Tendring Colchester Borders Garden Community Transport Evidence

Part I: Mode Share Targets

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Executive summary

Transport evidence to support the forthcoming Development Planning Document (DPD) for Tendring Colchester Borders Garden Community (TCBGC) has been set out in two parts. The report has been commissioned by Colchester City Council, Tendring District Council and Essex County Council.

Part 1 explains the approach to delivering sustainable mobility on TCBGC and suggests ambitious mode share targets. These targets are grounded in an understanding of the existing local transport system in Colchester and Tendring, current travel choices, trends for future travel behaviour and expected travel patterns to and from the garden community. The mode share targets are also informed by a mode share model which draws on evidence from elsewhere in the UK on the levels of sustainable travel that can be achieved.

The mode share targets divide trips into internal trips staying within the bounds of the garden community, hinterland trips less than five miles from the garden community and other residual trips. The targets for these trips are shown in the figure below at key points in time – 2033, 2041 and 2051 – alongside a comparison to a mode share based on current travel behaviour called a business as usual mode share.

Part 1 demonstrates how achieving the mode share targets will significantly contribute to carbon reduction thereby supporting climate emergency aims of the planning authorities. Suggestions are also provided for monitoring and evaluating progress against mode share targets over the lifetime of the garden community.

Part 2 presents the case for investment in transport infrastructure and supporting measures, which mitigate the transport impact of the garden community but also support the sustainable travel strategy aligned to the mode share targets. The measures have also been chosen to complement wider transport plans including the Colchester Future Transport Strategy. The transport infrastructure and supporting measures are expected to inform the Infrastructure Delivery Plan (IDP).Part 2 also provides evidence from the Colchester Transport Model that shows how implementing the strategy based on sustainable travel avoids severe congestion impacts on the highway

and local public transport network. This also supports environmental aims and the local economy, which requires a transport system which facilitates the efficient and affordable movement for all.

The transport evidence in Parts 1 and 2 of this report precedes further transport evidence that would be required for the detailed masterplan and planning applications. Further evidence, however, would be led by the developer Latimer with consideration given to the DPD and IDP.

1 Background

The Movement and Access Study, produced by Jacobs/Essex County Council in 2017, set out a transport ambition and objectives for the three new communities proposed at the time, as part of the vision for a network of sustainably connected Garden Communities across North Essex. This included headline mode share targets for 70% of trips to be by active and sustainable modes, with the remainder by private car.

These targets were ultimately not included within the Shared Strategic Part 1 Local Plan (Adopted in January 2021), through which the land required to deliver the Tendring Colchester Borders Garden Community (TCBGC) was allocated. Policy SP6 of the Plan requires, *inter alia,* a DPD to be produced that will include: *"Target mode shares for each transport mode and details of sustainable transport measures to support their achievement."*

1.1 Purpose of this report

This report, prepared by Integrated Transport Planning (ITP), builds upon case study evidence and mobility principles, presented in the Mode Share Strategy submitted as evidence to support the Share Strategic Part 1 Local Plan and developed in the Transport and Movement Framework for the TCBGC, that was provided as part of the evidence base for Regulation 18 Consultation of the proposed TCBGC DPD. This report develops this work, by strengthening and deepening the evidence base and developing targets based on the illustrative masterplan developed to support the DPD, and the off-site infrastructure proposals developed to support the accompanying Infrastructure Delivery Plan. This report is intended to inform the target mode shares that incorporated into policy via the DPD.

This work has been prepared alongside ongoing work being led by Prior+Partners (masterplanning), with support from ITP, and Jacobs/Essex County Council (costed packages of off-site transport improvements that will support the Garden Community's delivery).

A set of broader carbon targets, which consider the carbon costs (both emitted and embedded) of surface transport associated with the Garden Community, have also been developed based on the projected vehicle mode share and trip generation. The targets reference the Essex Climate Action Commission Net Zero recommendations and ECC's Local Transport Plan, with the ambition to support the UK Government's net zero by 2050 target.

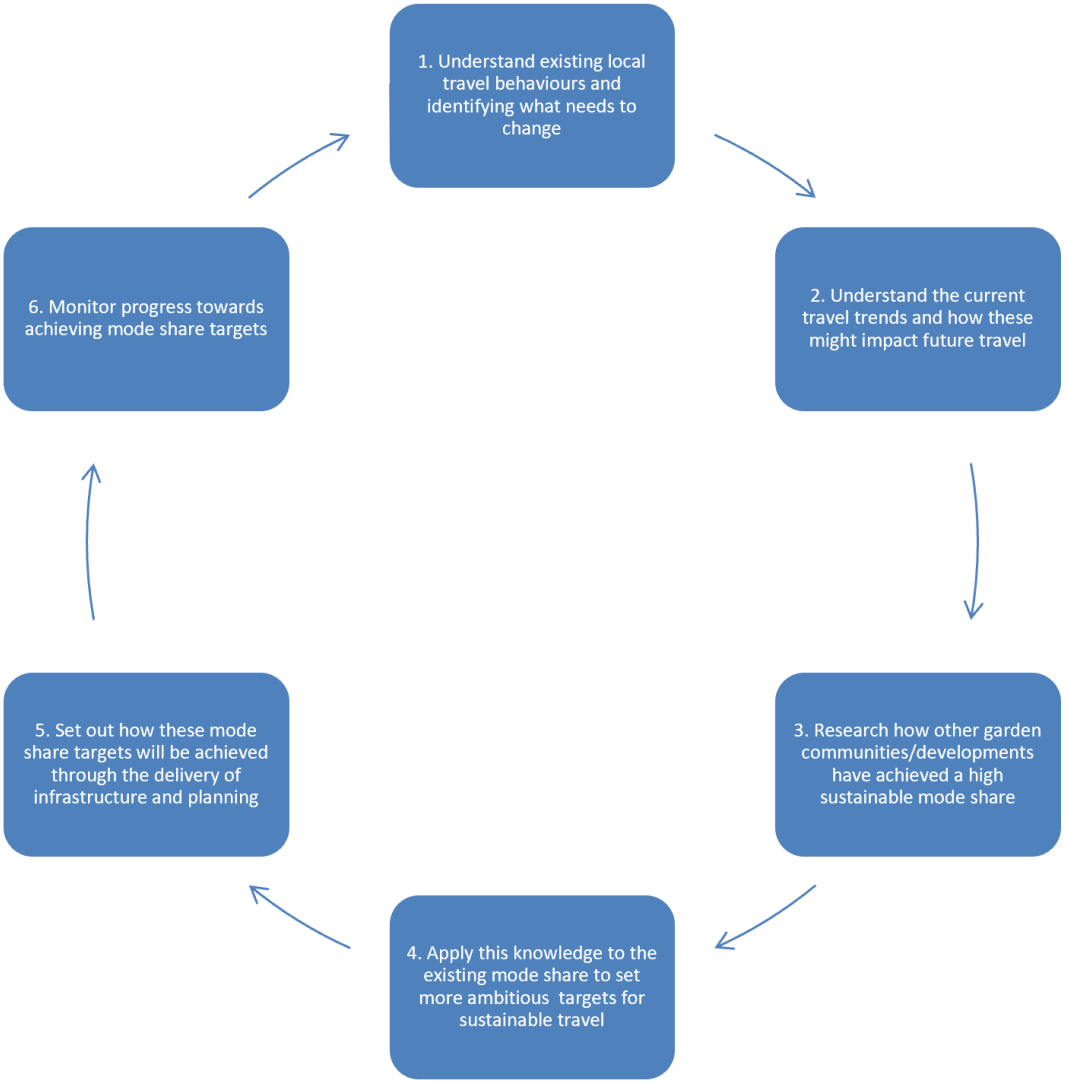
The report also proposes an approach to baselining, monitoring and evaluating the target mode shares suggested for the different neighbourhoods of the Garden Community. This approach will need to continue to be refined as the Garden Community moves through the planning process to delivery, to ensure it aligns closely with the phased realisation of the emerging masterplanning and associated delivery of strategic on- and off-site transport improvements (to which the mode share targets are inextricably linked).

The work has adopted a vision-led approach. This acknowledges the fact that the traditional 'predict and provide' approach, whereby existing behaviours are used as a baseline to model trends in the future, has too often resulted in car-dominated places, locking in car dependency, high carbon emissions and sedentary lifestyles. This is because the existing baseline is often derived from places that do not have good quality active and sustainable transport infrastructure. This car-dependent outcome is incompatible with the vision for a Garden Community. Our approach has been to envisage what the transport and mobility outcomes should be for the Garden Community, as set out in the masterplanning workstream, and then to ensure the proposed infrastructure – on- and off-street – will achieve the vision. We have taken case study evidence from best practice developments in the UK and Europe to determine what the impacts of high-quality land use planning and transport investment are and have applied that to the Tendring Colchester borders setting. The detail of how a 'business as usual' baseline has been uplifted to reflect the vision, is set out in more detail in Chapters 4 and 5.

1.2 Approaching to developing mode share targets

A logic map has been created (Figure 1-1) as a simple visual representation of the relationship between the various components of this project, and how they result in travel behaviour change. This has informed the structure of our work and how it has been reported.

Figure 1-1: Methodology Logic Map



The logic map visualise how change comes about in relation to travel behaviours, and how the various strands of work undertaken as part of this project interact overtime and are critical to achieving a robust set of mode share targets in the first place, founded on clear infrastructure proposals; how outcomes can be monitored to ensure the targets are achieved once development is on the ground; and how changes may need to be made to the strategy, should that be necessary, to achieve the mode share targets.

The chart is depicted as a cycle to represent the need for periodic reviews and updates to the evidence base through site monitoring as the development progresses and that throughout the lifetime of the development there will need to be constant reflection on the factors set out, in order to achieve sustainable outcomes.

1.3 Structure of the report

The chapters below relate to the logic map shown in Figure 1-1 and provide the evidence for setting mode share targets and achieving positive mode share outcomes.

Chapter 2: Transport and movement baseline captures current movement patterns around the TCBGC site using origin-destination mobile phone data and considers the strengths and weaknesses of the existing local walking, cycling public transport and road networks. It includes a summary of the key opportunities and challenges presented by the proposed development of the Garden Community.

Chapter 3: Evidence base review, incorporates further UK Garden Community case study evidence, expanding on Chapter 2, to comparatively benchmark the original TCBGC mode share targets with those being adopted at Garden Community developments elsewhere in the UK as well as other progressive developments internationally. It also reflects on the theories and trajectories of change to consider some of the unfolding trends (post-pandemic, and in the 21st Century's Climate Emergency context) that we believe need to positively influence the mode share targets and mobility outcomes associated with the TCBGC's realisation.

Chapter 4: Mode Share and Carbon sets out the Mode Share Modelling approach, which forecasts the achievable mode shares for the different neighbourhoods of the TCBGC growth area based upon the emerging packages of off-site transport improvements developed by Jacobs, and on-site transport/community facility developed by Prior+Partners and ITP. It includes an analysis of the carbon impacts of the Garden Community.

Chapter 5: Targets and phasing is informed by Mode Share Modelling presented in Chapter 4. It defines 'active' and 'sustainable' trips, and sets targets for 2033, 2041 and 2051.

Chapter 6: Monitoring and Management sets out an outline approach to baselining and monitoring the mode share targets to ensure future planning applications for TCBGC delivery phases correspond with the overarching method. This supports the ongoing development of the DPD by responding to the requirements of the Shared Section 1 of the Tendring & Colchester Local Plans, particularly in aligning the transport measures proposed with the mode share targets (Policy SP 6), and in identifying triggers for infrastructure in relation to phasing (Policies SP 8 and SP 9).

Finally, Chapter 7 summarises the Next Steps required to evolve the targets and outline monitoring and evaluation approach in line with the masterplan and infrastructure delivery plan.

2 Transport and movement baseline

This section of the report summarises current movement patterns and considers the strengths and weaknesses of the existing walking, cycling and public transport networks; highlighting challenges that need to be addressed if ambitious mode share targets are to be achieved.

Almost 40% of all trips within Colchester are less than 5km (3.1miles) in length. This suggests there is genuine potential to positively influence and encourage more journeys to be completed by active and sustainable modes.

2.1 Origin-destination analysis

To better understand where future residents may travel to and from, we analysed local origin-destination movements to identify key travel patterns in the current context (2016) and make predictions for future years (2051). Origin-Destination (O-D) data was supplied to ITP by Jacobs, in the form of an O-D matrix derived from a SATURN and EMME strategic model, making use of 2016 mobile phone network data. It should be noted that this data relates to pre-pandemic movement patterns. Emerging trends, which may also impact the form and nature of future journeys, are discussed in more detail in Chapter 3.

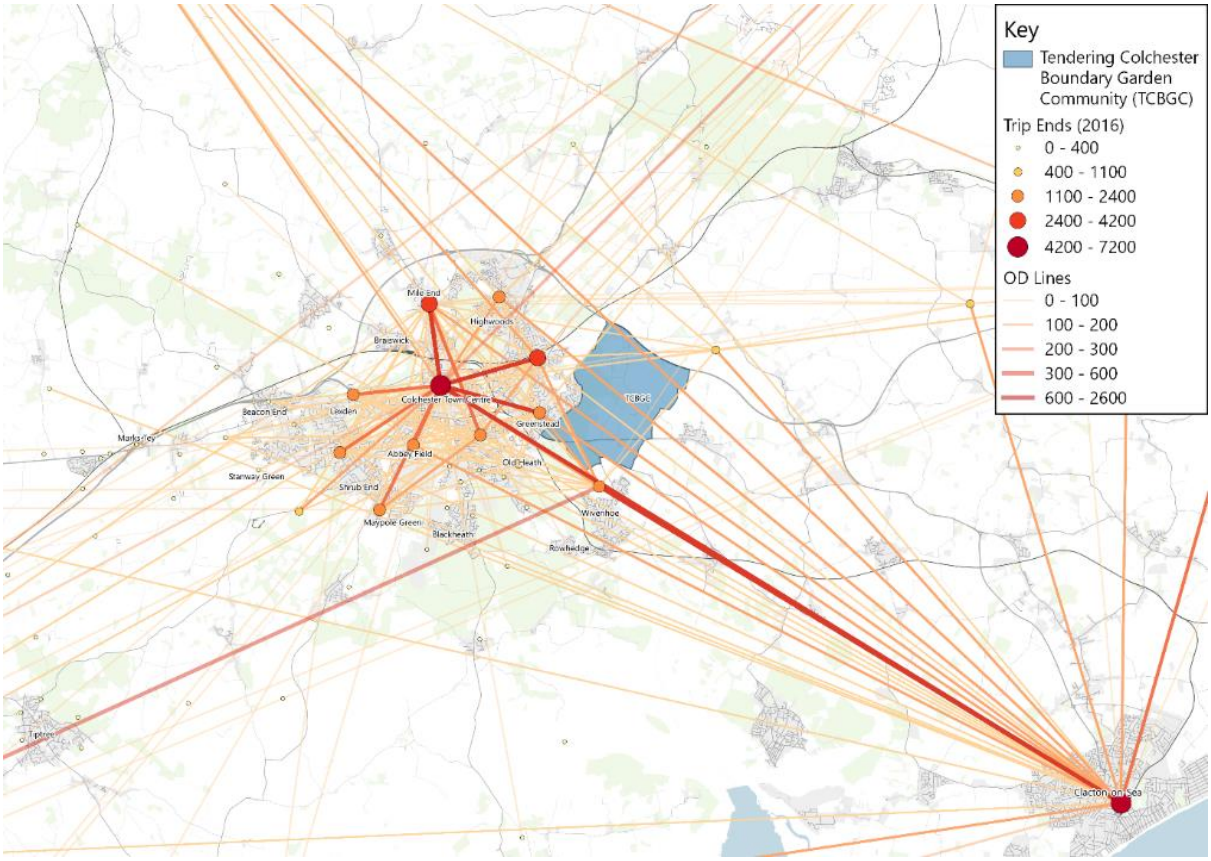
As shown in Figure 2-1, the size and shading of the dots (nodes) denote the number of trip origins or destination points and their location, whilst the width and shading of the lines represent the number of trips between the zones.

High-level analysis shows the predominant movements to and from Colchester and the areas surrounding TCBGC. Trips within the town are relatively short distances and focus on movements between residential areas, the town centre/employment areas, and other key trip attractors. There are a greater numbers of trips to/from the east of the town including from Mile End (key trip attractor includes Colchester Hospital), Greenstead (key trip attractor includes University of Essex Colchester Campus), and Hythe (key trip attractor includes the Hythe Rail Station and industrial estate). A smaller number of trips extend beyond the town to Sudbury in the North, and Ipswich to the East.

The closest nodes to TCBGC are the two eastern Colchester nodes and the Tendring (east of TCBGC boundary) and Wivenhoe (south of TCBGC boundary) nodes shown in Figure 2-1, with the most common movements from these nodes being to and from Colchester city centre, with high flows also going to and from Clacton on Sea and London.

The predominant future movements from TCBGC are expected to be to Colchester town centre and the University campus (to the immediate east of the town), as well as to and from Wivenhoe and Tendring districts with some longer distance movements to Chelmsford, Clacton, and London. These assumptions are supported by the existing travel patterns surrounding the site, but may be influenced by the emerging trends highlighted in Chapter 3 of this report.

Figure 2-1: Origin and destination movements



2.2 Current transport network and service provision

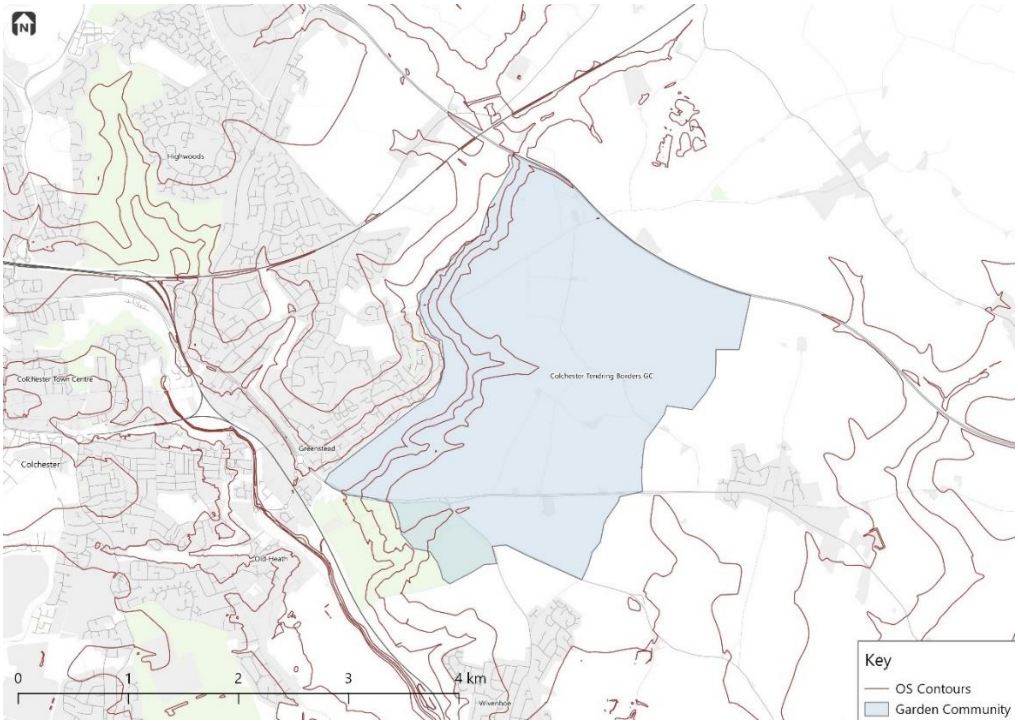
2.2.1 Cycling and Walking

Historic investment from the Cycle Cities and Towns programme (2009), the National Cycle Network, and more localised cycling infrastructure means Colchester has a reasonably well-developed cycle network with both on-road and off-road cycle routes. However, the quality of the routes in terms of priority and maintenance is generally sub-optimal, which limits their attractiveness.

The Great Eastern Main Line, Colchester-Clacton rail line, the A133 and the River Colne all present severance points from Colchester to TCBGC. Crossings

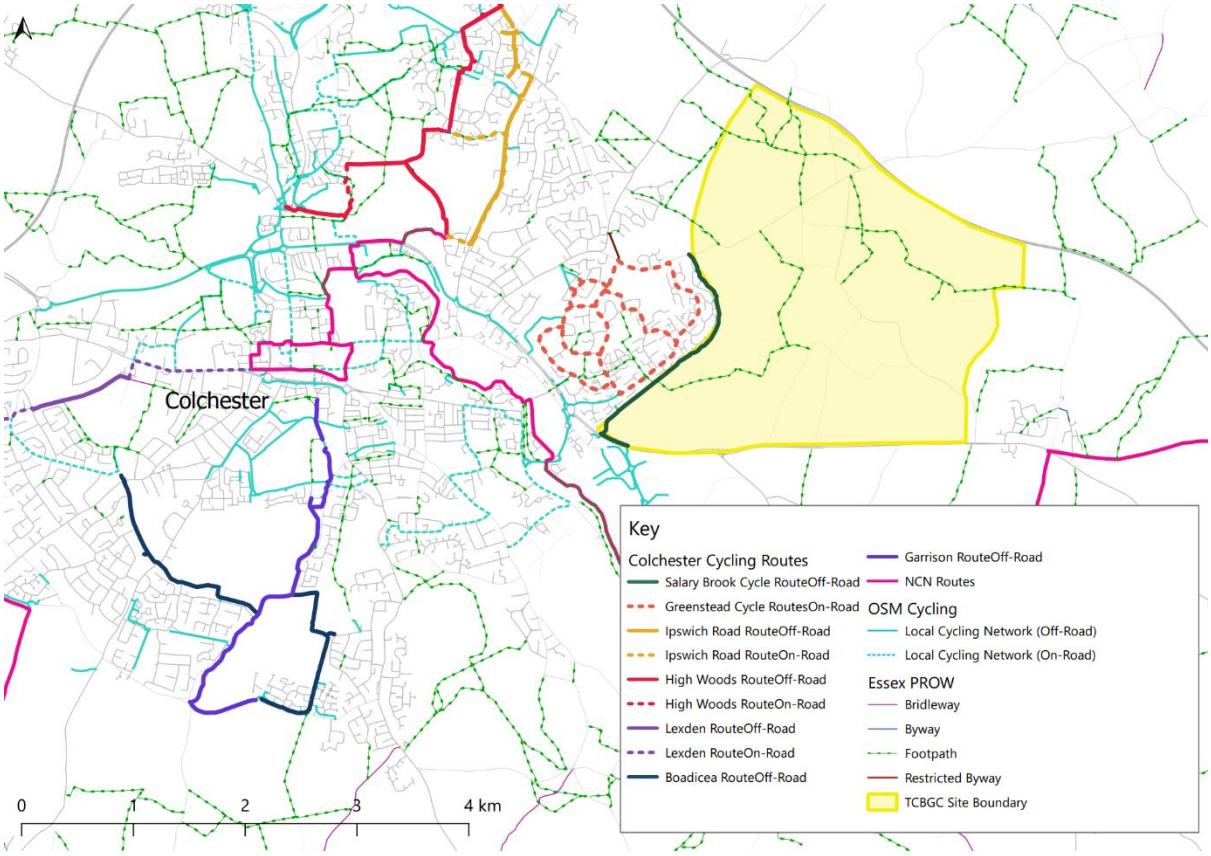
of these barriers are proposed as part of the illustrative masterplan, including crossings over the A133 towards the University and Wivenhoe. Salary Brook, where the levels change significantly either side of the Brook, also presents a key barrier to access between Greenstead and Highwoods and TCBGC. At present there are only a small number of Public Rights of Way that are largely unsuitable for cycling which link the two areas. Moderate gradients may also present challenges to cycling and walking, particularly towards the west of the development.

