LP Stage 2 trip rate and modal shift methodology note

Revision: 0.9

Lancashire County Council

Central Lancs LP Testing
27 June 2025

LP Stage 2 trip rate and modal shift methodology note

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1. Introduction

1.1 Background

Central Lancashire, encompassing the areas of Preston, Chorley, and South Ribble, operates as a unified local economy and commuting zone. The three Central Lancashire Planning Authorities - Preston City Council, South Ribble Borough Council, and Chorley Council - have decided to review the Joint Core Strategy and individual local plans and have formally agreed to work together to create a unified plan. Jacobs has been appointed by Lancashire County Council (LCC) to provide transport planning consultancy support to the Local Plan process.

In July 2012, the three councils adopted the Central Lancashire Core Strategy, the principal document within the statutory development plan for Central Lancashire. It outlines the strategic planning policies for the area and is supported by individual local plans, which were subsequently prepared by each council in 2015.

A review of the Core Strategy and the individual local plans commenced in 2018, aiming to produce a unified Central Lancashire Local Plan (CLLP). This new plan is intended to reflect both shared strategic policy objectives and more detailed non-strategic policies across the three councils.

Once adopted, the Central Lancashire Local Plan will replace the extant Central Lancashire Core Strategy (2012). The CLLP will address local housing needs, economic factors, environmental considerations including the climate emergency, community infrastructure, and strategic infrastructure needs, in a sustainable way.

The CLLP will also make site-specific strategic allocations to meet the identified development needs. Once the CLLP has completed all its formal statutory stages, it will be adopted as the development plan for all three councils and used to assess planning applications.

As part of the CLLP update, transport evidence needs to be developed by assessing the transport impacts and needs of the spatial growth options being considered. The methodology is based on the guidance included in the National Planning policy Framework and DfT's guidance on Transport evidence bases in plan making and decision taking. It also takes into account National Highways feedback on the Central Lancashire Core Strategy (CLLP) Preferred Options – Part One Consultation (December 2022). The assessment is being undertaken in following three stages:

- Stage 0: This stage involved the assessment of site allocations to support the Core Strategy team in evaluating identified sites from a transportation perspective. Assessment criteria were defined to evaluate each site or development area in terms of current and future transport connectivity.
- Stage 1: This stage involved the development of a Transport Evidence Base (TEB), which brought together all available data on existing transport provision and movement across the three districts. It also assessed the cumulative traffic impacts of the proposed Local Plan allocations and identified key junctions and corridors within Central Lancashire likely to experience increased pressure as a result.
- Stage 2: This stage involves a more detailed analysis and transport modelling of development scenarios, including the testing of mitigation options. The outcomes will inform the first phase of the Strategic Transport Assessment for the Local Plan publication and examination. This phase will present the proposed site allocations, the mitigation strategy, and strategic model outputs incorporating sustainable transport measures. A subsequent Phase 2 report will include updates to the strategic model following the integration of highway mitigation measures, along with any additional assessments required.

2. Prioritisation of interventions

Lancashire County Council (LCC) intend to adopt a "Decide and Provide" approach to the provision of transport infrastructure to support the Local Plan as part of its guiding principles, in place of traditional "Predict and Provide" approaches.

'Predict and Provide' can be broadly described as an approach to transport planning that uses current or historical traffic patterns to determine the future need for infrastructure. However, this approach tends to simply maintain the status quo by perpetuating dependence on the private car through provision of additional highway capacity. This approach is likely to promote increases in car trips at new development, as users tend to travel by the most convenient means to them, and this in turn will place increased pressure on local and strategic road networks.

By contrast, the 'decide and provide' approach to transport planning decides on a preferred vision of the future and then provides the means to work towards that whilst also accommodating uncertainty about the future. This offers the opportunity for more positive transport planning and will help to implement the transport user hierarchy by considering walking, cycling and public transport upfront.

In line with the 'decide and provide' approach, LCC intends to pursue a preferred vision of the future that emphasises a higher proportion of local and hyper-local trip-making for everyday trips, increased travel by public transport, walking, wheeling and cycling and reduced travel by private vehicle. This is consistent with Lancashire County Council's Environment and Climate Strategy and Net Zero Pathway options, as well as with national and regional policy including the Transport Decarbonisation Plan, Gear Change and National Bus Strategy.

In order to achieve this vision, we are proposing to adopt a hierarchy of preference, set out in Figure 1 , when considering potential transport interventions to mitigate and offset traffic and environmental impacts of developments. This hierarchy will apply both to the selection of schemes for the Local Transport Plan as part of the Local Plan to offset the impacts of allocated local plan sites, and in guidance to developers and applicants for planning permission of both allocated and windfall sites.

