Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Transport Assessment

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Chelsea Embankment Foreshore

Main Report

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Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Transport Assessment

Section 13: Chelsea Embankment Foreshore

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13.1 Introduction

13.1.1 This site-specific *Transport Assessment (TA)* presents the findings of the assessment of the transport issues of the Thames Tideway Tunnel project at the Chelsea Embankment Foreshore site located within the Royal Borough (RB) of Kensington and Chelsea.

13.1.2 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.

13.1.3 The site is located on the foreshore adjacent to, and west of, Chelsea Bridge Road (A3216) in the RB of Kensington and Chelsea. The Grounds of the Royal Hospital Chelsea and Ranelagh Gardens lie to the north of the site.

13.1.4 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.

13.1.5 The *TA* draws on a number of project-wide and application 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*.

13.1.6 The *TA* structure is as follows:

a. Section 13.2 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 13.3 outlines the assessment methodology used for the *TA* for the construction and operational phases

c. Section 13.4 details the baseline conditions on the transport network surrounding the site, including survey data analysis and accident analysis

d. Section 13.5 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 13.6 provides the assessment of the operational phase of the project

f. Section 13.7 summarises the *TA* findings.

13.2 Proposed development

13.2.1 The proposed development site is located on the north foreshore of the River Thames in the RB Kensington and Chelsea. It comprises part of the River Thames foreshore, sections of the eastbound and westbound carriageways and sections of the north and south side footways of Chelsea Embankment (A3212), and a small section of Ranelagh Gardens. Figure 13.2.1 in the Chelsea Embankment Foreshore *Transport Assessment* figures shows the Chelsea Embankment Foreshore site location.

13.2.2 The site is bounded to the north by the Royal Hospital Chelsea and its South Grounds, and Ranelagh Gardens. To the east are Chelsea Bridge Gardens and Chelsea Bridge (A3216), and residential properties, with the Lister Hospital to the northeast. Cadogan Pier and a mooring lie to the west of the site. The River Thames bounds the site to the east, south and west.

13.2.3 Existing access to the site is directly from Chelsea Embankment (A3212), which is part of the Transport for London Road Network (TLRN), close to the junction with Chelsea Bridge Road (A3216), Chelsea Bridge (A3216) and Grosvenor Road (A3212).

13.2.4 The development at Chelsea Embankment Foreshore consists of a CSO drop shaft and a CSO interception (Ranelagh CSO) in the River Thames foreshore and an overflow weir chamber to connect to the northern Low Level Sewer No.1 in the footway and carriageway of Chelsea Embankment (A3212).

Construction

13.2.5 The construction site would be located on the foreshore of the River Thames. In order to provide working areas, the site would also occupy parts of the north and south side footways and carriageways of Chelsea Embankment (A3212).

13.2.6 Construction at the Chelsea Embankment Foreshore site is anticipated to last for four years. There would be four phases of construction: phase 1 - site set-up and installation of cofferdam, phase 2 - shaft construction and tunnelling, phase 3 - construction of other structures, and phase 4 – removal of cofferdam and site demobilisation. The access plan and highway layout during construction (utility diversion phase, phase 1-2 and phase 3) plans in the Chelsea Embankment Foreshore *Transport Assessment* figures present the highway layout during construction.

13.2.7 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 13 Appendix E.

13.2.8 Construction at this site would take place in two locations, one located on the foreshore of the River Thames including the southern footway and part of the westbound carriageway of Chelsea Embankment and one located in the eastbound carriageway of Chelsea Embankment (A3212), including part of the northern footway.

13.2.9 The main construction site on the foreshore would be active throughout phases 1-3 of construction. The southern footway (Thames Path) would generally be closed, but would be reopened to the public during weekends (except during weekend working). At the beginning of construction phase 1 (site setup), utility diversion works would be undertaken prior to establishment of the cofferdam in the foreshore. Part of the eastbound carriageway and northern footway of Chelsea Embankment (A3212) would be closed during utility diversion works. Throughout the rest of the construction period, part of the westbound lane of Chelsea Embankment (A3212) would be closed intermittently when required, e.g. for stacking of vehicles during major concrete pours. Due to the width of the road, one lane in each direction would be maintained during the lane closures.

13.2.10 The site in the eastbound carriageway and northern footway would be required for construction of the overflow weir chamber on the Low Level Sewer No. 1, which runs underneath the eastbound carriageway. In construction phase 3 (construction of other structures), the overflow weir chamber would be built. This would also require closure of part of the eastbound carriageway and northern footway. Due to the width of the road, one lane in each direction would be maintained during the lane closures.

13.2.11 The Thames Path runs along the southern (riverside) footway of Chelsea Embankment (A3212). When the Thames Path is closed, pedestrians would be diverted to the northern footway, using an existing signalised pedestrian crossing to the west of the Bull Ring. During phases 1, 2 and 4 of construction (when the northern footway is open), pedestrians would be diverted back to the southern footway using the existing signalised crossing at the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216). During phase 3 of construction (when the northern footway is closed), pedestrians would be diverted back to the southern footway using a temporary signalised pedestrian crossing to the east of the main construction site.

13.2.12 Vehicle access to and from the site would take place using a left-turn in / left-turn out arrangement from the westbound carriageway of Chelsea Embankment (A3212), part of which would need to be closed for periods of time during the works. Vehicle access to the worksite in the eastbound carriageway of Chelsea Embankment (A3212) would take place from that carriageway on a left-turn in / left-turn out basis.

13.2.13 During phases 1 to 3 of construction (during construction of the cofferdam), a 3.3m wide lane would be created on the nearside of the westbound lane of Chelsea Embankment (A3212) to accommodate construction vehicles arriving at and departing from the site and to accommodate construction activities prior to the establishment of a worksite within the cofferdam. Following phase 1 of construction, this lane would be used intermittently, when required for construction activities, such as stacking of vehicles during a large concrete pour. The construction lane would reduce both the eastbound and westbound lanes of general traffic by 1.6m, to leave 4.3m lanes in each direction. Two lanes would remain open throughout construction – one in each direction.

13.2.14 In these phases, a 3.3m wide lane would also need to be created on the nearside of the eastbound carriageway of Chelsea Embankment (A3212) to accommodate construction vehicles accessing the worksite for construction of the overflow weir chamber. However, as with the foreshore area, two-way traffic would be maintained throughout the construction works.

13.2.15 There would be a gated access for the left-turn in / left-turn out movement for construction traffic travelling westbound along Chelsea Embankment (A3212). There would also be a gated access for the left-turn in / left-turn out movement for construction traffic travelling eastbound along Chelsea Embankment (A3212) to access the worksite.

13.2.16 Phase 4 of construction would involve removal of all the temporary traffic restrictions along Chelsea Embankment (A3212) and the highway layout would be reinstated to the baseline condition. However, the existing traffic island located to the east of the Bull Ring would be reinstated slightly to the east of its existing location.

13.2.17 During construction cofferdam fill (both import and export) and shaft and ‘other’ excavated material (export) would be transported by barge. For the assessment it has been assumed that 90% of these materials are 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.

13.2.18 Parking for five essential maintenance/operational vehicles would be provided on site. No worker parking would be provided.

13.2.19 Construction details for the site relevant to the construction transport assessment are summarised in Table 13.2.1.

Table 13.2.1 Construction details

Description	Assumption
Assumed peak period of construction lorry movements	Site Year 3 of construction
Assumed average peak daily construction lorry vehicle movements (in peak month of Site Year 3 of construction) and duration	84 movements per day (42 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	6 movements per day (3 barge trips)

Description	Assumption
construction)	
Typical types of lorry requiring access (comprising rigid-bodied, flatbed and articulated vehicles)	Excavated material lorries Plant and equipment deliveries Imported fill lorries Ready mix concrete lorries Office/general delivery lorries Rebar lorries Temporary construction material lorries including pipe/track/oils/greases lorries Shaft precast concrete lining lorries

Note: a movement is a construction vehicle/barge moving either to or from a 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

13.2.20 Figure 13.2.2 in the Chelsea Embankment Foreshore *Transport Assessment* figures shows the construction routes for the Chelsea Embankment Foreshore site. These have been discussed with both Transport for London (TfL) and the Local Highway Authority for the purpose of assessment.

13.2.21 The site is located on the TLRN on Chelsea Embankment (A3212). The main junctions along the construction traffic routes are:

a. Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) / Chelsea Bridge Road (A3216)

b. Grosvenor Road (A3212) / Millbank (A3212) / Vauxhall Bridge (A202) / Bessborough Gardens (A202)

c. Queenstown Road (A3216) / Prince of Wales Drive roundabout

d. Queenstown Road (A3216) / Battersea Park Road (A3205).

13.2.22 During all phases of construction at Chelsea Embankment Foreshore construction vehicles would use the TLRN and the Strategic Road Network (SRN). They would approach the main construction site from Grosvenor Road (A3212) and Chelsea Bridge (A3216) via the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) / Chelsea Bridge Road (A3216), approximately 150m east of the site, and travel westbound along Chelsea Embankment (A3212) to the site.

13.2.23 Vehicle access to and from the site would take place from the westbound carriageway of Chelsea Embankment (A3212) and would be arranged on a left-turn in / left turn-out basis.

13.2.24 Vehicles leaving the main construction site would travel westbound along Chelsea Embankment (A3212) and Cheyne Walk (A3220). Vehicles travelling to destinations to the north would need to continue their journey along Cremorne Road (A3220) and Gunter Grove (A308) towards West Cromwell Road (A4). Vehicles travelling to destinations to the south would need to cross Battersea Bridge Road (A3220) to continue their journey along Prince of Wales Drive (A3220) and Albert Bridge Road (A3220) towards Battersea.

13.2.25 Phase 3 of construction would include work in the northern footway and eastbound carriageway of Chelsea Embankment (A3212) concurrently with construction works at the foreshore site. Vehicles serving the site in the eastbound carriageway would take the eastbound carriageway of Chelsea Embankment (A3212) to get to the site and on their departure the construction vehicles would travel in the eastbound direction.

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

Proposed construction flows

Construction vehicles and barges

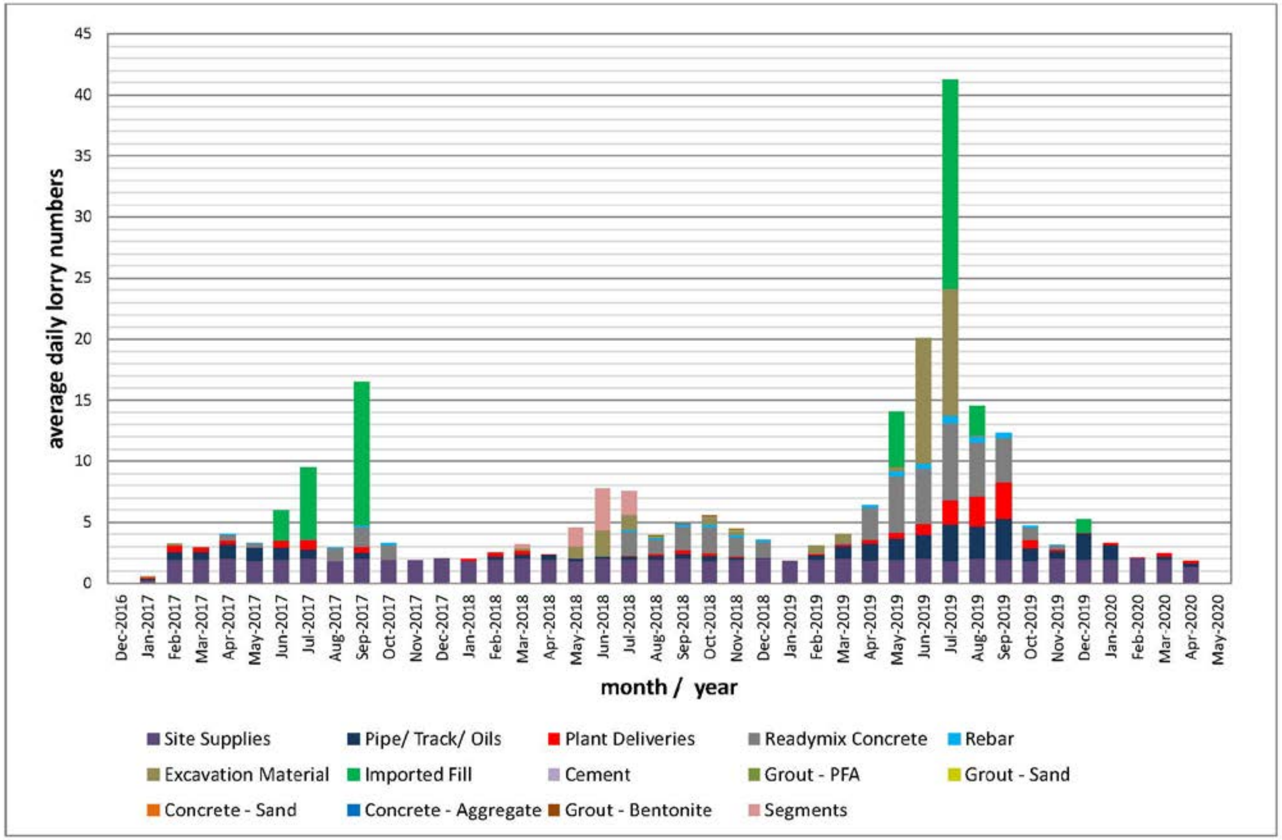
13.2.27 Vehicle movements would take place during the standard day shift of ten and a half hours on weekdays (08:00 to 18:30) and five and a half hours on Saturdays (08:00 to 13:30). In exceptional circumstances HGV and abnormal load movements could occur up to 22:00 on weekdays for large concrete pours and later at night on agreement with RB of Kensington and Chelsea.

13.2.28 Site-specific peak construction assessment years have been identified. The histograms in Plate 13.2.1 and Plate 13.2.2 show that the peak site-specific activity at the Chelsea Embankment Foreshore site for construction lorries would occur in Site Year 3 of construction. The peak activity for construction barges at this site would occur in Site Year 1 of construction.

13.2.29 This *TA* assesses these site-specific peak construction years. As detailed in Table 13.2.1, there would be an estimated 84 average peak daily construction lorry vehicle movements in the peak month of this peak year. Plate 13.2.1 shows how vehicular movements vary throughout the construction period. Plate 13.2.2 indicates the variation in the number of construction barge movements during construction.

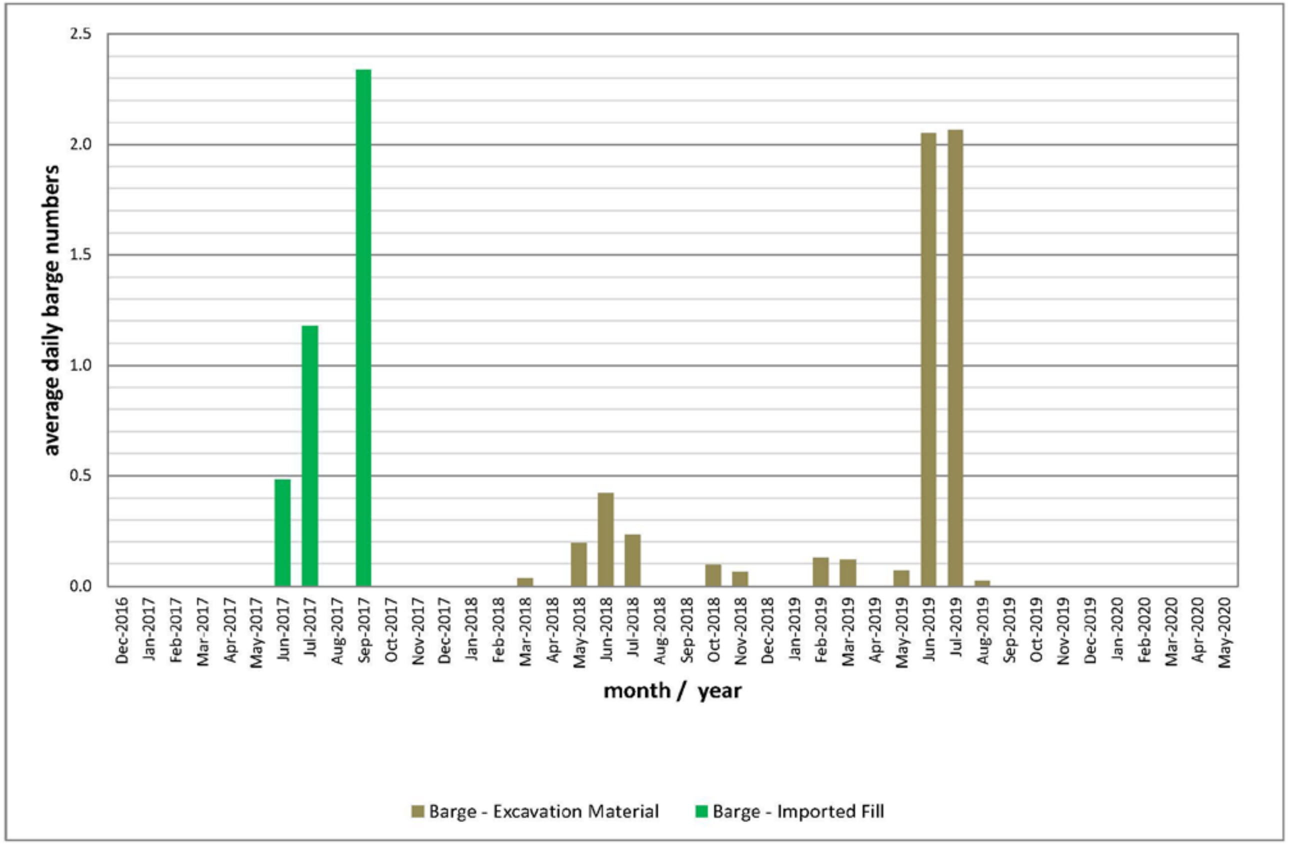
13.2.30 The assessment is based on 10% of the daily number of lorry journeys occurring in the peak hours, which has been agreed with TfL as a reasonable approach. It is recognised that it may be desirable to reduce the number of construction lorry movements in peak hours and the mechanisms for addressing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

Plate 13.2.1 Estimated construction lorry profile



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

Plate 13.2.2 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.

13.2.31 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.

13.2.32 The 07:00 to 09:00 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 13.4). 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.

13.2.33 Hourly construction vehicle trips during the inter-peak period are not expected to exceed the hourly trips assumed for the 08:00 to 09:00 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 08:00 and 09:00 and 17:00 and 18:00.

13.2.34 Other construction vehicle movements associated with site operations and contractor activities would be cars and light goods vehicles. The construction vehicle movements expected to be generated by the Chelsea Embankment Foreshore site are shown in Table 13.2.3.

Construction workers

13.2.35 The construction site is expected to require a maximum workforce of approximately 65 workers on site at any one time. The number and type of workers is shown in Table 13.2.2.

Table 13.2.2 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.*

13.2.36 The mode split outlined in Table 13.2.3 has been used to assess the changes as a result of the 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 Chelsea Embankment Foreshore site. The Census data indicates that the predominant mode of travel for journeys to work in this area is public transport.

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

13.2.37 There would be no parking provided within the site boundary for workers. As parking in the immediate locality and on surrounding streets is 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 13.2.3 to reflect increased levels of non-car use by workers at this site. The assessment has been undertaken on this basis.

Table 13.2.3 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	11%	7	7
National Rail	38%	25	25
Underground	35%	23	23
Car driver	<1%*	0	0
Car passenger	<1%*	0	0
Cycle	3%	2	2
Walk	10%	7	7
River	1%	1	1
Other (taxi/motorcycle)	2%	1	1
Total	100%	65	65

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

13.2.38 As indicated in Table 13.2.3, it is assumed that the predominant mode of travel for journeys to work in this area is public transport. Further, the primary public transport services used to access the area are London Underground via the station on Sloane Square (A3216) and bus via the bus stops on Chelsea Embankment (A3212) and Chelsea Bridge Road (A3216).

Vehicle movements summary

13.2.39 The total anticipated number of construction-related vehicle movements in the peak month of activity at this site is set out in Table 13.2.4.

Table 13.2.4 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%*	84	0	8	8	0
Other construction vehicle movements**	36	4	4	4	4
Worker vehicle movements***	nominal	0	0	0	0
Total	**120**	**4**	**12**	**12**	**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 include 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.*

13.2.40 An average peak flow of 120 vehicle movements a day is expected during the months of greatest activity during Site Year 3 of construction at this site. At other times in the construction period, vehicle flows would be lower than this average peak figure.

13.2.41 Table 13.2.4 shows that in the AM and PM peak hours, the Chelsea Embankment Foreshore site would generate approximately 12 vehicle movements.

Code of Construction Practice

13.2.42 Measures incorporated into the *Code of Construction Practice (CoCP) Part A* (Section 5) to reduce transport effects 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

13.2.43 In addition to the general transport measures within the *CoCP Part A*, the following measures have been incorporated into the *CoCP Part B* (Section 5) relating to the Chelsea Embankment Foreshore site:

a. all vehicles would access/egress site from the westbound lane, using a left turn in and left turn out arrangement

b. the site areas would be designed to maintain two-way traffic flow on Chelsea Embankment (A3212). If required, a suitable central safety barrier would be installed between alternate direction lanes

c. minimum lane width of 3.25m to be retained

d. the existing traffic island directly to the northeast of Bull Ring Gate would be removed

e. management arrangements during events in the adjacent area to be confirmed in consultation with the Local Highway Authority, TfL and other stakeholders

f. access through the Bull Ring entrance for set-up and take-down of the Chelsea Flower Show and Masterpiece events and for VIP access would be maintained during these events. Emergency access from Chelsea Embankment (A3212) would be maintained during the events

g. the diversion of the Thames Path would be adequately signed and a temporary signalised pedestrian crossing would be provided between the foreshore site and the worksite in the eastbound carriageway of Chelsea Embankment (A3212)

h. the riverside footway on Chelsea Embankment (A3212) would be reinstated for public use outside of working hours at weekends

i. arrangements to allow buses to turn right from A3212 into the bus stop in the Bull Ring area would be maintained, except during landscaping works in this area, unless agreed otherwise

j. the bus stop in the Bull Ring area would be suspended temporarily only during landscaping works in the area.

13.2.44 The effective implementation of the *CoCP Part A* and *Part B* measures is assumed within the assessment.

13.2.45 Based on current travel planning guidance including TfL's Travel planning for new development in London[1], this development falls within the threshold for producing a Strategic Framework Travel Plan. A *Draft Project Framework Travel Plan* has been prepared based on the TfL ATTrBuTE guidance[2]; this is submitted as part of the application documentation. The *Draft 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 the site-specific *Travel Plans* to be prepared by the site contractors. The site-specific travel planning requirements of relevance to the *Draft Project Framework Travel Plan* are as follows:

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

b. a mode split established for the Chelsea 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.

Other measures during construction

13.2.46 During construction phase 4 (site restoration) the existing kerb line of the Bull Ring would be realigned and a permanent site access point for the maintenance vehicles during the operational phase would be constructed.

Operation

13.2.47 For the operational phase, Chelsea Embankment (A3212) would be returned to the baseline highway layout, with the access to the CSO shaft provided in the foreshore site. There would be public access to this area excluding infrequent and short-term periods when the area would be closed off for maintenance access. The existing pedestrian island located to the east of the Bull Ring would be reinstated slightly further to the east.

13.2.48 Once the Thames Tideway Tunnel is operational it is not expected that there would be any significant changes to 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 issues considered during the operational phase are those affecting highway layout and operation.

13.2.49 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 RB of Kensington and Chelsea and TfL.

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

13.2.51 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. During Thames Path may need to be temporary diverted during the ten-yearly inspections.

13.2.52 During operation, the site would be accessed from the westbound carriageway of Chelsea Embankment (A3212) and the maintenance vehicles would approach the site from the Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) / Chelsea Bridge Road (A3216) junction. The highway layout during the operational phase is shown in the permanent highway layout plan in the Chelsea Embankment Foreshore *Transport Assessment figures.*

13.3 Assessment methodology

Engagement

13.3.1 An extensive scoping and technical engagement process has been undertaken. All consultee comments relevant to this site are presented in Volume 13 of the *Environmental Statement.*

13.3.2 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

13.3.3 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 Chelsea Embankment Foreshore, RB of Kensington Chelsea has been consulted and the comments which have arisen relating directly to Chelsea Embankment Foreshore have been recorded and responded to accordingly.

13.3.4 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 RB of Kensington Chelsea.

13.3.5 The key issues arising from the stakeholder engagement are:

a. ensuring that the assessment addresses the full extent of the construction works and the issues arising from the construction traffic associated with all Thames Tideway Tunnel project sites including traffic routing during construction

b. confirmation of the number of lorry movements per day and the vehicular access to the sites

c. the use of the river to transport materials during the construction works

d. provision of a temporary signalised pedestrian crossing between the foreshore site and the worksite on Chelsea Embankment (A3212)

e. operation of the SRN / TLRN in the vicinity of Chelsea Embankment (A3212)

f. Chelsea Barracks and Battersea Power Station development proposals should be considered as part of the baseline assessment

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

13.3.6 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.

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

Construction assessment area

13.3.8 The assessment area for the Chelsea Embankment Foreshore site includes the site access directly from Chelsea Embankment (A3212) which is a part of the TLRN. The junction of Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212) / Chelsea Bridge (A3216), approximately 150m to the east of the site, has also been assessed.

13.3.9 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).

13.3.10 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

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

13.3.12 The site-specific peak construction traffic year at Chelsea Embankment Foreshore is Site Year 3 of construction.

13.3.13 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

13.3.14 The assessment for each site takes account of construction vehicle movements associated with Chelsea 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 3 of construction.

13.3.15 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.

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

13.3.17 For future year assessments for the Chelsea 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.

13.3.18 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.

13.3.19 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 RB of Kensington Chelsea was applied to the traffic data collected in 2011 in the vicinity of the Chelsea Embankment Foreshore site to produce base case traffic flows for the purposes of local highway modelling.

13.3.20 Construction lorry, operational and worker vehicle movements (where relevant) associated with the Chelsea 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.

13.3.21 This approach provides a robust assessment case for local modelling as the baseline traffic has been growthed 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

13.3.22 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 18:30, this would be agreed in advance with TfL and the local highway authority.

13.3.23 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.

13.3.24 As para. 13.3.22 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.

13.3.25 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).

13.3.26 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.

13.3.27 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

13.3.28 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.

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

Operational assessment area

13.3.30 The assessment area for the operational assessment remains the same as for the construction assessment as outlined in para. 13.3.8.

Operational assessment year

13.3.31 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.

13.4 Baseline

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

Policy review

13.4.2 The site is located within the RB Kensington and Chelsea; the relevant national, regional, and local policy documents have been reviewed and included in Appendix A.

Existing land use

13.4.3 The site is located in reclaimed foreshore area behind the river wall adjacent to the Thames Path.

13.4.4 The nearest residential area is located approximately 100m to the west of the site at Embankment Gardens.

Existing access

13.4.5 The foreshore part of the site is not currently accessible by vehicle. There is pedestrian and cycle access from the Thames Path along the southern footway of Chelsea Embankment (A3212) which is indicated in Figure 13.4.1 in the Chelsea Embankment Foreshore *Transport Assessment* figures.

Pedestrian network and facilities

13.4.6 The key pedestrian network related to the Chelsea Embankment Foreshore site comprises:

a. Chelsea Embankment (A3212) providing an east-west link between the Bull Ring Gate bus stop and Cadogan Pier to the west and Chelsea Bridge (A3216), Chelsea Bridge Road (A3216) and Grosvenor Road (A3212) to the east

b. Grosvenor Road (A3212) providing an east-west link between Grosvenor Road bus stop to the east and the site, including the signalised pedestrian crossings at Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216) junction

c. Chelsea Bridge Road (A3216) providing a north-south link between Lister Hospital bus stop and Sloane Square Underground station (Circle and District lines) to the north and the site

d. Chelsea Bridge (A3216) providing a north-south link between Chelsea Bridge bus stop to the south and the site.

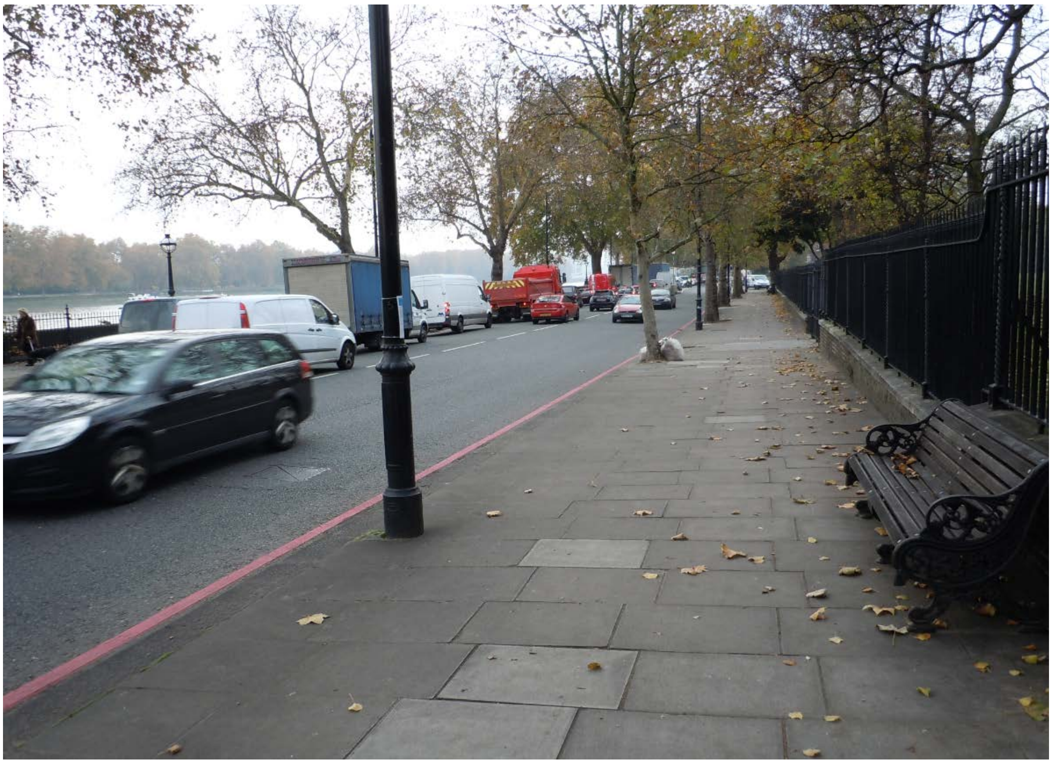
13.4.7 The Thames Path and the London Strategic Walk network in the vicinity of the site are shown on Figure 13.4.1 in the Chelsea Embankment Foreshore *Transport Assessment* figures.

13.4.8 The Thames Path (a Public Right of Way) runs along the southern footway of Chelsea Embankment (A3212), adjacent to the river. The Thames Path continues to the east along Grosvenor Road (A3212) and Millbank (A3212), and to the west along Cheyne Walk (A3220) and Lots Road. Plate 13.4.1 shows the Thames Path on the southern footway of Chelsea Embankment (A3212).

Plate 13.4.1 Thames Path facing west along Chelsea Embankment (A3212)

13.4.9 Chelsea Embankment (A3212) provides an east-west link for pedestrians along the north bank of the River Thames. The footways along either side of Chelsea Embankment (A3212) are between 2.2m and 4m wide. There is some provision for resting provided along the northern footway of Chelsea Embankment (A3212). This is shown in Plate 13.4.2.

Plate 13.4.2 Northern footway facing west along Chelsea Embankment (A3212)



13.4.10 Signalised pedestrian crossings are provided at the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216). All arms have staggered signalised pedestrian crossing facilities with tactile paving and dropped kerbs.

13.4.11 Additional signalised pedestrian crossing facilities are located 340m walking distance west of the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) / Chelsea Bridge Road (A3216) to the west of the Bull Ring.

13.4.12 Chelsea Bridge Road (A3216) has footways of between 3.5m and 4m wide on both sides of the road, providing a continuous north-south link between Lower Sloane Street, Pimlico Road (A3214) and Royal Hospital Road (B302) to the north, and Chelsea Embankment (A3212), Grosvenor Road (A3212) and Chelsea Bridge (A3216) to the south.

13.4.13 The pedestrian crossings along Chelsea Bridge Road (A3216) are at the junctions with Chelsea Bridge Road (A3216) and Ebury Bridge Road (B313) and Royal Hospital Road (B302), Pimlico Road (A3214), and Lower Sloane Street (A3216).

13.4.14 Grosvenor Road (A3212) to the east of the site provides a continuous east-west link between Chelsea Embankment (A3212), Chelsea Bridge Road (A3216) and Chelsea Bridge (A3216) to the west and Vauxhall Bridge Road (A202), Vauxhall Bridge (A202) and Millbank (A3212) to the east.

13.4.15 The road has footways of between1.5m and 2.8m wide on both sides. A signalised pedestrian crossing is provided to the north of the junction of Grosvenor Road (A3212) and Lupus Street.

13.4.16 Chelsea Bridge (A3216) crosses the River Thames into the London Borough of Wandsworth and has footways on both sides of the road providing a north-south link for pedestrians between Chelsea Embankment (A3212), Grosvenor Road (A3212), and Chelsea Bridge Road (A3216) to the north and Queenstown Road (A3216) to the south.

13.4.17 The width of the footways along Chelsea Bridge (A3216) is approximately 4m. No pedestrian crossing facility is provided on Chelsea Bridge (A3216).

Cycle network and facilities

13.4.18 The existing cycle network and facilities in the vicinity of the site are described below and shown on Figure 13.4.1 in the Chelsea Embankment Foreshore *Transport Assessment* figures.

13.4.19 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 Cheyne Walk (A3220), Chelsea Embankment (A3212), Grosvenor Road (A3212) and Lupus Street. The NCN Route 4 along Chelsea Embankment (A3212) is off-road and cyclists can share the southern footway of Chelsea Embankment (A3212) with pedestrians.

13.4.20 Cycle lanes are provided along Chelsea Bridge Road (A3216) in both directions between the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216) and the junction of Chelsea Bridge Road (A3216) / Pimlico Road (A3214) / Royal Hospital Road (B302) / Lower Sloane Street (A3216).

13.4.21 Cycle lanes are also provided along Chelsea Bridge (A3216) in both northbound and southbound directions and are shown in Plate 13.4.3.

13.4.22 Advanced stop lines are provided on the east and south arms of the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216).

Plate 13.4.3 Cycle lane south facing along Chelsea Bridge (A3216)

Barclays Cycle Superhighways

13.4.23 The closest Barclays Cycle Superhighway (CS) to the site is CS8 which routes from Westminster to Wandsworth, passing along Chelsea Bridge (A3216) and to the east along Grosvenor Road (A3212). The closest point of approach to the site is at Chelsea Bridge, approximately 200m walking distance to the east.

Barclays Cycle Hire Scheme

13.4.24 There is a Barclays Cycle Hire Docking station on Grosvenor Road (A3212) approximately 200m walking distance to the east of the site, to the east of the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216). This cycle docking station accommodates 15 bicycles and is shown in Plate 13.4.4.

Plate 13.4.4 Barclays Cycle Hire docking station along Grosvenor Road (A3212)

Cycle parking

13.4.25 There are no cycle parking facilities in the immediate vicinity of the Chelsea Embankment Foreshore site.

Public transport

Public Transport Accessibility Level

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

13.4.27 The site has a PTAL rating of 3, rated as 'moderate' (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 13.4.2 in the Chelsea Embankment Foreshore *Transport Assessment* figures.

Bus services

13.4.28 A total of five daytime and two 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 13.4.1 provides a summary of the bus services and their frequencies during the weekday peaks.

Table 13.4.1 Existing daytime weekday peak hour local bus services and frequencies (number of buses per hour)

Bus number	Origin - destination	Nearest bus stop to Chelsea Embankment Foreshore site	Approximate walking distance from Chelsea Embankment Foreshore site (m)	Weekday peak hour two-way frequencies	
				AM peak (08:00-09:00)	PM peak (17:00-18:00)
24	Grosvenor Road – Royal Free Hospital	Grosvenor Road	600	20	20
44	Victoria – Tooting	Lister Hospital	200	18	18
137	Streatham Hill – Marble Arch	Lister Hospital	200	33	24
360	Prince Consort Road – Newington Causeway	Bull Ring Gate	150	13	13
452	Station Terrace – Wandsworth Road Station	Lister Hospital	200	19	17

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

13.4.29 These bus routes operate from the following bus stops:

a. Bull Ring Gate bus stop on Chelsea Embankment (A3212) turning loop – (northbound only), 150m walking distance west of the site

b. Lister Hospital bus stop on Chelsea Bridge Road (A3216) – (northbound and southbound), 240m walking distance northeast of the site

c. Grosvenor Road bus stop on Grosvenor Road (A3212) – (eastbound and westbound), 610m walking distance east of the site.

13.4.30 On average there are a total of 103 daytime bus services per hour in the AM peak and 92 bus services per hour in the PM peak within a 640m walking distance of the site.

13.4.31 There are approximately 12 night-time bus services per hour Monday – Friday between 00:00 – 06:00 and on Saturdays between 00:00 – 06:00 within 640m walking distance of the site.

London Underground

13.4.32 As shown on Figure 13.4.2 in the Chelsea Embankment Foreshore *Transport Assessment* figures, the closest London Underground station to the site is Sloane Square which is located approximately 1.1km walking distance to the north of the site and is served by the Circle and District lines.

13.4.33 Circle Line trains from this station travel clockwise to Edgware Road and anti-clockwise to Hammersmith via Liverpool Street. The frequency of the Circle Line trains is approximately one every ten minutes providing six services per hour in each direction in the AM and PM peak hours.

13.4.34 District Line trains travel west to Earl's Court, Ealing Broadway and Richmond, south to Wimbledon, and east to Upminster. Currently in the AM and PM peak hours, the frequency of the District Line trains at Sloane Square is approximately one every two to three minutes providing 21-22 services per hour in each direction.

13.4.35 On average there are approximately 55 underground services in total during each of the AM and PM peak hours from Sloane Square Underground station.

13.4.36 Table 13.4.2 provides a summary of the London Underground services and their frequencies during the weekday peaks.

National Rail

13.4.37 As shown on Figure 13.4.2 in the Chelsea Embankment Foreshore *Transport Assessment* figures, the closest National Rail stations to the site are Battersea Park and Queenstown Road, both on the south side of the River Thames. Battersea Park and Queenstown Road are approximately 1.1km and 1.4km walking distance respectively to the south of the site.

13.4.38 Battersea Park is served by Southern services and provides northbound services to London Victoria and London Bridge, and southbound services to Sutton and Caterham.

13.4.39 In the AM peak hour there are approximately 21 services (14 northbound and seven southbound) calling at Battersea Park. In the PM peak hour there are approximately 21 services (15 northbound and six southbound).

13.4.40 Queenstown Road supplies access to South West Trains services which provide northbound services to London Waterloo and southbound services to Weybridge via Hounslow.

13.4.41 In the AM and PM peak hours there are approximately 16 services. In the AM peak hour there are 12 eastbound and four westbound services and in the PM peak hour there are 14 eastbound and two westbound services.

13.4.42 Table 13.4.3 provides a summary of the National Rail services and their frequencies during the weekday peaks.

Table 13.4.2 Existing London Underground weekday peak hour services and frequencies (number of services per hour)

Line	Origin – destination	Approximate walking distance from Chelsea Embankment Foreshore site (m)	Weekday peak hour two-way frequencies	
			AM peak (08:00-09:00)	PM peak (17:00-18:00)
Circle Line	Edgware Road – Hammersmith via Liverpool Street	1,100	12	12
District Line	Ealing Broadway, Richmond, Wimbledon, Kensington (Olympia) – Upminster	1,100	43	43

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

Table 13.4.3 Existing National Rail weekday peak hour services and frequencies (number of services per hour)

National Rail station	Origin – destination	Approximate walking distance from Chelsea Embankment Foreshore site (m)	Weekday peak hour two-way frequency	
			AM peak (08:00-09:00)	PM peak (17:00-18:00)
Battersea Park	London Victoria, London Bridge, Sutton, Caterham	1,100	21	21
Queenstown Road	London Waterloo, Weybridge	1,400	16	16

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

River passenger services

13.4.43 The nearest passenger pier to the site is Cadogan Pier, approximately 1km walking distance to the west of the site. The pier is served by Thames Executive Charters travelling between Blackfriars Millennium Pier in the east and Putney Pier in the west. Onward connections towards the east can be made at Blackfriars Millennium Pier as far as Woolwich Arsenal with Thames Clippers services.

13.4.44 The pier is served Monday to Friday and the morning service calls at Putney, Wandsworth, Chelsea Harbour, Cadogan, Embankment and Blackfriars piers. These river services are shown on Figure 13.4.2 in the Chelsea Embankment Foreshore *Transport Assessment* figures.

13.4.45 During the AM weekday peak hour, no westbound services run via this pier. In the PM weekday peak hour, there is one service in the westbound direction at 17:50. There is one eastbound service from the pier in the AM peak hour, at 08:25 and no eastbound service in the PM peak hour in the eastbound direction. Services do not run at weekends or on public holidays.

13.4.46 The frequency distribution of the services that stop at Cadogan Pier is shown in Table 13.4.4.

River navigation and access

13.4.47 There are no cargo handling piers in the immediate vicinity of the Chelsea Embankment Foreshore site.

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

13.4.49 It is estimated that the peak hour is between14:00 and 15:00, Monday to Friday. During this hour about 15 vessels are estimated to 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 13.4.5 shows the estimated passing traffic rate.

Taxis

13.4.50 Taxis (black cabs) can either be booked in advance, hailed on the street or located at designated taxi ranks. The nearest taxi rank to the site, one taxi rank provided, is located on Lower Sloane Street (Sloane Club) approximately 940m to the north of the site with one taxi space provided.

Table 13.4.4 Cadogan Pier weekday peak hour services and frequencies (number of services per hour)

River service	Origin – destination	Approximate walking distance from Chelsea Embankment Foreshore site (m)	Weekday peak hour two-way frequency	
			AM peak (08:00-09:00)	PM peak (17:00-18:00)
Thames Executive Charters	Putney – Blackfriars Millennium	1,000	1	1

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

Table 13.4.5 Aggregated typical river movement frequencies (number of 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
Chelsea Embankment Foreshore site	1	3	4	2	2	1	1	4	15	4	4	7	2	2	0	0	0	0

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

13.4.51 The site is located on Chelsea Embankment (A3212) as shown in Figure 13.2.1 in the Chelsea Embankment Foreshore *Transport Assessment* figures. Chelsea Embankment (A3212) is an 11.8m wide single carriageway with a 30mph speed limit. The road links Grosvenor Road (A3212) in the east with Cheyne Walk (A3220) and Cremorne Road (A3220) in the west. All these roads form part of the TLRN and are suitable for HGVs and long vehicles. These roads would be used by construction vehicles to travel to and from the Chelsea Embankment Foreshore site.

13.4.52 Construction vehicles would also use Chelsea Bridge (A3216) to access the site. Chelsea Bridge (A3216) forms part of the SRN and leads to Queenstown Road (A3216), Battersea Park Road (A3205) and Nine Elms Lane (A3205) to the south. Battersea Park Road (A3205) and Nine Elms Lane (A3205) form part of the TLRN and Queenstown Road (A3216) is part of the SRN.

13.4.53 All construction vehicles would approach the site via the signalised junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216).

13.4.54 Chelsea Embankment (A3212) flows into three lanes on the approach to the junction and two lanes on the exit from the junction. To the east of the junction, Grosvenor Road (A3212) has two lanes eastbound and westbound. Chelsea Bridge Road (A3216) to the north of the junction has two lanes in a southbound direction and two lanes in the northbound direction, and Chelsea Bridge (A3216) has two lanes northbound and a single lane southbound.

13.4.55 The Bull Ring is located to the west of the site and is accessed directly from Chelsea Embankment (A3212) providing a turnaround facility for bus service 360 as well as on-street car parking.

13.4.56 Local highway modelling has been undertaken to determine the operation of the Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216) junction in the baseline situation. This is discussed in paras. 13.4.115 to 13.4.119.

Parking

13.4.57 Figure 13.4.3 in the Chelsea Embankment Foreshore *Transport Assessment* figures shows the locations of the existing car parks, car club spaces and coach parking within the vicinity of the site. The existing off-street/private car parking and car clubs parking spaces are also shown in this figure.

Existing on-street car and motorcycle parking

13.4.58 On-street parking bays are provided along Chelsea Embankment (A3212), Cheyne Walk, Dilke Street, Embankment Gardens, Paradise Walk, Swan Walk, and Tite Street. Parking bays provided in the Bull Ring are for residents only.

13.4.59 In total there are 233 residents parking bays on the roads in the vicinity of the site. These parking bays are restricted between 08:30 and 22:00 Monday to Friday and 08:30 and 13:30 on Saturday.

13.4.60 On Chelsea Embankment (A3212), Cheyne Walk, Dilke Street and Embankment Gardens, there are a total of 17 pay and display parking bays with a maximum stay of four hours between 08:30 and 18:30 Monday to Friday and 08:30 and 13:30 on Saturday. The pay and display parking tariff is £4.00 per hour.

13.4.61 Motorcycle parking bays are located on Cheyne Walk, Embankment Gardens, Swan Walk, and Tite Street accommodating up to 25 motorcycles.

13.4.62 Table 13.4.6 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 13.4.11.

Table 13.4.6 Existing on-street car parking in the vicinity of the Chelsea Embankment Foreshore site

Road name	Type of parking and number of bays				
	Pay and display	Resident	Blue badge	Unrestricted	Short-term*
Chelsea Embankment (A3212) including Bull Ring	3	57	0	0	0
Cheyne Walk	3	40	0	0	0
Dilke Street	7	18	0	0	0
Embankment Gardens	4	47	1	0	0
Paradise Walk	0	9	0	0	0
Swan Walk	0	23	0	0	0
Tite Street	0	39	0	1	0

**The maximum stay for short-term parking bays is 20 minutes.*

Existing off-street/private car parking

13.4.63 The nearest off-street car park to the site is on Queenstown Road to the south, on the south side of the River Thames at a walking distance of approximately 600m. The car park is operated by Parking Partners (Management Services) Ltd and provides private parking for residents and a number of local businesses. The charges are shown in Table 13.4.7.

Table 13.4.7 Private parking charges

Duration	Charge
Up to 1 hour	£1.80
Up to 2 hour	£3.60
Up to 3 hour	£5.40
Up to 4 hour	£7.20
Up to 9 hour	£10.00
Up to 24 hour	£20.00

Coach parking

13.4.64 There is no provision for coach parking in the immediate vicinity of the site. The nearest coach parking locations are at Victoria Coach Station which is approximately 1.3km walking distance to the north-east of the site.

Car clubs

13.4.65 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.

13.4.66 The closest car club parking space to the site is operated by City Car Club and is approximately 250m walking distance away from the site on Grosvenor Waterside at Gatliff Road where car spaces are provided.

Servicing and deliveries

13.4.67 A loading / blue badge holder parking bay is located along Chelsea Embankment (A3212) to the east of the junction with Royal Hospital Road (B302) approximately 700m walking distance to the west of the site. The length of the bay is 30m and it is restricted between 08:00 – 19:00 Monday to Saturday with a maximum stay of 20 minutes for loading and maximum stay of three hours for blue badge holders.

Baseline survey data

Description of data

13.4.68 Automatic Traffic Count (ATC) data for Chelsea Embankment (A3212) were obtained from TfL and were analysed to identify the traffic flows along this road in December 2010. The flows are discussed in paras. 0 to 13.4.93.

13.4.69 In addition, junction movement data and a TRANSYT model for Chelsea Embankment (A3212) 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. 13.4.97.

13.4.70 Accident data in the assessment area for the most recent five-year period available were obtained from TfL which are further discussed in paras. 13.4.120 to 13.4.129.

13.4.71 Baseline survey data were collected in May, July, and September 2011 to establish the existing transport movements and usage of parking in the area. 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. Figure 13.4.4 in the Chelsea Embankment Foreshore *Transport Assessment* figures indicates the survey locations in the vicinity of the site.

13.4.72 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 September 2011 to establish the summer usage of Thames Path, the signalised pedestrian crossing to the west of the Bull Ring, and the signalised pedestrian crossings at the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216). As indicated in para. 13.4.71, the busiest survey data are shown in Table 13.4.9.

13.4.73 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 suspensions would be necessary or where additional parking demand might be generated by the proposed development.

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

13.4.75 The surveys undertaken and their locations are summarised in Table 13.4.8.

Table 13.4.8 Survey type and locations

<table>
<tr><th>Survey type and location</th><th>Dates</th></tr>
<tr><td colspan="2">Junction surveys (including pedestrian and cycle movements)</td></tr>
<tr><td>Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216)</td><td>12 and 14 May, and 1 and 3 September 2011*</td></tr>
<tr><td>Chelsea Embankment (A3212) / Royal Hospital Road (B302)</td><td rowspan="2">12 and 14 May 2011</td></tr>
<tr><td>Chelsea Embankment (A3212) / Albert Bridge (A3031) / Oakley Street (B304)</td></tr>
</table>

Survey type and location	Dates
Chelsea Bridge Road (A3216) / Ebury Bridge Road (B313)	9 and 12 July 2011
Chelsea Bridge Road (A3216) / Pimlico Road (A3214) / Lower Sloane Street (A3216) / Royal Hospital Road (B302)	
Automatic Traffic Count (ATC)	
Chelsea Embankment (A3212) – east of Embankment Gardens access	21 May – 13 June 2011
Pedestrian and cycle surveys	
Thames Path – the riverside footway of Chelsea Embankment (A3212) to the west of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216) junction	12 and 14 May, and 1 and 3 September 2011
Controlled pedestrian crossing on Chelsea Embankment (A3212) to the west of the Bull Ring	
Zebra crossing on Chelsea Embankment (A3212) to the west of the junction with Tite Street	
Parking surveys	
Chelsea Embankment (A3216) – from Albert Bridge (A3031) to Chelsea Bridge (A3216) including Bull Ring	9 and 11 June 2011
Embankment Gardens	
Swan Walk	
Dilke Street	
Paradise Walk	
Tite Street – from Chelsea Embankment (A3212) to Royal Hospital Road (B302)	
Cheyne Walk	

** Junction surveys were only conducted in May 2011, while the pedestrian and cycle movement surveys were conducted in May and September 2011.*

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

a. ATC on Chelsea Embankment (A3212) – east of Embankment Gardens access

b. junction survey at Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216) junction

c. junction survey at Chelsea Embankment (A3212) / Royal Hospital Road (B302) junction

d. junction survey at Chelsea Embankment (A3212) / Albert Bridge (A3031) / Oakley Street (B304) junction.

