TRANSPORT AND WORKS ACT 1992

THE NETWORK RAIL (OLD OAK COMMON GREAT WESTERN MAINLINE TRACK ACCESS) ORDER

APPENDICES TO PROOF OF EVIDENCE

OF

NICHOLAS GALLOP BSc

SUBMITTED ON BEHALF OF BELLAVIEW PROPERTIES LTD

DEPARTMENT FOR TRANSPORT REFERENCES:

TWA/21/APP/O1/OBJ/8;TWA/23/APP/02

DOCUMENT OBJ/08/04/Appendices

OCTOBER 2023

Appendix A

Existing pedestrian access points

1. Ranelagh Car Park
2. Hampden Street Footbridge
3. North Pole Line B
4. OOC Feeder Station
5. Friary Road
6. Acton Main Line
7. Acton Main Line station
8. Acton Main Line to Middle Yd
9. Hanger Lane Bridge
10. Ealing Broadway Station

Existing Road/Rail Access Points

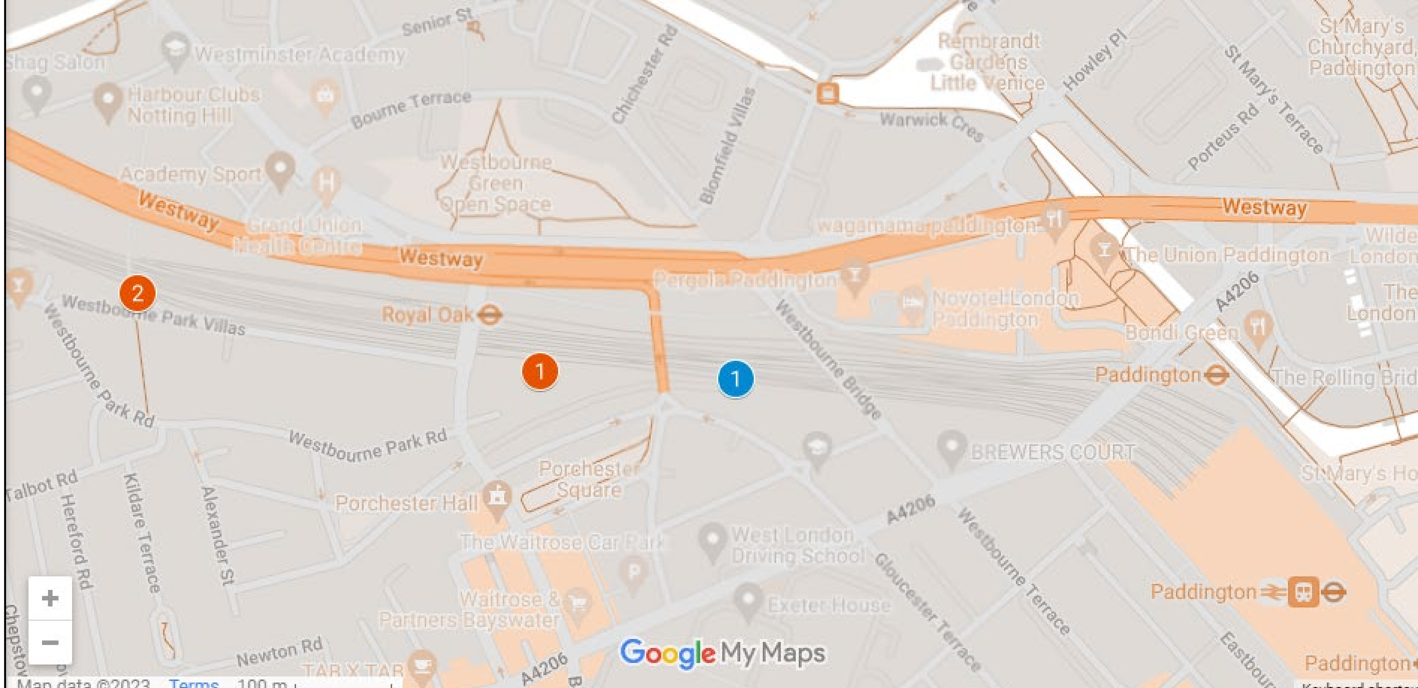
1. Paddington
2. Paddington New Yard
3. Westbourne Park
4. St Ervans Road
5. Barlby Gardens
6. Mitre Way
7. Noel Road / Old Oak Common
8. Acton Middle Yard
9. Longfield Avenue
10. Jacobs Ladder
11. Southall Headshunt
12. Southall

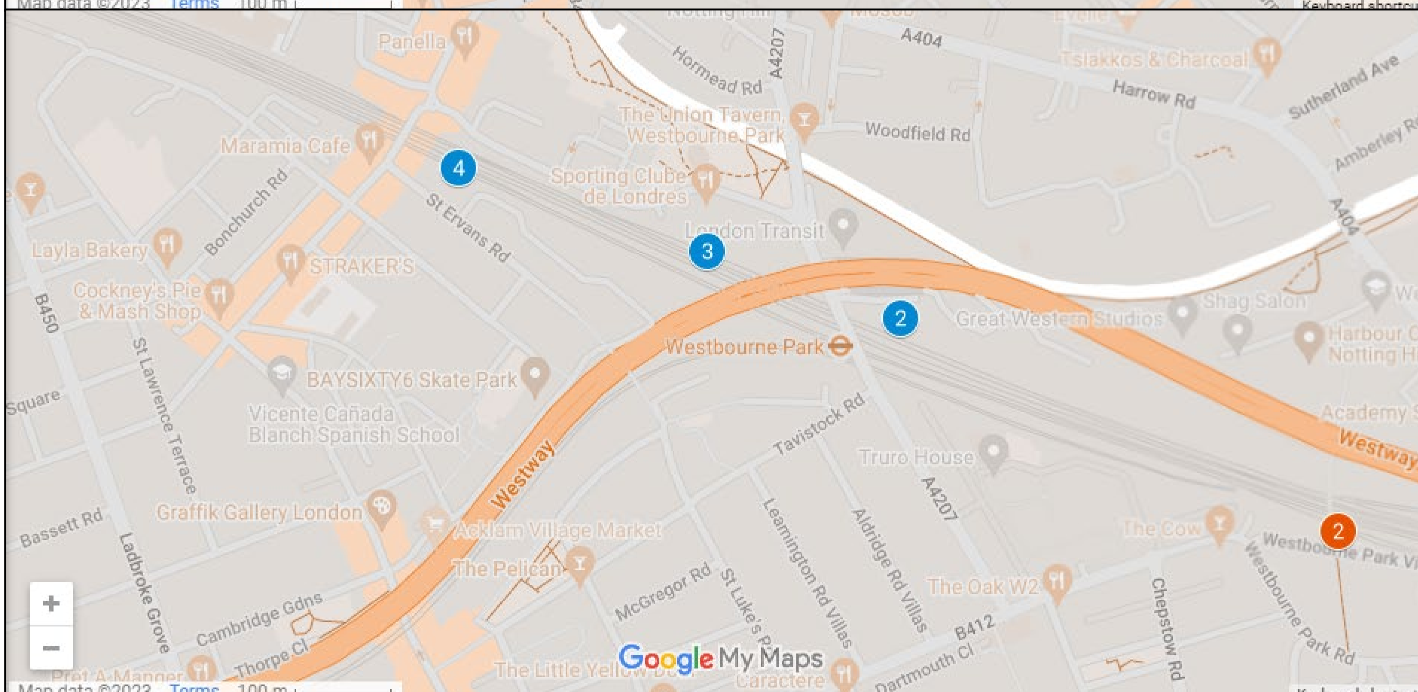
Alternative RRAP proposals

1. West of Engine & Carriage Line (OOC bridge)
2. West of Mitre Bridge
3. North Pole Depot Compound
4. Westway Estate
5. Westcott Park Community Garden
6. Bloomsbury Close

Horn Lane site

1. Proposed Temporary RRAP
2. Proposed Permanent RRAP





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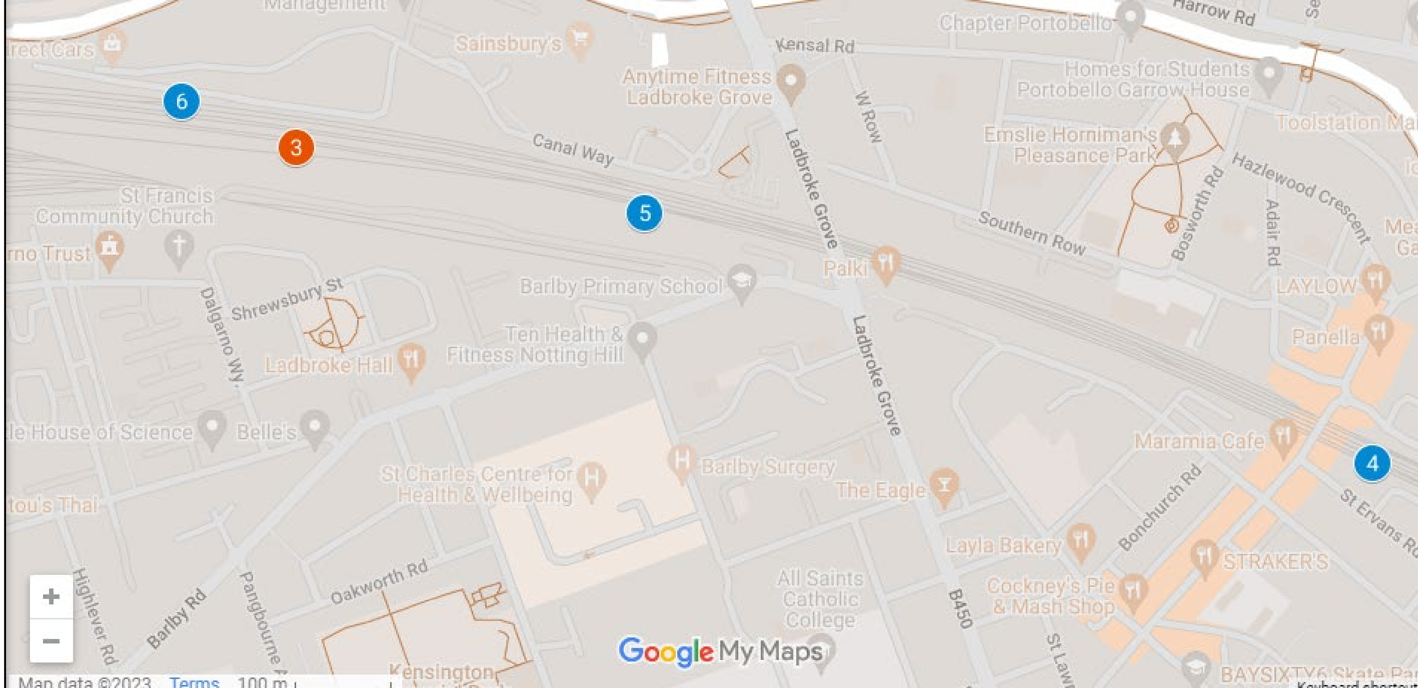

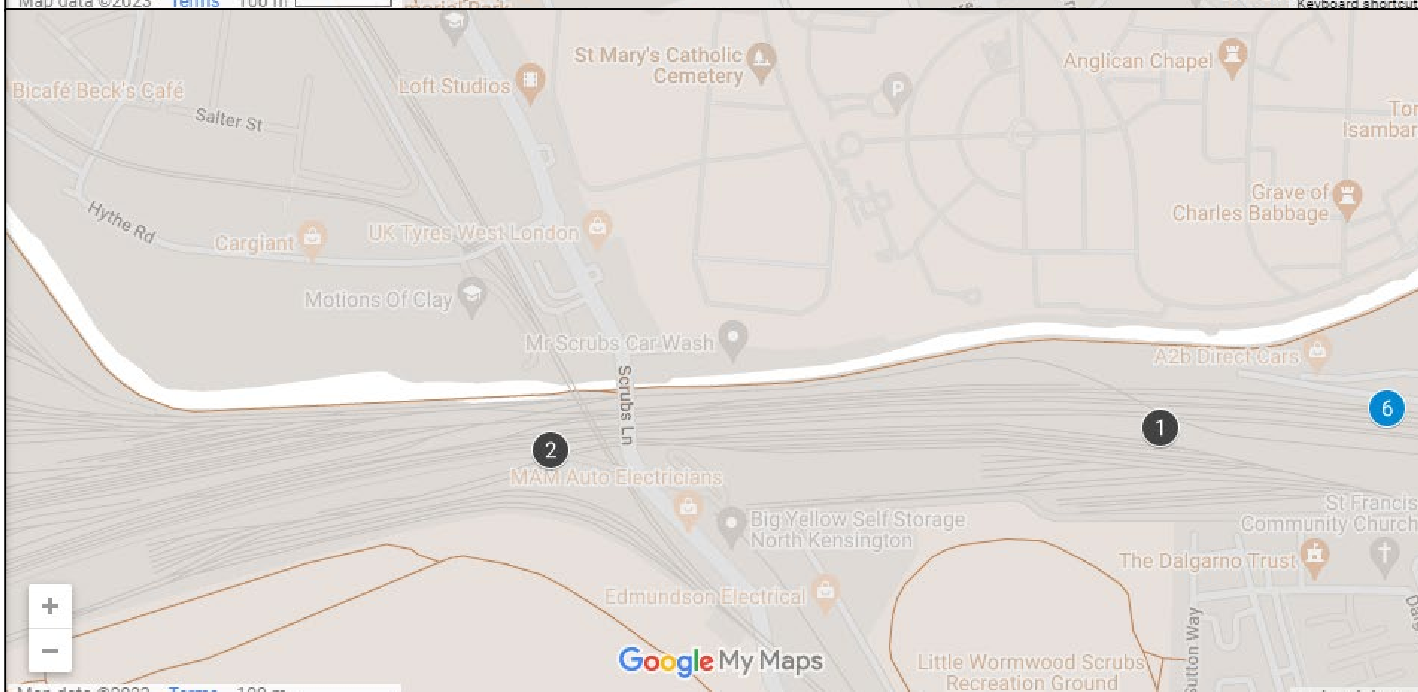

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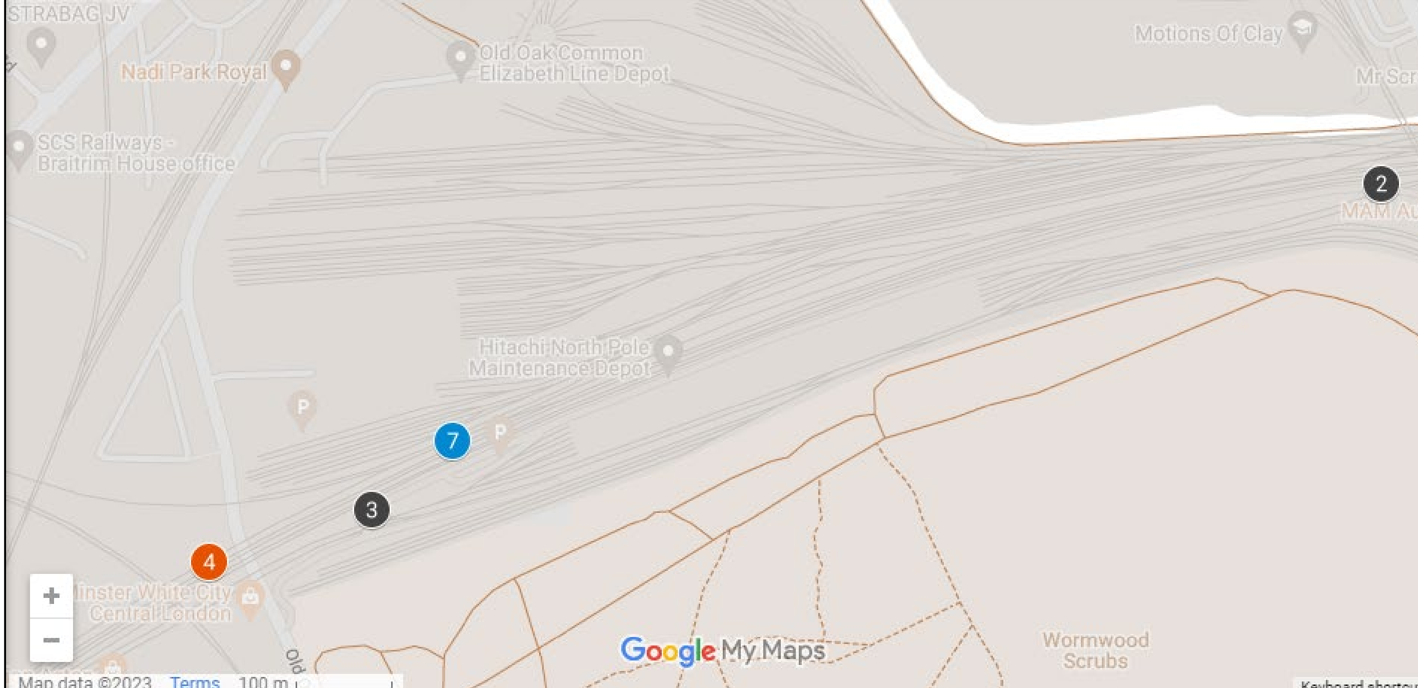

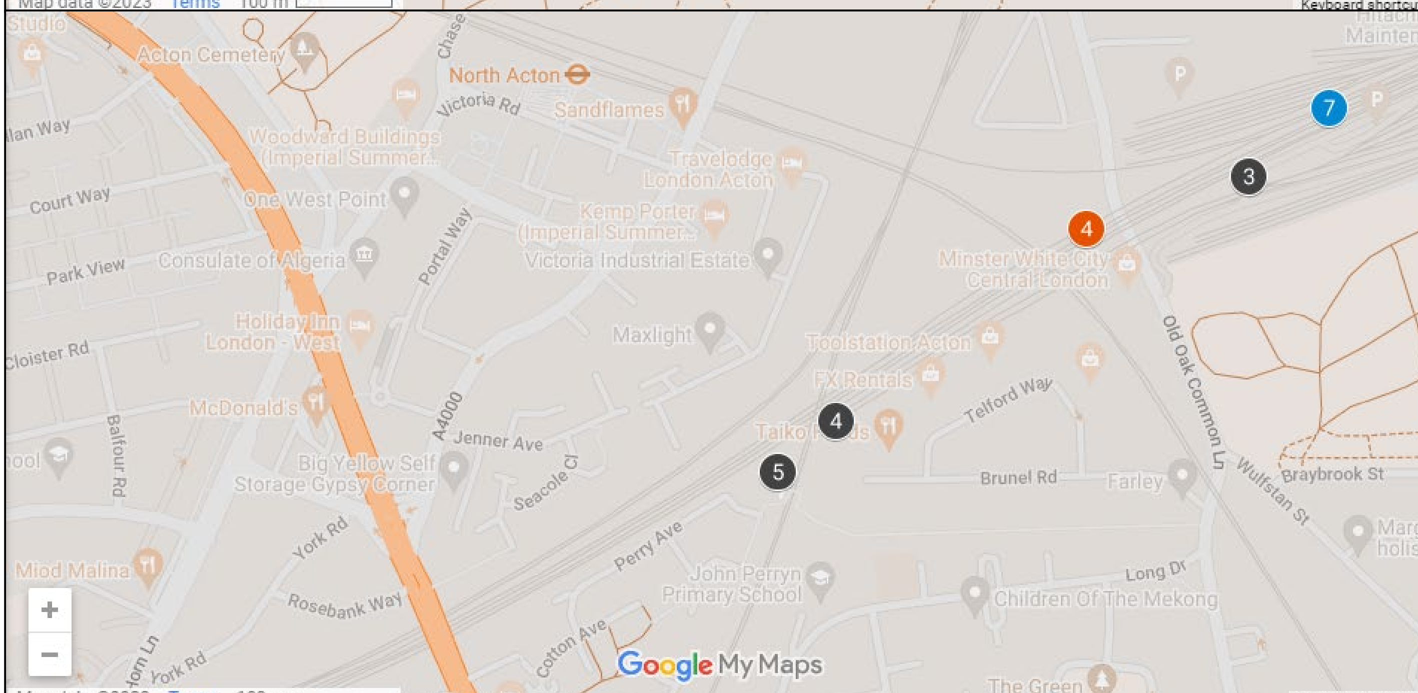

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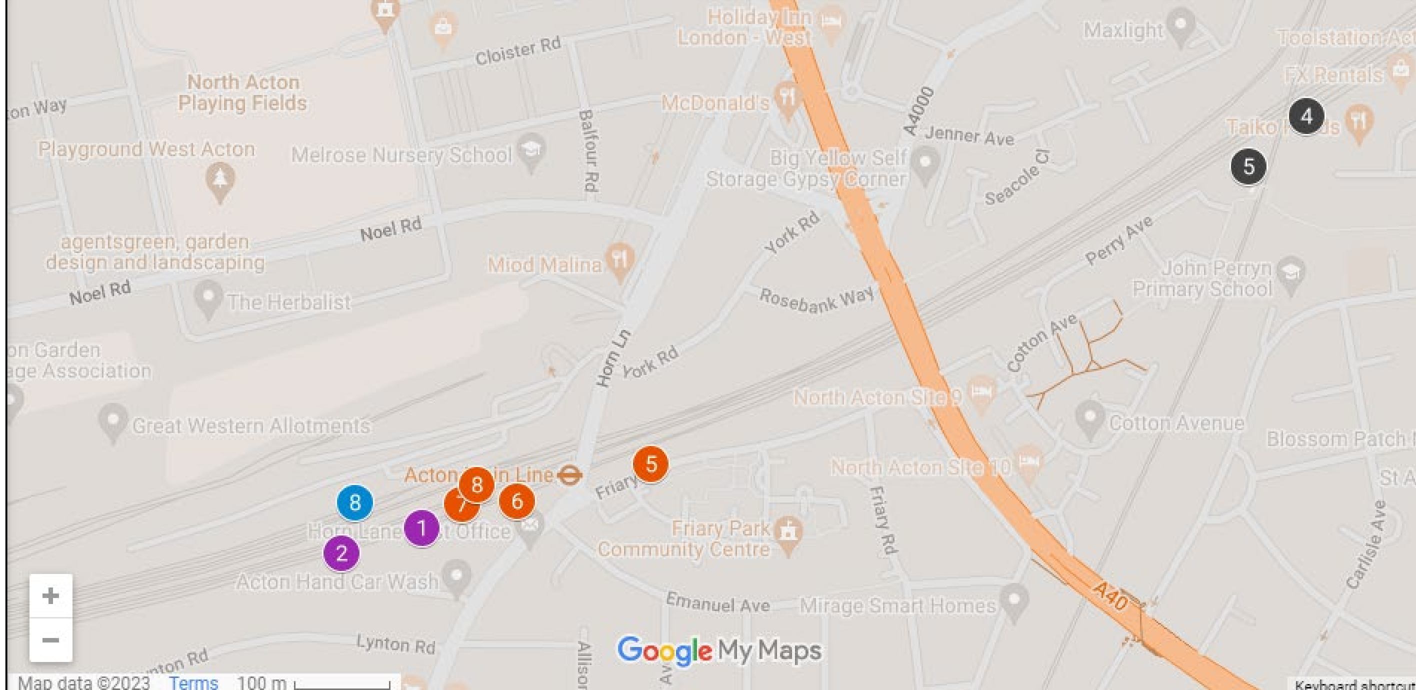

