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Bus Strategy

Addressable and Future Demand Study

19 January 2016



Considering the demand for
bus travel in West Yorkshire

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Important note:

The analysis presented in this report provides an indication of the potential scale of unfulfilled demand for commuting by bus under a series of simplifying assumptions.

This does not replace the detailed and disaggregated transport modelling that is required as part of wider work for the Bus Strategy.

The results presented in this document should be treated as high-level and indicative, for use in strategy formulation.

Executive Summary

Executive Summary

This study assesses a measure of addressable demand for bus commuting in West Yorkshire based on data from the 2011 Census and geospatial and passenger data provided to Deloitte by WYCA. This is augmented by a rough-order-of magnitude estimate of future demand potential on the basis of jobs created in the aspirational projections of the Leeds City Region Strategic Economic Plan.

Using regression analysis, the relationship between supply and demand side factors and reported use of bus transport for commuting purposes has been estimated and compared to observed use at the output area level. Additional or “untapped” demand has been identified in areas where observed levels of commuting by bus are below those estimated using the regression model. In these areas, demand could be captured by targeting individuals with characteristics similar to those of existing bus users whose mode and distance of commute could be substituted for bus transport. This report has also used ONS supergroups to categorise output areas and attempt to identify the characteristics of high propensity users of bus services

Identifying whether excess demand is likely to exist is important in informing decisions around bus service provision. It assists in establishing the total opportunity for bus travel in light of demand factors and identifies areas and customer segments with the highest potential to change their existing transport choices in favour of bus travel. The analysis contained herein is not constrained by bus supply, e.g. effective network capacity at peak.

Key findings:

- While total distance travelled per capita is in decline across the UK, trends in the use of different modes of transport differ significantly. In West Yorkshire, bus usage has fallen over the last 20 years, although a small increase since 2010/11 appears to be reversing recent recession induced decline
- Analysis of West Yorkshire output areas has identified a maximum of 17,600 potential additional bus commuters based on demographic and supply side data. Between 9,000 and 12,400 of these are estimated to be able to switch to commuting by bus after making sensible downward adjustments based on distance travelled and method of commute (which assume those able to switch to bus transport currently commute less than 10km by car)
- This represents an increase of between 9% and 12% above the 104,600 bus commuters observed in the 2011 Census and suggests that there is likely to be latent demand for bus use ‘in the system’, which might be captured through bus strategy interventions
- Observed bus users are drawn disproportionately from certain demographics groups, a fact that could inform which customer segments should be targeted to increase bus usage
- Ethnic, Metropolitan and Low income city output areas account for a high proportion of output areas displaying very high and high propensities towards bus use. These groups have the lowest incomes of the 8 ONS supergroups and are also amongst the least likely to own a car
- Rates of bus usage are higher for all supergroups in Leeds than in any of West Yorkshire’s other four boroughs and are particularly high relative to other areas within the Multicultural metropolitans and Constrained city dwellers supergroups. This suggests that developing a clearer understanding of why these groups display a high propensity towards bus use could inform strategies to increase their level of bus use in the rest of West Yorkshire
- Indicatively, the quantum of job growth embodied in the SEP could result in a further 7% to 18% increase in those travelling to work by bus. Taken together with the addressable demand, this suggests future demand could be c. 15% to 30% higher than today. For this to happen a series of supply-side constraints would need to be overcome (not considered here), and an effective and sustainable bus strategy would need to be implemented.

Study scope

Study scope

This study aims to establish the addressable demand for bus transport within West Yorkshire

Deloitte has been engaged by West Yorkshire Combined Authority (WYCA) to provide a study into the potential market size for bus travel in West Yorkshire. This forms part of Deloitte's wider work providing technical support into the development of business cases for the WYCA Bus Strategy project

This study provides an analysis of the historical and current demand for different modes of transport at both the national and regional level and establishes a baseline estimate of the potential additional patronage or "untapped demand" for bus services across West Yorkshire based on data supplied by WYCA and the 2011 Census. Using the available data contained in the census, "bus users" are considered to be those reporting that they travel to work by bus, meaning that the analysis considers the profile of commuters rather than that of all bus users

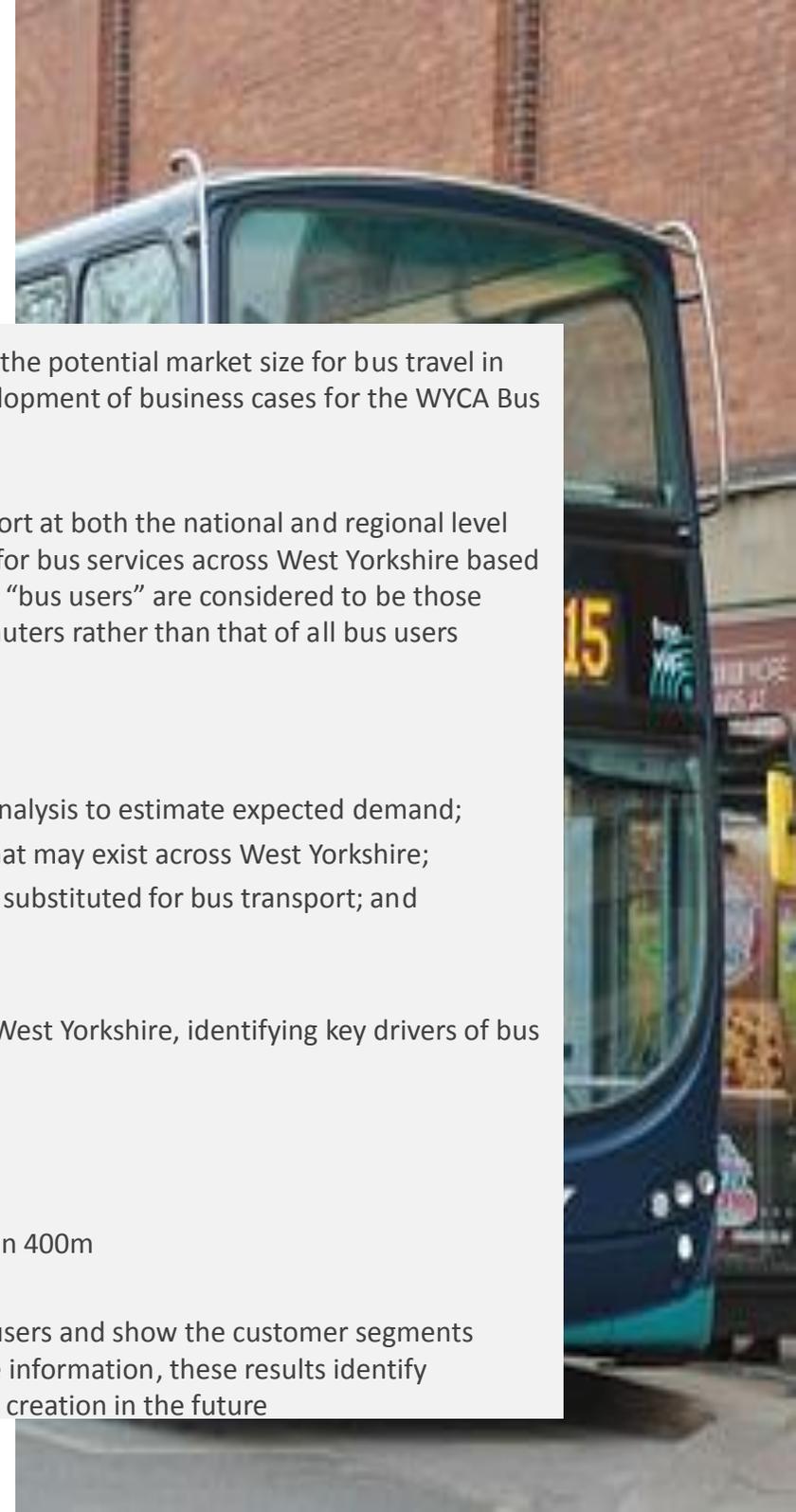
To assess the size of the potential market for bus travel, this study;

- Identifies the the baseline characteristics which correlate with bus usage and uses regression analysis to estimate expected demand;
- Uses the relationship identified to establish the quantity and location of additional bus users that may exist across West Yorkshire;
- Considers the proportion of additional bus users whose existing means of commuting could be substituted for bus transport; and
- Identifies the segments of the population that are most likely to use bus transport

The analysis considered almost 100 census variables and geospatial data related to bus supply in West Yorkshire, identifying key drivers of bus demand, which include;

- **Demand side drivers:** Ethnicity, income, gender, age, car ownership and employment
- **Area characteristics:** Urban/rural classification and ONS output area supergroup
- **Supply side drivers:** Nearby bus frequency, distances from stops and the number of stops within 400m

The results of this analysis identify areas where there exists high concentrations of potential bus users and show the customer segments which comprise the highest proportion of high propensity areas. Combined with exiting bus usage information, these results identify opportunities for increased provision to meet demand which could inform route changes or route creation in the future



Context

Context

Despite growth in UK transport demand since 1964, distance travelled per capita has been in decline since 2002. Preferences over modes of transport are also changing at the aggregate and local levels

Despite significant growth since 1964, distance travelled per capita had been in decline since 2002

- The number of kilometres travelled per person rose from 6,500 to 12,300 between 1964 and 2013, although it peaked at 13,500 in 2002 and is declining at an increasingly rapid rate¹
- Amongst the most common trip purposes, technology and behavioural change are reducing the need for people to travel. The internet is enabling people to work from home and order shopping online, while people are making less trips to visit friends. On a per capita basis, trips to work, shops and to visit friends (which together account for around half of all journeys) fell by 10%, 20% and 20% respectively between 2002 and 2014²
- If these trends continue, the size of the addressable market for transport is likely to decline further, though this could be offset by population growth³

Individual preferences over different modes of transport are changing and the trends in demand for bus transport differ by location

- Aggregate demand trends mask varying demand by transport mode. Since 1964, the share of distance travelled by bus has fallen from 21% to 5%, although the decline since 2002 is largely the result of a reduction in car travel¹
- Trends in bus trips per person vary dramatically between location. Trips per person in London (277) are significantly higher than in any other area of the country. Regionally, bus demand per capita is growing in the South and East of England and declining in the North and West of the country⁴
- While demand across all modes of transport is decreasing, bus demand could still increase if individuals could be induced to switch to bus transport from other modes

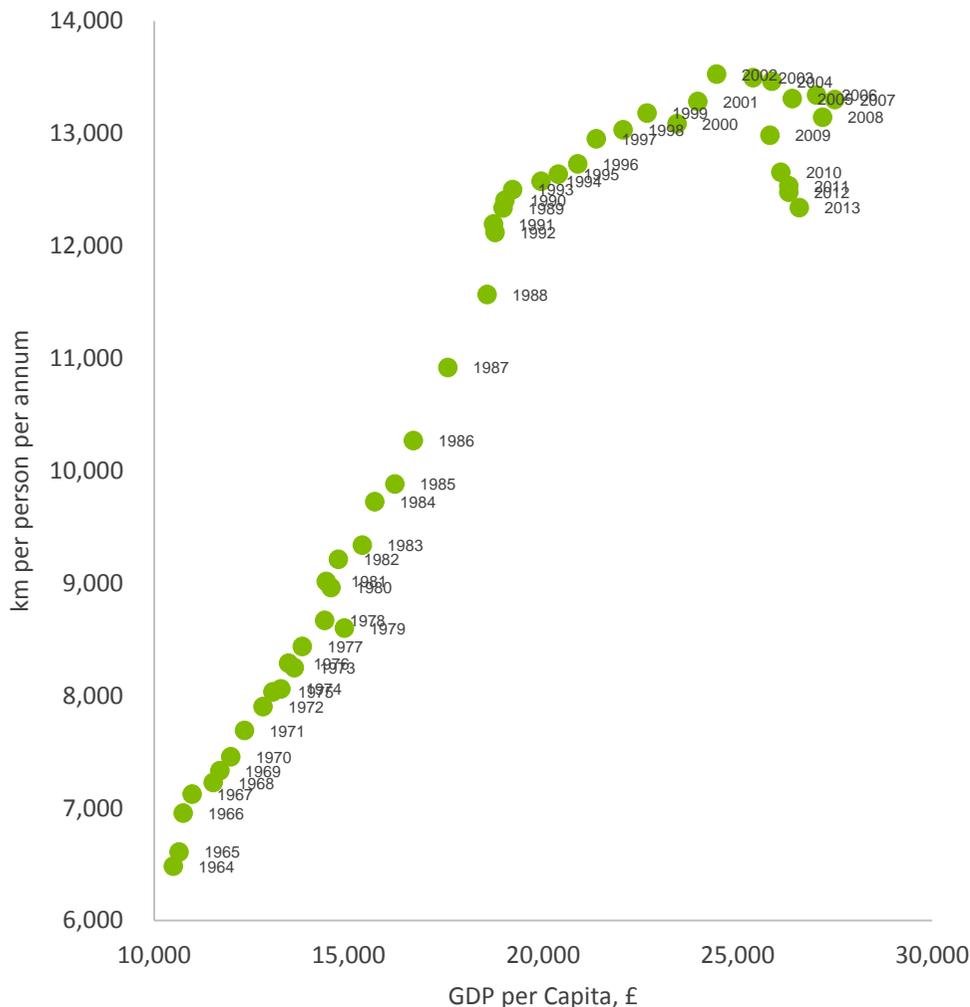
In West Yorkshire, the long term trend is a decline in bus journeys, both overall and at the per capita level. Following a sharp decline during the recession, there has been a small increase in both measures, though neither have recovered to their pre-recession levels

