TECHNICAL NOTE

A6 TO MANCHESTER AIRPORT RELIEF ROADA6MARR FORECASTING NOTE

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1. INTRODUCTION

1.1.1 A consortium of local authorities (Stockport Metropolitan Borough Council, Manchester City Council and Cheshire East Council) and Manchester Airport Group has been working since 2010 to prepare a submission to DfT for part-funding of the A6 to Manchester Airport Relief Road (see Figure 1). The scheme is based on the recommendations of the South East Manchester Multi Modal Strategy (SEMMMS) commissioned by central government in 1998, which highlighted a number of transport improvement opportunities that would benefit the local area. The relief road was a key element of that strategy and is designed to improve surface access to, from and between Manchester Airport and local town and district centres and employment sites, reduce the impact of traffic congestion on communities in Stockport, South Manchester and Northeast Cheshire, regenerate these communities through reduced severance and improved accessibility, and provide an improved route for freight.

1.1.2 The proposed scheme, illustrated schematically in Figure 1, will connect the A6 at Hazel Grove with the M56 at Manchester Airport. It consists of approximately 10 km of new dual two lane carriageway and seven new junctions, and will also incorporate the existing 4 km section of the A555 dual carriageway to the south of Bramhall.

1.1.3 To this end, SYSTRA was initially commissioned in February 2010 to construct a transport model system fit for the purpose of providing modelling inputs for a Major Scheme Business Case (MSBC) of A6MARR to the Department for Transport (DfT), which was subsequently updated in February 2012. This system has been developed and subsequently used to provide demand forecasts for A6MARR, as well as inputs for operational analyses, and economic and environmental appraisal. SYSTRA considers this system fit for the purpose of assessing the impacts of A6MARR and a primary consideration during the preparation of this note has been to demonstrate how the system complies with the DfT modelling requirements, as set out in the Transport Analysis Guidance (TAG).

1.1.4 A6MARR VDM has been used to produce forecasts of the preferred scheme for an opening year of 2017 and design year of 2032. Three scenarios have been tested: a Core scenario and two alternative scenarios incorporating more Pessimistic and Optimistic assumptions regarding land use developments and implementation of transport schemes.

1.1.5 This latest version of the report has been updated to include changes made throughout summer 2014 during which time the model was extended to cover a wider area to the south east of the scheme as well as updating model inputs to ensure compliance with the latest versions of TAG. This involved an increase to the number of model zones and a recalibration of the base year model. The forecasts produced during this tranche of work are known as “Test Run 2” (TR2). The development and calibration of the VDM is reported in the A6MARR Model Development Report (SYSTRA, October 2014).

1.1.6 This technical note is structured as follows:

- forecasting approach;
- reference forecasts including land use and demographic assumptions;
- supply assumptions;

- core scenario forecast results;
- high and low growth forecast results; and
- Appendix A public transport do minimum scheme details.

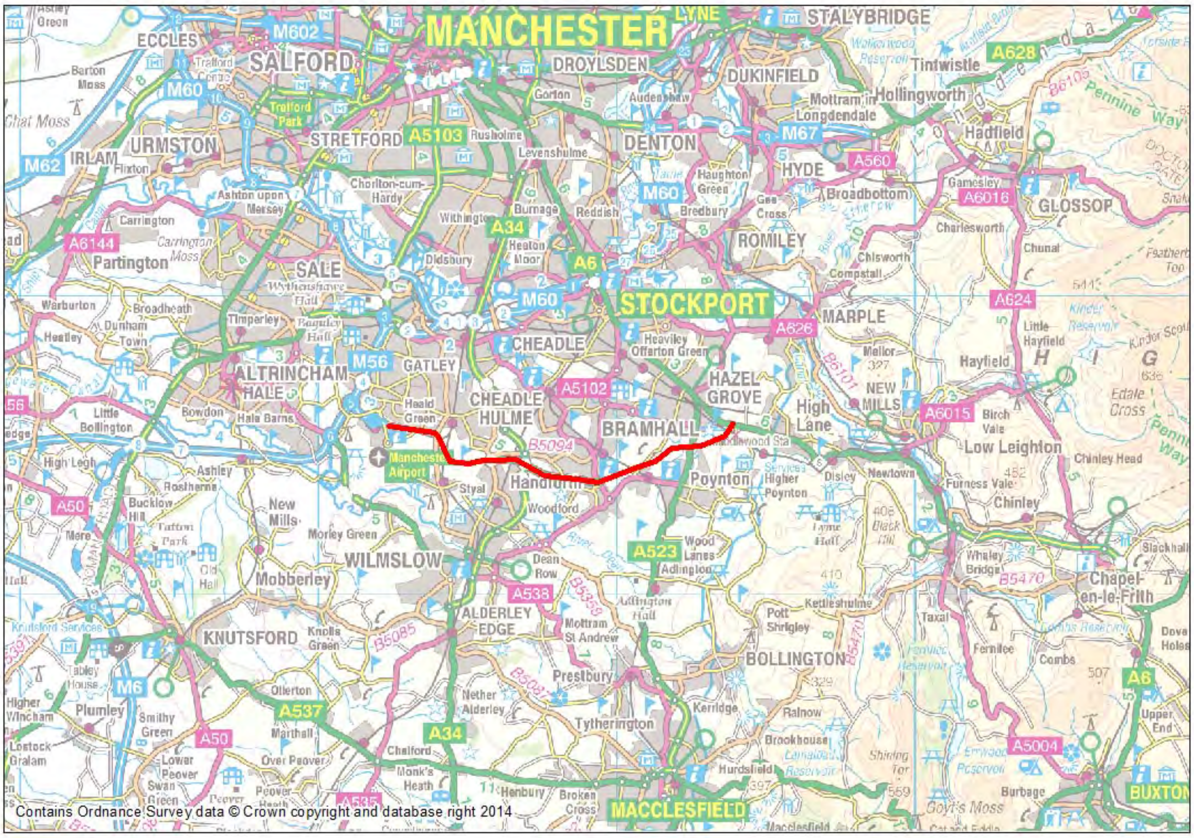

Figure 1. A6 to Manchester Airport Relief Road Scheme

2. FORECASTING APPROACH

2.1 Outline Methodology

2.1.1 Our approach to forecasting has followed the guidance set out in WebTAG Unit M4 (May 2014). TAG Unit M4 introduces a number of definitions of terms that are important for understanding the discussion in this note, including:

- a **forecast** is a single run of the transport model for a single year
- a **background assumption** is an assumed change between base and future year conditions that are assumed to happen independently of the scheme
- the **Uncertainty log**- this is a record of the assumptions made in the model that will affect travel demand and supply and is the basis for developing alternative scenarios to help understand the level of certainty we can have about the forecasts produced by the transport model;
- a **scenario** is a set of forecasts under a single set of assumptions;
- the **core scenario** is the most unbiased and realistic set of assumptions that will form the central case presented in the Appraisal Summary Table (AST). The approach to defining these assumptions is mandatory and specified in Chapter 3 of WebTAG Unit M4;
- an **alternative scenario** is an alternative set of background assumptions and the associated with-scheme and without-scheme forecasts;
- the **high growth and low growth scenarios** are part of the set of alternative scenarios, the mandatory approach to defining them is specified in Chapter 3 of WebTAG Unit M4
- a **reference forecast** is an input to the variable demand model that contains forecasts of demand that are consistent with future year demographic patterns but base generalised costs.
- **NTEM**: national assumptions about background growth in travel demand, provided by the Department for Transport through the National Trip End Model (NTEM) dataset.

2.1.2 The approach to forecasting set out in TAG Unit M4 is presented in Figure 2 and can be summarised as follows:

- apply exogenous growth factors to the base year validated matrices, taking into account local developments, to produce a reference forecast;
- produce without-scheme future year networks based on known changes from the base year and update values of time, PT fares and vehicle operating costs to reflect future year assumptions;
- using the reference forecast demand and without-scheme networks as inputs, run the variable demand model to convergence to produce a without-scheme forecast;
- add the scheme coding to the without-scheme networks to produce scheme networks; and
- using the reference forecast demand and with-scheme networks as inputs, run the variable demand model to convergence to produce a with-scheme forecast.

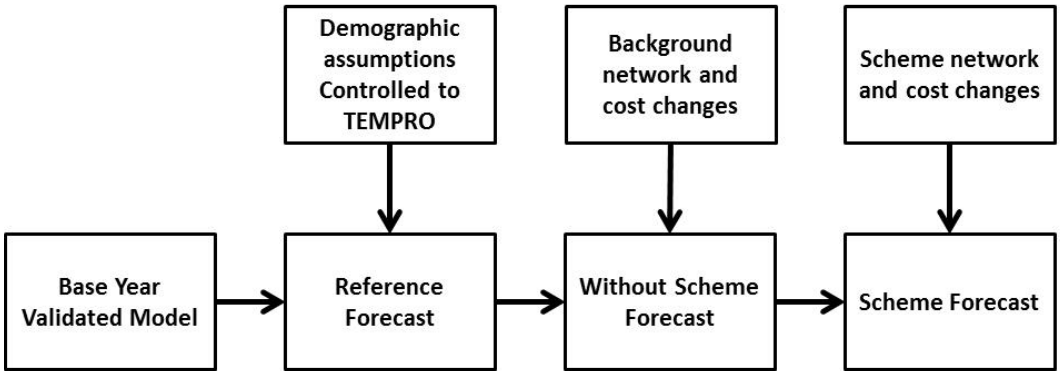

Figure 2. Basic approach to forecasting using a transport model

2.2 Scenario Definition

2.2.1 TAG Unit M4 states that the scheme should be tested under a number of scenarios for both the opening year (assumed to be 2017 for A6MARR) and a design year (15 years after opening, i.e. 2032 for A6MARR). The scenarios are:

- a core (most likely, unbiased) scenario;
- a high growth scenario; and
- a low growth scenario.

2.2.2 TAG M4 requires that the proposed developments in the area of the scheme are categorised into their probability of occurring, and only those defined as near certain or more than likely may be included in the Core Scenario. Table 1 summarises the categories of probability defined in TAG. For the core scenario, demand growth is then controlled to growth factors obtained from the National Trip End Model (NTEM).

Table 1. Classification of Future Year Developments

PROBABLITY OF THE INPUT	STATUS	CORE SCENARIO ASSUMPTIONS
Near certain: The outcome will happen or there is a high probability that it will happen.	Intent announced by proponent to regulatory agencies. Approved development proposals. Projects under construction.	This should form part of the core scenario.
More than likely: The outcome is likely to happen but there is some uncertainty.	Submission of planning or consent application imminent. Development application within the consent process.	This could form part of the core scenario.

Reasonably foreseeable: The outcome may happen, but there is significant uncertainty.	Identified within a development plan. Not directly associated with the transport strategy/scheme, but may occur if the strategy/scheme is implemented. Development conditional upon the transport strategy/scheme proceeding. Or, a committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty.	These should be excluded from the core scenario but may form part of the alternative scenarios.
Hypothetical: There is considerable uncertainty whether the outcome will ever happen.	Conjecture based upon currently available information. Discussed on a conceptual basis. One of a number of possible inputs in an initial consultation process. Or, a policy aspiration.	These should be excluded from the core scenario but may form part of the alternative scenarios.

2.2.3 TAG Unit M4 requires Low and High Growth Scenarios to be developed in order to establish whether the intervention is still appropriate:

- Under low demand assumptions, is the intervention still economically viable?
- Under high demand assumptions, is the intervention still effective in reducing congestion or crowding, or are there any adverse effects, e.g. on safety or the environment?

2.2.4 TAG sets out the required approach to the Low and High Growth scenarios in section 4.2 of Unit M4, stating that the High Growth scenario should be formed by adding a proportion of base year demand to the demand from the core scenario and low growth should be formed by subtracting a proportion of the base demand from the core scenario.

2.2.5 The Low and High Growth Scenarios are designed to test the impact of uncertainty in national trends in GDP growth, fuel price trends, and vehicle efficiency i.e. the assumptions implicit in the NTEM 6.2 forecasts. They are derived by taking the output demand from the Core Scenario plus or minus a proportion of the base year matrix.

