Harrow Area Action Plan

Phase II: Traffic Impact Assessment

Study Report | July 2012

SKM COLIN BUCHANAN

Harrow Area Action Plan
Phase II – Traffic Impact Assessment

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Prepared by:	Ashish Chandra
Approved by:	Atholl Noon

Sinclair Knight Merz

New City Court
20 St Thomas Street
London
SE1 9RS

Tel: +44 (0) 7393 6100
Web: www.skmcolinbuchanan.com

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Executive Summary

London Borough of Harrow (LBH) is currently developing an Area Action Plan to meet its aspiration for future residential and employment growth in the area. As part of the plan, a number of development proposals have been identified and their impact on the strategic highway network is being analysed.

The appraisal of the Harrow Area Action Plan is being carried out by TfL with support from SKM Colin Buchanan using the SATURN based West London Highway Assignment Model (WeLHAM). This report details the findings from the traffic impact assessment of the Harrow Area Action Plan (AAP) based on the assumptions currently made available by LBH.

WeLHAM, which is a strategic transport model based on the SATURN modelling software package, with a simulation network focusing primarily on the West London region with strategic links to the rest of London and the UK has been used for this study. An area with a radius of approximately 3-4 km around the AAP sites has been adopted as the core study area.

The traffic impact of AAP development proposals was assessed for the year 2021. The 2021 AAP Scenario ***with*** AAP development proposals was compared against a theoretical "2021 Base Minus" Scenario which includes background growth to 2021 and GLA planning assumptions for the entire model ***without*** any changes to the AAP zones. This gives a robust "with" and "without" assessment of AAP proposals. An additional "***Mitigation***" scenario was also developed to test likely highway improvement strategy to offset any negative traffic impact of the AAP proposal.

The appraisal focuses on twenty five key junctions located on the strategic road network which are vital to smooth traffic flow within the core study area.

Before assessing the impact of the AAP development proposals, the Base Minus scenario was compared against the existing traffic conditions represented in the base year model. It is noted that some of the key junctions already experience congestion during peak traffic hours, as seen in the base year results. There is a further increase in congestion at six key junctions (see Section 6.2) due to the background growth and other GLA proposals. Although the net impact of the GLA planning assumptions and the background growth means there is general decrease in highway capacity, there are a few junctions which experience a drop in the level of congestion.

The AAP proposals include 24 sites in Harrow which cumulatively add approximately an additional 1,892 trips in the morning and 2,153 trips in the evening peak. A comparison of AAP development scenario against Base Minus scenario shows that 7 more key junctions are likely to experience a further increase in level of traffic congestion in either AM or PM peak scenario (see Section 6.3).

Network performance results show that there is about a 3% drop in average network speed in both morning and evening peaks as a direct result of AAP proposals due to increase in overall congestion and resultant additional junction delays.

A number of aspirational highway schemes were identified as part of the programme to mitigate against the proposed AAP development impacts. These included changes to existing junctions, provision of additional highway capacity through minor works, and signalisation of some existing non-signalised junctions. Although the schemes tested as part of this study may not form the part of the main strategy, the initial results suggest that the key mitigation measures identified will bring relief to a number of key junctions.

The mitigation measures are aimed to improve the capacity at various junctions and hence increased the overall vehicle throughput in the network. As a result, it further attracts more vehicles to the network which increases the level of traffic congestion further. The improvement in the junction performance should therefore be viewed in comparison with the increase in the level of traffic through the junctions.

The proposed mitigation measure show a slight improvement in overall network speed however it is lower than the existing traffic conditions which comes with a 6% increase in travel demand which is reflected in the increase total vehicle-kms driven in the network over current traffic level in the morning peak.

Only one mitigation scenario was tested as part of this study. The existing models can be used test various combinations of the mitigation measures identified in Section 5.4. It is important to find the balance between introducing mitigation which increases the level of traffic in the study area but at the cost of decreasing level of service in the highway network.

It is recommended to carry out additional sensitivity tests to identify the combination of mitigation measures which will provide the best network performance. It is also important to analyse the incremental benefits of the mitigation measures against the cost of the individual scheme to identify the most economically efficient mitigation strategy.

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1 Introduction

1.1 Study Background

1.1.1 SKM CB is supporting TfL's Policy Planning team in the appraisal of the Harrow Area Action Plan using the SATURN based West London Highway Assignment Model (WeLHAM).

1.1.2 London Borough of Harrow (LBH) is currently developing an Area Action Plan to meet its aspiration for future residential and employment growth in the area. As part of the plan, a number of development proposals have been identified and their impact on the strategic highway network is being analysed.

1.1.3 This report details the preliminary findings from the traffic impact assessment of the Harrow Area Action Plan (AAP) based on the assumptions developed by LBH.

1.1.4 The WeLHAM model has been used to develop 2021 future scenarios models. WeLHAM is a strategic transport model, based on the SATURN modelling software package, with a simulation network focusing primarily on the West London region with strategic links to the rest of London and the UK.

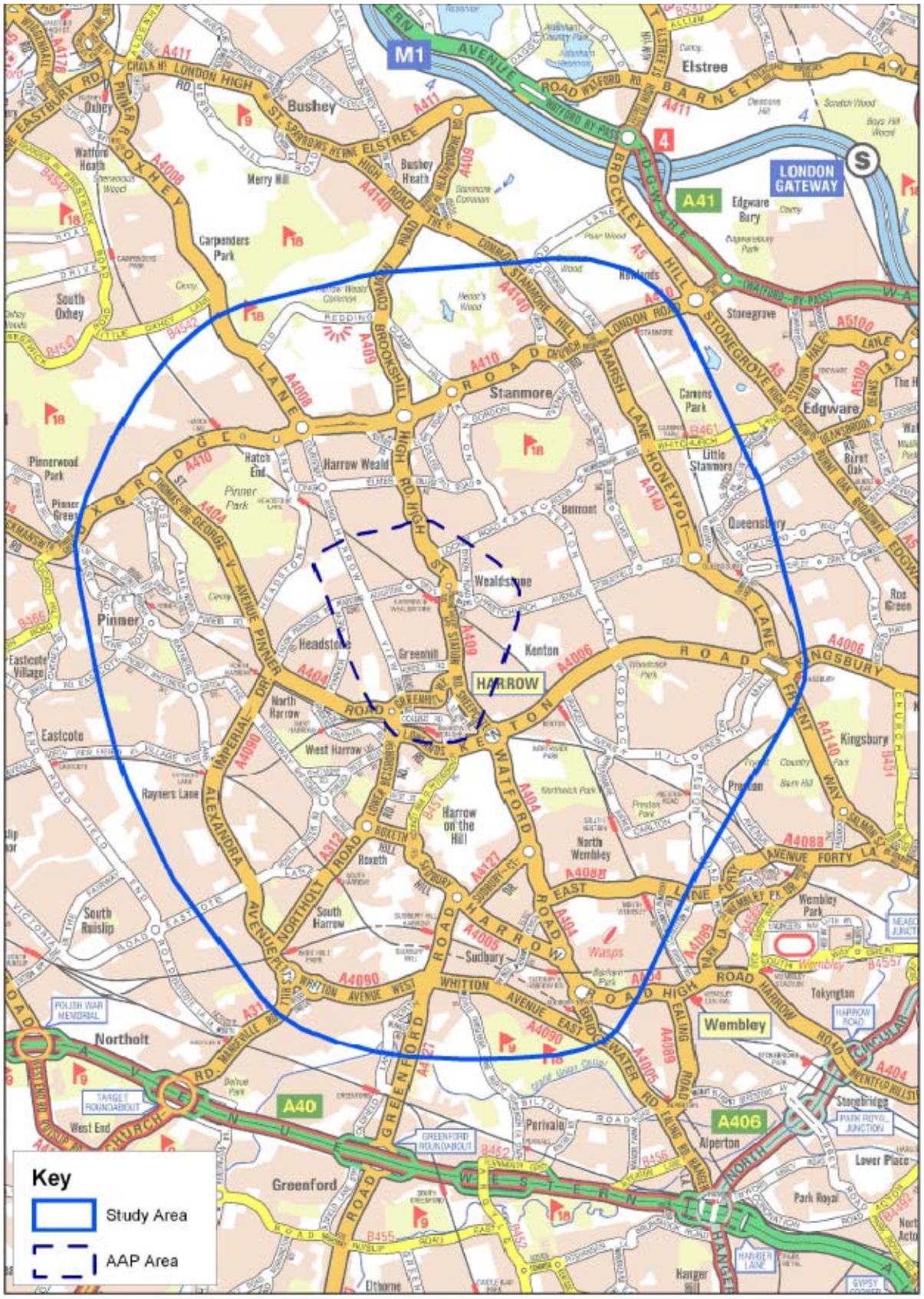
1.1.5 The traffic impact of the proposed developments has been evaluated by developing strategic transport models for "with" and "without" proposed developments and comparing the results from the two scenarios to isolate the likely impact of the AAP Proposals. An additional "Mitigation" scenario was also developed to test a likely mitigation strategy to offset any negative traffic impact of the AAP proposal. The present report includes an overview of the appraisal process including the assumptions used for the key modelling tasks.

1.1.6 The modelling assessment has been completed for average weekday AM and PM one hour peak periods. An area with a radius of approximately 3-4 km around the AAP sites has been adopted as the core study area, see Figure 1 below.

1.1.7 This report is divided into the following sub-sections:

- Section 2 below presents an overview of the Study Methodology;
- Section 3 highlights the existing traffic conditions with a review of the WeLHAM Base Year Model in the local study area;
- Section 4 presents the analysis of AAP development proposals and the incremental traffic demand generation from these sites;
- Section 5 discusses the methodology for development of the forecast scenario models along with set of mitigation measures tested as part of this study;
- Section 6 presents the evaluation methodology for comparing the forecast scenarios and key evaluation results from each modelled scenario;
- Section 7 presents and a comparative analysis of various scenarios and detailed network assessment; and
- Section 8 presents the main conclusions from the study.

Figure 1: Harrow AAP study area



2 Methodology Overview

2.1.1 The principal aim of this study is to evaluate the performance of the highway network, with respect to any increase in traffic caused by the AAP proposed developments, identify the parts of highway network directly impacted and test a mitigation strategy for offsetting these impacts.

2.1.2 In order to evaluate the highway impact of AAP proposals, strategic transport models for "with" and "without" proposed developments were developed using the WeLHAM model. The modelling results from the two scenarios were compared to isolate the likely impact of the AAP proposals.

2.1.3 The following steps have been undertaken:

Step 1: Evaluate the Base Year Highway Network Conditions

- The existing base year West London Highway Assignment Model (WeLHAM) was updated and the highway network enhanced to reflect the current traffic situation in the local study area.
- The WeLHAM base year model was refined and re-calibrated using additional local area traffic count data and TrafficMaster congestion plots to create a Harrow specific base year WeLHAM model.
- The outputs of this model along with TrafficMaster hotspot data were used to identify a set of key junctions to which would have a direct impact due to the AAP development proposals.

Step 2: Develop Demand Estimates for the AAP development sites

- The AAP development proposals and site information provided by LBH, which included the proposed increase in the number of residents and jobs related to the AAP developments, was used to forecast the additional highway traffic produced by the AAP sites.
- Trip generation rates from existing planning applications and the TRICS/TRAVL databases were used to estimate trip generation from these sites.
- The estimated trips were distributed to destination zones based on existing O-D distribution patterns from similar sites located in the Harrow area.

Step 3: Produce Future Year Models

- Two future year models scenarios were developed "without AAP development" (2021 Base Minus) and "with AAP development" (2021 Development Scenario).
- To complete the above step, firstly, a model with background traffic growth from 2009 to 2021 was developed, and then the AAP scenario was created by adding development trips on top of the background traffic growth.

Step 4: Evaluate the Network Performance of Future Year Models

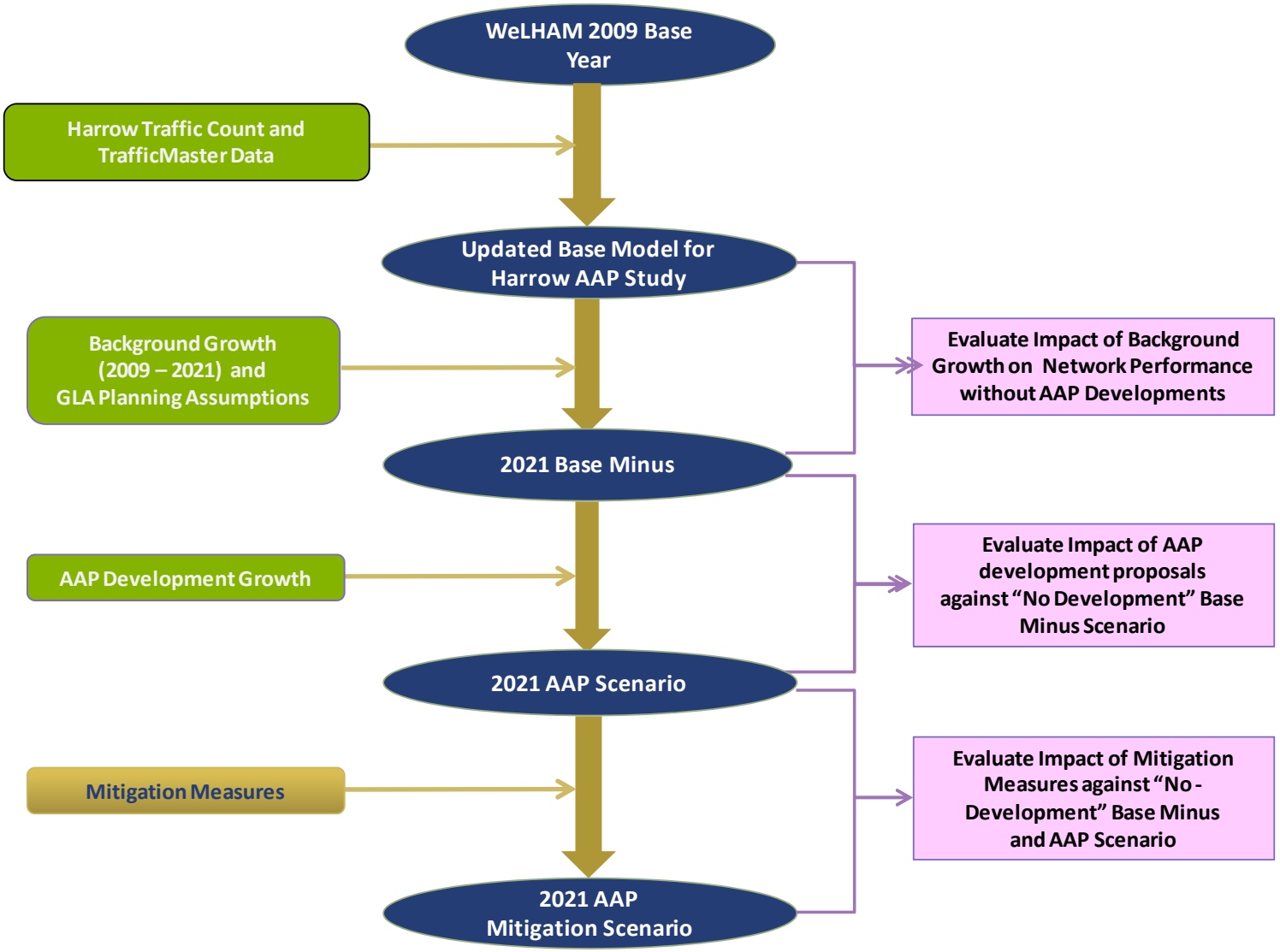
- The results of the base and future year model outputs were then evaluated on a comparative basis to highlight any deterioration in network performance resulting from either background or AAP traffic growth.
- Key junctions and part of the highway network was identified which was directly impacted. This comparison provides the basis for developing a Mitigation Strategy to offset any negative traffic impact of the AAP Proposals

Step 5: Develop a Mitigation Scenario Model

- LBH used to assessment of the AAP scenario to come up with likely mitigation measures for offsetting the growth in traffic. These measures were then included in a 2021 “Mitigation Scenario”.
- The 2021 Mitigation Scenario outputs were then evaluated on a comparative basis to highlight the impact of the Mitigation Strategy without any assessment of economic utility of these changes.

2.1.4 This process is shown schematically in Figure 2.

Figure 2: Modelling Overview



3 Base Year Network Assessment

3.1.1 The existing base year West London Highway Assignment Model (WeLHAM) was updated to replicate the existing traffic situation in the AAP study area.

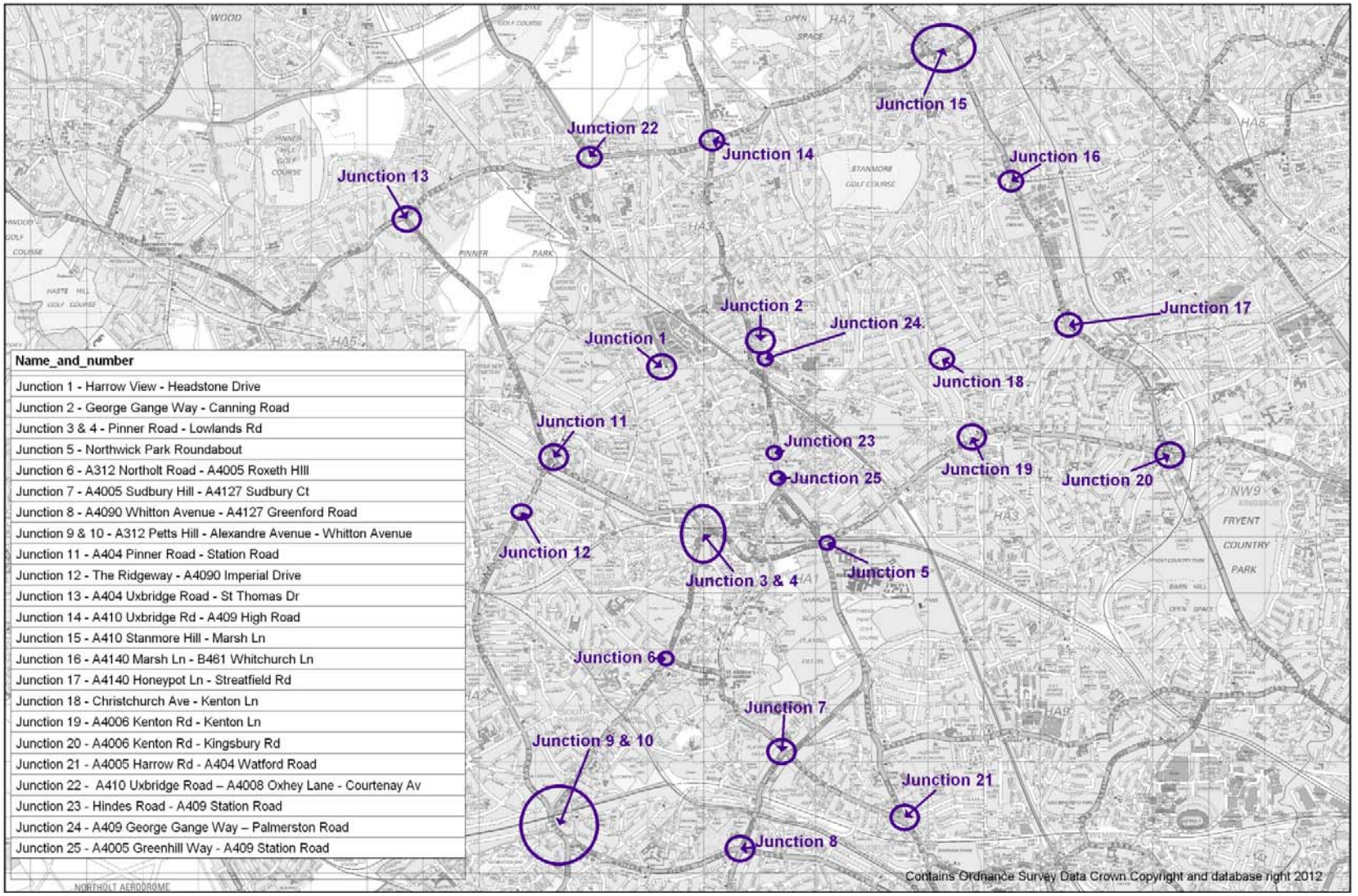
3.1.2 The WeLHAM base year model was refined and re-calibrated using additional local area traffic count data and TrafficMaster congestion plots to create a Harrow Specific Base Year WeLHAM model. Additional network links were added to make the network more detailed.

