TRANSPORT FOR LONDON

EVERY JOURNEY MATTERS

Local History

From Anglo-Saxon times until 1965, Barking and Dagenham were both part of Essex. On 1 April 1965 Barking and Dagenham merged to form the London Borough of Barking. It was renamed the London Borough of Barking and Dagenham on 1 January 1980. The change has been revolutionary. Over the last 150 years large projects have transformed the character of the borough. The borough's population has peaked and troughed in this period reflecting:

- The expansion of the railways and underground from 1854 to 1932;
- The building of the Becontree Estate from 1921 to 1934 which housed 115,652 people;
- The rapid industrialisation of the borough from the 1920s onwards and its decline which coincided with post 2nd World War "slum" clearance and the building of large predominantly flatted Council estates such as Gascoigne, Thames View, Becontree Heath and Marks Gate; and
- More recently the second wave of in-migration in the last twenty years of people from inner London and elsewhere to the borough.

Local Vision

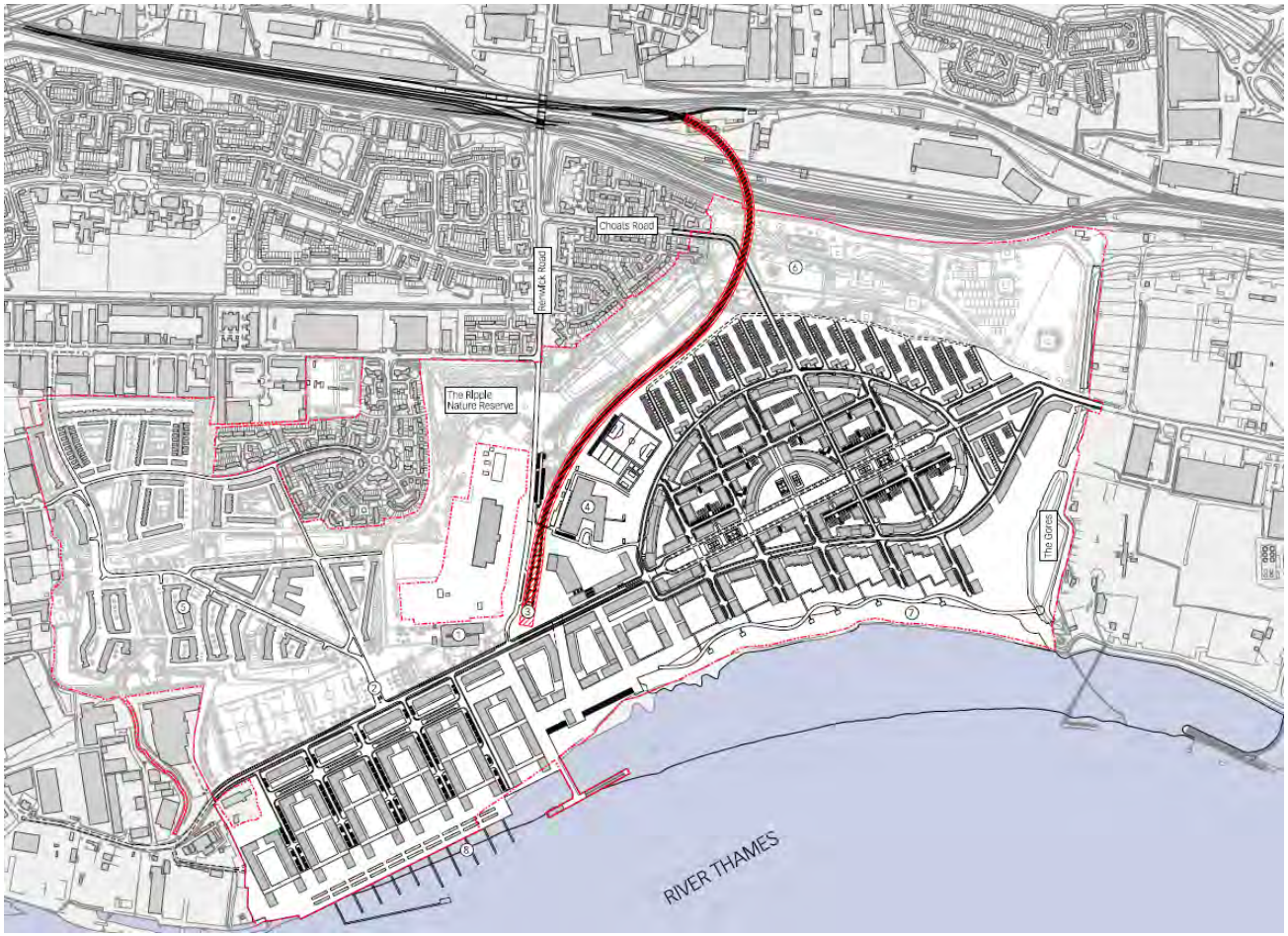
The borough has a number of growth hubs with an unrivalled opportunity to deliver a wide range of new jobs and housing across the borough. They are:

- Barking Riverside – one of the largest residential developments in the UK, 10,800 homes with superb River Thames frontage.
- Beam Park/Ford Stamping Plant – a major brownfield site with great potential for housing and commercial activity with 3,200 new homes and over 1,000 new jobs. New Beam Park Station.
- Castle Green – undergrounding the A13 and unlocking potential for 5,000 new homes around a new station on the London Overground line to Barking Riverside.

The Past - 1964

The Planned

The Future


Choats Road
Renwick Road
The Ripple Nature Reserve
The Bores
RIVER THAMES

Scope

- Barking Riverside is a key development area within the London Riverside Opportunity Area and BRE will act as a catalyst for its development
- The Barking Riverside development is London's single largest housing development opportunity with outline planning permission for 10,800 homes and 65,600 sq. m of commercial, retail and community facilities. This level of development cannot happen sustainably without the provision of appropriate transport infrastructure
- The Barking Riverside Extension is a £260m Project Programme for a 4.5km stretch of track that will extend the existing Gospel Oak to Barking line through to Barking Riverside and a new terminal station
- This extension would deliver London Overground services to a new station at the heart of the Barking Riverside community, with construction beginning in Autumn 2018 and train services commencing in 2021.
- The delivery of the extension will unlock a wide range of benefits for people in the local area and beyond, including almost 11,000 new homes, many of which are affordable, along with a new school and healthcare facilities and the construction of a new district centre with commercial and leisure facilities.
- The service will be 4-car train service at 15 minute intervals to deliver a 4 train per hour service. Arriva Rail Ltd will operate the services on behalf of TfL.

Key Stakeholders

- Network Rail
- SFN
- BRL
- LBBD
- DB Cargo
- Legal & General
- HS1
- Lineside neighbours – Land/Boundary fencing
- New Schools
- TOC's/FOC's

Build Strategy

- Build Only Contract
- RfL provide a Warranted GRIP5 Design
- Underwritten by Designers required to produce a Design that is "Fit for Purpose' instead of the norm of 'Reasonable Skill and Care'

- GRIP 6-8 Contractor will have some Design to do
- Temporary Works
- SSI Data
- Staged OLE changes
- Staged Signalling Designs
- Collaborate with NR TENE and NR Comms Field Services on aspects of the FTN, FTN-X and GSMR works.

- London Overground to Deliver under Scheme of Delegated Authority.

Scope of works

Existing infrastructure east of Barking Station

- Reinstatement of abandoned Down Goods line as new Up Riverside
- 3km of new ballasted track
- 13 renewed 4 track OLE portals
- 8 new 5 track or more OLE portals
- 62 new simple OLE structures
- 3 OLE Neutral section structures renewed
- 102 OLE piled foundations
- New 40mph crossover Up Goods-Up Riverside
- New 50mph connection Down Tilbury to Down Riverside
- Remodelled Ripple Lane West Sidings 10 renewed point ends
- 1.0 Km of associated ballasted track requiring formation remediation.
- New signaled routes with associated TPWS and AWS infrastructure

Scope of works

New North Viaduct over railway lands

- 300m long approach span founded on ground slab
  - 240no 450mm dia 12m deep piles
- 50m long retained fill ramp leading to;
  - “E” type steel underbridge over Through Goods Line
  - 11no 40m long Steel and concrete composite bridge spans
  - “E” type steel underbridge at Choats Road
  - 43no 25m long concrete viaduct spans
  - 560no 1.25m diameter piles to 30-40m depth
  - 20 1.4m diameter piles to form new box over Up Tilbury
  - 9no 1.5m diameter pile to 40m depth between HS1 running tunnels
- 1.5Km of twin track slab track
- 52no Twin track OLE portals
- 3km of new Series 2 OLE

