Accessibility Employment Projections for London

TECHNICAL REPORT

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SKM COLIN BUCHANAN

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Accessibility Employment Projections for London

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Contents

Executive Summary

Introduction

SKM Colin Buchanan was commissioned by GLA Economics in August 2012 to revise the employment growth distribution forecasts previously developed in 2009, which are derived from calculations of transport accessibility. The study involved:

- Calibration of a base relationship between transport accessibility and employment density using 2007 LTS data, testing different measures of time, density and access mode
- Forecasting of future changes in accessibility using the base relationship derived above
- Forecasting of future changes in the distribution of employment based on changes in future transport accessibility

Base Year Calibration

The strongest relationship is between employment density and combined public transport and highway access to population and employment combined when measured as generalised time. However, it is recommended that future employment distribution in London should be based on access *to population only*. This is because the relationship between transport accessibility to employment and employment density is artificially strong because employment is itself a function of employment i.e. it includes the same variable of employment in both sides of the relationship. In addition, the use of access to employment is not suitable for forecasting future employment distribution given its bias against areas that might experience significant employment growth from a low base level. Figure S1 shows this relationship graphically.

Future Year Accessibility Changes

Using the base year relationship derived previously, future changes in accessibility were derived by Borough. The Boroughs showing the greatest increase in accessibility in 2016 are Barnet, Bexley, Bromley and Harrow. The Boroughs showing the greatest increase in accessibility in 2021 are Barnet, Bexley, Greenwich and Hillingdon. Figure S2 shows % changes in combined public transport and highway access to population by Borough in 2021 relative to 2007.

It is noticeable that a reduction in accessibility occurs in most Boroughs in 2031 compared to 2021. This is because there are fewer infrastructure enhancements planned beyond 2021, as a result of which higher levels of crowding and highway congestion from increased transport demand reduce accessibility. However, it should be assumed that the drop in accessibility levels after 2021 will to a certain extent be offset by future investments that have not been accounted for in this analysis.

Figure S1 Employment Density versus Combined PT and Highway access to Population measured as Generalised Time – Borough Level

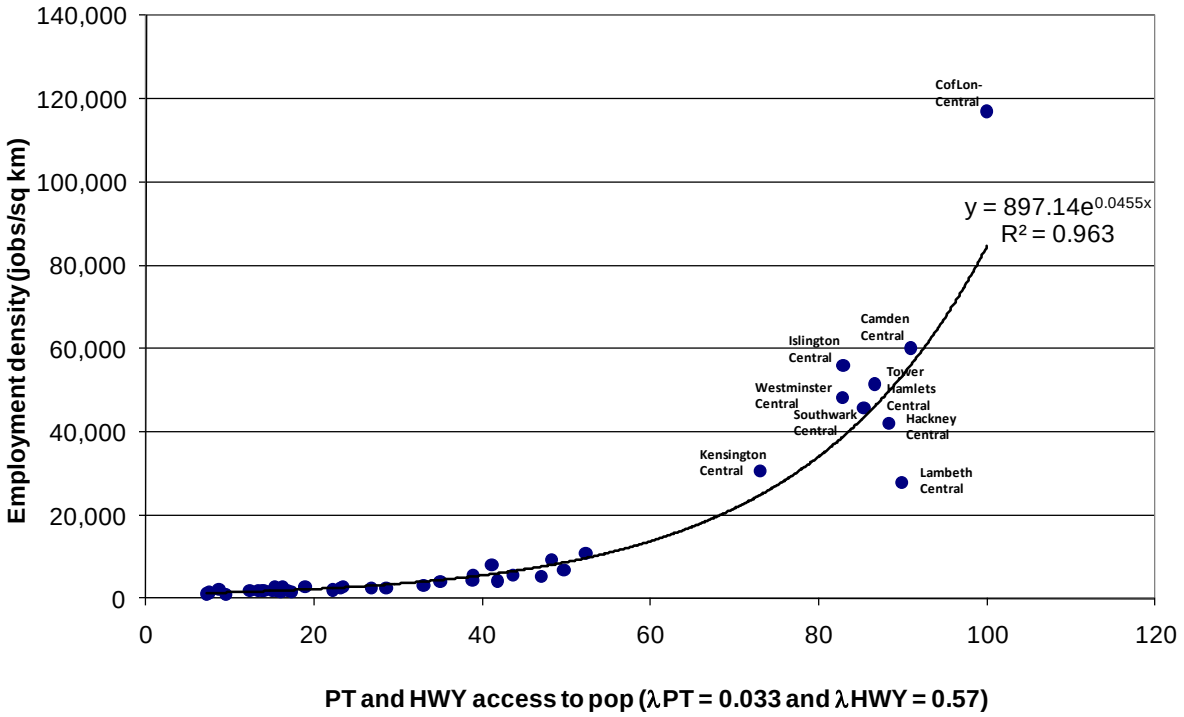
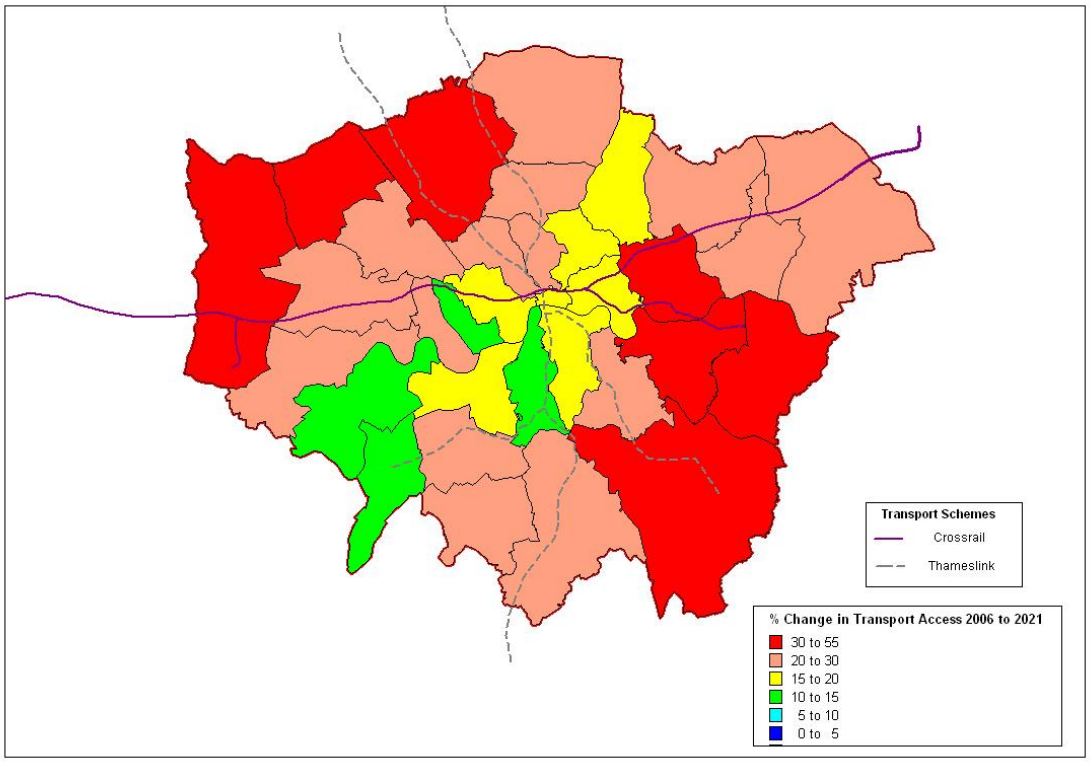


Figure S2 % change in combined PT and highway access to population 2007 to 2021 (including Crossrail)



Distribution of employment

The changes in future year accessibility were applied to 2007 employment levels to forecast future employment levels by Borough. It is important to stress that these projections only take into account changes in transport accessibility. There is no consideration of historic trends and site capacity meaning that the projections are not final but can be considered as theoretical 'potential' changes based on changes in transport accessibility on their own.

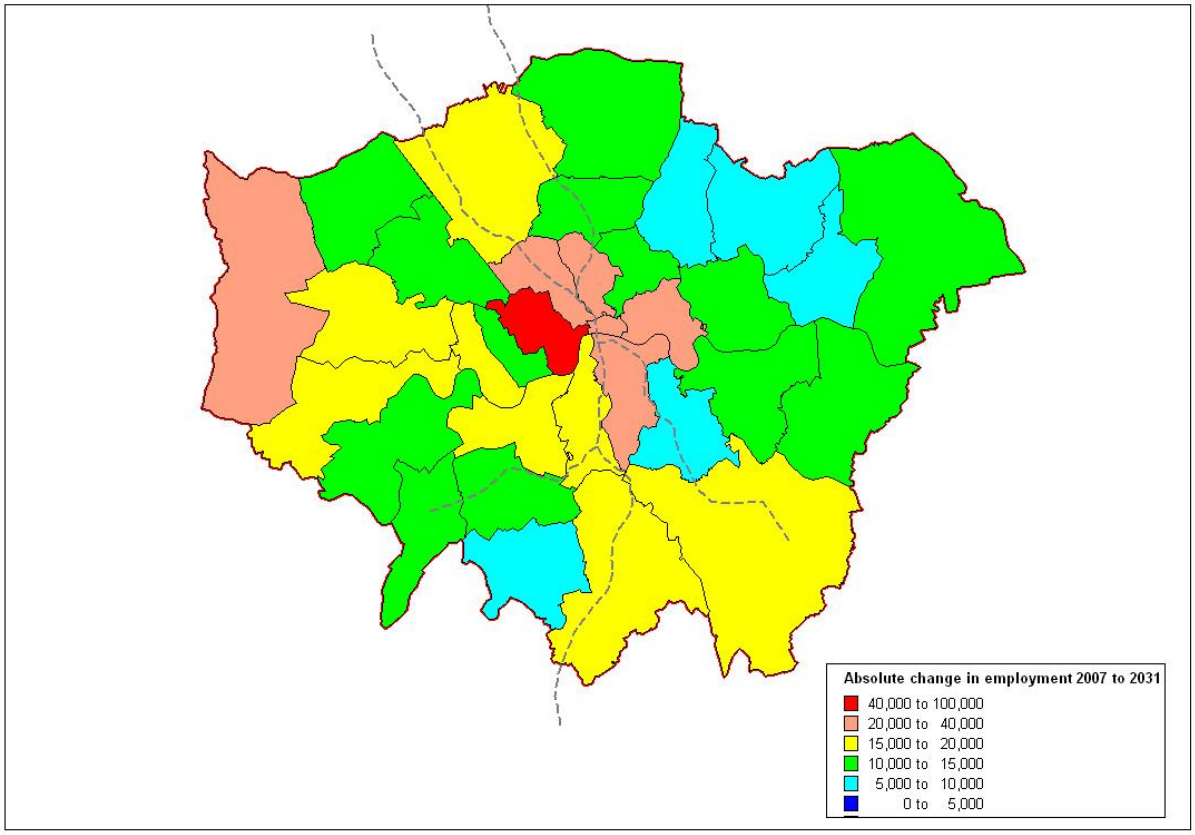
The methodology applied for distributing changes in employment based on future changes in accessibility makes the following assumptions:

- changes in employment density assume that Boroughs keep their differentials with the best fit curve between employment density and accessibility
- changes in accessibility have been applied to the growth in employment in each forecast year
- future employment levels in each Borough have been controlled to the GLA's total employment targets for London as a whole

The following findings were made:

- The changes in employment between the base year and each forecast year are largely driven by the equivalent changes in accessibility described in chapter 3 but are also affected by the amount of employment in each Borough i.e. a given change in accessibility results in a higher increase in employment in a Central London Borough than in an Outer London Borough.
- Figures S3 shows projected changes in employment by Borough in 2031 compared to 2007. It shows the increases in employment in 2031 are relatively evenly spread across London with the largest increases occurring in Central and Inner London and the Outer London Borough of Hillingdon.

