Cottam Parkway Railway Station

Environmental Statement

Volume 3: Appendices

Appendix 14.1: Traffic and Transport Assessment Methodology

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Appendix 14.1- Model Overview

1.1 Introduction

1.1.1. This Technical Note presents the development of multi-modal (Car and Rail and Rail Park & Ride) strategic model, which is developed for assessing wider impacts (including modal shift) due to Cottam Parkway Railway Station and which also served as a source model for the microsimulation.

1.1.2. Central Lancashire Highway Traffic Model (CLTM) is the existing TAG compliant highway model for the Lancashire area which has been developed from the predecessor model, PWD Model. The development of CLTM has incorporated a substantial review of the highway networks, new base year highway matrices and a new demand model process, a Production-Attraction (PA) based Variable Demand Model (VDM). The model has been validated for year 2019 in accordance with the Department for Transport's TAG guidance as part of the CLTM project.

1.1.3. As part of this project, the base year model has been updated to include Public Transport (PT) modelling. The highway and PT models use different software packages (SATURN and EMME, respectively) but are identical in terms of road network structure, and zone system. The CLTM highway model is fully integrated within the VDM. The highway model and PT model provides transport costs to the VDM which, in turn, provides trip matrices for the highway and PT model.

1.1.4. The main component of the scheme transport model is a highway model which provides a representation of the highway network within the study area, the traffic using it and the resulting traffic conditions. In order to incorporate a mode choice response, a separate public transport model was developed to include rail service.

1.1.5. The updated model consists of:

- A Highway Assignment Model representing vehicle-based movements across the Lancashire area for a 2019 weekday morning peak hour (08:00-09:00), an average inter-peak hour (10:00-16:00) and an evening peak hour (17:00-18:00);
- A Public Transport (PT) Assignment Model representing rail-based movements across the same area and time periods to include the PT sub-mode choice; and
- A multi-modal incremental Variable Demand Model (VDM) that forecasts change in trip frequency, choice of main mode and destination in response to changes in generalised costs.

1.1.6. Scheme evaluation is undertaken through comparison of a ‘Do Something’ case (with Cottam Parkway Railway Station) against a ‘Do Minimum’ case (the future year scenario without Cottam Parkway Railway Station).

1.1.7. Two future years have been defined for the traffic forecasting in accordance with guidance, namely the year of Scheme opening, 2024, and a design year which is the fifteenth year after Scheme opening, in this case 2039.

1.2 Highway Assignment Model

1.2.1 The highway model is coded in SATURN strategic modelling software, and has 579 zones and covers the AM peak, PM peak and interpeak. The VDM module of the DfT's Dynamic Integrated Assignment and Demand Modelling (DIADEM) manual deals with trip frequency and trip distribution but not mode choice. The development and validation of the base year model is detailed in the Local Model Validation Report (LMVR).

1.2.2 SATURN version 11. 4.07H was used for the highway modelling.

1.3 Public Transport Model

1.3.1 A public transport model has been set up to provide the public transport demand, time and fare data which is required as input to the variable demand model used to predict the potential modal shift effects of the Cottam Parkway Railway Station.

1.3.2 The public transport model covers the same study area as the highway model and uses the same base year, zoning system and time period. The model contains rail services only (no buses). Base year rail demand is developed using inputs from mobile phone data, Office of Rail and Road (ORR) station counts and MOIRA.

1.3.3 The public transport network and assignment model was developed using version 4.4.2 of the specialist transport modelling software EMME.

1.3.4 EMME is a multi-modal travel demand forecasting software, produced by INRO, which can be used to assess traffic and public transport network performance. The basic inputs were matrices representing demand on these public transport services and a representation of the public transport network, including routes, locations of stops / stations, service frequency, journey time and fares.

1.3.5 Details of the public transport model development is discussed in the subsequent sections.

1.4 Variable Demand Model

1.4.1 Transport schemes that have an impact on journey times and cost will, in principle, influence the level of demand for travel. The opening of a new scheme can elicit a number of responses by travellers including trip reassignment, re-timing, re-distribution and modal shift. These responses can result in additional trips and additional vehicle kilometrage on the road network, known as “induced traffic”.

1.4.2 TAG Unit M2 states that "the purpose of variable demand modelling is to predict and quantify these changes", and goes on to say that "there should be a presumption that the effects of variable demand on scheme benefits will be estimated quantitatively unless there is a compelling reason for not doing so".

1.4.3 The variable demand modelling (VDM) was undertaken using the Department for Transport's DIADEM software (Version 7.0, 64-bit). Further details of the VDM are given in Section 8 of this report.

1.5 Model Time Periods

1.5.1 Consistent with the CLTM model, the variable demand model works on the basis of 24 hour trip productions and attractions, while the highway assignment model uses hourly trip origins and destinations covering the AM and PM peak hours and an average inter-peak hour.

1.5.2 The CLTM highway assignment model time periods are as follows:

- AM peak hour – 08:00 to 09:00;
- Inter-peak hour – average hour between 10:00 and 16:00; and
- PM peak hour – 17:00 to 18:00.

1.6 Trip Purpose and User Classes

1.6.1 The CLTM model has following three trip purposes modelled:

- Employer's business;
- Commuting; and
- Other purposes (including leisure, shopping and personal business trips).

1.6.2 Goods vehicles were separated into light goods vehicles (LGV) and heavy goods vehicles (HGV).

1.6.3 Table Table 1.1 the trip purposes and vehicle types that are used in the traffic assignment. Demand in the SATURN traffic assignment is expressed in terms of Passenger Car Units (PCU). The factors used to convert from vehicles to PCUs are also listed in this table.

Table 1.1 Demand Model Purposes

<table>
<tr><th>ID</th><th>Demand Model Purpose</th><th>Demand Model Type</th><th>User Classes</th><th>Vehicle Class</th></tr>
<tr><td>1</td><td>Home-Bases Work</td><td>PA Doubly Constrained</td><td>UC1</td><td rowspan="5">VC1</td></tr>
<tr><td>2</td><td>Home-Based Employers Business</td><td>PA Singly (production) Constrained</td><td>UC2</td></tr>
<tr><td>3</td><td>Non-Home-Based Employers Business</td><td>OD Singly (origin) Constrained</td><td rowspan="3">UC3</td></tr>
<tr><td>4</td><td>Home-Based Other</td><td>PA Singly (production) Constrained</td></tr>
<tr><td>5</td><td>Non-Home-Based Other</td><td>OD Singly (origin) Constrained</td></tr>
<tr><td>6</td><td>Light Goods Vehicles</td><td>Fixed</td><td>UC4</td><td>VC2</td></tr>
<tr><td>7</td><td>Heavy Good Vehicles</td><td>Fixed</td><td>UC5</td><td>VC3</td></tr>
</table>

1.7 Highway Assignment Method

1.7.1 The assignment process is an important element as it predicts the routes that drivers will choose taking into account the level of traffic demand and the available road capacity. The assignment technique used in the CLTM model is the Wardrop equilibrium assignment method for multiple user classes.

1.8 Generalised Costs

1.8.1 Within the SATURN assignment two parameters are defined for each user class to calculate generalised cost: value of time; and vehicle operating cost. Journey times, distances and any tolls included in the model are then combined into a standard unit of generalised time based on these two parameters.

1.8.2 The values of time (VOT) used in the present year model were taken from the latest available TAG data book (May 2019, v1.12) at the time of model development. The values are in pence per minute (PPM) and pence per kilometre (PPK) and are provided in Table1.Table 2.

Table 1.2 Base Year Generalised Cost Parameters

Vehicle type	Trip Purpose	Time Period	Value of Time / PPM (p/min)	Vehicle operating cost / PPK (p/km)
Car	Commute	AM	20.79	5.75
	Business		31.02	12.08
	Other		14.35	5.75
LGV	Business		21.92	13.84
HGV	Business		44.51	35.69
Car	Commute	IP	21.14	5.67
	Business		31.78	11.89
	Other		15.29	5.67
LGV	Business		21.92	13.76
HGV	Business		44.51	35.69
Car	Commute	PM	20.87	5.81
	Business		31.46	12.22
	Other		15.03	5.81
LGV	Business		21.92	13.91
HGV	Business		44.51	35.69

2. Modelling Approach

2.1 Background and proportionality

2.1.1 The specification follows guidance provided in TAG unit M5.1 of January 2014. TAG emphasises the complexity of modelling parking and the need for proportionality in specifying Park & Ride (P&R) modelling.

2.1.2 Following simplified assumption has been made to represent Cottam Parkway P&R facility:

- Simplistically model P&R as part of an individual trip choice as opposed to a tour representation; and
- Not to consider capacity constraints at Cottam Parkway Railway Station.

2.2 Choice hierarchy

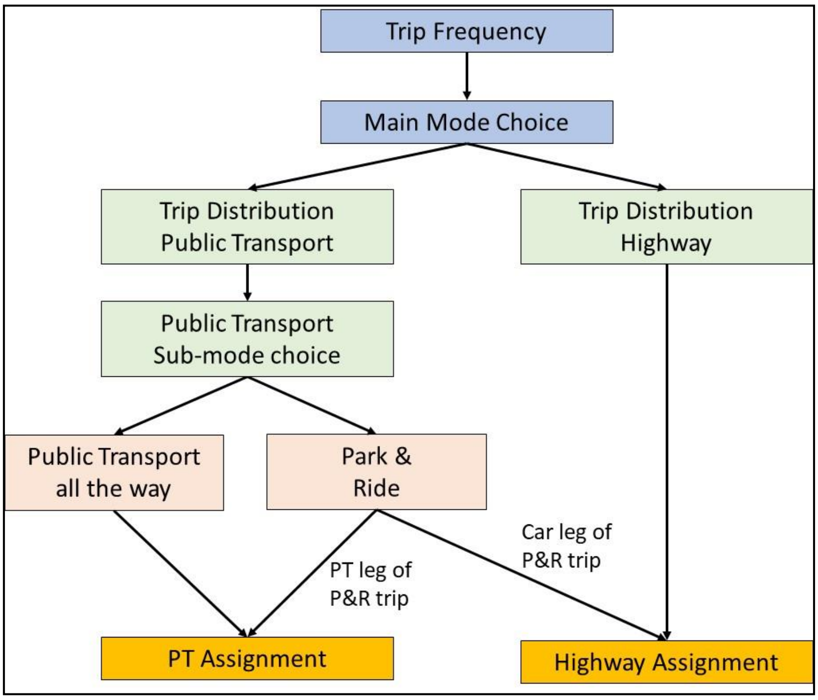
2.2.1 While TAG acknowledges that different hierarchies are valid if supported by local data, it suggests that – normally, and in the absence of any specific local evidence – mode choice should sit above distribution but the sub-mode choice between PT, Highway and P&R should be below the distribution stage.

2.2.2 There is a choice to be made on whether to position P&R as a sub-mode of car or a sub-mode of PT. TAG suggests that in the absence of local evidence on the relative sensitivity of choices, the positioning of P&R choice as a sub-mode of either car or public transport may be based on the following:

- where P&R is dominated by relatively short car legs in order to gain access to a substantial public transport leg, then positioning as a sub-mode of public transport is likely to be the more appropriate; and
- where the P&R site is located so as to attract relatively long car trips to change mode on the edge of the urban area, and where public transport mode share is low for the movements of interest, then treatment as a sub-mode of car is likely to be the more appropriate.

2.2.3 Given the main purpose of Cottam Parkway is to serve the commuting market into Preston, Blackpool and Manchester (and potentially the longer distance market via Preston), the model set-up with P&R positioned on the public transport side of the choice hierarchy is more appropriate, so the main mode choice is between car and public transport plus P&R. Extraction from public transport all-the-way is forecast at the P&R choice stage and extraction from car all-the-way is forecast at the main mode choice stage. This implies the choice hierarchy illustrated in Figure 2.3.

Figure 2 1 Choice Hierarchy



2.3 Form of the choice models

2.3.1 The new elements of main mode and PT sub-mode choice can be coded as simple logit models. The model forecasts the probability of a traveller choosing mode m as:

$$P_m = \frac{1}{1 + e^{U_{*,\overline{m}} - U_m}},$$

where U_m is the utility of mode m, and:

$$U_{*,\overline{m}} = \ln\left(\sum_{i \neq m} e^{U_i} \right)$$

is the composite utility of all other modes. With reference to the first equation, we see that the probability of choosing mode m is a simple function of utility difference.

2.3.2 Model coefficients map level-of-service measures to utility. It is these parameters which in general are the most important, as they define model sensitivity. In the first instance these should be chosen following general accepted practice (such as a walk time weighting of 2 for PT) but they can be adjusted as part of the model calibration.

2.4 Incremental vs absolute model

2.4.1 In principle the incremental implementation is always preferable as the “safer” choice. However, an absolute formulation is required where:

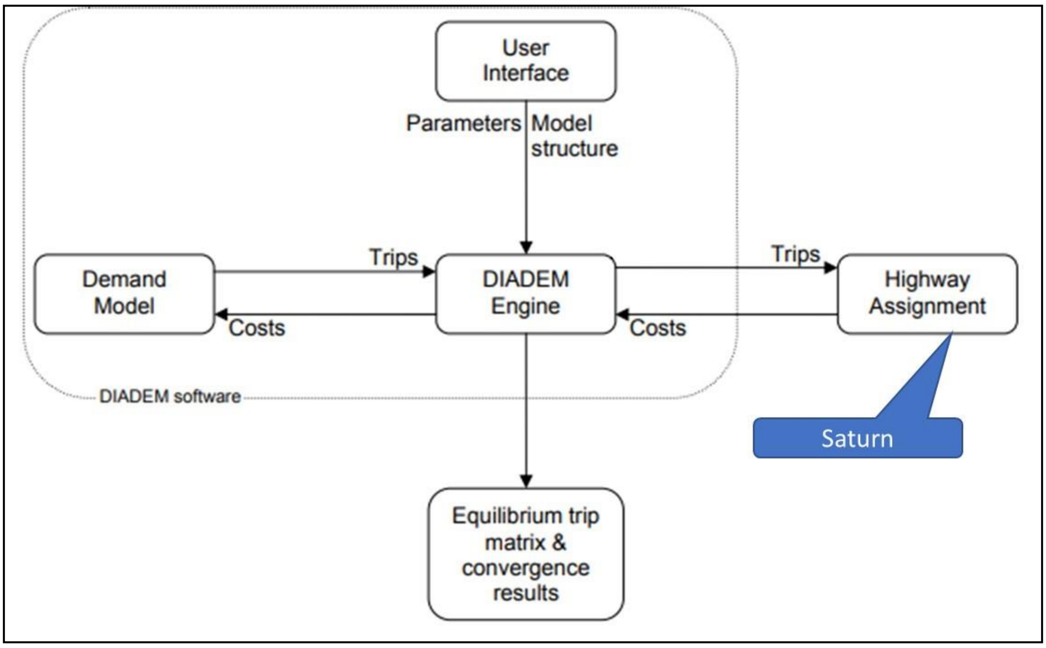
- A choice does not exist in the base year;
- Demand does not exist in the base year (e.g. development areas); or
- A choice is not made in the base year (e.g. no or very low use of PT for certain trips.

2.4.2 In our case have implemented the main mode choice model as an incremental model and the PT/P&R choice as an absolute model.

2.5 Existing models and software

2.5.1 The CLTM model set-up includes a calibrated SATURN-DIADEM highway demand module is illustrated in Figure 2,2 which has been adapted from the DIADEM manual.

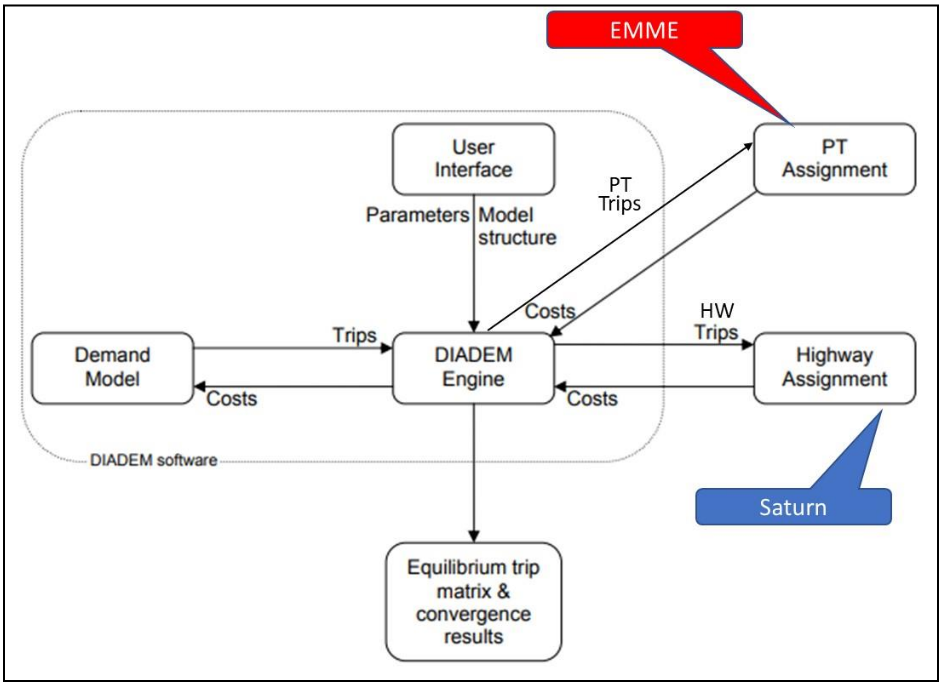
Figure 2 2: Existing Model Components and Linkages



2.6 Introduction of main mode choice

2.6.1 In the absence of public transport input, DIADEM deals with trip frequency and distribution only. However, DIADEM has the capability of including mode choice as a demand response if public transport costs are available. At a high level, the set-up is illustrated in Figure 2.3, again adapted from the DIADEM manual.

Figure 2 3: Model Components and Linkages with PT input

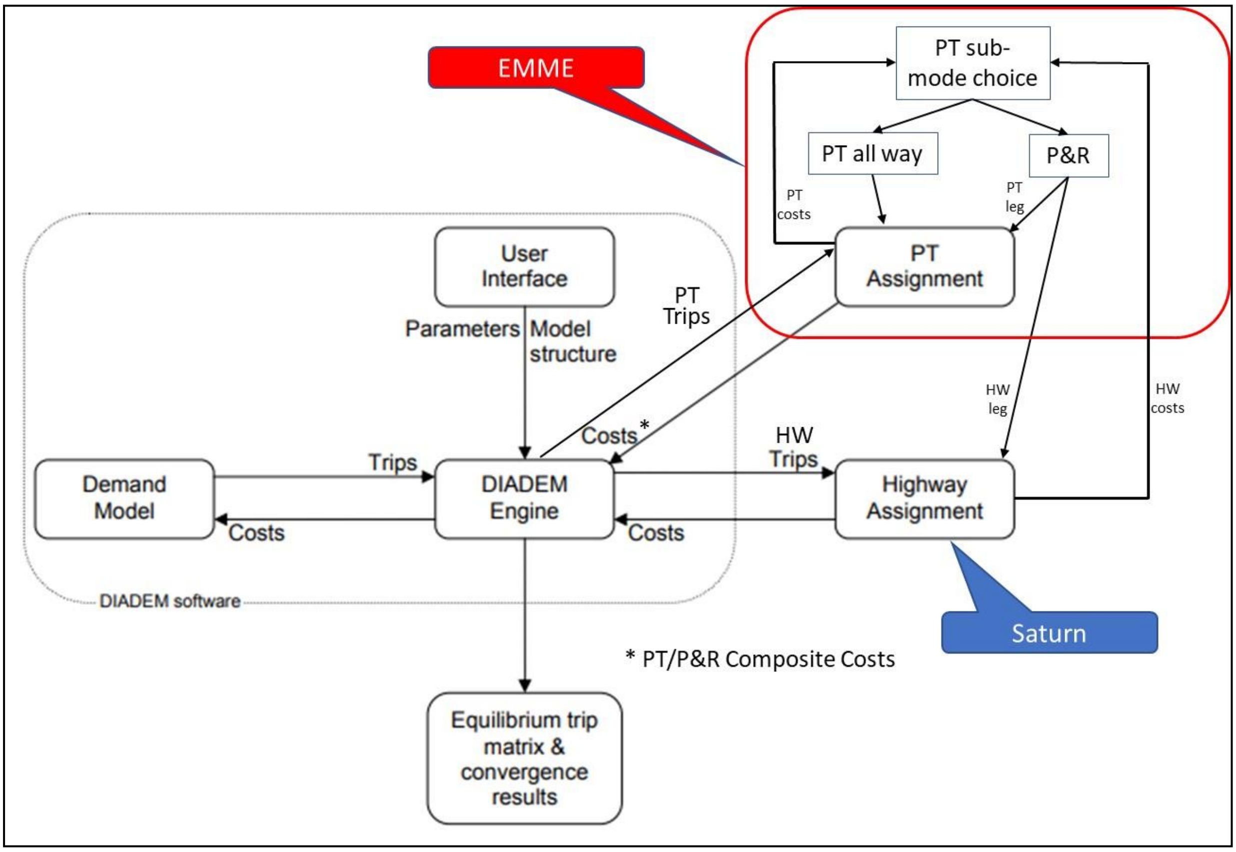


2.6.2 According to the DIADEM manual, mode choice is a simple two-way choice between car and PT. It does not deal with the complexities of any sub-mode choice but as long as an external process provides appropriate cost inputs for public transport, it is possible to use DIADEM for main mode choice and other responses. DIADEM allows the user to specify the response hierarchy and in the absence of any local evidence that would indicate a different hierarchy, we have placed mode choice above distribution in line with recommendations in TAG. As part of the DIADEM set-up, the main mode choice is formulated in the incremental form and undertaken at the all-day PA level.

2.7 Introduction of PT sub-mode choice

2.7.1 In our case, what is shown as “PT assignment” in Figure2.3, is refined to include the PT/P&R sub-mode choice as an absolute choice model at the modelled time period Origin-Destination (O-D) level. The high-level set-up and linkages are illustrated in Figure 2.4.

Figure 2 4: Model Components and Linkages with PT/P&R sub-mode choice



2.8 Model Iterations

2.8.1 DIADEM does not permit public transport costs to change within a modelled scenario and PT costs are not demand responsive. DIADEM will carry out a highway assignment every time it adjusts demand to see how costs are affected but assumes PT costs remain unchanged”. This means is that DIADEM in its standard set-up is sensitive to the changes in highway cost that result from any modal shift but not changes in PT costs. If such cost changes are significant, then they can be included in a manual outer loop in the DIADEM process. Following steps were undertaken:

1. Obtain an initial set of forecast PT costs for input to DIADEM

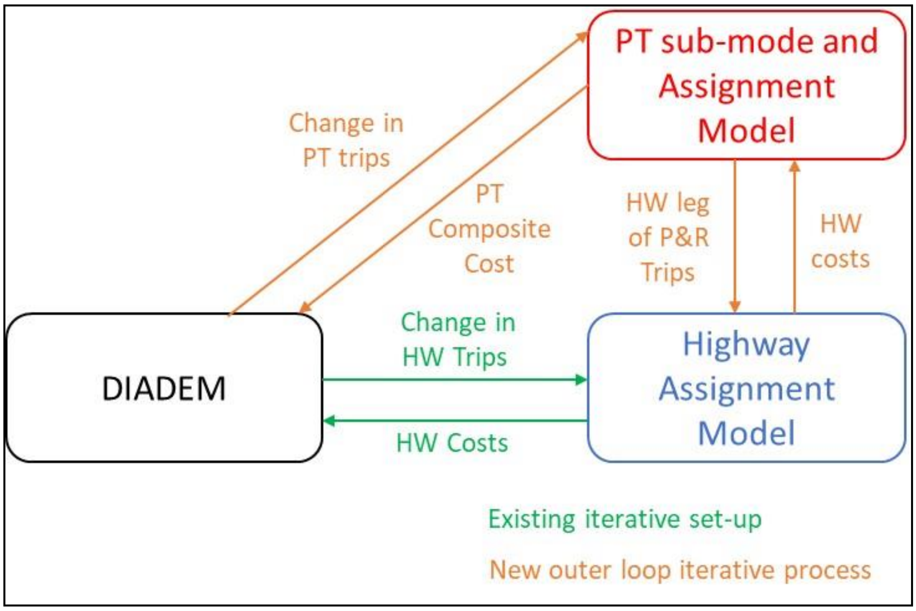
2. Run DIADEM with these PT costs

3. Based on DIADEM outputs (PT passenger demand, highway travel times) update the forecast PT costs and, if they have changed for those previously input, rerun DIADEM

4. Repeat as necessary until PT costs have stabilised

2.8.2 In our case, the PT assignment does not include crowding, so the pure PT costs do not change in response to demand. However, the costs of the highway leg of a P&R journey will change in response to highway demand levels and therefore the overall PT composite cost will change for some O-D pairs that include P&R as a viable choice. It was observed that the change was not very significant and therefore did not require further outer loop of iterations. Figure 2.5 illustrates the iterative process.

