OPPORTUNITY TO SHIFT MODES

Peninsula and Western Gateway

Introduction and Methodology

WSP was appointed by Peninsula Transport and Western Gateway sub-national transport bodies (STBs) to provide analysis into existing car journeys within the regions and determine which trips have the opportunity to be shifted to active and sustainable travel. This opportunity represents the options reasonably available to the public but not their propensity to take them.

This analysis has wider applications, as it could support the development of Local Transport Plans (LTP) and active and sustainable transport investment programmes.

METHODOLOGY OVERVIEW

Outputs from the South West Regional Traffic Model (SWRTM) were used to identify a representative sample of journey origins and destinations in the area.

The origin-destination trip matrices were run through Google's Directions Application Programming Interface (API) to provide real-world transport route options for each journey, to produce network distance and journey time per mode (walking, cycling, public transport and driving).

Additional analysis was undertaken to identify areas where more sustainable modes are competitive with driving, and quantified these figures with Passenger Car Units (PCU) and Vehicle Kilometres Travelled (VKT) measures of passenger flow. As part of this analysis, the potential reduction in carbon emissions was estimated and compared to the baseline carbon emissions.

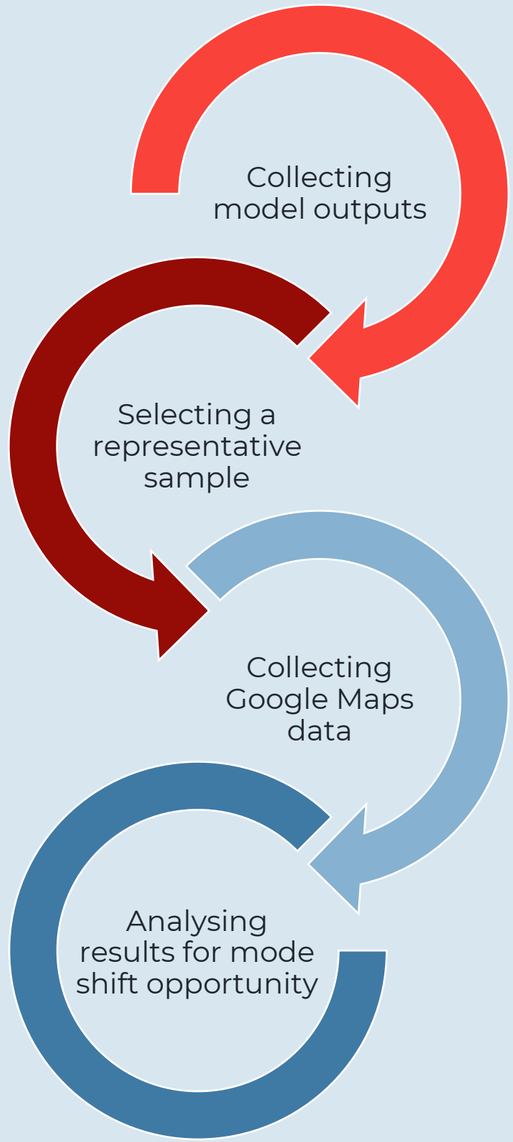


Figure 1: The opportunity to shift modes process

Opportunity to shift modes

WHICH CAR TRIPS COULD BE MADE BY ACTIVE AND SUSTAINABLE MODES?

To calculate this opportunity, data from a range of sources are used. These include:

- Modelling outputs, recording the origins, destinations and daily trip numbers of car journeys across the study area.
- Google Maps data, giving the distance, duration and route shape for a sample of these modelled trips.
- Government travel statistics and other research, which gives insight into how far people would be willing to travel by different modes.

Two scenarios have been developed to apply to this analysis, which are detailed in **Table A1**. They are:

Scenario 1: High mode shift – which has ambitious thresholds for trips to be made by sustainable modes as set out in the Department for Transport's Gear Change.

Scenario 2: Lower mode shift – which has a more conservative set of journey time limits for trips to be made by sustainable modes, achieving a 15-20 minute neighbourhood.

The urban – rural differentiation within these scenarios was introduced to account for people in rural areas lower use of active and sustainable modes.

Specifically, the National Travel Survey (NTS9903) indicates that people in rural **regions walk over a mile ~28% less** and **cycle ~19% less** often than people in urban regions across a year.

The statistics for 2018/2019 were then used to adjust the Gear Change based thresholds used for the urban regions. This data was taken for 2018/2019 in order to avoid disruptions caused by Covid-19.

The high scenario public transport threshold and the upper limit for journey times were chosen based on statistics from the Labour Force Survey (TSGB0111). These statistics represented the average time people in the South West region took public transport and drove to work.

