# Local Plan 2040: Summary of options carbon emissions

Overview report synthesising the carbon emissions evaluations for development (CDLP2040-CC03) and road transport usage (CDLP2040-CC04).
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## Executive summary

In order to understand the potential impacts on the causes of climate change from the development options for the Local Plan 2040, the carbon emissions from constructing and operating new buildings in the district and the carbon emissions from the transport system options have been calculated and presented in reports CDLP2040-CC03 and CDLP2040-CC04 respectively along with the methodology and assumptions.

This summary combines the two evaluations and tests the potential impact of adding carbon significant emissions reduction measures to the options. The basis for these tests is provided by:

- estimated modal shift provided by Jacobs assessment of transport options (Stage 3 Report - May 2021 Table 9.3 Overall likelihood of modal shift)
- Application of carbon reduction levels achieved through the 'Shared Streets' mobility plan as achieved in Ghent, Belgium
- estimated emissions reductions from net zero operational carbon buildings standards (CDLP2040-CC03 Table 3 and CDLP2040-CC02)

This summary evaluation finds that all development options add to the district carbon footprint due to the emissions from constructing and operating new buildings and infrastructure; the embodied carbon emissions from constructing new development is the largest contributor to emissions from development.

This summary evaluation shows the major reduction in carbon emissions that can be made by specifying net zero operational emissions standards for new construction and lower embodied carbon through using less carbon intensive construction materials. It also shows that the reduction in the total transport system emissions through the 'Shared Streets' option combined with net zero carbon construction may lead to the lowest overall option emissions.

More detailed evaluation of the carbon emissions from the selected local plan development option will be necessary to establish that the projected carbon emissions reductions can be realised.

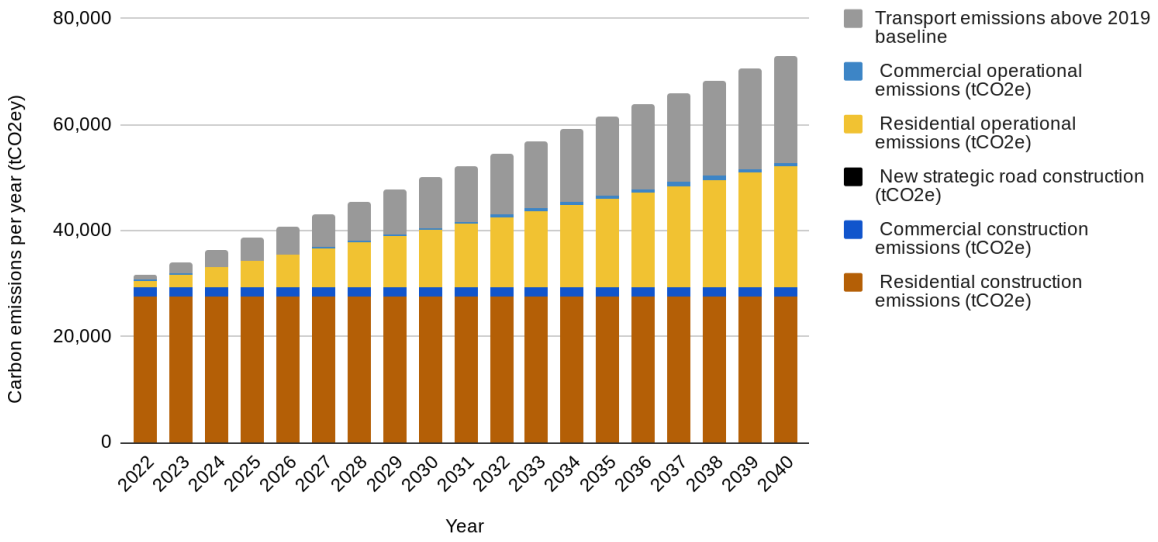
# Combined carbon emissions estimates from development and transportation options

The carbon emissions evaluation of development (CDLP2040-CC03) is based on the construction of infrastructure in a linear growth from 2022-2040 according to the 2040 targets and infrastructure construction components aggregated over the period.

The carbon emissions evaluation from transportation (CDLP2040-CC04) is based on the modelled transportation movements for the whole network 2040 as per the outputs of the Jacobs road transport modelling. This evaluation gives a one year (end of plan) snapshot to enable a comparison between options.

