TRANSPORT SCOTLAND
CÒMHDHAIL **ALBA**

Annex: Reducing car use for a healthier, fairer, and greener Scotland

Annex for a route map to achieve a 20 per cent reduction in car kilometres by 2030

Contents

Part 1: The origin of the 20 per cent car kilometre reduction target

The commitment to reduce car kilometres by 20 per cent by 2030, against a 2019 baseline, was determined through consideration of the overall emissions pathway for transport, which in turn was informed by the TIMES model alongside other evidence and assessments.

The Scottish Government used the TIMES (The Integrated MARKAL-EFOM System)[i] whole system energy model to inform the greenhouse gas emissions reductions required from each sector to meet targets set in the Climate Change Act (Emissions Reduction) (Scotland) Act 2019.[ii] Whilst the whole system has to meet a 75 per cent reduction in greenhouse gas emissions by 2030 (against 1990 levels), the transport sector's reduction in 56 per cent (from 14.6 $MtCO_2$ in 2018 to 6.5 $MtCO_2$ in 2030). Action taken in the 2020s is particularly important, both in order to achieve the stretching 2030 statutory target, and to avoid the worst effects of climate change.

The 20 per cent target was also shaped through consideration of a range of analyses, including published academic material and the UK Committee on Climate's Change assertions on mode shift away from private car use. Moreover, the figure was informed by research Transport Scotland commissioned from the Element Energy consultancy. The Element Energy work modelled a number of scenarios to account for the many uncertainties between now and 2030, including disruption to transport demand brought about by the COVID-19 pandemic.

The resulting report concluded that we cannot achieve this through technological solutions alone. It found that we must also facilitate radical behavioural change, comprising both modal shift and an overall reduction in vehicle demand, with reductions needed across the various vehicle fleets, including cars; light goods vehicles; heavy goods vehicles; ships; and aeroplanes, balancing the challenge involved for each fleet to achieve its reduction. For cars, this required a 20 per cent

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[i] Climatexchange. Potential for the use of TIMES in assessing energy system impacts of improved energy efficiency, 2017.
https://www.climatexchange.org.uk/media/2114/potential_for_the_use_of_times_in_assessing_energy_system_impacts_of_improved_energy_efficiency.pdf ClimateXChange, July 2017
[ii] Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. Available:
https://www.legislation.gov.uk/asp/2019/15/contents

reduction in the number of car kilometres travelled across the whole of Scotland between 2019 and 2030.[iii]

The report also concludes that in order for a 20 per cent reduction to be possible:

- The main transport mode for people moving within and between the urban regions of Scotland (this is assumed to include Edinburgh, Glasgow, Dundee, Aberdeen, and the satellite towns and villages that surround them) must switch from private cars to active or public and shared transport modes over the next decade.
- Walking must become the preferred mode of transport for short journeys and cycling, including bikes and e-cycles, must be a viable mode for both urban and inter-urban journeys.
- The use of active, public, and shared transport must be encouraged and facilitated through the provision of excellent infrastructure, Mobility as a Service (MaaS), and use of the sustainable travel hierarchy in all transport and land-use planning decisions.[iv]

The 20 per cent commitment applies to all cars, not only those powered by fossil fuels. Our commitment to reduce car kilometres is not just about meeting environment targets: the negative impacts of an overreliance on cars, including road traffic congestion, are experienced by everyone, regardless of whether they are able to enjoy the benefits of car use. Reducing car dependency and increasing the availability and accessibility of walking, cycling, and public transport can also have significant, positive impacts for equality, health and wellbeing, and the economy, including improved access to employment, education, and key services. To ensure that our commitment to reduce car use is compatible with a just transition, we do not want to create a situation where those who can afford electric vehicles are exempt from the need to change their travel behaviour.

[iii] Element Energy for Transport Scotland. Decarbonising the Scottish Transport Sector, 2021. https://www.transport.gov.scot/media/50354/decarbonising-the-scottish-transport-sector-summary-report-september-2021.pdf
[iv] ibid., pages 5-6.

Part 2: Data on current patterns of travel

Mode

Table 1: Average distance travelled in kilometres for walking, cycling, public transport and car (Sources: Scottish Household Survey, 2019 and internal analysis).

Main Mode of Transport Used	Average Distance Travelled (km)
Walking	1.6
Cycling	4.9
Public Transport (includes bus, rail, ferry, tram and underground)	18.3
Car	15.5
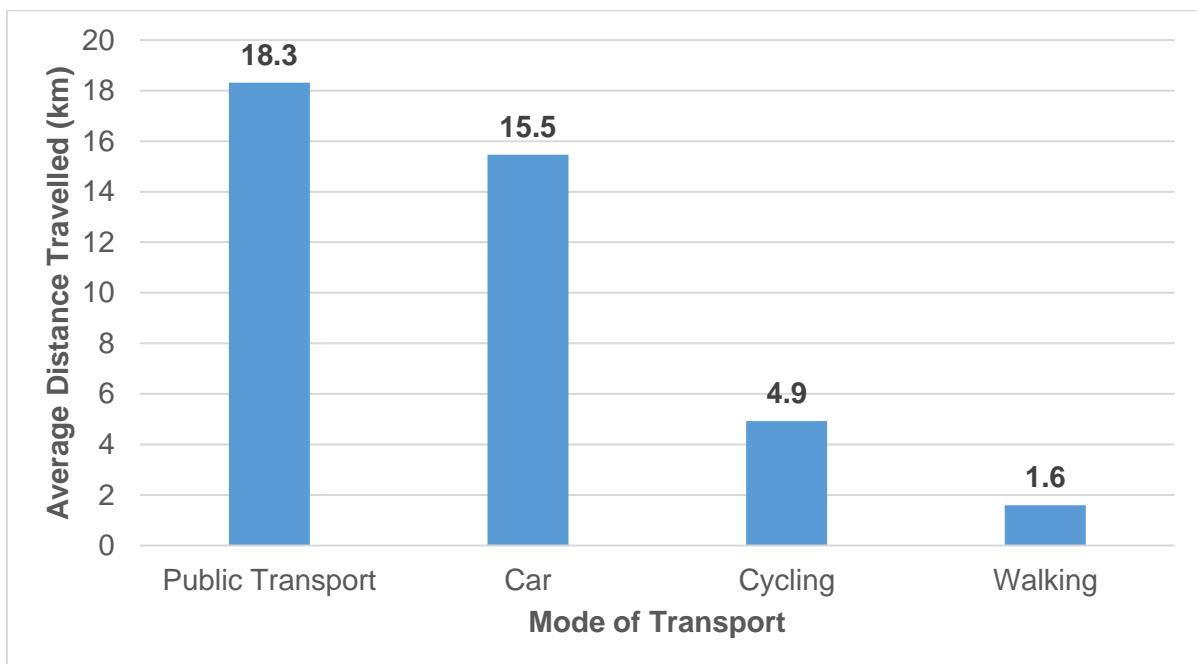
Figure 1: Average distance travelled in kilometres for walking, cycling, public transport and car (Sources: Scottish Household Survey, 2019 and internal analysis).

Age

Table 2: Total distance travelled by car for each age category (Sources: Scottish Household Survey, 2019 and internal analysis).

Age Category (years)	Total Distance Travelled by Car (km)	Total Distance Travelled by Car (%)
17 to 19	948	0.6
20 to 24	3,916	2.6
25 to 29	9,432	6.2
30 to 44	42,662	27.9
45 to 59	51,798	33.9
60 to 64	13,272	8.7
65 to 74	21,953	14.4
75 to 89	8,511	5.6
90 and over	487	0.3
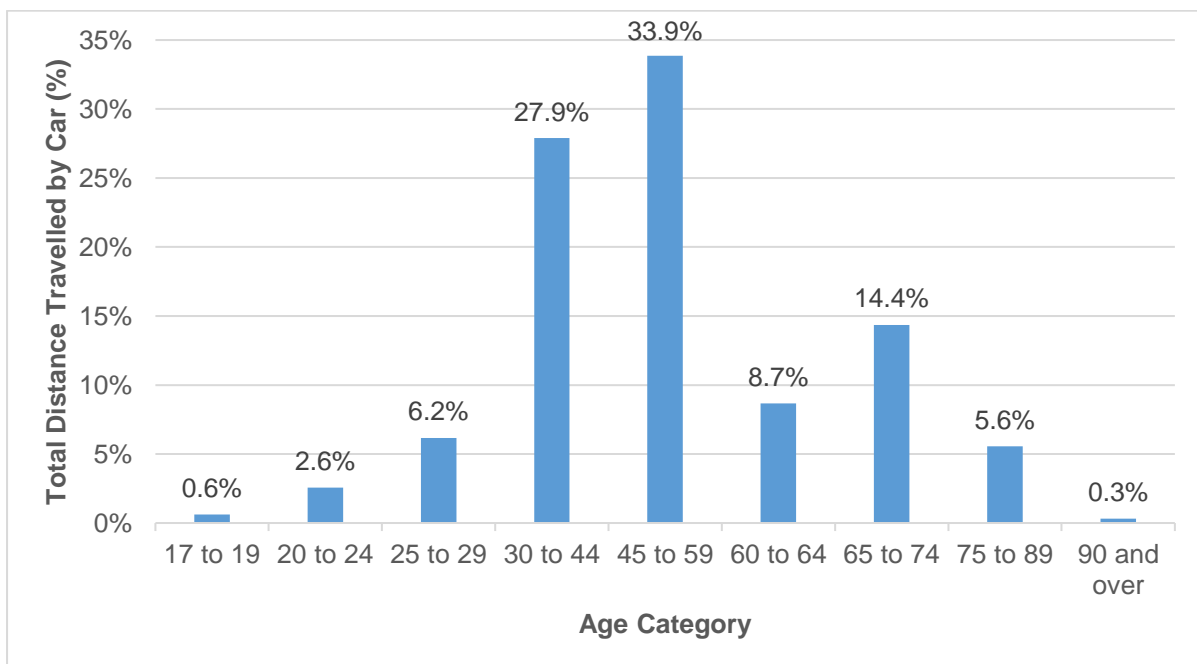
Figure 2: Total distance travelled by car for each age category (Sources: Scottish Household Survey, 2019 and internal analysis).