Figure 2 5: Iterative process

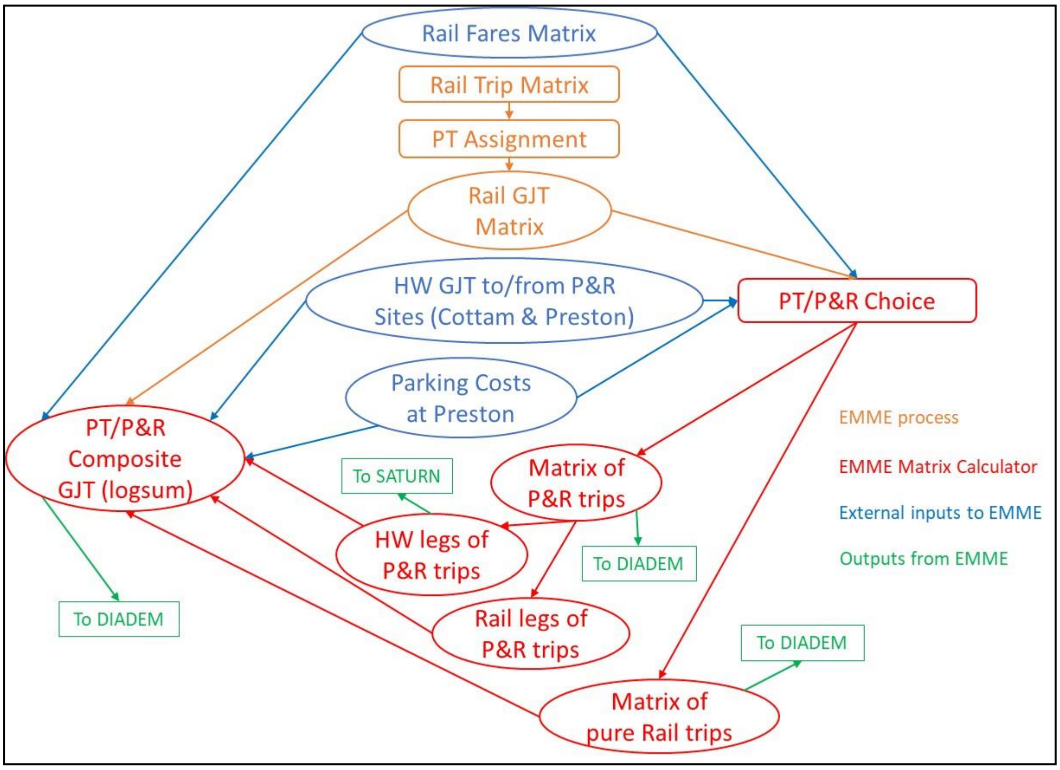


2.9 Model Implementation in EMME

2.9.1 The choice model is implemented in the Matrix Calculator in EMME. This is an extremely flexible tool that allows efficient calculations of any form on a matrix basis. It also provides effective procedures for matrix masking. Figure

2.6 illustrates the different elements of model implementation in EMME and relevant interfaces.

Figure 2 6: Model implementation in EMME



3. Public Transport Model

3.1 Overview

3.1.1 The public transport model (rail) is a completely new model which has been designed specifically to provide public transport inputs to the Transport Assessment of Cottam Parkway Railway Station. It is not designed to forecast public transport impacts, passenger volumes or benefits of other highway or public transport projects. The model provides the public transport demands and times/costs required to enable mode choice modelling within the VDM forecasting for the Scheme.

3.2 Rail Network

3.2.1 Railway station details were sourced from NaPTAN data. For railway stations within Preston District, all railway stations were coded. For external areas, only railway stations connected to zones were coded. Shape files of the National Rail network were used to define services while the network was simplified for external model areas.

3.2.2 The definition of transit lines (the public transport services included in the model) have been recoded to represent the service timetable in place in autumn 2018.

3.2.3 The geometry of the rail network was derived from OS OpenDATA Strategic Layer. The public transport network consists of modes, nodes, links and transit lines. All of which is created in the EMME to create an accurate representation of public transport network in Preston.

3.2.4 Electronic data sources of rail transport services were available, and were converted into public transport services using macros into EMME readable format such as Network Rail .CIF (Common Interface Format) files.

3.2.5 The public transport network was reviewed to verify that it is a realistic representation of the rail services as indicated in TAG Unit M3.2. This review also ensured that the model calibration and validation is not affected by routing issues and necessary adjustments of connectors were undertaken during the network validation stage.

3.2.6 The model links were also reviewed to prevent excessively long walking distances on the network, as well as any missing walk links from the Highway Model. This exercise focussed mainly on incorporating links that are relevant for the accessibility of the rail transport network.

3.2.7 Train operators which operate within the study area have been coded in detail, with headway information for each of the model peak hours. As the level of detail decreases, rail services generally provide longer distance inter-city connections and interchange opportunities across the network. These operating companies were coded nominally, with only key stations and services. The list of coded train is included in Appendix A.

3.2.8 Figure 3.1 and Figure 3.2 below show the extent of the rail network included within the model. As shown, the rail network covers as far as Glasgow to the north, to Holyhead and Cardiff in Wales, to Exeter in the south west, to the south to Southampton and Brighton/Hove, south east to Ashford (Kent) and north east to Norwich.

Figure 3 1 EMME Rail Network (Full)

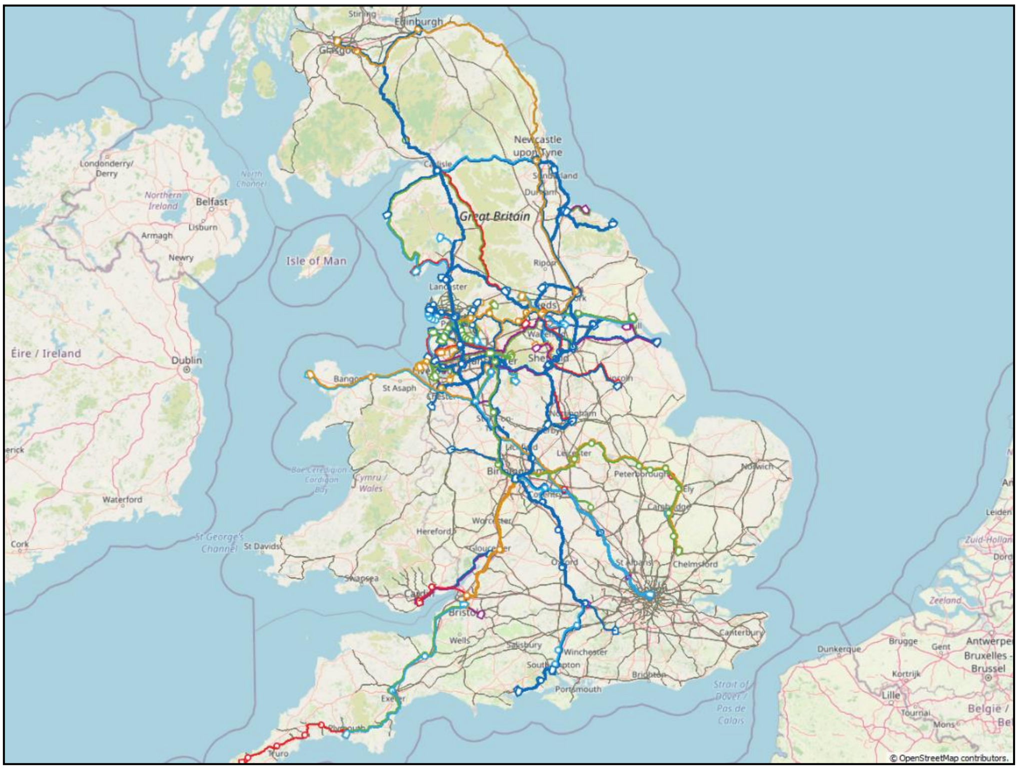
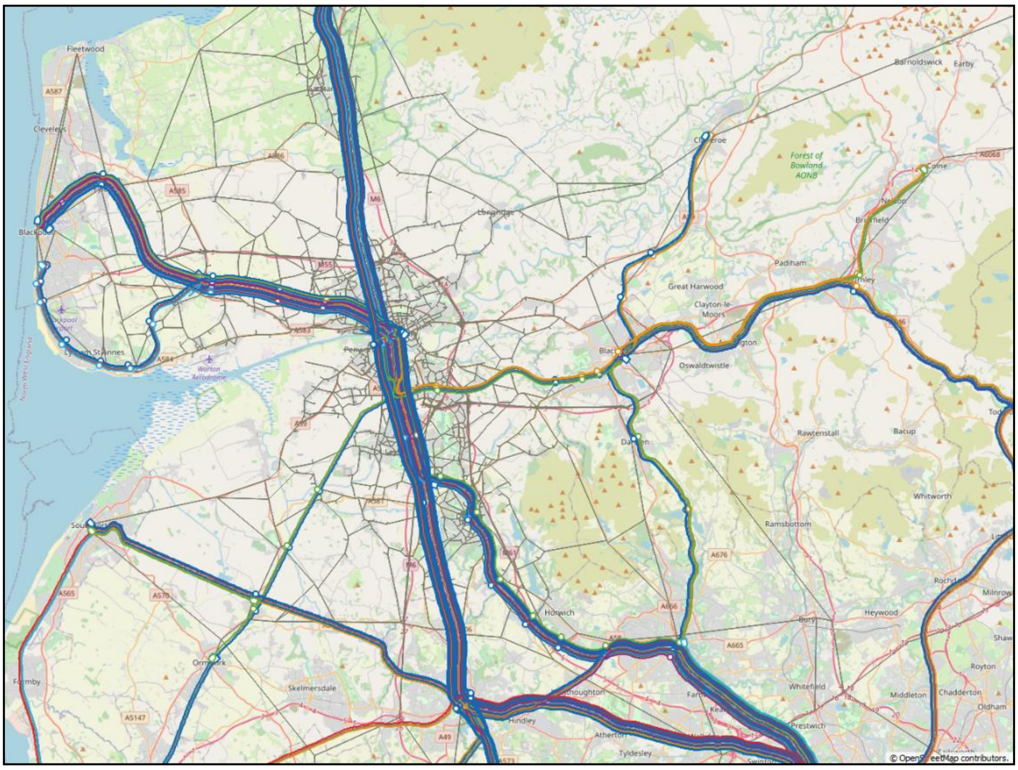


Figure 3 2 EMME Rail Network (Preston)



3.3 Walking Network

3.3.1 The SATURN highway links and connectors were coded for the transport systems allowing for pedestrians to access the road. These were reviewed to ensure that most of the walking links, were adequate to provide a real representation of interzonal walking trips in the study area. Apart from motorways all links coded in the SATURN model were open to walk mode. Rail stations can be accessed by the model zones using the highway links and connectors created for each station.

3.4 Public Transport Zones

3.4.1 Public transport zones align with the existing CLTM model zone system. The external zones allow a full representation of distances to external areas and will support the appropriate functioning of the demand model responses. The definition of the external area is based on the existing CLTM highway model.

3.5 Transit Modes

3.5.1 Within EMME two categories of mode are required for public transport modelling; transit modes and auxiliary transit modes. The transit mode is used to define the modes that provide passenger services. The PT model includes only Rail.

3.5.2 The auxiliary transit mode is used to define the access/egress from transit services. Walk and Bus is modelled as an auxiliary transit modes.

3.6 Bus Mode

3.6.1 As part of the scope, the bus mode is not been explicitly modelled in the EMME PT model. And therefore, a simplistic assumption has been made to represent bus journey times. The walk mode is capped up to 2km, and any trip beyond this distance is assumed to made by bus. Using a speed of 20km/h, the bus times is calculated based on the walk times by applying a factor of 0.25.

3.7 Parking Charges

3.7.1 Parking charges at Preston Railway Station is sourced from published data from relevant websites. In addition to the dedicated station parking, Fishergate shopping centre carpark which is next to the station is also considered as a potential parking location for rail passengers as there is good chance that people would use this facility instead of station car park due to lower parking fee charges.

3.7.2 Railway Station parking costs for Preston is as summarised in Table 3.1.

. Table 3 1 Parking Fee (in pounds)

Car Park	Capacity	Opening hours	Parking Fee
Preston station car park	1,025	Monday to Sunday (available at all times)	Daily: £12.00 Saturday: £6.00 Sunday: £6.00 Monthly: £166.00 Three Monthly: £374.00 Annual: £1200.00
Fishergate shopping centre	720	Sunday - 08:00 -18:00 Monday to Saturday - 08:00 - 19:00	Up to 1 hour £1.50 Up to 2 hours £2.00 Up to 3 hours £2.50 Up to 4 hours £3.50 Up to 5 hours £4.50 Up to 8 hours £7.50 Over 8 hours £8.50

3.7.3 The daily weekday parking fee was converted into highway generalised counts using the VoT corresponding to each of the demand segment. The parking cost was halved to spread the cost for outbound and return trip.

3.8 Public Transport Fare

3.8.1 For the Public Transport Assignment, and following guidance from TAG Unit M3.2, see below, Public Transport fares were not included as part of the assignment provided that they are not thought as to affect route choice.

3.8.2 "Where fares can influence route choice then it is essential to include them in the assignment. It is accepted that the complexity of some fare systems may prevent them from being represented exactly in the assignment model, but the model representation needs to be 'acceptable'. Acceptability can be gauged from whether the assignment model validates or not ".

3.8.3 However, matrices of fares were added to the later Variable Demand Model and added to the generalised cost as they will be an important influence on mode choice for some trips.

3.8.4 Rail and bus fare are coded into the model.

3.8.5 Rail fare were estimated from MOIRA and following steps details the methodology:

1. Aggregate MOIRA into a unique station-station matrix with sum of annual demand and revenue (i.e. group ticket types and Summer/Winter)
2. Join (1) with National Rail Travel Survey (NRTS) sample network distances
3. Calculate the average revenue per passenger kilometre from (2). Use distance bands as price/km will decrease for longer distance trips.
4. Join Mobile Network Data(MND) station catchment zones with PT model distances from zone-station.
5. Compare distance bands from (4) against NRTS access/egress observed data.
6. From (5) adjust catchments (e.g. remove very long-distance access legs).
7. Finalise assignment of zones to stations - check for zones without station and vice versa.
8. Assign station-station average MOIRA fare to the zone-zone matrix. Where average fare is missing, use the average price/km travelled (3) * station-station network distance.
9. Where a zone can use more than one station, weight fares is based on a probability of station choice

3.9 Generalised Cost Formulation

3.9.1 Generalised costs(GCs) are calculated in terms of minutes from highway and PT model time and distance skims as described below.

Car

3.9.2 Time and cost skims are extracted from SATURN highway models separately for the user classes: commute, business and other. Within the SATURN assignment two parameters are defined for each user class to calculate generalised cost: value of time; and vehicle operating cost. Journey times, distances and any tolls included in the model are then combined into a standard unit of generalised time based on these two parameters.

3.9.3 The values of time (VOT) used in the present year model were taken from the latest available TAG data book (July 2019, v1.14) at the time of model development.

Rail

3.9.4 Public transport GCs are calculated for each trip purpose, differing in respect of VOT. They are derived as follows:

$$C_{ij}^{(pt.p)} = f.D_{ij}/VOT^{(pt)} + I_{ij} + w.W_{ij} + x.X_{ij} + a.A_{ij}$$

Where:

$C_{ij}(pt.p)$= generalised cost by public transport between i and j for purpose segment (p);

f = fare per kilometre in pence;

D = travel distance in km;

$VOT^{(pt)}$ = value of time for segment p in pence per minute;

I = in-vehicle time in min;

w = wait time weight;

W = wait time in min;

x = transfer penalty in min;

X = number of transfers;

a = access and egress time weight; and

A = access and egress time in min.

Weights applied for walking and waiting are in line with TAG advice.

3.9.5 The parameters values used for the generalised cost calculation in the PT model are set out below. All values fall within thresholds described in TAG M3.2.

- Waiting Time : source of effective headways = transit line headway; Headway Fraction = 0.1 (passengers know the time table); Perception Factor = 1; Spread Factor =1
- Boarding Time: Global; Penalty = 10; Perception Factor = 1
- Boarding Costs: Global; Penalty = 0; Perception Factor = 1
- In-vehicle time: Perception Factor = 1
- Auxiliary transit time (mode walk): Perception Factor = 2

3.9.6 The 'wait time factor' is applied to the service headway (or effective headway) to determine the average wait time. A factor of 0.1 indicates that the average wait time is equal to 10% of the service headway (i.e. an hourly service would be modelled as having an average wait time of 6mins). The "wait time weight" is applied to this average wait time. The auxiliary transit time weight is applied to access, egress and any inter-service transfer from one node to another (e.g. walking).

3.9.7 Access time is defined as the time required to move from an origin zone to the node at which the first PT service is boarded. Conversely egress time is the time required after disembarking from the last PT service to reach the destination zone.

3.9.8 Boarding penalty of 10 minutes is defined for rail service. This penalty is incurred every time a service is boarded.

3.10 Effective Headways

3.10.1 EMME allows several approaches for how wait time is calculated, as follows:

- Using actual service headway. This approach looks at the service frequency and applies a common factor for all services to derive the average wait time. Typically a factor of 0.5 is assumed; therefore an hourly service would be modelled with a wait time of 30 minutes, while a 4 per hour service would have a modelled wait time of 7.5 minutes. This approach has the benefit of reflecting differences between all services with different headways, but can overestimate passenger response to improvements in low frequency services, as in practice people will tend to arrive at a stop soon before the scheduled departure time to avoid long wait times.

- Setting a ceiling for the maximum weight time allowed. This approach is based on the previous example, but sets an upper limit for the wait time. Whilst this approach prevents unrealistically long wait time from being derived, it means that the assignment procedure is not always able to reflect changes in service frequencies for infrequent services.

- Defining an “effective” service headway from which service wait time is derived. This approach enables a more sophisticated treatment of wait time to be modelled, for example a non-linear relationship between service frequency and wait time.

3.10.2 The third approach was judged to be most appropriate as it would enable more realistic modelling of responses to service frequency changes, without generating excessive time saving benefits for improvements to infrequent services. A non-linear effective headway curve has been developed for the PT model, adopting values proposed by the Passenger Demand Forecasting Handbook. This yields effective headways close to actual service headway for high frequency services. However, as the service headway increases (and the frequency decreases), effective headway also increases but the differences between actual and effective headways become greater.

3.11 Park & Ride

3.11.1 P&R is modelled as a sub-mode choice of the car main mode to forecast P&R site usage for car available demand segments on a PA basis. Two separate P&R sites are covered within the model area, as follows:

- Preston Railway Station (~1,025 car parking spaces)
- Buckshaw Parkway Station (~250 car parking spaces)

3.11.2 Parking capacity restraint is not modelled explicitly in the Demand Model to avoid the complexities of a full modelling of parking which would be viewed as disproportionate as per the TAG guidance on modelling parking and P&R.

3.11.3 The P&R sub-model is implemented in the following sequential steps:

1. Utilizing the triple-index operation feature in Emme modelling software to determine the minimum P&R journey cost and best/optimum P&R site for all OD pairs in the base year. The minimum P&R cost is computed based a combination of the journey cost for the car-only and rail sub-mode:

$$\mathrm{Min}(GC\_P\&R_{pqmin}) = \mathrm{Mink}(GC\_Car_{pkmin} + GC\_Railk_{qmin})$$

Where:

p = trip production

q = trip attraction

k = P&R site

GC_P&R = generalised cost for the entire P&R journey

GC_Car = generalised cost for the car-leg of the P&R journey, which includes perceived parking

costs at the P&R site

GC_Rail = generalised cost for the rail-leg of the P&R journey

2. Using the Zonal logit choice modeler module, auto and transit demand matrices for the two components of P&R trips is estimated based on the utility matrices calculated above for P&R and PT all the way calculated from the Transit Assignment.

3. The Two-leg trip chain module then computes the demand for first leg using car (origin to P&R station) and the second leg using rail (P&R station to final destination).

3.12 PT Assignment

3.12.1 The PT model uses EMME's Extended Transit Assignment algorithm. This offers an improved assignment methodology over the standard EMME transit assignment algorithm, by taking better account of service headways and journey times in the allocation of trips to PT services.

4. Demand Matrix Development

4.1 Data Sources

4.1.1 Base year, 2019, rail demand for the Cottam Parkway TA modelling was derived from MOIRA station-station data and Mobile Network Device (MND) derived journey observations provided by CitiLogik. This section describes the raw data and validation checks which were processes to create rail demand matrices for input into the multi-modal EMME model.

4.1.2 The main strength of using MND data is the large sample size compared to other survey methods and the ability to provide ultimate origin/destination locations (rather than station to station flows) without relying on demand synthesized from population, employment and trip rates.

4.1.3 The principal sources of OD data used in the matrices were:

- National Rail Travel Survey (NRTS) – used station entries and exits, trip purpose splits and mode of station access
- Office of Rail Regulation (ORR) station usage estimates – used for station entries and exits
- MOIRA (rail industry model) – extracts from MOIRA have been used to assist in benchmarking the rail matrices, including annual-to-daily and daily-to-period usage profiles and station-to-station movement calibration; and
- Mobile Network Data (MND) – provided station-to-station and rail catchment matrices derived from mobile network data
- National Travel Survey (NTS) – purpose splits, time of day splits
- National Trip End Model (NTEM) – purpose splits, time of day splits, car availability

4.2 MOIRA Railway-Station Ticket Data

4.2.1 MOIRA provides a front-end interface for rail ticket sales from the LENNON database and as such is the most accurate representation of annual rail trips between stations.

4.2.2 Data for Cottam Parkway TA modelling is taken for the year to March 2019 and full data is available only for stations with Northern Rail services from NT05 (through journeys without Northern Rail legs of a journey are excluded). MOIRA provides annualised totals without trip segmentation.

4.3 Mobile Network Data

4.3.1 Citi Logik was commissioned to provide station-to-station and rail catchment matrices derived from mobile network data (MND) data for trips associated with Preston station (i.e. trips passing through, starting, or ending at Preston Railway Station). The data was collected over a continuous period of 1 month for March 2019 and covers 21 weekdays and 10 weekend days.

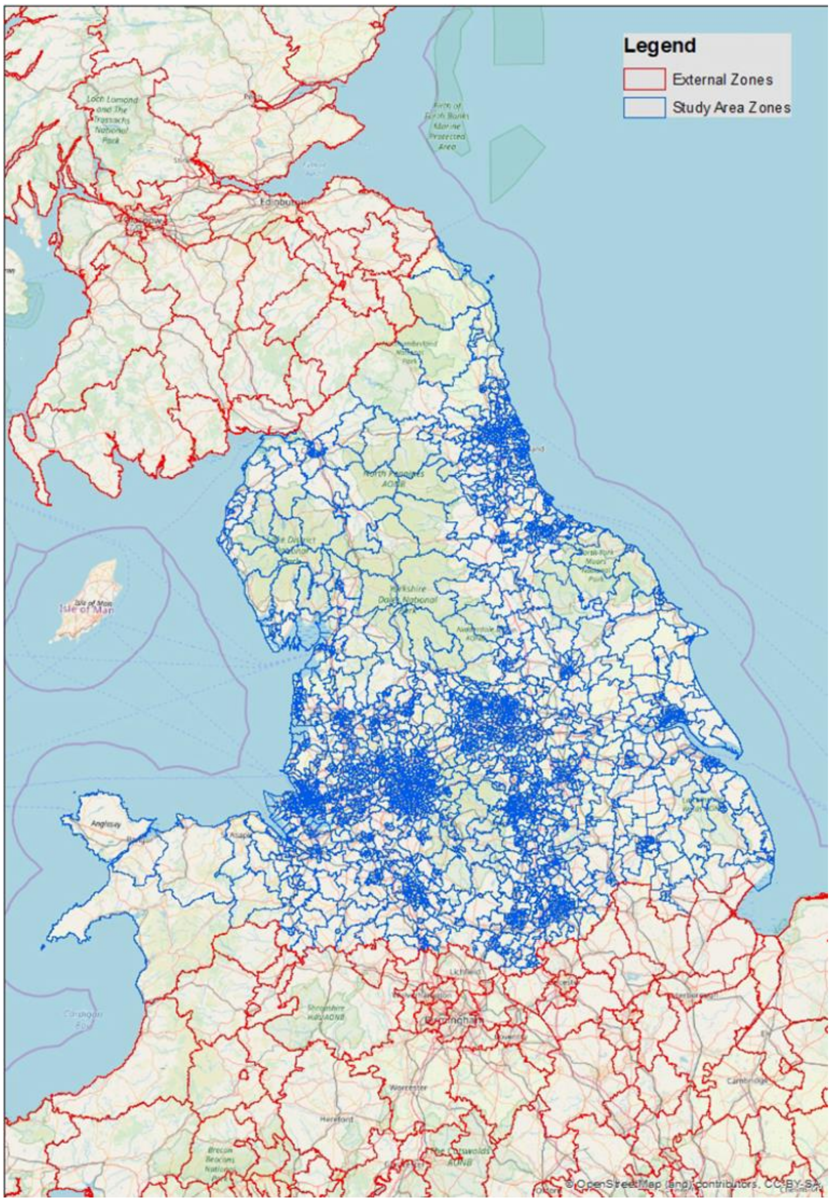
4.3.2 The data collection area for the project is shown in Figure 4-1.

