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Greater London Authority

Economic Impact of TRAFFIC LIGHTS

Technical Appendix - Junction Assessment

September 2009

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1.1 Background

1.1.1 GLA Economics commissioned Colin Buchanan (CB) to analyse the economic impact of using traffic signals to manage traffic at junctions in London. This Technical Appendix provides greater detail about the junction selection and traffic modelling techniques and methodology and should be read in conjunction with The Economic Impact of Traffic Signals main report.

1.2 Report structure

1.2.1 This report is structured as follows:

- Chapter 2 proposes an Assessment Framework to assess the utility of traffic signals based on traffic management and safety criteria;
- Chapter 3 describes alternative methods of junction control used in this study;
- Chapter 4 describes briefly the VISSIM models available for this study;
- Chapter 5 explains the criteria used for the selection of the junctions used in this study;
- Chapter 6 provides an analysis of road safety, road network management and traffic for the selected junctions;

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2 Junction assessment framework

2.1 Introduction

2.1.1 The present study follows on from our initial exploratory study which used a generic VISSIM model of a theoretical scenario to determine the threshold, in terms of the level of traffic, at which it is beneficial in economic terms to switch off the traffic signal control and allow traffic to behave under conventional priority rules.

2.1.2 This initial study concluded that the economic benefits and disbenefits of traffic signals are heavily dependent on factors including traffic composition, vehicle occupancy, pedestrian volumes and time of day. The study also highlighted that any assessment of traffic signals should take into account a wider spectrum of influencing factors including safety and network management issues.

2.1.3 CB has proposed that before calculating the economic benefits or disbenefits of using traffic signals to control junctions, it is important to establish the utility of the traffic signals and suitability of using an alternate method of control.

2.1.4 CB proposes the Assessment Framework shown in Figure 2.1 to assess the requirement for traffic signals and define the process to determine a suitable alternative method of control to replace the traffic signal control during periods of switch-off..

2.1.5 It is recognised that most junction appraisals which lead to the installation of traffic signals evaluate peak hour traffic flow conditions and generalise the use of signals over the complete day, week, month and year. This approach, although comprehensive in evaluating impact of traffic signals on safety and traffic flow under worst case conditions, fails to differentiate the operational requirements and benefits during other times of the day. The time of day parameter has been taken into account in this analysis to address this issue.

2.1.6 The Assessment Framework (see Figure 2.1) sets out the process by which appropriate junctions are selected for use in the economic assessment, and then how they are to be modelled following signal switch-off. It addresses the initial requirements for traffic signal control and the evaluation of factors that apply when considering whether a signal installation can be disabled either completely or for certain periods during the day, week, month or year.

2.2 Overview

2.2.1 As set out in *Transport in The Urban Environment (IHT 1997)*, traffic signals are used to control traffic movement through:

- improved road safety;
- major reductions in congestion;
- specific strategies which regulate the use of the road network.

2.2.2 This is described further in Design Standards for Signal schemes in London SQA-0064 (DTO 2007), which describes how The Traffic Control Liaison Committee suggested, in 2002, that to gain uniformity across London boroughs and to reduce the continuing increase in system maintenance costs, justification for signals is based on three criteria:

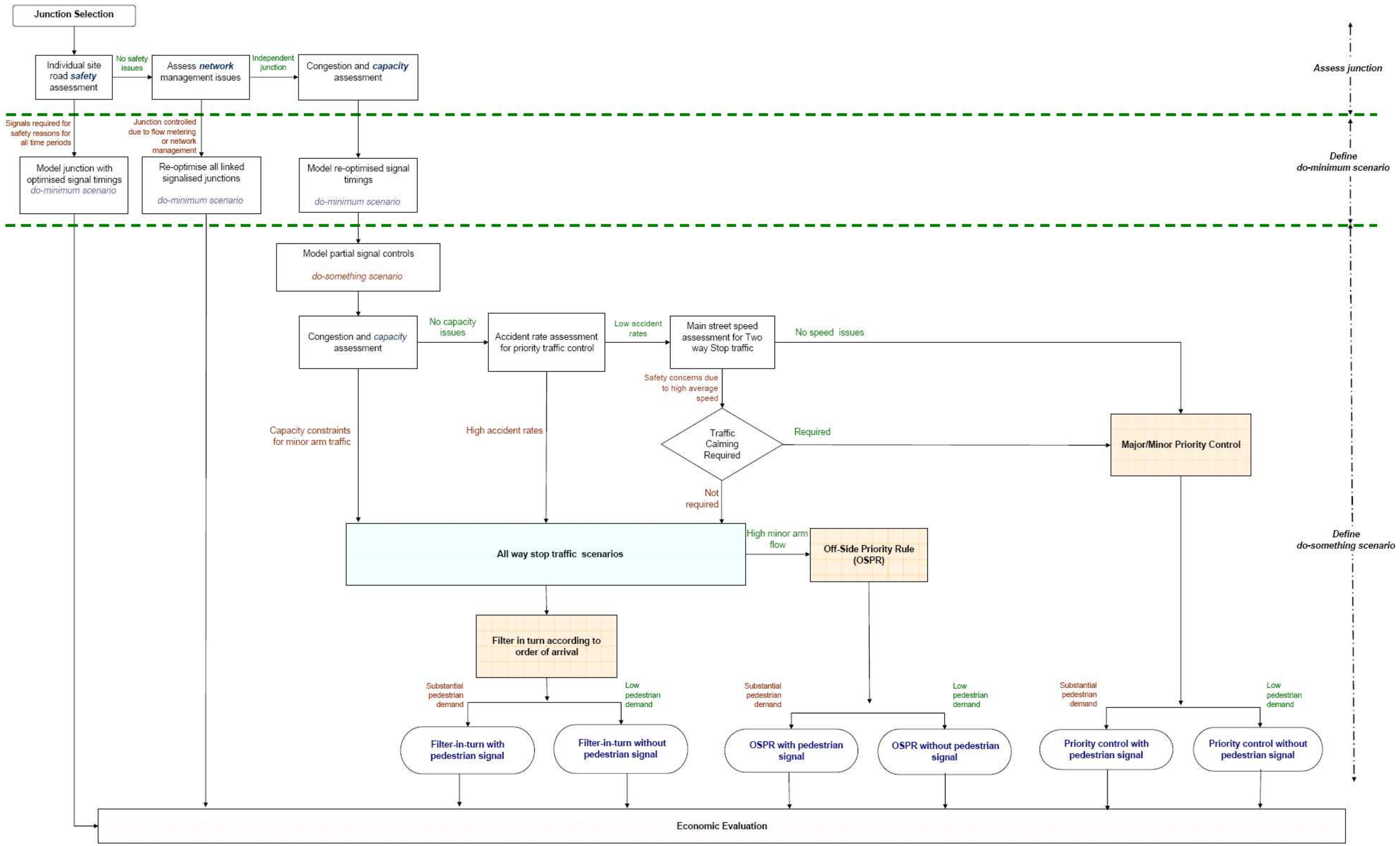
- the proposed site has higher than average accident and the scheme has a positive first year rate of return;
- junction carries total flow in excess of 600vph (30% from side roads) or 1400vph (10% from side roads), or turning flow in excess of 700vph or pedestrian flow in excess of 300 per hour on any arm;
- for a new development, where modelling evidence supports introduction.

2.2.3 The junction is therefore firstly assessed to determine whether or not signals are required on safety grounds, and the extent of risk were signals to be disabled. If this demonstrates that the risk of disabling is considered too high for a particular period, the junction is judged as requiring signal control and economic assessment is undertaken on this basis. If the risk is considered acceptable, then the next criteria is assessed.

2.2.4 The junction is then assessed to determine the importance of the signal control as part of a road network management strategy. If this demonstrates that, perhaps due to traffic flow metering requirements for example, the risk of disabling would undermine network management for a particular period, the junction is judged as requiring signal control and economic assessment is undertaken on this basis. If the risk is considered acceptable, then the next criteria is assessed.

2.2.5 The final criteria is junction capacity. This is assessed to determine whether traffic demand during a particular period can only be accommodated adequately using traffic signal control or can be accommodated using an alternative form of control. If so, what this form might be and then how best to model it using micro-simulation.

Figure 2.1: Junction Assessment Framework



2.3 Individual site road safety assessment

2.3.1 It is proposed that any road safety analysis should be site and time of day specific. Consideration of the safety issues which could arise and which should be considered prior to any formal decision-making, are set out in the following sections of this report.

The ratio of pedestrian and cyclists to vehicular traffic

2.3.2 The proportion of vehicular to pedestrian/cyclist numbers may influence the decisions regarding safety when considering switching off traffic signals.

2.3.3 The cost benefits of switching off the traffic signals, in terms of delay improvements, may be greater than the loss of the cost benefit of accident savings where the proportion of pedestrians or cyclists is very low relative to the proportion of vehicular traffic.

2.3.4 Where the proportion of pedestrians or cyclists is relatively high (such as near schools or other obvious pedestrian desire lines), there are likely to be many crossing movements and therefore a high level of vehicle/pedestrian conflicts. The cost benefit of providing signal control in terms of a possible reduction in the number of potential vehicle/pedestrian accidents arising from this conflict may be greater than any delay savings resulting from switching off the signals.

2.3.5 This would not be the case in situations where the overall traffic volume is very high. The number of potential gaps which could be used by pedestrians to cross safely is likely to be far fewer in high traffic volume situations.

2.3.6 Clearly, conditions would vary with time of day, and so an optimum traffic/pedestrian/cyclist volume and ratio would need to be identified. The time at which it may be most appropriate to switch off traffic signals would have to be decided on a site by site basis.

Carriageway widths

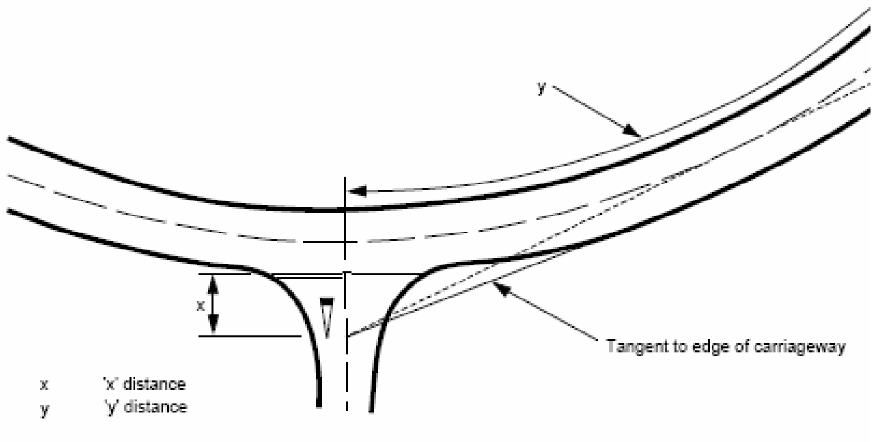
2.3.7 The overall width of the carriageway, and number of traffic lanes, should be a consideration in deciding whether traffic signals may be switched off, as the greater the distance that a pedestrian has to travel in order to cross the road, the greater the potential exposure to risk.

Junction layout and geometry

2.3.8 The layout of the junction (excluding roundabout junctions) in terms of inter-visibility, the number of arms and permitted movements, as well as whether or not there is any obvious priority, may all be factors in influencing safety at a junction during periods of traffic signal switch off. This can be outlined as follows:

- **Inter-visibility;** Where unobstructed junction inter-visibility (and visibility splays which comply with those required for the type of junction which will be created if traffic signals are switched off) can be achieved, such junctions should score well, as any reduction in safety is less likely to be serious than at junctions where there are obstructions to visibility. Although TD 50/04 recommends unobstructed junction inter-visibility, Relaxations or departures from standard sometimes result in the provision of signal controlled junctions which have poor junction inter-visibility.
- **Visibility splays at priority junctions;** Visibility splays at priority junctions are measured with two values known as distance ‘x’ and distance ‘y’. The ‘x’ distance is measured along the centreline of the major carriageway and should be 9 m (minimum of 2.4 m in difficult circumstances when traffic flows are low). From this point an approaching driver should be able to see clearly points to the left and right on the major road at a distance of 70m (distance ‘y’) for the design speed of major road of 50 kph, measured from its intersection with the centreline. The measurement of the ‘x’ and ‘y’ distances is shown in Figure 2.2.

Figure 2.2: Visibility standards with a curved major road (TD 42/95 Geometric Design of Major/Minor Priority Junctions)



- **DMSSD;** Desirable Minimum Stopping Sight Distance refers to drivers approaching the junction on the major and minor road and is chosen according to the design speed of this road. The DMSSD for the design speed of 50kph is 70m with one step below Desirable Minimum being 50m.
- **Forward visibility at entry to roundabout;** Drivers of vehicles approaching the give way line must be able to see objects of height between 0.26m and 2m on the full width of the circulatory carriageway for the Visibility Distance as specified in TD 16/ 93 Geometric design of Roundabouts.
- **Visibility to the right at roundabouts;** Drivers of all vehicles approaching the give way line must be able to see the full width of the circulatory carriageway to their right for the Visibility Distance as specified in TD16/93 Geometric design of roundabouts. It also needs to be checked from the centre of the offside lane at a distance of 15m back from the give way line.

- **Number of arms;** The more arms a junction has, and the higher the number of permitted turning movements, the higher the number of potential conflict points, and the higher the number of directions a crossing pedestrian may need to check before making the decision as to whether or not it is safe to cross.
- **Permitted movements;** Where some movements may be banned, the number of potential conflict points and directions of approaching traffic will be reduced, which could be safer than situations where all traffic movements are permitted. However, the signing and markings at such junctions will need to be carefully reviewed, as drivers may (incorrectly) assume that movements which are not permitted during the hours of signal operation are permitted when the signals are switched off or operate differently than during peak hours. This could result in a serious reduction in safety if unexpected manoeuvres are undertaken at certain time of day.
- **Obvious priority;** At junctions where there is a clear priority (such as roundabouts or three-armed junctions at which a minor road joins a major road at right angles in a clear T form), the ease with which drivers adapt to the new situation is likely to be greater, and so may have less of a safety implication. However, where priority is not clear (such as Y junctions, or crossroads junctions where the flow on each arm is relatively equal), the potential for conflict and driver/pedestrian indecision will be increased.

Pedestrian and Cyclist provision

2.3.9 The type and number of crossing facilities provided at a signal controlled junction, as well as the proximity of alternative crossing facilities on site, might influence safety, and should be considered. This can be outlined as follows:

- **Controlled crossing facilities:** When controlled crossing facilities are provided as part of the existing signal arrangement, and in the absence of other facilities, the greatest potential reduction in safety for pedestrians could be expected, in the event that signals are switched off or operate differently than in the peak hour. However, it would be expected that the reduction in safety would not be so great in locations where central refuges provide opportunity for pedestrians to cross in parts.
- **Signalised junctions where pedestrian crossing points are uncontrolled:** Removing signal control at such junctions may have a negative impact on safety as the number of gaps created for pedestrians to cross would be reduced. Pedestrian crossing behaviour may, however, be different to that at controlled crossing points as users may be more used to utilising gaps in traffic rather than obeying signal control.
- **Stand alone facilities nearby:** The proximity of alternative crossing facilities (such as Toucan or Pelican crossings) would be expected to mitigate the safety impact of a switch off.
- **ASL's:** At junctions where Advanced Stop Lines for cyclists are currently provided, the switching off of traffic signals is likely to result in traffic positioning itself closer to the junction (i.e. within the ASL) in order to maximise visibility. As a result, safety for cyclists at such junctions might be expected to decline during times when signals are switched off.

Characteristics of traffic

2.3.10 Factors such as driver approach and through speed and the proportion of heavy goods vehicles travelling through the junction are also likely to have an impact on safety during periods when the signals are switched off. This can be outlined as follows:

- **Approach speeds:** Whilst it is possible that traffic signal switch off could result in lower traffic speeds, as drivers may be unsure of priority (which could have a positive effect on safety), it is also possible that drivers who consider themselves on the priority arm or route will increase speed on approach. This will increase the risk to pedestrians trying to judge safe crossing gaps and drivers may be less willing to give way to traffic on other arms. This will, in turn, increase the potential for conflict with traffic on other arms.
- **Through speeds:** Traffic signal switch off may enable left-turning vehicles to approach and turn left at the junction more efficiently. Depending on opposing traffic movements, there could be increased opportunities for left-turning traffic to undertake this movement without stopping. This will give cyclists less warning of a large vehicle planning to turn left and potentially increase this already common collision type at junctions.
- **Goods vehicles:** The higher the proportion of such vehicles, the higher the potential for masking of traffic in adjacent lanes, and for an increase in the severity of any eventual collisions. Although possibly a minor factor, it will nevertheless have a negative impact on safety in the event of signal switch off.

Collision history

2.3.11 Analysis of the collision history at a junction under consideration will be of great benefit in assessing the likely safety implications of switching off traffic signals.

2.4 Road network management

2.4.1 The use of traffic signals could, in parts of the road network, be dictated by traffic management imperatives over local congestion or road safety considerations. This study will need to take this specific use into account. The following key assessments would be required:

- Is the traffic signal part of any strategic network, e.g. TLRN (Transport for London Road Network);
- Is the signal used for enforcing speed or flow metering; or
- Is the signal part of group of signals, e.g. SCOOT.

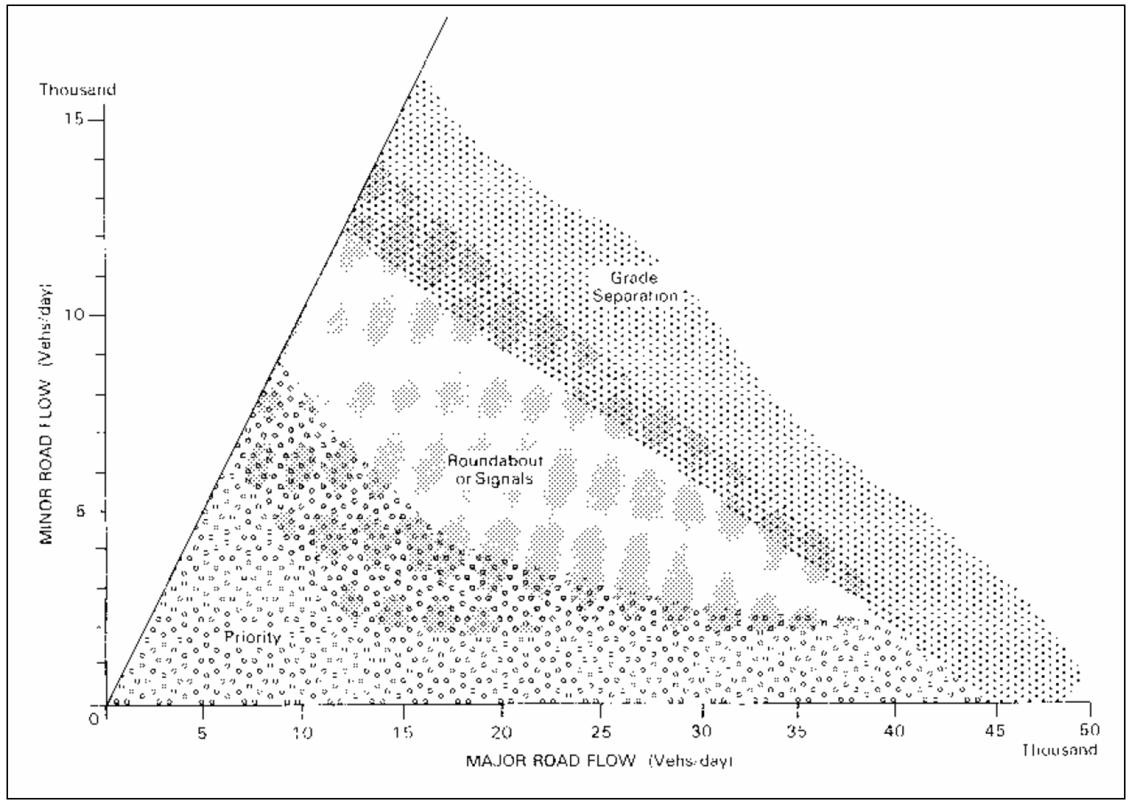
2.5 Congestion and capacity assessment

2.5.1 The positive or negative impact of traffic signals on congestion will be assessed through:

- the degree of saturation;
- the traffic throughput and reserve capacity;
- vehicular delay;
- delay to passengers and other street users;
- scope for further signal timing optimisation; and
- requirements during different times of the day.

2.5.2 Figure 2.3 shows the conventional approach to choosing junction type based on the simple relationship between traffic flows on major/minor roads, using average daily traffic demand. This diagram does not compare the type of junction to time of the day, but it gives a good indication of possible alternatives.

Figure 2.3: Type of Junction appropriate for different traffic flows on major/minor roads



Source: Transport in the Urban Environment

2.5.3 This part of the Framework will assess whether or not the level of traffic at a junction necessitates traffic signal control or not. As with the road safety section, this assessment will be site and time of day specific.

2.6 Mitigation and alternative strategies

2.6.1 The Framework defines alternate strategies in the event that signal performance is found to be sub-optimal or when the disadvantages due to the traffic signals outweigh the advantages during part of or a complete period.

2.6.2 A detailed review of existing measures and provisions within the legislation to provide for alternatives to current junction design has been conducted. These strategies may include:

- Introduce part–time signal control;
- Introduce flashing amber signal to traffic during off-peak scenario;
- Optimising the signal settings for all periods of day, if found to be inappropriate.

2.6.3 Part-time signal control is currently in use in the UK at roundabouts, although the number of sites has been diminishing in recent years due to safety and design concerns. The traffic signals are switched off for most of the day. If the entry arms suffer long queues, the traffic signals are automatically switched-on to regulate conflicts. This method is also considered at standard crossroads and T-junctions, but flashing amber arrangements might be preferred.

2.6.4 Presenting a flashing amber signal to traffic does not currently constitute a possible alternative within the UK context for the moment, but is supported by the Vienna convention and this method of control is now commonplace in some countries of Europe and across the World.

2.6.5 It is very difficult to predict what road-user response and behaviour would be during traffic signal switch-off. The closest condition that we have in the UK so far, save for a very few sites that have no technical evaluation of behaviour, is that which occurs during a signal failure. Attempts to standardise modelling/ forecasting techniques of this condition have, to date, not been particularly successful. This study considers a range of responses and possible methods of simplifying the assessment of these responses.

2.6.6 Table 3.1 presents the closest approximation to alternative conventional methods of control, or road-user responses, envisaged in the absence of formal traffic signal arrangement with the traditional green, red and amber signal.

Table 2.1: Approximation to alternative method of control

	Traffic Management Regime	Anarchic			Filter-in-turn (FiT)			Off-Side Priority Rule (OSPR)			Major/minor Priority Control		
	Degree of control	None	Regulated	Partial Control	None	Regulated	Partial Control	None	Regulated	Partial Control	None	Regulated	Partial Control
Control Regime	Vehicle to vehicle control regulations	None			Filter-in-turn according to order of arrival			Give way to vehicles approaching from the right (as if mini-roundabout)			Minor road traffic gives way to major road traffic (as if conventional major/minor priority junction)		
	Traffic signal regime	Switched off or flashing amber	Switched off or flashing amber	Flashing amber with all-red pedestrian crossing stage	Switched off or flashing amber	Switched off or flashing amber	Flashing amber with all-red pedestrian crossing stage	Switched off or flashing amber	Switched off or flashing amber	Flashing amber with all-red pedestrian crossing stage	Switched off or flashing amber	Switched off or flashing amber	Flashing amber with all-red pedestrian crossing stage
	Vehicle to pedestrian control regulations	None	Pedestrians have priority (presumed that crossings revert to zebra)	Vehicles must stop at red signal to allow pedestrians to cross	Filter-in-turn according to order of arrival	Pedestrians have priority (presumed that crossings revert to zebra)	Vehicles must stop at red signal to allow pedestrians to cross	None	Pedestrians have priority (presumed that crossings revert to zebra)	Vehicles must stop at red signal to allow pedestrians to cross	None	Pedestrians have priority (presumed that crossings revert to zebra)	Vehicles must stop at red signal to allow pedestrians to cross
Modelled User Behaviour	Driver behavior	No premeditated order, completely random	No premeditated order, completely random	No premeditated order, completely random, until pedestrian forces controlled crossing stage	Drivers judge priority according to order of arrival	Drivers judge priority according to order of arrival, but must give priority to pedestrians	Drivers judge priority according to order of arrival, until pedestrian forces controlled crossing stage	Drivers judge whether gap is sufficient to accord with off-side priority rule	Drivers judge whether gap is sufficient to accord with off-side priority rule, but must give priority to pedestrians	Drivers judge whether gap is sufficient to accord with off-side priority rule, until pedestrian forces controlled crossing stage	Drivers judge whether gap is sufficient to accord with conventional major/minor priority rule	Drivers judge whether gap is sufficient to accord with conventional major/minor priority rule, but must give priority to pedestrians	Drivers judge whether gap is sufficient to accord with conventional major/minor priority rule, until pedestrian forces controlled crossing stage
	Pedestrian behavior	No premeditated order, completely random	Pedestrians assume priority through presence on crossing	Pedestrians cross in gaps or force controlled crossing stage	Pedestrians judge priority according to order of arrival	Pedestrians assume priority through presence on crossing	Pedestrians cross in gaps or force controlled crossing stage	Pedestrians cross in gaps	Pedestrians assume priority through presence on crossing	Pedestrians cross in gaps or force controlled crossing stage	Pedestrians cross in gaps	Pedestrians assume priority through presence on crossing	Pedestrians cross in gaps or force controlled crossing stage

Note* Traffic signals switched off will normally require hooding or advance signal failure warning sign (could be VMS)

Traffic signals on flashing amber will require alteration to Road Traffic Regulation Act

Priority to pedestrians under flashing amber already covered by RTRA and Highway Code

3 Alternative method of control for this study

3.1 Introduction

3.1.1 The following sections describe the plausible regulatory framework for junction control should it be required to discontinue traffic signals completely or disable signal control during different times of the day, week or year. As such, these are based on principles of how traffic is likely to behave, or can be encouraged to behave, at junctions when signals are disabled. These assumptions regarding behaviour are based on information available, engineering judgement and expected limitations in absence of clear evidence.

3.1.2 At the time this report was being finalised, a live trial was underway at the Cabstand junction in Portishead, North Somerset to test the impact of disabling traffic signal control at all times. The trial was proving extremely successful in junction capacity terms, and provided an opportunity to witness first-hand the type of behaviour that occurs at junctions when traffic signal control is disabled completely, without any form of vehicular or pedestrian priority markings in place.

3.2 Literature review

Vienna Convention on Road Signs and Signals

3.2.2 The Vienna Convention on Road Signs and Signals is an international treaty designed to increase road safety and aid international road traffic by standardising the signing system for road signs, traffic signals and road markings in use internationally. This convention was agreed upon by the United Nations Economic and Social Council at the UNESC Conference on Road Traffic in Vienna, 7th October 1968 to 8th November 1968, was signed on 8th November 1968 and came into force on 6th June 1978. This conference also produced the Vienna Convention on Road Traffic, which complements this legislation by standardising international traffic laws.

3.2.3 The convention revised and substantially extended the earlier 1949 Geneva Protocol on Road Signs and Signals. Amendments, including new provision regarding the legibility of signs, priority at roundabouts and new signs to improve safety in tunnels were adopted in 2003.

3.2.4 The UK does not adopt the Convention in it’s entirety and roads signs are subject to the Traffic Signs Regulations and General Directions. It is not at all clear whether the UK’s road safety and performance characteristics would be better or worse under the Vienna Convention and this would seem to be an area that would benefit from further research, nevertheless, this serves to show that alternative conventions are in operation and that aspects might be appropriate for adoption, if required.

Traffic signal specification under the Convention

3.2.5 Table 3.1 shows the lamp colours which may be used for traffic signals and their meanings, as well as places and purposes for which the lights may be used, as specified by the Convention.

3.2.6 Any other use of the lights is in breach of the Convention.

Amber Flashing Light at intersections

3.2.7 A flashing amber light at intersections and a flashing lunar white light at crossings are not currently used in the UK. Flashing amber is, however, used at stand-alone PELICAN crossings. The Department for Transport could not authorise use of flashing amber signals at junctions until such time that their use at PELICAN crossings was terminated. This is entirely possible with the advent of PUFFIN crossings, which are gradually replacing PELICAN crossings across the country and which do not use a flashing amber signal. It might therefore seem sensible to begin to consider applications for flashing amber in the UK, in anticipation of the complete adoption of PUFFIN crossings facilities.

3.2.8 In accordance with the Convention, a single amber flashing light or two amber lights flashing alternately shall mean that drivers may proceed but shall do so with particular care. Flashing amber light may be installed alone or may also be used in place of a three- colour system at times when traffic demand is light.

3.2.9 For this study, three alternative methods of control are considered:

- Switching off traffic signals and not providing an alternative priority system;
- Introducing flashing amber with priority to the right;
- Introducing flashing amber with a minor/major road priority.

3.2.10 The application of these methods to junctions in the UK, along with the behaviour that might be expected – or which has been assumed, for simplicity, to occur under flashing amber is described below. This describes how road user behaviour has then been assessed within the micro-simulation environment.

Table 3.1: Signal aspects according to the Vienna Convention

Type	Shape	Colour	Position	Meaning
Non-flashing	Plain	Green	At intersection	Proceed
		Amber	At intersection, level crossing, swing bridge, airport, fire station or ferry terminal	Stop if possible
		Red	At intersection	Stop
		Red and amber	At intersection	Signal is about to change
	Arrow pointing left	Green	At intersection	Only traffic turning left may proceed
	Arrow pointing right	Green	At intersection	Only traffic turning right may proceed
	Arrow pointing upwards	Green	At intersection	Only traffic travelling straight ahead may proceed
	Arrow pointing downwards	Green	Above lane	Traffic may continue in lane
	Cross	Red	Above lane	Traffic may not enter lane
	Arrow pointing diagonally downwards	Amber or white	Above lane	Lane closes shortly ahead, change lane
Flashing	Plain	Double Red	At level crossing, swing bridge, airport, fire station or ferry terminal	Stop
		Amber	Anywhere except intersection	Proceed with caution
		Amber	At intersection	The priority is determined by Main Road or Yield signs
		Lunar white	At crossing	Proceed

3.3 Switch off, no traffic signal

Description

3.3.2 In this scenario traffic signals would be temporarily switched off during specific time periods. At present, it is assumed that this could generally only be carried out at locations where part-time signal control might be expected and priority is immediately obvious, namely at roundabouts. Drivers are assumed to give priority to traffic approaching from the right.

3.3.3 Without any evidence of whether or not part-time operation might be a solution for other forms of junction, it is not considered appropriate to apply this method of control to junction arrangements other than roundabouts for the purposes of this study. It is, however, a condition that is relatively commonplace when traffic signal faults occur.

Advantages

3.3.4 Disabling traffic signals at a roundabout would be expected to lead to drivers reverting to the form of behaviour normally expected at non-signalised roundabouts, namely giving priority to traffic approaching from the right. In this case there is unlikely to be any confusion regarding vehicular priority.

Disadvantages

3.3.5 If signals were switched off only during certain times of the day, this could lead to uncertainty between both drivers and pedestrians as to whether this was intentional or due to a mechanical fault. This problem would be resolved with the introduction of appropriate signage informing all road users of the temporary switch off and use of part-time signals, as is presently adopted in the UK.

3.3.6 If pedestrians were provided with controlled pedestrian facilities at a signal controlled roundabout, the switch-off will impact on their amenity and might affect their safety, by forcing them to look for gaps in oncoming traffic rather than cross the carriageway during a pedestrian stage. This assumes that pedestrians are expected to defer to vehicles and that vehicle drivers do not alter their behaviour to provide priority, which would be possible with further advance signing instructing drivers to yield to pedestrians, or indeed re-education.

3.3.7 The disabling of traffic signals removes the ability to manage fluctuations in demand, and capacity problems on one or more of the approaches might be encountered when there is a predominant flow of traffic in one direction.

3.4 Flashing amber, priority to the right

Description

3.4.2 In this scenario, normal operation of traffic signals would be replaced at certain times of the day with the introduction of flashing amber to all approaches. Drivers are assumed to give priority to vehicles approaching the junction from the right. This method would be feasible at all forms of junction, but is assumed to apply only to crossroad junctions for the purposes of this study.

3.4.3 If traffic demand is broadly balanced across all arms, then no single approach or movement is likely to 'force' priority for itself and so behaviour would be similar to that found at all-way stop junctions in the US. If, however, there is a predominant movement on a main road through a junction, behaviour is likely to revert to a conventional major/minor priority arrangement. If there is a predominant right-turn movement (for example), behaviour is likely to revert to a conventional offside priority arrangement.

3.4.4 This is likely, however, to be affected by the geometry of the junction and the number of approach lanes, and a junction that is clearly designed to have a major/minor road arrangement is then likely to influence traffic behaviour towards major/minor road priority behaviour.

Advantages

3.4.5 Introduction of flashing amber together with appropriate signage, akin to that found on the approach to mini-roundabouts in the UK, would give both drivers and pedestrians a good indication of the altered method of control at the junction, encouraging them to take appropriate care on the approach.

Disadvantages

3.4.6 Since priority is not immediately clear at a crossroad junction, an introduction of flashing amber could lead to some confusion and possible conflict between different streams of traffic. As well as signage, it would be beneficial to re-educate road users on appropriate behaviour at such locations, but this would be costly.

3.4.7 The lack of specific signal control removes the ability to manage fluctuations in demand, and capacity problems on one or more of the approaches might be encountered when there is a predominant flow of traffic in one direction. This would be solved by introducing detection equipment that would switch the signals back on, yet this could not be used on a minute by minute basis.

3.4.8 Pedestrian amenity will be affected and their safety could be affected if they were no longer provided with controlled facilities and there were insufficient gaps in traffic to cross the carriageway, assuming again that pedestrians would be expected to defer to vehicles. To avoid this, a pedestrian actuated crossing stage would be incorporated into the plan, yet it would mean that these facilities would also be required under normal traffic signal operating hours. Thus, formal crossing facilities would need to be introduced to all junctions where flashing amber was to be adopted.

3.5 Flashing amber, major/minor priority

Description

3.5.2 In this scenario, normal operation of traffic signals would be replaced at certain times of the day with the introduction of flashing amber. Drivers are assumed to apply priority rules of a major/minor priority junction. This method of control would be appropriate for T-junctions.

Advantages

3.5.3 An introduction of flashing amber in conjunction with appropriate signage , in the form of a standard UK advance warning sign for T junction and priority route, would make drivers aware of the altered method of control at the junction, encouraging them to take appropriate care on the approach.

Disadvantages

3.5.4 In a similar manner to crossroads, as well as signage it would be beneficial to re-educate road users on appropriate behaviour at such locations, but this would be costly.

3.5.5 The lack of specific signal control removes the ability to manage fluctuations in demand, and capacity problems on one or more of the approaches might be encountered when there is a predominant flow of traffic in one direction. This would be solved by introducing detection equipment that would switch the signals back on, yet this could not be used on a minute by minute basis.

