MOTT MACDONALD

Camberwell Station Reopening

Railplan Strategic Modelling

September 2017

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Contents

1 Introduction

The purpose of this study is to provide modelling evidence to ascertain the demand for rail services should Camberwell station be reopened. The station is expected to be opened in the mid-2020s assuming a case can be made for the scheme, funding is available and powers for construction and operation are granted.

Camberwell rail station served passengers in the Camberwell Green area from 1862 until 1916, where-after it remained open for goods use until it closed completely in 1964. Transport for London (TfL), along with key stakeholders Network Rail (NR) and London Borough of Southwark (LBS), have begun investigating the case for reopening the station to rail services.

The existing station location, which it is currently proposed would provide the site for a new station, is located south of Elephant & Castle and is currently on the through path for services via Denmark Hill and Loughborough Junction.

Figure 1: Camberwell Station Location

Source: Imagery ©2017 Google

This study investigates the impact of stopping combinations of Thameslink services that already run through the station site, and includes updated development assumptions for the surrounding area.

This study was undertaken using the latest version of TfL's strategic public transport modelling tool, Cube Railplan v7.1. The outputs of this stud focus on the three-hour AM peak period (07:00 – 10:00) and the six-hour inter-peak (IP) period (10:00 – 16:00). TfL's Demand Model, LTS, provided assignment matrices for Railplan reflecting changes in demand arising from land use and transport changes.

This report details the model development processes required to develop robust forecasts, and the subsequent results of the modelled scenarios. The outputs included in this report will provide key data in assessing the viability of the scheme and likely impacts on travel patterns in the immediate and wider areas.

Model tests for this study were undertaken in three distinct stages.

1. Initial forecasts were undertaken which tested the new station in the Railplan Public Transport Assignment model.
2. Revised forecasts were produced which included the specification of land use changes in the LTS demand model and subsequent incorporation of revised demand matrices.
3. A final stage of testing utilised the demand matrices from Stage 2 but also implemented various Forecasting Enhancements to produce the most accurate forecasts possible.

This note focusses on the inputs and outputs from Stage 3 of the modelling schedule as these are the tests that have been used to support the decision-making process.

Section 2 summarises a base year review process which has been undertaken to assess the suitability of model assumptions for testing this scheme. The review has considered the accuracy of network and service provision, and provides comparison to observed data.

Section 3 details the development of future year models to test station reopening scenarios, and includes assumptions regarding the station layout and Thameslink service patterns.

Section 4 outlines the LTS assumptions used to reflect assumed land use changes in the area surrounding Camberwell Station.

Section 5 details the forecasting enhancements implemented during the production of final Railplan outputs. These enhancements are intended to increase the accuracy and clarity of key metrics including travel time benefits, station usage and sub-mode choice.

Section 6 presents the outputs of the various test scenarios compared to do minimum scenarios. Outputs include travel time benefits, changes to assignment patterns across modes, and station activity.

Section 7 summarises the key conclusions of the study.

2 Base Year Review

To provide a robust basis upon which to extract model forecasts we have undertaken a review of the 2011 base year model in both the AM and IP periods. The review has concentrated on the area around the new station site, covering key model assumptions that will affect the performance of the new station; access, competing services, and comparison of modelled flows against observed data. The starting point for this assessment is the Cube Railplan v7.1 2011 base model A111rf04a. The processes detailed in this section do not comprise a WebTAG compliant model validation process, such an undertaking was out of scope of this project, but some key metrics where data was available have been investigated.

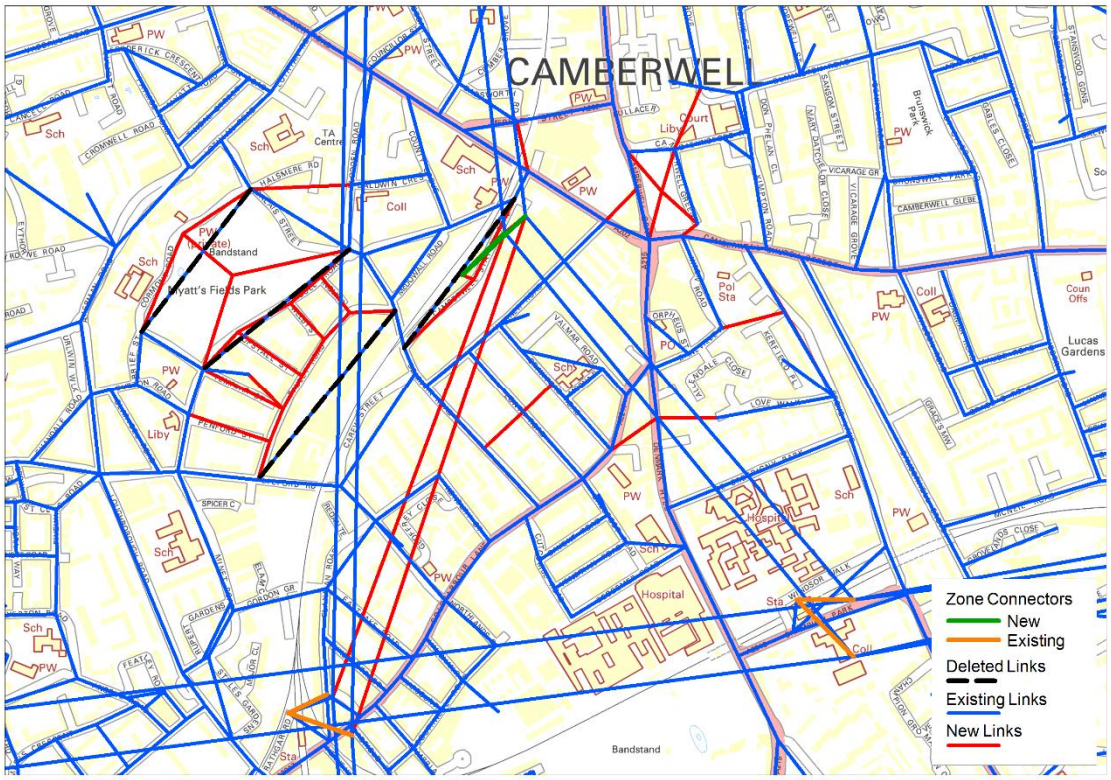
2.1 Review of Walk Network

The Railplan walk network provides access between demand zones and public transport stops. Ensuring the network is accurate is important in calculating route choice and ultimately generalised journey time.

We have undertaken a review of the model walk network in the vicinity of the station comparing to mapping and aerial imagery sourced from Google Maps[1]. Our review has highlighted a number of pedestrian routes that are not included in the standard Railplan model that we feel could be important in facilitating access to and egress from Camberwell station. These links, shown in Figure 2, have been coded into the model, with representative distances calculated using Google Maps. As a result of the additional network detail we have also reviewed and updated connector links between demand zones and the walk network.

[1] https://www.google.co.uk/maps accessed December 2016

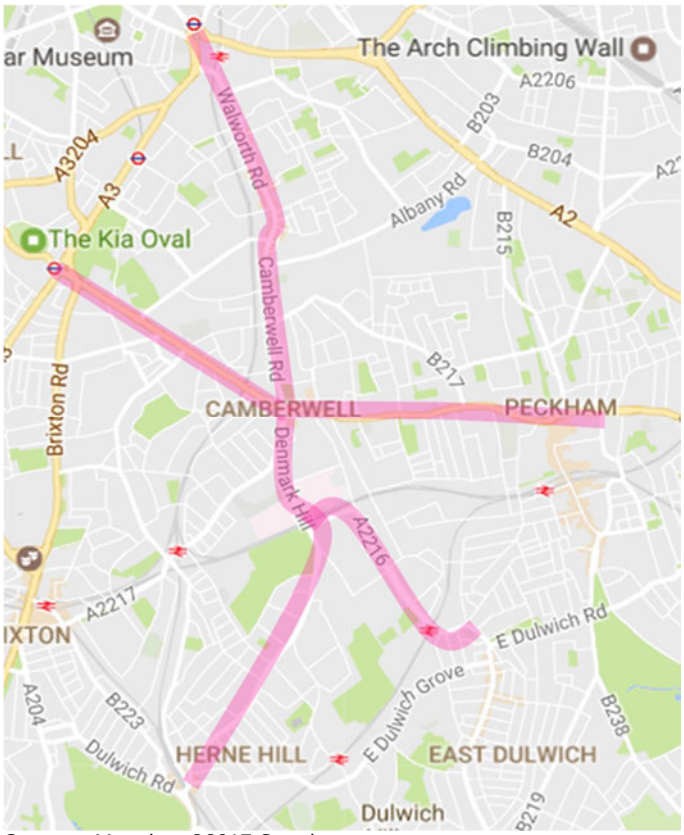
Figure 2: Walk Network Review – New Links



2.2 Review of Bus Service Provision

The Camberwell Green area is well served by bus routes to key destinations to the north, south, east and west including Elephant & Castle, Oval, Peckham, Dulwich and Herne Hill, and indicated in Figure 3. In order to be confident in the potential competition between rail and bus with a station operating we have reviewed the following key bus assumptions.