Results of the surveys

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

Pedestrians

13.4.78 Table 13.4.9 indicates the pedestrian flows surrounding the site during the AM, inter-peak, PM and weekend peak hours.

Table 13.4.9 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 Chelsea Embankment (A3212)	Eastbound	28	18	41	35
	Westbound	18	30	29	37
Controlled pedestrian crossing on Chelsea Embankment (A3212)	Northbound	5	1	2	0
	Southbound	3	0	9	5
Zebra crossing on Chelsea Embankment (A3212)	Northbound	3	5	7	6
	Southbound	6	11	8	6
Junction counts (pedestrian crossings at the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212)/ Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216))					
Chelsea Embankment (A3212) (west side)	Northbound	169	42	46	63
	Southbound	17	52	44	32
Grosvenor Road (A3212) (east side)	Northbound	114	38	61	75
	Southbound	33	18	66	60
Chelsea Bridge (A3216) (south side)	Eastbound	32	15	27	34
	Westbound	12	12	25	29
Chelsea Bridge Road (A3216) (north side)	Eastbound	10	14	28	26
	Westbound	80	34	31	43

13.4.79 Pedestrian surveys surrounding the site indicate that there is a small flow of pedestrians during the AM peak hour along the Thames Path of between 18 and 28 pedestrians in each direction. During the PM peak hour the overall total is similar with approximately 41 eastbound and 29 westbound pedestrians on the Thames Path.

13.4.80 Pedestrian surveys at the signalised pedestrian crossing and the zebra crossing along Chelsea Embankment (A3212) to the west of the site show that the pedestrian flow is low during the AM and PM peak hours on these two crossings.

13.4.81 A total of 467 and 328 pedestrians used the signalised pedestrian crossing at the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) / Chelsea Bridge Road (A3216) in the AM and PM peak hours respectively. During the AM peak hour, the predominant flow of pedestrians used the northbound Chelsea Embankment (A3212) crossing and during the PM peak hour there was a relatively balanced flow of pedestrians for all the crossings.

Cyclists

13.4.82 Cycle surveys around the site show the existing usage of cycle routes. Table 13.4.10 indicates the flows of bicycles along the Thames Path and Chelsea Embankment (A3212).

Table 13.4.10 Existing cycle flows

Road/route	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)
Thames Path on Chelsea Embankment (A3212)	Eastbound	9	4	8	2
	Westbound	15	13	14	10
Chelsea Embankment (A3212)	Eastbound	459	22	101	32
	Westbound	128	25	256	34

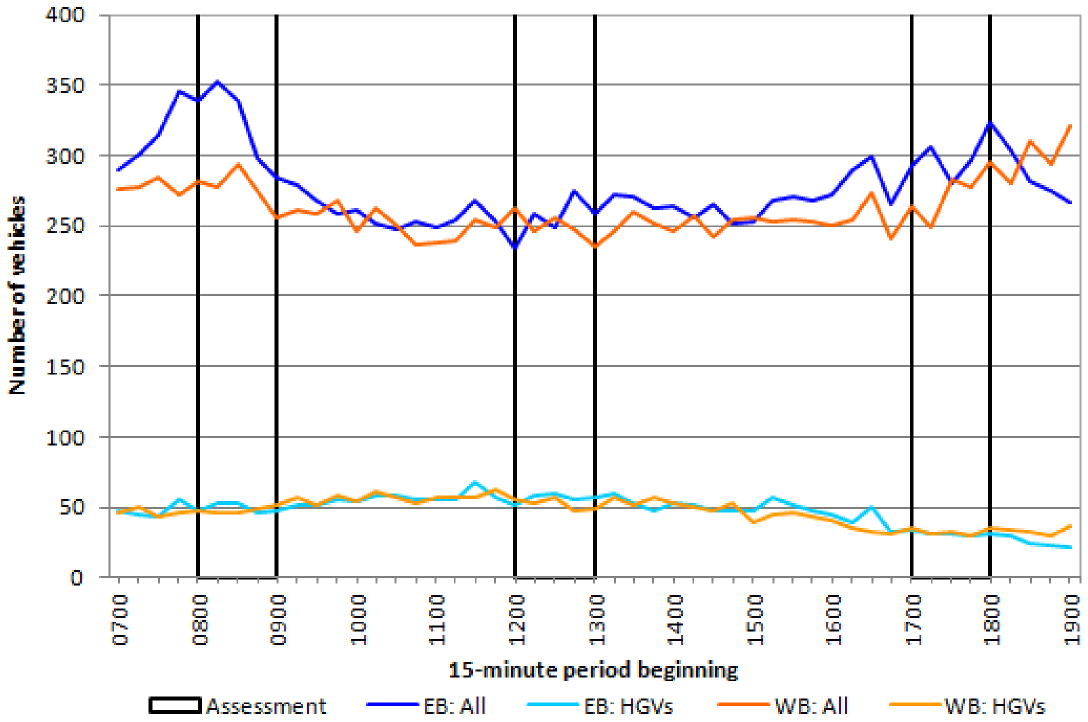
13.4.83 The cycle flow along the Thames Path passing the site is low with a maximum two-way flow of 24 cyclists in the AM peak hour and 22 cyclists in the PM peak hour. The predominant flow in both AM and PM peak hours is in the westbound direction.

13.4.84 There is a two-way flow of approximately 587 cycles along Chelsea Embankment (A3212) during the AM peak hour, and 357 cycles during the PM peak hour. In the AM peak hour, the predominant flow of cyclists is in the eastbound direction with 459 cyclists and in the PM peak hour the cycle flow is heavier in the westbound direction with 256 cyclists.

Traffic flows

13.4.85 ATC data collected as part of the surveys have been analysed to identify the existing traffic flows along Chelsea Embankment (A3212). 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 13.4.5.

Plate 13.4.5 Existing weekday 15-minute traffic flows on Chelsea Embankment (A3212) (ATC survey)



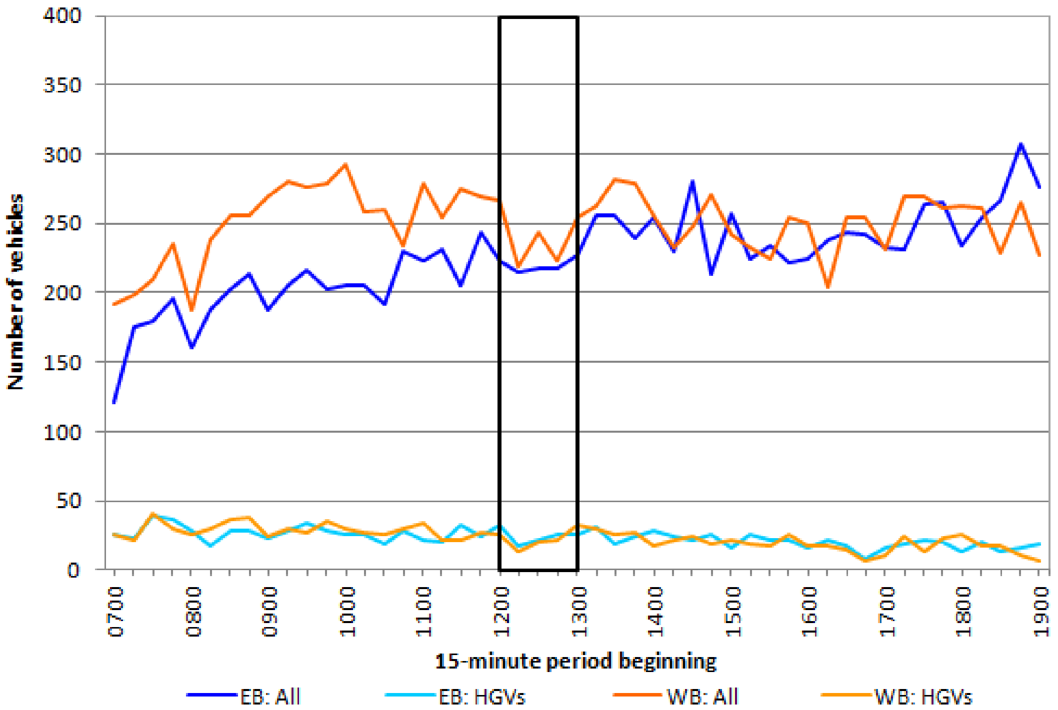
EB – East Bound, WB – West Bound. The black box represents the peak hour traffic flows used for the traffic assessment.

13.4.86 The weekday ATC data shows that between 08:00 and 09:00 there were approximately 2,460 two-way vehicle movements. The busiest 15 minute peak period in this period occurred after 08:30 with approximately 340 eastbound vehicles and approximately 290 westbound vehicles.

13.4.87 For the period between 17:00 and 18:00 there were approximately 2,250 two-way vehicle movements. The busiest 15 minute peak period in this period occurred after 17:45 with approximately 300 eastbound vehicles and approximately 280 westbound vehicles.

13.4.88 The Saturday vehicle and HGV flows for a 12-hour period (07:00-19:00) are shown in Plate 13.4.6. Analysis of the data showed that the Saturday peak travel period occurred between 18:00 and 19:00 with approximately 2,080 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 13.4.6 Existing Saturday 15-minute traffic flows on Chelsea Embankment (A3212) (ATC survey)

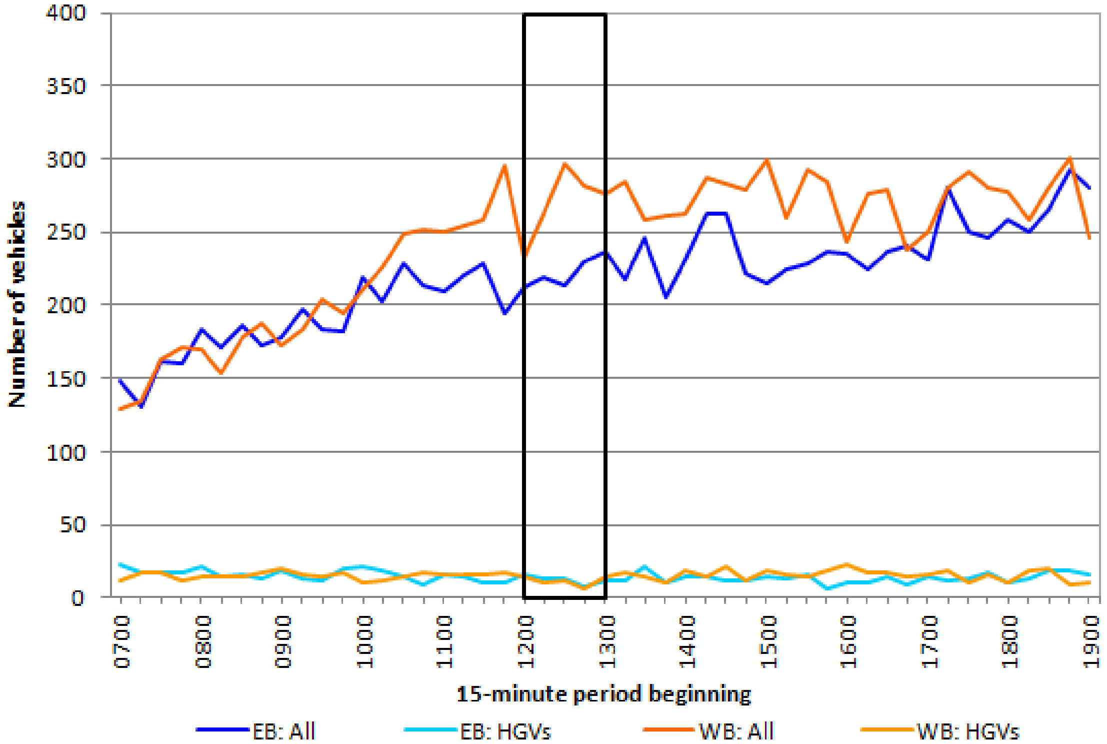


EB – East Bound, WB – West Bound. The black box represents the peak hour traffic flows used for the traffic assessment.

13.4.89 The Sunday vehicle and HGV flows for a 12-hour period (07:00-19:00) are shown in Plate 13.4.7

13.4.90 Analysis of the data showed that the Sunday peak travel period occurred between 18:00 and 19:00 with approximately 2,190 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.

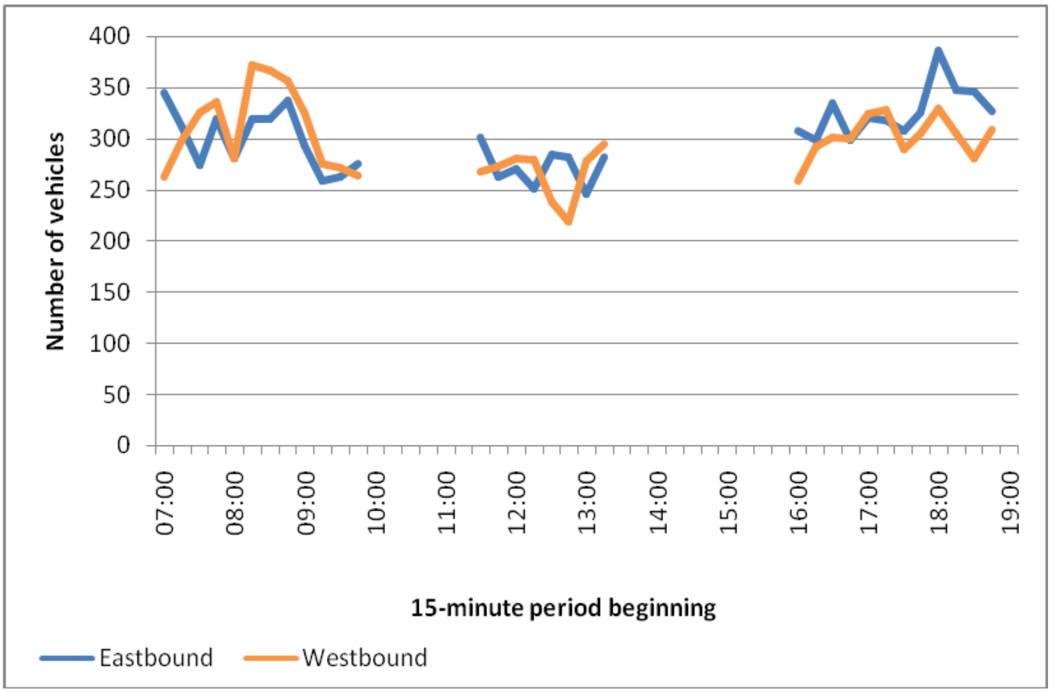
Plate 13.4.7 Existing Sunday 15-minute traffic flows on Chelsea Embankment (A3212) (ATC survey)



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

13.4.91 For comparison with the ATC survey data collected in 2011, the weekday vehicle flows for an eight-hour period (07:00-10:00, 12:00-13:00, and 16:00-19:00) in December 2010 on Chelsea Embankment (A3212), sourced from TfL information, are shown in Plate 13.4.8.

Plate 13.4.8 Existing weekday 15-minute traffic flows on Chelsea Embankment (A3212) (TfL survey)



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

13.4.92 The TfL ATC information shows that there is a total hourly two-way flow of 2,631 vehicles in the AM peak. There are 1,256 vehicles in the eastbound and 1,375 vehicles in the westbound direction.

13.4.93 In the PM peak hour, there is a total hourly two-way flow of approximately 2,516 vehicles along Chelsea Embankment (A3212). There is a balanced traffic flow in the eastbound and westbound directions with a flow of approximately 1,270 vehicles in the eastbound and 1,246 vehicles in the westbound direction.

13.4.94 The ATC survey for Chelsea Embankment (A3212) undertaken in 2011 has been validated against the TfL ATC survey data. The comparison shows that there is only a small difference between these two sets of data.

13.4.95 The junction surveys undertaken in 2011 have been validated against the TfL junction data and TRANSYT model. The baseline traffic flow diagrams in Figures 13.4.5 and 13.4.6 in the Chelsea Embankment Foreshore *Transport Assessment* figures show the AM and PM peak hour traffic flows as used in the TRANSYT model. Figures 13.4.7 and 13.4.8 show the junction survey data collected.

13.4.96 The junction surveys indicate that there is a total traffic flow of 3,866 and 3,806 vehicles in the AM and PM peak hours respectively using the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) / Chelsea Bridge Road (A3216). The dominant flows are 884 vehicles from Chelsea Embankment (A3212) to Grosvenor Road (A3212) in the AM peak hour and 829 vehicles from Grosvenor Road (A3212) to Chelsea Embankment (A312) in the PM peak hour.

13.4.97 The TfL data for the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) / Chelsea Bridge Road (A3216) indicates that there is a total traffic flow of 4,148 and 3,938 vehicles using this junction in the AM and PM peak hours respectively.

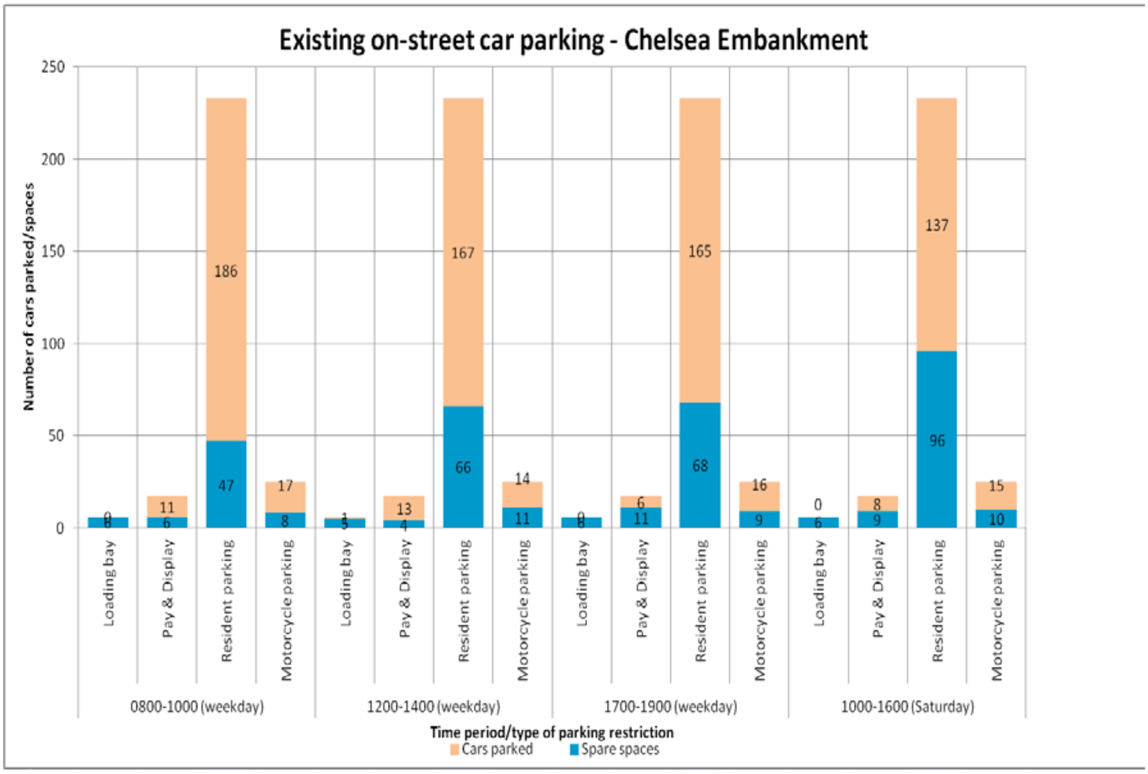
13.4.98 Comparison of the 2011 junction survey data against the TfL junction survey data used in the TRANSYT modelling shows that the 2011 data is slightly lower than, but of a similar order of magnitude to, that indicated in the TRANSYT model for this junction obtained from TfL.

13.4.99 Comparison of the 2011 junction survey data against the ATC survey data indicates that the flows on Chelsea Embankment (A3212) from the junction survey data are slightly lower than the ATC data but of a similar order of magnitude.

Parking

13.4.100 Plate 13.4.9 shows a histogram of the car and motorcycle parking survey results as well as loading bay availability and usage in the area surrounding the Chelsea Embankment Foreshore site during the AM, inter-peak, PM peaks on a weekday and during the weekend peak period.

Plate 13.4.9 Existing on-street car parking availability and usage



13.4.101 Table 13.4.11 indicates the parking capacity available throughout a weekday and on Saturday on the roads in the vicinity of the site.

Table 13.4.11 Resident, pay and display, 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
Chelsea Embankment (A3212)	Resident parking bays	57	28	35	34	36
	Pay and Display parking bays	3	3	3	2	2
	Loading bays	6	6	5	6	6
Cheyne Walk	Resident parking bays	40	6	12	7	11
	Pay and Display parking bays	3	0	1	2	2
	Motorcycle spaces	5	1	1	0	1
Dilke Street	Resident parking bays	18	0	2	4	4
	Pay and Display parking bays	7	1	0	5	3
Embankment Gardens	Resident parking bays	47	8	9	15	21
	Pay and Display parking bays	4	2	0	2	2
	Motorcycle spaces	10	4	7	7	5
Paradise Walk	Resident parking bays	9	0	1	0	0
Swan Walk	Resident parking bays	23	0	2	6	10
	Motorcycle spaces	5	0	0	0	2
Tite Street	Resident parking bays	39	5	5	2	14
	Motorcycle spaces	5	3	3	2	2

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

13.4.102 The parking surveys indicate that pay and display parking within the area is utilised between 35% and 75% and that there is generally spare capacity available on both weekdays and at weekends.

13.4.103 The usage of resident parking bays on Chelsea Embankment (A3212) is relatively high with more than 50% of the capacity utilised on weekdays and at weekends, although there is still spare capacity available on both weekdays and at weekends during the peak and off-peak periods.

13.4.104 Surveys were also undertaken to establish the usage of the loading bay along Chelsea Embankment (A3212). Results indicate that there is ample capacity as the loading bay along this road is not used for the majority of the day.

Local highway modelling

13.4.105 To establish the existing capacity on the local highway network, a scope was discussed with TfL and RB of Kensington Chelsea to model the junction of Chelsea Embankment (A3212) with Grosvenor Road (A3212), Chelsea Bridge (A3216) and Chelsea Bridge Road (A3216) using the TfL TRANSYT model as a base.

13.4.106 Traffic models for this junction 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.

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

13.4.108 The TfL Modelling Guidelines[5] and Modelling Audit Process (MAP)(TfL, 2011)[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.

13.4.109 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.

13.4.110 As part of the scope the local modelling is required for the adjacent junctions to the sites. The TfL TRANSYT model has been used as a base for the junction of Chelsea Embankment (A3212) with Grosvenor Road (A3212), Chelsea Bridge (A3216) and Chelsea Bridge Road (A3216) 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.

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

13.4.112 The weekday AM and PM baseline model queues for Chelsea Embankment (A3212) 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.

13.4.113 Figures 13.4.5 and 13.4.6 in the Chelsea 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.

13.4.114 Table 13.4.12 shows the modelling outputs for the baseline case. The overall junction performance shows that the junction is operating above capacity in the weekday AM and PM peak hours.

Table 13.4.12 Baseline TRANSYT model outputs

Approach	Movement	Weekday							
		AM peak hour (08:00-09:00)				PM peak hour (17:00-18:00)			
		Flow (PCU)	DoS	MMQ (PCU)	Delay (seconds per PCU)	Flow (PCU)	DoS	MMQ (PCU)	Delay (seconds per PCU)
Chelsea Embankment (A3212)	Ahead	589	74%	12	27	552	61%	11	24
	Ahead left	348	46%	6	20	308	36%	6	20
	Right	222	101%	15	171	292	97%	16	127
Grosvenor Road (A3212)	Ahead	460	93%	18	81	515	95%	23	85
	Ahead left	428	90%	16	75	502	97%	24	96
Chelsea Bridge Road (A3216)	Ahead	339	37%	4	11	430	89%	18	70
	Ahead left	170	22%	2	11	253	56%	7	43
Chelsea Bridge (A3216)	Ahead left	797	102%	43	120	642	89%	23	54
	Ahead right	510	67%	13	31	314	45%	8	31
		PRC		Total Delay (PCU hours)		PRC		Total Delay (PCU hours)	
Overall junction performance		-13%		69		-8%		65	

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 Passanger 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.

13.4.115 In the AM peak hour, the results show that the Chelsea Embankment (A3212) eastbound right turning movement and Chelsea Bridge (A3216) northbound ahead and left movements are operating over capacity in the baseline situation with queues of 15 and 43 vehicle lengths respectively. The Grosvenor Road (A3212) arm of the junction is operating just below the theoretical capacity with maximum queues of 18 vehicle lengths.

13.4.116 In the AM peak hour average delays are most significant on the Chelsea Embankment (A3212) eastbound right turn movement and Chelsea Bridge (A3216) northbound ahead and left movements with an average of 171 and 120 seconds of delay per PCU respectively.

13.4.117 In the PM peak hour the right turn on Chelsea Embankment (A3212) and both lanes of the Grosvenor Road (A3212) approach are operating just below theoretical capacity with maximum queues of 23-24 vehicle lengths. Average delays are greatest on the Chelsea Embankment (A3212) eastbound right turn movement experiences with an average of 127 seconds of delay per PCU.

13.4.118 The TRANSYT junction model outputs shows that total junction delay is 69 PCU hours in the AM peak period assessed and 65 PCU hours in the PM peak period assessed. These equate to 64 seconds per PCU in the AM peak and 61 seconds per PCU in the PM peak period assessed.

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

Accident analysis

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

13.4.121 A total of 18 serious accidents and 69 slight accidents occurred in the Chelsea Embankment Foreshore assessment area over the five years for which accident data was obtained and analysed. There were no fatal accidents.

13.4.122 The majority of the serious accidents occurred at the Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) junction.

13.4.123 In total, 16 accidents occurred along Chelsea Embankment (A3212). Of these, five were serious and occurred at:

a. the western junction with Embankment Gardens (one serious accident)

b. the eastern junction with Embankment Gardens (one serious accident)

c. the junction with Chelsea Embankment (Bull Ring) (one serious accident)

d. to the west of the junction with Chelsea Bridge Road (A3216), Grosvenor Road (a3212), Chelsea Bridge (A3216) (two serious accidents).

13.4.124 Of all of the accidents that occurred within the study area, ten involved goods vehicles, all of which were Light Goods Vehicles (LGVs). Of these accidents, six were slight and four were serious.

13.4.125 A total of seven accidents involved pedestrians. Of these, one was recorded as sustaining serious injuries and the remaining six slight injuries. The accidents involving pedestrians mainly occurred along Chelsea Bridge (A3216) and at the Chelsea Bridge Road (A3216) / Ebury Bridge Road junction.

13.4.126 Of the total accidents, 24 accidents involved cyclists of which six were classified as serious and 18 as slight. A third of the accidents involving cyclists occurred at the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) / Chelsea Bridge Road (A3216).

13.4.127 Of the five year accident data analysed, the information available suggests that none of the accidents happened as a result of the road layout.

13.4.128 Table 13.4.13 and Figure 13.4.9 in the Chelsea Embankment Foreshore *Transport Assessment* figures indicate the accidents that occurred within the vicinity of the site.

Table 13.4.13 Accidents severity 2006 to 2011

Location	Slight	Serious	Fatal	Total
Chelsea Embankment (A3212) between the junctions with Chelsea Bridge Road (A3216), Grosvenor Road (A3212), Chelsea Bridge (A3216), and Embankment Gardens	6	2	0	8
Chelsea Bridge Road (A3216) between the junctions with Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216), and Ebury Bridge Road (B313)	5	0	0	5
Grosvenor Road (A3212) between the junctions with Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216) and Lupus Street	5	0	0	5
Chelsea Bridge (A3216) within 100m of the junction with Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212)	4	2	0	6
Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) junction	26	6	0	32

Location	Slight	Serious	Fatal	Total
Chelsea Embankment (A3212) / Bull Ring junction	3	1	0	4
Chelsea Embankment (A3212) / Embankment Gardens junction (eastern junction)	0	1	0	1
Chelsea Embankment (A3212) / Embankment Gardens junction (western junction)	2	1	0	3
Chelsea Bridge Road (A3216) / Ebury Bridge Road (B313) junction	8	2	0	10
Grosvenor Road (A3212) / Lupus Street junction	10	3	0	13
Total	**69**	**18**	**0**	**87**

13.4.129 Of the seven pedestrian-injury accidents, five occurred on the roads expected to be used by construction vehicles within the study area. Inspection of the data showed that two of these occurred at junctions with signalised pedestrian crossing facilities, with the remaining accidents occurring at locations without signal control. Of the 24 accidents involving cyclists, 22 occurred on the roads/junctions expected to be used by construction vehicles within the study area. Figure 13.4.10 in the Chelsea Embankment Foreshore *Transport Assessment* figures shows the pedestrian and cycle accidents by severity that occurred within the vicinity of the site.

13.4.130 In the context of the construction HGV movements associated with the Chelsea 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[7].

13.4.131 Appendix D provides a full analysis of accidents within the local area surrounding Chelsea Embankment Foreshore.

13.5 Construction assessment

13.5.1 The *TA*, including both qualitative and quantitative analysis, has been undertaken drawing on discussions with TfL and the local highway authorites, 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.

13.5.2 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 Tunnel project, whether from the Chelsea Embankment Foreshore site or from other sites.

Construction base case

13.5.3 As described in Section 13.3 above, the construction assessment year for transport effects in relation to this site is Site Year 3 of construction.

Pedestrians and cyclists

13.5.4 There is a TfL proposal to replace the existing signalised pedestrian crossing on Chelsea Embankment (A3212) by the Bull Ring (approximately 10m west of the site) with a zebra crossing by Site Year 3 of construction.

13.5.5 There are no proposals to change the cycle network or facilities by Site Year 3 of construction and the construction base case for the cycle network and facilities is therefore the same as indicated in the baseline description in Section 13.4.

Public Transport

13.5.6 In terms of the public transport network, it is expected that London Underground capacity will increase by approximately 24% on the District Line compared to the current baseline as a result of the TfL London Underground Upgrade Plan[8]. 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.

13.5.7 Due to the traffic growth in the construction base case compared to the baseline situation, bus journey times along Chelsea Embankment (A3212), Chelsea Bridge Road (A3216), Grosvenor Road (A3212), Chelsea Bridge (A3216) and within the wider area will be affected. The effect on journey times is detailed under the highway operation and network assessment (paras. 13.5.22 and 13.5.24), but would result in an additional road network delay of a maximum of approximately one minute 30 seconds on the Chelsea Bridge (A3216) ahead and left movements at the junction of Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) in the AM peak hour and approximately eight minutes in the PM peak hour on Chelsea Embankment (A3212) right turn movement at the same junction.

13.5.8 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.

13.5.9 It is anticipated that patronage on public transport services may change between the baseline situation and Site Year 3 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

13.5.10 The underlying pattern of river use has not substantially changed in recent years, but the Mayor of London and TfL 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[9]. Consequently it is possible that the nature and number of vessel movements on the River Thames might change over time.

13.5.11 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 Chelsea Embankment Foreshore site. For this assessment, therefore, the construction base case has been assumed to be the same as the baseline position.

13.5.12 It is noted that a separate *Navigational Issues and Preliminary Risk Assessment* has been undertaken for the temporary construction works and permanent in-river structure at the Chelsea Embankment Foreshore site. This is reported separately outside of the *TA*.

Highway network and operation

13.5.13 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 Chelsea Embankment Foreshore site in Site Year 3 of construction without the Thames Tideway Tunnel project. The scope of this analysis has been discussed with RB of Kensington Chelsea and TfL.

13.5.14 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[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*.

13.5.15 For the Chelsea Embankment Foreshore site, CLoHAM has been used. The relevant growth factor for this site is described in para. 13.5.19. It was applied to the survey flows undertaken in 2011 to produce flows for the base and development cases.

13.5.16 It should be noted that these factors represent growth over the period to 2021, which is beyond Site Year 3 of construction at Chelsea Embankment Foreshore and therefore ensures that the construction base case for the highway network is robust.

Committed developments

13.5.17 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 3 of construction at Chelsea Embankment Foreshore. The committed developments in the immediate vicinity of the site are:

a. a change of use at Gordon House, the Orangery and Creek Lodge on Royal Hospital Road (B302)

b. a site licence for Christmas tree sales for Bull Ring Gate for 28 days in any one year

c. the Masterpiece London Art and Antiques Fair in the South Grounds of the Royal Hospital. It should be noted that this is a temporary event

d. redevelopment of Riverlight to provide a residential-led mixed-use development (on the south bank of the River Thames)

e. Northern Line Extension – extension of London Underground Northern Line (Charing Cross branch) to Battersea via new station at Nine Elms (on the south bank of the River Thames).

13.5.18 In the wider area, development at Battersea Power Station (phases 1, 2 and 3) on the south bank of the River Thames would be complete and operational by Site Year 3 of construction; however, phase 4 and part of phases 5 and 6 of this development would still be under construction in Site Year 3 of construction. Development at Chelsea Barracks would be under construction in Site Year 3 of construction. The strategic and local highway modelling has taken these committed developments into consideration.

Local highway modelling

13.5.19 The growth factors for RB of Kensington Chelsea based on CLoHAM have been discussed with TfL and RB of Kensington Chelsea and applied equally to all of the baseline traffic flow movements. The growth factors are:

a. Weekday AM Peak growth factor – +6.2%

b. Weekday PM Peak growth factor – +9.3%

13.5.20 Para. 13.3.10 explains the definition of the assessment area for local highway network modelling. At this site, the assessment examines only the nearest junction of the construction vehicle route with the TLRN.

13.5.21 The results of the construction base case TRANSYT 12 model for the junction of Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) in the vicinity of the site are shown in Table 13.5.1. The results indicate that the junction would operate above capacity in both peak hours without the Thames Tideway Tunnel project.

Table 13.5.1 Construction base case TRANSYT model outputs

Approach	Movement	Weekday							
		AM peak hour (08:00-09:00)				PM peak hour (17:00-18:00)			
		Flow (PCU)	DoS	MMQ (PCU)	Delay (seconds per PCU)	Flow (PCU)	DoS	MMQ (PCU)	Delay (seconds per PCU)
Chelsea Embankment (A3212)	Ahead	629	79%	17	37	607	68%	14	27
	Ahead Left	372	49%	8	26	337	39%	6	21
	Right	238	108%	21	254	321	142%	60	618
Grosvenor Road (A3212)	Ahead	492	99%	24	118	558	92%	20	58
	Ahead Left	458	97%	21	102	540	93%	20	63
Chelsea Bridge Road (A3216)	Ahead	363	39%	4	11	473	115%	48	304
	Ahead Left	181	23%	2	11	278	72%	8	45
Chelsea Bridge (A3216)	Ahead Left	852	109%	67	215	706	101%	36	114
	Ahead Right	546	72%	14	33	345	51%	8	30
		PRC		Total Delay (PCU hours)		PRC		Total Delay (PCU hours)	
Overall junction performance		-21%		113		-58%		149	

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 ES.

13.5.22 Compared to the baseline situation there will be a change in queue lengths at the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216). In the AM peak hour this would be most noticeable on the Chelsea Bridge (A3216) approach and in the PM peak hour would occur on the Chelsea Embankment (A3212), Chelsea Bridge Road (A3216) and Chelsea Bridge (A3216) approaches.

13.5.23 In addition it is anticipated that there will be an increase in average delay to vehicles in the construction base case compared to the baseline conditions. The increases in each peak hour reflect the fact that the junction would need to handle higher demands compared to the baseline situation.

13.5.24 The TRANSYT junction model output shows that total junction delay will be 113 PCU hours in the AM peak period assessed and 149 PCU hours in the PM peak period assessed. These equate to 98 seconds per PCU in the AM peak period assessed and 129 seconds per PCU in the PM peak period assessed.

Construction development case

13.5.25 This section summarises the findings of the assessment undertaken for the peak year of construction at the Chelsea Embankment Foreshore site (Site Year 3 of construction).

Pedestrian routes

13.5.26 As discussed in Section 13.2, construction activity would require pedestrian diversions that would result in changes to the pedestrian movements around Chelsea Embankment Foreshore. The construction phases – phase 1, phase 2, phase 3 and phase 4 plans in the Chelsea Embankment Foreshore *Transport Assessment* figures show the layout of pedestrian footways during construction.

13.5.27 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 Chelsea Embankment (A3212).

13.5.28 Pedestrians currently using the Thames Path along the riverside footway of Chelsea Embankment (A3212) would be diverted away from the section of the route coinciding with the worksite to the north side of Chelsea Embankment (A3212). This would be necessary throughout the construction works.

13.5.29 During construction phases 1 and 2, pedestrians would need to use the signalised pedestrian crossings at the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216) to cross Chelsea Embankment (A3212) to the east of the site and the existing signalised crossing located to the west of the Bull Ring to cross back.

13.5.30 In construction phase 3, a section of the northern footway along Chelsea Embankment (A3212) between the junction with Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216) and the Ambulance Gate to the Royal Hospital Chelsea Grounds, Ranelagh

Gardens would be closed to pedestrians in order to provide working areas for the worksite in the eastbound carriageway.

13.5.31 During phase 3, pedestrians would be able to cross Chelsea Embankment (A3212) using a temporary signalised pedestrian crossing which would be provided between the foreshore site and the worksite in the eastbound carriageway of Chelsea Embankment (A3212). Pedestrians would use the existing signalised crossing located to the west of the Bull Ring to cross back.

13.5.32 During construction works, the Thames Path would be opened for public use outside of working hours at weekends with appropriate measures to protect pedestrians.

13.5.33 In construction phase 4, the temporary signalised pedestrian crossing between the foreshore site and the worksite on the northern side of Chelsea Embankment (A3212) would be removed and no pedestrian diversions would be required.

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

13.5.35 Given this small increase in pedestrian numbers against baseline usage, an extension to the length of the pedestrian phase at the junction of Chelsea Embankment (A3212) / Chelsea Bridge (A3216) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) 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.

13.5.36 The pedestrian diversions and additional worker trips during construction would result in an increase to pedestrian flows on the northern footway along Chelsea Embankment (A3212).

13.5.37 It is anticipated that the pedestrian diversions around the Chelsea Embankment Foreshore site would result in a worst case journey time increase of approximately two minutes 40 seconds, based on the delay associated with the need to make two additional road crossings and the extension of the journey by 40m, based on a walking speed of 1.3m/sec. Other pedestrian movements in the area would, at worst, incur minor delays.

13.5.38 The need to make an additional two road crossings may raise the risk of accidents to pedestrians slightly, although the existing and temporary facilities to be provided either are or would be designed to operate in as safe a manner as possible.

13.5.39 During all construction work and on any section of road subject to temporary diversions or restriction imposed by roadworks associated with the Chelsea 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[11]. This will include compliance with the Equality Act 2010[12] to ensure safe passage for mobility and vision impaired pedestrians.

Cycle routes

13.5.40 Cyclists using the highway would experience an additional delay to journey time as a result of the construction works at the Chelsea Embankment Foreshore site. The effect on journey times on the highway network is identified in the TRANSYT modelling which is outlined in paras. 13.5.78 to 13.5.80. This suggests that there would be an increase of a maximum of 16 seconds per PCU in the AM peak hour on the Chelsea Bridge (A3216) northbound ahead and left turn movements and 14 seconds in the PM peak hour on the Chelsea Embankment (A3211) eastbound right turn movement and the Chelsea Bridge (A3216) northbound ahead and left turn movements compared with that in the construction base case. Cyclists making these movements could therefore experience additional delays of this order.

13.5.41 Cyclists using the NCN Route 4 along Chelsea Embankment (A3212) (traffic free on the Thames Path) would be diverted to the highway and would experience an additional delay to journey times as a result of the construction works at the Chelsea Embankment Foreshore site. The effect on journey times on the highway network is outlined in para. 13.5.40.

13.5.42 With regard to accidents and safety, while cyclists would not be required to make any additional road crossings as a result of the diversions and lane adjustments along Chelsea Embankment (A3212), there would be an increase in construction traffic flow of greater than four two-way HGV movements per hour but less than 20 two-way movements per hour which might increase the risk of accidents to cyclists.

13.5.43 Construction vehicles serving the site will 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.

13.5.44 During the construction period (phases 1-3), an intermittent lane closure would be required in the westbound lane of Chelsea Embankment (A3212) 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.

13.5.45 Measures set out in the *CoCP* described in para. 13.2.42 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 Chelsea 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[13]. This would include compliance with TfL guidance (Cyclists at Roadworks - Guidance[14]) to ensure safe passage for cyclists.

13.5.46 During the construction period, the operation and layout of the road network would change. In phases 1-3 of construction, the available carriageway width on Chelsea Embankment (A3212) between the Ambulance Gate to the Royal Hospital Chelsea Grounds, Ranelagh Gardens and the Bull Ring would be reduced both in the eastbound and westbound lanes by 1.6m. However, a minimum carriageway width of 4.3m, where HGVs can safely overtake cyclists, would be retained for traffic in each direction.

Bus routes and patronage

13.5.47 Bus service 360 runs past the site and uses the turnaround facility at Bull Ring Gate. This service would be able to continue to operate during the construction period except when landscaping works are being carried out to the Bull Ring. The 'loop' section of this bus service between Grosvenor Road (A3212) and the Bull Ring would be temporarily suspended during the landscaping works and buses would turn directly between Grosvenor Road (A3212) and Chelsea Bridge Road (A3216). Such arrangements are already used by the bus operator during major events at the Royal Hospital.

13.5.48 Additional construction vehicles serving the site and the traffic management arrangements along Chelsea Embankment (A3212) may affect some bus routes and bus journey times locally and within the wider area. The effect on journey times is identified in the TRANSYT modelling outlined in paras. 13.5.78 to 13.5.80, which suggests that there would be an increase of a maximum of 16 seconds per PCU in the AM peak hour on the Chelsea Bridge (A3216) northbound ahead and left turn movements and 14 seconds in the PM peak hour on the Chelsea Embankment (A3211) eastbound right turn movement and the Chelsea Bridge (A3216) northbound ahead and left turn movements compared with that in the construction base case. In the context of the local area and general journey times for bus services, this is not considered a significant change for bus users.

13.5.49 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 103 and 92 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 the Chelsea 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 and patronage

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

13.5.51 It is anticipated that there would be approximately 23 additional person trips on London Underground services in each of the AM and PM peak hours.

13.5.52 Due to the large number of London Underground services available at Sloane Square Underground station, this equates to less than one additional journey per train based on the 55 services per hour available at Sloane Square Underground station during the AM and PM peak hours which could be easily accommodated within existing capacity.

National rail and patronage

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

13.5.54 It is anticipated that construction at Chelsea Embankment Foreshore would result in 25 additional person trips on National Rail services in each of the AM and PM peak hours.

13.5.55 This represents less than one additional passenger per train on National Rail services into and out of Battersea Park and Queenstown Road stations in the AM and PM peak hours based on 21 and 16 services in the AM and PM peaks hours from Battersea Park and Queenstown Road stations respectively.

13.5.56 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

13.5.57 During construction, no river passenger services would be altered as a result of the works at Chelsea 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 13.2.3 and therefore there would be no discernible change in river patronage as a result of the construction proposals at this site.

River navigation and access

13.5.58 During construction it has been assumed that 90% of the cofferdam fill (both 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 six barge movements (three in each direction) a day.

13.5.59 Barges would be hauled by tugs which typically haul one to two barges at a time where possible and depending on mooring conditions. This means that there would be two to three tug movements at peak in each direction (four to six in total) per day at this site.

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

13.5.61 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 Chelsea Embankment Foreshore. This is reported separately outside of the *Environmental Statement* and *TA* as part of the application documentation.

Parking

13.5.62 Chelsea Embankment (A3212) does not have any on-street car parking available in the immediate vicinity of the site due to TLRN restrictions in the area.

13.5.63 With the exception of the ten resident parking bays in the Bull Ring, which would be temporarily restricted for a short period when landscaping works are taking place there, there would be no change to on-street parking (resident and pay and display) or private parking in the vicinity of the site as a result of the construction works.

13.5.64 Parking for five essential maintenance vehicles would be provided on site. However, there would be no on-site parking for workers. Parking restrictions on surrounding streets and site-specific *Travel Plan* measures would discourage workers from travelling by car to and from the site. There would therefore be no impact on local parking from construction workers.

13.5.65 There would be no change to the loading bay on Chelsea Embankment (A3212) to the east of the junction with Royal Hospital Road (B302).

Highway assessment

Highway layout

13.5.66 The highway layout during construction (utility diversion phase, phase 1-2 and phase 3) plans in the Chelsea Embankment Foreshore *Transport Assessment* figures show the highway layout during phases 1, 2 and 3 of the construction works at the Chelsea Embankment Foreshore site.

13.5.67 Construction at this site would take place in two places, one located on the foreshore of the River Thames which would be accessed from the westbound lane, and one located in the eastbound carriageway of Chelsea Embankment (A3212) which would be accessed from the eastbound lane.

13.5.68 The highway layout during construction vehicle swept path analysis plans in the Chelsea Embankment Foreshore *Transport Assessment* figures show the swept path movements and show that the construction vehicles are able to safely enter and leave the site.

Highway network

13.5.69 Construction lorry movements would be limited to the day shift only (08:00 to 18:30). In exceptional circumstances HGV and abnormal load movements could occur outside of normal working hours for large concrete pours and later at night on agreement with RB of Kensington Chelsea.

13.5.70 Table 13.2.4 in Section 13.2 shows the vehicle movement assumptions for the local peak traffic periods based on the peak months of construction activity at this site.

13.5.71 Assuming that 90% of the cofferdam fill (both import and export) and shaft and ‘other’ excavated material (export) is transported by barge with all other material by road, Table 13.2.4 shows an average peak flow of 120 vehicle movements a day is expected during the months of greatest activity during Site Year 3 of construction at this site. In the AM and PM peak hours, the Chelsea Embankment Foreshore site would generate approximately 12 vehicle movements.

13.5.72 The busiest peak in the AM and PM period for each type of movement (construction, other and worker) 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.

13.5.73 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.

13.5.74 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 Chelsea Embankment Foreshore site, or with other Thames Tideway Tunnels sites, that would use routes in the vicinity of the Chelsea Embankment Foreshore site. Figure 13.5.1 in the Chelsea Embankment Foreshore *Transport Assessment* figure shows the OmniTrans plot for the local road network around the Chelsea Embankment Foreshore site.

13.5.75 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.

13.5.76 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).

13.5.77 A summary of the construction assessment results from the TRANSYT model for the weekday AM and PM peak hours is presented in Table 13.5.2 and Table 13.5.3.

[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 13.5.2 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
Chelsea Embankment (A3212)	Ahead	629	79%	79%	0%	17	17	0	37	37	0
	Ahead left	372	49%	49%	0%	8	8	0	26	26	0
	Right	238	108%	108%	0%	21	21	0	254	254	0
Grosvenor Road (A3212)	Ahead	492	99%	99%	0%	24	24	0	118	118	0
	Ahead left	462	97%	97%	0%	21	21	0	102	106	+4
Chelsea Bridge Road (A3216)	Ahead	363	39%	39%	0%	4	4	0	11	11	0
	Ahead left	181	23%	23%	0%	2	2	0	11	11	0
Chelsea Bridge (A3216)	Ahead left	861	109%	111%	+2%	67	72	+5	215	231	+16
	Ahead right	546	72%	72%	0%	14	14	0	33	33	0
			PRC						Total delay (PCU hours)		
Overall junction performance			-21%	-23%	-2%				113	118	+5

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. 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 13.5.3 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
Chelsea Embankment (A3212)	Ahead	607	68%	68%	0%	14	14	0	27	27	0
	Ahead left	337	39%	39%	0%	6	6	0	21	21	0
	Right	321	142%	142%	0%	60	61	+1	618	632	+14
Grosvenor Road (A3212)	Ahead	557	92%	92%	0%	20	20	0	58	57	-1
	Ahead left	543	93%	94%	+1%	20	21	+1	63	65	+2
Chelsea Bridge Road (A3216)	Ahead	473	115%	115%	0%	48	48	0	304	300	-4
	Ahead left	278	72%	72%	0%	8	8	0	45	45	0
Chelsea Bridge (A3216)	Ahead left	715	101%	103%	+2%	36	40	+4	114	128	+14
	Ahead right	345	51%	51%	0%	8	8	0	30	30	0
			PRC						Total delay (PCU hours)		
Overall junction performance			-58%	-58%	0%				149	153	+4

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. 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.

13.5.78 The results indicate that in the AM peak hour the project would result in a very slight increase in use of the available capacity in the Chelsea Bridge (A3216) northbound ahead and left turn movement. In the PM peak hour, the increase in the use of capacity would be in the Grosvenor Road (A3212) westbound ahead and left turn movements and Chelsea Bridge (A3216) northbound ahead and left turn movements.

13.5.79 In the construction development case the change in road network delay during the AM and PM peak hours as a result of the additional construction traffic would be a maximum of 16 seconds per PCU in the AM peak hour on the Chelsea Bridge (A3216) northbound ahead and left turn movements and a maximum of 14 seconds per PCU during the PM peak hour on Chelsea Embankment (A3212) eastbound right turn movement and Chelsea Bridge (A3216) northbound ahead and left movements.

13.5.80 The TRANSYT junction model outputs show that total junction delay for the construction development case is 118 PCU hours in the AM peak period assessed and 153 PCU hours in the PM peak period assessed. These equate to 102 seconds per PCU in the AM and 132 seconds per PCU in the PM peak period assessed.

