

DRAFT Report
March 2022

Old Kent Road Opportunity Area Bus Demand and Capacity Study

London Borough of Southwark

steer

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1 Overview

Introduction

- 1.1 The Draft Area Action Plan (AAP), published by LB Southwark in 2017 and proposing the delivery of new homes and jobs along the Old Kent Road corridor, is currently being revised and updated (draft published for consultation in December 2020). Southwark is currently reviewing the evidence base supporting the document (including the surface transport study undertaken by Steer in 2016, which has been updated through an analysis in 2021) to ensure that the findings of the analyses undertaken in 2016-2017 are still valid, and if necessary, update them to reflect changes in the baseline conditions.
- 1.2 Bus services will play a key role in supporting the regeneration of the Old Kent Road (OKR) area, particularly prior to the delivery of the Bakerloo Line Extension. To ensure that the public transport network can support the delivery of new housing in the area in advance of the Bakerloo Line extension (BLE), LBS and GLA/TfL have agreed a phasing strategy: 9,500 homes will be committed and occupied in advance of the BLE.

Strategic assessment of scenarios

- 1.3 In support of the ongoing revision of the AAP, this Old Kent Road Bus Study is required to assess how the demand generated by the new developments will impact bus capacity in the Old Kent Road Opportunity Area (OKR OA) in advance of the delivery of the BLE.
- 1.4 To make this assessment TfL's strategic transport models have been updated and rerun as follows:
 - LTS demand model to forecast the trips generated by the developments including by mode and distribution (where they are travelling to or from);
 - Railplan public transport network model which provides a more detailed assessment of the routes people make through the public transport network; and
 - LoHAM highway transport network model which provides a more detailed assessment of the routes people make through the road network.
- 1.5 The analysis will focus on future year 2031 forecast models for the AM peak, supported with analysis of observed 2019 base corridor flows. Three future year scenarios have been developed in liaison with LB Southwark and TfL, as shown in Table 1.1.

Table 1.1: Future Year Core Scenarios (LTS, Railplan and SOLHAM Model Runs)

ID	Scenario	Commentary
1	2031 Base Minus (without development)	2031 London Plan growth across the GLA, except with non-structural growth from the OA removed. Ensure that the other local developments outside the OKR OA are correctly included.
2	2031 With OKR Development Reference Case	The addition of the full level of development currently envisaged by 2031 into the OA.
3	2031 With OKR Development Bus Capacity Upgrade	Developments as above but with a hypothetical future upgrade in bus capacity proposed by TfL Buses.

1.6 This technical report, describing the modelling process and results, is structured as follows:

- **Future Year Assumptions** – Describes the land use, demographic and network assumptions input into the LTS model for the future year 2031 scenarios.
- **Trip Generation Results** – Analysis of the results of the LTS, focusing on assessing the trip generation of the Old Kent Road developments.
- **Impact on the Public Transport Network** – Analysis of the modelled impacts of the development on the public transport network with a focus on the Old Kent Road bus corridor

2 Future Year Assumptions

Summary

2.1 Trip generation and mode share are forecasted by the LTS model, with the key model elements for this study as follows:

- The **Trip Generation** module updated with the new development assumptions. The model includes trip rate assumptions which account for the demographics, car ownership and PT accessibility of different areas. This produces trip rates by journey purpose, with adjustments made for mode share, distribution, and trip frequency in the full LTS run.
- The **Mode Share** module of the model takes inputs from Highway and Public Transport network models, which provides generalised journey times between modelled zones, to include congestion and crowding, and will account for the different levels of public transport accessibility by area.

Assumptions

Demand Updates

2.2 The future tests involved updates to the LTS transport land use and demographic inputs with the following demographic and land use information updated:

- Population living in the LTS zone
- Employment in the LTS zone
- Retail space
- Number of pupils at schools in the LTS zone
- Parking spaces in the LTS zone
- Car ownership in the LTS zone

2.3 TfL have an existing 'Reference Case' model which includes their central assessment of development growth in London and committed transport schemes. The initial step therefore involved taking this Reference Case model and creating a 2031 Base Minus scenario which removed any growth related to OKR OA to provide a comparator model to assess the impacts of development in the OA.

2.4 As well as updating assumptions in OKR following discussions with LB Southwark and TfL, development assumptions in surrounding OAs and growth areas were also reviewed and updated. Assumptions for the other areas are consistent between the Base Minus and with OKR development scenarios. Adjustments have been made to the following Opportunity Areas and Growth Areas:

- Canada Water
- Elephant and Castle
- New Bermondsey

- 2.5 As the standard TfL reference case already includes assumptions on the delivery of the developments in the areas above, these needed to be removed prior to adding in the agreed updated assumptions. To do this, TfL's strategic modelling team provided the 2016 and 2031 LTS land use and demographic data and TfL's assumptions on structural growth between 2016 and 2031.
- 2.6 Structural growth consists of TfL's assumptions on how demographics and land use will change without the implementation of specific growth areas, enabling us to provide background growth targets for 2031 before adding on the development. Table 2.1 provides a summary of the assumptions adopted for each Opportunity/Growth Area regarding population, employment, parking numbers, car ownership.

Network Updates

- 2.7 The 2031 future year reference case contains committed future year network changes. For example Crossrail is included, but the Bakerloo Line extension is not coded into the TfL reference case. The bus frequencies on OKR are assumed to be at the same level as in the existing situation. For the 'Base Minus' and the 'With Development Reference Case' scenarios the TfL reference case network was used. Prior to running the model being run checks were carried out to ensure that the bus frequencies on OKR are in line with expectations.
- 2.8 In addition a run with increased bus capacity on OKR has been completed following discussions with TfL's bus team. This has been run to ensure that public transport trip generation in the corridor is not suppressed due to lack of bus capacity and to reduce the impact of diversion of public transport trips away from the corridor. This is a hypothetical scenario to ensure there is enough capacity on the corridor to prevent any diversion away from the corridor, rather than representing a realistic proposal based on analysis of the forecast trip generation at the new developments. Bus frequencies for the key bus routes on OKR are 48 buses per hour in the reference case, which is increased by 40 buses per hour to around 88 buses per hour in the run with increased bus capacity.
- 2.9 The bus coding assumptions for key routes on OKR can be found below in Table 2.2.

Table 2.1: Study Area Opportunity Area Assumptions

OA	Scenario	Household Growth	Population Growth	Employment	Retail Jobs	Office Jobs	Parking (residential)	Car Ownership (residential)
Old Kent Road OA	With OKR Development Scenarios Only	9,500	22,895	5,000	1,268	3,732	285	3%
		The number of households is based on Old Kent Road OAAP (December 2020, timeline on page 37)	The growth in population is based on the current average household size of 2.41 in the Old Kent Road OA, calculated from information provided in the Old Kent Road OAAP (December 2020, pages 15 and 24)	The number of jobs is based on Old Kent Road OAAP	Retail jobs are calculated based on a ratio of 1 job per 20 sqm of retail floorspace, extracted from the Canada Water Masterplan Environmental Statement (May 2018, page 30 of Chapter 7, paragraph 7.175, Table 7.14). Please note that this value refers to A1 Retail GEA SQM.	Estimated as the difference between total jobs and retail jobs	Based on the assumption that most developments will be car free and only 3% accessible car parking will be provided for residential units. Based on the Planning Applications currently submitted, the net change in commercial car parking is negligible.	
Canada Water	Base Minus and With OKR Development Scenarios	2,989	5,045	21,025	3,590	18,445	600 + 1,000	20%
		Based on Canada Water Masterplan Environmental Statement (May 2018, page 35 of Chapter 7, paragraph 7.215). Please note that this figure relates to the Illustrative Masterplan.	Based on Canada Water Masterplan Environmental Statement (May 2018, page 24 of Chapter 7, paragraph 7.132). Please note that this figure relates to the Illustrative Masterplan.	Based on Canada Water Masterplan Environmental Statement (May 2018, page 30 of Chapter 7, paragraph 7.175).	Canada Water Masterplan Environmental Statement (May 2018, page 30 of Chapter 7, paragraph 7.175, Table 7.14).	Based on Canada Water Masterplan Environmental Statement (May 2018, page 30 of Chapter 7, paragraph 7.175).	600 residential spaces (0.2 spaces per household) and 1,000 commercial spaces. Based on Canada Water Masterplan Transport Assessment (May 2018, page 89, paragraph 7.6.4).	
Elephant and Castle	Base Minus and With OKR Development Scenarios	5,000	11,850	10,000	2,121	7,879	150	3%
		Based on 'Elephant and Castle' page on the Southwark Council's website (https://www.southwark.gov.uk/regeneration/elephant-and-castle , accessed May 2021). Please note that 4,000 homes are mentioned in Elephant & Castle SPD OAPF (2012, page 25, paragraph 3.1.4)	Based on the current average household size of 2.37 in 2020 LB Southwark, calculated from information provided in the Appendix D - Southwark Key Housing Stats 2020 (September 2020, pages 3 and 5)	Based on 'Elephant and Castle' page on the Southwark Council's website (https://www.southwark.gov.uk/regeneration/elephant-and-castle , accessed May 2021). Please note that 5,000 jobs are mentioned in Elephant & Castle SPD OAPF (2012, page 25, paragraph 3.1.4)	Retail jobs are calculated based on a ratio of 1 job per 20 sqm of retail floorspace. Floorspace based on 'Elephant and Castle' page on the Southwark Council's website (www.southwark.gov.uk/regeneration/elephant-and-castle , accessed May 2021).	Estimated as the difference between total jobs and retail jobs.	Based on the assumption that most developments will be car free and only 3% accessible car parking will be provided for residential units. No data available on commercial parking.	
New Bermondsey	Base Minus and With OKR Development Scenarios	3,500	8,645	2000	-	-	105	3%
		Based on 'The Scheme' page on the New Bermondsey's website (http://www.newbermondsey.com/the-scheme , accessed May 2021). Please note that this figure is different to the figure of 2,400 homes approved in the 2012 New Bermondsey outline planning application.	Based on the current average household size of 2.47 in LB Lewisham, calculated from information provided in the Homes for Lewisham: Draft Lewisham Housing Strategy 2015-2020 (page 5).	Based on 'The Scheme' page on the New Bermondsey's website (http://www.newbermondsey.com/the-scheme , accessed May 2021).			Based on the assumption that most developments will be car free and only 3% accessible car parking will be provided for residential units. No data available on commercial parking.	