Figure 3: Camberwell Bus Corridors



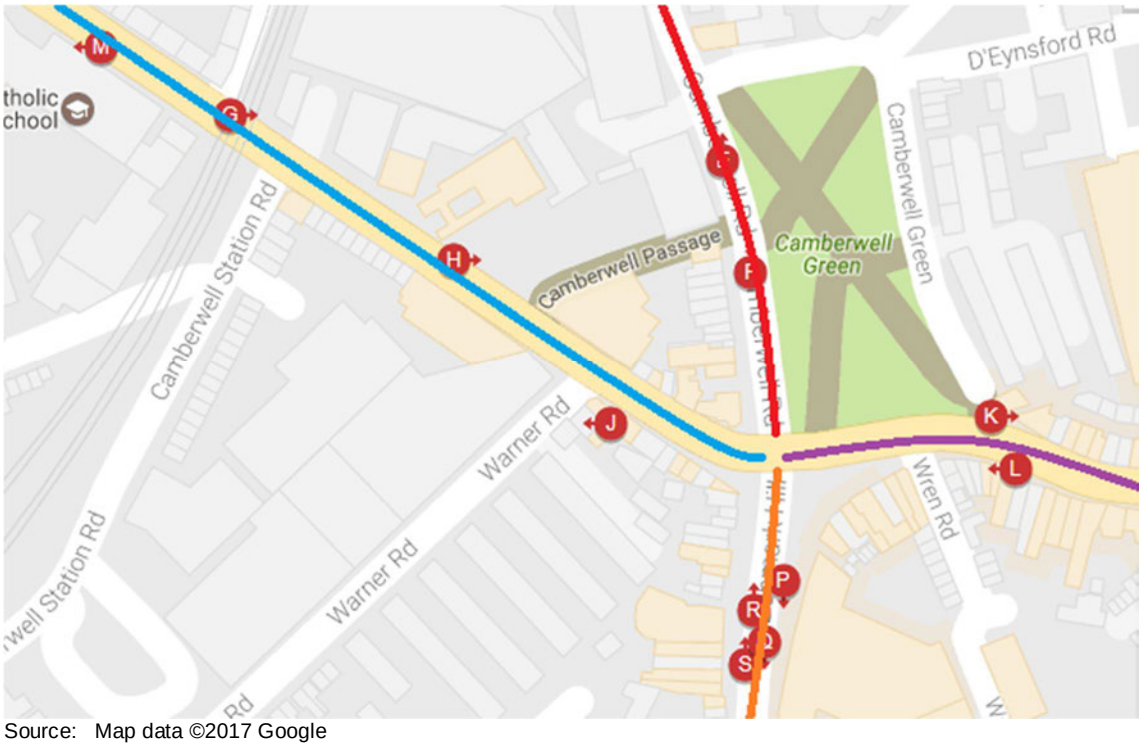
Source: Map data ©2017 Google

2.2.1 Bus Stop Locations

We have verified that bus stop locations in the model correspond to those on the ground at present; the model was found to be accurate according to data accessed on the TfL website[2], and we have not made any changes based on this review.

[2] https://tfl.gov.uk/modes/buses/ accessed December 2016

Figure 4: Camberwell Green Bus Stop Locations Verified



Source: Map data ©2017 Google

2.2.2 Corridor Frequency

We have reviewed the frequency of each bus service in the Camberwell Green area, comparing modelled assumptions to data on the TfL website. We have aggregated the various routes to a corridor level to ensure that service levels are accurate. No major issues were identified – small differences are apparent but reasonable for a strategic model and given the representative years of the two data sets (modelled data is 2011, observed data relates to 2017).

Table 1: Bus Corridor Frequency Comparison

	Route	Observed BPH (total of average per route) MP Period	AM Modelled BPH (total on link)	Observed BPH (total of average per route) IP Period	IP Modelled BPH (total on link)
A215 NB	To Camberwell Green	66.17	64.90	67.20	63.70
A215 SB	From Camberwell Green	59.90	66.70	62.78	63.70
A215 NB	From Camberwell Green	76.70	81.90	74.20	78.70
A215 SB	To Camberwell Green	74.27	83.20	76.20	78.70
A202 WB	To Camberwell Green	45.00	51.40	45.00	47.00
A202 EB	From Camberwell Green	40.50	51.10	43.00	47.00
A202 WB	From Camberwell Green	26.67	26.60	26.50	24.00
A202 EB	To Camberwell Green	23.50	26.60	24.50	24.00

2.2.3 Bus Speeds

Based on the corridors identified in Figure 3 we have also reviewed journey times between Camberwell Green and these key destinations, comparing modelled speeds to 2016 iBus data. This comparison, albeit between 2011 and 2016, highlighted that observed journey times were notably higher than those modelled. The findings are shown in Table 2 and have been addressed in the forecast models through the implementation of a bus speed adjustment (see Section 5.1).

Table 2: Observed and 2011 Modelled Bus Journey Times

Route	Direction	AM Observed Journey Time	AM 2011 Modelled Journey Time	IP Observed Journey Time	IP 2011 Modelled Journey Time
Camberwell Green - Elephant & Castle	(NB)	14.80	11.75	15.20	10.85
Elephant & Castle - Camberwell Green	(SB)	13.30	11.35	15.80	11.44
Camberwell Green - Oval	(WB)	10.70	8.52	7.90	6.22
Oval - Camberwell Green	(EB)	9.10	6.33	10.20	5.88
Camberwell Green - Peckham	(EB)	7.10	7.14	8.70	6.91
Peckham - Camberwell Green	(WB)	10.20	9.88	10.10	9.31
Camberwell Green - Herne Hill	(SB)	10.20	8.28	10.70	8.17
Herne Hill - Camberwell Green	(NB)	11.20	8.74	10.70	7.79
Camberwell Green - East Dulwich	(SB)	8.60	7.22	9.10	7.24
East Dulwich - Camberwell Green	(NB)	10.90	8.71	10.00	8.30

2.3 Review of Thameslink Modelled Flows

A review of the accuracy of passenger volumes on Thameslink services through Elephant & Castle (and the presently defunct Camberwell Station site) has been undertaken by comparing modelled flows to 2011 PIXC (Passengers In Excess of Capacity) counts provided by TfL. The results of the comparison, shown in Table 3, show that total flows through the Camberwell Station site are accurate in both directions and in both the AM and IP periods, and that there is a small imbalance between Catford and Wimbledon Loop services. The imbalance is not considered to be an issue for further modelling; although we are not validating the model to WebTAG criteria, if we were the most significant links in the northbound direction would fall within the acceptable variations set out in the guidance. As defined by the scope of this task, no changes were implemented to the model as a result of the findings.

Table 3: Thameslink Modelled Flows

		Up Direction Arrivals at E&C				Down Direction Departures from E&C			
		PIXC Cordon Count	Cube Railplan 2011 Base	Difference	% Difference	PIXC Cordon Count	Cube Railplan 2011 Base	Difference	% Difference
AM Peak Period	Catford Loop	10,963	9,317	-1,646	-18%	694	800	106	13%
	Wimbeldon Loop	8,046	8,888	842	9%	1,272	964	-308	-32%
	Total	**19,009**	**18,205**	**-804**	**-4%**	**1,966**	**1,764**	**-202**	**-11%**
Inter Peak Period	Catford Loop	1,575	1,423	-152	-11%	1,001	915	-86	-9%
	Wimbeldon Loop	1,844	1,802	-42	-2%	1,243	1,307	64	5%
	Total	**3,419**	**3,226**	**-193**	**-6%**	**2,244**	**2,222**	**-22**	**-1%**

3 Future Year Model Development

This section details the development of the future year models which have been used to test the various land use and transport scenarios for this study. This has included applying updates identified in the base year model review, adding in Camberwell Station and identifying and updating Thameslink service stopping patterns to use the new station.

3.1 Base Year Updates

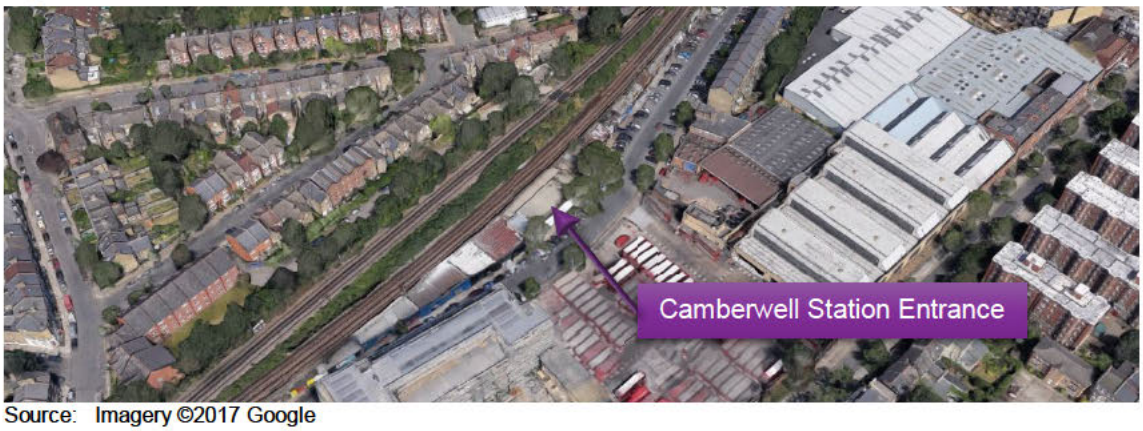
In order to forecast future demand patterns accurately we have applied our base year review findings to the future year model. In practice, this has involved the implementation of the walk network and zone connector updates detailed in Section 2.1.

It should be noted that bus journey time adjustments have been implemented – these are detailed in Section 5.1 of this report.

3.2 Camberwell Station Assumptions

Figure 5 shows the assumed station entrance location on Station Road. It is assumed this single entrance will provide access to an island platform at viaduct level offering access to northbound and southbound lines.

Figure 5: Camberwell Station Entrance Location



Source: Imagery ©2017 Google

We have assumed internal station distances in line with Railplan convention, accounting for:

- Distance from station entrance to mid-point of platform (noting that in lieu of detailed drawings and based on aerial imagery we are assuming that stairs/lifts to platform level will land at the mid-point)
- Time penalty for crossing ticket barriers
- Time penalty for vertical distance travelled by stairs

This results in a relatively short distance from station entrance to platform node of 60 metres, and a short interchange distance between northbound and southbound lines of 10 metres.

Platform nodes already exist in the future year reference case model so these have been utilised for this modelling (nodes 363251 and 362251 for northbound and southbound respectively).