Figure S3 Absolute change in employment 2007 to 2031



Conclusion

This study has shown a strong relationship between combined public transport and highway accessibility and employment density in Greater London, which is heavily weighted by the strength of the relationship between public transport accessibility and employment density, which was also identified in a previous study undertaken for the GLA in 2009. Using this relationship, the distribution of future employment in London has been forecast based on changes in transport accessibility. The highest forecast increases in employment in future years occur in Central and Inner London with a large increase also occurring in the Outer London Borough of Hillingdon.

It is important to stress that these projections only take into account changes in transport accessibility. There is no consideration of historic trends and site capacity meaning that the projections are not final but can be considered as theoretical 'potential' changes based on changes in transport accessibility on their own.

It is recommended that the relationship between transport accessibility and employment density and future employment distribution projections are re-assessed in future whenever updated base and future year LTS data is available as changes in the base year calibration or in future year infrastructure assumptions could result in a significant re-distribution of future employment.

1 Introduction

1.1 Background

1.1.1 The Greater London Authority (GLA) forecasts the future distribution of employment growth across London using three measures as follows:

- **Historic trends –** reflecting past preferences of employers for locating in particular boroughs;
- **Site capacity –** reflecting the availability of business sites across London; and
- **Future changes in Transport accessibility –** reflecting the need of most businesses to have good access to labour markets and clients

1.1.2 SKM Colin Buchanan was commissioned by GLA Economics in August 2012 to revise the employment growth distribution forecasts previously developed in 2009, which are derived from calculations of transport accessibility. The study involved undertaking the same set of analyses performed previously using updated inputs from Transport for London's (TfL) London Transportation Model (LTS) to determine whether the relationships between public transport accessibility and employment density previously identified remain and can be used to forecast future employment distribution.

1.1.3 LTS is a multi-modal model containing 1,285 zones, of which 879 are within the GLA area. The model uses measures of generalised time and generalised cost by mode between zones, in combination with input employment and population distributions by zone, to predict mode shares, link flows, crowding and journey times on both the public transport and highway networks in London.

1.1.4 The previous study, undertaken in 2009, made the following findings:

- The best fit relationship between accessibility and employment density was given using a gravity model formula based on public transport access and a single measure of employment density. A strong exponential relationship between employment density and public transport access to population was found with density increasing rapidly at high levels of accessibility. Central London showed high employment density and public transport accessibility and Outer London showed low employment density and public transport accessibility.
- Highway accessibility provided no improvement in the relationship with the conclusion that highway accessibility has little effect when compared with the more dominant impact of public transport accessibility.
- Future year analysis showed that boroughs along the Thameslink and Crossrail corridors benefit from the highest increases in accessibility levels whilst other boroughs experience a fall or stagnation in their levels of accessibility. This was the case for a number of boroughs post-2016 as the LTS model did not include any infrastructure improvements post-2016.
- In applying future changes in accessibility to the distribution of employment, differences between the best fit curve and each borough were maintained from the base year and above a certain level of accessibility, growth in employment was constrained. Most of the growth was

concentrated in Central and East London with South West London seeing a fall in employment.

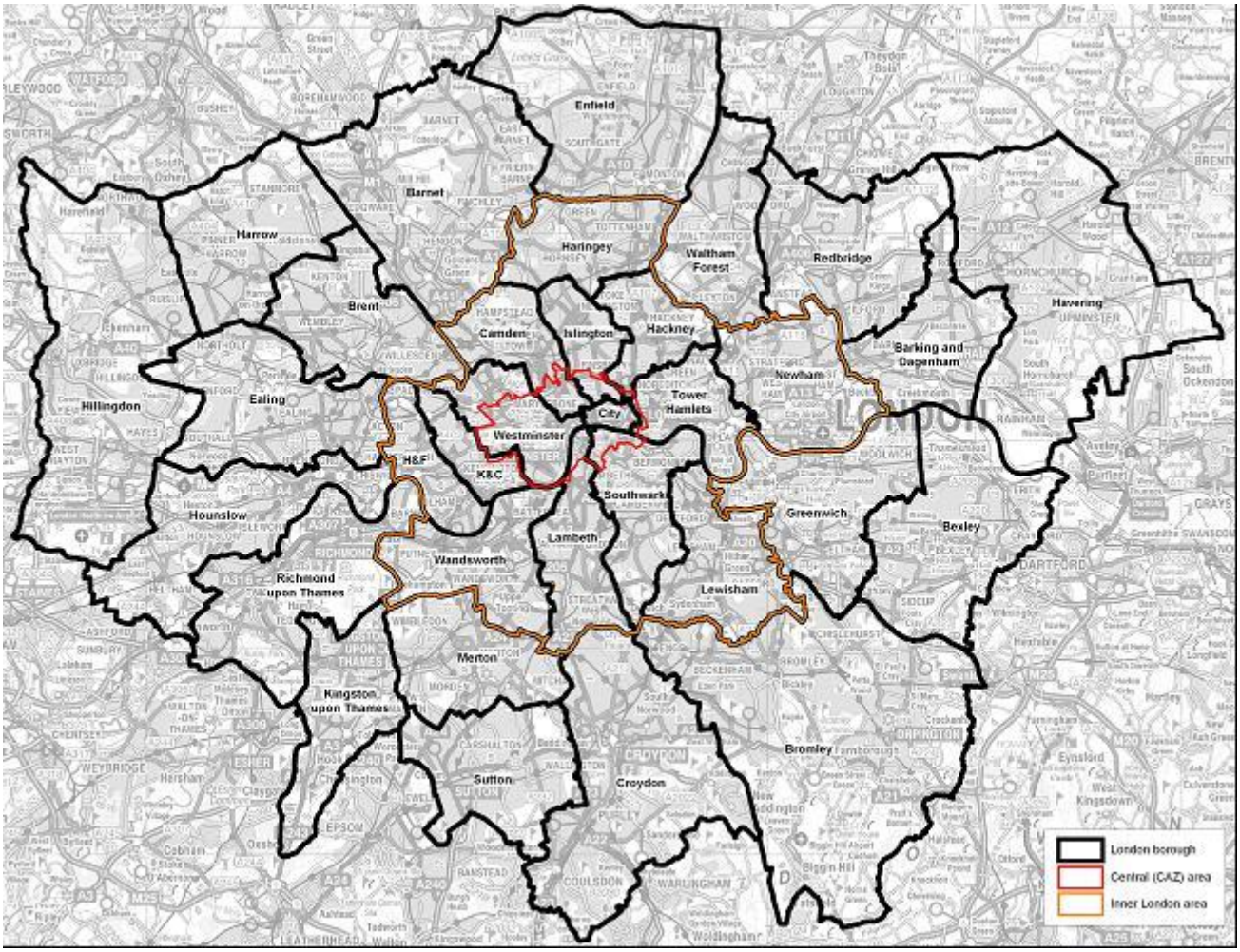
1.2 Overview

1.2.1 The first stage of the study was to calibrate the base relationship between transport accessibility and employment density. Different measures of transport accessibility were tested, varying by measurement unit (clock time/ generalised time/ generalised cost), access mode (public transport/highway/combined) and measure of density (population/employment/combined). The gravity model formula derived as part of the previous work was retained in all the testing, although optimal *lambda (λ)* values were adjusted to produce the strongest relationship between employment density and transport accessibility. The base year for this work was 2007, for which corresponding LTS data was provided in order to test all the scenarios described.

1.2.2 The relationship derived was used to forecast future changes in the distribution of employment based on changes in future transport accessibility. Projections were produced for 2016, 2021, 2026, 2031 and 2036 at a Borough level, with those boroughs located across the Central Activity Zone boundary split into two, giving a total of 41 'split borough' areas. These 'split boroughs' are displayed in Figure 1.1.

1.2.3 The central hypothesis, which was proved by the previous study, was that employment density is determined largely by access to labour supply, so that the greater the accessibility to population, the higher the employment density. It was also expected that employment density would be significantly influenced by accessibility to employment, in accordance with theories of employment agglomeration. As in the previous study, this was not used, as predicting a variable using a function of itself raises circularity issues.

Figure 1.1 London boroughs split by Central, Inner and Outer London



1.3 Report Structure

1.3.1 The remainder of the report is structured as follows:

- Chapter 2 summarises the methodology for calibrating the base year relationship between accessibility and employment distribution in London, and details the key base year results between accessibility and employment distribution;
- Chapter 3 describes the future year accessibility forecasts and what drives the changes in patterns;
- Chapter 4 describes the impacts of the accessibility changes on employment patterns for the four future model years; and
- Chapter 5 draws out the key conclusions of the study.

2 Base year calibration

2.1 Calculation of Transport Accessibility

2.1.1 Transport accessibility has been calculated using the gravity model formula shown below.

*Accessibility to population/employment = V * exp(-λ*T)*

Where;

V = population/employment

T = AM time from origin to destination (clock time/ generalised time/ generalised cost)

λ = constant

exp = exponential function

2.1.2 Accessibility to population/employment is calculated for LTS destination zones using total population/employment in the origin zone. Values at the split borough level have been derived by aggregating LTS zone population and employment levels and averaging LTS week-day AM Peak zone times. The zone times were sourced from base year (2007) zone-to-zone matrices of generalised time and cost.

2.1.3 The *λ* value represents the travel time/cost decay rate. A high *λ* value gives greater significance to shorter journey times when accessibility is calculated. A lower *λ* value implies that the impacts of accessibility changes are spread over a wider area.

2.1.4 Table 2.1 below shows what is included in each measure of time. The crowding model used in LTS for PT increases 'in vehicle' time by a variable amount depending on the level of demand compared to capacity on each link. So a crowding 'penalty' of 1 is used for links that are uncrowded, meaning no additional uplift is applied to the value of time. A crowding penalty of 1.5 would mean that the level of crowding is such that 50% should be added to the value of time.

Table 2.1 LTS zone to zone measures of accessibility

LTS Journey Time Measure	Public Transport (PT)	Highway (HW)
Clock Time	Total zone-to-zone journey (clock) time	Total zone-to-zone journey (clock) time (calculated using average road speed estimates, taking into account congestion constraints)
Generalised Time (GT)	As clock time, plus the following; - Boarding penalty per board (2.5 minutes) - Waiting Time Factor (multiplier of 2.5) - Walk Time Factor (multiplier of 2) - 'In vehicle' crowding factor (variable, depending on level of crowding)	As clock time, plus parking search time
Generalised cost (GC) converted back into time	As generalised time, plus fares, split by journey purpose	As generalised time, plus: - Journey purpose value of time - Vehicle operating costs - Toll costs

2.2 Calculation of Employment Density

2.2.1 Employment densities at split Borough level have been derived by aggregating LTS zone employment levels and dividing by total area less 'green space' using mapping data provided by TfL/GLA.

2.3 Calculation of relationship between Transport Accessibility and Employment Density

2.3.1 A number of regressions were run to determine the best fit (measured in terms of R sq) between transport accessibility and employment density involving adjustments to the calculation of transport accessibility. Each regression was performed at a Borough level whilst some were also performed at zone level.

2.3.2 An iterative process was used to adjust the λ value so that a best fit was achieved for each regression performed. Where a regression included both population and employment and/or both

public transport and highway access combined, separate λ values where assumed for each variable.

2.4 Findings

2.4.1 Table 2.2 shows all the regressions performed at Borough level, along with their respective fitness (measured in terms of R sq) and rank. As expected given the significantly larger sample size, the regressions performed at zone level give a significantly lower level of fitness compared to Borough level.

2.4.2 The strongest relationship is given between employment density and combined public transport and highway access to population and employment combined when measured as generalised time. This relationship is shown graphically in Figure 2.1.

2.4.3 The results differ in two ways compared to the 2009 study. Firstly, this study has found that the strongest relationship with employment density is provided by combined public transport and highway access, rather than just public transport access. This seems logical on the grounds that whilst highway accessibility shows a much weaker relationship with employment density, a relationship does exist between these two variables, hence a further marginal improvement when combined with public transport access. The problem in the 2009 study concerned strange patterns of highway accessibility that seem to have been resolved in the latest model.

