Gloucestershire Local Transport Plan

Carbon Evidence Base

Introduction

This report sets out the carbon evidence base underpinning the development of Gloucestershire's updated Local Transport Plan (LTP). This includes evidence on the sources of transport-related carbon emissions in the county and scenario analysis that has informed the selection of a local transport decarbonisation pathway.

The analysis documented in these slides aligns with Chapters 3 and 4 of the Department for Transport (DfT)'s Quantifiable Carbon Guidance (QCG). The estimates and scenario testing of current and future emissions reported here are based on the best-practice 'area-wide disaggregated traffic modelling analysis' referenced in QCG and sourced from Western Gateway Sub-National Transport Body.

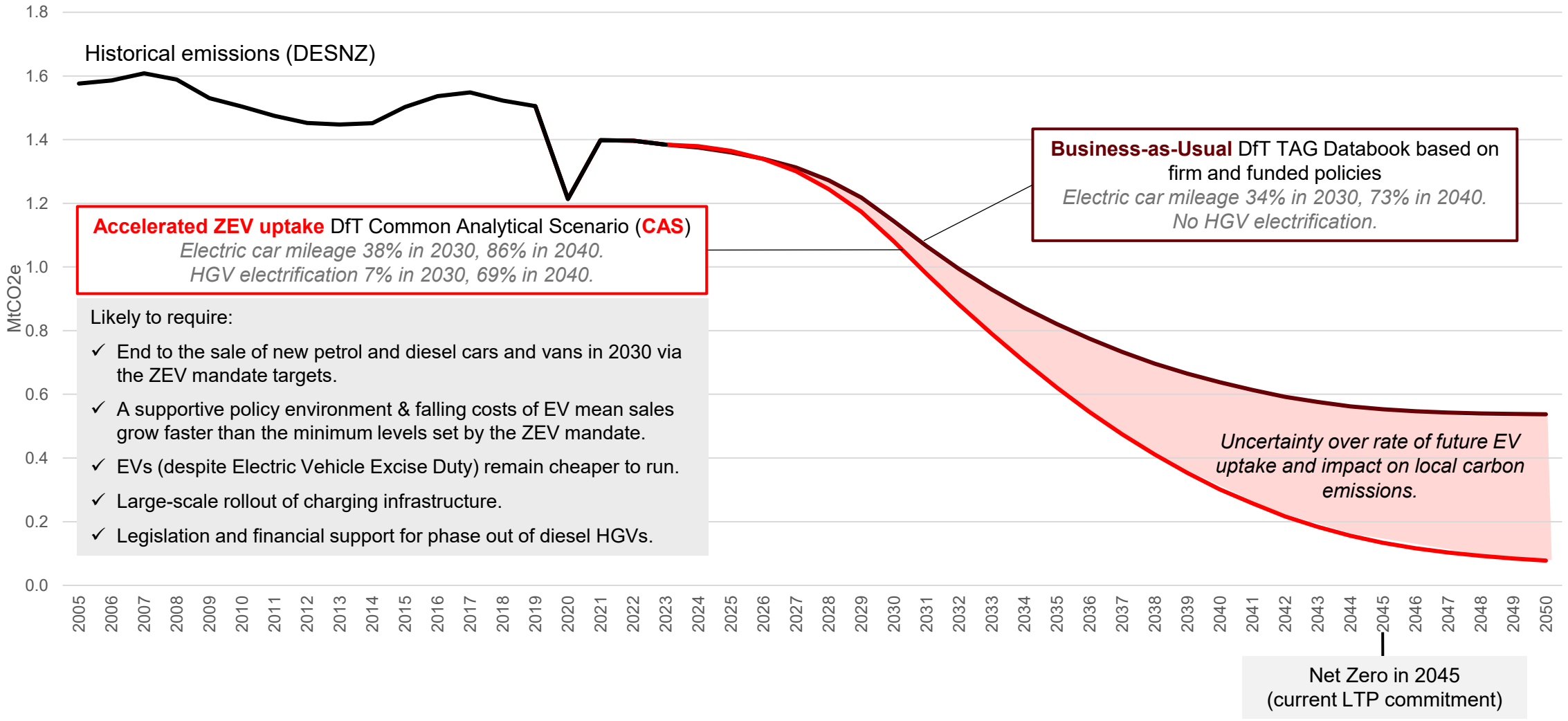
Analysis presented here should be reviewed alongside the 'Journey to Net Zero' routemap published in 2024. This analysis builds upon the principles and evidence in this work but uses the most up to date evidence and applies this specifically for use in the LTP update, aligning to DfT's QCG as published in October 2025.

This slidedeck only summarises the evidence prepared to inform the development of the LTP. For adopted policies and GCC's approach to transport decarbonisation the LTP Strategy, GCC's Climate Change Strategy and associated documents should be referred to.

Understanding Gloucestershire's transport emissions

Future emission forecasts

This chart shows historical transport emissions (Department for Energy Security and Net Zero – DESNZ, 2005–2023) with future projections under different scenarios of Zero Emission Vehicle (ZEV) uptake, illustrating the uncertainty in the pace of electrification and its impact on carbon emissions from transport use in the county.



Current (2023) user emission sources in Gloucestershire

Car 62% | LGV 16% | HGV 19% | PSV 2% | Rail 1%

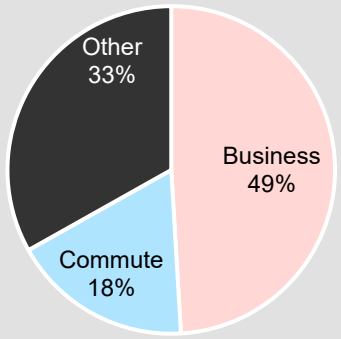
Cars are responsible for most, but **HGVs and LGVs account for a significant 35% of transport emissions in Gloucestershire. 51%** of these HGV/LGV emissions are from journeys of **25 miles and over**.

Only **14%** of emissions* are from journeys **up to 5 miles.**

40% of emissions* are from journeys **25 miles and over.**

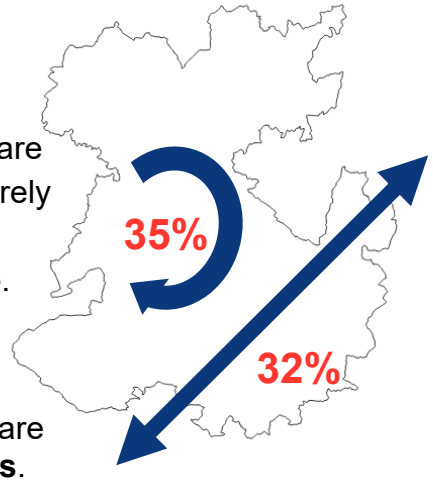
HGV trips account for **23%** of emissions* from journeys of **25 miles and over.**

Emissions* split by **journey purpose**:



67% of emissions* are from **business and commuting trips.** Within this, a substantial proportion is linked to longer journeys—with **53% of business** travel emissions and **34% of commuting** emissions arising from trips **over 25 miles**.

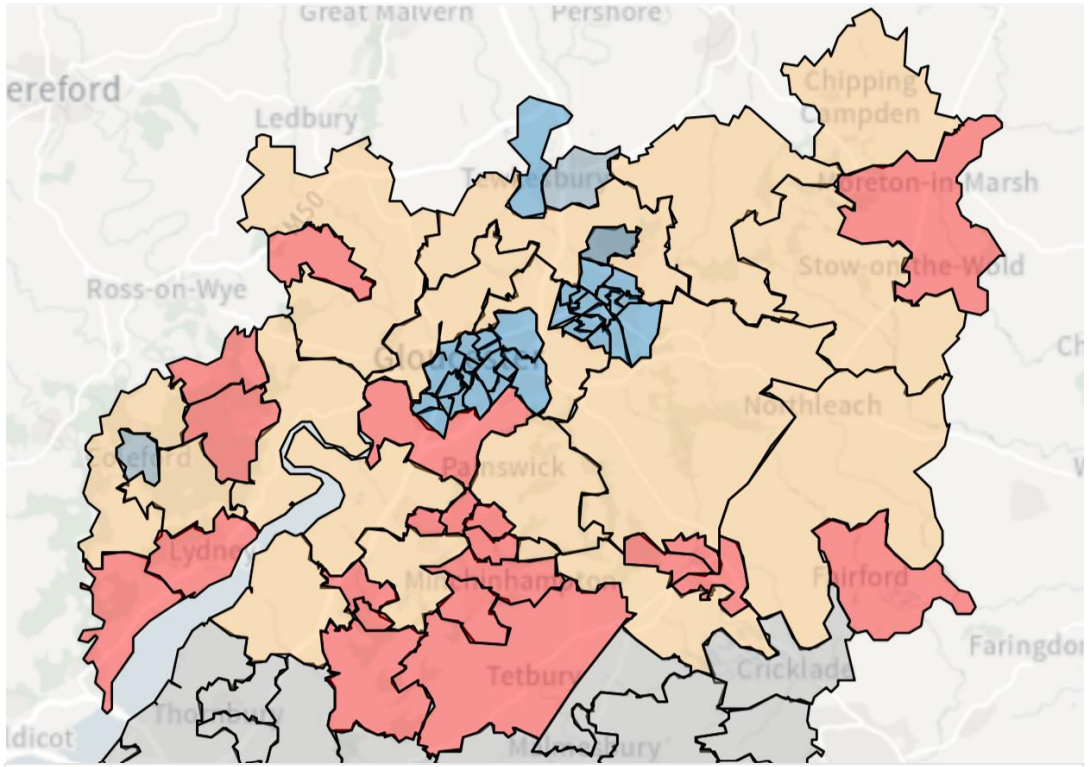
35% of emissions* are from trips made entirely **within Gloucestershire**.



32% of emissions* are from **through trips**.