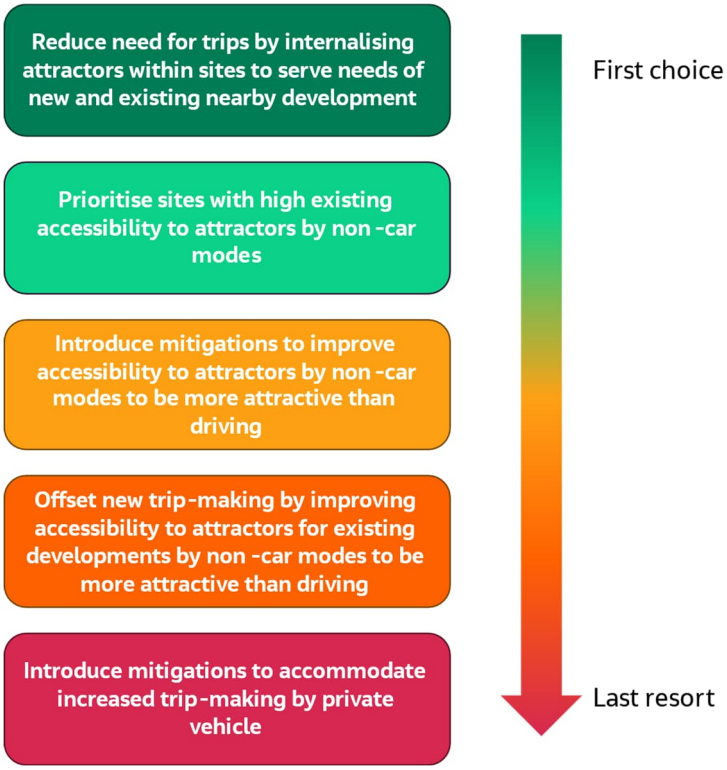

Figure 1: Hierarchy of preference in selecting transport interventions

The hierarchy approaches the challenge of addressing the transport impacts of new developments by;

1. Prioritising making developments inherently sustainable, by
    a. Reducing the need for trips
    b. Prioritising sites in areas with existing high-quality sustainable transport provision
2. Reducing the cumulative impacts on the highway network by
    a. Improving the provision of high-quality sustainable transport where it is currently insufficient
    b. Offsetting new trips by reducing trips elsewhere or shifting them to more sustainable modes
3. Mitigating the impacts on the highway network by improving capacity only as a last resort

2.1 Assessing impacts of interventions

When adopting a 'decide and provide' approach, it is important that the preferred vision is realistically achievable and that the measures identified to reach it can be reasonably expected to deliver the desired outcomes. This is known as a 'vision and validate' approach to assessing the impacts of transport strategy. A 'vision and validate' approach has been adopted to assess the impact of the proposed mitigations on the transport impacts of the Local Plan for the Transport Evidence base. This approach holistically reflects the combined impacts of the full range of mitigations, including both transport and non-transport mitigation and across all modes of transport, on the transport impacts of the proposed Local Plan.

The 'vision and validate' approach adopted for the Local Plan aligns with Lancashire County Councils "Decide and Provide: Transport Assessments in Lancashire Guidance". The approach reflects;

- A baseline assessment developed from historic data and known and existing trends, and trip rates for new sites based on their individual characteristics and land uses derived from TRICS, as set out in the Stage 1B report;
- Changes to the baseline in response to the proposed mitigations which are evidence-based and local, and derived from;
    - Site-specific assessment of the likely distances travelled to amenities from individual sites
    - Changes in mode share of active modes to individual amenities in line with existing patterns of travel behaviour from the location of sites in more sustainable locations and the provision of new amenities within and near to sites;
    - Changes in mode share of active modes for both existing trips and trips from new developments due to induced behaviour changes resulting from the creation of a connected network of high-quality walking and cycling routes, based on the coverage of the proposed network across the study area and existing and potential future propensity to cycle; and,
    - Changes in mode choice in response to improvements in public transport service frequency and speed, and the introduction of new public transport services, in line with the proposals set out in the Bus Service Improvement Plan and Infrastructure Delivery Plan derived through Variable Demand Modelling with mode choice; and,
- Benchmarking of the resultant impacts against meta-evaluation of cycling investment to ensure changes from the baseline are realistic.

As the Transport Evidence Base covers the impacts of the Local Plan and identified mitigations as a whole, the assessment does not reflect the impacts of any particular site. It also does not supersede the need for individual sites to undertake their own assessment when they come forwards, particularly in light of any

divergence between individual site proposals and their assumed characteristics in the Local Plan, other developments which have come forwards in the surrounding area in the interim, and the progress in delivery of mitigation measures set out in the Infrastructure Development Plan.

3. Implementation of Vision and Validate approach

3.1 Overview of methodology

When developing a 'vision and validate approach, it is important to clearly identify a "theory of change" which sets out how the adopted interventions will deliver the outcomes and impacts necessary to achieve the vision. This "theory of change" is set out in the form of a logic map, presented in Figure 2 below.