Construction mitigation

13.5.81 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 13.5.4.

Table 13.5.4 Chelsea Embankment Foreshore design measures

Phase	Issues	Design measures
Construction	Creating site access point	Creation of a 3.3m wide lane on the nearside of the westbound lane of Chelsea Embankment (A3212) to accommodate construction vehicles arriving at and departing from the site 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 northern footway of Chelsea Embankment (A3212) Diversion of the Thames Path would be adequately signed Provision of temporary signalised pedestrian crossing between the foreshore site and the worksite in the eastbound carriageway of Chelsea Embankment (A3212) in phase 3 Directing pedestrians and cyclists to the existing safe crossing points

Phase	Issues	Design measures
		Opening of the Thames Path on Chelsea Embankment (A3212) for public use at weekends
	Narrowing the carriageway of Chelsea Embankment (A3212)	Maintaining two-way traffic along Chelsea Embankment (A3212) Maintaining typical lane widths of 4.3m in each direction Removing the existing traffic island located to the northeast of Bull Ring Gate to assist free flow of two-way traffic along Chelsea Embankment (A3212) Maintaining access through the Bull Ring entrance for set-up and take-down of the Chelsea Flower Show and Masterpiece events and for VIP access Temporary removal of white lining and provision of new white lining and road markings as appropriate (approximate length would be 330m)
	Landscaping works in Bull Ring	Temporary suspension of bus stop and bus turning operations in Bull Ring area Diversion of bus route 360, turning directly between Grosvenor Road (A3212) and Chelsea Bridge Road (A3216) Restriction of resident parking bays in Bull Ring area
	Movement of construction traffic flows on the local highway network	Traffic signal optimisation at the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) / Chelsea Bridge Road (A3216) to achieve the most efficient operation of the junction
Operation	Creating access point	Provision of mountable kerb/reinforced vehicle crossing to accommodate ten yearly maintenance vehicles - architect to advise on finishes / material

13.5.82 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

13.5.83 The assessment outcomes reported earlier in this Section and in Volume 13 of the *Environmental Statement* are based on the *Transport Strategy*, as outlined in section 13.2. In that scenario, the number of construction vehicle movements generated by Chelsea Embankment Foreshore in the peak year of construction would be approximately 12 movements in the AM and PM peak hours respectively which would use the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216) to access the site.

13.5.84 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 numbers. In this sensitivity test, the construction vehicle movements would be approximately 30 in the AM and PM peak hours. This would be an increase of 18 movements in the AM and PM peak hours compared with that for the *Transport Strategy*.

13.5.85 A summary of the construction assessment results from the TRANSYT model for the junction of Chelsea Embankment (A3211) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) / Chelsea Bridge Road (A3216) in the weekday AM and PM peak hours using the sensitivity test figures is presented in Table 13.5.5 and Table 13.5.6.

Table 13.5.5 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
Chelsea Embankment (A3212)	Ahead	629	79%	79%	0%	17	17	0	37	37	0
	Ahead left	372	49%	49%	0%	8	8	0	26	26	0
	Right	238	108%	108%	0%	21	21	0	254	254	0
Grosvenor Road (A3212)	Ahead	492	99%	99%	0%	24	24	0	118	118	0
	Ahead left	462	97%	97%	0%	21	21	0	106	106	0
Chelsea Bridge Road (A3216)	Ahead	363	39%	39%	0%	4	4	0	11	11	0
	Ahead left	181	23%	23%	0%	2	2	0	11	11	0
Chelsea Bridge (A3216)	Ahead left	880	111%	113%	+2%	72	81	+9	231	265	+34
	Ahead right	546	72%	72%	0%	14	14	0	33	33	0
			PRC						Total Delay (PCU hours)		
Overall junction performance			-23%	-26%	-3%				118	127	+9

** 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. 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 13.5.6 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
Chelsea Embankment (A3212)	Ahead	607	68%	68%	0%	14	14	0	27	27	0
	Ahead left	337	39%	39%	0%	6	6	0	21	21	0
	Right	321	142%	142%	0%	61	61	0	632	632	0
Grosvenor Road (A3212)	Ahead	556	92%	92%	0%	20	20	0	57	57	0
	Ahead left	543	94%	94%	0%	21	21	0	65	65	0
Chelsea Bridge Road (A3216)	Ahead	473	115%	115%	0%	48	48	0	300	300	0
	Ahead left	278	72%	72%	0%	8	8	0	45	45	0
Chelsea Bridge (A3216)	Ahead left	735	103%	106%	+3%	40	48	+8	128	164	+36
	Ahead right	345	51%	51%	0%	8	8	0	30	30	0
			PRC						Total Delay (PCU hours)		
Overall junction performance			-58%	-58%	0%				153	161	+8

** 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. 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.

13.5.86 The results indicate that under the sensitivity test, the junction would operate above capacity in both AM and PM peak hours.

13.5.87 In the AM and PM peak hours the project would result in a further increase in the use of capacity on the Chelsea Bridge (A3216) northbound ahead and left turn movements compared with that for the *Transport Strategy*.

13.5.88 In the sensitivity test, the road network delay as a result of the additional construction traffic would be an increase of a maximum of 34 seconds per PCU in the AM and 36 seconds per PCU in the PM peak hours on the Chelsea Bridge (A3216) northbound ahead and left turn movements compared with that for the *Transport Strategy*.

13.5.89 The TRANSYT junction model output for the sensitivity test shows that total junction delay is 127 PCU hours in the AM peak period assessed and 161 PCU hours in the PM peak period assessed. These equate to 110 seconds per PCU in the AM peak period assessed and 138 seconds per PCU in the PM peak period assessed.

13.5.90 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 a proportion 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 13.3, the design measures which have been embedded directly in the design of the project and are listed in Table 13.5.4 would remain appropriate and there would be no need for further mitigation measures.

13.6 Operational assessment

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

13.6.2 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 13.2. This has been discussed with RB of Kensington Chelsea and TfL.

Operational base case

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

13.6.4 As explained in para. 13.2.48, the elements of the transport network considered in the operational assessment are highway layout and operation. For the purposes of the operational base case, it is anticipated that the highway layout will be as indicated in the construction base case.

Operational development case

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

13.6.6 Once the construction works at the Chelsea 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.

13.6.7 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.

13.6.8 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 when maintenance visits are made to the site.

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

13.6.10 During 3-6-monthly maintenance activity, 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 ten-yearly maintenance inspections, the Thames Path may need to be temporarily diverted.

Highway layout and operation

13.6.11 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 Chelsea Embankment Foreshore *Transport Assessment* figures demonstrates that the maintenance vehicles would be able to safely enter and leave the site.

13.6.12 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.

13.6.13 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 Chelsea Embankment Foreshore.

13.7 Summary of Transport Assessment findings

13.7.1 The key outcomes of this TA are indicated in Table 13.7.1.

Table 13.7.1 Chelsea Embankment Foreshore transport assessment results

Phase	Mode of transport	Key findings
Construction	Pedestrians	Approximately two minutes 40 seconds delay to pedestrian journeys currently using the Thames Path due to a 40m increase in journey distance and two additional road crossings in construction phases 1-3.
	Cyclists	Minimal delay (a maximum of 16 seconds per PCU in the AM peak hour on the Chelsea Bridge (A3216) northbound ahead and left turn movements and 14 seconds in the PM peak hour on the Chelsea Embankment (A3211) eastbound right turn movement and the Chelsea Bridge (A3216) northbound ahead and left turn movements compared with that in the construction base case). Cyclists making these movements could therefore experience additional delays of this order.
	Bus patronage and operators	Approximately seven worker trips would be made by bus which could be accommodated on base case services. There would be an increase of a maximum of 16 seconds per PCU in the AM peak hour on the Chelsea Bridge (A3216) northbound ahead and left turn movements and 14 seconds in the PM peak hour on the Chelsea Embankment (A3211) eastbound right turn movement and the Chelsea Bridge (A3216) northbound ahead and left turn movements compared with that in the construction base case. In the context of the local area and general journey times for bus services, this is not considered a significant change for bus users. Bus route 360 would not be able to serve the Bull Ring for a short period when landscaping works are taking place to the Bull Ring.
	London Underground and National Rail patronage	Approximately 48 worker trips would be made by London Underground or National Rail and could be accommodated on base case services.
	River passenger services and patronage	River services would not be altered during construction and construction barge movements would not significantly affect services. It is anticipated that few, if any, construction workers and labourers would use the river services to access the construction site, which would not significantly affect base case

Phase	Mode of transport	Key findings
		services.
	River navigation and access	A peak number of six barge movements would occur within Site Year 1 of construction which is not anticipated to impact on existing river navigation.
	Parking	Ten resident parking bays in the Bull Ring area would be temporarily restricted for a short period when landscaping works are taking place to the Bull Ring.
	Highway network and operation	Minimum typical lane widths of 4.3m in each direction would be maintained on Chelsea Embankment (A3212). One lane in each direction would remain in operation during construction. Approximately 120 additional daily vehicle movements would be generated by the construction works at Chelsea Embankment Foreshore in Site Year 3 of construction. Approximately 12 vehicle movements are anticipated in each of the AM and PM peak hours. The Chelsea Embankment (A3212) junction with Grosvenor Road (A3212), Chelsea Bridge (A3216) and Chelsea Bridge Road (A3216) will be operating above capacity in the construction base case. The addition of the Thames Tideway Tunnel project traffic would result in a maximum increase in delay of 16 seconds per PCU in the AM peak hour on the Chelsea Bridge (A3216) northbound ahead and left turn movements and a maximum of 14 seconds per PCU during the PM peak hour on Chelsea Embankment (A3212) eastbound right turn movement and the Chelsea Bridge (A3216) northbound ahead and left turn movements.
Operation	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.

References

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[7] Department for Transport (DfT), *Traffic Signs Manual Chapter 8 – Traffic Safety Measures and Signs for road Works and Temporary Situations*, 2009.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Transport Assessment

Doc Ref: **7.10.10**

Chelsea Embankment Foreshore

Appendices

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

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Transport Assessment

Section 13 Appendices: Chelsea 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 Chelsea 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 Royal Borough (RB) of Kensington and Chelsea.

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 Thames Tideway Tunnel has been considered as the preferred solution.

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

"The ES 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 a relatively moderate accessible transport hub and the proposed location has a Public Transport Accessibility Level (PTAL) rating of 3, rated as 'moderate'. 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 RB of Kensington and Chelsea have a number of policies relevant to transport. These are the Local Development Framework (LDF), Unitary Development Plan (UDP), Air Quality Supplementary Planning Document (SPD) and Transport SPD. All reflect regionally focused policies and are referred to where appropriate.

Local Development Framework – Core Strategy (RB of Kensington and Chelsea, 2010)

A.4.2 The LDF was adopted in December 2010, replacing the existing Unitary Development Plan. The focus of the framework is to *"set out the vision, objectives and detailed spatial strategy for future development in the Royal Borough up to 2028 along with specific strategic policies and targets, development management policies and site allocations".*

A.4.3 In relation to transport, it is the council's wish to improve the opportunities for residents to take up sustainable modes, by making them safe, easy and attractive.

A.4.4 **Policy CT1 – Improving alternatives to car use** sets out how the council plans to make using public transport, walking and cycling more attractive. There are a number of ways that this will be achieved, including:

a. Requiring that developments prove they will not adversely affect congestion or on-street parking;

b. Ensuring that developments incorporate measures to improve road safety;

c. Insisting that developers of large developments submit a transport assessment; and

d. Requesting that sites in close proximity to the Thames explore the potential to utilise freight delivery by water.

A.4.5 **Policy CR1 – Street Network** states that the council requires a well connected, inclusive and legible network of streets to be maintained and enhanced; this will be achieved by:

- Requiring new links and the removal of barriers that disconnect access for pedestrians, cyclists and people with limited mobility.

A.4.6 **Policy CR3 – Street and Outdoor Life** makes it clear that *"The Council will require opportunities to be taken within the street environment to create 'places' that support outdoor life, inclusive to all, adding to their attractiveness and vitality".* This will be achieved by:

a. Maintaining a free, safe and secure passage for pedestrians; and

b. Requiring that the occasional use of parks, gardens and open spaces for special events will be well-managed, and that in the duration, frequency and scale of the event has no adverse impact upon the road network.

A.4.7 **Policy CR4 – Streetscape** details the council's commitment to providing and maintaining a very high quality streetscape. In order to deliver this, the council will:

a. Require all work to, or affecting the public highway, to be carried out in accordance with the Council's adopted Streetscape Guidance;

b. Require all redundant or non-essential street furniture to be removed;

c. Retain and maintain historic street furniture, where it does not adversely impact on the safe functioning of the street;

d. Require that where there is an exceptional need for new street furniture that it is of high quality design and construction, and placed with great care, so as to relate well to the character and function of the street; and

e. Resist pavement crossovers and forecourt parking.

A.4.8 **Policy CR7 – Servicing** lays out the council's stance on servicing provision for new development. In particular it should not give rise to traffic congestion, conflict with pedestrians or be detrimental to residential amenity. The council will require:

a. Sufficient on-site servicing space that can accommodate the number and type of vehicles that will be generated without manoeuvring on the highway;

b. A servicing management plan for all sites with on-site servicing space;

c. Where developments cannot provide on-site servicing areas, they must demonstrate that they do not cause an adverse effect on traffic congestion, pedestrian safety, residential amenity or bus routes; and

d. On-site servicing space and entrances to be sensitive to the character and appearance of the building and wider townscape and streetscape.

A.4.9 **Policy CL5 – Amenity** states that the council expects all development within the borough to achieve high standards of amenity. There should be no significant impact due to increases in traffic, parking, noise, odours or vibration.

A.4.10 **Policy CE3 – Waste** requires that developments make use of rail and waterways to transport construction and other waste.

A.4.11 **Policy CE5 – Air Quality** makes it clear that the council will control the impact of development on air quality, including the impact of vehicles.

A.4.12 **Policy CE6 – Noise and Vibration** seeks to control and mitigate the impact of noise and vibration generating developments.

Unitary Development Plan (RB of Kensington and Chelsea, 2002)

A.4.13 The UDP was adopted in May 2002; it was replaced by the Core Strategy in December 2010, although a number of policies have been kept and therefore are still relevant.

A.4.14 The aim of the UDP is to provide a *"statutory planning framework for the local planning authority setting out the objectives, policies and proposals for the use of land and buildings in the area for 10 years"*. The council outlines its general strategic policy for transport as *"To seek a safe, efficient and environmentally acceptable transport system for the metropolitan area, whilst protecting the residential character, amenity and quality of the Royal Borough".*

A.4.15 **Policy STRAT 35 – To support an effective London-wide control of night-time and weekend lorry movement.**

A.4.16 **Policy CD5 – To seek to protect and enhance the established area of residential moorings at Battersea Reach** states that floating structures for transport purposes may be considered appropriate.

A.4.17 **Policy TR20 – To resist the loss of off-street coach parking**. Due to congestion problems that coaches cause, the council is keen to restrict any on-street parking provision for them. As a result, it is intended that off-street coach parking be retained.

A.4.18 **Policy TR21 – To support restrictions on coach movements in local areas.** This policy is supported in two ways:

a. Restricting on-street coach parking in the entire borough; and

b. By further restricting lorry and coach parking during evenings and weekends.

A.4.19 **Policy TR32 – Normally, to maintain the number of pay and display parking spaces in areas where off-street parking for visitors is limited** states that in areas with limited off-street parking, pay and display parking spaces should be protected. Demand for off-street parking will be controlled through price.

A.4.20 **Policy TR40 – To resist the formation of new accesses on the Major Roads**, this is because:

c. "The movement of vehicles and pedestrians gaining access to the large number of commercial and residential sites adjacent to Major

Roads can create problems for the safe and smooth flow of traffic on these roads".

A.4.21 **Policy TR44 – Normally to resist development which would result in the net loss of on-street residents' parking** is intended to maintain a supply of on street parking, which the council considers to be vital.

A.4.22 **Policy LR20 – To require that existing means of access to the foreshore are safeguarded and supplemented where appropriate**, lays down several requirements:

a. Points of access to the foreshore should be protected and new ones encouraged; and

b. Existing or new points of access cannot be opened without consulting the Harbourmaster.

Supplementary Planning Document (SPD) – Air Quality (RB of Kensington and Chelsea)

A.4.23 The Air Quality SPD sets out the council's requirements for development to reduce emissions within the borough. It was adopted in June 2009 and highlights a number of important strategies that contribute to reducing emissions.

A.4.24 The transport guidance in the Air Quality SPD mainly focuses on a number of measures to discourage high polluting vehicles and to encourage the use of more sustainable modes, including:

a. Walking and cycling strategies to encourage greater levels of walking and cycling;

b. The use of planning conditions or S106 agreements to reduce traffic and therefore emissions;

c. Expecting developers where possible to utilise or provide facilities for transporting passengers and/ or freight by water; and

d. Requiring developers to reduce emissions from construction vehicles, usually by requiring a particular euro standard to be met.

Supplementary Planning Document (SPD) – Transport (RB of Kensington and Chelsea)

A.4.25 The Transport SPD adopted in December 2008, is intended to complement and expand upon the policies set out in the UDP and LDF. There are six sections addressing transport planning policy matters:

a. Provision for pedestrians, Cyclists and Motorcyclists;

b. Car parking policy and standards;

c. Access and servicing;

d. Transport assessments; and

e. Travel Plans.

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Appendix B: PTAL analysis

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PTAI Study Report File Summary

PTAI Run Parameters

PTAI Run 20121409180351
Description 20121409180351
Run by user PTAL web application
Date and time 14/09/2012 18:03

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: 528395, 177880

Mode	Stop	Route	Distance (metres)	Frequency (vph)	Weight	Walk time (mins)	SWT (mins)	TAT (mins)	EDF	AI
BUS	CHELSEA LISTER HOSPITA	452	214.64	7.5	0.5	2.68	6.0	8.68	3.46	1.73
BUS	CHELSEA LISTER HOSPITAL	137	214.64	12.0	1.0	2.68	4.5	7.18	4.18	4.18
BUS	CHELSEA EMBKT BULL RING	360	179.98	5.0	0.5	2.25	8.0	10.25	2.93	1.46
BUS	CHELSEA LISTER HOSPITAL	44	214.64	6.0	0.5	2.68	7.0	9.68	3.1	1.55
BUS	GROSVENOR ROAD, PAXTON TERRACE	24	589.08	12.0	0.5	7.36	4.5	11.86	2.53	1.26
LT	SAP Points Not Found									
NR	SAP Points Not Found									

Total AI for this POI is 10.18.
PTAL Rating is 3.

Appendix C: Local modelling outputs

C.1 Baseline results, AM peak hour

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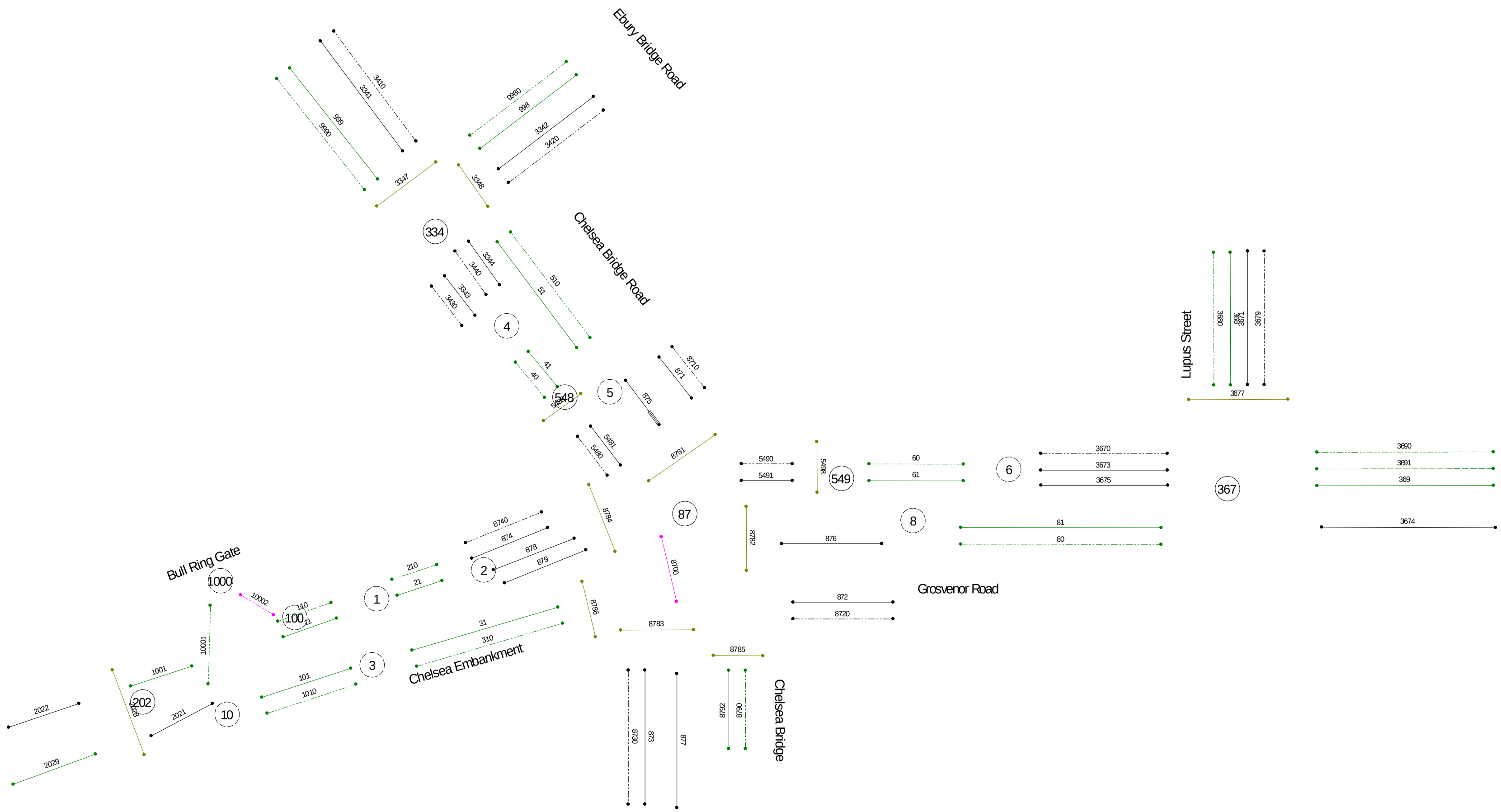
Network Diagram, baseline (AM peak hour)

Chelsea Embankment (AM Peak)



TRANSYT Link Results Summary, baseline (AM peak hour)

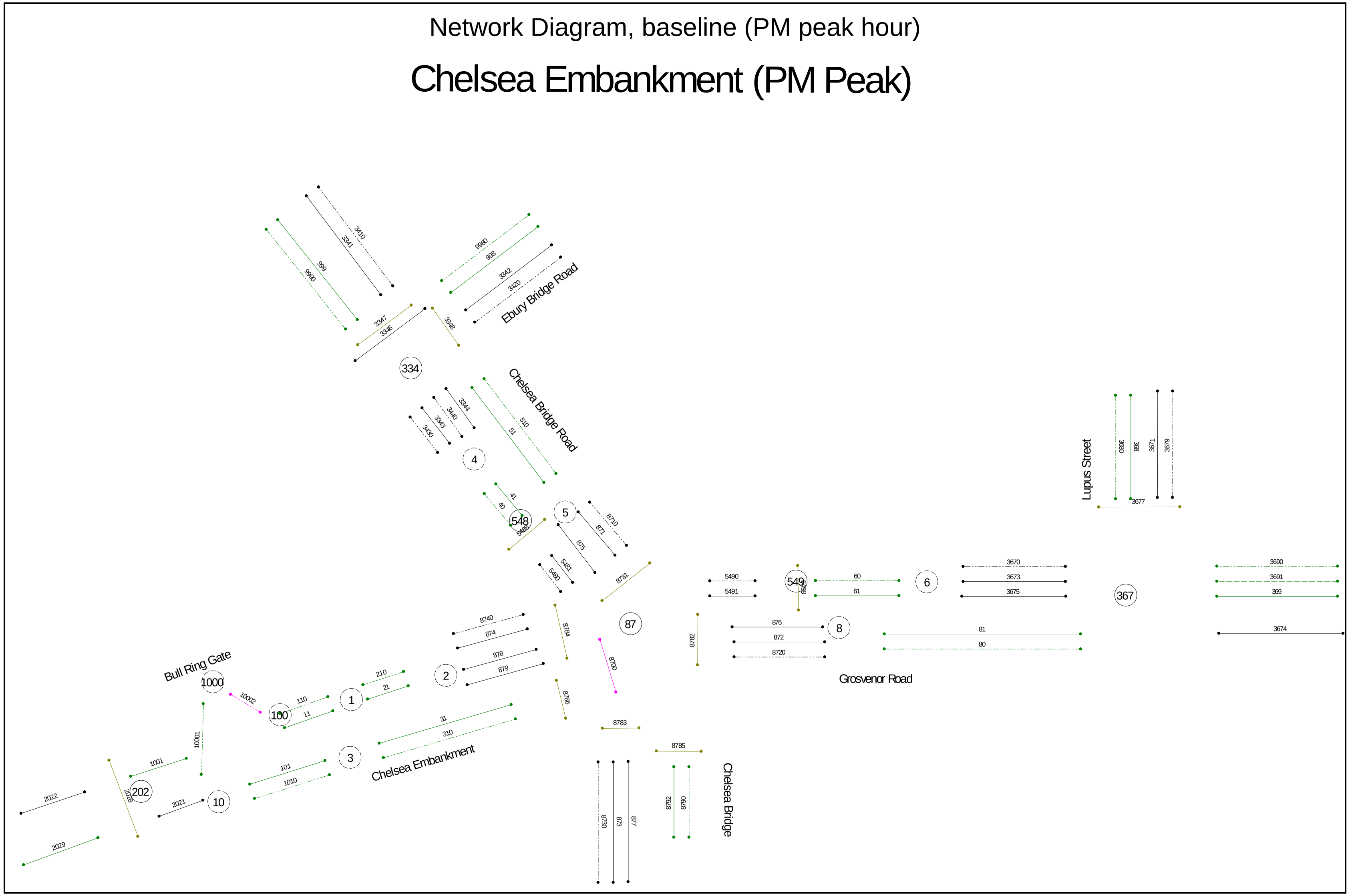
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
11	1	1149	2200	53	10	2	0.0	0.6	7.8	2	0.3	1	0.0	8.1
21	2	1149	4400	26	10	1	0.0	0.2	2.5	1	0.2	0	0.0	2.7
31	3	1094	4400	25	24	1	0.0	0.2	2.4	1	0.1	0	0.0	2.5
40	4	86	4400	20	37	1	0.0	0.0	0.2	0	0.0	0	0.0	0.2
41	4	786	4400	20	9	1	0.0	0.1	1.6	0	0.1	0	0.0	1.6
51	5	445	2200	23	14	1	0.0	0.1	1.9	1	0.1	0	0.0	1.9
60	6	10	2200	49	22	2	0.0	0.0	0.1	2	0.0	18	0.0	0.1
61	6	1069	2200	49	16	2	0.2	0.5	10.0	27	9.0	18	0.0	18.9
80	8	10	2200	40	19	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
81	8	878	2200	40	21	1	0.0	0.3	4.8	1	0.1	0	0.0	4.9
101	10	1094	2200	50	4	3	0.5	0.5	14.0	38	9.3	19	0.0	23.3
110	1	10	2200	53	9	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1
210	2	10	4400	26	13	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
310	3	10	4400	25	27	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
368	367	125	2000	7	18	1	0.0	0.0	0.5	1	0.0	0	0.0	0.5
369	367	929	2200	45	18	2	0.0	0.4	5.5	1	0.3	0	0.0	5.8
510	5	66	2200	23	12	1	0.0	0.0	0.3	1	0.0	0	0.0	0.3
871	87	106	1755	22	3	10	0.2	0.1	4.3	33	0.4	2	0.0	4.7
872	87	418	1825	90	8	74	4.7	3.9	122.6	128	8.1	16	0.0	130.8

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)
873	87	719	1760	102	18	120	6.3	17.6	338.8	165	25.2	43	0.0	364.0
874	87	338	1742	46	4	20	1.4	0.4	26.4	57	5.2	6	0.0	31.6
875	87	339	2097	37	3	10	0.7	0.3	13.8	33	1.3	4	0.0	15.1
876	87	460	1910	93	8	81	5.3	5.0	146.7	133	9.3	18	0.0	156.0
877	87	510	1711	67	18	30	3.3	1.0	60.9	83	9.0	13	0.0	69.9
878	87	588	1832	74	4	26	2.9	1.4	60.6	66	10.6	12	0.0	71.2
879	87	223	1760	101	4	171	2.4	8.2	150.3	192	11.5	15	0.0	161.8
998	334	319	2000	17	18	1	0.0	0.1	1.4	1	0.1	0	0.0	1.4
999	334	533	2000	29	18	1	0.0	0.2	2.7	1	0.1	0	0.0	2.8
1001	100	1149	2200	52	6	2	0.1	0.5	8.9	13	4.2	12	0.0	13.1
1010	10	10	2200	50	5	6	0.0	0.0	0.2	74	0.1	19	0.0	0.3
2021	202	1094	1984	102	3	103	7.2	24.2	446.1	203	47.3	50	0.0	493.4
2022	202	1149	2300	93	18	29	3.5	5.7	131.0	116	28.2	21	0.0	159.2
2028	202	10	10000	1	9	18	0.0	0.0	0.7	82	0.0	0	0.0	0.7
2029	202	1068	2000	53	18	2	0.0	0.6	8.1	2	0.4	1	0.0	8.5
3341	334	246	1771	56	18	39	2.1	0.5	37.4	89	4.7	8	0.0	42.1
3342	334	143	1391	18	18	11	0.3	0.1	6.1	42	1.3	2	0.0	7.4
3343	334	533	1733	44	4	3	0.1	0.4	6.0	4	0.5	1	0.0	6.5
3344	334	319	1676	47	4	8	0.3	0.4	10.0	28	1.9	3	0.0	11.9
3347	334	10	10000	1	9	48	0.1	0.0	1.9	96	0.0	0	0.0	1.9

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)
3348	334	10	10000	0	7	31	0.1	0.0	1.2	76	0.0	0	0.0	1.2
3410	334	52	1771	56	21	39	0.4	0.1	7.9	89	0.8	8	0.0	8.7
3420	334	14	1391	18	21	11	0.0	0.0	0.6	42	0.1	2	0.0	0.7
3430	334	53	1733	44	5	8	0.1	0.0	1.6	36	0.3	1	0.0	2.0
3440	334	16	1676	47	5	25	0.1	0.0	1.6	57	0.2	3	0.0	1.7
3670	367	10	1383	18	5	21	0.1	0.0	0.8	75	0.1	1	0.0	0.9
3671	367	79	1391	72	18	82	1.0	0.8	25.5	127	2.1	4	0.0	27.7
3673	367	150	1383	18	4	5	0.1	0.1	2.8	15	0.6	1	0.0	3.5
3674	367	828	1853	68	18	16	2.6	1.1	52.0	63	11.1	16	0.0	63.1
3675	367	919	1871	75	4	9	0.7	1.5	31.1	23	6.2	12	0.0	37.3
3677	367	10	10000	2	8	50	0.1	0.0	2.0	97	0.0	0	0.0	2.0
3679	367	36	1391	72	48	82	0.4	0.4	11.6	127	0.8	4	0.0	12.4
3680	367	10	2000	7	21	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
3690	367	24	2200	45	21	2	0.0	0.0	0.1	1	0.0	0	0.0	0.1
3691	367	45	2200	45	18	2	0.0	0.0	0.3	1	0.0	0	0.0	0.3
5480	548	86	3874	29	3	2	0.0	0.0	0.7	10	0.1	1	0.0	0.9
5481	548	786	3874	29	2	1	0.1	0.2	4.3	4	0.9	1	0.0	5.2
5488	548	10	10000	1	6	43	0.1	0.0	1.7	90	0.0	0	0.0	1.7
5490	549	10	3744	34	4	2	0.0	0.0	0.1	14	0.0	2	0.0	0.1
5491	549	1069	3744	34	3	2	0.2	0.3	6.5	7	0.6	2	0.0	7.1

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)
5498	549	10	10000	2	5	50	0.1	0.0	2.0	97	0.0	0	0.0	2.0
8700	87	131	600	22	2	4	0.0	0.1	2.0	0	0.0	0	0.0	2.0
8710	87	64	1755	22	3	7	0.1	0.1	1.8	29	0.3	2	0.0	2.1
8720	87	10	1825	90	8	43	0.0	0.1	1.7	125	0.2	16	0.0	1.9
8730	87	78	1760	102	21	120	0.7	1.9	36.8	165	2.2	43	0.0	39.0
8740	87	10	1742	46	5	11	0.0	0.0	0.4	54	0.1	6	0.0	0.5
8781	87	10	10000	0	7	18	0.0	0.0	0.7	58	0.0	0	0.0	0.7
8782	87	10	10000	0	7	9	0.0	0.0	0.4	40	0.0	0	0.0	0.4
8783	87	10	10000	0	9	18	0.0	0.0	0.7	58	0.0	0	0.0	0.7
8784	87	10	10000	0	9	18	0.0	0.0	0.7	58	0.0	0	0.0	0.7
8786	87	10	10000	2	5	50	0.1	0.0	2.0	97	0.0	0	0.0	2.0
8790	87	54	4000	20	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
8792	87	734	4000	20	18	1	0.0	0.1	1.6	1	0.1	0	0.0	1.7
9980	334	16	2000	17	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
9990	334	53	2000	29	21	1	0.0	0.0	0.3	1	0.0	0	0.0	0.3
10001	1000	10	2200	0	4	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
10002	100	10	715	2	31	4	0.0	0.0	0.2	0	0.0	0	0.0	0.2

C.2 Baseline results, PM peak hour



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)
11	1	1140	2200	53	10	2	0.0	0.5	7.8	1	0.2	1	0.0	8.0
21	2	1140	4400	26	10	1	0.0	0.2	2.5	0	0.2	0	0.0	2.6
31	3	1068	4400	25	24	1	0.0	0.2	2.3	0	0.1	0	0.0	2.4
40	4	62	4400	15	37	1	0.0	0.0	0.1	0	0.0	0	0.0	0.1
41	4	577	4400	15	9	1	0.0	0.1	1.1	0	0.0	0	0.0	1.1
51	5	624	2200	31	14	1	0.0	0.2	2.9	1	0.1	0	0.0	3.0
60	6	12	2200	54	22	2	0.0	0.0	0.1	2	0.0	29	0.0	0.1
61	6	1174	2200	54	16	5	1.0	0.6	22.1	54	19.4	29	0.0	41.5
80	8	18	2200	46	19	2	0.0	0.0	0.1	1	0.0	0	0.0	0.1
81	8	998	2200	46	21	2	0.0	0.4	6.0	1	0.1	0	0.0	6.1
101	10	1068	2200	49	4	4	0.7	0.5	16.5	46	10.9	24	0.0	27.3
110	1	18	2200	53	9	2	0.0	0.0	0.1	1	0.0	1	0.0	0.1
210	2	12	4400	26	13	1	0.0	0.0	0.0	0	0.0	0	0.0	0.0
310	3	18	4400	25	27	1	0.0	0.0	0.0	0	0.0	0	0.0	0.0
368	367	106	2000	6	18	1	0.0	0.0	0.4	1	0.0	0	0.0	0.4
369	367	1039	2200	49	18	2	0.0	0.5	6.6	1	0.3	0	0.0	6.8
510	5	58	2200	31	12	1	0.0	0.0	0.3	1	0.0	0	0.0	0.3
871	87	193	1755	56	3	43	1.8	0.5	32.7	83	1.9	7	0.0	34.6
872	87	483	1825	97	8	95	5.2	7.6	181.6	140	10.3	24	0.0	918.3
873	87	590	1767	89	18	54	5.4	3.4	125.0	107	13.4	23	0.0	138.3
874	87	296	1742	36	4	19	1.3	0.3	22.6	55	4.4	6	0.0	27.0

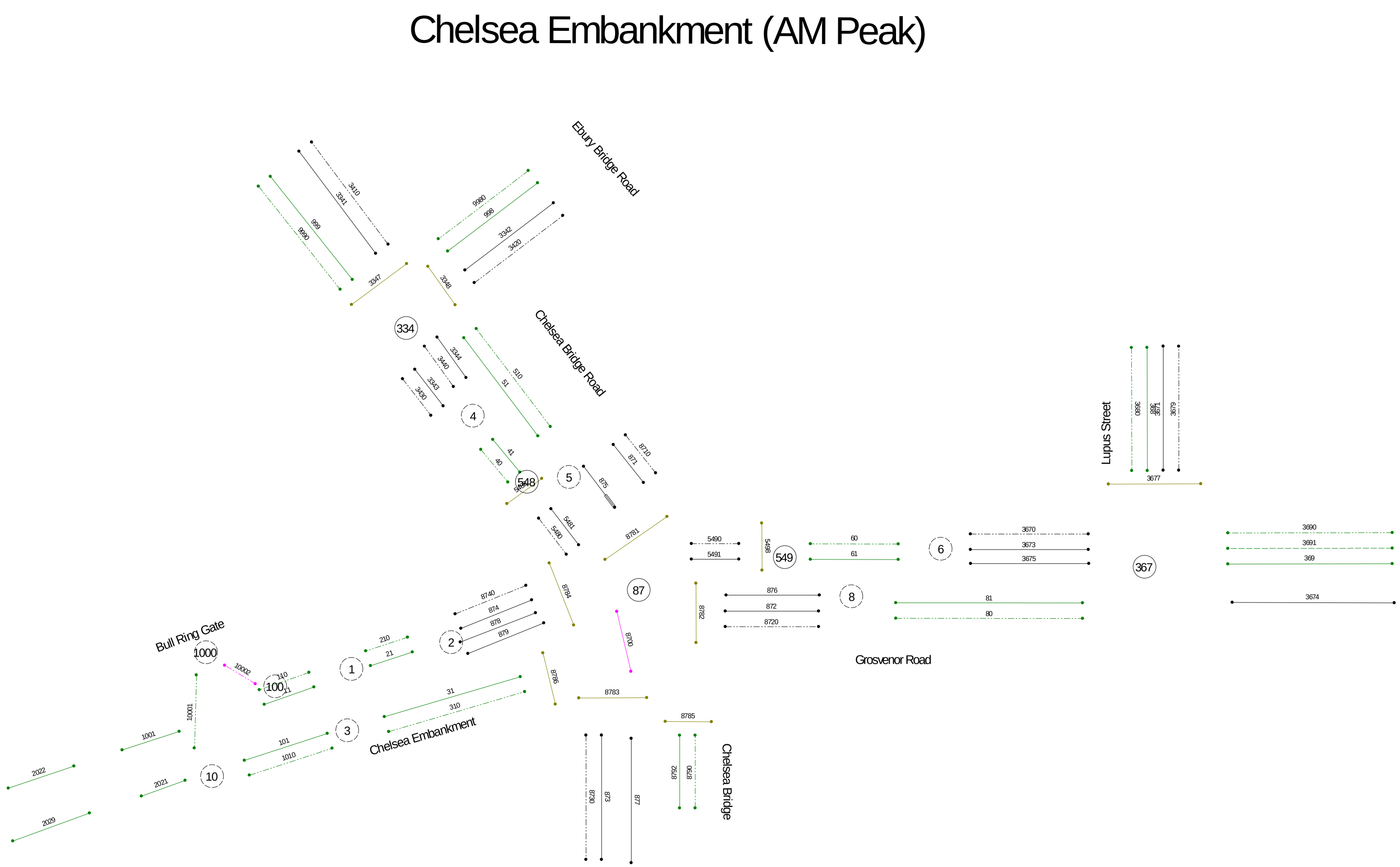
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
875	87	430	1863	89	3	69	4.6	3.7	117.1	119	6.0	18	0.0	123.1
876	87	515	1910	95	8	84	5.5	6.6	171.4	132	10.3	23	0.0	181.7
877	87	314	1711	45	18	30	2.2	0.4	37.6	74	4.9	8	0.0	42.6
878	87	552	1832	61	4	23	2.8	0.8	50.9	60	8.9	11	0.0	59.8
879	87	292	1804	97	4	127	3.7	6.6	146.0	155	12.2	16	0.0	158.3
998	334	177	2000	9	18	1	0.0	0.0	0.7	1	0.0	0	0.0	0.7
999	334	400	2000	22	18	1	0.0	0.1	1.8	1	0.1	0	0.0	1.9
1001	100	1140	2200	52	6	2	0.0	0.5	8.0	5	1.6	7	0.0	9.6
1010	10	18	2200	49	5	5	0.0	0.0	0.4	72	0.2	24	0.0	0.6
2021	202	1068	1984	77	3	22	4.9	1.6	93.4	92	20.9	28	0.0	114.3
2022	202	1140	2300	71	18	9	1.7	1.2	41.2	59	14.2	12	0.0	55.4
2028	202	10	10000	1	9	23	0.1	0.0	0.9	87	0.0	0	0.0	0.9
2029	202	1068	2000	53	18	2	0.0	0.6	8.1	2	0.4	1	0.0	8.5
3341	334	367	1771	47	18	14	1.0	0.4	19.7	67	5.2	5	0.0	24.9
3342	334	268	1391	41	18	15	0.7	0.3	15.4	68	3.8	3	0.0	19.2
3343	334	400	1733	37	4	7	0.5	0.3	10.3	37	3.2	5	0.0	13.5
3344	334	176	1676	84	4	67	1.1	2.2	46.7	158	5.9	6	0.0	52.6
3346	334	10	10000	0	9	20	0.1	0.0	0.8	75	0.7	0	0.0	1.4
3347	334	10	10000	1	9	25	0.1	0.0	1.0	91	0.0	0	0.0	1.0
3348	334	10	10000	0	7	16	0.0	0.0	0.6	72	0.0	0	0.0	0.6
3410	334	48	1771	47	21	14	0.1	0.1	2.6	67	0.5	5	0.0	3.1
3420	334	10	1391	41	21	15	0.0	0.0	0.6	68	0.1	3	0.0	0.7

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)
3430	334	48	1733	37	5	8	0.1	0.0	1.4	52	0.4	5	0.0	1.9
3440	334	12	1676	84	5	73	0.1	0.2	3.5	156	0.3	6	0.0	3.8
3670	367	12	1293	17	5	5	0.0	0.0	0.2	14	0.0	1	0.0	0.3
3671	367	110	1386	79	18	68	0.8	1.3	29.4	153	3.6	4	0.0	33.0
3673	367	106	1293	17	4	9	0.2	0.1	3.8	44	1.4	1	0.0	5.1
3674	367	911	1838	90	18	29	3.0	4.2	103.0	108	20.9	18	0.0	123.9
3675	367	1068	1871	104	4	123	7.6	28.7	516.5	207	65.1	59	0.0	581.6
3677	367	10	10000	1	8	27	0.1	0.0	1.0	93	0.0	0	0.0	1.1
3679	367	36	1386	79	48	68	0.3	0.4	9.6	153	0.9	4	0.0	10.6
3680	367	12	2000	6	21	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
3690	367	24	2200	49	21	2	0.0	0.0	0.2	1	0.0	0	0.0	0.2
3691	367	12	2200	49	18	2	0.0	0.0	0.1	1	0.0	0	0.0	0.1
5480	548	62	3874	20	3	1	0.0	0.0	0.2	1	0.0	0	0.0	0.2
5481	548	577	3874	20	2	1	0.0	0.1	2.2	2	0.3	0	0.0	2.5
5488	548	10	10000	1	6	51	0.1	0.0	2.0	91	0.0	0	0.0	2.0
5490	549	12	3744	31	4	1	0.0	0.0	0.0	1	0.0	3	0.0	0.0
5491	549	965	3744	31	3	2	0.3	0.2	7.1	9	0.8	3	0.0	7.9
5498	549	10	10000	2	5	57	0.1	0.0	2.2	97	0.0	0	0.0	2.2
8700	87	118	715	21	2	21	0.5	0.1	9.7	94	1.0	4	0.0	10.6
8710	87	60	1755	56	3	41	0.5	0.1	9.7	75	0.8	7	0.0	10.5
8720	87	18	1825	97	8	89	0.2	0.3	6.3	127	0.4	24	0.0	6.7
8730	87	52	1767	89	21	54	0.5	0.3	11.0	107	0.9	23	0.0	12.0

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)
8740	87	12	1742	36	5	20	0.1	0.0	0.9	83	0.2	6	0.0	1.1
8781	87	10	10000	0	7	9	0.0	0.0	0.4	38	0.0	0	0.0	0.4
8782	87	10	10000	0	7	11	0.0	0.0	0.4	41	0.0	0	0.0	0.4
8783	87	10	10000	0	9	17	0.0	0.0	0.7	53	0.0	0	0.0	0.7
8784	87	10	10000	0	9	24	0.1	0.0	0.9	62	0.0	0	0.0	0.9
8785	87	10	10000	2	5	58	0.2	0.0	2.3	98	0.0	0	0.0	2.3
8786	87	10	10000	1	5	50	0.1	0.0	2.0	90	0.0	0	0.0	2.0
8790	87	50	4000	28	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
8792	87	1056	4000	28	18	1	0.0	0.2	2.6	1	0.1	0	0.0	2.7
9980	334	12	2000	9	21	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
9990	334	48	2000	22	21	1	0.0	0.0	0.2	1	0.0	0	0.0	0.2
10001	1000	18	2200	1	4	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
10002	100	18	715	4	31	4	0.0	0.0	0.3	0	0.0	0	0.0	0.3

C.3 Construction base case results, AM peak hour

Network Diagram – Construction base case (AM peak hour)



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)
11	1	1229	2200	56	10	2	0.0	0.6	9.1	2	0.3	1	0.0	9.4
21	2	1229	4400	28	10	1	0.0	0.2	2.8	1	0.2	0	0.0	3.0
31	3	1148	4400	26	24	1	0.0	0.2	2.5	1	0.1	0	0.0	2.7
40	4	86	4400	20	37	1	0.0	0.0	0.2	0	0.0	0	0.0	0.2
41	4	815	4400	20	9	1	0.0	0.1	1.7	0	0.1	0	0.0	1.7
51	5	476	2200	25	14	1	0.0	0.1	2.0	1	0.1	0	0.0	2.1
60	6	11	2200	52	22	2	0.0	0.0	0.1	2	0.0	24	0.0	0.1
61	6	1144	2200	52	16	4	0.7	0.5	17.6	47	16.6	24	0.0	34.2
80	8	11	2200	43	19	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
81	8	940	2200	43	21	1	0.0	0.4	5.3	1	0.2	0	0.0	5.5
101	10	1148	2200	53	4	4	0.6	0.6	16.5	40	10.6	21	0.0	27.1
110	1	11	2200	56	9	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1
210	2	11	4400	28	13	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
310	3	11	4400	26	27	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
368	367	133	2000	7	18	1	0.0	0.0	0.5	1	0.0	0	0.0	0.5
369	367	995	2200	49	18	2	0.0	0.4	6.2	2	0.3	0	0.0	6.6
510	5	71	2200	25	12	1	0.0	0.0	0.3	1	0.0	0	0.0	0.3
871	87	113	1755	23	3	11	0.2	0.1	4.7	36	0.5	2	0.0	5.2
872	87	447	1825	97	8	101	5.2	7.3	178.1	149	10.1	21	0.0	188.2
873	87	769	1760	109	18	214	8.0	37.8	649.4	206	33.6	67	0.0	683.0
874	87	361	1742	49	4	26	2.1	0.5	36.9	73	7.2	8	0.0	44.1

