BEVs of the car and van fleet
National Grid's Future Energy Scenario[5]	2030	11%	-	36%	BEV penetration across the fleet
TfL London's 2030 Electric Vehicle (EV) infrastructure Strategy (2020)[6]	2025	9%	-	21%	Car and Van fleet (applied to total vehicles)
	2030	34%	-	49%	
GIPA[7]	2025	19%	-	21%	Car (ULEV)
AutoTrader[8]	2025		18%		Car (ULEV)
	2030		40%		
Average	2025	**15%**	**18%**	**20%**	Calculation incorporates CCC, TfL, GIPA,

[3] Climate Change Committee, 'Briefing document The UK's transition to electric vehicles'(2020) https://www.theccc.org.uk/wp-content/uploads/2020/12/The-UKs-transition-to-electric-vehicles.pdf
[4] Climate Change Committee, 'The Sixth Carbon Budget Surface Transport' (2020) https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Surface-transport.pdf
[5] ESO, Future Energy Scenarios 2022 https://www.nationalgrideso.com/future-energy/future-energy-scenarios
[6] TfL, 'London's 2030 electric vehicle infrastructure strategy' (2021) https://lruc.content.tfl.gov.uk/london-2030-electric-vehicle-infrastructure-strategy-executive-summary-december-2021.pdf
[7] IAAF, 'GiPA UK forecasts electrified vehicles will represent 20% of the passenger car parc by 2025' (2021) https://www.iaaf.co.uk/news/gipa-uk-forecasts-electrified-vehicles-will-represent-20-of-the-passenger-car-parc-by-2025/
[8] Autotrader, 'Demand for electric cars drops for first time since pandemic' (2022)https://plc.autotrader.co.uk/press-centre/news-hub/demand-for-electric-cars-drops-for-first-time-since-pandemic/

Source	Year	Low %	Medium %	High %	Comment
	2030	**28%**	**40%**	**41%**	AutoTrader, National Grid – dependent on available data for 2025 and 2030 forecast year.

2.2.3 The following scenarios were evaluated:

- **Low - Business-as-usual (BAU):** Assumes no change to policy; forecasts for 2025 and 2030 have been developed through extrapolating current registration trends with the use of DfT's benchmark of 15% (2025) and 40% (2030) of new car sales to be ULEVs respectively.
- **Medium - Good practice:** In line with the DfT's Road to Zero medium scenario which aims for 20% and 50% of new registrations to be ULEVs by 2025 and 2030 respectively.
- **High - Exemplar:** In line with the Government's aim for 30% and 70% of new sales to be plug-in vehicles by 2025 and 2030 respectively.

2.2.4 The low scenario does not reflect the accelerating growth in EV uptake and the political plans towards investing in EV technologies and adoption. Therefore, this scenario, although likely to underestimate the future number of EV registrations, offers a good baseline to illustrate the scale of change that will be required to achieve the remaining two scenarios.

2.2.5 The high scenario does the opposite and provides an 'upper limit' to our EV uptake projections and assumes that the perfect conditions exist to enable mass adoption of EVs across the UK between now and 2030. Achieving this scenario is similarly unlikely as it would require substantial investment from the private and public sector to remove the real (economic, supply chain, lack of infrastructure, energy) and perceived (range anxiety, mistrust of the technology) barriers that currently limit EV adoption. This scenario has been included to provide upper limit EVCP projections, which will inform discussions surrounding future-proofing the EVCP network beyond 2030.

2.2.6 The medium scenario has been developed following extensive desktop research on EV projections from similar studies published by private and public sector organisations. This scenario puts forward the most likely EV uptake projections and is closely aligned with industry projections. This scenario is intended to provide the most likely number of total registered EVs in 2025 and 2030, and the EVCP network that will be required to supply it.

2.3 Future Vehicle Uptake

2.3.1 Based on the baseline data presented within working paper 3, a bespoke model was developed to forecast future EV uptake in the TfSE area.

2.3.2 Two forecasting growth scenarios were applied to the DfT vehicle registration data:

- a mathematical linear extrapolation of growth in EV uptake and
- a 2% National Highways steady growth factor application.

2.3.3 Further information on the scenarios is provided in Section 2.5.1. Figure 1 shows the approach used for establishing growth in vehicle registrations. This has been used to calculate the potential variances in the number of EVs likely to be registered, average trip lengths and the impact on the environment.

2.4 Assumptions

2.4.1 To forecast the number of registered EVs and the total distance travelled in EVs across the TfSE area, several assumptions have been made. These include:

- EVs are assumed to be BEVs, PHEVs and fuel cell electric vehicles.
- ICE vehicles are assumed to be petrol and diesel engine cars.
- Only privately owned electric cars and LGVs registered in the defined districts and boroughs of the TfSE area have been considered.
- HGVs have not been considered.
- There is no net change in EVs entering or leaving the TfSE area because of residential or business relocations.
- The Low BAU scenario will be achievable and EV uptake will continue to increase within the TfSE area.
- Current vehicle usage (trip numbers, lengths and purposes) has been obtained from pre-covid 2019 National Highways' South East Regional Transport Model 2 (SERTM2) data, and is assumed to be representative.
- Current vehicle usage is projected following the same growth model applied to total vehicle registrations (linear extrapolation or National Highways 2% steady growth) to forecast future vehicle usage for different scenarios.
- As SERTM2 does not distinguish between private and company owned LGV trips in a district or borough, it is assumed that this split is equivalent to the split of private and company owned vehicle registrations for that district or borough (available from DfT registration data).
- Forecasted 2030 EVCP demand has been calculated using projected 2030 EV specifications.

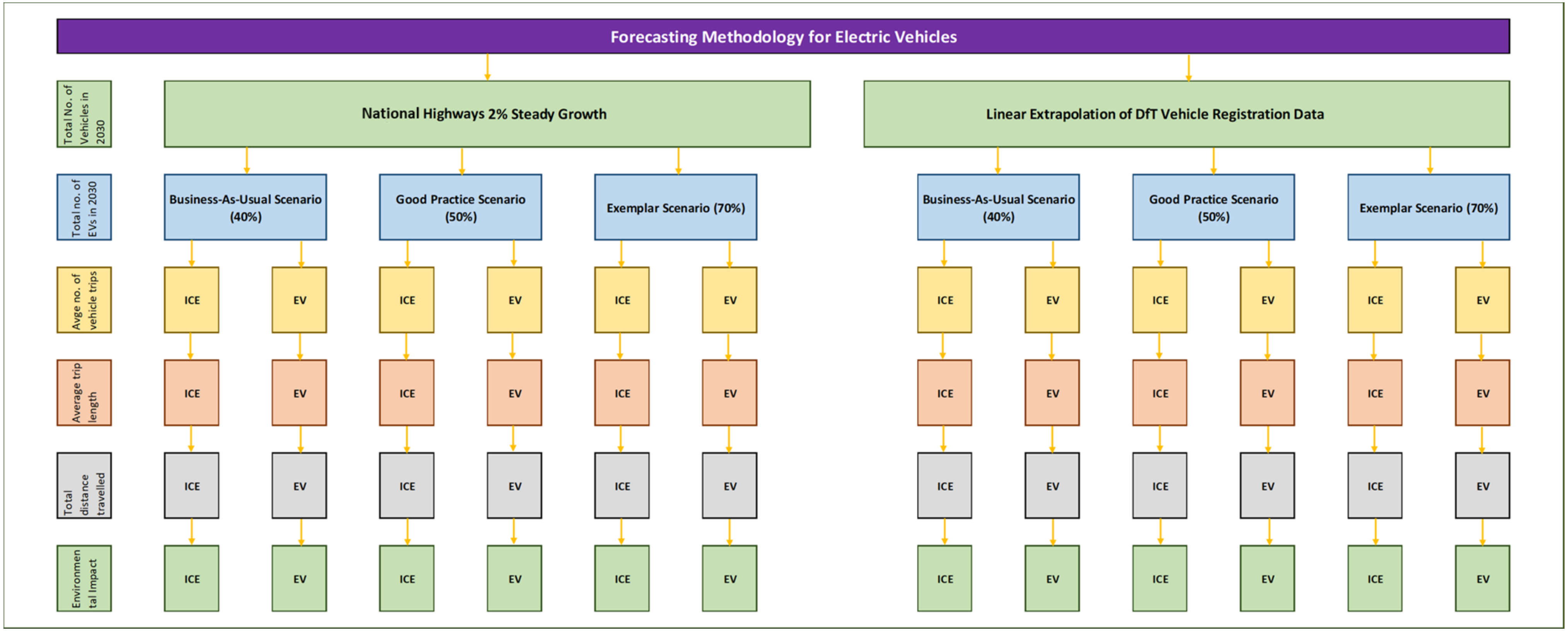


Figure 1 - Forecasting Methodology for Electric Vehicles

2.5 Future vehicle uptake in the UK

2.5.1 To show the potential variance in the general number of vehicles expected to be registered in the TfSE area by 2030, two growth projections were used: National Highways' 2% steady growth and DfT's linear extrapolated growth. Each projection has its strengths and weaknesses as outlined in Table 2 below:

Table 2 - Linear Extrapolation vs National Highways 2% Growth

National Highways 2% Steady Growth		Linear Extrapolation	
Advantages	Disadvantages	Advantages	Disadvantages
Consistent, predictable growth rate.	*Does not account for sudden shifts in technology which impacts uptake (although the extent to which this can be forecast is questionable).*	*Accounts for current trends to project similar uptake.*	*Does not account for sudden shifts in technology which impacts uptake (although the extent to which this can be forecasted is questionable).*
Provides a consistent change that is not impacted by outliers in data.	*Does not account for localised differences in uptake of vehicles.*	*Accounts for localised differences in uptake of vehicles.*	*Is impacted by outliers in data such as COVID-19 impacts.*
Gives a much more accurate representation of an average change in vehicle uptake across the UK over several years.	*Does not take account of the varied changes in uptake each year such as slumps in car sales.*	*Takes account of the varied changes in uptake each year such as slumps in car sales.*	*Difficulties establishing vehicle uptake across the UK over several years.*
Provides a representation across multiple areas that averages out potential variances between local authorities.			*Provides a representation across multiple areas that does not average out potential variances between local authorities.*

2.5.2 Both projections have been used to calculate the average changes in the total number of vehicles registered as well as the local and yearly variances in data. The actual number of vehicles registered in the future is likely to be somewhere between the two projections. The linear extrapolation method includes a vehicle growth of approximately 0.6% per year which is slightly lower than other forecasts including the DfT Road Traffic Forecasts[9]. The 2% growth assumption is at the higher end of vehicle growth forecasts and is therefore, based on a 'worst-case' scenario whereby demand for private vehicles continues to grow rather than diminish in favour of more sustainable transport modes. This will likely be an overestimate of future vehicle registrations.

2.5.3 Figure 2 Figure 2 - Licensed Cars Across the TfSE Study Area Between 2009 and 2021shows the total number of registered cars at the end of each year between 2009 and 2020 within the TfSE area.

[9] DfT, National Road Traffic Projections (2022). https://www.gov.uk/government/publications/national-road-traffic-projections

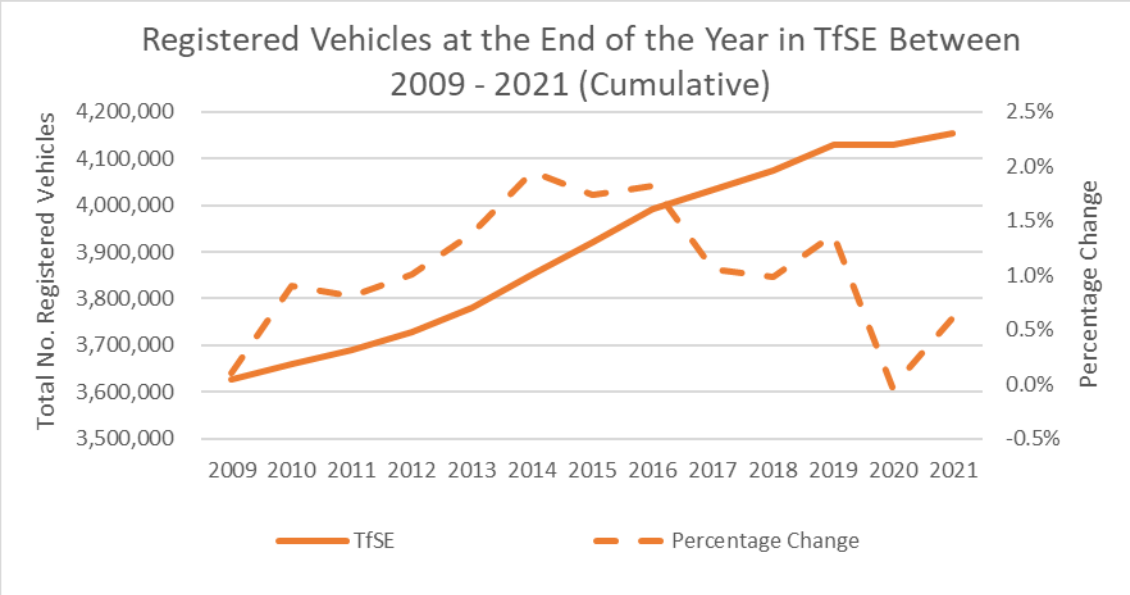


Figure 2 - Licensed Cars Across the TfSE Study Area Between 2009 and 2021

2.5.4 As can be seen from the graph, the TfSE area has seen substantial growth in the number of registered vehicles over the twelve-year period**, reaching a total of over 4,100,000 registered vehicles by 2021** (an overall increase of 525,434 vehicles since 2009, equating to a 12.65% increase).

2.5.5 Table 3 below shows the total numbers of vehicles expected to be registered, within the TfSE area, in 2025 and 2030 for both the National Highways 2% Steady Growth and Linear Extrapolation projections.

Table 3 - Forecasted Licensed Vehicles in the TfSE Study Area at the end of 2025 and 2030

Forecast Year	*National Highways 2% Steady Growth*	*Linear Extrapolation*
2025	*4,496,193*	*4,254,913*
2030	*4,964,003*	*4,381,250*

2.5.6 Table 3 shows that there is a noticeable difference in the number of registered vehicles forecast between the two projections, with a difference of over 241,000 registered vehicles by 2025 and increasing to over 582,000 by 2030. It is assumed that the total number of licensed vehicles in the TfSE study area at the end of 2030 will be between 4,381,250 and 4,964,003.

2.6 Future EV uptake in the TfSE area

2.6.1 BEV sales records for the TfSE area were taken from the DfT vehicle registration data. Baseline analysis of EV uptake for the TfSE area is covered in working paper 3. From this analysis, it is shown that by 2021 Q4, the South East region had around **34,133 BEVs registered**, which is higher than any other region in the UK. During 2021 BEVs accounted for **0.65% of total vehicles** registered across the TfSE area, a **76% increase from 2020**.**Error! Reference source not found.**Figure 3 below shows the projected number of registered EVs in 2025 and 2030, for the TfSE study area, under each of the Low (BAU), Medium (Good Practice) and High (Exemplar) scenarios, using both projection methodologies.

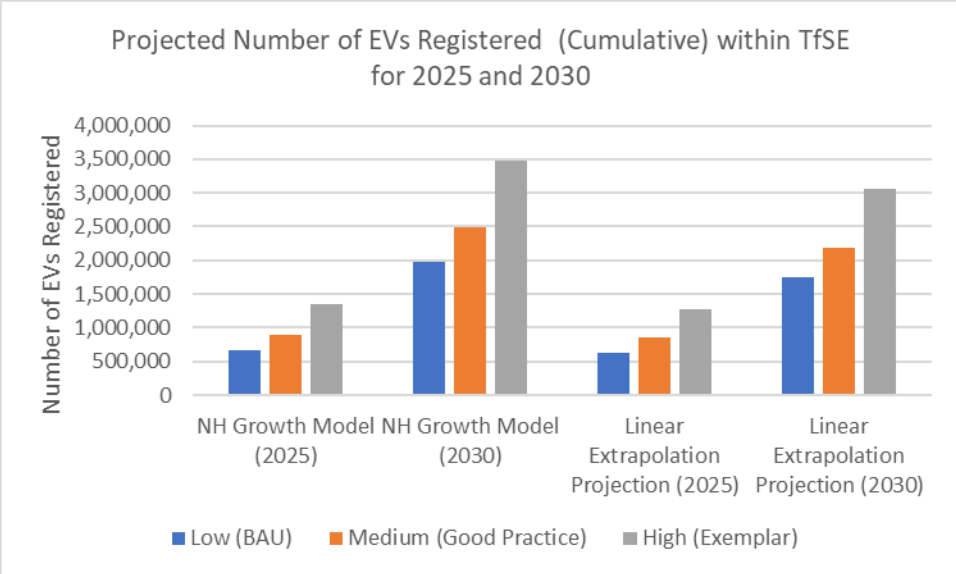


Figure 3 - Forecast Number of EVs in the TfSE Study Area at the end of 2025 and 2030

2.6.2 There is forecast to be a minimum registration of **over 638,230 to 674,400 EVs by 2025** according to the Linear Exponential Projection and the National Highways Vehicle Registration data to reach Low (BAU) levels.

2.6.3 There is forecast to be a maximum registration of **over 3,066,850 to 3,474,780 EVs by 2030** within TfSE area according to the Linear Exponential Projection and the National Highways Vehicle Registration data to reach High (Exemplar) levels.

2.6.4 EV registration forecasts for each local transport authority within the TfSE area are presented in 0, these are mapped in **Error! Reference source not found.**.

2.7 Vehicle usage

2.7.1 Vehicle usage data was acquired from National Highways' SERTM2. The total distances travelled for each selected projection, and year combined across the entire TfSE area are presented below in **Error! Reference source not found.**.

Table 4 - Total Distance Travelled Based on Selected Projection and Forecast Year

	National Highways 2% Steady Growth Projection		*Linear Extrapolation Projection*	
Vehicle Usage	*2025*	*2030*	*2025*	*2030*
Total Distance Travelled (miles)	*86,475,534*	*95,475,977*	*81,868,059*	*84,340,599*

2.7.2 Values of total distance travelled were then multiplied by the % EV uptake values based on the different forecast scenarios. This allows calculation of the total miles driven by EVs within the TfSE area, which enabled calculation of the projected environmental impacts.

2.7.3 Table 5 and Table 6 below show the total number of EVs forecasted and the total travelled distance (miles per day) based on the National Highways Steady Growth Forecast and the Linear Extrapolation Forecast, respectively, for each EV uptake scenario (Low (BAU), Medium (Good Practice) and High (Exemplar).

Table 5 - Total Distances Travelled by EVs in 2025 and 2030 in the TfSE Study Area Based on National Highways Growth Forecast, EV Uptake Scenarios and Vehicle Usage

Vehicle Usage/EV Uptake Scenarios		Low (BAU) Scenario	Medium (Good Practice) Scenario	High (Exemplar) Scenario
Number of EVs	2025	674,429	899,222	1,348,828
	2030	1,985,601	2,481,991	3,474,781
Total miles travelled per day	2025	12,971,330	17,295,107	25,942,660
	2030	38,190,391	47,737,988	66,833,184

Table 6 - Total Distances Travelled by EVs in 2025 and 2030 in the TfSE area based on Linear Extrapolation Forecast, EV Uptake Scenarios and Vehicle Usage

Vehicle Usage/EV Uptake Scenarios		Low Uptake	Medium Uptake	High Uptake
Number of EVs	2025	638,237	850,973	1,276,447
	2030	1,752,500	2,190,607	3,066,854
Total miles travelled per day	2025	12,280,209	16,373,612	24,560,418
	2030	33,736,240	42,170,300	59,038,419

2.7.4 The tables show that for both the National Highways Growth Forecast and the Linear Extrapolation Forecast, the total distances travelled by EVs increases in line with the proportion of EVs expected on the roads in the study area. The number of miles driven by EVs almost triples over five years, which results in equivalent emissions savings on the assumption that EV miles driven replace ICE miles driven.