Network Outputs

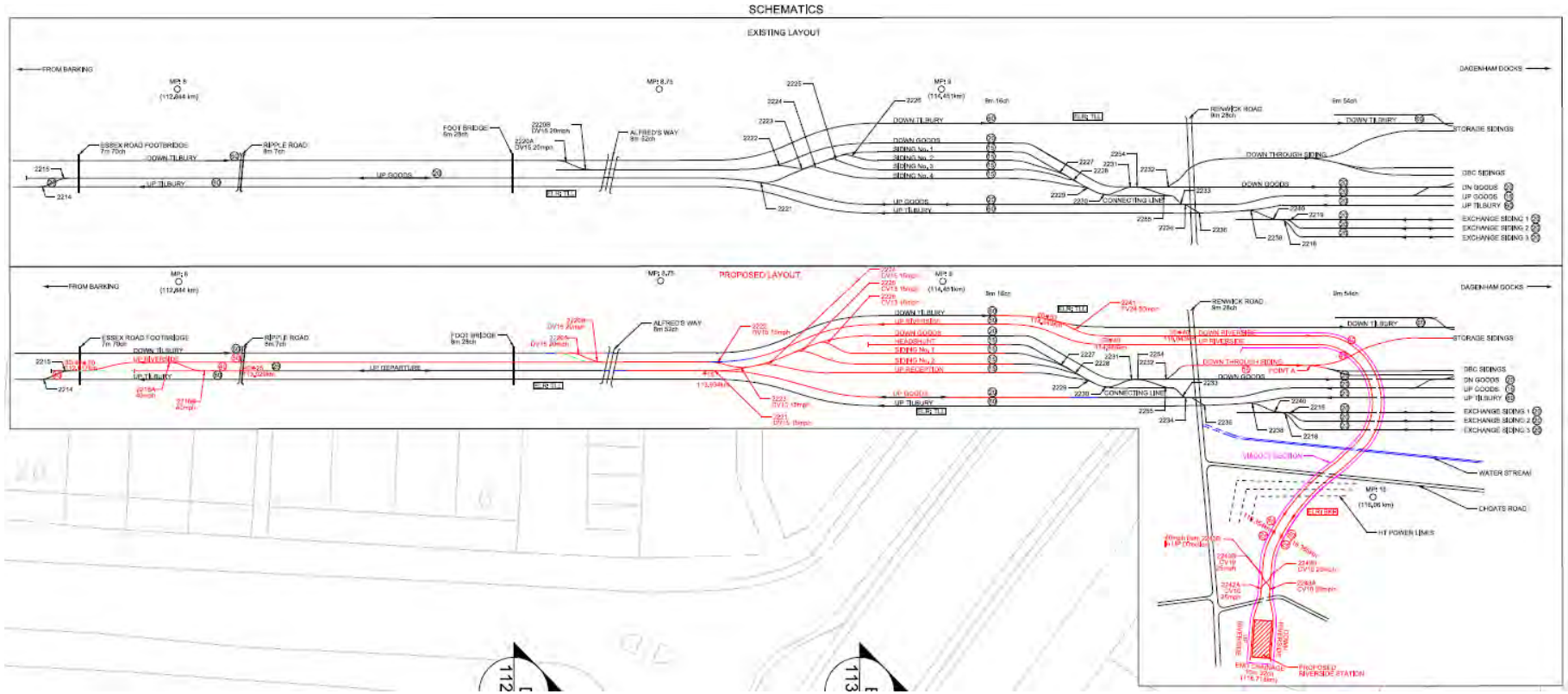
- New Infrastructure that supports
  - 4 TPH Barking Riverside to Gospel Oak
  - C2C future service requirements
    - This and 4TPH to Gospel Oak by traction power supply improvements to the area
  - Introduction of Beam Park Station
  - GB2 Gauge for HS1 Freight in all Ripple Lane sidings
  - 2 tph electrically hauled freight in peaks.

- Does not provide
  - Fully upgraded 25KV feeder station at Barking due to incoming cables needing renewal by UKPN


Thames
View School
Playing Field
River Roding
National Trust
Eastbury Manor House
Greatfields
Park
Barking Town Hall
Google
Google
51°32'33"N 0°04'28"E 728 m


The Gores
The Gores
Barking Power Station
The Ripple
Nature Reserve
Newlands Park
Thames
View School
Playing Field
Google
Google
51°32'12"N 0°05'42"E 727 m

On Network Alterations



Design Philosophy

K.I.S.S.

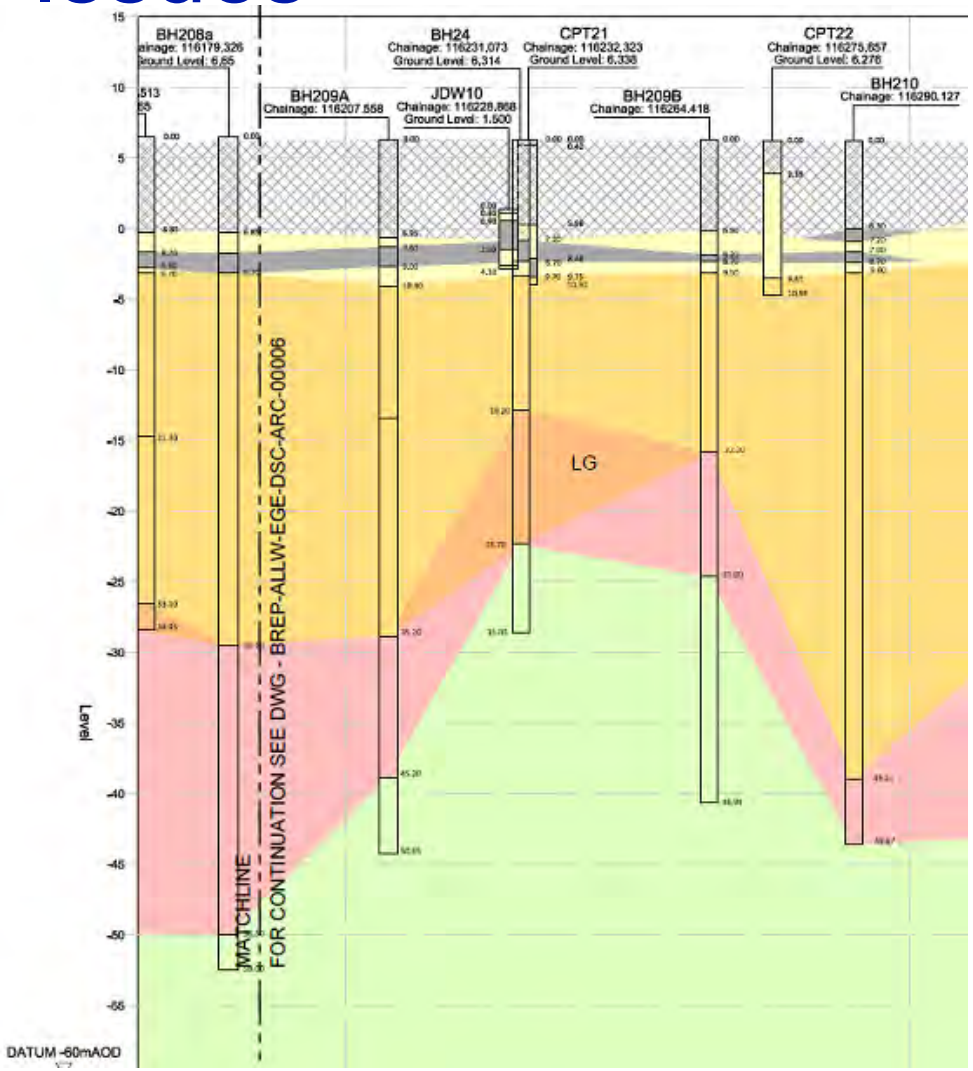
Modularise as much as possible e.g.

- Decided early on to standardise on 610mm OLEMI tubular piles for all OLE structures, later expanded to include all signal structures to avoid need for massive gravity side bearing foundations in poor ground.
- Adopt NR Standard Design E and U decks for bridge structures, although we do max out the U bridges to 40m
- Adopt Y8 precast concrete beams for concrete viaduct, and also use them for the station construction same size and moduli, just different lengths.
- Modular viaduct parapet units with standard ‘blisters’ for OLE structures which can be expanded to also form LOC and TEH base locations.

