Guildford Borough Council

Guildford Town and Approaches Movement Study

Vision, Objectives, Baseline and Business-As-Usual Report

Final Updated | March 2015

Job number   232012-00

ARUP

Document Verification

ARUP

Job title	Guildford Town and Approaches Movement Study		Job number 232012-00
Document title	Vision, Objectives, Baseline and Business-As-Usual Report		File reference 04-02-00
Document ref			

Revision	Date	Filename	004-A-Guildford TAMS Baseline and BAU Report - Draft.docx		
Draft	1 Oct 2013	Description	First draft		
			Prepared by	Checked by	Approved by
		Name	Doug Pickering	Stephen Bennett	Susan Claris
		Signature			
Revision 1	03 Dec 2013	Filename	20131203 Guildford TAMS Baseline and BAU Report – Draft Issue.docx		
		Description	Revised to reflect comments received from Guildford Borough Council		
			Prepared by	Checked by	Approved by
		Name	Anne Clarke	Doug Pickering	Stephen Bennett
		Signature			
Final	11 April 2014	Filename	Guildford TAMS Baseline and BAU Report - Final.docx		
		Description	Revised to reflect further comments received from Guildford Borough Council		
			Prepared by	Checked by	Approved by
		Name	Anne Clarke	Stephen Bennett	Susan Claris
		Signature			
Final Updated	Mar 2015	Filename	GTAMS Baseline and BAU Report – Final Updated March 2015.docx		
		Description	Revised to provide clarifications and to correct errors		
			Prepared by	Checked by	Approved by
		Name	Anne Clarke	Stephen Bennett	Susan Claris
		Signature			
Issue Document Verification with Document					✓

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Executive Summary

Arup was appointed by Guildford Borough Council (GBC) in July 2013 to undertake the **Guildford Town and Approaches Movement Study (GTAMS)**. The aim of the study was to develop a long term movement strategy to 2050 for the town of Guildford. This will inform the development of a new Local Plan for the borough for the period to 2031.

This report presents the findings of the first two stages of the study, the **Vision and Objectives Stage**, and the **Baseline and Business-As-Usual (BAU) Scenario Stage**.

The vision and objectives for the study were informed by the following:

- Discussions with the lead borough and county councillors and senior officers;

- A review of the existing policy framework and supporting evidence;

- A review of documentation and information, including maps, survey data, Guildford Borough Council and Surrey County Council plans, studies and strategies, and academic papers; and

- A Transport Futures stakeholder workshop, which was held in Guildford on Monday 16 September 2013. The aim of the workshop was to inform the development of the vision and objectives for the strategy.

Workshop exercises using informational **Drivers of Change** cards, covering social, technological, economic, environmental and political (STEEP) drivers, helped delegates identify the most pertinent issues and trends shaping Guildford's future.

The workshop outputs were analysed, encompassing the Drivers of Change that were identified and voted on by participants, in addition to the vision statements that were provided at and after the workshop.

The **principal thread was urban growth and congestion**, encompassing the following drivers:

- Urban migration (S);
- Transport (T);
- Smart and smaller vehicles (T);
- Congestion (Ec);
- Sustainable links to Heathrow and Gatwick (Ec);
- Connected communities by means other than by car (En);
- Infrastructure (P); and
- Planning policies (P).

Secondary threads were 'constraints and challenges facing the Council and the town of Guildford more widely' and 'information and communications technology'.

Bringing the above inputs together, a **vision statement** was developed that takes account of the key aspirations. The vision is wide-ranging and represents the future social, economic and environmental outcomes that transport can deliver (or support the delivery of), rather than specifying the form of the transport networks.

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The next step in the process was to develop **objectives** that will support the delivery of the vision, covering mobility, accessibility, economy, environment, and safety (the five key categories from the project brief). Objectives specify the directions for improvement, but not the means of achieving them. The objectives were developed through review and assessment of the drivers and vision statements identified by stakeholders, borough and county councillors and officers, and existing policy and supporting evidence.

The vision and objectives are shown overleaf. The process is summarised in the diagram below.

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VISION

The transport system in 2050 will sustain Guildford as a centre of excellence; with an attractive and thriving town centre; an innovative world-class high-tech employment sector; a high-quality resilient environment; an engaged, healthy and prosperous community; and excellent connections, locally, regionally, and internationally via airports and high speed rail links.

SUSTAINABLE MOBILITY OBJECTIVES

Mobility	Provide alternatives to the private car to travel to, from, and within the town
	Increase walking and cycling within the town
Accessibility	Improve accessibility to town centre by non-car modes of transport, in terms of both time and cost
	Improve accessibility to employment sites by non-car modes of transport, in terms of both time and cost
	Improve accessibility to regional links, particularly to London, and Heathrow and Gatwick airports
	Reduce severance of communities within the town caused by transport infrastructure
	Improve the viability of public transport in the town
Economy	Improve reliability of car journey times to, from and within the town
	Improve reliability of public transport journey times to, from and within the town
Environment	Reduce greenhouse gas emissions from transport in the town
	Reduce the proportion of the population affected by transport noise in the town
	Protect and enhance the townscape of Guildford
	Protect and enhance the landscape in and around Guildford
	Encourage a healthy community through active travel
Safety	Reduce the number of Killed or Seriously Injured (KSI) accidents in the borough

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The objectives were measured using **metrics**, which were used to describe the existing Baseline and the future Business-As-Usual scenarios. There were a significant number of metrics that could be used; however not all metrics aligned well with the vision, or were measurable with data and tools available to the study team. As such, a long list of metrics was developed and assessed in order to produce a shortlist. The shortlist was subsequently refined into a final set of metrics.

Each metric was:

- aligned with the vision and objectives;
- assessed for the Baseline and the forecast Business-As-Usual scenario in 2031 and 2050; and
- able to be used for the appraisal of interventions and packages of interventions, either quantitatively or qualitatively, relative to the Business-As-Usual scenario.

The **metrics** were:

- Total vehicle distance within Guildford borough;
- Sustainable mode share for Guildford borough residents' journey to work trips;
- Highway level of delay;
- Air quality impact caused by transport in Guildford town;
- Noise impact resulting from traffic on major roads;
- Brownfield and greenfield land use impact;
- Number of accidents resulting in Killed or Seriously Injured (KSI).
- Guildford town centre accessibility by non-car modes;
- Guildford Railway Station accessibility by non-car modes;
- Surrey Research Park accessibility by non-car modes;
- Slyfield Industrial Estate accessibility by non-car modes;
- Guildford Business Park accessibility by non-car modes;
- Bus level of delay;
- Urban public realm impact; and
- Number and amenity of pedestrian and cycle crossings of major transport barriers (e.g. A3, River Wey, Gyratory, Railway lines).

For each metric, the **Baseline** represents the existing situation and the **Business-As-Usual (BAU)** represents an estimate for how Guildford's transport system will perform in future without intervention. For each metric, the data sources and methods of assessing it are set out.

The metrics and their assessment were constrained by the availability of assessment tools. Where possible, Surrey County Council's SINTRAM strategic highway model was used as the basis for assessment.

The **next stage in the study** was the Scenario Analysis Stage. The vision, objectives and metrics identified in this report informed this next stage of work

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and were used to develop and assess scenarios in order to identify a preferred scenario.

1 Introduction

1.1 Context

Arup was appointed by Guildford Borough Council (GBC) in July 2013 to undertake the Guildford Town and Approaches Movement Study (GTAMS).

The aim of the study was to develop a long term movement strategy to 2050 for the town of Guildford. This will inform the development of a new Local Plan for the borough for the period to 2031.

This report presents the findings of the first two stages of the study, the Vision and Objectives Stage, and the Baseline and Business-As-Usual (BAU) Scenario Stage.

1.2 Scope of this Report

This report covers the following areas:

- Vision and Objectives (Chapter 2);
- Approach to Development of Metrics (Chapter 3);
- Development of Metrics (Chapter 4); and
- Baseline and Business-As-Usual Forecast (Chapter 5).

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2   Vision and Objectives

2.1   Approach

The aim of the Vision and Objectives Stage was to develop a headline vision for sustainable mobility in Guildford, including key objectives and targets (covering mobility, accessibility, economy, environment and safety).

The vision and objectives for the study were informed by the following:

- Discussions with the lead borough and county councillors and senior officers;
- A review of the existing policy framework and supporting evidence;
- A review of documentation and information, including maps, survey data, Guildford Borough Council and Surrey County Council plans, studies and strategies, and academic papers[1]; and
- A Transport Futures stakeholder workshop, which was held in Guildford on Monday 16 September 2013.

2.2   Transport Futures Workshop

The aim of the workshop was to inform the development of the vision and objectives for the strategy through stakeholder engagement, exploring the key drivers shaping Guildford and its transport futures to the year 2050.

Among the 42 delegates were members of Guildford Borough Council, Surrey County Council and a diverse range of stakeholders from the business and wider community, as shown in **Figure 1** and listed in Appendix B. Although a number of youth groups was invited, the workshop was under-represented by the youth demographic.

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[1] A full list of documents and data reviewed in this study is provided in Appendix A.

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Figure 1: Workshop attendees
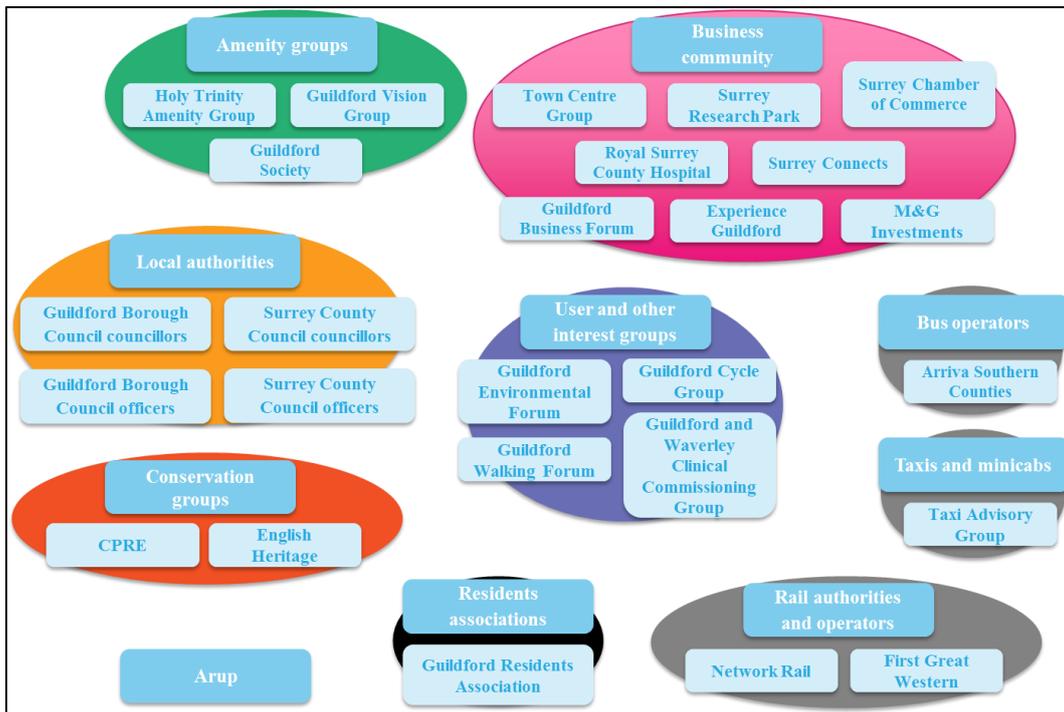
The objectives of the workshop were to:

- Inform the setting of a headline vision for sustainable mobility in Guildford;
- Generate consensus from stakeholders as to which key drivers will have the greatest impact on Guildford and its transport futures to 2050; and
- Solicit from individual stakeholders their vision for the transport future of Guildford in 2050.

2.3　　Workshop Agenda

To achieve the above objectives the following workshop agenda was developed:

16.00	Welcome (Stephen Bennett, Arup)
16.05	Study Context (Councillor James Palmer, Deputy Leader of GBC)
16.15	Keynote Presentation: Urban Drivers of Change (Mark Watts, Arup)
16.45	Introduction to the Drivers of Change (Marcus Morrell, Arup)
16.55	Drivers of Change – Exercise 1
17.40	Break
17.55	Drivers of Change – Exercise 2
18.30	Drivers of Change – Exercise 3
19.05	Report Out
19.35	Voting Exercise
19.40	Closing Comments and Vision Exercise
20.00	Close

After brief presentations to welcome stakeholders and provide the study context, a keynote presentation was given to highlight the major challenges facing urban areas, including population growth and rapid urbanisation, food supply and energy security. It also looked at case studies that illustrated the opportunities that towns and cities can leverage.

One of these case studies was the German city of Freiburg (population 230,000), which is twinned with Guildford. Long-term strategic planning has yielded results for the city over the course of several decades. Despite significant population and economic growth, vehicle use fell by 7% during the 1990-2006 period (measured in km/person), and it is estimated that 70% of all jobs are within walking distance of a public transport stop. The provision of 170km of cycle lanes has facilitated 27% of all trips being made by bicycle. Furthermore, evidence suggests that the city administration enjoys strong civic co-operation and support for its green policies.

2.3.1 Drivers of Change cards

In order to help delegates identify the most pertinent issues and trends shaping Guildford's future, a set of informational Drivers of Change cards were introduced as a workshop tool. These have been developed at Arup as part of an on-going research-driven initiative that seeks to identify and monitor drivers likely to have an impact on the built environment and society as a whole. Each card focuses on a single driver across a number of key topics including urbanisation, demographics, energy, climate change, water, and waste. Some of these drivers are global in nature, such as advances in technology or advancing climate change. Others are more local, such as congestion or planning laws.

The cards are divided into five domains that cover social, technological, economic, environmental and political drivers, which we refer to as STEEP. This framework acts as a comprehensive set of lenses through which to examine the future.

125 drivers of change cards were pre-selected by the Arup study team from over 300 cards available, with 25 per STEEP category. The selection was based on research and analysis to date, and an existing knowledge of the Guildford context.

After an introductory overview of the Drivers of Change programme and cards, delegates were put to work in five groups to identify which drivers are believed to have the most impact on Guildford and its transport future to 2050. Each group represented a different STEEP category and included a designated Chairperson to lead each exercise, encourage contribution from all participants and marshal their group's contribution within the time available.

Three exercise rounds were conducted to filter out less relevant Drivers of Change and to identify those of greatest future impact.

In the first round, delegates were asked to discard 10 of their 25 cards. They were also given up to five blank cards that they could fill out with new drivers that were not touched upon by the 25 pre-selected cards. Groups were asked to write titles and a brief description for these on the blank cards provided.

For the second round, delegates were asked to rotate to the next letter in the STEEP acronym (i.e. the Social group moved to Technology). The Chairpersons

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stayed at their respective tables and informed their incoming groups as to which cards remained. Each group then whittled their card selection down to 12. Up to two new drivers could be created and included as part of this number.

For the third and final round, delegates were invited to move to a new STEEP category of their choosing. During this session they were asked to identify just five drivers that they collectively believed to be the most impactful for Guildford and its transport future.

The 25 drivers (5 per STEEP category) were then reported out by each of the Chairpersons. Each delegate (Chairs included) was then given seven sticky dots, to vote on the seven drivers they personally felt to be the most compelling, by placing their dots on wall posters beside the relevant card. They had to place at least one vote in each STEEP category, and could only vote once for any one driver. This concluded the exercises.

2.4   Outcomes of the Workshop

The results of the Drivers of Change exercises by STEEP category are as follows:

Social (40 votes)	**Technological 45 votes)**
Urban migration (22 votes)	Transport (18 votes)
Ageing population (9)	Smart and smaller vehicles (11)
Not-in-my-backyard (5)	Growth of high-value added and technology industries in Guildford (8)
Social media (4)	Connectivity (7)
Open innovation (0)	Techno-reliance (1)
Economic (51 votes)	**Environmental (39 votes)**
Successful regeneration of the town centre (24 votes)	Connected communities by means other than car (13 votes)
Congestion (14)	Urban and geographical topography (12)
Sustainable links to Heathrow and Gatwick (5)	Meeting aspirations of people of Guildford (8)
Global economy (4)	Resource depletion (4)
Employment (4)	Climate change (2)
Political (52 votes)	
Political leadership (21 votes)	
Infrastructure (18)	
Planning policies (11)	
Peak oil (1)	
Impact awareness (1)	

In assessing these results, it was interesting to note the cross-linkages across all five STEEP domains.

The shortlisted Drivers of Change drivers have been reviewed to establish threads, which are themes common to multiple drivers across the STEEP categories. The principal thread is, unsurprisingly, **urban growth and congestion**, encompassing the following drivers:

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- Urban migration (S);
- Transport (T);
- Smart and smaller vehicles (T);
- Congestion (Ec);
- Sustainable links to Heathrow and Gatwick (Ec)*;
- Connected communities by means other than by car (En);
- Infrastructure (P); and
- Planning policies (P).

