Transport for London

Kingston Transport Study

Model Forecasting Report

Final | 13 June 2018




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Ove Arup & Partners Ltd
13 Fitzroy Street
London
W1T 4BQ
United Kingdom
www.arup.com

ARUP

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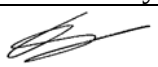
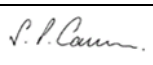
		Signature			
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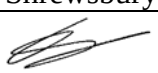
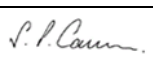
		Signature			
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Glossary

CR2 - Crossrail 2

Crossrail 2 is a proposed rail route in South East England, running from nine stations in Surrey to three in Hertfordshire providing a new North-South rail link across London.

GLA - Greater London Area

Greater London is a region of England which forms the administrative boundaries of London, as well as a county for the purposes of the lieutenancies. It is organised into 33 local government districts: the 32 London boroughs and the City of London.

KingHAM - Kingston Highways Assignment Model (Bespoke)

See LoHAM. A bespoke highway assignment model produced for Kingston.

KTC - Kingston Town Centre

LoHAM - London Highway Assignment Model

There are five sub-regional SATURN based highway assignment models available in London. This is the London-wide highway assignment model. The HAMs can be used for quantifying the impact of demand changes on the highway network in the future, assessing large highway infrastructure schemes and assessing policy changes which are likely to have an impact on the highway network.

LTS - London Transportation Studies Model

LTS is a strategic multi-modal four stage aggregate model for London and its surrounding area. It is used to prepare forecasts of growth in total travel, change in travel patterns, the transport mode chosen and the routing of trips through the road and public transport networks.

MTS - Mayor's Transport Strategy

OA - Opportunity Area

Opportunity Areas are London's major source of brownfield land which have significant capacity for development – such as housing or commercial use - and existing or potentially improved public transport access.

PCUs - Passenger Car Units

PCU is a metric used in Transportation Engineering to assess traffic-flow rate on a highway. A passenger car equivalent is essentially the impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single car.

PPMS - people standing per square metre of available standing space

PPMS is used as a measure of crowding on public transport services

RBK - Royal Borough of Kingston Upon Thames

RP - Railplan Model

Railplan is a public transport assignment model for London and its surrounding area. It can be used for assessing the impacts of major public transport schemes throughout London, assessing policy changes, to assess the effects of major developments on public transport and for station modelling.

SLA - Select Link Analysis

Strategic analysis depicting origins and destinations for traffic using a specified link in the network

SWML - South West Main Line

TfL - Transport for London

TL – Tolworth

V/C – Volume over capacity

A measure of stress on the highway network (volume divided by capacity)

Executive Summary

Context

In January 2015, Transport for London (TfL) invited proposals for a consultant team to undertake strategic assignment modelling to support the Kingston Transport Study, to help deliver the Local Plan for Kingston. Following the submission of proposals, TfL appointed Arup to undertake this work.

Growth and forecast scenarios

The South London Sub-region, in which Kingston is located, will see a substantial increase in population and employment over the next 20-year period. The Greater London Authority, TfL and the Royal Borough of Kingston (RBK) have proposed to produce a Local Plan for Kingston and have identified the potential for an additional 15,000 new homes and 30,000 new jobs in the borough by 2041, over and above the current London Plan[1]. To undertake the analysis for this study, assumptions have been made relating to the location and quantum of these developments. Whilst it is unlikely that individual sites will be developed exactly as modelled, this gives a reasonable indication of likely development. A combination of these employment and population forecasts, allied to wider growth within Greater London, has the potential to result in substantial pressure on certain areas of the transport network.

The objective of the commission was to assemble the empirical evidence base to support the study through robust strategic modelling by identifying the impacts of the proposed developments on the highway and public transport networks.

The study developed a 2011 base year transport model that was signed off by TfL. Following this, future year scenarios were developed covering different levels of growth in population and employment up to 2041, plus a view on which transport schemes to include for that year. These included major committed schemes forming TfL's future reference case together with local schemes identified by RBK. These included the Go Cycle schemes; a network of cycle routes and cycle improvement schemes across the borough designed to encourage mode shift from car to more sustainable modes. The scenarios tested were:

- **2041 Reference Case** – No additional growth associated within Kingston over and above the committed current London Plan growth, which represents increases of around 13,000 new homes and 5,000 new jobs in the borough by 2041. Details of those transport schemes likely to be in place by 2041 (committed schemes) were provided by TfL and refined by RBK;
- **2041 Medium growth without Crossrail 2 network** – This includes the reference case (Greater London Area - GLA) growth plus an additional level of growth identified by RBK of an additional 15,000 homes and

[1] The current 2016 London Plan, as opposed to the December 2017 Draft New London Plan

30,000 new jobs in the borough by 2041. However, the transport network does not include the proposed Crossrail 2 scheme (CR2); and

- **2041 Medium growth plus Crossrail 2 network** – This is the same as the medium growth scenario above but with the inclusion of Crossrail 2.

Population and employment growth

Using TfL's transport modelling suite[2], the change in several transport metrics between the base year and 2041 was assessed for the 3 forecast scenarios described previously. Growth across London is based on London Plan levels of housing and employment from the current 2016 London Plan; outside London, growth is based on the Department for Transport (DfT) TEMPro[3] forecasts. The growth in households and employment on a borough-wide basis is tabulated below (rounded to the nearest thousand), noting that there is no difference in households and employment between the medium growth with and without Crossrail 2 scenarios.

Table 1: Household and employment growth assumptions for 2041 scenarios

	Households	Employment
2011	73,000	72,000
2041 Ref Case	86,000	78,000
% Growth	18%	1%
2041 Medium Growth	101,000	107,000
% Growth	35%	39%

For each scenario, there are wide variations throughout the borough:

- The largest growth in the number of **households** in the reference case is focused around Kingston Centre (181%) and Norbiton (51%), with substantial growth in Tolworth & Berrylands and Chessington North;
- In the medium growth scenario, household growth is spread more evenly across the borough. Kingston Centre (277%) and Norbiton (106%) still represent the largest increases in households but there are large absolute changes in New Malden, Tolworth & Berrylands and Chessington as well;
- Growth in **employment** in the 2041 reference case scenario is focused around Chessington North with an increase of 34%, with increases in Kingston Centre (9%) and New Malden (23%). Elsewhere in the borough changes are minimal or decrease slightly; and
- For the Medium growth scenario, largest employment increases are found in Kingston Centre, Norbiton, Kingston North, and Chessington South.

The impacts of population and employment growth on network performance for each of these scenarios is set out below. Highway network performance has been

[2] The Multi-modal London Transportation Study (LTS) model, KingHAM highway assignment model, and Railplan public transport assignment model
[3] Trip End Model Presentation Program

assessed for the 08:00-09:00 peak hour and public transport for the peak period 07:00-10:00[4].

2041 reference case

Highways

Significant traffic growth is forecast on the strategic road network, primarily focused around the A3 westbound corridor between the junction with Coombe Lane, Tolworth junction, Hook junction and beyond. Traffic flows also increase on the A3 eastbound between Tolworth and Coombe Lane. In general terms, the increases in traffic on the strategic road network, will result in additional congestion and consequential re-routeing of traffic onto local roads.

Minor flow reductions are forecast on other strategic routes including the A240 Surbiton Road and the A307 Richmond Road within Kingston town centre; this could be attributed to road capacity reductions resulting from the proposed Go Cycle schemes within Kingston town centre.

Traffic delays during the peak hours across the borough are forecast to increase by 2041 largely due to increased traffic levels and the removal of road capacity. The Go Cycle schemes, whilst encouraging reduced car usage, do result in a reduction in road capacity resulting from the reallocation of road space. Most of the forecast increase in junction delays within the borough are focused around the town centre and on the A3 around Hook, which also have the greatest concentration of employment and household growth in comparison to the base year. There are also significant delays forecast on strategic routes south of the A3 towards Ewell, Cheam and West Sutton.

Public Transport

Passenger flows on the South West Main Line (SWML) in the inbound direction are forecast to increase substantially between the base year and 2041 between Surbiton and Wimbledon. Flows are also forecast to increase substantially in the outbound direction, although most of these trips have destinations external to the borough. Modest passenger increases are expected on the Kingston loop line through Kingston, Norbiton and New Malden for both directions of travel, and on the branch to Epsom via Motspur Park (both directions) between Wimbledon and Worcester Park.