The threshold was set as slightly higher than the public transport / driving time ratio and the upper journey time limit was taken from the average rail journey time across 2018/2019. The low scenario threshold was selected as a reasonable lower alternative.

Table A1: Scenarios developed for mode shift opportunity

Mode shift opportunity	Scenario 1 (High mode shift)	Scenario 2 (Lower mode shift)
Car trips which could be walked	**Urban:** Under 2 miles / 3.2 km **40 mins**	**Urban:** Under 1 mile / 1.6 km **20 mins**
	Rural: Under 1.4 miles / 2.3 km **30 mins**	**Rural:** Under 0.7 miles / 1.2 km **15 mins**
Car trips which could be cycled	**Urban:** Under 5 miles / 8km **30 mins**	**Urban:** Under 3 miles / 4.8 km **18 mins**
	Rural: Under 4.1 miles / 6.5 km **25 mins**	**Rural:** Under 2.4 miles / 3.9 km **15 mins**
Car trips which could be made by public transport – limited to 75 minute PT journey (i.e. a car trip of 25 minutes would be shifted to PT if the corresponding trip was less than 60 minutes (high mode shift) or 37.5 minutes (low mode shift)	Less than **2.4x** slower	Less than **1.5x** slower

Our Process

QUANTIFYING POSSIBLE MODE SHIFT ACROSS THE STUDY AREA

The South West Regional Traffic Model (SWRTM) was used to obtain daily trip numbers by origin and destination (O-D) pairs in the modelled year 2031.

In total 99,095,136 trips were extracted from the model, however, many of these trips fell outside of the study area and were not relevant to this study.

SWRTM outputs were filtered to focus on the Peninsula and Western Gateway study area. The following criteria were used within the sift:

- Removing non-car trips
- Applying a 150km max travel distance buffer
- Filtering for trips that started or ended within the study area
- No internal zone trips (analysed separately)

Once this sift had been undertaken the sample included 6,407,575 trips and 82,103,678 vehicle kilometres.

The sift criteria is presented graphically overleaf in **Figure A2.**

The Google Maps Directions API was used to calculate possible journey routes and durations for these selected trips.

Results from Google Maps were then analysed and compared against the travel time thresholds for each mode and each of the two scenarios presented previously in **Table A1**.

This gives a figure for proportion of driving trips which could shift to sustainable modes.

Figure A1 shows the breakdown of the SWRTM model trips and the sample analysed in this study.