*It is worth noting that "Aviation" almost made the final 5 Social drivers (it was discarded in the second round).

Another common thread focuses more on the **constraints and challenges facing the Council and the town of Guildford more widely**:

- Not-in-my-backyard (S);
- Urban and geographical topography (En);
- Resource depletion (En);
- Climate change (En)**;
- Peak oil (P); and
- Impact awareness (P).

** Note that 'Adaptation to greater extremes of weather', a new driver created in the workshop, was eliminated in the second round.

Another cluster of drivers relate to **information and communications technology** and related tools (connectivity, social media and open innovation). A number of ICT-related drivers were eliminated in the second round. These include artificial intelligence, the internet of things, intelligent buildings, demand management, adequate internet connection and provision, and urban informatics.

Finally, several new drivers were generated by participants that relate to a vision for Guildford. For example, one of the final technology drivers chosen was 'the growth of high-value added and technology industries in Guildford'. While this was undoubtedly a high impact driver, it could be argued that this represents an aspiration. Similarly, 'successful regeneration of the town centre' was aspirational in nature, rather than a driver. Another driver that was selected in the environment category was 'meeting aspirations of the people of Guildford'. This represents an aspiration that, if successful, could have a great impact on Guildford and its future.

2.5   The Vision

The workshop outputs were analysed, encompassing the Drivers of Change that were identified and voted on by participants, in addition to the six vision statements that were provided at and after the workshop. The vision statement was then developed through a consideration of these workshop outputs, the discussions that had taken place with the lead borough and county councillors and senior officers, and the review of the existing policy framework and supporting evidence.

The vision statement takes account of the key aspirations from the workshop. The vision is wide-ranging and represents the future social, economic and environmental outcomes that transport can deliver (or support the delivery of), rather than specifying the form of the transport networks. The objectives,

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reported in the next section, provide the basis for the appraisal of alternative transport future scenarios, interventions and packages of interventions in the context of the aspirations described in the vision statement.

The following vision statement resulted from the analysis:

> **"The transport system in 2050 will sustain Guildford as a centre of excellence; with an attractive and thriving town centre; an innovative world-class high-tech employment sector; a high-quality resilient environment; an engaged, healthy and prosperous community; and excellent connections, locally, regionally, and internationally via airports and high speed rail links."**

This statement is rationalised below, phrase by phrase, with the relevant outputs from the Drivers of Change and Vision statements.

Guildford in 2050 will be a centre of excellence

It was clear at the workshop that there was a desire to see Guildford as a 'centre of excellence' in all that it does.

An attractive and thriving town centre

Relevant Driver of Change	Vision Statement Inputs
Successful regeneration of the town centre (Economic, 24 votes)	Visitors enjoy coming
Infrastructure (Political, 18 votes)	Heritage
Transport (Technology, 18 votes) Meeting aspirations of the people of Guildford (Environment, 8 votes)	Residents walk and cycle
Congestion (Economic, 14 votes) Employment (Economic, 4 votes)	Businesses can do business here
Connected communities by means other than by car (Environment, 13 votes) Smart and smaller vehicles (Technology, 11 votes) Connectivity (Technology, 7 votes)	High quality town centre / public realm, well linked by public transport (various types beyond bus), state-of-the-art walking and cycling and much less dominance of the car.
Planning policies (Political, 11 votes)	Key words there are 'attractive' and retaining the 'character' of the town

An innovative world-class high-tech employment sector

Relevant Driver of Change	Vision Statement Inputs
Growth of high-value added and technology industries (Technology, 8 votes)	World-class
Global economy (Economic, 4 votes)	Businesses can do business here
Employment (Economic, 4 votes) Open innovation (Social, 0 votes)	Innovative, globally-aware city, environmentally aware and meeting the needs of the next 20 years as an economic leader.

A high quality resilient environment

Relevant Driver of Change	Vision Statement Inputs
Successful regeneration of the town centre (Economic, 24 votes) Planning policies (Political, 11 votes) Connected communities by means other than by car (Environment, 13 votes) Connectivity (Technology, 7 votes)	Guildford should be a sustainable community that delivers prosperity for all the residents whilst living within the environmental limits of the area and allowing the proceeds of growth to repay the current environmental debt.
Infrastructure (Political, 18 votes) Smart and smaller vehicles (Technology, 11 votes) Connectivity (Technology, 7 votes) Resource depletion (Environment, 4 votes) Climate change (Environment, 2 votes) Techno-reliance (Technology, 1 vote) Peak oil (Political, 1 vote)	Innovative, globally-aware city, environmentally aware and meeting the needs of the next 20 years as an economic leader.

An engaged, healthy and prosperous community

Relevant Driver of Change	Vision Statement Inputs
Successful regeneration of the town centre (Economic, 24 votes) Growth of high-value added and technology industries (Technology, 8 votes) Employment (Economic, 4 votes)	Businesses can do business here
Political leadership (Political, 21 votes) Meeting aspirations of the people of Guildford (Environment, 8 votes) Connectivity (Technology, 7 votes)	Guildford should be a sustainable community that delivers prosperity for all the residents whilst living within the environmental limits of the area and allowing the proceeds of growth to repay the current environmental debt.
Ageing population (Social, 9 votes) Social media (Social, 4 votes) Sustainable links to Heathrow and Gatwick (Economic, 5 votes) Global economy (Economic, 4 votes) Impact awareness (Political, 1 vote)	Innovative, globally-aware city, environmentally aware and meeting the needs of the next 20 years as an economic leader.

A well-connected town, both locally and regionally

Relevant Driver of Change	Vision Statement Inputs
Infrastructure (Political, 18 votes)	Residents walk and cycle
Transport (Technology, 18 votes) Connectivity (Technology, 7 votes)	High quality town centre / public realm, well linked by public transport (various types beyond bus), state-of-the-art walking and cycling and much less dominance of the car.
Connected communities by means other than by car (Environment, 13 votes) Sustainable links to Heathrow and Gatwick (Economic, 5 votes) Planning policies (Political, 11 votes)	If the town is to support an increasing population with new development etc., then a different approach (to transport planning) is required. The changes that have taken place in towns such as Oxford and Cambridge are

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Relevant Driver of Change	Vision Statement Inputs
Social media (Social, 4 votes)	good examples of what can be achieved, where sustainable transport modes are given priority and the town centre is given the opportunity to function as it should. A strong political lead will inevitably be required as not everyone will be convinced by such ideas. However Guildford's economy is strong enough to support such an approach and will be the better for it.

There is a number of drivers identified above that relate to the ways and means of delivering the interventions and the strategy, for example the use of technology or strong political leadership. These drivers were applied in the later stages of the study when the interventions and strategy were developed.

2.6   Sustainable Mobility Objectives

The next step in the process was to develop sustainable mobility objectives that support the vision, covering mobility, accessibility, economy, environment, and safety (the five key topics from the project brief). The objectives were developed through review and assessment of the drivers and vision statements identified by stakeholders, borough and county councillors and officers, and existing policy and supporting evidence, as reported in the previous sections. The objectives were developed to specifically meet the vision elements:

- An attractive and thriving town centre;
- An innovative world-class high-tech employment sector;
- A high-quality resilient environment;
- An engaged, healthy and prosperous community; and
- A well-connected town, both locally and regionally.

The resultant list of objectives is presented in **Table 1**. The 'Vision Elements' column shows how each objective relates to the vision elements.

Table 1: Sustainable Mobility Objectives

Category	Sustainable Mobility Objectives	An attractive and thriving town centre	An innovative world-class high-tech employment sector	A high-quality resilient environment	An engaged, healthy and prosperous community	A well-connected town, both locally and regionally
Mobility	Provide alternatives to the private car to travel to, from, and within the town	✓	✓	–	–	✓
	Increase walking and cycling within the town	✓	✓	–	–	✓

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Category	Sustainable Mobility Objectives	Vision Elements				
		An attractive and thriving town centre	An innovative world-class high-tech employment sector	A high-quality resilient environment	An engaged, healthy and prosperous community	A well-connected town, both locally and regionally
Accessibility	Improve accessibility to town centre by non-car modes of transport, in terms of both time and cost	✓	✓	–	✓	✓
	Improve accessibility to employment sites by non-car modes of transport, in terms of both time and cost	✓	✓	–	✓	✓
	Improve accessibility to regional links, particularly to London, and Heathrow and Gatwick airports	✓	✓	–	✓	✓
	Reduce severance of communities within the town caused by transport infrastructure	–	–	✓	✓	✓
	Enhance land use density and mix to improve the viability of public transport in the town	✓	✓	✓	✓	✓
Economy	Improve reliability of car journey times to, from and within the town	✓	✓	–	✓	–
	Improve reliability of public transport journey times to, from and within the town	✓	✓	–	✓	–
Environment	Reduce CO2 emissions from transport in the town	–	–	✓	–	–
	Reduce the proportion of the population affected by transport noise in the town	–	–	✓	✓	–
	Protect and enhance the townscape of Guildford	✓	–	✓	✓	–
	Protect and enhance the landscape in and around Guildford	–	–	✓	✓	–
	Encourage a healthy community through active travel	–	–	–	✓	–
Safety	Reduce the number of Killed or Seriously Injured (KSI) accidents in the borough	–	–	✓	✓	–

✓ = Positive link between objective and vision element, – = neutral link between objective and vision element.

The objectives were measured using metrics, which were also used to describe the baseline and future BAU scenarios (in the following chapters). The approach to the development of metrics is described in the next chapter.

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3 Approach to Development of Metrics for the Baseline and BAU Forecasts

It was considered essential that the final strategy arising from this study included interventions that could achieve the objectives developed during the Vision and Objectives Stage. As such, it was imperative that the adopted metrics be closely aligned with the objectives, and be quantified where possible.

This chapter summarises the approach for ensuring that appropriate metrics are identified and selected for application in the study. The subsequent Chapter 4 presents the metrics evaluation and shortlist based on this methodology.

3.1 Approach

There were a significant number of metrics that could be adopted for the purpose of evaluating the impact of an intervention; however not all metrics were able to be aligned with the objectives, and hence with the vision, or were measurable with the existing data and tools. As such, a long list of metrics was developed and assessed in order to produce a shortlist.

Each shortlisted metric was able to achieve the following:

- **Metric Quantification**: Be measureable at existing (~2013) conditions, and can be forecast to 2050; and

- **Metric Alignment**: Be aligned with the vision and objectives.

3.1.1 Metric Quantification

The Metric Quantification process is illustrated in **Figure 2**.

**Figure 2: Metric Quantification**
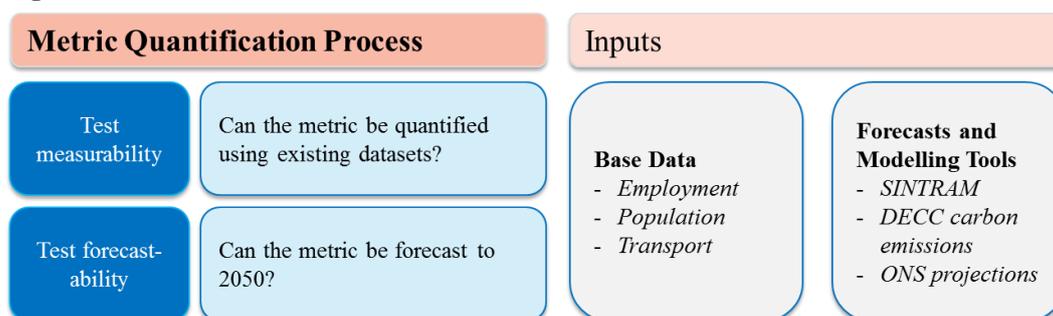
The inputs used to calculate the metrics aim to achieve a quantified assessment in which any assumptions made are explicit:

- **Base data**: if a relationship exists between the base data and any of the proposed metrics they were used to inform the baseline and business-as-usual scenarios. The Base Data sets are presented in **Appendix C** of this report.

- **Forecasts and Modelling tools**: if an existing modelling tool or forecast was available for use for this study, which may allow for direct quantification of the metric (*e.g. the SCC SINTRAM strategic highway model could be used to test a highway intervention, with the outputs, such as junction delays or link journey times, directly informing a metric*).

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3.1.2   Metric Alignment

The Metric Alignment process is illustrated in **Figure 3**.

Figure 3: Metric Alignment
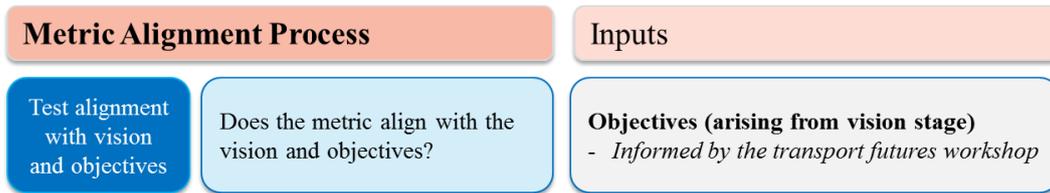
The inputs used to determine the metrics are intended to ensure alignment with the vision and objectives:

- **Objectives**: an assessment to confirm that the metric would be important in testing whether an intervention was likely to align with an objective, and hence with the vision' *(e.g. the objective to increase walking and cycling within the town could be tested from assessing mode share, which would provide an appropriate metric).* The objectives are those introduced in Chapter 2.

3.2   Metric Evaluation

A short list of metrics was required that covers all of the objectives presented within the previous chapter; ideally two or three metrics for each category would be available (i.e. for each category - mobility, accessibility, economy, environment and safety). If quantifiable metrics could not be established for a particular objective, a qualitative assessment would be required.

The flow chart in **Figure 4** summarises the process for shortlisting of the metrics.

Figure 4: Metric Evaluation Process
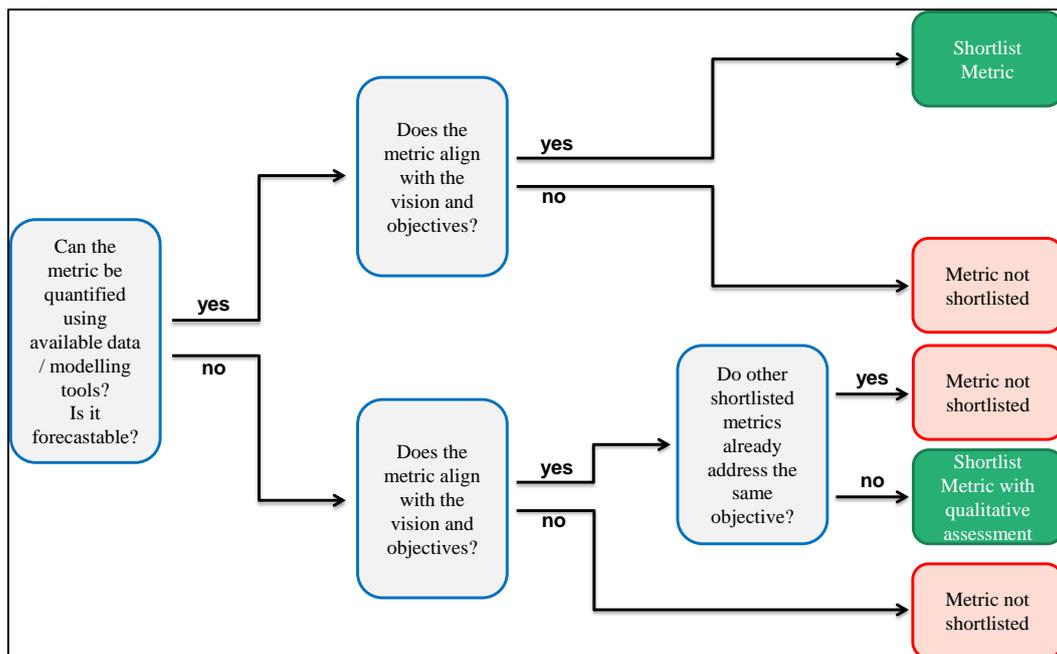
The development of metrics using this approach is presented in the next chapter.

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4 Development of Metrics

This chapter summarises the metrics development process, as follows:

- **Metrics Long List**: a long list of metrics from the GBC Project Brief, best practice (e.g. WebTAG), and review of research papers;
- **Metrics Assessment**: an assessment of the metric with respect to the Metric Quantification review, and the Metric Alignment review (discussed in the previous chapter); and
- **Metrics Shortlist**: a focused introduction to each of the recommended metrics, with further discussion as to how the metrics was developed and assessed.

All metrics were categorised into Mobility, Accessibility, Economy, Environment and Safety. This allowed for direct comparison with the objectives developed for each category, therefore ensuring that the metrics evaluation directly aligns with the overarching vision.