2.2.6 In the TAG methodology the proportion of the base year matrix is set to equal the square root of the number of years between the model base year and the forecast future year, multiplied by a factor p. TAG Unit M4 paragraph 4.2.4 suggests that p=2.0% is an appropriate value for matrices in a multi-modal demand model, having earlier suggested that 2.5% is appropriate for car, 1.5% for bus and 2.0% for rail.

2.2.7 TAG Unit M4 states that “it may be appropriate to vary local assumptions about demand in the high and low scenarios”. For A6MARR, it was decided that due to the scale, and proximity to the scheme of some of the local developments in the uncertainty log with “reasonably foreseeable” status (and therefore excluded from the core scenario), local development assumptions should be varied. This means that:

- In the high growth scenario, less likely developments should be included which were excluded from the core scenario; and
- In the low growth scenario, the least likely developments which were included in

the core scenario should be excluded.

2.2.8 TAG Unit M4 paragraph 4.2.10 states that local supply assumptions should not be varied for the high and low scenarios. Table 2 below summaries the assumptions used in the core, high and low growth scenarios.

Table 2. Scenario definition

SCENARIO	OVERALL GROWTH	LOCAL DEVELOPMENTS	SUPPLY
Core	NTEM	Near certain & more than likely	Near certain & more than likely
High	Core output + 2% * SQRT(Forecast Year - Base Year) * Base	Near certain, more than likely & reasonably foreseeable	Near certain & more than likely
Low	Core output - 2% * SQRT(Forecast Year - Base Year) * Base	Near certain only	Near certain & more than likely

3. REFERENCE FORECASTS

3.1 Introduction

3.1.1 The reference forecast input demand for the VDM is generated using a module known as the Exogenous Forecasting Model (EFM). The EFM applies exogenous growth factors calculated from the DfT's National Trip End Model (NTEM) to the base year demand and also produces demand associated with specific developments. The process the EFM undertakes is as follows:

- collate an Uncertainty Log for new developments, describing the type and scale of new developments as well as the likelihood of completion by the forecast year in question;
- use representative trip rates (by mode and time of day) derived using data from the TRICS database to create trip ends for each development;
- split trip ends into different purposes using purpose splits obtained from representative zones of the same land use type and amended to remove any implausible trip purposes e.g. education trips to a shopping development;
- combine outbound and inbound development trip ends for each time period into two way tours, as required for A6MARR-VDM;
- distribute trip ends for these new developments by applying the same distributions witnessed in the base matrices for neighbouring zones, thereby deriving a 'development' matrix;
- adjust the growth rates obtained from the National Trip End Model (NTEM) to allow for the addition of the 'development' matrix and apply these growth rates to the base year matrices to reflect background traffic growth; and
- add the 'development' matrix to the inflated base year matrices resulting in an overall level of growth which is controlled to that implied by NTEM.

3.2 Land Use and Demographic Inputs

3.2.1 The work to define land use assumptions for the A6MARR forecasting processes has focussed on an Area of Influence (AoI) of the scheme as shown in Figure 3. The AoI was originally defined using preliminary versions of the A6MARR SATURN model to determine the geographic area over which the A6MARR scheme had a significant impact on traffic route choice. For the latest model update, the AoI has been extended south and east to include Macclesfield and parts of the High Peak region (including Whaley Bridge, Chapel-en-le-Frith and Buxton) where the model has been extended and new survey data has been incorporated.

3.2.2 Land use assumptions were derived across a slightly wider area than the AoI covering the whole of Stockport, Trafford, Cheshire East and part of Manchester City authorities, as well as the eastern side of the High Peak authority.

3.2.3 Future year growth assumptions have been derived using data from a variety of sources:

- planning data from Local Authorities which partly lie in the AoI;
- data provided by Manchester Airport;
- National Trip End Model (NTEM) 6.2; and

- The National Transport Model (NTM).

3.2.4 Representatives of the consultant Atkins met with planning officers from Stockport, Manchester City, Cheshire East, Trafford and High Peak councils to understand their aspirations for future development across their authorities. Manchester City Council was asked to provide information about future developments for the section of their authority lying within the AoI of A6MARR (see Figure 3). Atkins used this information to develop an uncertainty log setting out the likelihood that each development would come to fruition by 2017 and also 2032.

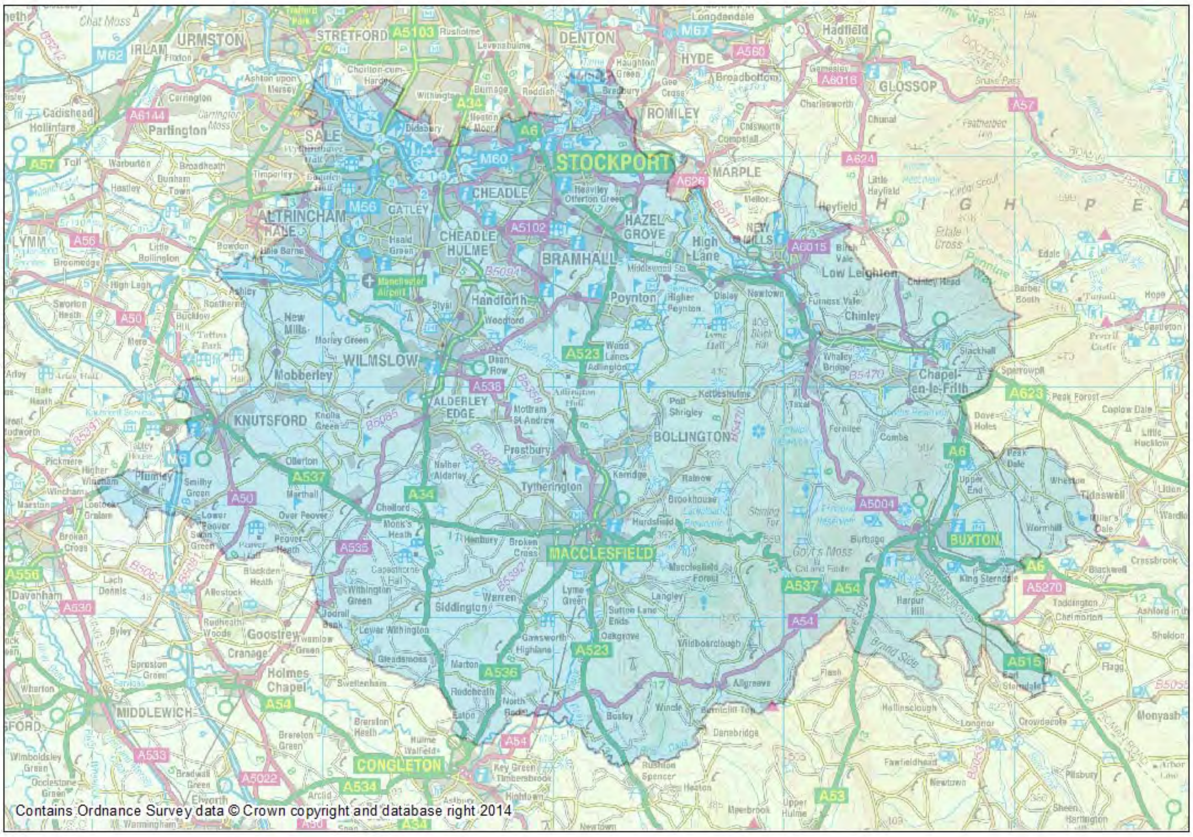

Figure 3. A6 to Manchester Airport Relief Road Area of Influence

3.2.5 Production and attraction travel growth was constrained to NTEM 6.2 forecasts as required by DfT, at the Local Authority district level within Greater Manchester and Cheshire East and at the county level beyond.

3.2.6 HFAS and Atkins met with Manchester Airport Group (MAG) to understand their expectations for future passenger growth and employment growth both within the airport itself and on adjacent development sites being promoted by MAG. These assumptions were subsequently included in A6MARR VDM forecasts.

3.2.7 Light and other goods vehicles are represented in the A6MARR VDM base model. Growth forecasts from the National Transport Model (NTM) were applied to these freight matrices.

3.3 Development Trip Generation

3.3.1 Trip rates were obtained from the TRICS database for each of the land use types shown in Table 3 by mode and time period. For developments within 2km of the scheme and with greater than 5000sqm or 100 dwellings, 85th percentile trips rates are used to derive development trips. Average trip rates are used for all other developments. This approach allows a single scenario to be developed to inform both design and appraisal exercises. Somewhat high-side demand will be predicted in the road corridor for design purposes; and general levels of growth across the modelled area will not be unduly biased. Table 3 indicates where 85th percentile trip rates have been extracted from TRICS, i.e. where there are developments of this type that fit the criteria.

Table 3. Development types and quantities

LAND USE REF	TYPE[1]	85TH %	QUANTITY 2017 CORE	QUANTITY 2032 CORE	UNITS
1	A1 Local shops - Non TC	Yes	9,556	24,653	sqm
2	A1 Local shops – TC [2]	Yes	22,865	22,865	sqm
3	A1 Superstore – EoTC & TC		4,527	4,527	sqm
4	A1 Superstore - Non TC		---	---	sqm
5	A3 Restaurants – TC		2,325	2,325	sqm
6	A4 Pub/Rest - Non TC		842	842	sqm
8	B1 Industrial Unit - Non TC	Yes	35,972	35,972	sqm
10	B1 Office - Non TC	Yes	315,583	513,378	sqm
11	B1 Office – TC		9,345	9,345	sqm
12a	B2 Smaller Industrial Estate - Non TC	Yes	52,555	56,055	sqm
12b	B2 Larger Industrial Estate - Non TC	Yes	47,099	111,680	sqm
13	B8 Commercial Warehousing - Non TC	Yes	40,937	40,937	sqm
14	C1 Hotel - Non TC	Yes	47,398	47,498	sqm
15	C1 Hotel – TC		---	2,254	sqm
16	C3 Apartments - Non TC		2,488	3,522	dwellings
17	C3 Apartments – TC		100	100	dwellings
18	C3 Houses - Non TC	Yes	7,637	11,237	dwellings

LAND USE REF	TYPE[1]	85TH %	QUANTITY 2017 CORE	QUANTITY 2032 CORE	UNITS
19	C3 Houses – TC		---	800	dwellings
21	D1 Private hospital - Non TC		15,785	15,785	sqm
24	D2 Cinema – TC		3,255	6,491	sqm
25	D2 Leisure Centre - Non TC	Yes	3,436	6,317	sqm
26	D1 – Nursery		743	743	sqm
31	Sheltered Housing		---	163	sqm

[1] TC = "Town Centre". EoTC = "Edge of Town Centre"

[2] No A1 town centre data is available from TRICS so the non town centre trip rates are used

3.3.2 Figure 4 shows the locations of all the residential developments in the model, and Figure 5 shows the locations of all the other developments in the model. The size of the circles on these figures is proportional to the total number of all day car trips (departures and arrivals combined) generated by the development once the trip rates have been applied.

3.3.3 Figure 6 shows the development trip ends (departures and arrivals combined) for each mode after the trip rates have been applied. Note that some of the Macclesfield developments are displayed slightly away from their true location (the town centre) so that they don't overlap in the Figure.