Gender

Table 3: Total distance travelled by car for each gender (Sources: Scottish Household Survey, 2019 and internal analysis).

Gender	Total Distance Travelled by Car (km)	Total Distance Travelled by Car (%)
Female	70,092	45.80
Male	82,883	54.16
Refused	61	0.04

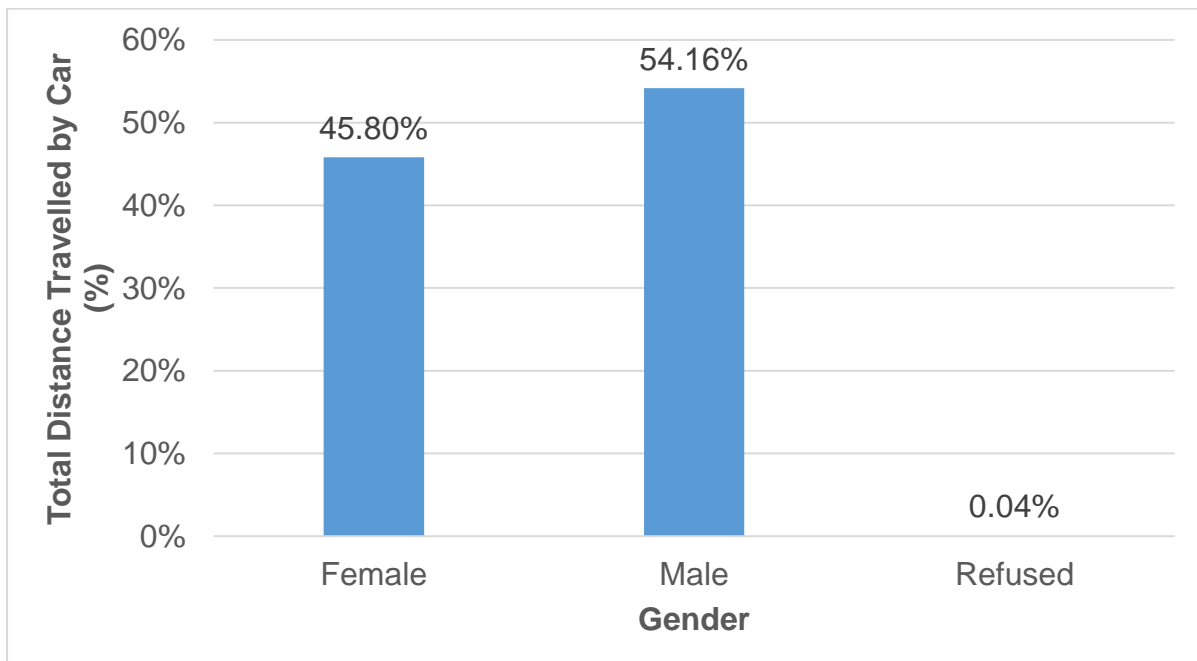**Figure 3:** Total distance travelled by car for each gender (Sources: Scottish Household Survey, 2019 and internal analysis).

Household income

Table 4: Total distance travelled by car for each annual household income quintile category (Sources: Scottish Household Survey, 2019 and internal analysis).

Annual Household Income (£)	Total Distance Travelled by Car (km)	Total Distance Travelled by Car (%)
15,080 and under	17,416	11.5
15,081 to 22,460	22,772	15.0
22,461 to 31,990	31,870	21.0
31,991 to 45,940	36,997	24.4
45,941 and over	42,362	28.0
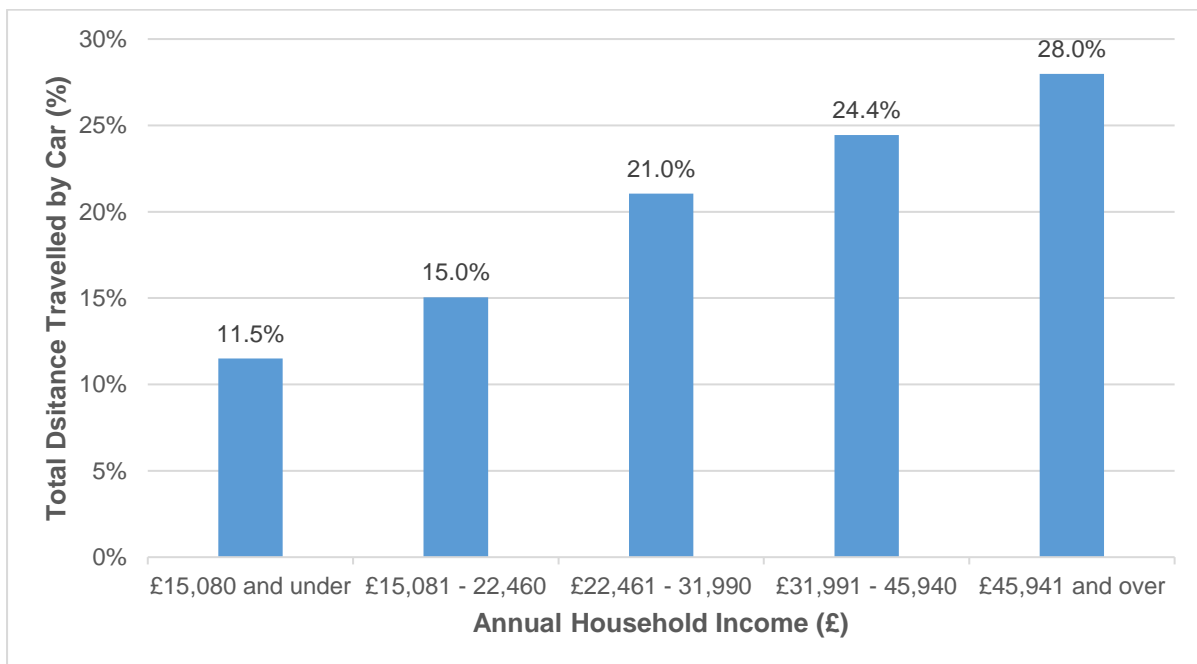
Figure 4: Total distance travelled by car for each annual household income quintile category (Sources: Scottish Household Survey, 2019 and internal analysis).

Table 5: Total distance travelled by car for each annual household income decile category (Sources: Scottish Household Survey, 2019 and internal analysis).

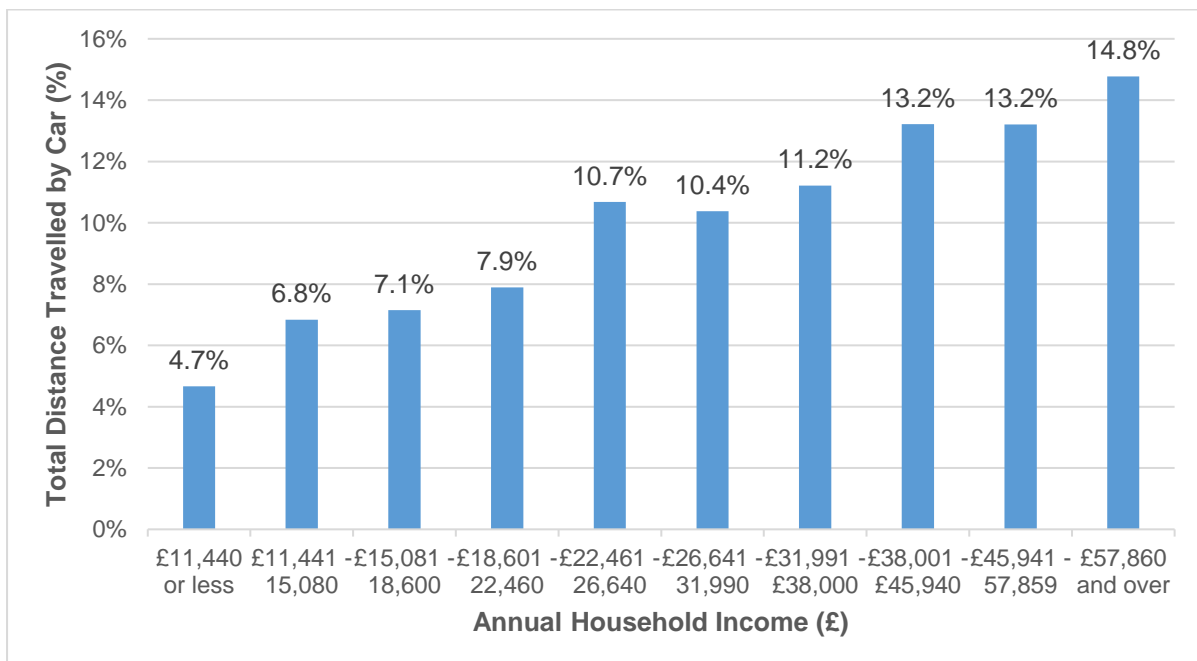| Annual Household Income (£)	Total Distance Travelled by Car (km)	Total Distance Travelled by Car (%)
11,440 and under	7,064	4.7
11,441 to 15,080	10,353	6.8
15,081 to 18,600	10,822	7.1
18,601 to 22,460	11,949	7.9
22,461 to 26,640	16,164	10.7
26,641 to 31,990	15,706	10.4
31,991 to 38,000	16,980	11.2
38,001 to 45, 940	20,017	13.2
45,941 to 57,859	19,990	13.2
57,860 and over	22,372	14.8

Figure 5: Total distance travelled by car for each annual household income decile category (Sources: Scottish Household Survey, 2019 and internal analysis).

Journey length

Table 6: Number of walking / cycling / public transport / car journeys for particular distances travelled (Sources: Scottish Household Survey, 2019 and internal analysis).