3.5.6 Pedestrian amenity will be affected and their safety could be affected if they were no longer provided with controlled facilities and there were insufficient gaps in traffic to cross the carriageway, assuming again that pedestrians would be expected to defer to vehicles. To avoid this, a pedestrian actuated crossing stage would be incorporated into the plan, yet it would mean that these facilities would also be required under normal traffic signal operating hours. Thus, formal crossing facilities would need to be introduced to all junctions where flashing amber was to be adopted.

3.6 Modelling assumptions

3.6.1 Some of these alternative methods of control are not generally in use in the UK. In order to model the behaviour of vehicular and pedestrian traffic at a junction where signal control is to be disabled, it is necessary to make assumptions that cannot be verified with robust evidence. However, in absence of any before-and-after data from appropriate sites in the UK, modelling assumptions have been made for the present study based on generalised traffic behaviour.

3.6.2 In addition, it was assumed that if the traffic signals were to be switched off (or flashing amber was introduced) for all or part of the day, all road users would be informed of the alternative control regime before it was introduced. As such, the study assumes drivers to be informed about the new regulations and expected behaviour through regulating traffic signs, public information campaigns, re-training and through gradual learning and word of mouth.

3.6.3 Further assumptions related to road safety and their plausible impacts have been considered in detail in Section 5.5 of the main report.

4 Models available for selection greater London area

4.1 Model selection criteria

4.1.1 As the current study is dependent on the availability of TfL approved VISSIM micro-simulation models of key junctions, all available VISSIM models were assessed on their mix of characteristics and availability of data.

4.1.2 A set of VISSIM micro-simulation traffic models were pre-selected and presented to the study team, to select the final junctions to be considered for further evaluations.

4.1.3 Most of the VISSIM models considered for pre-selection were developed for the purposes of providing DTO with live models with which to assess appropriate traffic management strategies and to test network resilience. As such, they needed to be calibrated and validated to particular DTO standards, which are set out in DTO Modelling Guidelines (current Version 2, July 2006). Others have been developed to assess the impact of proposed developments, but were still developed to DTO standards.

4.1.4 The selected models also include junctions which could potentially operate with an alternative method of traffic management control, such as flashing ambers, without giving rise to issues on the main route corridor.

4.1.5 The selected models represent a variety of urban traffic environments, but most of them were developed to deal with peak hour traffic congestion only.

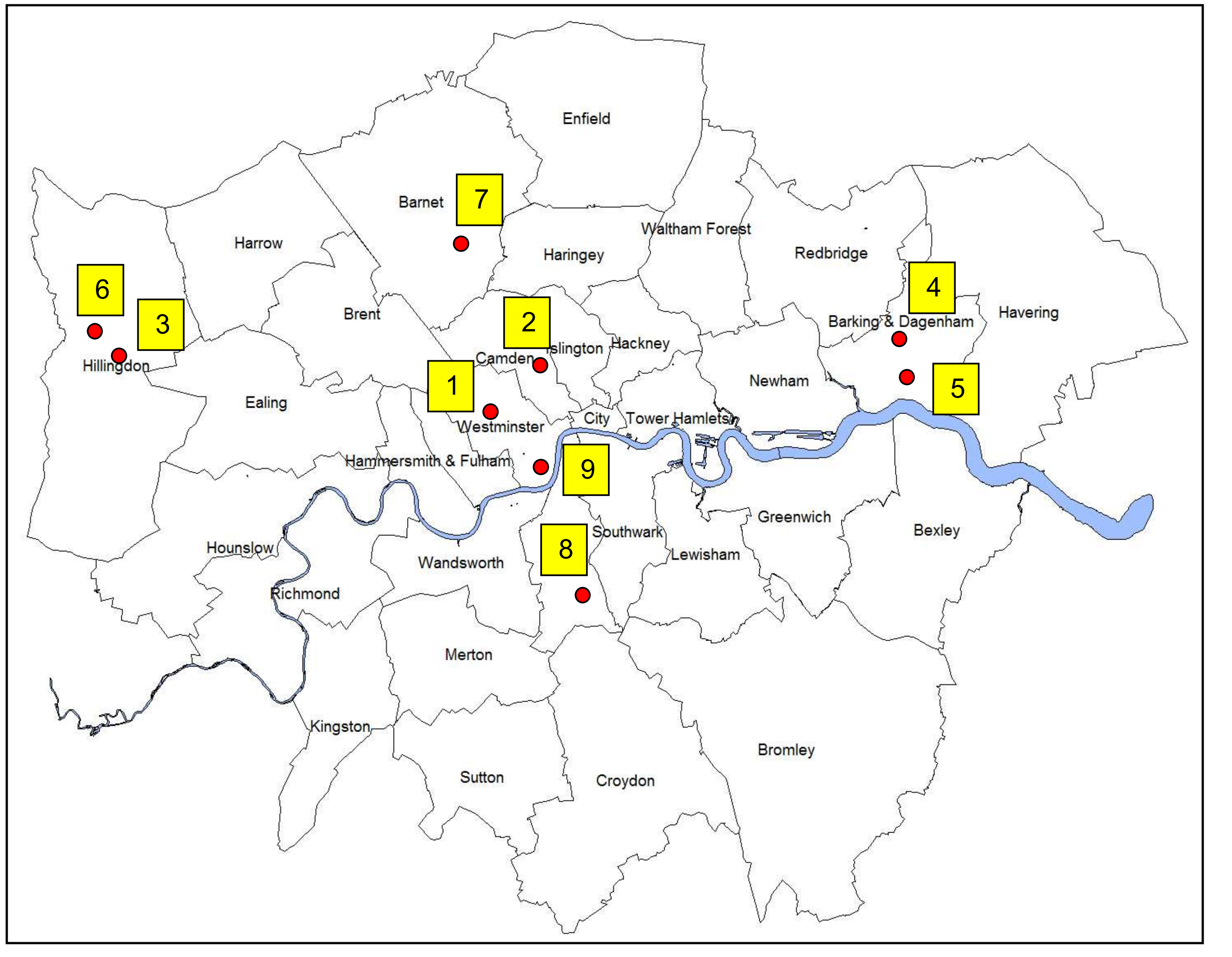
4.2 Model locations

4.2.1 Figure 4.1 shows the location of the following models, which were pre-selected for consideration for this study:

- 1 - Edgware Road Marble Arch;
- 2 - King's Cross Interchange;
- 3 - Church Road;
- 4 - Ilford Gyratory;
- 5 - A13 River Road;
- 6 - Hillingdon Station;
- 7 - East Barnet;
- 8 - West Norwood;
- 9 - Parliament Square and Victoria Embankment.

4.2.2 The model details are presented in the following sections of this report.

Figure 4.1: VISSIM model locations

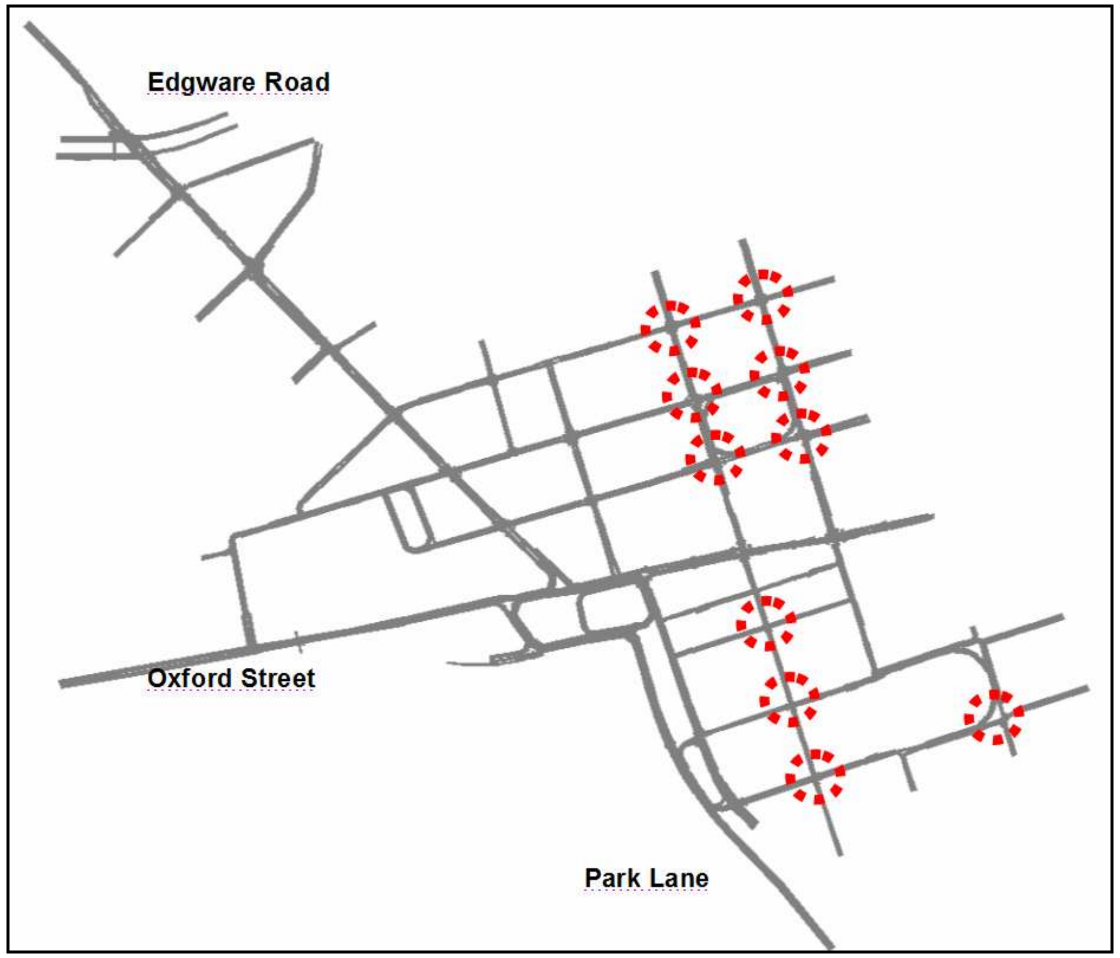


4.3 VISSIM model 1 – Edgware Road

Model Layout

4.3.2 Figure 4.1 shows the extent of the Marble Arch area VISSIM model and junctions potentially suitable for an alternative method of traffic management control.

Figure 4.1: Extent of Edgware Road - Marble Arch VISSIM model



Model initial purpose

4.3.3 This model has been developed to test the impact of the closure of the western end of Oxford Street to general traffic.

Model definition

4.3.4 Time periods available:

- morning
- evening

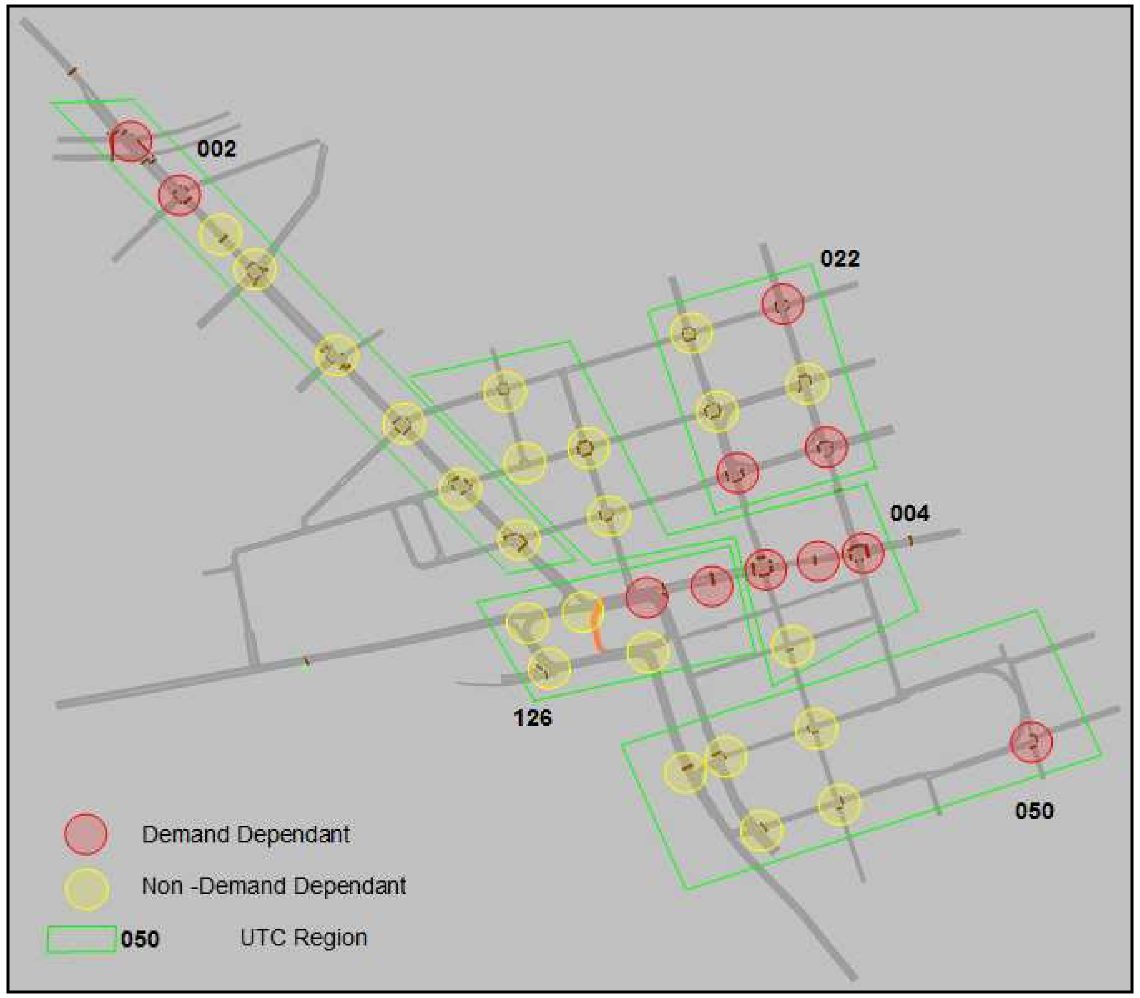
Model date and status

4.3.5 Early 2009, post-Marble Arch at-grade pedestrian crossing commissioning, which occurred in October 2008 and modified from the model constructed to assess the CCWEZ impact and timing strategies. Mostly DTO approved.

Potential junctions for study

4.3.6 Current method of control is shown on Figure 4.2.

Figure 4.2: Junction Method of Control



4.3.7 Region 022 consists of the following nodes:

- 01/171 - Gloucester Place/ George Street
- 01/072 - Portman Square/ Upper Berkeley Street/ Gloucester Place
- 01/173 - Baker Street/ George Street
- 01/174 - Baker Street/ Portman Square/ Fitzhardinge Street
- 01/175 - Seymour Street/ Portman Square/ Portman Street
- 01/176 - Baker Street/ Wigmore Street/ Portman Square

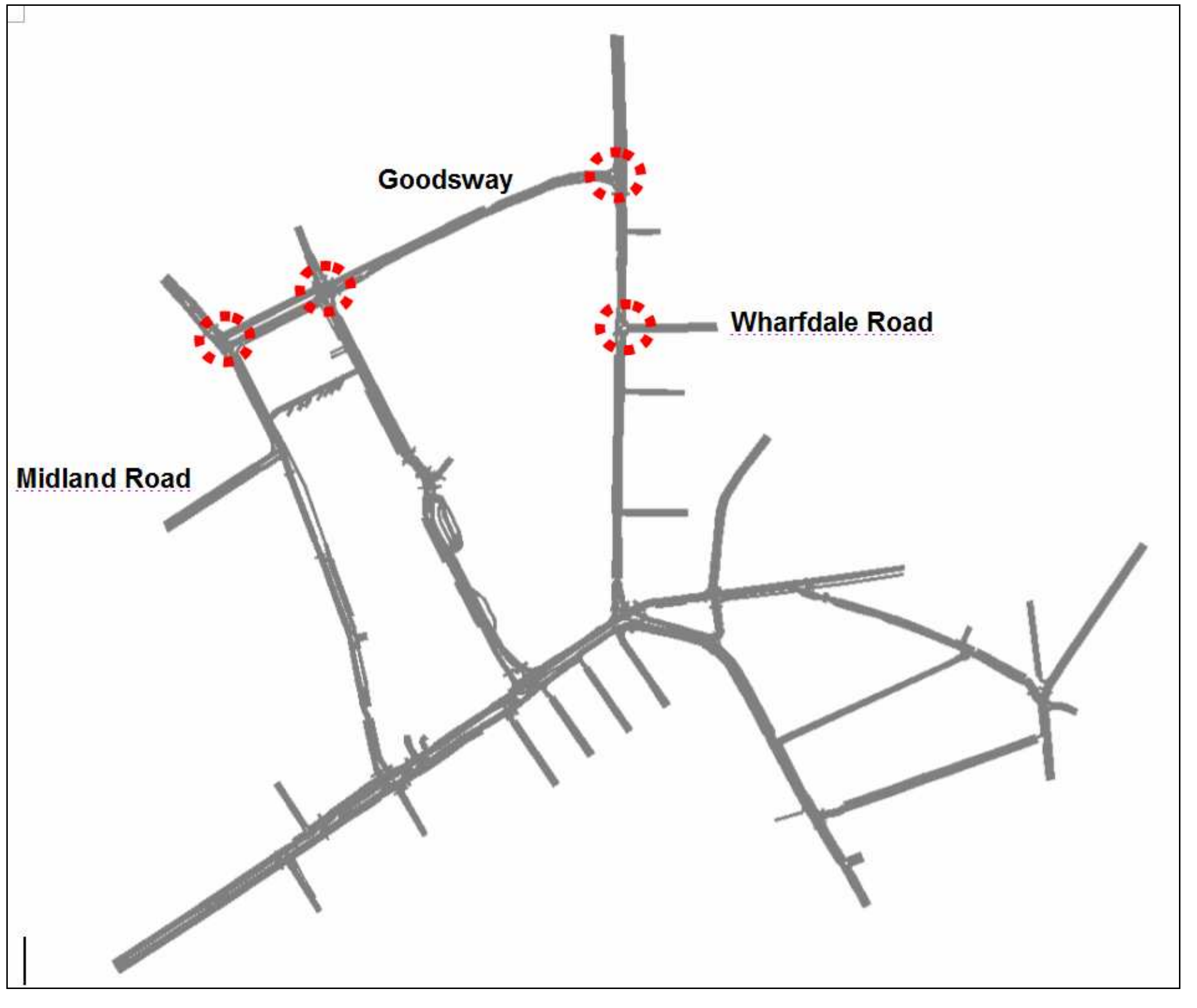
4.3.8 Region 050 includes the node 01/306 which represents Grosvenor Square/ Carlos Place/ Grosvenor Street junction.

4.4 VISSIM model 2 – A501 King's Cross Interchange

Model Layout

4.4.2 Figure 4.3 shows the extent of the Kings Cross area VISSIM model and junctions potentially suitable for an alternative method of traffic management control.

Figure 4.3: Extent of King's Cross Interchange VISSIM model



Model initial purpose

4.4.3 These models were developed to enable the testing of the impact of some of the proposed schemes in the study area, associated with the redevelopment of Kings Cross and Street Pancras stations and railway lands.

Model definition

4.4.4 Time periods available:

- morning
- inter-peak
- evening

Model date and status

4.4.5 Late 2008, post-St Pancras International Station opening in October 2008, not DTO audited.

Potential junctions for study

4.4.6 Potential junctions within the network are:

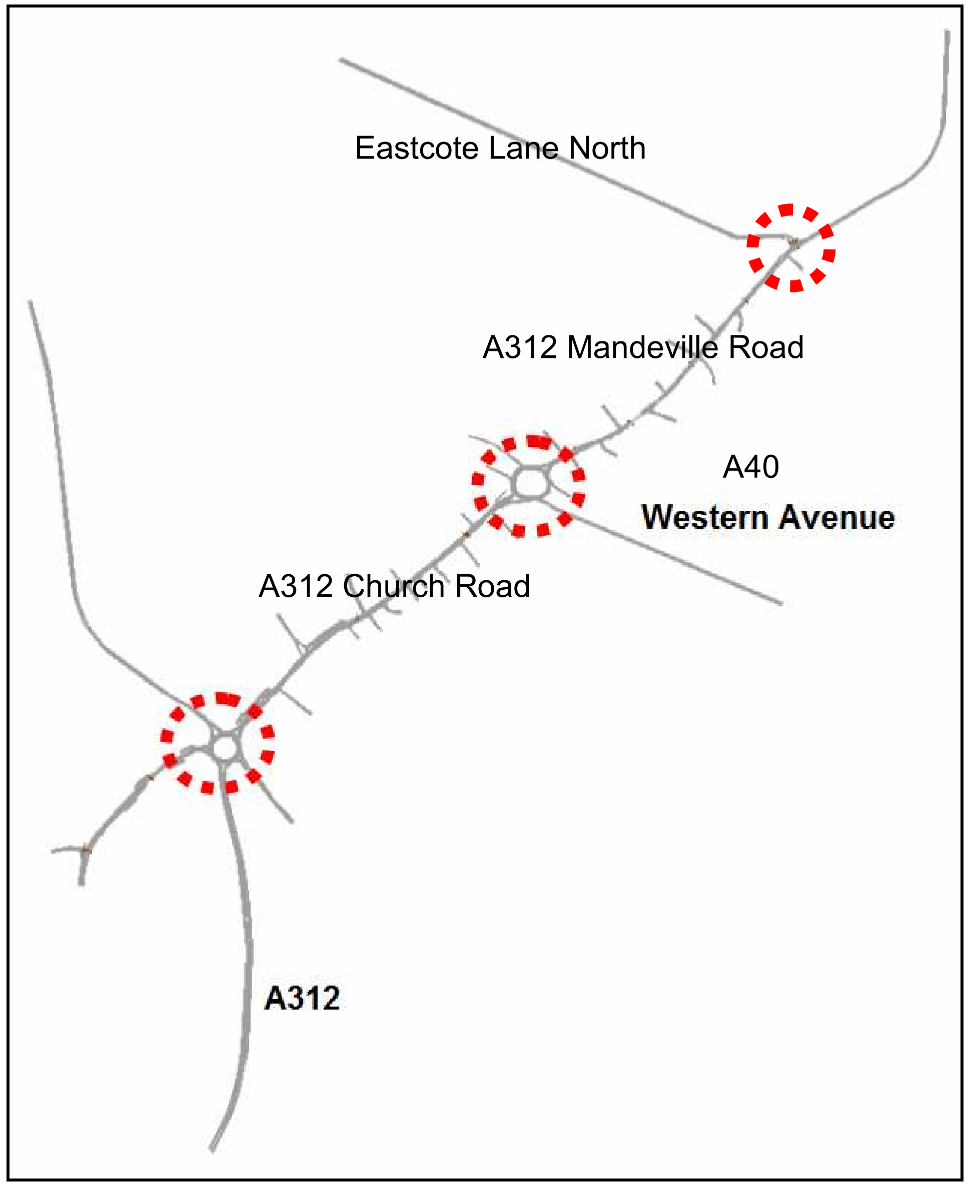
- 02/188 – York Way/Goods Way
- 02/221 & 02/227 – York Way/Wharfdale Road
- 02/267 – Midland Road /Goods Way/Pancras Road
- 02/266 – Goods Way/Pancras Road

4.5 VISSIM model 3 – A312 Church Road Corridor

Model Layout

4.5.2 Figure 4.4 shows the extent of the Church Road Corridor VISSIM model and junctions potentially suitable for an alternative method of traffic management control.

Figure 4.4: Extent of A312 Church Road Corridor VISSIM model



Model initial purpose

4.5.3 The model' purpose was to test modifications to Target Roundabout and the impact of the introduction of SCOOT along the corridor.

Model definition

4.5.4 Time periods available:

- morning
- inter-peak
- evening
- Saturday Peak

Model date and status

4.5.5 Mid 2007 and DTO audited.

Potential Junctions for study

4.5.6 Potential junctions within the network are:

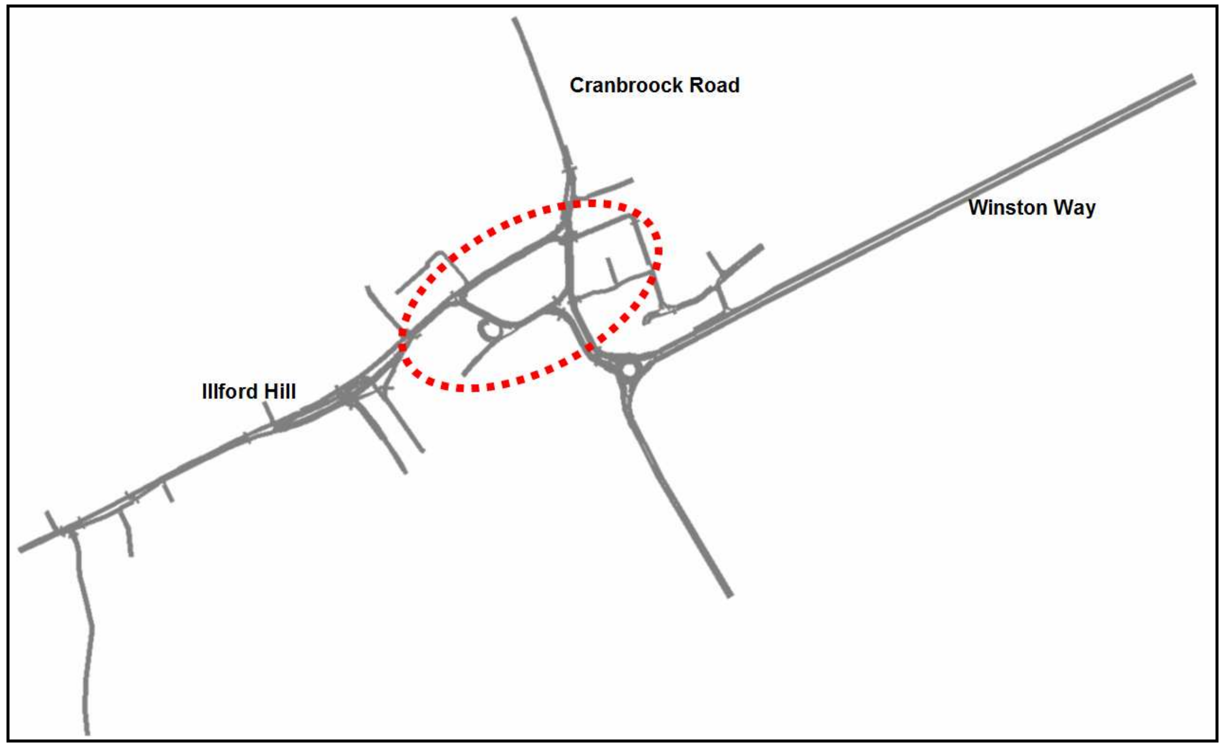
- Target roundabout
- White hart roundabout
- Mandeville Road/Eastcote Lane North

4.6 VISSIM model 4 - Ilford Gyratory

Model Layout

4.6.2 Figure 4.5 shows the extent of the Ilford Gyratory VISSIM model and junctions potentially suitable for an alternative method of traffic management control.

Figure 4.5: Extent of Ilford Gyratory VISSIM model



Model Initial purpose

4.6.3 The model was developed to assess the impact of the junction layout and signal timing changes for East London Bus Rapid Transit system.

Model definition

4.6.4 Time periods available:

- morning
- inter-peak
- evening

Model date and status

4.6.5 Early 2008 and VMAP audited. Works are currently occurring on site, but the proposed model is also available and DTO VMAP audited.

Potential junctions for study

4.6.6 Potential junctions within the network are:

- 14/015 High Road Ilford - Ilford lane - A118 Ilford Hill - A123 Cranbrook Rd
- 14/180 High Road Ilford - Ilford lane - A118 Ilford Hill - A123 Cranbrook Rd
- 14/039 A118 Chapel Road - Clements Lane - Winston Way
- 14/075 Ilford Hill - Chapel Road

4.7 VISSIM model 5 - A13/ River Road

Model Layout

4.7.2 Figure 4.6 shows the extent of the A13/ River Road area VISSIM model and junctions potentially suitable for an alternative method of traffic management control.

Model initial purpose

4.7.3 The model was developed to assess the impact of junction layout modifications and signal timing changes for East London Bus Rapid Transit system.

Model definition

4.7.4 Time periods available:

- morning
- inter-peak
- evening

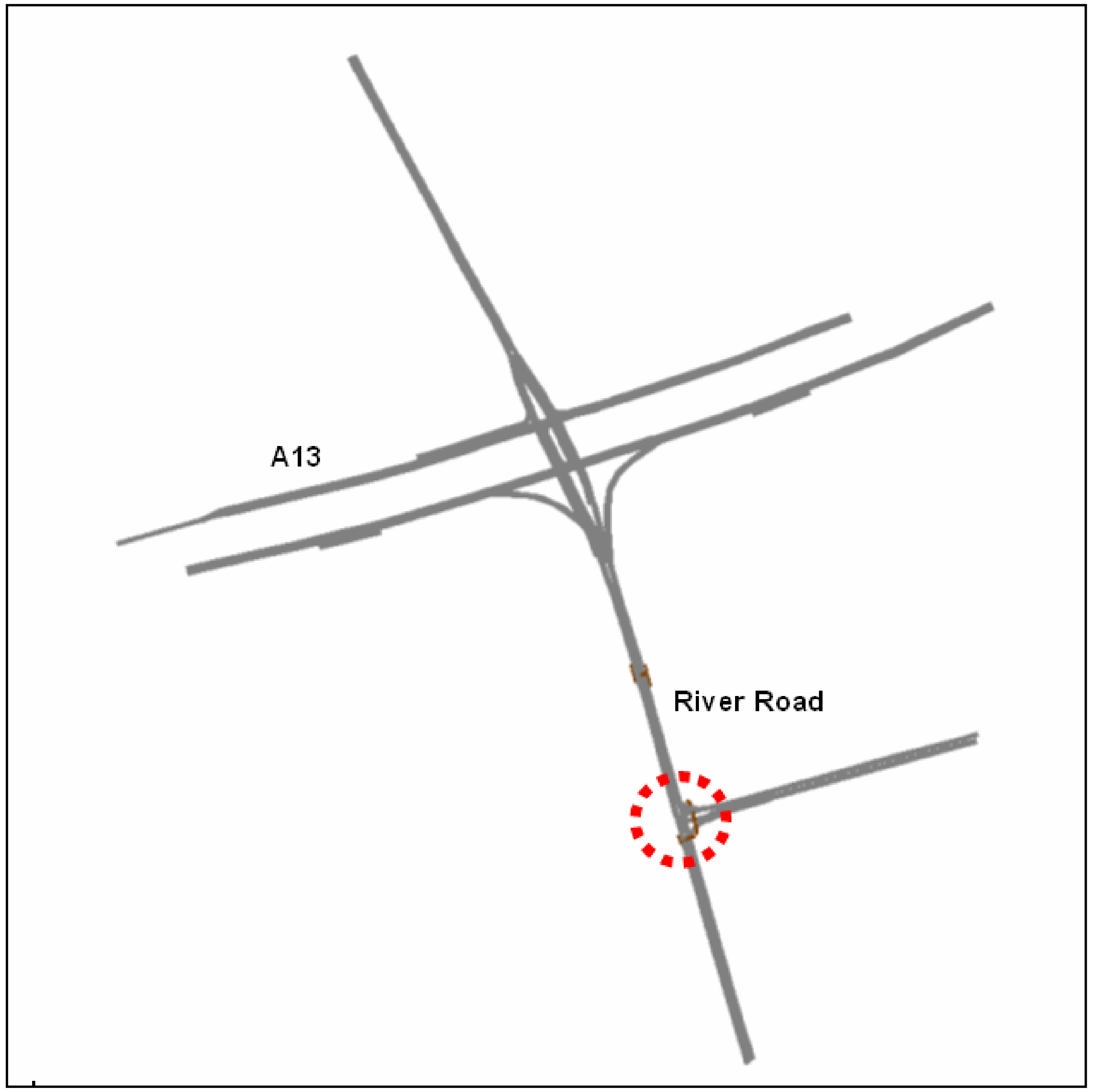
Model date and status

4.7.5 Early 2008 and DTO VMAP audited.

Potential junctions for study

- The only potential junction within the model is the River Road - Bastable Avenue

Figure 4.6: Extent of A13/River Road VISSIM model



4.8 VISSIM model 6 - Hillingdon Station

Model Layout

4.8.2 Figure 4.7 shows the extent of the Hillingdon Station area VISSIM model and junctions potentially suitable for an alternative method of traffic management control.

