



Reconfiguration of Westfield Avenue and Montfichet Road

Feasibility Design Report

May 2015

London Legacy Development Corporation



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Executive Summary

Background and Introduction

Mott MacDonald and Urban Movement have been working in collaboration with the London Legacy Development Corporation (LLDC) since November 2014 to develop design options that reflect a shared vision to bring about a transformation of the highway network in the Queen Elizabeth Olympic Park and provide a vastly improved public realm and significantly better facilities for pedestrians and cyclists.

The existing main road network within the Olympic Park, of which Westfield Avenue and Montfichet Road form a key part, was primarily designed to cope with the large scale traffic movements generated during the Olympics and by anticipated vehicular trips associated with visitors to the adjacent Westfield shopping centre. The road network served its purpose well, but now with the Games having finished, and people travelling to Westfield preferring to use the excellent public transport links as well as a higher than expected take up of cycling, stakeholders agree that the dual carriageway and associated overly complex junction layouts are no longer required.

LLDC commissioned this study in recognition of the opportunity for significant change within the Olympic Park. They wish to resolve a number of existing issues through the study including:

- Tree pit design that interferes with the footway and off-road cycle lane
- Excessive guard railing at crossings
- large areas of space that are dedicated to under-utilised median strips
- Street furniture that is uncoordinated and cluttered
- Poorly implemented cycle infrastructure
- Complex junction designs
- Pedestrian and crowd flow requirements for major sports and cultural events

Proposed Design

Mott MacDonald and Urban Movement have worked closely with LLDC and key stakeholders to develop a feasibility design proposal for Westfield Avenue and Montfichet Road. The proposed design meets the aspirations of LLDC as specified in the study brief and has the in principle agreement of all stakeholders who have been engaged in the design process through the project steering groups and individual stakeholder engagement activities.

The proposed design incorporates a number of innovative features that reflect current UK and International best practice, particularly in the field of cycle infrastructure design. Design features incorporated include a flexible verge to segregate cyclists from adjacent traffic and provide space



for planting, protected junctions for cyclists to remove conflict between turning vehicles and cyclists, and floating bus stops and lay-bys that do not impact on the directness of the cycle lane.

Traffic modelling has shown that with current traffic levels the proposed design can be incorporated without having a detrimental impact on junction capacity and operation. Sensitivity testing shows that the addition of 10% and 20% traffic to represent future growth can still be accommodated within the majority of the network. Two junctions were shown to exceed their theoretical capacity in the +20% scenario but only in the busiest Saturday PM peak scenario.

Scheme Costs and Delivery

High level costings produced based on the feasibility design shows that the total scheme is likely to cost in the region of £14.5m. This is based on a combination of measured items from the CAD drawings and allowances for other items. A 30% overall contingency is also included in this figure to represent the fact that the proposals are still at a relatively early stage of design and there are a number of unknowns that will undoubtedly emerge as the project progresses.

Construction of the scheme will be a complex and challenging task due to the comprehensive nature of the proposed changes and the adjacent development schemes that will start on site during the likely period of scheme construction. Significant opportunity exists to co-ordinate construction of the scheme with these adjacent developments and will be crucial to ensuring delivery within the desired timescales. A key date in the high level programme developed is March 2018, by when Westfield Avenue will be re-opened with utilities works and construction activity associated with the adjacent International Quarter development largely complete.

1 Introduction

1.1 Introduction

In 2014, LLDC and local stakeholders developed a vision for the Queen Elizabeth Olympic Park which included a vastly improved public realm and significantly better facilities for pedestrians and cyclists. In order to achieve this vision, it was acknowledged by key stakeholders that it would be necessary to reduce both Westfield Avenue and Montfichet Road to single lane carriageways to release the space required to develop new cycle and pedestrian facilities, along with improved areas of public space. It was envisaged that the reduction in the amount of carriageway and associated streetscape improvements would civilise the streets and reduce the perceived dominance of the carriageway.

Mott MacDonald and Urban Movement have been working in collaboration with the LLDC since November 2014 to develop design options that reflect the above vision and will bring about a transformation of the highway network in the Queen Elizabeth Olympic Park.

This report provides an overview of the design process from initial concept designs through to detailed designs for Westfield Avenue, Montfichet Road, and the additional areas which have been added to the design brief subsequently by LLDC and LB Newham. The report also provides commentary on further pieces of work which have influenced the final design for the Olympic Park including traffic modelling, stakeholder consultation and the public realm and materials strategy.

1.2 Study Brief and Objectives

The LLDC project brief required recommendations for the reduction and reconfiguration of the carriageway in Westfield Avenue and Montfichet Road, adopting best practice in relation to:

- Pedestrian priority and permeability
- Roadway designs that encourage 20mph movement
- Clear junction and crossing arrangements
- Appropriate cycle lane provision
- Creation of an appealing and robust public realm
- Mitigation of potential conflict between modes including bus movement
- Integration of bus stops

The brief also required that the reduction in traffic lanes should provide the opportunity to mitigate several undesirable aspects of Westfield Avenue and Montfichet Road that have created routes that are unpleasant for cyclists and pedestrians alike. These issues include:

- Tree pit design with a rough surface finish interferes with the ease of movement on both the footway and off-road cycle lane
- Excessive guard railing at crossings - these have been shown by Transport for London (TfL) to adversely impact on safety

- large areas of space are dedicated to under-utilised median strips which offer little value to motorists or pedestrians
- Street furniture and objects are generally uncoordinated with the pedestrian movement and cycle lanes, causing obstructions and visual clutter
- Cycle lanes are not optimally positioned - the off-carriageway cycle lanes present conflict with pedestrians at bus stops and junctions.
- Simplification of junctions, specifically at Westfield Avenue and International Way
- Access to Queen Elizabeth Olympic Park from Westfield across Westfield Avenue
- Pedestrian/crowd flow requirements for major sports and cultural events at the Olympic Stadium and at Queen Elizabeth Olympic Park

The required deliverables from the study were to prepare a report to include sketch drawings, detailed CAD drawings and visualisations for the proposed design and to make specific recommendations with respect to the options tested and provide the following for the preferred option:

- Traffic modelling (for both existing and proposed design)
- Traffic engineering design (roadways and junctions)
- Public realm and landscape strategy
- Outline specifications
- Material strategy
- Consultation with relevant stakeholders and landowners at each stage including LLDC, Westfield, LB Newham, Lend Lease, TfL and the GLA
- Preliminary cost assessment and value management
- An indicative construction programme and indicative construction phasing programme.

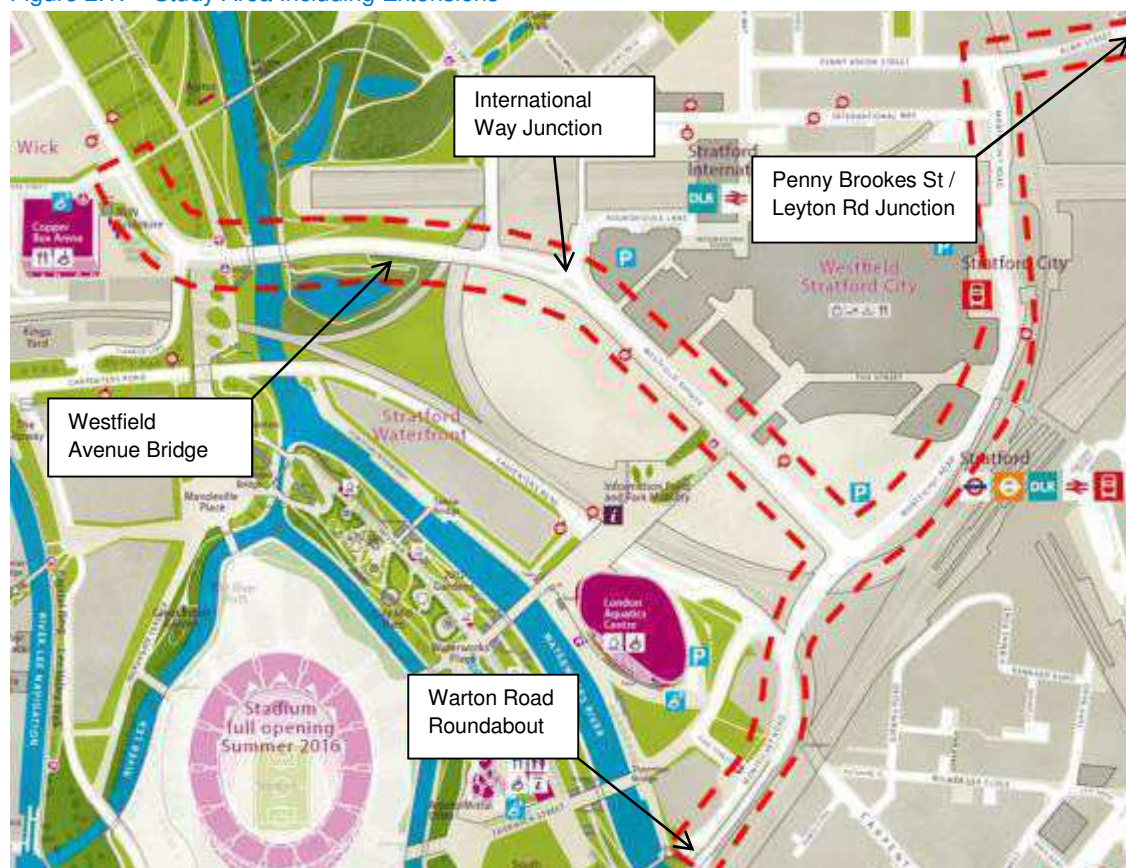
2 Study Area

2.1 Study Area Overview

The original area included within the study brief covered the area including Montfichet Road, Westfield Avenue and Waterden Road stretching as far as the Copper Box Arena. Part way through the study the area was expanded by LLDC and LB Newham to cover the section of Penny Brookes Street to the junction with Leyton Road, along with the southern section of Montfichet Road to incorporate the Pool Street junction and ending at the roundabout to the south.

Figure 2.1 below outlines the extent of the extended study area.

Figure 2.1: Study Area Including Extensions



Source: Base Plan Provided by LLDC

The existing main road network within the Olympic Park, of which Westfield Avenue and Montfichet Road form a key part, was primarily designed to cope with the large scale traffic movements generated during the Olympics and by anticipated vehicular trips associated with visitors to the adjacent Westfield shopping centre. The road network served its purpose well, but now with the Games having finished, and people travelling to Westfield preferring to use the excellent public transport links as well as a higher than

expected take up of cycling, stakeholders agree that the dual carriageway and associated overly complex junction layouts are no longer required.

The project brief has evolved as a result of this shift in demand within the Olympic Park to provide infrastructure which reflects the increased demand for cycling, pedestrian and public transport trips.

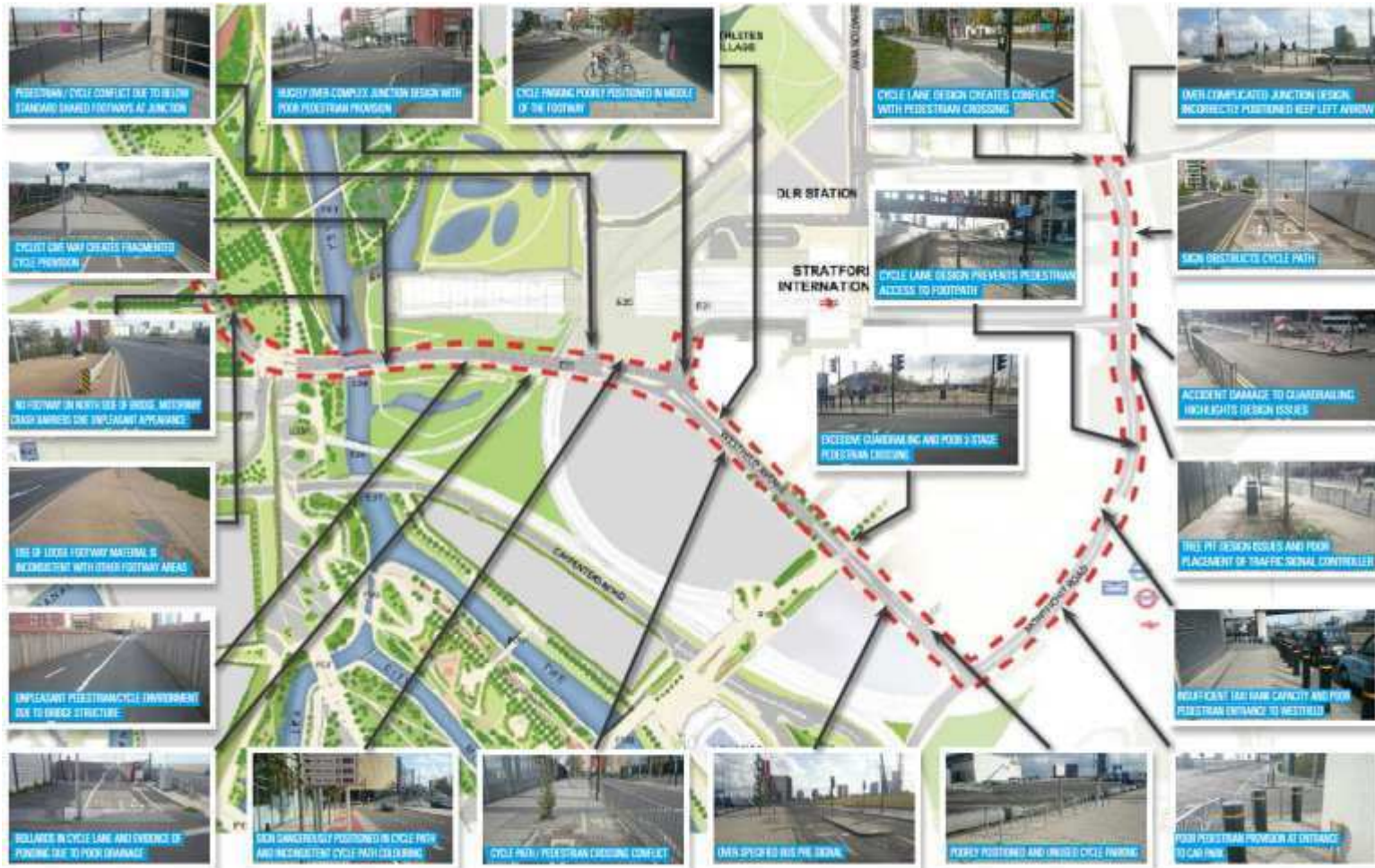
Our initial site visit to the Olympic Park in October 2014 confirmed the LLDC and key stakeholders' view that the area is to an extent blighted by the current dual carriageway and complex junction layouts, with traffic levels at the time of the visit far from justifying such a capacity-led approach to design. The knock-on impact of the dual carriageway is to the detriment of the cycle and pedestrian infrastructure.