Table 2.2: Bus Capacity - Reference Case and TfL assumptions

Route	Proposal	From	To	Reference case Buses per Hour	Increase in TfL Bus Test Buses per Hour	TfL Bus Test Buses per Hour	Notes
TBC	New Route	Canada Water	Aldwych	-	8	8	New route to provide links Canada Water to Old Kent Road and Capacity at Bricklayers Arms to Elephant
76	Extension	Tottenham Hale	Old Kent Road	-	7.5	7.5	Route extension that provides new links to north of London and Capacity at Bricklayers Arms to Elephant.
388	Extension	Stratford	Old Kent Road	-	5	5	Route extension that provides new links to north of London and Capacity at Bricklayers Arms to London Bridge.
415	Extension	Tulse Hill	Surrey Canal Road	-	8	8	Route extension that provides new links to north of London and Capacity at Bricklayers Arms to Elephant.
21	Frequency Increase	Lewisham	Newington Green	7.6	2.4	10	frequency increase to provide additional capacity at Bricklayers Arms to London Bridge
53	Frequency Increase	Plumstead	Waterloo	7.9	2.1	10	frequency increase to provide additional capacity at Bricklayers Arms to Elephant & Castle
63	Frequency Increase	Honor Oak	Kings Cross	11.4	2.6	14	frequency increase to provide additional capacity at Bricklayers Arms to Elephant & Castle
172	Frequency Increase	Brockley Rise	Aldwych	5.7	2.3	8	frequency increase to provide additional capacity at Bricklayers Arms to Elephant & Castle
363	Frequency Increase	Crystal Palace	Elephant	5.7	0.3	6	frequency increase to provide additional capacity at Bricklayers Arms to Elephant & Castle
453	Frequency Increase	Deptford Bridge	Marylebone	9.8	2.2	12	frequency increase to provide additional capacity at Bricklayers Arms to Elephant & Castle
Key Bus Route Frequency on OKR				48.1	40.4	88.5	
TBC	New Route	Deptford Bridge	Marylebone	9.8	2.2	12	New Route providing links between Lewisham and Canada Water. Not directly related to OKR, but has potential to remove flows from the corridor by providing alternative routes to rail/ underground.

Updates to LTS

Demand

- 2.11 In incorporating the assumptions highlighted above into LTS, the following additional assumptions were applied to the assumptions:
- **Employment** – LTS inputs blue- and white-collar workers with different assumptions on trip rates and modal preference. Therefore, we have split employment into blue and white collar by assuming all retail/ leisure workers are blue collar and all office workers are white collar.
 - **Population** – LTS forecasts include different assumptions on trip rates and modal preference based on age, income, and employment type of residents in the model zones. Our assumption is that this will be distributed as in the existing TfL reference case when adding in the new developments.

Zonal Disaggregation

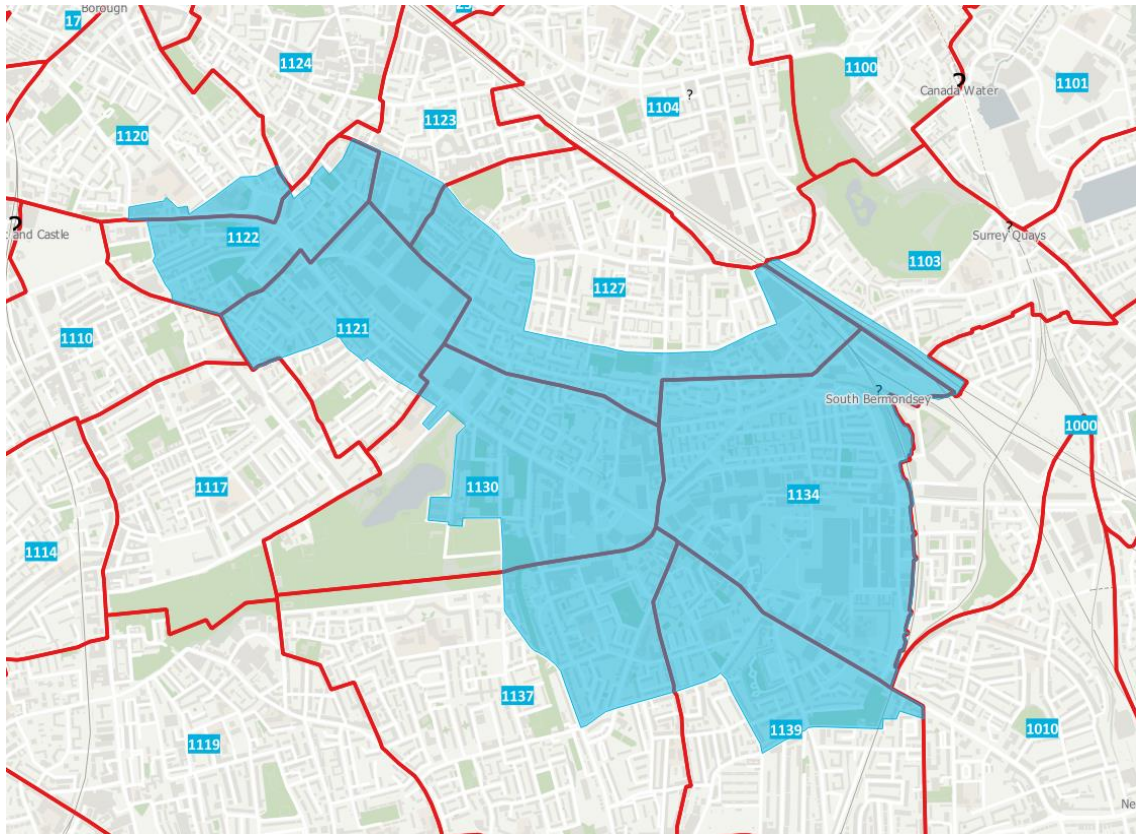
- 2.12 Following the establishment of the Base Minus and with OKR development scenarios, the new assumptions were input into the LTS model by splitting the development quantum into the appropriate LTS zone. For the OAs outside of OKR the development quanta were split based on the proportion of the OA within each LTS zone, with Figure 2.1 showing the OA (in blue) against the LTS zones in red.
- 2.13 For the OKR developments a more refined approach was taken to ensure that the developments were located in the correct location. The map below, showing locations of developments in the full buildout of the masterplan was used in combination with information extracted from the AAP or received from the Council on timing of developments. These were used to identify the locations of the developments to be tested in LTS. The development assumptions were then assigned to the relevant LTS zones as shown in Figure 2.2.

Figure 2.1: LTS Zone System Aligned with OKR OA



Source: Old Kent Road Opportunity Area Report, London Borough of Southwark

Figure 2.2: LTS Demand Model Zoning System in OKR OA



Source: Steer Analysis

2.14 Following this analysis, the following proportions were applied to the OKR OA totals to the LTS zones:

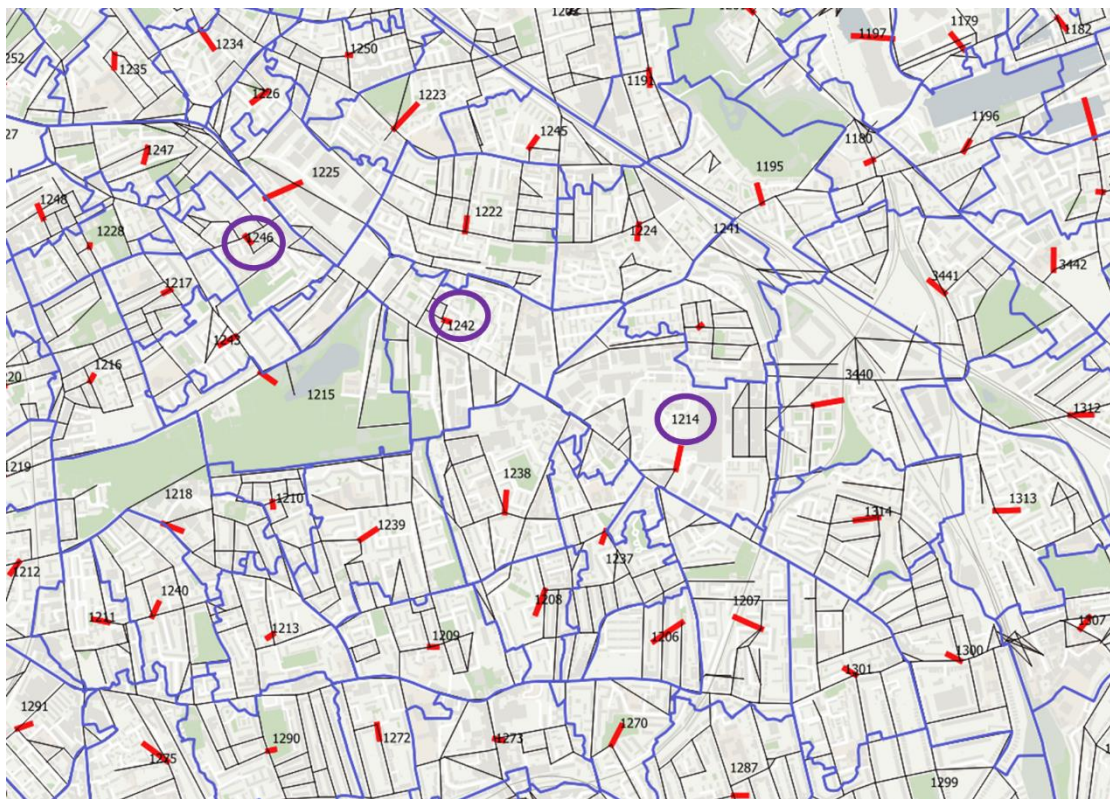
Table 2.3: Proportion of growth by LTS zone