Model initial purpose

4.8.3 The model was developed to assess the impact of a new development.

Model definition

4.8.4 Time periods available:

- morning
- evening
- Saturday Peak

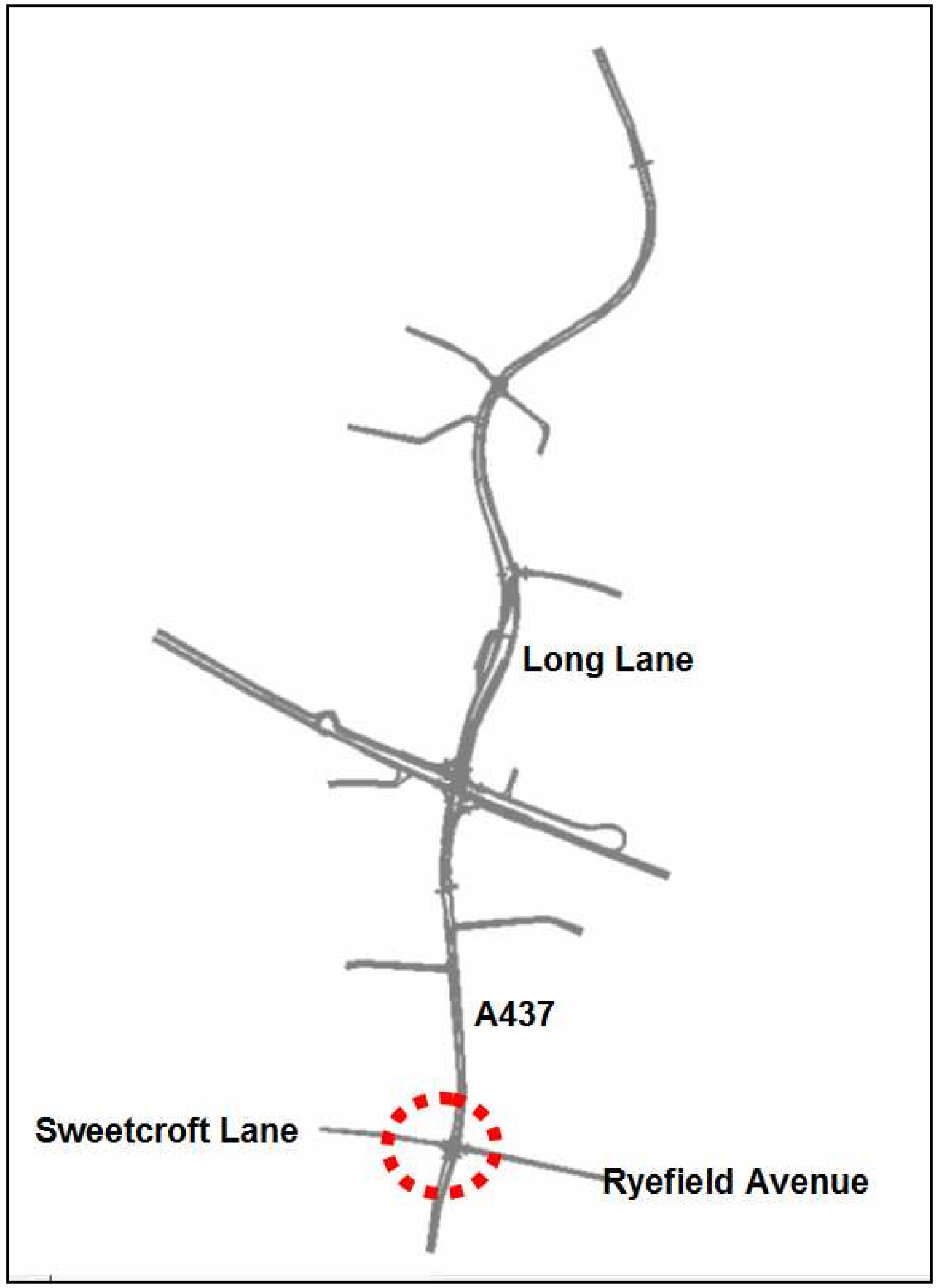
Model date and status

4.8.5 Early 2009, but the chosen junction is currently operating as demand dependant, not DTO audited.

Potential junctions for study

4.8.6 The only potential junction within the model is the Long Lane/ Sweetcroft Lane/ Ryefield Avenue

Figure 4.7: Extent of Hillingdon Station area VISSIM model

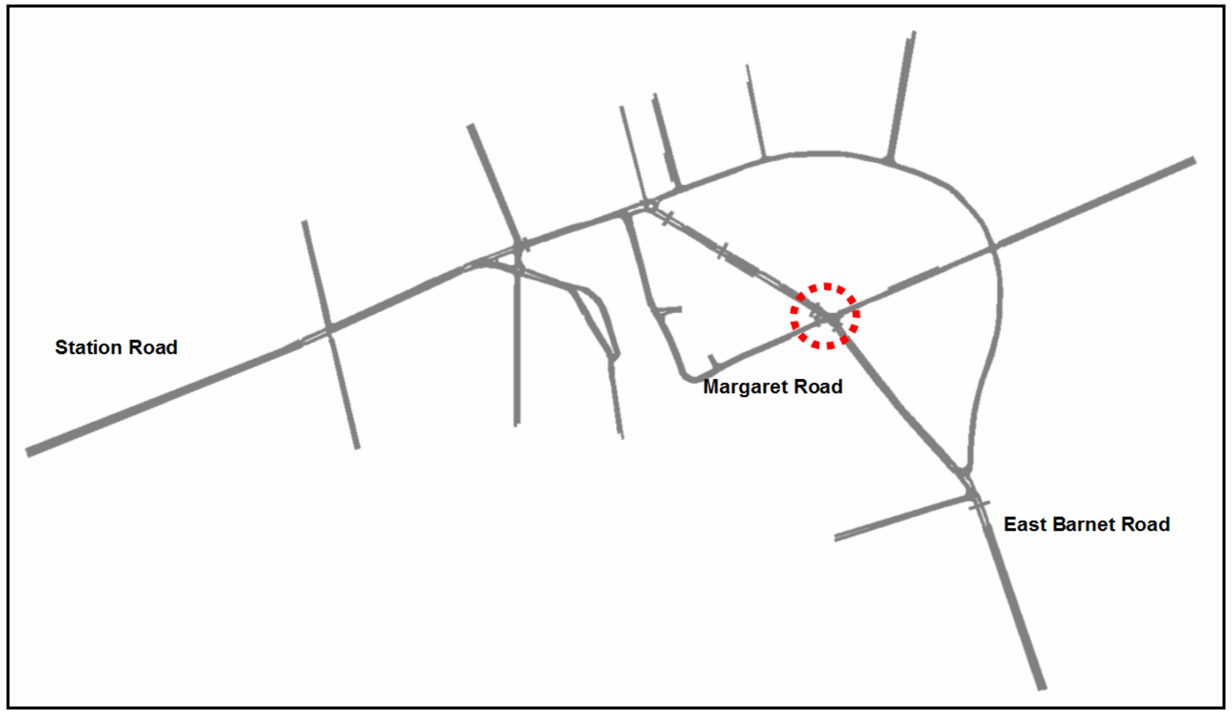


4.9 VISSIM model 7 - East Barnet

Model Layout

4.9.2 Figure 4.8 shows the extent of the East Barnet area VISSIM model and junctions potentially suitable for an alternative method of traffic management control.

Figure 4.8: Extent of East Barnet area VISSIM model



Model initial Purpose

4.9.3 The model was developed to assess the impact of a new development.

Model definition

4.9.4 Time periods available:

- morning
- evening
- Saturday Peak

Model date And status

4.9.5 Mid 2008, not DTO audited.

Potential Junctions for study

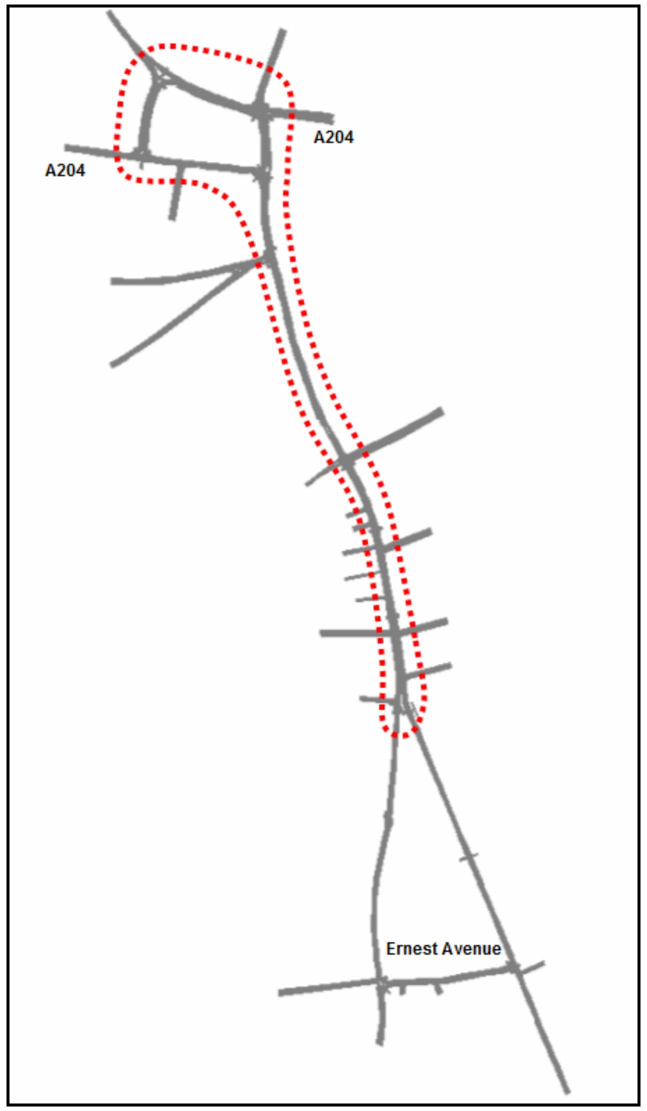
4.9.6 The only potential junction within the model is East Barnet Road/Margaret Road junction.

4.10 VISSIM model 8 – Norwood Road

Model layout

4.10.2 Figure 4.9 shows the extent of the West Norwood area VISSIM model and junctions potentially suitable for an alternative method of traffic management control.

Figure 4.9: Extent of West Norwood area VISSIM model



Model Initial purpose

4.10.3 The model was developed to assess the impact of a new development.

Model definition

4.10.4 Time periods available:

- morning
- inter-peak
- evening
- Saturday Peak

Model date and status

4.10.5 Mid 2008, not DTO audited.

Potential junctions for study

4.10.6 Potential junctions within the model are:

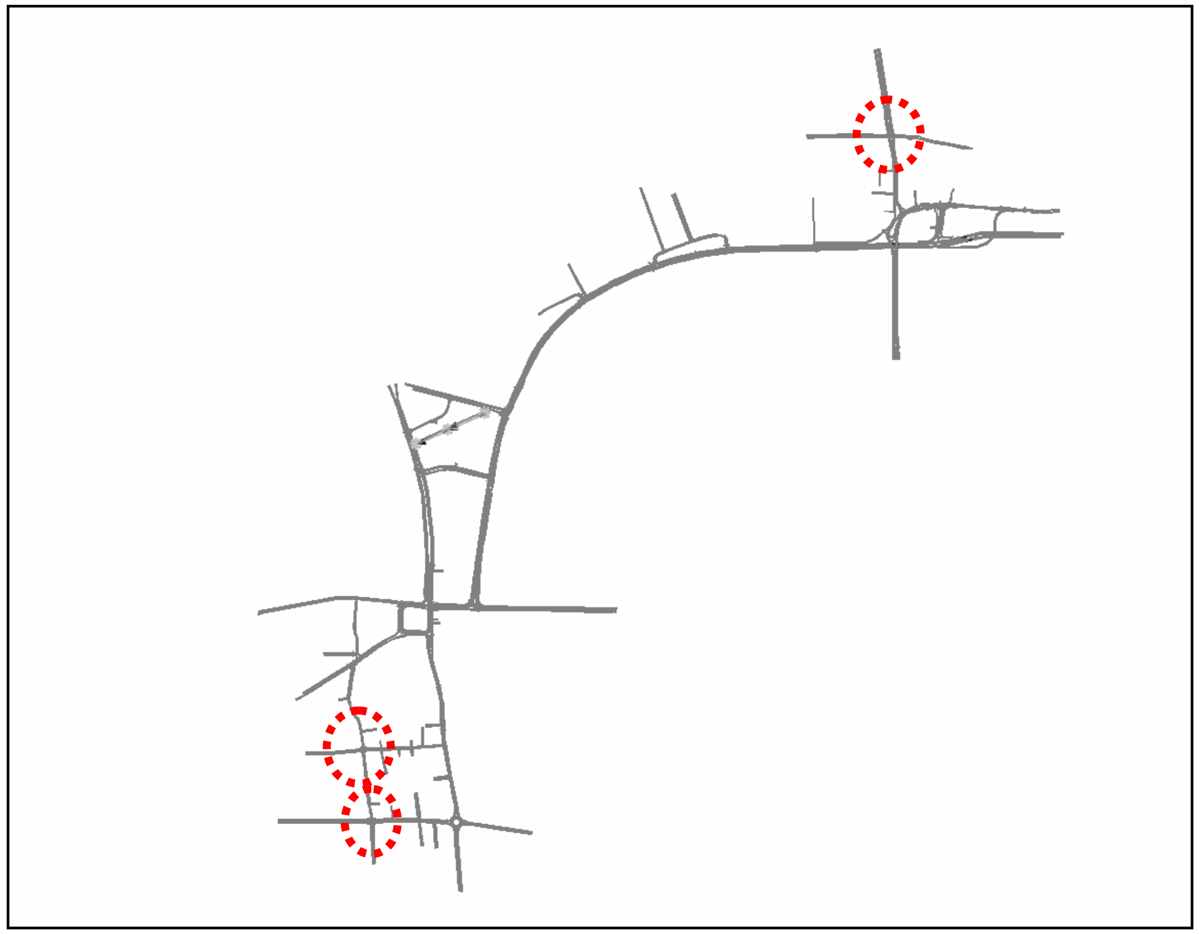
- 09/045 – A204 Tulse Hill – A215 Norwood Road - A205 Thurlow Park Road
- 09/046 - A215 Norwood Road - Palace Road
- 09/47 - A215 Norwood Road-Knights Hill-Norwood high street-Robson Road-Bloom grove
- 09/48 - A215 Norwood Road - York hill - Lancaster Avenue
- 09/306- A215 Norwood road - A205 Christchurch Road

4.11 VISSIM model 9 – Parliament Square

Model layout

4.11.2 Figure 4.10 shows the extent of the Parliament Square area VISSIM model and junctions potentially suitable for an alternative method of traffic management control.

Figure 4.10: Extent of Parliament Square area VISSIM model



Model initial purpose

4.11.3 The model was developed to assess the impact of a new development.

Model definition

4.11.4 Time period available is morning peak only

Model date and status

4.11.5 Early 2008, DTO audited.

Potential junctions for study

4.11.6 Potential junctions within the model are:

- Horseferry Road\ Marsham Street
- Great Peter Street\ Marsham Street
- Ludgate Circus

5 Junction selection

5.1 Representative junction types in London

5.1.1 To provide potential economic benefit/disbenefit results for Greater London, key junctions were selected which are representative of various characteristic mix of junctions present in London. These selected junctions were further analysed and assessed and the model results were used to produce the generalised economic analysis.

5.1.2 Table 5.1 shows the classification and distribution of signalised junctions in Greater London by:

- number of arms (3/4 or more);
- location (inner/outer London);
- network (TLRN/non-TLRN).

5.1.3 These categories will form the statistical basis of the generalisation of the modelling results for the economic evaluation. Please note that signalised pedestrian crossings, e.g. PELICANS, PUFFIN and TOUCAN crossings, were excluded from this list of signal installations.

Table 5.1: Greater London junctions per number of arms, location & Network

Junction type	Number of junctions	% of the total number of junctions
3 arms – Inner London – non-TLRN	**538**	**21.2%**
3 arms – Inner London – TLRN	387	15.3%
3 arms – Outer London – non-TLRN	**638**	**25.2%**
3 arms – Outer London – TLRN	220	8.7%
4 and more arms – Inner London – non-TLRN	215	8.5%
4 and more arms – Inner London – TLRN	**176**	**7.0%**
4 and more arms – Outer London – non-TLRN	**286**	**11.3%**
4 and more arms – Outer London – TLRN	**72**	**2.8%**
Total number of traffic junctions	**2,532**	**100.0%**

5.2 Selected Junctions

5.2.1 Table 5.2 shows the list of all junctions considered for this study and their characteristics.

5.2.2 Table 5.3 below shows the list of junctions selected for further evaluations. Due to study limitations, only five sets of junctions were considered and together they represent about 67.5% signalised junctions in London (excluding pedestrian crossings) based on the above criteria only. The selected junction types are highlighted in green in Table 5.1 above.

5.2.3 Also please note that the set of junctions on Edgware Road are a series of inter-connected traffic signals under the same control regime, where as the other junctions (orange) are set of independent signals.

Table 5.2: List of all junctions considered for the study

Model/Location	Junction
A5 Edgware Road (inter-connected traffic signals)	Gloucester Place/George Street
	Portman Square/Upper Berkeley Street
	Seymour Street/ Portman Square/ Portman Street
	Baker Street/George Street
	Baker Street/ Portman Square/ Fitzhardinge Street
	Baker Street/ Wigmore Street/ Portman Square
	Grosvenor Square/ Carlos Place/ Grosvenor Street
	Edgware Road/ Harrow Road/ Marylebone Rd
	Edgware Road/ Praed Street/ Chapel Street
	Edgware Road/ Sussex garden/ Old Marylebone Road
	Edgware Road/ Burwood Pl/ Harrowby St
	Edgware Road/ George St/ Kendal St
	Edgware Road/ Connaught St/ Upper Berkeley St
	Edgware Road/ Seymour St
A501 King's Cross Interchange	York Way/Goods Way
	York Way/Wharfdale Road
	Midland Road/Goods Way/Pancras Road
	Goods Way/Pancras Road
Church Rd	(A312/B455)-Target RB
	(A312/A40)-Whitehart RB
	Mandeville Road/ Eastcote Lane North
Ilford Gyratory	14/015 High Road Ilford - Ilford lane - A118 Ilford Hill - A123 Cranbrook Rd
	Roden Street /Chapel Rd
	Chapel Road - Winston Way
	Ilford Hill - Chapel Road
A13/ River Road	River Road - Bastable Avenue
Hillingdon Station	Long Lane/ Sweetcroft Lane/ Ryefield Avenue
East Barnet	East Barnet Road/Margaret Road
West Norwood	A204 Tulse Hill – A215 Norwood Road - A205 THURLOW PARK ROAD
	A215 Norwood Road - Palace Road

Table 5.3: List of selected junctions

Junction location	Key arms and intersections	Type of junction (no. of arms)	Peak major arm traffic flow (2-way morning peak)	Location
A5 Edgware Road (inter-connected traffic signals)	Edgware Road/ Harrow Road/ Marylebone Road	4-arm	615	Inner London
	Edgware Road/ Praed Street/ Chapel Street	4-arm	910	
	Edgware Road/ Sussex Garden/ Old Marylebone Road	4-arm	884	
	Edgware Road/ Burwood Place/ Harrowby Street	4-arm	941	
	Edgware Road/ George Street/ Kendal Street	4-arm	907	
	Edgware Road/ Connaught Street/ Upper Berkeley Street	4-arm	952	
	Edgware Road/ Seymour Street	4-arm	987	
Church Road	(A312/B455)-Target roundabout	Roundabout	1475	Outer London
A13/ River Road	River Road - Bastable Avenue	3-arm (T-junction)	884	Outer London
East Barnet	East Barnet Road/Margaret Road	4-arm	640	Outer London
West Norwood	A215 Norwood Road - Palace Road	3-arm (T-junction)	888	Inner London

6 Junction assessment

6.1 Edgware Road - Junction 8 (Harrow Road/ Marylebone Road)

Traffic mix and characteristics

6.1.2 The Edgware Road/Harrow Road/Marylebone Road junction is located in the London Borough of Westminster. Numerous trip generators are located in the area including the Edgware Road, Paddington and Marylebone stations.

6.1.3 The location of the Edgware Road/ Harrow Road/ Marylebone Road junction is shown in Figure 6.1.

Figure 6.1: Edgware Road/ Harrow Road/ Marylebone Road junction

6.1.4 Edgware Road and its surrounding area offers many shops, cafes and restaurants and constitutes an important trip generator which is likely to attract a high number of pedestrians and cyclists, during the day and evening.

6.1.5 A classified turning count survey was carried out on 4th July 2007 between 07:00- 10:00, 12:00- 14:00 and 16:00- 19:00. The summary of the morning and evening survey are shown in Table 6.1 and Table 6.2.

Table 6.1: Edgware Road/ Harrow Road/ Marylebone Road- morning turning count survey (07:00- 10:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Harrow Road	3251	186	145	5.7	4.5
Edgware Road(N)	3077	275	213	8.9	6.9
Marylebone Road	552	73	54	13	9.8
Edgware Road(S)	3452	69	243	2	7
Total	**10332**	**603**	**655**	**5.8**	**6.3**

Table 6.2: Edgware Road/ Harrow Road/ Marylebone Road- evening turning count survey (16:00- 19:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Harrow Road	2534	77	53	3	2.2
Edgware Road(N)	2835	101	74	3.6	2.6
Marylebone Road	664	126	18	19	2.7
Edgware Road(S)	3777	209	102	5.5	2.7
Total	**9810**	**513**	**247**	**5.2**	**2.5**

6.1.6 From the traffic surveys presented above it can be seen that cyclists amount to 5.8% during the morning period and 5.2% during the evening period. It has been assumed for the purposes of this study, based on advice from safety engineers, that the higher the proportion of cyclists the more likely there is to be an accident involving a cyclist. A cyclist proportion less than 10% is considered low. It is possible that a high proportion of cyclists will give a 'critical mass' making them more conspicuous, with the result that drivers are more cautious and risks to cyclists are reduced. There is, however, no evidence to support this and would seem to be an area that requires further research.

6.1.7 Pedestrian count surveys were not available but the volume of pedestrians during the day and evening is known to be high. For the purposes of this study, a volume greater than 500 pedestrians per hour is considered high, less than 300 pedestrians per hour is considered low. The safety issues are similar to those for cyclists.

6.1.8 It should be noted that the number of cyclists and pedestrians would most likely decrease significantly outside of the peak periods and especially after the close of train and underground stations in the immediate area.

6.1.9 The junction is located within a 30mph speed limit zone. No data is currently available on the approach speeds.

6.1.10 HGVs were estimated to represent 6.3% of vehicular traffic during the morning period and 2.5% during the evening period (see Table 6.1 and Table 6.2). This is a relatively low proportion of general traffic and it is considered that this will not influence safety if traffic signals were to be switched off. Without the benefit of any research into this issue, this assumption is based on engineering judgement.

Junction layout and geometry

6.1.11 Compliance to visibility displays and DMSSD with standards set out in TD 42/95 Geometric Design of Major/ Minor Junctions and TD 9/93 Highway Link Design is presented in Table 6.3.

Table 6.3: Edgware Road/ Harrow Road/ Marylebone Road junction- DMSSD and visibility splays

Approach/ Visibility	DMSSD=70m	Y= 70m (X=9m)	Y=70m (X=4.5m)	Y=70m (X=2.4m)
Edgware Road(N)	Yes	Yes	Yes	Yes
Edgware Road(S)	Yes	No	Yes	Yes
Harrow Road	Yes	Yes	Yes	Yes
Marylebone Road	Yes	Yes	Yes	Yes

6.1.12 Table 6.3 above shows that it would not be possible to achieve visibility splays of 70m with the ‘x’ distance of 9m on all of the approaches to the junction. It would be necessary to relax the ‘x’ value to 4.5m.

6.1.13 The DMSSD of 70m is achievable on all approaches to the junction.

6.1.14 All visibility/ DMSSD results are indicative only and should be confirmed with site measurements.

6.1.15 The number of lanes and carriageway widths at the Edgware Road/Harrow Road/Marylebone Road junction are shown in Table 6.4.

Table 6.4: Edgware Road/ Harrow Road/ Marylebone Road junction lanes and carriageway widths

Approach	Lane	Width (m)	Central Refuge
Harrow Road(N)	Nearside entry lane (ahead and left)	2.8	Yes
	Middle entry lane (ahead and right)	2.8	
	Offside entry lane (right)	2.8	No
Harrow Road(S)	3 exit lanes	9	No
Marylebone Road(S)	Nearside entry lane (ahead)	3	No
	Offside entry lane (ahead and right)	3	
Marylebone Road(N)	3 exit lanes	8	No
Edgware Road(S)	Nearside entry lane (left)	3	No
	Middle entry lane (ahead)	3	
	Offside entry lane (ahead)	2.8	Yes
	2 exit lanes	6.5	
Edgware Road(N)	Nearside entry lane (left)	2.5	No
	Middle entry lane (ahead)	2.8	
	Offside entry lane (ahead)	2.5	Yes
	2 exit lanes	6.8	

6.1.16 The number of lanes does not exceed three on any of the approaches or exits to the junction. Pedestrian refuge islands are provided on all arms of the junction between approach and exit lanes.

6.1.17 Although this is a six arm junction, it should be noted that the Harrow Road (N&S) arms as well as the Marylebone Road (N&S) arms are one way only which means that pedestrians only need to check one direction when crossing the carriageway at this location. This would greatly assist pedestrians in the event of an alternative method of control.

6.1.18 There is no right-turn allowed from Edgware Road (S) into Marylebone Road (N) and no right-turn from Edgware Road (N) into Harrow Road(S). The left turn from Marylebone Road (S) into Edgware Road (S) is also banned. This further reduces the number of potential conflict points and directions of approaching traffic which would work in favour of pedestrians if traffic signals were to be switched off. The signing and markings at the junction would need to be carefully reviewed to ensure that drivers do not assume incorrectly that the banned movements during the hours of signal operation are permitted at other times.

6.1.19 The priority at this junction is not immediately clear but the highest volumes of traffic were observed during the morning survey period on the Edgware Road (S) and Harrow Road approaches (see Table 6.1). During the evening survey period, the highest volumes of traffic were recorded on the Edgware Road (N&S) approaches (see Table 6.2).

Existing provision for pedestrians and cyclists

6.1.20 Staggered signal controlled pedestrian crossings are provided on all arms of the junction. In the event that signals were switched off, a potential reduction in safety for pedestrians could be expected at the crossings points. It should be noted, however, that all pedestrian crossings are provided with central refuges and it is considered, based on engineering judgement, that the opportunity to use an island as shelter while crossing uncontrolled will alleviate these safety concerns. This judgement would benefit from further research.

6.1.21 No stand alone crossings are located close to the junction.

6.1.22 No ASLs are provided at present at the junction. The safety of cyclists should therefore not be affected in the event of a switch off. It has been assumed, using engineering judgement, that the presence of formal cycle facilities (such as lead-in cycle lanes and ASLs) that are designed to operate in accordance with behaviour at a junction controlled by traffic signals, would not have the same significance if traffic signal control was disabled. This presents a new risk should cyclists believe that the markings do have significance, while other road users ignore them. This cannot be verified, as permanently uncontrolled junctions elsewhere (such as the continent) tend not to have any formal markings at all.

Collision history

6.1.23 A collision history was obtained from TfL for the Edgware Road/Harrow Road/Marylebone Road junction for the period of 36 months to November 2008.

6.1.24 A summary of the collision history is shown in Table 6.5.

Table 6.5: Edgware Road/ Harrow Road/ Marylebone Road collision history by year and severity

Severity/ Months To	12/11/2006	12/11/2007	12/11/2008	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Slight	2	5	7	14
Total	2	5	7	14

6.1.25 From the summary table presented above it can be observed that there were in total 14 accidents at the junction during the 36 month study period. All the accidents resulted in a slight injury and none of them resulted in a serious or fatal injury.

6.1.26 The collision rate per year is 4.7 which is above the Borough average of 2.32.

6.1.27 Three of the accidents involved pedestrians. This amounts to 21.4% which is below the Borough average of 33.1% at signalised junctions and 30.1% at priority junctions.

6.1.28 Three of the accidents (21.4%) involved cyclists, which is above the borough average of 13% at signalised junctions and 15.8% at give way junctions.

6.1.29 Two of the accidents occurred during wet conditions.

6.1.30 Three accidents (21.4%) happened during the hours of darkness which is below the borough average of 36% at signalised junctions and 29.3% at priority junctions.

6.1.31 Two of the accidents (14.3%) involved a right-turn manoeuvre which is below the borough average of 18.8% at signalised junctions and 25.1% at priority junctions.

6.1.32 The comparison of the numbers of accidents by year reveals an upward tendency with half of the accidents having taken place between November 2007 and November 2008.

Road network management

6.1.33 The Harrow Road/ Marylebone Road/Edgware Road junction forms part of the TLRN.

Traffic analysis

6.1.34 As part of this study, CB has carried out a revision and analysis of the existing Edgware Road VISSIM models for the morning (07:00- 08:00), Inter-Peak (12:00- 13:00), evening (17:00- 18:00) and Off-Peak (22:00- 01:00) periods. Proposed VISSIM models were prepared for the same time periods by replacing the existing signal control at selected junctions along Edgware Road with priority control given to traffic approaching from the right.

6.1.35 In the proposed VISSIM model traffic signals were switched off at the following locations;

- Edgware Road/ Marylebone Road/ Harrow Road junction
- Edgware Road/ Praed Street/ Chapel Street junction
- Edgware Road/ Sussex Gardens/ Old Marylebone Road junction
- Edgware Road/ Burwood Place/ Harrowby Street junction
- Edgware Road/ Kendal Street George Street junction
- Edgware Road/ Seymour Street junction

6.1.36 The location of traffic signals which were switched off in the proposed scenario is shown in Figure 6.2.

Figure 6.2: Location of junctions with switched off signal control

6.1.37 The existing signal control was replaced with priority control with vehicles giving priority to traffic approaching from the right. It was assumed that opposed right turners would give priority to straight ahead traffic.

6.1.38 All existing and proposed models were run for five random seeds with the simulation resolution of ten time steps/ simulation seconds and the results were averaged for the purpose of comparison between the existing/ proposed models and different time periods.

6.1.39 The network evaluation output was recorded for the following parameters for all vehicle types and all time periods;

- Average delay time per vehicle (s)
- Average number of stops
- Average speed (mph)
- Average stopped delay per vehicle (s)
- Total delay time (h)
- Total distance travelled (km)
- Number of stops
- Number of vehicles in the network
- Number of vehicles that have left the network
- Total stopped delay (h)
- Total travel time (h)

6.1.40 The network performance evaluation modelling results are summarised in Table 6.6

Table 6.6: Edgware Road VISSIM network performance evaluation modelling results

Parameter	morning		inter-peak		evening		off-peak	
	Base	Proposed	Base	Proposed	Base	Proposed	Base	Proposed
Average delay time per vehicle [s]	111	125	84	70	107	131	76	60
Average number of stops per vehicle	4	3	3	2	3	3	3	2
Average speed [mph]	6	6	5	6	6	6	7	8
Average stopped delay per vehicle [s	57	74	45	35	55	85	42	30
Total delay time [h]	378	422	212	176	409	487	408	320
Total distance travelled [km]	12915	12424	9447	9424	14169	12973	21793	21742
Number of stops	43801	38450	26145	22645	46079	40353	52358	43002
Number of vehicles in the network	1380	1721	1074	1023	1459	2145	216	199
Number of vehicles that have left the network	10840	10409	8039	8036	12230	11282	19116	19078
Total stopped delay [h]	193	250	114	88	211	315	227	162
Total travel time [h]	1327	1351	1076	1031	1418	1465	1854	1752

6.1.41 he network performance evaluation results for average delay time, average speed and total travel time are shown in Figure 6.3-5.

Figure 6.3: Average delay time per vehicle (s)

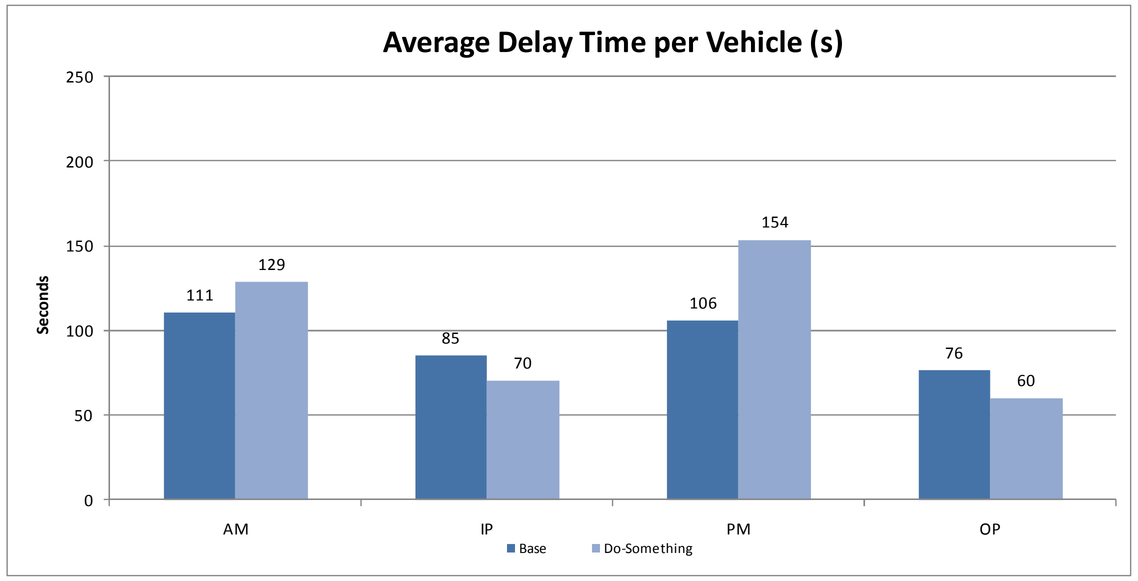


Figure 6.4: Total number of vehicles crossing the junction at Edgware Road

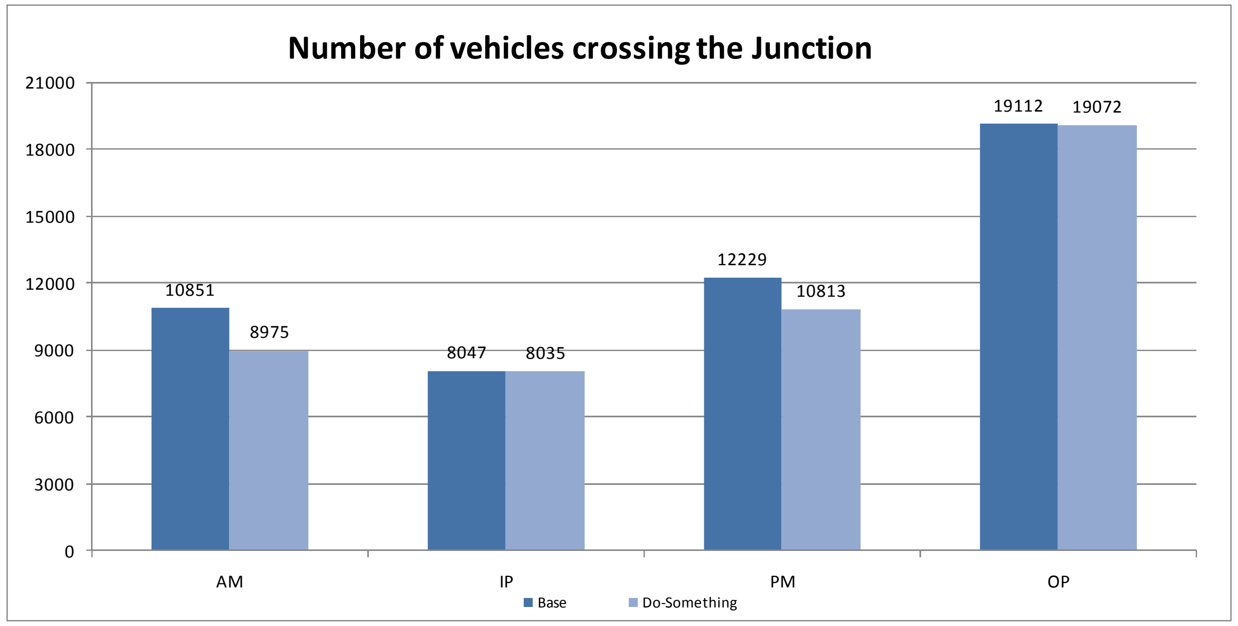


Figure 6.5: Average speed (mph)

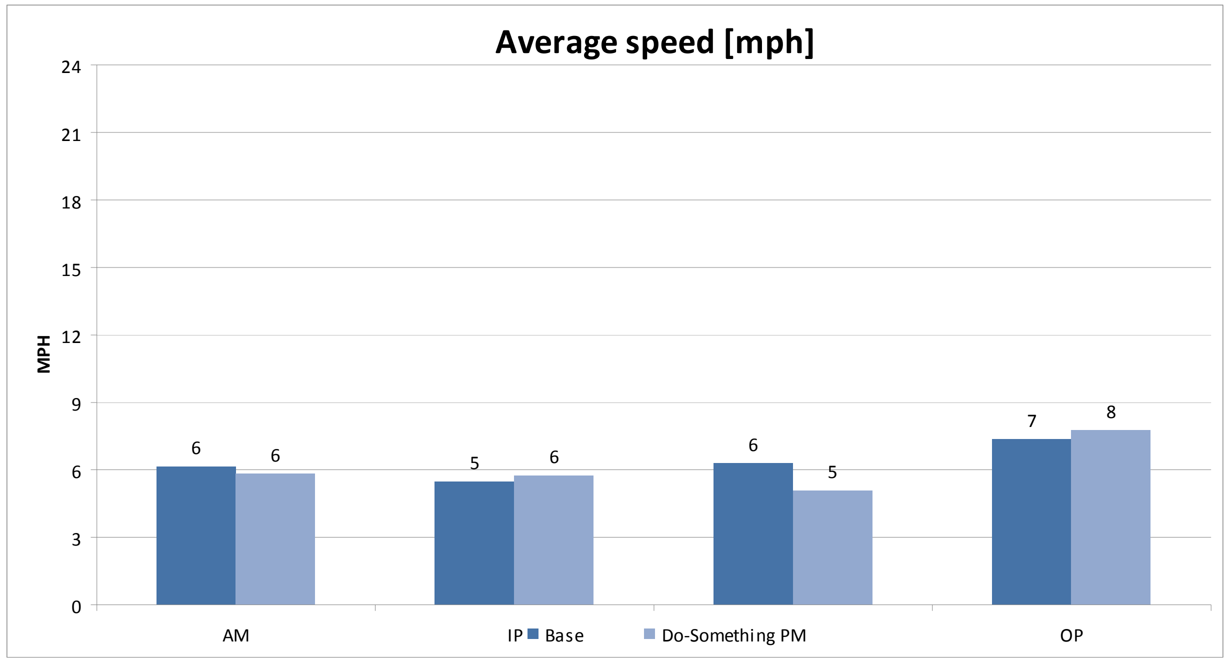
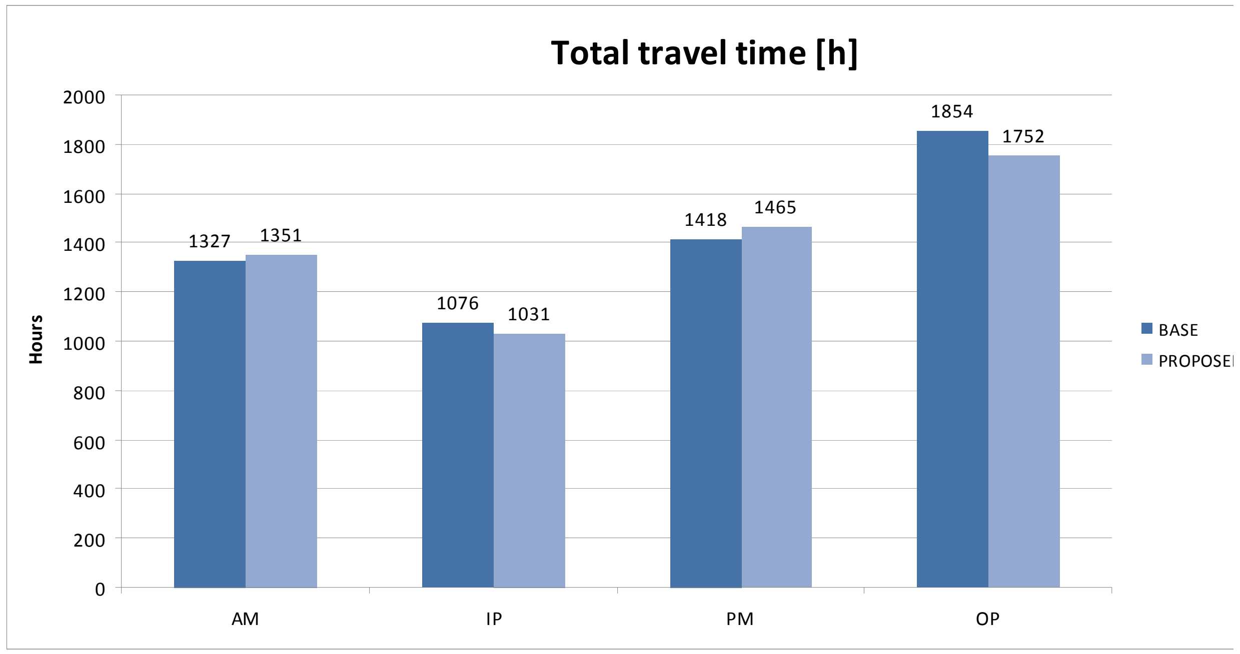


Figure 6.6: Total travel time (h)



6.1.42 The network performance evaluation results show that during the morning and evening peak period the network suffered increased delays and travel times and decreased vehicular speeds as per the proposed scenario. It has to be noted that the removal of signal control resulted in vehicular traffic coming to a gridlock in which case the results produced by VISSIM will not reflect the full extent of the problem. This clearly indicates that traffic signals cannot be switched off at the examined locations during the morning and evening peak periods.

