canterbury city council

Draft Canterbury District
Local Plan to 2045

CLIMATE CHANGE TOPIC PAPER

(OCTOBER 2022)

1. Executive Summary

1.1 The causes and consequences of climate change are central issues to the development of the new Canterbury District Local Plan to 2045. Actions to reduce carbon emissions and adapt to the changing climate and its impacts are necessary in all aspects of development and this is reflected in the proposed policies.

1.2 This report summarises evidence from the most up to date and relevant sources to inform climate change policies. It also sets out how the local plan will positively influence the ability of Canterbury District to reduce carbon emissions in a timely way. Further detailed reports provide additional analysis and evaluation of policy in key local plan areas of development options, buildings energy efficiency standards, transport options and energy are included as appendices.

1.3 The scale of change required to meet UK carbon budgets in the energy, buildings and transport sectors is very large and requires significant intervention from national, regional and local governments to enable the changes. Local planning policies in the new Local Plan will need to play a major part in ensuring that new development meets these challenges and opportunities head-on.

1.4 This evaluation of the development and transport emissions finds that policies to reduce operational and embodied carbon emissions from new development has the potential to reduce the cumulative carbon emissions from the plan by nearly 50% and that this is equivalent to around 20% of the pro-rata remaining carbon budget to 2050 for the district. The evaluation of the carbon emissions from road transport finds that the implementation of the movement plan in the transport strategy may yield a 15% reduction in carbon emissions from transport.

1.5 At the same time, development must take every opportunity to reduce the risk of direct and indirect climate change impacts. However, clearly the policies within the Local Plan on their own will not be enough on their own to meet carbon reduction targets or comprehensively adapt to the changing climate and the council is also working on a wide programme of climate change action. This programme of work includes projects to reduce carbon emissions from the council's assets and services, assisting and advising businesses and residents in the district, investing in infrastructure to enable electric vehicle transition and continuing the ongoing work to manage coastal and inland flood defences.

2. Key climate change policies within the Local Plan to 2045

2.1 The policies that will have the most significant effect on reducing carbon emissions from activities within Canterbury District are:

- Net zero operational carbon emissions standards for new developments
- Embodied carbon emissions assessments and reductions for new developments
- Reconfiguration of the transportation systems to enable a significant shift in local journeys by foot and bicycle and reduced journeys by individual private vehicles
- Enabling and supporting rapid increase of renewable electricity generation of all types across the district to meet the zero carbon energy supply needs of the district

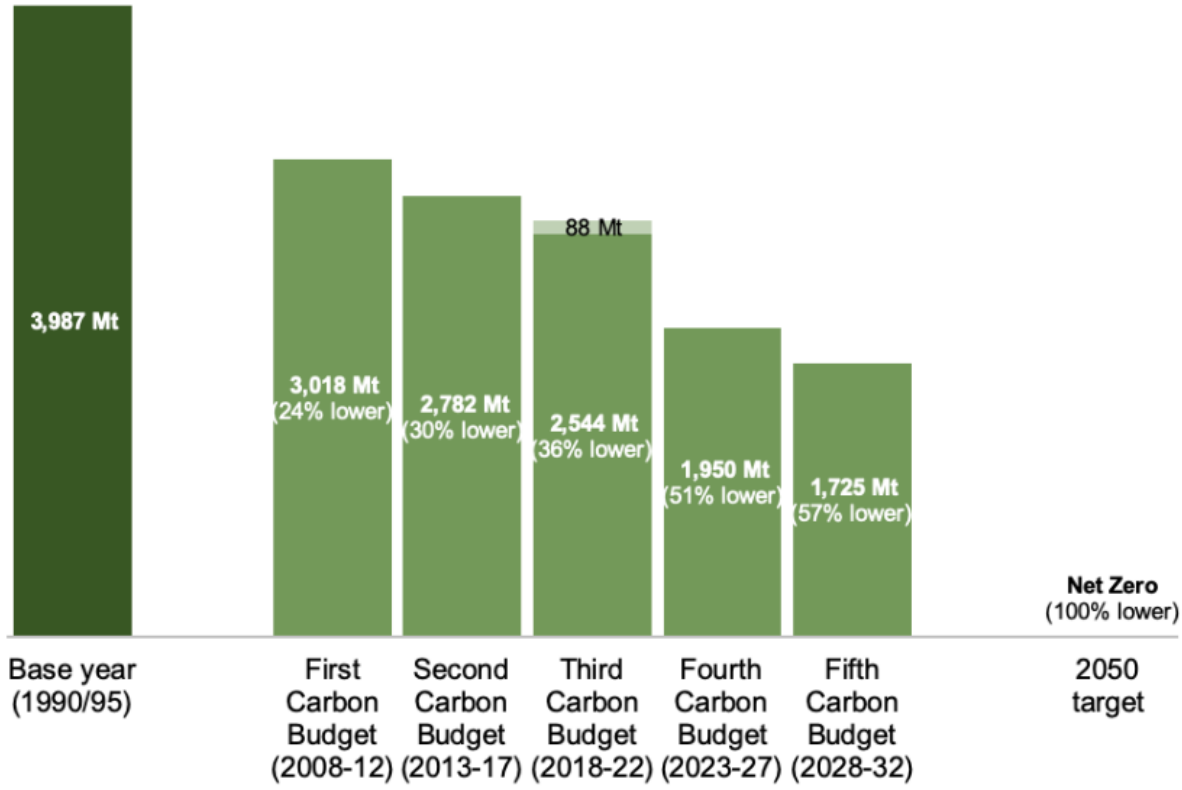
2.2 The policies that will have the most significant effect on adapting to the changing climate within Canterbury District are:

- Incorporating measures for resilience and adaptability to the effects of climate change at a building level, development site level and in relation of the development to the local area
- Increasing biodiversity and green infrastructure as part of development design so that the natural environment is resilient to the changing climate and brings co-benefits for society

3. The climate change evidence supporting the policies

3.1 The next 23 year period of time covered by the Canterbury District Local Plan 2045 has been highlighted internationally as a critical moment in human history: acting on the causes of climate change is crucial to minimise the risk of long term climate change instability and the worst impact of a changing climate. At the same time, parallel work to repair and restore resilient ecosystems and adapt to the changing climate must also be undertaken to reduce the impacts of climate and ecological change that are already underway.

3.2 The UK national context for reducing carbon emissions is set out in the carbon budgets of the Climate Change Act 2008:



Source: BEIS, UK Legislation.

3.3 There is a requirement under the legislation to reduce carbon emissions from 2022 levels by 33% by the 2028-32 fifth carbon budget period and then continue reductions to net zero. The National Planning Policy Framework paragraphs 152 - 173 state that the planning system should support the transition to a low carbon future in line with the Climate Change Act 2008 as well as adapting to the changing climate.

3.4 The Kent and Medway Energy and Low Emissions Strategy and Canterbury City Council's commitments through UK:100 include setting area carbon budgets and tracking performance to achieve these targets. The population pro-rata carbon budget 2023-2045 for Canterbury District is approximately 7000 kTCO2e.

3.5 Achieving the carbon budgets requires rapid and wide scale reduction of carbon emissions from all sectors. Within the context of the local plan key areas include building and consuming materials, heating and powering homes, transportation and energy production.

4. The future of buildings in Canterbury District

4.1 Analysis of different zero carbon pathways for Canterbury District shows that buildings are one of the sectors which must target zero emissions. The Committee on Climate Change, the Anthesis SCATTER Cities model, evidence for the Kent and Medway Energy and Low Emissions Strategy and our own analysis all concur that:

- New buildings must be designed to achieve net zero carbon operational carbon emissions as soon as practicable

- Opportunities to reduce carbon emissions from existing buildings should be taken when making modifications to remodel or extend them
- The embodied carbon in the materials and construction process of making and modifying buildings must be evaluated and minimised

In order to achieve this:

- New buildings built must be extremely energy efficient and have an ultra-low energy demand to heat and power the building
- Where heat is required in new buildings it should be heated by low-carbon heat such as heat pumps
- There should be no gas boilers installed in new homes
- Retrofitting existing buildings to improve energy efficiency and remove fossil fuel heating must be fully enabled through a variety of measures.

4.2 Alongside achieving net zero emissions, new buildings and modifications to existing buildings must incorporate measures to minimise climate change impacts from the hotter summers and heavier rainfall that will increase in frequency over the duration of the plan and beyond. In order to achieve this:

- Measures to avoid overheating must be incorporated into designs
- Drainage and runoff systems must be cater for projected heavy rainfall events to avoid surface water and drainage flooding to the building and impact on the locality

4.3 The Committee on Climate Change has published a report in 2019 named ‘UK housing – fit for the future?’. The report highlights the need to build new buildings with ‘ultra-low’ levels of energy use and makes a specific reference to space heating demand and recommends a maximum primary energy target of 15-20 kWh/m2/yr for new dwellings. This is consistent with targets for heat energy requirements specified by the Passivhaus standard, LETI and RIBA Sustainable Outcomes. This target is consistent with achieving Energy Performance Certificate level A. The Greater London authorities have required major developments to achieve net zero operational carbon emissions since 2016; Whole Life Carbon assessments have been required since 2021. Building Regulations were amended in 2022 to increase the level of energy efficiency as well as increasing requirements for ventilation and to avoid overheating. Whilst the 2022 Building Regulations do require some improvements to energy efficiency compared to the previous version, on their own they are not sufficient to ensure that new construction reduces operational and embodied carbon emissions to a sustainable level.

4.4 The council has concluded that future development in the district should be designed and built to be zero carbon operational emissions and that embodied carbon emissions evaluated and minimised without delay. Responding to climate change was one of the key issues raised through the Issues consultation in 2020. We then consulted on these outline policies as part of the Options consultation in 2021 and the policies were supported by over 75% of respondents. It is projected that an average of 1,252 new homes will be built in Canterbury District each year throughout the duration of the plan. To continue to design new developments with net positive carbon emissions simply adds to the already significant retrofit challenge of the future, delays progress on emissions reductions at a district level and passes the costs of retrofit onto the homeowner; costs that would be significantly less if implemented at the time of construction.

4.5 Setting net zero operational energy standards for new development within the district has the potential to reduce carbon emissions by over 800 ktCO2e over the plan period. Carbon emissions from the materials and construction process of new development within the district would contribute over 1,600 ktCO2e carbon emissions without work to reduce the embodied carbon emissions. Together this would consume over 20% of the remaining pro-rata carbon budget under the Climate Change Act 2008 for the district 2023-2045. The evaluation of the emissions impact of building operational and embodied carbon emissions is set out in Appendix 1.

4.6 The independent viability study for the Local Plan to 2045 has evaluated and factored in the costs of building new homes to net zero carbon standard, and this is shown to be viable and deliverable alongside other policy costs, such as for affordable housing. To build net-zero carbon homes and buildings with immediate effect is consistent with the district, county and national carbon emissions reduction targets. By setting these standards now, it does not unnecessarily consume Canterbury District's remaining carbon budget, and it is also consistent with the Climate Change Act 2008.