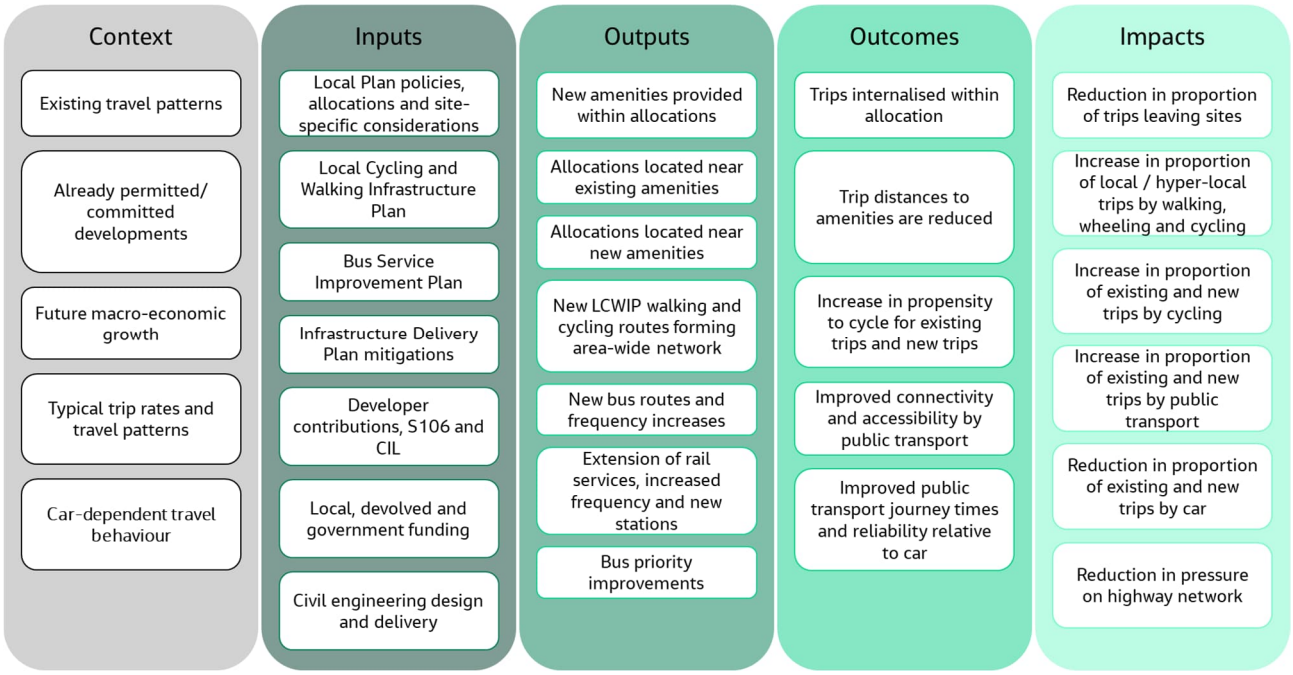

Figure 2: Logic map showing 'theory of change' for how interventions will achieve the vision

The theory of change informs the approach to validation by identifying the mechanisms by which the interventions will achieve the vision. Once identified, these mechanisms are incorporated into the assessment of transport impacts of the local plan to modify the Stage 1 assessment. Some interventions, such as improvements to public transport frequency and provision, can be directly incorporated into the transport assignment model, while the impact of other interventions must be estimated by other methods and incorporated into the demand model prior to assignment. The method by which each mechanism will be assessed is outlined in Figure 3 below.

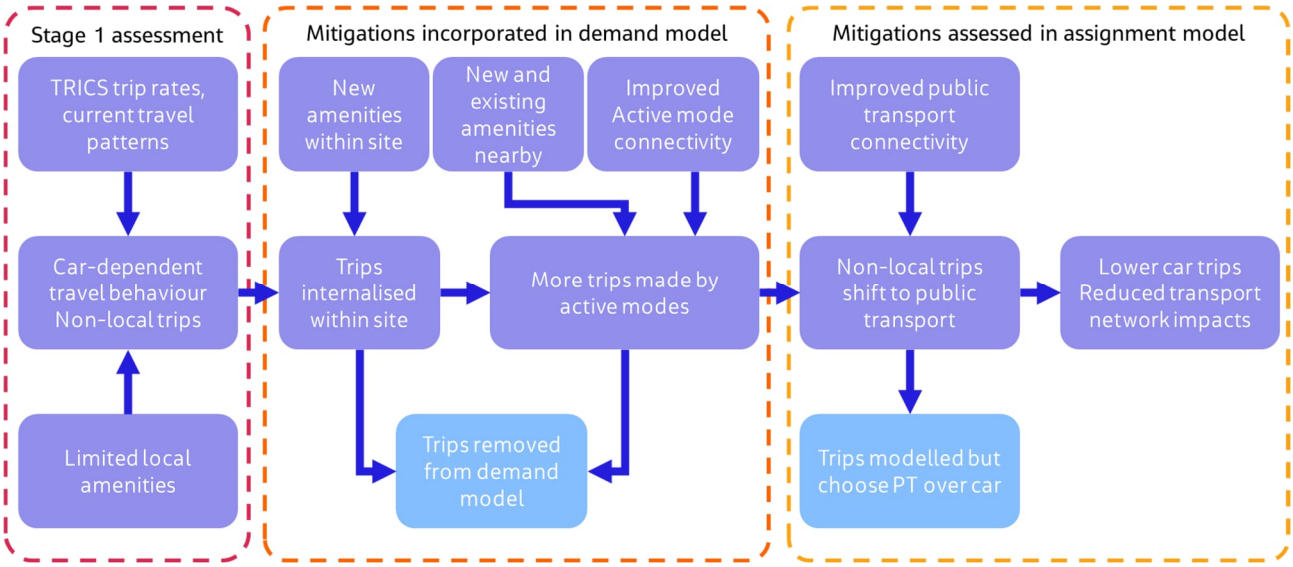

Figure 3: Approach to validating impact of mitigations

To implement this approach, a three-step process will be adopted;

Mitigations incorporate in demand model

1. Trips that would be made from allocated sites to attractors that are either

    a. Entirely within the allocation boundary, or;

    b. Short-distance trips made by walking, wheeling and cycling

    based on current typical travel behaviours are estimated and removed from the trip generation in the variable demand model

2. Trips from both local plan allocations and existing productions that would change to wheeling / cycling in response to the delivery of an area-wide network of high-quality cycling and walking routes are estimated and removed from the Origin-Destination trip matrices prior to assignment

Mitigations assessed in assignment model

3. Public transport improvements, along with any highway mitigations, are coded into the public transport and highway network. The remaining PT and highway trips are assigned to the network.