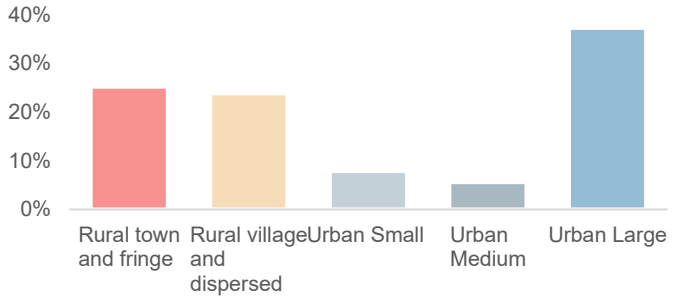
*These percentages are relative to car, LGV and HGV emissions only (excludes rail and PSV).

User carbon emissions by place-type



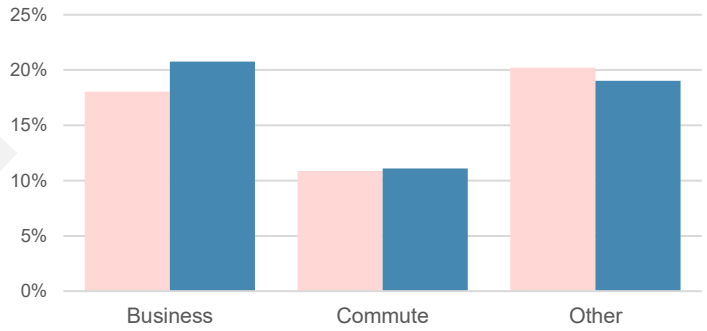
Rural Urban Classification	
Rural	Rural town & fringe
	Rural village & dispersed
Urban	Urban Small (within urban area with pop <25k)
	Urban Medium (within urban area with pop 25-100k)
	Urban Large (within urban area with pop 100-250k)

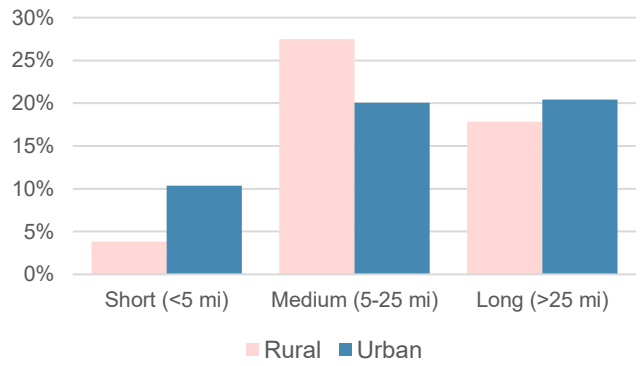
The place type data provide a high-level estimate of how emissions vary depending upon the geography of Gloucestershire.



51% of emissions are concentrated in urban areas, while 49% originate from rural place types.

- Business trips are the largest source of transport user emissions in urban place type.
- Rural emissions are dominated by 'other' trips, followed by business trips.



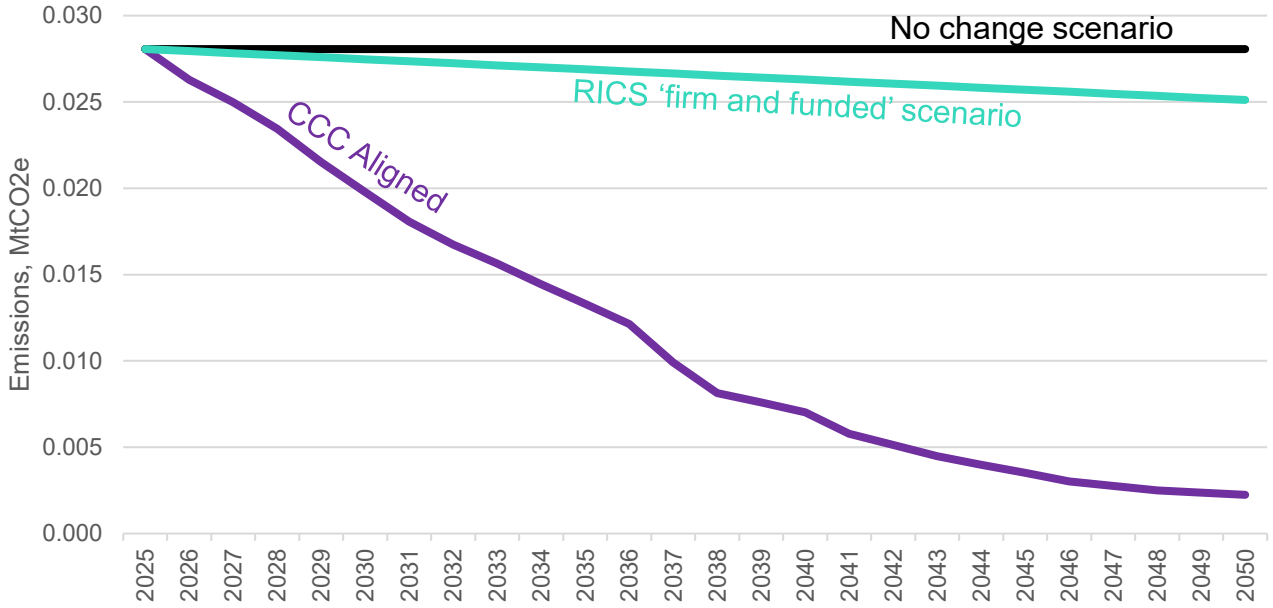


- Medium trips (5-25 miles): Rural areas emit approx. 37% more than Urban as rural residents travel further for everyday services.
- Urban areas: Long distance trips (>25 miles) have the highest emissions.
- A higher frequency of short distance trips are seen in urban place types.

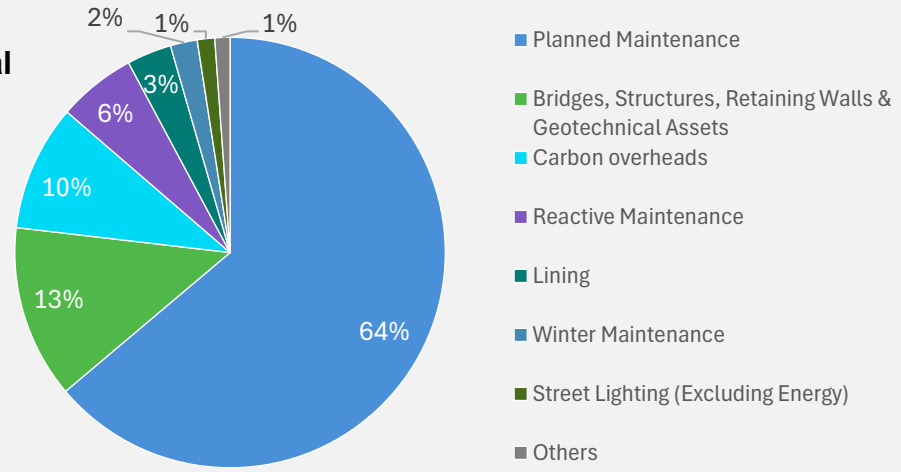
Note: All the place type emissions are attributed to trips originating in Gloucestershire.

Infrastructure carbon emission sources and forecast

Forecasts of GCC highways & transport infrastructure carbon



Emission breakdown by activities (financial year 2024-25)



In 2026 GCC were provided by ADEPT's Carbon Leadership Programme with a carbon footprint of all highways maintenance and operations activities. This estimated that these infrastructure carbon emissions were 28,061 tCO2e for the financial year 2024-2025. This does not include major projects.

A breakdown of these emissions is shown in the pie chart. Planned maintenance represents the largest source of GCC's infrastructure carbon emissions from repeatable activities: 17,915 tCO2e in 2024/5.

If these emissions remain constant in future years these activities would be responsible for 729,600 tCO2e between 2024 and 2050.

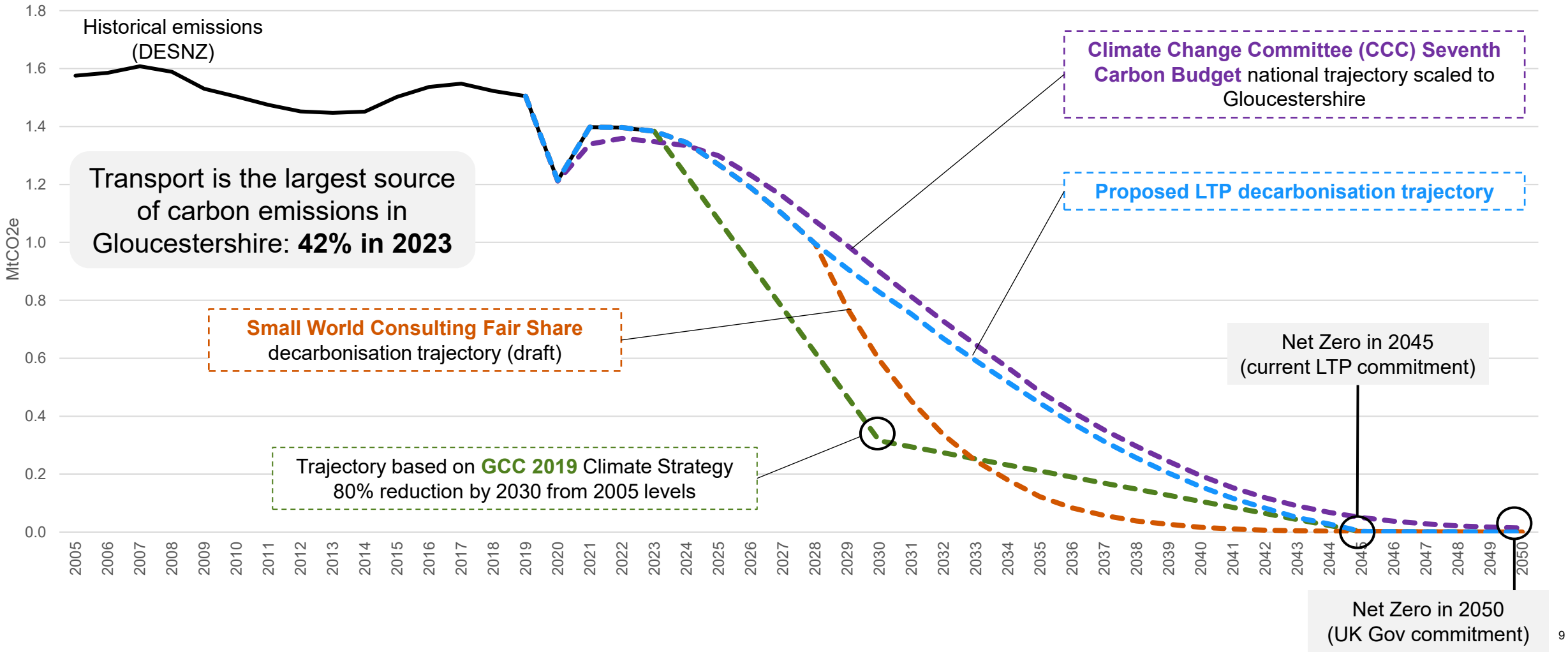
It is likely however that these emissions will reduce as a result of background trends that decarbonise energy and materials. This has indicatively been forecast using RICS 'firm and funded decarbonisation' scenario which suggests 50% decarbonisation of maintenance, repair and replacement emissions over a 120 year period; equating to 0.42% a year. Under this scenario GCC's cumulative highway maintenance and operation emissions would be 691,290 tCO2e between 2024 and 2050. This is equivalent to 3% of the user carbon emissions forecast to be emitted under a business-as-usual scenario over that same time period.

