Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Transport Assessment

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Victoria Embankment Foreshore

Main Report

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Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Transport Assessment

Section 17: Victoria Embankment Foreshore

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17.1 Introduction

17.1.1 This site-specific *Transport Assessment (TA)* presents the findings of the assessment of the transport issues of the Thames Tideway Tunnel project at the Victoria Embankment Foreshore site located within the City of Westminster.

17.1.2 The assessment takes into consideration the changes as a result of all other Thames Tideway Tunnel project sites to ensure that results indicate the significance of each individual site in combination with construction works being undertaken at other sites.

17.1.3 The site is adjacent to, and south of, the Hungerford Railway Bridge and Golden Jubilee footbridge. It is located in the reclaimed foreshore area behind the new river wall and includes moving one permanently moored vessel, the Tattershall Castle.

17.1.4 The purpose of this *TA* is to identify the site context, development proposals and any transport implications arising from these proposals to ensure that appropriate mitigation measures are identified, where necessary.

17.1.5 The *TA* draws on a number of project-wide and common documents which include the *Transport Strategy* and the *Code of Construction Practice (CoCP)*. Further detail on these documents which form the background to the *TA* can be found in Section 1 of the *TA*.

17.1.6 The *TA* structure is as follows:

a. Section 17.2 includes a description of the proposed development. This details construction phasing, vehicle and person trip generation and construction traffic routing. It also provides details on transport during the operational phase.

b. Section 17.3 outlines the assessment methodology used for the TA for the construction and operational phases.

c. Section 17.4 details the baseline conditions on the transport network surrounding the site, including survey data analysis and accident analysis.

d. Section 17.5 provides the assessment of the construction phase of the project, including a comparison between the construction base case and the construction development case. This section also outlines sensitivity testing for the highway network.

e. Section 17.6 provides the assessment of the operational phase of the project.

f. Section 17.7 summarises the *TA* findings.

17.2 Proposed development

17.2.1 The proposed development site is located in the City of Westminster. The site is located in the foreshore of the River Thames, with part of the site extending west onto a section of footway and carriageway of Victoria Embankment (A3211). A permanently moored boat, the Tattershall Castle (a floating bar and restaurant) is located within the site area. Figure 17.2.1 in the Victoria Embankment Foreshore *Transport Assessment* figures shows the Victoria Embankment Foreshore site location.

17.2.2 The site is bounded to the north, east and south by the River Thames and to the west by Victoria Embankment (A3211). To the north is the restaurant ship Hispaniola, and beyond that Hungerford Bridge/Golden Jubilee footbridges and Embankment Pier. Two moorings lie within the southern boundary of the site. Another mooring is located to the south of the site along with Whitehall Stairs which extend into the river and support the RAF memorial.

17.2.3 The closest buildings to the site, which includes residential properties, are those to the west of Whitehall Gardens and comprise Whitehall Court and the National Liberal Club.

17.2.4 Existing access to the site is directly from Victoria Embankment (A3211), which is part of the Transport for London Road Network (TLRN), close to the junctions with Northumberland Avenue (A400) to the north and Horse Guards Avenue to the south.

Construction

17.2.5 The construction site would be located on the foreshore of the River Thames. In order to provide working areas, the site would also occupy a section of the existing riverside footway of Victoria Embankment (A3211). Vehicle access to and from the site would take place from the nearside lane of the westbound carriageway of Victoria Embankment (A3211). This lane would need to be closed for periods of time during the works.

17.2.6 Construction at the Victoria Embankment Foreshore site is anticipated to last for four and a half years. There would be five phases of construction at the Victoria Embankment Foreshore site: phase 1 – covering site set-up (including advanced support works for utilities diversions prior to foreshore works, part of phase 1 only), phase 2 – shaft construction, phase 3 – tunnelling (connection tunnel), phase 4 – construction of other structures, and phase 5 – demobilisation and site restoration. The highway layout during utility diversion plan in the Victoria Embankment Foreshore *Transport Assessment* figures presents the highway layout during utility diversions, and the highway layout during construction – phases 1-5 plan in the Victoria Embankment Foreshore *Transport Assessment* figures presents the highway layout during construction.

17.2.7 Stage 1 Road Safety Audits have been carried out on the illustrative highway layouts proposed for this site. The *Road Safety Audits* for this site are contained in Section 17 Appendix F.

17.2.8 The Thames Path runs along the riverside footway of Victoria Embankment (A3211), within the site boundary. Pedestrians using the Thames Path would be diverted away from the section affected by construction works. This would be necessary throughout the construction works and therefore the route would be diverted to the western footway of Victoria Embankment (A3211) for the duration of the construction period. Pedestrians would use the existing signalised pedestrian crossings located at the junctions of Victoria Embankment (A3211) with Horse Guards Avenue and at Northumberland Avenue (A400) to cross between the eastern and western footways of Victoria Embankment (A3211).

17.2.9 Vehicle access to and from the site would take place using a 'left-turn in / left-turn out' arrangement from the westbound carriageway of Victoria Embankment (A3211).

17.2.10 During the early stages of utility diversion works, it would be necessary to reduce the carriageway width. The coach parking bays in the eastbound and westbound carriageway of Victoria Embankment (A3211) between the junctions with Northumberland Avenue (A400) and Horse Guards Avenue would be temporarily restricted. The loading bay in the westbound carriageway of Victoria Embankment (A3211) to the north of the coach parking bays and the motorcycle bay in the eastbound carriageway of Victoria Embankment (A3211) to the south of its junction with Northumberland Avenue (A400) would also be temporarily restricted during the utility diversion works.

17.2.11 In addition, the central reservation would be removed and lane widths would be reduced to allow two lanes in the eastbound carriageway and two lanes in the westbound carriageway of Victoria Embankment (A3211) to continue to operate. The width of the outside lanes would be 3m and the inside lanes would be 3.25m in each direction. For short periods it may be necessary to reduce the westbound carriageway of Victoria Embankment (A3211) to a single lane to undertake construction works. This would take place outside of peak hours or overnight; therefore, this has not been modelled within the *TA*.

17.2.12 During the later stages of utility diversions, the required working area would be smaller and the eastbound lanes of Victoria Embankment (A3211) would be reinstated to their existing lane widths. The westbound lanes of Victoria Embankment (A3211) would continue to operate at 3.25m and 3m.

17.2.13 Following the utility diversions, the coach parking bays and the motorcycle bay in the eastbound carriageway of Victoria Embankment (A3211) and the central reservation would be reinstated. However, the coach parking bays and the loading bay in the westbound carriageway of Victoria Embankment (A3211) would continue to be temporarily restricted.

17.2.14 During phases 1-4 of construction, intermittent closure of one westbound lane would be required. From time to time as required by the construction works, a lane would be created on the nearside lane of the westbound carriageway of Victoria Embankment (A3211) to accommodate construction vehicles arriving and departing from the site or when required for construction activities, such as stacking of vehicles during a large

concrete pour. Two lanes of traffic would be maintained in each direction. The width of the outside lanes would be 3m and the inside lanes would be 3.25m in each direction during the construction phases 1-4.

17.2.15 Phase 5 of construction would involve removal of all the temporary traffic restrictions along Victoria Embankment (A3211) and the highway layout would be reinstated to the baseline condition. The Thames Path would also be reinstated and the construction access would be removed.

17.2.16 During construction cofferdam fill (import and export), shaft and other excavated material (export) would be transported by barge and all other material by road. For the assessment it has been assumed that 90% of these materials would be taken by river. This allows for periods when the river is unavailable and material unsuitable for river transport. All other material would be transported by road.

17.2.17 Parking for five essential maintenance vehicles would be provided on site. No worker parking would be provided.

17.2.18 Construction details for the site relevant to the construction transport assessment are summarised in Table 17.2.1.

Table 17.2.1 Construction traffic details

Description	Assumption
Assumed peak period of construction lorry movements	Site Year 1 of construction
Assumed average peak daily construction lorry vehicle movements (in peak month of Site Year 1 of construction) and duration	28 movements per day (14 vehicle trips) For one month
Assumed peak period of construction barge movements	Site Year 1 of construction
Assumed average peak daily construction barge movements (in peak month of Site Year 1 of construction)	4 movements per day (2 barge trips)
Typical types of lorry requiring access (comprising rigid-bodied, flatbed and articulated vehicles)	Excavated material on lorries Plant and equipment deliveries Imported fill lorries Ready mix concrete lorries Office/general delivery lorries Steel reinforcement lorries Temporary construction material lorries including formwork and

Description	Assumption
	falsework Shaft precast concrete lining segments lorries

Note: a movement is a construction vehicle moving either to or from the site. A Site Year is a 12 month period, one in a series of Site Years; Site Year 1 commences at the start of construction.

Construction routes

17.2.19 Figure 17.2.2 in the Victoria Embankment Foreshore *Transport Assessment* figures shows the construction routes for the Victoria Embankment Foreshore site. These have been discussed with both Transport for London (TfL) and the Local Highway Authority. The site is located on the Transport for London Road Network (TLRN) on Victoria Embankment (A3211) approximately 40m south of the junction with Northumberland Avenue (A400). The site is on the east side of the highway and would be accessed from the westbound lane on Victoria Embankment (A3211).

17.2.20 The main junctions along the construction traffic routes are:

a. Victoria Embankment (A3211) / Savoy Street / Savoy Place

b. Victoria Embankment (A3211) / Northumberland Avenue (A400)

c. Victoria Embankment (A3211) / Horse Guards Avenue

d. Victoria Embankment (A3211) / Bridge Street (A302) / Westminster Bridge (A302).

17.2.21 During all phases of construction at Victoria Embankment Foreshore construction vehicles would use the TLRN and the Strategic Road Network (SRN). They would approach the site from the direction of Upper Thames Street (A3211) and Victoria Embankment (A3211) via the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400), approximately 40m north of the site, and travel westbound along Victoria Embankment (A3211) to the site. Vehicle access would be arranged on a 'left-turn in/ left-turn out' basis.

17.2.22 Vehicles leaving the site would travel along the westbound carriageway of Victoria Embankment (A3211) towards Westminster Bridge (A302). Vehicles travelling to destinations to the south would need to cross the bridge and continue their journey along the A3036 towards Lambeth or the A3200 or the A302 towards Elephant and Castle. Vehicles travelling to destinations to the north would turn right at the junction of Victoria Embankment (A3211) and Bridge Street (A302) and would take the A3212 northbound and southbound routes.

17.2.23 The exact routing of construction traffic depends on the origins and destinations of construction materials which are shown indicatively in the *Project-wide TA*.

17.2.24 This construction vehicle routing may overlap for a period with the closure of the Blackfriars Bridge westbound exit slip road onto Victoria

Embankment (A3211) which would be required for part of the works at Blackfriars Bridge Foreshore site. The assessment of the effect of construction routing for Blackfriars Bridge Foreshore and Victoria Embankment Foreshore is inherent in the highway network assessment, and further details of the network changes are located in the *Project-wide TA*.

Proposed construction flows

Construction vehicles and barges

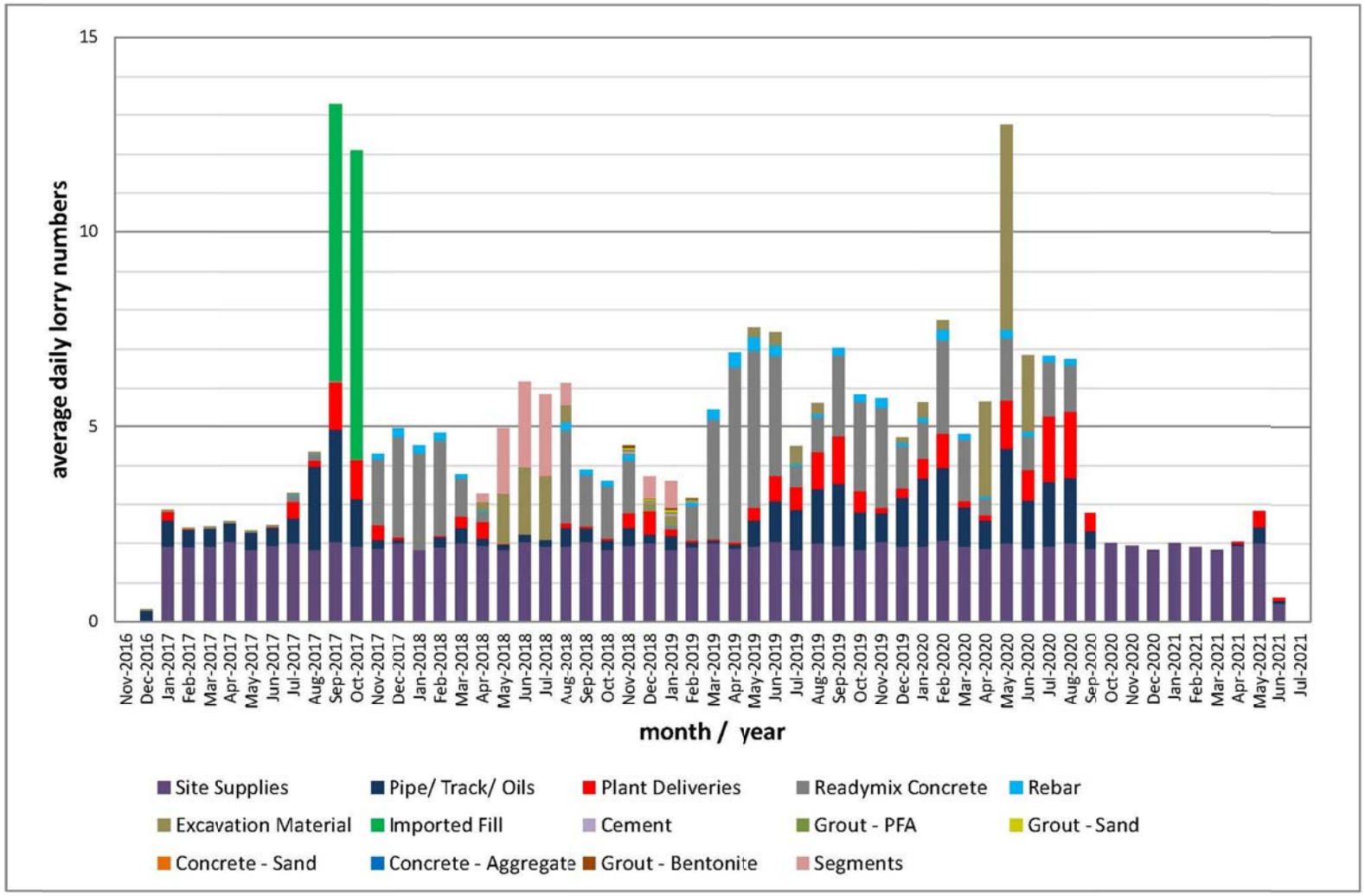
17.2.25 Vehicle movements would take place during the standard day shift of ten hours on weekdays (08:00 to 18:00) and five hours on Saturdays (08:00 to 13:00). In exceptional circumstances HGV and abnormal load movements could occur up to 22:00 for large concrete pours and later at night on agreement with Westminster City Council.

17.2.26 Site-specific peak construction assessment year has been identified. The histograms in Plate 17.2.1 and Plate 17.2.2 show that the peak site-specific activity at the Victoria Embankment Foreshore site for construction lorries would occur in Site Year 1 of construction. The peak activity of construction barges at this site would also occur in Site Year 1 of construction.

17.2.27 This *TA* assesses these site-specific peak construction years. As detailed in Table 17.2.1, there would be an estimated 28 average peak daily construction lorry vehicle movements in the peak month of this peak year and Plate 17.2.1 shows how the number of vehicular movements would vary throughout the construction period. Plate 17.2.2 indicates the variation in the number of construction barge movements during construction.

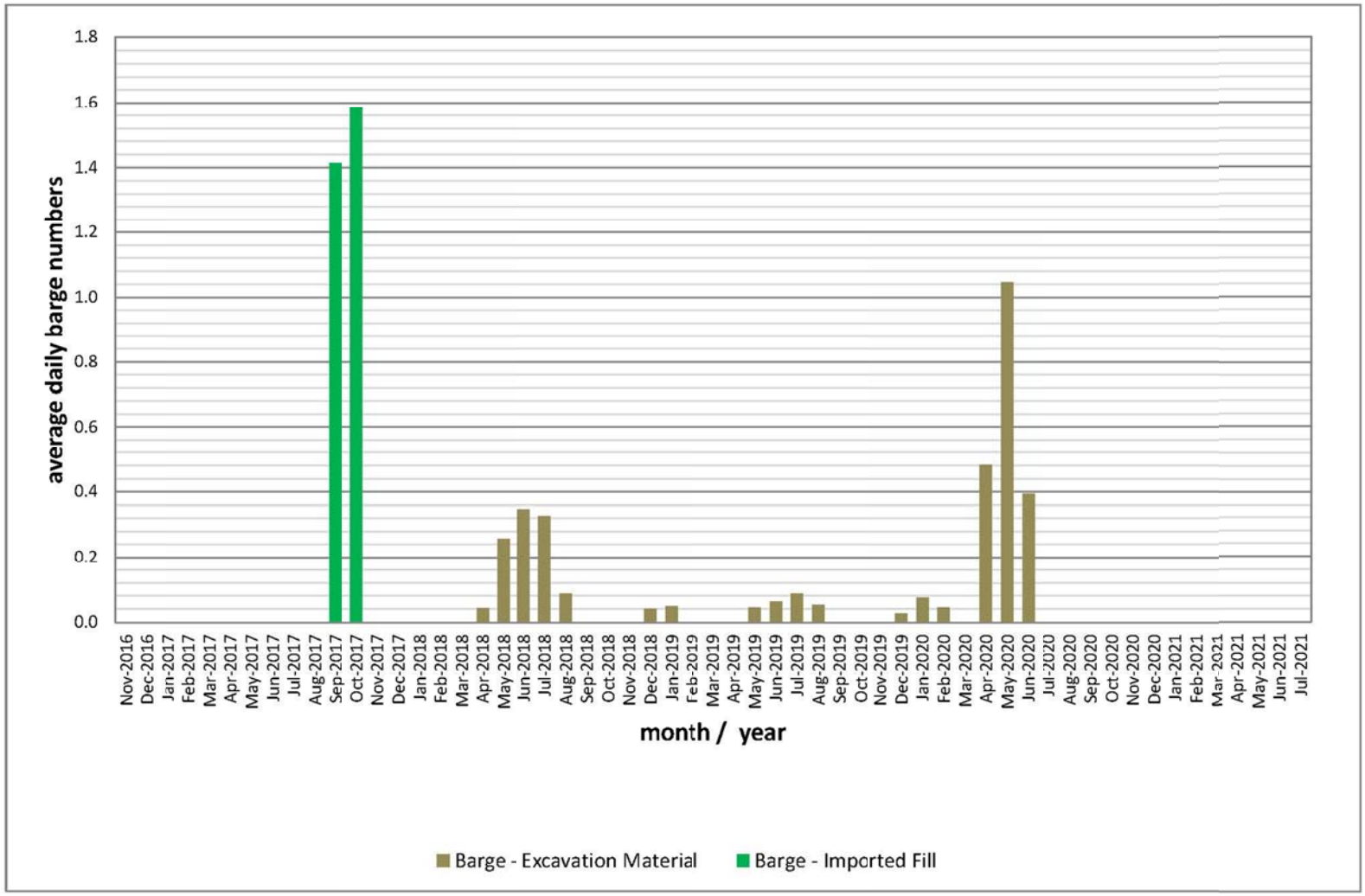
17.2.28 The assessment is based on 10% of the daily number of lorry journeys occurring in the peak hours, which has been agreed with TfL as a reasonable approach. It is recognised that it may be desirable to reduce the number of construction lorry movements in peak hours and the mechanisms for addressing this would form part of the *Traffic Management Plans* (TMP) which are required as part of the *CoCP*.

Plate 17.2.1 Estimated construction lorry profile



Note: Plate shows approximate volumes and number of vehicle trips based upon assumed timings for the works. It is not a programme and remains subject to change.

Plate 17.2.2 Estimated construction barge profile



Note: Plate shows approximate volumes and number of barge trips based upon assumed timings for the works. It is not a programme and remains subject to change.

17.2.29 As the *Project-wide TA* explains, the TfL Highway Assignment Models (HAMs) used for the strategic highway modelling represent peak hours of 08:00 to 09:00 and 17:00 to 18:00 and these have been taken as being the network-wide AM and PM peak hours in the project-wide and site-specific assessments.

17.2.30 The 07:00 - 09:00 and 17:00 - 19:00 periods identified from the local traffic surveys are busier on the network in the weekday than those encountered at the weekends (this is discussed in Section 16.4). Whilst the AM and PM peak hours differ slightly from these network-wide peak hours, in practice the number of vehicle movements at this site would be low in comparison to base case traffic flows on the adjacent network and is expected to be constant throughout the day.

17.2.31 Hourly construction vehicle trips during the inter-peak period are not expected to exceed the hourly trips assumed for the 07:00 to 08:00 and 17:00 to 18:00 periods used in this assessment. The peak travel periods used for the modelling in this assessment are therefore the weekday periods between 07:00 and 08:00 and 17:00 and 18:00.

17.2.32 Other construction vehicle movements associated with site operations and contractor activities would be cars and light goods vehicles (LGVs). The construction vehicle movements expected to be generated by the Victoria Embankment Foreshore site are shown in Table 17.2.4.

Construction workers

17.2.33 The construction site is expected to require a maximum workforce of 65 workers on site at any one time. The number and type of workers is shown in Table 17.2.2.

Table 17.2.2 Maximum estimated construction worker numbers

Contractor		Client
Staff*	**Labour****	**Staff*****
08:00-18:00	**08:00-18:00**	**08:00-18:00**
30	25	10

**Staff Contractor – engineering and support staff to direct and project manage the engineering work and site.*
***Labour – those working on site doing engineering, construction and manual work.*
****Staff Client – Engineering and support staff managing the project and supervising the Contractor*

17.2.34 The mode split outlined in Table 17.2.3 has been used to assess the changes as a result of worker journeys on the highway and

public transport networks. It has been derived using the 2001 Census[i] journey to work data for the area in the vicinity of the Victoria Embankment Foreshore site. The Census data indicates that the predominant mode of travel for journeys to work in this area is public transport.

17.2.35 At this site there would be no parking provided within the site boundary for workers. As parking on surrounding streets is also restricted, and measures to reduce car use would be incorporated into site-specific *Travel Plan* requirements, it is highly unlikely that any workers would travel by car. The Census mode shares have therefore been adjusted in Table 17.2.3 to reflect increased levels of non-car use by workers at this site. The assessment has been undertaken on this basis.

Table 17.2.3 Transport mode split

Mode	Percentage of trips to site	Equivalent number of worker trips (based on 65 worker trips)	
		AM peak hour (07:00-08:00)	PM peak hour (18:00-19:00)
Bus	10%	7	7
National Rail	41%	27	27
Underground	40%	26	26
Car driver	<1%*	0	0
Car passenger	<1%*	0	0
Cycle	2%	1	1
Walk	4%	3	3
River	0%	0	0
Other (taxi/motorcycle)	3%	2	2
Total	100%	65	65

** assuming to be zero for the purpose of this assessment*

17.2.36 As indicated in Table 17.2.3, it is assumed that the predominant mode of travel for journeys to work in this area is public transport and it is assumed that the primary public transport services used would be from Embankment and Westminster London Underground stations on Victoria Embankment (A3211), Charing Cross London Underground and National Rail station at Trafalgar Square and the bus stops on Victoria Embankment (A3211),

[i] Based on 2001 Census. This type of data had not been released from the 2011 Census at the time of the assessment.

Northumberland Avenue (A400), Strand (A4), and Whitehall (A3212).

Vehicle movements summary

17.2.37 The total anticipated number of construction-related vehicle movements in the peak month of activity at this site is set out in Table 17.2.4.

Table 17.2.4 Peak construction works vehicle movements

Vehicle type	Vehicle movements per time period				
	Total daily	07:00 to 08:00	08:00 to 09:00	17:00 to 18:00	18:00 to 19:00
Construction lorry vehicle movements 10%*	28	0	3	3	0
Other construction vehicle movements**	36	4	4	4	4
Worker vehicle movements***	nominal	0	0	0	0
Total	**64**	**4**	**7**	**7**	**4**

** The assessment has been based on 10% of the daily construction lorry movements associated with materials taking place in each of the peak hours.*
*** Other construction vehicle movements includes cars and light goods vehicles associated with site operations and contractor activity.*
**** Worker vehicle numbers are based on less than 1% of workers driving, on the basis that there would be no worker parking on site, on-street parking in the area is restricted, and site-specific Travel Plan measures would discourage workers from driving by car. In practical terms, this would be close to zero.*

17.2.38 An average peak flow of 64 vehicle movements a day is expected during the months of greatest activity during Site Year 1 of construction at this site. At other times in the construction period, vehicle flows would be lower than this average peak figure.

17.2.39 Table 17.2.4 shows that in the AM and PM peak hours, the Victoria Embankment Foreshore site would generate approximately seven vehicle movements.

Code of Construction Practice

17.2.40 Measures incorporated into the *Code of Construction Practice (CoCP) Part A* (Section 5) to reduce transport issues include:

a. site specific *TMP*: to set out how vehicular access to the site would be managed so as to minimise impact on the local area and communicate this with the local borough and other stakeholders. This includes any works on the highway,

diversion or temporary closure of the highway or public right of way

b. HGV management and control: to ensure construction vehicles use appropriate routes to the sites and the vehicle fleet and/or drivers meet current safety and environmental standards

c. site specific *River Transport Management Plans (RTMP)* are to be produced for each relevant worksite. As with the TMP's this would set out how river access to site would be managed so as to minimise impact on the river and communicate this with the PLA, local borough and other stakeholders.

17.2.41 In addition to the general transport measures within the *CoCP Part A*, the following measures have been incorporated into the *CoCP Part B* relating to the Victoria Embankment Foreshore site:

a. access to the site would be from Victoria Embankment with left turn into the site. Egress from the site would be left turn out travelling south

b. the site areas would be designed to maintain two-way flow for traffic along Victoria Embankment

c. construction works would maintain two lanes on both carriageways except for short durations outside peak hours or at night during utility diversions where only one lane on the southbound carriageway would be maintained

d. the impact of site areas on traffic lanes would be minimised

e. coach parking would be temporarily restricted to enable full use of traffic lanes on southbound carriageway. Coach parking spaces would be relocated to Albert Embankment (A3036) between Tinworth Street and Black Prince Road, Millbank (A3212) between Thorney Street and Atterbury Street, or Lambeth Palace Road (A3036) to the north of Lambeth Road (A3203) / Lambeth Bridge (A3203) / Albert Embankment (A3036) / Lambeth Palace Road (A3036) roundabout

f. minimum width of traffic lanes along Victoria Embankment to be retained would be one outer lane of 3m and one inner lane of 3.25m in each direction A suitable central safety barrier would be installed between alternate direction lanes

g. traffic barriers to be moved in and out as construction progresses as TfL require minimum land take within highway

h. the diversion of the Thames Path would be clearly signed.

17.2.42 Based on current travel planning guidance including TfL's Travel planning for new development in London (TfL, 2011)[1], this development falls within the threshold for producing a Strategic Framework Travel Plan. A *Project Framework Travel Plan* has been prepared based on the TfL ATTrBuTE guidance (TfL, 2011)[2]; this is submitted as part of the application documentation. The *Project Framework Travel Plan* addresses project-wide travel

planning measures, including the need for a project-wide Travel Plan Manager, initial travel surveys during construction and a monitoring framework. It also contains requirements and guidelines for site-specific *Travel Plans* to be prepared by the site contractors. The site-specific travel planning requirements of relevance to the *Project Framework Travel Plan* are as follows:

a. information on existing transport networks and travel initiatives for the Victoria Embankment Foreshore site

b. a mode split established for the Victoria Embankment Foreshore site construction workers to establish and monitor travel patterns

c. site-specific targets and interim targets based on the mode share which would link to objectives based on local, regional and national policy

d. a nominated person with responsibility for managing the *Travel Plan* monitoring and action plans specifically for this site.

Operation

17.2.43 For the operational phase, Victoria Embankment (A3211) would be returned to the baseline highway layout, with the permanent access to the combined sewer overflow (CSO) shaft provided in the foreshore site. There would be public access to this area excluding infrequent and short periods when the area would be closed off for maintenance access.

17.2.44 Once the Thames Tideway Tunnel project is operational it is not expected that there would be any significant issues for the transport infrastructure and operation within the local area, because maintenance trips to the site would be infrequent and short-term. On this basis, the only elements considered are:

a. effects on coach parking

b. effects on highway layout and operation.

17.2.45 These elements have been considered qualitatively because the changes required to the highway network during maintenance activity would be minor and temporary, meaning that a quantitative assessment is not required. The scope of this analysis has been discussed with Westminster City Council and TfL.

17.2.46 Given the level of transport activity associated with the Thames Tideway Tunnel project during the operational phase, only the localised transport effects around the Victoria Embankment Foreshore site have been assessed. Other Thames Tideway Tunnel project sites would not affect the area around the site in the operational phase and therefore they have not been considered in the assessment.

17.2.47 Access would be required for a light commercial vehicle on a three to six monthly maintenance schedule. Additionally, there would be more substantive maintenance visits at approximately ten year

intervals which would require access to enable two cranes and associated support vehicles to be brought to the site. The cranes would facilitate lowering and recovery of tunnel inspection teams and to provide duty/standby access for personnel. Temporary restriction of on-street coach parking in the vicinity of the site may be required to allow access for these cranes.

17.2.48 During operation, the site would be accessed from the westbound carriageway of Victoria Embankment (A3211) and the maintenance vehicles would approach the site from the Victoria Embankment (A3211) / Northumberland Avenue (A400) junction. The permanent highway layout plan in the Victoria Embankment Foreshore *Transport Assessment* figures shows the highway layout during the operational phase at Victoria Embankment Foreshore.

17.3 Assessment methodology

Engagement

17.3.1 An extensive scoping and technical engagement process has been undertaken. All consultee comments relevant to this site are presented in Volume 17 Section 12 of the *Environmental Statement*.

17.3.2 Whilst the effects associated with transport for the operational phase have been scoped out of the *Environmental Statement*, the *TA* examines the operational phase in order to satisfy the relevant stakeholders that technical issues have been addressed (for example, those associated with access for maintenance activities).

Consultees

17.3.3 Throughout the scoping and technical engagement process, the key stakeholders with regards to transport, primarily TfL and the relevant local authority for each site, have been consulted. For Victoria Embankment Foreshore, Westminster City Council has been consulted and the comments which have arisen relating directly to Victoria Embankment Foreshore have been recorded and responded to accordingly.

17.3.4 The key technical issues raised have been addressed as far as is practical at this stage within this *TA*, *Project-wide TA* and the *Environmental Statement*, in consultation with both TfL and Westminster City Council.

17.3.5 The key issues arising from stakeholder engagement are:

a. ensuring that the assessment covers the full extent of the construction works including the traffic diversions at Victoria Embankment Foreshore and the issues arising from the construction traffic associated with all Thames Tideway Tunnel project sites including traffic routing during construction

b. ensuring that the construction works do not unnecessarily impede traffic on the TLRN/SRN

c. making an assessment of river usage during the construction and post construction works in comparison to other modes of transport

d. relocation of the coach parking bays along Victoria Embankment (A3211) following their restriction during construction works

e. assessment of the capacity of footways and pedestrian crossings in the vicinity of the site

f. ensuring the width of the road is kept to a minimum standard for safety requirements

g. information on construction traffic associated with other Thames Tideway Tunnel sites should be provided

h. additional details and analyses of type of users involved in the accidents should be shown on a plan

i. Road Safety Audits should be carried out

j. justification should be provided of why some nearby junctions were not modelled

k. clarification of the basis for defining the year of construction is required

l. clarification of working hours assumed in the *TA* for the assessment is required

m. swept path analysis for vehicle access to the construction site and final operational site should be undertaken.

Construction

17.3.6 The assessment methodology for the construction phase follows that described in the *Project-wide TA*. There are no site-specific variations for undertaking the construction assessment of this site.

17.3.7 The effect of all other Thames Tideway Tunnel project sites on the area surrounding the Victoria Embankment Foreshore site has been taken into account within the assessment of the peak year of construction at this site.

Construction assessment area

17.3.8 The assessment area for the Victoria Embankment Foreshore site includes the site access directly from Victoria Embankment (A3211) which is a part of the TLRN. The junction of Victoria Embankment (A3211) / Northumberland Avenue (A400) approximately 40m to the north of the site and the junction of Victoria Embankment (A3211) / Horse Guards Avenue approximately 40m to the south of the site have also been assessed.

17.3.9 Consideration has also been given to the potential impacts on pedestrian and cycle routes, including the Thames Path, and on bus services and rail or river services within 640m and 960m of the site respectively. The Public Transport Accessibility Level (PTAL) of the site, calculated using TfL's approved PTAL methodology assumes a walking speed of 4.8km/h and considers rail stations within a 12 minute walk (960m) of the site and bus stops within an eight minute walk (640m).

17.3.10 The extent of the assessment area for the local highway network modelling has been informed by considering the volume of construction traffic at this site and the degree of impact that would be experienced at the nearest junction of the construction vehicle route with the SRN or TLRN. Where the assessment shows that the forecast impacts at this junction would not be significant, junctions further afield on the strategic network have not been assessed. Where impacts are forecast to be significant, a wider area of the local network has been considered in the assessment

Construction assessment year

17.3.11 To assess the busiest case scenario for the Victoria Embankment Foreshore locality, the peak construction traffic year has been identified. This ensures that the assessment for Victoria Embankment Foreshore takes into consideration the heaviest flow of construction vehicles at this site on local roads for the local modelling assessment.

17.3.12 The site-specific peak construction traffic year at Victoria Embankment Foreshore is Site Year 1 of construction.

17.3.13 The assessment of the aggregated Thames Tideway Tunnel project construction traffic flows on the wider highway network is included within the *Project-wide TA*.

Highway network modelling

17.3.14 The assessment for each site takes account of construction vehicle movements associated with Victoria Embankment Foreshore, together with construction traffic from other Thames Tideway Tunnel project sites that would use the highway network in the vicinity of this site in Site Year 1 of construction.

17.3.15 As indicated in the *Project-wide TA*, the TfL HAMs have been used as part of the assessment. The strategic highway modelling has used three of the HAMs, which cover west, central and east London. These three models cover the locations of all of the Thames Tideway Tunnel project sites and this approach has been agreed with TfL.

17.3.16 The HAMs have been developed by TfL using GLA employment and population forecast set out in the London Plan (GLA, 2011)[3]. As a result the assessment inherently takes into account a level of future growth and development across London.

17.3.17 For future year assessments for the Victoria Embankment Foreshore site, the TfL Central London HAM (CLoHAM) has been used to test the strategic highway network impacts associated with this site. Construction traffic associated with other Thames Tideway Tunnel project sites using the routes in this area has been included in the CLoHAM scenarios.

17.3.18 Construction lorry, operational and worker vehicle trips (where relevant) associated with the project peak month were assigned to CLoHAM to create the scenarios for testing strategic highway impacts.

17.3.19 CLoHAM also provides factors for the increase in vehicle-kilometres in the borough between the CLoHAM model base and forecast years (2008/9 and 2021 respectively). The relevant growth factor for the City of Westminster was applied to the traffic data collected in 2011 in the vicinity of the Victoria Embankment Foreshore site to produce base case traffic flows for the purposes of local highway modelling.

17.3.20 Construction lorry and operational vehicle movements associated with the Victoria Embankment Foreshore site for the site-specific peak month were added to the 2021 base case flows to provide the development case flows for local modelling.

17.3.21 This approach provides a robust assessment case for local modelling as the baseline traffic has been forecast to 2021, which is later than the site-specific peak year of construction, and no allowance has been made for existing traffic that might divert to other routes as a consequence of the use of local roads by the project related traffic.

Sensitivity testing

17.3.22 The ‘core’ assessment presented in the *TA* is based on the *Transport Strategy*. It examines the month(s) in which construction vehicle activity at this site would be greatest and uses the average daily number of construction lorry movements that would occur in that month. This is considered to be reasonable because it addresses:

a. the time at which construction vehicle movements would be greatest at this site and there would be longer periods when the number of vehicle movements would be lower

b. although there may be occasions in the peak month when the number of lorry movements in one day might exceed the average daily figure, these would be limited. The number of instances would be small in the context of the overall construction period at this site and would be offset by other times when the number of construction vehicle movements would be lower than the average daily figure for the peak month

c. if lorry movements are required outside the standard hours of 08:00 to 18:00, this would be agreed in advance with TfL and the Local Highway Authority.

17.3.23 The need for sensitivity testing has been discussed with TfL. Such a test could be used to address:

a. variation in construction vehicle numbers around the average daily figure for the peak month

b. a lower level of river transport for construction materials (leading to an increased number of lorry movements)

c. changes in programme which might lead to construction activity peaking at different times and/or a greater coincidence of peaks at adjacent sites which could lead to higher construction lorry flows on the surrounding highway network.

17.3.24 As para. 17.3.22 explains, if construction vehicle numbers were to exceed the average daily figure for the peak month, this would be an infrequent occurrence and should be seen in the context that the assessment is based on the peak month of construction activity at each site, rather than a lower 'typical' month.

17.3.25 It is expected that river transport will be used for certain construction materials and this forms part of the *Transport Strategy*. It is therefore not likely that all materials would be moved by road at all sites. However, there is the possibility that river transport might not be available at a particular site or sites for short periods of time and this might be the result of temporary navigational constraints, local issues temporarily preventing access to the river, or wider issues restricting river movements to a number of sites (such as the closure of the Thames Barrier).

17.3.26 In practice the potential for increased coincidence of construction peaks between sites is limited because of the sequential nature of the construction activities required. Whilst it is possible that individual site peaks might change slightly, it is very unlikely that all sites would experience peak activity in the same period.

17.3.27 Although these events, if they were to arise, would be limited and short-term, it has been agreed with TfL that sensitivity testing would be undertaken within the *TA* to identify the potential impacts associated with such occurrences. It has also been agreed that for consistency, the test would be based on the number of construction lorry movements that would be related to moving all construction materials by road. This has been assumed to act as a proxy for events of this nature and represents an upper bound on the level of construction traffic that could be expected.

Operation

17.3.28 The assessment methodology for the operational phase follows that described in the *Project-wide TA*. There are no site-specific variations for undertaking the operational assessment of this site.

17.3.29 Given the level of transport activity associated with the Thames Tideway Tunnel project during the operational phase, only the localised transport issues around the Victoria Embankment Foreshore site are assessed. Other Thames Tideway Tunnel project sites would not affect the area around Victoria Embankment Foreshore in the operational phase and therefore they have not been considered in the assessment.

Operational assessment area

17.3.30 The assessment area for the operational assessment remains the same as for the construction assessment as outlined in para. 17.3.8.

Operational assessment year

17.3.31 The operational assessment year has been taken as Year 1 of operation which is the year in which it is assumed that the Thames Tideway Tunnel project would become operational. As the number of vehicle movements associated with the operational phase would be low, there is no requirement to assess any other year beyond that date.

17.4 Baseline

17.4.1 This section sets out the baseline conditions on the local transport network in the vicinity of the Victoria Embankment Foreshore site in 2012, with the exception of the traffic survey data which was collected in 2011.

Policy review

17.4.2 The site is located within the City of Westminster; the relevant national, regional, and local policy documents have been reviewed and included in Appendix A.

17.4.3 Of notable importance to the Victoria Embankment Foreshore site is the Victoria Area Planning Brief which encompasses developments which may result in changes to the highway and transport networks in the area local to the site.

Existing land use

17.4.4 The site is located in reclaimed foreshore area behind the new river wall and currently includes one permanently moored vessel, the Tattershall Castle.

17.4.5 The nearest residential area is located approximately 65m to the west of the site at Whitehall Court.

Existing access

17.4.6 The foreshore part of the site is not currently accessible by vehicle. There is pedestrian and cycle access from the Thames Path along the eastern footway of Victoria Embankment (A3211) which is

indicated in Figure 17.4.1 in the Victoria Embankment Foreshore *Transport Assessment* figures.

Pedestrian network and facilities

17.4.7 The key pedestrian network related to the Victoria Embankment Foreshore site comprises:

a. Victoria Embankment (A3211) providing a north-south link between Embankment Pier and Embankment Underground station to the north and Westminster Millennium Pier and Westminster Underground station to the south

b. Northumberland Avenue (A400) providing an east-west link between Charing Cross Underground station and the Trafalgar Square bus stop to the west and Victoria Embankment (A3211) to the east

c. Horse Guards Avenue providing an east-west link between Victoria Embankment (A3211) to the east and Whitehall to the west.

17.4.8 The Thames Path and the London Strategic Walk network in the vicinity of the site are shown on Figure 17.4.1 in the Victoria Embankment Foreshore *Transport Assessment* figures.

17.4.9 The Thames Path (a Public Right of Way) runs along the eastern footway of Victoria Embankment (A3211), adjacent to the river. The Thames Path continues to the north along Victoria Embankment (A3211) and Paul's Walk, under Blackfriars Bridge, and to the south along Bridge Street (A302) and St Margaret Street (A302). Plate 17.4.1 indicates the Thames Path on the eastern footway of Victoria Embankment (A3211).

Plate 17.4.1 Thames Path facing north along Victoria Embankment (A3211)

17.4.10 Victoria Embankment (A3211) provides a continuous north-south link for pedestrians along the north bank of the River Thames. The footways along either side of Victoria Embankment (A3211) are between 4m and 11m wide. There is some provision for resting along the eastern footway of Victoria Embankment (A3211). Plate 17.4.2 indicates the western footway of Victoria Embankment (A3211).

Plate 17.4.2 Western footway facing north along Victoria Embankment (A3211)

17.4.11

17.4.12 Signalised pedestrian crossings are provided at the junctions of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue.

17.4.13 An additional signalised pedestrian crossing is provided on Victoria Embankment (A3211) in front of Embankment Underground station, and a zebra crossing is located to the south of Victoria Embankment (A3211) / Savoy Place junction.

17.4.14 Northumberland Avenue (A400) has footways of approximately 6m wide on both sides of the road, providing a continuous east-west link between Victoria Embankment (A3211) to the east and Whitehall (A3212), Strand (A4) and Trafalgar Square to the west. There is some provision for resting along both sides of Northumberland Avenue (A400).

17.4.15 A signalised pedestrian crossing facility is provided to the west of the junction of Northumberland Avenue (A400) and Great Scotland Yard to aid north-south pedestrian movement.

17.4.16 Horse Guards Avenue has footways of between 3m and 5m on both sides of the road, providing east-west link between Victoria Embankment (A3211) to the east and Whitehall (A3212) to the

west. Signalised pedestrian crossing facilities are provided to the west and south of the junction of Victoria Embankment (A3211) and Horse Guards Avenue.

Cycle network and facilities

17.4.17 The existing cycle network and facilities in the vicinity of the site are described below and shown on Figure 17.4.1 in the Victoria Embankment Foreshore *Transport Assessment* figures.

17.4.18 The main cycle route within the area is National Cycle Network (NCN) Route 4 (traffic free through the central section) which routes through central London along Chelsea Embankment (A3212) on the north side of the River Thames and Lambeth Palace Road, Belvedere Road, Upper Ground, Southwark Street (A3200) on the south side of the River Thames. Belvedere Road 900m to the southeast of the site is the closest point to NCN Route 4 from the Victoria Embankment Foreshore site.

17.4.19 Cyclists using the Thames Path are directed to cycle on the carriageway of Victoria Embankment (A3211) through this section of the path. An on-road cycle lane is provided along the eastbound carriageway of Victoria Embankment (A3211) between its junctions with Westminster Bridge Road (A302) and Bridge Street (A302) and Horse Guards Avenue as shown in Plate 17.4.3.

Plate 17.4.3 Cycle lane north facing along Victoria Embankment (A3211)

17.4.20 In the eastbound direction, on-road cycle signs are provided along Victoria Embankment (A3211) north of Horse Guards Avenue; however, there is no solid white line to separate the cyclists from vehicular traffic.

17.4.21 Advanced stop lines are provided on the south arms of the junctions of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue.

Barclays Cycle Superhighways

17.4.22 The closest Barclays Cycle Superhighway (CS) to the site is CS8 which runs from Westminster to Wandsworth. Westminster Bridge (A302) 600m to the south of the site is the closest point to CS8 from the Victoria Embankment Foreshore site.

Barclays Cycle Hire scheme

17.4.23 There is a Barclays Ccycle Hire docking station on Victoria Embankment (A3211) to the north of the junction with Horse Guards Avenue. This cycle docking station accommodates 29 bicycles and is shown in Plate 17.4.4.

17.4.24 A further 45 docking spaces are provided on Northumberland Avenue (A400) to the east of the junction with Whitehall Place, approximately 40m to the north of the site. Another 37 docking spaces are provided to the west of Northumberland Avenue (A400) / Whitehall Place junction, approximately 160m to the northwest of the site.

17.4.25 On Craven Street close to the junction with Strand (A4), 540m to the northwest of the site, 23 docking spaces are provided.

Plate 17.4.4 Barclays Cycle Hire docking station along Victoria Embankment (A3211)

Cycle parking

17.4.26 Five Sheffield Cycle Stands capable of accommodating up to ten bicycles are provided on the western footway of Victoria

Embankment (A3211) to the north of the junction with Northumberland Avenue (A400), outside Embankment Underground station, approximately 70m to the north of the site.

17.4.27 A further seven Sheffield Cycle Stands are available on the western footway of Victoria Embankment (A3211) to the north of Victoria Embankment (A3211) / Westminster Bridge Road (A302) / Bridge Street (A302) junction, approximately 490m to the south of the site.

17.4.28 Within approximately 50m of the site, to the northwest, four Sheffield Cycle Stands capable of accommodating up to eight bicycles are located along Northumberland Avenue (A400) to the west of the junction with Victoria Embankment (A3211).

17.4.29 A further eight and seven Sheffield Cycle Stands are located along Northumberland Avenue (A400) to the west of the junction with Great Scotland Yard (approximately 270m to the northwest of the site) and to the east of the junction with Trafalgar Square (Approximately 340m to the northwest of the site) respectively.

Public transport

Public Transport Accessibility Level

17.4.30 The Public Transport Accessibility Level (PTAL) of the site, calculated using TfL's approved PTAL methodology (TfL, 2010)[4] (analysis is included in Appendix B).

17.4.31 The site has a PTAL rating of 6b, rated as 'excellent' (with 1 being the lowest accessibility and 6b being the highest accessibility). The following sections detail the public transport services in the vicinity of the site which are shown on Figure 17.4.2 in the Victoria Embankment Foreshore *Transport Assessment* figures.

Bus services

17.4.32 There are no bus routes passing the site on Victoria Embankment (A3211) itself. A total of 20 daytime bus routes and 28 night bus routes operate within a 640m walking distance of the site. These bus services form a comprehensive network, extending outwards in all directions from the site. Table 17.4.1 provides a summary of the bus services and their frequencies during the weekday peaks.

17.4.33 These bus routes operate from the following bus stops:

a. Northumberland Avenue bus stop on Northumberland Avenue (A400) – northbound and southbound, 410m to the northwest

b. Whitehall Horse Guards bus stop on Whitehall (A3212) – northbound and southbound, 420m to the west

c. Trafalgar Square bus stop on Cockspur Street – eastbound and westbound, 585m to the northwest

d. Charing Cross Station bus stop on Strand (A4) – northbound and southbound, 550m to the northwest

e. Embankment Station bus stop on Victoria Embankment (A3211) – northbound and southbound, 620m to the north

Table 17.4.1 Existing daytime weekday peak hour local bus services and frequencies (number of buses per hour)

Bus number	Origin - destination	Nearest bus stop to Victoria Embankment Foreshore site	Approximate walking distance from Victoria Embankment Foreshore site (m)	Weekday peak hour two-way frequencies	
				AM peak hour (08:00-09:00)	PM peak hour (17:00-18:00)
3	Oxford Circus Station – Crystal Palace	Whitehall Horse Guards	420	21	20
6	Bertie Road – Aldwych	Charing Cross	550	21	21
9	Hammersmith Bus Station – Aldwych	Charing Cross	550	21	21
11	Fulham Town Hall – Liverpool Street	Whitehall Horse Guards	420	18	18
12	Oxford Circus – Dulwich Library	Whitehall Horse Guards	420	30	30
13	Golders Green – Aldwych	Charing Cross	550	18	18
15	Blackwall – Conduit Street	Charing Cross	550	16	16
23	Great Western Road – Liverpool Street	Charing Cross	550	20	20
24	Grosvenor Road – Royal Free Hospital	Whitehall Horse Guards	420	20	20
29	Trafalgar Square – Wood Green Station	Charing Cross	550	30	30
53	Whitehall – Plumstead	Whitehall Horse Guards	420	18	18

Bus number	Origin - destination	Nearest bus stop to Victoria Embankment Foreshore site	Approximate walking distance from Victoria Embankment Foreshore site (m)	Weekday peak hour two-way frequencies	
				AM peak hour (08:00-09:00)	PM peak hour (17:00-18:00)
87	Wandsworth Plain – Aldwych	Whitehall Horse Guards	420	22	22
88	Camden Gardens – Clapham Common Old Town	Whitehall Horse Guards	420	18	18
91	Trafalgar Square – Tottenham Lane	Northumberland Avenue	410	18	18
139	West End Green – Waterloo Station	Charing Cross	550	16	16
148	Denmark Hill – White City Bus Station	Westminster Station	620	16	16
159	Streatham – Paddington Basin	Whitehall Horse Guards	420	23	23
176	Penge – Tottenham Court Road	Charing Cross	550	15	15
211	Waterloo Station – Hammersmith Bus Station	Westminster Station	620	17	17
453	Deptford Bridge – Great Central Street	Whitehall Horse Guards	420	24	23

Note: Source: Transport for London (TfL) (2011) Timetables. Available at www.tfl.gov.uk (site last accessed December 2012)

17.4.34 On average there are approximately 402 daytime bus services per hour in the AM peak and 400 bus services per hour in the PM peak within a 640m walking distance of the site. There are approximately 44 night-time bus services per hour Monday – Friday between 00:00 – 06:00 and a total of 50 night-time bus services per hour on Saturdays between 00:00 – 06:00 within a 640m walking distance of the site.

London Underground

17.4.35 Embankment, Charing Cross, and Westminster Underground stations are located within a 960m walking distance of the site to the north, northwest, and south of the site respectively.

17.4.36 As shown on Figure 17.4.2 in the Victoria Embankment Foreshore *Transport Assessment* figures, Embankment Underground station, which is served by the Northern, Bakerloo, Circle and District lines, is located approximately 200m walking distance to the north of the site. Charing Cross Underground station is located approximately 420m walking distance to the northwest of the site and is served by the Northern and Bakerloo lines, and Westminster Underground station is 520m walking distance to the south of the site and is served by the Jubilee, Circle and District lines.

17.4.37 Northern Line trains from Charing Cross and Embankment Underground stations travel north to High Barnet and Edgware, and south to Kennington and Morden. The AM and PM peak frequencies of the Northern Line trains from Embankment and Charing Cross Underground stations are approximately one every two to five minutes, providing 20-24 services per hour in each direction. Bakerloo Line trains travel north to Harrow and Wealdstone and south to Elephant and Castle with AM and PM peak frequencies of approximately one every two-five minutes, providing 20-24 services per hour in each direction.

17.4.38 Circle Line trains from Westminster Underground station travel clockwise to Edgware Road and anti-clockwise to Hammersmith, with AM and PM peak frequencies of approximately one every eight to 12 minutes, providing five to eight services per hour in each direction. District Line trains travel west to Earl's Court, Ealing Broadway, Richmond, Wimbledon, and Kensington (Olympia), and east to Tower Hill and Upminster with AM and PM peak frequencies of approximately one every two to six minutes providing 12-20 services per hour in each direction.

17.4.39 In the AM and PM peaks, the frequency of the Jubilee Line trains from Westminster Underground station is approximately one every two to five minutes, providing 20-24 services per hour towards Stanmore, and one every two to four minutes providing 20-24 services per hour towards Stratford.

17.4.40 On average there are approximately 322 and 324 Underground services in total during each of the AM and PM peak hours respectively within a 960m walking distance of the site.

17.4.41 Table 17.4.2 provides a summary of the Underground services and their frequencies during the weekday peaks.

National Rail

17.4.42 As shown on Figure 17.4.2 in the Victoria Embankment Foreshore *Transport Assessment* figures, the closest National Rail station to the site is Charing Cross, located approximately 420m walking distance to the northwest of the site.

17.4.43 Charing Cross provides access to Southeastern train services to and from Hastings, Dartford, Ramsgate, Dover Priory and Ashford (Kent).

17.4.44 In the AM peak hour there are approximately 43 services (23 arrivals and 20 departures). In the PM peak hour there are approximately 44 services (19 arrivals and 25 departures).

17.4.45 Table 17.4.3 provides a summary of the National Rail services and their frequencies during the weekday peaks.

Table 17.4.2 Existing London Underground weekday peak hour services and frequencies (number of services per hour)

Line	Origin - destination	Nearest London Underground stations to the site	Approximate distance from the site (m)	Weekday peak hour two-way frequencies	
				AM peak hour (08:00-09:00)	PM peak hour (17:00-18:00)
Northern Line	High Barnet/Edgware – Morden	Embankment Charing Cross	200 420	40	40
Bakerloo Line	Elephant & Castle – Harrow & Wealdstone	Embankment Charing Cross	200 420	44	44
Circle Line	Edgware Road – Hammersmith	Embankment Westminster	200 520	11	12
District Line	Edgware Road, Ealing Broadway, Richmond, Wimbledon, Kensington (Olympia) – Tower Hill & Upminster	Embankment Westminster	200 520	44	44
Jubilee Line	Stanmore – Stratford	Westminster	520	44	44

Note: Source: Transport for London (TfL) (2012) Timetables. Available at www.tfl.gov.uk (site last accessed December 2012)

Table 17.4.3 Existing National Rail weekday peak hour services and frequencies (number of services per hour)

National Rail station	Origin - destination	Approximate distance from Victoria Embankment Foreshore site (m)	Weekday peak hour two-way frequencies	
			AM peak (08:00-09:00)	PM peak (17:00-18:00)
London Charing Cross	Hastings, Dartford, Ramsgate, Dover Priory, Ashford (Kent)	400	43	44

Note: Source: Railplanner information and timetables: www.nationalrail,co,uk (site last accessed December 2012)

River passenger services

17.4.46 There are four piers within walking distance of the site which provide river passenger services. These piers are shown on Figure 17.4.2 in the Victoria Embankment Foreshore *Transport Assessment* figures.

17.4.47 Westminster Millennium Pier lies 450m south of the site and Embankment Pier is 200m north of the site on the north bank of the River Thames. London Eye Millennium Pier and Festival Pier are located on the opposite side of the river, some 600m walk upstream and 580m walk downstream of the site respectively. Walking distances between the site and these two piers are considerably longer than the direct distance as it is necessary to cross the river at Westminster Bridge or the Golden Jubilee footbridge. Savoy Pier is located 450m to the north of the site but scheduled river bus services no longer stop at this pier.

17.4.48 Westminster Millennium, London Eye Millennium and Embankment Piers are used for both river bus and leisure cruise services, while Festival Pier is used only by leisure cruise services. These river services are shown on Figure 17.4.2 in the Victoria Embankment Foreshore *Transport Assessment* figures.

17.4.49 The closest pier, Embankment Pier, is served by Thames Clippers and Thames Executive Charters services. Thames Clippers services run between Embankment and London Eye Millennium Piers in the west and Woolwich Arsenal Pier in the east.

17.4.50 During the AM and PM weekday peaks, there is a frequency of approximately one Thames Clipper service every 20-25 minutes in the westbound direction and one every 30 minutes in the eastbound direction. During the PM peak hour, the number of the services increases to three with a frequency of one every 20 minutes.

17.4.51 The frequency of both eastbound and westbound services during the weekend is approximately one every 20 minutes in peak hours.

17.4.52 Embankment Pier is also served by Thames Executive Charters to Putney Pier in the west and Blackfriars Millennium Pier in the northeast. Onward connections can be made at Blackfriars Millennium Pier for eastbound piers as far as Woolwich Arsenal. Embankment Pier is currently accessed from the eastern footway of Victoria Embankment (A3211) and ticketing is located at the entrance to the pier.

17.4.53 The frequency distribution of all the services that stop at the piers near the Victoria Embankment Foreshore site is shown in Table 17.4.4. It is estimated that the peak hour for services stopping at the four piers is between 12:00 and 13:00 hours, Monday to Friday. Between 11:00 and 19:00 hours there are a total of at least 20 services visiting the four piers.

17.4.54 At Embankment Pier, there are a total of six and seven services in the AM and PM peak hours. There are four services running via London Eye Millennium Pier in the AM peak hour and nine in the PM peak hour. There are no river services via Festival and Westminster Millennium piers in the AM peak hour. In the PM peak hour, there are two services via Festival Pier and five from Westminster Millennium Pier.

River navigation

17.4.55 An analysis has been made of the typical volume of river vessel traffic passing the Victoria Embankment Foreshore site, based on published river passenger service timetables and estimates of freight traffic based on discussions with operators.

17.4.56 It is estimated that the peak hour is between 15:00 and 16:00, Monday to Friday. During this hour it is estimated that about 32 vessels typically pass the site. This figure is not constant as freight vessel transit patterns, which are included in the traffic, are influenced by the rising and falling tide. Therefore, such a peak will only occur every ten to 12 days when the tide is at its highest. Table 17.4.5 shows the estimated passing traffic rate.

Taxis

17.4.57 Taxis (black cabs) can either be booked in advance, hailed on the street or located at designated taxi ranks. The nearest taxi ranks to the site are located on Whitehall Place (150m walking distance) and Whitehall Court (200m walking distance) with one taxi rank provided on each road, each accommodating two taxis.

Table 17.4.4 Aggregated typical river passenger services frequencies (number of services per hour)

	06:00 – 07:00	07:00 – 08:00	08:00 – 09:00	9:00 – 10:00	10:00 – 11:00	11:00 – 12:00	12:00 – 13:00	13:00 – 14:00	14:00 – 15:00	15:00 – 16:00	16:00 – 17:00	17:00 – 18:00	18:00 – 19:00	19:00 – 20:00	20:00 – 21:00	21:00 – 22:00	22:00 – 23:00	23:00 – 00:00
Westminster Millennium Pier	0	0	0	2	6	7	7	6	6	6	6	5	4	2	1	1	0	0
London Eye Millennium Pier	0	2	4	5	6	7	8	8	8	8	8	9	8	7	5	3	1	1
Embankment Pier	2	3	6	4	6	7	8	8	8	8	8	7	7	4	3	1	1	1
Festival Pier	0	0	0	0	0	2	2	2	2	2	2	2	2	0	0	0	0	0
Total	**2**	**5**	**10**	**11**	**18**	**23**	**25**	**24**	**24**	**24**	**24**	**23**	**21**	**13**	**9**	**5**	**2**	**2**

Note: Source: http://www.tfl.gov.uk/modalpages/2648.aspx

Table 17.4.5 Aggregated typical river movement frequencies (passing craft per hour)

	06:00 – 07:00	07:00 – 08:00	08:00 – 09:00	9:00 – 10:00	10:00 – 11:00	11:00 – 12:00	12:00 – 13:00	13:00 – 14:00	14:00 – 15:00	15:00 – 16:00	16:00 – 17:00	17:00 – 18:00	18:00 – 19:00	19:00 – 20:00	20:00 – 21:00	21:00 – 22:00	22:00 – 23:00	23:00 – 00:00
Victoria Embankment Foreshore site	2	7	11	10	13	19	22	28	30	32	31	23	20	14	9	4	2	2

Note: Source: http://www.tfl.gov.uk/modalpages/2648.aspx *and consultation with aggregates companies, West London Waste Authority, barge operators, Port of London Authority*

Highway network and operation

17.4.58 The site is located on Victoria Embankment (A3211) as shown in Figure 17.2.1 in the Victoria Embankment Foreshore *Transport Assessment* figures.

17.4.59 Victoria Embankment (A3211) is a wide dual carriageway with a 30mph speed limit. The road links to Upper Thames Street (A3211) 1.4km to the northeast, and Bridge Street (A302) and Westminster Bridge (A302) 500m to the southwest. All these roads form part of the TLRN and they are suitable for HGVs and long vehicles. These roads would be used by the construction vehicles to travel to and from the Victoria Embankment Foreshore site.

17.4.60 Vehicles leaving the site would travel along the westbound carriageway of Victoria Embankment (A3211) towards Westminster Bridge (A302) and would need to cross the bridge. Westminster Bridge (A302) forms part of the TLRN. Construction vehicles would continue their journey southbound along the A3036 or northbound along the A3200 which both form part of the TLRN. Vehicles travelling north would turn right at the junction of Victoria Embankment (A3211) and Bridge Street (A302) and would take the A3212 northbound and southbound routes which forms part of the SRN.

17.4.61 All construction vehicles would approach the site via the signalised junction of Victoria Embankment (A3211) and Northumberland Avenue (A400). Victoria Embankment (A3211), eastbound and westbound, separates into three lanes on the approach to the junction with Northumberland Avenue (B308).

17.4.62 Northumberland Avenue (A400) is a single carriageway with two lanes on the approach and two lanes on the exit from the junction with Victoria Embankment (A3211). Northumberland Avenue (A400) is not part of the TLRN or SRN.

17.4.63 There are a number of signalised junctions along Victoria Embankment (A3211) to the north of the site, including those at Northumberland Avenue (A400), Temple Place and Savoy Street. The signalised junction of Victoria Embankment (A3211) and Horse Guards Avenue is located to the south of the site.

17.4.64 Local highway modelling has been undertaken to determine the operation of the junctions of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue in the baseline situation. This is discussed in paras. 17.4.131-17.4.137.

Parking

17.4.65 Figure 17.4.3 in the Victoria Embankment Foreshore *Transport Assessment* figures shows the locations of the existing car and coach parking within the vicinity of the site. The existing off-street/private car parking and car club parking spaces are also shown in this figure.

Existing on-street car and motorcycle parking

17.4.66 Victoria Embankment (A3211) does not have any on-street car parking available in the immediate vicinity of the site due to TLRN restrictions in the area.

17.4.67 There are ten pay and display parking bays along the westbound carriageway of Victoria Embankment (A3211) between Savoy Pier and Embankment Underground station. The charges are £4.40 per hour, with a maximum stay of four hours, with no return within one hour, between Monday to Saturday 08:30 and 18:30.

17.4.68 There are ten pay by phone parking bays along Northumberland Avenue (A400). The charges and time restrictions are the same as for the parking on Victoria Embankment (A3211) between Savoy Pier and Embankment Underground station.

17.4.69 There are a total of 68 resident car parking bays on Whitehall Court and Whitehall Place which are restricted at all times. Two blue badge parking bays are provided along Whitehall Place which are restricted to blue badge holders only at any time. From Monday to Friday between 08:30 and 18:30, the maximum stay is four hours, with no return within one hour.

17.4.70 A free motorcycle parking bay is located along the eastbound carriageway of Victoria Embankment (A3211) to the south of the junction with Northumberland Avenue (A400) which accommodates 30 motorcycles. The motorcycle parking is restricted Monday to Saturday between 07:00 and 19:00.

