REPORT N^{O} 70014672

LONDON CANCER HUB

DEVELOPMENT FRAMEWORK TRANSPORTATION REPORT

JANUARY 2017

WSP | PARSONS BRINCKERHOFF

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London Borough of Sutton, Institute of Cancer Research and The Royal Marsden

Project no: 70014672
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1 INTRODUCTION

1.1.1 This report is provided as supporting evidence for the London Cancer Hub (LCH) Development Framework. This standalone report provides a bespoke site specific evidence base and an appraisal of transport infrastructure required to deliver the development proposals over the planned implementation period up to 2030.

1.1.2 Two scenarios have been developed as part of the Development Framework:

- → Scenario A – A higher proposed Hospital Gross Floor Area (GFA) and lower Commercial GFA; and
- → Scenario B - A larger Commercial GFA and incremental build out of the Hospital GFA.

1.1.3 The schemes differ in the following ways:

- Scenario A generates a lower number of total trips when compared to Scenario B due to the quantums of floor space and land use types;
- Scenario A would have a moderate increase in the requirement for blue light access to access to hospital site and suitable routes to and from the site;
- Scenario A would have higher patient numbers, however catchment would remain relatively constant and would not generate trip levels as significant as Commercial uses;

1.1.4 The report is based on the Development Framework as this assesses the 'worst case' scenario of trip generations. It is accepted that as the scheme evolves that the GFA are likely to vary and therefore this scenario suitably addresses any minor changes to the scheme proposals. The quantum of development associated with Scenario B is attached at **Appendix A**.

1.1.5 In addition to the preparation of the LCH Development Framework, London Borough of Sutton (LBS) appointed consultants to prepare a Masterplan for Sutton Town Centre which includes a range of proposals for new development across various sectors, public realm improvements and transport improvements. AECOM have been appointed by LBS to assess the transport impact of the growth proposed in the Sutton Town Centre Masterplan. The London Cancer Hub Development Framework and Sutton Town Centre Masterplan will complement each other to achieve the Council's vision for Sutton. The supporting technical documents which are being prepared in support of both projects (including this report) will provide the evidence base to support the Sutton Local Plan which replaces the Local Development Framework once adopted.

1.1.6 This report provides commentary on the Development Framework indicative spatial plan and indicative development parcels.

Figure 1 Development Framework Indicative Development Parcels

1.1.7 In accordance with the LCH Development Brief this report addresses the following:

- Development of outline proposals and concept design including layout and other design issues ensuring functional, financial and technical feasibility; and
- Outline approach to critical delivery issues (infrastructure, financing and other issues identified during stage 1).
- Provide analysis of the most recent Travel Plan data for the Institute of Cancer Research (ICR), The Royal Marsden, and Epsom and St Helier Trust (ESH) to assess the origin / destination (O/D) of staff/visitors to provide and assist a considered and robust baseline.
- Provide analysis of the most recent Travel Plan data for the same three institutions to assess the current modal split of staff/visitors. Produce a separate modal split for staff/visitors living to the north and south of the LCH site given the difference in available public transport options available.
- Prepare revised trip generation figures based on the existing/proposed floor areas and employee numbers rather than the TRICS data previously used.

- Consideration of the proposed Secondary School trip generations derived from TRICS and LBS modal splits for existing schools in the area.
- An updated car park accumulation analysis to assess the maximum level of car parking required on site.
- Apply the revised trip generation figures to the proposed phasing strategy in order to understand the likely impact during each Wave and the trigger points for delivery of the identified transport infrastructure measures.

1.1.8 The report is structured as below:

- Section 1 – Introduction;
- Section 2 – Revised Evidence Base;
- Section 3 – Revised Trip Generation and Predicted Car Park Accumulation;
- Section 4 – Movement Generation & Multi Modal Transport Strategy;
- Section 5 – Delivery of Transport Infrastructure Based on the Phasing Strategy;
- Section 6 – Site Permeability and Movement;
- Section 7 –Utilities Assessment.

2 REVISED EVIDENCE BASE

2.1 TRAVEL PLAN DATA

2.1.1 Travel Plan data for the three institutions has been made available. This data includes:

- ICR
  - 2016 Staff Travel Survey (including postcodes and model of travel)
- The Royal Marsden
  - Patient postcodes
  - Staff postcodes and mode of travel (limited sample size)
  - Ambulance data (unused)
- ESH
  - Staff travel data
    - Postcodes
    - Data split between Sutton (26 responses) and other ESH sites in Epsom & St Helier.

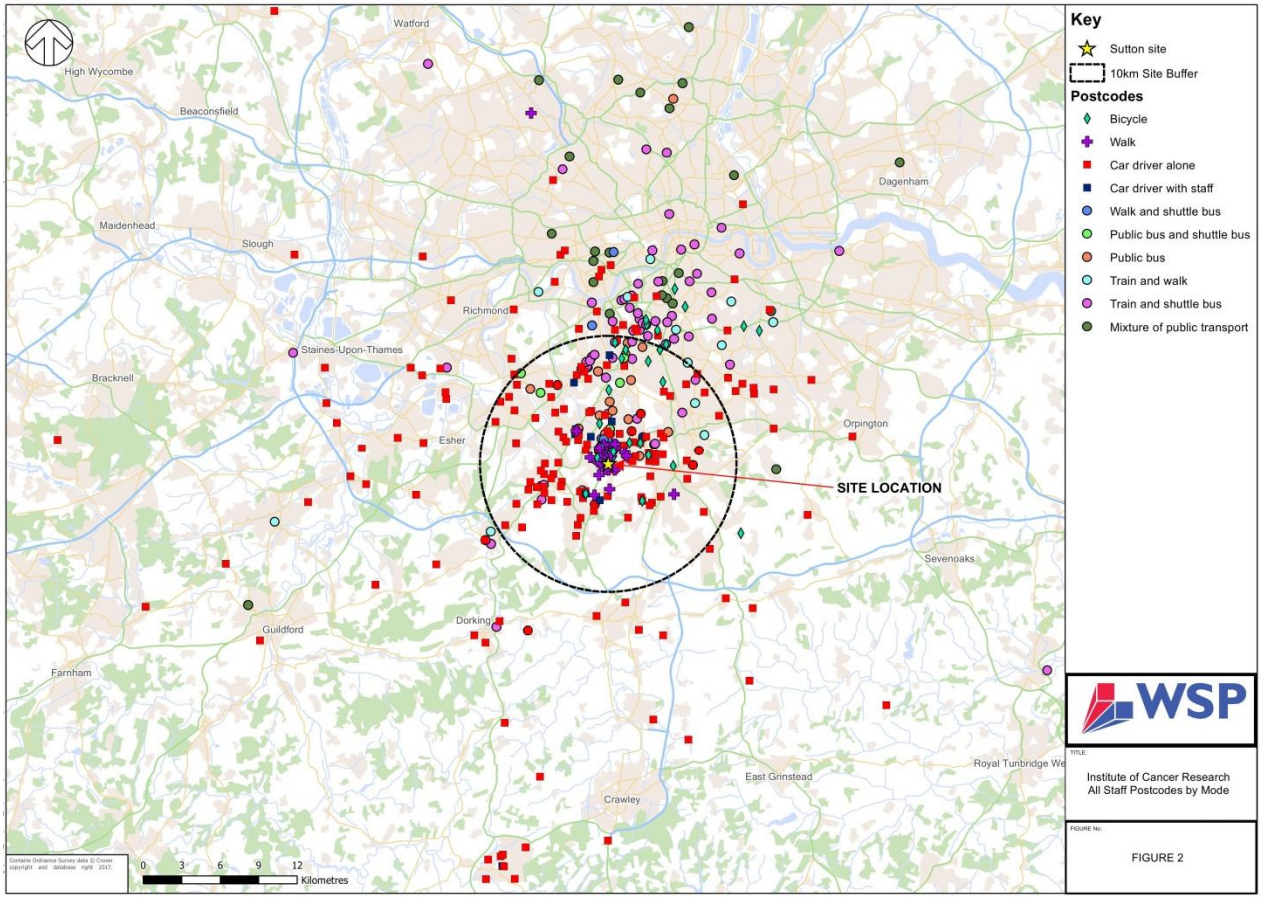
2.2 GIS ANALYSIS

2.2.1 The Travel Plan data has been analysed using GIS software to show where staff are likely to come from and their modal choice. The results for the three institutions are mapped and described below.

ICR RESULTS

2.2.2 Figure 2 shows where staff live in relation to the site by mode of transport based on the results of the 2016 Staff Travel Survey for the ICR. There were a total of 563 responses from a possible 738 which equates to a 78% response rate which is considered a robust sample size. Some of the responses either didn't provide details of the mode of transport used or picked other, therefore, 500 samples have been used.

Figure 2 ICR All Staff Postcodes by Mode



2.2.3 The plan at Figure 2 (also at **Appendix B**) clearly shows that a larger proportion of staff to north travel to the site by public transport while those living to the south travel by private car. To the north, in Greater London, public transport infrastructure and provision is more accessible with higher levels of frequency enabling a greater number of trips to be made by public transport. To the south, origins become more rural in nature and public transport provision becomes less easily accessible and therefore influencing modal shift to sustainable modes will be highly challenging.

2.2.4 Table 2-1 and 2-2 below show the modal split of staff currently working at the ICR split into north and south of the site, analysis shows that currently 78% of staff travel from the north.

Table 2-1 ICR Modal Split North

Mode of Travel	Number of Staff	Percentage of Staff
Walk	37	10%
Cycle	28	8%
Motorcycle	1	0%
Bus	58	16%
Rail	74	20%
Mix of Public Transport	23	6%
Car Driver	141	39%
Car Passenger	2	1%
Taxi	0	0%
Total	**364**	**100%**

Source : 2016 ICR Staff Travel Survey

Table 2-2 ICR Modal Split South

Mode of Travel	Number of Staff	Percentage of Staff
Walk	12	9%
Cycle	5	5%
Motorcycle	0	0%
Bus	1	1%
Rail	14	10%
Mix of Public Transport	3	2%
Car Driver	96	71%
Car Passenger	5	4%
Taxi	0	0%
Total	**136**	**100%**

Source : 2016 ICR Staff Travel Survey

2.2.5 The results clearly show that more staff drive from the south of the site due to the limited level of existing public transport provision available. There is scope based on the analysis undertaken to explore travel plan initiatives such as a site wide car sharing for those in close postcode proximity to reduce single occupancy car based trips.

2.2.6 Set out below in Table 2-3 is the modal split of all staff working at the ICR (north and south combined).

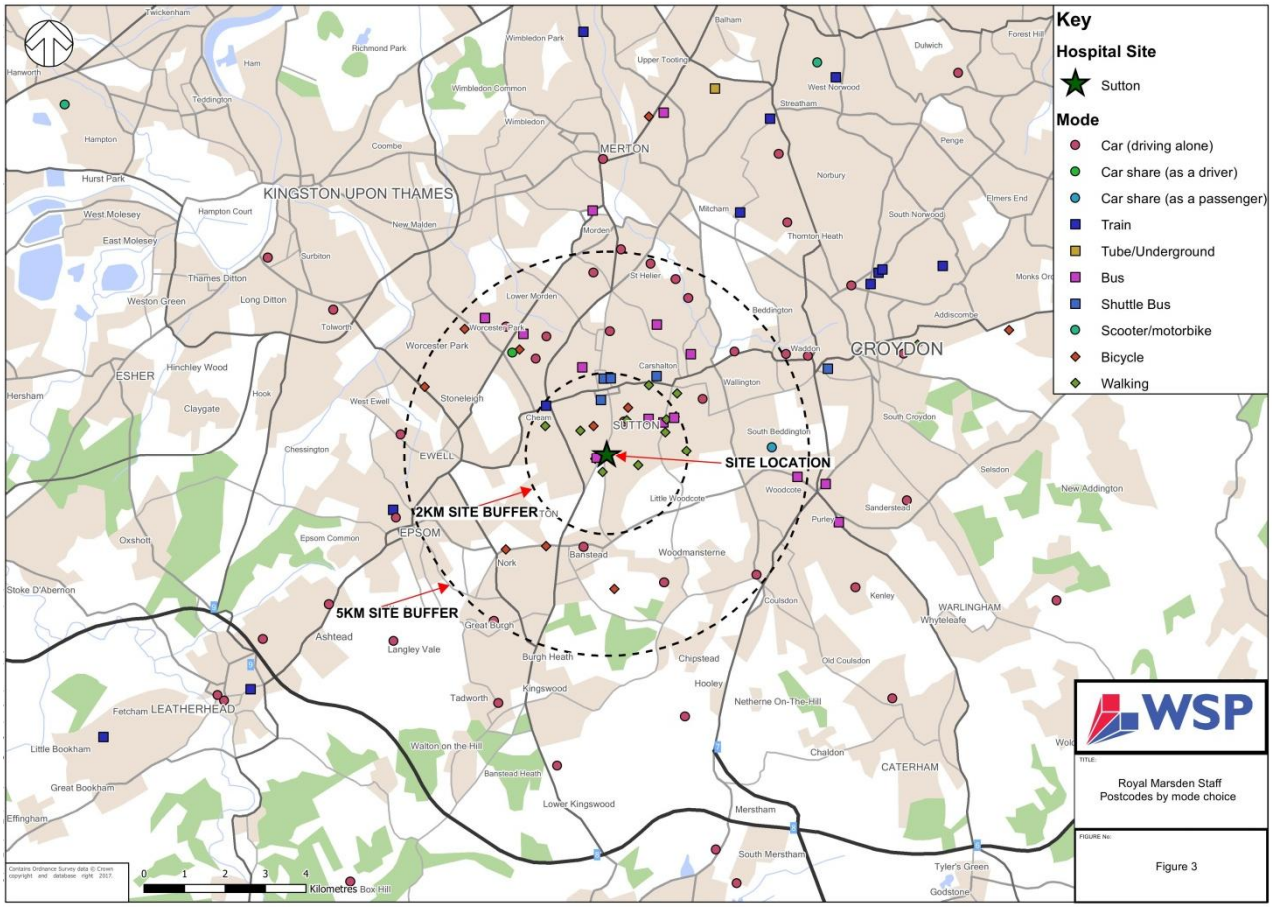
Table 2-3 ICR Modal Split - All Staff

Mode of Travel	Number of Staff	Percentage of Staff
Walk	49	10%
Cycle	33	7%
Motorcycle	1	0%
Bus	59	12%
Rail	88	17%
Mix of Public Transport	26	5%
Car Driver	237	47%
Car Passenger	7	1%
Taxi	0	0%
Total	**500**	**100%**

THE ROYAL MARSDEN RESULTS

2.2.7 Figure 3 (also at **Appendix C**) shows where staff live in relation to the site by mode of transport based on the results postcode and mode of travel data for The Royal Marsden. It should be noted that the sample size for this institution is limited (approx. 9% sample, 156 surveys for 1617 employees).

