Glasgow City Wide Active Travel

Strategic Business Case

Document Ref: LNP1-ARC-ZZZ-XX-RP-ZZ-00004

Revision: 3.0

JANUARY 2022

Glasgow
CITY COUNCIL

Glasgow City Wide Active Travel

Strategic Business Case

Version Control

Version	Date	Author	Checker	Reviewer	Approver	Changes
1	10/12/21	Various	CB	AR	DG	
2	11/01/22	Various	CB	GCC & AR	DG	Updates to address GCC comments
3	17/01/22	Various	CB	GCC & AR	DG	Updates to address GCC comments

Contents

Tables

Figures

1 Executive Summary

1.1.1 Glasgow is the biggest city in Scotland and is the economic engine and main commercial hub not only for the city region but also for the country. Almost 2.5 million people, half of Scotland's population, live within an hour of the city (source 2011 census).

1.1.2 Cycling is one of the fastest, cheapest and most flexible ways to get around Glasgow for those who are willing. Associated with the practical benefits of cycling, numerous direct and indirect health benefits are attained. For example, cycling will provide direct health benefits to the user but will also potentially remove traffic from the road improving air quality and reducing greenhouse gases for everyone. Glasgow is currently rolling out infrastructure and initiatives to promote cycling, but a significant ramp up of delivery is required to enable the mode shift to an active city envisaged by Glasgow City Council.

1.1.3 A step change in the provision of active travel infrastructure will provide safe active travel at all times of day, for more and more people. Walking and wheeling[1] infrastructure and public spaces must provide a more enabling environment for all, so that nobody feels disconnected from public transport, local services and their community.

1.1.4 This scheme will build on the active travel infrastructure developed over the last decade to create a more coherent cycle network across Glasgow. The aim is to provide people with a network of high-quality infrastructure, safe from motor traffic and providing a smooth, direct and comfortable journeys at all times of day and year across the whole of Glasgow. The scheme will use the knowledge gained from existing designs and learn lessons from the "Spaces for People'' temporary lanes created during the pandemic to deliver high quality infrastructure quicker. This will enable the opportunity for a network of segregated cycle infrastructure to be in place by 2031.

1.1.5 The strategic case sets out a strong narrative for investment in a city-wide active travel network. It demonstrates that whilst there is currently a relatively low base of active travel trips, it has been steadily growing. However, international comparisons suggest there is considerable scope for significant increases to be realised with appropriate interventions.

1.1.6 A range of local and national policies have been identified which closely align with objectives of the scheme. These include Glasgow City's Active Travel Strategy and Development Plan from a local perspective as well as the National Planning Framework and National Transport Strategy from a national perspective alongside many others.

1.1.7 A key element is the contribution towards the Sustainable and Low Carbon City theme within Glasgow City Councils Strategic Plan (2017-2022). The Active Travel

[1] Wheeling: refers to travelling by wheelchair

Strategy will directly contribute to reducing the city's carbon footprint through encouraging a shift towards active modes and reducing the level of congestion within the city.

1.1.8 Development of specific packages of interventions is currently underway to produce a coherent set of options for the scheme. As a consequence, the economic assessment of the scheme benefits has been undertaken for an indicative network of interventions to provide an idea of the magnitude of potential benefits.

1.1.9 A range of environmental, social and health benefits have been calculated as part of this indicative appraisal providing a comprehensive understanding of the impact of the scheme in terms of monetised benefits. Indicative costs have also been used to provide a benefit-cost ratio. The present quantified estimate of the benefit cost ratio is therefore 5.4 for the Active Travel Strategy, this represents a "Very High" value for money category.

2 Introduction

2.1 Background

2.1.1 Glasgow City Council have commissioned Arcadis and David Simmonds Consultancy to develop a Strategic Business Cases (SBC) for both Active Travel improvements across Glasgow and the development of Liveable Neighbourhoods across Glasgow in a series of six tranches. This business case will focus on the case for active travel improvements across Glasgow.

2.1.2 The economic appraisal presented in this report is based on the TELMoS18A model which is used with the permission of Transport Scotland. We accept full responsibility for the use made of this model and for the results obtained from it.

2.1.3 An SBC should provide a rationale for intervention and provide enough evidence for a scheme/project to proceed to development. It should detail the need for intervention and propose a variety of options with which to deal with the issue(s), in the context of Government objectives (or in some cases, as part of a wider strategic level assessment, such as the Strategic Transport Projects Review).

2.1.4 As a minimum, it should set out the Investment Objectives, and how they help meet Government strategy. This stage of the business case development will constitute the first version of the Strategic Case from the Five Case Model (making a robust case for change), which will be revisited in the OBC. Typically, the SBC is presented to decision makers and if successful, may proceed to development. Given the nature of the STAG process, schemes with a completed STAG appraisal will have demonstrated a sufficient level of detail to provide the Strategic Case.

2.1.5 The STAG Report and STAG Option Summary Table will be developed in the next iteration of this business case.

2.1.6 The introduction of step change in active travel across the city will make a significant contribution to several national and local policy objectives and particularly to the themes set out by Glasgow City Council in its Strategic Plan 2017 – 2022. Most notably the programme will make a major contribution to the Sustainable and Low Carbon City theme as increasing use of active travel modes will directly contribute to the desired outcomes of:

- A low carbon footprint as a council and as a city;
- More sustainable, integrated transport networks across the city and less congestion; and
- Increased use active travel, including walking ad cycling.

2.1.7 It will also make a major contribution towards one of the recommendations set out in Glasgow's Climate Plan:

- **Recommendation 4** - Improving Infrastructure for walking, cycling and remote working.

2.1.8 The details of how the Active Travel scheme will help deliver these outcomes and contribute to wider government policies are set out in the following chapters.

3 Strategic Case

3.1 Scheme Description

3.1.1 Glasgow is the biggest city in Scotland and is the economic engine and main commercial hub not only for the city region but also for the Country. Almost 2.5 million people, half of Scotland's population live within an hour of the city (source 2011 census).

3.1.2 Cycling is one of the fastest, cheapest and most flexible ways to get around Glasgow for those who are willing. Associated with the practical benefits of cycling, numerous direct and indirect health benefits are attained. For example, cycling will provide direct health benefits to the user but will also potentially remove traffic from the road improving air quality and reducing greenhouse gases for everyone. Glasgow is currently rolling out infrastructure and initiatives to promote cycling, but a significant ramp up of delivery is required to enable the mode shift to an active city envisaged by Glasgow City Council.

3.1.3 A step change in the provision of active travel infrastructure will provide safe active travel at all times of day, for more and more people. Walking and wheeling[2] infrastructure and public spaces must provide a more enabling environment for all, so that nobody feels disconnected from public transport, local services and their community.

3.1.4 Glasgow's Active Travel Strategy (ATS) along with the Liveable Neighbourhood plans will assist in creating a modern, resilient and sustainable transport system for Glasgow, to help transform the city into a more inclusive, liveable and attractive place for residents, businesses and visitors. This will complement the City Centre Transport Plan (CCTP) and the Bus Service Improvement Plan (BSIP), alongside the overarching Transport Strategy for Glasgow.

3.1.5 Glasgow's Active Travel Strategy 2022-2031 vision is for walking, cycling and wheeling to be the first and natural choice for everyday journeys, for people of all ages and ability to travel locally to schools, to shops, to work and connect to the city centre. This strategy is a recognition of the positive impact that transport, and active travel in particular, can make towards city's wider policy objectives on Climate and the Environment, Health and Wellbeing, Inclusion and Equality and Wealth and Inclusive Growth. The strategy is framed by three policy and action areas:

- **Connectivity**: people and place – rebalancing our streets and spaces – with a focus on networks and infrastructure in our street environments.
- **Unlocking change**: enabling everyone to walk, wheel or cycle – focusing on training and education and working collaboratively.
- **Thinking Differently**: encouraging, motivating and sustaining change – focusing on communication and promotion and inspiring people through

[2] Wheeling: refers to travelling by wheelchair

larger events and other activities.

3.1.6 This scheme will build on the active travel infrastructure developed over the last decade to create a more coherent cycle network across Glasgow. The aim is to provide people with high quality infrastructure, safe from motor traffic and providing a smooth, direct and comfortable journeys at all times of day and year. The scheme will build on knowledge gained from existing designs and learn lessons from the "Spaces for People'' temporary lanes created during the pandemic to deliver high quality infrastructure quicker. This will enable the opportunity of the proposed network of segregated cycle infrastructure to be in place by 2031.

3.1.7 The aims of the scheme are directly aligned with those of the Active Travel strategy:

- Enable direct clear active journeys to everywhere in Glasgow for everyone in Glasgow.
- Eliminate traffic danger as a reason not to cycle.
- Improve ability of Glasgow's road network to enable movement of people and goods.
- Be useable all year round.
- Encourage demographic use which is representative of Glasgow (e.g. 50% women).
- Provide easy access to Glasgow's green network of canals, rivers, parks and old railways.

3.1.8 During the pandemic, the Spaces for People (SfP) programme demonstrated how temporary materials enable rapid construction to test concepts and learn lessons. Projects which created adverse impacts could be quickly adjusted or removed. Within the lifetime of the programme designs evolved, with the latter Spaces for People project on Royston Road delivering smooth surfaces, improved bus stop layouts, and traffic light adjustments. While Glasgow is no longer in a COVID Emergency situation, we are in a Climate Emergency context which requires rapid modal shift to sustainable transport.

Complementary / Constraining Schemes

3.1.9 To compliment this city-wide active travel initiative the Liveable Neighbourhoods Programme (LNP) aims to transform streets, identified through meaningful engagement, into areas where people feel they are safe, pleasant, attractive environments. By enabling active travel as the first choice of transport, these projects will benefit public health by reducing noise and air pollution. To deliver Liveable Neighbourhoods in Glasgow, the infrastructure and place needs to be built that reflects the requirements and aspirations of people living within their local communities.

3.1.10 The LNP has four key themes: Local Town Centres; Everyday Journeys; Active Travel; Streets for People. An important aspect of LN's is ensuring support for active travel within neighbourhoods and connecting them to the city network.

3.1.11 The issues that will be addressed such as the spatial imbalance of vehicles over people and the priority of vehicles movement over people movement will bring

together existing initiatives such as car free zones around schools and the active travel strategy for the city. This will also assist in working towards the city's target to be carbon neutral by 2030.

3.2 Scheme Objectives

3.2.1 The aim of the scheme is to better connect neighbourhoods and a more enabling environment by developing an accessible, safe, coherent direct active travel network across Glasgow which removes social and safety barriers to active travel. The planning principles are based around two key factors from Cycle to Design (2021):

- **Coherence:** Cycling infrastructure should form a coherent network which links origins and destinations. It should link communities and facilities and integrate with other modes of travel. Routes should be continuous from an origin to a destination, be easy to navigate, well signed, intuitive and of a consistently high quality.
- **Directness:** Cyclists should be offered the most direct route based on existing and latent trip desire lines, minimising detours and delays. Directness has both geographical and time elements, affected by delays at junctions and crossings, as well as physical detours.

3.2.2 The Active Travel scheme aims to develop a city-wide network within Glasgow made up of a coherent and targeted package of interventions. The overarching objectives for the scheme are set out in Table 3-1.

Table 3-1 Active Travel Objectives

Objective No.	Theme	Objective	Target	Year
AT1	Inclusive and Accessible Design	Our networks and connections need to be planned and designed to create inclusive enabling environments for all to enjoy the benefits of active travel across the city.	All crossings and junctions to be fitted with appropriate tactile cones, paving, and dropped kerbs	2031
AT2	Connecting Neighbourhoods	We will work with communities, as part of the Liveable Neighbourhoods Plan process, to improve active permeability within and between neighbourhoods	GCC to complete	TBC
AT3	Improve active travel links with public transport	Improve walking and cycling links to bus stops, rail stations and public transport hubs, to create an	Delivery of mobility hubs. 50	2031

Objective No.	Theme	Objective	Target	Year
		integrated and sustainable travel network		
AT4	Design	To create an inclusive enabling environment that enables easy cycling across the city. To be developed alongside improved bus routes and the development of a Metro system to offer improved performance and choice for sustainable transport.	City Network usage has even gender distribution.	2031
AT5	Delivery	To contribute significantly to Glasgow's net zero commitments, which will require a challenging and achievable roll-out of infrastructure.	270 km delivered* 100km delivered *to be counted as delivered km links must be between two high quality protected junctions.	2031 2026
AT6	Streets for people	We will revamp Glasgow's neighbourhood streets to be focussed on the needs of people in order that streets can become more people friendly, enjoyable and attractive places.	Complete Liveable Neighbourhoods public conversations across Glasgow.	2026
AT7	Safe secure cycle parking	A vital piece on infrastructure for cycling at either end of a journey is somewhere appropriate to park cycles.	1 cycle parking pod per 50 flats 1 cycle parking pod per 20 flats	2026 2031
AT8	Safer walking and cycling to schools	Routes to school should be safe for people to choose active travel as an easy option.	All Schools to be on the network, or connected by few minutes cycle on low traffic street	2031

Objective No.	Theme	Objective	Target	Year
			(defined according to Cycle by Design criteria for mixed use) Measure: proportion of pupils being driven to school based on hands up survey	
AT9	Road Safety	Work with the road safety plan to build on Glasgow's signature to the POLIS statement on "new paradigm for safe city streets". Death and serious injury should not be accepted as an inevitable by-product of urban mobility. Traffic crashes and risk behaviours have underlying structural causes that we can act upon.	Deliver 25 new Low Traffic Neighbourhoods Deliver 75 Low Traffic Neighbourhoods Zero road deaths in Glasgow City.	2026 2031 2030

3.2.3 The objectives of the scheme will be used to assist in the development of the Critical Success Factors used in the option sifting process and the determination of the preferred way forward.

3.3 The Strategic Context

3.3.1 Since the expansion of the European Union (EU) in 2004, western European cities in particular have experienced a significant reduction in European grant funding and lack of investment into public realm infrastructure. This was followed by the full withdrawal of ERDF capital infrastructure funding in the case of many areas including Glasgow and most of western Scotland's city centres, following the end of the 2000-2006 Objective 2 Structural Funds Programme. This shift of resources towards the new Eastern European member states has had a substantial impact on the options for funding infrastructure in Glasgow.

3.3.2 This has been further exacerbated by significant and ongoing reductions in central government grants to local government which have impacted upon service provision and local regeneration initiatives, and reduced income from revenue-generating activities like Planning Services, or from developer contributions, due to the general development downturn.

Local / National Policies

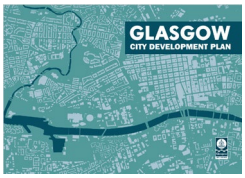
3.3.3 To determine how well the proposed scheme meets both local and national policy objectives, an overview of the national policies impacted by the scheme are provided in Table 3-2 with more detailed information provided in Table 3-3.