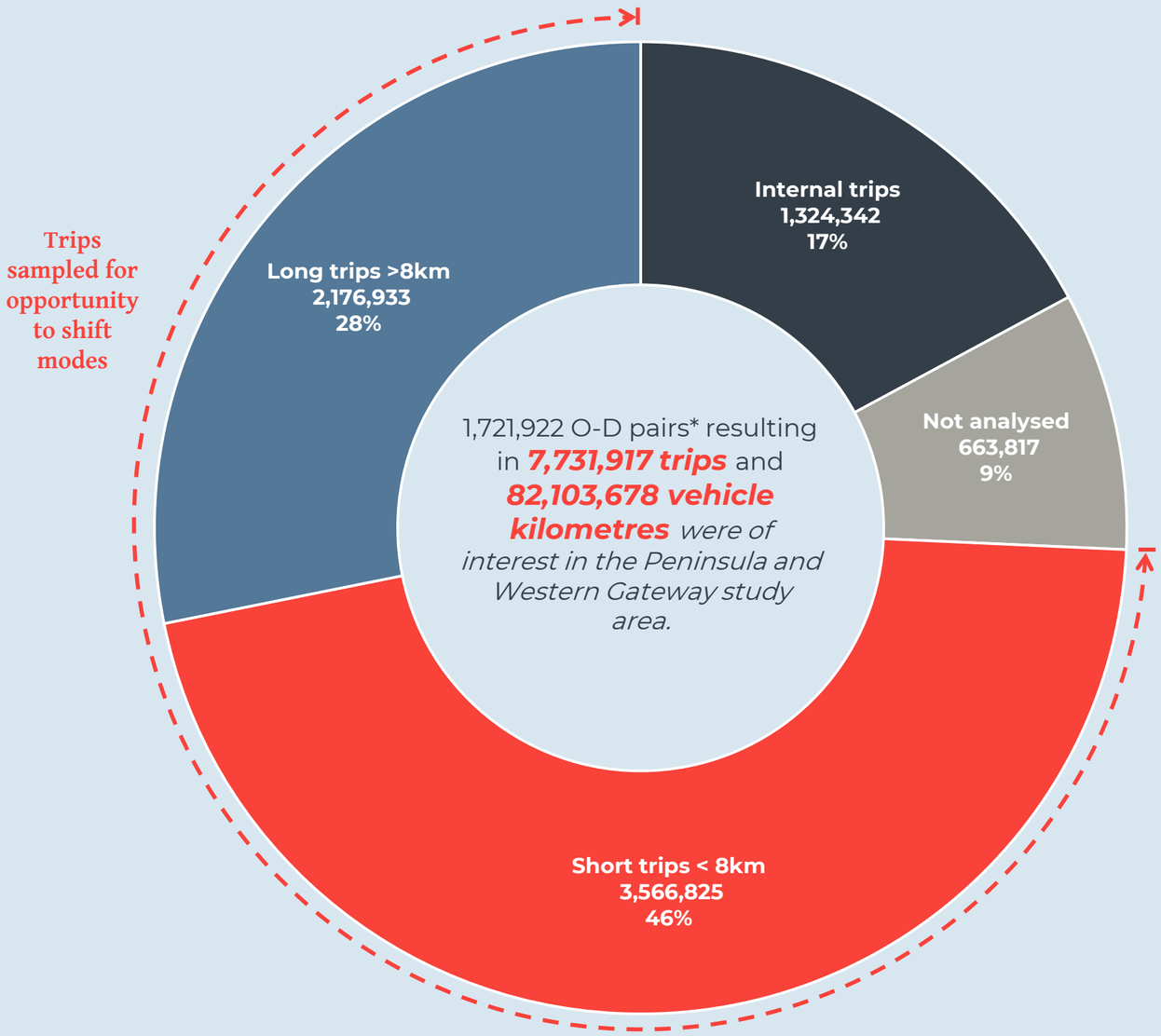


Figure A1: All trips modelled by SWRTM. The selected sample of trips is highlighted by the red dotted line.

** Includes internal zone trips which were then analysed separately*

SWRTM model output

14,161,372 unique O-D pairs containing 99,095,136 trips

Sift 1: removing non-car trips

7,331,745 unique O-D pairs containing 76,453,026 trips

Sift 2: removing O-D pairs over 150km apart

5,977,628 unique O-D pairs containing 76,034,781 trips

Sift 2: removing trips starting and ending outside the study area

1,721,922 unique O-D pairs containing 7,731,917 trips

Final sift: removing internal trips (analysed separately)

1,720,508 unique O-D pairs containing 6,407,575 trips

Figure A2: SWRTM output sifting approach

Analysing Internal Trips

GETTING AN INDICATION OF HOW INTERNAL TRIPS MAY SHIFT TO ACTIVE MODES

Due to limitations with SWRTM, it is not possible to extract the distance travelled, origins or destinations of trips that occur entirely within one zone. As this information is not available an alternative method of analysis has to be developed to find the opportunity to shift modes within zones.

The opportunity to shift to active travel modes is decided both by travel time and distance. While the travel time is not calculable without the origin and destination of the trips, a maximum trip distance can be estimated to assess the opportunity in the 'worst case scenario'.

To find this estimate, the longest straight line that could fit within the boundaries of the zone was found and its length was used as the longest potential internal trip length. This longest trip length can then be compared to the high and low scenario thresholds to determine if the internal trips would shift to active modes.

The longest distance was chosen so that the internal trips can be shifted to active modes with a high confidence that using smaller distances within the zone would not afford. The opportunity for internal trips to shift to public transport was not calculable as it relies entirely on journey times which this method does not analyse.