Figure 4 1 Study Area

4.4.1 The zoning considered for the project used MSOA boundaries inside the study area and Planet for external zones as shown in Figure 4.2.

4.4.2 The time-period definition corresponds to the trip start if the trip started inside the study area, or to the time it entered the study area if it started outside the study area.

Figure 4-2 – MSOA zone boundaries



5. Temporal Coverage

5.1 The rail matrices data down into the following day and time periods allowing for an aggregate view but also a more detailed view notwithstanding the privacy impacts this might generate:

- Day classification:
  - Split by weekday/weekend aggregated
- Time classification:
  - Daily matrix 24 hr
  - Period (AM, IP, PM, OP)

5.2 Trip-end files were provided by purpose and time period (with the same privacy rules applied as the OD data, but at trip-end level, to help with the correction of the privacy impacts).

6. Purpose

6.1 The inferred day-time (work) and night-time (home) locations of a device were used to assign the trip origin and destination into one of the following:

- Home;
- Work; and
- Other.

6.2 The identification of the home end is critical to the use of mobile phone data for transport planning purposes as it drives both the definition of the travel purposes and expansion.

6.3 Trip purpose is derived from rules relating to the trip OD combinations, such as home to work, other to home, etc. All trips were allocated one of the following five trip purposes:

- Home Based Work (HBW) including directionality (from home (OB) / to home (IB));
- Home Based Other (HBO) including directionality (from home (OB) / to home (IB));
- Non-Home-Based Work (NHBW);
- Non-Home-Based Other (NHBO); or
- Unknown.

Directionality allows for the derivation of PA matrices.

7. Sample Size and Expansion

7.1 The expansion factors are calculated by comparing the number of Vodafone users with the UK census count for each corresponding geographical location. Expansion factors are assigned to each zone. The expansion factor is then subsequently applied to the entire chain of trips attributed to mobile devices with an inferred home location (night-time presence) identified in that zone.

7.2 The size of the geographical area used to estimate expansion factors has a significant effect on the outcome of expansion. It is therefore important to calculate and use expansion factors at a disaggregated spatial level to account for variation in local mobile phone penetration and market shares.

8. Citi Logik MND Validation Checks

8.1 As part of Citi Logik's quality assurance process, a number of verifications were undertaken on the expanded and unexpanded person trips derived from the mobile phone data. These included:

- Station to station symmetry
- Station catchment symmetry
- Catchment distance versus distance travelled by rail
- Purpose symmetry and time of day analysis
- Trip length distribution
- Comparison with Census Population and ORR

8.2 The verifications in general showed acceptable correlations between origin and destination stations and catchment areas in the symmetry tests, and satisfactory correspondence between the MND ORR data for trips utilising Preston station.

8.3 Overall, verifications show that the MND rail data provided is suitable for project use with certain limitations that will need to be addressed as part of the base year matrix development.

8.4 In addition, Jacobs have undertaken further checks to ensure the quality of the data received. These are discussed in detail in the following sections.

9. Jacobs MND Validation Checks

9.1 Whilst trip validation checks were performed and reported by CitiLogik, further checks were undertaken against secondary sources to ensure a strong fit before processing. The further validation checks included:

- Extent of privacy thresholds
- Station trip end comparison against MOIRA and ORR rail totals
- Journey purpose analysis, total and by time of day against NRTS / NTEM
- MND trip symmetry for home-based purposes
- Logic check of catchment areas for stations (investigating trip origin zone and origin station used or destination zone and end station used)

9.2 In total 4 revisions of MND rail data were provided, following requests to improve daily trip end totals at stations compared to MOIRA, improve daily symmetry of trips by purpose and to improve station catchment areas, i.e. remove unlikely long distance travel to access the rail network from within study area stations when better local alternatives were available.

Extent of privacy thresholds

9.3 Percentage of threshold trips in OD matrices including both station to station and zone to zone matrices were checked to understand the extent of privacy threshold in the MND data.

Benchmarking against MOIRA and ORR

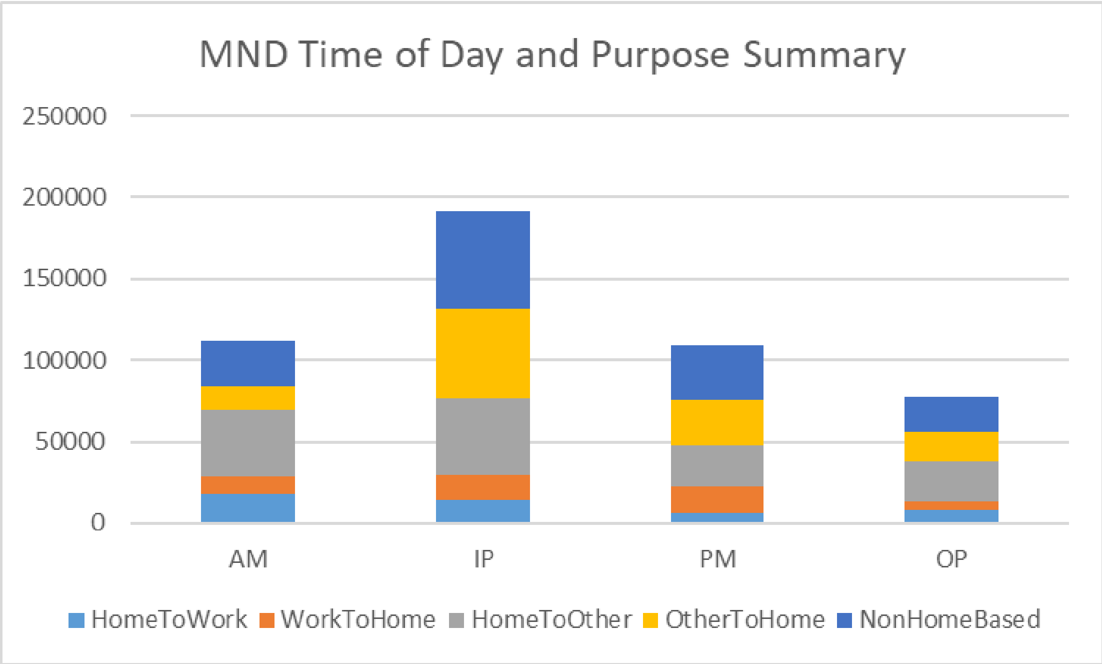
9.4 Table 9.1 shows the final revision summary of daily station entries and exits compared to MOIRA.

Table 9 1 Comparison of MND Station Daily Totals with Moira

Station	MND	MOIRA	Difference
Bamber Bridge	163	212	-23%
Lostock Hall	185	96	92%
Buckshaw Parkway	1,101	1,129	-2%
Preston	13,053	14,317	-9%
Salwick	42	4	852%
Croston	123	110	12%
Blackburn	2,761	3,697	-25%
Ansdell & Fairhaven	158	100	58%
Leyland	483	949	-49%
Squires Gate	71	56	27%
Pleasington	26	22	21%
Cherry Tree	128	91	40%
Moss Side	36	9	314%
Lytham	154	247	-38%
Blackpool Pleasure Beach	268	361	-26%
Darwen	778	828	-6%
Euxton Balshaw Lane	184	194	-5%
Layton (Lancs)	332	140	137%
Blackpool North	2,810	4,795	-41%
Poulton-le-Fylde	638	1,337	-52%
Blackpool South	224	325	-31%
St Annes-on-the-Sea	262	353	-26%
Mill Hill (Lancs)	296	174	70%
Kirkham & Wesham	820	727	13%
Adlington (Lancs)	438	317	38%
Chorley	1,411	1,764	-20%
Total	26,945	32,355	-17%

9.5 Figure 9.1 shows the summary of time of day and purpose for the final revision of input MND data. The figure shows that the MND data required further adjustment for use in variable demand modelling use. An adjustment to meet MOIRA station totals was key to ensuring current rail usage was represented in the model. Similarly, home-based work trips consistently made up a smaller proportion of total trips than expected in either NRTS or NTEM along with differences in time of day proportions.

Figure 9.1 MND Time of Day and Purpose Split



10. Rail Demand Methodology

10.1 The methodology to develop 2019 rail demand addresses the points raised in the MND Validation Checks section and is designed to create matrices consistent with inputs to the EMME multi-modal model. The steps taken are outlined below:

1. Start with MND station-station 24hr matrix

2. Apply MOIRA/MND factors to internal stations to adjust daily rail trip totals to MOIRA totals

3. Distribute station-station to zone-zone using cleaned catchment areas

4. Apply outbound MND time period and purpose splits by zone - 24hr symmetry is needed between outbound and return trips for variable demand modelling (via furness procedure to trip end totals)

5. Apply MND return time period proportions to transposed (4) matrices by purpose to get return journeys

6. Split Employer's Business from other trips using TEMPro totals at MSOA level

7. Split Non-Home Based into Other and Employer's Business using TEMPro at MSOA level

8. Split by car availability derived from TEMPro

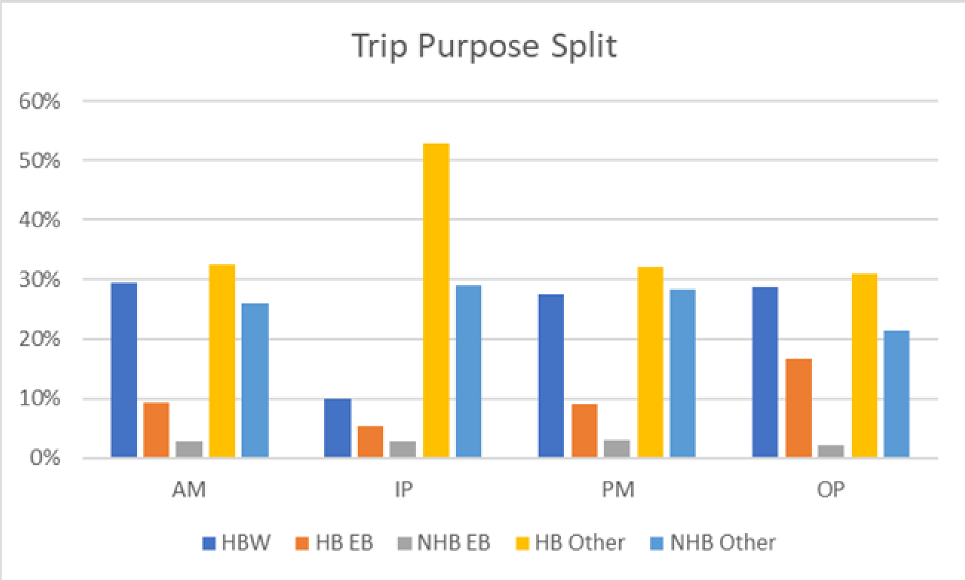
9. Disaggregate to CLTM zones via OAs using population and jobs proportions

10. Adjustments for Diadem input (directional OD to 24hr PA)

10.2 The output rail demand matches MOIRA demand totals by station. All modelled totals for rail stations with more than 200 daily passengers are within 20% of MOIRA and the overall model total is just 1% lower than observed.

10.3 Rail demand journey purposes and time of day were further adjusted using Diadem outbound, return and tour proportions within Diadem software to ensure consistency with NTEM and NTS. Final proportions are shown in Figure 10.1.

Figure 10 1 Rail Trip Purpose Split



11. Rail Model Calibration

11.1 The sensitivity of a logit choice models is controlled by a scale parameter (the greater the scale parameter, the more sensitive the model is to differences in generalised cost). In the absence of any locally available information on the mode choice, scale factors for main mode choice were based on TAG Unit M2 recommended median values, which were confirmed using the realism testing. These are summarised in Table11.1

Table 11.1 Scale factors for main mode choice (Car vs. PT)

Trip Purpose	Minimum	Median	Maximum
Home-based work	0.50	0.68	0.83
Home-based employers business	0.26	0.45	0.65
Home-based other	0.27	0.53	1

Non-home-based employers business	0.73	0.73	0.73
Non-home-based other	0.62	0.81	1

11.2 The calibration process also involved setting mode constants (adjustments to generalised costs for one or more alternatives) in order to replicate observed choices in the base case scenario. In the base year the model was calibrated to meet the following targets:

- proportions of rail access mode estimated from the survey conducted at Buckshaw station (33% walk, 46% P&R, 18% drop off, 1%cyc bus); and
- base year demand from analysis of MND and ORR data for internal stations.

12. Rail Assignment Validation

12.1 Following the construction of the public transport network and services and the accompanying public transport demand matrices, a calibration and validation exercise was undertaken to assess the robustness of the resulting model.

12.2 The validation process has been carried out in-line with current guidelines as set-out in the TAG M3.2. This states that validation should involve checks of:

- Validation of the trip matrix;
- Network and service validation; and
- Assignment validation.

12.3 The validation of the public transport network was an on-going iterative process during the model construction. A number of assignments were undertaken to achieve a validated model. The results of the final assignment are outlined in the following paragraphs.

12.1 Validation of Rail Matrix

12.1.1 Table 12.1 shows the number of rail trips assigned to the network. This indicates that virtually all of the trips in the matrices have been assigned.

Table 12.1 Assigned rail trips – 2019 trips

Source	AM	IP	PM
Matrix totals	2,303	1,875	1,934
Trips assigned	2,259	1,843	1,897
Not assigned (%)	0%	0%	0%

Table 11.2 AM Assigned Trip Statistics

Total demand	Assigned demand	Not assigned demand	Aux transit only demand	Total boardings	Avg lines per passenger	Passenger hours	Mean impedance
2,303	2,259	-	68	2,934	1	4,074	108

Table 11.3 IP Assigned Trip Statistics

Total demand	Assigned demand	Not assigned demand	Aux transit only demand	Total boardings	Avg lines per passenger	Passenger hours	Mean impedance
1,875	1,843	-	44	2,410	1	3,393	110

Table 11.4 PM Assigned Trip Statistics

Total demand	Assigned demand	Not assigned demand	Aux transit only demand	Total boardings	Avg lines per passenger	Passenger hours	Mean impedance
1,934	1,897	-	60	2,396	1	3,336	106

12.2 Rail Assignment Validation

12.2.1 TAG Unit M3.2 specifies validation criteria for public transport models, modelled flows on screenlines and also on individual links. No historic public transport count data was available for the project at the temporal resolution required for calibration, i.e. only annual statistics was available from the MOIRA and ORR were available. Additionally, a full public transport passenger survey was out of scope of the commission due to the current CO-VID 19 situations.

12.2.2 DfT guidance is taken here that unless observed flows are particularly low (less than 150 passengers per hour) modelled flows should be within 25% of the counts and for less than 150 passengers per hour modelled flows should be within 15% of the counts. This is denoted by a PASS/ FAIL criteria on the comparisons. GEH statistic information is also provided (which provides a measure of fit, taking in to account observed counts), where anything above 5 is considered poor (shown as red).

12.2.3 At an overall level, the stations in the modelled area for which we have observed data show a good match to the modelled boardings and alightings. The validation results for daily rail entries and exits are shown in Table 11.5. Apart from few small stations, the daily boarding and alighting counts validate at all stations with differences less than 25% (or GEH < 5).

Table 11.5 Rail assignment validation– Daily Entry and Exit

Station Name	Average 24hr Weekday. Observed Flow	Average 24hr Weekday. Modelled Flow	Actual Difference	% Difference	Pass/ Fail	GEH	Pass/ Fail
Adlington (Lancs) Rail Station	354	407	- 52	-15%	Pass	2.7	Pass
Ansdell & Fairhaven Rail Station	129	60	69	54%	Fail	7.1	Fail
Blackburn Rail Station	3,544	3,261	283	8%	Pass	4.8	Pass
Bamber Bridge Rail Station	200	226	- 27	-13%	Pass	1.8	Pass
Blackpool Pleasure Beach Rail Station	334	239	94	28%	Fail	5.6	Fail
Blackpool North Rail Station	4,351	4,250	101	2%	Pass	1.5	Pass
Blackpool South Rail Station	302	281	21	7%	Pass	1.2	Pass
Buckshaw Parkway Rail Station	1,156	1,193	- 37	-3%	Pass	1.1	Pass
Chorley Rail Station	1,660	1,561	99	6%	Pass	2.5	Pass
Croston Rail Station	112	132	- 19	-17%	Pass	1.8	Pass
Cherry Tree Rail Station	99	89	9	10%	Pass	1.0	Pass
Darwen Rail Station	823	902	- 79	-10%	Pass	2.7	Pass
Euxton Balshaw Lane Rail Station	195	248	- 53	-27%	Fail	3.6	Pass
Entwistle Rail Station	33	35	- 2	-7%	Pass	0.4	Pass
Kirkham & Wesham Rail Station	873	795	78	9%	Pass	2.7	Pass
Layton (Lancs) Rail Station	209	98	111	53%	Fail	9.0	Fail
Leyland Rail Station	930	899	31	3%	Pass	1.0	Pass
Lostock Hall Rail Station	116	119	- 3	-2%	Pass	0.3	Pass
Lytham Rail Station	205	166	39	19%	Pass	2.8	Pass
Mill Hill (Lancs) Rail Station	207	222	- 15	-7%	Pass	1.0	Pass
Moss Side Rail Station	17	15	3	15%	Pass	0.7	Pass
Poulton-le-Fylde Rail Station	1,239	1,123	116	9%	Pass	3.4	Pass
Pleasington Rail Station	21	20	1	6%	Pass	0.3	Pass
Preston Rail Station	14,318	14,097	221	2%	Pass	1.9	Pass
St Annes-on-the-Sea Rail Station	334	398	- 64	-19%	Pass	3.4	Pass
Salwick Rail Station	7	10	- 4	-55%	Fail	1.3	Pass
Squires Gate Rail Station	64	62	3	4%	Pass	0.4	Pass

12.3 Park & Ride Results

12.3.1 In the absence of any new surveys within the study area, Passenger survey undertaken at Buckshaw Parkway was used to benchmark the P&R trips. The surveys were undertaken on three days June 2016: Saturday 11th June, Monday 13th June and Tuesday 14th June.

12.3.2 The survey included passenger entry and exit counts at the single station entrance, cark park entry counts, and interviews with both boarding and alighting passengers.

12.3.3 The survey was undertaken by Acumen Fieldwork, using hand-held capture devices for the interviews, and manual counters for the passenger entry/exit and car park counts.

12.3.4 Passengers were asked what mode of transport they used to access the station. For boarding passengers, this represented the mode used to arrive at the station. For alighting passengers, this represented the mode used upon leaving the station to arrive at their final destination.

12.3.5 Table 11.6 summarises the peak hour P&R trips from model and from the survey. It can be observed that the model flows are lower in AM and PM outbound and return trips respectively.

Table 11.6 Park & Ride Modelled Vs Observed

Peak Hour	Model		Observed		Difference	
	Boarding	Alighting	Boarding	Alighting	Boarding	Alighting
AM	42	8	67	5	-25	3
IP	22	18	13	8	8	10
PM	22	51	12	82	10	-31
OP	5	15	8	14	-3	1

13. Variable Demand Modelling – Base Year

13.1 Background - CLTM VDM

13.1.1 The variable demand model for the CLTM model has been calibrated using the DIADEM software in accordance with the methodology and recommendations set out in TAG unit M2. Realism tests converged giving a relative gap of 0.03% (in line with TAG Unit M2). Overall, the demand model responses to change were realistic and within the requirements of TAG Unit M2.

13.1.2 The VDM is run as an incremental 24-hour Production/Attraction (P/A) based model. The spatial coverage of VDM is the same as the highway model and they use the same zone system and generalised cost parameters.

13.1.3 The Variable Demand Model is an incremental hierarchical choice model in line TAG M2 specification and calculates the changes of travellers liable to make travel choice based on change in travel costs. The choice mechanisms will be:

- *The destination of any given trip.*
- *The generation or loss of trips due to changes in highway accessibility.*

13.1.4 Mode choice was not included as a response as it has been shown that the change in highway costs is unlikely to cause significant modal shift.

13.1.5 Time of day choice is not included in VDM as there is no strong cost differential between time periods caused by the scheme.

13.1.6 Long distance trips without at least one trip end located in the 'Area of Detailed Modelling' or Rest of Fully Modelled Area were also separated out in the demand model, as changes in travel costs are not fully modelled for these movements and they should therefore be treated as fixed within the VDM process.

13.1.7 Further details of the calibration of the VDM and base year realism tests carried out to demonstrate realistic model responses is included in the Local Model Validation Report (LMVR).

13.2 Cottam Parkway VDM Approach

13.2.1 The variable demand modelling process undertaken as part of the Cottam Parkway for the CLTM model uses trip demand matrices in production/attraction (P/A) consistent with CLTM model.

13.2.2 Variable demand was undertaken for cars, with mode split choices between car and rail for those with a car available. Public transport users without a car available are assumed captive to public transport. LGVs and HGVs is assumed to have fixed demand.

13.2.3 Prior to the traffic forecasting using VDM, realism testing on the base year traffic model was undertaken to ensure that the CLTM transport model responded to changes in travel costs in a realistic way with the mode choice included.

13.2.4 The responses in the variable demand model are such that, if the generalised cost for a trip is greater than the cost in the reference assignment, then there would be some degree of trip suppression. Similarly, a decrease in travel cost would lead to trip induction. The extent of trip suppression or induction is governed by the spread parameter λ and the scaling parameter θ, for which, in the absence of local data, illustrative values provided in TAG Unit M2 was used.

13.2.5 Generally, the variable demand model for the forecast Do Minimums is done by pivoting off an equilibrium assignment that used the validated base matrices. The output from these DIADEM runs is then used to calculate incremental changes between the base year and the forecast year, which are then applied to the validated base year ‘assignment’ matrices. The demand model then creates forecast assignments using the Reference Case matrices to extract travel costs which are pivoted off the base year assignment.

13.2.6 The demand matrices developed pivoting from base resulted in reduction in public transport trips due to the decrease in VOC and increasing rail fares in future years. This methodology was therefore not considered appropriate for assessing the modal shift due to Cottam.

13.2.7 To address the above problem, it was decided that the Do Minimum model will not be pivoted off base and will be based on the fixed demand models. TAG Unit M4 states that where fixed demand models are being used, the trip matrix should be multiplied by two factors, one for growth in income and the other for growth in fuel. The factors were taken from the TAG databook 1.14 July2020 Sensitivity Testing version. The factors are summarised in Table 13.1.

Table 13.1 Income and Fuel Adjustment Factor

Year	Income Adj Factor	Fuel Cost Adj Factor
2019	1.0172	1.0565
2024	1.0185	1.0765
2039	1.0485	1.1439

13.2.8 The factors were applied as shown below:

<u>Matrix factor for 2019 to 2024</u>

NTEM trip-end growth is supplemented with:

Overall income adjustment factor = 1.0185 / 1.0172 = 1.00125

Overall fuel cost adjustment factor = 1.0765 /1.0565 = 1.0189

Therefore, the initial growth factor for each origin and destination trip end of the matrix should be:

Adjusted TEMPRO trip-end growth =1.00125 * 1.0189 = **1.02017**

<u>Similarly, for Matrix factor for 2019 to 2024</u>

NTEM trip-end growth is supplemented with:

Overall income adjustment factor = 1.0485/ 1.0172 = 1.03074

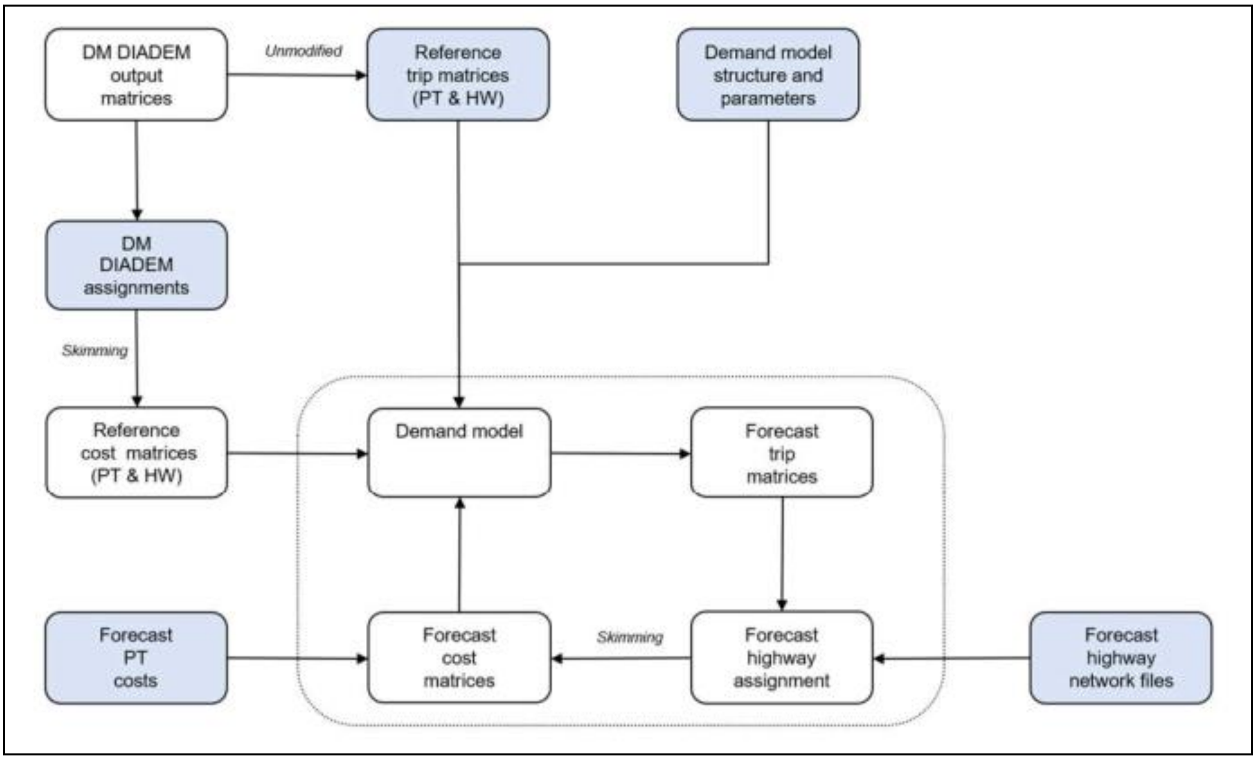
Overall fuel cost adjustment factor = 1.1439/1.0565 = 1.08273

Therefore, the initial growth factor for each origin and destination trip end of the matrix should be:

Adjusted TEMPRO trip-end growth =1.03074* 1.08273 = **1.11601**

13.2.9 The Do Something scenario is then generated by using travel costs from the factored Do Minimum Scenario as the pivot point. The variable demand model approach for the creation of Do Something scenarios is shown in Figure 13.1.