Figure 2-2: OS Gradient map



Significant improvements to the existing network, including new dedicated traffic-free routes to key destinations such as the university campus, town centre and key employment locations such as Colchester hospital, will be essential if the mode share targets are to be achieved.

Figure 2-3: Existing active travel routes



2.2.2 Public transport

Colchester is well served by public transport, with several town services operating on a 10-20min frequency and three rail stations Colchester, Colchester Town and Hythe. However, most 'inter regional' bus services to / from Colchester operate at lower service frequencies. Bus priority measures in Colchester are focused on the Town Centre and to the North of the town (serving the P+R). Low bus priority to the east contributes to unreliable journey times, with congestion common on St Andrews Avenue, around Greenstead Roundabout and at the A133 junction with Boundary Road. Colchester's main bus operator is First Essex, other operators include Arriva Colchester, Panther Travel, Ipswich Buses, Stephensons of Essex and Hedingham Omnibuses.

Two bus services currently operate on the A133 adjacent to TCBGC:

- the X76 between Colchester and Clacton, two buses per hour, and ;
- the 77 between Colchester and Aingers Green, one bus every two to three hours.

There are no bus routes intersecting the site and therefore a new rapid transit service is proposed to increase public transport usage at TCBGC.

A 'Turn up and go' regular connection to Colchester town centre, Hythe Station, Colchester Town Station, Colchester North Station and Colchester General Hospital already exists from the University of Essex Colchester Campus, which is close to the TCBGC site boundary. The journey time is approximately 25 minutes. Services do not connect to the Park & Ride.

Multi-operator daily and weekly ticketing is available through the Colchester Borough Card which allows unlimited bus travel in and around Colchester on all bus services.

Figure 2-4: AM frequency from the site

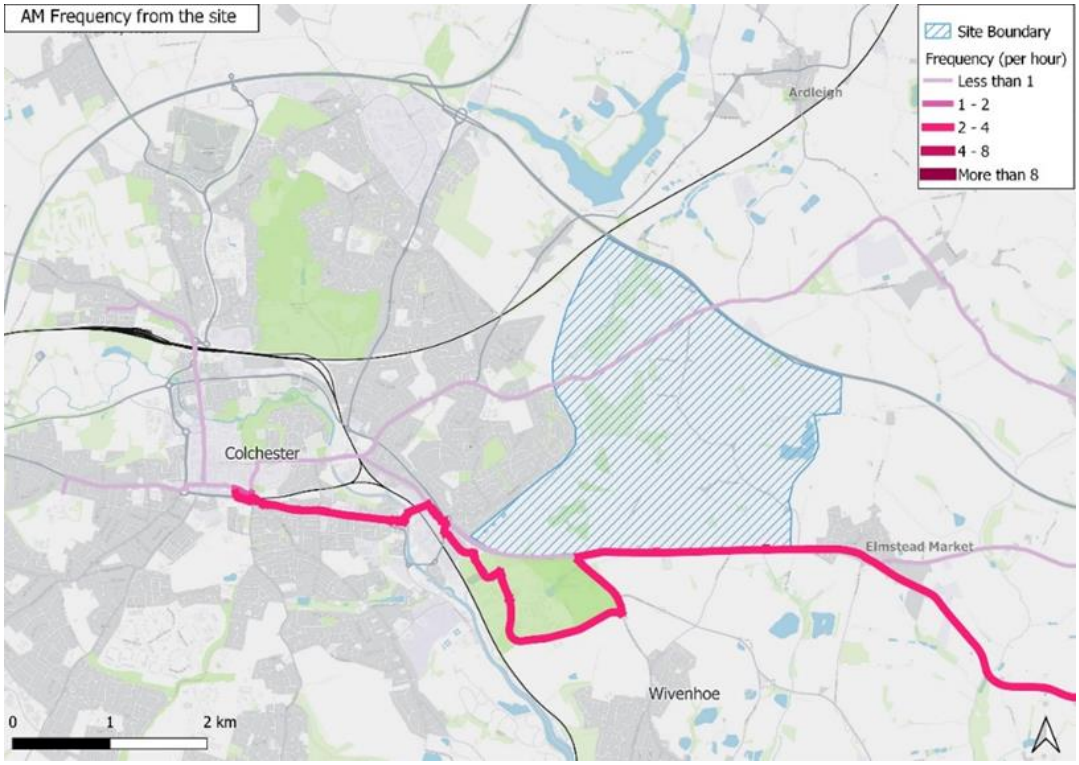
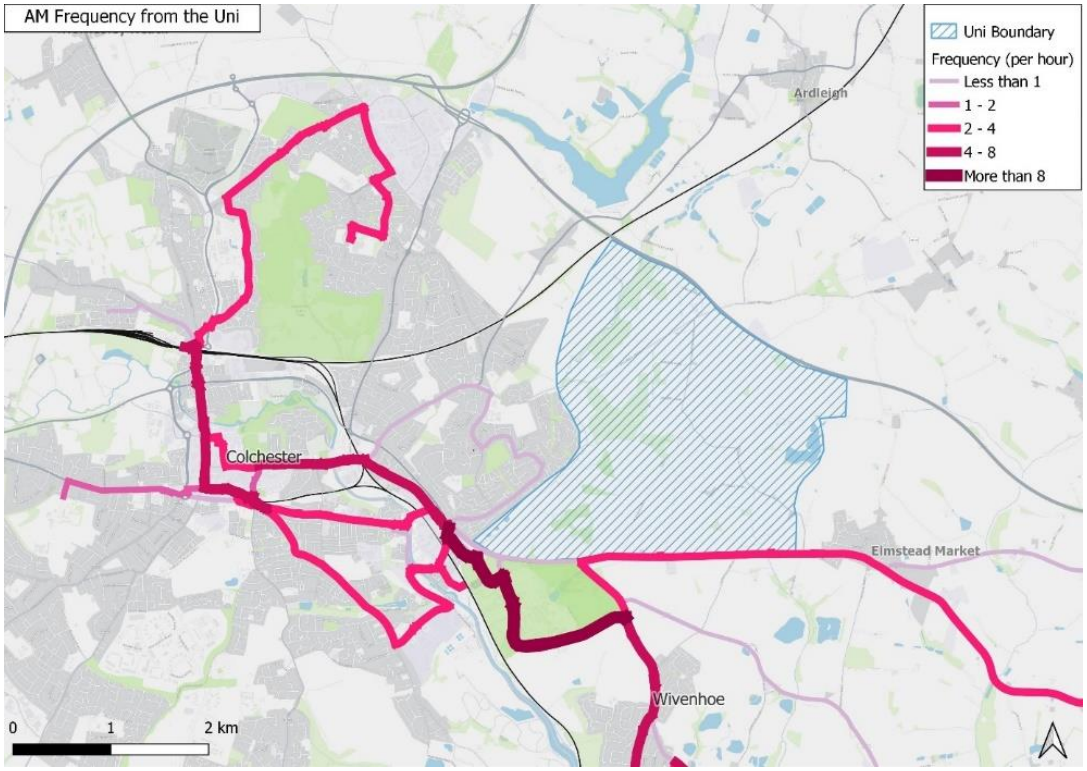


Figure 2-5: AM frequency from the university



2.2.3 Highway access and parking

Movement in Colchester and Tendring is currently dominated by private car use – with 61% of trips to work undertaken by car.

The TCBGC site is bound to the north and south by the A120 and A133 respectively, which are relatively high-speed, high volume inter-urban roads, particularly the A120, which is a trunk road with strategic importance managed by Highways England. The TCBGC site is intersected by several minor unclassified roads, including Tye Road, Turnip Lodge Lane, Wivenhoe Road and Allen's Lane, which typically serve agricultural land, private dwellings and a small number of businesses.

2.3 Existing mode share

In line with many locations outside major cities in the UK, movement in North Essex is currently dominated by private car use. This is a result of limited public transport and cycle route options. Available services and routes tend to be less direct and offer slower journey times than are possible by car. Existing trip patterns are therefore a product of the available transport links, including rail, bus and cycle routes.

The 2011 Census Method of Travel to Work data for Tendring and Colchester has been analysed to establish existing mode share in the area in relation to commuting trips. Table 2-1 describes the travel patterns found in this dataset, which includes ages 16-74 and excludes those not in employment. Although there are several limitations with using this dataset, not least that it does not consider non-commuter trips, it does provide a useful indicator of general travel habits in the region.

Table 2-1: Existing mode share (2011 Census)

Mode		Colchester & Tendring
Active Modes	Walk	12%
	Cycle	4%
	Total	**16%**
Public Transport	Rail	7%
	Bus	4%
	Total	**11%**
Car	Car	61%
	Car pax	5%
	Total	**66%**
Other		1%

The 2021 Census Method of Travel to Work data for Tendring and Colchester has been analysed, in order to provide a further benchmark. As well as the caveats set out above it should be noted that the Census was undertaken during the pandemic when lock downs were in effect. This meant that 28% of the workforce in Colchester and Tendring were working from home, with those who were travelling encouraged to avoid public transport. The figures in Table 2-2 therefore reflect only those who were travelling.

Table 2-2: Existing mode share (2021 Census)

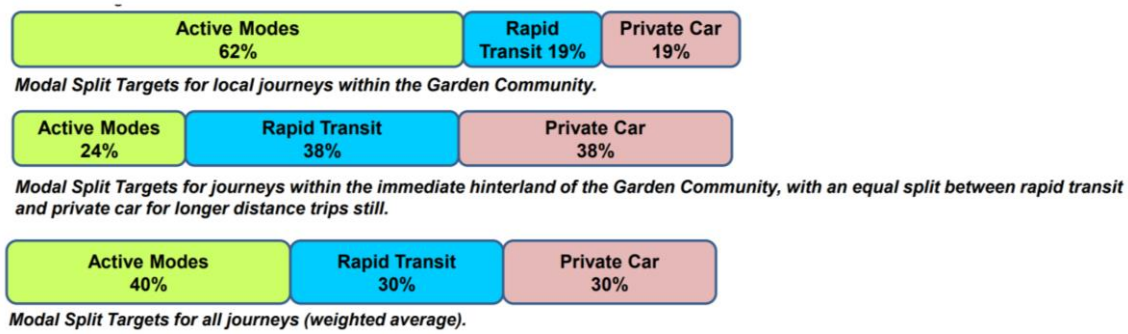
Mode		Colchester & Tendring
Active Modes	Walk	12%
	Cycle	3%

	Total	**15%**
Public Transport	Rail	3%
	Bus	3%
	Total	**6%**
Car	Car	71%
	Car pax	5%
	Total	**76%**
Other		3%

2.4 Mode share targets

The Movement and Access Study (2017) set out some mode share targets (Figure 2-6). These are more ambitious than with TCPA Garden City Principles, which aim for 60% of trips to be active and sustainable modes in new Garden Communities. Chapter 3 of this report explores the feasibility of delivering these targets through the experiences of other places that have achieved highly ambitious mode shares, their local context and the measures that have enabled their success.

Figure 2-6: Movement and Access Study Mode share targets for all journeys (top), local journeys (middle) and within the TCBGC hinterland (bottom)



Within the Movement and Access Study, each length of journey has a different mode share target:

- The overall travel mode share target for all journeys generated by TCBGC seeks 40% of trips to be completed by active modes (e.g. walking / cycling / scooting / running), with the remainder split equally between rapid transit (30%) and private car (30%).

- For local journeys within TCBGC, the mode share targets are more ambitious. They consider the potential for significant trip internalisation; giving a target for 62% of trips to be completed by active travel modes, with the remainder split equally between rapid transit and private car (19% each).
- For hinterland journeys outside of TCBGC, but no more than 5 miles, the target is for 24% of trips to be completed by active travel modes, and 38% each to be made by RT and private car.
- There are no targets for trips over 5 miles in length.

2.5 Summary of constraints and opportunities

Table 2-3 summarises the main constraints and opportunities identified through the work above, from the perspective of achieving sustainable mobility outcomes for trips originating in, and destined from, the TCBGC developments.

Table 2-3: Constraints and opportunities

	Opportunity	Constraints
Active Travel	• Historic investment in cycling and walking means Colchester has a reasonably developed cycle network with both on-road and off-road cycle routes. • A series of corridor wide and site-specific interventions have been proposed to improve active travel connections between TCBGC and Colchester. This includes routes to Colchester Hospital, Colchester Town Centre and Town Rail Station, Colchester Business Park, University Old Heath and Wivenhoe.	• None of the existing cycle routes around TCBGC provide direct access from the site to Colchester town centre, the University, Greenstead and Hythe therefore infrastructure investment is required. • The Great Eastern Main Line, Colchester-Clacton rail line, the A133 and the River Colne all present severance points from Colchester to TCBGC. • Salary Brook also presents a key barrier to access between Greenstead and Highwoods and TCBGC
RTS	• Give priority to short everyday trips to link people to work, education, retail and leisure. • Provide a dedicated, segregated, alignment through TCBGC	• Balancing the potential to serve the most users and keeping the service attractive in terms of journey time.

	• Lock in a high sustainable mode share at TCBGC. • Integrate land use and public transport. • Offer zero emission travel. • Provide green links across the site to create a green-grid network of walking and cycling routes. • Enhanced the natural environment with net biodiversity gains.	• Congestion impacts on rapid transit journey times in future years.
Highway	• The link road allows a zonal approach to access to be developed for the garden community, helping reduce internal car trips. • The link road was found to be necessary for the delivery of the TCBGC. • The link road can reduce traffic on the A133 into Colchester (along with a proposed Park & Choose), providing benefits if this capacity is reallocated for active and sustainable modes	• The link road has the potential to cause severance, noise, air quality and visual impacts. • The additional capacity provided by the link road is likely to be utilised by TCBGC traffic by 2051, minimising capacity relief of the wider highway network in later years (necessitating investment in alternatives such as RTS and active travel).
Mode Share	• Mode share aspirations for TCBGC are radically different to existing local travel patterns and place significant focus on sustainable movements. • A forward-focused 'vision led' approach is being advocated above the more reflective 'predict and provide'. • The high quality of the infrastructure and services enabled and delivered by TCBGC have the potential to influence mode share more widely (eg in existing communities) by making sustainable travel more attractive on and off site.	• There is a risk that minimal intervention in terms of sustainable transport infrastructure and rapid transit service provision could undermine the strategy and mean the targets are undeliverable. • The mode share targets are constrained by many unknowns at this stage but are an opportunity to be harnessed.

Movements	• The predominant future movement from the area around TCBGC is to Colchester town centre, with other local key movements being to the university, Wivenhoe and Tendring district with longer distance movements to Chelmsford, Clacton, and London also evident. • There is potential for many of these trips to be made by sustainable modes. • There is an opportunity to maximise on-site sustainable trips through the delivery of 15-minute neighbourhoods.	• The lack of existing high-quality walk, cycle and public transport links mean that the majority of trips will be made by private car unless there is significant investment in non-car modes.
Changing Lifestyles	• Covid-19 caused many people to re-think how they travel, how often and to where. This is particularly marked for commuting trips with DfT's attitude surveys and mode share data and 2021 Census data suggesting people have reduced the amount they travel to work and this trend is likely to continue post-pandemic. • Home working is likely to lead to a rise in more local movements as people stay closer to home which offers a greater opportunity for fostering sustainable movements for short journeys. • Fast broadband and reliable home internet are making many services possible online, such as digital banking, shopping and online learning, reducing the need to travel at all. • Freight management can manage trips made by delivery vehicles, which are increased with on-line shopping	• Public confidence in using shared forms of transport is recovering slower than private modes such as the car.

3 Evidence base review

3.1 Case study development

The Evidence Review commenced with revisiting the Transport and Movement Framework to extract case study examples of places that have achieved 'low car' mode shares and catalogue the measures they implemented to achieve them. All case studies were input into a framework (summary available on request), which recorded:

- Place/location.
- Percentage mode share across public transport, active travel and car use.
- Whether the mode share was for all journey purposes, journeys during set time periods, such as peak hours, or commuting journeys only (to ensure the mode share being considered was being applied consistently).
- Source of case study.
- Date of publication and data capture.
- A score of 1-3 for the reliability of source, determined by ITP.

The framework also recorded other key information about the case study locations, such as their population size, urban density and population age. Recording this additional information informs comparisons with the TCBGC development.

A gap-fill exercise was undertaken on the earlier evidence bases for the Mode Share Strategy and Transport and Movement Framework, to identify information that was outdated or unavailable and source replacements. This helped us to ensure the recording of new information published about these places since earlier work was captured and to ensure that the previously recorded information remained accurate.

The evidence base was supplemented by a comprehensive literature review activity which identified additional case studies from a range of countries and contexts across the UK and Europe which could be relevant to the development of mode share targets for TCBGC.

Measures that contributed to achieving a low car mode share in these places were listed and sorted into five categories, with different places typically having achieved their low car mode share by investment more substantially in one or more of these categories. The categories identified were:

- Public transport measures
- Active travel measures
- Traffic management measures
- Land use and internalisation
- Travel planning

Table 3-1 sets out the most commonly occurring interventions identified.

Table 3-1: Evidence review theme intervention break down

Theme	Intervention Type
Public transport	• High frequency services • Late running or 24hr services • Metro/light rail • Rapid transit services • Bus priority • Ticketing (including smart ticketing, e-ticketing, multi-use passes multi-modal and multi-operator ticketing • Transport hubs • Dense PT network • Park and Ride • Low cost/affordable travel • Wi-Fi on board • Alternative fuel PT vehicles • Bikes on public transport
Active travel	• Extensive network of high-quality cycle routes • Bike share (and e-Bike share) schemes • Bike parking • Bike priority • E-scooters • Flat terrain (natural enabler)
Traffic management	• Car share/Car Clubs • Filtered permeability / general traffic access restrictions • Road space reallocation • Electric moped share • Low emission zones • Speed restrictions (20mph) • Car free zones • Traffic calming • Parking restrictions • Workplace Parking Levy

Land use and internalisation	• Urban green • Higher density development • Mixed uses • Transport hubs
Travel Planning	• Behaviour change campaigns (including personalized travel planning (PTP), app based journey planners, campaigns targeting hard to reach groups and specific audiences, incentivised behaviour change)

Many of the locations reviewed implemented multiple measures and systems across these themes to achieve more sustainable mode shares. Although some of these interventions may not be feasible or appropriate for TCBGC (such as a metro system), the identification of these measures provides important context and a means of comparison. Although there are many variables to consider, examining the mode share differences between places with a metro system, and those places without them, allows us to determine roughly how critical this type of service is to achieve a high mode share to better understand the likelihood of TCBGC achieving their target mode share with measures that are considered feasible.

Furthermore, the analysis identified the most commonly occurring interventions across all locations. These can be assumed to be contributors to achieving a high mode share. Some of the most commonly occurring measures, such as an extensive network of high-quality cycle routes and rapid transit to key destinations are anticipated to be taken forward and help TCBGC achieve a high sustainable mode share.

During subsequent stages of work, this evidence base will inform outputs from the Mode Share Model, and guide the assessment of TCBGC communities' performance against each mode share metric.

3.2 Garden Community benchmarking

A benchmarking activity of target mode shares at other Garden communities was also completed. As set out in Table 3-2, most garden communities are aiming to deliver between 50-60% sustainable trips, with most aiming to deliver this by 2050. The exception is Ebbsfleet Garden Village, which has more ambitious mode share targets, broken down by mode and distance. Ebbsfleet seeks to achieve 85% sustainable travel for short distance trips and 65% for longer trips.

The TCBGC Movement and Access Study targets are more closely aligned to the Ebbsfleet Garden Community targets, with a target of 81% sustainable for internal trips and 62% for hinterland trips. These mode share aspirations are ambitious and seek a much greater level of sustainability than some of the other Garden Communities. For comparison, Ebbsfleet Garden Village is approximately double the size of TCBGC, with an estimated 14,000 homes to be built. Ebbsfleet also sits within the orbit of greater London and benefits from rail connections to central London, which is expected to be a key trip destination. With trips to central London less likely to be made by car, Ebbsfleet may lean on this infrastructure to help them achieve these ambitious mode share targets. TCBGC will likely be more reliant on new infrastructure if it is to achieve the same level of ambition.

Table 3-2: Garden Community mode share target benchmarking

Name	Target sustainable mode share
Aylesbury Garden Town	50%
Ebbsfleet Garden City	Short distance local trips (under 4 miles): • 55% active modes • 30% public transport • 15% private car Longer distance trips (over 4 miles): • 25% active modes • 40% public transport • 35% private car
Harlow and Gilston Garden Community	Within the new Garden Communities: • 60% sustainable Of all journeys across Harlow: • 50% sustainable
Hemel Garden Communities	Originating from and/or ending within Hemel Hempstead: • 40% sustainable Trips originating from and/or ending within the North and East Hemel Hempstead Growth Areas: • 60% sustainable

3.3 Drivers of change

The key drivers for change, as set out in Appendix A, are a list of current and emerging trends in population behaviour that are likely to influence future travel demand; disrupting established and habitual patterns in the delivery of transport and urban planning. Evidence-based assumptions about how communities will

live and travel in the near and not-so-distant future will guide decision-makers towards ambitious and flexible masterplanning that will capitalise on the trends identified, whilst complementing and facilitating the realisation of local, regional and national policy and strategy.

We have not sought to place significant emphasis on the potential key drivers for change in the successful delivery of the TCBGC. The influence they could have may therefore be considered likely to improve the mode share targets developed.

A review of key documents and wider literature has taken place to identify the key drivers for change that are most relevant to TCBGC. A description of each theme and the possible implications for TGBGC, as a result of each trend continuing to gain traction, are discussed in the following sections of this note.

4 Mode share and carbon forecasting

4.1 Travel mode share

This chapter and the following chapters set out what mode shares are realistically likely to be achieved through the illustrative masterplan and infrastructure proposed to accompany TCBGC – thereby reflecting a refined set of mode share targets to inform the DPD.

To understand the potential for TCBGC to achieve high levels of active and sustainable mode share as a result of new sustainable transport infrastructure, a bespoke 'Mode Shift Model' (MSM) has been developed. The MSM is a spreadsheet tool that allows the potential impact of proposed infrastructure interventions to be identified. Based on the case study evidence and assumptions regarding theories discussed earlier in this report, the MSM provides outputs at a high level about the likely impacts of introducing different interventions and infrastructure at different points in time and across different geographies. The outputted 'ambitious' trip rates from the MSM take into account the high quality sustainable transport infrastructure and compare that to 'Business as Usual' (BAU) trip rates, derived from the TRICS trip rate database. This approach informs the transport modelling undertaken by ECC to assess the impact the garden community, which is described in Part 2.