The data for each of the shortlisted metrics for the Baseline and BAU Forecast are presented in Chapter 5.

4.1 Metrics Long List

Table 2 introduces the metrics long list. This is a list of many possible metrics gathered from research of some key sources of information. The metrics long list was developed from the following sources:

- Guildford Borough Council (2013) 'Guildford Town and Approaches Movement Study Invitation to Tender';
- Hickman et al (2012) 'Examining Transport Futures with Scenario Analysis and MCA', Transportation Research Part A 46 (2012) 56-575;
- Litman (2008) 'Sustainable Transportation Indicators: A Recommended Research Program for Developing Sustainable Transportation Indicators and Data', 2009 Transportation Research Board Annual Meeting (Paper 09-3403); and
- UK Department for Transport, 'Transport Analysis Guidance - WebTAG'.

Table 2: Metrics Long List

Ref	Category	Sub-Category	Metric	Source(s)
mob1		Travel Activity	Number of trips in the study area	GBC - GTAMS Invitation to Tender
mob2		Travel Activity	Total distance of trips in the study area	GBC - GTAMS Invitation to Tender
mob3	Mobility	Travel Activity	Modal share, by trips and by distance	GBC - GTAMS Invitation to Tender
mob4		Travel Activity	Metric(s) illustrating route assignment	GBC - GTAMS Invitation to Tender
mob5		Vehicles	Motor vehicle ownership	Litman - Sustainable Transport Indicators
acc1		Town centre	Hansen measure of accessibility to Town Centres by mode	Hickman - Examining Transport Futures
acc2		Hospitals	Hansen measure of accessibility to Hospitals by mode	Hickman - Examining Transport Futures
acc3		Workplaces	Hansen measure of accessibility to Workplaces by mode	Hickman - Examining Transport Futures
acc4		Town centre	2026 households within 20 mins of Town Centres by mode	Hickman - Examining Transport Futures
acc5		Hospitals	2026 households within 20 mins of Hospitals by mode	Hickman - Examining Transport Futures
acc6		Workplaces	2026 households within 20 mins of Workplaces by mode	Hickman - Examining Transport Futures
acc7		Mobility options	Quality of walking, cycling, public transport, driving, taxi, etc	Litman - Sustainable Transport Indicators
acc8	Accessibility	Land use accessibility	Quality of land use accessibility	Litman - Sustainable Transport Indicators
acc9		Mobility substitutes	Internet access and delivery service quality	Litman - Sustainable Transport Indicators
acc10		Key destinations	Distance and time-based accessibility to key town centres / other destinations	GBC - GTAMS Invitation to Tender
acc11		Public transport catchment	To improve access to the transport system	WebTAG Unit 2.5 - AST
acc12		Mode options	To increase option values	WebTAG Unit 2.5 - AST
acc13		Severance	To reduce severance	WebTAG Unit 2.5 - AST
acc14		Basis Accessibility	Quality of accessibility for people with disabilities	Litman - Sustainable Transport Indicators
econ1		Resilience	Journey time reliability	GBC - GTAMS Invitation to Tender
econ2		Delays	Junction delays	GBC - GTAMS Invitation to Tender
econ3		Journey times	Travel time on links, by mode	GBC - GTAMS Invitation to Tender
econ4		Commute Costs	Access to jobs	Hickman - Examining Transport Futures
econ5	Economy	Transport Costs	Consumer expenditures on transport	Litman - Sustainable Transport Indicators
econ6		Infrastructure Costs	Expenditures on roads, public transport, parking, etc	Litman - Sustainable Transport Indicators
econ7		Affordability - Transport	Portion of household budgets needed to provide adequate transport	Litman - Sustainable Transport Indicators
econ8		Affordability - Housing	Affordable housing accessibility	Litman - Sustainable Transport Indicators
econ9		Pricing efficiency	Cost-based pricing	Litman - Sustainable Transport Indicators

Ref	Category	Sub-Category	Metric	Source(s)
env1		Strategic - emissions	Total carbon dioxide emissions by car, LGV, HGV, bus and rail	GBC - GTAMS Invitation to Tender and Hickman - Examining Transport Futures
env2		Local - Noise	Population affected by noise	Hickman - Examining Transport Futures
env3		Local - Noise	Number of households experiencing noise levels above 68db	Hickman - Examining Transport Futures
env4		Local - Noise	Population perceiving a noise nuisance	GBC - GTAMS Invitation to Tender and Hickman - Examining Transport Futures
env5		Local - Air Quality	Air quality impacts	GBC - GTAMS Invitation to Tender and Hickman - Examining Transport Futures
env6	Environment	Local - Air Quality	Number of days of exposure per year	Litman - Sustainable Transport Indicators
env7		Local - Noise	To reduce noise	WebTAG Unit 2.5 - AST
env8		Local - Air Quality	To improve local air quality	WebTAG Unit 2.5 - AST
env9		Strategic - emissions	To reduce greenhouse gases	WebTAG Unit 2.5 - AST
env10		Planning	To protect and enhance the landscape	WebTAG Unit 2.5 - AST
env11		Planning	To protect and enhance the townscape	WebTAG Unit 2.5 - AST
env12		Heritage	To protect the heritage of historic resources	WebTAG Unit 2.5 - AST
env13		Biodiversity	To support biodiversity	WebTAG Unit 2.5 - AST
env14		Water	To protect the water environment	WebTAG Unit 2.5 - AST
env15		Community	To encourage physical fitness	WebTAG Unit 2.5 - AST
env16		Public transport experience	To improve journey ambience	WebTAG Unit 2.5 - AST
saf1		Accidents	Number of personal injury accidents (PIAs)	GBC - GTAMS Invitation to Tender and Hickman - Examining Transport Futures
saf2		Accidents	Number of accidents resulting in slight injury	GBC - GTAMS Invitation to Tender and Hickman - Examining Transport Futures
saf3	Safety	Accidents	Number of accidents resulting in serious injury	GBC - GTAMS Invitation to Tender and Hickman - Examining Transport Futures
saf4		Accidents	Number of accidents involving fatalities	GBC - GTAMS Invitation to Tender and Hickman - Examining Transport Futures

4.2   Metrics Assessment

The metrics long list was assessed to determine which of the metrics are most appropriate and measurable for application on this study.

The process is described in the previous chapter, but in summary each metric was assessed in terms of:

- **Metric Quantification**: Be measureable at existing (~2013) conditions, and can be forecast to 2050.

- **Metric Alignment**: Be aligned with the vision and objectives.

This assessment is presented in **Table 3** to **Table 7** for each respective category.

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Table 3: Mobility Metrics Assessment

Ref	Category	Sub-Category	Metric (as defined at source)	Metric Quantification Process			Metric Alignment		Summary of Metric Assessment	
				Measureable (Existing)	Forecastable (future)	Discussion	*Objective*	Alignment with Objectives	Summary	Shortlisted Metric for GTAMS
mob1		Travel Activity	Number of trips in the study area	Method A: SINTRAM output for 2009 AM/PM peak trips. Method B: Trips per person per year (Surrey), 2002/10 average (National Travel survey data).	A: Can use existing and GTAMS-specific SINTRAM model run outputs for baseline and BAU forecasts as well as to test specific interventions/ scenarios. B: May be able to extrapolate based on historical change and generic assumptions.	A: Is based on SINTRAM output rather than assumptions but is uninformative when a fixed trip matrix is used. B: Provides data for trip rates by purpose, although is for all Surrey residents. Forecasting less straightforward.		Medium - vehicle trips only	Measureable to 2031 using an existing SINTRAM model scenario and to 2050 using the GTAMS-specific model runs. Reasonably well aligned, but cannot be used with a fixed trip matrix.	
mob2	Mobility	Travel Activity	Total distance of trips in the study area	Method A: SINTRAM output for 2009 AM/PM peak vehicle kilometres. Method B: Distance per person per year (Surrey), 2002/10 average (National Travel Survey data).	A: Can use existing and GTAMS-specific SINTRAM model run outputs for baseline and BAU forecasts as well as to test specific interventions/scenarios. B: May be able to extrapolate based on historical change and using generic assumptions.	A: Is based on SINTRAM output rather than assumptions. B: Data for distance travelled by trip purpose. Given sample sizes, data was combined across 2002/10 years to provide an average for Surrey residents. Not feasible to provide an average for Guildford borough residents.	*Provide alternatives to the private car to travel to, from, and within the town.*	Medium - car, LGV and HGV kilometres only	Measureable to 2031 using an existing SINTRAM model scenario and to 2050 using the GTAMS-specific model runs. Reasonably well aligned.	Total vehicle distance within Guildford borough
mob3		Travel Activity	Modal share, by trips and by distance	Modal share for work trips by Guildford borough residents (from 2011 census journey to work data)	May be able to use a basic model of changes to generalised cost but it would not be possible to do this to a level detailed enough to distinguish between different interventions/scenarios.	A link between mode share and the base data will be required for 2031 and 2050 BAU forecasts.	*Increase walking and cycling within the town.*	High - directly relevant to both objectives.	Difficult to measure, but an important metric to consider, and therefore a qualitative assessment is required.	Sustainable mode share for Guildford borough residents' journey to work trips.
mob4		Travel Activity	Metric(s) illustrating route assignment			No data readily available.		Low - route assignment relates more to highway route choices, which is not the focus of the objectives.	Low alignment with objectives - not shortlisted.	
mob5		Vehicles	Motor vehicle ownership	Cars/vans per household (2011 census data)	May be able to extrapolate from past trends (but need to consider recent peak car theory[2]).	Census data provides a reliable estimate of car ownership. A link between car ownership and the base data will be required for 2050 forecasts.		Medium - relevant to both objectives.	Medium alignment, but less informative than other metrics (mode share and vehicle distance).	

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[2] Phil Goodwin. October 2012. Peak Travel, Peak Car and the Future of Mobility: Evidence, Unresolved Issues, Policy Implications, and a Research Agenda. *Discussion Paper No. 2012-13*. Prepared for the *International Transport Forum* Roundtable on Long-Run Trends in Travel Demand 29-30 November 2012.

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Table 4: Accessibility Metrics Assessment

Ref	Category	Sub-Category	Metric (as defined at source)	Metric Quantification Process			Metric Alignment		Summary of Metric Assessment	
				Measureable (Existing)	Forecastable (future)	Discussion	*Objective*	Alignment with Objectives	Summary	Shortlisted Metric for GTAMS
acc1		Town centre	Hansen measure of accessibility to Town Centres by mode	Percentage of households within 30 minutes of town centre by public transport, 2006 - bus accessibility only [not equivalent to the Hansen measure].	No data, although for BAU it could be assumed that it will remain unchanged except for any direct impacts caused by the interventions.	Interesting and useful metric, but data only available for buses, and across Surrey. Significant data analysis would be required to complete for all public transport and to limit to Guildford.		High - town centre focus, and considers non-car modes	Difficult to measure, but high alignment.	Guildford town centre accessibility by non-car modes.
acc2		Hospitals	Hansen measure of accessibility to Hospitals by mode	Percentage of households within 30 minutes of hospital by public transport, 2006 - bus accessibility only [not equivalent to the Hansen measure].	No data, although for BAU it could be assumed that it will remain unchanged except for any direct impacts caused by the interventions.	Useful, although again Surrey wide and only for buses. Could widen to cover other workplaces in Guildford.		High - covers a major Guildford employer.	All of the accessibility to key trip attractors are difficult to measure, but respond well to the objectives. Therefore a bespoke high level accessibility tool is proposed to test accessibility to key employment centres, and to the railway station.	Guildford Railway Station accessibility by non-car modes.
acc3		Workplaces	Hansen measure of accessibility to Workplaces by mode	Average minimum travel time to reach 7 key services (employment centres, primary schools, secondary schools, further education, GPs, hospitals, food stores) by mode (DfT Accessibility Statistics for 2011)	No data, although for BAU it could be assumed that it will remain unchanged except for any direct impacts caused by the interventions.	Useful metric available for three 'mode groups' (public transport or walking, cycling, and car) and available at Guildford level	*Improve accessibility to town centre by non-car modes of transport, in terms of both time and cost.*	High - employment accessibility an important issue.		Surrey Reseach Park accessibility by non-car modes.
acc4	Accessibility	Town centre	2026 households within 20 mins of Town Centres by mode			No data readily available.	*Improve accessibility to employment sites by non-car modes of transport, in terms of both time and cost.*	High - all are comparable with the Hansen measures.		Slyfield Industrial Estate accessibility by non-car modes.
acc5		Hospitals	2026 households within 20 mins of Hospitals by mode			No data readily available.	*Improve accessibility to regional links, particularly to London, and Heathrow and Gatwick airports.*			Guildford Business Park accessibility by non-car modes.
acc6		Workplaces	2026 households within 20 mins of Workplaces by mode			No data readily available.	*Reduce severance of communities within the town caused by transport infrastructure.*			
acc7		Mobility options	Quality of walking, cycling, public transport, driving, taxi, etc			No data readily available.		Medium - objectives relate more to the time/cost implications (less around quality of space).	Difficult to measure, and not the most aligned with objectives.	

Table 4: Accessibility Metrics Assessment (continued)

				Metric Quantification Process			Metric Alignment		Summary of Metric Assessment	
Ref	Category	Sub-Category	Metric (as defined at source)	Measureable (Existing)	Forecastable (future)	Discussion	Objective	Alignment with Objectives	Summary	Shortlisted Metric for GTAMS
acc8		Land use accessibility	Quality of land use accessibility			No data readily available.		Medium - objectives focus more on specific trip attractors (town centre, employment centre).	Difficult to measure, and not the most aligned with objectives.	
acc9		Mobility substitutes	Internet access and delivery service quality	National household access, general local speed info (2012 national access, local quality data).	No data, although could be estimated based on existing trends/changing costs, speed info based on known planned upgrades.	Good quality historical data, although not at ward level for Guildford.		Low - objectives place greater emphasis on infrastructure and transport accesibility	Low alignment with objectives - not shortlisted.	
acc10		Key destinations	Distance and time-based accessibility to key town centres / other destinations			No data readily available.	*Improve accessibility to town centre by non-car modes of transport, in terms of both time and cost.*		Difficult to measure, and not the most aligned with objectives.	
acc11	Accessibility	Public transport catchment	To improve access to the transport system			No data readily available.	*Improve accessibility to employment sites by non-car modes of transport, in terms of both time and cost.*	Medium - objectives focus more on specific trip attractors (town centre, employment centre).	Difficult to measure, and not the most aligned with objectives.	
acc12		Mode options	To increase option values			No data readily available.	*Improve accessibility to regional links, particularly to London, and Heathrow and Gatwick airports.*	Low - and covered under the mobility metrics.	Difficult to measure, and not the most aligned with objectives.	
acc13		Severance	To reduce severance	Number of crossings of the A3, railway line and River Wey, and other barriers (identified as a problem in Guildford Borough Infrastructure Baseline, GBC, July 2013, p. 14) - using available maps.	No data, but will remain the same unless new infrastructure is planned.	Although no data is available, a high level assessment of crossing opportunities and level of severance for non-car modes would be relatively straightforward.	*Reduce severance of communities within the town caused by transport infrastructure.*	High - severance has repeatedly been raised as an issue in Guildford, and reducing severance is an identified objective.	High alignment, and can be tested to a reasonable level of confidence.	Number and amenity of pedestrian and cycle crossings of major transport barriers (e.g. A3, River Wey, Gyratory, Railway lines).
acc14		Basis Accessibility	Quality of accessibility for people with disabilities			No data readily available.		Medium - although an important issue, the accessibility objectives relate more to town and regional connections for all people.	Not highly aligned, but the severance related metric will to some degree address this issue.	