17.4.71 A further motorcycle parking bay is located along the eastbound carriageway of Victoria Embankment (A3211) close to Savoy Pier which accommodates 11 motorcycles. The charges are £4 per hour, with a maximum stay of two hours, between Monday to Friday 08:30 and 18:30 and Saturday 08:30 and 13:30.

17.4.72 A pay by phone motorcycle parking bay is located along Northumberland Avenue (A400) to the west of the junction with Craven Street. The bay accommodates 23 motorcycles and is restricted Monday to Saturday between 08:30 and 18:30.

17.4.73 Table 17.4.6 summarises the parking restrictions and the number of bays on the roads in the vicinity of the site. The availability and usage of parking capacity on a weekday and a Saturday on the roads in the vicinity of the site is summarised later in this section in Table 17.4.12.

Table 17.4.6 Existing on-street car parking in the vicinity of the Victoria Embankment site

Road name	Type of parking and number of bays					
	Pay and display	Resident	Blue badge	Unrestricted	Short-term*	Motorcycle spaces
Victoria Embankment (A3211)**	10	0	0	0	0	41
Northumberland Avenue (A400)	10	0	0	0	0	23
Great Scotland Yard	0	0	0	0	0	0
Horse Guards Avenue	0	0	0	0	0	0
Scotland Place	0	0	0	0	0	0
Whitehall Court	0	30	0	0	0	0
Whitehall Place	0	38	2	0	0	0

**The maximum stay for short-term parking bays is 20 minutes.*
*** Between Savoy Place and Westminster Bridge (A302).*

Existing off-street/private car parking

17.4.74 The nearest off-street council car park to the site is approximately 500m walking distance to the west of the site on Spring Gardens. The 24-hour car park is managed for Westminster City Council by Q-Park and it has 205 car spaces and 58 motorcycle spaces. The charges are shown in Table 17.4.7.

Table 17.4.7 Spring Gardens off-street parking charges

Duration	Charge
Up to 1 hour	£5.00
Up to 2 hours	£10.00
Up to 3 hours	£15.00
Up to 4 hours	£20.00
Up to 6 hours	£25.00
Up to 9 hours	£30.00
Up to 24 hours	£35.00
Annual season ticket	£4,495 + VAT
Annual season ticket (Electric Vehicle)	£699 + VAT

Coach parking

17.4.75 A coach parking bay is provided along the eastbound carriageway of Victoria Embankment (A3211) to the south of the junction with Northumberland Avenue (A400). The parking bay accommodates two coaches.

17.4.76 Seven coach parking bays are located along the westbound carriageway of Victoria Embankment (A3211) to the south of the junction with Northumberland Avenue (A400). A further eight coach parking bays are located along the westbound carriageway of Victoria Embankment (A3211) to the south of the junction with Horse Guards Avenue.

17.4.77 Further north on Victoria Embankment (A3211), close to Savoy Pier, two coach parking bays are located in the eastbound direction and five bays are located in the westbound direction, with a maximum stay of two hours, with no return within one hour, between Monday to Friday 08:30 and 18:30 and Saturday 08:30 and 13:30.

Car clubs

17.4.78 Car clubs provide members with easy access to cars for short-term use. Cars are available as and when needed and allow members to access a car without purchase, storage and operational costs associated with owning a private car.

17.4.79 When surveys were undertaken in May 2011, there were no car club parking spaces within a 640m walking distance of the site.

Servicing and deliveries

17.4.80 Two loading bays are located along Victoria Embankment (A3211), one to the north of the junction with Northumberland Avenue (A400) in the northbound carriageway approximately 300m walking distance to the north of the site, and one to the south of the junction with Savoy Place in the westbound carriageway on Victoria Embankment (A3211), approximately 500m walking distance to the north of the site. The loading bays are restricted to stays of 20 minutes Monday to Friday between 10:00 and 18:30 and Saturday between 08:30 and 18:30.

17.4.81 A loading bay with double yellow lines is located along Northumberland Avenue (A400) to the west of the junction with Great Scotland Yard, outside Club Quarters, approximately 360m walking distance to the northwest of the site. The restrictions allow commercial vehicles to stop for up to 20 minutes and HGVs to stop for a maximum of 40 minutes to load or unload.

Baseline survey data

Description of data

17.4.82 Automatic Traffic Count (ATC) data for Victoria Embankment (A3211) were obtained from TfL and were analysed to identify the traffic flows along this road in 2011. The flows are discussed in para. 17.4.108.

17.4.83 In addition, junction movement data and a TRANSYT model for Victoria Embankment (A3211) were obtained from TfL. Data have been analysed to validate the traffic surveys undertaken in 2011 for the project which are discussed in further detail in para. 17.4.110.

17.4.84 Accident data in the assessment area for the most recent five-year period available were obtained from TfL which are further discussed in paras. 17.4.138 to 17.4.149.

17.4.85 Baseline survey data were collected in four phases in May, July, and August 2011 and May 2012 to establish the existing transport movements and usage of parking in the area. Figure 17.4.4 in the Victoria Embankment Foreshore *Transport Assessment* figures indicates the survey locations in the vicinity of the site. Traffic surveys were carried out on a weekday and a weekend to represent a weekly profile of traffic at particular locations. Where two weekly profiles have been surveyed, the busiest survey was used.

17.4.86 As part of surveys in May and July 2011, manual and automated traffic surveys were undertaken to establish specific traffic, pedestrian and cycle movements including turning volumes, queue lengths and traffic signal timings. Parking surveys were undertaken to establish the availability and usage of parking in the vicinity of the site. Further pedestrian and cycle movement surveys were conducted in August 2011 for the signalised pedestrian crossings at the junction of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue, and the signalised pedestrian crossing on Victoria Embankment (A3211) outside Embankment Underground station. As part of surveys in May 2012, journey time surveys were undertaken along Victoria Embankment (A3211) from Westminster Bridge into the City of London. As indicated in para.17.4.85, the busiest survey data are shown in Table 17.4.9.

17.4.87 The scope of the surveys in terms of location and time periods was considered to ensure that the data required for assessment was collected. In some cases ATC data was collected on links to validate the junction count data and provide information for noise and air quality assessments. Pedestrian and cycle count data was collected at locations where flows could be affected by pedestrian and cycle diversions during construction, the generation of additional trips or where conflicts could occur with construction vehicles. Parking survey data was collected where it was possible that parking restrictions would be necessary or where additional parking demand might be generated by the proposed development.

17.4.88 The *Baseline Data Report* presents the method for field survey data collection and data collected through other sources which is in Appendix A to the *Project-wide TA (contained within Section 3)*.

17.4.89 The surveys undertaken and their locations are summarised in Table 17.4.8.

Table 17.4.8 Survey type and locations

Survey type and location	Date
Junction turning movement survey (including pedestrian and cycle movements)	
Victoria Embankment (A3211) / Northumberland Avenue (A400)	7 and 10 May, and 24 and 27 August 2011
Victoria Embankment (A3211) / Horse Guards Avenue*	24 and 27 August 2011
Automatic Traffic Count (ATC)**	
Northumberland Avenue (A400) – west of the junction with Victoria Embankment (A3211)	21 May – 10 June 2011
Pedestrian and cycle surveys	
Thames Path – the riverside footway of Victoria Embankment (A3211) to the south of the junction with Northumberland Avenue (A400)	7 and 10 May 2011
Zebra crossing on Victoria Embankment (A3211) to the south of the junction with Savoy Place	
Controlled pedestrian crossing on Victoria Embankment (A3211) to the north of the junction with Northumberland Avenue (A400), outside Embankment Underground station	7 and 10 May, and 24 and 27 August 2011
Parking surveys	
Victoria Embankment (A3211) between Savoy Place and Westminster Bridge (A302)	7 and 10 May 2011
Craig's Court	
Great Scotland Yard	
Scotland Place	
Whitehall Place	
Whitehall Court	
Horse Guards Avenue	
Temple Place (also relating to the Blackfriars Bridge Foreshore site)	
Essex Street (also relating to the Blackfriars Bridge Foreshore site)	
Surrey Street (also relating to the Blackfriars Bridge Foreshore site)	
Arundel Street(also relating to the Blackfriars Bridge Foreshore site)	

Survey type and location	Date
Maltravers Street (also relating to the Blackfriars Bridge Foreshore site)	
Milford Lane (also relating to the Blackfriars Bridge Foreshore site)	

**Pedestrian and cycle movement surveys only.*
***ATC data for Victoria Embankment has been provided by TfL – see para. 17.4.108*

17.4.90 The following ATC and junction surveys are on construction traffic routes to and from the Victoria Embankment Foreshore site:

a. ATC on Northumberland Avenue (A400) – west of the junction with Victoria Embankment (A3211)

b. junction survey at Victoria Embankment (A3211) / Northumberland Avenue (A400) junction

Results of the surveys

17.4.91 The surveys inform the baseline situation in the area surrounding the site and are summarised in the following paragraphs.

Pedestrians

17.4.92 Table 17.4.9 indicates the pedestrian flows surrounding the site during the AM, inter-peak, PM and weekend peak hours.

Table 17.4.9 Existing pedestrian flows

Pedestrian crossing	Direction	Weekday			Weekend
		AM peak (08:00-09:00)	Inter-peak (12:00-13:00)	PM peak (17:00-18:00)	(13:00-14:00)
Specific surveys					
Thames Path on Victoria Embankment (A3211)	Northbound	85	436	418	810
	Southbound	88	526	586	492
Controlled pedestrian crossing on Victoria Embankment (A3211) , outside Embankment Underground station	Eastbound	49	296	334	401
	Westbound	212	271	643	447
Zebra crossing on Victoria Embankment (A3211) to the south of the junction with Savoy Place	Eastbound	6	32	108	79
	Westbound	21	43	66	66
Junction counts (pedestrian crossings) at the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400)					
Controlled pedestrian crossing at the junction of Victoria Embankment (A3211) / Northumberland Avenue (northern arm)	Eastbound	13	73	110	141
	Westbound	4	48	76	124
Controlled pedestrian crossing at the junction of Victoria Embankment (A3211) / Northumberland Avenue (western arm)	Northbound	86	245	309	342
	Southbound	224	254	207	126
Controlled pedestrian crossing at the junction of Victoria Embankment (A3211) / Northumberland Avenue (southern arm)	Eastbound	13	56	222	103
	Westbound	25	158	174	289
Junction counts (pedestrian crossings) at the junction of Victoria Embankment (A3211) and Horse Guards Avenue					
Controlled pedestrian crossing on Victoria	Eastbound	8	99	149	108

Pedestrian crossing	Direction	Weekday			Weekend
		AM peak (08:00-09:00)	Inter-peak (12:00-13:00)	PM peak (17:00-18:00)	(13:00-14:00)
Embankment (A3211) to the south of the junction with Horse Guards Avenue	Westbound	17	62	87	89

17.4.93 Pedestrian surveys around the site during the AM and PM peaks indicate that there is a relatively balanced flow of pedestrians during the AM peak hour along the Thames Path directly outside the site of approximately 90 pedestrians in each direction. During the PM peak hour the flow is considerably heavier with approximately 586 southbound pedestrians and 418 northbound pedestrians.

17.4.94 Pedestrian surveys show that a total of 261 and 977 pedestrians used the signalised pedestrian crossing along Victoria Embankment (A3211) to the north of the junction with Northumberland Avenue (A400), outside the Embankment Underground station in the AM and PM peak hours respectively.

17.4.95 A total of 27 and 184 pedestrians used the zebra crossing along Victoria Embankment (A3211) to the south of the junction with Savoy Place in the AM and PM peak hours respectively.

17.4.96 A total of 365 and 1098 pedestrians used the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400) in the AM and PM peak hours respectively. During the AM peak hour, the predominant flow of pedestrians was southbound across the western arm of the junction (ie. across Northumberland Avenue (A400)) and during the PM peak hour the predominant flow of pedestrians was northbound across the same arm of the junction.

17.4.97 To establish the Pedestrian Level of Service (LoS) along the footways surrounding the site a Level of Service assessment was undertaken (see Methodology in the Project-wide TA). The results indicate there is adequate capacity for pedestrians within the existing network.

17.4.98 The footway immediately adjacent to the Victoria Embankment Foreshore site (ie, the eastern footway of Victoria Embankment (A3211)) and the western footway of Victoria Embankment (A3211) operate at LoS A during the AM and PM peaks for pedestrians, which indicates adequate space and capacity for pedestrians to circulate without obstruction or delay.

17.4.99 The crossings at the junction of Victoria Embankment (A3211) with Northumberland Avenue (A400) operate at LoS A during the AM peak hour and LoS B during the PM peak hour, indicating that there would be some restriction on pedestrian movement due to the volume of opposing pedestrian flows in the PM peak hour. However, this does not cause any significant delay and pedestrians are generally able to move freely.

17.4.100 Table 17.4.10 summarises the LoS findings.

Table 17.4.10 Baseline pedestrian levels of service

Pedestrian crossing	Weekday			Weekend
	AM peak (08:00-09:00)	Inter-peak (12:00-13:00)	PM peak (17:00-18:00)	(13:00-14:00)
Victoria Embankment (A3211) – eastern footway	LoS – A (free circulation)	LoS – A (free circulation)	LoS – A (free circulation)	LoS – B (minor conflicts)
Victoria Embankment (A3211) – western footway	LoS – A (free circulation)	LoS – A (free circulation)	LoS – A (free circulation)	LoS – A (free circulation)
Northumberland Avenue (A400) crossing at junction with Victoria Embankment (A3211)	LoS – A (free circulation)	LoS – B (minor conflicts)	LoS – B (minor conflicts)	LoS – B (minor conflicts)
Victoria Embankment (A32111) crossing to south of the junction with Northumberland Avenue (A400)	LoS – A (free circulation)	LoS – B (minor conflicts)	LoS – B (minor conflicts)	LoS – B (minor conflicts)
Victoria Embankment (A3211) crossing to the north of the junction with Northumberland Avenue (A400), outside Embankment Underground station	LoS – A (free circulation)	LoS – B (minor conflicts)	LoS – B (minor conflicts)	LoS – B (minor conflicts)

Cyclists

17.4.101 Cycle surveys around the site show the existing usage of the Thames Path and other cycle routes surrounding Victoria Embankment (A3211). Table 17.4.11 indicates the flows of bicycles along Victoria Embankment (A3211) and Northumberland Avenue (A400).

17.4.102 Table 17.4.11 indicates that during the AM peak hour, there is a heavy flow of cyclists eastbound along Victoria Embankment (A3211). During the PM peak hour the predominant flow of cyclists is southbound. Northumberland Avenue (A400) experiences moderate cycle flows during the AM and PM peaks, with a predominant eastbound flow in the AM peak hour and relatively balanced cycle flows during the PM peak hour.

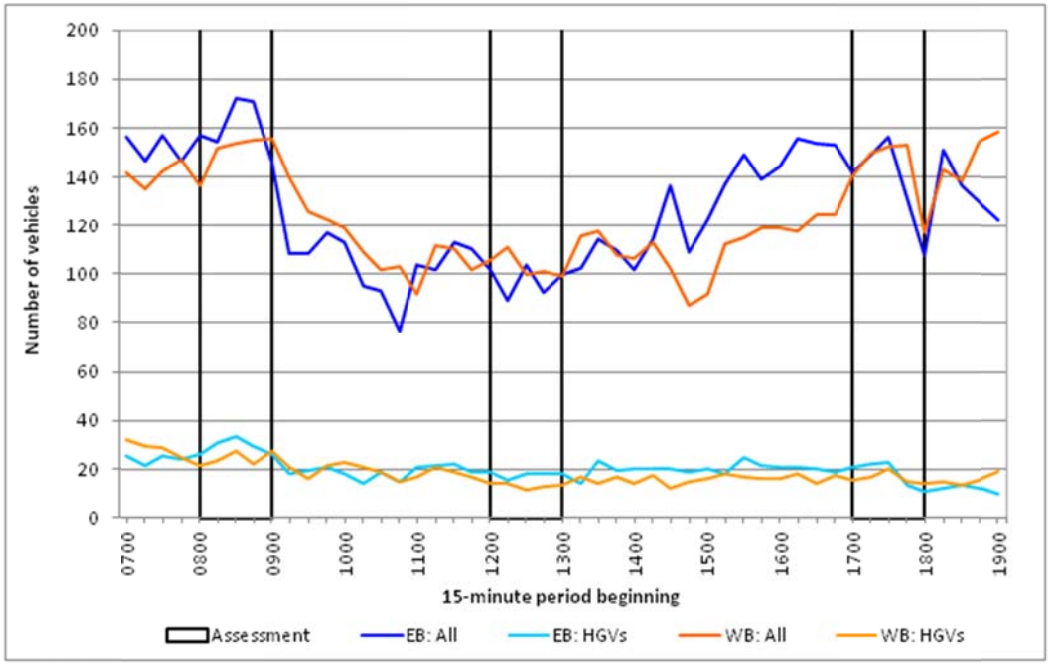
Table 17.4.11 Existing cycle flows

Road/route	Direction	Weekday			Weekend
		AM peak hour (08:00-09:00)	Inter-peak hour (12:00-13:00)	PM peak hour (17:00-18:00)	(13:00-14:00)
Victoria Embankment (A3211)	Eastbound	811	67	262	52
	Westbound	240	27	409	118
Northumberland Avenue (A400)	Eastbound	243	19	137	110
	Westbound	177	24	159	16

Traffic flows

17.4.103 ATC data collected as part of the surveys have been analysed to identify the existing traffic flows along Northumberland Avenue (A400). Weekday flows have been used as this is when the greatest impacts from the project are likely to be experienced. The weekday vehicle and HGV flows for a 12-hour period (07:00-19:00) are shown in Plate 17.4.5.

Plate 17.4.5 Existing weekday 15-minute traffic flows on Northumberland Avenue (A400) (ATC survey)



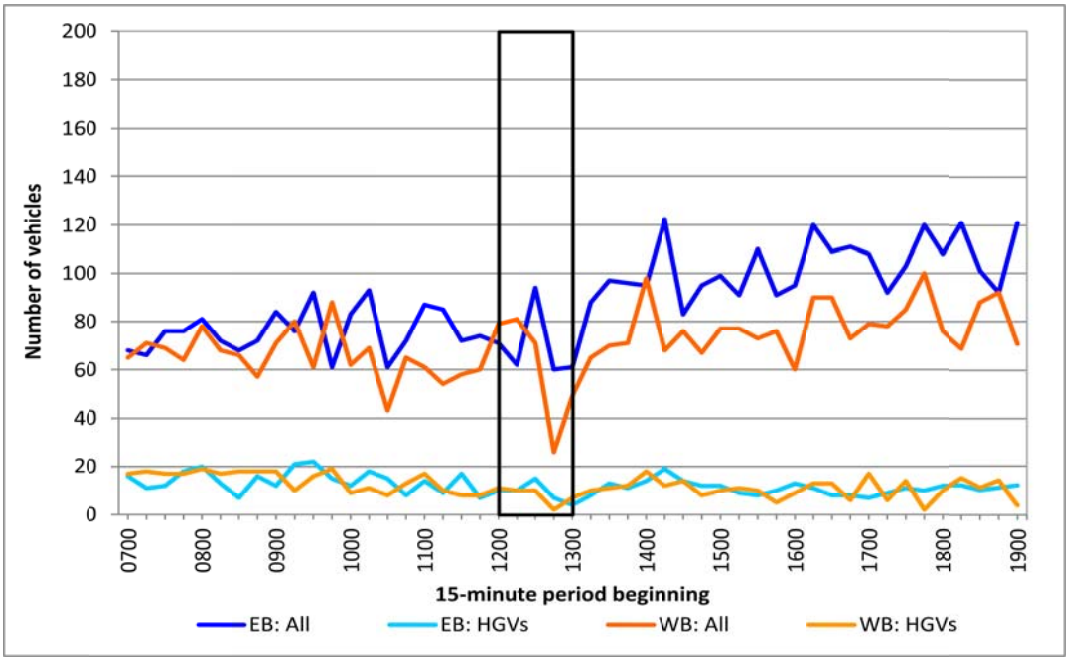
EB – East Bound, WB – West Bound. The black box represents the peak hour traffic flows used for the traffic assessment

17.4.104 The weekday ATC data shows that between 08:00 and 09:00 there were approximately 1,250 two-way vehicle movements. The busiest 15 minute peak period in this period occurred after 08:15 with approximately 170 eastbound vehicles and approximately 150 westbound vehicles.

17.4.105 For the period between 17:00 and 18:00 there were approximately 1,170 two-way vehicle movements. The busiest 15 minute peak period in this period occurred after 17:15 with approximately 160 eastbound vehicles and approximately150 westbound vehicles.

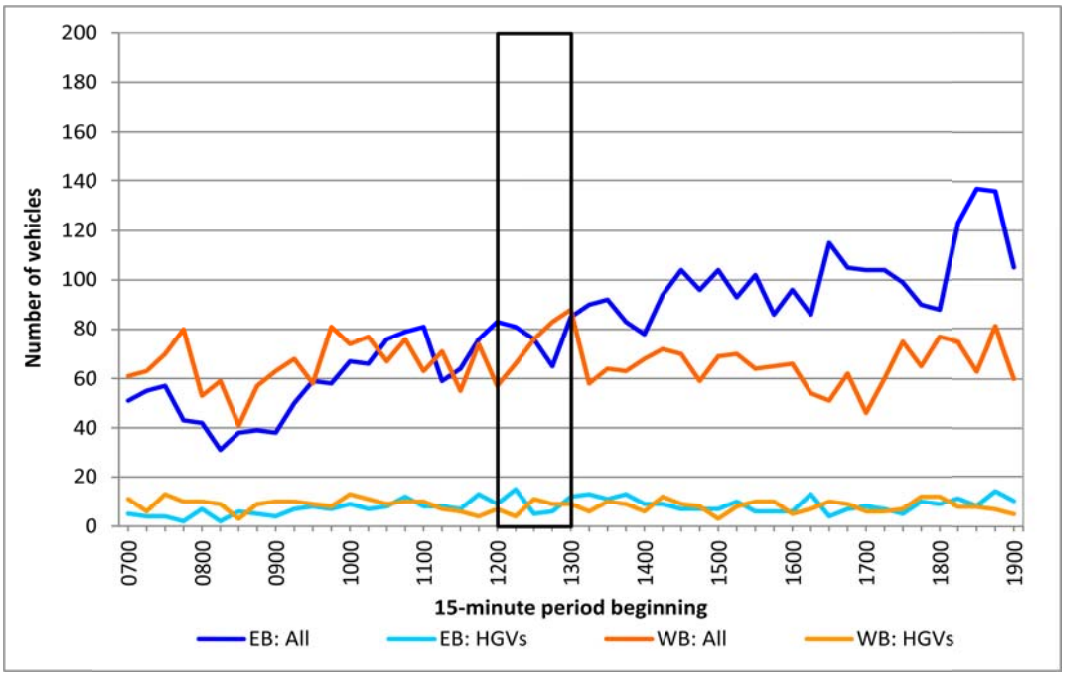
17.4.106 The Saturday vehicle and HGV flows for a 12-hour period (07:00-19:00) are shown in Plate 17.4.6. Analysis of the data showed that the Saturday peak travel period occurred between 17:00 and 18:00 with approximately 770 two-way movements recorded. This is less than the AM and PM weekday two-way traffic flows and the period falls outside of the expected weekend construction works vehicle movements period of between 08:00 and 13:30 on a Saturday.

Plate 17.4.6 Existing Saturday 15-minute traffic flows on Northumberland Avenue (A400) (ATC survey)



EB – East Bound, WB – West Bound. The black box represents the peak hour traffic flows used for the traffic assessment

Plate 17.4.7 Existing Sunday 15-minute traffic flows on Northumberland Avenue (A400) (ATC survey)



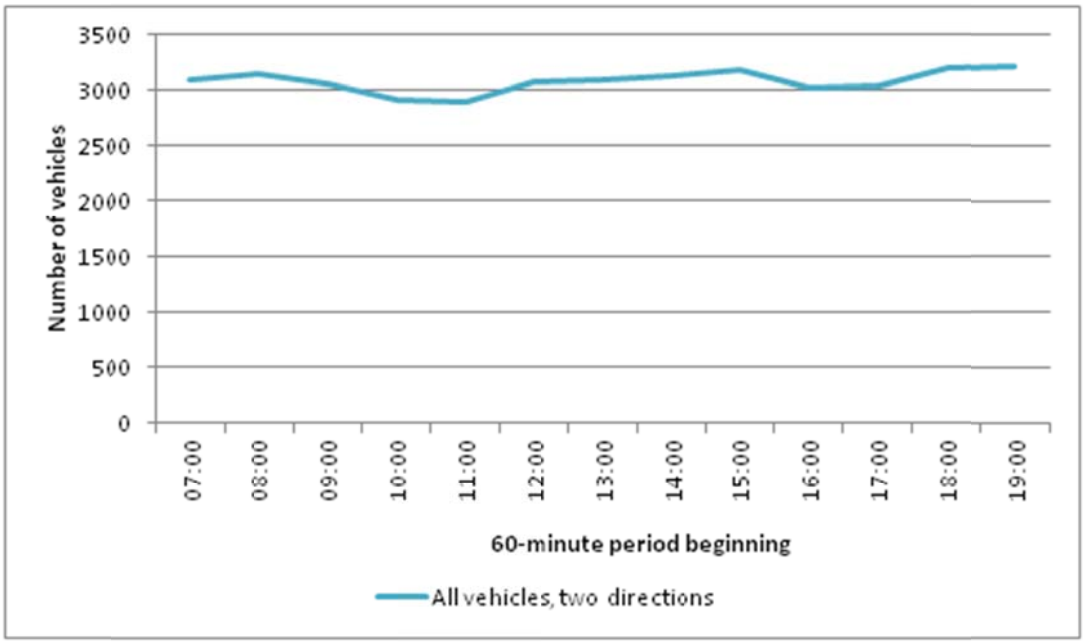
EB – East Bound, WB – West Bound. The black box represents the peak hour traffic flows used for the traffic assessment

17.4.107 The Sunday vehicle and HGV flows for a 12-hour period (07:00-19:00) are shown in Plate 17.4.7. Analysis of the data showed that the Sunday peak travel period occurred between 18:00 and 19:00 with approximately 780

two-way movements recorded. This is less than the AM and PM weekday two-way traffic flows. However, construction vehicle movements are not expected to take place on a Sunday.

17.4.108 The weekday two-way vehicle flows for a 12-hour period (07:00-19:00) on Victoria Embankment (A3211), sourced from TfL information, are shown in Plate 17.4.8. The TfL ATC information shows that the PM peak hour is the busiest hour, but only by a small margin over the rest of the day, with a two-way flow of approximately 3,225 vehicles.

Plate 17.4.8 Existing weekday two-way traffic flow on Victoria Embankment (A3211)



17.4.109 The junction surveys undertaken in 2011 have been validated against the TfL junction data and TRANSYT model. The baseline traffic flow diagrams in Figures 17.4.5 and 17.4.6 in the Victoria Embankment Foreshore *Transport Assessment* figures show the AM and PM peak hour traffic flows as used in the TRANSYT model. Figures 17.4.7 and 17.4.8 in the Victoria Embankment Foreshore *Transport Assessment* figures show the junction survey data collected.

17.4.110 The junction surveys indicate that there is a total traffic flow of 3,396 and 3,180 vehicles in the AM and PM peak hours respectively using the junction of Victoria Embankment (A3211) / Northumberland Avenue (A400). The dominant flows are 1,254 vehicles eastbound on Victoria Embankment (A3211) in the AM peak hour and 1,114 vehicles westbound on Victoria Embankment (A3211) in the PM peak hour.

17.4.111 The TfL data for the junction of Victoria Embankment (A3211) / Northumberland Avenue (A400) indicates that there is a total traffic flow of 2,919 and 3,438 vehicles using this junction in the AM and PM peak hours respectively.

17.4.112 Comparison of the 2011 junction survey against the TfL junction survey data used in the TRANSYT modelling shows that the 2011 data is slightly

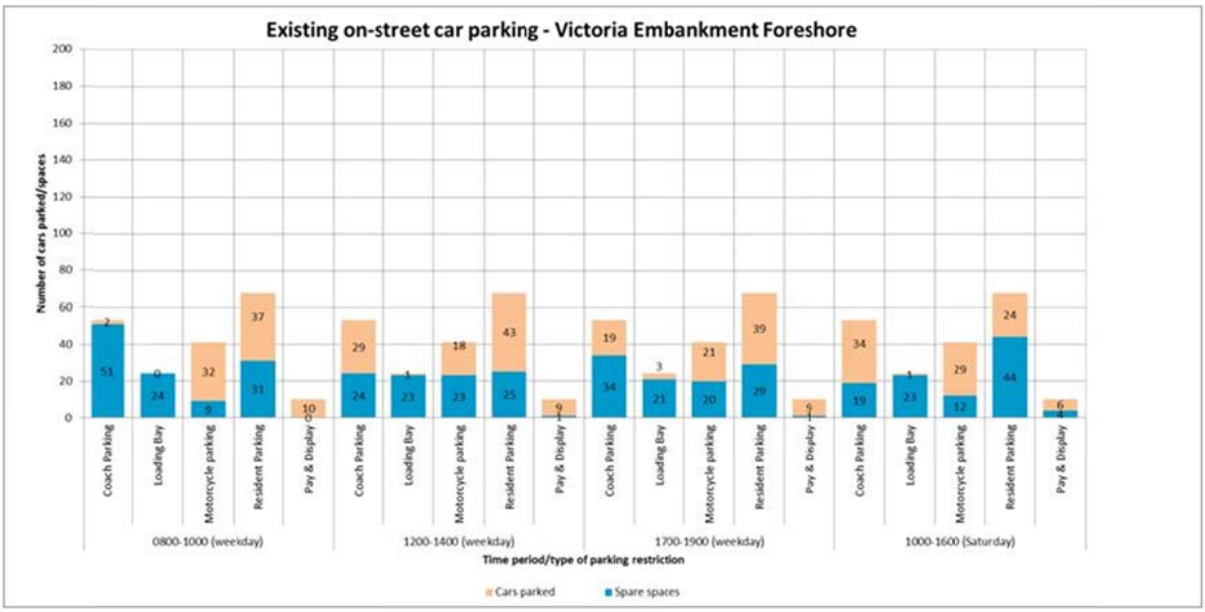
higher in the AM peak hour and lower in the PM peak hour, but of a similar order of magnitude, to that indicated in the TRANSYT model for this junction obtained from TfL.

17.4.113 Comparison of the junction survey data against the TfL ATC data indicates that the flows on Victoria Embankment (A3211) from the junction survey data are slightly lower than the ATC data but of a similar order of magnitude.

Parking

17.4.114 Plate 17.4.9 shows a histogram of the car and motorcycle parking survey results as well as coach parking and loading bay availability and usage in the area surrounding the Victoria Embankment Foreshore site during the AM, inter-peak, PM peaks on a weekday and during the weekend peak period.

Plate 17.4.9 Existing on-street car parking availability and usage



17.4.115 Table 17.4.12 shows the parking capacity availability throughout a weekday and a Saturday on the roads in the vicinity of the site.

Table 17.4.12 Resident, pay and display, coach, loading and motorcycle parking bay availability and usage*

Location	Number and Type of Bays		No. of spaces available			
			Weekday			Saturday
			08:00-10:00	12:00-14:00	17:00-19:00	12:00-14:00
Victoria Embankment (A3211)	Coach parking bays	48	47	19	30	17
	Loading bays	24	24	23	21	23
	Motorcycle spaces	41	9	23	20	12
	Pay and display parking bays	10	0	1	1	4
Great Scotland Yard	Coach parking bays	3	3	3	3	1
Whitehall Place	Coach parking bays	2	1	2	1	1
	Resident parking bays	38	25	22	25	27
	Blue badge parking bays	2	2	1	0	0
Whitehall Court	Resident parking bays	30	6	3	4	17

**Motorcycle spaces available based on an assumed width of 1m per motorcycle*

17.4.116 The results of the parking surveys indicate that usage of the coach parking bays along Victoria Embankment (A3211) is low in the AM peak but is heavier thereafter and at weekends, although there is still spare capacity available on both weekdays and at weekends during the peak and off-peak periods.

17.4.117 The usage of resident parking bays on the roads in the vicinity of the site is relatively high with more than 50% of the capacity utilised on weekdays although there is still spare capacity available. The usage of these bays is about 35% at weekends.

17.4.118 The usage of pay and display parking bays on the roads close to the site is low with less than 5% of the capacity utilised on weekdays but at weekends the usage of these parking bays reaches up to 20%.

17.4.119 The usage of motorcycle parking is relatively high with between 60% and 86% of the capacity utilised on weekdays and at weekends although there is still spare capacity available during the peak and off-peak periods.

17.4.120 Surveys were also undertaken to establish the usage of the loading bay along Victoria Embankment (A3211). Results indicate there is ample capacity as the loading bay along this road is not heavily used for the majority of the day.

Local highway modelling

17.4.121 To establish the existing capacity on the local highway network, a scope was discussed with TfL and Westminster City Council to model the junctions of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue using the TfL TRANSYT model as a base.

17.4.122 Traffic models for these junctions have been developed for this assessment and where possible suitable models from TfL have been used. The models have been constructed using on-street measurements of classified vehicle volumes and queue lengths.

17.4.123 The signal timings used in the assessment have been obtained from the TfL Signal Timing Sheet for this junction.

17.4.124 The TfL Modelling Guidelines (TfL, 2010)[5] and Modelling Audit Process (MAP) (TfL, 2010)[6] have been used as the basis for preparing and checking models and their outputs. All required input data has been used in order to calibrate the model. Where TfL models have been used, saturation flows have been retained where no change is proposed to junctions; where changes are proposed, saturation flows have been calculated and compared with site observations to determine suitable values. Validation of the models has been used on observed data including signal timings, vehicle volumes and queue lengths to provide the key criteria for comparison with modelled queue lengths.

17.4.125 The models are considered suitable for this planning stage and are intended to demonstrate the nature of the effects of the additional vehicles generated by the Thames Tideway Tunnels project in this location. It is acknowledged that these models may require further refinement as the project moves from planning to detailed design stage; however, as a period of time will elapse before construction commences at this site, it will be necessary in any case to review and revalidate the models against traffic conditions at that time, as is normal practice.

17.4.126 As part of the scope the local modelling is required for the adjacent junctions to the sites. The TfL model has been used as a base for the junction of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue for this site. As the strategic modelling has not identified any major issues at other junctions in the vicinity of the site, no local modelling is required for other junctions.

17.4.127 In discussions with TfL, the potential for concurrent construction activity at this site and the Blackfriars Bridge Foreshore site to affect traffic conditions on the whole length of Victoria Embankment (A3211) has been

raised. In order to assess this potential, a ‘sub-area’ traffic microsimulation model has been developed. The outcomes of this ‘sub-area’ assessment are reported in a specific section in the *Project-wide TA*.

17.4.128 The baseline model accounts for the current traffic and transport conditions within the vicinity of the site.

17.4.129 The weekday AM and PM baseline model queues for Victoria Embankment (A3211) were compared against observed queue lengths for the peak periods (from junction surveys) to validate the TRANSYT model and ensure reasonable representation of existing conditions.

17.4.130 Figure 17.4.5 and 17.4.6 in the Victoria Embankment Foreshore *Transport Assessment* figures show the traffic flows which were used for the baseline AM and PM peak hour assessments. They take TfL and survey data into account.

17.4.131 Table 17.4.13 shows the modelling outputs for the baseline case. The modelling results for the junction of Victoria Embankment (A3211) with Northumberland Avenue (A400) indicate that the junction is currently operating above capacity in the weekday AM peak hour and below capacity in the weekday PM peak hour.

Table 17.4.13 Baseline TRANSYT model outputs

Approach	Movement	Weekday							
		AM peak (08:00-09:00)				PM peak (17:00-18:00)			
		Flow (PCU)	DoS	MMQ (PCU)	Delay (seconds per PCU)	Flow (PCU)	DoS	MMQ (PCU)	Delay (seconds per PCU)
Junction of Victoria Embankment (A3211) and Northumberland Avenue (A400)									
Victoria Embankment (A3211) westbound	Right	354	95%	15	111	412	79%	11	53
	Ahead	1059	88%	31	41	1115	85%	20	25
Victoria Embankment (A3211) eastbound	Ahead	1254	99%	45	55	943	71%	11	8
	Left	99	28%	3	49	73	23%	2	58
Northumberland Avenue (A400)	Left right	275	67%	8	47	249	67%	7	50
	Left	366	72%	10	43	397	84%	12	55
		PRC		Total delay (PCU hours)		PRC		Total delay (PCU hours)	
Overall junction performance		-10%		51		+6%		27	
Junction of Victoria Embankment (A3211) and Horse Guards Avenue									
Victoria Embankment (A3211) westbound	Right	402	72%	9	34	506	69%	13	31
	Ahead	657	52%	7	11	729	53%	9	9
Victoria Embankment (A3211) eastbound	Ahead	1183	102%	55	106	843	83%	23	43
	Left	18	3%	0	26	18	4%	0	30
Horse Guards Avenue	Left / right	180	51%	5	36	183	77%	6	63

	PRC	Total Delay (PCU hours)	PRC	Total Delay (PCU hours)
Overall junction performance	-13%	43	+8%	20

Note: DoS represents Degree of Saturation; the ratio of flow to capacity. MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). Delay represents the mean delay per PCU. PCU represents Passenger Car Unit. PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 PCUs and pedal cycles are 0.2 PCUs.

17.4.132 The modelling results for the junction of Victoria Embankment (A3211) with Northumberland Avenue (A400) indicate that overall, the junction is currently operating above capacity in the weekday AM peak hour and below capacity in the weekday PM peak hour.

17.4.133 The AM peak hour is the busiest with maximum queues of approximately 45 vehicle lengths on the Victoria Embankment eastbound ahead movement. The delay to vehicles is most significant during the AM peak hour for vehicles turning right from Victoria Embankment westbound into Northumberland Avenue westbound, which currently experiences an average of 111 seconds of delay per PCU. In the PM peak hour, the maximum delay to vehicles is from Victoria Embankment (A3211) eastbound turning left to Northumberland Avenue (A400) with an average of 58 seconds per PCU.

17.4.134 The overall performance of Victoria Embankment (A3211) and Horse Guards Avenue junction shows that the junction is currently operating above capacity in the AM peak hour and below capacity in the PM peak hour. The validated model indicates that the maximum delay per PCU in the AM peak hour is along the eastbound carriageway of Victoria Embankment (A3211) moving ahead with an average of 106 seconds of delay per PCU. In the PM peak hour, the delay to vehicles is most significant for vehicles turning into Victoria Embankment (A3211) from Horse Guards Avenue with an average of 63 seconds of delay per PCU.

17.4.135 The TRANSYT junction model outputs shows that total junction delay for the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400) is 51 PCU hours in the AM peak period assessed and 27 PCU hours in the PM peak period assessed. These equate to 54 seconds per PCU in the AM and 31 seconds per PCU in the PM peak period assessed.

17.4.136 The TRANSYT junction model outputs shows that for the junction of Victoria Embankment (A3211) and Horse Guards Avenue the delay for the junction is 43 PCU hours in the AM peak period assessed and 20 PCU hours in the PM peak period assessed. These equate to 63 seconds per PCU in the AM and 31 seconds per PCU in the PM peak period assessed.

17.4.137 More detailed model outputs are included in Appendix D which also supplies diagrams showing the lane structure used for the assessment of the junction.

Accident analysis

17.4.138 Accident data in the assessment area for the most recent five-year period available were obtained from TfL.

17.4.139 A total of eight serious accidents and 41 slight accidents occurred in the Victoria Embankment Foreshore assessment area over the five years for which accident data was obtained and analysed. There were no fatal accidents.

17.4.140 On Victoria Embankment (A3211) between the junction with Horse Guards Avenue and the entrance to Embankment Gardens there have been a total of 44 accidents including those at the junctions. Of the total

accidents, eight were classified as serious and the remaining 36 accidents were recorded as slight.

17.4.141 The majority of the serious accidents occurred on Victoria Embankment (A3211) to the north of the junction with Northumberland Avenue (A400) outside Embankment Underground station.

17.4.142 One serious accident occurred on Victoria Embankment (A3211) to the south of the junction with Northumberland Avenue (A400), and two serious accidents occurred at the junction of Victoria Embankment (A3211) / Horse Guards Avenue. None of the serious accidents happened as a result of the road geometry.

17.4.143 Of the total accidents, three involved LGVs and two involved medium goods vehicles (MGVs), all of which were slight accidents.

17.4.144 In total, 18 pedestrians were involved in the accidents. Of these eight were recorded as serious and ten as slight accidents. Of the total accidents, three accidents involved cyclists of which all were classified as slight.

17.4.145 Of the five year accident data analysed, one accident happened as a result of the road layout. This accident involved a pedestrian and a bus/coach at the junction of Northumberland Avenue (A400) and Whitehall Place.

17.4.146 Table 17.4.14 and Figure 17.4.9 in the Victoria Embankment Foreshore *Transport Assessment* figures indicate the accidents that have occurred within the vicinity of the site.

Table 17.4.14 Accident severity 2006 to 2011

Location	Slight	Serious	Fatal	Total
Victoria Embankment (A3211) between the junction with Horse Guards Avenue and the entrance to Embankment Garden	12	6	0	18
Northumberland Avenue (A400) between the junction with Victoria Embankment (A3211) and the junction with Whitehall Place	1	0	0	1
Victoria Embankment (A3211) / Northumberland Avenue (A400) junction	18	0	0	18
Victoria Embankment (A3211) / Horse Guards Avenue junction	6	2	0	8
Northumberland Avenue (A400) / Whitehall Place junction	4	0	0	4
Total	**41**	**8**	**0**	**49**

17.4.147 Of the 18 pedestrian-injury accidents, 16 occurred on the roads expected to be used by construction vehicles within the study area. Inspection of the data showed that six of these occurred at junctions with signalised pedestrian crossing facilities, with the remaining accidents occurring at locations without signal control. Of the three accidents involving cyclists, all occurred on the roads/junctions expected to be used by construction vehicles within the study area. Figure 17.4.10 in the Victoria Embankment Foreshore *Transport Assessment* figures shows the pedestrian and cycle accidents by severity that occurred within the vicinity of the site.

17.4.148 In the context of the construction HGV movements associated with the Victoria Embankment Foreshore site, the accident risk to these modes of travel would be managed by providing pedestrian and cyclist awareness training for commercial drivers associated with the construction works as set out in the *CoCP*. For sections of roads affected by roadworks, the risk to all road users would be managed by the contractor(s) in accordance with the provisions made under the Traffic Signs Manual Chapter 8 – Traffic Safety Measures and Signs for Road Works (DfT, 2009)[7].

17.4.149 Appendix E provides a full analysis of accidents within the local area surrounding Victoria Embankment Foreshore.

17.5 Construction assessment

17.5.1 The *TA* for the Victoria Embankment Foreshore site including both qualitative and quantitative analysis has been undertaken drawing on discussions with TfL and the Local Highway Authorities, knowledge of the transport networks and their operational characteristics in the vicinity of the site and the anticipated construction programme, duration and levels of construction activity.

17.5.2 The construction assessment compares a construction base case, which represents transport conditions in the assessment year without the Thames Tideway Tunnel project, with a construction development case, which represents conditions with the Thames Tideway Tunnel project under construction. The construction base case does not include any traffic related to the Thames Tideway Tunnels, whether from the Victoria Embankment Foreshore site or from other sites.

Construction base case

17.5.3 As described in Section 17.3 above, the construction assessment year for transport effects in relation to this site is Site Year 1 of construction.

Pedestrians and cyclists

17.5.4 There are no proposals to change the cycle or pedestrian network by Site Year 1 of construction and the construction base case for these networks is therefore the same as indicated in the baseline description in Section 17.4.

17.5.5 The LoS on the surrounding pedestrian network would remain as indicated in the baseline situation, with sufficient capacity and no obstructions to movements.

Public transport

17.5.6 In terms of the public transport network, it is expected that as a result of the TfL London Underground Upgrade Plan (TfL, 2011)[8], compared to the current baseline, London Underground capacity will increase by approximately 20% and journey times will reduce by approximately 18% on the Northern Line. On the Jubilee Line there will be increases to capacity of approximately 33% and a reduction in journey times of approximately 22%. The TfL Upgrade Plan envisages a combined increase in capacity on the Circle and Hammersmith and City Line of 65% although it is clear that a significant proportion of this increase is attributed to the revised service patterns implemented in 2009, which will already be reflected in the baseline data. A 24% increase in capacity is anticipated on the District Line. Further works will take place on the Bakerloo Line to increase capacity however changes have not yet been detailed.

17.5.7 It is expected that river services between Putney and Blackfriars may increase from baseline conditions as a result of planned service changes which were being tendered at the time of writing.

17.5.8 It is anticipated that patronage on public transport services may change between the baseline situation and Site Year 1 of construction. Future patronage changes on bus, rail and river networks will be driven by a range of complex factors and there are inherent uncertainties in setting a patronage level for a future year. Therefore, in order to ensure that a busiest base case scenario has been used in assessing the result of additional construction worker journeys by public transport, the capacity for public transport services in the construction base case has been assumed to remain the same as capacity in the baseline situation. This ensures a robust assessment.

River navigation

17.5.9 The underlying pattern of river use has not substantially changed in recent years, but the Mayor of London and TfL do actively promote the use of passenger services and encourage the provision of more piers. Greater freight use is also encouraged through policies in the London Plan (GLA, 2011)[9]. Consequently it is possible that the nature and number of vessel movements on the River Thames might change over time.

17.5.10 However, it is difficult to determine what the scale and nature of any change might be and at the time of writing there were no specific proposals to alter river navigation patterns from the current baseline conditions in the vicinity of the Victoria Embankment Foreshore site. For this assessment, therefore, the construction base case has been assumed to be the same as the baseline position.

17.5.11 The London Eye Pier Extension will provide additional mooring for a vessel which will lie approximately 140m from the Victoria Embankment Foreshore site. This is not anticipated to alter river navigation.

17.5.12 It is noted that a separate *Navigational Issues and Preliminary Risk Assessment* has been undertaken for the temporary construction works and barges to be used at the Victoria Embankment Foreshore site. This is reported separately outside of the *TA*.

Highway network and operation

17.5.13 Baseline traffic flows (determined from the junction surveys and TfL data) have been used and forecasting carried out to understand the capacity on the highway network in the vicinity of the Victoria Embankment Foreshore site in Site Year 1 of construction without the Thames Tideway Tunnel project. The scope of this analysis has been discussed with Westminster City Council and TfL.

17.5.14 Strategic highway network modelling has been undertaken at a project-wide level using the TfL HAMs, which include forecasts of employment and population growth in line with the London Plan (GLA, 2011)[10]. Growth factors have been derived at individual borough level by comparing the 2008/9 base and 2021 forecast years in the HAMs, as described in the *Project-wide TA*.

17.5.15 For the Victoria Embankment Foreshore site, CLoHAM has been used. The relevant growth factor for this site is described in para. 17.5.19 which was applied to the survey flows undertaken in 2011 to produce flows for the base and development cases.

17.5.16 It should be noted that these factors represent growth over the period to 2021, which is beyond Site Year 1 of construction at Victoria Embankment Foreshore and therefore ensures that the construction base case for the highway network is robust.

Committed developments

17.5.17 The construction base case takes into account new developments that would be complete or under construction within the vicinity of the site by Site Year 1 of construction at Victoria Embankment Foreshore. These are:

a. the London Eye Pier extension, to the south of the existing London Eye Millennium Pier

b. mixed residential and office development at Elizabeth House on the south bank of the River Thames

c. mixed use development including community sports centre at Upper Ground / Doon Street on the south bank of the River Thames

d. mixed office and retail development at York House on the south bank of the River Thames

e. development at the Odeon West end site in Leicester Square to provide a new cinema, housing and restaurant facilities.

17.5.18 The strategic modelling using CLoHAM has inherently taken the Victoria Area Planning Brief proposals into consideration, which encompasses developments which may result in changes to the highway and transport networks in the area local to the site. As the local modelling also uses growth factors from CLoHAM, developments within that Brief have been allowed for in the local modelling.

Local highway modelling

17.5.19 The growth factors for the City of Westminster based on CLoHAM have been discussed with TfL and Westminster City Council and applied equally to all of the baseline traffic flow movements. The growth factors are:

a. Weekday AM Peak growth factor – +4.7%

b. Weekday PM Peak growth factor – +6.1%.

17.5.20 Para. 17.3.10 explains the definition of the assessment area for local highway network modelling. At this site, the assessment examines the junctions of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue which are the nearest junctions of the construction vehicle route with the TLRN.

17.5.21 The results of the construction base case TRANSYT 12 model for the junctions of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue in the vicinity of the site are shown in Table 17.5.1. The results indicate that the junction of Victoria Embankment (A3211) with Northumberland Avenue (A400) would continue to operate above capacity in the AM peak hour and would operate at capacity in the PM peak hour.

17.5.22 The junction of Victoria Embankment (A3211) and Horse Guards Avenue would operate within capacity in both peak hours. This compares to operation above capacity in the AM peak hour in the baseline situation and results from the inclusion of optimised signal timings within the construction base case modelling, compared to baseline conditions.

Table 17.5.1 Construction base case TRANSYT model outputs

Approach	Movement	Weekday							
		AM peak (08:00-09:00)				PM peak (17:00-18:00)			
		Flow (PCU)	DoS	MMQ (PCU)	Delay (seconds per PCU)	Flow (PCU)	DoS	MMQ (PCU)	Delay (seconds per PCU)
Junction of Victoria Embankment (A3211) and Northumberland Avenue (A400)									
Victoria Embankment (A3211) westbound	Right	371	95%	16	99	441	82%	12	55
	Ahead	1112	86%	29	24	1193	91%	28	31
Victoria Embankment (A3211) eastbound	Ahead	1316	94%	40	27	1009	79%	15	11
	Left	105	39%	3	61	78	24%	2	57
Northumberland Avenue (A400)	Left / right	289	92%	12	92	266	71%	8	52
	Left	385	92%	14	77	425	90%	15	67
		PRC		Total delay (PCU hours)		PRC		Total delay (PCU hours)	
Overall junction performance		-6%		45		-1%		33	
Junction of Victoria Embankment (A3211) and Horse Guards Avenue									
Victoria Embankment (A3211) westbound	Right	421	80%	11	40	542	82%	14	34
	Ahead	691	50%	6	7	780	59%	7	8
Victoria Embankment (A3211) eastbound	Ahead	1242	84%	31	32	902	80%	24	38
	Left	19	3%	0	19	19	4%	0	27
Horse Guards Avenue	Left / right	189	78%	6	63	196	78%	7	60

	PRC	Total Delay (PCU hours)	PRC	Total Delay (PCU hours)
Overall junction performance	+7%	20	+10%	20

Notes: 1. DoS represents Degree of Saturation; the ratio of flow to capacity . MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). Delay represents the mean delay per PCU. PCU represents Passenger Car Unit. PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 PCUs and pedal cycles are 0.2 PCUs.

2. Assessment has assumed that traffic signal optimisation has been undertaken as detailed in Volume 2 of the Environmental Statement.

17.5.23 Compared to the baseline situation there will be a change in queue lengths at the junctions of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue. In the AM peak hour this would be most noticeable on the Northumberland Avenue (A400) approach and in the PM peak hour on the westbound carriageway of Victoria Embankment (A3211) ahead movement at the junction of Victoria Embankment (A3211) / Northumberland Avenue (A400).

17.5.24 Results indicate that in the construction base case the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400) will continue to operate above capacity in the AM and PM peak hours and the total average delay will decrease by six seconds in the AM peak hour and will increase by six seconds in the PM peak hour compared with the baseline situation. Average queue lengths will increase slightly on certain arms in the AM peak hour and on all arms in the PM peak hour.

17.5.25 The junction of Victoria Embankment (A3211) and Horse Guards Avenue will operate below capacity in the AM and PM peak hours. In the construction base case the total average delay will decrease by 23 seconds in the AM peak hour and there will be no change in the PM peak hour compared with the baseline situation.

17.5.26 The TRANSYT junction model outputs shows that total junction delay for the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400) is 45 PCU hours in the AM peak period assessed and 33 PCU hours in the PM peak period assessed. These equate to 45 seconds per PCU in the AM and 35 seconds per PCU in the PM peak period assessed.

17.5.27 The TRANSYT junction model outputs shows that for the junction of Victoria Embankment (A3211) and Horse Guards Avenue the delay for the junction is 20 PCU hours in the AM and PM peak periods assessed. These equate to 29 seconds per PCU in the AM and PM peak periods assessed.

Construction development case

17.5.28 This section summarises the findings of the assessment undertaken for the peak year of construction at the Victoria Embankment Foreshore site (Site Year 1 of construction).

Pedestrian routes

17.5.29 As described in Section 17.2, the pedestrian diversions would result in changes to the pedestrian movements around Victoria Embankment Foreshore. The construction phasing plans in the Victoria Embankment Foreshore *Transport Assessment* figures show the layout of pedestrian footways during construction.

17.5.30 The construction site would be located on the foreshore of the River Thames and in order to provide working areas, the site would also occupy part of the riverside footway of Victoria Embankment (A3211).

17.5.31 Pedestrians using the Thames Path along the riverside footway of Victoria Embankment (A3211) would be diverted away from this section of the route. This would be necessary throughout the construction works and

therefore the route would be diverted to the western footway of Victoria Embankment (A3211) for the duration of the construction period.

17.5.32 Pedestrians would use the existing signalised pedestrian crossing located at the junctions of Victoria Embankment (A3211) with Horse Guards Avenue and at Northumberland Avenue (A400) to cross between the eastern and western footways of Victoria Embankment (A3211).

17.5.33 To assess a busiest case scenario, it has been anticipated that all worker trips would travel to and from the site by foot. As a result the 65 worker trips generated by the site have been added to the construction base case pedestrian flows during the AM and PM peak hours.

17.5.34 Given this small increase in pedestrian numbers against baseline usage, an extension to the length of the pedestrian phase at the junctions of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue would not be required. In addition, as the assessment assumes that all construction workers would travel in the peak hours, the increase in pedestrian numbers against baseline usage during the peak hours due to construction workers walking is considered to be a conservative estimate because, due to the site working start and finish times, many workers will be travelling outside of peak network hours.

17.5.35 The pedestrian diversions and additional worker trips during construction would result in an increase to pedestrian flows on the western footway along Victoria Embankment (A3211). However, analysis shows that pedestrian LoS values would not change in the AM peak hour and would change slightly in the PM peak hour from those in the construction base case. The western footway of Victoria Embankment (A3211) would continue to operate at LoS A in the AM peak hour, indicating free flow of pedestrian movements and no obstructions.

17.5.36 In the PM peak hour, the LoS value would change from LoS A to LoS B indicating that there would be some restriction on pedestrian movement due to diverting pedestrians from the Thames Path to the western footway of Victoria Embankment (A3211). However, this does not cause any significant delay and pedestrians are generally able to move freely.

17.5.37 The pedestrian diversions and additional construction worker trips during construction would also result in changes to pedestrian flows on the signalised pedestrian crossings on Victoria Embankment (A3211) outside Embankment Underground station and at the junction of Victoria Embankment (A3211) / Northumberland Avenue (A400). However, analysis shows that pedestrian LoS values would not change in the AM and PM peak hours.

17.5.38 It is anticipated that the pedestrian diversions around the Victoria Embankment Foreshore site would result in a journey time increase of approximately two minutes, based on the delay associated with the need to make two additional crossings and the extension of the journey by 40m and a walking speed of 1.3m/sec. Other pedestrian movements in the area would incur no additional delays.

17.5.39 The need for pedestrians using the riverside footway to make an additional two road crossings to follow the diversion route could increase pedestrian /

vehicle conflicts and therefore increase the risk of accidents occurring to pedestrians. It should be noted, however, that the crossings at Northumberland Avenue (A400) and Horse Guards Avenue which would be on the signed diversion route are both fully signal controlled.

17.5.40 During all construction work and on any section of road subject to temporary diversions or restriction imposed by roadworks associated with the Victoria Embankment Foreshore site, the risk to all road users would be managed by the contractor(s) in accordance with the provisions made under the Traffic Signs Manual Chapter 8 – Traffic Safety Measures and Signs for Road Works (DfT, 2009)[11]. This will include compliance with the Equality Act 2010 (HM Government, 2010)[12] to ensure safe passage for mobility and vision impaired pedestrians.

Cycle routes

17.5.41 Cyclists using the highway would experience an additional delay to journey time as a result of the construction works at the Victoria Embankment Foreshore site. The effect on journey times on the highway network is identified in the TRANSYT modelling which is outlined in paras. 17.5.89-17.5.95.

17.5.42 At the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400) this suggests there would be a change in overall average delay of no more than one second in either peak hour.

17.5.43 Cyclists making these movements could therefore experience additional delays of this order when passing along Victoria Embankment (A3211) and through these two junctions.

17.5.44 Cyclists would not be required to make any additional road crossings as a result of the construction works at Victoria Embankment Foreshore. However, during the construction period (phases 1-4), an intermittent lane closure would be required in the westbound carriageway of Victoria Embankment (A3211) to accommodate construction vehicles arriving at and departing from the site. This would result in the segregation of cyclists from the construction vehicles waiting at site access points. However, conflict points might still arise in locations where HGVs are accessing this area.

17.5.45 Although temporary changes would be made to the highway layout, cyclists would remain on the carriageway and minimum lane widths of 3.25m for the inside lanes in both directions would be maintained.

17.5.46 There would also be an increase in construction HGV movements of approximately three movements per hour on Victoria Embankment (A3211). Overall this would lead to a very minor increase in the risk of accidents to cyclists; however, appropriate signage would be provided to warn cyclists of the presence of large vehicles.

17.5.47 Construction vehicles serving the site would comprise a range of sizes and types, including light vans, rigid bodied vehicles and longer articulated vehicles. At this site the majority of the vehicles are expected to be medium or heavy rigid bodied goods vehicles.

17.5.48 Measures set out in the *CoCP* described in paras. 17.2.40 and 17.2.41 include increasing driver awareness of restrictions on the road network and marshalling of traffic at the site access. During all construction work and on any section of road subject to temporary diversions or restrictions imposed by roadworks associated with the Victoria Embankment Foreshore site, the risk to all road users would be managed by the contractor(s) in accordance with the provision made under the Traffic Signs Manual Chapter 8 – Traffic Safety Measures and Signs for Road Works (DfT, 2011)[13]. This would include compliance with TfL guidance (Cyclists at Roadworks – Guidance (TfL, 1999)[14]) to ensure safe passage for cyclists.

Bus routes and patronage

17.5.49 No bus services run immediately past the site. However, additional construction vehicles travelling along Victoria Embankment (A3211) and the traffic management arrangements along Victoria Embankment (A3211) may affect bus journey times on routes operating further north on Northumberland Avenue (A400) and in the wider area.

17.5.50 However, the anticipated construction traffic volumes are small, the strategic modelling reported in the *Project-wide TA* indicates no significant change in delays in this part of the network and there are no bus routes passing through the junctions of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue. In the context of the local area and general journey times for bus services, no significant change for bus users is expected.

17.5.51 It is expected that approximately seven additional two-way worker trips would be made by bus during the AM and PM peak hours. The area is served by a large number of bus routes with multiple origins and destinations, providing a total of 402 and 400 buses within 640m walking distance during the AM and PM peak hours. On this basis the additional worker trips made by bus in the peak hours to and from the Victoria Embankment Foreshore site would be capable of being accommodated on the base case bus services and would typically be within the normal daily variation in bus patronage on these routes.

London Underground patronage

17.5.52 No underground stations are directly adjacent to the site and therefore none would be directly affected by the construction site development.

17.5.53 It is anticipated that there would be approximately 26 additional person trips on London Underground services in each of the AM and PM peak hours.

17.5.54 Due to the large number of London Underground services available at the three Underground stations within the vicinity of the site, this equates to well under one person per train based on a frequency of 322 and 324 trains during the AM and PM peak hours respectively.

17.5.55 This additional patronage could be easily accommodated within existing capacity.

National Rail and patronage

17.5.56 No rail stations are directly adjacent to the site and therefore none would be directly affected by the construction site development.

17.5.57 It is anticipated that construction at Victoria Embankment Foreshore would result in 27 additional person trips on National Rail services in each of the AM and PM peak hours.

17.5.58 This represents approximately one additional passenger per train on National Rail services into and out of Charing Cross in the AM and PM peak hours based on 23 AM peak service arrivals and 25 PM peak service departures.

17.5.59 This equates to an insignificant number of additional passengers on each National Rail services in the local area, which could be easily accommodated within existing capacity.

River services and patronage

17.5.60 During construction, no river passenger services would be altered as a result of the works at Victoria Embankment Foreshore. It is anticipated that few, if any, construction workers and labourers would use the river services to access the construction site, based on the mode shares set out in Table 17.2.3 and therefore there would be no discernible change in river patronage as a result of the construction proposals at this site.

17.5.61 To facilitate construction works, the Tattershall Castle, a permanently moored bar/restaurant boat, would be moved to a new location to the south of the construction site. The Hispaniola would remain in its current location.

17.5.62 The loading bay associated with the Hispaniola and the Tattershall Castle on Victoria Embankment (A3211) would be temporarily restricted during the utility diversions and construction phases, as detailed in para. 17.5.73.

17.5.63 The operators of the Tattershall Castle and Hispaniola would be able to use the on-street loading bays on Victoria Embankment (A3211) to the north of its junction with Northumberland Avenue (A400) and to the south of the site in order to service the bars and restaurants on these vessels.

River navigation and access

17.5.64 During construction it has been assumed that 90% of the cofferdam fill (import and export) and shaft and other excavated material (export) would be transported by barge. The peak number of barge movements would occur in Site Year 1 of construction and would be an average of four barge movements (two in each direction) a day.

17.5.65 It is anticipated that 800T barges would be used at this site. Barges would be hauled by tugs which typically haul one to two barges at a time where possible and depending on tides and mooring conditions. This means that there would be up to two tug movements in each direction (up to four in total) per day at this site in Site Year 1 of construction.

17.5.66 It is anticipated that the impact on river navigation in the vicinity of the Victoria Embankment Foreshore site as a result of the additional barges arriving at the site would not be significant.

17.5.67 It is noted that a separate *Navigational Issues and Preliminary Risk Assessment* has been undertaken for the temporary construction works and barges to be used at Victoria Embankment Foreshore. This is reported separately outside of the *Environmental Statement* and *Transport Assessment* as part of the application documentation.

Parking

17.5.68 Victoria Embankment (A3211) does not have any on-street car parking available in the immediate vicinity of the site due to TLRN restrictions in the area. There would be no changes to on-street car parking (pay and display) or private parking in the vicinity of the site as a result of the construction works.

17.5.69 During the utility diversion works which is in advance of main construction works, nine coach parking bays along Victoria Embankment (A3211) would require relocation, seven from the westbound carriageway and two from the eastbound carriageway. Coach parking spaces would be relocated to Albert Embankment (A3036) between Tinworth Street and Black Prince Road, Millbank (A3212) between Thorney Street and Atterbury Street, or on Lambeth Palace Road (A3036) to the north of Lambeth Road (A3203) / Lambeth Bridge (A3203) / Albert Embankment (A3036) / Lambeth Palace Road (A3036) roundabout.