In addition to adding the station nodes and links we have ensured all Thameslink services from Denmark Hill (Catford Loop) and Loughborough Junction (Wimbledon Loop) route via Camberwell, even if they do not stop there. This update has been applied in the no-station scenarios too – with no material impact – to allow clearer comparison plots. New rail links to facilitate this have been calculated on a pro-rata basis from existing coding and distances measured using Google Maps.

3.3 Thameslink Service Coding

3.3.1 Transport Scenario Specifications

Table 4 shows the specifications for the three transport scenarios that were modelled for Camberwell Station reopening, which differ in the morning and inter-peak time periods.

Table 4: Railplan Test Specifications

	AM Peak			Inter Peak			
Transport Scenario	Catford Loop <> Thameslink Core	Catford Loop <> Blackfriars	Wimbledon Loop <> Thameslink Core	Catford Loop <> Thameslink Core	Catford Loop <> Blackfriars	Wimbledon Loop <> Thameslink Core	**Rolling Stock**
1	4tph	-	-	2tph	2tph	-	**8 car**
2	4tph	-	2tph	2tph	2tph	2tph	**8 car**
3	4tph	-	2tph	2tph	2tph	2tph	**12 car**

3.3.2 Railplan Service Coding

TfL and Network Rail provided a detailed specification of the routes, stopping patterns and frequencies to serve the new Camberwell Station. Upon review of the existing model assumptions the intended services to call at the new station were not identifiable. Therefore, it was agreed with TfL that we would identify the most suitable existing modelled services to stop at the station based on the requirement to model the correct frequency and capacity on the correct lines (Catford and Wimbledon Loops) and with the correct provision through the Thameslink core. (See Appendix A.1).

Route start and end points, intermediate calling points and small capacity variations were not edited to match the detail provided in the specification in order to maintain consistency with the rest of the Thameslink assumptions in the model and therefore allow us to isolate changes between assignments to the impacts of the scheme only.

A two-minute time penalty has been assumed for the additional stop at Camberwell, evenly distributed on arrival and departure segments.

Scenario 3 calls for 12-car rolling stock; seated and total capacity has been calculated on a pro-rata basis from existing 8-car assumptions, then matched to a suitable existing vehicle specification in the model. It should be noted that Scenario 3 is not intended to represent a change from 8 to 12-car services and as such an equivalent do minimum scenario also with 12-car assumptions has been produced to act as the baseline for this test.

4 LTS Assumptions Summary

TfL's London Transportation Studies (LTS) 4-stage demand model is used to determine the public transport demand assigned in Railplan. This study has defined several different LTS scenarios with varying levels of population/households and number of jobs. This section outlines LTS scenarios tested and resultant demand used in Railplan assignments. Three land use scenarios have been defined (A, B, C) in conjunction with London Borough of Southwark, and each has been run in a with and without station LTS test; the with station scenario always assuming Transport Scenario 2 for consistency and is assumed to unlock 10% more development potential than without a station.

4.1 LTS Specifications

LTS tests allow the specification of various socio-economic demand driver assumptions. For this study we have specified a net change in households (and therefore population) and jobs on the 2031 Committed (excluding HS2) Reference Case, with quantums and locations supplied by London Borough Southwark to represent assumed land use development in the area. The majority of land use change is not dependent on the station re-opening, though an additional 10% potential is assumed to be unlocked by the station. All other assumptions remain unchanged from the reference case.

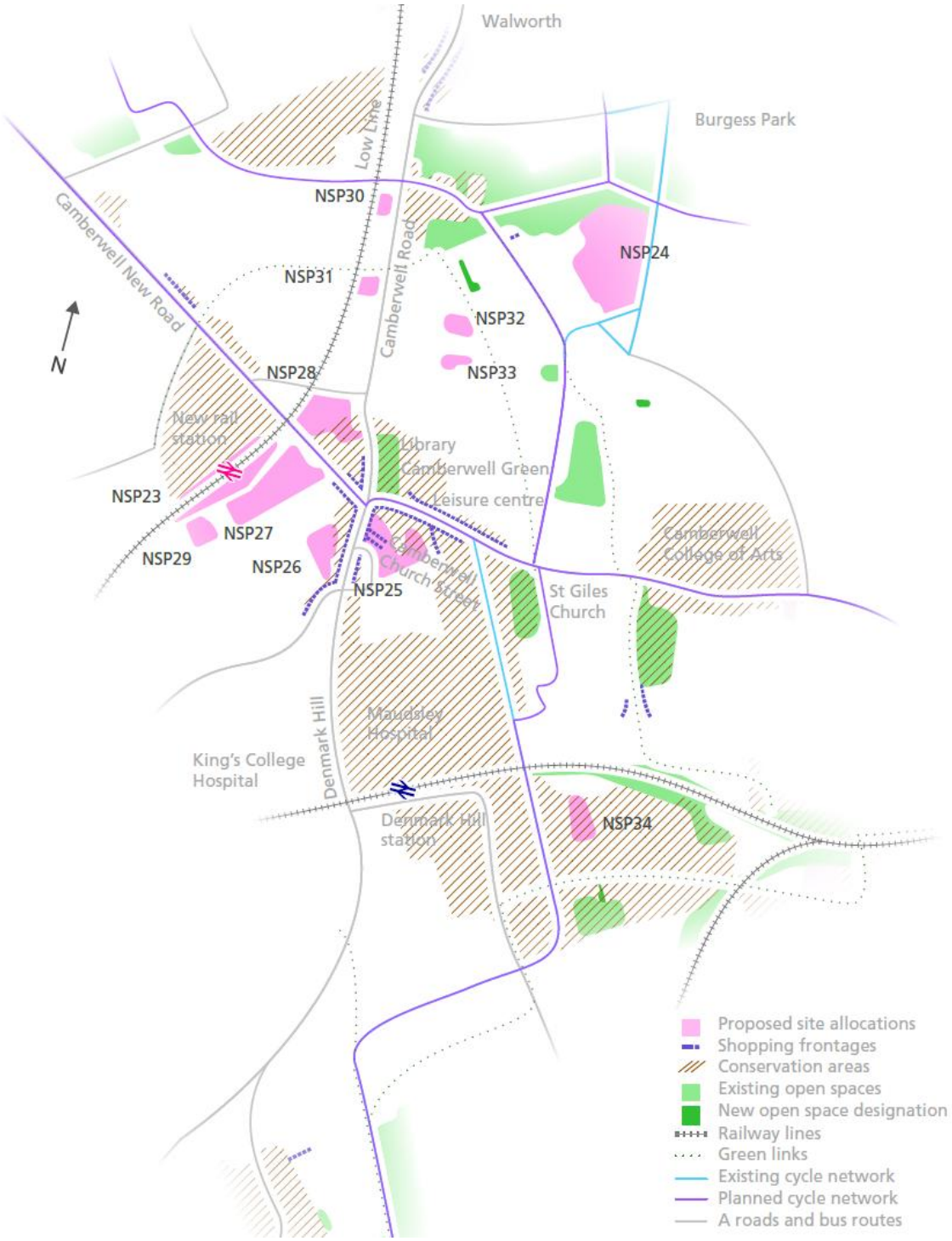
Table 5 shows input assumptions and resulting change in public transport trips for the AM peak period. Land use inputs have been allocated to LTS zones 1119, 1150, 1151 and 1220 depending on the geographical location of the site.

Table 5: Land Use Test Specifications

Scenario	Population	Homes	Jobs	AM Peak Period PT Trips	AM Peak Period PT Trips generated by Station
Land Use A (no station)	4,634	2,109	330	1,138	-
Land Use A (with station)	5,097	2,320	330	1,328	190
Land Use B (no station)	6,183	2,833	393	1,606	-
Land Use B (with station)	6,802	3,116	393	1,787	181
Land Use Cmax (no station)	9,431	4,322	0	2,309	-
Land Use Cmax (with station)	10,374	4,754	0	2,509	200

Figure 6 shows the location of the New Southwark Plan (NSP) sites where land use changes are assumed.

Figure 6: New Southwark Plan Sites



Source: New Southwark Plan: Area Visions and Site Allocations (preferred option), February 2017

5 Forecasting Enhancements

This section outlines a series of forecasting enhancements applied to the Railplan PT assignment model to increase the accuracy of model outputs. The enhancements have focussed on accuracy in sub-mode choice through adjusting bus speeds, reproportioning demand to ensure accurate station usage to reflect the actual location of development sites. In addition, measures have been taken to reduce model noise in travel time benefits outputs by eliminating small changes in generalised travel time and highway speeds in the wider network.

5.1 Bus Speed Adjustment

5.1.1 Overview

Bus is a key existing transport option for the area and would be the primary competition for the new station, therefore accurate representation of journey times is of high importance. Comparison of base year modelled journey times against observed data (2016 iBus data) suggests the model is under-stating bus journey times, as shown in Table 2. Testing has been undertaken on each of the core scenarios to reflect adjusted bus journey times on the five bus corridors via Camberwell: (refer also to Figure 3):

- Camberwell Green <> Elephant & Castle
- Camberwell Green <> Oval
- Camberwell Green <> Peckham
- Camberwell Green <> Herne Hill
- Camberwell Green <> East Dulwich

Analysis of modelled bus journey times, in minutes, along these corridors was undertaken; an average journey time across all bus routes was calculated using comparable start/end locations to the observed data.

5.1.2 LTS Congested Highways Feedback

Previous versions of Railplan did not have any change in bus journey times between base and future years, however LTS and the Cube Railplan PT Assignment model share a feedback mechanism which transfers highway impacts onto bus speeds. It was thought that this feedback may address some of the discrepancy between modelled and observed journey times, however, though a change was identified, it was still some way off the increase in times that the observed data suggests.

For the wider model, the congested highway feedback is considered a robust and important inclusion. However, the LTS congested highways feedback had very minimal impact on journey times in our local area, therefore a further bus speed adjustment process has been applied on the key corridors.