Table 3-2 Summary of scheme impact on key local and national policies

	Policy	Overview of Scheme Impact
Local Government Planning Policies	**Glasgow City Development plan**	The local development plan for Glasgow also focuses on the need for sustainability outlining the need for reducing non-essential car travel.
	Glasgow's Traffic and Road Safety Plan	This plan sets out the city's vision of no-one being killed or seriously injured in road accidents by 2030. Reducing car-based traffic, particularly on short to medium journeys at peak times is an objective closely aligned with the expected outcomes of this scheme.
	Glasgow's Active Travel Strategy 2022-2031	The strategy sets out the vision to make active travel first choice and to increase walking, wheeling and cycling across Glasgow.
	Glasgow City Centre Transport Strategy 2014-2024	This strategy aims to deliver balanced transport benefits, encourage sustainable transport and provide a vibrant city centre in line with City Centre Strategy objectives.
	Glasgow Strategic Plan 2017 to 2022	The city-wide active travel strategy will contribute to several of the themes of the strategic plan, in particular t the sustainable and low carbon city theme through reductions in car travel both in terms of transfer to active modes and reductions in journey length as local communities become increasingly self-contained.
	Glasgow's Liveable Neighbourhoods	Place active travel and public transport as a first choice whilst maintaining the transport needs of the city.

	Policy	Overview of Scheme Impact
Scottish Government National Plans, Policies and Strategies	**Scotland 2045. Fourth National Planning Framework – NPF4 (Draft)**	Focusses on the creation of sustainable, liveable, productive and distinctive places. A key objective of the project is to create more cohesive living spaces through the introduction of active travel solutions.
	National Transport Strategy 2 (NTS2, 2020)	Vision for a sustainable, inclusive, safe and accessible transport system. Active travel modes are one of the most sustainable mobility solutions and promoting these through the Active Travel Strategy will contribute to achieving this objective.
	Transport Scotland Active Travel Framework	Long term approach for increasing the uptake in walking and cycling. This is closely aligned with the objectives for this project and underlines the importance in encouraging participation in active travel.
	Let's get Scotland Walking – The National Walking Strategy	Outlines the vision for Scotland where everyone benefits from walking.
	Climate Change Plan 2018-32	Outlines the objective to reach zero carbon by 2030. Encouraging modal shift away from motorised transport is a key strategic driver for the Active Mode Strategy and will support this national objective.

Table 3-3 Impact of scheme on local and national policy

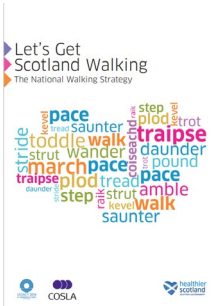
	Policy	Scheme Impact
Local Government Planning Policies	**Glasgow City Development plan** 	The City Development Plan (The Plan) is the new statutory Local Development Plan for Glasgow. It is the first of its kind for the City, and is designed to help residents and communities understand, and get involved in, the planning issues affecting their area. A clear 10-year planning framework for the City is set out in The Plan, including a spatial strategy, policies and proposals for the future use of land and infrastructure. It is recognised that the efficient use of land and provision of good infrastructure are important for the wellbeing of the City, particularly when supported by a commitment to create and maintain high quality places. The key aims of the plan is to provide a healthy, high-quality places that supports sustainable development. The strategic outcomes for Glasgow City Development plan are: • A vibrant place with a growing economy. • A thriving and sustainable place to live and work. • A connected place to move around and do business. • A green place which is resilient, accessible and attractive. CPD11 Sustainable Transport Policy aims to ensure that Glasgow is a connected city, characterised by sustainable active travel by; supporting better connectivity by public transport; discouraging non-essential car journeys; encouraging opportunities for active

Policy	Scheme Impact
	travel; reducing pollution and other negative effects associated with vehicular travel; and optimising the sustainable use of transport infrastructure.
Glasgow's Traffic and Road Safety Plan 	This plan sets out the city's vision of no-one being killed or seriously injured in road accidents by 2030. The Plan sets out a number of actions to achieve this target, which include prioritising active travel across the city. A significant step towards shifting that balance to active travel is by implementing a city wide 20mph speed limit. Slowing vehicle speeds opens up opportunities to walk and cycle more journeys, improving the environment we all live in Reducing car-based traffic, particularly on short to medium journeys at peak times, is just one of the key elements to reducing road casualties in Glasgow. We need to encourage safe sustainable active travel such as walking, cycling and wheeling and explore and support new methods of travel such as e-bikes and scooters. We also need to ensure our public transport system is an affordable and reliable option for everyone, and that it provides good access to healthcare, services and employment. Education, training and publicity is also a vital component in the safe-systems approach, to ensure all road users are risk aware, not only for themselves, but for other road users.
Glasgow's Active Travel Strategy 2022-2031 	Glasgow's active strategy has a fundamental role to play in achieving a successful transition to a carbon neutral, clean and sustainable city; tackling poverty, improving health and reducing inequality; contributes to inclusive economic success and creates place where all can thrive regardless of mobility or income. The strategy sets out the vision to make active travel first choice and to increase walking, wheeling and cycling across Glasgow for those who can. Walking, cycling and wheeling must be facilitated in ways that complement one another, and equally importantly, provide seamless links with local public transport services. This strategy places active travel as a meaningful and crucial element of our daily journeys and will contribute to Glasgow's health, economy, connectivity and wellbeing as well as helping to deliver on climate commitments. Accessibility and inclusion are core to this strategy. Active travel can reduce transport inequalities and offer residents greater independence to move around Glasgow. The proposed City Network will provide safe active travel at all times of day, for people of all abilities. Walking and wheeling infrastructure and public spaces must provide easy access for everyone, so that nobody feels disconnected from public transport, local services and their community. It addresses the barriers to cycling, but also, and perhaps more importantly, the barriers that prevent people from taking up cycling in the first place. In conjunction with the Liveable Neighbourhoods

Policy	Scheme Impact
	Plan, it will help to make streets feel safer to walk, wheel, play and spend time in.
Glasgow City Centre Transport Strategy 2014-2024 	The overall aim of the City Centre Strategy is to ensure that Glasgow's city centre is an attractive and sustainable place for residents, visitors and businesses. Transport obviously plays a key part in helping to deliver that aim. This is an objective led process which enables the development of a balanced strategy through extensive consultation and taking account of existing policies. The strategy acknowledges that the city centre is always changing. It seeks to achieve a balance between the varying transport needs and preferences of different users of the city centre. The transport issues that the strategy seeks to address are split into three categories; walking and cycling; public transport and traffic and parking. The strategy was then developed based upon two key concepts overarched by a hierarchy of transport modes. 1. Priority for pedestrians, public transport and cyclists 2. Minimising the impact of private cars. The first concept included the development of avenues which was based on providing an integrated pedestrian and cycling network linking key areas across Glasgow, improve cycle routes and infrastructure, coordinate network of bus corridors, and support rail and subway enhancements. The second concept included measures such as traffic management, encouraging parking at the periphery of the city centre, electric vehicle charging point, city car clubs and noise management areas.
Glasgow Strategic Plan 2017 to 2022 	This plan sets out the priority themes and commitments that will be delivered over the next five years by the council, its services and arm's length organisations. It will deliver a step change in how we: • Promote human rights and reduce inequalities across Glasgow. • Improve the life chances and choices for all our citizens. • Embed social justice in our policy making. • Empower our citizens, giving them a stake, and a say, in what happens in their local communities and communities of interest. The plan will be delivered on a thematic basis across seven cross cutting themes: a thriving economy; a vibrant city; a healthier city; excellent and inclusive education; a sustainable and low carbon city; resilient and empowered neighbourhoods and a well governed city that listens and responds. Glasgow continues to face challenges in addressing the impact of poverty, deprivation, inequality and the impact that it has on our citizens' health. There is a specific focus in this plan to address health to ensure that everyone can reach their full potential and

Policy	Scheme Impact
	take part in all the city has to offer in terms of job opportunities and good quality neighbourhoods. Glasgow aims to become a sustainable low carbon city. This is a long-term goal; however, there are actions and strategies that can be put in place now to deliver this ambition. Litter, the environment and transport remain high on the list of priorities for our citizens and businesses and this plan focuses on delivering improvement in these areas. Having clean, sociable, accessible and safe neighbourhoods for people to live and work in is a key driver for the delivery of Glasgow's commitment to reduce inequalities. Living in quality neighbourhoods, where you feel a sense of ownership over the decisions made in it, improves the health and wellbeing of Glasgow's people.
Glasgow's Liveable Neighbourhoods 	Glasgow's Liveable Neighbourhoods will be accessible and healthy places that allow people, of all ages and abilities, out to play and socialise in their local area. Neighbourhoods should perform in such a way that maximises the social, economic and environmental benefits of the area through interventions that improve localities and place and help to reduce the city's dependency on cars by making walking, cycling and public transport first choice. It is possible to rebalance the way streets are designed and used, to make them more people friendly and better for socialising and improving commercial activity. To also place active travel and public transport as a first choice whilst maintaining the transport needs of the city. Glasgow is adopting the 20-minute neighbourhood approach by establishing the Liveable Neighbourhoods Plan. The publication of this toolkit is the first stage of a 10-year programme that will focus on enabling communities and people of all abilities to improve their neighbourhoods. The four key themes of a liveable neighbourhood are: 1. Local Town centres - enable communities to meet their everyday needs locally and bring vibrancy, activity and jobs. 2. Everyday journeys - short journeys are made by car that could happen on foot or by bike: for example, to school, childcare, shops, or family and friends. 3. Active Travel - walking, cycling and moving around on your own help's health, wellbeing and carbon emissions. Streets for people - achieves a better balance between vehicles and people by working with local communities, learning from best practice elsewhere, and sharing design guidance.

Policy	Scheme Impact
Scotland 2045. Fourth National Planning Framework – NPF4 (Draft) 	The draft NPF4 sets out a vision for how Scotland's places will change in the future. It reflects priorities across Scottish Government portfolios and brings together a wide range of plans, programmes and policies. It explains how they will work together to build sustainable, liveable, productive and distinctive places. These proposed interventions within this scheme contribute to several objectives highlighted within the framework, these being: • Sustainable Places • Liveable Places • Productive Places • Distinctive Places 
National Transport Strategy 2 (NTS2, 2020) 	NTS2 contains a vision for Scotland's transport over the next 20 years. A sustainable, inclusive, safe and accessible transport system, helping to deliver a healthier, fairer and more prosperous Scotland for communities, business and visitors. The vision is underpinned by four interconnected priority areas, each with associated outcomes; reduces inequalities; takes climate action; helps deliver inclusive economic growth; and improves health and wellbeing. The importance of walking, wheeling and cycling is identified through the national 'Sustainable Travel Hierarchy'. At the national level the Sustainable Investment Hierarchy will be used to inform future investment decisions and ensure transport options that focus on reducing inequalities and the need to travel unsustainably are prioritised. It is prioritised above all other forms of transport.   : The Sustainable Investment Hierarchy
Transport Scotland Active Travel Framework	The Active Travel Framework brings together the key policy approaches to improving the uptake of walking and cycling in Scotland for travel. It has been produced collaboratively by Transport Scotland and key delivery partners, with input from Regional Transport Partnerships (RTPs) and local authorities.

Policy	Scheme Impact
	Drawing on the long-term shared vision and strategic objectives for active travel developed and set out in partnership in 2014, at its heart is an ambition that by 2030, Scotland's communities are shaped around people and place, enabling walking and cycling to be the most popular mode of travel for short, everyday journeys. The plans 2030 vision is that Scotland's communities are shaped around people, with walking or cycling the most popular choice for shorter everyday journeys. The Active travel long-term outcomes are designed to drive the delivery of the active travel vision and include: • Increase the number of people choosing walking, cycling and wheeling in Scotland. • High quality walking, cycling and wheeling infrastructure available to all. • Walking, cycling and wheeling is safer for all.
Let's Get Scotland Walking – The National Walking Strategy 	Scotland has outstanding opportunities for walking both in urban and rural areas. Walking can contribute positively to areas such as planning, regeneration, economic development, mental and physical health and wellbeing, transport, climate change and education. There are many benefits from getting Scotland walking, including: more people will use active travel more often and will walk more for pleasure and for recreation; children will have safer routes to school and local facilities; older people will feel more connected with their communities; employers will have a healthier and more productive workforce; Scotland will reduce its use of carbon; and local economies will benefit from increased footfall. Walking is highly cost-effective and demonstrates that prevention really is better than cure. The health risks of inactivity are stark – 7 Scots die every day due to inactivity, often long before they have to. The three strategic aims are: • Create a culture of walking where everyone walks more often as part of their everyday travel and for recreation and well-being • Better quality walking environments with attractive, well designed and managed built and natural spaces for everyone • Enable easy, convenient and safe independent mobility for everyone
Climate Change Plan 2018-32	The plan sets out how the city will achieve its goal of net-zero carbon by 2030, which was set following the City Council's declaration of a Climate and Ecological Emergency in 2019. The actions in the Climate Plan include preparation of an Active Travel Strategy. Climate change adaptation is about responding to the changes that we have seen in our climate over the last few decades and

Policy	Scheme Impact
	preparing for the challenges that will face as our climate continues to change. There are a range of outcomes highlighted in this strategy. There are three which relate directly to this scheme and its objectives. Outcome 1, for example, emphasises that Scotland's communities are inclusive, empowered, resilient and safe in response to the changing climate. Several of the proposed interventions will directly impact this outcome by enhancing social sustainability indicators such as social cohesion and interaction, attractive public realm and sustainable urban design (amongst others) (Dempsey *et al.,* 2011). Outcome 2 states how the people in Scotland who are most vulnerable to climate change can adapt and climate justice is embedded in climate change adaptation policy. Finally, Outcome 5 says that Scotland's natural environment is valued, enjoyed, protected and enhanced and has increased resilience to climate change.