- On an aggregate basis, the annual number of passenger journeys undertaken in West Yorkshire has fallen from 227m to 186m over the last 20 years. Today's number of journeys represents a 3% increase on the 180m journeys undertaken in 2010/11, which saw a sharp decline in journey numbers. In 2014/15, the 186m journeys undertaken was still below the 195m undertaken in 2008/09
- Since 2004/05, journeys per capita in West Yorkshire have declined to a greater extent (11%) than those in Yorkshire and the Humber as a whole (8%) and than the average decline for regions outside of London (6%) even in light of the small increase in journeys since 2010/11. The number of journeys per capita (82), however, still remains above both other areas (63 and 52 respectively)⁵

UK transport demand per capita

Aggregate demand for transport per capita across all modes appeared to reach a peak 2002. The pace of decline has increased since 2008 in response the recession and changing travel demand

Transport demand vs GDP per capita 1964-2013



- Despite strong growth throughout the latter half of the 20th century, growth in transport per capita began to slow in the 1990's and entered a phase of decline in 2002 that became increasingly rapid in 2008
- Observation of this trend has led a debate around whether “peak-transport” has been reached and whether demand will reduce further across all modes of transport³, as the result of a number of development which reduce the need for individuals to travel, including;

Income changes: Transport demand has fallen more sharply since the UK entered recession in 2008 and per capita incomes declined. The less rapid decline since 2002 and the fact this trend has continued as incomes have partially recovered, however, suggests that other factors are also contributing to the reduction

Telecommuting: The number of people working from home increased from 3.1m to 4.2m between 2002 and 2014 and now amounts to 13.9% of the population.⁴ Over the same period, the number of commuting trips per person (which account for 16% of total trips) fell by 10%⁵

Online shopping: 19% of trips in England are for the purpose of shopping, making it the most common individual reason for travel. The number of shopping trips made per person declined 20% between 2002 and 2014.⁵ Between 2011 to 2015, the number of people reporting online grocery purchases as their main form of shopping, eliminating the need for weekly trips, nearly doubled from 6% to 11%⁶

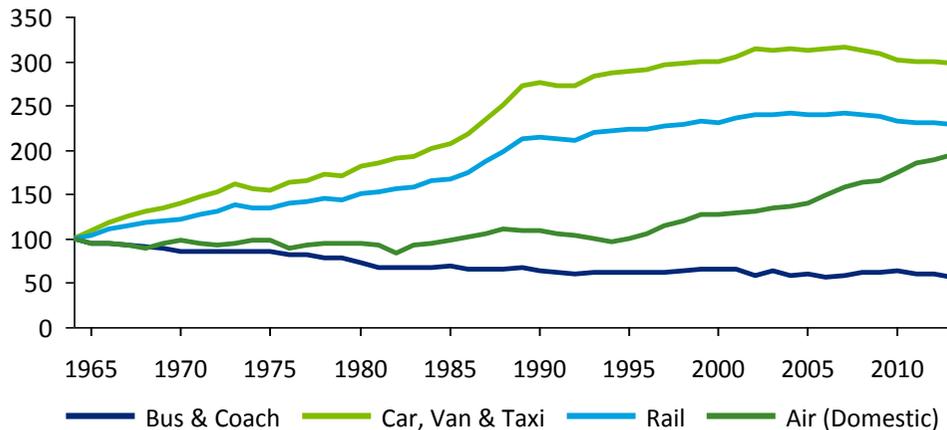
Reduced travel for social purposes: Since 2002, the number of trips to visit friends made per person (which account for 15% of total trips) fell by 20%.⁵ This could be driven by lifestyle choices as well as technology removing the need for physical presence in maintaining relationships

- Other factors, such as demographic change, are more likely to drive the mode of travel chosen rather than the overall distance travelled

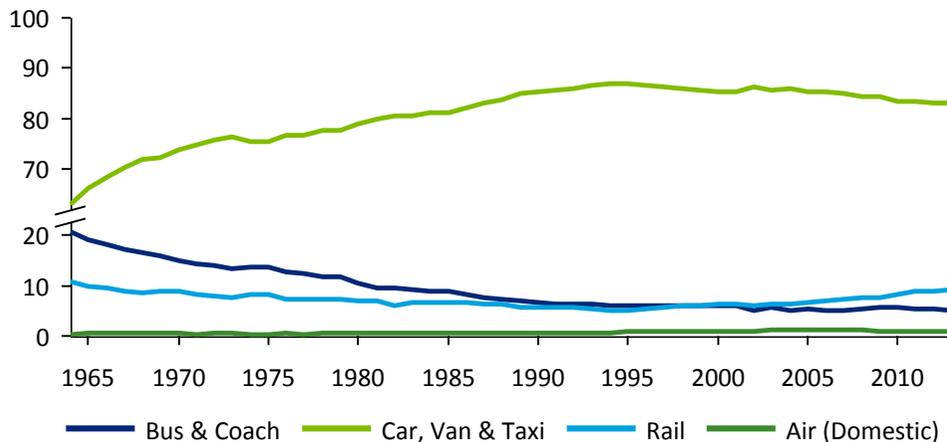
UK transport demand by mode of transport

The rise in travel demand since 1964 has been accompanied by a shift away from travel by bus towards car and rail transport. Overall, the proportion of travel undertaken by bus has fallen from 21% to 5%

Growth in UK transport demand by mode of transport 1964-2013 (1964=100)



Share of overall UK transport demand by mode of transport 1964-2013 (%)



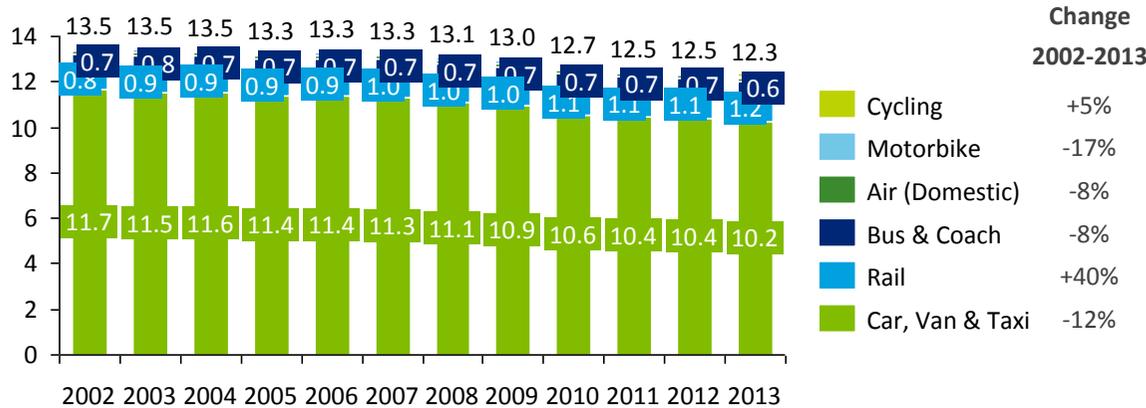
- The total number of passenger kilometres travelled in the UK rose from 340 billion to 768 billion between 1964 and 2013, reflecting the increased mobility of the UK population
- Together, the four categories displayed accounted for 98% of total passenger kilometres in the UK in 2013
- Since 1964, the total travel undertaken by car, van and taxi and rail has increased by 198% and 129% respectively, while the distance travelled by bus and coach has fallen by 43%
- As a result, over the period, the proportion of total travel undertaken by car, van and taxi has increased from 63% to 83% while the share of bus and coach travel has fallen from 21% to 5%
- In terms of market share, rail travel overtook coach and bus in 1999 and now accounts for 9% of all kilometres travelled
- While it has experienced strong demand growth, particularly since the mid-1990's, domestic air travel still accounts for just 1% of total distance travelled
- While demand for transport and choice of transport mode are affected by a range of supply and demand-side factors, it is clear that the changing demand pattern observed over the last 50 years shows a consistent and increasing preference for alternative modes of transport over travel bus
- More recently, in the last 10-15 years, car use has also begun to decline

Sources: (1) Department for Transport (2015), Passenger transport by mode, annual from 1952

UK transport demand per capita by mode of transport

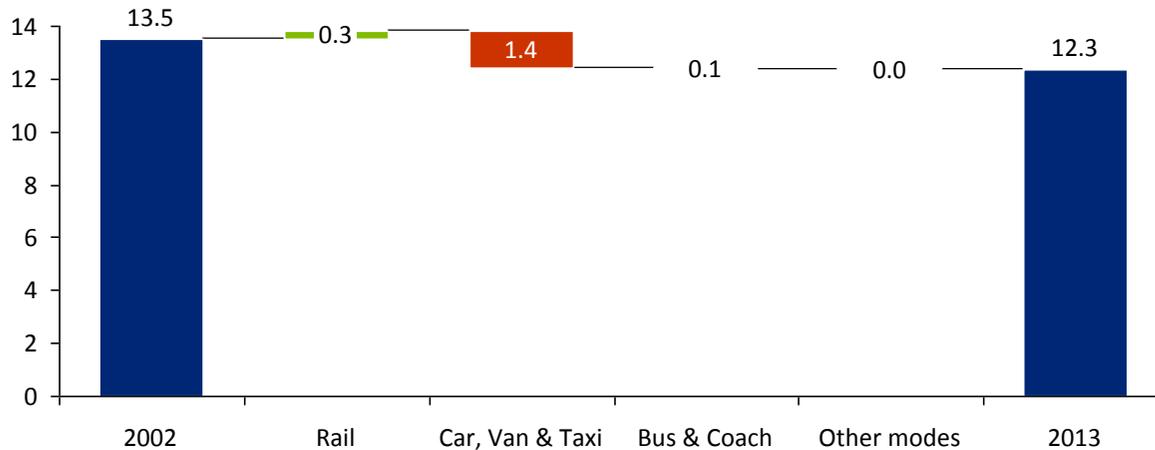
Since 2002, the decline in demand for transport has been driven by declining road use, partially offset by an increase in rail travel. The total decline in bus travel has been less than that of car use

Breakdown of per capita transport demand 2002-2013 (000's km)



- Commentary related to the level of saturation in the market observed over the past 10-15 years often focuses on individual modes of transport, rather than aggregate demand
- The largest contribution to the decline in passenger kilometres per capita has been a decline of 1,430km by car, van and taxi per person. There has also been a 60km reduction in bus and coach travel per person. These two declines have been partially offset by a 320km increase in rail travel per person

Breakdown of change in transport demand per capita 2002-2013 (000's km)



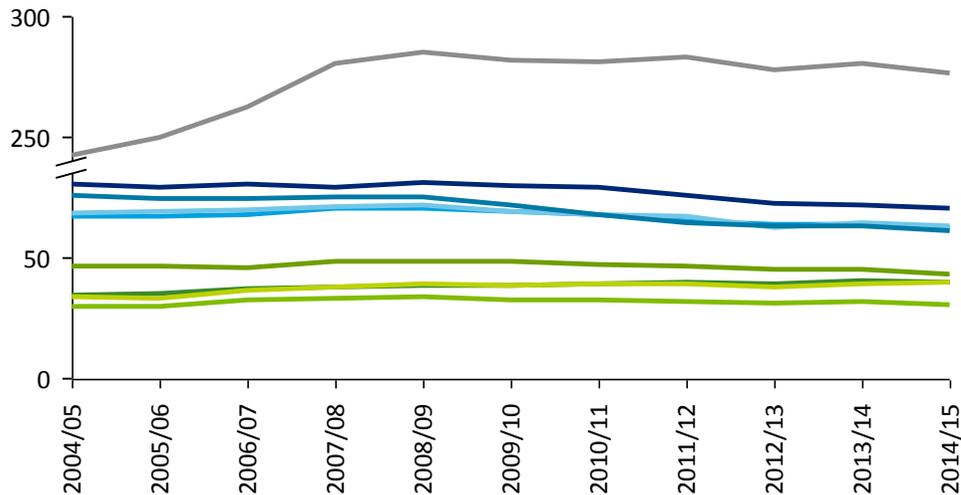
- A 2012 assessment of the significant decline in car use³ found it to be driven by;
 - Declining car ownership and use amongst young men
 - A reduction in company car use
 - A sharp decline in car use in London that was not replicated elsewhere in the country
- Despite these factors, the Department for Transport expects that road traffic will increase in the longer term. Overall, it expects the volume of traffic on the road to be 46% higher in 2040 than in 2013⁴ driven by population growth, rising incomes and falling fuel costs
- Importantly, public transport networks have not shown as significant a decline of the extent observed in car travel