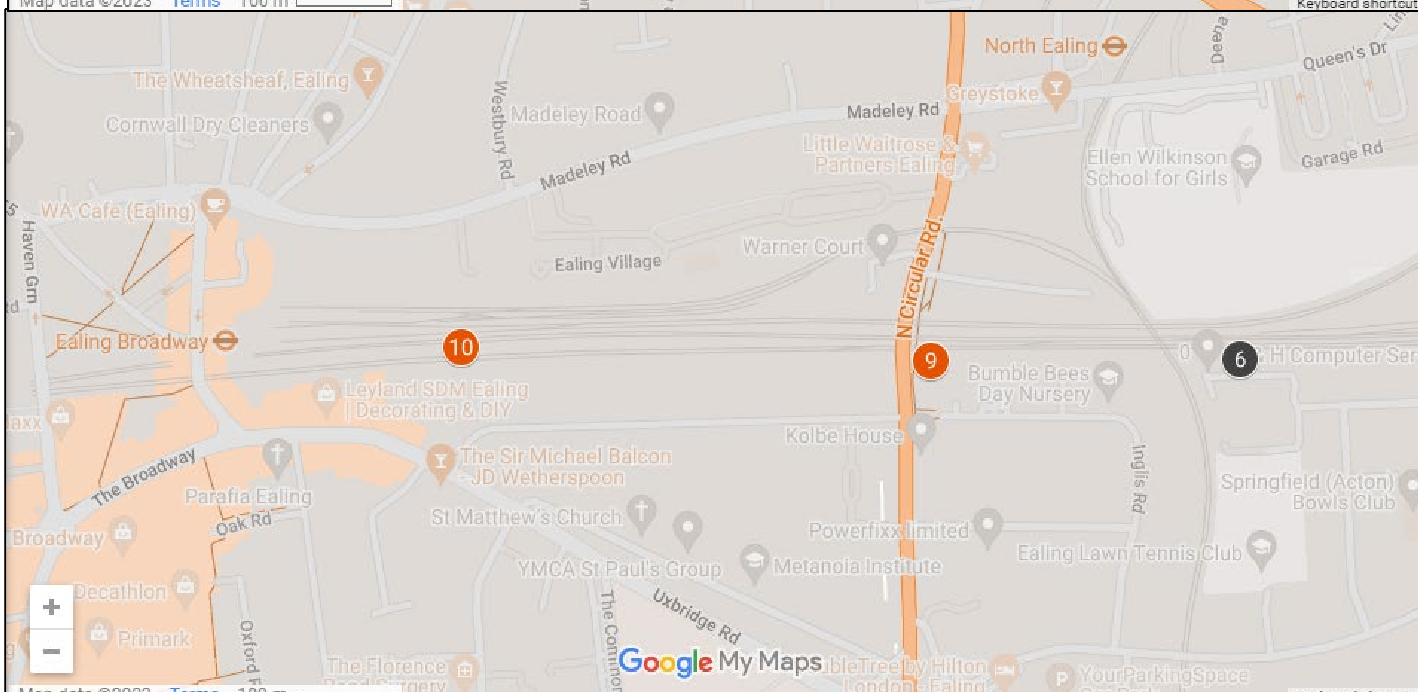

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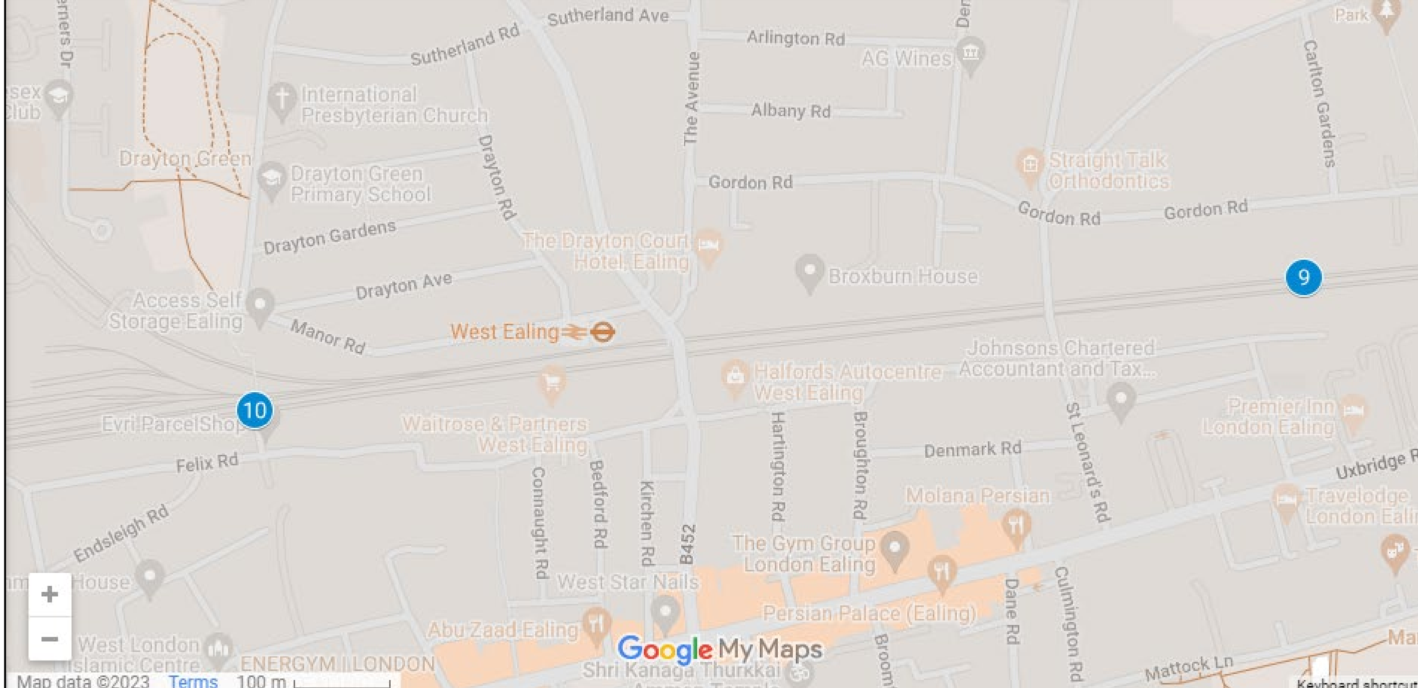
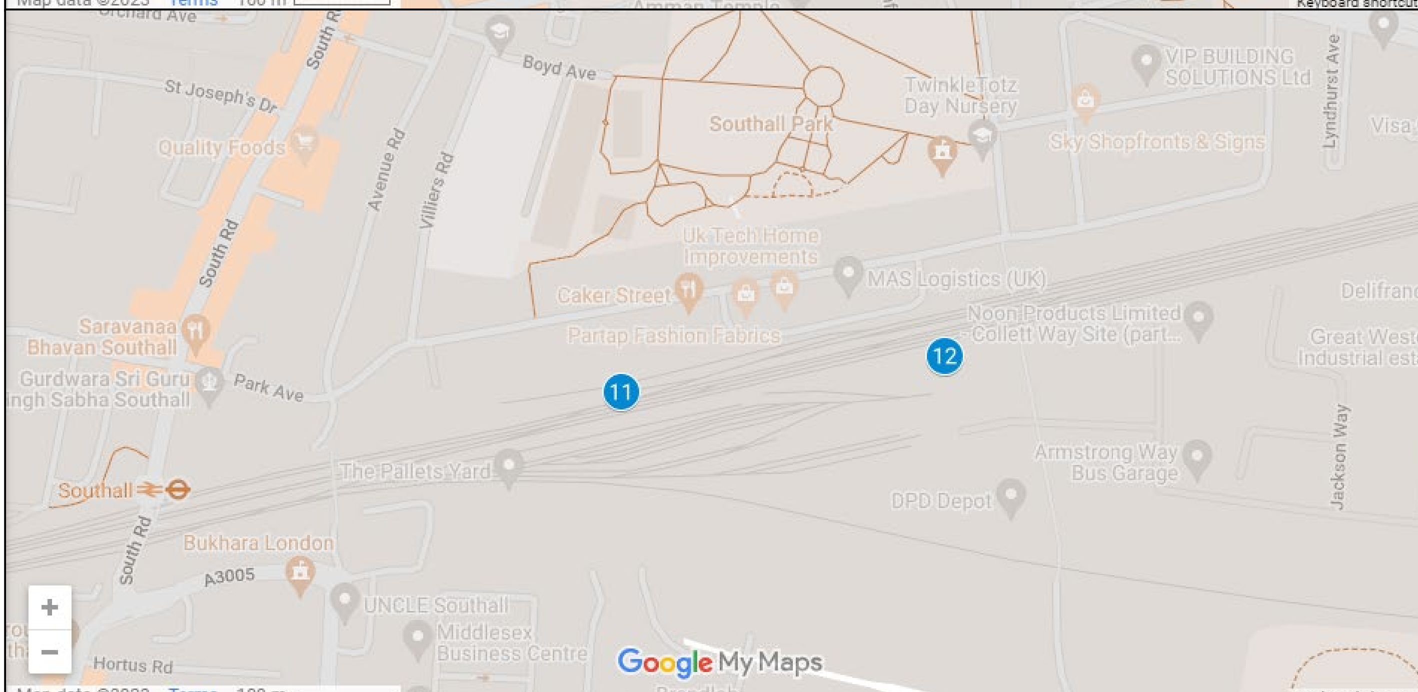




Appendix B

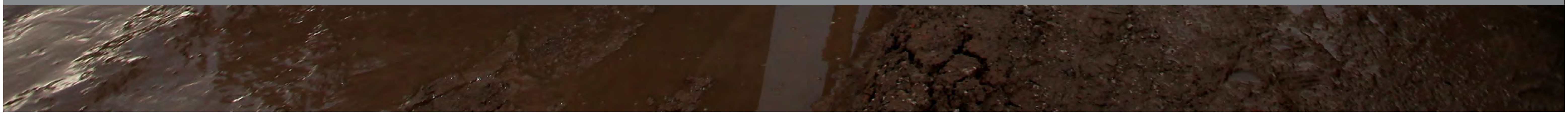
Colmar RRV crane

VolkerRail Ltd.

Address
Eagre House
J3 Business Park
Carr Hill
Don caster
South Yorkshire
DN4 8DE

W www.volkerrail.co.uk
T +44 (0)1302 791 100
E marketing@volkerrail.co.uk

VolkerRail



Colmar RRV

VolkerRail's plant devision has a fleet of heavy lifting Colmar road rail vehicles (RRV), cranes and excavators which are permitted to work next to rail lines open to traffic, with both mechanical and electrical fail safe slew limiters.

There are a wide range of attachments associated with our RRV's including various hydraulic grabs, ballast brushes, fast clipping machines and trailers, along with a wide range of specialist attachments for thimbling rail, ballast profiling, welding and more.

Our team of driver maintainer operators, who are highly qualified and experienced, deliver a client focused service by providing:

- Expert advice in all lifting and handling operations
- Plain line renewals, lifting panels solo or in tandem
- Lifting support for S&C renewals and construction
- Level crossing renewals
- Rapid and flexible client response
- Strong environmental awareness on site
- Plant operators licence working

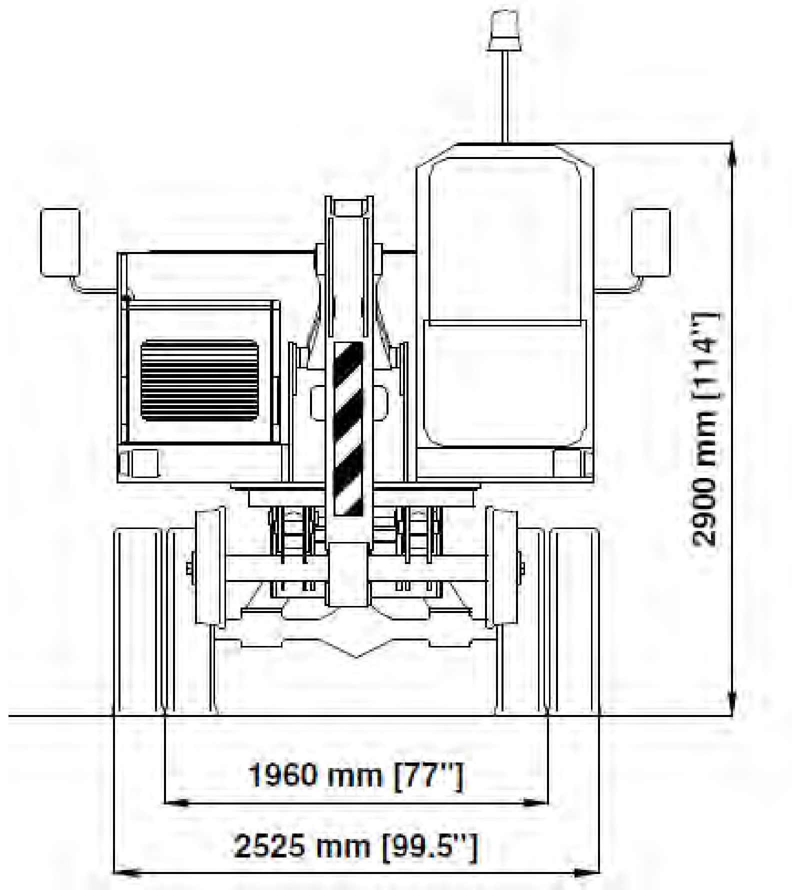
Technical information

Weight	32,000 kg
Maximum travelling speed	10 mph (16 Km/h)
Number of axles	2
Overall Length	7635 mm
Width	2525 mm
Height (road)	2900 mm
Height (rail)	3138 mm
Tail swing gauge exceedance (CW in)	290 mm (maximum)
Tail swing gauge exceedance (CW out)	790 mm (maximum)
Curve radius	80 m (minimum)
Gradient	1 in 29 (maximum)
Travelling cant	200 mm (maximum)
Working cant	200 mm (maximum)
On/off tracking cant	100 mm (maximum)
Wheel profile	P1
Engine	Deutz BF 6L 913.112
Engine Power (2800 rpm)	112 kw / 160 HP
Drive	9b
Rail wheels driven	4
Hydraulic system pressure	340 bar
Hydraulic system flow rate	184 l/min
Volume fuel tank	130 ltr
Year of construction	2001

Expert advice in all lifting and handling operations

Operation information

Loading/Off loading or on/off tracking:	1 Operator + m/c or c/c
Operation:	1 Operator + m/c or c/c
RCI system	Prolec Liftwatch
ALO working	Yes
Tandem lift mode	Yes
Towing capacity	46,000 kg / 4 trailers
Tandem lift mode	Yes
Towing capacity	80,000 kg / 4 trailers



Production Information

Lifting Point	SWL	Maximum Reach
Auxiliary	5 t	6 m
Tool pin (dipper retracted)	15 t	6.5 m
Tool pin (dipper extended)	15 t	7.5 m

A full set of duty charts are available upon request for all three lifting points and tandem lift modes.

Rail mode – Level rail - Tool pin – unlocked - 0° - height 3m – Distance 5m = 10.97t

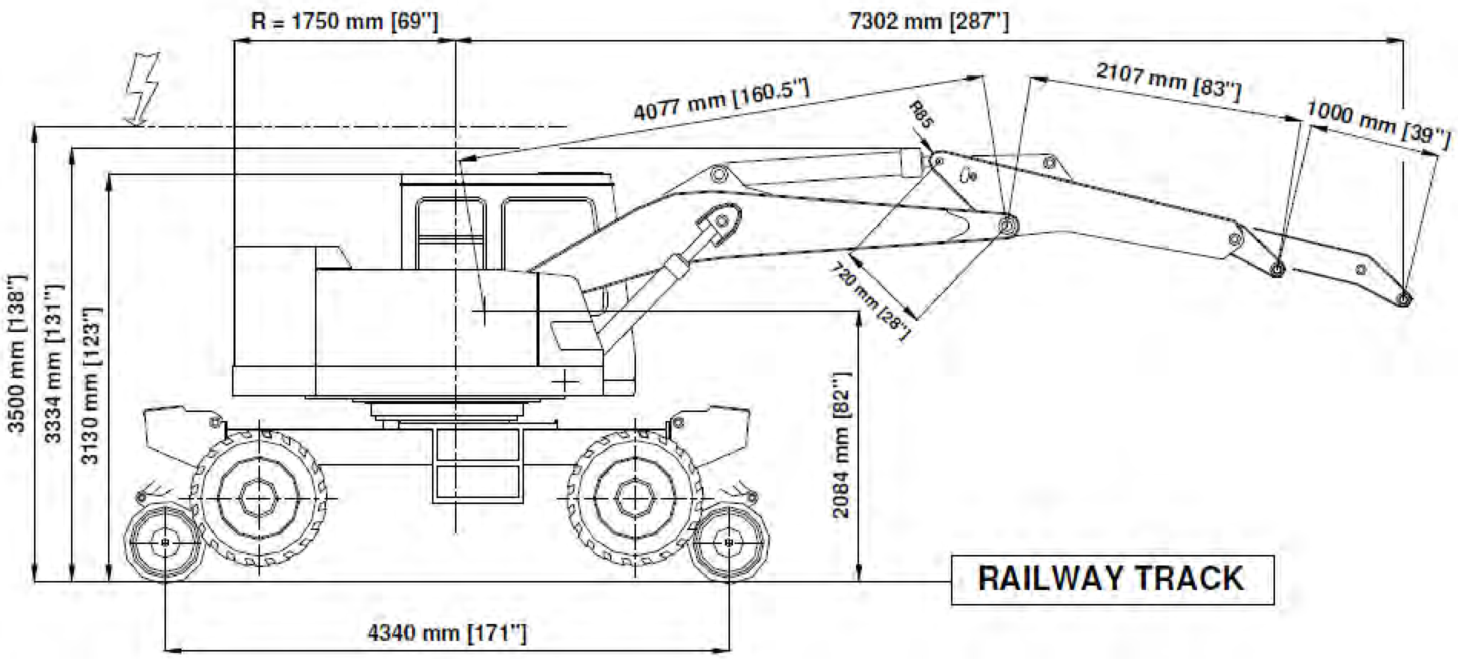
Rail mode – Level rail - Tool pin – locked - 180° - height 3m – Distance 5m = 11.88t

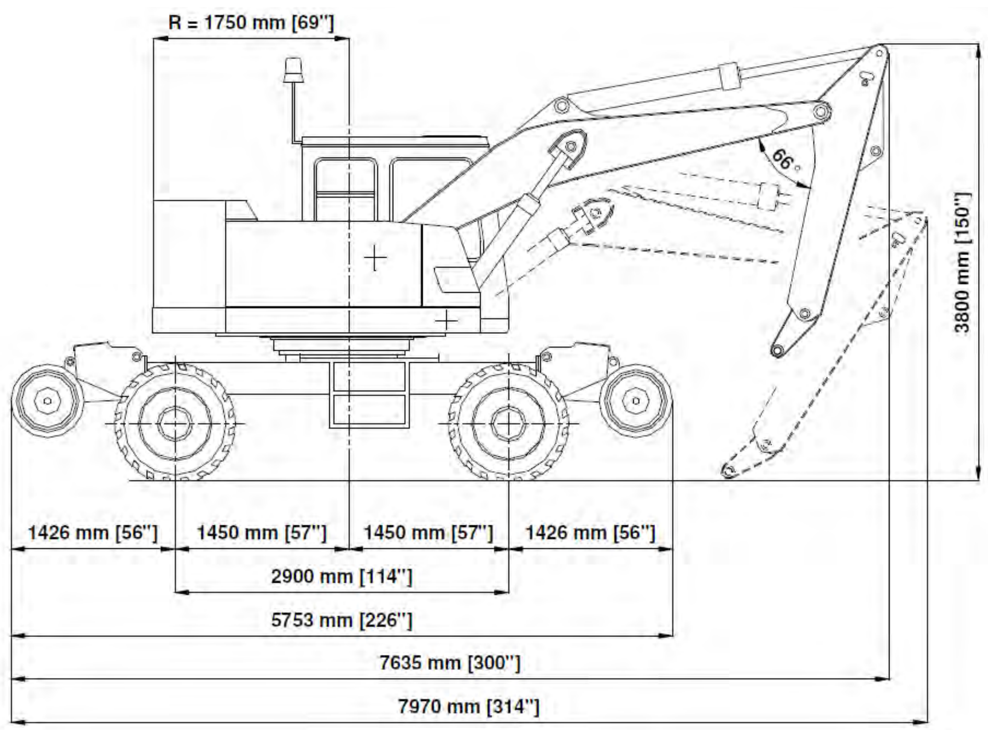
Attachments

- Volkerrail Attachments;
- Fassetta Beam
- Universal Beam
- 60ft Lifting Beam
- Log Grab
- Sleeper Grab
- Camlock
- Drag Clamp
- Pallet Forks
- Thimble
- Drum Carrier
- Clamshell Bucket
- Profile Bucket
- Ditch Bucket
- 2ft Bucket
- Tamping Bank
- nk

Many other attachments available on request, please email VolkerRail delivery manager, Scott Almond on scott.almond@volkerrail.co.uk

Rapid and flexible client response





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- Level crossing renewals
- Rapid and flexible client response
- Strong environmental awareness on site
- Plant operators licence working