17.5.70 During the main construction works, the two coach parking bays along the eastbound carriageway would be reinstated but the coach parking bays along the westbound carriageway would still be temporarily restricted to accommodate the site access arrangements and temporary traffic management arrangements on Victoria Embankment (A3211). These would be reinstated following construction.

17.5.71 The relocation of these coach bays to the locations explained in para. 17.5.69 has been discussed with TfL and Westminster City Council.

17.5.72 The existing coach parking bays along Victoria Embankment (A3211) between the junctions with Richmond Terrace and Horse Guards Avenue, and to the south of the junction with Savoy Place would be used for drop-off and picking-up passengers and the coach parking bays mentioned in para. 17.5.69 would be used as coaches awaiting area. The proposed relocation would increase the distance passengers would have to walk from Victoria Embankment (A3211) between 200m to 400m, but would result in only a slight increase to journey times for coaches using the relocated bays.

17.5.73 The loading bay in the westbound carriageway of Victoria Embankment (A3211) to the north of the coach parking bays would also be temporarily restricted during the construction works to enable the necessary traffic management arrangements. The loading bay on Victoria Embankment (A3211) to the north of its junction with Northumberland Avenue (A400) would be utilised as an alternative during this period. Other loading facilities within 200m of the existing facility could also be used as it is not significantly further in terms of walking or vehicle journey time from the existing location.

17.5.74 The motorcycle bay in the eastbound carriageway of Victoria Embankment (A3211) to the south of its junction with Northumberland Avenue (A400) would be restricted temporarily during the utility diversion works. The motorcycle bay would be reinstated to the baseline situation following the completion of those works. During the period of restriction, alternative motorcycle parking would not be provided as there would be spare capacity available in the surrounding area.

17.5.75 The highway layout during construction plan in the Victoria Embankment Foreshore *Transport Assessment* figures show the proposed restriction of coach, loading and motorcycle parking bays associated with the construction works at the Victoria Embankment Foreshore site.

17.5.76 The locations of the relocated coach parking bays are shown in the relocated coach bays on Albert Embankment, the relocated coach bays on Millbank, and the relocated coach bays on Lambeth Palace Road plans in the Victoria Embankment Foreshore *Transport Assessment* figures.

Highway assessment

Highway layout

17.5.77 The highway layout during utility diversion plan in the Victoria Embankment Foreshore *Transport Assessment* figures shows the highway layouts during utility diversion works, and the highway layout during construction – phases 1-5 plan in the Victoria Embankment Foreshore *Transport Assessment* figures show the highway layout during the main construction works at the Victoria Embankment Foreshore site.

17.5.78 The site is on the eastern side of Victoria Embankment (A3211) and would be accessed from the nearside lane of the westbound carriageway.

17.5.79 The highway layout during construction vehicle swept path analysis plans in the Victoria Embankment Foreshore *Transport Assessment* figures shows the swept path movements and shows that the construction vehicles would be able to safely enter and leave the site.

Highway network

17.5.80 Construction lorry movements would be limited to the day shift only (08:00 to 18:00 Monday to Friday and 08:00 to 13:00 Saturday). In exceptional circumstances HGV and abnormal load movements could occur up to 22:00 on weekdays for large concrete pours and later at night on agreement with Westminster City Council.

17.5.81 Table 17.2.4 in Section 17.2 shows the vehicle movement assumptions for the local peak traffic periods based on the peak months of construction activity at this site.

17.5.82 Assuming that 90% of the cofferdam fill (import and export) and shaft and other excavated material (export) would be transported by barge with all other material by road, Table 17.2.4 shows an average peak flow of 64 vehicle movements a day is expected during the months of greatest activity during Site Year 1 of construction at this site. In the AM and PM peak hours, the Victoria Embankment Foreshore site would generate approximately seven vehicle movements.

17.5.83 The busiest peak in the AM and PM period for each type of movement (construction lorries and other construction vehicles) has been combined in the development case and assessed against the peak hour operation of the highway network. In reality, not all peaks for these movements will occur concurrently and the peak for worker trips would be outside of the highway network peak hour, therefore, the assessment is considered to be robust.

17.5.84 The *Project-wide TA* explains the method used to assign construction traffic to the HAMs, from which the likely changes in turning movements at local junctions have been identified and added to the construction base case flows.

17.5.85 The assignment of construction lorry trips has been undertaken using OmniTrans[ii] software, which enables a fixed assignment to be created for these trips in order to ensure that they are assigned only to the proposed construction routes. The OmniTrans outputs also identify lorry traffic which would be associated with the Victoria Embankment Foreshore site, or with other Thames Tideway Tunnel project sites, that would use routes in the vicinity of the Victoria Embankment Foreshore site. Figure 17.5.1 in the Victoria Embankment Foreshore *Transport Assessment* figures shows the OmniTrans plot for the local road network around the Victoria Embankment Foreshore site.

17.5.86 It is anticipated that there would be an average of four additional two-way HGV movements during the peak hours associated with other Thames Tideway Tunnel project sites using Victoria Embankment (A3211) or its junctions with Northumberland Avenue (A400) and Horse Guards Avenue during Site Year 1 of construction at Victoria Embankment Foreshore.

17.5.87 Changes to the highway network during construction and the additional construction traffic generated by the project may lead to local changes in traffic flow and capacity. Local modelling has been undertaken to assess the effect on the highway operation resulting from these changes.

17.5.88 The local TRANSYT model has been used to apply the construction traffic demands and local geometrical changes to the construction base case to determine the changes in the highway network operation due to the project (ie, comparison of base and development cases).

17.5.89 A summary of the construction assessment results from the TRANSYT model for the weekday AM and PM peak hours is presented in Table 17.5.2 and Table 17.5.3.

[ii] OmniTrans is a software package used for multi-modal transport network modelling and in this case has been used to produce assignments of construction traffic across the proposed network of routes to be used for the project.

Table 17.5.2 Construction development case TRANSYT model outputs (AM peak)

Approach	Arm	Flow (PCU)	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (PCU)			Delay (seconds per PCU)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Junction of Victoria Embankment (A3211) and Northumberland Avenue (A400)											
Victoria Embankment (A3211) westbound	Right	372	95%	95%	0%	16	16	0	99	99	0
	Ahead	1118	86%	86%	0%	29	32	+3	24	24	0
Victoria Embankment (A3211) eastbound	Ahead	1316	94%	94%	0%	40	40	0	27	27	0
	Left	105	39%	39%	0%	3	3	0	61	61	0
Northumberland Avenue (A400)	Left right	293	92%	93%	+1%	12	12	0	92	97	+5
	Left	385	92%	92%	0%	14	14	0	77	77	0
			PRC						Total delay (PCU hours)		
Overall junction performance			-6%	-6%	0%				45	45	0
Junction of Victoria Embankment (A3211) and Horse Guards Avenue											
Victoria Embankment (A3211) westbound	Right	425	80%	81%	+1%	11	11	0	40	41	+1
	Ahead	697	50%	50%	0%	6	6	0	7	8	+1
Victoria Embankment (A3211) eastbound	Ahead	1242	84%	84%	0%	31	31	0	32	32	0
	Left	19	3%	3%	0%	0	0	0	19	19	0
Horse Guards Avenue	Left right	189	78%	78%	0%	6	6	0	63	63	0

	PRC				Total delay (PCU hours)		
Overall junction performance	+7%	+7%	0%		20	21	+1

Notes: 1. DoS represents Degree of Saturation; the ratio of flow to capacity . MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). Delay represents the mean delay per PCU. PCU represents Passenger Car Units. PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 PCUs and pedal cycles are 0.2 PCUs. Thames Tideway Tunnel construction vehicles would be a mixture of three- and four-axle vehicles and have therefore been given a PCU value of two.

2. Assessment has assumed that traffic signal optimisation has been undertaken as detailed in Volume 2 of the ES.

Table 17.5.3 Construction development case TRANSYT model outputs (PM peak)

Approach	Arm	Flow (PCU)	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (PCU)			Delay (seconds per PCU)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Junction of Victoria Embankment (A3211) and Northumberland Avenue (A400)											
Victoria Embankment (A3211) westbound	Right	441	82%	82%	0%	12	14	+2	55	53	-2
	Ahead	1194	91%	91%	0%	28	36	+8	31	26	-5
Victoria Embankment (A3211) eastbound	Ahead	1009	79%	79%	0%	15	10	-5	11	13	+2
	Left	78	24%	24%	0%	2	2	0	57	57	0
Northumberland Avenue (A400)	Left right	271	71%	73%	+2%	8	8	0	52	53	+1
	Left	426	90%	90%	0%	15	15	0	67	67	0
			PRC						Total delay (PCU hours)		
Overall average delay per PCU			-1%	-1%	0%				33	32	-1
Junction of Victoria Embankment (A3211) and Horse Guards Avenue											
Victoria Embankment (A3211) westbound	Right	544	82%	82%	0%	14	14	0	34	32	-2
	Ahead	784	59%	56%	-3%	5	5	0	6	6	-1
Victoria Embankment (A3211) eastbound	Ahead	902	80%	78%	-2%	24	23	-1	38	37	-1
	Left	19	4%	4%	0%	0	0	0	27	27	0
Horse Guards Avenue	Left right	196	78%	83%	0%	7	7	0	60	72	+12

	PRC				Total delay (PCU hours)		
Overall average delay per PCU	+8%	+8%	0%		20	20	0

Notes: 1. DoS represents Degree of Saturation; the ratio of flow to capacity . MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). Delay represents the mean delay per PCU. PCU represents Passenger Car Units. PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 PCUs and pedal cycles are 0.2 PCUs. Thames Tideway Tunnel construction vehicles would be a mixture of three- and four-axle vehicles and have therefore been given a PCU value of two.

2. Assessment has assumed that traffic signal optimisation has been undertaken as detailed in Volume 2 of the ES.

17.5.90 The construction traffic generated in the construction development case would produce a marginal increase in demand in the AM peak hour resulting in a slight increase to delay on this part of the network with a maximum increase in delay of five seconds per PCU on Northumberland Avenue (A400) for left and right turning traffic at the Victoria Embankment (A3211) / Northumberland Avenue (A400) junction.

17.5.91 In the PM peak hour, the increase in demand would result a slight increase in delay to road users with a maximum increase in delay of two seconds per PCU on Victoria Embankment (A3211) eastbound ahead movement at the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400).

17.5.92 The TRANSYT junction model outputs show that total junction delay for the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400) in the construction development case is 45 PCU hours in the AM peak period assessed and 32 PCU hours in the PM peak period assessed. These equate to 46 seconds per PCU in the AM and 34 seconds per PCU in the PM peak period assessed.

17.5.93 At the junction of Victoria Embankment / Horse Guards Avenue there would be no significant change to the capacity, queues or average delays in the AM peak hour. The maximum delay to vehicles would be one second per PCU on Victoria Embankment (A3211) westbound.

17.5.94 In the PM peak hour, there would be a maximum increase in average delay of 12 seconds per PCU for traffic turning from Horse Guards Avenue to Victoria Embankment (A3211).

17.5.95 The TRANSYT junction model outputs show that total junction delay for the junction of Victoria Embankment (A3211) and Horse Guards Avenue in the construction development case is 21 PCU hours in the AM peak period assessed and 20 PCU hours in the PM peak period assessed. These equate to 29 seconds per PCU in the AM and PM peak periods assessed.

Construction mitigation

17.5.96 The project has been designed to limit the issues arising on transport networks as far as possible and many measures have been embedded directly in the design of the project. These are summarised in Table 17.5.4.

Table 17.5.4 Victoria Embankment Foreshore design measures

Phase	Issues	Design measures
Construction	Creating site access point	• Creation of a 3.8m wide lane on the nearside of the westbound lane of Victoria Embankment (A3211) to accommodate construction vehicles arriving at and departing from the site during periods of greater construction activity. • Traffic barriers to be moved in and out as construction progresses as

Phase	Issues	Design measures
		TfL require minimum land take within highway • Creation of a gated access for the left-turn in / left turn-out movement for construction traffic
	Closure of the Thames Path	• Diversion of pedestrians from the Thames Path to the western footway of Victoria Embankment (A3211) • Diversion of the Thames Path would be adequately signed directing pedestrians and cyclists to the existing signal controlled crossings
	Narrowing the carriageway of Victoria Embankment (A3211)	• Maintaining two-way traffic along Victoria Embankment (A3211) • Maintaining two lanes in each direction with one lane minimum 3.25m and one lane minimum 3.0m in each direction. Short term closures down to one lane westbound, if required, would take place outside of peak hours. • Removing the central reservation along the section past the site to maintain lane widths • Restriction of two coach parking bays along the eastbound carriageway of Victoria Embankment (A3211) during utility diversion works • Restriction of seven coach parking bays along the westbound carriageway of Victoria Embankment (A3211) during the utility diversion and construction works • Restriction of motorcycle parking bay along the eastbound carriageway of Victoria Embankment (A3211) during utility diversion works • Restriction of loading bay along the westbound carriageway of Victoria Embankment (A3211) during the

Phase	Issues	Design measures
		utility diversion and construction works • Temporary removal of white lining and provision of new white lining and road markings as appropriate
	Movement of construction traffic flows on the local highway network	• Traffic signal optimisation at the junction of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue to achieve the most efficient operation of the junction
Operation	Creating access point	• Provision of new mountable kerb/reinforced vehicle crossing for maintenance access • To accommodate ten yearly maintenance vehicles

17.5.97 Further mitigation of the issues identified in the assessment, beyond the measures embedded within the design, is not possible because there are no alternative diversion routes within the local area.

Sensitivity testing

17.5.98 The assessment outcomes reported earlier in this Section and in Volume 17 of the *Environmental Statement* are based on the *Transport Strategy*, as outlined in Section 17.2. In that scenario, the number of construction vehicle movements generated by Victoria Embankment Foreshore in the peak year of construction would be approximately seven movements in the AM and PM peak hours which would use the junctions of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue.

17.5.99 A sensitivity test has been undertaken to examine the implications of variation in the number of construction vehicle movements in the peak month of activity at this site, including the possibility that river transport is not available for short periods of time which could temporarily increase vehicle number. In this sensitivity test, the construction vehicle movements in the peak year of construction would be approximately 34 in the AM and PM peak hours. This would be an increase of 27 movements in the AM and PM peak hours compared with that for the *Transport Strategy*.

17.5.100 A summary of the construction assessment results from the TRANSYT model for the junctions of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse Guards Avenue in the weekday AM and PM peak hours using the sensitivity test figures is presented in Table 17.5.5 and Table 17.5.6.

Table 17.5.5 Construction development case TRANSYT model outputs, sensitivity test (AM peak)

Approach	Arm	Sensitivity test flow (PCU)	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (PCU)			Delay (seconds per PCU)		
			EIA	Sensitivity test	Change	EIA	Sensitivity test	Change	EIA	Sensitivity test	Change
Junction of Victoria Embankment (A3211) and Northumberland Avenue (A400)											
Victoria Embankment (A3211) westbound	Right	373	95%	96%	+1%	16	16	0	99	101	+2
	Ahead	1142	86%	88%	+2%	32	31	-1	24	26	+2
Victoria Embankment (A3211) eastbound	Ahead	1316	94%	94%	0%	40	40	0	27	27	0
	Left	105	39%	39%	0%	3	3	0	61	61	0
Northumberland Avenue (A400)	Left right	289	93%	92%	-1%	12	12	0	97	92	-5
	left	386	92%	92%	0%	14	14	0	77	78	+1
			PRC						Total delay (PCU hours)		
Overall junction performance			-6%	-7%	-1%				45	46	+1
Junction of Victoria Embankment (A3211) and Horse Guards Avenue											
Victoria Embankment (A3211) westbound	Right	424	81%	81%	0%	11	11	0	41	42	+1
	Ahead	689	50%	50%	0%	6	6	0	8	7	-1
Victoria	Ahead	1242	84%	84%	0%	31	31	0	32	32	0

Embankment (A3211) eastbound	Left	19	3%	3%	0%	0	0	0	19	19	0
Horse Guards Avenue	Left right	189	78%	78%	0%	6	6	0	63	63	0
			PRC						**Total delay (PCU hours)**		
Overall junction performance			+7%	+7%	0%				21	21	0

Notes: 1. DoS represents Degree of Saturation; the ratio of flow to capacity . MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). Delay represents the mean delay per PCU. PCU represents Passenger Car Units. PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 PCUs and pedal cycles are 0.2 PCUs. Thames Tideway Tunnel construction vehicles would be a mixture of three- and four-axle vehicles and have therefore been given a PCU value of two.

2. Assessment has assumed that traffic signal optimisation has been undertaken as detailed in Volume 2 of the ES.

Table 17.5.6 Construction development case TRANSYT model outputs, sensitivity test (PM peak)

Approach	Arm	Sensitivity test flow (PCU)	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (PCU)			Delay (seconds per PCU)		
			EIA	Sensitivity test	Change	EIA	Sensitivity test	Change	EIA	Sensitivity test	Change
Junction of Victoria Embankment (A3211) and Northumberland Avenue (A400)											
Victoria Embankment (A3211) westbound	Right	442	82%	82%	0%	14	12	-2	53	52	-1
	Ahead	1223	91%	93%	+2%	36	25	-11	26	34	+8
Victoria Embankment (A3211) eastbound	Ahead	1009	79%	79%	0%	10	12	+2	13	12	-1
	Left	78	24%	24%	0%	2	2	0	57	57	0
Northumberland Avenue (A400)	Left right	266	73%	71%	-2%	8	8	0	53	52	-1
	left	426	90%	90%	0%	15	15	0	67	67	0
			PRC						Total delay (PCU hours)		
Overall junction performance			-1%	-3%	-2%				32	34	+2
Junction of Victoria Embankment (A3211) and Horse Guards Avenue											
Victoria Embankment (A3211) westbound	Right	540	82%	81%	-1%	14	15	+1	32	37	+5
	Ahead	812	56%	59%	+3%	5	8	+3	6	8	+2
Victoria	Ahead	902	78%	80%	+2%	23	24	+1	36	38	+2

Embankment (A3211) eastbound	Left	19	4%	4%	0%	0	0	0	26	27	+1
Horse Guards Avenue	Left right	196	83%	78%	-5%	7	7	0	71	60	-11
			PRC						**Total delay (PCU hours)**		
Overall junction performance			+8%	+11%	+3%				20	20	0

Notes: 1. DoS represents Degree of Saturation; the ratio of flow to capacity . MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). Delay represents the mean delay per PCU. PCU represents Passenger Car Units. PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 PCUs and pedal cycles are 0.2 PCUs. Thames Tideway Tunnel construction vehicles would be a mixture of three- and four-axle vehicles and have therefore been given a PCU value of two.

2. Assessment has assumed that traffic signal optimisation has been undertaken as detailed in Volume 2 of the ES.

17.5.101 The results indicate that under the sensitivity test, the junction of Victoria Embankment (A3211) / Northumberland Avenue (A400) would operate above capacity in both AM and PM peak hours and the junction of Victoria Embankment (A3211) and Horse Guards Avenue would operate below capacity in both AM and PM peak hours. This is similar to the results from the modelling with that for the *Transport Strategy* presented in paras. 17.5.89-17.5.95.

17.5.102 At the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400), there would be a slight increase in demand on the Victoria Embankment (A3211) westbound ahead and right movements compared with that for the *Transport Strategy* in the AM peak hour, while in the PM peak hour, increase in demand would occur on the westbound ahead movement.

17.5.103 At the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400), there would be an additional average delay of a maximum of two and eight seconds per vehicle in the AM and PM peak hours respectively on the Victoria Embankment (A3211) westbound ahead movement compared with that for the *Transport Strategy*. Overall, the change in total delay at this junction would increase by one second in the AM peak hour and two seconds in the PM peak hour in comparison with that for the *Transport Strategy*.

17.5.104 The TRANSYT junction model outputs show that total junction delay for the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400) is 46 PCU hours in the AM peak period assessed and 34 PCU hours in the PM peak period assessed. These equate to 46 seconds per PCU in the AM and 36 seconds per PCU in the PM peak period assessed.

17.5.105 At the junction of Victoria Embankment (A3211) and Horse Guards Avenue, during the AM peak hour there would be virtually no change to the operation of the junction, while in the PM peak hour, there would be slight reductions in capacity on the Victoria Embankment (A3211) eastbound and westbound ahead movement compared with that for the *Transport Strategy*.

17.5.106 At this junction there would be an increase in average delay of a maximum of one second and five seconds per vehicle in the AM and PM peak hours respectively on the Victoria Embankment (A3211) westbound right turn movement compared with that for the *Transport Strategy*. Overall, there would be no change in total delay at this junction as a result of the sensitivity test in comparison for the *Transport Strategy*.

17.5.107 The total junction delay for the junction of Victoria Embankment (A3211) and Horse Guards Avenue is 21 PCU hours in the AM peak period assessed and 20 PCU hours in the PM peak period assessed. These equate to 29 seconds per PCU in the AM and 30 seconds per PCU in the PM peak period assessed.

17.5.108 It must be recognised that this analysis represents a maximum sensitivity test and that the *Transport Strategy* envisages the use of the river to transport some of the construction materials required at this site. If the sensitivity test did occur over a prolonged period, which is unlikely for the

reasons given in Section 17.3, the design measures which have been embedded directly in the design of the project and are listed in Table 17.5.4 would remain appropriate and there would be no need for further mitigation measures.

17.6 Operational assessment

17.6.1 This section summarises the findings of the assessment undertaken for Year 1 of operation at the Victoria Embankment Foreshore site.

17.6.2 The assessment of the operational phase is limited to the physical issues associated with accessing the site from the highway network as outlined in Section 17.2. This has been discussed with Westminster City Council and TfL.

Operational base case

17.6.3 The operational assessment year for transport is Year 1 of operation.

17.6.4 As explained in para. 17.2.44, the elements of the transport network considered in the operational assessment are highway layout and operation and parking. For the purposes of the operational base case, it is anticipated that the highway layout and parking will be as indicated in the construction base case.

Operational development case

17.6.5 The operational development case for the site includes permanent changes in the vicinity of the Victoria Embankment Foreshore site as a result of the Thames Tideway Tunnel project and takes into consideration the occasional maintenance activities required at the site.

17.6.6 Once the construction works at the Victoria Embankment Foreshore site have been completed, a structure built out onto the foreshore would be constructed. This would form part of the public realm although access would be restricted periodically for inspection and maintenance purposes into the shaft and tunnel.

17.6.7 The transport demands created by the development in the operational phase would be extremely low and limited to occasional maintenance visits every three to six months, and larger cranes required for access to the shaft and tunnel every ten years.

17.6.8 The operational assessment has taken into consideration those elements that would be affected, which comprise the short-term changes to the highway layout and operation and parking when maintenance visits are made to the site.

17.6.9 The permanent highway layout plan in the Victoria Embankment Foreshore *Transport Assessment* figures shows the highway layout during the operational phase.

17.6.10 When regular maintenance activity takes place during the operational phase, pedestrians would not be diverted away from the Thames Path but would have to cross the site access point. When large maintenance

vehicles are required to access the site, pedestrian movements could be assisted by a banksman in order to ensure pedestrian safety. In addition, public access to the permanent structure in the foreshore would need to be restricted whilst maintenance activity takes place. During the ten-yearly maintenance inspections, it may be necessary to divert the Thames Path.

Parking

17.6.11 No change is expected to car parking in the vicinity of the site, compared to the base case, as a result of the operational phase of the proposed development at the Victoria Embankment Foreshore site.

17.6.12 When cranes are required to service the site, a maximum of four coach parking bays along the westbound carriageway of Victoria Embankment (A3211) would have to be temporarily restricted to ensure the vehicles have sufficient space to manoeuvre into the site. This temporary restriction would be on an infrequent basis and would occur approximately every ten years.

17.6.13 Taking into consideration the infrequent and temporary nature of the arrival of vehicles at Victoria Embankment Foreshore which would require parking restriction, it is anticipated impacts on coach parking in the local area would be insignificant.

Highway layout and operation

17.6.14 As a result of the highway layout changes during the operational phase an assessment has been undertaken to ensure that the highway layout provided is adequate for the large vehicles required to access the site during the operational phase. Swept paths have been undertaken for the largest vehicles including an 11.4m mobile crane, a 10m rigid vehicle and a 10.7m articulated vehicle. The permanent highway layout vehicle swept path analysis plan in the Victoria Embankment Foreshore *Transport Assessment* figures demonstrates that the maintenance vehicles would be able to safely enter and leave the site.

17.6.15 As identified above, and as a result of the large turning circles of the cranes, a maximum of four coach parking bays would have to be restricted to ensure these vehicles have sufficient space to manoeuvre into the site.

17.6.16 When larger vehicles are required to service the site, there may be some temporary, short-term delay to other road users while manoeuvres are made. However it is anticipated that the arrival of large vehicles would normally be scheduled to take place outside of the peak hours to minimise the effect on the local highway network.

17.6.17 Due to the infrequent nature of maintenance trips there is anticipated to be no significant change to the operation of the surrounding highway network during the operational phase at Victoria Embankment Foreshore.

17.7 Summary of Transport Assessment findings

17.7.1 The key outcomes of this TA are summarised in Table 17.7.1.

Table 17.7.1 Victoria Embankment Foreshore transport assessment results

Phase	Mode of transport	Key Findings
Construction	Pedestrians	Approximately two minute increase in journey time for pedestrians using the Thames Path due to a 40m increase in journey distance and two additional road crossings. Pedestrian LOS would be maintained at LoS A along the western footway of Victoria Embankment (A3211) in the AM peak hour, the same level as the construction base case. In the PM peak hour, the LoS value would change from LoS A to LoS B.
	Cyclists	At the junction of Victoria Embankment (A3211) with Northumberland Avenue (A400) and Horse guards Avenue there would be a change in overall average delay of no more than five seconds in either peak hours.
	Bus patronage and operators	Approximately seven two-way worker trips would be made by bus and could be accommodated on base case services. No significant change to bus journeys times on the bus network in the surrounding area.
	London Underground and National Rail patronage	Approximately 53 worker trips would be made by London Underground or National Rail and could be accommodated on base case services.
	River passenger services and patronage	The loading bay used by the Tattershall Castle and Hispaniola would be restricted during construction. Alternative facilities would be available within reasonable distance of these vessels. River services would not be altered during construction and construction barge movements and any additional patronage would not significantly affect services.
	River navigation and access	A peak number of four barge movements a day would occur within Site Year 1 of construction which is not anticipated to create a significant change to existing river navigation.
	Parking	Nine coach parking bays along Victoria Embankment (A3211) would be restricted, two in the eastbound carriageway and seven in the westbound carriageway. Alternative coach parking would be provided on Albert Embankment (A3036) for the duration of the utility

Phase	Mode of transport	Key Findings
		diversion and construction works. A motorcycle parking bay along the eastbound carriageway of Victoria Embankment (A3211) would be restricted during the utility diversion works. A loading bay along the westbound carriageway of Victoria Embankment (A3211) would be restricted during the utility diversion works.
	Highway network and operation	The width of the westbound carriageway of Victoria Embankment (A3211) would be reduced (through the restriction of coach parking bays) to accommodate construction vehicles arriving at and departing from the site. Two lanes in each direction would remain in operation during construction with appropriate traffic management. A maximum of approximately 64 additional daily construction traffic movements would be generated by the construction works at Victoria Embankment Foreshore in Site Year 1. The junction of Victoria Embankment (A3211) with Northumberland Avenue (A400) will operate above capacity in the construction base case and the junction of Victoria Embankment (A3211) and Horse Guards Avenue will operate below capacity. The addition of Thames Tideway Tunnel traffic to the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400) (estimated to be seven two-way vehicle movements during the peak hours) would result in a maximum increase in average delay of five seconds per PCU in the AM peak hour on Northumberland Avenue (A400) for left and right movements and a maximum of two seconds per PCU during the PM peak hour on the Victoria Embankment (A3211) eastbound ahead movement. The addition of construction traffic to the junction of Victoria Embankment (A3211) and Horse Guards Avenue would result in a maximum increase in average delay of one second per PCU in the AM peak hour on the westbound approach of Victoria Embankment (A3211) and a maximum of 12 seconds per PCU during the PM peak hour on Horse Guards Avenue.
Operation	Parking	A maximum of four coach parking bays along the westbound carriageway of Victoria Embankment (A3211) may require temporary restriction when large cranes require access to the site, approximately once every ten years.

Phase	Mode of transport	Key Findings
	Highway layout and operation	Some slight network delay may be experienced by other road users when large vehicles are accessing the site, however this would be infrequent and temporary.

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[14] Department for Transport (DfT), *Traffic Advisory Leaflet 15/99 – Cyclists at Road Works*, December 1999.

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Transport Assessment

Doc Ref: **7.10.14**

Victoria Embankment Foreshore

Appendices

APFP Regulations 2009: Regulation **5(2)(q)**

Hard copy available in

Box **52** Folder **A**
January 2013

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Transport Assessment

Section 17 Appendices: Victoria Embankment Foreshore

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Appendix A: Policy review

A.1 Introduction

A.1.1 There are a number of documents containing planning policies that are relevant to transport matters for the proposed development at Victoria Embankment Foreshore. This includes national, regional and local policies relevant to the site.

A.1.2 This section reviews current documents relevant to the proposed development which is situated within the City of Westminster.

A.2 National Policy

National Planning Policy Framework (March 2012)

A.2.1 The Department for Communities and Local Government published the National Planning Policy Framework (NPPF) in March 2012. The NPPF replaces a variety of existing planning guidance, most notable the following document, Planning Policy Guidance 13: Transport (November 2010).

A.2.2 The key objective of the NPPF is to create a policy context to support economic growth. The principle of the guidance is to place an emphasis on sustainable development, where environmental conditions should be considered alongside economical and social matters.

A.2.3 It outlines the importance of local development plans and notes that where development accords with an up to date development plan then the proposals should be approved. Moreover, it suggests that local authorities should follow the approach of the presumption in favour of sustainable development.

A.2.4 With particular reference to transport matters the documents states:

"*In preparing local plans, local planning authorities should therefore support a pattern of development which, where reasonable to do so, and facilitates the use of sustainable modes of transport.*"

A.2.5 The guidance goes on to advise at paragraph 32:

"All developments that generate significant amounts of movement should be supported by a Transport Statement or Transport Assessment. Plans and decisions should take account of whether:

a. the opportunities for sustainable transport modes have been taken up depending on the nature and location of the site, to reduce the need for major transport infrastructure;

b. safe and suitable access to the site can be achieved for all people; and

c. improvements can be undertaken within the transport network that cost effectively limit the significant impacts of the development. Development should only be prevented or refused on transport

grounds where the residual cumulative impacts of development are severe."

A.2.6 The document also states that:

"Plans should protect and exploit opportunities for the use of sustainable transport modes for the movement of goods or people". Therefore:

"A key tool to facilitate this would be a Travel Pan. *All developments which generate significant amounts of movement should be required to provide a Travel Plan".*

National Policy Statement for Waste Water (March 2012)

A.2.7 The National Policy Statement for Waste Water (NPS) was published by the Department of Environment, Food and Rural Affairs in March 2012. This National Policy Statement (NPS) sets out Government policy for the provision of major waste water infrastructures. The NPS does not recognise the Thames Tideway Tunnel project within the original thresholds which is contained within the Planning Act. However the document indicates that *"the Government has already stated its intention that the project should be considered at a national level"*.

A.2.8 The Secretary of State announced that development consent for the Thames Tideway Tunnel project should also be dealt with under the regime for nationally significant infrastructure projects under the Planning Act 2008.

A.2.9 The NPS seeks a sustainable long term solution to address the untreated sewage discharged into the river Thames and a Thames Tideway Tunnel has been considered as the preferred solution.

A.2.10 With particular reference to transport matters the document states:

"The Environmental Statement should include a transport assessment, using the NATA/WebTAG methodology stipulated in Department for Transport (DfT), or any successor to such methodology. Applicants should consult the Highways Agency and/or the relevant highway authority, as appropriate, on the assessment and on mitigation measures. The assessment should distinguish between the construction, operation and decommissioning project stages as appropriate".

A.2.11 The document states that the impacts on the surrounding transport infrastructure should be mitigated and where the mitigation measures are not sufficient the requirements to mitigate adverse impacts on transport networks should be considered.

A.2.12 Therefore it is advised to prepare a *Travel Plan* which includes demand management measures to mitigate transport impacts, and *"to provide details of proposed measures to improve access by public transport, walking and cycling, to reduce the need for parking associated with the proposal and to mitigate transport impacts".*

A.2.13 The NPS prefers water-borne or rail transport over road transport and where there is likely to be substantial HGV traffic, the following measures should be looked:

a. “control numbers of HGV movements to and from the site in a specified period during its construction and possibly on the routing of such movements;

b. make sufficient provision for HGV parking, either on the site or at dedicated facilities elsewhere, to avoid ‘overspill’ parking on public roads, prolonged queuing on approach roads and uncontrolled on-street HGV parking in normal operating conditions; and

c. ensure satisfactory arrangements for reasonably foreseeable abnormal disruption, in consultation with network providers and the responsible police force”.

A.2.14 The proposed development is located at an excellent accessible transport hub and the proposed location has a Public Transport Accessibility Level (PTAL) rating of 6b, rated as ‘excellent’. It is assumed that construction workers would not travel by car to and from the site on the basis that there would be no worker parking on site; on-street parking in the area is restricted; and site-specific *Travel Plan* measures will discourage workers from travelling by car.

A.3 Regional policy

The London Plan (July 2011)

A.3.1 The London Plan 2011 is produced by the Greater London Authority (GLA) and sets out the strategic planning guidance for London planning authorities. The Mayor of London is responsible for strategic planning and the production of a Spatial Development Strategy called The London Plan. The London plan sets out the integrated economic, environmental, transport and social framework for the development of London over the next 20-25 years. The Plan takes the year 2031 as its formal end date and its over-arching vision is supported by six detailed objectives for London:

a. A city that meets the challenges of economic and population growth;

b. An internationally competitive and successful city;

c. A city of diverse, strong, secure and accessible neighbourhoods;

d. A city that delights the senses;

e. A city that becomes a world leader in improving the environment; and

f. A city where it is easy, safe and convenient for everyone to access jobs, opportunities and facilities.

A.3.2 The last objective of the plan relates specifically to transport. Policies within the London Plan of relevance to the proposed development are outlined as follows:

A.3.3 **Policy 6.1 – Strategic Approach** advises that the mayor will work with all relevant partners to encourage the closer integration of transport and development by:

a. Encouraging patterns and nodes of development that reduce the need to travel, especially by car;

b. Seeking to improve the capacity and accessibility of public transport, walking and cycling, particularly in areas of greater demand;

c. Supporting development that generates high levels of trips at locations with high public transport accessibility and/or capacity, either currently or via committed, funded improvement;

d. Seeking to increase the use of the Blue Ribbon Network, especially the Thames, for passenger and freight use;

e. Facilitating the efficient distribution of freight whilst minimising its impacts on the transport network;

f. Supporting measures that encourage shifts to mode sustainable modes and appropriate demand management; and

g. Promoting greater use of low carbon technology so that carbon dioxide and other contributors to global warming are reduced.

A.3.4 **Policy 6.2 – Providing public transport capacity and safeguarding land for transport** which notes that development proposals that do not provide adequate safeguarding for the schemes should be refused.

A.3.5 **Policy 6.3 – Assessing effects of development on transport capacity** outlines that development proposals should ensure that impacts on transport capacity and the transport network, at both a corridor and local level, are fully assessed. Development should not adversely affect safety on the transport network. Where existing transport capacity is insufficient for the travel generated by proposed developments, and no firm plans exist for an increase in capacity, boroughs should ensure that the development proposals are phased until it is known that these requirements can be met. The policy notes that the use of *Travel Plans* and addressing freight issues can help reduce the impact of development on the transport network.

A.3.6 **Policy 6.7 – Better streets and surface transport** notes that high levels of priority should be provided to bus routes and there should be direct, secure, accessible and pleasant walking routes to stops. The development would include provision of transport to and from public transport nodes where sites are at a distance from public transport services.

A.3.7 **Policy 6.9 – Cycling** presents measures to increase cycling mode share in London to 5 percent by 2026. Measures include completing the Cycle Super Highways and expanding the London cycle hire scheme. To support this, developments should provide cycle parking to at least the minimum standards, provide showers and changing facilities and facilitate the major cycling schemes in London (Super Highways / Cycle Hire).

A.3.8 **Policy 6.10 – Walking** recommends the use of shared space principles with simplified streetscape, de-cluttering and access for all. Developments should therefore ensure high quality pedestrian environments and emphasise the quality of pedestrian and street space. It points to the

'Legible London' pedestrian wayfinding system as a successful measure to support walking journeys.

A.3.9 **Policy 6.13 – Parking** outlines the need to seek an appropriate balance between promoting new development and preventing excessive car parking provision that can undermine cycling, walking and public transport use. As such, car parking should reduce as public transport accessibility (measured by PTAL) increases. The policy advises that *Transport Assessments* and *Travel Plans* for major developments should give details of proposed measures to improve non-car based access, reduce parking and mitigate adverse transport impacts.

A.3.10 **Policy 6.14 – Freight** notes that freight distribution should be improved and movement of freight by rail and waterway should be promoted. To support this, developments that generate high number of freight movements should be located close to major transport routes. In addition, the Freight Operators Recognition Scheme, construction logistics plans and delivery and servicing plans should be promoted. The policy also advises the increase in the use of the Blue Ribbon Network for freight transport.

The Mayors Transport Strategy (GLA, 2010)

A.3.11 In addition to the London Plan, the Mayor has prepared a number of strategies that are essentially an extension of the London Plan. Published by the GLA in 2010, the Mayor's Transport Strategy (MTS) (Greater London Authority, May 2010) envisages *"London's Transport system excelling among that of global cities, providing access to opportunities for all people and enterprises while achieving the highest environmental standards and leading the world in its move towards tackling the urban transport challenges of the 21st century"*.

A.3.12 The MTS sets out a number of policy commitments or requirements which have implications for TfL and a range of other delivery partners including the GLA and the London boroughs. The policies that are relevant to the proposed development are:

a. **Policy 4** indicating that the Mayor will seek "to improve people's access to jobs, business' access to employment markets, business to business access, and freight access by seeking to ensure appropriate transport capacity and connectivity is provided on radial corridors into central London";

b. **Policy 5** seeks "to ensure efficient and effective access for people and goods within central London";

c. **Policy 8** supports "a range of transport improvements within metropolitan town centres for people and freight that help improve connectivity and promote the vitality and viability of town centres, and that provide enhanced travel facilities for pedestrians and cyclists";

d. **Policy 9** states that the Mayor "will use the local and strategic development control processes";

e. **Policy 11** specifies that the Mayor will "encourage the use of more sustainable, less congesting modes of transport, set appropriate

parking standards, and aim to increase public transport, walking and cycling mode share";

f. **Policy 12** states that the Mayor "will seek to improve the distribution of freight through the provision of better access to/from Strategic Industrial Locations, delivery and servicing plans, and other efficiency measures across London"; and

g. **Policy 15** and **Policy 16** indicate that the Mayor will seek to reduce emissions of air pollutants and noise impacts from transport respectively.

A.3.13 The *London Freight Plan, Sustainable Freight Distribution: a Plan for London* (TfL, June 2008) sets out the steps that have to be taken over the next five to ten years to identify and begin to address the challenge of delivering freight sustainably in the capital. Principles set in that document are expected to be relevant to the consideration of the construction logistics strategy for the proposed development.

A.4 Local policy

A.4.1 The city of Westminster has a number of policies relevant to transport. These are:

a. Local Development Framework – Core strategy;

b. Unitary Development Plan; and

c. Supplementary Planning Guidance for the River Thames Area.

A.4.2 The key points of the policies considered as part of the transport assessment are summarised below.

Core Strategy Development Plan Document (City of Westminster, 2001)

A.4.3 The Core Strategy Development Plan Document (DPD) sets out the spatial vision for Westminster along with core policies, monitoring and implementation. The Core Strategy forms part of the Local Development Framework (LDF) and, alongside other DPDs, replaced the Unitary Development Plan (UDP) adopted in 2007. The adoption of the Core Strategy on the 26 January 2011 has resulted in the deletion of further UDP policies. The transport related policies are identified below:

A.4.4 **Policy CS36 – Westminster's Blue Ribbon Network** seeks protection and improvement of the Blue Ribbon Network, which includes many of the waterways in the borough. Including improvements for:

a. Walking;

b. Cycling; and

c. Water based transport.

A.4.5 Development taking place along the riverside must address the waterside, seek to improve it and enhance access.

A.4.6 **Policy CS40 – Pedestrian Movement and Sustainable Transport** aims to prioritise pedestrian movements and create a safe and attractive pedestrian realm. This will be supported by:

a. Providing cycle facilities as part of all new development;

b. Reducing reliance on private motor vehicles and single occupancy trips;

c. Prioritising parking provision for the disabled, car sharers and alternatively fuelled vehicles; and

d. Developing river transport where possible.

A.4.7 **Policy CS41 – Servicing and Deliveries** states that *"Developments must demonstrate that the freight, servicing and deliveries required will be managed in such a way that minimises adverse impacts"*. Delivery and servicing needs are expected to be met within the development site, unless the council deems it impossible. If the public highway is used for servicing, the development is expected to pay the initial and on-going costs associated with its use.

A.4.8 **Policy CS42 – Major Transport Infrastructure** outlines that the council is willing to support improvements to transport infrastructure. Examples of improvements include:

a. Improvements to the public realm, especially for disabled and vulnerable users;

b. Increasing cycle parking and safety for cyclists, as long as pedestrian movement is not compromised;

c. Improving way-finding and legibility around Westminster to aid pedestrian movement;

d. Improving the convenience, connectivity, attractiveness and safety of Westminster's linear walking routes, including the Blue Ribbon Network; and

e. Improvements to river services and piers.

Unitary Development Plan (City of Westminster, 2007)

A.4.9 The Unitary Development Plan (UDP) sets out the aims and objectives for planning within the City of Westminster. It was adopted in January 2007 and the policies contained within it are used to assess the accessibility of planning applications being considered by the local planning authority. The UDP has been replaced by the Core Strategy. However, some policies, including all transport related policies, have been saved and are still current.

A.4.10 The transport related policies are mainly focussed on the protection of the environment against the intrusion of unnecessary traffic with car use reduction suggested as being a means by which *"to satisfy the requirements of the residents for reasonable environmental conditions"*.

A.4.11 The general aim of the UDP is *"to take a balanced approach to transport provision in order to meet as far as is possible the demands for increased*

mobility throughout the City while improving safety and air quality and reducing other environmental problems".

A.4.12 **Policy CENT 1 – The Central Activities Zone (CAZ) and CENT 4 - Central London Supporting Activities and Local Services** relate to protecting the CAZ and supporting activities in central London. Table 1.1 *"appropriate non-residential activities for Central Westminster" states, inter alia, "Activities supporting the use and enjoyment of the River Thames" are appropriate in the CAZ, CAZ Frontages, and the Thames Special Policy Area"*.

A.4.13 **Policy CENT 4 – Central London Supporting Activities and Local Services** intends to protect uses supporting Central London activities and local service users. Planning permission will not be granted for development that results in the loss of supporting activities or local services.

A.4.14 **Policy TRANS 1 – Protecting the Environment from the Effects of Transport Activities** has several key aims:

a. To improve air quality;

b. To reduce the emission of greenhouse gases;

c. To minimise noise disturbance;

d. To reduce the adverse effects of heavy vehicles, primarily through area-wide, local bans and parking controls; and

e. When introducing the above to implement high quality street design.

A.4.15 **TRANS 2 – Road Safety** seeks lower speeds of road traffic and fewer collisions with pedestrians. All development proposals should be designed to reduce the number and severity of road accidents.

A.4.16 **Policy TRANS 3 – Pedestrians** relates to improving the conditions for pedestrians. The council will aim to secure the following improvements for pedestrians:

a. Safety;

b. Ease;

c. Convenience; and

d. Directness of movement

A.4.17 These will usually be achieved by planning agreements and conditions, securing:

a. Footway widening;

b. Connecting walkways;

c. Footbridge location; and

d. Covered arcading.

A.4.18 **Policy TRANS 10 – Cycle Parking Standards** aims to make cycling more attractive. The council will require all developments to provide secure parking for bicycles that cannot be used for cars or motorcycles.

A.4.19 **Policy TRANS 12 – Water-based Transport** outlines how WCC intends to make water-based transit more attractive for passengers and freight, in particular:

a. Construction spoil; and

b. Waste.

A.4.20 **Policy TRANS 14 – Transport Assessments** states that developments fitting the criteria set out in Appendix 4.1 of the UDP, will be required to submit a transport assessment. The assessment should cover:

a. Trip generation;

b. Congestion;

c. Parking;

d. Safety;

e. Public transport;

f. Cycling; and

g. Pedestrians.

A.4.21 **Policy TRANS 16 – The Road Hierarchy** outlines the road hierarchy defined by WCC, as:

a. The Transport for London Route Network (TLRN);

b. London Distributor Roads;

c. Local Distributor Roads; and

d. Local roads.

A.4.22 The policy also states that developments will not usually be allowed to have direct vehicular access onto the TLRN or London Distributor Roads. Where no alternative access points exist, the number created will be kept to a minimum.

A.4.23 **Policy TRANS 20 – Off-street Serving, Deliveries and Collection** states that *"The City Council will require convenient access to all premises for servicing vehicles"*. In most cases provision for servicing is expected to be off-street and on-site. Such provision should be able to accommodate the size, type and frequency of arrival of servicing vehicles.

A.4.24 **Policy ENV 5 – Air Pollution** promotes measures to improve air quality by:

a. "Minimising traffic generated by developments;

b. Using natural ventilation systems and lighting wherever possible;

c. Using the most energy efficient forms of heating, air conditioning and active ventilation systems;

d. Careful design and positioning of central heating and ventilation exhausts;

e. Avoiding or reducing emissions from the burning of fossil fuels; and

f. Following the Westminster Considerate Builders' code of practice to contain dust and fumes on building sites".

A.4.25 **Policy RIV 4 – Promoting Activity** indicates that *"the provision of water-dependent and waterfront-enhancing uses will be encouraged, provided that such uses do not harm the amenity or ecology of the surrounding area, including the effect of any traffic and parking generated by the proposal, and have adequate serving arrangements"*.

A.4.26 **Policy RIV 5 – Development Built into or over the River** makes it clear that structures built over or into the river or the foreshore will normally be refused. Although structures that allow for the river to be used for increased recreation or transport may be acceptable.

Supplementary Planning Guidance for the River Thames Area (City of Westminster, 2000)

A.4.27 The document is unavailable in electronic format. TTT has sent an email to WCC to enquire to its status and whether they can view a copy in their offices.

Appendix B: PTAL analysis

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PTAI Study Report File Summary

PTAI Run Parameters

PTAI Run Parameters
PTAI Run: 20122409111513
Description: 20122409111513
Run by user: PTAL web application
Date and time: 24/09/2012 11:15

Walk File Parameters

Walk File: PLSQLTest
Day of Week: M-F
Time Period: AM Peak
Walk Speed: 4.8 kph
BUS Walk Access Time (mins): 8
BUS Reliability Factor: 2.0
LU LRT Walk Access Time (mins): 12
LU LRT Reliability Factor: 0.75
NATIONAL_RAIL Walk Access Time (mins): 12
NATIONAL_RAIL Reliability Factor: 0.75
Coordinates: 530387, 180194

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
BUS	WHITEHALL HORSE GUARDS	88	422.27	9.0	0.5	5.28	5.33	10.61	2.83	1.41
BUS	CHARING X/TRAFALGAR SQ	9	543.79	12.0	0.5	6.8	4.5	11.3	2.66	1.33
BUS	CHARING X/TRAFALGAR SQ	6	543.79	10.0	0.5	6.8	5.0	11.8	2.54	1.27
BUS	CHARING X/TRAFALGAR SQ	23	543.79	9.0	0.5	6.8	5.33	12.13	2.47	1.24
BUS	CHARING X/TRAFALGAR SQ	139	543.79	7.5	0.5	6.8	6.0	12.8	2.34	1.17
BUS	WHITEHALL HORSE GUARDS	3	422.27	8.0	0.5	5.28	5.75	11.03	2.72	1.36
BUS	CHARING X/TRAFALGAR SQ	13	543.79	8.0	0.5	6.8	5.75	12.55	2.39	1.2
BUS	WHITEHALL HORSE GUARDS	12	422.27	15.0	0.5	5.28	4.0	9.28	3.23	1.62
BUS	WHITEHALL HORSE GUARDS	159	422.27	12.0	0.5	5.28	4.5	9.78	3.07	1.53
BUS	CHARING X/TRAFALGAR SQ	15	543.79	7.5	0.5	6.8	6.0	12.8	2.34	1.17
BUS	WHITEHALL HORSE GUARDS	453	422.27	12.0	0.5	5.28	4.5	9.78	3.07	1.53
BUS	NORTHUMBERLAND AVENUE	29	407.21	15.0	0.5	5.09	4.0	9.09	3.3	1.65
BUS	WHITEHALL HORSE GUARDS	24	422.27	12.0	0.5	5.28	4.5	9.78	3.07	1.53

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
BUS	TRAFALGAR SQ NAT GALLERY	176	552.17	7.5	0.5	6.9	6.0	12.9	2.33	1.16
BUS	NORTHUMBERLAND AVENUE	91	407.21	8.0	0.5	5.09	5.75	10.84	2.77	1.38
BUS	WHITEHALL HORSE GUARDS	87	422.27	10.0	0.5	5.28	5.0	10.28	2.92	1.46
BUS	WHITEHALL HORSE GUARDS	11	422.27	8.0	0.5	5.28	5.75	11.03	2.72	1.36
BUS	EMBANKMENT STATION	388	210.13	6.0	0.5	2.63	7.0	9.63	3.12	1.56
BUS	WESTMINSTER STATION	211	624.48	8.0	0.5	7.81	5.75	13.56	2.21	1.11
BUS	WESTMINSTER STATION	148	624.48	8.0	0.5	7.81	5.75	13.56	2.21	1.11
BUS	VICTORIA EMBANKMENT GDNS	53	41.67	8.0	1.0	0.52	5.75	6.27	4.78	4.78
LU LRT	Embankment	District Line Tower Hill to Richmond	255.77	0.7	0.5	3.2	43.61	46.8	0.64	0.32
LU LRT	Embankment	District Line Wimbledon to Dagenham East	255.77	1.3	0.5	3.2	23.83	27.02	1.11	0.56
LU LRT	Embankment	District Line Richmond to Dagenham	255.77	0.3	0.5	3.2	100.75	103.95	0.29	0.14

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
		East								
LU LRT	Embankment	District Line Upminster to Wimbledon	255.77	3.3	0.5	3.2	9.84	13.04	2.3	1.15
LU LRT	Embankment	District Line Wimbledon to Tower Hill	255.77	2.0	0.5	3.2	15.75	18.95	1.58	0.79
LU LRT	Embankment	District Line Upminster to Ealing Broadway	255.77	6.7	0.5	3.2	5.23	8.42	3.56	1.78
LU LRT	Embankment	Bakerloo Line Elephant & Castle to Harrow & Wealdstone	255.77	5.7	0.5	3.2	6.01	9.21	3.26	1.63
LU LRT	Embankment	Northern Line Morden to Mill Hill East	255.77	1.0	0.5	3.2	30.75	33.95	0.88	0.44
LU LRT	Embankment	District Line Barking to Richmond	255.77	0.3	0.5	3.2	100.75	103.95	0.29	0.14
LU LRT	Embankment	District Line Dagenham East to Ealing Broadway	255.77	0.7	0.5	3.2	43.61	46.8	0.64	0.32

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
LU LRT	Embankment	District Line Tower Hill to Ealing Broadway	255.77	0.3	0.5	3.2	100.75	103.95	0.29	0.14
LU LRT	Embankment	Bakerloo Line Stonebridge Park to Elephant & Castle	255.77	5.0	0.5	3.2	6.75	9.95	3.02	1.51
LU LRT	Embankment	Northern Line Edgware to Morden	255.77	8.3	0.5	3.2	4.36	7.56	3.97	1.98
LU LRT	Embankment	District Line Richmond to Upminster	255.77	6.3	0.5	3.2	5.51	8.71	3.44	1.72
LU LRT	Embankment	Northern Line Kennington to Edgware	255.77	5.0	0.5	3.2	6.75	9.95	3.02	1.51
LU LRT	Embankment	Bakerloo Line Queen's Park to Elephant &	255.77	11.0	1.0	3.2	3.48	6.67	4.49	4.49

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
		Castle								
LU LRT	Embankment	Circle Line Edgware Road (Circle Line) to Hammersmith (H&C Line)	255.77	6.0	0.5	3.2	5.75	8.95	3.35	1.68
LU LRT	Embankment	Bakerloo Line Waterloo to Queen's Park	255.77	1.0	0.5	3.2	30.75	33.95	0.88	0.44
LU LRT	Embankment	District Line Wimbledon to Barking	255.77	1.7	0.5	3.2	18.4	21.59	1.39	0.69
LU LRT	Embankment	District Line Barking to Ealing Broadway	255.77	0.3	0.5	3.2	100.75	103.95	0.29	0.14
LU LRT	Embankment	Northern Line Mill Hill East to Kennington	255.77	4.3	0.5	3.2	7.73	10.92	2.75	1.37
LU LRT	Embankment	Bakerloo Line Waterloo to Harrow & Wealdstone	255.77	0.3	0.5	3.2	100.75	103.95	0.29	0.14
LU LRT	Embankment	Northern	255.77	5.4	0.5	3.2	6.31	9.5	3.16	1.58

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
		Line High Barnet to Kennington								
LU LRT	Embankment	Northern Line Morden to High Barnet	255.77	3.7	0.5	3.2	8.86	12.06	2.49	1.24
LU LRT	Westminster	Jubilee Line Stratford to Willesden Green	573.28	4.4	0.5	7.17	7.57	14.73	2.04	1.02
LU LRT	Westminster	Jubilee Line Wembley Park to Stratford	573.28	4.4	0.5	7.17	7.57	14.73	2.04	1.02
LU LRT	Westminster	Jubilee Line Stanmore to Stratford	573.28	17.8	0.5	7.17	2.44	9.6	3.12	1.56
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to DARTFORD	633.56	1.0	0.5	7.92	30.75	38.67	0.78	0.39
NATIONAL_RAIL	LONDON CHARING CROSS	STROOD to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	GRAVESEND BR to LONDON CHARING	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
		CROSS								
NATIONAL_RAIL	LONDON CHARING CROSS	GILLINGHAM (KENT) to LONDON CHARING CROSS	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING CROSS	SIDCUP BR to LONDON CHARING CROSS	633.56	1.0	0.5	7.92	30.75	38.67	0.78	0.39
NATIONAL_RAIL	LONDON CHARING CROSS	BARNEHURST BR to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	HAYES BR (KENT) to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	HAYES BR (KENT) to LONDON CHARING CROSS	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING CROSS	RAMSGATE to LONDON CHARING CROSS	633.56	1.7	0.5	7.92	18.4	26.32	1.14	0.57
NATIONAL_RAIL	LONDON CHARING	ORE to	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
	CROSS	LONDON CHARING CROSS								
NATIONAL_RAIL	LONDON CHARING CROSS	MARGATE to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to MARGATE	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to RAMSGATE	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to DOVER PRIORY	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to HAYES BR (KENT)	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to DARTFORD	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to ORPINGTON	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	GILLINGHAM (KENT) to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	SLADE GREEN to LONDON CHARING CROSS	633.56	1.0	0.5	7.92	30.75	38.67	0.78	0.39
NATIONAL_RAIL	LONDON CHARING CROSS	DARTFORD to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	CRAYFORD BR to LONDON CHARING CROSS	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING CROSS	HAYES BR (KENT) to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING	HAYES BR (KENT) to	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
	CROSS	LONDON CHARING CROSS								
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to GRAVESEND BR	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to NEW BECKENHAM BR	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	TUNBRIDGE WELLS to LONDON CHARING CROSS	633.56	1.33	0.5	7.92	23.31	31.23	0.96	0.48
NATIONAL_RAIL	LONDON CHARING CROSS	ORPINGTON to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	DARTFORD to LONDON CHARING CROSS	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING CROSS	DARTFORD to LONDON	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
		CHARING CROSS								
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to ROCHESTER	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to DOVER PRIORY	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to ORPINGTON	633.56	2.3	1.0	7.92	13.79	21.71	1.38	1.38
NATIONAL_RAIL	LONDON CHARING CROSS	STROOD to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	GRAVESEND BR to LONDON CHARING CROSS	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING CROSS	ORPINGTON to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
NATIONAL_RAIL	LONDON CHARING CROSS	DARTFORD to LONDON CHARING CROSS	633.56	1.33	0.5	7.92	23.31	31.23	0.96	0.48
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to GILLINGHAM (KENT)	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to GRAVESEND BR	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to HASTINGS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to MARGATE	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	CRAYFORD BR to LONDON CHARING CROSS	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING CROSS	HAYES BR (KENT) to LONDON CHARING	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
		CROSS								
NATIONAL_RAIL	LONDON CHARING CROSS	HAYES BR (KENT) to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to GRAVESEND BR	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to NEW BECKENHAM BR	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	TUNBRIDGE WELLS to LONDON CHARING CROSS	633.56	1.33	0.5	7.92	23.31	31.23	0.96	0.48
NATIONAL_RAIL	LONDON CHARING CROSS	ORPINGTON to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	DARTFORD to LONDON CHARING CROSS	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
NATIONAL_RAIL	LONDON CHARING CROSS	DARTFORD to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to ROCHESTER	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to DOVER PRIORY	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to ORPINGTON	633.56	2.3	1.0	7.92	13.79	21.71	1.38	1.38
NATIONAL_RAIL	LONDON CHARING CROSS	STROOD to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	GRAVESEND BR to LONDON CHARING CROSS	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING CROSS	ORPINGTON to LONDON	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
		CHARING CROSS								
NATIONAL_RAIL	LONDON CHARING CROSS	DARTFORD to LONDON CHARING CROSS	633.56	1.33	0.5	7.92	23.31	31.23	0.96	0.48
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to GILLINGHAM (KENT)	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to GRAVESEND BR	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to HASTINGS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to MARGATE	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	CRAYFORD BR to LONDON CHARING CROSS	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING	HAYES BR	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
	CROSS	(KENT) to LONDON CHARING CROSS								
NATIONAL_RAIL	LONDON CHARING CROSS	HAYES BR (KENT) to LONDON CHARING CROSS	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to GRAVESEND BR	633.56	0.67	0.5	7.92	45.53	53.45	0.56	0.28
NATIONAL_RAIL	LONDON CHARING CROSS	LONDON CHARING CROSS to NEW BECKENHAM BR	633.56	0.33	0.5	7.92	91.66	99.58	0.3	0.15

Note: Total AI for this POI is 75.86.
PTAL Rating is 6b.