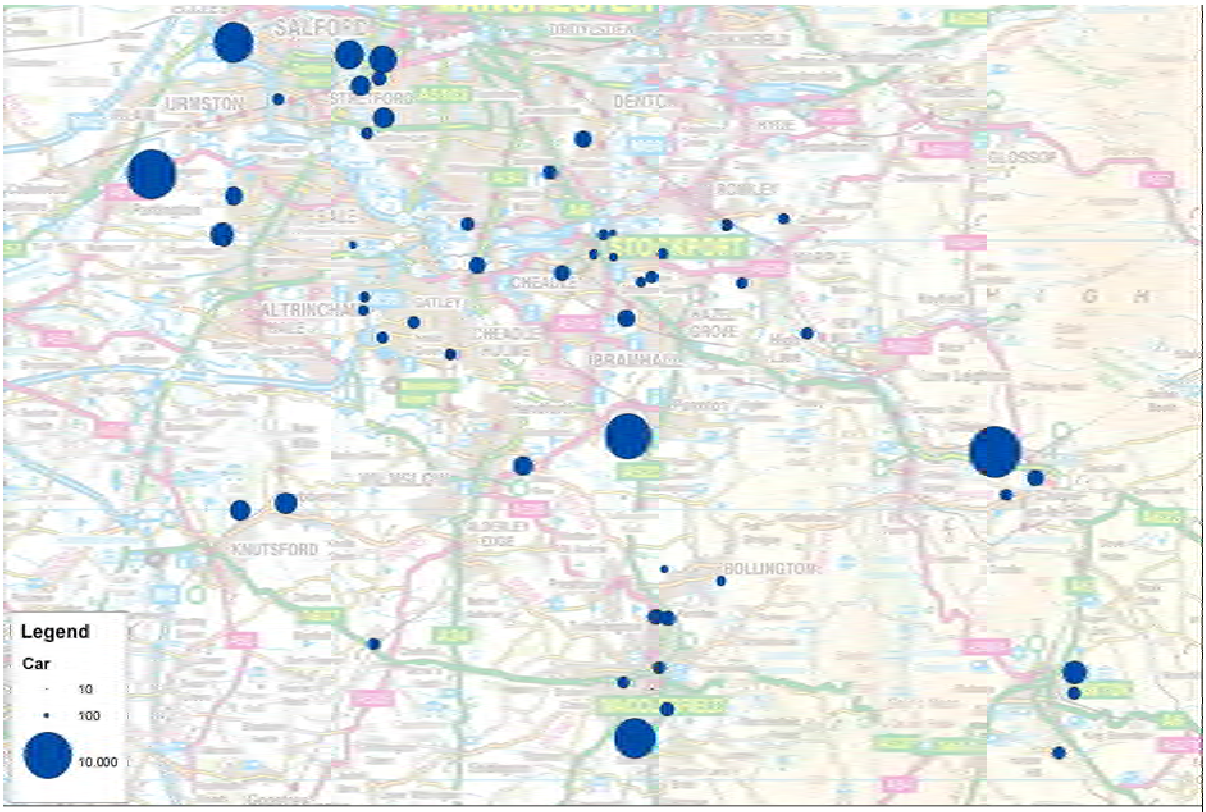

Figure 4. Development Locations – Residential

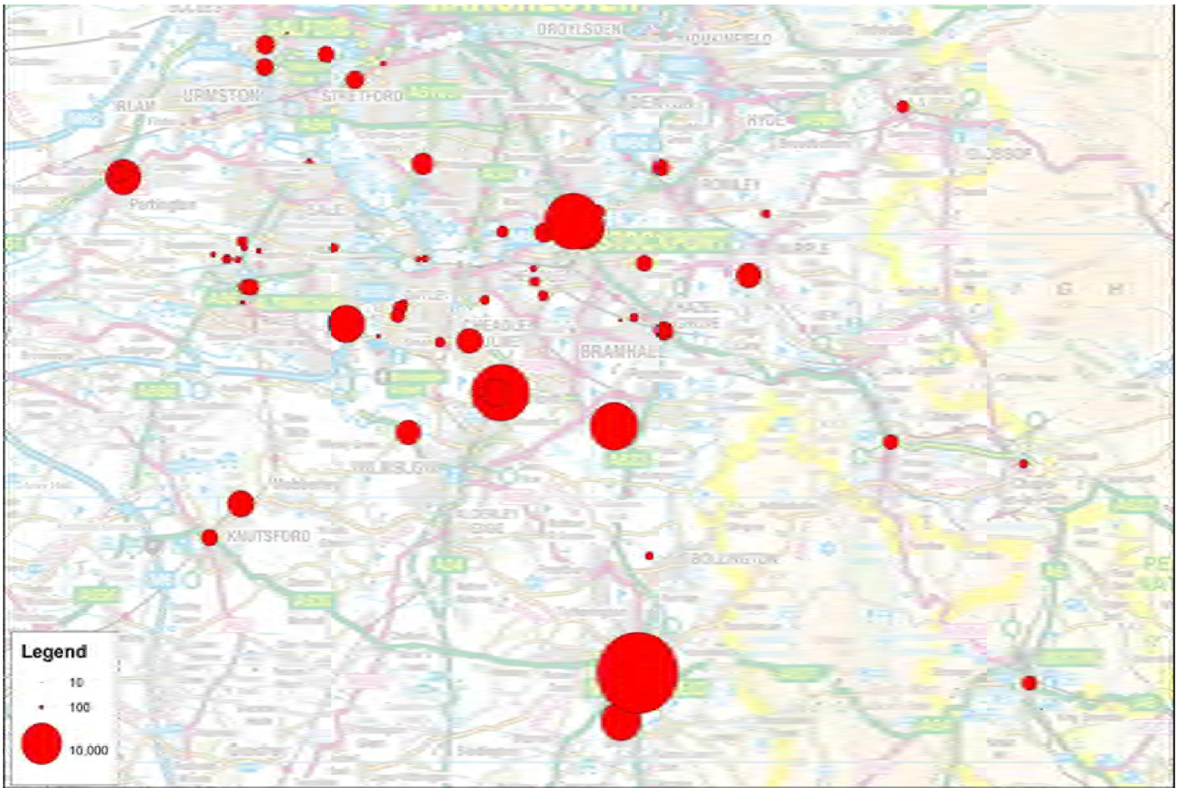

Figure 5. Development Locations – Non-Residential

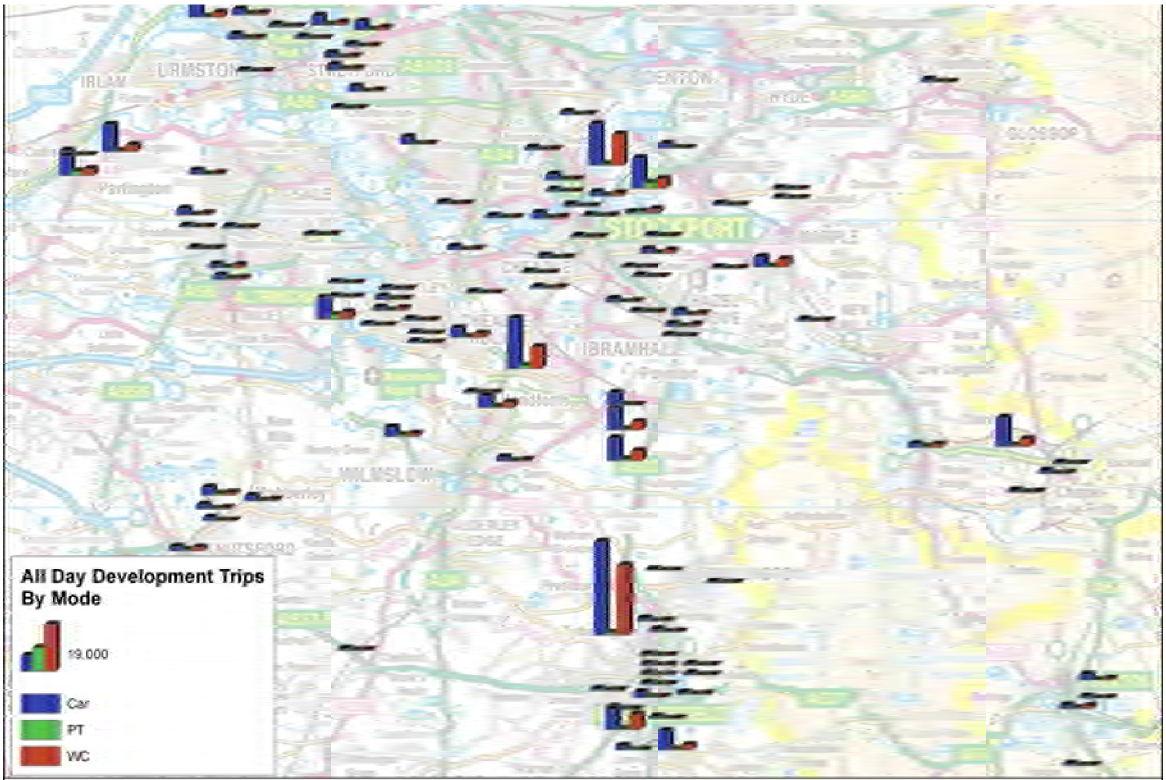

Figure 6. Development Trip Ends by Mode (all day person trips)

3.4 Development Trip Segmentation

3.4.1 Purpose splits have been obtained by identifying zones which are of predominantly a single land use type and taking the base year purpose splits from these zones to apply to the development trip ends. For example the zone containing the a town centre retail core may be used for obtaining the purpose splits for a new shopping development. Representative zones (and hence implied purpose splits) were identified for each of the following land use types:

- A1 shops;
- B1 business and office;
- B2 general industrial;
- C1 hotels;
- C3 dwellings; and
- D2 leisure (cinema, sports facilities etc).

3.4.2 In some cases the representative zones may contain a small number of trips of implausible purposes, for example if the zone is largely office buildings but there are some shops then a small number of shopping trips would be implied by the base year matrices. These would not be appropriate to apply to a new office development so the purpose splits have been adjusted to remove any implausible purposes before being applied to the development trip ends.

3.5 Development Trip Distribution

3.5.1 Development trip ends are distributed by cloning distributions of productions and attractions of the same journey purpose from neighbouring zones. Using neighbouring zones ensures that the trip length distributions remain similar to those observed in the base year matrices and using purpose specific distributions ensures that for example commute attraction trips associated with a new office development are only distributed to production zones which currently produce commute trips, i.e. largely residential zones.

3.5.2 The zones to be used for cloning are defined by a set of distribution sectors. Each development is allocated to a sector and given the distributions obtained from the zones in that sector. These distribution sectors are shown in Figure 7 below along with the locations of developments shown by the red dots. The sectors are designed to be small enough to create a sensible distribution of trips but large enough to include enough zones to ensure that the distributions are not too lumpy, i.e. only distributed to a few zones. The resulting patterns of distribution are included in Appendix B for the sectors and directions associated with some of the largest developments.

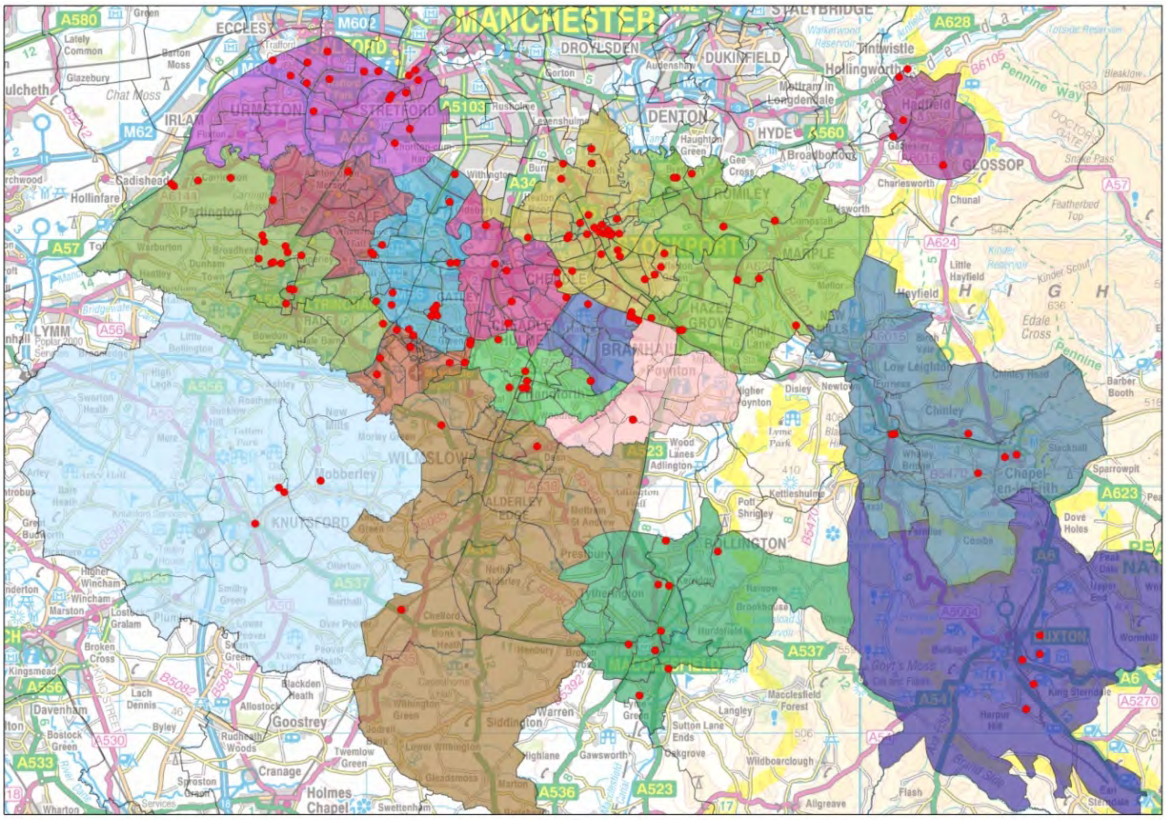

Figure 7. Distribution Sectors

3.6 Manchester Airport Developments

3.6.1 There are two major commercial (non flight related) developments for Manchester Airport to be included in future year forecasts. These are:

- Airport City (formerly known as the Burford site); and
- Manchester Business Park (formerly known as the Arlington/Goodmans site).

