OOPR
OLD OAK & PARK ROYAL
WALKING, CYCLING &
PUBLIC REALM

Network Modelling

APPENDIX TO MAIN REPORT
APRIL 2017

5th studio

Old Oak & Park Royal Walking, Cycling, Streets & Public Realm Strategy: Network Modelling

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Appendix 1 Network Assumptions and Unweighted Outputs

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1.0
Introduction

Alan Baxter Ltd (ABA) together with Wedderburn Transport Planning Ltd (Wedderburn) modelled the proposed development at Old Oak Common and Park Royal (OOPR) in West London. The purpose of this model was to inform the Old Oak & Park Royal Walking, Cycling, Streets & Public Realm Strategy, jointly commissioned by the Old Oak and Park Royal Development Corporation (OPDC) and Transport for London (TfL). The project was led by 5th Studio. ABA and Wedderburn's role was to provide a quantitative assessment of the masterplan proposals to identify likely levels of movement across the area, in order to inform key decisions on priority links.

This report summarises the model's methodology, the network and data used, the trips calculated, the testing of network combinations, and the final outputs. The model was primarily focused on pedestrian flows, with cycling trips also calculated. The model was for the year 2041 (i.e. final build scenario, as agreed with OPDC), and during the AM peak of 0700-1000. Other time periods were extrapolated from the AM peak. Various unweighted tests were performed in order to assess the strengths and weaknesses of different network combinations. The numbers from the final weighted model provide benchmark flows which inform typical street sections. From this, key conclusions have been reached about recommended links and infrastructure at the Old Oak Common and Park Royal development.

2.0
Model Methodology and Structure

The model's methodology and structure, as explained more fully in subsequent sections, can be summarised as follows:

Street Network ↓	The street network was modelled as links in the software QGIS.
Unweighted Tests ↓	Various combinations of the street network were tested in unweighted form (i.e. no trips yet assigned), to determine the advantages of different street configurations.
Trips ↓	Using relevant data, trips were calculated for each zone used in the model.
Weighting ↓	Street frontage values were used to weigh each link.
Weighted Analysis ↓	Station catchment analysis and relevant data were used to calculate multi-modal station entries. The software SDNA was used to calculate numbers of pedestrians on each link, for walk-only, and walk-to-station.
Final Outputs	Station interchange numbers were manually added, and a walk total value determined. The final outputs were used to demonstrate the calculation of minimum footway widths, as well as give an indication of interpeak numbers, bus and taxi movements at stations, and cycle numbers to station.

3.0
Network

The street network was based on that of the draft Local Plan, published by the Old Oak Common and Park Royal Development Corporation (OPDC) in February 2016 (see Figure 3-1). This defined an Opportunity Area (OA) boundary, with the eastern end of Old Oak featuring a primarily new street network. Additionally, 800m of street network was modelled beyond the OA boundary, as a "buffer zone". The inclusion of this buffer zone allowed for more representative pedestrian flows to be modelled within the OA boundary.

Figure 3-1 Masterplan in the Draft Local Plan[1]



Subsequent to workshops with the architects 5th Studio for the Walking, Cycling, Streets, and Public Realm Strategy, amendments were made to the street network at Old Oak. These amendments were based on more detailed levels issues investigated during the workshops, developers' draft proposals, and a general critique of the Local Plan's street network.

Whilst these network issues were ongoing during the time that the final weighted modelling was produced, a version of the network was adopted in order to provide a base/reference case to inform discussions moving forward.

The street network was modelled in the software QGIS. The data sourced for this street network was the OS Open Roads shapefile for roads in the UK, which was then clipped based on the OA boundary plus buffer zone. Links for the new street network in Old Oak were then directly modelled in QGIS, based on raster backgrounds of the Local Plan and 5th Studio's proposed amendments.

[1] https://www.london.gov.uk/sites/default/files/opdc_draft_local_plan.pdf

The OS Open Roads data also had to be audited before being finalised, in particular in areas of Park Royal and the buffer zone. This was because existing links had been modelled based on street routeing rather than pedestrian routeing. Therefore in certain instances, for example the A40, each footway was remodelled and pedestrian bridges and underpasses were added. Additionally, some pedestrian routes within parks and on canals had not been included in the OS Open Roads shapefile, and had to be added. Typically stair connections were modelled with a triangular or zig-zag form, to represent an inconvenient change in level. Stations were given a single "dummy" link, used for subsequent modelling e.g. for calculating station catchments values. Each new street link was given a phasing value, based on 5th Studio's proposals. See Figure 1 in **Appendix 1** for key streets identified in the network.

Figure 3-2 Final network modelled, with 800m buffer zone beyond OA boundary



4.0
Initial Unweighted Outputs

Prior to the network being weighted, initial analysis was performed on the street network. This was "unweighted" i.e. before any pedestrian numbers were assigned to links. This enabled a critique of the street network at an early stage of the project, in order to inform more detailed masterplan issues, and also to test various network configurations.

4.1 Unweighted Measures

Station Catchment

An early indication of the transformative effect of the new development can be shown via station catchment. The new development proposes the addition of three new stations: Old Oak (Crossrail/HS2), Hythe Road (Overground/Southern), and Old Oak Common Lane (Overground). Moreover the new street network provides improved connectivity for some existing stations. Station catchments for 2016 and 2041 are shown in Figures 3 & 4 in **Appendix 1**. With improved connections to enhanced public transport facilities, TfL PTAL scores will be significantly improved by 2041.

Connectivity

A second measure of the transformative effect of the new development can be shown via connectivity. This is the total length of links within a specified radius[2], and thus shows the proximity of link to other links in the network.

Connectivity for 2016 and 2041 is shown in Figures 5 & 6 in **Appendix 1**. As expected the most dramatic difference in 2041 is in the Old Oak area. The uniform street grid is shown to have very strong connectivity compared to the existing condition. Additionally, the street network in the vicinity of North Acton and Willesden Junction is shown to have improved connectivity, as additional streets have been added during the redevelopment.

Route Potential ("Betweenness")

The software SDNA[3] was used as a plugin within QGIS in order to output the value "betweenness". This value measures a route's potential for use, as an intermediate link used on various trip combinations in the network. Therefore when analysing the unweighted network, the most useful routes for key pedestrian movement were produced as a graphical output. This is shown for 2016 and 2041 – see Figures 7 & 8 in **Appendix 1**.

Within Old Oak, the High Street was shown as having significantly strong route potential for north-south movement, as was the "middle bridge" crossing the canal to the east of the high street. Grand Union Street was shown as having significantly

[2] In the case of walking, an 800m radius was used, as it is approximately a 10 minute walk.
[3] http://www.cardiff.ac.uk/sdna/

strong route potential for east-west movement, as was the existing Hythe Road leading to the Genesis Bridge, parts of the canal tow path, and the route from the EMR site to the Genesis Bridge. The existing major routes of Scrubs Lane, Victoria Road, and Old Oak Common Lane were also found to be strong. Within Wormwood Scrubs, routes to the north to the new development, and southwest to East Acton Station were strong.

Within Park Royal, the long axial streets of Chase Road, Park Royal Road, Coronation Road/Acton Lane, Abbey Road, and Twyford Abbey Road were found to have strong route potential. The pedestrian bridge to the north of Park Royal Station was also found to be strong.

4.2 Unweighted Tests

The unweighted model was used to test the likely benefits of various design options, and compare the usefulness of certain links. The test areas in question are identified in Figure 9 in **Appendix 1**. These can be summarised as follows:

Willesden Junction

Different configurations were tested with the value of "betweenness" – see Figures 10-12 in **Appendix 1,** with the key streets identified in Figure 1 in **Appendix 1**. These tests were based on the options proposed by 5th Studio in design workshops, providing links between new development at Old Oak North, Willesden Junction Station, and the existing communities in Harlesden to the north.

- Option 1: the High Street terminates south of the West Coast Main Line (WCML), with the existing footbridge used as the only crossing to Willesden Junction i.e. the existing condition. The existing footbridge was shown to be strong, with the north end of the High Street weak. Additionally the existing entrance to Willesden Junction from Harrow Road was shown to be relatively weak.
- Option 2: the High Street continues over the WCML, but then terminates with pedestrians needing to continue down stairs and to the east to reach the station entrance. Due to the inconvenience of the level changes and indirect route, the High Street was shown to be relatively weak, with the existing footbridge stronger. The Station Approach to the west of Willesden Junction was shown to be stronger than the previous option.
- Option 3: the High Street continues over the WCML, and turns east to join Harrow Road and Scrubs Lane as part of over-station development in the area. The high street as a whole was shown to be strong in this option, and is established as a key N-S route. The existing footbridge is used, but is less important than the High Street. The Station Approach to the west of Willesden Junction was shown to be as strong as Option 2.

Recommendation: Option 3. Extend the High Street north for a direct connection to a new station entrance and Harrow Road. Note that the existing footbridge would need to be completely rebuilt/substantially widened in order to be viable as the only crossing.

Viaduct Links

The value of "betweenness" was used to test the effect of adding an additional link from the Genesis Bridge to the EMR site – see Figures 13 & 14 in **Appendix 1**.

- Option 1: the link is not included. Links through the northern section of Old Oak North were less useful as through-routes and therefore weaker than links south of the rail embankment. The existing lower level road south of WCML is stronger for E-W movement to compensate for the lack of other E-W connections.
- Option 2: the link is included. A key E-W link from Old Oak Common Lane to Scrubs Lane was therefore established, and is found to be strong. Additionally the link to the Powerday site, and other links, are also strengthened.

Recommendation: Option 2. Include the direct link from the Genesis Bridge to the EMR site through the rail embankment.

North Acton

Station catchments were used to test the effect of including a new northern entrance to North Acton Station – see Figures 15 & 16 in **Appendix 1**.

- Option 1: the link is not included. Whilst access to the south has been improved by virtue of the new roads which are constructed with development plots, access to the north is largely as per the existing condition.
- Option 2: the link is included. There is a greater catchment northwards to existing development in Park Royal, and new development at Old Oak Common Lane. This will improve access to public transport in this area.

Recommendation: Option 2. Include the new northern link to North Acton.

Canal Bridges

In order to assess the priorities for bridges across the canal between Old Oak & Hythe Road, a number of combinations of bridges were tested. The unweighted analysis compares the "betweenness" of each combination – see Figures 17-20 in **Appendix 1**. It is complimented by further weighted analysis (see Section 7.1), where numbers of pedestrian movements are compared.

- Option 1: There are three major bridges between Old Oak & Hythe Road. From west to east, these are the High Street, the 'Middle' Bridge, and the HS2 Bridge. The High Street and 'Middle Bridge' are shown to be very strong, and are key N-S links. The HS2 bridge is shown to be moderately strong, but less than the other two bridges, and less than other routes in the development.
- Option 2: The High Street remains, the 'Middle' Bridge is a station interchange bridge for pedestrians with a stair down to street level, and the HS2 Bridge is realigned for a more direct connection to Scrubs Lane. The High Street and the HS2 Bridge are shown to be strong, and the 'Middle' Bridge is shown to be quite weak because of the inconvenient level change.
- Option 3: The High Street remains, and there is no 'Middle' Bridge as the HS2 Bridge is realigned for this purpose. Both bridges are shown to be strong. The

HS2 Bridge is stronger than in Option 1 as it has been given a better alignment and more direct connections.

- Option 4: The High Street is the dominant crossing (for all modes, not just ped/cycle), and the HS2 Bridge is reduced to a pedestrian-only link. Despite this, both links are shown to be strong. The HS2 Bridge is stronger than in Option 1 as it has been given a better alignment and more direct connections.

Recommendation: Option 1 features all of the bridges and is therefore taken forward for analysis in the weighted modelling, so that pedestrian numbers can be compared.

5.0
Trips

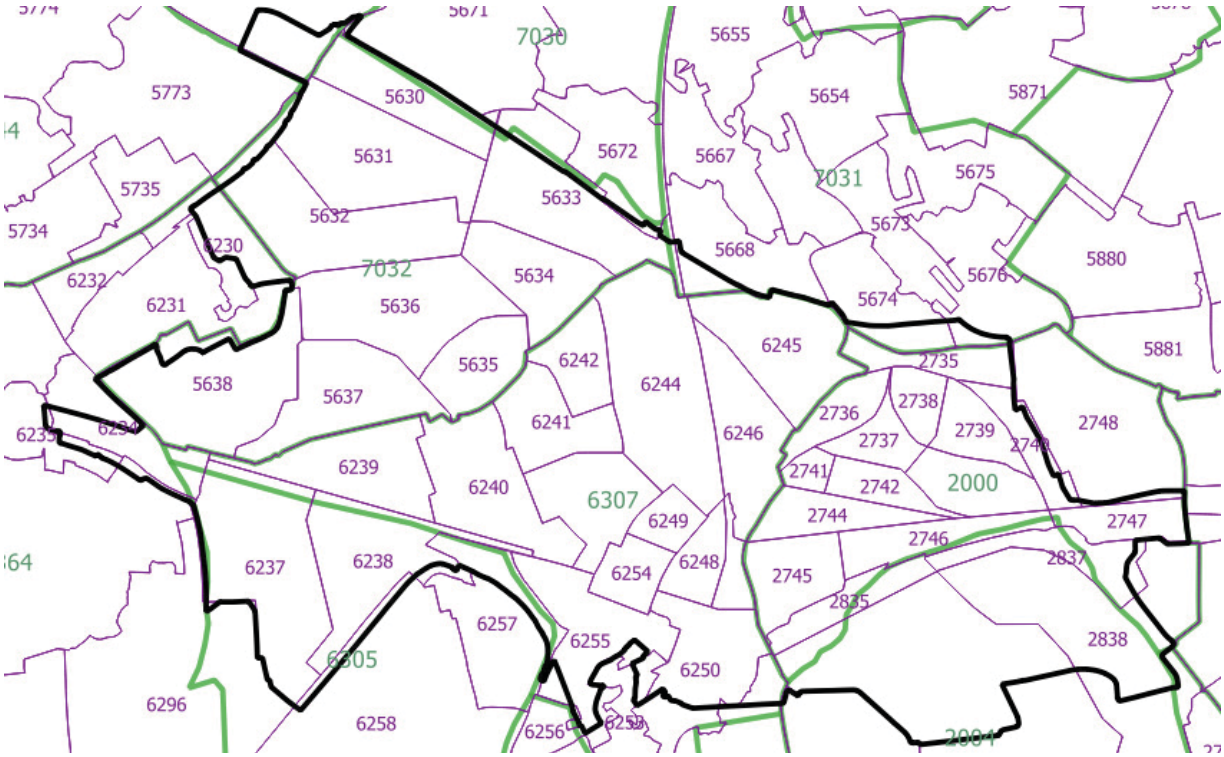
Trips were calculated for each Railplan zone, for 2041 0700-1000. Trips were calculated for several modes: walk only (e.g. walk directly to work), walk-to-station (for an onward journey), walk station interchange (i.e. an out of station transfer), cycle only (e.g. cycle to work), and cycle-to-station (for an onward journey). These trips were compiled in an excel file (not included in this report due to size, but available upon request).

5.1 Data Sources

Trips were derived from a number of data sources:

- London Transportation Studies (LTS) origin and destination data for 0700-1000 in 2041, for slw (slow modes i.e. walking and cycling), car, and public transport.
- Railplan 7.0 reference case data on jobs and homes in London split by Railplan zone.
- TfL Strategic Transport Study projected jobs and homes for the OOPR development split by Railplan zone.
- Railplan select link analysis (SLA) entry and exit data for relevant stations in the OA.
- TfL station interchange matrices for relevant stations in the OA.
- The TRICS database for B1 and Residential trip rates

Figure 5-1 Railplan zones (purple) and LTS zones (green) used in the model



5.2 Methodology

The general process for deriving trips was as follows:

- Initially, trips were derived from the TRICS database, for B1 office[4], and a mix of residential (flats privately owned, affordable, mixed private & affordable)[5] for relevant sites (London, generally in dense areas with high PTAL). These trip rates were used as a reference, and as a basis for modal split in further calculations.
- The LTS arrivals and departures were summarised for relevant LTS zones, for slw (slow modes), car, and public transport. Jobs and homes were then summarised for the relevant Railplan zones. Since this was in a different dataset, these jobs and homes had to be consolidated in order to be expressed in terms of LTS zone.
- Trips rates were then calculated using LTS arrivals and departures, LTS jobs and homes, and additional modal split proportions from TRICS. A manual override was also used to set intended cycling and vehicular mode shares. Sets of trip rates were calculated for three LTS zones: zone 2000 as representing the Old Oak development, zone 6307 as representing Park Royal areas with new areas of development, and zone 7032 as representing the remainder of Park Royal and the buffer zone. The final mode share is shown in Table 5-1, with final trip rates in the excel file which is available upon request.
- Trips were then expressed for each LTS zone. However, since LTS zones are larger in size and therefore coarser (e.g. only one zone for all of Old Oak), the trips were converted back to smaller Railplan form to enable more detailed and varied modelling across the network. Following this conversion, the Railplan SLA entry and exit numbers for each station were also added. This SLA data was predicted boarders and alighters for a "dummy" link in the network, and came in the form of station Origins and Destinations for each Railplan zone, including both ends of the trip. The data for Old Oak was originally treated as one combined station (HS2, Crossrail, GW, Overground), and required further breakdown by TfL in order to be expressed for each individual entrance.

Table 5-1 Summaries of Final Mode Share (0700-1000)

LTS Zone	Usage	All Vehicles	Cyclists	Pedestrians	Bus	Rail	Total
2000 (used for OOC development)	Resi	15.0%	5.0%	24.3%	23.8%	31.9%	100.0%
	B1 Office	5.0%	10.0%	12.8%	8.5%	63.8%	100.0%
6307 (Park Royal)	Resi	25.4%	2.9%	24.3%	20.2%	27.1%	100.0%
	B1 Office	19.2%	6.4%	13.8%	7.1%	53.5%	100.0%
7032 (Park Royal)	Resi	34.3%	0.8%	12.0%	22.6%	30.3%	100.0%
	B1 Office	30.8%	2.7%	9.0%	6.8%	50.8%	100.0%

[4] TRICS codes: CI-02-A-01, CI-02-A-02, CI-02-A-03, SK-02-A-01. Full information included in model excel file (not included due to size)

[5] TRICS codes: HK-03-C-02, HM-03-C-01, IS-03-C-02, HA-03-D-01, IS-03-D-02, EG-03-M-02, GR-03-M-01, HM-03-M-01. Full information included in model excel file (not included due to size)

6.0
Weighting

With trips calculated for each Railplan zone for each mode of transport, the next stage was to assign them to specific pedestrian links in the network. This was compiled in an excel file (not included in this report due to size).

6.1 Frontage Weighting

Each link was assigned a frontage value in the range of 0-4. This took into account residential or office frontage, and active (i.e. retail) frontage on streets in accordance with the local plan. Values were defined as follows:

Table 6-1 Frontage Weighting

Value	Frontage
0	None
1	1-Sided
2	2-Sided, or 1-Sided 1 Active
3	2-Sided, and 1 Active
4	2-Sided, and 2 Active

For example, an area of park would be assigned a frontage value of 0. A high street with residential/office entrances and retail frontage on both sides of the street would be assigned a frontage value of 4. The frontage assumptions in the network are as shown in Figure 2 in **Appendix 1**.

The zonal trips were assigned to links using these frontage weighting factors. This procedure was then normalised so that the sum of all weighted trips matched the sum of all unweighted trips in each zone (i.e. so that additional trips were not being created when multiplying by the weighting factors).