5.1.3 Bus Speed Adjustment Assumptions

To account for additional congestion in future years, we have assumed that 2016 observed journey times would reflect the growth from the modelled 2011 journey times to the 2031 modelled

times[3], balancing increased congestion due to the rise in future demand increase and the impacts of future priority schemes between 2017 and 2031.

Individual adjustment factors have been calculated for each corridor and applied to the morning and inter-peak input bus speeds. Factors were calculated from 2011 data (which is the input to future year models) to bring them up to the observed 2016 journey times. The exceptions to this rule are as follows, and fit with the modelling principles and implementation in Cube Railplan:

- Application of a factor of 1 when the 2016 observed is lower than 2011 modelled journey times along a bus route corridor, to retain the slowest speeds.
- Application of an increase factor to adjust 2011 modelled journey times to reflect 2031 modelled journey times (i.e. the LTS feedback figure), along corridors where 2031 journey times are higher than the 2016 observed data.

The resultant factors are shown in Table 6.

For some bus routes, there is an overlap of links resulting from matching the model links to the iBus data captured, therefore a choice of two factors. The factor chosen to be used in the input files, was based on the largest number of buses per hour for the relevant bus services identified for each of the overlapping routes.

Table 6: Bus Speed Adjustment Factors

Route	Direction	AM Modelled 2011 to Observed 2016 factor	IP Modelled 2011 to Observed 2016 factor
Camberwell Green - Elephant & Castle	(NB)	1.33	1.40
Elephant & Castle - Camberwell Green	(SB)	1.17	1.38
Camberwell Green – Oval	(WB)	1.26	1.27
Oval - Camberwell Green	(EB)	1.44	1.73
Camberwell Green - Peckham	(EB)	1.00	1.26
Peckham - Camberwell Green	(WB)	1.04	1.08
Camberwell Green - Herne Hill	(SB)	1.23	1.31
Herne Hill - Camberwell Green	(NB)	1.28	1.49
Camberwell Green - East Dulwich	(SB)	1.19	1.26
East Dulwich - Camberwell Green	(NB)	1.25	1.20

Table 7 shows the morning peak 2011 modelled, 2016 observed and final 2031 modelled journey times after factoring has been applied. Some acceptable minor discrepancies are evident but this is due to the issue of shared links on differing corridors.

Table 7: Morning-Peak Journey Times

Route	Direction	AM 2016 Observed Journey Time	AM 2011 Modelled Journey Time	AM 2031 Final Modelled Journey Time
Camberwell Green - Elephant & Castle	(NB)	14.80	11.75	15.63
Elephant & Castle - Camberwell Green	(SB)	13.30	11.35	13.15
Camberwell Green – Oval	(WB)	10.70	8.52	10.69
Oval - Camberwell Green	(EB)	9.10	6.33	7.89

[3] Note – pre LTS sensitivity tests on the initial fixed demand outputs assumed bus journey times should reflect 2016 levels plus an additional 15% increase, however, after the inclusion of LTS congested highway networks the resulting journey times were higher and therefore the additional 15% adjustment was deemed unnecessary for final tests.

Route	Direction	AM 2016 Observed Journey Time	AM 2011 Modelled Journey Time	AM 2031 Final Modelled Journey Time
Camberwell Green - Peckham	(EB)	7.10	7.14	6.62
Peckham - Camberwell Green	(WB)	10.20	9.88	10.30
Camberwell Green - Herne Hill	(SB)	10.20	8.28	9.72
Herne Hill - Camberwell Green	(NB)	11.20	8.74	11.13
Camberwell Green - East Dulwich	(SB)	8.60	7.22	8.02
East Dulwich - Camberwell Green	(NB)	10.90	8.71	10.90

5.2 Matrix Adjustments

Two complimentary matrix adjustments have been applied to the matrices which are output from LTS and applied in the assignment model. These are intended to eliminate noise in the extremities of the model, which should not be impacted by the scheme, (matrix smoothing) and to ensure that local trip making is accurately reflected (re-proportioning of trips).

5.2.1 Matrix Smoothing

During analysis of travel time benefits it was noted that there appeared to be a significant amount of model noise – small changes in generalised journey time that when amplified through the relatively large numbers of trips were drowning out the actual impacts of the scheme. Travel time benefits represent differences between do minimum (no station) and do something (with station, Transport Scenarios 1, 2, 3).

As such, a decision was made to implement a ‘smoothing’ calculation whereby the difference between do something and do minimum demand matrices was skimmed from the matrices and only retained for zones where development changes are intended to occur, thus removing any spurious changes in demand across London. It should be noted that during assignment this method does not have any adverse effects on the change in accessibility, route options or impacts on existing users.

It should also be noted that this process did not significantly impact travel time benefit stabilitybut has been retained in the final results.

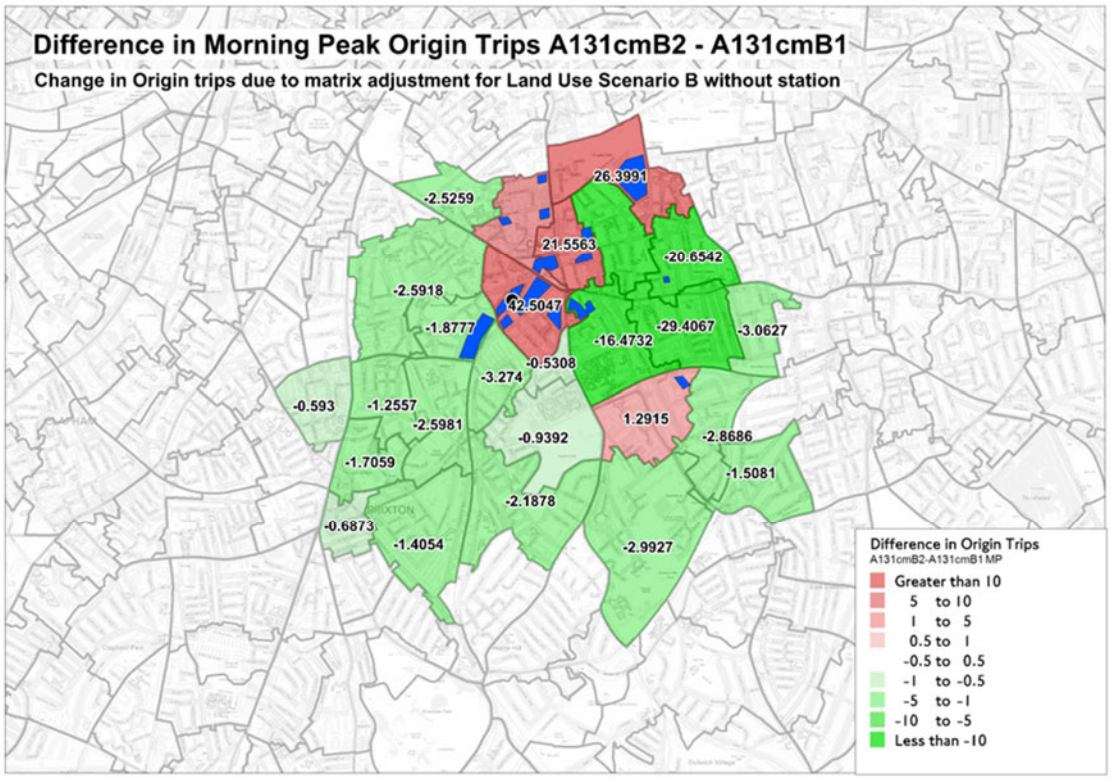
5.2.2 Re-proportioning of Trips

Land use changes are applied at LTS Level, however Railplan uses a more detailed zoning system. The standard disaggregation process between LTS and Railplan means that our specific development site trips are distributed across multiple Railplan zones associated with each LTS zone. This results in trips being spread out a considerable distance from their intended origin or destination. The reproportioning process ensures the correct number of public transport trips are in the Railplan zones containing development sites, enhancing accuracy of mode choice.

Figure 7 shows how trips in the Land Use B Scenario 2 (without station) matrices have been redistributed to match the location of the blue NSP sites. The figure shows that without this process a sizable number of potential Camberwell Station users would be located where they are more likely to use other bus or other rail options.

It should be noted that given the dominance of homes over jobs in the development assumptions we have only applied the re-proportioning to origin trips in the AM peak period.

Figure 7: Example of Re-proportioned Trip Matrix



5.3 Congested Highways Networks

As mentioned previously, LTS has a feedback mechanism which transfers highway impacts onto bus speeds. Section 5.1.2 explained how the output of this process has been adopted for the wider model area with localised adjustments made to key Camberwell bus corridors. However, when analysis of the matrix smoothing process showed minimal impact on reducing noise in time travel benefits, we noted that do minimum and do something assignments use differing wider model congested highway network impacts. We concluded that this could be the cause of widespread noise between do minimum and do something travel time benefits. Analysis proved that this was the case, and as such the decision was made to implement Land Use Scenario specific outputs from LTS, but with do minimum outputs used consistently across the corresponding do something assignments. This enhancement has been effective in reducing model noise in travel time benefit outputs across all modes.

Evidence of the successful smoothing of benefits can be seen in Figure 8 which shows travel time benefits aggregated by origin borough; we can see that the right-hand column created using consistent congested highway networks has a much more sensible spread of change in relation to the addition of a station at Camberwell.

Figure 8: Benefits Smoothing – With and Without Consistent Congested Highway Networks

	Different Cong. Networks	Consistent Cong. Networks
City of London	111	121
City of Westminster	1,012	59
Tower Hamlets	-1,888	159
Newham	1,495	152
Hackney	463	57
Islington	220	-166
Camden	-648	-352
Kensington and Chelsea	-118	158
Hammersmith and Fulham	287	184
Wandsworth	3,463	-60
Lambeth	9,542	189
Southwark	-4,011	-4,422
Lewisham	3,518	1,962
Barking and Dagenham	1,036	125
Havering	1,639	1,111
Redbridge	-133	210
Waltham Forest	-4,426	-73
Haringey	-3,042	-285
Enfield	6,923	-104
Barnet	2,549	-4
Brent	1,005	20
Harrow	67	50
Ealing	5,295	288
Hillingdon	-1,305	180
Hounslow	-1,253	172
Richmond upon Thames	233	106
Kingston upon Thames	622	71
Merton	1,122	1,178
Sutton	-5,133	700
Croydon	12,403	428
Bromley	5,334	4,229
Greenwich	-2,804	226
Bexley	521	382
Kent County	6,871	5,614
External	11,243	4,701

6 Strategic Modelling Outputs

This section summarises the strategic modelling outputs of the modelled future year scenarios. The outputs presented focus on the AM peak assignments which have been used to inform the decision-making process. Key outputs include travel time benefits, change in public transport assignment (route and sub-more choice) and Camberwell Station usage.