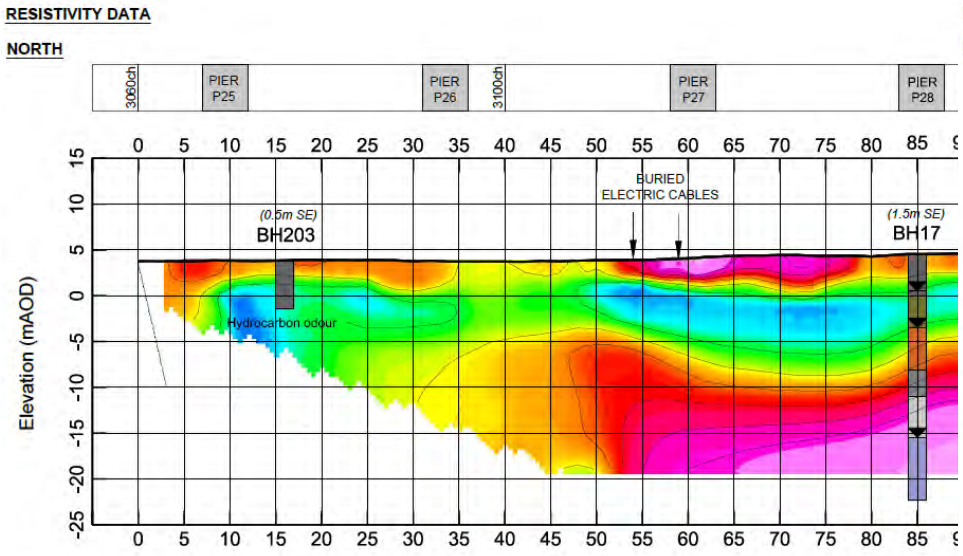
Geo-Technical Issues

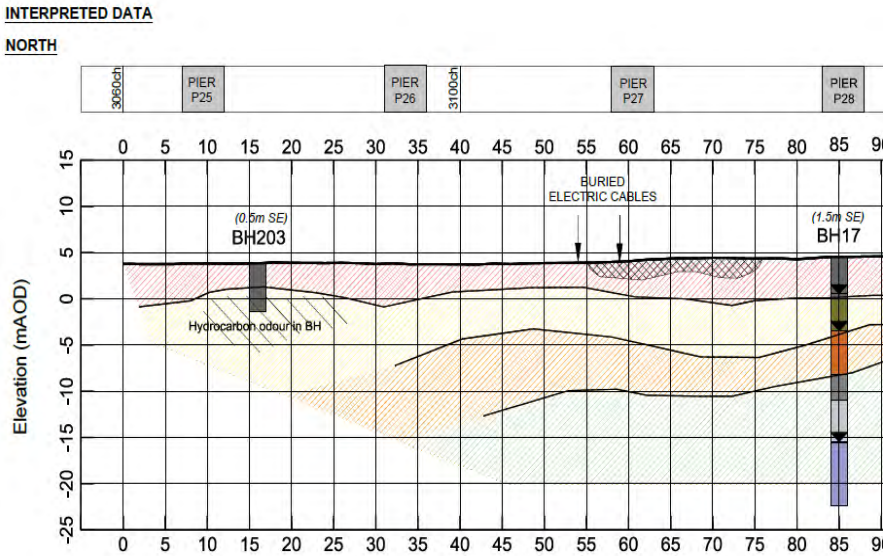
Extremely Variable ground conditions, especially on the Brown field site;

- Alluvial deposits
- Peat to 5m depth in places
- High water table, to 1m BGL
- Piles to a depth of 29m minimum to get good end bearing pressures
- Piles oversized due to ineffective upper length and shear forces.
- Faults in the geology.



Geo-Technical Issues





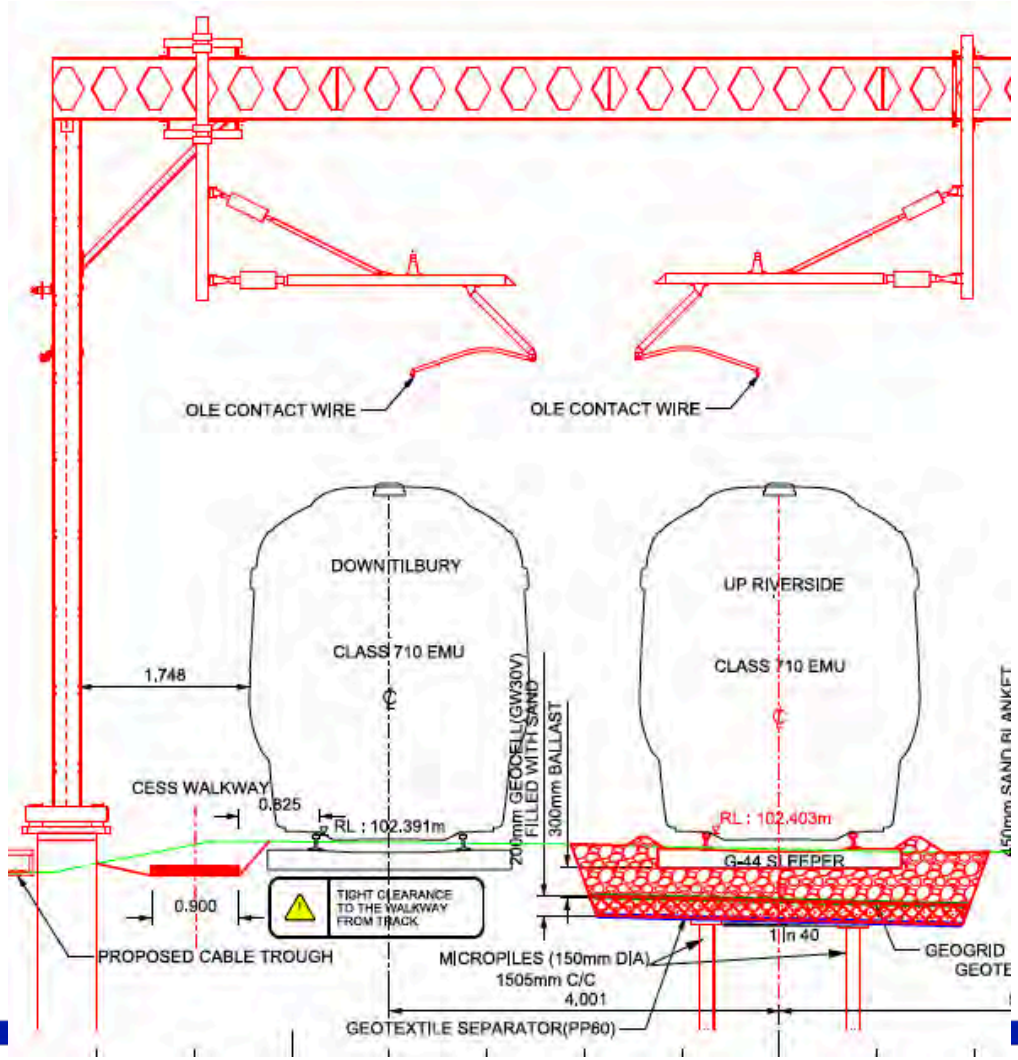
Formation and Trackbed

Compliant to TRK4239

Use of Geo-cells and deep capping layers being optimised

Considering Steel Sleepers for sidings as new build – less dead load. Has worked well on the Fens.

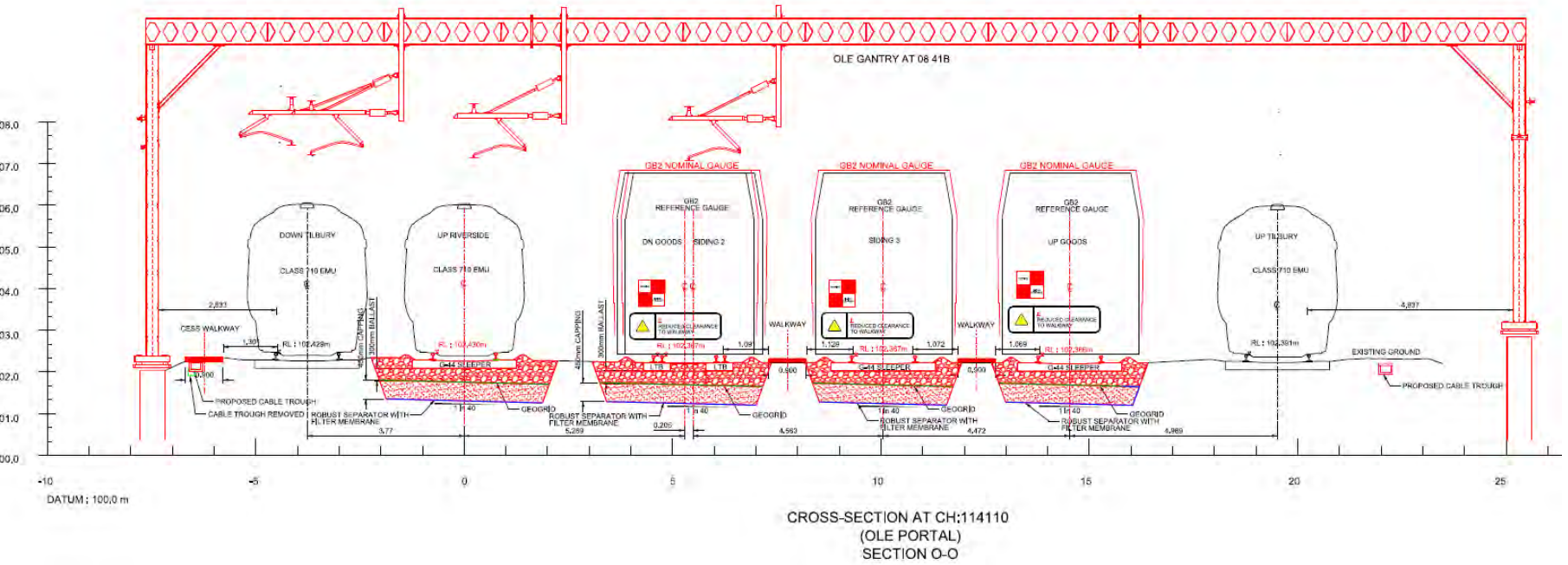
Extensive use of micro-piling for some 400m of new Up and down Riverside.