The bullet points below highlight some of the key issues observed throughout the study area;

- Highway design and alignment encourages greater vehicle speeds
- Excessive use of pedestrian guard-railings
- Street clutter obstructs pedestrian and cycle facilities
- Poorly positioned hostile vehicle mitigation (bollards) that have a detrimental effect on the pedestrian environment
- Inconsistent, fragmented and confusing cycle infrastructure
- Staggered and multi-stage pedestrian crossings
- Poor quality and underutilised cycle parking
- Uneven tree pit surfaces in cycle lane and footway areas
- Planting that is out of context and inappropriately scaled in comparison to the surroundings
- Lack of footway and sections of footway where pedestrians are prohibited due to the presence of the cycle lane
- Inconsistent surface treatment of footways and cycle facilities
- Over provision of bus priority infrastructure and inconsistent installation of bus shelters

Some of these issues and the locations where they have been identified are highlighted on the plan included overleaf as figure 2.2.

Figure 2.2: Issues and Opportunities Plan



The remainder of this chapter provides a brief overview of the key issues in the three distinct areas identified in the original project brief, as well as the two additional areas which have been added at the request of LB Newham, namely Penny Brookes Street and Montfichet Road south to the Wharton Road Roundabout.

2.2 Westfield Avenue & Montfichet Road

Westfield Avenue and Montfichet Road form the key axis of the study area and act as main roads within the Olympic Park. They serve all the main Westfield car park entrances and will also act as main entry points to planned mixed use developments at The International Quarter (TIQ) and Cherry Park. These routes are perhaps the clearest example of the capacity-led approach to design, and while attempts have been made to accommodate pedestrians and cyclists, cyclist provision is in the form of off-road bi-directional tracks which are often fragmented and indirect, while pedestrian facilities do not cater for key desire lines and often involve the use of multiple staggered crossings.

The routes are characterised by the presence of numerous signalised junctions in close proximity to one another; in total there are ten junctions with a further three standalone signalised pedestrian crossings.

Figure 2.3: Poor Quality Cycle Infrastructure – Westfield Avenue



Figure 2.4: Indirect Pedestrian crossing – Westfield Avenue



The current high degree of physical separation between transport modes, wide dual carriageways and generous corner geometries also allows for high speed vehicular movement, which does not align with the aspiration of the LLDC Street Technical Design Guide.

Other key issues identified in the Westfield Avenue / Montfichet Road area are as follows:

- Large areas are dedicated to median strips, which offer little value to motorists or pedestrians
- The off-carriageway cycle lanes present conflict with pedestrians at bus stops and junctions
- The Hostile Vehicle Mitigation (HVM), designed to protect Westfield from terrorist attack, is provided in the form of bollards which have been placed irregularly and are disruptive to pedestrian movements

- Excessive guardrailling restricts pedestrian movement and permeability, and encourages higher vehicle speeds
- Redundant bus priority measures occupy wasted space in the carriageway which could serve more useful purposes
- Inadequate taxi provision means taxis regularly queue in the bus lane on Montfichet Road
- Street furniture and objects are uncoordinated with the pedestrian areas and cycle lane
- Rough surface of tree pit design interferes with the footway and off-road cycle lane
- The area is lacking greenery, and what planting does exist is uncoordinated and out of scale with the surrounding buildings

2.3 Westfield Avenue / International Way Junction

The Westfield Avenue / International Way junction is the main junction within the study area and carries by far the largest number of vehicles. The junction is highly complex and occupies a large area with a high degree of physical separation between transport modes with generous corner geometries. Although pedestrian crossing facilities are provided, these are rarely on the desire line and require multiple crossing stages to get from one side to the other. In the context of the potential changes to Westfield Avenue, the junction would require significant re-design to accommodate the revised layout.

Figure 2.5: Multiple Crossing Stages – International Way Junction



Figure 2.6: Highly Complex Layout - International Way Junction



Other key issues identified at the Westfield Avenue / International Way junction are as follows:

- Excessive guardrailling restricts pedestrian movement and contributes to higher vehicle speeds
- The excessively large carriageway dominates the street scene and results in poor provision for pedestrians and cyclists
- The central median strip is overly large with redundant guardrailling preventing informal pedestrian crossing opportunities

- Lack of crossing provision on side streets
- Off-carriageway cycle lanes introduce conflicts with tree planting, bus stops and pedestrian crossings

2.4 Westfield Avenue Bridge

Westfield Avenue Bridge, situated at the western end of the study area, is a key link for motorists, cyclists and pedestrians allowing connectivity between Stratford to the Park, East Wick, Sweetwater and Hackney Wick. However, the existing design provides only for vehicular traffic, resembling the character of a motorway rather than a street designed to accommodate all forms of movement.

Four lanes of traffic dominate the area with a bi-directional cycle track and footway provided on the southern side, isolated between two tall bridge abutments which create a sense of isolation. There is no footway on the north side despite an obvious pedestrian desire line.

Figure 2.7: Existing layout on Westfield Bridge



Figure 2.8: Isolated Cycle Track and Footway – Westfield Bridge



Any future redesign of the bridge should take into consideration the following key issues:

- The lack of a footway on the north side of the bridge
- Presence of over specified motorway safety barriers
- A wide dual-carriageway that dominates the street scene and is no longer required in capacity terms
- Lighting and signage which is more akin to a motorway environment as opposed to an urban street
- Generous geometries encouraging vehicles to travel at high speeds
- Segregation of different user groups
- Off carriageway cycle lanes with several obstacles creating potential hazards

2.5 Additional Study Areas

In addition to the original three areas identified in the project brief and outlined above, LB Newham requested the inclusion of two further areas as it was felt that they formed a logical extension to the original study area, and also because it would ensure further application of the innovative design measures being developed for Montfichet Road and Westfield Avenue.

2.6 Penny Brookes Street

Penny Brookes Street, at the northern end of the study area, has the potential to be an important connection between the Westfield Avenue/Montfichet Road proposals and the new housing developments to the north of the park, as well as connecting into Leyton Road to the east. The existing arrangement on Penny Brookes Street incorporates advisory cycle lanes; however there are no cycle facilities at the junction with Leyton Road which has recently been re-designed.

Figure 2.9: Penny Brookes Street – Looking Towards the Junction with Leyton Road



2.7 Montfichet Road South to Warton Road

The additional section of Montfichet Road extends from the junction with Westfield Avenue to the roundabout junction with Warton Road. The carriageway through the majority of this section is elevated via a bridge structure which has a steady gradient heading north to south. At the bottom of the gradient where Montfichet Road meets with Warton Road, an unnecessary roundabout takes vehicles round a sharp bend and underneath two bridges which create significant barriers in the existing cycle network. Site

observations suggest the gradient creates high speeds as vehicles proceed down the hill and towards the roundabout where they can proceed unopposed.

This section has the potential to form an important connection within the local cycling network as Warton Road eventually connects with Cycle Superhighway 2 on Stratford High Street, which in turn connects cyclists with central London.

The existing cycle infrastructure is a confusing mixture of an off-street bi-directional cycle lane and a shared use track. The bi-directional cycle lane is interrupted at regular intervals by lighting columns, pedestrian crossings and guardrailing.

Figure 2.10: Montfichet Road Looking South



Figure 2.11: Warton Road Roundabout



3 Design Options

3.1 Introduction

This section provides an overview of the design process from developing initial cross-sections through to identifying preferred layouts to be applied on Montfichet Road and Westfield Avenue.

The bulk of the initial design work concentrated on developing concept design options which considered a range of different approaches for re-allocating roadspace on Westfield Avenue and Montfichet Road. The cross-section concept designs provided an effective way of communicating to stakeholders how the potential removal of the existing dual-carriageway would create the opportunity to use the newly created space in a range of different ways.

Initial cross-section designs developed by LLDC formed the starting point of the design process and these early ideas were then developed further by the design team to produce a series of four options in each case for Westfield Avenue and Montfichet Road.

The design scope on the Westfield Avenue Bridge and the additional study areas (Penny Brookes Street and Montfichet Road South) is more limited as these sites are heavily constrained by the existing bridge structures. The design process for these sections therefore did not follow the same process and preferred designs were identified from a more limited range of options based on site visits and design team discussions.

3.2 LLDC Initial Cross-Section Designs

Prior to this study commencing, LLDC developed a series of initial cross section sketches to demonstrate how the roadspace could be re-allocated following the possible removal of the dual carriageway. These are shown in figure 3.1 overleaf.

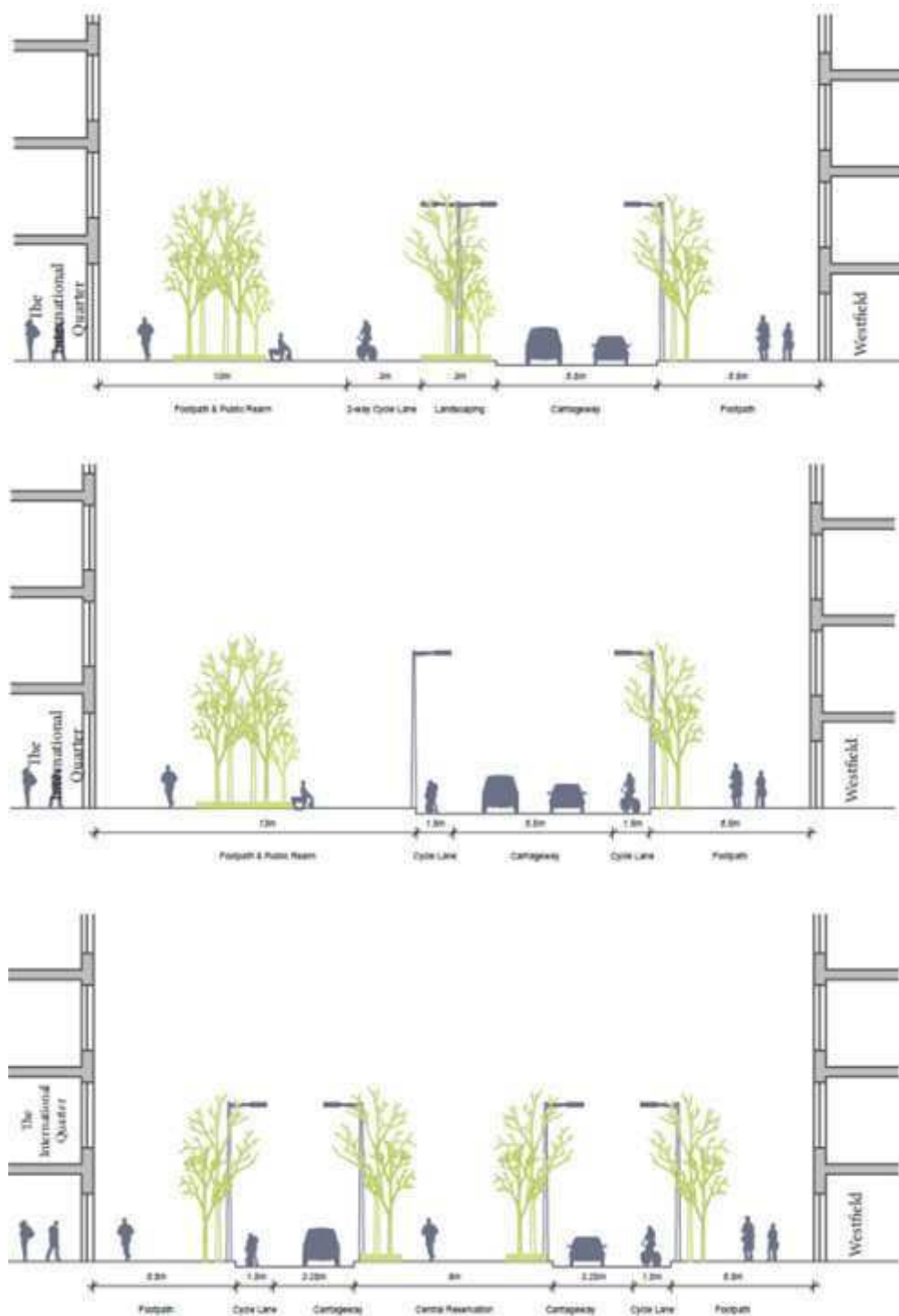
In each arrangement the carriageway has been reduced to a single vehicular lane in each direction with additional space given to a mixture of the footway, cycle lane and an extended central median. In two options the central reservation has been retained and in one layout it has been widened.

Our initial review of these sketch options revealed a preference for accommodating cyclists in with-flow cycle lanes wherever possible, thereby avoiding the issues of fragmentation and lack of connectivity at junctions as is evident in the existing bi-directional cycle track layout. A further point to note in relation to the cycling facilities in the sketch plans is that they are only 1.5m wide (or 3m wide for bi-directional), whereas 2m is now considered to be the minimum desirable width for good cycle facilities.

The initial review also highlighted the lack of segregated cycle facilities which it was felt would further enhance the quality of potential cycle facilities provided.

The option which suggested widening of the central median was considered less viable than the other options proposed, as further consideration would have to be given to the potential usefulness of the wide median strip, and whether or not in practice this would be desirable to users.