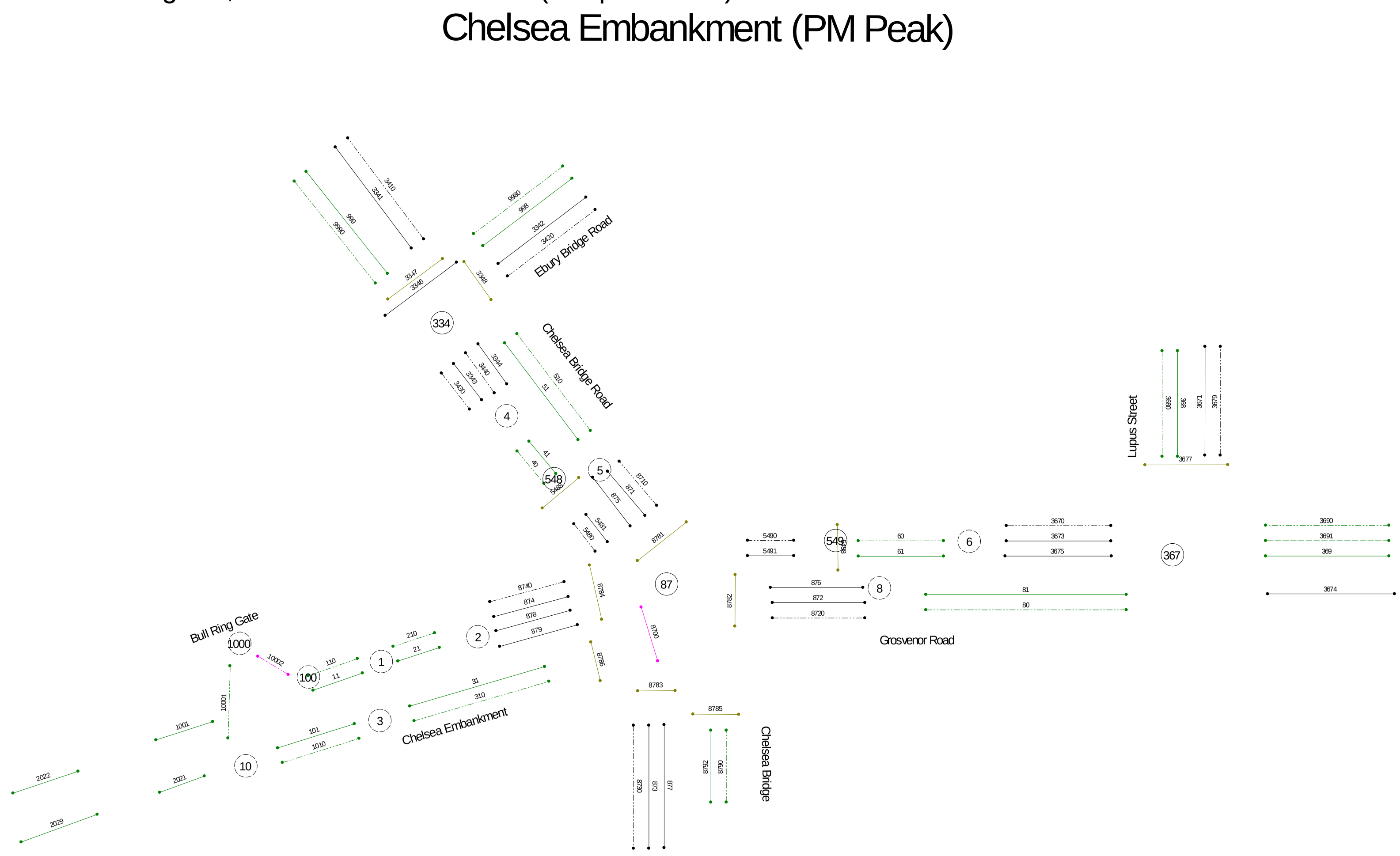
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
875	87	363	2097	39	3	11	0.8	0.3	15.3	36	1.5	4	0.0	16.8
876	87	492	1910	99	8	118	5.8	10.3	228.5	160	12.0	24	0.0	240.5
877	87	546	1711	72	18	32	3.6	1.3	69.3	87	10.1	14	0.0	79.4
878	87	629	1832	79	4	36	4.5	1.9	90.0	93	15.8	17	0.0	105.8
879	87	238	1760	108	4	253	3.2	13.6	237.8	218	14.0	21	0.0	251.8
998	334	331	2000	17	18	1	0.0	0.1	1.4	1	0.1	0	0.0	1.5
999	334	553	2000	30	18	1	0.0	0.2	2.8	1	0.1	0	0.0	3.0
1001	100	1229	2200	56	6	2	0.0	0.6	9.0	2	0.6	1	0.0	9.6
1010	10	11	2200	53	5	6	0.0	0.0	0.3	80	0.1	21	0.0	0.4
2021	10	1148	1984	58	3	3	0.4	0.7	14.8	36	9.0	22	0.0	23.7
2022	10	1229	2300	53	18	2	0.0	0.6	8.1	2	0.4	1	0.0	8.6
2029	10	1148	2000	57	18	2	0.0	0.7	9.6	2	0.5	1	0.0	10.0
3341	334	263	1771	59	18	38	2.2	0.6	39.8	89	5.0	8	0.0	44.7
3342	334	153	1391	20	18	11	0.4	0.1	6.9	44	1.4	2	0.0	8.3
3343	334	553	1733	46	4	3	0.1	0.4	6.7	7	0.9	2	0.0	7.6
3344	334	331	1676	50	4	9	0.4	0.5	11.9	28	2.1	4	0.0	14.0
3347	334	11	10000	2	9	48	0.1	0.0	2.1	96	0.0	0	0.0	2.1
3348	334	11	10000	0	7	30	0.1	0.0	1.3	75	0.0	0	0.0	1.3
3410	334	56	1771	59	21	38	0.5	0.1	8.5	89	0.9	8	0.0	9.3
3420	334	15	1391	20	21	11	0.0	0.0	0.7	44	0.1	2	0.0	0.8
3430	334	53	1733	46	5	8	0.1	0.0	1.7	36	0.4	2	0.0	2.0
3440	334	16	1676	50	5	27	0.1	0.0	1.7	56	0.2	4	0.0	1.9

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)
3670	367	11	1383	19	5	19	0.1	0.0	0.8	82	0.2	1	0.0	1.0
3671	367	85	1391	77	18	90	1.1	1.1	30.2	134	2.4	5	0.0	32.6
3673	367	160	1383	19	4	5	0.1	0.1	3.1	16	0.8	1	0.0	3.8
3674	367	886	1853	73	18	17	2.9	1.3	60.9	68	12.7	18	0.0	73.6
3675	367	984	1871	80	4	10	0.8	2.0	40.0	28	8.2	18	0.0	48.2
3677	367	11	10000	2	8	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
3679	367	39	1391	77	48	90	0.5	0.5	13.9	134	0.9	5	0.0	14.8
3680	367	11	2000	7	21	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
3690	367	26	2200	49	21	2	0.0	0.0	0.2	2	0.0	0	0.0	0.2
3691	367	48	2200	49	18	2	0.0	0.0	0.3	2	0.0	0	0.0	0.3
5480	548	87	3874	30	3	1	0.0	0.0	0.4	7	0.1	2	0.0	0.6
5481	548	815	3874	30	2	1	0.1	0.2	4.1	5	1.1	2	0.0	5.2
5488	548	11	10000	1	6	43	0.1	0.0	1.9	90	0.0	0	0.0	1.9
5490	549	11	3744	37	4	6	0.0	0.0	0.2	38	0.1	4	0.0	0.3
5491	549	1144	3744	37	3	2	0.3	0.3	8.2	10	1.0	4	0.0	9.1
5498	549	11	10000	2	5	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
8700	87	140	600	23	2	4	0.0	0.2	2.2	0	0.0	0	0.0	2.2
8710	87	68	1755	23	3	7	0.1	0.1	2.0	34	0.4	2	0.0	2.3
8720	87	11	1825	97	8	71	0.0	0.2	3.1	147	0.3	21	0.0	3.4
8730	87	83	1760	109	21	214	0.9	4.1	70.1	206	2.9	67	0.0	73.0
8740	87	11	1742	49	5	12	0.0	0.0	0.5	61	0.1	8	0.0	0.6
8781	87	11	10000	0	7	18	0.1	0.0	0.8	58	0.0	0	0.0	0.8

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)
8782	87	11	10000	0	7	9	0.0	0.0	0.4	40	0.0	0	0.0	0.4
8783	87	11	10000	0	9	18	0.1	0.0	0.8	58	0.0	0	0.0	0.8
8784	87	11	10000	0	9	18	0.1	0.0	0.8	58	0.0	0	0.0	0.8
8786	87	11	10000	2	5	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
8790	87	58	4000	21	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
8792	87	768	4000	21	18	1	0.0	0.1	1.7	1	0.1	0	0.0	1.8
9980	334	16	2000	17	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
9990	334	53	2000	30	21	1	0.0	0.0	0.3	1	0.0	0	0.0	0.3
10001	1000	11	2200	0	4	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
10002	100	11	715	2	31	4	0.0	0.0	0.2	0	0.0	0	0.0	0.2

C.4 Construction base case results, PM peak hour

Network Diagram, construction base case (PM peak hour)



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)
11	1	1254	2200	58	10	2	0.0	0.7	9.6	2	0.3	1	0.0	9.9
21	2	1254	4400	29	10	1	0.0	0.2	2.8	1	0.2	0	0.0	3.0
31	3	1165	4400	27	24	1	0.0	0.2	2.6	1	0.1	0	0.0	2.7
40	4	66	4400	16	37	1	0.0	0.0	0.1	1	0.0	7	0.0	0.1
41	4	633	4400	16	9	1	0.0	0.1	1.6	9	1.0	7	0.0	2.6
51	5	685	2200	34	14	1	0.0	0.2	3.4	1	0.1	0	0.0	3.5
60	6	13	2200	59	22	2	0.0	0.0	0.1	2	0.0	31	0.0	0.1
61	6	1289	2200	59	16	9	2.4	0.7	43.9	70	27.8	31	0.0	71.8
80	8	18	2200	50	19	2	0.0	0.0	0.1	1	0.0	1	0.0	0.1
81	8	1090	2200	50	21	2	0.0	0.5	7.1	2	0.2	1	0.0	7.3
101	10	1165	2200	54	4	4	0.8	0.6	19.2	48	12.7	24	0.0	31.8
110	1	18	2200	58	9	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1
210	2	12	4400	29	13	1	0.0	0.0	0.0	0	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)
310	3	18	4400	27	27	1	0.0	0.0	0.0	0	0.0	0	0.0	0.0
368	367	117	2000	6	18	1	0.0	0.0	0.4	1	0.0	0	0.0	0.5
369	367	1183	2200	55	18	2	0.0	0.6	8.6	2	0.4	1	0.0	9.0
510	5	64	2200	34	12	1	0.0	0.0	0.3	1	0.0	0	0.0	0.3
871	87	212	1755	72	3	45	1.7	0.9	37.4	94	2.3	8	0.0	39.8
872	87	528	1825	94	8	63	3.9	5.8	137.8	129	10.4	21	0.0	699.4
873	87	649	1767	101	18	113	5.9	14.6	290.0	161	22.2	36	0.0	312.2
874	87	326	1742	40	4	20	1.5	0.3	26.1	64	5.6	7	0.0	31.7
875	87	473	1863	115	3	304	5.6	33.8	560.0	229	12.7	48	0.0	572.7
876	87	563	1910	93	8	59	4.0	5.2	131.2	124	10.6	21	0.0	141.9
877	87	345	1711	51	18	29	2.3	0.5	39.9	78	5.7	8	0.0	45.7
878	87	607	1832	68	4	26	3.4	1.0	63.0	79	12.9	14	0.0	75.9
879	87	321	1804	142	4	618	7.0	49.4	800.4	256	22.2	61	0.0	822.6
998	334	194	2000	10	18	1	0.0	0.1	0.8	1	0.0	0	0.0	0.8

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)
999	334	439	2000	25	18	1	0.0	0.1	2.1	1	0.1	0	0.0	2.2
1001	100	1254	2200	57	6	2	0.0	0.7	9.4	2	0.6	1	0.0	10.0
1010	10	18	2200	54	5	3	0.0	0.0	0.2	28	0.1	24	0.0	0.3
2021	10	1165	1984	59	3	3	0.3	0.7	14.4	33	8.2	22	0.0	22.6
2022	10	1254	2300	55	18	2	0.0	0.6	8.5	2	0.4	1	0.0	8.9
2029	10	1165	2000	58	18	2	0.0	0.7	9.9	2	0.5	1	0.0	10.4
3341	334	404	1771	57	18	26	2.4	0.6	41.9	76	6.5	10	0.0	48.4
3342	334	295	1391	47	18	24	1.5	0.4	27.7	70	4.4	6	0.0	32.1
3343	334	439	1733	37	4	4	0.2	0.3	7.1	30	2.8	5	0.0	9.8
3344	334	194	1676	46	4	21	0.7	0.4	15.8	62	2.5	4	0.0	18.3
3346	334	11	10000	1	9	42	0.1	0.0	1.8	86	0.8	0	0.0	2.6
3347	334	11	10000	2	9	48	0.1	0.0	2.1	96	0.0	0	0.0	2.1
3348	334	11	10000	0	7	20	0.1	0.0	0.9	61	0.0	0	0.0	0.9
3410	334	53	1771	57	21	26	0.3	0.1	5.5	76	0.7	10	0.0	6.2

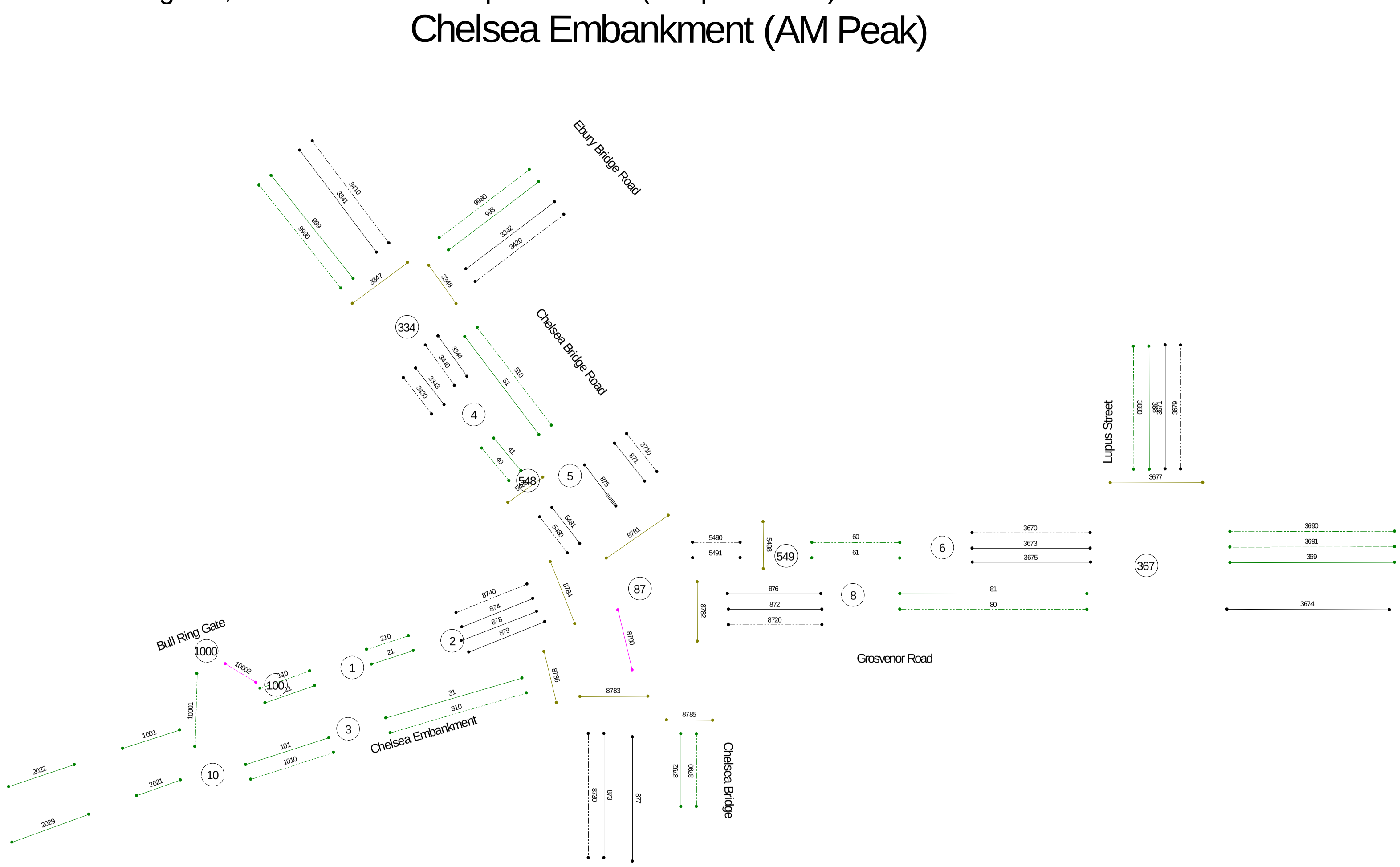
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
3420	334	11	1391	47	21	24	0.1	0.0	1.0	70	0.1	6	0.0	1.2
3430	334	52	1733	37	5	10	0.1	0.0	2.0	54	0.5	5	0.0	2.5
3440	334	13	1676	46	5	48	0.1	0.0	2.5	88	0.2	4	0.0	2.7
3670	367	13	1293	15	5	3	0.0	0.0	0.1	3	0.0	1	0.0	0.2
3671	367	121	1386	110	18	293	1.7	8.2	139.8	229	5.9	16	0.0	145.7
3673	367	116	1293	15	4	6	0.1	0.1	2.7	32	1.1	1	0.0	3.8
3674	367	1002	1838	82	18	21	3.6	2.3	83.2	77	16.4	23	0.0	99.6
3675	367	1173	1871	94	4	40	6.0	7.1	185.5	115	39.7	40	0.0	225.1
3677	367	11	10000	2	8	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
3679	367	40	1386	110	48	293	0.5	2.7	46.2	229	1.6	16	0.0	47.8
3680	367	13	2000	6	21	1	0.0	0.0	0.0	1	0.0	0	0.0	0.1
3690	367	24	2200	55	21	2	0.0	0.0	0.2	2	0.0	1	0.0	0.2
3691	367	13	2200	55	18	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1
5480	548	66	3874	5	3	6	0.1	0.0	1.7	44	0.5	2	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)
5481	548	85	3874	5	2	6	0.1	0.0	1.9	40	0.9	2	0.0	2.8
5488	548	11	10000	1	6	43	0.1	0.0	1.9	90	0.0	0	0.0	1.9
5490	549	13	3744	35	4	1	0.0	0.0	0.0	1	0.0	20	0.0	0.0
5491	549	1062	3744	35	3	5	1.2	0.3	20.1	61	5.6	20	0.0	25.7
5498	549	11	10000	2	5	48	0.1	0.0	2.1	96	0.0	0	0.0	2.1
8700	87	130	715	23	2	18	0.5	0.1	9.3	97	1.1	4	0.0	10.4
8710	87	66	1755	72	3	39	0.4	0.3	10.2	88	1.0	8	0.0	11.1
8720	87	18	1825	94	8	102	0.3	0.2	7.2	123	0.4	21	0.0	7.7
8730	87	57	1767	101	21	113	0.5	1.3	25.5	161	1.6	36	0.0	27.0
8740	87	12	1742	40	5	23	0.1	0.0	1.1	84	0.2	7	0.0	1.2
8781	87	11	10000	0	7	7	0.0	0.0	0.3	36	0.0	0	0.0	0.3
8782	87	11	10000	0	7	12	0.0	0.0	0.5	46	0.0	0	0.0	0.5
8783	87	11	10000	0	9	15	0.0	0.0	0.7	53	0.0	0	0.0	0.7
8784	87	11	10000	0	9	22	0.1	0.0	0.9	64	0.0	0	0.0	0.9

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)
8785	87	11	10000	2	5	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
8786	87	11	10000	2	5	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
8790	87	55	4000	26	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
8792	87	1003	4000	26	18	1	0.0	0.2	2.4	1	0.1	0	0.0	2.5
9980	334	13	2000	10	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
9990	334	52	2000	25	21	1	0.0	0.0	0.2	1	0.0	0	0.0	0.3
10001	1000	18	2200	1	4	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
10002	100	18	715	4	31	4	0.0	0.0	0.3	0	0.0	0	0.0	0.3

C.5 Construction development case results, AM peak hour

Network Diagram, construction development case (AM peak hour)



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)
11	1	1229	2200	56	10	2	0.0	0.6	9.1	2	0.3	1	0.0	9.4
21	2	1229	4400	28	10	1	0.0	0.2	2.8	1	0.2	0	0.0	3.0
31	3	1155	4400	27	24	1	0.0	0.2	2.5	1	0.1	0	0.0	2.7
40	4	86	4400	20	37	1	0.0	0.0	0.2	0	0.0	0	0.0	0.2
41	4	811	4400	20	9	1	0.0	0.1	1.6	0	0.1	0	0.0	1.7
51	5	476	2200	25	14	1	0.0	0.1	2.0	1	0.1	0	0.0	2.1
60	6	11	2200	52	22	2	0.0	0.0	0.1	2	0.0	24	0.0	0.1
61	6	1144	2200	52	16	4	0.7	0.5	17.6	47	16.6	24	0.0	34.2
80	8	11	2200	43	19	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
81	8	943	2200	43	21	1	0.0	0.4	5.4	1	0.2	0	0.0	5.5
101	10	1155	2200	53	4	4	0.6	0.6	16.7	40	10.7	21	0.0	27.5
110	1	11	2200	56	9	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1
210	2	11	4400	28	13	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
310	3	11	4400	27	27	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)
368	367	133	2000	7	18	1	0.0	0.0	0.5	1	0.0	0	0.0	0.5
369	367	995	2200	49	18	2	0.0	0.4	6.2	2	0.3	0	0.0	6.6
510	5	71	2200	25	12	1	0.0	0.0	0.3	1	0.0	0	0.0	0.3
871	87	113	1755	23	3	11	0.2	0.1	4.7	36	0.5	2	0.0	5.2
872	87	451	1825	97	8	105	5.3	7.9	187.1	152	10.4	21	0.0	197.5
873	87	778	1760	111	18	230	8.2	41.5	706.7	211	34.8	72	0.0	741.5
874	87	361	1742	49	4	26	2.1	0.5	36.9	73	7.2	8	0.0	44.1
875	87	363	2097	39	3	11	0.8	0.3	15.3	36	1.5	4	0.0	16.8
876	87	492	1910	99	8	117	5.8	10.2	227.2	160	11.9	24	0.0	239.1
877	87	546	1711	72	18	32	3.6	1.3	69.3	87	10.1	14	0.0	79.4
878	87	629	1832	79	4	36	4.5	1.9	90.0	93	15.8	17	0.0	105.8
879	87	238	1760	108	4	253	3.2	13.6	237.8	218	14.0	21	0.0	251.8
998	334	329	2000	17	18	1	0.0	0.1	1.4	1	0.1	0	0.0	1.5
999	334	550	2000	30	18	1	0.0	0.2	2.8	1	0.1	0	0.0	2.9
1001	100	1229	2200	56	6	2	0.0	0.6	9.0	2	0.6	1	0.0	9.6

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)
1010	10	11	2200	53	5	6	0.0	0.0	0.3	80	0.1	21	0.0	0.4
2021	10	1155	1984	58	3	3	0.4	0.7	15.0	36	9.0	22	0.0	24.0
2022	10	1229	2300	53	18	2	0.0	0.6	8.1	2	0.4	1	0.0	8.6
2029	10	1155	2000	58	18	2	0.0	0.7	9.7	2	0.5	1	0.0	10.2
3341	334	263	1771	59	18	38	2.2	0.6	39.8	89	5.0	8	0.0	44.7
3342	334	153	1391	20	18	11	0.4	0.1	6.9	44	1.4	2	0.0	8.3
3343	334	550	1733	46	4	3	0.1	0.4	6.7	7	0.9	2	0.0	7.6
3344	334	329	1676	50	4	9	0.4	0.5	11.8	28	2.1	4	0.0	13.9
3347	334	11	10000	2	9	48	0.1	0.0	2.1	96	0.0	0	0.0	2.1
3348	334	11	10000	0	7	30	0.1	0.0	1.3	75	0.0	0	0.0	1.3
3410	334	56	1771	59	21	38	0.5	0.1	8.5	89	0.9	8	0.0	9.3
3420	334	15	1391	20	21	11	0.0	0.0	0.7	44	0.1	2	0.0	0.8
3430	334	53	1733	46	5	8	0.1	0.0	1.7	35	0.3	2	0.0	2.0
3440	334	15	1676	50	5	29	0.1	0.0	1.7	56	0.2	4	0.0	1.9
3670	367	11	1383	19	5	19	0.1	0.0	0.8	82	0.2	1	0.0	1.0

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)
3671	367	85	1391	77	18	90	1.1	1.1	30.2	134	2.4	5	0.0	32.6
3673	367	160	1383	19	4	5	0.1	0.1	3.1	16	0.8	1	0.0	3.8
3674	367	889	1853	73	18	18	3.0	1.4	61.4	68	12.8	18	0.0	74.2
3675	367	984	1871	80	4	10	0.8	2.0	40.0	28	8.2	18	0.0	48.2
3677	367	11	10000	2	8	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
3679	367	39	1391	77	48	90	0.5	0.5	13.9	134	0.9	5	0.0	14.8
3680	367	11	2000	7	21	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
3690	367	26	2200	49	21	2	0.0	0.0	0.2	2	0.0	0	0.0	0.2
3691	367	48	2200	49	18	2	0.0	0.0	0.3	2	0.0	0	0.0	0.3
5480	548	86	3874	30	3	1	0.0	0.0	0.4	7	0.1	2	0.0	0.5
5481	548	811	3874	30	2	1	0.1	0.2	4.1	5	1.1	2	0.0	5.1
5488	548	11	10000	1	6	43	0.1	0.0	1.9	90	0.0	0	0.0	1.9
5490	549	11	3744	37	4	6	0.0	0.0	0.2	38	0.1	4	0.0	0.3
5491	549	1144	3744	37	3	2	0.3	0.3	8.2	10	1.0	4	0.0	9.1
5498	549	11	10000	2	5	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2

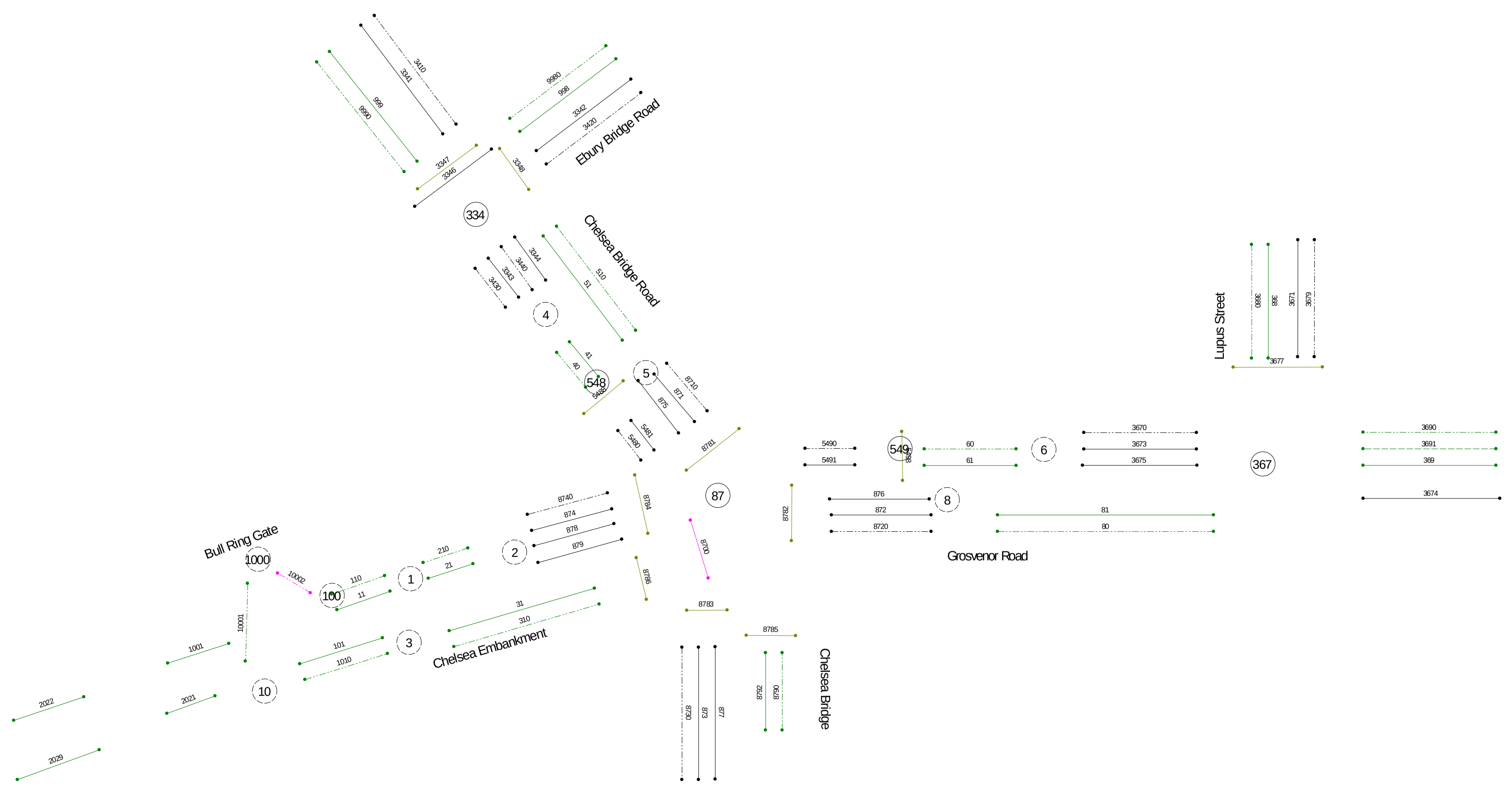
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
8700	87	140	600	23	2	4	0.0	0.2	2.2	0	0.0	0	0.0	2.2
8710	87	68	1755	23	3	7	0.1	0.1	2.0	34	0.4	2	0.0	2.3
8720	87	11	1825	97	8	75	0.0	0.2	3.3	151	0.3	21	0.0	3.6
8730	87	83	1760	111	21	230	0.9	4.4	75.4	211	3.0	72	0.0	78.4
8740	87	11	1742	49	5	12	0.0	0.0	0.5	61	0.1	8	0.0	0.6
8781	87	11	10000	0	7	18	0.1	0.0	0.8	58	0.0	0	0.0	0.8
8782	87	11	10000	0	7	9	0.0	0.0	0.4	40	0.0	0	0.0	0.4
8783	87	11	10000	0	9	18	0.1	0.0	0.8	58	0.0	0	0.0	0.8
8784	87	11	10000	0	9	18	0.1	0.0	0.8	58	0.0	0	0.0	0.8
8786	87	11	10000	2	5	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
8790	87	58	4000	21	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
8792	87	768	4000	21	18	1	0.0	0.1	1.7	1	0.1	0	0.0	1.8
9980	334	15	2000	17	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
9990	334	53	2000	30	21	1	0.0	0.0	0.3	1	0.0	0	0.0	0.3
10001	1000	11	2200	0	4	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)
10002	100	11	715	2	31	4	0.0	0.0	0.2	0	0.0	0	0.0	0.2

C.6 Construction development case results, PM peak hour

Network Diagram, construction development case (PM peak hour)

Chelsea Embankment (PM Peak)



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)
11	1	1254	2200	58	10	2	0.0	0.7	9.6	2	0.3	1	0.0	9.9
21	2	1254	4400	29	10	1	0.0	0.2	2.8	1	0.2	0	0.0	3.0
31	3	1162	4400	27	24	1	0.0	0.2	2.6	1	0.1	0	0.0	2.7
40	4	64	4400	16	37	1	0.0	0.0	0.1	1	0.0	8	0.0	0.1
41	4	624	4400	16	9	1	0.0	0.1	1.8	14	1.5	8	0.0	3.3
51	5	685	2200	34	14	1	0.0	0.2	3.4	1	0.1	0	0.0	3.5
60	6	13	2200	59	22	2	0.0	0.0	0.1	2	0.0	31	0.0	0.1
61	6	1289	2200	59	16	9	2.4	0.7	43.7	71	28.2	31	0.0	71.9
80	8	17	2200	50	19	2	0.0	0.0	0.1	1	0.0	0	0.0	0.1
81	8	1083	2200	50	21	2	0.0	0.5	7.0	2	0.2	0	0.0	7.2
101	10	1162	2200	54	4	4	0.7	0.6	18.7	47	12.4	24	0.0	31.1
110	1	17	2200	58	9	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1
210	2	11	4400	29	13	1	0.0	0.0	0.0	0	0.0	0	0.0	0.0
310	3	17	4400	27	27	1	0.0	0.0	0.0	0	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)
368	367	117	2000	7	18	1	0.0	0.0	0.4	1	0.0	0	0.0	0.5
369	367	1182	2200	55	18	2	0.0	0.6	8.5	2	0.4	1	0.0	9.0
510	5	64	2200	34	12	1	0.0	0.0	0.3	1	0.0	0	0.0	0.3
871	87	212	1755	72	3	45	1.7	0.9	37.5	93	2.3	8	0.0	39.8
872	87	526	1825	94	8	65	3.9	5.5	134.3	127	10.3	21	0.0	681.6
873	87	658	1767	103	18	128	6.1	17.2	331.6	169	23.6	40	0.0	355.2
874	87	326	1742	39	4	20	1.5	0.3	26.0	64	5.6	6	0.0	31.6
875	87	473	1863	115	3	300	5.6	33.8	559.6	229	12.7	48	0.0	572.2
876	87	557	1910	92	8	57	4.0	4.7	124.6	120	10.3	20	0.0	134.9
877	87	345	1711	51	18	29	2.3	0.5	39.9	78	5.7	8	0.0	45.7
878	87	607	1832	68	4	26	3.4	1.0	63.0	79	12.9	14	0.0	75.9
879	87	321	1804	142	4	632	6.9	49.4	799.6	256	22.2	61	0.0	821.8
998	334	191	2000	10	18	1	0.0	0.1	0.8	1	0.0	0	0.0	0.8
999	334	433	2000	24	18	1	0.0	0.1	2.0	1	0.1	0	0.0	2.1
1001	100	1254	2200	57	6	2	0.0	0.7	9.4	2	0.6	1	0.0	10.0

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)
1010	10	17	2200	54	5	3	0.0	0.0	0.2	23	0.1	24	0.0	0.2
2021	10	1162	1984	59	3	3	0.3	0.7	14.5	33	8.4	22	0.0	22.9
2022	10	1254	2300	55	18	2	0.0	0.6	8.5	2	0.4	1	0.0	8.9
2029	10	1162	2000	58	18	2	0.0	0.7	9.8	2	0.5	1	0.0	10.3
3341	334	404	1771	57	18	26	2.4	0.6	41.9	76	6.5	10	0.0	48.4
3342	334	295	1391	47	18	24	1.5	0.4	27.7	70	4.4	6	0.0	32.1
3343	334	433	1733	37	4	4	0.2	0.3	7.1	34	3.1	6	0.0	10.2
3344	334	191	1676	45	4	20	0.7	0.4	14.8	55	2.2	3	0.0	17.0
3346	334	11	10000	1	9	42	0.1	0.0	1.8	86	0.8	0	0.0	2.6
3347	334	11	10000	2	9	48	0.1	0.0	2.1	96	0.0	0	0.0	2.1
3348	334	11	10000	0	7	20	0.1	0.0	0.9	61	0.0	0	0.0	0.9
3410	334	53	1771	57	21	26	0.3	0.1	5.5	76	0.7	10	0.0	6.2
3420	334	11	1391	47	21	24	0.1	0.0	1.0	70	0.1	6	0.0	1.2
3430	334	50	1733	37	5	10	0.1	0.0	2.1	55	0.5	6	0.0	2.6
3440	334	12	1676	45	5	51	0.1	0.0	2.4	85	0.2	3	0.0	2.6

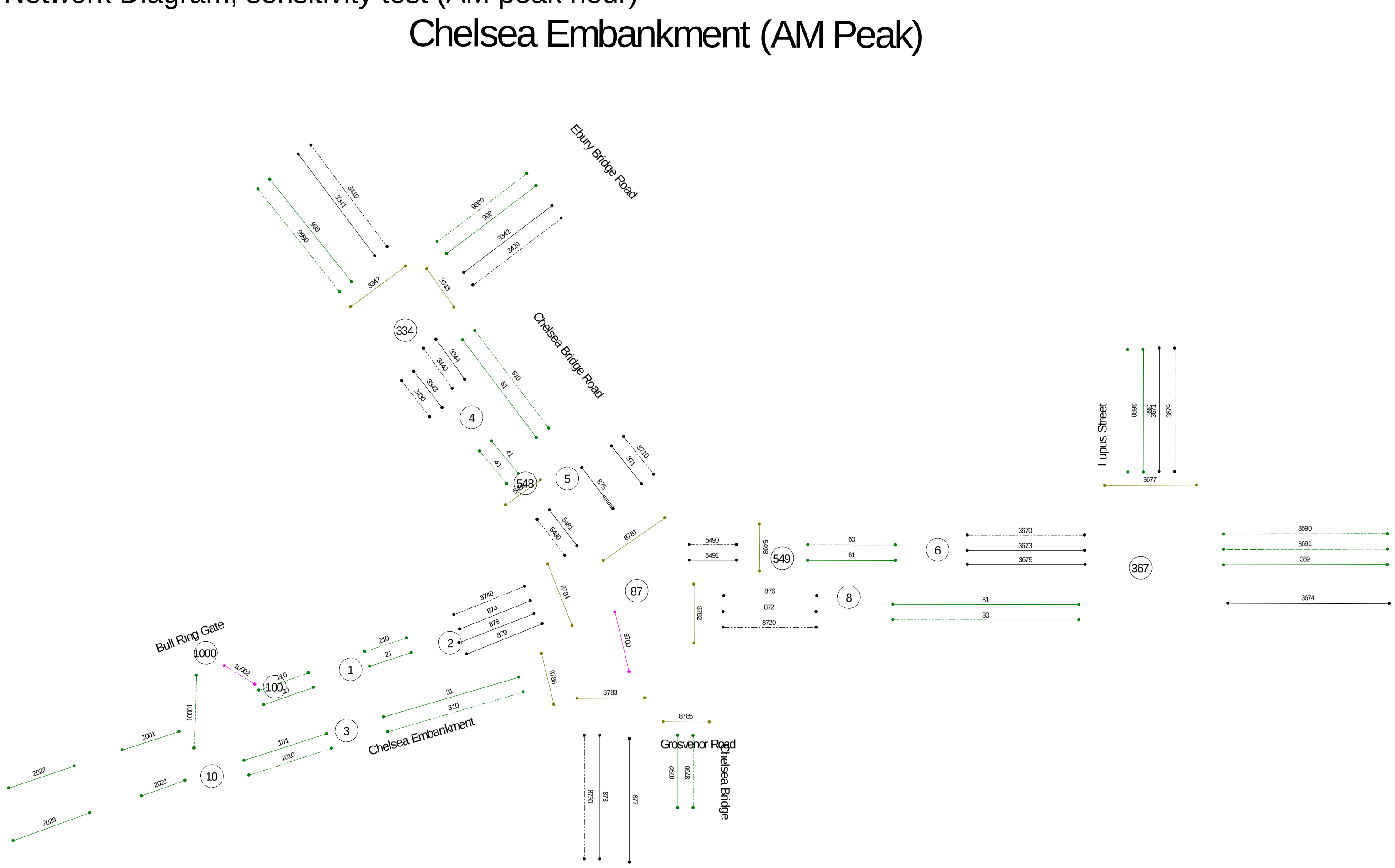
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
3670	367	13	1293	15	5	3	0.0	0.0	0.1	4	0.0	1	0.0	0.2
3671	367	121	1386	121	18	417	1.8	12.3	199.2	248	6.4	21	0.0	205.6
3673	367	116	1293	15	4	6	0.1	0.1	2.6	31	1.1	1	0.0	3.7
3674	367	1004	1838	81	18	20	3.4	2.1	78.5	75	15.9	23	0.0	94.5
3675	367	1173	1871	93	4	36	5.9	6.0	167.8	111	38.6	38	0.0	206.4
3677	367	11	10000	2	8	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
3679	367	40	1386	121	48	417	0.6	4.1	65.9	248	1.7	21	0.0	67.6
3680	367	13	2000	7	21	1	0.0	0.0	0.0	1	0.0	0	0.0	0.1
3690	367	21	2200	55	21	2	0.0	0.0	0.2	1	0.0	1	0.0	0.2
3691	367	13	2200	55	18	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1
5480	548	64	3874	5	3	7	0.1	0.0	1.6	43	0.5	2	0.0	2.1
5481	548	84	3874	5	2	6	0.1	0.0	2.1	41	1.0	2	0.0	3.0
5488	548	11	10000	1	6	43	0.1	0.0	1.9	90	0.0	0	0.0	1.9
5490	549	13	3744	35	4	1	0.0	0.0	0.0	1	0.0	19	0.0	0.0
5491	549	1062	3744	35	3	4	0.9	0.3	16.8	55	5.1	19	0.0	21.8

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)
5498	549	11	10000	2	5	48	0.1	0.0	2.1	96	0.0	0	0.0	2.1
8700	87	130	715	23	2	18	0.5	0.1	9.3	97	1.1	4	0.0	10.4
8710	87	66	1755	72	3	39	0.4	0.3	10.2	85	1.0	8	0.0	11.2
8720	87	17	1825	94	8	97	0.3	0.2	6.5	110	0.4	21	0.0	6.9
8730	87	57	1767	103	21	128	0.5	1.5	28.7	169	1.6	40	0.0	30.4
8740	87	11	1742	39	5	23	0.1	0.0	1.0	76	0.2	6	0.0	1.2
8781	87	11	10000	0	7	7	0.0	0.0	0.3	36	0.0	0	0.0	0.3
8782	87	11	10000	0	7	12	0.0	0.0	0.5	46	0.0	0	0.0	0.5
8783	87	11	10000	0	9	15	0.0	0.0	0.7	53	0.0	0	0.0	0.7
8784	87	11	10000	0	9	22	0.1	0.0	0.9	64	0.0	0	0.0	0.9
8785	87	11	10000	2	5	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
8786	87	11	10000	2	5	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
8790	87	55	4000	26	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
8792	87	1002	4000	26	18	1	0.0	0.2	2.4	1	0.1	0	0.0	2.5
9980	334	12	2000	10	21	1	0.0	0.0	0.0	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)
9990	334	50	2000	24	21	1	0.0	0.0	0.2	1	0.0	0	0.0	0.2
10001	1000	17	2200	1	4	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
10002	100	16	715	4	31	4	0.0	0.0	0.3	0	0.0	0	0.0	0.3

C.7 Construction development case results, sensitivity test, AM peak hour

Network Diagram, sensitivity test (AM peak hour)



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)
11	1	1229	2200	56	10	2	0.0	0.6	9.1	2	0.3	1	0.0	9.4
21	2	1229	4400	28	10	1	0.0	0.2	2.8	1	0.2	0	0.0	3.0
31	3	1166	4400	27	24	1	0.0	0.2	2.6	1	0.1	0	0.0	2.7
40	4	84	4400	20	37	1	0.0	0.0	0.2	0	0.0	0	0.0	0.2
41	4	804	4400	20	9	1	0.0	0.1	1.6	0	0.1	0	0.0	1.7
51	5	476	2200	25	14	1	0.0	0.1	2.0	1	0.1	0	0.0	2.1
60	6	11	2200	52	22	2	0.0	0.0	0.1	2	0.0	24	0.0	0.1
61	6	1144	2200	52	16	4	0.7	0.5	17.6	47	16.6	24	0.0	34.2
80	8	11	2200	43	19	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
81	8	943	2200	43	21	1	0.0	0.4	5.4	1	0.2	0	0.0	5.5
101	10	1166	2200	53	4	4	0.7	0.6	18.1	42	11.5	22	0.0	29.6
110	1	11	2200	56	9	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1
210	2	11	4400	28	13	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)
310	3	11	4400	27	27	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
368	367	133	2000	7	18	1	0.0	0.0	0.5	1	0.0	0	0.0	0.5
369	367	995	2200	49	18	2	0.0	0.4	6.2	2	0.3	0	0.0	6.6
510	5	71	2200	25	12	1	0.0	0.0	0.3	1	0.0	0	0.0	0.3
871	87	113	1755	23	3	11	0.2	0.1	4.7	36	0.5	2	0.0	5.2
872	87	451	1825	97	8	105	5.3	7.9	187.1	152	10.4	21	0.0	197.5
873	87	797	1760	113	18	264	8.9	49.6	830.4	220	37.2	81	0.0	867.6
874	87	361	1742	49	4	26	2.1	0.5	36.9	73	7.2	8	0.0	44.0
875	87	363	2097	39	3	11	0.8	0.3	15.3	36	1.5	4	0.0	16.8
876	87	492	1910	99	8	117	5.8	10.2	227.2	160	11.9	24	0.0	239.1
877	87	546	1711	72	18	32	3.6	1.3	69.3	87	10.1	14	0.0	79.4
878	87	629	1832	79	4	36	4.5	1.9	90.0	93	15.8	17	0.0	105.8
879	87	238	1760	108	4	253	3.2	13.6	237.8	218	14.0	21	0.0	251.8
998	334	326	2000	17	18	1	0.0	0.1	1.4	1	0.1	0	0.0	1.5

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)
999	334	545	2000	30	18	1	0.0	0.2	2.8	1	0.1	0	0.0	2.9
1001	100	1229	2200	56	6	2	0.0	0.6	9.0	2	0.6	1	0.0	9.6
1010	10	11	2200	53	5	7	0.0	0.0	0.3	83	0.2	22	0.0	0.5
2021	10	1166	1984	59	3	3	0.4	0.7	15.5	37	9.4	22	0.0	25.0
2022	10	1229	2300	53	18	2	0.0	0.6	8.1	2	0.4	1	0.0	8.6
2029	10	1166	2000	58	18	2	0.0	0.7	9.9	2	0.5	1	0.0	10.4
3341	334	263	1771	59	18	38	2.2	0.6	39.8	89	5.0	8	0.0	44.7
3342	334	153	1391	20	18	11	0.4	0.1	6.9	44	1.4	2	0.0	8.3
3343	334	545	1733	45	4	3	0.1	0.4	6.6	7	0.9	2	0.0	7.5
3344	334	326	1676	49	4	9	0.4	0.5	11.6	28	2.0	4	0.0	13.7
3347	334	11	10000	2	9	48	0.1	0.0	2.1	96	0.0	0	0.0	2.1
3348	334	11	10000	0	7	30	0.1	0.0	1.3	75	0.0	0	0.0	1.3
3410	334	56	1771	59	21	38	0.5	0.1	8.5	89	0.9	8	0.0	9.3
3420	334	15	1391	20	21	11	0.0	0.0	0.7	44	0.1	2	0.0	0.8

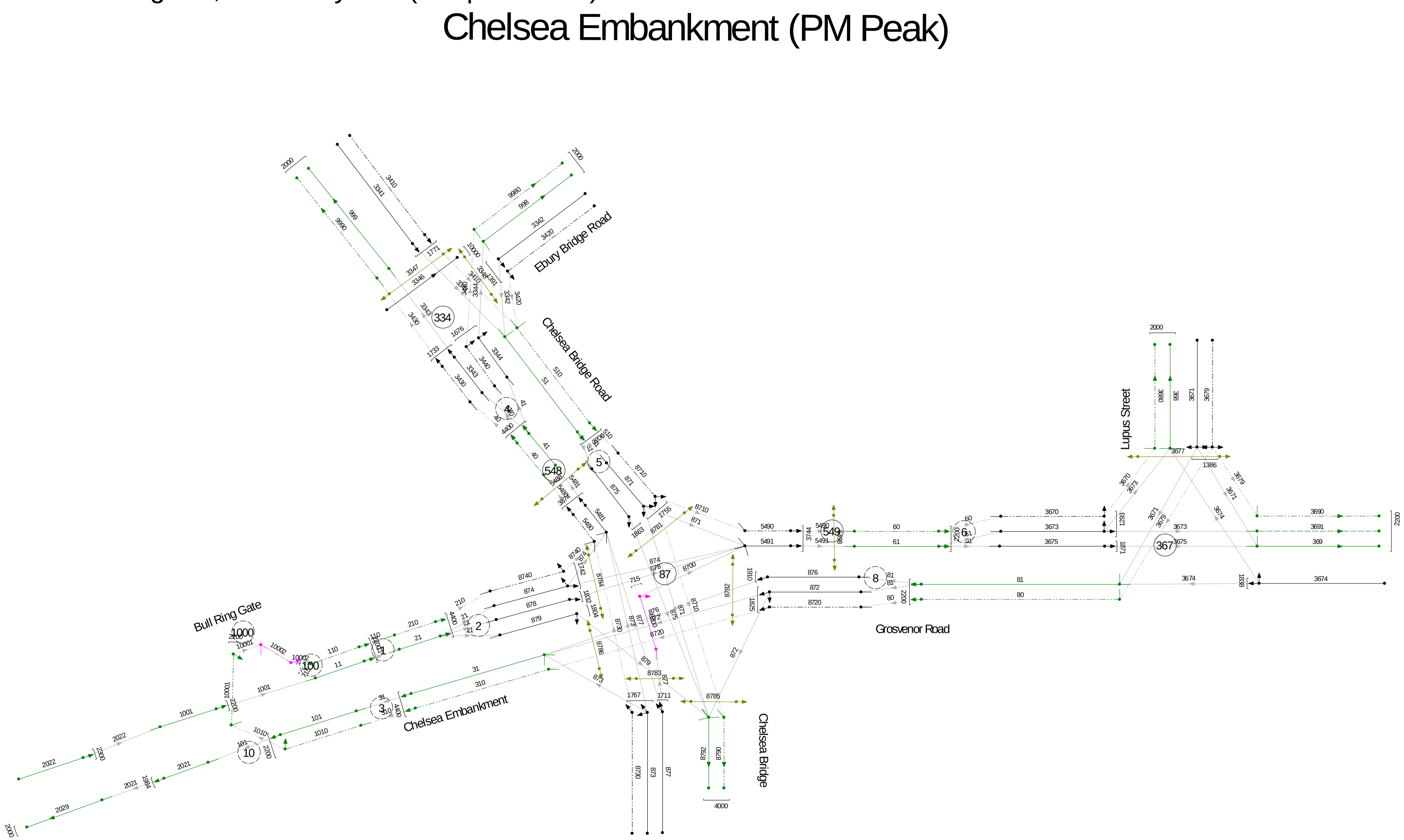
Link	Node	Actual Flow (PCU/H)	Sat. Flow (PCU/H)	Degree Of Saturation (%)	Mean Cruise Time Per PCU (sec)	Mean Delay Time Per PCU (sec)	Uniform Delay (PCU-H/H)	Rand + OverSat Delay (PCU-H/H)	Cost Of Delay (£/H)	Mean Stops Per PCU (%)	Cost Of Stops (£/H)	Mean Max Queue (PCU)	Average Excess Queue (PCU)	P.I. (£/H)
3430	334	52	1733	45	5	8	0.1	0.0	1.6	34	0.3	2	0.0	2.0
3440	334	15	1676	49	5	28	0.1	0.0	1.6	55	0.2	4	0.0	1.8
3670	367	11	1383	19	5	19	0.1	0.0	0.8	82	0.2	1	0.0	1.0
3671	367	85	1391	77	18	90	1.1	1.1	30.2	134	2.4	5	0.0	32.6
3673	367	160	1383	19	4	5	0.1	0.1	3.1	16	0.8	1	0.0	3.8
3674	367	889	1853	73	18	18	3.0	1.4	61.4	68	12.8	18	0.0	74.2
3675	367	984	1871	80	4	10	0.8	2.0	40.0	28	8.2	18	0.0	48.2
3677	367	11	10000	2	8	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
3679	367	39	1391	77	48	90	0.5	0.5	13.9	134	0.9	5	0.0	14.8
3680	367	11	2000	7	21	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
3690	367	26	2200	49	21	2	0.0	0.0	0.2	2	0.0	0	0.0	0.2
3691	367	48	2200	49	18	2	0.0	0.0	0.3	2	0.0	0	0.0	0.3
5480	548	84	3874	29	3	1	0.0	0.0	0.4	7	0.1	1	0.0	0.5
5481	548	804	3874	29	2	1	0.1	0.2	4.0	5	1.1	1	0.0	5.1