Increases in passenger flows result in consequential increases in crowding. Crowding is generally measured as passengers per metre² (PPMS), with the higher the number the more crowded the train. Crowding levels that exceed 4 PPMS are considered very crowded and likely to lead to operational knock-on impacts in terms of increased boarding times at stations.

Crowding on the SWML between destinations outside the study area and Clapham Junction increases over the 30-year period from an average of 2-3 PPMS in 2011

[4] These time periods reflect the periods covered in TfL's models

to an average of 4-5 PPMS in 2041. In the same period, there is little impact to crowding on services through Kingston-Norbiton.

The branches from Epsom via Motspur Park, and Worcester Park to Raynes Park and Wimbledon are also overcrowded in the 2041 reference case scenario, although they do not materially worsen over the 30-year period.

2041 Medium growth without Crossrail 2

Highways

The additional growth in homes and jobs associated with the medium growth scenario is forecast to have a marginal impact on traffic flows, with most of the substantial pressures on the network occurring due to growth between the base year and the 2041 reference case. Those roads that experience traffic increases are predominantly focused around areas east of Kingston town centre in Norbiton and New Malden, reflecting the location of additional employment and households. Despite the relatively small traffic increases, the fact that the network is already very congested has a disproportionate impact on delays, particularly within Kingston town centre and along the A3 within the vicinity of most of the additional homes and jobs.

Public Transport

There are relatively minor changes to public transport demand with much of the increase on rail in the counter-peak direction. This is likely to be driven by a forecast increase in local employment opportunities within the borough. Passenger flows increase modestly between Raynes Park and Norbiton, as does flows between Kingston and Norbiton. The change in demand beyond Kingston station is low, suggesting that most of the demand increases are driven by travel to and from Kingston rather than through trips.

Due to the small flow changes, the additional demand on the network between the 2041 reference case and medium growth scenario is not forecast to exacerbate crowding conditions. The results highlight that most of the network constraints and crowding on rail arise due to the passenger growth forecast between the 2011 base year and 2041 reference case.

2041 Medium growth with Crossrail 2

Highways

As the highway demand does not change between the medium growth with and without Crossrail 2, there is a negligible impact on highway flows or delays with this scenario.

Public Transport

The addition of Crossrail 2 is forecast to have a substantial impact on rail passenger demand on the network in 2041 due to significant increase in rail service frequency and capacity.

Flows towards central London from Kingston via Norbiton increase significantly, and even more so between New Malden and Wimbledon where the branches from Chessington, Epsom and Hampton Court merge. Although demand increases are generally higher towards London, flows in the outbound direction towards the borough also increase substantially (e.g. New Malden to Kingston).

These flow increases manifest themselves as large increases in station entries and exits across the borough. With Crossrail 2, station entries at Kingston increase by 70% and exits by 155%; for Norbiton, station exits increase by 108% resulting from increased employment opportunities and better access facilitated by Crossrail 2.

Despite the significant flow increases, Crossrail 2 is forecast to have a significant impact on alleviating crowding on the network in and around Kingston. Crowding on the SWML through Surbiton, Berrylands, New Malden and Raynes Park decreases by 2 PPMS with Crossrail 2, and by the same level for the Epsom branch via Worcester Park and Raynes Park.

Mitigation Scenarios

Following analysis of the network stresses on both the highways and public transport networks, and a few workshops attended by TfL, RBK and Arup; two mitigation packages were developed comprising of transport schemes with and without a demand management scenario. These can be summarised as:

Package 1 schemes:

- **Kingston Town Centre –** This was modified to include a 2-way bus lane through Clarence Street, and the conversion of one-way working on the existing gyratory to 2-way working;
- **TfL Tolworth Roundabout Scheme (T2 Scheme)** – A dedicated lane for the heavy left turn from Kingston Road to the A3, extended the greenway along Kingston Road, and included a package of small scale traffic efficiency measures, urban realm and greening measures;
- **TfL Hook Roundabout Scheme (H1 Scheme)** – Comprised of a new link at Hook Road Roundabout to link to the A3 southbound; and
- **Bus Service Improvements** – which included a 10% frequency increase across the borough, re-routing associated with the town centre scheme, and a new Clarence Street 2-way bus link.

Package 2 schemes (as Package 1, but to include):

- An ambitious pan London policy to **reduce car mode share** incorporating TfL's healthy streets agenda, substantial spending on public transport infrastructure including Crossrail 2, and travel demand management. This could include measures such as road user charging, a more sustainable freight policy, a work place parking levy, and road space re-allocation; and
- **Crossrail 2**.

The results for each package are set out below.

Package 1 analysis:

The forecast traffic flow changes can be summarised as:

- Large increases on the new anticlockwise section of the current gyratory;
- Some flow increases north of the town centre and across Kingston bridge;
- Local re-routeing on Kings Road/Richmond Park Road, Elm Road and Park Road linking to the A308 due to reduced capacity on the A307; and
- Traffic routeing through Seven Kings Way instead of the now busier A307 and A308.

At the Tolworth and Hook junctions, the combined impacts of the 2 schemes can be summarised as:

- Modest increases on the proposed Hook H1 slip road and A3 southbound to the south of this;
- Flows on the A309 eastbound Kingston bypass approaching Hook increase with the new opportunity to join the A3 southbound at Hook;
- Increases in clockwise circulating flows at Hook roundabout but no significant delay increases;
- Reduced A3 eastbound flows between Hook and Tolworth junctions, and a reduction in circulating flows at Tolworth roundabout due to the need for this "U-turn" movement now removed;
- The Tolworth scheme results in flow increase on the A240 Tolworth Road northbound towards the roundabout, however, lower circulating flows resulting from the Hook H1 scheme mitigate this; and
- Minor reductions on local roads (e.g. Jubilee Way/Cox Lane) between the A240 and A243 Hook Road.

In terms of delays, the town centre gyratory scheme to allow bi-directional running has a negative impact on several junctions. Average delay per vehicle is forecast to increase by more than 90 seconds at the following junctions:

- A307 (Fairfield North) and A308 (London Road);

- A308 (London Road) and Albert Road;
- A308 (Sopwith Way) and A307 (Richmond Road) north of Kingston station; and
- A307/A308 Wheatfield Way.

The Clarence Street bus lane leads to a reduction in bus journey times (with reduced junction delay) for buses re-routing onto the north-south Clarence Street and across Kingston. Although journey distances for other highway vehicles that would have previously used Clarence Street northbound increase, journey times decrease due to multiple junction delay reductions. Junction delays increase significantly at access points onto the old gyratory.

Package 2 analysis:

The demand management measures are forecast to result in large decreases in traffic flows across the borough with key observations being:

- Decrease in flows on the A3 (southbound) between New Malden (junction with the B282) and Tolworth, as well as in both directions between New Malden and Kingston Vale;
- Decrease in eastbound flows on the A308 (Hampton Court Road) across Hampton Court Park, Ditton Hill, and Sugden; and
- Decrease on southbound A310 (Kingston Road) towards Kingston Town Centre and across Kingston bridge.

Other noted increases are:

- Hook Road (northbound) from Chessington North to Hook Roundabout;
- Leatherhead Road between Chessington North and South stations; and
- Kingston bypass between Hook junction and Hinchley Wood station.

The model shows that within Kingston town centre, delays are likely to fall across all major junctions due to demand management and Crossrail 2, with the greatest reductions to junction delay (90+ seconds) forecast at Brook Street/Wheatfield Way, Albert Road/A308 London Road, and A308 Sopwith Way/A307 Richmond Road (near Kingston railway station).

The model also shows minor improvements to junctions along the A3 including Coombe Lane West and Malden Road (near Motspur Park railway station). Around the Tolworth and Hook Junctions, decreases in delays are concentrated around Hook (including both off ramps approaching Hook roundabout). Benefits also extend to junctions along Hook Road (A243) towards Chessington North and South Stations and the junction with Bridge Road.

At Tolworth, including the on/off ramps to the A3 southbound, there are forecast to be significant improvements to delay with demand management in place for the link between Tolworth Roundabout and the A3 southbound, and the A240 Kingston Road that connects to Tolworth junction.