The Government however is seeking to decarbonise the economy by 2050. A more ambitious scenario of decarbonisation is therefore plausible. To represent this possible future an 'accelerated industrial decarbonisation' scenario has been tested using the annual reductions for the industrial sector included in the Committee on Climate Change's (CCC) Seventh Carbon Budget advice which focuses on reducing emissions from diverse production activities, energy use, and process emissions within industry. Under this scenario GCC's cumulative highway maintenance and operation emissions would be 302,913 tCO2e between 2024 and 2050. This is equivalent to 1.9% of user carbon emissions forecast to be emitted under an 'accelerated ZEV uptake' scenario over that same time period.

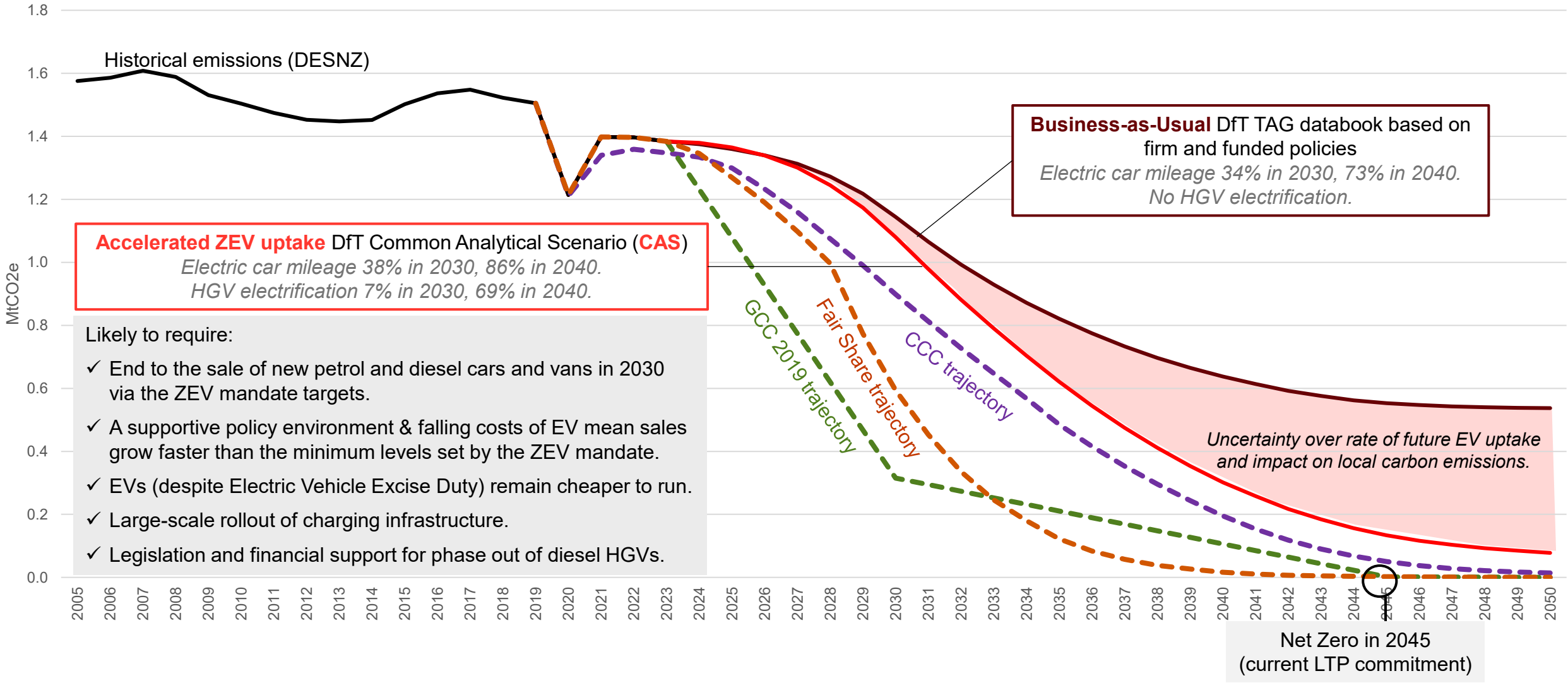
Decarbonisation Pathway Scenarios

How quickly should transport decarbonise?

The chart illustrates different decarbonisation trajectories for Gloucestershire's transport emissions. All of the trajectories shown here would see the contribution of Gloucestershire's transport to climate change reduced at least in line with the national pace of transport decarbonisation the Climate Change Committee (CCC) have suggested is needed to achieve the UK's carbon budgets. Informed by this, an LTP decarbonisation trajectory has been developed that would achieve Net Zero by 2045 and be consistent with UK carbon budgets.



Electric Vehicles won't be enough…



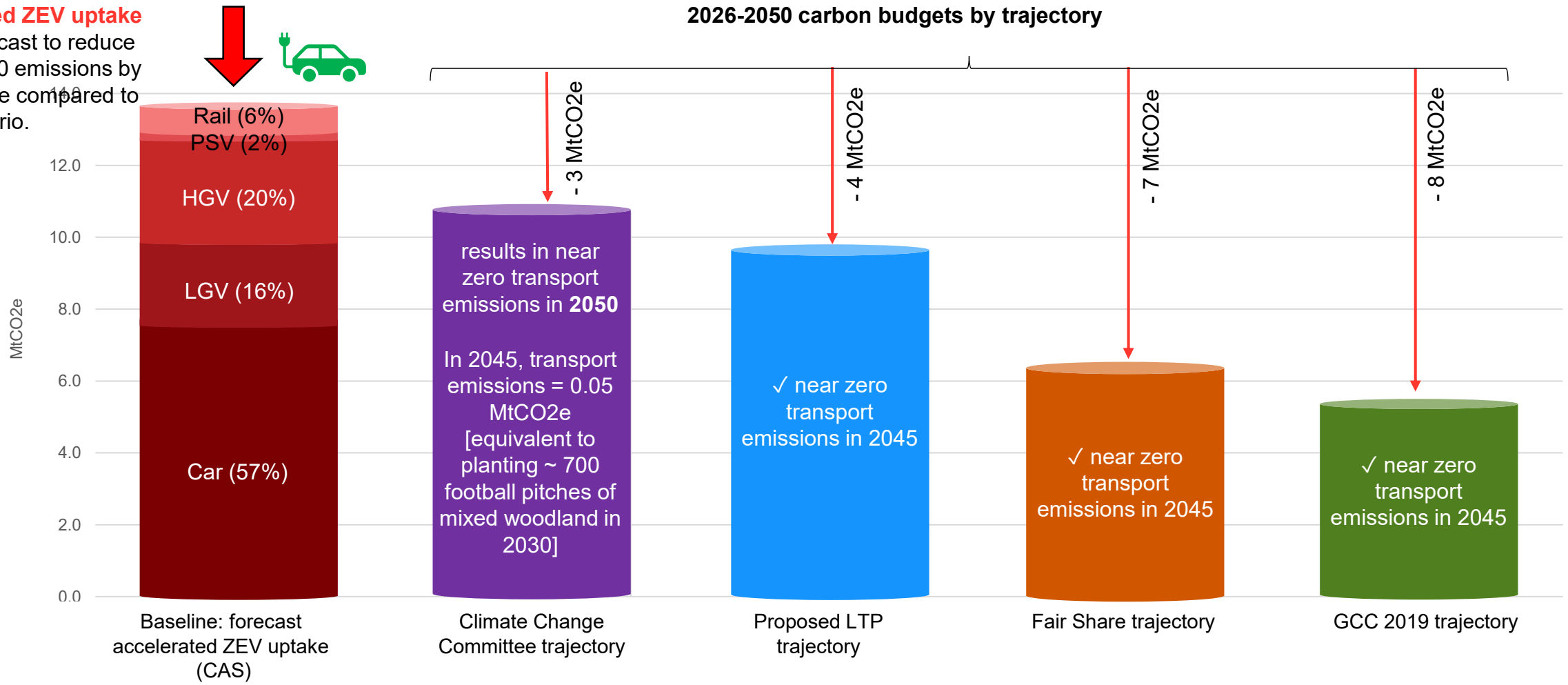
Likely to require:

- ✓ End to the sale of new petrol and diesel cars and vans in 2030 via the ZEV mandate targets.
- ✓ A supportive policy environment & falling costs of EV mean sales grow faster than the minimum levels set by the ZEV mandate.
- ✓ EVs (despite Electric Vehicle Excise Duty) remain cheaper to run.
- ✓ Large-scale rollout of charging infrastructure.
- ✓ Legislation and financial support for phase out of diesel HGVs.

While accelerated ZEV uptake could deliver the majority of transport emission reductions, even ambitious scenarios leave residual emissions and are largely dependent on national policy. This means Gloucestershire cannot reach Net Zero through electrification alone, requiring the LTP to also seek to avoid and shift travel demand.

