Putting the Community First

BARNET
LONDON BOROUGH

Local Development Framework

Core Strategy - **Barnet's Transport Review**

August 2011

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1. Introduction

1.1.1 This paper reviews the forecast transport conditions across Barnet for the period of the LDF up to 2026 and beyond to 2031. It assesses the likely level of traffic on key routes in the borough, delays at junctions and crowding levels on the Underground and overground train networks.

1.1.2 Information supplied by Transport for London (TfL) has been largely utilised, including that derived from the new North London Highway Model. This Model has produced robust forecasts for the borough., However, analysis for south west Barnet has utilised data from the Transport Assessment produced as part of the outline planning application for the approved Brent Cross Cricklewood (BXC) development scheme (C17559/08 approved 28/10/2010). This is more detailed than the TfL data available for the south west of the borough. The BXC transport data has been scrutinised by the council and TfL as part of the assessment of the outline planning application, and is fully compatible with all relevant TfL and national (WEBTAG) guidance.

1.1.3 Information derived from Area Action Plans and Transport Assessments (TA's) produced in association with the regeneration of priority estates has also been utilised to check and confirm compatibility with the area wide forecasts.

2. Scope of review

2.1.1 Growth between the 2008 base year for the TfL models and 2031 has been based on TfL forecasts of employment and population growth in Barnet, which take account of the proposed key growth areas in the London Plan, including the Opportunity Areas of Colindale, and Brent Cross Cricklewood and the Mill Hill East Area of Intensification in Barnet, as well as growth in other parts of north London, such as Wembley.

2.1.2 The review focuses on the AM peak (08:00 to 09:00) period as this is known to be when highway and public transport congestion levels are generally highest, due primarily to the overlap between home to work and home to school trips at that time, coupled with the fact that Barnet has very high quality educational facilities, including eight of the best schools in the country, which encourages net in migration of pupils from other authorities, including those immediately adjacent to Barnet. Tackling the school run is one the Council's priorities as set out in the LDF Core Strategy.

2.1.3 In terms of public transport rail and tube travel are focused on in this review because of the dominant radial travel pattern in Barnet which is a known capacity issue that will be added to as the borough's population increases from under 350,000 in 2011 towards 400,000 by 2030.

2.1.4 Bus travel is considered less of a strategic transport mode as it is more dispersed across the borough and passenger numbers are lower. Bus travel is not focused on in this review.

3. Barnet's Infrastructure Delivery Plan

3.1.1 The review also examines whether there are any locations where the draft Infrastructure Delivery Programme (IDP) is not proposing to address the predicted congestion, as well as identifying locations which are likely to be 'hotspots' in the future and where the need for improvements should be kept under review. This will therefore help inform the final version of the IDP and subsequent revisions. This

review itself is also anticipated to be regularly updated, to account for any changes in growth projections and as major developments are implemented.

4. Rail, tube and bus (RAILPLAN) model

4.1.1 Rail and tube crowding information has been derived from TfL's London-wide Railplan model. Railplan also provides information on bus travel where passenger numbers are generally lower and travel patterns more dispersed across the borough. Improvements are expected to come forward incrementally for bus travel in Barnet through working with TfL, as well as developing new and improved bus routes as part of major regeneration schemes.

5. North London highway assignment model (NoLHAM)

5.1.1 This is one of a series of bespoke sub-regional highway models built by TfL to support the Mayor's Transport Strategy (MTS), the Sub Regional Transport Plans (SRTPs) and the work of the Sub Regional Panels. The core area of the model covers Barnet, Haringey, Enfield, Waltham Forest, Hackney, Islington, Camden, Westminster, City of London and Kensington and Chelsea, as well as parts of Brent, Harrow and Hertfordshire, within which each junction is modelled in detail. The model also covers the rest of Greater London and the whole of the UK, which are represented at a much simplified level. The base year is 2008 with interim year forecasts available up to 2031 which is compatible with the MTS, the SRTP and the LDF. This produces robust forecasts at the the borough level. The Model accounts for expected increases in traffic levels, including that associated with regeneration areas in Barnet. The model has already been utilised in Barnet, having been used as one of the assessment tools in the development of the improvement scheme currently being implemented at Henlys Corner.

5.1.2 The Model uses the internationally recognised SATURN suite of traffic modelling programmes and includes all the main roads in Barnet within the core model simulation area, including the entire length of the TfL road network (TLRN) and all the borough and 'A' and 'B' class roads (and part of the 'C' class as well). The detailed level of modelling in the core area is demonstrated by the 800 zones, over 3,000 junctions and over 10,000 links representing the highway network. TfL have involved some of the UKs leading transport modelling experts in the development of the model and undertook various sophisticated tests to confirm the robustness of the networks, trip matrices and trip matrix manipulation processes.

5.1.3 A number of independent traffic counts and modelled traffic flows not used by TfL in developing the NoLHAM have been utilised to confirm the validity of the 2008 base year flow projections, as well as the future year forecasts. This includes information derived from the modelling work undertaken in the Colindale area, including various traffic counts and traffic model flow predictions from the Colindale 'hotspot' model, as well as the modelling work which was undertaken in support of the approved AAP.

6. Regeneration schemes in Barnet

6.1. Brent Cross Cricklewood regeneration scheme

6.1.1 The Brent Cross Cricklewood scheme is one of the most ambitious and challenging developments proposed in the UK at the present time. Once started, it will take

approximately 20 years to build out the scheme. Further details are available in table 1.

Table 1: Brent Cross Cricklewood

Planning Framework	Brent Cross Cricklewood Development Framework 2005
Vision	Major focus for new jobs and homes, building upon the area's strategic location and its key rail facilities. All new development will be built to the highest standards of design as well as to the highest environmental standards. A new town centre will be fully integrated into the regeneration scheme.
Number of new homes being built	7,500
New jobs created	Approximately 27,000
Infrastructure works include	New and improved open spaces
	Re-provision of primary schools and leisure centre
	New primary care centre
	New library
	New Waste Handling Facility and Combined Heat and Power Plant
	Accessibility improvements to Brent Cross and Cricklewood stations
	New Thames link railway station at Staples Corner
	New Tempelhof Bridge and A406 Pedestrian Bridge
	New Brent Cross Bus Station
	Improvements to A41 / A406 and new M1 junction with A5 / A406

6.1.2 **Progress**

Outline Planning Consent was issued by the Local Planning Authority on 28 October 2010. The planning conditions require that Phase 1 should commence no later than 7 years from grant of consent. It is envisaged that the scheme will commence on site in late 2014 / early 2015.

6.1.3 **Monitoring**

A list of indicators is set out in the Core Strategy (Appendix B) specifically to monitor progress towards implementation of the consent for Brent Cross – Cricklewood.

6.1.4 The multi-modal modelling for Brent Cross – Cricklewood utilised existing London Transportation Studies (LTS) SATURN highway and Railplan public transport models which were significantly enhanced for the local area and area of influence of the scheme. This is the same approach as TfL used in developing the sub regional models with LTS providing the high level input into NoLHAM. The BXC highway and public transport models were combined with a Demand Model that iterated between the models to produce forecast mode shares (the TfL sub regional models include a similar 'demand balancing' model). AM peak, PM peak and Saturday peak (2-3pm) modelling was undertaken for a 2005 base year which was calibrated and validated to an acceptable level and forecasts produced for 2026. Interim assessments were also carried out for 2016, and a 2031 AM peak sensitivity test undertaken.

6.1.5 This BXC modelling work took account of a significant number of other committed schemes across London and Barnet, however the quality of the highway model

outputs away from the core model area, particularly for the east of the borough, is less than that produced by NoLHAM, so BXC related data and modelling output has only been used to supplement the NoLHAM forecasts for the area immediately adjacent to BXC, comprising the M1, A406, A41 and A5. This is further justified by the inclusion in the BXC highway models of the proposed junction improvements on these roads, including the new road bridge from the A5 extending over the midland mainline railway into the development, which have not been included in the current NoLHAM reference case model.

6.1.6 The BXC modelling work was scrutinised by specialist independent consultants appointed by the Council and also by consultants procured by TfL and the Highways Agency (HA), and the outline Planning Permission was issued by Barnet in October 2010.

6.2. Colindale Regeneration scheme

6.2.1 Details for the Colindale Area Action Plan (AAP) regeneration area are shown in table 2.

Table 2: Colindale AAP proposal

Planning Framework	Colindale Area Action Plan - 2010
Vision	Colindale will by 2021 be a vibrant successful and diverse neighbourhood where people will want to live, work and visit. It will accommodate high quality sustainable developments within four 'Corridors of Change' and a new neighbourhood centre. Colindale will become a successful suburb in North London, providing existing and new communities with high quality local services, improved transport and access to enhanced green space and leisure facilities.
Number of new homes being built	10,000
New jobs created	Approximately 1,000
Infrastructure works include	New public piazza and transport interchange at Colindale Avenue
	New and improved open spaces
	New primary schools
	New Combined Heat and Power system

6.2.2 **Progress**

The Area Action Plan (AAP) for Colindale was adopted in March 2010.

6.2.3 **Monitoring**

Progress against the AAP monitoring indicators is set out in Barnet's Annual Monitoring Report.

6.2.4 Consultants procured by TfL and Barnet built area wide AM and PM peak models of Colindale in 2007/8 using the SATURN assignment model. These were used to support and evaluate the phased programme of schemes included in the Colindale Area Action Plan (CAAP), which are also in the IDP, including improvements at A41 / Aerodrome Road, A5 / Colindale Avenue, re-alignment of Aerodrome Road to a new junction with Grahame Park Way and the re-aligned Lanacre Avenue and the Peel link between Aerodrome Road and Colindeep Lane.

6.2.5 The SATURN Modelling report for the CAAP was issued in June 2009. The base year was 2007 and future year forecasts were produced for 2011, 2016 and 2021. As part of the CAAP more detailed transport analysis was carried out including the

creation of a more detailed highway model for the AM peak. This used the VISSIM microscopic modelling package to better understand local impacts and also supported and reinforced the findings of the more strategic SATURN modelling.

6.2.6 The traffic models have been used in the assessment of subsequent major planning applications in the area such as Colindale Hospital, Brent Works and the latest phases of the Grahame Park estate regeneration.

6.2.7 The CAAP base year traffic forecasts have been compared to NoLHAM for two stretches of the A5, High Street south of the A5100 in Edgware, and The Hyde south of the A4006. CAAP two-way traffic flows of approximately 1,900 at each location closely accord with the NoLHAM outputs. This gives confidence that the NoLHAM base year model forecasts are robust, and hence that the future year forecasts used in this review are reliable.

6.3. Mill Hill East Regeneration Scheme

6.3.1 Details for Mill Hill East Area Action Plan development area (AAP) are shown in table 3.

Table 3: Mill Hill East AAP proposal

Planning Framework	Mill Hill East Area Action Plan - 2009
Vision	Mill Hill East represents a major regeneration and development opportunity in the heart of Barnet. Within 15 years the Mill Hill East area will have been transformed through one of the highest quality sustainable developments in North London. Within a green suburban context it will provide new homes and business opportunities with high quality community services, transport and access to open space and leisure facilities.
Number of new homes being built	2,000
New jobs created	Approximately 500
Infrastructure works include	New public open space including children's play facilities, formal sports provision and natural areas.
	New mixed use high street
	New east – west distributor road
	New primary school
	New local healthcare facility

6.3.2 **Progress**

The Area Action Plan (AAP) for Mill Hill East was adopted in January 2009.

6.3.3 **Monitoring**

Progress against the AAP monitoring indicators is set out at Table Y.