Due to the iterative convergence process of the Variable Demand Model in conjunction with the assignment model, steps 2 and 3 are repeated on iteration of the VDM.

The following sections set out the methodology for Steps 1 and 2. The methodology for Step 3 is covered in the main Stage 2 report.

3.2 Step 1 – Trip internalisation / shift to non-motorised modes following existing behaviour

Under current travel behaviour, as captured in 2023 National Travel Survey (NTS) data (see Figure 4), people are more likely to make short-distance trips by non-motorised modes (walking, wheeling and cycling). Where allocated sites are close to trip attractors, the trips from the development are more likely to be made by non-motorised modes.

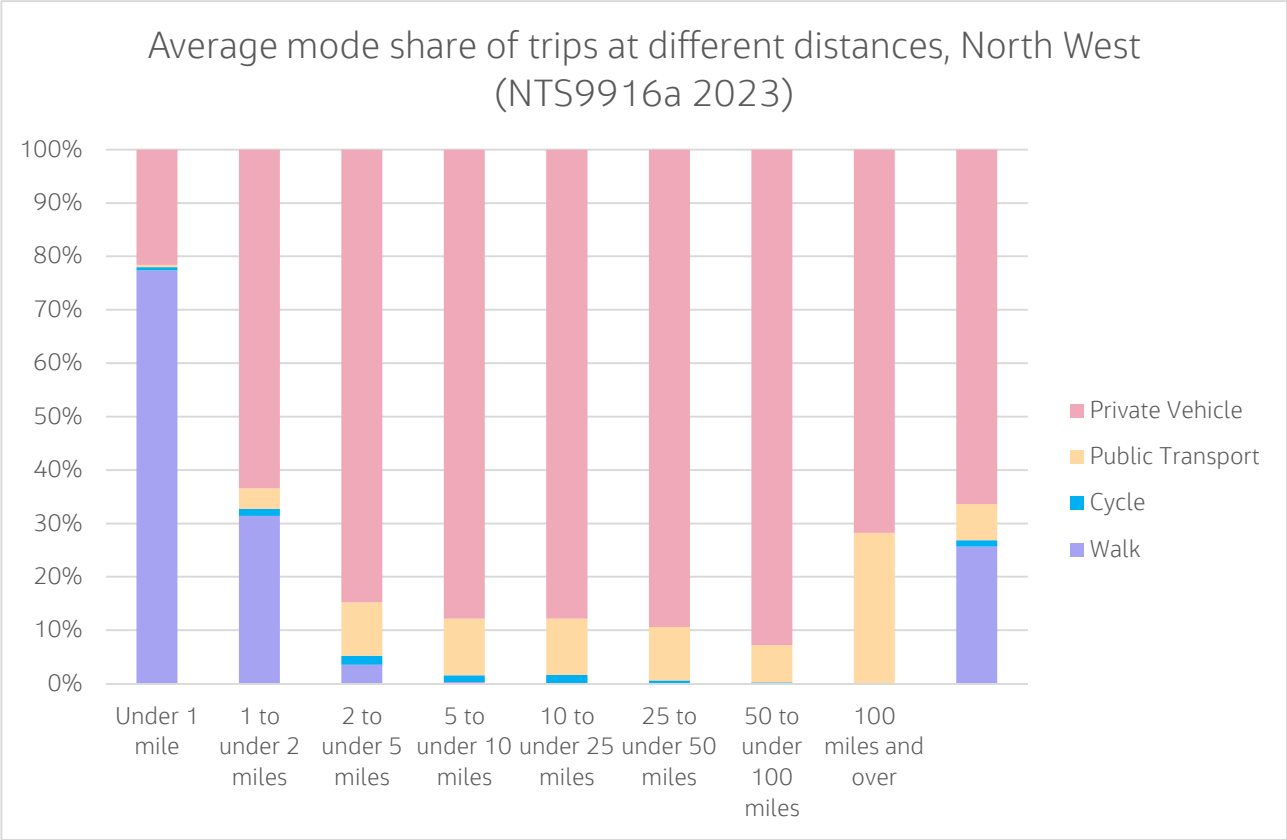

Figure 4: Average mode share of trips in different distance bands in the North West, NTS9916

The baseline trip rates derived from TRICS represent the trip rates for an average development site of a given type in the UK. The trip rates derived from TRICS represent motorised trips only, as walking and cycling trips are not modelled in the traffic model. A key assumption is that the average trip from the average development site (represented by TRICS) is as likely to be made by motorised modes (car, motorcycle, taxi, public transport etc) as the national average for a trip of this type (shown in Figure 5). This assumption is reasonable, given that the typical development pattern of sites included in the TRICS database across several decades is of car-dependent development in predominantly less accessible areas and not supported by adequate walking, cycling or public transport links, a view reflected by the DfT Science Advisory Council paper "Land use and transport planning" (April 2024).