Figure 3 Royal Marsden Staff Postcodes by Mode



2.2.8 Table 2-3 below show the modal split of staff currently working at The Royal Marsden. The modal split is more evenly spread between north and south, therefore, it has not been considered appropriate to break the modal split between those living to the north and south of the site.

Table 2-4 The Royal Marsden Modal Split

Mode of Travel	Number of Staff	Percentage of Staff
Walk	13	8%
Cycle	12	8%
Motorcycle	2	1%
Public Bus	15	9%
Rail	25	16%
Shuttle Bus	4	3%
Car Driver (Alone)	80	51%
Car Driver (with passenger)	3	2%
Car Passenger	1	1%
Taxi/Other	1	1%
Total	**156**	**100%**

Source : 2015 Royal Marsden Staff Travel Survey

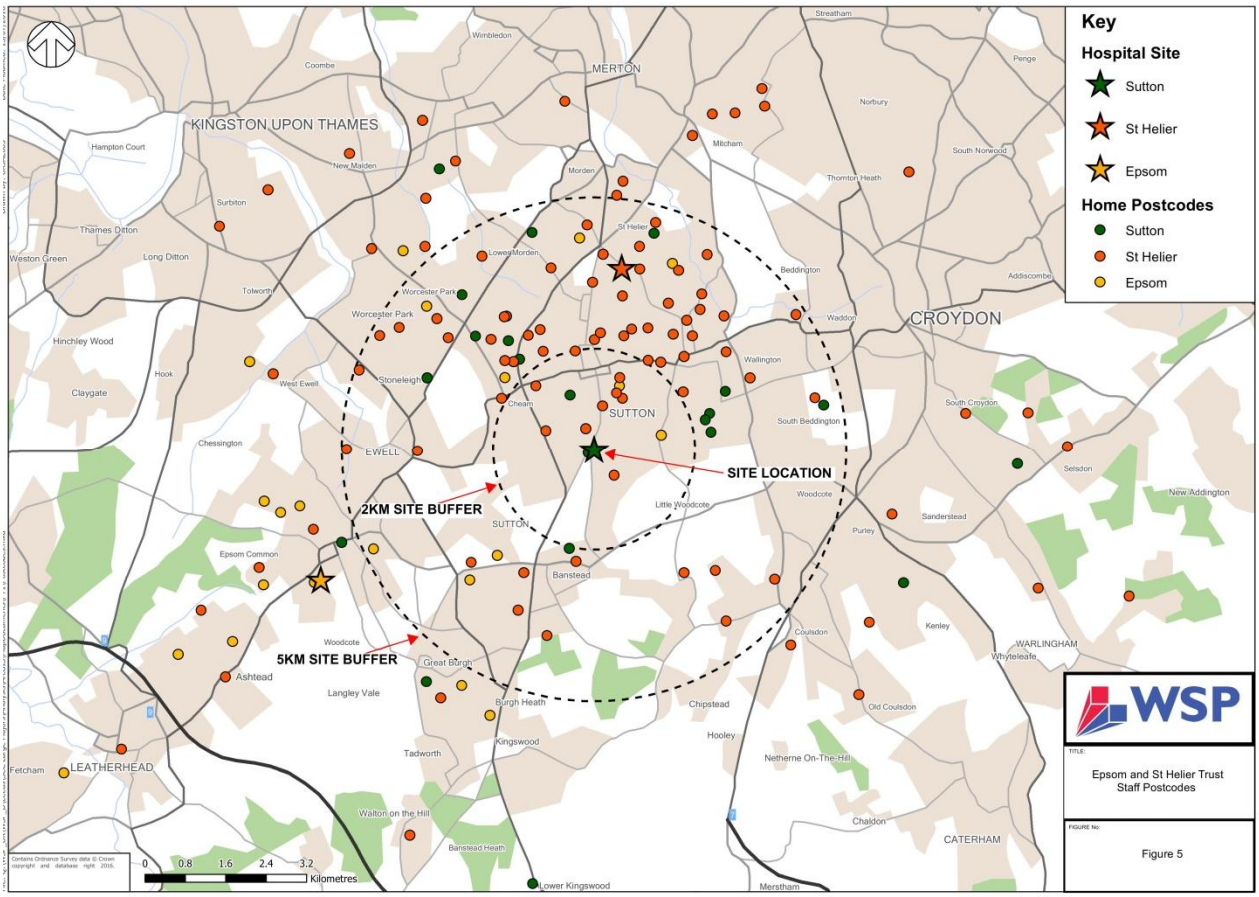
2.2.9 Figure 4 (also at **Appendix D**) shows where patients live in relation to The Royal Marsden site by postcode sector. Although this will be different in the future as the patients change, it gives an idea of the sites catchment.

Figure 3 Royal Marsden Patient Postcode Sectors

ESH RESULTS

2.2.10 Figure 5 (also at **Appendix E**) shows where staff live in relation to the three ESH sites at Sutton, Epsom and St Helier and are provided for information. Modal split data was available for the ESH sites, however, the postcodes and mode of travel results are not linked. This means that although it is possible to identify where staff live (as shown on the plan below) it is not possible to identify how those staff currently travel to the three ESH sites from their place of residence. On this basis, the data for The Royal Marsden has been used to assess the origin and modal split of the proposed hospital, this is considered appropriate based on The Royal Marsden catchment, staff profile and availability of site specific modal split data.

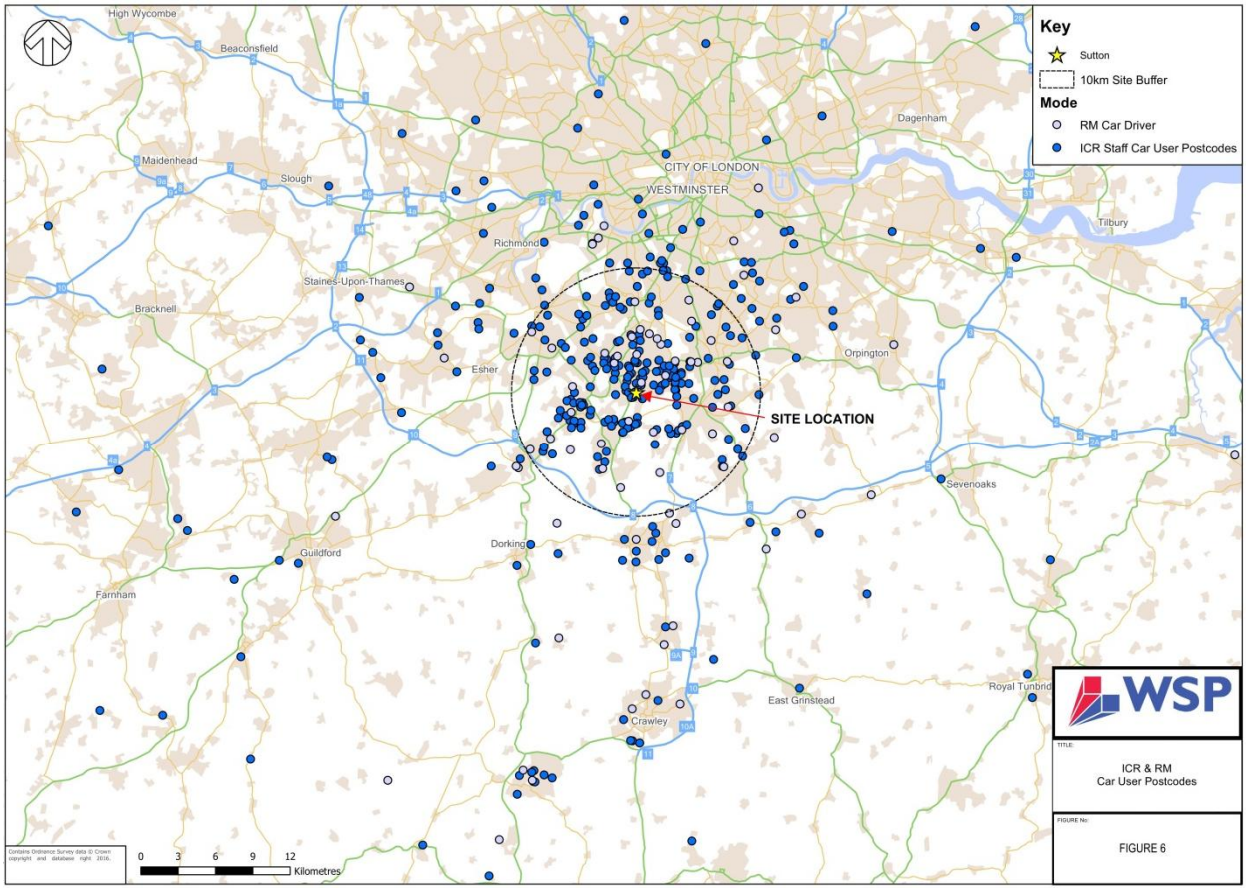
Figure 4 Epsom and St Helier Trust Staff Postcodes



ICR AND THE ROYAL MARSDEN ALL CAR USERS

2.2.11 Figure 6 (also at **Appendix F**) shows all car users combined for the ICR and The Royal Marsden.

Figure 5 ICR & RM Car User Postcodes



2.2.12 The GIS mapping analysis within Figure 6 has been used as the basis for the gravity model to assess the origin of staff travelling to the site by car which is described in more detail in Section 3.

3 REVISED TRIP GENERATION AND PREDICTED CAR PARK ACCUMULATION

3.1.1 The following section sets out the methodology used to assess the expected level of trip generation for the ICR and Royal Marsden hospital elements of the LCH site. Scenario B has been used in order to be robust given that it is based on larger proportion of research and development/commercial floor space which results in a higher trip generation. In addition to the hospital and commercial uses the proposed secondary school is also considered.

3.1.2 This section also sets out the changes to maximum applicable parking provision to accord with latest quantum of development.

3.1.3 It is important to note that the impact of the trips generated by the development detailed in this section are based upon existing trip distribution patterns and modal splits taken from travel plan survey data as detailed in Section 2.

3.1.4 As the scheme is developed alongside supporting infrastructure and the implementation of sustainable travel initiatives, trip generations and distributions will change resulting in less car based trips occurring than those predicted in this report. However for the purposes of robustness, this report currently seeks to assess the development as a 'worst case scenario' in terms of car based trip generation in order to effectively identify potential mitigation and support a local plan allocation.

3.2 PROPOSED TRIP GENERATION

ICR AND COMMERCIAL ELEMENT

3.2.1 In order the calculate the trip generation associated with the ICR / Commercial element of the LCH site the proposed floor area of 156,845m^2 has been devided by the existing floor area of 19,655m^2 which results in a factor of 7.98.

3.2.2 This factor has been applied to the 738 existing staff to calculate the total number of trips by mode to the proposed ICR / Commercial element of the LCH site. The total daily person trips by mode for staff living to the north and south of the site are shown below in Table 3-1.

Table 3-1 ICR / Commercial Total Daily Person Trip by Mode

Mode of Travel	Existing Arrivals (Estimated)	Proposed Arrivals (Estimated)	Existing Departures (Estimated)	Proposed Departures (Estimated)
Walk	74	589	74	589
Cycle	52	412	52	412
Motorcycle	7	59	7	59
Bus	89	707	89	707
Rail	125	1001	125	1001
Mix of Public Transport	37	294	37	294
Car Driver	347	2768	347	2768
Car Passenger	7	59	7	59
Taxi	0	0	0	0
TOTAL	**738**	**5889**	**738**	**5889**

Source: WSP|Parsons Brinkerhoff Consultant Calculations

3.2.3 Through discussions with the ICR it has been agreed that two thirds (66%) of staff will arrive on site during the morning peak hour period (8am – 9am) with the remainder (33%) arriving outside of the peak period in line with existing staff travel patterns. The same methodology has been applied to the evening peak hour period (5pm – 6pm). Table 3-2 shows the existing estimated total peak hour person trips by mode for staff living to the north and south of the site. Table 3-3 shows the estimated proposed total peak hour person trips by mode for staff living to the north and south of the site

Table 3-2 ICR / Commercial Total Peak Hour Trips by Mode – Existing (Estimated)

Mode of Travel	AM Peak		PM Peak	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
Walk	49	0	0	49
Cycle	34	0	0	34
Motorcycle	5	0	0	5
Bus	58	0	0	58
Rail	83	0	0	83
Mix of Public Transport	24	0	0	24
Car Driver	229	0	0	229
Car Passenger	5	0	0	5
Taxi	0	0	0	0
TOTAL	**487**	**0**	**0**	**487**

Source: WSP|Parsons Brinkerhoff Consultant Calculations

Table 3-3 ICR / Commercial Total Peak Hour Trips by Mode – Proposed (Estimated)

Mode of Travel	AM Peak		PM Peak	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
Walk	389	0	0	389
Cycle	272	0	0	272
Motorcycle	39	0	0	39
Bus	466	0	0	466
Rail	661	0	0	661
Mix of Public Transport	194	0	0	194
Car Driver	1827	0	0	1827
Car Passenger	39	0	0	39
Taxi	0	0	0	0
TOTAL	**3887**	**0**	**0**	**3887**

Source: WSP|Parsons Brinkerhoff Consultant Calculations

THE ROYAL MARSDEN HOSPITAL ELEMENT

3.2.4 The trip generation for The Royal Marsden Hospital element of the LCH development has been calculated using total person trip rates for hospital sites. The TRICS data which includes staff and patients/visitors has been used in the absence of predicted staff and patient/visitor figures for The Royal Marsden hospital element of the LCH development proposals. The total person peak hour trip rates are shown in Table 3-4 below.

Table 3-4 Royal Marsden Total Person Peak Hour Trip Rates

LAND USE	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
General hospital (per 100m^2)	1.402	0.521	0.603	1.249

Source: TRICS Database

3.2.5 The existing floor area of 50,387m^2 is a combination of the three ESH sites (Epsom, St Helier and Sutton) and The Royal Marsden. The proposed floor area of The Royal Marsden Hospital element of TRM is 78,410m^2.

3.2.6 The total person peak hour trip generation for The Royal Marsden as it is currently has been derived by applying the existing floor area (50,387m^2) to the total person peak hour trip rates in Table 3-4. The existing peak hour trip generation by mode is shown below in Table 3-5.