Figure 3.1: LLDC Initial Cross-Section Designs



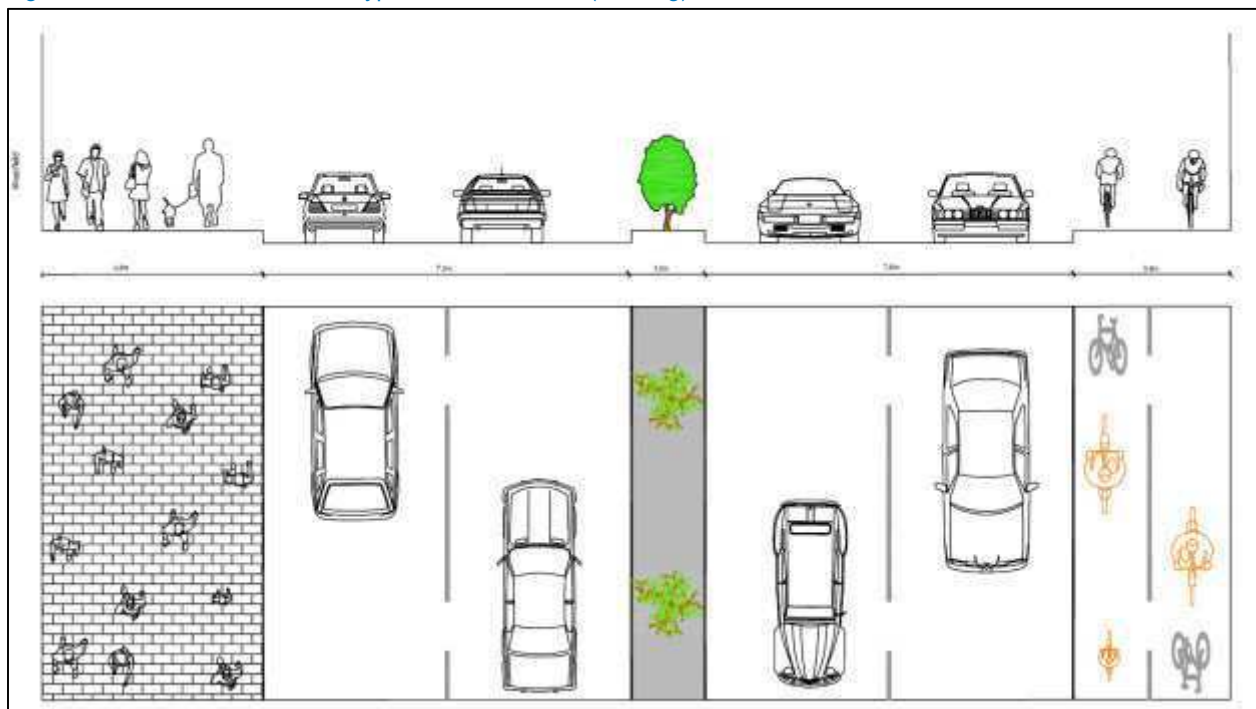
3.3 Mott MacDonald & Urban Movement Design Options

Montfichet Road

Although Montfichet Road varies in width and layout throughout its length, the typical cross-section measures 24.2m wide and is dominated by the dual carriageway and central median strip which together occupy a combined width of 16.5m.

The cross-section of the existing layout shown below illustrates how permeability for cyclists and pedestrians is very limited. In this section pedestrians are constrained to the western footway, whilst cyclists are only allowed to use the bi-directional track on the eastern footway (which pedestrians are prohibited from using). Pedestrian and cyclist movements across the road are limited to the designated crossing points, which in themselves present their own challenge as they are not located on pedestrian desire lines, and often involve multiple staggers.

Figure 3.2: Montfichet Road – Typical Cross Section (Existing)



Four concept cross-sections have been developed for Montfichet Road, each of which provides the below design features as a minimum:

- Created new footway for pedestrians on the east of Montfichet Road
- New dedicated cycle facilities in both directions
- Reduce the dual carriageway down to a single vehicular lane in each direction

Options 1 & 2, shown in figures 3.3 and 3.4 below, both retain the existing central reservation. **Option 1** removes a vehicle lane in each direction and introduces wider, with-flow segregated cycle tracks. However, the arrangement retains the central median and 4.5m wide vehicle lanes are required to provide sufficient passing space in the event of a vehicle breakdown or other kerbside activity. This means that the overall permeability of the environment is not significantly improved.

Option 2 replaces the existing northbound vehicle lanes with a bi-directional cycle track, and a significantly widened pedestrian footway. This option would provide a clear and direct route for cycles on Montfichet Road which would be fully separated from general traffic. A further benefit of this option is that it would require less construction works than the other options as the eastern half of the cross-section ties into the existing highways arrangement.

Figure 3.3: Montfichet Road – Option 1



Figure 3.4: Montfichet Road – Option 2



Option 3 significantly reduces the impact of the carriageway on Montfichet Road through a combination of narrowing the carriageway to 2 x 3.5m vehicle lanes, removing the central median strip and introducing wide segregated cycle tracks. The removal of the central carriageway space also frees up significant additional space which has been added to the footways, providing further benefit.

Option 4 introduces the concept of continental ‘flexible verges’, located between the cycle tracks and the carriageway. Similarly to option 3, the central reservation is removed and the vehicle lanes reduced to 3.5m wide. The benefit of the ‘flexible verges’ is that they allow flexibility within the design to accommodate kerbside activity such as deliveries and buses without interrupting the operation of the cycle tracks or general traffic.

Figure 3.5: Montfichet Road – Option 3



Figure 3.6: Montfichet Road – Option 4



Figures 3.7 and 3.8 below demonstrate how the flexible verges would operate in practice.

Figure 3.7: Example of a Cycle Track Protected By a Flexible Verge



Figure 3.8: Bus Stop Accommodated Within a Flexible Verge

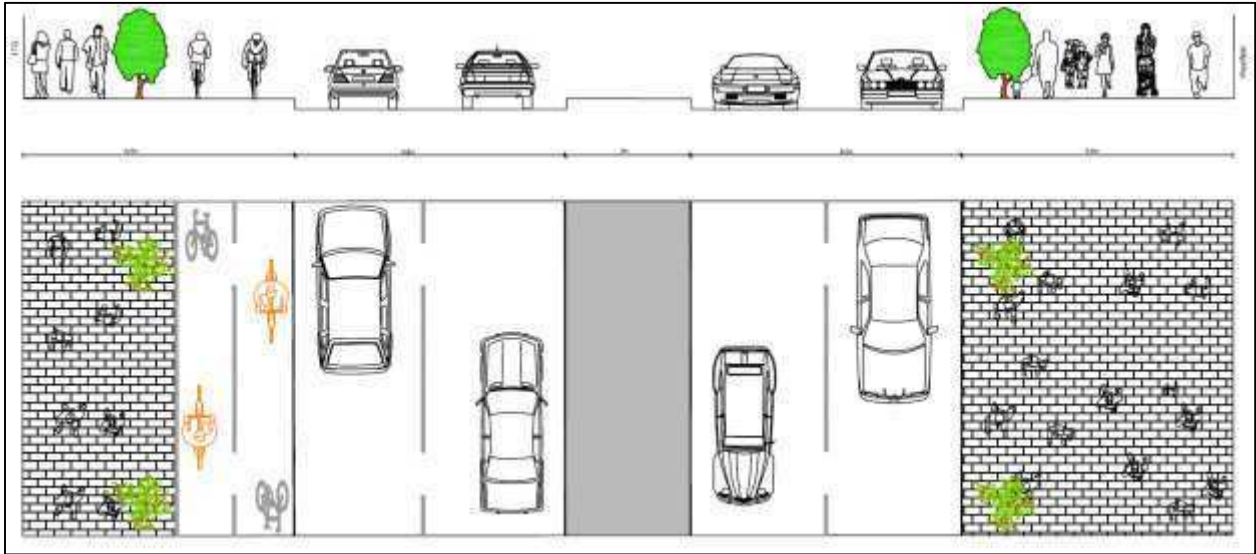


Westfield Avenue

The existing cross-section of Westfield Avenue bears certain similarities to Montfichet Road, with the key difference being that the central median is considerably wider at 3m. The footprint of Westfield Avenue is also wider at 29m from back of footway to building line. The other key differences relate to the fact that Westfield Avenue is very linear in form with the layout being consistent along its length. There are also very few junctions on Westfield Avenue as opposed to Montfichet Road where multiple junctions are present.

Figure 3.9 below illustrates the existing layout of Westfield Avenue.

Figure 3.9: Westfield Avenue – Typical Cross Section (Existing)



The four concept options for Montfichet Road have also been applied to Westfield Avenue and are shown in figures 3.10, 3.11, 3.12 and 3.13 below. The additional width on Westfield Avenue allows for more generous widths on footways, cycle tracks and verges and this space has been allocated to the most appropriate land use in each option.

Figure 3.10: Westfield Avenue – Option 1

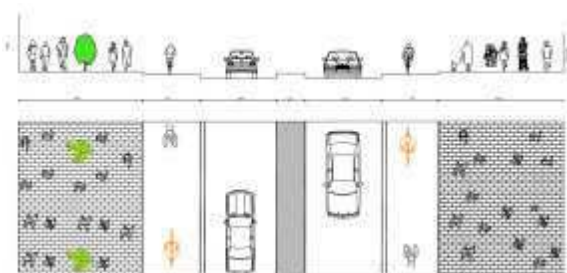


Figure 3.11: Westfield Avenue – Option 2



Figure 3.12: Westfield Avenue – Option 3



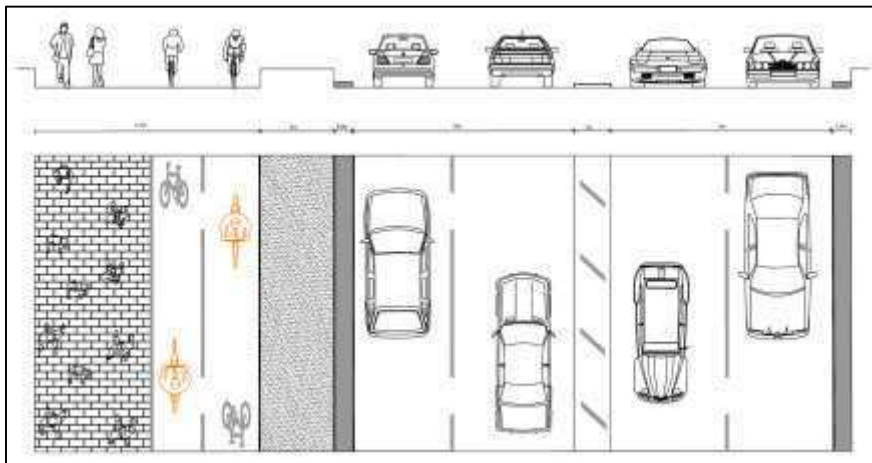
Figure 3.13: Westfield Avenue – Option 4



Westfield Avenue Bridge

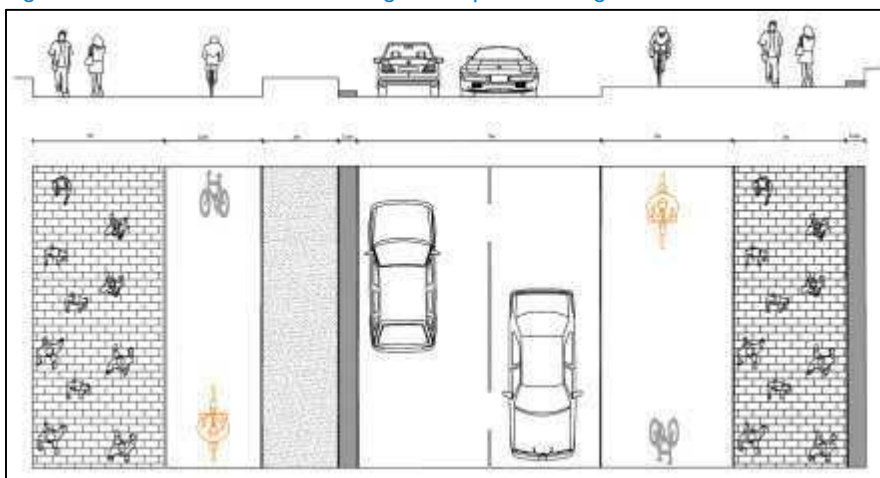
The existing cross section of Westfield Avenue Bridge incorporates four lanes of traffic while cycle and pedestrian facilities are segregated from the main carriageway by a tall bridge structure on the southern side of the bridge. There is currently no footway on the north side.

Figure 3.14: Westfield Avenue Bridge – Typical Cross Section (Existing)



Due to the heavily constrained nature of this section a single design option was produced that removed the dual carriageway and introduces a footway and with-flow segregated cycle lane on the north side of the bridge in place of the traffic lanes. This option is illustrated in Figure 3.15 below.

Figure 3.15: Westfield Avenue Bridge – Proposed Design



Penny Brookes Street / Montfichet Road South

Similarly to the Westfield Avenue Bridge section described previously, both of these sections are heavily constrained by the existing bridge structures and narrow carriageways and footways that characterise these areas. Opportunities for significant reallocation of roadspace are therefore limited.

However, the designs progressed for these areas have attempted to continue the themes developed for the original study area wherever possible in order to create a consistent design throughout the entire study area.

3.4 Preferred Design Options – Westfield Avenue and Montfichet Road

Following discussion with LLDC officers, stakeholders and internal design reviews, it was agreed that **Option 4** was the favoured option as a basic template to be applied across the study area. It was felt that this option best addressed the original study aims, particularly in relation to the creation of high quality walking and cycling infrastructure, an improved public realm and reduction of the current dual-carriageway layout which dominates the street scene.

However, it became apparent as the design progressed to the next stage that the varying layout and multiple junctions situated on Montfichet Road presented significant difficulty in accommodating Option 4. In particular, the introduction of with-flow cycle lanes on each side of the carriageway posed significant design problems at the numerous junctions that the northbound cycle lane would pass through. In addition, the amount of kerbside activity in the vicinity of the Westfield entrance was such that safely accommodating cyclists in the presence of a significant number of taxis and buses posed further design challenges.

With the above in mind it was agreed that **Option 4** was the preferred option for Westfield Avenue and that a variation of **Option 2** was the preferred option for Montfichet Road.

The retention of a bi-directional cycle track on Montfichet Road is considered a slight compromise in terms of cycling level of service but with the challenges outlined above it is felt that this represents the best option to guarantee a more comfortable and cohesive journey for cyclists in both directions. This is especially so in this case where there are very few points at which a cyclist would need to diverge from the bi-directional cycle track and access a facility or junction on the west side of Montfichet Road. In practice, the only place where this movement would need to be catered for would be in the vicinity of the Westfield entrance where the existing toucan crossing would be located closer to the desire line. The existing bi-directional cycle track on Montfichet Road is poorly implemented and would be comprehensively re-designed under these proposals to accommodate a flexible verge between the cycle track and carriageway and a more cohesive pedestrian environment on both sides of Montfichet Road.

4 Preferred Design – Key Features

4.1 Introduction

This section provides an overview of some of the key features associated with the preferred design for the study area. The purpose of this chapter is not to describe every element of the design in extensive detail; instead it highlights key features and solutions which have been used in order to deliver the best design solution possible in different situations.