2.4.4 Secondly, this study has shown that a stronger relationship is given with access to population and employment combined rather than employment (with combined public transport and highway access). Again, this seems logical on the grounds that two individual relationships are being combined. The strength of this relationship is demonstrated by the regression analysis shown in Figure 2.1, which suggests that variations in either accessibility or employment density explain nearly 96.5% of the values of the other variable.

2.4.5 It is also noticeable that the top twelve regressions give similarly strong relationships between employment density and transport accessibility. Common to all these regressions is the inclusion of access by public transport, however there are variations between these regressions in the time measure used (generalised time, generalised cost and clock time) and the access origin assumed (population, employment and population and employment combined). For this reason and because of the issues identified with the use of access to employment as part of the 2009 study (see para 2.4.6 below), it is recommended that the forecasting of future employment distribution in London should be based on the relationship between combined public transport and highway access *to population* and employment density when measured as generalised time (which gives the second strongest regression performed). Figure 2.2 shows this relationship graphically.

2.4.6 The issues with using a relationship between employment density and transport accessibility to employment to forecast future employment distribution are (a) employment is itself a function of employment and (b) the use of access to employment for forecasting future employment distribution is biased against areas which might experience significant employment growth from a low base level.

2.4.7 Figure 2.2 shows that the relationship between combined public transport and highway access to population and employment density is influenced by whether the split Borough is located in Central, Inner or Outer London, as those split Boroughs with the highest employment densities and accessibility are all located in Central London (the City of London forms part of the Central Activity Zone). Some further analysis was undertaken to plot two distinct data sets; one including Outer London Boroughs only (see Figure 2.3) and the other including Inner and Central London Boroughs only (see Figure 2.4). There is a much stronger relationship in the Inner and Central London Boroughs, which is a reflection of the higher employment densities that are supported in these areas by their greater accessibility; the exponential nature of the relationship is further enhanced in this instance.

Table 2.2 Regressions Performed – Borough Level

Regression	Level of Fit (R sq)	Rank
Public transport access to population measured as generalised time	91%	17
Public transport access to employment measured as generalised time	96%	8
Public transport access to population and employment combined measured as generalised time	95%	11
Public transport access to population measured as generalised cost	87%	19
Public transport access to employment measured as generalised cost	96%	7
Public transport access to population and employment combined measured as generalised cost	96%	10
Public transport access to population measured as clock time	92%	16
Public transport access to employment measured as clock time	96%	9
Public transport access to population and employment combined measured as clock time	95%	12
Highway access to population measured as generalised time	50%	21
Highway access to employment measured as generalised time	93%	14
Highway access to population and employment combined measured as generalised time	92%	15
Highway access to population measured as clock time	59%	20
Highway access to employment measured as clock time	94%	13
Highway access to population and employment combined measured as clock time	90%	18
Combined public transport and highway access (weighted by respective mode shares) to population measured as generalised time	96%	2
Combined public transport and highway access (weighted by respective mode shares) to employment measured as generalised time	96%	3
Combined public transport and highway access (weighted by respective mode shares) to population and employment measured as generalised time	96%	1
Combined public transport and highway access (weighted by respective mode shares) to population measured as clock time	96%	6
Combined public transport and highway access (weighted by respective mode shares) to employment measured as clock time	96%	4
Combined public transport and highway access (weighted by respective mode shares) to population and employment measured as clock time	96%	4

Figure 2.1 Employment Density versus Combined PT and Highway access to Population and Employment combined measured as Generalised Time – Borough Level

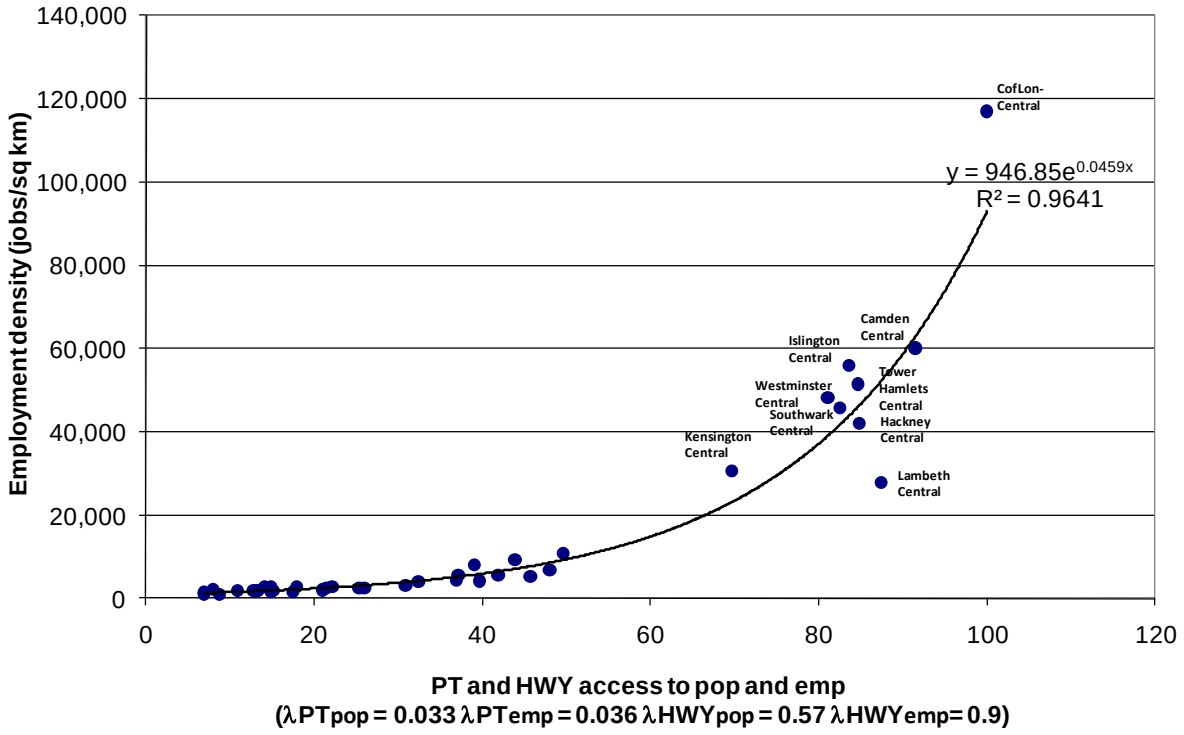


Figure 2.2 Employment Density versus Combined PT and Highway access to Population measured as Generalised Time – Borough Level

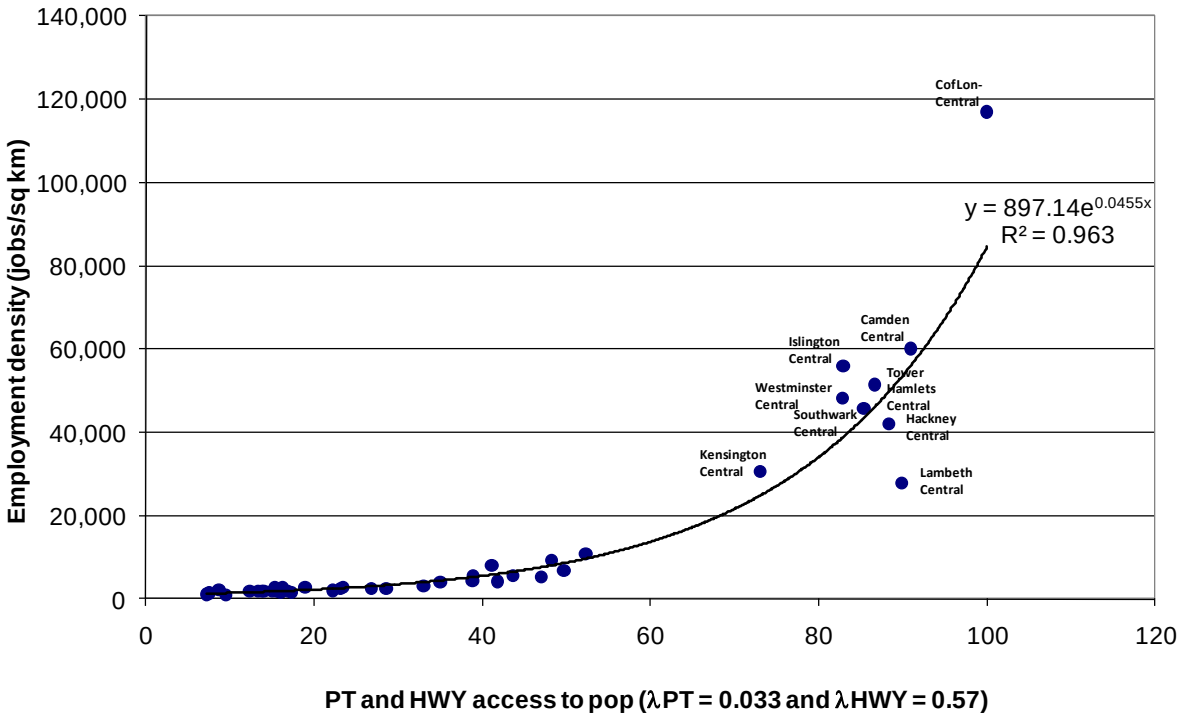


Figure 2.3 Employment Density versus Combined PT and Highway access to Population measured as Generalised Time – Outer London Boroughs