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Table 5: Economy Metrics Assessment

Ref	Category	Sub-Category	Metric (as defined at source)	Metric Quantification Process			Metric Alignment		Summary of Metric Assessment	
				Measureable (Existing)	Forecastable (future)	Discussion	Objective	Alignment with Objectives	Summary	Shortlisted Metric for GTAMS
econ1		Resilience	Journey time reliability	Average vehicular speed data (2009 AM and PM peak period data).	Can use existing and GTAMS-specific SINTRAM model run outputs for baseline and BAU forecasts as well as to test specific interventions/scenarios.	SINTRAM model available to test highway journey performance. Not as relevant for public transport journeys.		High - relating to car journey reliability.	SINTRAM model is able to provide appropriate outputs, well aligned with the objectives.	Highway level of delay.
econ2		Delays	Junction delays	Peak junction delay, vehicle hours per peak period (2009 peak data).	Can use existing and GTAMS-specific SINTRAM model run outputs for baseline and BAU forecasts as well as to test specific interventions/scenarios.			High - relating to car journey reliability.		
econ3		Journey times	Travel time on links, by mode	Bus delay, based on assessment of capacity along bus routes from SINTRAM outputs.	Can use existing and GTAMS-specific SINTRAM model run outputs for baseline and BAU forecasts as well as to test specific interventions/scenarios.	SINTRAM model available to test route utilisation by vehicles along key bus corridors		High - relating to bus journey reliability.	Indicates the impact of the relationship between buses and other vehicles along key bus routes on bus journey times. Not possible to assess travel time/delay on foot or by bike using the SINTRAM model.	Bus level of delay.
econ4	Economy	Commute Costs	Access to jobs	Proportion of jobs in city centre wards and across all wards; percentage of jobs filled by local residents (2009 Inter Departmental Business Register data), and (2001 Census data (both in 2009 Economic Strategy).	No data, but TRICS trip rate data could be applied to any land use proposals to test impact to existing jobs data (for town centre wards).	Measurable, although data is presented in terms of number of jobs (does not provide journey to work or accessibility metrics).	Improve reliability of car journey times to, from and within the town.	Low - and covered under the accessibility metrics.	Not to be progressed.	
econ5		Transport Costs	Consumer expenditures on transport	Percentage of household expenditure on transport for South East region (ONS 2013).	No data, but could forecast using estimated fuel price changes and income growth.	Good existing data, but forecasting would need to be informed by much wider economic factors (could potentially link change to GDP). But assumptions would be required and fuel costs and fare increases.	Improve reliability of public transport journey times to, from and within the town.	Low - objectives focus more on quality and amenity of public transport services.	Low alignment with objectives - not shortlisted.	
econ6		Infrastructure Costs	Expenditures on roads, public transport, parking, etc			Although no existing data, the infrastructure spend could be a relative assessment (i.e. spend on public transport vs. highways, and comparative across the interventions).		Medium - infrastructure spend could be linked to journey reliability.	Include as part of a comparative assessment when evaluating packages of interventions.	
econ7		Affordability - Transport	Portion of household budgets needed to provide adequate transport	Percentage of household expenditure on transport for South East region (ONS 2013).	No data, but could forecast using estimated fuel price changes and income growth.	As per 'econ5', could be forecast but would require assumptions around wider economic factors.		Low - objectives focus more on quality and amenity of public transport services.	Low alignment with objectives - not shortlisted.	
econ8		Affordability - Housing	Affordable housing accessibility			No data readily available.		Low - and accessibility metrics cover access to key trip attractors across the Borough.	Low alignment with objectives - not shortlisted.	
econ9		Pricing efficiency	Cost-based pricing			No data readily available.		Low - objectives focus more on quality and amenity of public transport services.	Low alignment with objectives - not shortlisted.	

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Table 6: Environmental Metrics Assessment

Ref	Category	Sub-Category	Metric (as defined at source)	Metric Quantification Process			Metric Alignment		Summary of Metric Assessment	
				Measureable (Existing)	Forecastable (future)	Discussion	Objective	Alignment with Objectives	Summary	Shortlisted Metric for GTAMS
env1		Strategic - emissions	Total carbon dioxide emissions by car, LGV, HGV, bus and rail	Local and Regional CO2 Emissions Estimates for 2005-2011 (Ricardo-AEA for DECC, 2013).	Could be forecast using estimated changes to vehicle km and DfT fuel efficiency/vehicle fleet appraisal advice.	Existing information on CO2 emissions from transport could be used to determine a rule of thumb relationship between CO2 emissions and vehicle kilometres.		High - responds well to the carbon dioxide emissions objective.	Measureable and aligns well - comparable with env5.	
env2		Local - Noise	Population affected by noise	DEFRA Noise Action Plan (2010) identifies existing areas subject to noise problems.	A relationship between noise emissions and traffic volumes/distance travelled could be estimated from base data, and extrapolated for future scenarios.	Measurable for existing and future scenarios. SINTRAM modelling can be used to establish changes to the number of vehicle trips at noise sensitive locations.		High - noise pollution is directly referenced within the objectives.	Measureable and aligns well.	Noise impacts resulting from traffic on major roads.
env3		Local Noise	Number of households experiencing noise levels above 68db			No data readily available.				
env4		Local - Noise	Population perceiving a noise nuisance			No data readily available.				
env5		Local - Air Quality	Air quality impacts	Background air pollution, Guildford 2010, by pollutant type e.g. PM25 (DEFRA 2010[3]).	Defra have forecasted to 2030.	DEFRA data shows air pollution by cause (road/motorway, industry, rail, etc). Therefore existing relationships to vehicle kilometres could be applied to develop a rule of thumb relationship.	Reduce CO2 emissions from transport in the town.	High - air quality data responds well to the carbon dioxide emissions objective.	Measureable and aligns well. Method assumes no change in the relationship between total vehicle kilometres and air quality impacts between the baseline and BAU years. This approach is acceptable because this assumption will be upheld for each test.	Air quality impact caused by transport in Guildford town.
env6		Air Pollution Exposure	Number of days of exposure per year			No data readily available.	Reduce the proportion of the population affected by transport noise in the town.			
env7	Environment		To reduce noise			No data readily available.				
env8			To improve local air quality			As per env5.	Protect and enhance the townscape of Guildford.			
env9			To reduce greenhouse gases			As per env1.	Protect and enhance the landscape in and around Guildford.			
env10			To protect and enhance the landscape			No data readily available.	Encourage a healthy community through active travel.	High - directly relates to an objective.	Difficult to measure, but an important metric to consider, and therefore a qualitative assessment is required.	Brownfield and greenfield land use impact.
env11			To protect and enhance the townscape			No data readily available.		High - directly relates to an objective.	Difficult to measure, but an important metric to consider, and therefore a qualitative assessment is required.	Urban public realm impact.
env12			To protect the heritage of historic resources			No data readily available.				
env13			To support biodiversity			No data readily available.				
env14			To protect the water environment			No data readily available.				
env15			To encourage physical fitness	How often people walk or cycle for utility purposes in Guildford 2010/11 (DfT 2013[4])	May be able to extrapolate based on existing trend lines, and through forecast mode share.	Baseline and future scenario forecasts can be estimated in parallel with the mobility mode share metric.		High - directly relates to the healthy community objective.	Aligns well, and could be assessed using the mode share data emerging from the analysis undertaken to assess the mobility metrics.	Mode share for Guildford borough residents' journey to work trips.
env16			To improve journey ambience			No data readily available.				

Table 7: Safety Metrics Assessment

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[3] Department for Environment Food and Rural Affairs (DEFRA). 2010. *2010 Based Background Maps for NOx, NO2, PM10 and PM2.5* [online]. Available from: http://laqm.defra.gov.uk/maps/maps2010.html#2010BackgroundMaps
[4] Department for Transport (DfT). 2013. Local area walking and cycling in England 2011/12 and XLS tables [online]. Available from: https://www.gov.uk/government/publications/local-area-walking-and-cycling-in-england-2011-12 (N.B. Excluding the summary sheet, statistics contained in the datasheets are actually for 2010/11)

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| Ref | Category | Sub-Category | Metric (as defined at source) | Metric Quantification Process | | | Metric Alignment | | Summary of Metric Assessment | |
				Measureable (Existing)	Forecastable (future)	Discussion	*Objective*	Alignment with Objectives	Summary	Shortlisted Metric for GTAMS
saf1		Accidents	Number of personal injury accidents (PIAs)	Total number of accidents reported to police 2012, Guildford District LA (STATS19 2012 data).	May be able to extrapolate based on existing trend lines	Relationship could be reached between existing accident data and total vehicle kilometres from SINTRAM outputs for the 2009 baseline, then applied to SINTRAM outputs for the 2031 and 2050 BAU and for specific interventions/scenarios.	*Reduce the number of Killed or Seriously Injured (KSI) accidents in the Borough.*	High - metrics directly correlate with the objectives.	All have high alignment and are measureable. Method assumes no change in the relationship between total vehicle kilometres and accident rates between the baseline and BAU years. This approach is acceptable because this assumption will be upheld for each test.	Number of accidents resulting in Killed or Seriously Injured (KSI).
saf2	Safety	Accidents	Number of accidents resulting in slight injury	Total number of accidents reported to police 2012, Guildford District LA (STATS19 2012 data).	May be able to extrapolate based on existing trend lines					
saf3		Accidents	Number of accidents resulting in serious injury	Total number of accidents reported to police 2012, Guildford District LA (STATS19 2012 data).	May be able to extrapolate based on existing trend lines					
saf4		Accidents	Number of accidents involving fatalities	Total number of accidents reported to police 2012, Guildford District LA (STATS19 2012 data).	May be able to extrapolate based on existing trend lines					

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4.3   Metrics Shortlist

The shortlisted metrics resulting from the assessment presented above are summarised in **Table 8**.

Table 8: Metrics Shortlist

Objective	Metric	Geo-graphical Coverage	SINTRAM model outputs, data and approach used for metric appraisal	
			Intermediate and Major Highway Schemes & Packages of Sustainable Transport Interventions	**Other Interventions**
Mobility				
Provide alternatives to the private car to travel to, from, and within the town. Increase walking and cycling within the town.	Total vehicle distance within Guildford borough	Borough	SINTRAM model data	Professional judgement
	Mode share for Guildford borough residents' journey to work trips.	Borough	Professional judgement	Professional judgement
Accessibility				
Improve accessibility to town centre by non-car modes of transport, in terms of both time and cost.	Guildford town centre, Guildford Railway Station, Surrey Research Park, Slyfield Industrial Estate and Guildford Business Park accessibility by non-car modes.	Town	SINTRAM model data	Professional judgement

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Objective	Metric	Geo-graphical Coverage	SINTRAM model outputs, data and approach used for metric appraisal	
			Intermediate and Major Highway Schemes & Packages of Sustainable Transport Interventions	Other Interventions
Improve accessibility to employment sites by non-car modes of transport, in terms of both time and cost. Improve accessibility to regional links, particularly to London, and Heathrow and Gatwick airports. Reduce severance of communities within the town caused by transport infrastructure.	Number and amenity of pedestrian and cycle crossings of major transport barriers (e.g. A3, River Wey, Gyratory, Railway lines).	Town	Professional judgement	Professional judgement
Economy				
Improve reliability of car journey times to, from and within the town. Improve reliability of public transport journey times to, from and within the town.	Highway level of delay	Borough	SINTRAM model data	Professional judgement
	Bus level of delay	Town	SINTRAM model data	Professional judgement

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Objective	Metric	Geographical Coverage	SINTRAM model outputs, data and approach used for metric appraisal	
			Intermediate and Major Highway Schemes & Packages of Sustainable Transport Interventions	Other Interventions
Environment				
Reduce CO2 emissions from transport in the town.	Air quality impact caused by transport in Guildford town	Borough	SINTRAM model data	Professional judgement
Reduce the proportion of the population affected by transport noise in the town.	Noise impact resulting from traffic on major roads	Borough	SINTRAM model data	Professional judgement
Protect and enhance the townscape of Guildford.	Brownfield and greenfield land use impact	Borough	Professional judgement	Professional judgement
Protect and enhance the landscape in and around Guildford.	Urban public realm impact	Town	Professional judgement	Professional judgement
Encourage a healthy community through active travel.				
Safety				
Reduce the number of Killed or Seriously Injured (KSI) accidents in the borough.	Number of accidents resulting in Killed or Seriously Injured (KSI)	Borough	SINTRAM model data	Professional judgement

The next chapter presents the Baseline and Business-As-Usual Forecast for each of these metrics.

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5 Baseline and Business-As-Usual Forecast

This chapter presents the Baseline and Business-As-Usual forecast data using the shortlisted metrics identified in the previous chapter.

5.1 Definitions

For each metric, the **Baseline** represents the existing situation. The baseline year and source of information varies by metric, as it depends on the most recent year and source of information available.

The **Business-As-Usual (BAU)** represents an estimate for how Guildford's transport system will perform in future without intervention. The BAU was forecast for each metric in 2031 and 2050.

The metrics and their assessment were constrained by the availability of assessment tools. Where possible, Surrey County Council's SINTRAM strategic highway model was used as the basis for assessment.

5.2 Data Sources and Tools

The sources of data information for each Baseline and BAU Forecast vary by metric, depending on availability.

The forecasting of metrics was constrained by the availability of assessment tools. For the study, SINTRAM, configured as a highways-only model which includes cars, HGVs and LGVs but no other modes of transport, was the only transport model available to the study team. Where possible, SINTRAM was used to forecast metrics.

There were no other readymade tools for forecasting various other metrics, including sustainable mode share and the accessibility of destinations. For these metrics, relatively simplistic approaches were developed (e.g. accessibility assessment based on bus timetable information, combined with forecast highway vehicle speed changes in the SINTRAM scenarios) or professional judgements were made to give qualitative assessments.

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5.3 Business-As-Usual Definition

5.3.1 Infrastructure Assumptions

The Business-As-Usual Forecast assumes the following infrastructure schemes:

Strategic Road Network

The Highways Agency has no committed plans to improve traffic management, network management or to increase capacity of the A3 trunk road in the borough.

A new Onslow park-and-ride site, promoted by Surrey County Council and Guildford Borough Council, opened in November 2013. It intercepts traffic approaching the town along the A3 and A31 Hog's Back from the west, which should help reduce congestion on the A3 between the Stag Hill interchange junction and the Wooden Bridge junction.

Local Road Network

The Onslow park-and-ride site (described above), opened in November 2013. The approach to the new site is via the Egerton Road/Gill Avenue/Richard Meyjes Road junction.

Bus, P&R and Coach Services

The Surrey TravelSMART project, funded by the Local Sustainable Transport Fund (LSTF), will deliver bus priority and corridor improvements along the following routes in the period to March 2015:

- University of Surrey, Royal Surrey County Hospital and Surrey Research Park to Guildford town centre
- Aldershot to Guildford town centre
- Woking to Guildford town centre
- Slyfield industrial estate to Guildford town centre
- Burpham to Guildford town centre
- Merrow to Guildford town centre
- Godalming to Guildford town centre
- Shalford / Cranleigh to Guildford town centre
- Farnham to Guildford town centre

Train Services

There are two limited, committed schemes for the South West Main Line in the short term:

- Train lengthening – to be used on various services including from Guildford, Aldershot, Portsmouth and Alton.
- Further capacity improvements at London Waterloo station.

Source: based on the Guildford Borough Infrastructure Baseline, Guildford Borough Council, July 2013.

5.3.2 Application of SINTRAM Strategic Highway Model

Surrey County Council's SINTRAM strategic highway model was used to inform the 2031 and 2050 BAU scenarios, producing data used to calculate the relevant metrics.

A fuller description of the SINTRAM strategic highway model is given in the 'Guildford Borough Preliminary Growth Scenarios Transport Assessment Report' (Surrey County Council, August 2013).

Further details of the 2009 Baseline and the 2031 and 2050 BAU scenarios are provided below.

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5.3.2.1   2009 Baseline Scenario

Arup undertook a new model run for the 2009 Baseline scenario utilising the 2009 base network and trip matrix prepared by Surrey County Council for the Preliminary Growth Scenarios Transport Assessment (as detailed in the Guildford Borough Preliminary Growth Scenarios Transport Assessment Report (Surrey County Council, August 2013).

5.3.2.2   2031 BAU Scenario

Arup undertook a new model run for the 2031 BAU scenario derived from the 2031 Scenario 1 trip matrix as reported in the Preliminary Growth Scenarios Transport Assessment Report (Surrey County Council, August 2013).

This scenario represents the following:

- For Guildford borough:
  - Trips associated with new developments in the borough which had received planning permission by April 2012 (replacing the trips associated with the existing land uses for the sites of these new developments);
  - Trips associated with the existing land uses in all other places in the borough;
  - Plus background growth to 2031 in trips resulting from changes in demographic profile and car ownership in the borough using Department for Transport forecasts.
- For the rest of the country, trips representing full development in the rest of the United Kingdom to 2031, including background growth, using Department for Transport forecasts.

The use of this scenario was agreed with the study's Steering Group in October 2013. The alternative of using another of the various scenarios which included potential future development sites was rejected, as at that stage GBC had not identified a proposed spatial development strategy to 2031. Also, given the number of potential interventions to be tested, it was not considered efficient to select more than one scenario as the GTAMS study's 2031 BAU.[5]

As outlined above, the scenarios in the SINTRAM strategic highway model used forecast data from the Department for Transport. Specifically this data was the NTEM (National Trip End Model) 6.2 dataset in conjunction with TEMPro (Trip End Model Presentation Programme) 6.2, as described in the Preliminary Growth Scenarios Transport Assessment Report (Surrey County Council, August 2013). NTEM datasets are long-term forecasts. They represent the Department for Transport's best estimate of the long-term response to demographic and economic trends. Forecasts such as NTEM datasets are always subject to uncertainty.