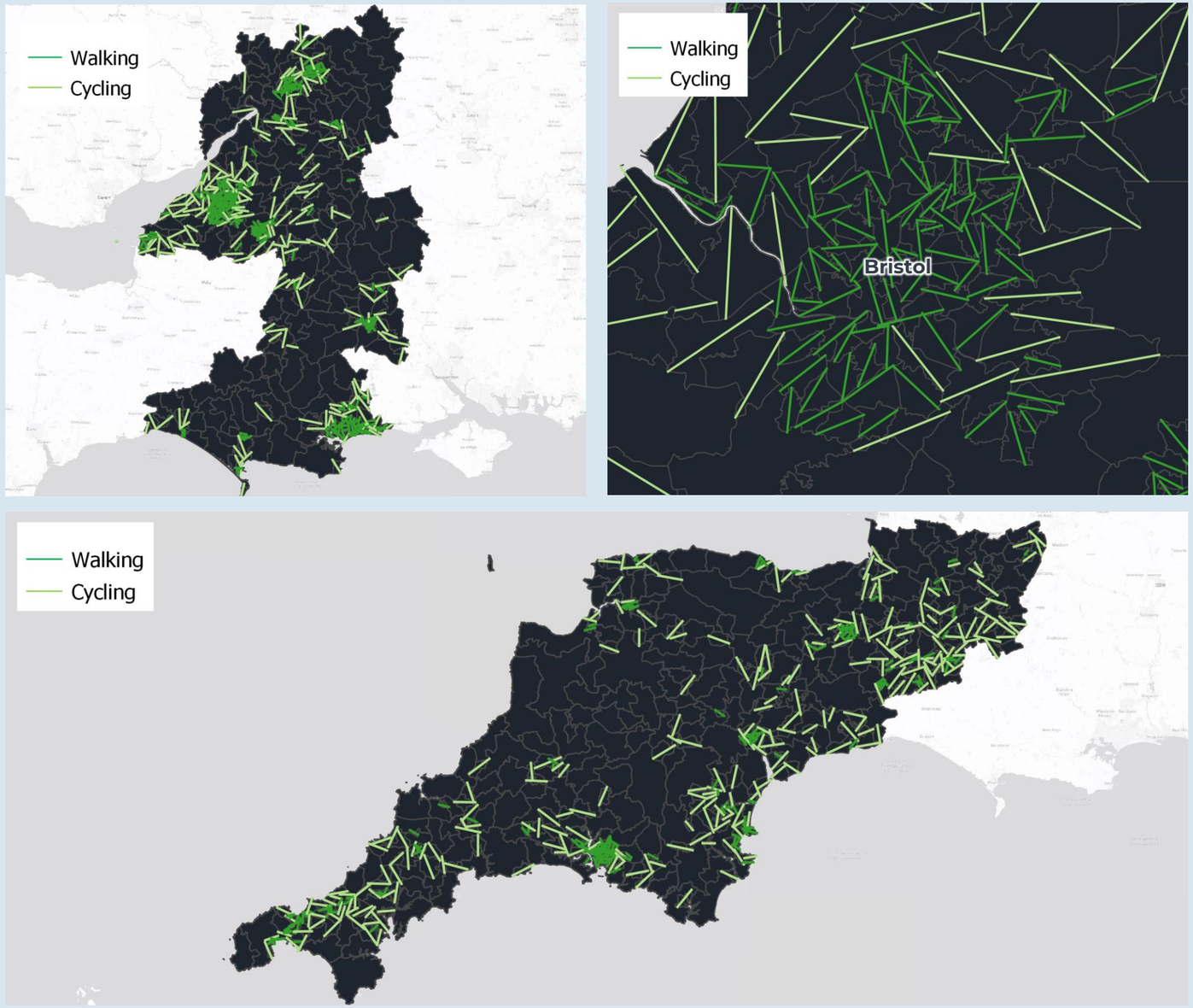


Figure A3: Longest lines highlighted within zones where internal trips were considered to be taken by active travel. Dark green lines represent distances below the walking threshold, and light green lines represent distances between the walking and cycling threshold. (Top left) the Western Gateway study area, (top right) an urban region and (bottom) the Peninsula study area.

Mode shift opportunity

WHAT IS THE MODE SHIFT OPPORTUNITY ACROSS THE STUDY AREA?

Figure A4 shows high and low mode shift opportunity for trips and vehicle kilometres travelled (VKT) within the study area.

17% of trips are identified as internal within the same zone. Based on the size of the zone analysed, between 7% (lower mode shift scenario) and 11% (higher mode shift scenario) of trips are identified as short internal trips which are likely to be undertaken by active travel modes. The remaining 10% (lower scenario) and 6% (higher scenario) long internal trips and therefore more likely to be undertaken by other modes (i.e. public transport or driving).

Based on the sample of data analysed using the API, in the higher mode shift scenario as many as 43% of trips could be shifted from car to active or public transport. This includes almost a quarter of trips which are cyclable, demonstrating the large opportunity that bicycle travel uptake presents to support the decarbonisation of transport in the study area.

The lower mode shift scenario presents a more modest 24% shift from cars to sustainable modes. This includes 21% of trips which could be cycled even given the shorter time threshold of 18 minutes (or 15 minutes in rural areas).

When assessing mode shift opportunity by kilometres travelled, there is a larger proportion of kilometres which must be made by car than when measuring by trip numbers. Non-analysed car trips take up 25% of total trips within the study area.