Scale of challenge

Accelerated ZEV uptake (CAS) forecast to reduce 2026 - 2050 emissions by 6.5 MtCO2e compared to BaU scenario.



The chart illustrates the carbon budgets associated with an accelerated ZEV uptake scenario (red) and alternative decarbonisation pathways (coloured cylinders), highlighting how the total (cumulative) emissions differ under each. The gap between the ZEV-led baseline and the pathway budgets shows the additional emission reductions required beyond electrification emphasising that the pace of decarbonisation and cumulative emissions are critical to staying within climate limits.

Impacts of vehicle led decarbonisation pathway

- Persistent congestion and pressure on road space leading to need for capacity schemes.
- EVs are heavier, increasing road maintenance needs.
- Continued road safety risks.
- Health impacts from poor air quality associated with particulate matter from tyre wear.
- High upfront vehicle costs = inequitable transition.
- Missed co-benefits associated with sustainable travel (e.g. improved health outcomes, better public realm spaces).
- Feasibility risks (e.g. whether manufacturers and supply chain can meet demand).

The Rebound Effect: a study in Norway found that EV ownership leads to an **increase** in car trip **demand of 10-20%**.

Photo reference Forecourt Trader: EV owners report long queues for chargers over Christmas period.

Western Gateway STB's Carbon Assessment Playbook

Traffic models inc. growth forecasts

Vkms in 2019 and forecast in 2030 & 2040

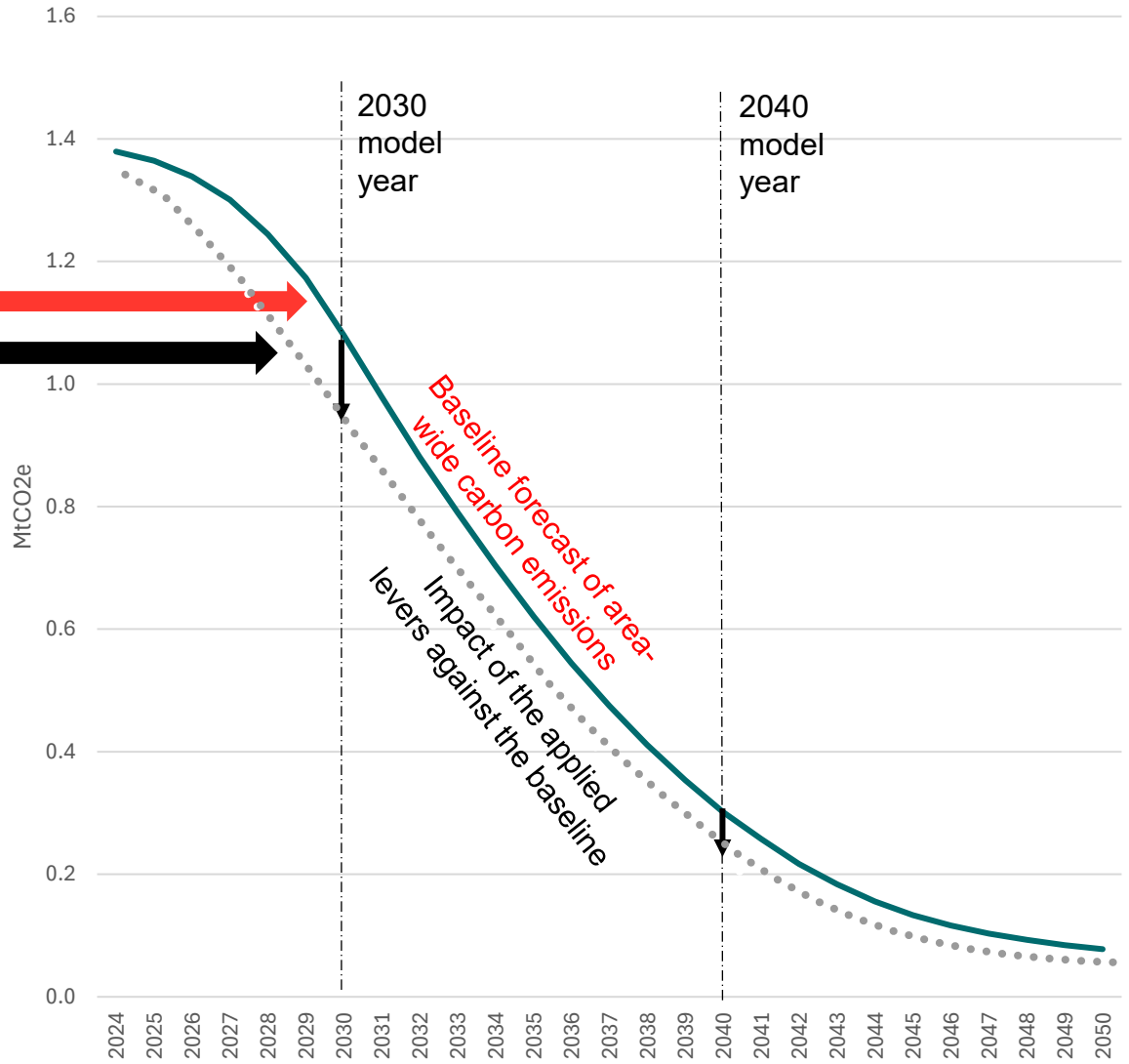
Broken down by:

Vehicle type	Place type
Trip length	Trip purpose

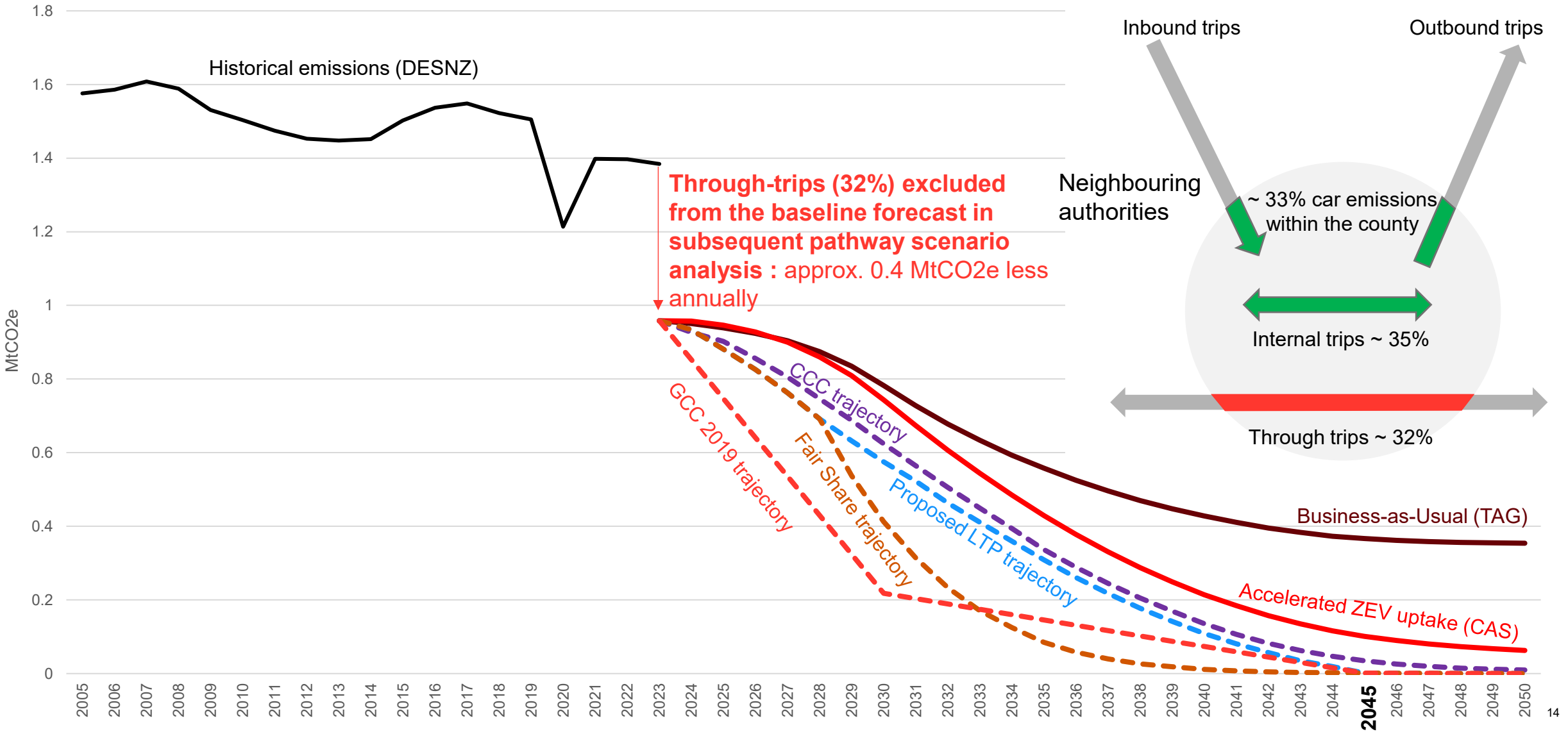
Carbon calcs under accelerated EV scenario

Levers are applied to that vkm baseline forecast (and specific segments of demand within it) *e.g. a 10% reduction in trips less than 1 mile (X vkms * 0.9)*

The above flow chart explain how levers are applied to the baseline vehicle kilometres (vkms) and electric vehicle (EV) uptake to estimate how changes in transport outcomes will influence carbon emissions.