Mode shares have been developed across different trip lengths – aligning with the format of the initial Movement and Access Study targets for ease of comparison – as well as different geographic areas, as below:

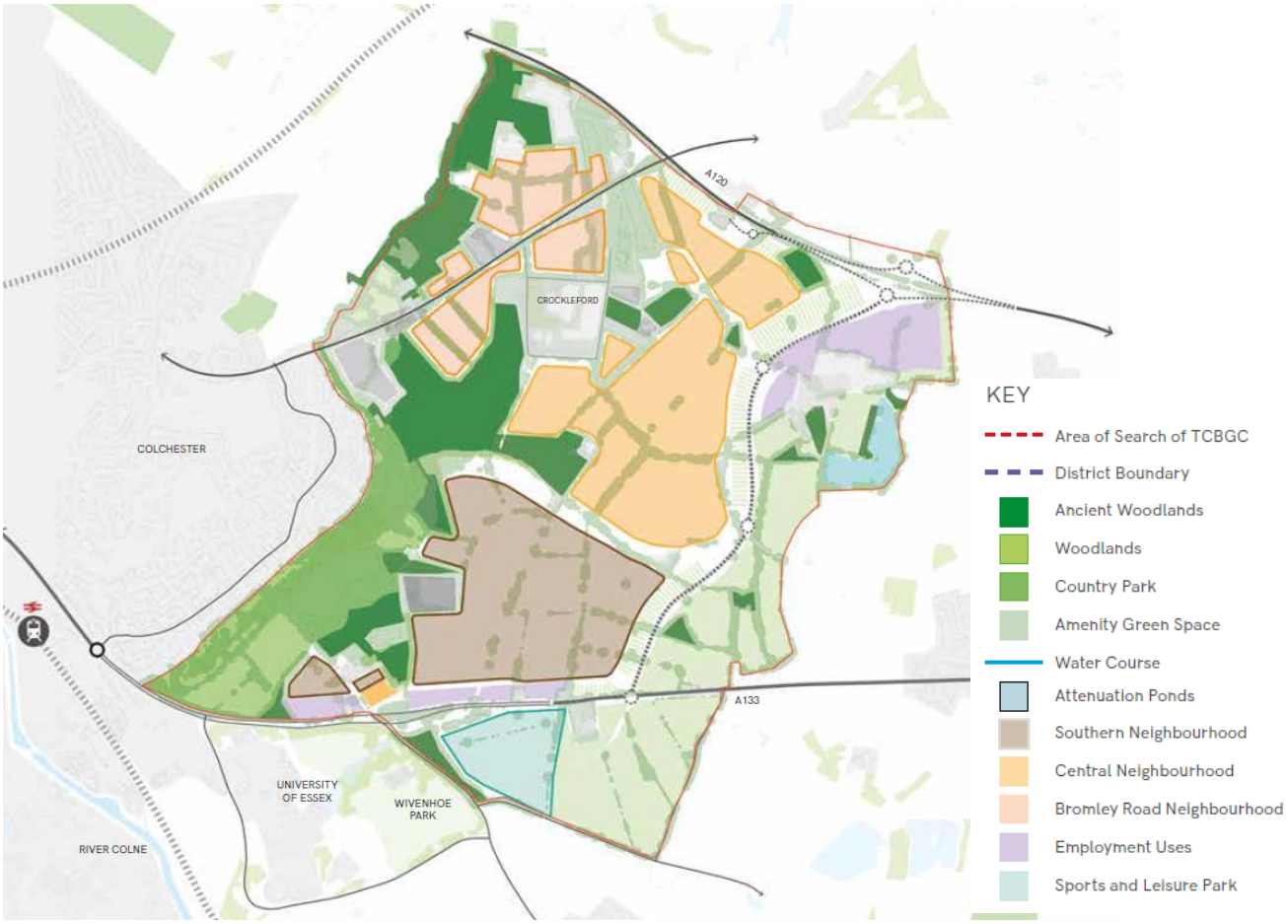
- Trip length: The mode share targets set out in the Movement and Access Study were comprised of internal trips and hinterland trips (up to five miles in length). The refined mode share targets are therefore made up of these two components plus the residual trips (those over five miles).
- Geographic area**:** the TCBGC site has been split into three neighbourhoods – southern, central* and Bromley Road (northern) – reflecting the on-going masterplanning and phasing work and that each of the neighbourhoods will have a different character, as well as different transport interventions.

The process has been used to understand likely mode share targets (for each trip length) in 2033, 2041 and 2051. The methodology is the same for each, but the 2033 and 2041 mode shares have been established based on the phasing

*Central neighborhood as referred to in this report is now known as Northern. Northern neighborhood as referred to in this document is now known as Crockleford Neighbourhood, as in the DPD.

of infrastructure delivery, with Phase 1 being complete by 2033 and Phase 2 by 2041.

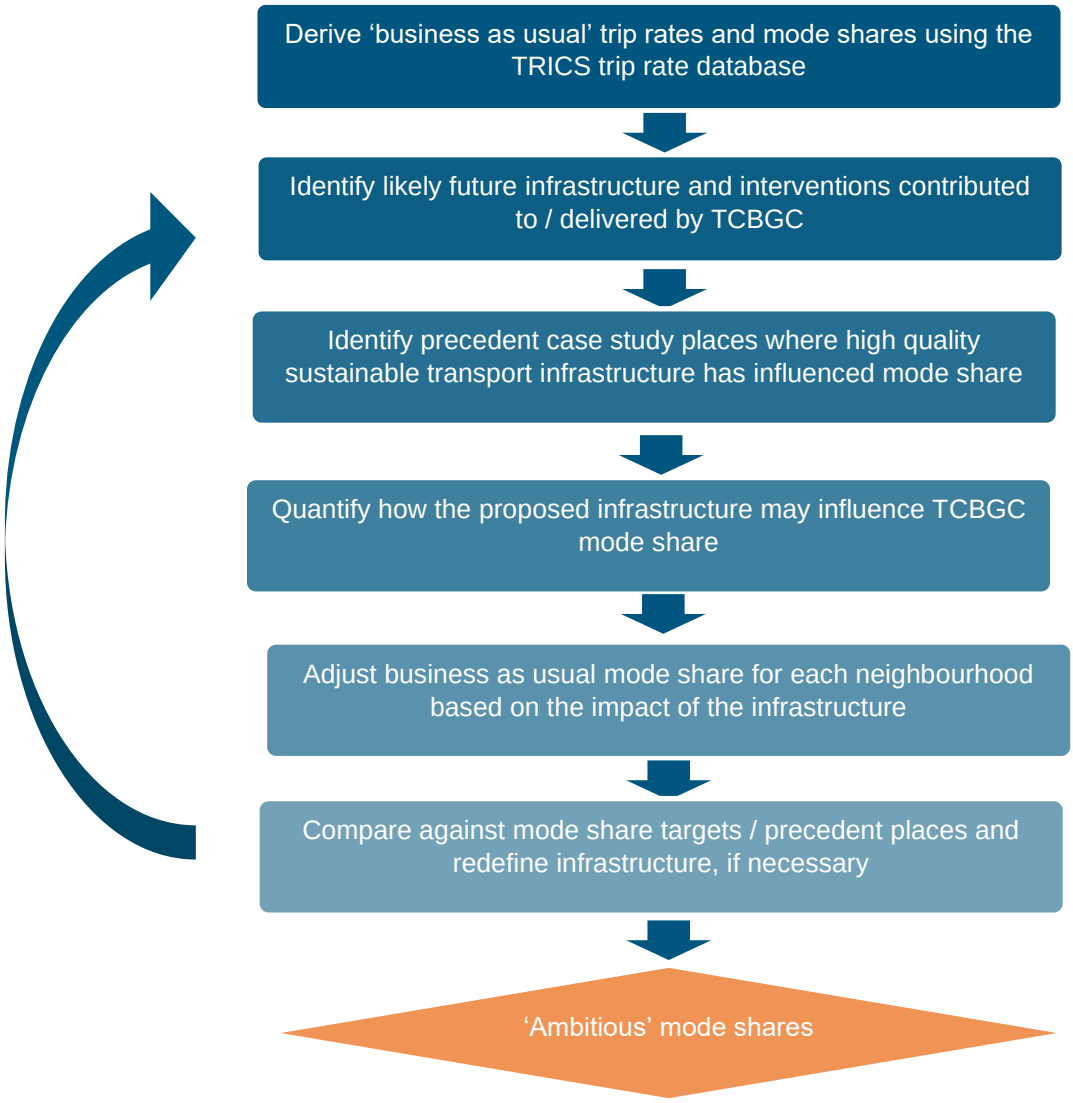
Figure 4-1: TCBGC neighbourhoods



The MSM approach is illustrated in Figure 4-2 overleaf. More detail on the process is set out in Appendix B, with this Chapter providing a non-technical summary. The mode share outputs are discussed in Chapter 5.

It should be noted that the primary focus of this has been on residential land uses and the trips generated by them, given they represent the most significant land use at TCBGC.

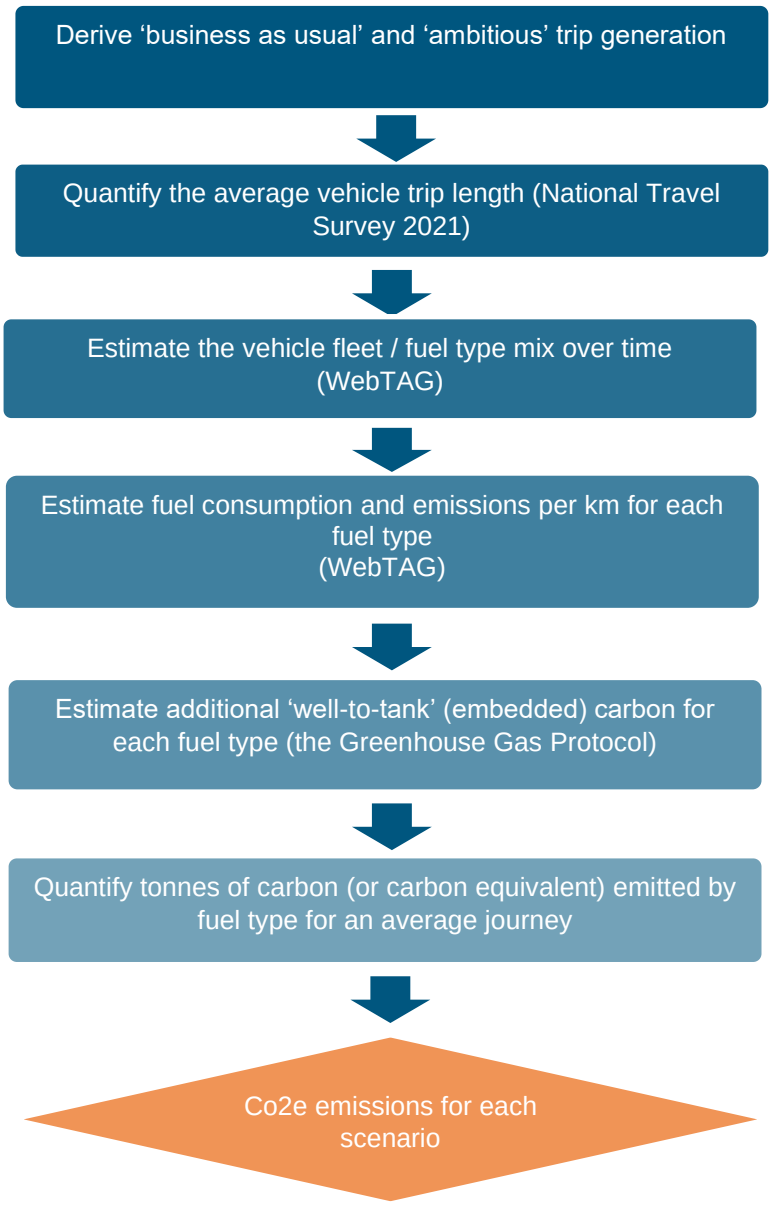
Figure 4-2: Mode Shift Model approach



4.2 Carbon modelling

The MSM approach outlined above provides an estimation of the number of vehicles generated by each neighbourhood across different trip lengths and different phases of the development. As a result, the transport emissions of vehicles associated with TBCGC can be estimated using a carbon and carbon equivalent emissions model. As with the MSM, the process for estimating carbon equivalent (Co2e) emissions from development-generated vehicles is summarised at a high level in Figure 4-3, with the detailed calculations shown in **Appendix B** and the results discussed in Chapter 5 of this report.

Figure 4-3: Carbon modelling approach



For reference, based on the DfT TAG databook, Table 4-1 summarises the fleet mixes expected up to 2051. It is noted that the TAG values could be considered pessimistic, with a relatively high proportion of petrol and diesel vehicle making up the fleet in 2050, even after a ban on internal combustion engine sales in 2030. The resultant carbon emissions presented in Chapter 5 are therefore considered to be robust, particularly in the context of the theories and trajectories of change presented in Chapter 3.

Table 4-1: Fleet mix up to 2051

Fuel type	***Year***			
	2022	**2033**	**2041**	**2051**
Diesel	43%	16%	9%	8%
Petrol	52%	37%	28%	24%
*Electric**	5%	47%	63%	67%

**Electric vehicles comprise fully electric batteries only. TAG aggregates hybrid vehicles into petrol and diesel fuel types.*

5 Targets and phasing

5.1 Defining 'Active and Sustainable' travel modes

Active modes are considered to be **walking** and **cycling**, which is consistent with the Garden City Principles. Active travel may also include **micro-mobility** options in the TCBGC context (eg rollerblades, skateboards, tricycles and scooters, as well as wheelchairs and adapted cycles). These modes are prioritised through the illustrative masterplan.

These modes are at the top of the TCBGC transport hierarchy, as set out in the illustrative masterplan evidence base.

The proposed rapid transport system (RTS) and public transport are considered to be any **local bus rapid transit** and **demand-responsive bus** services. The illustrative masterplan prioritises these modes, along with active travel, above private car use with routes directly penetrating the heart of the Garden Community.

Other modes, are not included in the definitions of active and sustainable transport for the purposes of trips leaving the Garden Community include:

- **Private car trips**, **whether propelled by internal combustion engine, electric motor, or other forms of technology (e.g. Hydrogen).** This reflects that, even if private car travel can be decarbonised in respect of exhaust emissions, there are wider energy generation, community severance, public health and safety, place-making, and other external social cost considerations that need to be included in any appraisal of the benefits of private car use.
- **Car-Share, Car Pool/Car Club, and taxi trips** can certainly be considered more sustainable than single occupancy private car use in some circumstances (e.g. where they reduce vehicle ownership in households), but are difficult to measure and monitor and ultimately less sustainable than equivalent walk/cycle/local public transport journeys in the context of the TCBGC vision and sustainable transport objectives.
- **Rail** travel is undoubtedly more 'sustainable' however, these trips can only be considered sustainable if the connecting trip is via RTS or active modes. In which case, the trip is considered to be a 'RTS and public transport' or 'active modes' trip.

5.1.1 What constitutes a trip?

The primary focus of the TCBGC mode share targets is upon person trips. They are expected to reflect the bulk of trips generated by the TCBGC, as well as the majority of transport related carbon emissions generated from travel demand arising from the development. Transport produced 24% of the UK's total emissions in 2020, and remains the largest emitting sector in the UK. In 2020, cars made up 76% of the road vehicle miles travelled within the UK, and produced 52% of transport emissions.

5.2 Mode share forecasts

5.2.1 2033

A summary of the alternative, 'ambitious' mode share outputs from the MSM which will inform the TCBGC mode share targets is set out below. An interim forecast of TCBGC's mode share outcome in 2033 has been produced to help track progress towards the 2051 targets. Successfully achieving these outcomes is based on the following assumptions:

- Funding availability will be front loaded with the most impactful priority infrastructure delivered by 2033 (see Part II of the evidence base review reporting).
- Priority infrastructure which will have the greatest impacts on travel behaviour will be delivered before future residents establish travel habits, on the basis that travel behaviour patterns are harder to change once engrained (see Part II of the evidence base review reporting).

Averages for all neighbourhoods combined are shown in Table 5-1, comparing the 'Business As Usual' mode share (derived using TRICS, as outlined in Chapter 4) with the 'ambitious' mode shares. For simplicity this is shown for the morning peak hour, with the values and scale of change being comparable in both peak hours.

Table 5-1: BAU and ambitious mode share averages for 2033 (AM peak hour)

Mode	BAU				Ambitious			
	Internal	Hinterland	Residual	Average	Internal	Hinterland	Residual	Average
Vehicles	47%	73%	90%	66%	21%	56%	88%	53%
Public transport	1%	7%	8%	5%	10%	17%	10%	11%
Active travel	52%	20%	2%	29%	69%	27%	2%	36%

'Vehicles' denotes all vehicles generated, including private vehicles, taxis and goods vehicles

Table 5-2 shows a breakdown of the 'ambitious' mode share outputs for 2033, disaggregated by each of the three notional neighbourhood areas within TCBGC.

Table 5-2: Ambitious mode share outputs by neighbourhood for 2033 (AM peak hour)

Neighbourhood	Mode	Internal mode share	Hinterland mode share	Residual mode share
Southern	Vehicles	17%	53%	86%
	Public transport	12%	20%	12%
	Active travel	71%	27%	2%
Central	Vehicles	25%	58%	90%
	Public transport	8%	15%	8%
	Active travel	67%	27%	2%
Northern	Vehicles	47%	73%	90%
	Public transport	1%	7%	8%
	Active travel	52%	20%	2%

5.2.2 2041

Averages for all neighbourhoods combined are shown by trip length, and compared with BAU, in Table 5-3.

Table 5-3: BAU and ambitious mode share averages for 2041

Mode	BAU				Ambitious			
	Internal	Hinterland	Residual	Average	Internal	Hinterland	Residual	Average
Vehicles	47%	73%	90%	66%	16%	53%	89%	43%
Public transport	1%	7%	8%	5%	10%	18%	9%	15%
Active travel	52%	20%	2%	29%	74%	29%	2%	42%

Table 5-4 shows a breakdown of the mode share outputs for 2041, per mode, for different trip lengths and by each neighbourhood. These are shown for the AM peak hour.

Table 5-4: Ambitious mode share outputs by neighbourhood for 2041

Neighbourhood	Mode	Internal mode share	Hinterland mode share	Residual mode share
Southern	Vehicles	7%	49%	86%
	Public transport	13%	20%	12%
	Active travel	80%	31%	2%
Central	Vehicles	11%	48%	90%
	Public transport	13%	22%	8%
	Active travel	76%	30%	2%
Northern	Vehicles	29%	63%	90%
	Public transport	5%	11%	8%
	Active travel	66%	26%	2%

5.2.3 2051

Averages for all neighbourhoods combined are shown by trip length, and compared with BAU, in Table 5-5.

Table 5-5: BAU and ambitious mode share averages for 2051

Mode	BAU				Ambitious			
	Internal	Hinterland	Residual	Average	Internal	Hinterland	Residual	Average
Vehicles	47%	73%	90%	66%	9%	48%	86%	38%
Public transport	1%	7%	8%	5%	13%	20%	12%	17%
Active travel	52%	20%	2%	29%	78%	32%	2%	45%

Table 5-6 shows a breakdown of the mode share outputs for 2051, per mode, for different trip lengths and by each neighbourhood. These are shown for the AM peak hour.

Table 5-6: Ambitious mode share outputs by neighbourhood for 2051

Neighbourhood	Mode	Internal mode share	Hinterland mode share	Residual mode share
South	Vehicles	7%	43%	83%
	Public transport	13%	22%	15%
	Active travel	80%	35%	2%
Central	Vehicles	7%	43%	88%
	Public transport	13%	22%	10%
	Active travel	80%	35%	2%
North	Vehicles	12%	58%	88%
	Public transport	13%	15%	10%
	Active travel	75%	27%	2%

5.2.4 Mode share summary

As TCBGC is built out over time, more infrastructure will become available through various funding streams and delivery timescales (see Part II of the evidence base review reporting). This will increase the uptake of sustainable travel via connections to new destinations and improved connections to existing destinations. Therefore, the mode share targets for 2051 are more ambitious than the 2041 and 2033 targets, with 2033 already proposing significant progress towards sustainability from the BAU scenario.

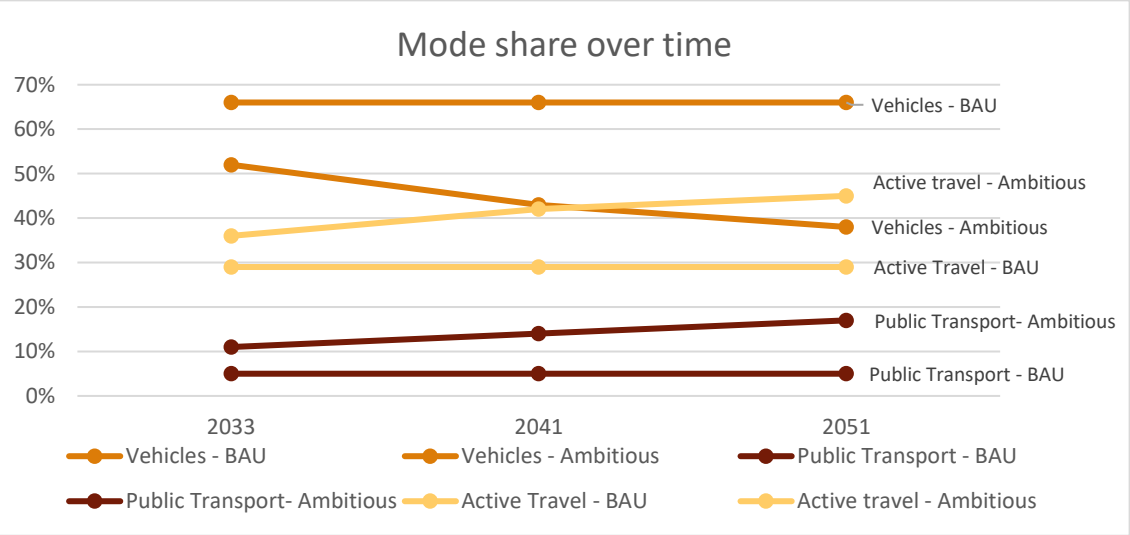
A summary of the mode share targets by year is set out in Table 5-7: Mode share targets by year

Table 5-7: Mode share targets by year

	2033	2041	2051
Active Travel	36%	42%	45%
Public Transport	11%	15%	17%
Vehicles	53%	43%	38%

Figure 5-1 shows a comparison of ambitious mode share averages and business as usual over the life of the development.

Figure 5-1:Ambitious mode share targets and business over life of development



The site is expected to be fully built out by 2051 and, therefore, the 2051 targets represent the final mode share targets for the site considered as part of this project. The outputs for 2033 and 2041 can be seen as interim targets to monitor progress towards the 2051 targets.