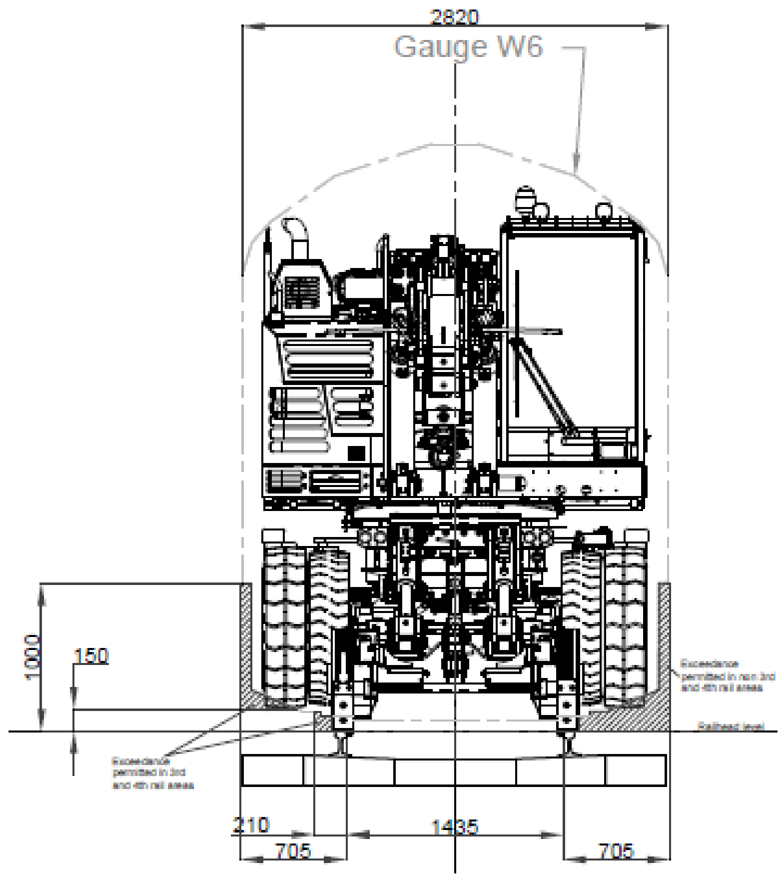
Technical information

Weight	32,000 kg
Maximum travelling speed	15 mph (25 Km/h)
Number of axles	2
Overall Length	5225 mm
Width	2820 mm
Height (road)	3270 mm
Height (rail)	3500 mm
Tail swing gauge exceedance (CW in)	690 mm (max)
Tail swing gauge exceedance (CW out)	1230 mm (max)
Height of tail swing above rail head	1385 mm (min)
Minimum curve radius	80 m
Maximum gradient	1 in 25
Maximum travelling cant	200 mm
Maximum working cant	150 mm
Maximum on/off tracking cant	100 mm
Wheel profile	P1
Engine	Deutz TCD 6.1-L6 Tier 4
Engine Power (2200 rpm)	150 kw
Drive	9b
Rail wheels driven	4
Hydraulic system pressure	350 bar
Hydraulic system flow rate	180 l/min
Volume fuel tank	450 ltr
Year of construction	2014

Expert advice in all lifting and handling operations

Operation information

Loading/Off loading or on/off tracking	1 Operator + m/c or c/c
Operation	1 Operator + m/c or c/c
RCI system	GKD 3RCI
ALO working	Yes
On/off track, travel and work under live overheads	Yes
Quick hitch installed	Yes
Tandem lift mode	Yes
Towing capacity	80,000 kg / 4 trailers



Production Information

Lifting point	SWL	Maximum reach
Auxiliary	6tonne	6.7m
Quick hitch (tool pin)	9.5tonne	7m
Tool pin (no quick hitch)	16tonne	7m
Quick hitch lifting eye	6tonne	7.5m

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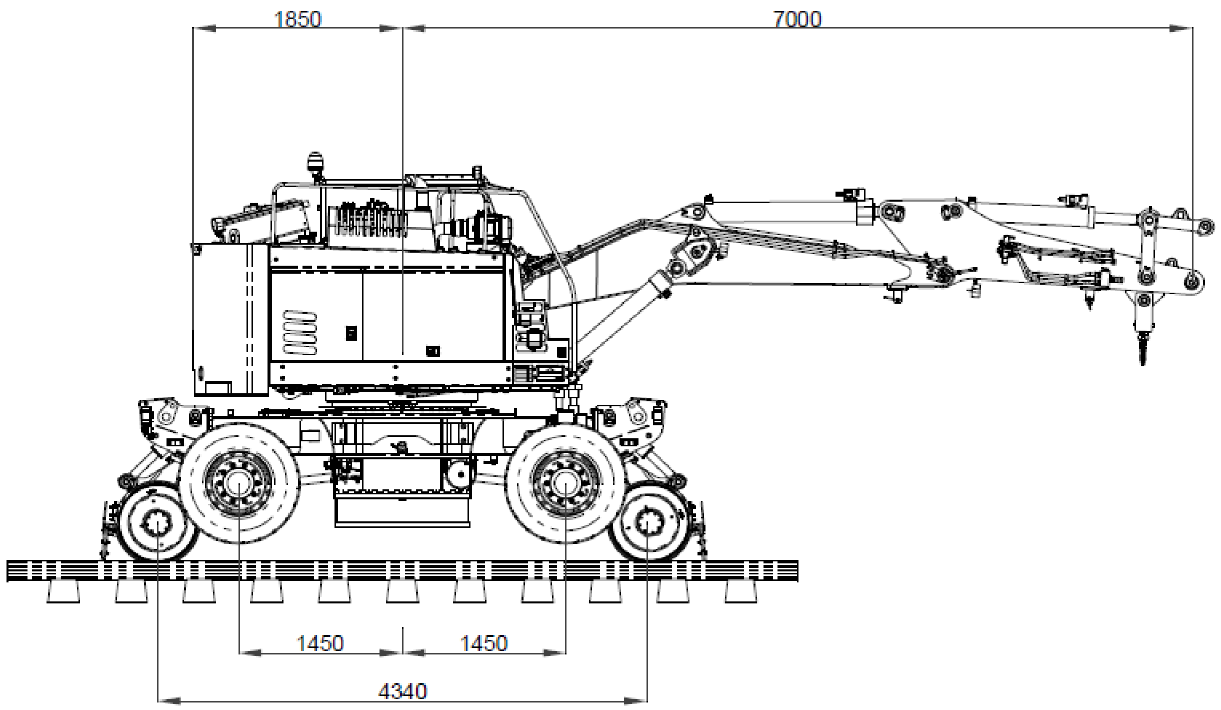

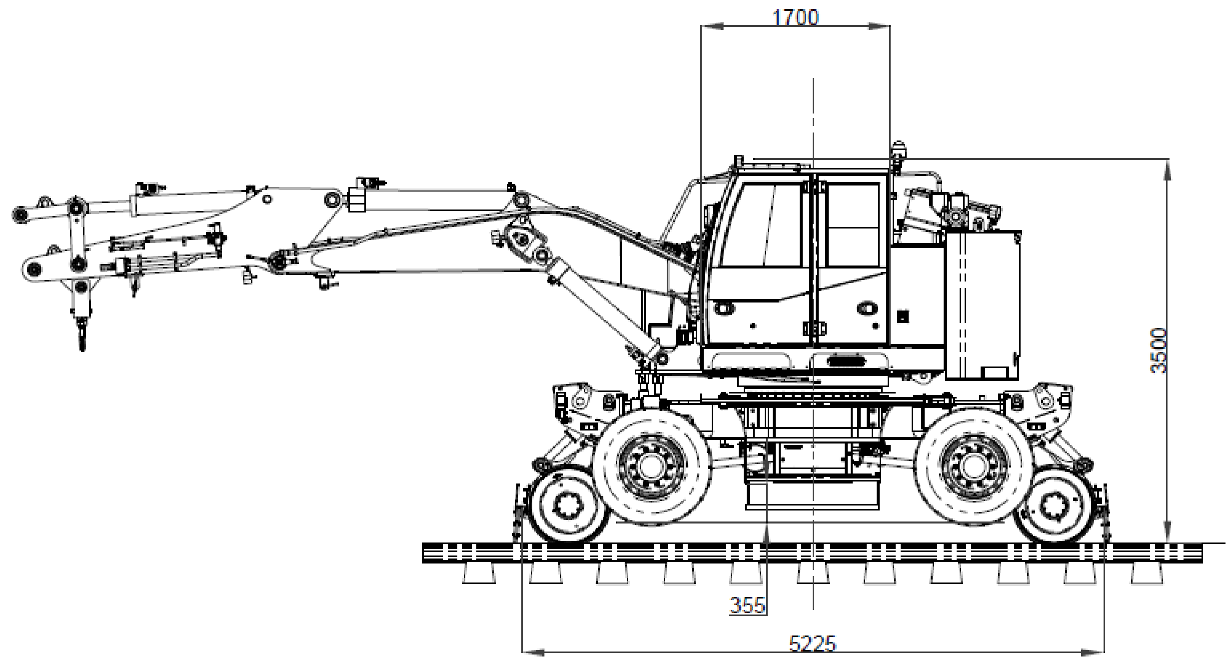

GOS DOOSAN DX170W-7 ROAD/RAIL CONVERSIONS

G.O.S. Tool & Engineering Services Ltd. Heritage Court Road, Gilchrist Thomas Ind. Est., Blaenavon, U.K NP4 9RL
T: +44 (0) 0195 790230 www.gosengineering.co.uk

GOS DOOSAN DX170W-7 WHEELED EXCAVATOR
ROAD/RAIL CONVERSIONS

WORLD LEADING TECHNOLOGY

Renowned for its innovative road/rail vehicles (RRV's) over many years, GOS uses the well-proven Doosan DX170-7 wheeled excavator as the base for a comprehensive range of friction drive and hydrostatic drive machines to match all challenging work applications.

RELIABILITY
Building on the standard Doosan excavator's reliability, all GOS engineering changes follow the Doosan philosophy, using superior material and enhanced impact strength components. Against the Network Rail Plant Performance System (PPS) criteria, GOS DX170W-7 based machines score 99.8 % reliability.

SUPERIOR STABILITY
Using "in-house" design and manufacturing facilities, GOS optimise the use of additional counterweight and chassis mounted mass, to ensure superior machine stability, delivering class - leading lift capability. Stabiliser leg option available.

YOUR SAFETY IS OUR PRIORITY
As well as the standard Doosan equipment, GOS road/rail machines feature additional cameras and work lights, fire suppression systems, additional strategically positioned emergency stops, enhanced "working at height" guards. All in accordance with exacting Network Rail safety standards.

TOTAL CONTROL
Using upgraded components, towing connections for fully automatic rail trailer braking (air or hydraulically actuated) fitted to both ends of the machine. Direct rail wheel or hydrostatic braking available, depending on selected model. All machines feature the latest Network Rail Approved Rated Capacity Indicator (RCI), in accordance with the current issues of industry standards RIS-1530-PLT and BS EN 15746.

EASE OF OPERATION
The GOS RCI installation (complete with cab mounted touch screen) meets all the requirements for adjacent and open line operation (ALO with "virtual wall" function), working under overhead cables (OLE with height limit) and tandem lifting, as well as delivering general load/lift status and control.

RECOVERY SYSTEM
On-board 11 hp Diesel engine (with electric start) provided for emergency recovery, complete with integrated hydraulic connections and circuitry. This permits the machine to return back into rail gauge before removal from the breakdown site, using a tow bar and appropriate rescue road/railer.

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VERSATILITY AT IT'S MAX...

OPERATIONAL TASKS

Suitably equipped, here's just a few examples of the variety of tasks that this versatile machine can undertake:

- Track tamping
- Rail brushing
- Site layout and preparation work
- Sleeper changing
- MOVAX vibro pile driving
- Tilt rotator use
- Grading and formation building
- Lifting fork fitment for pallet handling
- Suction ballast excavation unit
- Long rail handling/thimbling
- Long and "super long" boom capability
- Pile hammer use
- Gantry and OLE installation
- Mulching/flailing
- Multiple standard bucket use
- Multiple attachment use with quick hitch for log grabbing, bag lifting, hammer/breaker, etc.

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THE POWER TO RAISE PRODUCTIVITY

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FRICTION DRIVE VERSION

INTRODUCTION

The GOS DX170W-7 Series road/rail machines have become the company's core product – they are the UK market leader, for this size of machine.

The friction drive version is the acknowledged prime workhorse of the UK rail maintenance industry. As the name implies, travel drive utilises the friction between the machine's rubber tyres and the rail wheels.
This is the simplest and most robust option built by GOS and has a measured reliability factor of 99.8 %.

Currently, two main variants are available:
- DX170 Ultimate 250 –
  Approx. finished machine weight 25 tonnes
- DX170 Ultimate 270 — labelled "the heavy lifter"
- Approx. finished machine weight 31 tonnes
  Key features include:
- Direct rail wheel braking
- Rail trailer towing (both hydraulic and air actuation) up to 140 tonnes
- Enhanced lift performance
- Full function Network Rail Approved RCI system with "virtual wall" and height limitation, enabling operation under live OLE and with adjacent line open (ALO)
- Various dipper configurations available, including 2.1m (civil option) and 5.5m (lifting option, typically used for gantry installation maintenance and other lineside works). Longer booms also available, up to 10m length

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HYDROSTATIC DRIVE VERSION

INTRODUCTION

Similar to the friction drive version, except that travel drive is by the use of hydrostatic motors bolted directly to the rail wheels. Rail wheel braking is provided by the control/regulation of the hydrostatic motors.

Based on the Doosan DX170W-7 wheeled excavator, the GOS DX170W Hydrostatic Drive Series includes:

- Hydrostatic travel drive capability, including rail wheel braking
- Optional retractable stabiliser legs at each "corner" of the machine to provide additional stability in operation (Variant HS only)

Currently, 4 main variants are available:

- DX170 SH Ultimate 250/270 – Standard machine, NO drop down stabilisers
- DX170 HS Ultimate 270 - WITH drop down stabilisers, for increased lift capacity and enhanced machine stability
- DX170 SH Ultimate 270 SL (Self Levelling) - Standard machine, NO drop down stabilisers
- DX170 HS Ultimate 270 SL (Self Levelling) - Selflevelling machine WITH drop down stabilisers, for increased lift capacity and enhanced machine stability

Key features include:

- Where the SL variant is selected, the self levelling function (SLF) is provided to allow the machine to perform at its optimum capability, allowing the excavator boom to remains essentially PERPENDICULAR to the horizon (IRRESPECTIVE of the rail cant) and thus prevent boom side loading.
  The SLF acts ONLY on the fixed/levelling axle of the machine.
- Hydrostatic rail wheel braking
- Rail trailer towing (both hydraulic and air actuation) up to 70 tonnes
- Enhanced lift performance
- Full function Network Rail Approved RCI system with "virtual wall" and height limitation, enabling operation under live OLE and with adjacent line open (ALO)
- Various dipper configurations available, including 2.1 m (civil option) and 5.5 m (lifting option, typically used for gantry installation maintenance and other lineside works). Longer booms also available, up to 10m length.

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ENGINE
Designed to deliver superior performance and fuel efficiency, the Doosan DLo6V diesel engine fully meets the latest Stage V emission regulations. To optimise machine performance, the engine uses high-pressure fuel injectors, air-to-air inter-cooler and electronic engine controls. 4-Cyle Water-Cooled. wastegate Turbocharged. Diesel Oxidation Catalyst (DOC). Selective Catalytic Reduction (SCR) and Diesel Particulate Filter (DPF)

TYRE DIMENSIONS
10 X 20 Trelleborg Highway profile, foam filled

OVERALL WIDTH
2800 mm

UNDERCARRIAGE
Essentially as per Doosan standard construction but design enhanced to specifically endure the rigours of road/rail operation on Network Rail and other rail infrastructures.

GOS modifications to chassis (including additional counterweight mass as required by version/variant) using comparable high specification steel to that used on the Doosan OEM build.

WHEELBASE
Road mode (all variants) : 2650 mm
Rail mode: SH Variant: 4600 mm
HS Variant: 5467 mm
SL Variant: 5519 mm

HYDRAULIC SYSTEM
The e-EPOS (Electric Power Optimising System) is the brain of the excavator - minimising fuel consumption and optimising the efficiency of the hydraulic system for all working conditions. To harmonise the operation of the engine and the hydraulics, the e-EPOS is connected to the engine's electronic control unit (ECU) via a data transfer link.

- The hydraulic system enables independent, or combined operations
- 2 travel speeds offer either increased torque, or high speed
- Cross-sensing pump system for fuel savings.
- Auto-deceleration system
- 4 operating modes. 4 power modes
- Flow and pressure control of auxillary hydraulic circuits from control panel
- Computer-aided pump flow control

HYDRAULIC CYLINDERS
Component cylinders remain as per standard Doosan fitment, but with GOS modified boom geometry, to increase hydraulic power by up to 30%, to suit rail specific application.

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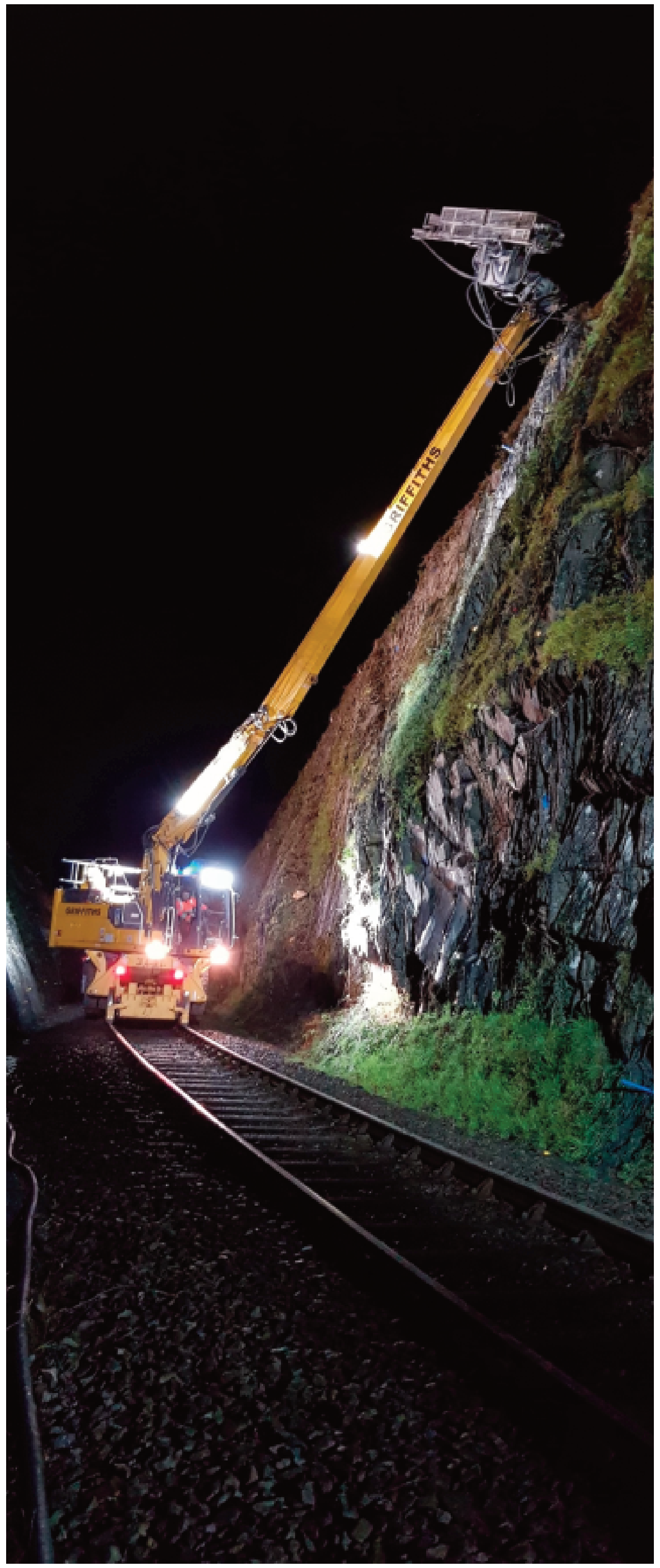
- Machine built in general accordance with local railway legislation, such as the current UK Railway Group Standard RIS-1530-PLT, EN15746 and AS7502.
- Compliant with the requirements of Network Rail Remit MLD/R003 – Remit for fitment of Electro and Electromechanical Movement Limiting Devices (UK only).
- Variants currently available to suit 1435mm and 1600mm nominal gauges.
- Ability to on/off track on 150mm cant. Fully stable on 180mm cant in work mode and 200mm in travel mode.
- Available with or without drop down stabilisers, dependent on selected variant
- LUL specification compliant version available
- 700mm diameter cast steel rail wheels fitted to heavy duty EN16T steel axles
- Hydraulically operated railgear with double pilot-operated check valves
- Anti-burst protection on ALL boom elements
- Rail gear raise/lower deployment interlock system
- Pivoting axle with axle-lock cylinders and pilot-operated check valves
- Approved Rated Capacity Indicator system, including data logging
- Fully automatic trailer park and service braking.
- Quick connect service and park brake couplings front andrear for towing trailers
- Friction driver version – travel drive using rubber tyres directly driving rail wheels
- Direct rail wheel braking (friction driver version) – using separate brake disc and actuating system. Acts directly on rail wheel
- Hydrostatic drive version - travel drive using hydrostatic motors bolted to rail wheels, including slip reduction system
- Rail wheel braking (hydrostatic drive version) - via hydrostatic drive system/motor directly bolted to rail wheel.

BRAKE OPERATION TYPE	PARK BRAKE - AVAILABLE RELEASE PRESSURE RANGE (BAR)	SERVICE BRAKE - AVAILABLE INPUT PRESSURE RANGE (BAR)
Hydraulic	30 MIN, 100 MAX	0-100 MAX
Air	4.0, MIN, 6.0 MAX	0-6 MAX

- Electrical sockets front and rear for operating automatic lighting on trailers. Also compatible with Philmor/GOS T Series trailer personnel carrier attachments.
- Chassis mounted rail lighting with automatic direction switching and neutral “all red” condition
- Emergency recovery tow bar, with 40mm diameter end connections
- Emergency recovery system, using 11 HP diesel recovery engine with electric start, together with tow bar
- Cab fitted fire extinguisher – Aqueous Film Forming Foam (AFFF) Type.
- GOS RailSafe CANbus based control system with diagnostic capabilities. Cab mounted display screen.