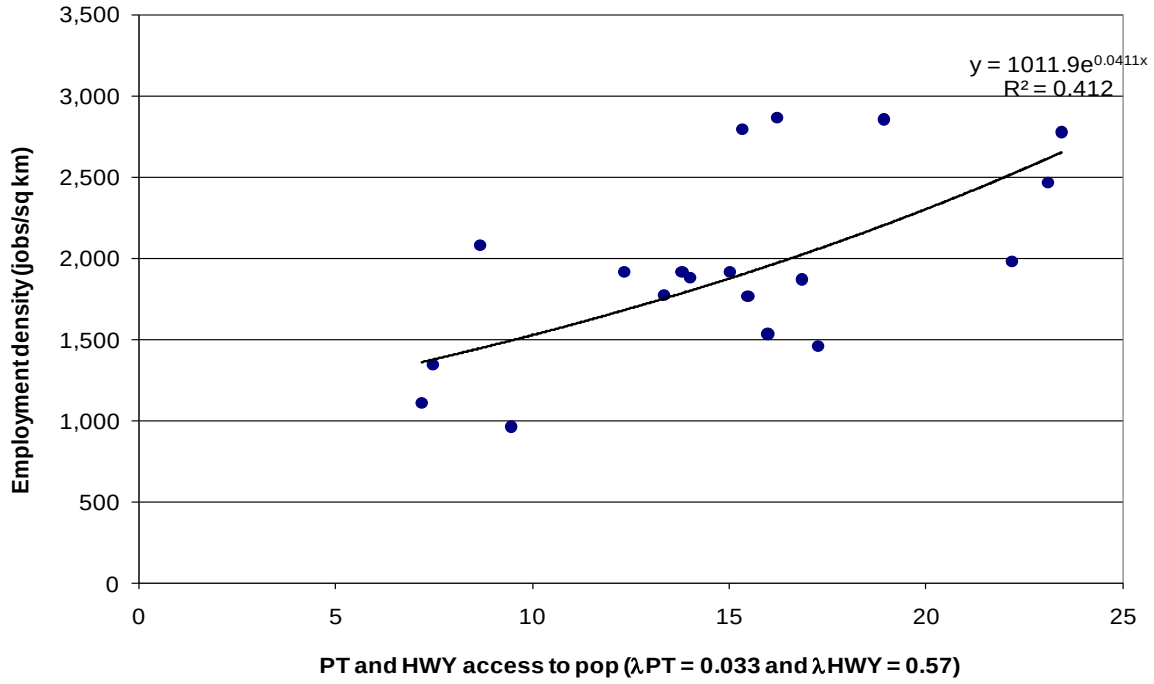
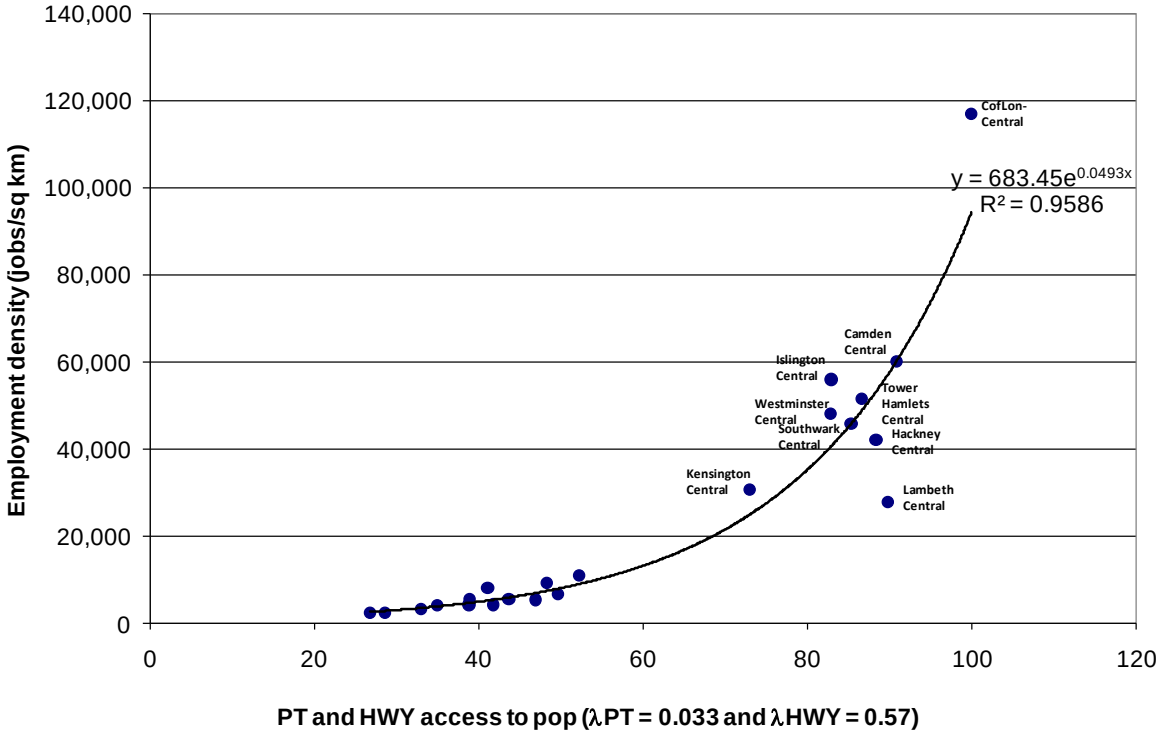


Figure 2.4 Employment Density versus Combined PT and Highway access to Population measured as Generalised Time – Central and Inner London Boroughs



2.5 Conclusions

2.5.1 Despite the change in the best fit relationship and in the rankings of the regressions performed compared to the 2009 study, the findings accord with the previous study in the sense that the strength of the relationship between employment density and combined public transport and highway access is heavily weighted by the strength of the relationship between employment density and public transport access. The strength of the relationship with public transport access can be rationalised in the following way:

1) The most dense employment area of Central London is almost entirely dependent on access to labour supply via public transport

2) Hence the distribution of population is heavily dependent on public transport access to Central London

3) Employment outside Central London is more 'population-dependent' i.e. is dependent on demand from the local population, hence is also located principally on the basis of public transport accessibility to Central London

4) Public transport accessibility is hence the prime driver for all development density in London

2.5.2 The weaker relationship between employment density and highway accessibility (which is even applicable in Outer London) can be explained by highway accessibility being much more evenly distributed than public transport accessibility whereas employment is not distributed evenly.

2.5.3 It should be noted that these conclusions are based at a strategic, London-wide level. However, there are instances at a localised level where the relationships described are not valid. For example, there are clusters of employment that are based predominantly on highway accessibility, notably on the M4 corridor and around the M25. Similarly, there are locations with high public transport accessibility, such as around mainline rail termini in Central London, which have low employment density. At a London-wide level however it is public transport accessibility that seems to be the key driving force behind variations in development density.

3 Future year accessibility changes

3.1 Methodology

3.1.1 Chapter 2 described how a base year relationship was calibrated between employment density and transport accessibility. In determining how future employment growth is distributed therefore it is changes to accessibility patterns that need to be taken into account. The relationship between employment density and combined public transport and highway access to population was therefore used to forecast future changes in accessibility based on changes in generalised time to each split Borough. Changes in generalised time in each future year take into account changes in the pure journey time as well as crowding and other penalties (all of which are measured in time) between zones within the LTS model; these elements of generalised time are in turn affected by new infrastructure as these present new route choices and additional transport capacity.

3.1.2 In addition to the same parameters and gravity model formula being used, future year accessibility was also determined using 2007 population and employment density values meaning that the only difference between the base year and each future year was the change in generalised time to each split Borough. This ensures that future year accessibility is determined solely by changes in transport infrastructure and does not take account of changes in population distribution, which has the desired effect of showing the sole effects of transport investment on employment density. Appendix A shows the public transport infrastructure assumptions in each modelled year.

3.2 Findings

3.2.1 Table 3.1 shows changes in transport accessibility by split Borough in each forecast year. The Boroughs showing the greatest increase in accessibility in 2016 are Barnet, Bexley, Bromley and Harrow. In the case of Barnet, there are a number of National Rail enhancements through the Borough including Thameslink and Northern Line PPP improvements. In Bexley and Bromley there are a number of improvements to National Rail Services such as the Integrated Kent Franchise taking place between 2007 and 2016. Harrow benefits from improvements to National Rail and LUL Jubilee and Metropolitan lines. The parts of London showing the the smallest increase in accessibility in 2016 are the Central Area Zone (CAZ), as well as the Boroughs of Hounslow, Kensington and Chelsea and Richmond. The low increase in the CAZ is surprising given the large number of schemes introduced between 2007 and 2016 which serve this area including both National Rail and LUL PPP upgrades. This can be explained by (a) accessibility levels to the CAZ already being high in 2007 therefore generating lower proportionate increases in accessibility relative to other Boroughs and (b) improvements in transport provision being offset by increases in crowding and highway.

3.2.2 All Boroughs show an improvement in accessibility in 2021 compared to 2016. The largest improvements are shown in Barnet, Bexley, Greenwich and Hillingdon. There are a number of further improvements in National Rail over this period including further enhancements as part of the Thameslink programme as well as further upgrades on the LUL Northern and Piccadilly Lines. The introduction of Crossrail in 2017 is a major driver of improvements in accessibility across London, particularly in Bexley, Greenwich and Hillingdon.

3.2.3 It is noticeable that a reduction in accessibility occurs in most Boroughs in 2031 compared to 2021, the largest of which take place in Central and Inner London Boroughs. This is because there are fewer infrastructure enhancements planned beyond 2021, as a result of which higher levels of crowding and highway congestion from increased transport demand reduces accessibility.

3.2.4 The lack of infrastructure improvements within the LTS model post-2021 is a reflection of TfL's committed transport investments and is not necessarily a reflection of transport improvements that will occur in reality. It is likely that TfL will respond with additional schemes not included in LTS in response to a worsening in crowding and highway congestion. It should therefore be assumed that the drop in accessibility levels after 2021 will to a certain extent be offset by future investments that have not been accounted for in this analysis.

3.2.5 It is also noticeable that the two main Central London Boroughs, the City of London and Westminster, show a low increase in accessibility relative to the other Boroughs, despite benefiting from the largest absolute improvement in public transport provision. This is the result of (a) accessibility levels to these Boroughs already being high in 2007 therefore generating lower proportionate increases in accessibility relative to other Boroughs and (b) public transport crowding/highway congestion having a more significant impact on public transport routes into Central London.

3.2.6 Figures 3.1 to 3.4 show the changes in access to population between 2007 and each future year spatially. In effect it shows the transport accessibility scores in 2016, 2021, 2026 and 2031 displayed in Table 3.1 relative to the 2007 base index of 100 (by Borough, rather than by split Borough).

Table 3.1 Change in combined public transport and highway accessibility index by Split Borough (2007 Base = 100)

Split Borough	2016	2021 (including Crossrail)	2021 – 2016	2026	2026 – 2021	2031	2031 – 2026
Barking-OuterGL	118	125	7	125	1	125	-1
Barnet-OuterGL	123	142	19	142	0	140	-2
Bexley-OuterGL	131	152	21	154	2	154	0
Brent-OuterGL	114	122	8	123	0	122	-1
Bromley-OuterGL	120	133	13	133	0	132	-1
Camden-Central	106	117	11	115	-2	111	-3
Camden-Inner	115	128	12	127	-1	124	-2
CofLon-Central	106	116	10	114	-2	110	-3
Croydon-OuterGL	109	129	20	128	-1	126	-2
Ealing-OuterGL	107	127	20	127	-1	125	-2
Enfield-OuterGL	110	126	16	127	1	126	-1
Grnwich-OuterGL	119	138	19	139	0	137	-2
Hackney-Central	109	117	8	115	-2	112	-3
Hackney-Inner	112	121	9	120	-1	118	-2
Hammersm-Inner	111	125	13	123	-2	120	-3
Haringey-Inner	112	125	12	124	0	123	-2
Harrow-OuterGL	120	131	11	131	0	130	0
Havering-OuterGL	115	127	12	128	0	127	-1
Hillingd-OuterGL	119	144	26	143	-1	141	-2
Hounslow-OuterGL	106	121	16	121	0	120	-1
Isling-Central	107	118	11	116	-3	113	-3
Isling-Inner	113	126	13	124	-1	122	-3
Kensingt-Central	102	112	10	110	-3	106	-4
Kensingt-Inner	101	112	11	111	-2	108	-3
Kingston-OuterGL	111	115	4	115	0	114	-1
Lambeth-Central	106	112	6	110	-2	107	-3
Lambeth-Inner	110	117	7	116	-1	114	-2
Lewisham-Inner	116	123	7	122	-1	121	-2
Merton-OuterGL	117	125	8	124	-1	122	-2
Newham-Inner	119	135	15	135	0	133	-2
Redbridg-OuterGL	109	120	12	121	1	119	-1
Richmond-OuterGL	107	113	7	113	0	112	-1
Southwar-Central	107	115	8	113	-2	110	-3
Southwar-Inner	114	122	8	121	-1	119	-2
Sutton-OuterGL	111	124	13	124	0	123	-1
THamlets-Central	106	115	8	113	-2	110	-3
THamlets-Inner	113	124	12	123	-2	120	-3
WalthamF-OuterGL	112	117	5	118	0	117	-1
Wandswor-Inner	112	118	6	117	-1	114	-3
Wminster-Central	106	115	9	113	-2	110	-4
Wminster-Inner	109	118	9	118	0	115	-3