3.1.3 The TrafficMaster data provides average network conditions in the form of network congestion plots as shown in Appendix A. These network plots were used to assess the current congestion levels in the morning (AM) and evening (PM) peak scenarios. The base year models were compared to TrafficMaster data to ensure that the existing traffic conditions are well represented in the base year models.

3.1.4 It was found that a number of the junctions and links in the Harrow AAP study area are currently experiencing capacity constraints. There are also some key junctions which are vital to the overall highway network performance and service level. In total 25 Junctions, as shown below in Figure 3, were selected for the assessment of AAP development proposals. These include -

- Junction 1: Harrow View Headstone Drive
- Junction 2: George Gange Way- Canning Road
- Junction 3: Pinner Road -Lowlands Road
- Junction 4: A312 Bessborough Road - A404 Lowlands Road
- Junction 5: Northwick Park Roundabout
- Junction 6: A312 Northolt Road - A4005 Roxeth Hill
- Junction 7: A4005 Sudbury Hill - A4127 Sudbury Ct
- Junction 8: A4090 Whitton Avenue - A4127 Greenford Road
- Junction 9: A312 Petts Hill - A4090 Whitton Avenue
- Junction 10: A312 Petts Hill - A4090 Alexandra Avenue
- Junction 11: A404 Pinner Road - A4090 Station Road
- Junction 12: The Ridgeway - A4090 Imperial Drive
- Junction 13: A404 Uxbridge Road - St Thomas Drive
- Junction 14: A410 Uxbridge Road - High Road
- Junction 15: A410 Stanmore Hill - Marsh Lane
- Junction 16: A4140 Marsh Lane - B461 Whitchurch Lane
- Junction 17: A4140 Honeypot Lane - Streatfield Road
- Junction 18: Christchurch Avenue - Kenton Lane
- Junction 19: A4006 Kenton Road - Kenton Lane
- Junction 20: A4006 Kenton Road - Kingsbury Road
- Junction 21: A4005 Harrow Road – A404 Watford Road
- Junction 22: A410 Uxbridge Road – A4008 Oxhey Lane-Courtenay Avenue
- Junction 23: Hindes Road – A409 Station Road
- Junction 24: A409 George Gange Way – Palmerston Road
- Junction 25: A4005 Greenhill Way – A409 Station Road.

Figure 3: Central Harrow AAP study area – Key Junctions



Name_and_number
Junction 1 - Harrow View - Headstone Drive
Junction 2 - George Gange Way - Canning Road
Junction 3 & 4 - Pinner Road - Lowlands Rd
Junction 5 - Northwick Park Roundabout
Junction 6 - A312 Northolt Road - A4005 Roxeth Hlll
Junction 7 - A4005 Sudbury Hill - A4127 Sudbury Ct
Junction 8 - A4090 Whitton Avenue - A4127 Greenford Road
Junction 9 & 10 - A312 Petts Hill - Alexandre Avenue - Whitton Avenue
Junction 11 - A404 Pinner Road - Station Road
Junction 12 - The Ridgeway - A4090 Imperial Drive
Junction 13 - A404 Uxbridge Road - St Thomas Dr
Junction 14 - A410 Uxbridge Rd - A409 High Road
Junction 15 - A410 Stanmore Hill - Marsh Ln
Junction 16 - A4140 Marsh Ln - B461 Whitchurch Ln
Junction 17 - A4140 Honeypot Ln - Streatfield Rd
Junction 18 - Christchurch Ave - Kenton Ln
Junction 19 - A4006 Kenton Rd - Kenton Ln
Junction 20 - A4006 Kenton Rd - Kingsbury Rd
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Junction 23 - Hindes Road - A409 Station Road
Junction 24 - A409 George Gange Way – Palmerston Road
Junction 25 - A4005 Greenhill Way - A409 Station Road

4 AAP Trip Generation Analysis

4.1 AAP Development Sites

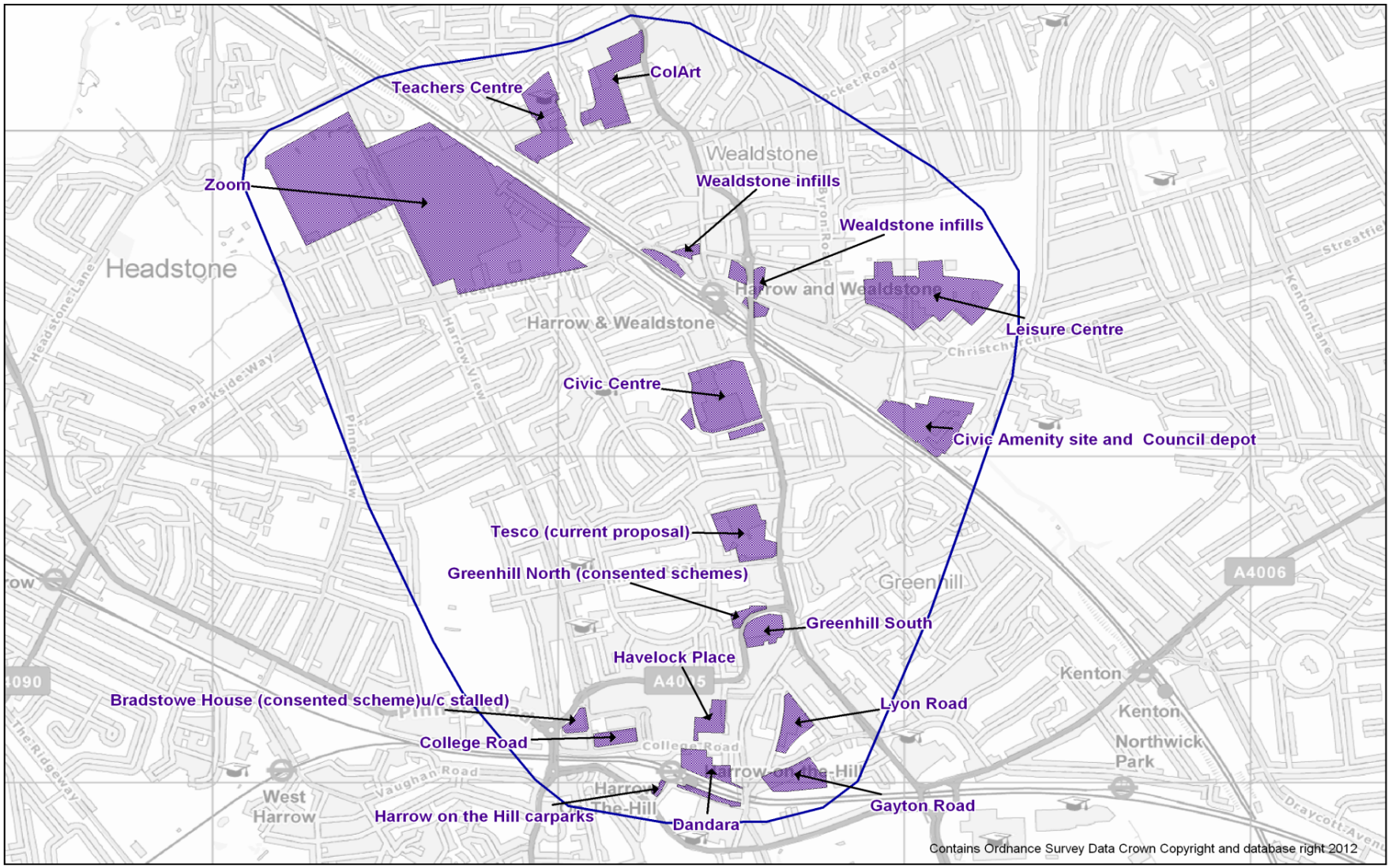
4.1.1 Table 1 below shows the list of development sites being considered under the AAP proposals by London Borough of Harrow. The locations of the AAP development sites are shown in Figure 4 below. Against each development, there is a forecast of expected employment and residential level for the site. This has been used to estimate the number of trips generated from each site.

Table 1: Harrow AAP – proposed Development Site Details

Ref	Area (ha)	Site Name	Land Use	Total Units	Total Jobs	GFA(m²) (RFA)	Parking
2	8.4	Zoom	Residential (C3) (Mixed, Majority Houses*)	235	-	-	281
			Education (Primary School) (D1)	-	100	3,175	-
2	15.9	Kodak	Residential (C3) (Mixed, Majority Flats*)	795	-	-	575
			Student Accommodation (C1/C3)	220	-	-	-
			Employment (B1 Office) (Employ mix 1:10)	-	540	5,400	400
			Employment (B2 General Industry)	-	495	19,800	
			Employment (B8 Storage)	-	154	10,800	
			Food-Store (A1)	-	235	4,000	
			Residential Care Home (C2)	-	-	5,000	
			Sheltered Housing (C3/C2)	-	-	4,300	
			Community Use (D2)	-	-	1,920	
3	2.8	Teachers Centre	Education (Secondary School) (D1)	-	170	9,000	-
4	2.4	Col Art	Residential (C3) (Mixed, Majority Flats*)	150	-	-	75
			Employment Office (B1) (Employ mix 1:12)	-	42	500	-
			Employment "Creative Industry" (B1) (Employment mix (1:20)	-	100	2,000	-
5	2.31	Wealdstone Car Park	Food-Store (A1)	-	130	2,250	140
			Place of Worship (D2)	-	-	250	
6		Wealdstone Infills	Residential (C3) (Mixed, All Flats*)	100	-	-	0
			Hotel (C1)	79	30	-	-
			Retail/Office/Leisure (A/B1/D2)	-	65	2,000	-
7		Palmerston Rd/George Gange Way	Residential (C3) (Mixed All Flats*)	96	-	-	48
			Employment Office(B1) (Employ mix 1:40)	-	68	2,700	-
			Retail/Leisure/Hotel (A/D2/C1)	-	17	500	-
			Community Use (D2)	-	12	-	-
8	5.14	Leisure Centre	Residential (C3) (Mixed, Majority Flats*)	180	-	-	90-144
9	2.73	Civic Amenity Site & Council Depot		-	-	-	-

Ref	Area (ha)	Site Name	Land Use	Total Units	Total Jobs	GFA(m^2) (RFA)	Parking
10	4.1	Civic Centre	Residential (C3) (Mixed, Majority Flats*)	300	-	-	150-240
			High St Retail/Leisure & Comm (A1/D2)	-	125	2,400	-
12	2.15	Tesco (Consented Schemes)	Food-Store (A1)	-	205	5,641	66
			Residential (C3) (All Affordable*)	14	-	-	-
13	TBC	Greenhill Way North (Consented Schemes)	Residential (C3) (Mixed All Flats*)	37	-	-	7
			Hotel (C1)	101	40	-	-
14	1.2	Greenhill Way South	Residential (C3) (Mixed All Flats)	90	-	-	-
			Retail/Community (A1/D2)	-	160	2,880	274
15	0.63	Neptune Point (Consented Scheme)	Food-Store (A1)	-	200	3,458	220
			Residential (C3) (Mixed All Flats*)	147	-	-	75
16	0.32	Bradstowe House (Consented Scheme)	Residential (C3) (All Private*)	144	-	-	167
			Leisure (D2)	-	50	3,273	
			Retail (A1)	-	85	1,617	
17	0.5	College Road West	Residential (C3) (Mixed, Majority Flats*)	140	-	-	28
			Employment Office (B1) (Employ mix 1:12)	-	500	6,000	-
			Retail (A1/A3)	-	105	2,000	-
18	0.57	Havelock Place	Retail (A1)	-	45	850	-
19	1.05	Dandara	Residential (C3) (Mixed, All Flats*)	400	-	-	80
			Community Library (D1)	-	40	1,800	-
20	0.15	Harrow on the Hill Car Park West	Residential (C3) (Mixed, Majority Flats*)	45	-	-	0
			Office/Cafés (B1/A3)	-	14	240	-
22		Harrow on the Hill Car Park East	Social/Community (D2)	-	50	1,500	-
21	0.9	Lowlands Recreational Grounds	Outdoor Performace Space/Leisure (D2)	-	-	-	-
			Cafés (A3)	-	-	-	-
23	1.32	Lyon Road	Residential (C3) (Mixed, Majority Flats*)	300	-	-	-
			Employment Office (B1) (Employ mix 1:12)	-	145	1,750	132
			Health/Retail (D1/A1/A3)	-	55	1,640	
24	1.2	Gayton Road	Residential (C3) (Mixed, Majority Flats*)	350	-	-	88-175
			Community Use (D2)	-	30	-	-

Figure 4: Harrow AAP development Site Locations



4.2 Development Trip Ends

4.2.1 A comparison was made between the trips rates derived from the Traffic Assessment (TA) report in the Planning Applications for the consented Kodak site and those derived from TRAVL and TRICS databases. In most cases trip rates presented in the TA were used as they were considered mid-range. Elsewhere, trip rates derived from TRAVL were used to fill the gaps where necessary.

4.2.2 The following assumptions were made while estimating the level of trip generation from the AAP sites.

i. All residential trips were estimated on the basis of the number of average household units. Three main classes of residential developments were identified: “affordable”, “private“ or “mixed”. A bespoke trip rate for each site was extracted from TRAVL to reflect individual housing mixes.

ii. For the residential sites which have a mix of 'private' and 'affordable' housing, the ratio of houses to flats was considered when generating trip rates.

iii. Two sets of trip rates were identified; one for sites where the majority of units are houses and another where the majority of units are flats. However, TRAVL only includes one site suitable for the 'majority flats' sites which are unusually high and therefore considered not to be comparable. Therefore the 'majority houses' trip rate was applied to all sites. An exception to this is described in Note 5 below.

iv. A number of sites in the AAP proposals were identified as having zero or low parking provision. These sites were all sites which had a majority of flats over houses or were exclusively flats. For these sites the 'majority houses' trip rates were converted to 'per bedroom' trip rates based on the ratio of units to beds at the Zoom Site.

v. Trip generation for the food-stores was based on a 23.7% increase, linked to increase in floor area as a result of store extension.

4.2.3 Although employment estimates were provided for some of the development sites, the gross area of the development site was used to estimate trips generated using the trip rates for individual type of commercial development. The level of employment provides an indication of the trip generation level at the site.

4.2.4 Table 2 below shows a summary of key statistics for the AAP development proposal and Table 3 below shows a summary of trip ends derived from the above analysis. These are also shown geographically aggregated to the WeLHAM zoning system in Figure 5 - Figure 6.

Table 2: Summary of AAP development sites statistics

Development proposals Summary	
Total Site Area	53.77 ha
No. of residential units	3,923
Employment Growth (jobs)	4,007
Total Retail Area	26,746 m^2
Total office area	47,200 m^2

Table 3: Highway Trip Generation from the proposed AAP development sites

Ref	Area (ha)	Site Name	Land Use	Traffic Generation			
				AM Peak (8-9)		PM Peak (5-6)	
				IN	OUT	IN	OUT
2	8.4	Zoom	Residential (C3) (Mixed, Majority Houses	14	42	32	16
			Education (Primary School) (D1)	146	87	10	22
2	15.9	Kodak	Residential (C3) (Mixed, Majority Flats*)	46	143	108	55
			Student Accommodation (C1/C3)	3	1	3	5
			Employment (B1 Office) (Employ mix 1:10)	83	2	14	90
			Employment (B2 General Industry)	58	8	13	56
			Employment (B8 Storage)	30	5	8	44
			Food-Store (A1)	42	18	102	123
			Residential Care Home (C2)	7	1	5	11
			Sheltered Housing (C3/C2)	6	1	4	10
			Community Use (D2)				
3	2.8	Teachers Centre	Education (Secondary School) (D1)	83	51	11	17
4	2.4	Col Art	Residential (C3) (Mixed, Majority Flats*)	7	21	16	8
			Employment Office (B1) (Employ mix 1:12)	8	0	1	8
			Employment "Creative Industry" (B1) (Employment mix (1:20)	12	1	2	9
5	2.31	Wealdstone Car Park	Food-Store (A1)	22	8	53	60
			Place of Worship (D2)				
6		Wealdstone Infills	Residential (C3) (Mixed, All Flats*)	2	6	5	2
			Hotel (C1)	3	5	3	3
			Retail/Office/Leisure (A/B1/D2)	10	0	2	11
7		Palmerston Rd/George Gange Way	Residential (C3) (Mixed All Flats*)	3	11	8	4
			Employment Office(B1) (Employ mix 1:40)	17	1	2	12
			Retail/Leisure/Hotel (A/D2/C1)	3	0	0	3
			Community Use (D2)				
8	5.14	Leisure Centre	Residential (C3) (Mixed, Majority Flats*)	10	32	24	12
9	2.73	Civic Amenity Site & Council Depot					
10	4.1	Civic Centre	Residential (C3) (Mixed, Majority Flats*)	17	54	41	21
			High St Retail/Leisure&Community (A1/D2)	19	0	3	20
12	2.15	Tesco (Consented Schemes)	Food-Store (A1)	66	48	70	71
			Residential (C3) (All Affordable*)	1	3	2	1
13	TBC	Greenhill Way North (Consented Schemes)	Residential (C3) (Mixed All Flats*)	1	4	3	2
			Hotel (C1)	4	7	4	4

Ref	Area (ha)	Site Name	Land Use	Traffic Generation			
				AM Peak (8-9)		PM Peak (5-6)	
				IN	OUT	IN	OUT
14	1.2	Greenhill Way South	Residential (C3) (Mixed All Flats)	3	10	8	4
			Retail/Community (A1/D2)	22	0	4	24
15	0.63	Neptune Point (Consented Scheme)	Food-Store (A1)	58	23	147	168
			Residential (C3) (Mixed All Flats*)	5	16	12	6
16	0.32	Bradstowe House (Consented Scheme)	Residential (C3) (All Private*)	8	27	20	11
			Leisure (D2)	32	3	20	21
			Retail (A1)	12	0	2	13
17	0.5	College Road West	Residential (C3) (Mixed, Majority Flats*)	5	16	12	6
			Employment Office (B1) (Employ mix 1:12)	93	2	15	100
			Retail (A1/A3)	15	0	3	17
18	0.57	Havelock Place	Retail (A1)	10	6	36	35
19	1.05	Dandara	Residential (C3) (Mixed, All Flats*)	15	46	34	18
			Community Library (D1)	20	7	12	14
20	0.15	Harrow on the Hill Car Park West	Residential (C3) (Mixed, Majority Flats*)	2	5	4	2
			Office/Cafés (B1/A3)	4	0	1	4
22		Harrow on the Hill Car Park East	Social/Community (D2)				
21	0.9	Lowlands Recreational Grounds	Outdoor Performace Space/Leisure (D2)				
			Cafés (A3)				
23	1.32	Lyon Road	Residential (C3) (Mixed, Majority Flats*)	12	36	27	14
			Employment Office (B1) (Employ mix 1:12)	27	1	4	29
			Health/Retail (D1/A1/A3)	8	0	1	9
24	1.2	Gayton Road	Residential (C3) (Mixed, Majority Flats*)	13	40	30	15
			Community Use (D2)				
			TOTAL	**1,089**	**803**	**942**	**1,211**
			Two Way Total	**1,892**		**2,153**	