Figure 13.1 Structure of Diadem Run, incremental model pivoting off the Do-Minimum



13.2.10 In developing the variable demand model parameters to be used in forecasting, the initial values were based on the median illustrative values of λ by journey purpose quoted in TAG. A systematic approach was then followed to calibrate the parameters. This process also involved the incorporation of cost damping parameters to weaken the response of long-distance journeys, as advised in TAG guidance consistent with base year VDM.

13.2.11 Future year highway networks and vehicle matrices were input to DIADEM along with EMME output public transport costs and passenger matrices. DIADEM starts by comparing the initial highway and public transport costs and then uses mode choice parameters to switch trips between highway and public transport, before recalculating new highway costs. This continues until specified convergence criteria are met.

13.3 Demand segmentation

13.3.1 Variable Demand Modelling is only carried out for car available trips, both by car and by public transport, but not for freight trips, as it is assumed that the total freight traffic is fixed, but susceptible to re-routeing.

13.3.2 The variable demand parameters (the spread parameter λ and scaling parameter θ) can vary significantly between different trip purposes. This reflects the likelihood that the number, mode and distribution of more essential trips, such as employers' business trips, are less affected by congestion than discretionary travel, such as leisure trips.

13.3.3 Some private trips are also treated as fixed. This is the case for long distance external-external movements without one or both trip ends in the Area of Detailed Modelling' and for trips that are classed as 'no car available', which are therefore captive to public transport.

13.3.4 The car based demand segments and matrices were inherited from the CLHTM. The PT demand segments are consistent with the highway demand segments and were modelled in a 24 hour production/attraction (P/A) format, as recommended by TAG.

13.3.5 The public transport demand was further split into 'car available' and 'no car available' to separate those trips that have the opportunity to switch to private car from those that do not have that opportunity. In this respect, 'No car available' trips are assumed to be captive to public transport.

13.3.6 The demand segments used in the VDM are specified in Table 13.2

Table 13.2 Demand Segments in the Variable Demand Model

ID	Demand Model Purpose	Demand Model Type	User Classes	Vehicle Class
1	Home-Bases Work	PA Doubly Constrained	UC1	VC1
2	Home-Based Employers Business	PA Singly (production) Constrained	UC2	
3	Non-Home-Based Employers Business	OD Singly (origin) Constrained	UC3	
4	Home-Based Other	PA Singly (production) Constrained		
5	Non-Home-Based Other	OD Singly (origin) Constrained		
6	Light Goods Vehicles	Fixed	UC4	VC2
7	Heavy Good Vehicles	Fixed	UC5	VC3

13.4 Generalised Costs

13.4.1 In principle, the basis for route choice in a highway assignment model is that of generalised cost. The generalised cost of travel is based on a combination of factors that drivers take into account when choosing routes, mainly time and distance.

13.4.2 Generalised cost parameters are used in a SATURN model to represent travellers' value of time by pence per minute (PPM) and distance by pence per kilometre (PPK). Values of PPK and PPM can be set universally for the entire model or individually by user class. Where a choice of route exists (as in nearly all cases) these values are used to determine which available route has a lower 'cost' to the traveller.

13.4.3 The SATURN assignment procedure uses the following generalised cost formulation, with everything converted to equivalent minutes:

Generalised Cost = Time + PPK/PPM * Distance + Toll / PPM.

Where: PPM = pence per minute, and PPK = pence per kilometre

13.4.4 The generalised cost coefficients used in the base model are inherited from the CLTM. For leisure and other trip purposes, highway and rail modes have similar values of time, however for the business purpose, the slightly VoTs from TAG are slightly different as they change based on the distance bands. For mode choice modelling, this is conceptually problematic because it implies that the same person applies different values of time when considering travelling by different modes. And therefore, the same values of time have been applied for both highway and PT assignment models.

13.4.5 The generalised costs (in 2010 prices) that were used in the base and forecast models are shown in Table 13.3 and Table 13.5.

Table 13.3 Base Year Generalised Cost Parameter Values

Vehicle Type	Trip Purpose	Time Period	PPK (Pence per Kilometre)
Car / Rail	Commute	AM	5.75
	Business		12.07
	Other		5.75
	Commute	IP	5.67
	Business		11.89
	Other		5.67
	Commute	PM	5.81
	Business		12.12
	Other		5.81

Table 13.4 Future Year 2024 Generalised Cost Parameter Values

Vehicle Type	Trip Purpose	Time Period	PPK (Pence per Kilometre)
Car / Rail	Commute	AM	5.339
	Business		11.516
	Other		5.339
	Commute	IP	5.265
	Business		11.335
	Other		5.265
	Commute	PM	5.397
	Business		11.651
	Other		5.397

Table 13.5 Future Year 2039 Generalised Cost Parameter Values

Vehicle Type	Trip Purpose	Time Period	PPK (Pence per Kilometre)
Car / Rail	Commute	AM	3.965
	Business		8.71
	Other		3.965
	Commute	IP	3.917
	Business		8.552
	Other		3.917
	Commute	PM	4.001
	Business		8.826
	Other		4.001

13.5 DIADEM Set-up

13.5.1 The DIADEM assessments were set up to model the following demand responses:

- Frequency
- Modal split
- Re-distribution

13.5.2 A PA based incremental logit model has been used.

13.5.3 Doubly constrained re-distribution was used for commuting trips, and origin constrained re-distribution for employers business and other trips. External to external trips have been frozen.

13.5.4 LGV and HGV highway trips have been retained as fixed demand segments following the minimum segmentation advice in TAG unit 3.10.2 2.3.3

13.6 Selection of Lambda Sensitivity Parameters

13.6.1 Following advice from TAG Unit M2 chapter 6.5.5, median lambdas and thetas were adopted as a starting point for the calibration of the VDM. This is the standard approach recommended for those cases were no locally calibrated data is available. These median values are the result of a study undertaken by the Department for Transport for a number of UK transport models.

13.6.2 The median values of Lambdas (λ) and mode choice Thetas (θ) parameters for rail given as in the latest TAG Unit M2 guidance are used as the starting point and then these are adjusted until satisfactory elasticity for the base year is achieved. The highway values for Lambdas (λ) for estimation choice was inherited from the calibrated CLTM model.

13.6.3 The DIADEM model parameters for each journey purpose (i.e. commuting, employers business, other) are shown in table below. These are based on the guidance in TAG unit 3.10.3.

Table 13.6 Sensitivity Parameters

Table 5.1 Illustrative Destination Choice Parameters

TRIP PURPOSE AND MODE	MINIMUM	MEDIAN	MAXIMUM	SAMPLE
CAR				
Home-based work	0.054	0.065	0.113	7
Home-based employers business	0.038	0.067	0.106	5
Home-based other	0.074	0.090	0.160	4
Non-home-based employers business	0.069	0.081	0.107	3
Non-home-based other	0.073	0.077	0.105	3
PUBLIC TRANSPORT				
Home-based work	0.023	0.033	0.043	7
Home-based employers business	0.030	0.036	0.044	4
Home-based other	0.033	0.036	0.062	4
Non-home-based employers business	0.038	0.042	0.045	2
Non-home-based other	0.032	0.033	0.035	3

Table 13.7 Mode Choice Scaling Parameters

Table 5.2 Illustrative Main Mode Choice Scaling Parameters

TRIP PURPOSE	MINIMUM	MEDIAN	MAXIMUM	SAMPLE
Home-based work	0.50	0.68	0.83	6
Home-based employers business	0.26	0.45	0.65	2
Home-based other	0.27	0.53	1.00	4
Non-home-based employers business	0.73	0.73	0.73	1
Non-home-based other	0.62	0.81	1.00	2

13.7 Process for Realism Testing

13.7.1 It is essential for any model to demonstrate its plausibility by ensuring it behaves realistically. For this purpose and following guidance from TAG Unit 2 Chapter 6.4, a series of realism tests were undertaken by changing various components of travel costs and times and checking the overall demand response.

13.7.2 The acceptability of the model's responses to changes in costs and journey times is determined by its demand elasticities. Specifically, the model tests are expected to demonstrate the VDM responsiveness to changes in car fuel cost, public transport fare and car journey times. The realism tests, required by TAG M2, Section 6.4, are the following:

- Fuel Cost increase impact on Vehicle kilometres (10% or 20%)

- General PT Fare increase impact on Trips (10% or 20%)
- Change in car journey time impact on Trips (due to congestion)
- DIADEM Convergence

13.7.3 The acceptability of how a demand model responds to changes in costs is through the demand, elasticity of the base year model. The demand elasticity calculates the proportional change in demand of changes in costs or time within the calibrated base year model and is calculated using the formula below:

$e = (\log(T^1) - \log(T^0)) / (\log(C^1) - \log(C^0))$

Where:

- T^0 and T^1 are the trips before and after the changes in cost
- C^0 to C^1 are journey costs before and after the changes
- e is the elasticity of demand

13.8 Fuel Cost Elasticities - Guidelines

13.8.1 TAG Unit M2 paragraph 6.4.14, based on a number of UK studies on car travel and fuel prices and costs, suggests that car use elasticity with respect to fuel cost increments should report to be around -0.3. In addition, the Department's view is that:

Annual average fuel cost elasticity should lie within -0.25 and -0.35

13.8.2 The guidance, paragraph 6.4.17, also suggests that elasticities may be regarded as more plausible if:

- The pattern of average elasticities shows values for employers' business trips near to -0.1, for discretionary trips near to -0.4, and for commuting and education somewhere near the average; and

- The pattern of all-purpose elasticities shows peak period elasticities which are lower than inter-peak elasticities which are lower than off-peak elasticities.

13.8.3 Elasticities of Public Transport trips with respect to increases in fares are advised to lie between a range from -0.2 to -0.9, considering values close to the -0.2 extreme to be unlikely and considering the elasticities also to be more plausible if:

- The pattern of average public transport fare elasticities show peak values for non-discretionary purposes which are lower than those for discretionary trips; and

- The pattern of all-purpose elasticities shows peak period elasticities which are lower than those for the inter-peak.

13.8.4 Regarding journey time elasticities TAG U2 6.4.28 suggests that output elasticities should be checked to ensure that values are not stronger than 2.00.

13.8.5 Table 13.8 below summarise the recommended elasticities that should be achieved during the realism testing as outlined by TAG.

Table 13.8 Summary of TAG recommended elasticities for realism testing

Realism Test	High	Low
Average Fuel Cost (veh km)	-035	-0.25

PT Main Mode Fare (trips)	-0.90	-0.20
Car Journey Time (trips)	No Stronger than -2.0	

13.8.6 Since the guidance was published revised Values of Time (VoT) have been released. For commute VoT has increased by 47% (values £6.81 to £10.01). This means that any monetary cost change (e.g. that in a fuel cost realism test) when converted to equivalent generalised time (minutes) would reduce to 68% (i.e. 1.0/1.47) of its previous values.

13.8.7 For employer's business trips the car driver VoT has approximately halved (based on short or mid distance band being used), and the generalised time equivalent of a monetary cost change would be approximately 100% larger as a result. For other journey purposes, VoT was reduced by 25%, so generalised time equivalent of a fixed monetary cost change increase by 33% on switching to new Databook values.

13.8.8 In the realism tests, these proportionate changes in the proportion of time and monetary cost (converted to time units with the use of revised values of time) within the generalised cost formulation, feed directly into elasticity calculations, and corresponding changes in elasticities by journey purposes should be expected. Thus, the outturn employer's business fuel cost elasticity should be expected to change from approximately -0.1 to -0.2.

13.8.9 The commute elasticity would be in the range of -0.15 to -0.20 instead of -0.25. Trip for other journey purposes would have an elasticity in the range of -0.50 to -0.55 instead of -0.4. Although the elasticities for individual purposes change, the overall elasticity should continue to have values similar to those in TAG and lie in the -0.25 to -0.35 range.

13.8.10 Calculations are matrix based, and network based using car vehicle kilometre changes calculated from car trip matrices and skimmed distance matrices. Calculations are based on demand segments and model areas with variable demand, i.e. excludes ‘external to external’ trips, intrazonal demand and freight.

13.9 Generalised cost parameters for fuel cost increase

13.9.1 A new SATURN Vehicle Operating Cost parameter PPK (Pence per Kilometre) has been calculated from the validated model PPK for each user class.

13.9.2 Table 13.9 shows the PPK values used in the validated base assignment model and the PPK values that reflect a 20% fuel cost increase. As part of the realism tests, the fuel cost element of the model generalised cost coefficient (the distance coefficient) was increased by 20%. The 20% increase was used to reduce the impact that model noise has on the calculations.

Table 13.9- Fuel elasticities Generalised Cost co-efficient

Vehicle Type	Trip Purpose	Time Period	Validated Base Year	20% Fuel Cost Increase
Car	Commute	AM	5.75	6.90
	Business		12.07	13.03
	Other		5.75	6.90
	Commute	IP	5.67	6.80
	Business		11.89	12.83
	Other		5.67	6.80
	Commute	PM	5.81	6.97
	Business		12.12	13.08
	Other		5.81	6.97

13.10 Cost Damping

13.10.1 Consistent with CLTM DIADEM set up, cost damping has been utilised. The use of cost damping was deemed necessary during the CLTM project as initial realism tests using median value parameters and varying them within the permitted 25% ranges did not give acceptable elasticities, with long distance trips being oversensitive for some purposes.

13.10.2 There is evidence that long distance trips are less sensitive to changes in costs than short distance trips and TAG Unit M2 recommends that cost damping functions are included in the variable demand process. The idea behind cost damping is to adjust the costs for longer trips so that their sensitivity to individual cost components (such as fuel cost or travel time) is reduced.

13.10.3 TAG states that if cost damping is employed, it should apply to all person demand responses, and should be applied to both car and public transport costs. The public transport costs have the same cost damping parameters as the highways and was found satisfactory through the realism tests undertaken.

13.10.4 DIADEM offers a range of different methods of applying cost damping. The approach used for this study is the first option, damping by a Function of Distance.

The damped cost is given by the formula:

$$G' = (d/k)^{-\alpha}.(t + c/VOT),$$

Where:

t = time (minutes)

c = cost (pence)

VOT = value of time (pence per minute)

d' = trip length; and

α and k = parameters that need to be calibrated.

13.10.5 TAG acknowledges that whilst there is no firm guidance provided on setting the parameters for cost damping, TAG Unit M2, paragraph 3.3.10 provides the following commonly used parameters which were adopted.

Table 13.10 - Cost Damping TAG Unit M2 Parameters

Parameter	Description	Commonly used value
α	must be positive and less than 1 and should be determined by experimentation in the course of adjusting a model so that it meets the requirements of realism tests	0.5
k	must also be positive and in the same units as d'	30 km
d'	calculated by skimming distances	30 km

13.11 Realism Testing Results

13.11.1 This section presents outturn results from the following analysis:

- *Car fuel cost elasticities.*
- *Public Transport fare elasticities*
- *Network based elasticities.*
- *Journey time elasticities.*
- *DIADEM Convergence.*

13.12 Car Fuel Cost Elasticities

13.12.1 Calibration of the destination model parameters was conducted in line with guidance from TAG Unit M2 para 6.6.5 using the CLTM calibrated highway parameters and median values taken from Table 5.1 of the same document for Public transport. A sequence of model runs was conducted, as described below, in order to achieve calibration.

13.12.2 A run was undertaken using the median parameter settings from TAG Unit M2 Table 5.1 for PT and calibrated highway parameters from CLTM model. The results indicated that in all time periods the responses were within the acceptable limits.

13.12.3 The outturn fuel cost elasticities from the realism testing of the run are presented in Table 13.11.

Table 13.11 - Car fuel cost elasticities – 20% fuel cost increase

Time Period	Matrix Based			
	Commute	Employer Business	Other	Overall
Target	**Approx. -0.17**	**Approx. -0.2**	**Approx. -0.53**	**-0.25 to -0.35**
AM	-0.187	-0.181	-0.387	-0.257
IP	-0.201	-0.191	-0.416	-0.344
PM	-0.188	-0.181	-0.417	-0.303
Elasticity Results_12 Hour (excl. weekends)	**-0.19**	**-0.186**	**-0.412**	**-0.311**
Elasticity Results_12 Hour (incl. weekends)	**-0.221**	**-0.188**	**-0.414**	**-0.327**

13.12.4 The table indicates final demand model calibration results, based on the changes outlined above. The resulting elasticities (based on all non-fixed trips which are subject to variable demand) have:

- All-purpose all-day elasticities on the right side of -0.3 (result -0.327, is in range of -0.30 to -0.35);
    - IP elasticity for all-purposes is higher than AM & PM.
    - Business elasticity is close to -0.2 target

- Commute elasticity is in the range of -0.15 and -0.2
- Other elasticity is the most sensitive

13.13 Public Transport Fare Elasticities

13.13.1 The elasticity of Public Transport trip kilometres with respect to fare cost increase should lie typically in the range of -0.2 to -0.90. Table 13.12 show an average elasticity for a 20% fare cost increase of -0.388, falling within the required boundary.

13.13.2 In addition, the guidance in paragraph 6.4.22 also suggests that elasticities may be regarded as more plausible if average elasticities show:

- Business and Work to be lower, or weaker, than for Other trips. In our case this is true for every time period.
- AM and PM values to be weaker than inter-peak. In our case AM and PM are -0.379 and -0.389 against -0.390 for the inter-peak.

Table 13.12 – PT fare cost elasticities – 20% fare cost increase

Time Period	Matrix Based			
	Commute	Employer Business	Other	Overall
AM	**-0.329**	**-0.257**	**-0.431**	**-0.379**
IP	-0.307	-0.274	-0.412	-0.39
PM	-0.321	-0.255	-0.448	-0.389
Elasticity Results_12 Hour (excl. weekends)	-0.321	-0.263	-0.424	-0.387
Elasticity Results_12 Hour (incl. weekends)	**-0.452**	**-0.268**	**-0.418**	**-0.388**

13.14 Network Based Elasticities

13.14.1 Network based elasticities were calculated and are presented in Table 13.13 below. This indicates that the elasticities are close to the matrix-based values summarised above.

Table 13.13 – Network Based Elasticities – Results

Time Period	Purpose	Matrix based	Network based
AM	Commute	-0.513	-0.498
	EB	-0.346	-0.291
	Other	-0.883	-0.593
IP	Commute	-0.541	-0.516
	EB	-0.362	-0.215
	Other	-0.951	-0.656
PM	Commute	-0.513	-0.516
	EB	-0.353	-0.23
	Other	-0.95	-0.637

Time Period	Network Based			
	Commute	Employer Business	Other	Overall
Target	**Approx. -0.17**	**Approx. -0.2**	**Approx. -0.53**	**-0.25 to -0.35**
AM	-0.19	-0.12	-0.28	-0.2
IP	-0.2	-0.13	-0.35	-0.27
PM	-0.2	-0.13	-0.35	-0.23
Elasticity Results_12 Hour (excl. weekends)	**-0.2**	**-0.13**	**-0.34**	**-0.25**
Elasticity Results_12 Hour (incl. weekends)	**-0.2**	**-0.13**	**-0.34**	**-0.25**

13.15 Journey Time Elasticity

13.15.1 Car journey time elasticities were calculated using the fuel cost elasticities and cost damping, using the equation below:

$$E^{time} = E^{fuel} \frac{p^{time}}{p^{fuel}}$$

Where $\boldsymbol{p}^{time}$ is cost of travel as a proportion of generalised cost; and $\boldsymbol{p}^{fuel}$ is the cost of fuel as a proportion of total generalised cost.

13.15.2 Furthermore, if the total vehicle kilometres (K) and total vehicle hours (T) are known then the following relationship can be derived:

$$\frac{p^{time}}{p^{fuel}} = \frac{aT}{bK}$$

where ***a*** is the cost per hour; and ***b*** is the cost per km.

13.15.3 Consequently, using the above relationship, the car elasticities of vehicle kms with respect to journey time elasticities have been derived and the results are presented within Table 13.14.

Table 13.14 - Car Journey time elasticities – Results

Time Period	Purpose	Matrix based	Network based
AM	Commute	-0.513	-0.498
	EB	-0.346	-0.291
	Other	-0.883	-0.593
IP	Commute	-0.541	-0.516
	EB	-0.362	-0.215
	Other	-0.951	-0.656
PM	Commute	-0.513	-0.516
	EB	-0.353	-0.23
	Other	-0.95	-0.637

13.15.4 The above table demonstrates that the car journey time elasticities are below the TAG-recommended threshold of -2.0 and are therefore TAG compliant and acceptable to be used as part of forecasting

13.16 DIADEM Convergence

13.16.1 Based on the lambda parameters derived in the realism tests, the forecast models have been run through DIADEM. DIADEM software undertakes the variable demand modelling process in response to changing travel times or costs. The process is iterative and modifies the model demand matrices between SATURN assignments until a balance is achieved between demand and the capacity of the road network. The success in achieving this balance or equilibrium is defined using convergence criteria such as the demand/supply gap, commonly termed '%Gap'.

13.16.2 The objective of this process is to achieve well converged models with realistic demand responses, thereby improving the accuracy of the Scheme benefit calculations. TAG Unit M2 recommends, where possible, to aim to achieve a demand/supply gap of less than 0.1%. If that cannot be reached then a demand/supply gap of no greater than 0.2% is recommended.

13.16.3 The DIADEM models achieved a relative gap convergence level of 0.03% in 10 iterations, which suggests the demand - supply convergence of the variable demand traffic model is acceptable.

13.16.4 The SATURN assignments in each time period have converged in 49, 18 & 26 iterations for the AM, IP, PM assignments respectively meeting the convergence criteria for 4 consecutive iterations. The convergence criteria were set so that over 98% (RSTOP) of link flows do not change by more than 1% (PCNEAR) for 4 (NISTOP) consecutive iterations.

13.16.5 It has therefore been shown that the traffic model is stable and has converged to an acceptable standard.

14. Forecasting

14.1 Introduction

14.1.1 Car demand forecasting undertaken for the A582 scheme (2024 and 2039) were used as the Cottam Parkway Station reference case scenario. The EDGE database provided growth rates for the background rail demand for each of the modelled forecast years. The site-specific rail trips were estimated by applying on the MOIRA based trip rates to developments using stations catchments (distance to stations).

14.1.2 The rail sub mode choice is modelled in EMME which provides the choice of either using public transport all the way or using the P&R facility. The resultant mode choice results are then used to estimate the PT composite costs, which is fed back to DIADEM to get the updated main mode choice demand. The mode choice model is used to estimate the change in mode share when Cottam Parkway station is included in the model.

14.2 Overall Approach

14.2.1 EMME PT model was used to assess rail forecasts for Cottam Parkway Station. There are two main elements covered:

- Changes in demand at existing stations from new or amended services (including suppression of demand by extra station calls); and
- Demand at newly opened stations (including assessment of the number of trips that are made by people who are already rail users, albeit using other stations).

14.3 Demand Growth

14.3.1 In order to use the transport model to assess the impact of the Cottam Parkway Station, the forecast matrices for 2024 and 2039 are required. These combine general background growth and details of specific developments. A mode choice model is then applied which estimate the number of public transport trips.

14.3.2 To be consistent with the highway model forecasts, the predicted rail growth in 24-hour rail trip productions and attractions were initially estimated using growth forecast by the National Trip End Model. This data was extracted using TEMPro version 7.2.

Table14. 1 TEMPro Growth Factor – PA Average Weekday (2019-2024)

NTEM forecasts produced public transport (rail) users is summarised in Table 9-1 and Table 9-2 below.