6.3.4 The AAP was supported by AM and PM peak VISSIM models of the area, which were subsequently refined and updated as part of the Outline Planning Application TA. The TA produced traffic forecasts for 2023 and included the Holders Hill Road / A1 junction. The MHE traffic forecasts assume a 0.6% growth in background traffic levels per annum. This is consistent with the methodology applied to many other development areas and major applications in the borough, and ensures a robust assessment is carried out, particularly in light of the fact that peak hour traffic levels in the MHE area are estimated to have fallen by an average of about 5% between 2007 and 2010. The MHE model predicts two-way traffic levels of some 4,000 vehicles in the AM peak in 2023, consistently close to the future year forecasts estimated by the NoLHAM. The assessment proved that the MHE development

would not add to existing traffic problems at this junction and as a result no works were proposed. The existing and future situations do demonstrate capacity issues but if current negative growth persists this is not thought to become a constraint beyond 2016.

6.3.5 The priority housing estates of Stonegrove / Spur Road and West Hendon are the focus of regeneration in order to meet the Decent Homes Standard and deliver a greater range and variety of accommodation. Progress reports on these schemes are set out below.

6.4. West Hendon Regeneration scheme

6.4.1 Located between the A5 and the Welsh Harp Reservoir the West Hendon Estate is a product of the 1960s. The existing 680 homes will be replaced by a new mixed tenure neighbourhood of up to 2,200 new homes, a net increase of 1,500 homes. Development of the Initial Phase of 186 new homes is underway. It is estimated that the scheme will be completed before 2026, and includes removal of the Perryfield Way gyratory system and on-line widening of the A5. The redevelopment of West Hendon is being taken forward in parallel, but independently of the regeneration of Brent Cross – Cricklewood.

6.4.2 Regeneration of this priority housing estate was approved in July 2008. As this was the first major regeneration scheme to be approved in Barnet the TA did not take into account the other schemes, as none of these could be assumed to be committed developments at the time. Given the large number of subsequent approvals in relation to major planning applications and regeneration schemes in the area, including those in Brent as well as Colindale and BXC, the West Hendon model traffic forecasts are now effectively out of date, and so unsuitable for use in this review. Forecast traffic levels on this part of the A5 have utilised the more recent and reliable BXC forecasts.

6.4.3 It should be noted that at the time of preparing this review (spring 2011) the council was engaged in discussions with the West Hendon development partners about a possible Section 73 application, which would involve updated traffic modelling. Any new models would be required to take into account the other major developments, including BXC, and may therefore be utilised when this Review is updated in the future.

6.5. Stonegrove Regeneration Scheme

6.5.1 Stonegrove and Spur Road are two post war interconnected housing estates in Edgware which are being redeveloped as one. Regeneration will create a new neighbourhood linked to its surroundings on the edge of London's Green Belt. Nearly 1,000 new homes will be provided to replace 600 existing ones, a net increase of 400. This programme is well under way and 120 new homes were completed in 2010. The scheme is expected to be completed before 2021.

6.5.2 This estate regeneration scheme received outline planning permission in 2008 and involves intensified use of the site together with various highway improvements including the creation of a new access point on the A5 to better distribute estate traffic and reduce pressure on the A41 and Canons Corner junctions. Predicted traffic flows along the A5 from the Stonegrove TA have been compared to the NoLHAM 2031 forecasts. The traffic flows in the Stonegrove TA are 2006 base year and 2027 forecast year and along the A5 vary by several hundred vehicles depending on which stretch of the A5 is being examined, but the range of forecast traffic flows for 2027 are comparable to the 2031 NoLHAM for the northbound (approx. 800 vehicles) but higher than NoLHAM in the southbound (approx. 1,000 versus 800), whereas they would be expected to be similar or slightly higher given the 4 year difference in the forecast future years. However, it is likely that the

NoLHAM takes account of constrained traffic movements across a wider area, and so reflects congestion further south on the A5 in the AM peak.

7. Highway model traffic flows and junction delays

7.1. 2008 North London highway model traffic flows

7.1.1 The 2008 base year traffic flows for 31 of the key links in the borough have been extracted from NoLHAM and the BXC TA. Directional and two-way flows (rounded to the nearest 50 vehicles) have been input to a spreadsheet, and are summarised for the key borough routes in the table below.

Borough main road route	AM peak two-way traffic flows
M1 approaching Staples Corner	4,050
A5 between Stonegrove and Cricklewood	1,350 – 2,550
A1 and A41 corridors	2,600 – 5,000
A406 North Circular Road	4,050 – 8,200
A1000 corridor	750 – 2,000
A598 corridor	1,400 – 1,850

7.1.2 It can be seen that the highest traffic flows in the AM peak are along the North Circular Road, although the stretch with the highest flows, of around 8200 vehicles, is actually in Brent, being the section west of the M1 / A5 / A406 interchange at Staples Corner. The next highest traffic flow is again in the vicinity of BXC being the A41 Hendon Way with about 5,000 vehicles. The M1 carries just over 4,000 vehicles in the AM peak, its capacity being effectively constrained by the amount of traffic that can pass through Staples Corner. The remaining key roads in the borough have lower absolute traffic flows, although they are known to operate close to or over capacity as most are effectively single carriageway roads with many side roads and pedestrian crossings, which affect the smooth flow of traffic on the main routes.

7.2. 2016 North London highway model traffic flows

7.2.1 Much of the borough road network is already more-or-less at capacity in the am peak, so the potential for growth in many locations is fairly limited, unless it is facilitated through development related improvement schemes. The significant exception to this is along the A406 where capacity is potentially available to accommodate up to 30% growth to 2031. This is in the east of the borough and around the A406 /A1 Henly's Corner where the existing traffic signalised crossroads are being replaced with a partial gyratory. NoLHAM has been used to forecast the benefits of the scheme, which is predicted to reduce average delays per vehicle on Regents Park Road and Finchley Lane, as well as on the TLRN, by several minutes, including up to four minutes on average for vehicles using the A1 and A406 in the AM peak.

7.2.2 To the west capacity for growth is constrained by existing high traffic flows and pinch points on the network, such as the Brent Street / Golders Green Road junction and junctions in the Brent Cross area, which are unlikely to be improved as part of the BXC regeneration scheme by 2016.

7.2.3 The plot in Figure 1 shows the predicted model flow differences from the NoLHAM between 2008 and 2016. Green bands show where traffic flows are predicted to increase and blue where they are expected to fall. The benefit of the Henlys Corner partial gyratory scheme is clearly illustrated, in accommodating higher traffic flows on the TLRN, but of particular note are the various borough roads in the east of Barnet which are predicted to be relieved of some traffic due to the A406 / A1 improvement. These include roads in Whetstone, Friern Barnet, Woodside Park and throughout Finchley, including the A1003, A598, A109 and B550 where around a 10% average reduction in traffic flows is predicted as traffic is effectively attracted to the A406.

7.3. 2031 North London highway model traffic flows

7.3.1 The plot in **Figure 2** illustrates the 2008 versus 2031 flow differences which shows generally very small changes on the borough roads, reflecting the existing high level of traffic flows, as well as those forecast for 2016, and that much of the borough road network is already at capacity. Compared to **Figure 1** in the east of the borough it can be seen that there are less links highlighted in blue and more in green reflecting the fact that some of the benefit of the Henly's Corner improvement scheme to the borough roads has been reduced due to further traffic growth occurring on the network.

7.3.2 The main growth is on strategic roads such as the A406, A41, A1 and M1, with up to 30% from 2008 on the A406 in the east of the borough, although this is expected to be lower than illustrated in the south west of the borough where the more accurate and detailed BXC model forecasts predict modest increases up to 10-15% at most, even with the BXC related A5 / A406 / M1 / A41 junction improvements. These will accommodate the development related traffic which is expected to, in effect, displace existing highway trips which are predicted to change mode or time of travel or not be made at all as they are associated with land use activity which will be extinguished by the redevelopment scheme.

7.3.3 There is also some growth predicted in the north of the borough and on orbital routes such as the A410, A411 and A5109 of up to about 10-15%. This will have implications for any major development proposals in those locations and the emerging Town Centre Framework for Chipping Barnet.

7.4. 2008 North London highway model junction delays

7.4.1 **Figure 3** shows the node delays in passenger car units (pcu's) for the AM peak hour. These are coloured coded where the total delays at the relevant node or junction are over 50 pcu's, rising in bands from 50 to 75 pcus, 75 to 100 pcus, 100 to 250 pcus and 250 to 1000 pcus. The vast majority of junctions in the borough can be seen in Figure 3 to have relatively low levels of delays. Where there are delays most are on the TLRN, particularly on the A1 and A41 corridors, but especially at Henlys Corner. The only junction on the borough road network which has high levels of delays (100 to 250 pcus) is the crossroads in Whetstone, which were examined as part of the borough A1000 Congestion Reduction Study undertaken recently, and continue to be reviewed by borough highway engineers and TfL. As with other congestion 'hotspot' locations in the borough the council will seek any town centre re-development opportunities that may come forward to address this location.

7.5. 2016 North London highway model junction delays

7.5.1 **Figure 4** illustrates the junction delays for 2016, and presents a similar picture across much of the borough as shown in 2008, particularly on the TLRN. The exception is towards the eastern part of the borough where the impact of the Henlys Corner scheme can be clearly seen, which a reduction in forecast delays at this interchange itself, together with lower delays on borough roads that have been partially relieved by the A406 improvement. These include Long Lane / Squires Lane, A1000 / A504 junction in East Finchley and the A1003 / Colney Hatch Lane junction in Friern Barnet.

7.5.2 On the western side of the borough delays are forecast to increase at a number of locations along the A5 however. The signalised junction with Deansbrook Road in Edgware is identified in particular, as are some junctions in Cricklewood. The latter are expected to be addressed as part of the BXC regeneration scheme and the whole of the A5 has recently been the subject of a further borough led Congestion Reduction Study, so there are unlikely to be any further improvements at Deansbrook Road in the short term. As this junction is between the Colindale Regeneration area and Edgware town centre it is likely to act increasingly as a network constraint in future years (but see IDP section below).

7.5.3 One other borough road junction is identified as having high delays in 2016 that is the A504 / A502, The Quadrant. Again, this is an existing signalised junction which has already been investigated and capacity maximised, and so as with A5 / Deansbrook Road will tend to act as a network constraint in future years.

7.6. 2031 North London highway model junction delays

7.6.1 The junction modelling assessment work for 2031 is illustrated in Figure 5. This predicts that the key borough junctions that are expected to be experiencing high levels of delay in 2031 are as flows:

- A5 / Station Road in Edgware,
- A5 / Deansbrook Road,
- A41/ Aerodrome Road,
- *East End Road / Ballards Lane,
- Nether Street / Ballards Lane in Finchley Church End,
- the Whetstone town centre crossroads,
- A1000 / Underhill,
- *Friern Barnet Lane / Colney Hatch Lane,
- *A1000 / Fortis Green Road in East Finchley; and lastly
- A4006 Colindeep Lane / A5.

7.6.2 There are also several junctions on the TLRN, including along the A1, A41 and A406 where high delays are likely to be experienced, all of which are already signalled. This also applies to the above list of borough roads. Some of the junctions have plans for improvement via the Regeneration schemes, and / or as strategic improvement schemes,, such as the A5, A406 and A41 in the vicinity of BXC and West Hendon, and also possibly the A1000 / Underhill junction as part of the Dollis Valley regeneration scheme.

7.6.3 There may be opportunities for improvements to some of the junctions via future re-development schemes although this cannot be confirmed at this stage. Most of the locations are existing constrained town centre locations where the council has

already looked at improving capacity as much as possible. Any further improvements at these locations would require significant land and property take, and unless this is associated with and funded by development of the area, it is not considered affordable or desirable. These issues are discussed further below, in the section relating to the IDP.

7.6.4 It is noticeable that some of the above borough junctions (marked *) are the ones that had reduced delays in 2016 compared to 2008 due to the positive impact of the Henly's Corner improvement scheme. By 2031 traffic growth has eroded the benefits and these junctions again have high delays. In the long term, particularly towards the end of the LDF period the inherited proposed strategic junction improvement schemes for Henlys Corner and at Golders Green Road on the A406, which involve grade separation of the A406, should therefore be reviewed.