As a result, where site allocations are close to trip attractors, TRICS over-estimates the proportion of trips that will be made to those attractors by motorised modes and underestimates the proportion by non-motorised modes, as it is representing travel behaviour of an average site that is located further away from equivalent attractors.

Comparison between Figure 4 and Figure 5 shows that for Shopping, Personal Business and Leisure trips, where the destination is less than 2km from an allocation, trips are more likely to be made by active modes (walking, wheeling or cycling) than the national average, while for education trips this is true for destinations within 1km of an allocation. This reflects the difference in mode choice based only on current travel behaviour from the location of allocated sites, without any additional provision of additional infrastructure.

This applies to trips where the user has an effectively unconstrained choice of which attractor to choose as their destination is over a short to medium time-period and can make their choice based on the relative ease of travel, such as shopping trips, or where attractor choice is constrained but closely linked to distance through catchment areas, such as trips to GPs and schools. In the Transport model, these trip purposes are contained within the HBO (Home-based Other) user class. However for commuting trips (HBW) and employers' business (EB), destination choice is largely constrained by other factors.

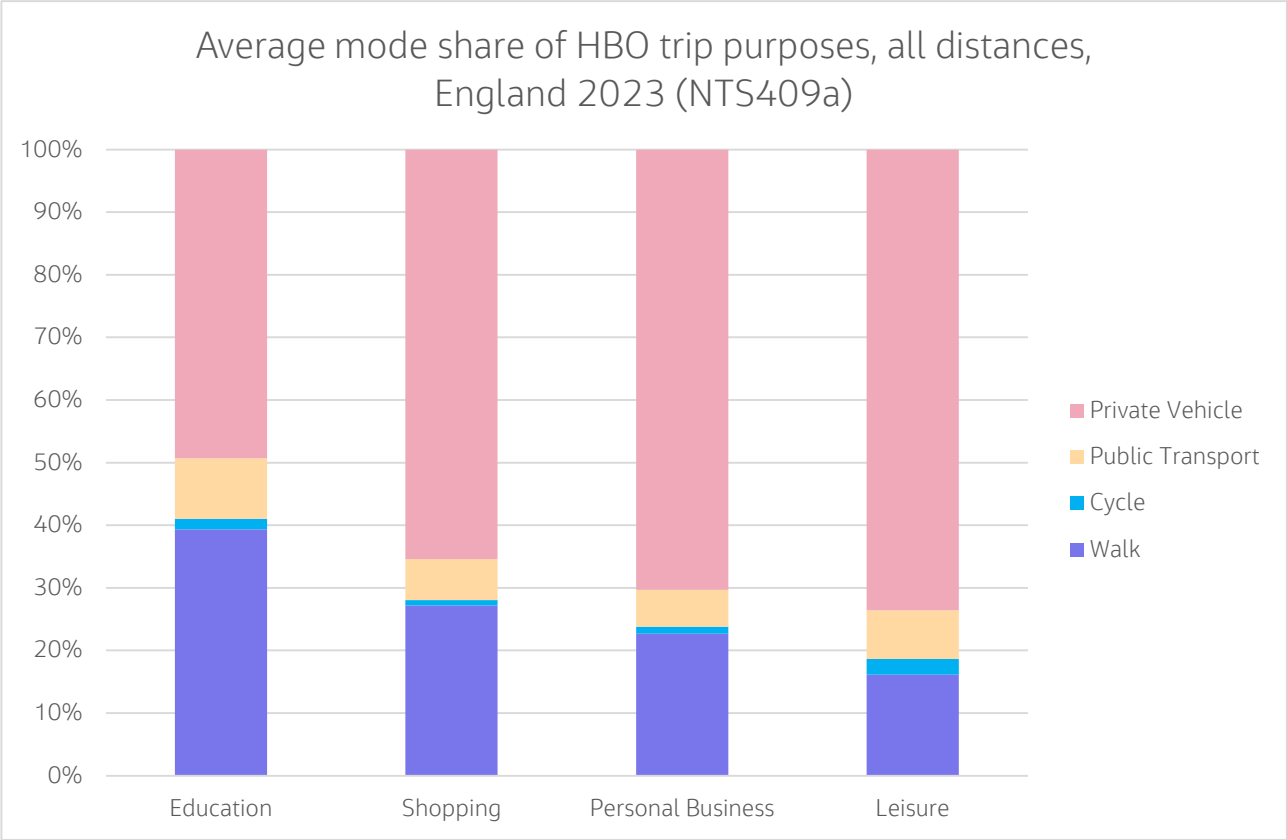

Figure 5: National average mode share for NTS trip purposes comprising HBO trips (NTS409a)

Where an attractor is within the development site itself, it is assumed that the trips are fully internalised (i.e. do not leave the model zone containing the development) and 100% of trip productions to that attractor are removed from the transport model regardless of mode choice. These trips are assumed to take place entirely within the local network within these developments, which are not represented in the traffic model, and will not affect the wider road network.