Of analysed trips, 17% of vehicle kilometres could be shifted to sustainable modes in the high scenario, with 7% for the lower scenario. This demonstrates how a small number of longer trips can outweigh the large number of shorter trips when measuring vehicle kilometres. As VKT is proportional to carbon emissions, it is key to reduce car kilometres as well as car trips.

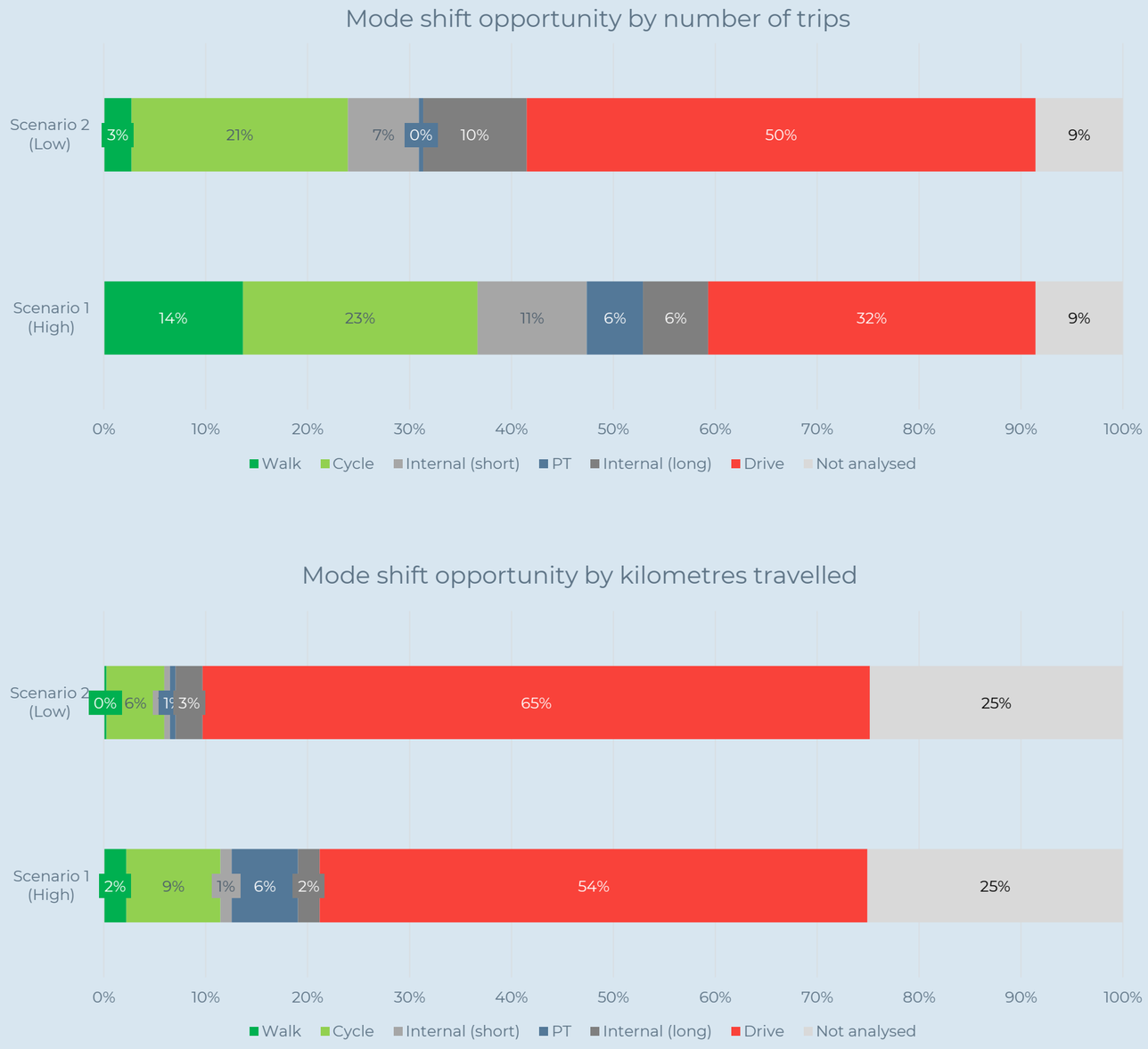


Figure A4: Mode shift opportunity (by number of trips and vehicle kilometres travelled)

Mode shift opportunity

WHAT IS THE URBAN RURAL SPLIT?

Mode shift opportunity in trip numbers for urban and rural areas is shown opposite in **Figure A5**. This assesses only shorter trips (<8km) between zones, which are trips that could possibly be walked or cycled.