7.7. 2008 versus 2016 junction delays

7.7.1 **Figure 6** is one of the two node / junction delay difference plots, which compares the change in junction delays across the borough between 2008 and 2016. Each junction is colour-coded to indicate the predicted level of change, with the vast majority of junctions being coloured green, which indicates only a small change in delays. Increases are coloured yellow, orange and red; the latter where total delays at a junction are predicted to increase by more than 100 pcu's. The reduction in delays at Henlys Corner is shown in blue (the adjacent yellow dots should be ignored as this is due to the way the junction has been coded in the model). Significantly increased delays are fairly limited and are all on the TLRN.

7.8. 2008 versus 2031 junction delays

7.8.1 **Figure 7** is the second node / junction delay difference plot and compares 2008 with 2031. It can be seen that nearly all the junctions in Barnet on borough roads show a minimal amount of change, whilst there are less than 20 junctions highlighted yellow, orange and red with most being on the TLRN, and some of the most notable locations have already been discussed in the sections above on traffic flows, such as A5 / Deansbrook Road and A1 / Holders Hill Road.

7.8.2 The junctions at either end of Spur Road in Stonegrove are both highlighted although Canon's Corner in particular is planned to have some minor improvements to reduce congestion as part of the Stonegrove estate regeneration. Another location on the borough road network that is highlighted is that of Nether Street with A598 Ballards Lane in Finchley Church End. Again this is a signalised town centre junction with little opportunity for further improvement, and is therefore expected to act as a network constraint in the future.

8. Borough wide highway movement statistics

8.1.1 The table below summarises borough information from NoLHAM for 2008, 2016 and 2031 on the total distance travelled by vehicles in Barnet during the AM peak and the average speed of vehicles. The impact of the background and development related growth on the road network in Barnet is clearly illustrated, particularly during years beyond 2016 when the relatively short term benefit of the Henly's Corner scheme is expected to be reduced by further traffic growth. The average speed of each vehicle is predicted to fall from over 27 km/h to 25 km/h by 2031. Although this is not a significant drop in speed it should be noted that this is only an average figure and within this there will be locations where congestion will be worse than currently experienced.

	Base 2008	Ref Case 2016	Ref Case 2031	% Diff 2016-2008	% Diff 2031-2008
Travel Distance (pcu-kms)	321,557	327,893	355,466	2.0%	10.5%
Speed (km/hr)	27.4	27.0	25.0	-1.5%	-8.8%

9. Underground crowding plots

9.1.1 **Figures 8** to **11** show average forecast levels of AM peak crowding on the Underground network in London for 2006, 2016, 2021 and 2031 respectively. The direction of the arrows shows which direction the crowding level applies to and unsurprisingly it is southbound along both branches of the Northern Line in Barnet. Each arrow represents a stretch of line between two stations. Unfortunately, the Mill Hill East branch is omitted from all but the 2031 plot in **Figure 11**, although it has been confirmed that this branch has low levels of crowding throughout the assessment period.

9.1.2 On the Edgware branch crowding levels in Barnet in 2006 were generally low with on average less than one person standing per square metre and it is not until trains pass Golders Green that crowding increases to an average of between one and two passengers standing per square metre. Similarly on the High Barnet branch crowding levels in Barnet in 2006 were generally low with less than one person standing per square metre and it is not until trains pass East Finchley that crowding increases to between one and two passengers standing per square metre.

9.1.3 The above levels of crowding on both Northern line branches are repeated in 2016, 2021 and 2031 (see **Figures 9, 10** and **11** respectively). This is because of the positive impact associated with the planned and proposed upgrades to the Northern line, as set out in Chapter 5 of the Mayor's Transport Strategy. The first upgrade, which is expected to be completed around 2014 and set out in the current TfL Business Plan, will increase capacity by 20%. The second upgrade is planned to increase capacity by 33% on the Bank Branch and 17% on the Charing Cross branch, as a result of a full recast of the service patterns. The impact on peak hour train frequency on the Bank branch as a result of the upgrades is to increase the number of trains from the existing 20 to 24 with the first upgrade and potentially to 32 with the second upgrade. The second upgrade is beyond the life of the current TfL Business Plan but is expected to be delivered by around 2020.

10. Rail crowding plots

10.1.1 Similar to the Underground above **Figures 12** to **15** show average AM peak crowding on the National Rail network across London for the same years, with the same style and key. The two routes directly affecting Barnet residents and businesses are

- the Thameslink route between Kings Cross / St Pancras and St Albans, which to the south provides a route through London and onwards to the south coast and to the north extends to Birmingham and cities beyond (known as the Midland Mainline);

- the suburban rail service route that uses the East Coast Mainline between Kings Cross and Scotland, with services operating between Welwyn Garden City and Finsbury Park, terminating at either Kings Cross or Moorgate.

10.1.2 **Figure 12** shows that the routes through Barnet already experience some levels of crowding in the 2006 base year. On the Welwyn route at New Barnet station there are on average one to two passengers standing per square metre and by Oakleigh Park this increases to an average of two to three passengers. On the Thameslink line passenger crowding is worse with an average of three to four passengers standing per square metre on trains passing through the borough.

10.1.3 **Figure 13** clearly shows the positive impact that the Thameslink Upgrade will have on crowding levels on trains passing through the borough in 2016. On both rail routes crowding levels are reduced to averages of either less than one or between one and two standing passengers per square metre. This pattern is also evident in the 2021 plot shown in **Figure 14**, although by that time growth in demand is forecast to increase the level of crowding on the Welwyn route to the extent that the crowding level is one to two standing passengers per square metre on all trains passing through Barnet. By 2031 (**Figure 15**), this level of crowding is also expected to be experienced on trains throughout Barnet on the St Albans route as well.

11. Infrastructure delivery programme

11.1.1 The Infrastructure Delivery Plan (IDP) provides a high-level risk assessment and cost analysis framework for the delivery of infrastructure necessary to improve opportunities for and quality of life of the Borough's residents. It details the delivery of 'critical', 'necessary' and 'preferred' community benefits including educational and healthcare facilities; highways improvements; and open space provision for future and existing residents from all of the Borough's diverse communities.

11.1.2 The IDP contains information on the type, timing and potential costs of the infrastructure needed to support the housing development set out in the Core Strategy. The IDP and its subsequent updates will enable the Council and Local Strategic Partnership partners to plan effectively for population change and to maximise the potential benefits associated with this to achieve wider economic, social and environmental objectives.

11.1.3 Barnet's IDP also sets out a broad concept of 'prioritisation of infrastructure' to ensure that the Council focuses on delivery of the right infrastructure at the right times that best serves the Borough and enhances Barnet as a successful London suburb. This responds to the anticipated timing for delivery of major housing developments, divided into three time periods: 2011-15, 2016-20 and 2021-25. The objective of prioritisation is also to recognise that some infrastructure is required as a result of population growth and change, whereas other infrastructure is primarily needed to improve overall quality of life for residents or to achieve wider sustainability objectives. The IDP therefore identifies which infrastructure is critical in relation to delivering Core Strategy objectives, which infrastructure is necessary but not critical, and which is preferred if funding is available.

11.1.4 The IDP includes all the highway improvements or mitigation measures proposed across the borough in relation to the various Regeneration schemes, and as mentioned above the list of key junction delays in 2031 includes two of these, A41 / Aerodrome Road and A1000 / Underhill. Of the others there are two locations along the A598 Ballards Lane in Finchley Church End where there are various development opportunities but growth is constrained due to the capacity of the Nether Street junction and the bridge over the Northern Line and improvement /

widening would be desirable in the foreseeable future however this solution is expensive and would need to be funded by development, or other externally sourced funding.

11.1.5 Two of the key junctions, Friern Barnet Lane / Colney Hatch Lane and A1000 / Fortis Green Road are planned to be examined within the next few years as part of Local Implementation Plan (LIP) corridor studies, and if feasible improvements are identified LIP or other funding sources will be sought.

11.1.6 A further two of the key junctions are in town centre locations where there may be opportunities to deliver development related improvements.

11.1.7 These are first in Whetstone, at the A1000 / A5109 / A109 crossroads where the current staggered signals arrangement results in extensive peak period queuing, and where there may be opportunities to secure an improvement as part of a redevelopment of the town centre that would deliver a more efficient signalised junction.

11.1.8 The second location is the A5 / Station Road in Edgware as there are various proposals being considered as part of the evolving Edgware town centre planning framework which is focusing on potential redevelopment of the area around the Broadwalk shopping centre, including possible additional transport links from main roads in the area, which may help relieve this key junction.

11.1.9 The above leaves two further junctions, both on the A5, at Deansbrook Road and Colindeep Lane, which are located between Regeneration areas and town centre locations that the council would like to improve. This means that these locations have no proposed mitigation measure in relation to any one scheme but are likely to be affected by relatively small impacts due to a number of schemes, such as BXC, West Hendon and Colindale in the case of the Colindeep Lane junction and Colindale and Edgware town centre in the case of Deansbrook Road. In addition to the Barnet developments there are also known to be a number of other redevelopments taking place in the vicinity of the A5, in Brent for example. The council is committed to working with Brent and TfL to identify options which could be funded through development.

11.1.10 It can be concluded from the above that it would be highly desirable to undertake a more detailed study of the A5 Corridor for the medium to long term which would be advantageous in terms of being able to help define the development potential of the corridor having regard to the detailed cumulative impacts of all the Regeneration and development planned and proposed, not just in Barnet but in adjacent boroughs as well, particularly with respect to later years of the LDF. A comprehensive study of the A5 Corridor using NoLHAM as a basis, but with more detailed information input from relevant TAs and other studies, could also address other issues, including how to deal with cross A5 movements, many of which are significant and a number of key routes are not aligned directly via crossroads, but involve staggered turning movements. The study could also look at the implications for the side road network if key junction improvements, at Colindeep Lane and Deansbrook Road for example, were not practicable, and what additional measures would be required locally to protect local roads from adverse impacts. Finally, such a study could also help inform the development of the Edgware town centre strategy.

12. Conclusions

12.1.1 By 2031 the above review indicates that movement across Barnet will in general and on average not be too dissimilar to that currently experienced. This is for two main reasons:

12.1.2 Although the population is forecast to increase from just over 330,000 in 2008 to nearly 415,000 by 2031 the key regeneration schemes in the west and centre of the borough that will deliver a substantial element of this growth all have comprehensive packages of transport mitigation measures, and in the case of some of the key regeneration related highway and public transport improvement schemes will also result in better travel conditions for the adjacent communities as well;

12.1.3 Much of the negative impact associated with the expected traffic growth in the east of the borough will be effectively offset by the improvement scheme currently being implemented at Henly's Corner.

12.1.4 It is clear that a junction improvement at Henly's Corner has a positive impact on traffic flows and delays on borough roads across a substantial part of the borough, and further consideration, particularly towards the end of the LDF period, should be given to examining what further improvements at this crucial interchange, together with that at A406 / Golders Green Road, may be feasible.

12.1.5 It will be essential for action to be taken to address the other key network constraints on the TLRN in the south west of the borough, and these are programmed as part of the BXC and West Hendon Regeneration schemes. At the same time it is important that the key Regeneration areas, principally at BXC and Colindale, achieve the mode-split targets set out in the relevant TA and AAP documents to help ensure that travel conditions remain acceptable in this part of north London.

12.1.6 A key future challenge is to ensure that residents of these new communities do not adopt the same patterns of travel behaviour and high car usage of the current typical Barnet residents.

12.1.7 Other regeneration related highway improvement schemes are going to be essential to help keep Barnet moving and deliver a Successful London Suburb, particularly in Colindale and to a lesser extent, Mill Hill East.

12.1.8 The planned upgrades of the Northern Line and the Thameslink Enhancement Programme will be vital to help facilitate growth in Barnet by providing more capacity to satisfy increasing traditional demand for commuting radial travel movements. In the case of the Underground, assuming both the proposed upgrades take place crowding levels in 2031 are predicted to be similar to those experienced today. This is because the additional capacity delivered through the upgrades will in effect be absorbed by the growth in passenger levels associated with the planned major developments. On the Barnet part of the national rail network crowding levels are expected to be lower due to the Thameslink upgrade, and much of the demand associated with the BXC regeneration scheme is expected to be in the contra-peak direction.