Figure 3.1 % change in combined PT and highway access to population 2007 to 2016

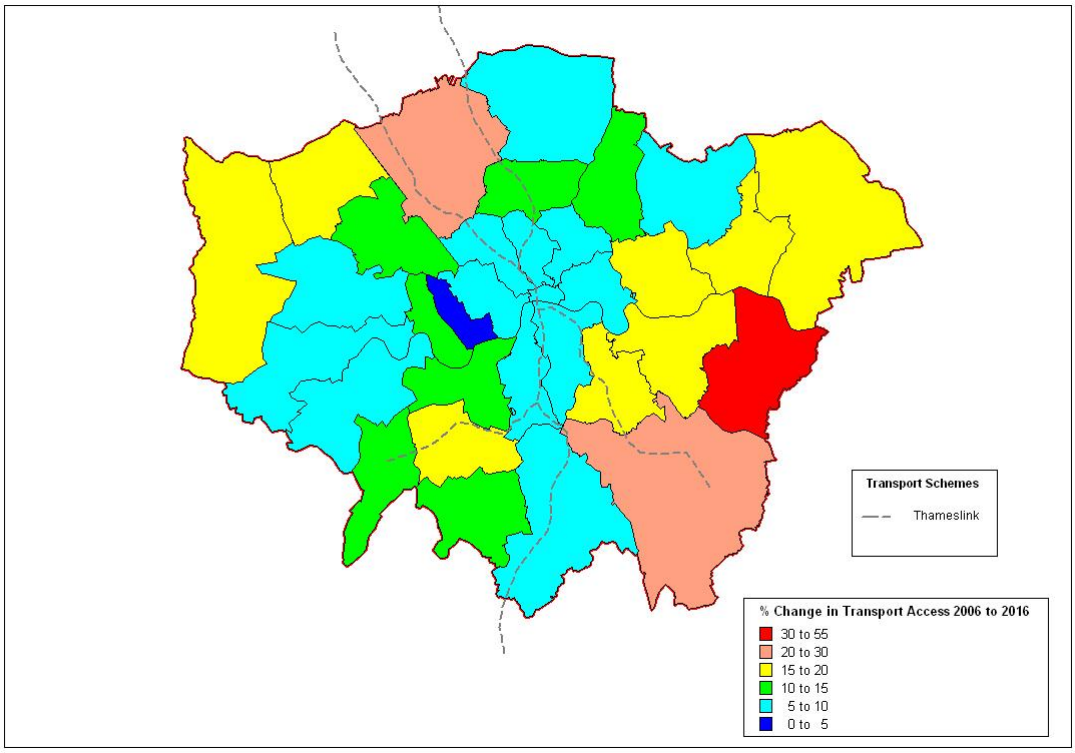


Figure 3.2 % change in combined PT and highway access to population 2007 to 2021 (including Crossrail)

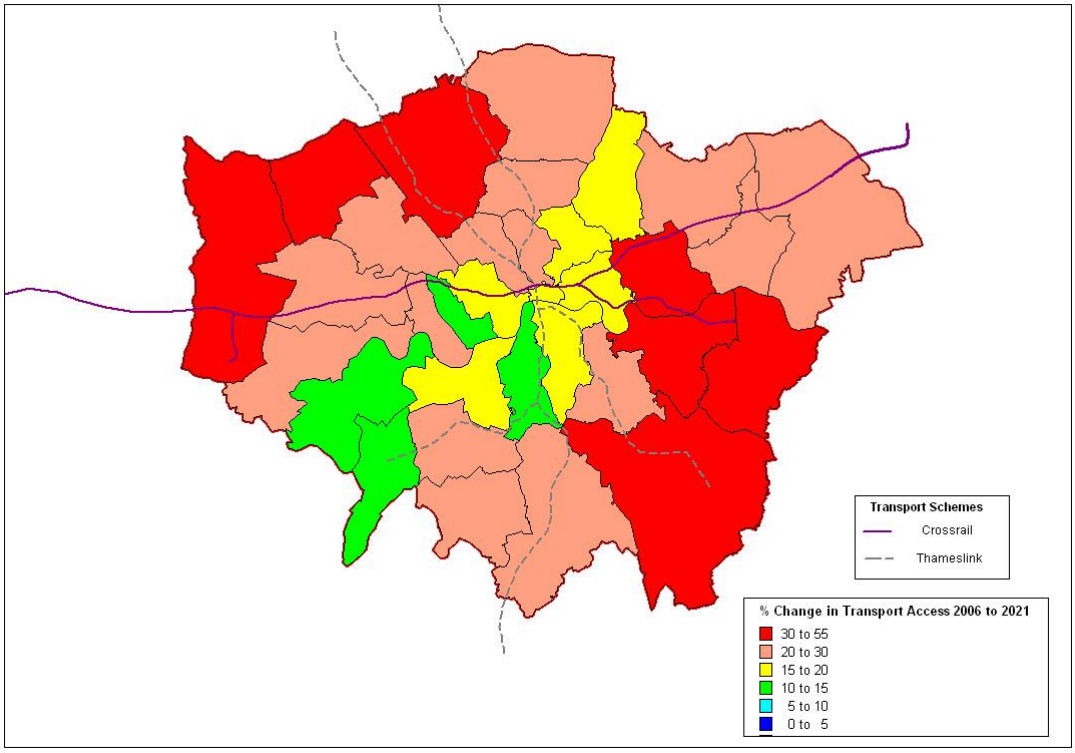


Figure 3.3 % change in combined PT and highway access to population 2007 to 2026

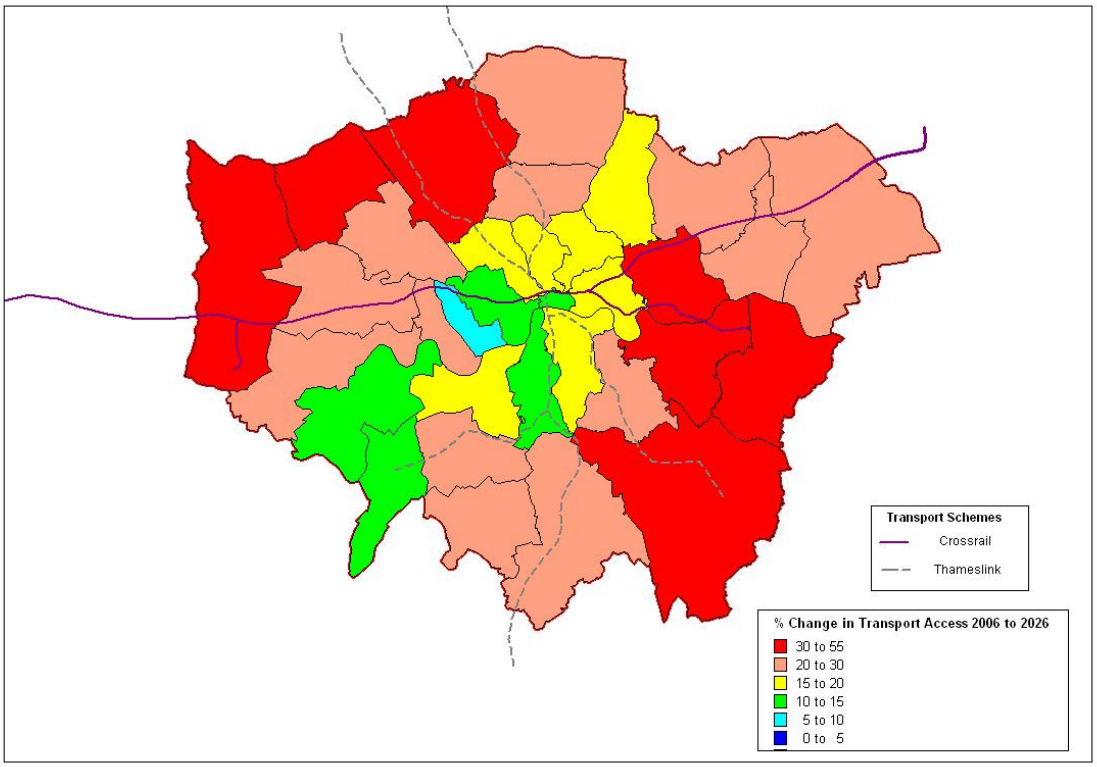
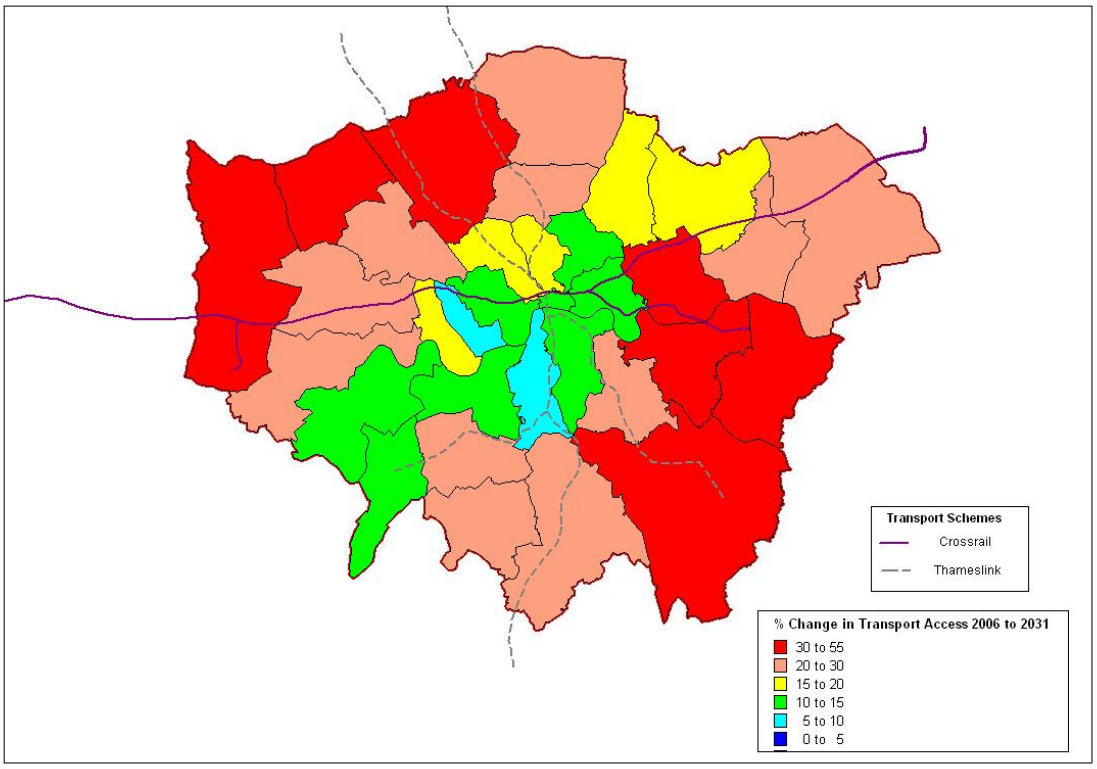


Figure 3.4 % change in combined PT and highway access to population 2007 to 2031



4 Future Distribution of employment

4.1 Methodology

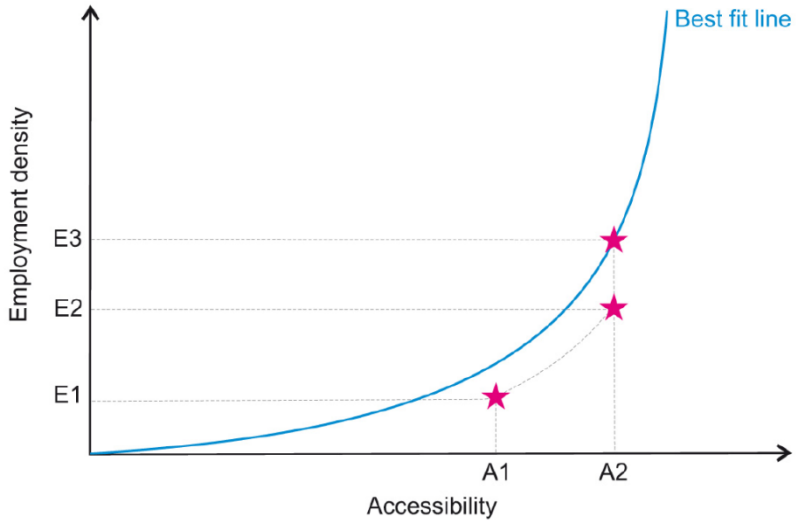
4.1.1 The changes in future year accessibility described in chapter 3 were applied to 2007 employment levels to forecast future employment levels by Borough. It is important to stress that these projections only take into account changes in transport accessibility. There is no consideration of historic trends and site capacity meaning that the projections are not final but can be considered as theoretical 'potential' changes based on changes in transport accessibility on their own.