Figure 5: AAP Development Zones – AM Highway Trip Ends

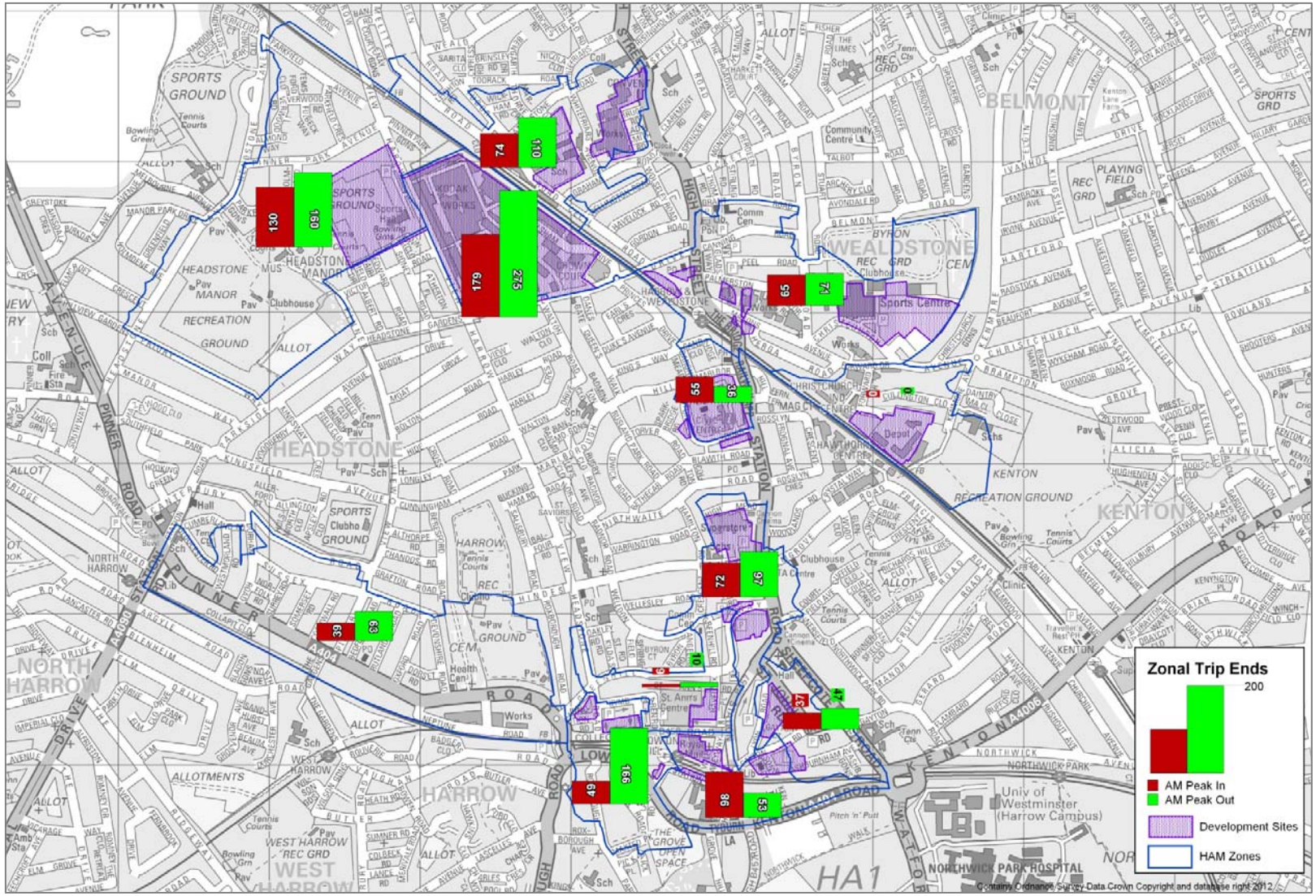
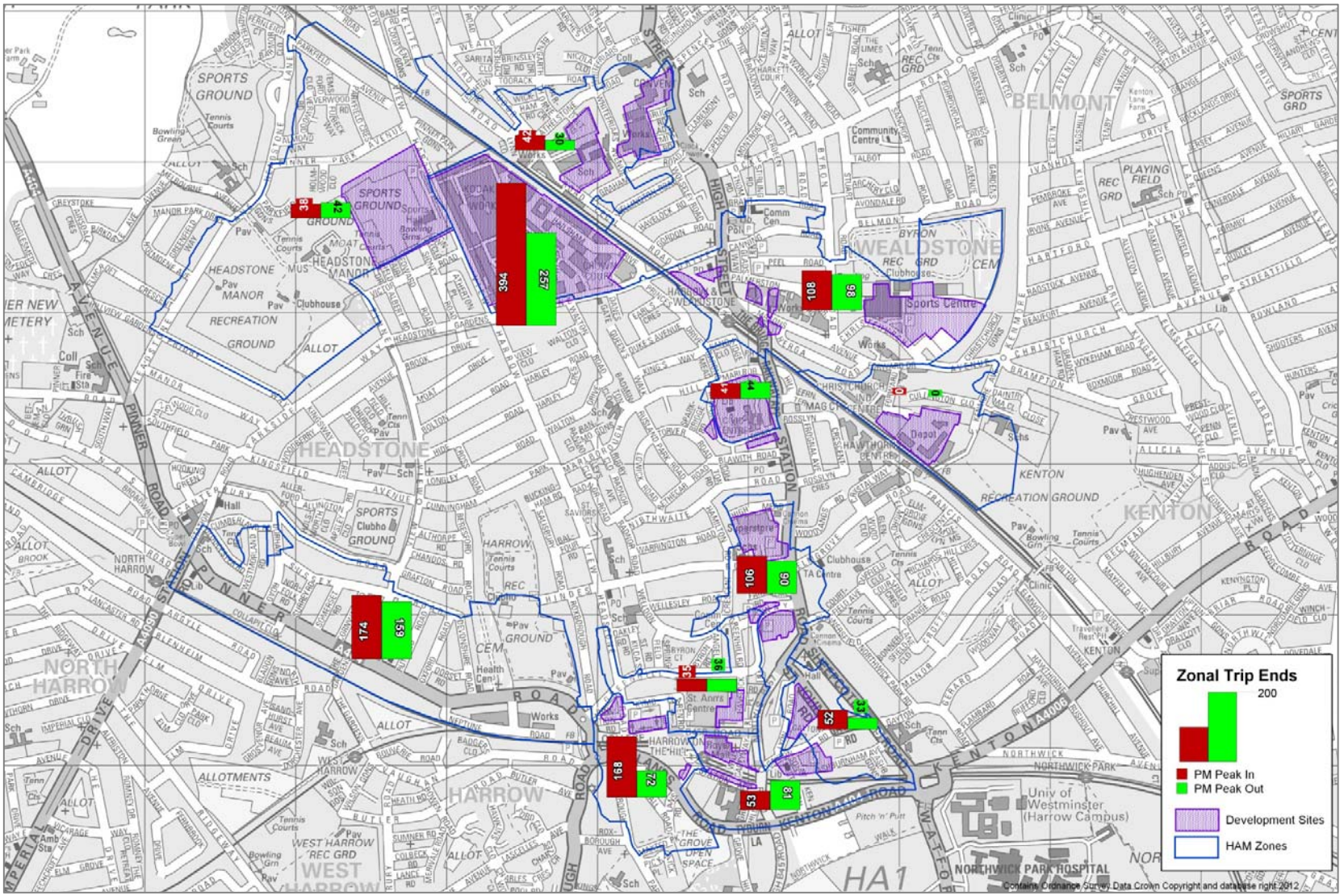


Figure 6: AAP Development Zones – PM Highway Trip Ends



5 Future Year Model Development

5.1 Future Year Model Scenarios

5.1.1 The traffic impact of AAP development proposals was assessed for the year 2021 using the WeLHAM Reference Case model. This already includes the GLA planning assumption for West London and a background growth in traffic till 2021.

5.1.2 The "2021 AAP Scenario" ***with*** AAP development proposals was compared against a theoretical "2021 Base Minus" Scenario which includes background growth to 2021 and GLA planning assumptions for the entire Greater London area, ***without*** any changes to the AAP zones. The AAP zones were thus kept at 2009 levels of trip generation in the Base Minus scenario. This gives a robust "with" and "without" assessment of AAP proposals.

5.1.3 The AAP scenario was used to evaluate the potential traffic impact of development proposals and some key junctions were identified which needed mitigation against increased traffic congestion. These changes were modelled in a new forecast scenario with AAP development proposals and proposed mitigation measures.

5.1.4 The following scenarios have been developed for the 2021 assessment year:

a) ***2021 Base Minus***: including background growth to 2021 and GLA planning assumptions without any changes to the AAP zones.

b) ***2021 AAP Development Scenario***: 2021 Base Minus plus Harrow AAP development.

c) ***2021 AAP Mitigation Scenario***: 2021 AAP scenario with proposed mitigations.

5.1.5 The highway network provided with the Reference Case model has already been "optimised" to reflect the changes in signal controls settings to cope with the resultant traffic conditions. This Reference Case model was used as the starting point for all the future year models.

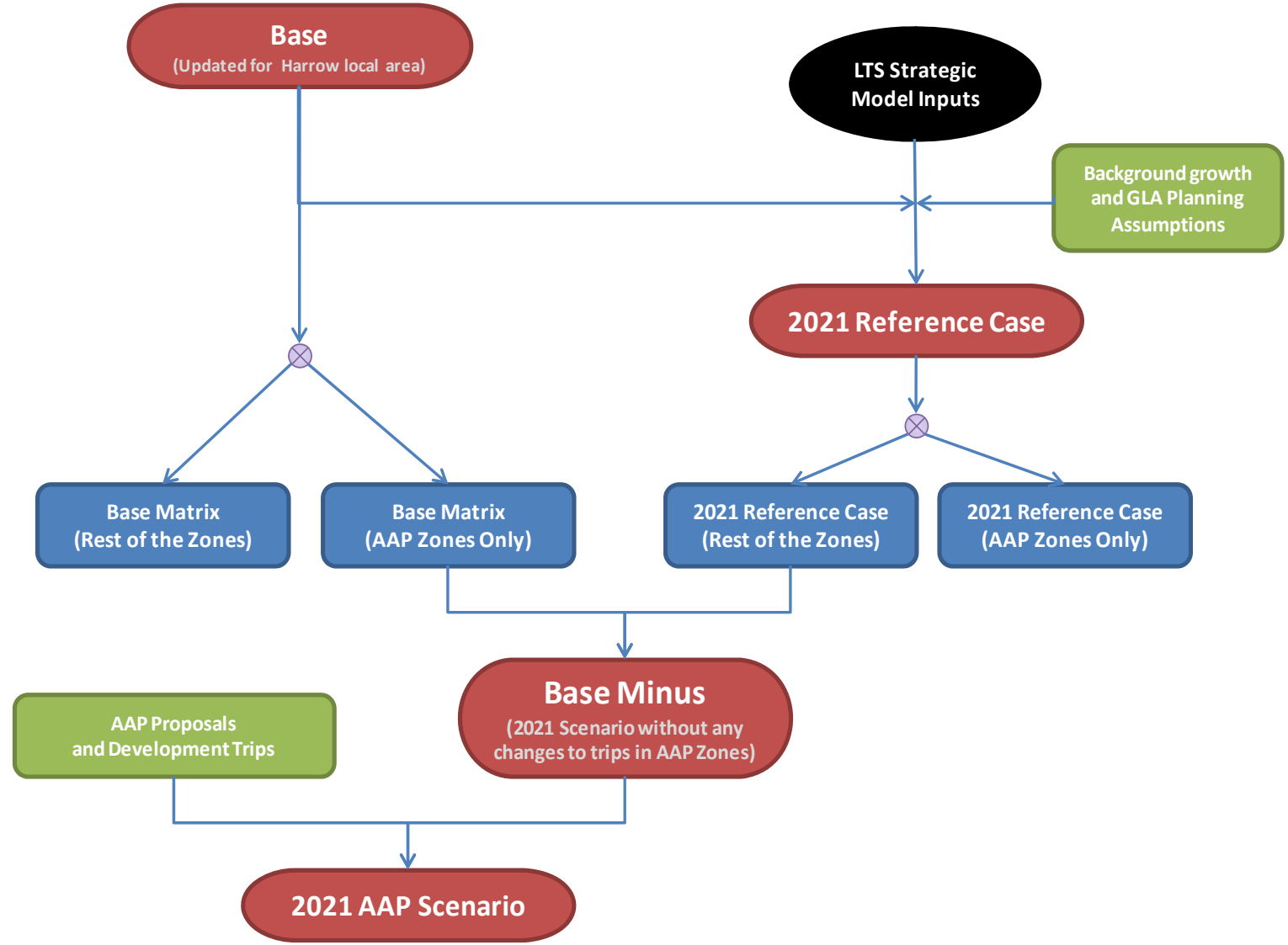
5.2 Demand Matrix Development

5.2.1 The process for constructing demand matrices for the 2021 Base Minus and 2021 Development Scenario, as shown in Figure 7 below, is summarised as follows:

1. Remove GLA planning growth traffic from the existing TfL 2021 Reference Case Matrix and replace it with the trips from the Base Year Matrix. This produces the 2021 Base Minus matrix.
2. Derive OD matrices from the WeLHAM base year model for zones in the Harrow area representing AAP development. Factor each zone according to the trip generation estimates for the AAP sites. This produces the development traffic demand matrix.

   (Please note that for most of the AAP zones, the resultant distribution is the same as that in the base year model and the trip ends have been factored to the AAP level. However, for Kodak and Zoom sites, the distribution of trips on the nearby link was used to produce the distribution of trips from these developments. This is done to reflect the mixed nature of developments on these sites.)
3. Add the development traffic matrix to the 2021 Base Minus matrix. This produces the 2021 AAP Development Scenario matrix.

Figure 7: Matrix Development Overview



Sector Movement Analysis

5.2.2 A sector-to-sector movement comparison was done to understand the changes in demand over the three demand scenarios. As the WeLHAM model is much bigger than the Harrow study area, a cordon was created around the core study area and sector movements were analysed based on the cordon matrices.

5.2.3 Table 4 shows the distribution of traffic in the Harrow study area for the AM and PM peak by AAP Development Zones, other Internal Zones in the study area and the External Zones for different scenarios.

5.2.4 Analysis of the sector comparisons indicates that overall there is only a small increase in traffic from 2009 to 2021. This increase is in general related to growth in external-to-external traffic as well as re-distribution of internal traffic away from Internal-Internal movements towards longer distance internal-external movements.

5.2.5 The 2021 AAP Scenario includes approximately 1,860 two-way additional trips in the AM peak scenario and 2,117 two-way additional trips in the PM peak scenario from the AAP development sites after balancing the matrix for origins and destinations. There is also a small decrease in other sector movements in both the AM and PM peaks due to new developments replacing exiting land use and reassignment effects.

Table 4: Sector to Sector movements Base, 2021 Base Minus and 2021 AAP Development Scenario comparison

AM Peak ***Base Year Vs 2021 Base Minus***

	Base AM				2021 AM Base Minus				Difference			
	AAP	Internal	External	Total	AAP	Internal	External	Total	AAP	Internal	External	Total
AAP	67	758	720	**1,545**	67	759	721	**1,546**	0	1	0	**2**
Internal	939	10,860	13,579	**25,378**	940	10,314	13,828	**25,082**	1	-546	249	**-296**
External	827	10,921	3,180	**14,929**	819	11,146	3,494	**15,459**	-8	224	314	**530**
Total	**1,832**	**22,539**	**17,480**	**41,851**	**1,825**	**22,218**	**18,043**	**42,086**	**-7**	**-321**	**563**	**235**

AM Peak ***2021 Scenario Vs 2021 Base Minus***

	2021 AM Base Minus				2021 AM Scenario				Difference			
	AAP	Internal	External	Total	AAP	Internal	External	Total	AAP	Internal	External	Total
AAP	67	759	721	**1,546**	95	1,206	1,046	**2,347**	28	447	326	**801**
Internal	940	10,314	13,828	**25,082**	1,482	10,304	13,832	**25,618**	542	-10	5	**536**
External	819	11,146	3,494	**15,459**	1,308	11,124	3,371	**15,803**	489	-21	-124	**345**
Total	**1,825**	**22,218**	**18,043**	**42,086**	**2,885**	**22,634**	**18,249**	**43,768**	**1,059**	**416**	**207**	**1,682**

PM Peak ***Base Year Vs 2021 Base Minus***

	Base PM				2021 PM Base Minus				Difference			
	AAP	Internal	External	Total	AAP	Internal	External	Total	AAP	Internal	External	Total
AAP	101	893	1,059	**2,053**	101	894	1,060	**2,056**	0	1	1	**2**
Internal	922	11,470	11,165	**23,558**	925	11,143	11,409	**23,478**	4	-327	244	**-80**
External	566	13,512	2,894	**16,972**	567	13,571	3,034	**17,172**	1	60	140	**200**
Total	**1,589**	**25,875**	**15,118**	**42,582**	**1,594**	**25,609**	**15,502**	**42,705**	**5**	**-267**	**384**	**122**

PM Peak ***2021 Scenario Vs 2021 Base Minus***

	2021 PM Base Minus				2021 PM Scenario				Difference			
	AAP	Internal	External	Total	AAP	Internal	External	Total	AAP	Internal	External	Total
AAP	101	894	1,060	**2,056**	136	1,453	1,674	**3,262**	34	558	614	**1,207**
Internal	925	11,143	11,409	**23,478**	1,501	11,122	11,428	**24,052**	576	-21	19	**574**
External	567	13,571	3,034	**17,172**	867	13,531	2,933	**17,331**	300	-40	-101	**159**
Total	**1,594**	**25,609**	**15,502**	**42,705**	**2,504**	**26,106**	**16,035**	**44,645**	**910**	**497**	**533**	**1,940**

5.3 Background Highway Schemes

5.3.1 The following schemes were included in both the 2021 Scenario networks:

- Station Road junction alterations: converted to a bus link
- Kodak and Zoom site access converted to Roundabout
- Connectors revised to account for the proposed Harrow AAP development

5.3.2 Please note that no further signal optimisation has been included for the AAP scenarios but some signalised junctions were re-optimised for the Mitigation Scenario. In addition to the above, additional mitigation measures were identified as described below.

5.4 Mitigation Measures

5.4.1 A number of aspirational highway schemes were identified as part of the programme to mitigate against the proposed AAP development impacts. These included changes to existing junctions, provision of additional highway capacity through minor works, and signalisation of some existing non-signalised junctions.