2.8 Environmental impact

2.8.1 To assess the environmental impact of EV uptake, 2022 emissions factors[10] were taken from Department for Environment, Food and Rural Affairs (DEFRA) GHG conversion factors. DEFRA emissions factors provide the average CO_2e (carbon dioxide equivalent) and N_2O emissions in kilograms per mile for different types of vehicles including petrol, diesel, PHEV and BEV. Emission factors include up-stream emissions, including grid emissions from the generation of electricity by the UK power grid used to charge PHEVs and BEVs.

	ICE		EV		Difference (ICE – EV)	
GHG	N_2O	CO_2e	N_2O	CO_2e	N_2O	
kg / mile	0.2758	0.001805	0.1114	0.00057	0.1644	0.00124

2.8.2 Table 7 presents the DEFRA emission factors (in kg per mile) for both ICE vehicles (petrol and diesel) and EVs (BEV and PHEV).

2.8.3 For this analysis, average values were used for ICE vehicles and EV, to calculate the average CO_2e and N_2O savings in tonnes per mile driven by an EV rather than an ICE, as shown in Table 8. Forecasts have been made assuming 2021 emissions factors remain constant however, there are multiple factors that will impact this in future years (e.g. renewable energy generation for grid electricity). This means that these emission factors will underestimate the environmental benefits over time as the grid moves to a higher proportion of power generated from renewables.

Table 7 - DEFRA Emission Factors for ICE Vehicles and EVs

	ICE		EV		Difference (ICE – EV)	
GHG	N_2O	CO_2e	N_2O	CO_2e	N_2O	
kg / mile	0.2758	0.001805	0.1114	0.00057	0.1644	0.00124

2.8.4 Projected total emissions were calculated for each EV uptake scenario for both the National Highways 2% and Linear Extrapolation growth models. The results of this analysis are presented below, in **Error! Reference source not found.** and Table 9, and include the total distance travelled by EVs and the corresponding reduction in CO2e and N_2O emissions in tonnes per year.

2.8.5

		Low Uptake	Medium Uptake	High Uptake
Total Daily EV distance (miles)	2025	12,971,330	17,295,107	25,942,660
	2030	38,190,391	47,737,988	66,833,184
Total Carbon Savings (tCO_2e per year)	2025	2,032,096	2,709,461	4,064,191
	2030	5,982,928	7,478,659	10,470,123

[10] DEFRA, GHG Reporting: Conversion Factors (2022). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1083854/ghg-conversion-factors-2022-condensed-set.xls

Total N_2O Savings (tN_2O per year)	*2025*	*15,325*	*20,434*	*30,651*
	2030	*45,121*	*56,401*	*78,962*

Table 8 – Emissions Saved Based on EV Uptake for 2025 and 2030

Table 9 - The Total Daily Distance Travelled by EVs and the Potential Emissions Savings for the Linear Extrapolation Forecast

		Low Uptake	*Medium Uptake*	*High Uptake*
Total Daily EV distance (miles)	*2025*	*12,280,209*	*16,373,612*	*24,560,418*
	2030	*33,736,240*	*42,170,300*	*59,038,419*
Total Carbon Savings (tCO_2e per year)	*2025*	*1,923,824*	*2,565,099*	*3,847,649*
	2030	*5,285,138*	*6,606,422*	*9,248,991*
Total N_2O Savings (tN_2O per year)	*2025*	*14,509*	*19,345*	*29,018*
	2030	*39,859*	*49,823*	*69,753*

2.8.6 Forecasted emission savings as a result of EV uptake for each local transport authority within the TfSE area are presented in 0.

2.9 Forecast Model Result Summary

2.9.1 A forecasting assessment has been undertaken to investigate EV uptake and provide a comparison against ICE vehicles, including environmental impact considerations.

2.9.2 Based on **Error! Reference source not found.Error! Reference source not found.** and Table 9 there is the potential to save between **1,923,824 tonnes and 4,064,191 of CO_2e per year by 2025**. By 2030, these saving would increase to **5,285,138 tonnes and 10,470,123 tonnes** because of increased EV uptake for general use within the TfSE area. One tonne of **CO_2 emissions is the equivalent of the average emissions of one passenger on a return flight from Paris to New York[11].**

2.9.3 There is also the potential to save anywhere between **14,509 tonnes and 30,651 tonnes of N_2O per year by 2025**. By 2030, these reductions could increase to between **39,859 tonnes and 78,962 tonnes** because of increased EV uptake.

2.9.4 Using the Linear Extrapolation forecasting method, **EV uptake in the TfSE area could save 6,606,422 tonnes of CO_2 emissions and 49,823 tonnes of N_2O each year by 2030,** if a Medium scenario for EV implementation is achieved. The medium scenario is where 50% of all vehicle registrations are EVs**.**

2.9.5 However, to achieve these benefits, this will require **2,190,607 EVs** (Table 6) to be on the roads by 2030. This, compared to the current figure of approximately **34,133 BEVs** demonstrates the growth needed in the number of EVCPs that will be required to support this demand.

[11] Climate Neutral Group, What Exactly Is 1 Tonne of CO2? https://www.climateneutralgroup.com/en/news/what-exactly-is-1-tonne-of-co2/

2.10 Forecast for 2050

2.10.1 Desktop research revealed that by 2050, up to 49 million vehicles would be electric, accounting for 100% of vehicle stock in the UK[12]. According to Ofgem, by 2050, electric cars and vans are expected to need 65-100TWh of electricity annually: an increase of 20-30% over today's levels[13]. Limited research is currently available on detailed modelling for 2050 forecasts due to uncertainty around the rapidly changing EV and EVCI market, population and housing growth, policy investment in EVs and EVCI and changes in the way we work and travel. Forecasts which project EVs to account for 100% of all cars and vans on the road by 2050 would also need to factor in alternative fuels such as hydrogen. At present, hydrogen as a fuel source for the automotive industry is at its infancy in terms of market share in the UK. However, hydrogen holds considerable potential to account for a larger market share in the future with further investment in the supply side.

[12] Climate Change Committee - Briefing document The UK's transition to electric vehicles https://www.theccc.org.uk/wp-content/uploads/2020/12/The-UKs-transition-to-electric-vehicles.pdf
[13] Ofgem - Enabling the transition to electric vehicles https://www.ofgem.gov.uk/sites/default/files/2021-09/Enabling%20the%20transition%20to%20electric%20vehicles%20-%20the%20regulators%20priorities%20for%20a%20green%20fair%20future.pdf

3 EVCP Forecasting

3.1 Overview

3.1.1 The next stage of analysis forecasts the future demand of EVCPs in 2025 and 2030, based on overall vehicle trip lengths extracted from SERTM2 and visitor data. To do this, different trip types and the appropriate EVCP in each case were considered. These were:

- On-Street Residential (7 kW) EVCP– General domestic / commuter trips
- Town Centre / Public Fast (22 kW) EVCP – General domestic / leisure trips
- Rapid Destination (50 kW) EVCP – Visitor Trips

3.1.2 An overview of the three typical trip use cases were considered for which three different EVCP types would be best suited. This is presented in **Error! Reference source not found.**.

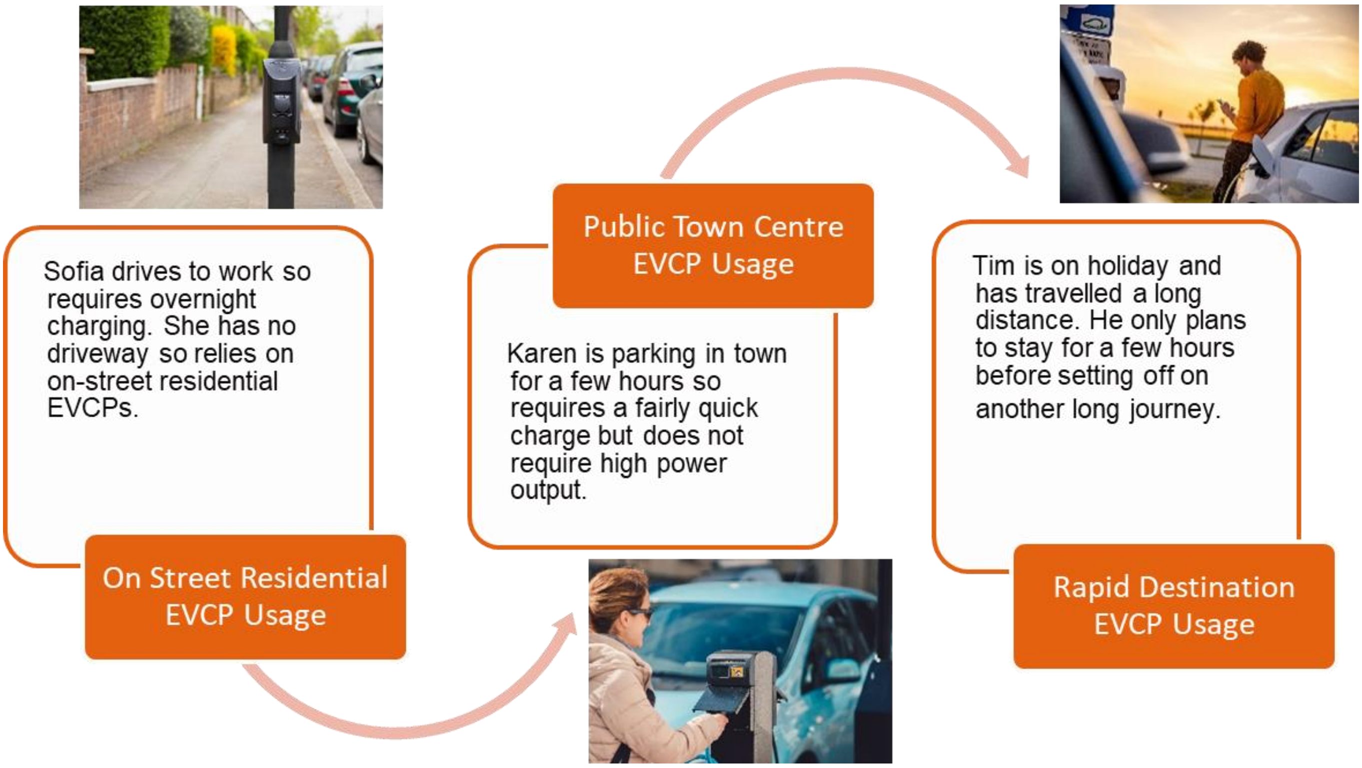


Figure 4 - Different EVCP Use Cases

3.1.3 The trip types and EVCP use cases have been developed to ensure that the modelling covers the key locations and the common types of trips made that would require the use of public charging. This approach follows a similar method to the modelling undertaken in HM Government's 2022 publication 'Taking charge: the electric vehicle infrastructure strategy'[14] with their national forecasts based on 'Residential on-street', 'Destination', and 'Transit' use cases.

3.1.4 The charging infrastructure associated for each use case has been selected to represent the most suitable option based on expected dwell time at each location. This is further discussed in Section, 3.5, 3.6 and 3.7.

3.1.5 It should be noted that the following EVCP forecasting does not account for freight trips and company owned vehicles. The modelling for these use cases will be progressed at a later stage to forecast the level of EVCP demand at depot sites and on the public charging infrastructure network.

3.1.6 Further information on the different types of EVCPs, their power ratings, and their typical use cases is covered in working paper 3 – Establish Baseline.

3.2 Total Daily Mileage – General domestic, leisure and commuter trips

3.2.1 To calculate the overall number of vehicle trips, and therefore the total distances travelled of private car and LGV use classes for different trip purposes, data has been extracted from SERTM2 for each Local Development Authority (LDA) that lies within the study area. The model outputs are available for a 24-hour period with a base year of 2019.

3.2.2 Overall vehicle trip lengths extracted from the SERTM2 model for Car Commuting (UC1), Car Business (UC2) and LGV (UC4) user classes were considered for general domestic / commuter vehicle trips. Car Others (UC3) and LGV (UC4) user classes were considered for general domestic / leisure trips. The SERTM2 model outputs for the overall TfSE study area are summarised below for the base year of 2019:

- General domestic / commuter vehicle trip lengths – 66.52 million kms
- General domestic / leisure trips vehicle trip lengths – 75.37 million kms

3.2.3 It is assumed that total vehicle kilometers travelled within the TfSE area will grow at the same rate as the number of vehicles forecasted in the study area by 2025 and 2030. This was determined by assessing the National Travel Survey (NTS) dataset Table NTS0308b15 to understand average distance travelled by trip length and mode in England.

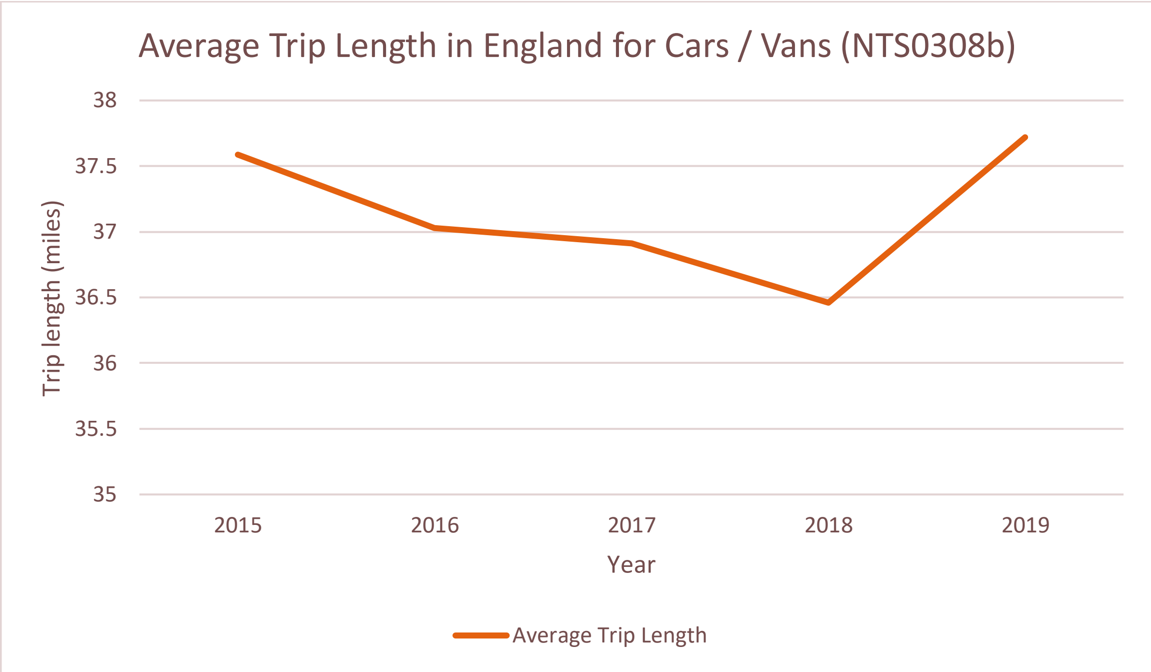
3.2.4 Table 10 shows trip length in England for the 5 years before the COVID-19 pandemic (to exclude the impact of lockdowns on trip length). Although there are increases in the number of short trips taken by car, the scale of difference in the number of trips made for longer trips means that there is very little change in the average trip length between 2015 and 2019.

3.2.5 Data has not been analysed after 2019, as the data available in NTS for 2020 and 2021 was heavily impacted by COVID-19 travel disruption, and as such cannot be used as a reliable source for long term planning.

[14] HM Government - Taking charge: the electric vehicle infrastructure strategy (2022). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1065576/taking-charge-the-electric-vehicle-infrastructure-strategy.pdf

[15]Gov.uk, Statistical data set: Mode of travel (2013) https://www.gov.uk/government/statistical-data-sets/nts03-modal-comparisons#trips-stages-distance-and-time-spent-travelling

Figure 5 - Average Trip Length by Car / Van in England 2015-2019 (National Travel Survey)



3.2.6 The average trip length per year has been calculated using the NTS dataset to establish a total mileage in each year and average trip length. The total mileage in each year has been calculated by multiplying the number of trips in each banding by the average of the banding, for example a trip length of 7.5 miles has been assumed for the 5mi – 10mi banding. 0.5 miles has been used for the < 1mi banding and 125 miles has been used for the > 100mi banding.

Table 10 - Trip Length by Car / Van in England 2015-2019 (National Travel Survey)

Year	< 1mi	1mi – 2mi	2mi – 5mi	5mi – 10mi	10mi – 25mi	25mi – 50mi	50mi – 100mi	> 100mi	**Average Trip Length**
2015	12	78	368	541	910	568	374	416	**37.59mi**
2016	13	79	387	549	903	566	394	397	**37.03mi**
2017	13	84	376	541	923	576	357	408	**36.91mi**
2018	15	82	381	548	944	508	388	387	**36.46mi**
2019	14	81	370	517	904	528	366	418	**37.72mi**
2015-2019 % Change	**+ 16%**	**+ 4%**	**+ 1%**	**- 4%**	**- 1%**	**- 7%**	**- 2%**	**+ 0%**	**+ 0%**

3.3 Total Daily Mileage – Visitor trips

3.3.1 Visitor travel data has been obtained from The Great Britain Day Visitor 2019 Annual Report[16]. This captured average three yearly figures (2017 to 2019) for visitor trips into and within the TfSE area. This includes trips lasting over 3 hours and overnight trips for holidays, business and visiting family. Overnight trips in the LDA and all annual visitor trips were converted into daily visitor trips.

3.3.2 In order to estimate the number of Car and Van trips from daily visitor trips, 2018-19 National Transport Survey data for the South East region was used to calculate the modal share of Car & Van Driver trips, which was then multiplied by the daily visitor trips. The results of this analysis are summarised below:

3.3.3 Average Overnight Visitor Car & Van Trips to the region:
- Daily: 19,617
- Annually: 7,160,210

3.3.4 Average Day Visitor Car & Van Trips (3hours+) to the region:
- Daily: 449,998
- Annually: 164,249,163

3.3.5 Assuming that the number of visitor trips remain constant, DfT's ULEV market share percentages for the Low, Medium and High uptake scenarios for 2025 and 2030 were then applied to determine the projected daily number of EV trips into the TfSE area for visitors. From The Great Britain Day Visitor 2019 Annual Report, average visitor trip length for South East England region is 42 miles and using the above results, the overall daily miles travelled by EVs by visitors were calculated for 2025 and 2030. Visitor numbers can vary by season, however, due to the regional scale of this study this has been treated as an average over the year within the model. These results are illustrated in Table 11 below.