6.2 Trips to Station

Trips-to-station had now been calculated for each link. However a further step was required to separate these into the different options for accessing each station: walk, cycle, bus, and taxi/other. In order to do this, the following rule was applied, based on a Vauxhall Nine Elms Study:

- If walk distance is less than 400m, everyone walks
- If walk distance is between 400m and 1,600m, the walk mode share decreases in a linear fashion from 100% at 400m to 50% at 1,600m
- If walk distance is greater than 1,600m, nobody walks

Therefore by calculating the distance of each link from each station, and using the proportion of non-walk station entries from the trip rates, detailed trips-to-station could be calculated, which are summarised in Table 6-2:

Table 6-2 Summary of Trips to Station in Opportunity Area + Buffer Zone

Station	Trips Total	Walk	Cycle	Bus	Taxi/ Other	% Walk	% Cycle	% Bus	% Taxi/ Other
North Acton	6104	4493	301	1229	82	73.6%	4.9%	20.1%	1.3%
Stonebridge Park	3452	2362	166	870	55	68.4%	4.8%	25.2%	1.6%
Harlesden	5829	4291	298	1148	92	73.6%	5.1%	19.7%	1.6%
Acton Main Line	915	740	21	140	13	80.9%	2.3%	15.3%	1.5%
Willesden Junction	7031	5032	338	1539	122	71.6%	4.8%	21.9%	1.7%
National Rail/Crossrail	18531	13279	898	3862	492	71.7%	4.8%	20.8%	2.7%
Old Oak Common Lane	2230	1551	86	548	45	69.5%	3.9%	24.6%	2.0%
Hythe Road	9483	6843	598	1829	213	72.2%	6.3%	19.3%	2.2%
HS2	753	228	60	428	37	30.3%	7.9%	56.8%	5.0%
East Acton	9057	7469	341	1147	100	82.5%	3.8%	12.7%	1.1%
Hanger Lane	4310	2887	240	963	219	67.0%	5.6%	22.4%	5.1%
Park Royal	2075	1233	125	627	91	59.4%	6.0%	30.2%	4.4%
Kensal Green	3685	2809	99	715	61	76.2%	2.7%	19.4%	1.7%
West Acton	2205	1587	103	473	42	72.0%	4.7%	21.5%	1.9%

6.3 SDNA Analysis

Each link now had a complete set of trips (minus station interchanges, addressed in section 6.4 below). The plugin SDNA was then used within GIS to perform a weighted analysis on the street network, using the 'betweenness' measure to assign trips to links with greater potential for being through routes. The results of this are discussed in section 7.0 below.

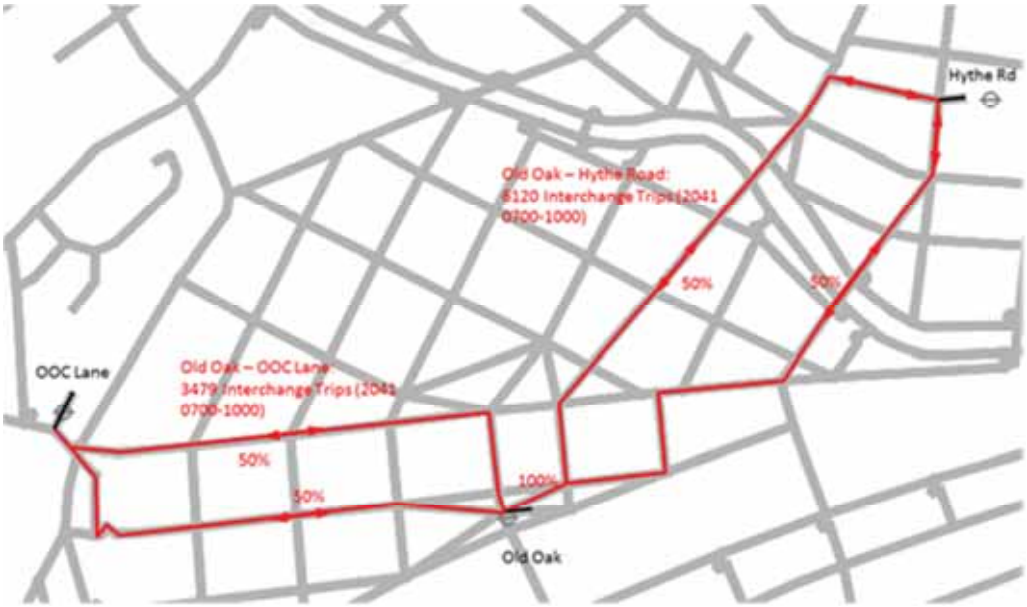
6.4 Station Interchange

Station interchange numbers were assigned directly to each link, and therefore took place after the SDNA analysis. Interchanges occur between Old Oak (Crossrail/HS2), Hythe Road and Old Oak Common Lane (Overground). The interchange numbers for 2041 0700-1000 were provided by TfL and are as follows:

- OO-Hythe Road: 6120
- OO-OOC Lane: 3479

At the time of the study, the nature of station interchanges was yet to be confirmed, with an underpass proposed between Old Oak–OOC Lane, and a bridge (potentially with a travellator) proposed between Oak Oak–Hythe Road. Many of these would be paid links, and therefore not modelled. However it is assumed that at least a small percentage will use the public realm for this interchange. For the percentage that do, a simplistic routeing was assumed as shown in Figure 6-1.

Figure 6-1 Simplified Station Interchange Routeing

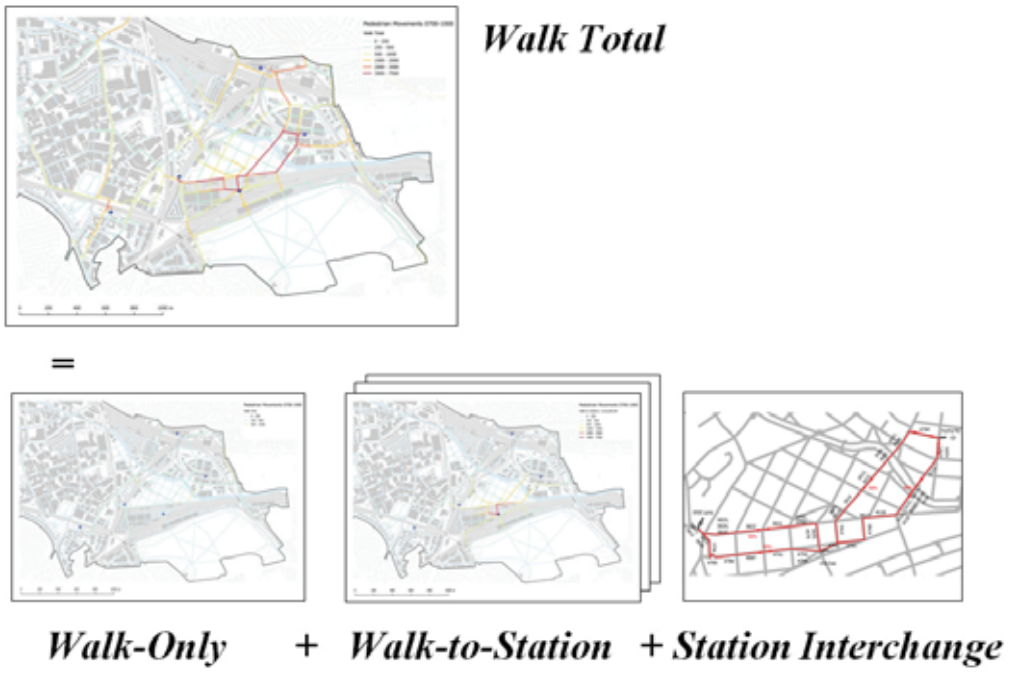


7.0
Final Outputs

7.1 Final Trips

For pedestrian flows, totals are calculated as follows:

Figure 7-1 Walk Total Calculation[6]



Walk-only trips and walk-to-station for each station were analysed separately, and can be seen in Figures 21-26 in **Appendix 2**. Walk totals excluding the interchange flows is seen in Figure 27, and including the interchange flows in Figure 29. These flows are then addressed in Section 7.2. For reference, key streets are identified in Figure 1 in **Appendix 1**.

The key observations from the weighted modelling can be summarised as follows:

- The most heavily used streets in the development are the High Street, Grand Union Street, the 'Middle' Bridge, and Hythe Road. These typically have >3000 movements (walk total minus interchange) for a weekday 0700-1000, with a central section of the High Street having 5560[7] movements (see Figure 27).
- Other routes with notable flows are Scrubs Lane, Victoria Road, OOC Lane, both entries to North Acton, Willesden Junction Station Approach, the new link between OOCL and Victoria Road, Harrow Road, Chase Road, Park Royal Road, Chandos Road, the links across the Great Western, the Genesis Bridge, and various other streets in the Old Oak North & South grid network.

[6] Note: see section 5.0 for definitions. These exclude walking components from bus/taxi journeys (addressed in Section 7.5).

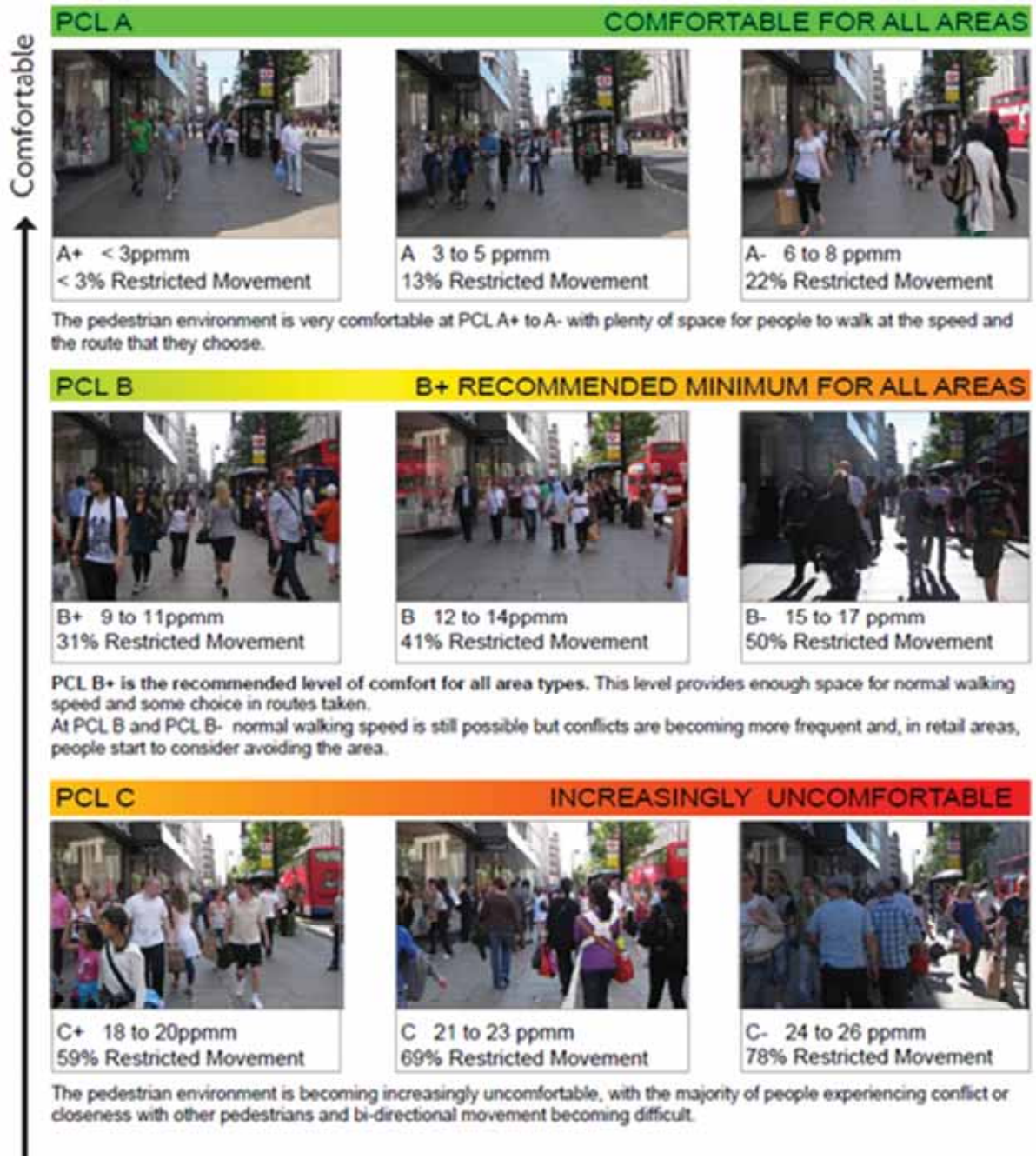
[7] Note: numbers rounded to nearest 10

- Walk-to-station numbers are the dominant pedestrian flow. By comparison walk-only numbers are a relatively small proportion (see Figure 21).
- The station interchange numbers are significant. If 100% are assumed to use the street network (i.e. if no travellator bridge and underpass are constructed), then the maximum flows on the central portion of the high street increase from 5560 to 8620, and on the 'Middle' Bridge from 4040 to 7100 (see Figures 28 & 29).
- Old Oak is the most heavily used station. Figure 22 shows these flows as being quite concentrated; however when a design is finalised it will likely have multiple entrances, which will spread the flows over different routes in the Old Oak South grid.
- The High Street Bridge which crosses the WCML is a significant route to Willesden Junction, with >4000 movements. Similar flows are seen as the High Street connects to Harrow Road.
- Hythe Road is more heavily used than the other connections to Scrubs Lane.
- Of the two links which cross from Old Oak South to Wormwood Scrubs, both have notable flows, but the eastern link is used more. The western link may be affected by the inconvenient level change from deck level to Scrubs level
- The HS2 Bridge is noticeably less used than the High Street and 'Middle' Bridge.

7.2 Minimum Footway Widths

The TfL 'Pedestrian Comfort Guidance for London' methodology has been used to calculate minimum footway widths. The methodology calculates a pedestrian comfort level based on crowding levels measured in people per meter per minute. A scale is provided for pedestrian comfort levels from A to E (see Figure 7-2).

Figure 7-2 Pedestrian Comfort Levels[8]



The minimum recommended level of comfort is B+, which equates to a crowding of 10 ppmm (pedestrians per clear footway width (m) per minute). Assuming a worst case of 8624 pedestrian movements – on the High Street with the full station interchange – this equates to 4312 for each side of the street and 2156 for the hourly peak (i.e. 50% of 3 hour peak). Therefore the following minimum footway width is calculated:

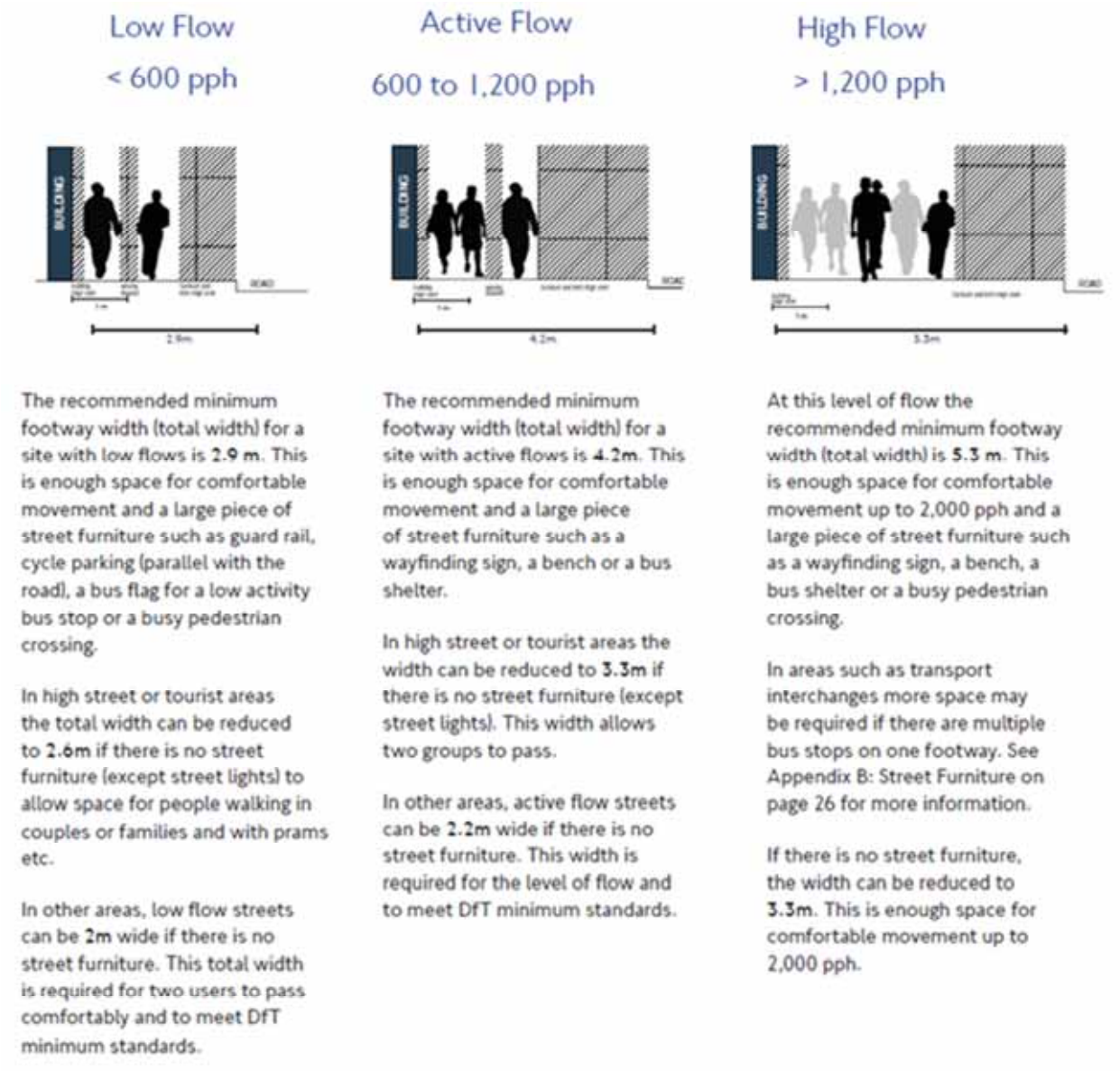
2156pphr / (60mins x 10pppm) = 3.6m

[8] Source: http://content.tfl.gov.uk/pedestrian-comfort-guidance-technical-guide.pdf

Using this calculation, the TfL document summarises a range of minimum widths for three broad flow categories – see Figure 7-3. Flows are given in pedestrians per hour. Therefore, in order to determine the pedestrian width required for each new street, the pedestrian flow outputs from the weighted modelling should be used on a case-by-case basis along with the guidance in Figure 7-3 on minimum widths.

Note that this design guidance gives a minimum width for clear, unimpeded pedestrian space for each flow category. In a typical street section additional widths will be required for street furniture zones, building buffers, kerb buffers, and active frontage widths. These must all be considered in the design of each finalised street section.

Figure 7-3 TfL Guidance: Minimum Pedestrian Widths



7.3 Benchmark Flow Comparisons

It is useful to use other streets in London for a benchmark comparison of pedestrian flows. Table 7-1 summarises some examples of bridges and high streets.

Table 7-1 Pedestrian Flow Comparisons

	Total Pedestrian Flows, Weekday 0700-1000
Old Oak Common	
High Street Bridge	5560
"Middle" Bridge	4040
High Street Bridge + interchange flows	8620
"Middle" Bridge + interchange flows	7100
Central London	
Tower Bridge	4250
London Bridge	18380
Millennium Bridge	3220
Blackfriars Bridge	5510
Waterloo Bridge	5180
Hungerford Bridge (N&S)	5520
Vauxhall Bridge	2710
Battersea Bridge	1080
Long Acre	2660
Wansted High Street	1530

7.4 Cycle Parking at Stations

Trips to station were shown in Table 6-2, including numbers for cycle-to-station. Of these, the following is assumed:

- 60% standard bicycle
- 20% cycle hire
- 20% folding bicycle
- Parking demand = total AM peak period trips +20% growth

Note that since departures are deducted from arrivals, and vice-versa, there may also be a discount on parking numbers. However, the table provides an order-of-magnitude for cycle parking and cycle hire.

Table 7-2 Cycle Parking and Cycle Hire Numbers

Station	Cycle-to-station	Arrivals	Departures	Cycle Parking	Cycle Hire
North Acton	301	134	167	216	72
Stonebridge Park	166	103	62	119	40
Harlesden	298	165	133	215	72
Acton Main Line	21	7	14	15	5
Willesden Junction	338	179	159	243	81
National Rail/Crossrail	898	431	466	646	215
Old Oak Common Lane	86	21	66	62	21
Hythe Road	598	252	347	431	144
HS2	60	41	19	43	14
East Acton	341	126	215	246	82
Hanger Lane	240	137	104	173	58
Park Royal	125	55	70	90	30
Kensal Green	99	54	46	72	24
West Acton	103	60	43	74	25

Separate modelling by TfL for existing stations in the area showed an increase in cycle parking from 2015 to 2026, under a 'do something' scenario which increased mode share from 0.5-1% to 3.5-5%. Cycling numbers were approximately half of that modelled by ABA for 2041 (with the ambitious cycle target set). However as an interim scenario without full development it can be considered broadly consistent with the order of magnitude numbers in Table 4 1.

7.5 Bus and Taxi Movements at Stations

Note that Table 6-2 also shows trips to each station using bus and taxi. These trip numbers are often significant; for example there are 4290 bus trips arriving and departing from Crossrail/NR/HS2 during 0700-1000. Passengers will therefore have a short pedestrian trip, to and from bus stands and taxi ranks, to be added to their overall journey. These may happen in numerous locations; for example a large station such as Old Oak may have many taxi ranks and bus stops in different areas. Additional pedestrian space should therefore be accounted for in the design of the public realm for these short, concentrated movements.