AVAILABLE OPTIONS

- Double cab. Seating for one passenger.
- FIRETRACE automatic AFFF system
- “Deadman” or “vigilance” operator systems.
- “Blind side” CCTV system
- 5.5m and 10m “long reach” dippers
- ENGCON specific Tiltrotator driver controls
- MOVAX Pile Driver specific driver controls
- Rail wheel brake emergency recovery hydraulic connection
- Work restraint anchor point
- Power connections on boom elements
- Hydraulically operated retractable machine stabiliser legs at front and rear of the machine (HS and HS-SL variant only)
- Optional approved system wireless tandem link available
- Dedicated hammer flow valve for enhanced equipment operations, eg rail brushing

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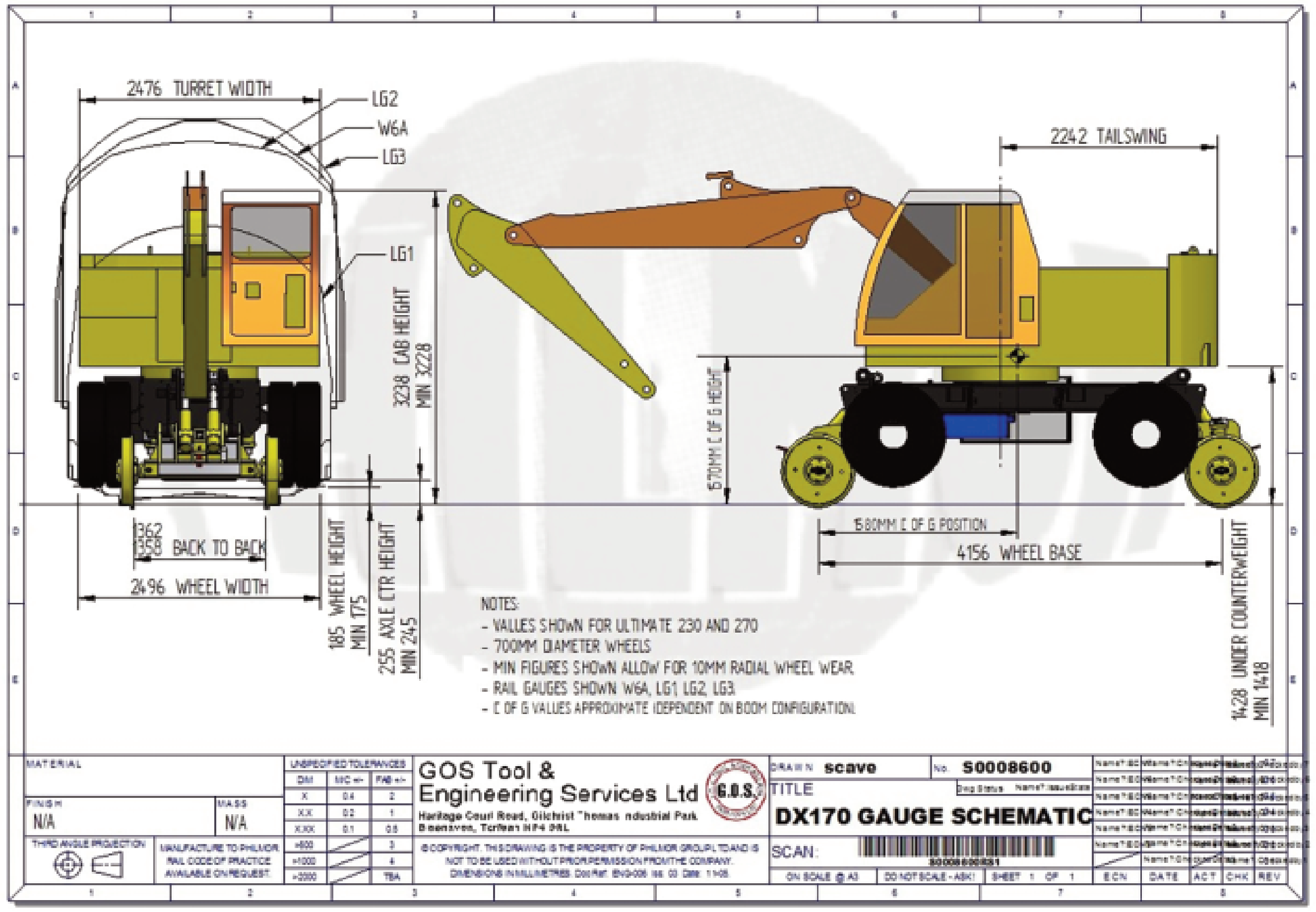
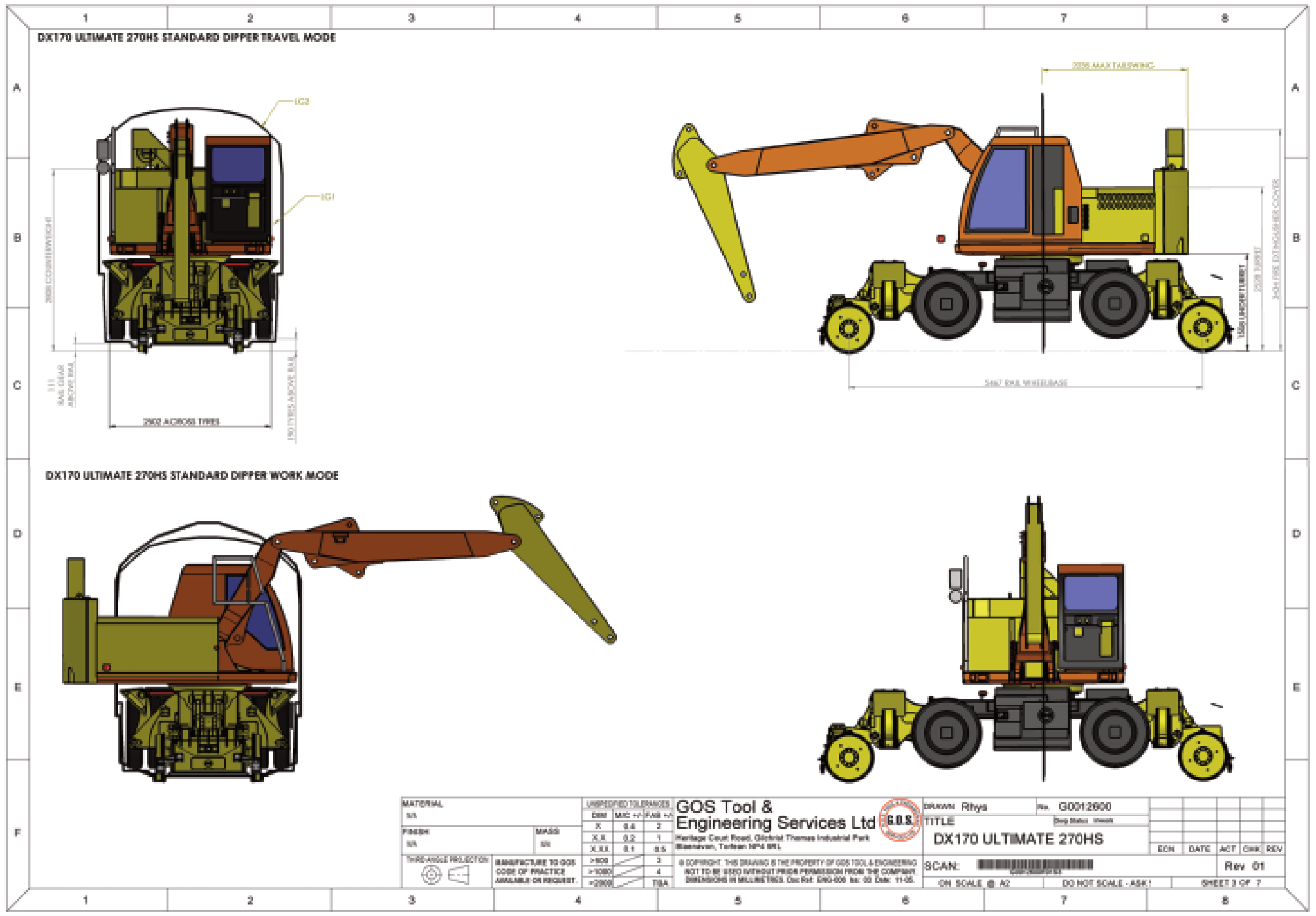


Friction Drive - DX Ultimate 250/270



Hydrostatic Drive - DX Ultimate 270HS with 2.1m Dipper

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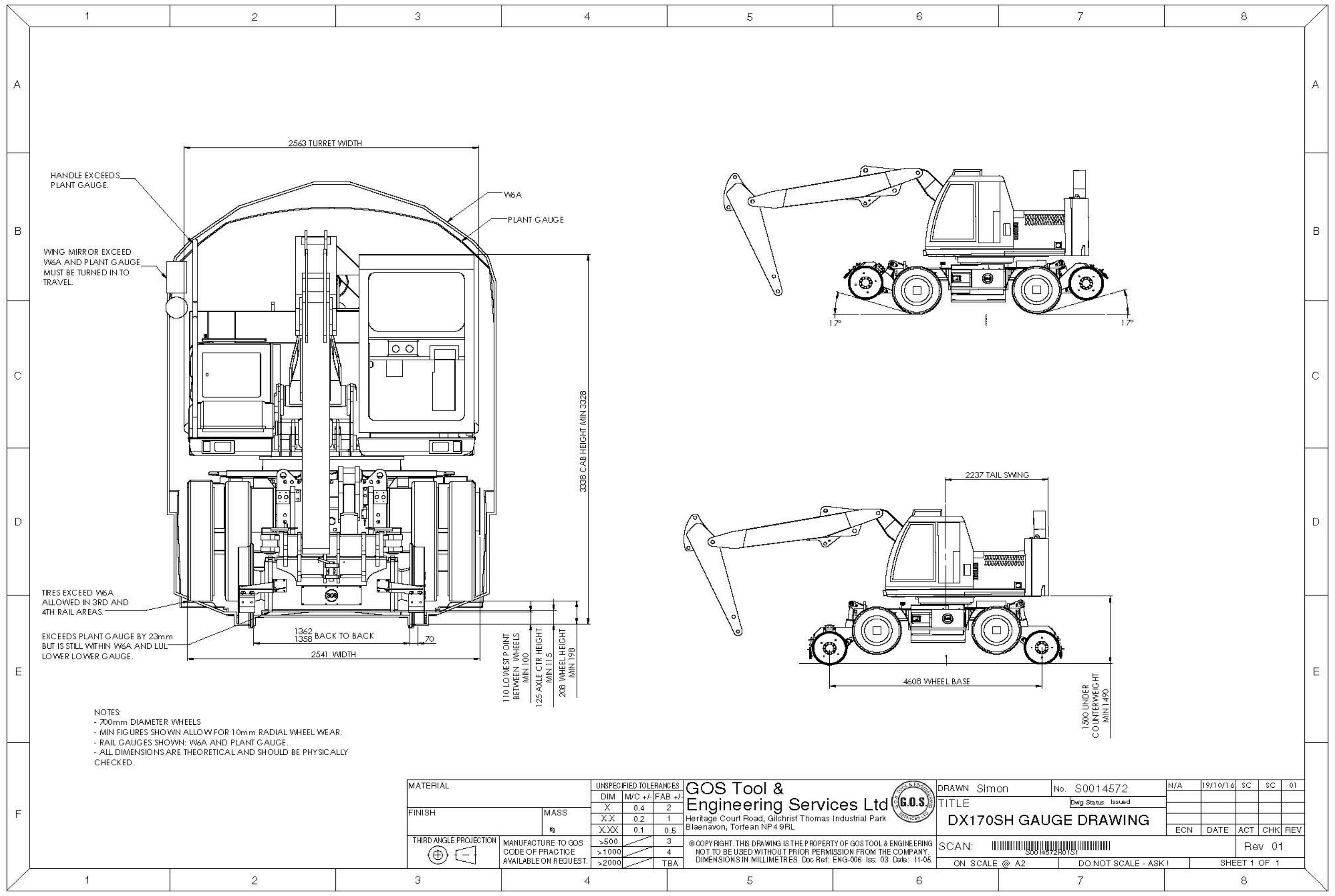
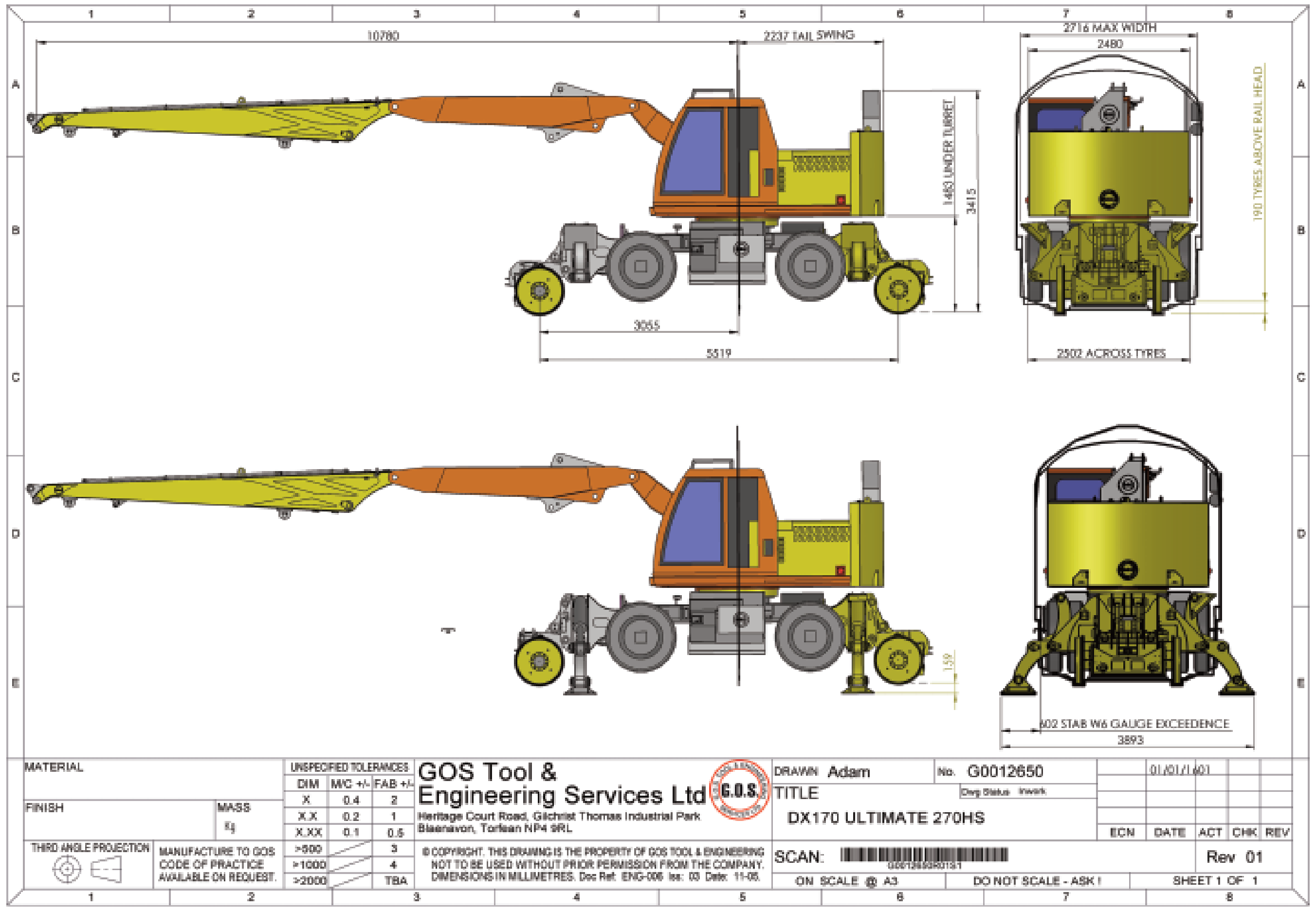


Hydrostatic Drive - DX Ultimate 270HS with 2.1m Dipper



Hydrostatic Drive - DX Ultimate 270HS with 5.5m Dipper
and self levelling function (SL)

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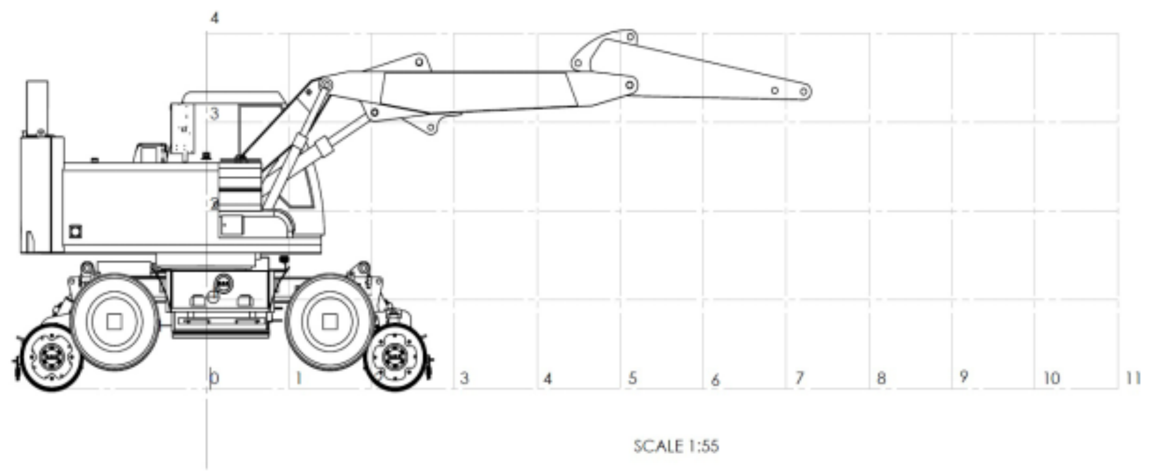
DX170 WITH STANDARD DIPPER - HORIZONTAL REACH

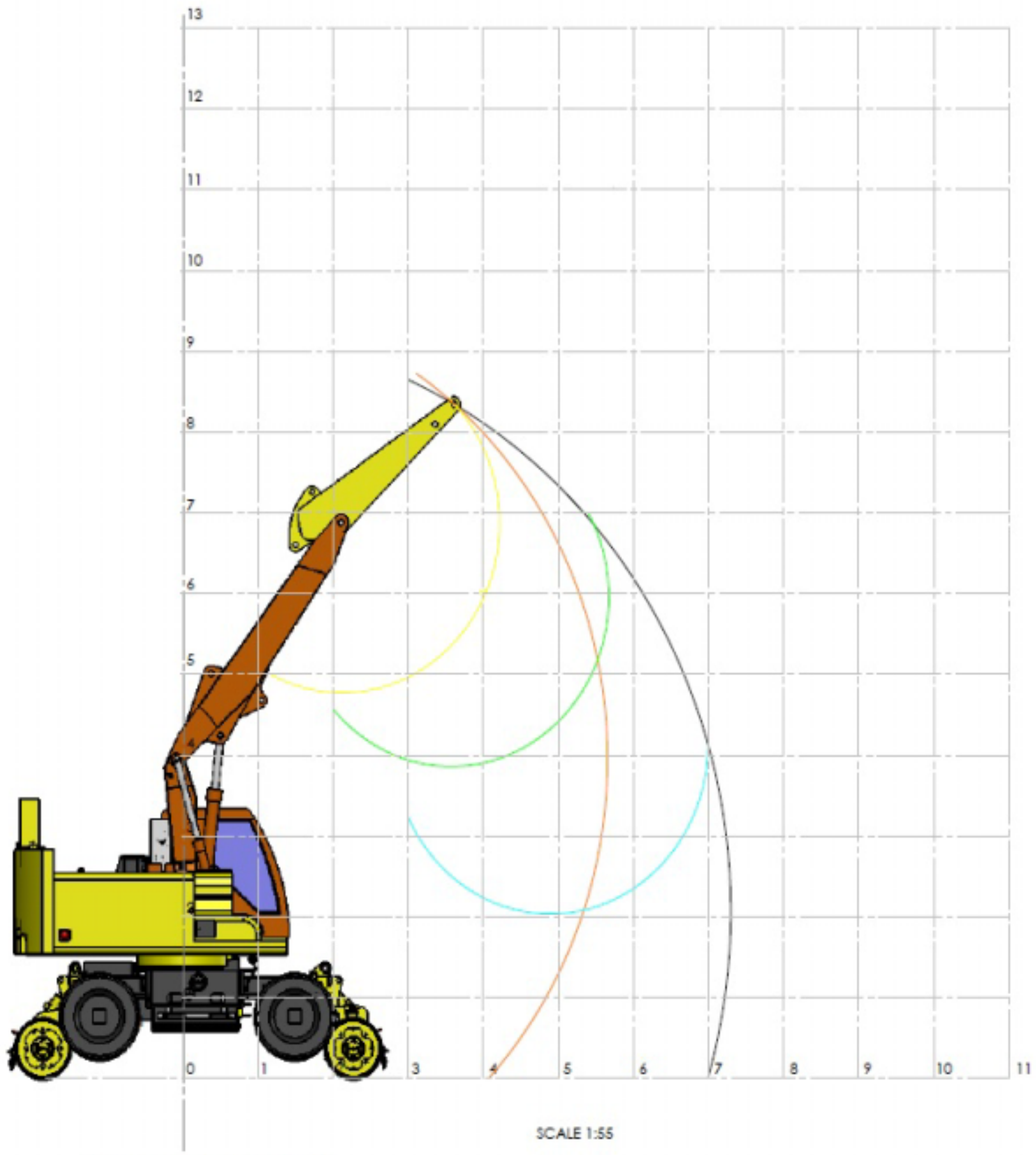


DX170 Ultimate 270 with Standard 2.1m Dipper

TYPICAL WORKING RANGE

G.O.S. TOOL & ENGINEERING SERVICES LTD

DX170 WITH STANDARD DIPPER - BOOM CONFIGURATIONS



BOOM REPRESENTATION TABLE

BOOM COLOUR	MAX STUB ANGLE	CANT CONDITIONS	SLEW CONDITIONS
ORANGE AND YELLOW	96°	ROAD/LEVEL/DOWN CANT	PIVOT END ∠ 35° FIXED END ∠ 15°
GREEN	77°	<2°(50MM)/UP CANT	35° - 165° 195° - 325°
BLUE	52°	>2°(150MM)/UP CANT	