Table 11 - Total Trips and Distances Travelled by visitors to the TfSE area in EVs in 2025 and 2030

	2025			2030		
	Low 15%	Medium 20%	High 30%	Low 40%	Medium 50%	High 70%
Average Trip Length[17]	42 miles					
Daily Car & Van Visits*	469,610*					
Projected Daily EV Trips	70,442	93,922	140,883	187,884	234,805	328,727
Daily EV Mileage (miles)	2,958,543	3,944,724	5,917,086	7,889,448	9,861,810	13,506,534

**A summation of overnight trips and day (3 hr+) trips*

[16] Visit Britain, The Great Britain Day Visitor 2019 Annual Report (2019). https://www.visitbritain.org/sites/default/files/vb-corporate/gbdvs_2019_annual_report_-_a.pdf
[17] Visit Britain, The Great Britain Day Visitor 2019 Annual Report (2019). Trips by distance, Figure 4.4. https://www.visitbritain.org/sites/default/files/vb-corporate/gbdvs_2019_annual_report_-_a.pdf

3.4 On-Street Residential EVCP

3.4.1 Research has shown that currently 75%[18] of all charging events occur at home. Of these events, it is estimated that currently 40%[19] rely on on-street parking (i.e., there is no private driveway available). On-street residential chargers are low powered (up to 7kW) and can provide a full charge (0% to 100%) in around 7 to 13 hours depending on charging speed and battery size. For this reason, they are best suited for EV commuters as they can plug in their vehicle when they return in the evening, charge overnight and it will be fully charged for the next day.

3.4.2 Given the power supply and the typical use case, the maximum power output of a single on-street EVCP can be approximated. This is illustrated in Table 12, below.

Table 12 - Maximum Daily Power Output of an On-Street Residential EVCP

	Power Output (kW)	Utilisation Timeframe	Utilisation Hours	Max Power Output per day (kWh)
On-street Residential EVCP	7	18:00 – 07:00	13	91

3.4.3 It is important to note, given the long duration of charging sessions required, it is likely only a single user will be able to charge their EV per EVCP each day.

3.5 Public Town Centre EVCPs

3.5.1 Public town centre EVCPs are of higher power and are typically used to provide small ‘top-ups’ in charge between the longer residential charging session. They are typically aimed at EV users who go into town for shopping or leisure purposes and are therefore only away from their vehicles for a few hours at a time.

3.5.2 These EVCPs are typically used during the day and may be used by multiple users in a single day. Following the same process as above, the maximum power output of a single fast EVCP is presented in Table 13 below.

Table 13 - Maximum Daily Power Output of a Public Town Centre Fast EVCP

	Power Output (kW)	Utilisation Timeframe	Utilisation Hours	Max Power Output per day (kWh)
Public Fast EVCP	22	08:00 – 19:00	11	242

3.6 Rapid Destination EVCPs

3.6.1 Rapid destination EVCPs are of high power and can provide significant charge (0% to 80%) over very short periods of time. These EVCPs are typically located at visitor destinations and petrol stations, facilitating long-haul EV journeys with minimal added time required for charging.

[18] Element Energy, EV Charging Behaviour Study (2019). http://www.element-energy.co.uk/wordpress/wp-content/uploads/2019/04/20190329-NG-EV-CHARGING-BEHAVIOUR-STUDY-FINAL-REPORT-V1-EXTERNAL.pdf
[19] Office for National Statistics, Over half of younger drivers likely to switch to electric in next decade (2021). https://www.ons.gov.uk/economy/environmentalaccounts/articles/overhalfofyoungerdriverslikelytoswitchtoelectricinnextdecade/2021-10-25

3.6.2 These EVCPs are utilised for longer periods of the day given that long-haul journeys typically start earlier and end later than average commute or domestic trips. The maximum power output of a single destination EVCP is presented in Table 14 below.

Table 14 - Maximum Daily Power Output of a Destination Rapid EVCP

	Power Output (kW)	Utilisation Timeframe	Utilisation Hours	Max Power Output per day (kWh)
Destination Rapid EVCP	50	06:00 – 21:00	15	750

3.7 Forecasting Future EV Performance

3.7.1 EV technology is constantly developing with batteries becoming more powerful, and EV ranges growing. To accurately model future EVCI requirements, Table 15 outlines the forecasts for future EV performance.

Table 15 - Forecasted Future EV Battery Performance

	Range (miles)	Battery Size (kWh)	Battery Efficiency (kWh/mile)	EV Performance (miles/kWh)
Current EV Specifications[20] (Renault Zoe ZE50[21])	195	52	267	3.8
Forecasted 2030 EV Specifications[22]	375	75	200	5

3.7.2 The values of battery efficiency were then used to convert the total number of EV miles driven for a particular use case (e.g., commuting) into the total power required to complete those miles.

3.8 Charging Behaviour

3.8.1 Modelling by Element Energy estimates that currently residential overnight charging represents 75%[23] of daily charging demand. Homes without off-street parking account for 40% of the residential overnight charging and fast public EVCPs account for 6%. The remaining demand is for workplace EVCPs, which are typically privately procured, owned, and operated.

3.8.2 It is assumed that 100% of visitors who travel within the TfSE area will use rapid destination chargepoints. Visitors need to charge quickly on route if they are travelling long distances and with a large proportion of visitors staying 3+ hours they would have less time at the destination to charge in comparison to overnight stays. Additionally, EVs travelling longer distances will need larger batteries (unless they charge multiple times) so for the purpose of the model the assumption is a rapid charger would be best fit for purpose.

3.8.3 The assumption is that 75% of charging demand will require residential EVCPs, 6% will require public fast EVCPs, and 100% of visitors will require rapid destination EVCPs. This assumption is shown in **Error! Reference source not found.** to Table *20*.

[20] NimbleFins, Average Electric Car Range in the UK 2021. https://www.nimblefins.co.uk/average-electric-car-range
[21] EV Database, Renault Zoe ZE50 R110. https://ev-database.uk/car/1164/Renault-Zoe-ZE50-R110
[22] IEA, Global EV Outlook (2020). https://www.iea.org/reports/global-ev-outlook-2020
[23] Element Energy, EV Charging Behaviour Study (2019). http://www.element-energy.co.uk/wordpress/wp-content/uploads/2019/04/20190329-NG-EV-CHARGING-BEHAVIOUR-STUDY-FINAL-REPORT-V1-EXTERNAL.pdf

3.9 EVCP Requirements

3.9.1 Using these findings and the forecasted daily EV miles for each use case, estimates were made on the number of EVCPs required across the TfSE area to support future EV usage. The results of these calculations are presented in **Error! Reference source not found.** to Table *20*.

Table 16 - Forecasts for Required On-street residential EVCPs across the TfSE area

On-street residential EVCPs	
Daily Charging Demand	75%
(Residential) On-street Demand	40%
Max Daily EVCP Power Output (kWh)	91

2025	National Highway 2% Growth			Linear Extrapolation		
	Low	Medium	High	Low	Medium	High
Daily EV Miles (1000s)	2,025.1	2,700.2	4,050.3	1,917.2	2,556.2	3,834.4
Power needed (kWh)	540,045	720,060	1,080,090	511,253	681,670	1,022,505
EVCPs needed (Single Socket)	5,935	7,913	11,869	5,618	7,491	11,236
2030	**National Highway 2% Growth**			**Linear Extrapolation**		
	Low	Medium	High	Low	Medium	High
Daily EV Miles (1000s)	5,962.5	7,453.1	10,434.4	5,266.7	6,583.3	9,216.7
Power needed (kWh)	1,192,507	1,490,633	2,086,887	1,053,341	1,316,676	1,843,347
EVCPs needed (Single Socket)	13,104	16,381	22,933	11,575	14,469	20,257

Table 17 - Forecasts for Required Public Fast EVCPs across the TfSE area

Town Centre / Public Fast EVCPs						
Daily Charging Demand	6%					
(Residential) On-street Demand	-					
Max Daily EVCP Power Output (kWh)	242					
2025	National Highway 2% Growth			Linear Extrapolation		
	Low	Medium	High	Low	Medium	High
Daily EV Miles (1000s)	459	612	918.1	434.6	579.5	869.2
Power needed (kWh)	122,413	163,217	244,826	115,902	154,536	231,803
EVCPs needed (Single Socket)	506	674	1,012	479	639	958
2030	National Highway 2% Growth			Linear Extrapolation		
	Low	Medium	High	Low	Medium	High
Daily EV Miles (1000s)	1,351.5	1,689.4	2,365.2	1,194.1	1,492.7	2,089.7
Power needed (kWh)	270,308	337,884	473,038	238,831	298,539	417,954
EVCPs needed (Single Socket)	1,117	1,396	1,955	987	1,234	1,727

Table 18 - Forecasts for Required Rapid Destination EVCPs across the TfSE area

Rapid Destination EVCPs			
Visitors Charging Demand	100%		
(Residential) On-street Demand	-		
Max Daily EVCP Power Output (kWh)	750		
2025	Low	Medium	High
Daily EV Miles (1000s)	2,958.5	3,944.7	5,917
Power needed (kWh)	788,945	1,051,926	1,577,889
EVCPs needed (Single Socket)	1,052	1,403	2,104
2030	Low	Medium	High
Daily EV Miles (1000s)	7,889.4	9,861.8	13,806.5
Power needed (kWh)	1,577,889	1,972,361	2,761,306
EVCPs needed (Single Socket)	2,104	2,630	3,682

3.9.2 Table 19 summarises the findings of the EVCP forecasting, providing the percentage increase required against the baseline low and high uptake scenarios for the TfSE area.

Table 19 - Summary Table

Use Case	Year	Low Uptake Scenario	Percentage Increase Required against Baseline Scenario*	High Uptake Scenario	Percentage Increase Required against Baseline Scenario*
On-street residential	2025	5,618 7kW EVCPs	447% increase in Fast (7kW / 22kW) Public EVCPs	11,869 7kW EVCPs	1,056% increase in Fast (7kW / 22kW) Public EVCPs
	2030	11,575 7kW EVCPs	1,028% increase in Fast (7kW / 22kW) Public EVCPs	22,933 7kW EVCPs	2,134% increase in Fast (7kW / 22kW) Public EVCPs
Town centre / public fast	2025	479 22kW EVCPs	447% increase in Fast (7kW / 22kW) Public EVCPs	1,012 22kW EVCPs	1,056% increase in Fast (7kW / 22kW) Public EVCPs
	2030	987 22kW EVCPs	1,028% increase in Fast (7kW / 22kW) Public EVCPs	1,955 22kW EVCPs	2,134% increase in Fast (7kW / 22kW) Public EVCPs
Rapid destination	2025	1,052 50kW EVCPs	250% increase in Rapid/Ultra Rapid Public EVCPs	2,104 50kW EVCPs	599% increase in Rapid/Ultra Rapid Public EVCPs
	2030	2,104 50kW EVCPs	599% increase in Rapid/Ultra Rapid Public EVCPs	3,683 50kW EVCPs	1,123% increase in Rapid/Ultra Rapid Public EVCPs

* The % increase for the On-street and Town centre use cases represent the total additional number of fast (7kW – 22kW) EVCPs required across the whole TfSE area. This is because existing EVCP baseline data does not include detail on use case.

3.9.3 As shown in Table 19,**Error! Reference source not found.** the assessment revealed that for the on-street residential EVCPs, a minimum number of 5,618 and 11,575 single socket (7 kW) EVCPs will be required on-street by 2025 and 2030 respectively for the TfSE area. For the High ULEV Uptake scenario, 11,869 and 22,933 EVCPs (7 kW) will be required on-street by 2025 and 2030 respectively for the TfSE area.

3.9.4 For the town centre / public fast EVCPs, a minimum number of 479 and 987 single socket (22 kW) EVCPs will be required by 2025 and 2030 respectively, across the TfSE area. For the High ULEV Uptake scenario, 1,012 and 1,955 EVCPs (22 kW) will be required by 2025 and 2030 respectively.

3.9.5 Compared to the public fast EVCPs identified for the baseline scenario in work package 3, this is a 447% and a significant 1,028% increase in required Fast (7kW / 22kW) Public EVCPs by 2025 and 2030 respectively, in the Low uptake scenario. In the High uptake scenario, the results forecast higher values with a 1,056% and a 2,134% increase in required Fast Public EVCPs by 2025 and 2030 respectively.

3.9.6 For the rapid destination EVCPs, a minimum number of 1,052 and 2,104 single socket (50 kW) EVCPs will be required by 2025 and 2030 respectively, across the study area. For the High ULEV Uptake scenario, 2,104 and 3,682 EVCPs (50 kW) will be required by 2025 and 2030 respectively.

3.9.7 Compared to the baseline scenario, this is a 250% and a 599% increase in required Rapid/Ultra Rapid Public EVCPs by 2025 and 2030 respectively, in the Low uptake scenario. In the high uptake scenario, the results forecast a 599% and a substantial 1,123% increase in required Rapid/Ultra Rapid Public EVCPs by 2025 and 2030 respectively.

3.9.8 It should also be noted that these calculations assume zero redundancy across the EVCP network and that each EVCP achieves 100% daily utilisation. In practice, a degree of redundancy should be incorporated to account for scenarios that would prevent charging such as, maintenance issues or EVCPs being blocked by vehicles not using the bay to charge. It is recommended that further discussions with stakeholders in the TfSE area take place to develop appropriate ‘factors of safety’ to account for redundancy and utilisation and apply these to the values presented in Table 19. These factors will be highly dependent upon risk appetite and budgetary constraints which will be unique to each individual LTA.

3.9.9 The TfSE area forecast EVCP requirements for the low and high uptake scenarios in 2025 and 2030 have been presented above. The corresponding number of EVCPs required for every district and borough authority across the low, medium and high scenarios are presented in:

- On-Street Residential – 0
- Public Town Centre – 0
- Rapid Destination – 0

3.10 Comparative Review

3.10.1 A comparison has been undertaken to correlate the forecasts presented in this working paper against other industry EVCP forecasts. It is important to note that variations in modelled outputs will be common, due to the number of parameters and assumptions used, as well as the rapidly changing EV and EVCP market.

3.10.2 The forecasts of EVCPs required for the TfSE area and the UK have been compared using the proportion of the UK population in the TfSE area (12%).

3.10.3 Table *20* shows these comparisons for three national projections. Using the high scenario modelled outputs (28,495 EVCPs), the number of EVCPs projected for the TfSE area ranges between 9.5% to 26% of the total number of EVCPs projected for the UK by 2030. This demonstrates that the high scenario forecast for the TfSE area is well correlated with other industry forecasts.

Table 20 - Proportion of EVCPs forecasted for TfSE in Relation to the Number of EVCPs forecasted for the UK by 2030

-	Arcadis TfSE Strategy	Taking Charge: EV infrastructure strategy[24]	Climate Change Committee Transition to EVs[25]	Transport & Environment[26] Charging Forward
-	28,495 in TfSE area	300,000 in UK	280,000 in UK	108,000 in UK
% of EVCPS in TfSE area	-	9.5%	10.2%	26.0%

3.10.4 Although the Taking charge: the electric vehicle infrastructure strategy figure does have an upper range above 300,000, it is heavily caveated in the report. Assumptions such as trip lengths increasing, consumers adopting inefficient charging behaviour and BEVs occupying chargers whilst not charging are some of the factors that are not in line with current predictions and are being actively disincentivised.

[24] HM Government, 'Taking Charge: the electric vehicle strategy' (2022). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1065576/taking-charge-the-electric-vehicle-infrastructure-strategy.pdf

[25] Climate Change Committee, 'The Sixth Carbon Budget' (2020) https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Surface-transport.pdf

[26] Transport and Environment, 'Charging Forward: Creating a world class UK charging network' (2021) https://www.transportenvironment.org/wp-content/uploads/2021/08/2021_05_Charging-Forward_Creating_a_world-class_UK_charging_network_final.pdf

4 Future Grid Analysis

4.1 Approach

4.1.1 The grid capacity assessment measured the influence of EV charging on the grid network by 2025. As covered in working paper 2 – Policy and Operational Context, both UKPN[27] and SSEN[28] have developed their own EV strategies, outlining ambitious plans to reinforce and expand their power supplies to accommodate future EV uptake. For this reason, forecasted EV uptake data for 2025 has been used, as opposed to that of 2030, to maintain relevance to the current state of the grid network. The usage of current EV technology with respect to range and battery capacity has been used for this assessment to maintain consistency. The forecasted state of the grid in 2025 has been calculated from the current demand headroom of primary substations within the TfSE area[29] along with average daily EV demand. The methodology calculated the average daily EV recharge based on current EV technology and regular daily vehicle journey trends. The methodology applied for this analysis is detailed below.

$$Daily\ EV\ Battery\ Usage\ (\%) = \frac{Average\ Daily\ Mileage}{Maximum\ EV\ Range}$$

$$Average\ Daily\ Recharge\ Required\ (kWh\ per\ EV) = Battery\ Capacity * Daily\ EV\ Battery\ Usage$$

4.2 Future RAG Assessment

4.2.1 Combining this methodology with 2025 EV performance data, presented in Table 15, and an average daily mileage taken from SERTM2 across the 46 districts and borough authorities and 16 local transport authorities within the TfSE area, the following results were obtained.

$$Daily\ EV\ Battery\ Usage\ (\%) = \frac{19.23\ miles}{195\ miles} = 9.86\%$$

$$Average\ Daily\ Recharge\ Required\ (kWh\ per\ EV) = 52kWh * 9.86\% = 5.13kWh$$

4.2.2 Future substation capacity has been assessed against the number of EVs that can be charged simultaneously, based on projected daily power demand. These findings have been presented in Table 21, and mapped in Figure 5Figure 5, below.