Main Mode of Transport	Number of journeys:			
	< 2 km	2 – 5 km	5 – 10 km	> 10 km
Walking	3,626	545	86	77
Cycling	100	63	35	22
Public Transport (includes bus, rail, ferry, tram and underground)	238	431	438	497
Car	2,136	2,280	1,781	3,699

Table 7: Percentage of walking / cycling / public transport / car journeys for particular distances travelled (Sources: Scottish Household Survey, 2019 and internal analysis)

Main Mode of Transport	% of journeys:			
	< 2 km	2 – 5 km	5 – 10 km	> 10 km
Walking	84%	13%	2%	2%
Cycling	45%	29%	16%	10%
Public Transport (includes bus, rail, ferry, tram and underground)	15%	27%	27%	31%
Car	22%	23%	18%	37%

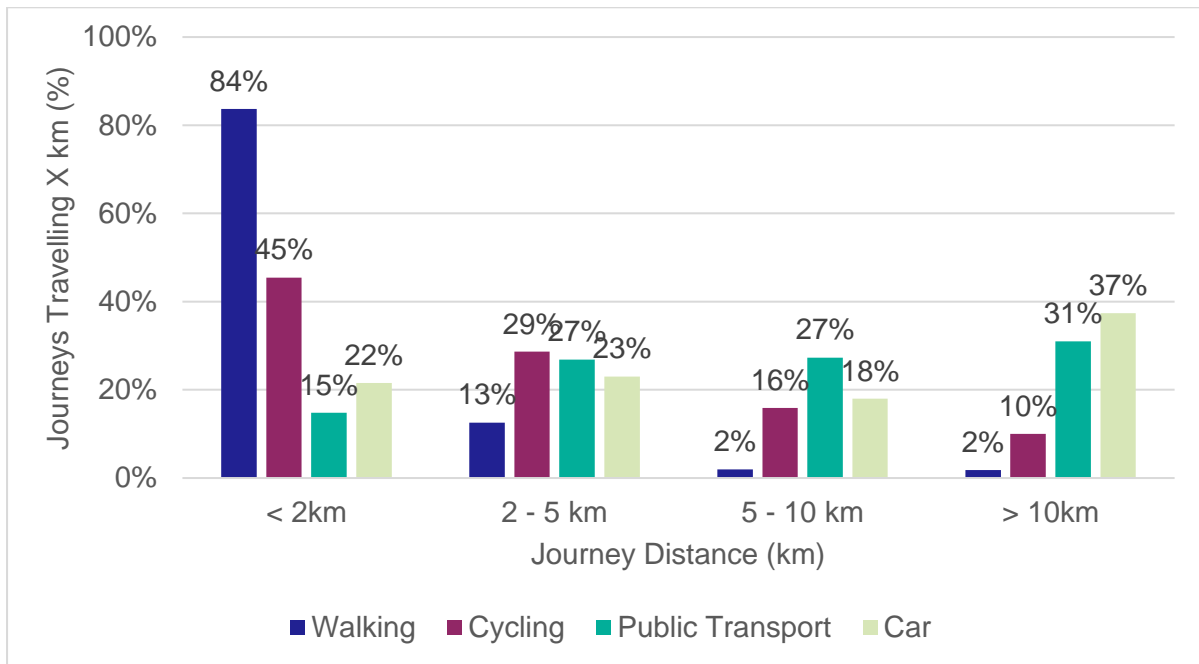**Figure 6:** Percentage of walking / cycling / public transport / car journeys for particular distances travelled (Sources: Scottish Household Survey, 2019 and internal analysis).

Journey origin and destination

Table 8: Total distance travelled by walking for each urban-rural destination (Sources: Scottish Household Survey, 2019; and Scottish Government Urban Rural Classification 2016, 6-fold; and internal analysis).

Total distance travelled by walking (km)		Destination							
		Large Urban Areas	Other Urban Areas	Accessible Small Towns	Remote Small Towns	Accessible Rural Areas	Remote Rural Areas	Outside of Scotland	Total
Origin	Large Urban Areas	1,759	65	54	-	117	-	-	1,995
	Other Urban Areas	89	1,403	42	-	213	83	-	1,829
	Accessible Small Towns	46	58	259	30	138	-	-	531
	Remote Small Towns	-	-	-	297	145	64	-	505
	Accessible Rural Areas	209	192	133	144	468	23	-	1,170

Remote Rural Areas	-	83	-	72	16	481	-	652
Outside of Scotland	243	-	-	-	-	-	-	243
Total	2,346	1,801	488	542	1,097	651	-	6,925

Table 9: Percentage of total distance travelled by walking for each urban-rural destination (Sources: Scottish Household Survey, 2019; and Scottish Government Urban Rural Classification 2016, 6-fold; and internal analysis)
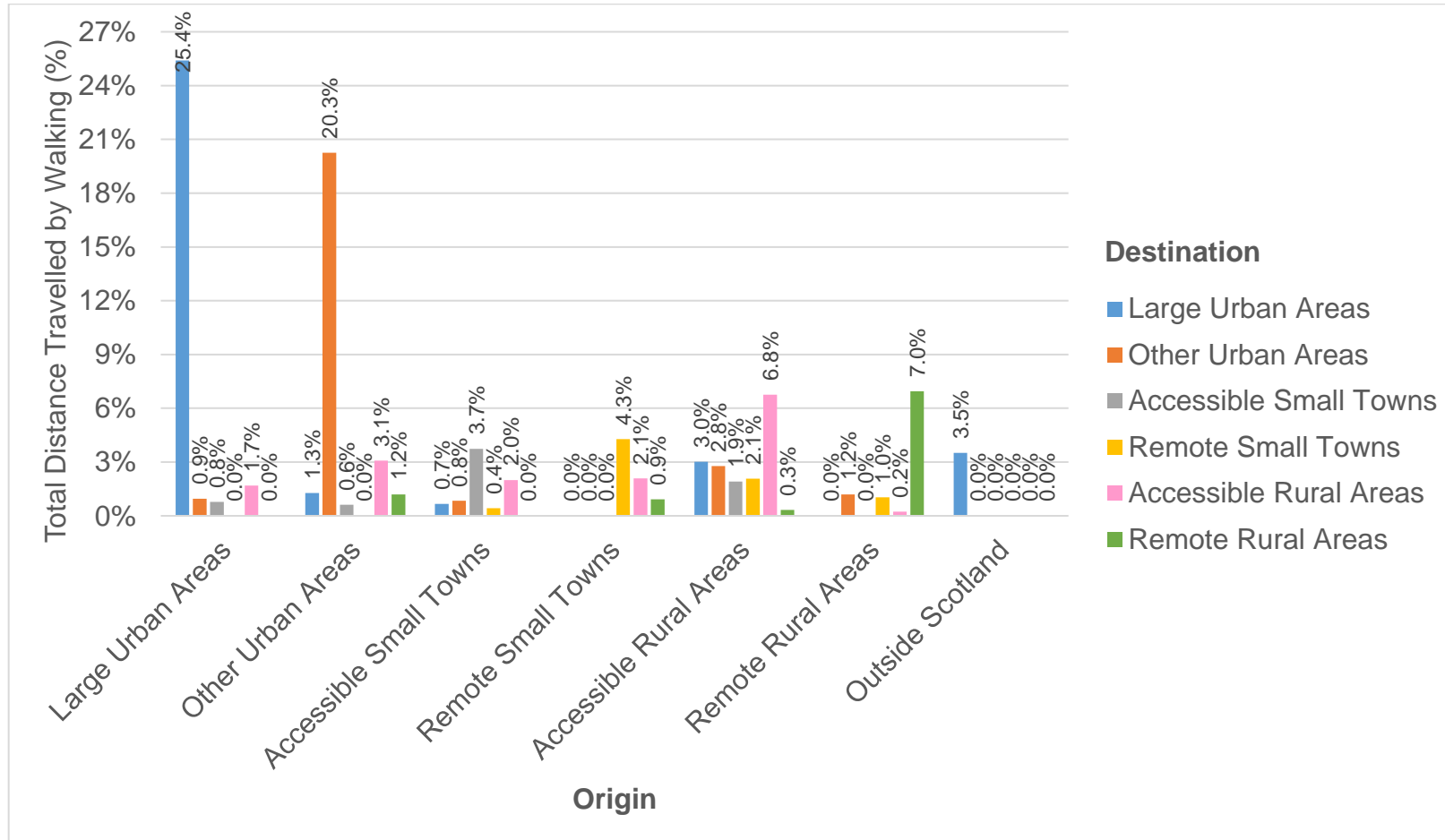
Total distance travelled by walking (%)		Destination							
		Large Urban Areas	Other Urban Areas	Accessible Small Towns	Remote Small Towns	Accessible Rural Areas	Remote Rural Areas	Outside of Scotland	**Total**
Origin	Large Urban Areas	25.4	0.9	0.8	-	1.7	-	-	28.8
	Other Urban Areas	1.3	20.3	0.6	-	3.1	1.2	-	26.4
	Accessible Small Towns	0.7	0.8	3.7	0.4	2.0	-	-	7.7
	Remote Small Towns	-	-	-	4.3	2.1	0.9	-	7.3
	Accessible Rural Areas	3.0	2.8	1.9	2.1	6.8	0.3	-	16.9

Remote Rural Areas	-	1.2	-	1.0	0.2	7.0	-	9.4
Outside of Scotland	3.5	-	-	-	-	-	-	3.5
Total	33.9	26.0	7.0	7.8	15.8	9.4	-	