12.1.9 This review has identified that a study of the A5 Corridor and adjacent network linkages would be advantageous to help identify the detailed cumulative impact of all planned and proposed development in this key functional economic and housing growth area covering this part of the West of the Borough. Understanding the long term growth capacity of the corridor and the extent to which key constraining junctions can be improved and the costs that would be required is essential.

Figure 1: NoLHAM flow difference plot 2008 v 2016

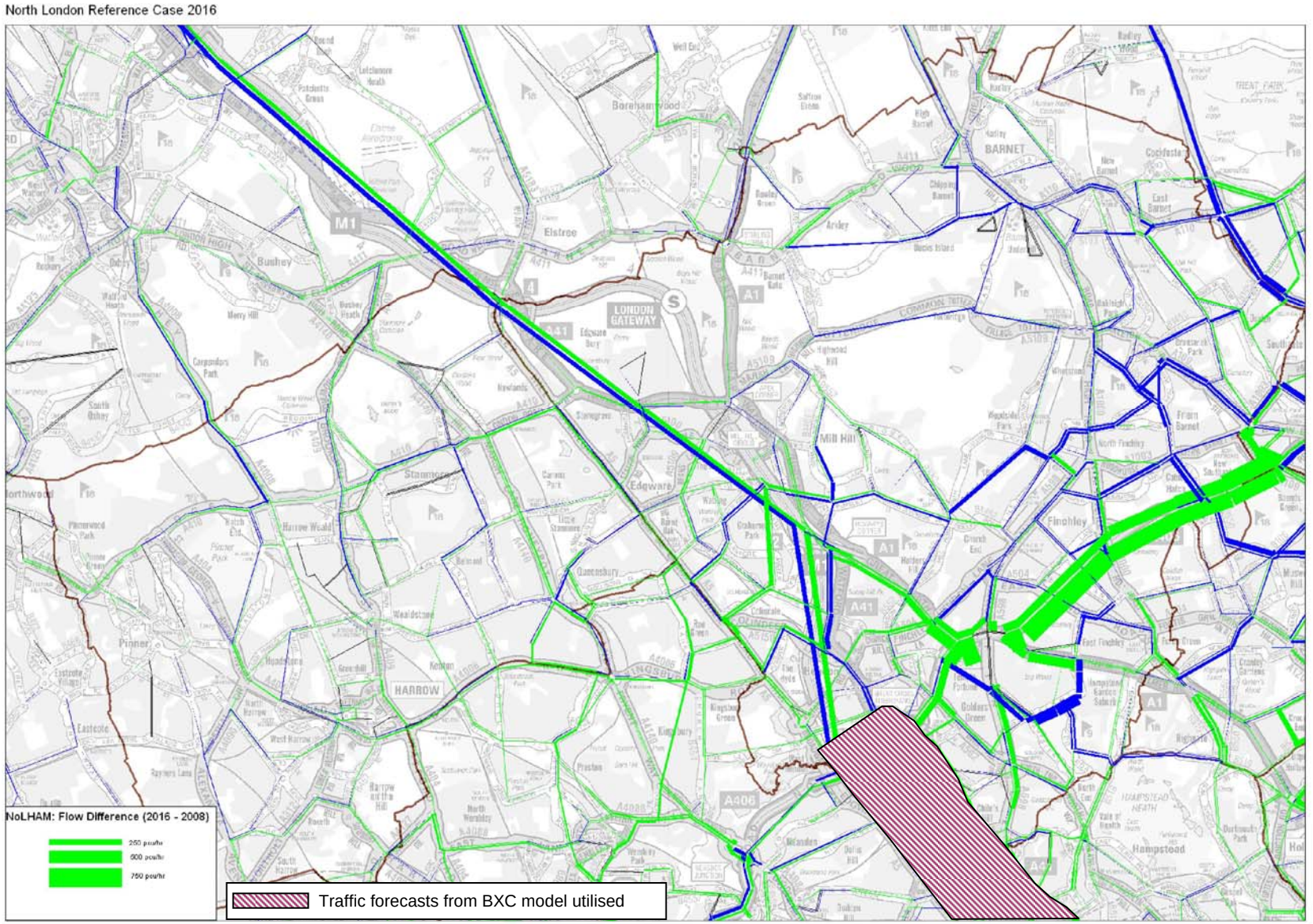


Figure 2: NoLHAM flow difference plot 2008 v 2031

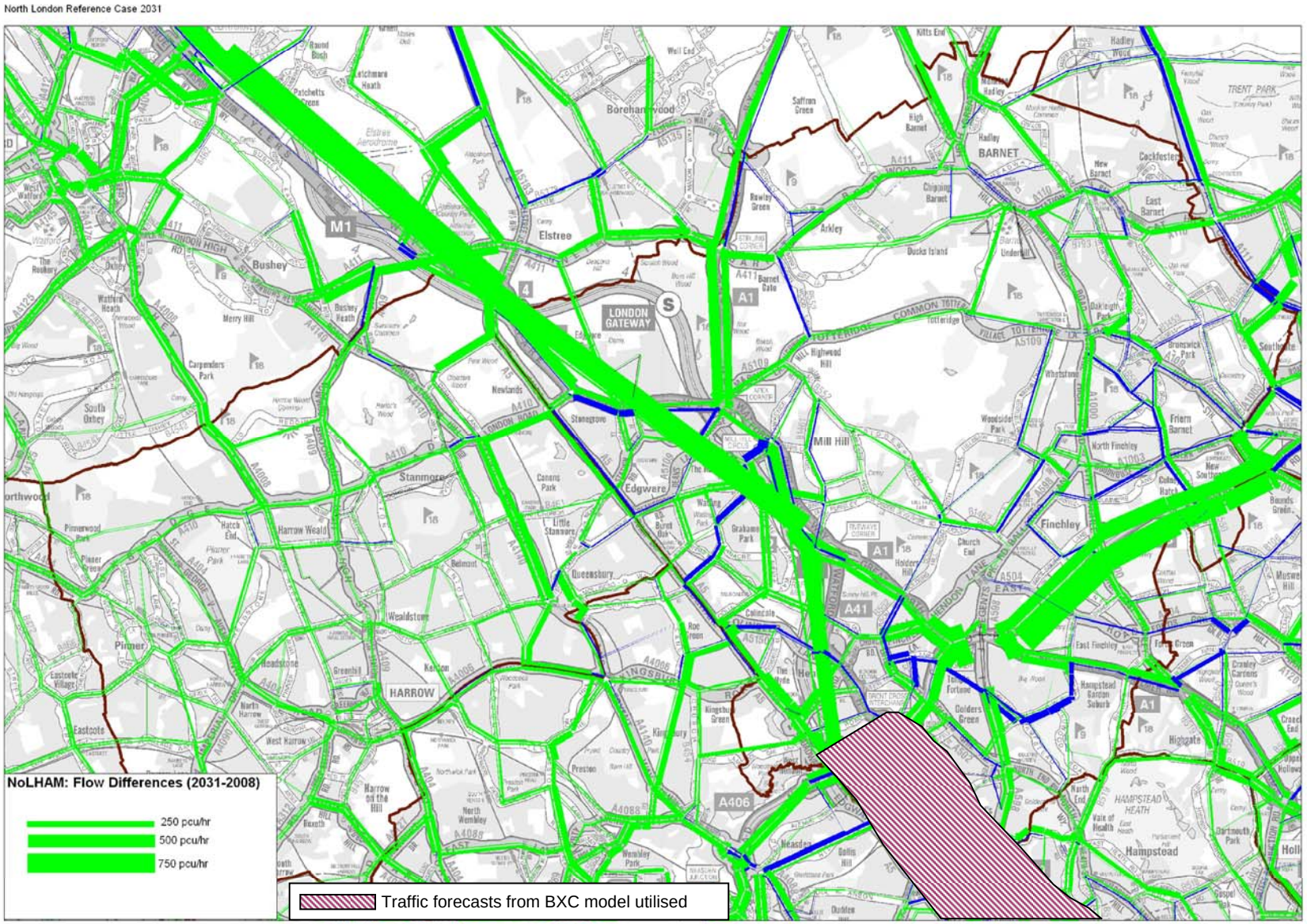


Figure 3: NoLHAM node delays 2008

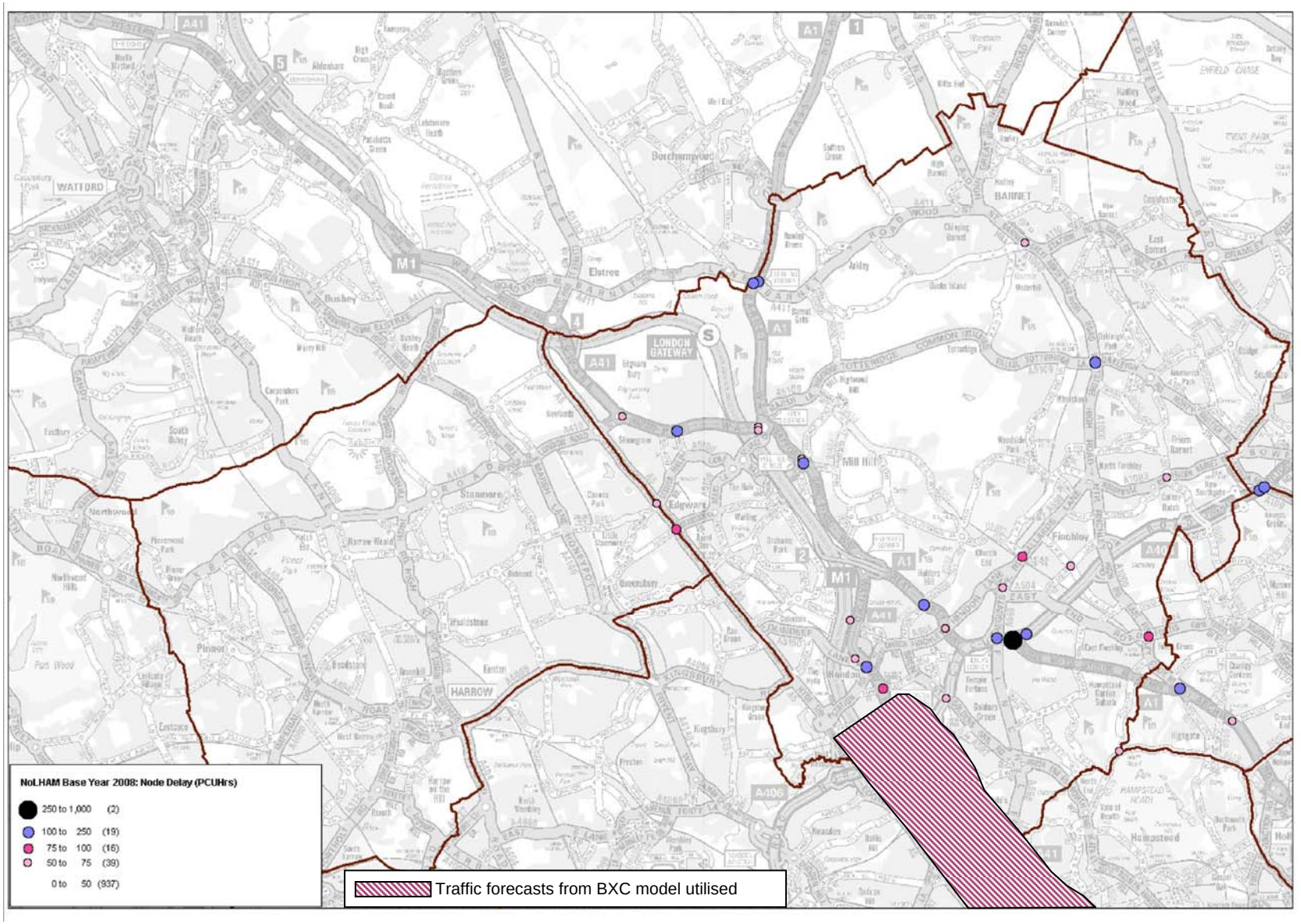


Figure 4: NoLHAM node delays 2016

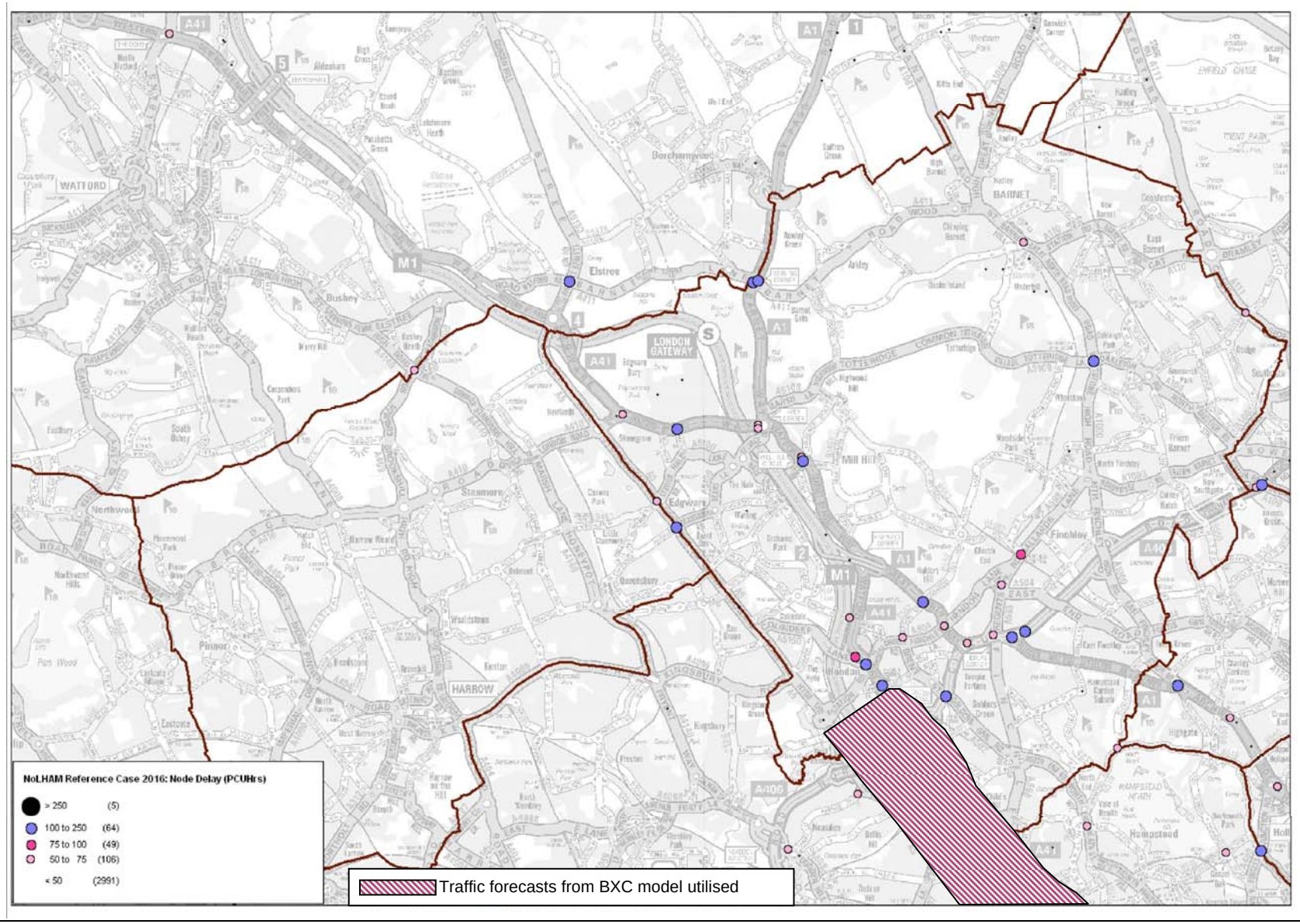