3.6.2 The following assumptions have been made for the developments:

- For Airport City (Burford) it is assumed that the site is fully developed and occupied by 2032 and development/occupation by 2017 is assumed to be 50%; and
- For Manchester Business Park (Arlington/Goodmans) it is assumed that the site is fully developed and occupied by 2032 and development/occupation by 2017 is assumed to be 66%. These figures reflect the fact that about a quarter of the permitted floorspace is currently built and occupied (by Cuzzons, Regus and Ericcson).

Table 4. Estimated Floorspace and Jobs on the Airport City and Goodmans Development Sites

	AIRPORT CITY / BURFORD	GOODMANS
Permitted Floorspace (sqm B1)	50,000	50,000
Occupied 2009 (sqm)	0	17,065
Occupied 2017 (sqm)	25,000	41,800
Occupied 2032 (sqm)	50,000	62,700
Jobs 2009	0	806
Jobs 2017	1,180	1,970
Jobs 2032	2,360	2,960

3.7 LDF Growth

3.7.1 As described above, a detailed uncertainty log and subsequently representative travel patterns were derived for future developments for zones within the AoI of A6MARR. By definition the accuracy of modelling in the AoI is of most importance to the appraisal of the scheme. However it was important to include some representation of changes to future land use across the county of Greater Manchester, in particular considering the proximity of the Regional Centre of Manchester City Centre to the AoI.

3.7.2 Previous work by SYSTRA and David Simmonds Consultancy (in 2009) to represent the Local Development Framework (LDF) provided a readily available dataset for redistributing trips across the rest of Greater Manchester, not just within the AoI. Growth factors were applied to production and attractions trip ends for zones within Greater Manchester (beyond the AofI of the scheme) based on forecasts of changes in trip making due to net gain in dwellings, office floor space and industrial floor space.

3.8 NTEM Growth

3.8.1 TAG guidance indicates that when modelling for business cases is submitted to the Department for Transport, scenarios assuming central growth in demand such as the Core scenario must be controlled to the growth in travel demand in the NTEM dataset at an appropriate spatial area.

3.8.2 When creating the future year demand matrices input to A6MARR VDM, changes were first made to the travel patterns associated with the developments within the AoI included in the uncertainty log. The information from the LDF forecasts was then used to adjust travel patterns across the rest of Greater Manchester, but not within the AoI.

3.8.3 In a final step, trip end growth was controlled to NTEM 6.2 forecasts. This was undertaken at the district level within Greater Manchester, the pre-April 2009 Cheshire East districts[1] and at the county level beyond (East Midlands, Derbyshire, Yorkshire, Lancashire and Merseyside). Growth for the 15 external zones was controlled to the NTEM growth forecast for Great Britain as a whole.

3.8.4 NTEM trip end growth factors were applied separately for productions and attractions, disaggregated by mode, purpose and household car availability.

3.9 Manchester Airport Growth

3.9.1 Manchester Airport is a significant trip attractor within the AoI of A6MARR. Situated at the western end of the scheme future growth in passenger and employee travel would be expected to have a significant impact on scheme appraisal. HFAS and Atkins therefore met with representatives of Manchester Airport Group (MAG) to understand their view on future changes to travel demand at the Airport. HFAS produced a note documenting the assumptions which would be included in forecasts, and these were agreed with MAG through further consultation.

3.9.2 The zoning system at Manchester Airport developed for the A6MARR SATURN and PT-TRIPS assignment models were highly disaggregate in order to improve accuracy of network loading in the assignment models. SYSTRA considered this level of aggregation inappropriate for demand response modelling as air travellers' response to changing Airport access costs is best thought of in terms of the whole journey from home to the check-in desk, rather than to a particular car park or public transport terminus. For this reason a single zone was used within the demand model to represent demand to/from Manchester Airport terminals (see Figure 8).

3.9.3 Further, special treatment was given to passenger and employee trips to/from Manchester Airport in A6MARR VDM. These trips were allocated to a separate set of demand segments, in order that different choice responses could be imposed on this demand from those used across the rest of the model. Choice response associated with these Airport demand segments has been restricted to mode choice, as distributional and time of day responses to changing access travel cost are unlikely to impact on passengers and employees travelling to an Airport. For example air passengers have a very restricted set of airport choices, and time of day choice is strongly influenced by flight schedules and air fares.

3.9.4 Separating travel to/from Manchester Airport from the other demand segments

[1] Crewe and Nantwich, Macclesfield and Congleton

facilitated the application of separate growth factors to this demand, from that applied to the rest of the model. Forecasts of passenger numbers were obtained from the DfT's UK Aviation Forecasts published in January 2012. These forecasts were interpolated to create growth factors between the A6MARR model base year of 2009 and the forecast years of 2017 and 2032. The forecasts and resulting growth factors are shown in Table 5.

3.9.5 Growth in all person trips to and from Manchester Airport was assumed to increase by the same ratio as that of passengers. This assumption implies that the number of employees at the airport would increase in the same proportion as air patronage. MAG has reviewed these assumptions and agreed that they are reasonable.

Table 5. Airport passenger growth

YEAR	PASSENGERS (MILLION PER ANNUM)	GROWTH FROM 2009
2009 (actual)	18.6	-
2017 (interpolated)	20.7	11%
2020 (DfT UK Aviation)	22.1	19%
2030 (DfT UK Aviation)	28.1	51%
2032 (interpolated)	29.5	59%

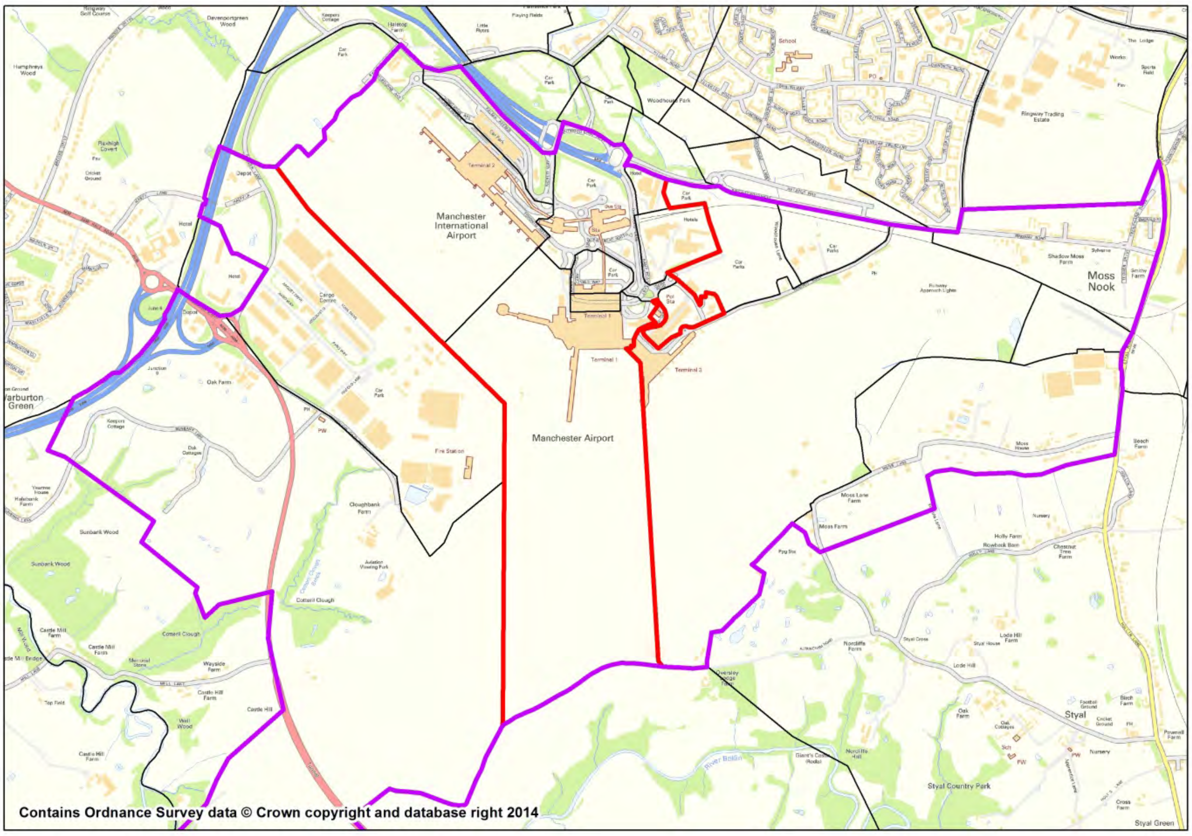

Figure 8. Manchester Airport Boundaries (Purple line indicates zones included in separate airport demand segments; red line indicates terminal zones aggregated to single zone in demand model)

3.10 Freight Growth

3.10.1 Freight growth was applied uniformly across the whole model using data from the National Transport Model (NTM) 2013. The growth factors are shown in Table 6.

Table 6. Goods vehicle growth factors

YEAR	GOODS VEHICLE TYPE	GROWTH FACTOR (FROM 2009)
2017	LGV	1.17
	OGV	0.94
2032	LGV	1.65
	OGV	1.05

3.10.2 Separate goods vehicle trip end growth constraints were applied to Manchester Airport's cargo terminal (A6MARR zone 288, A6MARR VDM zone 25). Growth factors were calculated based on a combination of previous demand forecasts for the Blue/Yellow works and floor space figures taken from MAG's "The Need for Land" document (June 2010) . The final assumptions which were applied to both light and other goods were:

- 49% and 45% growth in goods traffic to/from the Cargo Centre (A6MARR zone 288, A6MARR VDM zone 25) between 2009 and 2017 for AM and PM peak hours respectively;
- 49% growth between 2009 and 2017 for the inter peak goods traffic to/from the Cargo Centre (based on the AM peak outbound growth from the Blue/Yellow works forecasts i.e. the higher of the peak figures); and
- 51% growth in goods traffic to/from the Cargo Centre between 2017 and 2032 (all periods) in line with the Airport's projected growth (2013 to 2030) in floor area; this will be a robust estimate as it will assume that the level of floor area growth is reflected directly in the growth of goods vehicle movements.

3.11 Outturn Reference Forecasts

3.11.1 Table 7 shows the resulting car origin trip end demand growth on a 17 sector system designed for assessing the impacts of A6MARR. The sector system is shown in Figure 9. The growth at Manchester Airport is larger than the growth rates specified in section 3.9 since this sector also includes the adjacent Airport City developments which generate a large number of trips, and other residential areas around the airport.