Table 21 - Future RAG assessment of TfSE primary substations based on projected capacity for simultaneous EV charges

RAG Status	Maximum #EVs that could be charged simultaneously	# Primary Substations	Details
Green	>2500	123	No Upgrades Required
Amber	1500 – 2500	108	No Immediate Upgrades Required
Red	< 1500	204	Futureproofing Upgrades Required
Grey	0	20	Further Investigation required

[27] UK Power Networks, Electric Vehicle Strategy. https://innovation.ukpowernetworks.co.uk/wp-content/uploads/2019/11/UK-Power-Networks-Electric-Vehicle-Strategy-November-19.pdf
[28] Scottish and Southern Electricity Networks, Electric Vehicle Strategy. https://www.ssen.co.uk/globalassets/electric-vehicle/ev-media/ssen-ev-strategy-september-2020.pdf
[29] Analysis of TfSE's current grid network is covered in greater detail in working paper 3 – Establish Baseline

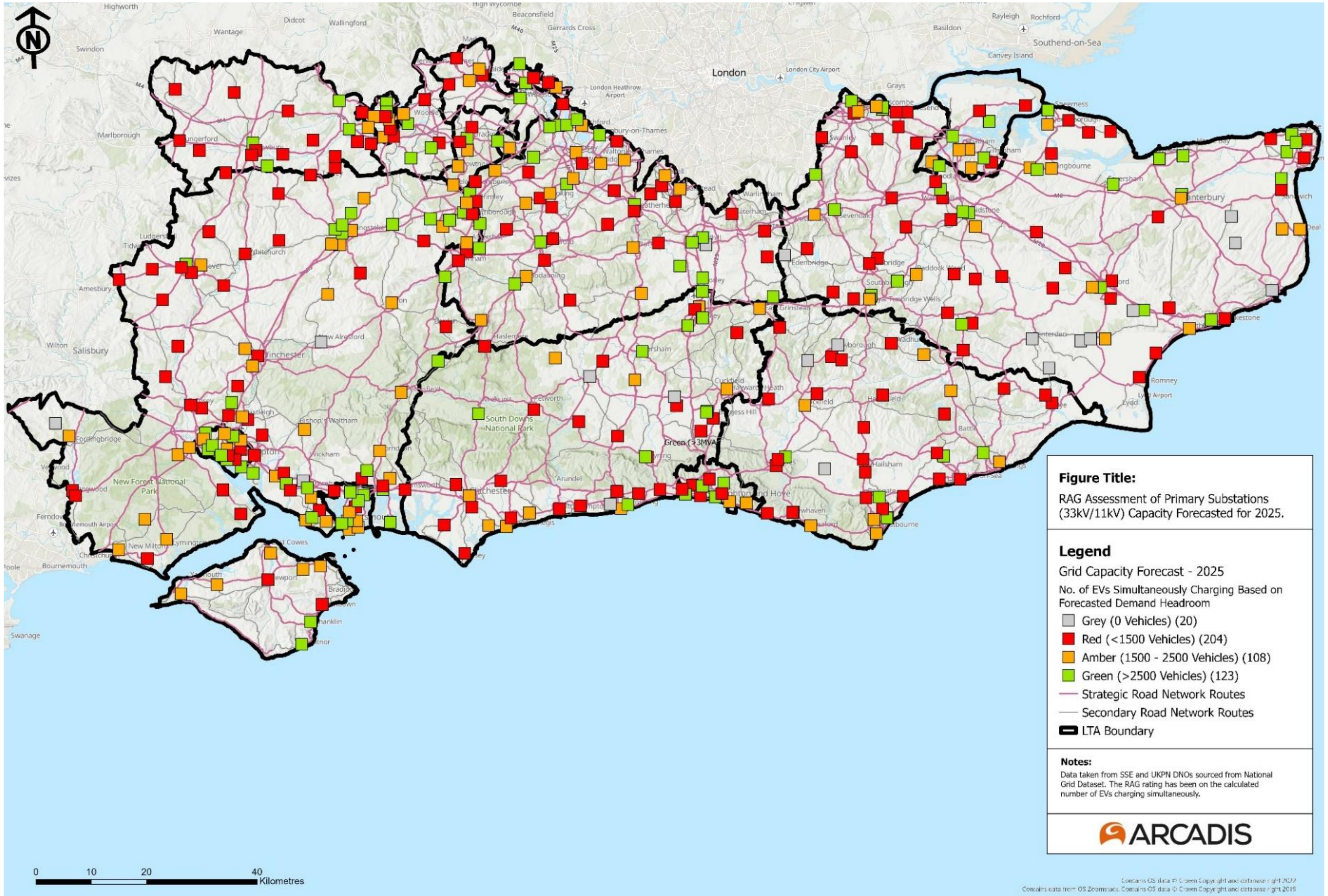


Figure 5 - Map of Future Grid RAG Assessment

4.3 Future Grid Assessment Result Summary

4.3.1 A simplifying assumption of this analysis is that the average daily mileage of EVs is consistent across each primary substation within the TfSE area. It is likely that mileage of rural EV users will be higher than the regional average and consequently a greater need to recharge at rural substations. This would lead to greater demand on rural substations and therefore a lower number of EVs could be simultaneously charged. The opposite would be true for dense urban locations, where fewer and shorter journeys will be completed by cars.

4.3.2 From the results of this analysis, a significant proportion of primary substations across the TfSE area will require grid capacity upgrades to cater for the expected EV uptake by 2025. From the map in Figure 5, there is a largely even distribution of RAG rated substations across the TfSE area. However, there are some isolated areas that appear to have high concentrations of red and amber rated substations, and these should therefore be the focus of engagement with UKPN and SSEN DNOs. These areas include:

- Southern West Sussex
- Western Hampshire
- Southern Hampshire
- Northern East Sussex
- Western Berkshire
- Northern Isle of Wight

4.3.3 Costs associated with reinforcing the power grid to increase capacity at a single location can range from £75,000-£2 million and take over 6 months to plan, design, and carry out the required works[30]. Additionally, even sites with adequate supply, will require DNO intervention to create a new connection and install the required electrical infrastructure (e.g., high voltage cables and transformers). This can take up to 12 weeks and can cost up to £75,000 per site. These costs and timeframes must be accounted for within budgets and programmes by any local authority planning to install new EVCPs. For this reason, it is essential that local authorities within the TfSE area work close in collaboration with their respective DNOs to assess future demand and map areas in the TfSE area where power upgrades should be focussed to accommodate planned EVCP installation.

4.3.4 The total existing capacity across all primary substations in the TfSE area has been estimated to be sufficient to provide the required power to simultaneously charge over 993,000 EVs. The relationship between this available capacity and the EV forecasts is shown in Table 22, below.

Table 22 - Grid Capacity for Simultaneous EV Charging as % of Forecasted EV Uptake.

	National Highways 2% Growth			Linear Extrapolation		
2025	Low 15%	Medium 20%	High 30%	Low 15%	Medium 20%	High 30%
Forecasted EVs	674,429	899,222	1,348,828	638,237	850,973	1,276,447
Grid Capacity (Simultaneous EV Charging)	993,109 EVs					
%EVs Supplied	147.3%	110.4%	73.6%	155.6%	116.7%	77.8%

[30] UK Power Networks, Getting electric vehicles moving (2022) https://media.umbraco.io/stage-uk-power-networks/pwwftji5/a_guide_for_electric_fleets.pdf

4.3.5 It is important to note that although these results suggest there is ample power supply within the TfSE area to meet demands of a Medium (20%) EV uptake scenario, it does not account for the difference in spatial distribution between the supply and demand of power (i.e. is the spare capacity in the right place?). Furthermore, as shown in Section 2.6, the lowest 2030 projection of EV uptake (1,752,500 EVs) greatly exceeds the highest 2025 projections (1,348,828 EVs) at which point the current grid would only have capacity to accommodate 56% of forecasted EVs across the TfSE area. This highlights the extent of required upgrades across the TfSE area's power supply.

4.3.6 While it may seem arbitrary to measure power capacity in terms of simultaneous EV charging, research into charging behaviour statistics, covered in 3.8, has shown that up to 75% of all EV charging events may occur overnight. It is therefore highly likely that the grid will have to accommodate a significant number of EVs being charged simultaneously on a daily basis.

5 Identification of Suitable Locations for EVCPs

5.1 Introduction

5.1.1 This section identifies a pipeline of EVCI opportunities for public and private sector investment at a local transport authority level and provides a strategic view of the current/future demand for charging. To identify and select optimal areas for priority locations for EVCI, a suitability assessment using GIS has been undertaken and visualised within the EVCI Locate app. Through this process, the following sets of spatial data have been collected, and a set of scoring parameters developed to identify and rank suitable sites.

5.2 Assessment Criteria - Methodology

5.2.1 GIS was used to identify gaps across the existing EVCP network and determine suitable locations for the installations of EVCPs. The following spatial data has been used as parameters to develop a suitability analysis heat map:

- Existing EVCP network (1-mile iso distance).
- LA Assets (Council owned land e.g., LA car parks).
- Substation Capacity.
- Railway Stations.
- Highway Network: A Roads, B Roads, all undefined roads.
- Air Quality Management Areas.
- Retail Centres.
- Land use and amenities.
- Flooding (river and sea, and surface water).

5.2.2 The suitability analysis is based on proximity/distance to the features in the layers listed above. The layers are assessed with a score between 1 (low) and 5 (high). Each layer is broken down into a 5m-by-5m cell which is attributed a score based on distance from the cells in each of the layers.

5.2.3 For flood zones, the closer each cell is to the flood zone, the lower the score, e.g. a cell within 15m of a flood zone would be given a score of 1. The further you are away from the flood zone the higher the score e.g. more than 60m from a food zone the cell would be given a score of 5. However, other layers such as land use and amenities, the closer you are to an amenity, the higher the score, and the further you are away from it, the lower the score. The reclassification of boundaries based on distance and it's attributed scoring is based professional judgement.

5.2.4 For substation capacity, each primary substation has been assigned a RAG status based on headroom capacity (as shown in working paper 3 – Establish Baseline), as data on underground lines were unavailable at the time of data collection. Using the GIS tool the TfSE study area was divided into irregular triangular polygons generated from a set of primary substation points. Each polygon defines an area of influence around each primary substation and any location inside the polygon is assigned to that primary substation. This provides coverage for each primary substation and the impact it has based on its headroom capacity. Scoring for primary substations were based on the following: Red (1), Amber (3), Green (5).

5.2.5 Due to the varied levels of data received by each LTA, 16 independently scored assessments were undertaken to ensure a fair assessment. Table 23 below highlights the spatial data that was included for each LTA.

Table 23 - Spatial Data Included Within the EVCI Locate App

LTA	Existing EVCP Network	LA Assets	Substation Capacity	Railway Station	Highway Network	AQMA	High Streets/ Business Improvement District/ Regen Areas/ Urban Areas	Land Use and Amenities	Flood Zone	Highway Adoption	Parking Restriction	Street Lighting	EV Uptake	Terraced Housing	Deprivation
Bracknell Forest Borough Council	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓
Brighton and Hove City Council	✓	✓	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓
East Sussex County Council	✓	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓
Hampshire County Council	✓	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓
Isle of Wight Council	✓	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓
Kent County Council	✓	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✓	✓	✓	✓
Medway Council	✓	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓
Portsmouth City Council	✓	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓

LTA	Existing EVCP Network	LA Assets	Substation Capacity	Railway Station	Highway Network	AQMA	High Streets/ Business Improvement District/ Regen Areas/ Urban Areas	Land Use and Amenities	Flood Zone	Highway Adoption	Parking Restriction	Street Lighting	EV Uptake	Terraced Housing	Deprivation
Reading Council	✓	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓
Slough Council	✓	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓
Southampton City Council	✓	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓
Surrey County Council	✓	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓
West Berkshire Council	✓	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓
West Sussex County Council	✓	✗	✓	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓	✓
Royal Borough of Windsor and Maidenhead	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓
Wokingham Borough Council	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

5.2.6 The suitability analysis heat map, alongside the supporting spatial data (highway adoption, parking restrictions, street lighting, forecasted EV uptake, terraced housing, deprivation), have been presented in a bespoke web application (EVCI Locate tool) designed to identify and plot proposed EVCP locations across the TfSE study area. Figure 6 below is a screen capture of the application, highlighting the priority areas for installation based on the total average score for each of the parameters stated above. Areas shown in dark green are deemed as more suitable and should be prioritised, areas shown in amber are somewhat suitable, whereas areas in red are deemed not desirable and considered a lower priority.

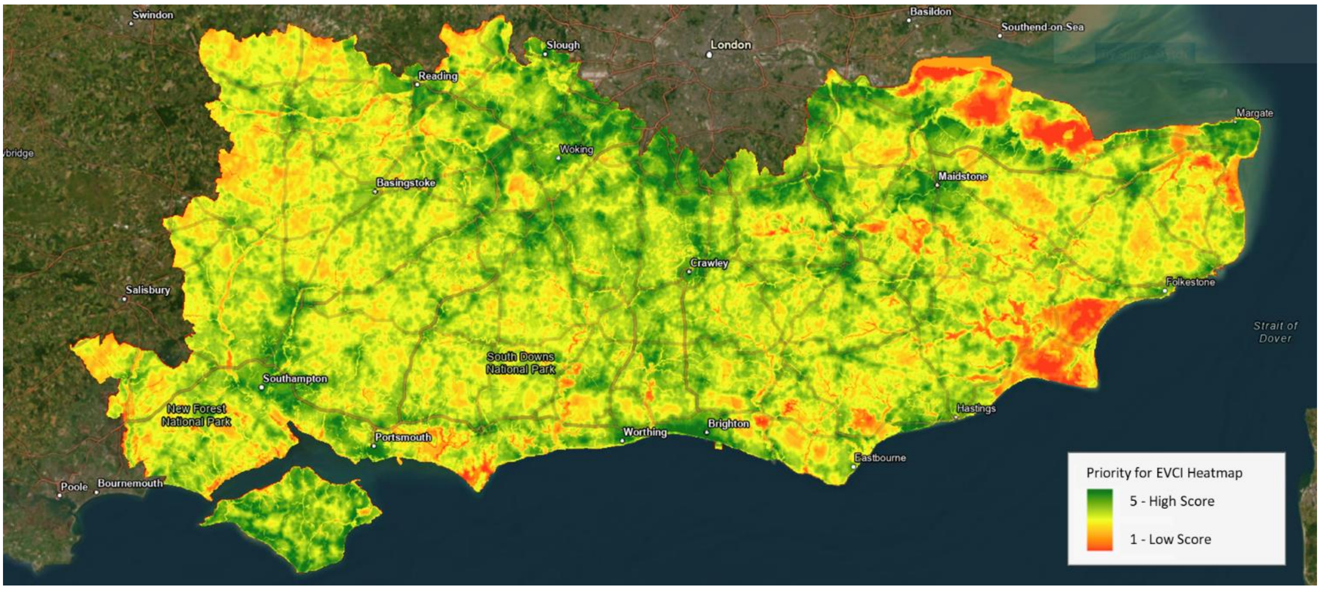


Figure 6 - Snapshot of the EVCI Locate Tool for the TfSE Study Area

5.2.7 Figure 7 below highlights an example of the EVCI Locate app at a town level. Ashford, a town in Kent, has been used to showcase the visualisation of the suitability analysis. This illustrates the ability of the tool to drill down into a more focussed view for respective LTAs and district and borough authorities within the TfSE area. Priority should be given to areas where it is currently showing the darkest green areas, whilst areas shown as red or amber should be considered as low and medium priority respectively. For Ashford, there are red areas in several directions around the periphery of the town centre; this is due to flood zones, a lack of land use amenities, distance away from strategic highway network, and low headroom capacity (evidenced for the large red area to the northwest of Ashford).

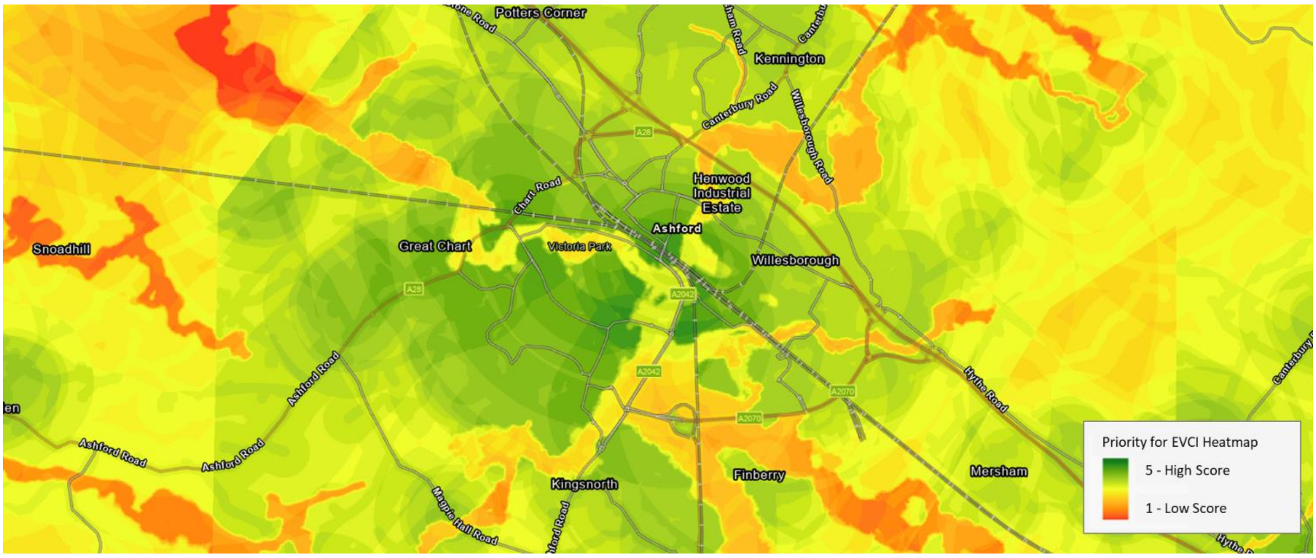


Figure 7 - Snapshot of the EVCI Locate Tool – Ashford, Kent

5.2.8 EV uptake has also been visualised within the EVCI Locate tool. GIS has been used to disaggregate the EV uptake at a Local District Authority level to an Output Area (OA) scale using car ownership percentages to proportionally distribute EVs for each Local Authority across the TfSE region. GIS plans have also been produced highlighting EV uptake for each local transport authority for both growth projections and for both forecast years (2025 and 2030). This can be seen in Appendix E.

6 Summary and Conclusions

6.1.1 This working paper provides a robust evidence base to inform TfSE's EV Charging Infrastructure Strategy by establishing future EV adoption figures based on different uptake scenarios. Projected EV adoption has then fed into models to quantify:

- The possible emission savings as a result of EV uptake.
- The required level of residential, public, and destination EVCP to support increased demand.
- The impact on the region's power network supply.

EV Forecasting

6.1.2 The EV forecast quantifies the potential environmental benefits of projected adoption of EVs and reduction in use of ICEs.

6.1.3 The assessment revealed that on a regional scale there is the potential to save between 10,470,123 tonnes and 15,285,138 tonnes of CO_2e per year by 2030. There is also the potential to save anywhere between 39,859 tonnes and 78,962 tonnes of N_2O per year by 2030 due to increased EV uptake.

6.1.4 However, for this to be achieved, a significant increase in the number of EVCPs will be required to support the 1,752,500 EVs registered by 2030. The forecasts for EV uptake for 2025 and 2030 provide a strong evidence base in support of the vision and actions set out in local, regional and national policy.

EVCP Forecasting

6.1.5 An EVCP forecasting model was developed for on-street residential, town centre / public fast and rapid destination use cases to estimate the number of public chargepoints required in the TfSE study area to meet the growing EV charging demand for the forecasted years 2025 and 2030.

6.1.6 The assessment revealed that on a regional scale, for the on-street residential EVCPs, a minimum number of 5,618 and 11,575 single socket (7 kW) EVCPs will be required on-street by 2025 and 2030 respectively.

6.1.7 For the town centre / public fast EVCPs, a minimum number of 479 and 987 single socket (22 kW) EVCPs will be required by 2025 and 2030 respectively, across the study area.

6.1.8 For the rapid destination EVCPs, a minimum number of 1,052 and 2,104 single socket (50 kW) EVCPs will be required by 2025 and 2030 respectively, across the study area.

6.1.9 It is to be noted that these are only the minimum EVCP requirements based on DfT's Low ULEV Market uptake percentages for 2025 and 2030 for the TfSE study area.

Future Grid Analysis

6.1.10 An assessment of the primary substations (obtained from UKPN and SSE) revealed that on a regional scale, the existing network has ample capacity to simultaneously charge over 993,000 EVs, exceeding EV projections up to a medium uptake scenario for 2025.

6.1.11 However, a RAG assessment of each primary substation under future conditions showed that 204, out of the 455 assessed, fell into the red categorisation and would likely require immediate reinforcement. A further, 108 were categorised as Amber, and would likely require reinforcement in the near future. This is a significant proportion of the TfSE area's power infrastructure. Costs associated with reinforcing the power grid can range from £75,000-£2 million and take over 6 months to complete. This highlights the need for close collaboration with DNOs and proactive planning to ensure ample power is available to supply EVCI.