The SINTRAM strategic highway model covering Guildford borough was validated for the weekday average AM peak hour and the average PM peak hour. Such modelling of the peak periods is Surrey County Council's standard practice

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[5] A proposed spatial development strategy was identified in the Draft Guildford borough Local Plan: Strategy and Sites (GBC, July 2014). GBC proposes to test a number of shortlisted interventions with respect to the emerging Local Plan spatial development strategy in due course.

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in its strategic transport assessments of Local Plan spatial development strategy scenarios.

5.3.2.3   2050 BAU Scenario

There was no existing 2050 scenario in SINTRAM. The 2050 BAU scenario was developed specifically for this study.

The approach to develop the 2050 BAU scenario was to estimate the future travel demand by extrapolating the number of trips in each model zone from 2009 to 2031 forwards to 2050. The 2009-2031 annual trip growth rate was calculated and applied to the 2031 trips for the appropriate number of years to get to 2050. Once done for all zones, this gives the total estimated demand for 2050.

The transport network remained the same, as per the 2031 BAU scenario, assuming no further transport interventions beyond the committed schemes already included in 2031.

5.4   Baseline and Business-As-Usual Forecast

This section presents the 2009 Baseline and Business-As-Usual Forecasts for 2031 and 2050 for each of the metrics:

- Total vehicle distance within Guildford borough;
- Sustainable mode share for Guildford borough residents' journey to work trips;
- Highway level of delay;
- Air quality impact caused by transport in Guildford town;
- Noise impact resulting from traffic on major roads;
- Brownfield and greenfield land use impact;
- Number of accidents resulting in Killed or Seriously Injured (KSI);
- Guildford town centre accessibility by non-car modes;
- Guildford Railway Station accessibility by non-car modes;
- Surrey Research Park accessibility by non-car modes;
- Slyfield Industrial Estate accessibility by non-car modes;
- Guildford Business Park accessibility by non-car modes;
- Bus level of delay;
- Urban public realm impact; and
- Number and amenity of pedestrian and cycle crossings of major transport barriers (e.g. A3, River Wey, Gyratory, Railway lines).

For each metric, the data is displayed in a table with a description of the measurement and forecast of the metric, with data sources and calculation methods, followed by the Baseline and BAU Forecast data.

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5.4.1 Mobility Metrics

Total vehicle distance within Guildford borough

Vehicle distance data is an output of the Arup model runs carried out using Surrey County Council's SINTRAM strategic highway model for each of the scenarios; namely the 2009 Baseline and the 2031 and 2050 BAU scenarios.

The impact of Intermediate and Major Highway Schemes and Packages of Sustainable Transport Interventions will be assessed through analysis of SINTRAM outputs.

For Other Interventions, which cannot be modelled in SINTRAM, a professional judgement of the expected impact on total vehicle distance was made.

Data sources and tools:

- Arup model runs using SCC's SINTRAM strategic highway model, version 6, in conjunction with OmniTRANS version 6.0.10 transport modelling software.

Baseline and Business-As-Usual Data

Year	Total vehicle distance (kilometres), AM Peak Hour - Average weekday (07:00-10:00)	Percentage change from 2009 baseline (AM)	Total vehicle distance (kilometres), PM Peak Hour - Average weekday (16:00-19:00)	Percentage change from 2009 baseline (PM)	Total vehicle distance (kilometres), AM and PM Peak Hours - Average weekday	Percentage change from 2009 baseline (AM and PM)
2009 Baseline	514424	0%	520621	0%	1035045	0%
2031 BAU	568681	11%	591687	14%	1160369	12%
2050 BAU	672818	31%	978372	88%	1651190	60%

Sustainable mode share for Guildford borough residents' journey to work trips

The recently released journey to work data from the 2011 Census provides a useful baseline for peak period trips and is available at a borough level.

In order to forecast sustainable mode share for the 2031 and 2050 BAU scenarios, the following approach was adopted:

1) 2009 and 2031 SINTRAM vehicle trip forecasts used to establish a baseline estimate of growth for vehicle movements (a CAGR of <0.2%).

2) Population and employment growth projections (from Appendix C: Base Data) used to establish overall trip growth to 2031 (~1.1% CAGR).

3) With future car trips fixed as per the SINTRAM forecast, other non-car modes are factored by applying these growth rates to the baseline trip volumes to give a forecast BAU trip volume for each mode.

4) These BAU trip volumes are then converted to mode share for comparison.

5) Mode share for all modes is then assumed to remain constant from 2031 to 2050; this assumes that growth in trips is distributed across all modes proportionally from 2031 onwards. The resulting forecast mode shares for 'train', 'bus, minibus or coach', 'bicycle' and 'on foot', together, represent forecast sustainable mode share for 2031 and 2050 in the BAU scenarios.

6) In the Appraisal of Interventions stage, the BAU Forecast for 2031 and 2050, compared to the 2009 Baseline, is qualitative scored as 'Slight increase' in Sustainable mode share.

Because SINTRAM is a strategic highway model rather than a multi-modal model it is not possible to assess the impact of interventions on mode choice within the model for the purpose of appraising the interventions. Instead, a qualitative assessment of the impact of each intervention on sustainable mode share is carried out for the appraisal.

Data sources and tools:

- Guildford Borough Preliminary Growth Scenarios Transport Assessment Report (Surrey County Council, August 2013) – SINTRAM model outputs.

- Employment and population base data (see Appendix C).

Baseline and Business-As-Usual Data

Journey to Work Mode	2009 Baseline	2031 BAU	Change to 2009	2050 BAU	Change to 2009
Works mainly at or from home	7.8%	9.2%	1.5%	9.2%	1.5%
Underground, metro, light rail or tram	0.3%	0.4%	0.1%	0.4%	0.1%
Train	11.3%	13.5%	2.1%	13.5%	2.1%
Bus, minibus or coach	3.4%	4.1%	0.6%	4.1%	0.6%
Taxi or minicab	0.2%	0.3%	0.0%	0.3%	0.0%
Driving a car or van	57.3%	50.4%	-6.9%	50.4%	-6.9%
Passenger in a car or van	3.7%	3.2%	-0.4%	3.2%	-0.4%
Motorcycle, scooter or moped	0.8%	0.9%	0.1%	0.9%	0.1%
Bicycle	2.6%	3.1%	0.5%	3.1%	0.5%
On foot	12.0%	14.3%	2.3%	14.3%	2.3%
Other	0.6%	0.7%	0.1%	0.7%	0.1%
Sustainable mode share total	*29.6%*	*35.2%*	*5.6%*	*35.2%*	*5.6%*
Total	129.6%	100.0%		100.0%	

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5.4.2   Accessibility Metrics

Guildford town centre accessibility by non-car modes

Analysis of bus journey times to the town centre (bus station) was undertaken to establish a Baseline, which serves as a proxy of the level of accessibility from different areas of the town and beyond, to the north, south, east and west. This provided information on bus services from these directions, the peak and off-peak service frequencies, and the journey time to the town centre. Appendix D provides further information on the methodology used to analyse bus journey times.

TravelSMART bus priority and corridor improvement initiatives may result in reduced journey times; however, quantified impacts or an updated timetable are not readily available. As such, the Baseline is based on the 2013 timetable. The 2031 and 2050 BAU forecasts assume increased journey times in line with the SINTRAM forecast highway speed reductions along the routes utilised by buses to the town centre. The journey times reflect the longest times in either the AM or PM peak period, and in whichever direction is the peak.

Data sources and tools:

- Surrey County Council Bus Maps and Timetables.

- Arup model runs using SCC's SINTRAM strategic highway model, version 6, in conjunction with OmniTRANS version 6.0.10 transport modelling software.

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Baseline and Business-As-Usual Data

Direction:	North	South	East	West
Destination:	Jacobs Well	Godalming	Burpham	Park Barn
Service number	34/35	70/71/72/46	36/37	4/5/17/26/27
Peak frequency (buses per hour)	3	4	6	12
Off-peak frequency (buses per hour)	3	5	6	12
Maximum base journey time (as timetabled)	28	38	38	25
Baseline Trip Time - 2013 (minutes)	28 mins	38 mins	38 mins	25 mins
Business-as-Usual Trip Time - 2031 (minutes)	29 mins	39 mins	39 mins	25 mins
Business-as-Usual Trip Time - 2050 (minutes)	34 mins	46 mins	46 mins	30 mins

Guildford Railway Station accessibility by non-car modes

Analysis of bus journey times to Guildford Railway Station has been undertaken to establish a Baseline, which serves as a proxy of the level of accessibility from different areas of the town and beyond, to the north, south, east and west. This provided information on bus services from these directions, the peak and off-peak service frequencies, and the journey time to the railway station. Appendix D provides further information on the methodology used to analyse bus journey times.

TravelSMART bus priority and corridor improvement initiatives may result in reduced journey times, however, quantified impacts and updated timetable are not readily available. As such, the Baseline is based on the 2013 timetable. The 2031 and 2050 BAU forecasts assume increased journey times in line with the SINTRAM forecast highway speed reductions along the routes utilised by buses to Guildford Railway Station. The journey times reflect the longest times in either the AM or PM peak period, and in whichever direction is the peak. Where a change is required or there is no direct service, service frequency was used to establish an average waiting time (half the headway) which is included in the calculation.

Data sources and tools:

- Surrey County Council Bus Maps and Timetables.

- Arup model runs using SCC's SINTRAM strategic highway model, version 6, in conjunction with OmniTRANS version 6.0.10 transport modelling software.

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Baseline and Business-As-Usual Data

Direction:	North	South	East	West	Town Centre
Destination:	*Jacobs Well*	*Godalming*	*Burpham*	*Park Barn*	*Bus Station*
Service number	walk to Friary Bus Station then 34/35	46	walk to Friary Bus Station then 36/37	4,5,17,26,27	only 0.4 miles
Peak frequency (buses per hour)	3	1	3	8	~
Off-peak frequency (buses per hour)	3	1	3	8	~
Baseline Trip Time - 2013 (minutes)	Walk to Friary Bus Station = 10 mins + 10 mins avg wait + 28 mins travel = **48 mins**	**36 mins**	Walk to Friary Bus Station = 10 mins + 10 mins avg wait + 38 mins travel = **58 mins**	**22 mins**	**10 mins walk**
Business-as-Usual Trip Time - 2031 (minutes)	**49 mins**	**37 mins**	**59 mins**	**22 mins**	**10 mins walk**
Business-as-Usual Trip Time - 2050 (minutes)	**55 mins**	**41 mins**	**67 mins**	**25 mins**	**10 mins walk**

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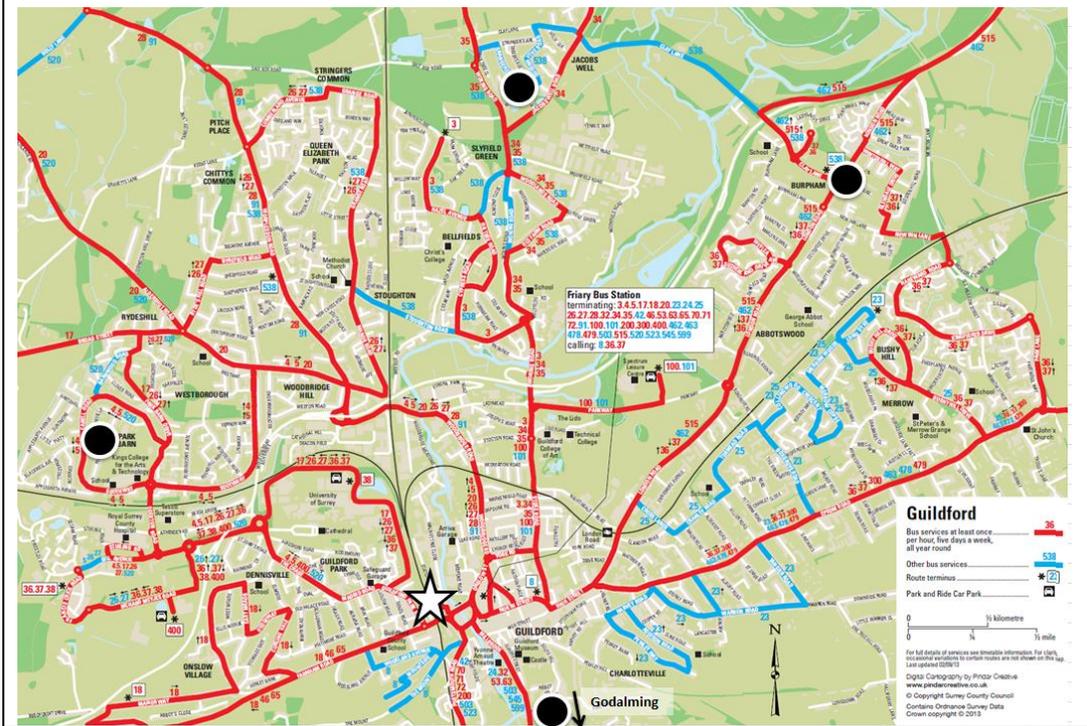
Surrey Research Park accessibility by non-car modes

Analysis of bus journey times to the Surrey Research Park has been undertaken to establish a Baseline, which serves as a proxy of the level of accessibility from different areas of the town and beyond, to the north, south, east and west. This provided information on bus services from these directions, the peak and off-peak service frequencies, and the journey time to the Surrey Research Park. Appendix D provides further information on the methodology used to analyse bus journey times.

TravelSMART bus priority and corridor improvement initiatives may result in reduced journey times, however, quantified impacts and updated timetable are not readily available. As such, the Baseline is based on the 2013 timetable. The 2031 and 2050 BAU forecasts assume increased journey times in line with the SINTRAM forecast highway speed reductions along the routes utilised by buses to the Surrey Research Park. The journey times reflect the longest times in either the AM or PM peak period, and in whichever direction is the peak. Where a change is required, service frequency is used to establish an average waiting time (half the headway) which is included in the calculation.

Data sources and tools:

- Surrey County Council Bus Maps and Timetables.

- Arup model runs using SCC's SINTRAM strategic highway model, version 6, in conjunction with OmniTRANS version 6.0.10 transport modelling software.

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Baseline and Business-As-Usual Data

Direction:	North	South	East	West	Town Centre
Destination:	Jacobs Well	Godalming	Burpham	Park Barn	Bus Station
Service number	36/37 - then transfer at Friary Bus Station to 34/35.	36/37 - then transfer at Friary Bus Station to 70/71/72/46.	36/37	4/5/17/26/27	36/37
Peak frequency (buses per hour) bus 1	3	3	3	12	3
Off-peak frequency (buses per hour) bus 1	3	3	3	12	3
Peak frequency (buses per hour) bus 2	3	4	~	~	~
Off-peak frequency (buses per hour) bus 2	3	5	~	~	~
Bus time (bus 1)	20	20	44	10	20
Bus time (bus 2)	28	38	~	~	~
Transfer time (based on lowest frequency)	10	10	~	~	~
Baseline Trip Time - 2013 (minutes)	20 mins + 28 + 10 mins transfer time = **58 mins**	20 mins + 38 + 10 mins transfer time = **68 mins**	**44 mins**	**10 mins**	**20 mins**
Business-as-Usual Trip Time - 2031 (minutes)	**59 mins**	**69 mins**	**45 mins**	**10 mins**	**20 mins**
Business-as-Usual Trip Time - 2050 (minutes)	**67 mins**	**79 mins**	**51 mins**	**12 mins**	**23 mins**

Slyfield Industrial Estate accessibility by non-car modes

Analysis of bus journey times to the Slyfield Industrial Estate has been undertaken to establish a Baseline, which serves as a proxy of the level of accessibility from different areas of the town and beyond, to the north, south, east and west. This provided information on bus services from these directions, the peak and off-peak service frequencies, and the journey time to the Slyfield Industrial Estate. Appendix D provides further information on the methodology used to analyse bus journey times.

TravelSMART bus priority and corridor improvement initiatives may result in reduced journey times, however, quantified impacts and updated timetable are not readily available. As such, the Baseline is based on the 2013 timetable. The 2031 and 2050 BAU forecasts assume increased journey times in line with the SINTRAM forecast highway speed reductions along the routes utilised by buses to the Slyfield Industrial Estate. The journey times reflect the longest times in either the AM or PM peak period, and in whichever direction is the peak. Where a change is required, service frequency is used to establish an average waiting time (half the headway) which is included in the calculation.

Data sources and tools:

- Surrey County Council Bus Maps and Timetables.

- Arup model runs using SCC's SINTRAM strategic highway model, version 6, in conjunction with OmniTRANS version 6.0.10 transport modelling software.