Table 7. Reference forecast demand (all day car trip ends originating in each sector)

SECTOR	BASE	2017 REFERENCE		2032 REFERENCE	
	ABSOLUTE TRIPS	ABSOLUTE TRIPS	% CHANGE	ABSOLUTE TRIPS	% CHANGE
Manchester Airport & surrounds	125,245	151,736	21%	188,278	50%
Cheadle & Wilmslow	273,105	278,767	2%	303,406	11%
Stockport	527,493	557,110	6%	597,747	13%
Sale & Altrincham	487,885	511,225	5%	541,860	11%
Manchester	1,614,180	1,760,684	9%	1,960,100	21%
Knutsford & Northwich	231,040	236,007	2%	247,076	7%
Macclesfield	216,800	234,427	8%	247,156	14%
High Peak	119,645	133,253	11%	154,940	30%
Wigan	933,040	1,004,381	8%	1,075,391	15%
Bolton & Bury	800,666	822,839	3%	859,721	7%
Rochdale	378,725	399,117	5%	432,028	14%

Oldham & Ashton	797,971	833,824	4%	909,390	14%
North of GM	7,416,890	8,033,245	8%	9,158,194	23%
East of GM	3,252,673	3,488,590	7%	3,814,089	17%
South of GM	1,648,595	1,750,643	6%	1,927,367	17%
West of GM	4,169,911	4,331,822	4%	4,544,828	9%
External	24,957	27,490	10%	30,285	21%
Total	**22,993,862**	**24,527,671**	**7%**	**26,961,570**	**17%**

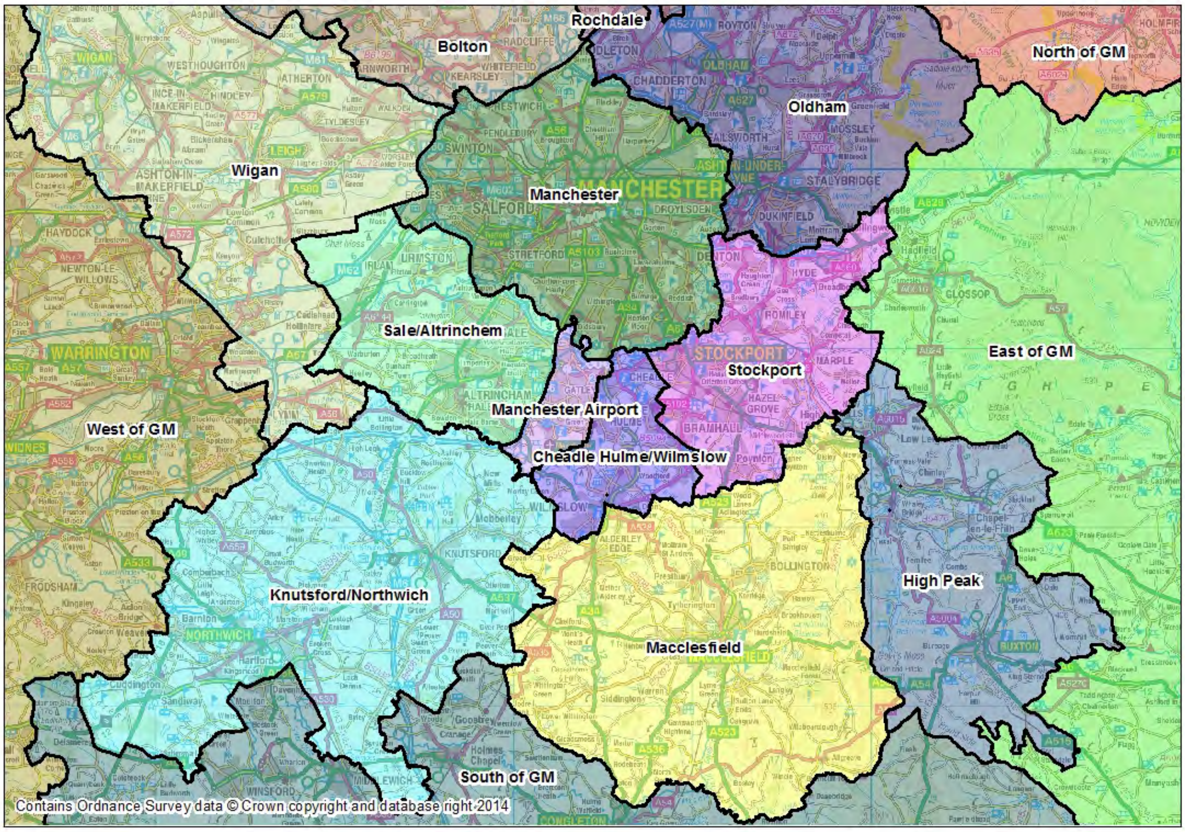

Figure 9. Sector system

4. SUPPLY ASSUMPTIONS

4.1.1 Each highway and public transport (PT) scheme is allocated to either hypothetical, reasonable foreseeable, more than likely or near certain categories in 2017 and 2032. Table 2 above shows the allocation of schemes to scenarios.

4.2 Highway

4.2.1 Atkins made contact with the relevant local authorities and the Highways Agency in order to understand which highway schemes should be included in the do minimum networks at 2017 and 2032. HFAS subsequently coded these schemes on to the base year SATURN assignment networks and provided them to SYSTRA for inclusion in A6MARR VDM.

4.2.2 The following highway schemes are included in the 2017 networks:

- Alderley Edge Bypass (opened in 2010 after the model base year);
- A556 Bypass;
- Manchester Airport Blue and Yellow Works;
- Cross City Bus – Oxford Road Corridor (now under construction);
- highway changes related to the Manchester Airport Metrolink (now under construction);
- M60 Junction 3 / Kingsway widening (completed in 2012);
- M60 Junction 12 to 15 Widening;
- M60 Junction 8 to 12 Managed Motorway Scheme;
- Super Western Gateway Infrastructure Scheme (WGIS);
- Buxton Road / New Road Signals; and
- Airport Demand Management.

4.2.3 In addition, the 2032 networks include the Manchester Airport Red works (M56 J5-6 widening).

4.2.4 Future year values of time and vehicle operating costs for input to the demand and assignment models have been derived using data from the WebTAG Databook and the changes relative to the base year are summarised in Table 8.

Table 8. SATURN PPM and PPK changes from base to forecast years

USERCLASS	2017			2032		
	PPM CHANGE	PPK CHANGE	PPM/PPK CHANGE	PPM CHANGE	PPK CHANGE	PPM/PPK CHANGE
Commute	7%	8%	**-1%**	42%	-17%	**71%**
EB	7%	1%	**6%**	43%	-10%	**58%**
Other	5%	8%	**-3%**	37%	-17%	**64%**
LGV	8%	4%	**4%**	45%	-3%	**49%**
OGV	8%	16%	**-8%**	45%	30%	**12%**

4.3 Public Transport

4.3.1 TfGM, Research & Intelligence originally provided the A6MARR modelling team with a perspective on the likelihood that prospective significant public transport schemes will come to fruition across Greater Manchester in 2017 and 2032. The list of schemes has been refined for the latest model update and the likelihood of completion is shown in Table 9.

Table 9. Likelihood of Completion of significant PT Schemes at 2017 and 2032

SCHEME	CURRENT STATUS (2014)	2017	2032
Metrolink: Phase 3b extensions (Rochdale line, East Didsbury line and Ashton line)	Complete	Complete	Complete
Metrolink: Airport line and Second City Crossing (2CC)	Under construction	Near Certain	Near Certain
Metrolink: Trafford Park	Planning stages	Hypothetical	Hypothetical
Leigh-Salford-Manchester Busway	Under construction	Near Certain	Near Certain
Cross City Bus Package	Under construction	Near Certain	Near Certain
Northern Hub rail improvements	Under construction	Hypothetical (not scheduled to be complete by 2017)	Near Certain

4.3.2 The core scenario includes all schemes rated as More than Likely or Near Certain, therefore all the schemes in table 7 are included with the exception of Trafford Park Metrolink and the Northern Hub improvements which are only included at 2032.

4.3.3 Further details of the coding of these schemes are available in Appendix A. Bus services were adjusted to fit the revised networks following the addition of the highway schemes.

4.3.4 The Northern Hub is a series of rail upgrades to the network in the north of England. The key benefits of the scheme are:

- two new fast trains per hour between Liverpool and Manchester Victoria;
- two new fast trains per hour between Leeds and Manchester;
- reductions in journey time of 10–15 minutes between Liverpool and Manchester;
- reductions in journey time of up to 10 minutes between Leeds and Manchester;

- a new viaduct, known as the Ordsall Chord, to connect Manchester's Victoria, Oxford Road and Piccadilly stations and allow direct services through the city to Manchester Airport; and
- electrification of the line between Manchester and Liverpool.

4.3.5 It is likely that these improvements will not have a significant impact on rail travel along the A6MARR corridor, for example between Hazel Grove, Poynton or Bramhall and Manchester Airport since an interchange at Manchester Piccadilly is still required. Nevertheless, the improvements are reflected in the public transport model via changes to the timings and frequencies of existing services and addition of new services where applicable.

4.3.6 Public transport fares have been assumed to rise at 1% per annum above the growth in RPI between 2009 and 2017 and 2032 in line with central government policy.

4.3.7 It is assumed that the current ticketing options available to passengers of all modes are those that would be available in the future, as is implicitly assumed in the fare tables.

4.3.8 Future year PT values of time for input to the demand and assignment models have been derived using data from the WebTAG Databook. These values are summarised in Table 10 below.

Table 10. Future year VOT by purpose (pence per minute, 2010 prices, 2009 values)

PURPOSE	2009	2017	2032
Commute	11.3	11.4	15.4
Employer's Business	37.6	38.2	51.4
Leisure / Other	10.0	10.1	13.6

4.4 Parking and Mode Share at Manchester Airport

4.4.1 Following their discussions with MAG, HFAS produced a note "Modelling of Manchester Airport – Forecasting Assumptions", which set out what assumptions would be made in A6MARR VDM with regard to future travel to/from Manchester Airport and likely infrastructure enhancements.

4.4.2 The likely growth in travel demand at Manchester Airport due to both increases in air travel and nearby development were covered in Section 3 of this note. This section explains the supply side changes at Manchester Airport and how these are modelled in A6MARR-VDM.

4.4.3 Figure 10 shows the zones around Manchester Airport, some of which are discussed in the following sections.

Figure 10. Manchester Airport Assignment Model Zones

4.4.4 It is estimated that by 2032 there will be a need for an additional 18,000 to 32,400 additional car park spaces for passenger use and approximately 4,400 spaces for staff use (source: "The Need for Land" – MAG). Furthermore, it is anticipated that some existing long stay car parks will need to be relocated to allow expansion of the apron areas.

4.4.5 Following discussion with MAG, the following assumptions have been made:

- Long stay parking displaced from the Sydney Avenue area (assignment zone 289) will be relocated to a site near the Airport Viewing Park off Sun Bank Lane (assignment zone 288).
- Long stay parking displaced from the Ringway Road area (assignment zone 309 and 310) will be relocated to land north of Ringway Road and east of Shadow Moss Road (assignment zone 311). The new car park is actually in the area covered by zone 312, however the connections for zone 311 are a good representation for the car park, and connect into Ringway Road between the junctions with Shadow Moss Lane and Hollin Lane.
- Short stay parking within the central terminal area will be assumed to expand to meet demand. Growth in trips to the airport terminals has been allocated to the zones representing the short stay parking areas whilst the zones representing the pick-up and drop-off areas have been assumed to remain constant.

4.4.6 As suggested by MAG, privately operated Airport-related car parks in the Moss Lane area (assignment zone 1080) will be assumed to remain at current levels (i.e. no growth over time).

4.4.7 MAG has set a target of 40% of trips to and from Manchester Airport being by non-car modes. The Airport Masterplan states that this will be achieved by:

- promotion of public transport;
- completion of the Airport extension to the Metrolink network.
- developing a mix of off site park-and-ride and on site parking;
- discouraging “kiss and fly” and taxi use; and
- use of demand management techniques (assumed to be a £2 access charge for the latest set of forecasts) designed to discourage private vehicles entering the airport area.

4.4.8 The Airport Metrolink extension and demand management measures have been incorporated in each scenario within A6MARR VDM, such that increases in the cost of car trips to/from the airport relative to other modes will lead to reduction in mode share for car. However A6MARR VDM does not aim to explicitly meet the 40% mode share target for non car trips set by Manchester Airport. Rather the calibrated VDM predicts mode choice based on the generalised cost of each alternative.

4.4.9 Demand to and from Manchester Airport is modelled in separate demand segments to the rest of the model, allowing only mode split changes to be modelled, i.e. no distribution or macro time of day response to cost changes. This ensures that the increase in cost of car travel to/from the airport can only result in a modal switch rather than a destination or time of day switch.