Table 3-5 Royal Marsden Total Peak Hour Trips by Mode - Existing

MODE OF TRAVEL	AM PEAK		PM PEAK	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
Car driver (alone)	360	134	155	321
Train	106	39	46	94
Walk	57	21	24	50
Bicycle	57	21	24	50
Shuttle Bus	21	8	9	19
Public Bus	64	24	27	57
Car driver (with passenger)	14	5	6	13
Car passenger	7	3	3	6
Motorcycle/ scooter	7	3	3	6
Other	7	3	3	6
Underground	7	3	3	6
TOTAL	**706**	**263**	**304**	**629**

Source: WSP\|Parsons Brinkerhoff Consultant Calculations

3.2.7 The proposed floor area of 78,410m^2 has been applied to the total person peak hour trip rates derived from TRICS (Table 3-4) to calculate the total person trips for the proposed Royal Marsden element of the LCH site and is shown below in Table 3-6.

Table 3-6 Royal Marsden Total Peak Hour Trips by Mode - Proposed

Mode of Travel	AM Peak		PM Peak	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
Car driver (alone)	561	208	241	499
Train	165	61	71	147
Walk	88	33	38	78
Bicycle	88	33	38	78
Shuttle Bus	33	12	14	29
Public Bus	99	37	43	88
Car driver (with passenger)	22	8	9	20
Car passenger	11	4	5	10
Motorcycle/ scooter	11	4	5	10
Other	11	4	5	10
Underground	11	4	5	10
TOTAL	**1099**	**409**	**473**	**979**

Source: WSP|Parsons Brinkerhoff Consultant Calculations

DISTRIBUTION

3.2.8 A gravity model has been used to define the route staff take when accessing the site by private car based on the GIS mapping for all car drivers currently working at the ICR and The Royal Marsden. It has been assumed that the car drivers to the proposed LCH development will access the site based on the distribution derived from the gravity model for the existing ICR and The Royal Marsden. The gravity model is attached at attached at **Appendix G** and the findings are described further in Section 5.

NET IMPACT OF THE LCH PROPOSALS

3.2.9 It should be noted that a proportion of the proposed development's GFA will replace a number of existing buildings on the site. As these buildings are an extant land use, it would be possible to justify the GFA of these buildings (and their generated trips) to be rebuilt without the need to justify their proportional highways impact. Therefore the trips generated upto the site's extant GFA are not 'new' trips and should not be considered in any net trip generation calculations for the site.

3.2.10 In order to assess the net impact of the LCH proposals, an exercise has been undertaken which compares the existing peak hour traffic generation of the existing ICR/Royal Marsden against the potential peak hour traffic generation of the proposed LCH development

3.2.11 Table 3-7 shows the existing peak hour traffic generation for the ICR (Table 3-2) and The Royal Marsden (Table 3-5) combined.

Table 3-7 ICR and Royal Marsden Total Peak Hour Traffic generation - Existing

Mode of Travel	AM Peak		PM Peak	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
Car driver	603	139	161	563

Source: WSP|Parsons Brinkerhoff Consultant Calculations

3.2.12 Table 3-8 shows the potential peak hour traffic generation associated with the ICR / Commercial Uses (Table 3-3) and The Royal Marsden hospital (Table 3-6).

Table 3-8 ICR/Commercial and The Royal Marsden Total Peak Hour Traffic Generation - Proposed

Mode of Travel	AM Peak		PM Peak	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
Car driver	2409	217	251	2346

Source: WSP|Parsons Brinkerhoff Consultant Calculations

3.2.13 Table 3-9 shows the net difference once the figures within Table 3-7 have been deducted from the figures within Table 3-8.

Table 3-9 ICR/Commercial and The Royal Marsden Total Peak Hour Traffic Generation - Net Difference

Mode of Travel	AM Peak		PM Peak	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
Car driver	1814	77	90	1791

Source: WSP|Parsons Brinkerhoff Consultant Calculations

3.2.14 The results show that the net impact will be 1,891 and 1,881 additional traffic movements on the surrounding local highway network during the morning and evening peak hour periods respectively.

3.3 PARKING PROVISION

3.3.1 The GFA figures for scenario B have been used to calculate the maximum parking requirements for the ICR / Commercial and The Royal Marsden elements of the LCH site by undertaking a parking accumulation assessment. The results have then been assessed against the London Borough of Sutton (LBS) parking standards and consideration of the London Plan standards. Cycle parking will be provided in accordance with the London Plan standards.

MAXIMUM CAR PARKING STANDARDS

3.3.2 Tables 3-10 provides the maximum parking standards for the Borough, it is however key to note that parking provision would be agreed on a site specific basis and this provision should be considered as a guideline figure for appraisal purposes. A number of the existing buildings on site considered to be commercial uses were constructed prior the publication of these standards at 1 space per 30m^2, therefore consideration of existing and proposed quantum's should be considered to ensure operationally the holistic site provision is appropriate.

3.3.3 The site has a Public Transport Accessibility Level (PTAL) ranging from 1a on the eastern boundary to 2 for the remainder of the site, on a scale of 1 to 6 where 6b is most accessible. The site is therefore currently considered to have relatively poor accessibility to public transport.

Table 3-10 London borough of Sutton - Maximum Parking for Land Use Types

LAND USE	CAR PARKING	MOTORCYCLE PARKING	CYCLE PARKING
Hospital	Individually Assessed (Currently 1 space per 84m^2)	1 space per 20 car parking spaces	1 space per 250m^2
Research / Commercial	1 space per 100m^2		1 space per 250m^2

Source : London Borough of Sutton Local Development Framework

3.3.4 Based on the maximum car parking standards when considered against the proposed GFAs, the development could provide a total of 2,502 spaces (this assumes hospital at the existing ratio of 1:84m^2 and is considered appropriate for this process). The car parking standards state that the requirements for a hospital land use class should be individually assessed given that there is a mix of staff and patient/visitor parking required. All other land uses on the LCH site are considered as ancillary to the development, therefore, no additional parking is proposed.

3.3.5 An allowance should be made within the emerging development schedules to accommodate the required number of motor-cycle and pedal cycle spaces.

3.3.6 Electric Vehicle charging points should also be provided in line with relevant policy. The London Plan currently requires commercial uses to provide 20% active and 10% passive electric vehicle charging points based on the total parking provision for these uses.

NOW TOTAL GROSS FLOOR AREA (GFA)

3.3.7 The current preferred option redefines the proposed GFA for each future use and it is therefore appropriate to re-assess the impact of the current option on the maximum level of parking provision within the site.

3.3.8 Table 3-11 below presents the maximum permissible parking on site based on the revised GFA figures.

Table 3-11 Maximum Parking Provision Based on GFA

LAND USE	GFA	CAR PARKING	MOTORCYCLE PARKING	CYCLE PARKING
Research / Commercial	156,845	1569	79	628
Royal Marsden	78,410	933	47	314
Total	**235,255**	**2,502**	**126**	**942**

Source: WSP|Parsons Brinkerhoff Consultant Calculations

3.3.9 Tables 3-11 shows that the maximum permissible parking on site for the Consultation layout is 2,502 spaces. This level of provision is approximately in line the current proposed provision of 2,500 spaces which is to be delivered within Wave 1. It should be noted that the car parking figure for the Royal Marsden Hospital element of the LCH is based on the requirement derived using the TRICS data (as described earlier in this section). The proposed secondary school proposes c. 80 spaces specifically for school use. The implications for this based on current proposed uses are discussed in the following section of this report.

3.3.10 Set out below in Table 3-12 is a breakdown of the maximum car parking provisions based on GFA for each wave of the LCH site (the actual provision proposed should be considered for each wave as provided specifically in Section 5, with Wave 1 effectively providing a holistic car parking solution for the site).

Table 3-12 Proposed Car Parking by Wave (by sqm)

LAND USE	GFA	CAR PARKING
Wave 0	8,000 Commercial/ICR + Secondary School	80 + 80
Wave 1	53,515 Commercial/ICR	535
Wave 2	68,265 Commercial/ICR + 78,410 Proposed TRM	683 + 933
Wave 3	27,065 Commercial/ICR	270
Total Cumulative	**156,845 Commercial/ICR + 78,410 Proposed TRM + Secondary School**	**2582 (inc. 80 for School)**

3.3.11 The existing site currently provides approximately 1200 parking spaces on site for staff and visitors, which is over and above the current maximum permissible parking space policy standards (when accounting for current GFA / Employment). Parking has previously been raised as an issue for planning applications as it has been deemed that any additional demand is not catered for appropriately in the respective proposals Therefore the proposed parking provision must accommodate expected demand and be to the satisfaction of the local highway authority, residents and planning committee.

3.3.12 Table 3-13 shows the parking requirements based on the anticipated trips to the site throughout the day based on the methodology set out earlier in this section. The predicted parking accumulation of 3,679 occupied spaces across the LCH site demonstrates that the demand exceeds the maximum prevision based on the parking standards. Those uses considered ancillary to the development proposals such as community uses, patient hotel and retail do not specifically consider parking provision as it is considered that peak usage will fall outside of the development peaks, but also the majority of trips are linked or complimentary to other uses.

3.3.13 A comprehensive package of sustainable transport measures and travel planning initiatives will be implemented by the proposed development seeking a significant reduction in private car journeys and thus parking demand. On this basis the development proposes 2,500 spaces to cater for the expected demand factoring in required future modal shift at the site.

3.3.14 Table 3-13 below shows the anticipated parking accumulation of the LCH site based on the existing modal shift. The accumulation is based on the arrival and departure profile from the TRICS data for the hospital element. For the ICR / Commercial element, the peak hour arrivals in the AM peak (8:00 – 9:00) and departures in the PM Peak (17:00 – 18:00) are based on 66% of staff. The remaining 34% will be arriving and departing outside the peak periods.

Table 3-13 ICR and Royal Marsden Hospital Combined Parking Accumulation

Time Period	Arrivals	Departures	Accumulation
07:00 - 08:00	474	143	331
08:00 - 09:00	1524	216	1638
09:00 - 10:00	2306	260	3683
10:00 - 11:00	311	312	3682
11:00 - 12:00	322	350	3654
12:00 - 13:00	326	359	3621
13:00 - 14:00	434	382	3672
14:00 - 15:00	439	432	**3679**
15:00 - 16:00	337	434	3582
16:00 - 17:00	248	567	3263
17:00 - 18:00	251	2346	1168
18:00 - 19:00	281	1290	159
19:00 - 20:00	205	223	141
20:00 - 21:00	110	222	29
21:00 - 22:00	28	58	0

Source: WSP|Parsons Brinkerhoff Consultant Calculations

3.3.16 This clearly emphasises the need for transformational enhancements to public transport accessibility and high quality service provision in order to deliver a substantial modal shift which will ensure that the LCH site operates within the proposed parking provision.

4 MOVEMENT GENERATION & MULTI MODAL TRANSPORT STRATEGY

4.1.1 Travel Plan surveys and reporting for both ICR (2016 data) and The Royal Marsden (2015 data) identify the current travel to work journeys by mode for the existing site. The individual and combined average journeys are presented in Table 4-1 below.

4.1.2 Table 4-1 details journey to work by transport mode, with the total number of person trips factored against each percentage. Currently, there are 1,476 members of staff employed at the ICR and 3,234 employees at TRM. This equates to a total of 4,710 employees at the existing site. Whilst there was not a 100% response rate on the Travel Planning Surveys, these factors are considered to be robust to provide a suitable baseline assessment of expected staff movements by mode that currently occur at the site. It is also key to note that many staff work on a shift basis so movements to and from the site do not occur in a singular peak hour and are staggered across a working day and therefore as an example car parking demand would not be as great as the numbers shown in Table 4-1 during any peak occupancy of parking on and surrounding the existing site.

4.1.3 Table 4-1 also provides the anticipated future daily travel to work journeys based on the total GFA of the LCH development proposals. Table 4-1 purely takes account of expected employment based trips to the site.

Table 4-1 Current Travel to Work Journeys

	Current Travel to Work Journeys				Future Travel to Work Journeys	
	PERCENTAGE SHARE		Current Average	No. of Journeys	Without Intervention	
MODE	ICR (2016)	Royal Marsden (2015)			No. of Journeys	Net Change
Car Driver (alone)	47%	51%	49%	2308	8237	5929
Car Driver (with passenger)	-	2%	2%	94	336	242
Car Passenger	1%	1%	1%	47	168	121
Bus	12%	9%	11%	518	1849	1331
Shuttle Bus	-	3%	3%	141	504	363
Train / Underground	17%	16%	17%	801	2858	2057
Other / Mixture of Public Transport	5%	1%	3%	141	504	363
Bicycle	7%	8%	8%	377	1345	968
Walking	10%	8%	9%	424	1513	1089

4.1.4 The quantum of all network trips created by the site will be determined and fully assessed during future work stages of the planning application(s). This will include any visitor / patient / delivery / servicing based journeys on the surrounding network.

4.1.5 Following further consideration of the data presented in Table 4-1 above, there is an essential requirement to ensure that there is a significant modal shift in both arrivals and departures away from single occupancy car based trips to enable the site to operate without a detrimental impact upon the surrounding highway network. Whist various mitigation schemes can be provided to reduce the impact of the scheme proposals on the highway network, this will require a fundamental travel planning strategy to facilitate modal shift and management of demand.

4.1.6 Table 4-2 below presents the suggested modal shift targets that would be required to enable the site to remain self-contained (with supporting infrastructure projects), thus reducing the impact of the development to the surrounding transport network. These targets would be achieved through a series of sustainable Travel Planning initiatives, including the improved provision and new public transport services, accompanied by infrastructure with a range of complimentary measures including walking and cycling improvements as detailed within this report.

4.1.7 Key to this process will be the acknowledgement that modal shift for journeys from the north of the site will be far easier to influence and capture due to existing and proposed public transport infrastructure. It is likely that as the site Waves are built out, that the catchment of the site will change with a higher concentration of people living closer to the site providing an active catchment for walking and cycling based trips.

Table 4-2 Modal Shift Targets

	Current Journeys		Future Travel to Work Journeys		
	Without Intervention		With Intervention		
MODE	Current Average	No. of Journeys	Proposed Target	No. of Journeys	Net Change
Car (Driving Alone)	49%	2308	15%	2623	323
Car Share (as Driver)	2%	94	10%	1748	1654
Car Share (as Passenger)	1%	47		-	-
Bus	11%	518	15%	2623	2104
Shuttle Bus	3%	141	40%	6993	1743
Train / Underground	17%	801			
Other / Mixture of Public Transport	3%	141			
Bicycle	8%	377	10%	1748	1372
Walking	9%	424	10%	1748	1324

4.1.8 It is recognised that the proposed modal split targets shown in Table 4-2 are highly ambitious and potentially only achievable through implementation and incentivisation of an exemplar sustainable transport, in parallel to significant investment in public transport. Such investment would clearly have wider transport and economic benefits in terms of extraction from existing modes (beyond the operation of the LCH site) to create capacity within the existing network that will support wider economic growth and facilitate cross modal integration. In accordance with the proposed targets set out in Table 4-2, an outline strategy would initially aim to achieve and build upon the follow targets:

- More than halve the current (%) private car journeys to work;
- Almost double the current (%) of public transport based journeys to work; and
- Increase travel by sustainable modes of transport based journeys to work by 50%.