6.1.43 From the network performance evaluation results it can be observed that both during the inter-peak and Off-Peak period the overall performance of the network improves as per the proposed option. Average and total delay time as well as travel time decrease when the traffic signals are replaced with priority control. At the same time vehicular speed increases during both time periods.

6.1.44 The analysis of the existing and proposed Edgware Road VISSIM models shows that the signal control cannot be replaced with priority control during the morning and evening peak periods without having a serious impact on the operation of the network. The tests showed that this would lead to an unacceptable increase in congestion, blocking back and as a result to a complete gridlock.

6.1.45 The same analysis carried out for the inter-peak and Off-Peak periods show that the overall performance of the network would improve as per the proposed option. This would indicate that switching off of the traffic signals could be beneficial in economic terms when compared with the existing situation.

6.1.46 The analysis of road safety, network management and traffic at the Edgware Road/ Marylebone Road/ Harrow Road junction is summarised in Table 6.6.

6.1.47 From the indicator table it can be observed that the overall tendency is against the switch off of traffic signals at this location. The most important factors are high numbers of pedestrians/ cyclists, higher than average number of accidents with an increasing trend in collisions as well as the fact that the junction forms part of the TLRN and is linked to other junctions in the corridor.

Figure 6.7: Edgware Road/ Marylebone Road/ Harrow Road junction- road safety, network management and traffic analysis indicator table

Edgware Road/ Harrow Road/ Marylebone Rd

	POTENTIAL RISK INDICATORS		
	against………..switch off………….for		
TRAFFIC MIX AND CHARACTERISTICS	**HIGH**	**MEDIUM**	**LOW**
Volume of traffic		✓	
Percentage of goods traffic			✓
Volume of cyclist movements			✓
Pedestrian activity	✓		
JUNCTION LAYOUT AND GEOMETRY	**HIGH/ YES**	**PART**	**LOW/NO**
Visibility requirements of TD 42/95 NOT achieved		✓	
Total number of traffic lanes/ overall carriageway width	✓		
No. of arms	✓		
Total number of permitted movements			✓
Unclear priority	✓		
PEDESTRIAN AND CYCLIST PROVISION	**YES**	**SOME/ PART**	**NO**
Central refuges/ islands not provided	✓		
Controlled crossing facilities provided as part of signal control	✓		
Absence of stand alone crossings close to the junction	✓		
Advanced Stop Lines provided for cyclists?			✓
COLLISION HISTORY (latest 36 months)	**YES**	**PART**	**NO**
High risk site?	✓		
Increasing trend in collisions?	✓		
%age of pedestrian Collisions > average			✓
%age of cyclist Collisions > average	✓		
%age of dark Collisions > average			✓
% Right turning accidents > average			✓
NETWORK MANAGEMENT			
TLRN junction	✓		
Part of corridor management	✓		
OVERALL TENDENCY	✓		

6.2 Edgware Road - Junction 9 (Praed Street/ Chapel Street)

Traffic mix and characteristics

6.2.2 The Edgware Road/Praed Street/ Chapel Street junction is located in the London Borough of Westminster, close to Paddington and Edgware Road stations.

6.2.3 The location of the Edgware Road/ Praed Street/ Chapel Street junction is shown in Figure 6.8.

Figure 6.8: Edgware Road/ Praed Street/ Chapel Street junction

6.2.4 Edgware Road and its surrounding area offers many shops, cafes and restaurants and constitutes an important trip generator which is likely to attract high number of pedestrians and cyclists, especially during the hours of the day.

6.2.5 A classified traffic count survey was carried out at the junction on Wednesday, 4th July 2007 between 07:00- 10:00, 12:00- 14:00 and 16:00- 19:00. The morning and evening results of the traffic count survey are summarised in Table 6.7 and Table 6.8.

Table 6.7: Edgware Road/ Praed Street/ Chapel Street morning turning count survey (07:00- 10:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Edgware Road(S)	3151	63	216	2	6.9
Edgware Road(N)	3685	300	209	8.1	5.7
Praed Street	1423	147	117	10.3	8.2
Chapel Street (one way out)	0	0	0	0	0
Total	**8259**	**510**	**542**	**6.2**	**6.6**

Table 6.8: Edgware Road/ Praed Street/ Chapel Street evening running count survey (16:00- 19:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Edgware Road(S)	3266	185	91	5.7	2.8
Edgware Road(N)	3245	97	70	3	2.2
Praed Street	1983	130	46	6.6	2.3
Chapel Street (one way out)	0	0	0	0	0
Total	**8494**	**412**	**207**	**4.9**	**2.4**

6.2.6 From the classified turning counts presented above it can be seen that cyclists constitute 6.2% of vehicular traffic during the morning, and 4.9% during the evening period.

6.2.7 Pedestrian count surveys were not available but the volume of pedestrians during the day and evening is known to be high.

6.2.8 The junction is located within a 30mph speed limit zone. No data is currently available on the approach speeds.

6.2.9 HGVs are estimated to constitute 6.6% of vehicular traffic during the morning survey period and 2.4% during the evening survey period (see Table 6.7 and Table 6.8). This is a relatively low proportion of general traffic and should not cause safety concerns in the event of a switch off.

Junction layout and geometry

6.2.10 Compliance to visibility splays and Desired Minimum Stopping Sight Distances (DMSSD) with standards set out in TD 42/95 Geometric Design of Major/ Minor Junctions and TD 9/93 Highway Link Design is presented in Table 6.9.

Table 6.9: Edgware Road/ Praed Street/ Chapel Street junction- DMSSD and visibility splays

Approach/ Visibility	DMSSD=70m	Y= 70m (X=9m)	Y=70m (X=4.5m)	Y=70m (X=2.4m)
Edgware Road(N)	Yes	No	Yes	Yes
Edgware Road(S)	Yes	No	No	No
Praed St	Yes	No	Yes	Yes
Chapel St	Yes	No	Yes	Yes

6.2.11 Table 6.9 above shows that it would not be possible to achieve visibility splays of 70m with the x distance of 9m on any of the approaches to the junction. The Edgware Road(S) approach could not achieve the visibility splay of 70m even with the 'x' value decreased to 2.4m. On other approaches, the 'x' value would need to be relaxed to 4.5m.

6.2.12 The DMSSD of 70m is achievable on all approaches to the junction.

6.2.13 It has to be noted that these results are indicative only and should be confirmed with site measurements.

6.2.14 The number of lanes and carriageway widths at the Edgware Road/ Praed St/ Chapel Street junction are shown in Table 6.10.

Table 6.10: Edgware Road/ Praed Street/ Chapel Street junction lanes and carriageway widths

Approach	Lane	Width (m)	Central Refuge
Edgware Road(S)	Nearside entry lane (ahead)	3	No
	Offside entry lane (ahead)	3	Yes
	2 exit lanes	6	
Praed St	Nearside entry lane (left)	3	Yes
	Middle entry lane (ahead)	3.5	
	Offside entry lane (right)	3.5	No
Edgware Road(N)	Nearside entry lane (ahead and left)	3.5	No
	Offside entry lane (ahead)	3.5	Yes
	3 exit lanes	10	
Chapel St	2 exit lanes	7	No

6.2.15 From the table above it can be seen that the number of lanes does not exceed three on any of the approaches/ exits of the junction. The presence of central refuges facilitates pedestrian movements across the junction.

6.2.16 This is a four arm junction with two of the arms (Praed Street and Chapel Street) being one way only. This significantly reduces the number of possible conflicts and would facilitate a carriageway crossing for pedestrians in the event of a switch off.

6.2.17 The right-turn from Edgware Road into Chapel Street is banned which further reduces the number of potential conflicts at the junction.

6.2.18 The layout of the junction does not indicate clearly which movement would have priority if traffic signals were to be switched off. Judging from the volume of traffic (see Table 6.7 and Table 6.8) Edgware Road carries more traffic and should be given priority over Praed Street.

Pedestrian and cyclist provision

6.2.19 There are staggered signal controlled pedestrian crossings provided on the Praed Street and Edgware Road (N) arms of the junction. Switching off signals could decrease pedestrian safety at these locations. However, the reduction in safety is not expected to be so great in locations where central refuges are provided.

6.2.20 Uncontrolled straight across pedestrian crossings are located on the Chapel Street and Edgware Road (S) arms of the junction. In this case pedestrians are already used to exploiting gaps in traffic rather than obeying signal control.

6.2.21 An ASL is provided on the Praed Street approach to the junction. In this case switching off traffic signals could have a negative impact on the safety of cyclists. Drivers would be expected to position themselves closer to the junction (within the ASL) to maximise visibility.

Collision history

6.2.22 A collision history was obtained from TfL for the Edgware Road/ Praed Street/ Chapel Street junction for the period of 36 months to November 2008.

6.2.23 A summary of the collision history is shown in Table 6.11.

Table 6.11: Edgware Road/ Praed Street/ Chapel Street collision history by year and severity

Severity/ Months To	12/11/2006	12/11/2007	12/11/2008	Total
Fatal	0	0	0	0
Serious	0	0	1	1
Slight	5	7	3	15
Total	5	7	4	16

6.2.24 The collision summary presented above shows that there were 16 accidents in total during the 36 month study period. Fifteen accidents resulted in slight injury and one in serious injury. No fatalities were recorded at the junction during this time period.

6.2.25 The collision rate per year is 5.3 which is above the borough average of 2.32 at signalised junctions.

6.2.26 Six of the accidents (37.5%) involved pedestrians which is above the borough average of 33.1% at signalised junctions and 30.1% at signal controlled junctions.

6.2.27 None of the accidents involved cyclists.

6.2.28 Five accidents (31.3%) occurred during the hours of darkness which is below the borough average of 36% at signalised junctions and slightly above 29.3% at priority junctions.

6.2.29 None of the accidents involved right turning vehicles.

6.2.30 The spread of the accidents over the three year time period shows an increase during 2007 from five to seven accidents, followed by a drop in 2008 to three accidents.

Road network management

6.2.31 The Edgware Road/ Praed Street/ Chapel Street junction forms part of the TLRN.

Traffic analysis

6.2.32 The analysis of road safety, network management and traffic at the Edgware Road/ Praed St/ Chapel Street junction is summarised in Figure 6.9.

6.2.33 From the traffic analysis indicator table it can be seen that the overall tendency is against the switch off of traffic signals at this location. The main factors are high number of pedestrians/ cyclists, higher than average number of accidents with high percentage of pedestrian collisions and the fact that this junction forms part of the TLRN and its signal control is linked to other junctions in the corridor.

Figure 6.9: Edgware Road/ Praed St/ Chapel Street junction- road safety, network management and traffic analysis indicator table

Edgware Road/ Praed Street/ Chapel Street

	POTENTIAL RISK INDICATORS		
	against…	switch off…	….for
TRAFFIC MIX AND CHARACTERISTICS	**HIGH**	**MEDIUM**	**LOW**
Volume of traffic		✓	
Percentage of goods traffic			✓
Volume of cyclist movements			✓
Pedestrian activity	✓		
JUNCTION LAYOUT AND GEOMETRY	**HIGH/ YES**	**PART**	**LOW/NO**
Visibility requirements of TD 42/95 NOT achieved	✓		
Total number of traffic lanes/ overall carriageway width	✓		
No. of arms		✓	
Total number of permitted movements			✓
Unclear priority	✓		
PEDESTRIAN AND CYCLIST PROVISION	**YES**	**SOME/ PART**	**NO**
Central refuges/ islands not provided		✓	
Controlled crossing facilities provided as part of signal control		✓	
Absence of stand-alone crossings close to the junction	✓		
Advanced Stop Lines provided for cyclists?		✓	
COLLISION HISTORY (latest 36 months)	**YES**	**PART**	**NO**
High risk site?	✓		
Increasing trend in collisions?			✓
%age of pedestrian Collisions > average	✓		
%age of cyclist Collisions > average			✓
%age of dark Collisions > average			✓
% Right turning accidents > average			✓
NETWORK MANAGEMENT			
TLRN junction	✓		
Part of corridor management	✓		
OVERALL TENDENCY	✓		

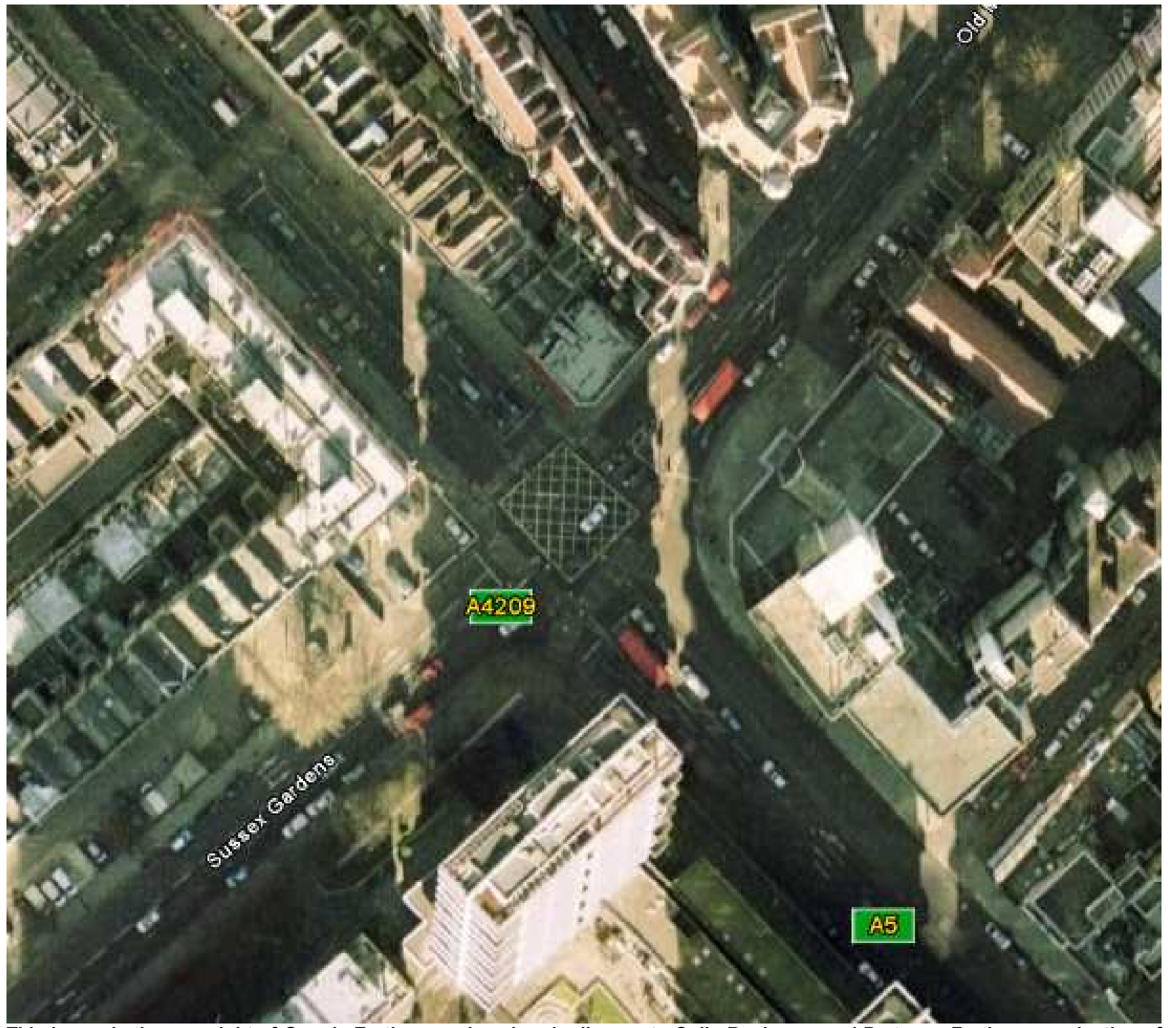
6.3 Edgware Road - Junction 10 (Old Marylebone Road)

Traffic mix and characteristics

6.3.2 The Edgware Road/ Sussex Gardens/ Old Marylebone Road junction is located in the London Borough of Westminster, close to Paddington and Edgware Road stations.

6.3.3 The location of the Edgware Road/ Sussex Gardens/ Old Marylebone Road junction is shown in Figure 6.10.

Figure 6.10: Edgware Road/ Sussex Gardens/ Old Marylebone Road junction



6.3.4 Edgware Road and its surrounding area offers many shops, cafes and restaurants and constitutes an important trip generator which is likely to attract high number of pedestrians and cyclists, especially during the hours of the day.

6.3.5 Classified turning traffic count surveys was carried out at the junction on Wednesday, 4th July 2007 between 07:00- 10:00, 12:00- 14:00 and 16:00-19:00. A summary of the morning and evening survey is shown in Table 6.12 and Table 6.13 below.

Table 6.12: Edgware Road/ Sussex Gardens/ Old Marylebone Road morning turning count survey (07:00- 10:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Edgware Road(N)	3490	285	215	8	6
Edgware Road(S)	3552	69	230	1.9	6.5
Sussex Gardens	1395	121	48	8.7	3.4
Old Marylebone Rd	1463	135	73	9.2	5
Total	**9900**	**610**	**566**	**6.2**	**5.7**

Table 6.13: Edgware Road/ Sussex Gardens/ Old Marylebone Road turning count survey (16:00- 19:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Edgware Road(N)	3311	107	60	3.2	1.8
Edgware Road(S)	3741	191	101	5.1	2.7
Sussex Gardens	1598	81	19	5.1	1.2
Old Marylebone Rd	1901	184	34	9.7	1.8
Total	**10551**	**563**	**214**	**5.3**	**2**

6.3.6 From the turning count surveys summarised above it can be observed that cyclists amount to 6.2% of vehicular traffic during the morning survey period, and 5.3% during the evening survey period.

6.3.7 Pedestrian count surveys were not available but the volume of pedestrians during the day and evening is known to be high.

6.3.8 The junction is located within a 30mph speed limit zone. No data is currently available on the approach speeds.

6.3.9 HGVs constitute 5.7% of general traffic during the morning survey period, and 2% during the evening survey period (see Table 6.12 and Table 6.13). This is a relatively low percentage and the number of HGVs would not be expected to cause any serious safety concerns if the signals were to be switched off.

Junction layout and geometry

6.3.10 Compliance to visibility splays and DMSSD with standards set out in TD 42/95 Geometric Design of Major/ Minor Junctions and TD 9/93 Highway Link Design is presented in Table 6.14.

Table 6.14: Edgware Road/ Sussex Gardens/ Old Marylebone Road junction- DMSSD and visibility splays

Approach/ Visibility	DMSSD=70m	Y= 70m (X=9m)	Y=70m (X=4.5m)	Y=70m (X=2.4m)
Edgware Road(N)	Yes	No	No	No
Edgware Road(S)	Yes	No	Yes	Yes
Sussex Gardens	Yes	No	Yes	Yes
Old Marylebone Rd	Yes	No	Yes	Yes

6.3.11 Table 6.14 shows that it would be impossible to achieve visibility splays of 70m with the 'x' distance of 9m of any of the approaches to the junction. The visibility splay of 70m could not be achieved on the Edgware Road (N) approach even with the relaxation of the 'x' value to 2.4m. On the other approaches, the 'x' value would need to be decreased to 4.5m. These results are indicative only and should be confirmed with site measurements.

6.3.12 The DMSSD of 70m can be achieved on all approaches to the junction.

6.3.13 It has to be noted that the results are only indicative and should be confirmed with site measurements.

6.3.14 The number of lanes and carriageway widths at the Edgware Road/ Sussex Gardens/ Old Marylebone Road junction are shown in Table 6.15.

Table 6.15: Edgware Road/ Sussex Gardens/ Old Marylebone Road junction lanes and carriageway widths

Approach	Lane	Width (m)	Central Refuge
Edgware Road(S)	Nearside entry lane (ahead)	3	No
	Offside entry lane (ahead)	3	Yes
	2 exit lanes	6.0	
Edgware Road(N)	Nearside entry lane (left)	4.7	Yes
	Middle entry lane (ahead)	5.3	Yes
	2 exit lanes	7.4	
Old Marylebone Rd	Nearside entry lane (left)	4.3	Yes
	2 Middle entry lanes (ahead)	6.3	Yes
	2 exit lanes	6.7	
Sussex Gardens	Nearside entry lane(ahead and left)	3.0	No
	Middle entry lane (ahead)	3.0	Yes
	2 exit lanes	5.5	

6.3.15 From the table above it can be seen that the number of lanes does not exceed three on any of the approaches/exits of the junction. The presence of central refuges facilitates pedestrian movements across the junction.

6.3.16 This is a four arm junction with right turning movements being banned on all approaches. Additionally, the left turn from Edgware Road (N) into Old Marylebone Road is not permitted. This reduced the number of potential conflicts and would facilitate junction crossing for pedestrians in the event of a switch off.

6.3.17 The signing and marking should be carefully reviewed at the junction to ensure that drivers are aware of the banned movements when signals are switched off.

6.3.18 Since this is a four arm crossroad junction, the priority would not be immediately clear in the event of a signal switch off. Traffic surveys (see Table 8.1 and 8.2) indicate that the predominant traffic flow is on the Edgware Road (N&S) approaches to the junction, in which case Edgware Road should be given priority over Sussex Gardens and Old Marylebone Road.

Pedestrian and cyclist provision

6.3.19 There are signal controlled staggered pedestrian crossing on the Edgware Rd(S), Sussex Gardens and Old Marylebone Road arms. An uncontrolled straight across pedestrian crossing is provided on the Edgware Road (N) arm of the junction.

6.3.20 No ASLs are provided on any of the approaches to the junctions and therefore the safety of cyclists would not be expected to suffer in the event of a switch off.

Collision history

6.3.21 A collision history was obtained from TfL for the Edgware Road/ Sussex Gardens/ Old Marylebone Road junction for the period of 36 months to November 2008.

6.3.22 A summary of the collision history is shown in Table 6.16.

Table 6.16: Edgware Road/ Sussex Gardens/ Old Marylebone Road junction collision history by year and severity

Severity/ Months To	12/11/2006	12/11/2007	12/11/2008	Total
Fatal	1	0	0	1
Serious	1	2	2	5
Slight	2	2	8	12
Total	4	4	10	18

6.3.23 The results of the collision history summary shown above reveal that there were 18 accidents in total at the junction during the 36 month study period. Twelve accidents resulted in a slight injury and five accidents, in serious injuries.

6.3.24 The collision rate, 6 accidents per year, is above the borough average of 2.32 at signalised junctions.

6.3.25 There was one fatal accident which took place on 15th June 2006 when a pedestrian crossing the junction from north-east to south-west failed to look properly and walked into the path of an oncoming bus. The accident occurred at midday during light and dry conditions.

6.3.26 Eight of the accidents (44.4%) involved pedestrians which is above the borough average of 33.1% at signalised junctions and 30.1% at priority junctions.

6.3.27 Two of the accidents (11%) involved cyclists which is below the borough average of 13% at signalised junctions and 15.8% at priority junctions.

6.3.28 Five accidents (27.8%) took place during the hours of darkness which is below the borough average of 36% at signalised junctions and 29.3% at priority junctions.

6.3.29 Four accidents (22.2%) involved vehicles performing a right-turn manoeuvre which is above the borough average of 18.8% at signalised junctions and below the average of 25.1% at priority junctions. The spread of the number of accidents during the three year study period shows a sharp increase between November 2007 and November 2008 from two, to eight accidents.

Road network management

6.3.30 The Edgware Road/ Sussex Gardens/ Old Marylebone Road junction forms part of the TLRN.

Traffic analysis

6.3.31 The analysis of road safety, network management and traffic at the Edgware Road/ Sussex Gardens/ Old Marylebone Road junction is summarised in Figure 6.11.

6.3.32 From the indicator table it can be seen that the overall tendency is against the switch off of traffic signals at this location. The main factors are high number of pedestrians/ cyclists, higher than average number of accidents with an increasing trend and high percentage of pedestrian collisions. The junction forms part of the TLRN and its signal control is linked to other junctions within the corridor which would cause further problems in the event of a switch off.

Figure 6.11: Edgware Road/ Sussex Gardens/ Old Marylebone Road junction-road safety, network management and traffic analysis indicator table

Edgware Road/ Sussex Gardens/ Old Marylebone Rd

	POTENTIAL RISK INDICATORS against………switch off……….….for		
TRAFFIC MIX AND CHARACTERISTICS	**HIGH**	**MEDIUM**	**LOW**
Volume of traffic		✓	
Percentage of goods traffic			✓
Volume of cyclist movements			✓
Pedestrian activity	✓		
JUNCTION LAYOUT AND GEOMETRY	**HIGH/ YES**	**PART**	**LOW/NO**
Visibility requirements of TD 42/95 NOT achieved	✓		
Total number of traffic lanes/ overall carriageway width		✓	
No. of arms		✓	
Total number of permitted movements			✓
Unclear priority	✓		
PEDESTRIAN AND CYCLIST PROVISION	**YES**	**SOME/ PART**	**NO**
Central refuges/ islands not provided		✓	
Controlled crossing facilities provided as part of signal control		✓	
Absence of stand-alone crossings close to the junction	✓		
Advanced Stop Lines provided for cyclists?			✓
COLLISION HISTORY (latest 36 months)	**YES**	**PART**	**NO**
High risk site?	✓		
Increasing trend in collisions?	✓		
%age of pedestrian Collisions > average	✓		
%age of cyclist Collisions > average			✓
%age of dark Collisions > average			✓
% Right turning accidents > average	✓		
NETWORK MANAGEMENT			
TLRN junction	✓		
Part of corridor management	✓		
OVERALL TENDENCY	✓		

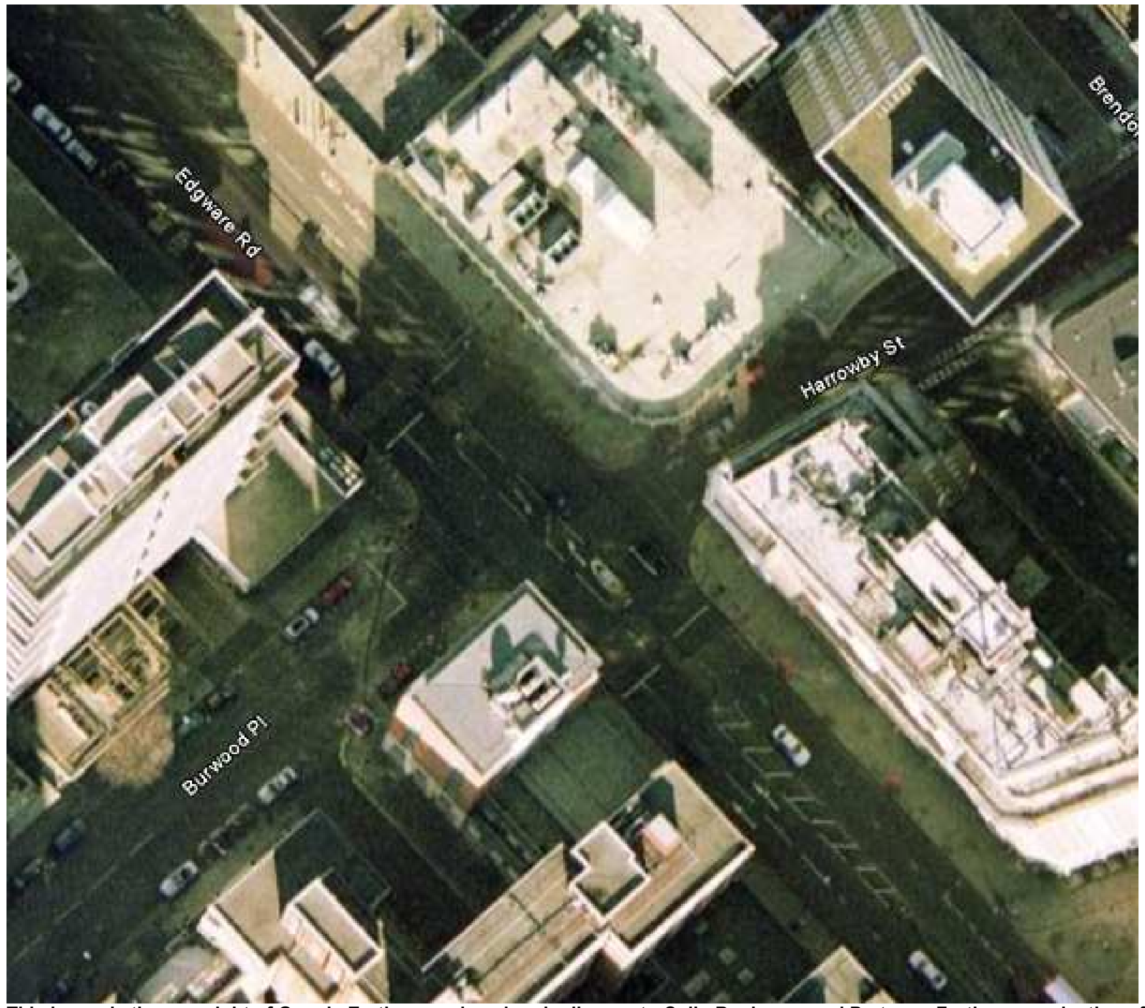
6.4 Edgware Road - Junction 11 (Burwood Place/ Harrowby Street)

Traffic mix and characteristics

6.4.2 The Edgware Road/Burwood Place/ Harrowby Street junction is located within the London Borough of Westminster in an area populated with shops, restaurants and cafes. The nearest stations are Edgware Road tube station in the north, and Marble Arch tube station in the south.

6.4.3 The location of the Edgware Road/ Burwood Place junction is shown in Figure 6.12.

Figure 6.12: The Edgware Road/ Burwood Place/ Harrowby Street junction



6.4.4 A classified turning count survey was carried out at the junction on Wednesday, 4th July 2007 between 07:00- 10:00, 12:00- 14:00 and 16:00- 19:00. The morning and evening survey results are summarised in Table 6.17 and Table 6.18.

Table 6.17: Edgware Road/ Burwood Place/ Harrowby Street junction morning turning count survey (07:00- 10:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Edgware Road(N)	3866	272	275	7	7
Edgware Road(S)	3465	70	235	2	6.8
Burwood Place	242	13	19	5.4	7.9
Harrowby Street	247	20	12	8.1	4.9
Total	**7820**	**375**	**541**	**4.8**	**6.9**

Table 6.18: Edgware Road/ Burwood Place/ Harrowby Street junction evening turning count survey (16:00- 19:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Edgware Road(N)	3704	127	82	3.4	2.2
Edgware Road(S)	3572	171	102	4.8	2.9
Burwood Place	432	21	9	4.9	2.1
Harrowby Street	348	12	8	3.4	2.3
Total	**8056**	**331**	**201**	**4.1**	**2.5**

6.4.5 The results of the morning and evening traffic count survey show that during the morning survey period (07:00- 10:00) cyclists represented 4.8% of vehicular traffic. During the evening survey period (16:00- 19:00) they amounted to 4.1% of general traffic. This is a small percentage and should not be a cause for concern in the event of a switch off.