4.5 Definition of Preferred Scheme

4.5.1 The preferred scheme that has been assessed in these forecasts has been represented as a two lane dual carriageway with a mixture of grade separated and at-grade junctions. The junctions along the road are:

- B5166 Styal Road – signalised;
- B5358 Wilmslow Road – grade separated;
- A34 Kingsway / Handforth Bypass – grade separated roundabout;
- A5102 Woodford Road - grade separated;
- A5149 Chester Road – signalised roundabout from spur;
- A523 Macclesfield Road – signalised; and
- A6 Buxton Road – signalised.

4.5.2 The scheme also includes an upgrade from one lane to two of the existing Ringway Road West from Shadow Moss Road to the M56 spur at the Airport.

5. CORE SCENARIO FORECASTS

5.1 Introduction

5.1.1 The role of the VDM is to allow the reference forecast demand produced by the EFM to respond to changes in the cost of travel over time. These changes in cost will be different for each zone pair, mode of travel, purpose of travel and time of day and can be influenced by factors including:

- increased congestion due to the underlying increase in car trips forecast by the National Trip End Model (NTEM);
- changes in values of time and vehicle operating costs as forecast by WebTAG;
- changes in PT fares;
- introduction of new PT services or changes to journeys times / headways for existing services;
- introduction of new road infrastructure; and
- the inclusion of significant new developments causing additional local congestion.

5.1.2 The demand model compares the costs of travel for the future year with "reference" costs from the base year model and allows demand to shift between alternative destinations, modes and time periods depending on the relative costs of each option. For example where the A6MARR scheme is introduced there is a reduction in car journey time and distance for movements which benefit from the scheme relative to the base year reference costs. This cost reduction will lead to an increase in car demand for these movements along with a reduction in car trips to other destinations (redistribution) and to a lesser extent a reduction in PT trips on the same movements (mode switch).

5.1.3 Details of the factors listed above which contribute to changes in cost over time have been discussed in prior sections of this note. This section reports on the outcome demand changes and how these compare to the reference demand forecasts.

5.2 Without-Scheme Forecasts

5.2.1 Table 11 shows the percentage change in origin trip end demand from both the reference demand (input to the VDM) and from the base demand to the outturn without-scheme forecast demand. These figures are all for the all-day car person trip matrices stored in the VDM.

5.2.2 It can be seen that in general the VDM has the overall effect of slightly reducing car demand. This is due to the increased costs of car travel in the future due to additional congestion. This effect is most prominent on trips to and from the Manchester and Manchester Airport sectors due to the higher levels of growth in the input matrices on these movements leading to a higher increase in cost due to additional congestion.

Table 11. Core scenario without-scheme forecasts compared to reference forecasts and base (all day car trips originating in each sector)

SECTOR	2017		2032	
	% CHANGE FROM REFERENCE FORECAST	% CHANGE FROM BASE	% CHANGE FROM REFERENCE FORECAST	% CHANGE FROM BASE
Manchester Airport & surrounds	-3.7%	17%	-4.7%	43%
Cheadle & Wilmslow	-0.3%	2%	-0.4%	11%
Stockport	-0.4%	5%	-0.1%	13%
Sale & Altrincham	-0.9%	4%	-0.1%	11%
Manchester	-1.5%	7%	-2.3%	19%
Knutsford & Northwich	-0.8%	1%	1.4%	8%
Macclesfield	-1.2%	7%	2.1%	16%
High Peak	-1.2%	10%	1.1%	31%
Wigan	-1.0%	7%	0.0%	15%
Bolton & Bury	-0.8%	2%	0.0%	7%
Rochdale	-0.7%	5%	-0.1%	14%
Oldham & Ashton	-0.6%	4%	-0.2%	14%
North of GM	-1.0%	7%	-1.2%	22%
East of GM	-0.9%	6%	-1.1%	16%
South of GM	-0.8%	5%	-0.8%	16%
West of GM	-0.8%	3%	-0.3%	9%
External	-0.7%	9%	5.4%	28%
Total	**-0.9%**	**6%**	**-0.9%**	**16%**

5.2.3 Table 12 presents the average car trip length and indexed total car trip km in both the reference (input) demand and the without-scheme forecast demand. The effect of the VDM is different in 2017 and 2032. In 2017 there is a reduction in average trip length and total trip kilometres relative to the reference forecast whereas in 2032 there is an increase. We would expect to see an increase since the improvements to vehicle efficiency and increasing value of time result in longer distance car trips on high speed roads becoming relatively more attractive compared to shorter distance.

5.2.4 However at 2017 the opposite effect occurs, i.e. a reduction in trip kilometres and an implied shift from longer to shorter distance movements. This can be explained by looking at the change in value of time (pence per minute or PPM) and vehicle operating cost (pence per kilometre or PPK) input to the SATURN highway model (see Table 8) in the forecast years.

5.2.5 At 2017, the vast majority of traffic (commute and other user classes) see a reduction in the ratio of PPM to PPK meaning that operating cost (PPK) becomes more important than it was in the base year and therefore users are willing to take a shorter route through the network in order to minimise distance at the expense of spending more time travelling. All else equal, this will result in reduced vehicle-kilometres in the 2017 forecasts than the base year. This is of course offset by an increase in overall demand between the base and 2017 which tends to increase overall trip km (but not average trip length).

5.2.6 The higher operating cost also means that shorter distance journeys become relatively more attractive than longer distance in 2017 and the demand model responds to this cost change via its destination choice mechanism which moves demand from longer distance movements to shorter distance.

5.2.7 At 2032, the PPK is forecast to reduce significantly as vehicle efficiency is assumed to improve. Meanwhile PPM is forecast to increase, meaning that the expected effect of increasing trip kilometres and increasing average trip length is observed due to the longer distance movements becoming relatively more attractive than shorter distance.

Table 12. Change in average trip length and trip kilometres

FORECAST	AVERAGE TRIP LENGTH (KM)	INDEXED TOTAL TRIP KM
Base	14.2	100
2017 Reference (input)	14.3	107.0
2017 Without-Scheme (output)	14.0	103.7
2032 Reference (input)	14.5	119.4
2032 Without-Scheme (output)	15.0	122.6

5.3 With-Scheme Forecasts

5.3.1 The with scheme forecasts are identical to the without-scheme forecasts except for the inclusion of the A6MARR scheme coding in the SATURN highway model. This change creates reduced congestion and reduced travel costs compared to the without-scheme case and the demand model responds by increasing car demand on OD pairs which benefit from these improvements.

5.3.2 At the global level there is very little change in demand since the main impact of the scheme in demand terms is a re-distribution of existing car demand rather than a mode shift from other modes. Table 13 shows the demand changes from the without-scheme to the with-scheme forecasts on those sector pairs which see the largest increase due to the scheme. The sector pairs are, as expected, those which are likely to involve making use of A6MARR and hence would see a reduction in travel cost. The changes at 2032 are slightly higher due to the higher level of background demand growth.

Table 13. Sector to sector demand changes due to A6MARR (all day car person trips)

SECTOR PAIR	WITHOUT SCHEME	WITH SCHEME	ABSOLUTE CHANGE	% CHANGE
2017				
Cheadle Hulme/Wilmslow <-> Airport	32,690	33,836	1,146	4%
Stockport <-> Airport	13,924	15,227	1,302	9%
Stockport <-> Cheadle Hulme/Wilmslow	93,400	95,520	2,120	2%
Cheadle Hulme/Wilmslow <-> Sale/Altincham	26,966	28,813	1,847	7%
Stockport <-> Sale/Altincham	17,982	19,357	1,375	8%
Macclesfield <-> Manchester Airport	5,600	5,898	298	5%
High Peak <-> Manchester Airport	949	1,224	274	29%
Knutsford/Northwich <-> Stockport	4,235	4,564	329	8%
High Peak <-> Cheadle Hulme/Wilmslow	2,692	3,312	620	23%
2032				
Cheadle Hulme/Wilmslow <-> Airport	37,683	39,873	2,190	6%
Stockport <-> Airport	17,221	19,310	2,089	12%
Stockport <-> Cheadle Hulme/Wilmslow	102,606	106,831	4,224	4%
Cheadle Hulme/Wilmslow <-> Sale/Altincham	28,646	31,170	2,524	9%
Stockport <-> Sale/Altincham	19,011	20,737	1,726	9%

Macclesfield <-> Manchester Airport	7,939	8,435	496	6%
High Peak <-> Manchester Airport	1,516	1,965	448	30%
Knutsford/Northwich <-> Stockport	4,741	5,197	456	10%
High Peak <-> Cheadle Hulme/Wilmslow	3,730	4,500	769	21%

5.3.3 Changes in average trip length and total trip kilometres are negligible between the without-scheme and with-scheme forecasts.

5.4 Peak Hour Assignment Forecasts

5.4.1 The demand forecasts presented so far in this note are based on the period person demand stored in the VDM, rather than the outturn peak hour assignment demand. The assignment demand is created by applying demand differences from the base year to the fully converged future year VDM matrices to the base year assignment matrices, as detailed in the Model Development Report.

5.4.2 Table 14 shows the matrix totals by time period for the without-scheme and with-scheme forecasts. The demand growth is broadly in line with the forecasts presented in the previous chapter, however the matrix totals include freight growth trips so the outturn growth is not completely comparable with the figures presented for the VDM demand in previous tables. There is a higher growth rate in the inter peak due to the greater proportion of "other" trips which have a higher growth rate than commute and business trips in the original TEMPRO exogenous growth factors.

5.4.3 There is a negligible change at the matrix total level between the with-scheme and without-scheme forecasts. However since the changes are applied at a zone pair (O-D) level the same pattern of changes seen in the demand model matrices will be carried through to the assignment matrices, so there are increases in demand on zone pairs which benefit from the scheme as discussed in the previous section.

Table 14. Peak hour assignment matrix totals (hourly PCUs)

TIME PERIOD	BASE	WITHOUT-SCHEME	WITH-SCHEME	WITHOUT SCHEME / BASE	WITH-SCHEME / WITHOUT-SCHEME
2017					
AM Peak	1,404,371	1,466,474	1,466,688	4.4%	0.0%
Inter Peak	1,007,951	1,063,682	1,063,665	5.5%	0.0%
PM Peak	1,238,939	1,303,078	1,303,230	5.2%	0.0%
2032					

AM Peak	1,404,371	1,653,112	1,653,574	17.7%	0.0%
Inter Peak	1,007,951	1,242,175	1,242,313	23.2%	0.0%
PM Peak	1,238,939	1,481,524	1,482,160	19.6%	0.0%

6. HIGH AND LOW GROWTH FORECASTS

6.1 Introduction

6.1.1 As discussed in section 2, TAG requires that alternative high and low growth scenarios are modelled in order to test the uncertainty surrounding the assumptions which are used in generating the forecasts.

6.1.2 Since the high and low growth forecasts pivot from the output without-scheme forecast demand it has already been adjusted to account for changes in the cost of travel over time, i.e. vehicle operating cost and value of time changes. The high and low growth scenarios allow demand to respond to the extra or reduced congestion caused by increasing or reducing the traffic levels in each of the forecast years.

6.1.3 Additionally, in the high growth scenario extra developments are added which are not included in the core scenario, and these can have an impact on local congestion and travel costs in the vicinity of these developments.

6.2 Without-Scheme Forecasts

6.2.1 Table 15 shows the changes in the output high and low growth origin trip ends relative to the equivalent core scenario matrices. These figures have been calculated from the all day period person demand stored within the VDM. Overall the changes are in line with the method set out in section 2 whereby a proportion of the base matrices are added or removed from the core scenario output. However there are larger changes where specific developments have been added or removed due to their likelihood.