7.6 Interpeak Modelling

The weighted modelling results showed pedestrian movements from 0700-1000, during commuting hours with significant station entries and exits. However, interpeak movement can have a different nature. For example walk-only trips are typically higher in commercial areas during the interpeak (i.e. lunch trips). High Streets are typically busier for walk-only trips during the interpeak and weekends (i.e. retail trips). TfL guidance provides summaries of street typologies and the levels of pedestrian flows in the peak versus the interpeak[9]. For high streets, the hourly weekend peak is an average of 3.5x the hourly weekday AM peak. Figures 30 & 31 in **Appendix 2** give an indication of the resulting effect on the network if this factor is

[9] Source: TfL supporting technical document 'Level of Service Guidance for London', unpublished

applied to streets with active frontage. Streets such as High Street and Grand Union Street will have higher walk-only use, as will Scrubs Lane, Hythe Road, and the Canal.

These figures exclude the significant walk-to-station numbers, which would need to be provided by TfL for the interpeak period. However, a rough calculation using TRICS trip rates can be used to get an order of magnitude for this movement. Walk-to-station during the weekend peak will be only 48% of the flows seen during the AM hourly peak. Therefore a section of the High Street can be compared as follows:

Table 7-3 Interpeak Rough Calculation for High Street

	Walk Only	Walk-to-Station	Walk Total
Weekday 08:00-9:00	182	2368	2550
Weekend 15:00-16:00	647	1137	1784

Whilst footfall along the High Street is less during the weekend interpeak, it can still be expected to be high and on a similar order of magnitude. Therefore the widths provided for the weekday AM will be appropriate for weekend use.

8.0
Conclusion

The Old Oak Common and Park Royal streets and public realm model has produced pedestrian flows for the 2041 final build condition, during the 0700-1000 weekday AM peak. This has informed the Walking, Cycling, Street and Public Realm Strategy at Old Oak and Park Royal.

The modelling took place during a time of revision of the street network, as developer proposals and alternative schemes were being considered. The network therefore resembles that of the OPDC Local Plan, and as such can be used as a reference as alternative proposals are considered.

Whilst pedestrian flows were the key output driving infrastructure recommendations, cycling trip rates and trips are also available in the model's output. Furthermore, bus and taxi-at-station trips were available in the output, and can be used to estimate localised – and oftentimes significant – pedestrian flows and usage to be taken into consideration in the public realm design.

The model files have been set up in QGIS and excel. Therefore it is possible to perform analysis on updated development proposals: for example street network updates, changes to new development quanta, and revised trip rate targets. For modelling during different time periods, however – for example the 2026 AM peak or 2041 interpeak – new Railplan SLA data would need to be sourced from TfL.

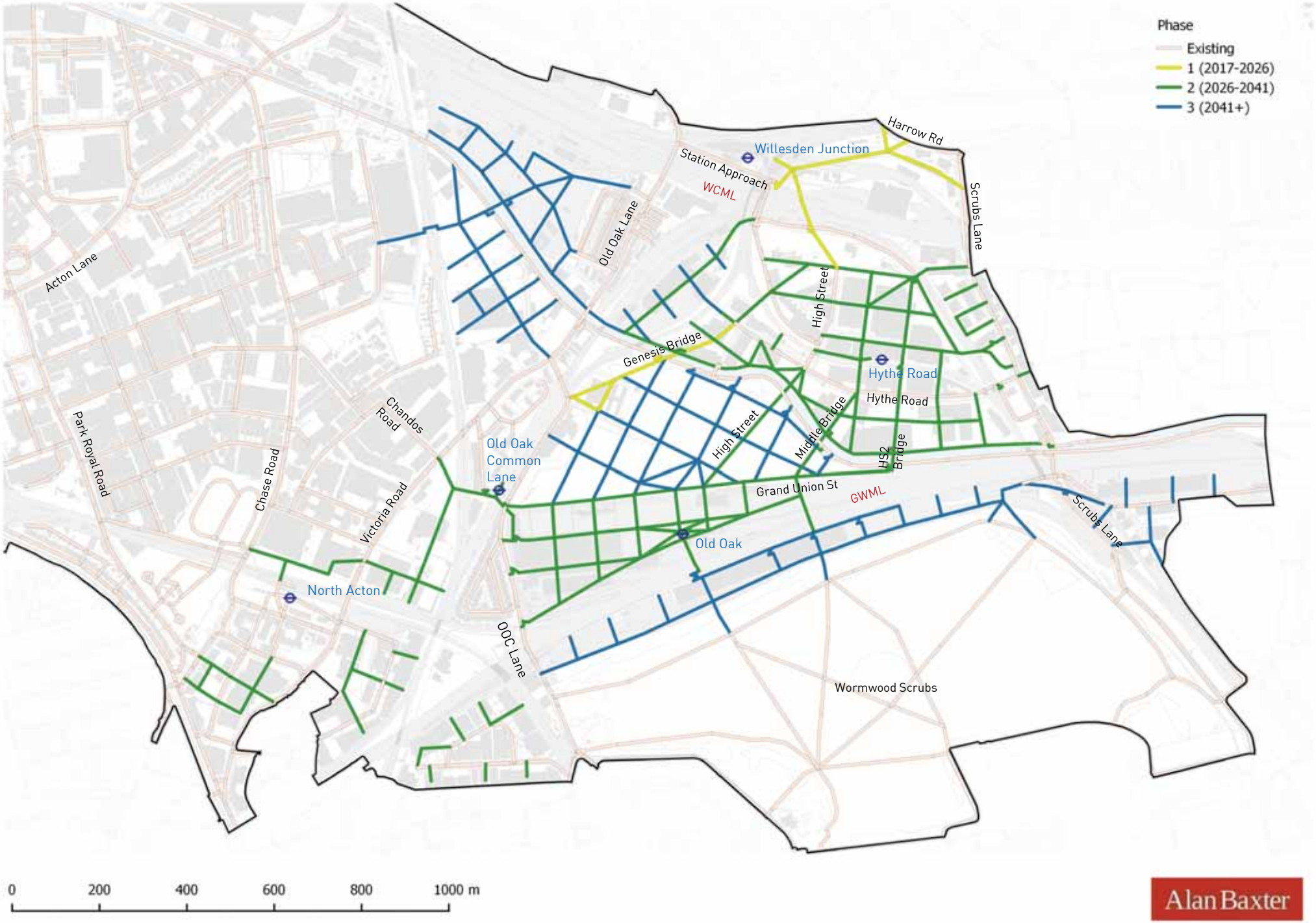
The general conclusion of the report is that pedestrian flows are significant given the scale of development. These have been calculated from a number of data sources, as well as using the route potential of links and weighting assigned for frontage. From these flows, required minimum footway widths for new and existing streets in the Opportunity Area can be calculated, in addition to space required for localised bus and taxi movements.