There is a large divide between urban and rural areas regarding proportion of trips which can be shifted to sustainable modes. In the high scenario, **93% of trips could be shifted in urban areas**, but this figure is **only 54% in rural areas**. While walking can facilitate over a quarter of urban trips, the large distances in rural areas mean that a half hour trip can only carry 3% of trips.

In the low scenario, car dependency rises from 38% in urban areas to 76% in rural areas. Public transport holds only 1% of short rural trips and no short urban trips, indicating that services are not competitive with driving.

Many shorter trips which may be possible by public transport are potentially cannibalised by active modes, especially in urban areas. In the high mode shift scenario, active travel accounts for 91% of trips with just 2% for public transport. However, the low mode shift scenario assigns a lower 62% of trips to active transport and no trips to public transport.

Also to note, as the opportunity calculated is based on drive time and distance comparisons with the Google API it does not predict human behaviour. This is important to consider for rural areas where a lack of infrastructure, people's ability etc. may affect their likelihood to switch modes.

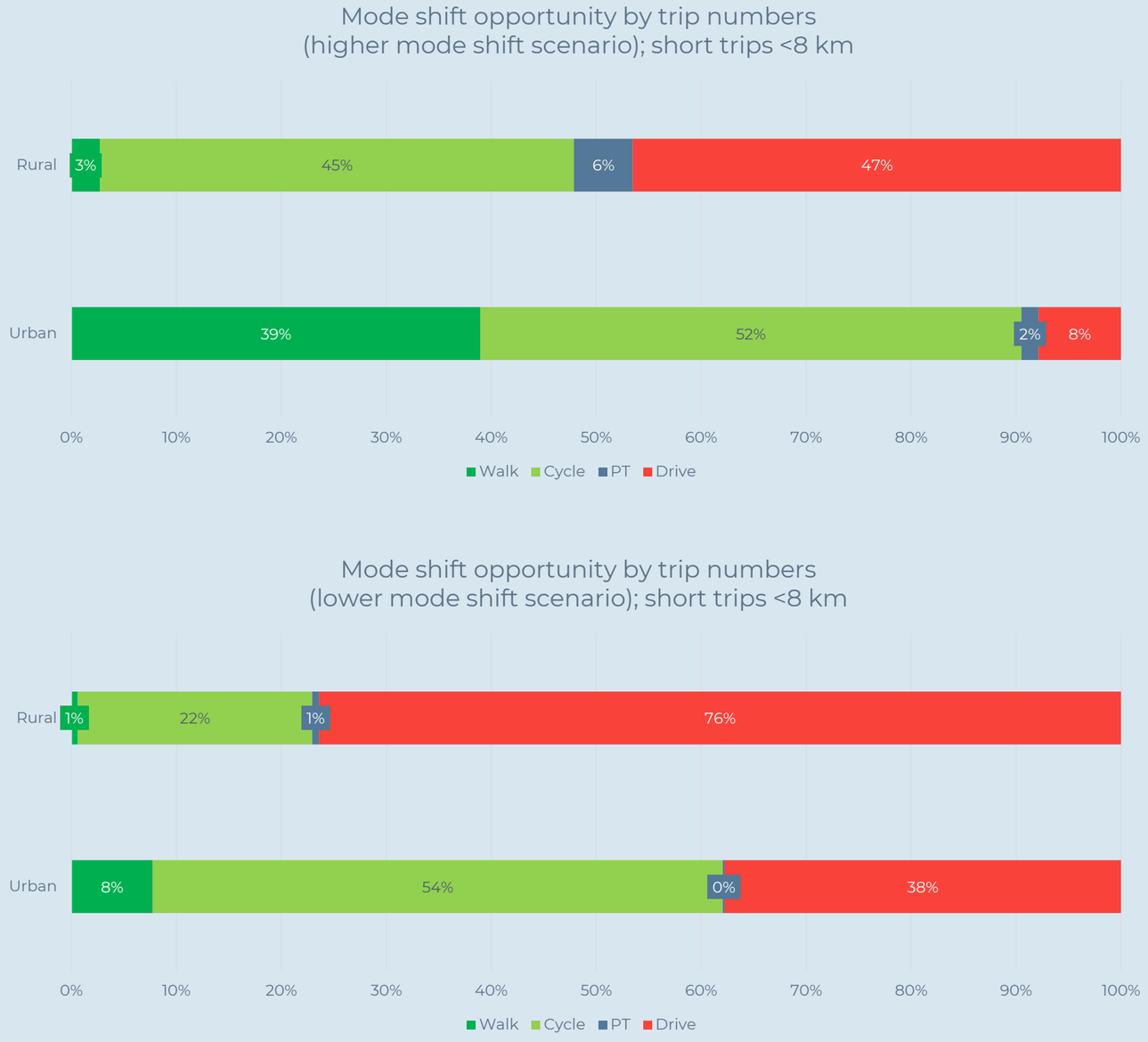


Figure A5: Mode shift opportunity among short trips (by number of trips) by urban and rural areas.