Sources: (1) Department for Transport (2015), Passenger transport by mode, annual from 1952; (2) ONS (2015) CDP chain linked and mid-year population estimates; (3) ORR, ITC, Transport Scotland & the RAC Foundation (2012), On the move: Making sense of car and train travel trends in Britain (4) Department for Transport (2013); Action for roads: A network for the 21st century

UK bus transport demand per capita by region

Growth in demand for bus transport differs across England, with trips per person increasing in London and the South and decreasing in the North

Bus journeys per capita by region 2004/05-2013/14 (#)



Note: Changes to the estimation method employed by DfT mean the series 2004/05-2014/15 is more representative of actual changes

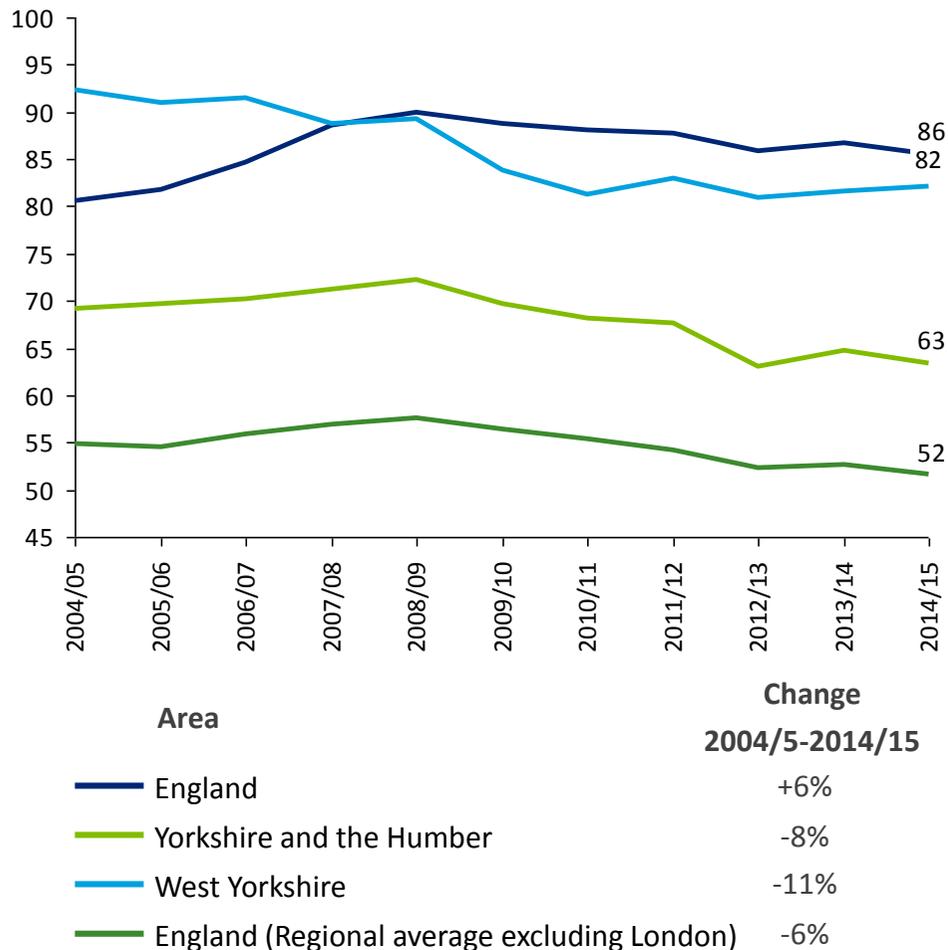


- The small decline in the distance travelled by bus obscures differences in the dynamics between London, the rest of the South and the North of England
- There has been a significant increase in bus journeys per capita within London and the South and East of the England since 2004/05, while the number of journeys in the North and West have fallen
- Since 2004/05, annual number of journey's per capita in London, the South East and South West grew by 14%, 15% and 18% respectively. This obscures a significant decline in other areas when looked at on an aggregate basis, particularly given that London accounts for around half of bus journeys each year¹
- In the North East, North West and Yorkshire and the Humber, where bus usage has historically been higher than all regions apart from London, bus journeys per capita fell by 13%, 7% and 8% respectively¹
- The increase in London has been attributed to both supply and demand side factors, as well as structural changes which might not be replicable outside of the capital. For example, TfL states that the primary driver of travel demand in London is its population growth²
- Some of the factors identified as contributing to London's growing transport demand could, however, be of interest to planners. Availability of bus travel in London is one factor for its high usage – 95% of households are within 400m of a bus stop² and socio-economic and demographic factors such as age and income also influence transport mode choice³ and could be used to identify areas of potential high-demand

UK and West Yorkshire bus transport demand per capita

Since 2004, the decline in bus journeys per capita has been more significant in West Yorkshire than elsewhere, but the figure still remains relatively high and has increased slightly since 2010/11

Annual bus journeys per capita 2004/05-2014/15 (#)

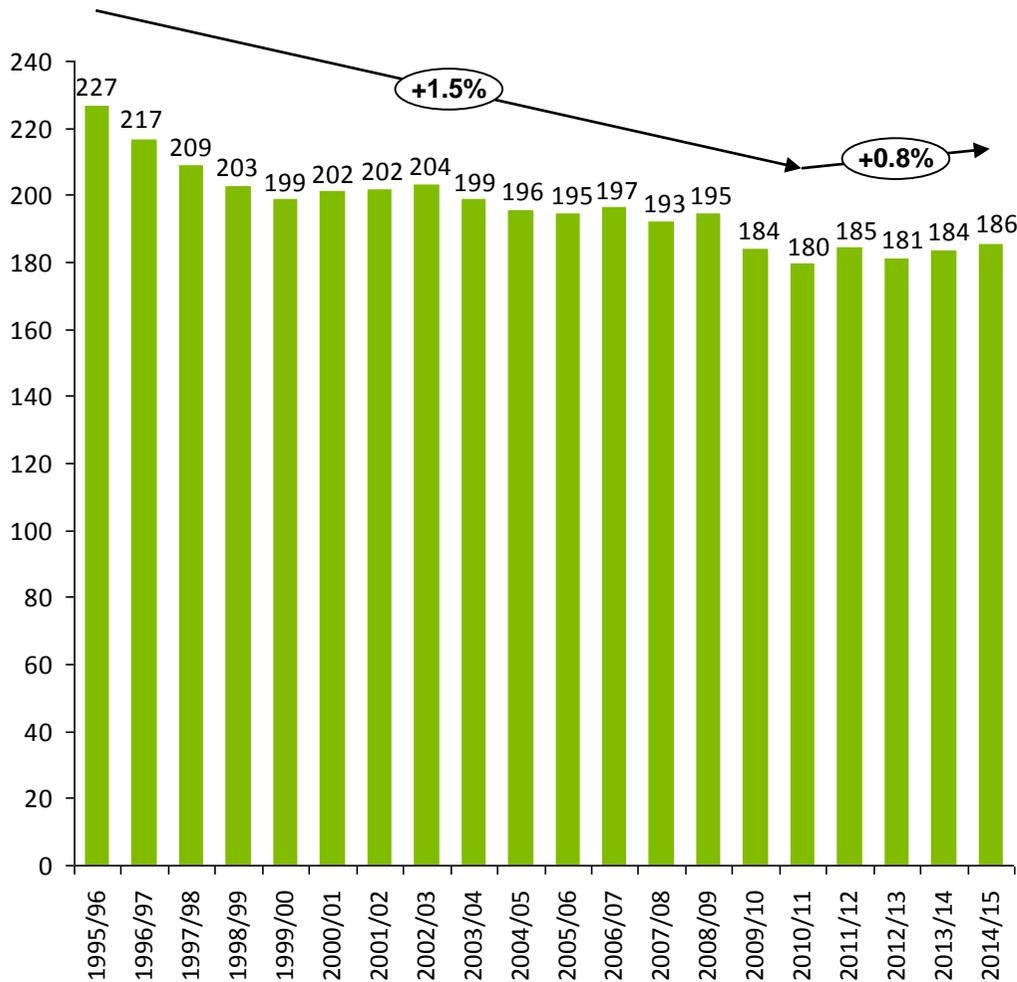


- Although the number of passenger journeys per capita in England has actually increased since 2004/05,¹ the distance travelled by bus has declined,² meaning that the average distance per trip has fallen
- The increase in trips per capita is distorted by the contribution of London, which accounts for 51% of total passenger journeys in England¹
- Structural differences in the London bus market relative to the rest of the UK, as well as demand drivers such as population growth and car availability that follow different patterns than that of the UK as a whole mean that it is more representative to consider England excluding London when making comparisons
- Excluding London, the average region in England has experienced a decline in passenger journeys of 6% since 2004/05¹
- The 11% decline in journeys per capita West Yorkshire has been larger than that in both England (excl. London) and Yorkshire and the Humber as a whole, although the average number of passenger journeys per capita (82) remains above the level of Yorkshire and the Humber (63) and England (excl. London) (52)^{3,4}. More recently, there has been a slight increase in journeys per passenger, suggesting demand is increasing
- This recovery appears to be reversing the decline caused by the recession and whether long term growth could be achieved would depend on the ability of the network to absorb additional demand. For example, whether supply side factors in the network are restricting access and/or whether potential customers utilising alternate modes of transport could be encouraged to travel by bus more regularly

West Yorkshire aggregate bus demand

The number of passenger journeys in West Yorkshire has declined over the last 20 years. Despite this long term trend, it has recovered slightly following the recession, growing 0.8% annually since 2010/11

Annual Bus journeys in West Yorkshire (million)



- Over a 20 year period, the number of passenger journeys undertaken in West Yorkshire has fallen by 40.9m, or 2.0m annually¹
- Over the past 5 years, the number of annual passenger journeys has grown by 0.8% annually, to 186m, following a sharp decline over the two year period 2008/09 to 2010/11 that was likely caused by economic recession
- Overall, the number of passenger journeys has increased by 3% since the all time low of 180m in 2010/11, though it has yet to return to pre-crisis levels, suggesting some of the decline resulting from the recession has persisted despite the recovery
- The recent recovery in journeys is also present in journeys per capita, which have increased from 79 to 82 trips per person² over the same period, although the current level is still below the the level just prior to the recession

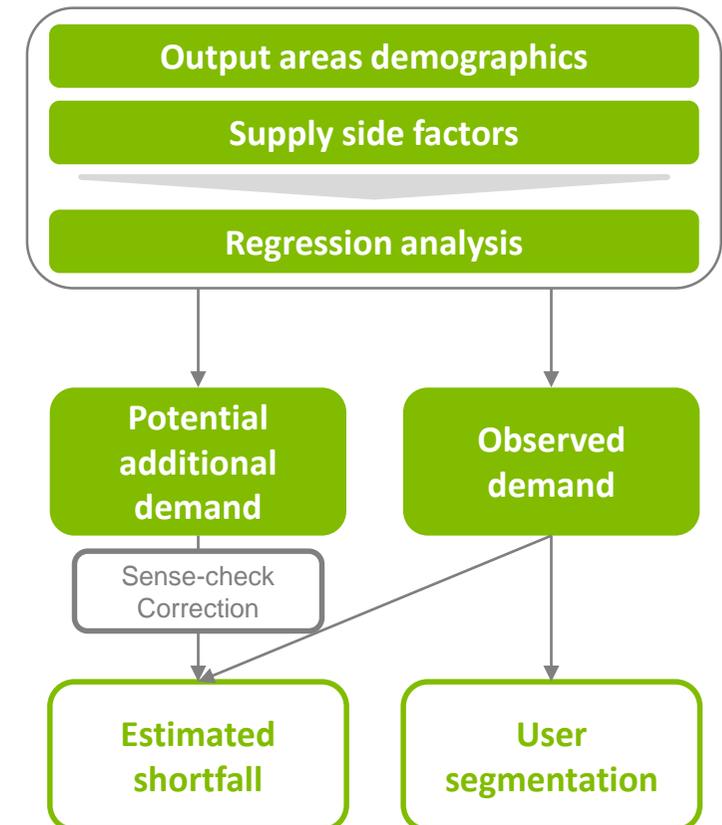
Sources: (1) Bus passenger reimbursement survey data provided by WYCA; (2) Oxford Economics (2015), Population statistics

Methodology

Addressable Demand: Strategic

This study identifies high potential areas for service improvements by providing estimates of the size and location of the untapped journey demand and identifying high propensity bus user characteristics