5. The future of movement and transport in Canterbury District

5.1 According to UK local authority and regional greenhouse gas emissions national statistics 2022, emissions from road transport are a major component of the greenhouse gas emissions in Canterbury district, producing around 40% of the emissions from energy, predominantly from the combustion of petrol and diesel fueled vehicles. Reducing emissions from road transport is a key component of reducing the causes of climate change in the UK Government plans and the Kent and Medway Energy and Low Emissions Strategy.

5.2 The evidence base from the Committee on Climate Change, Kent and Medway Energy and Low Emissions Strategy and Department for Transport show major transformation of the movement of people and goods is necessary to meet net zero carbon emissions goals. The strategies in the evidence base to do this include:

- Fleet mix transformation to zero emissions vehicles as rapidly as possible
- A major shift away to active travel away from vehicles for short and local journeys
- A significant increase in vehicle use efficiency through higher occupancy rates, shared modes of travel and public transport
- Smarter and more efficient ways of working and distribution of goods

5.3 The spatial planning and transport infrastructure in the proposed local plan include an ambitious plan to change movement and transport patterns and modes in Canterbury using a zoned Circulation Plan. The plan also includes interventions in Whitstable and Herne Bay. There are multiple co-benefits to these proposals for reducing emissions, improving air quality, reducing congestion, improving walking and cycling connectivity, and making quieter and safer neighbourhoods.

5.4 The Transport for the South East Decarbonisation Pathways Report (Version 3.0 September 2022) provides an analysis of the carbon emissions reductions that are possible from different interventions. The analysis finds that the main factors in defining a pathway to

net zero carbon are interventions to reduce the number of trips we make, shift the mode of travel used to zero emission modes, and to reduce vehicle emissions to zero. The report concludes “For all involved in the planning and delivery of interventions, this includes doing so with great urgency and to a significant or full extent – perhaps the likes of which we have never seen before.”

5.5 Based on the breakdown of journeys and transport carbon emissions by journey length in the South East, the influence of the Local Plan on carbon emissions from transport can be summarised as follows:

Journey length	Proportion of personal trips in the South East (2018-19 NTS9911)	Proportion of transport carbon emissions in the South East (2018, TFSE)	Local Plan policy and schemes potential influence on reducing carbon emissions
Local journeys <5 km	~40%	3%	High (through walking and cycling infrastructure, neighbourhood planning and transport connectivity)
District journeys 5-20 km	~40%	15%	Medium (connectivity to public transport, spatial planning to reduce the need to commute, distribution hubs)
Journeys > 20 km	~20%	82%	Low (connectivity to rail stations, distribution hubs)

5.6 It has become clear during the evolution of the Canterbury District Local Plan and the work to evaluate the carbon emissions from future transport movements in the district that the modelled proposed changes to the road network and the current long term national road fleet mix projections through to 2045 will not be enough on their own to deliver the carbon emissions reductions from movement and transport within the district in line with national and regional goals. The road transport model which provides the basis for evaluating transport carbon emissions presents a situation where transport patterns and modes of travel and distribution continue to develop in a similar pattern to the past and is therefore a pessimistic projection of transport carbon emissions.

5.7 Further policies and interventions beyond those presented in the Local Plan will therefore be necessary to progressively reduce transport carbon emissions at a much faster pace than will be delivered by local walking and cycling and light fleet electrification on their own.

5.8 Appendix 2 presents an evaluation of transport carbon emissions based on the traffic model.

6. The future of energy in Canterbury District

6.1 In order to achieve the objectives of reducing district carbon emissions and providing the renewable power to enable the switch away from fossil fuels, the Local Plan 2045 needs to provide clear direction and policy for the provision of sufficient renewable energy generation in the district. The evidence that supports the Kent and Medway Energy and Low Emissions Strategy says that in order to achieve power decarbonisation goals, successful pathways include:

- Over 50% additional offshore wind generation
- Multiple onshore wind generation developments of a range of sizes
- Much more rapid deployment of rooftop solar electricity and heat generation
- Continued development or community and utility scale solar electricity installations

Other renewable energy infrastructure including biomass, biogas and hydro power installations may also have a small role to play.

6.2 Although the development of renewable energy generation within Canterbury District up to 2022 has been above average across Kent County, it has not been delivered at the scale and pace required to provide a replacement power source for fossil fueled heating and transport.

6.3 The Local Plan therefore includes policies that encourage suitable proposals of all types of renewable and low carbon energy generation and associated infrastructure within the district.

6.4 As part of the plan development process there was a specific call for sites where renewable energy generation might be considered. The council has considered the submitted sites and, based on the available evidence, has decided at present to implement areawide policies for renewable energy instead of specific site allocations for the draft plan. The following section sets out the call for sites process in more detail.

7. Call for Renewable energy sites submissions

7.1 Three Call for Sites have been undertaken since 2020, to inform the draft Local Plan. The first Call for Sites ran from 7th February to 30th June 2020. A second Call for Sites ran from 12th May 2021 to 9th July 2021. Sites could be submitted for a variety of uses including:

- Housing (including affordable housing and specialist accommodation for students);
- A variety of accommodation for older persons (including retirement properties/villages, care homes, extra care, sheltered housing);
- A variety of accommodation for disabled and specialist needs housing;
- Self and custom-build housing (including community led housing and co-housing groups);
- Gypsy, Traveller and Travelling Showpersons pitches (including transit and stopping places).