Gauging

- Gauging as per normal using Clearoute 2 for passenger running lines to agreed vehicle library
- Ripple Lane siding 1 currently cleared to GB2 gauge.
- All alterations to any siding and this includes the Up Goods and Departure Line to also be to GB2 gauge as these are currently foul.
- Use of Defined gauging as required by BS-EN 5273 is therefore required and has been undertaken.
- Diversionary Route for freight services require gauge clearance at Upminster Platform 1 as foul to W6a, W7, W8, W9 and W10 gauges.

Typical Cross-Section Through Sidings



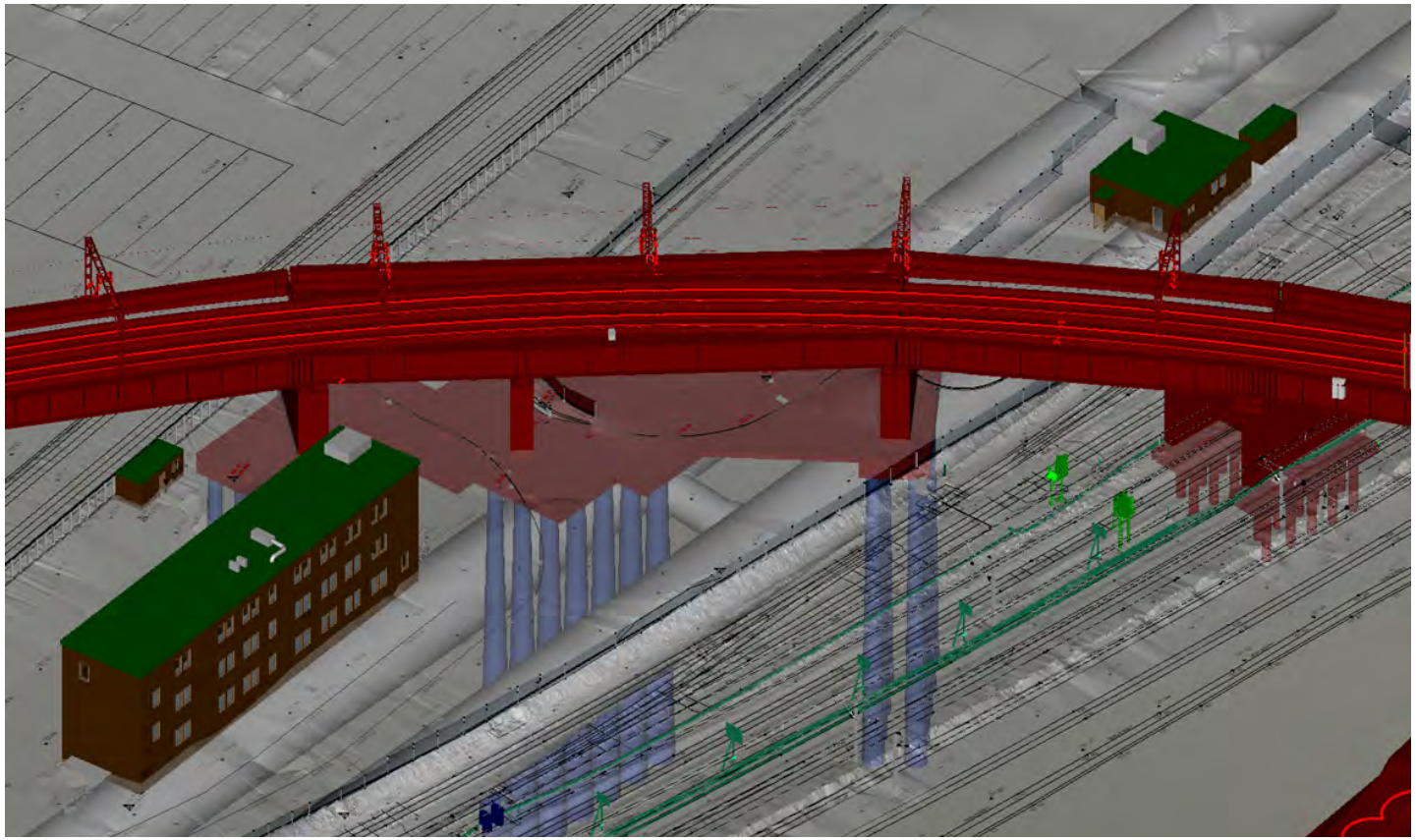
CROSS-SECTION AT CH;114110
(OLE PORTAL)
SECTION O-O

BARKING RIVERSIDE

OVERGROUND

EVERY JOURNEY MATTERS

Challenges – HS1 Running Tunnels



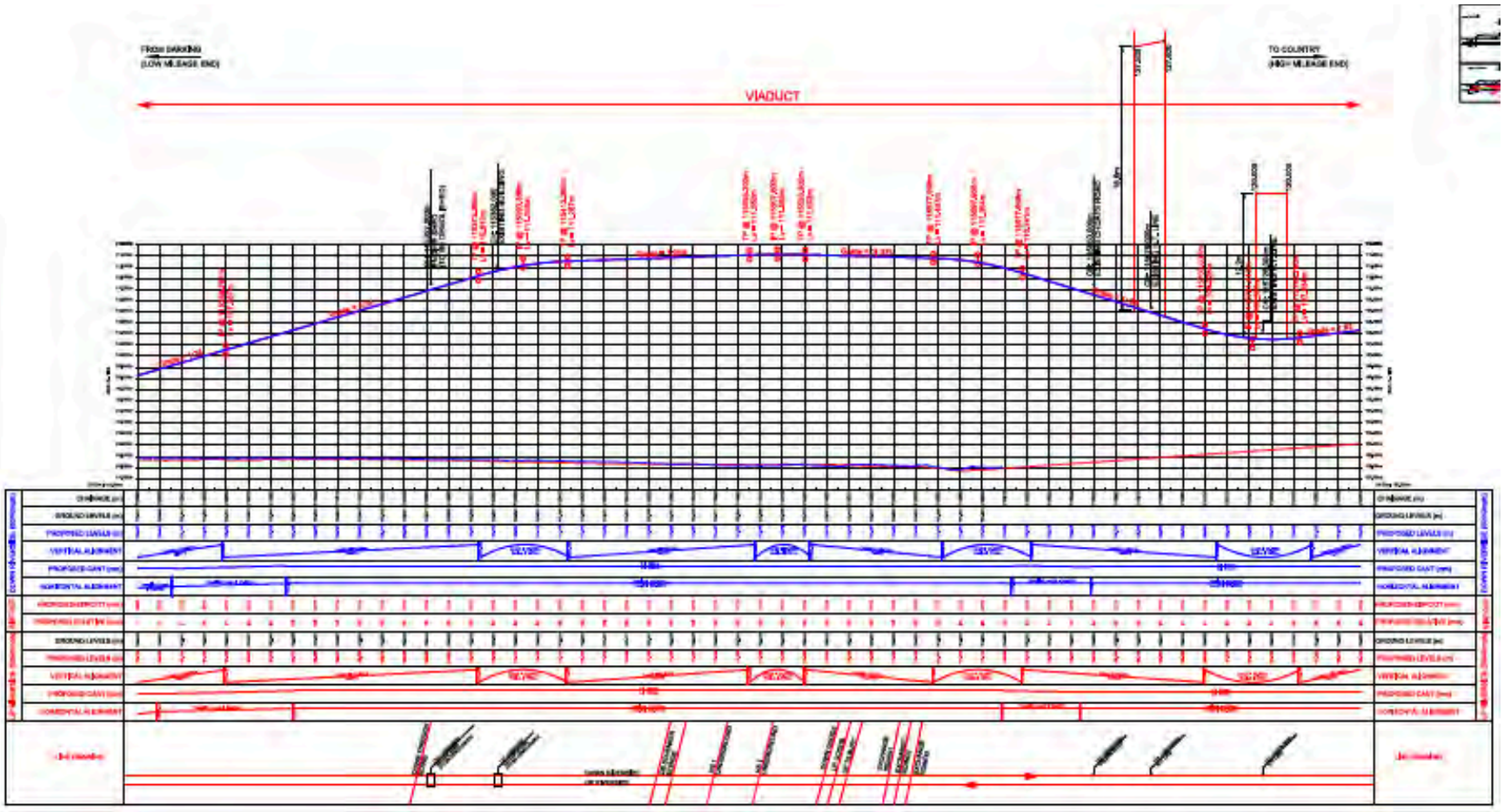
HS1 Details

- Each HS1 tunnel has a 3m surrounding annulus – “No-Go’ zone
- Approx. 3m between annuli of each tunnel as a clear envelope for construction
- BRE supporting structure requires 10 No 1.5m dia piles to a depth of 40m between the HS1 tunnels
- Piling to be carried out under liquid support – Bentonite
- Piling to be carried out whilst HS1 in operation at linespeed with no Cover-Speed permitted
- Surveyed and scanned HS1 tunnels to locate them to an accuracy of +/-20mm in the federated BIM model
- This required an unique grid transformation from the CTRL grid to OSGB36 and then into LSG2007 the Engineering Grid for the Project. Thanks to UCL for this!
- Project has developed a tunnel monitoring strategy and plan and will be using tri-axicial tilt sensors to monitor tunnel and track deformation during works.