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Baseline and Business-As-Usual Data

Direction:	North	South	East	West	Town Centre
Destination:	*Jacobs Well*	*Godalming*	*Burpham*	*Park Barn*	*Bus Station*
Service number	34/35	34/35 - then transfer at Friary Bus Station to 70/71/72/46	34/35 - then transfer at Friary Bus Station to 36/37	34/35 - then transfer at Friary Bus Station to 4/5/17/26/27	34/35
Peak frequency (buses per hour)	3	3	3	3	3
Off-peak frequency (buses per hour)	3	3	3	3	3
Peak frequency (buses per hour) bus 2	~	4	3	8	~
Off-peak frequency (buses per hour) bus 2	~	5	3	8	~
Bus time (bus 1)	4	24	24	24	24
Bus time (bus 2)	~	38	38	25	~
Transfer time (based on lowest frequency)	~	10	5	4	~
Baseline Trip Time - 2013 (minutes)	**4 mins**	24 + 38 + 10 mins transfer time = **72 mins**	24 + 38 + 5 mins transfer time = **67 mins**	24 + 25 + 4 mins transfer time = **53 mins**	**24 mins**
Business-as-Usual Trip Time - 2031 (minutes)	**4 mins**	**73 mins**	**68 mins**	**54 mins**	**24 mins**
Business-as-Usual Trip Time - 2050 (minutes)	**5 mins**	**83 mins**	**77 mins**	**61 mins**	**28 mins**
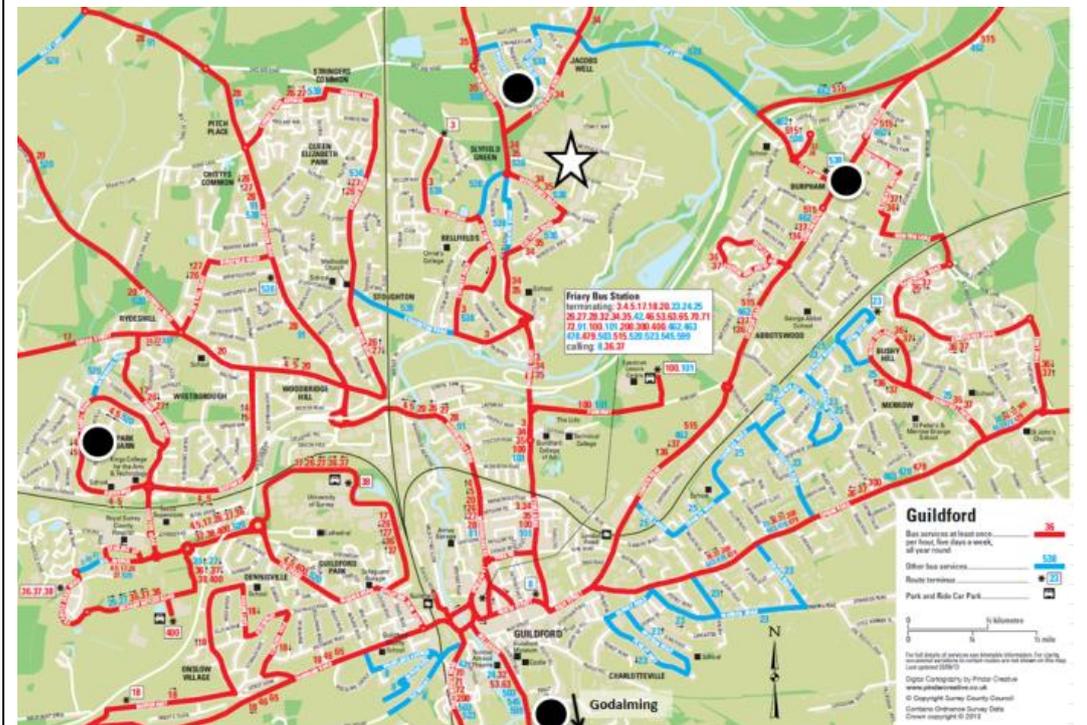
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Guildford Business Park accessibility by non-car modes

Analysis of bus journey times to the Guildford Business Park has been undertaken to establish a Baseline, which serves as a proxy of the level of accessibility from different areas of the town and beyond, to the north, south, east and west. This provided information on bus services from these directions, the peak and off-peak service frequencies, and the journey time to the Guildford Business Park. Appendix D provides further information on the methodology used to analyse bus journey times.

TravelSMART bus priority and corridor improvement initiatives may result in reduced journey times, however, quantified impacts and updated timetable are not readily available. As such, the Baseline is based on the 2013 timetable. The 2031 and 2050 BAU forecasts assume increased journey times in line with the SINTRAM forecast highway speed reductions along the routes utilised by buses to the Guildford Business Park. The journey times reflect the longest times in either the AM or PM peak period, and in whichever direction is the peak. Where a change is required, service frequency is used to establish an average waiting time (half the headway) which is included in the calculation.

A dedicated courtesy shuttle bus runs regularly to Guildford mainline station and town centre, with up to 6 services an hour at peak times. This provision is included within the peak hour analysis.

Data sources and tools:

- Surrey County Council Bus Maps and Timetables.

- Arup model runs using SCC's SINTRAM strategic highway model, version 6, in conjunction with OmniTRANS version 6.0.10 transport modelling software.

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Baseline and Business-As-Usual Data

Direction:	North	South	East	West	Town Centre
Destination:	*Jacobs Well*	*Godalming*	*Burpham*	*Park Barn*	*Bus Station*
Service number	4/5/20/26/27/28/ shuttle - then transfer at Friary Bus Station to 34/35.	4/5/20/26/27/28/ shuttle - then transfer at Friary Bus Station to 70/71/72/46	4/5/20/26/27/28/ shuttle - then transfer at Friary Bus Station to 36/37	4/5/20/26/27/28/ shuttle - then transfer at Friary Bus Station to 4/5/17/26/27	4/5/20/26/27/28 + shuttle services
Peak frequency (buses per hour)	21	21	21	21	21
Off-peak frequency (buses per hour)	15	15	15	15	15
Peak frequency (buses per hour) bus 2	3	4	3	8	~
Off-peak frequency (buses per hour) bus 2	3	5	3	8	~
Bus time (bus 1)	13	13	13	13	13
Bus time (bus 2)	28	38	38	25	~
Transfer time (based on lowest frequency)	10	8	10	4	~
Baseline Trip Time - 2013 (minutes)	13 + 28 + 10 mins transfer time = **51 mins**	13 + 38 + 8 mins transfer time = **59 mins**	13 + 38 + 10 mins transfer time = **61 mins**	13 + 25 mins + 4 mins transfer time = **42 mins**	**13 mins**
Business-as-Usual Trip Time - 2031 (minutes)	**52 mins**	**60 mins**	**62 mins**	**43 mins**	**13 mins**
Business-as-Usual Trip Time - 2050 (minutes)	**64 mins**	**74 mins**	**76 mins**	**52 mins**	**16 mins**

Overall accessibility by non-car modes

The overall metric representing accessibility by non-car modes gives an indication of the relative change in accessibility levels between the Baseline and the BAU scenarios.

This is calculated by taking the percentage change in trip times for each location and calculating the average change across all locations to give an average for the scenario. These data are presented below.

As with the BAU scenarios, the impact of Intermediate and Major Highway Schemes and Packages of Sustainable Transport Interventions on bus journey times was assessed through analysis of SINTRAM outputs.

For Other Interventions which cannot be modelled in SINTRAM, a professional judgement of the expected impact on bus journey times was made.

Baseline and Business-As-Usual Data

Location	Average percentage change in bus trip times for all routes studied (2031 BAU)	Average percentage change in bus trip times for all routes studied (2050 BAU)
Guildford town centre	1.8%	20.8%
Surrey Research Park, Onslow	1.8%	16.0%
Slyfield Industrial Estate, Stoke	1.2%	15.2%
Guildford Business Park, Onslow	1.7%	24.7%
Guildford Railway Station	1.7%	15.2%
Average across all locations	1.7%	18.4%

Note: Average change in bus trip times refers to all routes studied between N, E, S, W, Town Centre and the location specified, for example Surrey Research Park.

Number and amenity of pedestrian and cycle crossings of major transport barriers (e.g. A3, River Wey, Gyratory, Railway lines)

The opportunities for pedestrians and cyclists to cross the major transport barriers via bridges, subways or underpasses, or at-grade facilities was assessed. This includes crossings suitable for pedestrians and/or cyclists that are either provided as part of a road crossing of one of the barriers (where there is specific provision for pedestrians in the form of a pavement, e.g. Bridge Street over the River Wey) or as a separate pedestrian and/or cyclist crossing of one of the barriers (e.g. Yorkies Bridge over the railway lines).

Given that there are no committed proposals for the introduction, removal or replacement of crossing points, the BAU forecasts for 2031 and 2050 are assumed to be the same as the Baseline.

The assessment of interventions considered changes to both the number and amenity of crossings relative to the relevant BAU scenario. For example, for the A3 Widening intervention, the assessment was for an increase in severance, because although it was assumed that the number of crossings of the A3 trunk road would remain the same, the A3 trunk road – one of the barriers assessed in this metric – is widened and therefore the amenity of pedestrian and cycle crossings is reduced.

Baseline and Business-As-Usual Data
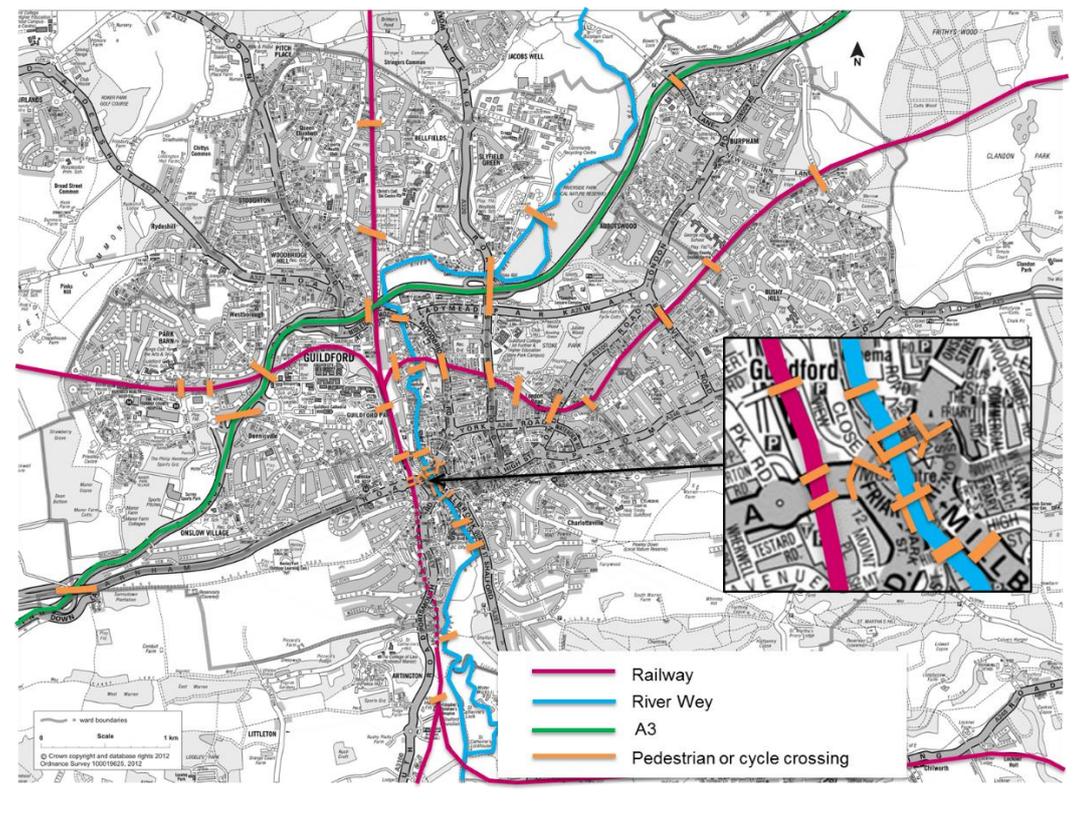
5.4.3   Economy Metrics

Highway level of delay

The 'highway level of delay' metric is the sum of the total delay time in minutes at each junction in Guildford borough that is represented in the SINTRAM model for the AM and PM peak periods combined.

For each turn on a junction (node) a delay is calculated by the model. Subsequently, for each turning movement this value is multiplied with the volume (load) on that turn. These values are summed for the whole junction and divided by the sum of the loads. This produces a weighted average delay for the junction. Delay time is extracted from the model for each junction in Guildford borough for a given period (AM or PM) and the sum of this delay time across all nodes is calculated to give a total for the period. This is then added to the other period to give total delay time for the scenario.

The impact of Intermediate and Major Highway Schemes and Packages of Sustainable Transport Interventions on junction delay was assessed through analysis of SINTRAM outputs.

For Other Interventions, which cannot be modelled in SINTRAM, a professional judgement of the expected impact on junction delay was made.

Data sources and tools:

- Arup model runs using SCC's SINTRAM strategic highway model, version 6, in conjunction with OmniTRANS version 6.0.10 transport modelling software.

Baseline and Business-As-Usual Data

Time period / Year	2009 Baseline	2031 BAU	Percentage change 2009-2031	2050 BAU	Percentage change 2009-2050
AM Peak Hour - Average weekday (07:00-10:00)	7465	8282	11%	11740	57%
PM Peak Hour - Average weekday (16:00-19:00)	7202	8257	15%	42080	484%
Both	14667	16539	13%	53820	267%

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Bus level of delay

The level of delay for public transport was assessed through:

- A review of the primary bus services to understand which roads are key for bus reliability within the highway network.

- Analysis of the SINTRAM outputs to establish which of these roads are operating near capacity, or are likely to near capacity for forecast demand scenarios.

- Calculating the average % utilisation (traffic volume / capacity) on the main bus routes, which is a metric for understanding the likelihood of delay occurring to bus services. Both AM and PM flows were assessed.

The impact of Intermediate and Major Highway Schemes and Packages of Sustainable Transport Interventions was assessed through analysis of the % utilisation for these key bus routes. For Other Interventions which cannot be modelled in SINTRAM, a professional judgement of the expected impact on delay to buses was made.

Data sources and tools:

- Arup model runs using SCC's SINTRAM strategic highway model, version 6, in conjunction with OmniTRANS version 6.0.10 transport modelling software.

- Surrey County Council Bus Maps and Timetables.

Baseline and Business-As-Usual Data

Bus route section	Bus routes that utilise this section	Direction	Volume to capacity ratio (AM)			Volume to capacity ratio (PM)			Direction	Volume to capacity ratio (AM)			Volume to capacity ratio (PM)		
			2009	2031	2050	2009	2031	2050		2009	2031	2050	2009	2031	2050
Egerton Rd	4, 5, 17, 26, 27, 36, 37, 38, 400, 520	1	0.76	0.64	0.79	0.27	0.38	1.38	2	0.30	0.24	0.51	0.71	0.71	1.69
Southway (2)	4, 5	1	0.24	0.12	0.32	0.00	0.01	0.17	2	0.12	0.07	0.24	0.06	0.06	0.71
A323 Aldershot Rd	20, 4, 5	1	0.45	0.50	0.68	0.72	0.83	1.29	2	0.98	1.04	1.26	0.99	1.02	1.29
A322 Worplesdon Rd	26, 27, 28, 91, 538	1	0.92	0.97	1.28	0.90	0.92	1.66	2	0.72	0.77	0.90	0.85	0.95	1.19
A25 Midleton Rd	4, 5, 20, 26, 27, 28, 91	1	0.54	0.57	0.64	0.55	0.60	0.89	2	0.53	0.54	0.77	0.45	0.50	0.97
A322 Woodbridge Rd	4, 5, 20, 26, 27, 28, 91	1	0.70	0.75	1.11	0.89	0.94	1.15	2	0.79	0.86	1.23	0.84	0.99	2.04
A322 Woodbridge Rd (2)	4, 5, 20, 26, 27, 28, 91	1	0.94	1.03	1.28	0.84	1.00	1.55	2	1.03	1.05	1.18	1.17	1.16	1.32
North St	All routes serving Friary Bus Station	1	0.19	0.23	0.40	0.35	0.35	0.75	2	0.36	0.41	0.63	0.38	0.46	0.80
A3100 High St	36, 37, 462, 515, 300, 463, 478, 479	1	0.38	0.44	0.65	0.36	0.41	0.70	2	0.17	0.21	0.36	0.37	0.39	1.25
A3100 London Rd	36, 37, 462, 515	1	0.92	0.96	0.98	1.08	1.13	1.51	2	1.02	1.10	1.38	1.00	1.15	1.43
A3100 London Rd (2)	36, 37, 462, 515	1	0.91	0.98	1.26	0.89	0.97	1.26	2	0.78	0.81	0.82	0.98	0.96	1.39
A320 Stoke Rd	3, 34, 35, 100, 101	1	0.59	0.60	0.69	0.34	0.36	0.86	2	0.24	0.25	0.30	0.61	0.60	0.78
A320 Stoke Rd (2)	3, 34, 35, 100, 101	1	0.76	0.79	1.05	0.77	0.76	1.31	2	0.80	0.80	0.87	1.19	1.14	1.34
A320 Woking Rd	3, 34, 35	1	1.35	1.34	1.93	1.19	1.30	2.93	2	1.28	1.31	1.58	1.40	1.42	2.08
Old Farm Road	34, 35, 538	1	0.17	0.17	0.15	0.24	0.23	0.21	2	0.28	0.28	0.29	0.17	0.21	0.19
Woodlands Rd	34, 35, 538	1	0.08	0.08	0.11	0.12	0.14	0.18	2	0.07	0.07	0.09	0.13	0.10	0.12
Gill Ave	4, 5, 17, 26, 27, 520	1	0.14	0.15	0.15	0.16	0.15	0.16	2	0.14	0.14	0.14	0.17	0.18	0.18
Richard Meyjes Road	26, 27, 36, 37, 38	1	0.00	0.00	0.00	0.00	0.00	0.00	2	0.00	0.00	0.00	0.00	0.00	0.00
Park St	42, 70, 71, 72, 200, 503, 523	1	0.72	0.79	0.91	0.56	0.56	1.01	2	0.49	0.53	0.55	0.59	0.72	1.37

All route sections, both directions	AM			PM			Both		
	2009	2031	2050	2009	2031	2050	2009	2031	2050
Number of roads over capacity (RFC > 0.85)	9	10	15	11	14	24	20	24	39
Average RFC	0.55	0.57	0.72	0.59	0.63	1.03	0.57	0.60	0.88
Average percentage change in utilisation from 2009 Baseline	0.0%	3.5%	31.7%	0.0%	6.6%	75.5%	0.0%	5.1%	54.3%

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5.4.4   Environment Metrics

Air quality impact caused by transport in Guildford town

The Department of Energy & Climate Change (DECC) publishes statistics related to carbon dioxide emissions across key sectors, including Industry and Commercial; Domestic; Railways; Road Transport and Land Use, Land Use Change and Forestry.