4.1.9 The extension of the existing south London Tramlink network as part of a best in class public transport strategy would bring exponential benefits to all, not limited to the journeys of visitors and patients but also to the surrounding neighbours of the site by serving to ensure that the impact of its future daily operation is accommodated within its own boundary and the exacerbated concern over the impact of long term indiscriminate and unwanted parking is removed. Further to this, the scheme will support and remove barriers to economic growth in the London Borough of Sutton and the wider South London corridor. It should be noted that further detailed assessment of the tram extension business case and alignment choice will be required to ensure that it delivers appropriate benefits to the scheme (and wider catchment) including a significant proportion of modal shift and direct interconnectivity / interchange with existing public transport infrastructure.

4.1.10 The predicted car parking accumulation for the LCH site presented previously in Table 3-8 has been adjusted based on the modal shift targets identified within Table 4-2. The resultant car parking accumulation is shown below in Table 4-3.

Table 4-3 ICR and Co Royal Marsden Hospital Combined Parking Accumulation with Modal Shift

Time Period	Arrivals	Departures	Accumulation
07:00 - 08:00	223	67	156
08:00 - 09:00	775	102	829
09:00 - 10:00	1198	123	1904
10:00 - 11:00	147	147	1904
11:00 - 12:00	152	165	1890
12:00 - 13:00	154	169	1875
13:00 - 14:00	205	180	1899
14:00 - 15:00	207	204	**1902**
15:00 - 16:00	159	205	1856
16:00 - 17:00	117	267	1706
17:00 - 18:00	118	1217	608
18:00 - 19:00	132	665	75
19:00 - 20:00	97	105	66
20:00 - 21:00	52	105	14
21:00 - 22:00	13	27	0

Source: WSP|Parsons Brinkerhoff Consultant Calculations

4.1.11 The figures within Table 4-3 demonstrate that delivering a modal shift in line with the targets set out within Table 4-2 through an public transport strategy will reduce parking demand below the level currently proposed.

4.1.12 At this stage, no operational or capacity assessment of the existing highway infrastructure has been undertaken and the robustness of the proposed targets should be re-assessed in line with the required transport modelling and detailed analysis undertaken as part of stage 6 of the development brief.

5 DELIVERY OF TRANSPORT INFRASTRUCTURE BASED ON PHASING STRATEGY

5.1 PHASING STRATEGY

5.1.1 This section sets out what the net impact of the development is likely to be in each Wave of its delivery based on the phasing strategy over a 14 year delivery period from 2017 to 2030.

5.1.2 The phasing strategy has four distinct Waves from Wave 0 through to Wave 3 and has been based upon the GFAs for Scenario B. The phasing strategy includes two scenarios for Wave 2.

5.1.3 Consideration has been given to existing base traffic levels on the local and regional highway network to determine the likely impact of each development Wave to determine when and where appropriate mitigation is likely to be required. Where available, traffic data has been considered when preparing the mitigation proposals detailed in this section for the local highway network, these are however subject to the appropriate modelling appraisals to determine schemes, interventions are currently based on the judgement of consultants and TfL.

5.1.4 Neighbouring Highway Authorities and the strategic highway network have been taken into consideration during the preparation of the Development Framework. It is considered that should the mitigation proposals detailed for each Wave in this section be implemented that this would result in no adverse impact on the wider highway network. Detailed and focussed assessment would be undertaken by any Transport Assessments prepared and in consultation / scoping with appropriate highway authorities. It should be noted that funding for any mitigation measures has not yet been secured.

5.1.5 A gravity model (attached at **Appendix G**) has been produced based the existing travel behaviour of staff at the ICR and the Royal Marsden accessing the site by car. The distribution (attached at **Appendix H**) derived from the gravity model has been assigned to the surrounding highway network based on the likely route staff/ visitors will take when travelling to and from the LCH site. The route assignment of the likely traffic distribution is shown below in Table 5-1. The Table also shows the corresponding two-way vehicle movements associate with the development once fully built out.

Table 5-1 Route Assignment

Route	Percentage of traffic assigned	2-way Traffic Movements	
		AM Peak	PM Peak
Brighton Road (south of Belmont Rise)	16%	427	422
Belmont Rise	31%	807	798
Brighton Road (from Sutton town centre)	7%	283	248
Northey Avenue	13%	343	339
St Dunstan's Hill	18%	467	461
Banstead Road South	30%	836	746
Fir Tree Road	5%	139	137
Sutton Lane	16%	425	420

5.1.6 The distribution assignment shows that majority of trips to the site are from the east (30%) and west (31%). Approximately 32% of trips are likely to access the site from Surrey to the south with the remaining 7% of trips accessing the site from the centre of Sutton. It should be noted that the two-way vehicle movements shown above in Table 5-1 are based on a number of assumptions at this stage. A detailed Transport Assessment will be required as part of a later stage of the LCH Development Framework process. The likely distribution is shown on the diagram at **Appendix H**.

WAVE 0

5.1.7 Wave 0 proposes a new secondary school at 12,390m^2 and 8,000m^2 ICR / Commercial floor space. A full planning application for the new secondary school was submission to LBS in December 2016 which is supported by a Transport Assessment also prepared by WSP | Parsons Brinkerhoff. The generated traffic flows associated with the ICR / Commercial element of Wave 0 have been calculated using a factor of 0.4 based on the difference between the existing and proposed floor space. The trips associated with the ICR / Commercial element have been assigned to the surrounding highway network using the distribution derived from the gravity model described earlier within this report. The traffic flows generated by Wave 0 of the LCH site are shown on diagram at **Appendix I**.

The total cumulative person trip generation by mode associated with Wave 0 is shown below in Table 5-2. The figures associated with the ICR / Commercial floor space have been derived by applying the mode of travel percentages set out earlier in this report to the total person trips for Wave 0. It should be noted that the figures in Table 5-2 make no allowance for the amount of existing trips that will be replaced as part of the delivery of Wave 0.

Table 5-2 Total Cumulative Person Peak Hour Trips by Mode - Wave 0

Mode of Travel	AM Peak		PM Peak	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
Walk	295	0	0	41
Cycle	46	0	0	22
Motorcycle	2	0	0	2
Bus	555	0	0	58
Rail	34	0	0	40
Mix of Public Transport	10	0	0	11
Car Driver	316	0	0	171
Car Passenger	51	0	0	10
Taxi	0	0	0	0
TOTAL	**1308**	**0**	**0**	**354**

Source: WSP|Parsons Brinkerhoff Consultant Calculations

TRANSPORT INFRASTRUCTURE REQUIRED

5.1.8 Currently no new transport infrastructure or highways mitigation is considered necessary to facilitate the delivery of the proposed ICR / Commercial floor space in Wave 0 given that the distribution of the car driver trips are spread across numerous junctions on the network, further to this the above figures account for no net reduction in trips.

5.1.9 Through the work being carried out for the School's Transport Assessment, public consultation feedback and key stakeholder comments, TfL are currently considering if existing bus service provision is suitable to meet proposed demand during school peak periods.

5.1.10 A comprehensive Travel Plan would be developed for the LCH site which would include a package of 'Smarter Travel' sustainable transport measures to support the modal shift targets. Measures would be identified for each Wave with agreed modal shift targets seeking to meet the final target identified post Wave 3.

WAVE 1

5.1.11 Wave 1 proposes a total of 53,515m^2 ICR / Commercial floor space and an under croft multi-storey car park of 2,500 spaces.

5.1.12 Wave 1 also comprises, 2,200m^2 of patent hotel floor space, 1,900m^2 of leisure/library floor space, 1,765m^2 of community floor space and 2,300m^2 of retail floor space. These uses are considered to be ancillary to the LCH development proposals and are therefore not considered in any highways / traffic generation calculations in this report.

5.1.13 The generated traffic flows associated with the ICR / Commercial floor space element of Wave 1 have been calculated using a factor of 2.7 based on the difference between the existing and proposed floor space. The trips associated with the ICR / Commercial floor space element of Wave 1 have been assigned to the surrounding highway network using the distribution. The traffic flows generated by Wave 0 to Wave 1 of the LCH site are shown on diagram at **Appendix J**. The total cumulative person trip generation by mode associated with Wave 0 and Wave 1 is shown below in Table 5-3. It should be noted that the figures in Table 5-3 make no allowance for the amount of existing trips that will be replaced as part of the delivery of Wave 1.

Table 5-3 Total Cumulative Person Peak Hour Trips by Mode - Wave 0 to Wave 1

Mode of Travel	AM Peak		PM Peak	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
Walk	431	0	0	173
Cycle	160	0	0	107
Motorcycle	15	0	0	25
Bus	633	0	0	212
Rail	259	0	0	267
Mix of Public Transport	76	0	0	76
Car Driver	995	0	0	796
Car Passenger	68	0	0	24
Taxi	0	0	0	0
TOTAL	**2638**	**0**	**0**	**1681**

Source: WSP|Parsons Brinkerhoff Consultant Calculations

TRANSPORT INFRASTRUCTURE REQUIRED

5.1.14 A package of improvements to pedestrian and cycle facilities on key routes will need to be delivered as identified as potential options that the applicant could consider within the London Cancer Hub, Transport Issues and Options Report by TfL. One of the key routes is between the site and Belmont station. In addition to enhancing pedestrian/cycling infrastructure, existing bus services could be enhanced in order to mitigate the impact of Wave 0 and Wave 1. The Site Wide Travel Plan will continue to be implemented throughout the implementation of the LCH proposals in order to influence the mode of transport staff/ patients/ visitors use to access the site and deliver the modal shift targets identified.

HIGHWAY IMPROVEMENTS

5.1.15 In addition to the sustainable modes measures identified above, it is likely that some off site highways mitigation will be required of existing junctions where capacity will be met or exceeded, this mitigation is currently unfunded. The likely junctions impacted upon can be identified by the traffic flow spreadsheets appended to this report, these flows however do not account for any net reduction of existing land uses or anticipated modal split to ensure a worst case scenario is assessed. The comprehensive Transport Assessment that would be prepared in support of the planning application (or an earlier study on highways capacity) would assess all relevant junctions and propose appropriate mitigation where required.

5.1.16 The delivery of Wave 1 on the LCH site could likely trigger the need for highway improvements at a number of key junctions including (but not exclusively) the following:

- Brighton Road/ Chiltern Road/ Cotswold Road;
- Cotswold Road/ Downs Road/ Sutton Lane;
- Brighton Road/ Downs Road/ Station Road;
- Belmont Rise/ Brighton Road.

5.1.17 The Brighton Road/ Chiltern Road/ Cotswold Road junction has been identified by LBS for implementation of a junction improvement as part of some wider network improvements. This would be implemented prior to the occupation of the Wave 1 development. The layout would be considered inclusive of the cumulative development impact, including school, subsequent development Waves and any major infrastructure projects to be implemented.

PEDESTRIAN IMPROVEMENTS

5.1.18 The walking routes to the site from Belmont station are via Downs Road or Pelton Avenue and these routes could be enhanced as identified as potential options that the applicant could consider within the TfL report as the site increases in GFA and demand. Pedestrian crossings in the locality of the site are limited. Pedestrian crossing facilities on the desire lines between Belmont Station will need to be delivered. This includes Cotswold Road which currently has no formal pedestrian crossing facilities.

5.1.19 Wayfinding within the locality will need to be improved in order to direct patients/visitors who are unfamiliar with the area.

5.1.20 TfL have stated that they would require a Pedestrian Environment Review System (PERS) audit and a Pedestrian Comfort Levels audit to be undertaken in order to assess the pedestrian flows to/from the site, where they would occur and how suitable to local pedestrian environment is to accommodate the increase flows.

CYCLING IMPROVEMENTS

5.1.21 Cycling infrastructure on key routes will need to be delivered in order to promote this mode and deliver the modal shift targets. The key route identified for improvements within the TfL report is between the site and Sutton town centre along Brighton Road as this could deliver significant journey time benefits. There are a number of existing local routes which are already conducive to cycling, therefore, improvements are not considered necessary.

BUS IMPROVEMENTS

5.1.22 The site is currently served by five bus routes which are within an acceptable walking distance of the site in addition to the shuttle service which operates between the hospital and Sutton town centre. However, the site currently has a low PTAL of between 1 and 2 depending on the area of the site.

5.1.23 Currently the ICR and The Royal Marsden operate three shuttle buses, providing a frequent service for staff between the site and Belmont Station (funded by the ICR and The Royal Marsden), this service currently experiences high levels of occupancy and is considered as a viable service by existing staff. It is proposed during the development of Wave 1 to increase the number of shuttle buses and the frequency of service incrementally to cater for increased demand as floor area is completed. The cost of providing additional shuttle bus services is considered to be low / moderate, assuming a bus and driver would cost c£60k per annum. Routes, destinations and catchments could also be explored to encourage further modal shift, with additional / new services potentially more appealing to staff given they are transported directly to site from their chosen origin.

5.1.24 As identified in the TfL report, improvements to commercial bus services could include the re-routing of both the 80 and 280 services directly into the site with an increased level of frequency, and in addition, the frequency of the S1, S3 and S4 could also be increased. It is anticipated that the associated cost of a single additional bus service is approximately £350k per annum, therefore consideration must be given to the total investment that may be required to cater for the anticipated demand and increase in services, particularly giving consideration to the expansion of shuttle bus provision and expansion of potential services and catchments.

WAVE 2

5.1.25 Wave 2 proposes 68,265m^2 ICR / Commercial floor space and 78,410 m^2 The Royal Marsden floor space. The trips associated with the ICR / Commercial element have been calculated using a factor of 3.5 based on the difference between the existing and proposed floor space. The trips associated with The Royal Marsden element are taken from Table 3-6 of this report.

5.1.26 The generated traffic flows for the ICR / Commercial and The Royal Marsden elements have been assigned to the surrounding highway network using the distribution. The traffic flows generated by Wave 0 to Wave 2 of the LCH site are shown on diagram at **Appendix K**. Please note that the traffic generation associated with The Royal Marsden Hospital which includes staff and patients/visitors has been distributed onto the surrounding highway network using the same distribution.

5.1.27 The total cumulative trip generation by mode associated with Wave 0 to Wave 2 is shown below in Table 5-4. It should be noted that the figures in Table 5-4 make no allowance for the amount of existing trips that will be replaced as part of the delivery of Wave 2.