6.4.6 Pedestrian count surveys were not available but the volume of pedestrian during the day and evening is known to be high.

6.4.7 The junction is located within a 30mph speed limit zone. No data is currently available on the approach speeds.

6.4.8 HGVs constitute 6.9% of general traffic during the morning survey period and 2.5% during the evening survey period (see Table 6.17 and Table 6.18). This is a relatively low percentage of traffic and should not cause and serious safety concerns in the event of a switch off.

Junction layout and geometry

6.4.9 A compliance of visibility splays and DMSSD with standards set out in TD 42/95 Geometric Design of Major/ Minor Junctions and TD 9/93 Highway Link Design is presented in Table 6.19.

Table 6.19: Edgware Road/ Harrowby Street/ Burwood Place junction- DMSSD and visibility splays

Approach/ Visibility	DMSSD=70m	Y= 70m (X=9m)	Y=70m (X=4.5m)	Y=70m (X=2.4m)
Edgware Road(N)	Yes	Yes	Yes	Yes
Edgware Road(S)	Yes	No	Yes	Yes
Burwood Pl	Yes	No	Yes	Yes
Harrowby St	Yes	Yes	Yes	Yes

6.4.10 Table 6.19 shows that it would be impossible to achieve the visibility splay of 70m on all approaches to the junction with the 'x' distance of 9m. The 'x' distance would need to be lowered to 4.5m.

6.4.11 DMSSD of 70m can be achieved on all approaches to the junction.

6.4.12 It has to be noted that all visibility/ DMSSD results are indicative only and should be confirmed with site measurements.

6.4.13 The number of lanes and carriageway widths at the Edgware Road/ Burwood Pl/ Harrowby junction are shown in Table 6.20.

Table 6.20: Edgware Road/ Burwood Place/ Harrowby Street junction lanes and carriageway widths

Approach	Lane	Width (m)	Central Refuge
Edgware Road(S)	Nearside lane (ahead and left)	2.9	No
	Offside lane (ahead and right)	2.9	Yes
	2 exit lanes	5.7	
Harrowby Street	Single lane (ahead right and left)	4.0	No
	One lane exit	4.0	
Edgware Road(N)	Nearside lane (ahead and left)	3.0	No
	Offside lane(ahead and right)	3.0	Yes
	2 lanes exit	5.7	
Burnwood Place	Single lane (ahead, left, right)	4.5	No
	Exit lane	4.6	

6.4.14 From the table above it can be seen that the number of lanes does not exceed three on any of the approaches/ exits of the junction. The presence of central refuges facilitates pedestrian movements across the junction.

6.4.15 This is a four arm crossroad junction with all movements being permitted.

6.4.16 Since this is a crossroad junction, the priority would not be immediately clear in the event of a switch off. Judging by the traffic flows shown in Table 6.17 and Table 6.18, Edgware Road carries the majority of traffic flow and should be given priority over Burwood Place and Harrowby Street if traffic signals were to be switched off.

Pedestrian and cyclist provision

6.4.17 At present the junction is provided with two staggered signal controlled pedestrian crossings on Edgware Road (N&S). Uncontrolled straight across pedestrian crossings are located on the Harrowby Street and Burwood Place arms.

6.4.18 No stand alone pedestrian crossings are located nearby.

6.4.19 Existing traffic islands on Edgware Road would facilitate pedestrian movements across the junction if traffic signals were switched off.

6.4.20 No ASLs are provided at the junction. Safety for cyclists is therefore not expected to decline during times when signals are switched off.

Collision history

6.4.21 A collision history was obtained from TfL for the Edgware Road/ Harrowby Street/ Burwood Place junction for the period of 36 months to November 2008.

6.4.22 A summary of the collision history is shown in Table 6.21.

Table 6.21: Edgware Road/ Harrowby Street/ Burwood Place junction collision history by year and severity

Severity/ Months To	12/11/2006	12/11/2007	12/11/2008	Total
Fatal	0	0	0	0
Serious	0	1	1	2
Slight	4	3	1	8
Total	4	4	2	10

6.4.23 The collision summary for the Edgware Road/ Harrowby St/ Burwood Place junction shows that during the three year study period there were, in total, ten accidents at the junction. Eight accidents resulted in a slight injury and two accidents resulted in serious injuries. No fatal accidents occurred at the junction over the three year study period.

6.4.24 The collision rate per year at this junction is 3.3 which is above the borough average of 2.32 at signalised junctions.

6.4.25 One of the accidents (10%) involved a pedestrian which is below the borough average of 33.1% at signalised junctions and 30.1% at priority controlled junctions.

6.4.26 Two accidents (20%) involved cyclists which is below the borough average of 13% at signalised junctions and 15.8% at priority junctions.

6.4.27 Five accidents (50%) took place during the hours of darkness which is above the borough average of 36% at signalised junctions and 29.3% at priority junctions.

6.4.28 Four accidents (40%) involved vehicles turning right which is above the borough average of 18.8% at signalised junctions and 25.1% at priority junctions.

6.4.29 A decrease in the number of accidents can be observed during the last year of the study period, from four to two accidents.

Road network management

6.4.30 The Edgware Road/ Burwood Place/ Harrowby Street junction forms part of the TLRN.

Traffic analysis

6.4.31 The analysis of road safety, network management and traffic at the Edgware Road/ Burwood Place/ Harrowby Street Junction is summarised in Figure 6.12

6.4.32 The indicator table shows that the overall tendency is against the switch off of traffic signals at this location, mainly due to higher than average number of accidents, high number of pedestrians/ cyclists and the fact that the junction forms part of the TLRN and is linked to other junctions in the corridor.

Figure 6.13: Edgware Road/ Burwood Place/ Harrowby Street junction- road safety, network management and traffic analysis indicator table

Edgware Road/ Burwood Place/ Harrowby Street

	POTENTIAL RISK INDICATORS		
	against……..switch off…………...for		
TRAFFIC MIX AND CHARACTERISTICS	**HIGH**	**MEDIUM**	**LOW**
Volume of traffic		✓	
Percentage of goods traffic			✓
Volume of cyclist movements			✓
Pedestrian activity	✓		
JUNCTION LAYOUT AND GEOMETRY	**HIGH/ YES**	**PART**	**LOW/NO**
Visibility requirements of TD 42/95 NOT achieved		✓	
Total number of traffic lanes/ overall carriageway width		✓	
No. of arms		✓	
Total number of permitted movements	✓		
Unclear priority	✓		
PEDESTRIAN AND CYCLIST PROVISION	**YES**	**SOME/ PART**	**NO**
Central refuges/ islands not provided		✓	
Controlled crossing facilities provided as part of signal control		✓	
Absence of stand-alone crossings close to the junction	✓		
Advanced Stop Lines provided for cyclists?			✓
COLLISION HISTORY (latest 36 months)	**YES**	**PART**	**NO**
High risk site?	✓		
Increasing trend in collisions?			✓
%age of pedestrian Collisions > average			✓
%age of cyclist Collisions > average			✓
%age of dark Collisions > average	✓		
% Right turning accidents > average	✓		
NETWORK MANAGEMENT			
TLRN junction	✓		
Part of corridor management	✓		
OVERALL TENDENCY	✓		

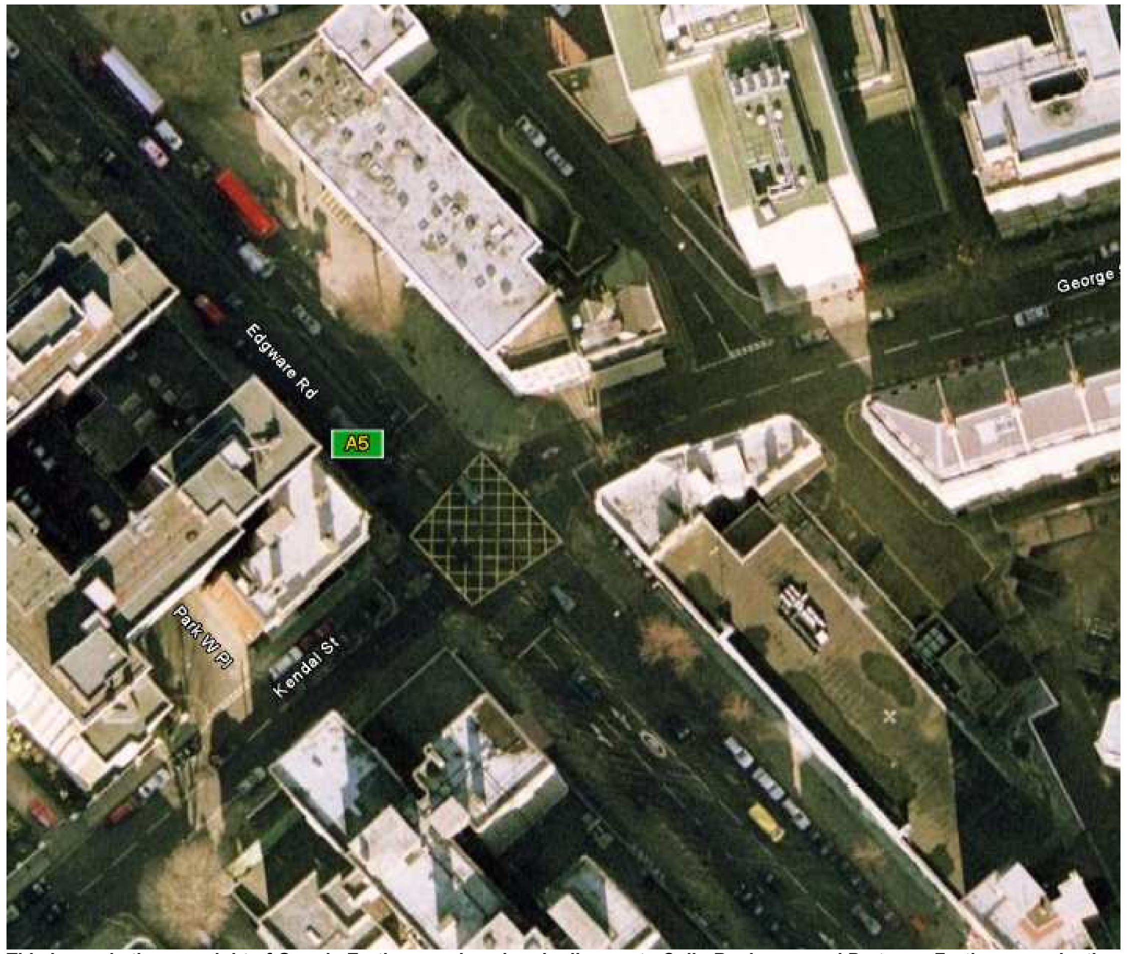
6.5 Edgware Road - Junction 12 (George Street/ Kendal Street)

Traffic mix and characteristics

6.5.2 The Edgware Road/ George Street/ Kendal Street junction is located within the London Borough of Westminster. The area is populated with shops, restaurants, cafes and offices. The nearest underground stations are Edgware Road to the north and Marble Arch to the south.

6.5.3 The location of the Edgware Road/ George Street/ Kendal Street junction is show in Figure 6.14.

Figure 6.14: Edgware Road/ George Street/ Kendal Street junction



6.5.4 A classified turning count survey was carried out at the junction on Wednesday, 4th July 2007 between 07:00-10:00, 12:00- 14:00 and 16:00-19:00. The results of the morning and evening traffic survey are summarised in Table 6.22 and Table 6.23.

Table 6.22: Edgware Road/ George St/ Kendal Street junction morning turning count survey (07:00- 10:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Edgware Road(N)	3597	246	234	6.8	6.5
Edgware Road(S)	3601	78	198	2.2	5.5
Kendal St	544	120	7	22	1.3
George St	721	124	26	3.6	3.6
Total	**8463**	**568**	**465**	**6.7**	**5.5**

Table 6.23: Edgware Road/ George St/ Kendal Street junction evening turning count survey (16:00- 19:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Edgware Road(N)	3369	109	68	3.2	2
Edgware Road(S)	3748	182	92	4.9	2.5
Kendal St	659	80	1	12.1	0.2
George St	1177	207	5	17.6	0.4
Total	**8953**	**578**	**166**	**6.5**	**1.9**

6.5.5 The results of the morning and evening traffic count survey show that during the morning survey period (07:00- 10:00) cyclists represented 6.7% of vehicular traffic. During the evening survey period (16:00- 19:00) they amounted to 6.5% of general traffic. This is a small percentage and should not be a cause for concern in the even of a switch off.

6.5.6 Pedestrian count surveys were not available but the volume of pedestrian during the day and evening is known to be high.

6.5.7 The junction is located within a 30mph speed limit zone. No data is currently available on the approach speeds.

6.5.8 HGVs constitute 5.5% of general traffic during the morning survey period and 1.9% during the evening survey period (see Table 6.22 and Table 6.23). This is a relatively low percentage of traffic and should not cause and serious safety concerns in the event of a switch off.

Junction layout and geometry

6.5.9 Compliance to visibility splays and DMSSD with standards set out in TD 42/95 Geometric Design of Major/ Minor Junctions and TD 9/93 Highway Link Design is presented in Table 6.24.

Table 6.24: Edgware Road/ Kendal Street/ George Street junction- DMSSD and visibility splays

Approach/ Visibility	DMSSD=70m	Y= 70m (X=9m)	Y=70m (X=4.5m)	Y=70m (X=2.4m)
Edgware Road(N)	Yes	No	Yes	Yes
Edgware Road(S)	Yes	No	No	No
Kendal St	Yes	No	Yes	Yes
George St	Yes	Yes	Yes	Yes

6.5.10 Table 6.24 shows that the visibility splay of 70m cannot be achieved on any of the approaches with the 'x' distance of 9m. On the Edgware Road(S) approach the required visibility splay cannot be achieved even when the 'x' distance is lowered to 2.4m. On all the other approaches, the 'x' distance would need to be relaxed to 4.5m.

6.5.11 The DMSSD of 70m can be achieved on all approaches to the junction.

6.5.12 The visibility and DMSSD results are indicative only and should be confirmed with site measurements.

6.5.13 The number of lanes and carriageway widths at the Edgware Road/ Kendal St/ George Street junction are shown in Table 6.25.

Table 6.25: Edgware Road/ George Street/ Kendal Street junction lanes and carriageway widths

Approach	Lane	Width (m)	Central Refuge
Edgware Road(S)	Nearside lane entry (ahead & left)	2.8	No
	Offside lane (ahead)	3.0	Yes
	2 lane exit	6.8	
George Street	Single lane (ahead, left, right)	4.9	Yes
	One lane exit	4.5	
Edgware Road(N)	Nearside lane (ahead and left)	3.2	No
	Offside lane (ahead and right)	3.2	Yes
	2 lane exit	6.0	
Kendal Street	Single lane (ahead, right, left)	4.4	Yes
	Single lane exit	5.0	

6.5.14 From the table above it can be seen that the number of lanes does not exceed three on any of the approaches/exits of the junction. The presence of central refuges facilitates pedestrian movements across the junction.

6.5.15 This is a four arm crossroad junction with all movements being permitted.

6.5.16 Since this is a crossroad junction, the priority would not be immediately clear in the event of a switch off. Judging from the traffic flows shown in Table 6.22 and Table 6.23, Edgware Road carries the majority of traffic flow and should be given priority over Kendal Street and George Street if traffic signals were to be switched off.

Pedestrian and cyclist provision

6.5.17 Pedestrians are provided with uncontrolled pedestrian crossings on all four arms of the junction.

6.5.18 In the event of a switch off pedestrians' safety could be affected if there were no sufficient gaps provided in traffic. On the other hand at such locations pedestrians are more accustomed to taking advantage of gaps in traffic than at signal controlled crossings.

6.5.19 No ASLs are provided at the junction. Safety for cyclists is therefore not expected to decline during times when signals are switched off

Collision history

6.5.20 A collision history was obtained from TfL for the Edgware Road/ Kendal Street/ George Street junction for the period of 36 months to November 2008.

6.5.21 A summary of the collision history is shown in Table 6.26.

Table 6.26: Edgware Road/ Kendal Street/ George Street collision history per year and severity

Severity/ Months To	12/11/2006	12/11/2007	12/11/2008	Total
Fatal	0	0	0	0
Serious	1	0	1	2
Slight	1	5	4	10
Total	2	5	5	12

6.5.22 The collision history summary shows that there were in total 12 accidents at the junction within the three year study period. Ten accidents resulted in slight injuries. Two accidents resulted in a serious injury. There were no fatal accidents.

6.5.23 The collision rate per year at the junction is 4 which is above the borough average of 2.32.

6.5.24 Six of the accidents (50%) involved pedestrians which is above the borough average of 33.1% at signalised junction and 30.1% at priority controlled junctions. None of the accidents involved cyclists. One accident took place during wet conditions.

6.5.25 Six accidents (50%) occurred during the hours of darkness. This is above the borough average of 36% at signalised junctions and 29.3% at priority junctions.

6.5.26 One accident (8.3%) involved a vehicle turning right. This is below the borough average of 18.8% at signalised junctions and 25.1% at priority junctions. There was an increase in the number of accidents between November 2006 and November 2007 (from two to five accidents). During the following year the number of accidents remained similar, at four.

Road network management

6.5.27 The Edgware Road/ Kendal Street/ George Street junction forms part of the TLRN.

Traffic analysis

6.5.28 The analysis of road safety, network management and traffic at the Edgware Road/ Kendall Street/ George Street Junction is summarised in Figure 6.15

6.5.29 The indicator table shows that the overall tendency is against the switch off of traffic signals at this location, mainly due to higher than average number of accidents, high number of pedestrians/ cyclists and the fact that the junction forms part of the TLRN and is linked to other junctions in the corridor.

Figure 6.15: Edgware Road/ Kendal Street/ George Street junction- road safety, network management and traffic analysis summary

Edgware Road/ George Street/ Kendal Street

	POTENTIAL RISK INDICATORS		
	against……….switch off…….…….for		
TRAFFIC MIX AND CHARACTERISTICS	**HIGH**	**MEDIUM**	**LOW**
Volume of traffic		✓	
Percentage of goods traffic			✓
Volume of cyclist movements			✓
Pedestrian activity	✓		
JUNCTION LAYOUT AND GEOMETRY	**HIGH/ YES**	**PART**	**LOW/NO**
Visibility requirements of TD 42/95 NOT achieved	✓		
Total number of traffic lanes/ overall carriageway width		✓	
No. of arms		✓	
Total number of permitted movements	✓		
Unclear priority	✓		
PEDESTRIAN AND CYCLIST PROVISION	**YES**	**SOME/ PART**	**NO**
Central refuges/ islands not provided		✓	
Controlled crossing facilities provided as part of signal control			✓
Absence of stand-alone crossings close to the junction	✓		
Advanced Stop Lines provided for cyclists?			✓
COLLISION HISTORY (latest 36 months)	**YES**	**PART**	**NO**
High risk site?	✓		
Increasing trend in collisions?		✓	
%age of pedestrian Collisions > average	✓		
%age of cyclist Collisions > average			✓
%age of dark Collisions > average	✓		
% Right turning accidents > average			✓
NETWORK MANAGEMENT			
TLRN junction	✓		
Part of corridor management	✓		
OVERALL TENDENCY	✓		

6.6 Edgware Road - Junction 12 (Upper Berkeley Street)

Traffic mix and characteristics

6.6.2 The Edgware Road/ Connaught Street/ Upper Berkeley Street junction is located within the London Borough of Westminster. The area is populated with shops, restaurants, cafes and offices. The nearest underground stations are Edgware Road to the north and Marble Arch to the south.

6.6.3 The location of the Edgware Road/ Upper Berkeley Street junction is shown in Figure 6.16.

Figure 6.16: Edgware Road/ Upper Berkeley Street junction

6.6.4 A classified turning count survey was carried out at the junction on Wednesday, 4th July 2007 between 07:00-10:00, 12:00- 14:00 and 16:00-19:00. The results of the morning and evening traffic survey are summarised in Table 6.27 and Table 6.28.

Table 6.27: Edgware Road/ Connaught Street/ Upper Berkeley Street morning turning counts (07:00- 10:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Edgware Road(N)	3666	220	252	6	6.9
Edgware Road(S)	3495	69	236	2	6.8
Connaught St	1045	166	28	15.9	2.7
Upper Berkeley St	503	49	19	9.7	3.8
Total	**8709**	**504**	**535**	**5.8**	**6.1**

Table 6.28: Edgware Road/ Connaught Street/ Upper Berkeley Street evening turning counts (16:00- 19:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Edgware Road(N)	3487	102	77	2.9	2.2
Edgware Road(S)	3728	154	93	4.1	2.5
Connaught St	1044	57	4	5.5	0.4
Upper Berkeley St	752	64	6	8.5	0.8
Total	**9011**	**377**	**180**	**4.2**	**2**

6.6.5 The results of the morning and evening traffic count survey show that during the morning survey period (07:00- 10:00) cyclists represented 5.8% of vehicular traffic. During the evening survey period (16:00- 19:00) they amounted to 4.2% of general traffic. The ratio of cyclists to vehicular traffic is relatively low and should not raise any serious safety concerns in the event of a switch off.

6.6.6 Pedestrian count surveys were not available but the volume of pedestrian during the day and evening is known to be high.

6.6.7 The junction is located within a 30mph speed limit zone. No data is currently available on the approach speeds.

6.6.8 HGVs constitute 6.1% of general traffic during the morning survey period and 2% during the evening survey period (see Table 6.27 and Table 6.28). This is a relatively low percentage of traffic and should not cause any serious safety concerns in the event of a switch off.

Junction layout and geometry

6.6.9 Compliance to visibility splays and DMSSD with standards set out in TD 42/95 Geometric Design of Major/ Minor Junctions and TD 9/93 Highway Link Design is presented in Table 6.29.

Table 6.29: Edgware Road/ Connaught Street/ Upper Berkeley Street junction- DMSSD and visibility splays

Approach/ Visibility	DMSSD=70m	Y= 70m (X=9m)	Y=70m (X=4.5m)	Y=70m (X=2.4m)
Edgware Road(N)	Yes	No	Yes	Yes
Edgware Road(S)	Yes	No	Yes	Yes
Connaught St	Yes	Yes	Yes	Yes
Upper Berkeley St	Yes	Yes	Yes	Yes

6.6.10 Table 6.29 shows that the required visibility splay of 70m could not be achieved on the Edgware Road approaches unless the ‘x’ distance was lowered to 4.5m.

6.6.11 The DMSSD of 70m could be achieved on all approaches.

6.6.12 It should be noted that the DMSSD and visibility measurements are indicative only and should be confirmed with site measurements.

6.6.13 The number of lanes and carriageway widths at the Edgware Road/ Connaught St/ Upper Berkeley Street junction are shown in Table 6.30.

Table 6.30: Edgware Road/ Connaught Street/ Upper Berkeley Street junction lanes and carriageway widths

Approach	Lane	Width (m)	Central Refuge
Edgware Road(S)	Single lane (ahead, left and right)	5.9	Yes
	2 lane exit	6.5	
Upper Berkley Street	Single lane (ahead, left, right)	4.3	No
	One lane exit	5.3	
Edgware Road(N)	Nearside lane (ahead, left)	3.3	No
	Offside lane (ahead)	3.1	Yes
	Exit	6.0	
Connaught Street	Single lane (ahead, left, right)	5.0	No
	exit	5.2	

6.6.14 From the table above it can be seen that the number of lanes does not exceed three on any of the approaches/ exits of the junction. The presence of central refuges facilitates pedestrian movements across the junction.

6.6.15 This is a four arm crossroad junction with all movements being permitted.

6.6.16 The priority would not be immediately obvious in the event of a switch off, however traffic surveys indicate that Edgware Road carries the majority of flow and should be given priority over Connaught Street and Upper Berkeley Street (see Table 6.27 and Table 6.28)

Pedestrian and cyclist provision

6.6.17 Straight across uncontrolled pedestrian crossings are provided on all four arms of the junction.

6.6.18 This could cause safety issues in the event of a switch off if traffic flow is high and pedestrians are not provided with sufficient gaps to cross. However, at the same time pedestrians are likely to be more used to taking advantage of gaps in traffic than they would be if there were signal controlled crossings provided.

6.6.19 No stand alone pedestrian crossings are located near the junction.

6.6.20 No ASLs are provided at the junction. Safety for cyclists is therefore not expected to decline during times when signals are switched off

Collision history

6.6.21 A collision history was obtained from TfL for the Edgware Road/ Connaught St/ Upper Berkeley Street junction for the period of 36 months to November 2008.

6.6.22 A summary of the collision history is shown in Table 6.31.

Table 6.31: Edgware Road/ Connaught Street/ Upper Berkeley Street junction collision history per year and severity

Severity/ Months To	12/11/2006	12/11/2007	12/11/2008	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Slight	2	5	1	8
Total	2	5	1	8

6.6.23 The collision history summary above shows that there were in total eight accidents which all resulted in slight injuries. There were no serious or fatal accidents at the junction during the 3 year study period.

6.6.24 The collision rate per year at this junction is 2.7 which is only slightly above the borough average of 2.32.

6.6.25 One of the accidents (12.5%) involved a pedestrian. This is below the borough average of 33.1% at signalised junctions and 30.1% at priority junctions.

6.6.26 One of the accidents (12.5%) involved a cyclist. This is below the borough average of 13% at signalised junctions and 15.8% at priority junctions.

6.6.27 Four accidents (50%) happened during the hours of darkness. This is above the borough average of 36% at signalised junctions and 29.3% at priority junctions.

6.6.28 There were no accidents involving vehicles turning right. There was an increase in the number of accidents between November 2006 and November 2007 (from two to five) with a subsequent drop to one accident in 2008.

Road network Management

6.6.29 The Edgware Road/ Connaught Street/ Upper Berkeley junction forms part of the TLRN.

Traffic analysis

6.6.30 The analysis of road safety, network management and traffic at the Edgware Road/ Connaught St/ Upper Berkeley Street Junction is summarised in

Figure 6.17.

6.6.31 The overall tendency shown in the indicator table is in favour of the switch off of traffic signals at this location. This is mainly due to a good safety record of the junction. However, it has to be noted that high number of pedestrians/ cyclists and the fact that the junction forms part of the TLRN/ is linked with other junctions speak against the switch off. If the switch off was to be considered, it could only take place during the off-peak period, most likely late at night when the pedestrian activity is the lowest.

Figure 6.17: Edgware Road/ Connaught Street/ Upper Berkeley Street junction-road safety, network management and traffic indicator table

Edgware Road/ Connaught Street/ Upper Berkeley Street	POTENTIAL RISK INDICATORS against……..switch off…………..for		
TRAFFIC MIX AND CHARACTERISTICS	**HIGH**	**MEDIUM**	**LOW**
Volume of traffic		✓	
Percentage of goods traffic			✓
Volume of cyclist movements			✓
Pedestrian activity	✓		
JUNCTION LAYOUT AND GEOMETRY	**HIGH/ YES**	**PART**	**LOW/NO**
Visibility requirements of TD 42/95 NOT achieved		✓	
Total number of traffic lanes/ overall carriageway width		✓	
No. of arms		✓	
Total number of permitted movements	✓		
Unclear priority	✓		
PEDESTRIAN AND CYCLIST PROVISION	**YES**	**SOME/ PART**	**NO**
Central refuges/ islands not provided		✓	
Controlled crossing facilities provided as part of signal control			✓
Absence of stand-alone crossings close to the junction	✓		
Advanced Stop Lines provided for cyclists?			✓
COLLISION HISTORY (latest 36 months)	**YES**	**PART**	**NO**
High risk site?		✓	
Increasing trend in collisions?			✓
%age of pedestrian Collisions > average			✓
%age of cyclist Collisions > average			✓
%age of dark Collisions > average	✓		
% Right turning accidents > average			✓
NETWORK MANAGEMENT			
TLRN junction	✓		
Part of corridor management	✓		
OVERALL TENDENCY			✓

6.7 Edgware Road - Junction 13 (Seymour Street)

Traffic mix and characteristics

6.7.2 The Edgware Road/ Seymour Street junction is located within the London Borough of Westminster, just north of Oxford Street with numerous shops, restaurants and cafes. The nearest underground station is Marble Arch to the south.

6.7.3 The location of the Edgware Road/ Seymour Street junction is shown in Figure 6.18.

Figure 6.18: Edgware Road/ Seymour Street junction

6.7.4 A classified turning count survey was carried out at the junction on Wednesday, 4th July 2007 between 07:00-10:00, 12:00- 14:00 and 16:00-19:00. The results of the morning and evening traffic survey are summarised in Table 6.32 and Table 6.33.

Table 6.32: Edgware Road/ Seymour Street morning traffic counts (07:00- 10:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Edgware Road(N)	3812	192	267	5	7
Edgware Road(S)	3447	70	213	2	6.2
Seymour Street (W)	423	63	10	14.9	2.4
Seymour Street (E)	439	42	19	9.6	4.3
Total	**8121**	**367**	**509**	**4.5**	**6.3**

Table 6.33: Edgware Road/ Seymour Street evening traffic counts (16:00- 19:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Edgware Road(N)	3626	90	80	2.5	2.2
Edgware Road(S)	3576	126	82	3.5	2.3
Seymour Street (W)	484	24	10	5	2.1
Seymour Street (E)	1054	152	17	14.4	1.6
Total	**8740**	**392**	**189**	**4.5**	**2.2**

6.7.5 The results of the morning and evening traffic count survey show that both during the morning and evening survey period (07:00- 10:00 and 16:00-19:00) cyclists represented 4.5% of vehicular traffic. The ratio of cyclists to vehicular traffic is relatively low and should not raise any serious safety concerns in the event of a switch off.

6.7.6 Pedestrian count surveys were not available but the volume of pedestrian during the day and evening is known to be high.

6.7.7 The junction is located within a 30mph speed limit zone. No data is currently available on the approach speeds.

6.7.8 HGVs constitute 6.3% of general traffic during the morning survey period and 2.2% during the evening survey period (see Table 6.32 and Table 6.33). This is a relatively low percentage of traffic and should not cause and serious safety concerns in the event of a switch off.

Junction layout and geometry

6.7.9 Compliance to visibility splays and DMSSD with standards set out in TD 42/95 Geometric Design of Major/ Minor Junctions and TD 9/93 Highway Link Design is presented in Table 6.34.

Table 6.34: Edgware Road/ Seymour Street junction- DMSSD and visibility splays

Approach/ Visibility	DMSSD=70m	Y= 70m (X=9m)	Y=70m (X=4.5m)	Y=70m (X=2.4m)
Edgware Road(N)	Yes	No	Yes	Yes
Edgware Road(S)	Yes	No	Yes	Yes
Seymour Street (W)	Yes	Yes	Yes	Yes
Seymour Street (E)	Yes	Yes	Yes	Yes

6.7.10 Table 6.34 shows that the required visibility splay of 70m could not be achieved on the Edgware Road approaches without lowering the ‘x’ value to 4.5m.

6.7.11 The DMSSD of 70m could be achieved on all approaches.

6.7.12 The DMSSD and visibility splay measurements are indicative only and should be confirmed with site measurements.

6.7.13 The number of lanes and carriageway widths at the Edgware Road/ Seymour Street junction are shown in Table 6.35.

Table 6.35: Edgware Road/ Seymour Street junction- lanes and carriageway width

Approach	Lane	Width (m)	Central Refuge
Edgware Road(S)	Nearside lane (ahead and left)	3.1	No
	Offside lane (ahead and right)	3.1	Yes
	2 exit lanes	5.7	
Seymour Street (E)	Single lane (ahead right and left)	4.5	No
	One lane exit	5.2	
Edgware Road(N)	Nearside lane (ahead and left)	3.5	No
	Offside lane(ahead)	3.5	Yes
	2 lanes exit	6.6	
Seymour Street (W)	Single lane (ahead, left)	5.2	No
	Exit lane	5.0	

6.7.14 From the table above it can be seen that the number of lanes does not exceed three on any of the approaches/ exits of the junction. The presence of central refuges facilitates pedestrian movements across the junction.

6.7.15 This is a four arm crossroad junction. The right-turn is not permitted from Edgware Road(S) into Seymour Street (E) and from Seymour Street (W) into Edgware Road(S). The left turn is not allowed from Seymour Street (E) into Edgware Road(S). This reduces the number of possible conflicts at the junction facilitating junction crossing form pedestrians in the event of a switch off.

6.7.16 Since this is a crossroad junction, the priority would not be immediately clear if the junction was to become priority controlled. However, traffic surveys show that Edgware Road carried the majority of traffic (see Table 6.32 and Table 6.33) and would most likely be given priority over Seymour Street.

Pedestrian and cyclist provision

6.7.17 There is a signal controlled straight across pedestrian crossing on the Edgware Road(S) arm of the junction.

6.7.18 Uncontrolled pedestrian crossings are provided on all other arms of the junction.

6.7.19 There are no stand alone pedestrian crossings located nearby.

6.7.20 No ASLs are present on any of the approaches to the junction. Safety for cyclists is therefore not expected to decline during times when signals are switched off.

Collision history

6.7.21 A collision history was obtained from TfL for the Edgware Road/ Seymour Street junction for the period of 36 months to November 2008.

6.7.22 A summary of the collision history is shown in Table 6.36.

Table 6.36: Edgware Road/ Seymour Street collision history summary per year and severity

Severity/ Months To	12/11/2006	12/11/2007	12/11/2008	Total
Fatal	1	0	1	2
Serious	0	0	0	0
Slight	1	4	2	7
Total	2	4	3	9

6.7.23 From the collision history summary presented above it can be seen that there were in total nine accidents at the junction during the three year study period. Seven accidents resulted in slight injuries and two accidents resulted in fatalities. One of the fatal accidents involved two casualties, one of which suffered serious injuries.

6.7.24 The collision rate per year at the junction is 3 which is above the borough average of 2.32.

6.7.25 Four accidents (44.4%) involved pedestrians. This is above the borough average of 33.1% at signalised junctions and 30.1% at priority junctions.

6.7.26 One accident (11.1%) involved a cyclist. This is below the borough average 13% at signalised junctions and above 15.8% at priority junctions.

6.7.27 Three accidents occurred during the hours of darkness. At 33.3% this figure is lower than the borough average of 36% at signalised junctions and above the borough average of 29.3% at priority junctions.

6.7.28 The first fatal accident happened on 23rd July 2006 when two pedestrians were crossing the junction away from the crossing, failed to look properly and walked into the path of an approaching bus. One of them suffered fatal, and another one serious injuries.

6.7.29 The second fatal accident took place on 9th June 2008 when a pedestrian under the influence of alcohol fell into the path of an approaching bus.

6.7.30 One accident (11.1%) involved a vehicle turning right. This is below the borough average of 18.8% at signalised junctions and 25.1% at priority junctions.

6.7.31 The number of accidents increased visibly during the second year of the study period and subsequently decreased during the final year of the study period.

Road network management

6.7.32 The Edgware Road/ Seymour Street junction forms part of the TLRN.

Traffic analysis

6.7.33 The analysis of road safety, network management and traffic at the Edgware Road/ Seymour Street Junction is summarised in Figure 6.19.