This data has been extracted at Local Authority level for Guildford borough, for the historical years 2005-2011.

SINTRAM outputs for a corresponding year (2009) have been used to establish a relationship between total vehicle distance within Guildford borough (in km) and transport emissions. The future year total vehicle distance travelled data from SINTRAM is then used as a basis for estimating future year emissions. Improved vehicle engine technology has not been considered (existing emission rates are assumed).

The impact of Intermediate and Major Highway Schemes and Packages of Sustainable Transport Interventions were assessed through analysis of SINTRAM outputs for total vehicle distance within Guildford borough. It is noted that non-road transport emissions account for <0.5% of existing transport carbon dioxide emissions within Guildford borough.

For Other Interventions, which cannot be modelled in SINTRAM, a professional judgement of the expected impact on air quality was made.

Data sources and tools:

- Arup model runs using SCC's SINTRAM strategic highway model, version 6, in conjunction with OmniTRANS version 6.0.10 transport modelling software.

- DECC CO^2 transport emissions data (2005-2011).

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Baseline and Business-As-Usual Data

DECC CO^2 transport emissions data

Year	2005-2011
Release date	11/07/2013
Units	kt CO$_2$

Year	Road Transport (A roads)	K. Road Transport (Minor roads)	Transport (Road) Total	Percentage change from 2009 baseline
2005	*321.1*	*98.3*	*419.4*	
2006	*311.9*	*96.2*	*408.2*	
2007	*310.4*	*98.0*	*408.5*	
2008	*291.9*	*96.7*	*388.6*	
Baseline (2009)	281.9	94.3	376.2	
2010	*279.1*	*92.0*	*371.1*	
2011	*284.6*	*89.7*	*374.3*	
Business-As-Usual forecast (2031)	316.0	105.7	**421.7**	**12%**
Business-As-Usual forecast (2050)	449.7	150.4	**600.1**	**60%**

Noise impact resulting from traffic on major roads

There is no purpose-built tool to assess noise levels in the borough.

First Priority Locations for noise action planning through the Noise Action Plan: Major Roads (outside first round agglomerations) (Department for Environment, Food and Rural Affairs (Defra), 2010) identifies within Guildford borough a number of locations experiencing noise issues:

- rated as 'First Priority' were the A3, B3000, A247, A31, A322, A320, A25 and A281

- rated as 'Important Areas' were the A281, A331 and A323

These are shown on the plan reproduced below.

SINTRAM traffic volume data has been extracted for these locations where represented in the model, and increases in traffic volumes over time are assumed to reflect likely increase in noise volume. This allows for an assessment of the impact of an intervention through analysis of SINTRAM outputs for Intermediate and Major Highway Schemes and Packages of Sustainable Transport.

For Other Interventions which cannot be modelled in SINTRAM, a professional judgement of the expected noise impact was made considering factors such as change in traffic volumes in 'First Priority' and 'Important Area' locations and proximity to residential areas.

Data sources and tools:

- Arup model runs using SCC's SINTRAM strategic highway model, version 6, in conjunction with OmniTRANS version 6.0.10 transport modelling software.

- DEFRA Noise Action Plan, 2010.

Baseline and Business-As-Usual Data

Road	Section	Status	2009 Baseline Flow (vph, both directions, AM and PM peak period)	2031 BAU Flow (vph, both directions, AM and PM peak period)	Increase 2009-2031 %	2050 BAU Flow (vph, both directions, AM and PM peak period)	Increase 2009-2050 %
	London Road		16,820	17,542	4%	23,315	39%
A3	Guildford By-Pass	First Priority Location	29,854	31,586	6%	38,014	27%
	Farnham Road		1,674	2,212	32%	3,950	136%
A31	Hog's Back	First Priority Location	9,326	9,911	6%	13,578	46%
A25	Woodbridge Road	First Priority Location	6,716	7,061	5%	10,713	60%
A331	Blackwater Valley Road	Important Area	6,738	8,184	21%	9,843	46%
All assessed roads			71,128	76,496	**8%**	99,413	**40%**

Noise Action Planning Important Areas (Tile 128)

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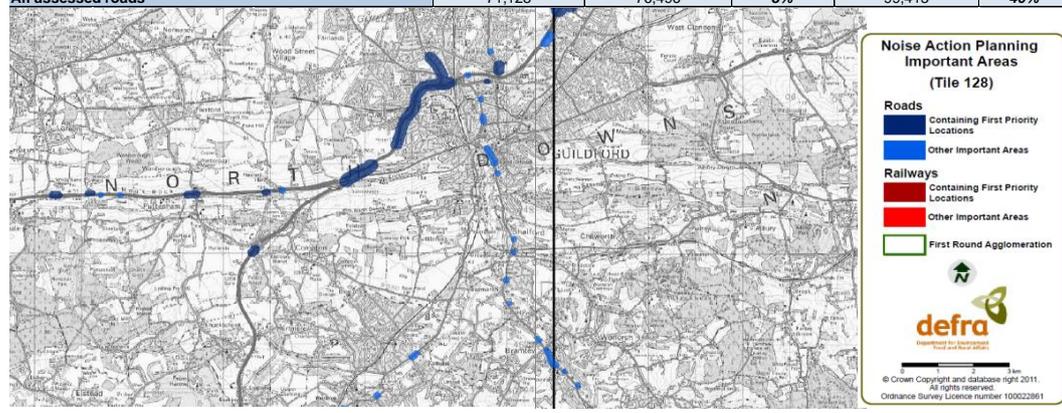
Brownfield and greenfield land use impact

The plan below indicates the existing strategic planning and landscape designations within the borough, including Green Belt and Area of Outstanding Natural Beauty.

In this study, assumptions about future development have not been made (e.g. densification of existing built up areas, development on brownfield land and development on greenfield land). Therefore, the existing, or Baseline, pattern of land uses is assumed for the BAU scenarios.

A professional judgement of the brownfield and greenfield land use impact was made relative to this, in terms of 'positive' and 'negative' impacts, particularly on greenfield land.

Data sources and tools:

- Key strategic planning and landscape designations in Guildford borough *(Source: Figure B2 from Guildford Borough Local Plan Strategy and Sites Issues and Options, Guildford BC, October 2013).*

Baseline and Business-As-Usual Data

Source: Guildford Borough Council

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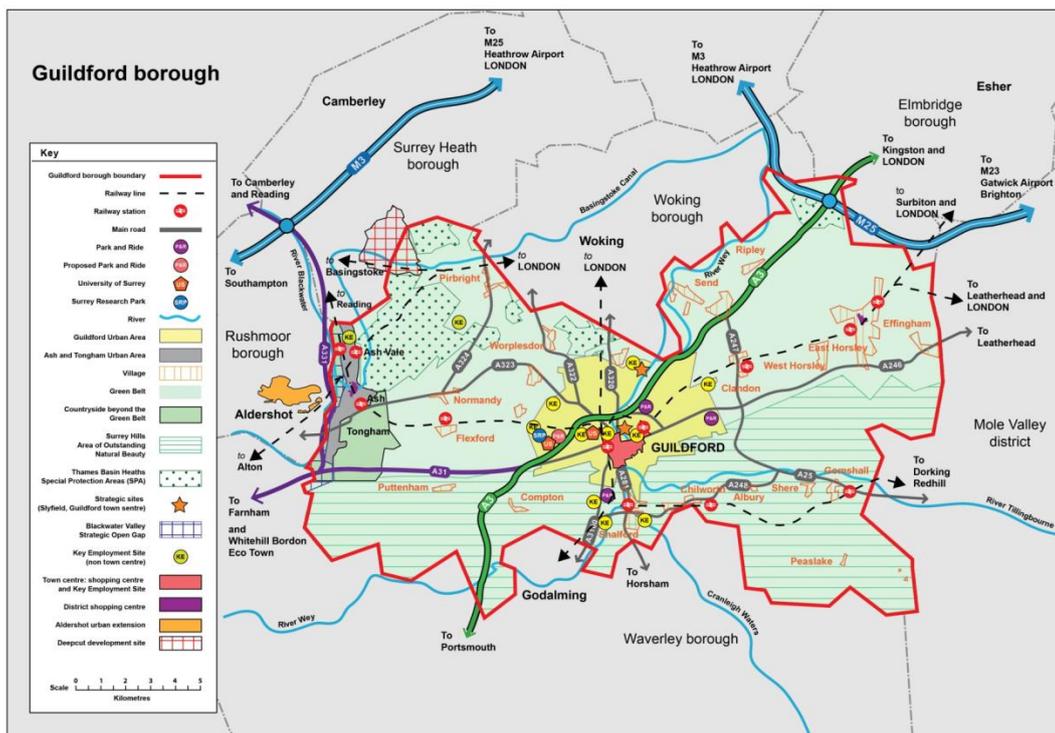
Urban public realm impact

A professional judgement of the urban public realm impact was made, through consideration of the quality of the walking and cycling environment in the town. Proposed interventions were assessed against the existing conditions shown on the following data sources:

Data sources and tools:

- TravelSMART Surrey plan showing the extent of the cycle routes.

- Guildford Borough Infrastructure Baseline (Guildford Borough Council, July 2013) existing walking provision.

- Guildford gyratory: enhancing movement and place (Atkins, 2013).

Baseline and Business-As-Usual Data

Walking: On most Local Road Network roads in Guildford town and in the villages there is at least one footway, and usually two. Pedestrian crossings are commonplace. In Guildford town centre, there is significant priority for pedestrians; on High Street, North Street, around the castle and on the lanes that connect them. There are unclear and indirect routes, narrow footways, extensive guard railing and several subways, which can feel intimidating at night.

The document 'Guildford gyratory: enhancing movement and place' (Atkins, 2013) recognises accessibility issues relating to pedestrian permeability including crossing the River Wey and interaction with other modes, as well as a generally poor quality of public realm.

Cycling (plan from TravelSMART):

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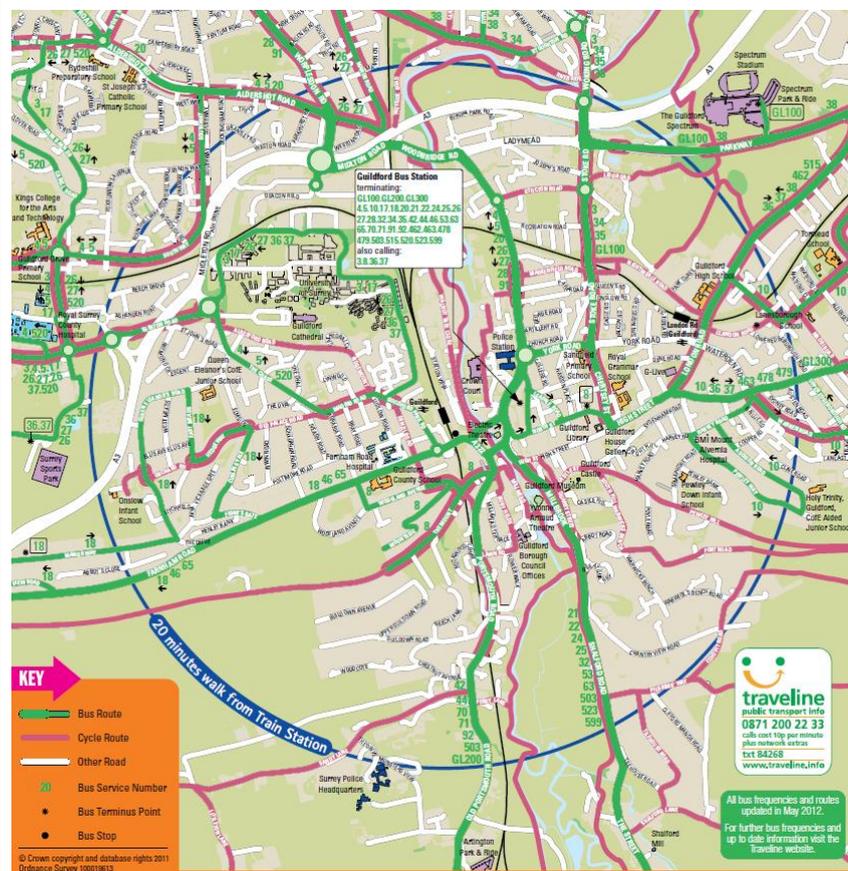
5.4.5 Safety Metrics

Number of accidents resulting in Killed or Seriously Injured (KSI)

Road Accidents and Safety Data have been extracted from the DfT STATS19 data portal for the Guildford borough area, based on the most recent 2012 available dataset.

SINTRAM outputs were extracted to understand the relationship between vehicle distance travelled (in km) with accident rate.

The derived factor was then applied to forecast year SINTRAM outputs for total vehicle distance within Guildford borough in order to estimate BAU accident forecasts. Likewise, this allows for an assessment of the impact of an intervention through analysis of SINTRAM outputs for Intermediate and Major Highway Schemes and Packages of Sustainable Transport.

For Other Interventions which cannot be modelled in SINTRAM, a professional judgement of the expected impact on accidents resulting in Killed or Seriously Injured was made.

Data sources and tools:

- Department for Transport STATS19 data.

- Arup model runs using SCC's SINTRAM strategic highway model, version 6, in conjunction with OmniTRANS version 6.0.10 transport modelling software.

Baseline and Business-As-Usual Data

Severity	2012	BAU 2031	BAU 2050
All	615	689	981
Slight	524	587	836
Serious	87	98	139
Fatal	4	4	6
Change from 2009 Baseline		**12%**	**60%**

5.4.6 Metrics Summary

The metrics, and sub-metrics where applicable, across all categories are summarised in the following table:

Table 9: Metrics Summary

Geographical coverage	Metric (full title)	Metric (shortened title)	SINTRAM model outputs, data and approach used for metric appraisal by category of intervention	
			Intermediate and Major Highway Schemes **Packages of Sustainable Transport Interventions**	**Other Interventions**
Borough	Total vehicle distance within Guildford borough	Vehicle distance	SINTRAM model data	Professional judgement
	Sustainable mode share for Guildford borough residents' journey to work trips	Sustainable mode share	Professional judgement	Professional judgement
	Highway level of delay	Highway level of delay	SINTRAM model data	Professional judgement
	Air quality impact caused by transport in Guildford town	Air quality impact	SINTRAM model data	Professional judgement
	Noise impact resulting from traffic on major roads	Noise impact	SINTRAM model data	Professional judgement
	Brownfield and greenfield land use impact	Land use impact	Professional judgement	Professional judgement
	Number of accidents resulting in Killed or Seriously Injured (KSI)	Road accidents	SINTRAM model data	Professional judgement
Town	Guildford town centre accessibility by non-car modes	Accessibility by non-car modes [aggregated]	SINTRAM model data	Professional judgement

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Geographical coverage	Metric (full title)	Metric (shortened title)	SINTRAM model outputs, data and approach used for metric appraisal by category of intervention	
			Intermediate and Major Highway Schemes **Packages of Sustainable Transport Interventions**	**Other Interventions**
	Guildford Railway Station accessibility by non-car modes			Professional judgement
	Surrey Research Park accessibility by non-car modes			Professional judgement
	Slyfield Industrial Estate accessibility by non-car modes			Professional judgement
	Guildford Business Park accessibility by non-car modes			Professional judgement
	Bus level of delay	Bus level of delay	SINTRAM model data	Professional judgement
	Urban public realm impact	Urban public realm impact	Professional judgement	Professional judgement
	Number and amenity of pedestrian and cycle crossings of major transport barriers (e.g. A3, River Wey, Gyratory, Railway lines)	Severance (pedestrian and cycle links)	Professional judgement	Professional judgement
	Cross-town journey times by car*	Cross-town journey times by car	SINTRAM model data	Professional judgement
	Town centre traffic volumes*	Town centre traffic volumes	SINTRAM model data	Professional judgement

*Not a main metric but included for illustrative purposes at the request of GBC.