To determine how many trips are likely to switch to active modes based on proximity to attractors, the HBO Productions from each Housing and Mixed-Use allocation were split into its constituent NTS purposes; Education, Shopping, Leisure and Personal Business. Sub-purposes for each of these were then defined, based on the NTS definition of each trip purpose category, and individual attractors for these sub-purposes. For some sub-purposes, no category of attractor could be defined (e.g. Holiday and day trips) or attractor choice was considered constrained, and these were excluded.

The proportion of each sub-purpose was estimated using a range of data sources, including;

- National Travel Survey table 9906 sub-division of Leisure trips
- ONS Retail Sales Index sector percentages of all retailing
- NHS recorded number of primary and secondary appointments in the North West

The resultant split of overall HBO productions to sub-purposes and their relevant attractors is shown in Table 1.

Table 1: Derived split of HBO trips to NTS purposes, sub-purposes and relevant attractors

NTS Trip Purpose	% of HBO trips	Travel reason/sub-purpose	Attractor	% of trip purpose	% of HBO trips
Education or Education escort	19.8%	Primary education	Primary Schools	33.9%	6.7%
		Secondary education	Secondary Schools	46.6%	9.2%
		Tertiary Education, colleges etc	*No Attractor* (choice of university/college based on admission not proximity)	19.5%	3.9%
Shopping	27.6%	Non-specialist food	Grocery stores/supermarkets and new/existing Local Centres	50.3%	13.9%
		Cosmetics and medicines, alcohol and tobacco, specialist food, second hand goods	Local, Town or District centres	8.2%	2.3%
		Comparison retail (clothing, footwear, computers, books, hardware, electrical appliances etc)	Town or District centres	24.2%	6.7%
		Specialist retail (e.g. furniture, jewellery)	District centres	17.3%	4.8%
Leisure	39.8%	Individual exercise, "just walk"	Open space	10%	4.0%
		Eating out / socialising	Pubs/restaurants/cafes	20%	8.0%
		Physical Activity and clubs	Sports clubs, community facilities	10%	4.0%
		Holidays or daytrips, visiting friends/family at private home, other leisure	No Attractor	60%	23.8%
Personal Business	12.8%	Health - Secondary Care	Hospitals / Health Hubs	7.3%	0.9%
		Health - Primary Care	GPs / Pharmacy / Health Hubs	22.7%	2.9%
		General errands, personal finance/banking	Local, Town or District Centres	20.0%	2.6%
		Other Personal Business	No Attractor	50.0%	6.4%

For each sub-purpose, the travel distance to the nearest attractor from each residential and mixed-use allocation was calculated by taking the straight-line distance between the centre of the allocation and nearest attractor in each category multiplied by a tortuosity factor of 200% (determined by benchmarking against the ratio of crow-flies and actual shortest walking distance between existing residential areas and attractors). Where an attractor is to be located inside an allocated site, as identified by site-specific considerations set out in the Local Plan, the distance band was categorised as "internal".

We define the Non-Motorised mode share (NM%) as the % of all trips in each category (purpose or distance band) made by walking or cycling in the 2023 National Travel Survey, while the Motorised mode share is the % of all trips made by all other modes.

For each distance band *NM%(Distance)* is calculated from NTS9916 using data for the North West (see Figure 4), while for each journey purpose within HBO, the average Non-motorised mode share Avg_NM% is calculated using NTS409a (see Figure 5).

For each journey purpose and distance band, a Reduction Factor (as a %) is calculated using the formula;

If Distance = Internal

$$\text{Reduction Factor (Internal, Purpose)} = 0\%$$

Else If NM%(Distance) > Avg_NM%(NTS Purpose)

$$\text{Reduction Factor (Distance, NTS Purpose)} = \frac{(100\% - NM\%(Distance))}{(100\% - Avg\_NM\%(NTS\ Purpose))}$$

Else

$$\text{Reduction Factor (Distance, NTS Purpose)} = 100\%$$

The resultant reduction factors are shown in Table 2.

Table 2: Reduction factors applied to HBO Productions by NTS purpose and distance band

Distance Band / NTS Purpose	Education	Shopping	Personal Business	Leisure
Internal	0%	0%	0%	0%
Under 1 mile	37%	31%	29%	27%
1 to under 2 miles	100%	93%	88%	83%
2 to under 5 miles	100%	100%	100%	100%
5 to under 10 miles	100%	100%	100%	100%
10 to under 25 miles	100%	100%	100%	100%
25 to under 50 miles	100%	100%	100%	100%
50 to under 100 miles	100%	100%	100%	100%
100 miles and over	100%	100%	100%	100%

For each housing and mixed use allocation and sub-purpose, the HBO trip Production split into sub-purposes are mutliplied by the appropriate reduction factor for the distance band to the nearest applicable ammenity to calculate a reduced trip production, giving a unique reduction in HBO trips to each allocation based on its proximity to various amenities. These reductions range from 6% to 51%, with an average reduction of 29%. The highest reductions are seen for sites in central Preston with short distances to most attractors, and Strategic Site 5 (Land West of Cottam and East of Preston Western Distributor), which incorporates both a health hub, greenspace and new town centre, and therefore has multiple sub-purposes that are internalised, as well as being in close proximity to planned new schools.