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)
5488	548	11	10000	1	6	43	0.1	0.0	1.9	90	0.0	0	0.0	1.9
5490	549	11	3744	37	4	6	0.0	0.0	0.2	38	0.1	4	0.0	0.3
5491	549	1144	3744	37	3	2	0.3	0.3	8.2	10	1.0	4	0.0	9.1
5498	549	11	10000	2	5	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
8700	87	140	600	23	2	4	0.0	0.2	2.2	0	0.0	0	0.0	2.2
8710	87	68	1755	23	3	7	0.1	0.1	2.0	34	0.4	2	0.0	2.3
8720	87	11	1825	97	8	75	0.0	0.2	3.3	151	0.3	21	0.0	3.6
8730	87	83	1760	113	21	264	0.9	5.2	86.5	220	3.1	81	0.0	89.6
8740	87	11	1742	49	5	12	0.0	0.0	0.5	59	0.1	8	0.0	0.6
8781	87	11	10000	0	7	18	0.1	0.0	0.8	58	0.0	0	0.0	0.8
8782	87	11	10000	0	7	9	0.0	0.0	0.4	40	0.0	0	0.0	0.4
8783	87	11	10000	0	9	18	0.1	0.0	0.8	58	0.0	0	0.0	0.8
8784	87	11	10000	0	9	18	0.1	0.0	0.8	58	0.0	0	0.0	0.8
8786	87	11	10000	2	5	50	0.1	0.0	2.2	97	0.0	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)
8790	87	58	4000	21	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
8792	87	768	4000	21	18	1	0.0	0.1	1.7	1	0.1	0	0.0	1.8
9980	334	15	2000	17	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
9990	334	52	2000	30	21	1	0.0	0.0	0.3	1	0.0	0	0.0	0.3
10001	1000	11	2200	0	4	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
10002	100	11	715	2	31	4	0.0	0.0	0.2	0	0.0	0	0.0	0.2

C.8 Construction development case results, sensitivity test, PM peak hour

Network Diagram, sensitivity test (PM peak hour)



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)
11	1	1254	2200	58	10	2	0.0	0.7	9.6	2	0.3	1	0.0	9.9
21	2	1254	4400	29	10	1	0.0	0.2	2.8	1	0.2	0	0.0	3.0
31	3	1174	4400	27	24	1	0.0	0.2	2.6	1	0.1	0	0.0	2.7
40	4	63	4400	15	37	1	0.0	0.0	0.1	1	0.0	8	0.0	0.1
41	4	615	4400	15	9	1	0.0	0.1	1.7	12	1.3	8	0.0	3.1
51	5	685	2200	34	14	1	0.0	0.2	3.4	1	0.1	0	0.0	3.5
60	6	13	2200	59	22	2	0.0	0.0	0.1	2	0.0	31	0.0	0.1
61	6	1289	2200	59	16	9	2.4	0.7	43.7	71	28.2	31	0.0	71.9
80	8	17	2200	50	19	2	0.0	0.0	0.1	1	0.0	0	0.0	0.1
81	8	1082	2200	50	21	2	0.0	0.5	7.0	2	0.2	0	0.0	7.2
101	10	1174	2200	54	4	4	0.9	0.6	20.4	49	13.2	24	0.0	33.6
110	1	16	2200	58	9	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1
210	2	11	4400	29	13	1	0.0	0.0	0.0	0	0.0	0	0.0	0.0
310	3	17	4400	27	27	1	0.0	0.0	0.0	0	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)
368	367	117	2000	7	18	1	0.0	0.0	0.4	1	0.0	0	0.0	0.5
369	367	1182	2200	55	18	2	0.0	0.6	8.5	2	0.4	1	0.0	9.0
510	5	64	2200	34	12	1	0.0	0.0	0.3	1	0.0	0	0.0	0.3
871	87	212	1755	72	3	45	1.7	0.9	37.5	93	2.3	8	0.0	39.8
872	87	526	1825	94	8	64	3.9	5.5	133.6	126	10.3	21	0.0	678.2
873	87	678	1767	106	18	164	6.7	24.2	438.0	187	26.8	48	0.0	464.8
874	87	326	1742	39	4	20	1.5	0.3	26.0	64	5.6	6	0.0	31.6
875	87	473	1863	115	3	300	5.6	33.8	559.6	229	12.7	48	0.0	572.2
876	87	556	1910	92	8	57	4.0	4.7	124.0	120	10.3	20	0.0	134.3
877	87	345	1711	51	18	29	2.3	0.5	39.9	78	5.7	8	0.0	45.7
878	87	607	1832	68	4	26	3.4	1.0	63.0	79	12.9	14	0.0	75.9
879	87	321	1804	142	4	632	6.9	49.4	799.6	256	22.2	61	0.0	821.8
998	334	188	2000	10	18	1	0.0	0.1	0.7	1	0.0	0	0.0	0.8
999	334	427	2000	24	18	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)
1001	100	1254	2200	57	6	2	0.0	0.7	9.4	2	0.6	1	0.0	10.0
1010	10	17	2200	54	5	3	0.0	0.0	0.2	25	0.1	24	0.0	0.3
2021	10	1174	1984	59	3	3	0.3	0.7	15.1	34	8.7	23	0.0	23.8
2022	10	1254	2300	55	18	2	0.0	0.6	8.5	2	0.4	1	0.0	8.9
2029	10	1174	2000	59	18	2	0.0	0.7	10.1	2	0.5	1	0.0	10.6
3341	334	404	1771	57	18	26	2.4	0.6	41.9	76	6.5	10	0.0	48.4
3342	334	295	1391	47	18	24	1.5	0.4	27.7	70	4.4	6	0.0	32.1
3343	334	427	1733	36	4	4	0.2	0.3	6.9	32	3.0	6	0.0	10.0
3344	334	188	1676	44	4	20	0.7	0.4	14.6	54	2.2	3	0.0	16.8
3346	334	11	10000	1	9	42	0.1	0.0	1.8	86	0.8	0	0.0	2.6
3347	334	11	10000	2	9	48	0.1	0.0	2.1	96	0.0	0	0.0	2.1
3348	334	11	10000	0	7	20	0.1	0.0	0.9	61	0.0	0	0.0	0.9
3410	334	53	1771	57	21	26	0.3	0.1	5.5	76	0.7	10	0.0	6.2
3420	334	11	1391	47	21	24	0.1	0.0	1.0	70	0.1	6	0.0	1.2

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)
3430	334	49	1733	36	5	10	0.1	0.0	2.0	53	0.5	6	0.0	2.5
3440	334	12	1676	44	5	50	0.1	0.0	2.4	83	0.2	3	0.0	2.5
3670	367	13	1293	15	5	3	0.0	0.0	0.1	4	0.0	1	0.0	0.2
3671	367	121	1386	121	18	417	1.8	12.3	199.2	248	6.4	21	0.0	205.6
3673	367	116	1293	15	4	6	0.1	0.1	2.6	31	1.1	1	0.0	3.7
3674	367	1005	1838	81	18	20	3.4	2.1	78.8	75	15.9	23	0.0	94.8
3675	367	1173	1871	93	4	36	5.9	6.0	167.8	111	38.6	38	0.0	206.4
3677	367	11	10000	2	8	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
3679	367	40	1386	121	48	417	0.6	4.1	65.9	248	1.7	21	0.0	67.6
3680	367	13	2000	7	21	1	0.0	0.0	0.0	1	0.0	0	0.0	0.1
3690	367	21	2200	55	21	2	0.0	0.0	0.2	1	0.0	1	0.0	0.2
3691	367	13	2200	55	18	2	0.0	0.0	0.1	2	0.0	1	0.0	0.1
5480	548	63	3874	5	3	6	0.1	0.0	1.6	42	0.5	2	0.0	2.1
5481	548	82	3874	5	2	6	0.1	0.0	2.0	41	0.9	2	0.0	3.0

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)
5488	548	11	10000	1	6	43	0.1	0.0	1.9	90	0.0	0	0.0	1.9
5490	549	13	3744	35	4	1	0.0	0.0	0.0	1	0.0	19	0.0	0.0
5491	549	1062	3744	35	3	4	0.9	0.3	16.8	55	5.1	19	0.0	21.8
5498	549	11	10000	2	5	48	0.1	0.0	2.1	96	0.0	0	0.0	2.1
8700	87	130	715	23	2	18	0.5	0.1	9.3	97	1.1	4	0.0	10.4
8710	87	66	1755	72	3	39	0.4	0.3	10.2	85	1.0	8	0.0	11.2
8720	87	17	1825	94	8	97	0.3	0.2	6.5	110	0.4	21	0.0	6.9
8730	87	57	1767	106	21	164	0.6	2.0	36.8	187	1.8	48	0.0	38.6
8740	87	11	1742	39	5	22	0.1	0.0	1.0	76	0.2	6	0.0	1.1
8781	87	11	10000	0	7	7	0.0	0.0	0.3	36	0.0	0	0.0	0.3
8782	87	11	10000	0	7	12	0.0	0.0	0.5	46	0.0	0	0.0	0.5
8783	87	11	10000	0	9	15	0.0	0.0	0.7	53	0.0	0	0.0	0.7
8784	87	11	10000	0	9	22	0.1	0.0	0.9	64	0.0	0	0.0	0.9
8785	87	11	10000	2	5	50	0.1	0.0	2.2	97	0.0	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)
8786	87	11	10000	2	5	50	0.1	0.0	2.2	97	0.0	0	0.0	2.2
8790	87	55	4000	26	21	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
8792	87	1002	4000	26	18	1	0.0	0.2	2.4	1	0.1	0	0.0	2.5
9980	334	12	2000	10	21	1	0.0	0.0	0.0	1	0.0	0	0.0	0.0
9990	334	49	2000	24	21	1	0.0	0.0	0.2	1	0.0	0	0.0	0.2
10001	1000	17	2200	1	4	1	0.0	0.0	0.1	1	0.0	0	0.0	0.1
10002	100	16	715	4	31	4	0.0	0.0	0.3	0	0.0	0	0.0	0.3

Appendix D: Accident analysis

D.1 Existing highway safety analysis

D.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.

D.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. Chelsea Embankment (A3212) between the junction with Chelsea Bridge Road (A3216)/ Grosvenor Road (A3212) / Chelsea Bridge (A3216) and the junction with Embankment Gardens

b. Chelsea Bridge Road (A3216) between the junction with Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) and the junction with Ebury Bridge Road (B313)

c. Grosvenor Road (A3212) between the junction with Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216) and the junction with Lupus Street

d. Chelsea Bridge (A3216) – 100m from its junction with Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212) junction

e. Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) junction

f. Chelsea Embankment (A3212) / Embankment Gardens junction

g. Chelsea Bridge Road (A3216) / Ebury Bridge Road (B313) junction

h. Grosvenor Road (A3212) / Lupus Street junction.

D.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.

D.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 D.1.

Table D.1 Accident severity 2006 to 2011

Location	Slight	Serious	Fatal	Total
Chelsea Embankment (A3212)*	6	2	0	8
Chelsea Bridge Road (A3216)**	5	0	0	5
Grosvenor Road (A3212)***	5	0	0	5

Location	Slight	Serious	Fatal	Total
Chelsea Bridge (A3216)****	4	2	0	6
Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) junction	26	6	0	32
Chelsea Embankment (A3212) / Bull Ring junction	3	1	0	4
Chelsea Embankment (A3212) / Embankment Gardens junction (eastern junction)	0	1	0	1
Chelsea Embankment (A3212) / Embankment Gardens junction (western junction)	2	1	0	3
Chelsea Bridge Road (A3216) / Ebury Bridge Road (B313) junction	8	2	0	10
Grosvenor Road (A3212) / Lupus Street junction	10	3	0	13
Total	**69**	**18**	**0**	**87**

** Chelsea Embankment (A3212) between the junctions with Chelsea Bridge Road (A3216), Grosvenor Road (A3212), Chelsea Bridge (A3216), and Embankment Gardens.*
***Chelsea Bridge Road (A3216) between the junctions with Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216), and Ebury Bridge Road (B313).*
****Grosvenor Road (A3212) between the junctions with Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Chelsea Bridge (A3216) and Lupus Street.*
*****Chelsea Bridge (A3216) within 100m of the junction with Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212).*

D.1.5 A total of 18 serious accidents and 69 slight accidents occurred in the Chelsea Embankment Foreshore assessment area over the five years for which accident data was obtained and analysed. There were no fatal accidents.

Chelsea Embankment (A3212)

D.1.6 Chelsea Embankment (A3212) runs east-west to the north of the site. Chelsea Embankment (A3212) is an 11.8m wide single carriageway with a 30mph speed limit. The road links to Grosvenor Road (A3212) in the east and Cheyne Walk (A3220) and Cremorne Road (A3220) in the west. Chelsea Embankment (A3212) within the assessment area is between the junctions with Chelsea Bridge Road (A3216), Grosvenor Road (A3212), Chelsea Bridge (A3216), and Embankment Gardens.

D.1.7 In total, 16 accidents occurred along Chelsea Embankment (A3212) in the local area and the junctions associated. Those junctions included within this analysis are as follow:

a. Chelsea Embankment (A3212) / Chelsea Embankment Bull Ring

b. Chelsea Embankment (A3212) / Embankment Gardens (eastern junction)

c. Chelsea Embankment (A3212) / Embankment Gardens (western junction).

D.1.8 Of the total 16 accidents, five were classified as serious with one occurring at the junction with Embankment Gardens (western junction), one at the junction with Embankment Gardens (eastern junction), one at the junction with Chelsea Embankment (Bull Ring), and two occurred to the west of the junction with Chelsea Bridge Road (A3216), Grosvenor Road (A3212), Chelsea Bridge (A3216).

D.1.9 Four of the serious accidents involved cars colliding with pedal cycles, a motorcycle and a car, and one involved a light goods vehicle (LGV) and a motorcycle. The accident which involved LGV occurred at the junction of Chelsea Embankment (A3212) and Embankment Gardens (western junction).

D.1.10 The major contributory factors in the serious accidents were not looking properly, failing to judge another person's path or speed, and making poor manoeuvres.

D.1.11 The remaining 11 accidents were classified as slight with six accidents occurred along Chelsea Embankment (A3212) in the local area away from the junctions. The remaining five accidents happened at the junctions associated with Chelsea Embankment (A3212). Of these five accidents, three occurred at the junction of Chelsea Embankment (A3212) and Chelsea Embankment (Bull Ring) and two occurred at the junction of Chelsea Embankment (A3212) and Embankment Gardens (western junction).

D.1.12 The majority of the slight accidents involved cars, motorcycles and pedal cycles, and none of them involved goods vehicles or pedestrians. The accidents predominately resulted from failing to look properly, failing to judge the other person's path or speed, and following too close.

D.1.13 A further total of 32 accidents occurred at the junction of Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212) / Chelsea Bridge (A3216), of which 26 accidents were categorised as slight and six as serious.

D.1.14 Of the six serious accidents, one accident involved a LGV colliding with a car and a motorcycle which caused by not looking properly and failing to judge the other person's path or speed.

D.1.15 The remaining serious accidents involved cars, taxis, motorcycles, and a pedal cycle. These accidents predominately resulted from poor manoeuvring, and failing to judge the other person's path or speed.

D.1.16 Of the total 26 accidents, one accident involved a LGV colliding with a motorcycle caused by the LGV making a U-turn into path of the motorcycle. One accident involved a pedestrian colliding with a car which was caused by the driver not looking properly.

D.1.17 The remaining slight accidents mainly involved cars, motorcycles, pedal cycles, taxis, and bus/coaches. These accidents were predominately caused by not looking properly, reckless driving, and failing to judge the other person's path or speed.

D.1.18 Of the five year accident data analysed for Chelsea Embankment (A3212) in the local area and the junctions associated, the information available suggests that none of the accidents happened as a result of the road layout.

Chelsea Bridge Road (A3216)

D.1.19 Chelsea Bridge Road (A3216) runs north-south to the east of the site. The two-way road leads to Pimlico Road (A3214), Royal Hospital Road (B302) and Lower Sloane Street (A3216) to the north, and to the south it leads to Chelsea Embankment (A3212), Grosvenor Road (A3212), and Chelsea Bridge (A3216).

D.1.20 Chelsea Bridge Road (A3216) within the assessment area is between the junction with Chelsea Embankment (A3212), Grosvenor Road (A3212), and Chelsea Bridge (A3216), and the junction with Ebury Bridge Road (B313).

D.1.21 Between April 2006 and March 2011, a total of 15 accidents occurred along Chelsea Bridge Road (A3216) and its junction with Ebury Bridge Road (B313).

D.1.22 Of the total accidents, ten accidents occurred at the junction of Chelsea Bridge Road (A3216) and Ebury Bridge Road (B313). Of these ten accidents, two were classified as serious. One of the serious accidents involved a LGV and a taxi caused by illness or disability (mental or physical). The other serious accident involved a motorcycle and was caused by the rider braking sharply to avoid another vehicle and lost control and fell from vehicle.

D.1.23 The remaining eight accidents which occurred at the junction of Chelsea Bridge Road (A3216) and Ebury Bridge Road (B313), and the five accidents which occurred along Chelsea Bridge Road (A3216) away from junctions were all classified as slight.

D.1.24 Three of the slight accidents involved LGVs colliding with a car and two pedal cycles which mainly caused by not looking properly and failing to judge the other person's path or speed.

D.1.25 Three accidents involved pedestrians, one colliding with a motorcycle, and the other two collided with cars. These accidents were mainly caused by the pedestrians failing to look properly or failing to judge vehicle's path or speed, and the vehicles vision being affected either due to weather conditions or stationary or parked vehicle.

D.1.26 The remaining slight accidents mainly involved cars, motorcycles, and taxis and were predominately caused by not looking properly, following too close or disobeying automatic traffic signals.

D.1.27 Of the five year accident data analysed for Chelsea Bridge Road (A3216) in the local area and the junction with Ebury Bridge Road (B313), the information available suggests that none of the accidents happened as a result of the road layout.

Grosvenor Road (A3212)

D.1.28 Grosvenor Road (A3212) is a single carriageway which runs to the east of the site. The road links to Chelsea Bridge Road (A3216), Chelsea Embankment (A3212), and Chelsea Bridge (A3216) to the west, and Vauxhall Bridge (A202), Bessborough Gardens (A202), and Millbank (A3212) to the east.

D.1.29 Grosvenor Road (A3212) within the assessment area is between the junction with Chelsea Bridge Road (A3216), Chelsea Embankment (A3212), and Chelsea Bridge (A3216) and the junction with Lupus Street.

D.1.30 There have been a total of 18 accidents in this area, with 13 accidents occurred at the junction of Grosvenor Road (A3212) / Lupus Street, and five accidents occurred along Grosvenor Road (A3212) in the local area.

D.1.31 Of the total accidents, 15 were classified as slight and three as serious. One of the serious accidents involved a LGV which was travelling along the westbound carriageway of Grosvenor Road (A3212) and crashed into a tree placed on the southern footway. The accident happened to the east of the junction of Grosvenor Road (A3212) / Lupus Street and was caused by the driver being impaired by alcohol.

D.1.32 The other two serious accidents involved pedal cycles, one collided with a motorcycle and one with a car. Both accidents occurred at Grosvenor Road (A3212) / Lupus Street junction. The accident which involved a motorcycle and a pedal cycle was caused by the motorcycle being pursued and lost control and hit the cyclist. The accident which involved a car and a pedal cycle was caused by not looking properly and poor manoeuvring.

D.1.33 Of the total 15 slight accidents, one accident involved a passenger who slipped and fell whilst boarding a bus. The accident occurred at the bus stop located to the east Grosvenor Road (A3212) / Lupus Street junction.

D.1.34 Of the total slight accidents, five accidents happened as bicycles collided with motor vehicles including cars and a bus/coach. Three of these accidents occurred at the junction of Grosvenor Road (A3212) / Lupus Street and two accidents occurred along Grosvenor Road (A3212) away from junctions. These accidents were mainly caused by not looking properly, poor manoeuvring and driving recklessly.

D.1.35 Two of the slight accidents involved LGVs which collided with motorcycles. One of the accidents happened along Grosvenor Road (A3212) away from junctions and the other accident occurred at the junction with Lupus Street. Not looking properly, reckless driving and travelling too fast for conditions were the main causes of these accidents.

D.1.36 The remaining seven slight accidents involve cars, motorcycles, and a taxi, with five accidents happened at the junction of Grosvenor Road (A3212) / Lupus Street and two along Grosvenor Road (A3212) in the local area. The accidents were predominately caused by failing to look properly, reckless driving and making poor manoeuvres.

D.1.37 Of the accidents occurred along Grosvenor Road (A3212) in the local area and the junction with Lupus Street, none happened as a result of the road geometry.

Chelsea Bridge (A3216)

D.1.38 Chelsea Bridge (A3216) is a two-way single-carriageway which runs to the east of the site. The road leads to Chelsea Bridge Road (A3216), Chelsea Embankment (A3212), and Grosvenor Road (A3216) to the north and to Queens Town Road to the south.

D.1.39 Chelsea Bridge (A3216) within the assessment area is between its junction with Chelsea Embankment (A3212), Chelsea Bridge Road (A3216), and Grosvenor Road (A3212) and 100m from that junction.

D.1.40 In total, six accidents occurred along this stretch of road, with two accidents classified as serious and four as slight. One of the serious accidents involved a car and a motorcycle which caused by poor manoeuvring and failing to look properly. The other serious accident involved a motorcycle and a pedestrian, and the accident happened due to the pedestrian crossing the road masked by stationary or parked vehicle.

D.1.41 Of the four slight accidents occurred along Chelsea Bridge (A3216), one accident involved a pedestrian colliding with a bicycle, and one accident involved collision of two LGVs and a motorcycle. The remaining slight accidents involved cars, a taxi and a pedal cycle.

D.1.42 The slight accidents mainly caused by not looking properly, failing to judge the other person's path or speed, and careless driving.

D.1.43 Of the five year accident data analysed for Chelsea Bridge (A3216) in the local area, the information available suggests that none of the accidents happened as a result of the road layout.

D.2 Summary and conclusion

D.2.1 Of the five year accident data analysed, the largest number of road traffic accidents occurred at:

a. Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) junction

b. Grosvenor Road (A3212) / Lupus Street junction

c. Chelsea Bridge Road (A3216) / Ebury Bridge Road (B313) junction.

D.2.2 Most of the accidents which occurred at these three junctions were classified as slight, with 11 serious accidents.

D.2.3 In total, 18 serious accidents occurred in the assessment area with the majority happened at the junction of Chelsea Embankment (A3212) / Chelsea Bridge Road (A3216) / Grosvenor Road (A3212) / Chelsea Bridge (A3216). Not looking properly, failing to judge the other person's path or speed, following too close, and poor manoeuvring were the main causes of the serious accidents. Hence, the serious accidents which occurred within the assessment area did not happen as a result of the road geometry.

D.2.4 Of the total accidents, ten accidents occurred in the study area which involved Goods Vehicles, all of which were LGVs. Of these accidents, six were slight accidents and the remaining four accidents were serious.

D.2.5 In total, seven pedestrians were involved in accidents. Of these one was recorded as serious and the remaining six as slight. The accidents involving pedestrians mainly occurred along Chelsea Bridge (A3216) and at the Chelsea Bridge Road (A3216) / Ebury Bridge Road junction.

D.2.1 Of the total accidents, 24 accidents involved cyclists of which six were classified as serious and 18 as slight. A third of the accidents involving cyclists occurred at the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) / Chelsea Bridge Road (A3216).

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Appendix E: Road Safety Audits

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Thames Water Utilities Limited

Thames Tideway Tunnel - Chelsea Embankment Foreshore

Stage 1 Road Safety Audit

Project Ref: 27016/033

Doc Ref: CE01

15th February 2013

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Document Control Sheet

Project Name: **Thames Tideway Tunnel - Chelsea Embankment Foreshore**

Project Ref: **27016/033**

Report Title: **Stage 1 Road Safety Audit**

Doc Ref: **CE01**

Date: **15th February 2013**

	Name	Position	Signature	Date
Prepared by:	Simon Owen	Principal Technician		15th February 2013
Reviewed by:	Matthew Fleming	Technician Grade 1		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

Peter Brett Associates LLP disclaims any responsibility to the Client and others in respect of any matters outside the scope of this report. This report has been prepared with reasonable skill, care and diligence within the terms of the Contract with the Client and generally in accordance with the appropriate ACE Agreement and taking account of the manpower, resources, investigations and testing devoted to it by agreement with the Client. This report is confidential to the Client and Peter Brett Associates LLP accepts no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

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Contents

Appendices

1 Introduction

1.1 Peter Brett Associates LLP has 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 Chelsea Embankment Foreshore 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 At this location the surrounding highway network is urban in nature, within a 30mph speed limit, is illuminated by a system of street lighting. Chelsea Embankment is a wide single carriageway, with footways on both sides of the carriageway.

1.4 The scheme proposals that affect the existing highway consist of the following phases:-

- Construction Phases:-
  - Various phases where the carriageway is narrowed whilst maintaining two way flow with associated traffic management in Chelsea Embankment to accommodate the passage of large delivery vehicles accessing the site.
  - Closure of existing foot / cycleway adjacent to the Thames with pedestrians diverted via the existing and proposed temporary signal controlled crossings to the opposite footway.
  - Temporary vehicle access across existing footway with opening formed in existing parapet of river wall;
  - Closure of the Bull-Ring and suspension of Coach (bus stop) and Car Parking adjacent at the Bull-Ring.
  - Increased 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, existing foot / cycleways reopened;
  - New permanent vehicle access constructed across footway with opening formed in existing parapet of river wall;
  - 6 monthly maintenance access required by transit van;
  - 10 yearly maintenance required by rigid HGV / mobile crane.

1.5 The Audit Team Membership was as follows:-

Audit Team Leader:-

Simon Owen Peter Brett Associates, Reading

Team member:-

Matthew Fleming Peter Brett Associates, Taunton

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 13:15 and 14:00. The weather during the site visit was cold and dry. 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 Phases

2.1 Problem

Location - General

Summary - Conflict through traffic management on Chelsea Embankment

The proposed arrangement of traffic management will have narrow lanes with potentially sharp changes of direction. The road has a high volume of large vehicles and cycles within the general traffic. Generally high vehicle speeds and vehicles running two-abreast in both directions, during heavier flows, were observed during the site visit. This 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
- Conflict between opposing vehicles

The swept path drawings provided relate to access for construction traffic, but do not indicate the passage of vehicles through the proposed traffic management. It is noted that the speed at which the swept path analysis has been carried out at is 5kph. This is a very slow speed and may not be realistic for construction vehicles accessing the site from the public highway or the general through traffic negotiation the traffic management.

No vehicle swept paths have been provided for the Utility Diversion construction arrangement, where it looks likely that large vehicles entering / exiting the site may cause other vehicles to make injudicious manoeuvres to avoid collision.

Recommendation

The swept path for both general vehicles and construction vehicles passing through the traffic management should be generated to confirm large vehicles can be accommodated without conflicting with opposing traffic or temporary traffic management features. Speeds need to be appropriate and realistic for the manoeuvres being undertaken. The Design Team should also consider the following, with all findings presented for consideration at a supplementary Stage 1 RSA:

- 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
- Construction vehicles to complete manoeuvres in one movement to clear carriageway and path of general traffic.
- The effect of Construction vehicles slowing / turning manoeuvres on other vehicles in carriageway.
- Opposing traffic flows – in particular at merges, cranked centrelines and right turns into the Bull-Ring.

2.2 Location - General

Summary - All user conflict due to obstructed forward and inter visibility

The proposals indicate that there are likely to be several locations throughout the scheme where drivers of both construction and public vehicles will be required to give-way to or at least anticipate the movements of each other to avoid potential conflict. It is unclear how construction traffic accessing the site is intended to depart from and re-join the general traffic lane in the vicinity of the lane narrowing tapers. It is unclear what type of temporary barrier is to be used to isolate the general traffic and construction vehicles and subject to its height and construction this could obstruct intervisibility between all users. Furthermore, the presence of large existing trees may obstruct visibility.

Recommendation

Review all proposed temporary traffic management layouts to ensure they afford all road users adequate forward / intervisibility and understanding of priority for the road ahead. Provision needs to be made for construction vehicles to safely depart from and re-join the general traffic lane. The review should consider the following, with findings presented for consideration at a supplementary Stage 1 RSA:

- The arrangements for all phases to be accessed to and from the general traffic lane road.
- Swept path manoeuvres of construction traffic and general traffic
- Forward visibility and junction visibility
- The proposed barrier type and its potential to become an obstruction to visibility

2.3 Location - General

Summary - Conflict between pedestrians and vehicles

The proposals indicate that the foot / cycleway adjacent to the Thames will be closed to a varying degree with pedestrians being diverted to the existing footway on the north side of the Chelsea Embankment to continue their journey. The closure and diversion will have the following characteristics that may give rise to an increased risk for pedestrians, especially when considered in the context of the likely high pedestrian flows:

- The proposed diversion route is longer and has more conflict points with other users and obstructions and trip /slip hazards when compared with the closed route. It also utilises the existing signal controlled crossing which was observed to have a 30-50 second (approx.) wait times to cross the carriageway. This may encourage pedestrians to seek uncontrolled crossing opportunities throughout Chelsea Embankment and across the front of the Bull Ring.
- The proposed temporary signalised crossing is located at a gated vehicle access on the north side of Chelsea Embankment close to significant trees
- The proposed location is likely to receive considerable pedestrian flows during special events

Recommendation

Review the proposed footway closures and diversions to ensure that they can be negotiated safely and provide an adequate level of service in the context of potentially high pedestrian flows. Review the operation and pedestrian waiting time at the signalised pedestrian crossing to ensure this does not discourage the intended use of the diversion route.

Review the location of the temporary signalised pedestrian crossing and relocate if necessary to avoid any undue conflict with the existing gated access and also to ensure that appropriate forward visibility to signals can be achieved. Ensure adequate space can be safeguarded for advance signage of diversion/restrictions without obstructing busy footways. Details to be prepared and submitted for consideration at a Stage 2 RSA.

2.4 Location - General

Summary - Conflict between cyclists and other road users

The proposals indicate that the foot / cycleway adjacent to the Thames will be closed to a varying degree but it is not clear how cyclists will be directed to continue their journey from this point. The proposals do not indicate how cyclists will be directed to leave and re-join the foot/cycleway safely which may give rise to an increased risk of conflict between cyclists and other road users on both the footway and carriageway.

Recommendation

Review the proposed foot /cycleway closures and diversions and incorporate details to ensure that cyclists can continue their journey safely. Particular attention should be given to providing appropriate lane widths through the traffic management to accommodate cyclists safely.

Bull-Ring Resurfacing

2.5 Location - Bull Ring plus wider network

Summary - Conflict for all users

The existing turnaround / access to the Royal Hospital grounds provide parking and bus stop facilities around its circumference. These provisions will be temporarily suspended during the resurfacing of this area which may cause confusion for drivers and pedestrians and potentially lead to injudicious manoeuvres or parking at general location in the vicinity. No proposals for an alternative temporary bus stop have been provided.

Recommendation

The proposals should include appropriate temporary replacement facilities, with advance warning of temporary suspension given.

2.6 Location - North side of Chelsea Embankment

Summary - Increased risk of conflict for all users

The proposals associated with the resurfacing of the Bull-Ring appear to indicate a closure of the footway on the north side of Chelsea Embankment where it circulates around the Bull-Ring. This creates a discontinuity for pedestrians travelling west along this footway requiring them to make an uncontrolled crossing of the carriageway to continue their journey. The temporary pedestrian crossing associated with other construction phases is proposed to be removed during this phase. It is also unclear how all road users would gain access to the Royal Hospital Grounds from Chelsea Embankment when the existing access is obstructed – especially a concern if maintained as an access route for the emergency services.

Recommendation

The proposals should include adequate safe provision for pedestrians to cross Chelsea Embankment, during this phase. The proposals should also make safe provision for all users requiring access to the Royal Hospital Grounds from Chelsea Embankment.

Operational Phase

2.7 Problem

Location - Permanent Vehicle Access

Summary - Conflict for all users

The proposed permanent maintenance access is indicated as a vehicle footway crossing between the Chelsea Embankment and the parapet river wall. The proposals do not indicate if / 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 in one movement 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. Furthermore, the proposals should provide adequate junction visibility and intervisibility to pedestrians in the footway – special consideration should be given to the potential obstruction of visibility by parapet walls and trees etc.

2.8 Problem

Location - Permanent Vehicle Access

Summary - Conflict for all users

The proposed site access location is adjacent to large existing trees that may 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.

2.9 Problem

Location - Permanent Vehicle Access

Summary - Conflict for all users

The proposed site access swept paths indicate vehicles 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 have 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.

3 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.

Audit Team Leader:

Name: Simon Owen — Signed: [signature]

Position: Principal Technician — Date: 15th February 2013

Organisation: Peter Brett Associates

Address: Caversham Bridge House
Waterman Place
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RG1 8DN

Audit Team Members:

Name: Matthew Fleming — Signed: [signature]

Position: Technician Grade 1 — Date: 15th February 2013

Organisation: Peter Brett Associates

Address: Lakeside House
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Blackbrook Park Avenue
Taunton
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Appendix A

Appendix A

Information Utilised in this Stage 1 Road Safety Audit:-

- Figure 13.2.1 – Transport - Site Location Plan;
- Figure 13.2.2 – Transport - Construction Traffic Routes;
- Figure 13.4.9 – Transport - Accident Locations;

- DCO-PP-12X-CHEEF-140026 - Highway Layout During Construction – Existing Highway Layout;
- DCO-PP-12X-CHEEF-140027 - Highway Layout During Construction – (Utility Diversion Layout);
- DCO-PP-12X-CHEEF-140028 - Highway Layout During Construction – Phase 1 and 2;
- DCO-PP-12X-CHEEF-140029 - Highway Layout During Construction – Phase 3;
- DCO-PP-12X-CHEEF-140030 - Highway Layout During Construction – Bullring Resurfacing
- DCO-PP-12X-CHEEF-140031 - Highway Layout During Construction – Permanent Highway Layout;
- DCO-PP-12X-CHEEF-140032 - Highway Layout During Construction – Vehicle Swept Path Analysis – 1 of 3;
- DCO-PP-12X-CHEEF-140033 - Highway Layout During Construction – Vehicle Swept Path Analysis – 2 of 3;
- DCO-PP-12X-CHEEF-140034 - Highway Layout During Construction – Vehicle Swept Path Analysis – 3 of 3;
- DCO-PP-12X-CHEEF-140035 – Permanent Highway Layout – Vehicle Swept Path Analysis;

- DCO-PP-12X-CHEEF-140003 – Access Plan;
- DCO-PP-12X-CHEEF-140019 – Construction Phases – phase 1 Site setup;
- DCO-PP-12X-CHEEF-140020 – Construction Phases – phase 2 Shaft construction and tunnelling;
- DCO-PP-12X-CHEEF-140021 – Construction Phases – phase 3 Construction of other structures;
- DCO-PP-12X-CHEEF-140022 – Construction Phases – phase 4 Site demobilisation;
- DCO-PP-12X-CHEEF-140027 – Highway layout during construction (Utility diversion phase);
- DCO-PP-12X-CHEEF-140028 – Highway layout during construction Phase 1 - 2
- DCO-PP-12X-CHEEF-140029 – Highway layout during construction Phase 3
- DCO-PP-12X-CHEEF-140030 – Highway layout during construction Bullring resurfacing;
- DCO-PP-12X-CHEEF-140031 – Permanent highway layout;

- 213601-01 – Facility and Amenity Map;
- Technical Note – Information for Blackfriars Foreshore Stage 1 RSA;
- Technical Memorandum – Blackfriars Bridge Foreshore – Accident Analysis;

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/CE1, 27016/S1RSA1/CE2, 27016/S1RSA1/CE3, 27016/S1RSA1/CE4;

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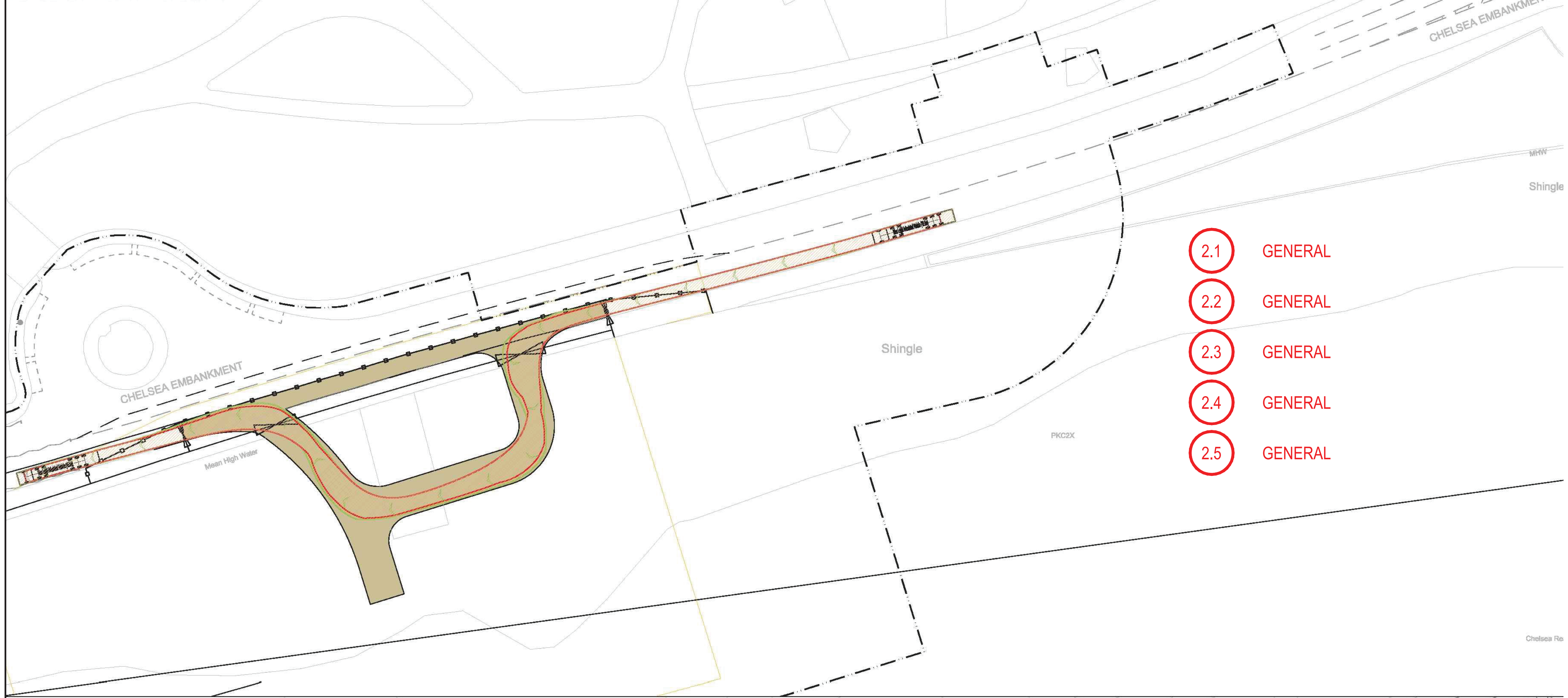

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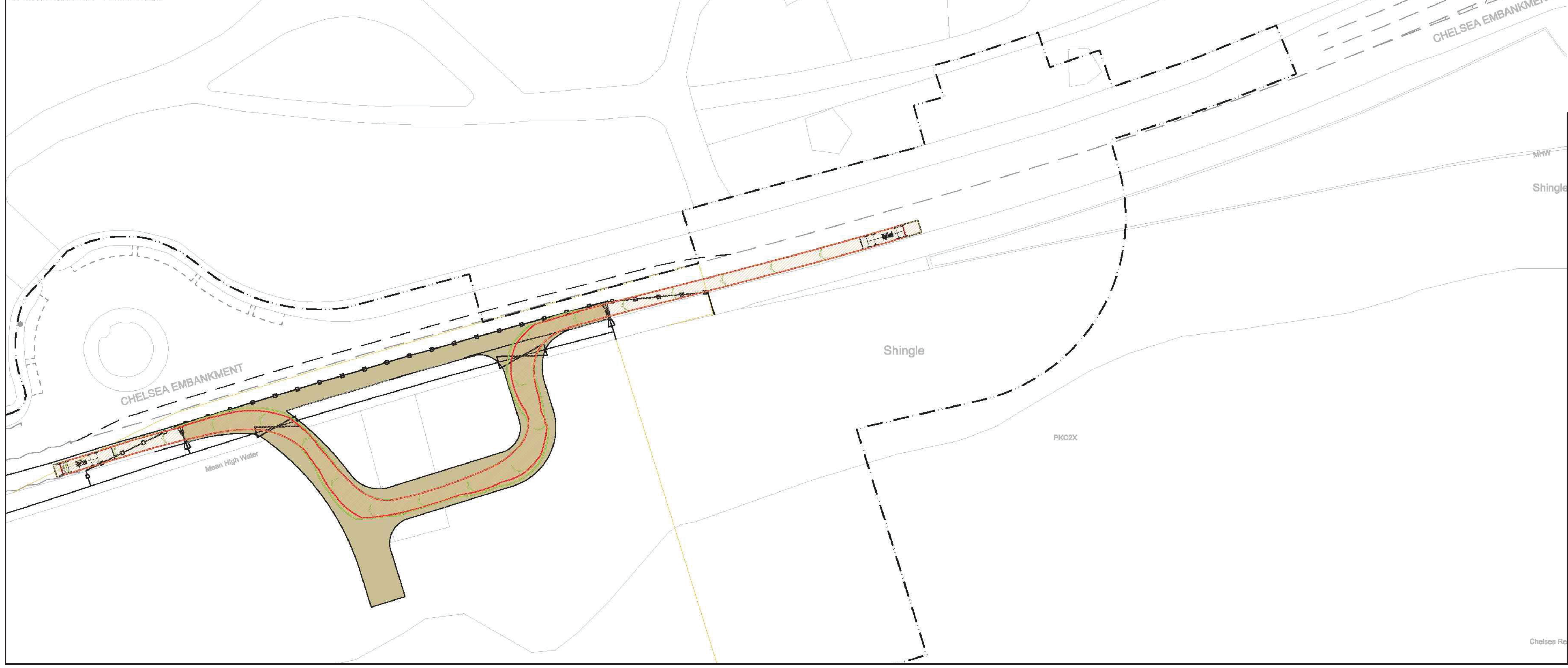

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Drawing Issue Status
STAGE 1 ROAD SAFETY AUDIT

THAMES TIDEWAY TUNNEL
CHELSEA EMBANKMENT

SITE REFERENCE PLAN (1 OF 4)

Client
Thames Water
THAMES WATER UTILITIES

Date of 1st Issue	Drawn by
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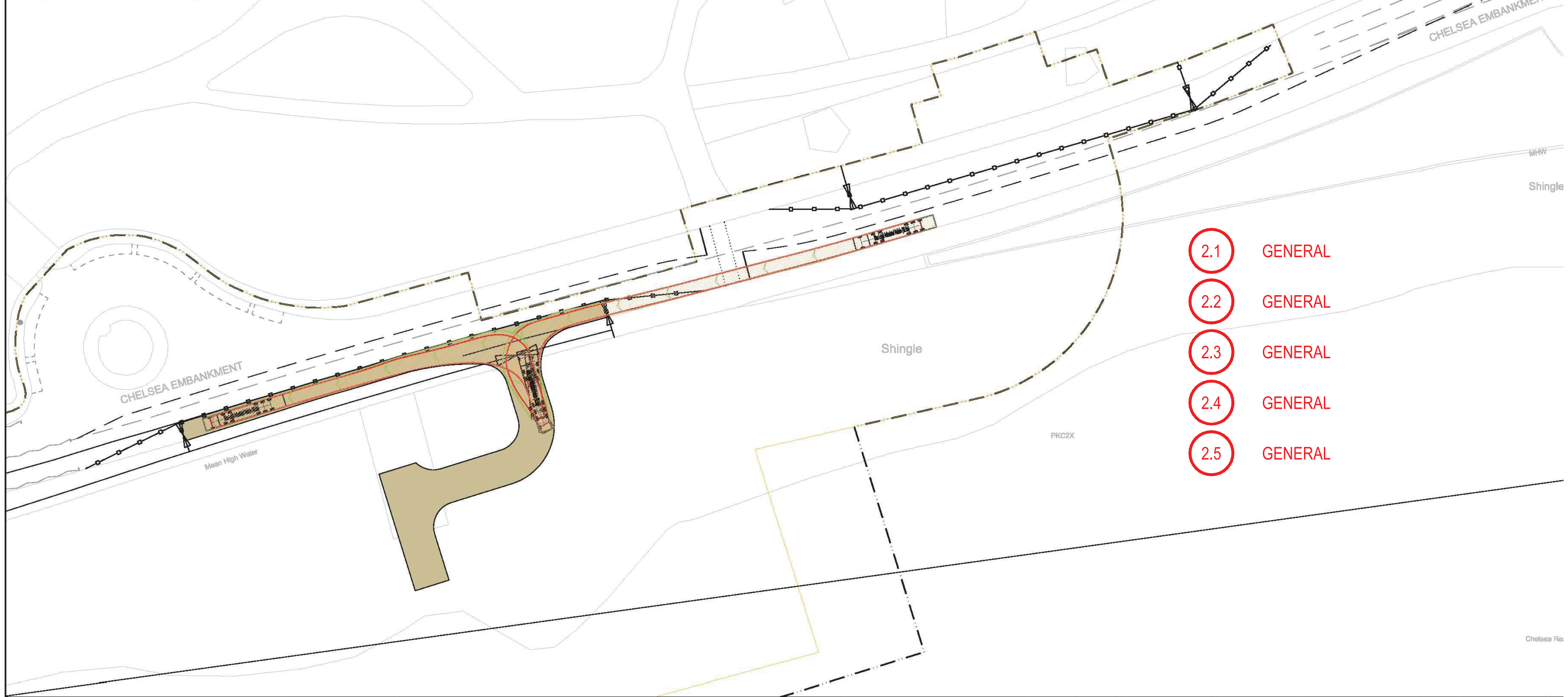

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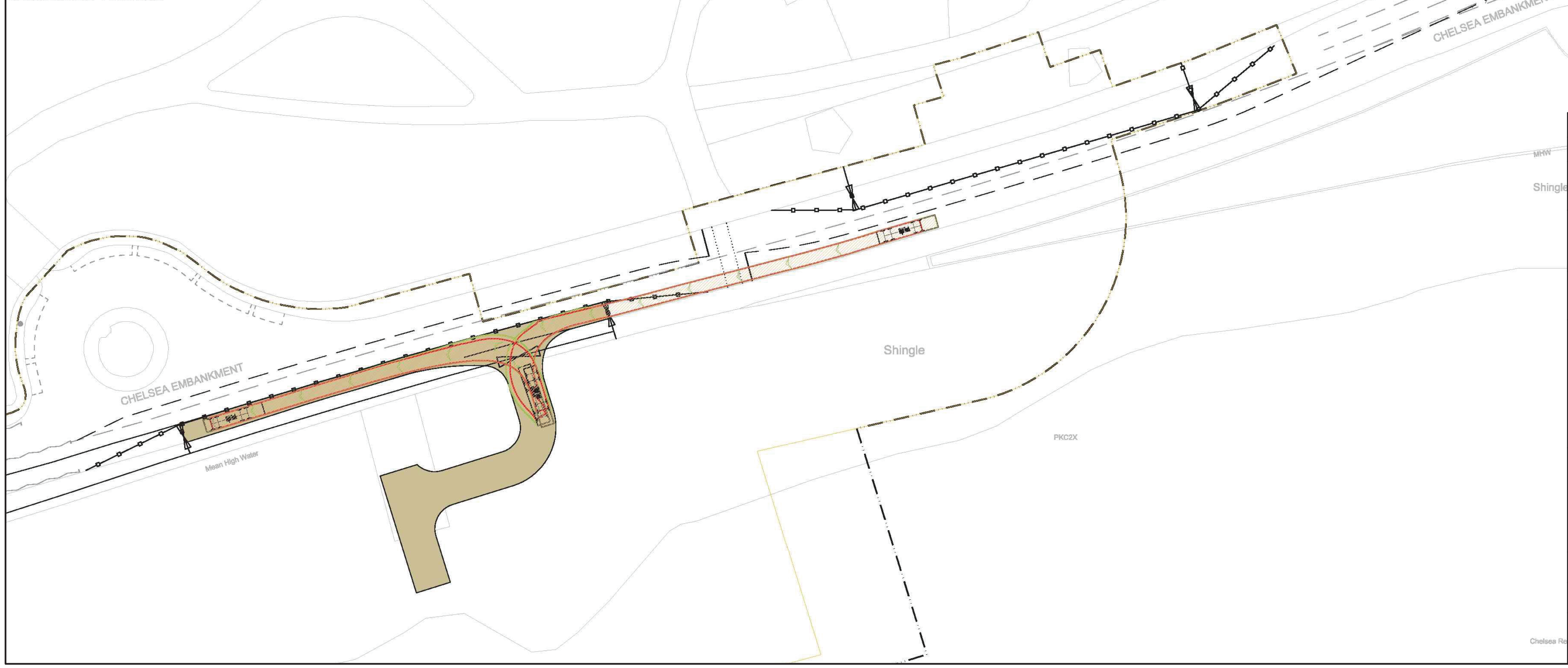