In order to combine the two evaluations to provide a combined summary of both the development and transport emissions for comparison purposes, it is necessary to convert the 2040 transport model into a year on year estimation of emissions. The chosen method applies a linear growth from the base year 2019 to the modeled 2040 traffic flows to evaluate the additional emissions generated by the modelled increase in road transport options.

**Figure 1: illustration of the combination of calculated construction and operation emissions for buildings and transport using a linear rate of development**




The illustration in figure 1 shows how the year on year emissions from constructing new development and transport infrastructure (embodied emissions) plus the operational emissions from healing and powering the new buildings (operational emissions) evolve over the period of the plan. The pattern is similar for all the options, with the scale and gradient affected by the volume of development proposed, the amount of transport infrastructure proposed and the consequent heat, power and transport emissions.

In reality, emissions changes are likely to be more variable year to year, depending on the rate of development and particularly the implementation of the major transport infrastructure components in some of the options.

## Potential impact of policies to reduce carbon emissions

A secondary analysis investigates the potential impact of carbon reduction measures that might be enabled by:

- Implementing policy to ensure that buildings are constructed to net zero operational energy, which are policy Local Plan 2040 policy options
- Maximising the option potential to reduce transport emissions through modal shift (based on the road transport indicators)

Option 5 component 'Shared Streets' is based on a method of restructuring the road system in the district urban centres as demonstrated in Ghent, Belgium. Ghent has similarities with Canterbury: a historic city centre within a rural municipality/district. In Ghent, the introduction of the Circulation Plan which selectively reallocated road space to walking, cycling and public transport, has led to rapid transformation of the urban transport system. Through the implementation of the Circulation Plan in Ghent -

> *Bicycle traffic in the city center has increased by 50%. The number of cyclists from and to the city center rose by 60%. The number of public transport users increased by 6% on a daily basis, with a greater increase in the evening rush hour of 25%. The number of cars entering and leaving the city center, on the other hand, has fallen sharply, by an average of 17%.*
>
> Source: Klimaatplan 2020-2025, translation.

The Ghent approach requires major whole system transformation and includes a multi-faceted mobility plan that includes incentives to enhance walking, cycling and public transport, and routes for private cars that are around the historic city of Ghent using an outer ring road. The programme in Ghent is continuing to apply further enhancements through to 2025 in order to sustain the switch to active travel and public transport.

The emissions reduction from 2007 - 2018 from at the municipality level was 12% (Source: Klimaatplan 2020-2025, translation), whereas the reduction in emissions from transport over the same period in Canterbury district was 4% (Source: National Statistics). For this comparative analysis a system level reduction of road transport emissions of 0.7% per year has been used to represent the potential of the application of the 'Shared Streets' principle across the district.

The level of uncertainty in this approach is high and the analysis is indicative; more detailed and accurate design, modelling and evaluation will be required to ensure that the selected development and transport options achieve the system level carbon emissions reduction goals to net zero by 2050.

# Baseline emissions comparison

National statistics for local authority emissions from energy evaluate that Canterbury district produced around 600,000 tCO2e from energy in 2018.

Subnational carbon footprint evaluations from DEFRA which include the energy related emissions and the carbon emissions from goods and services imported to the district give an estimate of 1,500,000 tCO2e total carbon footprint for 2017 (based on a district population pro-rata of the UK national carbon footprint). These district level emissions are discussed in more detail in the report CDLP2040-CC01 Climate change, carbon emissions and air quality strategic overview.

Emissions from Canterbury district road transport in 2018 were estimated to be around 230,000 tCO2e which is around 38% of the district direct emissions from energy and around 15% of the total carbon footprint for the district.

The emissions generated from the construction of new buildings and infrastructure delivered through local plans is much less well understood and there is currently no official dataset for these emissions sources. The supply chain for new construction is complex, involves many components and many of the emissions are in the form of energy emissions at the point of manufacture in the UK or overseas, some of which are already counted in the UK national emissions data.

The UK Green Building Council estimates that the total carbon footprint of new construction is around 6% of the UK carbon footprint[1]. The Statista evaluation of carbon dioxide (CO2) emissions from the construction industry in the United Kingdom (UK) from 1990 to 2019 based on national statistics says;

> The levels of carbon dioxide emissions from the United Kingdom construction industry have seen an overall increase over the past 30 years. In 1990, emissions from this sector amounted to 9.3 million metric tons and in 2019 were approximately 13 million metric tons. This was roughly three percent of the total carbon dioxide emissions in the UK that year.