Area Description		HB Work		HB Employers Business		HBO	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction
Region	NW	0.997	0.997	0.995	0.995	0.986	0.986
County	Lancashire	1.009	1.009	0.998	0.998	0.984	0.984
Authority	Preston	1.036	1.010	0.999	0.999	0.988	0.986

Table 14.2 TEMPro Growth Factor – PA Average Weekday (2019-2039)

Area Description		HB Work		HB Employers Business		HBO	
Level	Name	Production	Attraction	Production	Attraction	Production	Attraction
Region	NW	0.997	0.997	1.000	1.000	0.989	0.989
County	Lancashire	1.020	1.019	1.007	1.006	0.983	0.982
Authority	Preston	1.065	1.023	1.007	1.009	0.989	0.986

14.3.3 As summarised in the above tables, the growth factors predicted by NTEM looks significantly low when compared to the highway demand growth. To ensure the growth factors are reasonable, Rail growth using DfT's EDGE forecasts were also estimated. Also, it should be noted that the EDGE forecasts were taken for the ongoing Cottam Business Study and was deemed better to use the same growth factors to have consistent forecasting approach. The EDGE database provides growth rates of the rail demand on a geographical basis, which was matched with the station-to-station flows for which the forecasts of rail patronage are required.

14.3.4 Forecast rail growth was applied using DfT EDGE exogenous growth factors (version OR55) as a constraint on total growth.

14.3.5 EDGE growth was available for flows between major stations within regions. Each model zone was assigned to the nearest major station for application of rail growth, this follows Local Authority District boundaries where possible.

14.3.6 Growth factors were calculated from the base year 2019 to each of the forecast years. The growth factors by major station area are shown in Table 14.3.

Table 14.3 EDGE Rail Forecast

Area	Year	Growth
Preston	2024	1.044
Blackpool North	2024	1.041
Blackburn	2024	1.038
Manchester	2024	1.036
GB	2024	1.056
Preston	2039	1.260
Blackpool North	2039	1.256
Blackburn	2039	1.214
Manchester	2039	1.234
GB	2039	1.309

14.3.7 Rail trips from local development were calculated for home-based trip purposes only. This is deemed appropriate, since local development trips were small and neared negligible amounts once disaggregated by journey purpose and time period.

14.3.8 Local development rail weekday trip ends were calculated by multiplying expected development population by a 2019 weekday rail trip rate for the nearest station. The trip rate was derived by dividing MOIRA demand by population within 1.2km or 5km bands of the station. Full population data by band was only available for Preston station, other station trip rates were pro-rata'd based on station usage.

14.3.9 In total there are 221 and 409 local development weekday trips in 2024 and 2039 respectively.

14.3.10 This approach takes account of distance to station and rail service patterns at the nearest station in the estimate of trips expected to use the rail network from local development sites.

14.3.11 Local development trip ends were then distributed using parental zones in the base year to create a development matrix for each trip purpose and time period.

14.3.12 To constrain forecast trips, the EDGE growth was applied to the 2019 base year demand, then the distributed development trip ends were subtracted. The remaining trip ends were used to furness the base year matrices to get background growth.

14.3.13 The sum of development trips and background growth trips equals EDGE trip constraints.

14.4 Rail Fare Increases

14.4.1 Public transport fares were assumed to rise in line with the retail price index over the forecast period and as such were treated as being constant in real terms. As per TAG unitA5-3 Rail Appraisal, demand and revenue forecasts should be based on current fares policy (usually a nominal increase of RPI+X%). Nominal fare increases should be converted to real terms using the GDP deflator. TAG Data Book Table A5.3.1 provides the relevant GDP deflator and RPI series.

Table 14.4 Rail Fare Increases

Year	RPI +1 % index	GDP Deflator index	Rail fare increase index	Rail Fare increase from 2019
2019	1.4	1.17	1.2	
2024	1.71	1.29	1.32	1.1
2039	5.04	2.39	2.11	1.76

14.5 Cottam Rail Services

14.5.1 The 2016 business case development included timetable analysis of the options for the train service level that might call at a new facility concluded three service options.

- Option 1: Three trains per hour
  - 1 tph Blackpool North – Manchester Airport;
  - 1 tph Blackpool North – Manchester Piccadilly, and;
  - 1 tph Blackpool North – York.
- Option 2: Four trains per hour
  - Additional 1 tph Blackpool North – Liverpool Lime Street.
- Option 3: Five trains per hour
  - Additional 1 tph Blackpool South – Colne.

14.5.2 2019 study reconfirmed the routes after electrification of the route and recommended following services for Cottam Station:

- The Blackpool North - York service – 3tph
- The Blackpool North - Manchester Airport – 3tph

- the Blackpool North - Hazel Grove service –3 tph
- To Preston – 3 tph
- To Manchester Piccadilly – 2 tph
- To Blackburn – 1 tph
- To Halifax and York – 1 tph
- To Manchester Airport – 1 tph
- To Stockport – 1 tph

14.6 Fixed Demand Model Runs

14.6.1 Fixed demand models have been prepared as a reference case, which provides the best estimate of what traffic conditions will look like in the forecast model years of 2024 and 2039 with and without the Cottam Parkway Station prior VDM.

14.7 Fixed Demand SATURN Outputs

14.7.1 SATURN traffic flow comparison plots were produced to understand the growth between base year and forecast year and the changes between the Do Minimum and Do Something scenarios. The forecast change between Base (2019) and Baseline traffic flows (PCUs) on links are shown for the AM and PM peak hours in the following sections.

Base Year Vs Do Minimum

14.7.2 The forecast change between Base (2019) and Forecast Year 2024 Do Minimum flows on links are shown for the AM and PM peak hours in Figure 14.1 through Figure 14.2. Green bars represent increase in traffic while blue bars represent decreases. In general traffic flows across all corridor have increased. Where there are network changes such as the Preston Western Distributor Road and East West link Road, the traffic flow differences are not visible due to model network differences. Traffic flow reduction is also seen for some roads in the vicinity of roads where future highway schemes is proposed. Similar traffic patterns can be seen for both 2024 and 2039 future year scenarios.

Figure 14.1 Do Minimum 2024 Vs Base Year Traffic Flows – AM Peak

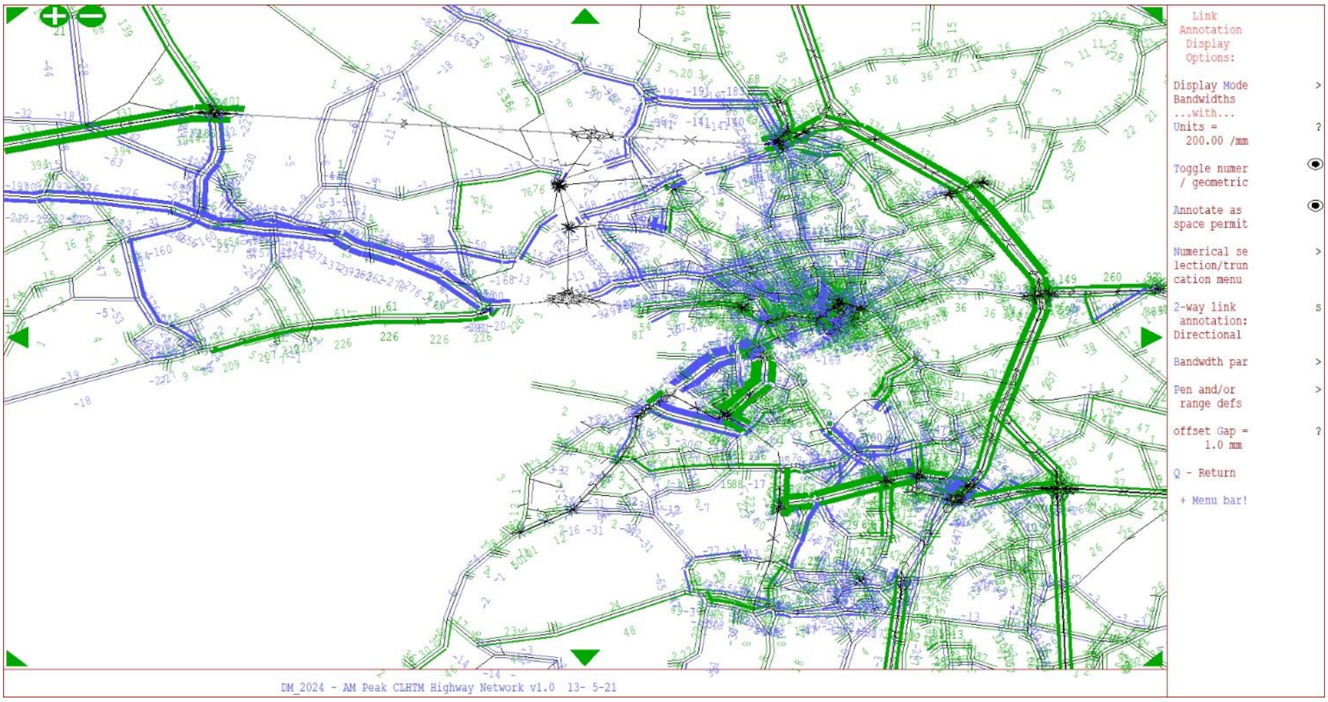


Figure 14.2 Do Minimum 2024 Vs Base Year Traffic Flows – PM Peak

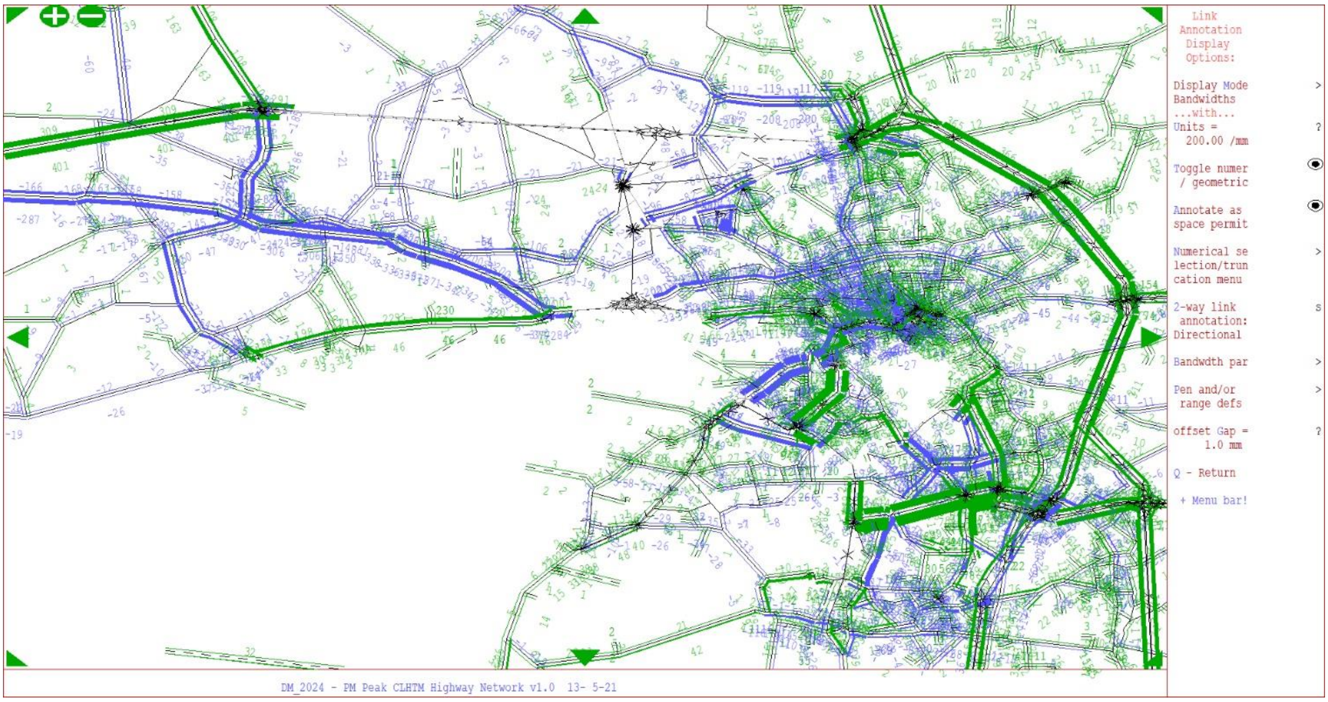


Figure 14.3 Do Minimum 2039 Vs Base Year Traffic Flows – AM Peak

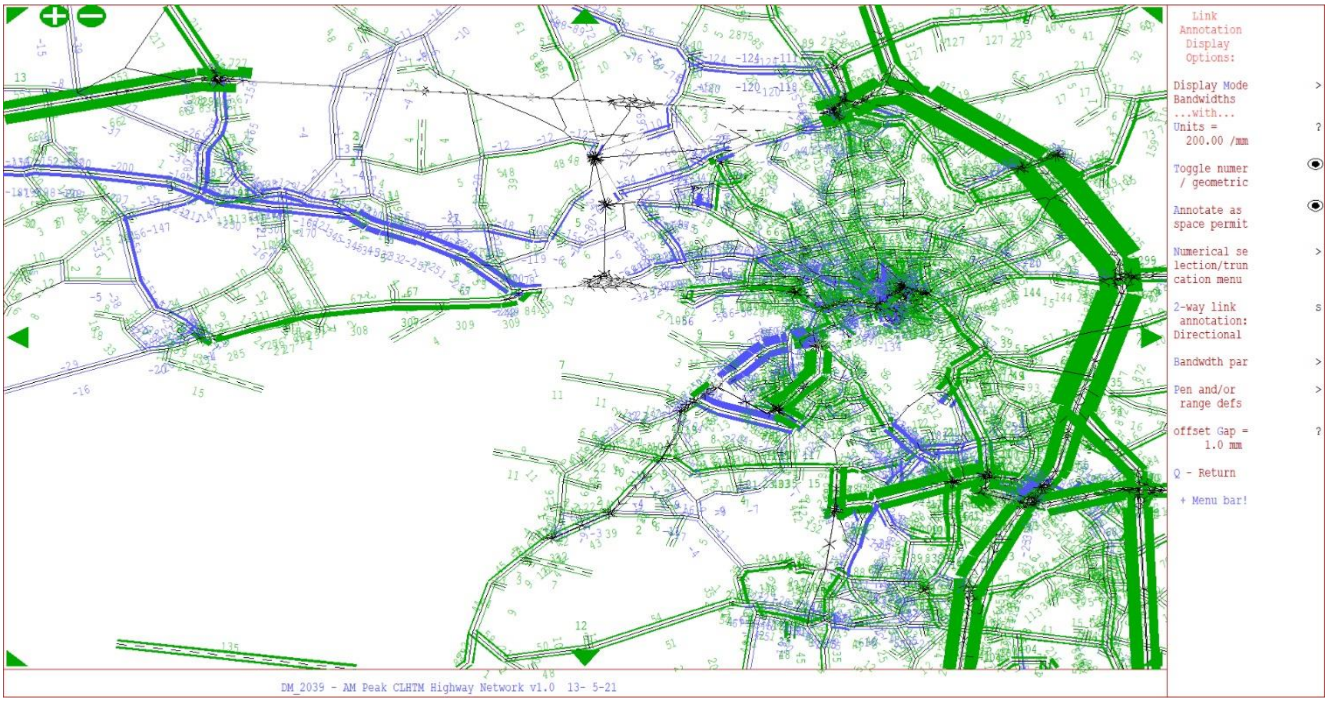
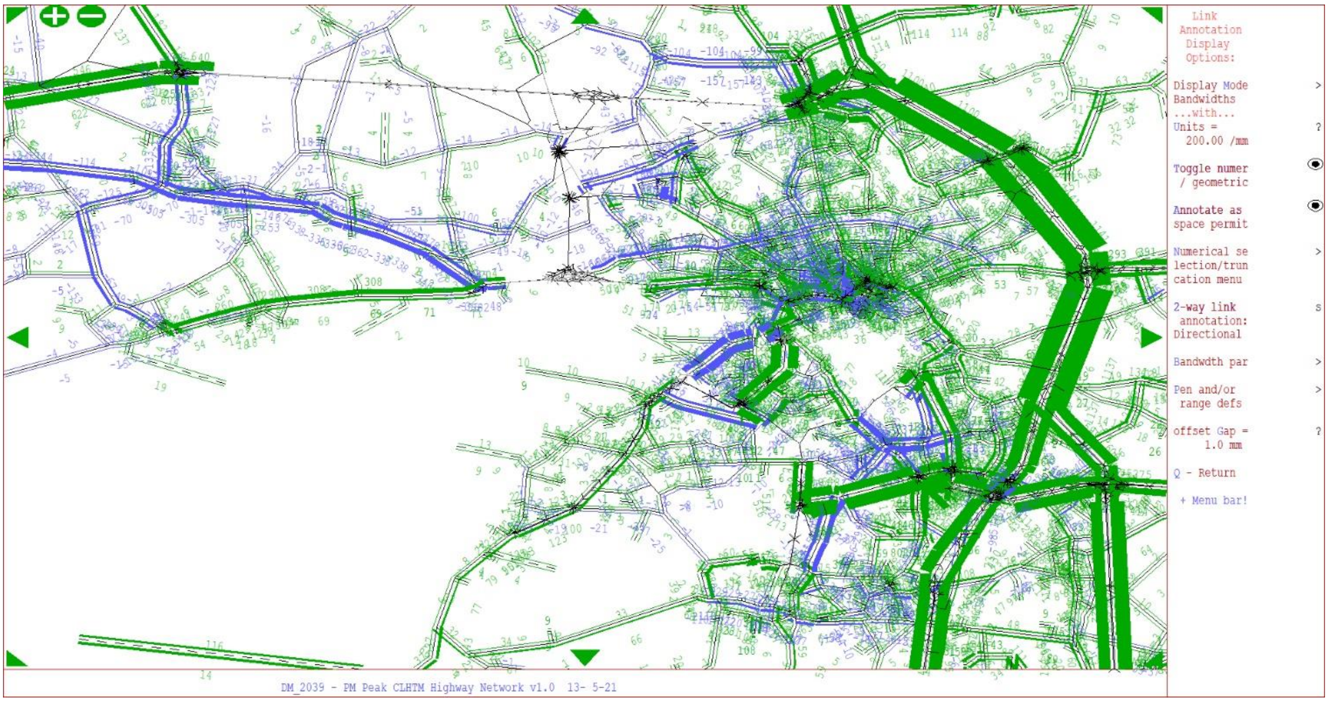


Figure 14.4 Do Minimum 2039 Vs Base Year Traffic Flows – PM Peak



Do Minimum Vs Do Something

14.7.3 Traffic flow comparisons between Do Minimum and Do Something forecast year flows are shown in Figure 14.1 through to Figure 14.8.

14.7.4 Green bars represent increase in traffic in Do Something scenario while blue bars represent decreases. As expected, the only significant change in traffic flows is seen around the Cottam Station access roads along Lea Road and along the PWD Road. The pattern is similar in both 2024 and 2039 future year scenarios.