FURTHER NOTE :
- ANGLES WILL HAVE 14° EXTRA WITH >400KG LOAD

DX170 Ultimate 270 with Standard 2.1m Dipper

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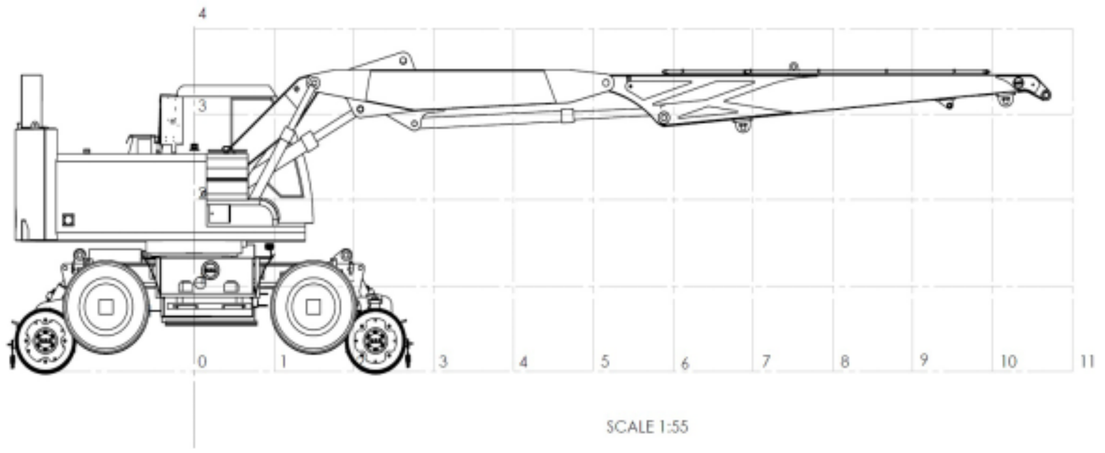
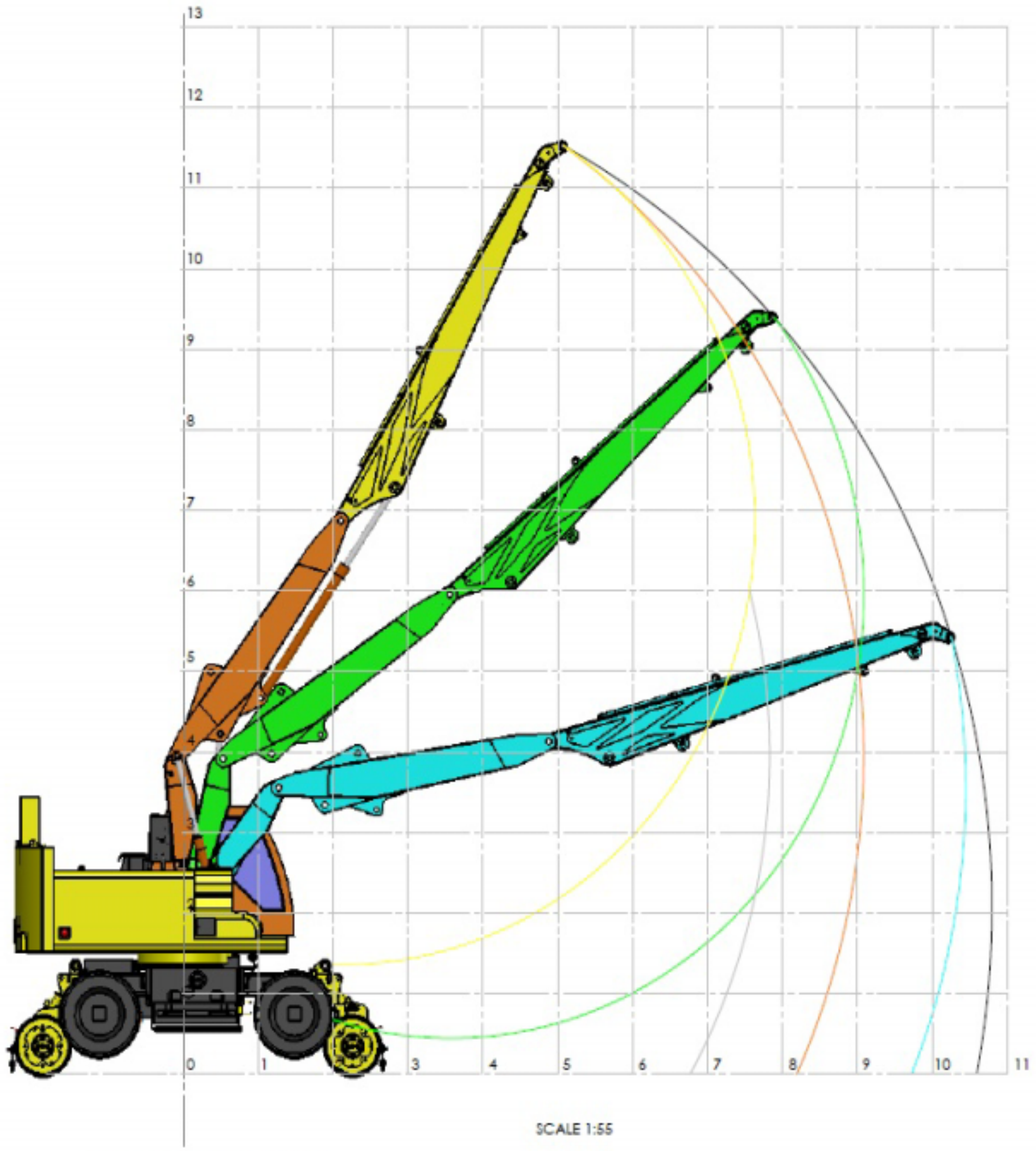
TYPICAL WORKING RANGE

DX170 WITH 5.5M DIPPER - HORIZONTAL REACH



DX170 with 5.5m Dipper - Horizontal Reach

DX170 WITH 5.5M DIPPER - BOOM CONFIGURATIONS



BOOM REPRESENTATION TABLE

BOOM COLOUR	MAX STUB ANGLE	CANT CONDITIONS	SLEW CONDITIONS
ORANGE AND YELLOW	96°	ROAD/LEVEL/DOWN CANT	PIVOT END ∠35° FIXED END ∠15°
GREEN	77°	<2°(50MM)/UP CANT	35° - 165° 195° - 325°
BLUE	52°	>2°(150MM)/UP CANT	

FURTHER NOTE :
- ANGLES WILL HAVE 14° EXTRA WITH >400KG LOAD

DX170 Ultimate 270 with Standard 5m Dipper

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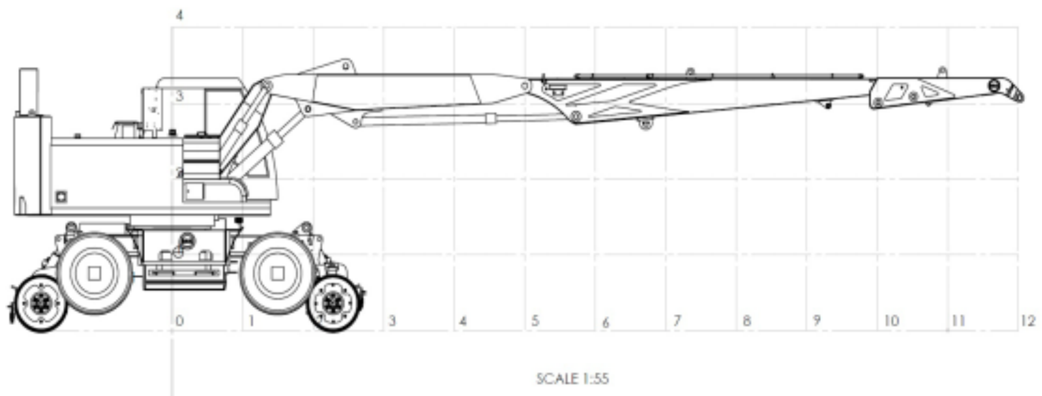
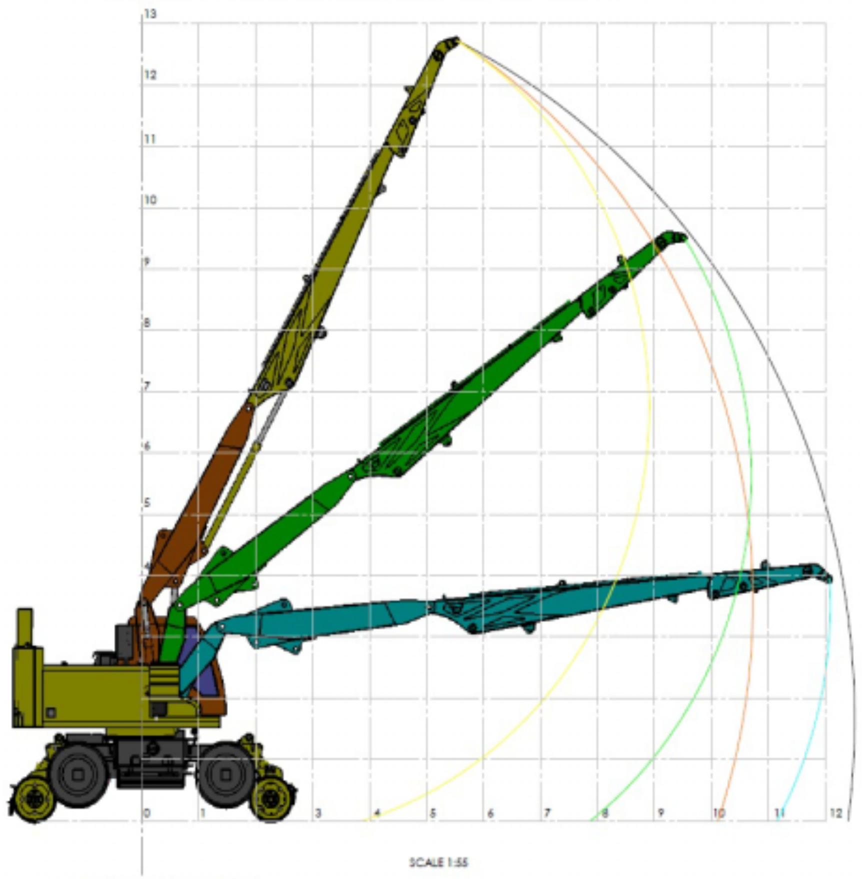
G.O.S. TOOL & ENGINEERING SERVICES LTD

DX170 WITH 5.5M DIPPER + 1.5M EXTENSION - HORIZONTAL REACH



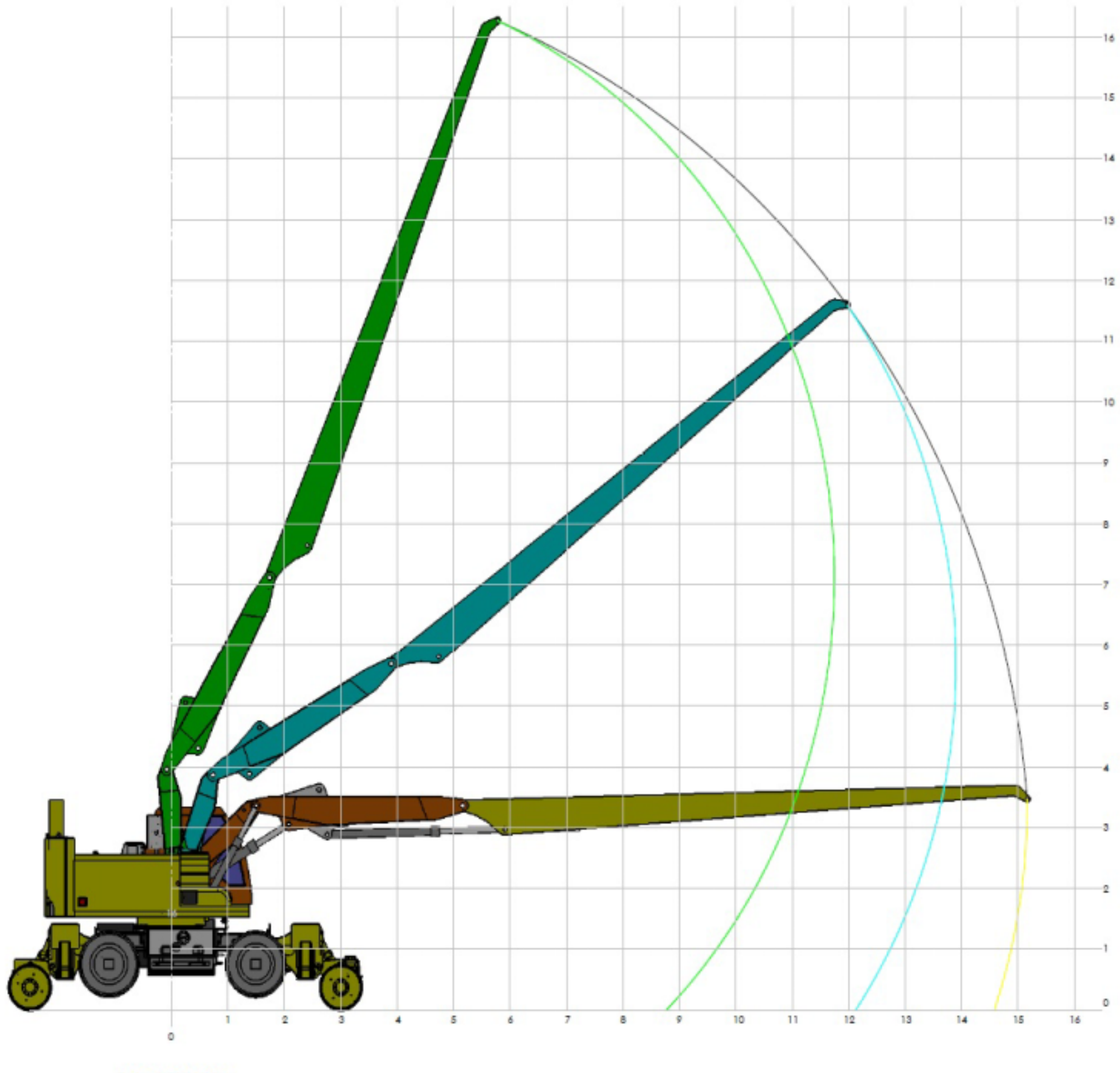
DX170 WITH 5.5M DIPPER + 1.5M DIPPER EXTENSION - BOOM CONFIGURATIONS



BOOM REPRESENTATION TABLE

BOOM COLOUR	MAX STUB ANGLE	CANT CONDITIONS	SLEW CONDITIONS
ORANGE AND YELLOW	96°	ROAD/LEVEL/DOWN CANT	PIVOT END / 35° FIXED END / 15°
GREEN	77°	<2°(50MM)/UP CANT	35° - 165° 195° - 325°
BLUE	52°	>2°(150MM)/UP CANT	

FURTHER NOTE :
- ANGLES WILL HAVE 14° EXTRA WITH >400KG LOAD



DX170 Ultimate with 5m Dipper + Extension

DX170 Ultimate 170HS with 10m Dipper

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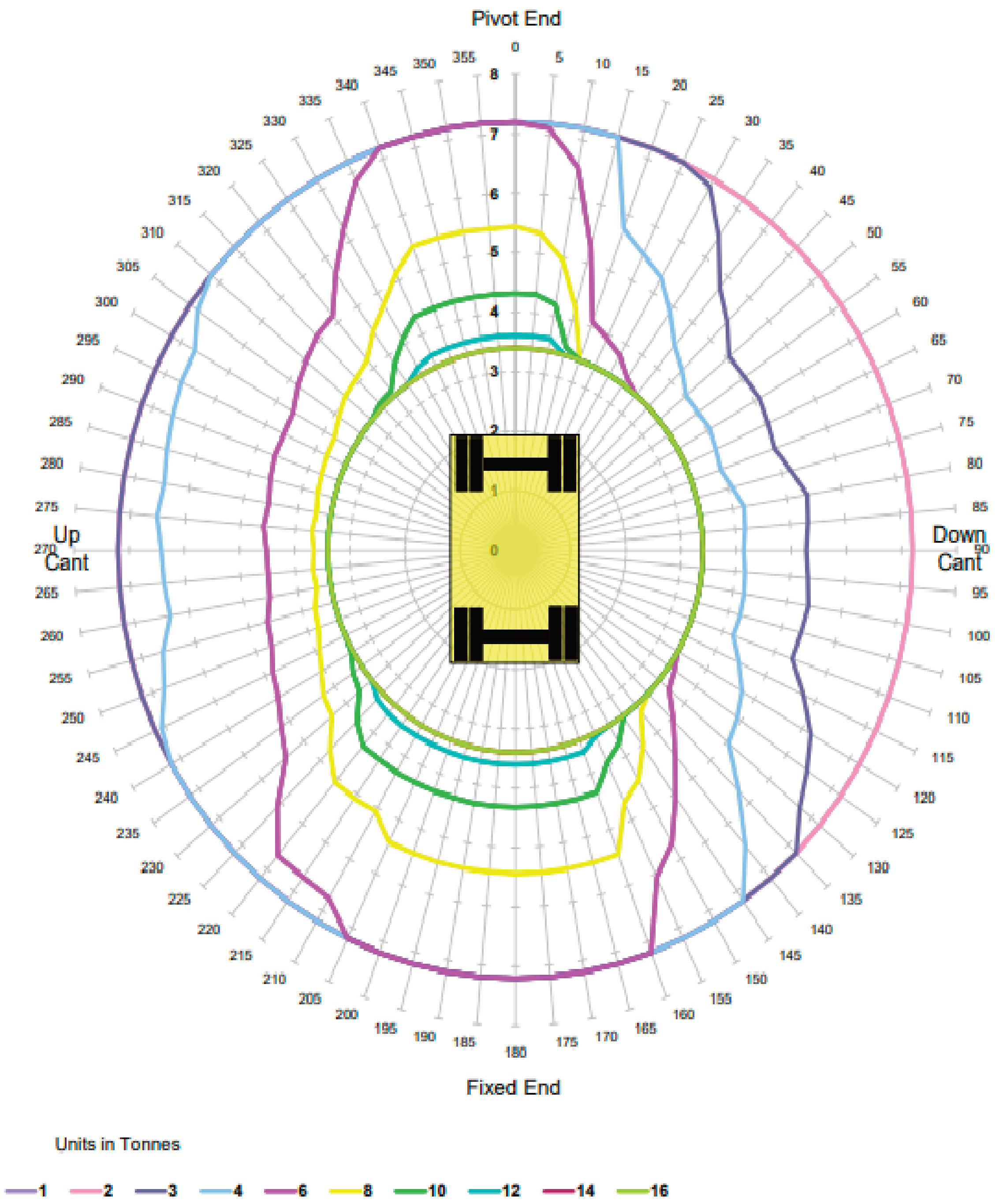
GOS TOOL AND ENGINEERING SERVICES LTD

DOOSAN DX170 HS

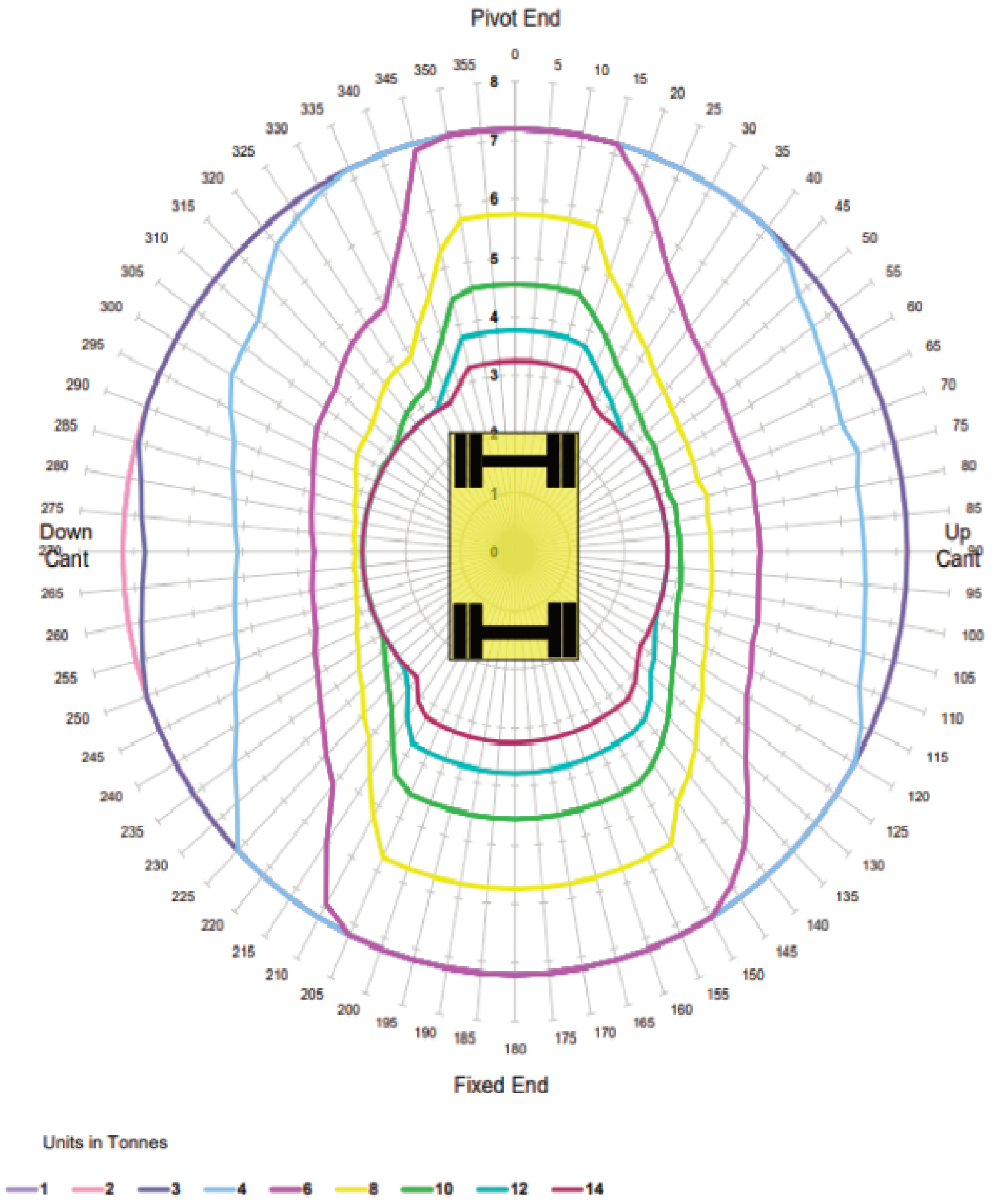
Max Capacity Contours of Radius(m) Plots 2.1m Dipper
Gradient 1 in -25 Height 2m Lift BP
Locked Rail Cant -150mm