6.7.34 The overall tendency presented in the indicator table shows equal number of factors in favour and against the switch off of traffic signals at this location. However, with higher than average number of accidents, high percentage of pedestrian collisions and high pedestrian/ cycle activity, this site should not be considered for the switch off.

Figure 6.19: Edgware Road/ Seymour Street junction- road safety, network management and traffic analysis indicator table

Edgware Road/ Seymour Street

	POTENTIAL RISK INDICATORS		
	against……..switch off……….…..for		
TRAFFIC MIX AND CHARACTERISTICS	**HIGH**	**MEDIUM**	**LOW**
Volume of traffic		✓	
Percentage of goods traffic			✓
Volume of cyclist movements			✓
Pedestrian activity	✓		
JUNCTION LAYOUT AND GEOMETRY	**HIGH/ YES**	**PART**	**LOW/NO**
Visibility requirements of TD 42/95 NOT achieved		✓	
Total number of traffic lanes/ overall carriageway width		✓	
No. of arms		✓	
Total number of permitted movements			✓
Unclear priority	✓		
PEDESTRIAN AND CYCLIST PROVISION	**YES**	**SOME/ PART**	**NO**
Central refuges/ islands not provided		✓	
Controlled crossing facilities provided as part of signal control		✓	
Absence of stand-alone crossings close to the junction	✓		
Advanced Stop Lines provided for cyclists?			✓
COLLISION HISTORY (latest 36 months)	**YES**	**PART**	**NO**
High risk site?	✓		
Increasing trend in collisions?		✓	
%age of pedestrian Collisions > average	✓		
%age of cyclist Collisions > average			✓
%age of dark Collisions > average			✓
% Right turning accidents > average			✓
NETWORK MANAGEMENT			
TLRN junction	✓		
Part of corridor management	✓		
OVERALL TENDENCY		✓	

6.8 Target Roundabout

Traffic mix and characteristics

6.8.2 Target Roundabout is a major grade separated junction between the A316 Church Road and the A40. It is located in the London Borough of Ealing in an area that is mostly residential in character with schools, parks and golf courses located nearby.

6.8.3 The location of the Target Roundabout is shown in Figure 6.20

Figure 6.20: Target Roundabout

6.8.4 A classified turning count survey was carried out at the roundabout on 11th November 2005 between 07:00- 10:00, 12:00- 14:00 and 16:00- 19:00). The results of the morning and evening survey are summarised in Table 6.37 and Table 6.38 below.

Table 6.37: Church Road/ Western Avenue/ Target Roundabout morning traffic counts (07:00- 10:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Church Road(S)	3527	5	212	0.1	6
Church Road(N)	3490	3	219	0.1	6.2
Western Avenue (W)	2047	7	137	0.3	6.7
Western Avenue (E)	4982	0	323	0	6.4
Total	**14046**	**15**	**891**	**0.1**	**6.3**

Table 6.38: Church Road Western Avenue/ Target Roundabout evening traffic counts (16:00- 19:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Church Road(S)	3573	8	82	0.2	2.3
Church Road(N)	3322	7	97	0.2	2.9
Western Avenue (W)	1451	2	26	0.1	1.8
Western Avenue (E)	6169	1	230	0	3.7
Total	**14515**	**18**	**435**	**0.1**	**3**

6.8.5 The results of the morning and evening traffic count survey show that cyclists amount to 0.1% of vehicular traffic both during the morning and evening survey periods. This is a very low percentage due to the use of the subways and should not cause any safety concern in the event of a switch off. The results of the TfL LRSU report *An analysis of accidents at roundabouts 'before' and 'after' signal implementation (2003)*, shows that accidents involving cyclists went from 1 per annum to none per annum following the introduction of traffic signal control at this roundabout (over 3-year periods). This might demonstrate that traffic signal control (regardless of the low volume) reduced the risk to cyclists. The report also describes, however, an increase from none to over 1 per annum at Greenford Roundabout, not far away, following the introduction of signal control. Data that is available clearly does not provide a safety case one way or the other.

6.8.6 There are no at-grade pedestrian facility at Target roundabout. Underpasses are provided which are also used by cyclists.

6.8.7 The roundabout is located within a 30mph speed limit zone. No data is currently available on the approach speeds.

6.8.8 HGVs constitute 6.3% of general traffic during the morning survey period and 3% during the evening survey period (see Table 6.37 and Table 6.38). This is a relatively low percentage of traffic and should not cause and serious safety concerns in the event of a switch off.

Junction layout and geometry

6.8.9 A compliance of visibility distances at roundabouts with standards set out in TD 42/95 Geometric Design of Roundabouts is presented in Table 6.39.

Table 6.39: Church Road/ Western Avenue/ Target Roundabout junction-visibility distances

Approach/ visibility	Forward	To the right	To the right (15m)
Church Road(S)	Yes	Yes	Yes
Church Road(N)	Yes	Yes	Yes
Western Avenue (W)	Yes	Yes	Yes
Western Avenue (E)	Yes	Yes	Yes

6.8.10 Table 6.39 shows that all approaches to the roundabout comply with the requirements for visibility distances at roundabouts.

6.8.11 The measurements of visibility distances are indicative only and would need to be confirmed with site measurements.

6.8.12 The number of lanes and carriageway widths at the Church Road/ Western Ave/ Target RB junction are shown in Table 6.40.

Table 6.40: Church Road/ Western Avenue/ Target Roundabout lanes and carriageway widths

Approach	Lane	Width (m)	Central Refuge
Church Road(S)	Nearside entry lane (left)	3.4	No
	Middle entry lane (ahead)	3.4	No
	Offside entry lane (ahead)	3.4	Yes
	2 exit lanes	7.5	
Church Road(N)	Nearside entry lane	3.2	No
	Middle entry lane	3.2	No
	Offside entry lane	3.2	Yes
	2 exit lanes	8	
Western Avenue (E)	Nearside entry lane (left)	2.6	No
	Middle entry lane (ahead)	2.9	No
	Offside entry lane (right)	2.5	No
	2 exit lanes	7.5	No
Western Avenue (W)	Nearside entry lane	3.3	No
	Offside entry lane	3	No
	Exit lane	5.5	No

6.8.13 From the table above it can be seen that the number of lanes does not exceed three on any of the approaches/ exits of the roundabout. Exit and entry arms are divided with splitter islands or are completely separate (Western Avenue approaches).

6.8.14 This is an existing roundabout where the priority would be immediately clear in the event of a switch off (priority given to traffic approaching from the right).

Pedestrian and cyclist provision

6.8.15 There are currently no at-grade pedestrian or cycle facilities provided at the Church Road/ Western Avenue/ Target Roundabout. All the facilities are grade separated.

Collision history

6.8.16 A collision history was obtained from TfL for the Target Roundabout for the period of 36 months to November 2008.

6.8.17 A summary of the collision history is shown in Table 6.41.

6.8.18 There were in total 38 accidents at the Target Roundabout during the 3 year study period. Two accidents resulted in serious injuries and 36, in slight injuries.

6.8.19 At 12.7, the yearly collision rate at the junction is significantly higher than the borough average rate of 1.96. The issue of how to assess the number of accidents at signal controlled junctions is not straight forward. Were the junction to be priority controlled, it would be assessed as a single roundabout junction, rather then individual priority junctions at each approach. Typically across London, these show an accident rate between 2-3 PIAs per annum. It is therefore difficult to suggest that adding traffic signals then constitutes separate, but linked, junctions where the accident rate at each can be assessed. Even if it were, the typical rate at each, based on latest figures from LRSU, would be between 1.5-2 PIAs per annum per site (a total of between 6-8 PIAs per annum for the whole roundabout).

Table 6.41: Church Road/ Western Avenue/ Target Roundabout collision history per year and severity

Severity/ Months To	12/11/2006	12/11/2007	12/11/2008	Total
Fatal	0	0	0	0
Serious	1	1	0	2
Slight	11	10	15	36
Total	12	11	15	38

6.8.20 Three of the accidents (7.9%) involved pedestrians. This is lower than the borough average of 19.2% at signalised junctions and higher than the borough average of 5% at roundabouts. These accidents highlight the fact that pedestrians do not always use the underpass provided.

6.8.21 There were no accidents involving cyclists at this roundabout.

6.8.22 Twelve accidents (31.6%) occurred during the hours of darkness. This is lower than the borough average of 36% at signalised junctions and only slightly higher than the borough average of 30.8% at roundabouts.

6.8.23 And increase in the number of accidents can be observed during the last year of the study period, from 11 to 15.

Road network management

6.8.24 The Church Road/ Western Avenue/ Target Roundabout junction forms part of the TLRN.

Traffic analysis

6.8.25 As part of the Economic Impact of Traffic signals Study Phase 2, CB have carried out an analysis of the existing A312 Church Road corridor VISSIM models for the morning (07:00- 08:00), Inter-Peak (12:00- 13:00), evening (17:00- 18:00) and Off-Peak (22:00- 01:00) periods. Proposed VISSIM models were prepared for the same time periods by replacing the existing signal control at the Target Roundabout with offside priority control. The priority control method used is consistent with that encountered at standard non- signalised roundabouts (priority to the right).

6.8.26 All existing and proposed models were run for five random seeds with the simulation resolution of ten time steps/ simulation seconds and the results were averaged for the purpose of comparison between the existing/ proposed models and different time periods.

6.8.27 The network evaluation output was recorded for the following parameters for all vehicle types and all time periods;

- Average delay time per vehicle (s)
- Average number of stops
- Average speed (mph)
- Average stopped delay per vehicle (s)
- Total delay time (h)
- Total distance travelled (km)
- Number of stops
- Number of vehicles in the network
- Number of vehicles that have left the network
- Total stopped delay (h)
- Total travel time (h)

6.8.28 Modelling results are summarised in Table 6.42.

Table 6.42: A312 Church Road corridor VISSIM network performance evaluation results

Parameter	morning		inter-peak		evening		off-peak	
	Base	Proposed	Base	Proposed	Base	Proposed	Base	Proposed
Average delay time per vehicle [s]	243	242	113	197	162	208	47	37
Average number of stops per vehicle	6	6	3	5	4	5	2	1
Average speed [mph]	10	10	16	12	13	11	21	22
Average stopped delay per vehicle [s	78	75	51	96	64	78	29	22
Total delay time [h]	747	707	296	486	465	572	234	184
Total Distance travelled [km]	18194	17707	17129	15931	17821	16833	30132	30127
Number of stops	66301	58874	32210	46944	43408	50328	31552	24546
Number of vehicles in the network	1375	1267	726	997	1022	1111	215	204
Number of vehicles that have left the network	9703	9233	8672	7902	9287	8782	17563	17551
Total stopped delay [h]	239	219	133	238	183	214	142	106
Total travel time [h]	1137	1085	664	826	851	936	898	848

6.8.29 The average delay time per vehicle, average speed and total travel time results are shown in Figure 6.21- Figure 6.24.

6.8.30 The average delay time per vehicle increases in all study periods with the introduction of priority control as per the proposed option. The increase is the most visible during the morning and inter-peak time periods.

6.8.31 The average speed decreases with the introduction of the proposed scenario in all time periods with the exception of the Off-peak, when it does not change.

Figure 6.21: Average delay time per vehicle (s)

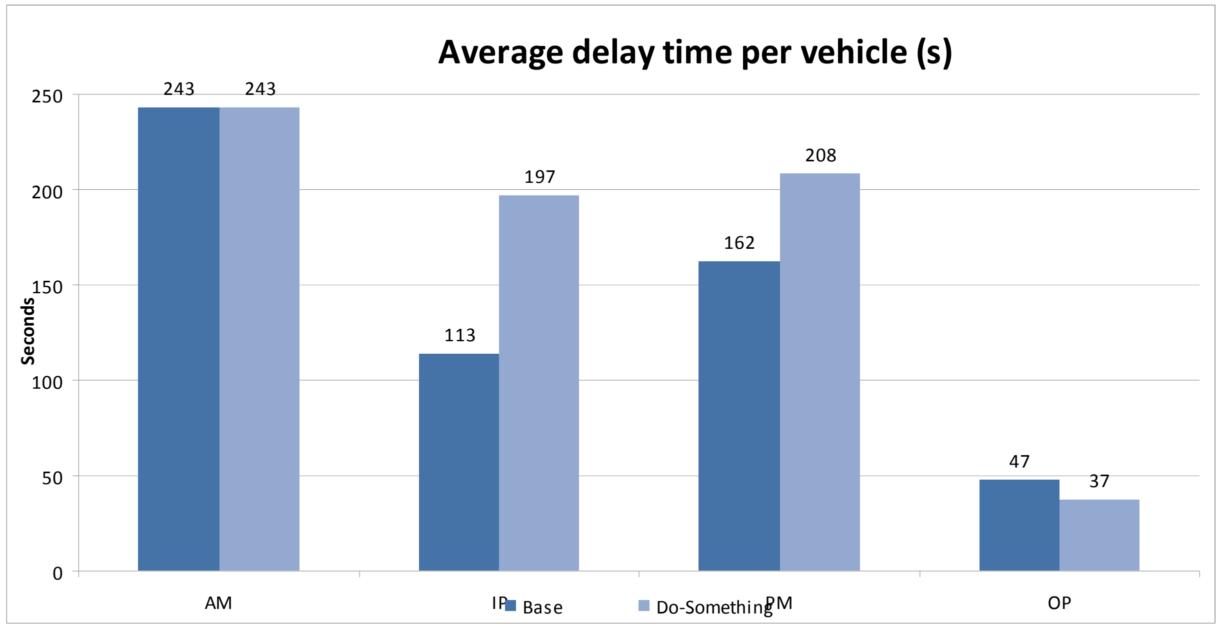
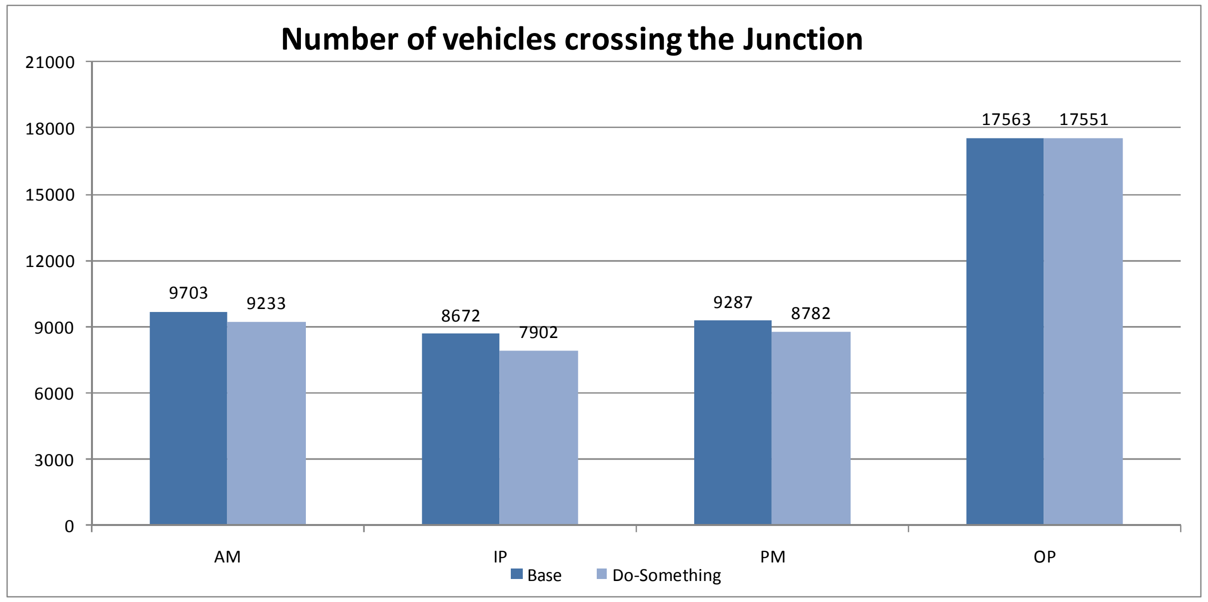


Figure 6.22: Total number of vehicles crossing the Target Roundabout



6.8.32 The analysis of the existing and proposed A312 Church Road corridor VISSIM models show that the introduction of priority control at the Target Roundabout in place of traffic signal control would not be beneficial in economic terms with longer journey times and increased delays for vehicular traffic.

Figure 6.23: Average speed (mph)

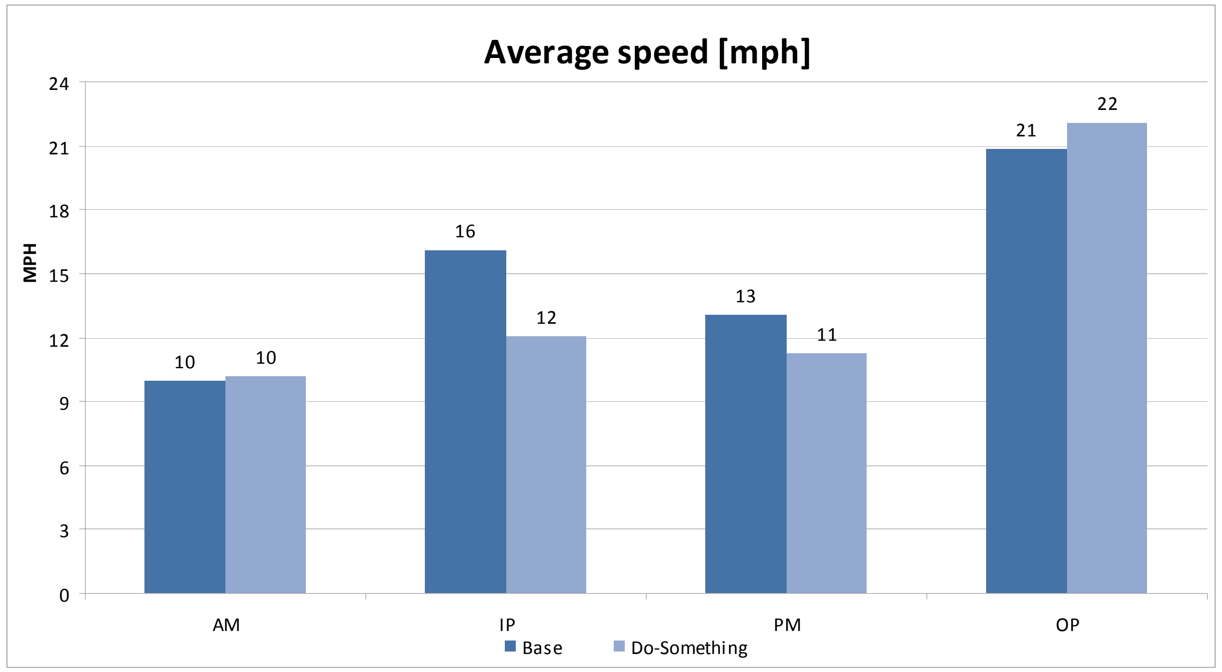
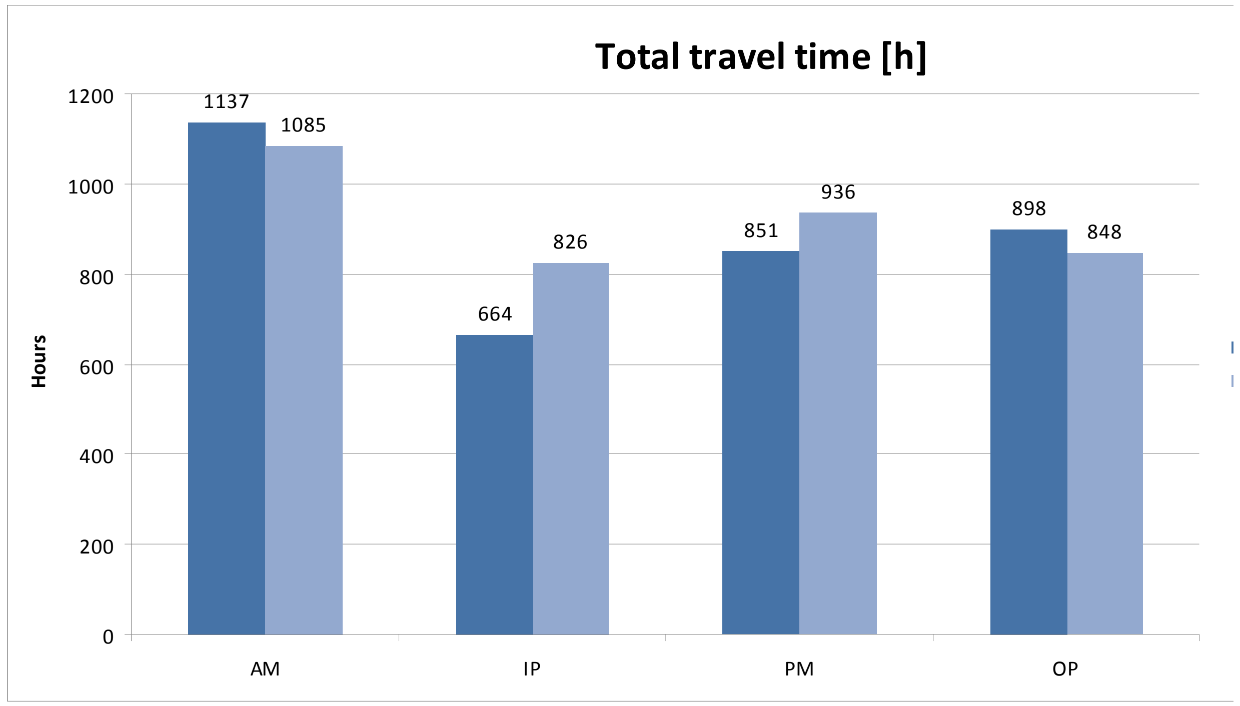


Figure 6.24: Total travel time (h)



6.8.33 The total travel time increases with the introduction of priority control during all study periods with the increase being the most visible during the morning and inter-peak periods.

6.8.34 The network performance evaluation results show that the network operates better with traffic signals remaining in place. The removal of traffic signals causes delays to vehicular traffic, longer journey times and lower speeds.

6.8.35 The analysis of road safety, network management and traffic at the Church Road/ Western Ave/ Target Roundabout junction is summarised in Figure 6.25.

6.8.36 The overall tendency presented in the indicator table is in favour of the switch off of traffic signals. This is mainly due to the layout of the roundabout with good visibility splays and very low pedestrian/ cycle activity. From the economic perspective however, the switch off of traffic signals does not bring any benefits with average delays and total travel times deteriorating with the introduction of priority control in most of the time periods. If the switch off was to be considered, it should only take place during the off-peak time period when the volume of traffic decreases significantly.

Figure 6.25: Church Road/ Western Ave/ Target Roundabout junction- road safety, network management and traffic indicator table

Church Road/ Western Ave/ Target Roundabout

	POTENTIAL RISK INDICATORS		
	against……..switch off…………..for		
TRAFFIC MIX AND CHARACTERISTICS	**HIGH**	**MEDIUM**	**LOW**
Volume of traffic	✓		
Percentage of goods traffic			✓
Volume of cyclist movements			✓
Pedestrian activity			✓
JUNCTION LAYOUT AND GEOMETRY	**HIGH/ YES**	**PART**	**LOW/NO**
Visibility requirements of TD 42/95 NOT achieved			✓
Total number of traffic lanes/ overall carriageway width	✓		
No. of arms		✓	
Total number of permitted movements			✓
Unclear priority			✓
PEDESTRIAN AND CYCLIST PROVISION	**YES**	**SOME/ PART**	**NO**
Central refuges/ islands not provided	✓		
Controlled crossing facilities provided as part of signal control			✓
Absence of stand-alone crossings close to the junction	✓		
Advanced Stop Lines provided for cyclists?			✓
COLLISION HISTORY (latest 36 months)	**YES**	**PART**	**NO**
High risk site?	✓		
Increasing trend in collisions?		✓	
%age of pedestrian Collisions > average			✓
%age of cyclist Collisions > average			✓
%age of dark Collisions > average			✓
% Right turning accidents > average		N/A	
NETWORK MANAGEMENT			
TLRN junction	✓		
Part of corridor management		✓	
OVERALL TENDENCY			✓

6.9 River Road

Traffic mix and characteristics

6.9.2 The River Road/Bastable Avenue junction is located in the London Borough Barking and Dagenham. The area is mainly residential and commercial in character with the Lyon Business Park located north of Bastable Avenue.

6.9.3 The location of the River Road/ Bastable Avenue junction is shown in Figure 6.26.

Figure 6.26: River Road/ Bastable Avenue

6.9.4 A classified turning count was carried out at the junction on 28th March 2007 between 08:00- 09:00, 12:00- 13:00 and 17:00- 18:00. The total number of vehicles recorded during these three time periods are summarised in Table 6.43.

Table 6.43: River Road/Bastable Avenue traffic count survey (08:00-09:00, 12:00- 13:00, 17:00- 18:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
River Road(N)	2154	21	499	1	23
River Road(S)	2248	8	462	0.4	20.6
Bastable Avenue	607	2	18	0.3	3
Total	**5009**	**31**	**979**	**0.6**	**19.5**

6.9.5 The results of the traffic count survey show that during the study period cyclists only amounted to 0.6% of traffic which is very low and should not cause any safety concerns in the event of a switch off.

6.9.6 Pedestrian survey was carried out on the south arm of River Road on Friday, 20th October 2006 between 07:30- 18:00 in fifteen minute periods. The summary of the survey is shown in Table 6.44.

Table 6.44: River Road/Bastable Avenue pedestrian survey (07:30- 18:00)

Approach	Direction	
	Westbound	**Eastbound**
River Road(S)	84	214

6.9.7 There were a total of 84 pedestrians recorded during the study period crossing River Road in the westbound, and 214 in the eastbound direction. This is a very low number when compared with the total number of vehicles at this location.

6.9.8 The junction is located within a 30mph speed limit zone. No data is currently available on the approach speeds.

6.9.9 HGVs constitute 19.5% of vehicular traffic at the junction (see Table 6.43 and Table 6.44). This is a relatively high percentage and although possibly a minor factor, it would nevertheless have a negative impact on safety in the event of a switch off.

Junction layout and geometry

6.9.10 Compliance to visibility splays and DMSSD with standards set out in TD 42/95 Geometric Design of Major/ Minor Junctions and TD 9/93 Highway Link Design is presented in Table 6.45.

Table 6.45: River Road/ Bastable Avenue junction- DMSSD and visibility splays

Approach/ Visibility	DMSSD=70m	Y= 70m (X=9m)	Y=70m (X=4.5m)	Y=70m (X=2.4m)
River Road(N)	Yes	No	No	Yes
River Road(S)	Yes	No	No	No
Bastable Ave	Yes	No	No	Yes

6.9.11 Table 6.45 shows that the required visibility splay of 70m cannot be achieved on any of the approaches to the junction with the 'x' distance at 4.5-9m.

6.9.12 The DMSSD of 70m can be achieved on all approaches.

6.9.13 The DMSSD and visibility splay measurements are indicative only and should be confirmed with site measurements.

6.9.14 The number of lanes and carriageway widths at the River Road/ Bastable Avenue junction are shown in Table 6.46.

Table 6.46: River Road/ Bastable Avenue

Approach	Lane	Width (m)	Central Refuge
River Road(N)	Entry lane	4.4	Yes
	Exit lane	3.3	
River Road(S)	Entry lane	4.1	Yes
	Exit lane	3.3	
Bastable Ave	Nearside entry lane	3.6	
	Offside entry lane	3.6	Yes
	2 exit lanes	5.5	

6.9.15 From the table above it can be seen that the number of lanes does not exceed two on any of the approaches/ exits of the roundabout.

6.9.16 This is a three arm T-junction with all movements permitted.

6.9.17 Since this is a T- junction, the priority should be clear, the priority being given to River Road.

Pedestrian and cyclist provision

6.9.18 There is a staggered signal controlled crossing provided on Bastable Avenue and a straight across signal controlled pedestrian crossing on River Road (S). There is no pedestrian crossing on River Road (N) approach to the junction.

6.9.19 No cycle facilities are provided at the junction in which case the safety of cyclists should not be affected in the event of a switch off.

Collision history

6.9.20 A collision history was obtained from TfL for the River Road/Bastable Avenue for the period of 36 months to November 2008.

6.9.21 A summary of the collision history is shown in Table 6.47.

Table 6.47: River Road/Bastable Avenue collision history per year and severity

Severity/ Months To	12/11/2006	12/11/2007	12/11/2008	Total
Fatal	0	0	0	0
Serious	0	0	1	1
Slight	0	0	1	1
Total	0	0	2	2

6.9.22 There were a total of two accidents at the junction during the 36 month study period. Both accidents resulted in slight injuries. There were no serious or fatal injuries during the study period.

6.9.23 The yearly collision rate of 0.7 is lower than the borough average of 3.81.

6.9.24 There were no accidents involving pedestrians.

6.9.25 One accident involved a cyclist. This may appear counter-intuitive when considering the conclusion described in Para 6.9.19, however the issue of whether or not there are accidents involving cyclists when traffic signals are operating will not, perhaps, have any influence on whether or not there are accidents involving cyclists during a period when signals are disabled.

6.9.26 Research carried out by Colin Buchanan, considering the number and type of accidents that occurred across the whole of London over a 3-year period during periods when traffic signals were classed as 'not in use' revealed that there was a lower than average number of accidents involving pedestrians and cyclists.

6.9.27 This is, however, in no way conclusive evidence of whether or not a junction is actually safer for cyclists without any control, because of a number of possible influencing parameters either at each of the sites themselves, or more generally about driver behaviour under these conditions. Further research is required on this issue.

6.9.28 One accident happened during the hours of darkness.

6.9.29 None of the accidents involved right turning vehicles.

Road network management

6.9.30 The River Road/ Bastable Avenue junction does not form part of the TLRN.

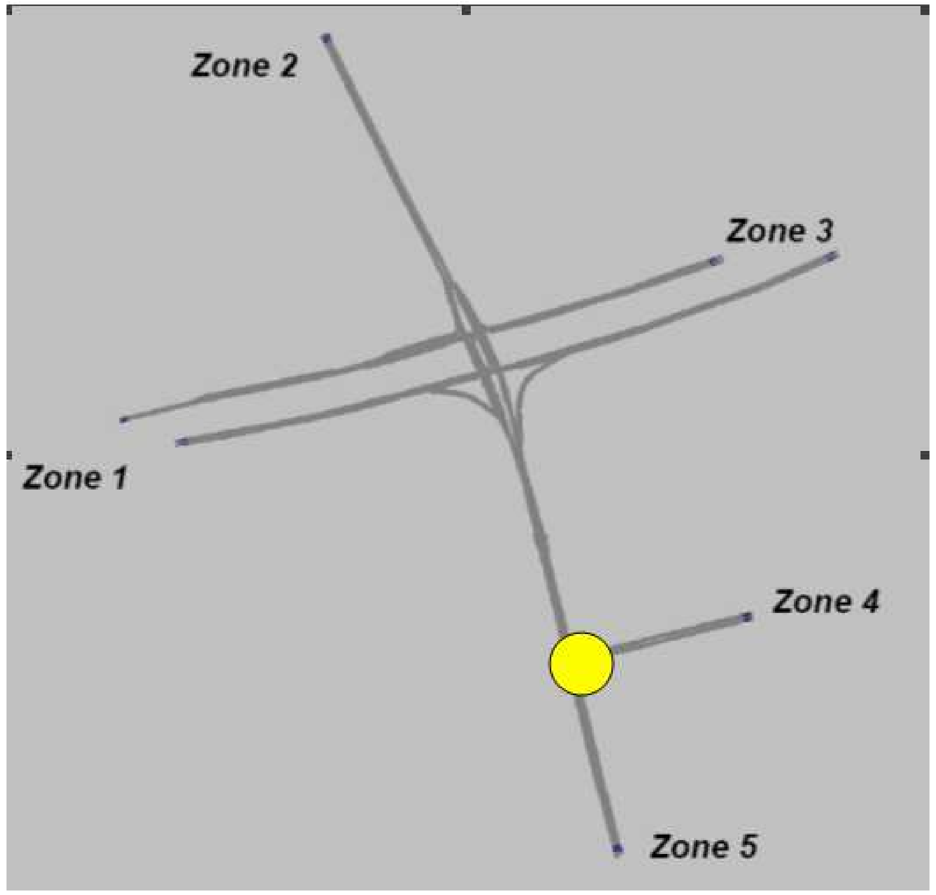
Traffic analysis

6.9.31 As part of the Economic Impact of Traffic signals Study Phase 2, CB have carried out a revision and analysis of the existing A13 VISSIM models for the morning (07:00- 08:00), Inter-Peak (12:00- 13:00), evening (17:00- 18:00) and Off-Peak (22:00- 01:00) periods. Proposed VISSIM models were prepared for the same time periods by replacing the existing signal control at the River Road/ Bastable Avenue with major/ minor priority control with River Road having the priority over Bastable Avenue.

6.9.32 In the proposed A13 VISSIM model traffic signals were switched off at the River Road/ Bastable Avenue junction and replaced with major/ minor priority rule.

6.9.33 The location of traffic signals which were switched off in the proposed scenario is shown in Figure 6.27.

Figure 6.27: A13 VISSIM model- location of the junction where traffic signals were switched off



6.9.34 All existing and proposed models were run for five random seeds with the simulation resolution of ten time steps/ simulation seconds and the results were averaged for the purpose of comparison between the existing/ proposed models and different time periods.