Figure 7: Percentage of total distance travelled by walking for each urban-rural destination (Sources: Scottish Household Survey, 2019; and Scottish Government Urban Rural Classification 2016, 6-fold; and internal analysis)
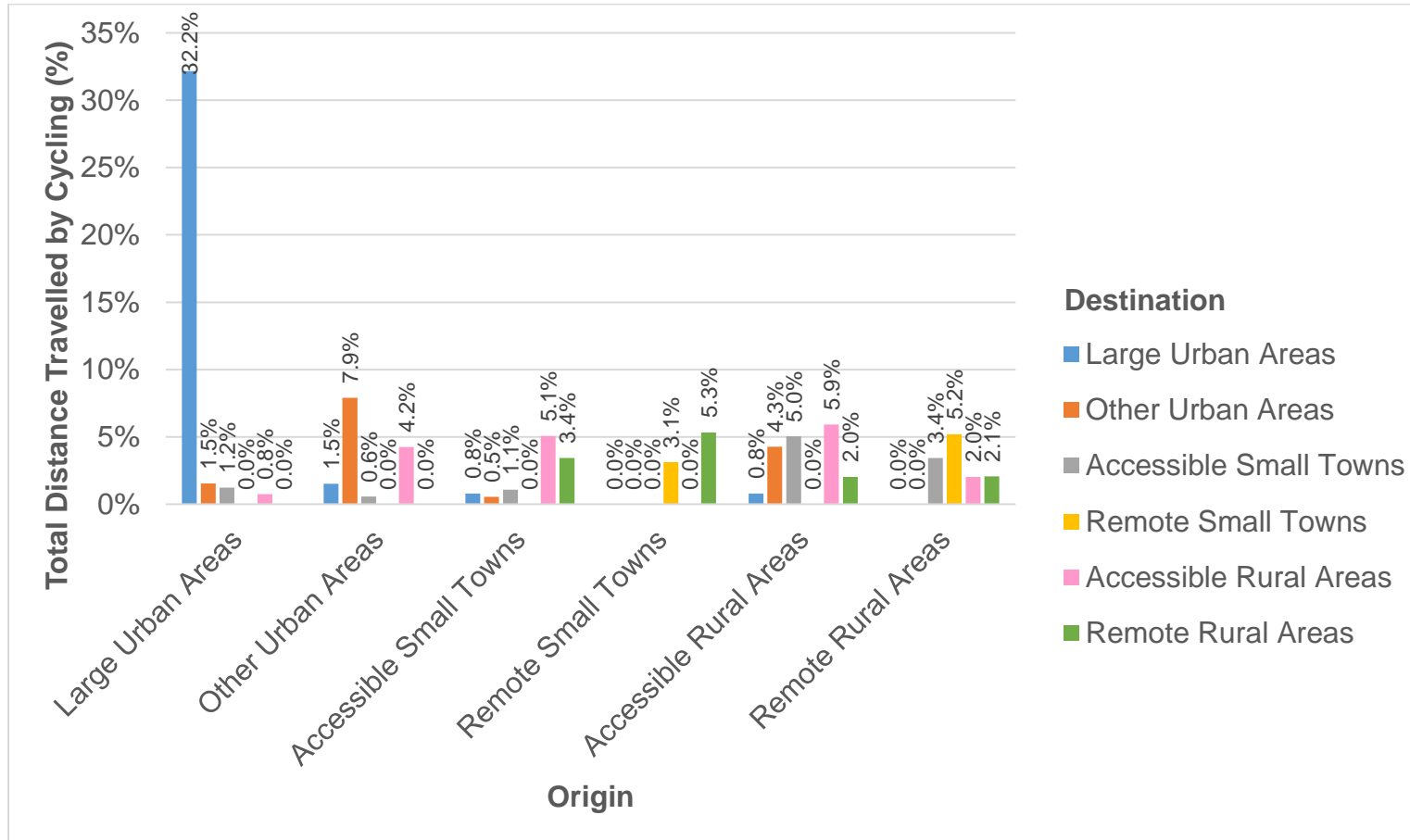
Table 10: Total distance travelled by cycling for each urban-rural destination (Sources: Scottish Household Survey, 2019; and Scottish Government Urban Rural Classification 2016, 6-fold; and internal analysis).

Total distance travelled by cycling (km)		Destination							
		Large Urban Areas	Other Urban Areas	Accessible Small Towns	Remote Small Towns	Accessible Rural Areas	Remote Rural Areas	Outside of Scotland	Total
Origin	Large Urban Areas	348	17	13	-	8		-	386
	Other Urban Areas	16	86	6	-	46		-	154
	Accessible Small Towns	8	6	12	-	55	37	-	118
	Remote Small Towns	-	-	-	34	-	58	-	92
	Accessible Rural Areas	9	46	54	-	64	22	-	195
	Remote Rural Areas	-	-	37	56	22	22	-	138
	Outside of Scotland	-	-	-	-	-	-	-	-
	Total	382	154	123	90	195	139	-	1,083

Table 11: Percentage of total distance travelled by cycling for each urban-rural destination (Sources: Scottish Household Survey, 2019; and Scottish Government Urban Rural Classification 2016, 6-fold; and internal analysis)

Total distance travelled by cycling (%)		Destination							
		Large Urban Areas	Other Urban Areas	Accessible Small Towns	Remote Small Towns	Accessible Rural Areas	Remote Rural Areas	Outside of Scotland	Total
Origin	Large Urban Areas	32.2	1.5	1.2	-	0.8	-	-	35.7
	Other Urban Areas	1.5	7.9	0.6	-	4.2	-	-	14.2
	Accessible Small Towns	0.8	0.5	1.1	-	5.1	3.4	-	10.9
	Remote Small Towns	-	-	-	3.1	-	5.3	-	8.5
	Accessible Rural Areas	0.8	4.3	5.0	-	5.9	2.0	-	18.0
	Remote Rural Areas	-	-	3.4	5.2	2.0	2.1	-	12.7

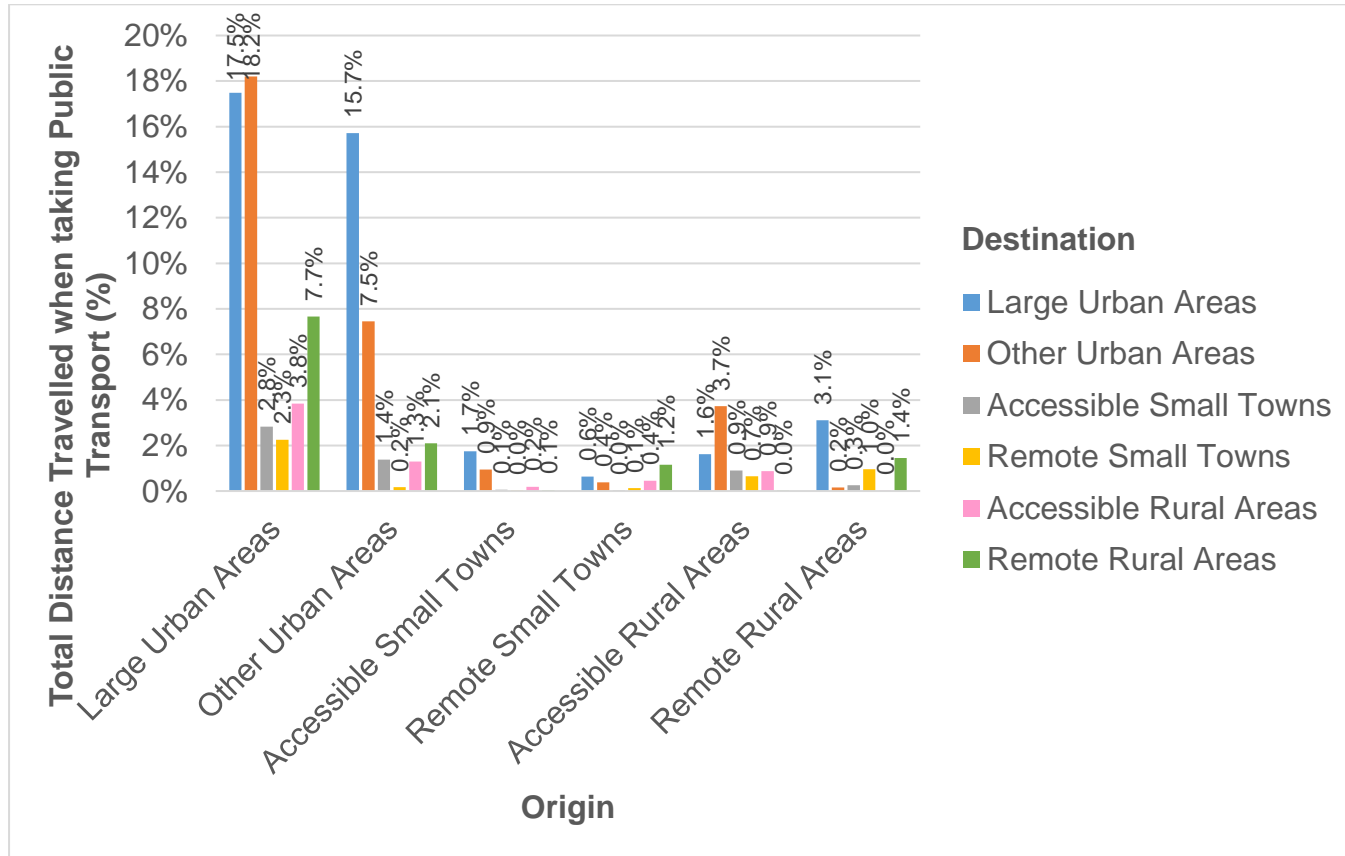|	Outside of Scotland	-	-	-	-	-	-	-	-
	Total	35.2	14.3	11.3	8.3	18.0	12.9	-	**-**

Figure 8: Percentage of total distance travelled by cycling for each urban-rural destination (Sources: Scottish Household Survey, 2019; and Scottish Government Urban Rural Classification 2016, 6-fold; and internal analysis)

Table 12: Total distance travelled by taking public transport for each urban-rural destination (Sources: Scottish Household Survey, 2019; and Scottish Government Urban Rural Classification 2016, 6-fold; and internal analysis)

Total distance travelled by taking public transport (km)		Destination							
		Large Urban Areas	Other Urban Areas	Accessible Small Towns	Remote Small Towns	Accessible Rural Areas	Remote Rural Areas	Outside of Scotland	Total
Origin	Large Urban Areas	6,902	7,185	1,115	890	1,514	3,022	-	20,627
	Other Urban Areas	6,201	2,943	546	70	512	830	-	11,100
	Accessible Small Towns	687	374	24	15	76	21	-	1,195
	Remote Small Towns	250	152	16	52	176	458	-	1,105
	Accessible Rural Areas	640	1,470	358	259	347	11	-	3,083
	Remote Rural Areas	1,229	63	102	381	10	570	-	2,354
	Outside of Scotland	-	-	-	-	-	-	-	-
	Total	15,908	12,187	2,162	1,665	2,634	4,910	-	39,465