Appendix 1

Network Assumptions and Unweighted Outputs

Phasing Assumptions, and Key Streets

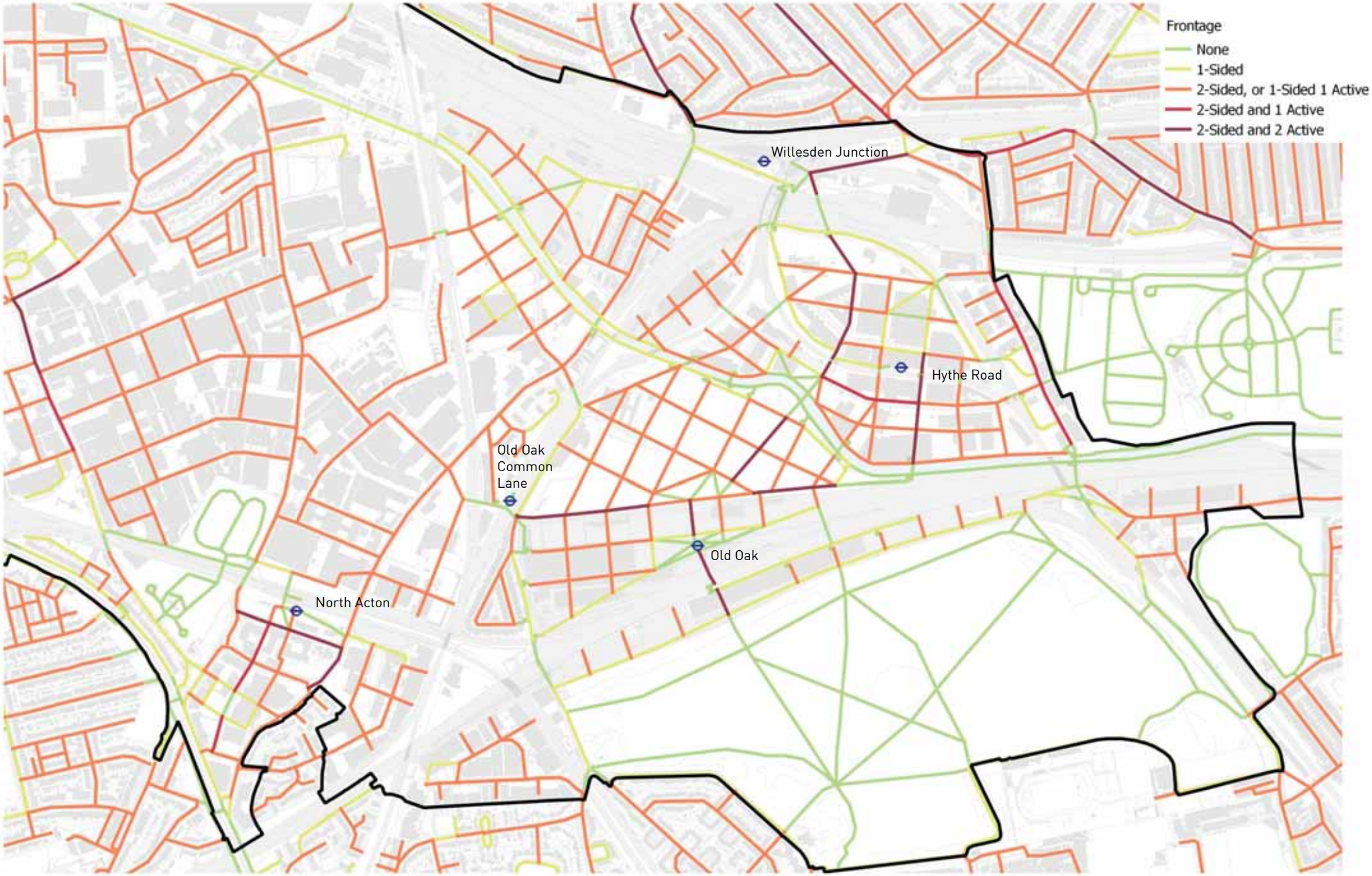
Figure 1



Alan Baxter

Frontage Assumptions

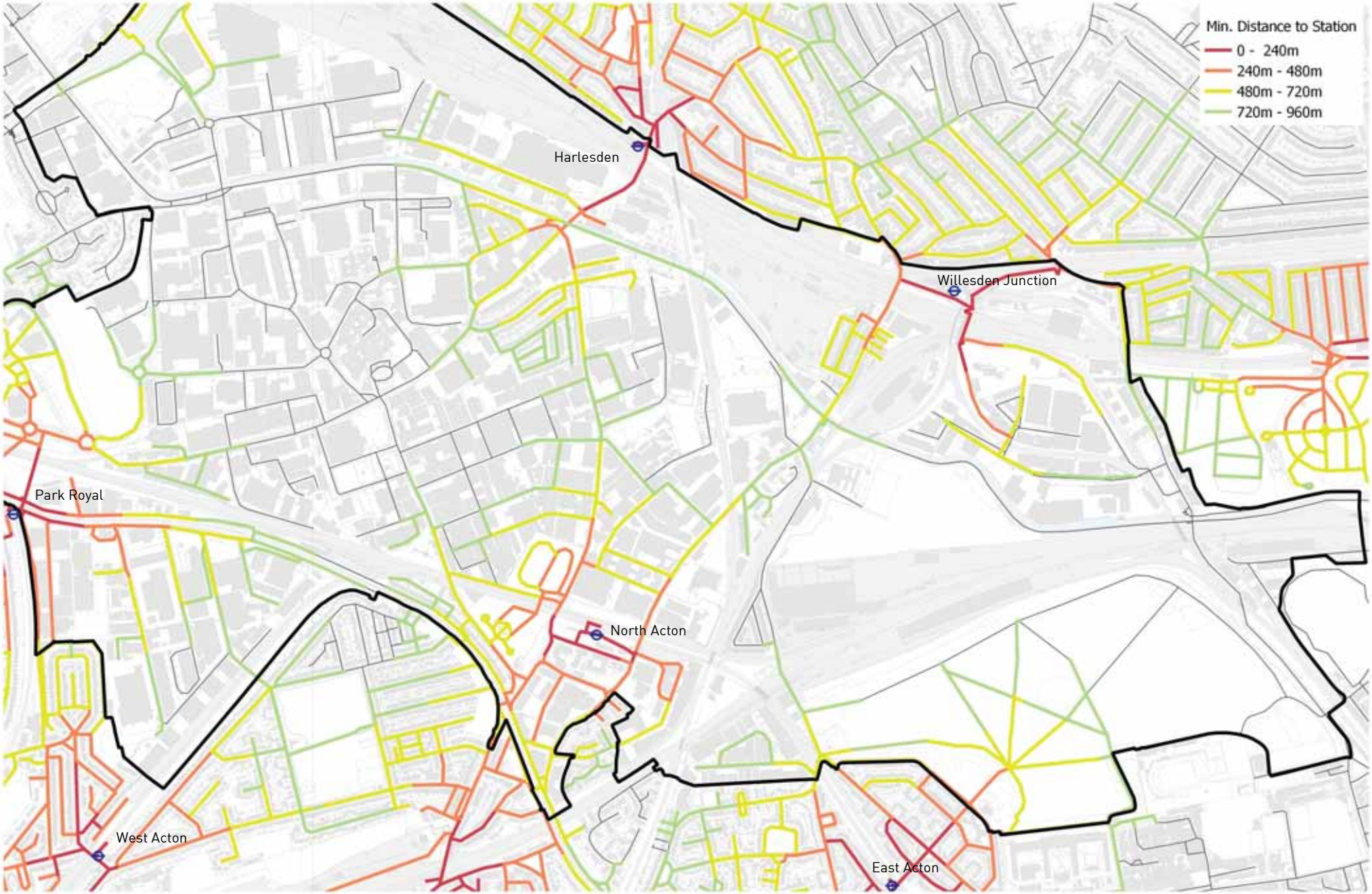
Figure 2



Alan Baxter

Catchment: Existing

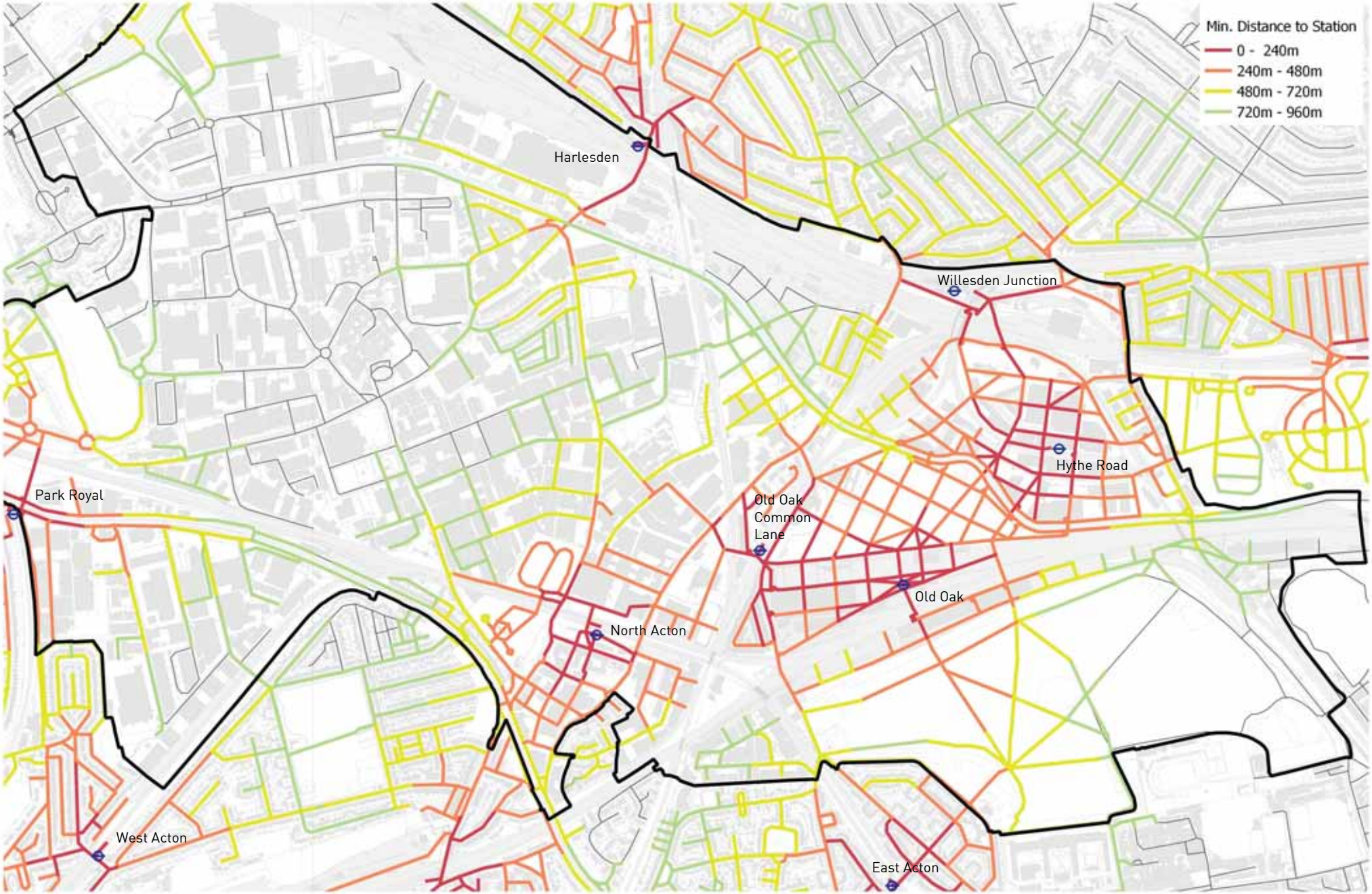
Figure 3



Alan Baxter

Catchment: 2041

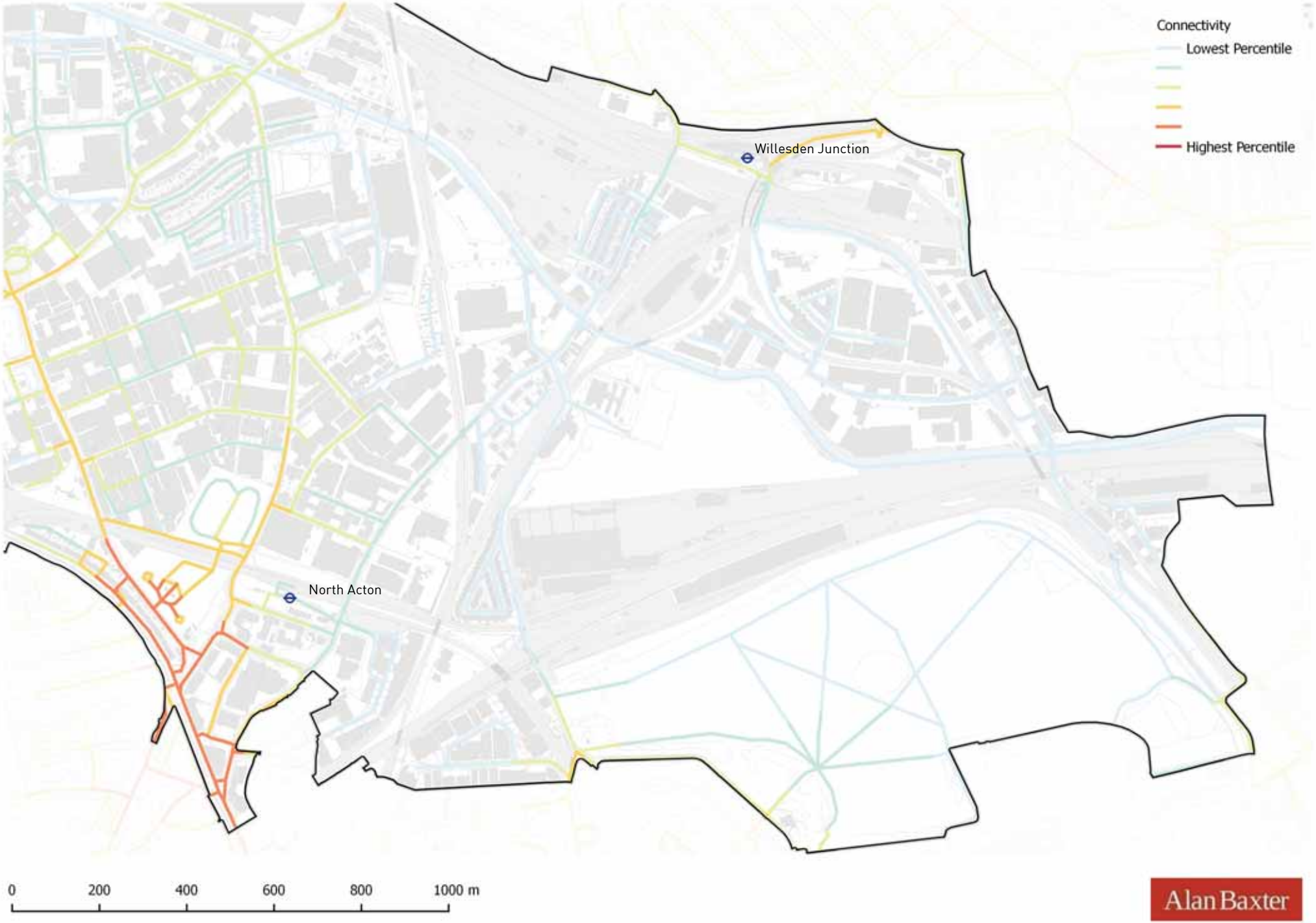
Figure 4



Alan Baxter

Connectivity: Existing

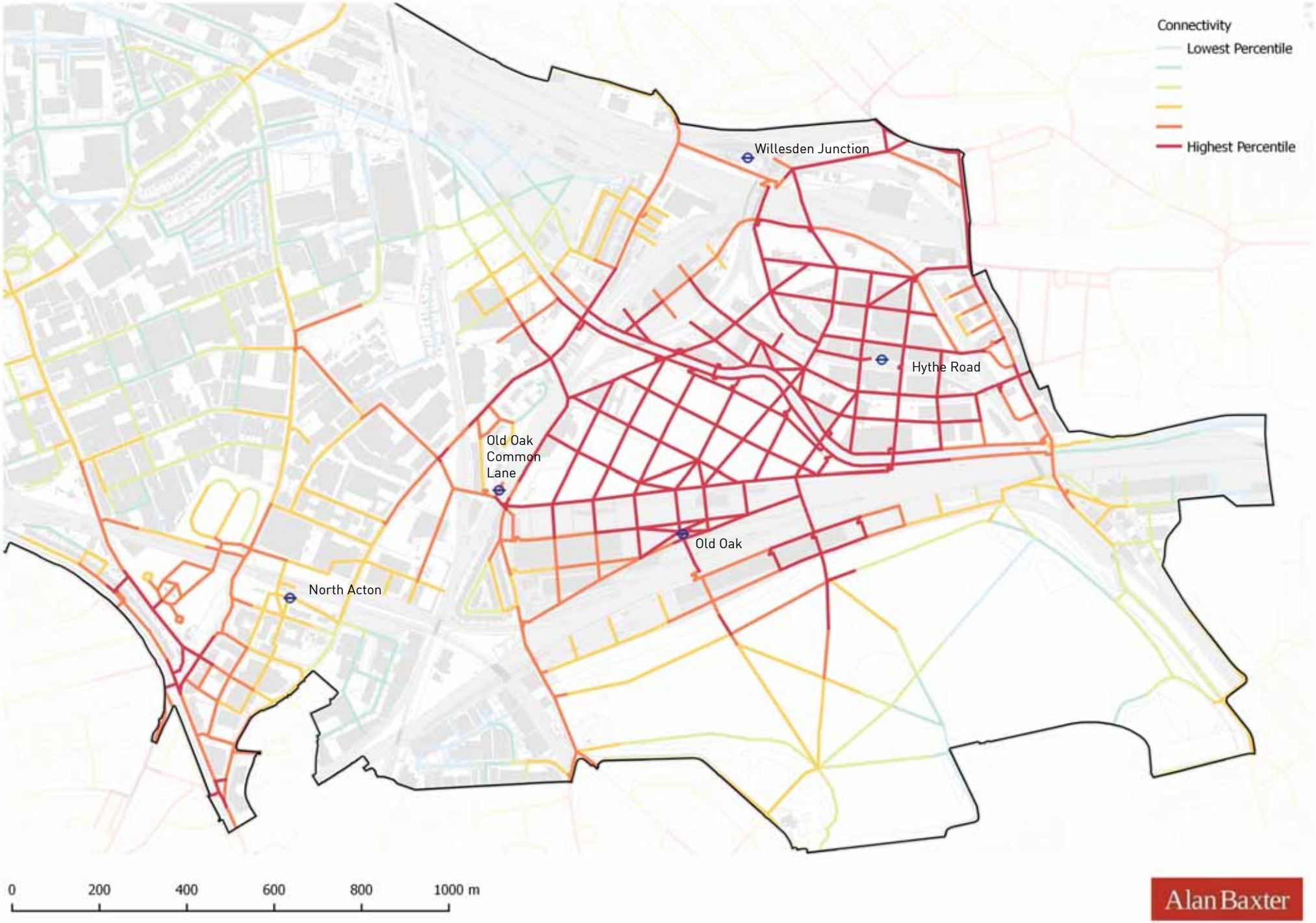
Figure 5



Alan Baxter

Connectivity: 2041

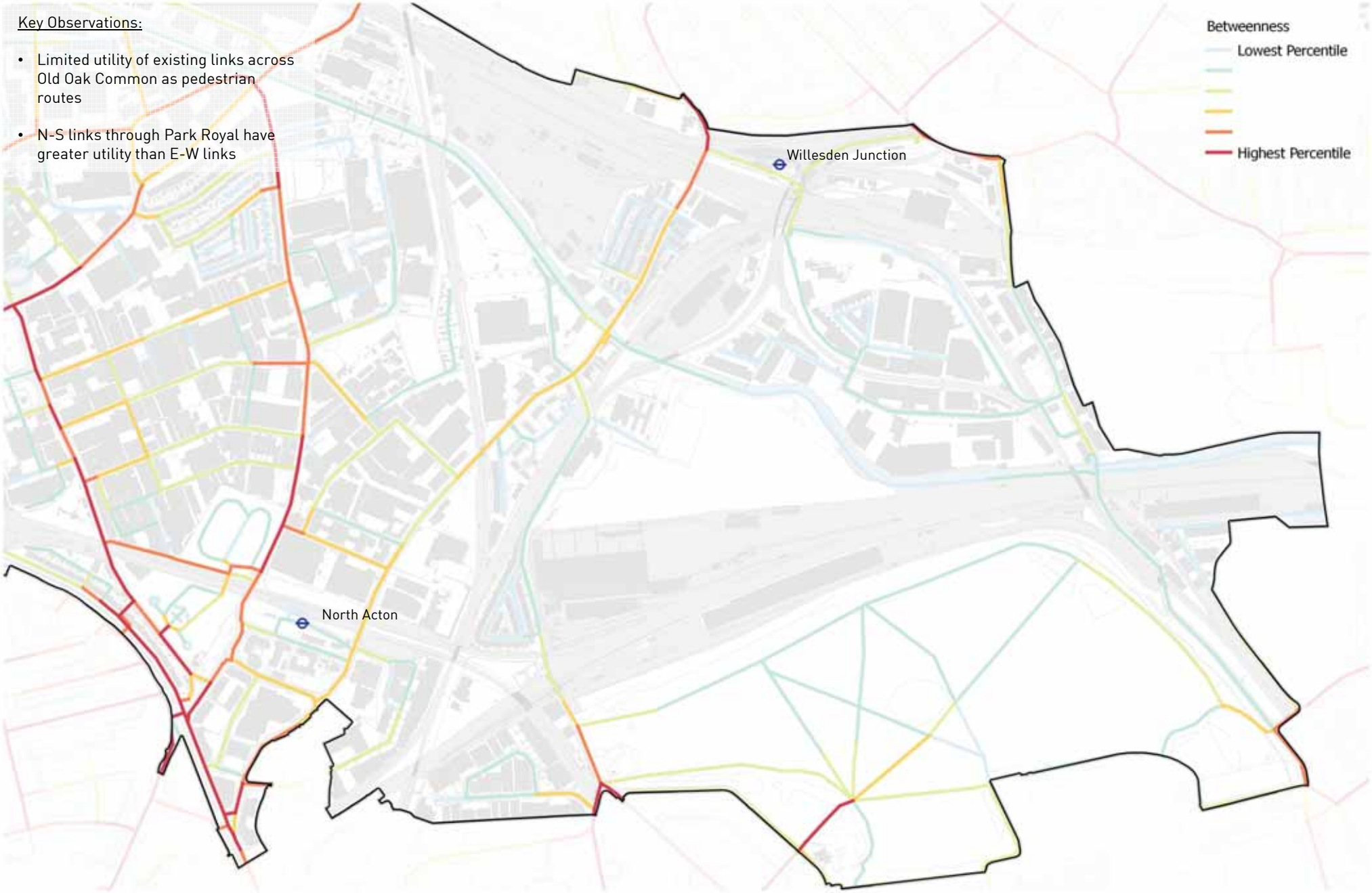
Figure 6



Alan Baxter

Route Potential: Existing

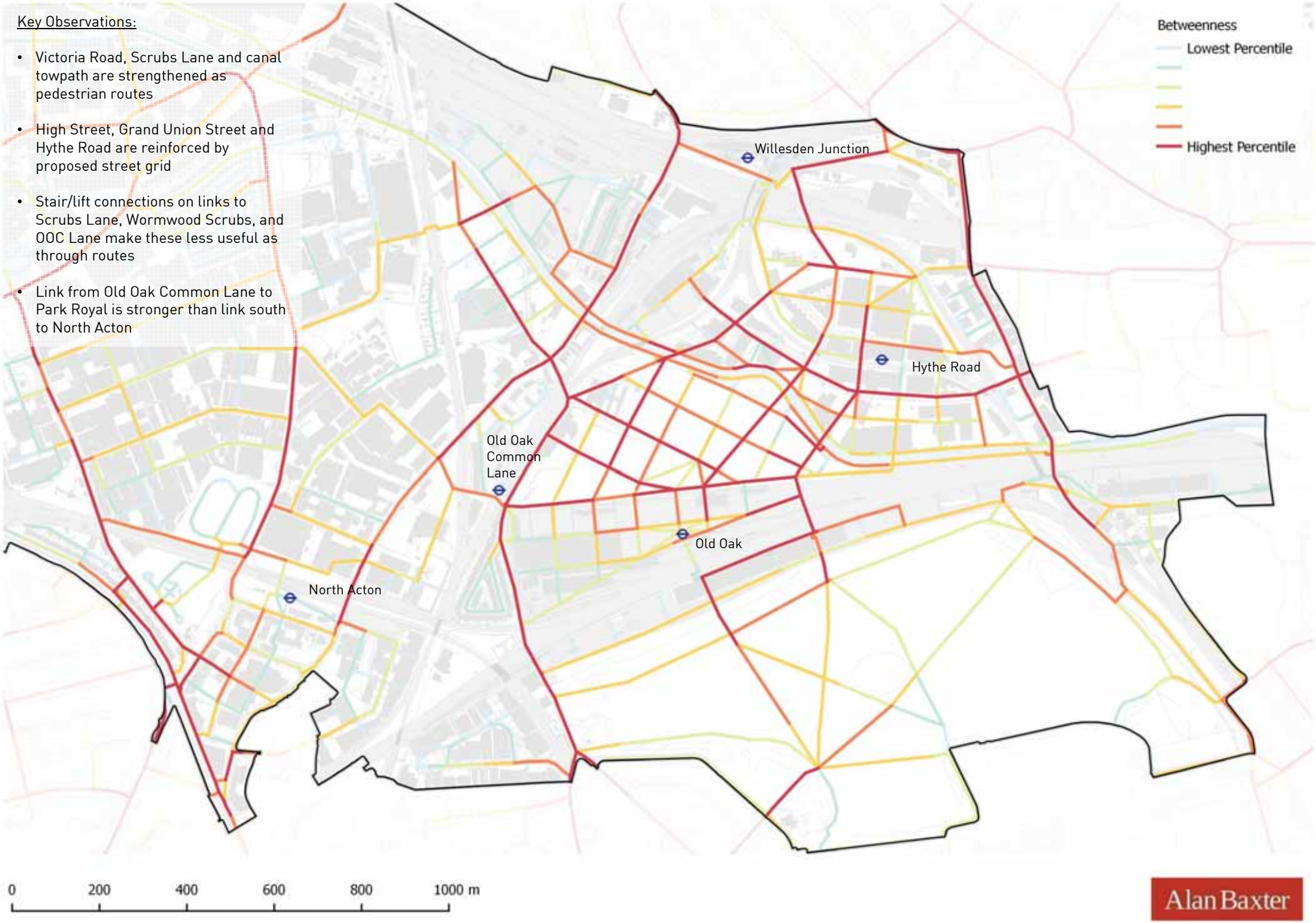
Figure 7