- This report forms part of Deloitte’s wider work assisting WYCA in the development of business cases for the WYCA Bus Strategy project. It is intended to provide an estimate of the addressable demand from bus passengers for commuting purposes across West Yorkshire
- In the year 2014/15 there were an estimated 186m passenger journeys across West Yorkshire, a reduction of approximately 40.9m journeys over 20 years. Although the number of journeys undertaken has increased slightly since 2010/11, this appears to be a reversal of the share decline in 2009/10 and the present number of journeys has not returned to its pre-recession level. Whether this trend of long term decline can be reversed will depend on the level addressable demand for bus journeys and how it can be served by the existing bus network
- This study used supply and demand side characteristics to identify the number of people who might be expected to be bus users based on their characteristics but did not report commuting by bus in the 2011 census
- To reflect the fact it would not be possible to capture all of this demand, the total figure has been corrected to omit those whose current commute distance and mode choice means that they would be very unlikely to switch to bus transport
- By assessing the demographic profile of areas by usage rates, it is also possible to segment potential customers and identify the types of individuals most likely to use bus services
- Targeting higher propensity users with lower than expected observed bus use, rather than users unlikely to switch to bus transport, would be likely to be a more effective way of increasing overall use



Addressable Demand: Technical

A five-step approach was used to identify and build the propensity model which estimates the demand for bus commutes by output area and arrive at an estimate for addressable demand

Data discovery: Open data (Output Area boundaries, Census 2011 variables, travel to work data and demographic segments) were sourced along with bus stop locations and frequencies from WYCA. These were collated, integrated and mapped using a geospatial software tool

Spatial analysis: The geospatial tool allowed the relationships between Output Areas and bus stop locations and frequencies to be determined (e.g. the number of bus stops within a 5 minute walk time). For the purpose of this analysis, Output Area populated weighted centroids were used as origin locations

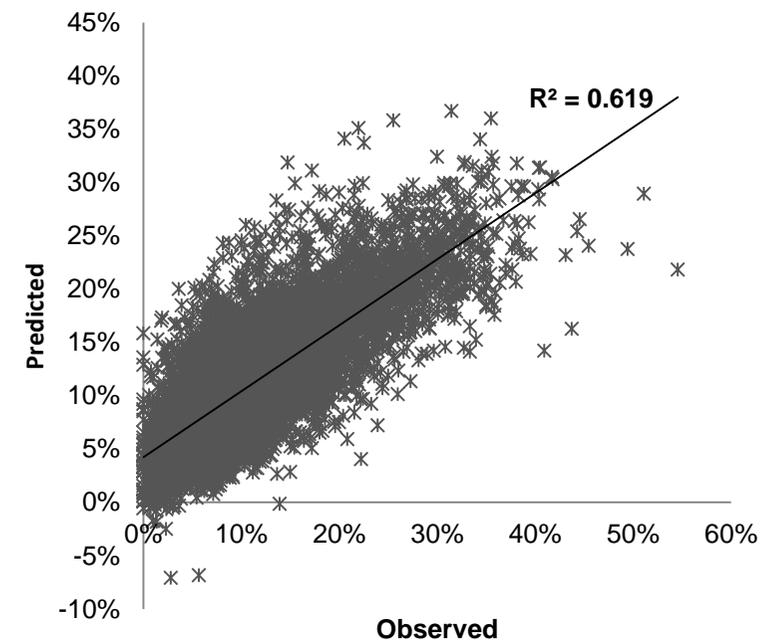
Variable selection: An iterative approach was used to determine the key driving factors that impact the likelihood of bus usage. Cross correlations were considered at this stage to ensure that the variables selected were relevant and appropriate

Model development: The propensity model was built in R, an open source statistical package, to assess the likelihood of bus usage, given the demographic characteristics and local bus supply characteristics of an output area

Additional demand estimation: The initial modelling identified an additional 17,600 users. This is estimated as the difference between predicted and observed demand across areas where predicted demand exceeded the demand observed in the 2011 Census

Addressable demand estimation: This estimate was corrected to reflect the fact that some commuters (those travelling over 10km and/or by modes other than car such as rail) would be unlikely to switch to bus transport. This gave a revised estimate for the addressable market of between 9,000 and 12,400 commuters, based on the proportion of non-bus commuters making trips under 10km by car applied to the initial 17,600 estimate. Addressable demand refers to latent demand in the current population and is separate from future demand growth, which is considered separately

Predicted vs observed proportion of bus commuters



Future Demand: Strategic & technical

A high-level and top-down approach has been used to translate economic growth in the Strategic Economic Plan to bus demand. This is a simplistic method which is not a substitute for full modelling.

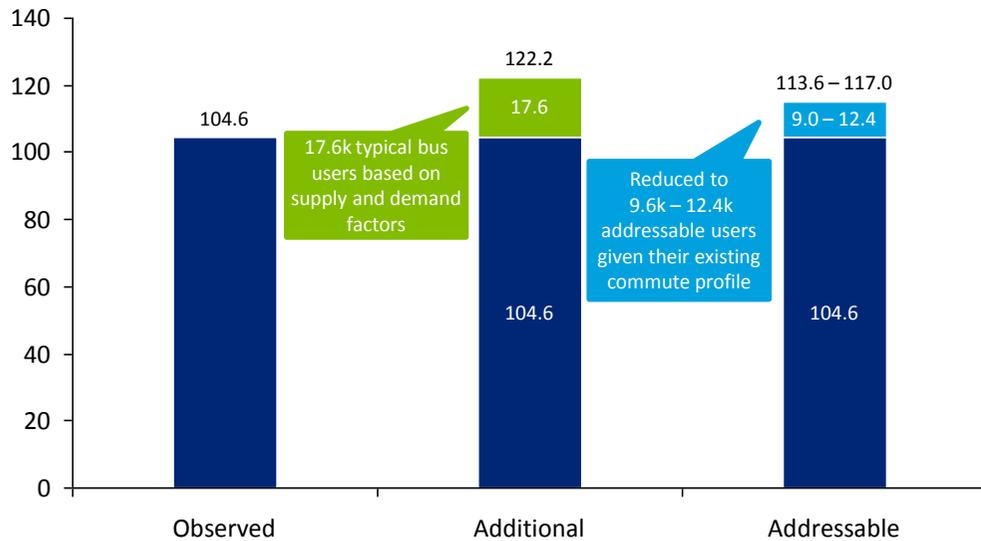
- The relationship between transport infrastructure and the economy is complex, and runs in both directions:
 - On the demand side, a better bus service will support growth through the 'derived' demand for mobility - more people working means more people moving around; and
 - Further growth might also be expected through improved transport connectivity as a supply-side driver of the economy in the long-run – better transport attracts more people, firms and activity to the area
- How much of the opportunity for travel to work patronage growth is captured or driven by bus is thus dependent upon:
 - **Demand:** The extent to which the Bus Strategy can provide the connectivity required to underpin all elements of the SEP (not just transport-related schemes); and
 - **Supply:** The extent to which the Bus Strategy can help to generate additional economic activity as part of an improved City Region offer
- Based on a simple method of extrapolation from the SEP, it is possible to estimate the potential increase in the number of bus trips relative to today:
 - **Estimate 1:** Use transport scheme related trip growth (18,000). Allocate growth to bus on the basis of current mode split for travel to work (12%)
 - **Estimate 2:** Use all scheme related trip growth (85,000). Allocate growth to bus on the basis of current mode split for travel to work (12%)
 - **Intermediate Step:** Use transport scheme related trip growth (18,000). Allocate all growth to bus (implying total mode split share for bus of 13.5%)
 - **Estimate 3:** Use total SEP trip growth (85,000). Split between bus and non-bus using the mode split achieved in the intermediate step (13.5%).
- As demand is a complex mix of the two causal chains acting together, with neither acting independently of the other, at modal level this means the above method is particularly simplistic. Bus serves some demand well – e.g. peak and working day trips, to/from city centres, but does not serve others well – i.e. off-peak, particularly early morning, evening and Sunday trips to peripheral locations. Furthermore, the road network is, as a very broad generalisation, full at peak times with those peaks spreading. Add to this the fact that labour markets expand around major cities and draw workers from a larger catchment, and it is apparent that full disaggregated modelling of demand is required to control for complex relationships and nuances in mode, geography and other factors.

Addressable Demand Analysis

Demand breakdown by borough

The total addressable market is 113,600-117,000 commuters based users switching to bus. This represents a 9% to 12% increase on current levels but does not adjust for capacity constraints at peak

Observed, additional and addressable bus commuters (000's)



- From 2011 census data, the observed demand for bus transport for commuting purposes amounted to 104,600 people
- Analysis of customer demographics and bus supply variables indicates that potential additional demand amounts to an upper limit 17,600
- Some customers within the bus user demographic would not be able to switch to bus transport for their commutes given their current mode and distance of travel. It was assumed that only car users commuting less than 10km were likely to switch to bus transport, reducing the estimate of the addressable market to between 9,000 and 12,400 and resulting in a total market estimate of 113,600 to 117,000
- The potential additional demand suggests that Kirklees has a high number of households with the characteristics of bus users who were not commuting by bus. One third of the identified additional demand is based in Kirklees, although much is concentrated around rail stations that might reduce the chance of passengers switching to other modes
- Leeds appears to offer less of an opportunity relative to its existing market size. Despite accounting for almost half of journeys and commuters at present, only a quarter of identified demand is based there. Given the size of the Leeds market, however, it still accounts for the second largest share of “untapped” demand. Significant housing growth could have contributed to some of the largest pockets of potential additional demand in South Leeds (see later)

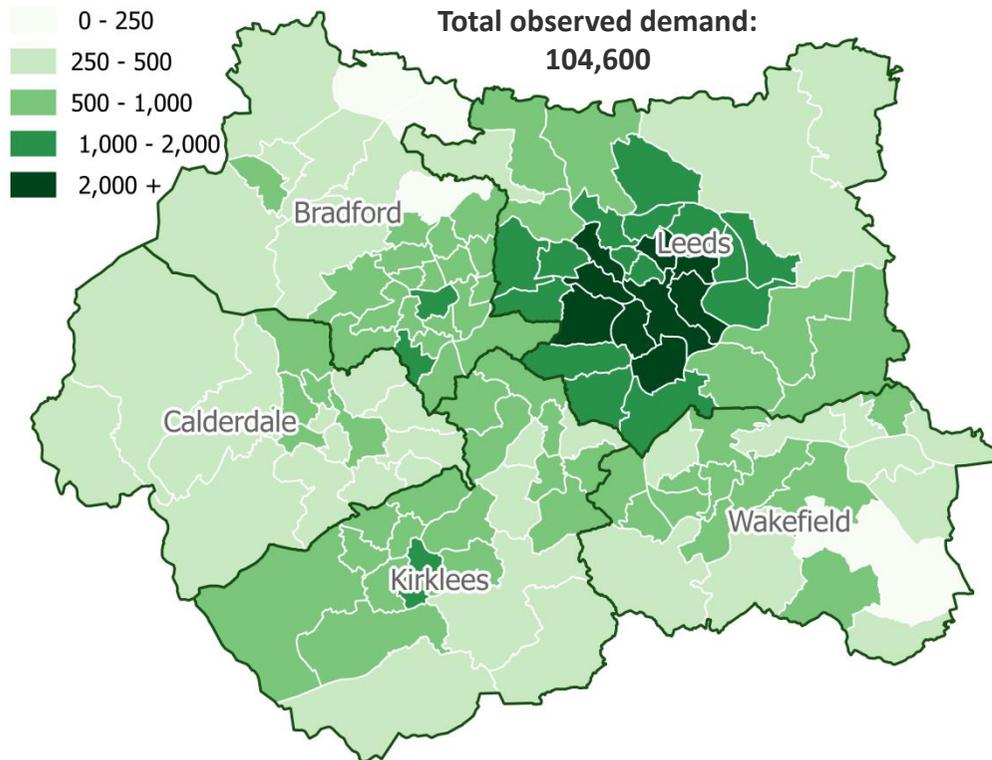
Observed and additional bus journeys by borough and share of total

Borough	Observed commuters (k, % share)	Share of potential additional demand (k, % share)
Bradford	20.0k (19%)	3.1k (18%)
Calderdale	8.2k (8%)	1.3k (8%)
Kirklees	15.1k (14%)	5.8k (33%)
Leeds	50.5k (48%)	4.5k (26%)
Wakefield	10.7k (16%)	2.9k (16%)
Total	104.6k	17.6k