4.1.2 The changes in employment density assume that Boroughs keep their differentials with the best fit curve between employment density and accessibility. For example, if a Borough shows a 10% higher employment density than expected based on the best fit curve in the base year, this difference is retained in future years with changes in accessibility. This is shown in Figure 4.1 where an increase in accessibility from A1 to A2 leads to an increase in employment density from E1 to E2 rather than to E3, which assumes employment density converges towards the best fit situation.

4.1.3 The reason for the adoption of this approach in forecasting future employment density is that by assuming future employment density will be based on the best fit relationship, it is possible that employment might fall with an increase in accessibility, depending on where employment is situated on the curve in the base year, which is illogical.

4.1.4 The changes in accessibility have been applied to the growth in employment in each forecast year (compared to 2007) and not total employment in each forecast year. Future employment levels in each Borough have been controlled to the GLA's employment trend forecasts for London as a whole, which exclude self-employed workers.

Figure 4.1 Different approaches to future change in employment density



4.2 Findings

4.2.1 Figure 4.2 shows the percentage difference between existing employment levels and employment levels predicted by the best fit line for each Borough. Or in other words, it shows the difference between actual employment levels in 2007 and employment levels which would exist were the statistical relationship identified between transport accessibility and employment density replicated in reality. It shows most of East London has a level of employment lower than expected based on its level of transport accessibility, with Lambeth showing the lowest level of employment relative to the expected trend. Most West London Boroughs show a level of employment higher than expected. The relative approach assumes that these differentials will remain in future years.

4.2.2 The changes in employment between the base year and each forecast year are largely driven by the equivalent changes in accessibility described in chapter 3 but are also affected by the amount of employment in each Borough i.e. a given change in accessibility results in a higher increase in employment in a Central London Borough than in an Outer London Borough.

4.2.3 Based on changes in transport accessibility from 2007 and the amount of employment in each Borough in 2007, Figures 4.3 and 4.4 show projected changes in absolute employment levels by Borough in 2016 and 2031 respectively, compared to 2007. They show the highest increases in employment occur in Central/Inner London with a large increase also forecast in the Outer London Borough of Hillingdon, otherwise employment growth is relatively evenly spread across London. The lowest increases in employment occur in those Boroughs which have low increases in accessibility and/or a relatively low level of existing employment.

4.2.4 Whilst LTS data is not available for the 2036 forecast year, it was assumed that the forecast total growth in employment in this year would be accommodated through the implementation of transport infrastructure enhancements which are not yet planned. Therefore the same improvements in accessibility assumed for 2031 were applied to forecast the distribution of employment growth in 2036.

4.2.5 Table 4.1 shows forecast total employment distribution by split Borough. Table 4.2 shows the absolute change in employment by Borough compared to the GLA's trend forecasts, which do not take into account the effect of changes in accessibility. It shows a general shift in employment from the most accessible Boroughs in and around Central London to Outer London Boroughs.