Across all years, internal trips have the highest proportions of sustainable travel (active travel and public transport). This is due to internal trips being shorter and the early development of on-site high-quality infrastructure and site layout, which makes cycling attractive and convenient and the site wide connectivity to an RTS service (see the illustrative masterplan and supporting evidence base).

Hinterland trips tend to achieve higher levels of public transport usage than internal trips, but lower levels of cycling and walking and lower levels of

sustainable transport overall. This is influenced by how well connected TCBGC is to RTS and the attractiveness of walking and cycling for longer trips (up to 5 miles) (see Part II of the evidence base review for detail on the proposed off-site infrastructure, including phasing).

Residual trips achieve the lowest sustainable travel percentages across all years. This is influenced by a number of factors, including service provision beyond five miles of the TCBGC site boundary and the attractiveness of cycling and walking for longer distances.

Some of the wider benefits that TCBGC may have on mode share, such as the impacts of the park and choose facility on the way people travel after its delivery, have not been explored in this study and will contribute to modal shift within the existing community.

5.3 Carbon forecasts

5.3.1 Model outputs

The mode shares presented above result in different volumes of vehicle trip generation for each neighbourhood, trip length and year. As outlined in Chapter 4, Co2e emissions for TCBGC trips have been estimated based on standardised values for fuel consumption, journey lengths and projected fleet mixes. Co2e refers to carbon dioxide equivalent, meaning the equivalent global warming impact of various greenhouse gases to a unit of carbon. The resulting projected emissions from the BAU and mode shift scenarios are summarised in Table 5-8 and Table 5-9, respectively. These are shown as averages across all neighbourhoods and trip lengths, and the 2051 year is shown.

Table 5-8: BAU scenario carbon emissions by year

Year	Vehicles generated		Co2e emissions - Tonnes			
	AM peak	PM peak	AM peak	PM peak	Daily	Annual
2033	800	747	0.94	0.88	9.12	2,289
2041	1,585	1,486	1.28	1.20	12.37	3,104
2051	3,038	2,860	2.12	2.30	22.14	5,556

Table 5-9: Target mode share carbon emissions by year

Year	Vehicles generated		Co2e emissions - Tonnes			
	AM peak	PM peak	AM peak	PM peak	Daily	Annual
2033	618	583	0.73	0.69	7.08	1,776
2041	1,119	1,064	0.90	0.86	8.79	2,206
2051	1,974	1,909	1.38	1.54	14.59	3,662

'AM Peak' and 'PM Peak' refer to peak hours

'Daily' refers to a 12hr typical weekday

'Annual' refers to an approximation of emissions over 365 days, based on the 12hr weekday values

Table 5-10 shows the savings in vehicles generated and tonnes emitted between the BAU and ambitious mode share approaches.

Table 5-10: Vehicle and carbon savings

Year	Vehicles saved		Co2e emissions - Tonnes			
	AM peak	PM peak	AM peak	PM peak	Daily	Annual
2033	-182	-165	-0.05	-0.06	-0.55	-139
2041	-467	-422	-0.38	-0.34	-3.58	-898
2051	-1,064	-951	-0.74	-0.77	-7.55	-1,894

This demonstrates that, if the sustainable transport infrastructure is delivered, the savings in Co2e generated by TBCGC vehicles compared with a BAU scenario would be in the order of 1,895 tonnes per year, a reduction of 34%.

5.3.2 Target setting

The mode share outputs from the MSM approach have been used to set the mode share targets for TCBGC. If the same approach to carbon targets is taken, i.e. adopting the outputs of the model, they would be:

- 2033 = 1,800 TCo2e annually from trips starting / ending within TCBGC
- 2041 = 2,200 TCo2e annually from trips starting / ending within TCBGC
- 2051 = 3,700 TCo2e annually from trips starting / ending within TCBGC

That said, the Co2e emission outputs demonstrate that transport will still materially contribute towards TCBGC's and Essex's carbon footprint in 2050, when the Essex Climate Commission has committed to net zero carbon. It is therefore suggested that the Co2e emission estimations do not form targets, as

they could (or should) be bettered if they are to genuinely contribute towards ECC's net zero ambitions.

This should recognise the fact that truly net zero carbon is difficult to achieve for transport emissions based on current technology; even a fully electric fleet would not be zero carbon based on current manufacturing processes. There will therefore need to be other carbon negative activities within TCBGC and more widely to achieve net development neutrality. These activities should align with the Essex Climate Action Commission's 'Making Essex Carbon Neutral' report.

This should not, however, be taken for granted; there should also be a continued drive for transport innovation and change, as outlined in the theories and trajectories of change summary. Transport technology is constantly evolving and a net zero target should be a catalyst for more efficient vehicles, faster uptake of electrification, and a more reliable and compatible charging network. This level of innovation is not necessarily captured in the DfT TAG fleet mix forecasts upon which the estimated emissions from development at TCBGC are based - in those forecasts, as much as a third of vehicles on the road in 2051 still petrol or diesel engines.

An optimistic approach, going beyond the level electrification assumed by the DfT, could set out a future where 90-100% of vehicles in 2051 are electric, with the expectation that every resident-owned vehicle in TCBGC is electric. On this basis, the carbon emissions for TCBGC would be as presented in Table 5-11.

Table 5-11: TCBGC vehicle emissions assuming 90% electrification by 2051

Year	Dwellings	% of electric vehicles	Vehicles generated		Co2e emissions - Tonnes			
			AM peak	PM peak	AM peak	PM peak	Daily	Annual
2033	1,900	50%	618	583	0.69	0.65	6.69	1,678
2041	3,900	70%	1,119	1,064	0.73	0.69	7.08	1,778
2051	7,800	90%	1,974	1,909	0.44	1.24	8.40	2,108

These estimates are based on the same vehicle trip generation resulting from the 'ambitious' mode shares, but with more optimistic assumptions on the uptake of electric vehicles. These more ambitious carbon targets could be adopted for TCBGC, i.e.:

- 2033 = 1,700 TCo2e annually from trips starting / ending within TCBGC
- 2041 = 1,800 TCo2e annually from trips starting / ending within TCBGC
- 2051 = 2,100 TCo2e annually from trips starting / ending within TCBGC

These targets are reliant on our vision-led strategy - putting the vision first and backfilling with the measures needed to get there - combined with embracing and facilitating a theory of change, both of which are needed to achieve low-carbon outcomes.

5.4 Transport improvements needed to achieve mode share

Part II of the evidence base review sets out the measures that are proposed to achieve the mode share targets.

6 Monitoring and management

This section of the report sets out the key actions to be undertaken to manage the target monitoring process and the role of travel planning.

A full monitoring and management plan can be found in Appendix C.

- **Establishing a baseline** through household travel survey data collection is critical for understanding how residents are travelling when they first move to the site. As the site is not yet built, this is currently unknown. This will help with analysing the impacts of infrastructure delivery and travel plan measures on mode share over time.
- **Travel survey distribution** A data sample of approximately 1,000 households will be required to ensure a 95% confidence level in the data collected. As response rates vary, a greater number of households will need to be contacted than the total responses needed. It is therefore recommended that all households receive the survey as part of their house purchase completion process. Participation should be incentivised.
- **Digital survey** response options should be considered to minimise administration time and postal delays in receiving completed surveys.
- **TCBGC-wide Workplace Travel Plan Network could be formed** Baseline data for incoming trips ending in TCBGC (which cannot be linked to an outgoing trip from TCBGC) should be collected through business travel survey data collected through the Workplace Travel Plan Network at such a time that this becomes available.
- **Development of a Framework Travel Plan and site wide Travel Plan** which will set out the mode share targets for each phase of development and explain how these targets will be achieved.
- **Appointment of a travel plan officer** is recommended to oversee the travel plan monitoring, which will track progress towards achieving the mode share targets.
- **Monitoring activities** to take place no less than every five years for 30 years and every ten years thereafter
- **Consideration should be given to penalties** enshrined in Section 106 agreements or planning conditions
- **Data ownership** should be confirmed prior to baselining and monitoring activities to ensure that partner authorities have access to all data, even if this is initially collected by developers or third parties.

6.1 TCBGC monitoring framework

The Monitoring Framework is an outline, which will require input the TCBGC Monitoring Working Group (thereby including the partner authorities, developers, agents etc.), but nevertheless represents a considered balance of pragmatic, feasible approaches which are still likely to capture the necessary data to monitor progress towards the TCBGC mode share.

Table 6-1: Monitoring framework

Metric	Monitoring activity	Responsibility to fund	Frequency and Duration	Sample size
Core				
Existing resident person trip numbers, purpose, origin/destination and mode share for all trip types.	Baseline Travel Survey	Local authorities / their agents using contributions from developers	Every five years until 2056.	1,000 households
'ending within TCBGC' person trip mode share	Workplace Travel Plan surveys – as part of the TCBGC Workplace Travel Plan Network	Developers / their agents	Likely to be annually in line with site-specific Travel Plan monitoring commitments	All available workplace Travel Plans as and when they are occupied
Corroborative				
Total vehicle trip generation of TCBGC	Traffic surveys / Digital monitoring/ permanent counters at TCBGC	Developers / their agents – as part of Travel Plan monitoring	In line with Travel Plan monitoring commitments	All highway accesses
Background vehicle trips in Colchester	Traffic surveys on existing network / permanent counters on	Local authorities / their agents	In line with TCBGC travel survey frequency	Key access / egress points, and potentially

	existing network (could make use of Vivacity)			'hotspots' or areas of interest
Uptake (patronage) of new public transport interventions and background public transport trips in Colchester	Public transport patronage	Local authorities / their agents	In line with TCBGC travel survey frequency	All new services, e.g. on RTS, plus regular services in Colchester.
Number of cycle trips	Permanent cycle counters on key routes, ideally which capture scooter, modified bike etc. trips	Developers or local authorities, dependent on where the counter is	In line with TCBGC travel survey frequency and Travel Plan monitoring commitments	At key locations identified during baselining,
Number of pedestrian trips	Permanent pedestrian counters on key routes (could make use of CCTV counting technology)	Developers or local authorities, dependent on where the counter is	In line with TCBGC travel survey frequency and Travel Plan monitoring commitments	At key locations identified during baselining,

7 Next Steps

This report has set out a proposed set of mode share targets for the Garden Community, based on an understanding of the existing baseline travel patterns and infrastructure, the illustrative masterplan and the proposed transport infrastructure. The work will inform the DPD, which will be consulted on.

Once the Regulation 19 consultation of the DPD is complete, there will be a need to review the evidence base, including masterplan and proposed infrastructure, to take account of the comments received. This may require tweaks to be made to the mode share targets. The DPD will then be submitted to the Secretary of State and be subject to a full Examination in Public, before being adopted subject to any amendments.

Once adopted the masterplan will be developed by the developers, who will submit planning applications to secure consent to deliver the Garden Community. The work set out in this document will assist the developer in preparing their application proposals and the Local Planning Authorities in the determination of the applications.

Appendices

Essex Highways

Appendix A:

Theories and trajectories of change

Safer, greener, healthier

a company of Royal HaskoningDHV

RINGWAY JACOBS integrated expertise

Essex County Council

Trend	Explanation	Relevance to TCBGC	Conclusions
Ageing population	• Life expectancy is increasing and birth-rate is decreasing in the UK. • People are living longer because of medical advancements and access to healthcare • Over 65s population in Essex is expected to increase from 20.8% in 2019 to 25.5% by 2035 with the over 85s proportion increasing from 2.8% to 4.7% • Life expectancy higher for those born in Essex compared to UK average	• The Essex Transport Strategy states *'Ensuring that elderly people are supported to provide them with best quality of life will raise new challenges for the ways in which services are provided'.* • Demand for housing that meets the needs of older people will increase • *As of 2015,* driving remains the most common form of transport for older people in the UK, with 68% of households where someone is aged over 70 having their own car[1] • *Older people make more trips than their younger counterparts*[2].	• Being within a short walk of a local shop, post office, Dr surgery or a bus stop which can take residents to essential services and bring them home can help older people living on TCBGC to retain their independence and remain economically and socially active, even for those with reduced mobility. • Sustainable transport options must be more convenient than the car and publication of routes and timetables must not rely exclusively on digital technologies.

[1] The Future of Transport in an Ageing Society
[2] Older people travel the most

Young people not learning to drive	• In 2021, the number of young people qualified to drive in the UK fell to the lowest level on record. 2.97 million people aged 16 to 25 in the UK held a full licence, down from 3.32 million in March 2020. The number of young people increased in the same period. • The costs of learning to drive are prohibitive for young people (17-20 yrs). More specifically, the costs of learning to drive (41%), buying a car (31%) and insuring it (30%). Fewer than one in five (19%) of respondents said they were not interested in driving[3].	• Young people in TCBGC may be more reliant on public transport, active travel and demand responsive travel services. • If sustainable transport fulfils their needs and de-incentivises driving at a later date then demand for parking will be reduced, whereas demand for convenient fast transit services to key destinations will increase.	• A reduction in vehicle ownership caused by fewer young people learning to drive may help TCBGC to achieve a high sustainable mode share. However, alternatives must meet user needs and adapt accordingly overtime to maintain this.
Health and obesity crisis	• In a 2020 NHS study[4]… • 67% of men and 60% of women were classed as overweight or obese with inactivity thought to be a significant contributor. • 60-66% of people in Essex were active, 40% of adults were inactive.	• Quality walking and cycling infrastructure that connects people with key destinations could help to tackle the obesity crisis by reducing inactivity • By making driving less convenient, residents will need to walk or cycle to their destination or bus stop, or at the very least to their car for longer trips	• Achieving a high sustainable mode share is linked to having a healthier population at TCBGC. Residents may initially need positive encouragement to start walking and cycling, possibly through a behaviour change campaign.
Home working	• The decentralisation of work is a growing trend accelerated by the covid-19 pandemic and the availability of digital innovations such as fast mobile data and Wi-Fi	• Home working can reduce volumes of traffic, particularly in the traditional AM and PM peak periods of the day	• Increased levels of home working will ultimately help TCBGC to achieve a high sustainable mode share. However, this is

[3] Number of young people with driving licence in Great Britain at lowest on record | Motoring | The Guardian
[4] https://digital.nhs.uk/data-and-information/publications/statistical/statistics-on-obesity-physical-activity-and-diet/england-2020/part-6-diet-copy#top

	• In 2020, 36% of working adults reported having worked from home at least once in the last seven days[5] • If all of the workers within their survey who are now working from home some or all of the time, who did not used to work from home all of the time, continued to do so for two days per week there would be a likely reduction in commuting trips of around 14%[6] • Since the Covid-19 pandemic, home working is widely practised in Essex, with large employers retaining this working practice through hybrid working.		largely dependent on the employers and industries of future residents and should not be relied upon as a contributor to higher sustainable mode share.
Electrification of vehicles	• Growth in the electric vehicle market will contribute towards emission reduction but will not reduce traffic volumes and car dependency. • Prohibitively high costs are expected to fall over time and battery life is expected to increase, leading to wider uptake rather than modal shift • EV's reduce the costs per mile of driving due to the high duty on petrol and diesel and low VAT on domestic energy. The additional purchase price is very quickly being offset by these 'in-use' benefits.	• The use of electric car club vehicles could help to reduce vehicle volumes and car dependency. • All TCBGC homes with associated parking spaces will need to have electric vehicle chargers due to changes in building regulations. •	• The increase in EV ownership and use will not support TCGBC's mode shift targets. However, the uptake of electric vehicles for residual trips which cannot be made by public transport, walking and cycling will help to mitigate any air quality impacts generated by the development.

[5] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/homeworkingandspendingduringthecoronaviruscovid19pandemicgreatbritain/april2020tojanuary2022

[6] https://www.creds.ac.uk/wp-content/uploads/CREDS-covid-transport-report.pdf

	• 0.5% of all vehicles licensed in the UK were ultra-low emission vehicles at the end of 2018. • To achieve the net zero target, sales of non-zero emission cars, vans and motorcycles are likely to need to end by 2035[7] the UK Government plans to ban the sale of new petrol and diesel vehicles from 2030.		
Shared mobility – Car clubs	• Car clubs replace privately-owned cars with fewer and more efficient shared vehicles, which are convenient and affordable to access 24/7. Car clubs allow their members to reserve a car in advance to ensure availability or use the service more spontaneously through an app. • Membership of car clubs in the UK grew by 24% in 2021. 20 private cars were replaced by each car club vehicle last year, and more than 116,000 private vehicles have been taken off the road by active car club members. [8] • Emissions from car club vehicles are 27% lower than the average UK car, and 12% of car club vehicles in the UK are electric, compared to only 1% of privately-owned cars.	• At present, car clubs in Essex are clustered around city centres. Wider distribution of car club vehicles around TCBGC would have great potential to reduce car dependency, congestion and emissions as well as the amount of land given over to parking through a reduction in car ownership. • Car club usage could be promoted to TCBGC residents for longer distance trips which cannot easily be made by sustainable transport.	• For shared mobility to positively influence mode share at TCGBC, new shared mobility options need to be integrated with different mobility options, allowing users to reach their destination by single mode or transfer seamlessly between modes for last mile connectivity. For example, providing shared bikes, e-scooters or car club pick up points at transport hubs such as rapid transit stops. •

[7] Net Zero - Technical Report - Climate Change Committee (theccc.org.uk)
[8] CoMoUK's Car Club Annual Report 2021

Shared mobility **E-scooters**	• The UK government is currently undertaking E-scooter trials at locations across the UK, including Basildon, Colchester and Chelmsford in Essex • E-scooters are available to anyone with a driving licence to hire on an ad-hoc basis for short trips. • In 2021, three quarters of Essex users were riding an e-scooter instead of a personal car at least a few times a month.[9] •	• E-scooters use existing infrastructure and can be rolled out quickly across an area and geofenced to prevent misuse. • E-scooters are a good alternative for those who feel less comfortable riding a bike or are unable to participate in active travel • E-scooters are electric and therefore their environmental impacts are lower than those of most private cars, they are also more space efficient due to vehicles being shared and not spending long periods of time out of use and parked. • E-scooters could help those with reduced mobility to make short local trips in and around TCBGC and contribute towards greater uptake of sustainable travel for hinterland trips.	• Shared mobility options can make journeys that would otherwise need to be made by car, possible by walking cycling or public transport and can help TCBGC achieve a higher sustainable mode share. • • Geofencing is critical in the successful roll out of shared micro-mobility to prevent vehicles from cluttering streets and becoming trip hazards for other users. This would be an important consideration for TCBGC.
Shared mobility –	• Schemes where bikes or e-bikes are available to multiple users for short term ad-hoc hire. The most common form of bike share is a self-service system where users can find bikes on street and unlock them using an app.	• There are no major bike share schemes currently running in Essex. However, access to a bike or e-bike without the responsibility for storing, repairs and risk of theft may appeal to TCBGC residents	

[9] https://www.gazette-news.co.uk/news/20273967.tier-e-scooters-million-rides-essex/

Bike share and electric bike share	• CoMo UK estimates that there are over 2.8 million bike share members in the UK, of which 1.75 million are active members, having used a bike share service in the last 12 months[10]	and encourage active and sustainable travel.	
Urbanisation	• Urbanisation refers to the population shift from rural to urban areas. This can be caused by migration towards existing larger urban settlements, or the process of making an area more urban as a result of planned development. • Excluding migration to rural areas during the Covid-19 pandemic, longer term trends show that younger populations migrate to cities and urban areas seeking better employment prospects. Rural areas are commonly and increasingly characterised by an older population. • Due to space constraints for new development in existing urban areas, rural areas are becoming more urbanised to address the national housing shortage which has resulted from population growth, with new developments often built on the periphery of urban areas.	• Whilst over 70% of Essex remains rural, the Chelmsford Local Plan requires more than 43,000 homes to be built by 2033, with further growth needed across the county. • New developments should aspire to the same low carbon objectives and ensure adequate provision of services and amenities, accessible mobility hubs, demand responsive and rapid transport services and 20-minute neighbourhoods to improve the quality of life of their residents.	• TCBGC is a garden community located on the eastern edge of Colchester and is an example of urbanisation of the rural area between Colchester and Tendring. • TCBGC should aim to meet the needs of a diverse resident population and should monitor the travel preferences of their prospective residents to ensure that the package of sustainable travel measures offered is attractive and meets user needs.

For further information on Colchester and the wider region, please see Appendix B within Part 2 of this report.

[10] https://www.como.org.uk/shared-bikes/overview-and-benefits

Essex Highways

Appendix B:

TCBGC Mode Shift and Carbon Modelling Approach

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1. Introduction

This Technical Note has been produced to outline the process of using the Mode Shift Model to derive mode share targets for Tendring Colchester Borders Garden Community, based on the phasing, extent and quality of infrastructure delivery. The approach to estimating carbon equivalent (Co2e) emissions from vehicle trips is also outlined. This Note should be read in conjunction with the main report, titled *TCBGC Evidence Base Reporting V2-0* (dated 20/01/2023).

To understand the potential for TCBGC to achieve high levels of active and sustainable mode share as a result of new sustainable transport infrastructure, a bespoke 'Mode Shift Model' (MSM) has been developed. Based on the case study evidence and assumptions theories of change discussed earlier in this report, this models **at a high level** the likely impacts of introducing different interventions and infrastructure at different points in time and across different geographies.

Mode shares have been developed across different trip lengths – aligning with the format of the initial Movement and Access Study targets for ease of comparison – as well as different geographic areas, as below:

- **Trip length**: The mode share targets set out in the Movement and Access Study were comprised of internal trips and hinterland trips (up to five miles in length). Our mode share targets are made up of these two components plus the residual trips (those over five miles).
- **Geographic area:** the TCBGC site has been split into three neighbourhoods – south, central and north – reflecting the on-going masterplanning and phasing work and that each of the neighbourhoods will have a different character, as well as different transport interventions.

These have then been combined to provide an overall average. This approach acknowledges that the potential mode share achievable will be different on different parts of the site, and for different trip lengths.

The process of defining the mode share outputs has then been undertaken in two parts:

1) Establishing baseline 'business as usual' trip rates and mode shares.
2) Applying the bespoke MSM to generate revised alternative, 'ambitious' trip rates and mode shares, which will inform the TCBGC mode share targets.

The process has been used to understand likely progress towards the mode share targets (for each trip length) in 2033, 2041 and 2051. The methodology is the same

for each, but the 2033 and 2041 mode shares have been established based on the phasing of infrastructure delivery, with Phase 1 being complete by 2033 and Phase 2 by 2041.