33% of transport emissions are from through trips



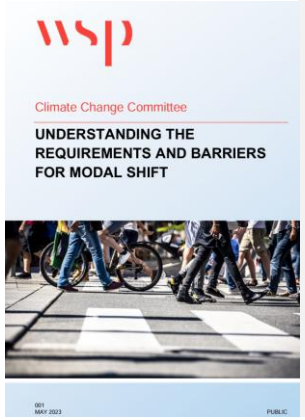
Better alternatives to car are essential

Capability
e.g. confidence, skills, information

Opportunity
e.g. high-quality networks and services

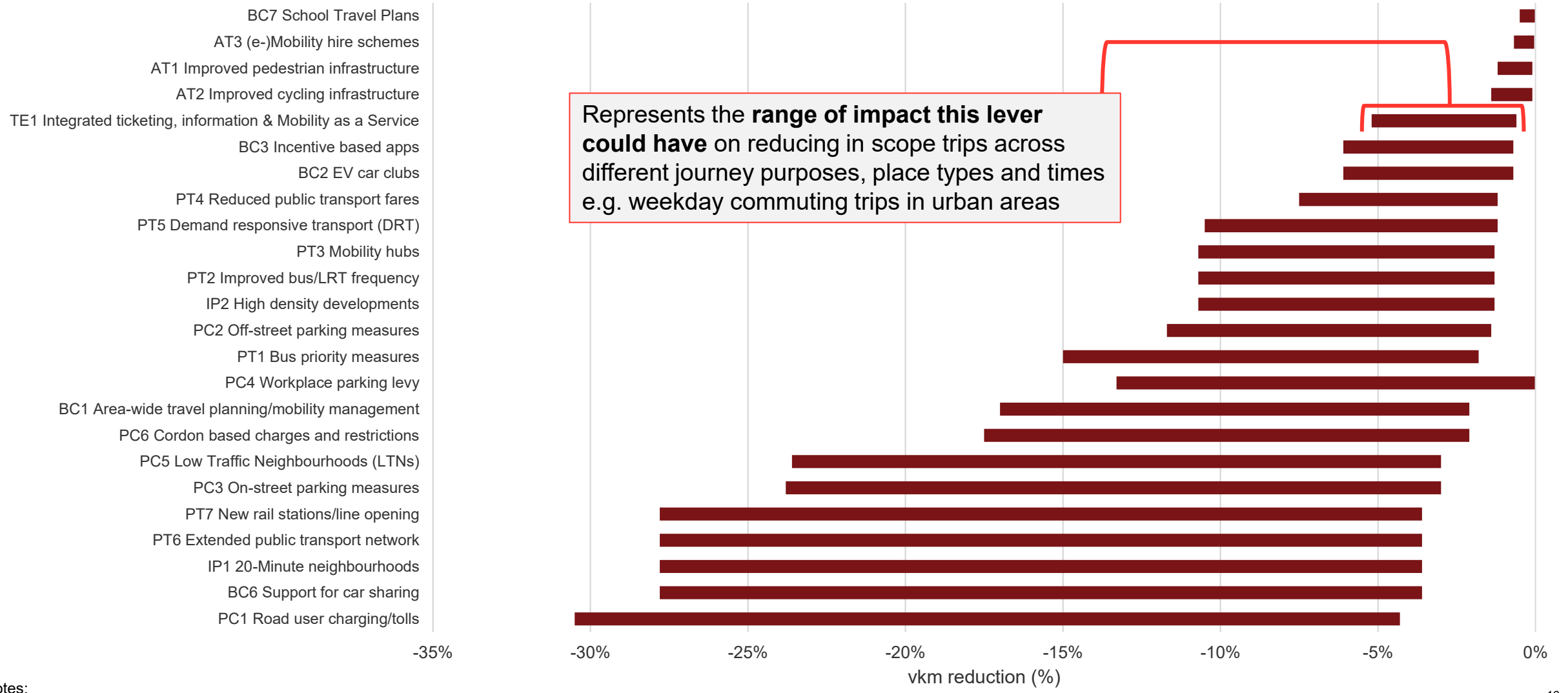
Motivation
e.g. health, cost, time, identity

Behaviour
Focus on car-reduction and increasing uptake of sustainable modes.



"Achieving meaningful modal shift requires a **combination of measures aiming to reduce car use and measures that offer people alternatives**, supported by effective communication and engagement activities."

Comparing the impact of different transport policies



Notes:
- Reflects % reduction against in scope trips only (e.g. weekday commuting trips in urban areas)
- The range reflects impact across different journey purposes, place times and times

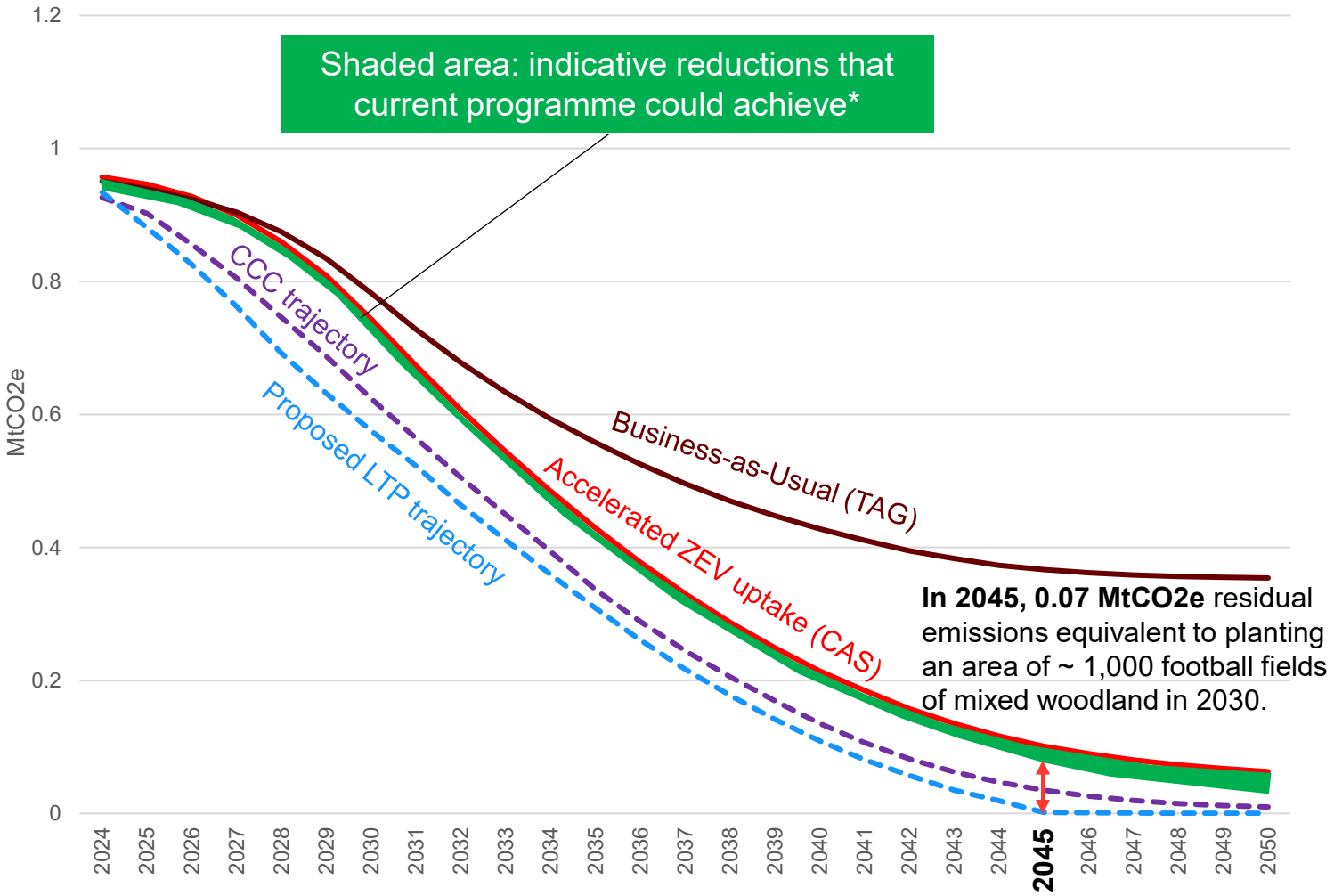
Decarbonisation Pathway Scenarios

The four scenarios below represent a structured spectrum of policy ambition from continuation of existing initiatives to transformative systemic change.

Scenario	Ambition level	Defining Policy Mechanisms	Emissions Reduction Trajectory
Scenario 1 Accelerated ZEV uptake and continuation of GCC's current transport investments	Low	Continuation of GCC policies: active travel promotion, public transport enhancement, land use planning, speed management. ZEV fleet transition as primary lever.	Modest reductions; significant residual gap to Net Zero.
Scenario 2 Sustainable transport investment	Medium	Builds on Scenario 1 with ambitious investment in sustainable transport infrastructure and targeted behaviour change: reducing short-trip car dependency, increasing bus mode share, improving vehicle occupancy, optimising freight movements.	Stronger reductions than Scenario 1; Net Zero gap remains.
Scenario 3a LTP Scenario	High	Combines sustained infrastructure investment with demand management measures increasing the financial cost and reducing convenience of private car use, alongside substantial road network reallocation to sustainable modes.	Achieves Net Zero by 2045 with substantial co-benefits.
Scenario 3b LTP Scenario + national demand policies or external factors	Very high	Requires reduction in private car travel to levels comparable to the COVID-19 pandemic. Such outcomes are likely beyond local control and would depend on national interventions or external shocks, but highlight the upper bound of what may be needed.	Meets the most ambitious emissions trajectory (GCC 2019 trajectory).

LTP Scenario 1: Accelerated ZEV Uptake and continuation of transport investment

Headline finding: Continuation of current transport investments is unlikely to be enough to meet a Carbon Budget aligned trajectory.



In 2045, 0.07 MtCO2e residual emissions equivalent to planting an area of ~ 1,000 football fields of mixed woodland in 2030.