Figure 4.2 Differentials in employment density compared with the best fit line

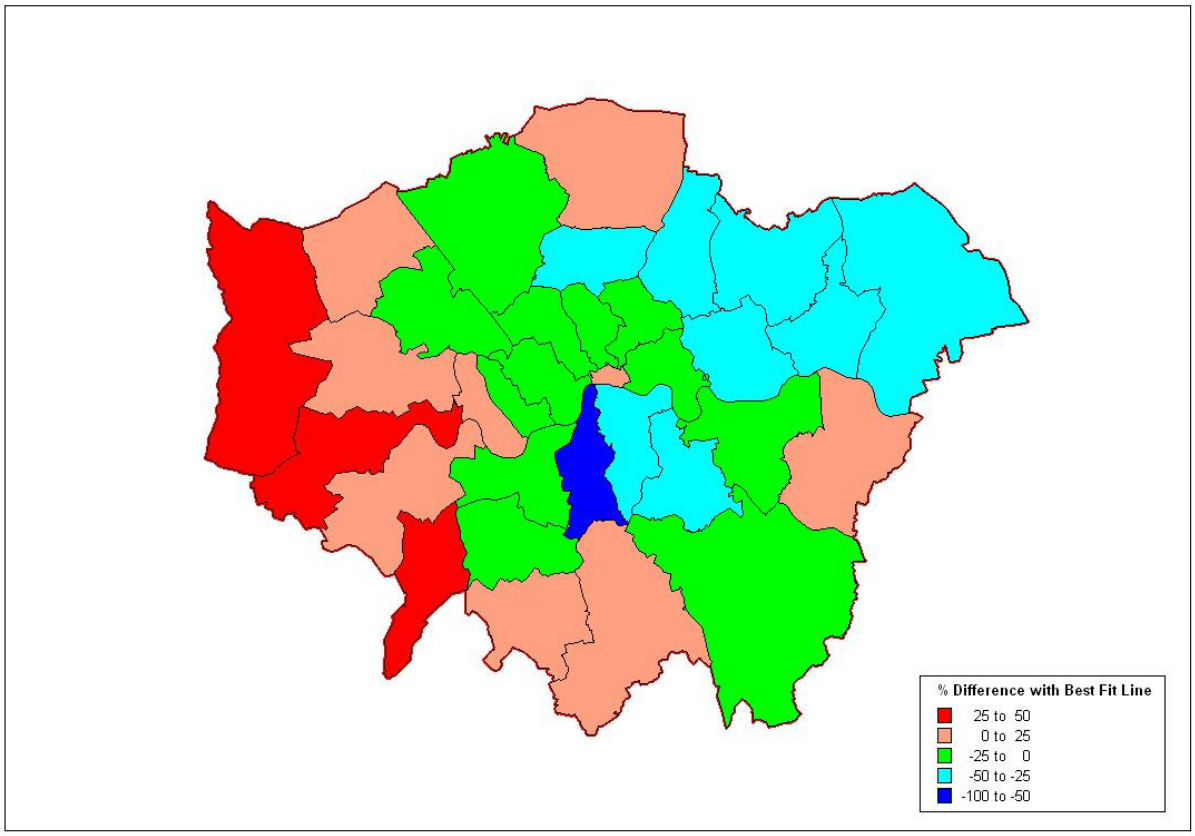


Figure 4.3 Absolute change in employment 2007 to 2016

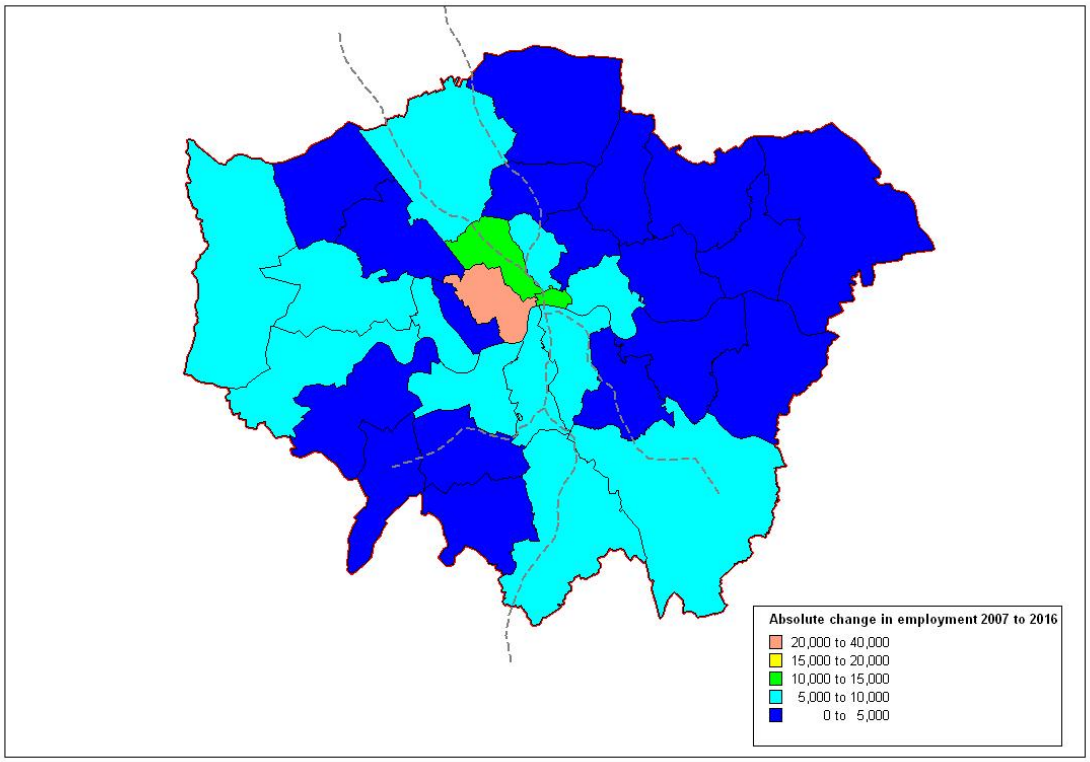


Figure 4.4 Absolute change in employment 2007 to 2031

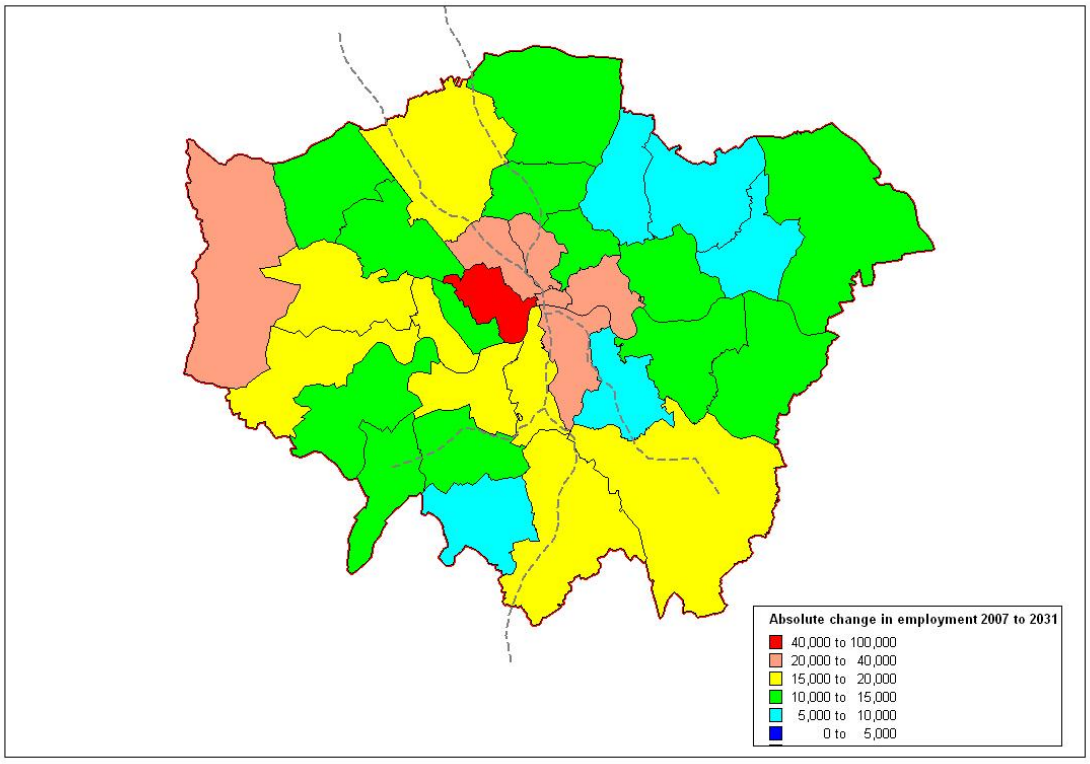


Table 4.1 Accessibility Employment Projections by Split Borough

Borough	2007	2016	2021	2026	2031	2036
Barking-OuterGL	45,000	47,000	48,000	50,000	51,000	53,000
Barnet-OuterGL	107,000	114,000	118,000	122,000	127,000	132,000
Bexley-OuterGL	64,000	67,000	70,000	73,000	76,000	78,000
Brent-OuterGL	93,000	97,000	100,000	103,000	107,000	110,000
Bromley-OuterGL	111,000	117,000	121,000	125,000	129,000	134,000
Camden-Central	188,000	196,000	201,000	206,000	211,000	216,000
Camden-Inner	86,000	90,000	93,000	95,000	98,000	101,000
CofLon-Central	325,000	339,000	347,000	356,000	365,000	374,000
Croydon-OuterGL	128,000	134,000	139,000	143,000	148,000	153,000
Ealing-OuterGL	118,000	123,000	127,000	132,000	136,000	140,000
Enfield-OuterGL	92,000	96,000	100,000	103,000	106,000	110,000
Grnwich-OuterGL	67,000	71,000	73,000	76,000	79,000	81,000
Hackney-Central	8,000	9,000	9,000	9,000	9,000	10,000
Hackney-Inner	76,000	79,000	81,000	84,000	86,000	89,000
Hammersm-Inner	115,000	121,000	125,000	128,000	132,000	136,000
Haringey-Inner	62,000	65,000	68,000	70,000	73,000	75,000
Harrow-OuterGL	66,000	70,000	72,000	75,000	77,000	80,000
Havering-OuterGL	70,000	73,000	76,000	78,000	81,000	84,000
Hillingd-OuterGL	187,000	196,000	203,000	210,000	217,000	224,000
Hounslow-OuterGL	119,000	125,000	128,000	132,000	136,000	140,000
Isling-Central	114,000	119,000	122,000	125,000	128,000	131,000
Isling-Inner	72,000	75,000	77,000	80,000	82,000	84,000
Kensingt-Central	12,000	13,000	13,000	13,000	14,000	14,000
Kensingt-Inner	97,000	101,000	104,000	107,000	110,000	113,000
Kingston-OuterGL	74,000	78,000	80,000	82,000	85,000	87,000
Lambeth-Central	36,000	38,000	39,000	40,000	41,000	42,000
Lambeth-Inner	83,000	87,000	89,000	91,000	94,000	97,000
Lewisham-Inner	61,000	65,000	67,000	69,000	71,000	73,000
Merton-OuterGL	65,000	68,000	71,000	73,000	75,000	78,000
Newham-Inner	74,000	77,000	80,000	82,000	85,000	88,000
Redbridg-OuterGL	64,000	67,000	69,000	71,000	73,000	75,000
Richmond-OuterGL	69,000	73,000	75,000	77,000	80,000	83,000
Southwar-Central	91,000	96,000	98,000	101,000	104,000	107,000
Southwar-Inner	80,000	85,000	87,000	90,000	93,000	96,000
Sutton-OuterGL	60,000	63,000	65,000	67,000	70,000	72,000
THamlets-Central	26,000	27,000	28,000	29,000	29,000	30,000
THamlets-Inner	176,000	184,000	189,000	194,000	199,000	204,000
WalthamF-OuterGL	57,000	60,000	62,000	63,000	65,000	67,000
Wandswor-Inner	106,000	112,000	115,000	118,000	121,000	125,000
Wminster-Central	554,000	577,000	591,000	605,000	620,000	635,000
Wminster-Inner	37,000	39,000	40,000	41,000	42,000	43,000
TOTAL	**4,135,000**	**4,333,000**	**4,460,000**	**4,588,000**	**4,725,000**	**4,864,000**

Table 4.2 Difference in Employment projections by Split Borough with GLA Trend Forecasts

Borough	2016	2021	2026	2031	2036
Barking-OuterGL	4,000	8,000	14,000	18,000	23,000
Barnet-OuterGL	1,000	4,000	7,000	11,000	15,000
Bexley-OuterGL	4,000	6,000	9,000	11,000	13,000
Brent-OuterGL	4,000	10,000	16,000	23,000	29,000
Bromley-OuterGL	21,000	23,000	25,000	28,000	31,000
Camden-Central	-9,000	-9,000	-10,000	-10,000	-11,000
Camden-Inner	-1,000	-1,000	-2,000	-2,000	-2,000
CofLon-Central	-27,000	-23,000	-17,000	-11,000	-4,000
Croydon-OuterGL	26,000	35,000	43,000	53,000	62,000
Ealing-OuterGL	10,000	17,000	25,000	32,000	40,000
Enfield-OuterGL	6,000	11,000	15,000	19,000	25,000
Grnwich-OuterGL	2,000	3,000	5,000	7,000	9,000
Hackney-Central	-1,000	-1,000	-2,000	-2,000	-2,000
Hackney-Inner	0	1,000	4,000	6,000	9,000
Hammersm-Inner	-6,000	-10,000	-15,000	-19,000	-24,000
Haringey-Inner	8,000	11,000	14,000	18,000	21,000
Harrow-OuterGL	6,000	7,000	10,000	11,000	14,000
Havering-OuterGL	3,000	6,000	7,000	10,000	13,000
Hillingd-OuterGL	8,000	7,000	6,000	5,000	4,000
Hounslow-OuterGL	-2,000	-3,000	-2,000	-1,000	0
Isling-Central	5,000	1,000	-4,000	-9,000	-14,000
Isling-Inner	-1,000	-4,000	-7,000	-10,000	-14,000
Kensingt-Central	0	-1,000	-1,000	-1,000	-1,000
Kensingt-Inner	-1,000	-1,000	-1,000	-1,000	0
Kingston-OuterGL	8,000	10,000	11,000	14,000	16,000
Lambeth-Central	-1,000	-1,000	-1,000	-1,000	0
Lambeth-Inner	0	1,000	4,000	7,000	9,000
Lewisham-Inner	7,000	9,000	11,000	14,000	16,000
Merton-OuterGL	-2,000	0	0	1,000	3,000
Newham-Inner	0	0	-1,000	0	0
Redbridg-OuterGL	2,000	3,000	3,000	4,000	6,000
Richmond-OuterGL	0	0	-1,000	0	1,000
Southwar-Central	-15,000	-27,000	-37,000	-48,000	-61,000
Southwar-Inner	-8,000	-15,000	-24,000	-33,000	-43,000
Sutton-OuterGL	-4,000	-3,000	-1,000	1,000	3,000
THamlets-Central	-6,000	-9,000	-13,000	-19,000	-25,000
THamlets-Inner	-47,000	-78,000	-114,000	-154,000	-201,000
WalthamF-OuterGL	2,000	2,000	2,000	3,000	4,000
Wandswor-Inner	7,000	7,000	7,000	7,000	8,000
Wminster-Central	-2,000	3,000	10,000	19,000	29,000
Wminster-Inner	0	1,000	1,000	1,000	2,000
TOTAL	0	0	0	0	0

4.3 Summary of Method for Derivation of Employment Forecasts by split Borough

4.3.1 This section shows how future year employment in each split Borough is calculated step by step.

a) Transport accessibility and employment density calculated for the 2007 Base Year
b) This is then compared against the London-wide 2007 trend which is determined by measuring the relationship between transport accessibility and employment density in all Boroughs combined
c) Future year transport accessibility calculated based on changes in infrastructure and the resultant changes in generalised time
d) Future year employment growth derived from the relative difference in future year accessibility between split Boroughs
e) Future year employment growth controlled to the GLA's employment growth target
f) Future year employment growth added to 2007 employment to give final employment forecast by split Borough

4.3.2 Appendix B provides a more detailed worked example.

5 Conclusion

5.1 Summary

5.1.1 This study has re-affirmed the strong relationship between public transport accessibility and employment density in Greater London identified in previous work undertaken for the GLA. Unlike the 2009 study, which found the strongest relationship with employment density to be given by public transport access only, this study has shown that a combination of public transport and highway access provides a slightly stronger relationship. However, public transport accessibility still dominates the relationship.

5.1.2 Whilst the strongest relationship is between combined public transport and highway accessibility to population and employment and employment density, this relationship is artificially strong because employment is itself a function of employment i.e. it includes measurement of the relationship between transport accessibility to employment and employment density hence includes the same variable of employment in both sides of the relationship. In addition, the use of access to employment is not suitable for forecasting future employment distribution given its bias against areas that might experience significant employment growth from a low base level. Therefore, the base year relationship between combined public transport and highway access to population and employment density was used as the basis for forecasting future changes in transport accessibility and distribution of employment.

5.1.3 There is a raft of proposed public transport enhancements that provide improvements in accessibility levels to all Boroughs up to 2021. In some Boroughs, significant improvements in accessibility do not take place until 2021, reflecting the introduction of Crossrail in 2019 and other major schemes between 2016 and 2021. After 2021, improvements in accessibility are much more limited with a reduction in accessibility occurring in the majority of Boroughs in 2031 compared to 2021. This is a result of fewer schemes planned over this time horizon, which causes higher crowding and highway congestion. The drop in accessibility levels after 2021 will be offset by future investments that are not currently accounted for in LTS.

5.1.4 Based on the forecast changes in accessibility, the highest increases in employment occur in Central and Inner London with a large increase also occurring in the Outer London Borough of Hillingdon. However, compared to the GLA's trend forecasts, these projections show a general shift in employment from the most accessible Boroughs in and around Central London to Outer London Boroughs.

5.2 Limits of the Approach

5.2.1 It is important to stress that these projections only take into account changes in transport accessibility. There is no consideration of historic trends and site capacity meaning that the projections are not final but can be considered as theoretical 'potential' changes based on changes in transport accessibility alone, also assuming that new jobs are mobile and respond fully to changes in accessibility. The forecasts are also based on the assumption that the base 2007 relationship between employment density and PT accessibility is optimal, which may not be the case in reality.

5.2.2 As noted in the introduction of this report, historic trends and site capacity are the other factors that form the "triangulation process" used to forecast employment for the London Plan.

5.2.3 In addition, the methodology described here aims to establish an optimal relationship between employment and accessibility, but it does not determine the direction of causation between these factors. In reality, there is likely to be some circularity to the relationship, with employment and population growth resulting in improvements to accessibility, which in turn is likely to lead to further employment growth. The relationship is complex and has been simplified for the purposes of this study in order to make clear projections.

5.3 Recommendations

5.3.1 The forecasts summarised in this report constitute robust projections of future employment distribution based on changes in combined public transport and highway accessibility. However, it is important to stress that these forecasts are based on the assumption that the future location of new employment is completely mobile and responds only to changes in transport accessibility patterns. The forecasts should only be assessed in the context of a full consideration of the other factors and constraints influencing the location of employment in the GLA area, particularly historic trends and available site capacity.

5.3.2 It is recommended that the relationship between transport accessibility and employment density and future employment distribution projections are re-assessed in future whenever updated base and future year LTS data is available. This is particularly critical given the similar strengths of relationship identified as part of this study and the change in relative strength of the regressions performed compared to the 2009 study. Also, if the GLA proposes to use these employment projections in its long-term planning work, changes in the base year calibration or in future year infrastructure assumptions could result in a significant re-distribution of future employment.