BARKING RIVERSIDE

Challenges – Choats Road & UHV TN Lines

Choats Road & UHV TN Lines, Vert Profile

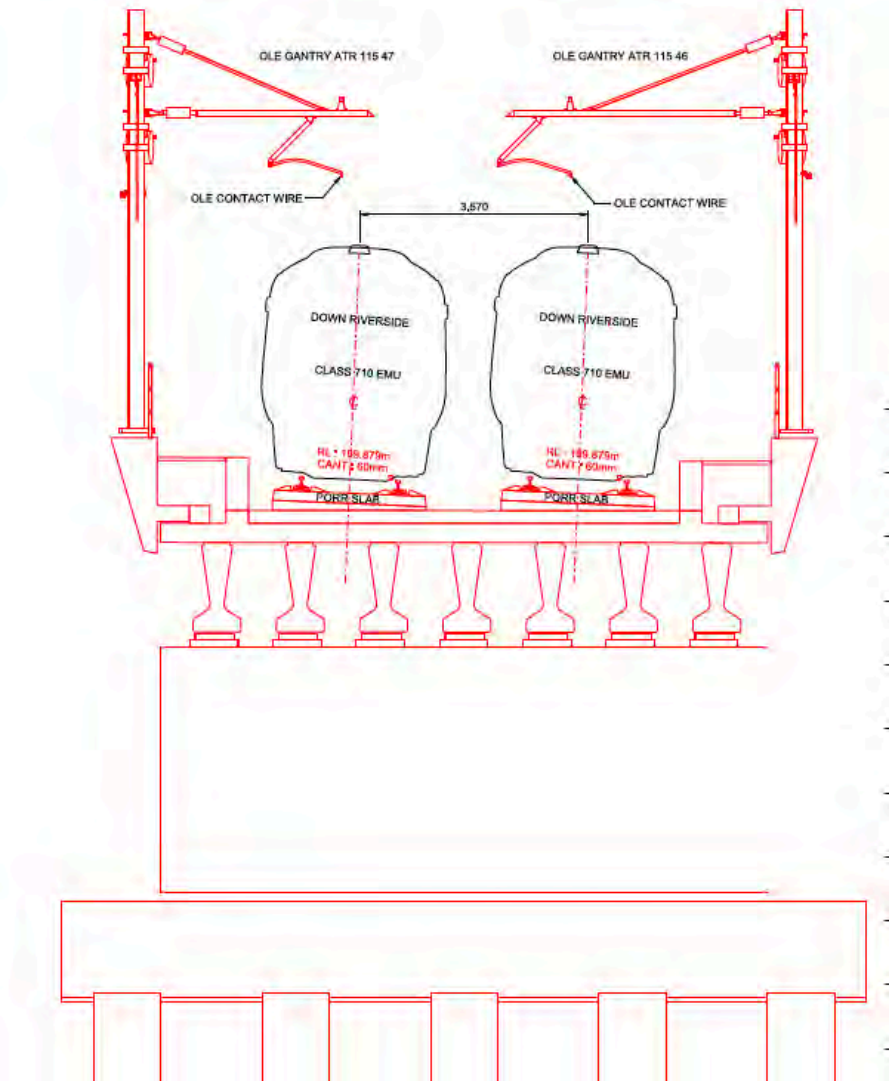


Scope of works – Viaduct

Viaduct

- 1.5km of concrete/steel viaduct & composite bridge spans
- 1.5Km of twin track slab track
- 52no Twin track OLE portals
- Barking Riverside Station

Viaduct Construction



Ramp and Viaduct Track Form

Challenges
1 in 40 gradient cresting to a 225m radius curve, with CWR for noise limitation
Steep gradient to get over HS1 Exchange sidings, over Choats Road then under UHV transmission lines before rising to give permeability beneath viaduct.

225m radius curve modelled using Vampire and Dynamis to determine best track parameters for performance – especially Tγ.
Modelled

- Linespeed of 40mph with 10mph over/underspeed
- With and without check rails
- With and without gauge widening
- Tare and Crush laden
- A theoretically overly torsionally stiff primary suspension to produce higher angles of attack

Modelling Outputs Y/Q

Crossrail PMS Laden V4_2							
Speed	**Gauge**	**Case**	**Applied Cant**	**Checked Yes/No**	**Max Y/Q Limit = 1.0**	**Max ΔQ/Q Limit = 0.6**	**Max. Wheel Lift Limit = 6mm**
40mph (Distance: 300m – 500m)	**1435mm**	A	100mm	Yes	0.04	0.30	0.67
		B	100mm	No	0.37	0.31	0.88
		C	50mm	Yes	0.09	0.38	0.69
		D	50mm	No	0.38	0.40	0.88
	1438mm	A	100mm	Yes	0.03	0.30	0.39
		B	100mm	No	0.37	0.31	0.88
		C	50mm	Yes	0.08	0.38	0.40
		D	50mm	No	0.37	0.40	0.88
	1441mm	A	100mm	Yes	0.03	0.31	0.14
		B	100mm	No	0.37	0.31	0.88
		C	50mm	Yes	0.07	0.38	0.15
		D	50mm	No	0.37	0.40	0.88

Table 2: Derailment Indicators – Peak Values – With and Without Check Rail – Speed 40mph

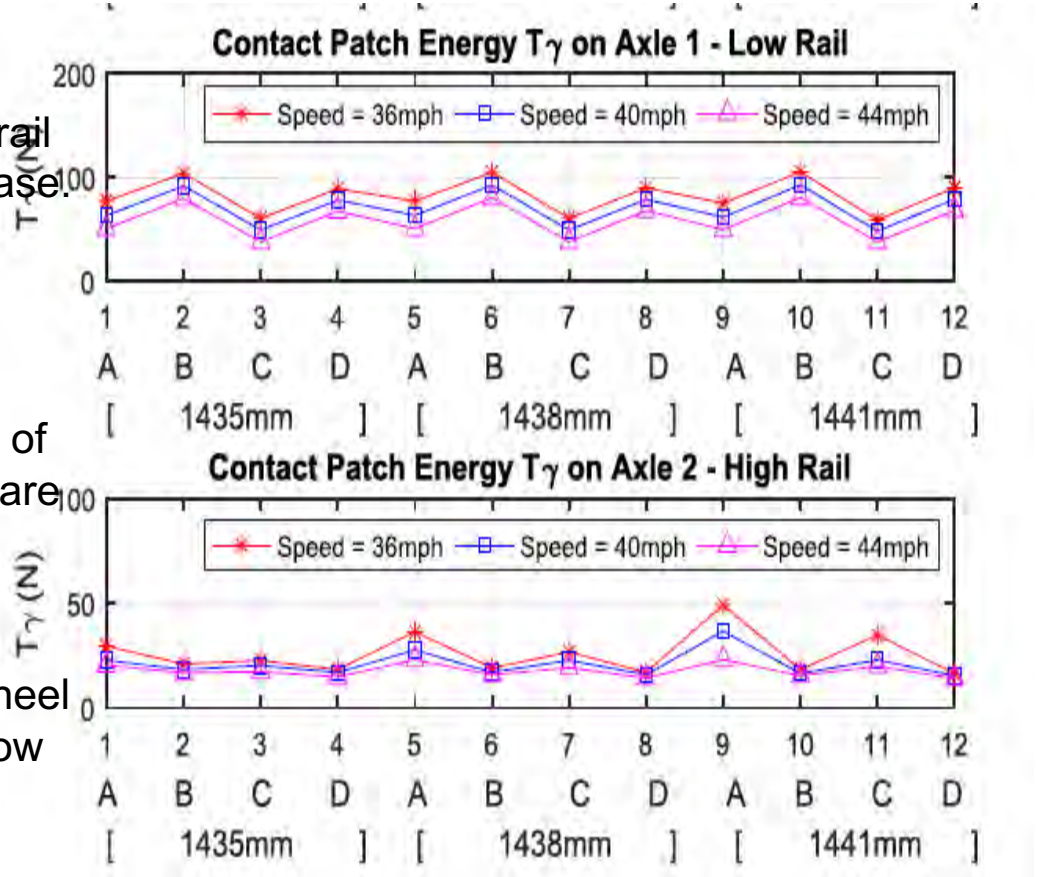
With variation in track gauge, applied cant and vehicle speed, the un-checked and checked cases results in only marginal changes in Y/Q and wheel lift.

Modelling Outputs Tγ

Tγ values on the tread contacts of the high rail were found to be lower in the un-checked case. This is a result of the loads being shared between the tread and flange contacts.

On the low rail the converse is true. In the unchecked case the tread contact reacts all of the low rail forces and hence the Tγ values are higher in this configuration.

Hence when the check rail is present, a proportion of the Tγ is apportioned to the wheel flangeback and check rail and thereby the low rail tread component is reduced.



Recommendations

- For the Crush Laden vehicle the peak Y/Q value was found to be 0.37 relative to the limit value of 1.0. This resulted in a peak wheel lift of 0.8mm relative to a limit value of 6mm. As would be expected these peak values are predicted for the high rail flanging wheel of the unchecked case.

- The additional simulations for the Class 345 in the Tare condition and modified Tare condition (higher plan-view stiffness) resulted in only a marginal increase in the maximum recorded Y/Q ratio to 0.42, with a corresponding wheel lift of 0.88mm. Both values remaining significantly below the limit levels.