6.1.12 These cost and timeframes must be accounted for within budgets and programmes by any local authority planning to install new EVCPs. For this reason, it is essential that local authorities within the TfSE area work closely in collaboration with UKPN and SSEN to assess future demand and map areas in the TfSE area where power upgrades should be focussed to accommodate planned EVCP installation.

Identification of suitable locations for EVCPs

6.1.13 The EVCI Locate app suitability analysis heat map, will provide support to local transport authorities to identify strategically located sites to expand the current EVCI network. The supplementary data layers such as deprivation, terraced housing, parking restrictions and EV uptake provide a more holistic consideration when selecting sites beyond physical constraints. As the assessment has been designed to assess each of the 16 local transport authorities independently, the app and the heatmap can be updated when more data is available from each local transport authority in the future.

Next Stage

6.1.14 The next stage will be to build upon this research and evidence base to:

- Gain further understanding of the extent to which private and public fleet vehicles will affect public EVCI and depot-based demand on the grid (which will be carried out within working paper 5).
- Ensure the overall strategy and action plan align with the findings of this working paper.
- Help provide local transport authorities with an evidence base to develop their own EVCI strategies and provide sufficient EVCI.

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Appendix A: EV Forecast Analysis by Local Transport Authority

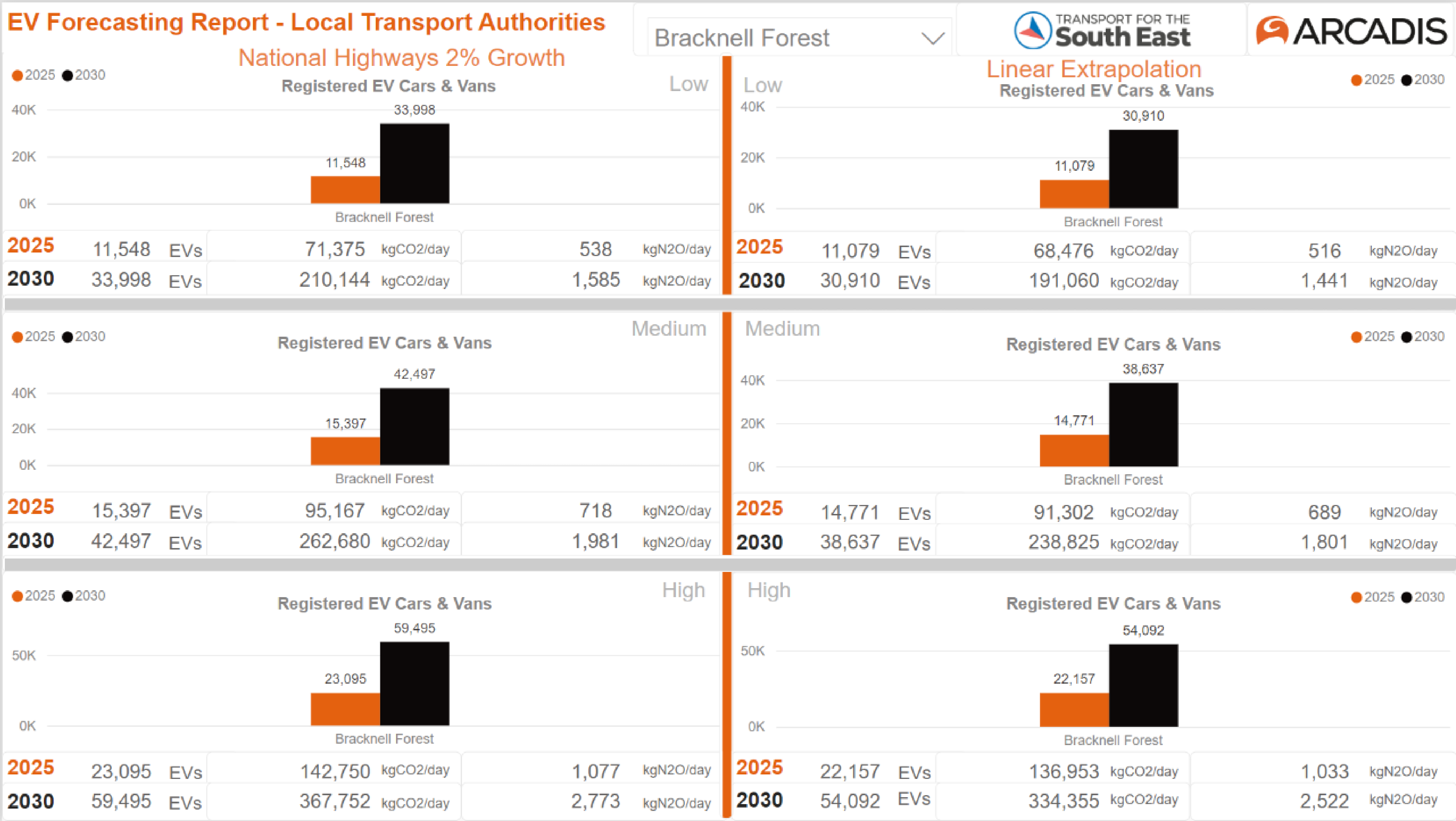

Figure 8 - EV Forecasting Report: Bracknell Forest

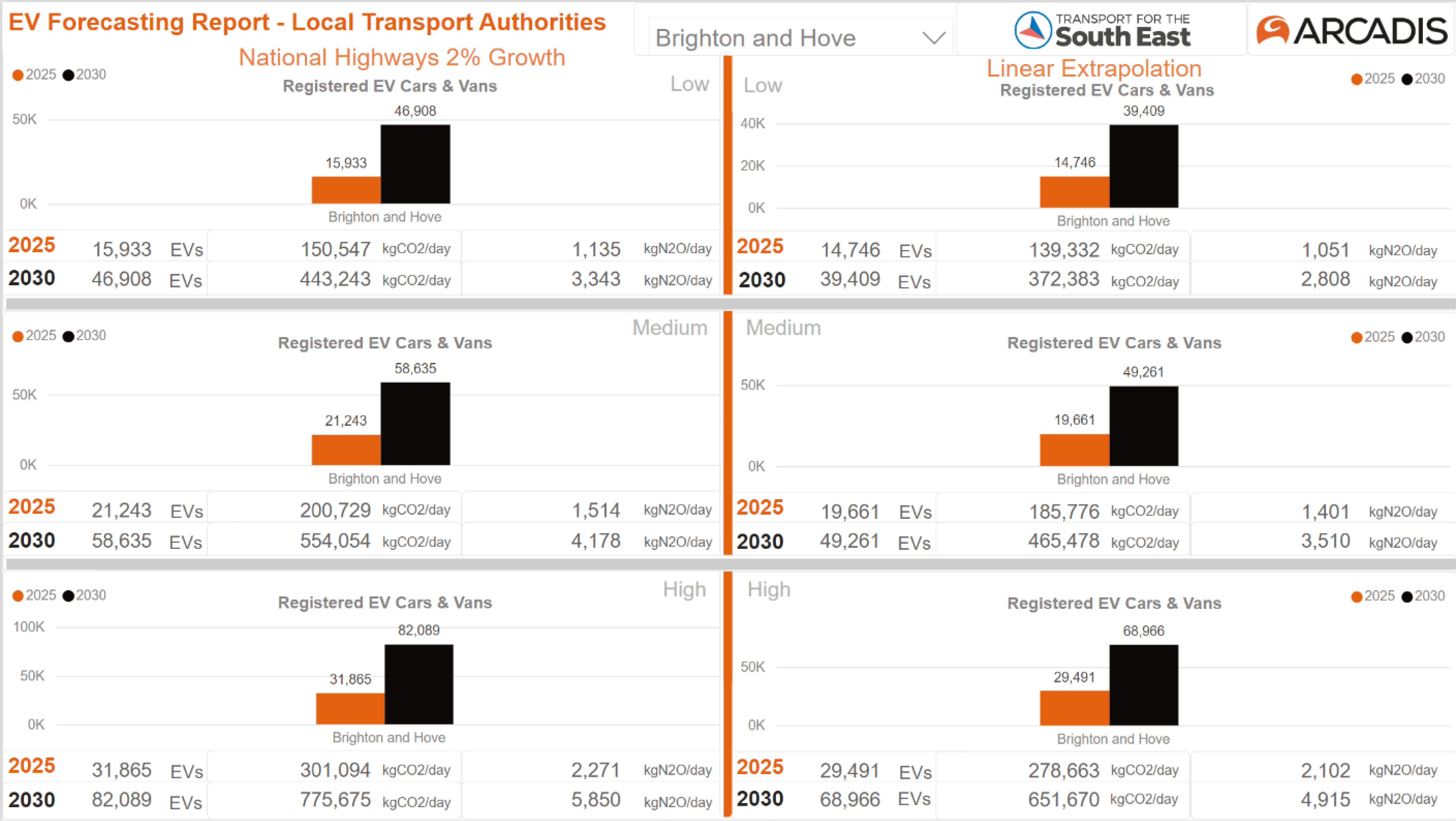

Figure 9 - EV Forecasting Report: Brighton and Hove

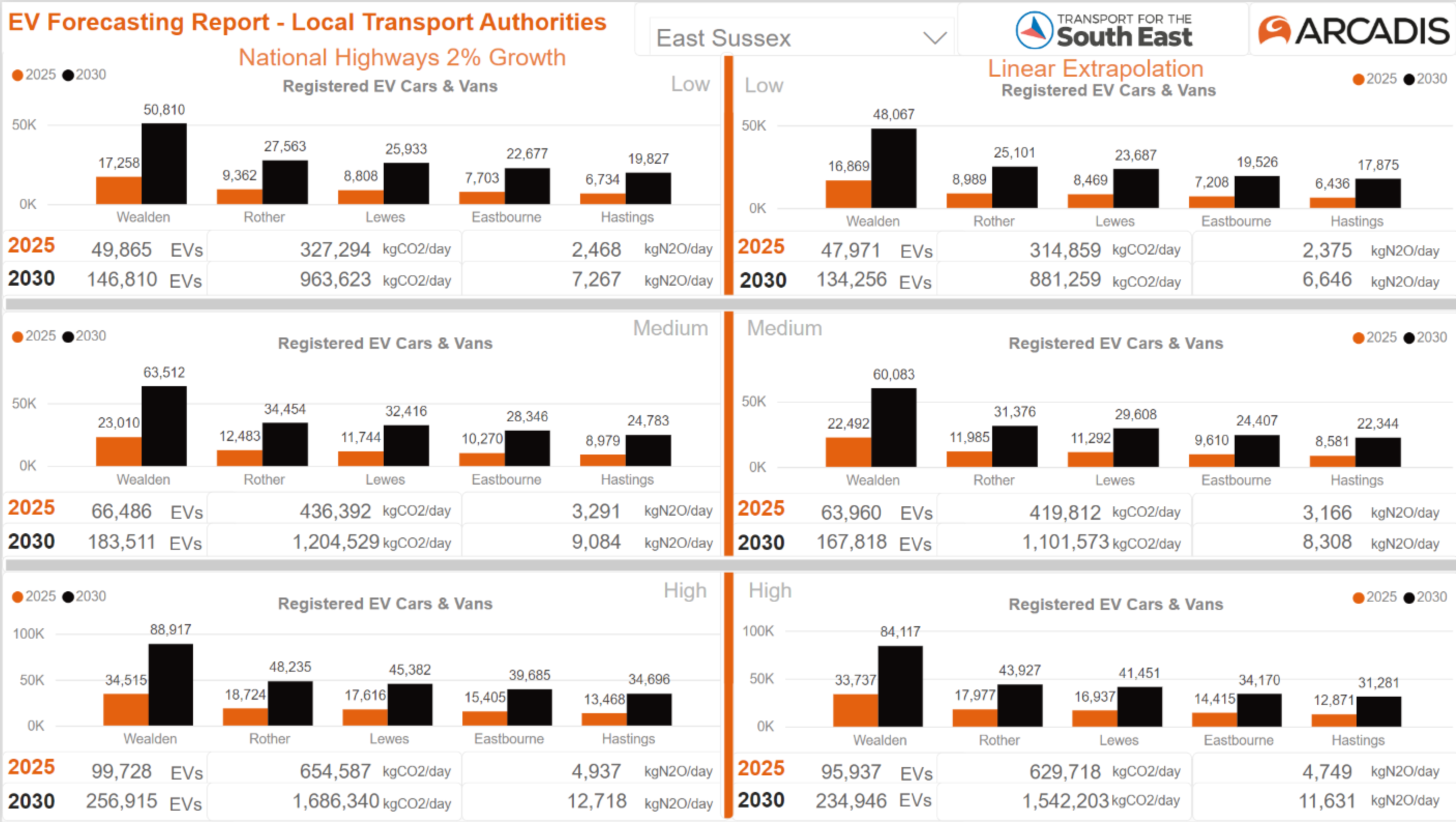

Figure 10 - EV Forecasting Report: East Sussex

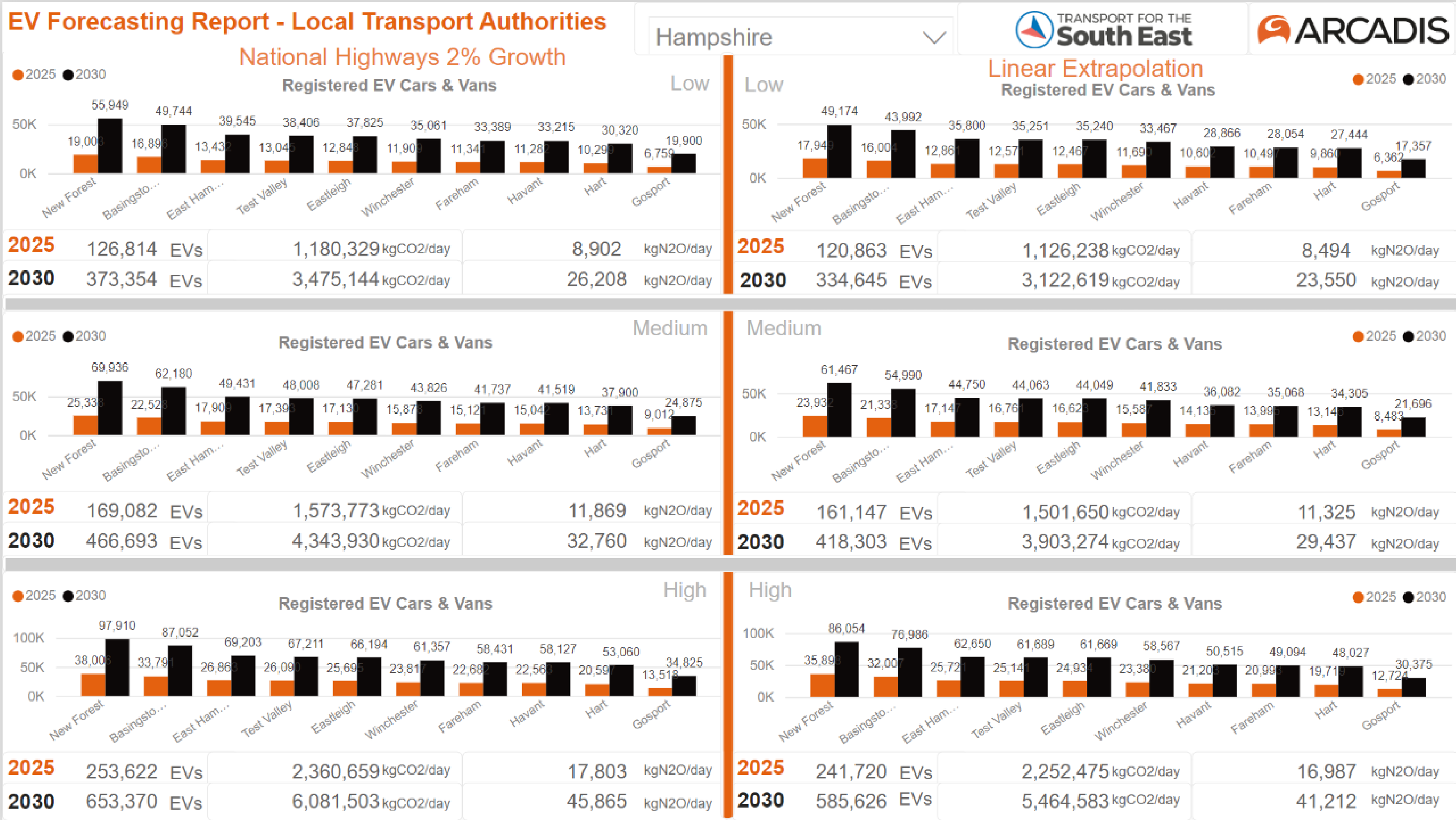

Figure 11 - EV Forecasting Report: Hampshire

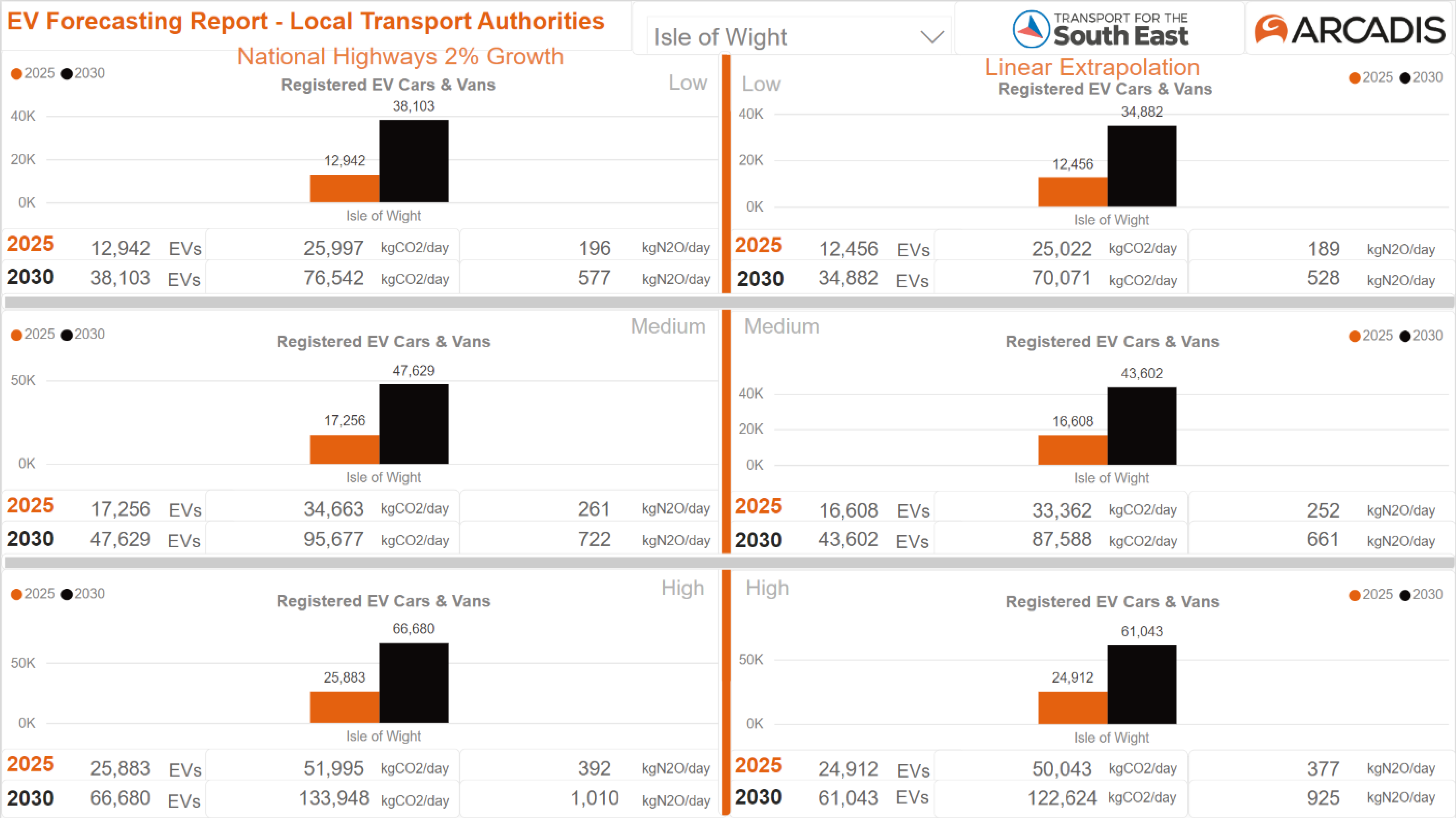

Figure 12 - EV Forecasting Report: Isle of Wight

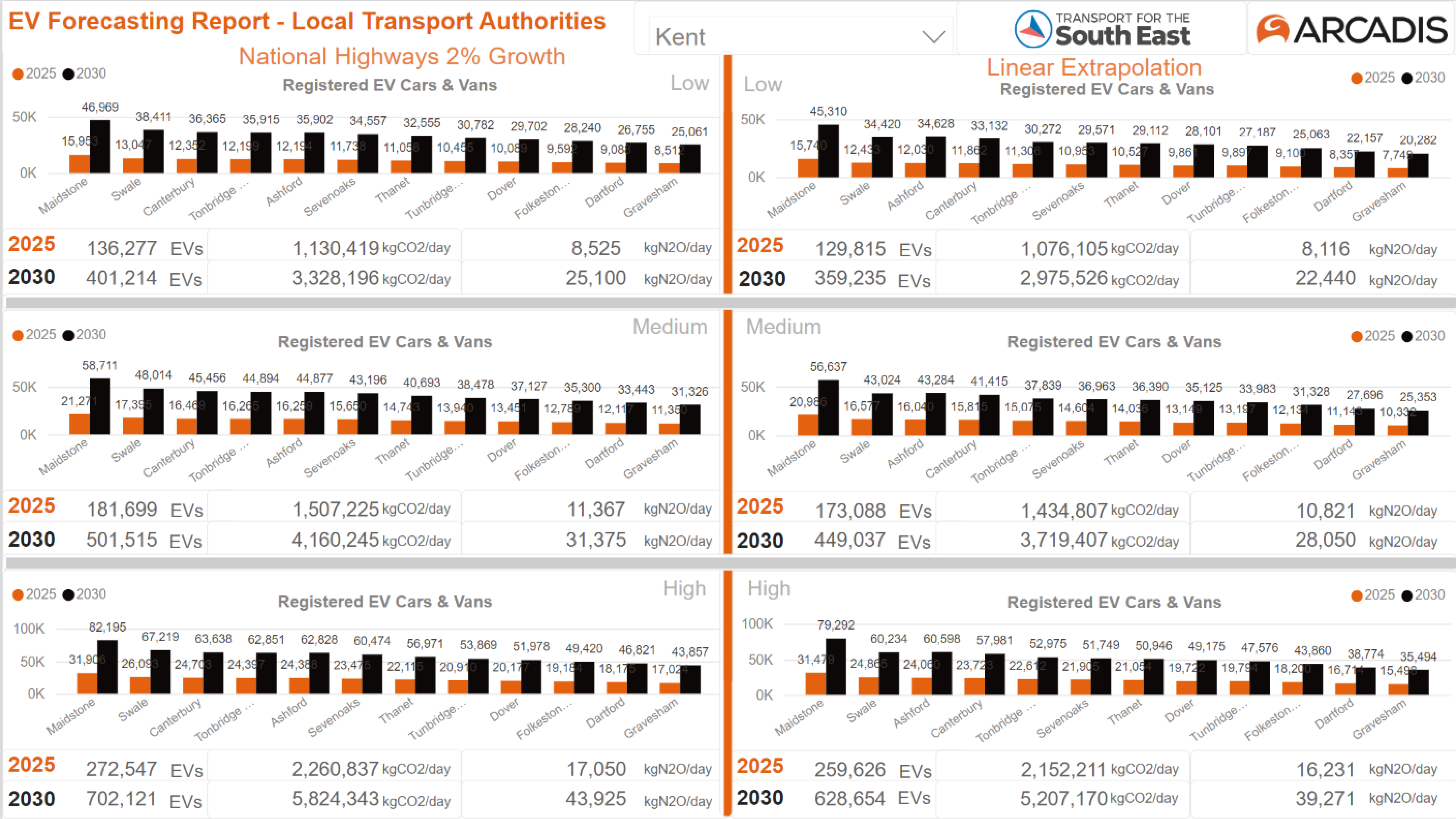

Figure 13 - EV Forecasting Report: Kent

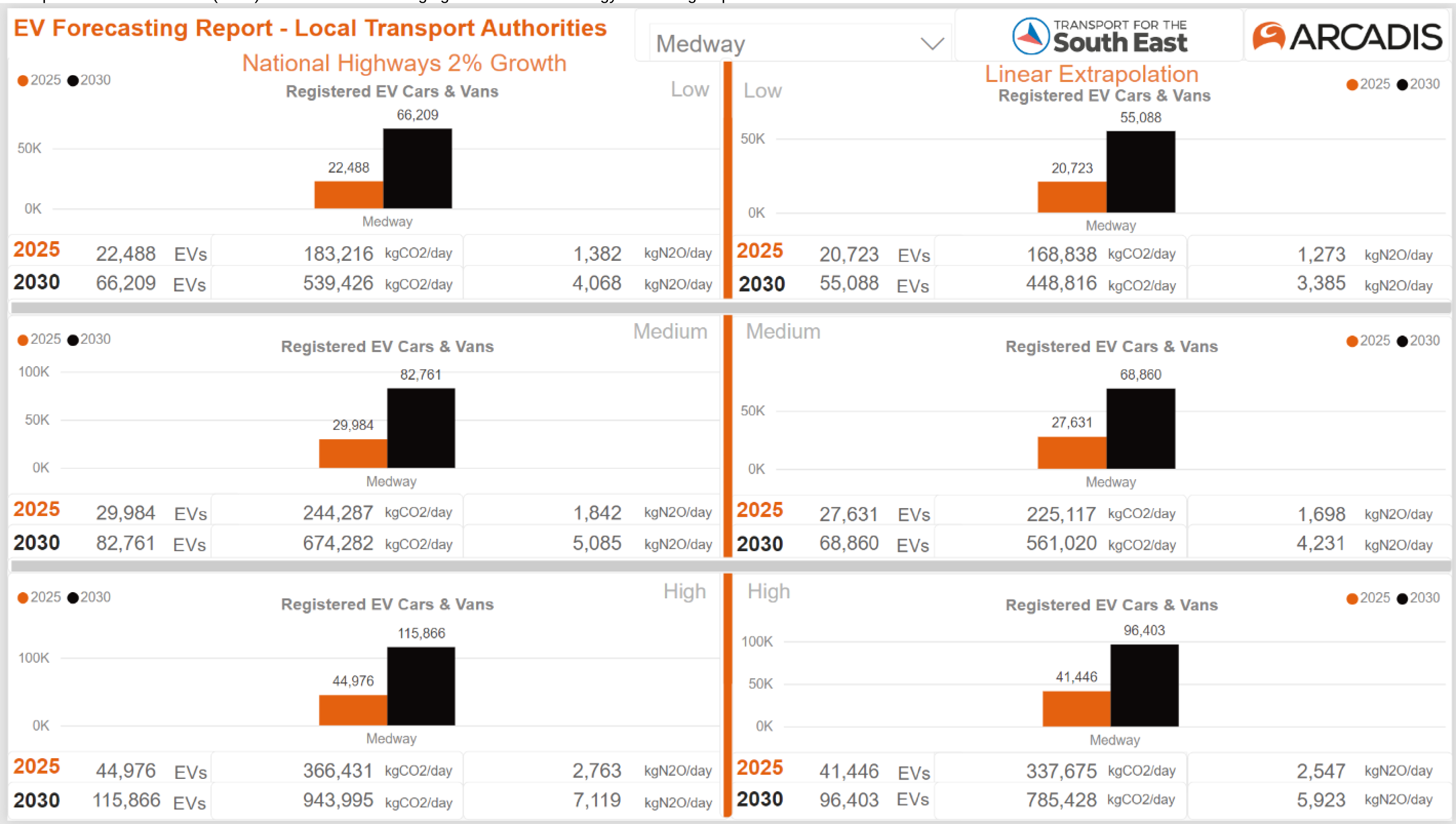

Figure 14 - EV Forecasting Report: Medway

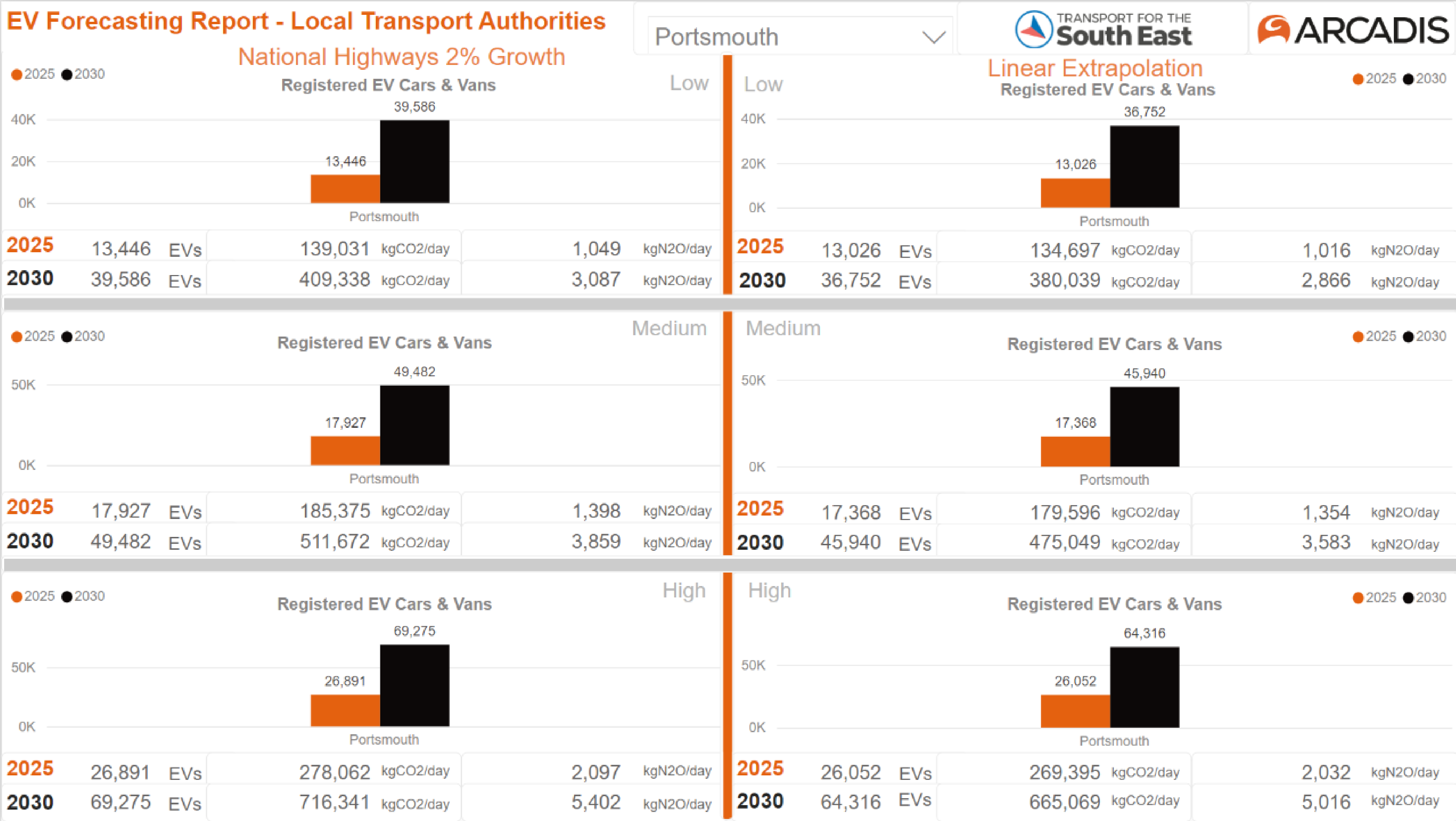

Figure 15 - EV Forecasting Report: Portsmouth

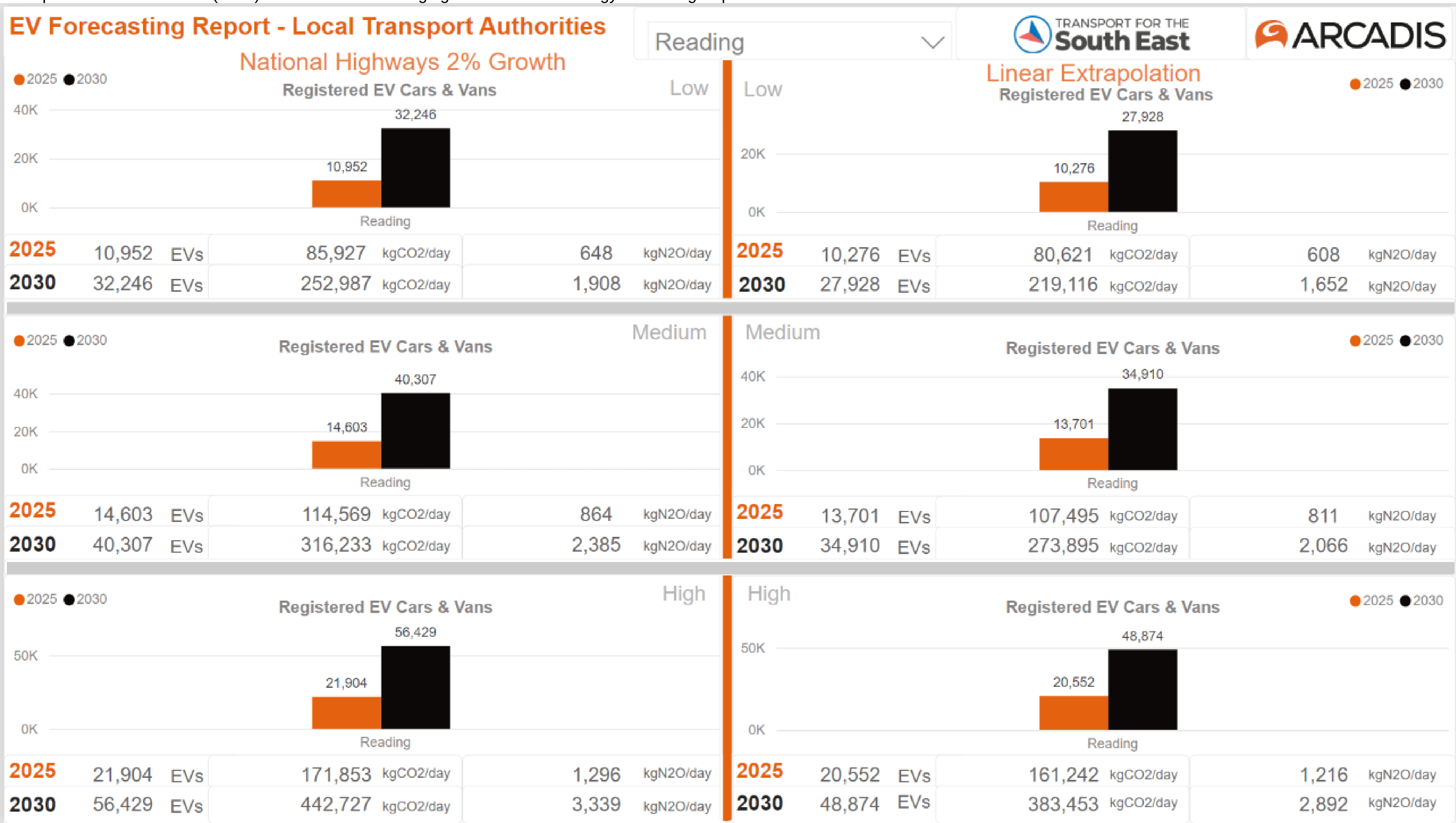

Figure 16 - EV Forecasting Report: Reading

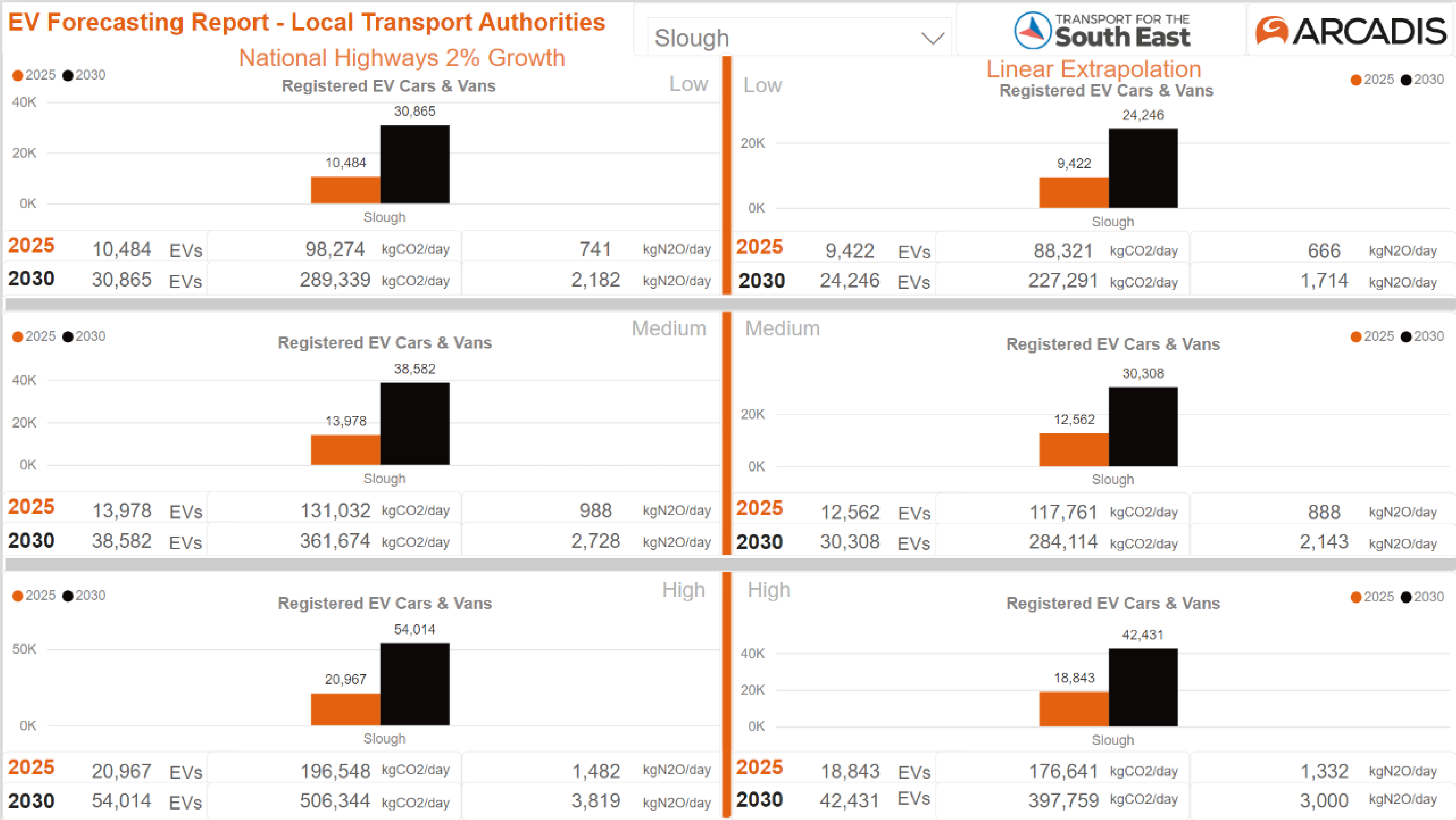

Figure 17 - EV Forecasting Report: Slough

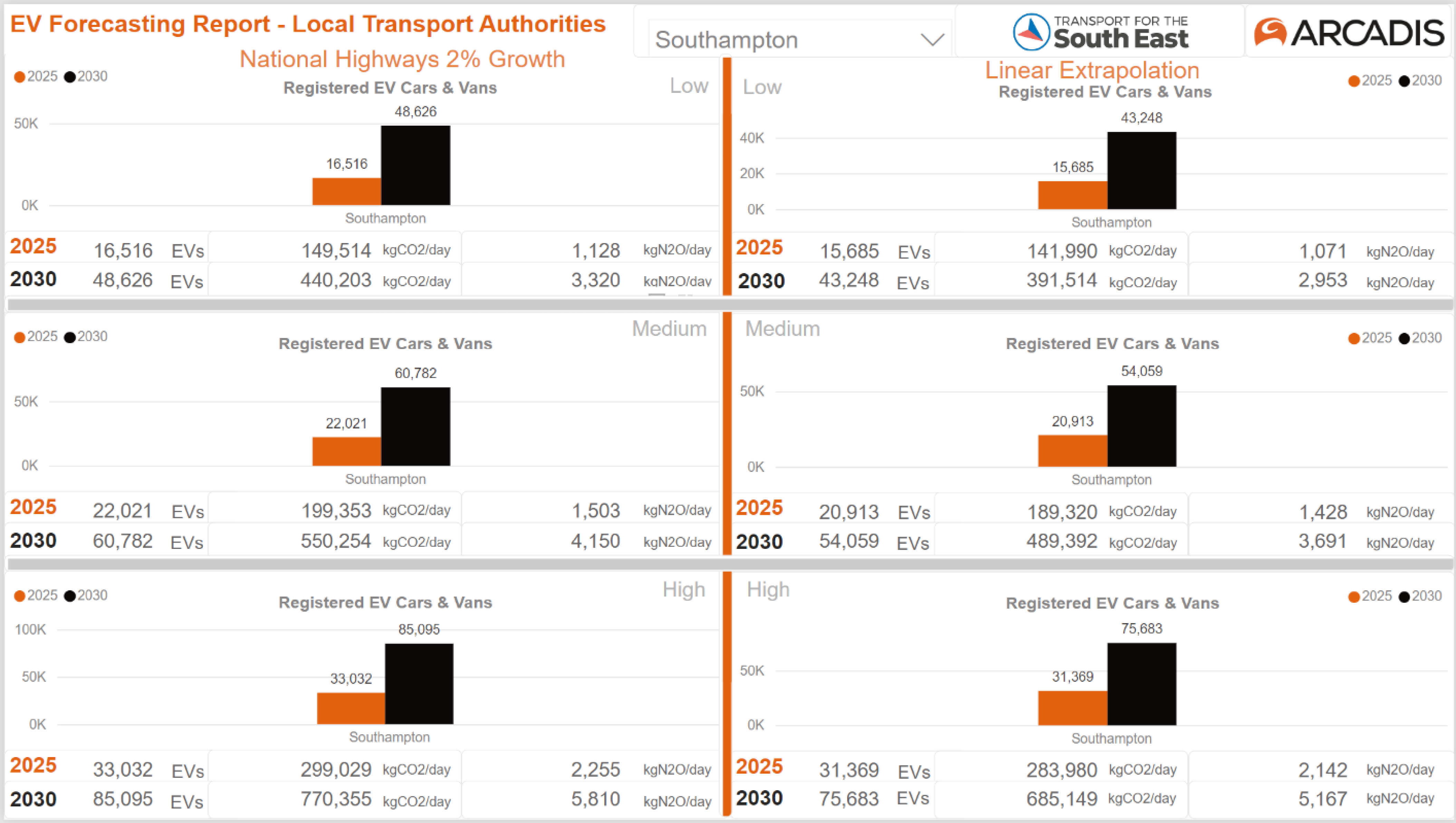

Figure 18 - EV Forecasting Report: Southampton

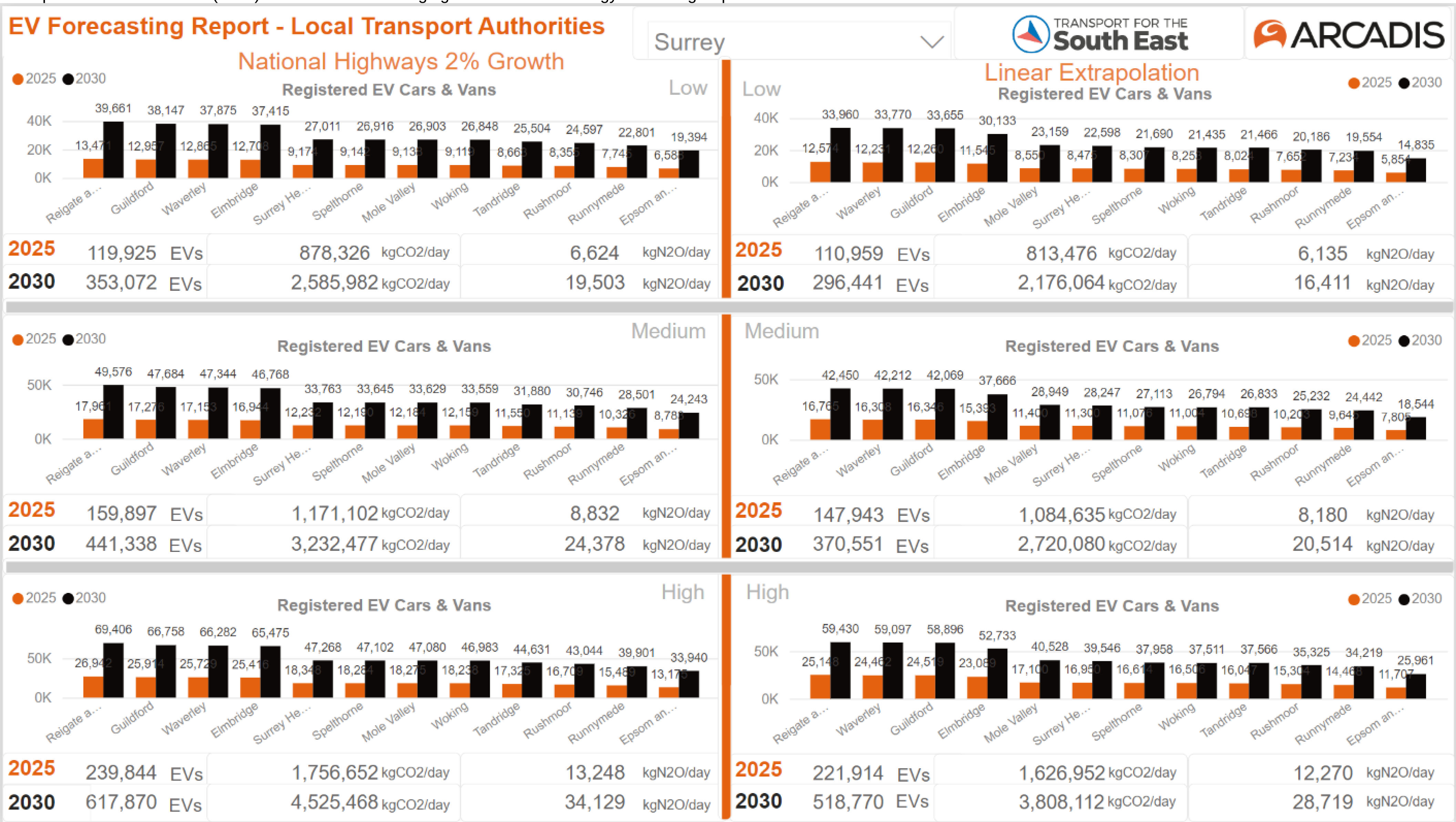

Figure 19 - EV Forecasting Report: Surrey

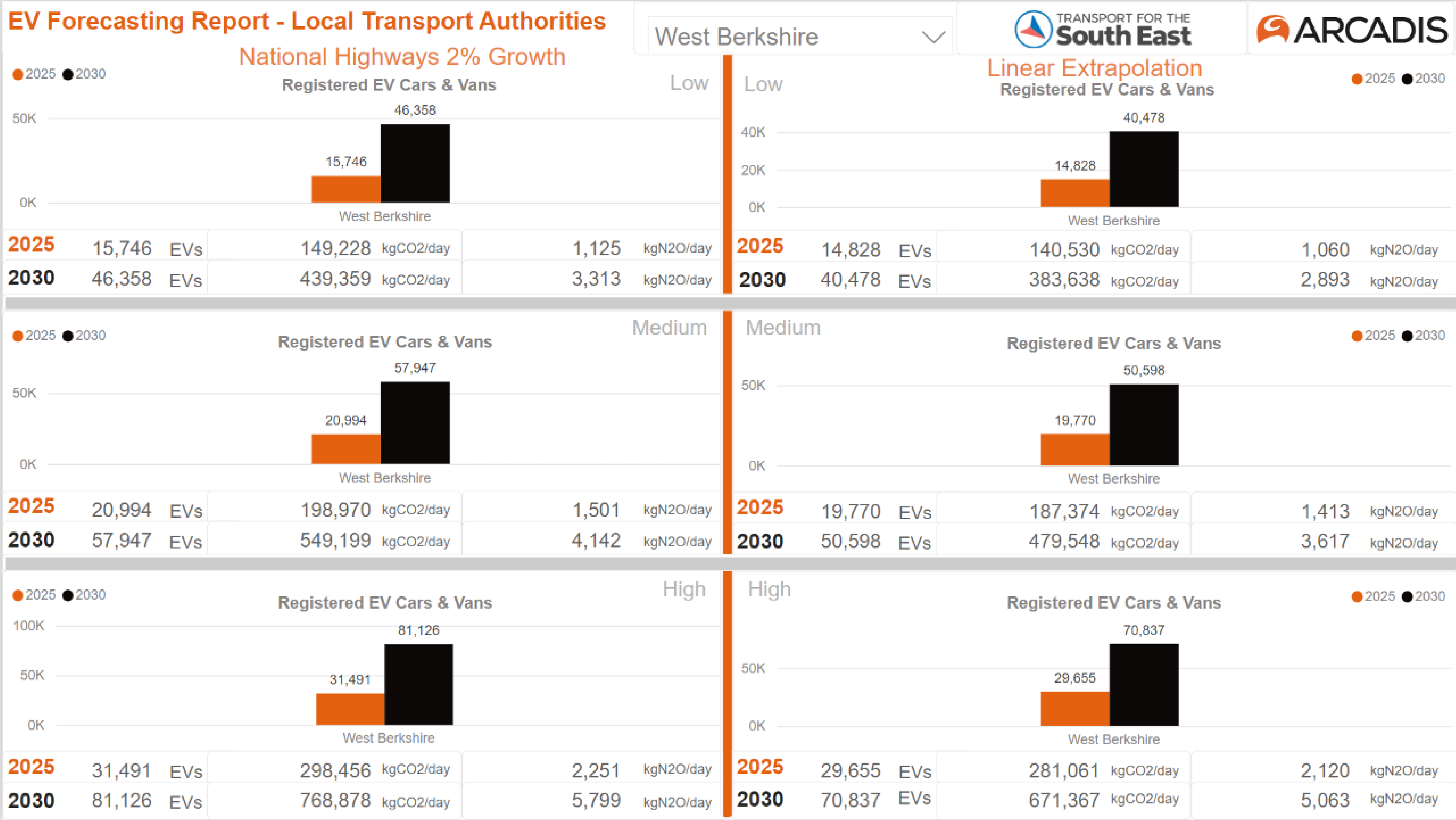

Figure 20 - EV Forecasting Report: West Berkshire

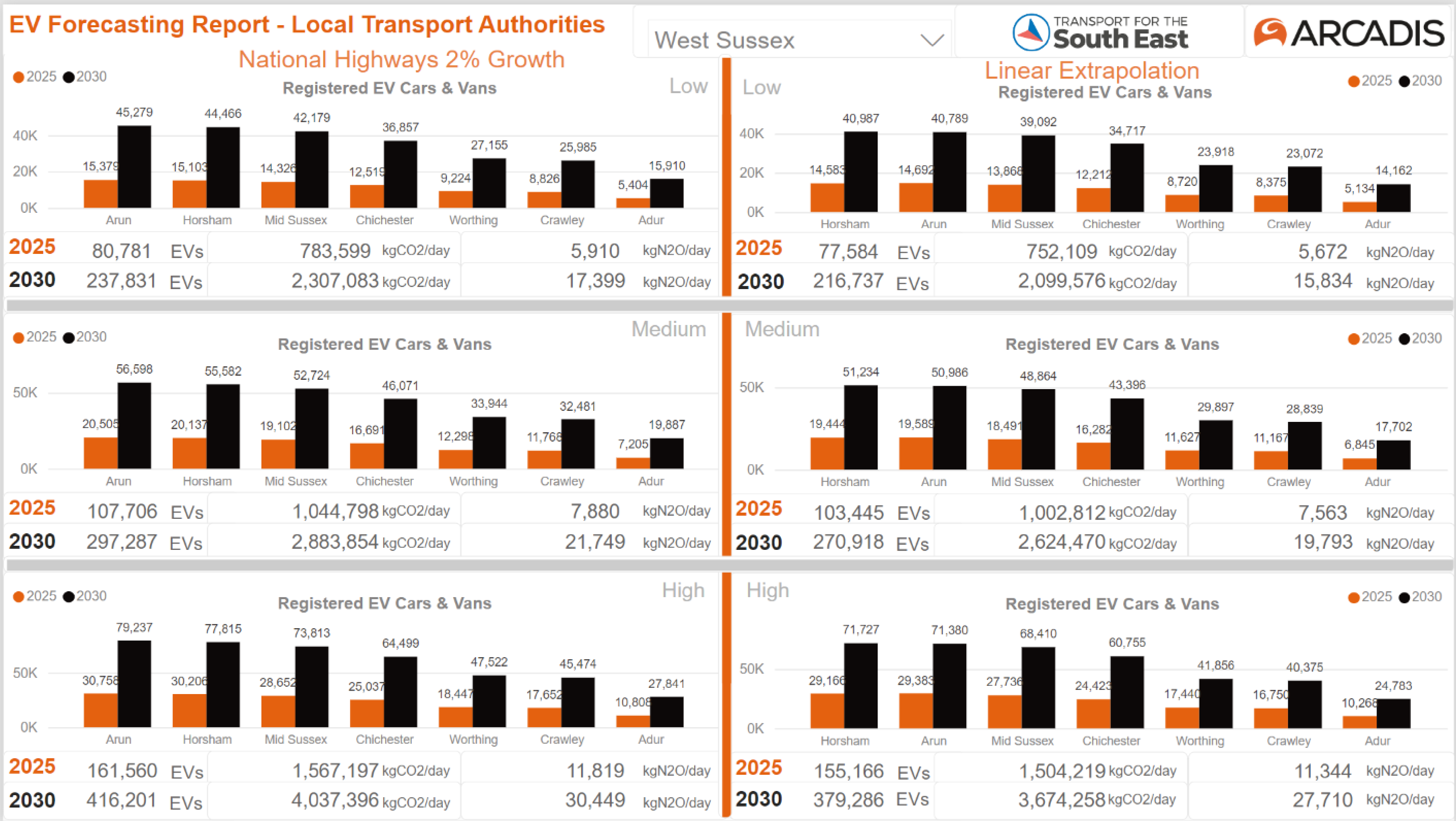

Figure 21 - EV Forecasting Report: West Sussex

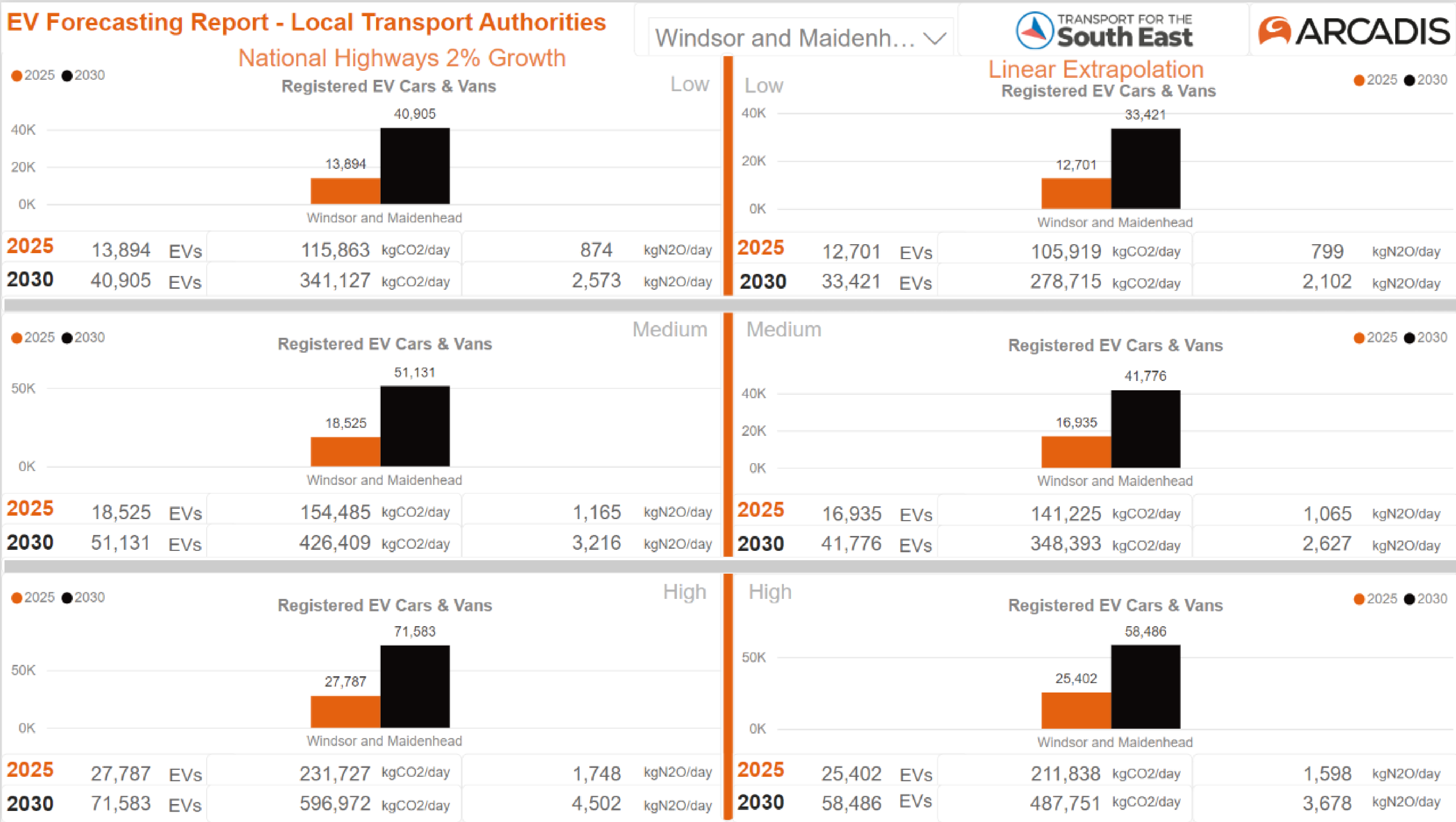

Figure 22 - EV Forecasting Report: Windsor and Maidenhead

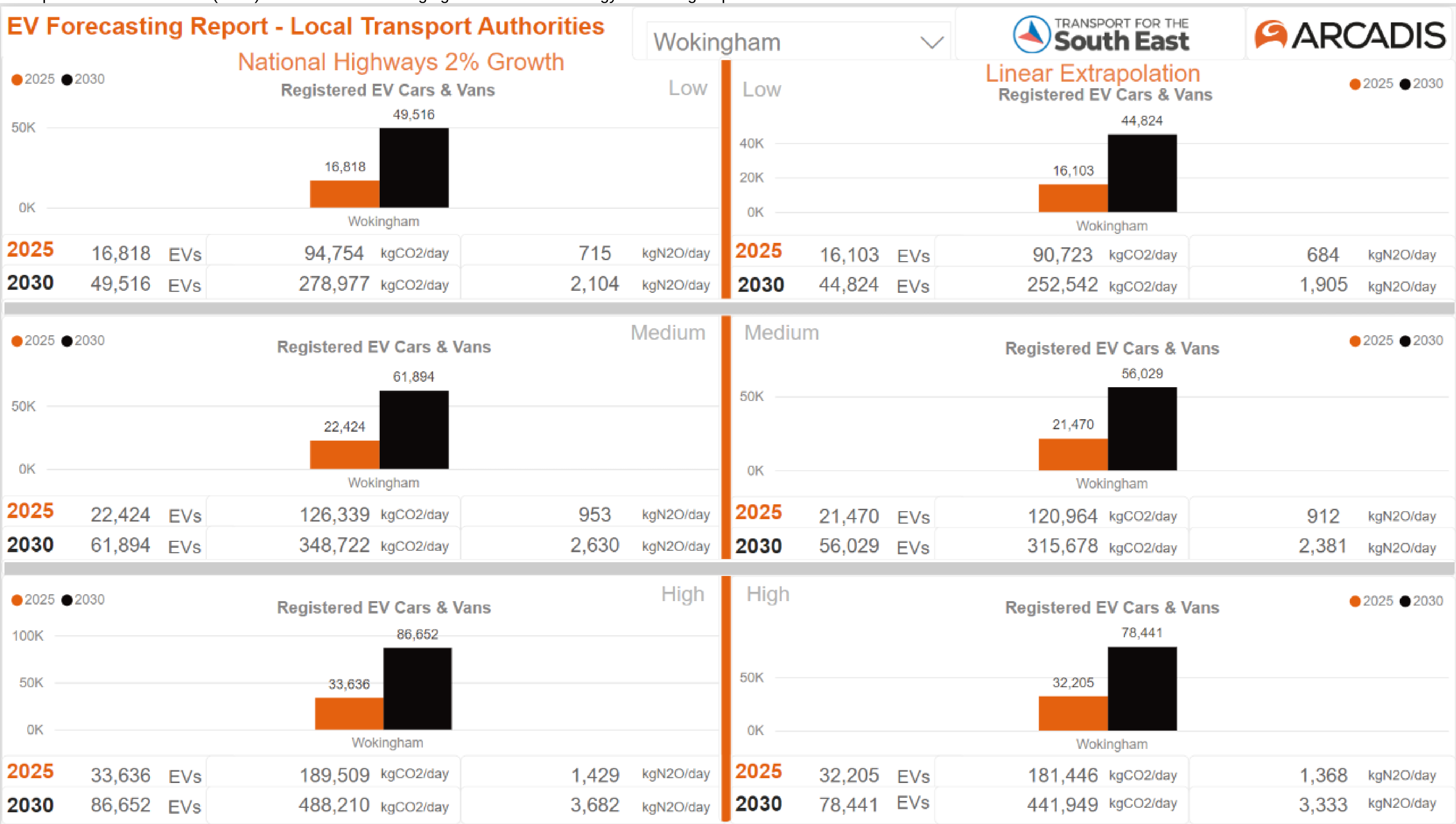

Figure 23 - EV Forecasting Report: Wokingham

Appendix B: Commuting Use Case