3.3 Step 2 – Behaviour Change – induced mode shift to active travel

Mitigation measures have been identified in the IDP to support walking, wheeling and cycling, including both routes identified from the Lancashire Local Cycling and Walking Plan (LCWIP) and additional new routes identified related to specific sites. These measures will induce a shift from motorised modes to wheeling and cycling, which are not captured in the variable demand model and assignment model. To account for this behaviour change, an estimate needs to be made of how many trips will shift from motorised modes to active modes.

It has been widely established that investment in improvements to provision for active modes leads to increases in the willingness of individual to make trips by walking and cycling. Evaluation of the Cycle City Ambition Programme[1] by the DfT and Sustrans shows that the delivery of area-wide cycle networks, such as the active travel enhancements proposed in the LCWIP and IDP, are cost-effective at incentivising increases in cycling levels, with similar programmes across a wide area delivering 6% annual increases in cycling levels over a sustained period. Analysis shows that these increases are likely to be maintained or grow over the long-term.

As this change in behaviour is a consequence of the delivery of new walking and cycling infrastructure, any change in modal share is additional to that estimated in Step 1, which reflects modal share under existing average travel behaviours only. Both existing trips and trips from new development may potentially change mode in response to the delivery of improved cycling routes.

A range of factors affect the willingness of users to cycle for everyday trips, including the distance and hilliness of routes[2], as well as the attractiveness and comfort of cycling routes, often referred to as "journey ambience" or "journey quality". The Propensity to Cycle Tool[3] (PCT) has been developed to estimate the modal share of trips by cycling between 2011 census Middle Super Output Areas (MSOAs) based on route distance and hilliness under a variety of scenarios representing differing overall levels of cycling, including a baseline scenario taken from the 2011 census.

For each PCT scenario, the reduction in non-cycling trips is calculated as;

$$Trip\ Reduction(MSOA_O, MSOA_D, Scenario) = \frac{1 - PCT\ cycle\ mode\ share(MSOA_O, MSOA_D, Scenario)}{1 - PCT\ cycle\ mode\ share(MSOA_O, MSOA_D, Baseline)}$$

The distance and hilliness of a given route will not be affected by improvements to infrastructure, and as such any change in mode choice will only be a factor of improvement in attractiveness and comfort. As it is impractical to quantify this for all the potential routes, PCT scenarios with higher propensity to cycle will be used to estimate the potential mode shift. To ensure a realistic level of mode shift, the total volume of trips changing to cycling will be benchmarked against the Cycling and walking investment strategy: active travel investment models[4].

To estimate the proportion of trips between any two zones experiencing an improvement in route attractiveness and comfort, the prioritised LCWIP and additional cycling improvements from the IDP were overlaid with the traffic model zone structure within the study area (see Figure 6). The cycle network coverage of each zone was calculated as the proportion of the zone which falls within a 250m buffer of a cycling route.

[1] Sloman L, Dennis S, Hopkinson L, Goodman A, Farla K, Hiblin B and Turner J (2021) Summary and Synthesis of Evidence: Cycle City Ambition Programme 2013-2018

[2] Lovelace, R., Goodman, A., Aldred, R., Berkoff, N., Abbas, A., & Woodcock, J. (2017). The Propensity to Cycle Tool: An open source online system for sustainable transport planning. Journal of Transport and Land Use, 10(1)

[3] https://www.pct.bike/

[4] https://www.gov.uk/government/publications/cycling-and-walking-investment-strategy-active-travel-investment-models

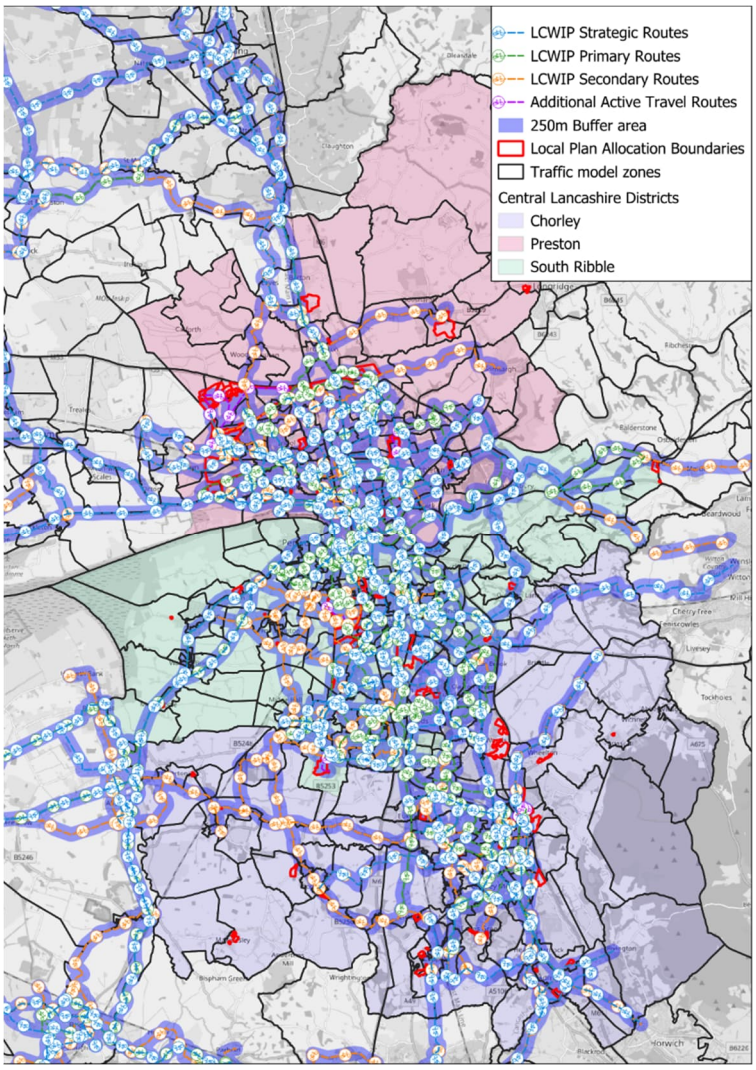

Figure 6: Coverage of LCWIP and additional active travel routes with transport model zones in the study area