Continuation of current investment includes:

Policy	Potential MtCO2e reduction	Reasoning for potential impact
Active travel investment inc. completion of the cycle spine	<1%**	% of overall trips affected county-wide is small. Physical opportunity alone unlikely enough
Bus Rapid Transit (inc. Park & Ride)	<1%**	Physical opportunity alone unlikely enough.
Local Plan policies compliant with emerging NPPF	1-2%	Moderate % of trips potentially affected.
Speed limit reductions	<2%	Large number of trips affected; lower speeds and less acceleration reduces emissions

** This is an indicative estimate based on professional judgement and previous scheme assessments. It does not account for potential increases in carbon from highway schemes.*

*** These infrastructure improvements are critical enablers to other policies and provide wider benefits.*

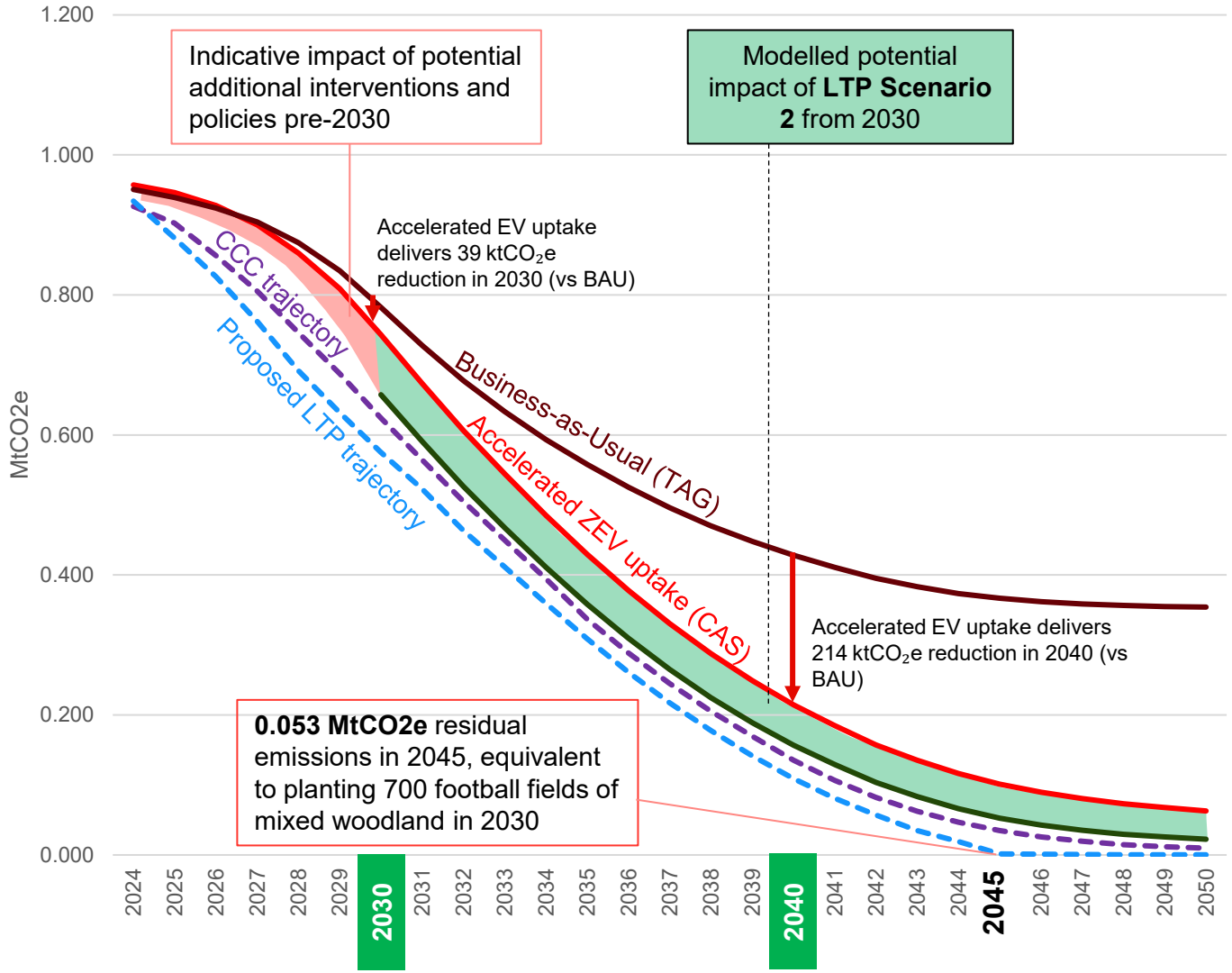
LTP Scenario 2: Sustainable transport investment

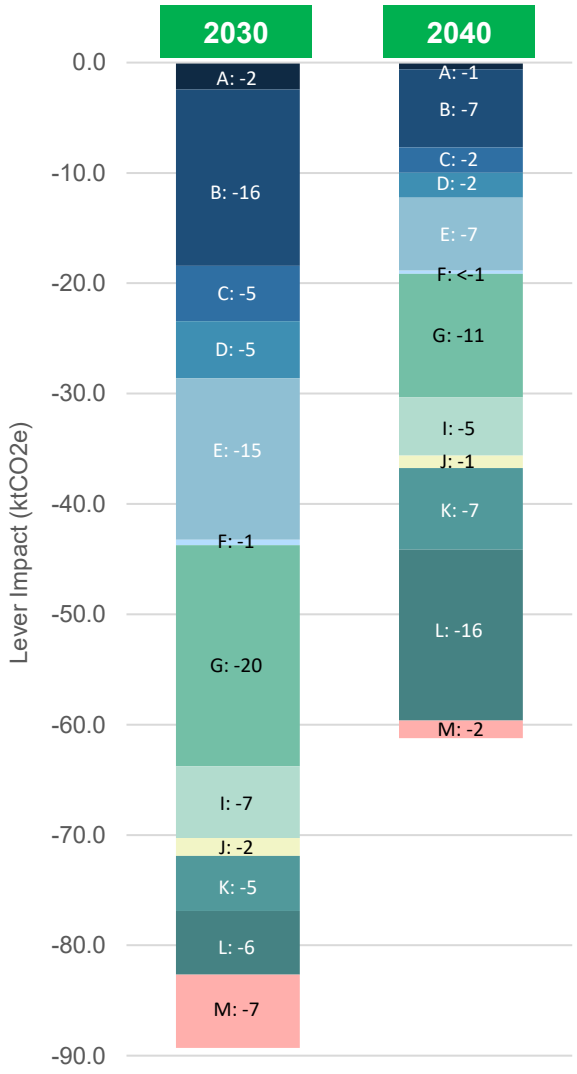
ID	Lever	Proportion of total county-wide vkms in-scope	Modelled change in 2030	Modelled change in 2040	Example interventions
A	Reduction in traffic growth	100%	-2%	0%	Vision-led SDS with metrics to reduce trip rates
B	Reduction in business and commute car vkms	40%	-5%	-5%	Support for online services and travel planning
C	Reduction in commuting trips through increased vehicle occupancy	25%	-2.5%	-2.5%	Support for business travel planning and ride sharing
D	Reduction in short distance trips (<5 miles) by localisation	12%	-5%	-5%	Improvements in local services (e.g. town centre regeneration & local employment hubs)
E	Reduction in long distance trips (5-25 miles) by meeting needs locally	39%	-5%	-5%	
F	Reduction in urban freight movements	1%	-1.5% (HGV) -2.5% (LGV)	-1.5% (HGV) -2.5% (LGV)	Freight consolidation & last mile solutions e.g. e-cargo bikes
G	Reduction in short distance trips (<5 miles) through active travel (urban only)	8%	-25% from 2030	-50%	Full build out of urban LCWIP proposals, including targeted road space reallocation + parking policy
H	Reduction in short distance trips (<5 miles) through active travel (rural only)	4%	NA	N/A	N/A
I	Increased bus patronage leading to reduction in car kms	80%	-1.0%	-2.5%	BSIP delivery / BRT / express network
J	Increased rail patronage leading to reduction in car kms	80%	-0.25%	-0.5%	Improved rail access, new stations and increased rail frequency
K	Bus electrification	N/A	50% by 2030	100% by 2040	Electric buses
L	Rail electrification	NA	25% by 2030	50% by 2040	Expansion of electrified lines
M	Reductions in carbon emissions from speed limit changes*	100%	1%	1%	
			Cross-cutting behaviour measures :		+ increase parking charges and limit supply to support Park & Ride

* This is an indicative reduction on overall emissions, not tested in the tools

LTP Scenario 2: Sustainable transport investment

Headline finding: ambitious sustainable transport networks and a sustainable SDS supported by parking policy could achieve the CCC's trajectory





ID	Lever
A*	Reduction in traffic growth
B	Reduction in business and commute car vkms
C	Reduction in commuting trips through increased vehicle occupancy
D	Reduction in short distance trips (<5 miles) by localisation
E	Reduction in long distance trips (5-25 miles) by meeting needs locally
F	Reduction in urban freight movements
G	Reduction in short distance trips (<5 miles) through active travel (urban only)
H	Reduction in short distance trips (<5 miles) through active travel (rural only)
I*	Increased bus patronage leading to reduction in car kms
J*	Increased rail patronage leading to reduction in car kms
K	Bus electrification
L	Rail electrification
M	Reduced speed limit