- Economic development (including offices, storage, distribution centres, industrial uses, leisure, retail and tourism uses);
- Community facilities and uses; and
- Land for biodiversity habitats, open space and Local Green Spaces.

7.4 Although renewable energy sites could be submitted under the first two call for sites exercises, the category was not made explicit and no sites were submitted for this purpose.

7.5 A targeted natural environment and renewable energy Call for Sites ran from 9th February 2022 to 11th March 2022, to identify further potential sites to help the district meet its climate change and ecological goals.

7.6 To maximise engagement and awareness of the Call for Sites, the Council notified statutory bodies, stakeholders, those listed on the Local Plan contact database and placed details on social media channels. Details were also published on the Council's website and newsroom.

7.7 Sites submitted for development (such as housing, employment and commercial) were assessed in the Strategic Land Availability Assessment (2022) and Sustainability Appraisal of Strategic Land Availability Assessment (2022).

7.8 This document reviews the sites submitted for renewable energy purposes, focussing on solar photovoltaic and wind energy at utility scale which are identified as the renewable energy sources with the largest potential for the district. This does not preclude other forms of renewable energy development in the district such as hydro power, biogas and hydrogen production.

8. Renewable energy site assessment methodology

8.1 Across the sites there were various different proposals submitted. To ensure the correct assessment was undertaken it was essential to understand the applicant's proposal and the current status of the site.

The methodology for assessing the submissions is set out below:

- **Step 1** - What is the status of the site?
    - Does it have an existing planning permission? Will this contradict or inhibit the site's capacity to endure past the Local Plan?
    - Has it been submitted through the call for sites for a different purpose? If so, what was the outcome of the assessment?
- **Step 2** - Identify what the next steps will be.
    - Has it been assessed in another part of this document (i.e. was it proposed as a Local Green Space, Green Gap, Protected Open Space under 2017 Local Plan Policy OS9 or wetland). If so, what was the outcome of the assessment?
    - Is it already included within the draft Local Plan? If so, under which policy?
    - Does it require further assessment?
- **Step 3** - Site visits
    - Undertaken in 2022 each site was site visited and key features such as topography; notable views into and from the site; trees and landscape features; and notable built form was recorded.
- **Step 4** - Assess impacts from potential renewable energy development focussing on solar photovoltaic and wind power
    - Is the site brownfield / greenfield, does it have any protected designations, what might be the impacts on landscape, townscape, views, transport, PRoW on any renewable energy development on the site
- **Step 5** - Review the renewable energy potential for the site
    - Provide an indication of the suitability of the site for future renewable energy use
    - Highlight particular considerations should the developer(s) want to pursue a project

6.3 Renewable energy site assessments

Fifteen sites were submitted for consideration. Table 6.3.1 summarises the renewable energy site assessments.

Table 6.3.1

Site reference	Site name	Applicants proposed use	Sites status	Site renewable energy potential (focussing on solar photovoltaic and wind generation at utility scale)
SLAA275	Nickle Farm, Ashford Road, Chartham	Wind turbine(s) situated in the orchards to the north west of the site, south of the railway	33 planning applications 1998 - 2020. Several involve roof mounted solar arrays, all approved. Search CT4 7PF	This proposal appears to meet the requirements to generate renewable energy for onsite industrial use and for the local community benefit. Consideration of its impact on the Pilgrim's Way public footpath, which runs through the site, will be necessary at the planning stage.
SLAA280	Marley Lane Solar Farm and Battery Storage Facility	Solar power generation and battery storage	Currently agricultural land; CA/21/00812 Environmental Impact Assessment (EIA) Screening opinion request in relation to proposed installation of a solar farm and battery storage facility with associated infrastructure - No objection	Renewable solar energy and associated infrastructure may be suitable in this location, subject to appropriate design. The site is large and careful consideration of the relationship with the local community will be necessary. Co-location of wind energy may be considered.
SLAA281	University of Kent - Surplus Land - Sites BCD and EF	Renewable energy power generation and associated infrastructure	Agricultural land within the University of Kent land holdings.	There are opportunities for renewable energy across the sites. However, there are a range of natural environment, landscape and infrastructure constraints which must be carefully considered for any scheme design.

Site reference	Site name	Applicants proposed use	Sites status	Site renewable energy potential (focussing on solar photovoltaic and wind generation at utility scale)
SLAA282	Hawcroft lane Solar Farm and Battery Storage Facility	Solar power generation and battery storage	Currently agricultural land	Renewable solar energy and associated infrastructure may be suitable in this location, subject to appropriate design. Co-location of wind energy may be considered.
SLAA283	Land adjoining Woodlands Farm, Calcott	Solar power generation and battery storage	Currently agricultural land	Renewable solar energy and associated infrastructure would be suitable in this location, subject to suitable design. Co-location of wind energy may be considered.
SLAA284	Land South of A28 Sturry	Renewable energy sites	Currently agricultural land	This low lying land may have a priority use for ecosystem services. Co-location of solar generation predominantly for on-site power use may be considered.
SLAA285	Land at Canterbury Substations	Both renewable energy and natural environment	Mixed industrial use major substation surrounded by mature riverside woodland and natural environment; part of the site was formerly Canterbury Environment Centre	Although there is scope for some solar generation within the hard standing area of the site, this is small scale.
SLAA287	Mount Land	Renewable energy sites	Currently agricultural land	Renewable solar energy would be suitable in this location, subject to suitable design.