Alan Baxter

Route Potential: 2041

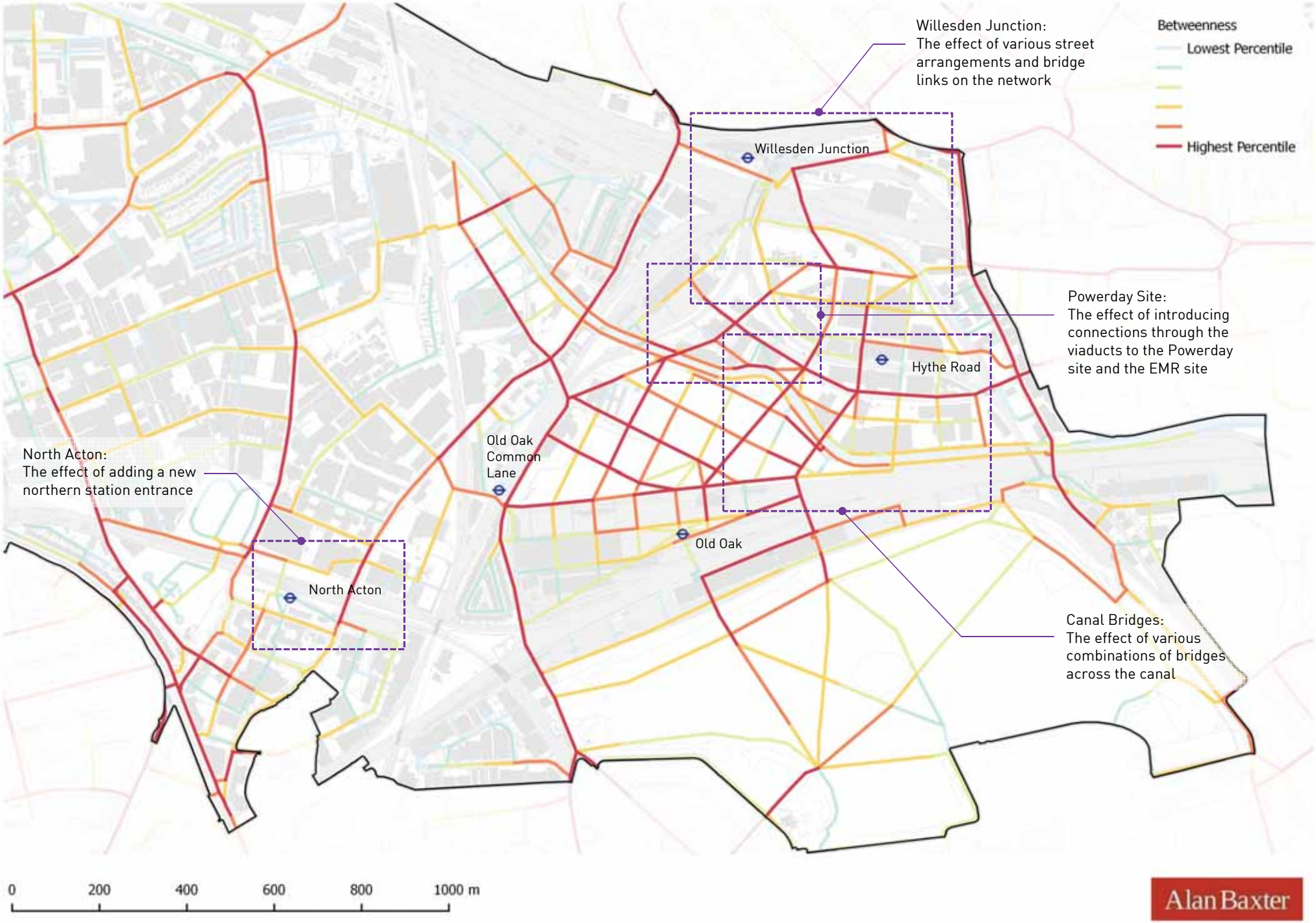
Figure 8



Alan Baxter

Network Tests

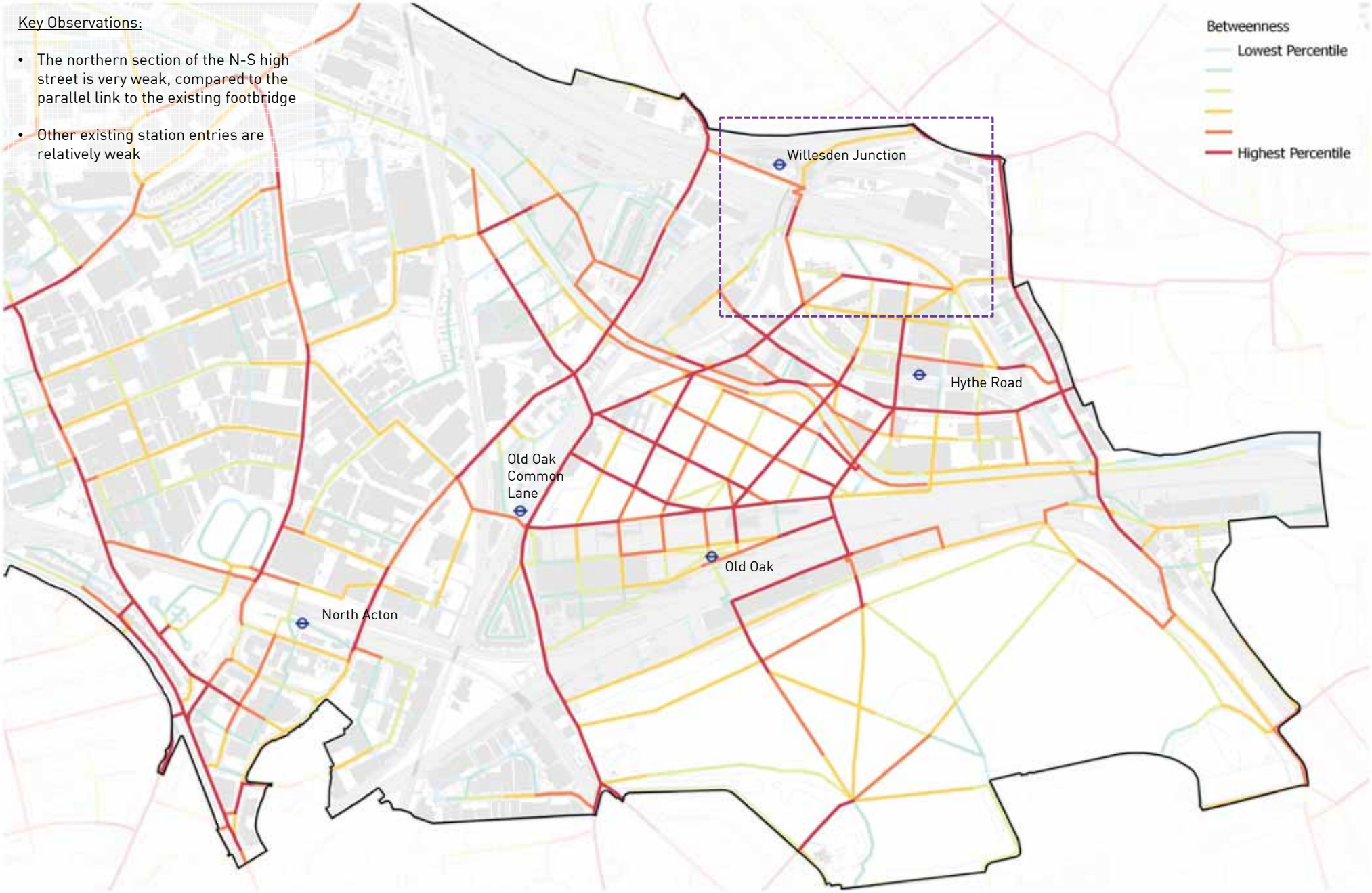
Figure 9



Alan Baxter

Willesden Junction, Option 1: No new bridge

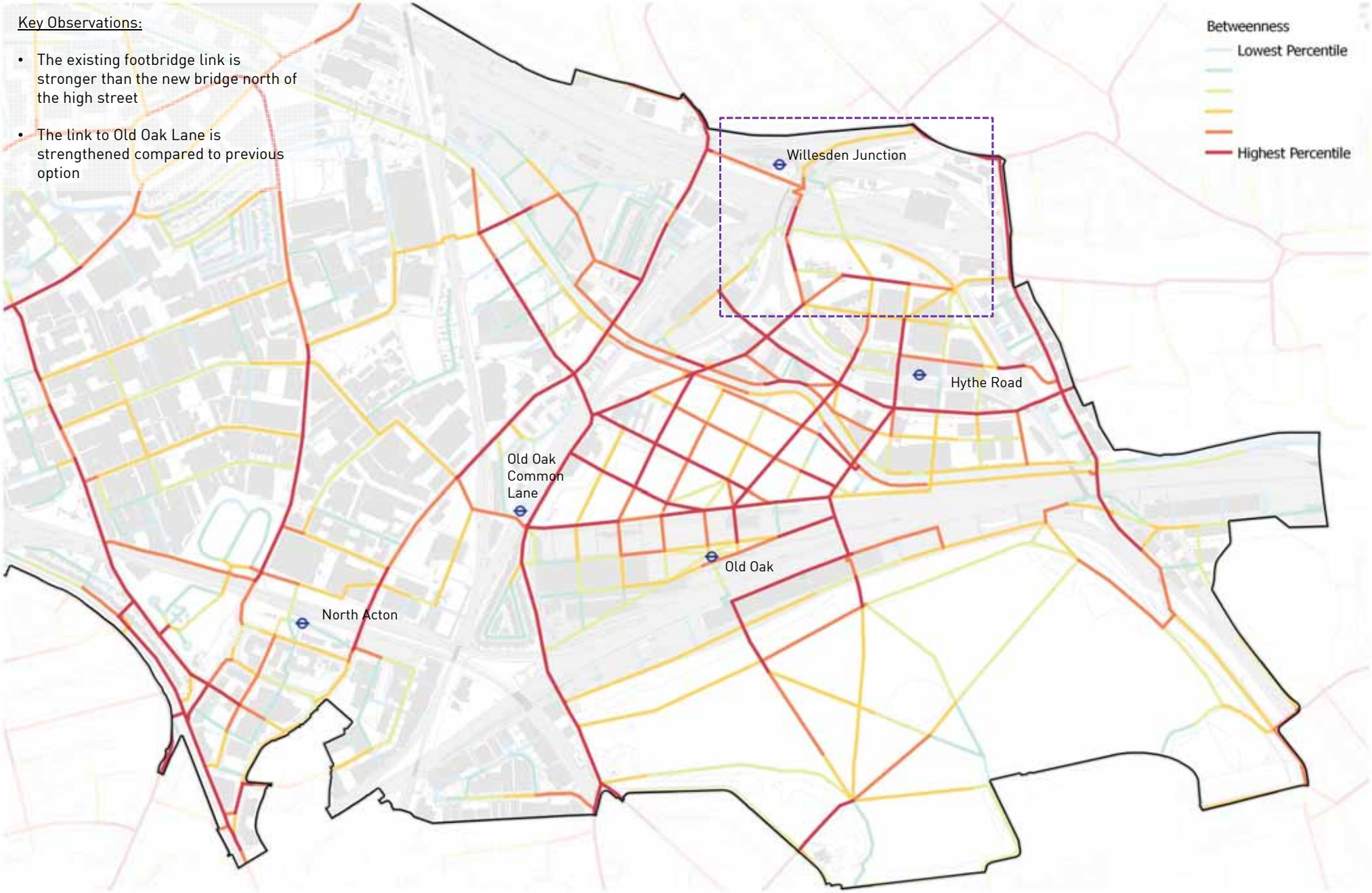
Figure 10



Alan Baxter

Willesden Junction, Option 2: Footbridge and stair from High Street

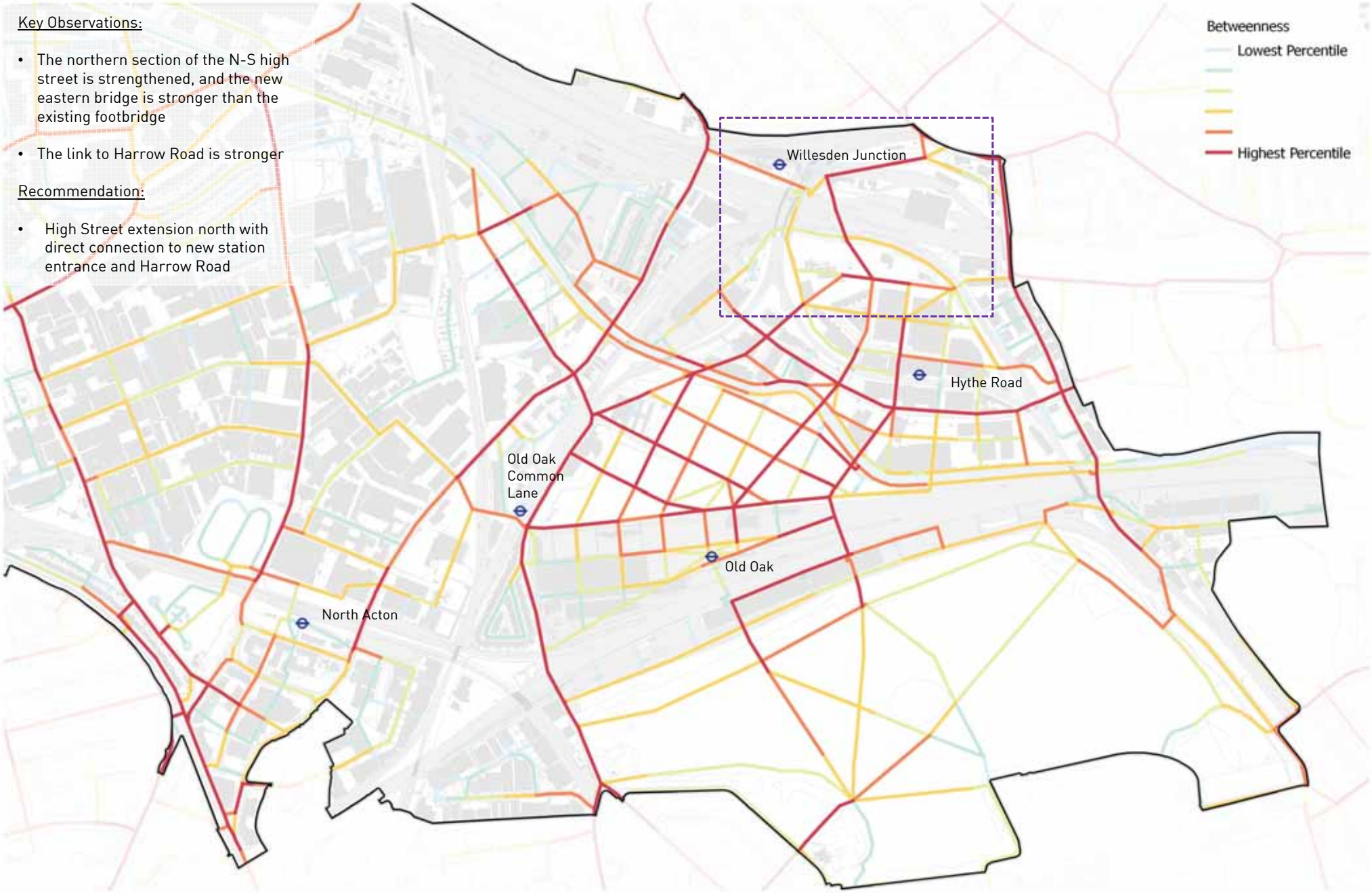
Figure 11



Alan Baxter

Willesden Junction, Option 3: High Street to Harrow Road

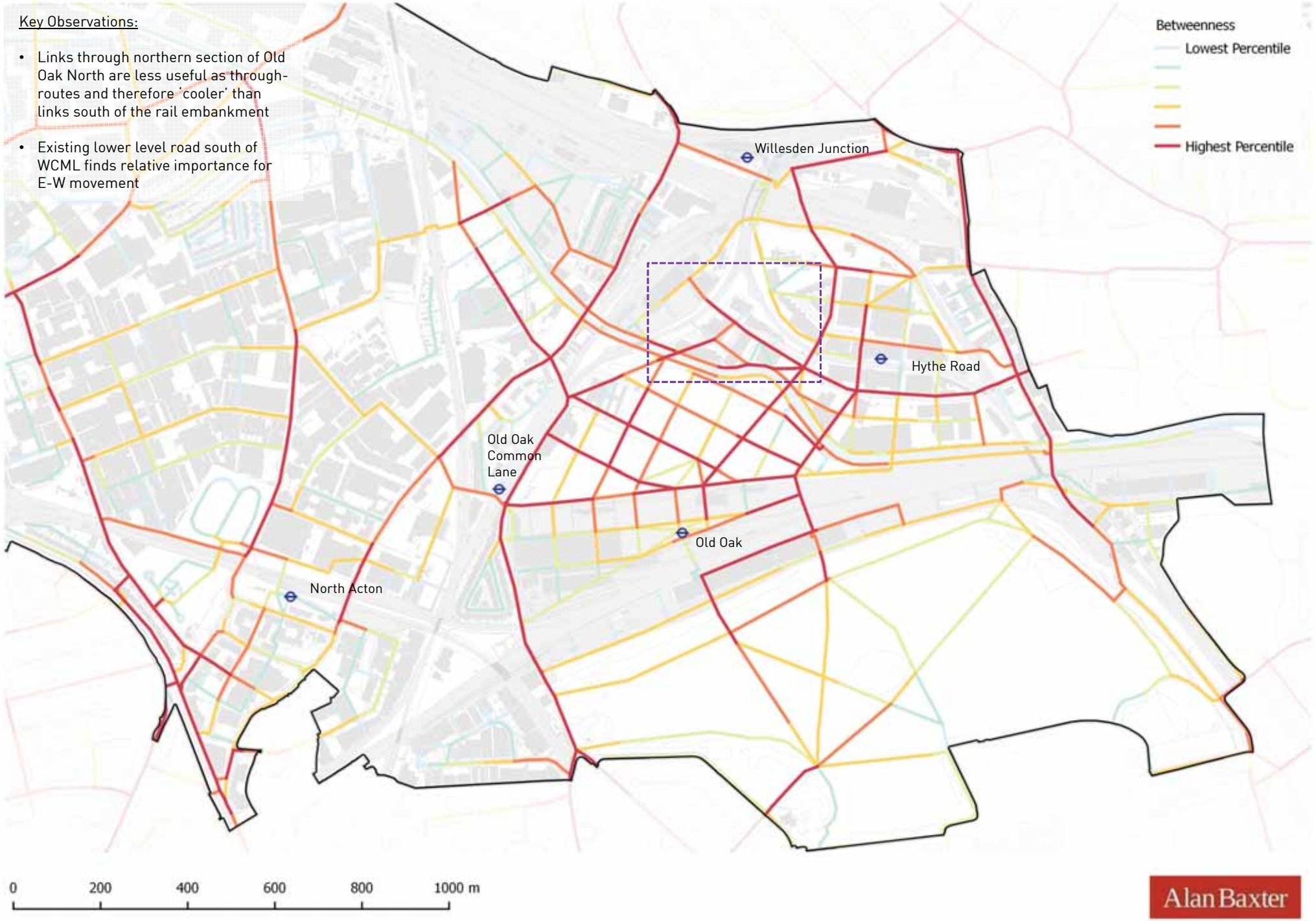
Figure 12



Alan Baxter

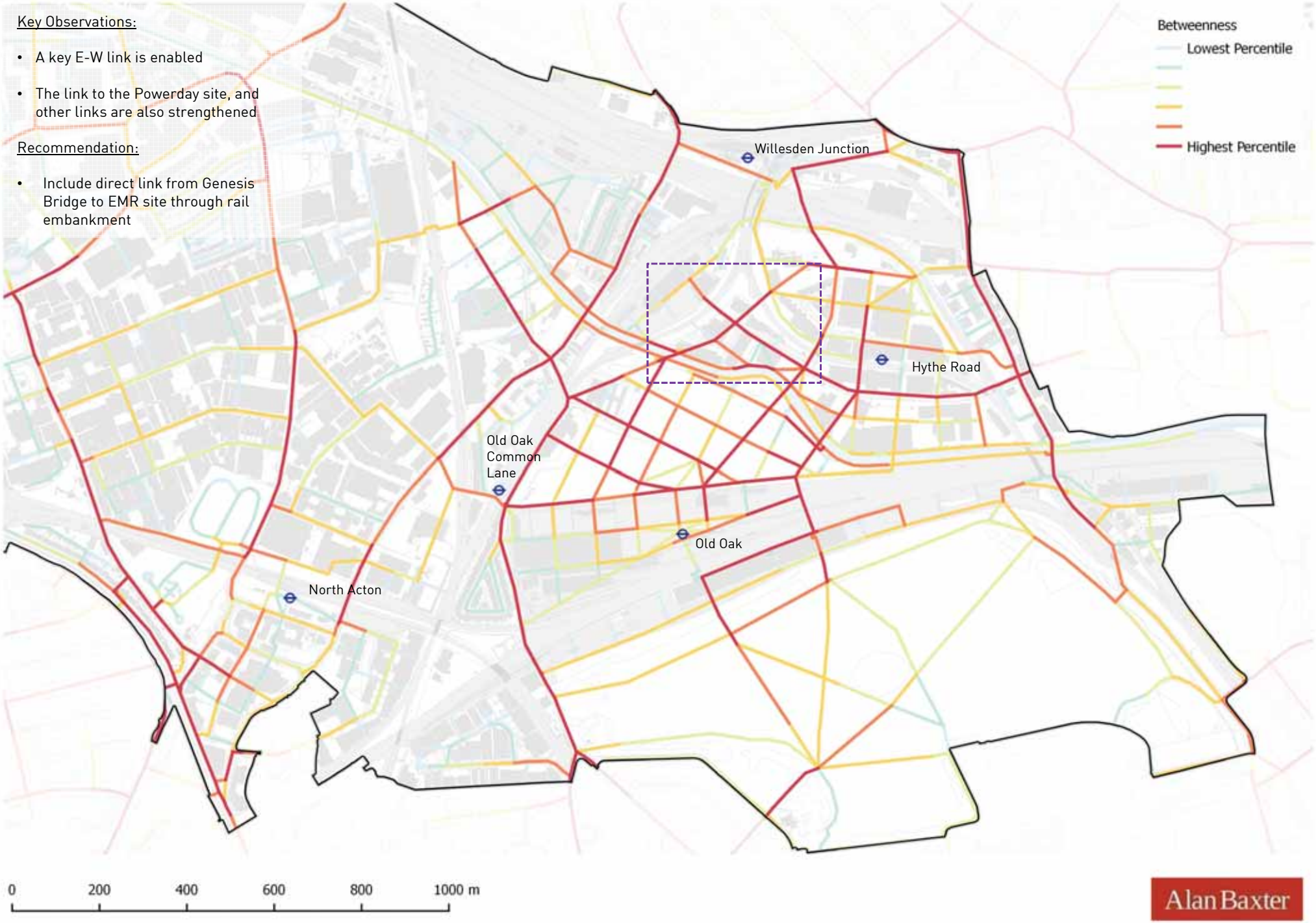
Viaduct Links, Option 1: Link from Genesis Bridge to EMR site is not included