LTS Zone	Households %	Jobs %
1121	1%	0%
1130	47%	38%
1134	50%	61%
1139	2%	1%
Total	100%	100%

2.15 While the LTS demand model (trip frequency, trip distribution and mode share) has a relatively disaggregate zonal system, the public transport model within LTS is more refined. The disaggregation factors splitting transport demand to the assignment models zoning system was also reviewed, to ensure that development demand within the assignment model could access the public transport network as accurately as possible, and to ensure that PT trip generation was not suppressed due to unrealistically long walking times to stops.

2.16 Figure 2.3 below shows the zone connectors for the LTS public transport model, with the zones highlighted in purple chosen to represent the developments. The LTS demand model and assignment model zones do not align perfectly: there are some overlapping between the two systems, but the LTS zoning is less detailed – therefore, we have loaded the development trips onto fewer zones in the PT model.

Figure 2.3: Zonal Disaggregation for with Development



2.17 The disaggregation factors were adjusted based on the increases in demand being loaded onto the Public Transport zones as follows.

Table 2.4: Proportion of growth by PT zone

LTS Zone	HH %	Jobs %
1246	1%	0%
1242	47%	38%
1214	52%	62%
Total	100%	100%

Network

2.18 Updates were made to the 2031 With OKR Development Bus Capacity Upgrade as described in Table 2.2 above.

3 Chapter 3 – Trip Generation Results

Overview

3.1 This section summarises the results of the 2031 LTS model runs, focusing on the trip generation in the OKR OA as a result of the development.

12 Hour Trip Ends

3.2 Table 3.1 and Table 3.2 below show a summary of the 12-hour (07:00-19:00) trip generation and mode shares in the LTS zones covering the OKR OA, comparing with and without development. The following observations can be made:

- **Total trips increase by 14% with a slightly higher trip generation in the ‘Bus Capacity Upgrade’ scenario.**
- **Car trips increase by 6%, reflecting the low car ownership assumptions.**
- **Active modes show the biggest increases of between 16%-18% depending on the scenario.**
- **PT increases by 14.5% in the ‘Bus Capacity Upgrade’ compared to 12.5% in the ‘Reference Case’ development scenario, highlighting the impact of the improved bus network on PT trip making in the corridor.**

Table 3.1: 2031 12 Hour Trip Generation from LTS

Scenario	Car	PT	Active	All
Base Minus	38,611	139,377	106,782	284,770
With OKR Development Reference Case	40,849	156,813	126,013	323,675
Absolute Change (‘With OKR Ref Case’ – BM)	2,238	17,436	19,231	38,905
% Change (‘With OKR Ref Case’/BM)	5.8%	12.5%	18.0%	13.7%
With OKR Development Bus Capacity Upgrade	40,862	159,713	123,924	324,499
Absolute Change (‘With OKR Bus Upgrade’ – BM)	2,251	20,336	17,142	39,730
% Change (‘With OKR Bus Upgrade’/BM)	5.8%	14.6%	16.1%	14.0%

Table 3.2: 2031 12 Hour Mode Shares from LTS

Scenario	Car	PT	Active
Base Minus	13.6%	48.9%	37.5%
With OKR Reference Case	12.6%	48.4%	38.9%
With OKR Development and Bus Capacity Upgrade	12.6%	49.2%	38.2%
% Change (‘With OKR Ref Case’-BM)	-0.9%	-0.5%	1.4%
% Change (‘With OKR Bus Upgrade’-BM)	-1.0%	0.3%	0.7%

AM Peak Hour Trip Rates

- 3.3 The assessment of public transport bus capacity is focused on the AM Peak period. Therefore, before assigning the matrices to the Railplan models, checks were carried out on the trip generation in the AM Peak.
- 3.4 Following the conversion of the LTS trips into the AM Peak Railplan demand, outputs were processed to provide AM Peak Hour trip generation for all modes. These were compared against analysis of the TRICS database by the TfL Buses team (choosing reference sites that are directly comparable to those being delivered in OKR).
- 3.5 The results, of this analysis is shown in Table 3.3 and Table 3.4 below. Table 3.3 shows the two-way trips across all land use types (households, retail, and employment) and Table 3.4 a comparison of the household trip rates.
- 3.6 The overall trip generation is slightly lower in the AM peak than forecast by TRICS, however given long term trend in reduced trip rates in London (prior to COVID-19 pandemic) these results are within a reasonable range.

Table 3.3: AM Peak Hour Trip Generation Comparing Local Transport Assessments with LTS

Scenario	Car Person Trips	Public Transport Trips	Active Trips	Total Trips
Reference Case	595	3,869	3,624	8,088
Bus Capacity Upgrade	587	4,158	3,392	8,138

Table 3.4: AM Peak Hour Household Trip Rates

Scenario	Trip Rate
Modelled Household Trip Rates	
Reference Case	0.650
Bus Capacity Upgrade	0.654
TRICS Trip Rates	
TRICS Low	0.661
TRICS High	0.673

- 3.7 The mode shares of the development trips were also analysed. Table 3.4 shows the mode shares for residential developments, all development trips (e.g., including employment and business purposes) and the mode share for the whole opportunity area including non-development trips.

Table 3.5: AM Peak Hour Mode Share Assumptions Following LTS Run

Mode Share	Reference Case Scenario			Bus Capacity Upgrade Scenario		
	HH Dev Trips	All Dev Trips	All Trips Dev Zone	HH Dev Trips	All Dev Trips	All Trips Dev Zone
PT Mode Share	50.2%	47.8%	47.7%	53.3%	51.1%	49.2%
Car Mode Share	5.0%	7.4%	11.6%	5.0%	7.2%	11.5%
Active Mode Share	44.8%	44.8%	40.7%	41.7%	41.7%	39.3%

3.8 While highway trip generation is low in comparison with the rest of the zone, it is higher than the AAP’s aspirations in minimising highway mode shares. Therefore, following discussions with LBS and TfL, and reviewing transport assessments along the corridor, it was decided to limit the highway mode share to 3% across all development trip types, with additional car person trips switched to PT before updating and running the Railplan model.

3.9 Following these updates, the final peak hour development trip generation assumptions are shown in Table 3.6

Table 3.6: AM Peak Hour Trip Generation Following 3% Highway Mode Share Assumptions

Scenario	Car Person Trips	Public Transport Trips	Active Trips	Total Trips
Reference Case	243	4,222	3,624	8,088
Bus Capacity Upgrade	244	4,502	3,392	8,138

4 Impact on the Public Transport Network

Overview

4.1 Following the LTS model runs, the Railplan assignment model has been updated and run for the three scenarios. While Railplan has been used to assess the network wide impacts, the outputs from the model have been processed in Excel to provide a more detailed assessment of capacity issues on the OKR corridor. The corridor model uses observed bus count data provided by TfL in combination with model outputs to make this assessment.

4.2 The chapter is structured as follows:

- **Railplan Updates** provides a summary of the process applied to update Railplan to reflect the different scenarios
- **Network Impacts** describes the results in the Railplan model showing the wider impacts of the development trips and new bus network.
- **Corridor Impacts** describes the impacts on the OKR corridor including any capacity issues.
- **Summary** brings the analysis together and provides a conclusion on the impacts on the bus network.

Railplan Updates

Demand Updates

4.3 Following the LTS runs, the demand matrices are converted into Railplan using an existing TfL process which includes the following:

- Disaggregation to the more detailed Railplan zoning system from the less detailed LTS zoning system
- Adjustments to 'pivot' off the Railplan calibrated matrices

4.4 For the Base Minus scenario, these converted matrices are used directly in the updated model runs. For the 'with development' scenarios, additional processing was undertaken as follows:

- Increase PT totals to reflect the highway 3% mode share assumption
- Ensure all additional trips in the 'with development' scenario from the base minus are loaded onto the development zones following the disaggregation from the LTS model (see Figure 4.1 below for zone locations).

4.5 The demand matrices were updated by calculating the adjusted zone origin and destination target totals for all zones of the development area based on the Household and Jobs proportions of growth in the Railplan development zones, as shown in Table 4.1, Table 4.2 and Table 4.3 below.