For any given pair of zones, the proportion of trips experiencing an improvement in journey quality, and therefore which may change modes to cycling, is estimated as the product of the coverage of each zone.

Within the study area, each MSOA is comprised of multiple zones. For each pair of zones, the corresponding MSOA-MSOA pairing is identified, and the trip reduction for that pair of zones can be calculated as;

$$Trip\ Reduction(Origin, Destination, Scenario) = 1 - ((Coverage(Origin) \times Coverage(Destination) \times S \times (1 - Trip\ Reduction(MSOA_O, MSOA_D, Scenario))$$

Where S is a constant scaling factor applied to represent partial progress towards more ambitious PCT scenarios.

As the original mode, purpose and time of day of cycling trips is unknown, this Trip Reduction factor is applied to 24hr PA matrices for all motorised modes in the transport model and therefore affects all modes, time periods and purposes proportionately, although the remaining motorised trips may switch mode in response to journey time changes in subsequent iterations of the Variable Demand Model.

To establish an appropriate PCT scenario and scaling factor to apply, the total number of new weekday 2-way cycling trips was calculated by applying the Trip Reduction factor to 24hr PA matrices and compared to benchmarks.

The benchmark number of new stages was calculated using the DfT's Active Travel Fund 5 Uplifts tool. The total number of km of new cycling route in each district (Preston, South Ribble and Chorley) was calculated and entered into the ATF5 Uplifts tool as an "Area-wide cycle network", which best represents the overall LCWIP network - described in the tool as "a mix of scheme types (cycle superhighways, quietways, off-road routes etc.)". The cost per km was assumed to be the same as the Uplift Tool's benchmark (£1.1million/km).

The ATF5 tool presents a range of additional weekday cycling stages, representing Low, Middle and High increases. It should be noted that the ATF5 tool includes factors to each Local Authority based on presumed "intrinsic" cycling potential, and has been known to under-estimate increases in cycling levels in Lancashire and in minor urban areas when compared against post-opening evaluation of completed schemes. As such, the Middle increase is considered a conservative estimate of potential mode shift, while the High increase is considered a plausible optimistic estimate.

Based on the benchmarking, two uplift scenarios were defined representing more conservative and more optimistic assumptions. For the Central scenario, the PCT's Government Target (Near Market) scenario was used with no scaling factor applied, representing a more conservative level of increase. The overall increase in cycling levels is slightly lower than the ATF5 tool's Medium uplift benchmark, representing a pessimistic estimate of potential modal shift.

PCT Scenario used	govnearmkt
Scaling Factor	1

	Study Area Trips	
Original Motorised trips 24hr	960,285	
New cycling trips from factors	35,863	3.7%
Remaining motorised trips 24hr	924,422	96.3%

Max O-D mode shift
12.9%

Benchmark trips from DfT Uplifts Tool	Total Central Lancs	Preston	South Ribble	Chorley	% of Benchmark
Low	23,267	11,106	6,247	5,913	154%
Middle	39,325	18,771	10,559	9,994	91%
High	82,529	39,395	22,159	20,975	43%

For the more optimistic scenario, the PCT Go Dutch scenario was used with a 50% scaling factor, representing users in Preston becoming half as likely to cycle as travellers in the Netherlands for the same distance and hilliness. Given the Netherlands took 30 years to transition from a similarly car-dependent society as Lancashire to its present patterns of travel, and the Local Plan has a 15-year time horizon, this is considered achievable. The overall increase in cycling levels is slightly higher than the ATF5 tool's High uplift benchmark, further confirming this is a plausibly achievable increase.

PCT Scenario used	dutch
Scaling Factor	0.5

	Study Area Trips	
Original Motorised trips 24hr	960,285	
New cycling trips from factors	91,422	9.5%
Remaining motorised trips 24hr	868,863	90.5%

Max O-D mode shift
23.7%

Benchmark trips from DfT Uplifts Tool	Total Central Lancs	Preston	South Ribble	Chorley	% of Benchmark
Low	23,267	11,106	6,247	5,913	393%
Middle	39,325	18,771	10,559	9,994	232%
High	82,529	39,395	22,159	20,975	111%

3.4 Step 3 – Behaviour Change – induced mode shift to public transport

The adjustments to trip rates made in Steps 1 and 2 are implemented within the Variable Demand Model to adjust the generated trip matrices used in traffic assignment. As outlined above, public transport and highway improvements can be accurately represented within the assignment model and their impacts on mode choice captured through the VDM. The main Stage 2 report will present the model outputs following the incorporation of trip rate and mode share adjustments discussed in this note.