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Drawing Issue Status
STAGE 1 ROAD SAFETY AUDIT

THAMES TIDEWAY TUNNEL
CHELSEA EMBANKMENT

SITE REFERENCE PLAN (2 OF 4)

Client
THAMES WATER UTILITIES

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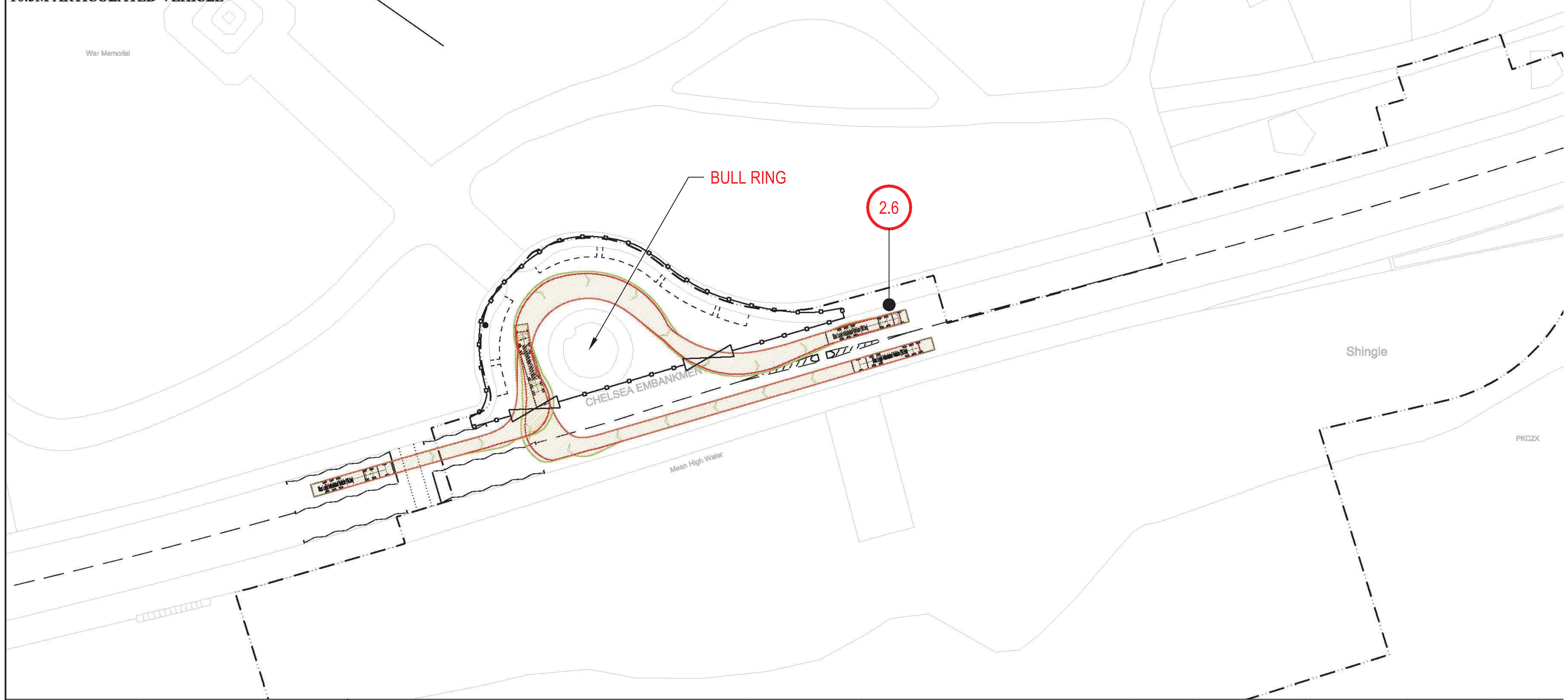

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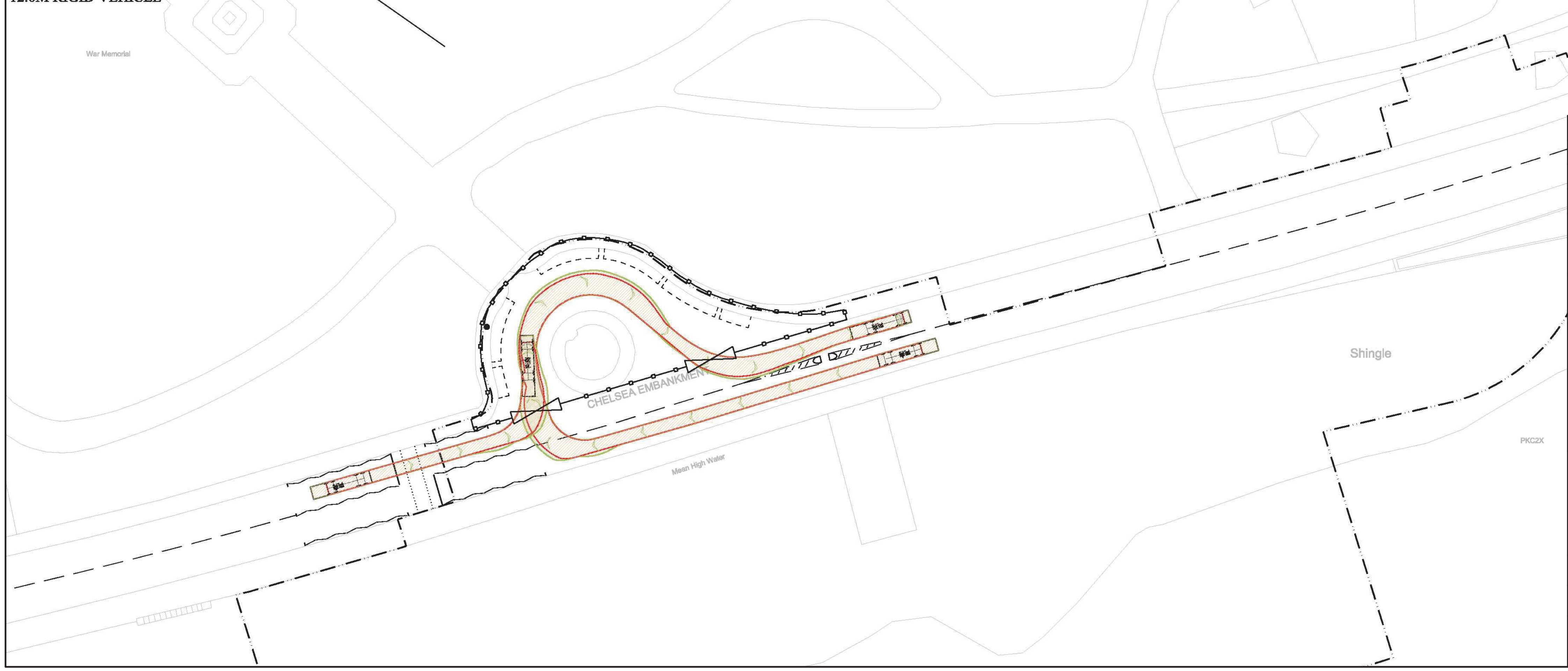

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Drawing Issue Status

STAGE 1 ROAD SAFETY AUDIT

THAMES TIDEWAY TUNNEL
CHELSEA EMBANKMENT

SITE REFERENCE PLAN (3 OF 4)

Client

Thames Water

THAMES WATER UTILITIES

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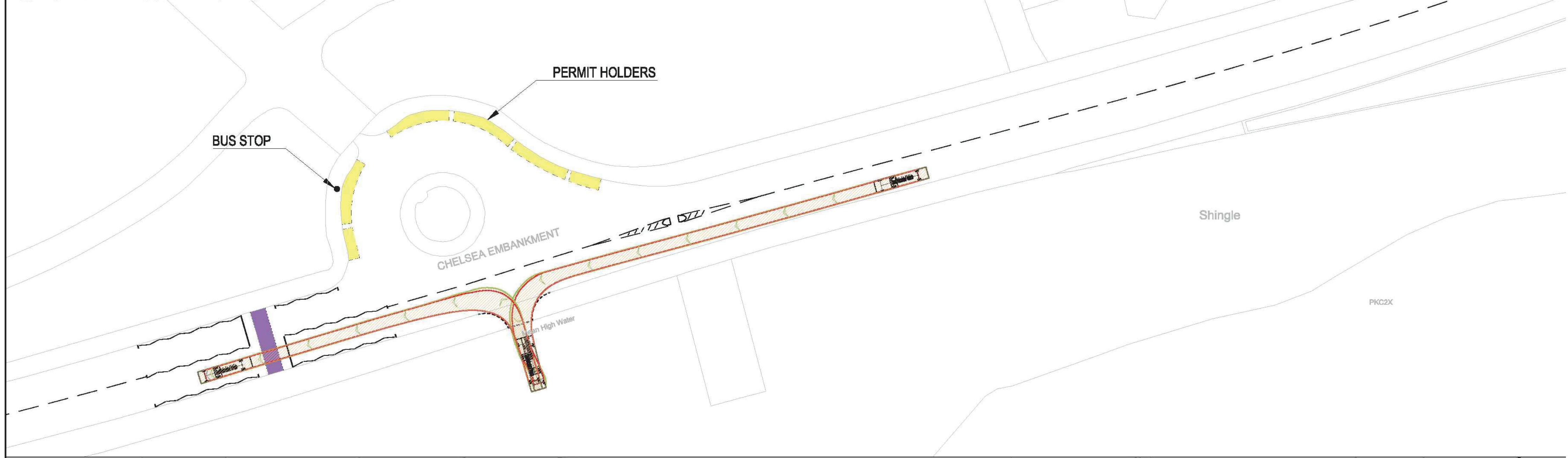

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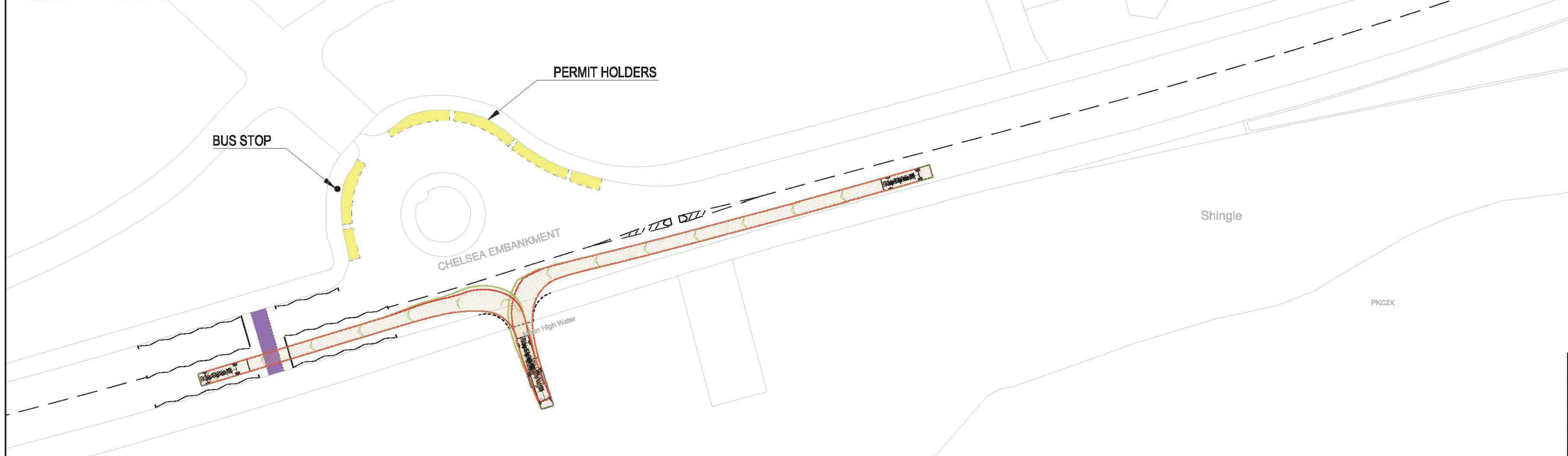

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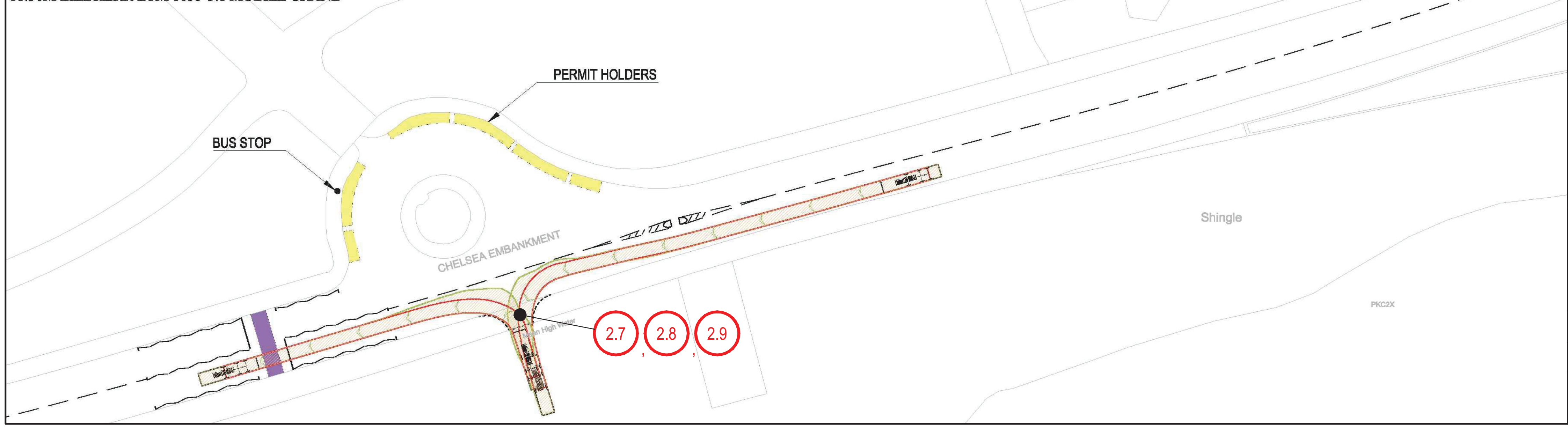

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STAGE 1 ROAD SAFETY AUDIT

THAMES TIDEWAY TUNNEL
CHELSEA EMBANKMENT

SITE REFERENCE PLAN (4 OF 4)

Client
THAMES WATER UTILITIES

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Technical Note

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Project title	Thames Tideway Tunnel	Job number	211146-04
cc		File reference	211146
Prepared by	F Jahanshahi	Date	17 February 2013
Subject	RSA Stage 1 - Designers response for Chelsea Embankment Foreshore		

1 Introduction

This report is the Designer’s Response to the Stage 1 Road Safety Audit Report for Chelsea Embankment Foreshore completed on 15 February 2013.

2 Responses to the items arising from the Stage 1 Road Safety Audit

2.1 Problem –

Location: *General*

Summary: *Conflict through traffic management on Chelsea Embankment*

Description: The proposed arrangement of traffic management will have narrow lanes with potentially sharp changes of direction. The road has a high volume of large vehicles and cycles within the general traffic. Generally high vehicle speeds and vehicles running two-abreast in both directions, during heavier flows, were observed during the site visit. This 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
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The swept path drawings provided relate to access for construction traffic, but do not indicate the passage of vehicles through the proposed traffic management. It is noted that the speed at which the swept path analysis has been carried out at is 5kph. This is a very slow speed and may not be realistic for construction vehicles accessing the site from the public highway or the general through traffic negotiation the traffic management.

No vehicle swept paths have been provided for the Utility Diversion construction arrangement, where it looks likely that large vehicles entering / exiting the site may cause other vehicles to make injudicious manoeuvres to avoid collision.

Recommendation: The swept path for vehicles passing through the traffic management should be generated to confirm large vehicles can be accommodated without conflicting with opposing traffic or temporary traffic management features. Speeds need to be appropriate and realistic for the manoeuvres being undertaken. The Design Team should also consider the following, with all findings presented for consideration at a supplementary Stage 1 RSA:

- 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
- Completing manoeuvres in one movement to clear carriageway
- The effect of slowing / turning manoeuvres on other vehicles in carriageway
- Opposing traffic flows – in particular at merges, cranked centrelines and right turns into the Bull-Ring.

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.

A construction vehicle swept path analysis plan for the utility diversion phase will be provided at detail design (stage 2).

2.2 Problem –

Location: *General*

Summary: *All user conflict due to obstructed forward and inter visibility*

Description: The proposals indicate that there are likely to be several locations throughout the scheme where drivers of both construction and public vehicles will be required to give-way to or at least anticipate the movements of each other to avoid potential conflict. It is unclear how construction traffic accessing the site is intended to depart from and re-join the general traffic lane in the vicinity of the lane narrowing tapers. It is unclear what type of temporary barrier is to be used to isolate the general traffic and construction vehicles and subject to its height and construction this could obstruct intervisibility between all users. Furthermore, the presence of large existing trees may obstruct visibility.

Recommendation: Review all proposed temporary traffic management layouts to ensure they afford all road users adequate forward / intervisibility and understanding of priority for the road ahead. Provision needs to be made for construction vehicles to safely depart from and re-join the general traffic lane. The review should consider the following, with findings presented for consideration at a supplementary Stage 1 RSA:

- The arrangements for all phases to be accessed to and from the general traffic lane road.
- Swept path manoeuvres of construction traffic and general traffic
- Forward visibility and junction visibility
- The proposed barrier type and its potential to become an obstruction to visibility.

Designer's response

Recommendation noted. Detail design (stage 2) will review vehicle access arrangements to ensure access / egress points have adequate forward visibility, including detailing of barrier type and additional road markings and/or signage that may be required.

Construction vehicle manoeuvres have been carried out and these are shown in the construction vehicle swept path analysis plan in the Chelsea Embankment Foreshore *Transport Assessment* figures.

2.3 Problem –

Location: *General*

Summary: *Conflict between pedestrians and vehicles*

Description: The proposals indicate that the foot / cycleway adjacent to the Thames will be closed to a varying degree with pedestrians being diverted to the existing footway on the north side of the Chelsea Embankment to continue their journey. The closure and diversion will have the following characteristics that may give rise to an increased risk for pedestrians, especially when considered in the context of the likely high pedestrian flows.

- The proposed diversion route is longer and has more conflict points with other users and obstructions and trip /slip hazards when compared with the closed route. It also utilises the existing signal controlled crossing which was observed to have a 30-50 second (approx.) wait times to cross the carriageway. This may encourage pedestrians to seek uncontrolled crossing opportunities throughout Chelsea Embankment and across the front of the Bull Ring.
- The proposed temporary signalised crossing is located at a gated vehicle access on the north side of Chelsea Embankment close to significant trees
- The proposed location is likely to receive considerable pedestrian flows during special events

Recommendation: Review the proposed footway closures and diversions to ensure that they can be negotiated safely and provide an adequate level of service in the context of potentially high pedestrian flows. Review the operation and pedestrian waiting time at the signalised pedestrian crossing to ensure this does not discourage the intended use of the diversion route.

Review the location of the temporary signalised pedestrian crossing and relocate if necessary to avoid any undue conflict with the existing gated access and also to ensure that appropriate forward visibility to signals can be achieved. Ensure adequate space can be safeguarded for advance signage of diversion/restrictions without obstructing busy footways. Details to be prepared and submitted for consideration at a Stage 2 RSA.

Designer’s response

Recommendation noted. The proposed closure and diversion of the pedestrians from the southern footway of Chelsea Embankment (A3212), and the operation of the signalised pedestrian crossings at the junction of Chelsea Embankment (A3212) / Grosvenor Road (A3212) / Chelsea Bridge (A3216) / Chelsea Bridge Road (A3216) will be reviewed at detail design (stage 2).

The Chelsea Embankment Foreshore *Transport Assessment* document sets out the volume of pedestrians using the footways in the vicinity of the site. The potential changes to level of service with implementation of the footway diversions will be reviewed at detail design (stage 2).

The location of the temporary signalised pedestrian crossing, visibility and signage will also be reviewed at detail design (stage 2).

2.4 Problem –

Location: *General*

Summary: *Conflict between cyclists and other road users*

Description: The proposals indicate that the foot / cycleway adjacent to the Thames will be closed to a varying degree but it is not clear how cyclists will be directed to continue their journey from this point. The proposals do not indicate how cyclists will be directed to leave and re-join the foot/cycleway safely which may give rise to an increased risk of conflict between cyclists and other road users on both the footway and carriageway.

Recommendation: Review the proposed foot /cycleway closures and diversions and incorporate details to ensure that cyclists can continue their journey safely. Particular attention should be given to providing appropriate lane widths through the traffic management to accommodate cyclists safely.

Designer’s response

Cyclists using the NCN Route 4 along Thames Path on Chelsea Embankment (A3212) would be diverted to the highway; however, they would not be required to make any additional road crossings as a result of the diversions and lane adjustments along Chelsea Embankment (A3212).

In phases 1-3 of construction, the available carriageway width on Chelsea Embankment (A3212) between the Ambulance Gate to the Royal Hospital Chelsea Grounds, Ranelagh Gardens and the Bull Ring would be reduced both in the eastbound and westbound lanes by 1.6m. However, a minimum carriageway width of 4.3m, where HGVs can safely overtake cyclists, would be retained for traffic in each direction.

Detail design (stage 2) will review the proposed cycle diversion further.

2.5 Problem –

Location: *Bull Ring plus wider network*

Summary: *Conflict for all users*

Description: The existing turnaround / access to the Royal Hospital grounds provide parking and bus stop facilities around its circumference. These provisions will be temporarily suspended during the resurfacing of this area which may cause confusion for drivers and pedestrians and potentially lead to injudicious manoeuvres or parking at general location in the vicinity. No proposals for an alternative temporary bus stop have been provided.

Recommendation: The proposals should include appropriate temporary replacement facilities, with advance warning of temporary suspension given.

Designer's response

The resident parking bays in the Bull Ring would be temporary restricted for a short period when landscaping works are taking place there. These spaces would not be re-provided as there is spare capacity currently shown to be available on the roads in the vicinity of the site.

Bus service 360 runs past the site and uses the turnaround facility at Bull Ring Gate. This service would be able to continue to operate during the construction period except when landscaping works are being carried out to the Bull Ring. The 'loop' section of this bus service between Grosvenor Road (A3212) and the Bull Ring would be temporarily restricted during the landscaping works and buses would turn directly between Grosvenor Road (A3212) and Chelsea Bridge Road (A3216). Such arrangements are already used by the bus operator during major events at the Royal Hospital.

2.6 Problem –

Location: *North side of Chelsea Embankment*

Summary: *Increased risk of conflict for all users*

Description: The proposals associated with the resurfacing of the Bull-Ring appear to indicate a closure of the footway on the north side of Chelsea Embankment where it circulates around the Bull-Ring. This creates a discontinuity for pedestrians travelling west along this footway requiring them to make an uncontrolled crossing of the carriageway to continue their journey. It is also unclear how all road users would gain access to the Royal Hospital Grounds from Chelsea Embankment when the existing access is obstructed – especially a concern if maintained as an access route for the emergency services.

Recommendation: The proposals should include adequate safe provision for pedestrians during this phase. The proposals should also make safe provision for all users requiring access to the Royal Hospital Grounds from Chelsea Embankment.

Designer's response

Recommendation noted. Detail design (stage 2) will review the access to the Royal Hospital Grounds from Chelsea Embankment (A3212).

The northern footway of Chelsea Embankment (A3212) around the Bull Ring area would not be closed during the landscaping works. However, the footway will be reviewed at detail design (stage 2) to ensure suitable minimum footway width would be retained during the landscaping works.

Operational phase

2.7 Problem –

Location: *Permanent vehicle access*

Summary: *Conflict for all users*

Description: The proposed permanent maintenance access is indicated as a vehicle footway crossing between the Chelsea Embankment and the parapet river wall. The proposals do not indicate if / 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 in one movement 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. Furthermore, the proposals should provide adequate junction visibility and intervisibility to pedestrians in the footway – special consideration should be given to the potential obstruction of visibility by parapet walls and trees etc.

Designer's response

Recommendation noted. Detail design (stage 2) will determine the layout of the site in its operational phase. Review of vehicle turning movement to access site will be undertaken to ensure highway / footway manoeuvres are appropriate.

2.8 Problem –

Location: *Permanent vehicle access*

Summary: *Conflict for all users*

Description: The proposed site access location is adjacent to large existing trees that may 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. The vehicle swept path analysis and intervisibility to vehicles / pedestrians will be reviewed at detail design (stage 2).

2.9 Problem –

Location: *Permanent vehicle access*

Summary: *Conflict for all users*

Description: The proposed site access swept paths indicate vehicles 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 have 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 the operational phase. Review of vehicle turning movement to access site will be undertaken to ensure on-site manoeuvring is appropriate and vehicles can exit the site in forward gear.

DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
Name	F Jahanshahi	G Wicks	S Jenkins
Signature			

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Transport Assessment

Doc Ref: **7.10.10**

Chelsea Embankment Foreshore

Figures

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

Hard copy available in

Box **51** Folder **A**
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Transport Assessment

Section 13: Chelsea Embankment Foreshore figures

List of contents

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Plans

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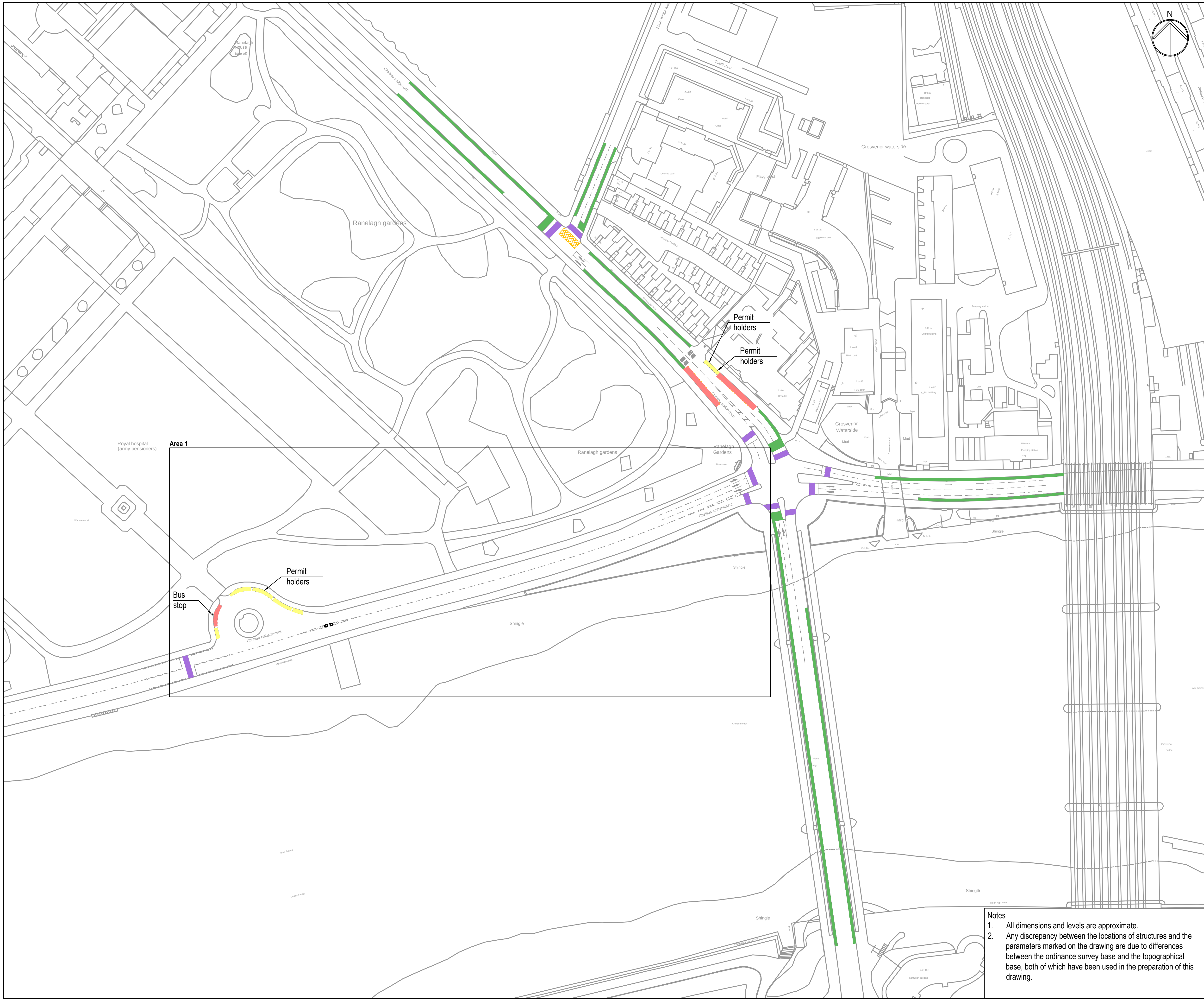
Chelsea Embankment Foreshore

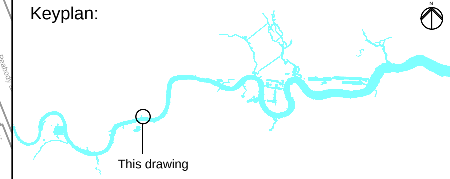
THAMES TIDEWAY TUNNEL - SCHEDULE OF ASSOCIATED HIGHWAY WORKS

Drawing Number	Works Reference	Location	Item of Work	Date of Implementation
DCO-PP-12X-CHEEF-140027	CHEEF_C01	Chelsea Embankment	Remove / obscure existing white lining and provide new white lining and road markings as appropriate (minimum 3.25m lane each way to be provided). Approximate length 200m.	TBC
DCO-PP-12X-CHEEF-140028	CHEEF_C02	Chelsea Embankment	Removal of pedestrian refuge island. Including 2No. Illuminated bollard and 1 No. illuminated pole and beacon.	TBC
	CHEEF_C03	Chelsea Embankment	Remove / obscure temporary white lining and provide new white lining and road markings as appropriate. Approximate length 150m.	TBC
	CHEEF_C04	Chelsea Embankment	Remove / obscure existing white lining and provide new white lining and road markings as appropriate (minimum 3.25m lane each way to be provided). Approximate length 200m.	TBC
DCO-PP-12X-CHEEF-140029	CHEEF_C05	Chelsea Embankment	Provision of temporary signal controlled pedestrian crossing. Including all associated paving and road markings.	TBC
	CHEEF_C06	Chelsea Embankment	Remove / obscure existing white lining and provide new white lining and road markings as appropriate (minimum 3.25m lane each way to be provided). Approximate length 200m.	TBC
DCO-PP-12X-CHEEF-140030	CHEEF_C07	Chelsea Embankment (Bull Ring)	Temporary suspension of parking spaces (approximately 8 vehicle bays) and bus stop.	TBC
	CHEEF_C08	Chelsea Embankment	Remove / obscure temporary white lining and provide new white lining and road markings as appropriate. Approximate length 150m.	TBC
	CHEEF_C09	Chelsea Embankment	Removal of temporary signal controlled pedestrian crossing. Including all associated paving and road markings.	TBC
	CHEEF_C10	Chelsea Embankment	Remove / obscure existing white lining and provide new white lining and road markings as appropriate. Approximate length 200m.	TBC
DCO-PP-12X-CHEEF-140031	CHEEF_P01	Chelsea Embankment	Reinstatement of parking spaces (approximately 8 vehicle bays) and bus stop.	TBC
	CHEEF_P02	Chelsea Embankment	Construction of pedestrian refuge island. Including 2No. Illuminated bollard and 1 No. illuminated pole and beacon (refer to Proposed landscape plan sheet 1 of 2 for location).	TBC
	CHEEF_P03	Chelsea Embankment	New access point for maintenance vehicles for foreshore site. Strengthened footway and partially dropped kerbing to be used.	TBC



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
- On street parking
- Pedestrian crossing
- Cycle lane / advance stop line
- Bus stop / stand

On street parking

Cycle lane	Permit holders
barclays cycle superhighways mon - fri 7.00am - 7.00pm	resident permit holders only mon - fri 8.30am - 10.00pm
cycle lane mon - fri 8.00am - 6.30pm	sat 8.30am - 1.30pm

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

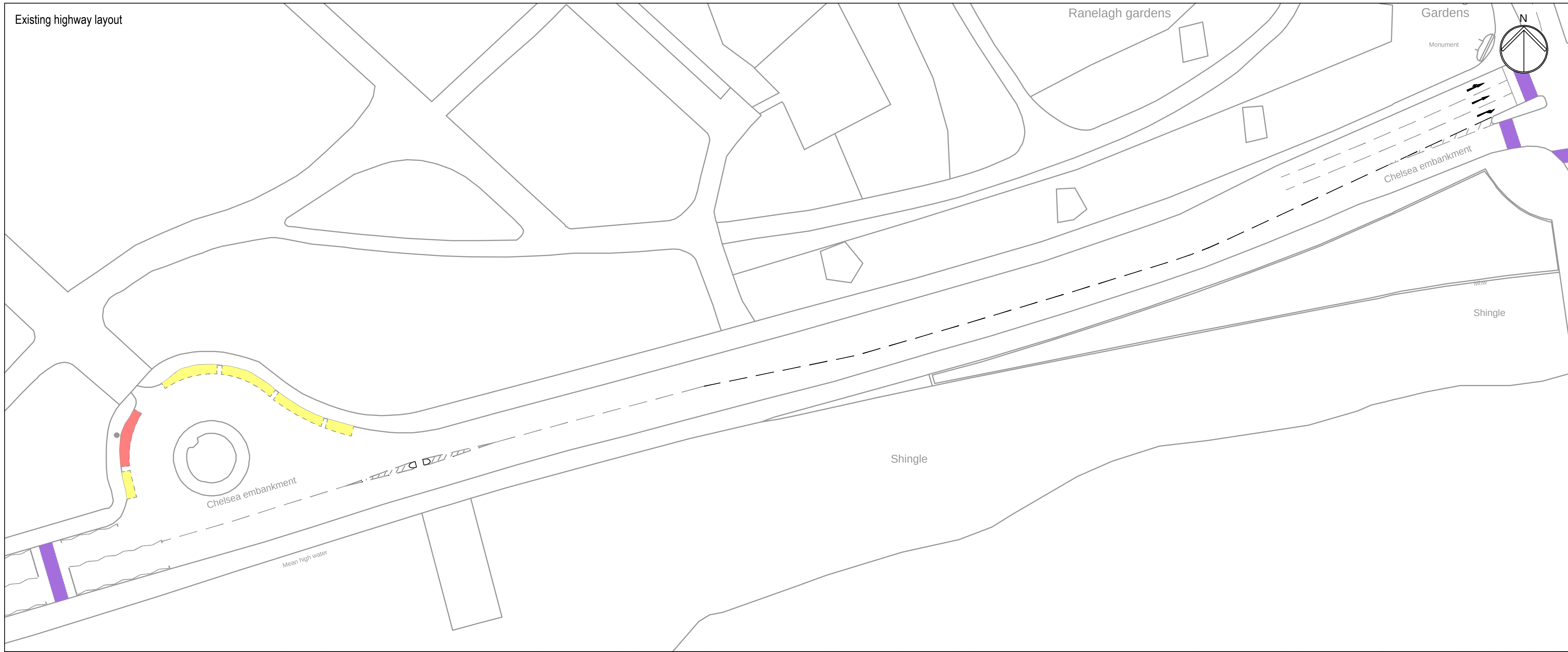
Location
Chelsea Embankment Foreshore
RB Kensington and Chelsea

Document Information
Application for Development Consent
Existing highway layout

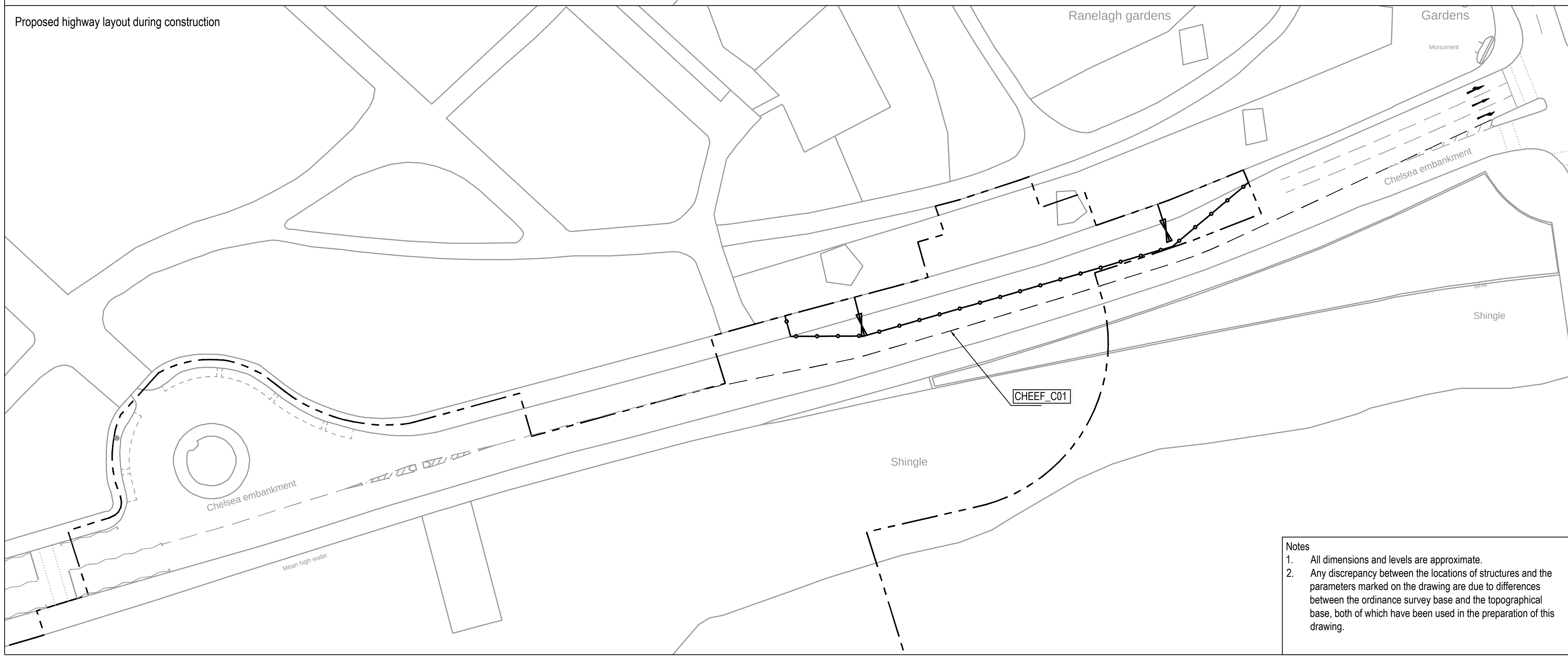
DCO-PP-12X-CHEEF-140026
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Existing highway layout



Proposed highway layout during construction



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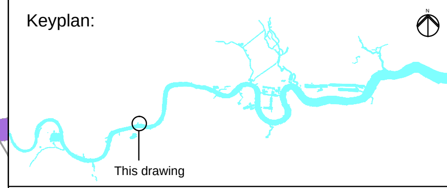
Keyplan:



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

Revised
- L.L.A.U.
- CHEEF_C00 See schedule of works
- Traffic barrier
- Site access point

On street parking

Cycle lane
barclays cycle superhighways
mon - fri 7.00am - 7.00pm
cycle lane mon - fri 8.00am - 6.30pm

Permit holders
resident permit holders only
mon - fri 8.30am - 10.00pm
sat 8.30am - 1.30pm

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 - utility diversion

10m 0 40m

Scale 1:500 at A1
1:1000 if reproduced at A3

ILLUSTRATIVE

Location
Chelsea Embankment Foreshore
RB Kensington and Chelsea

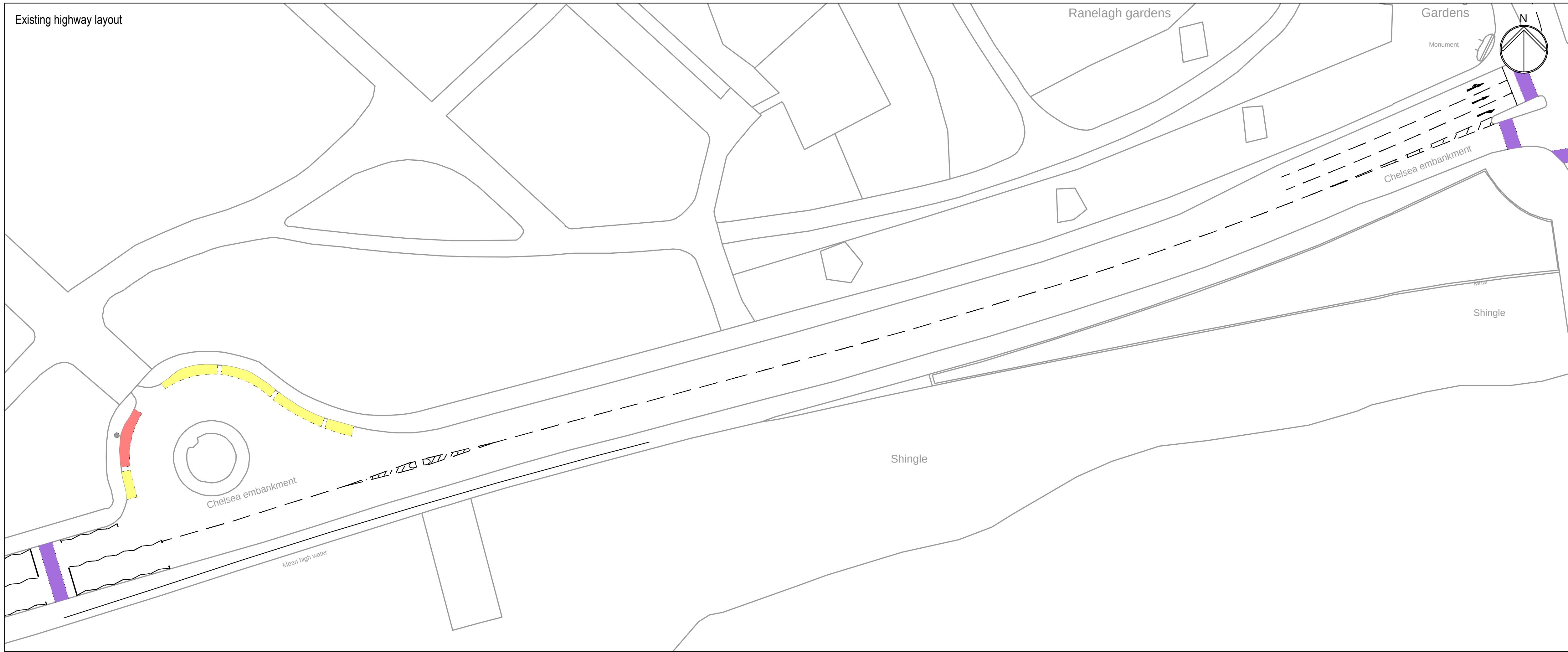
Document Information
Application for Development Consent

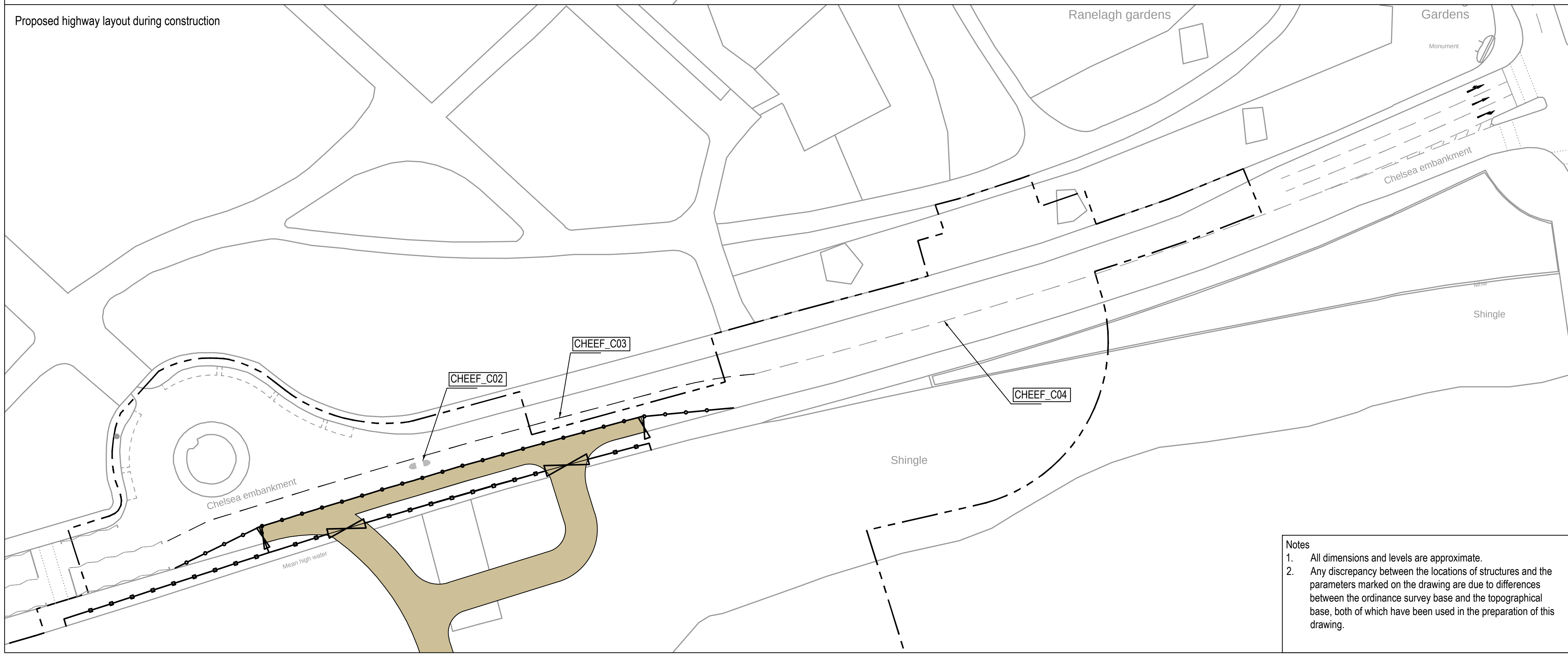
Highway layout during construction
(Utility diversion phase)

DCO-PP-12X-CHEEF-140027
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water





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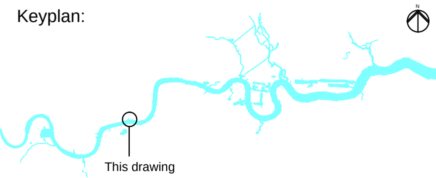
Keyplan:



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Key

Existing
- On street parking
- Bus stop / stand
- Pedestrian crossing

Revised
- L.A.U.
- CHEEF_C00 See schedule of works
- Traffic barrier
- Site access point
- Site hoarding

On street parking

Permit holder
permit holders only
mon - fri 8:30am - 10.00pm
sat - 8.30am - 1.30pm

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
Chelsea Embankment Foreshore
RB Kensington and Chelsea

Document Information
Application for Development Consent

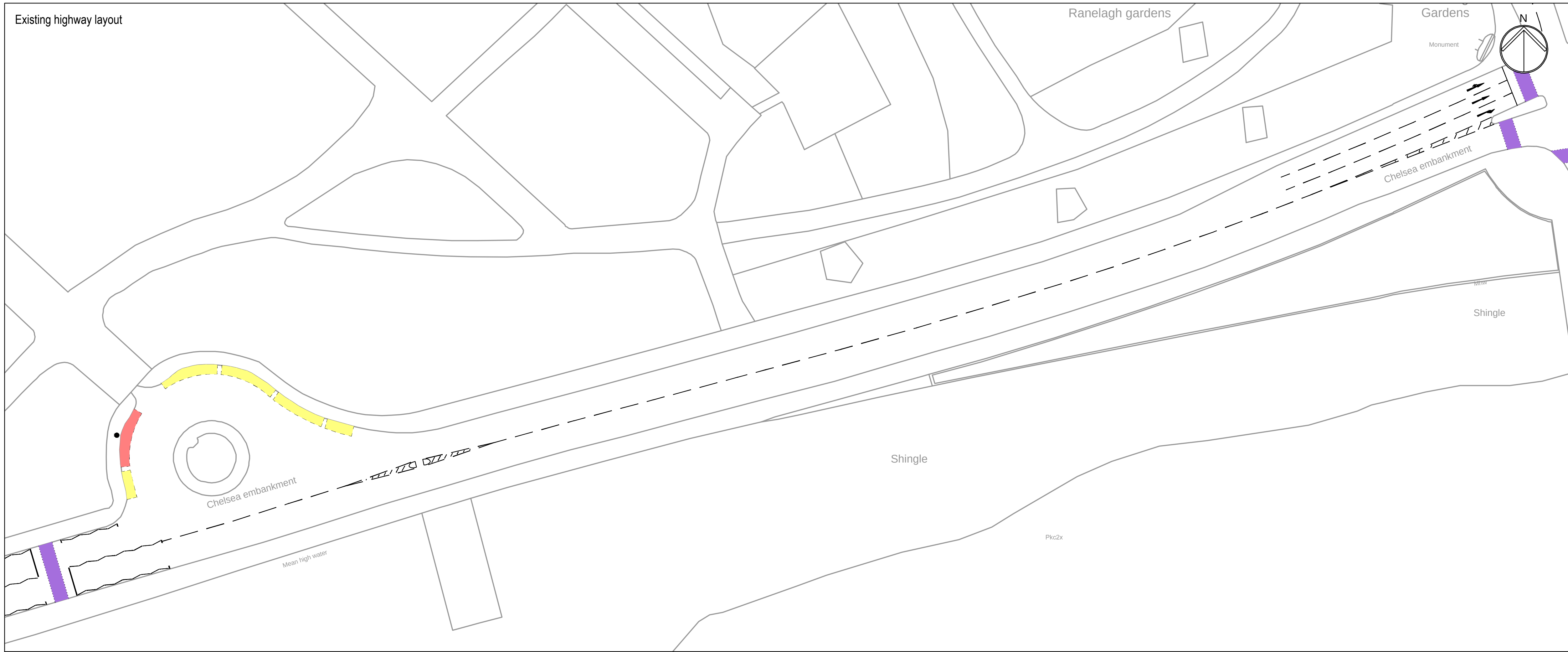
Highway layout during construction
Phase 1 - 2