Figure 13



Viaduct Links, Option 2: Link from Genesis Bridge to EMR site is included

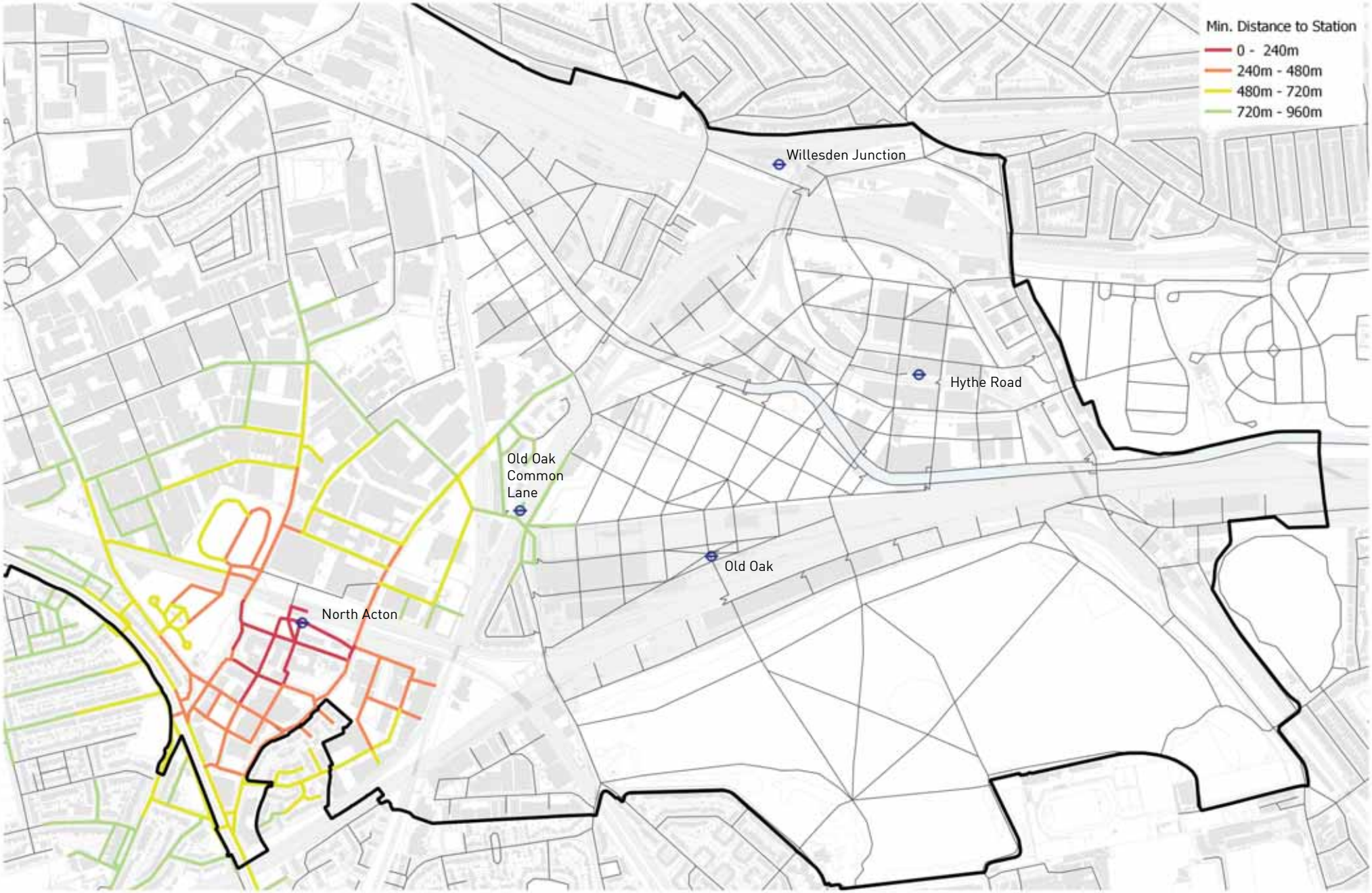
Figure 14



Alan Baxter

North Acton, Option 1: No link to the north of the Station

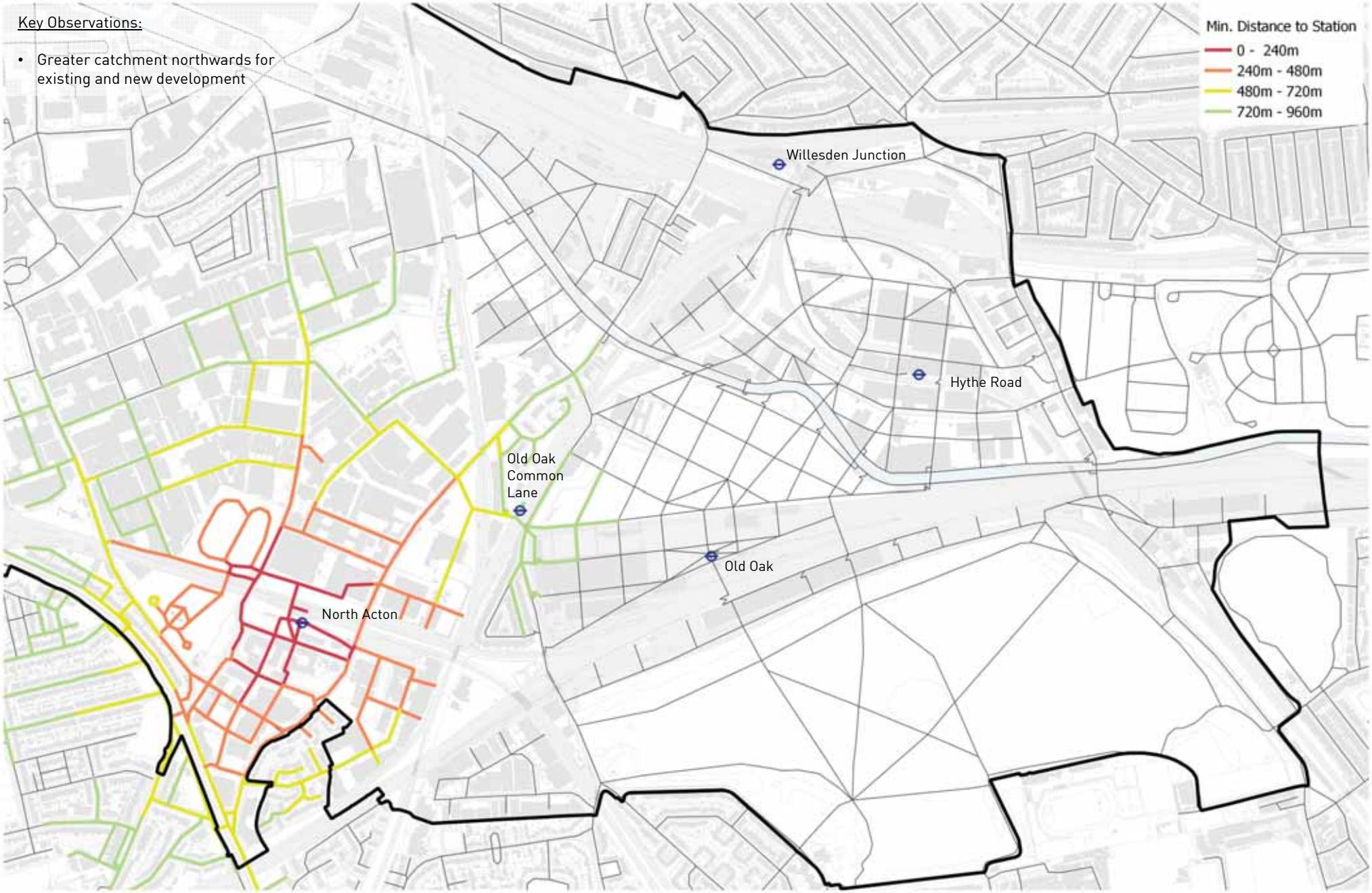
Figure 15



Alan Baxter

North Acton, Option 2: Link to the north of the Station

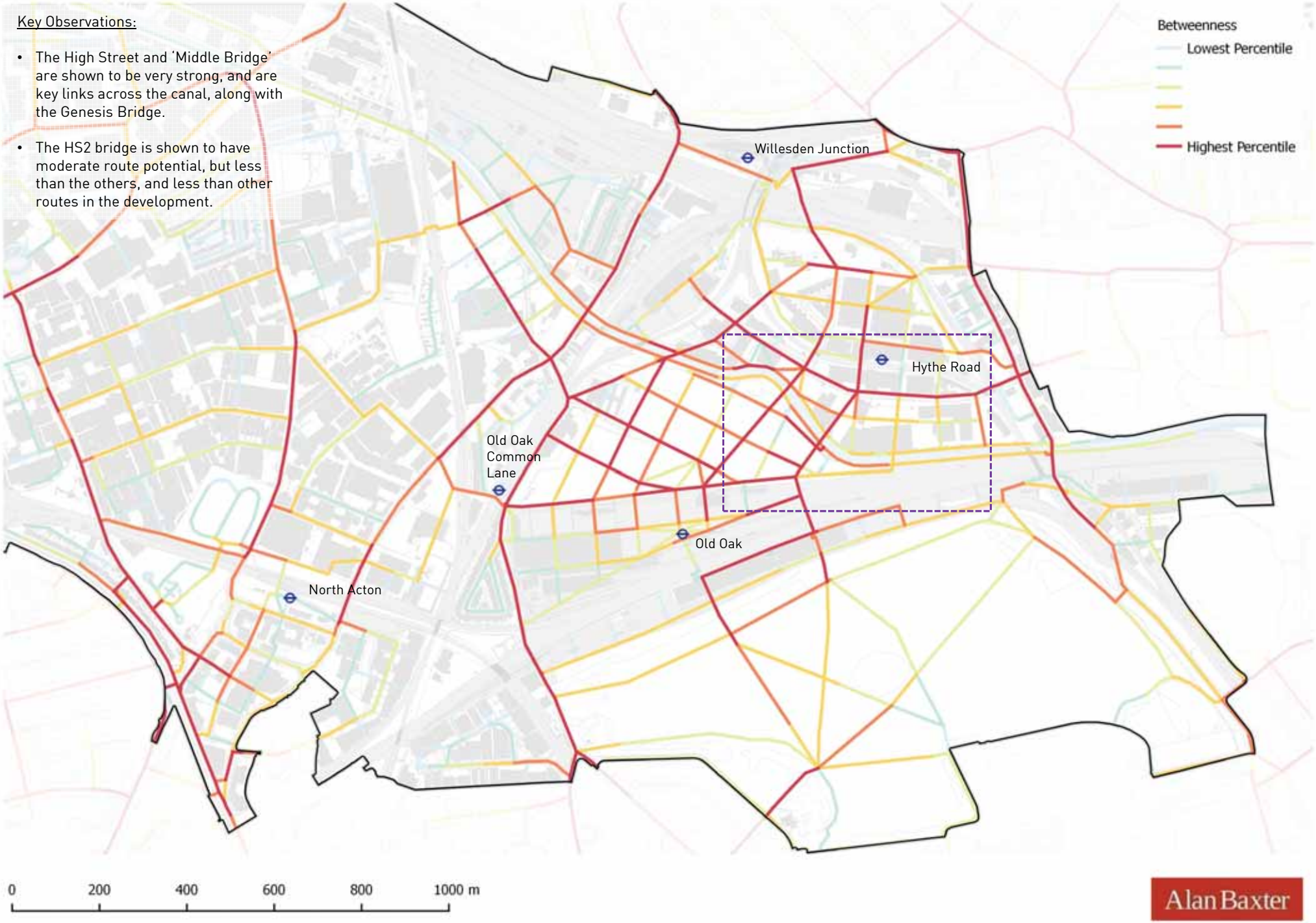
Figure 16



Alan Baxter

Canal Bridges, Option 1: High Street Bridge, 'Middle' Bridge, HS2 Bridge

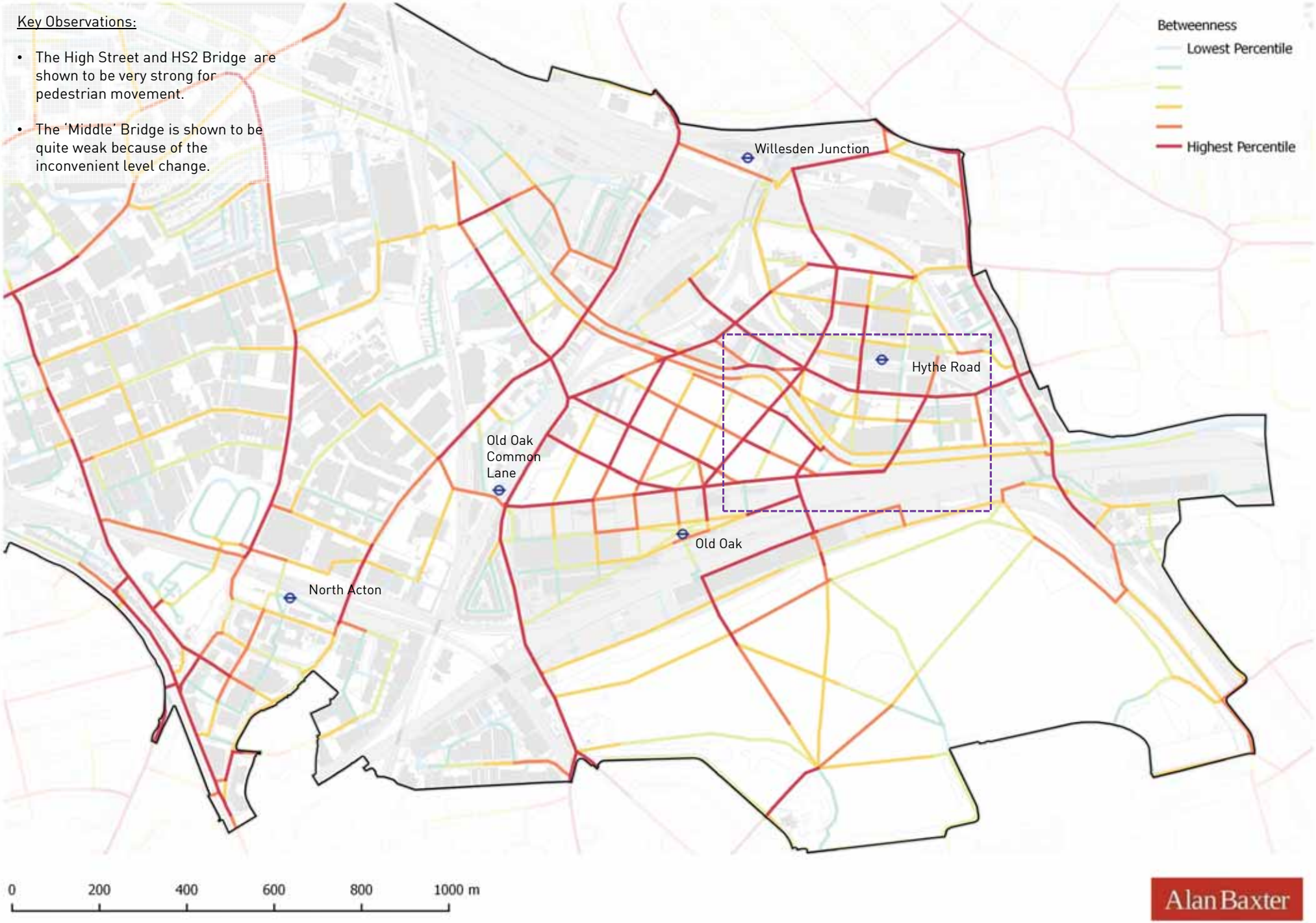
Figure 17



Alan Baxter

Canal Bridges, Option 2: Pedestrian Interchange & All Modes Bridge

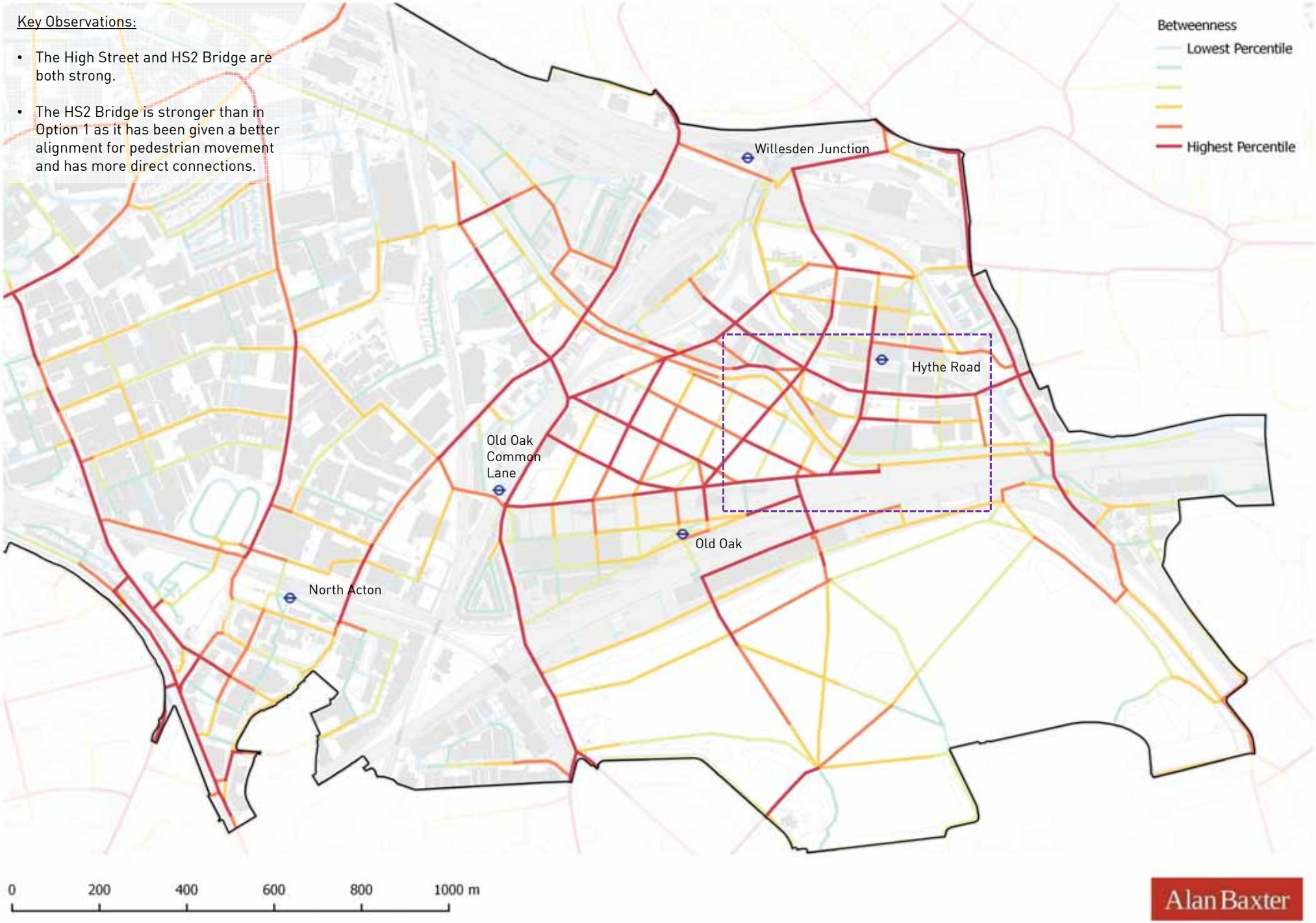
Figure 18



Alan Baxter

Canal Bridges, Option 3: Combined All Modes Bridge & Interchange