The full set of design drawings are included in Appendix A (drawing numbers MMD-347654-C-DR-00-XX-00002 to MMD-347654-C-DR-00-XX-00008)

4.2 Flexible Verge

The incorporation of the ‘flexible verge’ into much of the study area is a fundamental element of the design and one that facilitates the introduction of uninterrupted cycle facilities throughout the area. The concept of the flexible verge is taken from several European cities with established cycling cultures and infrastructure standards that have led to high cycle mode share. Figure 4.1 below demonstrates how the proposed verge arrangement would be implemented on Westfield Avenue.

Figure 4.1: Visualisation Showing the Flexible Verge on Westfield Avenue



The verge is typically used to separate the cycle track from the adjacent carriageway and can be anywhere up to 3 metres wide. The benefit of introducing such a verge is that any kerbside activity such as loading bays, taxi ranks and bus stops etc is incorporated within the verge, meaning that the cycle track passing behind is uninterrupted and does not need to constantly start/stop or deviate offline to negotiate obstacles.

The verge also provides an ideal location for soft landscaping elements, with low growing plant species and street trees incorporated within. Subject to further design, it may also be feasible to incorporate a Sustainable Urban Drainage Systems (SUDS) design into the verge in certain areas.

4.3 Protected Junctions for Cyclists

Where necessary, junctions have been designed to offer cyclists full protection against turning vehicle movements, thus eliminating the potential for conflict between vehicles and pedestrians. The proposed design adopts principles commonly used in mainland Europe where similar designs are becoming commonplace and are shown to be effective. A typical example would see the use of 'false zebras' to highlight the area where pedestrians will need to cross the cycle lanes in order to reach the push button pedestrian facility and tactile waiting area. However, in discussion with TfL stakeholders it is understood that the use of false zebras is not fully accepted by TfL and therefore they have been omitted from the design at this stage. Instead, the footway material would extend through the cycle lane to indicate pedestrian priority at these locations. We understand that forthcoming revisions to TSRGD will legalise the use of false zebras in the UK and therefore the design is such that these could be added at a later date if so desired. Indeed, there is a strong possibility that these will have been accepted for use by the DfT and TfL before this scheme is implemented.

The obvious advantage of the protected junction design is the elimination of vehicle / cyclist conflict. However, this does come with some disbenefit in the form of potentially increased waiting times for cyclists to pass through the junction. In order to make a straight ahead movement in the proposed arrangement, a cyclist would be required to call the all red pedestrian / cycle phase and wait for the green signal to cross. The potential delay incurred would depend on the signal timings and this can be adjusted to suit local needs and priorities following implementation.

The protected junction design also introduces the potential for increased conflict between cyclists and pedestrians, particularly in the area where pedestrians will need to cross the cycle lane to reach the signalised crossing. However, in practice it is not possible to eliminate all potential conflict from a junction where cyclists, pedestrians and vehicles are present and it is the design team's view that the likelihood of such conflict occurring is minimal. Furthermore, the consequences of any conflict that does occur would, in the main, be far less serious than that occurring between vehicles and cyclists where the consequences can often be fatal.

Figure 4.2: Proposed Protected Cyclist Junction – Westfield Avenue / Montfichet Road Junction



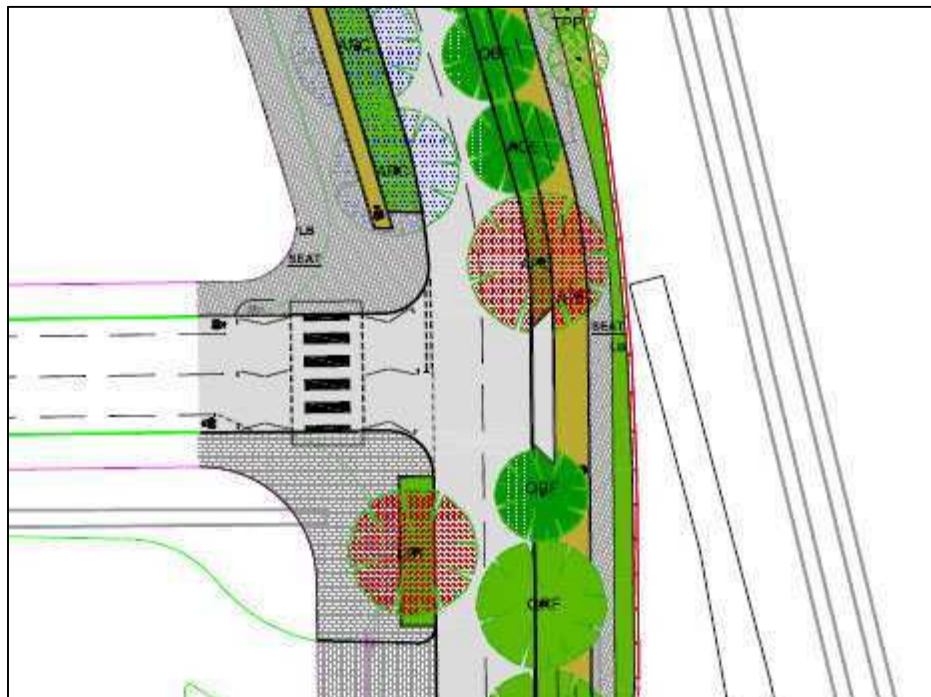
4.4 Removal of Traffic Signals

During the initial scoping work it was apparent that the need for all existing signalised junctions to remain under signal control was questionable. In particular, the northern section of Montfichet Road suffers from numerous junctions in very close proximity, many of which appear to be operating well within capacity. This was subsequently confirmed by the traffic modelling exercise undertaken as part of the study (refer to Section 7 for further information).

In particular, the junction of Montfichet Road / International Way was shown to be operating well within capacity and with relatively few vehicles turning in and out of the side road arm. Following confirmation of acceptable operation through the traffic modelling, this junction has been re-designed as a simple priority junction with a zebra crossing provided on the side road arm for pedestrians.

The effect of this is to simplify and declutter the environment and to create a less 'stop/start' journey for all road users.

Figure 4.3: Proposed Removal of Traffic Signals – Montfichet Road / International Way Junction



4.5 Taxi and Coach Provision – Montfichet Road

The kerbside space around the entrance to Westfield Shopping Centre on Montfichet Road is in high demand from taxis and buses and shortly will become busier still with the arrival of further taxis and the addition of coaches displaced as part of the Meridian Square development. National Express and other scheduled coaches are likely to be transferred to Montfichet Road while the Meridian Square works are taking place and their longer term location is unclear.

Currently, a small taxi rank layby serving around five taxis is located in this area but it is consistently over-capacity with up to 20 taxis illegally queuing in the bus lane immediately behind the rank.

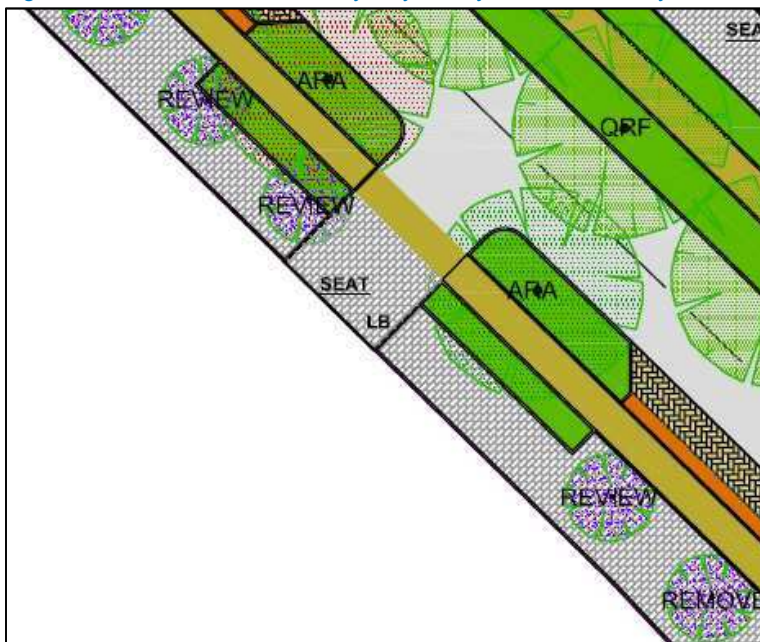
The proposed design introduces a larger taxi rank in place of the existing bus lane and accommodates north and southbound coach bays for up to two coaches each adjacent to the bus station. Additional space is also provided in these areas with an enlarged footway that can accommodate additional shelters and supporting infrastructure as required.

4.6 Side Road Entry Treatments / Continuous Footways

Where feasible, continuous footway/cycle track treatments are proposed across all minor side entrances on Westfield Avenue to maximise continuity of the cycle tracks and footways along the route. Headway treatments are a well-established method of reducing vehicle speeds and improving visibility of crossing

pedestrians at side junctions; continuous footways are a further development upon this design as it shifts the perceived priority at side junctions and significantly improves pedestrian and cycle comfort.

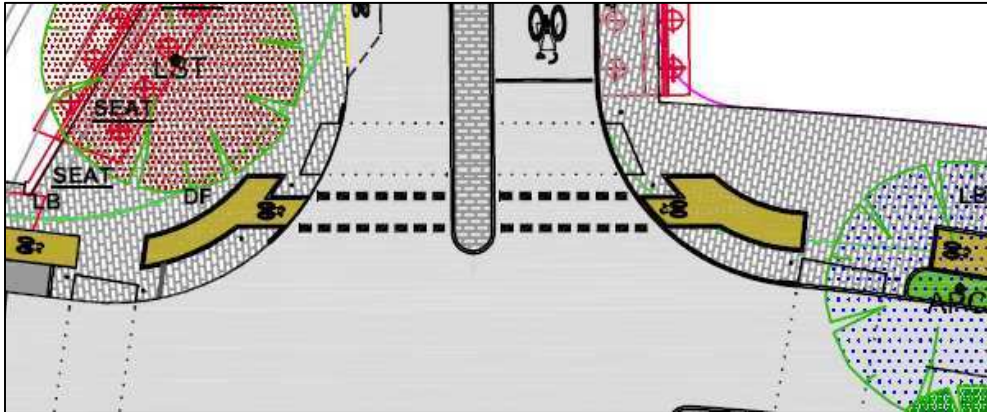
Figure 4.4: Continuous Footway / Cycleway Side Road Entry Treatment – Westfield Avenue



4.7 Separated Cycle / Pedestrian Crossings

In line with European best practice, cycle and pedestrian crossing movements have been separated so that each can cross in their own space unopposed. The pedestrian crossing facility is no different from a standard arrangement, but rather than converting to a toucan crossing which introduces the potential for conflict between users, a separate cycle crossing area is delineated through the use of 'elephant footprint' markings. The separation provides cyclists with a clear route to follow through junctions on the desire line and away from conflict with slower moving pedestrians.

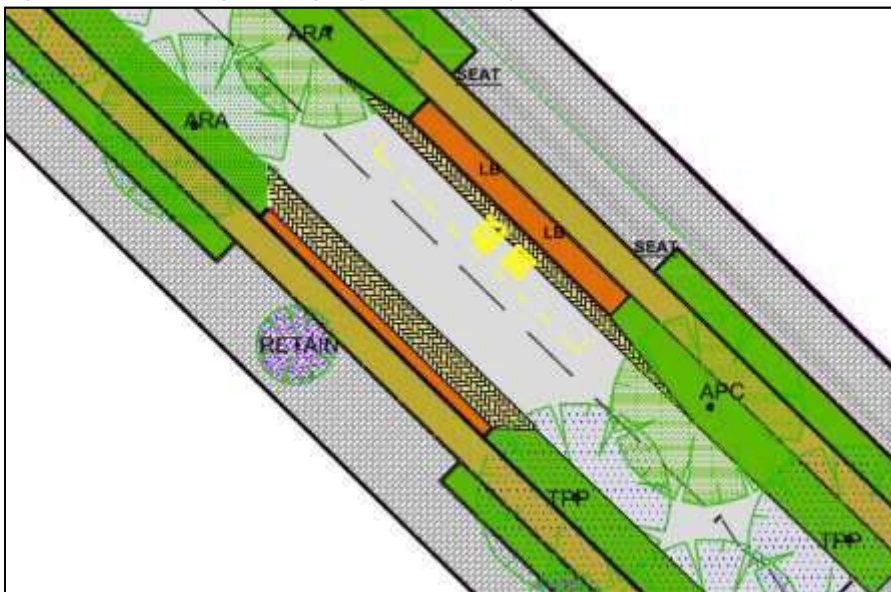
Figure 4.5: Separate Pedestrian / Cycle Crossing



4.8 Loading Bays & Bus Stops - Westfield Avenue

As previously described, a floating verge has been proposed throughout the majority of the study area to separate the cycle lane from the adjacent carriageway. One of the main benefits of this is that all loading bays and bus stops along Westfield Avenue will be recessed within the verge, thus ensuring that kerbside activity does not impact upon the operation of the cycle lane which will pass behind. A key issue with the existing cycle infrastructure is that it 'gives-up' at obstacles within the streetscape such as bus stops and pedestrian crossings; the resulting infrastructure is inconsistent and disconnected.

Figure 4.6: Floating Loading Bay and Bus Stop – Westfield Avenue



4.9 Removal of Roundabout on Montfichet Road South

The proposed removal of the Montfichet Road (south) roundabout provides the opportunity to create an additional area of public space as well as a new dedicated cycle path that would link to the new path proposed by LB Newham in the arches under the railway bridge. This would enable cycles and pedestrians to travel safely through the area, rather than on the existing carriageway under the bridge which is a very hostile environment for cyclists and unpleasant for pedestrians.

Figure 4.7: Removal of Roundabout on Montfichet Road South



4.10 Two-Stage Cyclist Right Turn – Leyton Road Junction

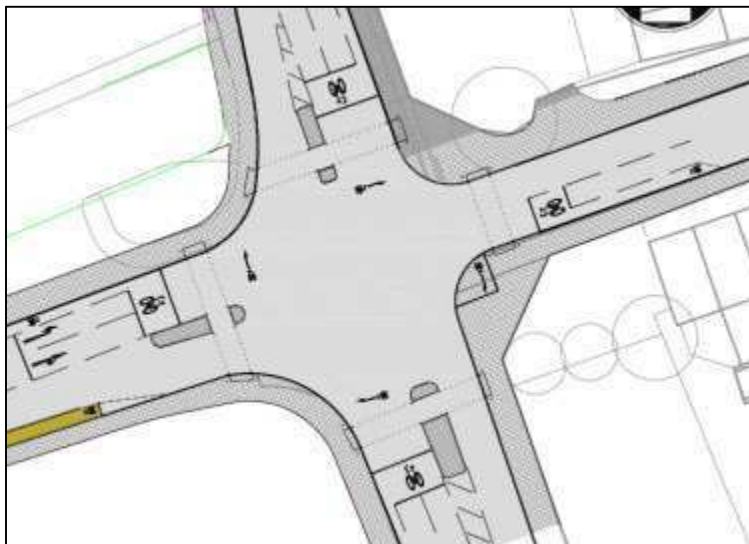
The junction of Penny Brookes St and Leyton Road has recently been re-designed to increase capacity. This factor, combined with a lack of available space, has limited the extent to which significant modifications could be accommodated. The design process tested various different options including the previously mentioned protected junction design but it was not feasible to achieve such an arrangement in this location.