GOS TOOL AND ENGINEERING SERVICES LTD

DOOSAN ULTIMATE 270

Max Capacity Contours of Radius(m) Plots 2.1m Dipper
Gradient 1 in -25 Height 2m Lift BP
Locked Rail Cant 50mm



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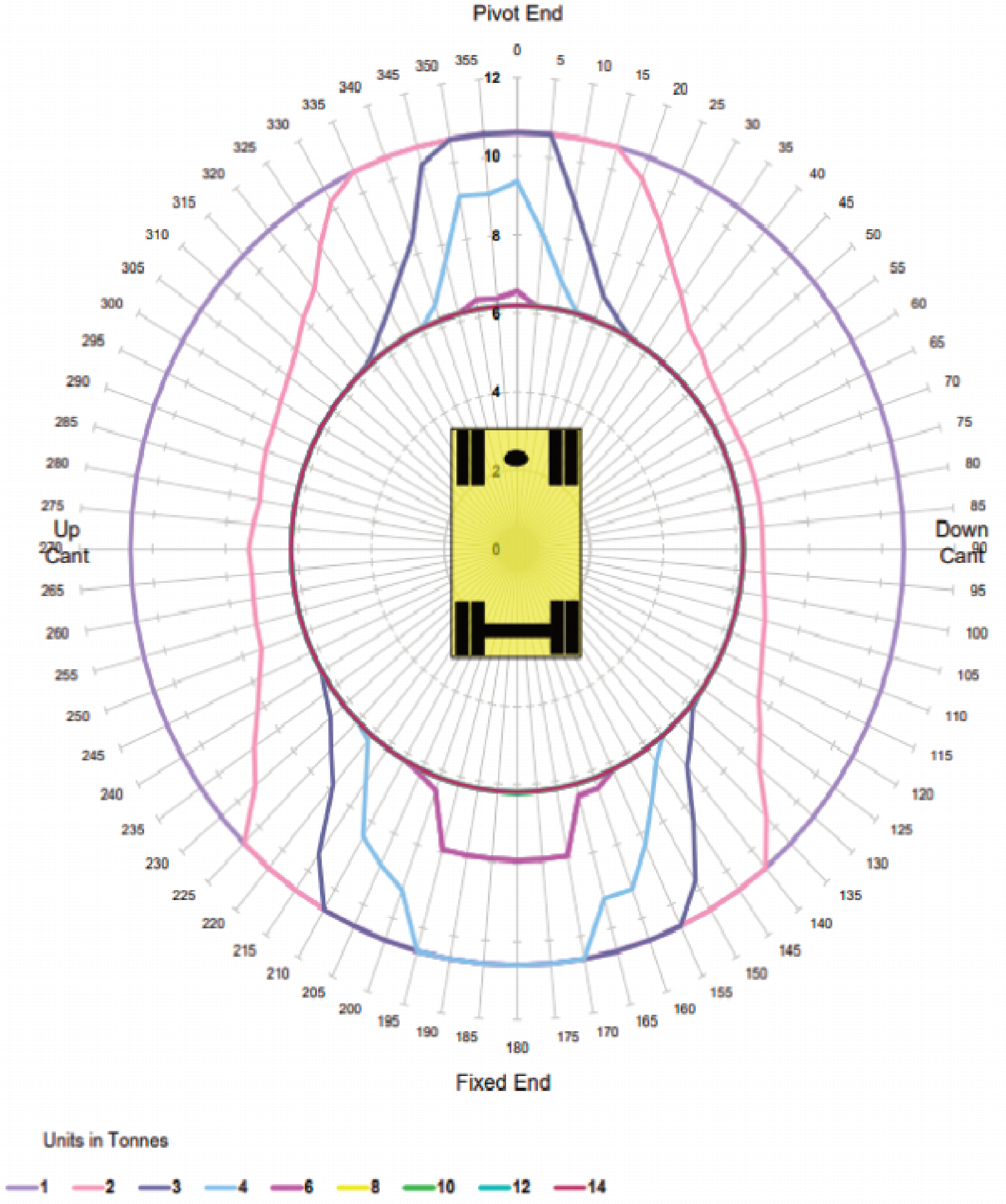
GOS TOOL AND ENGINEERING SERVICES LTD

DOOSAN ULTIMATE 270

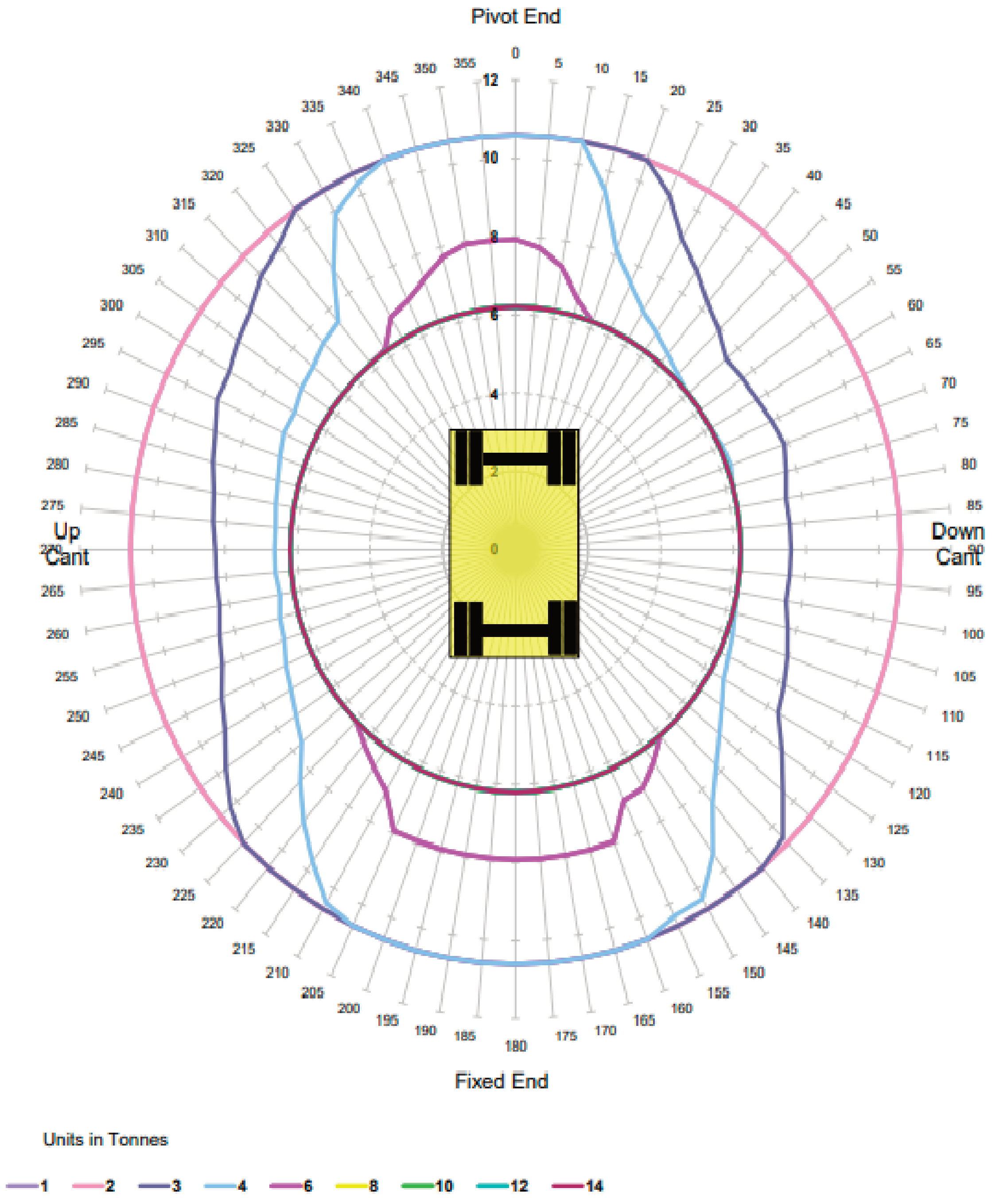
Max Capacity Contours of Radius(m) Plots 5.5m Dipper
Gradient 1 in -25 Height 2m Lift BP
Unlocked Rail Cant -50mm



GOS TOOL AND ENGINEERING SERVICES LTD

DOOSAN ULTIMATE 270

Max Capacity Contours of Radius(m) Plots 5.5m Dipper
Gradient 1 in -25 Height 2m Lift BP
Locked Rail Cant -50mm



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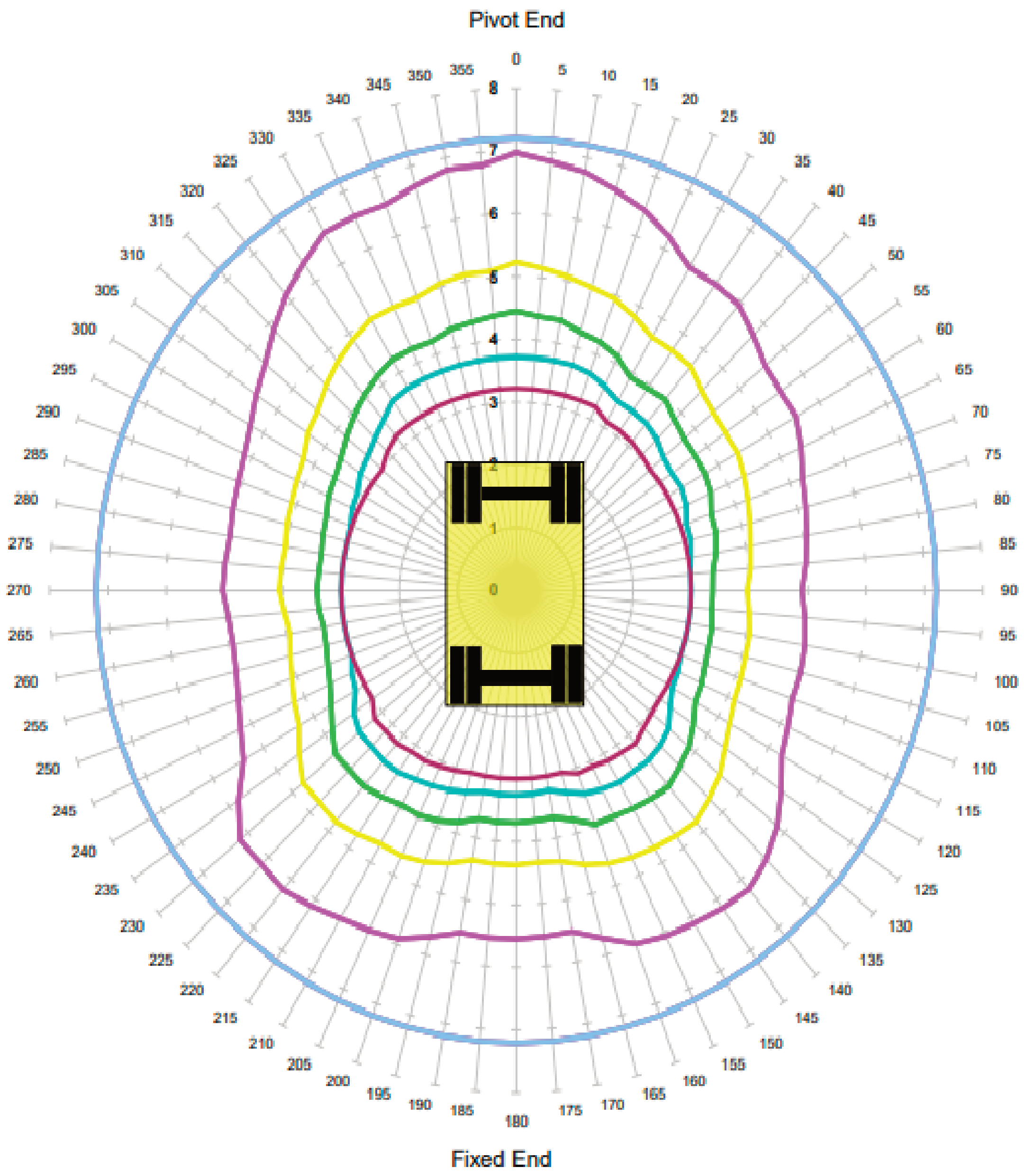
GOS TOOL AND ENGINEERING SERVICES LTD

DOOSAN ULTIMATE 270

Max Capacity Contours of Radius(m) Plots 2.1m Dipper
Level Ground Height 2m Lift BP
Locked Road



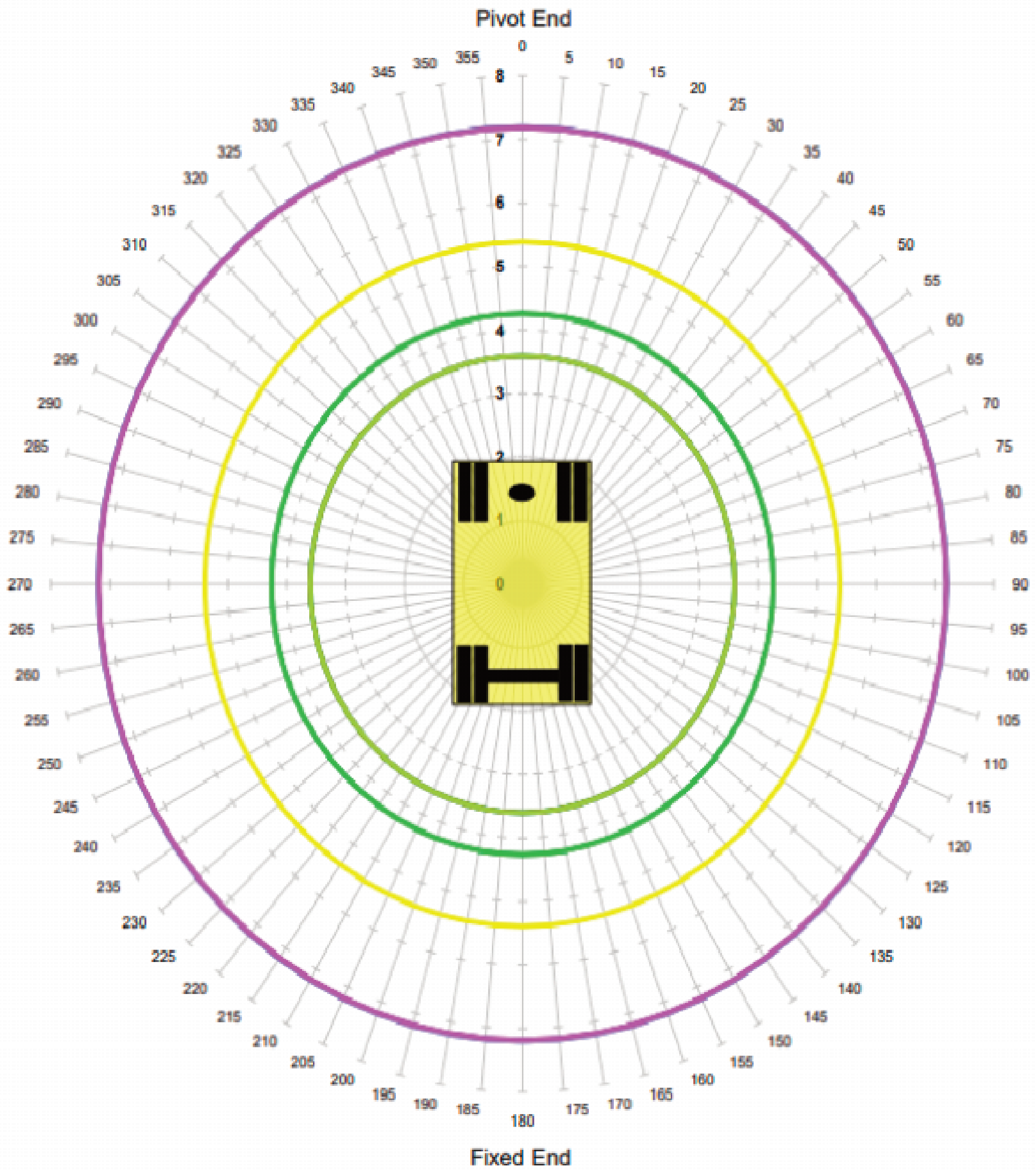
Units in Tonnes

1 2 3 4 6 8 10 12 14

GOS TOOL AND ENGINEERING SERVICES LTD

DOOSAN DX170 HS

Max Capacity Contours of Radius(m) Plots 2.1m Dipper
Level Ground Height 2m Lift BP
Stabilisers



Units in Tonnes

1 2 3 4 6 8 10 12 14 16

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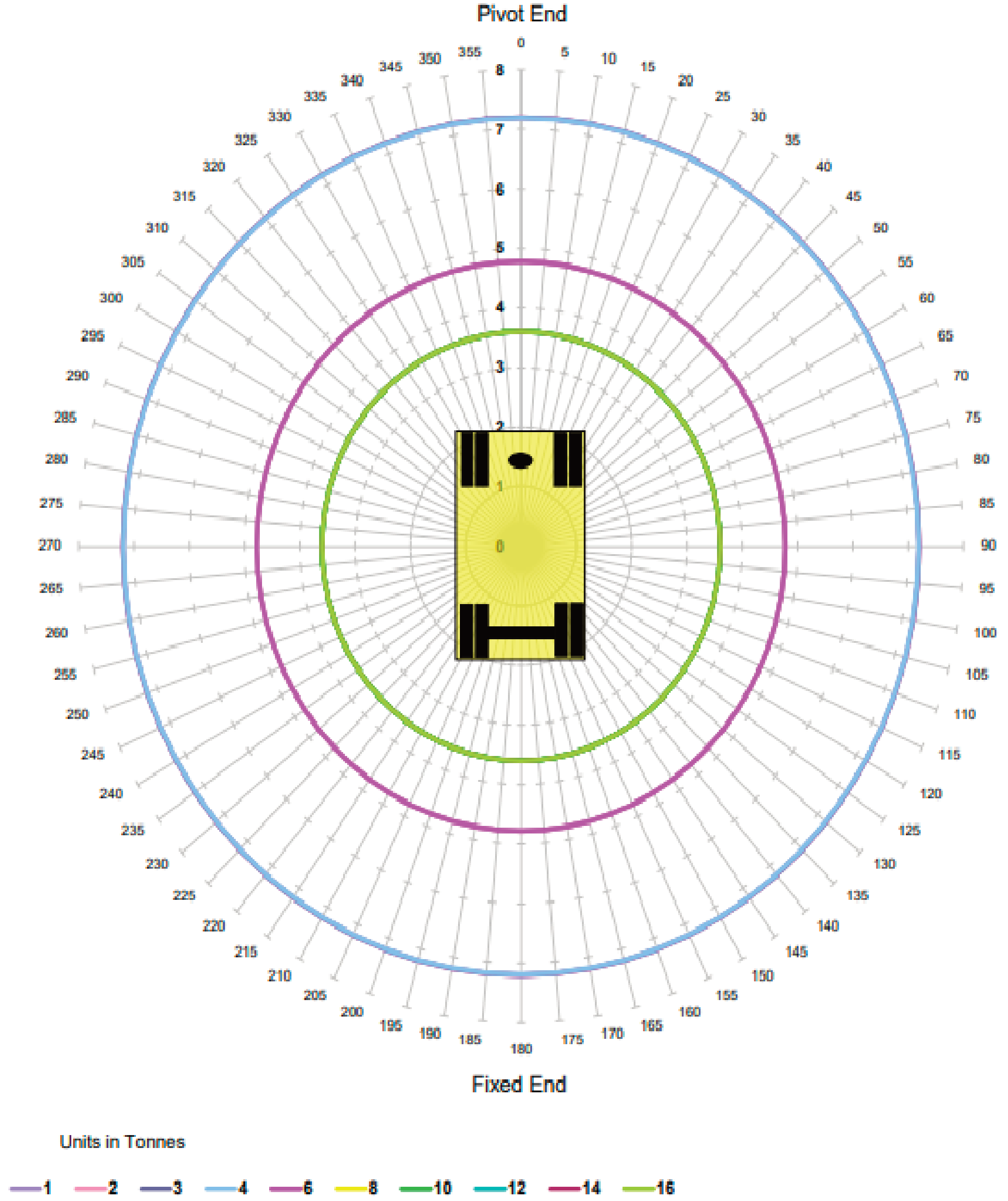
T: +44 (0) 0195 790230 www.gosengineering.co.uk

GOS TOOL AND ENGINEERING SERVICES LTD

DOOSAN DX170 HS

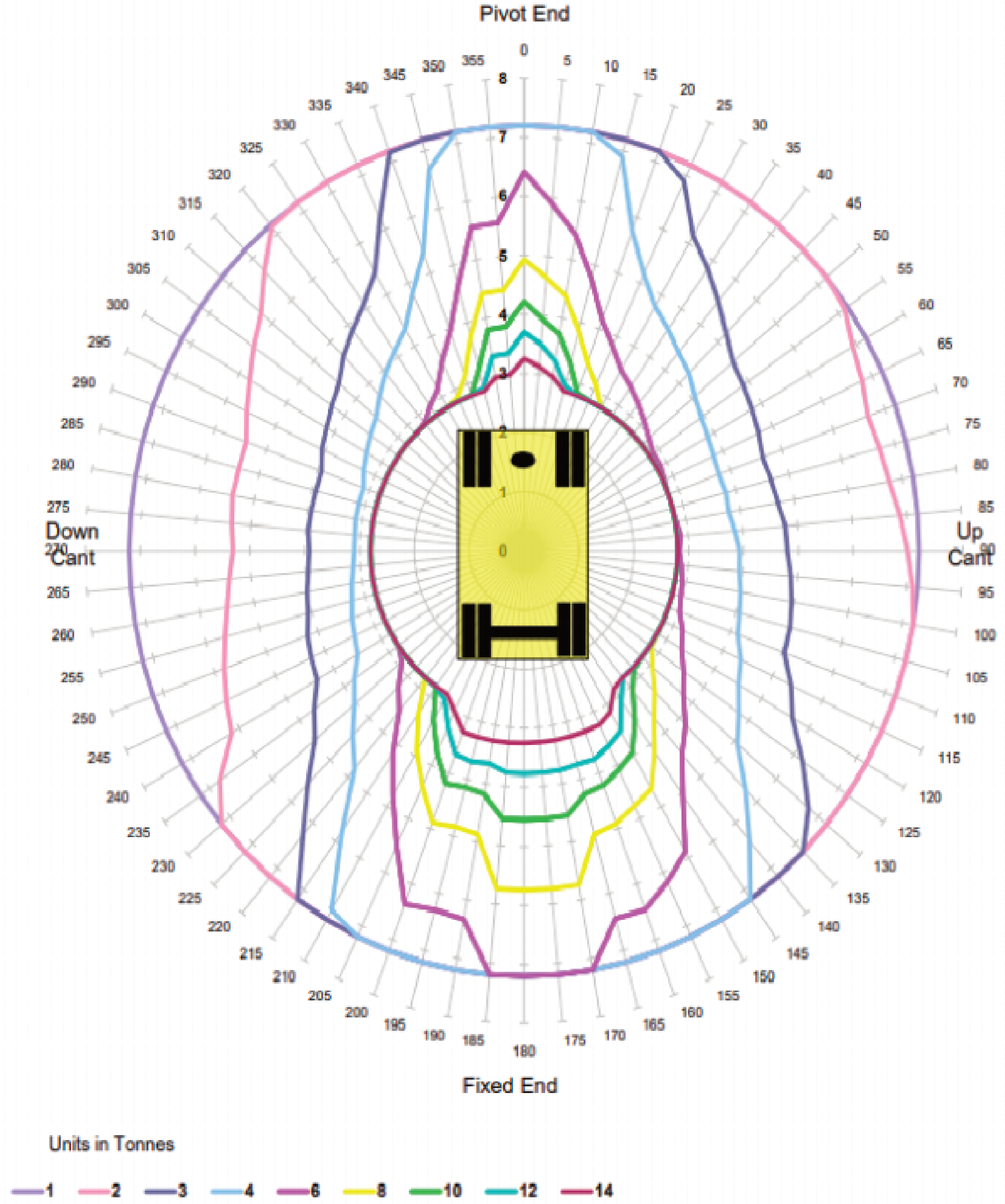
Max Capacity Contours of Radius(m) Plots 2.1m Dipper
Level Ground Height 2m Lift BP
Stabilisers Tandem



GOS TOOL AND ENGINEERING SERVICES LTD

DOOSAN ULTIMATE 270

Max Capacity Contours of Radius(m) Plots 2.1m Dipper
Gradient 1 in -25 Height 2m Lift BP
Unlocked Rail Cant 50mm



Appendix C

On Track Plant – Volker Rail Beaver Tamper

3 Comments / Track Machines / By matt

Volker Rail Beaver Lightweight Tamper

This is an informational article for railway enthusiasts about the Volker Rail "Beaver" Tamper. Rail Record website does not supply track maintenance vehicles.