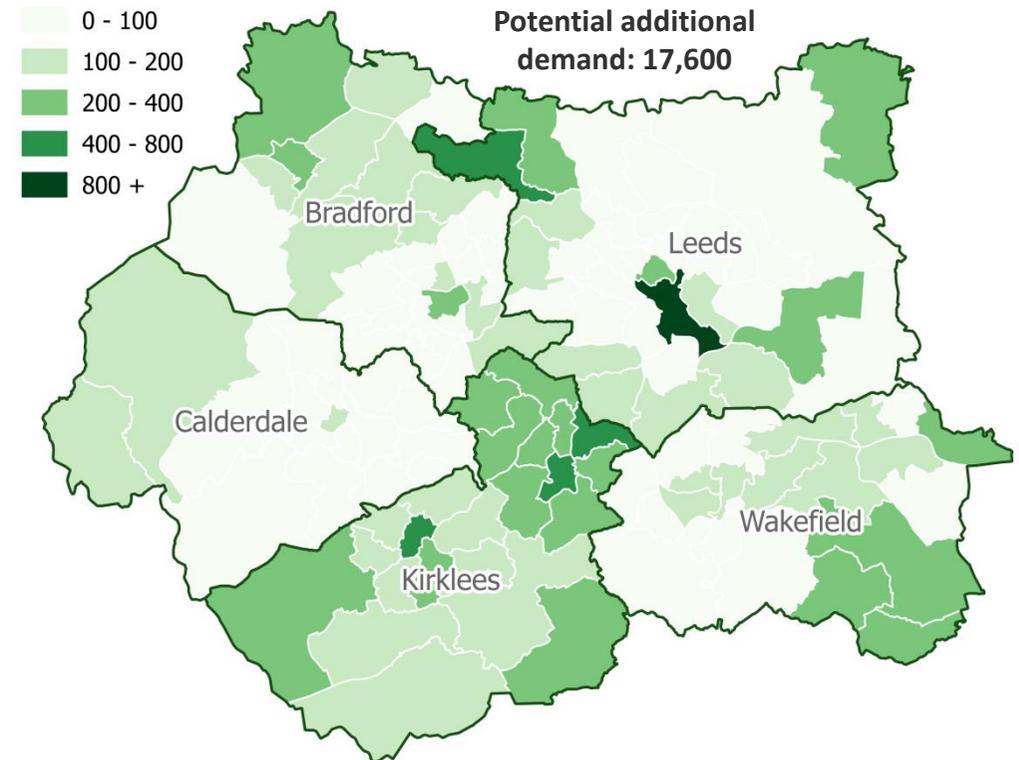
Observed and potential additional demand

Mapping identified volumes of observed demand around Leeds and its bordering wards in other boroughs. Additional demand is more dispersed, with a high volume across Kirklees

Observed Demand (Wards 2013)



Additional Demand (Wards 2013)



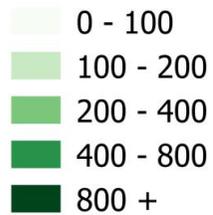
- 104,600 households reported bus was their primary means of commuting to work
- Observed demand is particularly high across wards in Leeds where 9 wards have observed demand of over 2000 people
- Overall, Leeds accounts for 23 of the top 25 wards by observed demand

- Modelling also identifies 17,600 potential additional bus users based on the demographic characteristics of typical bus commuters, but this figure does not consider whether bus transport would be a viable option for their commute given their existing mode choice and journey distance
- These are distributed across the five boroughs with particularly high concentrations in Kirklees and Leeds
- Over half (13) of the top 25 wards are located in Kirklees

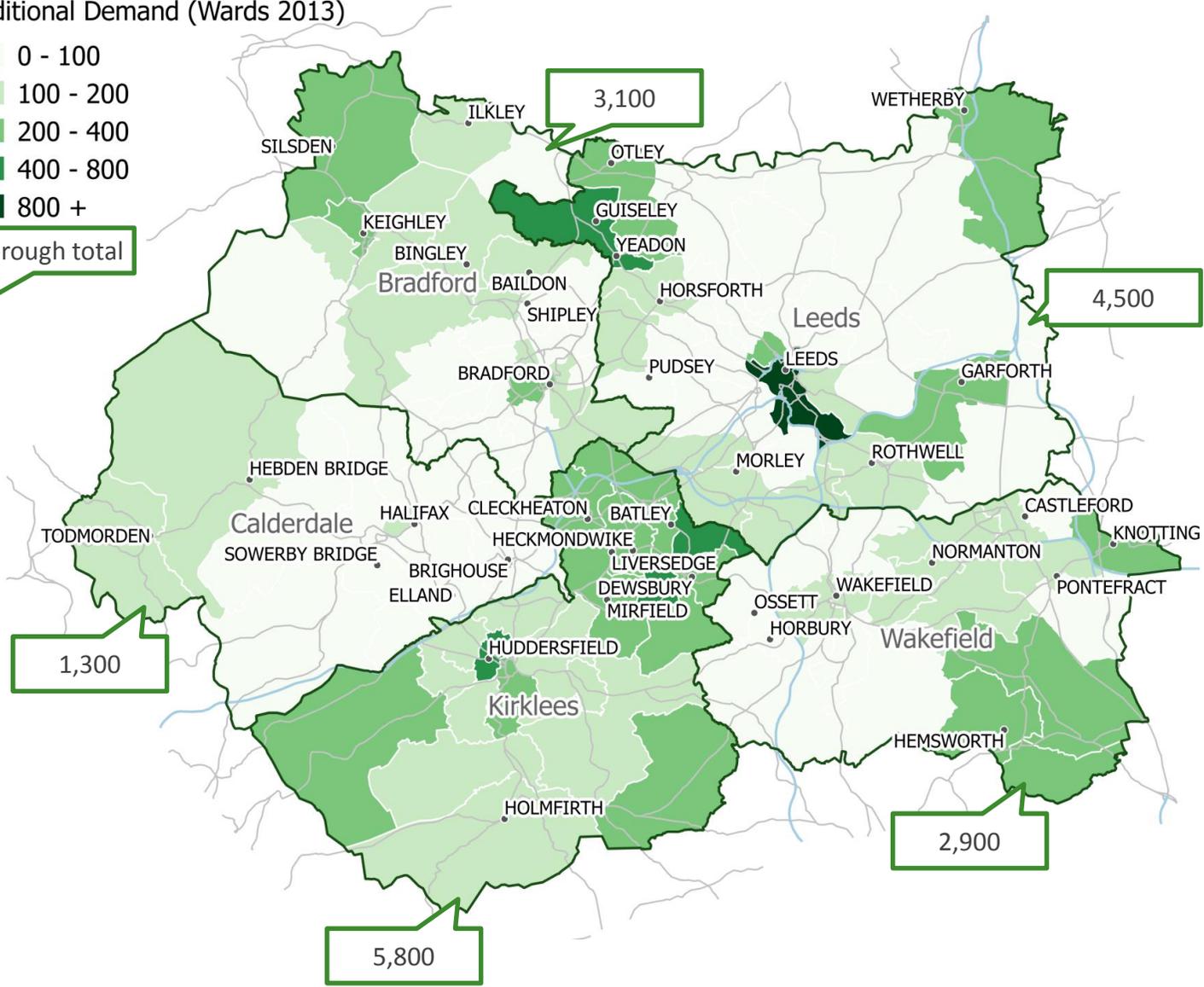
Potential additional demand

In Kirklees, additional demand is spread across the borough, with pockets of high potential demand identified in the North. Potential additional demand in Leeds is more concentrated

Additional Demand (Wards 2013)



Borough total

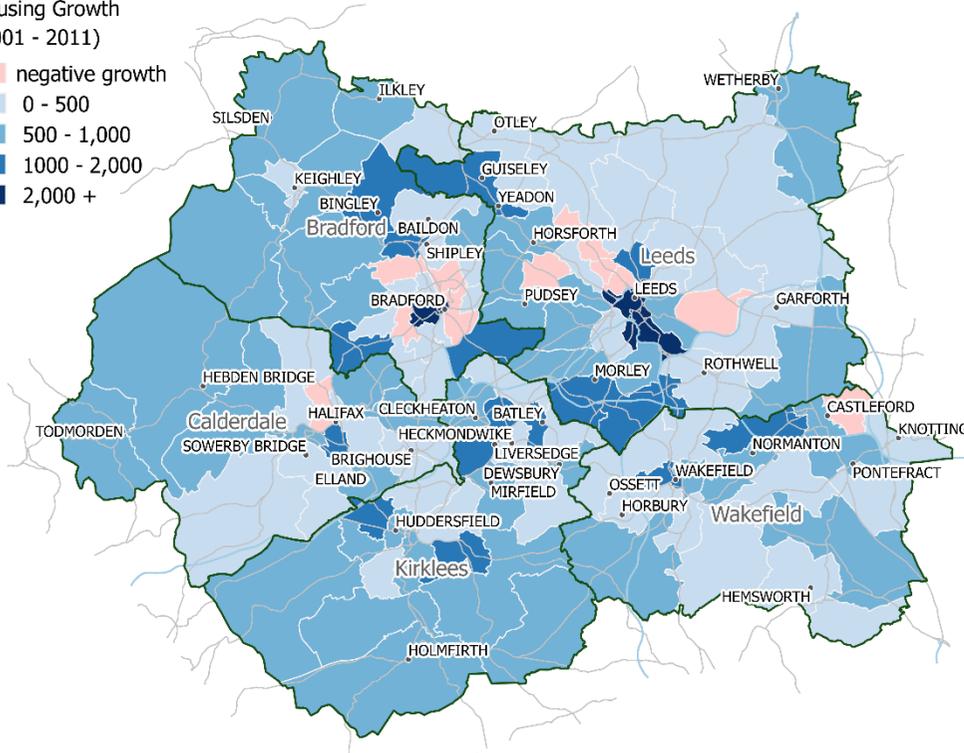
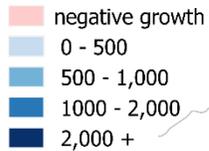


- Kirklees and Leeds together account for 10,300 of the 17,600 potential additional commuters estimated by the model (5,800 and 4,500 respectively)
- Kirklees contains the largest number of potential bus commuters of the five boroughs. Analysis shows large pockets of “untapped demand” in the north of the borough around Batley, Dewsbury and Liversedge although this area is well served by rail stations
- Additional demand in Leeds is more concentrated. City and Hunslet contains 1,100 potential bus commuters based on Deloitte’s analysis, accounting for almost a quarter of all additional demand in Leeds. This could have been driven by the significant growth in housing in the area between 2001 to 2011

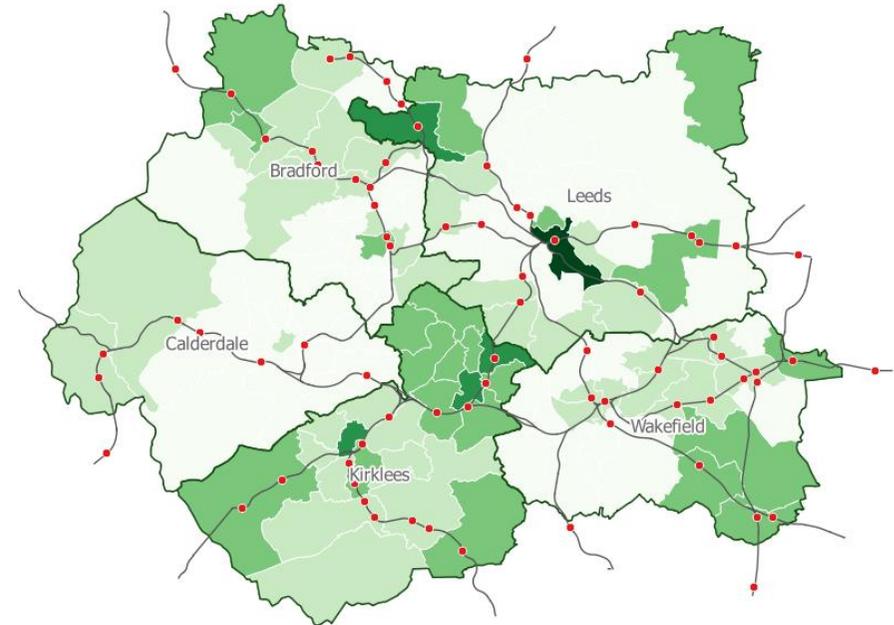
Factors influencing potential additional demand

Housing growth in Leeds and rail station locations in Kirklees could be contributing to some of the identified additional demand. Both areas merit further evaluation

Housing Growth
(2001 - 2011)



Rail stations locations and potential additional demand



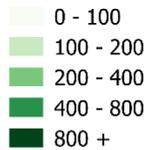
- The significant concentration of potential additional demand in the ward of City and Hunslet in Leeds could have been driven by population growth in the area in the years preceding the 2011 census
- Between 2001 and 2011, over 2000 housing units were built in the ward
- An inflow of individuals with the typical demographics of bus users might not have been accompanied by capacity increases, resulting in excess demand that has ultimately been absorbed by other modes of transport

- The scale of the potential additional demand against observed bus usage identified in Kirklees could be driven by the presence of rail stations in the North East of the borough
- Highly convenient rail travel options could divert typical bus users to rail transport, resulting in the model overestimating the scale of the opportunity in some areas
- For this reason, transport mode (as well as commuting distance) has been considered to arrive at a revised estimate for the achievable increase in bus usage