Despite these issues, it was still felt important to develop a design that would improve cyclist comfort through the junction and therefore enable an important link to the proposed new facilities on Montfichet Road and Westfield Avenue. With this in mind, a 'two stage right turn' facility for cycles has been proposed. This arrangement discourages cycles from turning right from the outside vehicle lane in one movement

against opposing traffic and instead cycles are encouraged to use the inside lane, travel straight ahead and wait on the left hand side in a protected area, before then travelling straight ahead with the next phase of signals. The theory is that this arrangement reduces turning conflicts between cycles and other road users by reducing cycle movements to straight ahead only.

Two-Stage right turns are created by using advisory cycle logos and arrows around the junction to indicate to cycles where to turn and wait within the junction. However, in this case an innovative dropped-kerb facility for right-turning cycles turning from Leyton Road into Penny Brookes Street has been incorporated because the narrow road width does not provide sufficient space to wait safely in the carriageway.

Figure 4.8: Proposed 2-Stage Right Turn – Leyton Road



4.11 Hostile Vehicle Mitigation

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5 Stakeholder Consultation

5.1 Introduction

The project brief stipulated that engagement with relevant stakeholders should be undertaken throughout the study in order to ensure continued support for the emerging proposals and to achieve a strong level of support for the final design.

This section outlines the extensive engagement that has been undertaken at various stages of the study.

5.2 Stakeholder Steering Group

The formation of a stakeholder steering group, consisting of key consultees and delivery partners, was the central focus of the stakeholder engagement activities.

The steering group, assembled by LLDC, consisted of the following representatives:

- LLDC Real Estate and Planning Directorate
- LLDC Planning Policy and Decisions Directorate
- LLDC Park Operations and Venues Directorate
- LLDC Transport Planning Specialist Advisor
- LB Newham Strategic Regeneration, Planning and Olympic Legacy
- LB Newham Operations
- LB Newham Traffic Management and Safety
- Westfield
- Lend Lease
- TfL Bus Operations
- TfL Cycling
- TfL Borough Planning

There have been four meetings of the steering group at appropriate times throughout the study, one of which was combined with a longer design session that enabled members of the group to review the initial concept designs put forward and express preferences for the different options.

Information was shared at the steering groups through PowerPoint presentations that were tailored to each steering group in order to convey the key messages emerging from the study at that particular time. Feedback received from members of the group has been very positive throughout the process.

5.3 Further Stakeholder Consultation

In addition to the steering group meetings, a series of more focussed stakeholder meetings have been held to discuss more detailed issues arising throughout the study. These are listed below with a brief description of each.

- **Metropolitan Police Counter Terrorism Security Advisor** – to discuss issues relating to Hostile Vehicle Mitigation (HVM) requirements and emerging technologies in this area
- **TfL** – Three design progress meetings held with internal TfL stakeholders including coaches, private hire (taxis), bus operations, cycling and Borough programmes
- **Westfield** – Two meetings held to discuss proposals for Taxi / Coach drop-off facilities on Montfichet Road and to discuss emerging proposals for the Cherry Park development to understand how these can be integrated with the design proposals
- **Lend Lease** – to discuss linkages between emerging design and The International Quarter (TIQ) development
- **LLDC Transport Advisor** – to discuss methodology for modelling future traffic flows

5.4 Quality Review Panel (QRP)

The QRP is an independent design review panel engaged by LLDC to review proposals at key stages of the design process. A series of recommendations are provided by the QRP at the end of the session which the design team should consider and incorporate where possible.

The study team presented key concepts and the draft designs to the QRP on 26th February 2015 and a number of interesting points were discussed between the design panel and the study team. The full design panel report is included in Appendix B and the summary comment is provided below.

“The Quality Review Panel strongly supports the aspiration to reconfigure Westfield Avenue and Montfichet Road, to create a better environment for pedestrians and cyclists. Rigorous analysis has informed the proposed improvements, which would transform the quality of the environment, particularly for pedestrians and cyclists”.

5.5 Built Environment Access Panel (BEAP)

Similar to the QRP, BEAP is a group of local volunteers who are engaged by LLDC to review design proposals at an appropriate stage from the perspective of users with a range of disabilities.

The study team presented the key concepts and draft designs to BEAP on 25th February 2015. The presentation triggered an interesting debate about some of the key issues in inclusive design at the current time, many of which are evident within the Olympic Park currently. The majority of the discussion focussed

on potential areas of cycle / pedestrian conflict and covered topics such as delineation between the footway and cycle lanes, 'floating' bus stops and pedestrian / cyclist crossing facilities.

The full BEAP report is included in Appendix C and a summary of the key points is provided below.

- Avoid, 'grey on grey'. Ensure good visual (tonal) contrast between surfaces in accordance with good practice
- Avoid dark tree pits – could be confused by some people with visual impairment as hole in the ground
- Ensure all street furniture (including utility boxes) are highlighted appropriately
- Reference current (and new) TfL guidance as well as LLDC's Inclusive Design Standards and Streetscape design guide and aim to exceed these where possible to achieve an exemplar scheme
- Ensure tactile paving is implemented correctly and not over used, resulting in confusing environments
- Consider:
 - Directional signage (for pedestrians and cyclists)
 - Highlight location of key facilities such as blue badge parking and toilets
- Have appropriate seating (with back and arm rests) every 50m
- BEAP generally supportive of a verge to separate cyclists and pedestrians
- Design team to come back to present the proposed 'false zebra crossing' proposal in more detail
- Design team also to come back with more detail on signalised pedestrian crossing proposals – including any use of zebra crossings (as opposed to the existing traffic light solution currently found on Westfield Ave)
- BEAP welcomed straight pedestrian crossings as opposed to penned in dog-leg crossings, as currently found on Westfield Ave

The majority of the comments made would be addressed where possible in the subsequent stages of the design but where possible any comments appropriate for this stage of the design have been incorporated accordingly.

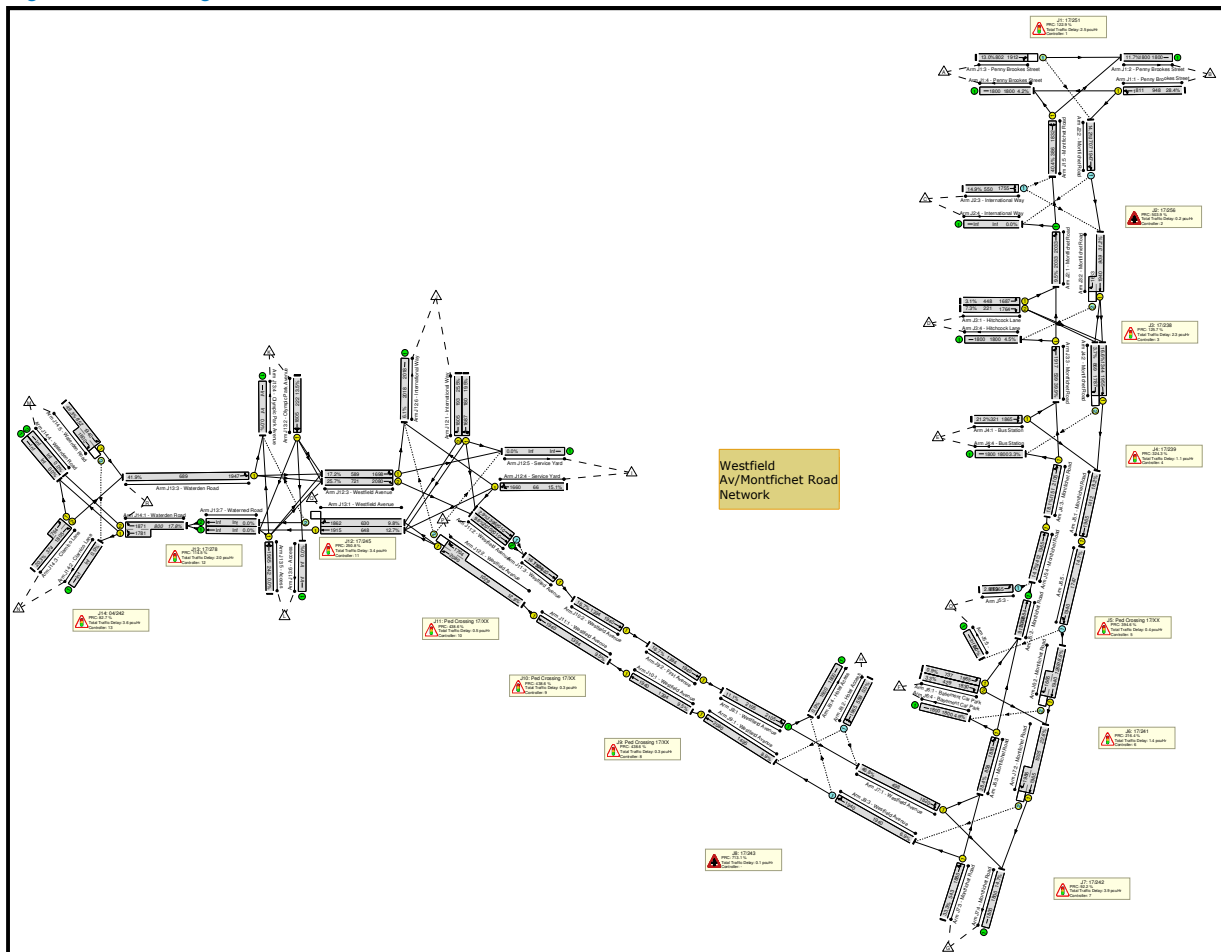
6 Traffic Modelling

6.1 Introduction

In accordance with the project brief, a comprehensive traffic modelling exercise has been undertaken to assess the impacts of the proposed design on the surrounding highway network.

The model developed is based on a fully validated 2011 Linsig model provided by TfL which has been updated with observed base flows collected on site in November / December 2014 as outlined below. The model extent is illustrated in the network diagram in figure 6.1 below:

Figure 6.1: Linsig Model Extents



The time periods covered by the model are as follows:

- Weekday AM (7:45 - 8:45), INTER (12:00 - 13:00) and PM Peak (16:45 - 17:45)
- Saturday INTER (13:00 - 14:00) and PM Peak (17:30 - 18:30)

Following discussion between LLDC, Westfield and LB Newham, the following scenarios were modelled:

Existing layout:

- Base (2014 observed flows)

Preferred Design:

- Base (2014 observed flows)
- Base+10% - Sensitivity test to represent a current worst case scenario
- Base+20% - Sensitivity test to represent possible 2031 future traffic levels

The 'Base+10%' scenario was included at the request of Westfield who undertook a comparison of the observed flows against their own car park entry/exit data. This comparison showed that the Saturday 29th November survey equated to the 8th busiest Saturday of 2014 in terms of vehicle entries / exits from the Westfield car parks. Further analysis showed that the busiest day of the year had around 10% more vehicle movements, hence the modelling of the 'Base+10%' scenario.

The 'Base+20%' scenario is considered a reasonable representation of likely future flows up to 2031, taking account of any background traffic growth and the impact of proposed future development, such as the International Quarter, Cherry Park, Olympicopolis, and Chobham Manor. There was some difficulty in arriving at a reasonable percentage uplift for the future flows scenario as previous strategic modelling undertaken through the Legacy Communities Scheme (LCS) and Stadium Transport Assessment (TA) does not cover the full extent of the study area and uses a forecast 2014 base year. The forecast 2014 base is not comparable to the observed flows collected through the traffic surveys and therefore any predicted future year flows could not be relied upon. The 20% uplift figure was arrived at by comparing forecast 2014 flows and forecast 2031 flows on Westfield Avenue, where the 2014 observed flows compared relatively well with the forecast 2014 flows from the LCS model. The predicted increase in flows equated to 20% and therefore this figure was applied across the network.

In both the 'Base+10%' and 'Base+20%' scenario the uplift has been applied evenly to all arms of every junction and is therefore considered to represent a worst case scenario.

6.2 Traffic Surveys

A comprehensive set of traffic surveys was carried out to inform the modelling on Saturday 29th November and Tuesday 2nd December 2014. The following data was collected through the surveys:

- Fully classified turning counts for each signalised junction within the original study area, including pedestrians
- Pedestrian counts at each of the standalone pedestrian crossings within the original study area
- Measurement of saturation flows and queue lengths for all approaches of the Westfield Avenue / International Way Junction

- 7-day Automatic Traffic Counts (ATCs) at specified locations on Westfield Avenue (x2) and Montfichet Road (x1)

The ATC surveys were in place between Saturday 29th November and Monday 8th December 2014 inclusive.

Weekday classified junction counts took place over the following time periods:

- AM Peak - 07:00 to 10:00
- Inter Peak – 10:00 to 13:00
- PM Peak - 16:00 to 19:00

Saturday classified junction counts took place over the following time periods:

- Inter Peak – 11:00 to 14:00
- PM Peak - 16:00 to 19:00

The full set of traffic data has been supplied to LLDC previously but further copies can be provided on request.

6.3 Modelling Results

A summary table of the modelling results along with the full Linsig model output reports is included in Appendix D. A brief commentary of the results is set out below.

Existing Layout with Base Flows

As anticipated, the model run of the existing layout showed significant spare capacity in all of the modelled junctions across all time periods. The Saturday PM peak period was the busiest period modelled. Of the junctions modelled, the International Way / Westfield Avenue junction was closest to reaching its theoretical capacity (measured by % Degree of Saturation (DoS)), with the International Way arm reaching 84.8% DoS.

The Saturday PM peak scenario was shown to be the busiest of all time periods and this coincides with highest number of vehicle movements exiting the Westfield car parks. It is reasonable to suggest, therefore, that access to and from Westfield by car is the critical factor in determining the operation of the network as opposed to wider traffic movements associated with the weekday AM and PM peak scenarios.