A Volker Rail lightweight tamper is seen on a level crossing at Newhaven Harbour during engineering work at Newhaven Marine aggregate sidings.

The Beaver tamper is a lightweight track tamper owned by Volker Rail. It has a top speed of 20mph and due to this, it is taken to work sites by lorry, rather than self propelled on the mainline.

The Volker Rail Beaver tamper has 4 arms at each corner of the machine which extend, support, and lift the unit.

Arms beside each cab on each side stablise the tamper whilst it is lifted off the ground. The arms at each end lift the machine.

A centre pivot extends from underneath the tamper, which is used to help rotate the machine once off the ground. Following rotation, the centre pivoting arm can be retracted, and the lorry can be positioned underneath the tamper before taking it away.

The Beaver tamper is rotated on a pivot at the middle of the machine as seen in the photograph. The workers can then push it round facing the right direction.

Tampers are used in engineering possessions to compact freshly laid ballast around the railway sleepers.

The tamper is taken away by lorry to the next work site.

Author: matt

Owner of Rail Record

← Previous Post

Next Post →

3 COMMENTS

Oldest

Mark Stuart 3 years ago

Hi,

I'm a Track Maintenance Engineer for NetworkRail on the Anglia Route based at Romford and would be interested in the Beaver Tamper. We are suffering with weak embankments currently.

0 Reply

matt 3 years ago

Author

Reply to Mark Stuart

Hi Mark it may be worth contacting volker rail as we're an informational website / blog and don't supply maintenance services. Best regards

1 Reply

Daniel 3 years ago

Hi mark if you send a email
Daniel.wade@volkerrail.co.uk if is the me for the tamper

0 Reply

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Track Machines

UK Rail Information

Uncategorized

Appendix D

Sleepless nights for residents kept awake by 'horrendous noise' from rail improvement works

18th April 2019

through Newport. Picture - GWR.

Residents in Newport are furious at the disturbance from rail improvement works being carried out throughout the night.

One disgruntled Newport resident, Jemma Porter, shared a time stamped video on Twitter showing how loud the works were at 11:45pm.

She said “I’ve been advised by friends and family who have seen my post that the work is currently happening in the Maindee area which is roughly a mile from where I live.

"However, a number of people who have seen my post have also heard the disruption and that extends from the beechwood area to the St Julians.”

happen every night.

"As you can hear [in the video] the noise is horrendous and I'm unable to sleep through it and given my working hours you can imagine the inconvenience."

Ms Porter said she hadn't received any communication from Network Rail before the work started. Network Rail provide written communication with residents within a 250m radius around where the work is taking place and up to a 500m radius if it is expected to be loud work.

Work is usually done on railways at nights to minimise disruption for commuters throughout the day but noise disruption is expected, although as stated on Network Rail's website they aim to reduce noise pollution and disturbance by using localised noise barriers.

A Network Rail spokesperson said: "The noises in Newport are related to the modernisation of the South Wales Mainline and we apologise to neighbours disturbed by this activity.

"Specifically, the noise is caused by piling, which is noisy work but essential to the modernisation programme. For the safety of our track workers, this work is carried out when trains are not running, often overnight."

Network Rail says "essential maintenance" the reason behind noisy works which woke residents

20th June 2020

BASINGSTOKE

By Riley Krause
@cavemankrause
Senior Reporter

Share

Network Rail have confirmed the reason behind the "noisy works" which woke residents in the middle of the night.

The ***Gazette*** previously reported on how a neighbour was left furious after he was woken up at 3.30am to the sound of noisy works coming from Basingstoke Train Station.

Jamie, who lives in the town, described the overpowering noise as "like a train screeching to a halt, only continuously".

It was shortly after 3.30am on Sunday when he heard the sounds coming from the tracks, just behind his home.

He told The Gazette: "We were woken up and the noise lasted until 5am. We had no sleep in that period as it was so intrusive.

"I know others on the estate were affected."

Network Rail have now responded to a request for comment and confirmed the reason for the noise.

A Network Rail spokesman said: “Our team has been carrying out essential maintenance in and around the Basingstoke area using the opportunity created now there are fewer trains running.

"This will improve reliability of the railway when the regular timetable resumes.

"We have reminded teams to send out notices to local residents when there is going to be pre-planned work which is going to be noisy.

"Anyone with any concerns should contact us on 0345 711 4141.”

BASINGSTOKE

Share

Bristol resident 'unable to sleep' due to overnight station construction work

And in June 24-hour construction works are planned for 16 days

SHARE 21

By Yvonne Deeney Community Reporter **00:01, 10 MAY 2023**

Bookmark

continue into 2024 and is taking place on the site of the former Ashley Hill railway station which closed to the public in the 1960s.

Once complete the station will initially be served by trains operating between Filton Abbey Wood and Temple Meads. Overnight works on selected Saturdays are set to continue until Christmas, and in early June 24-hour construction is planned for 16 consecutive days.

David Trew who lives on Station Road has told Bristol Live the work that is currently being carried out from midnight on Saturdays until 7am on Sundays is 'not acceptable'. He said that he took his concerns to National Rail and the noise complaints team at Bristol City Council but said he has not been provided with any resolution.

READ MORE: Section of major walking and cycling path in Bristol to close for at least a year

Mr Trew said that after experiencing a stroke in 2019, getting a good night's sleep has become more important for him. But while he was patiently waiting for Network Rail's response to his complaints he received a letter last week informing him of two weeks of 24-hour construction which he described as 'appalling'.

The letter from Network Rail dated May 2, outlines the timetable for construction works taking place until September and informs neighbours of two community drop ins taking place over the next week. The 24-hour working period, which is set to commence on June 3, has been outlined as an 'incredibly busy period' with both of the new station's platforms set to be completed by June 19.

Once this 'main blockade' period is complete, Network Rail will move on to what has been called the 'post blockade' construction phase which will involve the installation of footbridges, lifts, lighting and electrical signage. This phase which will involve overnight construction wor 3 on selected Saturday evenings is set to continue until Christmas.

Network Rail has apologised in advance to neighbours and stated in the recent letter that the company will do its best to keep 'all unnecessary noise to a minimum' and is limiting vehicle movements via Station Road. But the letter added that bringing materials and equipment via Privacy s also 'unavoidable'.

said: “Many of us are unable to sleep due to the noise from the site - bleeping machinery, the

“I have remonstrated with the workers directly, to be greeted with shoulder-shrugging. I have phoned National Rail directly, to be told that National Rail has permission from the government to build this station, and a contract with the council to work on weekdays.

“As such, I was politely told to 'go away'. I have complained to the council about the noise and at first the noise complaints people seemed helpful - they listened sympathetically, and sent me a 14-day noise diary to complete, I have completed this and sent it back.

“I have sent two emails since and have also phoned, to be placed on hold, telling me I was number one on the queue. After hearing this for 46 minutes, I gave up and I phoned back a week later to the same thing.

“On Saturday morning (May 6), a letter from National Rail where we are told that [the company] plans to work 24/7 from June 1 to 16. If Saturday nights were unacceptable, then this is doubly unacceptable. We are a suburban area - most folk must work during the day, so to have disturbed sleep is appalling.”

A Network Rail spokesperson said: “We apologise for any disruption as we work to deliver a brand-new train station for this community. Unfortunately we do need to complete a proportion of the work at night, when trains aren’t running. This has included the need to break out the old station platform which has been a noisy process.

"We’re doing everything we can to keep disruption to a minimum and are working to keep residents informed, via letters and drop in sessions. We recently issued an update letter and have face to face drop in sessions coming up on the 10 and 15 May.

“We have an intensive period of 24/7 working in June, but this will reduce the overall programme by more than six months, cutting the length of time we’re impacting

Work is stopped after neighbours complain of 2am 'racket'

8th November 2012

By Stephanie Cureton

Share 8 Comments

NETWORK Rail has been forced to stop chopping down “potentially hazardous” trees at a Wirral train station after residents complained it was causing them sleepless nights.

Workmen had started to saw down trees at Wallasey Village station during the early hours of the morning in a bid to reduce the safety risk they posed.

However local residents soon bombarded Wirral Council and Network rail with complaints as chainsaws and workers’ conversations kept them awake all night.

The work has now been suspended until further notice after the council gave them a warning notice.

WirralGlobe

Melanie Neilson, whose house backs onto the tracks, said she was struggling to sleep through the “racket.”

She said: “I have been awake since 2am this morning listening to the God-awful racket that is trees being chain-sawed – I have to be up at six!

“I have been told Network Rail could be breaching noise pollution levels for that hour of the night – not only were the chainsaws a constant bind but the workmen are all shouting to each other too.

“I live a couple of roads back from the actual track so those who live next to it must be demented.”

Residents, whose homes overlooked the embankment of trees, initially feared that the scheme to cut down the trees would rob them of their privacy and leave them open to flooding problems.

It was later agreed that extra fencing would be put up while laurel trees and shrubs would also be planted.

The work is being done from 11pm until 5am every night this week but now it is not known when it will be picked up again.

A Network rail spokesman said: “We were told by the council about a number of complaints they had received.

"The work now has been halted indefinitely, although we have had calls from some residents are angry that the work has been stopped.”

Bleary-eyed residents complain of non-stop 'screeching' on North Wales railway line

Round-the-clock track works are ongoing in Deeside, Flintshire

By **Andrew Forgrave** Countryside and tourism editor **05:30, 6 MAR 2023**

Track renewal is leaving some residents with little sleep (Image: Ian Bartlett) "screeching" as rail wagons rumble through the day and night.

advance notice, it's caught some people unawares. Round the clock works are due to continue until Sunday, March 19, leaving some people wondering if they'll ever catch some sleep.

"I know the repairs have to be done," said one woman. "However the noise has been horrendous started at least 4am this morning, all day and still going."

READ MORE: Everything you need to know ahead of A55 roadworks that come into force from tomorrow

One resident complained of being sleep deprived because her dogs "keep going nuts" over the noise. Another who lives three streets away was kept awake until 3am on Sunday morning. "It must be hell for people who live closer to it," he said.

A woman who lives right next to the line confirmed this was the case. She said: "I haven't slept for the last 2 nights. Glad I'm off next week, I'm so tired. It's all through the night!"

much as possible. We are sorry if we do disturb you."

Bidston line. These began on Saturday, March 4, and are so far scheduled until Monday, March 13, at 7am. More details of replacement buses the following week will be made available closer to the time.

Network Rail plans more works in Shotton later in March and in April. Affected dates are the weekends of March 25-26, and April 8-9.

A further week of activity is planned on April 15-21. On these dates, work will be carried out overnight, between 10.55pm and 9.40am. Network Rail warned these date could change.

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- **Where every mobile speed camera in North Wales will be in March 2023**
- **Amazing £1m 'haunted' house with mock castle and 5,000 bags of Haribo sweets on sale in North Wales**
- **Mum left 'in tears' as theatre security remove her family during panto**

8

News

Peterborough residents angered after being woken up at 4am by rail works

Early morning rail works woke up huge numbers of Peterborough residents on Sunday.

By Joel Lamy
Published 27th Apr 2020, 11:56 BST - 2 min read
Updated 27th Apr 2020, 16:32 BST

Loud noise heard in Peterborough in the early hours of the morning - video Andy Si...
Peterborough Telegraph

1:08

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People living in Werrington, Walton, Paston and Gunthorpe reported having their sleep disturbed at 4am by a loud drilling noise which was due to Network Rail engineers carrying out work to build a dive under at Werrington Junction.

Network Rail said it had sent out letters to more than 500 residents warning them that the works were due to take place.

However, among those to voice their anger on social media at being woken up was landlord of The Ploughman in Werrington, Andy Simmonds, who tweeted Network Rail that he would be making a formal complaint to **Peterborough** City Council.

Other residents voicing their disapproval also did not appear to be aware that the works were due to take place.

A Network Rail spokesperson said: “Most of the work to install sheet piling at Werrington has taken place during the day time, but some of it can only be carried out safely overnight when there are no trains on the line.

“Letters were sent to over 500 residents who live near the railway so they were aware that work would be taking place in the area between 11.45pm on Saturday to 8am on Sunday.

“We work hard to minimise the impact our work has on the community. Vibration piling is mainly used which can only be felt by those who are close to the site. However, due to the ground conditions, hammer piling also had to be used in some locations, which was louder.

Werrington Junction

“We would like to apologise to residents for any disruption that this work caused. It was essential that it was carried out so the line could be reopened on Sunday morning. This meant train services could continue getting those who cannot work from home, such as doctors and nurses, to and from their jobs and so that vital supplies could continue to be transported across the county via freight services.

“This ongoing work is part of the £1.2 billion East Coast Upgrade. We have measures in place to minimise disruption for residents and will continue to clearly communicate with them as work progresses on the project.”

The dive under will take freight trains off the East Coast Main Line and connect them with the Great Northern Great Eastern Line as part of a multi-million pound scheme.

Once completed this will help ease congestion and create capacity for more train services to run on the East Coast Main line to and from London King’s Cross in the future.

Noise concerns have previously been raised, although this did not stop the scheme being approved following a public inquiry.

Related topics: Network Rail | People | Peterborough | Werrington

Appendix E

WIKIPEDIA
The Free Encyclopedia

British Rail MPV

The **Multiple-purpose Vehicle** or **MPV** is a purpose-built departmental derivative of a diesel multiple unit. Twenty-five two-car units were ordered by Railtrack to enable it to replace its varied collection of ageing departmental vehicles, many of which were converted from redundant passenger stock.

Railtrack Multi-Purpose Vehicle

DR98926 at Swanwick

In service	1999 - Present
Manufacturer	Windhoff
Built at	Münster
Family name	CargoSprinter
Constructed	1998-2001, 2012
Entered service	1999-present
Number built	18 single units 32 double units
Formation	1 or 2 cars
Operator(s)	Network Rail
Specifications	
Track gauge	1,435 mm (4 ft 8½ in) standard gauge

The vehicles were built in Germany by Windhoff. The design is based on the Windhoff "CargoSprinter" units that are operated by Deutsche Bahn (Germany) and CRT Group (Australia). Normally a unit consists of one powered vehicle fitted with twin 265 kW (355 hp) Railpac diesel engines,[1] semi-permanently coupled to an unpowered slave unit without engines. The later orders for the South East of England and for overhead line replacement are instead composed of two powered units, to give better acceleration and top speed.[1] When first built there were problems with the vehicles being 'out of gauge' when running empty.

The concept of the design is that each vehicle has a driving cab and an under floor engine/transmission with Multiple unit (MU) control. The majority of each vehicle is a flat load bed that can carry combinations of 10-foot and 20-foot modules that are secured using the locking system for ISO standard containers. Modules can be changed as required to suit current requirements.

In 2005, two powered MPV units were used to form a "Freight Multiple Unit" for freight trials, made by coupling standard freight wagons in between the pair of MPV units. Temporary multiple unit control cables were run along the wagons in order to connect the two MPVs, which are acting as locomotives working as a push-pull train.

Variants

There are five distinct types of MPV unit that represent the development of the concept for use in the UK. All are owned by Network Rail.

Number Range			Description	Comments
DR98901-902	+	DR98951-952	Prototypes	Work in semi-permanently coupled pairs, e.g. DR98907+DR98957.
DR98903-925	+	DR98953-974	Production units	
DR98926-932	+	DR98976-982		
DR98001-014			Overhead-Line MPV	Some painted in White livery and some now in Network Rail yellow livery. Were used on West Coast Main Line, most are now stored.
DR97011-014				Painted in Blue livery. Used on High Speed 1.


Railtrack MPV, nos. DR98917+DR98967, at Doncaster Works on 27 July 2003. These purpose-built departmental vehicles were built to replace older trains converted from former passenger vehicles.

High output wiring train

For the replacement of overhead lines on the West Coast Main Line at the start of the 2000s, Railtrack designed and ordered two new self-powered High Output Wiring Trains (HOWT). The order was placed with Windhoff in July 1999 and the first train available for trials in Germany in June 2000 before being shipped to the United Kingdom shortly afterwards. The replacement program using the new trains began in November 2000.[2]


DR98915 and DR98965 passing through Lincoln on 26 October 2007

Replacement of a tensioned overhead span measuring 1000–1500 metres takes four hours with a HOWT, compared to sixteen hours for original method (using rolling stock and road-rail vehicles).[2] Up to 30 crew are required to operate the HOWT.[3]


DR98915 and DR98965 passing through Lincoln on 26 October 2007

The full train comprises nine vehicles; four MPV CargoSprinter-based units and five flatbed units. All of the units were designed to accept standard shipping container modules, secured with standard ISO twistlock clamps, allowing modules to be transferred as needed. After the full train has arrived at the work site it is split into five sections. The sections follow each other along the length of wire to be replaced, each performing a step in the wiring renewal process, according to the modules it carries:[2]

1. Old wire recovery
   - MPV unit (short working platform), facing forwards
   - Flatbed unit (old wire cable drums)
2. Catenary cleanup
   - Flatbed unit (long working platform)
   - Flatbed unit (long working platform)
3. New wire deployment and tensioning

- Flatbed unit (new wire cable drums)
- MPV unit (short working platform), facing backwards

4. Registration and alignment
   - MPV unit (short working platform), facing forwards
   - Flatbed (long working platform)
5. Measuring and recording
   - MPV unit (recording/pantograph cabin; rotating working platform), facing backwards[2]

At the end of February 2003, a total of 650 wire lengths had been replaced by the two trains. Two conventional wiring trains would have taken over seven years,[2] as the conventional trains would be limited to one single sixteen-hour engineering possession per week (only available at weekends).[2] The cost of each of the two trains was £3.3 million.[3]

Welsh freight trials

For a five-week period beginning in March 2005, trials were undertaken in Wales, transporting timber from Aberystwyth to a wood-chip factory at Chirk.

The daily service, arrived at Aberystwyth at 09:22, allowed approximately 2.5 hours for loading of the timber and then departed, loaded, at 11:50 as 6Z21.[4] On the single-track Cambrian Line the freight service was timed to follow in the footsteps of a regular passenger service to avoid potentials for delay.[5] The combined freight multiple unit (FMU) reversed in platform three at Wrexham General railway station and continued to the Kronospan private siding at Chirk.