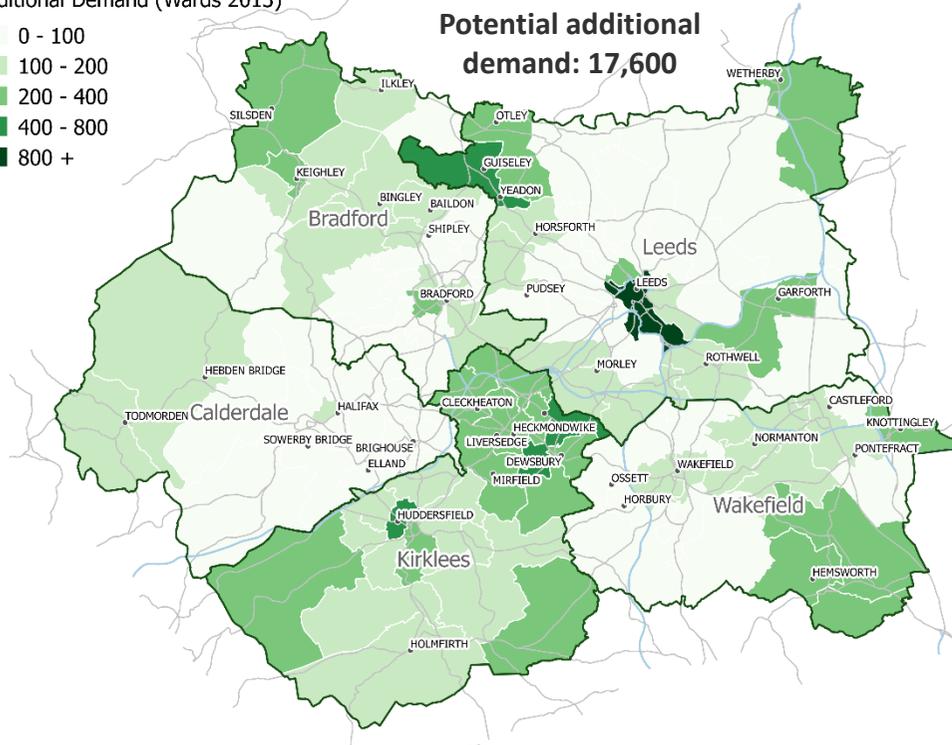
Potential transition from car to bus use

Given their distance and mode of commute, between 9,000 and 12,400 commuters could transition to bus use, an increase of between 9% and 12% above existing demand of 104,600

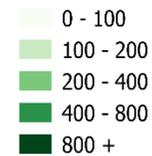
Additional Demand (Wards 2013)



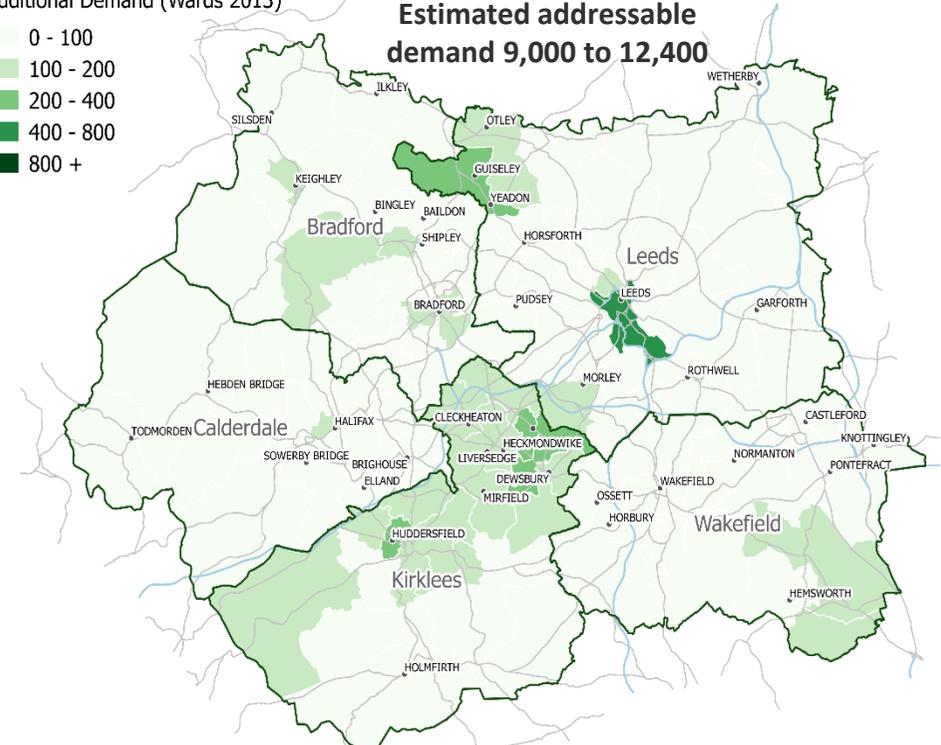
Potential additional demand: 17,600



Additional Demand (Wards 2013)



Estimated addressable demand 9,000 to 12,400



- Despite the 17,600 potential additional bus users identified, it is not likely all could be induced to switch transport modes
- While some of those currently commuting by car would have the potential to switch modes in favour of buses, this would not be feasible for longer journeys for which a bus would be less practical
- Assuming that only those commuting by car for distances below 10km are able to transition to bus use, the level of additional demand likely to be realised is estimated to be between 9,000 to 12,400 addressable commuters
- Discounting longer commutes removes much of the additional demand from rural areas, where commutes are likely to be longer. The concentrations of demand in Kirklees and Leeds remain and the pocket of demand in Guiseley and Yeadon persists, suggesting this area also merits further attention

Comparisons of high and low propensity areas

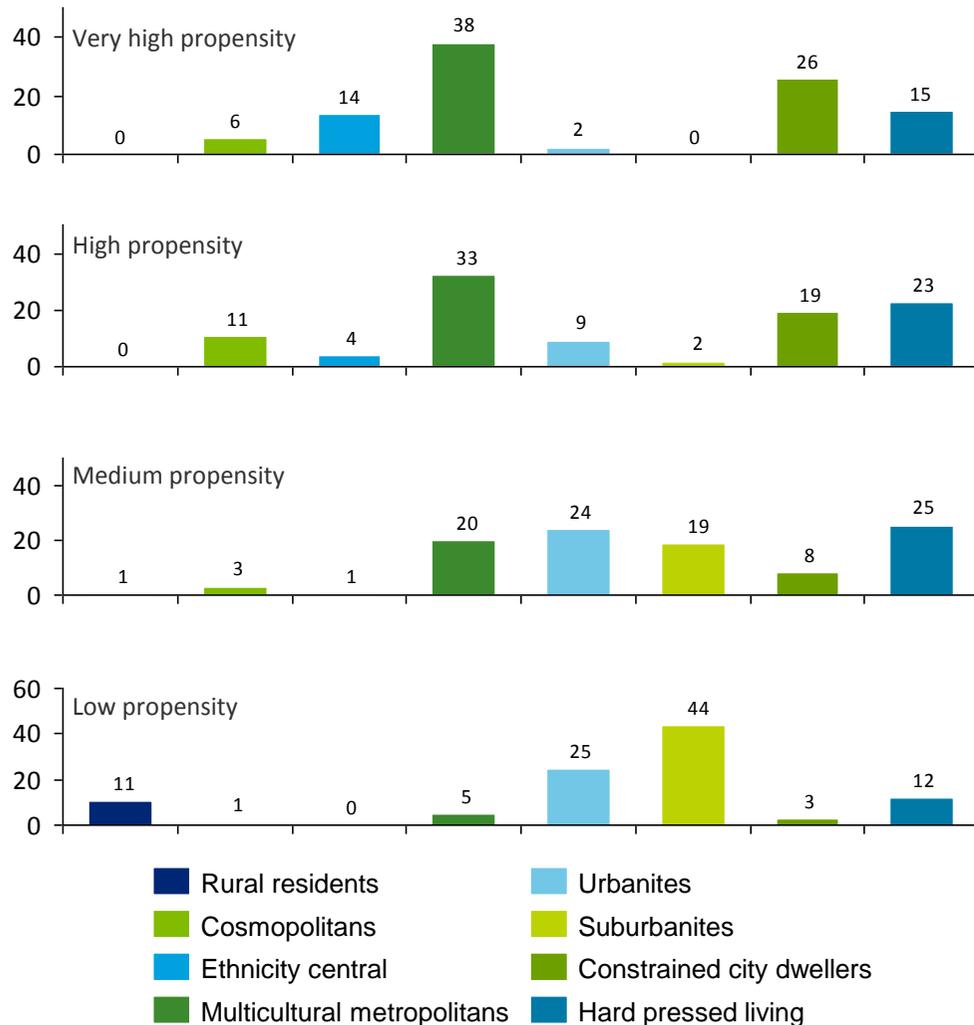
Very high-propensity bus use areas have fewer white residents, more young people and lower incomes. They are also likely to have a high frequency of existing bus services within a short distance

Characteristic	Observed bus demand				Insight	
	Very high-propensity areas	High propensity areas	Average propensity areas	Low propensity areas		
Definition	Observed use 100% above average ^A	Observed use 50% above average	Observed use within 50% average	Observed use less than 50% average	n/a	
Number of areas (#)	701	758	3790	1882		
Average proportion of commuters (%)	28%	19%	10%	3%		
Supply	Average distance to route (m)	94	91	93	<ul style="list-style-type: none"> Except for low propensity areas, the distance to the nearest route and bus stop count are similar across the very high to medium propensity groups. The frequency of service, however, is much higher in very high and high propensity areas than in medium and low propensity areas 	
	Bus stop count within 400m	11	11	11		8
	Frequency of buses within 400m	78	64	43		20
Demand	Proportion of white residents (%)	73%	79%	83%	92%	<ul style="list-style-type: none"> Areas with higher non-white populations are more likely to have a high proportion of bus users
	Proportion of male residents (%)	49%	49%	49%	49%	<ul style="list-style-type: none"> Deloitte's analysis did find the proportion of females to correlate positively with bus demand, but gender-balance is broadly similar across areas of different propensities
	Proportion of 16-24 (%)	16%	17%	12%	9%	<ul style="list-style-type: none"> Very high and high propensity areas have a higher proportion of 16-24 year olds
	Average weekly household income (after housing costs) (£)	£350	£380	£420	£480	<ul style="list-style-type: none"> Very high and high propensity areas have lower household incomes while low propensity areas have significantly higher incomes than all other types
	Proportion of urban areas (%)	13%	31%	45%	42%	<ul style="list-style-type: none"> Very high propensity areas are less likely to be urban. This could be the result of non-urban areas having fewer travel alternatives (e.g. walking/cycling) compared to city centre areas. This could also be explained by areas on the fringes of urban areas, not classified as urban themselves, having high commuter populations
	Proportion of population economically active	63%	65%	69%	71%	<ul style="list-style-type: none"> Very high and high propensity areas have lower economically active populations. Since this analysis considers commuting, this finding is likely to relate to the areas in which typical bus commuters live (lower income, ethnically diverse etc.) rather than bus users themselves
	Proportion of households without cars (%)	56%	44%	28%	15%	<ul style="list-style-type: none"> Very high and high propensity areas have lower rates of car ownership

Propensity for bus use breakdown by ONS Supergroup

Higher propensity users include Ethnicity central, Multicultural metropolitans and Constrained city dwellers. The Hard pressed display a medium propensity while (Sub)urbanites show a low propensity