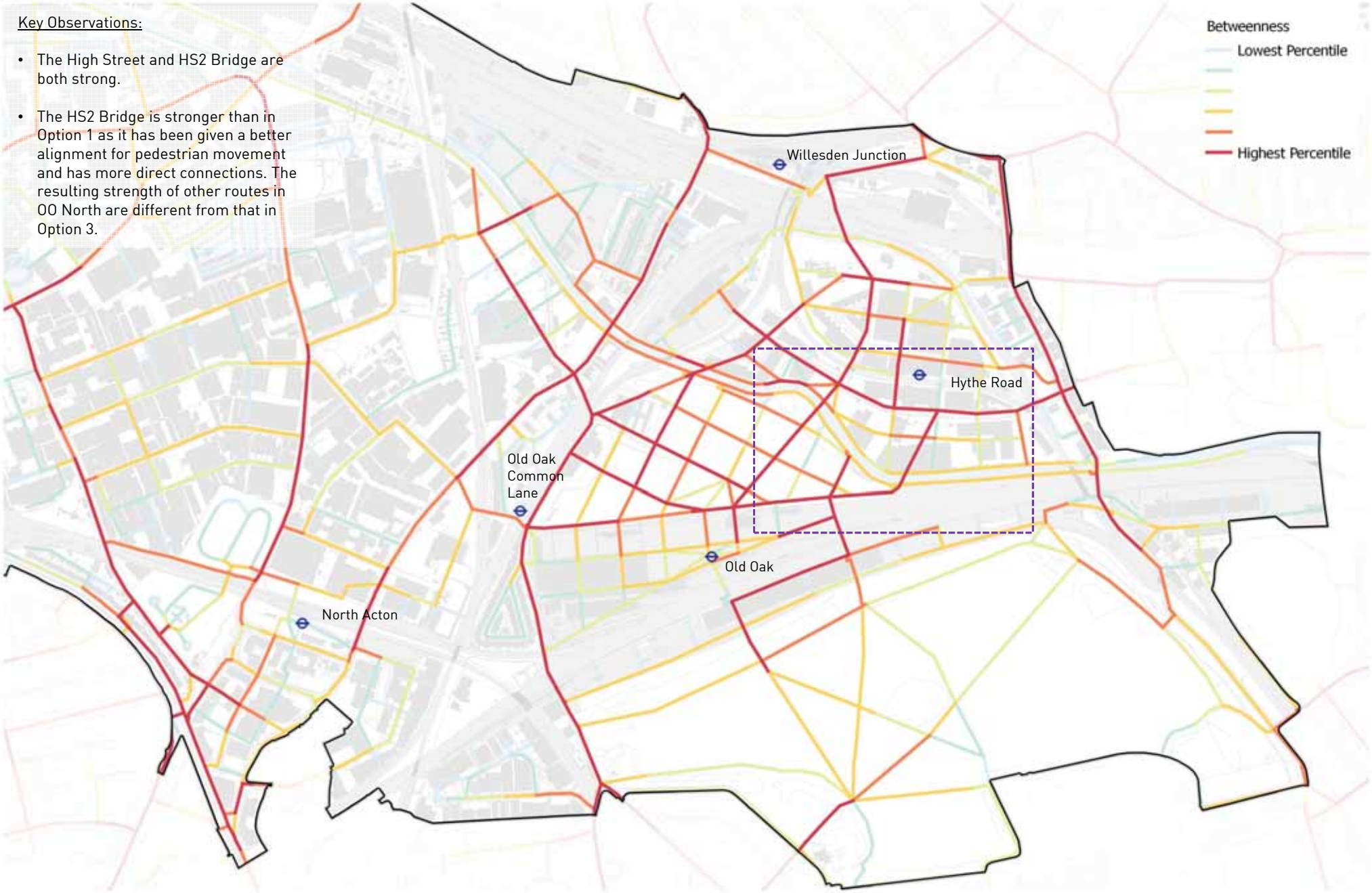
Figure 19



Alan Baxter

Canal Bridges, Option 4: High Street Interchange

Figure 20



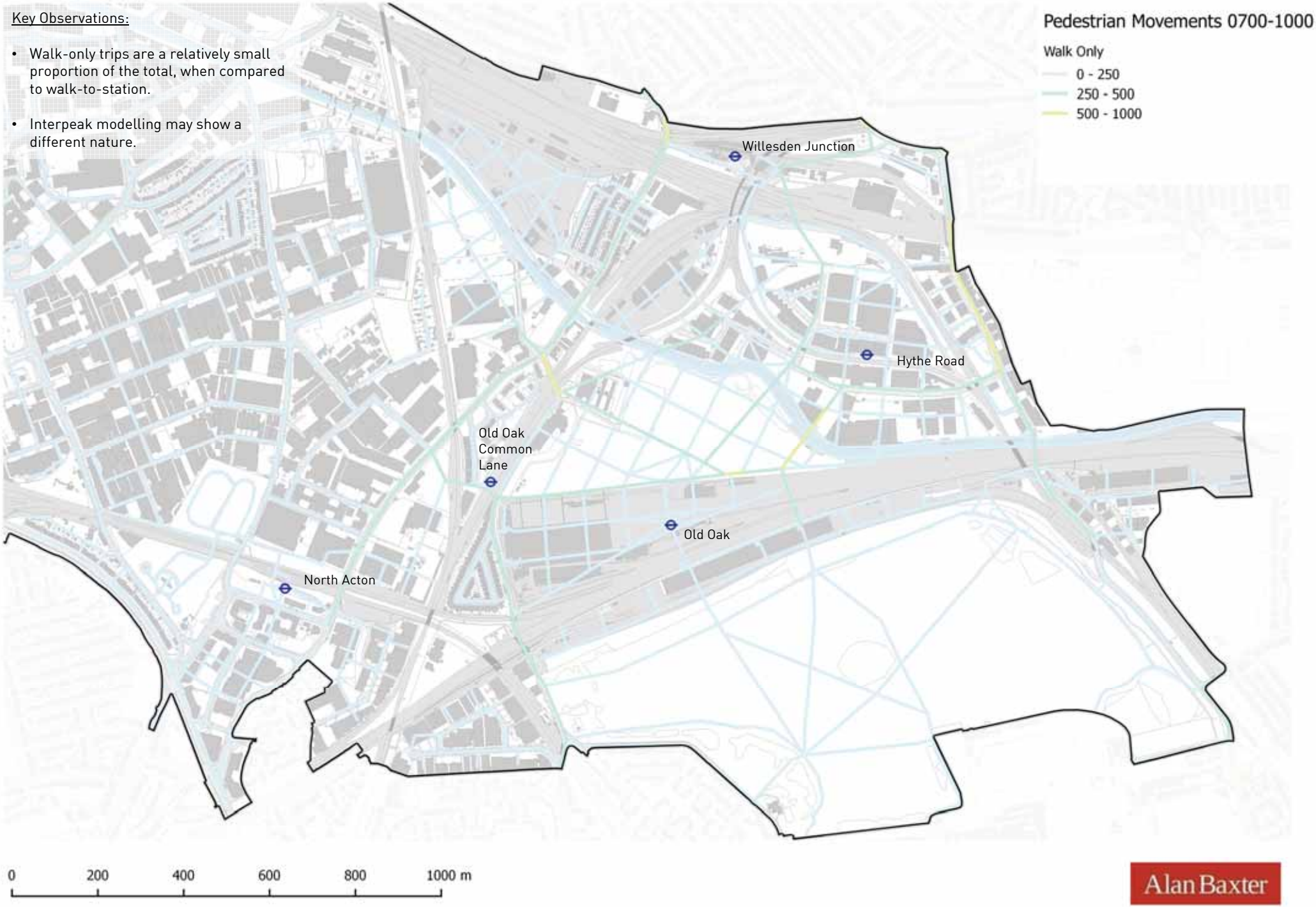
Alan Baxter

Appendix 2

Weighted Outputs

Weighted Modelling: Walk Only

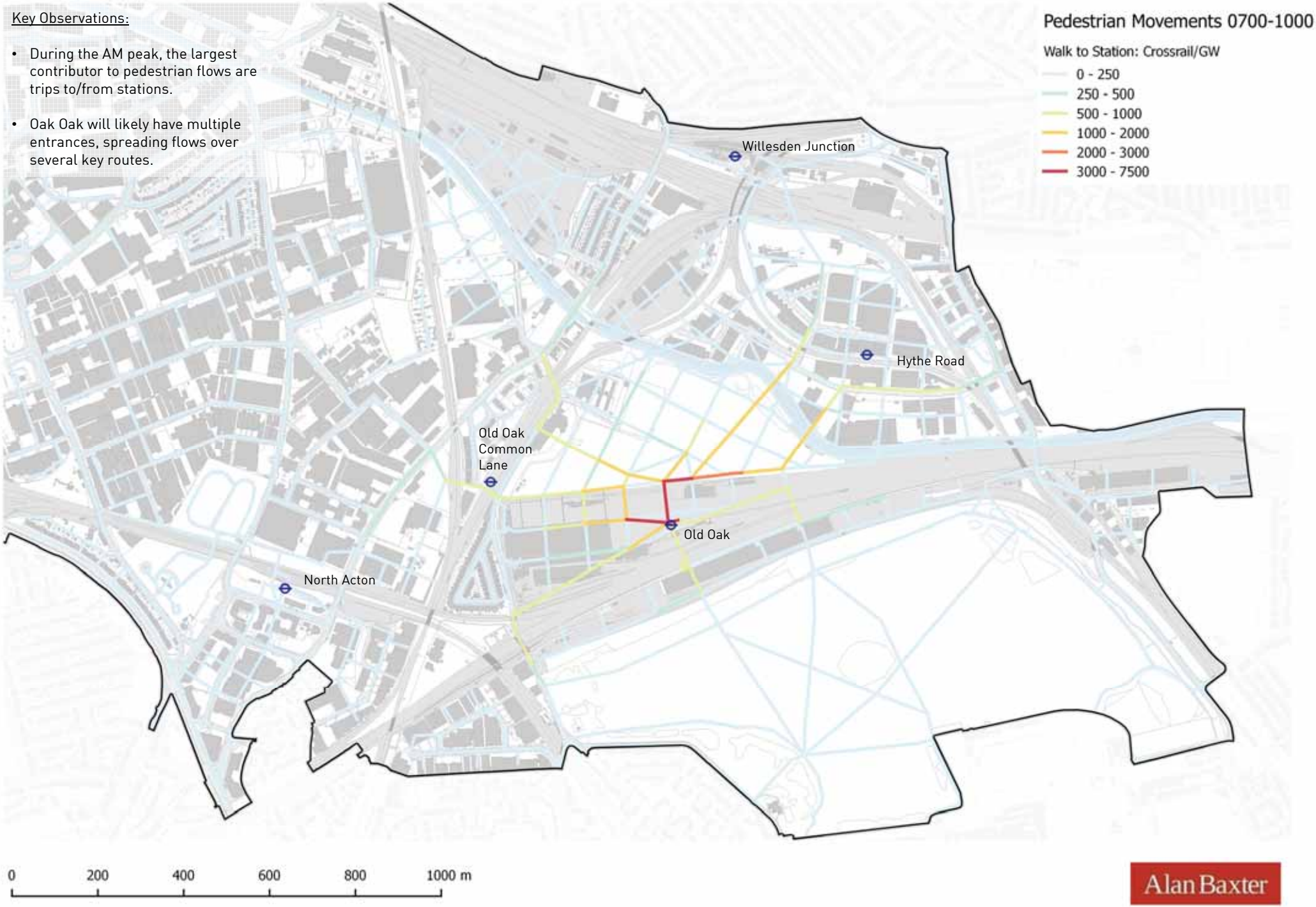
Figure 21



Alan Baxter

Weighted Modelling: Walk to Old Oak

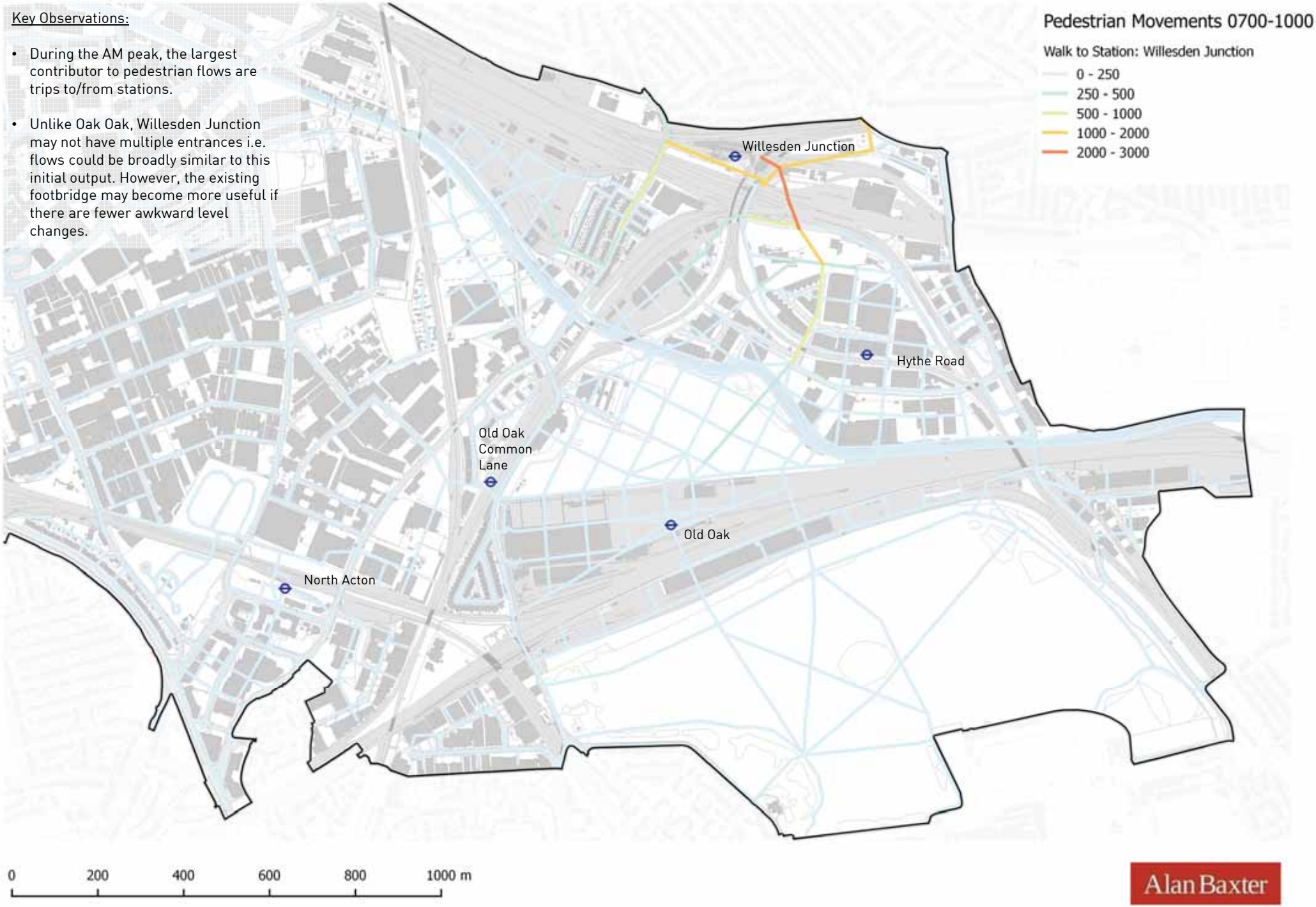
Figure 22



Alan Baxter

Weighted Modelling: Walk to Willesden Junction

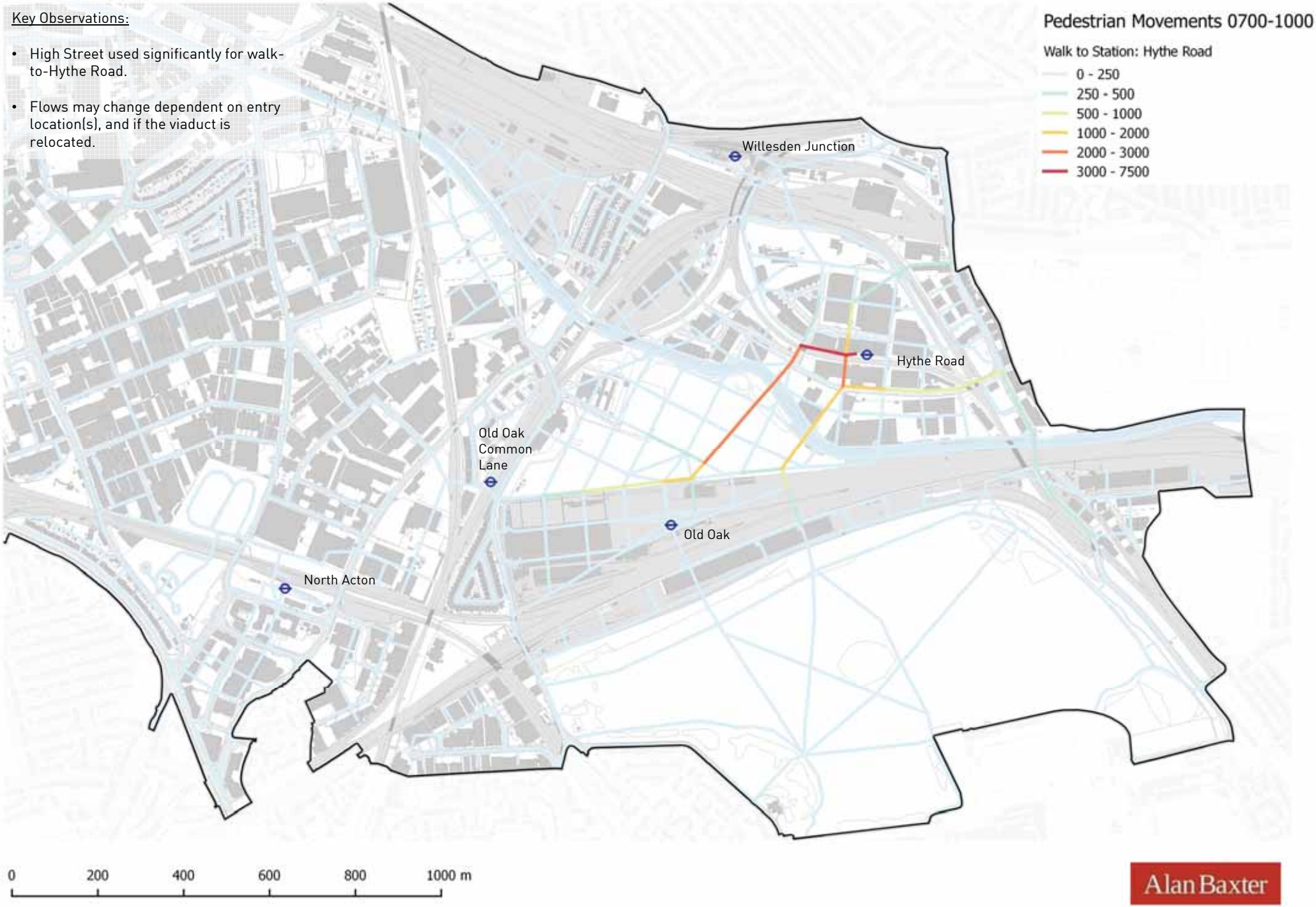
Figure 23



Alan Baxter

Weighted Modelling: Walk to Hythe Road

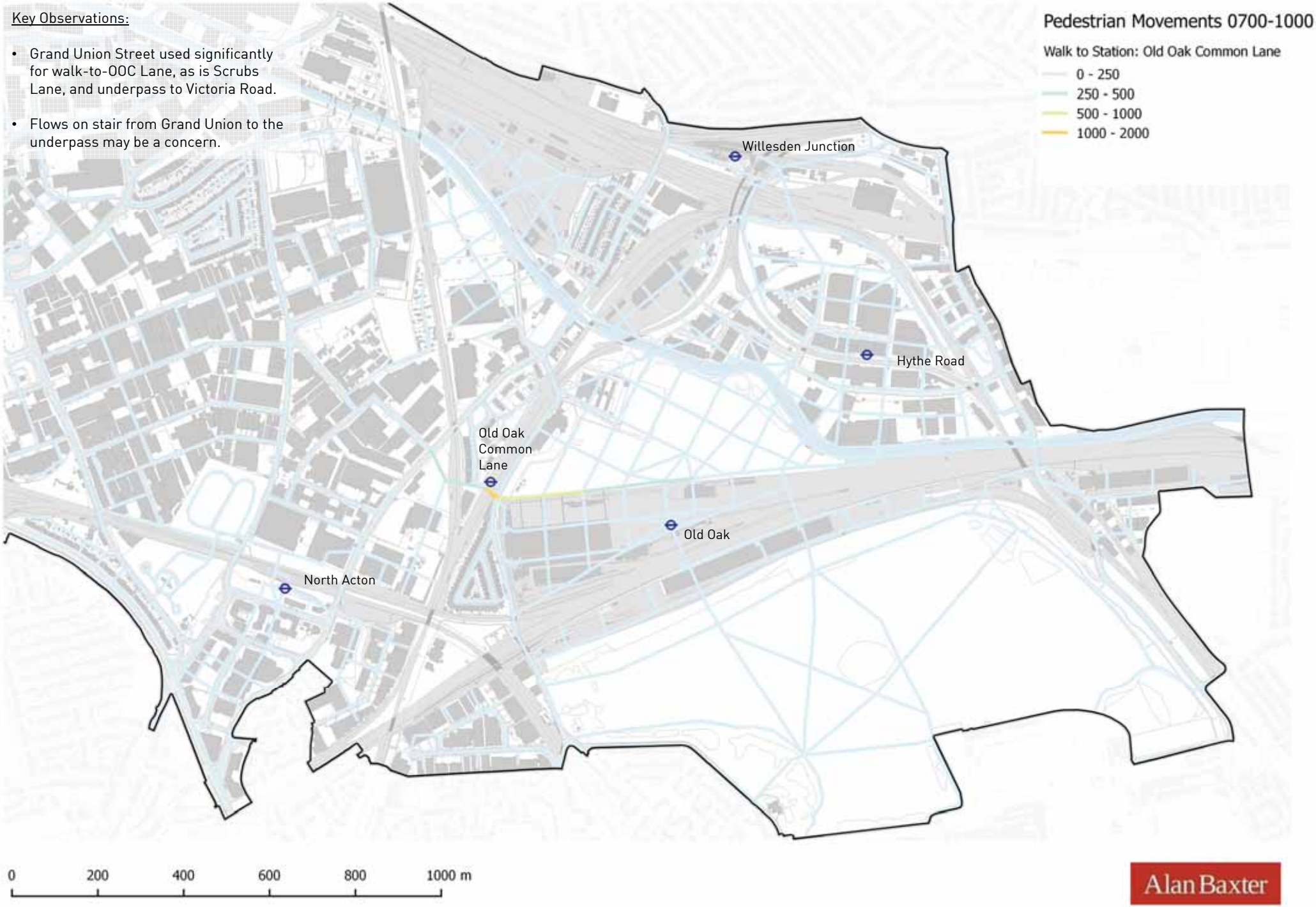
Figure 24



Alan Baxter

Weighted Modelling: Walk to Old Oak Common Lane

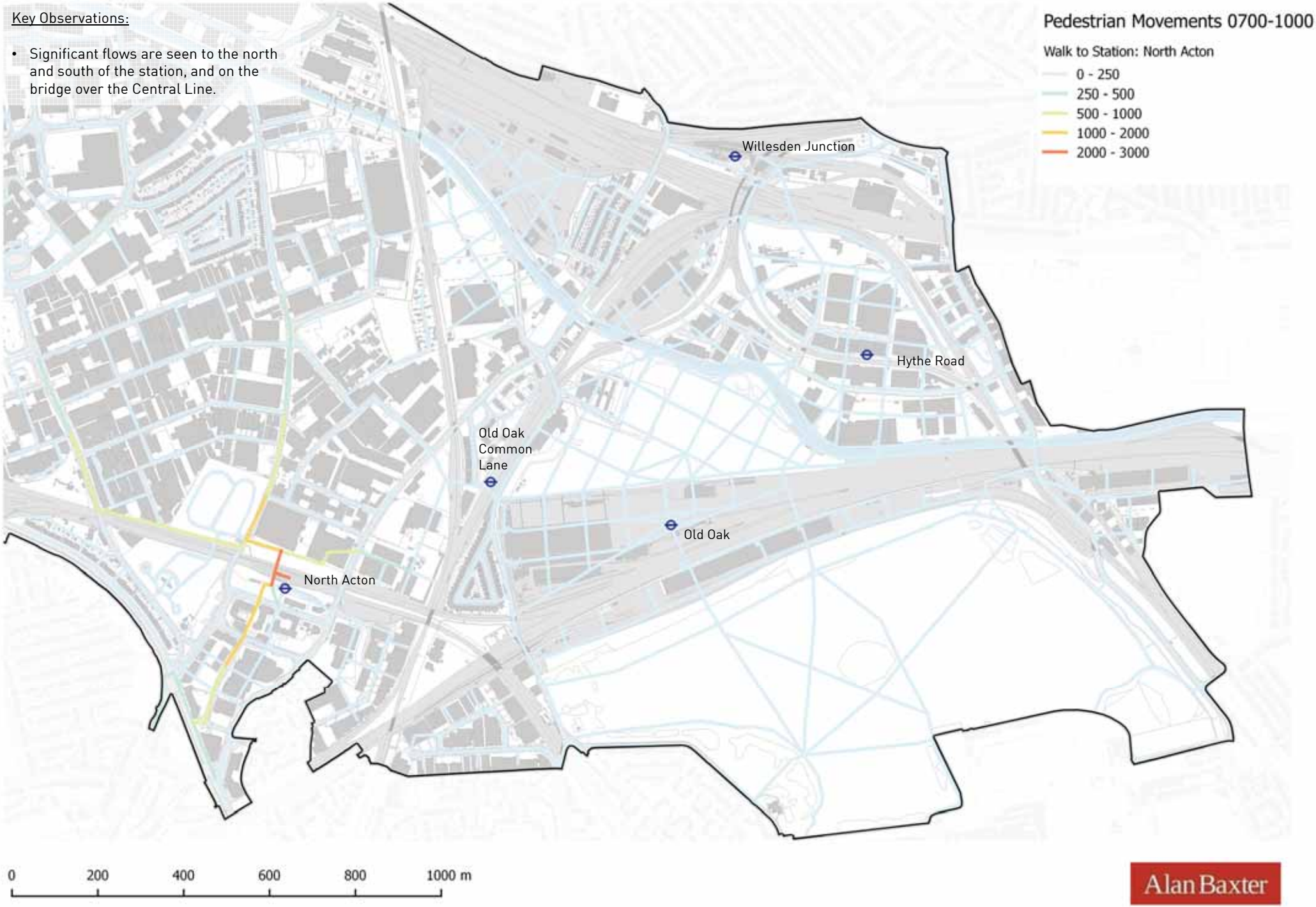
Figure 25



Alan Baxter