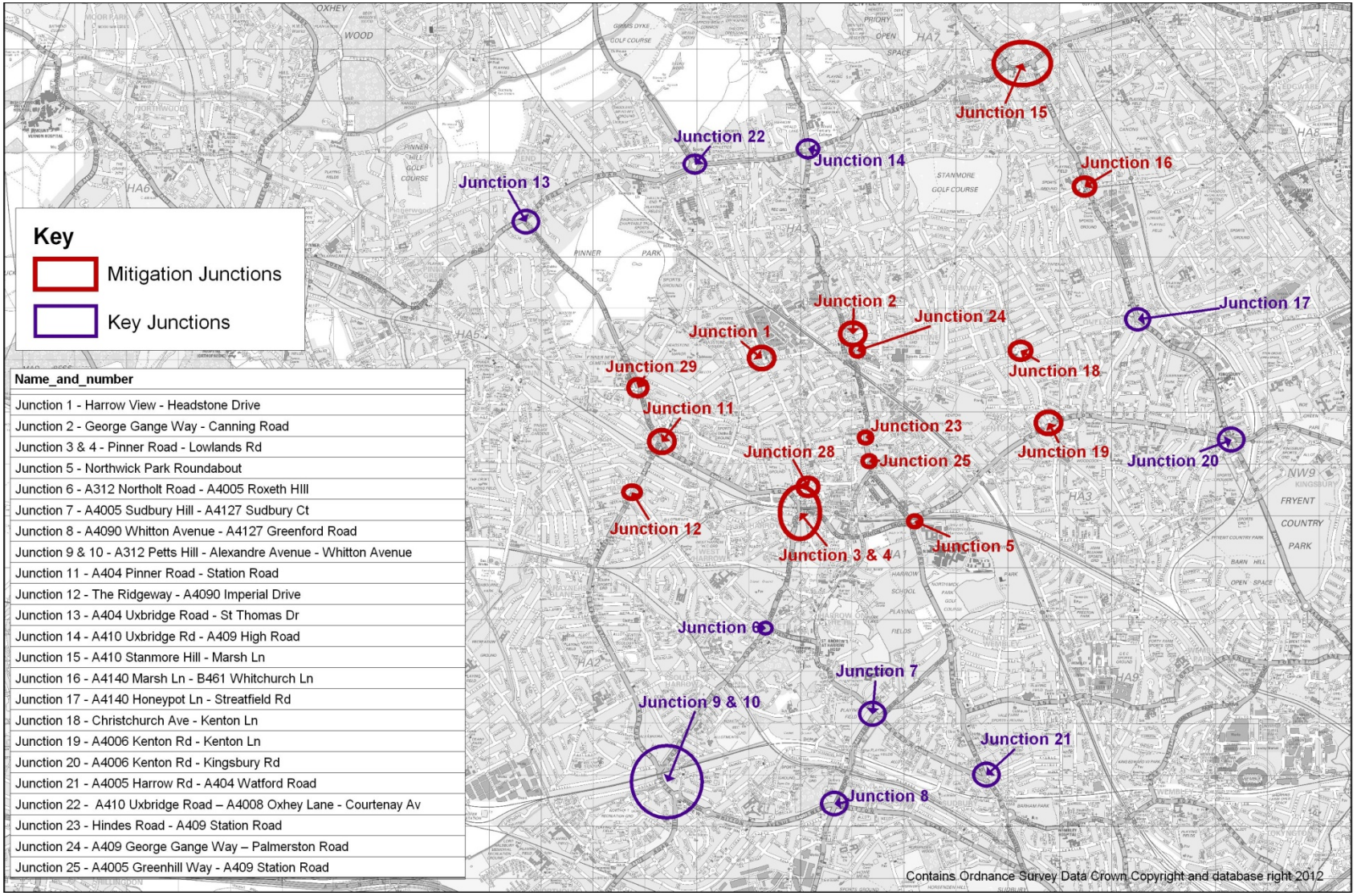
5.4.2 Table 5 below lists all highway improvement schemes along with the details of the key changes. The location of these proposed mitigations is shown geographically in Figure 8.

Table 5: Highway Mitigation Measures for the Key Junction

ID	Junction	Traffic Aspirations including future schemes
1	Harrow View / Headstone Drive	Developer funding for improvements to the junction, additional short lanes on all four arms or possible roundabout
2	George Gange Way / Canning Road	1. At anytime waiting restrictions implemented to north of the junction to remove delays caused by kerbside loading 2. Improvements to be implemented in service road to enable rear access 3. SCOOT optimisation of High Street junctions
3 & 4	Pinner Road / Lowlands Road	Removal of bus lane and the creation of a right turn for buses only into College Road (give way junction) Enabling of two way buses on College Road
5	Northwick Park Roundabout	Signalising of the roundabout
6	A312 Northolt Road / A4005 Roxeth Hill	Removal of traffic lights at Roxeth Hill / Northolt Road / Shaftesbury Avenue to potentially be replaced by a double mini roundabout.
11	A404 Pinner Road / A4090 Station Road	Removal of the off road cycle lane on the western arm and the widening of the carriageway to increase the left turn filter to be 12 car lengths Road widening to create a left turn only lane on the southern arm for an additional 5 car lengths Review of the signals

ID	Junction	Traffic Aspirations including future schemes
12	The Ridgeway / A4090 Imperial Drive	Major junction widening to incorporate additional short lane in the north and southbound arms
15	A410 Stanmore Hill / Marsh Lane	1. Creation of a left turn lane of 5 car lengths along the western arm signals at the Stanmore Hill / Uxbridge Road Junction 2. Upgrading the signals to SCOOT and re-prioritising Marsh Lane / Uxbridge Road junction 3. Road widening along London Road to implement a third traffic lane travelling east
16	A4140 Marsh Lane / B461 Whitchurch Lane	Road widening on the western arm to create a left turn filter for 5 lengths. Road widening on the northern arm to create a left turn filter for 3 car lengths. Creation of a left turn filter lane for 5 car lengths on the eastern arm. Road widening on the southern arm to create a left turn filter for 4 car lengths.
18	Christchurch Avenue / Kenton Lane	Potential widening of the Eastern arms and re-signalling
19	A4006 Kenton Road / Kenton Lane	The introduction of a left turn lane at Kenton Road towards Kingsbury
23	Hindes Road / A409 Station Road	Potential changes to the Station Road / Hindes Road Junction with the removal of the bus gate and associated secondary stop line and signals (LIP 2013/14 and developer funding)
24	A409 George Gange Way / Palmerston Road	1.Widening of the overpass to create a second lane for 10 car lengths. 2. Improvements to signage and road markings, in the vicinity, to improve the flow of the traffic. 3. Relocation of the signalled pedestrian crossing or its conversion to a zebra. 4. Signalising junction and removal of independent pedestrian crossing
25	A4005 Greenhill Way / A409 Station Road	1. Change from 1 left 2 right to 2 lefts 1 rights 2. Carriageway widening in the western arm to provide an additional right turn lane

Figure 8: Location of proposed mitigation measures



Name_and_number
Junction 1 - Harrow View - Headstone Drive
Junction 2 - George Gange Way - Canning Road
Junction 3 & 4 - Pinner Road - Lowlands Rd
Junction 5 - Northwick Park Roundabout
Junction 6 - A312 Northolt Road - A4005 Roxeth Hill
Junction 7 - A4005 Sudbury Hill - A4127 Sudbury Ct
Junction 8 - A4090 Whitton Avenue - A4127 Greenford Road
Junction 9 & 10 - A312 Petts Hill - Alexandre Avenue - Whitton Avenue
Junction 11 - A404 Pinner Road - Station Road
Junction 12 - The Ridgeway - A4090 Imperial Drive
Junction 13 - A404 Uxbridge Road - St Thomas Dr
Junction 14 - A410 Uxbridge Rd - A409 High Road
Junction 15 - A410 Stanmore Hill - Marsh Ln
Junction 16 - A4140 Marsh Ln - B461 Whitchurch Ln
Junction 17 - A4140 Honeypot Ln - Streatfield Rd
Junction 18 - Christchurch Ave - Kenton Ln
Junction 19 - A4006 Kenton Rd - Kenton Ln
Junction 20 - A4006 Kenton Rd - Kingsbury Rd
Junction 21 - A4005 Harrow Rd - A404 Watford Road
Junction 22 - A410 Uxbridge Road – A4008 Oxhey Lane - Courtenay Av
Junction 23 - Hindes Road - A409 Station Road
Junction 24 - A409 George Gange Way – Palmerston Road
Junction 25 - A4005 Greenhill Way - A409 Station Road

6 Future Year Network Assessment

6.1 Evaluation Methodology

6.1.1 To assess the likely impact of AAP development proposals, firstly it is important to understand the state of highway network without the AAP developments. The AAP proposals are deemed to have a negative impact only if the cumulative impact is a worsening of traffic congestion.

6.1.2 The following comparisons have been carried out to evaluate the effects of background traffic growth (from 2009 to 2021) and the traffic impact of AAP development proposals:

- Assessment of background traffic growth: Base year vs. 2021 Base Minus.
- ***Assessment of AAP development traffic impact:*** 2021 With AAP Scenario vs. 2021 Base Minus (without AAP developments).
- ***Assessment of Mitigated Measures against Base Minus:*** 2021 AAP with mitigation Measures vs. 2021 Base Minus (without AAP developments).

6.1.3 The first comparison brings out the impact of background growth without any AAP developments. The second comparison highlights the impact of the AAP development proposals against an equivalent "without development" scenario described above as Base Minus. The third comparison highlights the impact of mitigation measures against the theoretical Base Minus scenarios and also a relative performance against the non-mitigated AAP development scenario.

6.1.4 The comparative analysis of these different model runs has focused on increasing levels of congestion on the approaching arms quantified by the following three different thresholds of traffic volume to capacity ratios (V/C):

- It is desirable to keep the capacity utilisation below 80%, as above this threshold the delay starts to increase exponentially.
- In case of key traffic junctions where traffic volumes are significantly higher than usual, it may be "acceptable" to have capacity utilisation under 90%.
- Anything above the 90% threshold is not desirable or acceptable. Mitigation measures should be identified if the junction or link capacity utilisation crosses this threshold.

6.1.5 In view of the above capacity utilisation thresholds, to compare the impact of the background growth and AAP proposals, for each modelled scenario, each approaching arm of the key junctions identified in Section 3 was categorised in 6 progressive levels of capacity utilisations giving them a capacity utilisation or ***"Saturation Score"*** between 1 and 6 such that:

Score 1: 0 – 80%
Score 2: 80 – 85%
Score 3: 85 – 90%
Score 4: 90 – 95%
Score 5: 95 – 100%
Score 6: over 100%

6.1.6 The sum of "Saturation Score" for all the approach arms of the junction gives a "***Cumulative Saturation Score"*** for each junction. The "*average capacity utilisation*" was thus calculated using the Cumulative Score divided by number of arms. Like the link flow saturation, junctions were thus classified according to the following threshold levels:

- ***Green "Satisfactory":*** between 0-80% V/C
- ***Blue "Over Desirable Capacity"*** : between 80% - 85% V/C
- ***Yellow "Approaching Acceptable Capacity"*** : between 85% - 90% V/C
- ***Amber "Over Acceptable Capacity":*** between 90% - 95% V/C
- ***Red "Approaching Capacity Limit"***: over 95% V/C.
- ***Black "Over Capacity"*** over 100% V/C

6.1.7 The above classification is essentially derived from the Cumulative Junction Scores which were categorised into the above thresholds. A detailed classification along with a breakdown of results from different modelled scenarios is presented in Appendix B.

Section 6.2 and 6.3 below describe all the junctions which have been identified as having capacity issues from the analysis of the Background Growth and AAP development traffic growth comparisons described above.

6.1.8 Table 6 and Table 7 show the list of key junction and their level of service defined as highest volume-to-capacity (V/C) ratio for any inbound arm on the junction, for all three scenarios – Base, Base Minus and AAP Scenario. Junctions with at least one inbound link having a V/C over 90% is shown in red or purple box.

6.2 Background Traffic Growth - Results Summary

6.2.1 A comparison of the 2021 Base Minus against the Base Year model results show that the following junctions will already be experiencing higher level of congestion:

In morning (AM) peak:

- Junction 4: A312 Bessborough Rd - A404 Lowlands Rd
- Junction 7: A4005 Sudbury Hill - A4127 Sudbury Ct
- Junction 13: A404 Uxbridge Road - St Thomas Dr

In addition to the above, in the evening (PM) peak at:

- Junction 1: Harrow View Headstone Drive
- Junction 12: The Ridgeway - A4090 Imperial Drive
- Junction 21: A4005 Harrow Road – A404 Watford Road

6.2.2 In addition, due to reduction in traffic, the following junctions will also experience a reduction in congestion in the morning peak:

- Junction 17: A4140 Honeypot Lane - Streatfield Rd
- Junction 23: Hindes Road – A409 Station Road

6.2.3 Table 6 below summarises the changes at the each junction based on the colour grading defined above. A detailed breakdown of junction level-of-service (V/C) on each arm of the key

junctions is given below in Appendix B. These tables show all junctions where there has been a substantial change in inbound arm link saturation.

6.2.4 As such, this analysis shows that in 2021 a number of junctions are already likely to be either "over acceptable capacity" or "over-capacity" resulting in queues and severe delays at these junctions.

6.2.5 Figure 9 and Figure 10 below show the AM and PM peak base year link V/C and junction delay results. Figure 11 and Figure 12 below show the AM and PM peak 2021 Base Minus link V/C and junction delay results.

Table 6: Changes to junction performance with background growth in 2021 Base Minus scenario

ID	Junction	AM Peak		PM Peak	
		Base	Base Minus	Base	Base Minus
1	Harrow View Headstone Drive	Blue	Blue	Blue	Green
2	George Gange Way- Canning Road	Green	Green	Green	Green
3	Pinner Road -Lowlands Rd	Amber	Amber	Green	Green
4	A312 Bessborough Rd - A404 Lowlands Rd	Orange	Red	Black	Black
5	Northwick Park Roundabout	Red	Red	Red	Red
6	A312 Northolt Road - A4005 Roxeth Hill	Blue	Blue	Blue	Blue
7	A4005 Sudbury Hill - A4127 Sudbury Ct	Amber	Orange	Amber	Orange
8	A4090 Whitton Avenue - A4127 Greenford Road	Orange	Orange	Red	Red
9	A312 Petts Hill - A4090 Whitton Av	Blue	Blue	Blue	Blue
10	A312 Petts Hill - A4090 Alexandra Av	Green	Green	Green	Green
11	A404 Pinner Road - A4090 Station Road	Amber	Amber	Blue	Blue
12	The Ridgeway - A4090 Imperial Drive	Amber	Amber	Orange	Red
13	A404 Uxbridge Road - St Thomas Dr	Green	Blue	Green	Green
14	A410 Uxbridge Rd - Headstone Ln	Blue	Blue	Blue	Blue
15	A410 Stanmore Hill - Marsh Ln	Amber	Amber	Amber	Amber
16	A4140 Marsh Ln - B461 Whitchurch Ln	Orange	Orange	Red	Red
17	A4140 Honeypot Ln - Streatfield Rd	Red	Orange	Amber	Amber
18	Christchurch Ave - Kenton Ln	Amber	Amber	Red	Red
19	A4006 Kenton Rd - Kenton Ln	Red	Red	Red	Red
20	A4006 Kenton Rd - Kingsbury Rd	Orange	Orange	Orange	Orange
21	A4005 Harrow Road – A404 Watford Road	Orange	Orange	Green	Blue
22	A410 Uxbridge Road – A4008 Oxhey Lane	Blue	Blue	Amber	Amber
23	Hindes Road – A409 Station Road	Orange	Amber	Blue	Blue
24	A409 George Gange Way – Palmerston Road	Blue	Blue	Green	Green
25	A4005 Greenhill Way – A409 Station Road	Blue	Blue	Green	Green

Figure 9: Link V/C and Junction Delay results – AM Base Year Scenario

Figure 10: Link V/C and Junction Delay results – PM Base Year Scenario

Figure 11: Link V/C and Junction Delay results – 2021 AM Base Minus Scenario

Figure 12: Link V/C and Junction Delay results – 2021 PM Base Minus Scenario

6.3 AAP Traffic Growth - Results Summary

6.3.1 The 2021 AAP scenario was then compared against the Base Minus scenario. As discussed above, the AAP scenario model includes additional trip generation from the AAP developments. These additional trips were assigned using the WeLHAM 2021 AAP scenario and the assignment results were compared to the "without development" Base Minus scenario.

6.3.2 The following junctions were identified as experiencing a further increase in level of traffic congestion in either AM or PM peak when compared to the Base Minus scenario:

- Junction 1: Harrow View Headstone Drive
- Junction 7: A4005 Sudbury Hill - A4127 Sudbury Ct
- Junction 11: A404 Pinner Road - A4090 Station Road
- Junction 21: A4005 Harrow Road – A404 Watford Road
- Junction 22: A410 Uxbridge Road – A4008 Oxhey Lane-Courtenay Av
- Junction 23: Hindes Road – A409 Station Road
- Junction 25: A4005 Greenhill Way – A409 Station Road.

6.3.3 It should be noted that some of the junctions appear in both the list of junctions showing an increase in congestion due to AAP development and background traffic growth. This is because analysis of the model results indicates that the operational performance of these junctions, which have already decreased due to background traffic, will deteriorate further due to AAP development growth.

6.3.4 Table 7 below summarises the level of service (V/C) at all the key junctions. Figure 13 and Figure 14 show the AM and PM peak 2021 AAP Development Scenario link V/C and junction delay results.

Mitigation Measures

6.3.5 The above analysis was used to identify key parts of the highway network which need mitigation against increased traffic levels. The following are the key stress points identified in the core study area

- ***A4006-A404 EW corridor*** – The main area impacted by the AAP traffic is the A4006-A404 east-west corridor along Kenton Road, Lowlands Road and Pinner Road. All the key junctions on this corridor are showing significant delay (PCU-hrs) at the junctions and the incoming arms are showing high V/C saturation levels.
- Station Road - Hindes Road junction near Greenhill
- Harrow View/Headstone Road coming into Greenhill Way
- Some junctions around Station Road near North Harrow are also being affected. This includes junction with
  a. Station Road - Pinner Road
  b. Headstone Ln – George V Ave junction
  c. increased traffic on Kingsfield Ave / Cunningham Park roads going into Harrow view
- North of the Kodak site, there is indication of re-routing happening around Courtenay Ave and Uxbridge Road, with traffic likely to be rerouting towards Headstone Lane.

6.3.6 It is suggested that the focus of the mitigation has to be on some selected junctions north of Kodak site which is showing some re-routing and the A4006-A404 corridor. Diversifying and re-routeing traffic around the key development area may also be helpful.