Site reference	Site name	Applicants proposed use	Sites status	Site renewable energy potential (focussing on solar photovoltaic and wind generation at utility scale)
SLAA288	Field at Tonford Lane	Renewable energy sites	Currently agricultural land	This is a relatively small site with potential to provide energy to adjacent farm, railway and/or grid export. Renewable solar energy may be suitable in this location, subject to appropriate design.
SLAA289	Curtis Wood Park	Renewable energy site and/or natural environment site	Local nature reserve	This site is not suitable for a large scale renewable energy project because it is a nature reserve.
SLAA290	Cherry Orchard Playing Field	Renewable energy site and/or natural environment site	The playing pitch is protected through the Playing Pitch Strategy and the accessible open space is included in the draft Open Space Strategy	This site is not suitable for a large scale renewable energy project because it is a leisure and open space area.
SLAA291	Strode Park	Renewable energy site and/or natural environment site	Large building and an area covered by trees.	This site is unlikely to be suitable for a large scale renewable energy project. Rooftop solar PV and/or solar walkways may be suitable to provide energy for onsite use with design that is sensitive to the existing buildings on the site.

Site reference	Site name	Applicants proposed use	Sites status	Site renewable energy potential (focussing on solar photovoltaic and wind generation at utility scale)
SLAA292	Herne Infant and Junior Schools	Renewable energy site and/or natural environment site	School buildings with large rood expanses, car parking, playgrounds and playing pitches. The playing pitches are protected through the Playing Pitch Strategy.	Part of the site is protected in the draft Local Plan under Policy DS24 - Publicly accessible open space and sports. The building roofs are suitable for solar PV and there is potential for some solar PV canopies within the car parking areas. Solar walkways may also provide shade. There is potential for a community energy scheme.
SLAA294	Herne Mill	Renewable energy site	Historic locally listed windmill in a residential area.	This site does not have the potential for any significant renewable energy generation.
SLAA297	Broomfield Community Park	Renewable energy site and/or natural environment site	The majority of the site is accessible open space included in the draft Open Space Strategy The site includes open space, a bike track and cycling centre, allotments and agricultural land.	There may be potential for a community renewable energy scheme on some portions of the site.

Appendix 1: 2045 development carbon emissions evaluation

Technical report on the evaluation of effect on carbon emissions (greenhouse gas emissions) associated with draft Local Plan development.

A1.1 Appendix 1 summary

A1.1.1 The greenhouse gas emissions (also referred to as carbon emissions) generated by constructing (embodied emissions) and operating (operational emissions) new development and infrastructure are significant contributors to the district's overall carbon footprint.

This evaluation calculates the projected greenhouse gas emissions from the development proposed for the Canterbury District Local Plan 2045 and finds that:

- The cumulative construction emissions through to 2045 would consume around 20% of the remaining carbon budget for the district if 2019 construction methods and building energy standard were applied
- The emissions generated from residential construction are the largest proportion of the development emissions
- The cumulative greenhouse gas emissions through to 2045 from new development can be reduced by nearly 50% by setting high energy efficiency standards now, and this will have a benefit beyond 2045

The report recommends:

- Implementing policy for planned developments to evaluate and reduce the embodied carbon emissions from the materials and construction process of new buildings
- The planning authority to maintain a register of embodied carbon emissions from approved and completed developments
- The Local Plan to set net zero operational emissions standards for new development in the district
- Life cycle carbon assessments are undertaken for the road infrastructure schemes as per Highways England SA 119 Climate in order to determine their contribution to district emissions reduction

A1.2 Development carbon emissions basis

Table A1.2.1: Local Plan 2045 high level development summary for building emissions evaluation

Development options	Transport schemes	Committed residential development not yet built (no. dwellings)	Total new residential development (no. dwellings)	Planned employment space to be developed (m2)
Option 5V3	Shared Streets Removed A2 Off Slip Bus Lane Approach Western & Eastern Bypass New Wincheap Multi Storey Thanington 4th Slip Hospital Access Blockers & Corridors 4th Park & Ride	10,756	16,943	149,380

A1.3 Emissions factors

The following emissions factors have been used for the evaluation:

Table A1.3.1: Emissions factors for construction of buildings and roads, and operation of buildings

Activity	Emissions factor	Source	Notes
Embodied emissions (domestic) Emissions from constructing a typical brick UK home (including groundworks and local infrastructure)	42.5 tonnes CO_{2e} for the average UK house of 85m^2 usable floor area 650 $kgCO_{2e}/m^2$ is the RIBA target value for 2025 = 38.5 tCO_{2e} for the average 85m^2 house	Atkins / RICS / CITU	Typical range 500-1000 $kgCO_{2e}/m^2$ during the construction process (Atkins/RICS) for all 1-3 storey housing types. Note that apartments and more than 3 storeys have higher embodied emissions. Includes the groundworks and local infrastructure for the development.
Embodied emissions reduction through evaluation and reduction	Reduced by 35%	Mid-range estimate from a range of studies	LETI target is 300kgCO2e/m2 for 2030
Operational emissions (domestic) Emissions from	2.4 tonnes CO_{2e} per year (for typical current new build home EPC B) (28 $kgCO_{2e}/m^2/y$)	Domesticenergymap.uk + UK EPC Register on	The emissions from running gas central heating and the electricity to power the home. This is equivalent to