Active travel in Glasgow

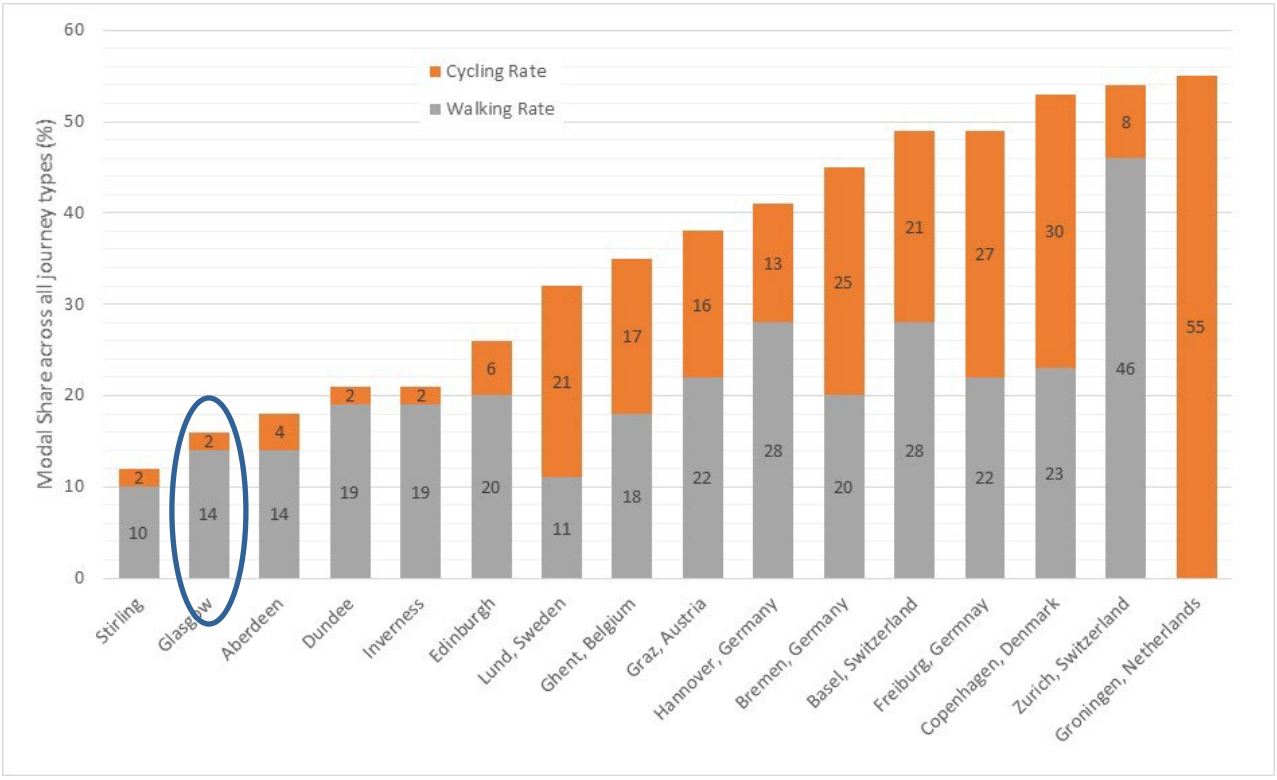
3.3.4 The Glasgow Indicators Project[3] details the wellbeing of Glasgow's population across a range of domains, allowing progress to be monitored and encourages civic engagement in the cross-cutting issues that face the city. This includes analyses from a range of data sources to provide information on travel behaviour and transport in Glasgow to highlight positive and negative trends.

National / International Comparison

3.3.5 National and international comparisons have been provided outlining the walking and cycling behaviour in Glasgow and Scotland more widely with other European cities. Figure 3-1 provides this comparison.

[3] Understanding Glasgow | The Glasgow Indicators Project

Figure 3-1 Walking and Cycling in selected Scottish and European Cities[4]



3.3.6 The level of cycling mode share within Glasgow, and Scotland more generally, is significantly lower than other European cities. There is clear room for improvement to put Glasgow at the forefront of sustainable travel in Europe. The Active Travel Strategy aims to increase the active mode share by investing in the infrastructure provision enabling faster and safer journeys walkers and cyclists. Targeted interventions as part of the development of the city network will attempt to realise these aims. The following sections of the business case will outline further details on walking and cycling within Glasgow.

3.3.7 Cities across Europe, for example in Paris from 2018, have seen a step change in participating in active travel modes (particularly cycling) largely due to infrastructure changes and planned lower traffic levels on key routes. New protected bike lanes have resulted in a doubling or even tripling of number of riders on some busy main roads and more residents of the greater Paris region cycle rather than take the busiest line of the city's metro. The left bank of the Seine has been free from motor traffic since 2016 creating a new public gathering area. The improvement of cycling infrastructure in Paris was a reaction to the need to reduce emissions and cut air pollution in the city.

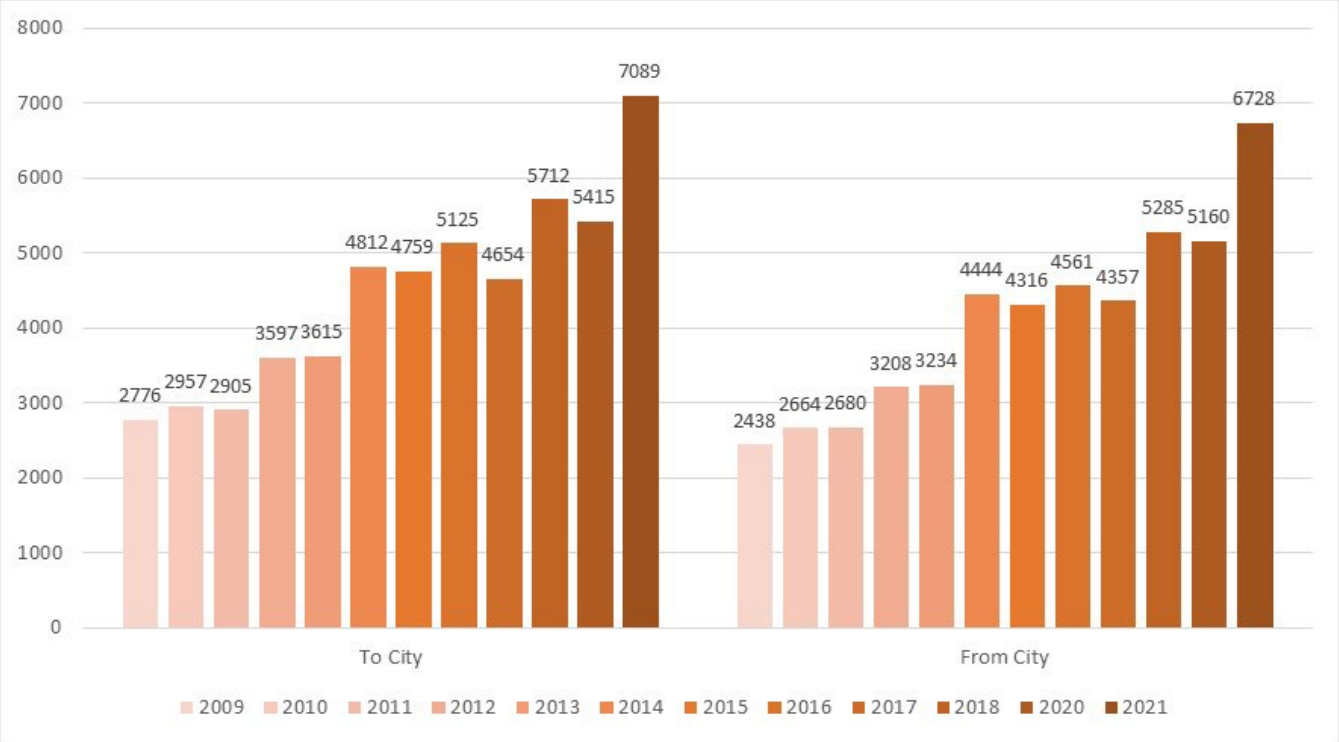
Cycling

3.3.8 Cycling is a key element of the Active Travel Strategy. Over the last decade, Glasgow City Council commissioned a count of cyclists and pedestrians entering and leaving

[4] Source: Civilising the Streets, Transform Scotland, 2010

the city centre annually between 2009-2018 as shown in Figure 3-2. A total of 35 sites forms a cordon around the centre of the city and are monitored between 6:00am and 8:00pm over two successive days each September. All pedestrian and cycle movement at these locations, to and from the city, are counted.

Figure 3-2 Glasgow Cycle Counts 2009-2021 (based on 2-day surveys)



3.3.9 There has been a 165% increase in cycle trips into and out of the city over the period 2009 to 2021. In 2021, the cordon survey counted nearly 14,000 trips into and out of the city per day by bicycle. This figure represents a 30% increase in the number of cycle trips compared to the previous year. Between 2009 and 2021, cycle trips into and out of the city centre (as recorded by the cordon survey) increased on average by 14% per year. Some of this change may be due to the introduction of the Glasgow's Mass Automated Cycle Hire (MACH) scheme launched in 2014.

3.3.10 Glasgow's MACH scheme was launched in June 2014 just prior to the start of the Commonwealth Games. The scheme initially provided 400 bikes for public hire at 31 locations across the city and with additional temporary sites at 6 Glasgow 2014 Commonwealth Games venues. Since then, extra cycle hire stations in the east and south of the city have been added, as well as new bikes in September 2017 and again in August 2018. In October 2015, the South West City Way opened providing a 2km segregated cycle route running north-south between Pollokshields and the Tradeston Bridge.

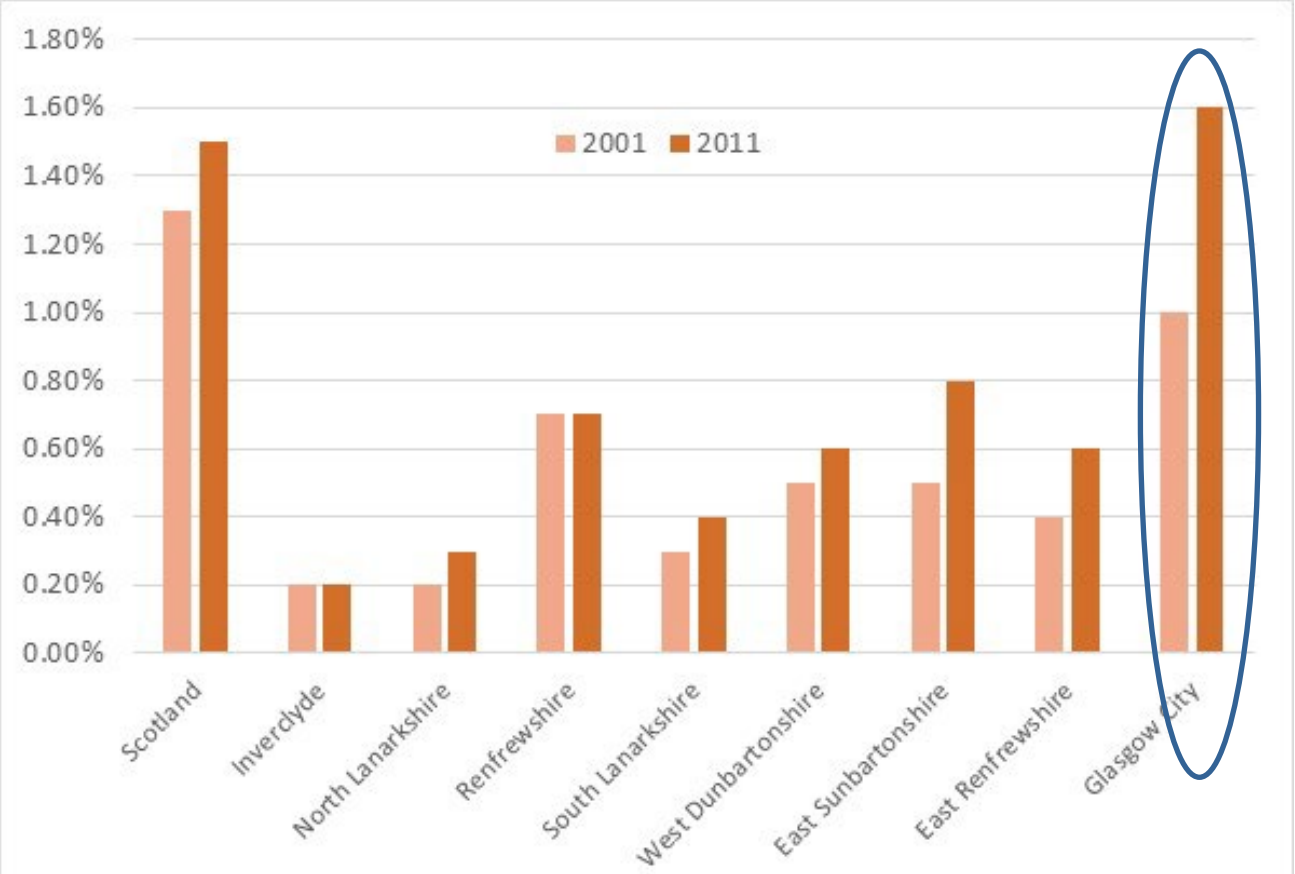
3.3.11 The success of the cycle hire scheme, alongside improvements to infrastructure, has contributed to the increased levels of cycling in Glasgow in recent years. This provides a strong indication that there is latent demand for cycling and that investment in active travel will have a significant response in terms of modal share.

3.3.12 During COVID-19 pandemic there was a slight decline in cycle count numbers in 2020 compared to 2018 (a survey was not undertaken in 2019) but there was a large increase in 2021 which could suggest that people have taken up cycling during the pandemic and are maintaining this behaviour.

3.3.13 In May 2013, the Glasgow Centre for Population Health (GCPH) published a study detailing the health economic benefits of cycle commuting into and out of the centre of Glasgow. This study was based on applying a Health Economic Analysis Tool (HEAT) for cycling - an online tool created by the World Health Organisation - to the cordon count data. In 2012, it was estimated that cycle commuting into the city centre was worth over £4 million in terms of reduced mortality; this is likely to be an underestimate of the health economic benefits because the model does not take account of reduced illness and other health benefits conferred by cycling.

3.3.14 Commuting to work or study by bicycle rose in every local authority in Glasgow and Clyde Valley between 2001 and 2011, as shown in Figure 3-3. However, despite this, levels of cycle commuting are still very low compared to other modes of transport, such as driving to work. In the majority of local authorities in the area less than 1% of commuters are cyclists. Glasgow is the exception, where regular cycle commuters rose from 1% to 1.6% in the period 2001-2011. In the same period, at a national level, the proportion of cyclist commuters rose from 1.3% to 1.5% between 2001 and 2011. 2019 data suggests that cycle commute mode share in Glasgow grew significantly grew to 4%.