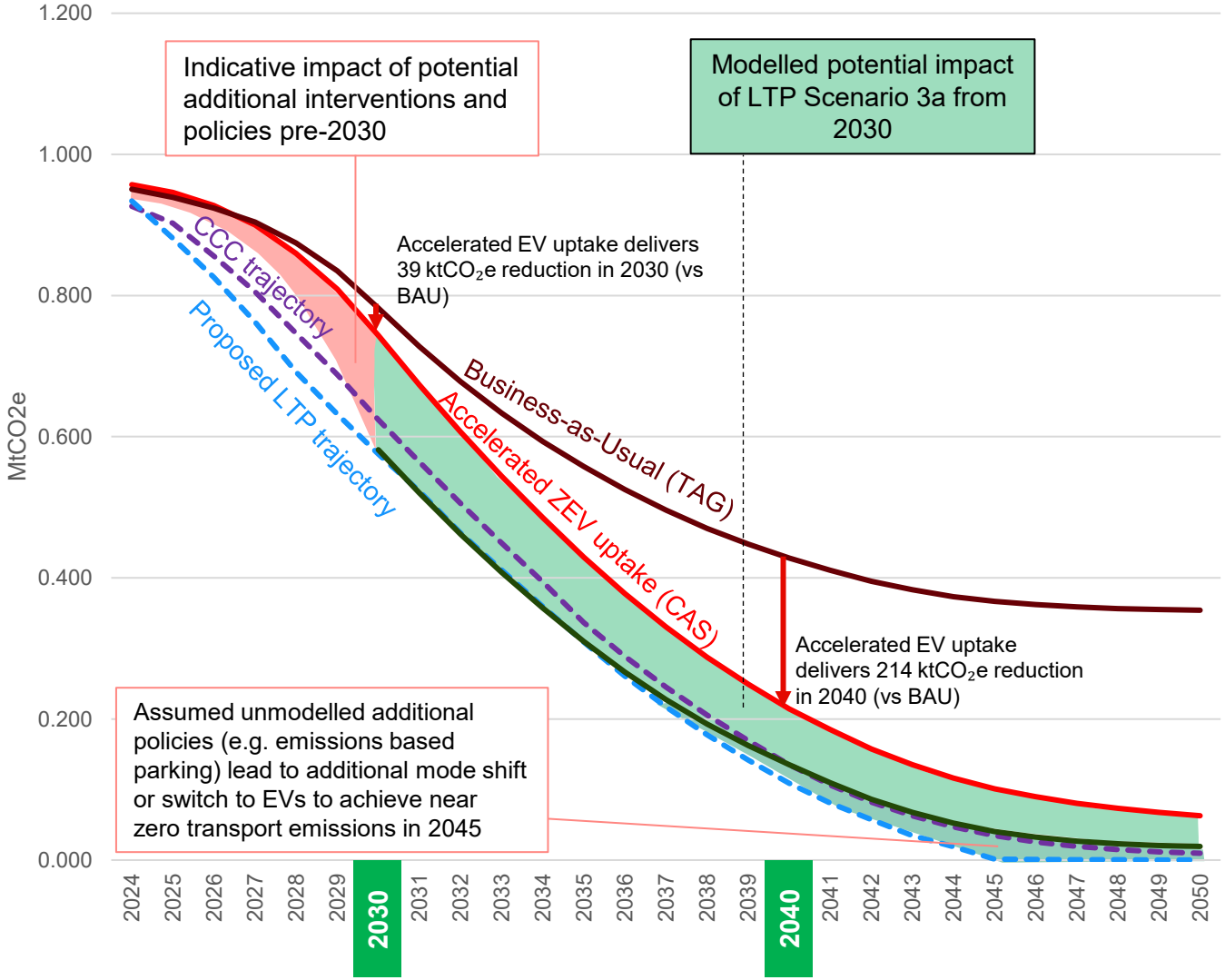
LTP Scenario 3a: LTP Scenario

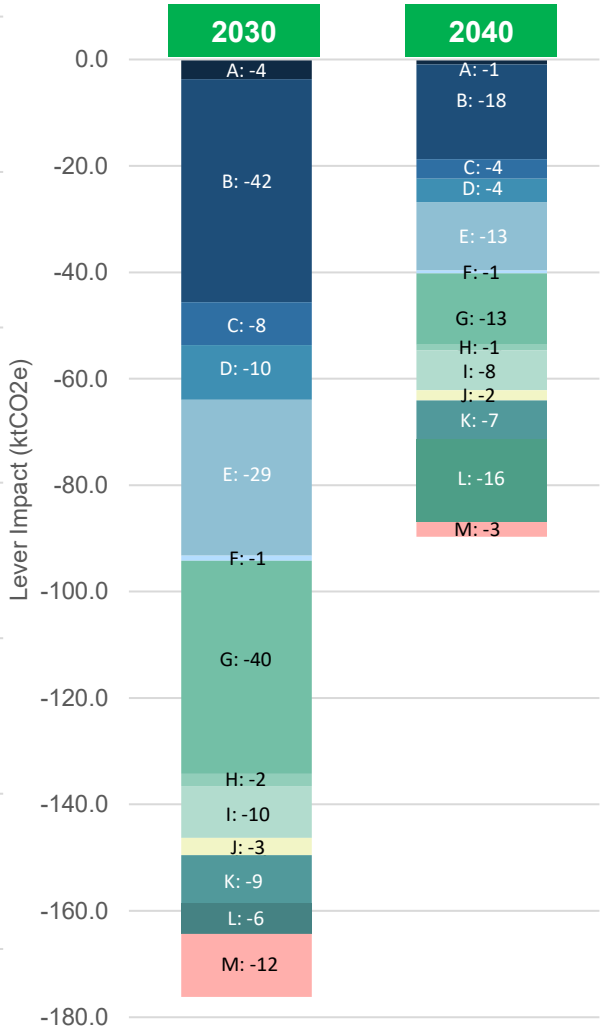
ID	Lever	Proportion of total county-wide vkms in-scope	Modelled change in 2030	Modelled change in 2040	Example interventions
A	Reduction in traffic growth	100%	-3% (-1%)	0%	Vision-led SDS with metrics to reduce trip rates
B	Reduction in business and commute car vkms	40%	-10% (-5%) -15% (-10%)	-10% (-5%) -15% (-10%)	Support for online services and travel planning
C	Reduction in commuting trips through increased vehicle occupancy	25%	-4% (-1.5%)	-4% (-1.5%)	Support for business travel planning and ride sharing
D	Reduction in short distance trips (<5 miles) by localisation	12%	-10% (-5%)	-10% (-5%)	Improvements in local services (e.g. town centre regeneration & local employment hubs)
E	Reduction in long distance trips (5-25 miles) by meeting needs locally	39%	-10% (-5%)	-10% (-5%)	
F	Reduction in urban freight movements (HGV & LGV)	1%	-2% (-0.5%) -5% (-2.5%)	-2% (-0.5%) -5% (-2.5%)	Freight consolidation & last mile solutions e.g. e-cargo bikes
G	Reduction in short distance trips (<5 miles) through active travel (urban only)	8%	-50% (-25%)	-50% (0%)	Full build out of urban LCWIP proposals, including coordinated road space reallocation (e.g. modal-filters)
H	Reduction in short distance trips (<5 miles) through active travel (rural only)	4%	-10% (-10%)	-10% (-10%)	Full build out of county-wide active travel in line with LCWIP
I	Increased bus patronage leading to reduction in car kms	80%	-1.5% (-0.5%)	-3.5% (-1%)	Complete roll out of express bus network (gold BRT) inc. mobility hubs to capture rural trips
J	Increased rail patronage leading to reduction in car kms	80%	-0.5 % (-0.25%)	-0.75% (-0.25%)	Improved rail access, new stations and increased rail frequency
K	Bus electrification	N/A	75% (+25%)	100% (0%)	Electric buses
L	Rail electrification	NA	25% (0%)	50% (0%)	Expansion of electrified lines
M	Reductions in carbon emissions from speed limit changes*	100%	2% (+1%)	2% (+1%)	
				Cross-cutting behaviour measures :	**further fiscal measures e.g. a low emission zone, workplace parking levy & reinvest revenue in infrastructure**

* This is an indicative reduction on overall emissions, not tested in the tools

LTP Scenario 3a: LTP Scenario

Headline finding: an LTP that incorporates demand management could achieve an LTP decarbonisation trajectory and Net Zero by 2045





ID	Lever
A	Reduction in traffic growth
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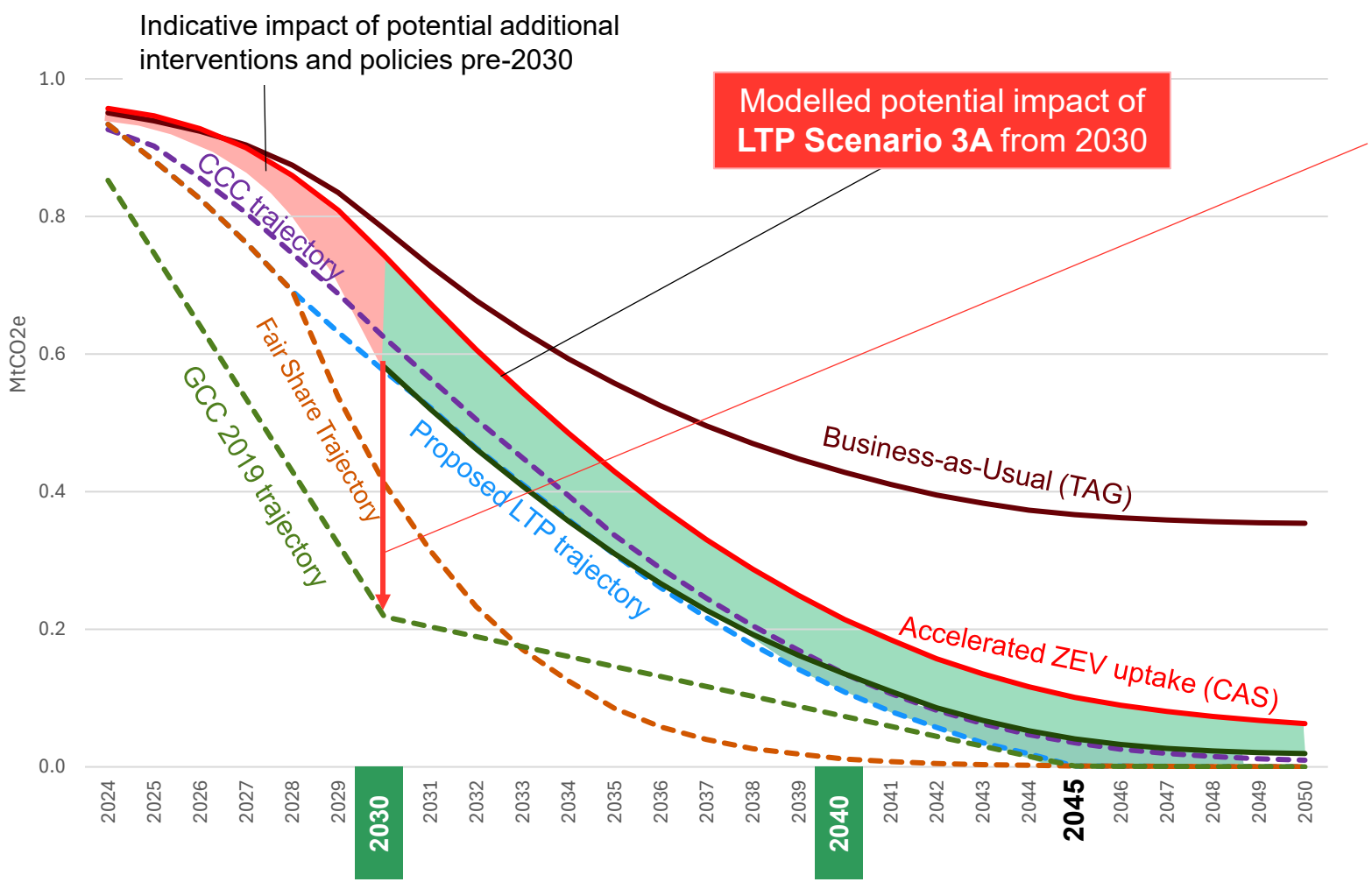
F	Reduction in urban freight movements
G	Reduction in short distance trips (<5 miles) through active travel (urban only)
H	Reduction in short distance trips (<5 miles) through active travel (rural only)
I	Increased bus patronage leading to reduction in car kms
J	Increased rail patronage leading to reduction in car kms
K	Bus electrification
L	Rail electrification
M	Reduced speed limit