** Percentages may not add up to 100% completely due to rounding*

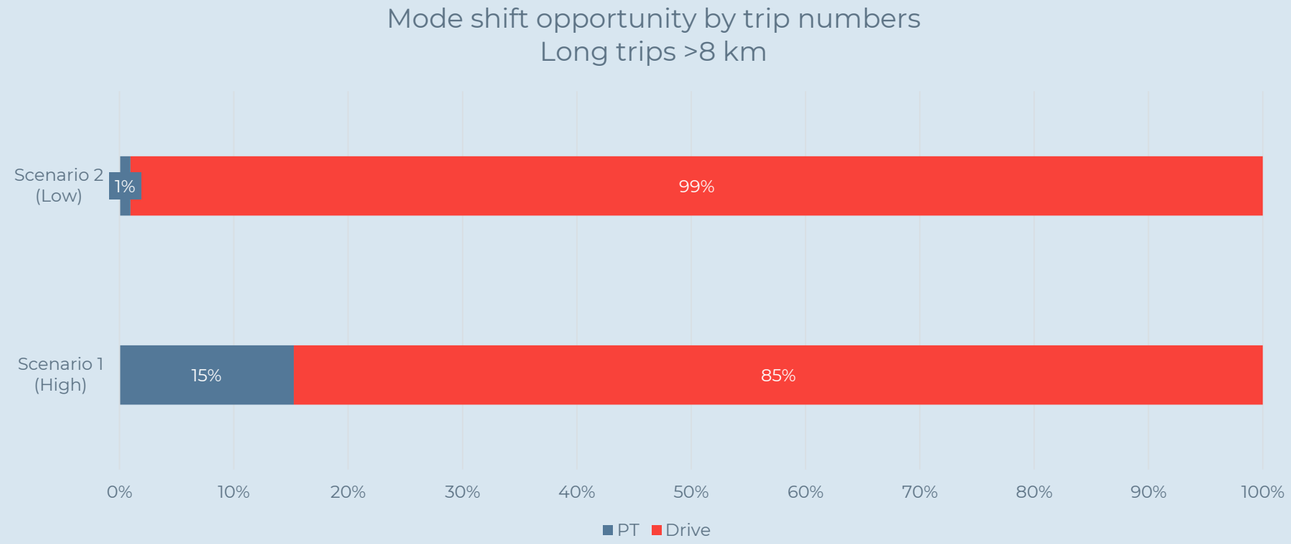
Mode shift opportunity

WHAT IS THE PT DRIVE SPLIT?

Mode shift opportunity in trip numbers and VKT is shown opposite in **Figure A6**. This assesses only longer trips (>8km) as these are trips that are very likely to be made by public transport or car.

This analysis shows that even with the high mode shift scenario's threshold of public transport journey times being as much as 2.4 times slower than driving, and without competition from active modes, only 15% of trips could be shifted to public transport. The lower mode shift scenario, of 1.5 times slower than the equivalent journey by car, sees just 1% of trips having the opportunity to shift from car to public transport.

Similarly, this analysis found that 11% of VKT could be shifted from car in the high scenario and 1% in the low scenario. This suggests that those trips that were shifted in the high scenario were dominated by shorter long trips. A comparison of public transport and car journey times are presented later.