- Under the conditions simulated a check rail is not required to mitigate against flange climb derailment risk as indicators remain consistently low in an un-checked state. However fitment of a check rail would offer increased derailment protection/containment in response to unforeseen events.

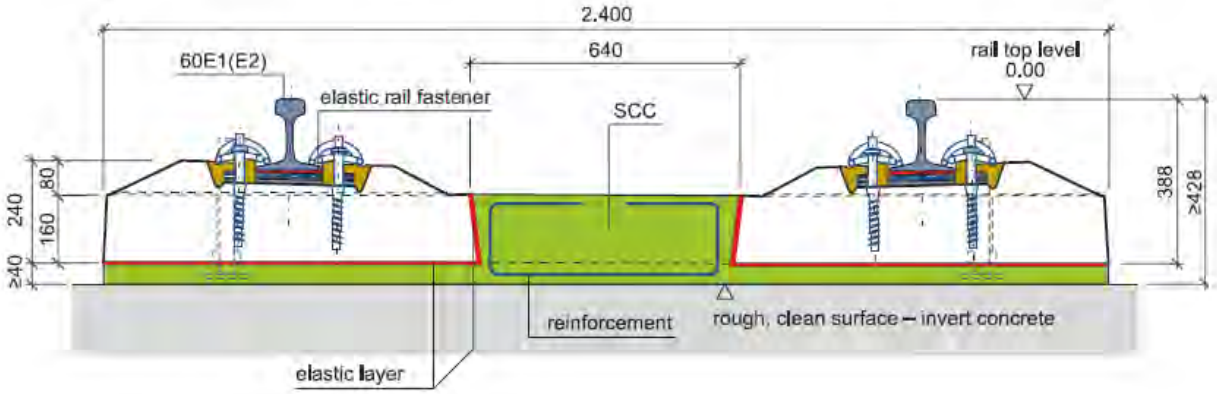
Recommendations

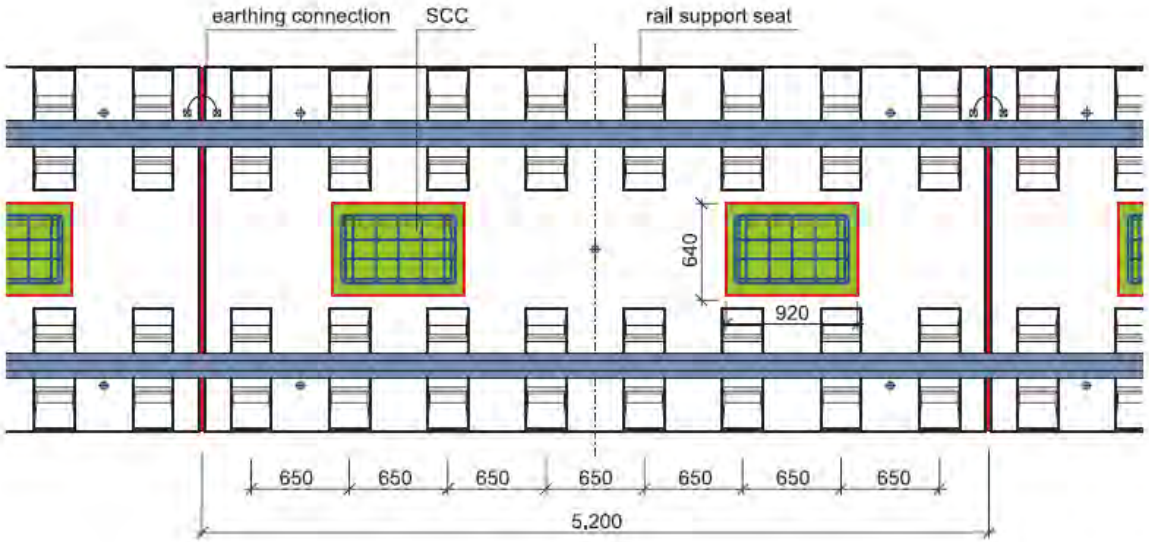
With regards to gauge widening there is no significant net benefit found and hence it is recommended that no gauge widening is applied.

As all cases studied were at a high cant deficiency (>80mm) there was not a significant additional benefit demonstrated in reducing applied cant (increasing deficiency) from the proposed design value of 100mm down to 50mm. And hence from a passenger comfort perspective it is recommended the applied cant remains at 100mm.

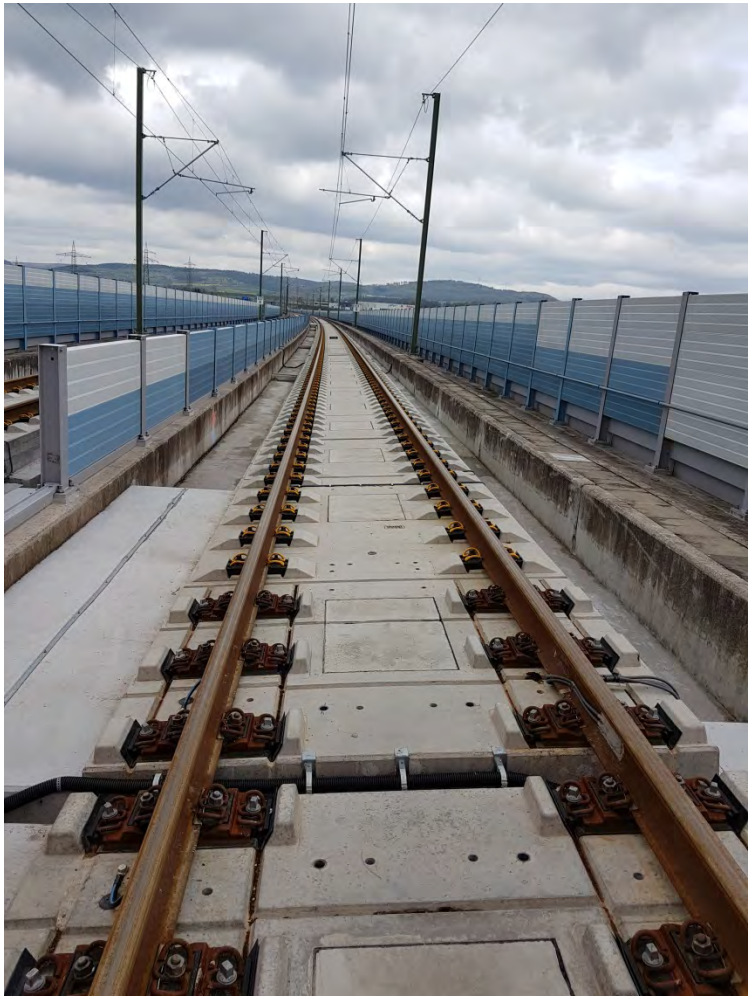
It is noted that a number of the applied cant levels and speeds studied result in excessive cant deficiencies (122.6mm)