Table 15. High and Low growth trip end changes from Core scenario (all day person demand)

SECTOR	2017		2032	
	% CHANGE CORE TO LOW	% CHANGE CORE TO HIGH	% CHANGE CORE TO LOW	% CHANGE CORE TO HIGH
Manchester Airport & surrounds	-5.4%	7.3%	-7.7%	6.9%
Cheadle & Wilmslow	-6.2%	12.5%	-14.7%	17.6%
Stockport	-5.9%	11.6%	-11.1%	11.6%
Sale & Altrincham	-7.7%	6.7%	-10.6%	9.2%
Manchester	-5.9%	5.7%	-8.2%	6.4%
Knutsford & Northwich	-6.2%	7.2%	-11.1%	9.5%
Macclesfield	-19.7%	7.6%	-28.9%	13.6%
High Peak	-6.4%	6.1%	-8.7%	10.5%

Wigan	-5.4%	4.2%	-8.0%	6.4%
Bolton & Bury	-5.3%	4.5%	-7.9%	6.8%
Rochdale	-5.5%	4.5%	-8.1%	6.6%
Oldham & Ashton	-5.5%	4.9%	-8.0%	7.0%
North of GM	-5.2%	4.4%	-7.3%	6.6%
East of GM	-5.2%	4.6%	-7.7%	7.2%
South of GM	-5.8%	4.9%	-8.4%	7.7%
West of GM	-5.5%	4.7%	-8.4%	7.7%
External	-6.4%	6.2%	-9.7%	8.7%
Total	**-5.6%**	**5.0%**	**-8.3%**	**7.3%**

6.3 With-Scheme Forecasts

6.3.1 As would be expected, the inclusion of A6MARR has a similar effect in the High and Low growth scenarios as seen under the core scenario, with increases in car demand no the same sector pairs as detailed in section 5.3. However the changes are of a higher or lower magnitude due to the different levels of demand in these scenarios.

6.3.2 Table 16 shows the all-day car person demand changes due to the scheme on the same sector pairs identified in section 5.3 under each of the three scenarios. Whilst the percentage changes under all scenarios remains similar, the absolute changes are higher in the High growth and lower in the Low growth. This is magnified in 2032 due to the larger deviation from the Core, reflecting the higher level of uncertainty.

Table 16. Sector to sector changes due to A6MARR (with-scheme minus without-scheme) on key sectors under Core, High and Low growth scenarios (all day car person trips)

SECTOR PAIR	ABSOLUTE CHANGE			% CHANGE		
	CORE	HIGH	LOW	CORE	HIGH	LOW
2017						
Cheadle Hulme/Wilmslow <-> Airport	1,146	1,794	999	4%	5%	3%
Stockport <-> Airport	1,302	1,550	1,243	9%	10%	9%

Stockport <-> Cheadle Hulme/Wilmslow	2,120	3,639	1,893	2%	3%	2%
Cheadle Hulme/Wilmslow <-> Sale/Altincham	1,847	2,580	1,633	7%	9%	7%
Stockport <-> Sale/Altincham	1,375	1,656	1,282	8%	9%	8%
Macclesfield <-> Manchester Airport	298	337	278	5%	6%	6%
High Peak <-> Manchester Airport	274	275	259	29%	28%	28%
Knutsford/Northwich <-> Stockport	329	384	307	8%	9%	8%
High Peak <-> Cheadle Hulme/Wilmslow	620	636	559	23%	22%	22%
2032						
Cheadle Hulme/Wilmslow <-> Airport	2,190	3,929	1,484	6%	9%	4%
Stockport <-> Airport	2,089	2,642	1,876	12%	15%	12%
Stockport <-> Cheadle Hulme/Wilmslow	4,224	7,539	2,389	4%	6%	3%
Cheadle Hulme/Wilmslow <-> Sale/Altincham	2,524	3,803	1,730	9%	12%	7%
Stockport <-> Sale/Altincham	1,726	2,158	1,531	9%	11%	9%
Macclesfield <-> Manchester Airport	496	638	446	6%	8%	6%
High Peak <-> Manchester Airport	448	455	413	30%	30%	28%
Knutsford/Northwich <-> Stockport	456	544	381	10%	12%	9%
High Peak <-> Cheadle Hulme/Wilmslow	769	880	595	21%	23%	17%

6.4 Peak Hour Assignment Forecasts

6.4.1 As with the core scenario, the peak hour assignment matrices are created by applying demand changes from the outturn VDM matrices to the base year peak hour assignment matrices and so the pattern of demand changes is the same as reported above. The resulting matrix totals are shown in Tables 17 and 18. The 2017 Low matrices are lower than the base year since the growth implied by TEMPRO is less than the deviation required in TAG. As with the core scenario, the scheme has a negligible effect at the global level.

Table 17. High growth peak hour assignment matrix totals (hourly PCUs)

TIME PERIOD	WITHOUT-SCHEME	WITH-SCHEME	WITHOUT SCHEME / BASE	WITH-SCHEME / WITHOUT-SCHEME
2017				
AM Peak	1,528,881	1,529,416	8.9%	0.0%
Inter Peak	1,113,416	1,113,553	10.5%	0.0%
PM Peak	1,369,762	1,370,116	10.6%	0.0%
2032				
AM Peak	1,736,895	1,737,553	23.7%	0.0%
Inter Peak	1,315,286	1,315,580	30.5%	0.0%
PM Peak	1,575,128	1,576,067	27.1%	0.1%

Table 18. Low growth peak hour assignment matrix totals (hourly PCUs)

TIME PERIOD	WITHOUT-SCHEME	WITH-SCHEME	WITHOUT SCHEME / BASE	WITH-SCHEME / WITHOUT-SCHEME
2017				
AM Peak	1,382,638	1,382,867	-1.5%	0.0%
Inter Peak	998,006	997,943	-1.0%	0.0%
PM Peak	1,228,966	1,229,132	-0.8%	0.0%
2032				
AM Peak	1,517,741	1,517,988	8.1%	0.0%
Inter Peak	1,130,182	1,130,128	12.1%	0.0%
PM Peak	1,365,952	1,366,220	10.3%	0.0%

7. APPENDIX A: PUBLIC TRANSPORT SCHEME DETAILS

7.1 Metrolink

7.1.1 The committed Metrolink Capacity and Renewals programme and the Phase 3 extensions to the network were included in the Do Minimum strategies at both 2017 and 2032. The Capacity and Renewals work began in 2007 and work on the construction of the 3a extensions has now completed, with phased openings between 2010 and 2013. Improvements include:

- the extension from Victoria to Oldham and Rochdale along the existing railway line (note that the rail services along the Oldham/Rochdale railway line were removed from the model in future years);
- the extension from Piccadilly to Ashton;
- the spur to MediaCity UK;
- the extension from Trafford Bar to East Didsbury;
- extension to Manchester Airport; and
- a second crossing of Manchester City Centre.

7.1.2 SYSTRA has assumed the following schedule of Metrolink services.

Table 19. Future Year Metrolink Service Patterns

SERVICE	VIA	TRAMS PER HOUR
Bury to Altrincham	Mosley Street	5
Bury to Ashton	Piccadilly	5
Altrincham to Ashton	Piccadilly	5
Piccadilly to Eccles		5
Shaw to Airport	Oldham Town Centre and 2CC	5
Rochdale Station to Airport	Oldham Town Centre and 2CC	5
Media City to Piccadilly		5
East Didsbury to Victoria	2CC	10

7.2 Bus

7.2.1 Bus service patterns and frequencies have been assumed to be unchanged from those in the modelled base year of 2009.

7.2.2 In addition, all scenarios at 2017 and 2032 include elements of the Cross City Bus Package and the Leigh Salford Manchester guided bus way scheme.

Table 20. Cross City Bus Service Frequency (buses per hour)

LINE	AM	IP	PM	EVENING
Manchester Royal Infirmary and Leigh	4	3	4	2
Manchester Royal Infirmary and Atherton	4	3	4	2
Manchester Royal Infirmary and Middleton	6	6	6	2
Parrs Wood and Pendelton	6	6	6	2
Christie Hospital and Pendleton	6	6	6	2

7.2.3 A service frequency of 6 services per hour in each direction has been assumed for the Leigh Salford Manchester guided bus way scheme.

7.3 Rail

7.3.1 Rail service patterns and frequencies have been assumed to be unchanged from those in the base year of 2009.

8. APPENDIX B: DEVELOPMENT TRIP DISTRIBUTION PLOTS

8.1.1 The resulting distributions for some of the most important distribution sectors have been extracted and are displayed in Figures B1 to B4 below for car trips only. To keep the number of plots manageable, distributions are presented only for the sectors and directions associated with some of the largest developments, as follows:

- Figure 11 - Productions from Chapel-en-le-Frith and Chinley (used for new housing development at Chinley);
- Figure 12 - Productions from Macclesfield (used for new housing development in Macclesfield);
- Figure 13 - Attractions to Macclesfield (used for new shopping development in Macclesfield); and
- Figure 14 - Attractions to Manchester Airport (used for Airport City office developments).

8.1.2 The production plots show where productions generated by developments in that sector (e.g. new housing in the High Peak sector) will be distributed to different attraction zones whilst the attraction plots show where attractions generated by a development (e.g. new offices at Airport City) will be distributed to different production zones. The size of the bars is proportional to the percentage of trips distributed to each sector for each purpose, such that the total for each purpose is 100%. The group of zones used to create the distribution is highlighted blue and these correspond to the distribution sectors defined in Figure 7, section 3.5.