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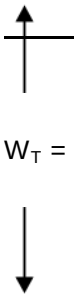
Appendix C: Pedestrian Level of Service (LoS)

C.1 Victoria Embankment (A3211) – eastern footway, baseline, AM peak hour

Peak 15 minute:

V_1= 28 ped/15min

V_2= 23 ped/15min



			W_{B1} (kerb)	=	1.6	ft	0.50	m
			W_{B2} (street furn.)	=	3.3	ft	1.00	m
W_T =	1.8	ft	W_E (effective width)	=	13.1	ft	4.00	m
	6	m	W_{B3} (window shop)	=	0.0	ft	0.00	m
			W_{B4} (bldg protrusions)	=	0.0	ft	0.00	m
			W_{B5} (inside clearance)	=	1.6	ft	0.50	m

Pedestrian volume:

V_1	=	28	ped/15min
V_2	=	23	ped/15min
$V_p=V_1+V_2$	=	51.0	ped/15min

Walkway width:

W_T	=	19.7	ft	6.0	m
$W_B=W_{B1}+W_{B2}+W_{B3}+W_{B4}+W_{B5}$	=	6.6	ft	2.0	m
$W_E=W_T - W_B$	=	13.1	ft	4.0	m

Average walkway LOS:

$v=V_p / 15W_E$	=	0.3	ped/min/ft	0.9	ped/min/m
Average LOS		**A**			

Platoon walkway LOS:

$v_p=v+4$	=	4.3	ped/min/ft	4.9	ped/min/m
Platoon LOS		**A**			

C.2 Victoria Embankment (A3211) – eastern footway, baseline, PM peak hour

Peak 15 minute:

V_1= 179 ped/15min

V_2= 124 ped/15min

			W_{B1} (kerb)	=	1.6	ft	0.50	m
			W_{B2} (street furn.)	=	3.3	ft	1.00	m
W_T =	1.8	ft	W_E (effective width)	=	13.1	ft	4.00	m
	6	m	W_{B3} (window shop)	=	0.0	ft	0.00	m
			W_{B4} (bldg protrusions)	=	0.0	ft	0.00	m
			W_{B5} (inside clearance)	=	1.6	ft	0.50	m

Pedestrian volume:

V_1	=	179	ped/15min
V_2	=	124	ped/15min
$V_p=V_1+V_2$	=	303.0	ped/15min

Walkway width:

W_T	=	19.7	ft	6.0	m
$W_B=W_{B1}+W_{B2}+W_{B3}+W_{B4}+W_{B5}$	=	6.6	ft	2.0	m
$W_E=W_T - W_B$	=	13.1	ft	4.0	m

Average walkway LOS:

$v=V_p / 15W_E$	=	1.5	ped/min/ft	5.1	ped/min/m

Average LOS | **A**

Platoon walkway LOS:

$v_p=v+4$	=	5.5	ped/min/ft	9.1	ped/min/m

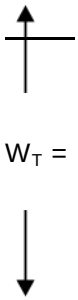
Platoon LOS | **B**

C.3 Victoria Embankment (A3211) – western footway, baseline, AM peak hour

Peak 15 minute:

V_1= 67 ped/15min

V_2= 24 ped/15min



W_T = 1.8 ft / 6 m

W_{B1} (kerb)	=	1.6	ft	0.50	m
W_{B2} (street furn.)	=	3.3	ft	1.00	m
W_E (effective width)	=	13.1	ft	4.00	m
W_{B3} (window shop)	=	0.0	ft	0.00	m
W_{B4} (bldg protrusions)	=	0.0	ft	0.00	m
W_{B5} (inside clearance)	=	1.6	ft	0.50	m

Pedestrian volume:

V_1	=	67	ped/15min
V_2	=	24	ped/15min
$V_p=V_1+V_2$	=	91.0	ped/15min

Walkway width:

W_T	=	19.7	ft	6.0	m
$W_B=W_{B1}+W_{B2}+W_{B3}+W_{B4}+W_{B5}$	=	6.6	ft	2.0	m
$W_E=W_T - W_B$	=	13.1	ft	4.0	m

Average walkway LOS:

$v=V_p / 15W_E$	=	0.5	ped/min/ft	1.5	ped/min/m

Average LOS **A**

Platoon walkway LOS:

$v_p=v+4$	=	4.5	ped/min/ft	5.5	ped/min/m

Platoon LOS **A**

C.4 Victoria Embankment (A3211) – western footway, baseline, PM peak hour

Peak 15 minute:

V_1= 61 ped/15min

V_2= 107 ped/15min

W_T = 1.8 ft / 6 m

W_{B1} (kerb)	=	1.6	ft	0.50	m
W_{B2} (street furn.)	=	3.3	ft	1.00	m
W_E (effective width)	=	13.1	ft	4.00	m
W_{B3} (window shop)	=	0.0	ft	0.00	m
W_{B4} (bldg protrusions)	=	0.0	ft	0.00	m
W_{B5} (inside clearance)	=	1.6	ft	0.50	m

Pedestrian volume:

V_1	=	61	ped/15min
V_2	=	107	ped/15min
$V_p=V_1+V_2$	=	168.0	ped/15min

Walkway width:

W_T	=	19.7	ft	6.0	m
$W_B=W_{B1}+W_{B2}+W_{B3}+W_{B4}+W_{B5}$	=	6.6	ft	2.0	m
$W_E=W_T - W_B$	=	13.1	ft	4.0	m

Average walkway LOS:

$v=V_p / 15W_E$	=	0.9	ped/min/ft	2.8	ped/min/m

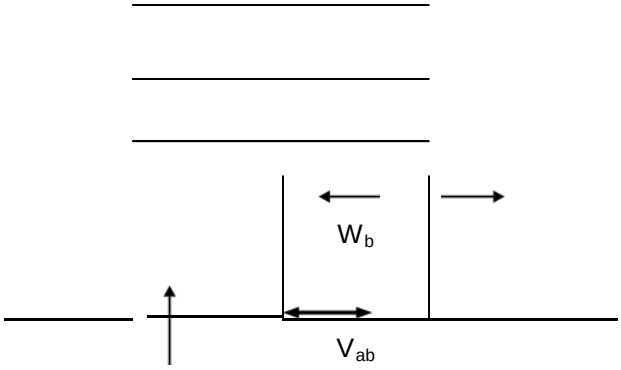
Average LOS **A**

Platoon walkway LOS:

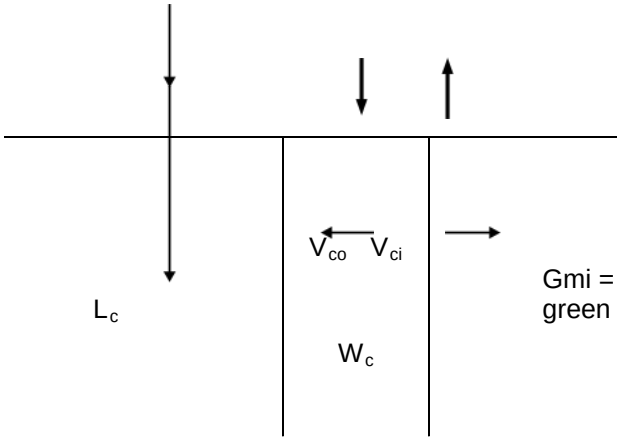
$v_p=v+4$	=	4.9	ped/min/ft	6.8	ped/min/m

Platoon LOS **B**

C.5 Northumberland Avenue (A400) crossing at junction with Victoria Embankment (A3211), baseline, AM peak hour



Sidewalk A



Crosswalk C

Gmi = traffic green

Signal Timing (sec)

C=	95		
G_{mj} =	68	R_{mj}=	27
G_{mi} =	27	R_{mi}=	68

Pedestrian Volumes

Flow	Ped/min		Ped/Cyc	
v_{ci}	5		7.9	
v_{co}	2		3.2	
v_{ab}	2		3.2	
v_{tot}	9.0		14.3	
W_a =	9.8	ft	3	m
W_b =	9.8	ft	3	m
W_c =	9.8	ft	3	m
L_c =	72.2	ft	22	m

Net Corner Area:

A = W_aW_b =	96.9	sq ft	9.0	sq m

Available Time Space:

		sq ft min		sq m min
TS = A x C/60 =	153.4		14.3	

Hold Area Waiting Times: (use ped/cycle)

Q_{tco} = [(v_{co})((R_{mj}) /C)((R_{mj}) /2)]/60 =	0.2	ped min

Hold Area Time Space:

		sq ft min		sq m min
TS_h = 5(Q_{tco}), or 0.4645(Q_{tco})	1.0		0.1	

Circulation Time Space:

		sq ft		sq m	
$TS_c = TS - TS_h =$	152.4	min	14.2	min	

Total Circulation Volume:

$v_c = v_{ci} + v_{co} + v_{ab} =$	14.3	ped (per cycle)

Total Circulation Time:

$t_c = v_c \times 4/60 =$	1.0	ped min

Pedestrian Space and LOS:

		sq ft		sq m /	**LOS**	**A**
$M = TS_c / t_c =$	160.4	/ ped	14.9	ped		

Crosswalk Areas:

$A_c = L_c W_c =$	710.4	sq ft	66.0	sq m

Crosswalk Time-Space:

		sq ft		sq m
$TS_c = A_c (G_{mj} - 3)/60 =$	769.6	min	71.5	min

Crossing Times:

$t_{wc} = L_c / 1.2 =$	18.3	sec

Crosswalk Occupancy Time: (use ped/cycle)

$T_{wc} = (v_{ci}+v_{co})(t_{wc} /60) =$	3.4	ped/ min

Average Pedestrian Space:

		sq ft		sq m /	**LOS**	**A**
$M_c = TS_c / T_{wc} =$	227.3	/ ped	21.1	ped		

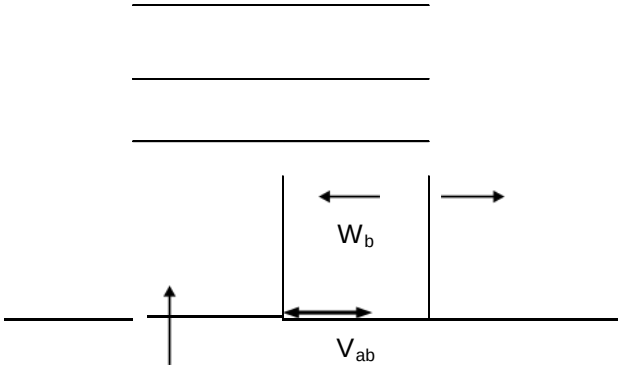
Maximum surge: (use ped/min)

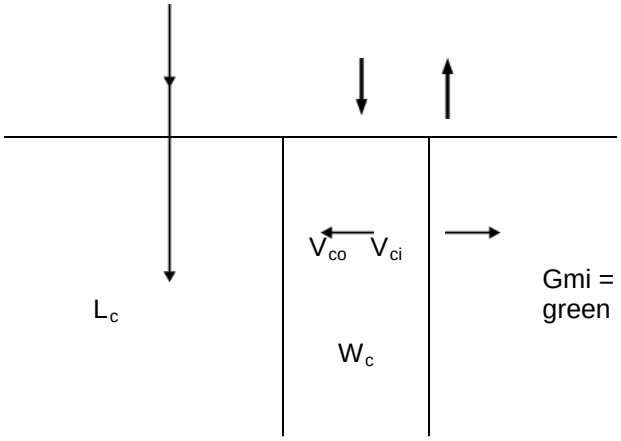
$V_{mc} = (v_{ci}+v_{co})(R_{mj} + 3 + t_{wc})/60 =$	5.6	ped

Surge Pedestrian Space:

		sq ft		sq m /	**LOS**	**B**
$M_c(max) = A_c / V_{mc} =$	126.0	/ ped	11.7	ped		

C.6 Northumberland Avenue (A400) crossing at junction with Victoria Embankment (A3211), baseline, PM peak hour





Gmi = traffic green

Signal Timing (sec)

C=	96		
G_{mj} =	70	R_{mj}=	26
G_{mi} =	26	R_{mi}=	70

Pedestrian Volumes

Flow	Ped/min		Ped/Cyc	
v_{ci}	6		9.6	
v_{co}	6		9.6	
v_{ab}	3		4.8	
v_{tot}	15.0		24.0	
W_a =	9.8	ft	3	m
W_b =	9.8	ft	3	m
W_c =	9.8	ft	3	m
L_c =	72.2	ft	22	m

Net Corner Area:

A = W_aW_b =	96.9	sq ft	9.0	sq m

Available Time Space:

		sq ft min		sq m min
TS = A x C/60 =	155.0		14.4	

Hold Area Waiting Times: (use ped/cycle)

Q_{tco} = [(v_{co})((R_{mj}) /C)((R_{mj}) /2)]/60 =	0.6	ped min

Hold Area Time Space:

		sq ft min		sq m min
TS_h = 5(Q_{tco}), or 0.4645(Q_{tco})	2.8		0.3	

Circulation Time Space:

		sq ft		sq m	
$TS_c = TS - TS_h =$	152.2	min	14.1	min	

Total Circulation Volume:

$v_c = v_{ci} + v_{co} + v_{ab} =$	24.0	ped (per cycle)

Total Circulation Time:

$t_c = v_c \times 4/60 =$	1.6	ped min

Pedestrian Space and LOS:

		sq ft		sq m /	**LOS**	**B**
$M = TS_c / t_c =$	95.1	/ ped	8.8	ped		

Crosswalk Areas:

$A_c = L_c W_c =$	710.4	sq ft	66.0	sq m

Crosswalk Time-Space:

		sq ft		sq m
$TS_c = A_c (G_{mj} - 3)/60 =$	793.3	min	73.7	min

Crossing Times:

$t_{wc} = L_c / 1.2 =$	18.3	sec

Crosswalk Occupancy Time: (use ped/cycle)

$T_{wc} = (v_{ci}+v_{co})(t_{wc} /60) =$	5.9	ped/ min

Average Pedestrian Space:

		sq ft		sq m /	**LOS**	**A**
$M_c = TS_c / T_{wc} =$	135.2	/ ped	12.6	ped		

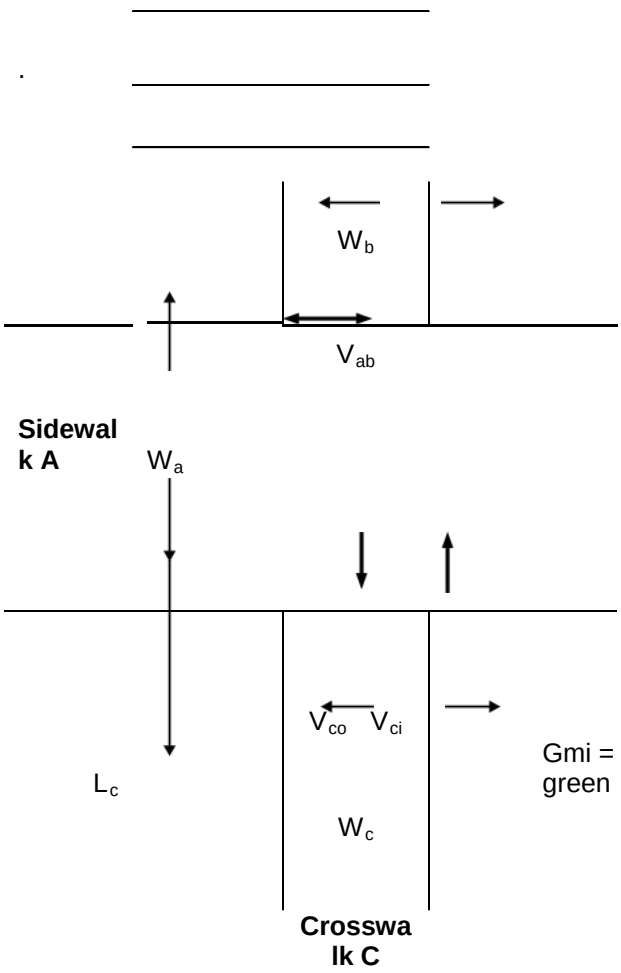
Maximum surge: (use ped/min)

$V_{mc} = (v_{ci}+v_{co})(R_{mj} + 3 + t_{wc})/60 =$	9.5	ped

Surge Pedestrian Space:

		sq ft		sq m /	**LOS**	**B**
$M_c(max) = A_c / V_{mc} =$	75.0	/ ped	7.0	ped		

C.7 Pedestrian crossing on Victoria Embankment (A3211) outside Embankment Underground station, baseline, AM peak hour



Gmi = traffic green

Signal Timing (sec)

C=	96		
G_{mj} =	19	R_{mj}=	77
G_{mi} =	77	R_{mi}=	19

Pedestrian Volumes

Flow	Ped/min		Ped/Cyc	
v_{ci}	7		11.2	
v_{co}	1		1.6	
v_{ab}	3		4.8	
v_{tot}	11.0		17.6	
W_a =	19.7	ft	6	m
W_b =	9.8	ft	3	m
W_c =	9.8	ft	3	m
L_c =	55.8	ft	17	m

Net Corner Area:

A = W_aW_b =	193.8	sq ft	18.0	sq m

Available Time Space:

		sq ft		sq m
TS = A x C/60 =	310.0	min	28.8	min

Hold Area Waiting Times: (use ped/cycle)

Q_{tco} = [(v_{co})((R_{mj}) /C)((R_{mj}) /2)]/60 =	0.8	ped min

Hold Area Time Space:

		sq ft		sq m
TS_h = 5(Q_{tco}), or 0.4645(Q_{tco})	4.1	min	0.4	min

Circulation Time Space:

		sq ft		sq m	
$TS_c = TS - TS_h =$	305.9	min	28.4	min	

Total Circulation Volume:

$v_c = v_{ci} + v_{co} + v_{ab} =$	17.6	ped (per cycle)

Total Circulation Time:

$t_c = v_c \times 4/60 =$	1.2	ped min

Pedestrian Space and LOS:

		sq ft		sq m /	**LOS**	**A**
$M = TS_c / t_c =$	260.7	/ ped	24.2	ped		

Crosswalk Areas:

$A_c = L_c W_c =$	549.0	sq ft	51.0	sq m

Crosswalk Time-Space:

		sq ft		sq m
$TS_c = A_c (G_{mj} - 3)/60 =$	146.4	min	13.6	min

Crossing Times:

$t_{wc} = L_c / 1.2 =$	14.2	sec

Crosswalk Occupancy Time: (use ped/cycle)

$T_{wc} = (v_{ci}+v_{co})(t_{wc} /60) =$	3.0	ped/ min

Average Pedestrian Space:

		sq ft		sq m /	**LOS**	**B**
$M_c = TS_c / T_{wc} =$	48.4	/ ped	4.5	ped		

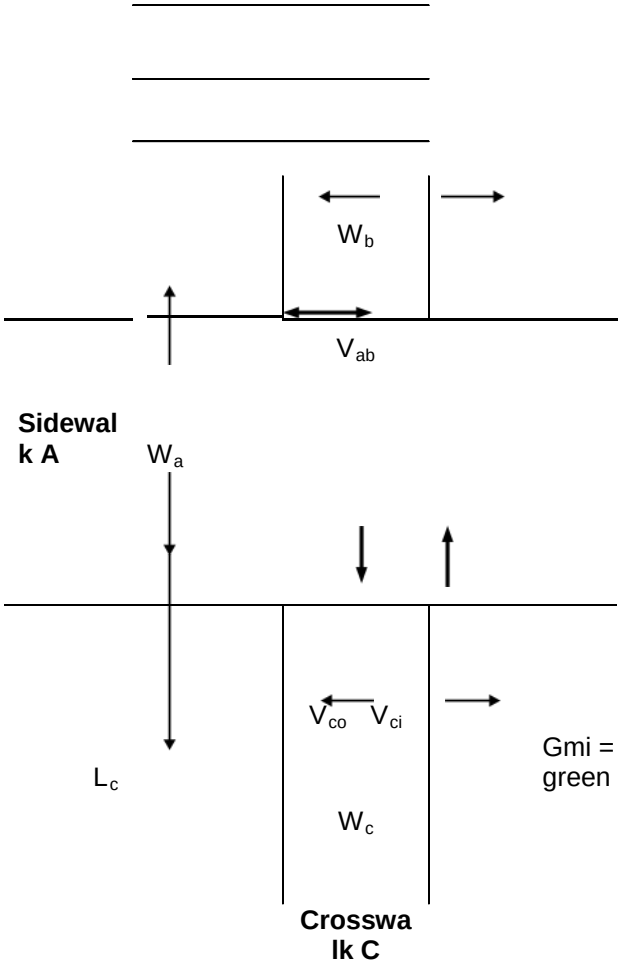
Maximum surge: (use ped/min)

$V_{mc} = (v_{ci}+v_{co})(R_{mj} + 3 + t_{wc})/60 =$	12.6	ped

Surge Pedestrian Space:

		sq ft		sq m /	**LOS**	**B**
$M_c(max) = A_c / V_{mc} =$	43.7	/ ped	4.1	ped		

C.8 Pedestrian crossing on Victoria Embankment (A3211) outside Embankment Underground station, baseline, PM peak hour



Gmi = traffic green

Signal Timing (sec)

C=	96		
G_{mj} =	19	R_{mj}=	77
G_{mi} =	77	R_{mi}=	19

Pedestrian Volumes

Flow	Ped/min		Ped/Cyc	
v_{ci}	5		8.0	
v_{co}	6		9.6	
v_{ab}	17		27.2	
v_{tot}	28.0		44.8	
W_a =	19.7	ft	6	m
W_b =	9.8	ft	3	m
W_c =	9.8	ft	3	m
L_c =	55.8	ft	17	m

Net Corner Area:

A = W_aW_b =	193.8	sq ft	18.0	sq m

Available Time Space:

		sq ft		sq m
TS = A x C/60 =	310.0	min	28.8	min

Hold Area Waiting Times: (use ped/cycle)

Q_{tco} = [(v_{co})((R_{mj}) /C)((R_{mj}) /2)]/60 =	4.9	ped min

Hold Area Time Space:

		sq ft		sq m
TS_h = 5(Q_{tco}), or 0.4645(Q_{tco})	24.7	min	2.3	min

Circulation Time Space:

		sq ft		sq m	
$TS_c = TS - TS_h =$	285.3	min	26.5	min	

Total Circulation Volume:

$v_c = v_{ci} + v_{co} + v_{ab} =$	44.8	ped (per cycle)

Total Circulation Time:

$t_c = v_c \times 4/60 =$	3.0	ped min

Pedestrian Space and LOS:

		sq ft		sq m /	**LOS**	**B**
$M = TS_c / t_c =$	95.5	/ ped	8.9	ped		

Crosswalk Areas:

$A_c = L_c W_c =$	549.0	sq ft	51.0	sq m

Crosswalk Time-Space:

$TS_c = A_c (G_{mj} - 3)/60 =$	146.4	sq ft min	13.6	sq m min

Crossing Times:

$t_{wc} = L_c / 1.2 =$	14.2	sec

Crosswalk Occupancy Time: (use ped/cycle)

$T_{wc} = (v_{ci}+v_{co})(t_{wc} /60) =$	4.2	ped/ min

Average Pedestrian Space:

		sq ft		sq m /	**LOS**	**C**
$M_c = TS_c / T_{wc} =$	35.2	/ ped	3.3	ped		

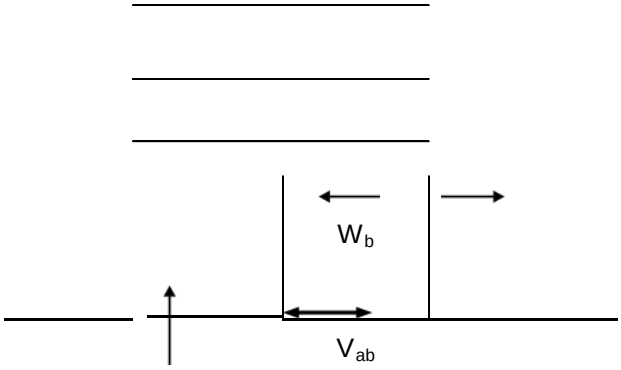
Maximum surge: (use ped/min)

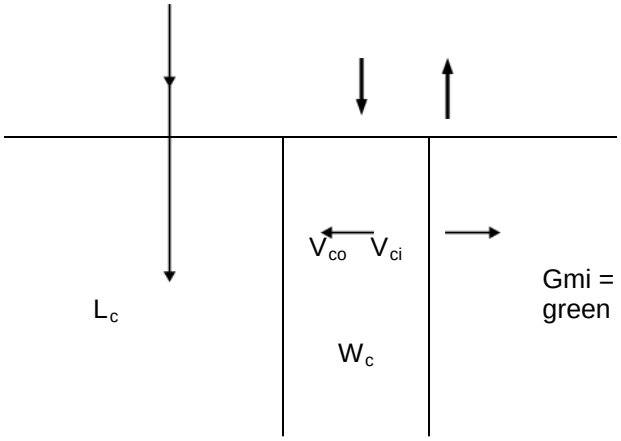
$V_{mc} = (v_{ci}+v_{co})(R_{mj} + 3 + t_{wc})/60 =$	17.3	ped

Surge Pedestrian Space:

		sq ft		sq m /	**LOS**	**C**
$M_c(max) = A_c / V_{mc} =$	31.8	/ ped	3.0	ped		

C.9 Victoria Embankment (A3211) crossing to the south of the junction with Northumberland Avenue (A400), baseline, AM peak hour





Gmi = traffic green

Signal Timing (sec)

C=	96		
G_{mj} =	64	R_{mj}=	32
G_{mi} =	32	R_{mi}=	64

Pedestrian Volumes

Flow	Ped/min		Ped/Cyc	
v_{ci}	1		1.6	
v_{co}	1		1.6	
v_{ab}	3		4.8	
v_{tot}	5.0		8.0	
W_a =	19.7	ft	6	m
W_b =	9.8	ft	3	m
W_c =	9.8	ft	3	m
L_c =	55.8	ft	17	m

Net Corner Area:

A = W_aW_b =	193.8	sq ft	18.0	sq m

Available Time Space:

		sq ft min		sq m min
TS = A x C/60 =	310.0		28.8	

Hold Area Waiting Times: (use ped/cycle)

Q_{tco} = [(v_{co})((R_{mj}) /C)((R_{mj}) /2)]/60 =	0.1	ped min

Hold Area Time Space:

		sq ft min		sq m min
TS_h = 5(Q_{tco}), or 0.4645(Q_{tco})	0.7		0.1	

Circulation Time Space:

$TS_c = TS - TS_h =$	309.3	sq ft min	28.7	sq m min	

Total Circulation Volume:

$v_c = v_{ci} + v_{co} + v_{ab} =$	8.0	ped (per cycle)

Total Circulation Time:

$t_c = v_c \times 4/60 =$	0.5	ped min

Pedestrian Space and LOS:

$M = TS_c / t_c =$	579.9	sq ft / ped	53.9	sq m / ped	**LOS**	**A**

Crosswalk Areas:

$A_c = L_c W_c =$	549.0	sq ft	51.0	sq m

Crosswalk Time-Space:

$TS_c = A_c (G_{mj} - 3)/60 =$	558.1	sq ft min	51.9	sq m min

Crossing Times:

$t_{wc} = L_c / 1.2 =$	14.2	sec

Crosswalk Occupancy Time: (use ped/cycle)

$T_{wc} = (v_{ci}+v_{co})(t_{wc} /60) =$	0.8	ped/ min

Average Pedestrian Space:

$M_c = TS_c / T_{wc} =$	738.7	sq ft / ped	68.6	sq m / ped	**LOS**	**A**

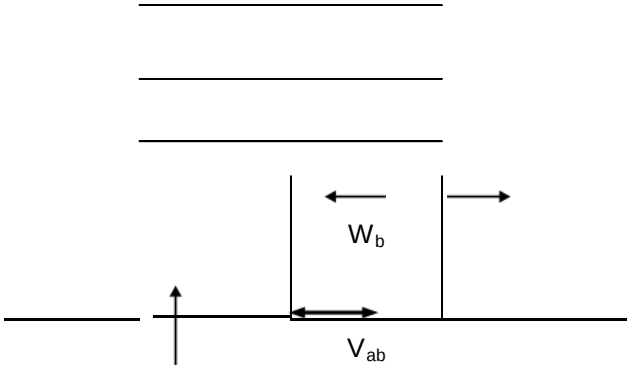
Maximum surge: (use ped/min)

$V_{mc} = (v_{ci}+v_{co})(R_{mj} + 3 + t_{wc})/60 =$ 1.6 ped

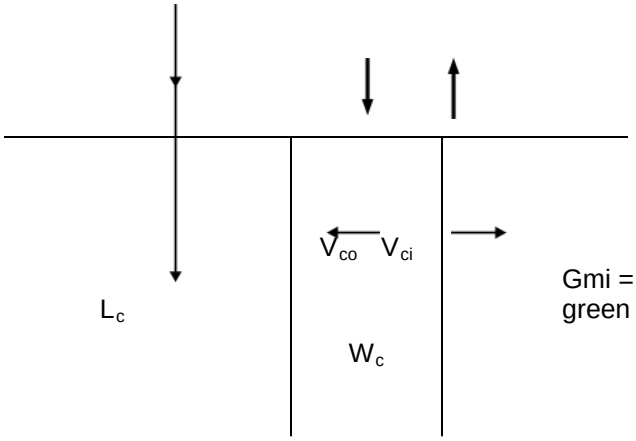
Surge Pedestrian Space:

$M_c(max) = A_c / V_{mc} =$	335.0	sq ft / ped	31.1	sq m / ped	**LOS**	**A**

C.10 Victoria Embankment (A3211) crossing to the south of the junction with Northumberland Avenue (A400), baseline, PM peak hour



Sidewalk A



Crosswalk C

Gmi = traffic green

Signal Timing (sec)

C=	95		
G_{mj}=	62	R_{mj}=	33
G_{mi}=	33	R_{mi}=	62

Pedestrian Volumes

Flow	Ped/min		Ped/Cyc	
v_{ci}	5		7.9	
v_{co}	3		4.8	
v_{ab}	17		26.9	
v_{tot}	25.0		39.6	
W_a =	19.7	ft	6	m
W_b =	9.8	ft	3	m
W_c =	9.8	ft	3	m
L_c =	55.8	ft	17	m

Net Corner Area:

A = W_aW_b =	193.8	sq ft	18.0	sq m

Available Time Space:

		sq ft min		sq m min
TS = A x C/60 =	306.8		28.5	

Hold Area Waiting Times: (use ped/cycle)

Q_{tco} = $[(v_{co})((R_{mj})/C)((R_{mj})/2)]/60$ =	0.5	ped min

Hold Area Time Space:

		sq ft min		sq m min
TS_h = 5(Q_{tco}), or 0.4645(Q_{tco})	2.3		0.2	

Circulation Time Space:

$TS_c = TS - TS_h =$	304.5	sq ft min	28.3	sq m min		

Total Circulation Volume:

$v_c = v_{ci} + v_{co} + v_{ab} =$	39.6	ped (per cycle)

Total Circulation Time:

$t_c = v_c \times 4/60 =$	2.6	ped min

Pedestrian Space and LOS:

$M = TS_c / t_c =$	115.4	sq ft / ped	10.7	sq m / ped	**LOS**	**B**

Crosswalk Areas:

$A_c = L_c W_c =$	549.0	sq ft	51.0	sq m

Crosswalk Time-Space:

$TS_c = A_c (G_{mj} - 3)/60 =$	539.8	sq ft min	50.2	sq m min

Crossing Times:

$t_{wc} = L_c / 1.2 =$	14.2	sec

Crosswalk Occupancy Time: (use ped/cycle)

$T_{wc} = (v_{ci}+v_{co})(t_{wc} /60) =$	3.0	ped /min

Average Pedestrian Space:

$M_c = TS_c / T_{wc} =$	180.5	sq ft / ped	16.8	sq m / ped	**LOS**	**A**

Maximum surge: (use ped/min)

$V_{mc} = (v_{ci}+v_{co})(R_{mj} + 3 + t_{wc})/60 =$	6.7	ped

Surge Pedestrian Space:

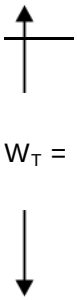
$M_c(max) = A_c / V_{mc} =$	82.1	sq ft / ped	7.6	sq m / ped	**LOS**	**B**

C.11 Victoria Embankment (A3211) – western footway, construction development case, AM peak hour

Peak 15 minute:

V_1= 93 ped/15min

V_2= 47 ped/15min



W_T = 1.8 ft / 6 m

W_{B1} (kerb)	=	1.6	ft	0.50	m
W_{B2} (street furn.)	=	3.3	ft	1.00	m
W_E (effective width)	=	13.1	ft	4.00	m
W_{B3} (window shop)	=	0.0	ft	0.00	m
W_{B4} (bldg protrusions)	=	0.0	ft	0.00	m
W_{B5} (inside clearance)	=	1.6	ft	0.50	m

Pedestrian volume:

V_1	=	93	ped/15min
V_2	=	47	ped/15min
$V_p=V_1+V_2$	=	140.0	ped/15min

Walkway width:

W_T	=	19.7	ft	6.0	m
$W_B=W_{B1}+W_{B2}+W_{B3}+W_{B4}+W_{B5}$	=	6.6	ft	2.0	m
$W_E=W_T - W_B$	=	13.1	ft	4.0	m

Average walkway LOS:

$v=V_p / 15W_E$	=	0.7	ped/min/ft	2.3	ped/min/m

Average LOS **A**

Platoon walkway LOS:

$v_p=v+4$	=	4.7	ped/min/ft	6.3	ped/min/m

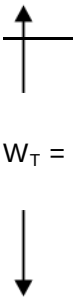
Platoon LOS **A**

C.12 Victoria Embankment (A3211) – western footway, construction development case, PM peak hour

Peak 15 minute:

V_1= 240 ped/15min

V_2= 231 ped/15min



W_T = 1.8 ft / 6 m

W_{B1} (kerb)	=	1.6	ft	0.50	m
W_{B2} (street furn.)	=	3.3	ft	1.00	m
W_E (effective width)	=	13.1	ft	4.00	m
W_{B3} (window shop)	=	0.0	ft	0.00	m
W_{B4} (bldg protrusions)	=	0.0	ft	0.00	m
W_{B5} (inside clearance)	=	1.6	ft	0.50	m

Pedestrian volume:

V_1	=	240	ped/15min
V_2	=	231	ped/15min
$V_p=V_1+V_2$	=	471.0	ped/15min

Walkway width:

W_T	=	19.7	ft	6.0	m
$W_B=W_{B1}+W_{B2}+W_{B3}+W_{B4}+W_{B5}$	=	6.6	ft	2.0	m
$W_E=W_T - W_B$	=	13.1	ft	4.0	m

Average walkway LOS:

$v=V_p / 15W_E$	=	2.4	ped/min/ft	7.9	ped/min/m

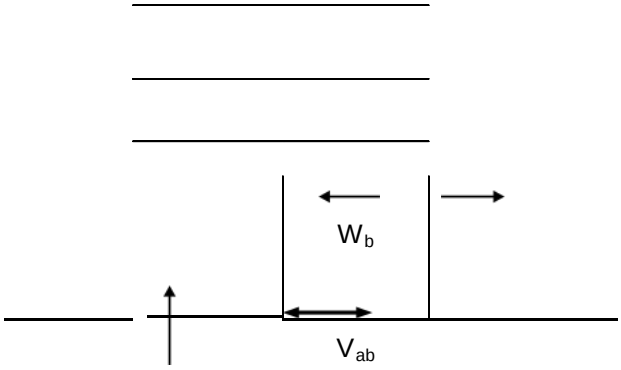
Average LOS **B**

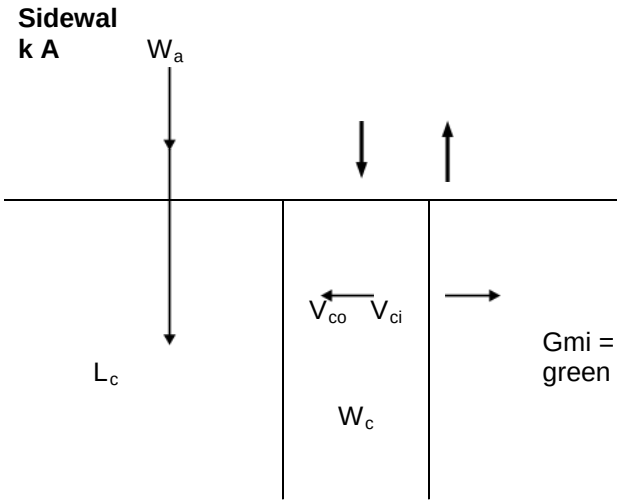
Platoon walkway LOS:

$v_p=v+4$	=	6.4	ped/min/ft	11.9	ped/min/m

Platoon LOS **B**

C.13 Pedestrian crossing on Victoria Embankment (A3211) outside Embankment Underground station, construction development case, AM peak hour





Gmi = traffic green

Signal Timing (sec)

C=	96		
G_{mj} =	19	R_{mj}=	77
G_{mi} =	77	R_{mi}=	19

Pedestrian Volumes

Flow	Ped/min		Ped/Cyc	
v_{ci}	8		12.8	
v_{co}	1		1.6	
v_{ab}	3		4.8	
v_{tot}	12.0		19.2	
W_a =	19.7	ft	6	m
W_b =	9.8	ft	3	m
W_c =	9.8	ft	3	m
L_c =	55.8	ft	17	m

Net Corner Area:

A = W_aW_b =	193.8	sq ft	18.0	sq m

Available Time Space:

		sq ft		sq m
TS = A x C/60 =	310.0	min	28.8	min

Hold Area Waiting Times: (use ped/cycle)

Q_{tco} = [(v_{co})((R_{mj}) /C)((R_{mj}) /2)]/60 =	0.8	ped min

Hold Area Time Space:

		sq ft		sq m
TS_h = 5(Q_{tco}), or 0.4645(Q_{tco})	4.1	min	0.4	min

Circulation Time Space:

$TS_c = TS - TS_h =$	305.9	sq ft min	28.4	sq m min	

Total Circulation Volume:

$v_c = v_{ci} + v_{co} + v_{ab} =$	19.2	ped (per cycle)

Total Circulation Time:

$t_c = v_c \times 4/60 =$	1.3	ped min

Pedestrian Space and LOS:

$M = TS_c / t_c =$	239.0	sq ft / ped	22.2	sq m / ped	**LOS**	**A**

Crosswalk Areas:

$A_c = L_c W_c =$	549.0	sq ft	51.0	sq m

Crosswalk Time-Space:

$TS_c = A_c (G_{mj} - 3)/60 =$	146.4	sq ft min	13.6	sq m min

Crossing Times:

$t_{wc} = L_c / 1.2 =$	14.2	sec

Crosswalk Occupancy Time: (use ped/cycle)

$T_{wc} = (v_{ci}+v_{co})(t_{wc} /60) =$	3.4	ped/ min

Average Pedestrian Space:

$M_c = TS_c / T_{wc} =$	43.1	sq ft / ped	4.0	sq m / ped	**LOS**	**B**

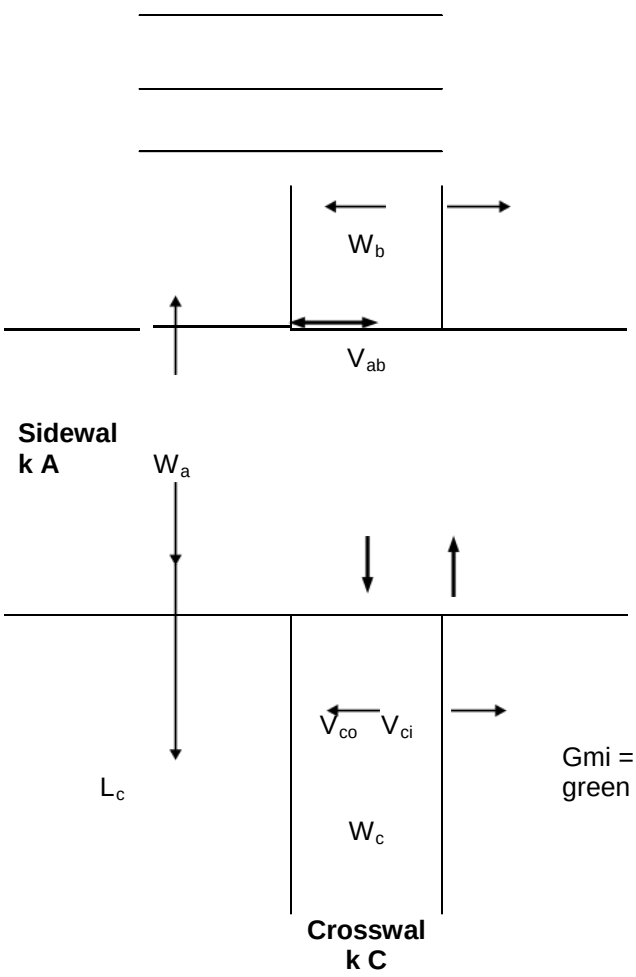
Maximum surge: (use ped/min)

$V_{mc} = (v_{ci}+v_{co})(R_{mj} + 3 + t_{wc})/60 =$ 14.1 ped

Surge Pedestrian Space:

$M_c(max) = A_c / V_{mc} =$	38.9	sq ft / ped	3.6	sq m / ped	**LOS**	**C**

C.14 Pedestrian crossing on Victoria Embankment (A3211) outside Embankment Underground station, construction development case, PM peak hour



Gmi = traffic green

Signal Timing (sec)

C=	96		
G_{m_j}=	19	R_{m_j}=	77
G_{m_i}=	77	R_{m_i}=	19

Pedestrian Volumes

Flow	Ped/min		Ped/Cyc	
v_{ci}	6		9.6	
v_{co}	6		9.6	
v_{ab}	17		27.2	
v_{tot}	29.0		46.4	
W_a =	19.7	ft	6	m
W_b =	9.8	ft	3	m
W_c =	9.8	ft	3	m
L_c =	55.8	ft	17	m

Net Corner Area:

A = $W_a W_b$ =	193.8	sq ft	18.0	sq m

Available Time Space:

		sq ft min		sq m min
TS = A x C/60 =	310.0		28.8	

Hold Area Waiting Times: (use ped/cycle)

Q_{tco} = $[(v_{co})((R_{mj})/C)((R_{mj})/2)]/60$ =	4.9	ped min

Hold Area Time Space:

		sq ft min		sq m min
TS_h = 5(Q_{tco}), or 0.4645(Q_{tco})	24.7		2.3	

Circulation Time Space:

$TS_c = TS - TS_h =$	285.3	sq ft min	26.5	sq m min		

Total Circulation Volume:

$v_c = v_{ci} + v_{co} + v_{ab} =$	46.4	ped (per cycle)

Total Circulation Time:

$t_c = v_c \times 4/60 =$	3.1	ped min

Pedestrian Space and LOS:

$M = TS_c / t_c =$	92.2	sq ft / ped	8.6	sq m / ped	**LOS**	**B**

Crosswalk Areas:

$A_c = L_c W_c =$	549.0	sq ft	51.0	sq m	

Crosswalk Time-Space:

$TS_c = A_c (G_{mj} - 3)/60 =$	146.4	sq ft min	13.6	sq m min	

Crossing Times:

$t_{wc} = L_c / 1.2 =$	14.2	sec

Crosswalk Occupancy Time: (use ped/cycle)

$T_{wc} = (v_{ci}+v_{co})(t_{wc} /60) =$	4.5	ped /min

Average Pedestrian Space:

$M_c = TS_c / T_{wc} =$	32.3	sq ft / ped	3.0	sq m / ped	**LOS**	**C**

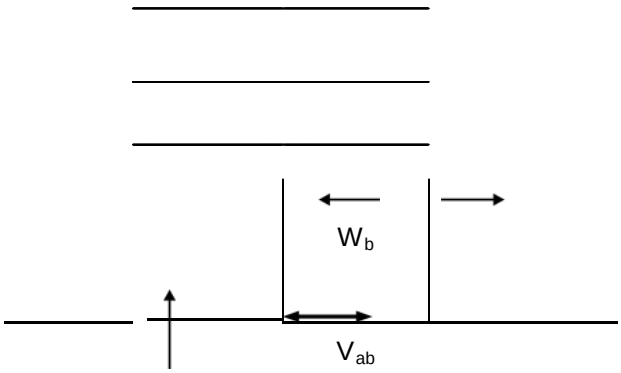
Maximum surge: (use ped/min)

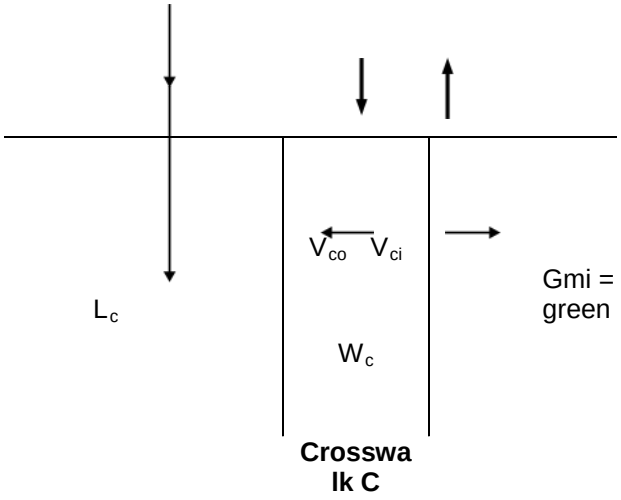
$V_{mc} = (v_{ci}+v_{co})(R_{mj} + 3 + t_{wc})/60 =$	18.8	ped

Surge Pedestrian Space:

$M_c(max) = A_c / V_{mc} =$	29.1	sq ft / ped	2.7	sq m / ped	**LOS**	**C**

C.15 Victoria Embankment (A3211) crossing to the south of the junction with Northumberland Avenue (A400), construction development case, AM peak hour





Gmi = traffic green

Signal Timing (sec)

C=	96		
G_{mj} =	64	R_{mj}=	32
G_{mi} =	32	R_{mi}=	64

Pedestrian Volumes

Flow	Ped/min		Ped/Cyc	
v_{ci}	4		6.4	
v_{co}	1		1.6	
v_{ab}	3		4.8	
v_{tot}	8.0		12.8	
W_a =	19.7	ft	6	m
W_b =	9.8	ft	3	m
W_c =	9.8	ft	3	m
L_c =	55.8	ft	17	m

Net Corner Area:

A = W_aW_b =	193.8	sq ft	18.0	sq m

Available Time Space:

		sq ft		sq m
TS = A x C/60 =	310.0	min	28.8	min

Hold Area Waiting Times: (use ped/cycle)

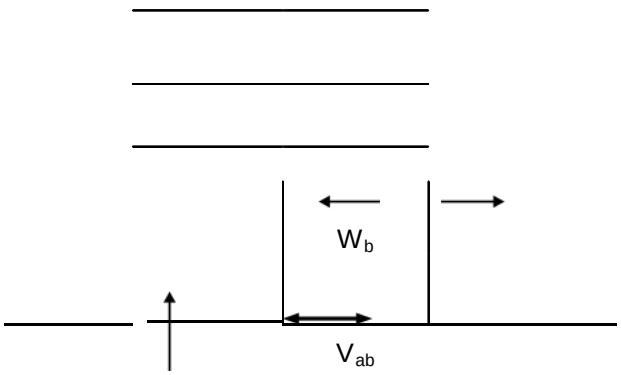
Q_{tco} = [(v_{co})((R_{mj}) /C)((R_{mj}) /2)]/60 =	0.1	ped min

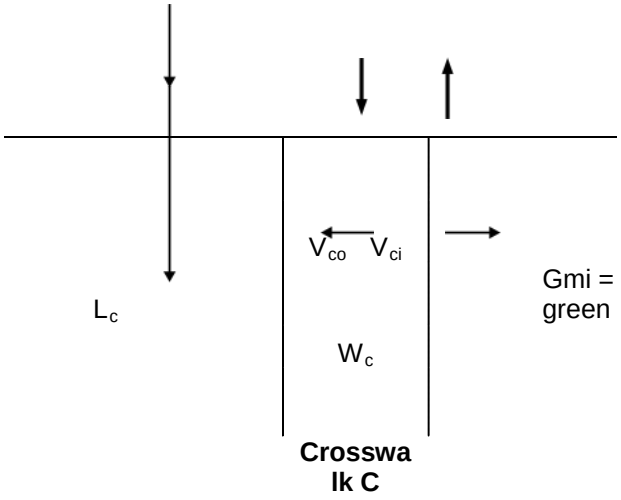
Hold Area Time Space:

TS_h = 5(Q_{tco}), or 0.4645(Q_{tco})	0.7	sq ft	0.1	sq m

		min		min	
Circulation Time Space:					
		sq ft		sq m	
$TS_c = TS - TS_h =$	309.3	min	28.7	min	
Total Circulation Volume:					
$v_c = v_{ci} + v_{co} + v_{ab} =$	12.8	ped (per cycle)			
Total Circulation Time:					
		ped			
$t_c = v_c \times 4/60 =$	0.9	min			
Pedestrian Space and LOS:					
		sq ft		sq m /	**LOS** A
$M = TS_c / t_c =$	362.5	/ ped	33.7	ped	
Crosswalk Areas:					
$A_c = L_c W_c =$	549.0	sq ft	51.0	sq m	
Crosswalk Time-Space:					
$TS_c = A_c (G_{mj} - 3)/60 =$	558.1	sq ft min	51.9	sq m min	
Crossing Times:					
$t_{wc} = L_c / 1.2 =$	14.2	sec			
Crosswalk Occupancy Time: (use ped/cycle)					
$T_{wc} = (v_{ci}+v_{co})(t_{wc} /60) =$	1.9	ped/ min			
Average Pedestrian Space:					
		sq ft		sq m /	**LOS** A
$M_c = TS_c / T_{wc} =$	295.5	/ ped	27.5	ped	
Maximum surge: (use ped/min)					
$V_{mc} = (v_{ci}+v_{co})(R_{mj} + 3 + t_{wc})/60 =$	4.1	ped			
Surge Pedestrian Space:					
		sq ft		sq m /	**LOS** A
$M_c(max) = A_c / V_{mc} =$	134.0	/ ped	12.4	ped	

C.16 Victoria Embankment (A3211) crossing to the south of the junction with Northumberland Avenue (A400), construction development case, PM peak hour





Gmi = traffic green

Signal Timing (sec)

C=	95		
G_{mj} =	62	R_{mj}=	33
G_{mi} =	33	R_{mi}=	62

Pedestrian Volumes

Flow	Ped/min		Ped/Cyc	
v_{ci}	22		34.8	
v_{co}	3		4.8	
v_{ab}	17		26.9	
v_{tot}	42.0		66.5	
W_a =	19.7	ft	6	m
W_b =	9.8	ft	3	m
W_c =	9.8	ft	3	m
L_c =	55.8	ft	17	m

Net Corner Area:

A = $W_a W_b$ =	193.8	sq ft	18.0	sq m

Available Time Space:

		sq ft		sq m
TS = A x C/60 =	306.8	min	28.5	min

Hold Area Waiting Times: (use ped/cycle)

Q_{tco} = [(v_{co})((R_{mj}) /C)((R_{mj}) /2)]/60 =	0.5	ped min

Hold Area Time Space:

TS_h = 5(Q_{tco}), or 0.4645(Q_{tco})	2.3	sq ft	0.2	sq m

		min		min	
Circulation Time Space:					
		sq ft		sq m	
$TS_c = TS - TS_h =$	304.5	min	28.3	min	
Total Circulation Volume:					
$v_c = v_{ci} + v_{co} + v_{ab} =$	66.5	ped (per cycle)			
Total Circulation Time:					
		ped			
$t_c = v_c \times 4/60 =$	4.4	min			
Pedestrian Space and LOS:					
		sq ft		sq m /	**LOS** B
$M = TS_c / t_c =$	68.7	/ ped	6.4	ped	
Crosswalk Areas:					
$A_c = L_c W_c =$	549.0	sq ft	51.0	sq m	
Crosswalk Time-Space:					
$TS_c = A_c (G_{mj} - 3)/60 =$	539.8	sq ft min	50.2	sq m min	
Crossing Times:					
$t_{wc} = L_c / 1.2 =$	14.2	sec			
Crosswalk Occupancy Time: (use ped/cycle)					
$T_{wc} = (v_{ci}+v_{co})(t_{wc} /60) =$	9.3	ped/ min			
Average Pedestrian Space:					
		sq ft		sq m /	**LOS** B
$M_c = TS_c / T_{wc} =$	57.8	/ ped	5.4	ped	
Maximum surge: (use ped/min)					
$V_{mc} = (v_{ci}+v_{co})(R_{mj} + 3 + t_{wc})/60 =$	20.9	ped			
Surge Pedestrian Space:					
		sq ft		sq m /	**LOS** C
$M_c(max) = A_c / V_{mc} =$	26.3	/ ped	2.4	ped	

Appendix D: Local modelling outputs

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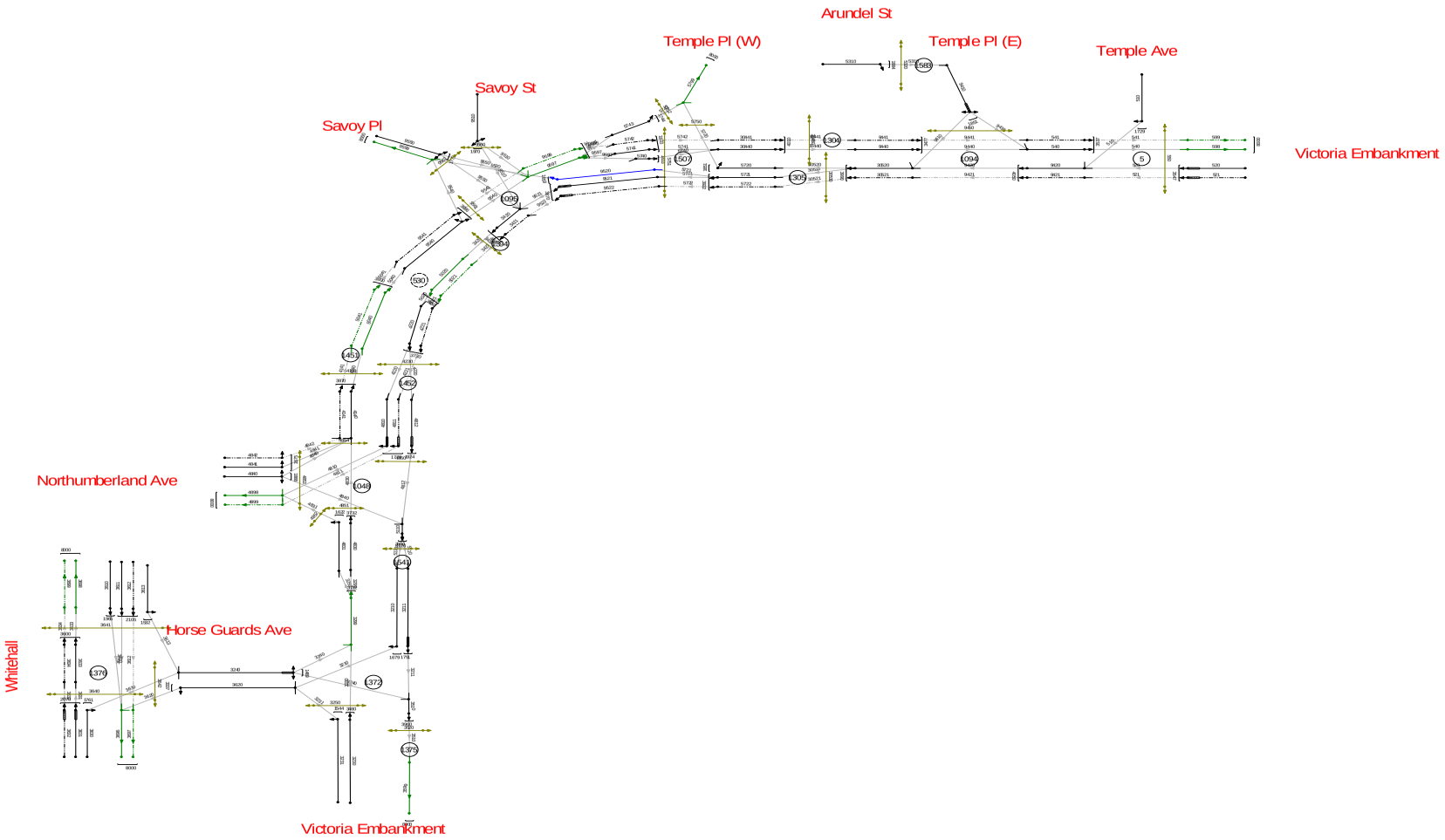
D.1 Baseline results, AM peak hour

Network Diagram, baseline (AM peak hour)



Network results

TRANSYT Link Results Summary, baseline (AM peak hour)

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
510	5	40	1729	9	10	30	0.3	0.0	4.8	76	2.1	1	0.0	6.9
520	5	1646	4011	64	15	11	4.0	0.9	69.3	49	25.1	23	0.0	94.4
521	5	11	4011	64	17	11	0.0	0.0	0.5	49	0.1	23	0.0	0.6
540	5	1884	3537	84	21	14	4.8	2.6	105.9	66	36.9	34	0.0	142.8
541	5	11	3537	84	23	13	0.0	0.0	0.6	90	0.3	34	0.0	0.9
550	5	20	10000	2	17	40	0.2	0.0	3.2	90	0.0	0	0.0	3.2
598	5	1884	8000	24	15	0	0.0	0.2	2.2	0	0.2	0	0.0	2.4
599	5	11	8000	24	16	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
3210	1372	401	1679	72	16	34	2.5	1.2	53.7	77	6.9	9	0.0	60.5
3211	1372	658	1751	52	15	11	1.4	0.5	27.7	38	6.4	7	0.0	34.2
3230	1372	1183	3480	102	16	106	11.1	23.9	496.2	159	50.8	55	0.0	546.9
3231	1372	18	1544	3	16	26	0.1	0.0	1.8	69	0.3	0	0.0	2.2
3240	1372	180	1869	51	25	36	1.3	0.5	25.2	96	2.0	5	0.0	27.3
3250	1372	20	10000	0	8	11	0.1	0.0	0.9	46	0.0	0	0.0	0.9
3299	1372	1330	3732	36	9	1	0.0	0.3	3.9	1	0.2	0	0.0	4.2
3420	1394	1401	4040	37	4	1	0.0	0.3	4.2	1	0.1	0	0.0	4.3
3421	1394	11	4040	37	4	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
3430	1394	20	10000	3	8	46	0.2	0.0	3.6	97	0.0	1	0.0	3.6
3510	1375	668	3960	18	3	1	0.0	0.1	2.0	5	0.6	1	0.0	2.7

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
3520	1375	20	10000	3	6	45	0.2	0.0	3.6	96	0.0	1	0.0	3.6
3599	1375	668	8000	8	16	0	0.0	0.0	0.6	0	0.0	0	0.0	0.7
3610	1376	141	1965	23	16	28	1.0	0.1	15.7	75	2.9	3	0.0	18.5
3611	1376	105	2105	43	16	31	0.8	0.1	12.8	81	2.3	6	0.0	15.1
3612	1376	178	2105	43	17	31	1.3	0.2	21.8	81	3.6	6	0.0	25.3
3613	1376	10	1532	2	16	27	0.1	0.0	1.0	70	0.2	0	0.0	1.2
3620	1376	420	3337	57	22	24	2.1	0.7	39.4	55	2.9	7	0.0	42.3
3630	1376	159	1761	15	16	11	0.4	0.1	6.7	44	1.9	2	0.0	8.6
3631	1376	363	2196	42	16	12	0.9	0.2	16.8	49	4.8	8	0.0	21.6
3632	1376	181	2196	42	17	12	0.5	0.1	8.4	49	2.2	8	0.0	10.6
3633	1376	363	3600	25	5	3	0.2	0.1	4.5	7	0.3	1	0.0	4.8
3634	1376	181	3600	25	3	2	0.0	0.1	1.5	4	0.2	1	0.0	1.7
3640	1376	20	10000	1	10	38	0.2	0.0	3.0	88	0.0	0	0.0	3.0
3641	1376	20	10000	1	10	38	0.2	0.0	3.0	88	0.0	0	0.0	3.0
3642	1376	20	10000	2	10	38	0.2	0.0	3.0	88	0.0	0	0.0	3.0
3696	1376	681	8000	11	18	0	0.0	0.0	0.7	0	0.0	0	0.0	0.7
3697	1376	178	8000	11	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
3698	1376	363	8000	7	16	0	0.0	0.0	0.3	0	0.0	0	0.0	0.4
3699	1376	181	8000	7	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
4140	1451	1806	3870	58	9	4	1.3	0.7	27.6	16	6.8	8	0.0	34.4
4141	1451	11	3870	58	10	1	0.0	0.0	0.1	1	0.0	8	0.0	0.1

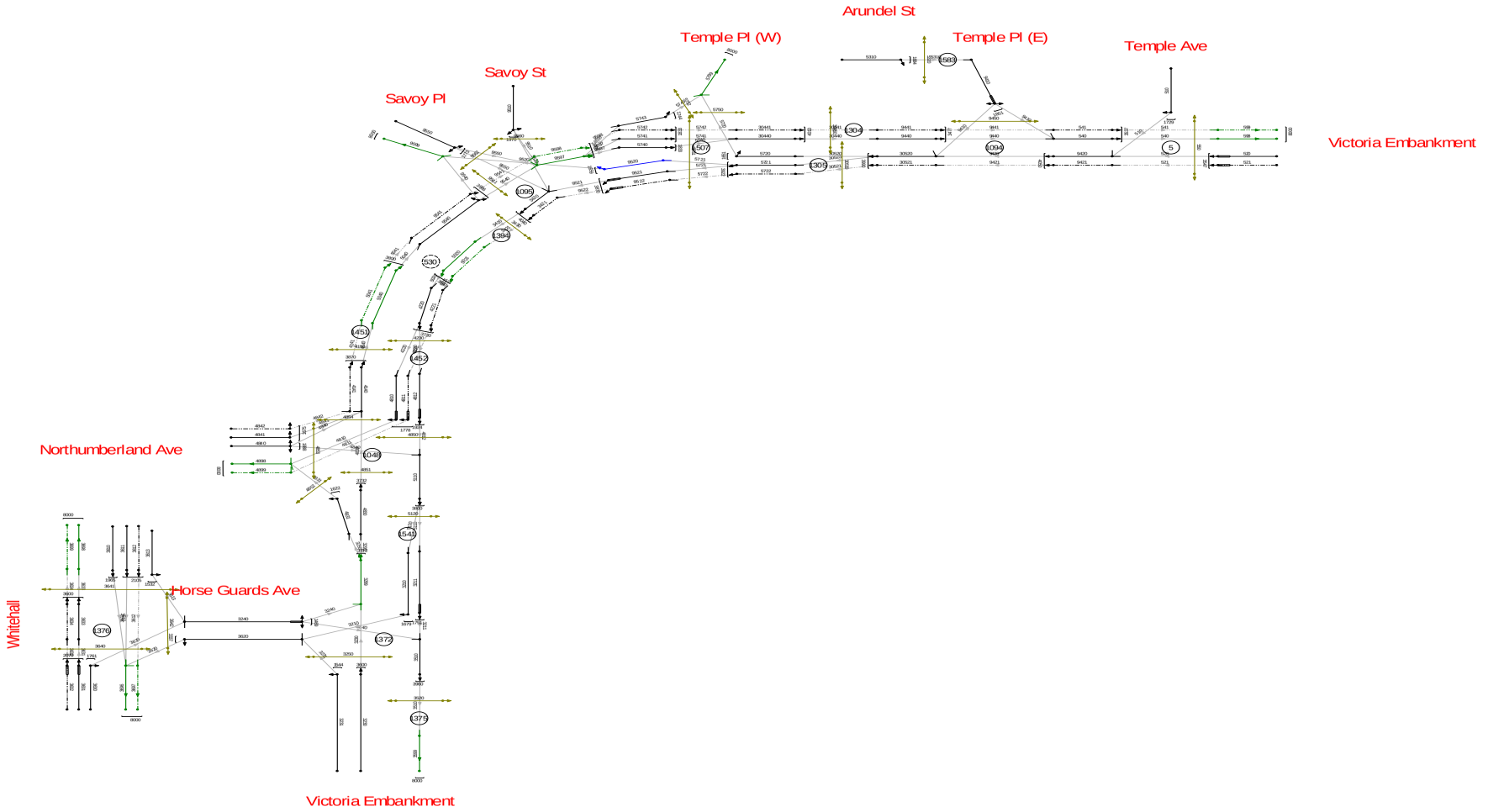
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
4150	1451	20	10000	3	6	44	0.2	0.0	3.5	94	0.0	1	0.0	3.5
4220	1452	1401	3730	47	16	8	2.5	0.4	41.4	64	19.0	27	0.0	60.4
4221	1452	11	3730	47	16	11	0.0	0.0	0.5	89	0.2	27	0.0	0.7
4230	1452	20	10000	3	8	45	0.2	0.0	3.5	95	0.0	1	0.0	3.5
4810	1048	342	2228	95	8	111	4.9	5.7	149.8	152	7.5	15	0.0	157.3
4811	1048	11	2228	95	33	104	0.1	0.2	4.5	152	0.5	15	0.0	5.0
4812	1048	1059	2052	88	8	41	8.3	3.6	169.9	110	16.6	31	0.0	186.5
4830	1048	1232	3732	99	9	55	4.2	14.7	268.9	101	37.2	45	0.0	306.0
4831	1048	98	1622	28	9	49	1.1	0.2	19.0	97	2.7	3	0.0	21.7
4840	1048	275	1888	67	16	47	2.6	1.0	51.2	102	7.5	8	0.0	58.7
4841	1048	355	1675	72	16	43	3.0	1.2	59.6	99	9.5	10	0.0	69.1
4842	1048	11	1675	72	18	43	0.1	0.0	1.8	99	0.2	10	0.0	2.1
4850	1048	20	10000	1	7	28	0.2	0.0	2.2	75	0.0	0	0.0	2.2
4851	1048	20	10000	0	5	12	0.1	0.0	1.0	49	0.0	0	0.0	1.0
4852	1048	20	10000	0	5	6	0.0	0.0	0.4	33	0.0	0	0.0	0.4
4853	1048	20	10000	1	16	28	0.2	0.0	2.2	75	0.0	0	0.0	2.2
4854	1048	20	10000	1	6	35	0.2	0.0	2.8	84	0.0	0	0.0	2.8
4898	1048	440	8000	6	20	0	0.0	0.0	0.4	0	0.0	0	0.0	0.4
4899	1048	11	8000	6	21	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
5020	530	1401	3800	37	15	1	0.0	0.3	4.2	1	0.2	0	0.0	4.3
5021	530	11	3800	37	12	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
5040	530	1806	3800	48	16	1	0.0	0.5	6.5	1	0.4	0	0.0	6.9
5041	530	11	3800	48	45	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
5110	1541	1115	3800	32	5	1	0.0	0.2	3.6	2	0.3	1	0.0	3.9
5120	1541	20	10000	3	5	46	0.2	0.0	3.6	97	0.0	1	0.0	3.6
5310	1583	293	1684	22	16	5	0.2	0.1	5.3	26	2.0	2	0.0	7.3
5320	1583	20	10000	3	6	45	0.2	0.0	3.6	96	0.0	1	0.0	3.6
5720	1507	311	1651	79	11	63	3.6	1.8	76.8	120	9.6	10	0.0	86.4
5721	1507	1398	3922	49	12	4	1.0	0.5	21.1	14	4.7	5	0.0	25.8
5722	1507	11	3922	49	12	2	0.0	0.0	0.1	3	0.0	5	0.0	0.1
5740	1507	1017	1833	86	4	25	4.2	2.9	101.9	60	16.7	16	0.0	118.5
5741	1507	573	1833	47	4	13	1.6	0.4	29.3	45	7.0	7	0.0	36.3
5742	1507	11	1833	47	4	12	0.0	0.0	0.5	38	0.1	7	0.0	0.6
5743	1507	259	1744	23	4	12	0.7	0.1	11.8	43	3.1	3	0.0	14.9
5750	1507	20	10000	0	6	7	0.0	0.0	0.6	38	0.0	0	0.0	0.6
5751	1507	20	10000	1	15	36	0.2	0.0	2.9	86	0.0	0	0.0	2.9
5752	1507	20	10000	1	5	36	0.2	0.0	2.9	86	0.0	0	0.0	2.9
5799	1507	570	8000	7	17	0	0.0	0.0	0.5	0	0.0	0	0.0	0.6
9410	1094	293	2266	48	15	31	2.1	0.5	35.9	70	2.1	6	0.0	38.0
9420	1094	1686	4050	67	21	16	6.4	1.0	105.7	61	27.7	26	0.0	133.3
9421	1094	11	4050	67	40	23	0.1	0.0	1.0	87	0.2	26	0.0	1.2
9440	1094	1590	3477	74	6	23	8.7	1.4	143.2	67	37.6	25	0.0	180.8