Table 13: Percentage of total distance travelled by taking public transport for each urban-rural destination (Sources: Scottish Household Survey, 2019; and Scottish Government Urban Rural Classification 2016, 6-fold; and internal analysis)

Total distance travelled when taking public transport (%)		Destination							
		Large Urban Areas	Other Urban Areas	Accessible Small Towns	Remote Small Towns	Accessible Rural Areas	Remote Rural Areas	Outside of Scotland	Total
Origin	Large Urban Areas	17.5	18.2	2.8	2.3	3.8	7.7	-	52.3
	Other Urban Areas	15.7	7.5	1.4	0.2	1.3	2.1	-	28.1
	Accessible Small Towns	1.7	0.9	0.1	-	0.2	0.1	-	3.0
	Remote Small Towns	0.6	0.4	-	0.1	0.4	1.2	-	2.8
	Accessible Rural Areas	1.6	3.7	0.9	0.7	0.9	-	-	7.8
	Remote Rural Areas	3.1	0.2	0.3	1.0	-	1.4	-	6.0
	Outside of Scotland	-	-	-	-	-	-	-	-
	Total	40.3	30.9	5.5	4.2	6.7	12.4	-	

Figure 9: Percentage of total distance travelled by taking public transport for each urban-rural destination (Sources: Scottish Household Survey, 2019; and Scottish Government Urban Rural Classification 2016, 6-fold; and internal analysis)

Table 14: Total distance travelled by car for each urban-rural destination (Sources: Scottish Household Survey, 2019; and Scottish Government Urban Rural Classification 2016, 6-fold; and internal analysis).
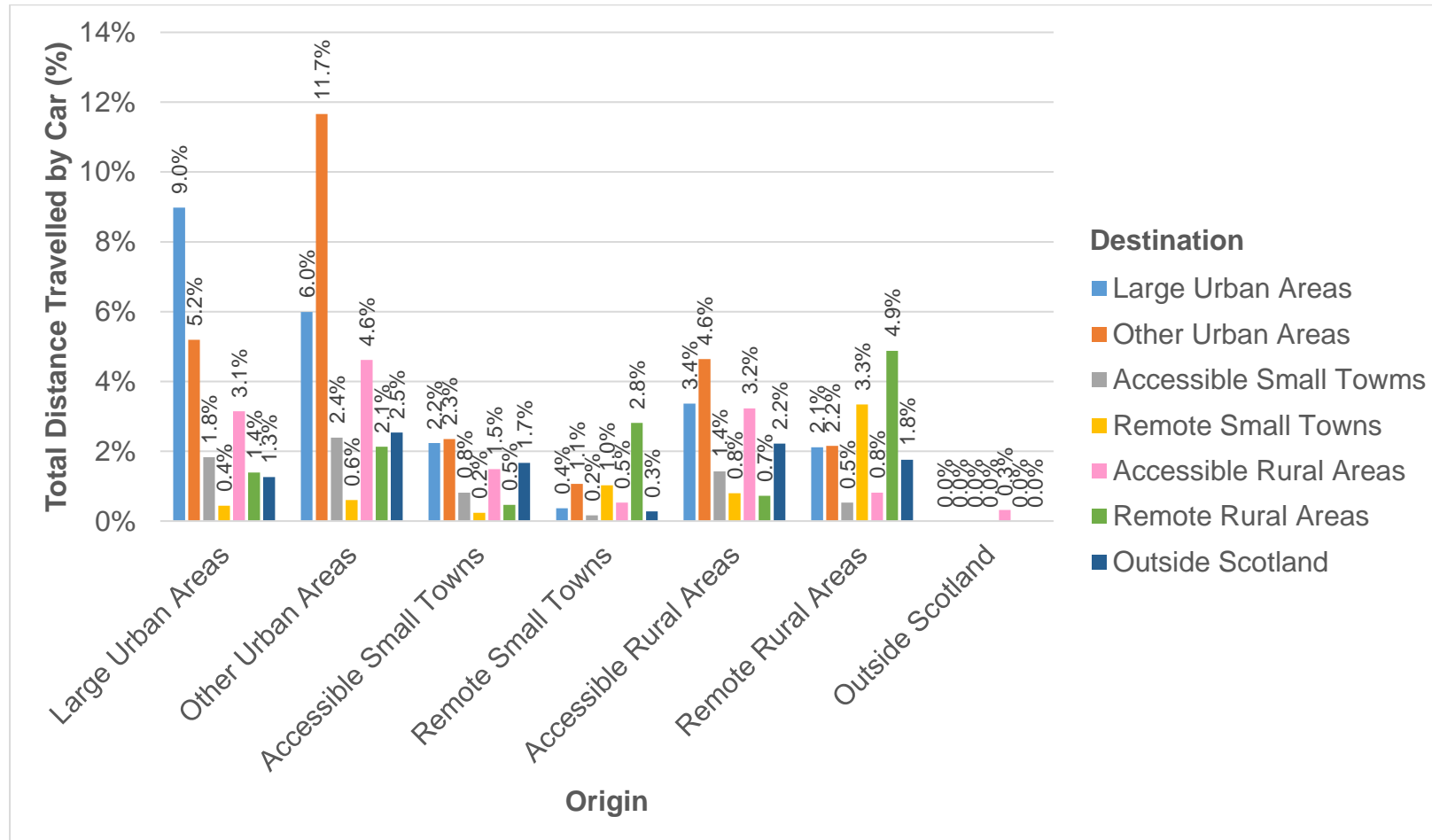
Total distance travelled by car (km)		Destination							
		Large Urban Areas	Other Urban Areas	Accessible Small Towns	Remote Small Towns	Accessible Rural Areas	Remote Rural Areas	Outside of Scotland	**Total**
Origin	Large Urban Areas	13,745	9,171	3,417	558	5,152	3,236	-	35,279
	Other Urban Areas	7,947	17,847	3,592	1,628	7,107	3,302	-	41,422
	Accessible Small Towns	2,798	3,662	1,251	255	2,183	806	-	10,955
	Remote Small Towns	671	921	368	1,575	1,223	5,109		9,868
	Accessible Rural Areas	4,817	7,062	2,279	805	4,944	1,251	494	21,653
	Remote Rural Areas	2,125	3,255	712	4,308	1,104	7,469	-	18,972

Outside of Scotland	1,926	3,885	2,553	430	3,401	2,693	-	14,887
Total	34,028	45,803	14,172	9,559	25,114	23,866	494	153,036

Table 15: Percentage of total distance travelled by car for each urban-rural destination (Sources: Scottish Household Survey, 2019; and Scottish Government Urban Rural Classification 2016, 6-fold; and internal analysis).

Total distance travelled by car (%)		Destination							
		Large Urban Areas	Other Urban Areas	Accessible Small Towns	Remote Small Towns	Accessible Rural Areas	Remote Rural Areas	Outside of Scotland	Total
Origin	Large Urban Areas	9.0	6.0	2.2	0.4	3.4	2.1	-	23.1
	Other Urban Areas	5.2	11.7	2.3	1.1	4.6	2.2	-	27.1
	Accessible Small Towns	1.8	2.4	0.8	0.2	1.4	0.5	-	7.2
	Remote Small Towns	0.4	0.6	0.2	1.0	0.8	3.3	-	6.4
	Accessible Rural Areas	3.1	4.6	1.5	0.5	3.2	0.8	0.3	14.1
	Remote Rural Areas	1.4	2.1	0.5	2.8	0.7	4.9	-	12.4
	Outside of Scotland	1.3	2.5	1.7	0.3	2.2	1.8	-	9.7
	Total	22.2	29.9	9.3	6.2	16.4	15.6	0.3	10-

Figure 10: Percentage of total distance travelled by car for each urban-rural destination (Sources: Scottish Household Survey, 2019; and Scottish Government Urban Rural Classification 2016, 6-fold; and internal analysis).

Access to car

Table 16: Percentage of households with access to at least one car by income and urban-rural classification, 2015-2019 (combined). (Source: Scottish Household Survey, 2019)

Percentage with access to car						
	Income quintile					
	1= lowest 20%	2	3	4	5 = highest 20%	All incomes
Urban-rural classification						
Large urban areas	32	45	65	81	92	63
Other urban areas	40	57	77	92	98	73
Accessible small towns	52	67	81	94	99	80
Remote small towns	43	61	77	92	99	74
Accessible rural	68	78	91	97	100	89
Remote rural	63	77	90	98	99	86
All areas	42	57	75	90	96	72

Local Authority-level data

Table 17: Total number and percentage of population, land area and million car kilometres for each Council Area in Scotland. (Sources: National Records of Scotland and Department for Transport).