Table 5-4 Total Cumulative Person Peak Hour Trips by Mode - Wave 0 to Wave 2

Mode of Travel	AM Peak		PM Peak	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
Walk	685	33	38	421
Cycle	345	33	38	312
Motorcycle	43	4	5	42
Bus	1049	49	57	538
Rail	712	61	71	700
Mix of Public Transport	183	8	9	181
Car Driver	2317	217	251	2108
Car Passenger	92	4	5	50
Taxi	0	0	0	0
TOTAL	**5426**	**409**	**473**	**4352**

Source: WSP|Parsons Brinkerhoff Consultant Calculations

TRANSPORT INFRASTRUCTURE REQUIRED

HIGHWAY IMPROVEMENTS

5.1.28 The delivery of Wave 2 which comprises the largest quantum of development on the LCH site could trigger the need for off-site highway improvements at a number of key junctions including (but not exclusively) the following:

- Belmont Rise/ Cheam Road;
- Brighton Road/ Bolters Lane/ Fir Tree Road;
- Banstead Road/ The Warren;
- Banstead Road/ Staplehurst Road;
- Tadworth Roundabout; and
- M25 Junction 8.

5.1.29 The level of highway improvements required at the junctions identified above and any other junctions is a judgements based on the trip generation figures and will be assessed as through a Transport Assessment as part of a future work stage of the development brief.

PEDESTRIAN / CYCLING / BUS IMPROVEMENTS

5.1.30 Following implementation of Wave 1 infrastructure improvements, provision would be reviewed to identify where additional schemes would further benefit LCH. Should any schemes be identified that could actively encourage modal shift, these would be appraised and potentially implemented.

MAJOR SCHEMES

5.1.31 As Wave 2 proposes to deliver the highest quantum of development; and thus the highest proportional impact on the highway network, it is highly likely that a major infrastructure / transportation scheme will be required to create a step change in modal shift.

5.1.32 The two primary existing ‘major’ schemes that have been potentially identified as delivering significant modal shift at LBS are:

- Twin tracking of existing railway between Belmont and Sutton stations on the Victoria Line (TfL estimated cost £23m);
- Extension of the south London tram to Sutton Station is £288m and in additional £100m from Sutton Station to Belmont.

5.1.33 Currently both schemes remain at feasibility stage without any commitment to funding. However both are considered to deliver significant benefits in relation to modal split and economic growth across LBS and the wider south London corridor.

5.1.34 Further detailed assessment work (including an appropriate BCR appraisal) will be required to determine the feasibility, deliverability and justification of their implementation. This additional appraisal work is encouraged to be undertaken at the earliest opportunity given that a major project is the likely catalyst to deliver the step change in modal split at LCH.

WAVE 3

5.1.35 Wave 3 proposes 27,065 ICR / Commercial floor space.

5.1.36 The trips associated with the ICR / Commercial element have been calculated using a factor of 1.4 based on the difference between the existing and proposed floor space. The generated traffic flows associated with the commercial element of Wave 3 have been assigned to the surrounding highway network using the distribution. The traffic flows generated by Wave 0 to Wave 3 of the LCH site are shown on the diagram at **Appendix L**.

5.1.37 The total cumulative person peak hour trip generation by mode associated with all four Waves is shown below in Table 5-5. It should be noted that the figures in Table 5-5 make no allowance for the amount of existing trips that will be replaced as part of the delivery of Wave 3.

Table 5-5 Total Cumulative Person Peak Hour Trips by Mode - Wave 0 to Wave 3

Mode of Travel	AM Peak		PM Peak	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
Walk	752	33	38	488
Cycle	392	33	38	359
Motorcycle	50	4	5	49
Bus	1130	49	57	618
Rail	826	61	71	814
Mix of Public Transport	216	8	9	215
Car Driver	2632	217	251	2423
Car Passenger	99	4	5	56
Taxi	0	0	0	0
TOTAL	**6096**	**409**	**473**	**5022**

Source: WSP|Parsons Brinkerhoff Consultant Calculations

5.1.38 The net change in total person trip generation by mode when deducting the existing from the proposed floor area is shown below in Table 5-6. These trips do not account for any expected modal shift as a result of any proposed mitigation or infrastructure provision (just discounting the existing GFA generated trips), these numbers are expected to reduce significantly as mitigation and Travel Planning measures are implemented.

Table 5-6 Total Cumulative Person Peak Hour Trips by Mode - Net Difference

Mode of Travel	AM Peak		PM Peak	
	ARRIVALS	DEPARTURES	ARRIVALS	DEPARTURES
Walk	651	23	21	391
Cycle	324	14	15	267
Motorcycle	38	1	2	47
Bus	929	25	42	500
Rail	633	38	22	635
Mix of Public Transport	172	0	0	172
Car Driver	2092	89	97	1871
Car Passenger	91	4	3	46
Taxi	-7	-3	-3	-6
TOTAL	**4922**	**192**	**199**	**3922**

Source: WSP|Parsons Brinkerhoff Consultant Calculations

TRANSPORT INFRASTRUCTURE REQUIRED

5.1.39 It is anticipated that following the implementation of the required transport infrastructure elements for Wave 2, no further mitigation would be required for Wave 3 as this would sufficiently cover the relatively low increase in GFA in addition to Wave 2.

5.1.40 However, the implemented site wide Travel Plan will be continually reviewed on a regular basis to ensure that further and new initiatives are identified and implemented across the LCH in order to assist and continue delivery of modal shift aspirations.

6 SITE PERMEABILITY AND MOVEMENT

6.1 SITE ACCESSIBILITY

6.1.1 This section provides a high level commentary on the current framework proposals and addresses the key provisions for site accessibility. Figure 7 details the high level holistic Transport Infrastructure proposals with potential access for all modes of transport, further detail on the proposed site permeability and location of walking, cycling and vehicle routes are provided in the Development Framework document and would be further developed at planning application stage..

Figure 6 Site Accessibility

Source: LCH Development Framework (August 2016)

6.2 CAR MOVEMENT

6.2.1 The main vehicle entry point is to be derived via a 'Green Spine' connecting from Brighton Road / Cotswolds Road junction. A major junction improvement will be required during implementation of Wave 1 at this location (as detailed in previous section) to facilitate the provision of all movements into the site. The form of junction will most likely be signal controlled with the scale of any works being determined by the number and quantum of modes requiring direct access at this point.

6.2.2 A secondary access is provided further south on Cotswolds Road. As the development proposals evolve the junction arrangements and internal operation will require detailed analysis to assess the operational performance and impact on the external highway network. This would consider aspects of one-way operation and prohibition of specific vehicle types.

6.2.3 For completeness it is suggested that a third access be provided onto Downs Road which may provide a bus only route, but again this would require detailed analysis at the appropriate stage. It is key to maintain flexibility on access options across the site, particularly during the development of the holistic scheme, for example this could be blue light routes for different hospital uses or pedestrian / cycle only routes.

6.2.4 Vehicular access to the proposed secondary school is from Chiltern Road initially. Once the wider London Cancer Hub is delivered, a vehicle only route will be provided at the south-east corner of the secondary school site. This will enable teachers/ visitors to access to the school without impacting upon Chiltern Road, therefore, resulting in a local benefit to residents.

6.2.5 Considering the existing perception from local residents with regard to nuisance parking associated with ICR, ESH and The Royal Marsden, the parking (staff) and drop off/pick up points for the school should be designed considerately to minimise impact on surrounding residents.

6.2.6 The current option proposes a total of 2,500 parking spaces to be provided on site. The appropriateness of this figure will be determined at future work stages but at this point, given the existing proportion of work based private car trips to the site, the figure further emphasises the need to achieve a holistic change in travel patterns to avoid any overspill of parking onto the surrounding local network.

6.3 PUBLIC TRANSPORT ACCESS

6.3.1 The indicative bus operation in and around the site is considered acceptable, however, this will evolve as the details of the wider (transformational) public transport system become clear and the existing bus service provision adapts to be responsive to migrated demand.

6.3.2 Bus stops could be integrated within close proximity to future tram facilities to enable interchange between modes and around clustering of retail and associated facilities (travel information points, ticketing machines etc) for user convenience.

6.3.3 There are currently two potential tram connections in to the site as detailed in the Development Framework, effectively one from the west and one from the north west of the site boundary As no preferred route currently exists, the options of both road and rail corridors should be considered as part of any business case / scheme development

6.3.4 These alignment provides separate tram/vehicle access to the site, which is beneficial to efficient tram operation. These have the following benefits:

- Dependent upon growth in vehicle demand and car park management (barrier control, charging regime, limited days use etc) the segregated tram access allows the tram to enter the site unimpeded enhancing journey times and passenger experience;
- Allows for the complex vehicular access junction to operate as efficiently as possible;
- Minimise the land take associated with a range of uses operating on the green spine;
- Provide stop facilities for the neighbouring residential areas (external to the site) – an additional tram stop could also be provided within the site itself; and
- Simplified tram crossing of Brighton Road.

6.4 PEDESTRIAN MOVEMENTS

6.4.1 The current framework proposes an acceptable level of connection with the external network. However, the critical issue associated with such facilities is the design including shared space, segregation and integration with tram and vehicle conflict points.

6.4.2 It is considered appropriate to define additional pedestrian and / or cycling links with surrounding neighbourhood. Three additional links to increase permeability could potentially be provided at:

- Bawtree Close through to Banstead Road South to the east;
- Clifton Avenue to the south; and
- Along the eastern boundary of the school to provide a link to Chiltern Road to the north.

6.4.3 It would prove beneficial at this stage to designate indicative locations for key internal cycling facilities or hub(s).

7 UTILITIES ASSESSMENT

7.1 UTILITY LOADING

7.1.1 Tables 7-1 to 7-3 give provide revised estimates of proposed loadings based on an a further review of Scenario B, with the following assumptions:

- Occupancy figures & benchmark loads taken from BSRIA rules of thumb;
- Occupancy figures based on gross area hence water storage volumes for offices, school and hospital could be reduced; and
- Hospital usage based on number of beds.

Table 7-1 Utility Loading

	Utility Load							
Development	**Area (m^2)**	**Occupancy (m2/ person)**	**Total Occupancy**	**Electrical Load (W/m^2)**	**Electrical Load (kW)**	**Electric (MVA)**	**Electrical usage (kWh / annum / m2)**	**Annual Electrical Usage (MWh / annum)**
School	12,390	10	1,239	50	620	1	40	496
ICR / Commercial	156,845	10	13,071	74	13,646	15	81	14,900
Royal Marsden - Hospital	78,410	N/A	502	88	6,273	8	99	7,057
MSCP	20,000	-	-	10	200	1	20	400
Retail	3,360	5	672	160	538	1	165	554
Community	11,770	10	1,177	50	589	3	95	1,118

Source: WSP|Parsons Brinkerhoff Consultant Calculations

Table 7-2 Utility Loading (2)

	Utility Load				
Development	**Area (m^2)**	**Heating load (W/m^2)**	**Peak Heating (kWh)**	**Annual Heating Load (kWh/m^2/annum)**	**Total Annual Heating Usage (MWh/annum)**
School	12,390	87	1,078	150	1,859
ICR / Commercial	156,845	59	10,980	102	18,821
Royal Marsden - Hospital	78,410	106	7,539	513	36,395
MSCP	20,000	N/A	N/A	N/A	N/A
Retail	3,360	100	336	165	554
Community	11,770	70	824	120	1412

Source: WSP|Parsons Brinkerhoff Consultant Calculations

Table 7-3 Utility Loading (3)

	Utility Load				
Development	**Cooling load (W/m^2)**	**Peak Cooling (kWh)**	**Water usage / person / day**	**Potable Water (m^3/day) - excluding peaking factors**	**Foul Water (m^3/day) - excluding peaking factors**
School	N/A	N/A	20	25	25
ICR / Commercial	74	13,646	13	196	196
Royal Marsden - Hospital	183	12,999	367	166	166
MSCP	N/A	N/A	N/A	N/A	N/A
Retail	140	470	10	7	7
Community	87	1,024	6	7	7

Source: WSP|Parsons Brinkerhoff Consultant Calculations

Appendix A

QUANTUM OF DEVELOPMENT – SCENARIO B

Appendix B

ICR ALL STAFF POSTCODES BY MODE (FIGURE 2)

Appendix C

ROYAL MARSDEN STAFF POSTCODES BY MODE CHOICE (FIGURE 3)

Appendix D

ROYAL MARSDEN PATIENTS POSTCODE SECTOR (FIGURE 4)

Appendix E

EPSOM AND ST HELIER TRUST STAFF POSTCODES (FIGURE 5)

Appendix F

ICR & ROYAL MARSDEN CAR USER POSTCODES (FIGURE 6)

Appendix G

GRAVITY MODEL

Appendix H

DISTRIBUTION

Appendix I

WAVE 0 DEVELOPMENT TRAFFIC FLOWS

Appendix J

WAVE 0 – 1 DEVELOPMENT TRAFFIC FLOWS

Appendix K

WAVE 0 – 2 DEVELOPMENT TRAFFIC FLOWS

Appendix L

WAVE 0 – 3 DEVELOPMENT TRAFFIC FLOWS

Appendix A

QUANTUM OF DEVELOPMENT – SCENARIO B

SCENARIO B - Incremental TRM development - approx. figures. SQM

WAVE	QUANTUMS (approx. GEA)	Plot size	Public Realm (excluded from total)	MSCP (excluded from total)	Existing Buildings to be retained long term, GIA (excluded from total, as counted within new use)	Existing TRM Buildings, to be retained short-mid term, demolished in Wave 2, GIA	TRM Hospital	Research (commercial - ie 'for profit)	Academic / Charitable user	Research (not for profit - ie ICR)	Residential / Patient Hotel	Other non profit (ie Maggie's centre)	School	Leisure/Library	Community	Retail	TOTAL
Plot 1	0	School	16625										12,390				12,390
Plot 2	1	Business / Offices / Retail / Community	1010					2,330							480	300	3,110
Plot 3	1	Business / Offices	930					4,640									4,640
Plot 4	1	Business	2955					6,465									6,465
Plot 5	1	Community / Business (includes Heritage buildings)	7920			2780		2,440							1,285	1,250	4,975
Plot 6	1	ICR / Retail	5115						9,615							750	10,365
Plot 7	2	Business / Offices	4260					12,475									12,475
Plot 8	2	Business / Offices / Retail	4260					18,040							1,355		19,395
Plot 9	1	Business/Offices/ICR/Community/patient hotel (Knowledge Centre)	3745					6,930	8,695		2,200			1,155			18,980
Plot 10	1	Sports/Leisure: Energy Spine, North	1260											745			745
Plot 11a	0	ICR (NEW BUILDING 1) (figure as portion of quoted 20,400sqm)	3,450							8,000							8,000
Plot 11b	1	ICR (NEW BUILDINGS 1-3) (figure as portion of quoted 20,400sqm)	3,515							12,400							12,400
Plot 12	0 + 2	TRM (including ambulatory care building + Maggies)	8015				18,025					1,150					19,175
Plot 13	2	TRM (including existing CMP)	2400			3480	4,760	4,850									9,610
plot 14	2	Business / Leisure / ICR / Community / Retail	3160	4225				4,750							750	1,200	600 7,300
Plot 15	N/A + 2	Existing ICR / CHP / Business	6980			15752		3,625		19,655					505		23,785
Plot 16	2	TRM/Offices (including CYPC)	4370			3000	11,400										11,400
Plot 17	2	TRM	2480					8,630									8,630
Plot 18	2	TRM	7190				9,085	10,740									19,825
Plot 19	2	TRM	2425				11,300										11,300
Plot 20	2	ICR/ Community	2750							5,155					505		5,660
Plot 21	2	TRM	1075				4,600										4,600
Plot 22	2	TRM	2760				7,210										7,210
Plot 23	2	TRM (including Cyclotron)	2120			2500	5,010										5,010
Plot 24	2	TRM	1755				7,020										7,020
Plot 25	3	Business	2205					7,250									7,250
Plot 26	3	Business	2820					5,645									5,645
Plot 27	3	Business	5890	1,395				14,170									14,170
	Totals	113,440	5,620	0	27,512		78,410	112,980	18,310	45,210	2,200	1,150	12,390	2,650	5,330	2,900	
															GRAND TOTAL	281,530	