Table 4.1: AM Peak Period Railplan Development Zone Base Minus Demand Development Zone Totals

Zone	Origin (trips)	Destination (trips)
1214	975	814
1242	1,559	2,127
1246	1,112	1,502
Total	3,784	3,739

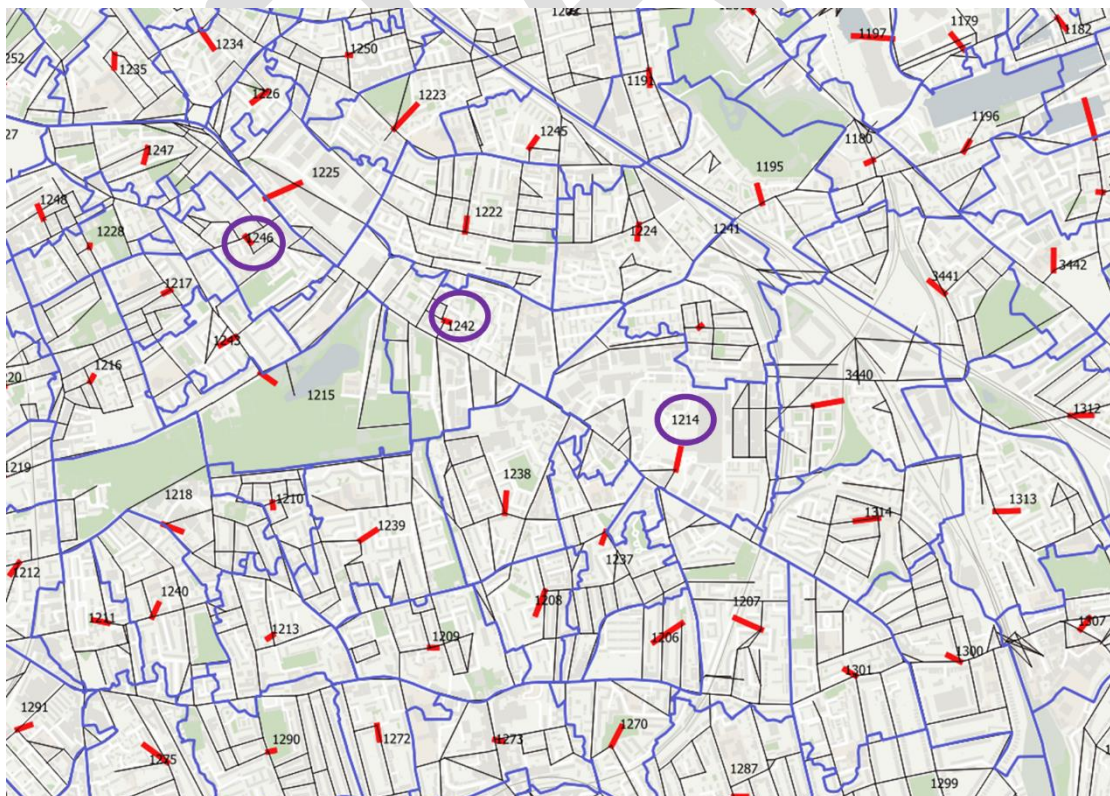
Table 4.2: Railplan Development Zone ‘With Development Reference Case’ Demand Development Zone Totals

Zone	Origin (trips)	Destination (trips)
1214	4,052	2,715
1242	4,383	3,309
1246	1,177	1,502
Total	9,612	7,526

Table 4.3: Railplan Development Zone ‘With Development Bus Capacity Upgrades’ Demand Development Zone Totals

Zone	Origin (trips)	Destination (trips)
1214	4,213	2,892
1242	4,531	3,420
1246	1,180	1,502
Total	9,924	7,814

Figure 4.1: Railplan Development Zone Locations



Network Updates

4.6 The public transport network was updated following the same approach as described in the LTS section above.

Network Impacts

4.7 Figure 4.2 and Figure 4.3 on the following pages show the change in passenger flows on the wider transport network and bus network in the OKR area, comparing the 2031 OKR development scenarios with the Base Minus. Figure 4.2 shows the 'Reference Case' scenario and Figure 4.3 the 'Bus Upgrade' Scenario.

4.8 The key observations from the 'Reference Case' scenario comparison are as follows:

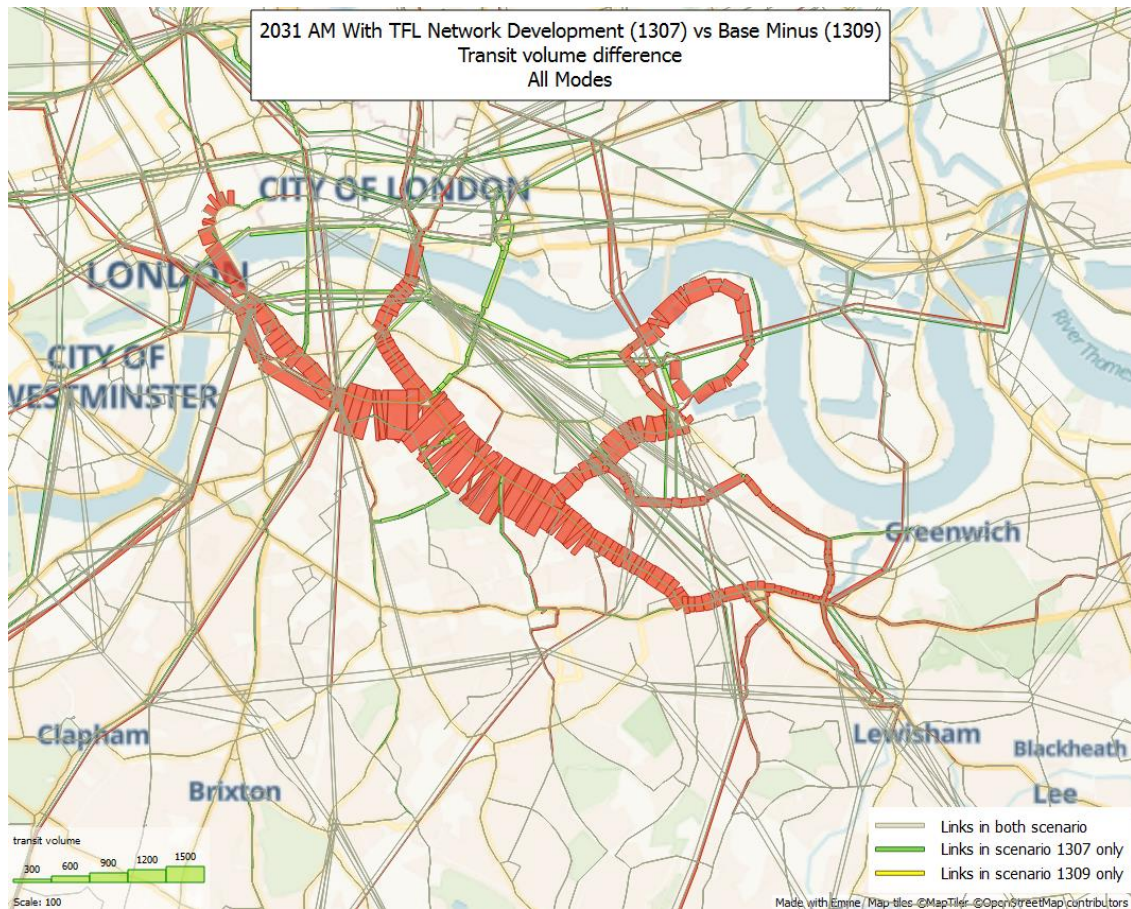
- The most significant passenger demand flow from the OA heads westbound along OKR, towards Elephant and Castle.
- There is significant interchange at Elephant and Castle, particularly onto the Bakerloo Line.
- A significant proportion of the demand using the OKR corridor heads eastbound towards New Cross.
- There is evidence of diversion away from the corridor, onto parallel bus corridors such as Peckham Road.

4.9 The 'Bus Upgrade' shows similar trip patterns, but the capacity upgrades have brought additional passenger demand onto those routes, especially on OKR. This is reflected in reductions in some parallel routes including rail lines into London Bridge as non-OA passengers switch to use the OKR corridor.