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
9441	1094	11	3477	74	31	25	0.1	0.0	1.1	89	0.3	25	0.0	1.3
9450	1094	20	10000	0	14	7	0.0	0.0	0.6	37	0.0	0	0.0	0.6
9510	1095	69	1970	26	16	46	0.7	0.2	12.6	95	1.8	2	0.0	14.3
9520	1095	39	1659	42	21	50	0.2	0.4	7.7	105	0.9	1	0.0	8.6
9521	1095	1359	3870	52	21	7	2.2	0.5	38.5	28	8.2	11	0.0	46.7
9522	1095	11	3870	52	21	3	0.0	0.0	0.1	7	0.0	11	0.0	0.1
9540	1095	1806	3886	69	12	8	2.8	1.1	55.4	40	23.3	21	0.0	78.8
9541	1095	11	3886	69	13	4	0.0	0.0	0.2	18	0.1	21	0.0	0.2
9550	1095	53	1773	29	16	53	0.6	0.2	11.1	103	1.5	1	0.0	12.6
9560	1095	20	10000	0	6	4	0.0	0.0	0.3	28	0.0	0	0.0	0.3
9561	1095	20	10000	1	7	31	0.2	0.0	2.4	79	0.0	0	0.0	2.4
9562	1095	20	10000	3	10	46	0.2	0.0	3.6	97	0.0	1	0.0	3.6
9597	1095	1850	3666	51	16	1	0.0	0.5	7.3	1	0.6	1	0.0	7.9
9598	1095	11	3666	51	17	1	0.0	0.0	0.0	1	0.0	1	0.0	0.0
9599	1095	75	8000	1	20	0	0.0	0.0	0.1	0	0.0	0	0.0	0.1
30440	1304	1590	4010	49	11	6	2.2	0.5	38.1	48	21.0	22	0.0	59.1
30441	1304	11	4010	49	11	6	0.0	0.0	0.2	38	0.1	22	0.0	0.4
30450	1304	20	10000	3	7	45	0.2	0.0	3.5	95	0.0	1	0.0	3.5
30520	1305	1709	3990	47	8	1	0.0	0.4	6.9	4	1.0	4	0.0	8.0
30521	1305	11	3990	47	8	1	0.0	0.0	0.0	2	0.0	4	0.0	0.0
30530	1305	20	10000	3	7	45	0.2	0.0	3.5	95	0.0	1	0.0	3.5

D.2 Baseline results, PM peak hour

Network Diagram, baseline (PM peak hour)



Network results

TRANSYT Link Results Summary, baseline (PM peak hour)

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
510	5	77	1729	16	16	31	0.6	0.1	9.5	79	1.6	2	0.0	11.1
520	5	1152	4069	44	15	9	2.5	0.4	40.6	43	15.4	14	0.0	56.0
521	5	12	4069	44	17	9	0.0	0.0	0.4	43	0.1	14	0.0	0.6
540	5	1663	3537	75	21	16	5.7	1.4	102.1	62	30.3	28	0.0	132.4
541	5	12	3537	75	23	12	0.0	0.0	0.6	39	0.1	28	0.0	0.7
550	5	20	10000	2	17	40	0.2	0.0	3.2	90	0.0	0	0.0	3.2
598	5	1663	8000	21	10	0	0.0	0.1	1.9	0	0.3	0	0.0	2.2
599	5	12	8000	21	16	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
3210	1372	507	1679	69	16	31	3.3	1.1	62.2	92	10.4	13	0.0	72.6
3211	1372	729	1799	53	15	9	1.3	0.6	25.6	43	8.0	9	0.0	33.6
3230	1372	843	3600	83	16	43	7.6	2.4	142.1	101	23.0	23	0.0	165.1
3231	1372	18	1544	4	16	30	0.1	0.0	2.1	75	0.4	0	0.0	2.5
3240	1372	183	1745	77	25	63	1.6	1.6	45.2	125	2.7	6	0.0	47.9
3250	1372	20	10000	0	8	8	0.0	0.0	0.6	40	0.0	0	0.0	0.7
3299	1372	1016	3732	27	9	1	0.0	0.2	2.7	1	0.1	0	0.0	2.8
3420	1394	1515	4040	43	4	1	0.0	0.4	5.7	2	0.3	1	0.0	6.0
3421	1394	12	4040	43	4	1	0.0	0.0	0.0	1	0.0	1	0.0	0.0
3430	1394	20	10000	3	8	46	0.2	0.0	3.6	97	0.0	1	0.0	3.6
3510	1375	739	3960	20	3	1	0.1	0.1	3.9	15	2.1	4	0.0	5.9

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
3520	1375	20	10000	3	6	45	0.2	0.0	3.6	96	0.0	1	0.0	3.6
3599	1375	739	8000	9	16	0	0.0	0.1	0.7	0	0.1	0	0.0	0.8
3610	1376	124	1965	20	16	27	0.8	0.1	13.2	73	2.4	2	0.0	15.6
3611	1376	115	2105	43	16	30	0.8	0.1	13.7	80	2.5	6	0.0	16.2
3612	1376	175	2105	43	17	30	1.2	0.2	20.8	80	3.4	6	0.0	24.2
3613	1376	10	1532	2	16	26	0.1	0.0	1.0	69	0.2	0	0.0	1.2
3620	1376	525	3337	72	22	24	2.3	1.3	50.3	68	4.5	11	0.0	54.8
3630	1376	168	1761	16	16	10	0.4	0.1	6.8	43	2.0	2	0.0	8.8
3631	1376	379	2318	40	16	11	0.9	0.2	16.2	45	4.6	7	0.0	20.9
3632	1376	175	2318	40	17	11	0.4	0.1	7.5	45	1.9	7	0.0	9.4
3633	1376	379	3600	25	5	3	0.2	0.1	4.6	7	0.3	1	0.0	4.9
3634	1376	175	3600	25	3	2	0.0	0.1	1.4	4	0.2	1	0.0	1.6
3640	1376	20	10000	2	10	38	0.2	0.0	3.0	88	0.0	0	0.0	3.0
3641	1376	20	10000	2	10	38	0.2	0.0	3.0	88	0.0	0	0.0	3.0
3642	1376	20	10000	2	10	40	0.2	0.0	3.2	90	0.0	0	0.0	3.2
3696	1376	803	8000	12	18	0	0.0	0.1	0.8	0	0.1	0	0.0	0.9
3697	1376	175	8000	12	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
3698	1376	379	8000	7	16	0	0.0	0.0	0.4	0	0.0	0	0.0	0.4
3699	1376	175	8000	7	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
4140	1451	1456	3870	44	9	5	1.6	0.4	28.0	37	12.5	14	0.0	40.5
4141	1451	12	3870	44	10	1	0.0	0.0	0.0	1	0.0	14	0.0	0.0

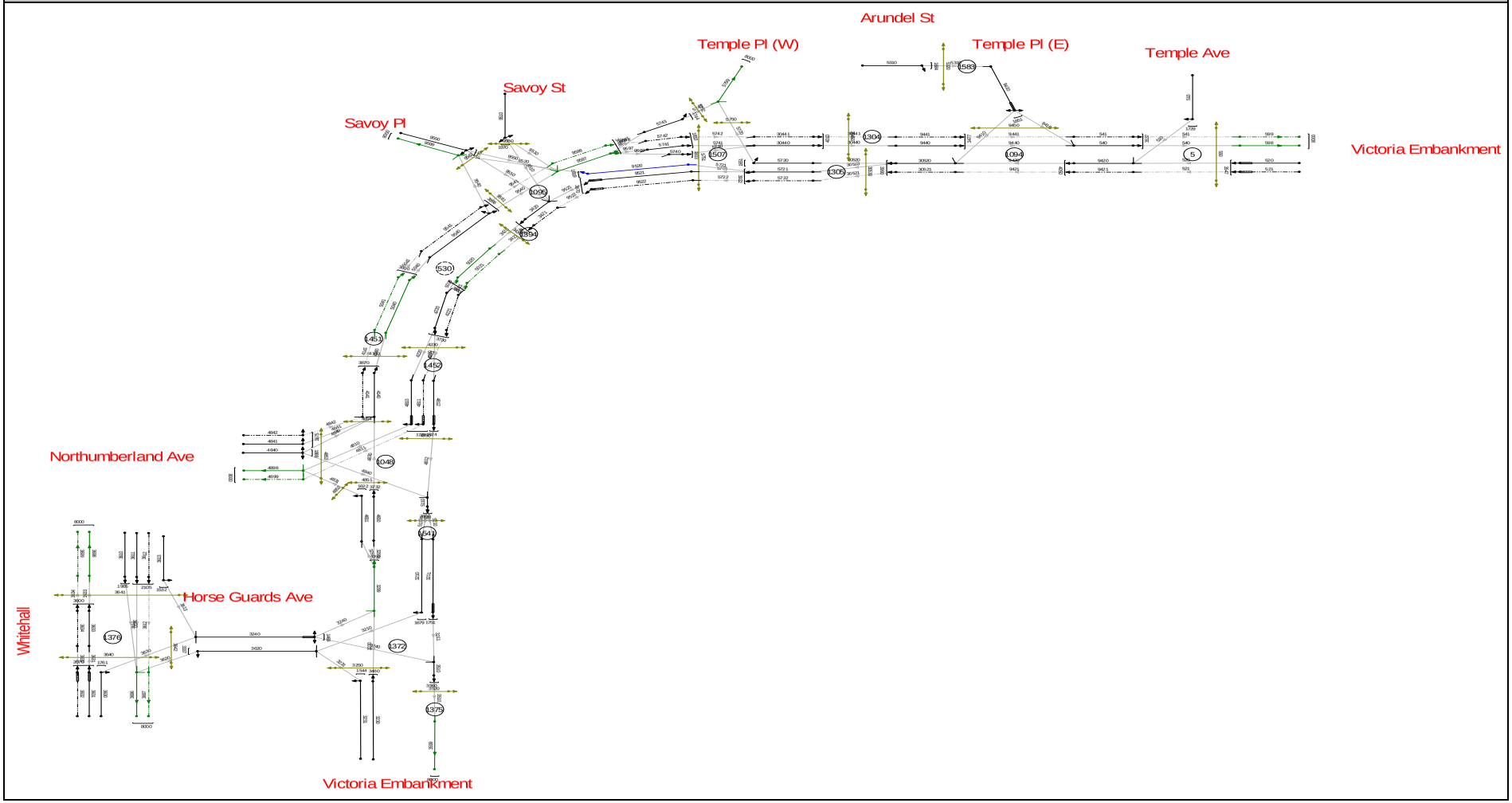
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
4150	1451	20	10000	3	6	44	0.2	0.0	3.5	94	0.0	1	0.0	3.5
4220	1452	1515	3730	46	16	3	1.0	0.4	20.0	27	8.7	12	0.0	28.6
4221	1452	12	3730	46	16	2	0.0	0.0	0.1	17	0.0	12	0.0	0.1
4230	1452	20	10000	3	8	45	0.2	0.0	3.5	95	0.0	1	0.0	3.5
4810	1048	400	3128	79	8	53	4.1	1.8	83.2	97	5.5	11	0.0	88.8
4811	1048	12	3128	79	33	52	0.1	0.1	2.5	105	0.4	11	0.0	2.8
4812	1048	1115	2172	85	8	25	5.1	2.7	111.6	73	11.5	20	0.0	123.2
4830	1048	943	3732	71	9	8	0.9	1.2	30.6	31	8.6	11	0.0	39.2
4831	1048	73	1622	23	9	58	1.0	0.1	16.6	100	2.1	2	0.0	18.7
4840	1048	249	1888	67	16	50	2.5	1.0	48.9	103	6.9	7	0.0	55.9
4841	1048	385	1675	84	16	55	3.5	2.4	83.9	113	11.7	12	0.0	95.7
4842	1048	12	1675	84	18	55	0.1	0.1	2.6	113	0.3	12	0.0	2.9
4850	1048	20	10000	1	7	29	0.2	0.0	2.3	77	0.0	0	0.0	2.3
4851	1048	20	10000	0	5	13	0.1	0.0	1.1	51	0.0	0	0.0	1.1
4852	1048	20	10000	0	5	5	0.0	0.0	0.4	30	0.0	0	0.0	0.4
4853	1048	20	10000	1	16	26	0.1	0.0	2.1	73	0.0	0	0.0	2.1
4854	1048	20	10000	1	6	35	0.2	0.0	2.8	84	0.0	0	0.0	2.8
4898	1048	473	8000	6	20	0	0.0	0.0	0.4	0	0.0	0	0.0	0.5
4899	1048	12	8000	6	21	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
5020	530	1515	3800	40	15	1	0.0	0.3	4.7	1	0.2	0	0.0	4.9
5021	530	12	3800	40	12	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
5040	530	1456	3800	39	16	1	0.0	0.3	4.4	1	0.3	0	0.0	4.7
5041	530	12	3800	39	45	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
5110	1541	1236	3800	38	5	3	0.6	0.3	13.4	19	2.7	6	0.0	16.1
5120	1541	20	10000	3	5	45	0.2	0.0	3.6	96	0.0	1	0.0	3.6
5310	1583	317	1684	24	16	5	0.3	0.2	5.8	26	2.2	2	0.0	8.0
5320	1583	20	10000	3	6	45	0.2	0.0	3.6	96	0.0	1	0.0	3.6
5720	1507	263	1651	70	11	67	3.7	1.1	69.2	115	7.8	8	0.0	77.0
5721	1507	1404	3922	49	12	2	0.4	0.5	12.4	7	2.4	3	0.0	14.8
5722	1507	12	3922	49	12	1	0.0	0.0	0.1	1	0.0	3	0.0	0.1
5740	1507	728	1833	61	4	6	0.3	0.8	15.7	12	2.4	2	0.0	18.0
5741	1507	592	1833	48	4	4	0.2	0.5	8.8	9	1.4	1	0.0	10.1
5742	1507	12	1833	48	4	3	0.0	0.0	0.1	4	0.0	1	0.0	0.1
5743	1507	197	1744	17	4	3	0.1	0.1	2.3	8	0.4	0	0.0	2.8
5750	1507	20	10000	0	6	7	0.0	0.0	0.6	37	0.0	0	0.0	0.6
5751	1507	20	10000	1	15	38	0.2	0.0	3.0	88	0.0	0	0.0	3.0
5752	1507	20	10000	1	5	38	0.2	0.0	3.0	88	0.0	0	0.0	3.0
5799	1507	461	8000	6	17	0	0.0	0.0	0.4	0	0.0	0	0.0	0.5
9410	1094	281	2404	43	15	30	1.9	0.4	32.8	82	2.3	6	0.0	35.2
9420	1094	1630	4050	65	21	7	2.4	0.9	46.4	54	23.6	28	0.0	70.0
9421	1094	12	4050	65	40	9	0.0	0.0	0.4	41	0.1	28	0.0	0.5
9440	1094	1320	3477	61	6	12	3.4	0.8	59.9	49	22.4	17	0.0	82.3

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
9441	1094	12	3477	61	31	13	0.0	0.0	0.6	53	0.2	17	0.0	0.8
9450	1094	20	10000	0	14	7	0.0	0.0	0.6	38	0.0	0	0.0	0.6
9510	1095	112	1970	42	16	50	1.2	0.4	22.0	101	3.0	3	0.0	25.0
9520	1095	11	1659	18	21	67	0.1	0.1	2.9	94	0.2	0	0.0	3.1
9521	1095	1393	3933	60	21	17	5.8	0.7	92.9	54	15.9	20	0.0	108.8
9522	1095	12	3933	60	21	20	0.1	0.0	1.0	62	0.2	20	0.0	1.1
9540	1095	1456	3886	64	12	17	5.9	0.9	96.0	55	25.9	22	0.0	121.8
9541	1095	12	3886	64	13	18	0.1	0.0	0.9	55	0.2	22	0.0	1.0
9550	1095	80	1773	43	16	57	0.9	0.4	18.1	108	2.3	2	0.0	20.5
9560	1095	20	10000	0	6	5	0.0	0.0	0.4	29	0.0	0	0.0	0.4
9561	1095	20	10000	1	7	32	0.2	0.0	2.5	80	0.0	0	0.0	2.5
9562	1095	20	10000	3	10	45	0.2	0.0	3.6	96	0.0	1	0.0	3.6
9597	1095	1517	3666	42	16	1	0.0	0.4	5.1	1	0.5	2	0.0	5.6
9598	1095	12	3666	42	17	1	0.0	0.0	0.0	1	0.0	2	0.0	0.0
9599	1095	20	8000	0	20	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
30440	1304	1320	4010	41	11	4	1.1	0.3	20.3	28	9.9	11	0.0	30.2
30441	1304	12	4010	41	11	5	0.0	0.0	0.2	41	0.1	11	0.0	0.4
30450	1304	20	10000	3	7	45	0.2	0.0	3.5	95	0.0	1	0.0	3.5
30520	1305	1667	3990	49	8	1	0.0	0.5	7.5	2	0.5	1	0.0	8.0
30521	1305	12	3990	49	8	1	0.0	0.0	0.0	1	0.0	1	0.0	0.1
30530	1305	20	10000	3	7	45	0.2	0.0	3.5	95	0.0	1	0.0	3.5

D.3 Construction base case results, AM peak hour

Network Diagram, construction base case (AM peak hour)



Network results

TRANSYT Link Results Summary, construction base case (AM peak hour)

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
510	5	42	1729	9	10	30	0.3	0.0	5.0	76	2.2	1	0.0	7.3
520	5	1728	4011	67	15	11	4.3	1.0	75.4	51	27.0	25	0.0	102.4
521	5	12	4011	67	17	11	0.0	0.0	0.5	51	0.1	25	0.0	0.7
540	5	1987	3537	89	21	19	6.4	3.9	146.2	72	42.7	41	0.0	188.9
541	5	12	3537	89	23	13	0.0	0.0	0.6	34	0.1	41	0.0	0.7
550	5	21	10000	2	17	40	0.2	0.0	3.3	90	0.0	1	0.0	3.3
598	5	1987	8000	25	15	0	0.0	0.2	2.4	0	0.2	0	0.0	2.5
599	5	12	8000	25	16	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
3210	1372	422	1679	80	16	39	2.7	2.0	65.6	93	8.7	11	0.0	74.3
3211	1372	691	1751	50	15	7	0.8	0.5	18.3	31	5.5	6	0.0	23.8
3230	1372	1242	3480	84	16	32	8.4	2.5	155.4	92	31.0	31	0.0	186.3
3231	1372	19	1544	3	16	19	0.1	0.0	1.4	58	0.3	0	0.0	1.7
3240	1372	189	2123	78	25	63	1.6	1.6	46.7	123	2.7	6	0.0	49.4
3250	1372	21	10000	0	8	16	0.1	0.0	1.3	56	0.0	0	0.0	1.3
3299	1372	1421	3732	38	9	1	0.0	0.3	4.4	1	0.2	0	0.0	4.6
3420	1394	1471	4040	39	4	1	0.0	0.3	4.5	1	0.1	0	0.0	4.7
3421	1394	12	4040	39	4	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
3430	1394	21	10000	3	8	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
3510	1375	700	3960	18	3	1	0.0	0.1	1.6	1	0.1	0	0.0	1.7

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
3520	1375	21	10000	3	6	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
3599	1375	700	8000	9	16	0	0.0	0.0	0.7	0	0.0	0	0.0	0.7
3610	1376	148	1965	24	16	28	1.0	0.2	16.6	76	3.0	3	0.0	19.6
3611	1376	110	2105	45	16	31	0.8	0.2	13.6	82	2.4	7	0.0	16.0
3612	1376	187	2105	45	17	31	1.4	0.3	23.1	82	3.8	7	0.0	26.9
3613	1376	11	1532	2	16	27	0.1	0.0	1.2	70	0.2	0	0.0	1.4
3620	1376	441	3337	60	22	26	2.4	0.8	44.9	51	2.8	6	0.0	47.7
3630	1376	167	1761	16	16	11	0.4	0.1	7.1	44	2.0	2	0.0	9.1
3631	1376	381	2196	44	16	12	1.0	0.3	18.0	50	5.2	8	0.0	23.2
3632	1376	190	2196	44	17	12	0.5	0.1	9.0	50	2.3	8	0.0	11.3
3633	1376	381	3600	27	5	3	0.2	0.1	4.8	7	0.3	1	0.0	5.0
3634	1376	190	3600	27	3	2	0.1	0.1	1.6	4	0.2	1	0.0	1.8
3640	1376	21	10000	2	10	38	0.2	0.0	3.2	88	0.0	0	0.0	3.2
3641	1376	21	10000	2	10	38	0.2	0.0	3.2	88	0.0	0	0.0	3.2
3642	1376	21	10000	2	10	38	0.2	0.0	3.2	88	0.0	0	0.0	3.2
3696	1376	714	8000	11	18	0	0.0	0.1	0.7	0	0.1	0	0.0	0.8
3697	1376	187	8000	11	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
3698	1376	381	8000	7	16	0	0.0	0.0	0.4	0	0.0	0	0.0	0.4
3699	1376	190	8000	7	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
4140	1451	1919	3870	61	9	2	0.0	0.8	11.2	2	0.7	1	0.0	11.9
4141	1451	12	3870	61	10	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1

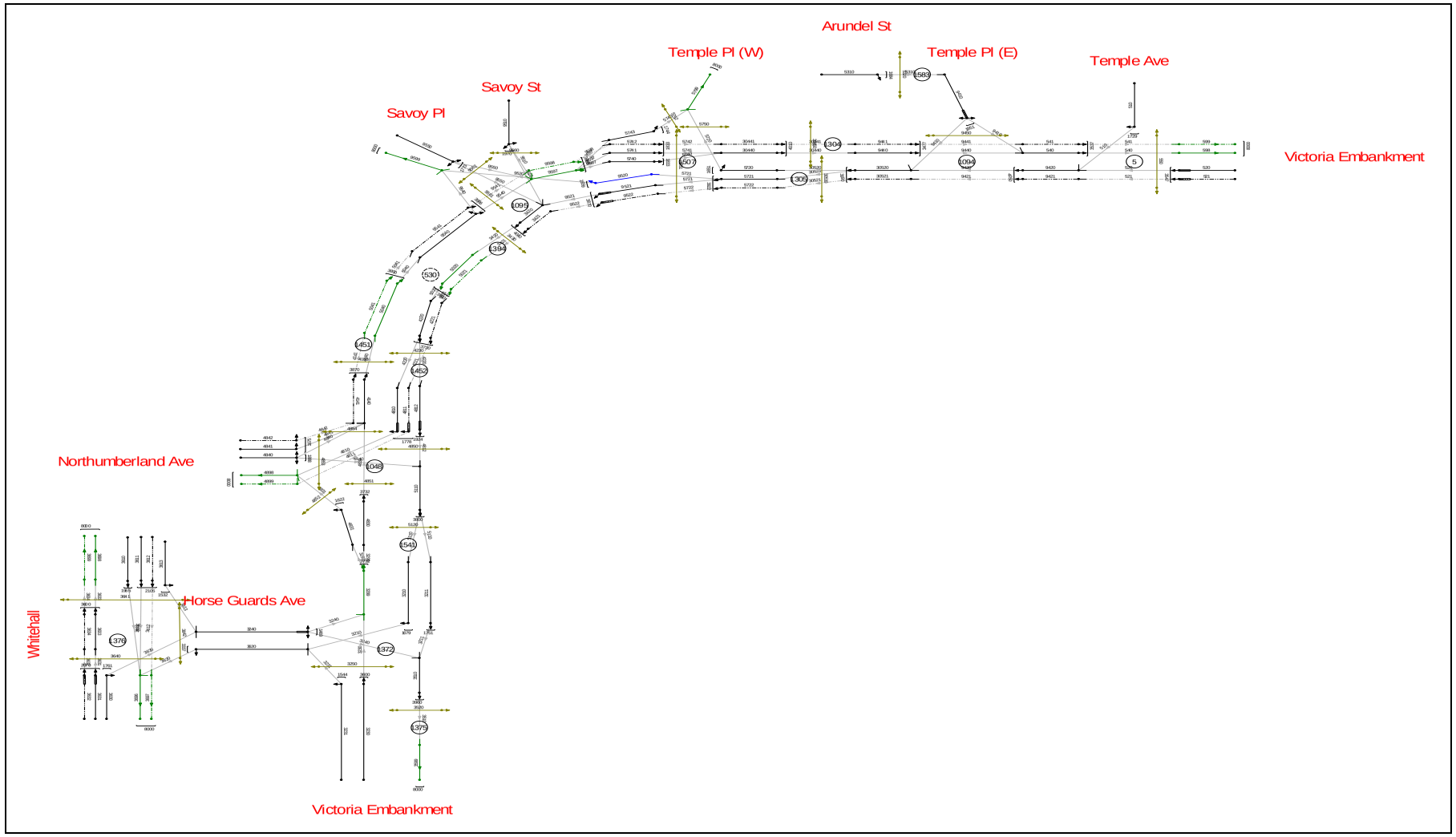
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
4150	1451	21	10000	3	6	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6
4220	1452	1471	3730	49	16	3	0.7	0.5	16.2	13	4.0	5	0.0	20.2
4221	1452	12	3730	49	16	1	0.0	0.0	0.1	3	0.0	5	0.0	0.1
4230	1452	21	10000	3	8	45	0.2	0.0	3.7	95	0.0	1	0.0	3.7
4810	1048	359	2201	95	8	98	4.0	5.8	138.7	149	7.7	16	0.0	146.3
4811	1048	12	2201	95	33	93	0.1	0.2	4.4	148	0.5	16	0.0	4.9
4812	1048	1112	2042	86	8	24	4.4	2.9	104.3	96	15.2	28	0.0	119.5
4830	1048	1316	3732	94	9	27	3.3	6.8	142.5	90	35.0	39	0.0	177.5
4831	1048	105	1622	39	9	61	1.5	0.3	25.3	106	3.1	3	0.0	28.4
4840	1048	289	1888	92	16	92	3.2	4.2	105.0	143	11.2	12	0.0	116.1
4841	1048	373	1675	92	16	77	3.6	4.4	113.5	134	13.4	14	0.0	127.0
4842	1048	12	1675	92	18	77	0.1	0.1	3.7	134	0.4	14	0.0	4.0
4850	1048	21	10000	1	7	33	0.2	0.0	2.7	81	0.0	0	0.0	2.7
4851	1048	21	10000	0	5	15	0.1	0.0	1.2	53	0.0	0	0.0	1.2
4852	1048	21	10000	0	5	4	0.0	0.0	0.3	27	0.0	0	0.0	0.3
4853	1048	21	10000	1	16	25	0.1	0.0	2.0	70	0.0	0	0.0	2.0
4854	1048	21	10000	1	6	34	0.2	0.0	2.9	83	0.0	0	0.0	2.9
4898	1048	464	8000	6	20	0	0.0	0.0	0.4	0	0.0	0	0.0	0.5
4899	1048	12	8000	6	21	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
5020	530	1471	3800	39	15	1	0.0	0.3	4.5	1	0.2	0	0.0	4.7
5021	530	12	3800	39	12	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
5040	530	1919	3800	51	16	1	0.0	0.5	7.3	1	0.5	1	0.0	7.8
5041	530	12	3800	51	45	1	0.0	0.0	0.0	1	0.0	1	0.0	0.0
5110	1541	1171	3800	33	5	1	0.0	0.2	3.6	1	0.1	0	0.0	3.7
5120	1541	21	10000	3	5	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
5310	1583	308	1684	23	16	5	0.2	0.2	5.6	25	2.1	2	0.0	7.7
5320	1583	21	10000	3	6	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
5720	1507	327	1651	105	11	208	4.6	14.2	267.7	207	17.4	23	0.0	285.1
5721	1507	1468	3922	61	12	6	1.6	0.8	33.8	34	12.2	20	0.0	46.0
5722	1507	12	3922	61	12	6	0.0	0.0	0.3	26	0.1	20	0.0	0.4
5740	1507	1081	1833	101	4	71	1.8	19.5	303.1	113	32.9	48	0.0	336.0
5741	1507	609	1833	55	4	6	0.5	0.6	15.0	14	2.3	2	0.0	17.3
5742	1507	12	1833	55	4	6	0.0	0.0	0.3	10	0.0	2	0.0	0.3
5743	1507	275	1744	23	4	4	0.1	0.1	4.0	11	0.8	1	0.0	4.9
5750	1507	21	10000	0	6	6	0.0	0.0	0.5	32	0.0	0	0.0	0.5
5751	1507	21	10000	1	15	34	0.2	0.0	2.8	82	0.0	0	0.0	2.8
5752	1507	21	10000	1	5	34	0.2	0.0	2.8	82	0.0	0	0.0	2.8
5799	1507	585	8000	7	17	0	0.0	0.0	0.6	0	0.0	0	0.0	0.6
9410	1094	308	2571	77	15	53	3.0	1.6	64.7	110	3.5	9	0.0	68.1
9420	1094	1770	4050	59	21	2	0.4	0.7	15.4	11	5.3	17	0.0	20.7
9421	1094	12	4050	59	40	4	0.0	0.0	0.2	16	0.0	17	0.0	0.2
9440	1094	1678	3477	66	6	11	4.3	1.0	74.3	42	24.7	19	0.0	99.0

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
9441	1094	12	3477	66	31	17	0.0	0.0	0.8	77	0.3	19	0.0	1.1
9450	1094	21	10000	0	14	4	0.0	0.0	0.3	26	0.0	0	0.0	0.3
9510	1095	72	1970	27	16	46	0.7	0.2	13.2	97	1.9	2	0.0	15.1
9520	1095	41	1659	32	21	45	0.3	0.2	7.3	98	0.9	1	0.0	8.2
9521	1095	1427	3870	53	21	7	2.2	0.6	39.7	28	8.5	11	0.0	48.2
9522	1095	12	3870	53	21	8	0.0	0.0	0.4	32	0.1	11	0.0	0.5
9540	1095	1919	3886	71	12	5	1.5	1.2	38.5	34	20.9	22	0.0	59.4
9541	1095	12	3886	71	13	4	0.0	0.0	0.2	29	0.1	22	0.0	0.3
9550	1095	56	1773	38	16	61	0.6	0.3	13.5	110	1.7	2	0.0	15.1
9560	1095	21	10000	0	6	4	0.0	0.0	0.4	28	0.0	0	0.0	0.4
9561	1095	21	10000	1	7	33	0.2	0.0	2.7	81	0.0	0	0.0	2.7
9562	1095	21	10000	3	10	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
9597	1095	1965	3666	54	16	1	0.0	0.6	8.3	1	0.8	3	0.0	9.1
9598	1095	12	3666	54	17	1	0.0	0.0	0.1	1	0.0	3	0.0	0.1
9599	1095	80	8000	1	20	0	0.0	0.0	0.1	0	0.0	0	0.0	0.1
30440	1304	1678	4010	52	11	1	0.0	0.5	7.6	1	0.5	1	0.0	8.2
30441	1304	12	4010	52	11	1	0.0	0.0	0.1	1	0.0	1	0.0	0.1
30450	1304	21	10000	3	7	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6
30520	1305	1794	3990	49	8	1	0.0	0.5	7.2	2	0.4	1	0.0	7.6
30521	1305	12	3990	49	8	1	0.0	0.0	0.0	1	0.0	1	0.0	0.0
30530	1305	21	10000	3	7	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6

D.4 Construction base case results, PM peak hour

Network Diagram, construction base case (PM peak hour)


Arundel St
Temple Pl (W)
Temple Pl (E)
Temple Ave
Savoy St
Savoy Pl
Victoria Embankment
Northumberland Ave
Horse Guards Ave
Whitehall
Victoria Embankment

Network results

TRANSYT Link Results Summary, construction base case (PM peak hour)

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
510	5	82	1729	18	16	31	0.6	0.1	10.2	79	1.8	2	0.0	11.9
520	5	1233	4069	47	15	9	2.7	0.4	44.6	44	16.7	15	0.0	61.3
521	5	13	4069	47	17	9	0.0	0.0	0.5	44	0.1	15	0.0	0.6
540	5	1777	3537	80	21	17	6.2	1.9	115.4	54	28.1	26	0.0	143.5
541	5	13	3537	80	23	20	0.1	0.0	1.0	69	0.3	26	0.0	1.3
550	5	21	10000	2	17	40	0.2	0.0	3.3	90	0.0	1	0.0	3.3
598	5	1777	8000	22	10	0	0.0	0.1	2.0	0	0.4	0	0.0	2.4
599	5	13	8000	22	16	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
3210	1372	542	1679	82	16	34	2.9	2.1	71.7	90	10.9	14	0.0	82.6
3211	1372	780	1751	59	15	8	1.0	0.7	23.8	33	6.6	7	0.0	30.4
3230	1372	902	3600	80	16	38	7.6	2.0	135.9	96	23.4	24	0.0	159.3
3231	1372	19	1544	4	16	27	0.1	0.0	2.0	71	0.4	0	0.0	2.4
3240	1372	196	1726	78	25	60	1.6	1.7	46.7	123	2.8	7	0.0	49.5
3250	1372	21	10000	0	8	10	0.1	0.0	0.8	44	0.0	0	0.0	0.8
3299	1372	1087	3732	29	9	1	0.0	0.2	2.9	1	0.2	0	0.0	3.1
3420	1394	1622	4040	46	4	1	0.0	0.4	6.2	1	0.2	1	0.0	6.4
3421	1394	13	4040	46	4	1	0.0	0.0	0.0	1	0.0	1	0.0	0.1
3430	1394	21	10000	3	8	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
3510	1375	791	3960	22	3	1	0.0	0.1	2.0	1	0.1	0	0.0	2.1

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
3520	1375	21	10000	3	6	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
3599	1375	791	8000	10	16	0	0.0	0.1	0.8	0	0.1	0	0.0	0.8
3610	1376	133	1965	21	16	27	0.9	0.1	14.2	73	2.6	3	0.0	16.9
3611	1376	123	2105	46	16	31	0.9	0.2	14.9	81	2.7	7	0.0	17.6
3612	1376	187	2105	46	17	31	1.3	0.3	22.6	81	3.7	7	0.0	26.3
3613	1376	11	1532	2	16	26	0.1	0.0	1.1	69	0.2	0	0.0	1.3
3620	1376	562	3337	77	22	25	2.2	1.6	55.2	91	6.4	15	0.0	61.6
3630	1376	180	1761	17	16	10	0.4	0.1	7.4	43	2.1	2	0.0	9.5
3631	1376	406	2318	42	16	11	1.0	0.3	17.7	45	5.0	7	0.0	22.7
3632	1376	187	2318	42	17	11	0.5	0.1	8.1	45	2.1	7	0.0	10.2
3633	1376	406	3600	27	5	3	0.2	0.1	5.0	7	0.3	1	0.0	5.3
3634	1376	187	3600	27	3	2	0.0	0.1	1.5	4	0.2	1	0.0	1.7
3640	1376	21	10000	2	10	38	0.2	0.0	3.2	88	0.0	0	0.0	3.2
3641	1376	21	10000	2	10	38	0.2	0.0	3.2	88	0.0	0	0.0	3.2
3642	1376	21	10000	2	10	40	0.2	0.0	3.3	90	0.0	1	0.0	3.3
3696	1376	860	8000	13	18	0	0.0	0.1	0.9	0	0.1	0	0.0	0.9
3697	1376	187	8000	13	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
3698	1376	406	8000	7	16	0	0.0	0.0	0.4	0	0.0	0	0.0	0.4
3699	1376	187	8000	7	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
4140	1451	1558	3870	47	9	1	0.0	0.4	6.2	1	0.4	0	0.0	6.6
4141	1451	13	3870	47	10	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1

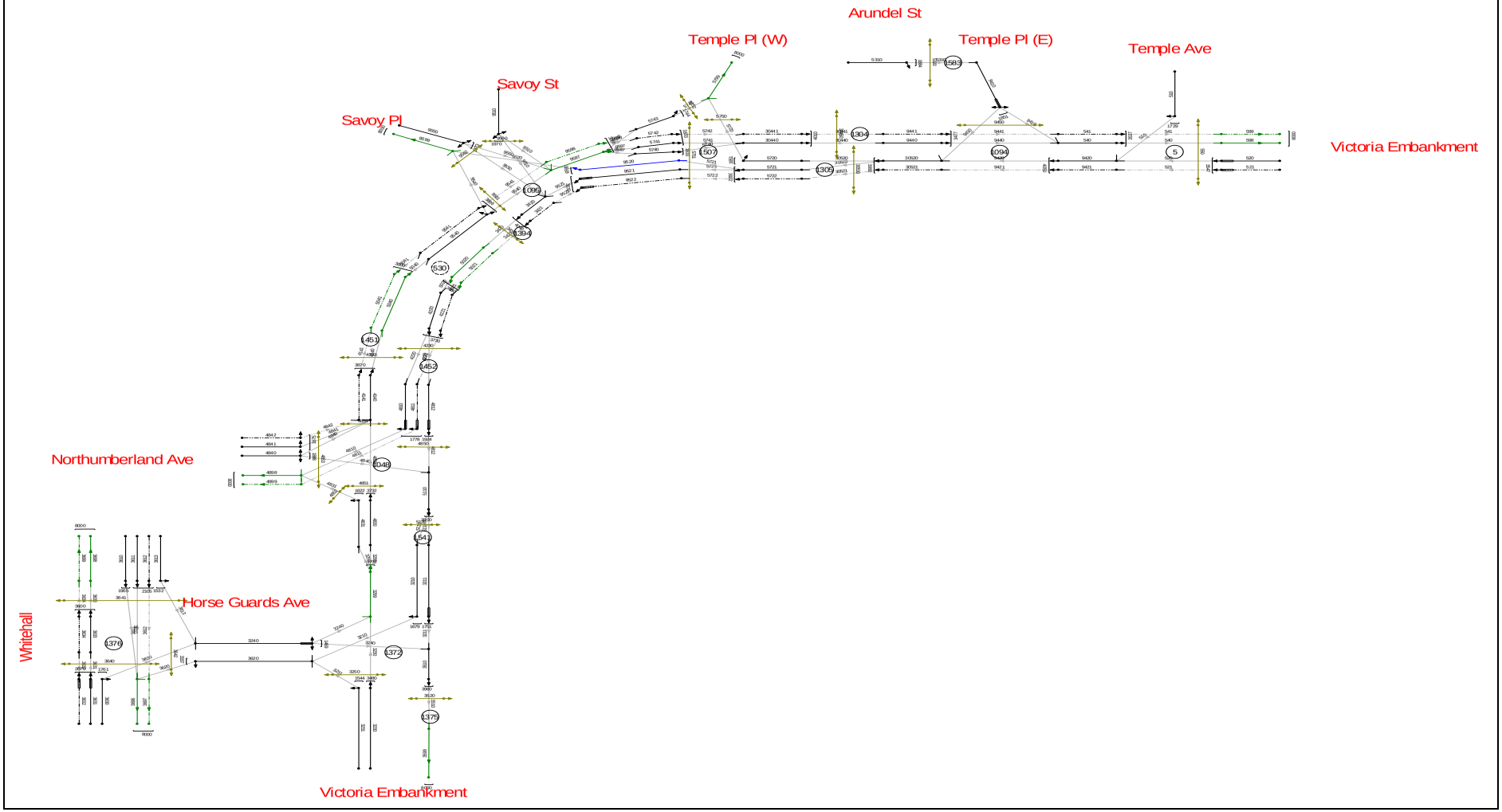
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
4150	1451	21	10000	3	6	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6
4220	1452	1622	3730	49	16	1	0.0	0.5	7.6	3	0.9	1	0.0	8.5
4221	1452	13	3730	49	16	1	0.0	0.0	0.1	3	0.0	1	0.0	0.1
4230	1452	21	10000	3	8	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6
4810	1048	428	3048	82	8	55	4.4	2.1	92.6	100	6.1	12	0.0	98.8
4811	1048	13	3048	82	33	58	0.1	0.1	3.0	109	0.4	12	0.0	3.4
4812	1048	1193	2172	91	8	31	5.6	4.7	145.6	89	15.1	28	0.0	160.7
4830	1048	1009	3732	79	9	11	1.4	1.8	45.1	39	11.6	15	0.0	56.7
4831	1048	78	1622	24	9	57	1.1	0.2	17.4	100	2.2	2	0.0	19.7
4840	1048	266	1888	71	16	52	2.7	1.2	54.9	107	7.7	8	0.0	62.6
4841	1048	412	1675	90	16	67	3.8	3.8	108.2	125	13.9	15	0.0	122.1
4842	1048	13	1675	90	18	67	0.1	0.1	3.4	125	0.4	15	0.0	3.8
4850	1048	21	10000	1	7	29	0.2	0.0	2.4	77	0.0	0	0.0	2.4
4851	1048	21	10000	0	5	13	0.1	0.0	1.1	51	0.0	0	0.0	1.1
4852	1048	21	10000	0	5	5	0.0	0.0	0.4	30	0.0	0	0.0	0.4
4853	1048	21	10000	1	16	27	0.2	0.0	2.2	74	0.0	0	0.0	2.2
4854	1048	21	10000	1	6	35	0.2	0.0	2.9	84	0.0	0	0.0	2.9
4898	1048	506	8000	6	20	0	0.0	0.0	0.5	0	0.0	0	0.0	0.5
4899	1048	13	8000	6	21	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
5020	530	1622	3800	43	15	1	0.0	0.4	5.3	1	0.2	0	0.0	5.5
5021	530	13	3800	43	12	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
5040	530	1558	3800	41	16	1	0.0	0.3	5.0	1	0.3	0	0.0	5.3
5041	530	13	3800	41	45	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
5110	1541	1322	3800	41	5	1	0.1	0.3	5.6	2	0.3	1	0.0	5.9
5120	1541	21	10000	3	5	45	0.2	0.0	3.7	96	0.0	1	0.0	3.7
5310	1583	339	1684	26	16	5	0.3	0.2	6.3	26	2.4	3	0.0	8.7
5320	1583	21	10000	3	6	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
5720	1507	282	1651	86	11	65	2.3	2.8	72.1	128	9.3	10	0.0	81.3
5721	1507	1502	3922	64	12	16	5.8	0.9	94.9	54	19.8	23	0.0	114.6
5722	1507	13	3922	64	12	22	0.1	0.0	1.1	72	0.2	23	0.0	1.3
5740	1507	778	1833	74	4	14	1.7	1.4	43.8	43	9.1	10	0.0	52.8
5741	1507	632	1833	58	4	8	0.8	0.7	20.5	24	4.1	5	0.0	24.6
5742	1507	13	1833	58	4	6	0.0	0.0	0.3	16	0.1	5	0.0	0.3
5743	1507	211	1744	18	4	5	0.2	0.1	3.8	14	0.8	1	0.0	4.6
5750	1507	21	10000	0	6	6	0.0	0.0	0.5	33	0.0	0	0.0	0.5
5751	1507	21	10000	1	15	33	0.2	0.0	2.7	81	0.0	0	0.0	2.7
5752	1507	21	10000	1	5	33	0.2	0.0	2.7	81	0.0	0	0.0	2.7
5799	1507	493	8000	6	17	0	0.0	0.0	0.5	0	0.0	0	0.0	0.5
9410	1094	301	2811	69	15	47	2.9	1.1	55.9	103	3.2	8	0.0	59.1
9420	1094	1744	4050	59	21	3	0.8	0.7	21.7	21	9.7	17	0.0	31.4
9421	1094	13	4050	59	40	5	0.0	0.0	0.2	23	0.1	17	0.0	0.3
9440	1094	1410	3477	55	6	2	0.0	0.6	9.2	4	1.8	2	0.0	10.9

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
9441	1094	13	3477	55	31	5	0.0	0.0	0.2	19	0.1	2	0.0	0.3
9450	1094	21	10000	0	14	4	0.0	0.0	0.3	25	0.0	0	0.0	0.3
9510	1095	120	1970	45	16	51	1.3	0.4	23.9	101	3.3	3	0.0	27.2
9520	1095	12	1659	44	21	156	0.1	0.4	7.4	174	0.5	1	0.0	7.9
9521	1095	1490	3931	62	21	13	4.6	0.8	76.6	51	16.2	21	0.0	92.8
9522	1095	13	3931	62	21	10	0.0	0.0	0.5	31	0.1	21	0.0	0.6
9540	1095	1558	3886	66	12	7	1.9	1.0	39.8	17	8.6	8	0.0	48.4
9541	1095	13	3886	66	13	7	0.0	0.0	0.3	19	0.1	8	0.0	0.4
9550	1095	86	1773	58	16	71	1.0	0.7	24.1	122	2.8	3	0.0	26.9
9560	1095	21	10000	0	6	5	0.0	0.0	0.4	29	0.0	0	0.0	0.4
9561	1095	21	10000	1	7	34	0.2	0.0	2.8	82	0.0	0	0.0	2.8
9562	1095	21	10000	3	10	45	0.2	0.0	3.7	96	0.0	1	0.0	3.7
9597	1095	1621	3666	45	16	1	0.0	0.4	5.7	1	0.5	0	0.0	6.1
9598	1095	13	3666	45	17	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
9599	1095	25	8000	0	20	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
30440	1304	1410	4010	44	11	1	0.0	0.4	5.5	1	0.4	0	0.0	5.9
30441	1304	13	4010	44	11	1	0.0	0.0	0.0	1	0.0	0	0.0	0.1
30450	1304	21	10000	3	7	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6
30520	1305	1784	3990	53	8	2	0.4	0.6	13.4	9	2.3	4	0.0	15.7
30521	1305	13	3990	53	8	2	0.0	0.0	0.1	9	0.0	4	0.0	0.1
30530	1305	21	10000	3	7	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6

D.5 Construction development case results, AM peak hour

Network Diagram, construction development case (AM peak hour)



Network results

TRANSYT Link Results Summary, construction development case (AM peak hour)

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
510	5	42	1729	9	10	31	0.3	0.0	5.0	75	2.2	1	0.0	7.3
520	5	1732	4011	67	15	11	4.3	1.0	75.8	51	27.2	25	0.0	102.9
521	5	11	4011	67	17	11	0.0	0.0	0.5	51	0.1	25	0.0	0.6
540	5	1987	3537	89	21	19	6.4	3.9	146.1	72	42.8	40	0.0	188.9
541	5	11	3537	89	23	13	0.0	0.0	0.5	33	0.1	40	0.0	0.6
550	5	20	10000	2	17	39	0.2	0.0	3.1	89	0.0	0	0.0	3.1
598	5	1987	8000	25	15	0	0.0	0.2	2.4	0	0.2	0	0.0	2.5
599	5	11	8000	25	16	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
3210	1372	425	1679	81	16	41	2.8	2.0	69.5	95	8.9	11	0.0	78.4
3211	1372	697	1751	50	15	8	0.9	0.5	20.6	34	6.0	6	0.0	26.6
3230	1372	1242	3480	84	16	32	8.4	2.5	155.4	92	31.0	31	0.0	186.3
3231	1372	19	1544	3	16	19	0.1	0.0	1.4	58	0.3	0	0.0	1.7
3240	1372	189	2123	78	25	63	1.6	1.6	46.7	123	2.7	6	0.0	49.4
3250	1372	20	10000	0	8	16	0.1	0.0	1.2	56	0.0	0	0.0	1.2
3299	1372	1421	3732	38	9	1	0.0	0.3	4.4	1	0.2	0	0.0	4.6
3420	1394	1478	4040	39	4	1	0.0	0.3	4.6	1	0.1	0	0.0	4.7
3421	1394	11	4040	39	4	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
3430	1394	20	10000	3	8	46	0.2	0.0	3.6	97	0.0	1	0.0	3.6
3510	1375	708	3960	19	3	1	0.0	0.1	1.7	1	0.1	0	0.0	1.8

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
3520	1375	20	10000	3	6	46	0.2	0.0	3.6	97	0.0	1	0.0	3.6
3599	1375	708	8000	9	16	0	0.0	0.0	0.7	0	0.0	0	0.0	0.7
3610	1376	115	1965	19	16	28	0.8	0.1	12.6	74	2.3	2	0.0	14.9
3611	1376	152	2105	50	16	32	1.1	0.2	19.4	84	3.4	8	0.0	22.9
3612	1376	178	2105	50	17	32	1.3	0.3	22.7	84	3.7	8	0.0	26.4
3613	1376	11	1532	2	16	27	0.1	0.0	1.2	70	0.2	0	0.0	1.4
3620	1376	460	3337	63	22	24	2.2	0.8	42.7	54	3.1	8	0.0	45.8
3630	1376	167	1761	16	16	11	0.4	0.1	7.1	44	2.0	2	0.0	9.1
3631	1376	390	2196	44	16	12	1.0	0.3	18.5	50	5.3	8	0.0	23.7
3632	1376	181	2196	44	17	12	0.5	0.1	8.6	50	2.2	8	0.0	10.8
3633	1376	390	3600	27	5	3	0.2	0.1	4.9	7	0.3	1	0.0	5.2
3634	1376	181	3600	27	3	2	0.0	0.1	1.5	4	0.2	1	0.0	1.7
3640	1376	20	10000	1	10	38	0.2	0.0	3.0	88	0.0	0	0.0	3.0
3641	1376	20	10000	1	10	38	0.2	0.0	3.0	88	0.0	0	0.0	3.0
3642	1376	20	10000	2	10	38	0.2	0.0	3.0	88	0.0	0	0.0	3.0
3696	1376	727	8000	11	18	0	0.0	0.1	0.7	0	0.1	0	0.0	0.8
3697	1376	178	8000	11	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
3698	1376	390	8000	7	16	0	0.0	0.0	0.4	0	0.0	0	0.0	0.4
3699	1376	181	8000	7	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
4140	1451	1920	3870	61	9	2	0.0	0.8	11.2	2	0.7	1	0.0	11.9
4141	1451	11	3870	61	10	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1

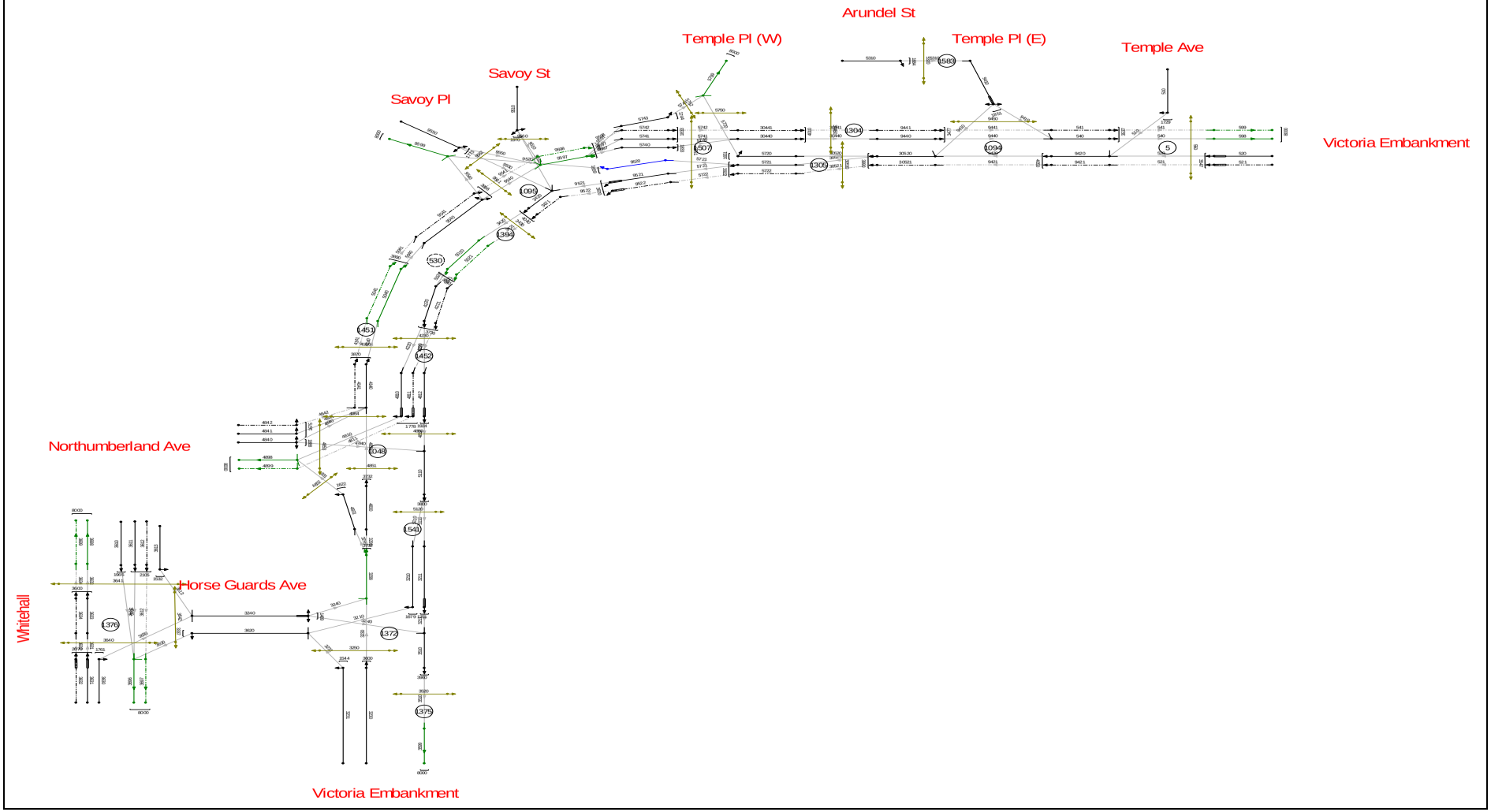
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
4150	1451	20	10000	3	6	45	0.2	0.0	3.5	95	0.0	1	0.0	3.5
4220	1452	1478	3730	49	16	2	0.5	0.5	13.8	13	4.0	6	0.0	17.8
4221	1452	11	3730	49	16	3	0.0	0.0	0.1	21	0.1	6	0.0	0.2
4230	1452	20	10000	3	8	44	0.2	0.0	3.5	94	0.0	1	0.0	3.5
4810	1048	361	2201	95	8	99	4.0	5.9	141.3	151	7.8	16	0.0	149.0
4811	1048	11	2201	95	33	93	0.1	0.2	4.1	148	0.5	16	0.0	4.5
4812	1048	1118	2042	86	8	24	4.4	3.0	105.2	107	17.0	32	0.0	122.2
4830	1048	1316	3732	94	9	27	3.2	6.8	141.5	93	36.2	40	0.0	177.7
4831	1048	105	1622	39	9	61	1.5	0.3	25.3	105	3.1	3	0.0	28.4
4840	1048	293	1888	93	16	97	3.2	4.7	112.5	148	11.7	12	0.0	124.2
4841	1048	374	1675	92	16	77	3.6	4.4	113.8	133	13.5	14	0.0	127.3
4842	1048	11	1675	92	18	77	0.1	0.1	3.3	133	0.3	14	0.0	3.7
4850	1048	20	10000	1	7	32	0.2	0.0	2.5	80	0.0	0	0.0	2.5
4851	1048	20	10000	0	5	15	0.1	0.0	1.2	55	0.0	0	0.0	1.2
4852	1048	20	10000	0	5	4	0.0	0.0	0.3	28	0.0	0	0.0	0.3
4853	1048	20	10000	1	16	25	0.1	0.0	2.0	71	0.0	0	0.0	2.0
4854	1048	20	10000	1	6	35	0.2	0.0	2.8	84	0.0	0	0.0	2.8
4898	1048	466	8000	6	20	0	0.0	0.0	0.4	0	0.0	0	0.0	0.5
4899	1048	11	8000	6	21	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
5020	530	1478	3800	39	15	1	0.0	0.3	4.5	1	0.2	0	0.0	4.7
5021	530	11	3800	39	12	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
5040	530	1920	3800	51	16	1	0.0	0.5	7.3	1	0.5	1	0.0	7.8
5041	530	11	3800	51	45	1	0.0	0.0	0.0	1	0.0	1	0.0	0.0
5110	1541	1181	3800	34	5	1	0.0	0.3	3.6	1	0.1	0	0.0	3.7
5120	1541	20	10000	3	5	46	0.2	0.0	3.6	97	0.0	1	0.0	3.6
5310	1583	308	1684	23	16	5	0.2	0.2	5.6	25	2.1	2	0.0	7.7
5320	1583	20	10000	3	6	46	0.2	0.0	3.6	97	0.0	1	0.0	3.6
5720	1507	327	1651	106	11	208	4.6	14.3	268.4	207	17.4	23	0.0	285.8
5721	1507	1475	3922	62	12	6	1.6	0.8	34.3	34	12.3	21	0.0	46.6
5722	1507	11	3922	62	12	6	0.0	0.0	0.3	26	0.1	21	0.0	0.3
5740	1507	1081	1833	101	4	71	1.8	19.6	304.4	112	32.7	48	0.0	337.1
5741	1507	609	1833	55	4	6	0.5	0.6	15.0	14	2.3	2	0.0	17.3
5742	1507	11	1833	55	4	5	0.0	0.0	0.2	9	0.0	2	0.0	0.3
5743	1507	275	1744	23	4	4	0.1	0.1	4.1	11	0.8	1	0.0	4.9
5750	1507	20	10000	0	6	5	0.0	0.0	0.4	31	0.0	0	0.0	0.4
5751	1507	20	10000	1	15	33	0.2	0.0	2.6	81	0.0	0	0.0	2.6
5752	1507	20	10000	1	5	33	0.2	0.0	2.6	81	0.0	0	0.0	2.6
5799	1507	585	8000	7	17	0	0.0	0.0	0.6	0	0.0	0	0.0	0.6
9410	1094	308	2571	77	15	53	3.0	1.6	64.6	110	3.4	9	0.0	68.1
9420	1094	1774	4050	60	21	2	0.3	0.7	15.3	11	5.4	15	0.0	20.7
9421	1094	11	4050	60	40	4	0.0	0.0	0.2	16	0.0	15	0.0	0.2
9440	1094	1678	3477	66	6	11	4.3	0.9	74.1	42	24.7	19	0.0	98.8

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
9441	1094	11	3477	66	31	16	0.0	0.0	0.7	75	0.2	19	0.0	0.9
9450	1094	20	10000	0	14	4	0.0	0.0	0.3	25	0.0	0	0.0	0.3
9510	1095	72	1970	27	16	47	0.7	0.2	13.2	96	1.9	2	0.0	15.1
9520	1095	41	1659	32	21	45	0.3	0.2	7.3	99	0.9	1	0.0	8.2
9521	1095	1434	3870	54	21	7	2.3	0.6	40.2	28	8.5	11	0.0	48.7
9522	1095	11	3870	54	21	8	0.0	0.0	0.4	31	0.1	11	0.0	0.4
9540	1095	1920	3886	71	12	5	1.5	1.2	38.4	34	20.7	23	0.0	59.2
9541	1095	11	3886	71	13	4	0.0	0.0	0.2	29	0.1	23	0.0	0.3
9550	1095	56	1773	38	16	61	0.7	0.3	13.5	111	1.7	2	0.0	15.2
9560	1095	20	10000	0	6	5	0.0	0.0	0.4	29	0.0	0	0.0	0.4
9561	1095	20	10000	1	7	34	0.2	0.0	2.6	82	0.0	0	0.0	2.6
9562	1095	20	10000	3	10	45	0.2	0.0	3.6	96	0.0	1	0.0	3.6
9597	1095	1965	3666	54	16	1	0.0	0.6	8.3	1	0.8	3	0.0	9.1
9598	1095	11	3666	54	17	1	0.0	0.0	0.0	1	0.0	3	0.0	0.1
9599	1095	80	8000	1	20	0	0.0	0.0	0.1	0	0.0	0	0.0	0.1
30440	1304	1678	4010	52	11	1	0.0	0.5	7.6	1	0.6	1	0.0	8.2
30441	1304	11	4010	52	11	1	0.0	0.0	0.0	1	0.0	1	0.0	0.1
30450	1304	20	10000	3	7	44	0.2	0.0	3.5	94	0.0	1	0.0	3.5
30520	1305	1835	3990	50	8	1	0.0	0.5	7.5	2	0.5	3	0.0	8.0
30521	1305	11	3990	50	8	1	0.0	0.0	0.0	1	0.0	3	0.0	0.0
30530	1305	20	10000	3	7	45	0.2	0.0	3.5	95	0.0	1	0.0	3.5

D.6 Construction development case results, PM peak hour

Network Diagram, construction development case (PM peak hour)



Network results

TRANSYT Link Results Summary, construction development case (PM peak hour)

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
510	5	82	1729	18	16	31	0.6	0.1	10.2	79	1.8	2	0.0	11.9
520	5	1236	4069	48	15	9	2.7	0.4	44.7	44	16.8	15	0.0	61.5
521	5	13	4069	48	17	9	0.0	0.0	0.5	44	0.1	15	0.0	0.6
540	5	1778	3537	80	21	9	2.5	1.9	62.9	29	15.0	15	0.0	77.9
541	5	13	3537	80	23	13	0.0	0.0	0.6	49	0.2	15	0.0	0.8
550	5	21	10000	2	17	40	0.2	0.0	3.3	90	0.0	1	0.0	3.3
598	5	1778	8000	22	10	0	0.0	0.1	2.0	0	0.4	0	0.0	2.4
599	5	13	8000	22	16	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
3210	1372	545	1679	82	16	32	2.6	2.2	67.9	88	10.7	14	0.0	78.6
3211	1372	784	1799	56	15	6	0.7	0.6	19.1	22	4.5	5	0.0	23.6
3230	1372	902	3600	78	16	36	7.4	1.7	128.8	94	22.8	23	0.0	151.6
3231	1372	19	1544	4	16	26	0.1	0.0	2.0	70	0.4	0	0.0	2.3
3240	1372	196	1745	83	25	71	1.7	2.2	55.2	131	3.0	7	0.0	58.2
3250	1372	21	10000	0	8	10	0.1	0.0	0.8	44	0.0	0	0.0	0.8
3299	1372	1087	3732	29	9	1	0.0	0.2	2.9	1	0.2	0	0.0	3.1
3420	1394	1623	4040	46	4	1	0.0	0.4	6.2	1	0.2	1	0.0	6.5
3421	1394	13	4040	46	4	1	0.0	0.0	0.0	1	0.0	1	0.0	0.1
3430	1394	21	10000	3	8	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
3510	1375	795	3960	22	3	1	0.0	0.1	2.0	1	0.2	0	0.0	2.2