LTP Scenario 3b: LTP Scenario + National Demand Policies or external factors

Headline finding: some form of significant national pricing policy or external factors would likely be needed to achieve the 80% by 2030 ambition or Fair Share Trajectory



A **30%+ reduction in car vkms** to achieve the Fair Share Trajectory or 80% by 2030 trajectory (similar to traffic reductions from the Covid pandemic).

This would likely require:

- A new model of national road pricing of system-wide demand suppression

OR…

- External factors such as prolonged fuel shortages

Comparing example policies in each scenario

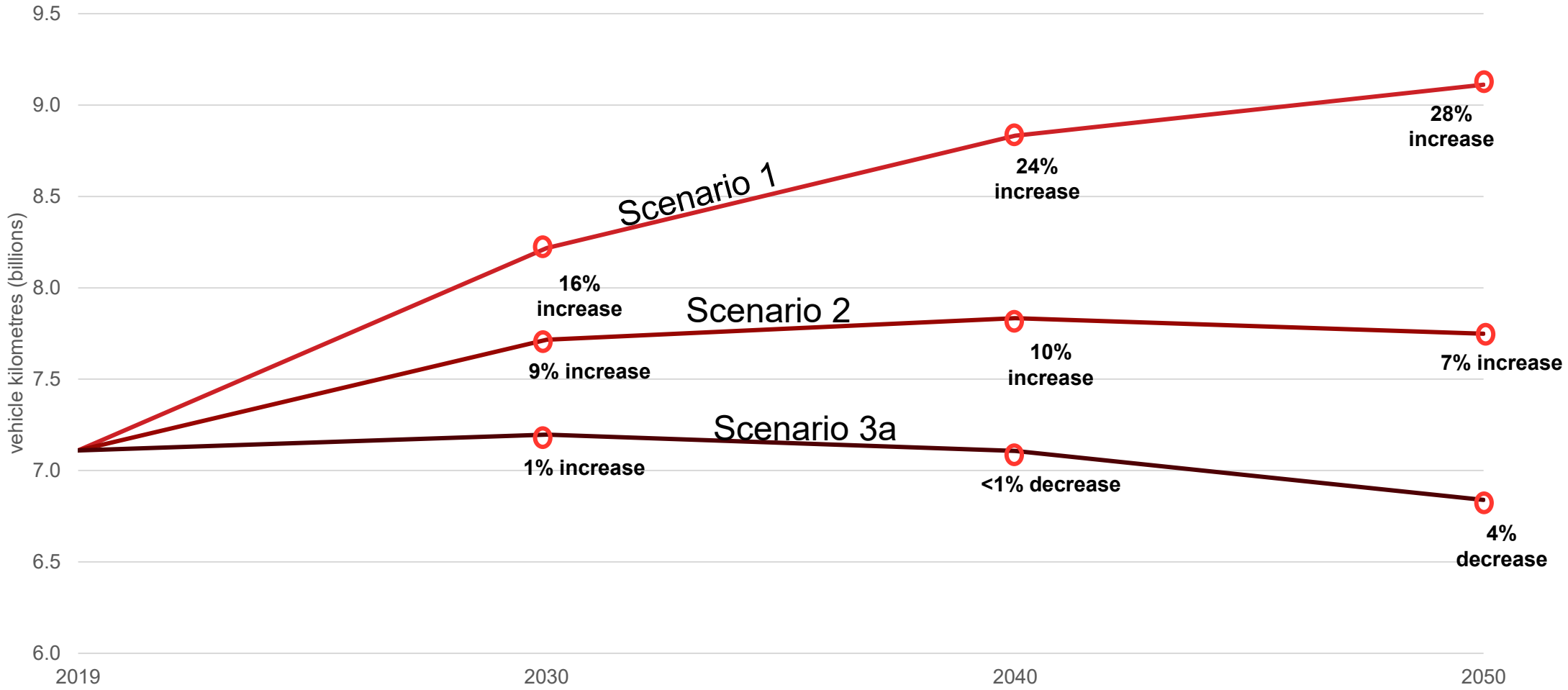
Delivery over time all assuming current levels of annual funding continue

Bolder GCC-led policies to influence travel demand

National policies to influence travel demand

Scenario	Category	2026-2029	2030-2043
1 (accelerated ZEV uptake and continuation of GCC's current transport investments)	Infrastructure	Completion of cycle spine & ongoing active travel investment (primarily urban area focused) BRT quick wins	Delivering the BSIP (bronze BRT)
	Spatial planning	Current Local Plan & planning policies	
	Behaviour	'think travel' campaign	N/A
2 (programme of sustainable transport investment)	Infrastructure		+ full build out of urban LCWIP proposals, including targeted roadspace reallocation + build out of county-wide bus network inc. BRT (silver BRT) inc. Park & Ride and bus priority schemes + improved rail access, new stations and increased rail frequency + mobility hubs to capture rural trips + freight consolidation & last mile solutions e.g. e-cargo bikes + 50% of bus fleet is electric by 2030 and 100% by 2040 + car clubs
	Spatial planning	+ vision-led SDS with metrics to reduce trip rates	+ monitoring and managing development sites to achieve desired vision-led metrics + strengthening local centres & neighbourhoods
	Behaviour	+ electrification of the bus fleet on core urban routes	+ increase parking charges and limit supply to support Park & Ride + increased support for online services, business travel planning and ride sharing
3a (LTP Scenario)	Infrastructure		+ full build out of county-wide active travel in line with LCWIP + complete roll out of express bus network (gold BRT) + coordinated roadspace reallocation (e.g. modal-filters) + greater infrastructure rollout with local revenue from financial measures + 75% of bus fleet is electric by 2030 and 100% by 2040
	Spatial planning		+ bolder vision metrics e.g. high internalisation rates, greater housing density
	Behaviour	+ support for active travel in rural areas e.g. e-bike shared use schemes	+ further fiscal measures e.g. a low emission zone, workplace parking levy, emission or vehicle sized based parking charges & reinvest revenue in infrastructure
3b	Behaviour		+ new model of national road pricing or events such as prolonged fuel shortages

Impact of each scenario on road traffic volumes from 2019



The graph illustrates the modelled county-wide vehicle mileage forecasts under different scenarios relative to the 2019 baseline. Under Scenario 3a, a 4% reduction in vehicle kilometers by 2050 is observed relative to 2019, based on the levers tested.

Key risks and mitigations

Risk	Potential mitigations
Disruption from climate change impacts	GCC's LTP contributes to mitigation of climate change through scenarios 2 or 3a Pursue actions in Gloucestershire's Climate Risk Vulnerability Assessment
Insufficient funding	Consider local revenue generation tools
Public resistance to demand management policies	Community engagement and co-design of policies Investment in sustainable transport Lobby Government for supportive policy
Infrastructure carbon impacts erode user carbon benefits	Continued consideration of whole-life carbon in LTP and scheme development
Road schemes increase user emissions and have large infrastructure carbon impacts	Adopt carbon management in scheme development and consider supporting policies (e.g. development controls and sustainable travel) to minimise any induced demand
Reliance on accelerated EV uptake.	Lobby Government to retain and strengthen EV policy Consider additional local interventions Expand countywide charging infrastructure
Poorly located new development leads to traffic growth	Work closely with districts to embed vision-led metrics in Local Plans. Monitor sites and intervene where metrics fall short. Use planning obligations and transport assessments to support sustainable spatial development.
Bus patronage and bus electrification underperform	Deliver the BSIP & BRT Collaborate on a joint bus electrification roadmap with operators. Use local levers (e.g. parking revenue) to co-fund fleet upgrades.
GCC lack influence on through-trips (approx. 30% of emissions)	Collaboration with National Highways and neighbouring authorities Adjust GCC's climate ambition to exclude through-trips

Conclusion

This report sets out the latest carbon evidence base and analysis prepared as part of the development of the updated LTP in 2026. This analysis has included development of a revised transport decarbonisation pathway to inform the ambition, policies and interventions included in the updated LTP.

Key conclusions of this analysis are:

- Transport in Gloucestershire cannot achieve GCC's existing 80% by 2030 ambition or the draft 'Fair Share Decarbonisation Trajectory' without significant national policy to reduce travel demand
- Net Zero by 2045 via a decarbonisation trajectory similar to the CCC's advised Seventh Carbon Budget pathway is achievable and has significant co-benefits
- This is dependent on an accelerated scenario of ZEV uptake, supported by local charging infrastructure delivery
- GCC can't directly influence all trips; collaboration with neighbouring authorities, National Highways and others will be needed but ambition should focus on trips in GCC's influence (i.e. exclude through-trips)
- Demand management policies (e.g. parking policies, local pricing schemes) will be needed alongside a comprehensive sustainable transport network
- Targeted policies (e.g. emissions based parking) could reduce the scale of demand management required and bring down emissions to near zero in 2045
- Some scenarios include residual transport emissions in 2045; extensive woodland creation may be needed if so