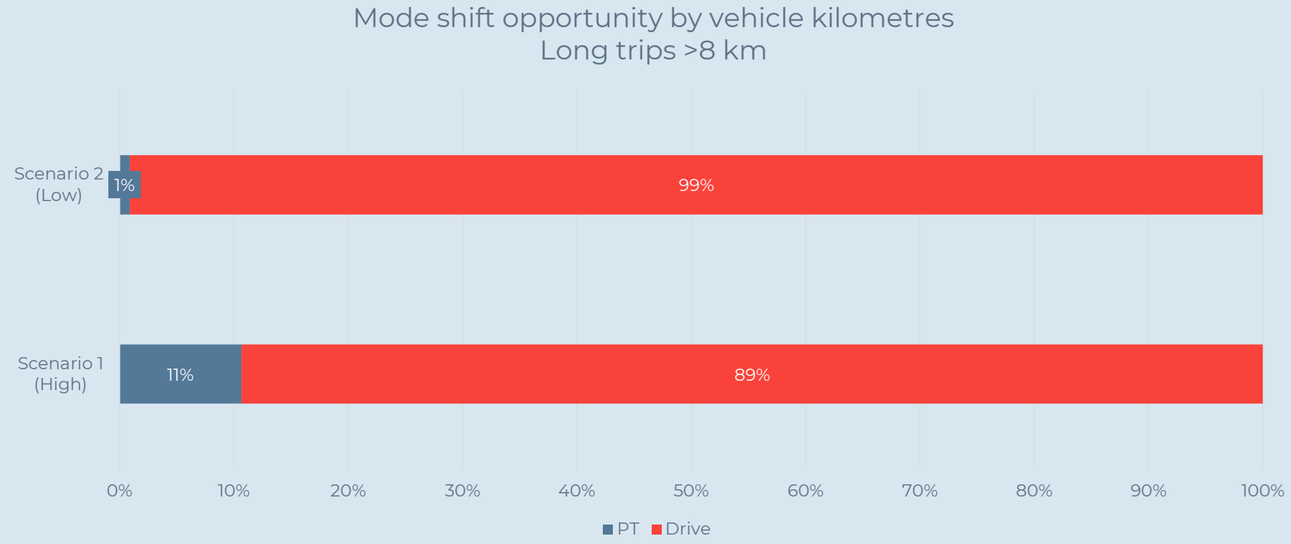


Figure A6: Mode shift opportunity among long trips (by number of trips and vehicle kilometres travelled).

Mode shift opportunity

DECARBONISATION

Carbon emissions were calculated for each mode using government carbon factors*. The factors used were 0.17 kgCO2e/km for car trips and 0.13 kgCO2e/km for public transport trips.

The carbon emissions for the two scenarios is shown opposite in **Figure A7** for the study area.

Across the region's 5,743,758 analysed daily car trips, there were 13,268 tonnes of daily CO2e emissions in the baseline scenario.

The results of this analysis show that under the higher mode shift scenario, 17% of baseline emissions could be removed by mode shift towards walking, cycling and public transport. This equates to 2,962 tonnes of daily CO2e per day. The lower mode shift scenario can reduce 6% of emissions (1,299 tonnes).

Table A2 overleaf presents all figures for trip numbers and people kilometres, as well as CO2e emissions and savings which were calculated for this analysis.

Figure A7: Carbon emissions and saving opportunity by scenario (measured in CO2e).

* https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022

Table A2: Results summary by scenario

Scenario	Internal Trips	Walk	Cycle	PT	Drive	Not Analysed
Baseline		**None**			**All**	
Trips	1,324,342 (17%)	0	0	0	5,743,758 (74%)	663,817 (9%)
People km	3,438,249 (estimated) (3%)	0	0	0	77,750,487 (72%)	26,535,256 (estimated) (25%)
Tonnes CO_2e	N/A	0	0	0	13,268.28	4,528.29 (estimated)
1: High mode shift		**40 mins or less**	**30 mins or less**	**PT if less than 2.4x slower than drive**		
Trips	1,324,342 (17%)	1,054,924 (14%)	1,779,584 (23%)	426,604 (6%)	2,482,646 (32%)	663,817 (9%)
People km	3,438,249 (estimated) (3%)	2,346,038 (2%)	9,770,263 (9%)	6,869,248 (6%)	56,912,384 (54%)	26,535,256 (estimated) (25%)
Tonnes CO_2e emissions; (% of total emissions)	N/A	0	0	594.22 (3%)	9,712.21 (55%)	4,528.29 (estimated) (25%)
Tonnes CO_2e savings; (% of total emissions)	N/A	-494.94 (3%)	-1,837.16 (10%)	-629.75 (4%)	0	N/A
2: Lower mode shift		**20 mins or less**	**15 mins or less**	**PT if less than 1.5x slower than drive**		
Trips	1,324,342 (17%)	209,974 (3%)	1,642,533 (21%)	31,316 (0%)	3,859,935 (50%)	663,817 (9%)
People km	3,438,249 (estimated) (3%)	280,639 (0%)	6,061,678 (6%)	579,046 (1%)	69,949,181 (65%)	26,535,256 (estimated) (25%)
Tonnes CO_2e emissions; (% of total emissions)	N/A	0	0	32.29 (0%)	11,936.97 (67%)	4,528.29 (estimated) (25%)
Tonnes CO_2e savings; (% of total emissions)	N/A	-61.42 (0%)	-1,151.88 (6%)	-85.72 (0%)	0	N/A