Proposed Layout with Base Flows

An initial model run of the proposed layout revealed a capacity issue at the Westfield Avenue / International Way junction, with DoS for this junction reaching in excess of 150%. Whilst not designing on

solely on capacity grounds, this level of potential delay was considered unacceptable and therefore some minor changes were incorporated into the junction design. The key change comprised the introduction of staggered junction crossings on the main Westfield Avenue east and west arms in place of the previous single stage crossings in the earlier design which required significantly more green time.

A revised model run of the same scenario but with the revised design showed all arms of all junctions to be within their theoretical capacity.

In the Saturday PM peak period, the Westfield Avenue / Montfichet Road junction was shown to be approaching its theoretical capacity with 89.7% DoS, and the Hitchcock Lane / Montfichet Road junction likewise with 87.6%. The revised layout for the Westfield Avenue / International Way junction reached a DoS of 86% in the Saturday PM peak period.

Proposed Layout with Base+10% Flows

As would be expected, the addition of 10% on top of the base flows results in several junctions becoming closer to their theoretical capacity. Indeed, two arms of the Montfichet Road / Hitchcock Lane are shown to exceed 90% DoS in the Saturday PM scenario (95.7%). A DoS in excess of 90% indicates that the junction operation may become unstable over this time with additional queuing expected.

All arms of all other junctions show a DoS of less than 90% for the +10% scenario.

Proposed Layout with Base+20% Flows

The addition of 20% on top of the base flows results in further increases in DoS at several junctions. Most notably, all three arms of the Hitchcock Ln/Montfichet Rd junction reach a DoS of 111% in the Saturday PM scenario.

The Westfield Ave / Montfichet Rd junction also exceeds 90% DoS in the Saturday PM scenario, with two arms reaching 92.3% and 94.7% respectively.

All arms of all other junctions show a DoS of less than 90% for the +20% scenario.

Modelling – General Discussion

In general, the modelling results show that the proposed changes to Westfield Avenue and Montfichet Road will not have an adverse impact on the capacity of the highway network. This is largely because there is significant spare capacity under the existing layout across all time periods.

The higher DoS at the Hitchcock Ln/Montfichet Rd junction in the +10% and +20% scenarios is caused in large part by the addition of the single stage crossing of the Montfichet Rd (north) arm. This introduces a requirement for an 'all-red' stage in the signal operation with a subsequent knock-on impact on the efficiency of the junction.

Similarly, the over 90% DoS result at the Westfield Ave / Montfichet Rd junction in the Saturday PM scenario is caused by the requirement for an all-red stage due to the single stage crossings.

In all cases, it is only the Saturday PM peak scenario which begins to show junctions approaching or exceeding capacity with the addition of 10% and 20% traffic flows. In all other time periods, all arms of all junctions show a DoS of less than 90%, suggesting operation within capacity. This is considered to be a successful outcome given the extensive changes that are proposed to all parts of the existing network.

It was agreed with stakeholders at an early stage that the +10% and +20% scenarios would not be used to influence the scheme design but rather to inform where capacity issues may arise if these traffic levels were to be reached in the future. It should also be noted that there are considerable uncertainties and difficulties in predicting future traffic flows in the Park, as demonstrated by the significant over-forecasting of previous strategic modelling which resulted in the network being configured in its current form with significant excess capacity.

It is also the view of stakeholders that the 'pay on foot' barrier entrance systems to the Westfield car parks are the capacity limiting factor at the local network level as opposed to the junctions themselves. This is demonstrated at weekends currently by significant queuing extending from the car park barriers with little queuing experienced on the wider network during these times. The impact of these entrances on the local network is not captured through the modelling process. It is considered likely that the maximum capacity of the car park entrances would still likely be the limiting factor on the overall network as opposed to the junctions on the wider network.

Further modelling work may be required, possibly in the form of microsimulation modelling, to test the impact of the car park entrances on the surrounding network, especially given the proposed reduction of lanes from dual carriageway to single carriageway where currently one lane can be used by vehicles queuing to access the car parks leaving the other lane free for other traffic.

7 Public Realm and Materials Strategy

7.1 Introduction

LLDC's 'Legacy Street: Technical Design Guide' sets out a vision to make the Queen Elizabeth Park a unique piece of London. A key element of this vision is the delivery of a 'high quality accessible public realm'; this public realm will create 'a network of pedestrian, bicycle, and street connections to the surrounding areas'. To help fulfil this vision; all streets within the Olympic Park should be designed with dedicated footways on both sides of the carriageway, and should be able to safely accommodate cyclists on the carriageway.

Figure 7.1: Typical streetscape in the Olympic Park with a segregated cycle track within a wide footway



This chapter sets out a public realm materials and components strategy specifically for the study area which has been the focus of Mott MacDonald and Urban Movement's work to date with LLDC. The intent of this strategy is to compliment the LLDC design guide as much as possible to ensure that the vision for the public realm is achieved on Montfichet Road, Westfield Avenue, and Waterden Road.

These existing streets currently have three distinct characters principally determined by the defining architecture, land use, streetscape qualities and visual context. The key characteristics of the three areas; Montfichet Road, Westfield Avenue, and Waterden Road are briefly described below:

- **Montfichet Road** feels like a service road; dominated by vehicular traffic, with no spatial definition along its eastern edge.
- **Westfield Avenue** is yet to be fully developed but when complete it will feel more like a modern 'downtown' urban street with active frontage (leisure, commercial, residential land uses etc.) lining both sides.
- **Waterden Road** has very little spatial definition as it is mostly elevated on bridges and embankments that cross the rivers, wetlands and railways of the Lea Valley/ Queen Elizabeth Park, and consequently has a calmer, 'parkland' character.

The above routes are identified as 'Primary Streets' in LLDC's design guide which means that they should provide the main strategic connections between the Queen Elizabeth Olympic Park and neighbouring areas such as Hackney and Waltham Forest. With regard to the public realm on these routes; buildings fronting onto these streets should seek to activate the public realm, and footways should be wide enough to accommodate outdoor seating without impacting upon the effective width of footways. Where applicable, the materials and components recommended in this chapter reflect the 'public realm elements' identified within the Design Guide for 'Primary Streets'. The recommended elements focus on paving types, street furniture, and lighting arrangements.

Figure 7.2: Montfichet Road - Example of Ongoing Development in the Olympic Park



7.2 Design Principles

The public realm interventions proposed for these three streets vary in response to the needs of each streetscape, but generally the following principles have been adhered to in response to the Design Principles contained within the LLDC Design Guide:

- Existing materials and components have been retained or reused wherever feasible & appropriate.
- Additional materials and components have been locally sourced / manufactured. These materials and components can be easily maintained and are readily available to the Boroughs' Highway teams.
- Whole-life costs, robustness and design life have been prioritized when choosing new materials and components.

- Hard impermeable paving has been minimized to reduce burdens on the surface water drainage system.
- Planting and permeable surfaces have been maximized to reduce burdens on the surface water drainage system and increase biodiversity in addition to the obvious amenity benefits.
- Planted and soft verges can be detailed as fully functioning SUDs features with appropriate engineering inputs.
- Road markings and signs should be installed where mandatory only, all discretionary signs and markings to be removed unless there is proven requirement. All streetscapes and proposed markings should adhere to the 'Naked Street' principles where possible.
- Seating has been concentrated at points of known demand (bus stops, taxi ranks, building entrances, public/social spaces etc.) and along routes as rest points at approximately 50m intervals on both footways. They are generally comfortable, with backs and arm rests.
- Cycle parking has been located at known demand points and at 50m intervals co-located with seats as required in the LLDC Design Guide.
- Lighting installations should be flexible and adhere to the requirements of individual streetscapes, rather than applying a blanket approach to new lighting installations.
- Drinking fountains have been located at all major intersections and social spaces; the fully accessible Able & Cole type to match those used in Queen Elizabeth Park.
- Existing Components; there are a number of materials and components across the site that can be retained in-situ, recycled or re-used (see below)

7.3 Existing Components

The LLDC Design Guide recommends that designers should 'reduce waste and use resources efficiently' as part of the construction process and they should consider re-using materials from demolition, and also reclaiming products or components where available. On this basis, we have identified the below list of materials and components that should be considered for re-use or re-allocation within the Olympic Park as part of the streetscape improvements.

- Concrete Setts: 100 x 100 x 100mm setts around tree pits should be crushed and used as sub-base.
- Kerbs: PCC conservation kerbs, 255 x 205mm, lifted for re-use.
- PCC slabs: 600 x 600mm & 450 x 600mm, lifted for reuse.
- Tactile paving: granite, lifted for re-use.
- Concrete (Escofet) slab benches: re-locate to social seating areas.

- Bike Racks and individual stands: relocated to suit new layout and areas of predicted demand.
- Litter and recycle bins: re-sited locally to respond to new layouts - additional ones needed at bus stops and areas of predicted demand.
- Salt bins: these should be relocated locally, away from busy pedestrian areas.
- Security bollards (stainless steel); if needed relocate to suit new layout.
- Security bollards (black); if needed relocate to suit new layout.
- Tree uprighters: retain with retained trees and re-locate in accordance with lighting strategy.
- Street lighting: relocate existing columns and match with new infrastructure where needed.

Whilst we have prepared an overarching materials and component strategy for the study area, we have also developed sub-strategies for each of the three streetscapes in response to their individual designs and layouts.

7.4 Montfichet Road

Existing Description

A wide dual carriageway `service road' is softened only with occasional semi-mature trees and ground cover central reservation planting. The overall lack of spatial definition and large scale of buildings creates a `vehicular' scaled space with few `invitations' to walk, cycle or `stay'.

Figure 7.3: Example of Existing Streetscape on Montfichet Road Looking North



The road is open to the east, as Stratford Station sits in a cutting, allowing views to the rapidly changing skyline of Stratford Town Centre. The two-metre high concrete parapet wall creates a blank edge to the east side and the massed bulk of the Westfield shopping centre is the most significant built feature on the western street edge with some very limited active frontage. It is unlikely that these principle edge conditions will change significantly in the foreseeable future with the exception of the car park site on the corner of Montfichet Road and Westfield Avenue. It is assumed that the proposed development on this site will be of a similar scale and type as Westfield in relationship with the public realm.

Design Intent

Montfichet Road is an important walking and cycling route that links the new residential districts of East Village to Westfield, Queen Elizabeth Park and Stratford Bus Station. Invitations to walk, cycle and stay need to be improved with new 'social' spaces at the Westfield Bridge and Bus Station. The scale of the space needs to be humanized with significant tree planting which will also mitigate wind tunnel effects and the bleak, hard character of the space.

The below table provides a detailed breakdown of our recommended materials and components for Montfichet Road – the recommendations are based upon the Material Schedule in the LLDC Design Guide.

Table 7.1: Montfichet Road – Proposed Materials and Components

MATERIAL	RE-USE OPTION	CONCRETE & STONE OPTION
ROAD KERBS	PC concrete 'conservation' kerbs 255 x 205mm*	Granite silver grey fine picked 150 x 200mm.
FLUSH EDGINGS	PC concrete 50x150mm	PC concrete 50x150mm
FOOTWAYS	PC Concrete slabs 600x600mm & 450x600mm*	PC concrete 600x900mm standard slab
CYCLEWAYS	Match existing: bonded crushed stone	Match existing: bonded crushed stone
CYCLE LANE DELINEATOR	PC concrete 200 x 200mm by Marshalls*	PC concrete 200 x 200mm by Marshalls*
CARRIAGEWAYS	New asphalt wearing course.	New asphalt wearing course.
VERGES	Planted	Planted
SEATS	To match existing: 2m black steel & recycled plastic with backs and arms rests	To match existing: 2m black steel & recycled plastic with backs and arms rests
LITTER/ RECYLCE BINS	To match existing: attached to light columns where possible	To match existing: attached to light columns where possible
STREET LIGHTS	Match existing	Match existing
TREES	Mixed native species – refer to planting plan	Mixed native species – refer to planting plan
SUDs/SHRUBS	Mixed groundcover species to be agreed – refer to planting plan	Mixed groundcover species to be agreed – refer to planting plan

*Re-used existing and/or reclaimed from Westfield Avenue

7.5 Waterden Road

Existing Description

The absence of built form along Waterden Road creates an open street corridor with extensive views out north, south and west across Queen Elizabeth Park towards Canary Wharf and central London. The essential ‘open’ parkland character of Waterden Road should be retained and reinforced, with increased opportunities to rest and enjoy the extensive views. Walking and cycling facilities are generally absent on the northern side of the road and should be introduced to help further enhance the appeal of Waterden Road as a key route for pedestrians and cyclists.

Design Intent

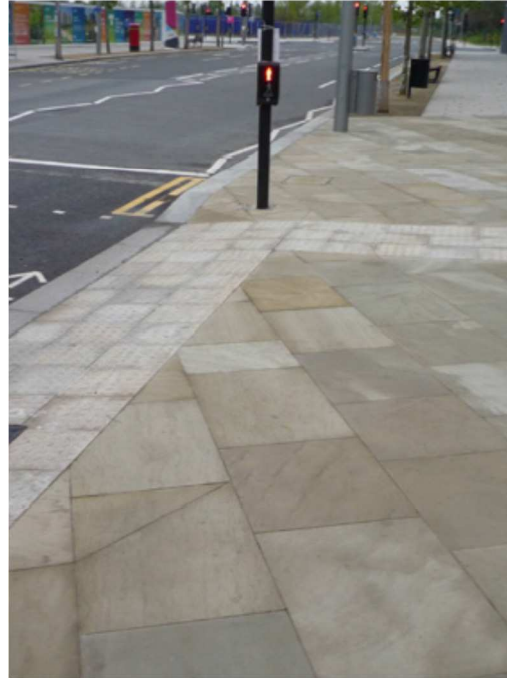
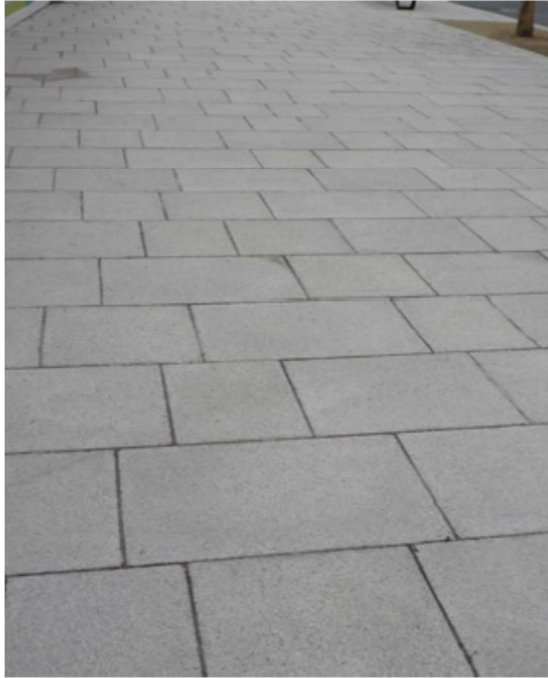
To create a strong east-west walking and cycling link to QEP which reflects the character of the Park and retains the open extensive views.