Council areas	Total			% of Scotland total		
	population (2020)	land area (sq km)	million car km (2019)	population (2020)	land area	car km (2019)
Source	National Records of Scotland	National Records of Scotland	Department for Transport			
Scotland	**5,466,000**	**77,901**	**36,747**			
Aberdeen City	229,060	186	1,244	4.2%	0.2%	3.4%
Aberdeenshire	260,780	6,313	2,475	4.8%	8.1%	6.7%
Angus	115,820	2,181	870	2.1%	2.8%	2.4%
Argyll and Bute	85,430	6,907	731	1.6%	8.9%	2.0%
City of Edinburgh	527,620	263	2,399	9.7%	0.3%	6.5%
Clackmannanshire	51,290	159	264	0.9%	0.2%	0.7%
Dumfries and Galloway	148,290	6,426	1,510	2.7%	8.2%	4.1%
Dundee City	148,820	60	663	2.7%	0.1%	1.8%
East Ayrshire	121,600	1,262	844	2.2%	1.6%	2.3%
East Dunbartonshire	108,750	174	450	2.0%	0.2%	1.2%
East Lothian	107,900	679	801	2.0%	0.9%	2.2%
East Renfrewshire	96,060	174	617	1.8%	0.2%	1.7%
Falkirk	160,560	297	1,258	2.9%	0.4%	3.4%
Fife	374,130	1,325	2,425	6.8%	1.7%	6.6%
Glasgow City	635,640	175	2,791	11.6%	0.2%	7.6%
Highland	235,430	25,653	2,179	4.3%	32.9%	5.9%
Inverclyde	77,060	160	430	1.4%	0.2%	1.2%
Midlothian	93,150	354	564	1.7%	0.5%	1.5%
Moray	95,710	2,238	603	1.8%	2.9%	1.6%
Na h-Eileanan Siar	26,500	3,056	168	0.5%	3.9%	0.5%

North Ayrshire	134,250	885	645	2.5%	1.1%	1.8%
North Lanarkshire	341,140	470	2,530	6.2%	0.6%	6.9%
Orkney Islands	22,400	991	107	0.4%	1.3%	0.3%
Perth and Kinross	151,910	5,286	1,906	2.8%	6.8%	5.2%
Renfrewshire	179,390	261	1,296	3.3%	0.3%	3.5%
Scottish Borders	115,240	4,732	949	2.1%	6.1%	2.6%
Shetland Islands	22,870	1,467	163	0.4%	1.9%	0.4%
South Ayrshire	112,140	1,222	797	2.1%	1.6%	2.2%
South Lanarkshire	320,820	1,772	2,008	5.9%	2.3%	5.5%
Stirling	94,080	2,186	1,040	1.7%	2.8%	2.8%
West Dunbartonshire	88,340	159	533	1.6%	0.2%	1.5%
West Lothian	183,820	428	1,485	3.4%	0.5%	4.0%

Part 3: Rapid evidence review of interventions to reduce car use

Aim

The rapid evidence review aimed to identify evidence in the existing policy literature on 'what works in reducing car use'; 'what works in increasing active travel mode share' and 'what works in increasing public transport mode share'.

Method

A rapid evidence review was conducted of the information contained in reviews published by key government and third-sector transport agencies in the past 10 years. Policy documents from the following organisations were sought by reviewing the 'research'; 'reports' and / or 'publications' sections of the websites of the following organisations: Transport Scotland; Public Health Scotland; Department for Transport; Public Health England; National Institute for Health and Clinical Excellence; European Commission (Mobility and Transport); WHO Europe (Transport and Health); Sustrans; Living Streets; Sport England; Cycling Scotland; Paths for all and Transform Scotland.

Policy documents were screened on title to identify those relevant to the research questions of 'what works in reducing car use'; 'what works in increasing active travel mode share' and 'what works in increasing public transport mode share'. Documents identified as being relevant based on title were reviewed to identify those that had used a literature review process to inform their conclusions. Policy documents whose conclusions were drawn from primary data or case studies alone were excluded from inclusion in this rapid evidence review. The rapid nature of this evidence review meant that quality appraisal of the reviews identified in the policy documents was not conducted, beyond identifying that they had followed a structured review process.

Evidence from the documents included in the review was extracted and synthesised in relation to the four sustainable travel behaviours of: reducing the need to travel; choosing local destinations; switching mode; and combining trips or sharing journeys. Where no evidence was identified using the rapid review methodology outlined above, other insights have been referenced, making clear that these insights come from additional sources.

Results

Evidence-based interventions to support reducing the need to travel

None of the reports identified through the rapid evidence review referred to interventions that had been implemented with the specific aim of encouraging people to reduce their need to travel, although one report did acknowledge the importance this option[1].

Analysis of travel behaviour in response to the COVID-19 pandemic, however, shows that a reduction in car travel is possible in response to public health messaging advising people not to travel, with data showing that in the initial lockdown period car traffic levels dropped to around 25 per cent of 2019 levels[2]. Research findings on home working have also shown the potential for changes in working patterns to lead to a reduction in travel, with modelling showing that if the 37 per cent of survey respondents who agreed with the statement '*I expect to work from home more often in the future'* worked from home 50 per cent of the time, there could be a 5 per cent reduction in car and van mileage[3]. It is, however, important to note that following the decrease in trips in the initial phase of the pandemic, car travel in Scotland has now returned to pre-pandemic levels, despite some continued home working. This suggests that policies to encourage people to work from home may not be effective in decreasing total car kilometres without other complementary measures to prevent an increase in car use for other trip purposes[4].

Evidence-based interventions to support people to choose local destinations

The rapid evidence review did not identify evidence for interventions where the outcome was explicitly to encourage a choice of local destination, however a number of interventions were identified that are shown to improve local environments for walking and cycling and these are reported here under this heading.

There is extensive evidence that the design of the local built environment can impact on the likelihood of walking and cycling[5], with the principles of 'walkability'; 'complete and compact neighbourhoods'; and 'safe and efficient connectivity' being identified as key[6]. 'Walkable neighbourhoods' which include high residential density, street connectivity and mixed land-use, including retail use, have been shown to double the likelihood of people walking for transport, with evidence that unobstructed and well-

maintained footpaths are one of the most effective intervention for increasing walking[7]. Mixed-use developments are important for providing short-trip distances amenable to walking and cycling, and 'filtered permeability' can help provide convenient routes for these modes while removing danger from motor traffic[8].

There is evidence that area-wide 20 mile per hour schemes have resulted in residents reporting that they are walking and cycling more, and that children are cycling more following the introduction of the schemes[9]. There is also evidence that traffic calming measures including speed humps, speed tables, cushions and roundabouts are all associated with increased walking and reduced risk of injury[10]. Evidence-based guidelines recommend addressing infrastructure issues that may discourage people from walking, for example motor traffic volume and speed; lack of convenient road crossings; poorly maintained footways; pavement parking and lack of dropped kerbs[11]. Evidence-based recommendations also include ensuring that planning permissions always prioritise the need for people (including those with limited mobility, children and young people) to be physically active as part of their daily lives, by ensuring suitable access by walking, wheeling or cycling to local amenities[12].

Evidence from the relatively recent intervention of 'school streets' road closures around schools shows that increases in walking trips are often immediate and significant[13], and that the number of children being driven to school can decrease[14]. There is evidence that parking restrictions, road safety improvements, traffic-free cycle lanes, school cycle parking and on-road cycle training are also important for increasing levels of walking and cycling to school[15]. There is evidence that increasing access to playgrounds and recreational facilities is associated with increased walking among adolescents[16], while street closures for 'street play' can encourage children to play actively, independently and safely close to home, avoiding the need to travel to a more distant location[17].

Evidence-based interventions to support people to switch modes

Reviews of evidence on interventions to support mode shift recognise the difficulty in disaggregating the contribution of different policy areas. There is evidence that interventions to reduce traffic; improve safety; increase access to other modes as well as promotional strategies all have a part to play in supporting people to move from car use to active travel[18].

Evidence supports the use of integrated packages of interventions to promote walking and cycling[19] and acknowledges the importance of engaging relevant sectors and stakeholders, including healthcare, education and workplaces[20]. Evidence suggests that comprehensive investment in a combination of interventions, including cycle infrastructure, cycle sharing schemes and promotional activities have led to doubling of cycling levels in cities such as Berlin, Paris, Barcelona and Bogota[21]. There is evidence from a range of UK studies that shows increases in walking and cycling in areas where investment has been made in largescale capital schemes such as networks and routes[22], with some evidence showing that segregated paths have been more effective than unsegregated paths and that networks with greater route density can encourage more cycling that linear routes[23]. The same review also found evidence that secure cycle parking; cycle hire schemes, including e-cycle hire schemes; cycle refurbishment programmes; and all-ability cycling schemes all support increased cycling[24]. There is however evidence that some cycle sharing schemes may result in mode shift from walking or public transport to cycling, rather than from car to cycling, particularly in cities where car use was relatively low prior to the introduction of cycle hire schemes[25].

There is evidence that investing in new public transport infrastructure can result in positive mode shift away from car and that smart ticketing and integrated travel planning can enable and incentivise both active travel and public transport use, however the importance of public transport being more cost effective and convenient than driving is also recognised[26]. Bus stop density; proximity to train stations; new or increased frequency of bus services; and concessionary fares schemes are all associated with increased bus use, as well as increased chances of walking as part of transport trips[27]. Evidence-based guidelines recommend ensuring that public transport services are reliable, accessible, including to those with sensory impairments, and that they support people to access leisure destinations such as blue and green spaces[28].

In terms of individual-level interventions, there is evidence that encouraging people to monitor their travel behaviour against social norms as well as highlighting stories of successful mode switches is effective in sustaining active and public transport choices, while financial incentives or penalties were found to only impact mode choice for the duration that the incentive was in place[29]. A recent evidence review focussing on mode shift to cycling concluded that while a mixture of 'soft' measures such as cycle training and 'hard' measures such as infrastructure are both required, it is necessary for the 'hard' measures to be in place first, in order for 'soft' measures to be effective[30]. There is evidence that household and workplace personal travel planning schemes as well as mass cycle rides; adult cycle training; led walks and

rides; and challenges can encourage people to try and in some cases continuing cycling or walking[31]. There is, however, some evidence that new cycle trips may replace trips that were previously walked[32]. There is also evidence that that the UK Cycle to Work salary sacrifice scheme has increased levels of cycling to work, and evidence from other countries that grants or subsidies for e-cycles can decrease car ownership[33]. Evidence-based guidance recommends providing support for people at 'transition points' in their lives such as when they are changing job, home or school as people may be more open to switching modes at these times[34].

Evidence-based guidance recommends taking action to disincentivise car use, in addition to action to promote use of alternative modes. This includes evidence-based recommendations to reallocate road space to support physically active modes of transport; restrict motor vehicle access; introduce road-user charging schemes; and introduce traffic calming schemes to restrict vehicle speeds[35]. There is evidence that reallocating street space away from private cars leads to improved street efficiency, meaning that more people can travel through streets in a given time period, which may help improve journey times for non-car modes and make these more attractive[36].

There is evidence of the effectiveness of road user charging schemes in supporting mode shift, such as the decrease in car use and increase in cycling levels seen in London following the introduction of a central congestion charge and the further reduction in the number of cars entering the zone following the introduction of an Ultra-Low Emission Zone Charge[37],[38]. There is modelled data to suggest that replacing fuel duty with road pricing could lead to a significant reduction in road traffic in the UK, without increasing overall costs to road users[39]. A UK Workplace Parking Levy scheme has also been shown to correlate with a positive impact on reducing traffic congestion and increasing public transport usage, by generating funding for investment in public transport improvements and incentivising employers to reconsider their parking provision[40]. It is, however, suggested that physically restricting or financially disincentivising car use works better when active travel or public transport alternatives are already in place[41].