Figure 4.2: Difference in transit volumes, where red bars show an increase from Base Minus to Reference Case Development



Figure 4.3: Difference in transit volumes, where red bars show an increase from Base Minus to the TfL Network Development

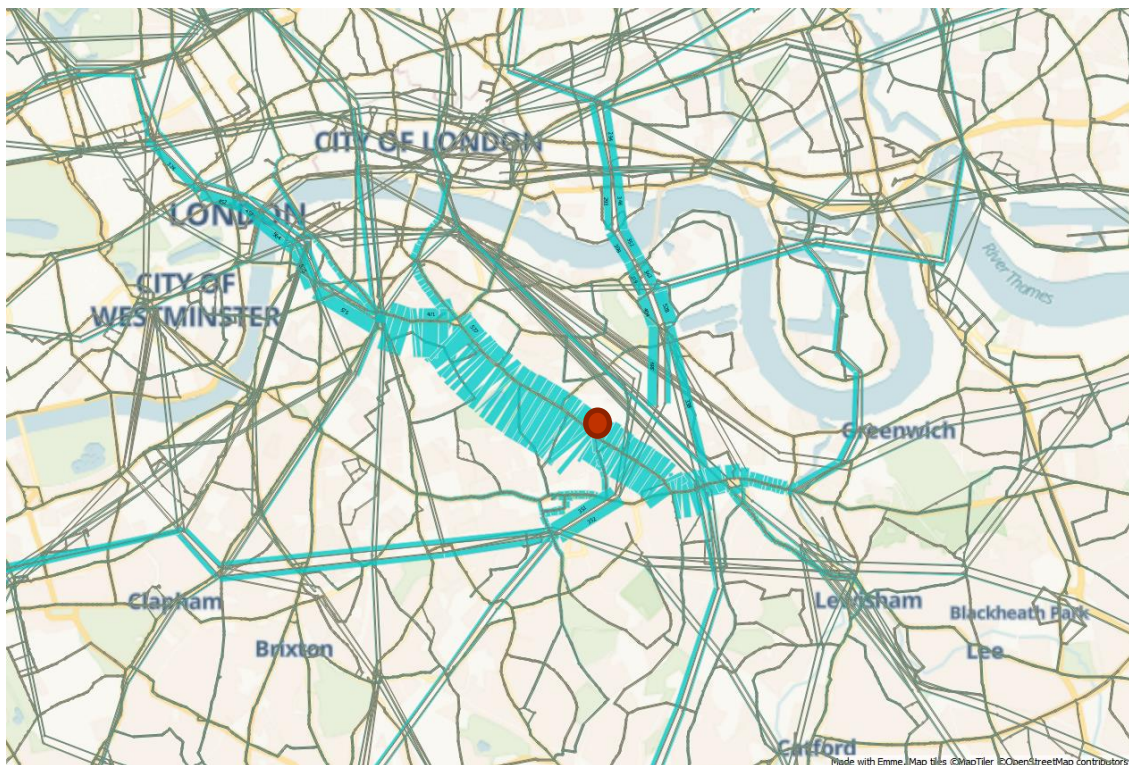


Development distribution

4.10 For the reference case development scenario, a Select Link Analysis (SLA) was performed on the Railplan zone with the highest development trips. As shown in Figure 4.4 (red dot marks development zone selected), the distribution of the transit volumes originating from the development area aligns with the key observations mentioned in paragraph 4.7 as follows:

- The majority of demand is to/ from Central London, particularly using the Bakerloo Line form Elephant and Castle.
- A significant segment of demand uses the London Overground via Canada Water to North of the river.
- A notable proportion goes towards Canary Wharf via DLR or Jubilee Line.

Figure 4.4: Select Link Analysis showing 'with Development reference case' distribution of transit volumes



Rail Crowding

4.11 In addition to the bus crowding, we have assessed crowding on the rail and tube lines using the Railplan model. Figure 4.5 shows the crowding levels in the Base Minus Scenario (the crowding plot is identical for the 'with development' Scenarios) with the following observations:

- There are no lines whose crowding is significantly impacted by the OKR developments, apart from a small increase in crowding on the Bakerloo Line between E&C and Waterloo in the development scenarios.
- The Northern Line Northbound at E&C is severely overcrowded in Base Minus. Increases at E&C and Borough will make this bad situation worse.
- There are no crowding issues on the Bakerloo Line at E&C (the first stop on the line into Central London).
- While there is additional PT demand in the 'Bus Upgrade', this is at a level where impacts on crowding on Rail/ London Underground is negligible given the level of demand on these services and the distance the stations are from the development.

Figure 4.5: Crowding bands for Rail and Tube (identical for the two scenarios)

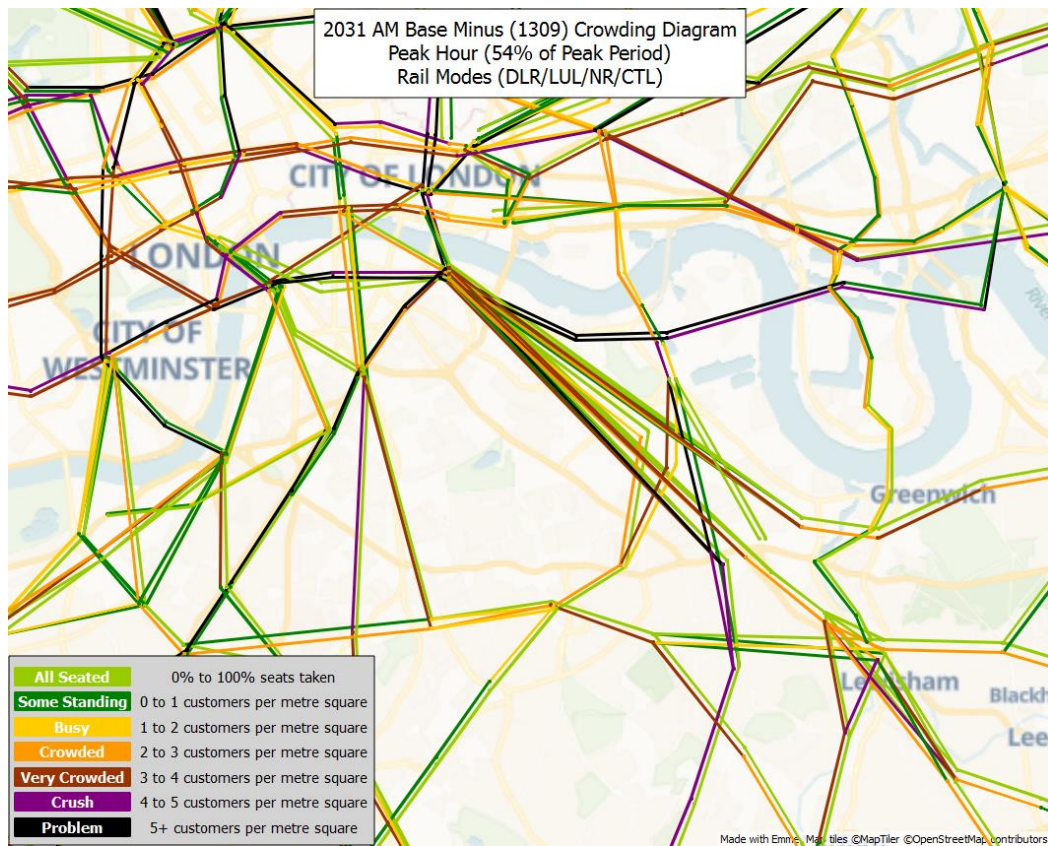
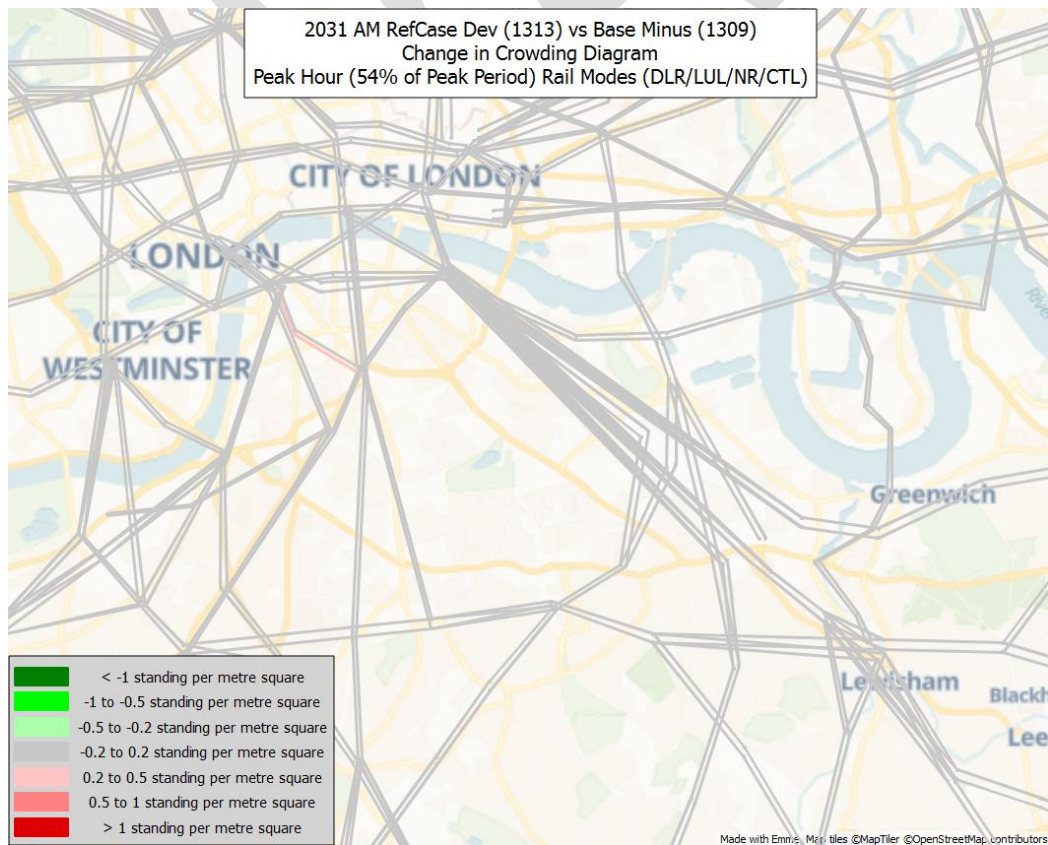


Figure 4.6: Change in crowding from Base Minus to AM 'with Development Reference Case' (identical for TfL Network Development comparison)



Corridor Model

- 4.12 To provide a more detailed assessment of the impact of the developments on Old Kent Road, a corridor model has been developed using outputs from Railplan in conjunction with observed bus passenger data. The assessment has focused on the section of bus routes along the Old Kent Road, to the west of the OA area, to assess capacity passing through Bricklayers Arms: this is likely to be section with the most significant capacity issues as a result of the development.
- 4.13 Table 4.4 below summarises the routes analysed. The routes have been combined based on their origin/destination to the West of OKR, with analysis focused on routes to/from Elephant and Castle, Borough and Tower Bridge.
- 4.14 In addition, a more detailed breakdown is provided for routes to/from Elephant and Castle, depending on whether they travel the full length of the road (full), terminate at Tesco (Tesco), or travel part of OKR leaving/entering the corridor at Trafalgar Ave.
- 4.15 The table also shows bus capacity assumed and route frequencies (based on actual 2019 frequencies) when assessing the corridor capacity. The Planning Capacity used is based on the assumptions provided by TfL through the BUSTO data. The actual vehicle capacity is higher at 87 passengers, so this provides a conservative assessment of capacity.
- 4.16 Using the observed bus frequencies for this more detailed corridor analysis rather than those in the Railplan model ensures that the capacity assessment is based on the actual frequencies observed on OKR, allowing for a more accurate assessment against current capacity. Bus frequencies in the model were checked to ensure they are broadly in line with actual frequencies so that the modelled corridor flows provide an appropriately accurate estimate of frequencies for the purpose of this strategic study.