Activity	Emissions factor	Source	Notes
heating and powering homes	0 tonnes CO2e per year for Net Zero / Passive House build	epc.opendatacommunities	a typical 85m^2 home of EPC efficiency
Embodied emissions (non-domestic)	50 - 1000+ $kgCO_{2e}/m^2$ 650 $kgCO_{2e}/m^2$ is the RIBA target value for 2025	RICS / Atkins / RIBA	Embodied emissions for non-domestic buildings vary widely from low for light industrial shed type to high for multiple storey office or hotel construction
Operational emissions (non-domestic)	10 - 20 $kgCO_{2e}/m^2.yr$	Commercial EPCs at level A performance (2020)	Commercial EPCs based on metered usage and 2020 UK greenhouse gas emissions factors for gas and electricity
Embodied emissions (road and associated infrastructure)	4,500 tCO_{2e} / Lane.km (New road infrastructure) 1,000 tCO_{2e} / Lane.km (Modification to existing road infrastructure)	Highways England data for other UK road schemes. Estimate.	Schemes differ significantly in complexity and especially where bridge building, embankments and cuttings are required. Data for modifications to existing road e.g. junction alterations are not currently readily available. Each scheme should have a more detailed estimate using the Highways England carbon calculation tool.
Embodied emissions reduction through evaluation and reduction	10% reduction	Estimate	A range of tactics including low carbon cement, recycled tarmac and aggregate may be able to further reduce emissions from road construction.

These emissions factors are based on the best available evidence; the level of accuracy is likely to be ±25% and the estimated emissions values should therefore be used as guidance only in the relative impacts between options.

A1.4 Assumptions

The following assumptions have been used for this evaluation:

Table A1.4.1: Model assumptions

Assumption	Notes
Energy systems change is consistent with current projections and evidence	Decarbonisation of the UK electricity supply continues and the grid capacity is expanded to meet the needs of transportation and heat decarbonisation in the South East. Fabric first building energy efficiency and a switch away from gas to meet carbon reduction goals are the key routes to reducing carbon emissions from buildings.
Rate of development is linear	The Local Plan does not directly specify the rate of development; it sets policy for how development planning should proceed. Analysis of development from 2009 to 2019 shows between year variability with a consistent underlying trend of 493 new residential properties per year (not including student accommodation developments). For this evaluation, a linear development from 2022 to 2045 is assumed.
Consistent size of residential developments	The average size of the developments is 90m2 / dwelling. This is based on the profile of houses and flats and bedroom sizes within the plan.

A1.5 Evaluation of development carbon emissions

A1.5.1 The evaluation of cumulative carbon emissions over the plan is only indicative because of the high level of assumptions and lack of detailed embodied carbon emissions data. The evaluation indicates that the incorporation of the operational and embodied carbon emissions within the plan may reduce carbon emissions significantly over the lifetime of the plan.

Table A1.5.1

2045 estimated cumulative emissions summary	**Option 5V3 development with no carbon emissions reduction policies**	**Option 5V3 mitigated**
Residential construction emissions (tCO2e)	1,615,890	1,403,273
Residential operational emissions (tCO2e)	800,487	0
Commercial construction emissions (tCO2e)	112,428	72,823
Commercial operational emissions (tCO2e)	25,768	0
New strategic road construction (tCO2e)	100,000	90,000
Total construction and building infrastructure emissions (tCO2e)	**2,654,574**	**1,566,096**

A1.5.2 The policies may lead to a near 50% reduction in carbon emissions from new development and this is in the region of 25% of the remaining carbon budget for the district from 2022 to 2050.

Appendix 2: 2045 road transport carbon emissions evaluation

Technical report on the evaluation of effect on carbon emissions (greenhouse gas emissions) associated with draft Local Plan road transport infrastructure based on traffic modelling outputs.

Appendix 2. Summary

This annex evaluates the projected carbon emissions from road transport from the proposed changes to the road network that have been traffic modelled to provide evidence for the Local Plan 2045.

The evaluation indicates that:

- The reconfiguration of the transport network in Canterbury and interventions in Herne Bay and Whitstable may reduce carbon emissions from transportation by 15% if the increase walking, cycling and modal shift objectives of the transport strategy are achieved
- Without walking and cycling interventions, based on the current fleet mix projections to 2045, the carbon emissions from transport will continue to increase, rising by 27% from 2019 to 2045

There are great uncertainties about the future emissions from road transport; the current national models are pessimistic about the transition to low emissions heavy goods vehicles, for which technology is still nascent.

A2.1 Introduction

The purpose of this evaluation is to evaluate the projected greenhouse gas emissions, referred to as carbon emissions, from road transport based on the modelled transport network in 2045.

A2.2 Methodology

In order to understand the climate change impacts of developing the road network, the output from the transport model has been used to calculate the projected greenhouse gas emissions from the road vehicles.

The road traffic model provides projections of the number of vehicles by type and the road speed at morning and evening peaks by portions of roads called links that join together at nodes.

The DEFRA Emissions Factor Toolkit is provided as a mechanism for calculating the emissions on sections of roads (links) based on the speed and number of vehicles by type. The model also includes projections of the emissions composition of vehicles based on the

national forecasting. The latest version of the Emissions Factor Toolkit EFT 11.0 also includes new tools for evaluating carbon emissions from road transport through to 2050.

The DEFRA Emissions Factor Toolkit provides an evaluation of the exhaust emissions from road transport for an individual section of road based on the length, road speed, mix of vehicles and a range of other factors. The tailpipe emissions calculations do not include greenhouse gas emissions associated with production and distribution of the fuel, maintenance of the vehicles and roads or any supply chain emissions associated with the operation of road traffic such as vehicle insurance and financing. The carbon emissions calculator within the tool includes estimates of the carbon emissions associated with generating the electricity to power electric vehicles.