Table 7.2: Waterden Road – Proposed Materials and Components

MATERIAL	RE-USE OPTION	CONCRETE & STONE OPTION
ROAD KERBS	PC concrete ‘conservation’ kerbs 255 x 205mm*	Granite silver grey fine picked 300x200mm.
FLUSH EDGINGS	PC concrete 50x150mm	Granite silver grey fine picked 150x200mm.
FOOTWAYS	PC Concrete slabs 600x600mm & 450x600mm*	York stone slabs 600x900mm
CYCLEWAYS	Match existing: bonded crushed stone	Match existing: bonded crushed stone
CYCLE LANE DELINEATOR	PC concrete 200 x 200mm by Marshalls*	PC concrete 200 x 200mm by Marshalls*
CARRIAGEWAYS	New asphalt wearing course	New asphalt wearing course.
SEATS	Timber & stainless steel to match QEP	Timber & stainless steel to match QEP
LITTER/ RECYLCE BINS	Match existing – mounted on light columns where feasible	Match existing – mounted on light columns where feasible
STREET LIGHTS	Existing retained	Existing retained
TREES	Mixed native species – refer to planting plan	Mixed native species – refer to planting plan
SUDs/SHRUBS	Mixed groundcover species to be agreed – refer to planting plan	Mixed groundcover species to be agreed – refer to planting plan

*Re-used existing and/or reclaimed from Westfield Avenue

Figure 7.4: Existing Materials used in the Olympic Park

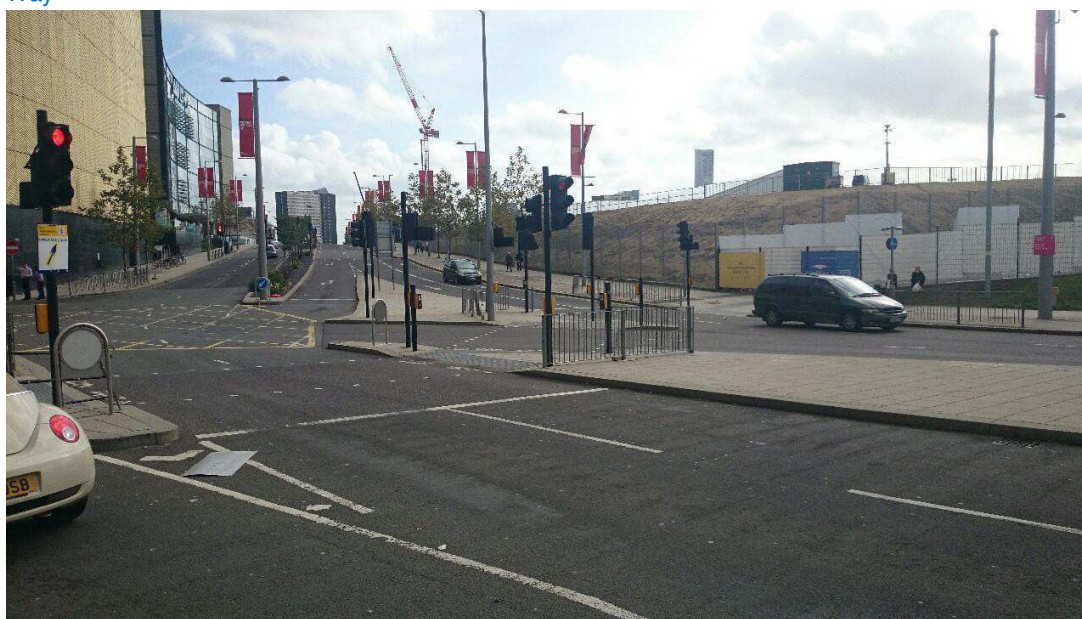


7.6 Westfield Avenue

Existing Situation

This street is continually evolving as it develops with large-scale buildings similar to Westfield and the student accommodation tower; however the appearance of future structures and the surrounding streetscape is likely to be of a similar design to what has already been completed. Westfield Avenue needs to be further humanised and softened with planting as the mass of the existing, and proposed built form will be very dominating and could have detrimental micro-climatic effects (wind tunnelling, shade etc.) when complete. The overall character of the space should reflect its greater use as a commercial and social street, with frequent invitations to sit and stay along with an improved walking and cycling environment.

Figure 7.5: View of the existing streetscape on Westfield Avenue - looking east from the junction with International Way



Design Intent

To create a contemporary ‘downtown’ urban street with social spaces that responds to the building uses. The scale of the street and defining architecture needs to be humanized with significant tree planting.

Table 7.3: Westfield Avenue – Proposed Materials and Components

MATERIAL	RE-USE OPTION	CONCRETE & STONE OPTION
ROAD KERBS	PC concrete ‘conservation’ kerbs 255 x 205mm	Granite silver grey fine picked 300x200mm.
FLUSH EDGINGS	PC concrete 50x150mm*	Granite silver grey fine picked 150x200mm.
FOOTWAYS	PC Concrete slabs 600x600mm & 450x600mm*	York stone slabs 600x900mm
CYCLEWAYS	Match existing: bonded crushed stone	n/a
CYCLE LANE DELINEATOR	PC concrete 200x200mm by Marshalls	PC concrete 200x200mm by Marshalls
CARRIAGEWAYS	New asphalt wearing course.	New asphalt wearing course.
LOADING/PARKING	Permeable PC concrete block paver, dark grey/charcoal	Permeable clay paver 200 x 100 square edged, dark grey/charcoal.
FOOTWAY CROSSOVERS	Permeable PC concrete block paver, dark grey/charcoal	York stone setts 100x200mm
VERGES	Planted	Planted
SEATS	Timber & stainless steel Voss BS20 with arm rests	Timber & stainless steel Voss BS20 with arm rests

MATERIAL	RE-USE OPTION	CONCRETE & STONE OPTION
LITTER/ RECYLCE BINS	Match existing – mounted on light columns where feasible	Match existing – mounted on light columns where feasible
STREET LIGHTS	Existing relocated	Existing relocated
TREES	Mixed native species – refer to planting plan	Mixed native species – refer to planting plan
SUDs/SHRUBS	Mixed groundcover species to be agreed – refer to planting plan	Mixed groundcover species to be agreed – refer to planting plan

7.7 Planting

We have recommended extensive use of street trees and shrub planting along the three streetscapes to soften the hard urban landscape and provide the benefits associated with a ‘green’ street such as micro-climatic enhancement, climate change mitigation, increased biodiversity, and general wellbeing. This approach compliments the LLDC Design Guide which states that ‘street trees are a valuable resource in the urban landscape and contribute greatly to the street scene’.

- Trees have been chosen to create mixed (to build in resilience) informal avenues using species set out in the ‘Legacy Street Technical Design Guide’ and known for their usefulness and reliability in street environments. The species of trees recommended is dependent on the assumed root volume available and the space for crown development. As a result a simple palette of medium and large trees has been used (see below).
- Shrubs will generally be limited to ground covering species that grow no more than 0.6m high and again will be chosen for their habitat value and suitability to urban streets. Shrub species will be chosen in consultation with a specialist ecologist when the SUD’s detail has been developed.
- Clear Footways; a key design consideration for all proposed street trees is that the tree pit configurations ensure a minimum effective footway width of 2m

Prior to recommending the installation of new trees and/or shrubs – we recommend that the below approach is followed to review the condition of existing trees within the Olympic Park.

1. Existing tree condition survey

A qualified arboriculturalist should carry a condition survey of the existing trees. They can then advise on the suitability (and methods) of the suitability of trees for transplanting.

2. Existing trees to be retained

A number of trees can be retained in their existing locations and should be protected in accordance with BS5837:2012 through the duration of the construction works.

3. Existing trees to be felled

A small number of trees are dead and or severely stressed and should be felled. To accommodate the works, it may be necessary to fell many more trees if the arboriculturalist’s report finds that the trees are not suitable for transplanting.

4. Existing trees to be transplanted

It may be feasible to transplant existing trees (pending the arboriculturalist's report) from the central reservations and footways to any available local sites. This will require some preparatory works to the trees to help them survive the transplanting process.

7.8 Proposed Tree Planting

The below list of proposed trees has been developed in conjunction with the recommended species in the LLDC Design Guide, and is also based on the combined project experiences of Mott MacDonald and Urban Movement in introducing new trees into streetscapes.

Table 7.4: Proposed Medium Street Trees

Drawing Ref	Species	Common Name
ACE	<i>Acer campestre</i> 'Elsrijk'	Field maple
CBF	<i>Carpinus betulus</i> 'Frans Fontaine'	Hornbeam
PCC	<i>Pyrus calleryana</i> 'Chanticleer'	Pear
SAM	<i>Sorbus aria</i> 'Majestica'	Whitebeam
TCG	<i>Tilia cordata</i> 'Greenspire'	Small leaf lime

Table 7.5: Proposed Large Street Trees

Drawing Ref	Species	Common Name
APC	<i>Acer platanoides</i> 'Columnare'	Norway maple
ARA	<i>Acer rubrum</i> 'Armstrong'	Red Maple
LST	<i>Liquidambar styraciflua</i>	Sweet gum
QRF	<i>Quercus robur</i> 'Fastigiata'	Cypress oak
TPP	<i>Tilia platyphyllos</i> 'Princes Street'	Broad leaf lime

7.9 Utilities

This planting strategy has been developed before trial holes have been excavated to confirm the absence (or otherwise) of underground utilities in the proposed tree rooting zones. If it proves impossible to plant a significant proportion of the trees as shown, then the strategy and layout needs to be revised to allow for the retention of all the existing trees (as identified by the Borough tree officer as suitable for retention in the tree condition survey) to ensure there is a significant tree presence on the street. Even if the existing trees are retained, additional species will still be required to achieve an amended strategy.

In essence the proposals for Montfichet Road, Waterden Road and Westfield Avenue will result in a net loss of carriageway and a net increase in footways, cycle tracks and trees/ planting. To implement the 're-use' strategy for Montfichet Road outlined above it will be necessary to construct Waterden Road/ Westfield Avenue first to enable slabs and kerbs to be lifted and stored for re-use. If the 'replace with new'

strategy is implemented kerbs and slabs should be lifted and stored for repair and maintenance re-use locally.

8 Scheme Costs and Construction Phasing

8.1 Introduction

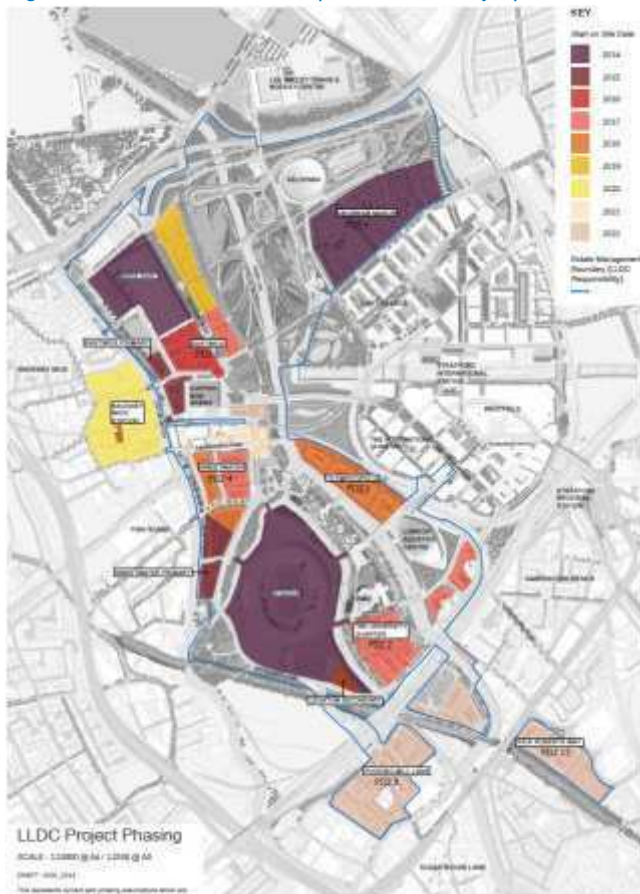
A key element of the study brief related to consideration of how the scheme could be delivered on the ground, and closely linked to this, the development of high level costings for the scheme broken down on a section by section basis.

This section provides a discussion on these two issues and outlines the approach taken in each case.