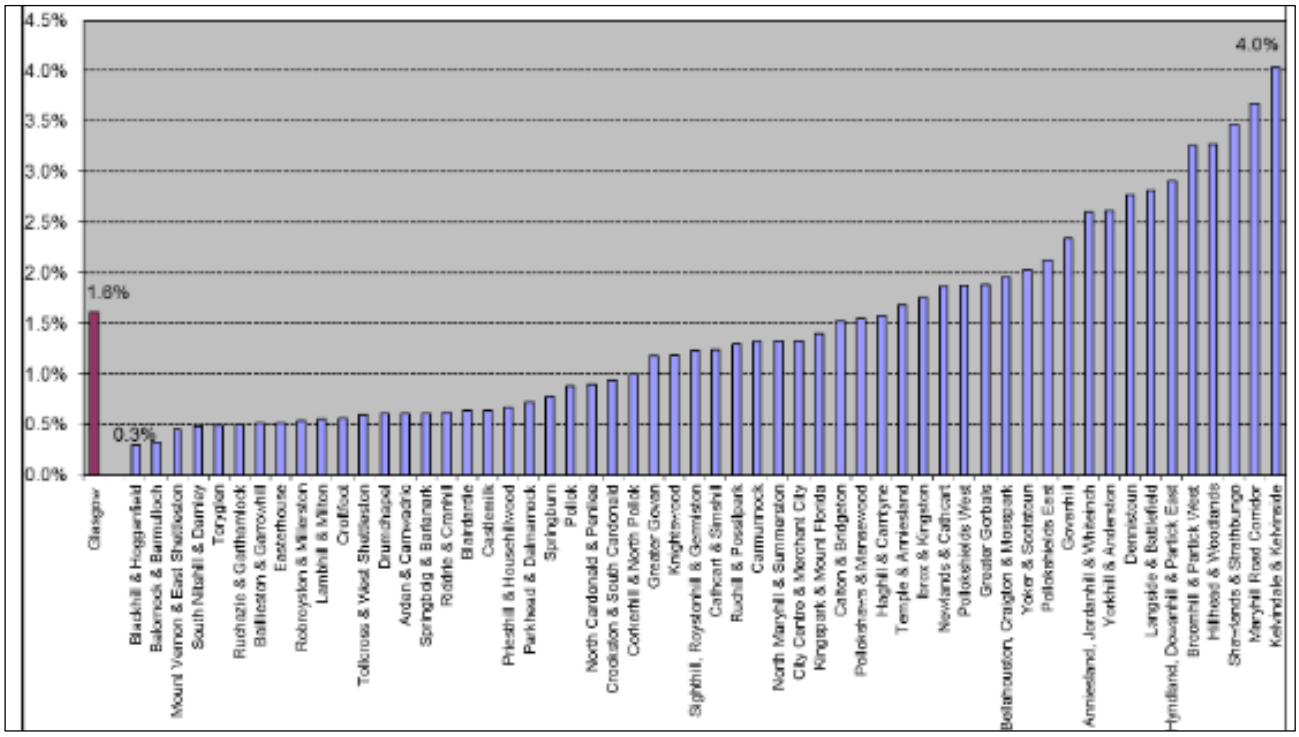
Figure 3-3 Proportion of commutes to work or study on a bicycle, Glasgow and Clyde Valley Local Authorities



3.3.15 Nationally, cycle commuting has remained at a low level over a long period, while commuting on foot and by bus has reduced as car commuting has risen.

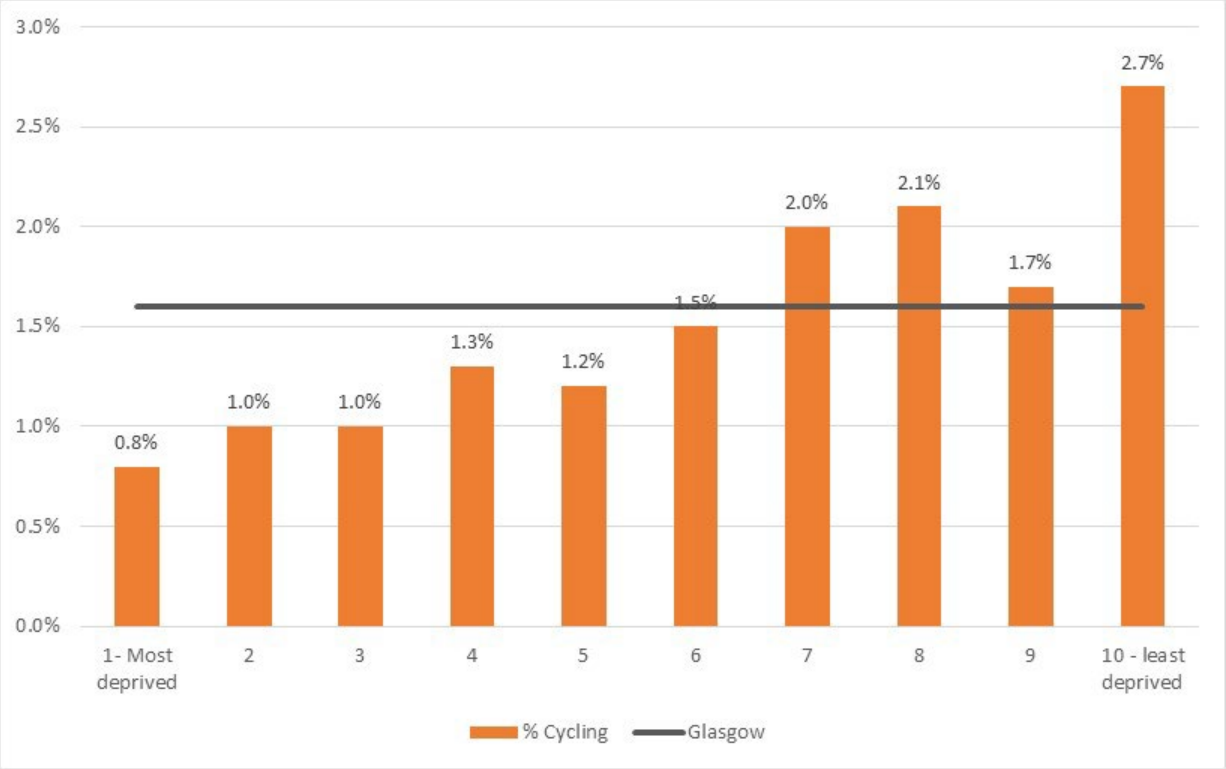
3.3.16 Within Glasgow neighbourhoods in 2011, the proportion of commuters who usually cycled to work or study in Glasgow was low, at only 1.6%, equating to 5,228 people. Levels of cycle commuting varied substantially (in relative terms) across Glasgow's neighbourhoods from 0.3% in Blackhill & Hogganfield (with less than 10 cyclists) to 4% in Kelvindale & Kelvinside (with nearly 250 cyclists) as presented in Figure 3-4.

Figure 3-4 Percentage of commutes to work or study by bicycle, Glasgow Neighbourhoods



3.3.17 There is a clear social gradient in relation to cycle commuting. In the most deprived decile of Glasgow only 0.8% of commuters cycled, while in Glasgow's least deprived decile, 2.7% of commuters cycled as presented in Figure 3-5. This provides some evidence of the need to introduce significant infrastructure to support the drive towards inclusive and accessible travel by design.

Figure 3-5 Percentage of commutes to work or study by bicycle, Glasgow Index of Multiple Deprivation decile



3.3.18 The total number of children travelling to school actively (by bike, on foot or skating/scootering) have declined since 2008 in Glasgow. However, while the numbers of children walking to school have reduced, there have been rises in cycling and skating/scootering. Approximately half of all children walk to school. In 2019, approximately 3% of children were cycling to school. The numbers of children skating and scootering to school has risen steeply in the last decade.

3.3.19 The 2018 Bike Life Glasgow report undertaken by Sustrans and Glasgow City Council, shows Glasgow has 293.3km of dedicated cycle routes for everyday cycling as shown in Table 3-4. However, the low mode share for cycling in Glasgow suggests that providing cycle infrastructure of shared use paths, painted lanes, or shared with bus has not led to mode shift from driving. Currently (Jan 2022) Glasgow now has 14km of cycle tacks within highway physically separated from pedestrians. These numbers exclude the Space for People (SfP) programme additions.

Table 3-4 Total Length (in km) of each type of cycle route within Glasgow (2018)

Cycle route type	***Length (KM)***
Bus and cycle lanes	*39.7*
On road painted cycle lanes	*49.2*
*Shared use footways**	*151.2*

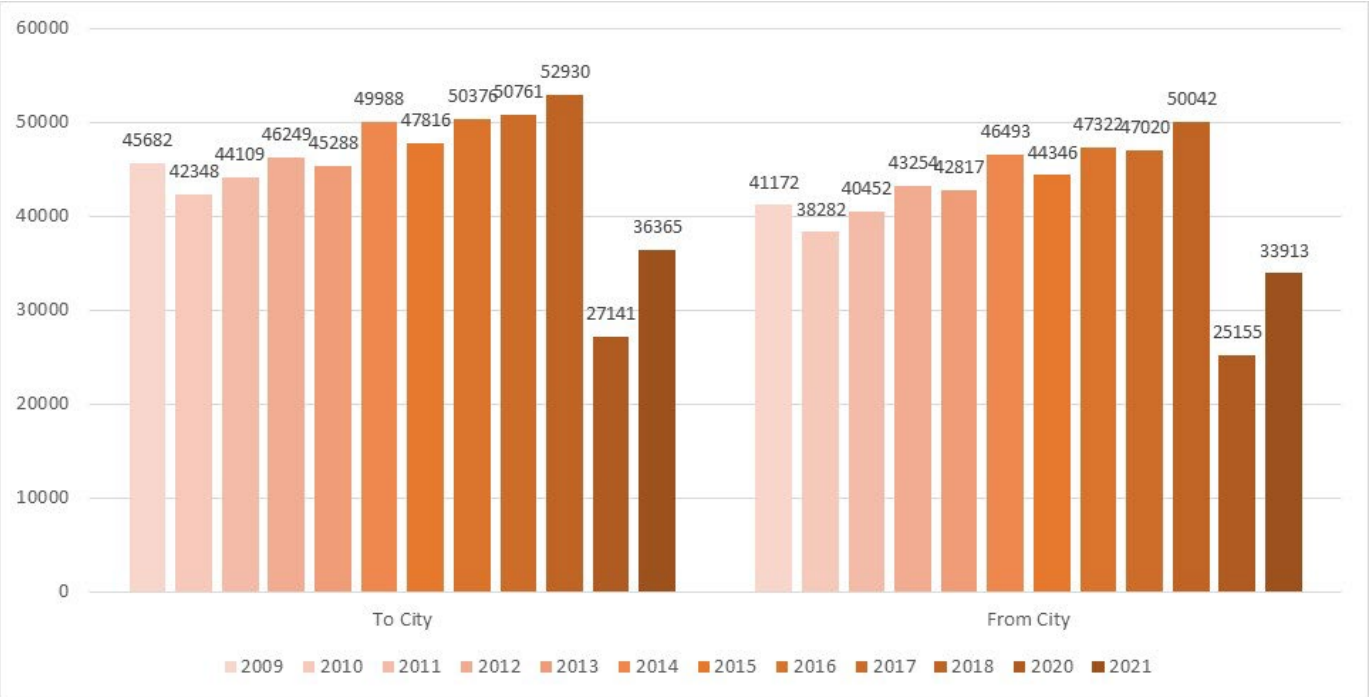
*Cycle tracks within highway, physically separated from pedestrians**	*7.5*
*Traffic free cycle routes away from the highways**	*45.7*
TOTAL	*293.3*

** Routes segregated from vehicles*

Walking

3.3.20 Over the last decade, Glasgow City Council commissioned a count of cyclists and pedestrians entering and leaving the city centre annually between 2009-2021 as shown in Figure 3-6. A total of 35 sites forms a cordon around the centre of the city and are monitored between 6:00am and 8:00pm over two successive days each September. All pedestrian and cycle movement at these locations, to and from the city, are counted.

Figure 3-6 Glasgow Pedestrian Counts 2009-2021(based on 2-day surveys)



3.3.21 There has been a 19% increase in pedestrian trips into and out of the city over the period 2009-2018, representing an annual rise of 2% per year. In 2018, the cordon count survey recorded nearly 103,000 trips into and out of the city centre per day, a rise of 5% over the previous year.

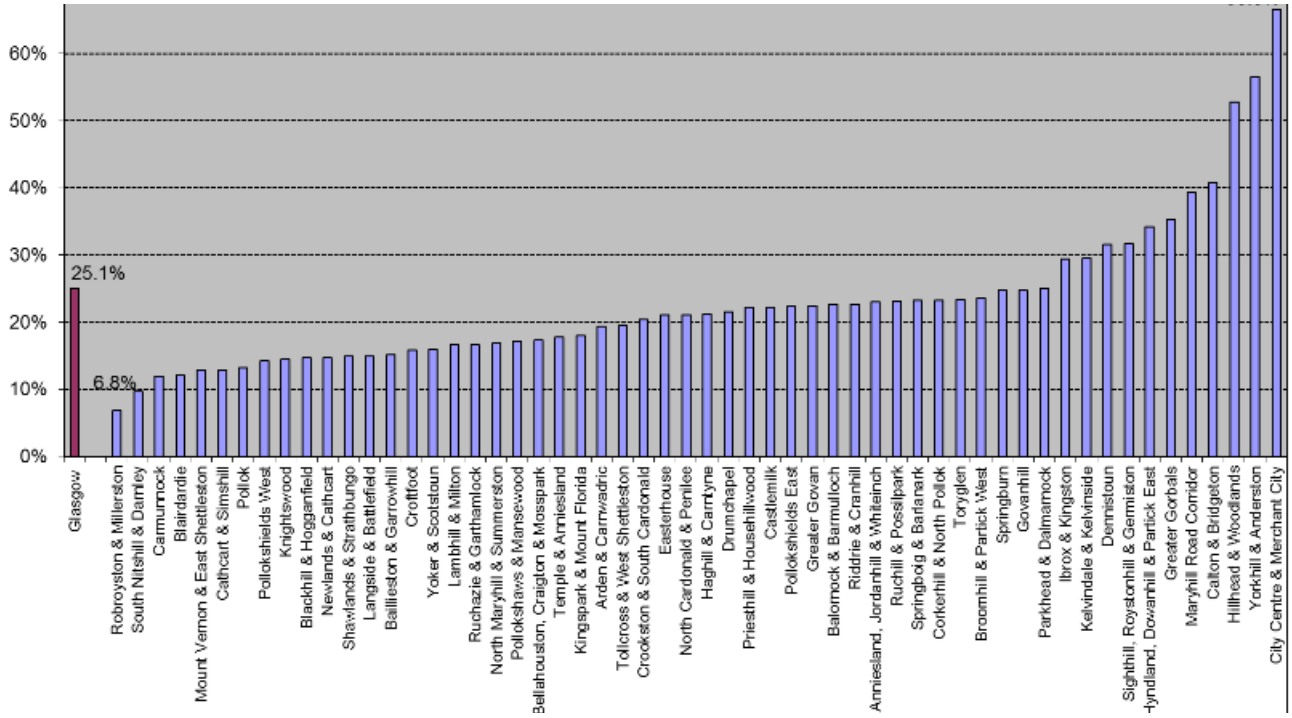
3.3.22 There was a sharp decrease in pedestrian trips into and out of the city during 2020 and 2021 compared to 2009-2018. This is likely to be an outcome of the COVID-19

pandemic and potentially reflecting the increase in working from home. There has been a 35% increase in pedestrian trips between 2020 and 2021 though which could reflect the easing of COVID-19 restrictions, although not restored to pre-pandemic levels.