Observed demand group breakdown by ONS supergroup
%



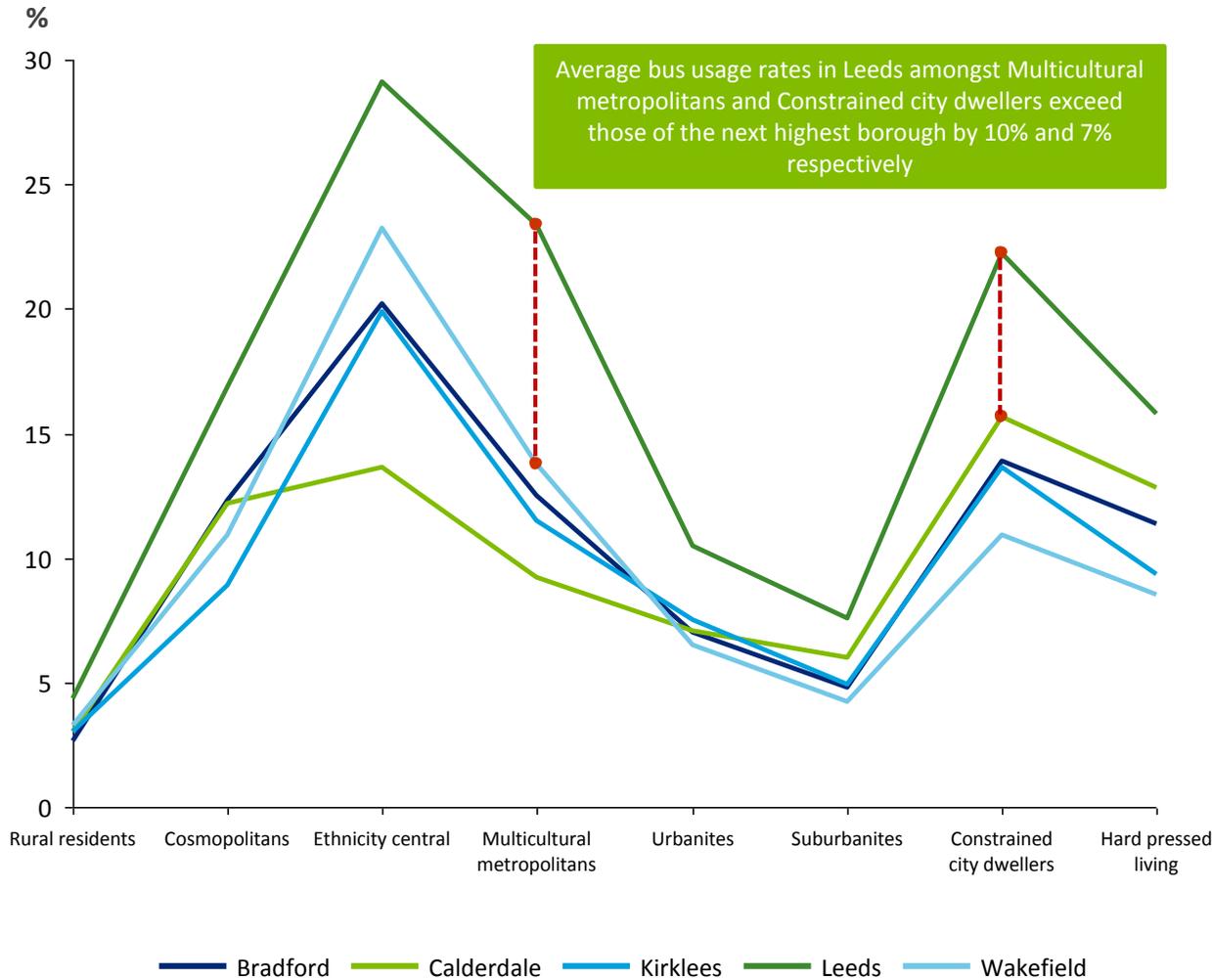
- ONS supergroups separate output areas into 8 distinct categories based on demographic characteristics of their residents^A. These categories are based on data which includes residents' ages, ethnicities, family status, housing, qualifications, car ownership and employment
- Amongst the very high and high propensity areas, Multicultural metropolitans (38%) and Constrained city dwellers (26%) make up over half of output area-level demand. Ethnicity central areas also account for a significantly higher proportion of the very high propensity group (14%) than they do across West Yorkshire (3%)
- Both Urbanites and Suburbanites are amongst the least likely to report commuting to work by bus, potentially explained by the fact that these two groups, along with Rural residents, exhibit high car ownership and incomes

Output area supergroup	Average proportion reporting commuting by bus ^B (%)
Rural residents	3%
Cosmopolitans	16%
Ethnicity central	26%
Multicultural metropolitans	16%
Urbanites	8%
Suburbanites	6%
Constrained city dwellers	17%
Hard pressed living	12%

Bus usage by ONS Supergroup and borough

Differences between usage rates of Multicultural metropolitans and Constrained city dwellers in and outside of Leeds could inform strategies to increase bus use amongst these high propensity segments

Average output area observed bus usage by ONS supergroup and borough

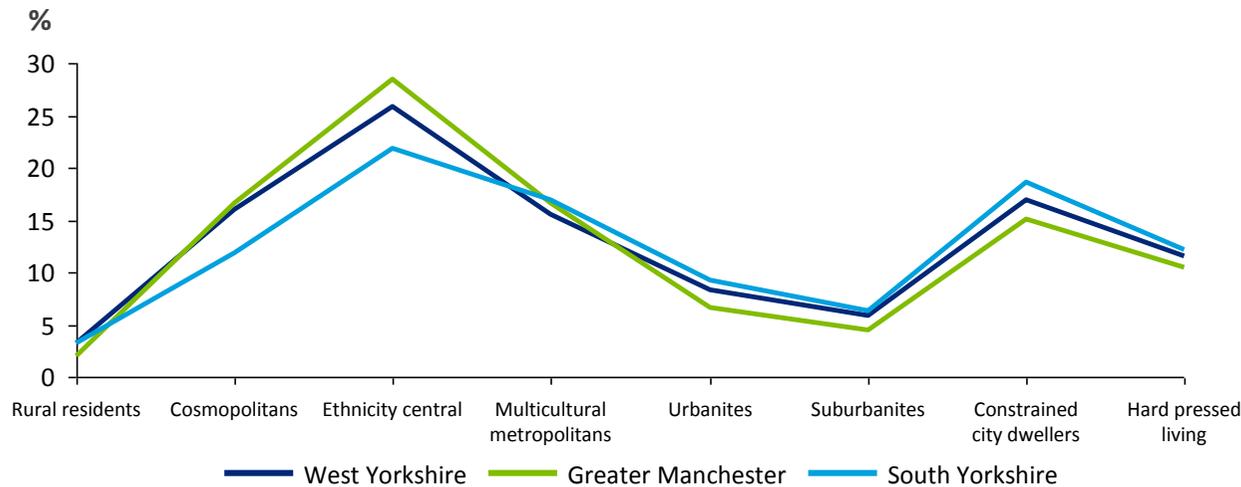


- The average bus usage per output area in Leeds is higher across all 8 supergroups than usage in other boroughs
- Multicultural metropolitan output areas in Leeds display almost twice the average propensity towards bus travel (23%) of demographically similar output areas in other boroughs (the next highest being Wakefield at 13%), potentially suggesting that supply side factors might constrain usage outside of Leeds
- A similar, but less significant divergence exists amongst Constrained city dwellers, where the propensity towards bus use in Leeds (22%) is 6 percentage points above similar output areas in other boroughs (the next highest being 16% in Calderdale)
- The difference persists, but is less significant for the Hard pressed living segment
- Understanding why these groups display significantly lower propensity toward bus use outside of Leeds could suggest measures to increase usage in these areas
- Only a very small number of Cosmopolitan and Ethnicity central output areas exist outside of Leeds and Bradford, meaning the sample sizes are insufficient to support cross-borough conclusions relating to these supergroups

Bus usage by ONS Supergroup and region

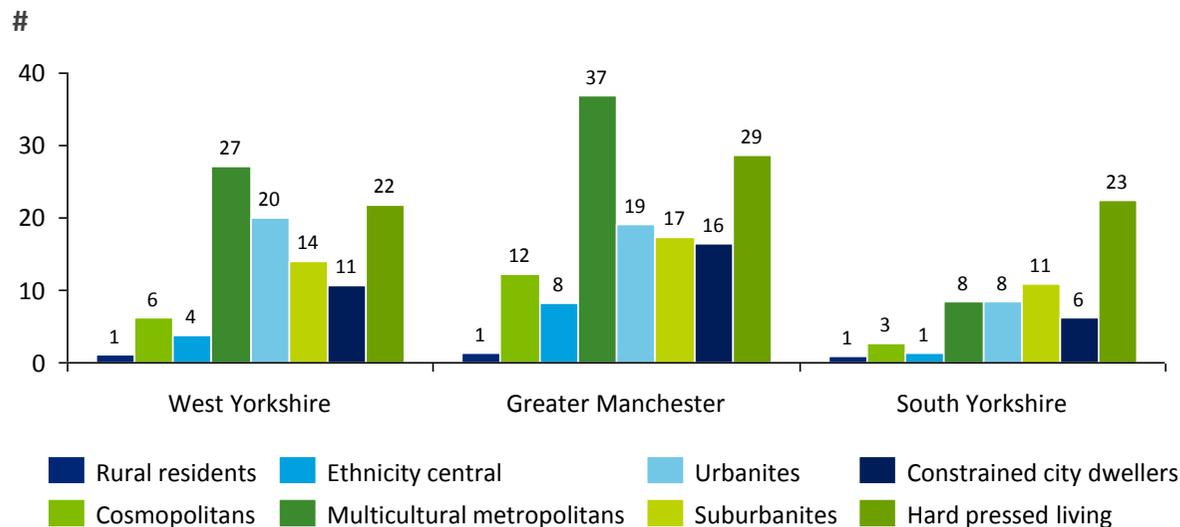
Rates of bus usage and usage by supergroup follow the same trends in nearby regions, although the composition of demand in West Yorkshire is more similar to Greater Manchester than South Yorkshire

Average output area bus usage by ONS supergroup and region



- Although different in size, the bus commuter market in West Yorkshire, appears very similar to that of South Yorkshire and Greater Manchester in terms of overall and supergroup-level usage propensity
- At the supergroup level, usage rates do not diverge sufficiently within any groups to suggest that any particular supergroup is under- or over-utilising the bus network in West Yorkshire for commuting purposes relative to their level of use in comparable regions
- Demographic differences mean that the relative significant of supergroups to overall commuter demand differs between the three regions
- The proportion of demand accounted for by each supergroup is more similar between West Yorkshire and Manchester than South Yorkshire, suggesting these two markets are more similar. This could suggest approaches tested in one market could be successfully applied to the other, if local characteristics were understood and controlled for

Total observed demand by supergroup and region



Region	Average proportion of bus commuters by output area	Number of reported bus commuters
West Yorkshire	11%	104600
Greater Manchester	10%	140192
South Yorkshire	11%	61251

Implications

Adjusted addressable demand is estimated to be between 9,000 and 12,400 commuters. Benchmarking suggests Metropolitan and City dwellers could be induced to increase their usage

Key factors have been identified as driving demand for bus transport which include supply side, demographic and area-specific variables

- Ethnicity, age, income and car ownership all correlate with bus usage, as does the frequency of bus services nearby. This has allowed areas of high potential commuter bus usage, which occur where levels of demand are lower than would be expected given their characteristics, to be identified

In 2011, the number of people reporting taking the bus to work in West Yorkshire was 104,600. Modelling identified an upper limit of 17,600 additional commuters based on supply and demand side factors and between 9,000 and 12,400 of these could have the potential to make the transition to bus given their transport options and commuting distances

- An estimated 17,600 people display the characteristics of bus commuters but did not report that they commuted to work by bus in the 2011 Census. While not all potential users could be converted to bus, between 9,000 and 12,400 commuters might reasonably be expected to transition to bus given their existing commutes by car of distances below 10km. This would represent an increase of between 9% and 12% on the observed level in 2011

This “untapped demand” amongst commuters is largely concentrated in a sub-set of wards, particularly in Kirklees and Leeds

- Half of the existing additional demand is based in one quarter of council wards, suggesting measures to increase bus usage could be concentrated in order to be more effective, on the basis of more targeted research and consultations
- Pockets of achievable potential demand exist in North East Kirklees, City and Hunslet in Leeds and in Guiseley and Yeadon in the North East of Leeds once those with commute profiles unlikely to be suited to buses are removed from the addressable demand

Ethnic minority, metropolitan and low-income city-based customer segments are particularly likely to be amongst high propensity user groups which could be prioritised to increase bus usage. Bus strategy interventions could capture this additional demand

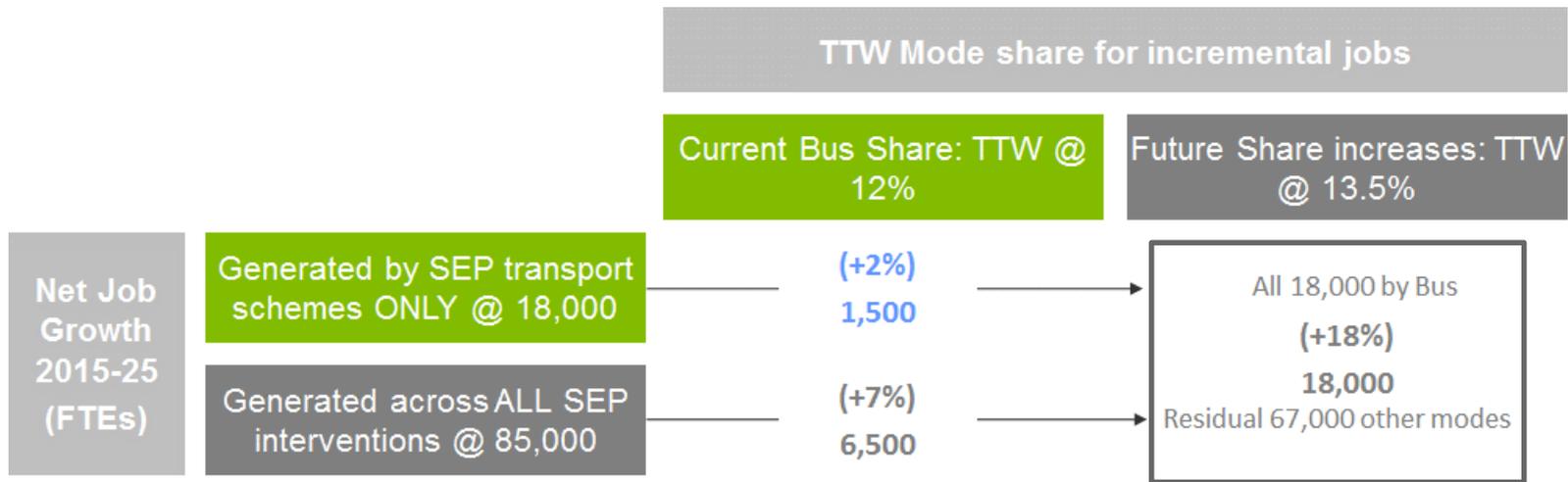
- Amongst very high propensity areas, where observed demand is double the output area average, output areas assigned the ONS supergroups Ethnicity central (14%), Multicultural metropolitans (38%) and Constrained city dwellers (26%) are heavily overrepresented compared to their overall share of the population of West Yorkshire (2%, 19% and 10% respectively)
- Rates of bus usage are higher for all supergroups in Leeds, but are particularly high relative to other areas for the Multicultural metropolitans and Constrained city dwellers supergroups. This suggests that developing a clearer understanding of why these groups display such a high propensity towards bus use in Leeds could inform strategies to increase their level of bus use in the rest of the region
- Benchmarking shows little difference between usage rates in West Yorkshire, South Yorkshire and Greater Manchester, although the supergroup composition of bus demand is most structurally similar between Greater Manchester and West Yorkshire. This could suggest that approaches undertaken in one of region could also be successful in the other (tram network notwithstanding)

Future Demand Analysis

Future demand: Strategic Economic Plan growth aspirations

In the SEP, net employment growth between 2015 and 2025 in Leeds City Region is estimated to be c. 85,000 FTE. Given constraints in other areas of the transport system, the bus system can be targeted to support a proportion of this economic growth as a result of a successful bus strategy.