Evidence-based interventions to support people to combine trips or share journeys

This rapid evidence review identified limited evidence on the impact of interventions to combine trips or share journeys. A Department for Transport-commissioned review of interventions reports that there is currently a lack of research on the behavioural impact of the MaaS approach, with existing evidence published to date

focussing on the potential and technical viability of such schemes rather than their impacts on behavioural change[42].

Evidence from studies identified separately to the rapid evidence review process has however shown a number of positive impacts from car sharing schemes[43,44,45].

Discussion

Published reports on the impacts of interventions on travel behaviour are largely focused on interventions such as physical infrastructure measures, socio-cultural interventions and individual-level behaviour change initiatives, with less evidence currently available on the impact of upstream policy interventions such as pricing mechanisms[46]. It is acknowledged that the rapid review was largely a review of transport policy documents, and so may not have fully captured information from related policy areas such as digital connectivity and spatial planning. It is also important to remember that the published evidence base can be biased in favour of interventions that are easier to implement and easier to evaluate, and that the *absence of evidence of impact* of more upstream interventions should not be misinterpreted as *evidence of no impact.* This is particularly relevant in the context of what is known about behaviour change initiatives outside of the transport sector, where the evidence indicates that upstream policy interventions have a greater impact than downstream engagement and promotional type interventions, in line with the Nuffield Ladder of Intervention[47],[48].

The rapid nature of the review meant the use of a restricted search approach and it is possible that additional evidence may be identified by widening the search methodology. There are however still likely to be some areas, particularly relating to newer policy approaches such as homeworking; 20-minute neighbourhoods; MaaS and micromobility, where evidence is less plentiful. Many interventions reported outcomes of increased walking, cycling or public transport use and it was not always possible to tell if that corresponded to a corresponding decrease in car use, of if some of the increase in other modes were a result of new trips. The rapid nature of the review meant the methodology of the evidence reviews presented in the reports identified was not critically appraised.

In summary the rapid evidence review identified evidence of effectiveness for a range of interventions to increase levels of walking and cycling in local environments, including neighbourhood walkability; speed reduction and other safety interventions; and school streets and other interventions to encourage active travel and decrease car use on the journey to school. The review also identified evidence for a broad

range of interventions to encourage mode shift; including infrastructure interventions to increase active travel and public transport use; 'soft' measures to engage people in the use of active travel and public transport infrastructure; and a range of measures to disincentivise car use. There was evidence that packages of measures are more effective at encouraging mode shift than stand-alone measures, and that the phasing of measures is important, with both 'soft' measures to encourage use of active travel and public transport, and car-disincentivisation measures both identified as being more effective once adequate active travel and public transport infrastructure is in place.

The review identified limited information in relation to combining journeys and sharing trips, however it is noted that evidence identified outside of the review methodology shows evidence of positive impacts from car-sharing schemes. The review did not identify evidence on the impacts interventions to encourage people to reduce their need travel, however through monitoring and evaluation of our policies we can hopefully contribute to this evidence base going forwards.

Part 4: Summary of research on attitudes and behaviours to car reduction

Transport Scotland have been monitoring public attitudes to transport and travel during the COVID-19 outbreak. This has included a number of interviews, focus groups and surveys, with questions on car use and the 20 per cent car kilometre reduction target included where appropriate[v].

Public opinion interviews, February / March 2021

Researchers from the University of Leeds and University of Stirling conducted interviews with 101 members of the public in Bristol, Glasgow, London, Manchester and Newcastle in February / March 2021 to understand public perspectives on the 20 per cent car kilometre reduction target. The majority of interviewees, 93 per cent, had a driving licence and the same percentage had access to one or more vehicles within the household. Interviewees were asked to consider *what they thought of the target*; *what the implications would be for them*; *what type of car trips they thought they would be able to reduce*; and *what could be done to assist them with reducing their car use*.

The researchers found that the majority, around 70 per cent, of interviewees support the target, including for: environmental and sustainability reasons; because of the potential health and wellbeing impacts; and because of other co-benefits including quieter, safer roads and reduced congestion. Interviewees also felt that it would be achievable given the behavioural changes that have been seen as part of the coronavirus pandemic. Around 20 per cent of interviewees responded with neutral comments, with around 10 per cent responding with negative comments including around lack of adequate transport alternatives and concerns around fairness.

When asked about how the target would affect them and the type of journeys they would change, the majority of interviewees' comments related to the opportunity to replace short, local car journeys with active travel alternatives. Suggestions also included rethinking the need to travel including by working from home and reducing the frequency with which they shop by car; making more use of local shops which

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[v] The COVID-19 Transport, travel and social adaptation study (TRANSAS) began in July 2020 and has included a series of online surveys, public interviews and policy interviews. More details about the research programme can be found at https://covid19transas.org

they can reach by active travel; switching to public transport; combining activities such as shopping and leisure into a single car trip; and car sharing for work commutes. The researchers noted that there were few comments in relation to leisure trips or longer trips which may not be replaceable with active travel.

The most frequently cited measure to assist with car reduction was improved public transport, mentioned by over 50 per cent of interviewees, including comments on the need for increased convenience, accessibility, desirability and lower cost, as well as the need for safety measures in the context of the ongoing pandemic. Interviewees also mentioned the potential benefit of park and ride schemes to help people access the public transport network. Financial incentives or penalties were also mentioned, including suggestions for incentives or discounts for alternative modes; workplace incentives for car sharing; tax relief for reduced annual mileage; as well as interventions to make it more expensive to travel by car, including increased fuel costs; increased vehicle tax and road user charging schemes. There were comments about the importance of redressing the balance between car and public transport, both in terms of cost and convenience. Comments were also made about the need to improve opportunities for walking and cycling, including providing safer infrastructure for both walking and cycling, as well as improved access to cycles; cycle storage and improved route-planning and wayfinding.

Qualitative research, July / August 2021

In July / August 2021 some additional qualitative research was conducted by the same research team, to help inform the content of a subsequent quantitative study to be carried out in October / November 2021. This involved conducting six focus groups, including four urban and semi-urban and two rural groups, with a total of 34 participants from different areas of Scotland[vi]. The focus groups asked people to consider *their current transport views and options in their area; their views on the 20 per cent car kilometre reduction target, and car use reduction more generally*; *their views on car-sharing and car clubs;* and *their views on messaging in relation to the 20 per cent car kilometre reduction target*.

The researchers found that most of the participants were not previously aware of the target, however after hearing more through the study they provided general levels of support and positive comments. There were some participants who were supportive

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[vi] The six focus groups were made of up of participants from Glasgow (Urban); Glasgow (Semi-Urban); Aberdeen (Urban); Aberdeen (Semi-Urban); with two Rural groups, containing a mixture of participants from different rural locations.

of the target in principle but who felt it would not be possible to change their individual behaviours. There were also comments about cars being only one contributor to the climate change challenge. There were some differences in the level of support between different focus groups, with participants in the Glasgow focus groups being more positive, while others were more hesitant about the feasibility of car reduction.

When asked how the target would affect them, the majority of participants mentioned avoiding the need to travel, for example by working from home or switching to active travel for existing short journeys and some mention of car sharing. There was little mention of changing or adapting journeys to visit more local destinations or to combine trip purposes into a single car journey. Participants also shared the types of journeys that they thought it would be less possible to change, including grocery shopping; long-distance trips to visit friends and family; leisure trips with children and leisure trips requiring sports equipment to be carried.

Participants also discussed measures that could help them to reduce their car use, including citing the benefits of a single source of information to help people plan journeys by alternative modes and enable people to compare the environmental impact of different travel options. The value of promoting active travel through schools and car-sharing through workplaces was also mentioned. Participants from rural areas cited cost as a particular issue, including the cost of public transport but also the higher cost of groceries in local shops prompting people to travel further distance to access lower-cost groceries. In addition to affordability, the need for public transport to be convenient, accessible, safe and to facilitate the carriage of large items such as bikes and leisure equipment was also cited. The researchers noted that those who currently have concessionary passes for public transport were more positive about it as an option.

The focus groups also asked participants for their views on messaging in relation to the 20 per cent car kilometre reduction target. Participants reported that messaging (both from government and private sector) currently appears to be mixed, with news of public transport fare rises seen to be in conflict with a government target to reduce car use, and private sector car advertisements seen as a further conflict. Participants reported wanting to see messaging that is *clear*, *honest* and *concise*, and includes both information on the dis-benefits of existing car use as well as the benefits of car reduction. Researchers also identified a need for messaging to be set in a context of what government has already done, and what they are proposing to do in order to meet the target, as well as messaging that shows that a reduction in car use is part of a wider programme to address climate change, including actions on non-car

transport as well as actions on emissions from outside the transport sector. The importance of local-level and targeting messaging was also cited, as well as the benefits of messaging coming from non-government sources, such as scientific and academic bodies as well as public figures and social media influencers.

Quantitative survey, October / Novemeber 2021

In October / November 2021 a quantitative telephone survey was carried out with a representative sample of 1001 adults aged over-16 from across Scotland. This was done as part of an ongoing survey that had been used to gain an understanding of current and intended future travel behaviours throughout the COVID-19 pandemic. Additional questions relating specifically to the 20 per cent car kilometre reduction target were included within this wave of the survey.

Survey respondents were asked *what trip purposes they currently use car for; which trip purposes would be easy or possible to make without car*; *alternatives options that would be chosen if car use was not available*; *reasons why it was deemed 'not possible' to use walk; cycle or public transport for certain trip types*; and the *perceived impact of different car disincentivisation measures on car use*.

Across all trip types asked about in the survey, an average of 62 per cent of respondents said they had used car for this trip purpose at least sometimes. This varied depending on the trip type, ranging from 20 per cent for taking children/young people to school or nursery to 82 per cent for food shopping. An average of around 8 per cent of respondents indicated that it would be easy not to use a car for trip types currently made by car, with a range from 5 per cent to 12 per cent depending on the trip type.