3.3.23 Overall, in Scotland there was a reduction in the percentage of commuters walking to work or study between 2001 and 2011, in Glasgow this reduced from 26.8% to 25.1%. Walking commuting has reduced as part of a long-term national trend that has been accompanied by increased car commuting. This long-term trend is not a sustainable transport solution, encouraging modal shift towards active modes will be a key driver in delivering sustainable and accessible transport for all and achieving

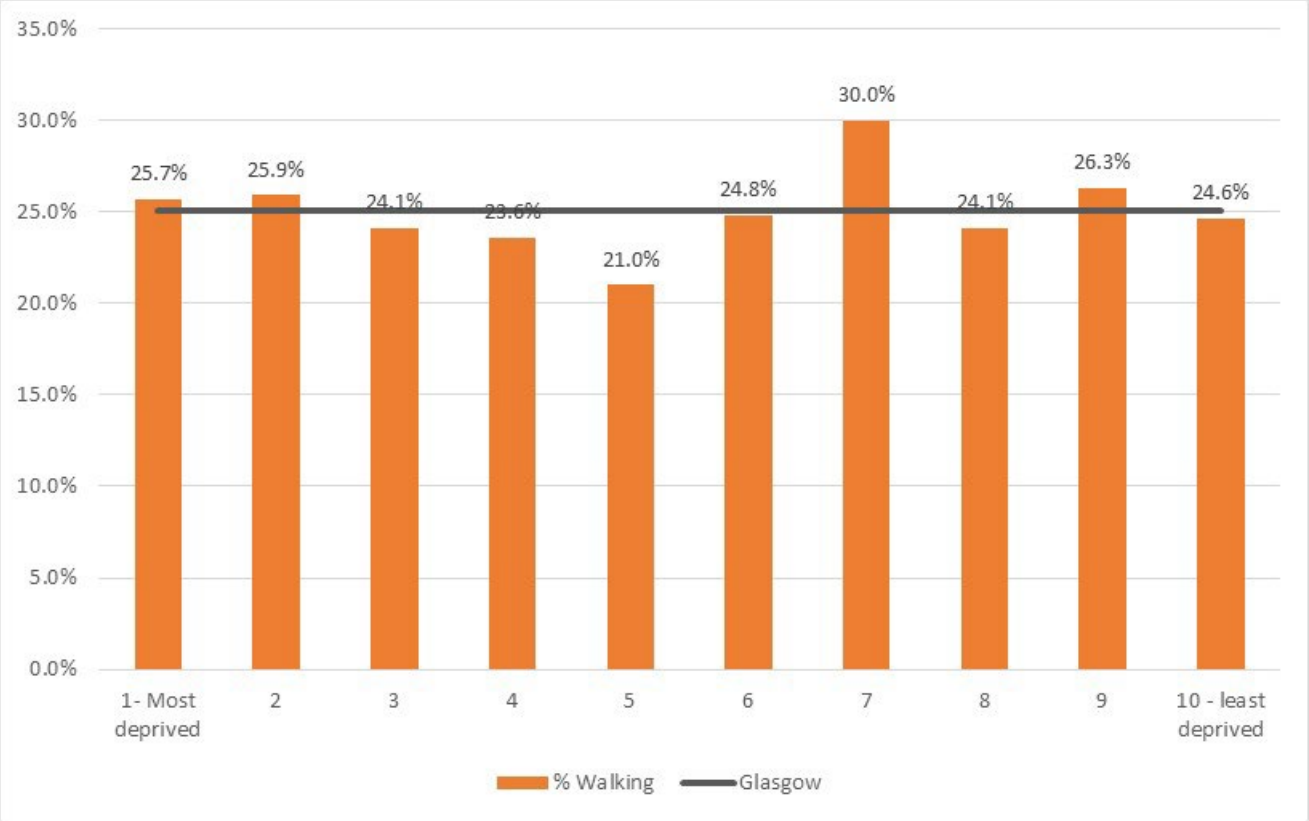
3.3.24 In 2011 the percentage of commuters who usually walked to work or study in Glasgow was 25.1%, equating to 81,377 people. The level of commuting on foot varied substantially across Glasgow's neighbourhoods from 6.8% in Robroyston and Millerston to 66.6% in the city centre and Merchant city as shown in Figure 3-7.

Figure 3-7 Percentage of commutes to work or study on foot, Glasgow neighbourhoods



3.3.25 In 2011, about a quarter of commuters (25.1%) walked to their place of work or study in Glasgow. There were no large differences in levels of walking comparing between more and less deprived parts of the city as shown in Figure 3-8.

Figure 3-8 Percentage of commutes to work or study by foot, Glasgow Index of Multiple Deprivation decile

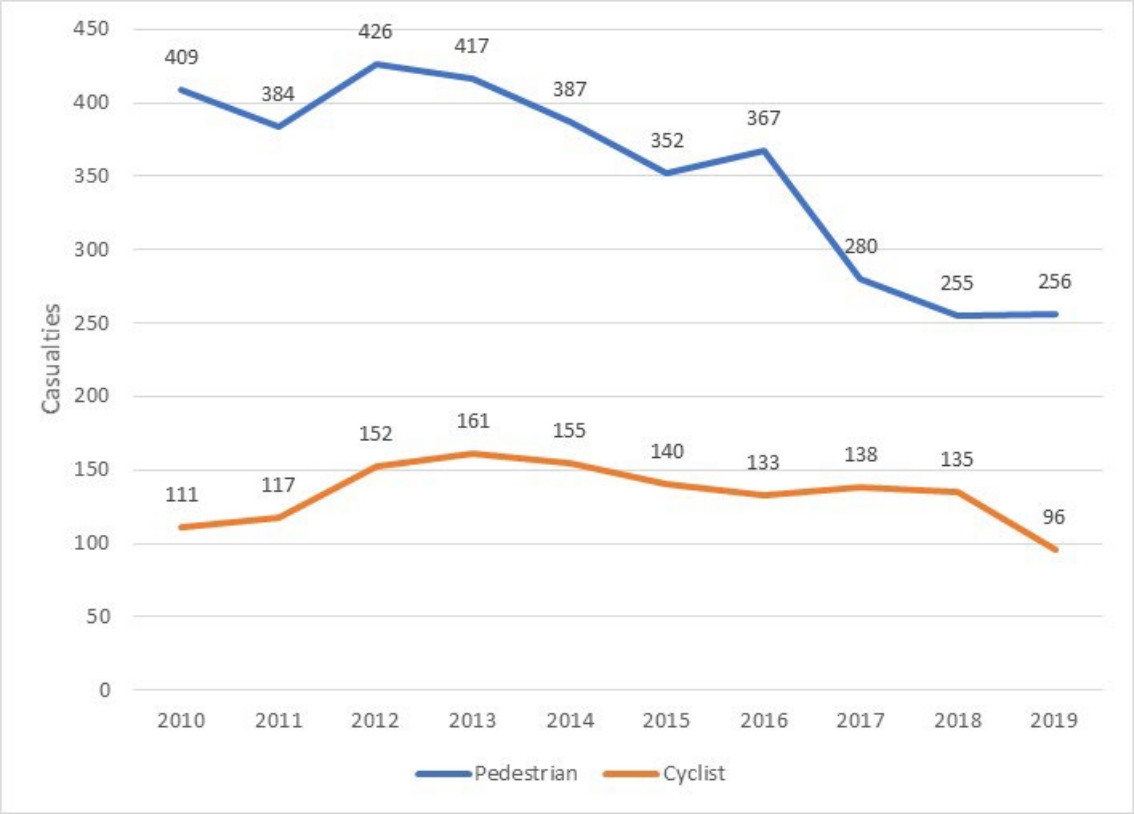


Cycling and Pedestrian Casualties

3.3.26 Taken from Glasgow's Road Safety Plan 2020-2030 pedestrian casualties have reduced significantly during the past decade. However, they have remained steady for the past 2 years. This indicates previous targeted measures have been effective, but also suggests that new innovative measures are required to make further gains in this area. A city-wide mandatory 20mph zone is a key factor to reduce pedestrian casualties to 2030 as shown in Figure 3-9.

3.3.27 Cycling trips in Glasgow have increased by 111% from 2009 to 2018 whilst cycling casualty rates have reduced. It should be noted that many cycling collisions involving slight injury go unreported, also shown in Figure 3-9.

Figure 3-9 Pedestrian and Cycling Casualties 2010-2020.



3.3.28 The road safety plan pulls together a summary of analysis from pedestrian casualties and highlights that:

- 72% involve a car
- 50% occurred at a junction
- 18% occurred at automatic traffic signals
- 73% occurred in fine weather
- 95% occurred in a 30mph limit

3.3.29 The road safety plan summaries the analysis of cycling casualties and highlights that:

- 60% involve riders aged 30-59 and 28% aged 20-29
- 70% occurred at a junction (54% give way junction and 15% at a controlled junction)
- 95% occurred in a 30mph limit
- 78% occurred in fine weather
- 74% occurred in light conditions
- 86% involve a car

3.3.30 The road safety plan also highlights that 62% of all child casualties in Glasgow from 2010-2020 were pedestrians. Child casualties also increase at the start and end of the school day.

3.3.31 A report from the Glasgow centre for Population Health looked at pedestrian and cyclist casualty trends in Scotland. The 2015 report highlighted the following key areas of concern:

- The rise in adult cyclist casualties.
- The consistently higher rate of pedestrian casualties in more deprived communities.
- The higher rate of child cyclist and pedestrian casualties in comparison with adults.
- Generally, a higher level of cyclist and pedestrian casualties in large urban areas.

3.3.32 The report makes a number of suggestions for what needs to happen to reduce casualties and encourage more people to walk and cycle, noting that no single approach will be enough and concurrent actions are required. Increased investment in safe, well designed and integrated infrastructure and area speed restrictions would reduce the real and perceived risks of accidents for pedestrians and cyclists. Better road maintenance, training programmes for cyclists, bus drivers and other road users and behaviour change campaigns could also play a role. Adopting approaches to neighbourhood design which enable safe walking, cycling and play will help create safer and more sustainable neighbourhoods.

Conclusions

3.3.33 A wide range of walking and cycling data has been analysed to understand and outline the current status of active mode travel within Glasgow. The data generally indicates that although the popularity of active modes is increasing, there has previously been a low level of active mode share compared to other European cities with similar climates. This indicates more can be done to increase the proportion of people walking and cycling in Glasgow. Introducing physical infrastructure and reducing traffic levels through the Active Travel Scheme is likely to have a considerable impact in achieving this objective as shown in the Netherlands and Paris as well as supporting net zero targets.

3.3.34 Achieving a shift towards active modes would have a significant impact in achieving numerous policy objectives such as reducing carbon emissions, allowing for more inclusive accessibility and improving connectivity between neighbourhoods. Some of the data is very clear on the lack of inclusivity around cycling with lower income deciles having a considerably lower proportion of commutes to work via bicycle.

3.4 Consultation

3.4.1 Prior to the development of the draft Active Travel Strategy 2022-2031, Glasgow City Council set up a series of one-to-one online conversations with members of the Active Travel Forum in May 2021 to learn about:

- Their work activities and issues that they have experienced throughout the pandemic.

- Projects and interventions at a local level that have been delivered or undertaken where there are overlapping opportunities for Active Travel Strategy and Liveable Neighbourhoods.
- Active travel barriers.
- What is missing from Glasgow's Strategic Plan for Cycling 2016-2025 that should be included in the Active Travel Strategy 2022-2031.

3.4.2 Consultation was held with (but not limited to) key stakeholders which assisted in the development of the structure and inception for the draft Active Travel Strategy 2022-2031.

Bike for Good	University of Glasgow
Cycling Scotland	University of Strathclyde
Cycling UK	Glasgow Eco Trust
Freewheel North	Go Bike
Glasgow Centre for Population Health	Living Streets
Get Glasgow Moving	St Paul's youth forum / On Bikes
Glasgow Caledonian University	NHS GCC
Scottish Cycling	Paths for All
South Seeds	SW Community Cycles
Sustrans	

3.4.3 In June 2021 an active travel forum and workshop was held online to:

- Develop and review themes, policies and actions; and
- Provide input on the active travel network.

3.4.4 This was facilitated through and online collaborative session with an interactive white board and post-it notes to record all views and suggestions.

3.4.5 Further online workshops were held in June and July 2021 with key internal departments of Glasgow Life, PEPASS, Spatial Planning, Technical Services, Planning, Road Safety Unit and Roads. This was to allow input into the themes and policies and to make sure that their needs were accounted for as well as making sure the language is consistent throughout council services. Once that process was complete the internal stakeholders reviewed spreadsheets containing all policy objectives and actions.

3.4.6 Further feedback on the Active Travel proposals will be sought from the Active Travel Forum and additional consultations within Glasgow City Council took place. The Active Travel Strategy and Action Plan public consultation ran from the 12th October to 12th November 2021. This comprised of the circulation of consultation documentation to all elected members and community councils, active travel forum representatives and other interested agencies.

3.4.7 The proposed publication dates of the Active Travel Strategy and associated City Network technical report is February 2022 following final approval of the Environment, Sustainability and Carbon Reduction City Policy committee.

3.4.8 Significant stakeholder engagement has been undertaken so far encompassing a wide range interested parties and gathering views on how the Active Travel Strategy and associated infrastructure interventions should be taken forward. Workshops have been undertaken to define potential interventions and further engagement is planned to package the interventions into potential options.

3.4.9 There is widespread support for a significant increase in the provision of city-wide-active travel infrastructure and the aims of the associated strategy from stakeholders in Glasgow

3.5 External Impacts

Brexit

3.5.1 The impact of Brexit on Glasgow and on the scheme poses many challenges, however, Glasgow has proved itself to be resilient when faced with other economic challenges. The consensus of opinion is that the UK and Scottish economies will weaken in the short to medium term as a direct result of the uncertainty generated following the UK vote to leave the EU.

3.5.2 In response to Brexit, the Scottish and UK Governments have been asked to commit to the following actions[5]:

- Maintaining a structural funds programme prioritising urban areas where the vast majority of Scotland's economic output is generated, and its population live.
- Accelerate City Deal capital infrastructure works.
- The transfer of surplus land holdings to Glasgow City Council to enable their inclusion in the city's Strategic Housing Investment Plan.
- To develop more effective collaborations across agencies and with Glasgow to support higher levels of city competitiveness, innovation and economic growth.