Table 4.4: Key Bus Routes on Old Kent Road Corridor

Bus Route	Planning Capacity (Passengers Per Bus)	Scheduled (Buses Per Hour)	To / From
21	70	9	Borough
42	70	5	Tower Bridge
53	70	7.5	E&C Full
63	70	10	E&C Partial
168	70	8.5	E&C Tesco
172	70	6	E&C Full
363	70	7.5	E&C Partial
415	70	5	E&C Tesco
453	70	14	E&C Full

- 4.17 Table 4.5 and Table 4.6 below show the corridor capacity calculated based on the frequencies and planning capacities. Please note the capacity for all scenario is assessed against the 2019 bus frequencies, even in the scenario with demand generated from the 'Bus Upgrade' scenario. This is to assess the gap between forecast demand and the current situation (the extra capacity has been included in the LTS and Railplan model runs).

Table 4.5: OKR Corridor Capacity Assumptions

Origin/ Destination	Frequency (Buses per Hour)	Corridor Design Capacity
Elephant and Castle	59	4,095
Borough	9	630
Tower Bridge	5	350
Combined	73	5,075

Table 4.6: OKR Elephant and Castle Routes Detailed Capacity Assumptions

Bus Route Groupings	Frequency (Buses per Hour)	Corridor Design Capacity
Through OKR	28	1,925
Partial OKR	18	1,225
OKR Tesco	14	945

4.18 In producing the forecasts, Railplan outputs are pivoted off the observed 2019 data to ensure that the corridor flows reflected current (pre-COVID19) conditions. The observed data was provided by TfL using BUSTO data for the peak AM hour. The following assumptions were made when producing the corridor forecasts:

- The Railplan base year is 2016, but we have assumed that bus patronage on the corridor between 2016 and 2019 in the AM peak on Old Kent Road is steady. While bus trends in London have shown a reduction in demand our understanding is that flows on OKR have not reduced (pre-COVID).
- 2016 Railplan flows at key locations are subtracted from the 2031 Base Minus Railplan bus link flows. The resulting flow is added onto the observed 2019 base year passenger counts, to provide the background growth.
- 2031 base minus flows are subtracted from the 2031 development scenario link flows and the resulting flow is added onto the Base Minus corridor forecasts, to provide the impact of the developments on the OKR corridor.

Peak Period Core Assessments

4.19 Table 4.6 and Table 4.7 below show the forecast passenger flows for the different corridor segments for 2019 observed data and the future 2031 scenario for the average peak hour period (07:00-10:00). Figure 4.7 summarises the forecast % growth from the base year with the following observed:

- Overall background growth (excluding the OKR development demand) is 8% overall, with the Eastbound direction showing significantly higher growth at 20% compared to 5% in the Westbound direction. This fits with GLA plans for growth areas in the East and Southeast of London. Percentage growth is therefore higher in this direction, which has more spare capacity.
- The OKR development causes significantly higher growth rates in the corridor with increases of 23% overall in the Reference Case network scenario and 44% in the Bus Upgrade scenario.

4.20 When assessing the forecast background growth, recent trends in London have shown reductions in bus patronage, meaning that the forecasts in this study are likely to be a worst case scenario, in terms of capacity impacts. The following trend analysis has shown:

- A year on year reduction in bus journeys since 2014/15, with a 7% reduction in passenger KMs between 2014/15 and 2018/19¹.
- TfL analysis of COVID impacts showing a significant reduction in bus patronage in central London².

Figure 4.7: Corridor Growth 2019 to 2031

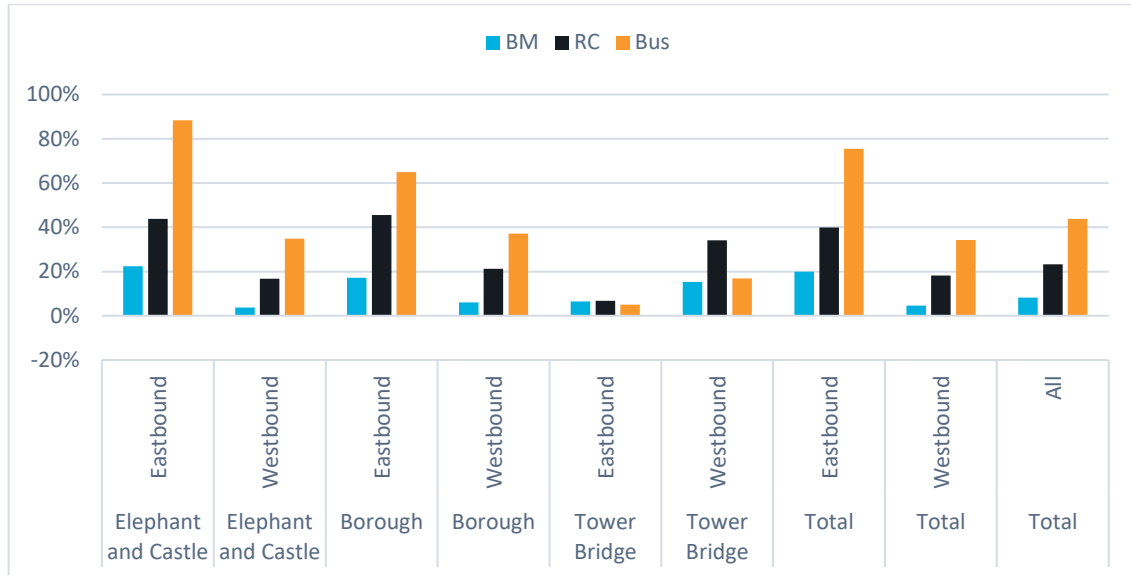


Table 4.7: AM Peak Period Average Hour (07:00-10:00) Passenger Flows

Origin/ Destination	Direction	Corridor Design Capacity	2019 (Observed Data)	Base Minus	With Dev Ref Case	With Dev Bus Upgrade
Elephant and Castle	Eastbound	4,095	965	1,182	1,388	1,818
Elephant and Castle	Westbound	4,095	3,550	3,683	4,144	4,786
Borough	Eastbound	630	203	238	296	335
Borough	Westbound	630	545	578	660	747
Tower Bridge	Eastbound	350	145	154	155	152
Tower Bridge	Westbound	350	219	252	293	256
Combined	Eastbound	5,075	1,314	1,575	1,838	2,305
Combined	Westbound	5,075	4,313	4,512	5,097	5,789

Table 4.8: AM Peak Period Average Hour (07:00-10:00) Passenger Flows– Elephant and Castle Detail

Origin/ Destination	Direction	Corridor Design Capacity	2019 (Observed Data)	Base Minus	With Dev Ref Case	With Dev Bus Upgrade
Through OKR	Eastbound	1,925	548	664	861	1,120

¹ London Travel Report, Transport for London, 2019

² Central London Bus Network Capacities Report, January 2022

Through OKR	Westbound	1,925	1,853	1,946	2,201	2,572
Partial OKR	Eastbound	1,225	289	355	356	345
Partial OKR	Westbound	1,225	1,134	1,164	1,241	1,089
OKR Tesco	Eastbound	945	128	163	170	353
OKR Tesco	Westbound	945	564	573	702	1,125

4.21 We have carried out an assessment of future passenger flows against network capacity. Figure 4.8 (by corridor) and Figure 4.9 (detailed E&C breakdown) below show a ‘spare capacity’ assessment with a negative percentage indicating that there is not enough capacity for the forecasted number of passengers. Table 4.9 and Table 4.10 below provide an assessment of volume over capacity (less than 100% means more passengers than capacity): where the link is over capacity, a summary of the additional buses required to meet the demand is provided. Additional buses are calculated by dividing the numbers of passengers exceeding the capacity divided by the planning capacity.