For those who indicated that they were travelling by car more frequently compared to prior to the Lockdown in 2020, the most prominent trip types more likely to be driven were for essential shopping, for example food (69 per cent); visits to friends/relatives (54 per cent); business/travel to work (46 per cent); non-essential shopping e.g. clothes (39 per cent); and to collect prescriptions/medicine (37 per cent). For those who indicated that they were travelling by car more frequently compared to prior to the lockdown in 2020, around half (47 per cent) said they were travelling the same distance, with round a third (31 per cent) saying they were travelling less distance and a fifth (21 per cent) saying they were travelling a greater distance. For those who indicated that they were travelling by car more now compared to prior to the lockdown in 2020, the main reasons for doing so were convenience (35 per cent) followed by concerns/fears about other modes (29 per cent).

The trip types where car is most commonly reported as being used at least sometimes were food shopping (82 per cent); visiting family/friends (81 per cent); to attend medical appointments (77 per cent); non-food shopping (72 per cent); leisure/recreation at the weekend (67 per cent); and holidays (67 per cent). Travel to work/education (48 per cent); travel as part of work/training (42 per cent) and to take children/young people to school or nursery (20 per cent) were less commonly cited as trip type where car is used at least sometimes.

Looking at the two most prominent trip types where respondents said they used a car at least sometimes, 57 per cent said it would be possible or easy, of whom 9 per cent said it would be easy not to use a car for food shopping, with 54 per cent saying it would be possible or easy and 7 per cent saying it would be easy to avoid car use for visiting family and friends. For all other trip types, between 41 per cent and 68 per cent said it would be possible or easy to avoid car use, with between 5 per cent and 12 per cent said it would be easy to avoid it.

Amongst trips where car was currently used, the most prominent trip types where it was reported to be possible or easy to avoid car use were for non-food shopping (68 per cent); for leisure/recreation (62 per cent during week; 61 per cent at weekends); to attend medical or non-work appointment (63 per cent); to take children/young people to school or nursery (55 per cent); and to visit friends/relatives (54 per cent); and to attend medical or non-work appointment (63 per cent). Conversely, respondents who said it would be impossible not to use car for certain trip types ranged from 30 per cent for non-food shopping to 52 per cent (to go on holiday).

Respondents were asked about what they would do for the same trip types, if they were to change their travel behaviour. With the exception of food shopping, across all other trip types, the most prominent response was to 'travel to the same destination but switch to public or active travel modes'. This ranged from 19 per cent for going on holiday to 31 per cent for attending a medical or non-work appointment. Travelling by car but combining with another trip purpose or another person was the next most prominent response across all trip types with the exception of both food and non-food shopping, using an online appointment or delivery was the most prominent response in terms of changing travel behaviour.

The main reasons respondents gave across all trip types for not using public or active travel modes were 'because there is no public transport option' and 'there is a public transport option but I find it slower'. The 'no public transport option' was more prominent across all trip types and highest for recreational activities (43 per cent at weekends and 39 per cent during the week); and to get to work (38 per cent). The

exception to this was for food shopping where the main reason given for not using public or active travel modes was 'I need to carry items that it would not be possible to carry without a car' (46 per cent).

When asked whether car disincentivisation measures would influence car use behaviour 48 per cent; 47 per cent and 42 per cent said that congestion charging/road tolls; reduced parking space availability; and higher parking charges, respectively would result in them using car less. Car free roads/zones and reduced road space for cars were cited by fewer respondents (33 per cent and 21 per cent respectively) as encouraging reduced car use. Conversely, across the same measures, respondents who said these measures would make no difference to their car use ranged from 43 per cent for congestion charging/road tolls to 71 per cent for reduced road space for car.

Part 5: Mapping of interventions to the COM-B behaviour change framework

We have considered the evidence based interventions to support decreased car use in the context of the COM-B model of behaviour change, which recognises that for any behaviour to be enacted, people must have *capability*, *opportunity* and be more *motivated* to carry out the desired behaviour than anything else that is in competition with it[vii]. Capability refers to people's psychological abilities (for example knowledge and mental skills) and physical abilities (for example dexterity and strength). Opportunity refers to the environment with which people interact, whether it be the physical environment (for example objects and time constraints), or the social environment (for example social cues and cultural norms). Motivation refers to mental processes that energise and direct behaviour. These include reflective processes (for example conscious decision making and inference), and automatic processes (for example feelings and habits).

Without all three enablers in place it is unlikely that the desired change will take place. Effective transport policy must therefore consist of interventions to help overcome known barriers and support people's *capability*, by providing them with knowledge of the travel options that are available; *opportunity*, by providing non-car options that are accessible and safe; and *motivation*, by ensuring non-car options compare more favourably than car, for example in terms of convenience; attractiveness and cost.

We have made use of the Behaviour Change Wheel approach in order to identify a range of evidence-based intervention types and policy options that are well-suited to influencing individual-level *capability*, *opportunity*, and *motivation* to reduce car use. Key investment and legislative interventions are mapped using the COM-B Behaviour Change Wheel approach in the table at the end of this section.[viii]

[vii] Public Health England. Achieving behaviour change. A guide for national government, 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/933328/UFG_National_Guide_v04.00__1___1_.pdf

[viii] ibid
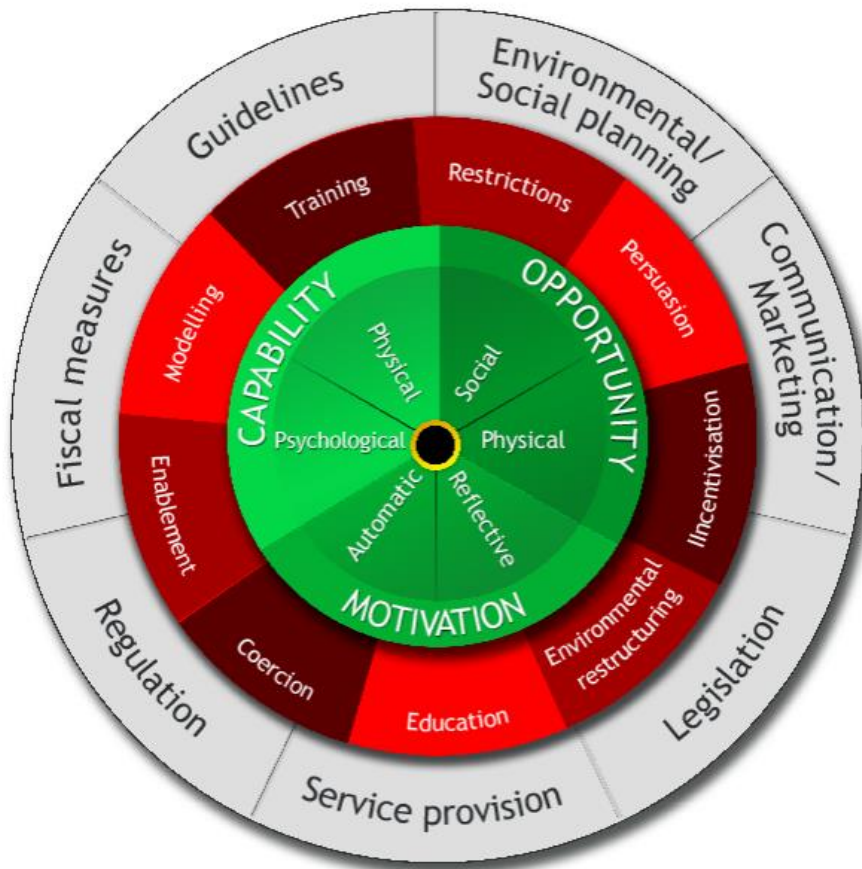
The Behaviour Change Wheel
Source: Mitchie et all 2011

Many of the interventions in the route map are designed improve the material conditions that will support people's *physical opportunities* to reduce their car use, for example through improved infrastructure and service provision. There are also a number of *incentivising* interventions to increase *motivation* to switch away from car use, by making alternatives comparatively more attractive, including in terms of convenience and cost. As outlined in the main route map document, people's motivation to choose one behaviour over another lies in the balance of individual-level benefits and dis-benefits and further exploration of equitable options to *disincentivise* car use will be conducted through the commissioning of additional research in 2022. As part of our national conversation on car use, we will also being undertaking additional communications and marketing to further support people's *capability* and *motivation* to choose sustainable travel options, in addition to improving their *opportunities* to do so.

Table: Mapping key interventions to the Behaviour Change Wheel Framework

Behaviour	Intervention	COM-B	Intervention Type	Policy Type
Reduce the need to travel	Extending superfast broadband	Opportunity (physical)	Environmental restructuring	Service provision
Reduce the need to travel	Extending 4G coverage	Opportunity (physical)	Environmental restructuring	Service provision
Live well locally	Place-based investment programme	Opportunity (physical & social)	Modelling	Service provision
Live well locally	New National Planning Framework	Opportunity (physical)	Environmental restructuring	Environmental planning
Live well locally	20mph Speed Limits	Opportunity (physical)	Restrictions	Legislation
Switch modes	Free bus travel for under-22s	Motivation (reflective)	Incentivisation	Fiscal Measures
Switch modes	Workplace parking regulations	Motivation (reflective)	Incentivisation	Fiscal Measures
Switch modes	Low emission zones	Motivation (reflective)	Incentivisation	Fiscal Measures
Switch modes	Investment in bus transport	Opportunity (physical)	Environmental restructuring	Environmental planning
Switch modes	Investment in the rail network	Opportunity (physical)	Environmental restructuring	Environmental planning
Switch modes	Learning for sustainability initiative	Capability (psychological)	Education	Service Provision
Switch modes	Free bikes for children	Opportunity (physical)	Enablement	Service provision
Switch modes	Prohibition on pavement parking	Opportunity (physical)	Restrictions	Legislation
Switch modes	Increased active travel budget	Opportunity (physical)	Environmental restructuring	Environmental planning
Share trips	Mobility as a Service Investment Fund	Capability (physical)	Enablement	Service Provision

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