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
3520	1375	21	10000	3	6	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
3599	1375	795	8000	10	16	0	0.0	0.1	0.8	0	0.1	0	0.0	0.8
3610	1376	133	1965	21	16	27	0.9	0.1	14.2	73	2.6	3	0.0	16.9
3611	1376	123	2105	46	16	31	0.9	0.2	14.9	81	2.7	7	0.0	17.6
3612	1376	187	2105	46	17	31	1.3	0.3	22.6	81	3.7	7	0.0	26.3
3613	1376	11	1532	2	16	26	0.1	0.0	1.1	69	0.2	0	0.0	1.3
3620	1376	564	3337	77	22	26	2.4	1.7	57.5	102	7.2	16	0.0	64.7
3630	1376	180	1761	17	16	10	0.4	0.1	7.4	43	2.1	2	0.0	9.5
3631	1376	406	2318	42	16	11	1.0	0.3	17.7	45	5.0	7	0.0	22.7
3632	1376	187	2318	42	17	11	0.5	0.1	8.1	45	2.1	7	0.0	10.2
3633	1376	406	3600	27	5	3	0.2	0.1	5.0	7	0.3	1	0.0	5.3
3634	1376	187	3600	27	3	2	0.0	0.1	1.5	4	0.2	1	0.0	1.7
3640	1376	21	10000	2	10	38	0.2	0.0	3.2	88	0.0	0	0.0	3.2
3641	1376	21	10000	2	10	38	0.2	0.0	3.2	88	0.0	0	0.0	3.2
3642	1376	21	10000	2	10	40	0.2	0.0	3.3	90	0.0	1	0.0	3.3
3696	1376	861	8000	13	18	0	0.0	0.1	0.9	0	0.1	0	0.0	0.9
3697	1376	187	8000	13	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
3698	1376	406	8000	7	16	0	0.0	0.0	0.4	0	0.0	0	0.0	0.4
3699	1376	187	8000	7	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
4140	1451	1559	3870	47	9	1	0.0	0.4	6.2	1	0.4	0	0.0	6.6
4141	1451	13	3870	47	10	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1

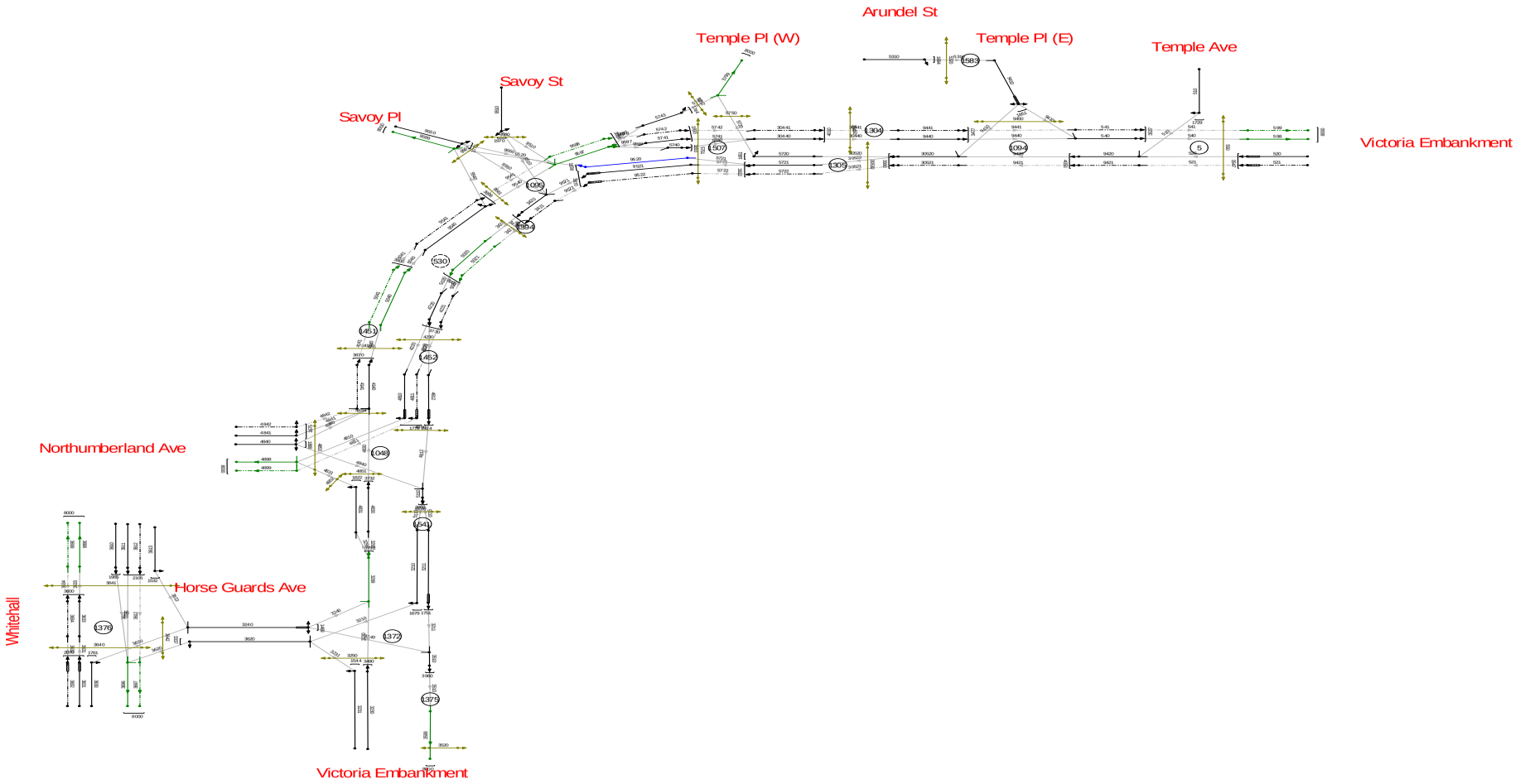
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
4150	1451	21	10000	3	6	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6
4220	1452	1623	3730	50	16	1	0.1	0.5	8.9	6	1.9	3	0.0	10.9
4221	1452	13	3730	50	16	1	0.0	0.0	0.1	4	0.0	3	0.0	0.1
4230	1452	21	10000	3	8	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6
4810	1048	428	3048	82	8	53	4.2	2.1	89.2	116	7.1	14	0.0	96.3
4811	1048	13	3048	82	33	47	0.1	0.1	2.4	111	0.4	14	0.0	2.8
4812	1048	1194	2172	91	8	26	3.9	4.7	121.3	111	19.0	36	0.0	140.3
4830	1048	1009	3732	79	9	13	1.9	1.8	52.7	32	9.6	10	0.0	62.3
4831	1048	78	1622	24	9	57	1.1	0.2	17.5	105	2.3	2	0.0	19.9
4840	1048	271	1888	73	16	53	2.7	1.3	56.9	108	7.9	8	0.0	64.8
4841	1048	413	1675	90	16	67	3.8	3.9	109.4	125	13.9	15	0.0	123.4
4842	1048	13	1675	90	18	67	0.1	0.1	3.4	125	0.4	15	0.0	3.8
4850	1048	21	10000	1	7	29	0.2	0.0	2.4	77	0.0	0	0.0	2.4
4851	1048	21	10000	0	5	13	0.1	0.0	1.1	51	0.0	0	0.0	1.1
4852	1048	21	10000	0	5	5	0.0	0.0	0.4	30	0.0	0	0.0	0.4
4853	1048	21	10000	1	16	27	0.2	0.0	2.2	74	0.0	0	0.0	2.2
4854	1048	21	10000	1	6	35	0.2	0.0	2.9	84	0.0	0	0.0	2.9
4898	1048	507	8000	6	20	0	0.0	0.0	0.5	0	0.0	0	0.0	0.5
4899	1048	13	8000	6	21	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
5020	530	1623	3800	43	15	1	0.0	0.4	5.3	1	0.2	0	0.0	5.5
5021	530	13	3800	43	12	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
5040	530	1559	3800	41	16	1	0.0	0.3	5.0	1	0.3	0	0.0	5.3
5041	530	13	3800	41	45	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
5110	1541	1328	3800	41	5	1	0.0	0.3	5.5	2	0.4	1	0.0	5.9
5120	1541	21	10000	3	5	45	0.2	0.0	3.7	96	0.0	1	0.0	3.7
5310	1583	339	1684	26	16	5	0.3	0.2	6.3	26	2.4	3	0.0	8.7
5320	1583	21	10000	3	6	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
5720	1507	279	1651	77	11	53	2.5	1.6	58.1	98	7.1	8	0.0	65.1
5721	1507	1504	3922	66	12	16	5.6	1.0	93.5	64	23.5	31	0.0	117.0
5722	1507	13	3922	66	12	9	0.0	0.0	0.5	45	0.1	31	0.0	0.6
5740	1507	778	1833	77	4	13	1.1	1.6	38.9	23	4.9	5	0.0	43.8
5741	1507	632	1833	60	4	8	0.6	0.7	18.9	16	2.7	3	0.0	21.6
5742	1507	13	1833	60	4	7	0.0	0.0	0.3	11	0.0	3	0.0	0.4
5743	1507	211	1744	18	4	4	0.1	0.1	3.5	12	0.7	1	0.0	4.2
5750	1507	21	10000	0	6	7	0.0	0.0	0.6	36	0.0	0	0.0	0.6
5751	1507	21	10000	1	15	30	0.2	0.0	2.5	78	0.0	0	0.0	2.5
5752	1507	21	10000	1	5	30	0.2	0.0	2.5	78	0.0	0	0.0	2.5
5799	1507	489	8000	6	17	0	0.0	0.0	0.5	0	0.0	0	0.0	0.5
9410	1094	301	2958	75	15	54	3.0	1.5	63.8	110	3.4	9	0.0	67.2
9420	1094	1746	4050	57	21	7	2.6	0.7	46.1	50	23.4	19	0.0	69.5
9421	1094	13	4050	57	40	9	0.0	0.0	0.5	56	0.2	19	0.0	0.6
9440	1094	1411	3477	54	6	2	0.2	0.6	10.6	4	1.8	2	0.0	12.5

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
9441	1094	13	3477	54	31	6	0.0	0.0	0.3	33	0.1	2	0.0	0.4
9450	1094	21	10000	0	14	3	0.0	0.0	0.2	23	0.0	0	0.0	0.2
9510	1095	120	1970	45	16	51	1.3	0.4	23.9	101	3.3	3	0.0	27.2
9520	1095	12	1659	9	21	32	0.1	0.0	1.5	63	0.2	0	0.0	1.7
9521	1095	1492	3931	62	21	8	2.5	0.8	46.9	21	6.8	9	0.0	53.7
9522	1095	13	3931	62	21	9	0.0	0.0	0.4	23	0.1	9	0.0	0.5
9540	1095	1559	3886	66	12	8	2.4	1.0	47.3	52	26.2	28	0.0	73.5
9541	1095	13	3886	66	13	7	0.0	0.0	0.3	55	0.2	28	0.0	0.5
9550	1095	86	1773	58	16	71	1.0	0.7	24.1	122	2.8	3	0.0	26.9
9560	1095	21	10000	0	6	5	0.0	0.0	0.4	29	0.0	0	0.0	0.4
9561	1095	21	10000	1	7	34	0.2	0.0	2.8	82	0.0	0	0.0	2.8
9562	1095	21	10000	3	10	45	0.2	0.0	3.7	96	0.0	1	0.0	3.7
9597	1095	1621	3666	45	16	1	0.0	0.4	6.1	3	1.4	13	0.0	7.5
9598	1095	13	3666	45	17	1	0.0	0.0	0.0	4	0.0	13	0.0	0.1
9599	1095	24	8000	0	20	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
30440	1304	1411	4010	44	11	1	0.0	0.4	5.5	1	0.4	0	0.0	5.9
30441	1304	13	4010	44	11	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
30450	1304	21	10000	3	7	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6
30520	1305	1786	3990	53	8	2	0.3	0.6	11.8	7	2.0	5	0.0	13.8
30521	1305	13	3990	53	8	1	0.0	0.0	0.1	4	0.0	5	0.0	0.1
30530	1305	21	10000	3	7	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6

D.7 Construction development case results, sensitivity test, AM peak hour

Network Diagram, sensitivity test (AM peak hour)



Network results

TRANSYT Link Results Summary, sensitivity test (AM peak hour)

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
510	5	42	1729	9	10	30	0.3	0.0	5.0	76	2.2	1	0.0	7.3
520	5	1759	4011	68	15	11	4.4	1.1	77.9	51	27.9	26	0.0	105.8
521	5	12	4011	68	17	11	0.0	0.0	0.5	51	0.2	26	0.0	0.7
540	5	1990	3537	89	21	18	6.1	3.9	141.7	71	41.6	39	0.0	183.3
541	5	12	3537	89	23	13	0.0	0.0	0.6	33	0.1	39	0.0	0.7
550	5	21	10000	2	17	40	0.2	0.0	3.3	90	0.0	1	0.0	3.3
598	5	1989	8000	25	15	0	0.0	0.2	2.4	0	0.2	0	0.0	2.5
599	5	12	8000	25	16	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
3210	1372	424	1679	81	16	42	2.9	2.0	69.5	95	9.0	11	0.0	78.4
3211	1372	689	1751	50	15	7	0.9	0.5	19.8	34	6.1	6	0.0	25.9
3230	1372	1242	3480	84	16	32	8.4	2.5	155.4	92	31.0	31	0.0	186.3
3231	1372	19	1544	3	16	19	0.1	0.0	1.4	58	0.3	0	0.0	1.7
3240	1372	189	2123	78	25	63	1.6	1.6	46.7	123	2.7	6	0.0	49.4
3250	1372	21	10000	0	8	16	0.1	0.0	1.3	56	0.0	0	0.0	1.3
3299	1372	1421	3732	38	9	1	0.0	0.3	4.4	1	0.2	0	0.0	4.6
3420	1394	1503	4040	40	4	1	0.0	0.3	4.7	1	0.1	0	0.0	4.8
3421	1394	12	4040	40	4	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
3430	1394	21	10000	3	8	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
3510	1375	731	3960	19	3	1	0.0	0.1	1.7	1	0.1	0	0.0	1.8

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
3520	1375	21	10000	3	6	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
3599	1375	731	8000	9	16	0	0.0	0.1	0.7	0	0.1	0	0.0	0.8
3610	1376	148	1965	24	16	28	1.0	0.2	16.6	76	3.0	3	0.0	19.6
3611	1376	110	2105	45	16	31	0.8	0.2	13.6	82	2.4	7	0.0	16.0
3612	1376	187	2105	45	17	31	1.4	0.3	23.1	82	3.8	7	0.0	26.9
3613	1376	11	1532	2	16	27	0.1	0.0	1.2	70	0.2	0	0.0	1.4
3620	1376	441	3337	60	22	23	2.0	0.8	39.8	51	2.8	6	0.0	42.6
3630	1376	167	1761	16	16	11	0.4	0.1	7.1	44	2.0	2	0.0	9.1
3631	1376	381	2196	44	16	12	1.0	0.3	18.0	50	5.2	8	0.0	23.2
3632	1376	190	2196	44	17	12	0.5	0.1	9.0	50	2.3	8	0.0	11.3
3633	1376	381	3600	27	5	3	0.2	0.1	4.8	7	0.3	1	0.0	5.0
3634	1376	190	3600	27	3	2	0.1	0.1	1.6	4	0.2	1	0.0	1.8
3640	1376	21	10000	2	10	38	0.2	0.0	3.2	88	0.0	0	0.0	3.2
3641	1376	21	10000	2	10	38	0.2	0.0	3.2	88	0.0	0	0.0	3.2
3642	1376	21	10000	2	10	38	0.2	0.0	3.2	88	0.0	0	0.0	3.2
3696	1376	715	8000	11	18	0	0.0	0.1	0.7	0	0.1	0	0.0	0.8
3697	1376	187	8000	11	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
3698	1376	381	8000	7	16	0	0.0	0.0	0.4	0	0.0	0	0.0	0.4
3699	1376	190	8000	7	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
4140	1451	1920	3870	61	9	2	0.0	0.8	11.2	2	0.7	1	0.0	11.9
4141	1451	12	3870	61	10	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1

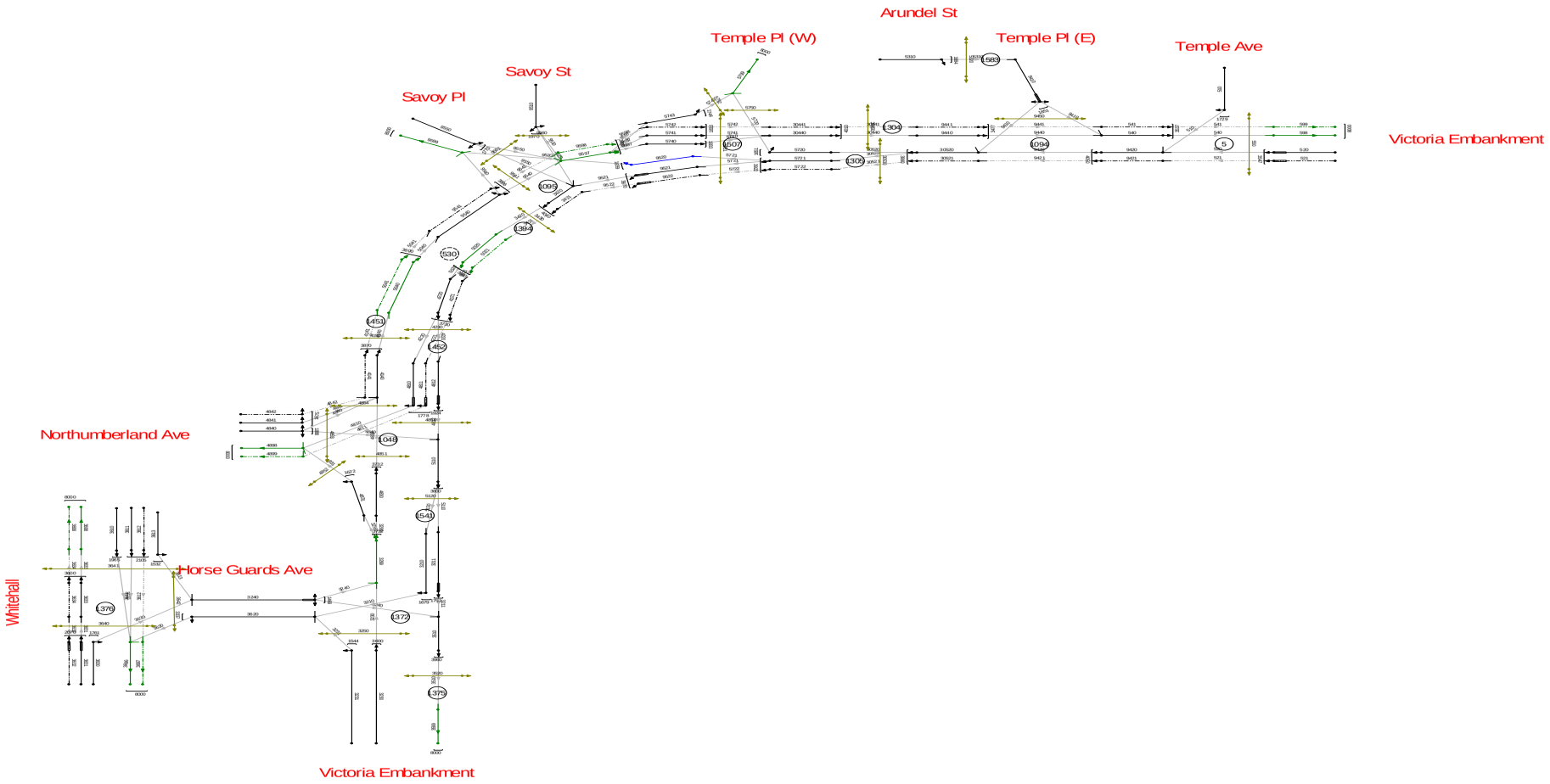
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
4150	1451	21	10000	3	6	45	0.2	0.0	3.7	95	0.0	1	0.0	3.7
4220	1452	1503	3730	50	16	3	0.5	0.5	14.7	10	3.3	4	0.0	18.0
4221	1452	12	3730	50	16	1	0.0	0.0	0.1	2	0.0	4	0.0	0.1
4230	1452	21	10000	3	8	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6
4810	1048	361	2201	96	8	101	4.1	6.0	143.6	151	7.8	16	0.0	151.3
4811	1048	12	2201	96	7	96	0.1	0.2	4.6	144	0.4	16	0.0	4.9
4812	1048	1142	2042	88	8	26	4.8	3.5	118.4	100	16.3	31	0.0	134.7
4830	1048	1316	3732	94	9	27	3.2	6.8	141.5	93	36.2	40	0.0	177.7
4831	1048	105	1622	39	9	61	1.5	0.3	25.3	105	3.1	3	0.0	28.4
4840	1048	289	1888	92	16	92	3.2	4.2	105.0	144	11.2	12	0.0	116.2
4841	1048	374	1675	92	16	78	3.6	4.5	115.1	134	13.5	14	0.0	128.6
4842	1048	12	1675	92	18	78	0.1	0.1	3.7	134	0.4	14	0.0	4.1
4850	1048	21	10000	1	7	32	0.2	0.0	2.6	80	0.0	0	0.0	2.6
4851	1048	21	10000	0	5	15	0.1	0.0	1.2	55	0.0	0	0.0	1.2
4852	1048	21	10000	0	5	4	0.0	0.0	0.4	28	0.0	0	0.0	0.4
4853	1048	21	10000	1	16	25	0.1	0.0	2.1	71	0.0	0	0.0	2.1
4854	1048	21	10000	1	6	35	0.2	0.0	2.9	84	0.0	0	0.0	2.9
4898	1048	466	8000	6	20	0	0.0	0.0	0.4	0	0.0	0	0.0	0.5
4899	1048	12	8000	6	21	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
5020	530	1503	3800	40	15	1	0.0	0.3	4.7	1	0.2	0	0.0	4.9
5021	530	12	3800	40	12	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
5040	530	1920	3800	51	16	1	0.0	0.5	7.3	1	0.5	1	0.0	7.8
5041	530	12	3800	51	45	1	0.0	0.0	0.0	1	0.0	1	0.0	0.0
5110	1541	1204	3800	34	5	1	0.0	0.3	3.7	1	0.1	0	0.0	3.9
5120	1541	21	10000	3	5	45	0.2	0.0	3.7	96	0.0	1	0.0	3.7
5310	1583	308	1684	23	16	5	0.2	0.2	5.6	25	2.1	2	0.0	7.7
5320	1583	21	10000	3	6	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
5720	1507	325	1651	105	11	202	4.6	13.6	258.7	203	17.1	22	0.0	275.8
5721	1507	1500	3922	63	12	6	1.7	0.8	35.7	39	14.5	23	0.0	50.2
5722	1507	12	3922	63	12	6	0.0	0.0	0.3	28	0.1	23	0.0	0.4
5740	1507	1081	1833	101	4	72	1.8	19.7	305.4	113	32.8	48	0.0	338.3
5741	1507	609	1833	55	4	6	0.5	0.6	15.0	14	2.3	2	0.0	17.3
5742	1507	12	1833	55	4	5	0.0	0.0	0.3	9	0.0	2	0.0	0.3
5743	1507	275	1744	23	4	4	0.1	0.1	4.1	11	0.8	1	0.0	4.9
5750	1507	21	10000	0	6	5	0.0	0.0	0.4	31	0.0	0	0.0	0.4
5751	1507	21	10000	1	15	33	0.2	0.0	2.7	81	0.0	0	0.0	2.7
5752	1507	21	10000	1	5	33	0.2	0.0	2.7	81	0.0	0	0.0	2.7
5799	1507	585	8000	7	17	0	0.0	0.0	0.6	0	0.0	0	0.0	0.6
9410	1094	308	2571	77	15	53	3.0	1.6	64.7	110	3.5	9	0.0	68.2
9420	1094	1801	4050	61	21	2	0.4	0.8	16.1	12	5.8	17	0.0	21.9
9421	1094	12	4050	61	40	4	0.0	0.0	0.2	17	0.0	17	0.0	0.2
9440	1094	1681	3477	66	6	12	4.5	1.0	77.0	44	25.8	20	0.0	102.9

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
9441	1094	12	3477	66	31	17	0.0	0.0	0.8	77	0.3	20	0.0	1.1
9450	1094	21	10000	0	14	4	0.0	0.0	0.3	26	0.0	0	0.0	0.3
9510	1095	72	1970	27	16	47	0.7	0.2	13.2	96	1.9	2	0.0	15.1
9520	1095	42	1659	33	21	45	0.3	0.2	7.4	100	0.9	1	0.0	8.3
9521	1095	1458	3870	54	21	7	2.3	0.6	40.8	28	8.6	11	0.0	49.5
9522	1095	12	3870	54	21	8	0.0	0.0	0.4	31	0.1	11	0.0	0.5
9540	1095	1920	3886	71	12	5	1.5	1.2	38.6	34	20.8	23	0.0	59.4
9541	1095	12	3886	71	13	4	0.0	0.0	0.2	29	0.1	23	0.0	0.3
9550	1095	56	1773	38	16	61	0.7	0.3	13.5	111	1.7	2	0.0	15.2
9560	1095	21	10000	0	6	5	0.0	0.0	0.4	29	0.0	0	0.0	0.4
9561	1095	21	10000	1	7	34	0.2	0.0	2.8	82	0.0	0	0.0	2.8
9562	1095	21	10000	3	10	45	0.2	0.0	3.7	96	0.0	1	0.0	3.7
9597	1095	1966	3666	54	16	1	0.0	0.6	8.3	1	0.8	5	0.0	9.1
9598	1095	12	3666	54	17	1	0.0	0.0	0.1	1	0.0	5	0.0	0.1
9599	1095	80	8000	1	20	0	0.0	0.0	0.1	0	0.0	0	0.0	0.1
30440	1304	1681	4010	52	11	1	0.0	0.5	7.6	1	0.5	1	0.0	8.2
30441	1304	12	4010	52	11	1	0.0	0.0	0.1	1	0.0	1	0.0	0.1
30450	1304	21	10000	3	7	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6
30520	1305	1825	3990	50	8	1	0.0	0.5	7.4	2	0.5	2	0.0	7.9
30521	1305	12	3990	50	8	1	0.0	0.0	0.0	2	0.0	2	0.0	0.1
30530	1305	21	10000	3	7	45	0.2	0.0	3.7	95	0.0	1	0.0	3.7

D.8 Construction development case results, sensitivity test, PM peak hour

Network Diagram, sensitivity test (PM peak hour)



Network results

TRANSYT Link Results Summary, sensitivity test (PM peak hour)

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
510	5	82	1729	18	16	31	0.6	0.1	10.2	79	1.8	2	0.0	11.9
520	5	1264	4069	49	15	9	2.8	0.5	46.1	44	17.2	16	0.0	63.3
521	5	13	4069	49	17	9	0.0	0.0	0.5	44	0.1	16	0.0	0.6
540	5	1778	3537	80	21	16	6.0	1.9	112.1	53	27.5	26	0.0	139.6
541	5	13	3537	80	23	19	0.1	0.0	1.0	64	0.2	26	0.0	1.2
550	5	21	10000	2	17	40	0.2	0.0	3.3	90	0.0	1	0.0	3.3
598	5	1778	8000	22	10	0	0.0	0.1	2.0	0	0.4	0	0.0	2.4
599	5	13	8000	22	16	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
3210	1372	540	1679	83	16	39	3.4	2.4	82.8	100	12.1	15	0.0	94.9
3211	1372	812	1800	59	15	8	1.1	0.7	25.5	34	7.0	8	0.0	32.6
3230	1372	902	3600	78	16	36	7.4	1.7	128.8	94	22.8	23	0.0	151.6
3231	1372	19	1544	4	16	26	0.1	0.0	2.0	70	0.4	0	0.0	2.3
3240	1372	196	1726	78	25	60	1.6	1.7	46.7	123	2.8	7	0.0	49.5
3250	1372	21	10000	0	8	10	0.1	0.0	0.8	44	0.0	0	0.0	0.8
3299	1372	1087	3732	29	9	1	0.0	0.2	2.9	1	0.2	0	0.0	3.1
3420	1394	1652	4040	47	4	1	0.0	0.4	6.4	1	0.2	1	0.0	6.7
3421	1394	13	4040	47	4	1	0.0	0.0	0.0	1	0.0	1	0.0	0.1
3430	1394	21	10000	3	8	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
3510	1375	826	3960	22	3	1	0.0	0.1	2.1	1	0.2	0	0.0	2.3

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
3520	1375	21	10000	3	6	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
3599	1375	826	8000	10	16	0	0.0	0.1	0.8	0	0.1	0	0.0	0.9
3610	1376	133	1965	21	16	27	0.9	0.1	14.2	73	2.6	3	0.0	16.9
3611	1376	123	2105	46	16	31	0.9	0.2	14.9	81	2.7	7	0.0	17.6
3612	1376	187	2105	46	17	31	1.3	0.3	22.6	81	3.7	7	0.0	26.3
3613	1376	11	1532	2	16	26	0.1	0.0	1.1	69	0.2	0	0.0	1.3
3620	1376	560	3337	77	22	24	2.1	1.6	52.4	93	6.5	15	0.0	58.9
3630	1376	180	1761	17	16	10	0.4	0.1	7.4	43	2.1	2	0.0	9.5
3631	1376	406	2318	42	16	11	1.0	0.3	17.7	45	5.0	7	0.0	22.7
3632	1376	187	2318	42	17	11	0.5	0.1	8.1	45	2.1	7	0.0	10.2
3633	1376	406	3600	27	5	3	0.2	0.1	5.0	7	0.3	1	0.0	5.3
3634	1376	187	3600	27	3	2	0.0	0.1	1.5	4	0.2	1	0.0	1.7
3640	1376	21	10000	2	10	38	0.2	0.0	3.2	88	0.0	0	0.0	3.2
3641	1376	21	10000	2	10	38	0.2	0.0	3.2	88	0.0	0	0.0	3.2
3642	1376	21	10000	2	10	40	0.2	0.0	3.3	90	0.0	1	0.0	3.3
3696	1376	858	8000	13	18	0	0.0	0.1	0.9	0	0.1	0	0.0	0.9
3697	1376	187	8000	13	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
3698	1376	406	8000	7	16	0	0.0	0.0	0.4	0	0.0	0	0.0	0.4
3699	1376	187	8000	7	17	0	0.0	0.0	0.2	0	0.0	0	0.0	0.2
4140	1451	1559	3870	47	9	1	0.0	0.4	6.3	1	0.4	0	0.0	6.7
4141	1451	13	3870	47	10	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
4150	1451	21	10000	3	6	45	0.2	0.0	3.7	95	0.0	1	0.0	3.7
4220	1452	1652	3730	50	16	1	0.0	0.5	7.8	3	0.9	1	0.0	8.7
4221	1452	13	3730	50	16	1	0.0	0.0	0.1	3	0.0	1	0.0	0.1
4230	1452	21	10000	3	8	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6
4810	1048	429	3048	82	8	52	4.1	2.1	87.9	100	6.1	12	0.0	94.0
4811	1048	13	3048	82	33	60	0.2	0.1	3.1	107	0.4	12	0.0	3.4
4812	1048	1222	2172	93	8	35	5.7	6.0	166.6	90	15.6	26	0.0	182.3
4830	1048	1009	3732	79	9	12	1.5	1.8	47.5	36	10.7	13	0.0	58.1
4831	1048	78	1622	24	9	57	1.1	0.2	17.4	101	2.2	2	0.0	19.6
4840	1048	266	1888	71	16	52	2.7	1.2	54.9	106	7.6	8	0.0	62.5
4841	1048	413	1675	90	16	67	3.8	3.9	109.4	125	14.0	15	0.0	123.3
4842	1048	13	1675	90	18	67	0.1	0.1	3.4	125	0.4	15	0.0	3.8
4850	1048	21	10000	1	7	30	0.2	0.0	2.5	78	0.0	0	0.0	2.5
4851	1048	21	10000	0	5	13	0.1	0.0	1.1	50	0.0	0	0.0	1.1
4852	1048	21	10000	0	5	5	0.0	0.0	0.4	31	0.0	0	0.0	0.4
4853	1048	21	10000	1	16	28	0.2	0.0	2.3	75	0.0	0	0.0	2.3
4854	1048	21	10000	1	6	34	0.2	0.0	2.9	83	0.0	0	0.0	2.9
4898	1048	508	8000	7	20	0	0.0	0.0	0.5	0	0.0	0	0.0	0.5
4899	1048	13	8000	7	21	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
5020	530	1652	3800	44	15	1	0.0	0.4	5.5	1	0.2	0	0.0	5.7
5021	530	13	3800	44	12	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
5040	530	1559	3800	41	16	1	0.0	0.3	5.0	1	0.3	0	0.0	5.3
5041	530	13	3800	41	45	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
5110	1541	1357	3800	42	5	1	0.1	0.4	6.9	5	0.8	2	0.0	7.7
5120	1541	21	10000	3	5	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
5310	1583	339	1684	26	16	5	0.3	0.2	6.3	26	2.4	3	0.0	8.7
5320	1583	21	10000	3	6	46	0.3	0.0	3.8	97	0.0	1	0.0	3.8
5720	1507	279	1651	74	11	45	2.1	1.4	49.0	108	7.8	8	0.0	56.8
5721	1507	1533	3922	53	12	8	2.6	0.6	45.6	41	15.4	17	0.0	61.0
5722	1507	13	3922	53	12	11	0.0	0.0	0.5	58	0.2	17	0.0	0.7
5740	1507	778	1833	65	4	6	0.5	0.9	19.6	31	6.5	8	0.0	26.1
5741	1507	632	1833	51	4	4	0.2	0.5	10.7	21	3.6	5	0.0	14.3
5742	1507	13	1833	51	4	4	0.0	0.0	0.2	17	0.1	5	0.0	0.2
5743	1507	211	1744	18	4	3	0.1	0.1	2.6	15	0.9	1	0.0	3.5
5750	1507	21	10000	0	6	7	0.0	0.0	0.6	36	0.0	0	0.0	0.6
5751	1507	21	10000	1	15	29	0.2	0.0	2.4	77	0.0	0	0.0	2.4
5752	1507	21	10000	1	5	29	0.2	0.0	2.4	77	0.0	0	0.0	2.4
5799	1507	490	8000	6	17	0	0.0	0.0	0.5	0	0.0	0	0.0	0.5
9410	1094	301	2811	69	15	47	2.9	1.1	56.1	103	3.1	8	0.0	59.2
9420	1094	1773	4050	60	21	4	1.0	0.7	25.1	24	11.3	17	0.0	36.5
9421	1094	13	4050	60	40	5	0.0	0.0	0.3	26	0.1	17	0.0	0.4
9440	1094	1411	3477	55	6	2	0.1	0.6	9.4	4	2.1	3	0.0	11.5

Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
9441	1094	13	3477	55	31	5	0.0	0.0	0.2	19	0.1	3	0.0	0.3
9450	1094	21	10000	0	14	4	0.0	0.0	0.3	26	0.0	0	0.0	0.3
9510	1095	120	1970	45	16	51	1.3	0.4	23.9	101	3.3	3	0.0	27.2
9520	1095	12	1659	33	21	105	0.1	0.2	5.0	141	0.4	1	0.0	5.4
9521	1095	1521	3931	63	21	10	3.4	0.9	60.9	58	18.7	24	0.0	79.6
9522	1095	13	3931	63	21	8	0.0	0.0	0.4	42	0.1	24	0.0	0.5
9540	1095	1559	3886	66	12	11	3.8	1.0	67.9	30	14.9	13	0.0	82.8
9541	1095	13	3886	66	13	10	0.0	0.0	0.5	28	0.1	13	0.0	0.6
9550	1095	86	1773	58	16	71	1.0	0.7	24.1	122	2.8	3	0.0	26.9
9560	1095	21	10000	0	6	5	0.0	0.0	0.4	29	0.0	0	0.0	0.4
9561	1095	21	10000	1	7	34	0.2	0.0	2.8	82	0.0	0	0.0	2.8
9562	1095	21	10000	3	10	45	0.2	0.0	3.7	96	0.0	1	0.0	3.7
9597	1095	1621	3666	45	16	1	0.0	0.4	5.7	1	0.5	0	0.0	6.1
9598	1095	13	3666	45	17	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
9599	1095	25	8000	0	20	0	0.0	0.0	0.0	0	0.0	0	0.0	0.0
30440	1304	1411	4010	44	11	1	0.0	0.4	5.6	1	0.5	0	0.0	6.1
30441	1304	13	4010	44	11	1	0.0	0.0	0.0	1	0.0	0	0.0	0.1
30450	1304	21	10000	3	7	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6
30520	1305	1812	3990	54	8	2	0.2	0.6	11.5	10	2.6	6	0.0	14.1
30521	1305	13	3990	54	8	2	0.0	0.0	0.1	19	0.1	6	0.0	0.2
30530	1305	21	10000	3	7	44	0.2	0.0	3.6	94	0.0	1	0.0	3.6

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Appendix E: Accident analysis

E.1 Existing highway safety analysis

E.1.1 Details of road traffic accident within the vicinity of the site have been obtained from Transport for London (TfL) and have been reviewed to determine whether there are particular problems or trends on the local highway network.

E.1.2 Data on accidents for the most recent five-year period from April 2006 until March 2011 has been analysed for the following junctions and surrounding roads:

a. Victoria Embankment (A3211) between the junction with Horse Guards Avenue and the entrance to Embankment Garden

b. Northumberland Avenue (A400) between the junction with Victoria Embankment (A3211) and the junction with Whitehall Place

c. Victoria Embankment (A3211) / Northumberland Avenue (A400) junction

d. Victoria Embankment (A3211) / Horse Guards Avenue junction

e. Northumberland Avenue (A308) / Whitehall Place junction.

E.1.3 Based on the DfT Design Manual for Roads and Bridges, Volume 13 Economic Assessment of Road Schemes, accidents have been analysed according to the method outlined in this guidance which states that accidents that have occurred within 20m of each junction are associated with that specific junction, and the remaining accidents are grouped to the relevant links.

E.1.4 The area of interest together with the locations of the recorded road traffic accidents and the severity of the accidents are indicated in Table E.1.

Table E.1 Accident severity 2006 to 2011

Location	Slight	Serious	Fatal	Total
Victoria Embankment (A3211)*	12	6	0	18
Northumberland Avenue (A400)**	1	0	0	1
Victoria Embankment (A3211) / Northumberland Avenue (A400) junction	18	0	0	18
Victoria Embankment (A3211) / Horse Guards Avenue junction	6	2	0	8
Northumberland Avenue (A400) / Whitehall Place junction	4	0	0	4
Total	**41**	**8**	**0**	**49**

*Note: * Victoria Embankment (A3211) between the junction with Horse Guards Avenue and the entrance to Embankment Garden.*

***Northumberland Avenue (A400) between the junctions with Victoria Embankment (A3211) and Whitehall Place.*

E.1.5 A total of eight serious accidents and 41 slight accidents occurred in the Victoria Embankment Foreshore assessment area over the five years for which accident data was obtained and analysed. There were no fatal accidents.

E.1.6 Road traffic accident analysis for individual junctions and roads within the vicinity of the site is discussed below.

Victoria Embankment (A3211)

E.1.7 Victoria Embankment (A3211) is a wide dual carriageway with a 30mph speed limit. The road links to Upper Thames Street (A3211) 1.4km to the northeast, and Bridge Street (A302) and Westminster Bridge (A302) 500m to the southwest.

E.1.8 On Victoria Embankment (A3211) between the junction with Horse Guards Avenue and the entrance to Embankment Gardens there have been a total of 44 accidents including those at the junctions. The junctions associated with this stretch of the road includes:

a. Victoria Embankment (A3211) / Northumberland Avenue (A400) junction

b. Victoria Embankment (A3211) / Horse Guards Avenue junction.

E.1.9 Of the total 44 accidents, 18 accidents occurred at the junction with Northumberland Avenue (A400) and eight at the junction with Horse Guards Avenue.

E.1.10 The remaining 18 accidents occurred along Victoria Embankment (A3211) away from junctions, with two happened to the south of the junction with Northumberland Avenue (A400) unto the junction with Horse Guards Avenue and the remaining 16 accidents happened to the north of the junction unto the entrance to Embankment Garden.

E.1.11 Of the total 44 accidents, eight were recorded as serious with the majority (five accidents) occurred along Victoria Embankment (A3211) to the north of the junction with Northumberland Avenue (A400) outside Embankment Underground station.

E.1.12 One serious accident occurred to the south of the junction of Victoria Embankment (A3211) / Northumberland Avenue (A400), and three serious accidents occurred at the junction of Victoria Embankment (A3211) / Horse Guards Avenue.

E.1.13 All the serious accidents involved pedestrians hit by cars, motorcycles, pedal cycles, and a taxi. The major contributory factors to the serious accidents were not looking properly and reckless driving.

E.1.14 Of the serious accidents occurred along Victoria Embankment (A3211) and at the junctions associated, none happened as a result of the road geometry.

E.1.15 The remaining 36 accidents were classified as slight with 12 accidents occurred away from the junctions along Victoria Embankment (A3211) and

the remaining 24 accidents happened at the junctions, with the majority occurred at the junction of Victoria Embankment (A3211) / Northumberland Avenue (A400).

E.1.16 Of the total slight accidents, eight involved pedestrians. Half of them were hit along Victoria Embankment (A3211) to the north of the junction with Northumberland Avenue (A400) of whom three were hit by taxis and one was hit by a car. Failing to look properly, reckless driving, and failing to judge the other vehicle's path or speed were the main causes of the accidents.

E.1.17 The other four pedestrians were hit at the junction of Victoria Embankment (A3211) / Northumberland Avenue (A400) by cars, a motorcycle and a bus/coach. The major contributory factors to the accidents were driving recklessly and not looking properly.

E.1.18 Three slight accidents involved pedal cycles, one collided with a light goods vehicle (LGV) at the junction of Victoria Embankment (A3211) / Horse Guards Avenue, two cyclists were involved in an accident at the junction of Victoria Embankment (A3211) / Northumberland Avenue (A400) when a car turned left across path of cyclists, and one was hit along Victoria Embankment (A3211) to the north of the junction with Northumberland Avenue (A400) when all vehicles were stationary at the junction and a medium goods vehicle (MGV) and a bus/coach pulled away trapping the pedal cycle in-between. Not looking properly, making poor manoeuvres and passing too close to cyclists were the main causes of the accidents.

E.1.19 Three of the slight accidents involved LGVs colliding with a taxi, a car, and a motorcycle. Two of the accidents happened at the junction of Victoria Embankment (A3211) / Horse Guards Avenue and one occurred to the north of the junction of Victoria Embankment (A3211) / Northumberland Avenue (A400).

E.1.20 There was an accident which involved a MGV and a motorcycle along Victoria Embankment (A3211) to the north of the junction with Northumberland Avenue (A400). The accident was mainly caused by the MGV not looking properly and making poor manoeuvres.

E.1.21 The remaining 21 slight accidents involved cars, taxis, buses/coaches, and motorcycles with the majority occurred at the junction of Victoria Embankment (A3211) and Northumberland Avenue (A400). The accidents were mainly caused by reckless driving, not looking properly, poor manoeuvring, and travelling too fast for conditions.

E.1.22 Of the slight accidents occurred along Victoria Embankment (A3211) and at the junctions associated, none happened as a result of the road geometry.

Northumberland Avenue (A400)

E.1.23 Northumberland Avenue (A400) is an east-west route which lies to the west of the site. To the east, the two-way street meets Victoria Embankment (A3211) at a signalised junction and to the northwest it leads to Trafalgar Square.

E.1.24 Northumberland Avenue (A400) within the assessment area is between the junction with Victoria Embankment (A3211) and the junction with Whitehall Place. The only junction within the study area is Northumberland Avenue (A400) / Whitehall Place junction.

E.1.25 Of the five year accident data analysed, one accident occurred along Northumberland Avenue (A400) to the west of the junction with Victoria Embankment (A3211). The accident recorded as slight and involved a car and a motorcycle. The accident was caused by not looking properly and making poor manoeuvres.

E.1.26 There were four accidents occurred at the junction of Northumberland Avenue (A400) and Whitehall Place and all were classified as slight. Two of the accidents involved pedestrians of whom one was hit by a bus/coach and one was hit by a taxi. In both accidents the pedestrians did not look properly and in the accident in which the pedestrian hit by a bus/coach, the road layout was one of the contributory factors due to the shared surface at the junction.

E.2 Summary and conclusion

E.2.1 Of the five year accident data analysed, the largest number of road traffic accidents occurred along Victoria Embankment (A3211) at the junction with Northumberland Avenue (A400) and to the north of the junction outside Embankment Underground station, with five serious accidents and 29 slight accidents.

E.2.2 In total eight serious accidents happened in the assessment area with no fatal accident over the five year accident data analysed. All the serious accidents involved pedestrians hit by cars, motorcycles, pedal cycles, and a taxi. The majority of the serious accidents occurred outside Embankment Underground station.

E.2.3 Of the remaining accidents, one occurred to the south of the junction of Victoria Embankment (A3211) / Northumberland Avenue (A400), and three at the junction of Victoria Embankment (A3211) / Horse Guards Avenue. None of the serious accidents happened as a result of the road geometry.

E.2.4 Of the total accidents, three involved LGVs and two involved MGVs, all of which were slight accidents.

E.2.5 In total, 18 pedestrians were involved in the accidents. Of these eight were recorded as serious and ten as slight accidents. Of the total accidents, three accidents involved cyclists of which all were classified as slight

E.2.6 Of the five year accident data analysed, one accident happened as a result of the road layout. The accident involved a pedestrian and a bus/coach at the junction of Northumberland Avenue (A400) and Whitehall Place. The accident could be happened due to the share surface at the junction.

Appendix F: Road Safety Audits

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Thames Water Utilities Limited

Thames Tideway Tunnel - Victoria Embankment Foreshore

Stage 1 Road Safety Audit

Project Ref: 27016/066

Doc Ref: 001

15th February 2013

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Document Control Sheet

Project Name: **Thames Tideway Tunnel - Victoria Embankment Foreshore**

Project Ref: **27016/066**

Report Title: **Stage 1 Road Safety Audit**

Doc Ref: **001**

Date: **15th February 2013**

	Name	Position	Signature	Date
Prepared by:	Matthew Fleming	Technician Grade 1		15th February 2013
Reviewed by:	Simon Owen	Principal Technician		15th February 2013
Approved by:	Alan Fry	Divisional Director		15th February 2013
For and on behalf of Peter Brett Associates LLP				

Revision	Date	Description	Prepared	Reviewed	Approved
-	18/02/13	Client Issue	MF	SO	AF

Contents

Appendices

1 Introduction

1.1 Peter Brett Associates LLP have been commissioned to undertake a series of Stage 1 Road Safety Audits on proposals associated with the construction of the Thames Tideway Tunnel project in London.

1.2 This Audit has been undertaken on the highway aspects of the proposal at Victoria Embankment, Westminster site and considers both the situation during the construction phase and post construction. At this location new temporary and permanent river walls will be created to retain a construction site platform and permanent maintenance site platform within the River Thames.

1.3 The surrounding highway network is urban in nature, within a 30mph speed limit, is illuminated by a system of street lighting, with footways on both sides of the carriageway.

1.4 The scheme proposals that affect the existing highway consist of the following design aspects:-

- Construction Phases:-
    - Suspending some existing parking bays along Victoria Embankment in order to accommodate the passage of large delivery vehicles accessing the site;
    - Realigning of southbound lanes around temporary works;
    - Implementing pedestrian diversion route along Victoria Embankment;
    - Higher construction vehicle flows expected, with 12hr working used during tunnel drive operations;
- Operational Phase:-
    - Highway layout to be returned to its current layout i.e. parking bays reinstated and pedestrian diversion removed;
    - 6 monthly maintenance access required by transit van;
    - 10 yearly maintenance required by rigid HCV / mobile crane – parking bays suspended as required for short term maintenance activity;

1.5 The Audit Team Membership was as follows:-

Audit Team Leader:-

Matthew Fleming Peter Brett Associates, Taunton

Team member:-

Simon Owen Peter Brett Associates, Reading

The Audit Team are independent of the Design Team.

1.6 The Audit took place during December 2012 to February 2013. The Audit Team visited the site on 12th December 2012 between 10:00 and 10:45. The weather during the site visit was cold and overcast. The Audit comprises of an examination of the documents listed in Appendix A.

1.7 The Audit Team have not been made aware of any Departure from Standards identified with this proposed scheme. The Audit Team have not been provided with a specific Audit Brief but have received a number of documents that are describing the proposed works.

1.8 The Audit Team have received a document summarising the recorded collision data within the surrounding highway network for a 5 year period (April 2006 to March 2011). The Audit Team have not been provided with the raw collision data, therefore, a full review and analysis of the recorded collisions cannot be undertaken as part of this Audit.

1.9 The Terms of Reference of this Audit are as described in Transport for London (TfL) Procedure SQA-0170. The Audit Team has examined and reported only on the road safety implications of the scheme as presented and has not examined or verified the compliance of the designs to any other criteria. However, to clearly explain a safety problem or the recommendation to resolve a problem the Audit Team may, on occasion, have referred to a design standard without touching on technical Audit.

1.10 This Audit has a maximum shelf life of 2 years. Should the scheme not progress to the next stage in its development within this period it should be re-audited.

1.11 Problems identified in the report are indicated by location and are shown on the site reference plan in Appendix B.

2 Items Raised from this Stage 1 Road Safety Audit

Construction Phase

2.1 Problem

Location - General

Summary - Conflict through traffic management southbound

The proposed arrangement of traffic management, (with potential sharp changes of direction, inadequate clearance from vehicle running lanes, gates adjacent to vehicle running lanes, short taper lengths, reduced number of lanes, reduced lane width and physical obstructions) and the high volume of large vehicles and cycles within the general traffic and generally high vehicle speeds observed during the site visit, may give rise to the following potential problems when considered independently and/or in combination with the onerous swept path movements of the construction design vehicles:

- Conflict between vehicles and cyclists
- Conflict between construction traffic and general traffic, when accessing and egressing the public highway
- Conflict between all vehicles and temporary traffic management street furniture
- Conflict between all vehicles and site operatives

The stated design speed of the vehicle swept paths is 5 km/h. It is unlikely that the movements between differing vehicles will be 5 km/h. Therefore, it is unclear whether the swept paths indicated are realistic. Some phases indicate that large vehicles entering / exiting the site will pass into adjacent live vehicle lanes, may not clear the carriageway and may cause other vehicles to make injudicious manoeuvres to avoid collision.

Recommendation

Notwithstanding the fact that the swept path analysis has been undertaken using Ordnance Survey data (and not topographical survey data), the speeds at which the Design Vehicles are undertaking the described manoeuvres are indicated as 5 km/h Whilst 5 km/h may be applicable for some of the movements shown this speed will not apply to all of them. Therefore, it is unclear whether all the swept paths indicated are realistic. These speeds need to be appropriate and realistic for the manoeuvres being undertaken. The existing swept paths should be repeated and new swept paths carried out in order to confirm that all manoeuvres can be completed safely at realistic speeds. The Design Team should also consider the following when determining the feasibility of vehicle movements:

- Test all individual and vehicle combinations / simultaneous swept path movements through the temporary traffic management and site access/exit
- Safe passing width to temporary traffic management and both existing and temporary street furniture
- Safe passing width to construction working zones
- Safe passing width to operational working zones of plant (for example the footprint of a mobile crane will be larger with its stabilisers down, can this be safely accommodated within the hoarding)
- Completing manoeuvres in one movement to clear carriageway
- The effect of slowing / turning manoeuvres on other vehicles in carriageway.

Lane widths through the traffic management should be appropriate to accommodate cyclists safely.

2.2 Problem

Location - Central reserve

Summary - Conflict between opposing vehicle flows.

The proposals indicate that heavy goods vehicles will be expected to proceed along Victoria Embankment and enter the site via a dedicated entrance to the north. The existing two lanes heading southbound will be realigned to enable the hoarding to be erected. The existing kerbed central reserve, separating the opposing vehicle flows in adjacent dual carriageways is shown as being narrowed or removed completely and replaced with traffic barrier of an unspecified nature. This is likely to increase the risk of conflict between opposing vehicles increasing the risk of conflict between users in both carriageways. Furthermore, existing street furniture in the central reserve will have reduced or no clearance to passing vehicles increasing the risk of becoming an obstruction.

Recommendation

Review the proposal to narrow / remove the central reserve and ensure that sufficient carriageway space is retained to afford safe passing space between all vehicles and street furniture / temporary traffic barriers etc.

2.3 Problem

Location - Site Access

Summary - Pedestrian diversion route could put pedestrians at risk

The proposals indicate that a section of footway along the site frontage is to be closed and safety hoarding erected. The footway is to be diverted onto the opposite side then back onto the eastern side of Victoria Embankment. The following points have been identified with the diversion and its application:

- The diversion route signs may be obstructed by existing trees resulting in pedestrians missing diversion signs and crossing the carriageway is places not envisaged by the engineer
- The existing crossings proposed to be utilised by the pedestrian diversion route add a significant amount of delay to pedestrians. This could result in pedestrians not crossing the carriageway is places not envisaged by the engineer
- Inconsistent use of blister paving through junctions along the diversion route may result in confusion of visually impaired pedestrians potentially putting them at risk from other road users
- There are instances of uneven surfaces and paving slabs that are not flush which could trip pedestrians.

Recommendation

Careful consideration must be given to the requirements of pedestrians through the intended diversion route making allowances to the mobility/visually impaired who might be expected to utilise the existing footway. Instances of potential confusion and conflict should be considered and appropriate measures utilised to minimise/eliminate where possible.

2.4 Problem

Location	-	Victoria Embankment
Summary signals	-	Position of traffic barrier could block visibility on to traffic

The traffic barrier for the temporary traffic management is not specified and could block the forward visibility onto the traffic signals of Victoria Embankment/Horse Guards Avenue for southbound vehicles which may not afford drivers/riders sufficient time to react and /or manoeuvre safely which could put them at risk or in conflict with other road users.

Recommendation

It is recommended that the visibility onto the traffic signals of Victoria Embankment/Horse Guards Avenue is not compromised.

2.5

Location	-	Displaced Coach Parking on Millbank and Albert Embankment
Summary	-	Obstructions to pedestrians

The proposed coach parking bays are adjacent to various items of street furniture close to the edge of the carriageway, which may obstruct the safe pedestrian access / egress to and from the coach.

Recommendation

The design team should consider the existing street furniture when determining the number and precise location of proposed parking bays. If necessary, street furniture should be relocated to avoid conflict.

2.6

Location	-	Displaced Coach Parking on Lambeth Palace Road and Albert Embankment
Summary	-	Obstruction of existing bus stops

The location of the temporary coach parking is located in close proximity to existing bus stops. Buses approaching these stops may have to make onerous manoeuvres around coaches that could cause additional delay and potentially result in vulnerable road users having to negotiate buses which could be straddling multiple lanes.

Recommendation

Existing bus stops should remain accessible without onerous manoeuvres by buses or said bus stops should be temporarily relocated/suspended.

2.7 Location - Displaced Coach Parking on Albert Embankment

Summary - Obstruction of traffic signals

The location of the temporary coach bays are in close proximity to existing traffic signals. The long durations that coaches could reside at the bays will reduce the forward visibility beyond just a momentary loss of visibility. Vehicles approaching the traffic signals may not be able to observe their state and could result in late decisions leading to either loss of control or conflict with other road users.

Recommendation
Ensure adequate forward visibility onto traffic signals.

2.8 Location - Displaced Coach Parking on Lambeth Palace Road

Summary - Lack of pedestrian crossing facilities could put pedestrians at risk.

The information provided has not identified if waiting coaches will be picking up/dropping off. If coaches are picking and dropping off at this location then pedestrians may look to cross Lambeth Palace Road. As there are no pedestrian crossing facilities near the coach bays they may cross the live carriageway possible putting them at risk from other road users.

Recommendation
Provide a suitable place to cross Lambeth Palace Road near the proposed coach bays if coaches are expected to pick up/drop off passengers.

Operational Phase (Post Construction)

2.9 Problem

Location - Permanent Vehicle Access

Summary - Conflict for all users

The proposed permanent maintenance access is indicated as a vehicle footpath crossing between the southbound carriageway of Victoria Embankment and the parapet river wall. The proposals do not indicate how this access will be secured or how unauthorised vehicle access may be restricted, but if a gate or bollards is provided along the line of the existing parapet wall it will not provide adequate space for a vehicle to clear the carriageway and as such may obstruct westbound vehicles. Furthermore, pedestrians may be required to walk in the carriageway to continue their journey.

Recommendation

Provision of a gate or other vehicle restriction and this access arrangement in general should be such that all vehicles required to access the site can clear the highway and footway in one movement.

2.10 Problem

Location - Permanent Vehicle Access

Summary - Conflict for all users

The proposed site access location is adjacent to large trees parking provision for large vehicles that are likely to obstruct intervisibility between all users and vehicles entering and exiting the site. Obstructed intervisibility may increase the risk of conflict due to difficulties anticipating the presence and movements of other users. This may be exacerbated by the potential for ad-hoc unscheduled use of this access as a pull-in / drop off outside of the scheduled movements of maintenance vehicles.

Recommendation

The permanent access arrangement should be designed to ensure that adequate intervisibility can be afforded for all users and vehicle movements associated with the proposed access.

2.11 Problem

Location - Permanent Vehicle Access

Summary - Conflict for all users

The proposed site access swept paths indicate vehicle entering and exiting the site but do not indicate the full turning manoeuvre on the site itself. It is therefore not clear if vehicles can exit the site in a forward gear. Should vehicles be required to reverse from the site the risk of conflict to all users will significantly increase.

Recommendation

The proposals must ensure that the largest anticipated vehicles can enter and exit the site in a forward gear.

2.12 Problem

Location - Victoria Embankment

Summary - Conflict for all users

The proposed permanent works layout indicates a zone within which permanent above ground structures would be located along Victoria Embankment in line with the works on the river side of the river wall. Other than general notes about ventilation columns no other detail has been provided about equipment being located in this area. The positioning of equipment

could obstruct the footway or generate narrowing's, could block visibility splays and could be in close proximity to passing vehicles on Victoria Embankment.

Recommendation

It is recommended that sufficient space and visibility is maintained to allow pedestrians and vehicles to pass safely.

Audit Team Statement

We certify that we have examined the drawings and documents listed in Appendix A to this Road Safety Audit Report. The Road Safety Audit has been carried out within the sole purpose of identifying any feature that could be removed or modified in order to improve the safety of the scheme. The problems identified have been noted in this report together with associated suggestions for safety improvements that we recommend should be studied for implementation.

No one on the Audit Team has been involved with the design of the measures.

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Signed: 

Position: Principal Engineer

Date: 15th February 2013

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Name: Simon Owen

Signed: 

Position: Senior Engineer

Date: 15th February 2013

Organisation: Peter Brett Associates

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Appendix A

Appendix A

Information Utilised in this Stage 1 Road Safety Audit:-

- Figure 17.2.1 – Transport – Site Location Plan;
- Figure 17.2.2 – Transport – Construction Traffic Routes;
- Figure 17.4.9 – Transport – Accident Locations;
- DCO-PP-16X-VCTEF-180005 – Access Plan;
- DCO-PP-16X-VCTEF-180010 – Permanent Works Layout;
- DCO-PP-16X-VCTEF-180028 – Construction Phases – Phase 1 Site Setup;
- DCO-PP-16X-VCTEF-180029 – Construction Phases – Phase 2 Shaft Construction and tunnelling;
- DCO-PP-16X-VCTEF-180030 – Construction Phases – Phase 3 Construction of other structures;
- DCO-PP-16X-VCTEF-180031 – Construction Phases – Phase 4 Site Demobilisation;
- DCO-PP-16X-VCTEF-180035 – Existing Highway Layout;
- DCO-PP-16X-VCTEF-180036 – Existing Highway Layout – Millbank;
- DCO-PP-16X-VCTEF-180037 – Existing Highway Layout – Albert Embankment;
- DCO-PP-16X-VCTEF-180038 – Existing Highway Layout – Lambeth Palace Road;
- DCO-PP-16X-VCTEF-180039 – Highway Layout During Utility Diversion;
- DCO-PP-16X-VCTEF-180040 – Highway Layout During Construction Phases 1-5;
- DCO-PP-16X-VCTEF-180041 – Relocated Coach Bays During Construction – Albert Embankment;
- DCO-PP-16X-VCTEF-180042 – Relocated Coach Bays – Lambeth Palace Road;
- DCO-PP-16X-VCTEF-180043 – Highway Layout During Construction – Coach Bays on Millbank;
- DCO-PP-16X-VCTEF-180044 – Permanent Highway Layout;
- DCO-PP-16X-VCTEF-180045 – Highway Layout During Construction – Vehicle Swept Path Analysis;
- DCO-PP-16X-VCTEF180046 – Permanent Highway Layout – Vehicle Swept Path Analysis;
- 2012-12-10_Thames Tideway Tunnel_Highway Mitigation Plan_Summary Notes_Central Sites
- Accident Data– Victoria Embankment
- Victoria Embankment Foreshore facility and Amenity Plan

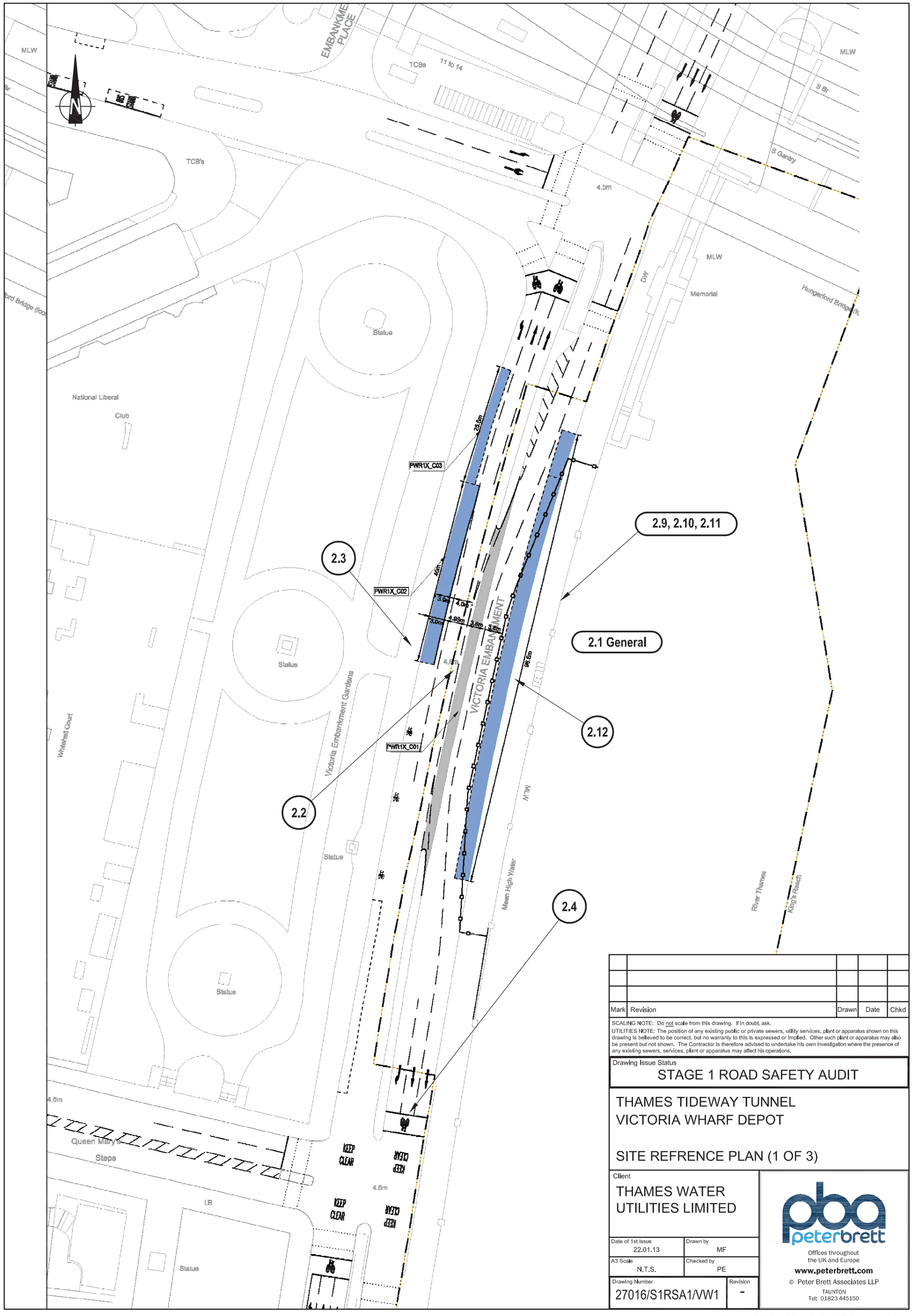
NB Some of the above drawings indicate a note that states ‘See Schedule of Works’. The Audit Team have not been provided with this Schedule.