The Committee on Climate Change Sector Summary: Manufacturing and Construction (December 2020) for the sixth carbon budget evaluates UK manufacturing and construction to be around 12% of overall UK domestic carbon emissions. The report does not disaggregate construction, but highlights the very large component that concrete, iron and steel contribute to UK carbon emissions and the urgent need to shift to lower carbon intensity construction materials in order to meet carbon reduction targets.

[1] https://www.ukgbc.org/climate-change/

**Figure 2: illustration of the average annual emissions (mid plan) from local plan options compared to baseline emissions**

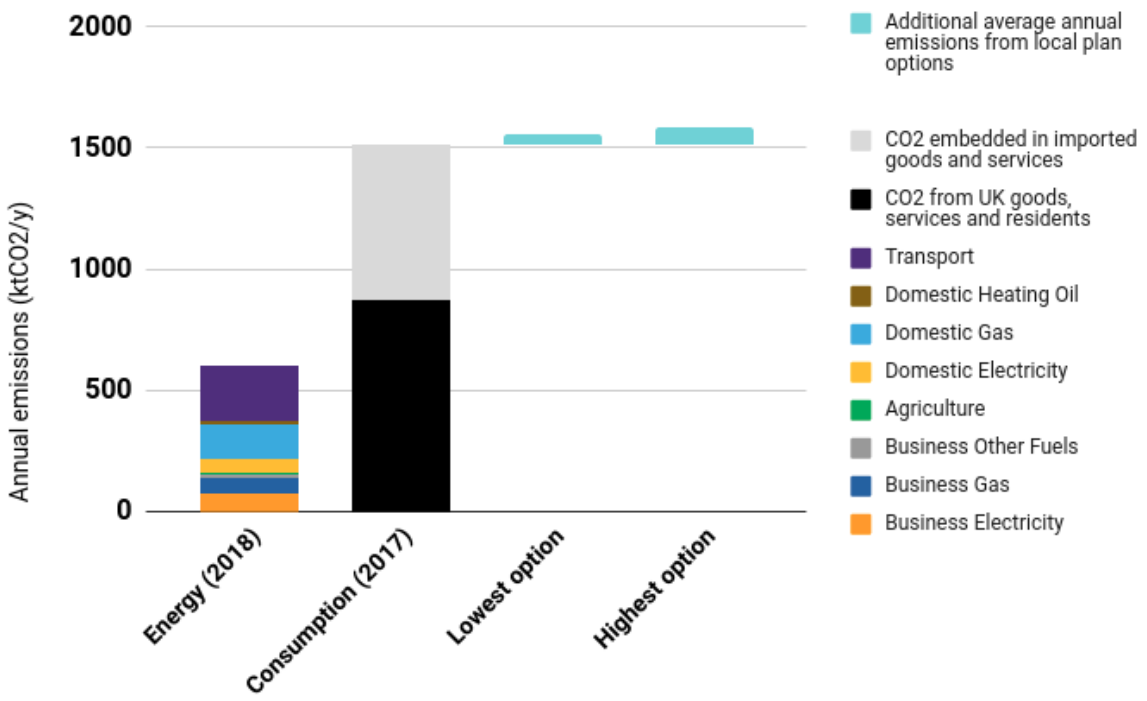


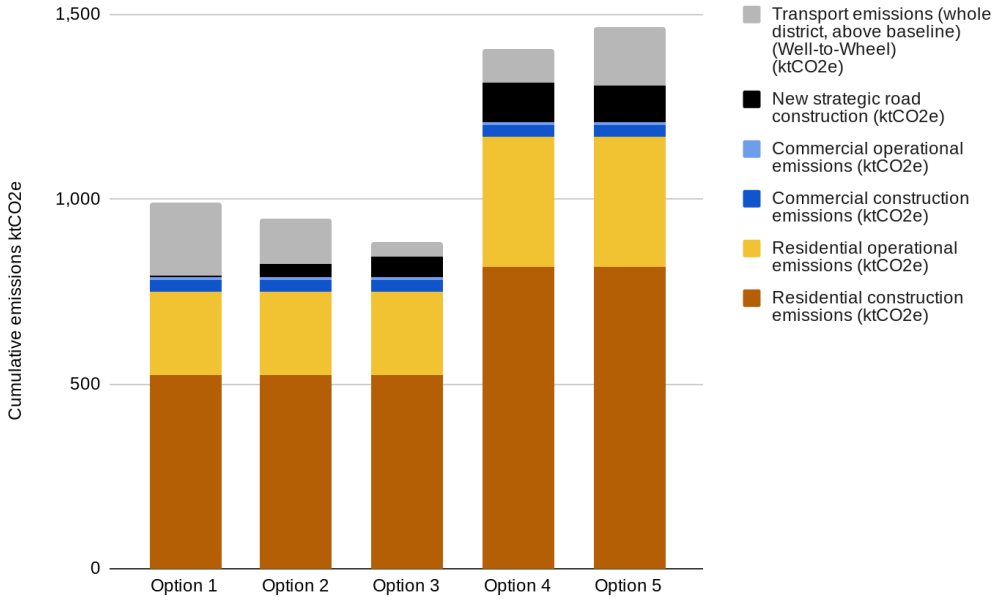

Figure 2 illustrates the scale of emissions from the local plan development options evaluated in this report to provide context. Note that there are other emissions that may be generated through development not specified within the local plan such as additional water, waste, power infrastructure, schools and healthcare facilities. The illustration shows that the local plan development emissions are comparable to evaluations from other sources and in the range 3-5% of the total district carbon footprint.