Figure 14.5 2024 Do Minimum Vs Do Something Traffic Flows – AM Peak

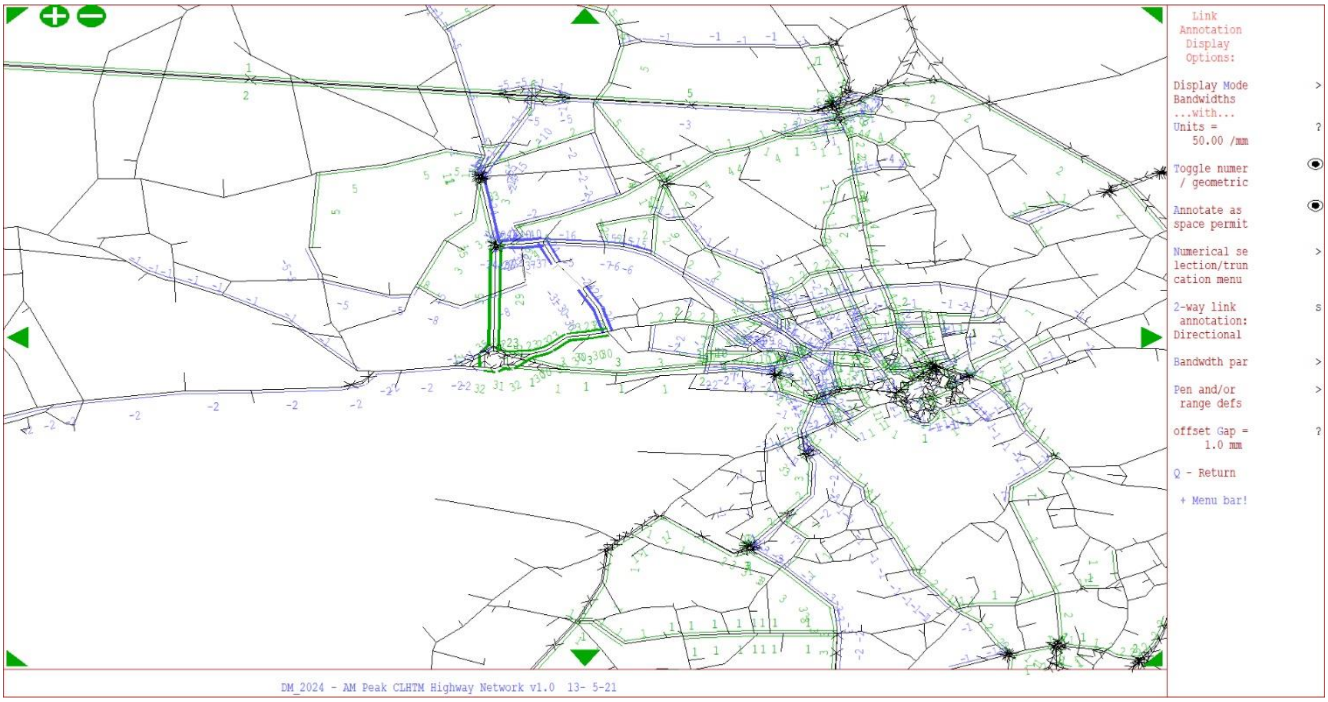


Figure 14.6 2024 Do Minimum Vs Do Something Traffic Flows – PM Peak

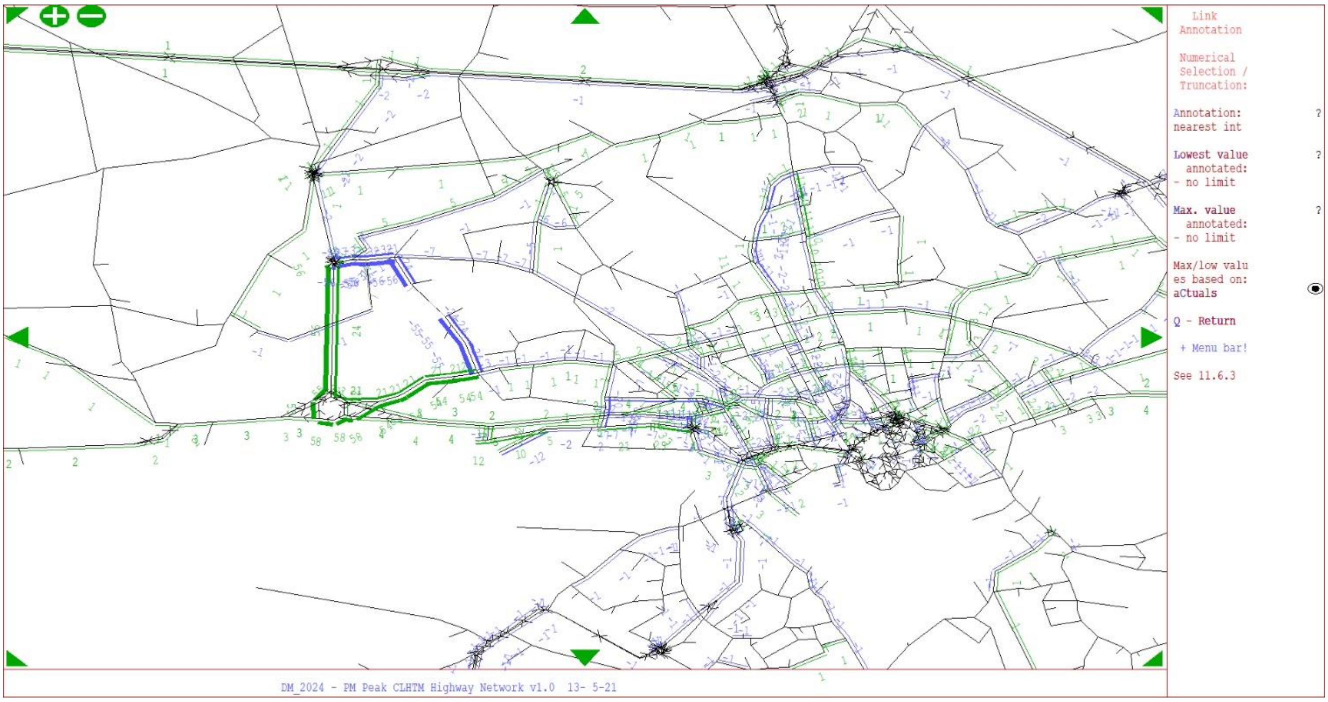


Figure 14.7 2039 Do Minimum Vs Do Something Traffic Flows – AM Peak

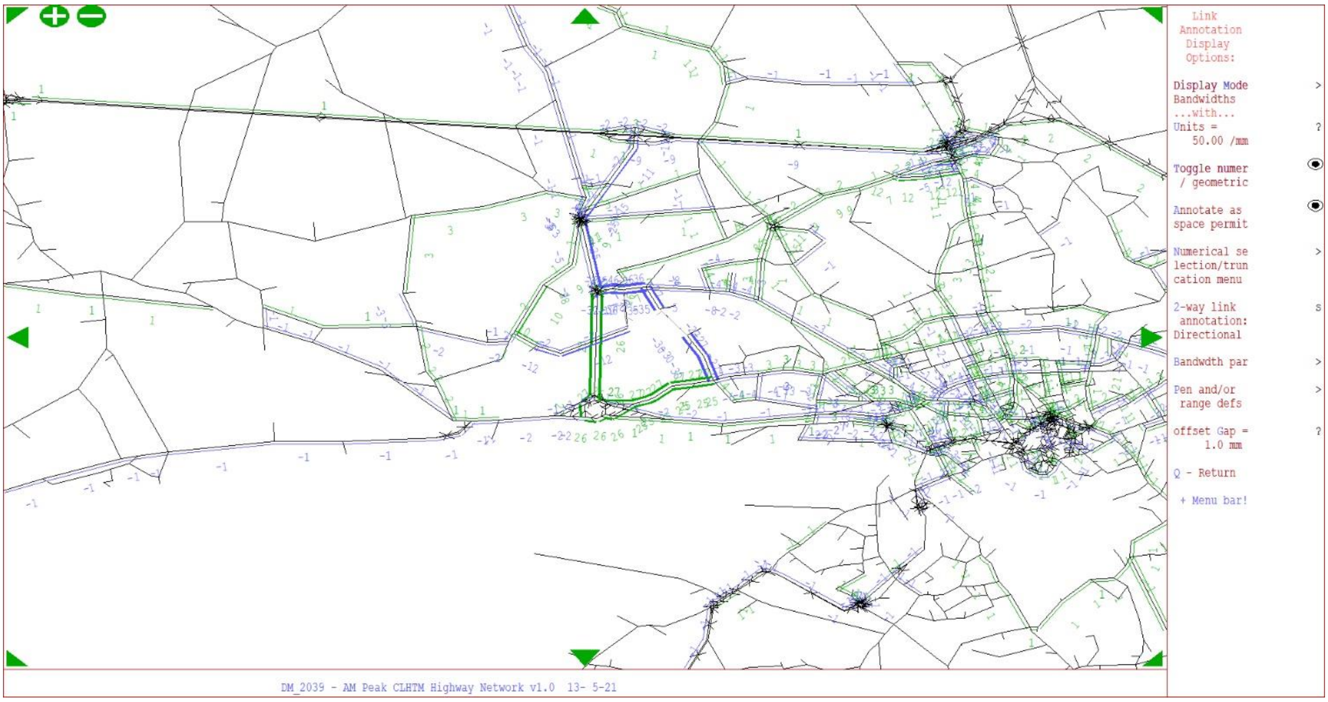
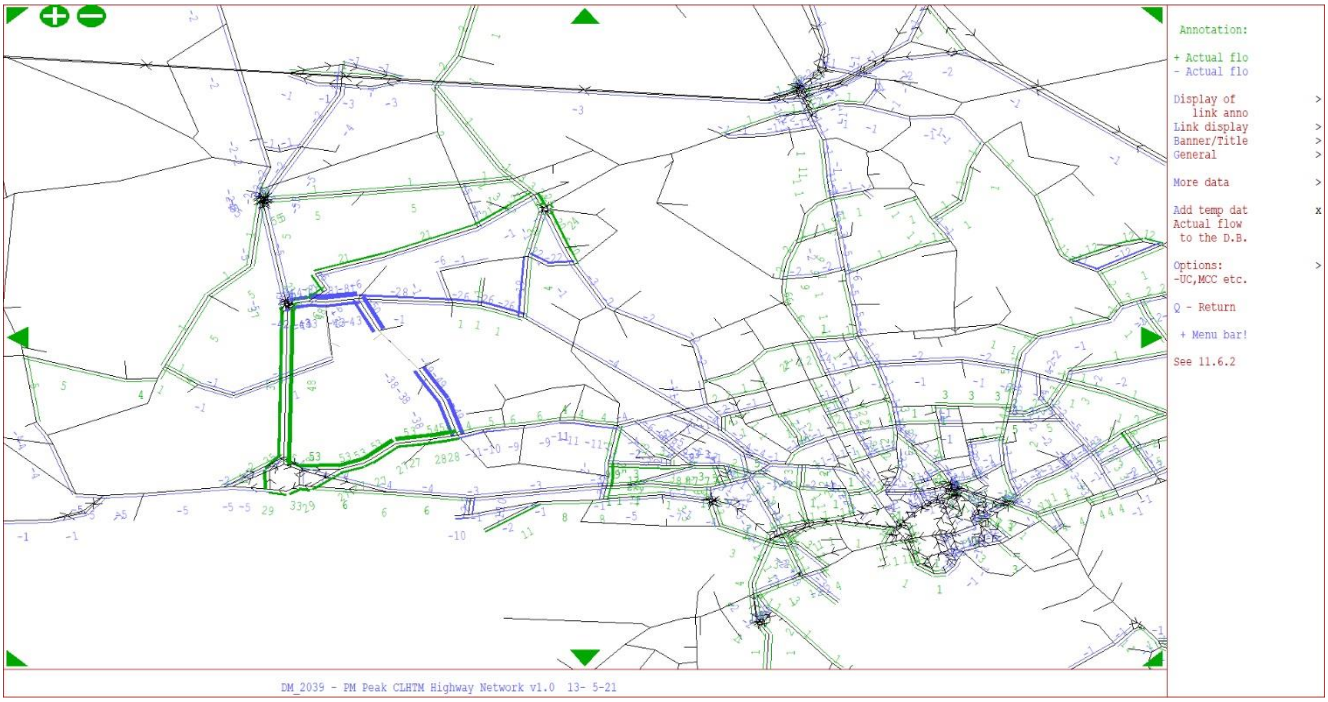


Figure 14.8 2039 Do Minimum Vs Do Something Traffic Flows – PM Peak



14.8 Fixed Demand EMME Outputs

14.8.1 EMME runs were undertaken with highway costs from fixed demand SATURN model runs and rail matrices projected for each of the future years using DfT's EDGE growth factors. Model runs were undertaken for both Do Minimum and Do Something scenarios and results are presented in the following summary tables.

14.8.2 Key points observed are:

- Background increase in rail passenger from base to future year 2024 Do Minimum scenario is around 5.9% consistent with the EDGE predicted rail growth.
- Background increase in rail passenger from base to future year 2039 Do Minimum scenario is around 26% consistent with the EDGE predicted rail growth.
- For future year 2024 Cottam Parkway Railway Station is predicted to serve 1,146 daily passengers, of which 921 (80%) passenger trips are abstracted from other nearby stations, primarily from Preston station and Buckshaw Parkway Station. Remaining 20% trips are newly generated trips.
- For future year 2039 Cottam Parkway Railway Station is predicted to serve 1,573 daily passengers, of which 1,248 (80%) passenger trips are abstracted from other nearby stations, primarily from Preston station and Buckshaw Parkway Station. Remaining 20% trips are newly generated trips.

14.8.3 Table 14.5 and Table 14.6 summarises the growth of rail passenger demand across all internal stations from base year to future years. Table 14.7 and Table 14.8 summarises the comparison between Do Minimum and Do Something scenario.

Table 14.5 Base Year Vs 2024 Do Minimum

Station Name	Average 24hr Weekday. Modelled Flow - 2019 Base Year	Average 24hr Weekday. Modelled Flow- DM 2024 Fixed Demand	Actual Difference Base - 2024 DM
Adlington (Lancs) Rail Station	407	423	16
Ansdell & Fairhaven Rail Station	60	63	3
Blackburn Rail Station	3,261	3,406	144
Bamber Bridge Rail Station	226	237	11
Blackpool Pleasure Beach Rail Station	239	253	13
Blackpool North Rail Station	4,250	4,525	275
Blackpool South Rail Station	281	297	17
Buckshaw Parkway Rail Station	1,193	1,339	146
Chorley Rail Station	1,561	1,629	68
Croston Rail Station	132	137	5
Cherry Tree Rail Station	89	93	4
Darwen Rail Station	902	950	48
Euxton Balshaw Lane Rail Station	248	260	12
Entwistle Rail Station	35	37	1
Kirkham & Wesham Rail Station	795	839	44
Layton (Lancs) Rail Station	98	104	6
Leyland Rail Station	899	951	53
Lostock Hall Rail Station	119	123	4
Lytham Rail Station	166	176	10
Mill Hill (Lancs) Rail Station	222	231	9
Moss Side Rail Station	15	17	2
Poulton-le-Fylde Rail Station	1,123	1,195	72
Pleasington Rail Station	20	21	1
Preston Rail Station	14,097	14,941	843
St Annes-on-the-Sea Rail Station	398	422	25
Salwick Rail Station	10	11	1
Squires Gate Rail Station	62	65	4
Total	**30,908**	**32,745**	**1,837**
Percentage Change			**5.94%**

Table 11.6 Base Year Vs 2039 Do Minimum

Station Name	Average 24hr Weekday. Modelled Flow - 2019 Base Year	Average 24hr Weekday. Modelled Flow- DM 2039 Fixed Demand	Actual Difference Base - 2039 DM
Adlington (Lancs) Rail Station	407	497	91
Ansdell & Fairhaven Rail Station	60	76	17
Blackburn Rail Station	3,261	3,983	722
Bamber Bridge Rail Station	226	283	56
Blackpool Pleasure Beach Rail Station	239	307	67
Blackpool North Rail Station	4,250	5,464	1,214
Blackpool South Rail Station	281	358	78
Buckshaw Parkway Rail Station	1,193	1,653	460
Chorley Rail Station	1,561	1,923	362
Croston Rail Station	132	161	29
Cherry Tree Rail Station	89	109	19
Darwen Rail Station	902	1,108	206
Euxton Balshaw Lane Rail Station	248	305	56
Entwistle Rail Station	35	42	7
Kirkham & Wesham Rail Station	795	1,001	206
Layton (Lancs) Rail Station	98	125	27
Leyland Rail Station	899	1,140	241
Lostock Hall Rail Station	119	144	26
Lytham Rail Station	166	211	45
Mill Hill (Lancs) Rail Station	222	272	51
Moss Side Rail Station	15	20	5
Poulton-le-Fylde Rail Station	1,123	1,437	314
Pleasington Rail Station	20	24	4
Preston Rail Station	14,097	17,936	3,839
St Annes-on-the-Sea Rail Station	398	509	111
Salwick Rail Station	10	13	2
Squires Gate Rail Station	62	78	16
Total	**30,908**	**39,181**	**8,273**
Percentage Change			**26.76%**

Table 11.7 Do Minimum 2024 Vs Do Something 2024

Station Name	Average 24hr Weekday. Modelled Flow- DM 2024 Fixed Demand	Average 24hr Weekday. Modelled Flow- DS 2024 Fixed Demand	Actual Difference 2024 DM-DS
Adlington (Lancs) Rail Station	423	423	0
Ansdell & Fairhaven Rail Station	63	64	2
Blackburn Rail Station	3,406	3,409	3
Bamber Bridge Rail Station	237	237	0
Blackpool Pleasure Beach Rail Station	253	254	2
Blackpool North Rail Station	4,525	4,538	13
Blackpool South Rail Station	297	300	3
Buckshaw Parkway Rail Station	1,339	1,247	-92
Chorley Rail Station	1,629	1,628	-2
Croston Rail Station	137	137	0
Cherry Tree Rail Station	93	93	0
Darwen Rail Station	950	951	1
Euxton Balshaw Lane Rail Station	260	262	2
Entwistle Rail Station	37	37	0
Kirkham & Wesham Rail Station	839	788	-51
Layton (Lancs) Rail Station	104	104	0
Leyland Rail Station	951	954	3
Lostock Hall Rail Station	123	123	0
Lytham Rail Station	176	175	-1
Mill Hill (Lancs) Rail Station	231	231	0
Moss Side Rail Station	17	18	1
Poulton-le-Fylde Rail Station	1,195	1,194	-1
Pleasington Rail Station	21	21	0
Preston Rail Station	14,941	14,177	-764
St Annes-on-the-Sea Rail Station	422	423	1
Salwick Rail Station	11	-	-11
Squires Gate Rail Station	65	64	-1
Cottam Rail Station (DS)	-	1,146	1146
Total	**32,745**	**32,997**	**252**

Table 11.8 Do Minimum 2039 Vs Do Something 2039

Station Name	Average 24hr Weekday. Modelled Flow- DM 2039 Fixed Demand	Average 24hr Weekday. Modelled Flow- DS 2039 Fixed Demand	Actual Difference 2039 DM-DS
Adlington (Lancs) Rail Station	497	497	0
Ansdell & Fairhaven Rail Station	76	77	1
Blackburn Rail Station	3,983	3,986	3
Bamber Bridge Rail Station	283	284	1
Blackpool Pleasure Beach Rail Station	307	307	0
Blackpool North Rail Station	5,464	5,487	23
Blackpool South Rail Station	358	362	3
Buckshaw Parkway Rail Station	1,653	1,531	-122
Chorley Rail Station	1,923	1,919	-4
Croston Rail Station	161	162	1
Cherry Tree Rail Station	109	109	0
Darwen Rail Station	1,108	1,108	0
Euxton Balshaw Lane Rail Station	305	306	2
Entwistle Rail Station	42	42	0
Kirkham & Wesham Rail Station	1,001	939	-63
Layton (Lancs) Rail Station	125	127	2
Leyland Rail Station	1,140	1,142	2
Lostock Hall Rail Station	144	145	0
Lytham Rail Station	211	210	-1
Mill Hill (Lancs) Rail Station	272	274	1
Moss Side Rail Station	20	21	1
Poulton-le-Fylde Rail Station	1,437	1,438	1
Pleasington Rail Station	24	24	0
Preston Rail Station	17,936	16,890	-1046
St Annes-on-the-Sea Rail Station	509	511	2
Salwick Rail Station	13	-	-13
Squires Gate Rail Station	78	76	-2
Cottam Rail Station (DS)	-	1,573	**1,573**
Total	**39,181**	**39,547**	**366**

14.9 Variable Demand Model Runs

14.9.1 For each of the forecast year, VDM runs are undertaken pivoting from the reference year costs for each of the three time periods:

- Do Minimum: the matrices were uplifted as per TAG recommendation to account for income and fuel factor as VDM for Do Minimum scenario was not undertaken.

- Do Something takes as its input the Do Minimum uplifted matrices and the Do Something network and outputs a set of post-VDM Do Something matrices. Do something is pivoted off the Do Minimum costs.

14.10 VDM Highway Results

14.10.1 The output matrix resulting from VDM varies between the Do Minimum and Do Something scenarios. This is because the travel cost for vehicle trips affected by the Cottam Parkway Station is likely to show some reduction due to an alternative train station available in the Do Something scenario and consequently could lead to induced traffic. The increase in PT demand is seen overall, which means that an increase in number of passenger trips were noted across many of the internal stations.

Table 14.9 Changes in Trips – Car

Year	Scenario	AM	IP	PM
2024	Base	358,879	253,624	348,025
	Do Minimum	375,293	266,461	364,392
	Do Something	375,303	266,464	364,414
	Change from Base to Do Minimum	4.6%	5.1%	4.7%
	Change from Do Minimum to Do Something	0.0027%	0.0011%	0.0060%
2039	Base	358,879	253,624	348,025
	Do Minimum	422,802	302,764	411,873
	Do Something	422,470	302,411	411,620
	Change from Base to Do Minimum	17.8%	19.4%	18.3%
	Change from Do Minimum to Do Something	-0.0783%	-0.1168%	-0.0614%

14.10.2 The increase in trips between the base year and forecast Do Minimum is largely a result of traffic growth and is in line with the TEMPro forecast projections for the study area.

14.10.3 The difference in highway trips between the Do Minimum and Do Something captures the modal shift response that is predicted to result from the introduction of the Scheme. Forecast year 2024 shows a slight increase in highway traffic due to a small proportion of public transport users shifting to car, which is because of less traffic congestion in 2024 and rail fare increases. However, in forecast year 2039 a minor decrease in highway traffic is seen as a result of modal shift response from car to public transport as people would respond to changes in highway network congestion and public transport cost.

14.11 VDM Public Transport Results

14.11.1 Public transport demand obtained from the VDM process was compared to see the impact of VDM. Table 14.10 presents the changes in PT demand from the Do Minimum and Do Something demand model, through the VDM process. The key points to note are:

- ▪ PT demand marginally increases for year 2024 across all time periods
- ▪ Increase in PT trips is observed for year 2039 across all time periods

Table 14.10 Public Transport Passenger Trips – 24 hrs

Scenario	AM	IP	PM	OP	Total
2024 DM	3,709	6,934	3,859	3,329	17,832
2024 DS	3,735	6,952	3,880	3,351	17,917
2024 (DS-DM)	25	17	21	21	85
2024 PT Increase (%)	1%	0%	1%	1%	0%
2039 DM	4,422	8,325	4,604	3,992	21,343
2039 DS	6,029	11,911	6,259	5,218	29,417
2039 (DS-DM)	1,607	3,585	1,656	1,226	8,074
2039 PT Increase (%)	36%	43%	36%	31%	38%

14.12 POST VDM EMME Outputs

14.12.1 EMME runs were undertaken using the post VDM PT matrices and highway costs from post VDM SATURN runs. Do Minimum and Do Something scenario PT runs were compared to see the impact of VDM on rail passenger demand. As observed in the post VDM highway trips, for year 2024 a marginal increase in overall PT trips is seen with an increase of 4% daily passenger trips for Cottam Parkway station.

14.12.2 For year 2039, the VDM process has increased the overall passenger trips by 25%, with an increase of 30% (479 passenger trips) daily passenger trips for Cottam Parkway station.

14.12.3 It should be noted that the existing rail users will experience an increase in travel time because of the additional stops at Cottam Parkway Station. These act as a counterweight to the time savings experienced by new rail users and existing rail users in the study area.

Table 14.11 Post VDM Do Minimum 2024 Vs Do Something 2024

Station Name	Average 24hr Weekday. Modelled Flow- DM 2024 Post VDM	Average 24hr Weekday. Modelled Flow- DS 2024 Post VDM	Actual Difference 2024 DM-DS
Adlington (Lancs) Rail Station	423	423	0
Ansdell & Fairhaven Rail Station	63	64	2
Blackburn Rail Station	3,406	3,400	-6
Bamber Bridge Rail Station	237	242	5
Blackpool Pleasure Beach Rail Station	253	253	1
Blackpool North Rail Station	4,525	4,544	18
Blackpool South Rail Station	297	300	3
Buckshaw Parkway Rail Station	1,339	1,236	-103
Chorley Rail Station	1,629	1,650	21
Croston Rail Station	137	144	7
Cherry Tree Rail Station	93	97	4
Darwen Rail Station	950	934	-16
Euxton Balshaw Lane Rail Station	260	252	-8
Entwistle Rail Station	37	38	1
Kirkham & Wesham Rail Station	839	804	-34
Layton (Lancs) Rail Station	104	104	1
Leyland Rail Station	951	959	7
Lostock Hall Rail Station	123	119	-3
Lytham Rail Station	176	172	-5
Mill Hill (Lancs) Rail Station	231	242	11
Moss Side Rail Station	17	13	-4
Poulton-le-Fylde Rail Station	1,195	1,202	6
Pleasington Rail Station	21	21	0
Preston Rail Station	14,941	14,224	-717
St Annes-on-the-Sea Rail Station	422	425	3
Salwick Rail Station	11	-	-11
Squires Gate Rail Station	65	65	0
Cottam Rail Station (DS)	-	1,196	**1,196**
Total	**32,745**	**33,124**	**379**

Table 14.12 Post VDM Do Minimum 2039 Vs Do Something 2039

Station Name	Average 24hr Weekday. Modelled Flow- DM 2039 Fixed Demand	Average 24hr Weekday. Modelled Flow- DS 2039 Fixed Demand	Actual Difference 2024 DM-DS
Adlington (Lancs) Rail Station	497	575	78
Ansdell & Fairhaven Rail Station	76	98	22
Blackburn Rail Station	3,983	4,815	832
Bamber Bridge Rail Station	283	344	61
Blackpool Pleasure Beach Rail Station	307	384	77
Blackpool North Rail Station	5,464	7,391	1928
Blackpool South Rail Station	358	521	163
Buckshaw Parkway Rail Station	1,653	1,929	276
Chorley Rail Station	1,923	2,335	412
Croston Rail Station	161	196	35
Cherry Tree Rail Station	109	137	28
Darwen Rail Station	1,108	1,306	198
Euxton Balshaw Lane Rail Station	305	355	51
Entwistle Rail Station	42	56	13
Kirkham & Wesham Rail Station	1,001	1,104	103
Layton (Lancs) Rail Station	125	173	48
Leyland Rail Station	1,140	1,396	256
Lostock Hall Rail Station	144	171	27
Lytham Rail Station	211	257	45
Mill Hill (Lancs) Rail Station	272	341	68
Moss Side Rail Station	20	18	-1
Poulton-le-Fylde Rail Station	1,437	2,000	563
Pleasington Rail Station	24	29	5
Preston Rail Station	17,936	20,488	2552
St Annes-on-the-Sea Rail Station	509	642	133
Salwick Rail Station	13	-	-13
Squires Gate Rail Station	78	98	20
Cottam Rail Station (DS)	-	2,052	**2,052**
Total	**39,181**	**49,212**	**10,031**

14.12.4 Park & Ride at Preston, Buckshaw and Cottam for the Do Minimum and Do Something scenarios for year 2024 and 2039 is summarised in Table 14.13 to Table 14.15.

Table 14.13 2024 Do Minimum Park & Ride Trips

Peak Hour	Boarding			Alighting		
	Preston	Buckshaw	Cottam	Preston	Buckshaw	Cottam
AM	44	41	26	10	8	6
IP	32	21	17	22	17	13
PM	29	22	18	64	51	37
OP	11	5	5	18	14	11

Table 14.142024 Do Something Park & Ride Trips

Peak Hour	Boarding		Alighting	
	Preston	Buckshaw	Preston	Buckshaw
AM	67	56	15	11
IP	51	31	35	25
PM	42	31	99	71
OP	17	8	28	20

Table 14.15 2039 Do Minimum Park & Ride Trips

Peak Hour	Boarding			Alighting		
	Preston	Buckshaw	Cottam	Preston	Buckshaw	Cottam
AM	70	64	48	16	12	10
IP	55	36	32	37	28	23
PM	42	34	30	101	79	66
OP	17	9	9	30	23	19

14.13 Benchmarking

14.13.1 The scheme is expected to generate 371k passenger journeys per annum at the new station, around 1,196 passenger journeys per day by year 2024. And is expected to generate 638k passenger journeys per annum at the new station, around 2,052 passenger journeys per day by year 2039. This around the level observed at Buckshaw Parkway and within the range of other main stations along the Preston – Blackpool line.

14.13.2 The expected passenger demand also compares well with the initial passenger demand forecasts produced as part of Cottam Parkway Business case study.

14.14 Network Performance

14.14.1 The total vehicle kilometres travelled and total vehicle hours recorded on the network, in relation to the number of trips made, provide an indication of the level of efficiency of the network. Higher vehicle kilometres indicate that people have to travel further or take longer routes to reach their destination. Higher vehicle hours indicate that people are taking longer to travel to their destinations suggesting a more congested network.

14.14.2 The difference in vehicle trips, kilometres and hours travelled between the Do Minimum and Do Something scenarios represents the impact of having Cottam Parkway Station. The results show that there is very minimal change in the Do Minimum and Do Something scenario.

14.14.3 The relative change in vehicles, kilometres and hours travelled between the key scenarios is summarised in Table 14.17 and Table 14.18.

Table 14.17 Changes in Vehicle – Kilometres

Year	Scenario	AM	IP	PM
2024	Base	1,320,349	1,037,579	1,337,440
	Do Minimum	1,392,530	1,095,719	1,414,808
	Do Something	1,392,876	1,095,956	1,415,570
	Change from Base to Do Minimum	5.5%	5.6%	5.8%
	Change from Do Minimum to Do Something	0.0248%	0.0217%	0.0539%
2039	Base	1,320,349	1,037,579	1,337,440
	Do Minimum	1,611,873	1,279,932	1,648,534
	Do Something	1,610,417	1,277,077	1,647,824
	Change from Base to Do Minimum	22.1%	23.4%	23.3%
	Change from Do Minimum to Do Something	-0.0903%	-0.2231%	-0.0431%

14.14.4 The increase in vehicle-kilometres between the base year and forecast Do Minimum in both forecast years is predicted to be similar to the growth in number of trips. The increase in vehicle-hours between the base year and forecast Do Minimum in 2024 is predicted to be slightly higher than the growth in number of vehicle-kilometres discussed above. By 2039 this difference is forecast to become significant. This illustrates the increasing level of traffic congestion predicted to result from general traffic growth.