Table 7: Changes to junction performance in 2021 AAP Development Scenario

ID	Junction	AM Peak		PM Peak	
		Base Minus	2021 AAP	Base Minus	2021 AAP
1	Harrow View Headstone Drive	Blue	Blue	Green	Blue
2	George Gange Way- Canning Road	Green	Green	Green	Green
3	Pinner Road -Lowlands Rd	Amber	Amber	Green	Green
4	A312 Bessborough Rd - A404 Lowlands Rd	Red	Red	Black	Black
5	Northwick Park Roundabout	Red	Red	Red	Red
6	A312 Northolt Road - A4005 Roxeth Hill	Blue	Blue	Blue	Blue
7	A4005 Sudbury Hill - A4127 Sudbury Ct	Orange	Orange	Orange	Red
8	A4090 Whitton Avenue - A4127 Greenford Road	Orange	Orange	Red	Red
9	A312 Petts Hill - A4090 Whilton Av	Blue	Blue	Blue	Blue
10	A312 Petts Hill - A4090 Alexandra Av	Green	Green	Green	Green
11	A404 Pinner Road - A4090 Station Road	Amber	Amber	Blue	Amber
12	The Ridgeway - A4090 Imperial Drive	Amber	Amber	Red	Red
13	A404 Uxbridge Road - St Thomas Dr	Blue	Blue	Green	Green
14	A410 Uxbridge Rd - Headstone Ln	Blue	Blue	Blue	Amber
15	A410 Stanmore Hill - Marsh Ln	Amber	Amber	Amber	Amber
16	A4140 Marsh Ln - B461 Whitchurch Ln	Orange	Orange	Red	Red
17	A4140 Honeypot Ln - Streatfield Rd	Orange	Orange	Amber	Amber
18	Christchurch Ave - Kenton Ln	Amber	Amber	Red	Red
19	A4006 Kenton Rd - Kenton Ln	Red	Red	Red	Red
20	A4006 Kenton Rd - Kingsbury Rd	Orange	Orange	Orange	Orange
21	A4005 Harrow Road – A404 Watford Road	Orange	Red	Blue	Blue
22	A410 Uxbridge Road – A4008 Oxhey Lane	Blue	Blue	Amber	Orange
23	Hindes Road – A409 Station Road	Amber	Orange	Blue	Blue
24	A409 George Gange Way – Palmerston Road	Blue	Blue	Green	Green
25	A4005 Greenhill Way – A409 Station Road	Blue	Blue	Green	Blue

Figure 13: Link V/C and Junction Delay results – 2021 AM Scenario

Figure 14: Link V/C and Junction Delay results – 2021 PM Scenario

6.4 Comparison of Mitigation Scenario

6.4.1 The analysis presented in Section 6.3 above was used to identify key mitigation measures as presented in Section 5.4

6.4.2 The ***"With mitigation"*** scenario was compared against the 2021 AAP scenario.

6.4.3 Of the junctions identified for mitigation measures as show above in Table 5, the following junctions showed significant improvements:

- Junction 11: A404 Pinner Road - A4090 Station Road
- Junction 15: A410 Stanmore Hill - Marsh Lane
- Junction 16: A4140 Marsh Lane - B461 Whitchurch Lane
- Junction 23: Hindes Road – A409 Station Road.

6.4.4 However there are couple of junction where the performance further deteriorated even with the mitigation measures, these include:

- Junction 1: Harrow View Headstone Drive
- Junction 4: A312 Bessborough Rd - A404 Lowlands Rd
- Junction 18: Christchurch Ave - Kenton Lane

6.4.5 The other junctions did not show any significant increase in the level of service.

6.4.6 It should be noted that the mitigation measures were aimed to improve the capacity at various junctions and hence increased the overall throughput in the network. Therefore the improvement in the junction performance should be viewed in comparison with the increase in the level of traffic through the junctions.

6.4.7 Table 8 below summarises the level of service (V/C) at all the key junctions. Figure 15 and Figure 16 show the AM and PM peak 2021 AAP Development Scenario link V/C and junction delay results.

6.4.8 A detailed comparison of the junction performance and overall network performance results are presented in Section 7 below.

Table 8: Changes to junction performance in 2021 AAP "with mitigation" Scenario

ID	Junction	AM Peak			PM Peak		
		Base Minus	2021 AAP	2021 AAP Mitigation	Base Minus	2021 AAP	2021 AAP Mitigation
1	Harrow View Headstone Drive	Blue	Blue	Amber	Green	Blue	Blue
2	George Gange Way- Canning Road	Green	Green	Green	Green	Green	Green
3	Pinner Road -Lowlands Rd	Amber	Amber	Amber	Green	Green	Green
4	A312 Bessborough Rd - A404 Lowlands Rd	Red	Red	Black	Black	Black	Black
5	Northwick Park Roundabout	Red	Red	Red	Red	Red	Red
6	A312 Northolt Road - A4005 Roxeth Hill	Blue	Blue	Blue	Blue	Blue	Blue
7	A4005 Sudbury Hill - A4127 Sudbury Ct	Orange	Orange	Orange	Orange	Red	Orange
8	A4090 Whitton Avenue - A4127 Greenford Road	Orange	Orange	Orange	Red	Red	Red
9	A312 Petts Hill - A4090 Whilton Av	Blue	Blue	Blue	Blue	Blue	Blue
10	A312 Petts Hill - A4090 Alexandra Av	Green	Green	Green	Green	Green	Green
11	A404 Pinner Road - A4090 Station Road	Amber	Amber	Blue	Blue	Amber	Orange
12	The Ridgeway - A4090 Imperial Drive	Amber	Amber	Amber	Red	Red	Amber
13	A404 Uxbridge Road - St Thomas Dr	Blue	Blue	Blue	Green	Green	Green
14	A410 Uxbridge Rd - Headstone Ln	Blue	Blue	Amber	Blue	Amber	Orange
15	A410 Stanmore Hill - Marsh Ln	Amber	Amber	Blue	Amber	Amber	Blue
16	A4140 Marsh Ln - B461 Whitchurch Ln	Orange	Orange	Blue	Red	Red	Blue
17	A4140 Honeypot Ln - Streatfield Rd	Orange	Orange	Orange	Amber	Amber	Amber
18	Christchurch Ave - Kenton Ln	Amber	Amber	Orange	Red	Red	Red
19	A4006 Kenton Rd - Kenton Ln	Red	Red	Red	Red	Red	Red
20	A4006 Kenton Rd - Kingsbury Rd	Orange	Orange	Red	Orange	Orange	Orange
21	A4005 Harrow Road – A404 Watford Road	Orange	Red	Red	Blue	Blue	Blue
22	A410 Uxbridge Road – A4008 Oxhey Lane	Blue	Blue	Blue	Amber	Orange	Orange
23	Hindes Road – A409 Station Road	Amber	Orange	Blue	Blue	Blue	Blue
24	A409 George Gange Way – Palmerston Road	Blue	Blue	Blue	Green	Green	Green
25	A4005 Greenhill Way – A409 Station Road	Blue	Blue	Blue	Green	Blue	Blue

Figure 15: Link V/C and Junction Delay results – 2021 AM "with mitigation" Scenario

Figure 16: Link V/C and Junction Delay results – 2021 PM "with mitigation" Scenario

7 Scenario Comparison

7.1 Network analysis

7.1.1 The highway network performance was evaluated at the link and junction levels. The approach arms of each key junction were evaluated for congestion through a Saturation Scoring system as described above. In addition, the performance of each junction in the model itself was evaluated for key performance indicators.

7.1.2 Table 9 and Table 10 below show the total delay at the junction in pcu-hrs for AM and PM peaks respectively.

Table 9: Total delay at Junction in PCU-Hrs in AM Peak

ID	Junction	AM Peak			
		Base	Base Minus	2021 AAP	2021 AAP Mitigation
1	Harrow View Headstone Drive	61	55	61	64
2	George Gange Way- Canning Road	2	2	2	1
3	Pinner Road -Lowlands Rd	11	13	12	11
4	A312 Bessborough Rd - A404 Lowlands Rd	26	32	34	36
5	Northwick Park Roundabout	66	73	104	69
6	A312 Northolt Road - A4005 Roxeth Hill	11	11	11	7
7	A4005 Sudbury Hill - A4127 Sudbury Ct	30	36	38	37
8	A4090 Whitton Avenue - A4127 Greenford Road	104	104	105	104
9	A312 Petts Hill - A4090 Whilton Av	4	5	5	5
10	A312 Petts Hill - A4090 Alexandra Av	19	20	19	26
11	A404 Pinner Road - A4090 Station Road	79	74	85	75
12	The Ridgeway - A4090 Imperial Drive	105	112	125	116
13	A404 Uxbridge Road - St Thomas Dr	5	6	8	8
14	A410 Uxbridge Rd - Headstone Ln	9	13	14	22
15	A410 Stanmore Hill - Marsh Ln	43	46	51	35
16	A4140 Marsh Ln - B461 Whitchurch Ln	75	80	85	64
17	A4140 Honeypot Ln - Streatfield Rd	17	11	7	13
18	Christchurch Ave - Kenton Ln	37	34	45	51
19	A4006 Kenton Rd - Kenton Ln	72	97	105	85
20	A4006 Kenton Rd - Kingsbury Rd	37	34	41	48
21	A4005 Harrow Road – A404 Watford Road	18	17	21	25
22	A410 Uxbridge Road – A4008 Oxhey Lane	13	13	13	13
23	Hindes Road – A409 Station Road	64	44	62	51
24	A409 George Gange Way – Palmerston Road	6	6	7	24
25	A4005 Greenhill Way – A409 Station Road	20	19	21	16

Table 10: Total delay at Junction in PCU-Hrs in PM Peak

ID	Junction	AM Peak			
		Base	Base Minus	2021 AAP	2021 AAP Mitigation
1	Harrow View Headstone Drive	62	60	68	68
2	George Gange Way- Canning Road	1	1	1	1
3	Pinner Road -Lowlands Rd	5	5	5	6
4	A312 Bessborough Rd - A404 Lowlands Rd	43	50	66	76
5	Northwick Park Roundabout	185	165	181	105
6	A312 Northolt Road - A4005 Roxeth Hill	19	20	22	9
7	A4005 Sudbury Hill - A4127 Sudbury Ct	42	58	70	47
8	A4090 Whitton Avenue - A4127 Greenford Road	97	96	97	96
9	A312 Petts Hill - A4090 Whilton Av	5	6	5	6
10	A312 Petts Hill - A4090 Alexandra Av	27	27	33	40
11	A404 Pinner Road - A4090 Station Road	62	61	71	103
12	The Ridgeway - A4090 Imperial Drive	135	153	170	98
13	A404 Uxbridge Road - St Thomas Dr	4	5	6	5
14	A410 Uxbridge Rd - Headstone Ln	12	15	25	31
15	A410 Stanmore Hill - Marsh Ln	29	30	29	26
16	A4140 Marsh Ln - B461 Whitchurch Ln	65	68	70	56
17	A4140 Honeypot Ln - Streatfield Rd	4	4	4	5
18	Christchurch Ave - Kenton Ln	68	69	78	73
19	A4006 Kenton Rd - Kenton Ln	67	67	78	67
20	A4006 Kenton Rd - Kingsbury Rd	79	81	81	95
21	A4005 Harrow Road – A404 Watford Road	6	8	8	8
22	A410 Uxbridge Road – A4008 Oxhey Lane	18	19	23	30
23	Hindes Road – A409 Station Road	17	19	21	23
24	A409 George Gange Way – Palmerston Road	6	6	7	20
25	A4005 Greenhill Way – A409 Station Road	16	16	19	18

7.1.3 The above analysis highlights that the following junction have high overall level of delay even after mitigation measures have been introduced:

- Junction 5: Northwick Park Roundabout
- Junction 8: A4090 Whitton Avenue - A4127 Greenford Road
- Junction 11: A404 Pinner Road - A4090 Station Road
- Junction 12: The Ridgeway - A4090 Imperial Drive.

7.1.4 The above junction performance should be viewed in comparison with the increased in flow levels. Detailed results with total overall flow at the junction and detailed model outputs for each scenario are presented in Appendix B.

Overall Traffic Impact on Junction

7.1.5 The overall impact of traffic on the key junctions in various scenarios is summarised below. This summary is based on link (approach arms) and junction (node) results from the highway models.

7.1.6 Table 11 below summarises the traffic impact on each junction due to background growth and the additional impact of the AAP proposals. It also summarises the impact mitigation measures have on each junction and finally compare the Mitigation Scenario against the existing situation to bring out the scale of changes between now and the proposed plan.

7.1.7 The table categorises each junction with a “negative” or a “positive” impact with each incremental scenario. This comparison is based on either the link or junction performance level changing between the two scenarios as discussed in the previous section.

7.1.8 If the junction is getting further congested in either AM or PM scenario it has been marked for a negative impact or conversely for a positive impact if the congestion decreases. Additional details have been provided with regards to where this congestion is developing.

7.1.9 The overall comparison aims to compare the scale of change between now and after implementation of AAP proposals along with proposed highway impact mitigations. It should be noted that 2021 scenario includes a number of background assumptions derived from the list of proposals accepted by GLA. Even if AAP proposals don’t go ahead, the background growth is likely to increase the level of congestion which is summarised in the first column.

Table 11: Summary of traffic impact in each forecast scenarios

ID	Junction	Background Growth Impact (2021 Base Minus vs. Base Year)	AAP Development Impact (2021 AAP vs. Base Minus)	Mitigation Impact (2021 Mitigation vs. AAP 2021)	Overall AAP Impact (Mitigation 2021 vs. Base)	Remarks
1	Harrow View Headstone Drive	Positive Impact	Negative Impact	Negative Impact	Negative Impact	Junction is already congested in the AM peak base year with V/C ratios >95% on Headstone Gardens (EB). Although it marginally reduces in the Base Minus scenario, in the AAP scenario congestion along Harrow View SB increases from 72% to 83% in the AM and on Headstone Drive WB from 78% to 80% in the PM. The Mitigation measure shows over the entire junction slightly get worse during the PM. Along Headstone Gardens (EB) the V/C ratio increase from 80% to 96% in the PM. Along Headstone Drive (WB) has improved in both AM and PM.
2	George Gange Way-Canning Road					No particular impact
3	Pinner Road -Lowlands Rd					The Junction is congested In the PM AAP development scenario. Pinner Road EB increases from the (base) 96% to 98% with the mitigation measures decrease by approximately 3% (from 98% to 95% V/C).
4	A312 Bessborough Rd - A404 Lowlands Rd	Negative Impact	Negative Impact	Negative Impact	Negative Impact	Junction is already congested in the AM and PM peak base year with V/C ratios >100% on A312 Bessborough Rd (NB) in the AM and PM as well as A404 Junction Rd (SB) V/C >101 in PM and 94% in the AM. In the Base Minus the junction get more congested, in the AAP scenario congestion along A404 Lowlands Road WB increases from 101% to 102% in the PM and decrease from 92% to 87% in the AM. The Mitigation measure shows overall the junction slightly gets worse during the AM. Under the mitigation measure it shows along A404 Lowlands Road (WB) with V/C ratio has increased from 87% to 96% in AM

ID	Junction	Background Growth Impact (2021 Base Minus vs. Base Year)	AAP Development Impact (2021 AAP vs. Base Minus)	Mitigation Impact (2021 Mitigation vs. AAP 2021)	Overall AAP Impact (Mitigation 2021 vs. Base)	Remarks
5	Northwick Park Roundabout		Negative Impact	Positive Impact		Junction is already congested in the AM and PM peak base year with V/C ratios >100%. In the AAP scenario there is an increase in congestion on A409 Watford Rd (NB) from 103% V/C to 107% in AM peak and Kenton Rd EB from 103% V/C to 105% V/C in PM peak. Significant congestion on A404 Kenton Rd EB in the AM peak due to background traffic from 94% to 97%. Under the mitigation measure this Roundabout was signalised and the congestion level has decreased significantly during the AM and PM with the junction delay in PCU Hr has decreased from 104 to 69 (-33%) in the AM and from 181 to 105 (42%) compare to AAP without mitigation. The congestion level has decreased significantly on A4006 Kenton Rd (WB) with V/C ratios % from 102% to 87% and A409 Watford Road (NB) with V/C ratios from 107% to 101% in the AM. In the PM peak the level of congestion has dropped down Along A4006 Kenton Rd (WB) with V/C ratios from 101% to 79% , A409 Watford Road (NB) with V/C ratios from 107% to 101% and A404 Kenton Rd (EB) with V/C ratios from 105% to 99%.
6	A312 Northolt Road - A4005 Roxeth Hill					The model does show a slight increase in congestion on Lower Rd SB from V/C 84% to 86% due to background traffic. Congestion levels do not increase significantly in AAP scenario. Under the mitigation measures the level of congestion on some approaches has improved.
7	A4005 Sudbury Hill - A4127 Sudbury Ct	Negative Impact	Negative Impact			Junction is congested in the AM (V/C 94%) and 99% in the PM peak base year with V/C ratios >100%. In AAP scenario, A4009 Sudbury Hill SB approach goes from 76% to >90% V/C in the PM. The A4127 Greenford Road also remains over capacity in all modelled scenarios. However under the mitigation scenario the junction operate slightly better during the PM Peak

ID	Junction	Background Growth Impact (2021 Base Minus vs. Base Year)	AAP Development Impact (2021 AAP vs. Base Minus)	Mitigation Impact (2021 Mitigation vs. AAP 2021)	Overall AAP Impact (Mitigation 2021 vs. Base)	Remarks
8	A4090 Whitton Avenue - A4127 Greenford Road					The junction is congested in the AM and PM Base. There is an increase in V/C, on A4090 Whitton Avenue West EB, from 84% to 86 % in the AM peak, also on A4127 Greenford Rd (NB) an increase from 87% to 90% in the PM, due to background traffic growth. In the AAP scenario and the mitigation measure the level of congestion similar to the Background growth.
9	A312 Petts Hill - A4090 Whilton Av					In PM peak AAP scenario, A312 Petts Hill EB link V/C ratio increases from 85% to 88% V/C. No significant changes during the mitigation
10	A312 Petts Hill - A4090 Alexandra Av					No particular impact
11	A404 Pinner Road - A4090 Station Road		Negative Impact	Negative Impact	Negative Impact	In AAP scenario V/C values increase from <80% to 84% during PM peak on A404 Pinner Road (WB), AA404 Pinner Road EB from 82% to 86%. The mitigation measures decrease congestion on A404 Pinner Road (EB) from 102% to 71% during AM peak period. However during the PM mitigation scenario most of the approaches the link V/C ratio show an increase particularly on Station Road (NB) from 89% to 102% while A404 Pinner Road (EB) show a decrease from 86% to 59% . Overall PCU-hr delay increases in PM peak with mitigations.

ID	Junction	Background Growth Impact (2021 Base Minus vs. Base Year)	AAP Development Impact (2021 AAP vs. Base Minus)	Mitigation Impact (2021 Mitigation vs. AAP 2021)	Overall AAP Impact (Mitigation 2021 vs. Base)	Remarks
12	The Ridgeway - A4090 Imperial Drive	Negative Impact	Negative Impact	Positive Impact		Junction is already congested in the AM and PM peak base year with high junction delay and link saturation >100%. In the Base Minus the junction get more congested, A4090 Imperial Drive (SB) link V/C increases from 86% to 91% during the AM peak and The Ridgeway (WB) link V/C increases from 77% to 86% during the PM peak. In AAP scenario the junction gets more congested along The Ridgeway WB link V/C increases from72% to 81% in the AM and an congestion increase from 86% to 92% in the PM peak. With major junction widening to incorporate additional short lane in the northbound and southbound, the junction has improved during the AM and PM peak with Link V/C ratio has decreased along A4090 Imperial Drive (SB) from>90% to <84% and A4090 Imperial Drive (NB) from>108% to 101% during the AM peak. PM peak under mitigation scenario there was also significant decrease with Link V/C ratio on A4090 Imperial Drive (SB) from>103% to <80% , A4090 Imperial Drive (NB) from>108% to <74% and along The Ridgeway WB from 92% to 86%. The mitigation scenario indicates that the Junction delay (PCU Hr) has also decreased significantly from 125 to 116 (-7%) in the AM and 170 to 98 (-42%)during PM peak.
13	A404 Uxbridge Road - St Thomas Dr	Negative Impact			Negative Impact	The base year model is relatively under-saturated with link V/C ratio <80% band however in the AM peak AAP scenario A404 Uxbridge road EB approach increases from 80 to 92% .