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Appendix A

Document List

Abbreviation	Full source name
Local sources - Guildford and Surrey	
ITT	Invitation To Tender (GBC, June 2013)
GBLP2003	Guildford Borough Local Plan (GBC, January 2003)
DLP20131b	Draft Local Plan - Item 11 (1b) - Local Plan Strategy and Sites Issues and Options (GBC, October 2013)
GSPS1	Guildford Strategic Parking Strategy (SDG, May 2012)
GSPS2	Guildford Strategic Parking Review (SDG, November 2012)
A3SCS	A3 Surrey Corridor Study: Strategic Report (Parsons Brinkerhoff and the Highways Agency, March 2009)
GBIB	Guildford Borough Infrastructure Baseline (GBC, July 2013)
GES	Guildford Economic Strategy 2013-2031 (University of Surrey, July 2009)
RGGS	Rethinking Guildford's one-way gyratory system (draft, GBC, May 2013)
BN	Traffic, pedestrians & Cycle movements in and around the Guildford Town Centre (Bibhas Neogi, December 2012)
GBSS	Guildford Bus Station Study Issues and Options Report (MVA, October 2011)
GTCSDS	Guildford Town Centre Strategic Development Study (Cushman & Wakefield, March 2010)
GITCF	Guildford Interim Town Centre Framework (GBC, September 2012)
AFG	Avoid Future Gridlock: Suggestion by the Guildford Society Transport Group for measures to relieve some of Guildford's Transport problems (April 2013)
LSERUS	London and South East Route Utilisation Strategy (Network Rail, July 2011)
EORRBS	Emerging options and refinements to replacement Bus Station Designs (MVA, April 2012)
SLTP3	Surrey Local Transport Plan 3 (implementation and Finance)
	Updated Guildford Borough Preliminary Growth Scenarios Transport Assessment Report (Surrey County Council, August 2013)
	Guildford Economic Development Study (GBC, 2009)
	Guildford Town Centre TRANSYT Network (MVA, 2012)
	Guildford Town Centre Vitality and Viability Report (GBC, 2008)
	Retail and Leisure Study (Roger Tym & Partners, May 2011)
	How many new homes? (GBC, Oct 2013)
	Guildford Borough Local Development Scheme (GBC, June 2013)
	Guildford Society's proposals for Guildford gyratory (Guildford Society, Feb 2013)
	Guildford and Woking Integrated Transport Study: Summary (SCC, 2006)
	Employment Land Assessment (GBC, July 2013)

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Academic and Research papers	
SPDT	Spatial Planning and the Demand for Travel (Hickman et al 2011)
DAT	Digital-Age Transportation: The Future of Urban Mobility (Fishman, Deloitte)
PFST	Planning for Sustainable Travel: Summary (CfIT 2009)
VBTP	Visioning and Backcasting for UK Transport Policy (VIBAT) (DfT 2006)
VTPI	Online TDM Encyclopaedia (VTPI 2013)

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Appendix B

Transport Futures Workshop Attendees

Sector	Organisation	Name & Role
Amenity groups	Guildford Society	Chris Blow, Chair, Transport Group
Amenity groups	Guildford Vision Group	John Rigg, Chair
Amenity groups	Holy Trinity Amenity Group	Bob Bromham
Bus operators	Arriva Southern Counties	Robert Patterson, Business Development Manager
Business community	Experience Guildford	Amanda Masters, General Manager
Business community	Guildford Business Forum	Derek Corden, Chairman, Transport and Property Group, Guildford Business Forum
Business community	M&G Investments	Jonathan Weymouth, Director: Development
Business community	Royal Surrey County Hospital	Graham Maynard, Head of Capital and Estates
Business community	Surrey Chamber of Commerce	Louise Punter, Chief Executive
Business community	Surrey Connects	Mark Pearson, Chief Executive
Business community	Surrey Research Park	Dr Malcolm Parry, Managing Director, Surrey Research Park
Business community	Town Centre Group	Glenn Prested
Conservation groups	Campaign for the Protection of Rural England (CRPE)	Tom Stevens
Conservation groups	English Heritage	Samantha Johnson, Inspector of Historic Buildings and Areas
Elected representatives	Guildford Borough Council	Cllr Stephen Mansbridge (Con), Leader of the Council
Elected representatives	Guildford Borough Council	Cllr James Palmer (Con), Deputy Leader of the Council and Lead Councillor for Town Centre Planning and Infrastructure
Elected representatives	Guildford Borough Council	Cllr Monika Juneja (Con), GBC Lead Councillor for Planning and Governance
Elected representatives	Guildford Borough Council	Cllr Angela Gunning (Lab)
Elected representatives	Guildford Borough Council	Cllr Tony Phillips (Lib Dem)
Elected representatives	Surrey County Council	Cllr David Goodwin (Lib Dem)
Elected representatives	Surrey County Council	Cllr Mark Brett-Warburton (Con), SCC Chairman of Guildford Local Committee
Guildford Borough Council Officers	Guildford Borough Council	Carol Humphrey, Head of Planning Services*

Sector	Organisation	Name & Role
Guildford Borough Council Officers	Guildford Borough Council	Donald Yell, Principal Transport Planner*
Guildford Borough Council Officers	Guildford Borough Council	Chris Mansfield, Head of Economic Development
Others	Independent	Bibhas Neogi
Others	University College London	Dr Robin Hickman
Rail authorities and operators	First Great Western	Mike Greedy
Rail authorities and operators	Network Rail	Paula Haustead, Route Enhancement Manager
Residents associations	Guildford Residents' Associations	Graham Hibbert, East Guildford Residents Association
Residents associations	Guildford Residents' Associations	Angus McIntosh, Weymount Residents Association
Surrey County Council Officers	Surrey County Council	Steve Howard, Major Schemes Project Manager
Surrey County Council Officers	Surrey County Council	Iain Reeve, Assistant Director Economy, Transport and Planning*
Surrey County Council Officers	Surrey County Council	Mike Green, West Team Manager Transportation Development Control*
Surrey County Council Officers	Surrey County Council	Lyndon Mendes, Transport Policy Team Manager
Surrey County Council Officers	Surrey County Council	Nick Greenwood, Transport Planner
Taxis and minicabs	Taxi Advisory Group	Mark Rostron
User and other interest groups	Guildford and Waverley Clinical Commissioning Group	Jackie Sowerbutts, Public Health Consultant, Surrey County Council
User and other interest groups	Guildford Cycle Group	Martin Taplin
User and other interest groups	Guildford Environmental Forum	Alastair Atkinson, Transport Lead, Guildford Environmental Forum
User and other interest groups	Guildford Walking Forum	Keith Chesterton, Chair
Arup consultant team	Arup	Susan Claris
Arup consultant team	Arup	Steve Bennett
Arup consultant team	Arup	Doug Pickering*
Arup consultant team	Arup	Mark Watts
Arup consultant team	Arup	Marcus Morrell

* - denotes Chair of discussion group

Appendix C

Base Data

C1.1 Base Data

The base data presented in this section was used to inform the calculation of the baseline and BAU scenarios for the metrics described only. The base data presented in this section was not used as an input to other metrics or to the SINTRAM modelling.

The base data are:

- **Population** – total number of residents and by location (urban/rural);
- **Employment** – total number of jobs and by sector; and
- **Transport** – various data including Census data on the method of travel to work, timetables for existing bus services in Guildford, data on pedestrian and cycle crossings of major transport barriers and data on road traffic accidents.

C1.1.1 Population

The total population of Guildford borough, split by town and the rest of the borough, is shown in **Table C1**. The 2001 and 2011 data are from the UK census. The 2050 BAU forecast was estimated by Arup using growth between 2011 Census data and 2010-based sub-national population projections for the year 2031 (Office for National Statistics, 21 March 2012), extrapolated to 2050[6].

Table C1: Population

Population	2001	Baseline (2011)	2031	Business-As-Usual Forecast (2050)
Guildford Town	63,717	70,407	81,810	90,193
Rest of Borough	65,984	66,776	77,590	85,541
Total	**129,701**	**137,183**	**159,400**	**175,734**

Census Data - Guildford Town = Westborough, Stoughton, Stoke, Burpham, Onslow, Friary St Nicolas, Holy Trinity, Christchurch, Merrow wards.

The population of Guildford is forecast by Arup to grow to 175,000 people by 2050, a 28% increase over the 2011 Census population. Around 90,000 of this population (51%) is forecast to live in Guildford town.

The population base data was only used to inform the BAU scenarios for the sustainable mode share for Guildford borough residents' journey to work trips metric.

C1.1.2 Employment

The number of jobs in Guildford by sector is shown in **Table C2**. The 2002 and 2008 data are from the Guildford Economic Development Strategy (2009). The

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[6] Source: Office for National Statistics: Census Data (2001 & 2011); 2010-based Sub-national population projection for 2031 (21 March 2012, available from: http://www.ons.gov.uk/ons/rel/snpp/sub-national-population-projections/2010-based-projections/stb-2010-based-snpp.html), estimated by Arup to2050.

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2010 data are from the Guildford Borough Employment Land Assessment 2013. The 2050 BAU forecast was estimated by Arup using growth between the 2008 data and employment forecasts for 2031 reported in the Guildford Borough Employment Land Assessment 2013, extrapolated to 2050.

The employment base data was only used to inform the BAU scenarios for the sustainable mode share for Guildford borough residents' journey to work trips metric.

Table C2: Employment (Jobs) by Sector

Number of jobs	2002	2008	Baseline (2010)	2031	Business-As-Usual Forecast (2050)
Energy, Minerals & Utilities	400	100	101	121	134
Agriculture & Fishing	450	450	456	543	605
Transport and Communications	2,700	2,100	2,130	2,534	2,823
Construction	2,450	2,800	2,840	3,379	3,764
Other Services	3,000	3,450	3,499	4,164	4,638
Manufacturing	5,700	4,800	4,868	5,793	6,453
Retail, Hotels & Restaurants	15,750	16,600	16,835	20,033	22,316
Commercial Services	14,350	19,000	19,269	22,930	25,542
Public Services	19,200	21,100	21,399	25,464	28,366
Total	**64,000**	**70,400**	**71,397**	**84,900**	**94,641**

Sources: Guildford Economic Development Strategy 2009 (2002 & 2008), Guildford Employment Land Assessment 2013 (growth to 2031), estimated by Arup (2050).

The number of jobs in Guildford is forecast by Arup to increase to 94,500 by 2050, a 32% increase on the 2010 figure. The majority of these jobs (81%) are forecast to be in the Retail, Hotels & Restaurants, Commercial Services, and Public Services sectors.

C1.1.3   Transport

2011 Census data on the method of travel to work are shown in **Section 5.4.1** in relation to the metric 'Sustainable mode share for Guildford borough residents' journey to work trips'.

Data from existing Guildford bus service timetables are shown in **Table D1**.

Data on pedestrian and cycle crossings of major transport barriers are shown in **Section 5.4.2** in relation to the metric 'Number and amenity of pedestrian and cycle crossings of major transport barriers (e.g. A3, River Wey, Gyratory, Railway lines)'. The data are taken from OS maps, Google maps, photos and site visits.

Data from the Department for Transport STATS19 data portal on road traffic accidents are shown in **Section 5.4.5** in relation to the metric 'Number of accidents resulting in Killed or Seriously Injured (KSI)'.

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Appendix D

Public transport journey times analysis - Methodology

Bus timetable information from the Surrey County Council and Traveline websites was used.[7] [8]

D1   Service frequency

Service frequency per hour as listed was the sum of the frequency of the available services serving that route (for example there are 12 services per hour in each direction between Park Barn and Guildford bus station).

D2   Transfer time

Service headway times were used to estimate average waiting times for transfers between buses and where a significant walk to reach a connecting bus stop was necessary (as with the route from Guildford Railway Station to Jacobs Well). Average waiting time was assumed to be half the headway time, so, for example, a frequency of three buses an hour would equate to a 20 minute headway time and therefore an average 10 minute waiting time. The service frequency used was for whichever of the two services being connected was least frequent.

For accessibility of the railway station, when a service stopped at the bus station but not the railway station a walk time of ten minutes between the railway station and bus station was assumed.

D3   Journey time

The longest bus journey time in the peak periods (07.00-10.00 and 16.00-19.00) in either direction was used as a proxy bus journey time (a worst case assumption was used).

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[7] Guildford, Godalming and Haslemere bus timetables can be found on the Surrey County Council website at http://www.surreycc.gov.uk/roads-and-transport/buses-and-trains/bus-timetables/guildford,-godalming-and-haslemere-bus-timetables. Timetables accessed January 2014.

[8] The search function on the Traveline South East website was used to supplement the timetables (for example where a location was not listed as a main bus stop on the timetable). Traveline South East's web address is http://www.travelinesoutheast.org.uk/se/XSLT_TRIP_REQUEST2?language=en&timeOffset=15 [accessed January 2014]

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Table D1 shows timetable information used for journey times (inbound and outbound refer to services towards and away from the town centre respectively).

Table D1: Bus journey times in January 2014

Service number	Peak frequency	Off-peak frequency	Origin	Destination	Slowest journey time (mins)	Detail (service number in brackets)
34, 35	3	3	Jacobs Well	Town centre/ bus station	28	8.21 inbound (34)
70, 71, 72	3	4	Godalming	Town centre/ bus station	20	Any 7.35-8.35 inbound
42	<1	<1	Godalming	Town centre/ bus station	26	Several e.g. 8.26 inbound
46	1	1	Godalming	Town centre/ bus station	38	8.10 inbound
36	3	3	Burpham	Town centre/ bus station	38	7.59 inbound
37	3	3	Burpham	Town centre/ bus station	31	e.g. 16.32 outbound
515	1	1	Burpham	Town centre/ bus station	17	e.g. 7.53 inbound
4, 5	8	8	Park Barn	Town centre/ bus station	25	17.00 outbound (5)
17	1	1	Park Barn	Town centre/ bus station	23	7.25 outbound
26, 27	3	3	Park Barn	Town centre/ bus station	30	Several e.g. 16.26 inbound (27)
17	1	1	Park Barn	Surrey Research Park	10	7.38 from Royal Surrey County Hospital
26, 27	3	3	Park Barn	Surrey Research Park	8	8.21 from Park Barn Drive
Walking	N/A	N/A	Park Barn	Surrey Research Park	18	Traveline
36, 37	3	3	Town centre/ bus station	Surrey Research Park	20	Several e.g. 16.41 outbound (37)
4, 5	4	4	Town centre/ bus station	Guildford Business Park	10	Several e.g. 16.08 outbound (4)
20	4	4	Town centre/ bus station	Guildford Business Park	9	e.g. 8.41 inbound
26, 27	2 or 3	3	Town centre/ bus station	Guildford Business Park	9	8.06 outbound (26)
28	1	1	Town centre/ bus station	Guildford Business Park	13	8.12 inbound
Walking	N/A	N/A	Town centre/ bus station	Guildford Business Park	25	Traveline
36, 37	3	3	Burpham	Surrey Research Park	44	8.08 from Burpham (37)
34, 35	3	3	Jacobs Well	Slyfield	4	Several
Walking	N/A	N/A	Jacobs Well	Slyfield	17	Traveline
34, 35	3	3	Slyfield	Town centre/ bus station	24	e.g. 8.25 inbound (34)
46	1	1	Godalming	Guildford railway station	36	8.10 inbound
36, 37	3	3	Burpham	Guildford railway station	30	17.44 outbound (from station) (this service to the station has not been used in the analysis because it does not stop at the station in both directions)
4, 5	4	4	Park Barn	Guildford railway station	19	e.g. 17.12 to station (4)
26, 27	3	3	Park Barn	Guildford railway station	22	e.g. 16.48 from station (27)
17	1	1	Park Barn	Guildford railway station	21	7.27 from station