6.1 Travel Time Benefits

Travel time benefits represent demand weighted generalised time savings (or increases) in minutes between zone pairs arising from changes in the do something scenario. Benefits are calculated differently for existing users and new users, where the rule of a half is applied to new user benefit. This output forms a key input to wider economic impacts analysis.

6.1.1 Summary of Benefits from Key Areas

Table 8 summarises the travel time benefits from key areas. The impacts fall into one of three categories:

- Areas which benefit in all scenarios – Southwark, Lambeth

  As expected these areas benefit in all scenarios as they are the main beneficiaries of improved public transport offering and accessibility to and from the area due to the new station. For Southwark, the 6tph options offer notably higher benefits than the 4tph option. Lambeth see higher benefits in the 4tph scenario than the 6tph scenario; this is likely due to the fact that through Loughborough Junction, impacted\ areas of Lambeth already have access to Wimbledon Loop services. Further detail of local benefits is show in Figure 9.
- Areas which benefit in some scenarios – Merton, Sutton

  As expected these areas see a small benefit in the 4tph scenario, caused by the availability of Catford Loop services instead of Wimbledon Loop services at the new station, thus alleviating line loads on the Wimbledon Loop services that serve these areas. In the 6thp scenarios, where Wimbledon Loop services call at Camberwell, there is a disbenefit as existing users journeys are slowed and more crowded. It should be noted that both the positive and negative impacts in these areas are small in scale.
- Areas which disbenefit in all scenarios – Lewisham, Bromley, Kent

  As expected these areas, served by the Catford Loop, suffer disbenefit in all scenarios due to the slowing down and increased crowding on these services. The impact is greater in Scenario 3, the 12-car operation, as the number of passengers affected by the slowing down is greatest.

The overall impact across the network in all scenarios is one of disbenefit, with the impact on existing users of the Catford Loop outweighing that for new and existing public transport users in Camberwell. It is worth reiterating here that the station is only assumed to unlock a further 10% development potential over the do minimum, with the vast majority of development not dependant on transport improvements, hence new user benefits are very small.

It is noted that testing 12-car services stopping at Camberwell results in a marked increase in overall disbenefit compared to the 8-car equivalent (Sc. 3 vs Sc. 2). The 12-car scenario benefits

have been calculated against an equivalent reference scenario also with 12-car services on the Thameslink routes of interest; this is because 12-car running is not unlocked by re-opening the station so should exist in the no-station scenario too. As such, in the 12-car scenarios there are a greater number of passengers using the services who are subsequently subject to the journey time delay due to the extra stop in the with-station scenario (up to 20% more passengers between Bromley and Central London, depending on the individual service)

Table 8: Summary of Travel Time Benefits

Land Use Scenario	A			B			Cmax		
Transport Scenario	**Sc. 1**	**Sc. 2**	**Sc. 3**	**Sc. 1**	**Sc. 2**	**Sc. 3**	**Sc. 1**	**Sc. 2**	**Sc. 3**
Origin Borough	*4tph 8-car*	*6tph 8-car*	*6tph 12-car*	*4tph 8-car*	*6tph 8-car*	*6tph 12-car*	*4tph 8-car*	*6tph 8-car*	*6tph 12-car*
Lambeth	-2,655	-369	-1,355	-2,891	-86	-3,031	-2,137	-51	-1,830
Sou hwark	-178	-3,525	-3,839	-324	-4,473	-5,130	-517	-5,397	-6,698
Lewisham	1,561	1,603	3,055	1,596	1,582	2,911	1,731	1,824	3,166
Merton	-132	1,361	1,510	-337	1,065	1,270	-292	1,205	1,394
Sutton	-464	216	323	47	703	841	-130	542	643
Bromley	2,448	3,194	10,832	2,237	3,097	10,362	2,511	3,499	10,839
Kent County	4,304	4,834	9,966	4,504	5,023	10,018	4,460	5,146	10,018
Total	**5,908**	**8,941**	**21,757**	**6,480**	**8,960**	**19,269**	**3,985**	**5,853**	**16,733**

It should be noted that all zones that are not included in GLA or Kent regions have been discarded from the benefits data as some external areas e.g. the West Country exhibited instability between tests and interference with scheme benefits which we would not expect given the changes being tested.

The scale of impact of the scheme is relatively small in comparison to schemes typically tested in strategic models. A disbenefit of around 10,000 minutes in the three-hour morning peak period equates to a financial value of approximately £1 million per year. The pattern of observed model impacts is generally sensible, but given the small nature of the changes, model noise maybe having a significant bearing on the results. It is therefore appropriate to consider individual numbers within the broader pattern of model outputs, rather than focussing on numbers in isolation.

The modelling is suggesting that the disbenefit of the additional stop at Camberwell to those boarding the services in outer London and Kent outweighs the benefit to the local Camberwell area. However, the disbenefit is relatively small and a valid conclusion would also be that the scheme is broadly neutral.

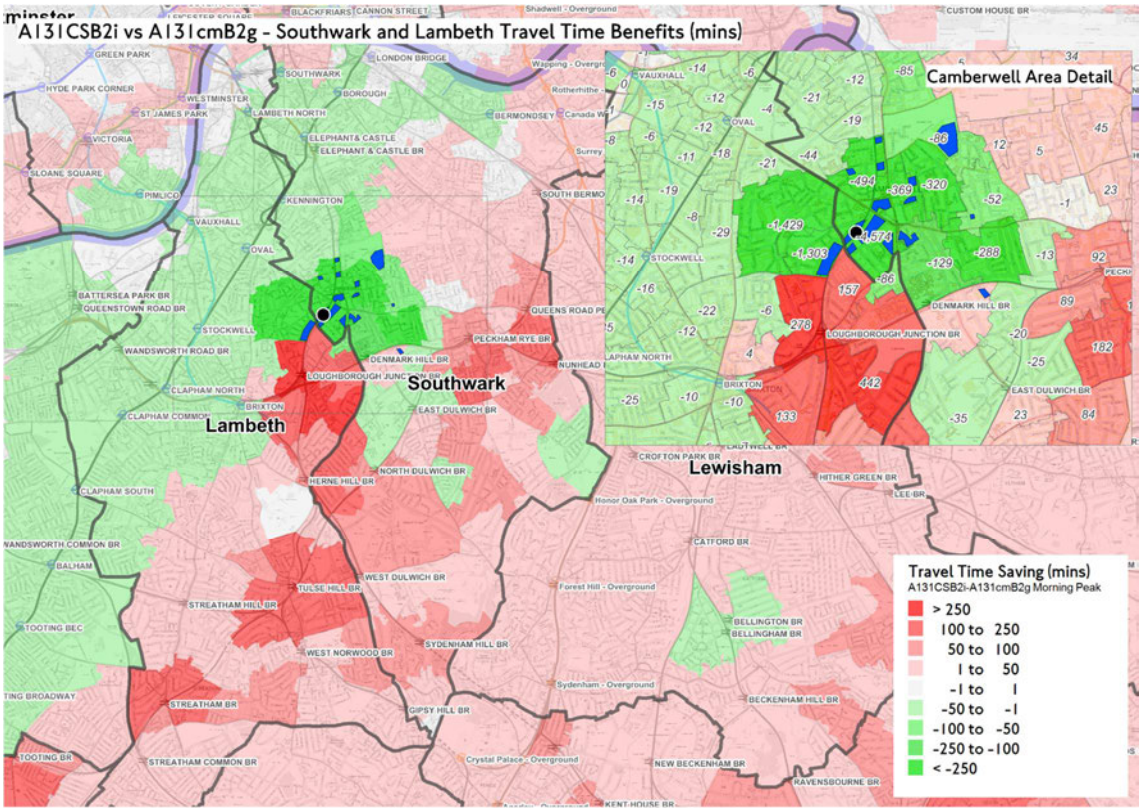
By calculating an indicative average benefit per user we can see that the travel time impacts are the result of a small impact to a larger number of users (those further out of London using Thameslnk via Camberwell) and a larger impact to a smaller number of local users; average impact on through passengers is a disbenefit of 0.7 generalised minutes, whereas the impact on local passengers is a benefit of 3.4 generalised minutes[4].

6.1.2 Local Benefits

Figure 9 shows the breakdown of benefits by origin zone in Lambeth and Southwark, by mapping the change in generalised journey time (red showing an increase in generalised time, as disbenefit, and green showing a saving, a benefit). We can see a clear pattern of benefit in the area surrounding the new station and new developments as well as an indication of the catchment of the new station and that of Loughborough Junction. The users of Loughborough Junction can be seen in the notable disbenefit around this station as these trips experience a proportionately high time penalty due to the additional stop on their journey.

[4] Based on test A131CSB2i. Indicative calculation based on benefit from Kent and Bromley / through passengers at Camberwell, and benefit from Southwark and Lambeth / Camberwell sta ion entries.