DCO-PP-12X-CHEEF-140028
January 2013

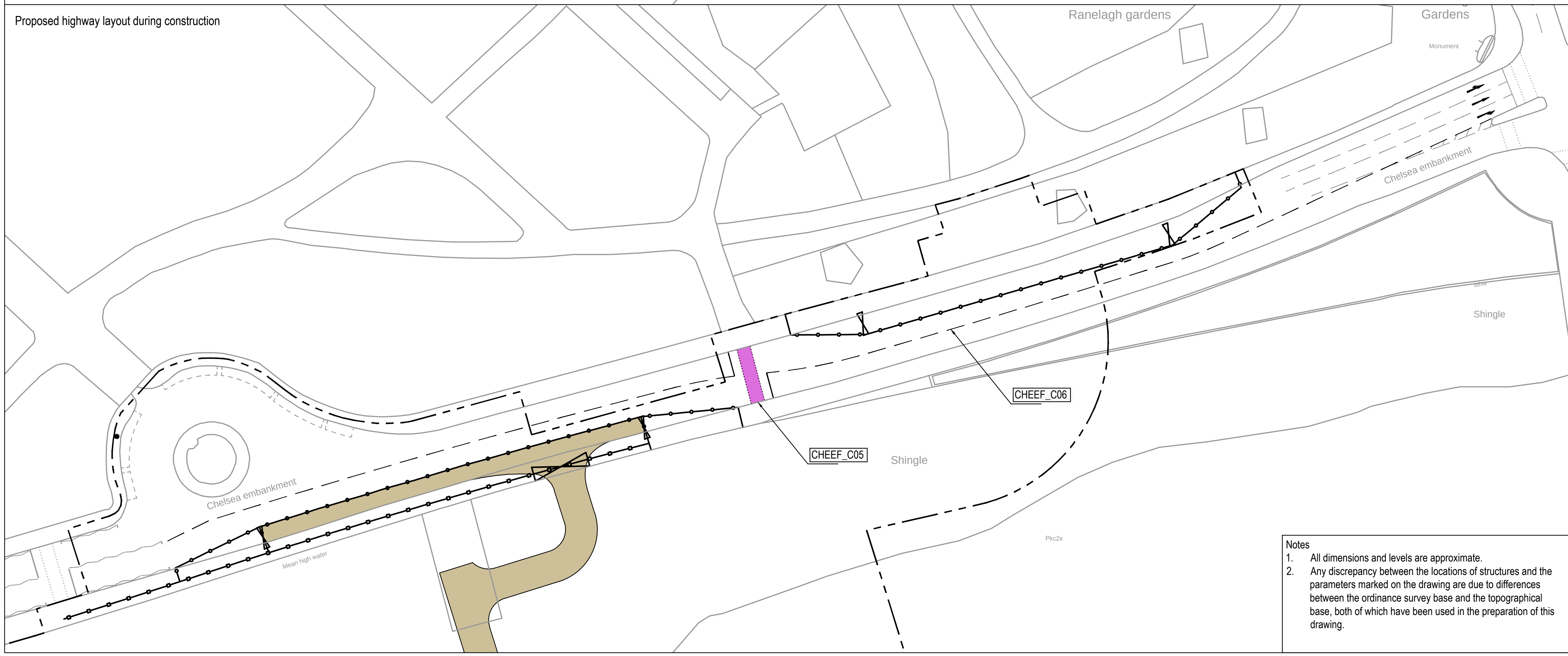
Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

Existing highway layout



Proposed highway layout during construction



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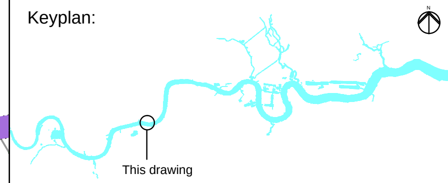

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Key

Existing
- On street parking
- Bus stop / stand
- Pedestrian crossing

Revised
- L.L.A.U.
- Site hoarding
- CHEEF_C00 See schedule of works
- Temporary pedestrian crossing
- Illustrative on-site manoeuvring zone
- Traffic barrier
- Site access point

On street parking

Permit holder
permit holders only
mon - fri 8:30am - 10.00pm
sat - 8.30am - 1.30pm

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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- 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
Chelsea Embankment Foreshore
RB Kensington and Chelsea

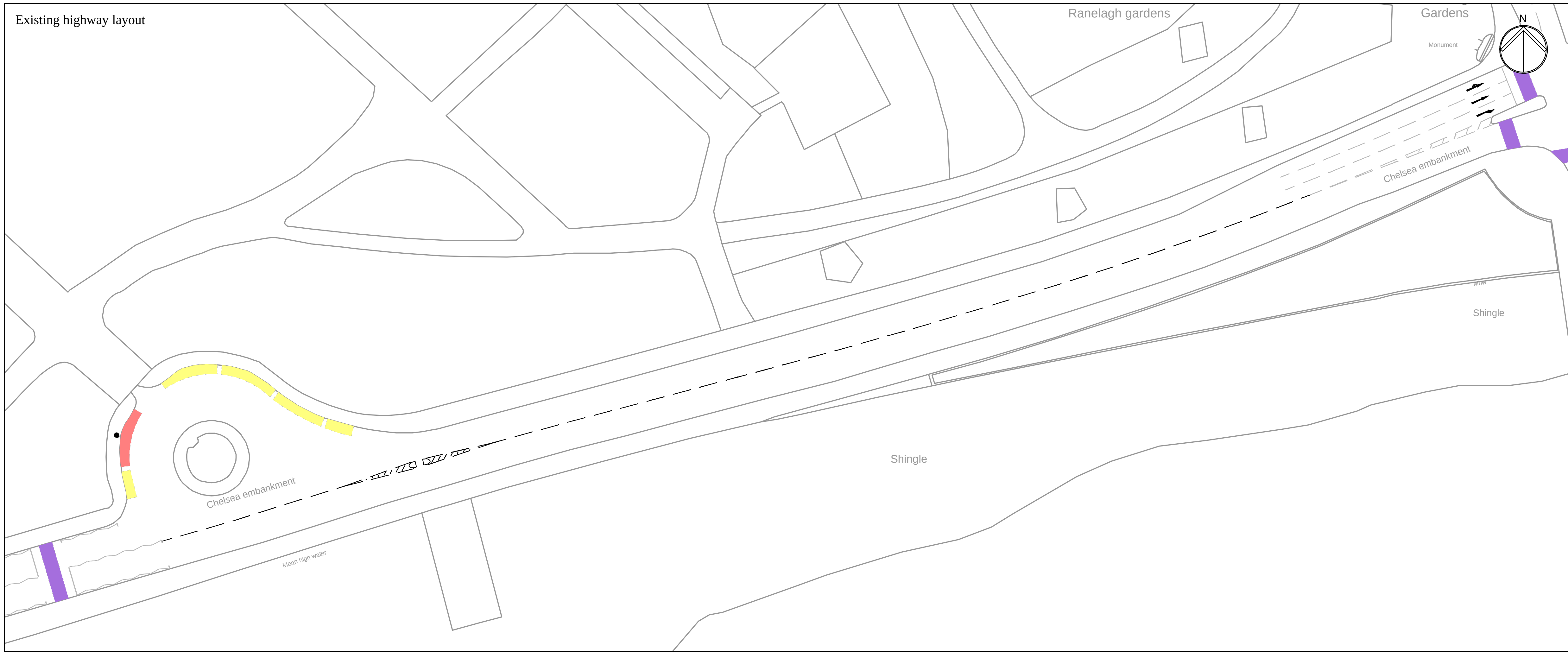
Document Information
Application for Development Consent
Highway layout during construction
Phase 3

DCO-PP-12X-CHEEF-140029
January 2013

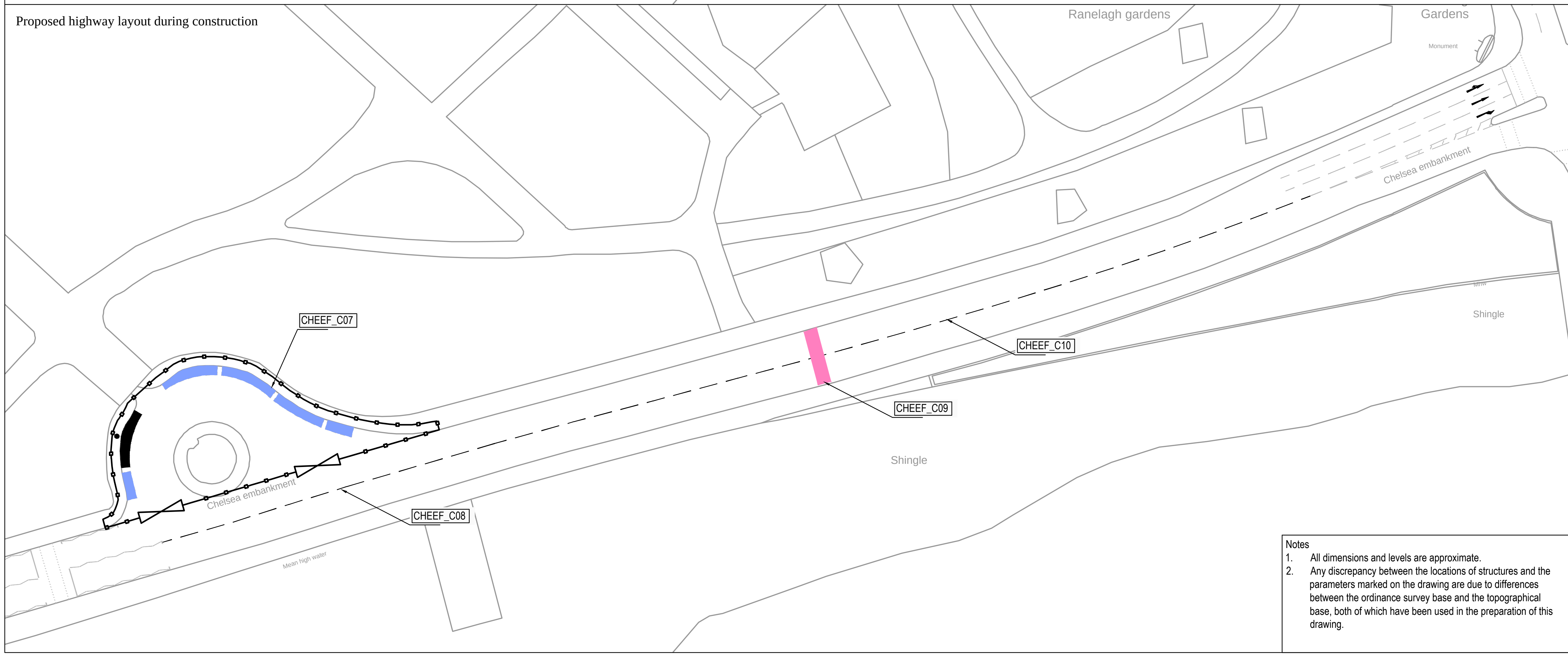
Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

Existing highway layout



Proposed highway layout during construction



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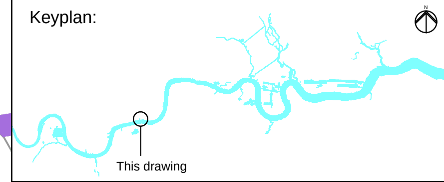

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Key

Existing
- On street parking
- Bus stop / stand
- Pedestrian crossing

Revised
- L.L.A.U.
- CHEEF_C00 See schedule of works
- Temporary pedestrian crossing
- Traffic barrier
- Site access point
- Temporary parking restriction
- Temporary bus stop restriction
- Removed pedestrian crossing

On street parking

Permit holder
permit holders only
mon - fri 8:30am - 10.00pm
sat - 8.30am - 1.30pm

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
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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 phases

10m 0 40m

Scale 1:500 at A1
1:1000 if reproduced at A3

ILLUSTRATIVE

Location
Chelsea Embankment Foreshore
RB Kensington and Chelsea

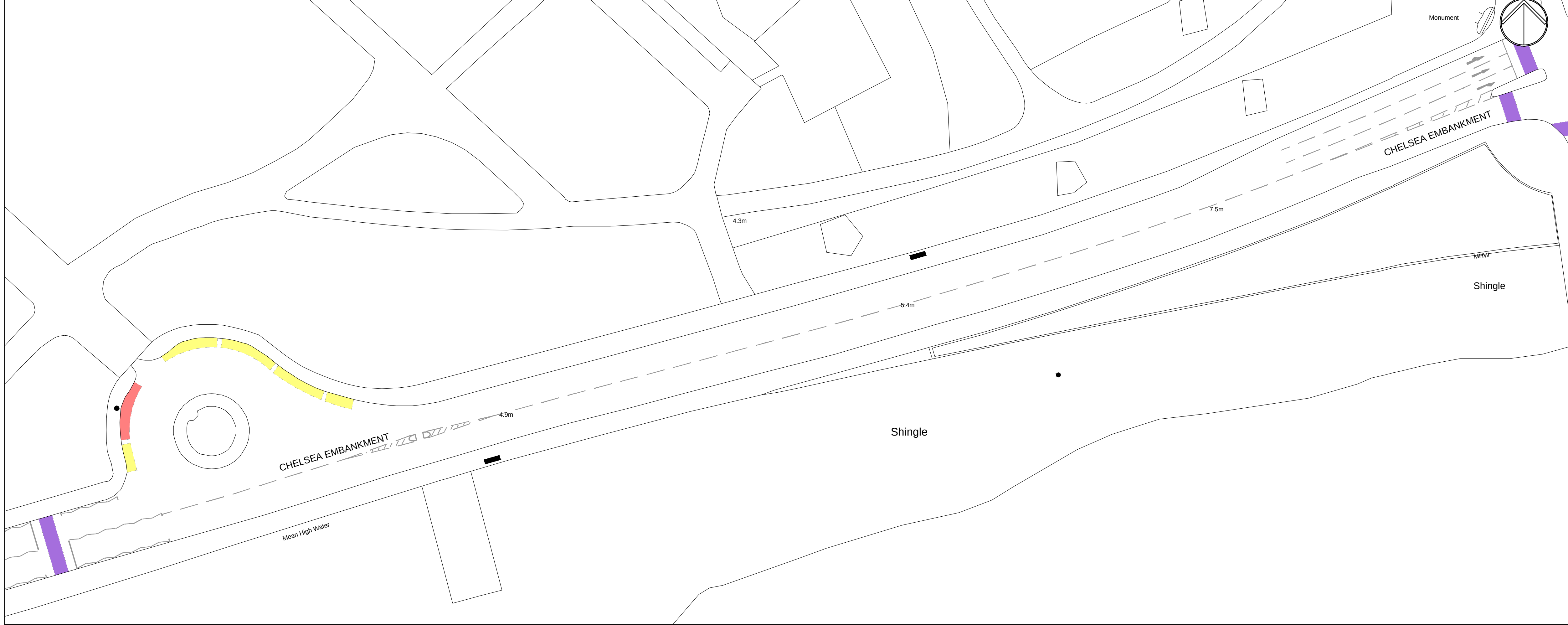
Document Information
Application for Development Consent
Highway layout during construction
Bullring resurfacing

DCO-PP-12X-CHEEF-140030
January 2013

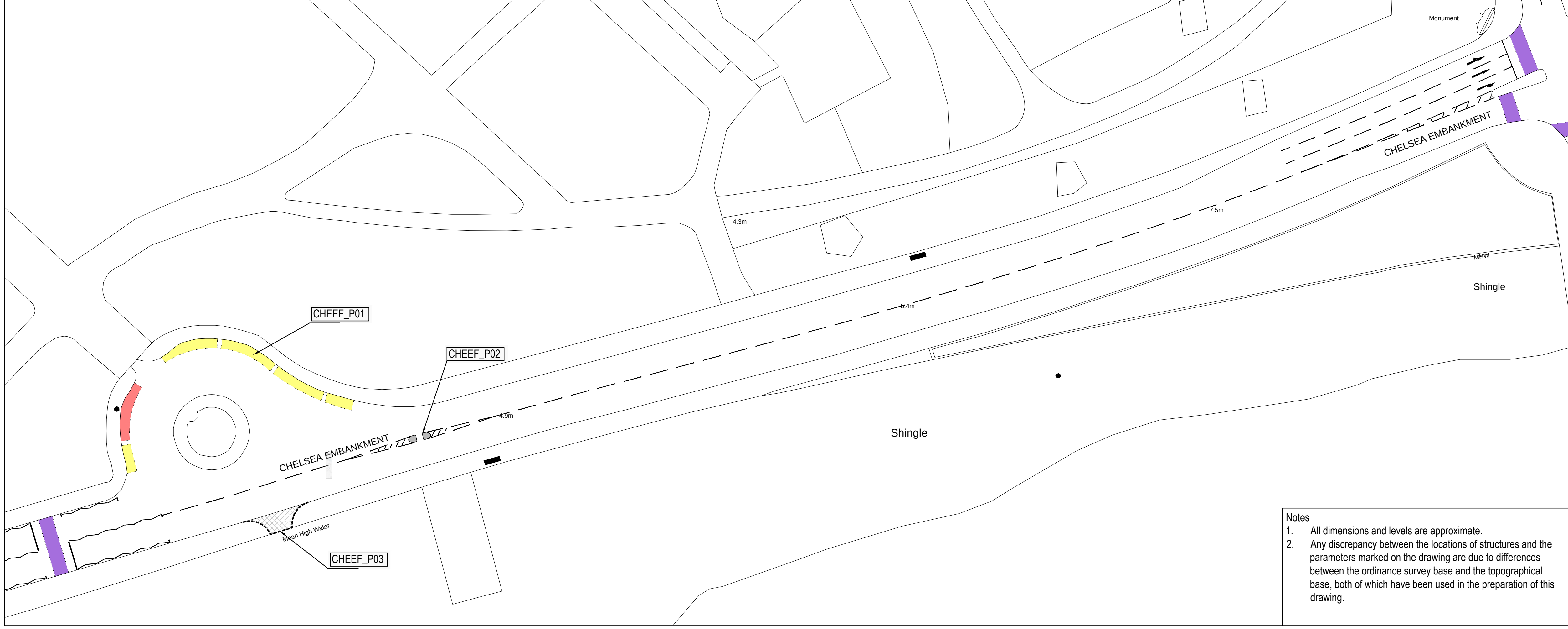
Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

Existing highway layout



Proposed highway layout during construction



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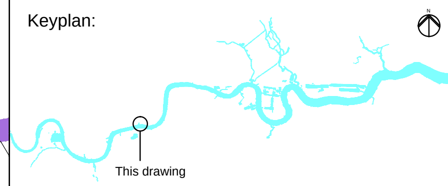

Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

Existing
- On street parking
- Bus stop / stand
- Pedestrian crossing

Revised
- CHEEF_C00 See schedule of works
- Pedestrian refuge
- Strengthen footway / vehicle crossover area

On street parking

Permit holder
permit holders only
mon - fri 8:30am - 10.00pm
sat - 8.30am - 1.30pm

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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- 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

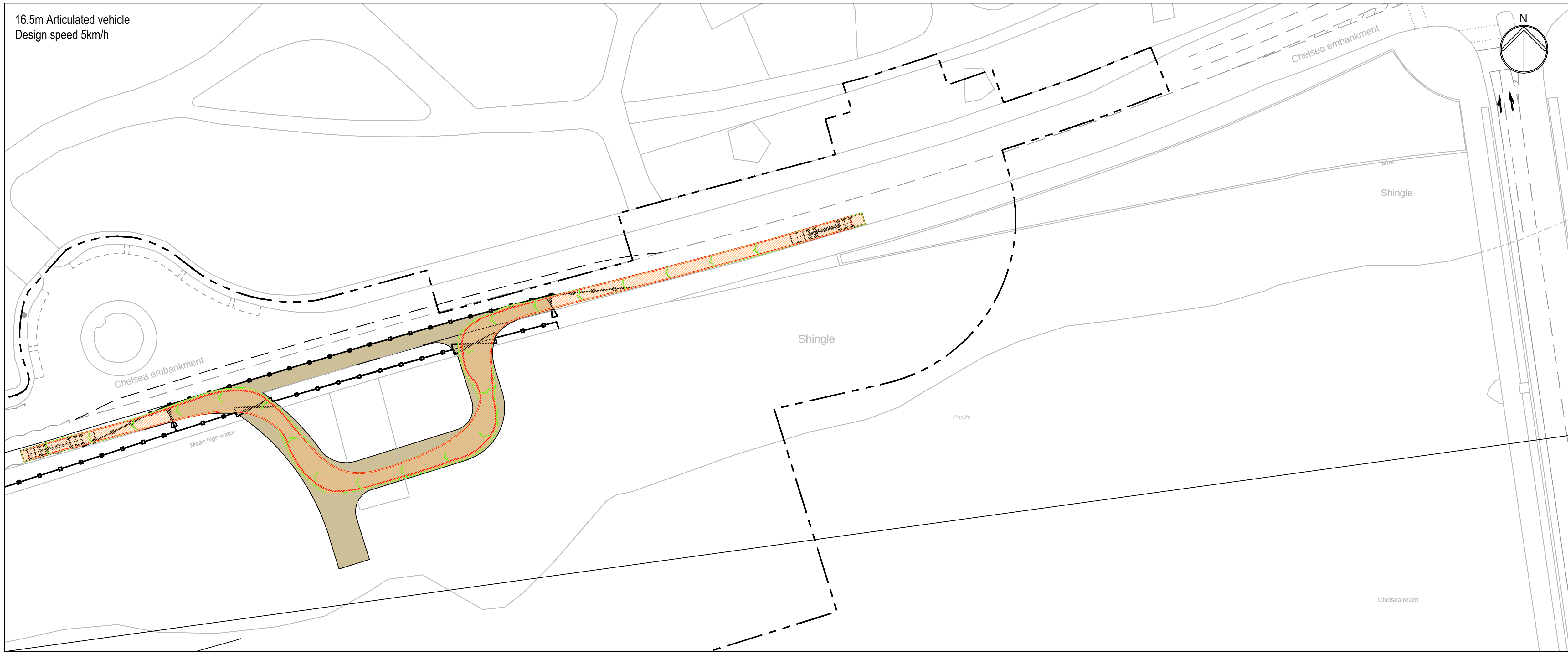
Location
Chelsea Embankment Foreshore
RB Kensington and Chelsea

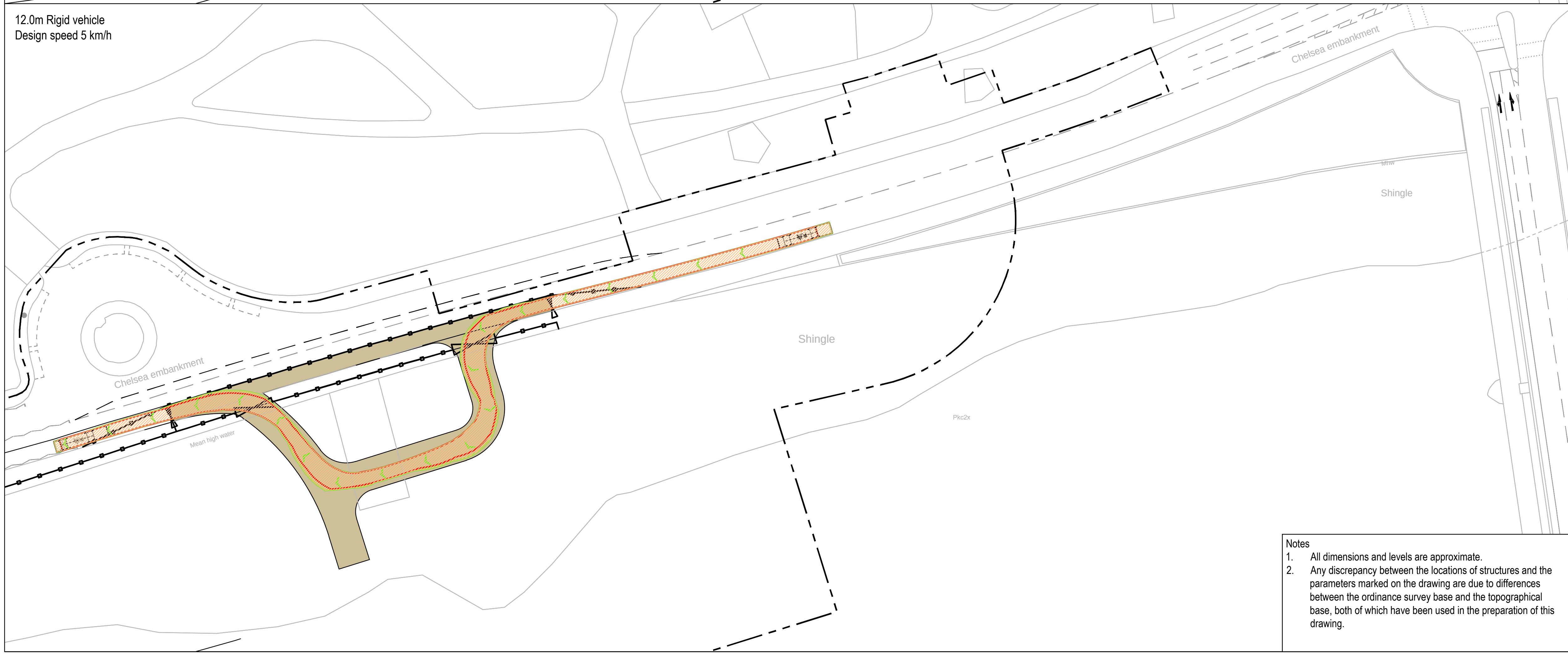
Document Information
Application for Development Consent
Permanent highway layout

DCO-PP-12X-CHEEF-140031
January 2013

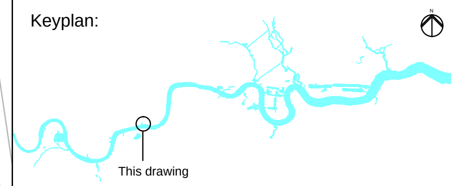
Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water



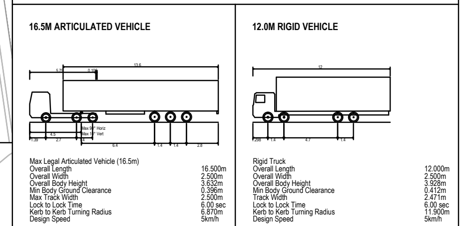


Keyplan:



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
- Vehicle body outlines
- Vehicle chassis outline
- Vehicle swept path
- L.L.A.U.



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
Chelsea Embankment Foreshore
RB Kensington and Chelsea

Document Information
Application for Development Consent
Highway layout during construction
Vehicle swept path analysis 1 of 3

DCO-PP-12X-CHEEF-140032
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

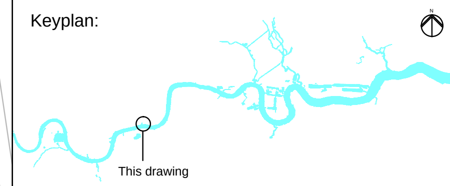
Notes
1. All dimensions and levels are approximate.
2. Any discrepancy between the locations of structures and the parameters marked on the drawing are due to differences between the ordinance survey base and the topographical base, both of which have been used in the preparation of this drawing.

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.

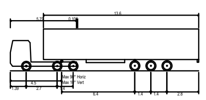
Keyplan:



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.

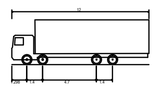
Key
- Illustrative on-site manoeuvring zone
- Vehicle body outlines
- Vehicle chassis outline
- Vehicle swept path
- L.L.A.U.

16.5m articulated vehicle



Max Legal Articulated Vehicle (16.5m)	
Overall Length	16.500m
Overall Width	2.500m
Overall Body Height	3.632m
Min Body Ground Clearance	0.396m
Max Track Width	2.500m
Lock to Lock Time	6.00 sec
Kerb to Kerb Turning Radius	6.870m
Design Speed	5km/h

12.0m rigid vehicle



Rigid Truck	
Overall Length	12.000m
Overall Width	2.500m
Overall Body Height	3.928m
Min Body Ground Clearance	0.412m
Track Width	2.471m
Lock to Lock Time	6.00 sec
Kerb to Kerb Turning Radius	11.900m
Design Speed	5km/h

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
Chelsea Embankment Foreshore
RB Kensington and Chelsea

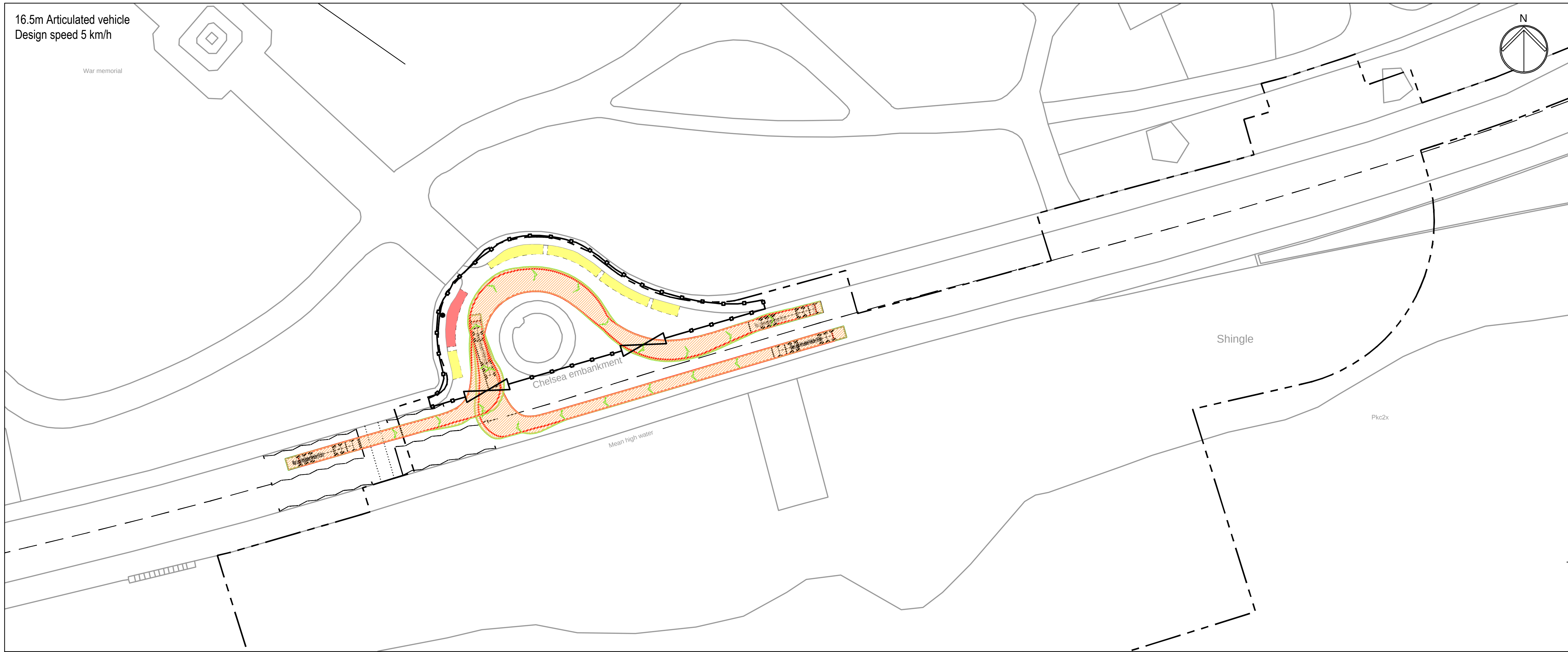
Document Information
Application for Development Consent
Highway layout during construction
Vehicle swept path analysis 2 of 3

DCO-PP-12X-CHEEF-140033
January 2013

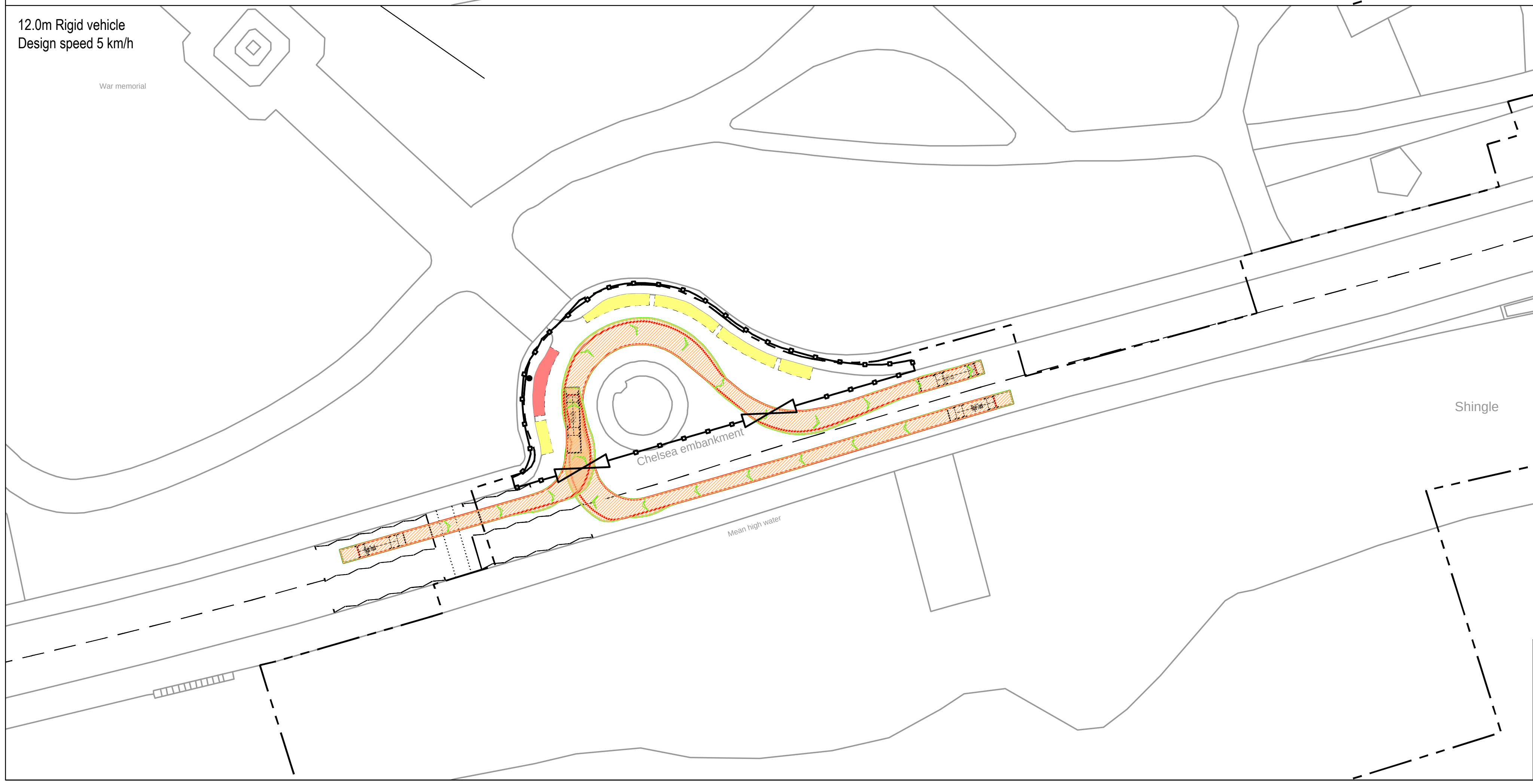
Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

16.5m Articulated vehicle
Design speed 5 km/h

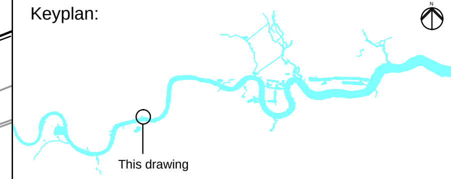


12.0m Rigid vehicle
Design speed 5 km/h



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:

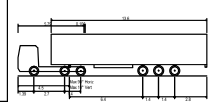


Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

Key

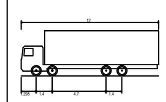
- Vehicle body outlines
- Vehicle chassis outline
- Vehicle swept path
- L.L.A.U.

16.5m Articulated vehicle



Max Legal Articulated Vehicle (16.5m)	
Overall Length	16.500m
Overall Width	2.500m
Overall Body Height	3.632m
Min Body Ground Clearance	0.396m
Max Track Width	2.500m
Lock to Lock Time	6.00 sec
Kerb to Kerb Turning Radius	6.870m
Design Speed	5km/h

12.0m Rigid vehicle



Rigid Truck	
Overall Length	12.000m
Overall Width	2.500m
Overall Body Height	3.928m
Min Body Ground Clearance	0.412m
Track Width	2.471m
Lock to Lock Time	6.00 sec
Kerb to Kerb Turning Radius	11.900m
Design Speed	5km/h

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
Chelsea Embankment Foreshore
RB Kensington and Chelsea

Document Information
Application for Development Consent

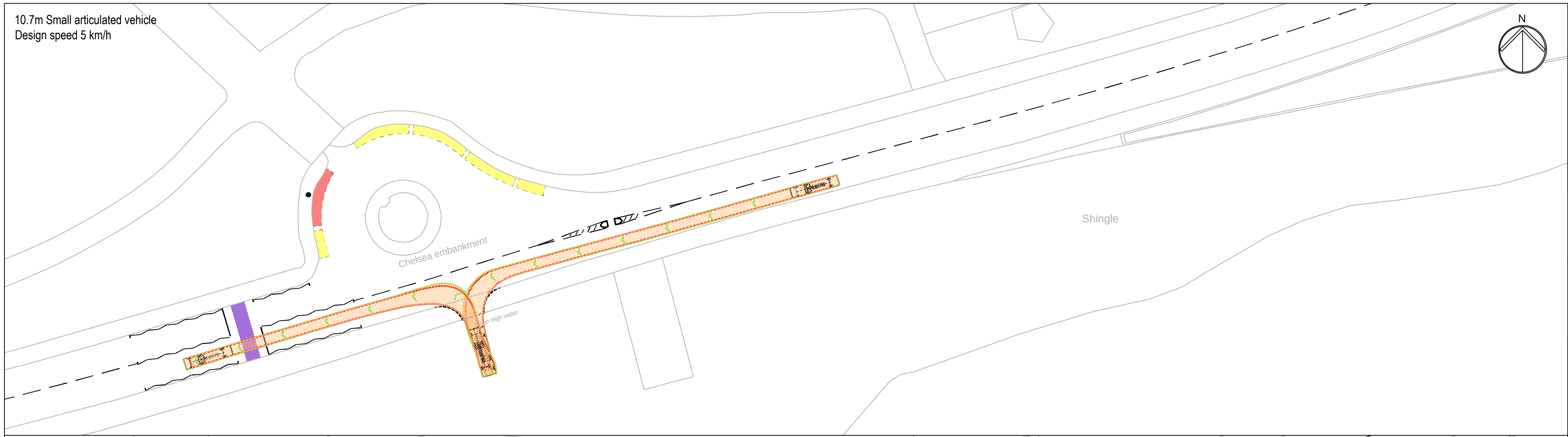
Highway layout during construction
Vehicle swept path analysis 3 of 3

DCO-PP-12X-CHEEF-140034
January 2013

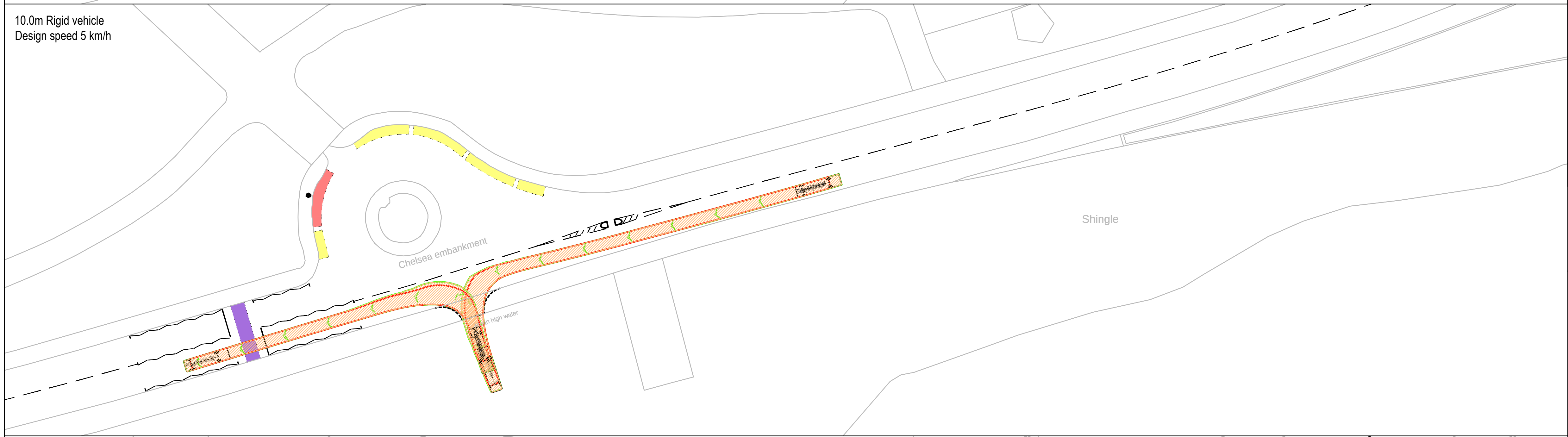
Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

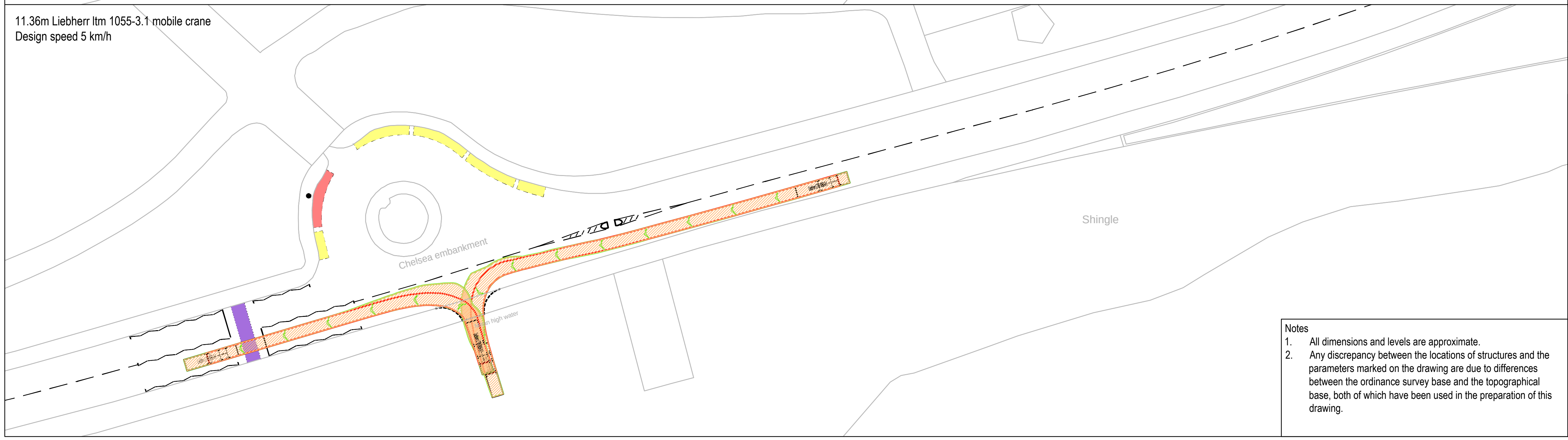
10.7m Small articulated vehicle
Design speed 5 km/h



10.0m Rigid vehicle
Design speed 5 km/h

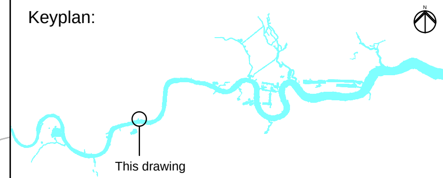


11.36m Liebherr ltm 1055-3.1 mobile crane
Design speed 5 km/h



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:

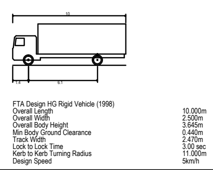


Coordinates are to be Ordance Survey Datum OSGB36. All levels are in metres and relate to the Tunnel Datum which is 100 metres below Ordnance Datum Newlyn.