Conclusion

Based on London-plan based growth in employment and jobs, there are forecast to be significant stresses on both the highway and public transport networks by 2041 with increases in traffic flows and consequential significant increases in traffic delays. Although the assessment of traffic conditions includes transport schemes likely to be in place by 2041, a number of these schemes within the borough relate to the Go Cycle programme. Whilst these schemes improve conditions for cyclists, and should help facilitate a shift to more sustainable modes, they do result in a reduction in road capacity resulting from the reallocation of road space.

Crowding on rail services through the borough is forecast to worsen considerably by 2041, particularly on the SWML services through Surbiton.

Although Crossrail 2 is in the very early stages of planning and no decision to build it has been made, it is expected that permission to build the line will be sought in the early 2020's, followed by construction and potential opening by the 2030's. As well as generating new travel opportunities with consequential benefits to mode choice and increased public transport patronage, Crossrail 2 will offer substantial relief to the expected train crowding and will largely mitigate against the forecast levels of train crowding, despite the increase in passengers.

A number of packages for highway schemes have been assessed and could help to mitigate traffic conditions in the borough. The conversion of the existing one-way gyratory to two-way operation, along with sustainable transport options including a bus-only operation along Clarence Street, could significantly improve the nature of the town centre. Results have shown that the impacts are relatively local but do include increases in delay at several junctions. If this scheme is to be progressed, further work will be required on developing detailed designs, combined with detailed micro-simulation modelling to ensure that the scheme is viable.

However, none of the highway schemes assessed will lead to a shift away from car-based travel or effect a switch to more sustainable modes. This will require a much more radical approach. To this end, a demand management scenario was tested, based on an ambitious pan-London policy to reduce car mode share that incorporated TfL's healthy streets agenda, substantial spending on public transport infrastructure (including Crossrail 2), and travel demand management. This could include measures such as: road user charging; a more sustainable freight policy; and a work place parking levy and road space re-allocation. Further work needs to be undertaken on the exact nature of what demand management should comprise of, and how it could be implemented across the GLA, and the modelled forecasts indicate that this is probably the only realistic way of reducing the reliance on car-based travel within and through the borough.

1 Introduction

1.1 Background to study

Arup were appointed by Transport for London (TfL) in January 2015 to undertake strategic assignment modelling to support the Kingston Transport Study and help deliver the Local Plan for the Royal Borough of Kingston upon Thames (RBK).

1.2 Context

Kingston is situated within the South London Sub-region, an area that will see a substantial increase in population and employment over the next 20-year period. The Greater London Authority, TfL and RBK have proposed to produce a Local Plan for Kingston, identifying the potential for a further 15,000 new homes and 30,000 new jobs in the borough by 2041. A combination of these employment and population forecasts, allied to wider growth within Greater London has the potential to result in substantial pressure on certain areas of the transport network.

The objective of the commission is to assemble the empirical evidence base to support the Transport Study through robust strategic assignment modelling by identifying the impacts of the proposed developments on the highway and public transport networks. This commission is therefore to provide the strategic modelling that will support the transport study, rather than the transport study itself. This report documents the assumptions and identifies the potential impacts of the proposed growth on the highway and public transport networks.

This model forecasting report represents the final main deliverable for this study. Both KingHAM[5] and Railplan-CUBE[6] local model validation reports were submitted to TfL on 7th July 2017, with other issue dates shown below.

- Inception report
- Local Model Validation Report(s) Railplan & KingHAM
- Forecasting workshop slide pack (14 November 2017)
- Mitigation workshop slide pack (29 November 2017)
- Mitigation results slide pack (22 December 2017, reissued 10 January 2018)
- **Final Forecasting Report including Mitigation testing (this report)**

[5] Production version 3 of TfL's London Highway Assignment Model (LoHAM) has been adopted for this study. TfL has produced, using their HAMoC tool, a beskpoke Kingston-centric version of for use in this study. The KingHAM model has a 2012 base year and represents the AM peak hour (08:00 – 09:00). It considers the routeing of vehicles and congestion on the road network.
[6] Railplan is a strategic public transport model for London and the southeast, which models the most likely travel patterns and choices of individual users and outputs the resulting levels of passenger volumes and crowding on the network.

1.3 Forecasting Scenarios

This study has developed three forecasting scenarios that cover different demand and network conditions for the 2041 forecast year:

- **2041 Reference Case (No OA growth)** – No additional growth associated with the Kingston Opportunity Area (OA). Growth and employment changes come from wider GLA forecasts. These represent a growth of ~13,000 new homes and ~5,000 new jobs from 2011 base year levels;
- **2041 Medium growth on a non-Crossrail 2 network** – includes reference case (GLA) growth and an additional medium level growth forecast identified in accordance with RBK for an additional ~15,000 homes and ~30,000 new jobs within the OA by 2041. However, this network **does not** include proposed Crossrail 2 network/services; and
- **2041 Medium growth on a with-Crossrail 2 network** – includes reference case (GLA) growth and an additional medium level growth forecast identified in accordance with RBK for an additional ~15,000 homes and ~30,000 new jobs within the OA by 2041. This network includes the proposed Crossrail 2 scheme.

Following analysis of the network stresses on both the highways and public transport networks, two mitigation scenarios were developed comprising a number of transport schemes with and without a demand management scenario. These mitigation scenarios are covered more fully in Section 6 of this report.

1.4 Crossrail 2

Crossrail 2 is a proposed rail route that will connect areas of South West London and Surrey to destinations in North East London and Hertfordshire, providing a new high frequency rail link in north/south tunnels through Central London. It will connect the SWML to the West Anglia Main Line, via Clapham Junction, Chelsea, Victoria, Tottenham Court Road, Euston St Pancras, Angel and Dalston. The new tunnel sections are proposed to begin from Wimbledon in the south and Tottenham Hale and Alexandra Palace in the north.

The proposals are forecast to alleviate existing congestion and overcrowding on other routes including the SWML into London Waterloo and London Underground Northern and Victoria lines.

Crossrail 2 will support 200,000 jobs, spur the development of 200,000 new homes across the region, and increase London's rail capacity by 10%. The impact is expected to be felt across the wider South East and beyond.

The borough of Kingston is well served by Crossrail 2, as it includes the replacement of existing suburban rail services out of London Waterloo. Branches to Shepperton, Hampton Court, Chessington South and Epsom all intersect the borough boundary. The Crossrail 2 branches in the South West converge into a single line at Raynes Park just outside the borough boundary to the North East.

2 Growth in Travel Demand

2.1 Approach and sources of information

TfL's London Transportation Study (LTS) model was run by TfL to provide the overall estimate of future travel demand for public transport and highways using housing and employment forecasts with respect to the Kingston OA. For the GLA area, LTS assumes levels of housing and employment from the current 2016 London Plan; outside London, growth is based on the DfT TEMPro[7] forecasts.

2.2 Population, Households & Employment

RBK provided revised planning assumptions for the borough that replaced the original assumptions supplied in the TfL 2041 reference case. Forecasts of additional population and employment growth were also received from RBK to create a medium growth (opportunity area) demand scenario.

The agreed projections by area (LTS zone) are summarised in **Table 2** to **Table 5** (rounded to the nearest ten) and **Figure 1** to **Figure 4**.

Table 2 to **Table 5** shows the household and employment growth assumptions from 2011 for both the 2041 Reference Case and the 2041 Medium OA growth assumptions. Households were calculated by taking the population growth forecasts and assuming a standard 2.2 persons per household ratio, in line with other work undertaken for TfL.