14.14.5 The difference in highway vehicle-kilometres between the Do Minimum and Do Something captures the distance savings that are predicted to result from the introduction of the Scheme. Similar to the trips comparison, a slight decrease in vehicle hours and kilometres is observed for the year 2024 across all time periods. However, in 2039 vehicle-kilometre savings are achieved despite the number of trips increasing slightly and trips lengthening in response to the Scheme.

Table 14.18 Changes in Vehicle – Hours

Year	Scenario	AM	IP	PM
2024	Base	23,901	17,455	24,233
	Do Minimum	25,007	18,241	25,419
	Do Something	25,010	18,242	25,441
	Change from Base to Do Minimum	4.6%	4.5%	4.9%
	Change from Do Minimum to Do Something	0.0128%	0.0049%	0.0881%
2039	Base	23,901	17,455	24,233
	Do Minimum	30,961	21,867	31,919
	Do Something	30,915	21,808	31,910
	Change from Base to Do Minimum	29.5%	25.3%	31.7%
	Change from Do Minimum to Do Something	-0.1499%	-0.2694%	-0.0269%

14.15 Catchment Areas

14.15.1 Rail origin and destinations for Cottam Station were extracted from respective EMME future year models to ensure that the potential catchment area for Cottam Parkway Station were realistic and reasonable. It was assumed that the key walk and cycle catchment area is 1.2km and the wider access area is 5km.

14.15.2 Figure 14.9 through Figure 14.12 shows the catchment areas for 1.2km and 5km for forecast year 2024 and 2039.

Figure 14.9 2024 PT Trips within 1.2km Catchment Area

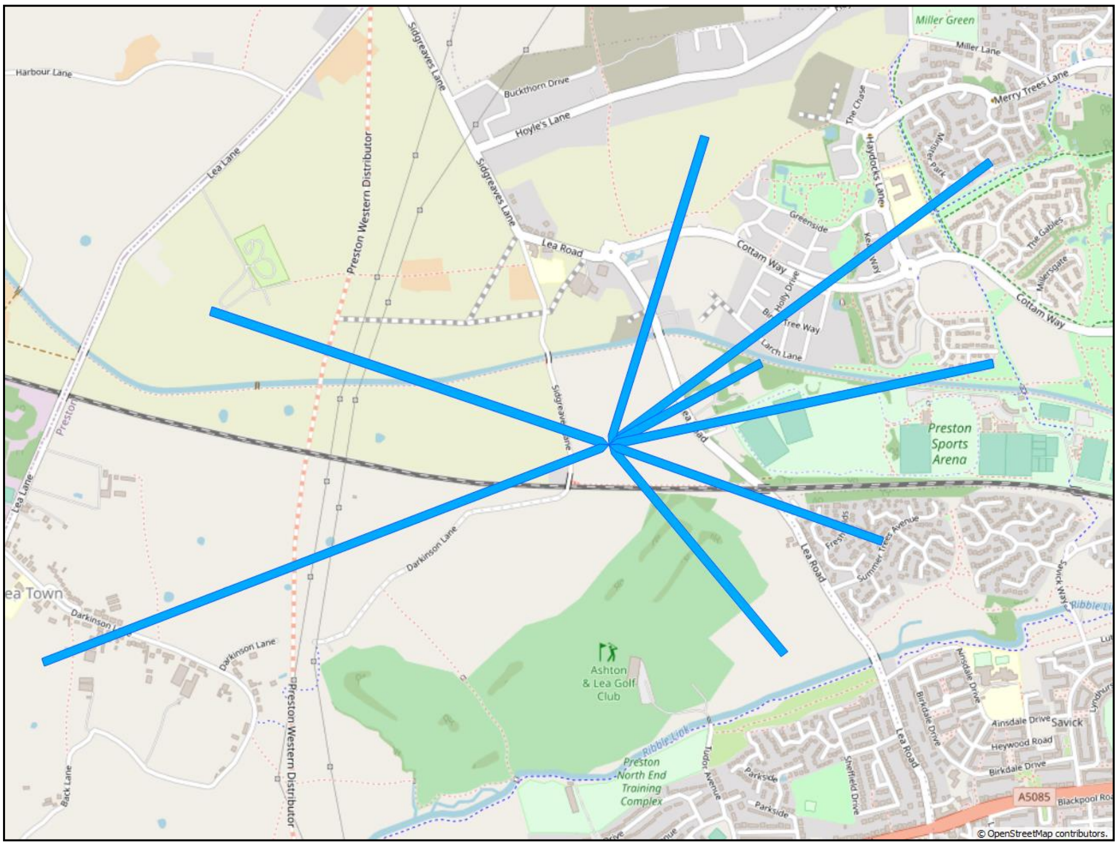


Figure 14.10 2024 PT Trips within 1.2km - 5km Catchment Area

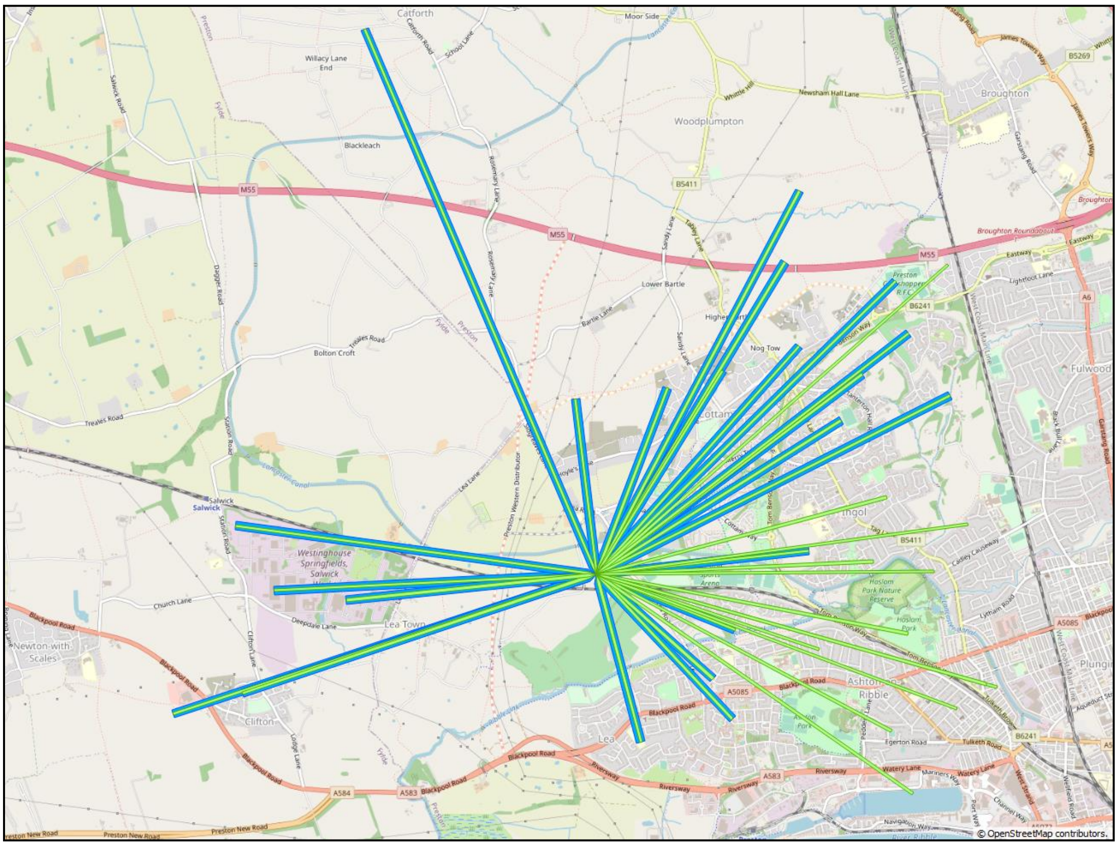


Figure 14.11 2024 PT Trips within 1.2km Catchment Area

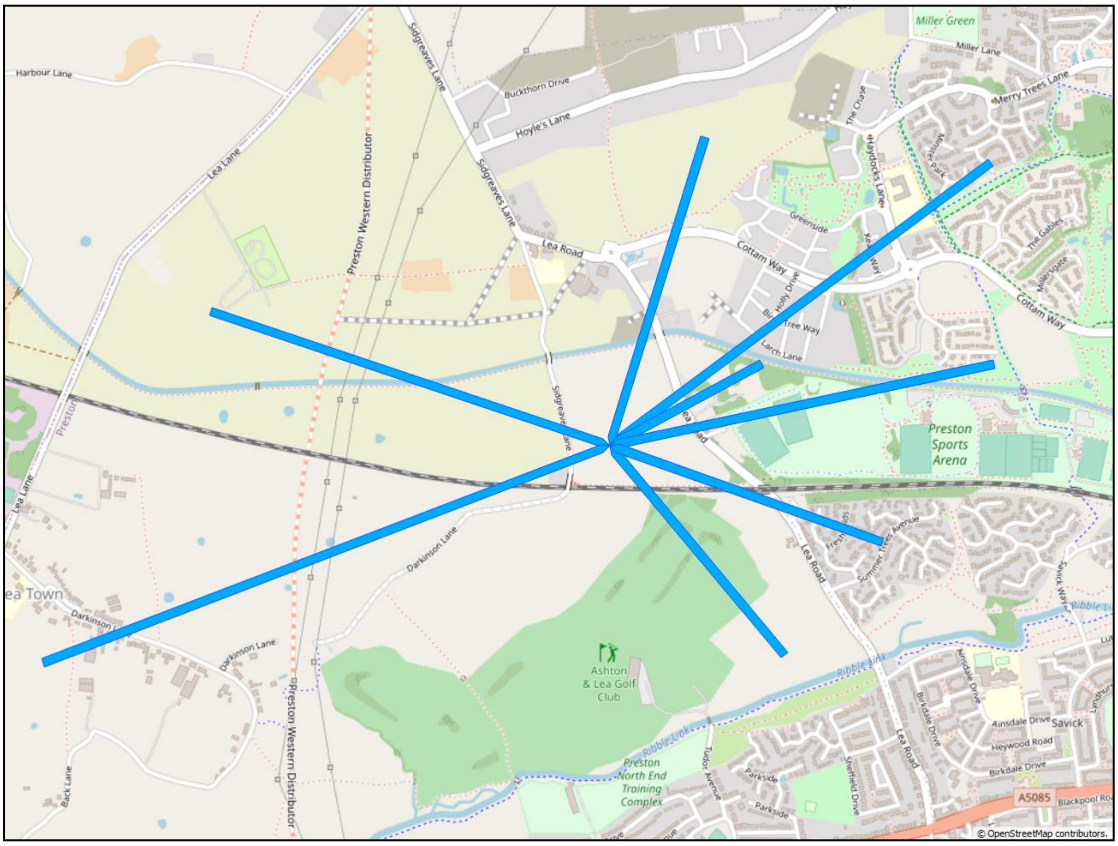
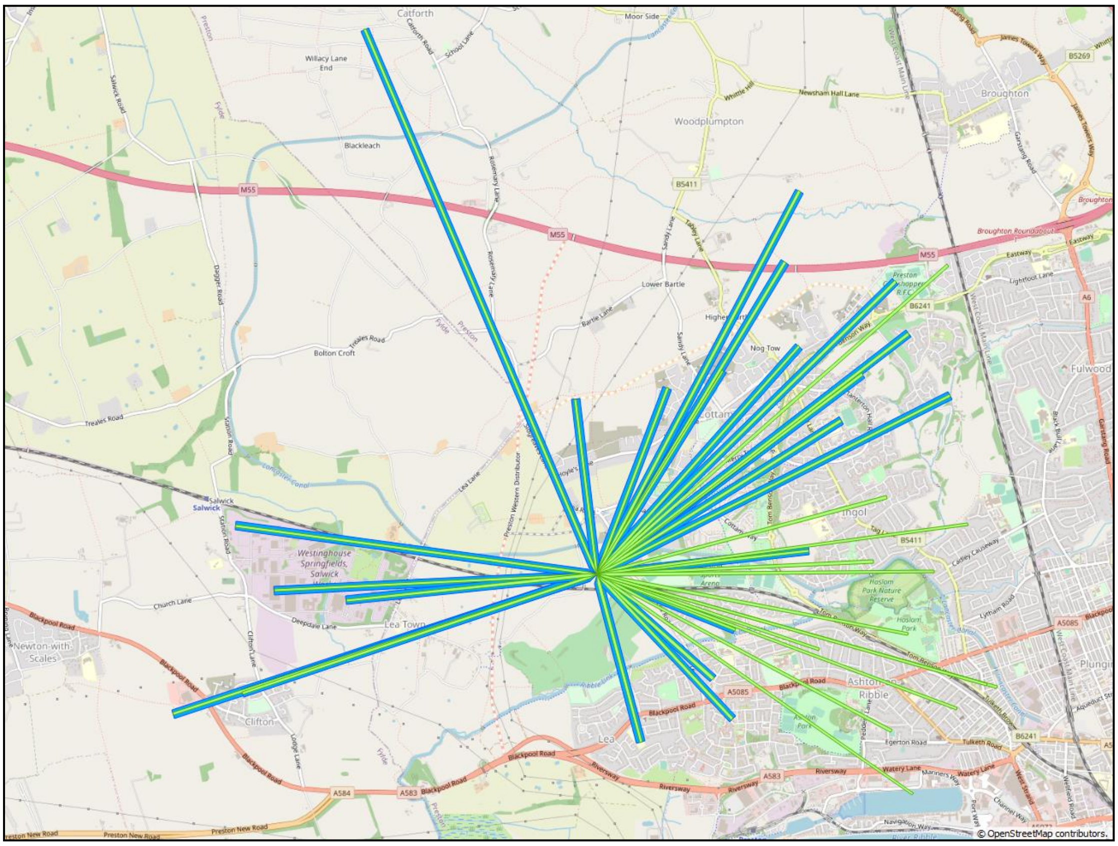


Figure 14.12 2039 PT Trips within 1.2km - 5km Catchment Area



14.16 EMME Public Transport Outputs

14.16.1 EMME PT trips represents the rail trips from Cottam Parkway Station and given an overview of major rail destinations. As can be seen from the figures below, the major destination are Manchester, Lancaster, Blackpool, Yorkshire and Liverpool.

14.16.2 The figures also show the P&R trips made to Cottam Parkway station for all time periods. In general, the P&R trips are primarily within 5km catchment area and few trips beyond the 5 km threshold. The long-distance P&R trips are marginal and is a result of logit choice model, where a small proportion is allocated to the mode with higher generalised cost.