[5] Brexit and the Glasgow economy: impacts, actions and asks. (2016) https://www.glasgow.gov.uk/CHttpHandler.ashx?id=35550&p=0

COVID-19

3.5.3 The global climate crisis as well as the COVID-19 pandemic has had a significant impact on the way we choose to travel. Sustainability is now at the heart of people's travel decisions and although the full consequences of COVID-19 on travel behaviour are yet to be fully understood, active travel is likely to remain, and potentially grow, as a preferred mode of transport with public transport potentially becoming less desirable.

4 Economic Case

4.1 Long List of Options

4.1.1 Early-stage work is ongoing to develop understand what types of interventions will work in specific locations and to start developing specific. The options will be worked up in more detail as they are developed along with the critical success factors that will be used to sift from the long list of options down to a short list for appraisal.

4.1.2 This assessment will provide a high-level overview of a range of interventions that could be combined to form specific options. Workshops are being undertaken in collaboration with the Glasgow City Council to assess which interventions are to be taken forward and how they are best grouped according to their fit with the overarching objectives. The interventions taken forward can be grouped into 3 main areas:

- Infrastructure to protect from traffic (segregated cycleways)
- Infrastructure that removes traffic (bus gates, Low Traffic Neighbourhoods)
- A combination of the two

4.1.3 A list of intervention types has been provided in Table 4-1.

Table 4-1 List of potential interventions

	Intervention Types	Description
Infrastructure to protect from traffic	Street Hierarchy	Define street type and local access provision
	Kidney Bean Junctions	Based on Dutch examples junction type could be used on larger roads to manage side street junctions
	Side Street Junctions	Provide continuous footways at side street junctions
	Contraflow Cycling	Define widths based on vehicle numbers
	Low Traffic Neighbourhoods	To help more people walk and cycle more, the Low Traffic Neighbourhoods aims to achieve a better balance between vehicles and people. It could also consider initiatives such as car free zones around schools.
	Signal Controlled Junctions	Protected signal-controlled junction
	Roundabouts	Protected roundabouts
	Cycle Parking	Amount of provision at different locations
	Active Travel Hubs	Mixture of options, based on context o Nextbike hire stations o Cargo bike hire o City Car Club o Electric Charging points, e-cycle, mobility scooter, car o Parcel boxes o Secure cycle parking o Toilet facilities o Drinking water

	Intervention Types	Description
		○ Taxi rank ○ Covered areas, seating, greenery
Infrastructure to remove and reduce traffic	Sustainable Transport Link Typologies	Sustainable Transport Corridors which enable high volume public transport and high-quality active travel infrastructure
	Wayfinding and Network Identity	Define wayfinding and signs for cycling and pedestrians
	Crossings and bus stops	Consideration of crossing type; mini zebras, visual pedestrian priority, controlled crossings or uncontrolled crossings
Combined	Materials	Assess surfacing, base layers, kerbs, planting and street furniture
	SfP Plus	Principle of constructing interactions zones to high standards

4.1.4 A more detailed options assessment will be undertaken at the commencement of the next stage of project development. The generation of the long list of options and sifting down to the short list will be undertaken then and included within the next iteration of the business case.

4.1.5 As part of the SBC submission, an appraisal of an indicative package of interventions will be provided to give an approximate view of what the benefits of the scheme might look like.

4.1.6 Critical Success Factors (CSFs) are defined as part of the options appraisal process to help rank and sift options to identify the better performing options and identify the preferred way forward. These will be worked up in the next iteration of the business case to inform the option testing process.

4.2 Appraisal Methodology

Direct, indirect and opportunity benefits: definitions

4.2.1 We suggest a three-way categorisation of benefits. Direct benefits are those that flow directly from the Active Travel Strategy (ATS) investments, either inherently (e.g. planting and maintaining a tree will achieve some carbon benefits) or so long as people continue to do what they're doing now (or, more precisely, in the relevant year(s) of the Base Case) e.g. walking along the High Street, in which case they may get the benefit of a quieter, cleaner, safer environment, and be healthier as a results

4.2.2 **Indirect benefits** will arise only if people change their behaviour, e.g. by walking instead of driving to the shops (whether the same shops or different ones). In these cases there will be often be benefits both to the people who make different decisions (if they make different decisions because the some of the alternatives they choose between have improved, it is axiomatic that they do so because they benefit; if they make different decisions because some alternatives have been made worse or eliminated altogether, then they will be worse off) other people affected by those decisions i.e. those affected by externalities such as benefitting from reduced air pollution because other people choose to drive less. These could also be negative – if for example people who already cycled to a certain destination now find that the cycle parking there is too congested.

4.2.3 **Opportunity benefits** are those which depend on another public sector decision and, in particular, those that would depend on the commitment of further public expenditure. (These may also be described as option values.)

4.3 Environmental benefits

4.3.1 These are benefits to the environment itself i.e. "looking after the planet". Benefits which are more about "looking after people" are in the health, social or economic categories.

Table 4-2 Environmental benefits: Initial assessment

Benefit	Comments: achievement	Comments: appraisal
Air quality: urban greening, such as the introduction of street trees, can also help to improve air quality	Local effect (particularly removal of particulates)	Value per tree (to draw from literature). If this a value of reduced pollution in terms of health improvements, move to health category.
	Global effect (sequestration of carbon)	Value per tree (to draw from literature) or carbon absorbed per tree (within the appraisal period) valued by standard (CCC) value
Climate[6]: shorter journeys and more use of active modes will reduce carbon emissions and increase climate resilience by reducing urban heat island effect	Correct if increased active travel abstracts from car use rather than from public transport (PT) use	Carbon reduction effects: standard emission calculations and carbon values applied to car flows. NB a study indicating that Glasgow does not display "heat island" characteristics was mentioned on 24/11, though it was also mentioned that Glasgow is starting to have heat issues on some summer days

[6] Also to pick up Derek Dunsire's own work – or updates – on value of carbon sequestration by trees

Mitigation of climate change	Increase in unpaved area and improvements to drainage will reduce risk of surface water flooding. NB not clear that ATS will increase the unpaved area (it might reduce it) and care will be needed in detail design and in maintenance to avoid drainage problems	To look for standard values e.g. per m^2 of unpaved surface in a major city area

Source: "Benefit" originally from TCPA (2021), edited and extended; other columns added (including notes from 24/11/21 meeting)

4.4 Health and wellbeing benefits

4.4.1 The equivalent table for benefits to individual's health and wellbeing is shown below. "Wellbeing" included to make it slightly wider than conventional "health", including for example reduced exposure to noise.

Table 4-3 Health benefits: initial assessment

Benefit	Comments: achievement	Comments: appraisal
Physical and mental health: health benefits of regular physical activity are well established; time spent walking in green spaces contributes directly to mental health and recovery	Depends on the person who switches to walking or cycling and which mode they switch from. Health benefit may be small if they are already fit or adopt these modes instead of taking other exercise. Need to consider visits to parks etc as well as walking to get to or from a destination	Queensland research provides a value of benefits per additional km walked or cycled (with a distinction depending on the previous level of activity of the walker/cyclist). To adapt to Glasgow – and to clarify what is the perceived benefit to the individual, what is the saving in health care costs
Healthcare costs: improved health from increased activity should relieve health service costs	As above	
Noise reduction	From reduction in car traffic and reduction in speeds	Standard noise calculations are very detailed
Accident Reduction	See text below	Standard transport appraisal methods available for accidents

Source: "Benefit" originally from TCPA (2021), edited and extended; other columns added (including notes from 24/11/21 meeting)

4.4.2 Accident reduction is a potentially important benefit. It is however not certain that more walking/cycling will reduce accidents; in the worst case it would simply increase the number of potential victims for car/pedestrian or car/cyclist collisions. Benefits to

older retired people of increased out-of-home physical activity will depend on maintaining high standards of pavement quality and cleanliness – injuries resulting from fall can be extremely damaging to subsequent mobility and independence. It may be significant that the TCPA document doesn't claim accident reduction as a benefit of 20MNs.

4.5 Social benefits

Table 4-4 Social benefits: Initial assessment

Benefit	Comments: achievement	Comments: appraisal
Sense of community: living in a walkable environment can support a sense of community and improve social interaction[7], as residents are more likely to know their neighbours and trust others, participate politically, and be involved in the community.	Depends on take-up	Question of how to measure and value these effects
Safety: increased pedestrian activity in public space can improve perceptions of safety[8] through passive surveillance ("eyes on the street"); investment in safe streets can also reduce the number of traffic-related pedestrian injuries and deaths	Accident consequences of increased walking and cycling should also be considered (under Health and/or Economic benefits?)	Question of how to measure and value these effects
Inclusiveness: creating a well-designed, more walkable environment provides opportunities to support inclusive design, e.g. encouraging older people to walk more, helping to prevent conditions such as arthritis; child-friendly streets allow for informal play and increased independence, which is important for child development		Question of how to measure and value these effects. Need to avoid double-counting with health benefits

Source: "Benefit" originally from TCPA (2021), edited and extended; other columns added (including notes from 24/11/21 meeting)

[7] Danish work on severance effects, quoted in Alsace report?

4.6 Economic benefits

Table 4-5 Economic benefits: Initial assessment

Benefit	Comments: achievement	Comments: appraisal
Improved accessibility to jobs and services	Accessibility calculations implemented in the TELMoS model combine and value the effect of faster or more enjoyable travel with the effects of changes in destinations e.g. if more jobs locate within the LN zone.	Improvements in the quality of walking/cycling and of access to PT will be valued in minutes and input to the model/appraisal process
Local businesses: better streets and public spaces can boost footfall and trading, and help reduce vacancy in high streets and town centres	This is in line with previous research on pedestrianisation but will mainly be at the expense of other businesses (conventional or online) elsewhere.	Relocation of employment is considered in the TELMoS model. Unless there is a reason to benefit some businesses at the expense of others, the benefit is in the additional choice (perhaps) and accessibility offered to customers (included above).
Productivity: walkable environments with highly connected street networks are more likely to make a positive contribution to labour productivity[9]	This is a net gain so long as the economy has the capacity to maintain full employment at full productivity (i.e. not if increased productivity of one group leaves other workers long-term unemployed)	Calculated in TELMoS
New jobs: keeping investment local through community wealth-building can develop the skills of local people and create stable, well-paying jobs	This seems to assume a higher proportion of independent, locally owned businesses sufficiently prosperous to generate such jobs (at the expense of non-local, chain businesses. Not clear how this could be pursued or that it is a logical consequence of other changes (e.g. greater footfall may attract more, not less, investment from outside firms)	Treat as an opportunity for further action rather than as an inherent part of the LN programme, except for the actions relating to procurement of goods for physical implementation of LNs.

[9] Local, easily accessible jobs may also contribute to increased labour participation (particularly among those with mobility problems and/or care commitments?).

Benefit	Comments: achievement	Comments: appraisal
Land value: investment in better place-making can boost land values	Implies higher rents being paid, which is a likely outcome but may create difficulties for small local businesses, or reduce value to local residents by driving out valuable but less profitable shops/services	Land values reflect the capture (by landlords) of benefits to occupiers; they are not additional benefits in themselves
Road congestion: making active travel safer and more inviting can reduce traffic and congestion.	Correct if increased active travel abstracts from car use rather than from PT use	If transfers from car to walk/cycle and any consequent reductions in congestion are modelled, should be captured in accessibility
Healthcare cost savings	Depend on balance between savings from increased physical activity and losses from possible increases in accidents.	See Queensland evidence.

Source: "Benefit" originally from TCPA (2021), edited and extended; other columns added (including notes from 24/11/21 meeting)

4.6.1 These benefits are all either indirect (in that depend on people or firms responding to changing circumstances or complex in that depend on data that is difficult to observe e.g. the numbers of people walking between different places (in future years). Fortunately, the TELMoS modelling developed for Transport Scotland provides a broad-brush representation of much of the necessary data and the potential responses.

4.7 Double counting and other issues

4.7.1 Land value uplift represent a transfer of benefits from occupiers to landlords, not additional benefits. We will therefore not consider them as a form of benefit, though the fact that benefits may be captured by landlords is of course significant to any discussion of distributional effects.

4.7.2 There is a question of whether longer-term mental health benefits to individuals of enjoying relaxation in green (or greener) spaces, and/or of walking/cycling rather than driving, are additional to or a double-counting of the immediate, perceived enjoyment or reduction in generalised cost. However, given the difficulties of measuring and valuing mental health benefits, this is not an immediate practical problem for the appraisal.

4.8 Distribution of Benefits

4.8.1 As the project progresses, we intend to look further into the distribution of benefits in terms of:

- Spatial distribution – where the benefits occur.

- Sectoral distributional – to which part of the economy (residents, firms etc).
- Social distribution – which kinds of households gain or lose in what ways (especially in terms of more / less well off).

4.9 Defining the programme to be appraised

Introduction

4.9.1 This section has to consider what is being appraised, and the context in which it is being appraised i.e. what is the Alternative Case and what is the Base Case with which it is being compared.

Approach

4.9.2 The present appraisal has to consider the costs and benefits of the city-wide Active Travel Scheme. Only limited design work has been done so far, and it seems highly likely that some parts of the work will be completed and in use before later parts of the design are drafted. A detailed appraisal, using costs based on quantity surveyors' examination of detailed plans, and benefits calculating from the impacts of those plans, is therefore not possible.

4.9.3 In this initial version of the business case, we are taking our own broad-brush assessment of the improvements that may be achieved (the impacts), in a form which can be input into the modelling calculations to forecast their consequences and their benefits. Similarly, the costs are based on initial estimates for parts of the city, extrapolated to a city-wide network.

4.9.4 The Base Case for the present draft appraisal is simply an existing TELMoS18A Do-Minimum forecast (that for the Business Low Traffic scenario), as prepared for Transport Scotland.

4.9.5 In the further work to be completed in early January 2022, the intention is to look at the interaction between the ATS and the LNs programme, and also to consider who the benefits of the ATS will change if the Glasgow Metro proposals are implemented in full.

4.10 Estimating the benefits

Introduction

4.10.1 This section sets out the more detailed assumptions and the results of the calculations for different benefits. For the model-based calculations, a summary is in Appendix A; more detailed documentation is available in the Model Development Report which has been prepared for Transport Scotland.

4.10.2 The focus is strictly on the effect of the ATS (the Alternative Case) compared with the situation which is the same but without the ATS (the Base Case). Providing we can maintain this focus we do not have to be concerned about deadweight effects i.e. the benefits of changes which are going to happen anyhow.

Appraisal period

4.10.3 The present appraisal of ATS assumes that benefits accrue over a period of 10 years. This is relatively short comparing with many local government investments but puts the estimates of ATS benefits on the same basis as the LNs benefits. It will understate the benefits of those parts of ATS which consist of “hard” and longer-lasting infrastructure; on the other hand, some parts will need regular renewal, such as road signs and lineage.