Viaduct Track Form



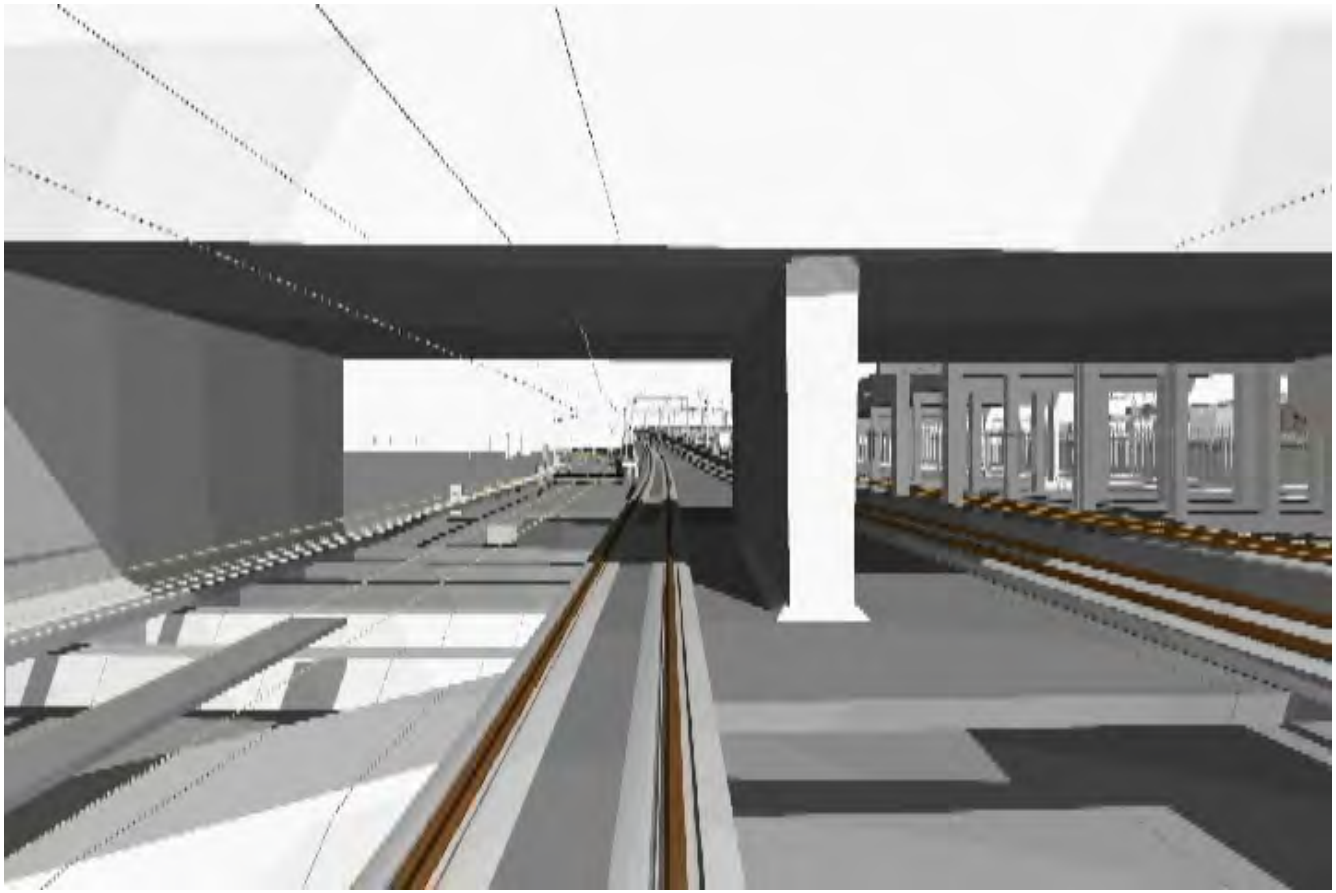


Viaduct Track Form



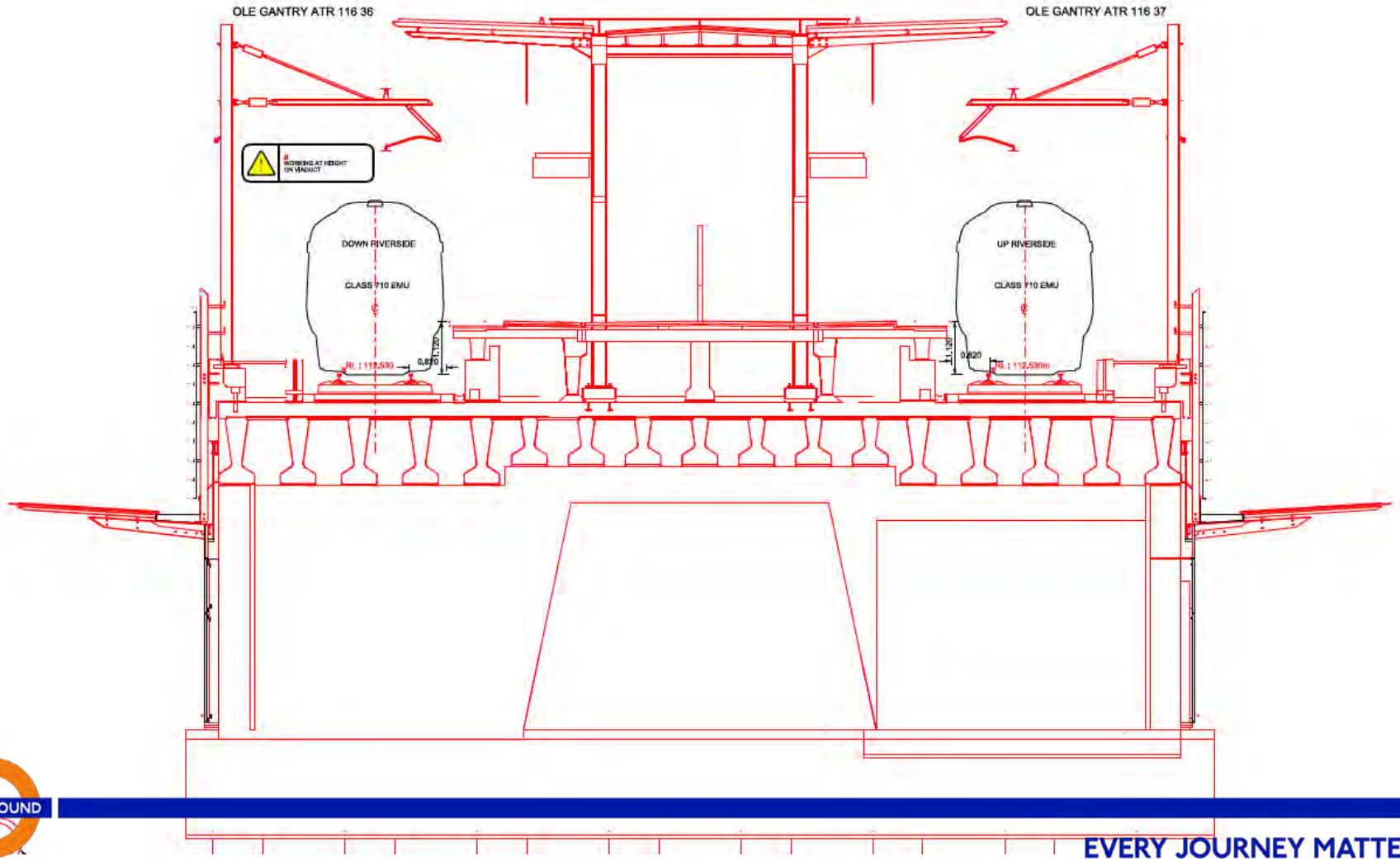
Track Form S&C

Viaduct Fly Through



Station Visualisation

Barking Riverside Station – Cross-Section



Riverside Station

Riverside Station

Riverside Station

BARKING RIVERSIDE

Is the Barking Riverside Extension the End of the Story?

Well not it is not, BRE and the access afforded to build the main scheme presents a Generational opportunity to deliver a tranche of additional works at least first cost.

These are;

- Castle Green Station
- Ripple Lane Sidings conversion to Ripple Lane Nodal yard
- Riverside station has active provision for 5 car services and passive for 6 car.

Castle Green Station

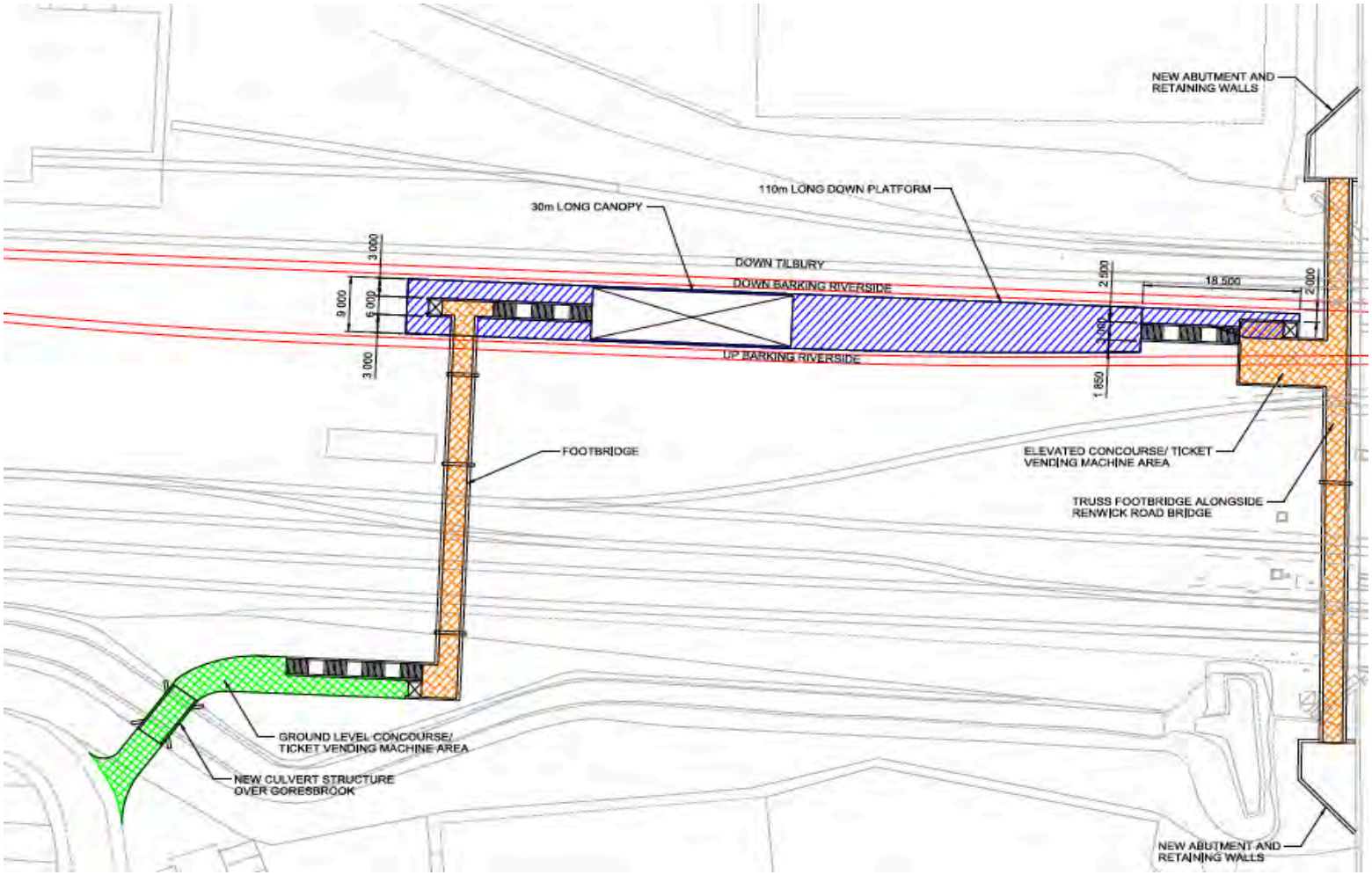
Transport for London are advancing plans to underground the A13 west of Lodge Avenue to just west of Gale Street.