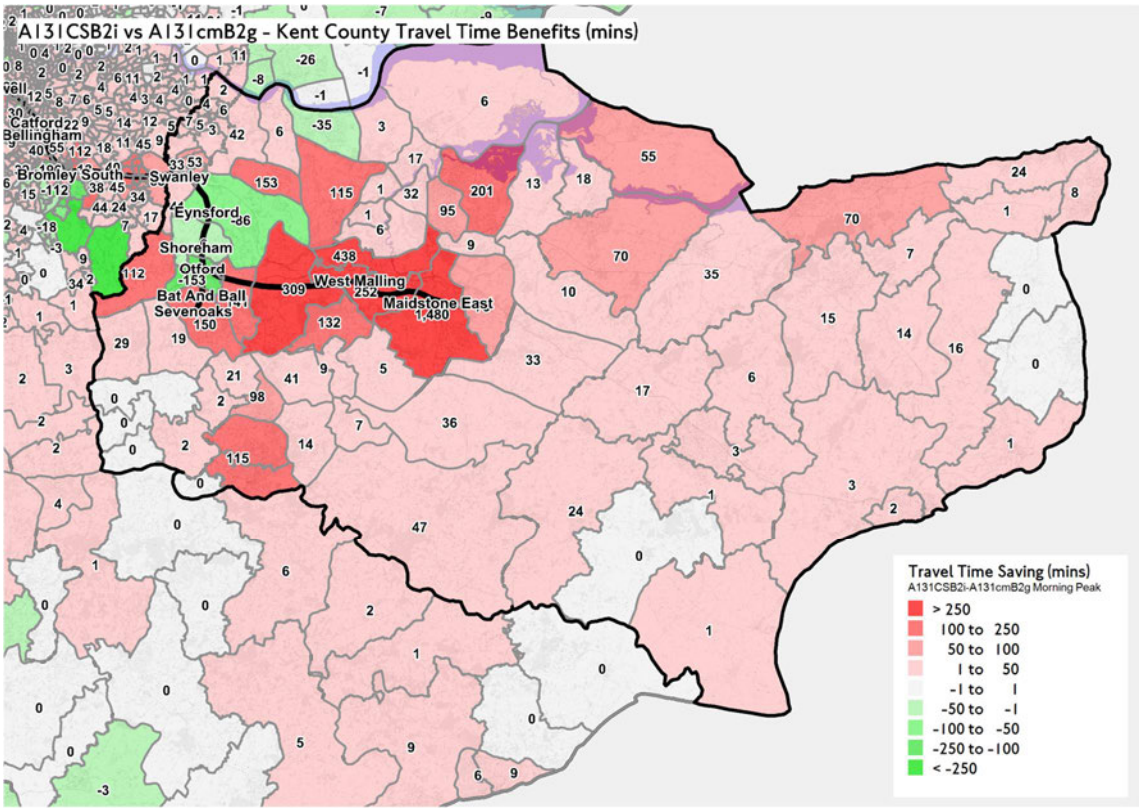
Figure 9: Example of Localised Benefits in Southwark and Lambeth



6.1.3 Kent Disbenefit

Investigation has been undertaken to verify that disbenefit to the Kent area is explainable. Figure 10 provides an example of the disbenefit to origin area in Kent, and shows the expected correlation between the Catford Loop services affected by the additional stop and areas they serve.

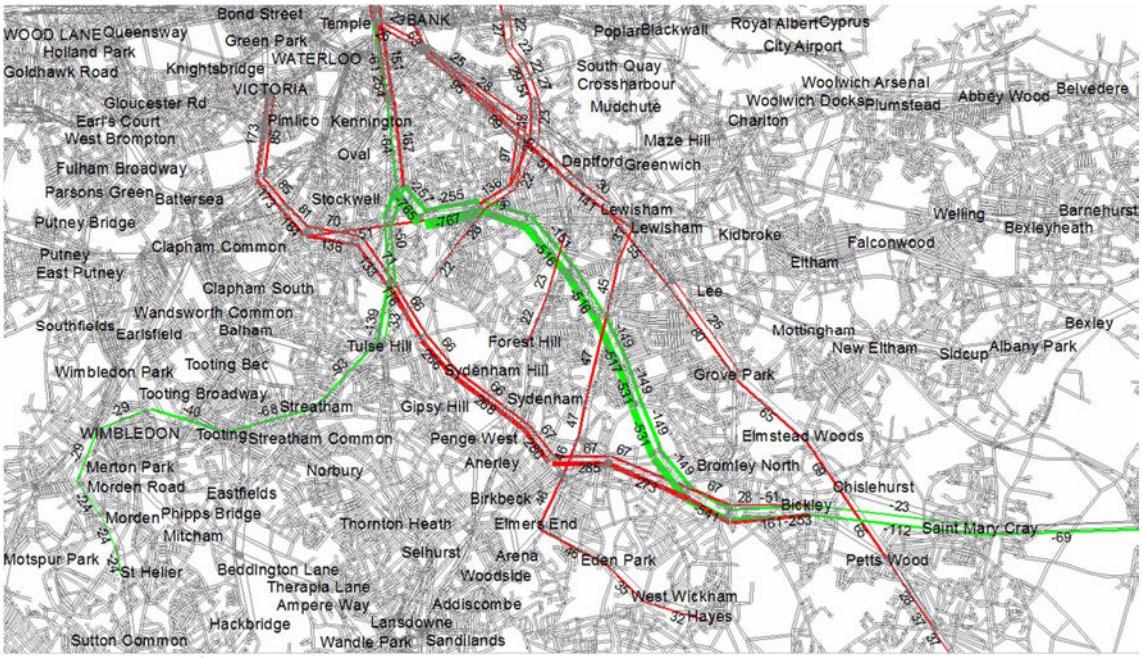
Figure 10: Example of Disbenefit in Kent



6.2 Change in Rail Assignment

Figure 11 shows the impacts of Camberwell station on the rail network in the surrounding areas. This plot represents the change in rail assignment over the three-hour morning peak period. The pattern of change is consistent across all land use and transport scenarios; actual scale of difference does vary but the impacts are consistently observed to result in increased volumes on Thameslink services via Camberwell, with trips switching predominantly from routes from Bromley to Victoria, Hayes and Kent via London Bridge, and London Victoria

Figure 11: Rail Volumes Difference Plot - Morning Peak Period



Source: A131CSB2i-A131cmB2g

The two-minute time penalty associated with the additional stop being made at Camberwell station results in a decrease of approximately 500 rail users in the Bromley area, to switch to alternative routes to London Bridge and London Victoria using Southeastern services. A further 250 users (approximately) change at Peckham Rye and change to use northbound Overground and bus services.

There is a slight reduction in rail volumes on the Wimbledon Loop, due to the two-minute stopping penalty at Camberwell. In comparison with the Catford line these numbers are very small, as proportionately the time penalty is less in terms of overall journey time on this line and there are also fewer alternative routes into London. This reduction is not seen in scenario 1 (4tph 8-car stock), as no Wimbledon Loop services stop at Camberwell.

The three-hour morning peak period modelled rail volumes for all 2031 land use and transport scenarios are shown in Figure 12.