# Evaluation

The cumulative emissions from the construction and operation of the development and specified road infrastructure over the lifetime of the plan as shown in figure 3 is between approximately 890 and 1,470 $ktCO_{2e}$ before taking into account policies to reduce carbon emissions from construction, higher efficiency design or measures to restructure the inner Canterbury transport system.

If the development is built to current standards and using conventional building material, around 50% of the emissions are generated from the construction process (embodied emissions) and over 25% from the heating and powering of the new developments (operational emissions).

**Figure 3: Plan options before carbon reduction policies implemented**



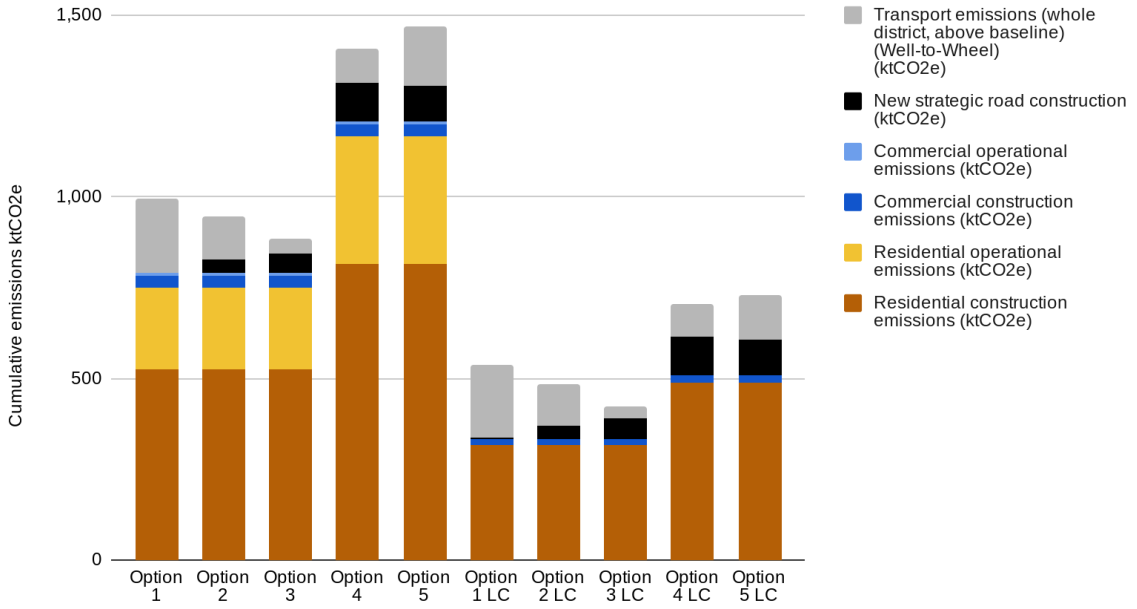

It is important to note the assumptions and levels of uncertainty within the analysis which are set out in the reports CDLP2040-CC03 and CDLP2040-CC04. The options that have been evaluated are in outline form and the embodied emissions can vary significantly if the infrastructure is more intensive and extensive than the average UK house and road construction values that have been used. The operational emissions are likely to be more accurate as they are based on large datasets and more established evaluations.