Workers (FTEs) commuting by bus to fulfil SEP labour market demand, Leeds City Region, 2025



Sources: Leeds City Region SEP, Deloitte/PBA Analysis, rounded to nearest 500 FTEs.

- This rough-order-of-magnitude analysis provides a theoretical envelope of potential demand increases (for commuting purposes only), which are dependent on high-level assumptions made.
- In a 'do-nothing' case where commuting mode share remains at 12% and only transport generated SEP jobs are taken to be additional (18,000), the increase in bus demand (measured in terms of commuters) is c. 2%, or 1,500 FTEs.
- In the case where case where commuting mode share remains at 12% and all SEP jobs are taken to be additional (85,000), the increase in bus demand (measured in terms of commuters) is c. 7%, or 6,500 FTEs.
- If all 18,000 transport-scheme induced commuting journeys are captured by bus (giving bus a increased share of TTW journeys of 13.5%), with all other jobs going to other modes, the increase in bus demand (measured in terms of commuters) is 18% or 18,000 FTEs.
- As discussed in the methodology section, these estimates are aspirational and indicative, omitting a number of important considerations. These will be revisited during the full modelling analysis required for the Final Business Case to support WYCA's Bus Strategy.

Implications

Aggregating addressable demand and future demand derived from the Strategic Economic Plan yields an envelope of demand that could be captured by bus

The effective range of demand increase for commuting by bus is c. 15 – 30%

Potential Demand Increases in Travel to Work by Bus, Leeds City Region, 2025, % increase from 2015

	Low Estimate	High Estimate
Addressable Demand	+ 9%	+ 12%
Future Demand	+ 7%	+ 18%
Total Demand	+ 16%	+ 30%

Sources: Leeds City Region SEP, Deloitte/PBA Analysis, rounded to nearest 500 FTEs.

- As these estimates are aspirational in nature, the range has been combined to give an average increase of 25%, slightly above the mid-point of 23%, for use in the JMP bus strategy document

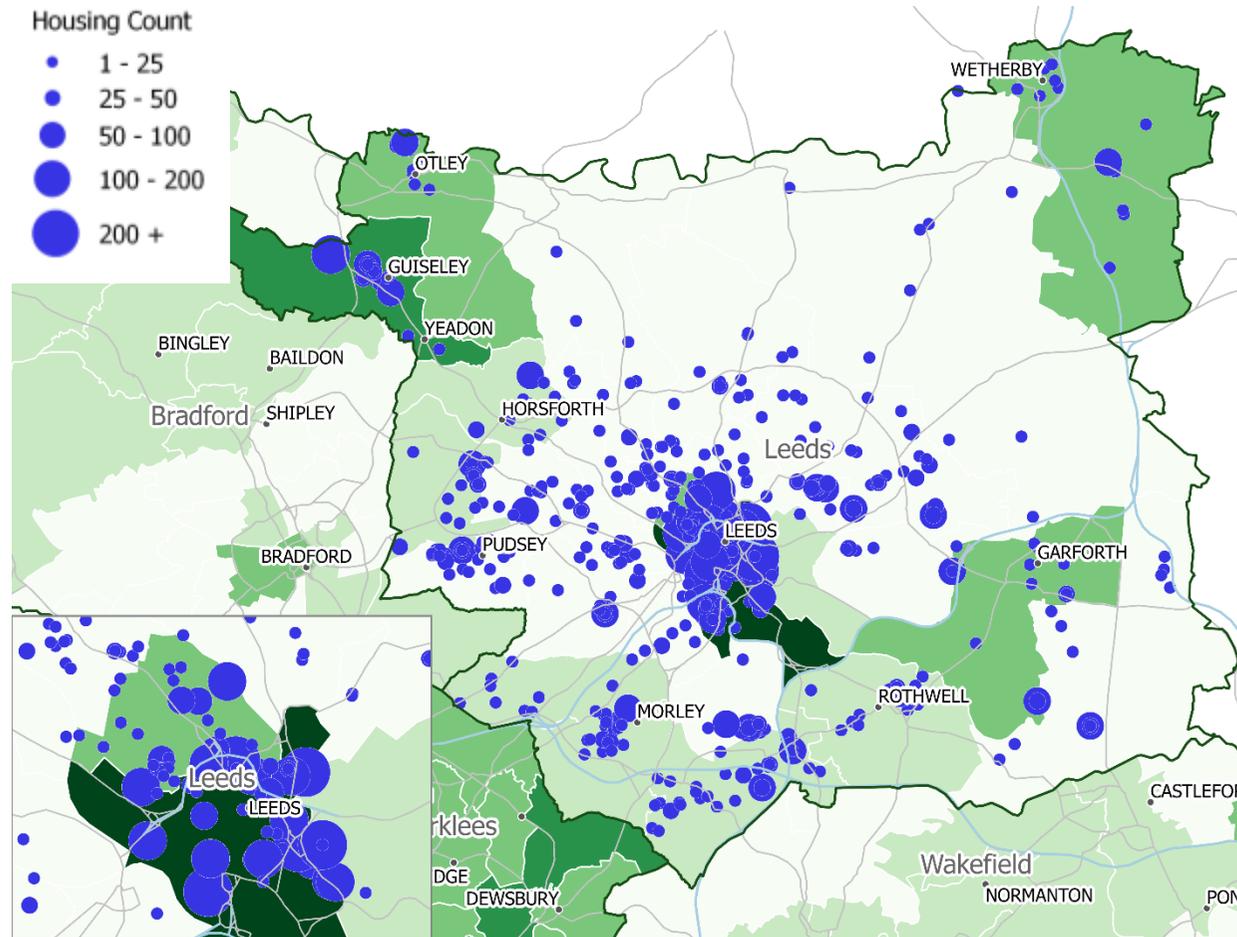
To achieve these levels of growth however, requires the alleviation of a number of constraints

- Bus commuting is capable of further supporting economic growth in West Yorkshire, as well as social inclusion and environmental objectives, but this is not a given and depends upon the successful implementation of the Bus Strategy and the attendant alleviation of a number of constraints
- If other modes are unable to accommodate the level of economic growth in the SEP, and bus provision is not fit-for-purpose take up the slack, the result is likely to be a reduction in productive capacity and slower rates of economic growth across West Yorkshire

Appendices

Appendix 1: Output area level housing growth in Leeds

Housing unit growth 2008-2015 and additional demand



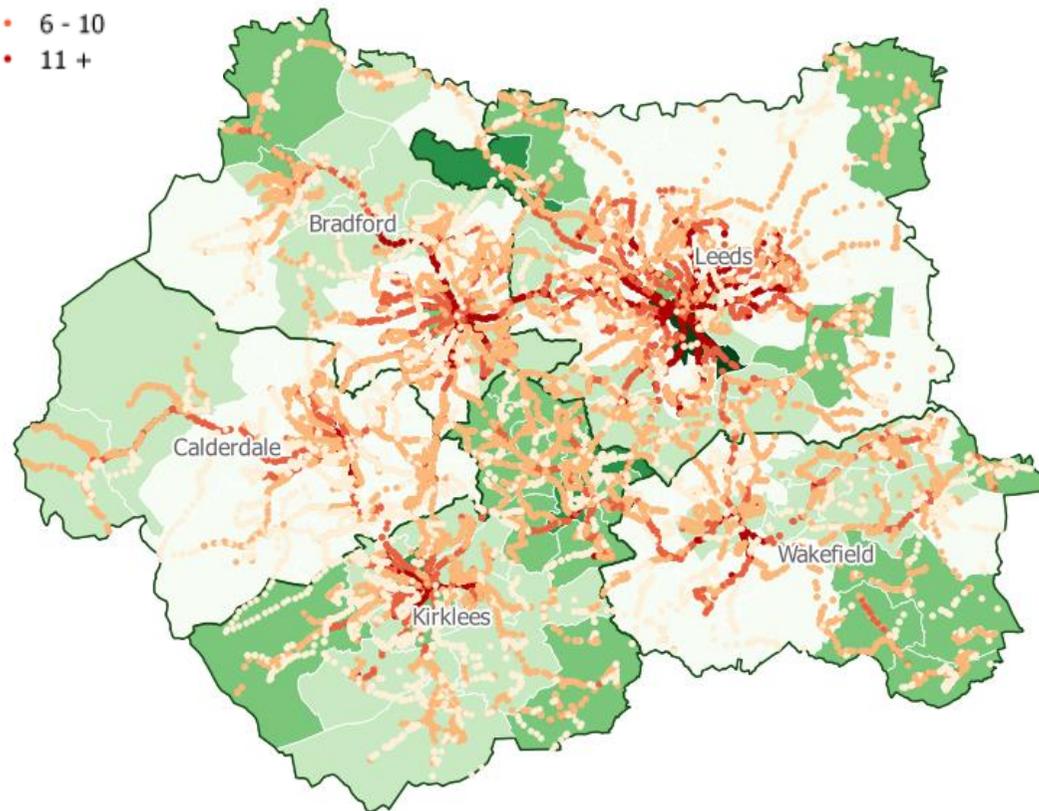
- Output area level housing growth between 2008 and 2015 within Leeds has been highly concentrated in the City and Hunslet ward
- Overall 1,111 housing units were built in City and Hunslet, almost 25% of the total of 4,535 built across Leeds over the period
- This is also where the greatest concentration of potential additional demand was identified, suggesting that an inflow of individuals with the characteristics of typical bus users to the area who did not report commuting by bus in the 2011 census
- Understanding the reason for this discrepancy, particularly whether it is motivated by demand or supply side factors, could assist in addressing the population growth in the ward and increase the level of bus usage amongst residents

Appendix 2: Bus stop and service frequency

Bus corridors (location and frequency) and additional demand

Bus Stop Frequency

- 1
- 2 - 5
- 6 - 10
- 11 +



- Mapping bus corridors and service frequencies highlights the extent to which areas are currently well served by bus connections
- This map shows additional demand (amounting to 17,600) against existing services
- The concentration of demand in the North West of Kirklees appears well served in terms of routes, although frequencies of service are below those of Leeds, Huddersfield and Bradford
- The concentration of demand in North West Leeds, around Guiseley and Yeadon might not be well served in terms of frequency, which could explain why a concentration of additional users not reporting commuting were identified by the model in this area

Appendix 3: Demographic characteristics of output areas by supergroup for West Yorkshire

Supergroup	Number of output areas	Average observed bus usage (%)	Average proportion without car (%)	Proportion of output areas classified as urban (%)	Average proportion of 16-24 year olds (%)	Average weekly household income (£)	Average proportion of white residents (%)
Rural residents	229	3.29%	9.65%	15.28%	8.24%	£500.35	97.71%
Cosmopolitans	250	16.05%	46.66%	12.40%	44.58%	£411.32	80.02%
Ethnicity central	149	25.81%	68.67%	29.53%	17.18%	£309.64	51.75%
Multicultural metropolitans	1359	15.54%	40.74%	45.03%	14.09%	£337.71	49.52%
Urbanites	1452	8.34%	19.94%	37.88%	10.03%	£468.44	92.91%
Suburbanites	1553	5.78%	11.28%	37.48%	8.97%	£483.65	94.07%
Constrained city dwellers	685	16.92%	53.49%	45.84%	10.42%	£392.17	91.97%
Hard pressed living	1454	11.61%	32.71%	46.77%	11.45%	£414.00	95.05%
All	7131	11.12%	29.47%	39.94%	12.20%	£424.11	84.08%



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