Figure 5: NoLHAM node delays 2031

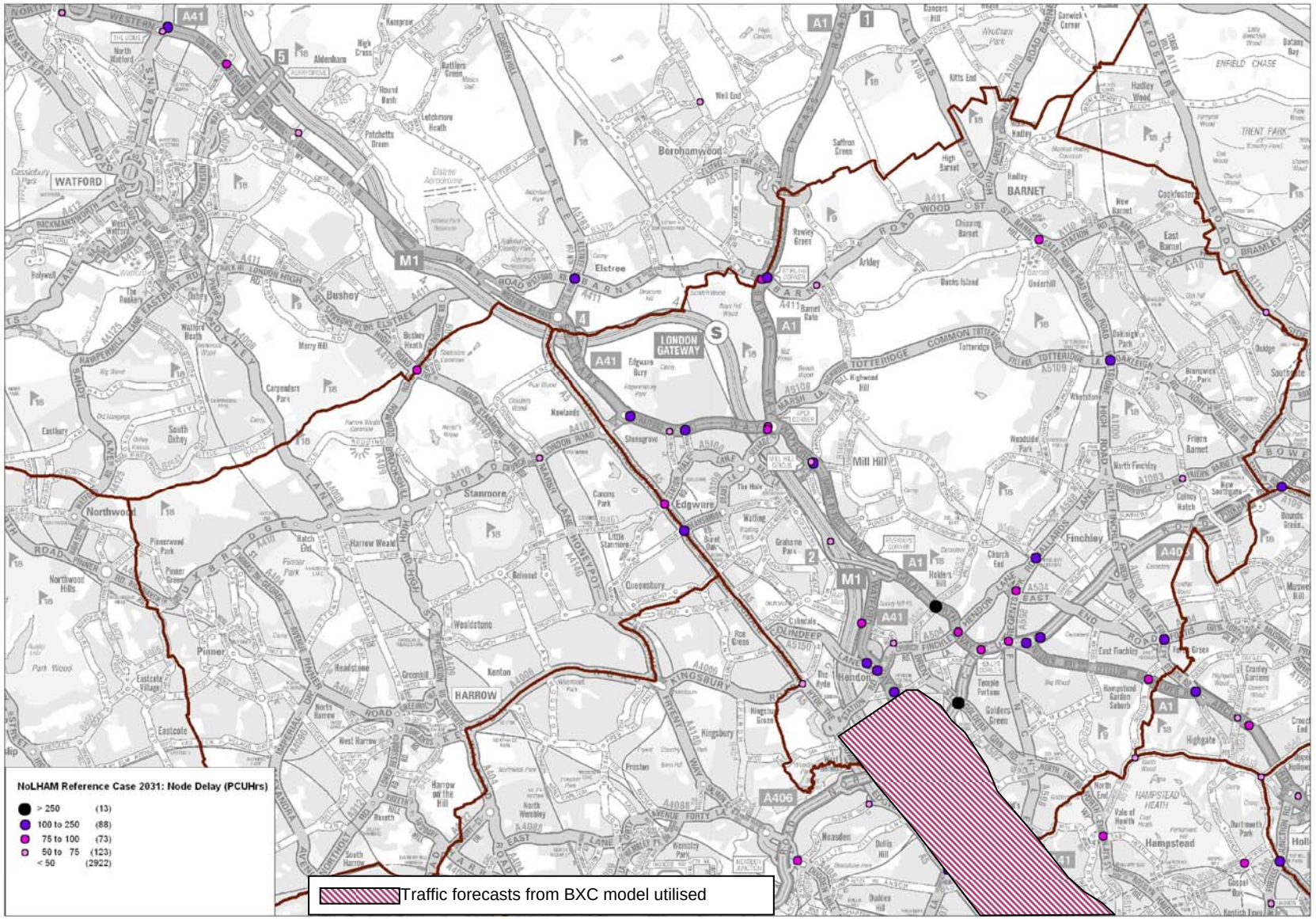


Figure 6: NoLHAM node delay difference plot 2008 v 2016

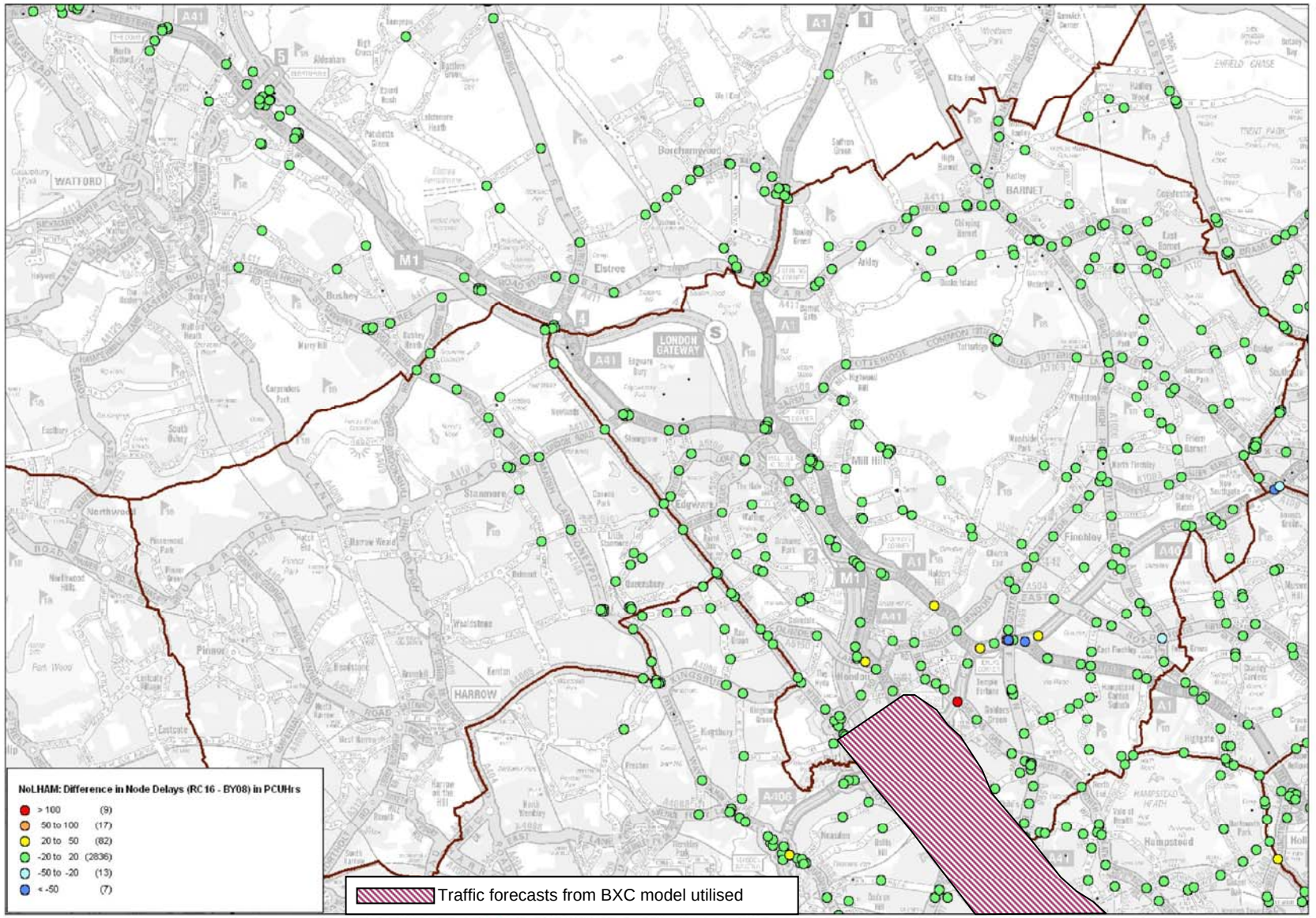


Figure 7: NoLHAM node delay difference plot 2008 v 2031

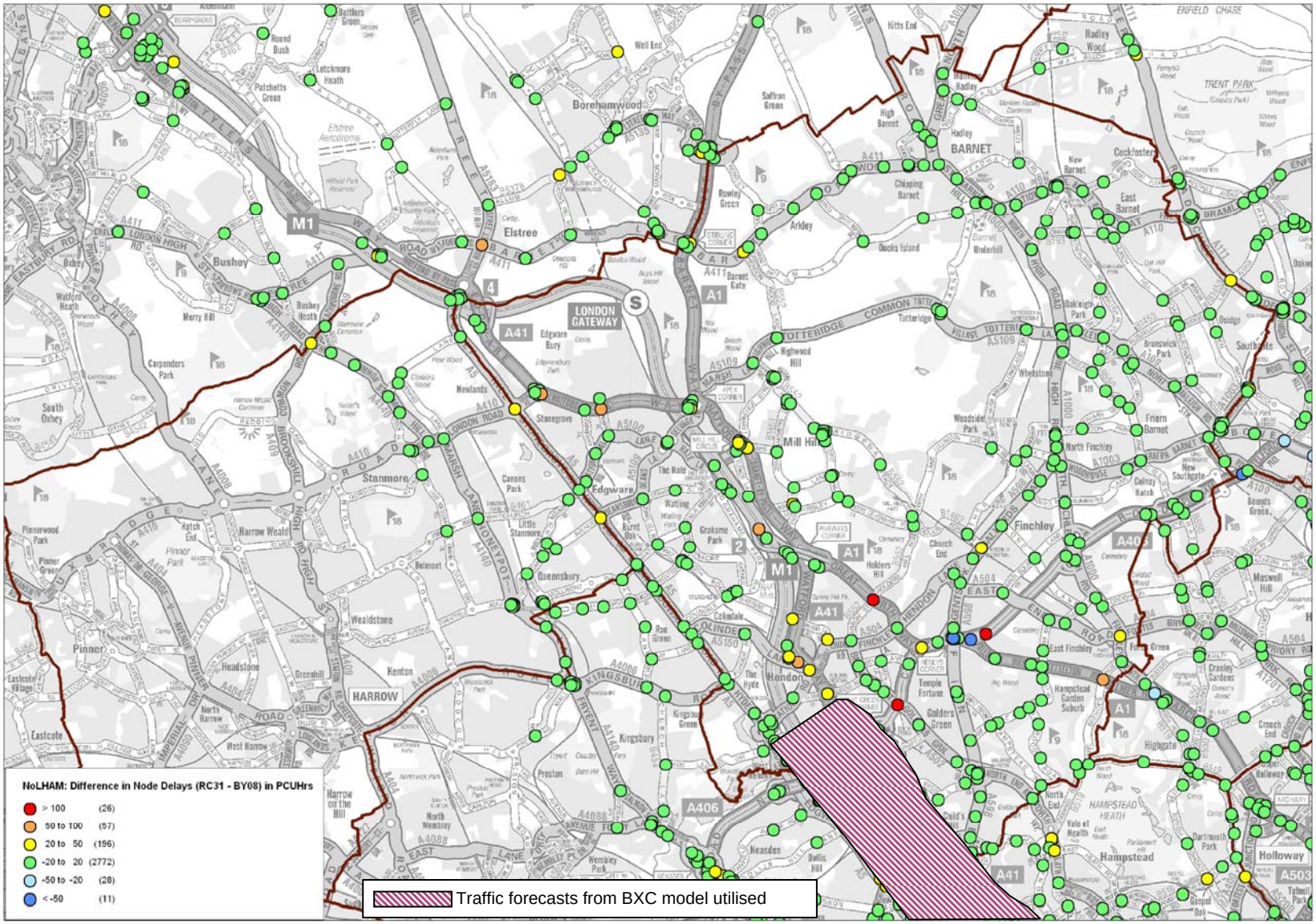


Figure 8: London Underground crowding plot 2006

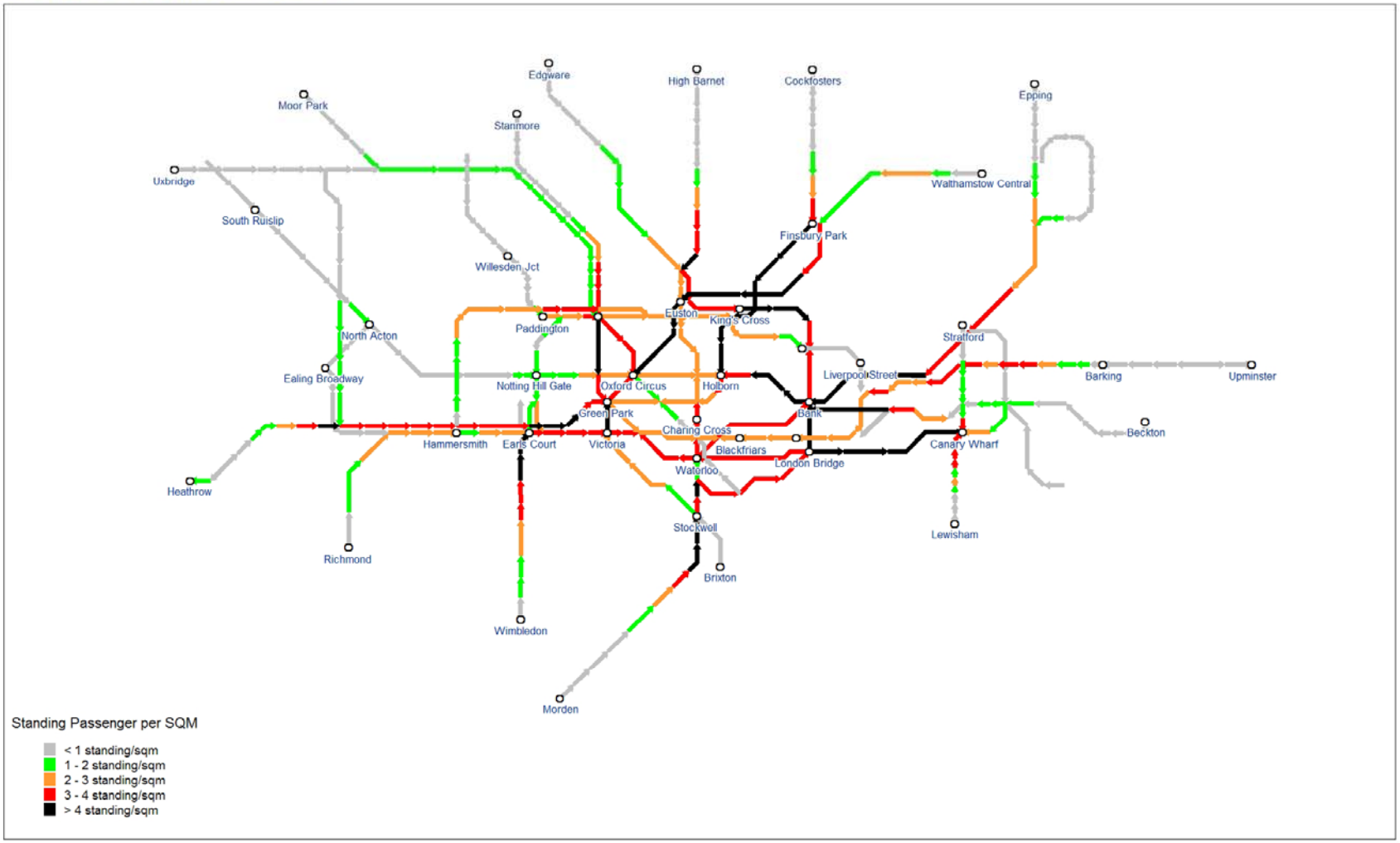
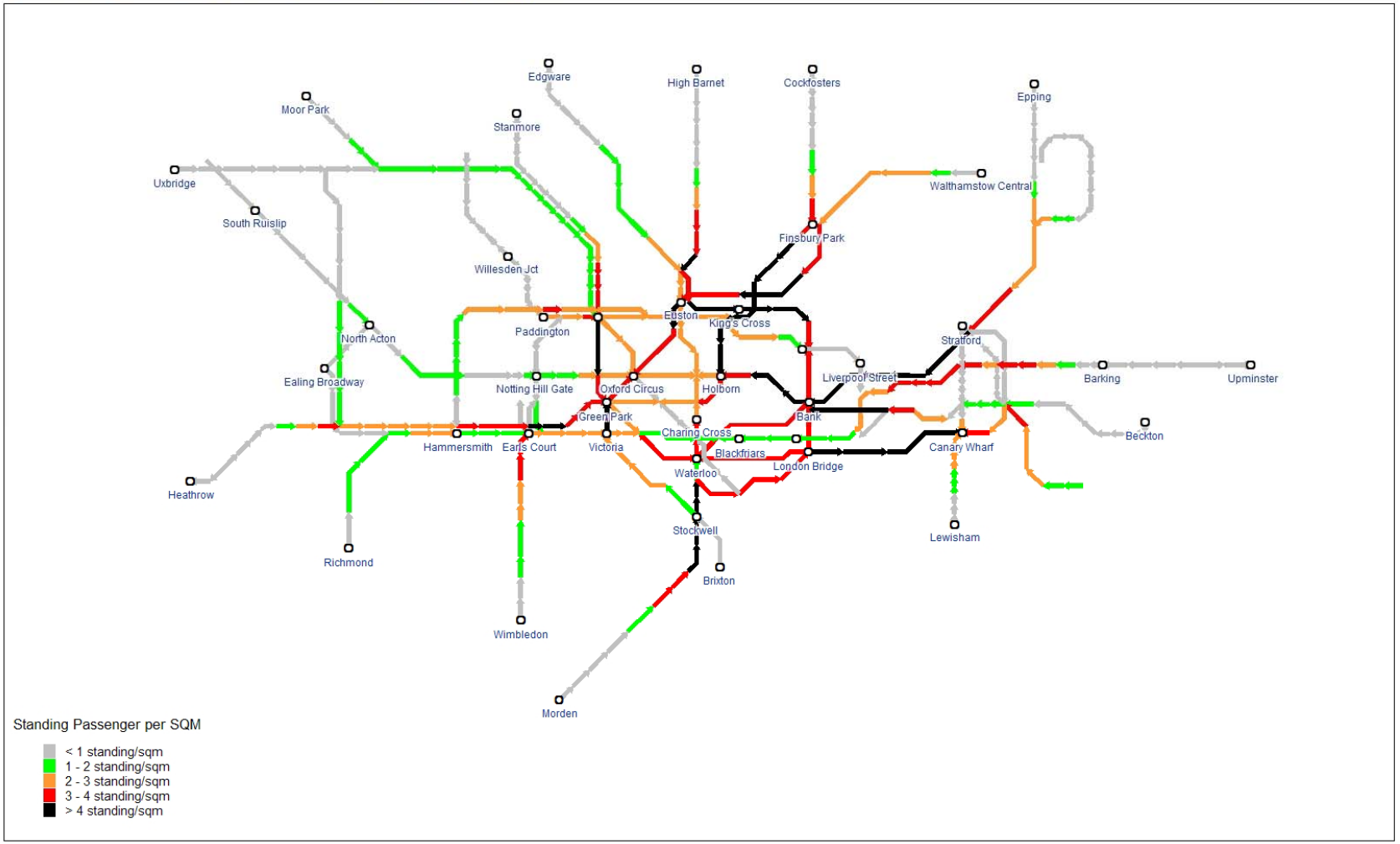