ID	Junction	Background Growth Impact (2021 Base Minus vs. Base Year)	AAP Development Impact (2021 AAP vs. Base Minus)	Mitigation Impact (2021 Mitigation vs. AAP 2021)	Overall AAP Impact (Mitigation 2021 vs. Base)	Remarks
14	A410 Uxbridge Rd - High Road		Negative Impact	Negative Impact	Negative Impact	Along A410 Uxbridge Road EB the link V/C ratio for both AM and PM peak in the base scenario was 90% and 94% respectively. However conditions do slightly deteriorate during the PM in the future year scenario. After the mitigation measure it shows that the junction slightly deteriorates during both AM and PM period. The junction also get more congested on A410 Uxbridge Road EB with Link V/C ratio increase from 98% to 101 % in the AM peak and A409 High Road NB from 85% to 95% during the PM peak.
15	A410 Stanmore Hill - Marsh Lane			Positive Impact	Positive Impact	TrafficMaster data shows delays at this junction on A410 Church Rd EB, A410 London Road WB in the AM and PM peaks. The model also shows delays at the junction along these links in both the AM and PM base year as well as the 2021 future year models. However comparison of the future year model scenarios does indicate that traffic congestion will slightly increase at this junction due to either background or AAP traffic growth. With mitigation measures overall the junction has improved during both period. A410 Church Road(EB) improves significantly with the congestion level decreased from 105% to 86% in AM and from >92% to <79% in the PM peak. As well as on A410 London Rd (WB) the level of congestion has decreased from 97% to 90% during AM. PM peak shows both links A410 The Broadway (WB) and A4140 Marsh Lane (NB) V/C ratio has dropped from (84% to 79%) and from (90% to 85%) respectively.

ID	Junction	Background Growth Impact (2021 Base Minus vs. Base Year)	AAP Development Impact (2021 AAP vs. Base Minus)	Mitigation Impact (2021 Mitigation vs. AAP 2021)	Overall AAP Impact (Mitigation 2021 vs. Base)	Remarks
16	A4140 Marsh Lane - B461 Whitchurch Lane		Negative Impact	Positive Impact	Positive Impact	TrafficMaster data shows delays at this junction on Marsh Lane SB and on Honey Pot Lane NB in both the AM and PM peaks. In addition to this TrafficMaster data also shows some congestion along Whitchurch Lane WB in the PM peak. The model also shows delays at the junction on these links in the AM and PM base year as well as the 2021 future year models. Furthermore the model also shows congestion along Wemborough Road EB which is not included in the TrafficMaster data set. However comparison of the future year model scenarios does not indicate that traffic congestion will substantially increase at this junction due to either background or AAP traffic growth. Overall junction has improved significantly after road widening on the approach arms for western, northern and western arm and creation of a left turn filter on eastern arm. The junction delay (PCU Hr) has also decreased significantly by 24% in the AM from (85 to 64) and by 21% from (70 to 56) during the PM peak.
17	A4140 Honeypot Lane - Streatfield Rd					Junction is already congested in the AM and PM peak base year with V/C ratios >100%. The A4140 Honey Pot Lane NB approach is over capacity in the AM base, in the 2021 AM Base Minus it increase to over 126% V/C. No further substantial increase in delay is predicted at this junction due to AAP development traffic growth.

ID	Junction	Background Growth Impact (2021 Base Minus vs. Base Year)	AAP Development Impact (2021 AAP vs. Base Minus)	Mitigation Impact (2021 Mitigation vs. AAP 2021)	Overall AAP Impact (Mitigation 2021 vs. Base)	Remarks
18	Christchurch Ave - Kenton Lane			Negative Impact	Negative Impact	In the base year model there is a substantial amount of congestion in the both the AM and PM peaks at this junction, specifically on Kenton Lane both direction and Streatfield Road WB. Analysis of the model results does not indicate that there will be any substantial deterioration in the operation of this junction during base minus and AAP scenario. Under the mitigation scenario on Kenton Lane (SB) the level of congestion has increased as V/C ratio goes from 89% to 98% as well as an increase in V/C on Christchurch Ave EB from 79% to 93% during the AM peak.
19	A4006 Kenton Rd - Kenton Lane	Negative Impact	Negative Impact		Negative Impact	In the AM peak Woodcock Hill NB shows an increase in congestion due to background from 76% to 87% V/C and Kenton Road WB approach goes from 97% to >100%. The introduction of a left turn lane at Kenton Road towards Kingsbury has helped the junction to operate slightly better with the junction delay (PCU) Hr has decreased significantly by 19% from (105 to 85) during the AM peak and decreased by 13% from (78 to 63) during the PM peak. The junction also shows that the level of congestion has decreased on Kenton Lane SB during both period with V/C ratio decrease from over 102% to 97% in the AM and from 88% to 72% during PM period.
20	A4006 Kenton Rd - Kingsbury Rd	Negative Impact		Negative Impact	Negative Impact	In the AM peak Base Minus A4140 Fryent Way and The Mall NB go from 69% to >80% and from 85% to 97% due respectively due to background traffic. In the Mitigation Measures scenario congestion along A4140 Fryent Way (NB) increases from 84% to 88% , A4006 Kenton Road EB increases from 97% to 101% in the AM . In the PM A4140 Honeypot Lane (SB) the level of congestion has increased for the link V/C ratio from 95% to 99%. The Mitigation measure shows overall the junction slightly get worse during the AM comparing to AAP scenario.

ID	Junction	Background Growth Impact (2021 Base Minus vs. Base Year)	AAP Development Impact (2021 AAP vs. Base Minus)	Mitigation Impact (2021 Mitigation vs. AAP 2021)	Overall AAP Impact (Mitigation 2021 vs. Base)	Remarks
21	A4005 Harrow Road – A404 Watford Road	Negative Impact	Negative Impact		Negative Impact	In the PM peak Base Minus Harrow Rd A4005 EB approach goes from 74% V/C to >88% V/ due to background traffic growth. In the AM peak A4005 Harrow Road (EB) V/C ratio has increase from 95-100 band to >100 band due to AAP.
22	A410 Uxbridge Road – A4008 Oxhey Lane-Courtenay Av		Negative Impact		Negative Impact	This junction is more congested during the PM base. Link V/C in the PM peak goes from 80-85% band to >95% band on Courtenay Avenue approach due to AAP scenario. It should be noted that under the Mitigation scenario does not show any significant changes in congestion.
23	Hindes Road – A409 Station Road		Negative Impact			Analysis of the model results indicates that V/C will increase on Station Rd in the SB direction in the AM peak (88% to 90%) and the NB direction in the PM peak (88% to 90%), due to AAP development traffic. It should be noted Mitigation scenario indicates an improvement to the junction during the AM peak with V/C has decrease on Station Rd (NB) from 99% to 83% and on Hindes Rd (EB) from 80% to 71% .
24	A409 George Gange Way – Palmerston Road					Traffic congestion is predicted to increase on George Gange Way SB due to AAP development traffic in the AM peak (82% to 86% V/C). No further significant increase in V/C is predicted in the Mitigation scenario.
25	A4005 Greenhill Way – A409 Station Road		Negative Impact		Negative Impact	Analysis of the model results indicates that V/C will increase on Station Rd SB in the PM peak (76% to 84%), due to AAP development traffic.

7.2 Network Performance Results Summary

7.2.1 Table 12 to Table 16 below shows the summary of key network performance parameter statistics for the Harrow AAP study area. In line with the increase in traffic, there is a small decrease in average speeds in both peak periods between Base and Base Minus scenarios.

7.2.2 The AAP scenario decreases the network speed further which means that additional highway mitigation measures will be required to bring back the network performance to the existing levels. Analysis of the 2021 AAP Development Scenario results again indicate that the decrease in average speed will be approximately in line with the increase in demand.

7.2.3 The proposed mitigation measure show a slight improvement in overall network speed; however, it is lower than the existing traffic conditions which comes with a 6% increase in travel demand which is reflected in the increase total vehicle-kms driven in the network over current traffic level in the morning peak.

7.2.4 All the network performance metrics concur with the above analysis. In the end there is almost 7% increase in congestion, measured as the difference between 2021 Mitigation vs Base and 2021 Base Minus vs Base change in level of congestion in Table 15, which can be attributed directly to AAP proposals with the mitigation measures. Additional sensitivity tests on the highway network mitigations and signal optimisation can help to improve the performance.

Table 12: Average Network Speeds Summary (Km/h)

	Comparison Case	Test Scenario	Comparison	Test	Changes	%Change
AM	2009 Base Year	2021 Base Minus	23.83	23.59	-0.2	-1.0%
	2021 Base Minus	2021 Scenario	23.59	22.83	-0.8	-3.2%
	2021 Scenario	2021 Mitigation Scenario	22.83	23.18	0.3	1.5%
	2009 Base Year	2021 Mitigation Scenario	23.83	23.18	-0.7	-2.7%
PM	2009 Base Year	2021 Base Minus	23.88	23.65	-0.2	-0.9%
	2021 Base Minus	2021 Scenario	23.65	22.87	-0.8	-3.3%
	2021 Scenario	2021 Mitigation Scenario	22.87	23.18	0.3	1.4%
	2009 Base Year	2021 Mitigation Scenario	23.88	23.18	-0.7	-2.9%

Table 13: Travel Distance (pcu-km)

	Comparison Case	Test Scenario	Comparison	Test	Changes	%Change
AM	2009 Base Year	2021 Base Minus	151,890	155,112	3,222	2.1%
	2021 Base Minus	2021 Scenario	155,112	159,935	4,823	3.1%
	2021 Scenario	2021 Mitigation Scenario	159,935	160,974	1,039	0.6%
	2009 Base Year	2021 Mitigation Scenario	151,890	160,974	9,083	6.0%
PM	2009 Base Year	2021 Base Minus	156,137	159,692	3,555	2.3%
	2021 Base Minus	2021 Scenario	159,692	165,881	6,189	3.9%
	2021 Scenario	2021 Mitigation Scenario	165,881	166,154	273	0.2%
	2009 Base Year	2021 Mitigation Scenario	156,137	166,154	10,017	6.4%

Table 14: Travel Time (pcu-hrs)

	Comparison Case	Test Scenario	Comparison	Test	Changes	%Change
AM	2009 Base Year	2021 Base Minus	6,374	6,574	200	3.1%
	2021 Base Minus	2021 Scenario	6,574	7,004	430	6.5%
	2021 Scenario	2021 Mitigation Scenario	7,004	6,945	-59	-0.8%
	2009 Base Year	2021 Mitigation Scenario	6,374	6,945	571	9.0%
PM	2009 Base Year	2021 Base Minus	6,540	6,752	212	3.2%
	2021 Base Minus	2021 Scenario	6,752	7,253	501	7.4%
	2021 Scenario	2021 Mitigation Scenario	7,253	7,167	-86	-1.2%
	2009 Base Year	2021 Mitigation Scenario	6,540	7,167	627	9.6%

Table 15: "Level of Congestion" Delays (pcu-hrs)

	Comparison Case	Test Scenario	Comparison	Test	Changes	%Change
AM	2009 Base Year	2021 Base Minus	0.631	0.656	0.025	4.0%
	2021 Base Minus	2021 Scenario	0.656	0.741	0.085	12.9%
	2021 Scenario	2021 Mitigation Scenario	0.741	0.702	-0.039	-5.3%
	2009 Base Year	2021 Mitigation Scenario	0.63	0.70	0.1	11.2%
PM	2009 Base Year	2021 Base Minus	0.626	0.650	0.024	3.8%
	2021 Base Minus	2021 Scenario	0.650	0.737	0.086	13.3%
	2021 Scenario	2021 Mitigation Scenario	0.737	0.701	-0.035	-4.8%
	2009 Base Year	2021 Mitigation Scenario	0.63	0.70	0.1	12.0%

Table 16: Queue at End of Modelled Period (pcu)

	Comparison Case	Test Scenario	Comparison	Test	Changes	%Change
AM	2009 Base Year	2021 Base Minus	804	815	11	1.4%
	2021 Base Minus	2021 Scenario	815	1,087	272	33.3%
	2021 Scenario	2021 Mitigation Scenario	1,087	861	-226	-20.8%
	2009 Base Year	2021 Mitigation Scenario	804	861	57	7.1%
PM	2009 Base Year	2021 Base Minus	709	858	149	21.0%
	2021 Base Minus	2021 Scenario	858	1,050	191	22.3%
	2021 Scenario	2021 Mitigation Scenario	1,050	818	-231	-22.0%
	2009 Base Year	2021 Mitigation Scenario	709	818	109	15.3%

8 Conclusions

8.1.1 This report provides the preliminary findings of the traffic impact assessment of the Harrow AAP development proposals. The appraisal focuses on twenty five key junctions located on the strategic road network which are vital to smooth traffic flow within the core study area.

8.1.2 The future year 2021 AAP Development Scenario was evaluated applying a trend based background growth to the current highway demand along with GLA planning assumptions for the rest of West London and then adding the estimated development trips.

8.1.3 The **2021 AAP Scenario** was compared against a theoretical **"Base Minus"** scenario which replicates a 2021 reference case with the GLA planning assumptions and background growth without any changes to the AAP zones. This gives a robust "**with**" and "**without**" assessment of AAP proposals.

Background Growth

8.1.4 Before assessing the impact of the AAP development proposals, the Base Minus scenario was compared against the existing traffic conditions represented in the base year model. It is noted that some of the key junctions already experience congestion during peak traffic hours, as seen in the base year results. There is a further increase in congestion at a number of junctions due to the background growth and other GLA proposals.

8.1.5 As such, this analysis shows that in 2021 a number of junctions are already likely to be either "over acceptable capacity" or "over-capacity" resulting in queues and severe delays at these junctions.

8.1.6 A comparison of the 2021 Base Minus against the Base Year model results show that the following junctions will already be experiencing higher level of congestion:

In morning (AM) peak:

- Junction 4: A312 Bessborough Rd - A404 Lowlands Rd
- Junction 7: A4005 Sudbury Hill - A4127 Sudbury Ct
- Junction 13: A404 Uxbridge Road - St Thomas Dr.

In addition to the above, in the evening (PM) peak at:

- Junction 1: Harrow View Headstone Drive
- Junction 12: The Ridgeway - A4090 Imperial Drive
- Junction 21: A4005 Harrow Road – A404 Watford Road.

Impact of AAP Development Proposals

8.1.7 The AAP proposals add approximately an additional 1,892 trips in the morning and 2,153 trips in the evening peak. The model was used to allocate these trips on to feeder links and assess their impact on nearby junctions.

8.1.8 The following junctions were identified as experiencing a further increase in level of traffic congestion in either AM or PM peak when compared to the Base Minus scenario:

- Junction 1: Harrow View Headstone Drive
- Junction 7: A4005 Sudbury Hill - A4127 Sudbury Ct
- Junction 11: A404 Pinner Road - A4090 Station Road

- Junction 21: A4005 Harrow Road – A404 Watford Road
- Junction 22: A410 Uxbridge Road – A4008 Oxhey Lane-Courtenay Av
- Junction 23: Hindes Road – A409 Station Road
- Junction 25: A4005 Greenhill Way – A409 Station Road.

8.1.9 It should be noted that some of the junctions appear in both the list of junctions showing an increase in congestion due to AAP development and background traffic growth. This is because analysis of the model results indicates that the operational performance of these junctions, which have already decreased due to background traffic, will deteriorate further due to AAP development growth.

Mitigation Measures

8.1.10 The above analysis was used to identify key parts of the highway network which need mitigation against increased traffic levels. The following are the key stress points identified in the core study area

- ***A4006-A404 EW corridor*** – The main area impacted by the AAP traffic is the A4006-A404 east-west corridor along Kenton Road, Lowlands Road and Pinner Road. All the key junctions on this corridor are showing significant delay (PCU-hrs) at the junctions and the incoming arms are showing high V/C saturation levels.
- Station Road - Hindes Road junction near Greenhill;
- Harrow View/Headstone Road coming into Greenhill Way
- Some junctions around Station Road near North Harrow are also being affected. This includes junction with
  a. Station Road - Pinner Road
  b. Headstone Lane – George V avenue junction
  c. increased traffic on Kingsfield Ave / Cunningham Park roads going into Harrow view
- North of the Kodak site, there is indication of re-routing happening around Courtenay Ave and Uxbridge Road, with traffic likely to be rerouting towards Headstone Lane.

8.1.11 It is suggested that the focus of the mitigation has to be on some selected junctions north of Kodak site which is showing some re-routing and the A4006-A404 corridor. Diversifying and re-routeing traffic around the key development area may also be helpful.

Evaluation of Mitigation Measures

8.1.12 The ***"With mitigation"*** scenario was compared against the 2021 AAP scenario. Of the junctions identified for mitigation measures as show above in Table 5, the following junctions showed significant improvements:

- Junction 11: A404 Pinner Road - A4090 Station Road
- Junction 15: A410 Stanmore Hill - Marsh Lane
- Junction 16: A4140 Marsh Lane - B461 Whitchurch Lane
- Junction 23: Hindes Road – A409 Station Road.

8.1.13 However there are couple of junction where the performance further deteriorated even with the mitigation measures, these include:

- Junction 1: Harrow View Headstone Drive
- Junction 4: A312 Bessborough Rd - A404 Lowlands Rd
- Junction 18: Christchurch Ave - Kenton Lane.

The other junctions did not show any significant increase in the level of service.

8.1.14 It should be noted that the only one mitigation test was modelled as part of this study. The existing models can be used test various combinations of the mitigation measures identified in Section 5.4. It is important to find the balance between introducing mitigation which increases the level of traffic in the study area but at the cost of decreasing level of service in the highway network.

8.1.15 It is recommended to carry out additional sensitivity tests to identify the combination of mitigation measures which will provide the best network performance. It is also important to analyse the performance of the mitigations against the cost of the mitigation measures to identify the most economically efficient mitigation strategy.

Network Performance

8.1.16 Network performance results show that in both Base Minus and AAP scenarios, there is a decrease in average network performance in-line with the increase in traffic without any further capacity enhancements. There is a small decrease in average speeds in both peak periods between 2009 base year and 2021 AAP Base Minus scenarios.

8.1.17 The AAP scenario decreases the network speed further which means that additional highway mitigation measures will be required to bring back the network performance to the existing levels. Analysis of the 2021 AAP Development Scenario results again indicate that the decrease in average speed will be approximately in-line with the increase in demand.

8.1.18 The proposed mitigation measure show a slight improvement in overall network speed however it is lower than the existing traffic conditions which comes with a 6% increase in travel demand which is reflected in the increase total vehicle-kms driven in the network over current traffic level in the morning peak.

8.1.19 All the network performance metrics concur with the above analysis. In the end there is almost 7% increase in congestion which can be attributed directly to AAP proposals with the mitigation measures. Additional sensitivity tests on the highway network mitigations and signal optimisation can help to improve the performance better.