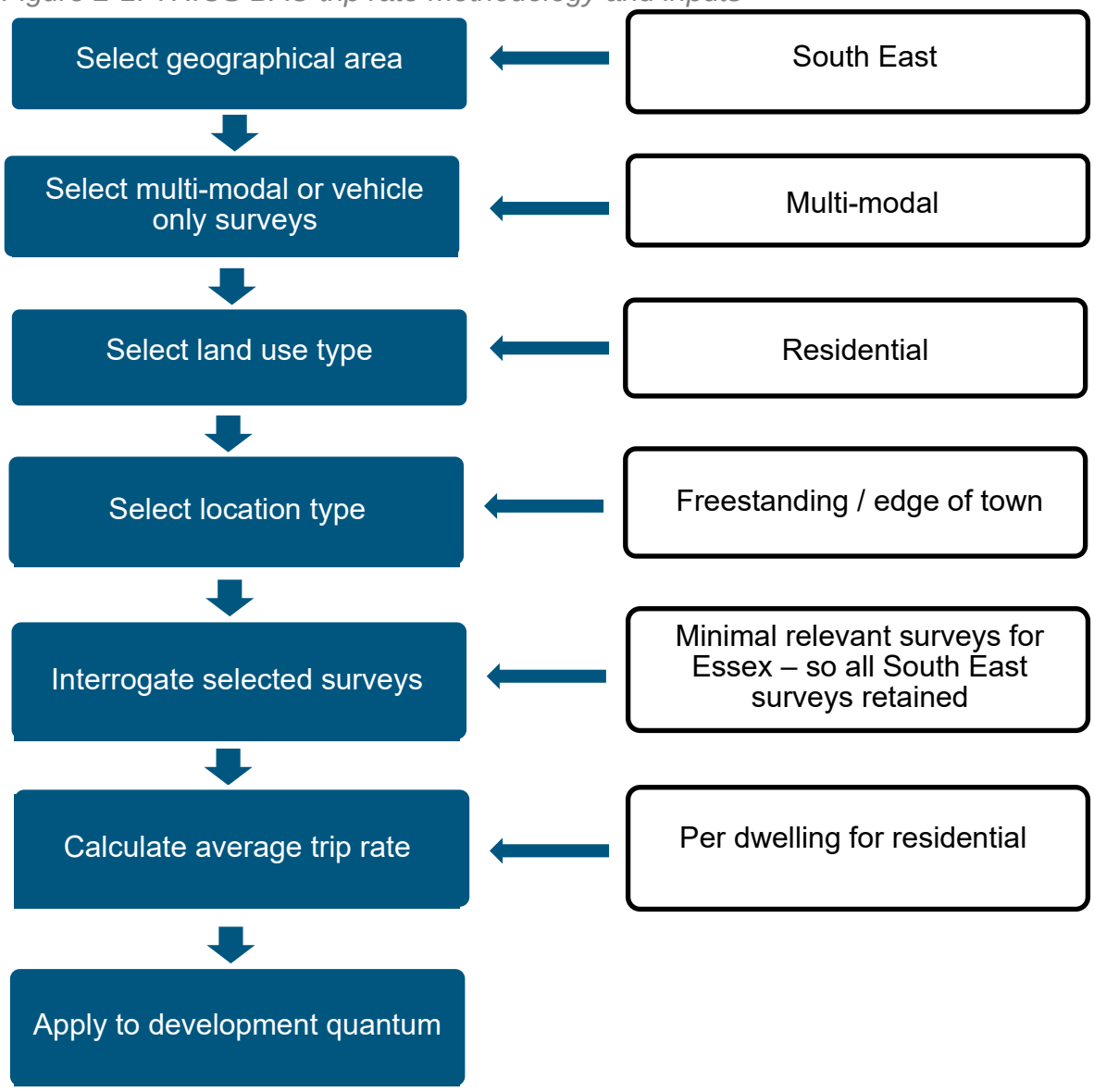
It should be noted that the primary focus of this has been on residential land uses and the trips generated by them, given they represent the most significant land use at TCBGC. There is also less certainty at present over where and what quantum of employment or other land uses will be provided (although this is being refined through the parallel masterplanning workstream).

2. TRICS 'Business as usual' trip rates and mode share

'Business as usual' (BAU) trip rates have initially been derived using the TRICS trip rate database. This is an 'industry standard' method for predicting the number of trips generated by a site, and aligns with the methodology used in the Colchester strategic highway model to derive vehicle trip rates. New trip rates have been derived from the TRICS database because the MSM uses 'multi-modal' trip rates and mode shares, rather than solely focussing on vehicle trip rates (as the strategic model does).

TRICS is based on surveys of different land uses around the UK, over a number of years, and is therefore an empirical method of predicting demand. The TRICS-based trip rate methodology and the inputs selected are summarised in Figure 2-1.

Figure 2-1: TRICS BAU trip rate methodology and inputs



Based on this, the 'BAU trip rates, providing a starting point for application to the GC neighbourhoods are shown in Figure 2-2. It indicates that, for one residential dwelling a total of 0.047 public transport users are predicted to be generated in the morning peak hour, and these could be by any public transport mode, including bus rapid transit. For 100 dwellings, 4.7 public transport users would be generated in the BAU scenario.

Figure 2-2: BAU residential trip rates and mode shares (two-way)

Land use	Area type	Mode	BAU trip rates		BAU mode share	
			AM peak	PM peak	AM peak	PM peak
Residential (per dwelling)	Freestanding and edge of town	Vehicles	0.518	0.483	73%	80%
		Public transport	0.047	0.026	7%	4%
		Active travel	0.058	0.093	20%	15%

'AM Peak' and 'PM Peak' refer to the peak hour.

It should be noted that the 'vehicle' trip rate shown in Figure 2-2 is not directly comparable with, for example, the car driver mode share provided by Census data. The vehicle trip rate is used to calculate the number of discrete vehicle trips generated by the site. This does not mean that out of all people entering or exiting the site, 73% of them would be driving a car; it means that out of all vehicle, public transport or active travel trips, 73% are vehicles. There will be a proportion of people who are passengers in vehicles and some other vehicle types such as taxis are included at a much lower volume. A 'vehicle' trip rate is also necessary for modelling purposes rather than a 'car driver' trip rate, and relates directly to the Movement and Access Study targets.

The reason that TRICS trip rates have been chosen as a basis for calculating mode share and trip generation of the neighbourhoods is that they give a reasonable representation of total trips throughout the day and / or during a specific time period. Data from the Census, for example, is a useful proxy where other data is not available, but it only accounts for commuting trips. Whilst these make up a large proportion of peak hour trips, they account for only around 15% of total trips and do not include trips relating to education, shopping, leisure, inbound commuting and delivery/servicing purposes.

However, TRICS data also comes with limitations. Whilst the TRICS trip rates allow for some consideration of the accessibility of a site, in terms of its geographical location and proximity to urban centres, there is little room to take into account other nuances. This is driven by the fact that TRICS is empirically based and cannot be tailored to reflect the characteristics of the specific site in question. The existing and potential connectivity of TCBGC, as outlined in previous and subsequent chapters, cannot be captured through this conventional approach.

As a result of this, and on a more fundamental level, use of TRICS trip rates is likely to only perpetuate trip generation and mode share characteristics that have come before. Applying the TRICS data to TCBGC would result in predictions of vehicle generation and car driver mode share very similar to the national average, because TRICS does not have any surveys of recent sites which have adopted a vision-led approach. This is precisely the reason that the MSM has been developed - to understand the implications of improvements to connectivity at a local level.

3. Applying TRICS BAU trip rates to different trip lengths

TRICS trip rates and mode share are relevant to trips external to a site and across all trip lengths. It has therefore been necessary to derive different trip rates to account for internal trips (as mode share targets are defined in the Movement and Access Study for internal trips), and to alter the TRICS trip rates to account for the realistic mode share of residual trips, given that these will very likely be more vehicle-based than the average TRICS trip rates.

The proportion of trips generated by TCBGC for each trip length are informed by the Colchester strategic model outputs, with the proportions relevant to each neighbourhood taken from the model zone most closely matching its geography. Some of the proportions for some of the zones in the model (particularly of internal trips) seemed unrealistic, potentially as a result of the ongoing masterplanning workstream having evolved since the model was built. For example, model zones representing the neighbourhoods around Bromley Road and the employment area had negligible proportions of internal trips. This is not considered realistic given the range of land uses now proposed, so these proportions were amended. The resulting trip distance proportions (translated into neighbourhood areas) are shown in Figure 3-1.

Figure 3-1: Trip distance proportions

Neighbourhood	Proportions of all Garden Community trips that are:					
	Internal trips		Hinterland trips		Residual trips	
	Strategic model proportion	Amended assumption	Strategic model proportion	Amended assumption	Strategic model proportion	Amended assumption
South (model zone 20)	40%	**40%**	55%	**55%**	5%	**5%**
Central (model zone 22)	0.07%	**35%**	91%	**56%**	9%	**9%**
North (model zone 25)	0.076%	**25%**	92%	**67%**	8%	**8%**

1.1 Internal trips

Internal trip rates were derived for cars in the Colchester strategic model, and these have been used as basis for defining multi-modal trip rates for TCBGC. These are shown in Figure 3-2.

Figure 3-2: Colchester Strategic Model car trip rates

Mode	AM Peak Hour			PM Peak Hour		
	Arrivals	Departures	Two-way	Arrivals	Departures	Two-way
Vehicles	0.029	0.071	0.100	0.076	0.040	0.116

As no trip rates were defined for active travel or public transport users, the mode shares for each mode needed to be defined to reverse-calculate trip rates for these. To define internal mode shares, the TRICS Cambourne Village Survey report was reviewed, as this is one of few studies that measures internal trips and mode shares within a large-scale development. Cambourne Village is acknowledged as a relatively car-dominated new development (compared to aspirations for TCBGC), and therefore it was deemed appropriate to use to represent a BAU set of mode shares for internal trips.

Cambourne contains a range of land uses internally, including a large food retail store, a pet store, gym, non-food retail, library, health centre, community centre and church. The mode shares from each individual land use are shown in Figure 3-3 and the average of internal trip mode shares from surveys across all these land uses (i.e. the mode share of trips made from within Cambourne to / from them) is summarised in Figure 3-4. These apply to all time periods.

Figure 3-3: Cambourne Village internal trip mode shares by land use

Mode	Land use						
	Morrisons	Just for Pets	Gym	Poundworld	Library and health centre	Community centre	Church
Vehicle	58%	65%	63%	58%	18%	31%	34%
Cyclist	2%	1%	9%	0%	16%	2%	8%
Pedestrian	36%	34%	27%	42%	64%	65%	57%
Public transport	1%	0%	0%	0%	0%	2%	1%

Figure 3-4: Cambourne Village internal trip average mode share

Mode	Average mode share
Vehicle	47%
Cyclist	5%
Pedestrian	46%
Public transport	1%

Whilst not all of these will necessarily be provided at TCBGC, they provide an average across a range of land uses and therefore a robust base in the absence of a defined land use composition at TBCGC. They also represent some land uses which typically generate high volumes of vehicle trips such as 'big box' retail and food superstores. These are not proposed for TCBGC and the more community focussed land uses such as library and community centre generate significantly fewer vehicle trips.

Comparing these mode shares with those derived for external trips from TRICS in Figure 2-2 shows that internal trips would be expected to be less vehicle dominated and more focussed on walking trips. This is as expected, but in the case of TCBGC it is anticipated that significantly more trips are made by walking and cycling internally.

Assuming that the internal car trip rates shown in Figure 3-2 represent 47% of all internal trips, the trip rates for active travel and public transport users were reverse calculated based on the Cambourne Village shares for those modes. This provides the overall BAU internal trip rates and mode shares shown in Figure 3-5.

Figure 3-5: TCBGC internal trip rates and mode shares (two-way)

Mode	BAU trip rates		BAU mode share	
	AM peak hour	PM peak hour	AM peak hour	PM peak hour
Vehicles	0.100	0.116	47%	47%
Public transport	0.002	0.001	1%	1%
Active travel	0.111	0.129	52%	52%

1.2 Residual trips

As previously noted, TRICS trip rates apply to all external trips of all lengths. These are therefore effectively an average, and will not necessarily be accurate when splitting trips into different trip lengths. A mode share of 70-80% vehicles and 15-20% active travel is deemed realistic for hinterland trips of up to five miles, but it is unlikely that 20% of trips over five miles would be made by active modes. Therefore alternative mode shares were defined for residual trips, and trip rates were reverse calculated from these.

The assumptions around proportions of vehicle, public transport and active travel trips were based on judgement and a variety of data sources, but namely the National Travel Survey which indicates that 99.6% of all walking trips are less than five miles. On this basis very few trips from TCBGC over five miles in length are likely to be walking, and similarly relatively few by cycling (both in a BAU and an ambitious alternative scenario). The assumptions on mode share for residual trips and the resultant BAU trip rates are shown in Figure 3-6 (same assumptions made for all time periods).

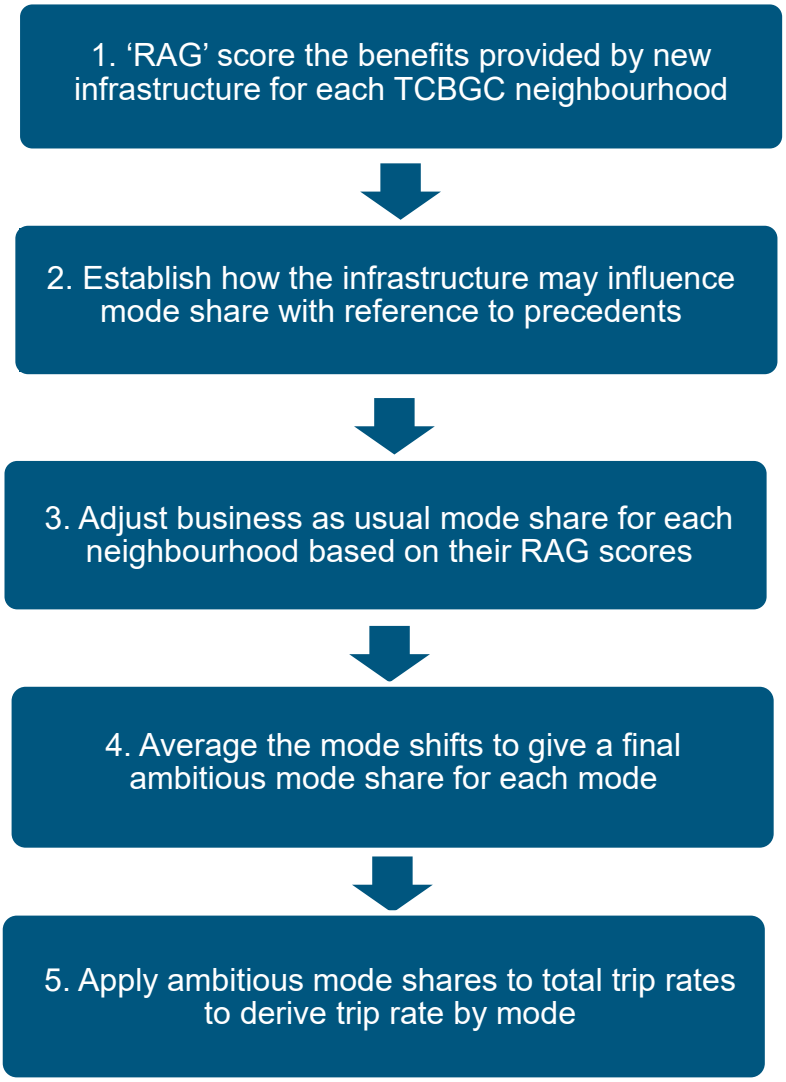
Figure 3-6: Residual mode shares and trip rates

Mode	BAU mode share		BAU trip rates	
	AM peak hour	PM peak hour	AM peak hour	PM peak hour
Vehicles	90%	90%	0.637	0.542
Public transport	8%	8%	0.057	0.048
Active travel	2%	2%	0.014	0.012

4. Developing the 'ambitious' TCBGC trip rates and mode shares

Alternative, 'ambitious' mode shares have been derived, using the BAU mode share as a basis. These inform the potential final mode shares achieved by TCBGC in 2033, 2041 and 2051 as a result of the vision-led approach and introduction of sustainable transport-focussed interventions and infrastructure. The overarching methodology adopted in the MSM to define alternative mode shares and trip rates is summarised in Figure 4-1.

Figure 4-1: Ambitious trip rate methodology



1.2.1 Stage 1: RAG score benefits provided by new infrastructure for each neighbourhood

Based on the proposed on- and off-site infrastructure, each neighbourhood has been assessed using a Red/Amber/Green (RAG) scoring framework against the infrastructure themes detailed in Chapter 4 of the main report. For ease of reference, these are replicated below:

1) Public transport
2) Active travel
3) Traffic management
4) Land use and internalisation
5) Behaviour change

Recognising that mode share will not only be different for each neighbourhood but also for different trip lengths, the exercise above has been completed for each neighbourhood and for each trip length (i.e. internal, hinterland and residual).

The RAG metrics were applied based on the judgement of the team, liaising with Jacobs on the infrastructure likely to be coming forward, and with the ITP and P+P masterplanning team with regard to the likely internal facilities and infrastructure. The detail of the RAG scoring is included at the end of this Technical Note.

1.2.2 Stage 2: influence of infrastructure on mode share with reference to precedents

The potential mode shift achievable across the communities as a result of infrastructure is calculated in the MSM by drawing on the evidence base review outlined in Chapter 4 of the main report. For each theme, places where high levels of mode share are achieved for that theme were identified. For example, places that achieved high walking and cycling mode share were identified under the active travel theme. So far as possible, places where bore minimal contextual reference to Colchester and TCBGC were not included – for example it was considered very unlikely that TCBGC could achieve similar levels of cycling to Amsterdam or Copenhagen, so these are not included under the active travel theme. The extent to which the selected places achieved modal shift from the BAU scenario is quantified and applied in Stage 3.

1.2.3 Stage 3: Adjust TRICS mode share for each neighbourhood based on their RAG scores

Dependent on the RAG rating applied to each neighbourhood and trip length for each metric, a mode shift adjustment is made to the TRICS mode share by the MSM. For example, if a neighbourhood achieved a green rating for cycle connectivity based on our understanding of on- and off-site cycle provision, the cycling mode shift would increase, reflecting more closely the locations identified in the evidence base review where high cycle mode share was achieved (as above in Stage 2). If it was assigned an amber rating, the cycling mode share would increase, but to a lesser extent. No changes were made for metrics where the neighbourhood achieved a red rating. This means that no mode shifts are proposed for the neighbourhoods performing worst against the connectivity metrics, and hence the BAU mode share would be perpetuated.

1.2.4 Stage 4: average the mode shift

Once the shifts referred to above are made, the MSM produces an average of all of the mode shifts, which is then pro-rated to give a summed figure back up to 100%.

This process was repeated for each theme and for each neighbourhood and trip length. An example of the process of the MSM is shown in Figure 4-2. This shows the morning peak hour in 2051, for the northern TCBGC neighbourhood hinterland trips.

Figure 4-2: Northern neighbourhood RAG and mode shifts in 2051 (AM peak)

N'hood	Theme					Mode	TRICS trip rates	TRICS mode share	Mode shift by theme					Ave	Ambitious mode share
	1	2	3	4	5				1	2	3	4	5		
Northern	2	2	1	*	3	Vehicles	0.518	73%	55%	56%	73%		35%	55%	58%
						Public transport	0.047	7%	20%	7%	7%	*	22%	14%	15%
						Active travel	0.143	20%	20%	36%	20%		23%	25%	27%

**theme 4 not relevant to hinterland trips as it covers land use and internalisation, so is left blank*

The RAG ratings applied to each neighbourhood and the subsequent mode shifts are presented at the end of this Technical Note.

1.2.5 Stage 6: apply ambitious mode share to trip rates to derive trip rate by mode

The final step in identifying the ambitious trip rates is to apply the mode shares identified above for each neighbourhood to the TRICS trip rates initially identified using the BAU trip rate methodology.

Again, the full process for all neighbourhoods is presented in **Appendix A**, whilst the example for the northern neighbourhood hinterland trips in the AM peak in 2050 is shown in Figure 4-3:

Figure 4-3: Northern neighbourhood ambitious mode share and trip rates

N'hood	Mode	TRICS Trip Rates	TRICS Mode Share	Ambitious Mode Share	Ambitious Trip Rates
Northern	Vehicles	0.518	73%	58%	0.416
	Public transport	0.047	7%	15%	0.104
	Active travel	0.143	20%	27%	0.188

The calculation of alternative, ambitious mode shares and trip rates allows for comparison of the number of vehicle, public transport user and active travel trips that would be generated under the BAU and ambitious scenarios, demonstrating that delivery of sustainable-transport focussed infrastructure should reduce vehicle trips and increase trips by other modes. The extent to which this happens depends on how well the neighbourhood scores against the themes, so further reductions in vehicle trips would require gr eater levels of high quality walk, cycle and public transport interventions. The difference in trip generation is shown using the northern neighbourhood hinterland trips example in Figure 4-4.

Figure 4-4: Northern neighbourhood BAU and ambitious trip generation

N'hood	Mode	BAU scenario trips	Ambitious scenario trips
Northern	Vehicles	694	557
	Public transport	63	139
	Active travel	192	252

The full outputs overleaf (and summarised in Chapter 6 of the main report) demonstrate that other neighbourhoods achieve more sustainable mode shares and greater reductions in vehicle trips across the different time periods and trip lengths

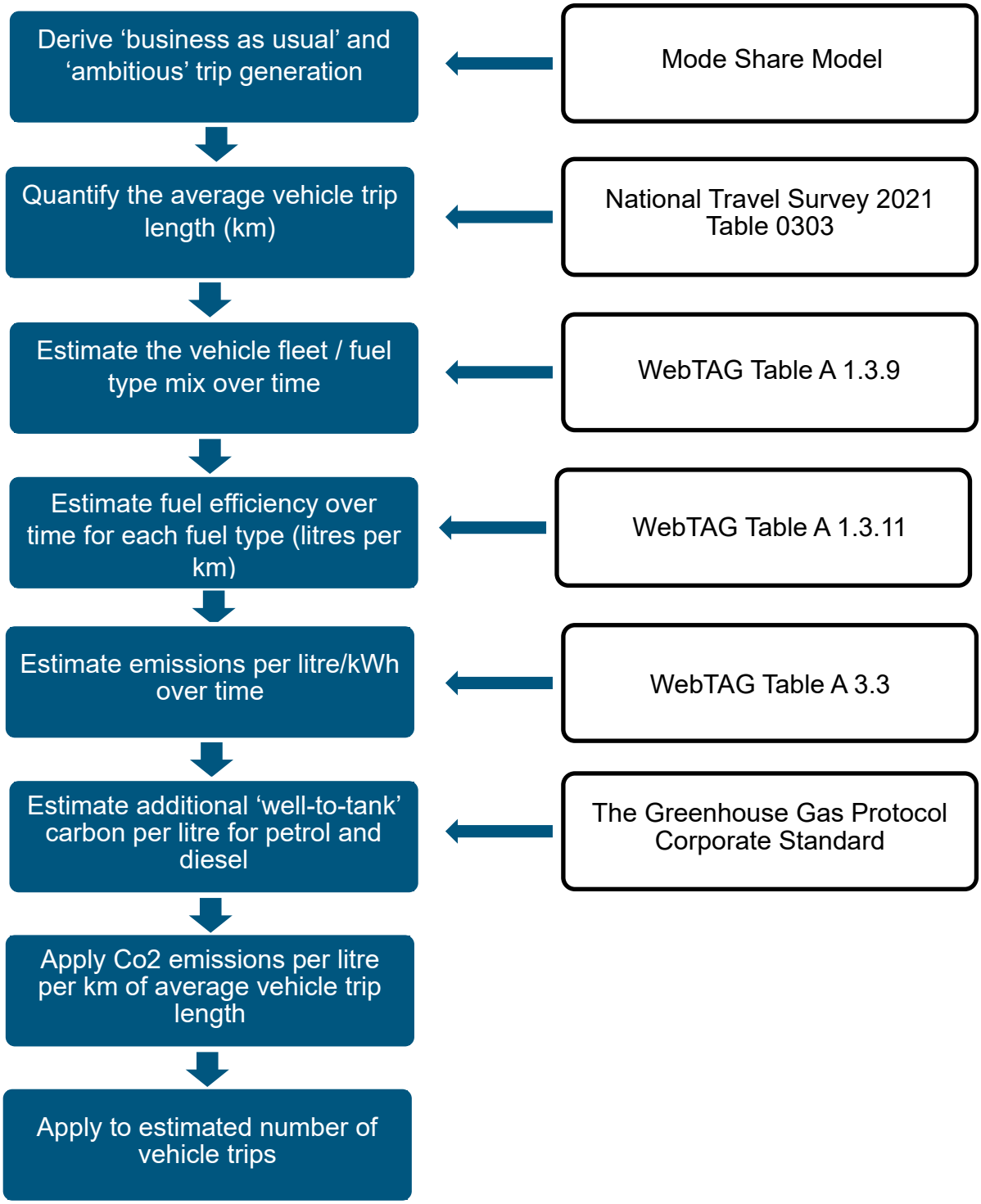
compared with the northern neighbourhood, whereas higher vehicle mode shares and trips are derived for residual trips, where there is less potential to influence them to achieve sustainable outcomes. The extent and quality of infrastructure provided is the key influence on all trip lengths and types in the MSM outputs and the resultant targets.