Figure 12: Rail Volumes - Morning Peak Period

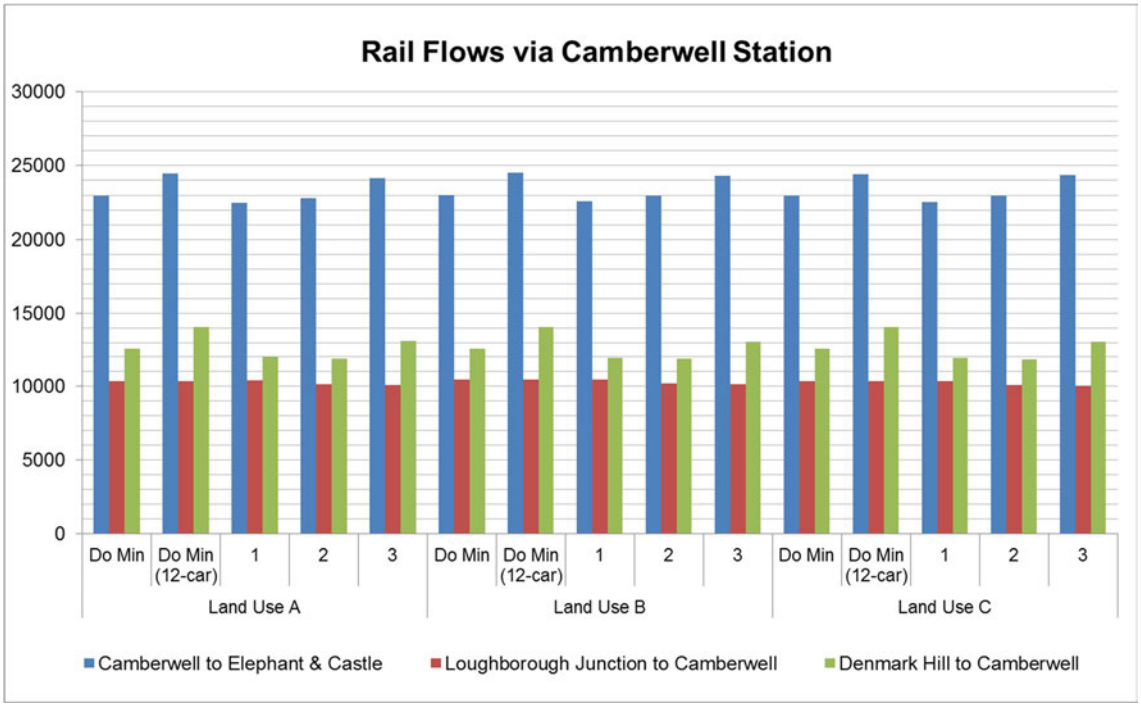


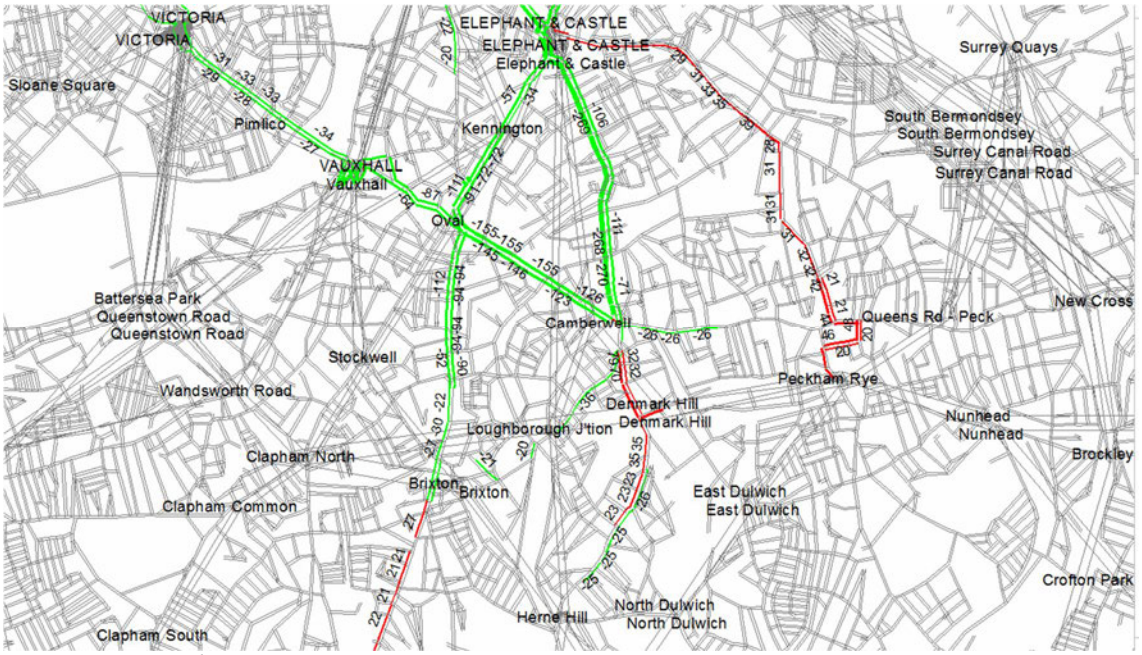
Figure 12 shows that the proportional impacts on overall flows into and out of Camberwell Station are small, ranging between 1% and 6% reductions in the do something scenarios. Comparing all do something scenarios to their respective do minimums (noting that Scenario 3 should only be compared to the 12-car do minimum) there is a net reduction of users; those seeking alternative routes due to slowing down of services outweigh the additional trips in the do something created by the 10% higher development figures.

6.3 Change in Bus Assignment

As seen in the change in rail assignment, the pattern of change in the bus network is prevalent across all land use and transport scenarios.

Figure 14 shows the difference in bus passenger volumes over the three-hour morning peak period in land use B transport scenario 2 versus the land use B without station option.

Figure 13: Bus Volumes Difference Plot - Morning Peak Period



Source: A131CSB2i-A131cmB2g

Camberwell station alleviates the bus routes towards Elephant & Castle and London Victoria via Oval and Vauxhall. The corridors between Brixton and Oval also have slightly reduced bus usage.

There is a slight increase in bus users from Peckham, northbound to Elephant & Castle. This will be due to the two-minute penalty for rail users of the Catford lines, however this switch in modes is very minimal. There is also a slight increase in bus usage around Denmark Hill for Camberwell station access.

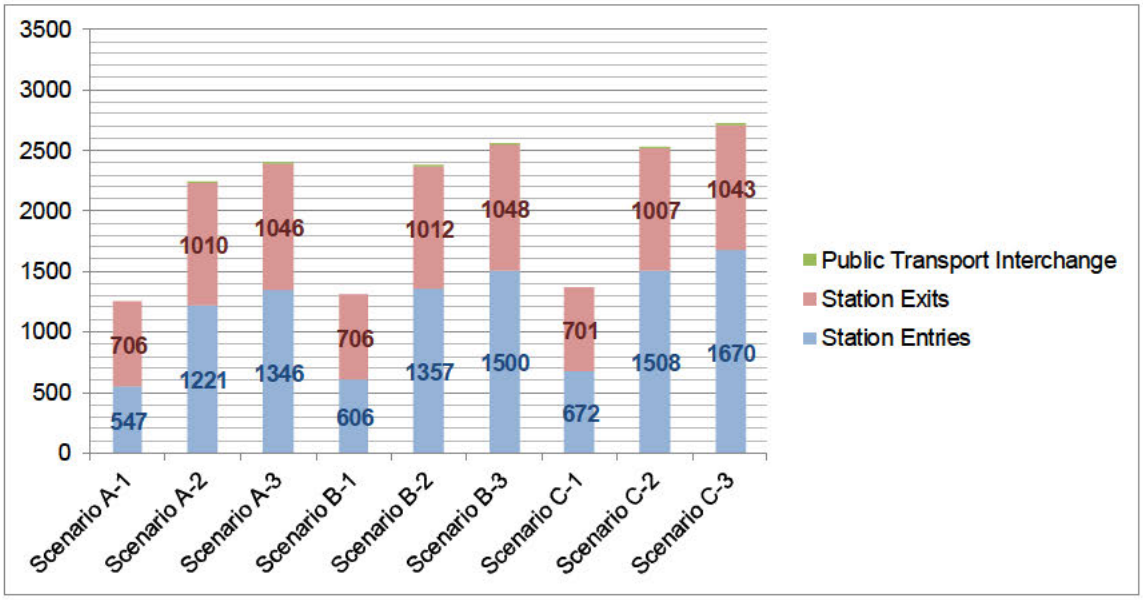
6.4 Camberwell Station Usage

This section presents the key observations from the station matrix data for Camberwell station reopening across all transport and land use scenarios. Figure 14 shows a summary of AM peak period station movements at Camberwell.

Usage of the new station is heavily influenced by the frequency of service, with a 6tph service attracting around 100% more station entries and 50% more station exits. It is also notable that in the 4tph service scenarios, the number of exits (i.e. Camberwell as a destination) outweighs entries. In the 6tph scenarios the numbers of entries are greater.

Overall station usage varies between approximately 1,250 trips and 2,700 trips in the three hour AM peak period. The correlation between the increase in usage and service frequency and larger development suggests a relatively strong local catchment but one that is still competing with bus and other rail stations.

Figure 14: Camberwell Station Usage



Key observations include:

- The change from 4tph to 6tph brings about the largest change in station use, with an approximate increase of 125% in station entries.
- The change to 12-car services brings in a much smaller increase in entries of just 10%.
- Land use B with station option generates 1,787 additional public transport trips. In transport scenario 1 606 of these are using Camberwell station. In contrast, the increase from 4tph to 6tph and 12-car rolling stock encourages 84% (1,500) of these additional trips to be made using Camberwell station.
- There are also notable number of station exits in all scenarios, strongly indicating the station has a significant role in accessing attraction areas in Camberwell (see Figure 16 for further detail).

6.5 Impacts at Neighbouring Stations

With Camberwell station in place trips to and from the area have an alternative option to using local bus services and existing stations at Loughborough Junction and Denmark Hill (Elephant & Castle is not in direct competition as this station is further away and has a distinctly different service offering with two London Underground lines).

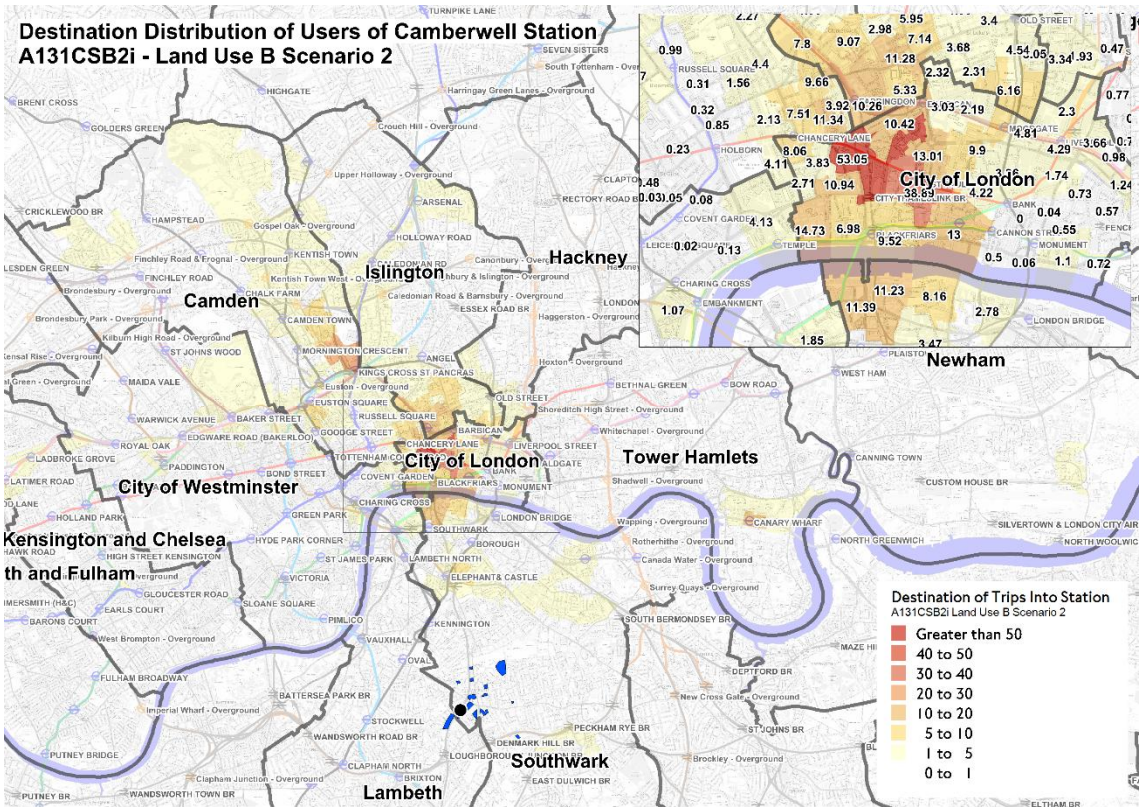
The increase in frequency of trains calling at Camberwell station between transport scenarios 1 (4tph) and 2 (6tph) which results in a step change in Camberwell station use causes a subsequent decrease in station entries and exits at Denmark Hill and Loughborough Junction.