The comparison between the options indicates with a continuation of current development building standards, Option 3 which includes the lower level of development focused in the urban areas and including strategic interventions to alleviate congestion and improve active travel is likely to generate the lowest carbon emissions.  The comparison also indicates that the local plan development will add a significant contribution to carbon emissions during 2022-2040, when emissions at a district level need to be reduced by around 75% to meet UK Carbon Budget commitments (see CDLP2040-CC01 for more details).

## Addition of local plan policies and interventions to reduce carbon emissions

If policies to reduce operational carbon emissions  of new development to net zero and reduce the embodied emissions by 40% then the carbon emissions of the development options can be significantly reduced. This is shown in figure 4 Options 1-5 LC.

**Figure 4: Plan options with carbon reduction policies implemented**




The impact of setting the higher standards for construction is very large, reducing the total emissions over the life of the plan by around 50% in all cases.

## Carbon reduction from 'Shared Streets'

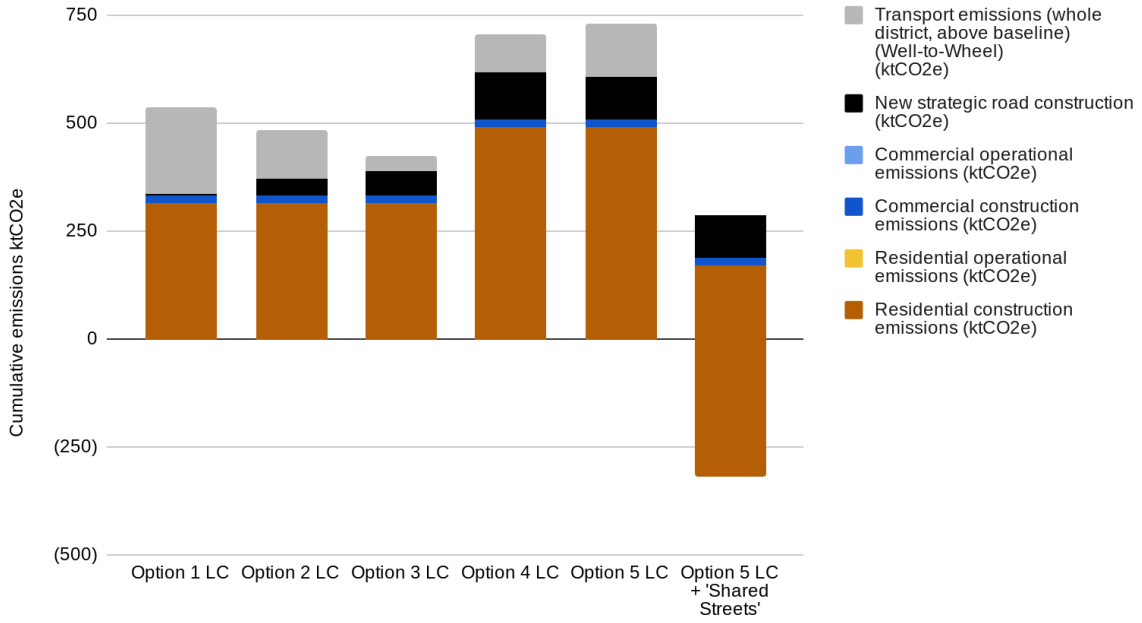
It is important to note that the transport model used to compare and contrast the options does not include the potential impacts of a shift in the proportion of journeys being made by cars to low carbon forms of transport such as walking and cycling, in particular from option 5. The model is based on applying current travel behaviours to future developments and the impacts it will have on road transport. The impact of a significant change in work patterns with more home working for example, or an increase in the propensity for people to walk or cycle from the suburbs to the urban centres because of improved pedestrian and cycle routes are not included in the traffic modelling.

Stakeholder responses to the Issues consultation commented that modal shift and reducing the reliance on cars would be key to addressing congestion, improving air quality and supporting a reduction in carbon emissions. Some respondents also commented that the improvements to walking and cycling infrastructure and other measures developed through the current Local Plan did not go far enough, and that more radical measures would be needed to address these key issues.