5. Carbon modelling

A high-level carbon model has been developed, based on standard data inputs from sources such as the DfT's TAG databooks, to estimate the carbon equivalent emissions resulting from vehicle trips generated by TCBGC. The process to derive vehicle trip distribution for each neighbourhood, trip length and future year is the same as that outlined above in this Technical Note.

The remaining process to convert vehicle trips into carbon emissions (emitted both at source and embedded in the fuelling/charging of vehicles) is summarised in Figure 5-1 overleaf.

Figure 5-1: Carbon modelling approach



The inputs derived from the various data sources above are replicated in the data sheet overleaf, with the detailed mode share and Co2e emission calculations and results on the following pages.

Constants

Variable	Emission / distance	Source	
Average car journey (km)	11.84	NTS 2021	7.4 miles converted to km
Average bus journey (outside London, km)	9.12	NTS 2021	5.7 miles converted to km
Annualisation factor	251		
Well-to-Tank diesel (kgco2e/litre)	0.6099		
Well-to-Tank petrol (kgco2e/litre)	0.6133		

2033 Cars

Fuel consumption diesel (litres per km)	0.0591
Fuel consumption petrol (litres per km)	0.0635
Fuel consumption electric (kWh/km)	0.1753

Diesel kgCo2e per litre	2.5086
Petrol kgCo2e per litre	2.1100
Electric kgCo2e per kWh	0.0687

Type of vehicle	Fleet mix	Fuel consumed per average trip	Units	Co2e per average trip	
Diesel	16%	0.6992	Litres	0.002180	T
Petrol	37%	0.7523	Litres	0.002049	T
Battery electric	47%	2.0757	kWh	0.000143	T

2041 Cars

Fuel consumption diesel (litres per km)	0.0607
Fuel consumption petrol (litres per km)	0.0644
Fuel consumption electric (kWh/km)	0.1655

Diesel kgCo2e per litre	2.5086
Petrol kgCo2e per litre	2.1100
Electric kgCo2e per kWh	0.0129

Type of vehicle	Fleet mix	Fuel consumed per average trip		Co2e per average trip	
Diesel	9%	0.7184	Litres	0.002240	T
Petrol	28%	0.7626	Litres	0.002077	T
Battery electric	63%	1.9593	kWh	0.000025	T

2051 Cars

Fuel consumption diesel (litres per km)	0.0607
Fuel consumption petrol (litres per km)	0.0646
Fuel consumption electric (kWh/km)	0.1567

Diesel kgCo2e per litre	2.5086
Petrol kgCo2e per litre	2.1100
Electric kgCo2e per kWh	0.0070

Type of vehicle	Fleet mix	Fuel consumed per average trip	Units	Co2e per average trip	
Diesel	8%	0.7190	Litres	0.002242	T
Petrol	24%	0.7649	Litres	0.002083	T
Battery electric	67%	1.8555	kWh	0.000013	T

Detailed model outputs:

2033

Mode share for internal trips **33% of all trips**

Garden Community Zone			Theme RAG rating					Mode	BAU Trip Rates		BAU Mode Share		BAU Trip Generation		BAU Co2e emissions - Tonnes				Mode	Ambitious Mode Share		Ambitious Trip Rates		Ambitious Trip Generation		Ambitious Co2e emissions - Tonnes				Mode	Difference in trips between BAU and mode shift scenarios		Co2e savings between BAU and ambitious scenarios - Tonnes			
			1	2	3	4	5		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Daily	Annually		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Daily	Annually		AM Peak	PM Peak	AM Peak	PM Peak	Daily	Annually
Neighbourhood 1 (South)			3	3	2	2	3	Vehicles	0.100	0.116	46.7%	46.7%	52	60	0.06	0.07	0.66	166	Vehicles	16.7%	16.7%	0.036	0.041	19	21	0.02	0.03	0.24	59	Vehicles	-33	-39	-0.04	-0.05	-0.43	-107
								Public transport	0.002	0.001	1.0%	0.6%	1	1					Public transport	12.0%	11.5%	0.026	0.028	13	15					Public transport	12	14				
								Active travel	0.111	0.129	51.9%	51.9%	58	67					Active travel	70.8%	70.9%	0.151	0.175	79	91					Active travel	21	24				
Neighbourhood 2 (Middle)				2	2	2	3	Vehicles	0.100	0.116	46.7%	46.7%	21	24	0.02	0.03	0.27	67	Vehicles	24.8%	24.8%	0.053	0.061	11	13	0.01	0.02	0.14	35	Vehicles	-10	-12	-0.01	-0.01	-0.13	-32
								Public transport	0.002	0.001	1.0%	0.6%	0	0					Public transport	8.4%	7.9%	0.018	0.019	4	4					Public transport	3	4				
								Active travel	0.111	0.129	51.9%	51.9%	23	27					Active travel	66.4%	66.4%	0.141	0.163	30	34					Active travel	6	7				
Neighbourhood 3 (North)			1	1	1	1	1	Vehicles	0.100	0.116	46.7%	46.7%	0	0	0.00	0.00	0.00	0	Vehicles	46.7%	46.7%	0.100	0.115	0	0	0.00	0.00	0.00	0	Vehicles	0	0	0.00	0.00	0.00	0
								Public transport	0.002	0.001	1.0%	0.6%	0	0					Public transport	1.0%	0.6%	0.002	0.001	0	0					Public transport	0	0				
								Active travel	0.111	0.129	51.9%	51.9%	0	0					Active travel	51.9%	51.9%	0.111	0.128	0	0					Active travel	0	0				
Whole Garden Community								Vehicles	0.100	0.116	46.7%	46.7%	73	85	0.09	0.10	0.93	233	Vehicles	20.8%	20.8%			30	34	0.03	0.04	0.38	94	Vehicles	-43	-50	-0.05	-0.06	-0.55	-139
								Public transport	0.002	0.001	1.0%	0.6%	2	1					Public transport	10.2%	9.7%			17	19					Public transport	16	18				
								Active travel	0.111	0.129	51.9%	51.9%	81	94					Active travel	68.6%	68.6%			108	125					Active travel	27	31				

Mode share for hinterland trips (within five miles) **59% of all trips**

Neighbourhood 1 (South)				2	1		3	Vehicles	0.518	0.483	73.2%	80.2%	370	345	0.44	0.41	4.22	1,059	Vehicles	53.2%	60.9%	0.377	0.367	270	262	0.32	0.31	3.13	787	Vehicles	-101	-83	-0.12	-0.10	-1.08	-272
								Public transport	0.047	0.026	6.6%	4.3%	34	19					Public transport	19.9%	17.3%	0.141	0.104	100	75					Public transport	67	56				
								Active travel	0.143	0.093	20.2%	15.4%	102	66					Active travel	26.9%	21.7%	0.190	0.131	136	94					Active travel	34	27				
Neighbourhood 2 (Middle)			2	2	1		3	Vehicles	0.518	0.483	73.2%	80.2%	174	162	0.21	0.19	1.98	498	Vehicles	58.1%	65.7%	0.411	0.395	138	133	0.16	0.16	1.60	401	Vehicles	-36	-29	-0.04	-0.03	-0.39	-97
								Public transport	0.047	0.026	6.6%	4.3%	16	9					Public transport	15.4%	12.9%	0.109	0.078	37	26					Public transport	21	17				
								Active travel	0.143	0.093	20.2%	15.4%	48	31					Active travel	26.5%	21.5%	0.188	0.129	63	43					Active travel	15	12				
Neighbourhood 3 (North)			1	1	1		1	Vehicles	0.518	0.483	73.2%	80.2%	0	0	0.00	0.00	0.00	0	Vehicles	73.2%	80.2%	0.518	0.483	0	0	0.00	0.00	0.00	0	Vehicles	0	0	0.00	0.00	0.00	0
								Public transport	0.047	0.026	6.6%	4.3%	0	0					Public transport	6.6%	4.3%	0.047	0.026	0	0					Public transport	0	0				
								Active travel	0.143	0.093	20.2%	15.4%	0	0					Active travel	20.2%	15.4%	0.143	0.093	0	0					Active travel	0	0				
Whole Garden Community								Vehicles	0.518	0.483	73.2%	80.2%	544	508	0.64	0.60	6.20	1,556	Vehicles	55.7%	63.3%			408	395	0.48	0.47	4.73	1,188	Vehicles	-137	-113	-0.16	-0.13	-1.47	-369
								Public transport	0.047	0.026	6.6%	4.3%	49	27					Public transport	17.6%	15.1%			137	101					Public transport	88	73				
								Active travel	0.143	0.093	20.2%	15.4%	150	98					Active travel	26.7%	21.6%			199	137					Active travel	49	39				

Mode share for residual trips (over five miles) **7% of all trips**

Neighbourhood 1 (South)				1	1		1	Vehicles	0.637	0.542	90.0%	90.0%	41	35	0.05	0.04	0.45	113	Vehicles	85.9%	85.9%	0.608	0.517	40	34	0.05	0.04	0.43	108	Vehicles	-2	-2	0.00	0.00	-0.02	-5
								Public transport	0.057	0.048	8.0%	8.0%	4	3					Public transport	12.1%	12.1%	0.086	0.073	6	5					Public transport	2	2				
								Active travel	0.014	0.012	2.0%	2.0%	1	1					Active travel	2.0%	2.0%	0.014	0.012	1	1					Active travel	0	0				
Neighbourhood 2 (Middle)				1	1		1	Vehicles	0.637	0.542	90.0%	90.0%	75	63	0.09	0.07	0.81	204	Vehicles	90.0%	90.0%	0.637	0.542	75	63	0.09	0.07	0.81	204	Vehicles	0	0	0.00	0.00	0.00	0
								Public transport	0.057	0.048	8.0%	8.0%	7	6					Public transport	8.0%	8.0%	0.057	0.048	7	6					Public transport	0	0				
								Active travel	0.014	0.012	2.0%	2.0%	2	1					Active travel	2.0%	2.0%	0.014	0.012	2	1					Active travel	0	0				
Neighbourhood 3 (North)				1	1		1	Vehicles	0.637	0.542	90.0%	90.0%	66	56	0.08	0.07	0.72	181	Vehicles	90.0%	90.0%	0.637	0.542	66	56	0.08	0.07	0.72	181	Vehicles	0	0	0.00	0.00	0.00	0
								Public transport	0.057	0.048	8.0%	8.0%	6	5					Public transport	8.0%	8.0%	0.057	0.048	6	5					Public transport	0	0				
								Active travel	0.014	0.012	2.0%	2.0%	1	1					Active travel	2.0%	2.0%	0.014	0.012	1	1					Active travel	0	0				
Whole Garden Community								Vehicles	0.637	0.542	90.0%	90.0%	182	155	0.21	0.18	1.99	499	Vehicles	87.9%	87.9%			180	153	0.21	0.18	1.97	494	Vehicles	-2	-2	0.00	0.00	-0.02	-5
								Public transport	0.057	0.048	8.0%	8.0%	16	14					Public transport	10.0%	10.0%			18	15					Public transport	2	2				
								Active travel	0.014	0.012	2.0%	2.0%	4	3					Active travel	2.0%	2.0%			4	3					Active travel	0	0				

Mode share for all trips **100% of all trips**

Neighbourhood 1								Vehicles	0.518	0.483	63.4%	67.3%	464	441	0.55	0.52	5.33	1,338	Vehicles	40.3%	44.5%			328	317	0.39	0.37	3.80	954	Vehicles	-136	-124	-0.16	-0.15	-1.53	-384
								Public transport	0.047	0.026	4.5%	3.0%	38	22					Public transport	16.3%	14.8%			119	94					Public transport	81	72				
								Active travel	0.143	0.093	32.0%	29.3%	161	134					Active travel	43.2%	40.4%			216	185					Active travel	55	51				
Neighbourhood 2								Vehicles	0.518	0.483	65.4%	69.4%	270	250	0.32	0.29	3.06	769	Vehicles	49.3%	53.6%			224	209	0.26	0.25	2.55	640	Vehicles	-46	-41	-0.05	-0.05	-0.51	-128
								Public transport	0.047	0.026	4.8%	3.3%	23	15					Public transport	12.3%	10.7%			47	36					Public transport	24	21				
								Active travel	0.143	0.093	29.6%	27.0%	73	60					Active travel	38.3%	35.4%			95	79					Active travel	21	19				
Neighbourhood 3								Vehicles	0.518	0.483	67.9%	72.6%	66	56	0.08	0.07	0.72	181	Vehicles	67.9%	72.6%			66	56	0.08	0.07	0.72	181	Vehicles	0	0	0.00	0.00	0.00	0
								Public transport	0.047	0.026	5.3%	3.7%	6	5					Public transport	5.3%	3.7%			6	5					Public transport	0	0				
								Active travel	0.143	0.093	26.7%	23.5%	1	1					Active travel	26.7%	23.5%			1	1					Active travel	0	0				
Whole Garden Community								Vehicles	0.518	0.483	65.6%	69.8%	800	747	0.94	0.88	9.12	2,289	Vehicles	52.5%	56.9%			618	583	0.73	0.69	7.08	1,776	Vehicles	-182	-165	-0.21	-0.19	-2.04	-513
								Public transport	0.047	0.026	4.9%	3.3%	67	42					Public transport	11.3%	9.7%			172	135					Public transport	105	93				
								Active travel	0.143	0.093	29.4%	26.6%	235	195					Active travel	36.1%	33.1%			312	266					Active travel	76	70				

2041

Mode share for internal trips **33% of all trips**

Garden Community Zone			Theme RAG rating					Mode	BAU Trip Rates		BAU Mode Share		BAU Trip Generation		BAU Co2e emissions - Tonnes				Mode	Ambitious Mode Share		Ambitious Trip Rates		Ambitious Trip Generation		Ambitious Co2e emissions - Tonnes				Mode	Difference in trips between BAU and mode shift scenarios		Co2e savings between BAU and ambitious scenarios - Tonnes			
			1	2	3	4	5		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Daily	Annually		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Daily	Annually		AM Peak	PM Peak	AM Peak	PM Peak	Daily	Annually
Neighbourhood 1 (South)			3	3	3	3	3	Vehicles	0.100	0.116	46.7%	46.7%	84	97	0.07	0.08	0.73	183	Vehicles	7.1%	7.1%	0.015	0.017	13	15	0.01	0.01	0.11	28	Vehicles	-71	-83	-0.06	-0.07	-0.62	-156
								Public transport	0.002	0.001	1.0%	0.6%	2	1					Public transport	13.1%	12.6%	0.028	0.031	23	26					Public transport	22	25				
								Active travel	0.111	0.129	51.9%	51.9%	93	108					Active travel	79.4%	79.5%	0.169	0.196	142	164					Active travel	49	56				
Neighbourhood 2 (Middle)			3	2	3	3	3	Vehicles	0.100	0.116	46.7%	46.7%	46	53	0.04	0.04	0.40	99	Vehicles	11.1%	11.1%	0.024	0.027	11	12	0.01	0.01	0.09	23	Vehicles	-35	-40	-0.03	-0.03	-0.30	-76
								Public transport	0.002	0.001	1.0%	0.6%	1	1					Public transport	13.0%	12.5%	0.028	0.031	13	14					Public transport	12	13				
								Active travel	0.111	0.129	51.9%	51.9%	51	59					Active travel	75.5%	75.6%	0.161	0.186	73	85					Active travel	23	26				
Neighbourhood 3 (North)			1	2	2	2	3	Vehicles	0.100	0.116	46.7%	46.7%	13	15	0.01	0.01	0.11	27	Vehicles	29.1%	29.1%	0.062	0.072	8	9	0.01	0.01	0.07	17	Vehicles	-5	-6	0.00	0.00	-0.04	-10
								Public transport	0.002	0.001	1.0%	0.6%	0	0					Public transport	4.9%	4.4%	0.010	0.011	1	1					Public transport	1	1				
								Active travel	0.111	0.129	51.9%	51.9%	14	16					Active travel	65.6%	65.7%	0.140	0.162	17	20					Active travel	4	4				
Whole Garden Community								Vehicles	0.100	0.116	46.7%	46.7%	142	165	0.11	0.13	1.23	310	Vehicles	15.7%	15.7%			31	36	0.03	0.03	0.27	68	Vehicles	-111	-129	-0.09	-0.10	-0.96	-242
								Public transport	0.002	0.001	1.0%	0.6%	3	2					Public transport	10.3%	9.8%			37	41					Public transport	34	39				
								Active travel	0.111	0.129	51.9%	51.9%	158	183					Active travel	73.5%	73.6%			233	269					Active travel	75	86				

Mode share for hinterland trips (within five miles) **59% of all trips**

Neighbourhood 1 (South)			3	3	1		3	Vehicles	0.518	0.483	73.2%	80.2%	598	558	0.48	0.45	4.65	1,168	Vehicles	48.7%	56.5%	0.345	0.340	399	393	0.32	0.32	3.19	800	Vehicles	-200	-165	-0.16	-0.13	-1.47	-369
								Public transport	0.047	0.026	6.6%	4.3%	54	30					Public transport	20.0%	17.4%	0.141	0.105	163	121					Public transport	109	91				
								Active travel	0.143	0.093	20.2%	15.4%	165	107					Active travel	31.3%	26.1%	0.222	0.157	256	182					Active travel	91	74				
Neighbourhood 2 (Middle)			3	2	2		3	Vehicles	0.518	0.483	73.2%	80.2%	377	352	0.30	0.28	2.93	736	Vehicles	48.2%	56.2%	0.341	0.338	248	246	0.20	0.20	1.99	500	Vehicles	-129	-105	-0.10	-0.08	-0.94	-236
								Public transport	0.047	0.026	6.6%	4.3%	34	19					Public transport	21.4%	18.7%	0.151	0.113	110	82					Public transport	76	63				
								Active travel	0.143	0.093	20.2%	15.4%	104	68					Active travel	30.4%	25.0%	0.215	0.151	157	110					Active travel	53	42				
Neighbourhood 3 (North)			1	2	1		3	Vehicles	0.518	0.483	73.2%	80.2%	174	162	0.14	0.13	1.35	339	Vehicles	62.8%	70.3%	0.445	0.423	149	142	0.12	0.11	1.17	294	Vehicles	-25	-20	-0.02	-0.02	-0.18	-45
								Public transport	0.047	0.026	6.6%	4.3%	16	9					Public transport	11.0%	8.5%	0.078	0.051	26	17					Public transport	10	9				
								Active travel	0.143	0.093	20.2%	15.4%	48	31					Active travel	26.2%	21.2%	0.185	0.127	62	43					Active travel	14	12				
Whole Garden Community								Vehicles	0.518	0.483	73.2%	80.2%	1149	1071	0.93	0.86	8.94	2,244	Vehicles	53.3%	61.0%			796	781	0.64	0.63	6.35	1,593	Vehicles	-353	-291	-0.28	-0.23	-2.59	-650
								Public transport	0.047	0.026	6.6%	4.3%	104	58					Public transport	17.4%	14.9%			299	221					Public transport	195	163				
								Active travel	0.143	0.093	20.2%	15.4%	317	206					Active travel	29.3%	24.1%			475	334					Active travel	158	128				

Mode share for residual trips (over five miles) **7% of all trips**

Neighbourhood 1 (South)				1	1		1	Vehicles	0.637	0.542	90.0%	90.0%	67	57	0.05	0.05	0.50	125	Vehicles	85.9%	85.9%	0.608	0.517	64	54	0.05	0.04	0.48	119	Vehicles	-3	-3	0.00	0.00	-0.02	-6
								Public transport	0.057	0.048	8.0%	8.0%	6	5					Public transport	12.1%	12.1%	0.086	0.073	9	8					Public transport	3	3				
								Active travel	0.014	0.012	2.0%	2.0%	1	1					Active travel	2.0%	2.0%	0.014	0.012	2	1					Active travel	0	0				
Neighbourhood 2 (Middle)			1	1	1		1	Vehicles	0.637	0.542	90.0%	90.0%	120	102	0.10	0.08	0.90	225	Vehicles	90.0%	90.0%	0.637	0.542	120	102	0.10	0.08	0.90	225	Vehicles	0	0	0.00	0.00	0.00	0
								Public transport	0.057	0.048	8.0%	8.0%	11	9					Public transport	8.0%	8.0%	0.057	0.048	11	9					Public transport	0	0				
								Active travel	0.014	0.012	2.0%	2.0%	3	2					Active travel	2.0%	2.0%	0.014	0.012	3	2					Active travel	0	0				
Neighbourhood 3 (North)			1	1	1		1	Vehicles	0.637	0.542	90.0%	90.0%	107	91	0.09	0.07	0.80	200	Vehicles	90.0%	90.0%	0.637	0.542	107	91	0.09	0.07	0.80	200	Vehicles	0	0	0.00	0.00	0.00	0
								Public transport	0.057	0.048	8.0%	8.0%	10	8					Public transport	8.0%	8.0%	0.057	0.048	10	8					Public transport	0	0				
								Active travel	0.014	0.012	2.0%	2.0%	2	2					Active travel	2.0%	2.0%	0.014	0.012	2	2					Active travel	0	0				
Whole Garden Community								Vehicles	0.637	0.542	90.0%	90.0%	294	250	0.24	0.20	2.19	550	Vehicles	88.6%	88.6%			291	248	0.23	0.20	2.17	545	Vehicles	-3	-3	0.00	0.00	-0.02	-6
								Public transport	0.057	0.048	8.0%	8.0%	26	22					Public transport	9.4%	9.4%			29	25					Public transport	3	3				
								Active travel	0.014	0.012	2.0%	2.0%	7	6					Active travel	2.0%	2.0%			7	6					Active travel	0	0				