Table 2: Household growth assumptions in the 2041 Reference Case

Name	2011	2041 Ref Case	Growth (abs)	Growth (%)
Kingston North	11,450	13,190	1,740	15%
Kingston Centre	1,240	3,490	2,250	181%
Norbiton	3,360	5,220	1,860	55%
Berrylands	5,210	6,340	1,130	22%
New Malden	7,120	7,960	840	12%
Kingston Vale	2,730	2,770	40	1%
Kingston South	5,680	6,670	990	17%
Surbiton North	3,160	3,520	360	11%
Surbiton	6,640	7,300	660	10%
Tolworth & Berrylands	9,950	11,160	1,210	12%
Old Malden	6,560	6,900	340	5%
Chessington North	7,860	9,020	1,160	15%
Chessington South	1,980	2,130	150	8%
TOTAL	**72,940**	**85,680**	**12,740**	**17%**

[7] Trip End Model Presentation Program

Table 3: Household growth assumptions in the 2041 Medium OA Growth

Name	2011	2041 Med OA	Growth (abs)	Growth (%)
Kingston North	11,450	13,870	2,420	21%
Kingston Centre	1,240	4,690	3,450	278%
Norbiton	3,360	6,910	3,550	106%
Berrylands	5,210	8,020	2,810	54%
New Malden	7,120	11,970	4,850	68%
Kingston Vale	2,730	2,770	40	1%
Kingston South	5,680	8,150	2,470	43%
Surbiton North	3,160	3,520	360	11%
Surbiton	6,640	7,490	850	13%
Tolworth & Berrylands	9,950	13,130	3,180	32%
Old Malden	6,560	7,100	540	8%
Chessington North	7,860	10,750	2,890	37%
Chessington South	1,980	2,780	800	40%
TOTAL	**72,940**	**101,130**	**28,190**	**39%**

Table 4: Employment growth assumptions in the 2041 Reference Case

Name	2011	2041 Ref Case	Growth (abs)	Growth (%)
Kingston North	9,440	9,930	490	5%
Kingston Centre	15,600	16,940	1,340	9%
Norbiton	3,300	3,420	120	4%
Berrylands	4,610	4,280	-330	-7%
New Malden	5,360	6,590	1,230	23%
Kingston Vale	2,290	2,510	220	10%
Kingston South	5,240	5,520	280	5%
Surbiton North	3,690	3,970	280	8%
Surbiton	3,420	3,520	100	3%
Tolworth & Berrylands	7,000	6,250	-750	-11%
Old Malden	2,640	2,760	120	5%
Chessington North	6,680	8,930	2,250	34%
Chessington South	3,190	3,160	-30	-1%
TOTAL	**72,450**	**77,780**	**5,330**	**7%**

Table 5: Employment growth assumptions in the 2041 Medium OA Growth

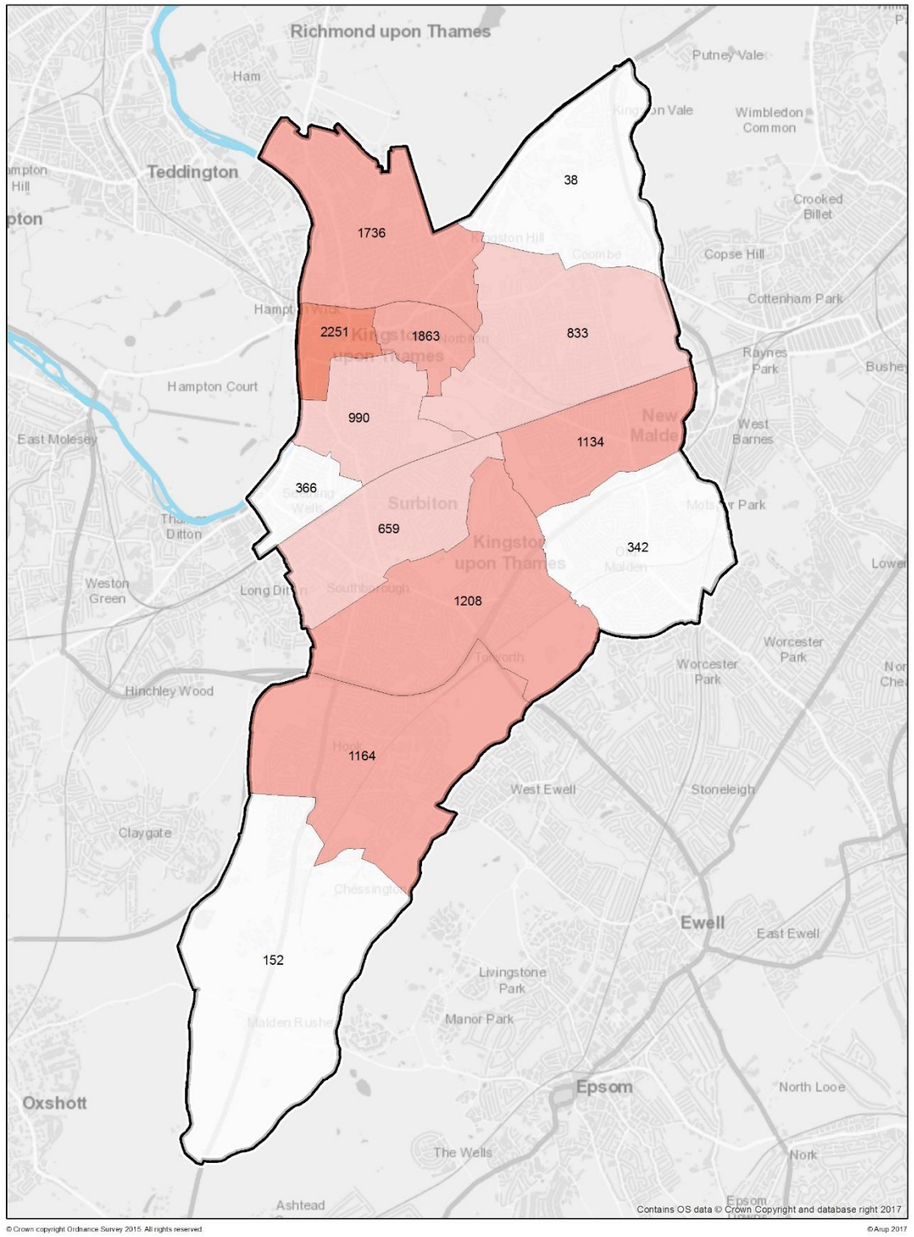
Name	2011	2041 Med OA	Growth (abs)	Growth (%)
Kingston North	9,440	16,790	7,350	78%
Kingston Centre	15,600	25,660	10,060	64%
Norbiton	3,300	6,840	3,540	107%
Berrylands	4,610	6,520	1,910	41%
New Malden	5,360	9,030	3,670	68%
Kingston Vale	2,290	2,510	220	10%
Kingston South	5,240	4,780	-460	-9%
Surbiton North	3,690	3,970	280	8%
Surbiton	3,420	3,510	90	3%
Tolworth & Berrylands	7,000	8,940	1,940	28%
Old Malden	2,640	2,760	120	5%
Chessington North	6,680	12,280	5,600	84%
Chessington South	3,190	3,300	110	3%
TOTAL	**72,450**	**106,867**	**34,417**	**47%**

Figure 1 to **Figure 4** shows the location and concentration of growth in households and employment for both modelled demand scenarios, and present absolute and relative percentage changes. The distribution of the changes between the 2011 base and 2041 reference case and medium OA are presented, with the key observations being:

- The largest growth in the number of **households** in the reference case is focused around Kingston Centre (181%) and Norbiton (51%). There is also substantial growth in Tolworth & Berrylands and Chessington North of around ~1,200 households although this represents a small relative change of 12-15%;
- In the medium growth scenario, the **household** growth is spread more evenly across the borough. Kingston Centre (277%) and Norbiton (106%) still represent the largest increases in households but there are large absolute changes in New Malden of around ~5,000 new homes. There is also a large absolute increase in Tolworth & Berrylands and Chessington North of ~3,000 homes representing an increase of 32% and 37% on 2011 respectively;
- Growth in **employment** in the 2041 reference case scenario is focused around Chessington North with an increase of 2,250 jobs on the 2011 base, representing an increase of 34%. There are also increases of ~1,300 in Kingston Centre (9%) and New Malden (23%). Elsewhere in the borough changes are minimal, while other areas such as Tolworth & Berrylands and Berrylands have seen decreases in employment of ~10%; and
- In the 2041 Medium growth scenario, most of the decreases in **employment** in the reference case are offset by additional forecast growth for certain areas.

The only area of the borough that continues to see a decrease in the number of jobs is the area to the south of Kingston town centre where jobs decrease by around ~500 (~9%). The largest increases in employment are found around Kingston Centre (~10,000 jobs), Norbiton and Kingston North. Growth in employment around Chessington North south of the A3 Tolworth and Hook junctions is forecast to see an employment increase of 84%.