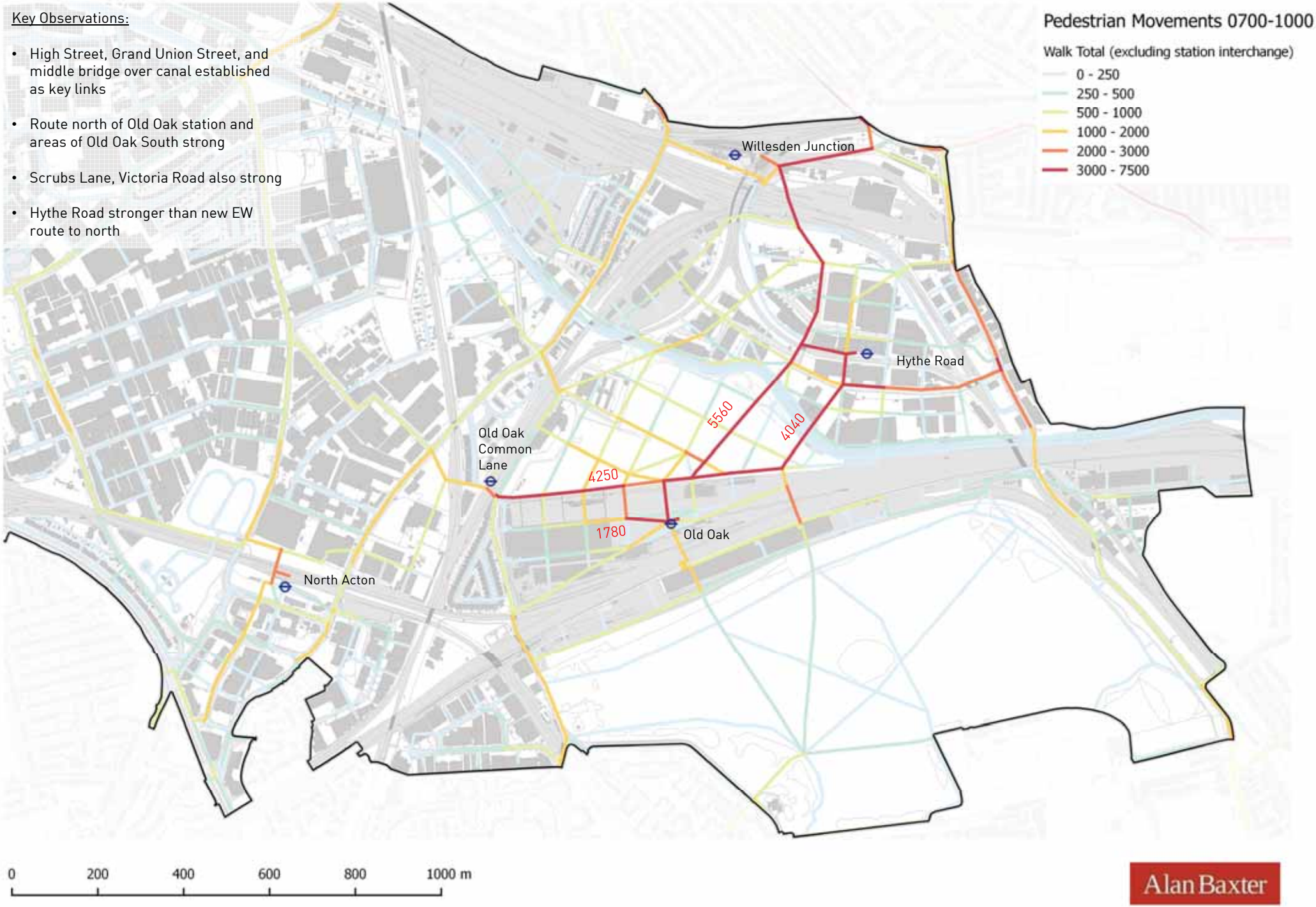
Weighted Modelling: Walk to North Acton

Figure 26



Weighted Modelling: Walk Total (excluding interchange)

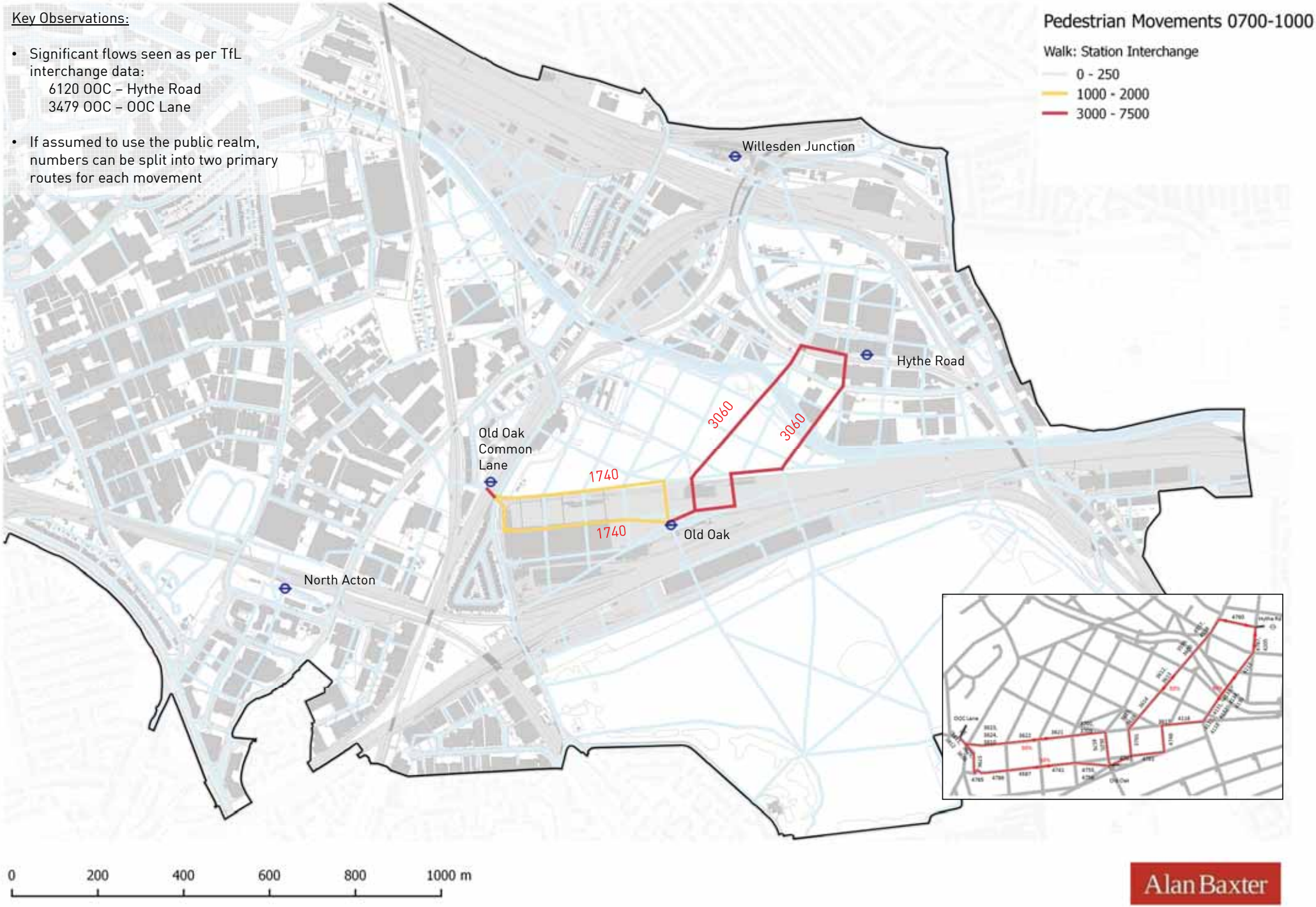
Figure 27



Alan Baxter

Weighted Modelling: Interchange (OOC-HR & OOC-OOCL)

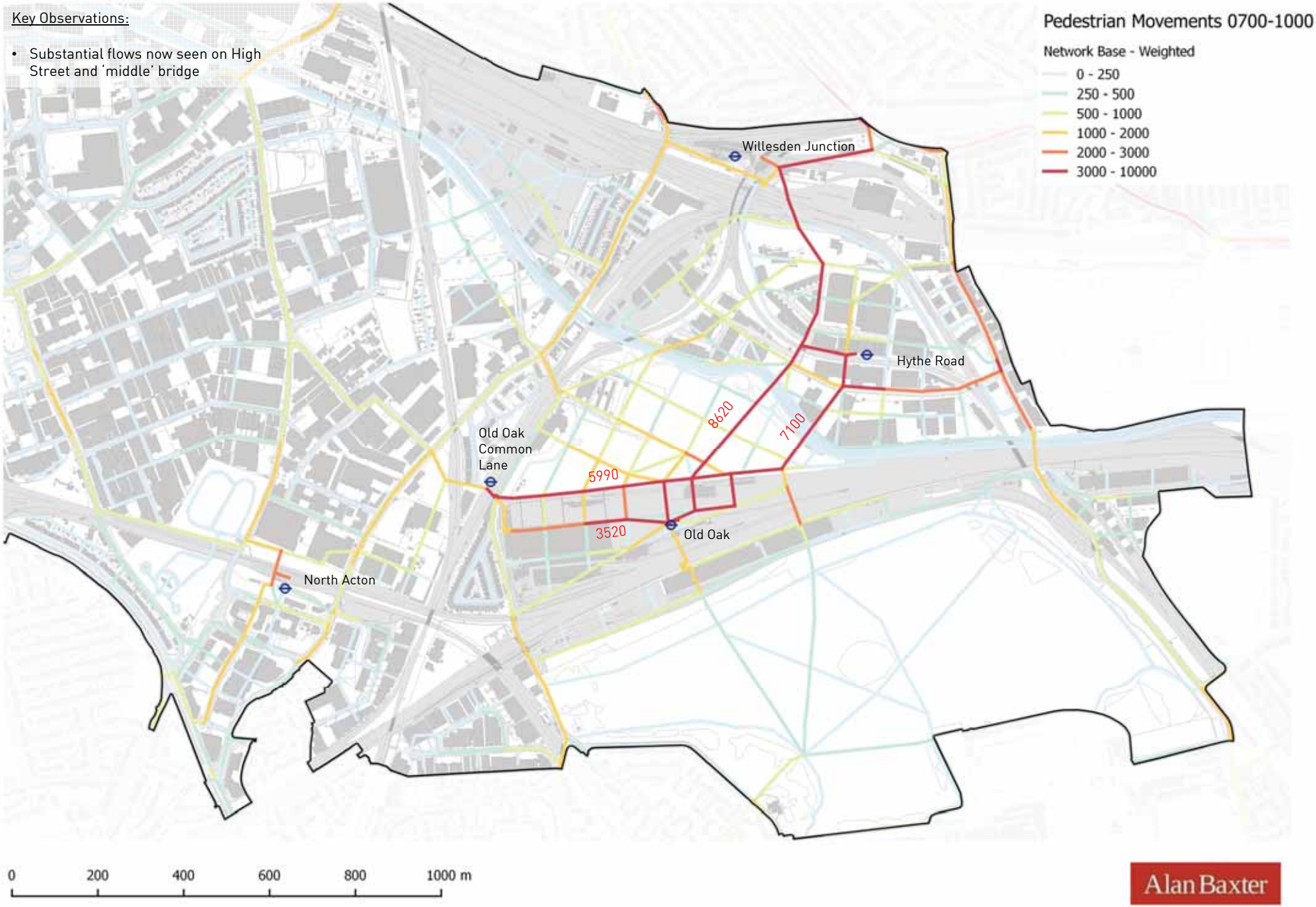
Figure 28



Alan Baxter

Weighted Modelling: Walk Total (+ max. interchange)

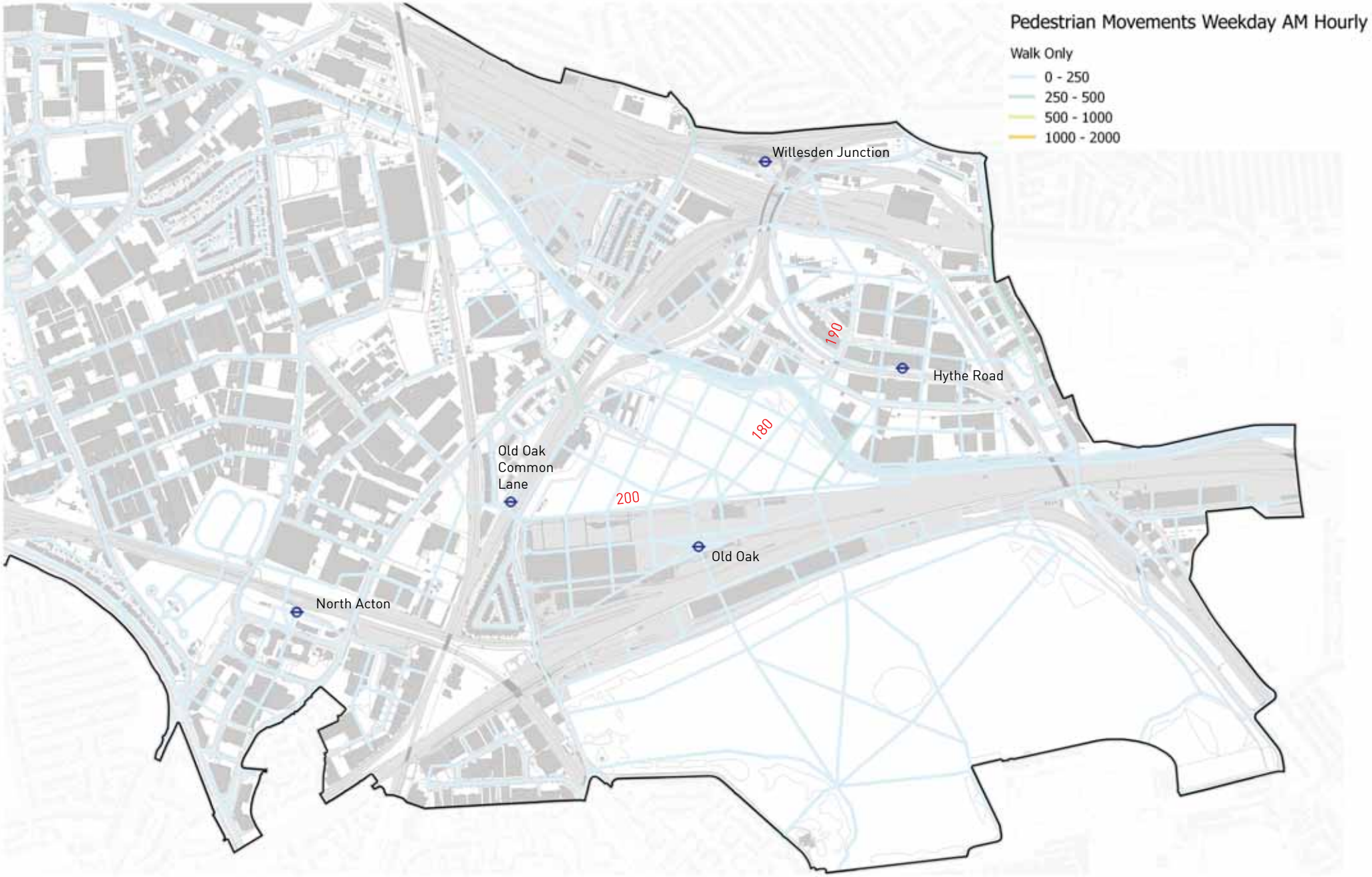
Figure 29



Alan Baxter

Weighted Modelling: Walk Only – Weekday AM Peak

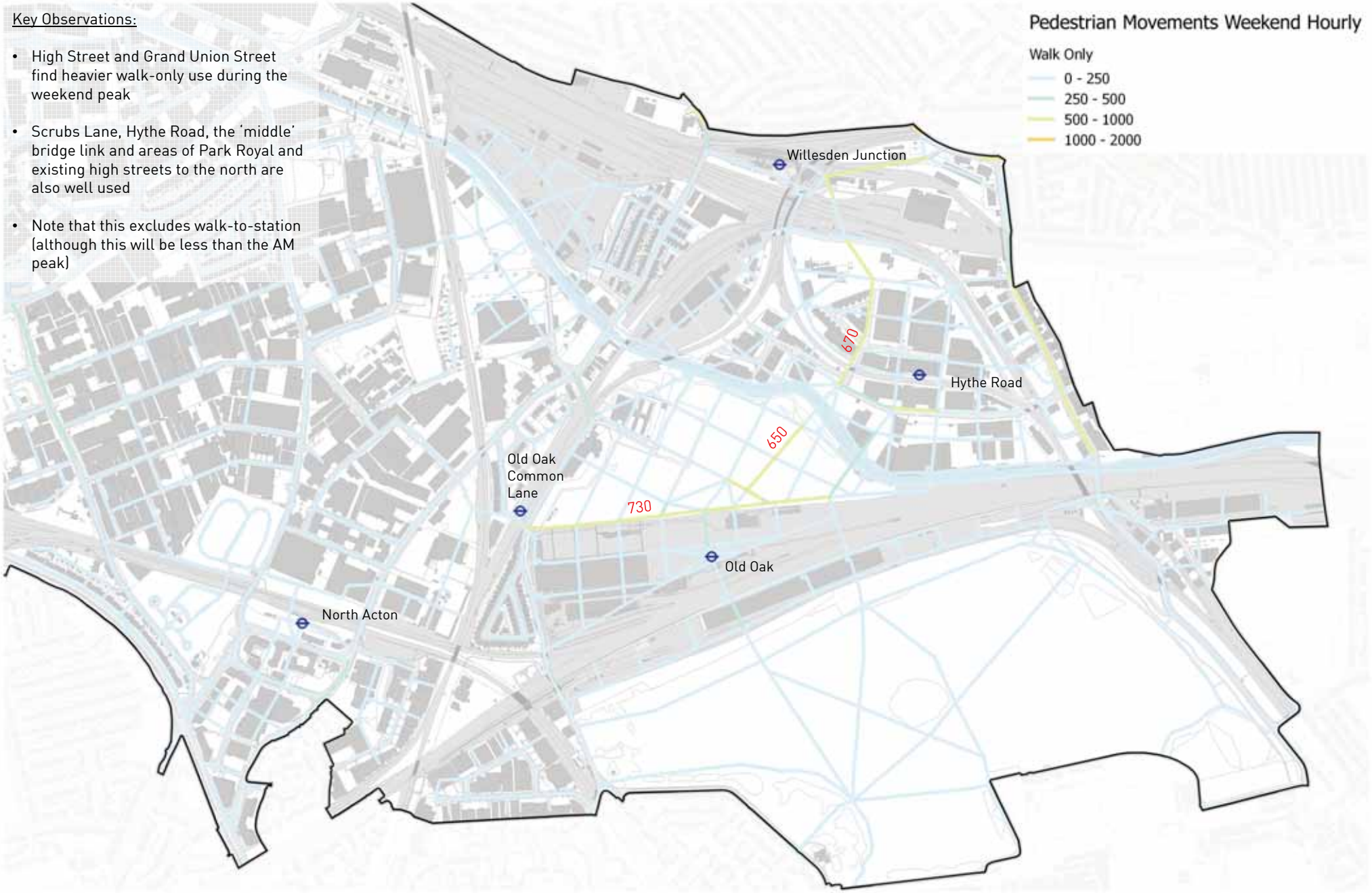
Figure 30



Alan Baxter

Weighted Modelling: Walk Only – Weekend Peak

Figure 31



Assumptions: Factor of 3.5 applied to streets with active retail frontage only. Multiplied hourly rate (50% of 3 hour)

Alan Baxter

5th
studio