4.10.4 This means that in the present calculations £1 of benefit is worth between 70p and 75p in year 10, but in year 11 there are no benefits at all. This is approximately equivalent to assuming that the benefits depreciate in a straight-line manner over approximately 18 years.

Environmental benefits

4.10.5 The following headings pick up from the potential environmental benefits listed in Section 4.3.

Air quality: local effects of traffic reduction

4.10.6 When the options for appraisal have been defined an estimate of the reduction in car trips and car-km from mode shift and changes in travel patterns that occur as a result of the ATS will be undertaken.

4.10.7 Since this reduction will be generally in shorter-than-average trips there should be a rather greater than proportional reduction in pollution, both through reducing the number of cold starts and because the short trips are more likely to be made in congested conditions.

4.10.8 It should however be kept in mind that changes in vehicle technology, particularly the expected reduction in internal combustion engine (ICE) cars and the growth in battery-electric ones, will tend to reduce the air quality benefits of transferring a given amount of car travel to active modes.

4.10.9 This value of the air quality improvement will therefore be assumed to decrease over the decade considered for consistency with the TELMoS scenario.

Reduction in greenhouse gas emissions

4.10.10 Detailed modelling of options is required to quantify these impacts and hence their benefits. As noted above, this will be undertaken when the options have been developed to a suitable level.

Health and well-being benefits

4.10.11 The following headings pick up from the categories of health and well-being benefits listed in section 4.4.

Direct benefits of improved health from increased physical activity

4.10.12 There is extensive evidence of the improvements in health that can result from increased physical activity for many people in highly developed economies. This evidence is such estimates of the value of improved health resulting from increased walking and cycling form part of the DfT method (and hence, we believe, the

Transport Scotland method) for economic appraisal of interventions which are forecast to lead to significant changes in the use of those active modes. The ATS is such an intervention.

4.10.13 Using the default assumptions in the DfT method[10] gives the following health benefits:

- One additional walking trip each working day produces a health benefit of £54.53 per year; and
- One additional cycle trip each working day produces a health benefit of £107.03 per year.

4.10.14 These benefits are for additional active mode travel in 2025, discounted to 2018. They include **only** the benefits of improved health in terms of:

- The value of reduced risks of premature death, and
- The additional economic activity (presumably GVA) due to reduced absence from work[11].

4.10.15 They therefore omit:

- Savings in the costs of health service treatment (which we would count as economic benefits)
- The non-wage value of better health to the individual concerned (and potentially to her/his family).

4.10.16 Initial calculations suggest that the increase in active mode trips could be in the range 50,000 – 60,000 trips per day. If 20% are additional cycle trips and the remainder additional walk trips, taking the mid-point number gives benefit in the first year:

- Additional walking trips: £54.53/trip/year * 44,000 trips = £2.4m/year
- Additional cycling trips, 107.03 * 11,000 = £1.2m year
- Total £3.6m per year.

4.10.17 Assuming no change over time, this equates to £31.5m over 10 years.

4.10.18 Again, we note that this is applying DfT default assumptions for the UK. There are numerous reasons why benefits in Glasgow may differ, but this has not been considered at this stage. Apart from the detailed differences in current or potential cycle trips, it is relevant that the Glasgow population still suffers from poorer-than-average health[12], meaning on the one hand that there are considerably greater than average benefits that might be realised through measures which improve health, but also the possibility that residents will fail to take up improved opportunities for walking

[10] Active Mode Appraisal Toolkit, downloaded from https://www.gov.uk/government/publications/tag-unit-a5-1-active-mode-appraisal

[11] DfT (2020) *Active Mode Appraisal Toolkit User Guide*.

[12] see The Herald, 7 January 2022 https://www.heraldscotland.com/news/19830191.glasgow-shake-off-sick-man-europe-tag-political-will/

and cycling precisely because they are unwell and unfit. A more detailed study would be required to assess the deviation from the UK average.

4.10.19 It should be noted that the benefits calculated using the DfT toolkit are for trips as they are usually considered in transport planning, i.e. a necessary way of getting from doing something in one place to doing something in another place (e.g. from home to workplace, or workplace to shops). They do not include any health benefits that would arise if the investment encouraged people to use the improved facilities to walk or ride purely for exercise i.e. to make trips that have no purpose other than mental and physical well-being. Some people will do that spontaneously; in other cases, it may be that a public information campaigns to encourage exercise generally, or the "prescription" of exercise for an individual by a GP, will be much more effective once the ATS is complete.

Reductions in health services costs from improved health

4.10.20 These would be counted under economic benefits.

Value of noise reduction

4.10.21 This has not been included in this appraisal as it would require a detailed definition each option and would needs more detailed analysis than is appropriate at this stage.

4.10.22 It should also be kept in mind that whilst cycling is almost silent (except when cyclists need to ring their bells or to shout warnings) and walking is very quiet, groups of cyclists or pedestrians talking loudly can be more of a disturbance in a residential street than passing cars, especially late at night.

Social benefits

4.10.23 The following headings pick up from the categories of social benefits listed in section 4.5.

Improved perception of pedestrian security

4.10.24 The increased presence of pedestrians and cyclists should help to improve perceived (and actual) security through more "eyes on the street". Quantified appraisal would need more detailed information on what other factors are affecting pedestrian security and whether the changes proposed will significantly change the situation, plus very detailed modelling of pedestrian movements (e.g. by time of day).

Accident reductions

4.10.25 It is not clear at this stage what the balance will be between:

- Reduced risk of accidents from slightly less traffic (assuming additional traffic restraint prevents any increase in speeds and hence in the likely severity of accidents); and
- Increased numbers of pedestrians and cyclists exposed to risk.

4.10.26 At this stage of appraisal, we have assumed that the ATS will include additional measures to reduce risks without adding to time/inconvenience penalties for pedestrians/cyclists.

4.10.27 The increase in “vulnerable” users may be offset by the effect that where pedestrians and cyclists are commonplace, motorists modify their behaviour and drive more cautiously.

Inclusiveness

4.10.28 Measures should be advantageous in encouraging people with limited mobility to get out more and hence potentially to interact more with others, but it is considered that this is more likely to arise from the more local measures under the LN programme than from ATS and hence has not been included in this appraisal.

Economic benefits

4.10.29 These can be calculated using TELMoS18A to model the effect of the interventions and the associated ULTrA appraisal calculations to appraise them. To do this we have to input a change in the generalised cost of walking and cycling, which are represented as a single “active mode” in the model. In order to represent the broad effects of the ATS, we have assumed that the interventions under the ATS will deliver:

- A 5% reduction in the generalised cost of the active mode in general; and
- An additional 10% reduction in the generalised cost of the active mode for journeys over 2km.

4.10.30 The first adjustment is intended to represent the reduction in time and inconvenience for walking journeys due to measures such as:

- More direct pedestrian routes (e.g. removal of kerbside barriers).
- Greater pedestrian priority at road crossings.
- Additional sidewalk space in busy areas.
- Removal of unnecessary obstacles e.g. signposts, telecoms cabinets, etc.

4.10.31 The second adjustment is intended to represent the improvement in speed and conditions for cycle trips due to equivalent measures for cycling, including a degree of separation from pedestrians, and having particular regard to cyclists’ preference for steady speeds rather than stop-go movement.

4.10.32 These changes are input to the run of the model for the “Alternative” or Do-Something Case; all other inputs are kept the same (the Base Case). The differences in output are therefore do solely to these input changes and can be taken as the impacts of the ATS.

4.10.33 The input changes in generalised costs improve residents’ accessibility to work and to shops and services. mainly for the fairly short journeys where active travel is a realistic alternative. For people who are already making such trips, this is a straightforward reduction in time or inconvenience, or an improvement in the quality of their journey. Other people will change their travel patterns, for example making slightly more trips to (and purchases from) local shops. Those shops will prosper slightly more as a result, which will tend to make the local shopping centres more attractive and to increase employment there.

4.10.34 Over time the improvement in the attractiveness of these centres, and the improvements in access by public transport to other areas, will become apparent to other people, and will tend to attract slightly more households wanting to live there. This can lead to an increase in demand for housing, some increases in rents, and possibly to changes in the mix of households in the area.

4.10.35 The initial estimate for the resulting benefits of the city-wide ATS, over the 10-year period from 2025 to 2035, is £1,843m. Note that this figure is inclusive of the economic effects of activity being drawn into Glasgow, and inclusive of the small resulting losses of accessibility in other authorities (the benefit within Glasgow is somewhat higher).

4.10.36 We have repeated that analysis using Do-Minimum outputs from TMfS18 which includes a representation of the Glasgow Metro and other schemes (excluding active mode improvements). This reduces the total benefits marginally, from £1,843m to £1,772m. The reduction is because the analysis sees active modes and public transport essentially as competing alternatives: residents who have the option of improved public transport are less inclined to make use of improved walking and cycling routes. Whilst that form of competition is, we believe, a real issue, the analysis may underestimate the potential for complementarity between ATS and Metro in at least two ways:

- We have not taken account of the potential for the ATS to improve access to public transport, including access to Metro stations/stops (this is however taken into account in the LN analysis); and
- There are more subtle forms of complementarity such as people walking or cycling when the weather is appropriate and using public transport on other days, which may jointly form an alternative to the car which neither active travel nor PR would achieve on their own.

4.10.37 As noted earlier, there are potential further benefits in terms of reduced costs of healthcare as a result of increased use of active modes, which we have not been able to quantify[13].

4.11 Estimating the Costs

Introduction

4.11.1 We have a provisional cost estimate for the city-wide ATS of £350m, and for the moment are taking that as given. This is a high-level estimate developed in the absence of specific proposals and hence is indicative only and will be updated as options are developed.

[13] Note that we are assuming here that someone who experiences ill-health as a result of taking insufficient exercise suffers as a result, despite the NHS incurring extra costs in treating him or her.

4.12 Value for money

Introduction

4.12.1 This section compares the benefits against the costs to assess value for money.

Benefit Cost Ratio for the Active Travel Strategy

4.12.2 The initial estimate of the accessibility benefits from the city-wide ATS over a 10-year period, based on simple assumptions about the degree of improvement for people walking or cycling, is £1,843m at 2018 values. To this can be added some £32m in health benefits (limited to the value of lives saved or prolonged, and additional economic activity), giving a total of £1,875m.

4.12.3 The present quantified estimate of the benefit cost ratio is therefore (1,875/350) = 5.35, or more appropriately between 5 and 6. The value falls slightly, but remains within that range, if the ATS is considered in addition to the proposals for Glasgow Metro – again, to the extent that we have been able to model this at present.

4.12.4 We assume that the standards of design, construction and maintenance will be such that accident risks and severities will be reduced, despite the increase in the numbers of pedestrians and cyclists, so that accident reduction benefits will also improve the benefit:cost ratio or at worst leave it unchanged.

4.12.5 In addition to the quantified benefits, there are further unquantified benefits to consider in terms of:

- The enjoyment of better health by individuals who exercise more as a result of the improvements in active travel provision.
- Reductions in the costs of the healthcare required by those individuals.
- Local air quality improvements and reductions in carbon emissions as a likely result of some trips transferring from car to active modes (though these benefits will diminish over time as electric cars replace internal combustion engines).

4.13 Conclusions

4.13.1 The high BCR ratio for the Active Travel Strategy is in line with other evidence for these kinds of interventions and suggests a strong case for the works proposed.

4.14 Strategic Case

4.14.1 A wide range of information has been presented outlining the objectives of the Active Travel Scheme within Glasgow and the types of measures expected to be put in place to achieve these aims. The scheme is designed to deliver key elements of Glasgow's Active Travel Strategy:

- Connectivity: people and place – rebalancing our streets and spaces – with a focus on networks and infrastructure in our street environments.
- Unlocking change: enabling everyone to walk, wheel or cycle – focusing on training and education and working collaboratively.
- Thinking Differently: encouraging, motivating and sustaining change – focusing on communication and promotion and inspiring people through larger events and other activities.

4.14.2 A range of local and national policy have been identified which closely align with objectives of the Active Travel Scheme. These include Glasgow City's Active Travel Strategy and Development Plan from a local perspective as well as the National Planning Framework and National Transport Strategy from a national perspective alongside many others.

4.14.3 A key element of this is the contribution towards the Sustainable and Low Carbon City theme within Glasgow City Councils Strategic Plan (2017-2022). The Active Travel Strategy will directly contribute to reducing the city's carbon footprint through encouraging a shift towards active modes and reducing the level of congestion within the city.

4.14.4 The strategic case provides a strong narrative for investment in the Active Travel Strategy and outlines clearly the benefits that are expected to be realised by the local population alongside wider benefits that would accrue to the whole city.

4.15 Economic Case

4.15.1 Development of specific packages of interventions is currently underway to produce a coherent set of options for the scheme. As a result, the economic assessment of the scheme benefits has been undertaken for an indicative package of interventions to provide an idea of the magnitude of potential benefits.

4.15.2 A range of environmental, social and health benefits have been calculated as part of the indicative appraisal providing a comprehensive understanding of the impact of the scheme in terms of monetised benefits. Indicative costs have also been used to provide a benefit-cost ratio. The present quantified estimate of the benefit cost ratio is therefore 5.4 for the Active Travel Strategy.

4.15.3 This represents a value for Money category of Very High.

4.16 Commercial Case

4.16.1 At the current SBC stage of assessment, detailed information regarding the preferred intervention is not yet available. As such, work in determining potential procurement routes for services rendered has not yet taken place. Glasgow City Council will investigate potential procurement routes in compliance with relevant guidance depending on the specific characteristics of the scheme requirements.

4.16.2 Further details on the Commercial Case will be provided in future iterations of the business case.

4.17 Financial Case

4.17.1 The preferred option is yet to be decided upon. As a result, work in identifying potential funding routes and overall scheme costs has not yet been undertaken. A funding request is yet to be finalised and will be produced in future iterations of the business case.

4.17.2 Further details on the Financial Case identifying specific funding requirements will be provided in future iterations of the business case.

4.18 Management Case

4.18.1 A Management Case has not been submitted at the current SBC stage of business case development. This is due to the preferred option for interventions not yet being finalised and final plans for delivery of the scheme lacking the necessary refinement for inclusion within the Management Case at this time.