On-Street Residential Use Case Forecast EVCI Numbers

District and Borough	National Highway						Linear Extrapolation					
	2025			2030			2025			2030		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Adur	39	51	77	85	107	149	37	49	73	76	95	133
Arun	91	121	182	201	251	351	87	116	174	181	226	317
Ashford	114	152	228	252	314	440	112	150	225	243	303	425
Basingstoke and Deane	168	223	335	370	462	647	159	212	317	327	409	573
Bracknell Forest	73	98	147	162	203	284	70	94	141	147	184	258
Brighton and Hove	172	229	343	379	474	663	159	212	318	319	398	557
Canterbury	96	128	193	213	266	372	92	123	185	194	242	339
Chichester	155	207	310	342	428	599	151	202	302	322	403	564
Crawley	199	265	398	440	550	769	189	252	378	390	488	683
Dartford	87	116	175	193	241	338	80	107	161	160	200	280
Dover	93	124	186	206	257	360	91	122	182	195	243	341
East Hampshire	135	180	270	299	373	523	129	173	259	270	338	473
Eastbourne	61	82	123	136	169	237	57	77	115	117	146	204
Eastleigh	122	163	245	270	338	473	119	158	238	252	315	441
Elmbridge	72	96	144	159	198	278	65	87	131	128	160	224
Epsom and Ewell	42	56	84	92	115	162	37	50	74	71	88	124
Fareham	116	154	232	256	320	448	107	143	214	215	269	376
Folkestone and Hythe	123	163	245	271	338	474	116	155	233	240	300	421
Gosport	70	93	140	155	193	271	66	88	132	135	169	236
Gravesham	70	93	140	154	193	270	64	85	127	125	156	219
Guildford	111	148	222	245	307	430	105	140	210	217	271	379
Hart	112	150	224	248	310	434	107	143	215	224	280	392
Hastings	47	63	94	104	130	182	45	60	90	94	117	164
Havant	99	132	198	219	273	383	93	124	186	190	238	333
Horsham	117	155	233	257	322	450	113	150	225	237	297	415
Isle of Wight	29	39	59	65	81	113	28	38	56	59	74	103
Lewes	62	82	123	136	170	239	59	79	119	125	156	218

On-Street Residential Use Case Forecast EVCI Numbers

District and Borough	National Highway						Linear Extrapolation					
	2025			2030			2025			2030		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Maidstone	122	163	244	269	337	471	120	160	241	260	325	455
Medway	194	259	388	429	536	750	179	239	358	357	446	624
Mid Sussex	134	178	267	295	369	516	129	172	258	273	342	478
Mole Valley	65	87	131	144	180	252	61	81	122	124	155	217
New Forest	201	268	402	444	555	777	190	253	380	390	488	683
Portsmouth	146	195	292	322	403	564	141	188	283	299	374	523
Reading	97	129	194	214	267	374	91	121	182	185	231	324
Reigate and Banstead	123	165	247	272	341	477	115	154	230	233	292	408
Rother	50	66	99	109	137	191	48	63	95	100	124	174
Runnymede	61	81	122	135	168	236	57	76	114	116	144	202
Rushmoor	80	106	159	176	220	307	73	97	146	144	180	252
Sevenoaks	110	146	220	242	303	424	102	137	205	207	259	363
Slough	107	143	214	237	296	414	96	129	193	186	233	326
Southampton	163	217	326	360	450	630	155	206	310	320	400	560
Spelthorne	69	92	138	152	190	266	63	84	125	123	153	215
Surrey Heath	54	72	108	119	149	209	50	67	100	100	125	175
Swale	97	130	195	215	269	376	93	124	186	193	241	337
Tandridge	69	92	138	153	191	268	64	85	128	129	161	225
Test Valley	129	172	257	284	355	497	124	165	248	261	326	456
Thanet	75	99	149	165	206	288	71	95	142	147	184	258
Tonbridge and Malling	113	151	227	250	313	438	105	140	210	211	264	369
Tunbridge Wells	90	121	181	200	250	350	86	114	171	176	221	309