Appendix B

Appendix B

Site Reference Plans

27016/S1RSA1/VW1, 27016/S1RSA1/VW2, 27016/S1RSA1/VW3



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SCALING NOTE: Do not scale from this drawing. If in doubt, ask.

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake his own investigation where the presence of any existing sewers, services, plant or apparatus may affect his operations.

Drawing Issue Status

STAGE 1 ROAD SAFETY AUDIT

THAMES TIDEWAY TUNNEL
VICTORIA WHARF DEPOT

SITE REFRENCE PLAN (1 OF 3)

Client

THAMES WATER UTILITIES LIMITED

Date of 1st Issue: 22.01.13	Drawn by: MF
A3 Scale: N.T.S.	Checked by: PE
Drawing Number: 27016/S1RSA1/VW1	Revision: -

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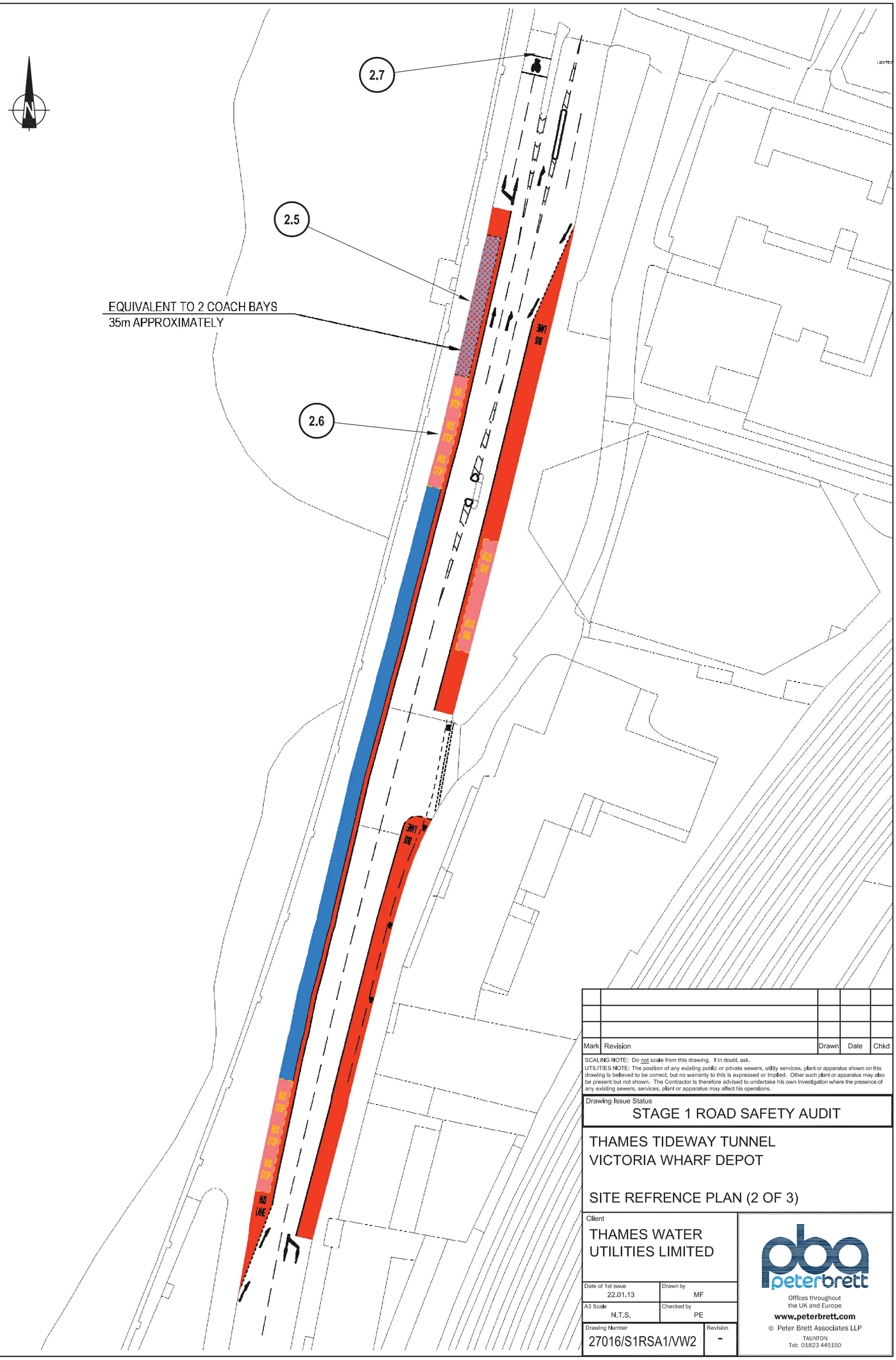

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Drawing Issue Status

STAGE 1 ROAD SAFETY AUDIT

THAMES TIDEWAY TUNNEL
VICTORIA WHARF DEPOT

SITE REFRENCE PLAN (2 OF 3)

Client

THAMES WATER UTILITIES LIMITED

Date of 1st Issue: 22.01.13	Drawn by: MF
A3 Scale: N.T.S.	Checked by: PE
Drawing Number: 27016/S1RSA1/VW2	Revision: -

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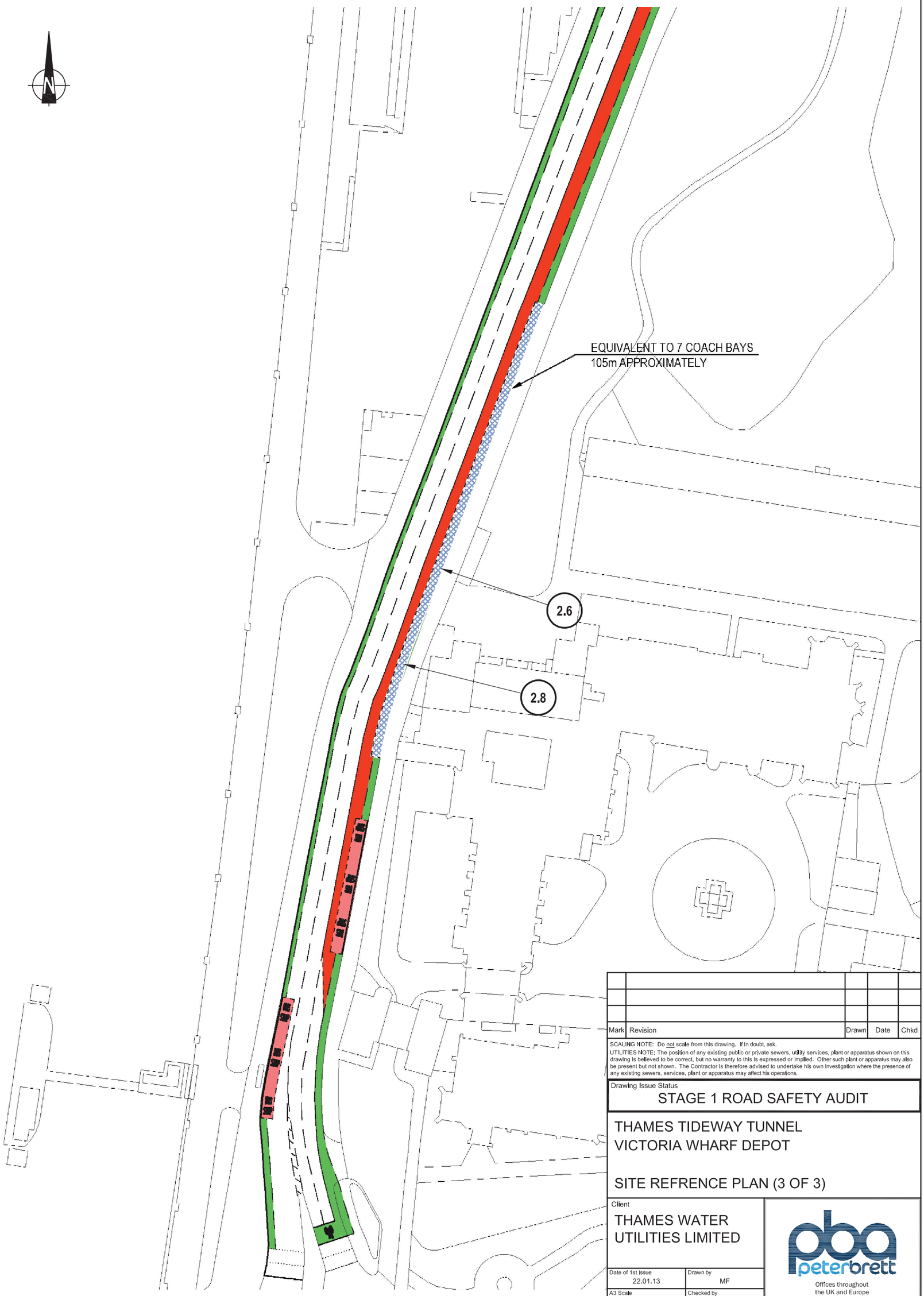

Mark	Revision	Drawn	Date	Chkd

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Drawing Issue Status

STAGE 1 ROAD SAFETY AUDIT

THAMES TIDEWAY TUNNEL
VICTORIA WHARF DEPOT

SITE REFRENCE PLAN (3 OF 3)

Client

THAMES WATER UTILITIES LIMITED

Date of 1st Issue	Drawn by
22.01.13	MF
A3 Scale	Checked by
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Drawing Number	Revision
27016/S1RSA1/VW3	-

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Technical Note

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cc		File reference	211146
Prepared by	F Jahanshahi	Date	15 February 2013
Subject	RSA Stage 1 - Designers response for Victoria Embankment Foreshore		

1 Introduction

This report is the Designer's Response to the Stage 1 Road Safety Audit Report for Victoria Embankment Foreshore completed on 15 February 2012.

2 Responses to the items arising from the Stage 1 Road Safety Audit

2.1 Problem –

Location: *General*

Summary: *Conflict through traffic management southbound*

Description: The proposed arrangement of traffic management, (with potential sharp changes of direction, inadequate clearance from vehicle running lanes, gates adjacent to vehicle running lanes, short taper lengths, reduced number of lanes, reduced lane width and physical obstructions) and the high volume of large vehicles and cycles within the general traffic and generally high vehicle speeds observed during the site visit, may give rise to the following potential problems when considered independently and/or in combination with the onerous swept path movements of the construction design vehicles:

- Conflict between vehicles and cyclists
- Conflict between construction traffic and general traffic, when accessing and egressing the public highway
- Conflict between all vehicles and temporary traffic management street furniture
- Conflict between all vehicles and site operatives

The stated design speed of the vehicle swept paths is 5 km/h. It is unlikely that the movements between differing vehicles will be 5 km/h. Therefore, it is unclear whether the swept paths indicated are realistic. Some phases indicate that large vehicles entering / exiting the site will pass into

adjacent live vehicle lanes, may not clear the carriageway and may cause other vehicles to make injudicious manoeuvres to avoid collision.

Recommendation: Notwithstanding the fact that the swept path analysis has been undertaken using Ordnance Survey data (and not topographical survey data), the speeds at which the Design Vehicles are undertaking the described manoeuvres are indicated as 5 km/h Whilst 5 km/h may be applicable for some of the movements shown this speed will not apply to all of them. Therefore, it is unclear whether all the swept paths indicated are realistic. These speeds need to be appropriate and realistic for the manoeuvres being undertaken. The existing swept paths should be repeated and new swept paths carried out in order to confirm that all manoeuvres can be completed safely at realistic speeds. The Design Team should also consider the following when determining the feasibility of vehicle movements:

- Test all individual and vehicle combinations / simultaneous swept path movements through the temporary traffic management and site access/exit
- Safe passing width to temporary traffic management and both existing and temporary street furniture
- Safe passing width to construction working zones
- Safe passing width to operational working zones of plant (for example the footprint of a mobile crane will be larger with its stabilisers down, can this be safely accommodated within the hoarding)
- Completing manoeuvres in one movement to clear carriageway
- The effect of slowing / turning manoeuvres on other vehicles in carriageway

Lane widths through the traffic management should be appropriate to accommodate cyclists safely.

Designer's response

Recommendations noted. The vehicle swept path analysis will be reviewed at detail design (stage 2) to ensure all manoeuvres, both individual and in combination, can be completed and suitable passing widths are provided at the work sites.

During the construction period, an intermittent lane closure would be required in the southbound carriageway of Victoria Embankment (A3211) to accommodate construction vehicles arriving at and departing from the site. This would result in the segregation of cyclists from the construction vehicles waiting at site access points. Although temporary changes would be made to the highway layout, cyclists would remain on the carriageway and minimum lane widths of 3.25m for the inside lanes in both directions would be maintained. In addition, appropriate signage would be provided to warn cyclists of the presence of large vehicles.

Measures set out in the *CoCP* described in the Victoria Embankment Foreshore *Transport Assessment* include increasing driver awareness of restrictions on the road network and marshalling of traffic at the site access. During all construction work and on any section of road subject to temporary diversions or restrictions imposed by roadworks associated with the Victoria Embankment Foreshore site, the risk to all road users would be managed by the contractor(s) in accordance with the provision made under the Traffic Signs Manual Chapter 8 – Traffic Safety Measures and Signs for Road Works. This would include compliance with TfL guidance (Cyclists at Roadworks - Guidance) to ensure safe passage for cyclists.

2.2 Problem –

Location: *Central reserve*

Summary: ***C****onflict between opposing vehicle flows*

Description: The proposals indicate that heavy goods vehicles will be expected to proceed along Victoria Embankment and enter the site via a dedicated entrance to the north. The existing two lanes heading southbound will be realigned to enable the hoarding to be erected. The existing kerbed central reserve, separating the opposing vehicle flows in adjacent dual carriageways is shown as being narrowed or removed completely. This is likely to increase the risk of conflict between opposing vehicles increasing the risk of conflict between users in both carriageways. Furthermore, existing street furniture in the central reserve will have reduced or no clearance to passing vehicles increasing the risk of becoming an obstruction.

Recommendation: Review the proposal to narrow / remove the central reserve and ensure that sufficient carriageway space is retained to afford safe passing space between all vehicles and street furniture / temporary traffic barriers etc.

Designer's response

Recommendation noted. Detail design (stage 2) will review the removal of the central reservation which has been proposed along the section of the Victoria Embankment (A3211) past the site to ensure sufficient space would be retained along the carriageways of Victoria Embankment (A3211) during construction period.

2.3 Problem –

Location: *Site Access*

Summary: *Pedestrian diversion route could put pedestrians at risk*

Description: The proposals indicate that a section of footway along the site frontage is to be closed and safety hoarding erected. The footway is to be diverted onto the opposite side then back onto the eastern side of Victoria Embankment. The following points have been identified with the diversion and its application:

- The diversion route signs may be obstructed by existing trees resulting in pedestrians missing diversion signs and crossing the carriageway is places not envisaged by the engineer
- The existing crossings proposed to be utilised by the pedestrian diversion route add a significant amount of delay to pedestrians. This could result in pedestrians not crossing the carriageway is places not envisaged by the engineer
- Inconsistent use of blister paving through junctions along the diversion route may result in confusion of visually impaired pedestrians potentially putting them at risk from other road users
- There are instances of uneven surfaces and paving slabs that are not flush which could trip pedestrians

Recommendation: Careful consideration must be given to the requirements of pedestrians through the intended diversion route making allowances to the mobility/visually impaired who might be

expected to utilise the existing footway. Instances of potential confusion and conflict should be considered and appropriate measures utilised to minimise/eliminate where possible.

Designer's response

Recommendations noted. The proposed closure and diversion of the pedestrians from the western footway of Victoria Embankment (A3212) to the eastern footway will be reviewed at detail design (stage 2). In addition, traffic management proposals to enable pedestrians, including wheelchair users, to safely cross Victoria Embankment (A3212) and use the eastern footway will be reviewed at detail design (stage 2).

2.4 Problem –

Location: *Victoria Embankment*

Summary: *Position of traffic barrier could block visibility on to traffic signals*

Description: The traffic barrier for the temporary traffic management is not specified and could block the forward visibility onto the traffic signals of Victoria Embankment/Horse Guards Avenue for southbound vehicles which may not afford drivers/riders sufficient time to react and /or manoeuvre safely which could put them at risk or in conflict with other road users.

Recommendation: It is recommended that the visibility onto the traffic signals of Victoria Embankment/Horse Guards Avenue is not compromised.

Designer's response

Recommendation noted. Adequate intervisibility for vehicles / pedestrians at the site access point will be taken into account at detail design (stage 2).

2.5 Problem –

Location: *Displaced Coach Parking on Millbank and Albert Embankment*

Summary: *Obstructions to pedestrians*

Description: The proposed coach parking bays are adjacent to various items of street furniture close to the edge of the carriageway, which may obstruct the safe pedestrian access / egress to and from the coach.

Recommendation: The design team should consider the existing street furniture when determining the number and precise location of proposed parking bays. If necessary, street furniture should be relocated to avoid conflict.

Designer's response

Recommendation noted. Detail design (stage 2) will review the proposed relocations of coach parking bays.

2.6 Problem –

Location: *Displaced Coach Parking on Lambeth Palace Road and Albert Embankment*

Summary: *Obstruction of existing bus stops*

Description: The location of the temporary coach parking is located in close proximity to existing bus stops. Buses approaching these stops may have to make onerous manoeuvres around coaches that could cause additional delay and potentially result in vulnerable road users having to negotiate buses which could be straddling multiple lanes.

Recommendation: Existing bus stops should remain accessible without onerous manoeuvres by buses or said bus stops should be temporarily relocated / suspended.

Designer's response

Recommendation noted. The proposed relocation of coach parking bays on Lambeth Palace Road (A3036) and Albert Embankment (A3036) will be reviewed in detail design (stage 2).

2.7 Problem –

Location: *Displaced Coach Parking on Albert Embankment*

Summary: *Obstruction of traffic signals*

Description: The location of the temporary coach bays are in close proximity to existing traffic signals. The long durations that coaches could reside at the bays will reduce the forward visibility beyond just a momentary loss of visibility. Vehicles approaching the traffic signals may not be able to observe their state and could result in late decisions leading to either loss of control or conflict with other road users.

Recommendation: Ensure adequate forward visibility onto traffic signals.

Designer's response

Recommendation noted. The location of the proposed coach parking bays will be reviewed at detail design (stage 2) to ensure suitable forward visibility to the traffic signals are maintained.

2.8 Problem –

Location: *Displaced Coach Parking on Lambeth Palace Road*

Summary: *Lack of pedestrian crossing facilities could put pedestrians at risk*

Description: The information provided has not identified if waiting coaches will be picking up/dropping off. If coaches are picking and dropping off at this location then pedestrians may look to cross Lambeth Palace Road. As there are no pedestrian crossing facilities near the coach bays they may cross the live carriageway possible putting them at risk from other road users.

Recommendation: Provide a suitable place to cross Lambeth Palace Road near the proposed coach bays if coaches are expected to pick up/drop off passengers.

Designer's response

Recommendation noted. Review of proposed coach parking bays will be undertaken at detail design (stage 2) and location finalised. The potential location for a pedestrian crossing facility will be undertaken at this time.

2.9 Problem –

Location: *Permanent vehicle access*

Summary: *Conflict for all users*

Description: The proposed permanent maintenance access is indicated as a vehicle footpath crossing between the southbound carriageway of Victoria Embankment and the parapet river wall. The proposals do not indicate how this access will be secured or how unauthorised vehicle access may be restricted, but if a gate or bollards is provided along the line of the existing parapet wall it will not provide adequate space for a vehicle to clear the carriageway and as such may obstruct westbound vehicles. Furthermore, pedestrians may be required to walk in the carriageway to continue their journey.

Recommendation: Provision of a gate or other vehicle restriction and this access arrangement in general should be such that all vehicles required to access the site can clear the highway and footway in one movement.

Designer's response

Recommendation noted. Detail design (stage 2) will determine the layout of the site in its operational phase and how the site is access would be restricted. The vehicle swept path analysis and intervisibility to vehicles / pedestrians will be reviewed at detail design (stage 2).

2.10 Problem

Location: Permanent Vehicle Access

Summary: Conflict for all users

The proposed site access location is adjacent to large trees parking provision for large vehicles that are likely to obstruct intervisibility between all users and vehicles entering and exiting the site. Obstructed intervisibility may increase the risk of conflict due to difficulties anticipating the presence and movements of other users. This may be exacerbated by the potential for ad-hoc unscheduled use of this access as a pull-in / drop off outside of the scheduled movements of maintenance vehicles.

Recommendation

The permanent access arrangement should be designed to ensure that adequate intervisibility can be afforded for all users and vehicle movements associated with the proposed access.

Designer's response

Recommendation noted. Detail design (stage 2) will determine the layout of the site in its operational phase and review vehicle swept path analysis and intervisibility to vehicles / pedestrians.

2.11 Problem

Location: Permanent Vehicle Access

Summary: Conflict for all users

The proposed site access swept paths indicate vehicle entering and exiting the site but do not indicate the full turning manoeuvre on the site itself. It is therefore not clear if vehicles can exit the site in a forward gear. Should vehicles be required to reverse from the site the risk of conflict to all users will significantly increase.

Recommendation

The proposals must ensure that the largest anticipated vehicles can enter and exit the site in a forward gear.

Designer's response

Recommendation noted. Detail design (stage 2) will determine the layout of the site in its operational phase and review the vehicle swept path analysis to ensure vehicle turning movements are possible.

2.12 Problem

Location: Victoria Embankment

Summary: Conflict for all users

The proposed permanent works layout indicates a zone within which permanent above ground structures would be located along Victoria Embankment in line with the works on the river side of the river wall. Other than general notes about ventilation columns no other detail has been provided about equipment being located in this area. The positioning of equipment could obstruct the footway or generate narrowing's, could block visibility splays and could be in close proximity to passing vehicles on Victoria Embankment.

Recommendation

It is recommended that sufficient space and visibility is maintained to allow pedestrians and vehicles to pass safely.

Technical Note

211146-04 15 February 2013

Designer's response

Recommendation noted. Detail design (stage 2) will determine the permanent operational layout of the site in its operational phase and review the pedestrian and vehicle requirements to ensure suitable sized areas are provided to enable both pedestrians and vehicles to use the foreshore space.

DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
Name	F Jahanshahi	G Wicks	S Jenkins
Signature			

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Transport Assessment

Doc Ref: **7.10.14**

Victoria Embankment Foreshore

Figures

APFP Regulations 2009: Regulation **5(2)(q)**

Hard copy available in

Box **52** Folder **A**
January 2013

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Transport Assessment

Section 17: Victoria Embankment Foreshore figures

List of contents

Plans

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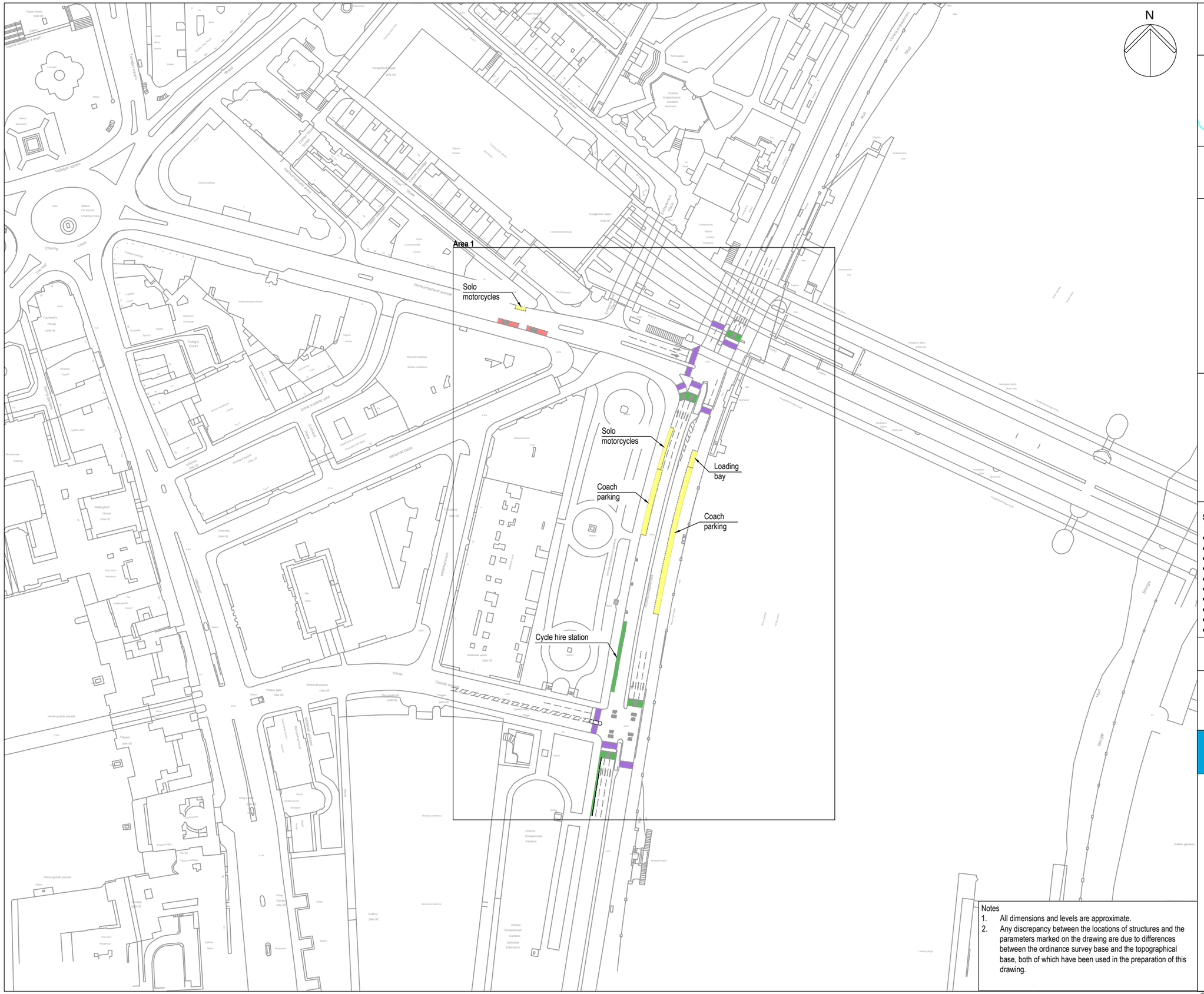
Victoria Embankment Foreshore

THAMES TIDEWAY TUNNEL - SCHEDULE OF ASSOCIATED HIGHWAY WORKS

Drawing Number	Works Reference	Location	Item of Work	Date of Implementation
DCO-PP-16X-VCTEF-180039	VCTEF_C01	Victoria Embankment	Removal of central reservation hardstanding and replacing with carriageway surfacing, including removal/obscuring existing white lining and provision of new road markings. Length approximately 100m.	TBC
	VCTEF_C02	Victoria Embankment, northbound lane	Suspension of parking bays, coach (2 No.)	TBC
	VCTEF_C03	Victoria Embankment, northbound lane	Suspension of parking bay, motorcycle (approx. 30m)	TBC
	VCTEF_C04	Victoria Embankment, southbound lane	Suspension of loading bay (1 No.)	TBC
	VCTEF_C05	Victoria Embankment, southbound lane	Suspension of parking bays, coach (7 No.)	TBC
DCO-PP-16X-VCTEF-180040	VCTEF_C06	Victoria Embankment, northbound lane	Re-provision of parking bay, motorcycle (approx. 30m)	TBC
	VCTEF_C07	Victoria Embankment, northbound lane	Re-provision of parking bays, coach (2 No.)	TBC
	VCTEF_C08	Victoria Embankment	Modification of traffic barrier to return northbound lane to its current layout, including removal/obscuring existing white lining and provision of new road markings. Length approximately 100m.	TBC
DCO-PP-16X-VCTEF-180041	VCTEF_C09	Albert Embankment, northbound lane	Provision of temporary coach bays (2 No.). Including removal/obscuring existing white lining and provision of new road markings.	TBC
DCO-PP-16X-VCTEF-180042	VCTEF_C10	Lambeth Palace Road, southbound lane	Provision of coach bays (7 No.). Including removal/obscuring existing white lining and provision of new road markings.	TBC
DCO-PP-16X-VCTEF-180043	VCTEF_C11	Millbank, southbound lane	Provision of temporary coach bays (5 No.). Including removal/obscuring existing white lining and provision of new road markings.	TBC
DCO-PP-16X-VCTEF-180044	VCTEF_P01	Victoria Embankment	Reinstatement of parking bays, coach (7no.) and loading (1no.). Length approx. 100m.	TBC
	VCTEF_P02	Victoria Embankment, northbound lane	Reinstatement of central reservation hardstanding and replacing with carriageway surfacing, including removal/obscuring existing white lining and provision of new road markings. Length approximately 100m.	TBC
	VCTEF_P03	Victoria Embankment, northbound lane	Provision of new vehicle crossover area	TBC



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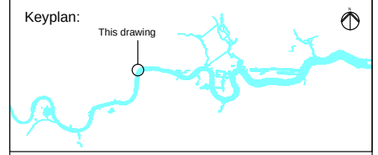


Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

- On street parking
- Bus stop / stand
- Pedestrian crossing
- Cycle lane / advance stop line / cycle hire

On street parking

Solo motorcycles
solo motorcycles only
mon - sat 7:00am - 7:00pm

Loading bay
loading bay
max 20 mins

Coach parking
buses & coaches only
mon - fri 8:30am - 6:30pm
sat 8:30am - 1:30pm
max stay 2 hours
no return within 1 hour

Standards

- Design manual for roads and bridges, Dft, 1992
- Traffic signs regulations & general directions, TSO, 2002
- Traffic signs manual, Dft, 2006
- Manual for streets, Dft, 2007
- Manual for streets 2, CIHT, 2010
- Designing for deliveries, Fta, 1998
- Cycle infrastructure design Ltn 2/08, Dft, 2008
- Design of pedestrian crossings Ltn 2/95, Dft, 1995
- Guidance for the use of tactile paving, Dft, 1998
- Accessible bus stop design guidance, TfL, 2006

Stage
Existing

10m 0 100m

Scale 1:1000 at A1
1:2000 if reproduced at A3

FOR INFORMATION

Location
Victoria Embankment Foreshore
City of Westminster

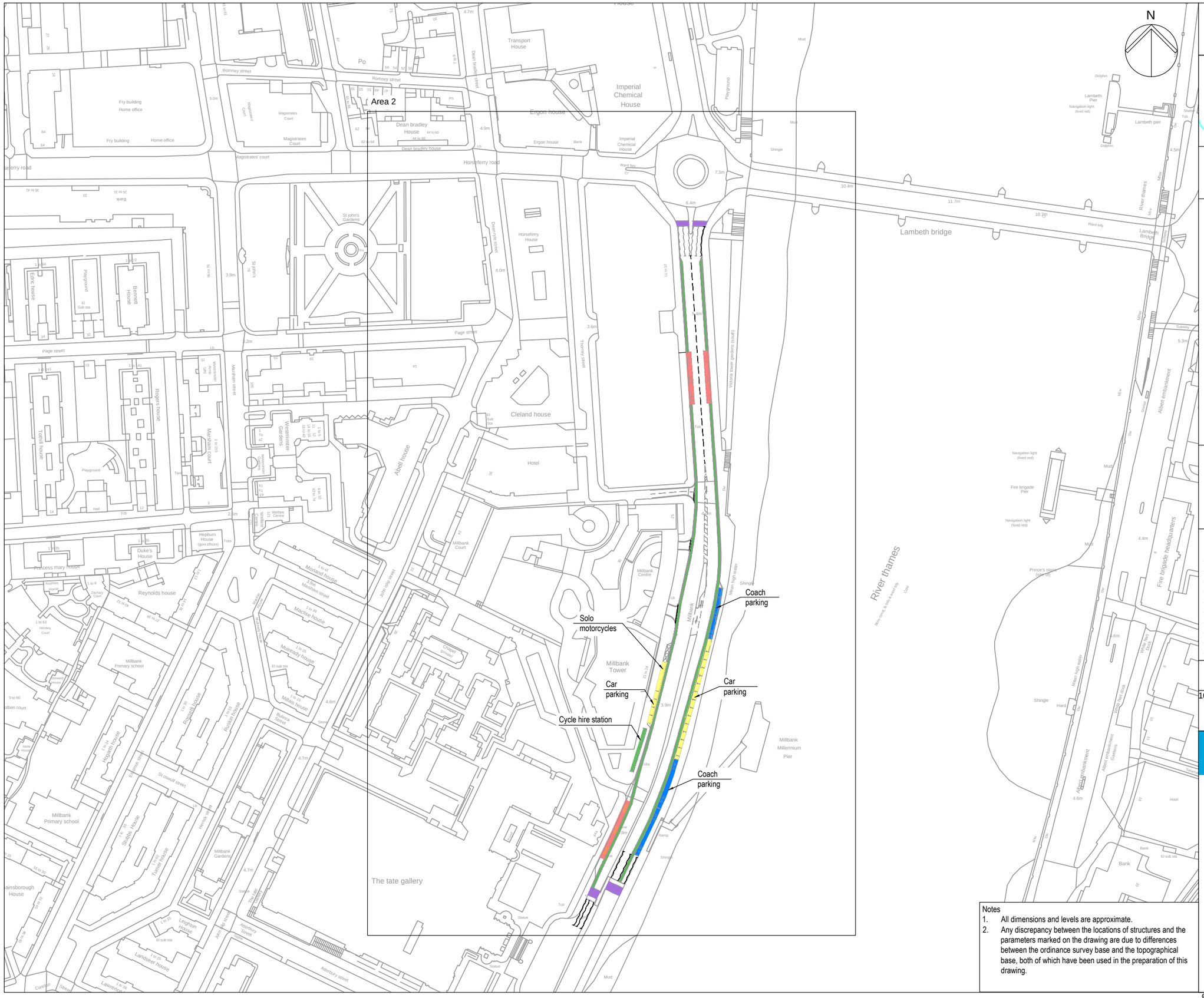
Document Information
Application for Development Consent
Existing highway layout

DCO-PP-16X-VCTEF-180035
January 2013

Notes
1. All dimensions and levels are approximate.
2. Any discrepancy between the locations of structures and the parameters marked on the drawing are due to differences between the ordinance survey base and the topographical base, both of which have been used in the preparation of this drawing.

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water



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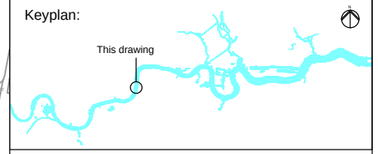
Keyplan:



Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

- On street parking
- Bus stop / stand
- Bus lane
- Pedestrian crossing
- Cycle lane / advance stop line / cycle hire
- Coach parking

On street parking

Solo motorcycles
solo motorcycles only
mon - sat 7:00am - 7:00pm

Coach parking
buses & coaches only
mon - fri 8:30am - 6:30pm
sat 8:30am - 1:30pm
max stay 2 hours
no return within 1 hour

Standards

- Design manual for roads and bridges, Dft, 1992
- Traffic signs regulations & general directions, TSO, 2002
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- Design of pedestrian crossings Ltn 2/95, Dft, 1995
- Guidance for the use of tactile paving, Dft, 1998
- Accessible bus stop design guidance, TfL, 2006

Stage
Existing

10m 0 100m

Scale 1:1000 at A1
1:2000 if reproduced at A3

FOR INFORMATION

Location

Victoria Embankment Foreshore
City of Westminster

Document Information

Application for Development Consent

Existing highway layout - Millbank
Millbank, LB Westminster

DCO-PP-16X-VCTEF-180036
January 2013

Notes
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Thames Tideway Tunnel
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Thames Water

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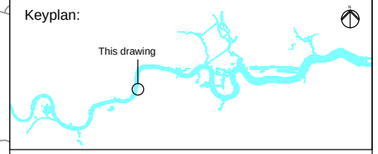
Keyplan:



Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

Existing
- Bus stop / stand
- Bus lane
- Coach parking

Standards

- Design manual for roads and bridges, Dft, 1992
- Traffic signs regulations & general directions, TSO, 2002
- Traffic signs manual, Dft, 2006
- Manual for streets, Dft, 2007
- Manual for streets 2, CIHT, 2010
- Designing for deliveries, Fta, 1998
- Cycle infrastructure design Ltn 2/08, Dft, 2008
- Design of pedestrian crossings Ltn 2/95, Dft, 1995
- Guidance for the use of tactile paving, Dft, 1998
- Accessible bus stop design guidance, TfL, 2006

Stage
Existing

10m 0 40m

Scale 1:500 at A1
1:1000 if reproduced at A3

FOR INFORMATION

Location
Victoria Embankment Foreshore
City of Westminster

Document Information
Application for Development Consent
Existing highway layout -
Albert Embankment, LB Lambeth

DCO-PP-16X-VCTEF-180037
January 2013

Notes
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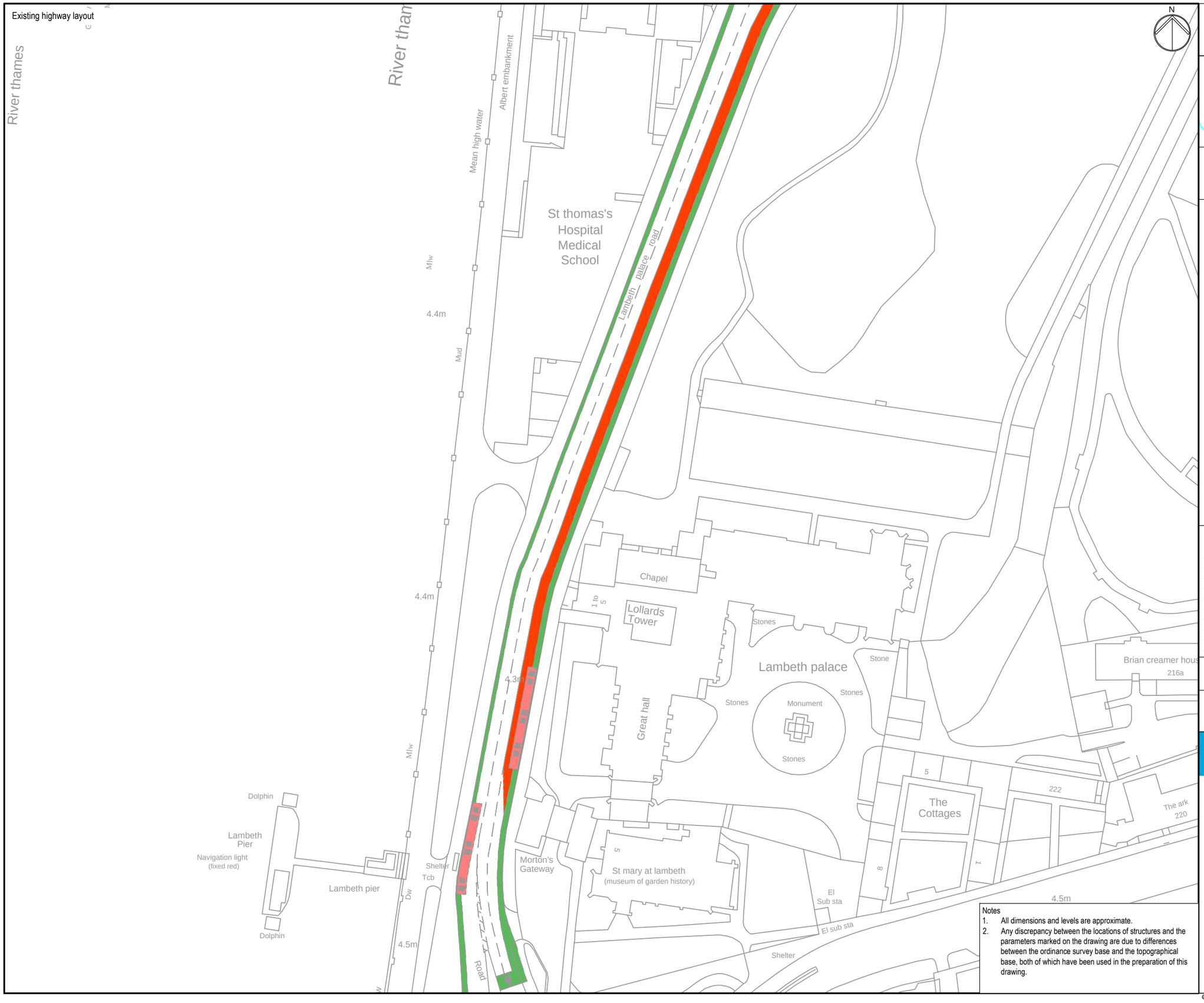
Existing highway layout



Notes
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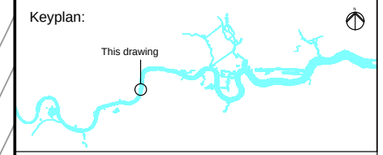
Keyplan:



Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

Existing
- Bus stop / stand
- Bus lane
- Cycle lane / advanced cycle stopline

Standards

- Design manual for roads and bridges, Dft, 1992
- Traffic signs regulations & general directions, TSO, 2002
- Traffic signs manual, Dft, 2006
- Manual for streets, Dft, 2007
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- Guidance for the use of tactile paving, Dft, 1998
- Accessible bus stop design guidance, TfL, 2006

Stage
Existing

10m 0 40m

Scale 1:500 at A1
1:1000 if reproduced at A3

FOR INFORMATION

Location
Victoria Embankment Foreshore
City of Westminster

Document Information
Application for Development Consent
Existing highway layout - Lambeth Palace Rd LB Lambeth

DCO-PP-16X-VCTEF-180038
January 2013

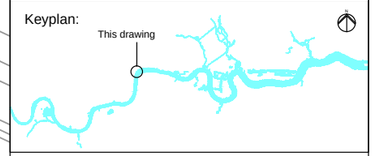
Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

Existing highway layout

Proposed highway layout during construction

Keyplan:



Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

Existing
- On street parking
- Bus stop / stand
- Pedestrian crossing
- Cycle lane / advance stop line

Revised
- L.L.A.U.
- Removal of central reserve
- Temporary restriction to on-street parking
- VCTEF_C01 See schedule of works
- Traffic barrier

On street parking

Solo motorcycle
solo motorcycles only at all times

Coach parking
buses & coaches only
mon - fri 8:30am - 6:30pm
sat 8:30am - 1:30pm
max stay 2 hours
no return within 1 hour

Standards

- Design manual for roads and bridges, Dft, 1992
- Traffic signs regulations & general directions, TSO, 2002
- Traffic signs manual, Dft, 2006
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- Designing for deliveries, Fta, 1998
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- Design of pedestrian crossings Ltn 2/95, Dft, 1995
- Guidance for the use of tactile paving, Dft, 1998
- Accessible bus stop design guidance, TfL, 2006

Stage
Construction phase

10m 0 40m

Scale 1:500 at A1
1:1000 if reproduced at A3

ILLUSTRATIVE

Location
Victoria Embankment Foreshore
City of Westminster

Document Information
Application for Development Consent
Highway layout during utility diversion

DCO-PP-16X-VCTEF-180039
January 2013

For proposed coach bay temporary locations see drawings
- DCO-PP-16X-VCTEF-180041
- DCO-PP-16X-VCTEF-180042
- DCO-PP-16X-VCTEF-180043

Notes
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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Existing highway layout

Proposed highway layout during construction

VCTEF_C06

VCTEF_C07

VCTEF_C08

3.25m

3.0m

96.5m

3.5m

For proposed coach bay temporary locations see drawings

- DCO-PP-16X-VCTEF-180041
- DCO-PP-16X-VCTEF-180042
- DCO-PP-16X-VCTEF-180043

Notes

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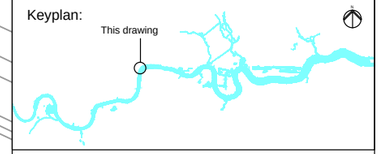
Keyplan:



Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

Existing
- On street parking
- Bus stop / stand
- Pedestrian crossing
- Cycle lane / advance stop line / cycle hire

Revised
- L.L.A.U.
- Suspended on street parking
- Reinstated on street parking
- VCTEF_C00 See schedule of works
- Hoarding line
- Site access
- Traffic barrier
- On site manoeuvering zone

On street parking

Solo motorcycle
solo motorcycles only at all times

Loading bay
max 20mins

Coach parking
buses & coaches only
mon - fri 8:30am - 6:30pm
sat 8:30am - 1:30pm
max stay 2 hours
no return within 1 hour

Standards

- Design manual for roads and bridges, Dft, 1992
- Traffic signs regulations & general directions, TSO, 2002
- Traffic signs manual, Dft, 2006
- Manual for streets, Dft, 2007
- Manual for streets 2, CIHT, 2010
- Designing for deliveries, Fta, 1998
- Cycle infrastructure design Ltn 2/08, Dft, 2008
- Design of pedestrian crossings Ltn 2/95, Dft, 1995
- Guidance for the use of tactile paving, Dft, 1998
- Accessible bus stop design guidance, TfL, 2006

Stage
Construction phases

10m 0 40m

Scale 1:500 at A1
1:1000 if reproduced at A3

ILLUSTRATIVE

Location
Victoria Embankment Foreshore
City of Westminster

Document Information
Application for Development Consent
Highway layout during construction
Phase 1 - 5

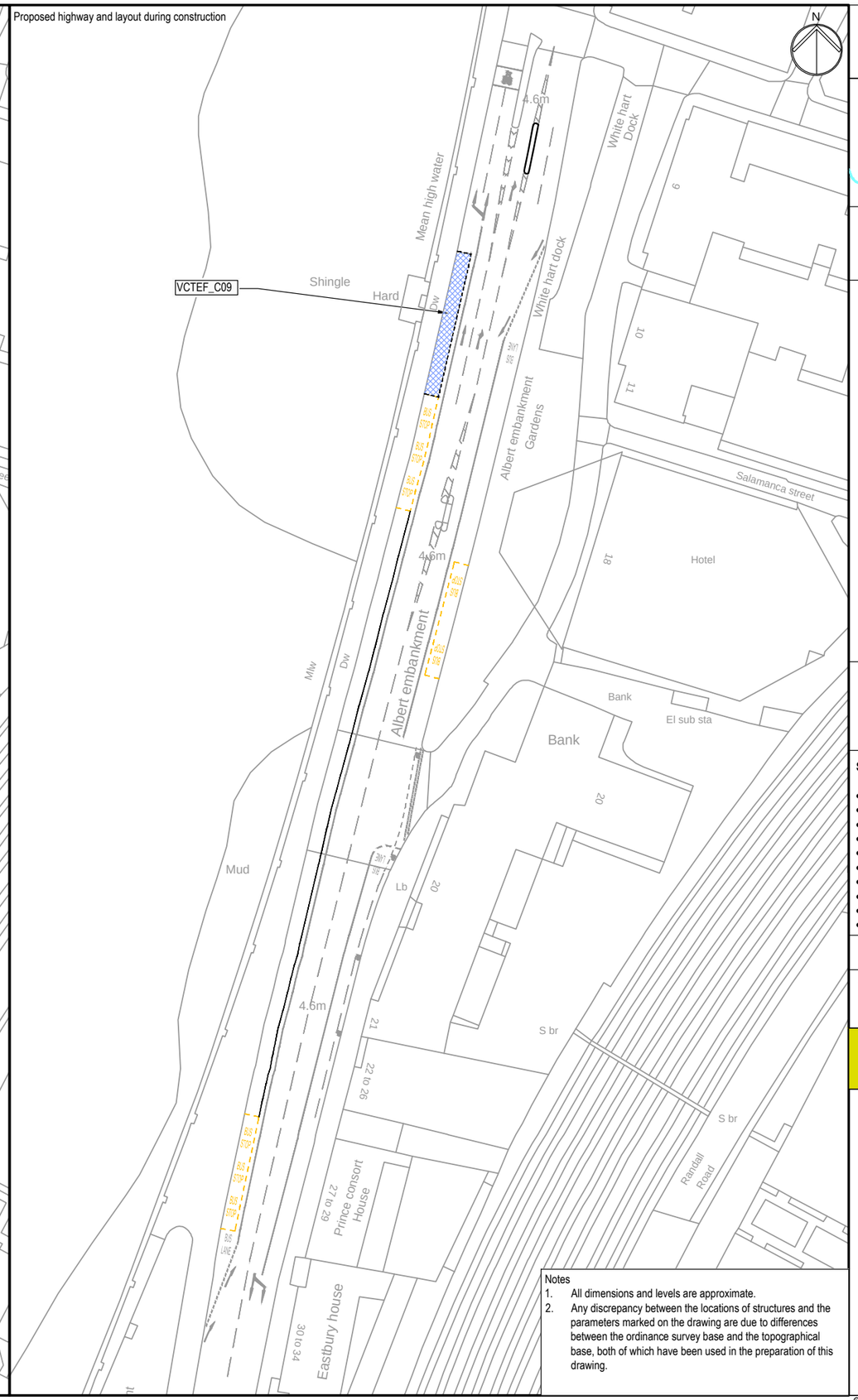
DCO-PP-16X-VCTEF-180040
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

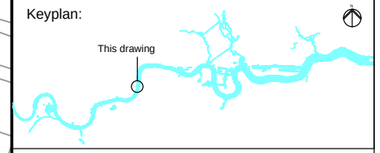
Thames Water

Existing highway and layout

Proposed highway and layout during construction



Keyplan:



Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

Existing
- Bus stop / stand
- Bus lane
- Coach parking

Revised
- Parking bay (coaches only)

On street parking

Coach parking
Coaches Mon - Fri 10am - 4pm

Standards

- Design manual for roads and bridges, Dft, 1992
- Traffic signs regulations & general directions, TSO, 2002
- Traffic signs manual, Dft, 2006
- Manual for streets, Dft, 2007
- Manual for streets 2, CIHT, 2010
- Designing for deliveries, Fta, 1998
- Cycle infrastructure design Ltn 2/08, Dft, 2008
- Design of pedestrian crossings Ltn 2/95, Dft, 1995
- Guidance for the use of tactile paving, Dft, 1998
- Accessible bus stop design guidance, TfL, 2006

Stage
Construction phase

10m 0 40m

Scale 1:500 at A1
1:1000 if reproduced at A3

ILLUSTRATIVE

Location
Victoria Embankment Foreshore
City of Westminster

Document Information
Application for Development Consent
Relocated coach bays during construction
Albert Embankment

DCO-PP-16X-VCTEF-180041
January 2013

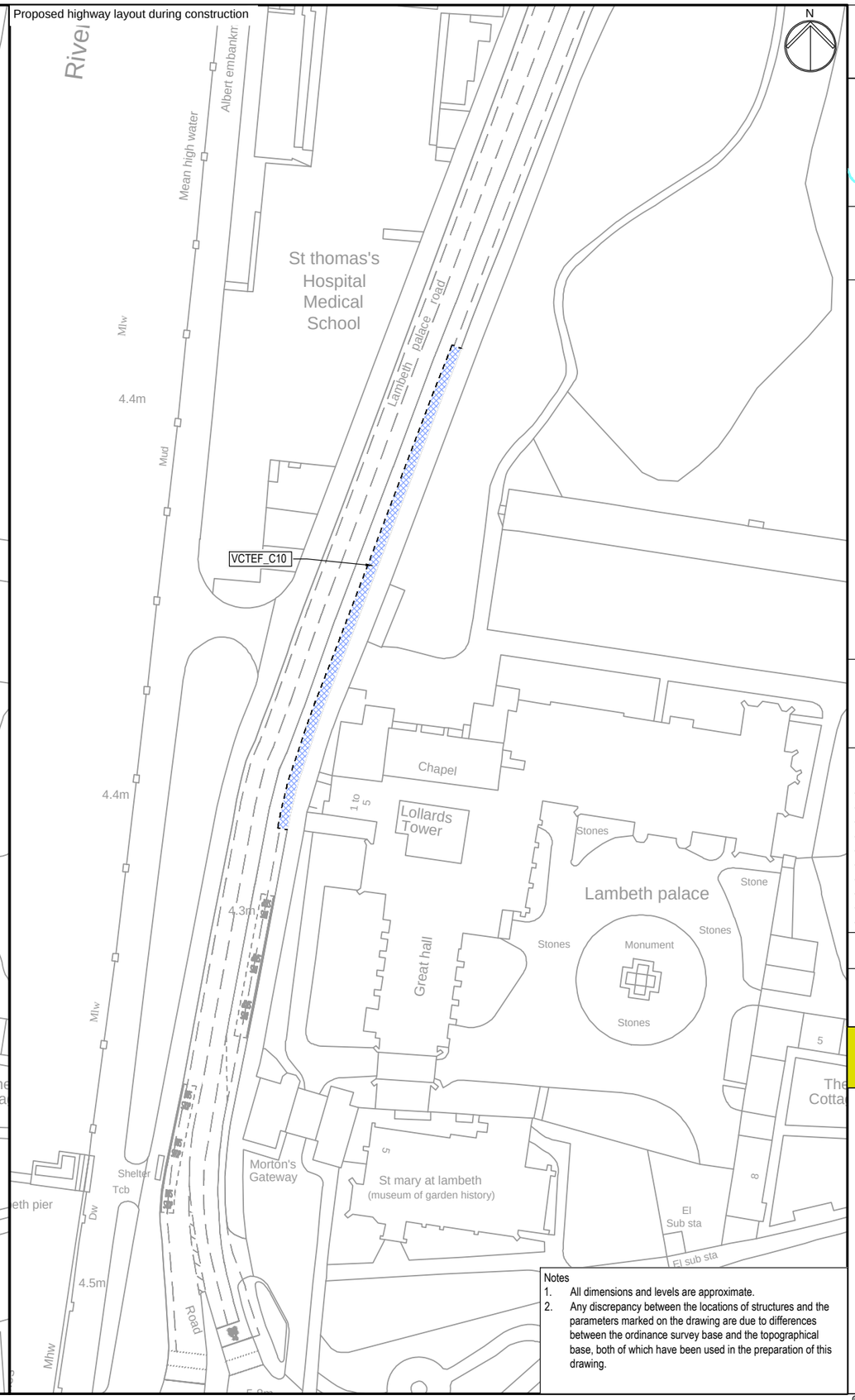
Notes
1. All dimensions and levels are approximate.
2. Any discrepancy between the locations of structures and the parameters marked on the drawing are due to differences between the ordinance survey base and the topographical base, both of which have been used in the preparation of this drawing.

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

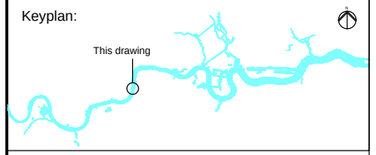
Thames Water

Existing highway layout

Proposed highway layout during construction



Keyplan:



Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

Existing
- Bus stop / stand
- Bus lane
- Cycle lane / advanced cycle stopline

Revised
- Parking bay (coaches only)

On street parking

Coach parking
Coaches Mon - Fri 10am - 4pm

Standards

- Design manual for roads and bridges, Dft, 1992
- Traffic signs regulations & general directions, TSO, 2002
- Traffic signs manual, Dft, 2006
- Manual for streets, Dft, 2007
- Manual for streets 2, CIHT, 2010
- Designing for deliveries, Fta, 1998
- Cycle infrastructure design Ltn 2/08, Dft, 2008
- Design of pedestrian crossings Ltn 2/95, Dft, 1995
- Guidance for the use of tactile paving, Dft, 1998
- Accessible bus stop design guidance, TfL, 2006

Stage
Construction phase

10m 0 40m

Scale 1:500 at A1
1:1000 if reproduced at A3

ILLUSTRATIVE

Location
Victoria Embankment Foreshore
City of Westminster

Document Information
Application for Development Consent

Relocated coach bays
Lambeth Palace Rd, LB Lambeth

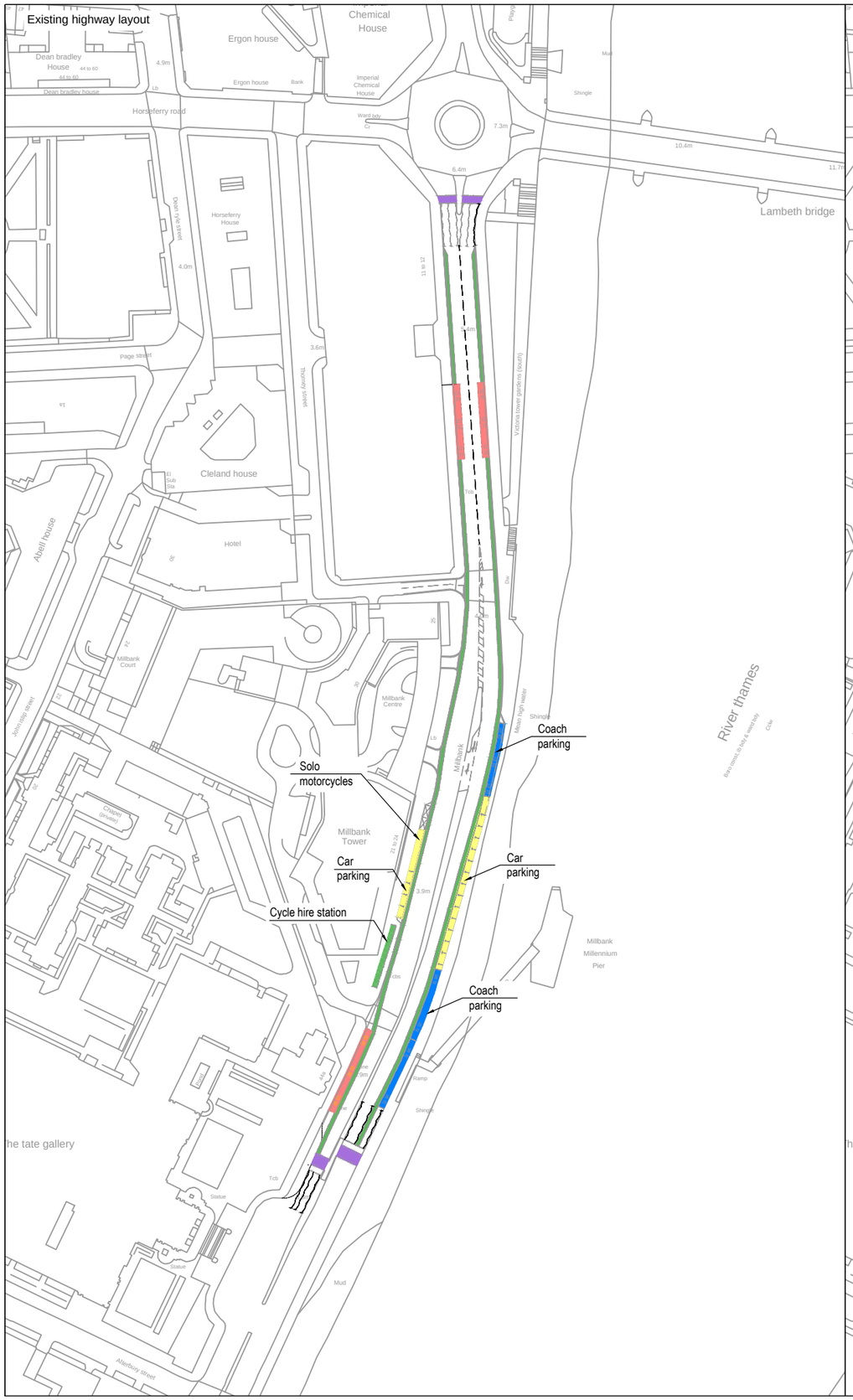
DCO-PP-16X-VCTEF-180042
January 2013

Notes
1. All dimensions and levels are approximate.
2. Any discrepancy between the locations of structures and the parameters marked on the drawing are due to differences between the ordinance survey base and the topographical base, both of which have been used in the preparation of this drawing.