4.22 The following is observed from the results:

- **Westbound buses towards Elephant and Castle and Borough are over capacity in both development scenarios. All other directions and corridors have sufficient capacity.**
- Looking in more detail at the Elephant and Castle routes, the **routes travelling the full length OKR have the worst capacity issues**, with Base Minus slightly over capacity (17% reference case and 29% bus upgrade). The routes which use Trafalgar Ave are also over capacity in the reference case scenario.
- In terms of additional buses required to meet the demand:
 - **In the Reference Case development scenario, 1 additional bus towards E&C in total, but 4 additional buses for the OKR through routes (with spare capacity on the Tesco Routes potentially available to mitigate this either through extension or rerouting). 1 additional bus would be required on the Borough Route.**
 - **In the ‘Bus Upgrade’ development scenario, 10 additional buses towards E&C in total and 2 additional buses would be required on the Borough Route.**
 - **In all scenarios tested the increase in buses required is significantly less than the additional 40 buses tested in the ‘bus upgrade’ scenario.**

Figure 4.8: AM Peak Period Average Hour (07:00-10:00) Spare Capacity Assessment – Summary

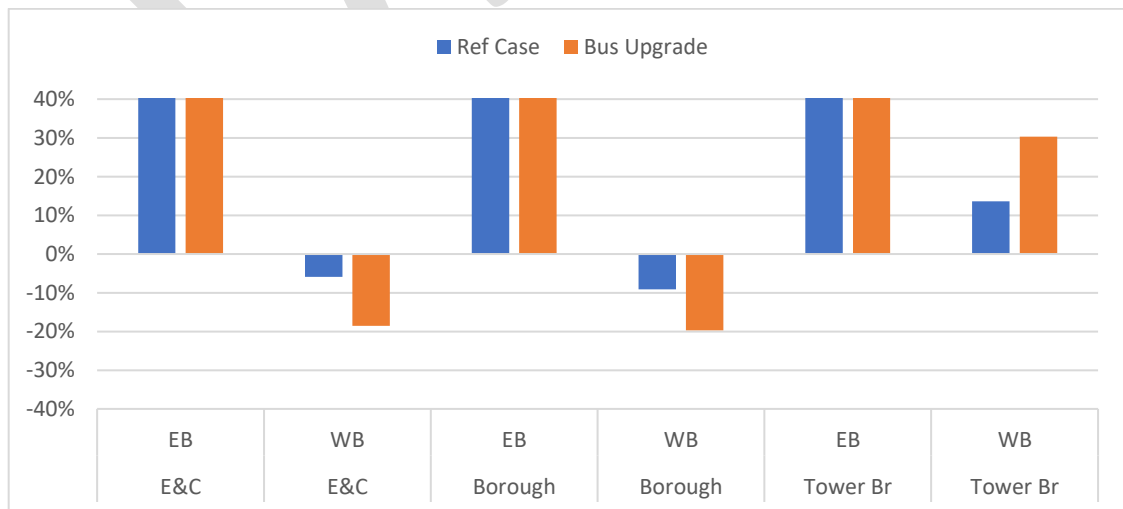


Figure 4.9: AM Peak Period Average Hour (07:00-10:00) Spare Capacity Assessment – E&C Detail

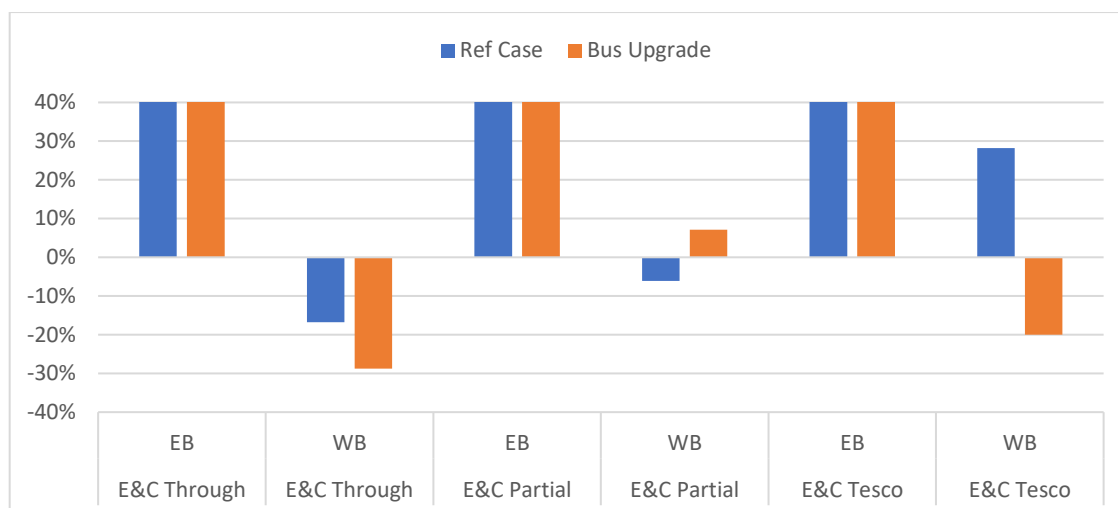


Table 4.9: AM Peak Period Average Hour (07:00-10:00) Capacity Assessment

Origin/ Destination	Direction	Volume over Capacity				Extra Buses Required			
		2019	BM	Dev RC	Dev Bus	2019	BM	Dev RC	Dev Bus
Elephant and Castle	Eastbound	424%	346%	295%	225%				
Elephant and Castle	Westbound	115%	111%	99%	86%			0.70	9.87
Borough	Eastbound	310%	264%	213%	188%				
Borough	Westbound	116%	109%	95%	84%			0.43	1.67
Tower Bridge	Eastbound	242%	227%	226%	230%				
Tower Bridge	Westbound	160%	139%	119%	137%				
Combined	Eastbound	386%	322%	276%	220%				
Combined	Westbound	118%	112%	100%	88%			0.32	10.20

Table 4.10: AM Peak Period Average Hour (07:00-10:00) Capacity Assessment - Elephant and Castle Detail

Origin/ Destination	Direction	Volume over Capacity				Extra Buses Required			
		2019	BM	Dev RC	Dev Bus	2019	BM	Dev RC	Dev Bus
Through	Eastbound	351%	290%	224%	172%				
Through	Westbound	104%	99%	87%	75%		0.30	3.95	9.25
Partial	Eastbound	424%	345%	344%	355%				
Partial	Westbound	108%	105%	99%	113%			0.24	
Tesco	Eastbound	739%	580%	556%	268%				
Tesco	Westbound	168%	165%	135%	84%				2.57

Peak Hour Assessment

4.23 In addition to the average hour assessment, the peak hour conditions have also been assessed. This provides an assessment of the capacity constraint during the busiest part of the peak providing the ‘worst’ hour in terms of capacity constraint. This has been carried out converting the three hour modelled flows into the peak using a factor of 0.35, with the following results (also shown in Table 4.11 to Table 4.14 below):

- In the Reference Case development scenario, 4 additional buses towards E&C in total, but 6 additional buses for the OKR through routes (with spare capacity on the Tesco Routes potentially available to mitigate this either through extension or rerouting). 1 additional bus would be required on the Borough Route.
- In the ‘Bus Upgrade’ development scenario, 14 additional buses towards E&C in total and 3 additional buses would be required on the Borough Route. As this assessment looks at the worst case, using these figures to inform the future planning of bus services would result in a reduced peak hour crowding but would require additional resources.

Table 4.11: AM Peak Hour Passenger Flows

Origin/ Destination	Direction	Corridor Design Capacity	2019 (Observed Data)	Base Minus	With Dev Ref Case	With Dev Bus Upgrade
Elephant and Castle	Eastbound	4,095	1,014	1,242	1,458	1,910
Elephant and Castle	Westbound	4,095	3,729	3,868	4,353	5,027
Borough	Eastbound	630	214	250	311	352
Borough	Westbound	630	572	607	693	785
Tower Bridge	Eastbound	350	152	162	163	160
Tower Bridge	Westbound	350	230	265	308	269
Combined	Eastbound	5,075	1,380	1,654	1,931	2,422
Combined	Westbound	5,075	4,531	4,740	5,355	6,081

Table 4.12: AM Peak Hour Passenger Flows– Elephant and Castle Detail

Origin/ Destination	Direction	Corridor Design Capacity	2019 (Observed Data)	Base Minus	With Dev Ref Case	With Dev Bus Upgrade
Through	Eastbound	1,925	576	697	905	1,177
Through	Westbound	1,925	1,946	2,045	2,312	2,702
Partial	Eastbound	1,225	304	373	374	362
Partial	Westbound	1,225	1,191	1,222	1,304	1,144
Tesco	Eastbound	945	134	171	179	370
Tesco	Westbound	945	592	602	737	1,182

Table 4.13: AM Peak Hour Capacity Assessment

Origin/ Destination	Direction	Volume over Capacity				Extra Buses Required			
		2019	BM	Dev RC	Dev Bus	2019	BM	Dev RC	Dev Bus
Elephant and Castle	Eastbound	404%	330%	281%	214%				
Elephant and Castle	Westbound	110%	106%	94%	81%			3.69	13.32
Borough	Eastbound	295%	252%	203%	179%				
Borough	Westbound	110%	104%	91%	80%			0.90	2.21
Tower Bridge	Eastbound	230%	216%	215%	219%				
Tower Bridge	Westbound	152%	132%	114%	130%				
Combined	Eastbound	368%	307%	263%	210%				
Combined	Westbound	112%	107%	95%	83%			3.99	14.37

Table 4.14: AM Peak Period Average Hour Capacity Assessment - Elephant and Castle Detail

Origin/ Destination	Direction	Volume over Capacity				Extra Buses Required			
		2019	BM	Dev RC	Dev Bus	2019	BM	Dev RC	Dev Bus
Through	Eastbound	334%	276%	213%	164%				
Through	Westbound	99%	94%	83%	71%	0.30	1.71	5.53	11.10
Partial	Eastbound	403%	328%	327%	338%				
Partial	Westbound	103%	100%	94%	107%			1.13	
Tesco	Eastbound	703%	552%	529%	255%				
Tesco	Westbound	160%	157%	128%	80%				3.38