	ADDITIONAL QUANTUM PER PHASE (approx. GEA)	Phase area - Total plot size by phase includes each plot within line	Public Realm (excluded from total)	MSCP (excluded from total)		Existing TRM Buildings, to be retained short-mid term, demolished in Wave 2, GIA	TRM Hospital	Research (commercial - ie 'for profit)	Academic / Charitable user	Research (not for profit - ie ICR)	Residential / Patient Hotel	Other non profit (ie Maggie's centre)	School	Leisure/Library	Community	Retail	
Existing ICR	Existing Stock (ICR, Plot 15)	8695			15752					19,655							19,655
Wave 0	Pending Stock	20635								8,000		1,150	12,390				21,540
Wave 1	Existing ESH Land redevelopment	52635	14320	75000	2780		0	22,805	18,310	12,400	2,200	0	0	1,900	1,765	2,300	61,680
Wave 2B	Existing TRM Land redevelopment	81590	3400		6480		78,410	63,110	0	5,155	0	0	0	750	3,565	600	151,590
Wave 3	Additional allotment land redevelopment	62520	28,720				0	27,065		0	0	0	0	0	0	0	27,065
	Totals	226,075	46,440	75,000	25,012	38,466	78,410	112,980	18,310	45,210	2,200	1,150	12,390	2,650	5,330	2,900	
															GRAND TOTAL	281,530	

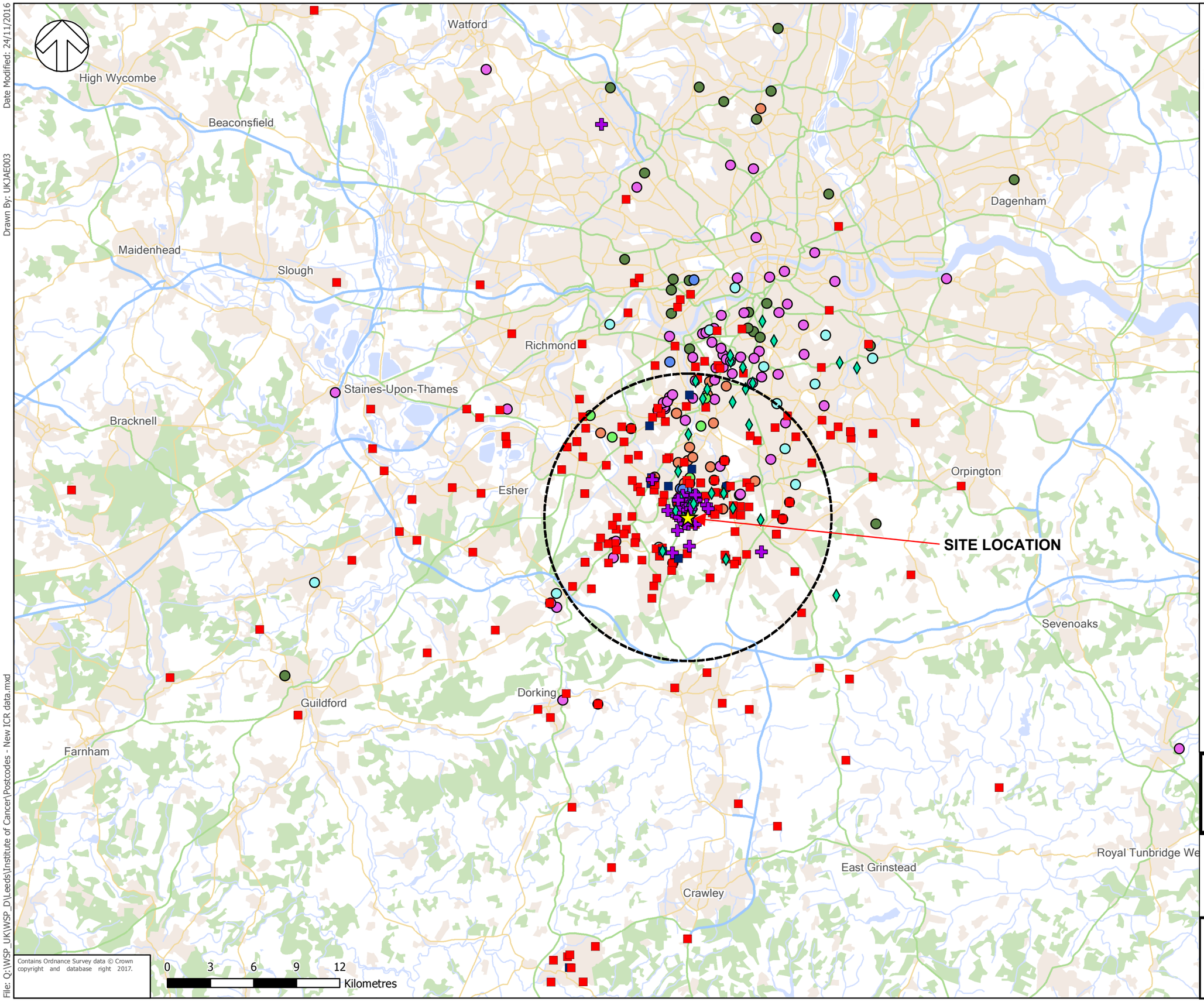
Appendix B

ICR ALL STAFF POSTCODES BY MODE (FIGURE 2)

Date Modified: 24/11/2016

Drawn By: UKJAE003

File: Q:\WSP_UK\WSP_DLeeds\Institute of Cancer\Postcodes - New ICR data.mxd



Key

- Sutton site
- 10km Site Buffer

Postcodes

- Bicycle
- Walk
- Car driver alone
- Car driver with staff
- Walk and shuttle bus
- Public bus and shuttle bus
- Public bus
- Train and walk
- Train and shuttle bus
- Mixture of public transport

WSP

TITLE:

Institute of Cancer Research
All Staff Postcodes by Mode

FIGURE No:

FIGURE 2

Appendix C

ROYAL MARSDEN STAFF POSTCODES BY MODE CHOICE (FIGURE 3)

Date Modified: 13/07/2016

Drawn By: UKJAE003

File: Q:\WSP_UK\WSP_D\Leeds\SCC Large Majors\Analysis\ArcGIS\MapDocuments\PT1\Postcodes.mxd

Key

Hospital Site

- Sutton

Mode

- Car (driving alone)
- Car share (as a driver)
- Car share (as a passenger)
- Train
- Tube/Underground
- Bus
- Shuttle Bus
- Scooter/motorbike
- Bicycle
- Walking

SITE LOCATION

12KM SITE BUFFER

5KM SITE BUFFER

Twickenham
Hanworth
Richmond Park
Ham
Teddington
Hampton
Hurst Park
West Molesey
East Molesey
Hampton Court
KINGSTON UPON THAMES
Surbiton
New Malden
Thames Ditton
Weston Green
Long Ditton
Tolworth
ESHER
Hinchley Wood
Hersham
Claygate
Hook
Chessington
Oxshott
Epsom Common
Stoke D'Abernon
Fetcham
LEATHERHEAD
Little Bookham
Great Bookham
Effingham
Wimbledon Park
Wimbledon Common
Wimbledon
Coombe
MERTON
Morden
Lower Morden
St Helier
Worcester Park
Stoneleigh
West Ewell
EWELL
Cheam
SUTTON
Carshalton
Wallington
Beddington
Waddon
CROYDON
Addiscombe
Balham
Upper Tooting
Streatham
West Norwood
Dulwich
Forest Hill
Penge
Norbury
Mitcham
Thornton Heath
South Norwood
Elmers End
Monks Orc
Selsdon
New Addington
Sanderstead
Purley
Woodcote
Little Woodcote
South Beddington
South Croydon
EPSOM
Banstead
Woodmansterne
Nork
Great Burgh
Ashtead
Langley Vale
Burgh Heath
Chipstead
Old Coulsdon
Coulsdon
Kenley
WARLINGHAM
Whyteleafe
Hooley
Kingswood
Tadworth
Netherne On-The-Hill
Walton on the Hill
Banstead Heath
Lower Kingswood
Chaldon
CATERHAM
Merstham
South Merstham
Tyler's Green
Godstone
Box Hill

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0 1 2 3 4 Kilometres

WSP

TITLE:

Royal Marsden Staff
Postcodes by mode choice

FIGURE No:

Figure 3

Appendix D

ROYAL MARSDEN PATIENTS POSTCODE SECTOR (FIGURE 4)

Date Modified: 27/07/2016

Drawn By: UKJAE003

Amersham
Watford
High Wycombe
Beaconsfield
Maidenhead
Slough
Reading
Bracknell
Staines-Upon-Thames
Richmond
CITY OF LONDON
WESTMINSTER
Dagenham
Tilbury
Kingston Upon Thames
Croydon
Orpington
Esher
Sutton
SITE LOCATION
Sevenoaks
Maidstone
Dorking
Reigate
Guildford
Farnham
Royal Tunbridge Wells
East Grinstead
Crawley
Horsham
Petersfield
Uckfield

Key

Name

Sutton

10km Site Buffer

Postcode Sector

Count

1 - 4

5 - 10

11 - 18

19 - 27

28 - 47

0 3.5 7 10.5 14

Kilometres

WSP

TITLE:

Royal Marsden Patients
Postcode Sector

FIGURE No:

FIGURE 4

File: Q:\WSP_UK\WSP_D\Leeds\Institute of Cancer\Postcodes.mxd

Appendix E

EPSOM AND ST HELIER TRUST STAFF POSTCODES (FIGURE 5)

Date Modified: 13/07/2016

Drawn By: UKJAE003

File: Q:\WSP_UK\WSP_D\Leeds\SCC Large Majors\Analysis\ArcGIS\MapDocuments\PT1\Postcodes.mxd

Key

Hospital Site

- Sutton
- St Helier
- Epsom

Home Postcodes

- Sutton
- St Helier
- Epsom

SITE LOCATION

2KM SITE BUFFER

5KM SITE BUFFER

KINGSTON UPON THAMES
MERTON
CROYDON
SUTTON
EWELL
LEATHERHEAD
WARLINGHAM
CATERHAM
Wimbledon
Streatham
Coombe
Penge
Norbury
Hampton Court
New Malden
Mitcham
South Norwood
Morden
Thornton Heath
Surbiton
Thames Ditton
St Helier
Weston Green
Long Ditton
Lower Morden
Beddington
Addiscombe
Tolworth
Worcester Park
Waddon
Hinchley Wood
Wallington
Hook
Stoneleigh
West Ewell
Claygate
Cheam
South Croydon
South Beddington
Chessington
Selsdon
Woodcote
New Addington
Little Woodcote
Sanderstead
Purley
Epsom Common
Banstead
Kenley
Coulsdon
Woodcote
Whyteleafe
Great Burgh
Ashtead
Langley Vale
Burgh Heath
Chipstead
Old Coulsdon
Hooley
Kingswood
Tadworth
Netherne On-The-Hill
Fetcham
Walton on the Hill
Chaldon
Banstead Heath
Lower Kingswood
Merstham

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0 0.8 1.6 2.4 3.2 Kilometres

WSP

TITLE:

Epsom and St Helier Trust
Staff Postcodes

FIGURE No:

Figure 5

Appendix F

ICR & ROYAL MARSDEN CAR USER POSTCODES (FIGURE 6)

Date Modified: 27/07/2016

Drawn By: UKJAE003

Key

Sutton

10km Site Buffer

Mode

RM Car Driver

ICR Staff Car User Postcodes

SITE LOCATION

High Wycombe
Beaconsfield
Maidenhead
Slough
Bracknell
Staines-Upon-Thames
Richmond
CITY OF LONDON
WESTMINSTER
Dagenham
Tilbury
Esher
Orpington
Sevenoaks
Dorking
Guildford
Farnham
East Grinstead
Crawley
Royal Tunbridge

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0 3 6 9 12 Kilometres

WSP

TITLE:

ICR & RM
Car User Postcodes

FIGURE No:

FIGURE 6

File: Q:\WSP_UK\WSP_D\Leeds\Institute of Cancer\Postcodes.mxd

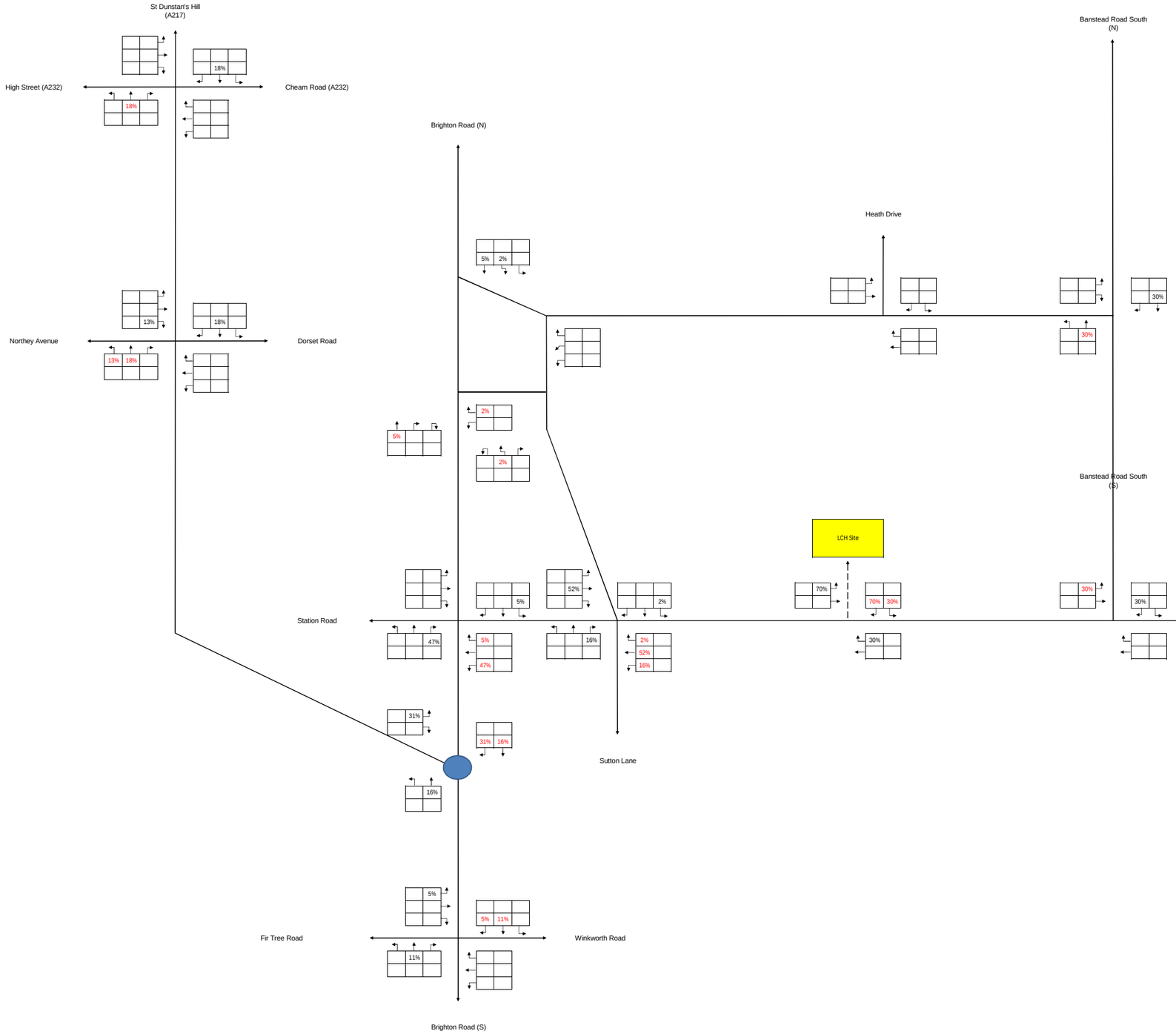
Appendix G

GRAVITY MODEL

Postcode Sector	Number of car drivers	Percentage	West														East		
			Downs Road	Cotswold Road	Sutton Lane	Brighton Road North	Brighton Road South	A217	Belmont Rise	Northey Avenue	High Street (A232)	Cheam Road (A232)	St Dunstan's Hill (A217)	Fir Tree Road	Winkworth Road	A217 S	Downs Road	Fairlawn Road	Banstead Road S
SM7	33	6.2%	6.2%		6.2%												6.0%		6.0%
SM5	32	6.0%															5.1%		5.1%
SM2	29	5.5%	4.4%	0.7%		2.2%	2.2%		2.2%	2.2%									
SM6	27	5.1%																	
SM1	24	4.5%	4.5%	1.4%		4.5%													
SM3	19	3.6%	3.6%				3.6%		3.6%				3.6%						
KT18	15	2.8%	2.8%				2.8%	2.8%						1.7%		1.1%			
CR0	14	2.6%															2.6%		2.6%
SW19	13	2.5%	2.5%				2.5%		2.5%				2.5%						
CR5	13	2.5%	1.7%		1.7%												0.7%		0.7%
KT17	12	2.3%	2.3%				2.3%	1.1%	1.1%	1.1%				1.1%					
RH1	10	1.9%	1.9%		1.9%														
KT4	9	1.7%	1.7%				1.7%		1.7%				1.7%						
SW17	9	1.7%	0.9%				0.9%		0.9%				0.9%				0.9%		0.9%
CR2	9	1.7%															1.7%		1.7%
KT21	8	1.5%	1.5%				1.5%	1.5%						0.9%		0.6%			
KT19	8	1.5%	1.5%				1.5%		1.5%	1.5%									
RH12	7	1.3%	1.3%				1.3%	1.3%								1.3%			
CR3	7	1.3%	0.7%		0.7%												0.7%		0.7%
RH11	7	1.3%	1.3%		0.7%		0.7%	0.7%								0.7%			
KT20	7	1.3%	1.3%				1.3%	1.3%								1.3%			
KT6	6	1.1%	1.1%				1.1%		1.1%	1.1%									
CR4	6	1.1%															1.1%		1.1%
BR3	6	1.1%															1.1%		1.1%
CR8	6	1.1%															1.1%		1.1%
RH2	5	0.9%	0.9%				0.9%	0.9%								0.9%			
SM4	5	0.9%	0.9%				0.9%		0.9%				0.9%						
RH6	4	0.8%	0.8%		0.2%		0.6%	0.6%								0.6%			
SW16	4	0.8%															0.8%		0.8%
KT22	4	0.8%	0.8%		0.2%		0.6%	0.6%								0.6%			
SW13	4	0.8%	0.8%				0.8%		0.8%				0.8%						
KT3	4	0.8%	0.8%				0.8%		0.8%				0.8%						
RH13	4	0.8%	0.8%				0.8%	0.8%								0.8%			
SW20	4	0.8%	0.8%				0.8%		0.8%				0.8%						
SW15	4	0.8%	0.8%				0.8%		0.8%				0.8%						
KT12	3	0.6%	0.6%				0.6%		0.6%	0.6%									
KT9	3	0.6%	0.6%				0.6%		0.6%	0.6%									
OX2	3	0.6%	0.6%				0.6%	0.6%								0.6%			
SE13	3	0.6%															0.6%		0.6%
RH8	3	0.6%	0.3%		0.3%												0.3%		0.3%
SE26	3	0.6%															0.6%		0.6%
BN1	3	0.6%	0.6%		0.6%														
TW12	3	0.6%	0.6%				0.6%		0.6%	0.3%			0.3%						
CR7	3	0.6%															0.6%		0.6%
KT5	3	0.6%	0.6%				0.6%		0.6%	0.6%									
TW10	2	0.4%	0.4%				0.4%		0.4%				0.4%						
SW10	2	0.4%	0.4%				0.4%		0.4%				0.4%						
GU12	2	0.4%	0.4%				0.4%	0.4%						0.4%					
KT2	2	0.4%	0.4%				0.4%		0.4%				0.4%						
KT8	2	0.4%	0.4%				0.4%		0.4%	0.2%			0.2%						
BN2	2	0.4%	0.4%		0.4%														
SW18	2	0.4%	0.4%				0.4%		0.4%				0.4%						
TW16	2	0.4%	0.4%				0.4%		0.4%	0.4%									
SW12	2	0.4%	0.2%				0.2%		0.2%				0.2%				0.2%		0.2%
GU22	2	0.4%	0.4%				0.4%		0.4%	0.4%									
GU2	2	0.4%	0.4%				0.4%	0.2%	0.2%	0.2%				0.2%					
BR1	2	0.4%															0.4%		0.4%
SE25	2	0.4%															0.4%		0.4%
GU8	2	0.4%	0.4%				0.4%	0.2%	0.2%	0.2%				0.2%					
RH5	2	0.4%	0.4%				0.4%	0.4%						0.2%		0.2%			
UB2	2	0.4%	0.4%				0.4%		0.4%	0.2%			0.2%						
RH3	2	0.4%	0.4%				0.4%	0.2%	0.2%	0.2%				0.2%					
KT15	2	0.4%	0.4%				0.4%		0.4%	0.4%									
RH14	2	0.4%	0.4%				0.4%	0.2%	0.2%	0.2%				0.2%					
BR2	2	0.4%	0.2%		0.2%												0.2%		0.2%
RH4	2	0.4%	0.4%				0.4%	0.2%	0.2%	0.2%				0.2%					
TN4	2	0.4%	0.2%		0.2%												0.2%		0.2%
SE23	2	0.4%															0.4%		0.4%
RH9	2	0.4%	0.2%		0.2%												0.2%		0.2%
RH10	2	0.4%	0.4%		0.4%														
SE19	2	0.4%															0.4%		0.4%
SW11	2	0.4%	0.4%				0.4%		0.4%				0.4%						
TW3	1	0.2%	0.1%				0.1%		0.1%	0.1%			0.1%						
TW7	1	0.2%	0.2%				0.2%		0.2%	0.1%			0.1%						
ME17	1	0.2%	0.2%		0.0%		0.2%	0.2%								0.2%			
TW18	1	0.2%	0.2%				0.2%		0.2%	0.2%									
SW4	1	0.2%	0.1%				0.1%		0.1%				0.1%				0.1%		0.1%
RH19	1	0.2%	0.2%		0.1%		0.1%	0.1%								0.1%			
RG4	1	0.2%	0.2%				0.2%	0.1%	0.1%				0.1%			0.1%			
UB10	1	0.2%	0.2%				0.2%	0.1%	0.1%	0.1%						0.1%			
RG45	1	0.2%	0.2%				0.2%	0.1%	0.1%				0.1%			0.1%			
W6	1	0.2%	0.2%				0.2%		0.2%				0.2%						
RH17	1	0.2%	0.2%		0.2%														
GU26	1	0.2%	0.2%				0.2%		0.2%	0.2%									
GU3	1	0.2%	0.2%				0.2%		0.2%	0.2%									
SE14	1	0.2%															0.2%		0.2%
DA1	1	0.2%	0.1%		0.1%												0.1%		0.1%
UB5	1	0.2%	0.2%				0.2%	0.1%	0.1%				0.1%			0.1%			
BN17	1	0.2%	0.2%		0.1%		0.1%	0.1%								0.1%			
KT16	1	0.2%	0.2%				0.2%	0.0%	0.1%	0.1%						0.1%			
TN13	1	0.2%	0.1%		0.1%												0.1%		0.1%
OX3	1	0.2%	0.2%				0.2%	0.1%	0.1%				0.1%			0.1%			
TN2	1	0.2%	0.1%		0.1%												0.1%		0.1%
NW2	1	0.2%	0.2%				0.2%		0.2%				0.2%						
SE20	1	0.2%															0.2%		0.2%
NW10	1	0.2%	0.2%				0.2%		0.2%				0.2%						
KT14	1	0.2%	0.2%				0.2%	0.2%		0.2%									
BN14	1	0.2%	0.2%				0.2%	0.2%								0.2%			
RG24	1	0.2%	0.2%				0.2%	0.1%	0.1%	0.1%						0.1%			
GU35	1	0.2%	0.2%				0.2%	0.0%	0.1%	0.1%						0.1%			
E7	1	0.2%	0.1%		0.1%												0.1%		0.1%
SO14	1	0.2%	0.2%				0.2%		0.2%	0.2%									
N12	1	0.2%	0.2%				0.2%		0.2%				0.2%						
KT7	1	0.2%	0.2%				0.2%		0.2%	0.2%									
DA16	1	0.2%															0.2%		0.2%
TN10	1	0.2%	0.2%		0.2%														
W1	1	0.2%	0.2%				0.2%		0.2%				0.2%						
E3	1	0.2%															0.2%		0.2%
SL3	1	0.2%	0.2%				0.2%	0.1%	0.1%				0.1%			0.1%			
AL6	1	0.2%	0.2%				0.2%	0.1%	0.1%				0.1%			0.1%			
BR4	1	0.2%															0.2%		0.2%
SW9	1	0.2%	0.1%				0.1%		0.1%				0.1%				0.1%		0.1%
N22	1	0.2%	0.2%		0.2%														
TN39	1	0.2%	0.2%		0.2%														
DA2	1	0.2%	0.1%		0.1%												0.1%		0.1%
TN8	1	0.2%	0.1%		0.1%												0.1%		0.1%
RM3	1	0.2%	0.1%		0.1%												0.1%		0.1%
GU14	1	0.2%	0.2%				0.2%		0.2%	0.2%									
RG10	1	0.2%	0.2%				0.2%	0.1%	0.1%				0.1%			0.1%			
GU52	1	0.2%	0.2%				0.2%		0.2%	0.2%									
ME16	1	0.2%	0.2%		0.2%														
GU4	1	0.2%	0.2%				0.2%	0.1%	0.1%	0.1%						0.1%			
RG31	1	0.2%	0.2%				0.2%	0.1%	0.1%				0.1%			0.1%			
SE22	1	0.2%															0.2%		0.2%
RH20	1	0.2%	0.2%				0.2%	0.2%								0.2%			
TN30	1	0.2%	0.2%		0.2%														
CT1	1	0.2%	0.2%		0.2%														
CR6	1	0.2%															0.2%		0.2%
EN8	1	0.2%	0.2%		0.2%														
SE16	1	0.2%															0.2%		0.2%
BR6	1	0.2%	0.1%		0.1%												0.1%		0.1%
SW14	1	0.2%	0.2%				0.2%		0.2%				0.2%						
TN16	1	0.2%	0.1%				0.1%		0.1%	0.1%							0.1%		0.1%
TW13	1	0.2%	0.2%				0.2%		0.2%	0.2%									
KT23	1	0.2%	0.2%				0.2%	0.2%								0.2%			
E17	1	0.2%															0.2%		0.2%
N17	1	0.2%	0.2%				0.2%		0.2%				0.2%						
RH16	1	0.2%	0.2%		0.0%		0.2%	0.2%								0.2%			
TW15	1	0.2%	0.2%				0.2%		0.2%	0.2%									
TOTAL	529	100%	70%	2%	16%	7%	47%	16%	31%	13%	0%	0%	18%	5%	0%	11%	30%	0%	30%