Option 5 includes a range of significant interventions designed to fundamentally change the way that people move around the city - prioritising walking and cycling and restricting car movements based on the Circulation Plan method used in Ghent. If the walking and cycling benefits of this approach are replicated in Canterbury then it may lead to a reduction in carbon emissions of around 13% over the plan period in excess of reductions in emissions due to projected changes to vehicle technologies over the period.

Applying this factor to the transport emissions for Option 5 reduces the district transport emissions by around 320,000 tCO2e over the duration of the plan.

**Figure 5: Plan options with carbon reduction policies implemented and option 5 'Shared streets'**

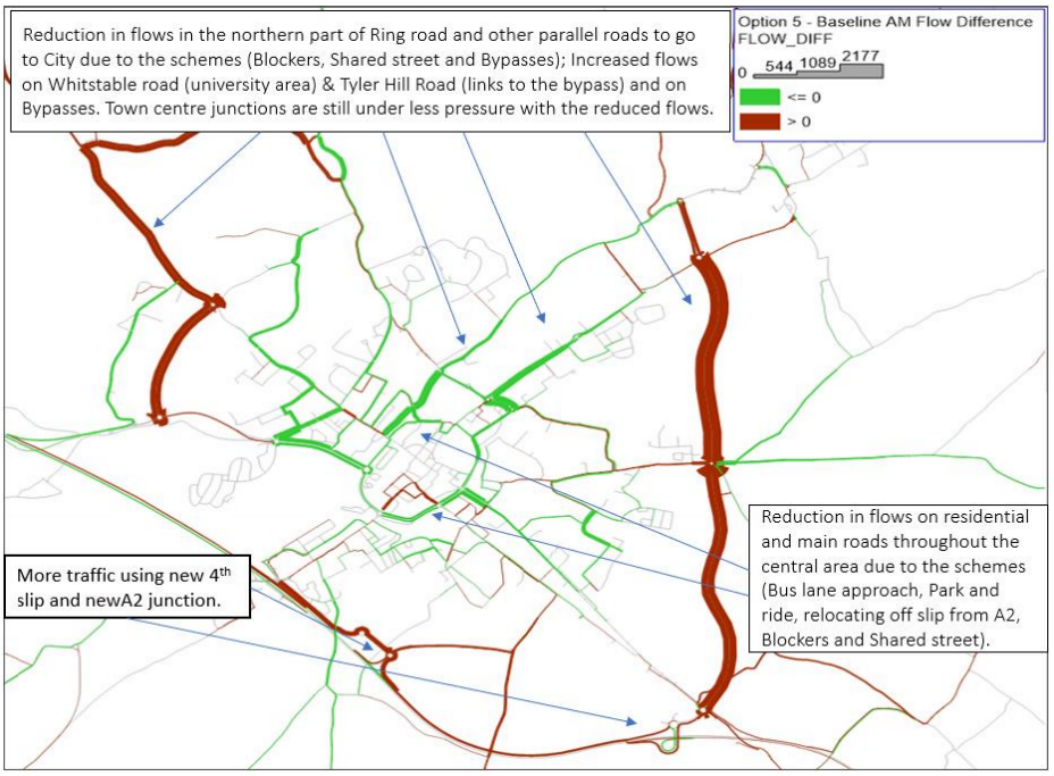



Option 5 with low carbon development policies and the fully implemented 'Shared streets' using a circulation plan shows the potential to have the lowest overall carbon emissions out of all the development options that have been evaluated.

There are considerable co-benefits of this option for air quality, health and quality of life for the urban areas and residential streets and these in turn bring associated social and economic benefits. Traffic flows for option 5 illustrated in figure 6 (reproduced from the traffic modelling Stage 3 Report - May 2021) show how the plan decreases road traffic movements in the residential streets.

However, as the traffic model does not reflect changes in travel behaviours, it therefore projects large volumes of traffic taking orbital routes around the city to replace cross-city short journeys. The experience from the Ghent implementation is that many of these journeys will be replaced by walking and cycling in the quieter and safer streets and improved walk and cycle ways: This reduction in vehicle traffic is what will deliver the overall traffic carbon emissions reduction of this option.

**Figure 6: Option 5 - Baseline modelled AM traffic flows**
(Stage 3 Report - May 2021 Figure 6-21)




The implementation of Option 5 with 'Shared streets' is a major endeavour with extensive detailed design aspects that will require cooperation and coordination between Canterbury City Council and Kent County Council, and significant community involvement in the process to enable its adoption.

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