A2.3 EFT output and conversion from link to total emissions

The Emissions Factor Toolkit (EFT) provides estimation of carbon dioxide, nitrogen oxides and particulate emissions from vehicle exhausts for sections of road. For this analysis the carbon dioxide emissions have been aggregated across all the sections of road (referred to as links in the model) and scaled up from the modelled morning and evening peak traffic flows in the traffic model to annual emissions using scaling factors provided by the modelling consultants, Jacobs.

In order to compare calculated tailpipe emissions to national data on district energy emissions which include emissions associated with extracting and distributing fuels from the source allocated at a district level, well-to-wheel and tank-to-wheel conversion factors have been used.

A2.4 Calculation sequence

1. Traffic model outputs supplied from the traffic model as spreadsheet with AM and PM peak flows by system averages and link averages, vehicle type, link length and road speed
2. Spreadsheet transformation from model output to EFT input
3. Load data to EFT and run model for each AM and PM peak
4. Download EFT output data
5. Combine AM and PM outputs and scale up to annual emissions

A2.5 Scaling up emissions from peak to annual emissions

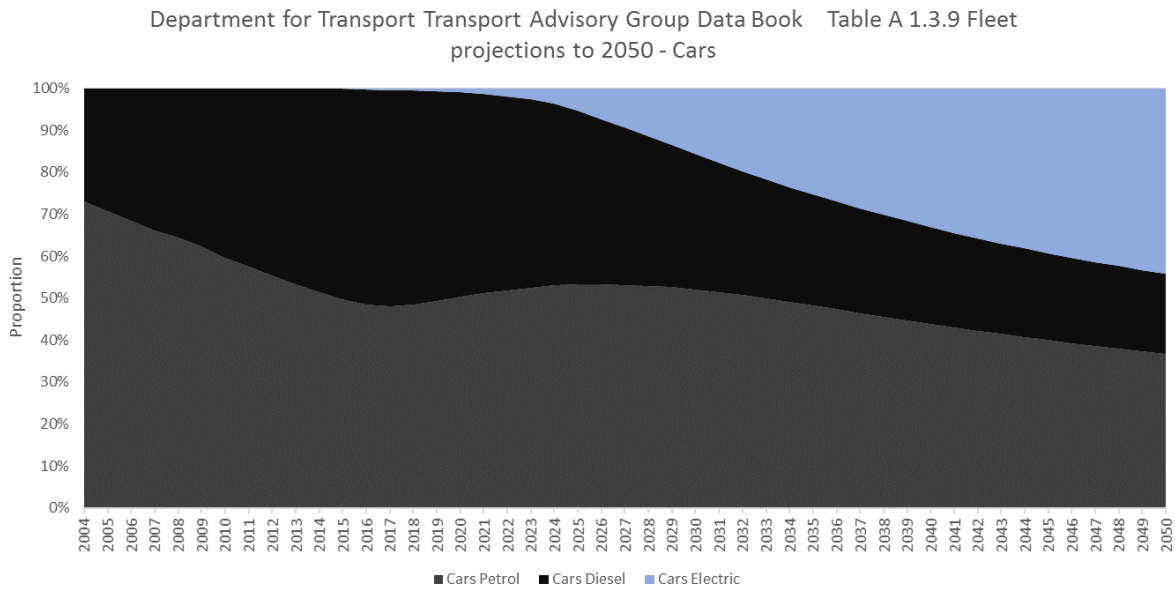
The following scaling factors were calculated by Jacobs and supplied to Canterbury City Council:

Factor Description	Factors	Comment
AM peak hour factor (1 hour peak hour to 3 hour peak period)	2.488	Based on Canterbury ATC database
PM peak hour factor (1 hour peak hour to 3 hour peak period)	2.756	
6h - 12h AAWT factor	1.832	
12h -24h AAWT factor	1.188	
24 AAWT to AADT (Motorway or high speed)	0.95	Based on wider Kent ATC database
24 AAWT to AADT (local/residential/rural roads)	0.92	Note: The factor 0.92 was used for the summary level calculations which applies to >85% of the links and road length

A2.6 Assumptions

The following assumptions have been made:

1. The projected fleet mix distribution of vehicles by emissions types in 2045 in the Emissions Factor Toolkit is based on Department for Transport Transport Advisory Group (DfT TAG) Data. The projections assume that the mix of road vehicles in Canterbury will be the same as the national projections. Under the DFT projections, by 2050 almost 50% of cars and small vans will be battery electric, with the rest of the fleet including buses and goods vehicles remaining fossil-fuel powered.



It is important to note that the DfT TAG projections do not achieve transition to zero emissions vehicles in line with the policy guidance from the Committee on Climate Change in order to reach Net Zero by 2050.

2. The traffic model allows for differential vehicle speeds by type of vehicle on each link i.e. with some overtaking by smaller faster vehicles. This is most applicable on dual carriageway sections of road. The EFT v.11.0 model does not allow for this approach and assumes a uniform average speed on the link for all vehicles travelling on the link. Within the model data the speed differential between vehicle types is small. For the emissions model the higher of the traffic model output speeds has been used.

3. For the model scale up from AM and PM peak to average annual daily traffic and annual emissions, the scale up methodology assumes that the vehicle speed and therefore emissions characteristics are constant in the scale up approach. In reality, the average speed of vehicles outside of the peaks may be slightly higher and therefore the link emissions slightly lower than calculated. The emissions to speed curve is relatively flat at higher speeds. If the overall emissions evaluation is very similar for options with very different road systems, this assumption may require revisiting.