Mode share for all trips **100% of all trips**

Neighbourhood 1								Vehicles	0.518	0.483	63.4%	67.3%	749	712	0.60	0.57	5.88	1,477	Vehicles	33.9%	38.2%			475	462	0.38	0.37	3.77	946	Vehicles	-274	-251	-0.22	-0.20	-2.11	-530
								Public transport	0.047	0.026	4.5%	3.0%	62	36					Public transport	16.8%	15.2%			196	155					Public transport	134	119				
								Active travel	0.143	0.093	32.0%	29.3%	260	217					Active travel	49.1%	46.3%			400	347					Active travel	140	130				
Neighbourhood 2								Vehicles	0.518	0.483	65.4%	69.4%	543	507	0.44	0.41	4.23	1,061	Vehicles	39.0%	43.5%			380	361	0.31	0.29	2.98	749	Vehicles	-163	-146	-0.13	-0.12	-1.24	-312
								Public transport	0.047	0.026	4.8%	3.3%	46	29					Public transport	17.2%	15.6%			133	105					Public transport	88	77				
								Active travel	0.143	0.093	29.6%	27.0%	157	129					Active travel	43.6%	40.6%			233	197					Active travel	75	68				
Neighbourhood 3								Vehicles	0.518	0.483	67.9%	72.6%	293	267	0.24	0.22	2.26	566	Vehicles	56.5%	61.6%			264	242	0.21	0.19	2.04	511	Vehicles	-29	-26	-0.02	-0.02	-0.22	-56
								Public transport	0.047	0.026	5.3%	3.7%	26	17					Public transport	9.2%	7.5%			37	27					Public transport	11	10				
								Active travel	0.143	0.093	26.7%	23.5%	64	49					Active travel	34.1%	30.8%			82	65					Active travel	18	16				
Whole Garden Community								Vehicles	0.518	0.483	65.6%	69.8%	1585	1486	1.28	1.20	12.37	3,104	Vehicles	43.1%	47.7%			1119	1064	0.90	0.86	8.79	2,206	Vehicles	-467	-422	-0.38	-0.34	-3.58	-898
								Public transport	0.047	0.026	4.9%	3.3%	133	82					Public transport	14.4%	12.8%			366	287					Public transport	232	205				
								Active travel	0.143	0.093	29.4%	26.6%	481	395					Active travel	42.3%	39.2%			714	609					Active travel	233	214				

2051

Mode share for internal trips **33% of all trips**

Scenario			Theme RAG rating					Mode	BAU Trip Rates		BAU Mode Share		BAU Trip Generation		BA Co2e emissions - Tonnes				Mode	Ambitious Mode Share		Ambitious Trip Rates		Ambitious Trip Generation		Ambitious Co2e emissions - Tonnes				Mode	Difference in trips between BAU and mode shift scenarios		Co2e savings between BAU and ambitious scenarios - Tonnes			
			1	2	3	4	5		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Daily	Annually		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Daily	Annually		AM Peak	PM Peak	AM Peak	PM Peak	Daily	Annually
Neighbourhood 1 (south)			3	3	3	3	3	Vehicles	0.100	0.116	46.7%	46.7%	118	137	0.08	0.11	0.96	242	Vehicles	7.1%	7.1%	0.015	0.017	18	21	0.01	0.02	0.14	36	Vehicles	-100	-116	-0.07	-0.09	-0.82	-206
								Public transport	0.002	0.001	1.0%	0.6%	3	2					Public transport	13.1%	12.6%	0.028	0.031	33	37					Public transport	30	35				
								Active travel	0.111	0.129	51.9%	51.9%	131	152					Active travel	79.4%	79.5%	0.169	0.196	200	231					Active travel	69	79				
Neighbourhood 2 (middle)			3	3	3	3	3	Vehicles	0.100	0.116	46.7%	46.7%	103	120	0.07	0.10	0.84	212	Vehicles	7.1%	7.1%	0.015	0.017	16	18	0.01	0.01	0.13	32	Vehicles	-88	-102	-0.06	-0.08	-0.72	-180
								Public transport	0.002	0.001	1.0%	0.6%	2	1					Public transport	13.1%	12.6%	0.028	0.031	29	32					Public transport	27	30				
								Active travel	0.111	0.129	51.9%	51.9%	115	133					Active travel	79.4%	79.5%	0.169	0.196	175	202					Active travel	60	69				
Neighbourhood 3 (north)			3	3	3	2	3	Vehicles	0.100	0.116	46.7%	46.7%	48	55	0.03	0.04	0.39	97	Vehicles	11.4%	11.4%	0.024	0.028	12	13	0.01	0.01	0.09	24	Vehicles	-36	-42	-0.03	-0.03	-0.29	-74
								Public transport	0.002	0.001	1.0%	0.6%	1	1					Public transport	13.0%	12.5%	0.028	0.031	13	15					Public transport	12	14				
								Active travel	0.111	0.129	51.9%	51.9%	53	61					Active travel	75.2%	75.3%	0.160	0.185	76	88					Active travel	23	27				
Whole Garden Community								Vehicles	0.100	0.116	46.7%	46.7%	269	312	0.19	0.25	2.19	551	Vehicles	8.5%	8.5%			45	52	0.03	0.04	0.37	92	Vehicles	-224	-260	-0.16	-0.21	-1.83	-459
								Public transport	0.002	0.001	1.0%	0.6%	6	4					Public transport	13.0%	12.6%			75	83					Public transport	69	79				
								Active travel	0.111	0.129	51.9%	51.9%	298	346					Active travel	78.0%	78.1%			451	521					Active travel	152	175				

Mode share for hinterland trips (within five miles) **59% of all trips**

Neighbourhood 1 (south)			3	3	2		3	Vehicles	0.518	0.483	73.2%	80.2%	840	784	0.59	0.63	6.09	1,529	Vehicles	43.5%	51.5%	0.308	0.310	500	503	0.35	0.41	3.77	947	Vehicles	-341	-280	-0.24	-0.23	-2.32	-582
								Public transport	0.047	0.026	6.6%	4.3%	76	42					Public transport	21.5%	18.8%	0.152	0.113	247	184					Public transport	171	142				
								Active travel	0.143	0.093	20.2%	15.4%	232	151					Active travel	35.0%	29.6%	0.248	0.178	402	289					Active travel	170	138				
Neighbourhood 2 (middle)			3	3	2		3	Vehicles	0.518	0.483	73.2%	80.2%	856	798	0.60	0.64	6.20	1,557	Vehicles	43.5%	51.5%	0.308	0.310	509	513	0.36	0.41	3.84	964	Vehicles	-347	-285	-0.24	-0.23	-2.36	-593
								Public transport	0.047	0.026	6.6%	4.3%	78	43					Public transport	21.5%	18.8%	0.152	0.113	251	187					Public transport	174	144				
								Active travel	0.143	0.093	20.2%	15.4%	236	154					Active travel	35.0%	29.6%	0.248	0.178	410	294					Active travel	173	141				
Neighbourhood 3 (north)			2	2	1		3	Vehicles	0.518	0.483	73.2%	80.2%	659	615	0.46	0.50	4.78	1,200	Vehicles	58.1%	65.7%	0.411	0.395	524	503	0.37	0.41	3.86	968	Vehicles	-136	-112	-0.10	-0.09	-0.92	-232
								Public transport	0.047	0.026	6.6%	4.3%	60	33					Public transport	15.4%	12.9%	0.109	0.078	138	99					Public transport	79	66				
								Active travel	0.143	0.093	20.2%	15.4%	182	118					Active travel	26.5%	21.5%	0.188	0.129	239	164					Active travel	57	46				
Whole Garden Community								Vehicles	0.518	0.483	73.2%	80.2%	2356	2196	1.65	1.77	17.08	4,287	Vehicles	48.4%	56.2%			1532	1519	1.07	1.22	11.47	2,880	Vehicles	-824	-677	-0.58	-0.55	-5.61	-1,407
								Public transport	0.047	0.026	6.6%	4.3%	214	118					Public transport	19.4%	16.9%			637	470					Public transport	423	352				
								Active travel	0.143	0.093	20.2%	15.4%	650	423					Active travel	32.2%	26.9%			1051	748					Active travel	401	325				

Mode share for residual trips (over five miles) **7% of all trips**

Neighbourhood 1 (south)			2	1	1		2	Vehicles	0.637	0.542	90.0%	90.0%	94	80	0.07	0.06	0.65	163	Vehicles	83.2%	83.2%	0.589	0.501	87	74	0.06	0.06	0.60	151	Vehicles	-7	-6	0.00	0.00	-0.05	-12
								Public transport	0.057	0.048	8.0%	8.0%	8	7					Public transport	14.4%	14.4%	0.102	0.086	15	13					Public transport	7	6				
								Active travel	0.014	0.012	2.0%	2.0%	2	2					Active travel	2.4%	2.4%	0.017	0.015	3	2					Active travel	0	0				
Neighbourhood 2 (middle)				1	1		2	Vehicles	0.637	0.542	90.0%	90.0%	169	144	0.12	0.12	1.17	294	Vehicles	87.5%	87.5%	0.619	0.527	164	140	0.11	0.11	1.14	286	Vehicles	-5	-4	0.00	0.00	-0.03	-8
								Public transport	0.057	0.048	8.0%	8.0%	15	13					Public transport	10.1%	10.1%	0.072	0.061	19	16					Public transport	4	3				
								Active travel	0.014	0.012	2.0%	2.0%	4	3					Active travel	2.4%	2.4%	0.017	0.014	5	4					Active travel	1	1				
Neighbourhood 3 (north)			1	1	1		2	Vehicles	0.637	0.542	90.0%	90.0%	150	128	0.11	0.10	1.04	261	Vehicles	87.5%	87.5%	0.619	0.527	146	124	0.10	0.10	1.01	254	Vehicles	-4	-4	0.00	0.00	-0.03	-7
								Public transport	0.057	0.048	8.0%	8.0%	13	11					Public transport	10.1%	10.1%	0.072	0.061	17	14					Public transport	4	3				
								Active travel	0.014	0.012	2.0%	2.0%	3	3					Active travel	2.4%	2.4%	0.017	0.014	4	3					Active travel	1	1				
Whole Garden Community								Vehicles	0.637	0.542	90.0%	90.0%	414	352	0.29	0.28	2.86	718	Vehicles	86.1%	86.1%			397	338	0.28	0.27	2.75	690	Vehicles	-16	-14	-0.01	-0.01	-0.11	-28
								Public transport	0.057	0.048	8.0%	8.0%	37	31					Public transport	11.5%	11.5%			51	43					Public transport	14	12				
								Active travel	0.014	0.012	2.0%	2.0%	9	8					Active travel	2.4%	2.4%			11	9					Active travel	2	2				

Mode share for all trips **100% of all trips**

Neighbourhood 1								Vehicles	0.518	0.483	63.4%	67.3%	1052	1000	0.74	0.81	7.71	1,935	Vehicles	30.9%	35.3%			604	598	0.42	0.48	4.52	1,135	Vehicles	-448	-403	-0.31	-0.32	-3.19	-800
								Public transport	0.047	0.026	4.5%	3.0%	87	51					Public transport	17.8%	16.1%			295	233					Public transport	208	182				
								Active travel	0.143	0.093	32.0%	29.3%	365	305					Active travel	51.2%	48.2%			605	522					Active travel	239	218				
Neighbourhood 2								Vehicles	0.518	0.483	65.4%	69.4%	1128	1062	0.79	0.85	8.22	2,063	Vehicles	34.7%	39.2%			689	670	0.48	0.54	5.11	1,282	Vehicles	-439	-391	-0.31	-0.31	-3.11	-781
								Public transport	0.047	0.026	4.8%	3.3%	95	57					Public transport	17.5%	15.9%			299	236					Public transport	204	178				
								Active travel	0.143	0.093	29.6%	27.0%	355	290					Active travel	47.6%	44.6%			589	500					Active travel	234	211				
Neighbourhood 3								Vehicles	0.518	0.483	67.9%	72.6%	857	798	0.60	0.64	6.21	1,559	Vehicles	48.8%	53.8%			681	641	0.48	0.52	4.96	1,245	Vehicles	-176	-157	-0.12	-0.13	-1.25	-313
								Public transport	0.047	0.026	5.3%	3.7%	74	45					Public transport	14.4%	12.6%			169	128					Public transport	94	83				
								Active travel	0.143	0.093	26.7%	23.5%	238	182					Active travel	36.8%	33.4%			319	256					Active travel	81	73				
Whole Garden Community								Vehicles	0.518	0.483	65.6%	69.8%	3038	2860	2.12	2.30	22.14	5,556	Vehicles	38.1%	42.8%			1974	1909	1.38	1.54	14.59	3,662	Vehicles	-1,064	-951	-0.74	-0.77	-7.55	-1,894
								Public transport	0.047	0.026	4.9%	3.3%	256	153					Public transport	16.5%	14.8%			762	597					Public transport	506	443				
								Active travel	0.143	0.093	29.4%	26.6%	958	777					Active travel	45.2%	42.1%			1513	1279					Active travel	555	502				

Summary of results

Trip Distance proportions (average across all neighbourhoods)

Internal	33%
Hinterland	59%
Residual	7%

Year	Trip distance			Mode	BAU Mode Share		BAU Trip Generation		BAU Co2e emissions - Tonnes				Ambitious Mode Share		Ambitious Trip Generation		Mode shift Co2e emissions - Tonnes				Difference in trips between BAU and mode shift scenarios		Co2e savings between BAU and mode shift scenarios - Tonnes			
					AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Daily	Annually	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	Daily	Annually	AM Peak	PM Peak	AM Peak	PM Peak	Daily	Annually
2033	Internal			Vehicles	46.7%	46.7%	73	85	0.09	0.10	0.93	233	20.8%	20.8%	30	34	0.03	0.04	0.38	94	-43	-50	-0.05	-0.06	-0.55	-139
				Public transport	1.0%	0.6%	2	1					10.2%	9.7%	17	19					16	18				
				Active travel	51.9%	51.9%	81	94					68.6%	68.6%	108	125					27	31				
	Hinterland			Vehicles	73.2%	80.2%	544	508	0.64	0.60	6.20	1,556	55.7%	63.3%	408	395	0.48	0.47	4.73	1,188	-137	-113	-0.16	-0.13	-1.47	-369
				Public transport	6.6%	4.3%	49	27					17.6%	15.1%	137	101					88	73				
				Active travel	20.2%	15.4%	150	98					26.7%	21.6%	199	137					49	39				
	Residual			Vehicles	90.0%	90.0%	182	155	0.21	0.18	1.99	499	87.9%	87.9%	180	153	0.21	0.18	1.97	494	-2	-2	0.00	0.00	-0.02	-5
				Public transport	8.0%	8.0%	16	14					10.0%	10.0%	18	15					2	2				
				Active travel	2.0%	2.0%	4	3					2.0%	2.0%	4	3					0	0				
	All			Vehicles	65.6%	69.8%	800	747	0.94	0.88	9.12	2,289	52.5%	56.9%	618	583	0.73	0.69	7.08	1,776	-182	-165	-0.21	-0.19	-2.04	-513
				Public transport	4.9%	3.3%	67	42					11.3%	9.7%	172	135					105	93				
				Active travel	29.4%	26.6%	235	195					36.1%	33.1%	312	266					76	70				
2041	Internal			Vehicles	46.7%	46.7%	142	165	0.11	0.13	1.23	310	15.7%	15.7%	31	36	0.03	0.03	0.27	68	-111	-129	-0.09	-0.10	-0.96	-242
				Public transport	1.0%	0.6%	3	2					10.3%	9.8%	37	41					34	39				
				Active travel	51.9%	51.9%	158	183					73.5%	73.6%	233	269					75	86				
	Hinterland			Vehicles	73.2%	80.2%	1149	1071	0.93	0.86	8.94	2,244	53.3%	61.0%	796	781	0.64	0.63	6.35	1,593	-353	-291	-0.28	-0.23	-2.59	-650
				Public transport	6.6%	4.3%	104	58					17.4%	14.9%	299	221					195	163				
				Active travel	20.2%	15.4%	317	206					29.3%	24.1%	475	334					158	128				
	Residual			Vehicles	90.0%	90.0%	294	250	0.24	0.20	2.19	550	88.6%	88.6%	291	248	0.23	0.20	2.17	545	-3	-3	0.00	0.00	-0.02	-6
				Public transport	8.0%	8.0%	26	22					9.4%	9.4%	29	25					3	3				
				Active travel	2.0%	2.0%	7	6					2.0%	2.0%	7	6					0	0				
	All			Vehicles	65.6%	69.8%	1585	1486	1.28	1.20	12.37	3,104	43.1%	47.7%	1119	1064	0.90	0.86	8.79	2,206	-467	-422	-0.38	-0.34	-3.58	-898
				Public transport	4.9%	3.3%	133	82					14.4%	12.8%	366	287					232	205				
				Active travel	29.4%	26.6%	481	395					42.3%	39.2%	714	609					233	214				
2051 (high)	Internal			Vehicles	46.7%	46.7%	269	312	0.19	0.25	2.19	551	8.5%	8.5%	45	52	0.03	0.04	0.37	92	-224	-260	-0.16	-0.21	-1.83	-459
				Public transport	1.0%	0.6%	6	4					13.0%	12.6%	75	83					69	79				
				Active travel	51.9%	51.9%	298	346					78.0%	78.1%	451	521					152	175				
	Hinterland			Vehicles	73.2%	80.2%	2356	2196	1.65	1.77	17.08	4,287	48.4%	56.2%	1532	1519	1.07	1.22	11.47	2,880	-824	-677	-0.58	-0.55	-5.61	-1,407
				Public transport	6.6%	4.3%	214	118					19.4%	16.9%	637	470					423	352				
				Active travel	20.2%	15.4%	650	423					32.2%	26.9%	1051	748					401	325				
	Residual			Vehicles	90.0%	90.0%	414	352	0.29	0.28	2.86	718	86.1%	86.1%	397	338	0.28	0.27	2.75	690	-16	-14	-0.01	-0.01	-0.11	-28
				Public transport	8.0%	8.0%	37	31					11.5%	11.5%	51	43					14	12				
				Active travel	2.0%	2.0%	9	8					2.4%	2.4%	11	9					2	2				
	All			Vehicles	65.6%	69.8%	3038	2860	2.12	2.30	22.14	5,556	38.1%	42.8%	1974	1909	1.38	1.54	14.59	3,662	-1,064	-951	-0.74	-0.77	-7.55	-1,894
				Public transport	4.9%	3.3%	256	153					16.5%	14.8%	762	597					506	443				
				Active travel	29.4%	26.6%	958	777					45.2%	42.1%	1513	1279					555	502				

Essex Highways

Appendix C

Monitoring and management

Safer, greener, healthier

itp a company of Royal HaskoningDHV

RINGWAY JACOBS integrated expertise

Essex County Council

1 Monitoring and management

1.1 Establishing a meaningful baseline

Understanding the baseline mode share in Colchester is essential and time-critical, as it will:

- Provide an accurate and current picture of TCBGC residents travel habits at occupation – the details and extents of which are currently unknown given that the site has not yet been built out and the age and limitations of other data sources, such as the 2011 national census.
- Establish the basis for future analysis of progress towards targets;
- Highlight any gaps in data, monitoring equipment or insufficiencies in survey methodologies at an early stage.

It is recommended that baseline surveys are undertaken at the time of resident occupation. using a bespoke, localised travel survey.

Table 1-1 outlines key requirements, metrics and outcomes which could be drawn from the Baseline travel survey. An important consideration in the design of the surveys will be the format and wording of the questions, tackling issues such as choosing a 'normal' or 'neutral' time period for respondents to answer around and trusting that respondents remember all journeys they made during this time period. Example question formats are included in Table 1-2 to provoke further thought and discussions. These could be combined into a travel diary, either in paper format and / or using an app. This could expand on answering questions about 'yesterday' or 'last week' to avoid capturing one-off travel behaviours.

Table 1-1: Colchester Travel Census Metrics

Core metrics	Example question formats	Data outputs	Significance
Establishing resident trip numbers and purpose	• Did you make any journeys yesterday? • What was the purpose of the journey(s) you made yesterday (e.g. journey 1 was to take children to school, journey 2 was to food shop)	• Number of trips made per person in a day • Purpose of each trip made	• Establishes how many trips are made by residents and why – percentage mode shares can then be quantified and categorised, and more targeted interventions introduced if necessary
Establishing where residents travel to / from	• For journey 1 yesterday, where did you go?	• Origin / destination of trips within Colchester and from Colchester to other towns / cities	• Informs the key components of the TCBGC target relating to distance of trips

Establishing how mode share changes temporally	• What time did you make journey 1 yesterday? (assumes survey respondents are asked about different days of the week) • Do your normally make journeys around this time?	• Mode share over the day / week	• Offers insight into whether mode share changes through the day or at the weekend – it is anticipated that car driver mode share will be higher outside of the peak hours
Establishing the baseline commuter mode share of residents	• Did you work from home? • Which modes of travel did you use to travel to work yesterday? Please list them in the order you used them (e.g. walk to bus stop then bus, or drive to station then train) • What was your main mode of travel to work this week? (i.e. on 3 or more days)	• Number of existing residents who travel to work by each mode of transport	• Informs the baseline mode share, and provides the most useful metric for comparisons with other data sets, e.g. national Census travel to work data
Establishing the baseline mode share for other trips by residents	• Last time you bought food for the household, did you go to the shop? What mode of travel did you use? • Last time your child went to school, how did they travel? (e.g. walked – not escorted, car – escorted etc.)	• Number of existing residents who travel to education, retail, leisure etc. by each mode of transport	• Informs the baseline mode share and allows for some comparison with national datasets e.g. National Travel Survey and Active Lives Survey

Supporting questions can be incorporated into the survey to draw out corroborative and attitudinal data which may be useful to inform decisions, interventions and strategies, on topics such as:

- Age, gender etc. (and the barriers faced by different demographics)
- Visible and hidden disabilities and impairments (and the barriers faced)
- Household income / expenditure on travel
- Linked trips
- Ad-hoc journeys, e.g. to alternative workplaces
- Attitudes towards sustainable travel initiatives, e.g. Mass Rapid Transit
- Attitudes towards public transport and parking pricing structures

The travel Census approach has recently been adopted at the Harlow & Gilston Garden Community, where a baseline of travel behaviours will be established in late 2022 from a sample of 10,000 households: https://hggt.co.uk/how-do-you-travel

1.1.1 Scale and sampling

To achieve a confidence level of 95% on a survey response, with a margin of error of 3%, a sample size of around 1,000 households would be required[1]. This needs to be considered against the likely response rate; the 2011 Census recorded a 95%

[1] Sample size calculator. Available at: https://www.surveymonkey.com/mp/sample-size-calculator/

household response rate [2], whilst travel survey response rates vary significantly – ITP's experience suggests that on average response rates could lie between 20% and 40% of all potential participants, or even lower under some circumstances.