Figure 1: Growth in households – base year to 2041 reference case



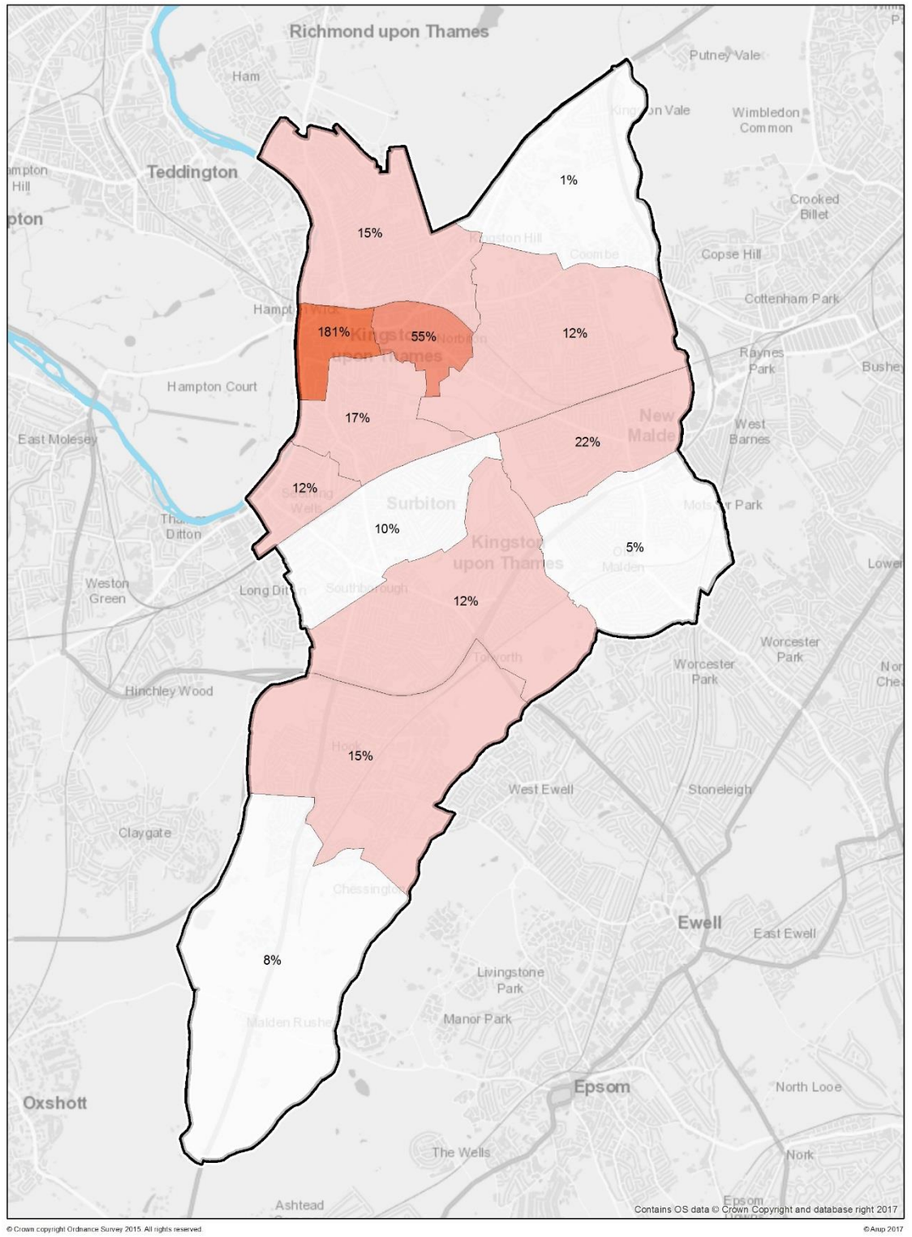
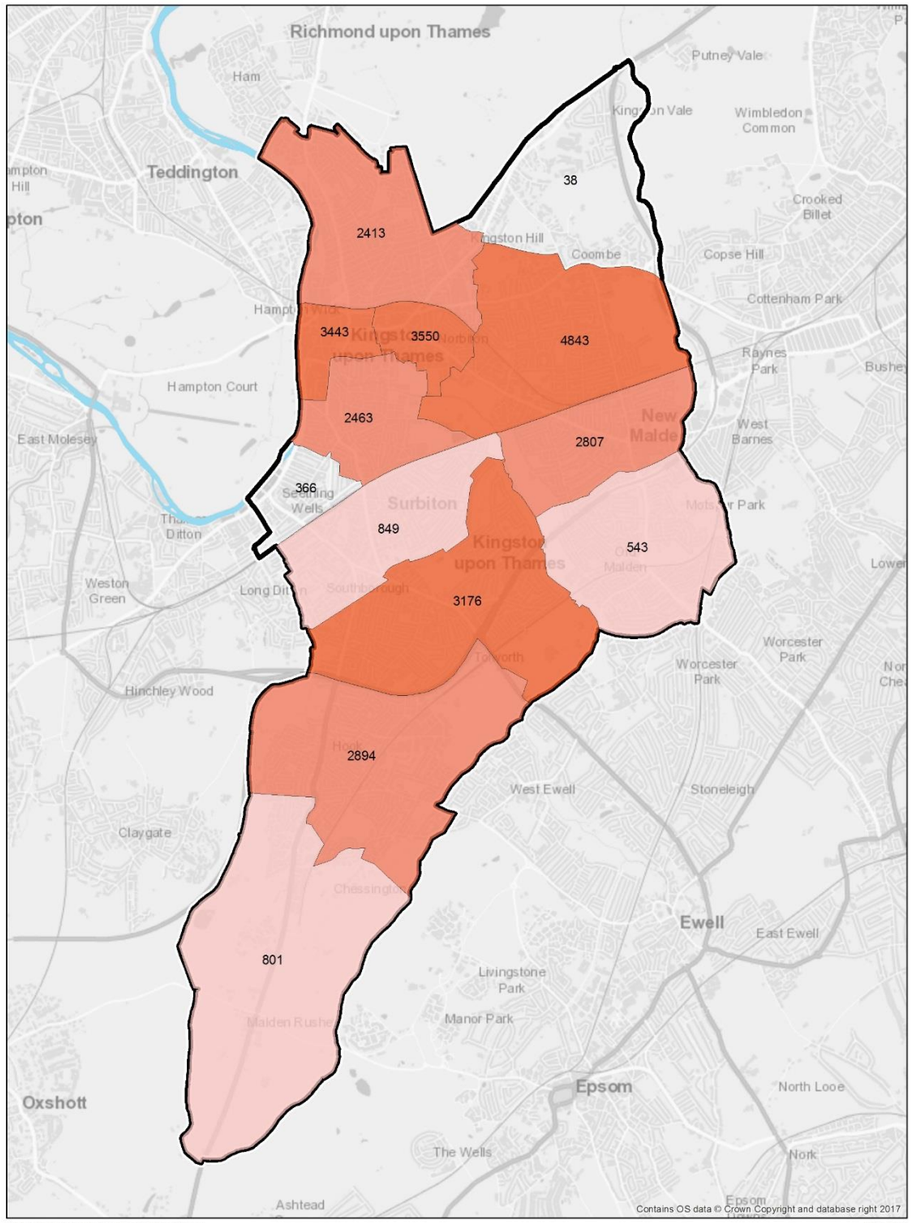