4. The Kent County Council approach to transport evaluated by the traffic model is based on current DfT TAG guidance for simulating road transport systems, commonly referred to as ‘predict and provide’. The modelling methodology as set out in the modelling report assumes:

    a. Increases is private vehicle ownership and usage enabled by economic factors

    b. Some basic assumptions on increased choice to use walking, cycling and public transport instead of personal transport.

5. The sequencing of transport system interventions to implement the neighbourhood and city movement plan that reallocates road space to public and active transport and provide new road routes around the city have not been modelled or evaluated.

6. The transport modelling and carbon emissions evaluation accordingly provides a pessimistic quantification of transport movements and associated emissions in 2045. In reality a reduction in private vehicle movements and more rapid transition away from fossil fuels will be necessary to achieve carbon emissions targets and reach Net Zero.

7. In the absence of a methodology or model to calculate emissions reductions from modal shift enabled by the implementation of the transport strategy, an additional 15% emissions reduction has been used to estimate the potential carbon emissions benefits of the plan. This is based on the reported 12% district wide emissions reductions achieved in the city of Ghent through the implementation of the Circulation Plan 2007 - 2018 (Source: Klimaatplan 2020-2025, translation) compared to the 4% emissions reductions achieved in Canterbury District during the same period. Based on this evidence, the deployment of progressive modal shift measures to deliver the Movement Plan could result in 0.7% additional reduction in carbon emissions per year or 15% reduction by 2045.

A2.7 Modelling results

A2.7.1 Baseline calibration

The road transport model developed by Kent County Council is based on road traffic survey data and the modelled regional road network. To calibrate the methodology used in this evaluation, the baseline output (2019) has been compared to the national energy emissions data for the district transport network (2018).

EFT emission calculations are from the vehicle exhausts and referred to as Tank to Wheel (TTW) and do not include any emissions from the production of the fuels or from the construction and maintenance of the fuels, vehicles or roads. National Statistics local authority emissions data are based on Well to Wheel (WTW) emissions factors and include the share of emissions from the processes to produce and refine the fuels used. tThe average factor for petrol and diesel of 134% is used to compare the the carbon emissions calculations:

Comparison of district road transport emissions calculations	**Tonnes carbon dioxide per year ($ktCO_2/y$)**
Total road transport emissions Canterbury District (Source: UK local authority and regional carbon dioxide emissions national statistics 2018)	230
Traffic Model output Baseline 2019 (with 2018 fleet mix) EFT11 transport model network average output scaled to WTW by 134%	237

Both figures are estimates using different methods and both will have ranges of uncertainty. There are multiple potential reasons for the differences:

- The transport model does not take into account issues such as engine idling, small vehicle movements (such as within a car park) or acceleration and deceleration at traffic junctions.
- The calculations from the Emissions Factor Toolkit are based on average traffic speeds and a level gradient. Slow moving traffic and vehicle loading have a large impact on increasing vehicle emissions.

The range of uncertainty in the emissions evaluation is important to keep in consideration when comparing and contrasting model outputs. The comparison of the transport model exhaust emissions to the national energy emissions data shows that the approach provides a comparable evaluation that is suitable for comparing carbon emissions from different transport options.

A2.7.2 2045 Forecast transport emissions

The model output provides a comparison between the 2019 baseline transport emissions with the traffic model for 2045 with an without carbon emissions reductions from modal shift:

Scenario	**Annual emissions from road traffic** **ktCO2/y**
Baseline Year (2019)	230
Option 5V3: City focussed development with active streets and relief roads at 2045	293
Option 5V3: City focussed development with active streets and relief roads **with modal shift estimates yielding 15% reduction in carbon emissions**	249

The evaluation shows that emissions are projected to increase from the baseline:

- The proposed option is projected to result in additional road traffic and carbon emissions by 2045 based on the vehicle fleet mix projections and trip generation from development in the traffic model
- The model does not reflect the shift to active travel away from using personal cars for short urban journeys that the strategy is designed to achieve. If modal shift is achieved similar to other places that have implemented a movement plan, then the carbon emissions would be reduced, but annual carbon emissions in 2045 will still be greater than in 2019.

A2.8 Recommendations

This evaluation of emissions from the local plan road transport options finds that:

- Without other interventions at a national and regional level, continued growth in journeys projected by proposed development within the plan will continue to increase carbon emissions.
- The projected traffic flow data that underpins this evaluation is not adequate to quantify the potential emissions reduction from the active travel components of the transport plans.
- Local journeys <5 km, although numerous and a major proportion of personal movement, only account for a small proportion of transport carbon emissions and therefore the Local Plan interventions to improve active travel and local public transport have a limited effect on reducing total transport carbon emissions.

Accepting that some of these issues can only be resolved at a national or regional scale, it is therefore recommended that a more detailed and comprehensive multimodal study to plan and evaluate the phased implementation of the transport strategy at the next stage of plan-making in order to find ways to reduce the projected carbon emissions over the duration of the plan.

A2.9 Glossary

AADT - Annual average daily traffic

AAWT - Average annual weekday traffic

Baseline - a reference point in time evaluation for comparison

EFT (Emissions Factor Toolkit)

GHG emissions - Greenhouse gas emissions

Fleet mix - describes what percentage of total vehicles is made up of what type of vehicle, which is then used to calculate emissions