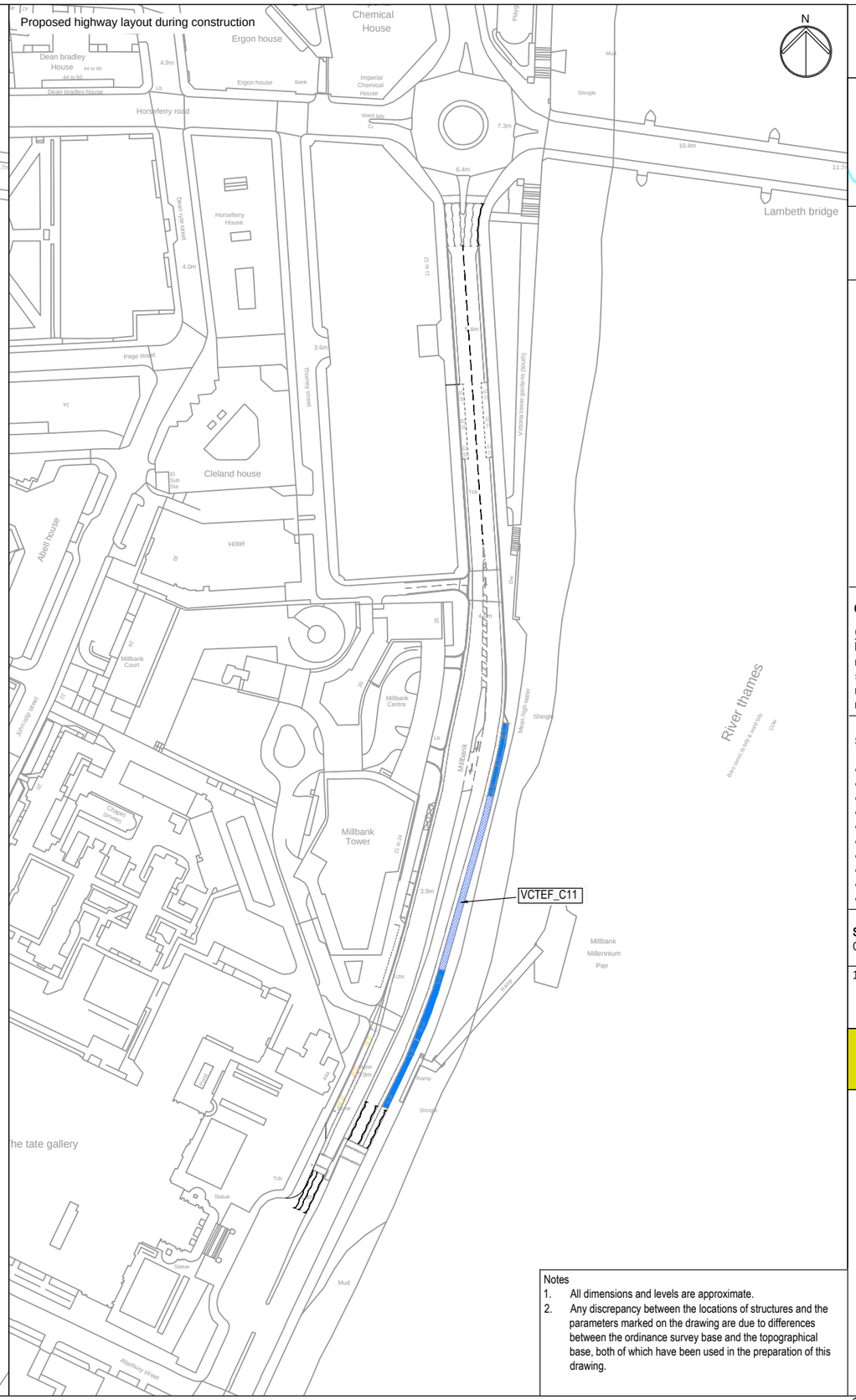
Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

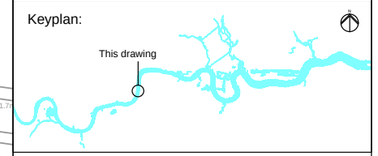
Existing highway layout



Proposed highway layout during construction



Keyplan:



Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

- On street parking
- Bus stop / stand
- Coach parking
- Pedestrian crossing
- Cycle lane / advance stop line / cycle hire
- On-street parking bay (coach parking only)

On street parking

Coach parking
buses & coaches only
mon - fri 8:30am - 6:30pm
sat 8:30am - 1:30pm
max stay 2 hours
no return within 1 hour

Standards

- Design manual for roads and bridges, Dft, 1992
- Traffic signs regulations & general directions, TSO, 2002
- Traffic signs manual, Dft, 2006
- Manual for streets, Dft, 2007
- Manual for streets 2, CIHT, 2010
- Designing for deliveries, Fta, 1998
- Cycle infrastructure design Ltn 2/08, Dft, 2008
- Design of pedestrian crossings Ltn 2/95, Dft, 1995
- Guidance for the use of tactile paving, Dft, 1998
- Accessible bus stop design guidance, TfL, 2006

Stage
Construction phase

10m 0 100m

Scale 1:1000 at A1
1:2000 if reproduced at A3

ILLUSTRATIVE

Location
Victoria Embankment Foreshore
City of Westminster

Document Information
Application for Development Consent
Highway layout during construction
Coach bays on Millbank

DCO-PP-16X-VCTEF-180043
January 2013

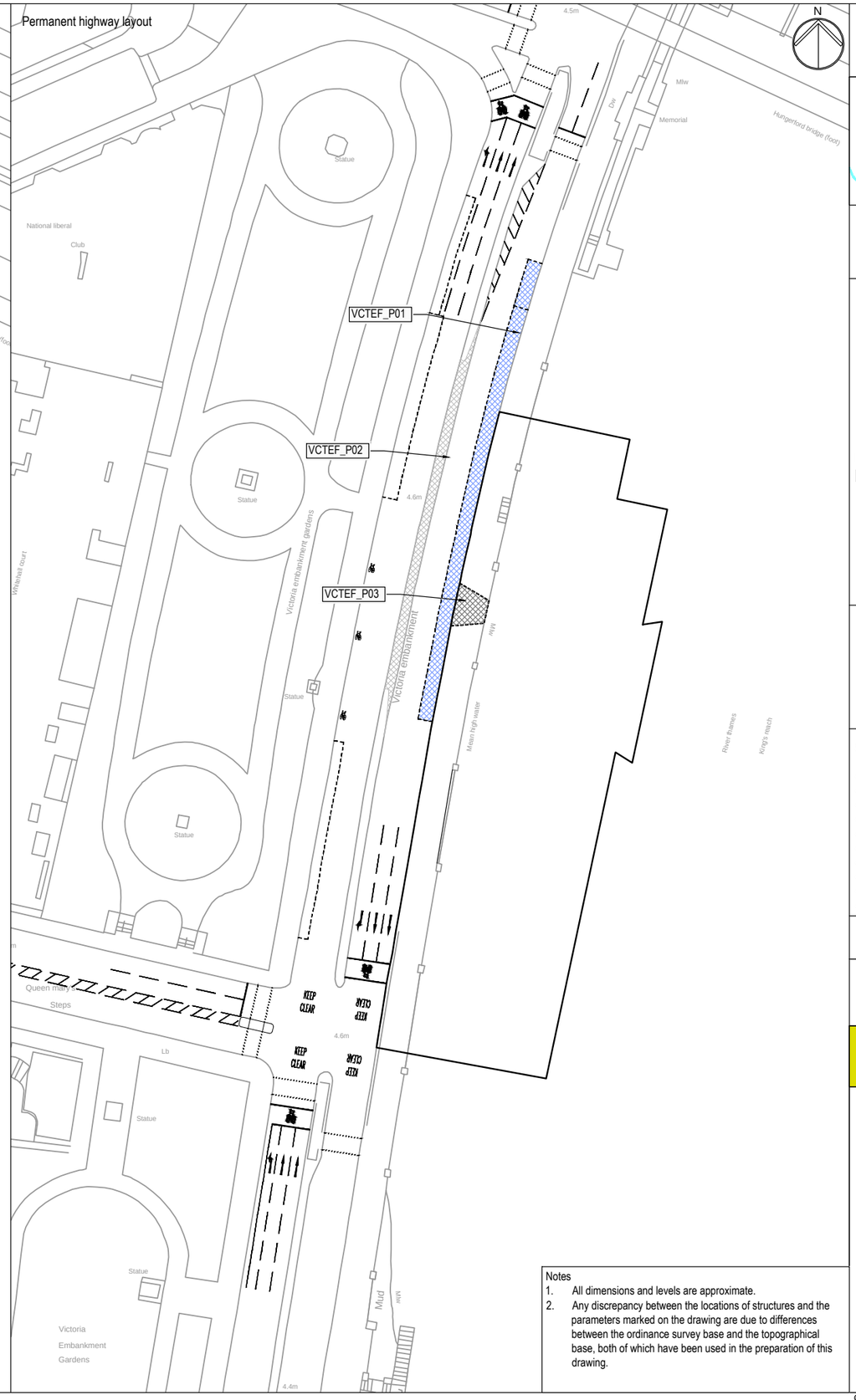
Notes
1. All dimensions and levels are approximate.
2. Any discrepancy between the locations of structures and the parameters marked on the drawing are due to differences between the ordinance survey base and the topographical base, both of which have been used in the preparation of this drawing.

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

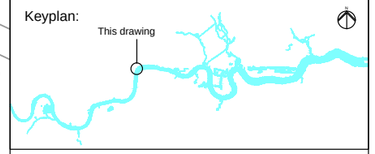
Existing highway layout

Permanent highway layout



Notes
1. All dimensions and levels are approximate.
2. Any discrepancy between the locations of structures and the parameters marked on the drawing are due to differences between the ordinance survey base and the topographical base, both of which have been used in the preparation of this drawing.

Keyplan:



Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

Existing
- On street parking
- Bus stop / stand
- Pedestrian crossing
- Cycle lane / advance stop line / Barclays cycle hire

Revised
- Reinstated central reservation
- Strengthen footway / vehicle crossover area
- Reinstated on street parking
- VCTEF_P00 See schedule of works
- Permanent works boundary

On street parking

Solo motorcycle
solo motorcycles only at all times

Coach parking
buses & coaches only
mon - fri 8:30am - 6:30pm
sat 8:30am - 1:30pm
max stay 2 hours
no return within 1 hour

Standards

- Design manual for roads and bridges, Dft, 1992
- Traffic signs regulations & general directions, TSO, 2002
- Traffic signs manual, Dft, 2006
- Manual for streets, Dft, 2007
- Manual for streets 2, CIHT, 2010
- Designing for deliveries, Fta, 1998
- Cycle infrastructure design Ltn 2/08, Dft, 2008
- Design of pedestrian crossings Ltn 2/95, Dft, 1995
- Guidance for the use of tactile paving, Dft, 1998
- Accessible bus stop design guidance, TfL, 2006

Stage
Permanent phase

10m 0 40m

Scale 1:500 at A1
1:1000 if reproduced at A3

ILLUSTRATIVE

Location
Victoria Embankment Foreshore
City of Westminster

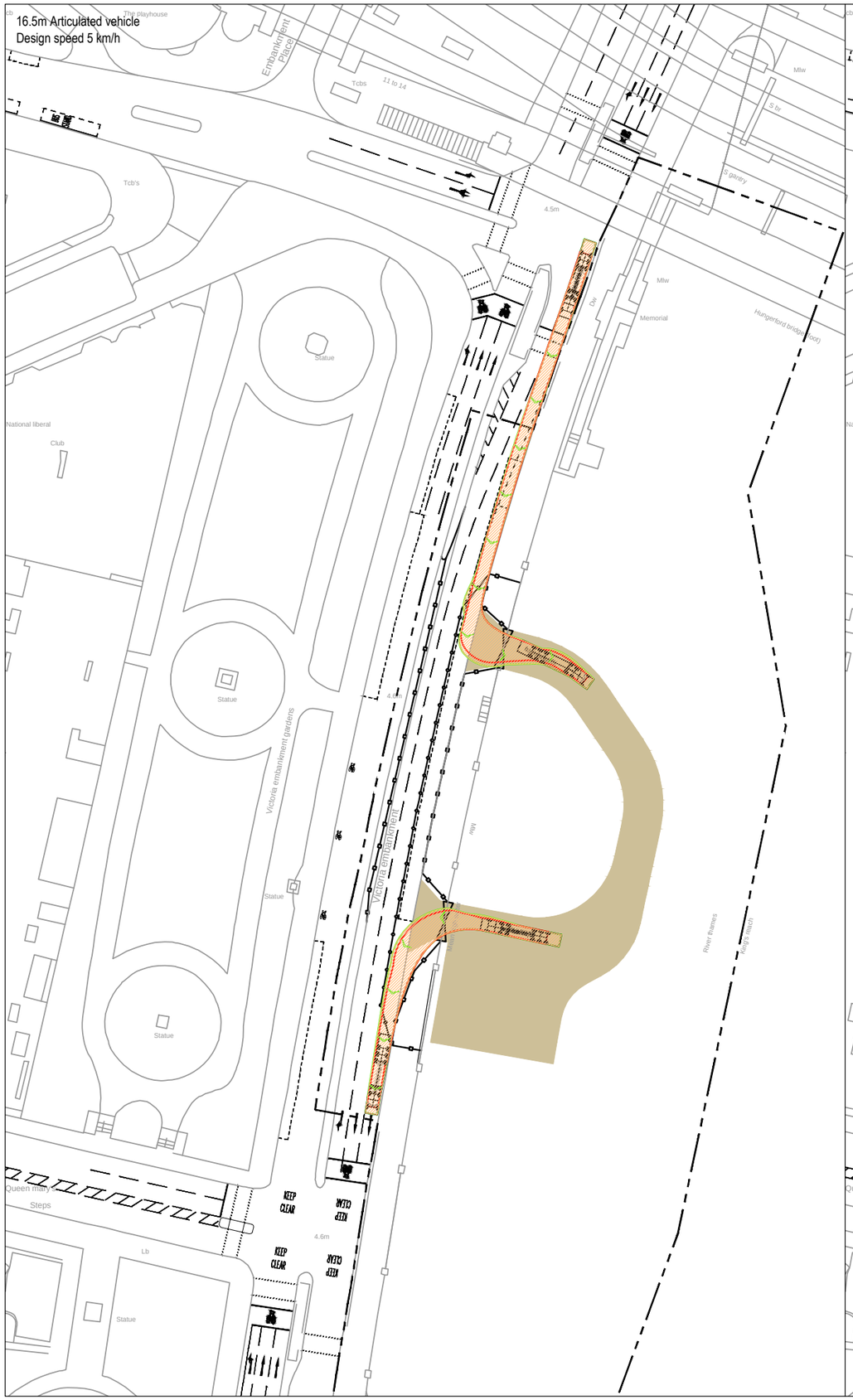
Document Information
Application for Development Consent
Permanent highway layout

DCO-PP-16X-VCTEF-180044
January 2013

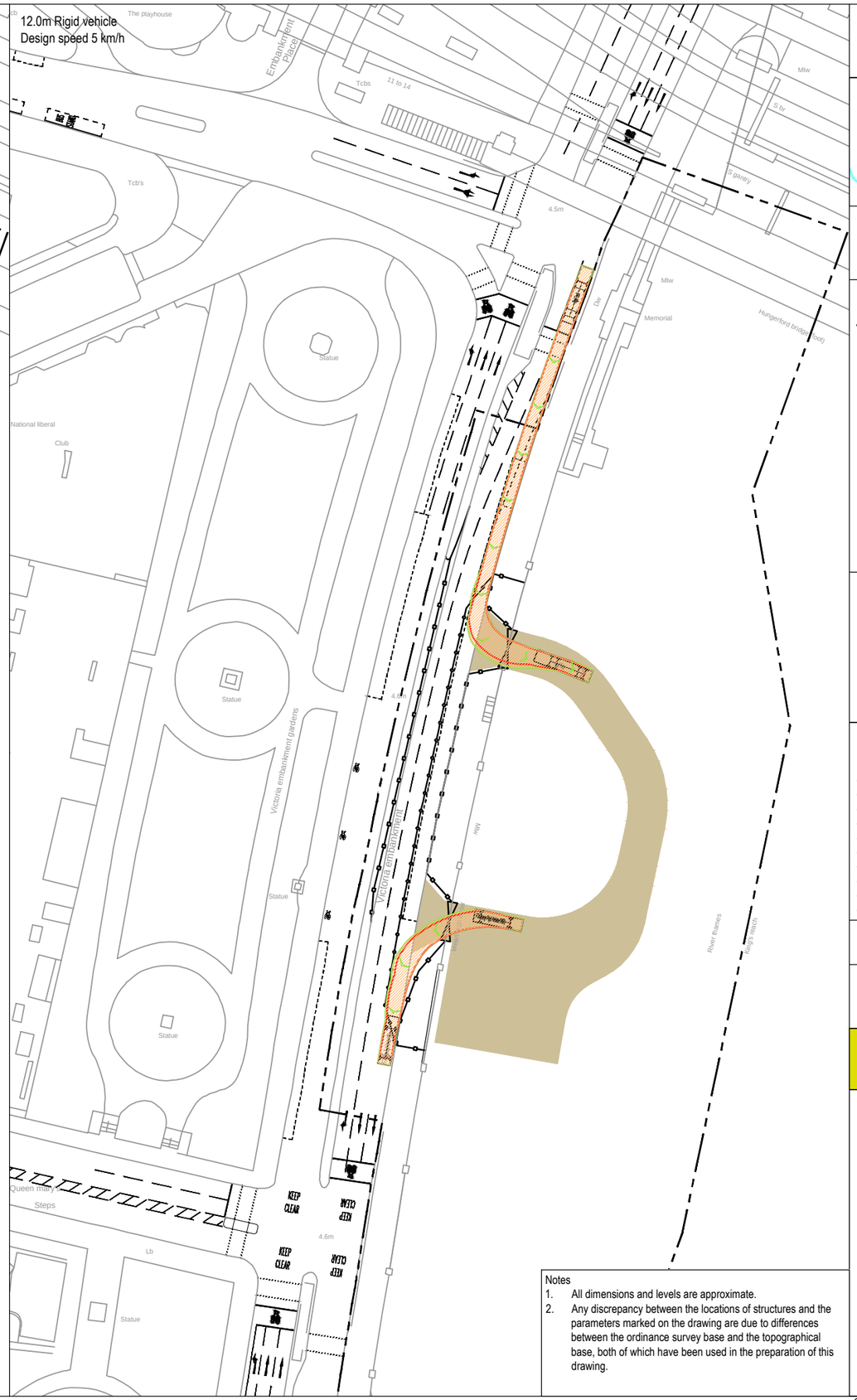
Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

16.5m Articulated vehicle
Design speed 5 km/h

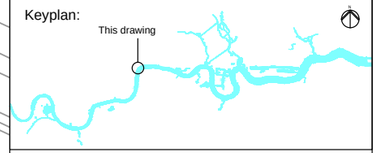


12.0m Rigid vehicle
Design speed 5 km/h



Notes
1. All dimensions and levels are approximate.
2. Any discrepancy between the locations of structures and the parameters marked on the drawing are due to differences between the ordinance survey base and the topographical base, both of which have been used in the preparation of this drawing.

Keyplan:



Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

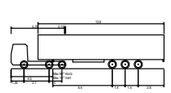
Key

- Illustrative on-site manoeuvring zone
- L.L.A.U

Vehicle swept path analysis

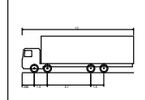
- Vehicle body outlines
- Vehicle chassis outline
- Vehicle swept path
- Hoarding line
- Site access
- Traffic barrier

16.5m articulated vehicle



Max Legal Articulated Vehicle (16.5m)	
Overall Length	16.500m
Overall Width	2.500m
Overall Body Height	3.832m
Min Body Ground Clearance	0.399m
Max Track Width	2.500m
Lock to Lock Time	9.00 sec
Kerb to Kerb Turning Radius	6.870m
Design Speed	5kmh

12.0m rigid vehicle



Rigid Truck	
Overall Length	12.000m
Overall Width	2.500m
Overall Body Height	3.928m
Min Body Ground Clearance	0.413m
Track Width	2.47 m
Lock to Lock Time	6.00 sec
Kerb to Kerb Turning Radius	11.900m
Design Speed	5kmh

Standards

- Design manual for roads and bridges, Dft, 1992
- Traffic signs regulations & general directions, TSO, 2002
- Traffic signs manual, Dft, 2006
- Manual for streets, Dft, 2007
- Manual for streets 2, CIHT, 2010
- Designing for deliveries, Fta, 1998
- Cycle infrastructure design Ltn 2/08, Dft, 2008
- Design of pedestrian crossings Ltn 2/95, Dft, 1995
- Guidance for the use of tactile paving, Dft, 1998
- Accessible bus stop design guidance, TfL, 2006

Stage
Construction phase

10m 0 40m

Scale 1:500 at A1
1:1000 if reproduced at A3

ILLUSTRATIVE

Location
Victoria Embankment Foreshore
City of Westminster

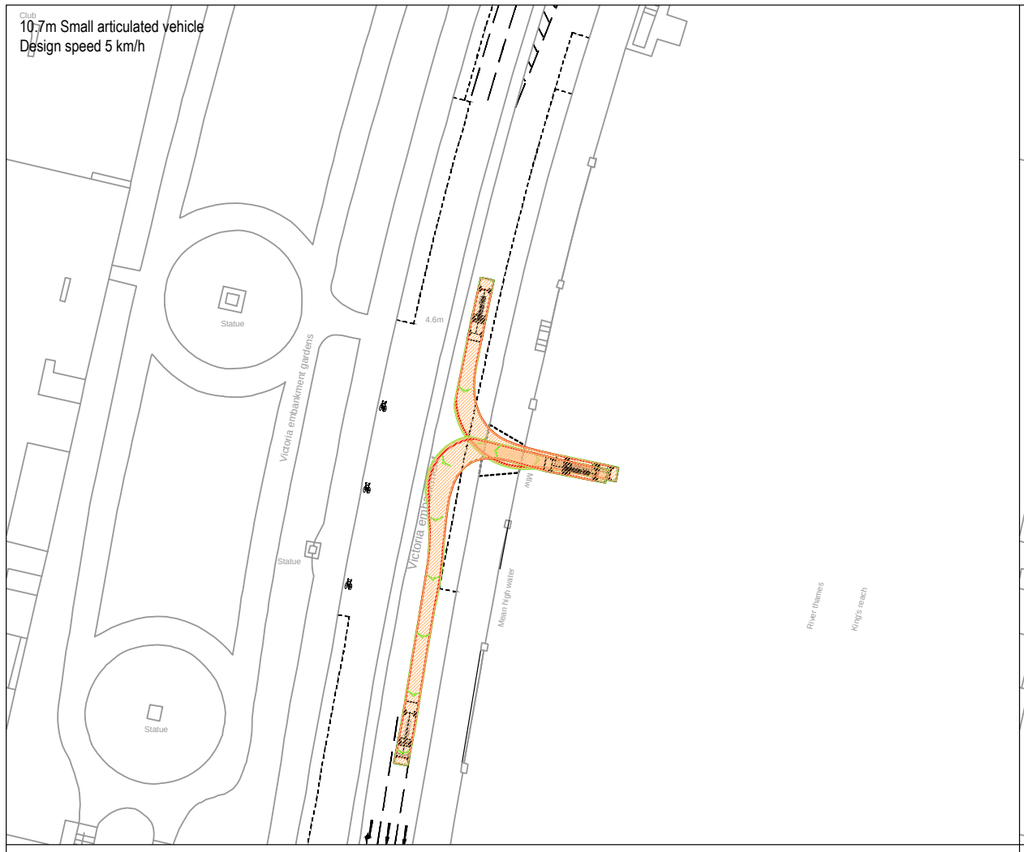
Document Information
Application for Development Consent
Highway layout during construction
Vehicle swept path analysis

DCO-PP-16X-VCTEF-180045
January 2013

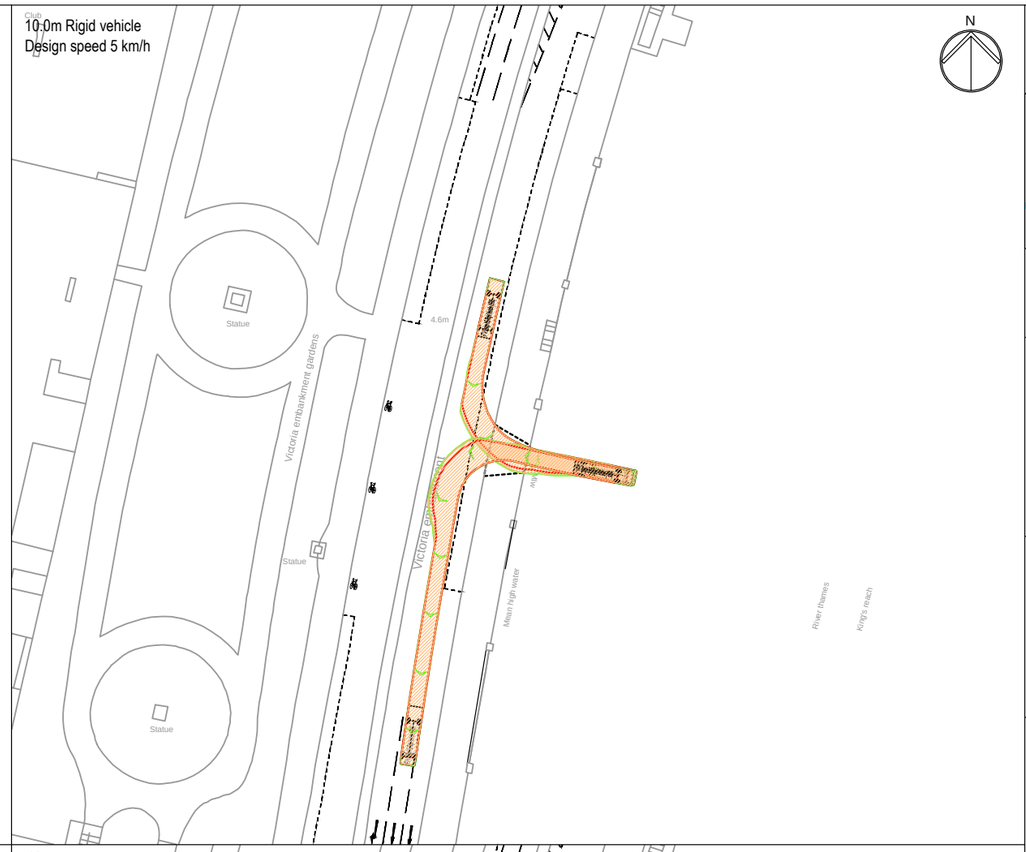
Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

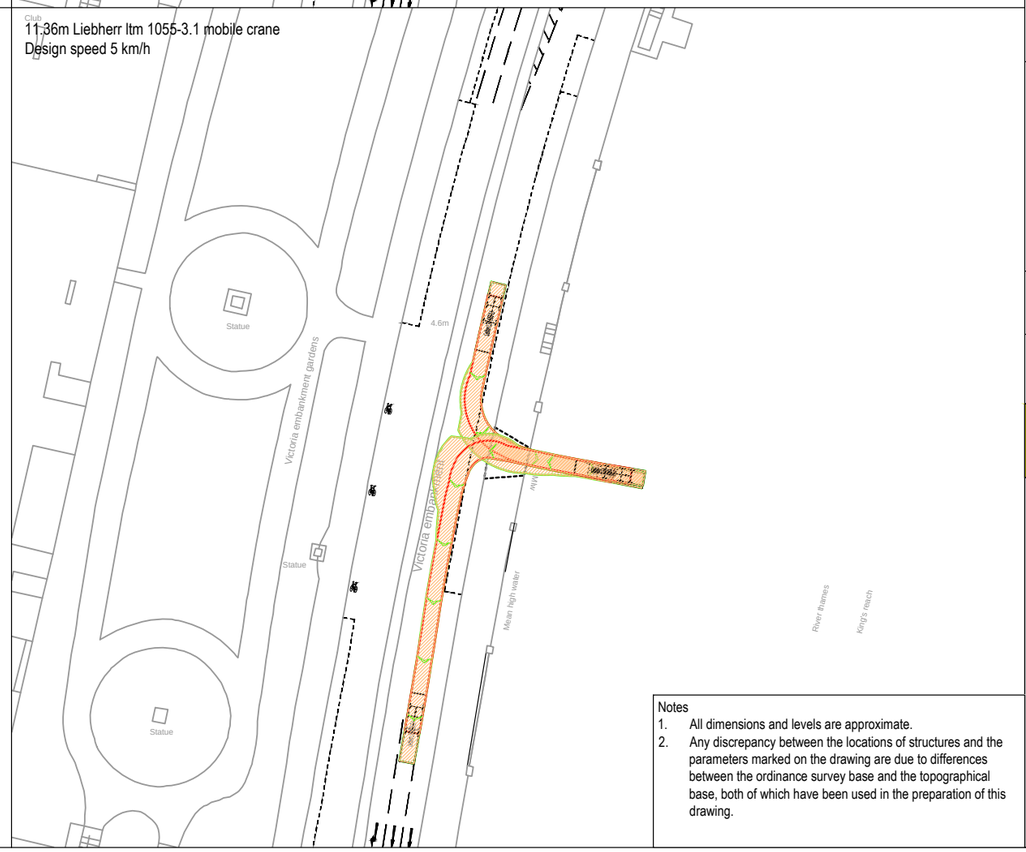
10.7m Small articulated vehicle
Design speed 5 km/h



10.0m Rigid vehicle
Design speed 5 km/h

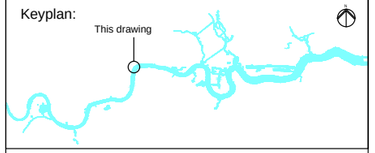


11.36m Liebherr ltm 1055-3.1 mobile crane
Design speed 5 km/h



Notes
1. All dimensions and levels are approximate.
2. Any discrepancy between the locations of structures and the parameters marked on the drawing are due to differences between the ordinance survey base and the topographical base, both of which have been used in the preparation of this drawing.

Keyplan:

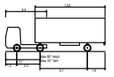


Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

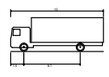
Vehicle swept path analysis
- Vehicle body outlines
- Vehicle chassis outline
- Vehicle swept path

10.7m small articulated vehicle



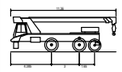
Small Articulated Vehicle	
Overall Length	10.700m
Overall Width	2.360m
Overall Body Height	3.604m
Min Body Ground Clearance	0.382m
Track Width	2.240m
Lock to Lock Time	6.00 sec
Kerb to Kerb Turning Radius	5.740m

10.0m rigid vehicle



FTA Design HG Rigid Vehicle (1998)	
Overall Length	10.000m
Overall Width	2.500m
Overall Body Height	3.645m
Min Body Ground Clearance	0.440m
Track Width	2.470m
Lock to Lock Time	3.00 sec
Kerb to Kerb Turning Radius	11.000m

11.36m liebherr ltm 1055-3.1 mobile crane



Liebherr LTM 1055-3.1 Mobile Crane	
Overall Length	11.360m
Overall Width	2.500m
Overall Body Height	3.733m
Min Body Ground Clearance	0.353m
Track Width	2.820m
Lock to Lock Time	4.00 sec
Wall to Wall Turning Radius	8.170m

Standards

- Design manual for roads and bridges, Dft, 1992
- Traffic signs regulations & general directions, TSO, 2002
- Traffic signs manual, Dft, 2006
- Manual for streets, Dft, 2007
- Manual for streets 2, CIHT, 2010
- Designing for deliveries, Fta, 1998
- Cycle infrastructure design Ltn 2/08, Dft, 2008
- Design of pedestrian crossings Ltn 2/95, Dft, 1995
- Guidance for the use of tactile paving, Dft, 1998
- Accessible bus stop design guidance, TfL, 2006

Stage
Permanent phase

10m 0 40m

Scale 1:500 at A1
1:1000 if reproduced at A3

ILLUSTRATIVE

Location
Victoria Embankment Foreshore
City of Westminster

Document Information
Application for Development Consent

Permanent highway layout -
Vehicle swept path analysis

DCO-PP-16X-VCTEF-180046
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

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Transport assessment figures

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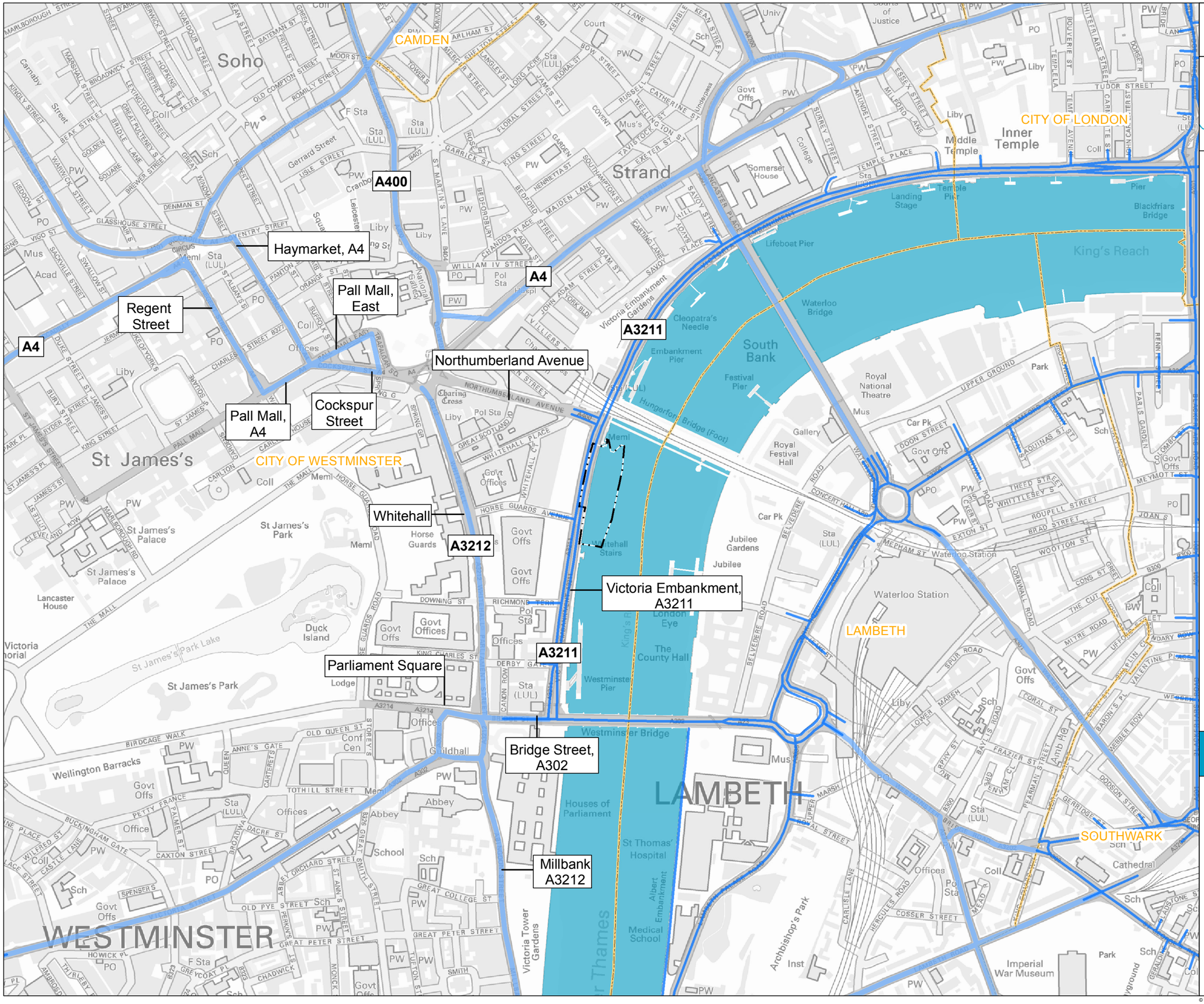


Keyplan:

Key

- TFL road network
- Strategic road network
- Limits of Land to be Acquired or Used
- Local authority boundary

110 55 0 110 m

Scale 1 : 7,500 at A3

FOR INFORMATION

Location

Victoria Embankment Foreshore
City Of Westminster

Document Information

Transport Assessment

Transport - site location plan

Figure 17.2.1

1PL03-TT-50663
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

Keyplan:

Key

- Site access
- TFL road network
- Strategic road network
- Primary construction route
- Limits of Land to be Acquired or Used
- Local authority boundary

110 55 0 110 m

Scale 1 : 7,500 at A3

FOR INFORMATION

Location
Victoria Embankment Foreshore
City Of Westminster

Document Information
Transport Assessment
Transport - construction traffic routes

Figure 17.2.2
1PL03-TT-50655
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

Keyplan:

Key

- National rail stations with cycle parking
- Undrground stations with cycle parking
- Barclays cycle hire docking stations
- London cycle routes
- London strategic walk network
- Thames path
- Pedestrian routes

National cycle network

Route Type

- Open Traffic Free
- Open on-road
- Limits of Land to be Acquired or Used
- Local authority boundary

110 55 0 110 m

Scale 1 : 7,500 at A3

FOR INFORMATION

Location

Victoria Embankment Foreshore
City Of Westminster

Document Information

Transport Assessment

Transport - pedestrian and cycle network

Figure 17.4.1

1PL03-TT-50671
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

Keyplan:

Key

- TFL bus stops
- National rail stations
- London underground stations
- Pier locations
- TfL bus routes
- Limits of Land to be Acquired or Used
- Local authority boundary

110 55 0 110 m

Scale 1 : 7,500 at A3

FOR INFORMATION

Location
Victoria Embankment Foreshore
City Of Westminster

Document Information
Transport Assessment
Transport - public transport

Figure 17.4.2
1PL03-TT-50679
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

Keyplan:

Key

- City Car
- Hertz on Demand
- Zip Car
- Private car parking
- Coach Parking
- Controlled Parking Zones and hours of operation
- Limits of Land to be Acquired or Used
- Local authority boundary

110 55 0 110 m

Scale 1 : 7,500 at A3

FOR INFORMATION

Location

Victoria Embankment Foreshore
City Of Westminster

Document Information

Transport Assessment

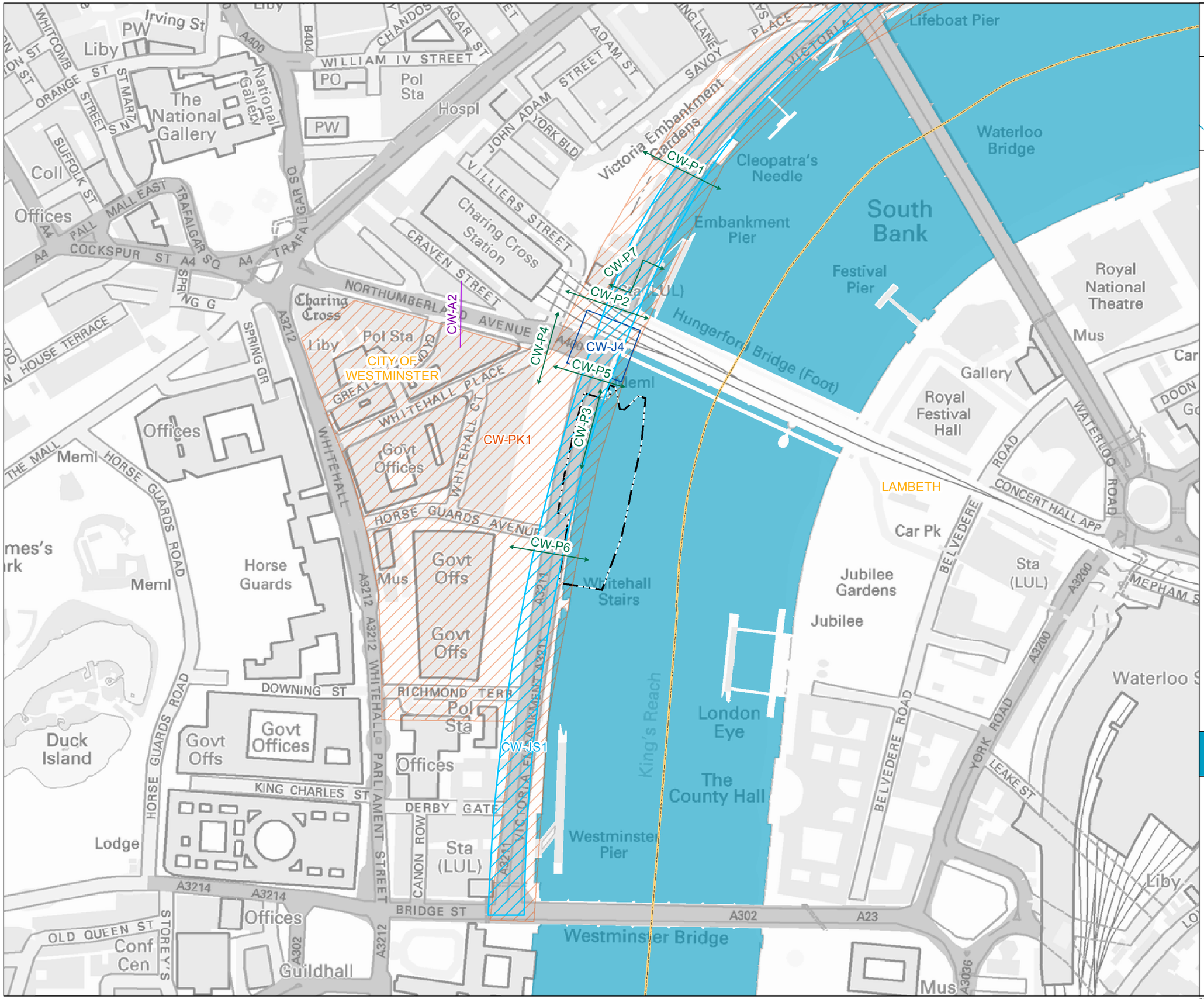
Transport - parking

Figure 17.4.3

1PL03-TT-50687
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water



Keyplan:

Key

- Automatic traffic count surveys
- Pedestrian and cycle surveys
- Junction surveys
- Journey time surveys
- Parking surveys
- Limits of Land to be Acquired or Used
- Local authority boundary

60 30 0 60 m

Scale 1 : 4,000 at A3

FOR INFORMATION

Location

Victoria Embankment Foreshore
City Of Westminster

Document Information

Transport Assessment

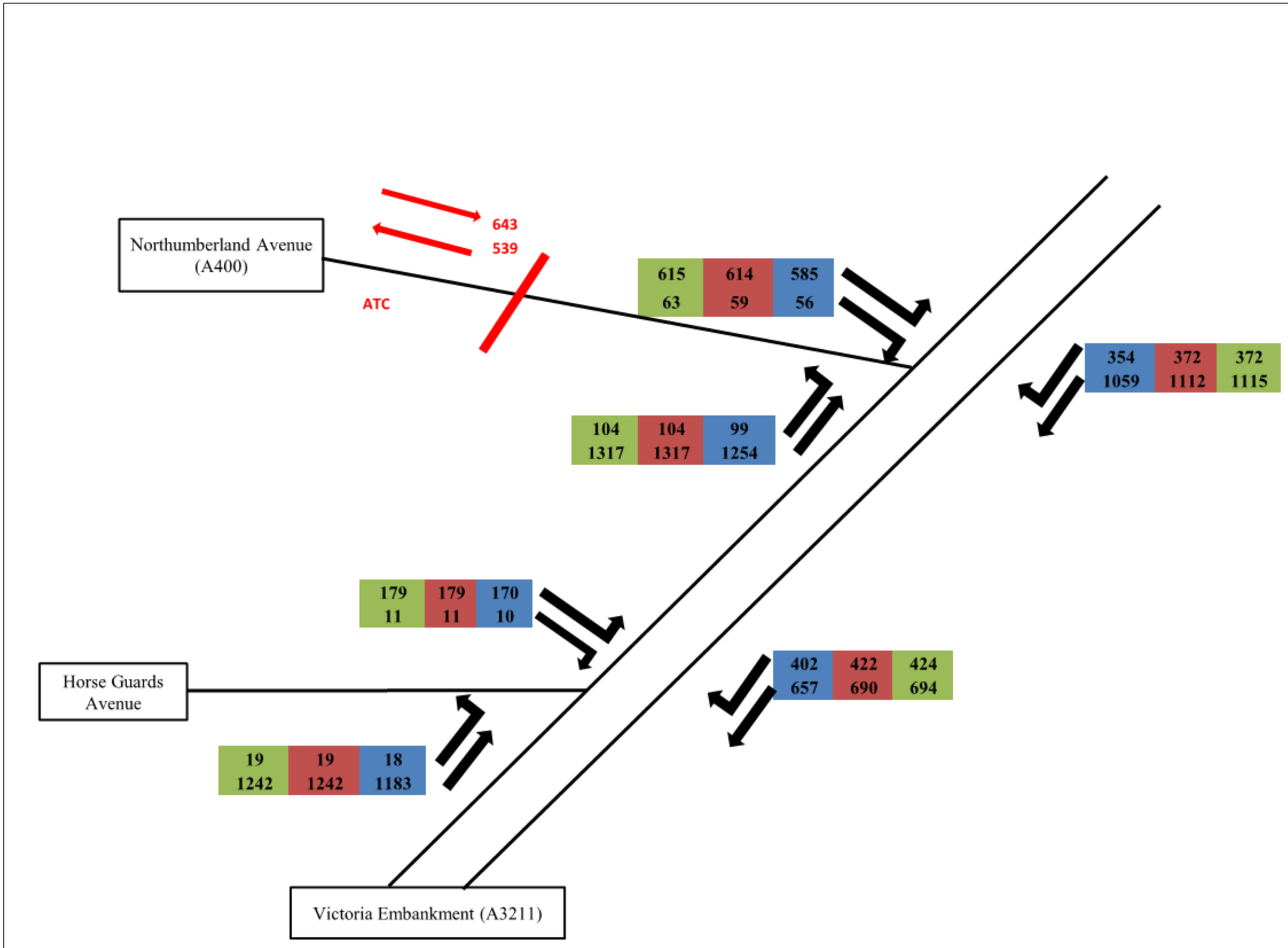
Transport - survey locations

Figure 17.4.4

1PL03-TT-50695
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water



Keyplan:

Key

- Base Traffic Flow
- Construction Base
- Development Case

FOR INFORMATION

Location

Victoria Embankment Foreshore
City Of Westminster

Document Information

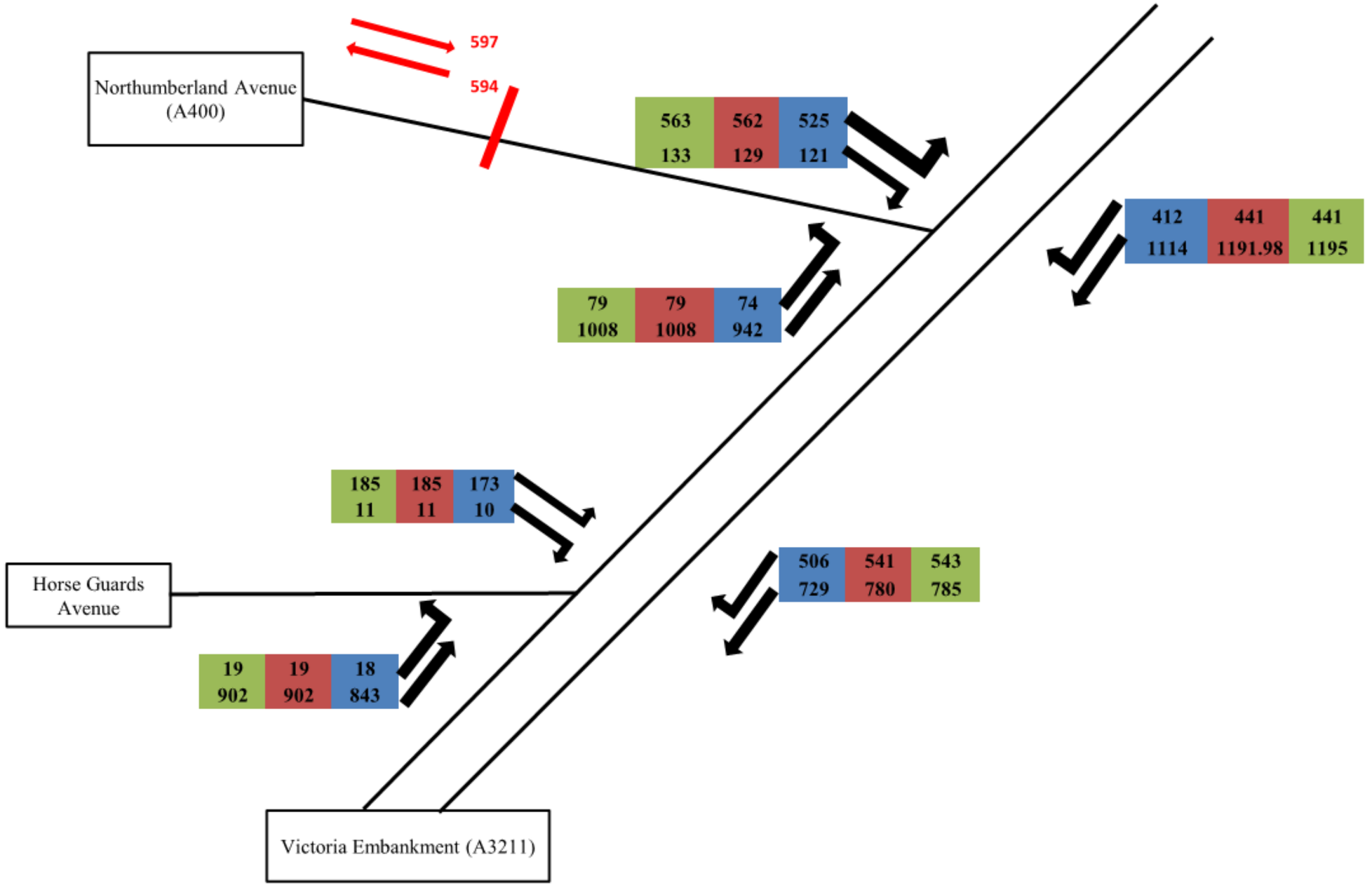
Transport Assessment

Transport - Baseline, Construction and Development case traffic flow (AM peak hour)
Figure 17.4.5

1PL03-TT-50914
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water



Keyplan:

Key

- Base Traffic Flow
- Construction Base
- Development Case

FOR INFORMATION

Location

Victoria Embankment Foreshore
City Of Westminster

Document Information

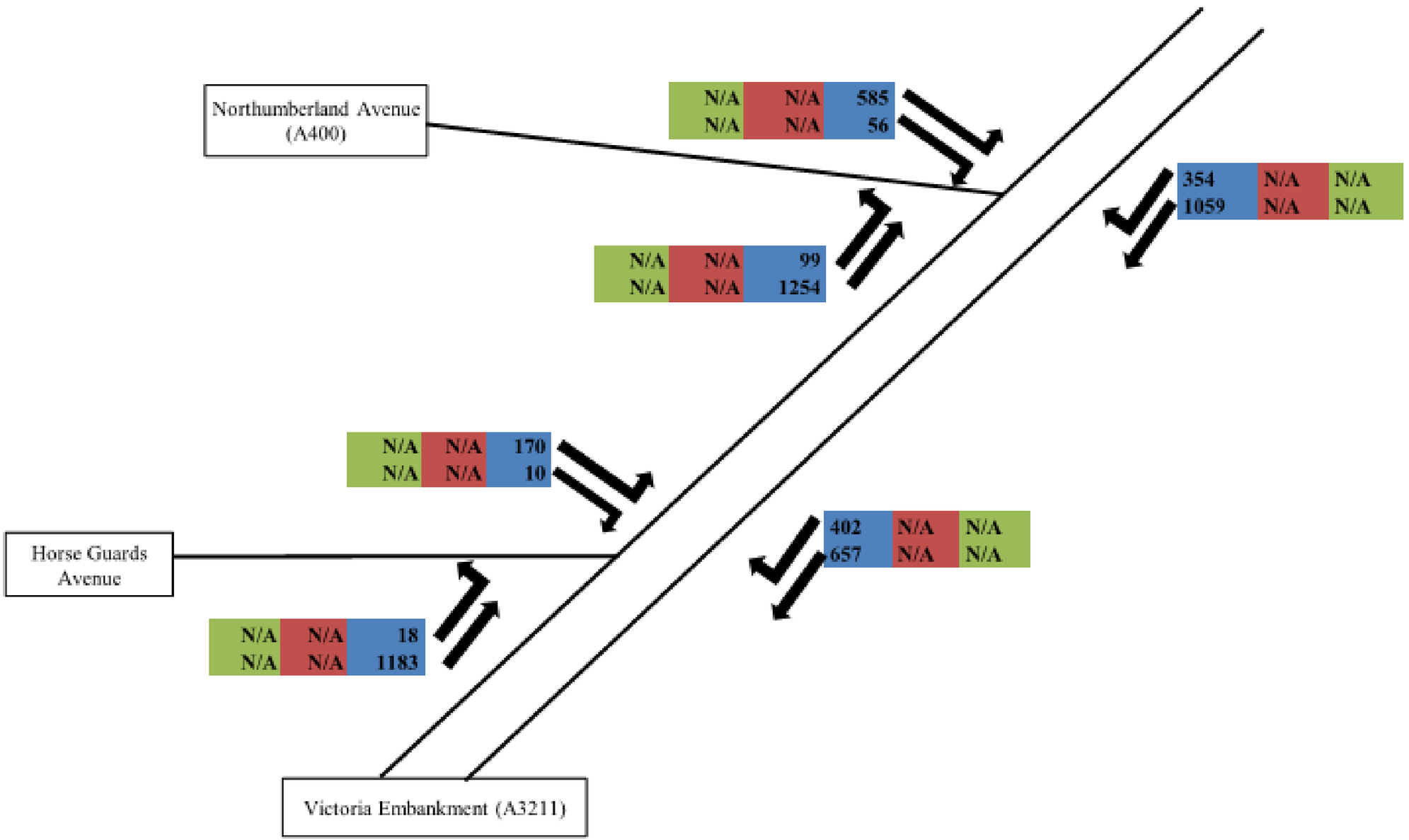
Transport Assessment

Transport - Baseline, Construction and Development case traffic flow (PM peak hour)
Figure 17.4.6

1PL03-TT-50938
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water



Keyplan:

Key

- Base Traffic Flow
- Construction Base
- Development Case

FOR INFORMATION

Location

Victoria Embankment Foreshore
City Of Westminster

Document Information

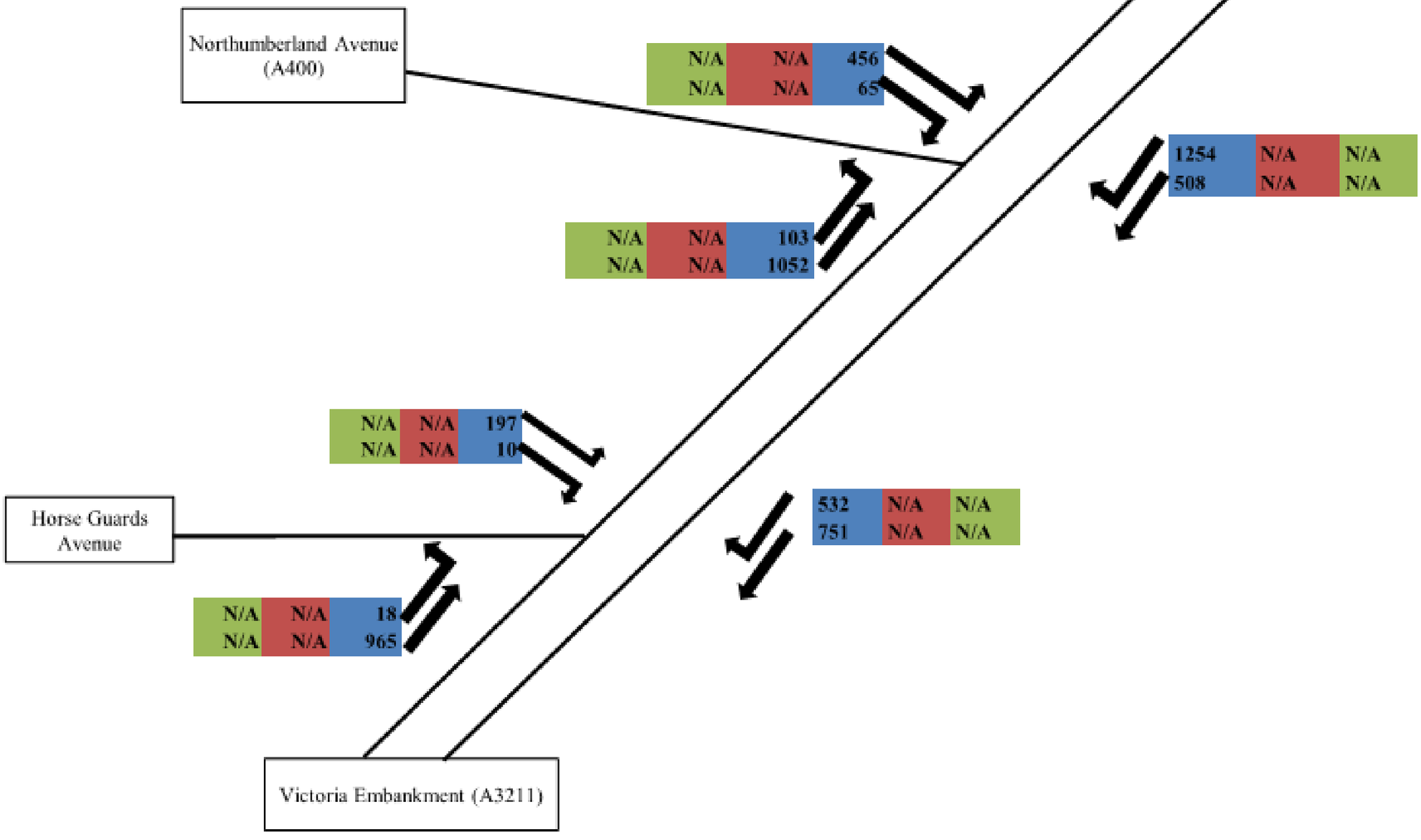
Transport Assessment

Transport – TfL Baseline Traffic Flow (AM peak hour)
Figure 17.4.7

1PL03-TT-50951
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water



Keyplan:

Key

- Base Traffic Flow
- Construction Base
- Development Case

FOR INFORMATION

Location

Victoria Embankment Foreshore
City Of Westminster

Document Information

Transport Assessment

Transport – TfL Baseline Traffic Flow (PM peak hour)
Figure 17.4.8

1PL03-TT-50957
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

Keyplan:

Key

- Slight
- Serious
- Limits of Land to be Acquired or Used
- Local authority boundary

110 55 0 110 m

Scale 1 : 7,500 at A3

FOR INFORMATION

Location

Victoria Embankment Foreshore
City Of Westminster

Document Information

Transport Assessment

Transport - accident locations

Figure.17.4.9

1PL03-TT-50759
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

Keyplan:

Key

Accidents

(Severity, Mode of travel)

- Slight, Pedestrian
- Slight, Pedal Cycle
- Serious, Pedestrian
- Serious, Pedal Cycle
- Limits of Land to be Acquired or Used
- Local authority boundary

110 55 0 110 m

Scale 1 : 7,500 at A3

FOR INFORMATION

Location

Victoria Embankment Foreshore
City Of Westminster

Document Information

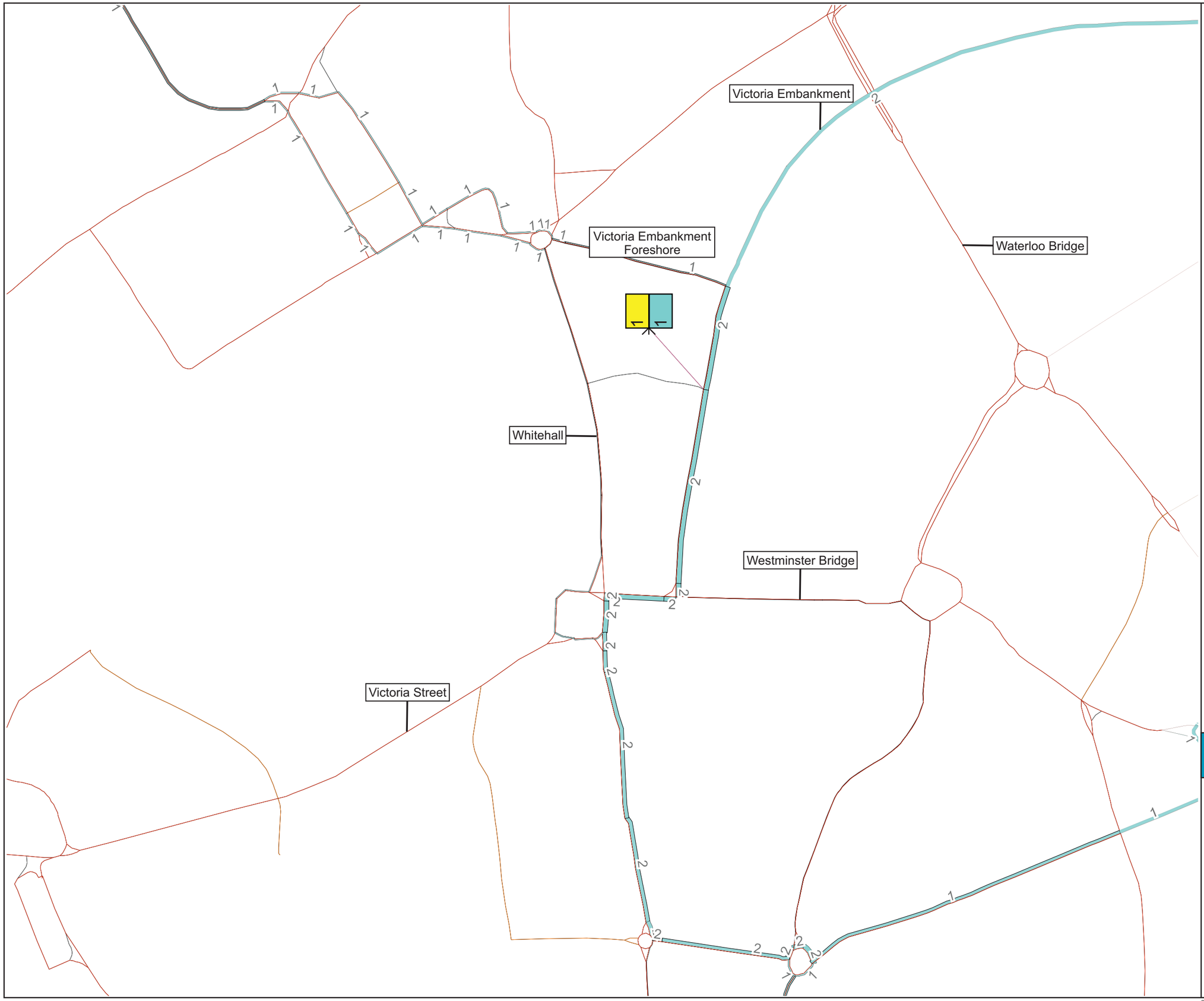
Transport Assessment

Transport - pedestrian and cyclist accidents by severity
Figure.17.4.10

1PL03-TT-50843
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water



Hourly construction lorries arrivals and departures

- Arrivals
- Departures

Hourly construction lorries movements

- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8
- 8 - 9
- 9 - 10
- 10 - 11
- 11 - 12
- 12 - 13
- 13 - 14
- 14 - 15
- > 15

Note: Construction vehicle flows include all Thames Tideway Tunnel sites on this network during this period.

FOR INFORMATION

Location

Victoria Embankment Foreshore
City of Westminster

Document Information

Transport Assessment
Hourly Construction Lorry Movements - Site Year 1 of Construction

Figure 17.5.1

1PL03-TT-50891

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

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Clearwater Court, Vastern Road, Reading RG1 8DB

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