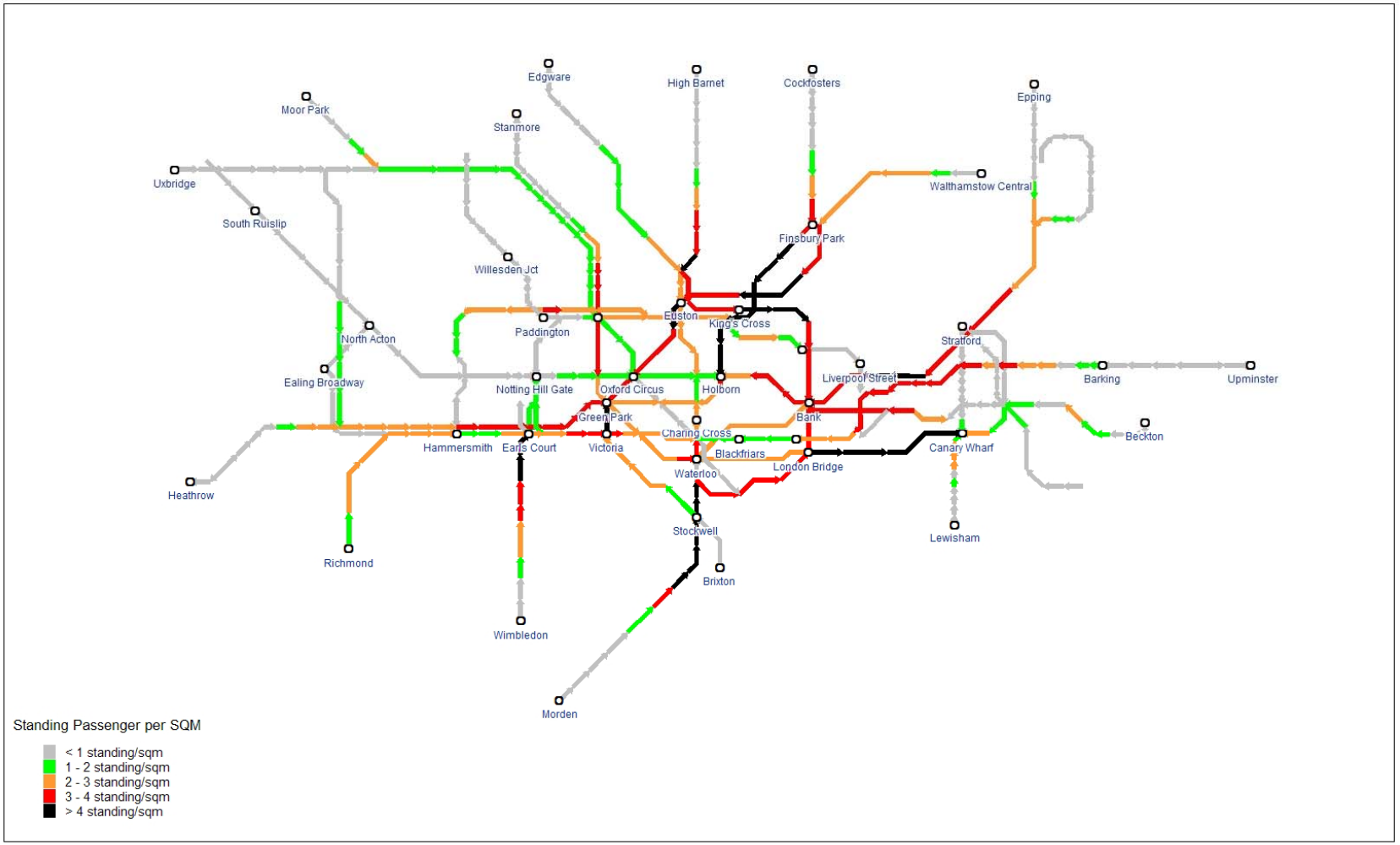
Figure 9: London Underground crowding plot 2016



MTS2 Reference Case: BF0712A (Feb 09)
Crowding plots includes reliability and shows:
- peak hour crowding (54% peak period demand)
- most crowded direction
- using a standing density factor of 7 pax/sqm

Transport for London

Figure 10: London Underground crowding plot 2021



MTS2 Reference Case: BF0712A (Feb 09)
Crowding plots includes reliability and shows:
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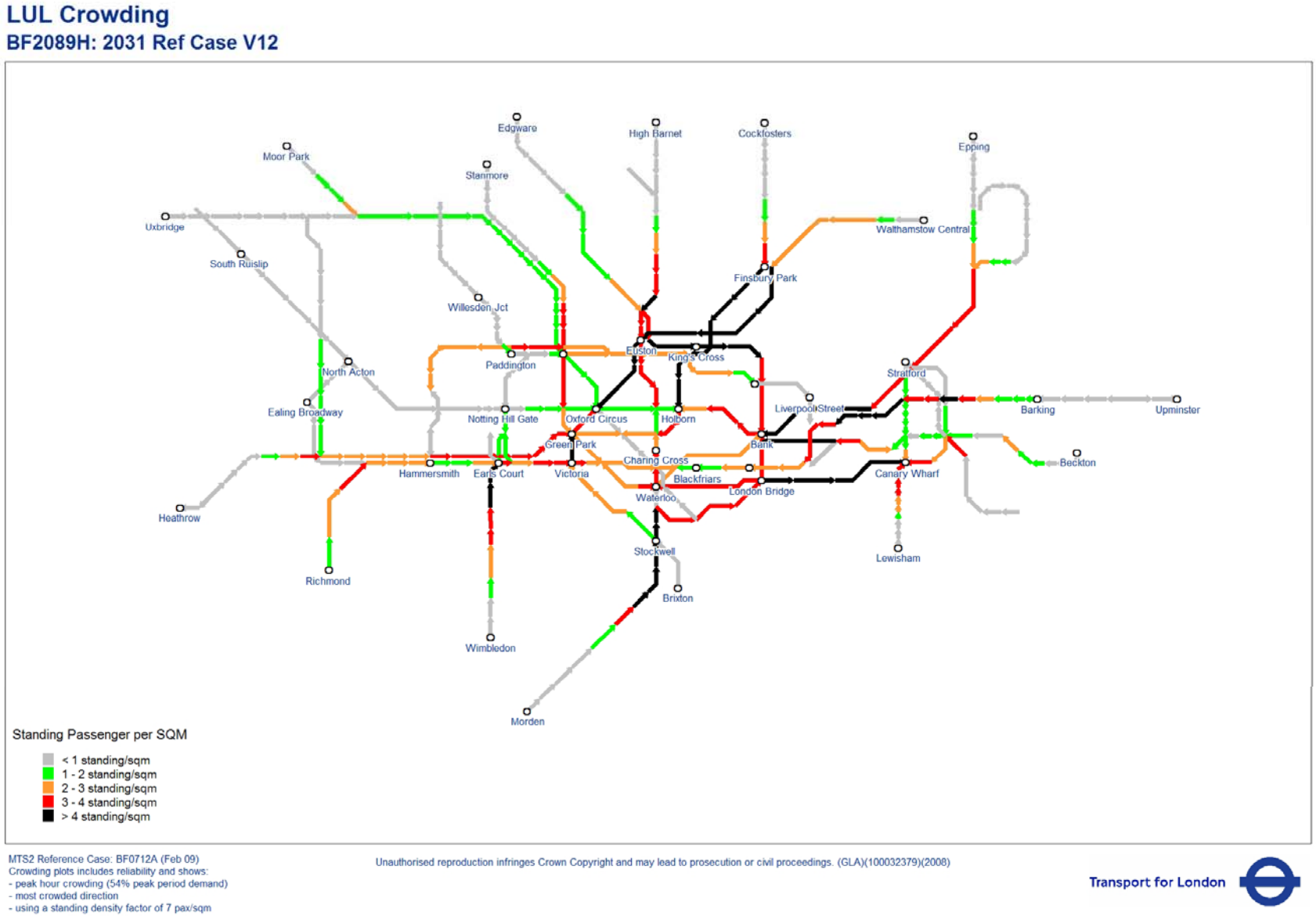
- most crowded direction
- using a standing density factor of 7 pax/sqm

Transport for London

Figure 11: London Underground crowding plot 2031



MTS2 Reference Case: BF0712A (Feb 09)
Crowding plots includes reliability and shows:
- peak hour crowding (54% peak period demand)
- most crowded direction
- using a standing density factor of 7 pax/sqm

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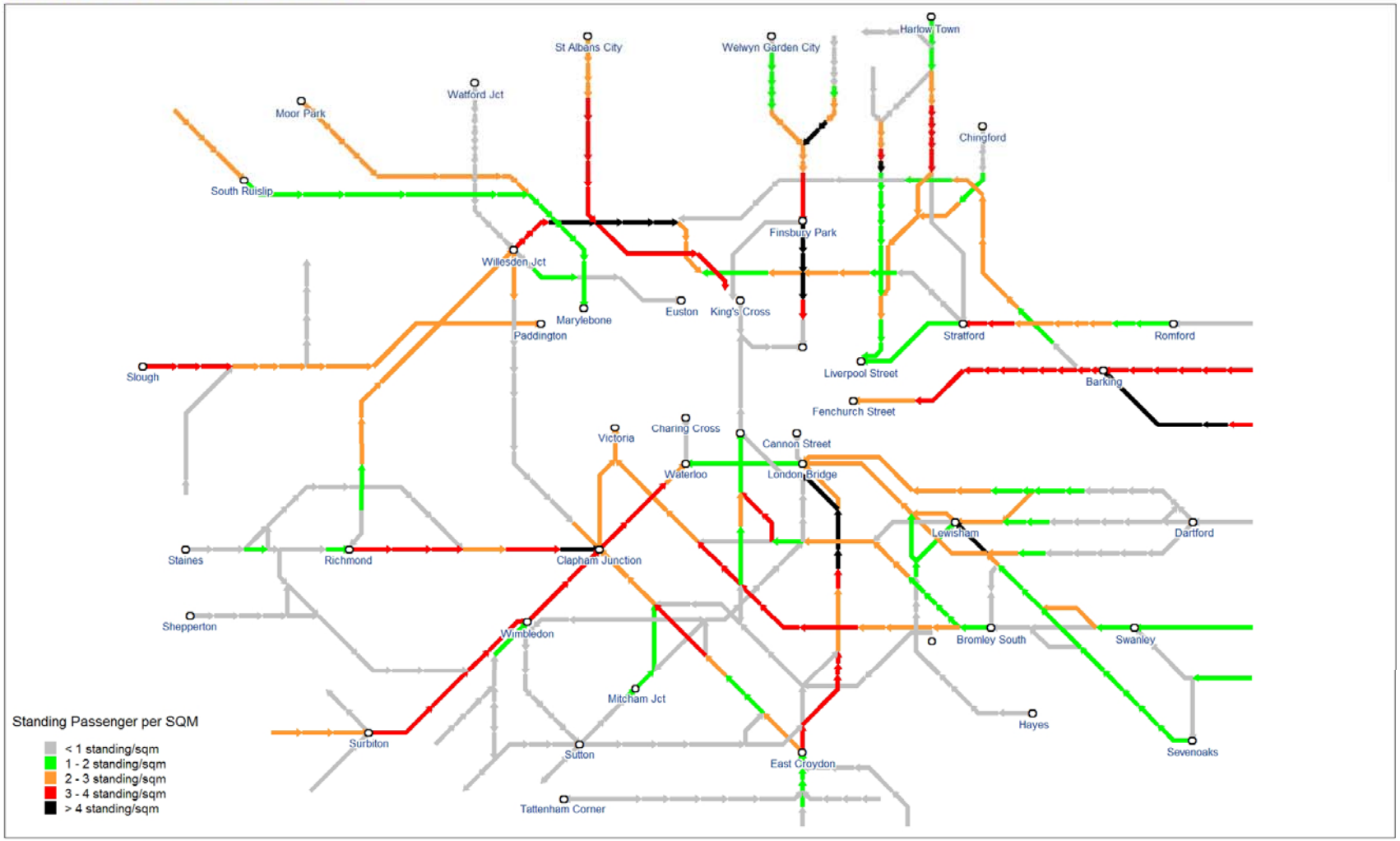
Figure 12: National Rail crowding plot 2006



MTS2 Reference Case: BF0712A (Feb 09)
Crowding plots includes reliability and shows:
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- most crowded direction
- using a standing density factor of 7 pax/sqm