Households would be targeted on the assumption that each household would give at least one response, with the survey structured such that additional household members can fill out questions / travel diaries as well – any additional respondents from each household will be bonus and at no extra material cost. Households / postal addresses, distinct from *homeowners*, are suggested targets, as there will then be the potential to capture more transient dwellers such as lodgers, renters, possibly even travelling communities.

It is recommended that all households are given an opportunity to participate during their house purchase completion rather than other methods which could introduce biases (e.g. self-selection, use of a survey app, entirely random selection), given that the mode share strategy will apply to TCBGC as a whole and its diverse users, with the proposed sustainable transport interventions intended to benefit all areas.

It has been assumed in this Monitoring Framework that the baseline survey and possibly future monitoring surveys will be undertaken primarily using a postal survey with freepost returns. This reflects the national census methodology and the Essex residential travel plan guidance and in the short term is likely to be the most straightforward method of collecting data for baselining (although not necessarily the most resource-efficient).

This could, equally, be undertaken using a 'push to online' method: letters including access codes and login credentials for an online survey are included in new home welcome packs or posted to occupied addresses. At the same time, a paper format of the questionnaire is included which can be returned by prepaid postage. Online completions would save administration resource required for inputting data from paper forms as well as the costs of return postage. The critical element of baselining for TGBGC is the short timescales and therefore in any case **we recommend that readily available tools are used for distributing and collecting baseline data.**

This being said, as technology advances and becomes more embedded into everyday life – for all demographics – then there will be the opportunity to technologize these processes, through smartphone apps for example. **We recommend that, using the push to online approach, a phased roll out of online survey and response methods is adopted, but monitored to ensure that all demographics are captured**. Monitoring of this uptake would be undertaken by the TCBGC Monitoring Working Group.

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[2] Office for National Statistics March 2011 Quality and Methodology Information. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/methodologies/2011censusstatisticsforenglandandwalesmarch2011qmi

1.1.2 Trips Ending in TCBGC

The baseline survey will be residentially focussed and therefore, by its nature, will exclude trips made by people travelling into TCBGC who live elsewhere. This is a key element of the TCBGC mode share target, which necessitates consideration of all trips generated by TCBGC, including those travelling into the Garden Community from the hinterland (5 miles) and further afield. These trips will include visitors to residential dwellings and trips to employment and community facilities on TCBGC.

It is intrinsically difficult to capture trips entering an area from external origins, without committing to intensive and costly data collection exercises such as roadside interviews, ANPR etc. These exercises provide incredibly useful snapshots, but often only a capture a proportion of all trips being made, and unconscious and geographical biases can easily be introduced. As such, if time and budgetary resources are available, these would be useful corroborative datasets for TCBGC to collect in support of the core baselining and monitoring activities.

To practically and cost-effectively capture 'ending within' TCBGC trips, it may instead be necessary to come back to commuter trip proxy data. Whilst there are limitations to this it is considered reasonable to assume that a greater proportion of trips coming into Colchester will be employment related rather than leisure, social, education etc.

Therefore, for the purposes of baselining, **we recommend that the mode share of trips ending in TCBGC is measured using recent workplace Travel Plan data from TCBGC at such a time that this becomes available.**

To establish a system of sourcing data, incentivising existing companies to implement Travel Plans, and compelling new developments to monitor workplace Travel Plans, **we recommend that a TCBGC-wide workplace Travel Plan Network is formed**.

We recommend that workplace Travel Plan data is then used for ongoing monitoring of trips ending within Colchester, albeit that the specific workplaces to which the data applies will change over time, i.e. as the circa five-year monitoring period for a Travel Plan ends, that site will cease to be monitored, but new employment developments are likely to have begun contributing to the TCBGC Workplace Travel Plan Network.

1.1.3 Corroborative data

Some corroborative data sources such as TRICS data and 2011 national census data will be very useful to substantiate and interpolate mode share, both now and in the future. Corroborative data will also be useful to inform questions over how and when mode share changes over the course of a day / week / month etc. Ideally, corroborative data will be readily available and open source or owned by the partner authorities, e.g. public transport patronage data or permanent vehicle count data. **We recommend that free, available corroborative data is collected now**.

There are however likely to be specific cycle / pedestrian routes or junctions of interest not currently recorded, often simply because development has not yet affected these areas to any great extent, and in these instances **we recommend that the GC developers fund the installation of counters / technologies for additional corroborative data collection** and that a standardised approach for this is adopted across the GCs.

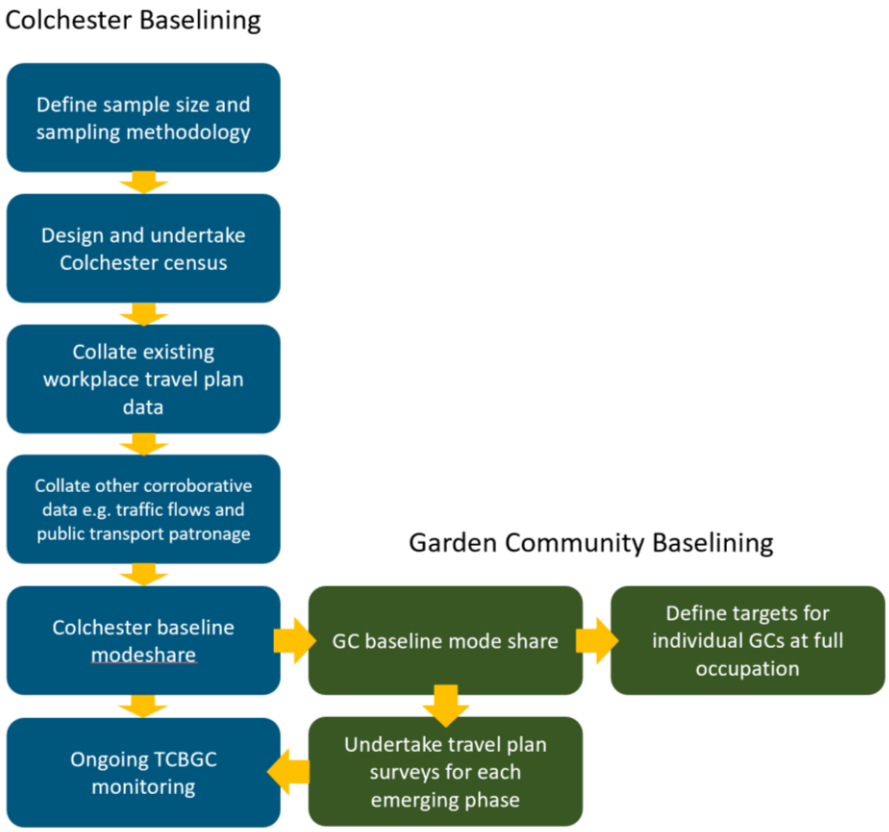
As well as standardisation within TCBGC, where possible the format of the data collected (mostly relevant to corroborative data) should also be in a format similar to that already owned by the partner authorities, for example if a certain counter is used elsewhere in Essex then it would be logical to use a counter of the same specification in TCBGC. This allows for comparison with other areas and, if necessary, ease roll out of the monitoring framework and network to cover larger areas of the counties.

1.1.4 GC baseline benchmarking approach

Other planned Garden Communities (GCs) will be constructed across the UK over the next ~30 years and therefore travel patterns associated with the existing GCs cannot practically inform the initial TCBGC baseline approach. Over time, as Garden Communities are built out, their surveys are likely to be considered in the context of the ongoing TCBGC monitoring activities being undertaken at that time. Over time, these will form a more complete picture of Garden Community travel behaviours which will allow for better benchmarking with other locations.

Figure 1-1 summarises this chapter and provides an outline baselining framework for understanding mode share in TCBGC.

Figure 1-1: Outline baselining framework



Regular travel pattern monitoring will be invaluable in achieving the TCBGC Vision because it will:

- Help the partner authorities understand trends and reasons behind lower than expected adoption of active and sustainable travel modes;
- Facilitate a regular flow of insightful and meaningful data into how people are choosing to travel;
- Allow partner authorities to identify successful and less successful measures and interventions and act appropriately.
- Provide a wider view on the full range of trips that people are making, and, crucially, how they change over time, for example through ways of working, impact of the GCs and their land-use mixes, impact of enhanced walk, cycle and public transport networks;
- Inform continuous and evolving decision-making around mobility investment priorities across TCBGC, for example identifying ‘quick wins’, targeting interventions into specific locations, further improving the range of travel options, and introducing more stringent complementary policies relating to parking or development management; and
- Give insight into changing local attitudes towards active and sustainable travel options in relation to time, progress in the GCs, climate change and delivery of significant transport investments.

1.2 Responsibility for monitoring

Table 1-2 summarises the three main parties likely to be involved in or responsible for monitoring in TCBGC.

Table 1-2: Monitoring Responsibilities

Party	Benefits	Drawbacks
Developers	• Likely to provide a relatively detailed level of travel data for the GCs at minimal cost to the partner authorities	• Developers may initial resist undertaking monitoring of wider TCBGC, but this is essential to provide perspective of wider travel patterns
Local authorities	• Provides some objectivity • Provides a wider TCBGC perspective • Local authorities likely to have more tools at their disposal / access to greater range of data • Can collect some costs from developers	• Developers may question contributions and monitoring activities if they have less control • The two-tier authorities and TCBGC team within them would result in a complex set-up
Third parties	• Independent and peer reviewed • Developers and local authorities jointly contribute • Could offer specialist data collection and analysis techniques and insights • Likely to be able to dedicate more time for monitoring administration and analysis, including of ongoing, passive data collection	• Requires an appreciation of the locality / understanding of TCBGC travel patterns • Potential for mistrust from residents

In practice, it is likely that a combination of the above would be best placed to manage and own the task of TCBGC monitoring. The specialist and independent qualities of a third-party organisation would be beneficial, but the local, financial and political interests of developers and the partner authorities are likely to have a bearing on decision making surrounding funding and implementation of monitoring.

A 'TCBGC Monitoring Working Group', or similar, should be instated, perhaps in part before baselining has even begun, to bring together the relevant and interested parties and provide a forum for discussion on how, when and what to monitor.

1.3 Travel Plan

Baselining of TCBGC will be undertaken before it is fully occupied. It is nevertheless recommended that the detail of surveying and monitoring the GC is agreed now.

As part of planning applications, planning conditions and Section 106 agreements, each GC (or multiple variable land use components of each GC) will be required to

prepare and implement a Framework Travel Plan and site wide Travel Plan, defined by the Colchester Borough Council Local Plan as *'A plan demonstrating how a development would encourage its users to use more sustainable methods of transport to access a development.'* .

The Framework Travel Plan will set out the mode share targets that each phase of development and explain how these targets will be achieved through a mix of transport network and service improvements and behaviour change interventions and incentives and should be reviewed and updated during each phase of development based on the current mode share, as defined by ongoing monitoring activities.

Table 1-3 sets out how the mode share targets may be achieved throughout the different development stages and the relationship between infrastructure delivery, travel plan measures and TCBGC phasing.

The TCBGC wide Travel Plan should be adopted and overseen by a Travel Plan officer, which may be funded by development and staffed by the Council, or provided by the developer(s) of the homes. The travel plan will include background information about the site, a summary of the local sustainable transport networks, the SMART mode share targets defined within this report, an action plan for achieving these targets and a monitoring plan that seeks to update and compare the travel patterns and mode choices of residents and employees based in the Garden Community against the baseline travel data. As a development generating significant amounts of movement, TCBGC will also be required to become a member of the Colchester Travel Plan Club which provides a range of resources to promote travel behaviour change for local business and organisations in Colchester.

Table 1-3: Mode share and development phasing

GC delivery phase	Delivery timeframe	Target mode share by phase completion (Internal)		Target mode share by phase completion (Hinterland)		Envisaged key Travel Plan interventions	Envisaged key infrastructure delivery
		PT	Active	PT	Active		
1	2025 – 2033	10%	69%	18%	27%	• Establish Area Travel Plan coordinator • Phase 1 Travel Plan based on framework travel plan • Baseline traffic counts & travel surveys to be undertaken • Develop home occupier info packs and local PT ticket incentives/cycle vouchers (e.g. bundled annual bus pass for each home) with local transport information • First round of monitoring surveys conducted	• RTS route construction commences • Bus services extended along A133 from University to GC development area • Cycle connections to Colchester being constructed alongside A133 • On-site strategic cycle routes commence into first phase • Link Road construction underway
2	2033-2041	10%	74%	17%	29%	• Second round of monitoring surveys conducted • Revisit Framework Travel Plan and phase 1 Travel Plan targets based on	• RTS services commence into GC South development • First Mobility Hub to open at University • Cycle connections to Colchester complete

						occupier behaviours to inform Phase 2 Travel Plan • Update/improve occupier info pack • Dr Bike sessions to be held in south of development	• Park and Choose • Mobility hub at train station to open towards end of phase
3	2041 – 2051	13%	78%	19%	32%	• Revisit Framework Travel Plan and phase 1 and 2 Travel Plan targets based on occupier behaviours to inform Phase 3 Travel Plan • Third round of monitoring surveys to be conducted • Update/improve occupier info pack • Dr Bike sessions to be held in south or centre of development	• Detail to follow once phasing plan and infrastructure delivery plan are clarified

The Travel Plan survey presents the opportunity to collect bespoke travel data from new residents via mechanisms which are effectively already in place through the planning process. The onus will be on developers, in line with the Essex County Council Travel Plan Guidelines and the expectation will be that surveys are undertaken of all new residents / employees, rather than a sample (recognising that the response rate will still not represent 100% of residents / employees).

The Travel Plan surveys and monitoring methodologies should align with the baseline data collection approaches and timescales to ensure that both datasets are comparable and interoperable. For example, unless not relevant or appropriate, the questions in the resident Travel Plan surveys should emulate those in the baseline survey.

The GC workplace Travel Plans will form part of the TCBGC Workplace Travel Plan Network and surveys should produce directly comparable (but perhaps enhanced) data to the key metrics extracted from existing Colchester workplace Travel Plan datasets.

In light of the above, **The TCBGC Monitoring Working Group should come together to agree a standardised approach to GC Travel Plans** as soon as possible and reviews this as developments in TCBGC begin to emerge. This should involve consideration of:

- Timing of Travel Plan baseline surveys – in keeping with conventional Travel Plan monitoring methodologies, this point could be three months after occupation of each defined phase of the respective GC.
- Required frequency and timing of Travel Plan surveys – likely to comprise a baseline survey after initial occupation, and then surveys at key milestones as the site is built out.
- Core Travel Plan survey questions – need to reflect the format and metrics of the baseline survey, possibly with GC-specific metrics;
- Duration of Travel Plan monitoring, recognising that over time the GCs could be encapsulated into Colchester
- Compulsory Travel Plan measures and monitoring activities, for example installation of permanent vehicle / cycle counters, traffic surveys, annual update reports.
- How new Travel Plans and the data collected through them can be integrated with other areas in Essex and neighbouring authorities, such

that standardisation can be achieved and any successful monitoring initiatives could be rolled out on a larger scale.

1.4 Frequency and duration

As with defining a sample size for baselining and monitoring, the frequency for undertaking monitoring activities will have a bearing on how much information is made available. Whilst the ideal scenario would be to collect as much data as possible surrounding mode share in TCBGC, the converse is that the more data which are collected, the higher the level of analysis which will be required from the partner authorities.

If time and resource are available, undertaking travel surveys annually would provide data to monitor mode share in relatively high detail. This is probably a best case, however, realistically one travel survey every five years is also likely to provide sufficient detailed data to monitor progress towards the mode share target.

With a frequency any lower than this, there is a risk of nuances and trends being lost or going unnoticed which in the long term could undermine the monitoring approach. We recommend that initially a frequency no less than once every five years is undertaken for the monitoring 'events'. In the interim, some monitoring activities such as collecting data from a permanent counter will be ongoing, however detailed analysis of such data could similarly be timed to coincide with the core monitoring events.

It may be appropriate to vary the frequency of the travel survey in the event there is scope to align data collection and analyses with the timing of detailed planning applications for subsequent phases of development in the Garden Community.

In terms of the duration of monitoring activities, the five-yearly surveys should be undertaken for 30 years (subject to the build out rates of the GCs). Surveys will logically continue up to when the last phase of the GC is complete, and the GC will have obligations to continue to monitor for at least five years after full occupation. This will give a (circa) '2056 mode share' which will ultimately be the measure of success of the TCBGC mode share target.

1.5 TCBGC Monitoring Framework

1.1 The Monitoring Framework is an outline, which will require input the TCBGC Monitoring Working Group (thereby including the partner authorities, developers, agents etc.), but nevertheless represents a considered balance of pragmatic, feasible approaches which are still likely to capture the necessary data to monitor progress towards the TCBGC mode share.

Table 1-4: Monitoring framework

Metric	Monitoring activity	Responsibility to fund	Frequency and Duration	Sample size
Core				
Existing resident person trip numbers, purpose, origin/destination and mode share for all trip types.	Baseline Travel Survey	Local authorities / their agents using contributions from developers	Every five years until 2056.	1,000 households
'ending within TCBGC' person trip mode share	Workplace Travel Plan surveys – as part of the TCBGC Workplace Travel Plan Network	Developers / their agents	Likely to be annually in line with site-specific Travel Plan monitoring commitments	All available workplace Travel Plans as and when they are occupied
Corroborative				
Total vehicle trip generation of TCBGC	Traffic surveys / Digital monitoring/ permanent counters at TCBGC	Developers / their agents – as part of Travel Plan monitoring	In line with Travel Plan monitoring commitments	All highway accesses
Background vehicle trips in Colchester	Traffic surveys on existing network / permanent counters on	Local authorities / their agents	In line with TCBGC travel survey frequency	Key access / egress points, and potentially 'hotspots' or areas of interest

	existing network (could make use of Vivacity)			
Uptake (patronage) of new public transport interventions and background public transport trips in Colchester	Public transport patronage	Local authorities / their agents	In line with TCBGC travel survey frequency	All new services, e.g. on RTS, plus regular services in Colchester.
Number of cycle trips	Permanent cycle counters on key routes, ideally which capture scooter, modified bike etc. trips	Developers or local authorities, dependent on where the counter is	In line with TCBGC travel survey frequency and Travel Plan monitoring commitments	At key locations identified during baselining,
Number of pedestrian trips	Permanent pedestrian counters on key routes (could make use of CCTV counting technology)	Developers or local authorities, dependent on where the counter is	In line with TCBGC travel survey frequency and Travel Plan monitoring commitments	At key locations identified during baselining, potentially some within GC sites as part of GC monitoring commitments

1.6 Incentives, penalties and funding

There are two facets to incentivising monitoring; encouraging residents or other visitors to TCBGC to respond or take part in monitoring or surveys, and incentivising developers to undertake thorough and regular monitoring activities which reflect the aspirations of TCBGC.

1.6.1 Respondents

Some of the monitoring activities suggested in this Technical Note will be passive, that is, there will be no direct need for agreement or participation from subjects. This is the case for traffic surveys, public transport patronage data collection etc.

In terms of actively collecting data, such as surveys, respondents could be motivated by:

- Rewards (e.g. material gifts, prize draws)
- Costs (e.g. time, money)
- Penalties (e.g. legal action)

For example, whilst the national Census is relatively time-consuming to complete as a respondent (a cost) and households are subject to a law obligating them to respond (a penalty), it achieves a high response rate potentially because the psychological element of respondents feeling like they are ‘part of something’ and helping out (a reward).

Aside from the ‘softer’ psychological rewards, material gifts could be used on a minimal level in TCBGC, such as a prize draw, but the cost/benefit of offering incentives attractive enough to influence all participants may not prove to be beneficial. We recommend that the focus on incentivising respondents rests on designing a survey and methodology which results in the least effort from individual households. This is likely to comprise a succinct questionnaire which is legible, straightforward and directly relevant to those living in TCBGC.

Consideration could be given to different options for returning the questionnaire. Whilst initial contact will likely have been by post (based on the recommendations in Chapter 3), there is the opportunity to allow participants to send back surveys by post, email, app etc. The BetterPoints app, for example, combines the opportunity to ask survey questions with gamification and incentives such as retail vouchers. The key in this instance would be to ensure that the data outputs from the app can continue to be used with the data from the TCBGC travel survey.

1.6.2 Developers

Developers, both of the GCs and any other sites who will contribute to TCBGC monitoring (i.e. through Travel Plan monitoring), are similarly likely to require some incentivisation or potential subjection to penalties.

Developers are likely to be attracted to 'least cost' methods which require minimal effort on their part, for example passive data collection methods previously mentioned such as installation of permanent counters. Aside from the initial output for installation, and minimal ongoing maintenance, these monitoring methodologies require very little proactivity on the part of the developer until it comes to analysing data. Aside from the baseline travel survey and monitoring surveys, **consideration should be given to using passive data collection methods as much as possible**, with full access to the data provided to the partner authorities**.**

Penalties will be 'in-built' into monitoring of new developments in some respects through the Travel Plan elements of the Monitoring Framework, as these are driven by planning commitments and Section 106 agreements which carry with them planning enforcements notices. In addition to these, **consideration should be given to additional penalties enshrined in Section 106 agreements or planning conditions** which are specific to TCBGC, depending on whether targets are met. These will require careful planning and legal consideration but could involve measures such as:

- Performance bonds, which are dependent on progress towards targets
- Metred access from developments onto the highway network
- Acceleration of planned investments ahead of delivery trajectory

1.6.3 Funding coordination and governance

Developers will initially cover the cost of many of the GC monitoring activities, for the lifetimes of the respective Travel Plans and / or the duration of conditions or obligations attached to planning permissions. However, as previously mentioned, they are unlikely to 'buy into' a solution which sees all monitoring costs, across all of TCBGC, borne solely by developers.

Potential sources of initial funding and funding to bolster developer contributions could be considered as follows:

- Establishing a 'Monitor & Manage' fund, amongst the partner authorities, to support the target monitoring process, and crucially to fund the first and subsequent baseline survey and workplace travel surveys before GCs can contribute into the fund

- Research and innovation funds (such as Innovate UK) – relevant if new technologies are used or developed such as creative use of Vivacity or a survey smartphone app
- Funding and grants from national or local Government – for example Capability fund and Ambition Fund.
- Funding from or secured through the South East Local Enterprise Partnership

In terms of the ownership and governance of the data collected, it is imperative that the partner authorities have access to all data, even if this is initially collected by developers or third parties. This would need to be written into any condition, Section 106 agreement etc. The TCBGC partner authorities will need to establish which authorities will ultimately own the data and / or a mechanism by which all partners own data.