Figure 2: Growth in households – base year to 2041 medium OA growth



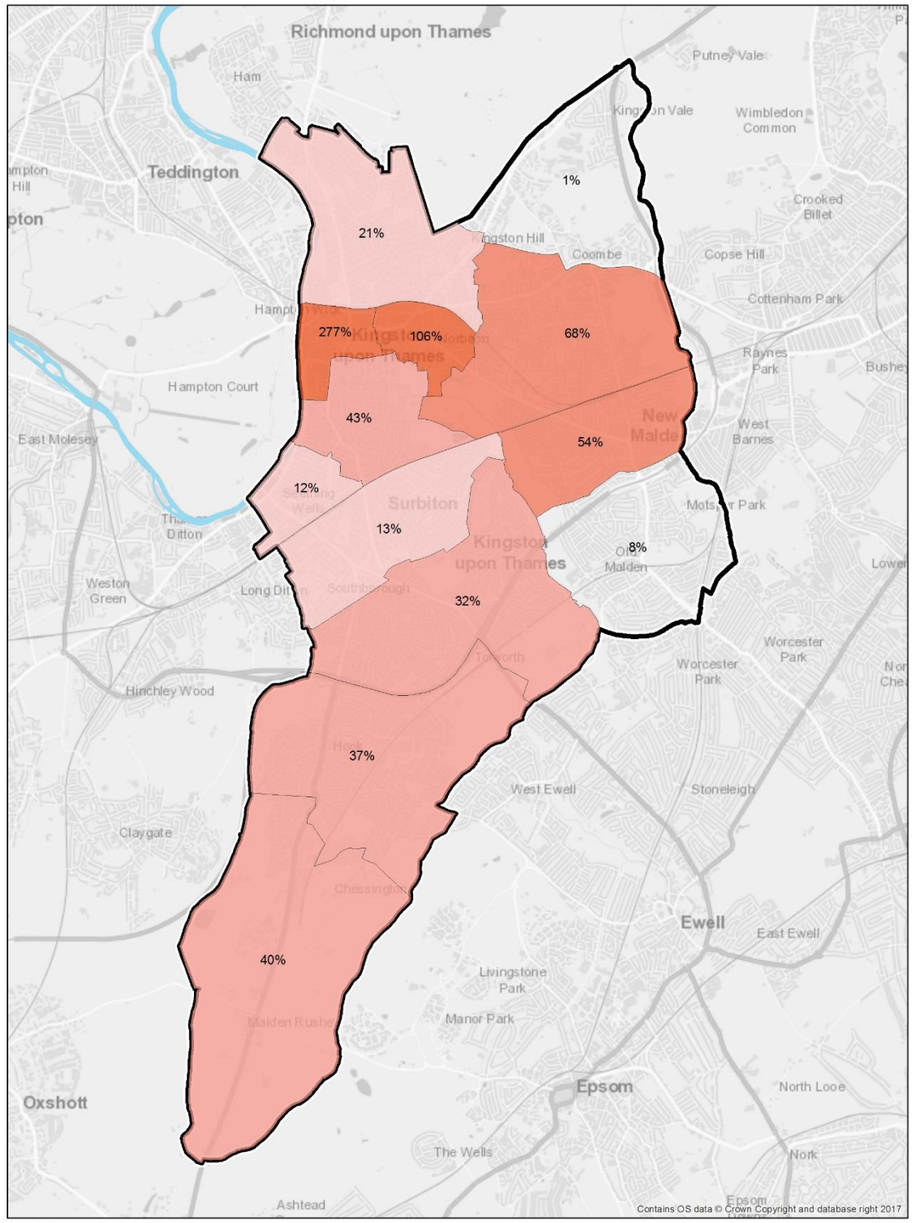
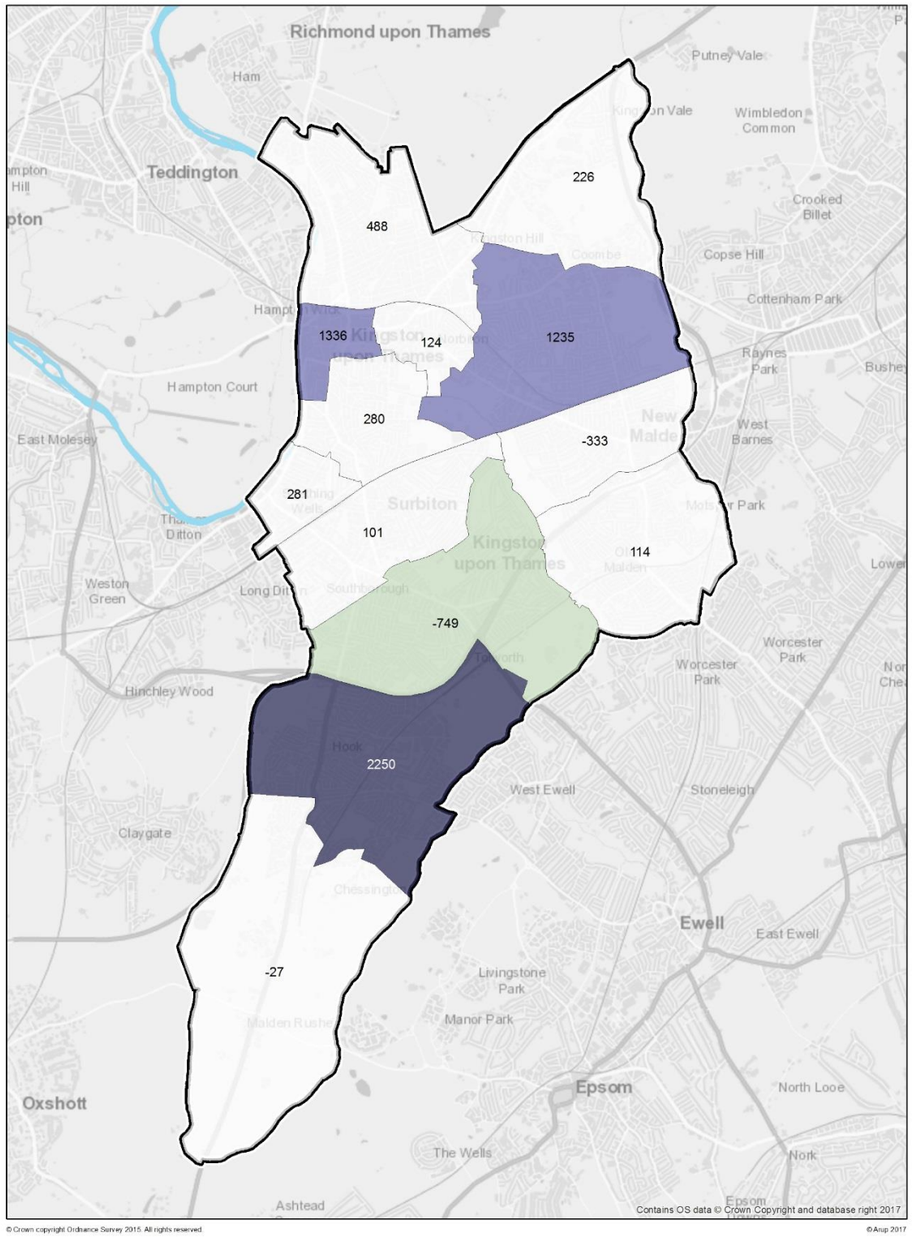
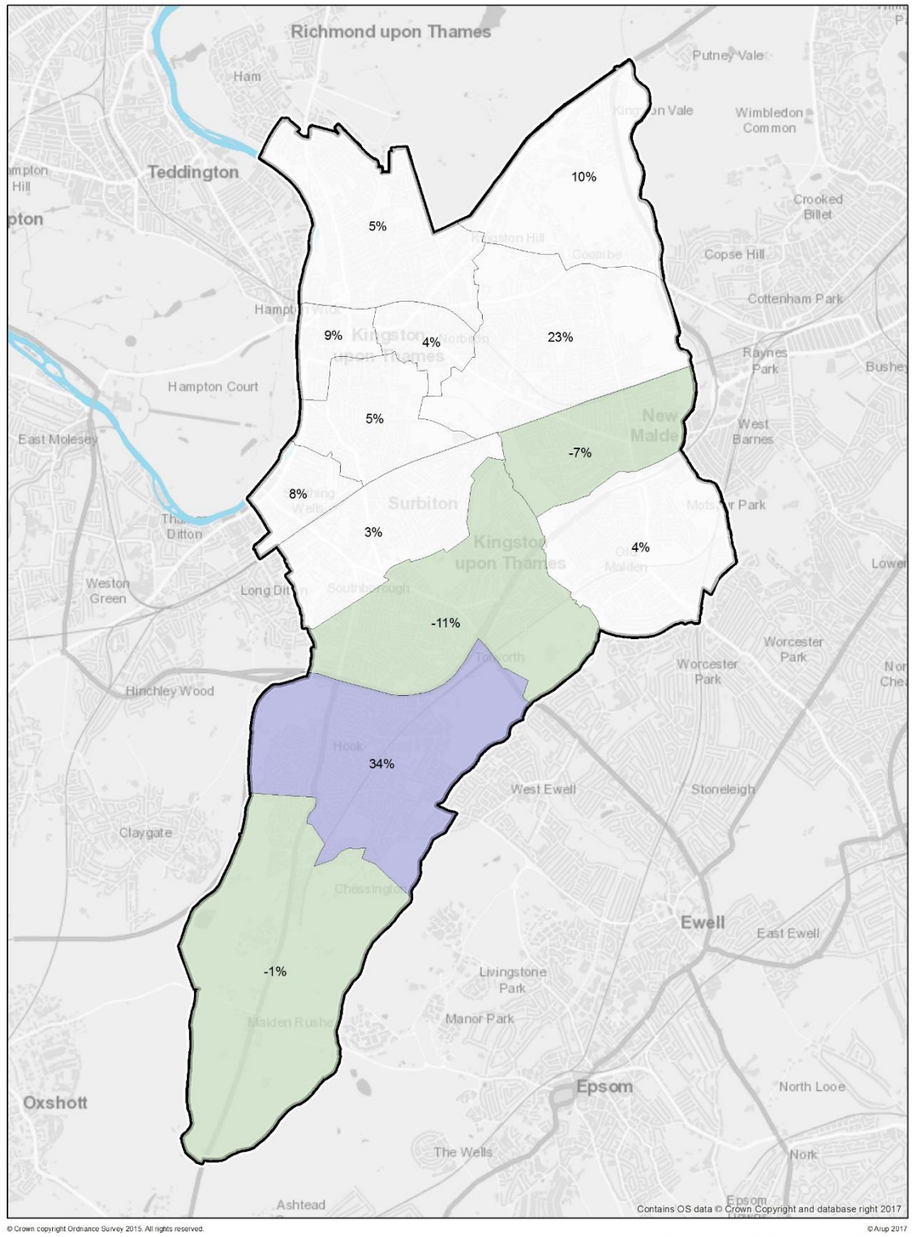