4.18.2 Further details on the Management Case will be provided in future iterations of the business case.

Appendix A – Methods Used

A.1 Introduction

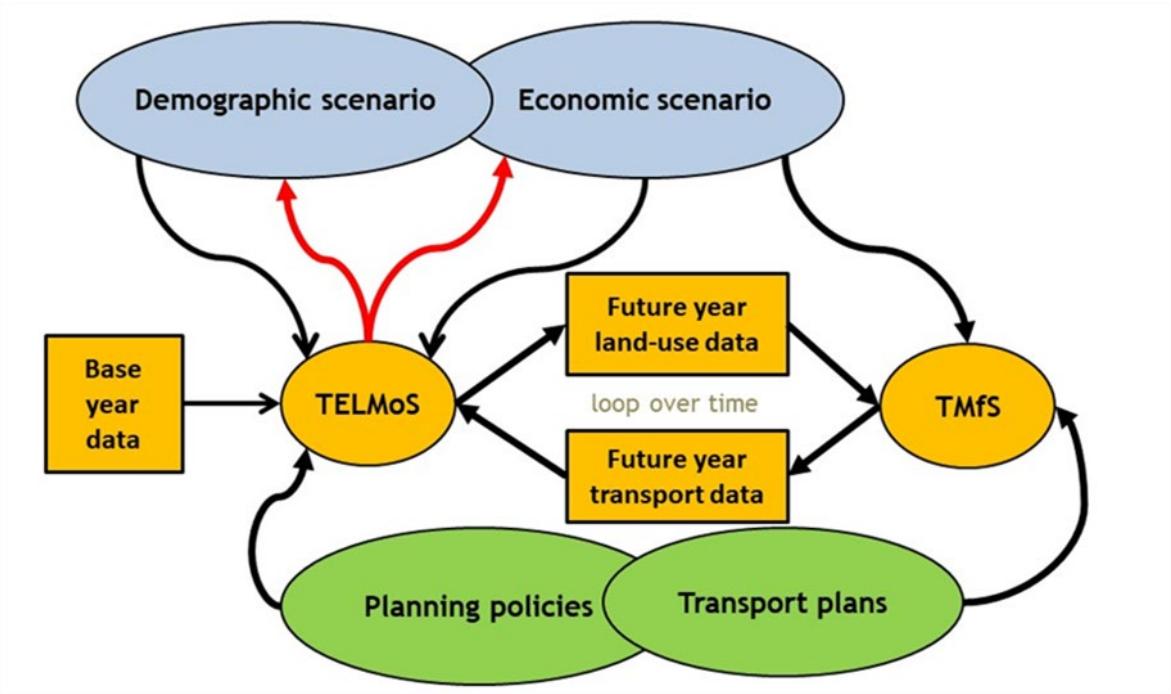
A.1.1 This Appendix provides a brief description of:

- the TELMoS model.
- the ULTrA appraisal approach.

A.2 TELMoS

A.2.1 TELMoS is one half of the national land-use/transport interaction model of Scotland. It is an application of the DELTA package, used in interaction with the Transport Model for Scotland as the main modelling framework for Transport Scotland's Land-Use and Transport Integration in Scotland (LATIS) programme. The overall structure of the TELMoS-TMfS system is shown in the figure below.

Land-use/transport interaction in TELMoS-TMfS



Geographical structure- zone system

A.2.2 The TELMos18 model covers the whole of Scotland, with external zones representing English region. There are 787 in Scotland, and 16 external zones.

A.2.3 The model also uses higher-level spatial units called macrozones. These are aggregations of sets of zones to functional economic areas (based on Census Travel to Work areas) which the regional economic model (REM) and migration model forecasts.

Base land-use data

A.2.4 The base year for TELMoS18 and TMfS is 2018. The starting land-use databases have been developed in a slightly different method because of the length of time since the last Census. A version of TELMoS14 model was adapted to the slightly different TELMoS18 zone system and used to produce a “best yet” forecast of change from 2014-2018. This forecast was constrained to observed data on population, households, and employment as well as using observed information on planning policy to ensure consistent growth in the stock of residential and commercial property.

A.3 Transport data

A.3.1 There is an interface between the Land use (TELMoS18) and Transport (TfMS18) Models that passes data between the two models.

A.3.2 The transport model requires employment and demographic data as a basis for travel demand. These data, in the form of population and household data by type and socio-economic status, are output from TELMoS18 into formatted files by zones and transferred to the transport model. The output data also includes specific types of employment sectors.

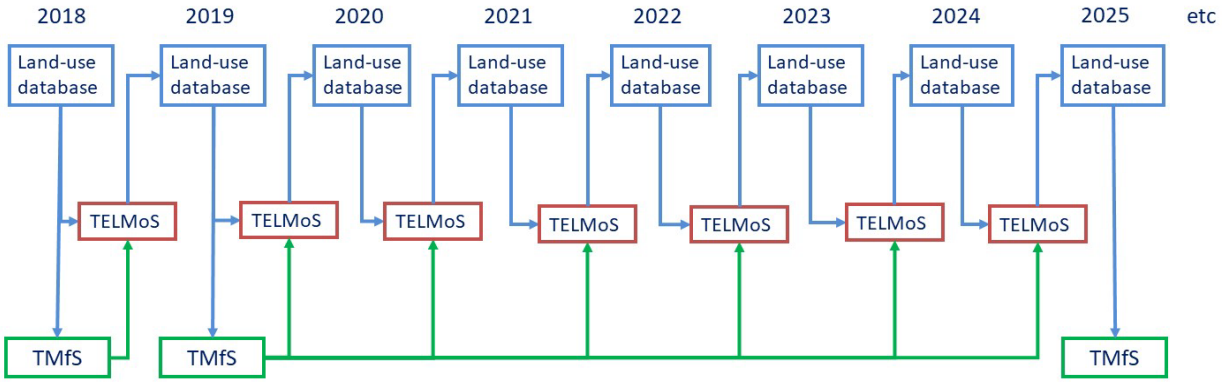
A.3.3 The land-use/economic model requires data describing how easy or difficult it is to travel or to move goods between any two zones, or within any zone (“intrazonal” movements). Ease or difficulty of movement is measured in terms of generalised costs, which reflect the time taken for the journey (including, for public transport journeys, access to/from stations, waiting time, etc.), its money cost and key elements of “inconvenience” such as congestion on roads or the number of changes between trains.

A.3.4 The transport data input to TELMoS18 consists of matrices of generalised costs by mode and purpose, for the base year and for each of the transport model forecast years: 2018, 2019, 2025 and every fifth year to 2045. In addition, estimates of generalized cost for active mode travel, based on distances, are used within TELMoS18 but are independent of TMfS.

Time horizon and modelled years

A.3.5 The TELMoS18 model runs in one-year steps from 2018 to 2050. The extension of the forecast period beyond the last transport model year would allow the model to capture some (albeit limited) land use impact of that final transport forecast and reflects the types of land-use timelags present in responding to transport changes.

Time-marching sequence



Business, household and developer processes: choices and responses

A.3.6 Business activity is measured mainly in terms of employment. National growth in employment (and the associated growth in production) is controlled to a given scenario. The present modelling work is concerned with how transport and land use interventions will affect the distribution of economic activity within Scotland and does not allow the totals to vary.

A.3.7 Within each run of the model, the location of employment is determined through processes which represent business choices about:

- where within Scotland to invest;
- where to trade and to produce; and
- at a more local level, about where to locate premises.

A.3.8 For the majority of sectors, each choice is influenced by accessibility or transport cost terms, as well as by a range of other variables.

A.3.9 The number of households and the size of the population are likewise constrained to a given national scenario. The location and mix of households and residents changes over time through:

- migration (longer-distance moves, particularly influenced by employment prospects);
- local moves (particularly influenced by housing availability, but also by accessibility to work and services); and
- gaining or losing employment.

A.3.10 Changes in the location of businesses affect households over time, by changing the demand for labour in each location; and changes in the location of households affect businesses over time, by changing the supply of labour and the demand for services.

A.3.11 Developer choices are represented by models of how much floorspace to build, and where to build it. Developers' decisions are driven by expected profits, which in turn are driven by occupier demand: development therefore tends to follow businesses and households, whilst also being constrained by the inputs representing planning policy (which control the amount of development that can take place in any location at any time).

A.3.12 The sensitivities of businesses, households and developers to different stimuli are set mainly by adjusting the model so as to reproduce, as far as practical and appropriate, elasticities or other measures of response which have been drawn from previous research.

Planning policy inputs

A.3.13 The land-use policy inputs are one of the key inputs to the TELMoS model. They inform the modelling of development. They influence the model's forecasts of future floorspace, and hence can strongly influence where people live and work. They determine:

- where development may take place;
- in which year land for development is likely to come forward; and
- the maximum amount of development that may take place in any zone.

A.3.14 The APPI18 data are based upon information provided by the 34 local planning authorities (i.e. the 32 local authorities and two national park authorities) and describe the scale and location of planned development.

A.3.15 Information is included for all eight of the land uses modelled within TELMoS are provided below.

Land Use Categories modelled in TELMoS18

Floorspace Type	Description
1	Residential
2	Retail
3	Office
4	Industrial
5	Warehouse
6	Leisure / Hotel
7	Education
8	Health

Accessibility calculations

A.3.16 The data obtained from TMfS18 is combined with TELMoS18's own data on land-uses to calculate a range of accessibility measures for each zone and macrozone. These are recalculated in each year of each forecast, in non-transport model years, the most recent generalised costs are used as well as the land-use forecast for the given year. It is worth reinforcing the concept that accessibility in DELTA is opportunity measured, and changes in planning policy and development can affect accessibility and long with changes in generalised costs.

A.3.17 Within a single forecast model run, the other sub-models are sensitive to changes in accessibility over time.

A.3.18 It is the differences between the accessibilities based on Do-Something generalised costs and those based on Do-Minimum generalised costs that give rise to the different forecasts and hence show the impact of any interventions tested.

A.4 ULTrA

A.4.1 ULTrA stands for "Unified Land-Use/Transport Appraisal" is a method and software package for "accessibility-based land-use/transport appraisal" which DSC have developed over the last decade, partly in projects commissioned by Transport for London.

A.4.2 "Accessibility-based land-use/transport appraisal" is an approach to economic assessment (cost benefit analysis) which:

- brings together the appraisal of land-use and transport changes, and hence (unlike conventional approaches) can be used to appraise integrated land-use/transport plans and proposals, as well as taking account of the impact of land-use interventions on transport and vice versa (which conventional methods cannot do).
- uses improvements in accessibility (how easily people or businesses can reach destinations, or be reached by others) rather than savings in travel time and cost, as the key measure of transport benefits. Critically, this recognizes benefits if destinations (e.g. work or shopping opportunities) are relocated closer to people who wish to reach them, as well as benefits if transport to existing destinations is improved; conventional transport appraisal can only recognize benefits from transport improvements.

A.4.3 The ULTrA application linked to TELMoS breaks down benefits by type of benefit (e.g. improved accessibility, increased income) and by beneficiary (households, firms, developers/landowners, government, other), as well as where the benefits are enjoyed. It therefore provides a considerable level of detail about the form and distribution of benefits (or malefits, since redistribution effects – e.g. one area gaining jobs at the expense of another – are common in the appraisal of land-use/transport proposals). Benefits are calculated from the differences between two TELMoS runs for each year of the appraisal period, and discounted to a present value in the usual way. The treatment of costs is conventional, except that if a proposal leads to private developers developing more housing or commercial floorspace, the costs of the development appear as negative benefits (malefits). (The returns they make on that development – the rents earned – appear as a benefit to them and (if rent levels increase) as a malefit to the occupiers.)

A.4.4 The following table sets out the full set of benefits estimated in the ULTrA application used here. (Only summary totals are used in the text, but the full results can be supplied on request.)

ULTrA output definitions

Sector	Item	Definition
Households	Accessibility	Benefit to households from improved accessibility to opportunities for work and services. NB improved accessibility may arise from any or all of: better transport provision; higher car ownership; more or better-located opportunities
	Household environment	Benefit to households from reduced traffic (dependent on data passed from transport model – not currently available in TELMoS18)
	Housing consumption	Benefit to households from lower housing cost per household and/or improved space per household. NB all households are represented as renters.

	Income	Benefit to households from increased income net of income tax, Council Tax and VAT on household expenditure. Income per household may increase through more household members in work or higher wages per worker. Wages may increase due to higher wages in particular work zones or increased commuting to zones offering higher wages.
	Leisure time and commuting costs	Benefit to households in increased leisure time and reduced commuting costs if the number of workers per household decreases. (So if income increases due to more household members in work, this will be negative i.e. a loss of benefit.)
	Car ownership costs	Benefit to households from reduced expenditure on car ownership. (So if increased incomes lead to increased car ownership, some of the benefits in income and accessibility will be offset by a negative here representing increase expenditure on car ownership.)
	Housing quality	Benefit to households from improved quality of housing areas i.e. from externality effects of higher-quality new development or better maintenance/improvement by other residents
	Total - households	Sum of the household benefit components listed above
Firms	Productivity	Gains to firms' profits from productivity effects e.g. agglomeration effects (increase in GVA minus increase in wages paid), moves to more productive locations
	Accessibility	Benefit from improved accessibility to other businesses
	Rent	Benefit from reduced rents
	Tax paid	Benefit from reduced taxes on profits. This represents the part of the above gains that is taken in corporation tax, so will always be negative (more tax paid) if the sum of the above three items is positive (more profit made).
	Total - firms	Sum of the firms' benefits listed above
Developers	Rent income	Benefit to developers/property owners from increases in (gross) income from rents (housing and commercial floorspace)
	Development and maintenance costs	Benefit to developers/property owners from reduction in development and maintenance costs (housing and commercial) (so an intervention that increases floorspace supply will show a negative here)
	Tax paid	Benefits from reduced taxes on profits. Equivalent to tax paid by firms (see above) except that a proportion of households are assumed to be owner-occupiers and not to pay tax on rent "income"
	Total – developers	Sum of the above benefits to developers/property owners
Public sector	Income tax revenue	Increase in government revenue due to more income tax paid
	VAT revenue	Increase in government revenue due to more value-added tax paid
	Unemployment benefit savings	Reduction in government expenditure due to less unemployment benefit paid
	Council tax	Increase in (local) government from more council tax paid

	revenues	
	Business rates revenues	Increase in (local) government from more business rates paid
	Taxes on profits	Increase in government revenue due to more corporation tax paid
	Fuel tax revenues	Increase in government revenue due to more tax paid on motor vehicles fuels
	PT revenues	
	Total – public sector	Sum of above increases in revenue (or reduction in cost) to public sector
Other	Regeneration	Shadow value of net increases in employment for residents in most deprived local authorities
	Social infrastructure costs	Savings in cost of land for social infrastructure (schools, hospitals) from population locating in areas where land is cheaper
	Environmental	Shadow value of greenhouse gas reduction (and possibly other benefits)
	Total	Sum of the benefits to the “other” sector
PVB		Present Value of Benefits = sum of all benefits listed above
PVC		Present Value of Costs (input exogenously)
NPV		Net Present Value = PVB-PVC
BCR		Benefit:Cost Ratio = PVB/PVC

Arcadis UK

80 Fenchurch Street
London EC3M 4BY
United Kingdom

T: +44 (0) 20 7812 2000

arcadis.com