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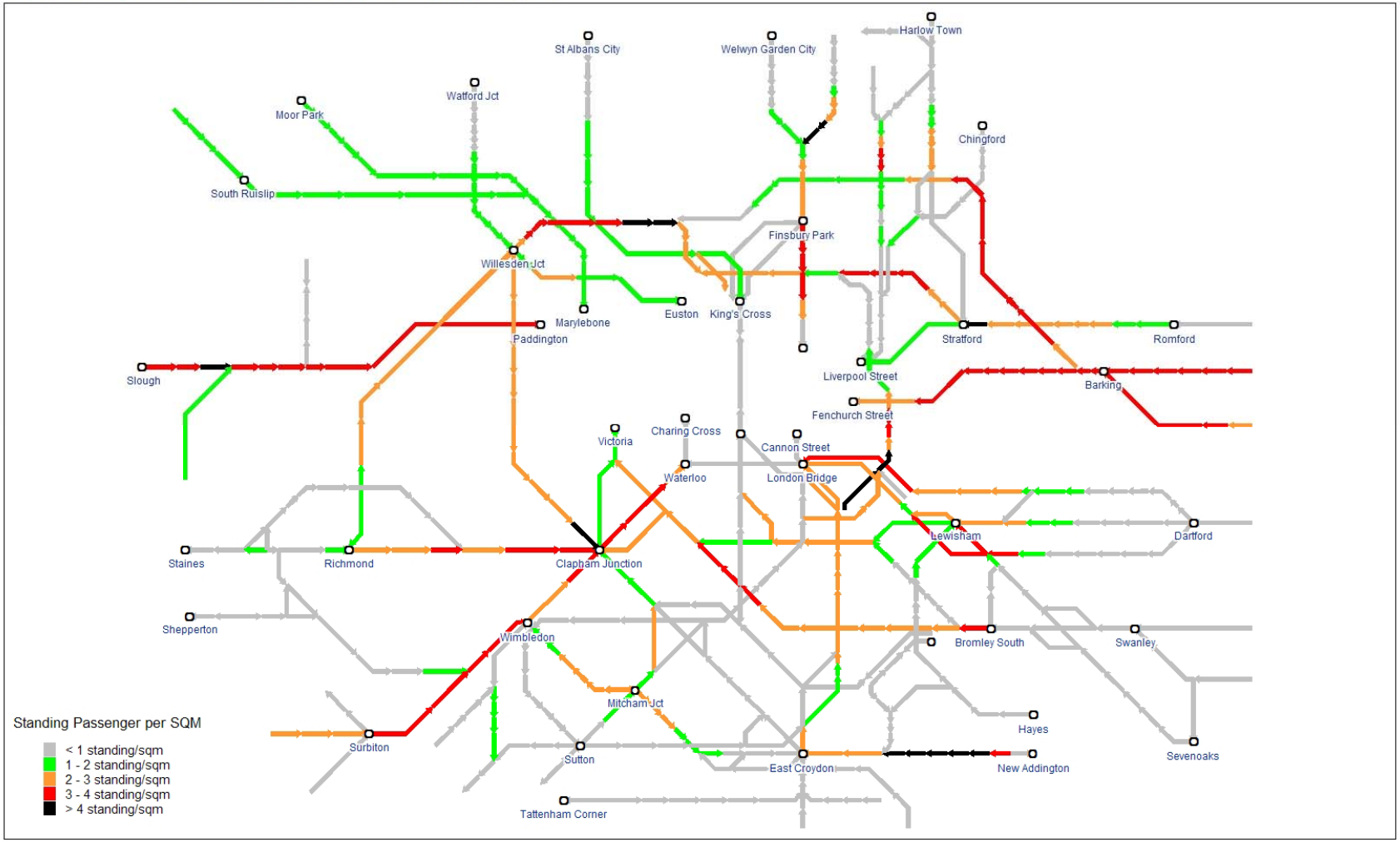
Figure 13: National Rail crowding plot 2016



MTS2 Reference Case: BF0712A (Feb 09)
Crowding plots includes reliability and shows:
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- most crowded direction
- using a standing density factor of 7 pax/sqm

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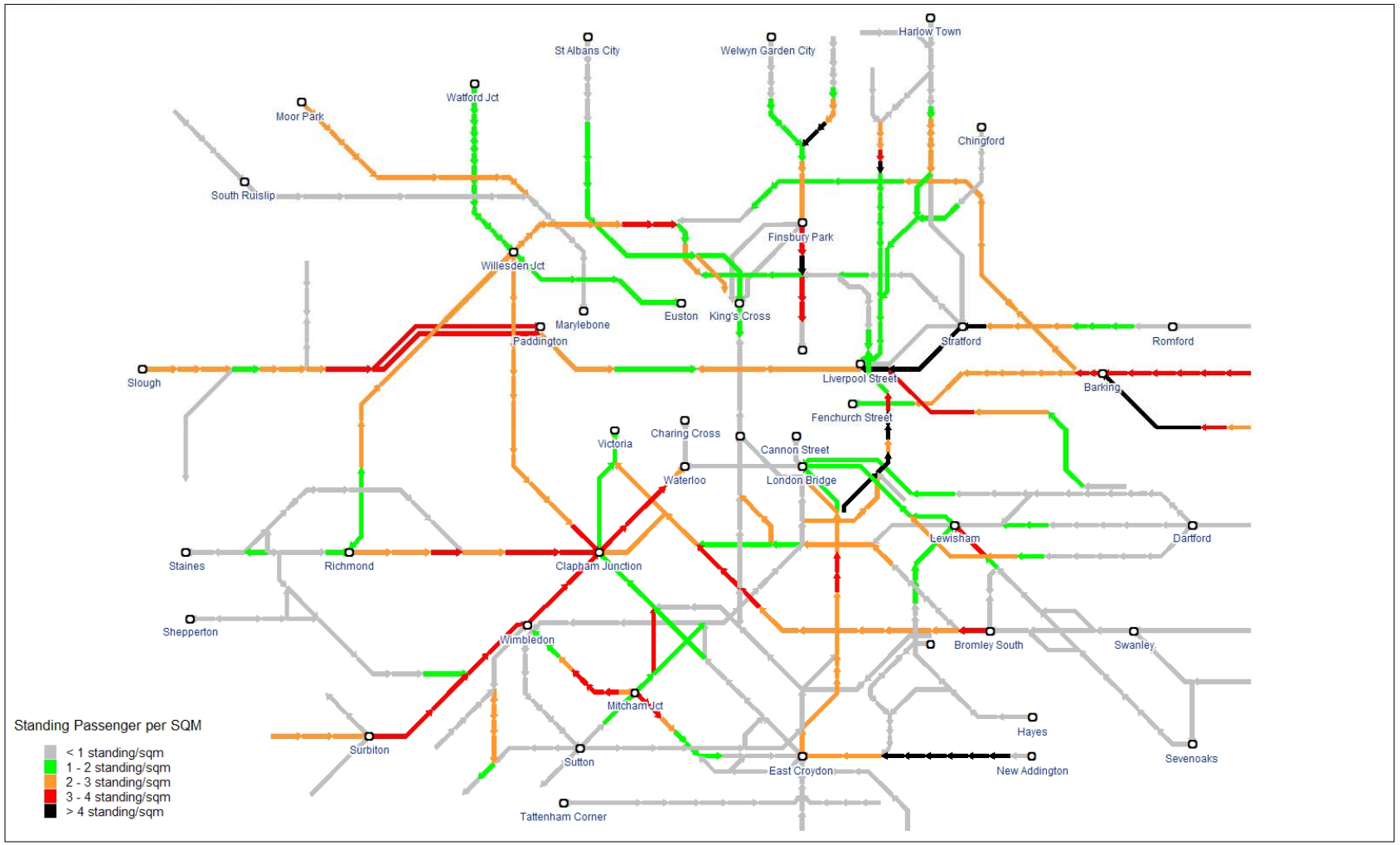
Figure 14: National Rail crowding plot 2021



MTS2 Reference Case: BF0712A (Feb 09)
Crowding plots includes reliability and shows:
- peak hour crowding (54% peak period demand)
- most crowded direction
- using a standing density factor of 7 pax/sqm

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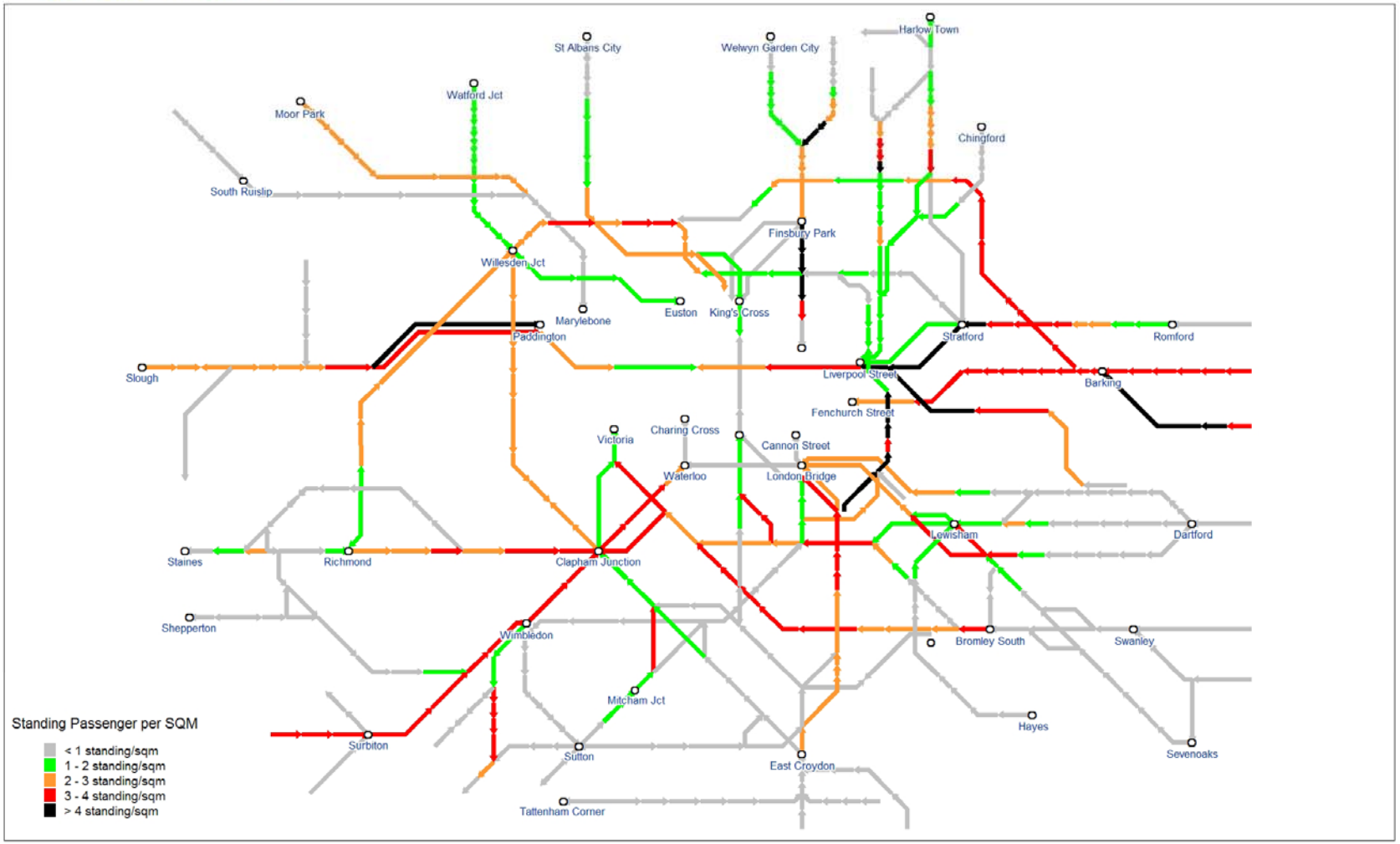
Figure 15: National Rail crowding plot 2031



MTS2 Reference Case: BF0712A (Feb 09)
Crowding plots includes reliability and shows:
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Transport for London