Waverley	97	129	194	214	267	374	92	123	184	191	238	334
Wealden	129	172	259	286	357	500	126	169	253	270	338	473
West Berkshire	168	224	336	371	464	650	158	211	317	324	405	567
Winchester	156	208	313	345	432	604	153	205	307	330	412	577
Windsor and Maidenhead	122	163	244	269	337	471	111	149	223	220	275	385
Woking	68	91	136	150	188	263	62	82	123	120	150	210
Wokingham	96	128	192	212	264	370	92	122	183	191	239	335

On-Street Residential Use Case Forecast EVCI Numbers

District and Borough	National Highway						Linear Extrapolation					
	2025			2030			2025			2030		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Worthing	*74*	*99*	*149*	*164*	*205*	*287*	*70*	*94*	*140*	*144*	*181*	*253*

Appendix C: General Domestic Use Case

Public Town Centre Use Case Forecast EVCI Numbers

District and Borough	National Highway 2% Uptake						Linear Extrapolation					
	2025			2030			2025			2030		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Adur	3	4	6	6	8	11	3	4	5	6	7	10
Arun	8	11	16	18	22	31	8	10	15	16	20	28
Ashford	10	13	19	22	27	38	10	13	19	21	26	36
Basingstoke and Deane	13	17	26	28	35	49	12	16	24	25	31	44
Bracknell Forest	6	8	13	14	17	24	6	8	12	13	16	22
Brighton and Hove	14	18	27	30	38	53	13	17	25	25	32	44
Canterbury	9	12	18	20	25	35	9	12	18	18	23	32
Chichester	14	18	27	30	38	53	13	18	27	28	36	50
Crawley	20	27	40	44	56	78	19	25	38	39	49	69
Dartford	8	11	16	18	22	31	7	10	15	15	18	25
Dover	8	11	17	19	23	33	8	11	17	18	22	31
East Hampshire	11	15	22	25	31	43	11	14	21	22	28	39
Eastbourne	5	7	10	12	14	20	5	7	10	10	12	17
Eastleigh	10	14	20	23	28	39	10	13	20	21	26	37
Elmbridge	7	9	14	15	19	27	6	8	12	12	15	21
Epsom and Ewell	4	5	7	8	10	14	3	4	7	6	8	11
Fareham	9	12	18	20	25	35	8	11	17	17	21	29
Folkestone and Hythe	11	14	21	23	29	41	10	13	20	21	26	36
Gosport	5	7	10	11	14	20	5	6	10	10	12	17
Gravesham	7	9	13	15	18	26	6	8	12	12	15	21
Guildford	10	13	20	22	27	38	9	12	19	19	24	33
Hart	9	12	18	19	24	34	8	11	17	18	22	31
Hastings	4	5	8	9	11	15	4	5	7	8	10	13
Havant	8	11	16	18	22	31	7	10	15	15	19	27
Horsham	10	14	21	23	29	40	10	13	20	21	26	37
Isle of Wight	3	4	5	6	8	11	3	4	5	6	7	10
Lewes	5	7	10	11	14	19	5	6	10	10	13	18

Maidstone	*11*	*15*	*22*	*24*	*30*	*43*	*11*	*15*	*22*	*24*	*29*	*41*
Medway	*18*	*23*	*35*	*39*	*48*	*68*	*16*	*22*	*32*	*32*	*40*	*56*
Mid Sussex	*11*	*14*	*21*	*24*	*30*	*41*	*10*	*14*	*21*	*22*	*27*	*38*
Mole Valley	*6*	*8*	*11*	*13*	*16*	*22*	*5*	*7*	*11*	*11*	*13*	*19*
New Forest	*17*	*23*	*34*	*38*	*47*	*66*	*16*	*22*	*32*	*33*	*42*	*58*
Portsmouth	*12*	*15*	*23*	*26*	*32*	*45*	*11*	*15*	*23*	*24*	*30*	*42*
Reading	*8*	*10*	*16*	*17*	*22*	*30*	*7*	*10*	*15*	*15*	*19*	*26*
Reigate and Banstead	*10*	*13*	*20*	*22*	*27*	*38*	*9*	*12*	*19*	*19*	*24*	*33*
Rother	*5*	*6*	*10*	*11*	*13*	*19*	*5*	*6*	*9*	*10*	*12*	*17*
Runnymede	*5*	*7*	*11*	*12*	*15*	*21*	*5*	*7*	*10*	*10*	*13*	*18*
Rushmoor	*7*	*9*	*13*	*15*	*18*	*26*	*6*	*8*	*12*	*12*	*15*	*21*
Sevenoaks	*10*	*13*	*19*	*22*	*27*	*38*	*9*	*12*	*18*	*18*	*23*	*32*
Slough	*7*	*10*	*14*	*16*	*20*	*28*	*7*	*9*	*13*	*13*	*16*	*22*
Southampton	*13*	*18*	*27*	*29*	*37*	*52*	*13*	*17*	*25*	*26*	*33*	*46*
Spelthorne	*6*	*8*	*12*	*13*	*16*	*22*	*5*	*7*	*11*	*10*	*13*	*18*