Appendix A LTS Public Transport Scheme Assumptions

Project / Line / TOC	Scheme Name	Sponsor	Responsible TfL Mode	Status (e.g. Committed)	Impl Date	Railplan - Name of overview or Status	Order	Comment
National Rail								
South Central	New Station: Mitcham Eastfields (South London)	DfT	London Rail	Implemented	2008	Eastfields	1	
Eurostar	Eurostar International Services to St Pancras	DfT	London Rail	Implemented	Nov-07	CTRL International	2	
High Speed 1	HS1 Domestic Services and associated South Eastern changes (IKF)	DfT	London Rail	Committed	Dec-09	High Speed 1	3	See also other South Eastern Changes
Heathrow	Heathrow Terminal 5 (Express / Connect)	DfT	London Rail	Implemented	Mar-08	Heathrow Terminal 5 NR	4	Connect superseded by Crossrail from 2021
Overground	London Overground SLC3 - North London Line (incl GoB & WLL)	DfT	London Rail	Committed	2011	*LO NLL*	5	
Overground	London Overground SLC3 - East London Line (excl Clapham Jn)	DfT	London Rail	Committed	2011	*LO ELL*	6	
Overground	London Overground SLC2 - 4c378 on Watford Services	DfT	London Rail	Committed	2010	*LO Watford 378*	7	
Overground	London Overground Speed Adjustment (Bakerloo)	LUL	London Rail	Committed	2026	London Overground Speed Adjustment	7	
Overground	London Overground SLC3 - East London Line Phase 2b to Clapham Jn	DfT	London Rail	Committed	2012	ELLX Ph2b	8	
Various	HLOS1 - as below				n/a	HLOS 1 includes below unless mentioned		
Great Eastern	HLOS1 - Great Eastern Services	DfT	London Rail	Committed	2011	Liverpool Street Services Great Eastern and West Anglia HLOS1	9	Impacted by Crossrail Dec 2018
West Anglia	HLOS1 - West Anglia Services	DfT	London Rail	Committed	2012			
Tilbury & Southend	HLOS1 - c2c Services	DfT	London Rail	De-committed	n/a	Fenchurch Services c2c HLOS	10b	
Chiltern	HLOS1 - Chiltern Services	DfT	London Rail	Committed	n/a	HLOS1 - Chiltern		Replaced by Evergreen Phase 3
Great Western	HLOS1 - GW Thames Valley Services	DfT	London Rail	Committed	n/a	HLOS1 - GW Thames Valley		Replaced by GWML Suburban Electrification
West Coast	HLOS1 - London Midland Services	DfT	London Rail	Committed	n/a	**superceeded by WCML below**		
Southern	HLOS1 - Southern Inners	DfT	London Rail	Committed	n/a	**Included in TL KO2**		
East Coast	Kings Cross Suburban Services (HLOS1)	DfT	London Rail	Committed	2011	HLOS1 - Great Northern	10	
East Coast	Kings Cross Suburban Services (Thameslink KO2)	DfT	London Rail	Committed	2018	TL KO2 - Kings Cross Suburban Services	10	
Thameslink	Thameslink - Through Services (KO1 2011, KO1.1 2016, KO2 Dec 2018)	DfT	London Rail	Committed	2011 2016 2018	TL - Through Services	11	
Thameslink	Moorgate GN Suburban Services (HLOS 2011, Thameslink KO2 Dec 2018)	DfT	London Rail	Committed	2011 2018	TL KO2 - Moorgate/ GN Suburban Services	12	
West Coast	West Coast Virgin High Frequency Services	DfT	London Rail	Implemented	Dec-08	VWC Dec 2008	13	
West Coast	West Coast Pendolino Lengthening (35x11car, 21x9car)	DfT	London Rail	Committed	2013		13	
East Coast	East Coast - 2tph Leeds services all day	DfT	London Rail	Implemented	May-07	Kings Cross Intercity Services	14	Superseded by new timetable (Eureka) 2011
East Coast	East Coast Timetable Recast (Eureka)	DfT	London Rail	Implemented	2011	Kings Cross Intercity Services	14	
Great Western	Paddington GWML Suburban Electrification ~~HEP~~	DfT	London Rail	Committed	2016	Paddington Suburban Services	15	Impacted by Crossrail Dec 2018
Midland	East Midlands 5tph from St Pancras incl Corby	DfT	London Rail	Implemented	Dec-08	East Midlands Dec 2008	16	
South Eastern	South Eastern changes associated with new HS1 Domestic Services	DfT	London Rail	Committed	Dec-09	**Included in TL KO2 - Victoria (SE) Services**		
West London	New Station: Imperial Wharf (WLL)	DfT	London Rail	Committed	Dec-09	**Included in LO NLL**		
West London	New Station: Shepherds Bush (WLL)	DfT	London Rail	Implemented	Dec-08	**Included in LO NLL**		
South Western	South West Trains - Southampton/Poole/Weymouth services	DfT	London Rail	Implemented	Dec-07	SWT Services Dec 2008	17	
South Western	HLOS1 - South West Trains Services	DfT	London Rail	Committed	2016	HLOS1 - SWT	17	
West Coast	West Coast (VHF) London Midland Services	DfT	London Rail	Implemented	Dec-09	London Midland Dec 2009	18	
Chiltern	Evergreen 3 Phase 1	DfT	London Rail	Implemented	2011	Evergreen 3 Phase 1	19	
Chiltern	Evergreen 3 Phase 2	DfT	London Rail	Committed	2013	Evergreen 3 Phase 2	19	
Chiltern	Chiltern Speed Adjustment (Metropolitan)	LUL	London Rail	Committed	2018	Chiltern Speed Adjustment	19	
South Eastern	Blackfriars Services (Thameslink KO0 2009, KO2 2018)	DfT	London Rail	Committed	2009 2018	South Eastern - Blackfriars Services	20	
South Eastern	Cannon St Services (IKF 2009, Thameslink KO2 2018)	DfT	London Rail	Committed	2011 2018	South Eastern - Cannon St Services	21	
South Eastern	Charing Cross Services (IKF 2009, Thameslink KO2 2018)	DfT	London Rail	Committed	2011 2018	South Eastern - Charing Cross Services	22	
South Eastern	Victoria (SE) Services (IKF 2009, Thameslink KO2 2018)	DfT	London Rail	Committed	2011 2018	South Eastern - Victoria (VE) Services	23	
South Eastern	South Eastern Other (EO) Services (IKF 2009)	DfT	London Rail	Committed	Dec-09	South Eastern - Other (EO) Services	24	
Brighton Main Line	Brighton Main Line RUS (Gatwick Express to Brighton in peaks)	DfT	London Rail	Implemented	Dec-08	Gatwick Exp Ext		Included in Victoria (SC) services
South Central	London Bridge Services (ELL 2011, Thameslink KO1 2011, KO2 2018)	DfT	London Rail	Committed	2011 2016 2018	Southern - London Bridge Services	25	
South Central	Victoria (SC) Services (BML RUS 2008, ELL 2011, Thameslink KO1 2011, HLOS 2016)	DfT	London Rail	Committed	2011 2016 2018	Southern - Victoria (SC) Services	26	
South Central	Southern - South Croydon to Shepherds Bush Services	DfT	London Rail	Committed	Dec-08	Southern WLL Services		
South Central	Southern - Watford Jn / Milton Keynes Services	DfT	London Rail	Implemented		Southern WLL Services		
South Central	Southern Other (EO) Services (2011)	DfT	London Rail	Committed	2011	TL KO2 - SO Services	27	
Crossrail 1	Crossrail 1 (Abbey Wood / Shenfield - Heathrow / Maidenhead)	DfT	London Rail	Committed	Dec-17	Crossrail 1	41	**Mark Lambert:** Needs to be done AFTER the DLR changes
London Underground								
Hammersmith & City / Circle Lines	New Station: White City Extension to Hammersmith		LUL	Implemented	2008	H&C - Circle White City and Ext to Hammersmith	30	
Piccadilly	Extension to Heathrow Terminal 5		LUL	Implemented	2008	Piccadilly ext to T5	31	
Jubilee	PPP Upgrade incl 7th car		LUL	Committed	2010	Jubilee Signalling	32a	
Waterloo & City	PPP Upgrade		LUL	Implemented	2008	Waterloo & City	32b	Has no affect
Victoria	PPP Upgrade - new trains		LUL	Committed	2010	Victoria new 09 Stock	32c	
Victoria	PPP Upgrade - signalling upgrades		LUL	Committed	2012	Victoria Signalling	32d	
Northern	PPP Upgrade - phase 1 (signalling upgrades)		LUL	Committed	2014	Northern Phase 1	32e	
Northern	PPP Upgrade - phase 2 (revised service pattern)		LUL	Committed	2018	Northern Phase 2	32f	
Piccadilly	PPP Upgrade incl new trains		LUL	Committed	2021	Piccadilly New Stock - Signalling	32g	
Metropolitan	New Trains		LUL	Committed	2016	Metropolitan New S Stock	32h	
Metropolitan	PPP Upgrade - new trains & partial service		LUL	Committed	2016	Metropolitan Partial Service	32i	
Metropolitan	Full service post PPP upgrade		LUL	Committed	2018	Metropolitan Full Service	32j	
Hammersmith & City / Circle Lines	PPP Upgrade incl new trains - partial service		LUL	Committed	2016	H&C - Circle New S Stock	32k	
Hammersmith & City / Circle Lines	Full service post PPP upgrade		LUL	Committed	2018	H&C - Circle Full Service	32l	
District	PPP Upgrade - new trains		LUL	Committed	2015	District New S Stock	32m	
District	Siganlling upgrades / Full service		LUL	Committed	2018	District Full Service	32n	
Bakerloo	WTT 36 - no trains terminating at Willesden Jn		LUL	Committed	May-08	Bakerloo Ext to Stonebridge		
Bakerloo	PPP Upgrade incl new trains		LUL	Committed	2026	Bakerloo New Stock - Signalling		
Dockland Light Rail								
DLR Bank Lewisham 3 ca	Bank - Lewisham 3 car upgrade	TfL		Committed	2010	**Included in DLR 2016 Spec**		
DLR Stratford 3 car	Poplar - Stratford 3 car upgrade	TfL		Committed				
DLR Woolwich A	Woolwich Arsenal extension	TfL		Implemented	Jan-09	Woolwich Arsenal	33	
DLR Stratford Int	Stratford International - Canning Town	TfL		Committed	May-10	Stratford International	34	
DLR	2016 Spec					DLR 2011 Spec	35	
Bus/Others								
Bus	Bus Improvements					Bus Improvements	36	
ELT	ELT Phase 1a					ELT Phase 1a	38	
ELT	ELT Phase 1b					ELT Phase 1b	39	
TG	91K Bus @ TG Area					High Bus	40	

Alan McMillan: Included in 2016

Alan McMillan: Excluded from RP6 etc. Buses based on March 2008 timetable which is 4% above 2006

Alan McMillan: Excluded. Requires Silvertown Crossing!

Appendix B Worked Example

This section shows how future year employment in each split Borough is calculated step by step, using the Westminster-Central split Borough in the 2016 forecast year as an example.

a) Transport accessibility from each LTS zone within the South-East of England to each split Borough calculated as follows (the formula takes account of the need to calculate a single accessibility score by weighting PT and highway accessibility by PT and highway demand);

((Population in each origin LTS zone * exp(-λ* average highway generalised time to each split Borough) * PT demand from each origin LTS zone to each split Borough)

+

(Population in each origin LTS zone * exp(-λ* average PT generalised time to each split Borough) * Highway demand from each origin LTS zone to each split Borough))

/

(PT demand from each origin LTS zone to each split Borough + Highway demand from each origin LTS zone to each split Borough)

Where λ=0.033 (PT) and 0.57 (Highway)

e.g. from the Southwark South LTS zone to Westminster-Central (2016);

((3,655 * exp (-0.57 * 13.5) * 33)

+

(3,655 * exp (-0.033 * 41.9) * 150))

/

(150 + 33)

= 736

b) The transport accessibility score from each LTS zone to each split Borough calculated in a) summed by split Borough

Westminster-Central (2016) = 709,238

c) Using the accessibility scores calculated in b), each split Borough given a relative accessibility score based on an index of 100 for each model year (2007, 2016, 2021, 2026 and 2031)

Westminster-Central (2016) = 5.06

d) An equivalent 2007 employment index calculated for each split Borough using LTS employment assumptions

Westminster-Central (2007) =12.23

e) A revised employment index calculated for each forecast year based on the change in accessibility index in each forecast year relative to 2007

Westminster-Central (2016) = 11.69

f) The revised employment index for each forecast year applied to the growth in the GLA employment target between each forecast year and 2007

Westminster-Central (2016) = (11.69/100)* 196,628 = 22,986

g) The growth in employment calculated in f) added to 2007 GLA employee levels which exclude self-employed workers

Westminster-Central (2016) = 22,986 + 553,972 = 576,958

h) Employment levels calculated in f) rounded to nearest 1,000

Westminster-Central (2016) = 577,000

Signature 

Position Technical Director

Company SKM Colin Buchanan

Date 20 March 2013