8.2 Construction Phasing

The proposed changes to the highway layout within the study area are significant and represent a major undertaking in construction terms. Coupled with this, a significant amount of development is planned for areas immediately adjacent to the carriageway, most notably the International Quarter, which is already underway, and Cherry Park which is currently at pre-application stage. Further development is planned in the near future, as demonstrated in figure 8.1 below which shows planned start dates on site:

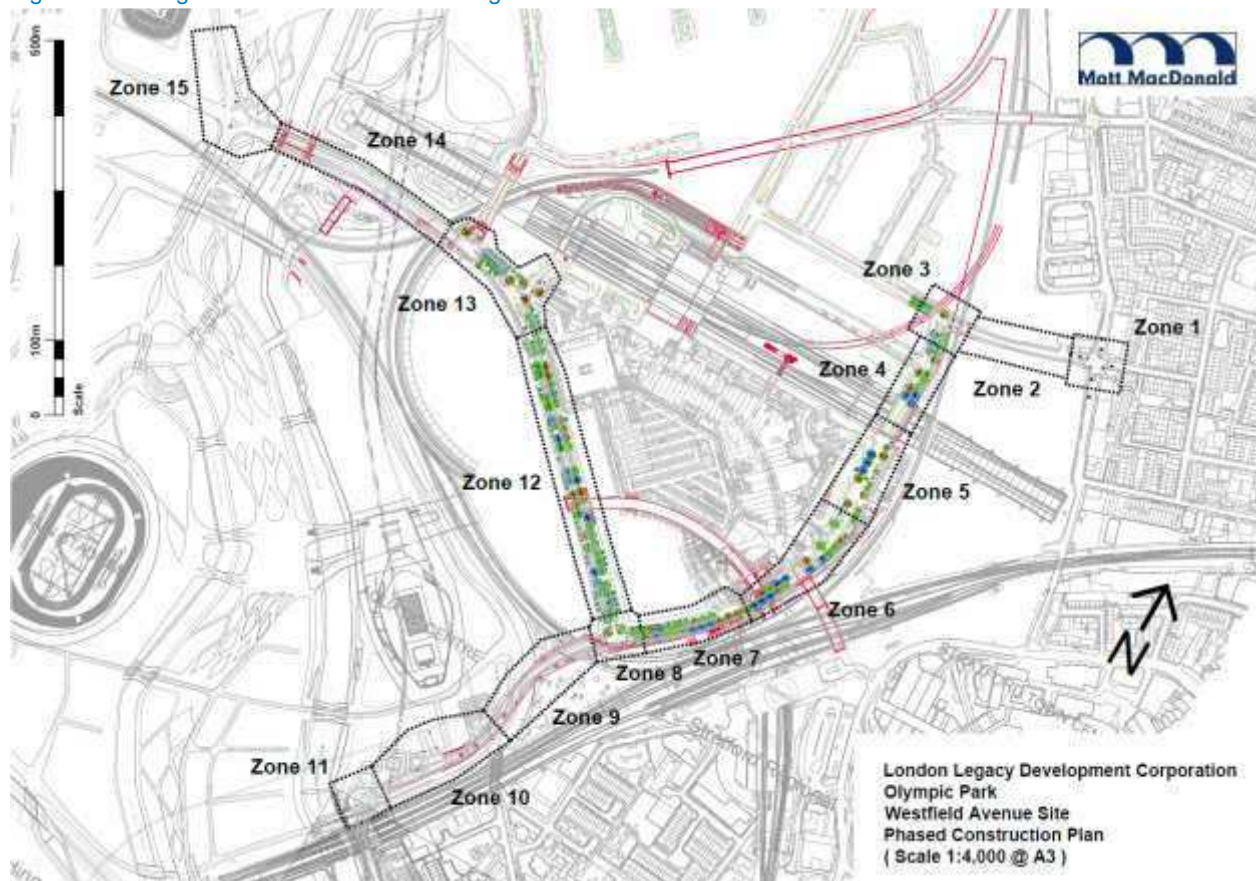
Figure 8.1: Planned Development in the Olympic Park



Source: LLDC

A high level construction phasing plan has been produced as shown in figure 8.2 below and included as an A3 PDF drawing in Appendix E. For consistency, this has also been used to prepare high level cost estimates for each of the identified sections as discussed subsequently in this section.

Figure 8.2: High Level Construction Phasing Plan



Due to the complex nature of the proposed improvements, it will likely prove difficult to implement individual sections of the central area in isolation. This is largely due to the proposal to remove the dual carriageway which would inevitably introduce the need for complicated transition arrangements between single and dual carriageway if adjacent sections were left as existing.

However, there are a number of potential opportunities for 'quick wins' within some sections where the proposals are relatively minor in nature and would not have an impact on adjacent sections. These areas are largely located on the periphery of the core scheme and are identified in table 8.1 below along with a brief description of the works and an estimated construction timescale.

Table 8.1: Potential 'Quick Win' Schemes

Zone	Scheme Description	Estimated Construction Timescale
1	Leyton Road Junction – Conversion to 2-stage right turn operation	1 month
2	Penny Brookes St – Addition of segregated cycle lanes	3 months
11	Warton Road – removal of roundabout and addition of cycle facilities	4 months
15	Waterden Road – minor junction changes to accommodate transition from existing single lane carriageway on Waterden Road	3 months
14	Westfield Avenue Bridge – removal of dual carriageway and introduction of footway on north side along with segregated cycleway	5 months

The sections of the scheme identified above could in theory be delivered at any time as funding becomes available. It is recommended that funding is sought for these relatively minor elements and that construction work should aim to commence within 6 months.

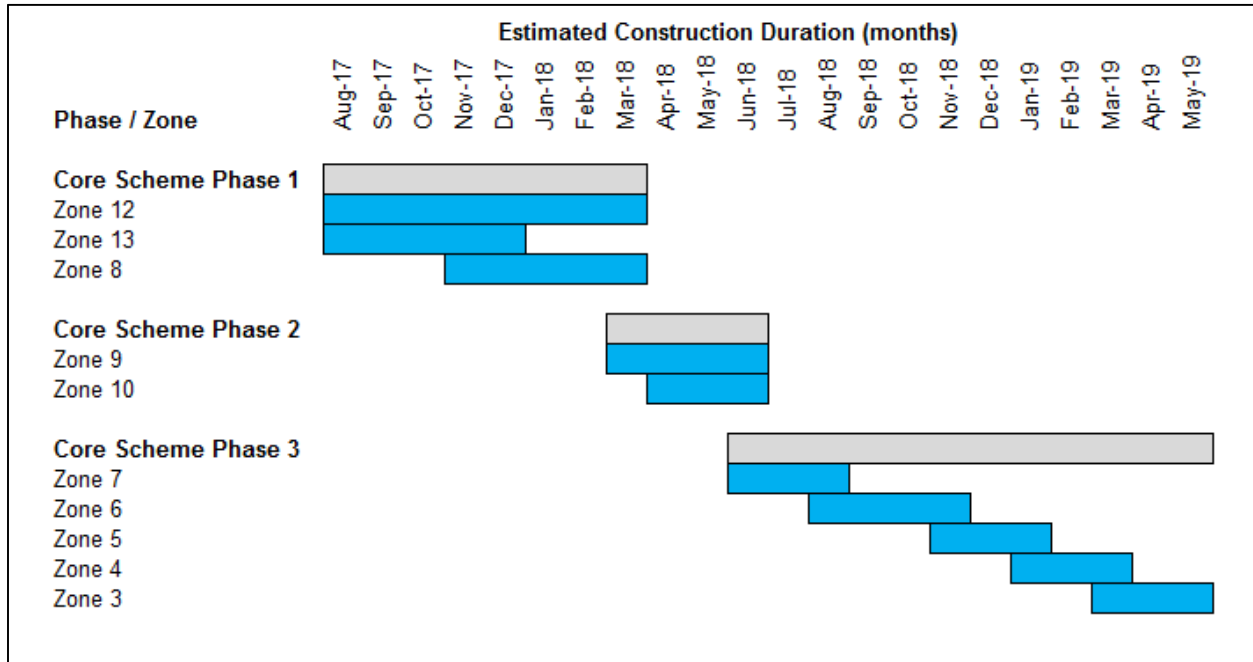
Delivery of the remaining sections of the scheme (referred to hereafter as the core scheme) will be somewhat more complex and possible links to adjacent development proposals need to be fully explored before a detailed programme can be developed. Whilst the adjacent development introduces a degree of complexity in construction terms, it also provides an opportunity for third party funding and the potential for joint construction works and/or Section 278 & 106 agreements.

A key milestone in terms of the completion of adjacent development sites is the proposed re-opening of Westfield Avenue and the main pedestrian route into the Olympic Park following completion of utility works and the majority of construction activity related to the earlier stages of the International Quarter development. The proposed date for this re-opening is March 2018 and LLDC are keen to ensure that the proposed changes to Westfield Avenue (Zone 12) are in place by that date. This is therefore seen as the key date which should drive the construction programme.

Based on the key March 2018 date outlined above, figure 8.3 overleaf outlines a high level construction phasing proposal for delivery of the core scheme. The early quick wins identified in table 8.1 are not included in this programme as their delivery is not dependant on other parts of the scheme.

The suggested approach is to prioritise construction of the Westfield Avenue (Zone 12) and adjacent sections (Zones 13 & 8) in order to meet the March 2018 re-opening date and to take advantage of possible funding and co-ordinated construction opportunities arising from the International Quarter and Cherry Park developments. This would comprise Phase 1 and it is suggested that construction of these sections would need to commence no later than August 2017 in order to meet this date, which should provide sufficient time for further design and preliminaries required in advance of construction commencing. If an earlier construction start date can be achieved then this should be accommodated.

Figure 8.3: High Level Construction Programme – Core Scheme



Following completion of Phase 1, it is suggested that Phase 2 should include the southern sections of Montfichet Road (Zones 9 & 10). These two sections could be progressed simultaneously and should take around 4 months to complete on-site.

The remaining sections would then comprise the main Montfichet Road section from its junction with Westfield Avenue north to the junction with Penny Brookes Street (Zones 7, 6, 5, 4 & 3). It is recommended that these sections should comprise Phase 3 of the project and should be delivered in a phased approach moving in a south – north direction. This would keep any disruption associated with the construction to a minimum and allow the remainder of the network to operate efficiently while the construction work is taking place.

8.3 High Level Cost Estimate

A high level cost estimate has been produced for each of the 15 zones identified on the plan in figure 8.2. In order to provide a robust estimate at this stage of design, wherever possible we have taken measured quantities and areas directly from the CAD drawings.

The quantities measured directly from the CAD drawings include the following:

- Length of existing kerb line to be removed
- Length of new kerb line

- Length of new footway/cycleway segregator
- Length of new footway/cycleway edgings
- Area of existing central reserve and/or footway/road island(s) to be reconstructed as carriageway
- Area of carriageway resurfacing (assumed all existing carriageway to be resurfaced)
- Area of new footway/cycleway and verges and/or road island(s)
- Landscaping of verges and street scene

For each of these, a unit cost has been applied which is based on our existing knowledge of typical contractor rates for such items. Details of the unit costs applied to each item are included in the detailed cost breakdown in Appendix F.

In addition to the measured items in each zone, an estimate of the traffic signal costs has been made on a zone by zone basis. Costs for drainage, signs & lines and streetlighting have been estimated for the entire scheme based on the length of total kerblin and applying assumed distances between drainage gullies and lighting columns.

Allowances for Traffic Management (TM), utilities diversions and unmeasured items have also been made (assumed each at 25% of measured costs). Finally, a contingency of 30% has been applied to the total cost to take account of any unknown issues that are inevitable at this stage of design. Table 8.2 below provides a summary of the costs by section.

Table 8.2: High Level Cost Summary

Zone	Estimated Cost
Measured items by zone	
Zone 1	£ 25k
Zone 2	£ 100k
Zone 3	£ 450k
Zone 4	£ 250k
Zone 5	£ 700k
Zone 6	£ 450k
Zone 7	£ 650k
Zone 8	£ 500k
Zone 9	£ 200k
Zone 10	£ 200k
Zone 11	£ 150k
Zone 12	£ 975k
Zone 13	£ 850k
Zone 14	£ 200k

Zone	Estimated Cost
Zone 15	£ 50k
Sub total	£ 5.75 M
Estimated costs (whole scheme)	
Signs and road markings	£ 150k
Drainage	£ 400k
Highway lighting	£ 250k
Sub total	£ 800k
Allowances	
Traffic management + restricted working (Allow + 25% uplift)	£ 1.3 M
Utilities diversions and works (Allow + 25% uplift)	£ 1.3 M
Unmeasured Items (Allow + 25% uplift)	£ 1.3 M
Sub total	£ 3.9 M
Contingency	
30%	£ 3.36 M
Detailed Design Fees and Supervision Costs (est)	£750k
Total (est)	£ 14.5 M

9 Next Steps and Conclusions

9.1 Next Steps

Given the lack of any secured funding for the scheme currently it is essential that a series of next steps are identified and agreed between LLDC and key delivery partners including Westfield, TfL, Lend Lease and LB Newham. As a starting point, it is suggested that immediate next steps should include the following:

- Consideration of available funding opportunities, particularly in relation to adjacent development sites where significant potential exists to secure contributions through the planning process. The immediate priorities for this should include the International Quarter, Cherry Park and proposals for Meridian Square that may result in taxis / coaches relocating to Montfichet Road
- Closely related to the above, development of a detailed implementation plan which links to committed developments
- Formation of a scheme delivery working group that can facilitate further discussion with stakeholders, especially TfL, Westfield, LB Newham
- Identification of short term funding that can be used to expedite delivery of the identified 'quick win' schemes
- Further design work and discussion with TfL / BEAP in relation to accessibility issues and pedestrian / cyclist conflict
- Commissioning of a Vehicle Dynamics Assessment to assess how the HVM cordon could be potentially reduced in scale or provided by an alternative means such as planters or seating
- Detailed design of measures to be progressed. It is suggested that this should be linked to the construction programme with the detailed design taking place in stages to reflect the intended delivery programme
- Identification and involvement of a contractor at the earliest possible stage to assist with delivery and costing considerations
- Application for planning permission (if necessary).

9.2 Conclusions

Mott MacDonald and Urban Movement have worked closely with LLDC and key stakeholders to develop a feasibility design proposal for Westfield Avenue and Montfichet Road. The proposed design meets the aspirations of LLDC as specified in the study brief and has the in principle agreement of all stakeholders who have been engaged in the design process through the project steering groups and individual stakeholder engagement activities.

The proposed design incorporates a number of innovative features that reflect current UK and International best practice, particularly in the field of cycle infrastructure design. Design features incorporated include a

flexible verge to segregate cyclists from adjacent traffic and provide space for planting, protected junctions for cyclists to remove conflict between turning vehicles and cyclists, and floating bus stops and lay-by's that do not impact on the directness of the cycle lane.

Traffic modelling has shown that with current traffic levels the proposed design can be incorporated without having a detrimental impact on junction capacity and operation. Sensitivity testing shows that the addition of 10% and 20% traffic to represent future growth can still be accommodated within the majority of the network. Two junctions were shown to exceed their theoretical capacity in the +20% scenario but only in the busiest Saturday PM peak scenario.

High level costings produced based on the feasibility design shows that the total scheme is likely to cost in the region of £14.5m. This is based on a combination of measured items from the CAD drawings and allowances for other items. A 30% overall contingency is also included in this figure to represent the fact that the proposals are still at a relatively early stage of design and there are a number of unknowns that will undoubtedly emerge as the project progresses.

Construction of the scheme will be a complex and challenging task due to the comprehensive nature of the proposed changes and the adjacent development schemes that will start on site during the likely period of scheme construction. Significant opportunity exists to co-ordinate construction of the scheme with these adjacent developments and will be crucial to ensuring delivery within the desired timescales. A key date in the high level programme developed is March 2018, by when Westfield Avenue will be re-opened with utilities works and construction activity associated with the adjacent International Quarter development largely complete.

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Appendix A. Proposed Layout Drawings



Appendix B. QRP Report



Appendix C. BEAP Report



Appendix D. Modelling Summary Table and Linsig Outputs

Appendix E. Construction Phasing Plan



Appendix F. Detailed Cost Estimate