Surrey Heath	*5*	*6*	*10*	*11*	*13*	*19*	*4*	*6*	*9*	*9*	*11*	*16*
Swale	*9*	*12*	*18*	*19*	*24*	*34*	*8*	*11*	*17*	*17*	*22*	*31*
Tandridge	*6*	*8*	*12*	*14*	*17*	*24*	*6*	*8*	*11*	*11*	*14*	*20*
Test Valley	*10*	*13*	*20*	*22*	*28*	*39*	*10*	*13*	*19*	*20*	*25*	*36*
Thanet	*8*	*10*	*15*	*17*	*21*	*29*	*7*	*10*	*15*	*15*	*19*	*26*
Tonbridge and Malling	*10*	*13*	*20*	*22*	*27*	*38*	*9*	*12*	*18*	*18*	*23*	*32*
Tunbridge Wells	*8*	*11*	*16*	*18*	*22*	*31*	*8*	*10*	*15*	*16*	*19*	*27*
Waverley	*9*	*12*	*17*	*19*	*24*	*34*	*8*	*11*	*17*	*17*	*21*	*30*
Wealden	*12*	*15*	*23*	*26*	*32*	*45*	*11*	*15*	*23*	*24*	*30*	*42*
West Berkshire	*13*	*17*	*26*	*28*	*35*	*49*	*12*	*16*	*24*	*25*	*31*	*43*
Winchester	*13*	*17*	*25*	*28*	*35*	*49*	*12*	*17*	*25*	*27*	*33*	*47*
Windsor and Maidenhead	*11*	*14*	*21*	*23*	*29*	*41*	*10*	*13*	*19*	*19*	*24*	*34*
Woking	*6*	*8*	*12*	*13*	*17*	*23*	*5*	*7*	*11*	*11*	*13*	*18*
Wokingham	*8*	*11*	*16*	*18*	*23*	*32*	*8*	*10*	*16*	*16*	*21*	*29*
Worthing	*6*	*8*	*12*	*13*	*16*	*23*	*6*	*7*	*11*	*11*	*14*	*20*

Appendix D: Tourism Use Case

District and Borough	Rapid Destination Use Case Forecast EVCI Numbers					
	2025			2030		
	Low	Medium	High	Low	Medium	High
Adur	2	3	4	4	5	7
Arun	24	32	48	48	60	84
Ashford	23	31	47	47	58	81
Basingstoke and Deane	26	35	53	53	66	92
Bracknell Forest	8	10	16	16	20	27
Brighton and Hove	73	97	145	145	181	254
Canterbury	35	47	71	71	88	124
Chichester	23	31	47	47	59	82
Crawley	16	21	32	32	40	55
Dartford	13	17	25	25	32	44
Dover	20	26	39	39	49	69
East Hampshire	15	20	30	30	37	52
Eastbourne	19	26	39	39	48	68
Eastleigh	9	12	18	18	23	32
Elmbridge	9	12	18	18	22	31
Epsom and Ewell	12	15	23	23	29	40
Fareham	9	12	18	18	23	32
Folkestone and Hythe						
Gosport	8	10	16	16	20	28
Gravesham	9	12	18	18	22	31
Guildford	18	24	36	36	45	62
Hart	6	7	11	11	14	20
Hastings	17	22	33	33	42	58
Havant	16	21	31	31	39	54
Horsham	19	26	38	38	48	67
Isle of Wight	28	38	57	57	71	100
Lewes	13	17	26	26	32	45
Maidstone	41	54	81	81	102	143
Medway	32	43	65	65	81	113
Mid Sussex	15	20	30	30	38	53
Mole Valley	12	16	23	23	29	41
New Forest	22	29	44	44	55	77
Portsmouth	49	65	97	97	121	170
Reading	35	46	69	69	87	122
Reigate and Banstead	9	12	18	18	23	32
Rother	20	26	39	39	49	69
Runnymede	5	7	10	10	13	18

District and Borough	Rapid Destination Use Case Forecast EVCI Numbers					
	2025			2030		
	Low	Medium	High	Low	Medium	High
Rushmoor	5	7	10	10	12	17
Sevenoaks	15	20	30	30	37	52
Slough	8	10	15	15	19	27
Southampton	44	58	87	87	109	152
Spelthorne	7	9	13	13	17	23
Surrey Heath	4	6	9	9	11	15
Swale	22	29	43	43	54	75
Tandridge	6	8	12	12	15	21
Test Valley	19	25	38	38	47	66
Thanet	26	35	52	52	65	91
Tonbridge and Malling	12	16	24	24	29	41
Tunbridge Wells	21	27	41	41	51	72
Waverley	12	17	25	25	31	44
Wealden	29	39	58	58	73	102
West Berkshire	17	23	35	35	44	61
Winchester	23	31	47	47	58	82
Windsor and Maidenhead	19	26	39	39	48	68
Woking	9	12	18	18	23	32
Wokingham	11	14	21	21	26	37
Worthing	14	19	29	29	36	50

Appendix E: EV Uptake Forecasts by Local Transport Authority

Attached separately due to size of file.
If required, please contact tf.se@eastsussex.gov.uk to be sent a copy.

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