6.9.35 The network evaluation output was recorded for the following parameters for all vehicle types and all time periods;

- Average delay time per vehicle (s)
- Average number of stops
- Average speed (mph)
- Average stopped delay per vehicle (s)
- Total delay time (h)
- Total distance travelled (km)
- Number of stops
- Number of vehicles in the network
- Number of vehicles that have left the network
- Total stopped delay (h)
- Total travel time (h)

6.9.36 The A13 VISSIM modelling results are summarised in Table 6.48.

Table 6.48: A13 VISSIM modelling results

Parameter	morning		inter-peak		evening		off-peak	
	Base	Proposed	Base	Proposed	Base	Proposed	Base	Proposed
Average delay time per vehicle [s]	55	79	59	57	59	66	36	31
Average number of stops per vehicle	1	2	1	1	1	1	1	1
Average speed [mph]	13	11	13	13	12	12	16	16
Average stopped delay per vehicle [s	33	48	37	36	38	43	23	20
Total delay time [h]	33	48	33	32	38	42	36	31
Total distance travelled [km]	1566	1559	1492	1491	1672	1674	2691	2691
Number of stops	2923	4674	2701	2654	2890	3373	3670	2875
Number of vehicles in the network	86	101	72	68	83	78	27	25
Number of vehicles that have left the network	2088	2079	1972	1971	2226	2234	3570	3570
Total stopped delay [h]	20	29	21	20	24	28	23	20
Total travel time [h]	76	90	74	73	83	87	107	103

6.9.37 The results of the network performance evaluation for the average delay time, average speed and total travel time are presented graphically in Figure 6.28-Figure 6.31

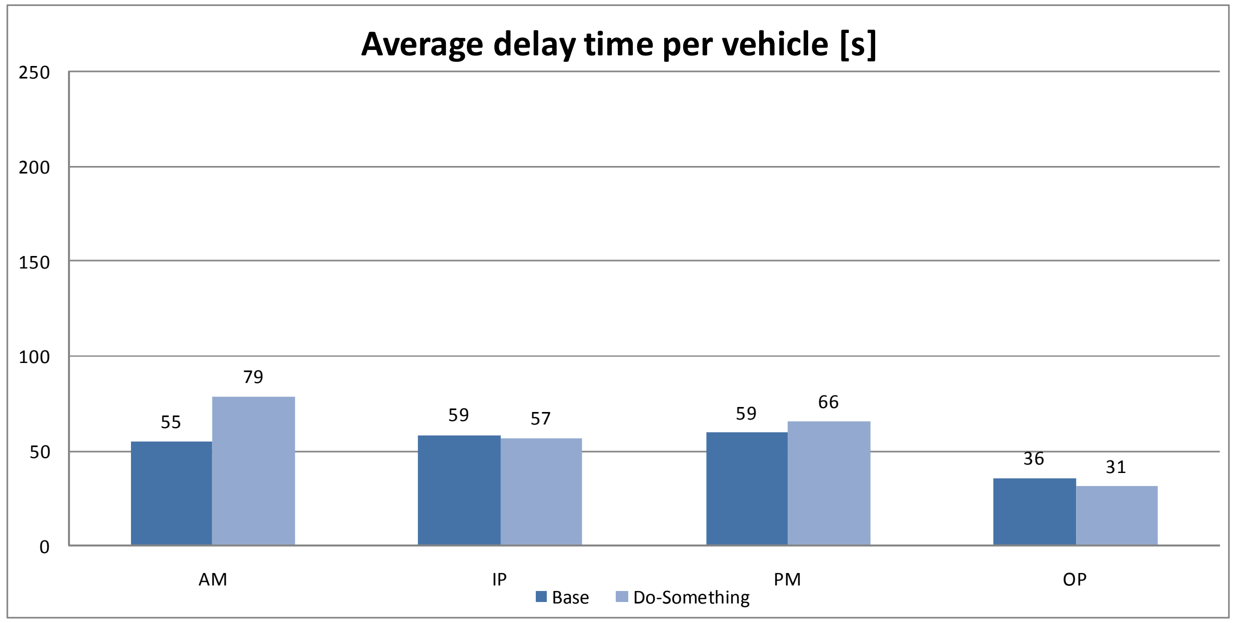
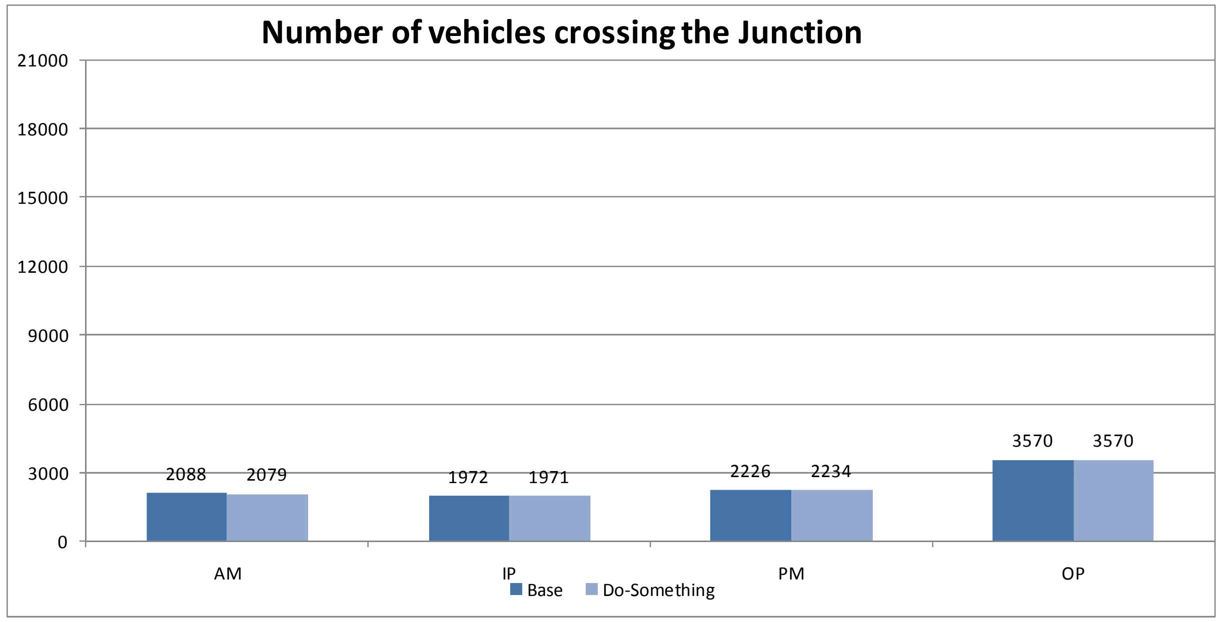


Figure 6.28: Average delay time per vehicle (s)

Figure 6.29: Total number of vehicles crossing at the A13 River Road junction



6.9.38 The average delay time per vehicle is slightly lower in the proposed scenario during the morning peak period when compared with the base model. During all other time periods the average delay increases when the traffic signals are switched off.

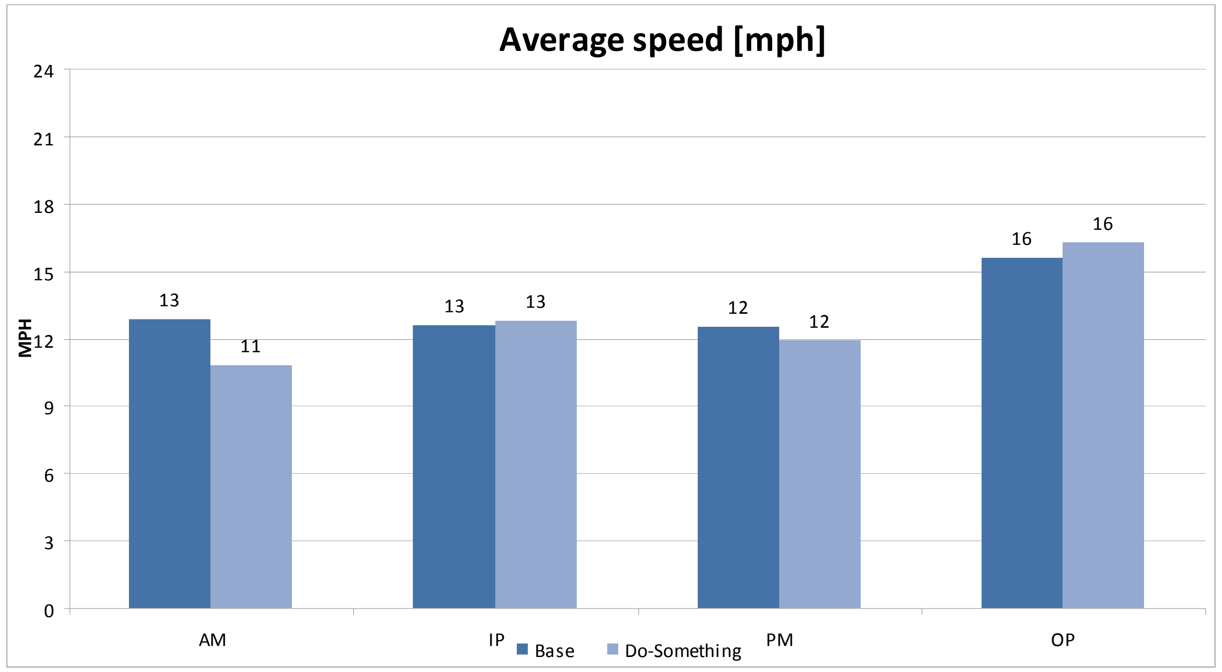


Figure 6.30: Average speed (mph)

6.9.39 The average speed decreases during all time periods in the proposed scenario when compared with the base model.

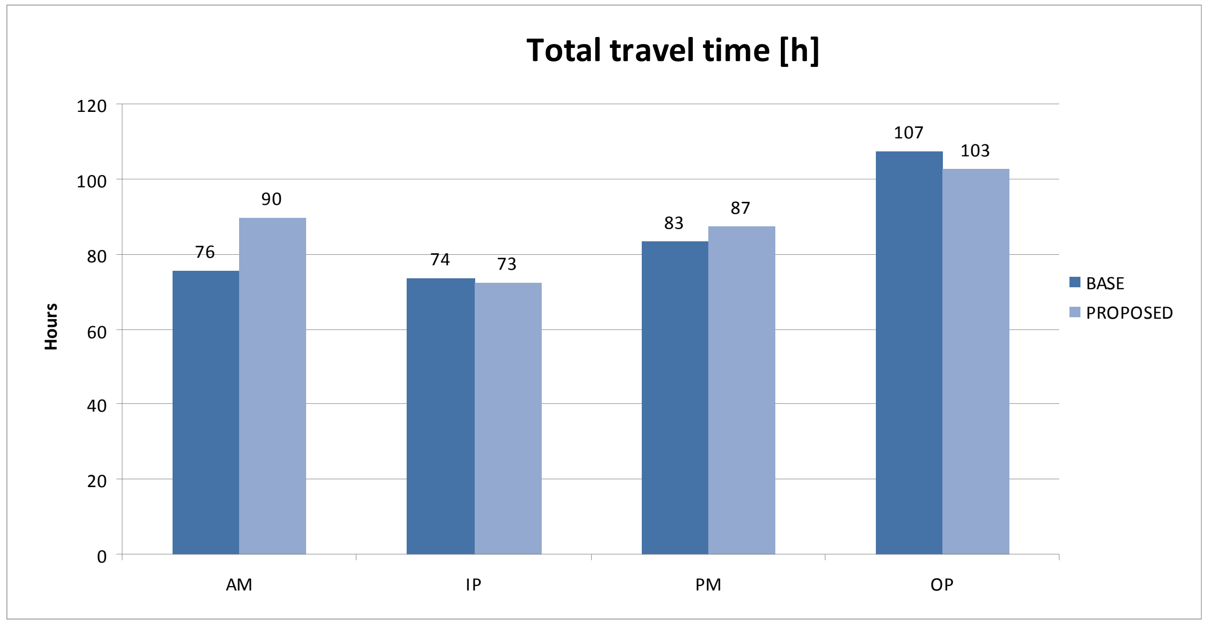


Figure 6.31: Total travel time (h)

6.9.40 The total travel time is lower during the morning peak period as per the proposed scenario. During all other time periods the total travel time increases with the introduction of priority control.

6.9.41 The analysis of the existing and proposed A13 VISSIM models show that during the morning peak periods replacing signal control with priority control at the River Road/ Bastable Avenue would have a positive impact on the network performance with both average delay times per vehicle and total travel times slightly decreasing as per the proposed scenario.

6.9.42 The network performance evaluation shows however that during all other study periods the introduction of priority control in place of the traffic signal control leads to weaker network performance with longer journey times, longer delays to vehicular traffic and lower speeds.

6.9.43 The analysis of road safety, network management and traffic at the River Road/ Bastable Avenue junction is summarised in Figure 6.32.

6.9.44 The overall tendency shown in the indicator table is in favour of the switch off. This is mainly due to a good accident record of the junction, low pedestrian/ cycle activity and the fact that the junction does not form part of the TLRN. However, in the economic terms it has to be noted that no improvement was recorded in journey times, delays or speeds. If traffic signals were to be switched off at this location, this should only be considered during the off-peak period when traffic volumes decrease significantly.

Figure 6.32: River Road/ Bastable Avenue junction- road safety, network management and traffic analysis indicator table

River Road/ Bastable Avenue

	POTENTIAL RISK INDICATORS		
	against………..switch off……..……..…for		
TRAFFIC MIX AND CHARACTERISTICS	**HIGH**	**MEDIUM**	**LOW**
Volume of traffic		✓	
Percentage of goods traffic	✓		
Volume of cyclist movements			✓
Pedestrian activity			✓
JUNCTION LAYOUT AND GEOMETRY	**HIGH/ YES**	**PART**	**LOW/NO**
Visibility requirements of TD 42/95 NOT achieved	✓		
Total number of traffic lanes/ overall carriageway width		✓	
No. of arms			✓
Total number of permitted movements	✓		
Unclear priority		✓	
PEDESTRIAN AND CYCLIST PROVISION	**YES**	**SOME/ PART**	**NO**
Central refuges/ islands not provided		✓	
Controlled crossing facilities provided as part of signal control		✓	
Absence of stand-alone crossings close to the junction	✓		
Advanced Stop Lines provided for cyclists?			✓
COLLISION HISTORY (latest 36 months)	**YES**	**PART**	**NO**
High risk site?			✓
Increasing trend in collisions?	✓		
%age of pedestrian Collisions > average			✓
%age of cyclist Collisions > average		✓	
%age of dark Collisions > average		✓	
% Right turning accidents > average			✓
NETWORK MANAGEMENT			
TLRN junction			✓
Part of corridor management		✓	
OVERALL TENDENCY		✓	✓

6.10 East Barnet Road/Margaret Road

Traffic mix and characteristics

6.10.2 The East Barnet Road/Margaret Road junction is located within the London Borough of Barnet forming part of the northern outskirts of Greater London with a largely residential character.

6.10.3 The location of the East Barnet Road/ Margaret Road junction is shown in Figure 6.33.

Figure 6.33: East Barnet Road/ Margaret Road junction

6.10.4 There are no obvious trip generators in the immediate vicinity of the junction which would attract high volumes of pedestrians and cyclists.

6.10.5 A classified turning count survey was carried out at this junction on Friday, 9th November 2007 between 07:00- 10:00 and 16:00- 19:00. The results of the survey are summarised in Table 6.49 and Table 6.50 below.

Table 6.49: East Barnet Road/ Margaret Road morning turning count survey (07:00- 10:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
East Barnet Road(N)	1730	4	27	0.2	1.6
Margaret Road(E)	122	0	2	0	1.6
East Barnet Road(S)	1604	1	16	0.06	1
Margaret Road(W)	259	0	10	0	3.9
Total	**3715**	**5**	**55**	**0.1**	**1.5**

Table 6.50: East Barnet Road/ Margaret Road evening turning count survey (16:00- 19:00)

Approach	Total No of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
East Barnet Road(N)	1549	2	17	0.1	1.1
Margaret Road(E)	98	0	0	0	0
East Barnet Road(S)	1430	2	8	0.1	0.6
Margaret Road(W)	552	2	1	0.4	0.2
Total	**3629**	**6**	**26**	**0.2**	**0.7**

6.10.6 During the three hour morning time period, only five cyclists were recorded at the junction with the total number of vehicles amounting to 3715. During the three hour evening time period, six cyclists were observed with the total number of vehicles reaching 3629 on all approaches to the junction.

6.10.7 A pedestrian count survey was carried out at the junction on 9th November 2007 between 07:00- 10:00 and 16:00- 19:00. The results of the pedestrian survey are summarised in Table 6.51 and Table 6.52 below.

Table 6.51: East Barnet Road/ Margaret Road morning pedestrian count survey (07:00- 10:00)

Approach	Direction	
	Westbound	**Eastbound**
East Barnet Road(N)	38	12
East Barnet Road(S)	40	21
	Northbound	**Southbound**
Margaret Road(E)	32	28
Margaret Road(W)	25	28
Total	**135**	**89**

Table 6.52: East Barnet Road/ Margaret Road evening pedestrian count survey (16:00- 19:00)

Approach	Direction	
	Westbound	**Eastbound**
East Barnet Road(N)	51	18
East Barnet Road(S)	33	25
	Northbound	**Southbound**
Margaret Road(E)	34	23
Margaret Road(W)	31	25
Total	**149**	**91**

6.10.8 Only 224 pedestrians were observed crossing the junction on all arms between 07:00- 10:00 and 240, between 16:00- 19:00.

6.10.9 It should be noted that the proportion of cyclists and pedestrians to vehicular traffic would most probably be even lower outside of the peak time period with no obvious trip generators being located in the immediate vicinity of the surveyed junction. As a result there should be no serious safety concerns in the event of a switch off.

6.10.10 The junction is located within the 30mph speed limit zone. No data is currently available regarding approach speeds at this location.

6.10.11 HGVs represent 1.5% of general traffic during the three hour morning survey time period and 0.7% of general traffic during the three hour evening survey time period (see Table 6.49 and Table 6.50). Low percentage of such vehicles means that there is less potential for masking of traffic in adjacent lanes and for an increase in the severity of any eventual collisions.

Junction layout and geometry

6.10.12 Compliance to visibility splays and DMSSD with standards set out in TD 42/95 Geometric Design of Major/Minor Junctions and TD 9/93 Highway Link Design is presented in Table 6.53.

Table 6.53: East Barnet Road/ Margaret Road junction- DMSSD and visibility splays

Approach/Visibility	DMSSD=70m	Y= 70m (X=9m)	Y=70m (X=4.5m)	Y=70m (X=2.4m)
East Barnet Road(N)	Yes	No	Yes	Yes
East Barnet Road(S)	Yes	No	No	Yes
Margaret Road(E)	Yes	Yes	Yes	Yes
Margaret Road(W)	Yes	No	No	Yes

6.10.13 From Table 6.53 shown above it can be observed that it is impossible to achieve visibility splays of 70m with the x distance of 9m on all of the approaches to the junction. It would be necessary to relax the 'x' value to 2.4m.

6.10.14 The DMSSD of 70m is achievable on all approaches to the junction.

6.10.15 All visibility/DMSSD results are indicative only and should be confirmed with site measurements.

6.10.16 This four arm junction is provided with one lane of traffic on each of the entry arms and one lane of traffic on each of the exit arms.

6.10.17 The number of lanes and carriageway widths for each of the approaches are shown in Table 6.54

Table 6.54: East Barnet Road/ Margaret Road- lanes and carriageway widths

Approach	Lane	Width (m)	Central refuge
East Barnet Road(N)	1 entry lane (all movements)	4	No
	1 exit lane	2.7	
East Barnet Road(S)	1 entry lane (all movements)	3.2	No
	1 exit lane	3.4	
Margaret Road(E)	1 lane (all movements)	2.8	No
	1 exit lane	3.4	
Margaret Road(W)	1 lane (all movements)	2.9	No
	1 exit lane	2.8	

6.10.18 The lack of multi lane approaches means that pedestrians do not need to travel large distances in order to cross the carriageway, therefore their safety should not be significantly compromised by switching off signals at this location.

6.10.19 The East Barnet Road/Margaret Road junction is a four arm crossroad junction with all movements being permitted on all of the approaches.

6.10.20 Since this is a crossroads junction, there is no obvious priority (such as at roundabouts or three-armed junction of a minor and major road joining at right angles). However, flow comparison shows that the volume of traffic is significantly higher on the East Barnet Road approaches than on the Margaret Road approaches to the junction (see Table 6.49 and Table 6.50). During the three hour morning period (07:00- 10:00) 3334 vehicles were recorded on East Barnet Road (north and southbound), and 381 vehicles on Margaret Road (east and westbound). During the three hour evening period, 2979 vehicles were observed on East Barnet Rd, and 650 on Margaret Road. This would indicate that the priority might naturally be given to East Barnet Road if traffic signals were to be switched off at this location.

Existing provision for pedestrians and cyclists

6.10.21 Signal controlled straight across pedestrian crossings are provided on all four arms of the junction. This could cause safety concerns if traffic signals were to be switched off. The situation could be greatly improved by providing central refuges for pedestrians.

6.10.22 There are no stand alone pedestrian facilities located nearby.

6.10.23 No ASLs are provided at the junction. Safety for cyclists is therefore not expected to decline during times when signals are switched off.

Collision history

6.10.24 A collision history was obtained from TfL for the East Barnet Road/Margaret Road junction for the period of 36 months to November 2008.

6.10.25 A summary of the collision history is shown in Table 6.55.

Table 6.55: East Barnet Road/ Margaret Road junction- collision history by year and severity

Severity/Months to	12/11/2006	12/11/2007	12/11/2008	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Slight	1	1	0	2
Total	1	1	0	2

6.10.26 From the table present above it can be observed that only two accidents took place at the East Barnet Road/Margaret Road junction within the study period. Both of them resulted in slight injuries, there were no serious or fatal injuries at this location.

6.10.27 None of the accidents happened during wet or dark conditions and none of them involved pedestrians or cyclists.

6.10.28 The collision rate per year at this junction is 0.7 which is below the borough rate of 2.64 at signal controlled junctions.

6.10.29 The number of accidents did not change significantly over the three year period.

Road network management

6.10.30 The East Barnet Road/ Margaret Road junction does not form part of the TLRN.

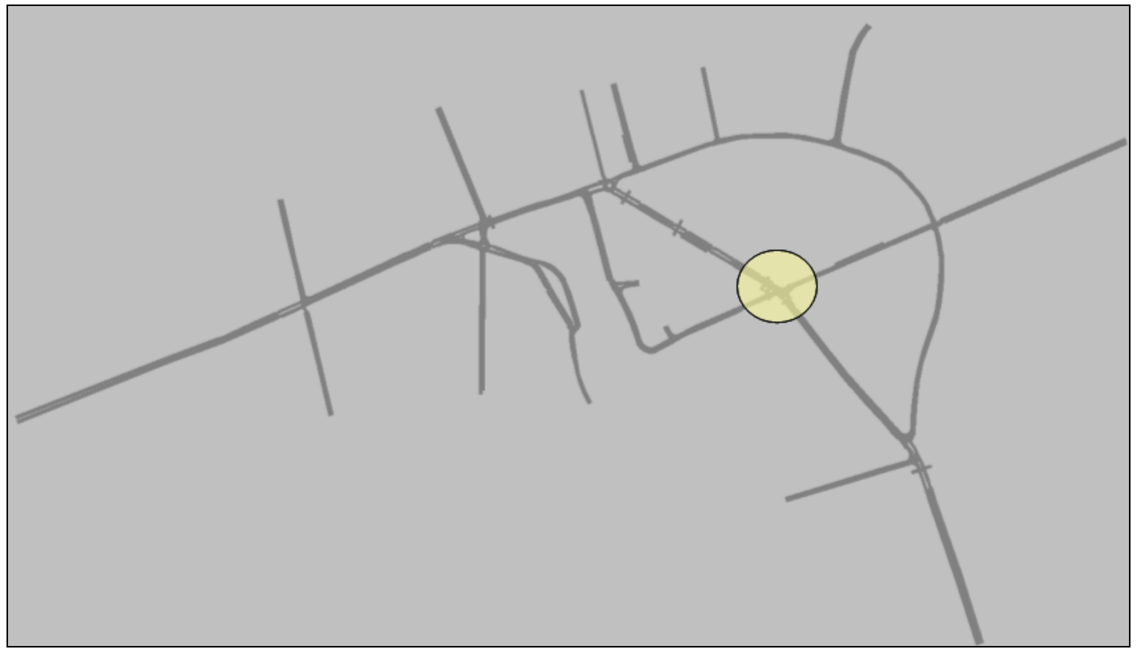
Traffic analysis

6.10.31 As part of the Economic Impact of Traffic signals Study, CB have carried out a revision of the existing West Norwood VISSIM models for the morning, inter-peak, off-peak and evening time periods as well as testing them for the proposed scenario during the same peak and off-peak hours.

6.10.32 The Proposed model is tested by switching off traffic signals at the A110 East Barnet Road/ Margaret Road junction and replacing signal control with an offside priority rule, giving priority to the vehicles coming from the right.

6.10.33 The location of traffic signals which were switched off in the proposed scenario is shown in Figure 6.34.

Figure 6.34: Location of the junction with switched off signals



6.10.34 All existing and proposed models were run for five random seeds with the simulation resolution of ten time steps/ simulation seconds and the results were averaged for the purpose of a comparison between the existing/ proposed models and different time periods.

6.10.35 The network evaluation output was recorded for the following parameters for all vehicle types and all time periods;

- Average delay time per vehicle (s)
- Average number of stops
- Average speed (mph)
- Average stopped delay per vehicle (s)
- Total delay time (h)
- Total distance travelled (km)
- Number of stops
- Number of vehicles in the network
- Number of vehicles that have left the network
- Total stopped delay (h)
- Total travel time (h)

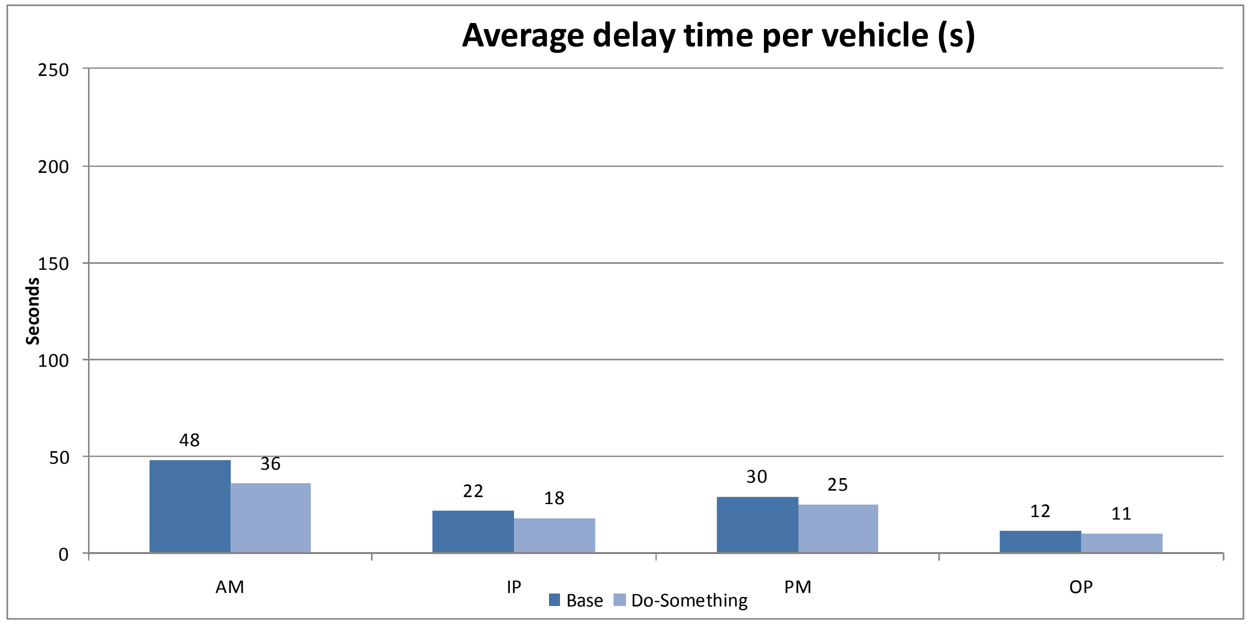
6.10.36 Modelling results are summarised in Table 6.56.

Table 6.56: East Barnet VISSIM network performance evaluation results

Parameter	morning		inter-peak		evening		off-peak	
	Base	Proposed	Base	Proposed	Base	Proposed	Base	Proposed
Average delay time per vehicle [s]	48	36	22	18	30	25	12	11
Average number of stops per vehicle	1	1	1	1	1	1	0	0
Average speed [mph]	9	9	8	8	9	9	3	3
Average stopped delay per vehicle [s]	14	7	4	2	6	3	1	0
Total delay time [h]	38	28	13	11	24	20	6	5
Total distance travelled [km]	2440	2451	1761	1761	2308	2309	1447	1447
Number of stops	3242	2647	1586	1200	2838	2343	628	451
Number of vehicles in the network	170	147	128	129	161	162	76	76
Number of vehicles that have left the network	2649	2658	2023	2016	2735	2732	1723	1722
Total stopped delay [h]	11	6	2	1	5	3	0	0
Total travel time [h]	174	164	132	129	156	152	263	262

6.10.37 The average delay time, average speed and total travel time results are shown in Figure 6.35- Figure 6.38.

Figure 6.35: Average delay time per vehicle (s)



6.10.38 The average delay time per vehicle is slightly lower in the proposed scenario during the inter-peak and off-peak period when compared with the base model. During other time periods the average delay increases when the traffic signals are switched off.

Figure 6.36: Total number of vehicles crossing the East Barnet junction

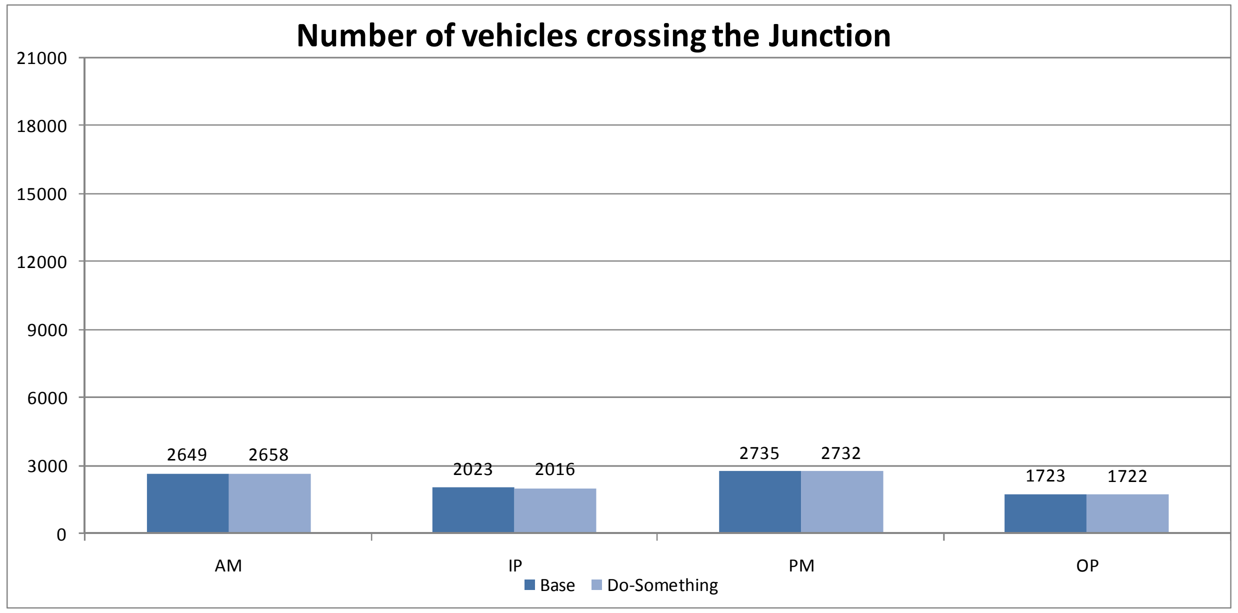
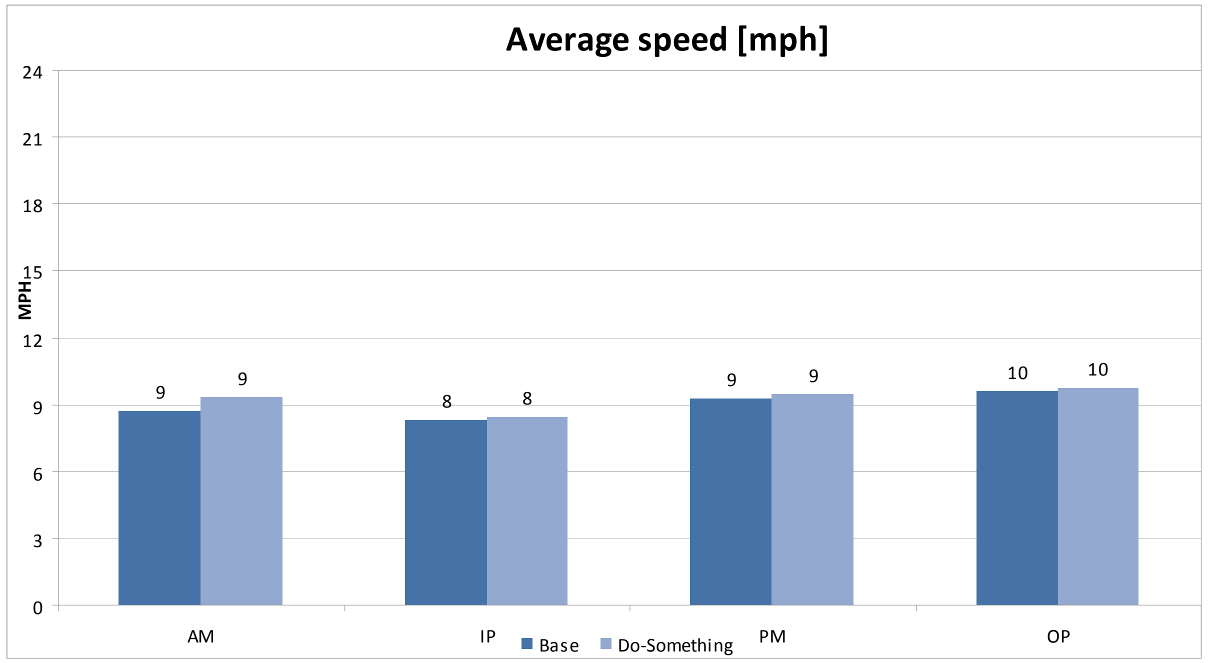
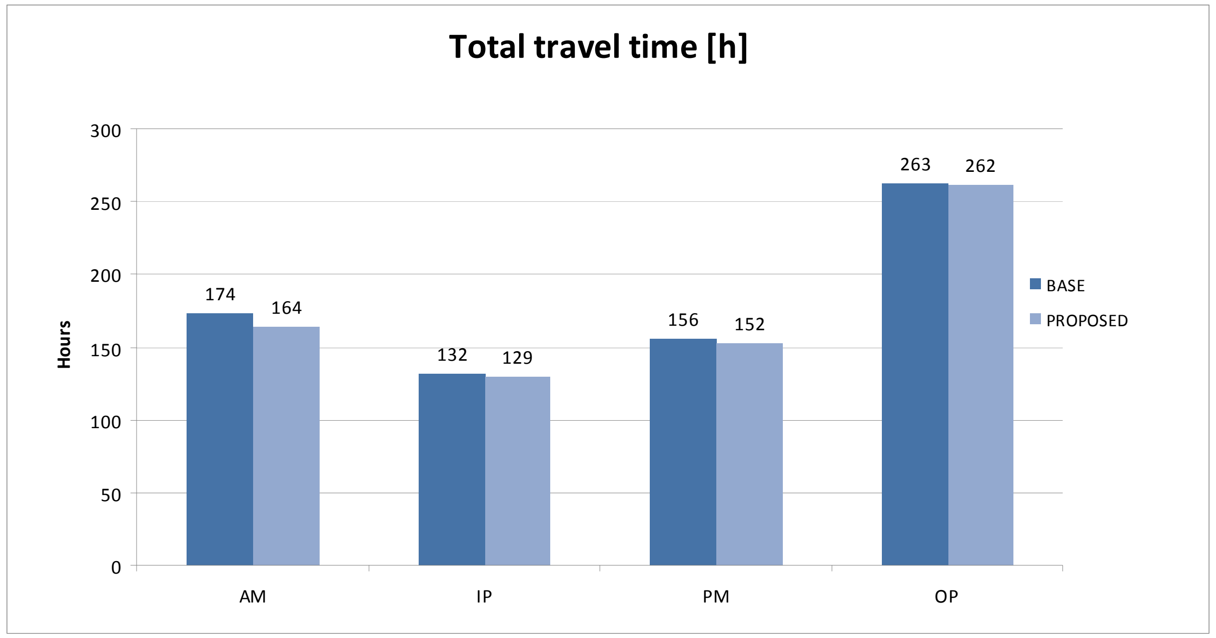


Figure 6.37: Average speed (mph)



6.10.39 The average speed increases only slightly during the inter-peak and off-peak time periods and decreases during the morning and evening peak time periods in the proposed scenario when compared with the base model.