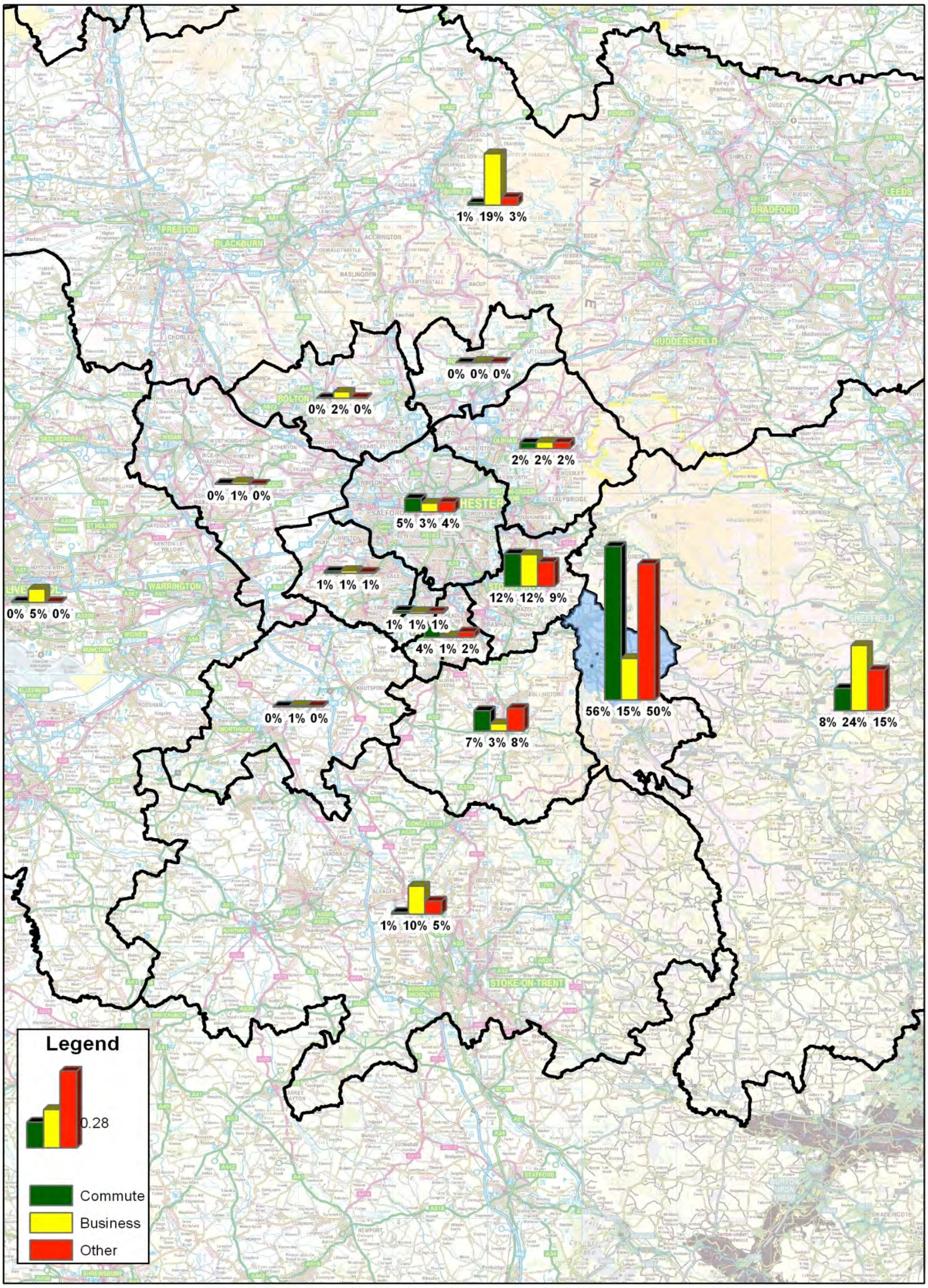

Figure 11. Distribution of Chapel-en-le-Frith & Chinley Car Productions

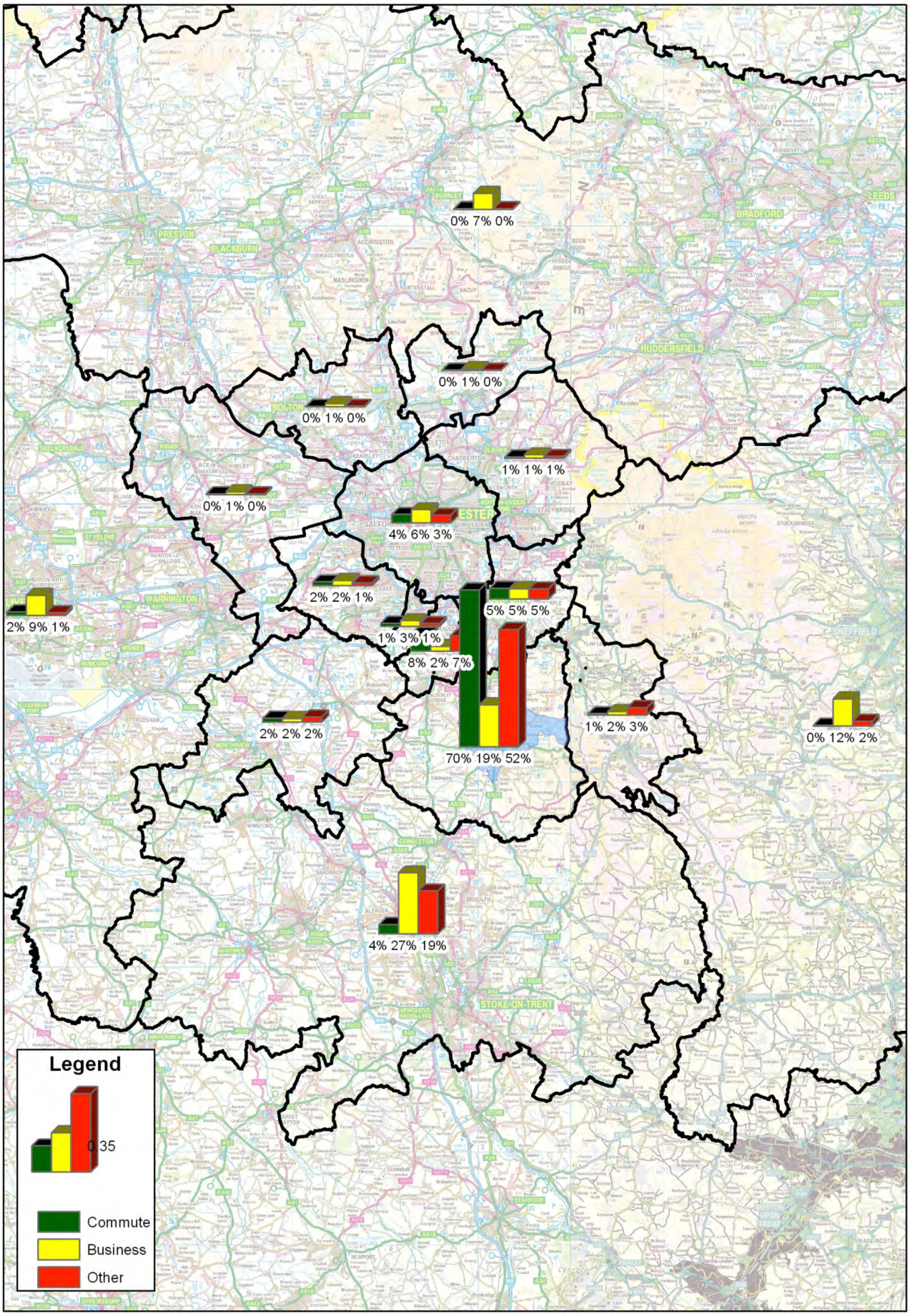

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Figure 12. Distribution of Macclesfield Car Productions

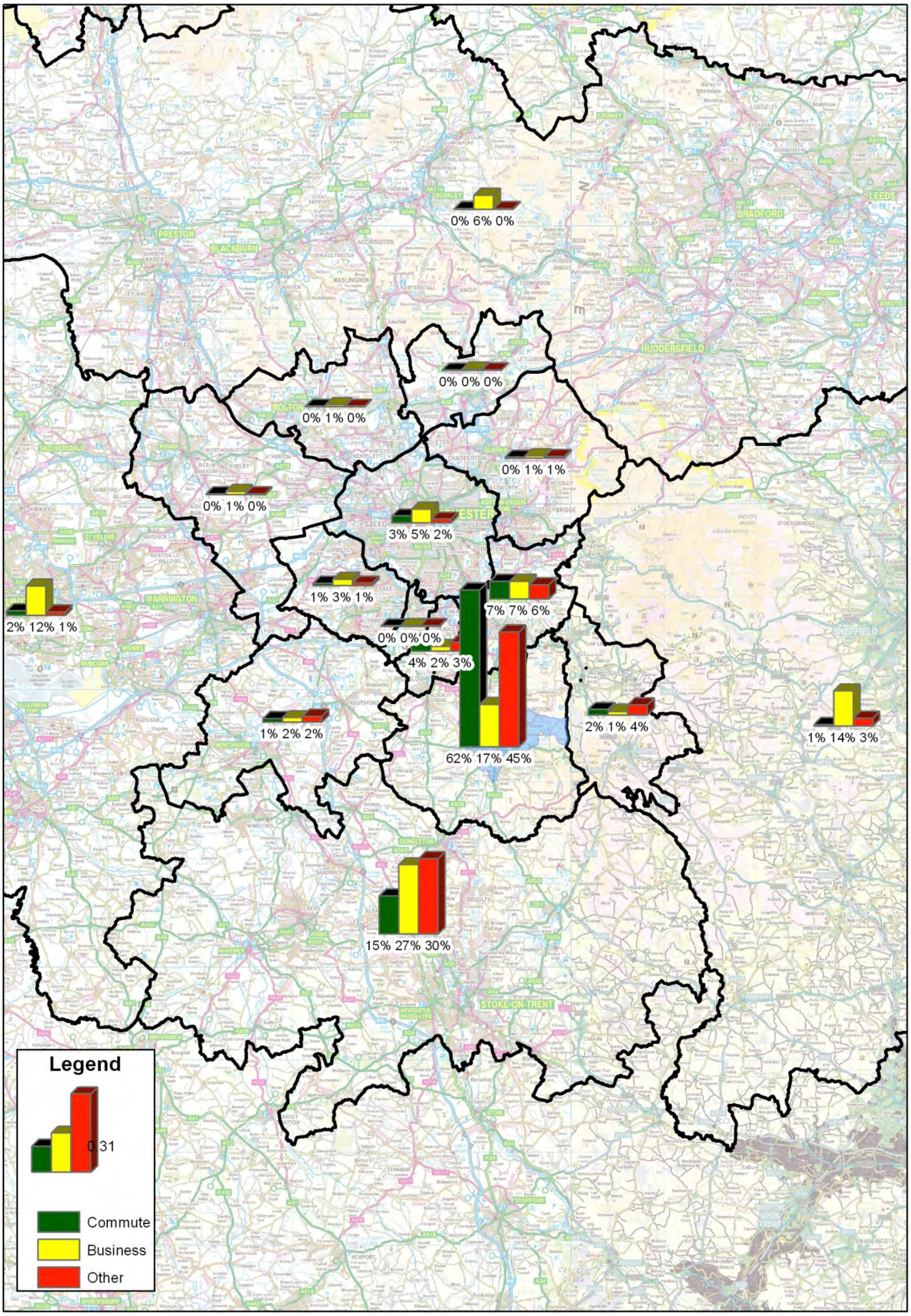

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Figure 13. Distribution of Macclesfield Car Attractions

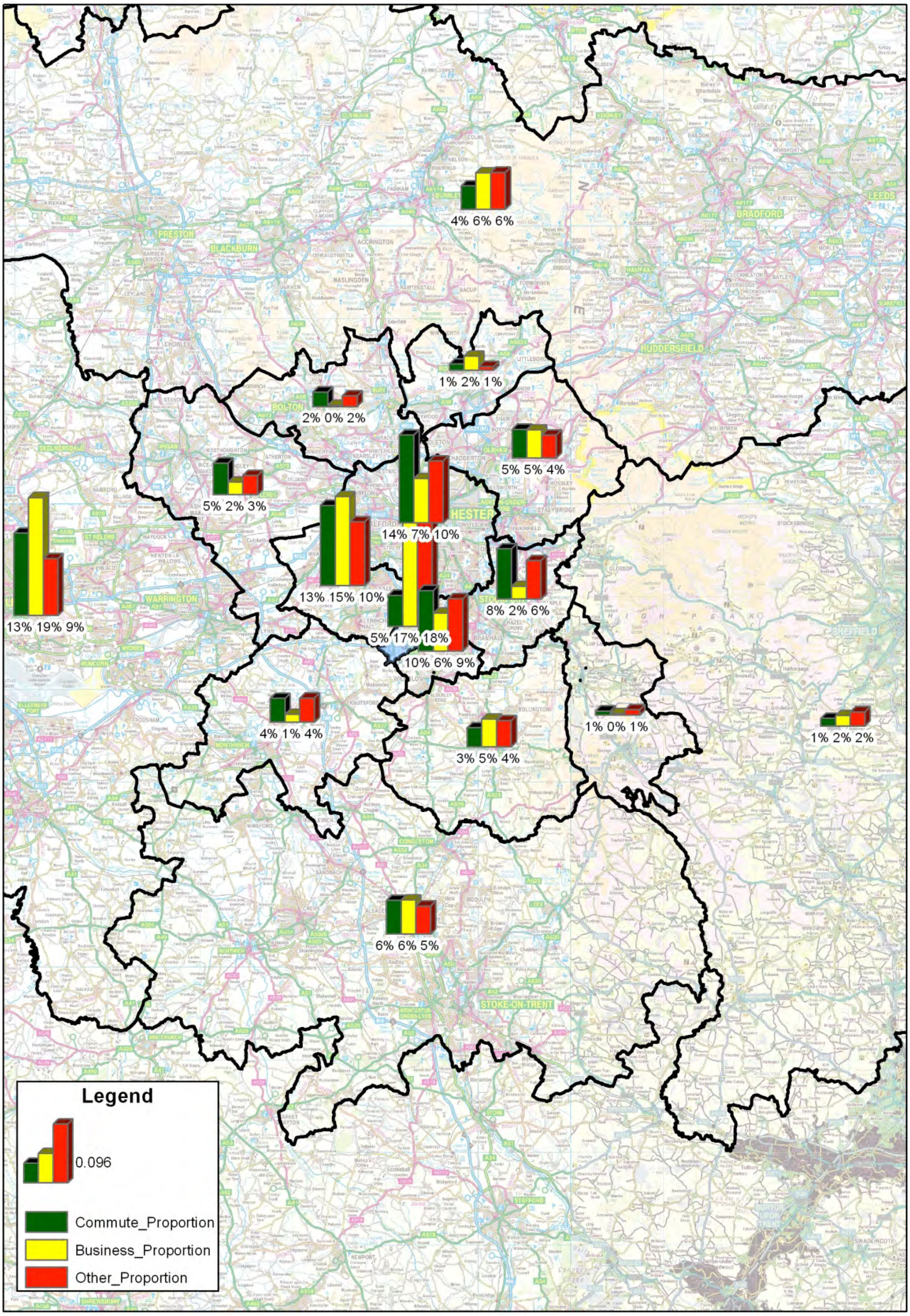

Figure 14. Distribution of Manchester Airport Car Attractions

APPROVAL

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