Appendix A: TrafficMaster Data

Figure A.1: May 2009 Average Delay – AM peak period 7 am to 10 am (working days only Mon to Fri)

Figure A.2: May 2009 Average Delay – PM peak period 4 pm to 7 pm (working days only Mon to Fri)

Appendix B: Detailed Model Outputs

The model outputs were analysed for an assessment of performance of all the junctions. The following comparisons were made:

1. Comparison of 2021 Base Minus vs. Base Year
2. Comparison of 2021 AAP Scenario against 2021 base Minus
3. Comparison of 2021 AAP with Mitigation Scenario against 2021 Base Minus

The tables for level of saturation (Volume / Capacity or V/C) for the main junction and their individual arms for AM and PM peaks are presented below. In assessing each scenario, the ***level of change in junction saturation*** was marked with the following scaling:

In the following tables, it is clear that the impact of AAP proposals is most critical on the junctions which are categorised as **(Red)** or in case of an oversaturated junction (**Black or Red**)

	Cumulative Saturation Score																							
Number of Arms	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
3																								
4																								
5																								
6																								

The above classification essentially gives the same categorisation for same average Saturation Score.

Table B.1: Link V/C Saturation in AM Peak

Scenario Comparison AM:			Junction V/C				Saturation Scores				Junction Classification			
ID	Junction Name	Approach Arm	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation
1	Harrow View Headstone Drive	Harrow view SB	82%	72%	83%	83%	2	1	2	2	Blue	Blue	Blue	Amber
		Headstone Drive WB	70%	68%	74%	58%	1	1	1	1				
		Harrow view NB	60%	57%	57%	61%	1	1	1	1				
		Headstone Gardens EB	95%	93%	94%	96%	4	4	4	5				
2	George Gange Way- Canning Road	George Gange Way SB	22%	24%	24%	24%	1	1	1	1	Green	Green	Green	Green
		Canning Road WB	64%	70%	70%	62%	1	1	1	1				
		George Gange Way NB	25%	30%	33%	38%	1	1	1	1				
3	Pinner Road - Lowlands Rd	A404 Pinner Road EB	96%	99%	98%	95%	5	5	5	5	Amber	Amber	Amber	Amber
		A4005 Greenhill way SB	49%	54%	55%	56%	1	1	1	1				
		A404 Junction Rd NB	59%	58%	58%	61%	1	1	1	1				
4	A312 Bessborough Rd - A404 Lowlands Rd	A404 Junction Rd SB	94%	100%	100%	100%	4	5	6	6	Orange	Red	Red	Black
		A404 Lowlands Road WB	83%	92%	87%	96%	2	4	3	5				
		A312 Bessborough Rd NB	100%	100%	100%	101%	6	6	6	6				
5	Northwick Park Roundabout	A409 Sheepcote Road SB	56%	54%	54%	87%	1	1	1	3	Red	Red	Red	Red
		A4006 Kenton Rd WB	102%	102%	102%	87%	6	6	6	3				
		A409 Watford Road NB	103%	103%	107%	101%	6	6	6	6				
		A404 Kenton Road EB	94%	97%	98%	96%	4	5	5	5				
6	A312 Northolt Road - A4005 Roxeth Hill	A312 Lower Road SB	84%	86%	83%	68%	2	3	2	1	Blue	Blue	Blue	Blue
		A4005 Roxeth Hill WB	29%	30%	32%	45%	1	1	1	1				
		A312 Northholt Road NB	47%	47%	46%	87%	1	1	1	3				

Scenario Comparison AM:			Junction V/C				Saturation Scores				Junction Classification			
ID	Junction Name	Approach Arm	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation
7	A4005 Sudbury Hill - A4127 Sudbury Ct	A4005 Sudbury Hill EB	73%	84%	82%	95%	1	2	2	4	Amber	Orange	Orange	Orange
		A4127 Greenford Road NB	99%	100%	100%	97%	5	5	6	5				
		A4127 Sudbury Court Drive SB	94%	98%	100%	100%	4	5	5	6				
		A4005 Harrow Road WB	43%	48%	50%	47%	1	1	1	1				
8	A4090 Whitton Avenue - A4127 Greenford Road	A4127 Greenford Rd SB	106%	105%	105%	105%	6	6	6	6	Orange	Orange	Orange	Orange
		A4090 Whitton Avenue East WB	73%	72%	72%	78%	1	1	1	1				
		A4127 Greenford Rd NB	94%	95%	96%	95%	4	4	5	4				
		A4090 Whitton Avenue West EB	84%	86%	87%	85%	2	3	3	2				
9	A312 Petts Hill - A4090 Whilton Av	A4090 Whitton Avenue West WB	39%	43%	43%	42%	1	1	1	1	Blue	Blue	Blue	Blue
		A312 Petts Hill NB	49%	54%	55%	65%	1	1	1	1				
		A312 Petts Hill EB	87%	87%	87%	87%	3	3	3	3				
10	A312 Petts Hill - A4090 Alexandra Av	A312 Northolt Road SB	55%	55%	54%	59%	1	1	1	1	Green	Green	Green	Green
		A312 Northolt Road SB WB	34%	37%	37%	40%	1	1	1	1				
		A4090 Alexandra Ave SB	44%	44%	45%	44%	1	1	1	1				
11	A404 Pinner Road - A4090 Station Road	Station Road SB	68%	66%	67%	64%	1	1	1	1	Amber	Amber	Amber	Blue
		A404 Pinner Road WB	52%	65%	64%	63%	1	1	1	1				
		Station Road NB	95%	87%	92%	92%	4	3	4	4				
		A404 Pinner Road EB	101%	101%	102%	71%	6	6	6	1				
12	The Ridgeway - A4090 Imperial Drive	A4090 Imperial Drive SB	86%	91%	90%	84%	3	4	3	2	Amber	Amber	Amber	Amber
		The Ridgeway WB	75%	72%	81%	87%	1	1	2	3				
		A4090 Imperial Drive NB	106%	107%	108%	101%	6	6	6	6				
		The Ridgeway EB	75%	74%	77%	76%	1	1	1	1				

Scenario Comparison AM:			Junction V/C				Saturation Scores				Junction Classification			
ID	Junction Name	Approach Arm	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation
13	A404 Uxbridge Road - St Thomas Dr	A410 Uxbridge Road WB	58%	57%	66%	62%	1	1	1	1	Green	Blue	Blue	Blue
		A404 St Thomas Drive NB	23%	25%	28%	28%	1	1	1	1				
		A410 Uxbridge Road EB	80%	85%	92%	93%	1	2	4	4				
14	A410 Uxbridge Rd - High Road	A409 Brookshill SB	57%	56%	61%	64%	1	1	1	1	Blue	Blue	Blue	Amber
		A410 Uxbridge Road WB	64%	73%	79%	80%	1	1	1	1				
		A409 High Road NB	53%	60%	69%	75%	1	1	1	1				
		A410 Uxbridge Road EB	90%	98%	98%	101%	4	5	5	6				
15	A410 Stanmore Hill - Marsh Ln	A4140 Stanmore Hill SB	52%	49%	50%	50%	1	1	1	1	Amber	Amber	Amber	Blue
		A410 Church Road EB	103%	104%	105%	86%	6	6	6	3				
		A410 The Broadway WB	67%	63%	63%	74%	1	1	1	1				
		A410 London Rd WB	89%	94%	97%	90%	3	4	5	3				
		A4140 Marsh Lane NB	80%	85%	84%	85%	2	2	2	2				
		A410 The Broadway EB	62%	59%	60%	60%	1	1	1	1				
16	A4140 Marsh Ln - B461 Whitchurch Ln	A4140 Marsh Lane SB	85%	79%	77%	65%	2	1	1	1	Orange	Orange	Orange	Blue
		B461 Witchurch Lane WB	94%	95%	97%	41%	4	5	5	1				
		A4140 Honeypot Lane NB	102%	103%	103%	89%	6	6	6	3				
		Wemborough Road EB	92%	86%	87%	86%	4	3	3	3				
17	A4140 Honeypot Ln - Streatfield Rd	A4140 Honeypot Lane SB	103%	101%	98%	103%	6	6	5	6	Red	Orange	Orange	Orange
		Taunton Way WB	57%	57%	59%	57%	1	1	1	1				
		A4140 Honeypot Lane NB	96%	126%	130%	133%	5	6	6	6				
		Charlton Road EB	98%	42%	45%	36%	5	1	1	1				
		Streatfield Road EB	104%	101%	98%	104%	6	6	5	6				

Scenario Comparison AM:			Junction V/C				Saturation Scores				Junction Classification			
ID	Junction Name	Approach Arm	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation
18	Christchurch Ave - Kenton Ln	Kenton Lane SB	81%	86%	89%	98%	2	3	3	5	Amber	Amber	Amber	Orange
		Streatfield Road WB	82%	85%	90%	89%	2	2	3	3				
		Kenton Lane NB	94%	92%	96%	76%	4	4	5	1				
		Christchruch Ave EB	90%	73%	79%	93%	3	1	1	4				
19	A4006 Kenton Rd - Kenton Ln	Kenton Lane SB	99%	100%	102%	97%	5	6	6	5	Red	Red	Red	Red
		A4006 Kenton Road WB	97%	100%	100%	101%	5	6	6	6				
		Woodcock Hill NB	76%	87%	95%	93%	1	3	5	4				
		A4006 Kenton Road EB	102%	105%	105%	103%	6	6	6	6				
20	A4006 Kenton Rd - Kingsbury Rd	A4140 Honeypot Lane SB	102%	101%	102%	102%	6	6	6	6	Orange	Orange	Orange	Red
		A4006 Kingsbury Road WB	51%	58%	59%	58%	1	1	1	1				
		A4140 Fryent Way NB	69%	80%	84%	88%	1	2	2	3				
		The Mall NB	90%	97%	97%	99%	3	5	5	5				
		A4006 Kenton Road EB	98%	96%	97%	101%	5	5	5	6				
21	A4005 Harrow Road – A404 Watford Road	A404 Watford Road SB	101%	101%	101%	102%	6	6	6	6	Orange	Orange	Red	Red
		A4005 Harrow Roa NB	50%	53%	55%	52%	1	1	1	1				
		A4005 Harrow Road EB	100%	99%	100%	101%	5	5	6	6				
22	A410 Uxbridge Road – A4008 Oxhey Lane-Courtenay Av	A4008 Oxhey Lane SB	83%	68%	69%	72%	2	1	1	1	Blue	Blue	Blue	Blue
		A410 Ubridge Road WB	77%	81%	84%	84%	1	2	2	2				
		Courtenay Avenue	66%	62%	69%	66%	1	1	1	1				
		A410 Ubridge Road EB	65%	73%	73%	74%	1	1	1	1				
23	Hindes Road – A409 Station	Station Road SB	89%	88%	90%	90%	3	3	4	3	Orange	Amber	Orange	Blue
		Station Road NB	101%	97%	99%	83%	6	5	5	2				

Scenario Comparison AM:			Junction V/C				Saturation Scores				Junction Classification			
ID	Junction Name	Approach Arm	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation
	Road	Hindes Rd EB	80%	76%	80%	71%	2	1	1	1				
24	A409 George Gange Way – Palmerston Road	George Gange Way SB	81%	82%	86%	78%	2	2	3	1	Blue	Blue	Blue	Blue
		Palmerston Rd WB	50%	43%	60%	50%	1	1	1	1				
		George Gange Way NB	52%	50%	55%	82%	1	1	1	2				
		Palmerston Rd EB	32%	31%	48%	35%	1	1	1	1				
25	A4005 Greenhill Way – A409 Station Road	Station Rd SB	86%	85%	88%	88%	3	2	3	3	Blue	Blue	Blue	Blue
		Station Rd NB	79%	73%	78%	70%	1	1	1	1				
		Greenhill Way EB	54%	55%	57%	46%	1	1	1	1				

Table B.2: Junction Saturation in PM Peak

Scenario Comparison PM:			Junction V/C				Saturation Score				Cumulative Junction Categorisation			
ID	Junction Name	Approach Arm	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation
1	Harrow View Headstone Drive	Harrow view SB	81%	73%	79%	71%	2	1	1	1	Blue	Green	Blue	Blue
		Headstone Drive WB	83%	78%	80%	64%	2	1	2	1				
		Harrow view NB	51%	53%	65%	57%	1	1	1	1				
		Headstone gardens EB	79%	78%	80%	95%	1	1	2	4				
2	George Gange Way- Canning Road	George Gange Way SB	12%	12%	16%	19%	1	1	1	1	Green	Green	Green	Green
		Canning Road WB	50%	55%	58%	44%	1	1	1	1				
		George Gange Way NB	25%	29%	31%	44%	1	1	1	1				
3	Pinner Road - Lowlands Rd	A404 Pinner Road EB	47%	36%	36%	43%	1	1	1	1	Green	Green	Green	Green
		A4005 GreenHill way SB	44%	43%	47%	49%	1	1	1	1				
		A404 Junction Rd NB	55%	56%	57%	58%	1	1	1	1				
4	A312 Bessborough Rd - A404 Lowlands Rd	A404 Junction Rd SB	101%	101%	101%	101%	6	6	6	6	Black	Black	Black	Black
		A404 Lowlands Road WB	97%	101%	102%	102%	5	6	6	6				
		A312 Bessborough Rd NB	101%	100%	101%	101%	6	6	6	6				
5	Northwick Park Roundabout	A409 Sheepcote Road SB	96%	99%	99%	105%	5	5	5	6	Red	Red	Red	Red
		A4006 Kenton Rd WB	100%	102%	101%	79%	6	6	6	1				
		A409 Watford Road NB	109%	107%	107%	101%	6	6	6	6				
		A404 Kenton Road EB	103%	103%	105%	97%	6	6	6	5				
6	A312 Northolt Road - A4005 Roxeth Hill	A312 Lower Road SB	92%	93%	93%	85%	4	4	4	2	Blue	Blue	Blue	Blue
		A4005 Roxeth Hill WB	59%	66%	69%	87%	1	1	1	3				
		A312 Northholt Road NB	40%	42%	42%	74%	1	1	1	1				
7	A4005 Sudbury	A4005 Sudbury Hill EB	76%	90%	98%	96%	1	4	5	5	Amber	Orange	Red	Orange

Scenario Comparison PM:			Junction V/C				Saturation Score				Cumulative Junction Categorisation			
ID	Junction Name	Approach Arm	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation
	Hill - A4127 Sudbury Ct	A4127 Greenford Road NB	101%	103%	104%	98%	6	6	6	5				
		A4127 Sudbury Court Drive SB	54%	54%	55%	52%	1	1	1	1				
		A4005 Harrow Road WB	93%	98%	99%	96%	4	5	5	5				
8	A4090 Whitton Avenue - A4127 Greenford Road	A4127 Greenford Rd SB	103%	103%	103%	103%	6	6	6	6	Red	Red	Red	Red
		A4090 Whitton Avenue East WB	95%	96%	96%	100%	4	5	5	5				
		A4127 Greenford Rd NB	87%	90%	90%	86%	3	4	3	3				
		A4090 Whitton Avenue West EB	95%	96%	96%	95%	4	5	5	4				
9	A312 Petts Hill - A4090 Whilton Av	A4090 Whitton Avenue West WB	52%	58%	55%	54%	1	1	1	1	Blue	Blue	Blue	Blue
		A312 Petts Hill NB	68%	66%	65%	70%	1	1	1	1				
		A312 Petts Hill EB	85%	85%	85%	88%	2	3	3	3				
10	A312 Petts Hill - A4090 Alexandra Av	A312 Northolt Road SB	43%	43%	53%	53%	1	1	1	1	Green	Green	Green	Green
		A312 Northolt Road SB WB	47%	49%	50%	51%	1	1	1	1				
		A4090 Alexandra Ave SB	28%	28%	28%	29%	1	1	1	1				
11	A404 Pinner Road - A4090 Station Road	Station Road SB	58%	60%	74%	80%	1	1	1	2	Blue	Blue	Amber	Orange
		A404 Pinner Road WB	81%	80%	84%	92%	2	2	2	4				
		Station Road NB	89%	88%	89%	102%	3	3	3	6				
		A404 Pinner Road EB	84%	82%	86%	59%	2	2	3	1				
12	The Ridgeway - A4090 Imperial Drive	A4090 Imperial Drive SB	102%	103%	103.5%	79.5%	6	6	6	1	Orange	Red	Red	Amber
		The Ridgeway WB	77%	86%	92%	86%	1	3	4	3				
		A4090 Imperial Drive NB	108%	109%	108%	74%	6	6	6	1				
		The Ridgeway EB	88%	88%	90%	92%	3	3	4	4				

Scenario Comparison PM:			Junction V/C				Saturation Score				Cumulative Junction Categorisation			
ID	Junction Name	Approach Arm	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation
13	A404 Uxbridge Road - St Thomas Dr	A410 Uxbridge Road WB	58%	62%	70%	65%	1	1	1	1	Green	Green	Green	Green
		A404 St Thomas Drive NB	34%	33%	39%	39%	1	1	1	1				
		A410 Uxbridge Road EB	60%	66%	75%	64%	1	1	1	1				
14	A410 Uxbridge Rd - High Road	A409 Brookshill SB	67%	67%	69%	70%	1	1	1	1	Blue	Blue	Amber	Orange
		A410 Uxbridge Road WB	75%	75%	81%	82%	1	1	2	2				
		A409 High Road NB	70%	68%	85%	95%	1	1	2	4				
		A410 Uxbridge Road EB	94%	99%	101%	102%	4	5	6	6				
15	A410 Stanmore Hill - Marsh Ln	A4140 Stanmore Hill SB	45%	47%	46%	48%	1	1	1	1	Amber	Amber	Amber	Blue
		A410 Church Road EB	91%	91%	92%	79%	4	4	4	1				
		A410 The Broadway WB	83%	85%	84%	79%	2	2	2	1				
		A410 London Rd WB	90%	91%	91%	90%	4	4	4	4				
		A4140 Marsh Lane NB	87%	91%	90%	85%	3	4	3	3				
		A410 The Broadway EB	61%	61%	61%	59%	1	1	1	1				
16	A4140 Marsh Ln - B461 Whitchurch Ln	A4140 Marsh Lane SB	104%	105%	105%	82%	6	6	6	2	Red	Red	Red	Blue
		B461 Witchurch Lane WB	99%	99%	100%	54%	5	5	5	1				
		A4140 Honeypot Lane NB	83%	85%	85%	74%	2	3	3	1				
		Wemborough Road EB	94%	94%	95%	75%	4	4	4	1				
17	A4140 Honeypot Ln - Streatfield Rd	A4140 Honeypot Lane SB	85%	83%	83%	89%	2	2	2	3	Amber	Amber	Amber	Amber
		Taunton Way WB	68%	71%	78%	67%	1	1	1	1				
		A4140 Honeypot Lane NB	102%	102%	103%	102%	6	6	6	6				
		Charlton Road EB	67%	67%	70%	56%	1	1	1	1				
		Streatfield Road EB	93%	94%	95%	93%	4	4	4	4				
18	Christchurch Ave	Kenton Lane SB	98%	98%	99%	99%	5	5	5	5	Red	Red	Red	Red