Figure 6.38: Total travel time (h)



6.10.40 The total travel time is lower during the inter-peak, evening and off-peak peak periods as per the proposed scenario. During the morning peak period the total travel time increases with the introduction of priority control.

6.10.41 The network performance evaluation results presented above indicate that the proposed scenario would work well during the Inter and Off-peak time periods, as well as the evening peak period. Introducing priority control at the A110 East Barnet Road/ Margaret Road junction would reduce delays to general traffic and improve speeds.

6.10.42 During the morning peak period however the introduction of priority control has a negative impact on the operation of the network with increased delays to traffic, lower speeds and longer journey times.

6.10.43 From the analysis shown above it can be concluded that the replacement of traffic signals with priority control at this location would only be beneficial in the economic terms during the Inter-Peak, Off-Peak and evening peak hours.

6.10.44 The analysis of road safety, network management and traffic at the East Barnet Road/ Margaret Road junction is summarised in Figure 6.39.

6.10.45 The overall tendency shown in the indicator table is largely in favour of the switch off of traffic signals. This is mainly due to low volume of traffic, low pedestrian/ cycle activity, excellent accident record and the fact that the junction does not form part of the TLRN and is not linked with any other junctions.

6.10.46 In economic terms it would be beneficial to replace signal control with priority during the Inter-Peak and Off-Peak time periods when average delays, travel times and speeds show improvement when compared with the existing situation.

Figure 6.39: East Barnet Road/ Margaret Road junction- road safety, network management and traffic analysis indicator table

East Barnet Road/ Margaret Road

	POTENTIAL RISK INDICATORS		
	against……..switch off…………..for		
TRAFFIC MIX AND CHARACTERISTICS	**HIGH**	**MEDIUM**	**LOW**
Volume of traffic			✓
Percentage of goods traffic			✓
Volume of cyclist movements			✓
Pedestrian activity			✓
JUNCTION LAYOUT AND GEOMETRY	**HIGH/ YES**	**PART**	**LOW/NO**
Visibility requirements of TD 42/95 NOT achieved	✓		
Total number of traffic lanes/ overall carriageway width		✓	
No. of arms		✓	
Total number of permitted movements	✓		
Unclear priority	✓		
PEDESTRIAN AND CYCLIST PROVISION	**YES**	**SOME/ PART**	**NO**
Central refuges/ islands not provided		✓	
Controlled crossing facilities provided as part of signal control	✓		
Absence of stand-alone crossings close to the junction	✓		
Advanced Stop Lines provided for cyclists?			✓
COLLISION HISTORY (latest 36 months)	**YES**	**PART**	**NO**
High risk site?			✓
Increasing trend in collisions?			✓
%age of pedestrian Collisions > average			✓
%age of cyclist Collisions > average			✓
%age of dark Collisions > average			✓
% Right turning accidents > average			✓
NETWORK MANAGEMENT			
TLRN junction			✓
Part of corridor management			✓
OVERALL TENDENCY			✓

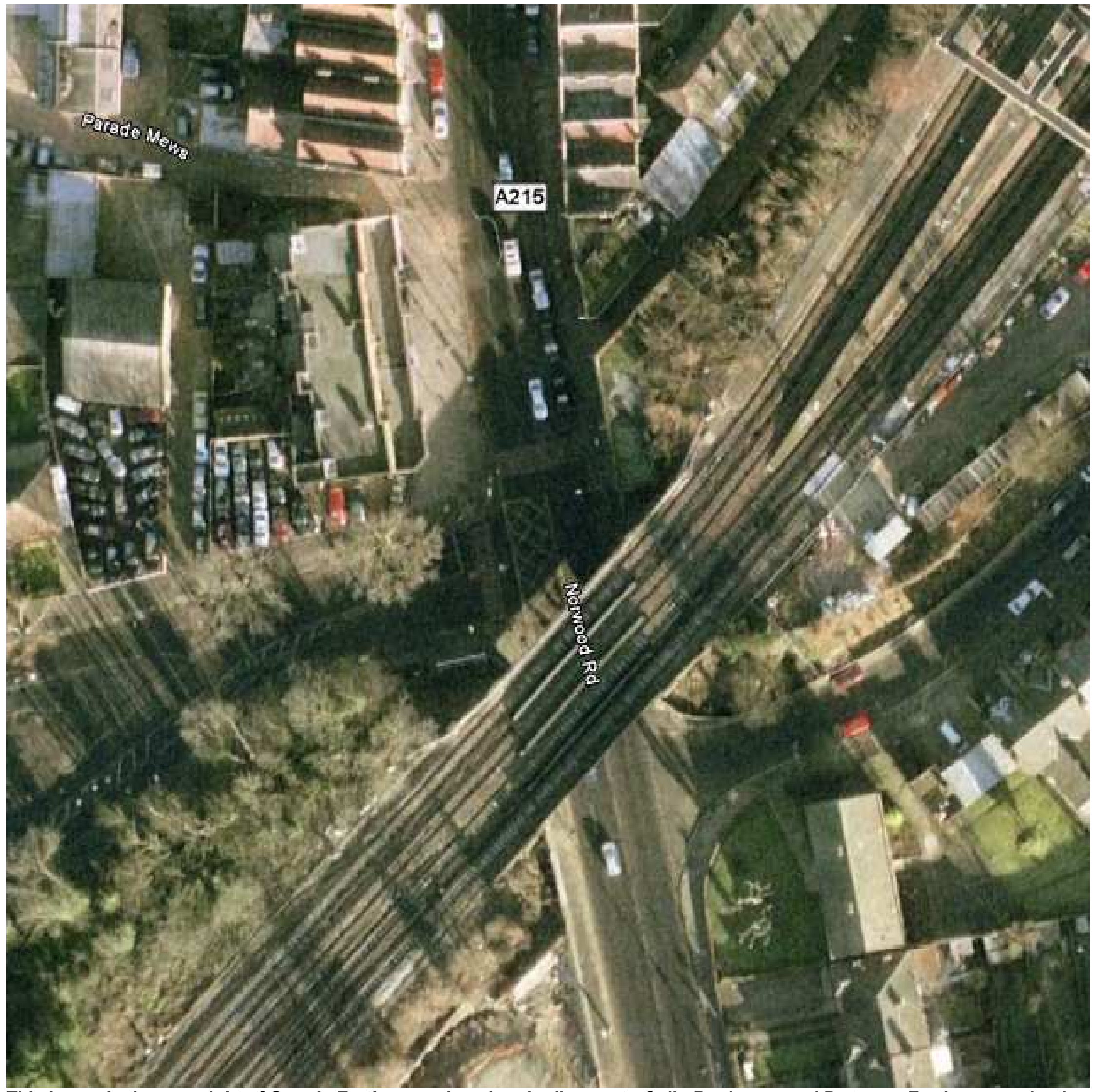
6.11 Norwood Road/ Palace Road

Traffic mix and characteristics

6.11.2 The A215 Norwood Road/Palace Road junction is located within the London Borough of Lambeth. The area is largely residential in character with the Tulse Hill rail station in close proximity.

6.11.3 The location of the Norwood Road/ Palace Road is shown in Figure 6.40

Figure 6.40: Norwood Road/ Palace Road junction



6.11.4 Classified turning count surveys were carried out at the junction on Thursday, 13th September 2007 between 07:00- 19:00.

6.11.5 The results of the survey are summarised in Table 6.57 and Table 6.58.

Table 6.57: Norwood Road/ Palace Road morning turning count survey (07:00-10:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Norwood Road(S)	923	48	6	5.2	0.7
Palace Road	340	17	1	5	0.3
Norwood Road(N)	543	7	1	1.3	0.2
Total	**1806**	**72**	**8**	**4**	**0.4**

Table 6.58: Norwood Road/ Palace Road evening turning count survey (16:00-19:00)

Approach	Total No Of Vehicles	Pedal Cycles	HGVs	% Pedal Cycles	% HGVs
Norwood Road(S)	707	15	2	2	0.3
Palace Road	344	7	0	2	0
Norwood Road(N)	757	32	0	4	0
Total	**1808**	**54**	**2**	**3**	**0.1**

6.11.6 During the three hour morning survey time period (07:00- 10:00) the total of 1806 vehicles were recorded at the junction with 72 of them being cyclists (4%). During the three hour evening survey time period (16:00- 19:00), the total of 1808 vehicles were observed, 54 of them representing cyclists (3%). From the classified turning count surveys it can be observed that the number of cyclists in proportion to general traffic is low.

6.11.7 Pedestrian count surveys were not available but the volume of pedestrians during the day and evening is known to be reasonably high.

6.11.8 The junction is located within a 30mph speed limit zone. No data is currently available on the approach speeds.

6.11.9 The percentage of HGVs recorded at the junction is very low, at 0.4% between 07:00- 10:00, and 0.1% between 16:00- 19:00 (see Table 6.57 and Table 6.58). In this case the number of HGVs would not have a negative impact on safety in the event of a switch off.

Junction layout and geometry

6.11.10 Compliance to visibility splays and DMSSD with standards set out in TD 42/95 Geometric Design of Major/ Minor Junctions and TD 9/93 Highway Link Design is presented in Table 6.59.

Table 6.59: Norwood Road/ Palace Road junction- DMSSD and visibility splays

Approach/ Visibility	DMSSD=70m	Y= 70m (X=9m)	Y=70m (X=4.5m)	Y=70m (X=2.4m)
Norwood Road(N)	Yes	No	Yes	Yes
Norwood Road(S)	Yes	No	Yes	Yes
Palace Rd	Yes	No	Yes	Yes

6.11.11 Table 6.59 above shows that it would not be possible to achieve visibility splays of 70m with the x distance of 9m on all of the approaches to the junction. It would be necessary to relax the 'x' value to 4.5m.

6.11.12 The DMSSD of 70m is achievable on all approaches to the junction.

6.11.13 All visibility/ DMSSD results are indicative only and should be confirmed with site measurements.

6.11.14 The number of lanes and carriageway widths at the Norwood Road/Palace Road junction are shown in Table 6.60.

Table 6.60: Norwood Road/ Palace Road- lanes and carriageway widths

Approach	Lane	Width (m)	Central Refuge
Palace Rd	1 entry lane (all movements)	5	yes
	2 exit lanes	6.5	
Norwood Road(N)	Nearside entry lane	2.5	no
	Offside entry lane	2.5	
	2 exit lanes	5.2	
Norwood Road(S)	Nearside entry lane	2.6	no
	Offside entry lane (ahead)	2.6	
	2 exit lanes	5	

6.11.15 The Palace Road approach consists of one entry and two exit lanes.

6.11.16 The Norwood Road approaches (both north and southbound) consist of two entry lanes and two exit lanes.

6.11.17 The number of lanes exceeds three on two of the three approaches with no traffic islands being provided. This could potentially have safety implications for pedestrians in the event of a switch off.

6.11.18 This is a three arm junction with all movements being permitted. This type of junction layout is relatively easy for pedestrians to negotiate.

6.11.19 At three-armed junctions like this one, the priority is clear and the potential for conflict is lower when compared with crossroad junctions and Y junctions.

Existing provision for pedestrians and cyclists

6.11.20 Signal controlled pedestrian crossings are provided on the Palace Road and Norwood Road (southbound) approaches to the junction. There is no pedestrian crossing available on the Norwood Road (northbound) approach to the junction.

6.11.21 Central refuge is provided on the Palace Road pedestrian crossing.

6.11.22 Introduction of additional central refuges could further improve pedestrian safety if traffic signals were to be switched off.

6.11.23 There are no stand alone facilities located nearby.

6.11.24 No cycle facilities are provided at this junction. As a result, cyclists' safety would not be expected to decline in the event traffic signals were to be switched off.

Collision history

6.11.25 A collision history was obtained from TfL for the Norwood Road/Palace Road junction for the period of 36 months to November 2008.

6.11.26 A summary of the collision history is shown in Table 6.61.

Table 6.61: Norwood Road/Palace Road- collision history by year and severity

Severity/ Months To	12/11/2006	12/11/2007	12/11/2008	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Slight	1	1	2	4
Total	1	1	2	4

6.11.27 The summary of the collision history shows that there were in total four accidents at the junction during the 36 month study period. All of the accidents resulted in slight injuries with no fatal or serious injuries having occurred.

6.11.28 One of the accidents took place during wet conditions and one involved a pedestrian.

6.11.29 The collision rate per year is 1.3 which is lower than the borough average of 2.94 at signal controlled junctions.

6.11.30 The percentage of pedestrian accidents of 25% is slightly higher than the borough average of 22.7% at signalised junctions and 21.2% at priority junctions. There were no accidents involving cyclists.

6.11.31 One of the accidents occurred when turning right. This amounts to 25% which is higher than the borough average of 19.8% at signalised junctions and lower than 30.3% at priority junctions.

6.11.32 There is no significant change in the number of accidents over the three years.

Road network management

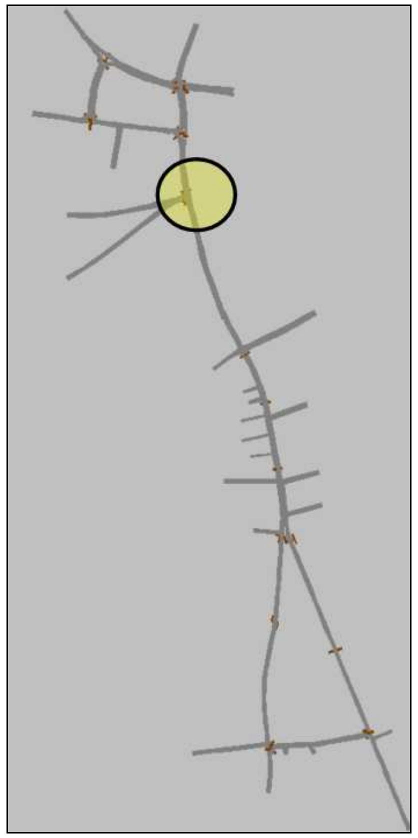
6.11.33 The A215 Norwood Road/Palace Road junction does not form part of the TLRN.

Traffic analysis

6.11.34 As part of the Economic Impact of Traffic signals Study Phase 2, CB have carried out a revision and analysis of the existing West Norwood models for the morning (07:00- 08:00), Inter-Peak (12:00- 13:00), evening (17:00- 18:00) and Off-Peak (22:00- 01:00) periods. Proposed VISSIM models were prepared for the same time periods by replacing the existing signal control at the A215 Norwood Road/ Palace Road junction with major/ minor priority control, with the traffic on A215 Norwood Road having the priority over Palace Road.

6.11.35 The location of traffic signals which were switched off in the proposed scenario is shown in Figure 6.41.

Figure 6.41: West Norwood VISSIM model- location of the junction where traffic signals were switched off



6.11.36 All existing and proposed models were run for five random seeds with the simulation resolution of ten time steps/ simulation seconds and the results were averaged for the purpose of comparison between the existing/ proposed models and different time periods.

6.11.37 The network evaluation output was recorded for the following parameters for all vehicle types and all time periods;

- Average delay time per vehicle (s)
- Average number of stops
- Average speed (mph)
- Average stopped delay per vehicle (s)
- Total delay time (h)
- Total distance travelled (km)
- Number of stops
- Number of vehicles in the network
- Number of vehicles that have left the network

- Total stopped delay (h)
- Total travel time (h)

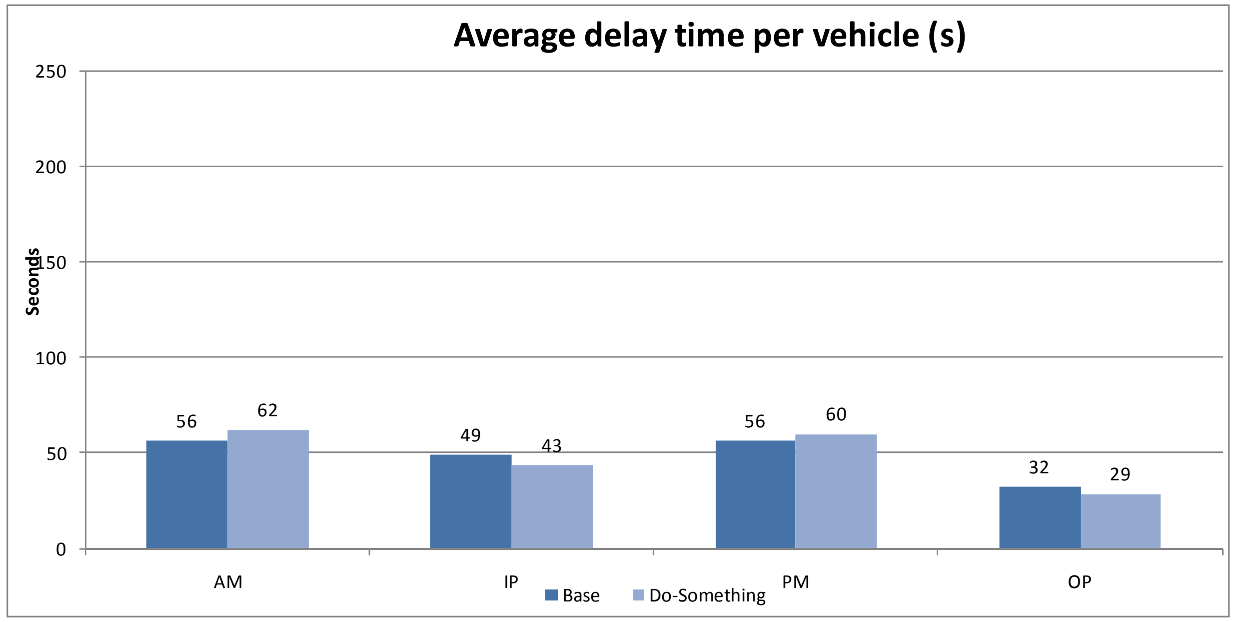
6.11.38 The results of the West Norwood VISSIM modelling are shown in Table 6.62.

Table 6.62: West Norwood VISSIM network performance evaluation modelling results

Parameter	morning		inter-peak		evening		off-peak	
	Base	Proposed	Base	Proposed	Base	Proposed	Base	Proposed
Average delay time per vehicle [s]	56	62	49	43	56	60	32	29
Average number of stops per vehicle	2	2	2	2	2	2	1	1
Average speed [mph]	10	10	10	10	10	9	11	11
Average stopped delay per vehicle [s]	25	29	25	20	27	30	17	14
Total delay time [h]	85	94	58	52	86	91	49	43
Total distance travelled [km]	3749	3741	2893	2899	3716	3701	3539	3528
Number of stops	9216	10104	6810	6544	9546	10109	6442	5643
Number of vehicles in the network	206	206	221	214	231	240	17	17
Number of vehicles that have left the network	5245	5237	4075	4075	5254	5239	5481	5473
Total stopped delay [h]	38	43	30	24	41	45	26	22
Total travel time [h]	237	244	187	182	238	243	209	204

6.11.39 The results of the network performance evaluation for average delay time, average speed and total travel time are shown in Figures Figure 6.42- Figure 6.45.

Figure 6.42: Average delay time per vehicle (s)



6.11.40 The average delay time per vehicle is slightly lower in the proposed scenario during the off-peak peak period when compared with the base model. During all other time periods the average delay increases when the traffic signals are switched off.

Figure 6.43: Total number of vehicles crossing the Norwood Road junction

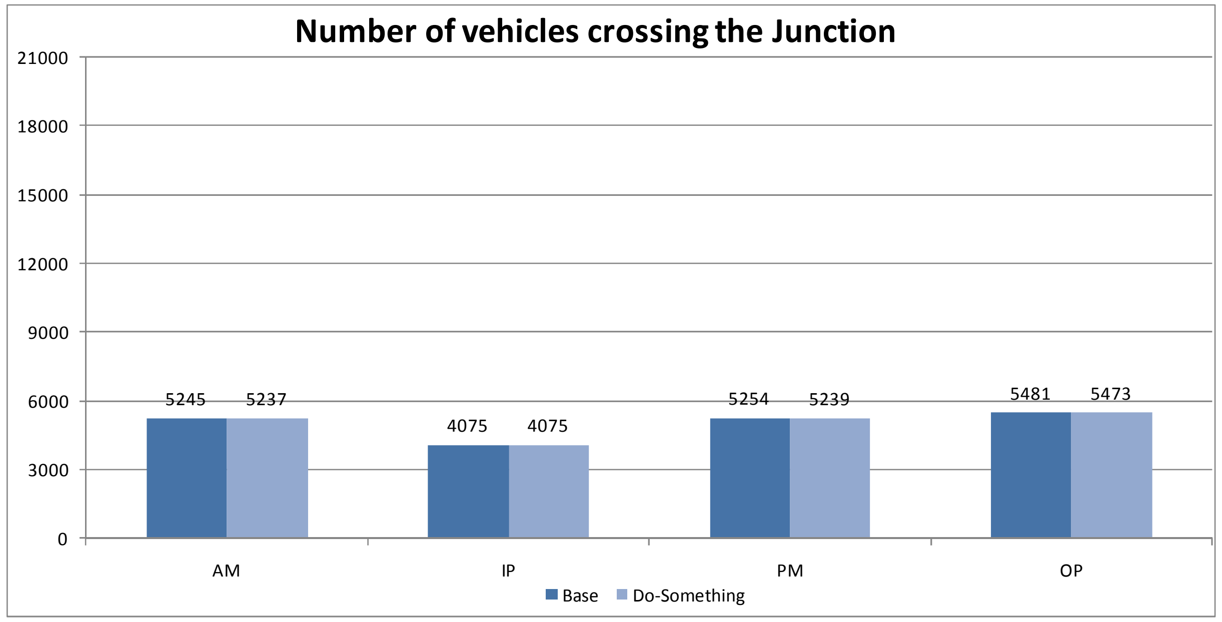
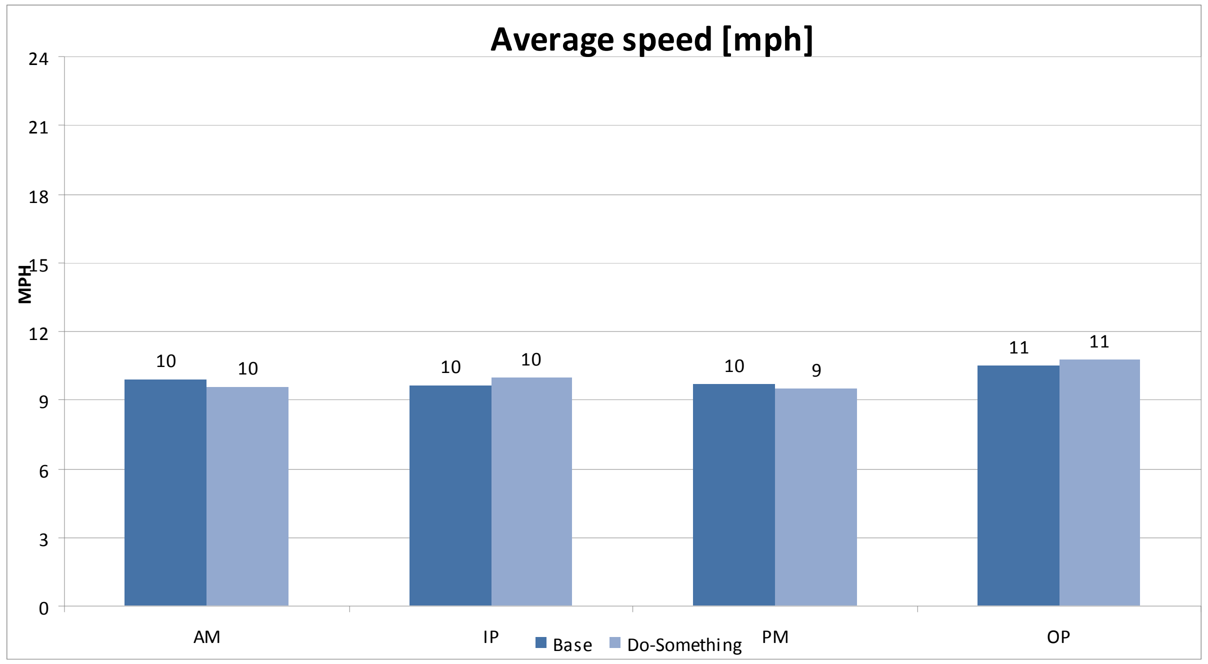
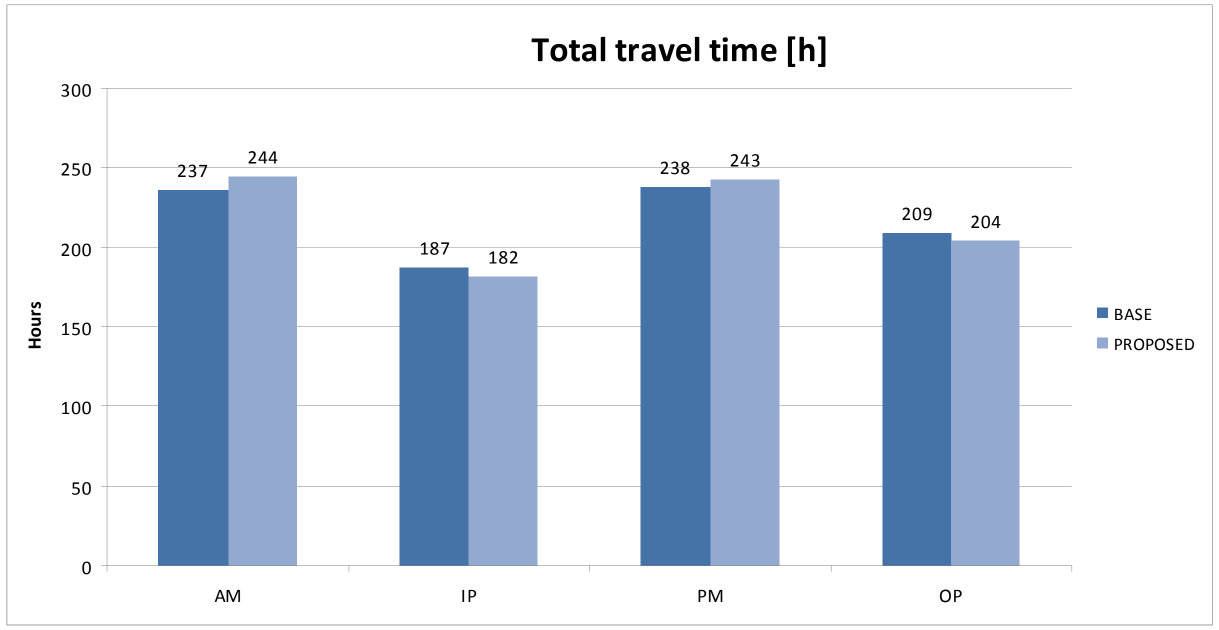


Figure 6.44: Average speed (mph)



6.11.41 The average speed decreases during all time periods in the proposed scenario when compared with the base model.

Figure 6.45: Total travel time (h)



6.11.42 The total travel time is lower during the Off-Peak period as per the proposed scenario. During all other time periods the total travel time increases with the introduction of priority control.

6.11.43 From the network performance evaluation it can be observed that the average delay time per vehicle [s], average number of stops per vehicles, average speed [mph], average stopped delay per vehicle [s], total delay time [h], total distance travelled [km], number of stops, number of vehicles in the network, number of vehicles that have left the network, total stopped delay [h], total travel time [h] have been improved during the off-peak period, but due to heavy traffic flows during the morning, inter-peak and evening peaks the situation the performance of the network deteriorated as per the proposed scenario.

6.11.44 The analysis of road safety, network management and traffic at the A215 Norwood Road/ Palace Road junction is summarised in Figure 6.46.

6.11.45 The overall tendency shown in the indicator table is in favour of the switch off of traffic signals. This is mainly due to low volumes of cyclists, good accident record and the fact that the junction does not form part of the TLRN. However, high numbers of pedestrians and higher than average proportion of collisions involving pedestrians speak against the removal of traffic signal control. In economic terms the removal of traffic signal control would be beneficial during the off-peak period and should only be considered at that time due to pedestrian safety concerns.

Figure 6.46: A215 Norwood Road/ Palace Road junction- road safety, network management and traffic indicator table

A215 Norwood Road/ Palace Rd

	POTENTIAL RISK INDICATORS against……..switch off…………..…for		
TRAFFIC MIX AND CHARACTERISTICS	**HIGH**	**MEDIUM**	**LOW**
Volume of traffic		✓	
Percentage of goods traffic			✓
Volume of cyclist movements			✓
Pedestrian activity	✓		
JUNCTION LAYOUT AND GEOMETRY	**HIGH/ YES**	**PART**	**LOW/NO**
Visibility requirements of TD 42/95 NOT achieved		✓	
Total number of traffic lanes/ overall carriageway width	✓		
No. of arms			✓
Total number of permitted movements	✓		
Unclear priority		✓	
PEDESTRIAN AND CYCLIST PROVISION	**YES**	**SOME/ PART**	**NO**
Central refuges/ islands not provided	✓		
Controlled crossing facilities provided as part of signal control		✓	
Absence of stand-alone crossings close to the junction	✓		
Advanced Stop Lines provided for cyclists			✓
COLLISION HISTORY (latest 36 months)	**YES**	**PART**	**NO**
High risk site?			✓
Increasing trend in collisions?		✓	
%age of pedestrian Collisions > average	✓		
%age of cyclist Collisions > average			✓
%age of dark Collisions > average			✓
% Right turning accidents > average		✓	
NETWORK MANAGEMENT			
TLRN junction			✓
Part of corridor management	✓		
OVERALL TENDENCY			✓

7 Peak hour traffic compositions

7.1.1 In addition to the above junction assessment, traffic composition in terms of various modes was analysed for evaluating user benefits for individual user classes. Table 7.1 – Table 7.5 below show traffic composition split at the junction under study.

Table 7.1: Edgware Road traffic composition

Time Period	Peak	Private Cars	Taxis	Motor Cycles	LGV's	MGV's	HGV's	Buses/ Coaches
Edgware Road(NB)								
8:00-9:00	Am	58.57%	1.94%	3.43%	19.82%	9.54%	1.64%	5.07%
12:00-13:00	IP	51.11%	3.32%	1.52%	26.04%	13.30%	0.83%	3.88%
17:00-18:00	PM	62.06%	3.58%	9.00%	17.13%	3.15%	0.52%	4.55%
22:00-01:00	OP	73.64%	7.86%	3.63%	7.59%	2.60%	0.16%	4.50%
Edgware Road(SB)								
8:00-9:00	Am	53.58%	1.72%	10.08%	24.67%	3.45%	1.06%	5.44%
12:00-13:00	IP	50.90%	6.45%	4.66%	22.04%	9.14%	0.00%	6.81%
17:00-18:00	PM	61.87%	5.47%	6.40%	17.47%	3.07%	0.00%	5.73%
22:00-01:00	OP	65.64%	10.91%	2.15%	11.34%	2.84%	0.17%	6.96%

Table 7.2: Norwood Road traffic composition

Time Period	Peak	Motor Cycles	Cars	LGV's	Buses	HGV's
Norwood Road(SB)						
8:00-9:00	Am	1.74%	78.27%	11.41%	0.24%	8.34%
12:00-13:00	IP	2.39%	81.27%	9.35%	0.25%	6.74%
17:00-18:00	PM	6.19%	84.00%	3.85%	0.09%	5.86%
22:00-01:00	OP	3.06%	85.02%	3.35%	0.07%	8.51%
Norwood Road(NB)						
8:00-9:00	Am	3.39%	80.64%	9.76%	0.00%	6.21%
12:00-13:00	IP	2.25%	83.57%	7.64%	0.17%	6.36%
17:00-18:00	PM	1.77%	86.57%	3.62%	0.00%	8.03%
22:00-01:00	OP	1.32%	83.86%	5.86%	0.00%	8.96%

Table 7.3: East Barnet traffic composition

Time Period	Peak	Cars/ Taxi	HGV's	LGV's	Buses
East Barnet South(SB)					
8:00-9:00	Am	94.23%	0.32%	3.65%	1.79%
12:00-13:00	IP	89.33%	0.41%	8.87%	1.40%
17:00-18:00	PM	92.63%	0.50%	3.84%	3.02%
22:00-01:00	OP	92.82%	0.00%	4.56%	2.62%
East Barnet South(NB)					
8:00-9:00	Am	94.85%	0.60%	4.37%	0.18%
12:00-13:00	IP	90.21%	0.70%	8.77%	0.32%
17:00-18:00	PM	93.77%	1.15%	4.40%	0.68%
22:00-01:00	OP	90.47%	0.49%	8.68%	0.35%

Table 7.4: A13 traffic composition

Time period	Peak	Private cars	Taxis	Motor cycles	LGV's	MGV's	HGV's	Buses/ coaches
A13 (WB)								
8:00-9:00	Am	29.89%	12.53%	21.93%	20.24%	6.18%	1.78%	7.45%
12:00-13:00	IP	43.19%	11.61%	8.98%	23.84%	6.66%	2.01%	3.72%
17:00-18:00	PM	53.54%	11.76%	12.61%	12.46%	5.10%	1.56%	2.97%
22:00-01:00	OP	54.19%	24.77%	5.18%	8.00%	2.82%	0.76%	4.27%
A13 (EB)								
8:00-9:00	Am	56.61%	9.06%	7.88%	15.30%	5.05%	4.31%	1.78%
12:00-13:00	IP	46.26%	6.44%	5.84%	29.34%	6.14%	4.34%	1.65%
17:00-18:00	PM	43.28%	12.99%	22.91%	15.45%	2.72%	1.84%	0.79%
22:00-01:00	OP	61.36%	20.19%	7.52%	5.55%	2.30%	0.95%	2.13%

Table 7.5: Church road traffic composition

Time Period	Peak	Car/Taxi	LGV	OGV 1	OGV 2	Bus/ Coach	M/Cycle	P/Cycle
Church Rd (SB)								
8:00-9:00	Am	80.78%	9.25%	3.18%	1.45%	3.11%	2.10%	0.14%
12:00-13:00	IP	72.53%	18.15%	5.13%	2.25%	1.31%	0.63%	0.00%
17:00-18:00	PM	79.85%	12.04%	3.43%	0.80%	1.97%	1.24%	0.66%
22:00-01:00	OP	72.53%	18.15%	5.13%	2.25%	1.31%	0.63%	0.00%
Church Rd (NB)								
8:00-9:00	Am	71.95%	13.35%	6.00%	2.42%	3.32%	2.78%	0.18%
12:00-13:00	IP	74.52%	14.47%	5.50%	2.38%	2.31%	0.68%	0.14%
17:00-18:00	PM	80.73%	10.28%	2.39%	1.01%	3.30%	2.02%	0.28%
22:00-01:00	OP	74.52%	14.47%	5.50%	2.38%	2.31%	0.68%	0.14%

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