Denmark Hill sees a decrease of approximately 200 station entries , from 2,350 to 2,150, and station exits decrease by 260 users, from 1,380 to 1,120. At Loughborough Junction, there are approximately 360 fewer total users. These decreases are the result of a switch in station choice for trips to and from the zones that lie between the three stations accessing by walk. An additional, smaller impact is also seen for trips from further afield via bus who are attracted to the higher frequency rail service at Camberwell.

6.6 Select Link Analysis

We have undertaken a Select Link Analysis to identify key destinations of Camberwell Station users. Figure 15 shows the distribution of destinations of users entering Camberwell Station over the three-hour morning peak period in Land Use scenario B Transport scenario 2.

Figure 15: Destinations of users entering Camberwell Station

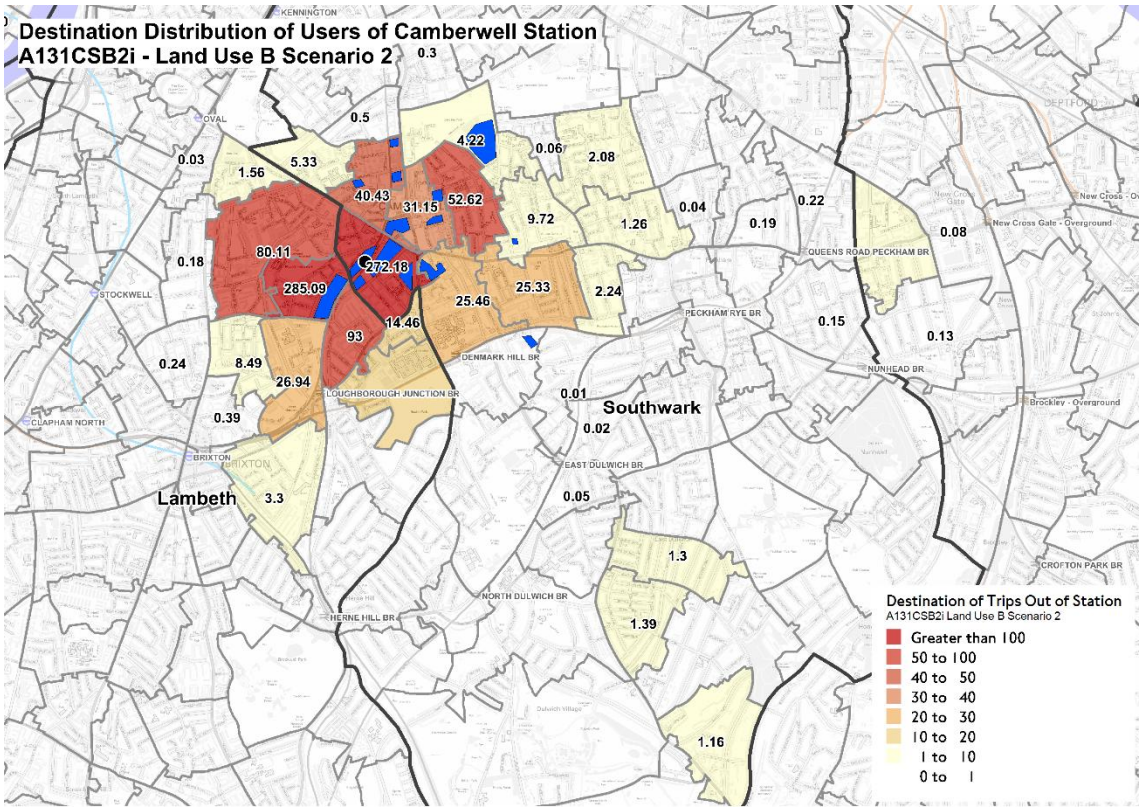


Source: A131CSB2i Morning-Peak Period

The majority of users entering the station have destinations in the City of London, particularly near City Thameslink station. Many users are also travelling to King's Cross St. Pancras International and across to Canary Wharf. A very small number of users are travelling to Peckham Rye and southbound towards Sutton, Merton, Bromley, and Kent. This is sensible, as this shows that a large number of users of Camberwell station are heading to key employment centres across London.

Figure 16 shows the destination distribution of users leaving Camberwell Station, over the three-hour morning peak period in land use B scenario 2.

Figure 16: Destinations of users leaving Camberwell Station



Source: A131CSB2i Morning-Peak Period

A large proportion of users leaving the station have destinations in the immediate vicinity of the station and the Camberwell Green area, which is likely to include trips to the schools/college in the immediate area. Some trips are being made to the hospital, however the key destinations are located to the west of Denmark Hill, where a number of retail and education sites are located, giving a sensible destination distribution.

7 Conclusions

This study has explored transport options for the re-opening of Camberwell station through testing the impacts of three stopping options for Thameslink services. In addition, land use changes around the station have been defined in line with current borough aspirations.

The strategic model outputs have provided narrative in several key areas:

- Travel time benefits – the impact on generalised journey times for those with improved accessibility due to the new station and those who are affected by slower services
- Changes in travel patterns – alleviation of existing services and associated re-routing to use the new station
- Station usage – the potential patronage of the station

Results show a reasonable usage of the station for access and egress in the AM peak and a sensible local catchment area, though there is a net reduction in overall flows on the affected lines due to route switching from areas outside of London and in outer Boroughs.

The impacts of switching, caused by the slowing down for existing users, does not have a material impact on any parallel routes as the absolute numbers are small.

It could be argued that in reality the time penalty of an extra stop would not be noticed by existing users, however, we have to consider this in our quantitative assessment of the scheme as it is this same measure that provides the benefits to the local area.

Through significant model development and investigation into assignment assumptions and results we feel we have arrived at a set of outputs that accurately reflect the scheme and its impacts.

The model predicts that the disbenefit of the time penalty of an additional stop for through passengers outweigh the benefits to those using the station. This could be a case of a small disbenefit to a large number of people outweighing a larger individual benefit to a small group of people. The modelled generalised travel time impacts of Camberwell station are small when compared to schemes that are typically assessed using strategic modelling. Given the relatively modest scale of generalised travel time impact a reasonable conclusion would be that the impact is broadly neutral with higher likelihood of a slightly negative overall impact.

The next steps of this scheme and study are to be decided by TfL and London Borough Southwark and associated stakeholders.

Appendices

A.1 Railplan Thameslink Service Summary

Table 9: AM Thameslink Service Summary

Route	Line Code	Trains per Hour	8-car Seat Capacity	8-car Total Capacity	Branch	Scenario 1	Scenario 2	Scenario 3
Gillingham (Kent) to Blackfriars via Loughborough Junction	BL201U	2	727	2176	Wimbledon Loop	No Change	No Change	No Change
Kent House to Blackfriars via Loughborough Junction	BL202U	2	685	1545	Wimbledon Loop	No Change	No Change	No Change
Luton <> Wimbledon via Loughborough Junction (Loop)	TH219S	2	416	1674	Wimbledon Loop	No Change	No Change	No Change
Luton <> Wimbledon via Loughborough Junction (Loop)	TH222S	2	416	1674	Wimbledon Loop	No Change	Stop @ Camberwell	Stop @ Camberwell and 12-car
Blackfriars to Sevenoaks via Denmark Hill	BL203D	2	316	1716	Catford Loop	No Change	No Change	No Change
Sevenoaks to Blackfriars via Denmark Hill	BL204U	2	316	1716	Catford Loop	No Change	No Change	No Change
Blackfriars to Bellingham via Denmark Hill	BL205D	2	316	1716	Catford Loop	No Change	No Change	No Change
Bellingham to Blackfriars via Denmark Hill	BL206U	2	316	1716	Catford Loop	No Change	No Change	No Change
Thameslink Core to Catford via Denmark Hill	TH215S	2	416	1674	Catford Loop	Stop @ Camberwell	Stop @ Camberwell	Stop @ Camberwell and 12-car
Catford to Thameslink Core via Denmark Hill	TH216N	2	416	1674	Catford Loop	Stop @ Camberwell	Stop @ Camberwell	Stop @ Camberwell and 12-car
Thameslink Core to Sevenoaks via Denmark Hill	TH217S	2	416	1674	Catford Loop	Stop @ Camberwell	Stop @ Camberwell	Stop @ Camberwell and 12-car
Sevenoaks to Thameslink Core via Denmark Hill	TH218N	2	416	1674	Catford Loop	Stop @ Camberwell	Stop @ Camberwell	Stop @ Camberwell and 12-car

Table 10: IP Thameslink Service Summary

Route	Line Code	Trains per Hour	8-car Seat Capacity	8-car Total Capacity	Branch	Scenario 1	Scenario 2	Scenario 3
Luton <> Wimbledon via Loughborough Junction (Loop)	TH242S	2	416	1674	Wimbledon Loop	No Change	Stop @ Camberwell	Stop @ Camberwell and 12-car
Luton <> Wimbledon via Loughborough Junction (Loop)	TH243S	2	416	1674	Wimbledon Loop	No Change	No Change	No Change
Blackfriars to Sevenoaks via Denmark Hill	BL210D	2	418	1818	Catford Loop	Stop @ Camberwell	Stop @ Camberwell	Stop @ Camberwell and 12-car
Sevenoaks to Blackfriars via Denmark Hill	BL211U	2	418	1818	Catford Loop	Stop @ Camberwell	Stop @ Camberwell	Stop @ Camberwell and 12-car
Blackfriars to Bellingham via Denmark Hill	BL212D	2	418	1818	Catford Loop	No Change	No Change	No Change
Bellingham to Blackfriars via Denmark Hill	BL213U	2	418	1818	Catford Loop	No Change	No Change	No Change