Figure 3: Growth in employment – base year to 2041 reference case

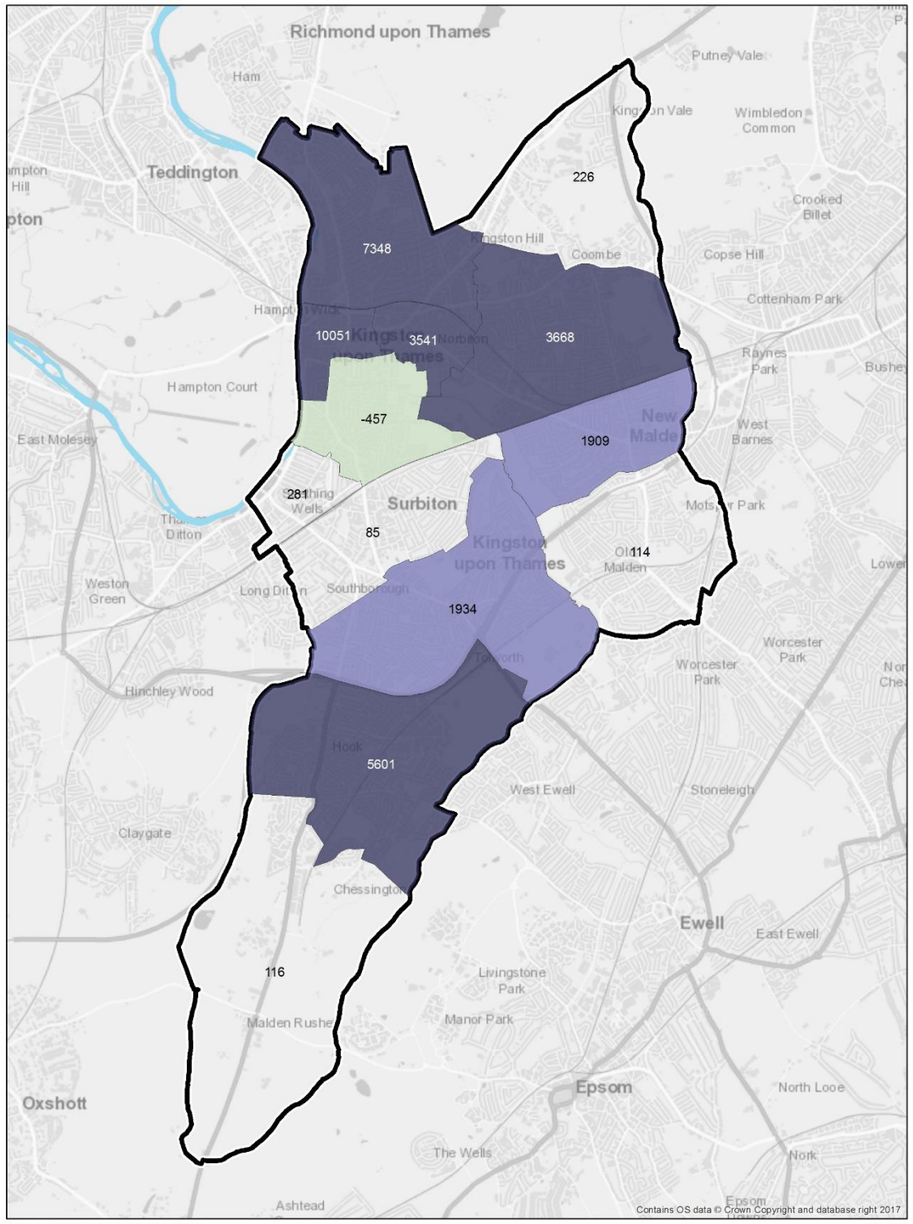


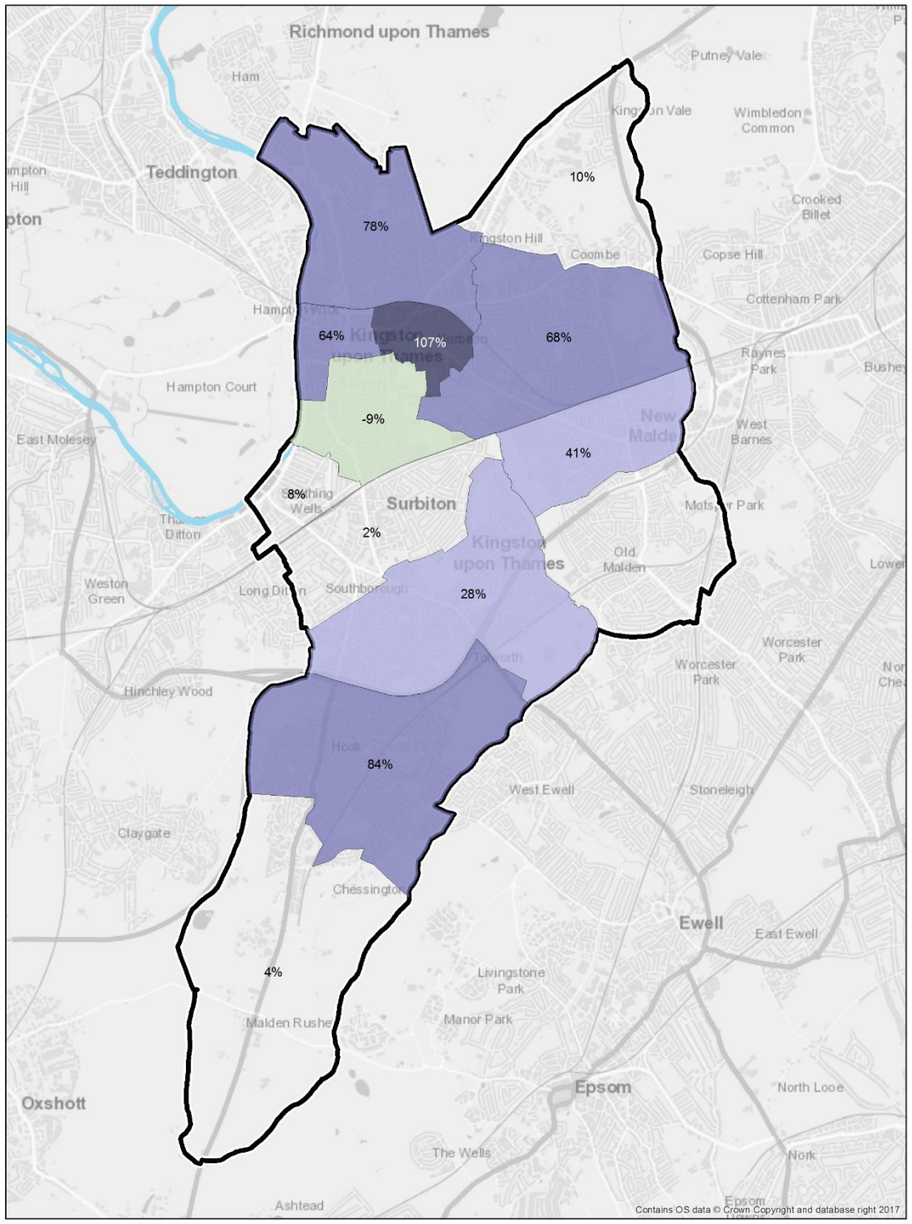
KINGSTON STRATEGIC HIGHWAY
AND PUBLIC TRANSPORT MODELLING
Kingston Opportunity Area