The London Overground extension also includes the potential for a new station at Thames View East. The business case for the undergrounding will demand a review of the industrial land allocation at Rippleside .

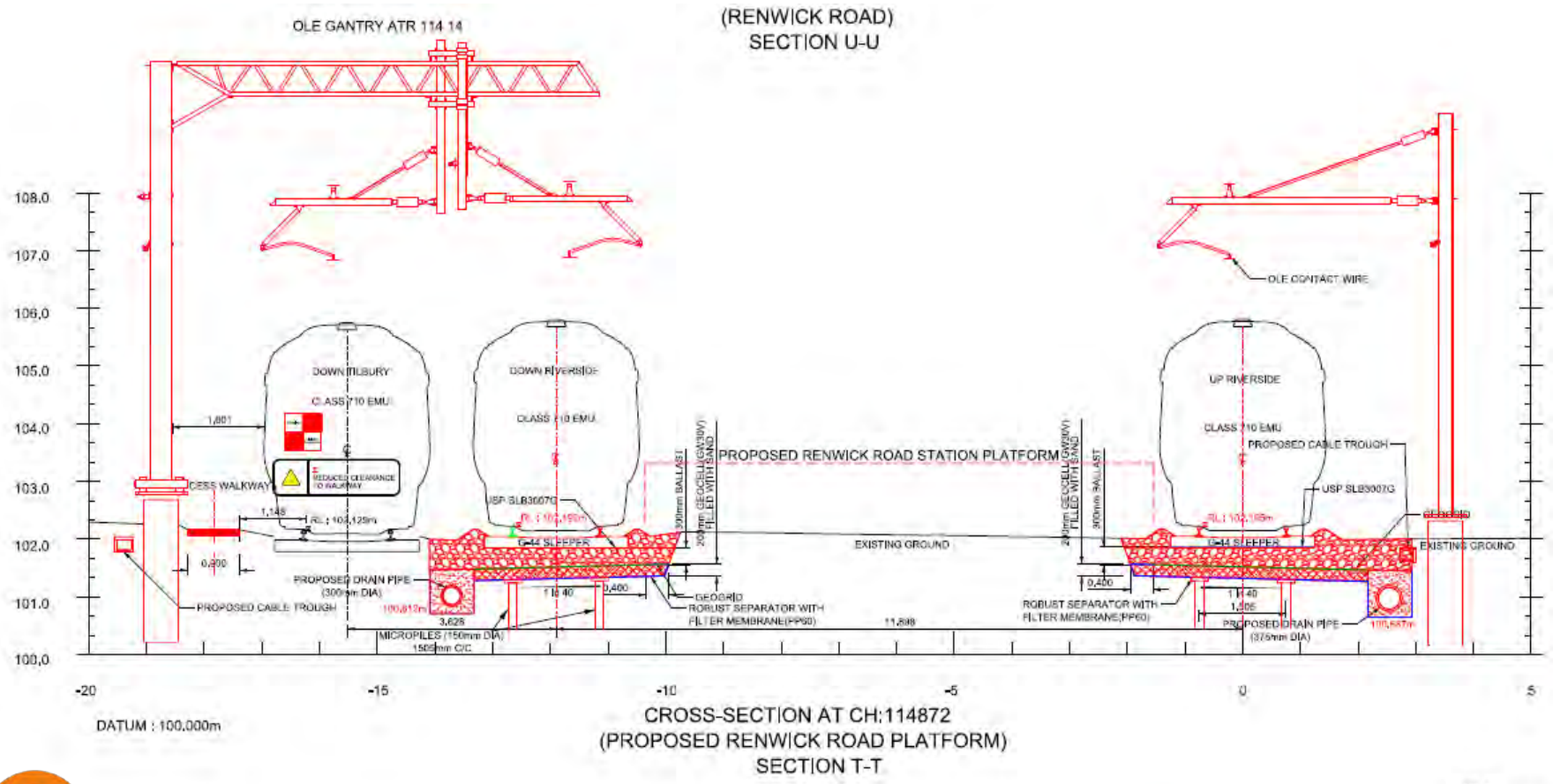
The new Overground station would allow a relatively high density of housing and complimentary uses to be achieved. The focal point for the new community will be the park, Castle Green.
The green open space will perform an important function, uniting the existing community on Goresbrook Road with the new homes to the south of the submerged A13. Undergrounding the A13 would remove the severance it causes and improve air quality. Thames View and Barking Riverside would be less isolated still if they were not also separated from the residential areas to the north and Castle Green by industry.

Castle Green Station

Castle Green Station



Castle Green Station – Passive Provision



Castle Green Station Passive Provision

Thinking ahead at AiP has some benefits!

- Up and Down alignments on the new BKR designed to accommodate a 9m wide island platform 106m
- Researched 5 different options with associated timetabling implications as part of the TWAO process
- Drainage designed to avoid platform footprint
- Signals sighted as if station present
- OLE designed such that the requirements of GL/RT1210 are met with no alterations required in the future in respect of clearances as per BS-EN50122 -1.
- Track geometry on approach on the Up had had cant removed to run at pure deficiency so that future low rail deformation is avoided when trains at lower speeds due to future braking.
- Concept Design envisages lightweight FRP construction to minimise requirements for foundations and use of heavy lifting equipment.

Ripple Lane Nodal Yard

Working with the Strategic Freight Network during the TWAO development phase we identified the potential to expand the old Ripple Lane sidings to a new Nodal Freight yard capable of holding at least 4 775m long freights and one 700m long freight.

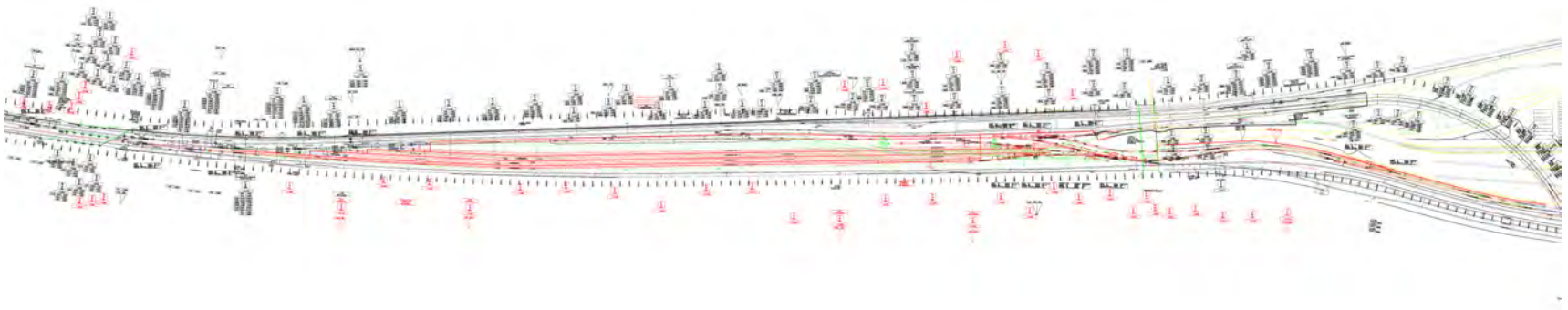
Benefits;

- Current sidings too short for most consists that run on the TLL so hardly used
- Freight paths to WCML and GWML will be constrained with the advent of Crossrail meaning all service will have to use the Gospel Oak to Barking Line
- The GOB is at capacity for passenger and freight paths. Longer freights double availability
- Stacking and flighting freights in the shoulder peaks enables more passenger service to run on the North London Lines, up to 10 tph from the current 8 tph.
- CBR of over 7:1

What have we done about this?

- Ripple Lane London End S&C which needed to be renewed anyway for BRE located as far West as possible to maximise the foot print.
- Developed a new follow on AiP as if BRE has been and can be varied in to our Delivery works.

Ripple Lane Nodal Yard



Works to Date

Works to Date

With Thanks To

- Paul Mountford – Arcadis CEM
- Nick Armes – Arcadis CRE Track
- Jas Atwal – Arcadis CRE Signalling
- Rob Williams – WSP PE Contact Systems
- Xavier Augereau – PE Structure, Buildings
- Adam Smith PE- Signalling
- Felix Bartle, Richard Winthrop – Topo Survey and Geo-Spatial Engineering

- Guy Bates – NR SFN
- Paul Whearty - NR SPE Track
- Martin Curnow
- Nigel Wilson – RAM-T
- Eliane Allgaard, Simon Thick – DRAM Anglia
- Paul Mint – E&P

Questions?