Appendix H

DISTRIBUTION



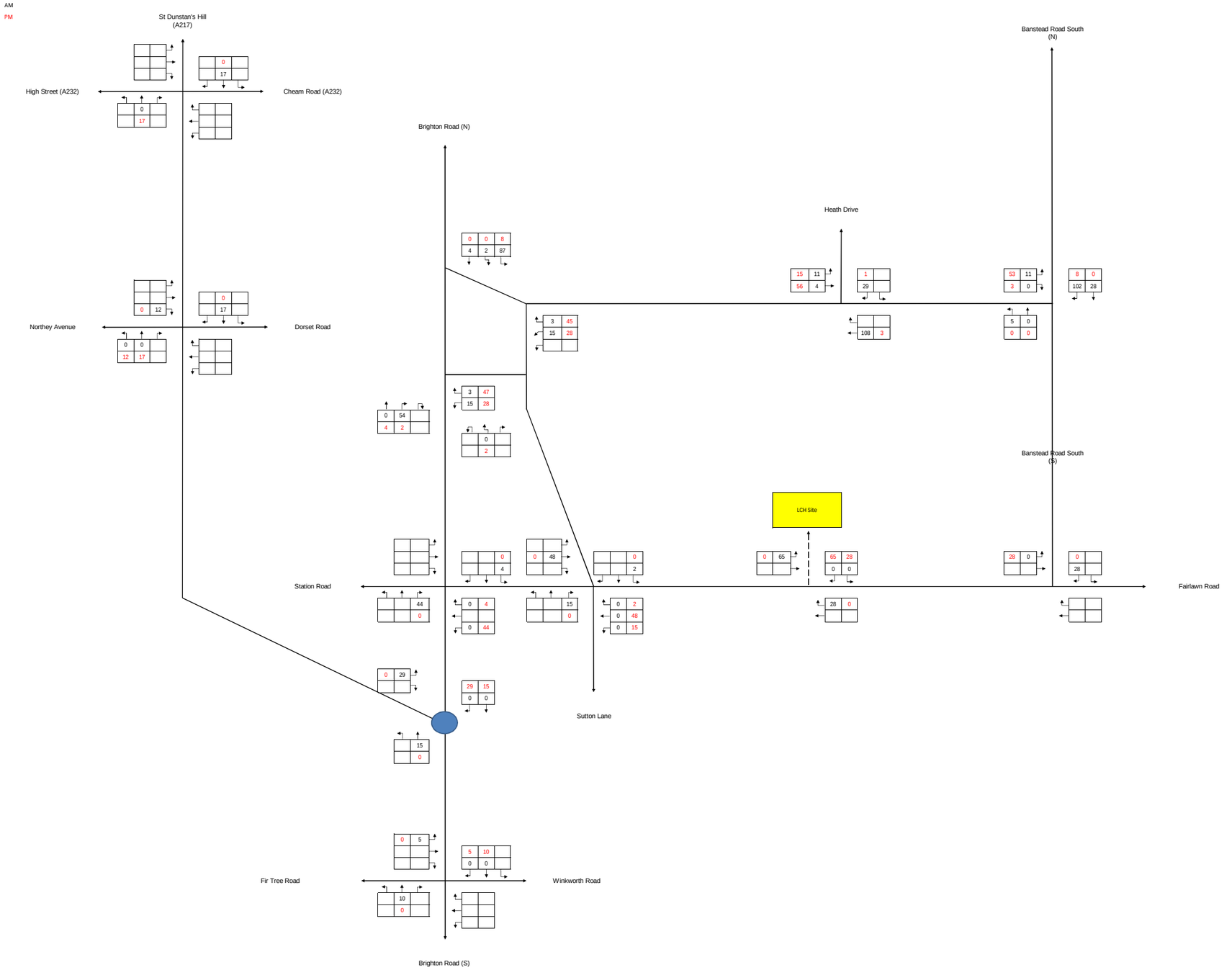
WSP | PARSONS BRINCKERHOFF	Distribution	Appendix H

Appendix I

WAVE 0 DEVELOPMENT TRAFFIC FLOWS

AM

PM



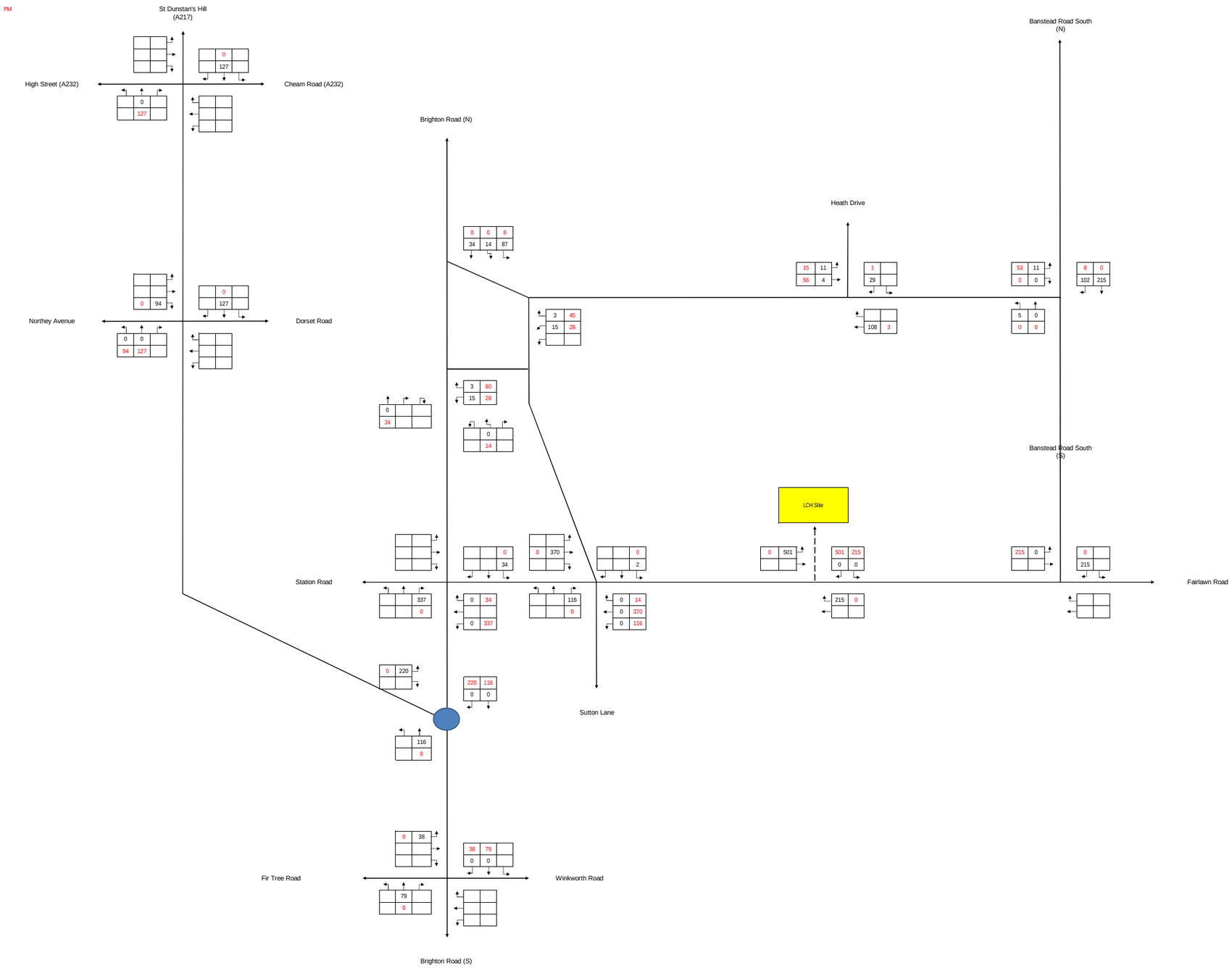
WSP | PARSONS BRINCKERHOFF	Wave 0	Appendix I

Appendix J

WAVE 0 – 1 DEVELOPMENT TRAFFIC FLOWS

AM

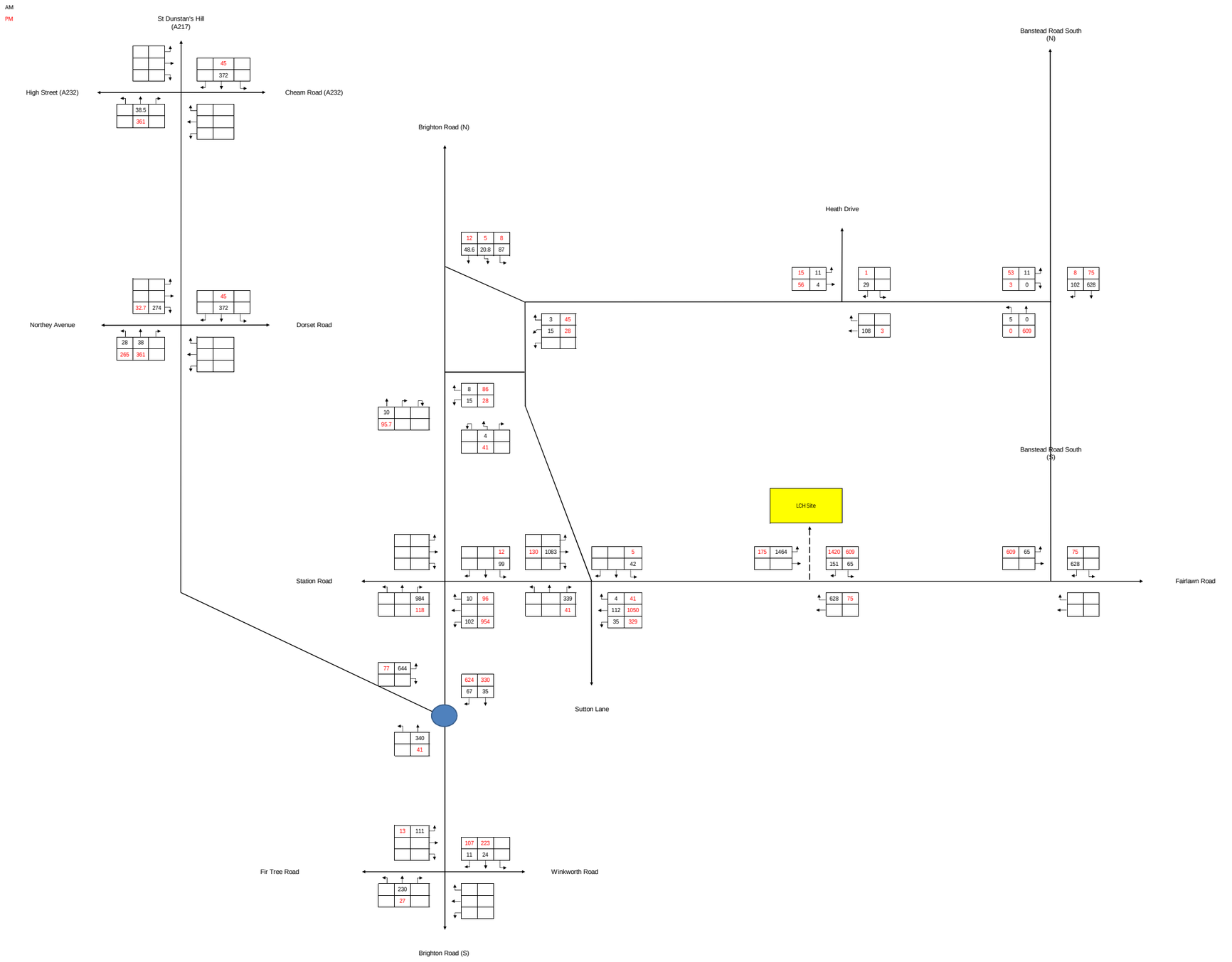
PM



WSP | PARSONS BRINCKERHOFF	Wave 0-1	Appendix J

Appendix K

WAVE 0 – 2 DEVELOPMENT TRAFFIC FLOWS



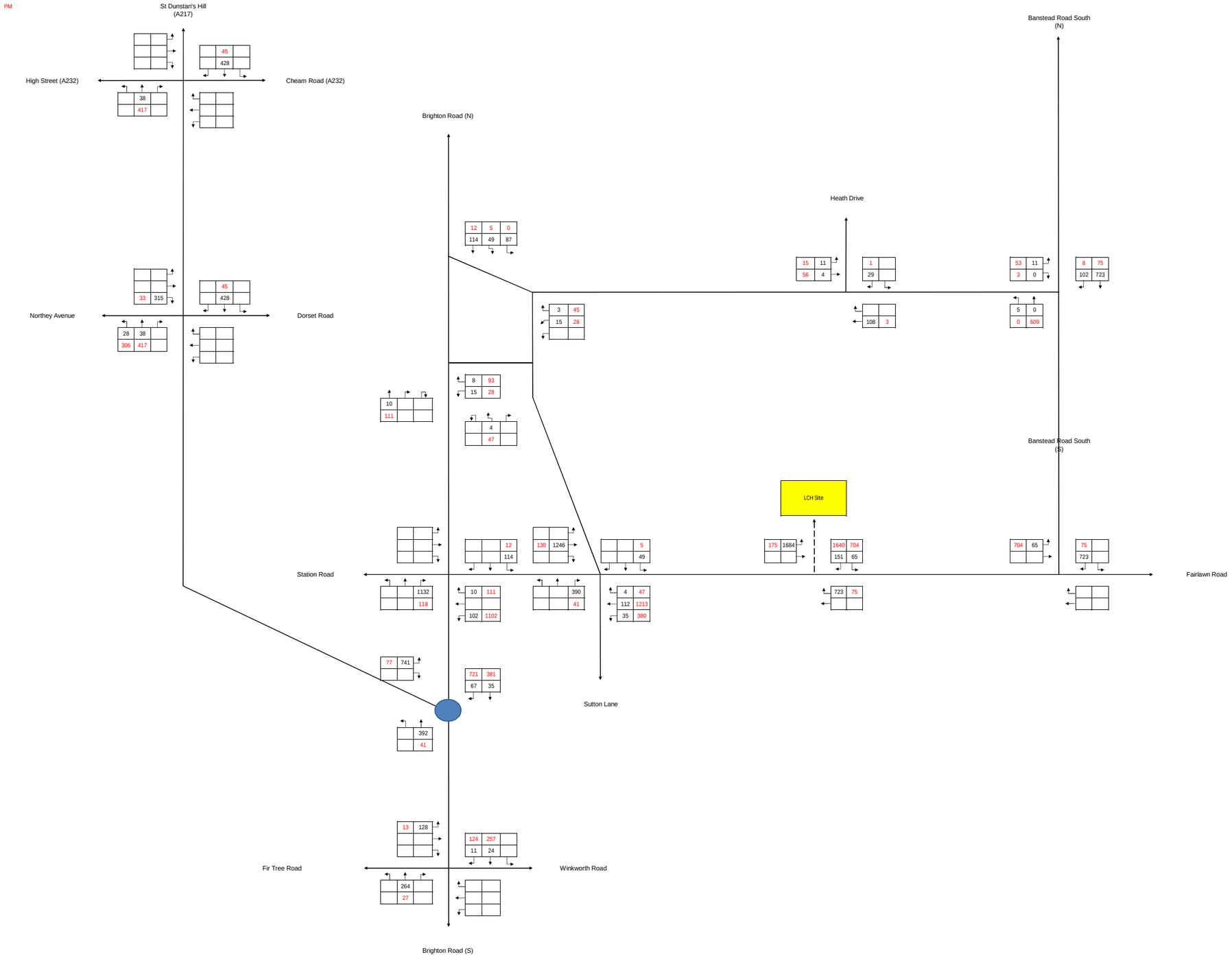
WSP | PARSONS BRINCKERHOFF	Wave 0-2	Appendix K

Appendix L

WAVE 0 – 3 DEVELOPMENT TRAFFIC FLOWS

AM

PM



WSP | PARSONS BRINCKERHOFF	Wave 0-3	Appendix L