14.16.3 The patterns for 2024 and 2039 are similar, with more trips in 2039 future years.

Figure 14.13 2024 Park & Ride Trips to Cottam Parkway Station – AM Peak

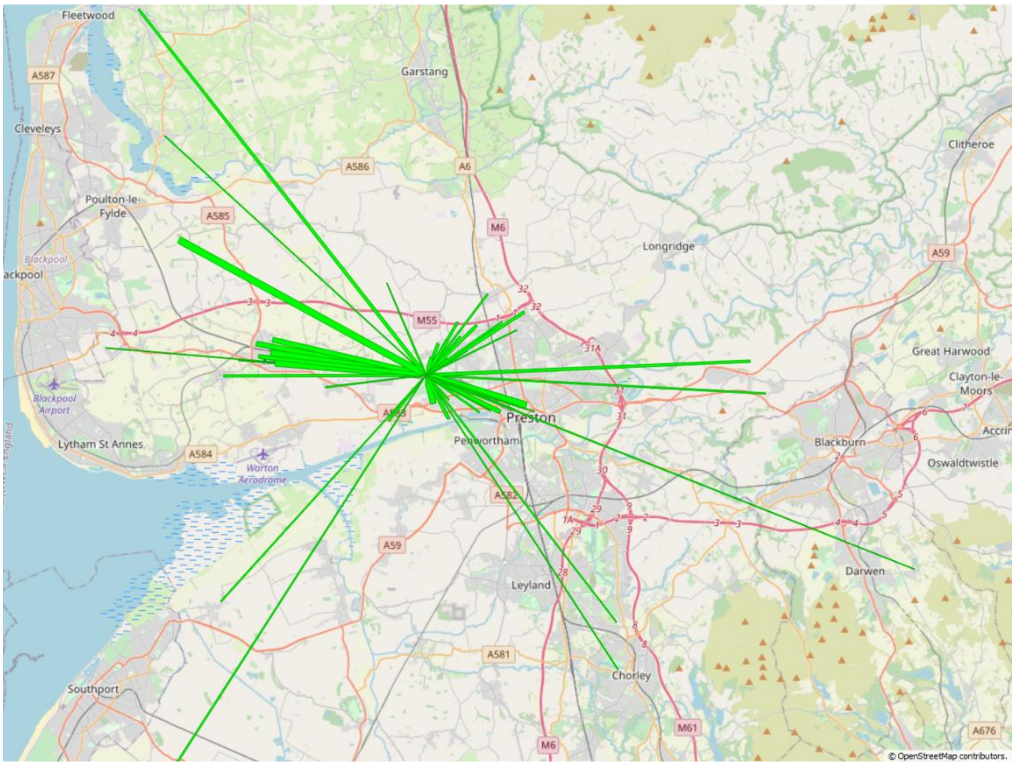


Figure 14 14 2024 PT Trips from Cottam Parkway Station – AM Peak

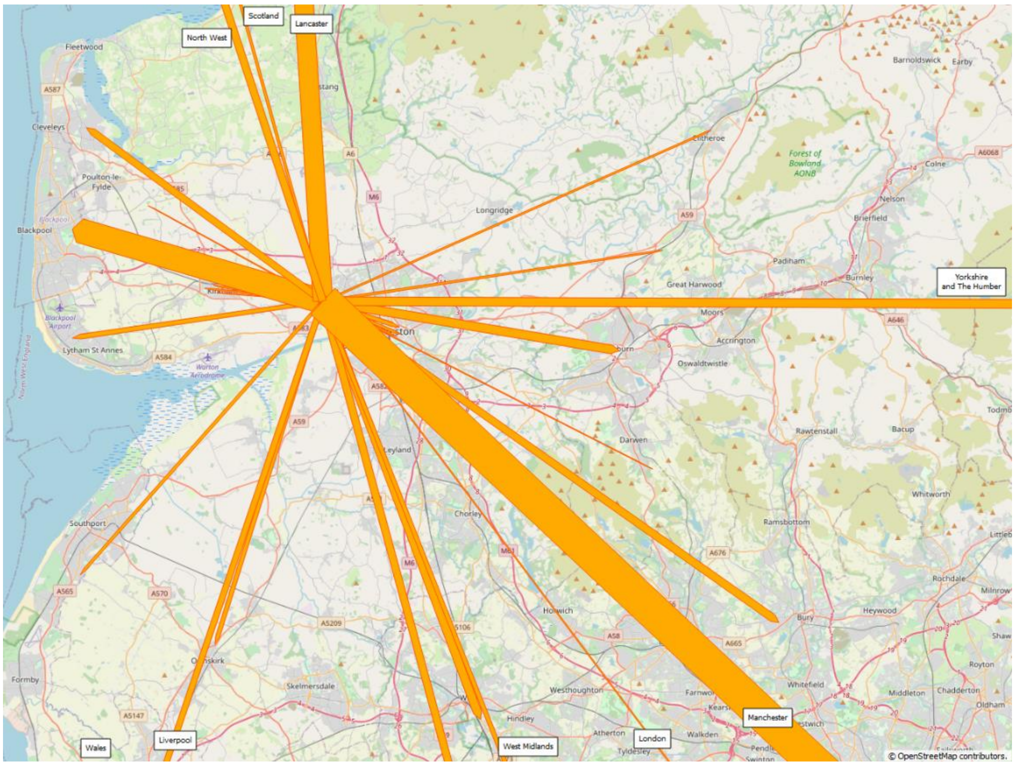


Figure 14.15 2024 Park & Ride Trips to Cottam Parkway Station – IP Peak

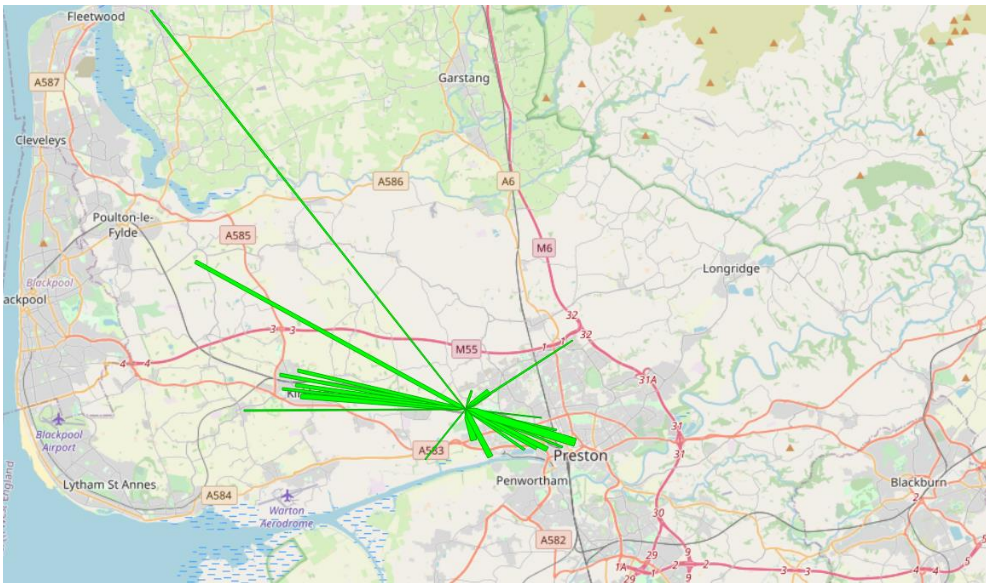


Figure 14 16 2024 PT Trips from Cottam Parkway Station – IP Peak

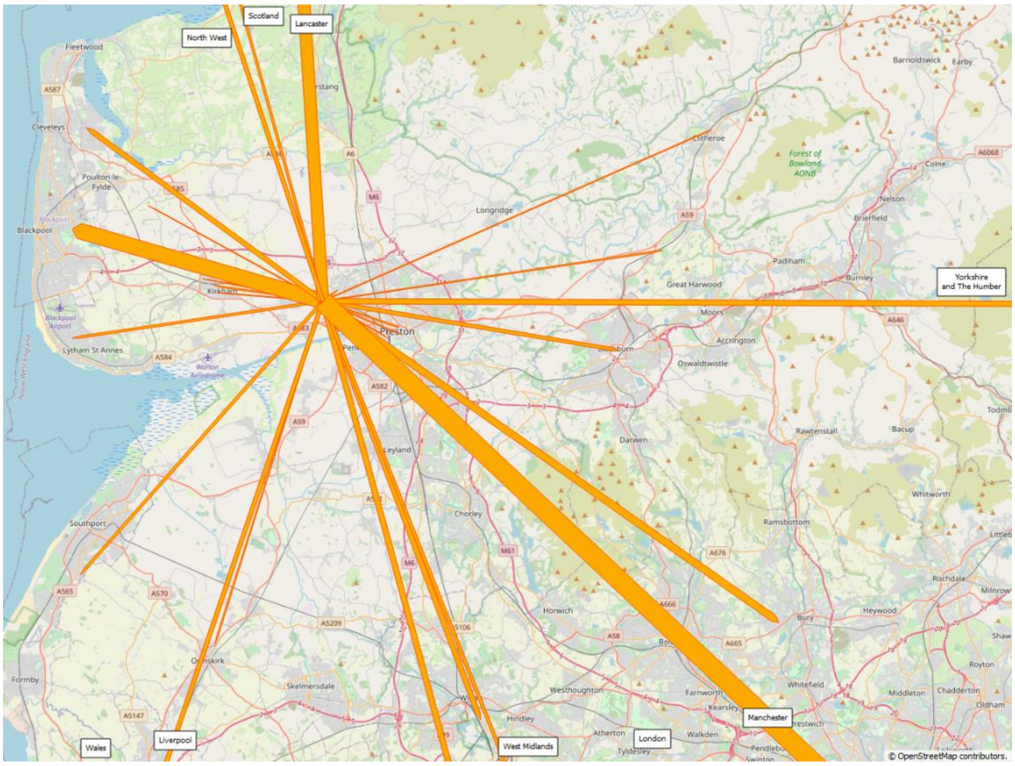


Figure 14.17 2024 Park & Ride Trips to Cottam Parkway Station – PM Peak

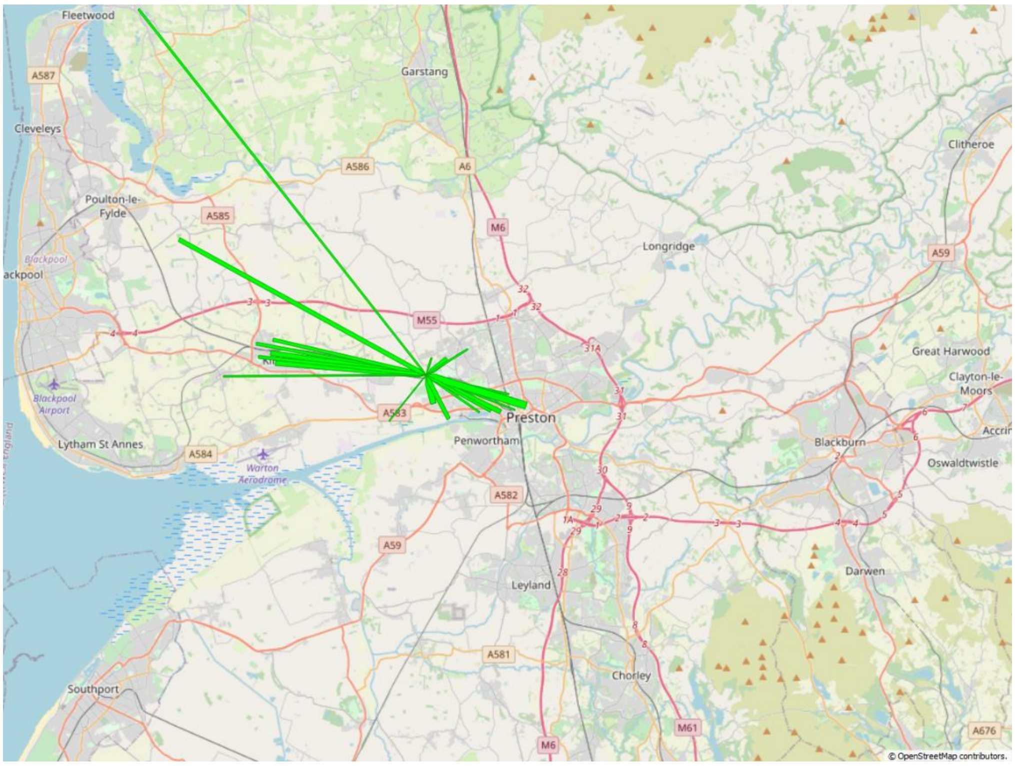


Figure 14.18 2024 PT Trips from Cottam Parkway Station – PM Peak

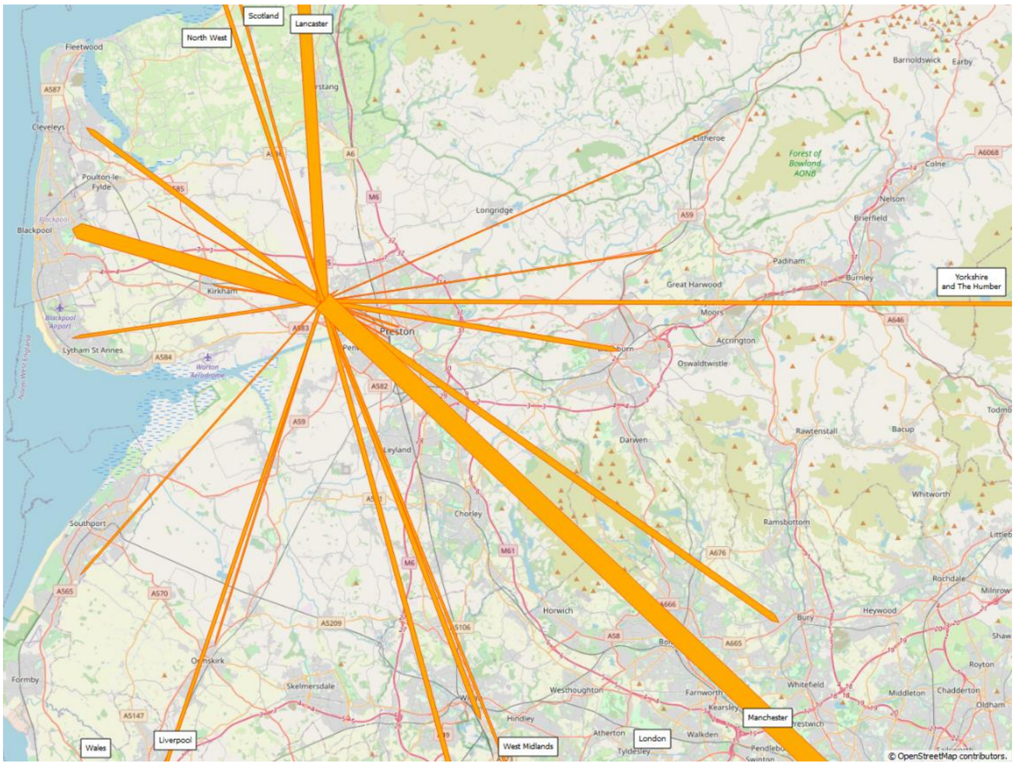


Figure 14.19 2039 Park & Ride Trips to Cottam Parkway Station – AM Peak

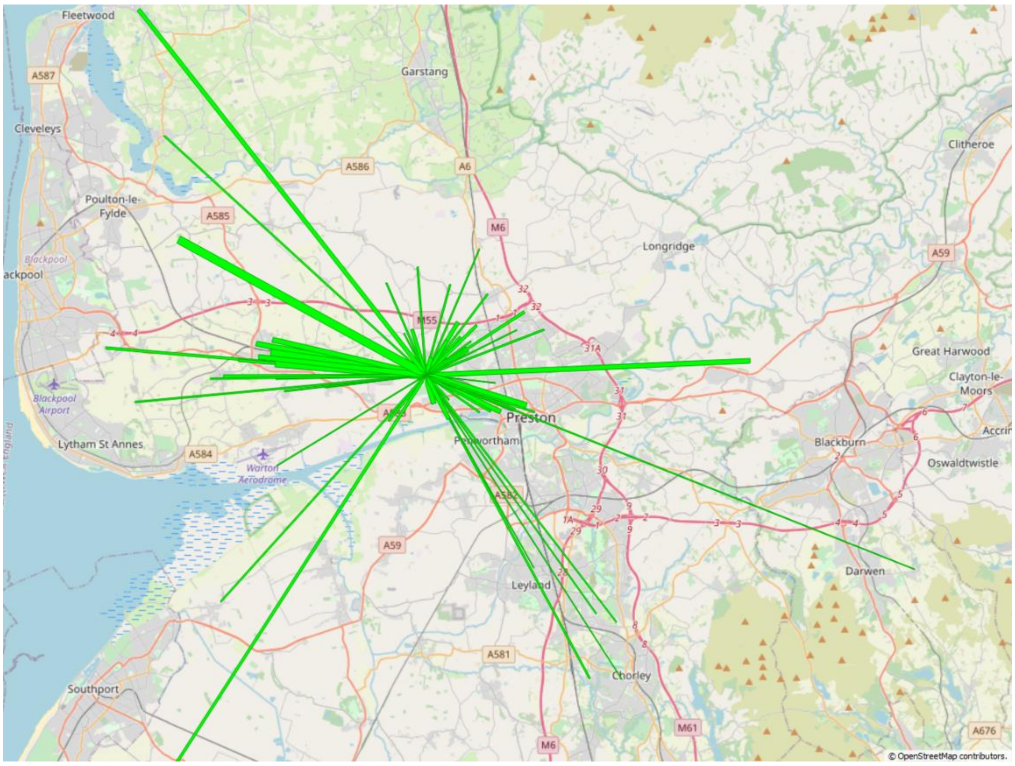


Figure 14.20 2039 PT Trips from Cottam Parkway Station – AM Peak

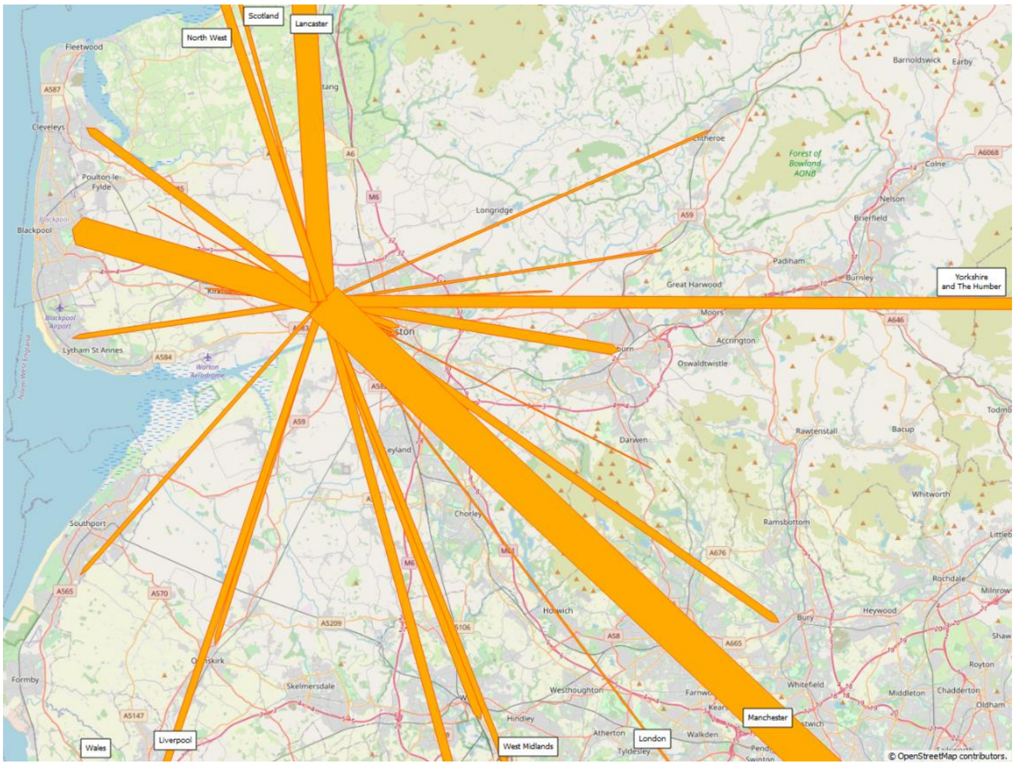


Figure 14.21 2039 Park & Ride Trips to Cottam Parkway Station – IP Peak

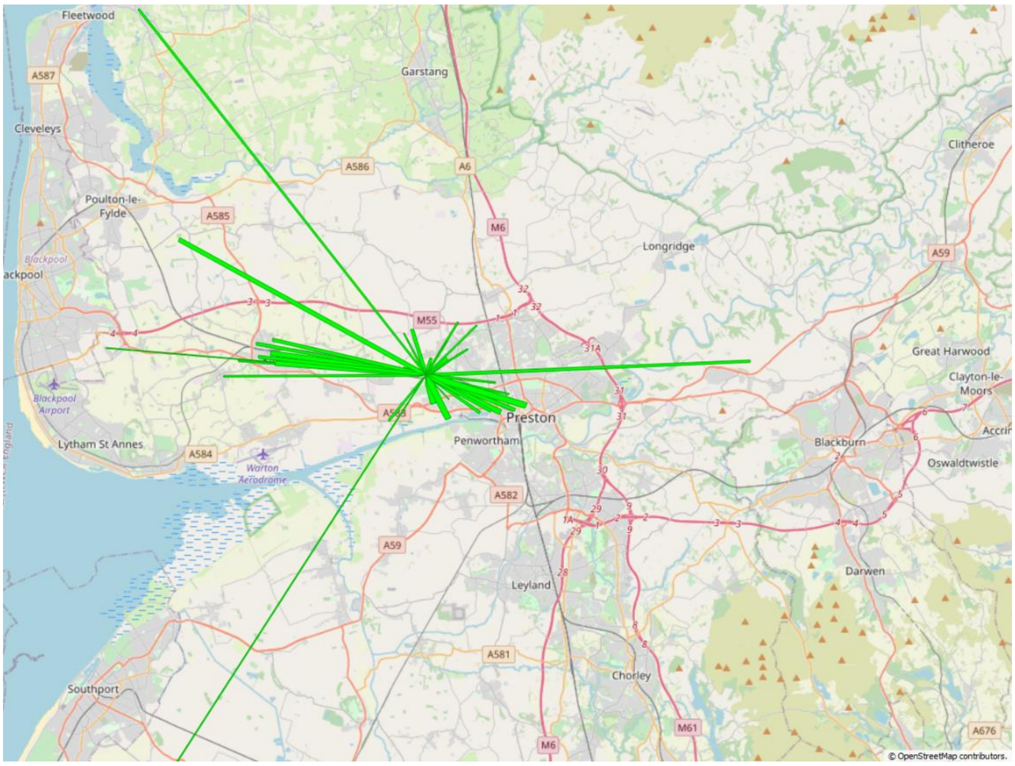


Figure 14.22 2039 PT Trips from Cottam Parkway Station – IP Peak

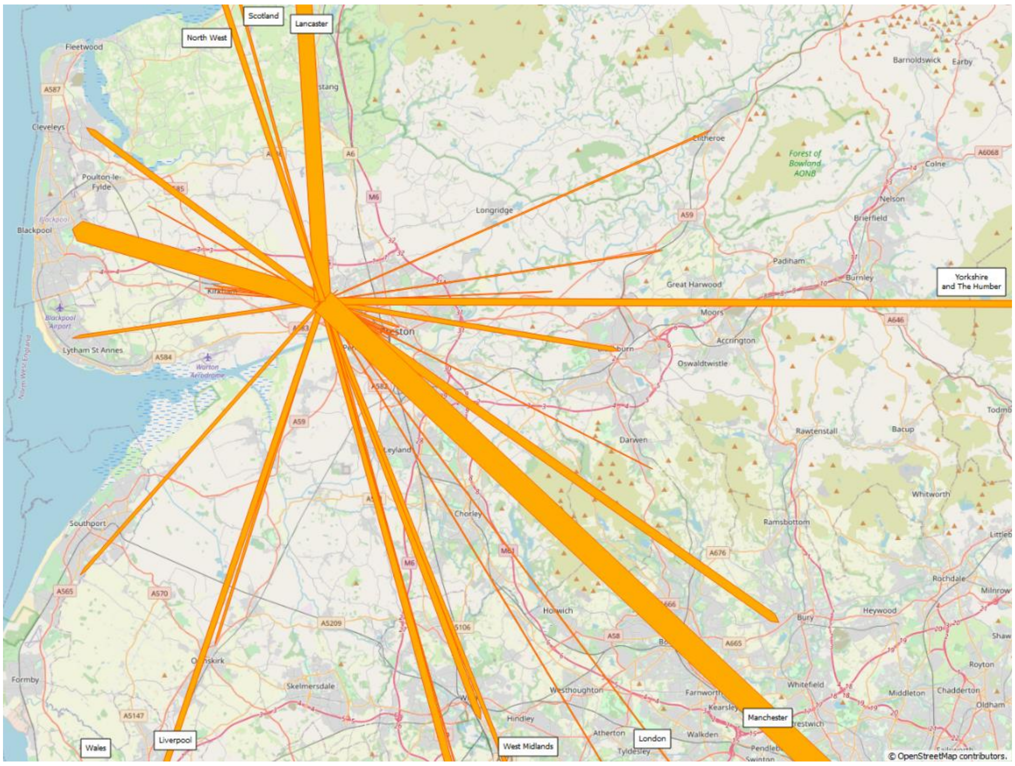


Figure 14.23 2039 Park & Ride Trips to Cottam Parkway Station – PM Peak

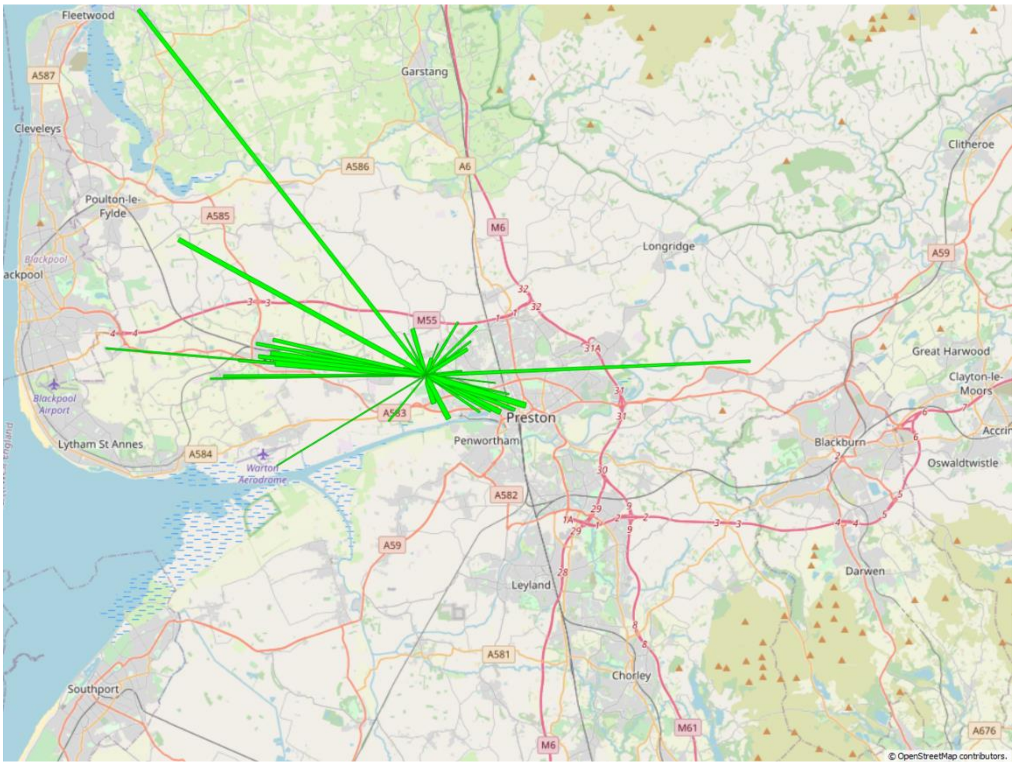
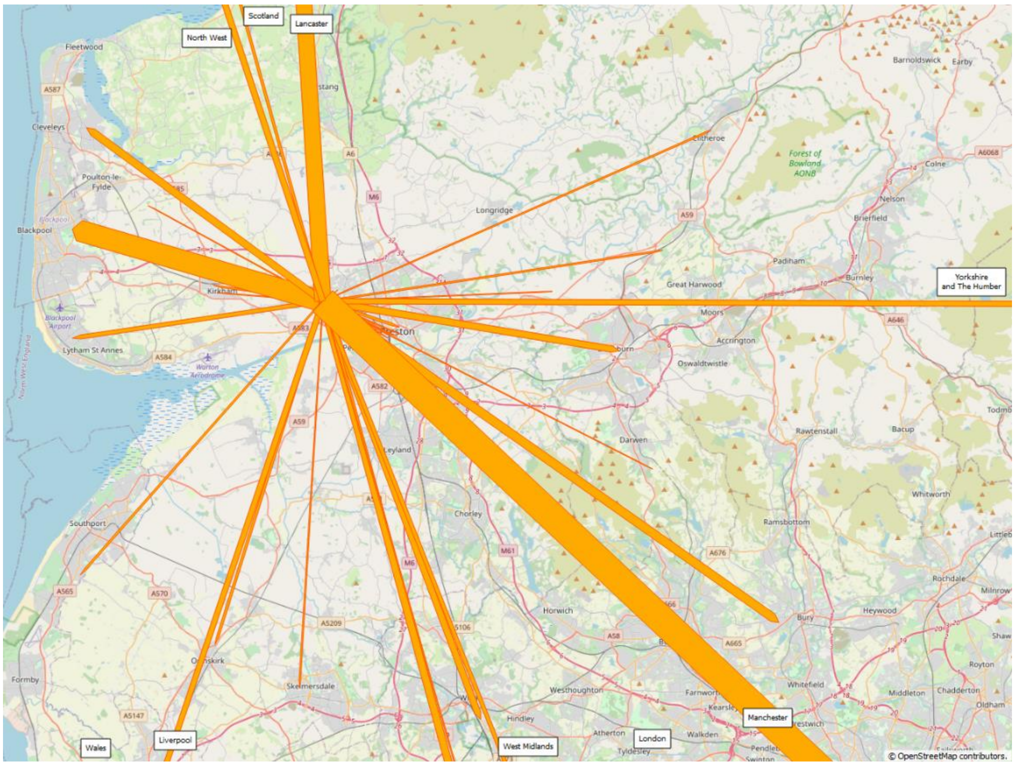


Figure 14.24 2039 PT Trips from Cottam Parkway Station – PM Peak



15. Summary

15.1 The highway model used for Cottam Parkway transport assessment is the CLTM model, which was re-based to 2019 using a comprehensive set of newly collected traffic and journey time and following guidance laid out in TAG Units M1, M2 and M3 as part of CLTM project.

15.2 The public transport network was built from scratch using the 2019 highway network as a starting point, with consistency between the PT and highway networks retained throughout. Rail network was added, and stop points and timetables were imported from OS OpenDATA Strategic Layer. It has been developed utilising EMME modelling software.

15.3 New PT zone connectors were defined as necessary to represent connections to the train stations within the study area. Walk links were defined to represent walk access mode to the stations.

15.4 Citi Logik was commissioned to provide station-to-station and rail catchment matrices derived from mobile network data (MND) data. The data was collected over a continuous period of 1 month for March 2019 and covers 21 weekdays and 10 weekend days. These were checked and verifications in general showed acceptable correlations between origin and destination stations and catchment areas in the symmetry tests, and satisfactory correspondence between the MND ORR data for trips utilising Preston station.

15.5 In the absence of any historic public transport count data (rail) for calibration, benchmarking was undertaken using annual statistics available from the MOIRA and ORR.

15.6 Values of time and PT fares were updated to 2016 and are consistent with the TAG data book (Oct 2017).

15.7 The VDM model is produced to provide robust future travel demand forecasts by estimating the impact of changing costs to destination and mode choice.

The variable demand modelling process undertaken as part of the Cottam Parkway for the CLTM model uses trip demand matrices in production/attraction (P/A) consistent with CLTM model. Variable demand was undertaken for cars, with mode split choices between car and rail for those with a car available. Public transport users without a car available are assumed captive to public transport. LGVs and HGVs is assumed to have fixed demand.

15.8 Prior to the traffic forecasting using VDM, realism testing on the base year traffic model was undertaken to ensure that the CLTM transport model responded to changes in travel costs in a realistic way with the mode choice included.

15.9 Validation of the rail assignment was validated by comparing modelled and observed flows of rail trips for all internal stations. The results show that overall the observed differences between the modelled and observed are within the acceptable limits.

15.10 Based on TAG recommendation, an incremental hierarchic mode and destination choice model was identified as the most suitable approach and calibrated following the available guidance. Overall, the model has been calibrated to produce plausible results for the all matrix-based realism tests.

15.11 The A582 model has been used to produce traffic forecasts that will inform the transport assessment for Cottam Parkway Railway Station. Forecasts of demand for 2024 and 2039 were developed based on a variety of inputs, including planning data and trip cost information. Mode share is forecast to change only slightly, and the sub-mode share within PT forecasts the PT all the way and P&R trips for future year scenarios.

15.12 The following scenarios were tested:

- A 'Do Minimum' scenario, in which committed transport improvement schemes have been added to the base year network; and

- A ‘Do Something’ scenario, which the Cottam Parkway Station and related access network changes.

15.13 Traffic forecasts have been produced for the AM peak, inter-peak and PM peak hours for the forecast years of 2024 (the opening year) and 2039 (the design year). The approach used in developing the forecasts and undertaking variable demand modelling has been undertaken in accordance with Department for Transport Guidance (TAG).

15.14 The proposed parkway station would serve a much wider area through accessibility provided by the PWD making access to rail better for a wide area of the both Preston and the Fylde and also providing better access to Blackpool, Preston, Manchester, the rest of Lancashire and the Fylde, as well as London.

15.15 Overall results show that there will be minimal impact on the highway network due to Cottam Parkway Station during the peak hour. Overall, it is expected that there will be some shift from the highway to public transport mode once the Cottam Parkway is built.

16. Conclusion

16.1 The CLTM introduces new and improved functionality of public transport representing rail. It has been created using Pre COVID-19 rail demand and has been calibrated and validated to TAG standards for a 2019 base year.

16.2 It is a strategic model suitable for the assessment of transport strategies and provides an excellent starting point for appraisal of individual schemes. The highway assignment stage takes full account of junction delays caused by congestion, and thereby produces a realistic representation of car journey times on the road network.

16.3 The model has strengths and features that make it the ideal tool to aid the strategic planning process. However, like all models, it has limitations, represents only a part of the reality of travel behaviour, and makes a number of assumptions that must be borne in mind when making decisions based on its outputs. Listed below are the main strengths of the Cottam PT model as well as its principal limitations and assumptions.

- In the absence of any PT surveys, the rail demand has been benchmarked against MOIRA and ORR.
- Rail model is not Passenger Demand Forecasting Handbook (PDHF) compliant and therefore cannot be used for rail scheme appraisal. However, it can provide inputs into the PDFH model.
- Though active modes such as walking and cycling trips are included in the model, they are not assigned to equivalent walking and cycling networks. Hence, whereas the cost of travel by mechanised modes is based on travel demand and network characteristics, the cost of travel for non-mechanised modes is calculated as a simple combination of travel time and distance. The model is thus limited in its ability to test policies that seek to increase trips by walking and cycling. In particular, the model cannot automatically capture the time savings and other user benefits accruing to pedestrians and cyclists as a result of priority and other network improvements that confer advantage on these modes.
- Promoters of individual schemes using this model are advised to assess the quality of the model in terms of network and zonal detail and base year validation performance within the Area of Influence of the Scheme.