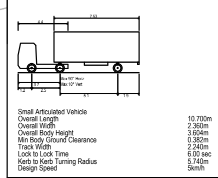
Key

Vehicle swept path analysis
- Vehicle body outlines
- Vehicle chassis outline
- Vehicle swept path

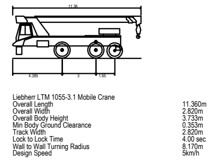
10.0m Rigid vehicle



10.7m Small articulated vehicle



11.36m Liebherr ltm 1055-3.1 mobile crane



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
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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
Permanent phase

10m 0 40m

Scale 1:500 at A1
1:1000 if reproduced at A3

ILLUSTRATIVE

Location
Chelsea Embankment Foreshore
RB Kensington and Chelsea

Document Information
Application for Development Consent

Permanent highway layout
Vehicle swept path analysis

DCO-PP-12X-CHEEF-140035
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water

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Transport assessment figures

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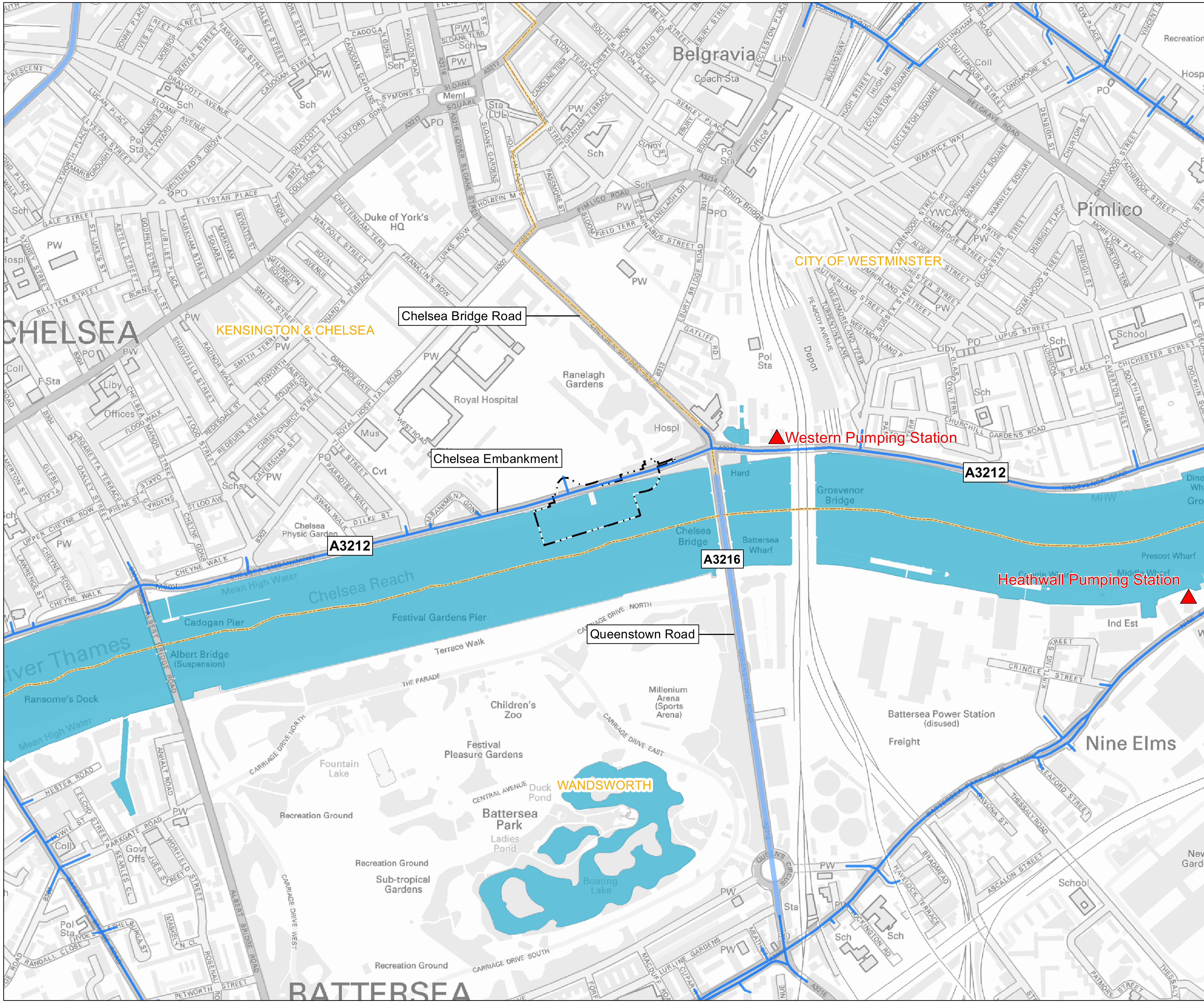
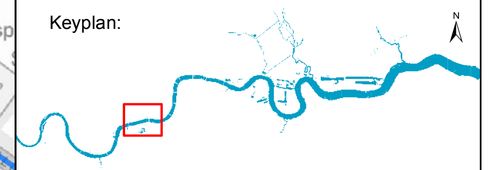


Keyplan:



Key

- Pumping station
- 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

Chelsea Embankment Foreshore

Royal Borough of Kensington and Chelsea

Document Information

Transport Assessment

Transport - site location plan

Figure 13.2.1

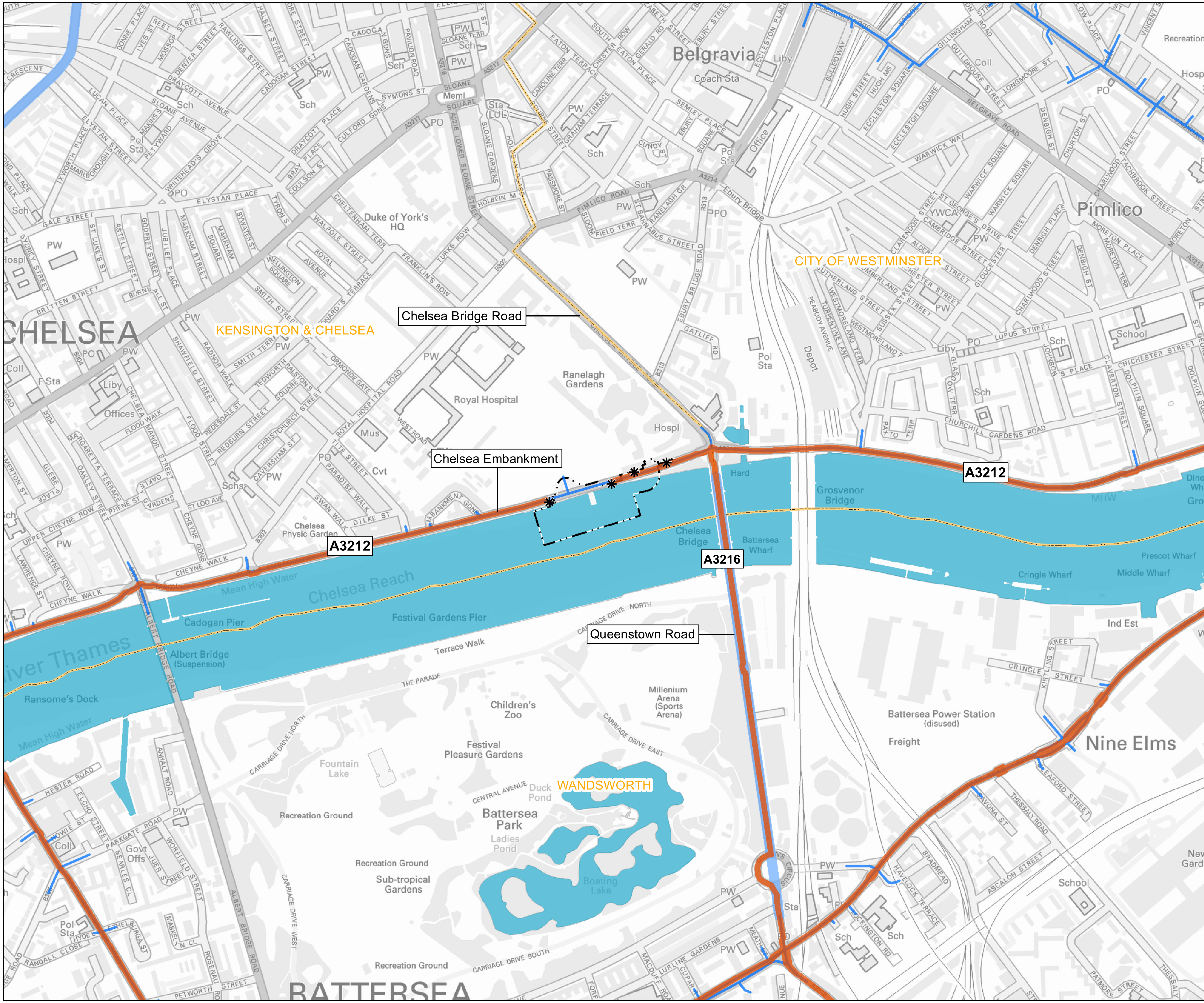
1PL03-TT-50610

January 2013

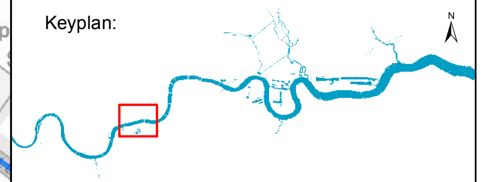
Thames Tideway Tunnel

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

Chelsea Embankment Foreshore

Royal Borough of Kensington and Chelsea

Document Information

Transport Assessment

Transport - construction traffic routes

Figure 13.2.2

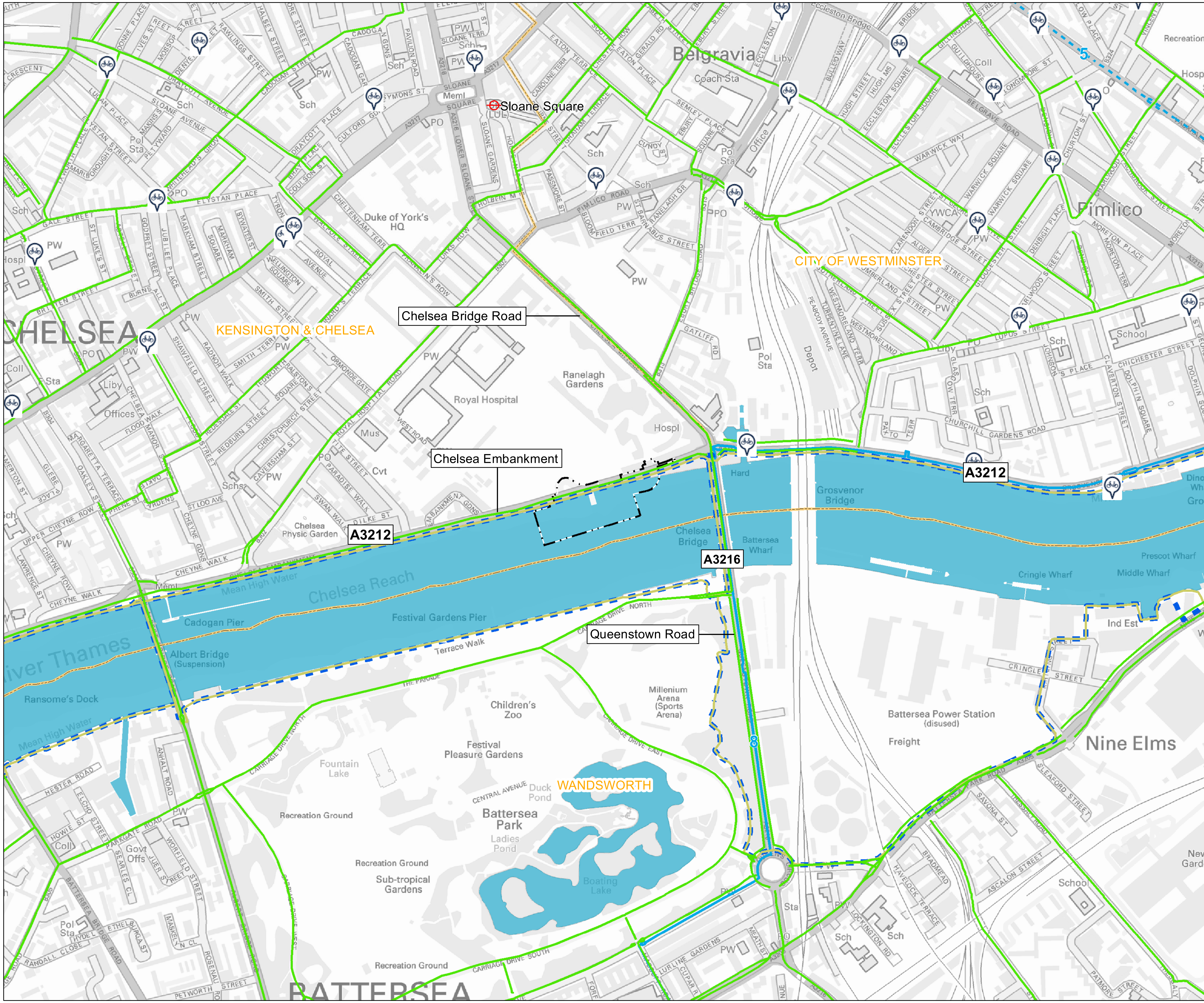
1PL03-TT-50602

January 2013

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

Thames Water



Keyplan:

Key

- Underground stations with cycle parking
- Barclays cycle hire locations
- London cycle routes
- London strategic walk network
- Cycle superhighway (open)
- Cycle superhighway (open 2013)
- Thames path

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

Chelsea Embankment Foreshore

Royal Borough of Kensington and Chelsea

Document Information

Environmental Statement

Transport - pedestrian and cycle network

Figure 13.4.1

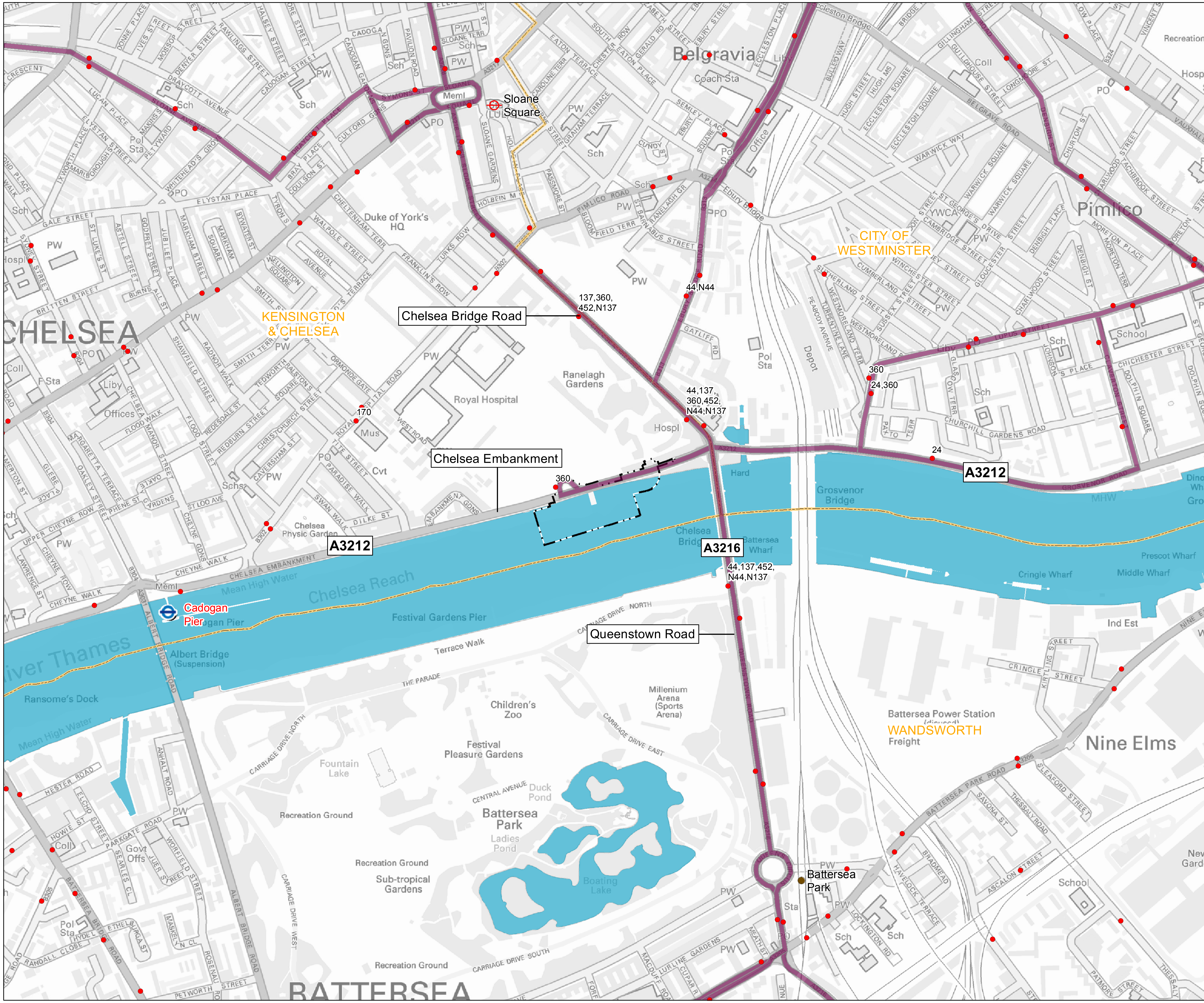
1PL03-TT-50618

January 2013

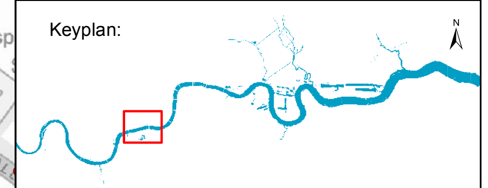
Thames Tideway Tunnel

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

Chelsea Embankment Foreshore

Royal Borough of Kensington and Chelsea

Document Information

Transport Assessment

Transport - public transport

Figure 13.4.2

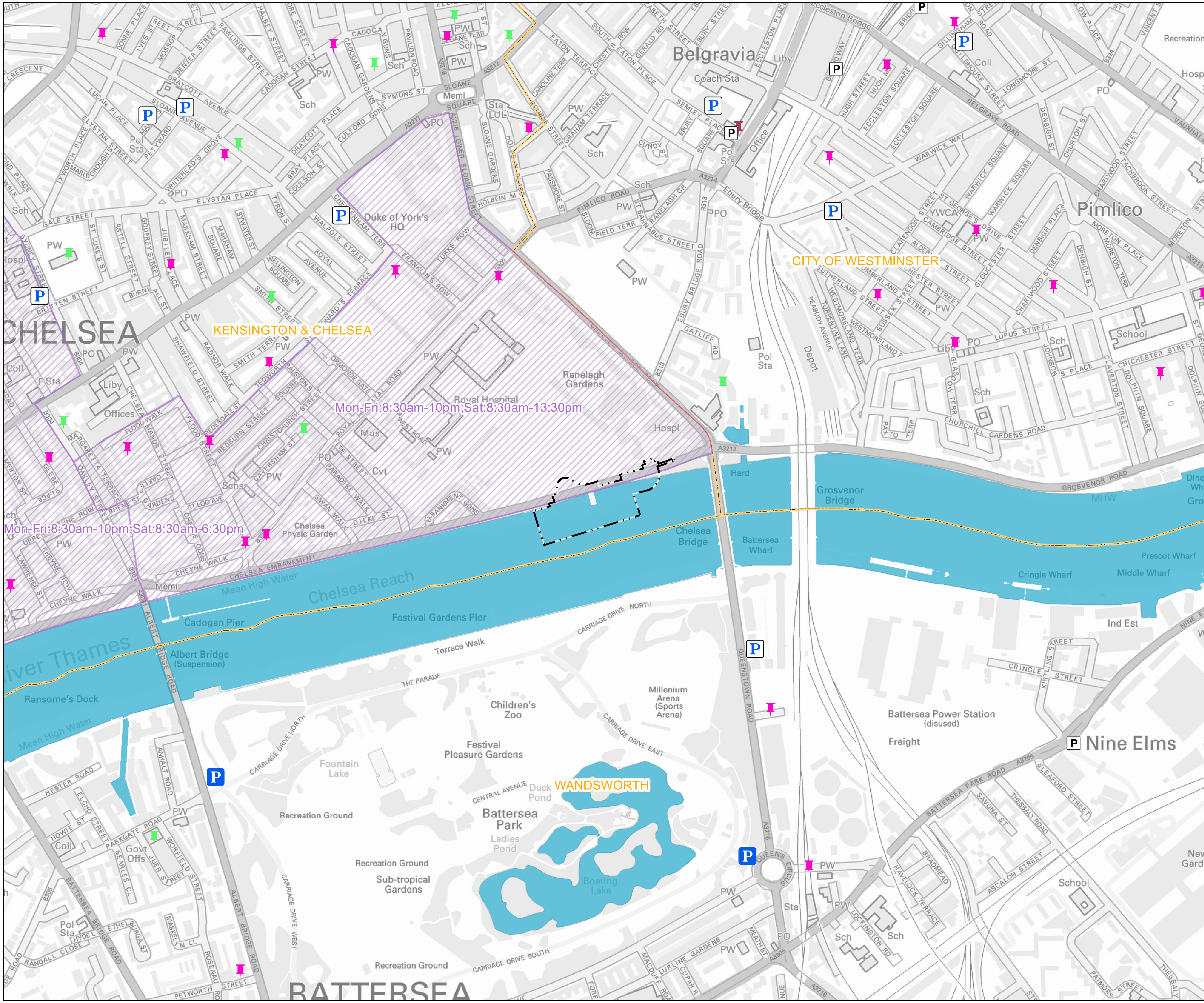
1PL03-TT-50626

January 2013

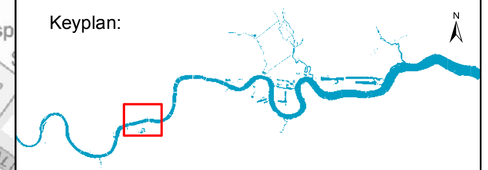
Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

Thames Water



Keyplan:



Key

- Council parking
- Private car parking
- Coach parking
- City Car
- Hertz on Demand
- Zip Car
- Controlled parking zones
- 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

Chelsea Embankment Foreshore

Royal Borough of Kensington and Chelsea

Document Information

Transport Assessment

Transport - parking

Figure 13.4.3

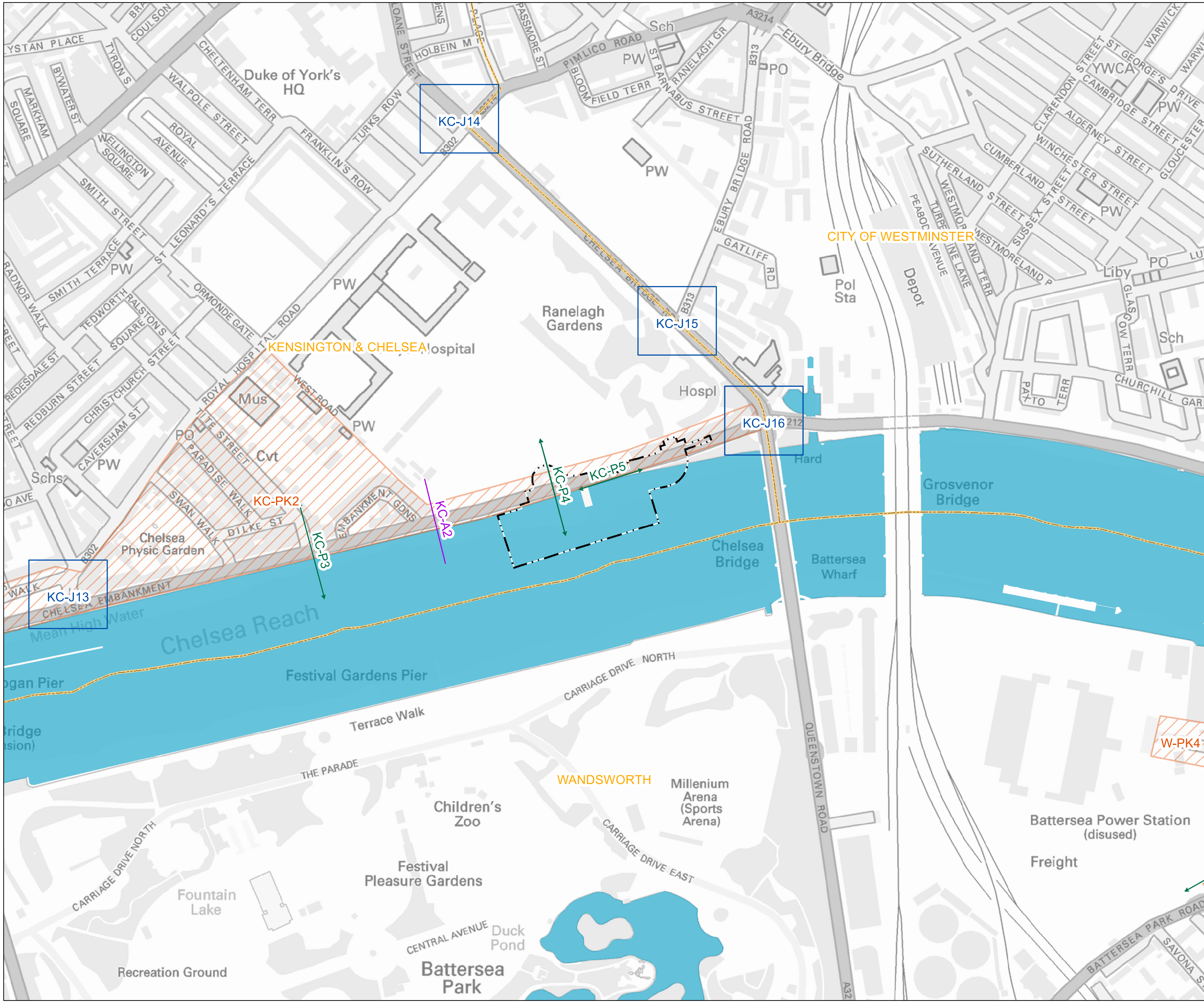
1PL03-TT-50634

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
- Parking surveys
- Limits of Land to be Acquired or Used
- Local authority boundary

80 40 0 80 m

Scale 1 : 5,000 at A3

FOR INFORMATION

Location

Chelsea Embankment Foreshore

Roal Borough of Kensington and Chelsea

Document Information

Transport Assessment

Transport - survey locations

Figure 13.4.4

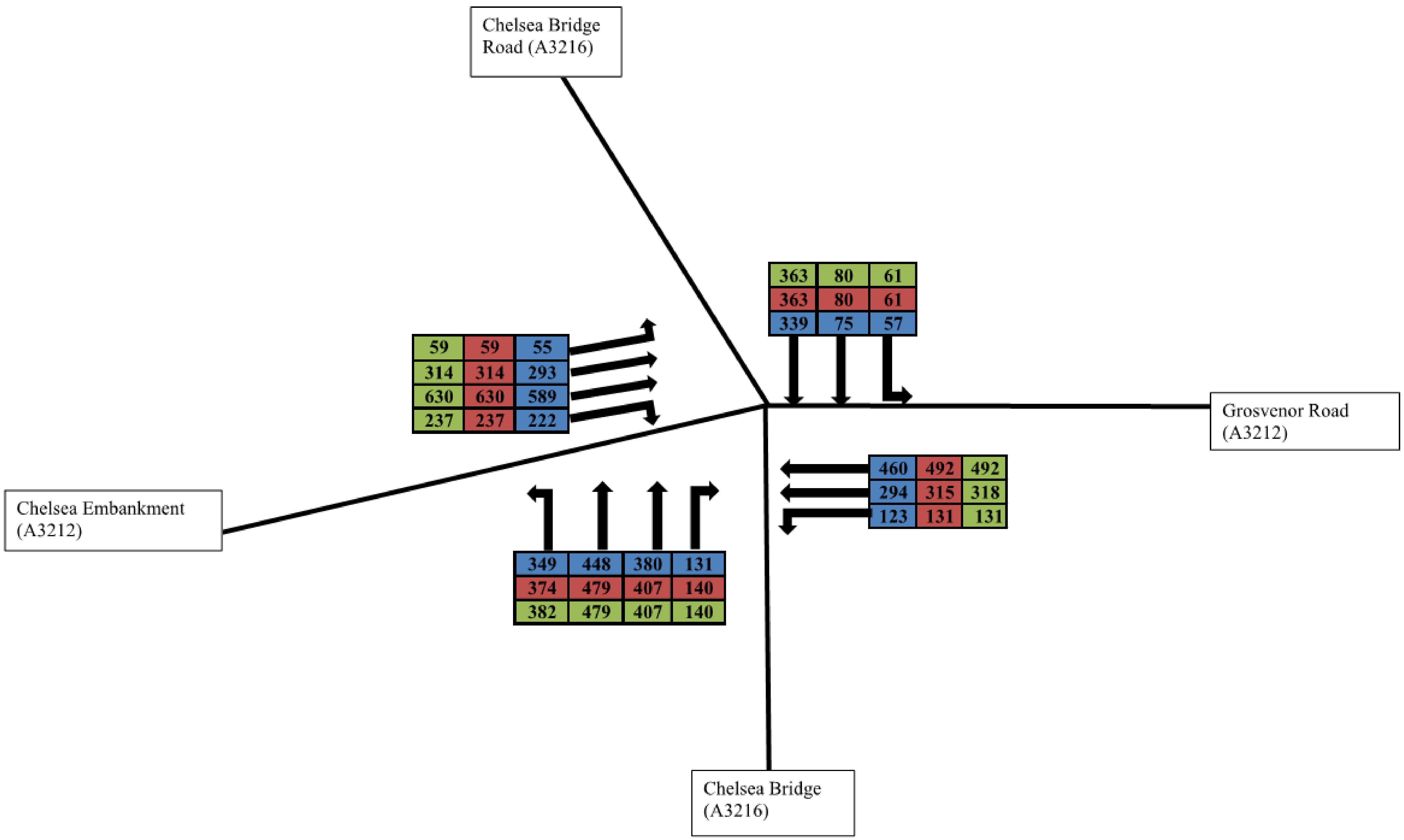
1PL03-TT-50642

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

Chelsea Embankment Foreshore

Royal Borough of Kensington and Chelsea

Document Information

Transport Assessment

Transport - Baseline, Construction and Development case traffic flow (AM peak hour)

Figure 13.4.5

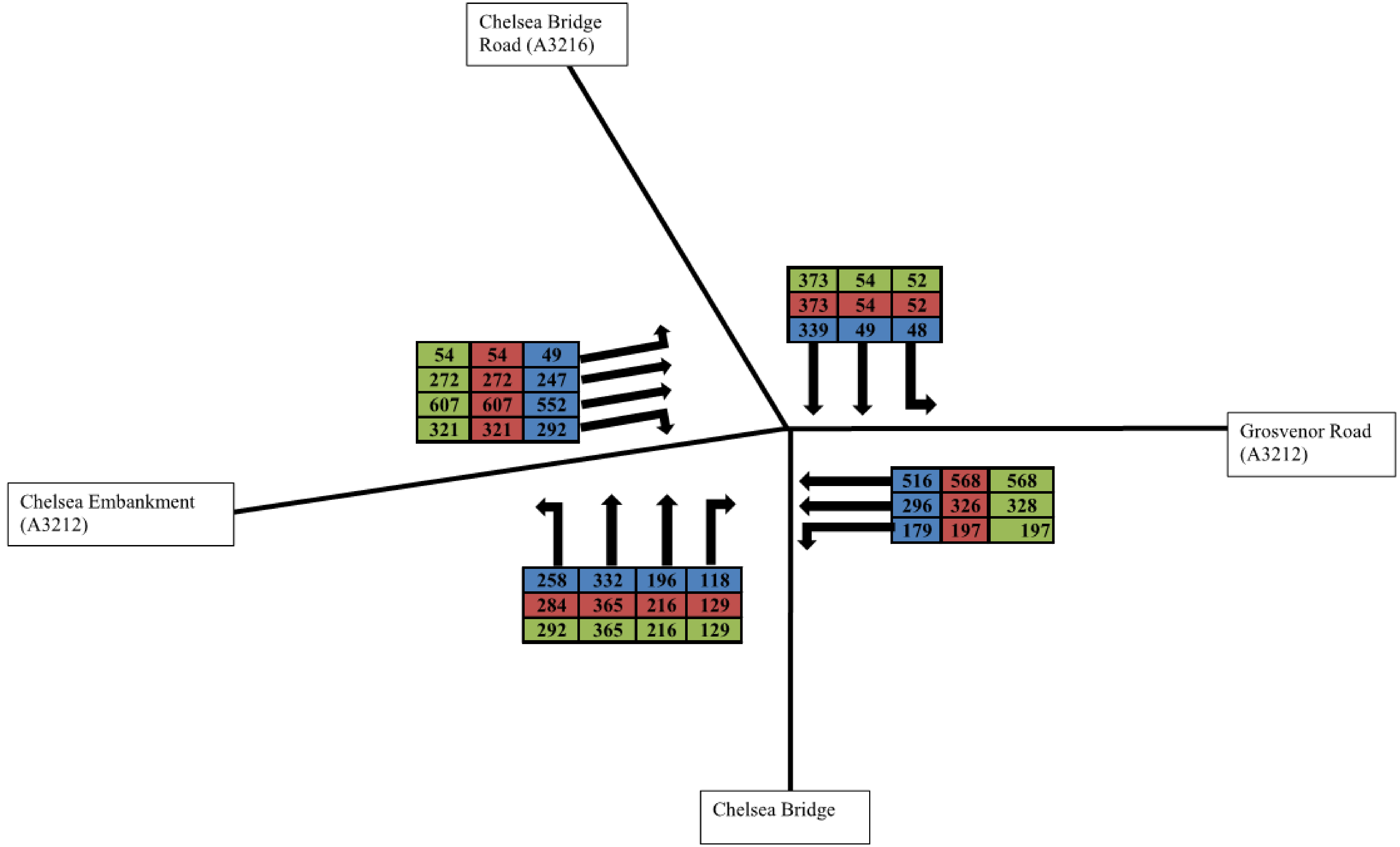
1PL03-TT-50925

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

Chelsea Embankment Foreshore

Royal Borough of Kensington and Chelsea

Document Information

Transport Assessment

Transport - Baseline, Construction and Development case traffic flow (PM peak hour)

Figure 13.4.6

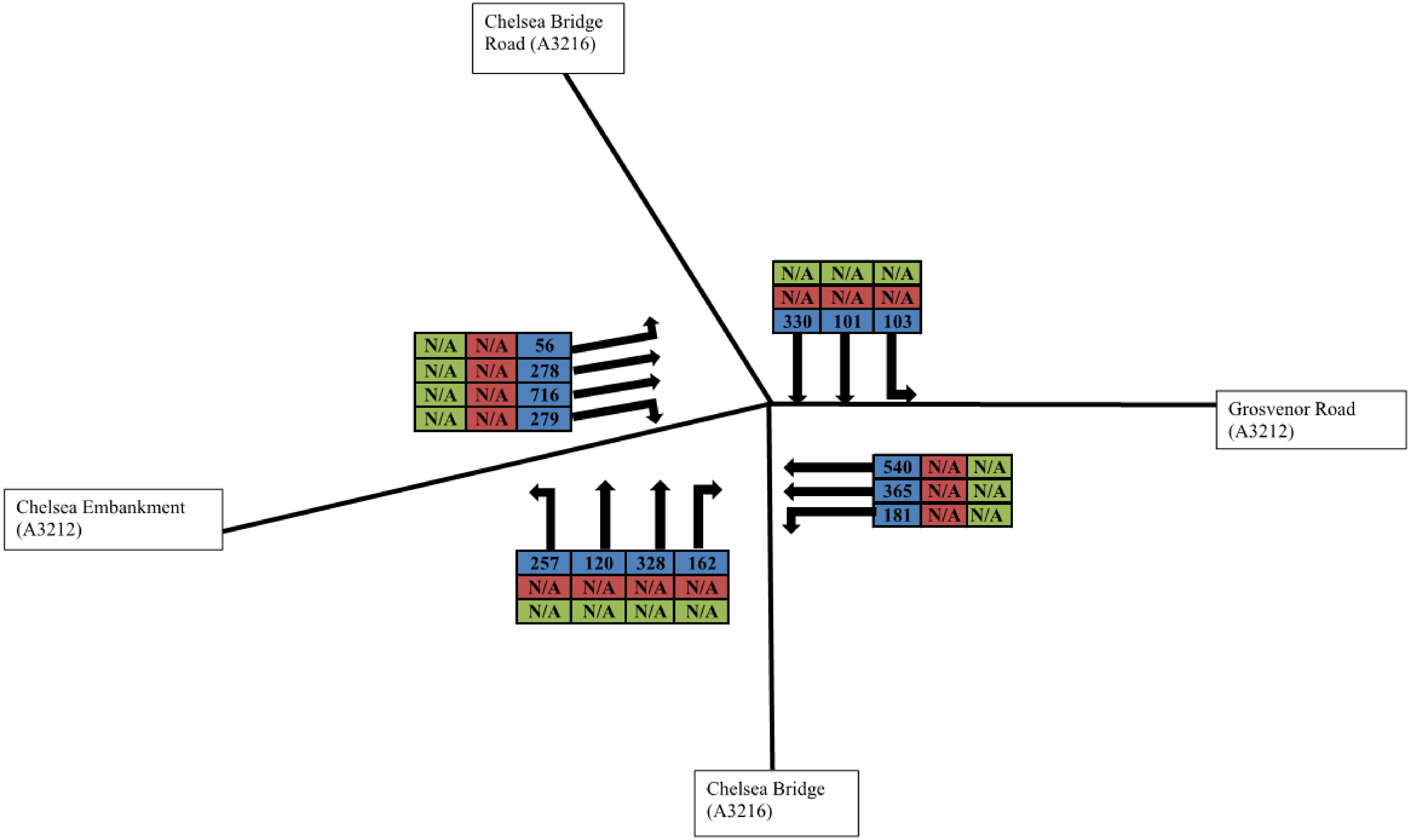
1PL03-TT-50925

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

Chelsea Embankment Foreshore

Royal Borough of Kensington and Chelsea

Document Information

Transport Assessment

Transport – TfL Baseline Traffic Flow (AM peak hour)

Figure 13.4.7

1PL03-TT-50947

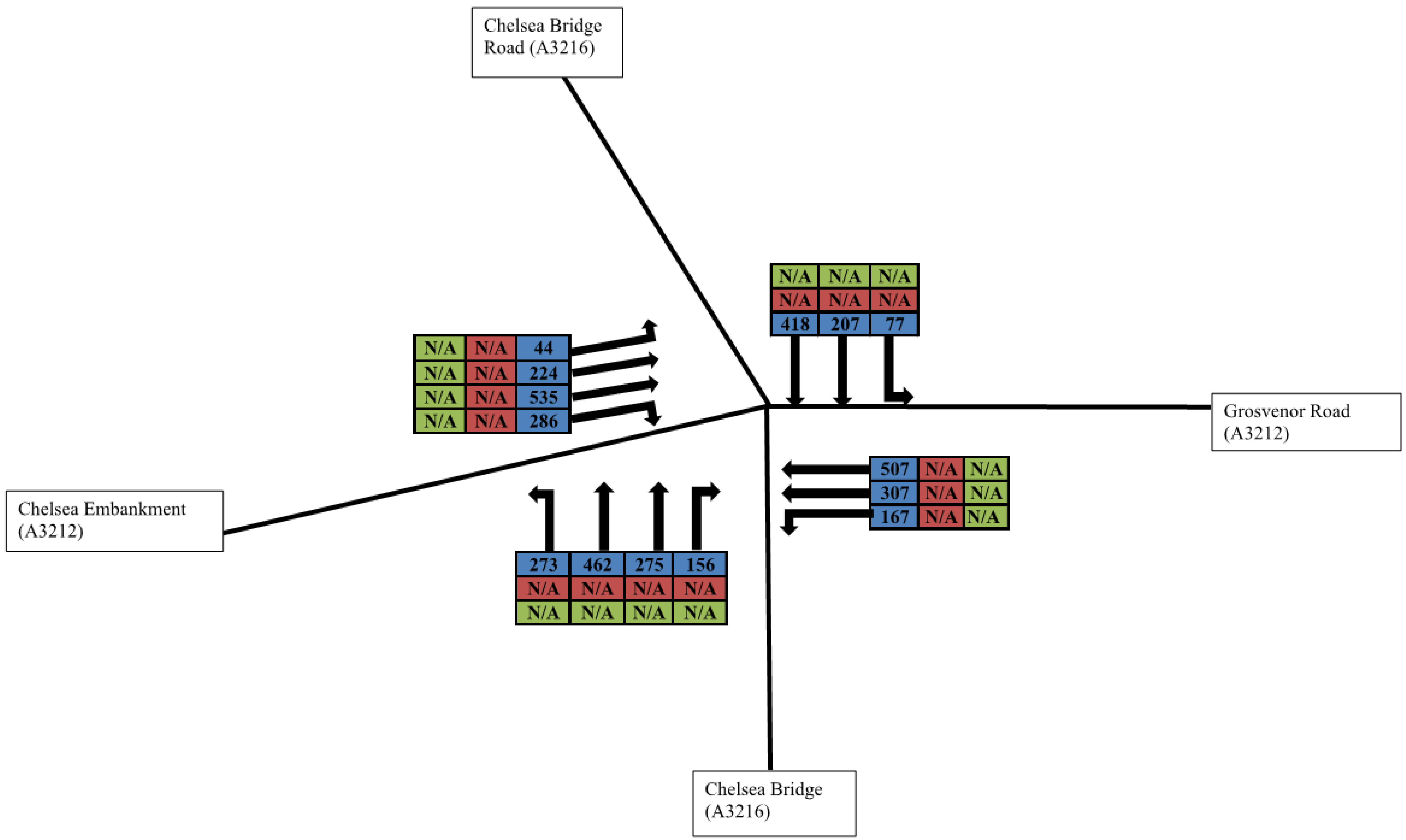
January 2013

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

Thames Water

Keyplan:



Key

- Base Traffic Flow
- Construction Base
- Development Case

FOR INFORMATION

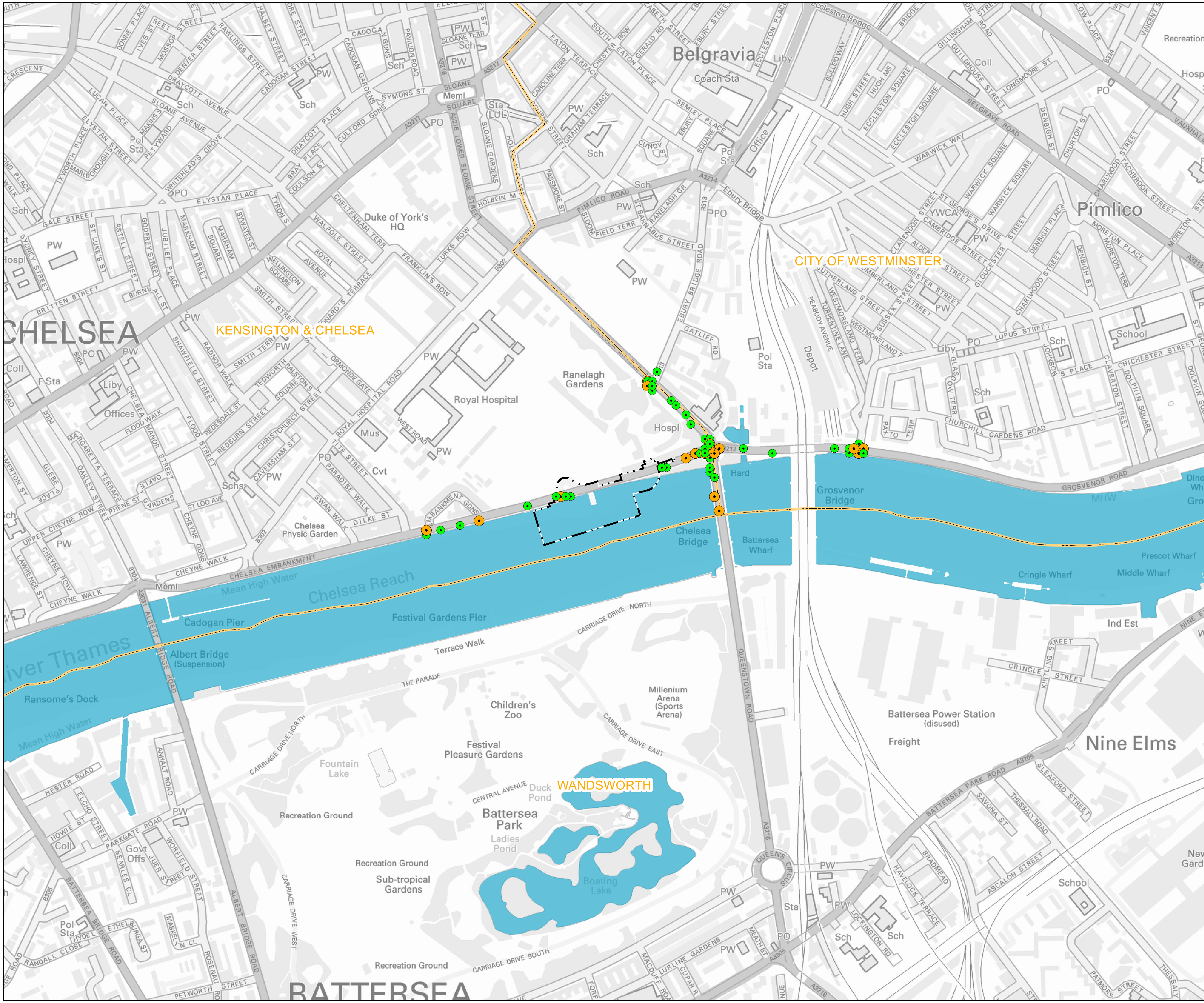
Location
Chelsea Embankment Foreshore
Royal Borough of Kensington and Chelsea

Document Information
Transport Assessment
Transport – TfL Baseline Traffic Flow (PM peak hour)
Figure 13.4.8

1PL03-TT-50953
January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water



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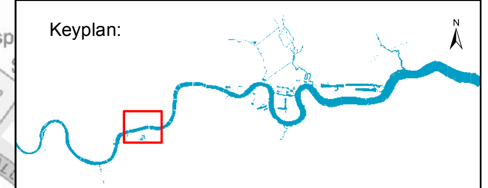
Keyplan:



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

Chelsea Embankment Foreshore

Royal Borough of Kensington and Chelsea

Document Information

Transport Assessment

Transport - accident locations

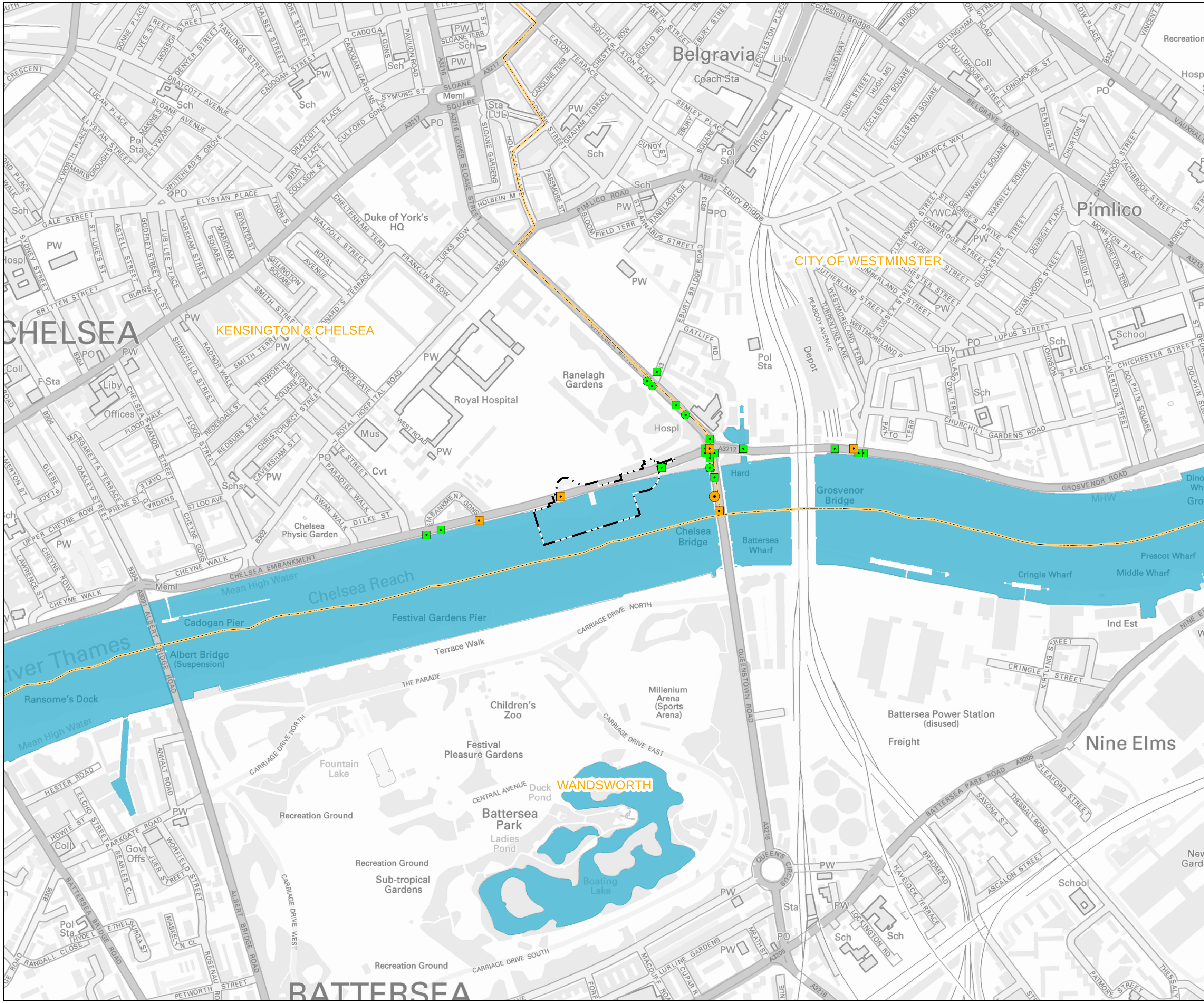
Figure 13.4.9

1PL03-TT-50746

January 2013

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Water



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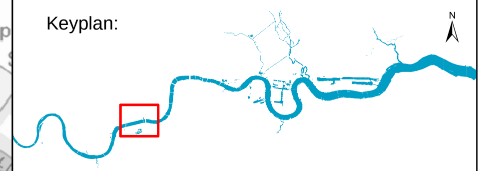
Keyplan:



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

Chelsea Embankment Foreshore

Royal Borough of Kensington and Chelsea

Document Information

Transport Assessment

Transport - pedestrian and cyclist accidents by severity

Figure 13.4.10

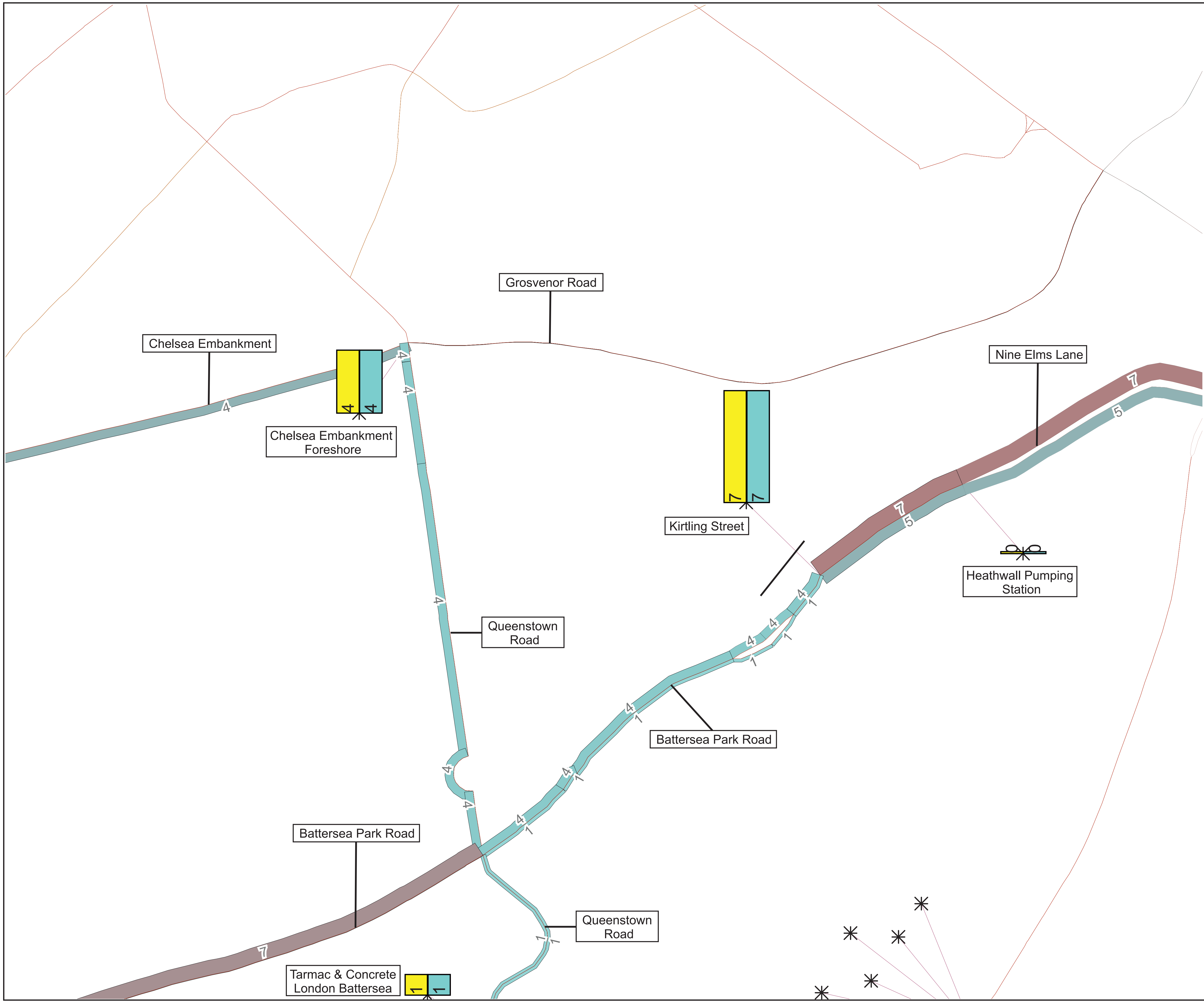
1PL03-TT-50830

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

Chelsea Embankment Foreshore
Royal Borough of Kensington & Chelsea

Document Information

Transport Assessment
Hourly Construction Lorry Movements - Site Year 3 of Construction

Figure 13.5.1

1PL03-TT-50894

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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