KINGSTON STRATEGIC HIGHWAY
AND PUBLIC TRANSPORT MODELLING
Kingston Opportunity Area

Figure 4: Growth in employment – base year to 2041 medium OA growth





2.3 Review of LTS outputs

The LTS outputs have been analysed and sense-checked to ensure that the trip-ends and mode share are in line with the growth assumption inputs outlined above. This section examines this process.

2.3.1 Trip-ends

Figure 45 to **Figure 50** in Appendix A shows the increase in **highway** trip-ends (origin and destination) for the morning peak hour (08:00 – 09:00). Trips have been mapped to the KingHAM zone structure, which has an increased definition (compared with LTS) within southwest London and around Kingston in order to improve model accuracy. Away from London, the highway trip zones become significantly more disaggregated.

Figure 51 to **Figure 56** in Appendix A shows the change in **public transport** trip-ends (origin and destination) for the morning peak period (07:00 – 10:00). Trips have been mapped to the Regional Railplan (RRP) zonal structure, which has a high level of definition within the Greater London Area, but significantly less definition for areas outside this area.

Each growth scenario is compared on an incremental basis in terms of:

- the growth between the 2011 base compared with the 2041 reference case; and
- the growth between the 2041 reference case compared with the 2041 medium growth scenario.

Trips are also presented for the Medium growth with Crossrail 2 scenario although it should be noted that the base demand between these scenarios do not change, just the distribution of trips and the resulting modal split between public transport, highway and active modes (see 2.3.2).

The figures are presented at both the Kingston borough and the wider GLA level to compare trip-end growth and distribution across other outer London boroughs.

Annotations have been included on the plots where necessary to provide a narrative on changes in the growth rates and distributions.

Highways

Between the 2011 base and the 2041 reference case there is a substantial decrease in highway origin trips across a large proportion of the Kingston borough; this decrease is typical of outer London boroughs. The wider GLA plot in **Figure 46** shows similar changes in other outer London boroughs within the M25. Boroughs such as Enfield, Barnet and Ealing all have a similar magnitude and distribution of origin trip-end changes to Kingston borough. There are small increases in highway trips (0-100) in and around Kingston Centre and Tolworth & Berrylands. Larger increases in origin trips can be seen in and around Hinchley Wood, West Ewell and Banstead.

There is a similar pattern for the highway destination trip-ends, although substantial changes are observed in and around Kingston Vale and New Malden to

the north east of the borough. Chessington North, Tolworth and Hook show a slight increase in the number of highway trips over the same period. Hinchley Wood and Banstead continue to show substantial increases in trips ends for destinations although it should be noted that these are external to the Kingston borough boundary.

Public Transport

There are observed increases in public transport trip origins between 2011 and 2041 across the whole of the Kingston borough. The most substantial increase in public transport origin trips is within the north of the borough, particularly for zones neighbouring Kingston Centre, Norbiton, Surbiton and New Malden stations. Areas north of Kingston town centre also increased by ~250 to 500 origin trips. Destination trips also increased, but are primarily focused around Kingston Town Centre and Norbiton (~250).

Plotting demand at the GLA level helps to indicate how the forecast increase in trips by public transport are distributed across the other London boroughs and areas immediately external to the GLA. Kingston is forecast to have a similar distribution of origin trip rates to neighbouring boroughs including Merton, Sutton, Croydon, Hounslow and Richmond, where the greatest trip rate growth is focused around major urban centres.

For destination trips, **Figure 53** highlights the increasing number of trips that are focused on destinations within the Central zone and Isle of Dogs. The highest growth in trip destinations are focused around Westminster, the City of London and more central areas of Camden and Islington. Tower Hamlets/Newham is also forecast to increase as a destination with trip growth focused heavily around employment areas in Canary Wharf (Isle of Dogs), Mile End/Bow and Stratford.

In areas external to the GLA, the large zone size in the Railplan model will contribute towards the total absolute growth in trips. To compare against Kingston these should also be compared in relative growth terms. In the south west, analysis of relative growth forecasts highlights an increase in public transport origin trips in areas including Guildford and other parts of Surrey. These areas are likely to contribute to an increase in public transport through-demand within the Kingston borough. In the medium OA growth scenario, the majority of additional public transport trips are allocated to the borough of Kingston due to the extra growth on top of the 2041 reference case assumptions, although the 2011 to 2041 growth is considerably greater. The largest increases in trip origins are focused around Kingston Centre, New Malden and Tolworth where a significant increase in additional housing and employment is forecast (see employment/household plots from LTS). The same pattern can be observed for PT destinations, although these are more concentrated on areas where a greater concentration of job growth is committed, such as areas between Tolworth and Chessington, Kingston North and New Malden. There is more of a build-up in destination trips in areas to the north of Kingston town centre.

The GLA level analysis indicates that additional trips (both origin and destination) within the GLA area are committed to Kingston borough. The shaded zones external to the GLA are likely flagged due to larger zone sizes, although the relative changes in trips in these zones will contribute to a very small proportion

of total trips from that zone. The largest relative changes are specific to the Kingston borough between these demand scenarios.

2.3.2 Mode share assumptions

The outputs from the LTS model show a changing pattern of mode share between the 2011 base and the 2041 forecasting scenarios. **Table 6** shows the modal splits for the additional trips that are added to the network for the 2041 medium OA growth scenario.

For the medium OA growth scenario, approximately 73,000 additional trips are added to the network; however, the percentage of these additional trips allocated to each mode differs between each network scenario. It is important to note that the growth in total trips (i.e. demand) in the forecast remains the same for the "with" and "without" Crossrail 2 scenarios.

For the medium OA growth scenario without Crossrail 2, 33% of the additional 73,000 trips are allocated to public transport, 39% are added to walking trips over 200m and cycling and 28% are added to highway trips. The higher walk and cycle mode share across the borough is aligned with the wider GLA ambitions for active travel, as part of the Mayor's Transport Strategy (MTS) Healthy Streets Agenda.

With Crossrail 2 included, public transport accounts for nearly half of all additional trips (46%). Highway trips decrease substantially to 21% of additional trips, with walking and cycling also reducing to 33%. This is reflective of a greater pull associated with Crossrail 2 and the effects of transit-oriented development and capacity benefits that it also brings, assuming that this will decrease the attractiveness of using private car. The reduced attractiveness of active travel reflects the decreased requirement to use walking/cycling as part of a trip to reach a high-quality public transport service (i.e. rail/LU station).

Table 6: LTS modal split assumptions

Growth Scenario	Car	PT	Active Modes[8]
2041 Medium OA Growth	+21,000	+23,900	+28,300
2041 Medium OA growth	**+29%**	**+33%**	**+39%**
2041 Medium OA with CR2	+15,700	+33,500	+24,000
2041 Medium OA with CR2	**+21%**	**+46%**	**+33%**

[8] Active modes include travel such as walking and cycling