Scenario Comparison PM:			Junction V/C				Saturation Score				Cumulative Junction Categorisation			
ID	Junction Name	Approach Arm	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation
	- Kenton Ln	Streatfield Road WB	94%	95%	94%	95%	4	4	4	4				
		Kenton Lane NB	97%	98%	102%	87%	5	5	6	3				
		Christchruch Ave EB	98%	98%	98%	98%	5	5	5	5				
19	A4006 Kenton Rd - Kenton Ln	Kenton Lane SB	84%	86%	88%	72%	2	3	3	1	Red	Red	Red	Red
		A4006 Kenton Road WB	98%	99%	100%	100%	5	5	5	5				
		Woodcock Hill NB	103%	103%	104%	103%	6	6	6	6				
		A4006 Kenton Road EB	101%	101%	102%	100%	6	6	6	6				
20	A4006 Kenton Rd - Kingsbury Rd	A4140 Honeypot Lane SB	91%	95%	95%	99%	4	4	4	5	Orange	Orange	Orange	Orange
		A4006 Kingsbury Road WB	55%	56%	56%	59%	1	1	1	1				
		A4140 Fryent Way NB	104%	104%	104%	105%	6	6	6	6				
		The Mall NB	102%	102%	102%	102%	6	6	6	6				
		A4006 Kenton Road EB	68%	70%	71%	82%	1	1	1	2				
21	A4005 Harrow Road – A404 Watford Road	A404 Watford Road SB	80%	82%	83%	88%	1	2	2	3	Green	Blue	Blue	Blue
		A4005 Harrow Roa NB	57%	61%	61%	57%	1	1	1	1				
		A4005 Harrow Road EB	74%	88%	89%	83%	1	3	3	2				
22	A410 Uxbridge Road – A4008 Oxhey Lane-Courtenay Av	A4008 Oxhey Lane SB	82%	83%	83%	82%	2	2	2	2	Amber	Amber	Orange	Orange
		A410 Ubridge Road WB	94%	95%	98%	95%	4	5	5	5				
		Courtenay Avenue	84%	85%	95%	101%	2	2	5	6				
		A410 Ubridge Road EB	73%	78%	79%	77%	1	1	1	1				
23	Hindes Road – A409 Station Road	Station Road SB	60%	63%	66%	70%	1	1	1	1	Blue	Blue	Blue	Blue
		Station Road NB	88%	88%	90%	83%	3	3	3	2				
		Hindes Rd EB	65%	68%	74%	69%	1	1	1	1				
24	A409 George	George Gange Way SB	64%	67%	72%	75%	1	1	1	1	Green	Green	Green	Green

Scenario Comparison PM:			Junction V/C				Saturation Score				Cumulative Junction Categorisation			
ID	Junction Name	Approach Arm	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation	Base	2021 Base Minus	2021 AAP Scenario	2021 AAP Scenario Mitigation
	Gange Way – Palmerston Road	Palmerston Rd WB	56%	53%	57%	53%	1	1	1	1				
		George Gange Way NB	57%	59%	60%	78%	1	1	1	1				
		Palmerston Rd EB	38%	42%	57%	44%	1	1	1	1				
25	A4005 Greenhill Way – A409 Station Road	Station Rd SB	72%	76%	84%	81%	1	1	2	2	Green	Green	Blue	Blue
		Station Rd NB	69%	71%	79%	85%	1	1	1	2				
		Greenhill Way EB	53%	53%	54%	50%	1	1	1	1				

Therefore the junction movements with any significant impact are marked in **Amber** or **Red**. In addition, the final level of junction saturation in the forecast scenarios is shown in the following colour bands:

Junction V/C	Band Colour
>100%	
>95%	
>90%	
>85%	
>80%	
<80%	

Table B.3: Junction Performance in AM Peak Base

ID	Junction Location	v/c	Delay (secs)	Flow (pcu)	Total Delay (pcu-hr)
1	Harrow View Headstone Drive	79	84	2605	61
2	George Gange Way- Canning Road	31	4	1538	2
3	Pinner Road -Lowlands Rd	62	14	2747	11
4	A312 Bessborough Rd - A404 Lowlands Rd	92	30	3115	26
5	Northwick Park Roundabout	88	63	3769	66
6	A312 Northolt Road - A4005 Roxeth Hill	42	21	1884	11
7	A4005 Sudbury Hill - A4127 Sudbury Ct	66	38	2869	30
8	A4090 Whitton Avenue - A4127 Greenford Road	91	177	2109	104
9	A312 Petts Hill - A4090 Whitton Av	59	8	2072	4
10	A312 Petts Hill - A4090 Alexandra Av	40	33	2099	19
11	A404 Pinner Road - A4090 Station Road	76	103	2760	79
12	The Ridgeway - A4090 Imperial Drive	85	155	2431	105
13	A404 Uxbridge Road - St Thomas Dr	53	8	2369	5
14	A410 Uxbridge Rd - Headstone Ln	66	11	3092	9
15	A410 Stanmore Hill - Marsh Ln	69	68	2251	43
16	A4140 Marsh Ln - B461 Whitchurch Ln	93	125	2154	75
17	A4140 Honeypot Ln - Streatfield Rd	66	25	2453	17
18	Christchurch Ave - Kenton Ln	87	62	2125	37
19	A4006 Kenton Rd - Kenton Ln	97	109	2392	72
20	A4006 Kenton Rd - Kingsbury Rd	81	31	4310	37
21	A4005 Harrow Road – A404 Watford Road	71	35	1863	18
22	A410 Uxbridge Road – A4008 Oxhey Lane	73	11	4123	13
23	Hindes Road – A409 Station Road	92	91	2523	64
24	A409 George Gange Way – Palmerston Road	57	10	2324	6
25	A4005 Greenhill Way – A409 Station Road	75	24	2908	20

Table B.4: Junction Performance in AM Peak Base Minus

ID	Junction Location	v/c	Delay (secs)	Flow (pcu)	Total Delay (pcu-hr)
1	Harrow View Headstone Drive	79	84	2600	61
2	George Gange Way- Canning Road	36	4	1770	2
3	Pinner Road -Lowlands Rd	63	15	2883	12
4	A312 Bessborough Rd - A404 Lowlands Rd	96	38	3217	34
5	Northwick Park Roundabout	90	100	3758	104
6	A312 Northolt Road - A4005 Roxeth Hill	43	20	1910	11
7	A4005 Sudbury Hill - A4127 Sudbury Ct	72	44	3112	38
8	A4090 Whitton Avenue - A4127 Greenford Road	92	176	2138	105
9	A312 Petts Hill - A4090 Whitton Av	62	8	2186	5
10	A312 Petts Hill - A4090 Alexandra Av	42	32	2205	19
11	A404 Pinner Road - A4090 Station Road	80	108	2843	85
12	The Ridgeway - A4090 Imperial Drive	89	182	2463	125
13	A404 Uxbridge Road - St Thomas Dr	61	10	2667	8
14	A410 Uxbridge Rd - Headstone Ln	78	15	3452	14
15	A410 Stanmore Hill - Marsh Ln	66	84	2176	51
16	A4140 Marsh Ln - B461 Whitchurch Ln	90	140	2189	85
17	A4140 Honeypot Ln - Streatfield Rd	81	10	2690	7
18	Christchurch Ave - Kenton Ln	89	73	2187	45
19	A4006 Kenton Rd - Kenton Ln	101	154	2458	105
20	A4006 Kenton Rd - Kingsbury Rd	86	33	4371	41
21	A4005 Harrow Road – A404 Watford Road	74	38	1932	21
22	A410 Uxbridge Road – A4008 Oxhey Lane	75	11	4262	13
23	Hindes Road – A409 Station Road	92	88	2531	62
24	A409 George Gange Way – Palmerston Road	64	11	2557	7
25	A4005 Greenhill Way – A409 Station Road	77	26	2961	21

Table B.5: Junction Performance in AM Peak 2021 AAP Scenario

ID	Junction Location	v/c	Delay (secs)	Flow (pcu)	Total Delay (pcu-hr)
1	Harrow View Headstone Drive	75	86	2705	64
2	George Gange Way- Canning Road	37	3	1804	1
3	Pinner Road -Lowlands Rd	65	13	3010	11
4	A312 Bessborough Rd - A404 Lowlands Rd	99	40	3252	36
5	Northwick Park Roundabout	92	57	4395	69
6	A312 Northolt Road - A4005 Roxeth Hill	69	9	2749	7
7	A4005 Sudbury Hill - A4127 Sudbury Ct	73	42	3141	37
8	A4090 Whitton Avenue - A4127 Greenford Road	92	174	2151	104
9	A312 Petts Hill - A4090 Whitton Av	64	8	2255	5
10	A312 Petts Hill - A4090 Alexandra Av	44	41	2295	26
11	A404 Pinner Road - A4090 Station Road	71	94	2903	75
12	The Ridgeway - A4090 Imperial Drive	88	150	2788	116
13	A404 Uxbridge Road - St Thomas Dr	60	10	2648	8
14	A410 Uxbridge Rd - Headstone Ln	80	23	3515	22
15	A410 Stanmore Hill - Marsh Ln	71	50	2473	35
16	A4140 Marsh Ln - B461 Whitchurch Ln	67	91	2532	64
17	A4140 Honeypot Ln - Streatfield Rd	79	18	2702	13
18	Christchurch Ave - Kenton Ln	87	77	2371	51
19	A4006 Kenton Rd - Kenton Ln	99	118	2607	85
20	A4006 Kenton Rd - Kingsbury Rd	88	39	4413	48
21	A4005 Harrow Road – A404 Watford Road	73	48	1903	25
22	A410 Uxbridge Road – A4008 Oxhey Lane	76	11	4283	13
23	Hindes Road – A409 Station Road	85	73	2525	51
24	A409 George Gange Way – Palmerston Road	68	42	2012	24
25	A4005 Greenhill Way – A409 Station Road	65	20	2916	16

Table B.6: Junction Performance in AM Peak 2021 AAP Scenario with mitigation

ID	Junction Location	v/c	Delay (secs)	Flow (pcu)	Total Delay (pcu-hr)
1	Harrow View Headstone Drive	75	86	2705	64
2	George Gange Way- Canning Road	37	3	1804	1
3	Pinner Road -Lowlands Rd	65	13	3010	11
4	A312 Bessborough Rd - A404 Lowlands Rd	99	40	3252	36
5	Northwick Park Roundabout	92	57	4395	69
6	A312 Northolt Road - A4005 Roxeth Hill	69	9	2749	7
7	A4005 Sudbury Hill - A4127 Sudbury Ct	73	42	3141	37
8	A4090 Whitton Avenue - A4127 Greenford Road	92	174	2151	104
9	A312 Petts Hill - A4090 Whitton Av	64	8	2255	5
10	A312 Petts Hill - A4090 Alexandra Av	44	41	2295	26
11	A404 Pinner Road - A4090 Station Road	71	94	2903	75
12	The Ridgeway - A4090 Imperial Drive	88	150	2788	116
13	A404 Uxbridge Road - St Thomas Dr	60	10	2648	8
14	A410 Uxbridge Rd - Headstone Ln	80	23	3515	22
15	A410 Stanmore Hill - Marsh Ln	71	50	2473	35
16	A4140 Marsh Ln - B461 Whitchurch Ln	67	91	2532	64
17	A4140 Honeypot Ln - Streatfield Rd	79	18	2702	13
18	Christchurch Ave - Kenton Ln	87	77	2371	51
19	A4006 Kenton Rd - Kenton Ln	99	118	2607	85
20	A4006 Kenton Rd - Kingsbury Rd	88	39	4413	48
21	A4005 Harrow Road – A404 Watford Road	73	48	1903	25
22	A410 Uxbridge Road – A4008 Oxhey Lane	76	11	4283	13
23	Hindes Road – A409 Station Road	85	73	2525	51
24	A409 George Gange Way – Palmerston Road	68	42	2012	24
25	A4005 Greenhill Way – A409 Station Road	65	20	2916	16

Table B.7: Junction Performance in PM Peak Base

ID	Junction Location	v/c	Delay (secs)	Flow (pcu)	Total Delay (pcu-hr)
1	Harrow View Headstone Drive	72	91	2469	62
2	George Gange Way- Canning Road	25	3	1269	1
3	Pinner Road -Lowlands Rd	49	7	2792	5
4	A312 Bessborough Rd - A404 Lowlands Rd	100	44	3515	43
5	Northwick Park Roundabout	104	225	2954	185
6	A312 Northolt Road - A4005 Roxeth Hill	56	30	2347	19
7	A4005 Sudbury Hill - A4127 Sudbury Ct	70	49	3098	42
8	A4090 Whitton Avenue - A4127 Greenford Road	95	158	2198	97
9	A312 Petts Hill - A4090 Whitton Av	67	8	2321	5
10	A312 Petts Hill - A4090 Alexandra Av	39	42	2375	27
11	A404 Pinner Road - A4090 Station Road	77	84	2665	62
12	The Ridgeway - A4090 Imperial Drive	94	207	2336	135
13	A404 Uxbridge Road - St Thomas Dr	50	7	2274	4
14	A410 Uxbridge Rd - Headstone Ln	77	13	3397	12
15	A410 Stanmore Hill - Marsh Ln	74	44	2387	29
16	A4140 Marsh Ln - B461 Whitchurch Ln	93	111	2107	65
17	A4140 Honeypot Ln - Streatfield Rd	65	5	2731	4
18	Christchurch Ave - Kenton Ln	97	106	2304	68
19	A4006 Kenton Rd - Kenton Ln	96	96	2509	67
20	A4006 Kenton Rd - Kingsbury Rd	80	65	4345	79
21	A4005 Harrow Road – A404 Watford Road	66	12	1783	6
22	A410 Uxbridge Road – A4008 Oxhey Lane	83	14	4613	18
23	Hindes Road – A409 Station Road	71	28	2206	17
24	A409 George Gange Way – Palmerston Road	56	9	2292	6
25	A4005 Greenhill Way – A409 Station Road	66	23	2577	16

Table B.8: Junction Performance in PM Peak Base Minus

ID	Junction Location	v/c	Delay (secs)	Flow (pcu)	Total Delay (pcu-hr)
1	Harrow View Headstone Drive	69	90	2399	60
2	George Gange Way- Canning Road	28	3	1392	1
3	Pinner Road -Lowlands Rd	48	7	2786	5
4	A312 Bessborough Rd - A404 Lowlands Rd	101	52	3434	50
5	Northwick Park Roundabout	104	193	3068	165
6	A312 Northolt Road - A4005 Roxeth Hill	59	29	2495	20
7	A4005 Sudbury Hill - A4127 Sudbury Ct	75	65	3202	58
8	A4090 Whitton Avenue - A4127 Greenford Road	96	155	2242	96
9	A312 Petts Hill - A4090 Whitton Av	70	8	2365	6
10	A312 Petts Hill - A4090 Alexandra Av	40	40	2415	27
11	A404 Pinner Road - A4090 Station Road	76	83	2655	61
12	The Ridgeway - A4090 Imperial Drive	97	228	2404	153
13	A404 Uxbridge Road - St Thomas Dr	53	7	2402	5
14	A410 Uxbridge Rd - Headstone Ln	78	16	3436	15
15	A410 Stanmore Hill - Marsh Ln	75	44	2426	30
16	A4140 Marsh Ln - B461 Whitchurch Ln	94	116	2120	68
17	A4140 Honeypot Ln - Streatfield Rd	65	5	2755	4
18	Christchurch Ave - Kenton Ln	97	108	2307	69
19	A4006 Kenton Rd - Kenton Ln	97	96	2526	67
20	A4006 Kenton Rd - Kingsbury Rd	81	66	4411	81
21	A4005 Harrow Road – A404 Watford Road	71	15	1863	8
22	A410 Uxbridge Road – A4008 Oxhey Lane	86	14	4676	19
23	Hindes Road – A409 Station Road	73	30	2267	19
24	A409 George Gange Way – Palmerston Road	57	9	2328	6
25	A4005 Greenhill Way – A409 Station Road	69	22	2658	16

Table B.9: Junction Performance in PM Peak 2021 AAP Scenario

ID	Junction Location	v/c	Delay (secs)	Flow (pcu)	Total Delay (pcu-hr)
1	Harrow View Headstone Drive	75	94	2595	68
2	George Gange Way- Canning Road	31	3	1531	1
3	Pinner Road -Lowlands Rd	49	7	2862	5
4	A312 Bessborough Rd - A404 Lowlands Rd	101	68	3486	66
5	Northwick Park Roundabout	104	213	3062	181
6	A312 Northolt Road - A4005 Roxeth Hill	60	31	2554	22
7	A4005 Sudbury Hill - A4127 Sudbury Ct	77	76	3307	70
8	A4090 Whitton Avenue - A4127 Greenford Road	96	156	2242	97
9	A312 Petts Hill - A4090 Whitton Av	69	8	2338	5
10	A312 Petts Hill - A4090 Alexandra Av	42	47	2485	33
11	A404 Pinner Road - A4090 Station Road	82	89	2862	71
12	The Ridgeway - A4090 Imperial Drive	99	249	2452	170
13	A404 Uxbridge Road - St Thomas Dr	61	8	2694	6
14	A410 Uxbridge Rd - Headstone Ln	84	25	3583	25
15	A410 Stanmore Hill - Marsh Ln	75	43	2421	29
16	A4140 Marsh Ln - B461 Whitchurch Ln	94	119	2127	70
17	A4140 Honeypot Ln - Streatfield Rd	65	5	2776	4
18	Christchurch Ave - Kenton Ln	98	121	2327	78
19	A4006 Kenton Rd - Kenton Ln	98	110	2548	78
20	A4006 Kenton Rd - Kingsbury Rd	82	66	4410	81
21	A4005 Harrow Road – A404 Watford Road	72	16	1875	8
22	A410 Uxbridge Road – A4008 Oxhey Lane	88	18	4767	23
23	Hindes Road – A409 Station Road	76	33	2354	21
24	A409 George Gange Way – Palmerston Road	63	10	2483	7
25	A4005 Greenhill Way – A409 Station Road	75	24	2904	19

Table B.10: Junction Performance in PM Peak 2021 AAP Scenario with mitigations

ID	Junction Location	v/c	Delay (secs)	Flow (pcu)	Total Delay (pcu-hr)
1	Harrow View Headstone Drive	70	96	2555	68
2	George Gange Way- Canning Road	34	2	1685	1
3	Pinner Road -Lowlands Rd	52	7	2957	6
4	A312 Bessborough Rd - A404 Lowlands Rd	102	76	3566	76
5	Northwick Park Roundabout	93	93	4097	105
6	A312 Northolt Road - A4005 Roxeth Hill	81	10	3039	9
7	A4005 Sudbury Hill - A4127 Sudbury Ct	75	51	3332	47
8	A4090 Whitton Avenue - A4127 Greenford Road	95	156	2225	96
9	A312 Petts Hill - A4090 Whitton Av	70	8	2382	6
10	A312 Petts Hill - A4090 Alexandra Av	43	57	2524	40
11	A404 Pinner Road - A4090 Station Road	83	115	3226	103
12	The Ridgeway - A4090 Imperial Drive	80	116	3058	98
13	A404 Uxbridge Road - St Thomas Dr	56	7	2480	5
14	A410 Uxbridge Rd - Headstone Ln	87	31	3650	31
15	A410 Stanmore Hill - Marsh Ln	71	38	2507	26
16	A4140 Marsh Ln - B461 Whitchurch Ln	69	79	2539	56
17	A4140 Honeypot Ln - Streatfield Rd	66	6	2773	5
18	Christchurch Ave - Kenton Ln	93	108	2456	73
19	A4006 Kenton Rd - Kenton Ln	93	95	2557	67
20	A4006 Kenton Rd - Kingsbury Rd	86	75	4540	95
21	A4005 Harrow Road – A404 Watford Road	69	15	1875	8
22	A410 Uxbridge Road – A4008 Oxhey Lane	88	23	4724	30
23	Hindes Road – A409 Station Road	76	33	2558	23
24	A409 George Gange Way – Palmerston Road	68	35	2116	20
25	A4005 Greenhill Way – A409 Station Road	68	21	3013	18