Diversion Impacts

4.24 To assess the diversion impacts caused by the development growth (i.e., existing passengers who use the OKR bus corridor switching to alternative routes), we analysed the additional bus passengers on all routes in and out of the OA in the development scenario. This analysis was carried out across the three-hour peak period The following bus flows were identified:

- OKR West of OA developments
- OKR East of OA developments
- Trafalgar Ave
- Dunton Rd

4.25 Bus flows were compared to PT trips generated by the development, with the gap between the two assumed to be a result of diversion. In reality, some PT development trips will walk to a train station such as South Bermondsey, but for the purpose of this exercise we have assumed all users will take a local bus. The following is observed:

- **In the Reference Case Scenario there is an increase of approximately 3000 passengers leaving the OA, compared to 6000 being generated by the development. This would indicate that around 3000 passengers over the three-hour period change route, away from the area.**

- **In the Bus Upgrade Scenario there are an additional 7,200 passengers leaving the OA, compared to a 6,300 increase in passengers showing around 1000 existing PT passengers switch to travelling through the OA as a result of the new bus capacity.**

Table 4.15: AM Peak Period (07:00-10:00) Change in Bus Passenger (Development Ref Case Scenario – Base Minus)

Demand Type	Development Demand	Additional Bus Demand on Network	Difference (Development - Network)	% of new demand on bus	% of missing new demand on bus
From OA	5,966	2,946	3,020	49%	51%
To OA	3,084	2,513	571	81%	19%
Total	9,049	5,458	3,591	60%	40%

Table 4.16: AM Peak Period (07:00-10:00) Change in Bus Passenger (Development Bus Upgrade Scenario – Base Minus)

Demand Type	Development Demand	Additional Bus Demand	Other Demand (Including Diversion)	% of new demand on bus	% of missing new demand on bus
From OA	6,278	7,243	-966	115%	-15%
To OA	3,371	7,280	-3,909	216%	-116%
Total	9,649	14,523	-4,874	151%	-51%

- 4.26 Following on from this analysis, an assessment of the impact on corridor capacity assuming no diversion away from the corridor has also been carried out (using factors derived from the analysis above). It should be noted that some diversion away from the corridor is reasonable as a segment of the corridor demand will have an alternative that is similar in journey costs (perceived journey times) to using OKR. In addition the diversion assumptions are based on all PT development trips taking a local bus, where a proportion will walk further afield to access the PT network (i.e. South Bermondsey), which will result in an overestimation of passengers diverting away from the corridor. While there is some uncertainty around the level of diversion, this analysis, considered in conjunction with the previous two analyses described above, will help to identify the range of required bus capacity increases.
- 4.27 This assessment was done by factoring down the increases in passenger flows on the key bus routes, by deriving factors from the figures in Table 4.16 above. Table 4.17 below shows the forecast flows and additional buses required to meet these passenger flows.

Table 4.17: Old Kent Road Bus Passenger Flows Assuming No Diversion Away from the corridor

Origin/ Destination	Peak Hour Flow	Average Hour Flow	Extra Buses Required Peak Hour	Extra Buses Required Average Hour
Elephant and Castle	1,821	1,733		
Elephant and Castle	4,873	4,639	11.1	7.8
Borough	339	322		
Borough	761	725	1.9	1.4
Tower Bridge	160	152		
Tower Bridge	268	255		
Combined	2,319	2,208		
Combined	5,902	5,619	11.8	7.8

Summary

- 4.28 The analysis of bus passenger flows shows that the additional bus demand generated by the OKR development has the potential to cause capacity issues on the corridor, particularly on the routes towards Elephant and Castle. Any additional capacity is likely to be significantly lower than was tested in the Bus Upgrade Scenario, with the maximum increase from existing frequencies in the scenarios assessed less than 15 buses compared to 40 in the test.
- 4.29 In deriving a strategy to accommodate additional demand generated by the developments it should be noted:
- **The Base Minus forecasts increases in bus passenger demand, despite trend analysis showing bus demand in London is reducing. These trends should be monitored to ensure that the OKR bus network is not over specified.**
 - **Some diversion from the corridor will be to alternatives on the PT network which are only marginally different to using OKR, so seeking to replace all capacity taken up by the development may be an inefficient use of the transport network.**

5 Summary and Conclusions

Overview

- 5.1 To support the ongoing revision of the AAP, this Old Kent Road Bus Study is required to assess how the demand generated by the new developments will impact bus capacity in the Old Kent Road Opportunity Area (OKR OA) in advance of the delivery of the BLE. To make this assessment TfL's strategic transport models have been updated and rerun as follows:
- LTS demand model to forecast the trips generated by the developments including by mode and distribution (where they are travelling to or from).
 - Railplan public transport network model which provides a more detailed assessment of the routes people take through the public transport network; and
 - LoHAM highway transport network model which provides a more detailed assessment of the routes people take through the road network.

- 5.2 Three scenarios have been run, a without development scenario and two development scenarios, with different levels of bus frequencies on Old Kent Road as described in Table 5.1.

Table 5.1: Future Year Core Scenarios (LTS, Railplan and SOLHAM Model Runs)

ID	Scenario	Commentary
1	2031 Base Minus (without development)	2031 London Plan growth across the GLA, except with non-structural growth from the OA removed. Ensure that the other local developments outside the OKR OA are correctly included.
2	2031 With OKR Development Reference Case	The addition of the full level of development currently envisaged by 2031 into the OA.
3	2031 With OKR Development Bus Capacity Upgrade	Developments as above but with a hypothetical future upgrade in bus capacity proposed by TfL Buses.

- 5.3 The 2031 LTS reference case model was updated to reflect the latest local growth area plans, with the 'Base Minus' scenario having all growth related to the OA removed from the model. Table 5.2 summarises the headline assumptions for the development in the Old Kent Road OA used in the with development scenarios.

Table 5.2: Old Kent Road OA Development Assumptions

Development Type	Figures
Households	9,500
Population	22,895
Employment	5,000
Retail Jobs	1,268
Office Jobs	3,732
Parking (residential)	285
Car Ownership (residential)	3%

Trip Generation

- 5.4 Following the model runs, checks were carried out to ensure that the level of development trips forecast by the model was plausible. We compared the trip rates against those derived from the TRICS database. As seen in Table 5.3 below the modelled trip rates are broadly in line with this data.

Table 5.3: AM Peak Hour Household Trip Rates

Scenario	Trip Rate
Modelled Household Trip Rates	
Reference Case	0.650
Bus Capacity Upgrade	0.654
TRICS Trip Rates	
TRICS Low	0.661
TRICS High	0.673

- 5.5 While highway trip generation is low in comparison with the rest of the zone, it is higher than the AAP's aspirations in minimising highway mode shares. Therefore, following discussions with LBS and TfL, and reviewing transport assessments along the corridor, it was decided to limit the highway mode share to 3% across all development trip types, with additional car person trips switched to PT before updating and running the Railplan model.
- 5.6 Following these updates, the final peak hour development trip generation assumptions are shown in Table 3.6

Table 5.4: AM Peak Hour Trip Generation Following 3% Highway Mode Share Assumptions

Scenario	Car Person Trips	Public Transport Trips	Active Trips	Total Trips
Reference Case	243	4,222	3,624	8,088
Bus Capacity Upgrade	244	4,502	3,392	8,138

Bus Impacts

- 5.7 Following the trip generation stage the Railplan model was run to assess the wider network impacts on the PT network. Outputs from the model were then extracted and a detailed corridor assessment was carried out focusing on passenger flows to the East of Bricklayers Arms. This process used observed bus data provided by TfL to ensure the results pivoted off reliable data.
- 5.8 The analysis of bus passenger flows shows that the additional bus demand generated by the OKR development has the potential to cause capacity issues on the corridor, particularly on the route towards Elephant and Castle. Any additional capacity is likely to be significantly lower than was tested in the Bus Upgrade Scenario, with the following additional hourly bus frequencies required across the AM Peak Period (07:00-10:00) to meet the planning capacity requirements:
- **In the Reference Case development scenario, 1 additional bus towards E&C in total, but 4 additional buses for the OKR through routes (with spare capacity on the Tesco Routes**

potentially available to mitigate this either through extension or rerouting). 1 additional bus would be required on the Borough Route.

- In the 'Bus Upgrade' development scenario, 10 additional buses towards E&C in total and 2 additional buses would be required on the Borough Route.
- We have also applied adjustments to the outputs to forecast the impact on the bus corridor assuming no diversion to/ from the corridor. In this scenario 8 additional buses towards E&C in total and 2 additional buses would be required on the Borough Route.
- Any additional bus frequencies required, is likely to be less than modelled in the 'bus upgrade' scenario. Around 10 extra buses per hour likely to be the upper limit of what is required across the peak period, compared to 40 extra buses in the test.

5.9 In deriving a strategy to accommodate additional demand generated by the developments it should be noted:

- The Base Minus forecasts increases in bus passenger demand, despite trend analysis showing bus demand in London is reducing. These trends should be monitored to ensure that the OKR bus network is not over specified.
- Some diversion from the corridor will be to alternatives on the PT network which are only marginally different to using OKR, so seeking to replace all capacity taken up by the development may be an inefficient use of the transport network.

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