The formation used the two halves of an MPV pair, sandwiched around seven open-sided air-braked timber (OTA) wagons. The MPV vehicles are normally designed to carry a combination of short shipping containers, and for the trial, one specially built containerised timber carrying module was constructed for the trial at a cost of around £15,000[5] and mounted on MPV DR98919. For the trial, the other MPV vehicle (DR98916) carried a water-tank module for ballast.[4] MPV units normally operate as pair consisting of a powered unit and an unpowered trailer; for the timber trials, both of the MPV units were powered versions. Additional mobile cab signalling equipment had to be carried.[5]

The trial had been scheduled to being on 3 March 2005. The first trip took place on 5 March 2005 and continued on weekdays until 1 April 2005. Loading at the Aberystwyth end was done with the train directly on the running line as no suitable terminal facilities were available and could be managed in as little as 90 minutes, with the use of three lorries delivering the timber supply.[5]

Out of the twenty-five scheduled journeys in the trial, nineteen were run, transporting a total of 2845 tonnes of timber (an average of 150–154 tonnes per trip).[5] Loading capacity was reduced on the first journey by an imposed requirement by Network Rail to tow a British Rail Class 37 at the rear of the train as insurance up the thirteen-mile[4] 1-in-47 incline at Talerddig.[5]

Switches and Crossings video train

Double-ended single-unit MPV number DR98008 is used by the Network Rail Asset Information department as a track geometry and video train.[6] In the Manchester area the unit is allowed to operate permissively throughout all station areas, replacing a large number of walked inspections.[6]

DR98008 configured as the S&C video train in 2011

Accidents and incidents

- On 3 December 2006, an MPV ran away following a collision with a tree. Similar to the later October 2017 incident, debris activated the brake release mechanism on the MPV, but was exacerbated by the operator failing to set the hand brake before dismounting to inspect the MPV for damage.[7]
- On 22 March 2016, an MPV ran away on the East Lancashire Railway and entered Manchester Metrolink tracks, where it was derailed on catch points.[8]
- On 17 October 2017, an MPV performing leaf removal duties near Markinch, Fife collided with a tree across the line. The accident damaged the MPV's braking system, causing the train to run away for 4 miles (6.4 km). Two crew sustained slight injuries jumping from the train.[9] The Rail Accident Investigation Branch released their report into the incident on 11 January 2018. The RAIB determined that debris from the tree strike activated a brake release mechanism on the MPV. The debris also separated all three brake hoses, which prevented the driver from reactivating the brakes.[7]

See also

- CargoSprinter
- M250 series (a Japanese freight EMU)

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1. Butcher, Roger (May 2000). "New on-track plant" (https://web.archive.org/web/20110708120545/http://www.cargosprinter.com/d/wh/akt/pre/061.htm). *Rail Infrastructure No. 15*. Archived from the original (http://www.cargosprinter.com/d/wh/akt/pre/061.htm) on 8 July 2011.
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3. "New and faster overhead wiring train - Innovative products" (http://findarticles.com/p/articles/mi_m0BQQ/is_3_41/ai_81006329/). International Railway Journal. March 2001. Retrieved 17 May 2009.
4. Crump, Eryl (15 March 2005). "Chasing the Cambrian timber train" (http://www.nwrail.org.uk/nw0503f.htm). *The North Wales coast railway Notice Board*.
5. Browne, John (May 2005). "Rail Freight Multiple Unit Trial, Aberystwyth to Chirk, March 2005, Final Report" (http://www.timbertransportforum.org.uk/Upload/Documents/41_Rail_freight_multiple_unit_trial.pdf) (PDF).
6. jlegay (21 December 2011). "Current deviations against current and withdrawn RGSs" (https://web.archive.org/web/20111016202833/http://www.rssb.co.uk/SiteCollectionDocuments/pdf/rgs/deviations/Deviations%20Register.pdf) (PDF). Rail Safety and Standards Board Ltd. Archived from the original (http://www.rssb.co.uk/SiteCollectionDocuments/pdf/rgs/deviations/Deviations%20Register.pdf) (PDF) on 16 October 2011. Retrieved 5 January 2012. "GE/RT8000/TS2 …

MPV S&C Video Train No. DR98008. … allowed to operate permissively within stations at Manchester … MPV S&C Video train will ultimately allow the removal of daylight (and night) S&C patrols as the train takes over the role."

7. Rail Accident Investigation Branch (11 January 2018). "Runaway of a maintenance train near Markinch, Fife" (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/676754/180111_R012018_Markinch.pdf) (PDF). Retrieved 22 November 2020.
8. "Runaway and derailment of a rail vehicle near Bury, Greater Manchester, 22 March 2016" (https://www.gov.uk/government/publications/bury-safety-digest/runaway-and-derailment-of-a-rail-vehicle-near-bury-greater-manchester-22-march-2016). Rail Accident Investigation Branch. 16 June 2016. Retrieved 8 November 2017.
9. Dalton, Alastair. "Train crew injured jumping from runaway train in Fife" (http://www.scotsman.com/news/transport/train-crew-injured-jumping-from-runaway-train-in-fife-1-4606870). *The Scotsman*. Johnston Publishing Ltd. Retrieved 7 November 2017.

External links

- On-Track Plant website (http://www.ontrackplant.com)
- Photos of MPVs (http://www.ontrackplant.com/photos/tags/mpv)
- Windhoff GmbH (https://web.archive.org/web/20040818055904/http://www.windhoff.com/e/index_v1.htm)

-

Appendix F

High Output Plant System (HOPS)

Our HOPS train is used for our project to electrify the Great Western Mainline.

Based at our High Output Operations Base in Swindon, the £40m state-of-the-art HOPS train builds overhead line equipment (OLE) for electrification of the Great Western Mainline.

It works for seven to eight hours – depending on where it's being used – for six nights a week.

With a top speed of 60mph – but working at 5mph during a possession, or 15mph if it's the only activity on site – the HOPS train can build the electrical infrastructure at an average of around one mile (1.6km) per night.

Factory train

Before starting work, our HOPS was tested on the High Marnham track, part of our Tuxford Rail Innovation & Development Centre.

Made up of 23 vehicles forming five 'consists' (the elements of the HOPS), the HOPS factory train has three specialised sections – each delivers a different stage of work:

1. There are two 'consists' each of five vehicles to build foundations for the OLE support structures that hold the electric wires. Five of them dig the foundations (which are one metre square by four metres deep) and fill them with concrete, while another five drive the steel tube piles into the ground. The piles measure between 610mm and 762mm in diameter.

2. There are three vehicles in the 'consist' that installs the main steelwork for the 15,000 OLE structures, as well as five in the 'consist' for installing 'small parts steelwork', and three to hang up the wires.
3. The third section has two platform vehicles for the final stages of wiring.

The HOPS is pre-loaded with everything it needs to install the overhead wiring and the structures that hold the electrical equipment.

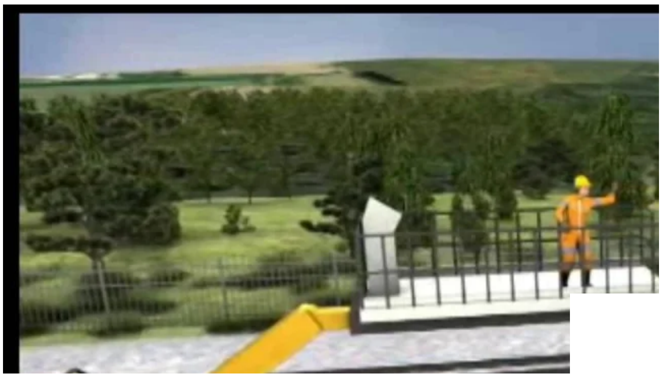
Operating the train

As with all [High Output](#) work, operating the HOPS train is a collaborative effort, from planning to logistics, materials supply and delivery. Every day, each vehicle is unloaded, refuelled, maintained and restocked.

Contractor Amey operates the HOPS train and provides the teams to cover the shifts as well as for maintenance and logistics. These teams manage and operate the Swindon operating base. Amey is working with us to increase the specialised OLE workforce in the South West, where the Great Western modernisation project is taking place, such as by supporting our Electrification Training Centre in Swindon.

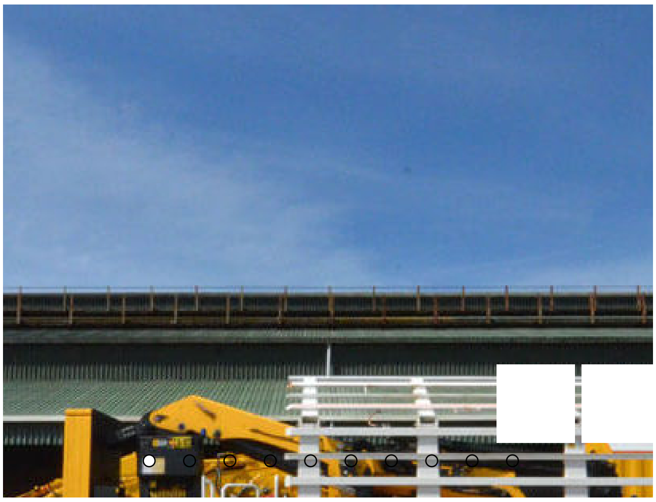
HOPS in numbers

- It can carry 30 piles in total.
- Per shift, it can install 15-20 piles, with each pile taking less than 15 minutes to install.
- It can hold 4 drums of electrical wire.
- Typically it installs 10-15 steel gantry sections (masts and booms) per shift (but can do up to 25-30 per shift).
- It installs 1-2 contact and catenary wires per shift (these wires carry electricity to the train through its pantograph).



HOPS capabilities and output 430 KB

HOPS glossary 136 KB



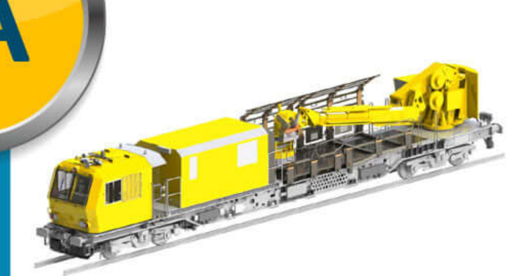
NetworkRail

HOPS | High Output Plant System

FOUNDATIONS CONSISTS

STEEL PILES FOUNDATIONS

1A


1.1.1
MPV with Movax Ram


1.1.2
Pile Carrier Wagon


MPV Fambo (Thor)

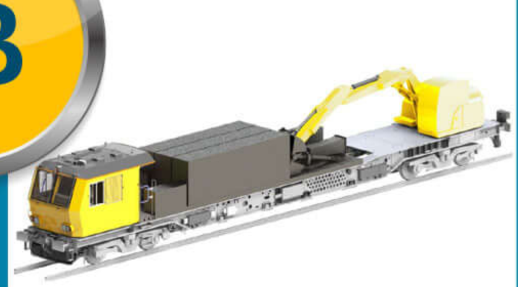

1.1.3
MPV with Movax Ram

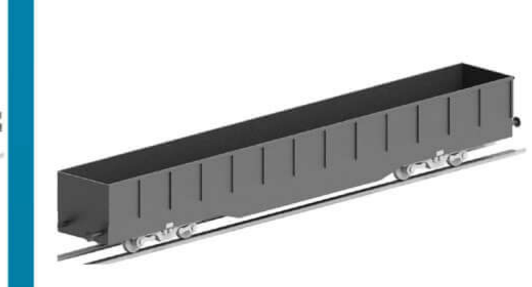

1.1.4
Pile Carrier Wagon

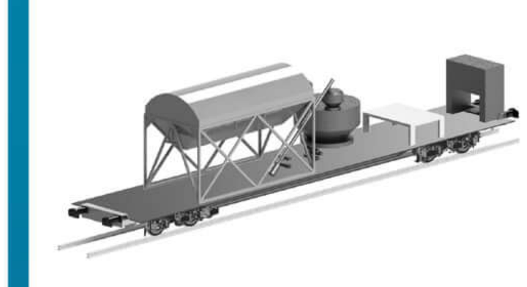

1.1.5
MPV with Fambo Ram

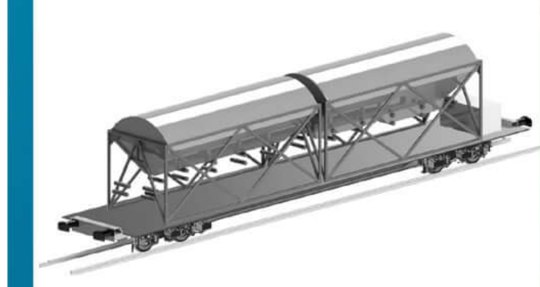
EXCAVATION & CONCRETE FOUNDATIONS

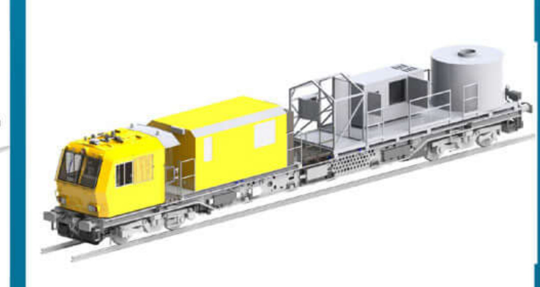
1B


1.2.1
MPV with Excavator


1.2.2
Spoil Wagon


1.2.3a
Concrete Mixing Unit

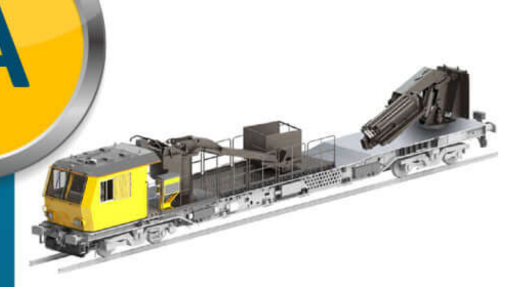

1.2.3b Sand
and Aggregate Hoppers


1.2.4 MPV
for Concrete Batching

STEEL & WIRING CONSISTS

STEEL WORK

2A


2.1.1 MPV
for Mast Erection


2.1.2
Structures Carrier Wagon

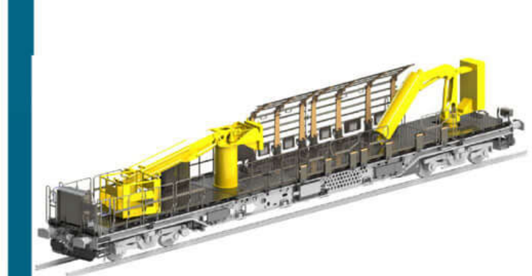

2.1.3a
MPV for Masts

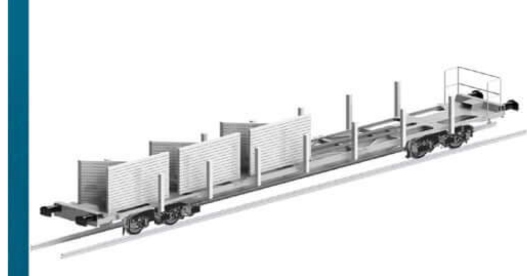
LEGEND
- MAIN LINE DRIVING CAB
- IN POSSESSION DRIVING CAB
- MAIN LINE DRIVING CAB (NO DRIVING CAPABILITY YET)

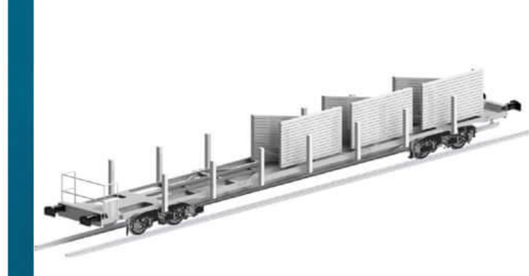
EARTHING, ATF & SPS

2B-1


2.2.1 MPV for Ancillary
Conductor


2.2.2 MPV for Ancillary
Conductor


2.2.2b SPS and Cantilever
Carrier Wagons

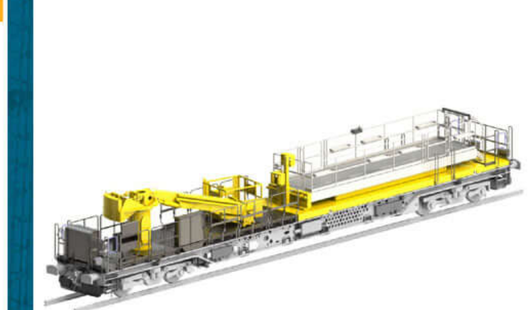

2.2.3 SPS and Cantilever
Carrier Wagons


2.2.4 MPV for Cantilever

CONTACT & CATENARY

2B-2


2.3.1 Wagon for Contact
Wire and Catenary


2.3.2 MPV for Contact
Wire and Catenary


2.3.3 MPV for Contact
Wire and Catenary

THE HOOB
High Output Operations Base

The HOOB is the operations base for the HOPS System. It is the facility that houses the Assets, materials and equipment needed for shifts and also where the HOPS system gets upgraded and maintained.

FINAL WORKS

FINAL WORKS

3


3.1
MPV for Final Works


3.2
MPV for Final Works

In partnership with

amey

Appendix G

Thursday 3 Sep 2015

Britain's first 'workshop on wheels' set to revolutionise railway maintenance

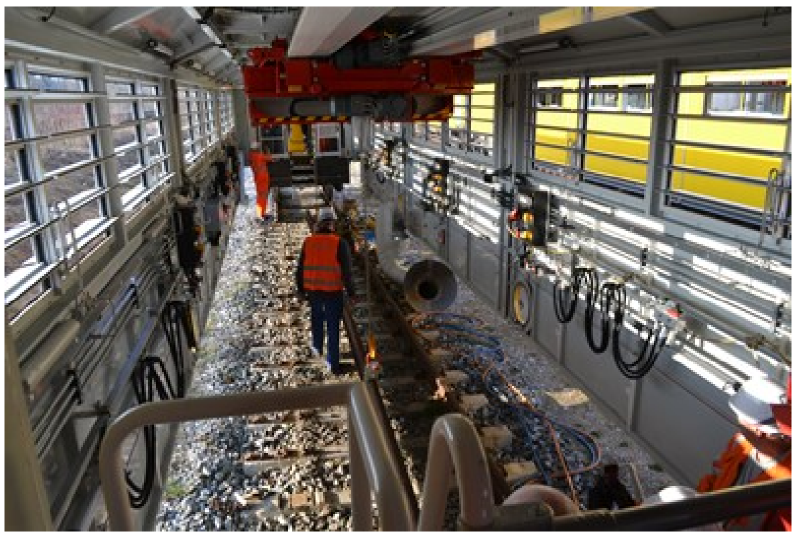
Region & Route: National

The first of a new fleet of engineering trains which will revolutionise the way Network Rail's 'orange army' carries out railway maintenance and repair work enters service this week.

The state-of-the-art mobile maintenance trains (MMTs) will make working on the railway quicker, safer and more efficient as well as less disruptive for passengers and freight. Based at locations around the country, the eight MMTs will provide a 'workshop on wheels' for engineers and track workers as they carry out repairs, renewals and upgrades to Britain's 20,000-mile rail network.

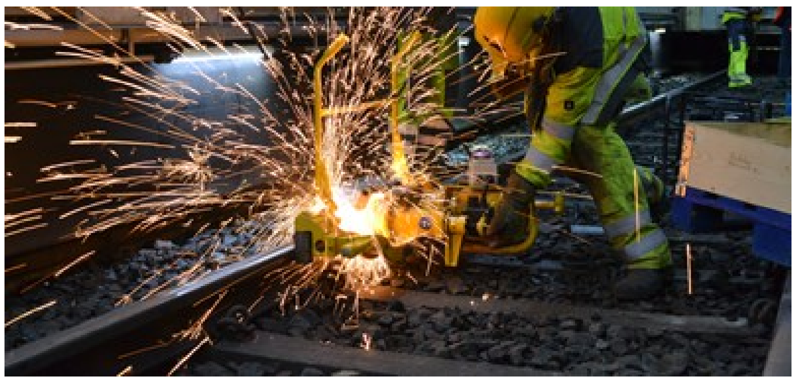
Each train will have a workshop, two built-in 2t cranes to move heavy equipment, multiple power points (400V, 110V, hydraulic and pneumatic) and will be able carry all the tools and supplies the engineers could need, alongside a welfare area with kitchen and toilet. But the MMT's key feature is the large, extendable work area that allows access to the track below, provides cover, floodlighting and – crucially – protection from passing trains.

As a result, the MMTs will reduce the amount of disruption engineering work usually causes as they may be able to work on a section of track without having to close the railway next to it. This will limit disruption during the day when engineers carry out repairs, while allowing better use of the railway at night for freight trains carrying everything from high street goods and mail, to cars for export and coal for power stations.



Neal Lawson, Network Rail's maintenance director, said: "Many tasks on the railway can only be carried out when the railway is closed to traffic – but with passenger numbers growing and demand for freight increasing at record levels, the need to keep the railway open round-the-clock is greater than ever before.

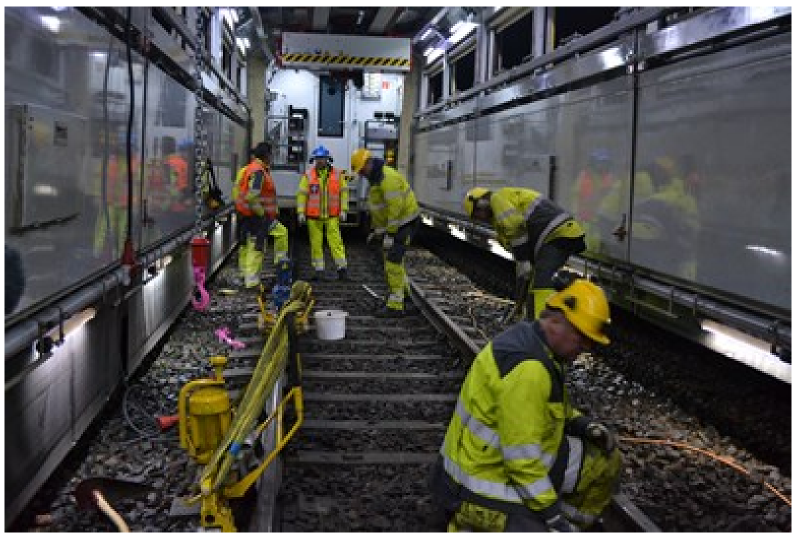
"These new trains mean our frontline staff can complete a wide range of maintenance and repairs more quickly and efficiently, reducing the need for costly and disruptive closures of the tracks. They'll also keep our people safe, warm and dry and better able to focus on getting the job done."



Teams will be able to board the MMT at a depot and be taken directly to the work site. In the safety of the work unit they can make repairs on a section of track or, using a slow 'creep' mode, are able to make rolling repairs. There are shutter blinds fitted in the upper section of the work unit, allowing natural light and ventilation in good weather. Closing these offers shelter and protection in bad conditions. The work unit also has adjustable side walls so the workspace can be increased where possible.

Corey White, an MMT supervisor based in Darlington, will be among the first of Network Rail's frontline staff to benefit from the new trains. "I'm lucky that I enjoy the job I do, but it can involve working in really tough conditions, a long way from shelter and simple comforts like a hot drink or a proper loo," said Corey.

"These new trains will make a massive difference to my team. We can get on the train at the depot with all the kit we need for a job and head straight to site. My favourite feature is the all-round lighting, which means we get pretty much perfect working conditions whatever the weather or time of day."



The MMTs have been manufactured by renowned railway construction and engineering experts Robel, in Freilassing, Germany and will be delivered to Network Rail over the next 12 months. The first one to arrive will be based in Darlington, with the second (based at Paddock Wood in Kent) arriving in October and the third (based at Derby) in December. The remaining five will be stationed at Woking, Retford, Romford, Peterborough and Horsham.

The fleet will be operated and maintained by Colas Rail under a three-year deal.

MEDIA INVITE:
If you'd like to see the MMT in action, we will be demoing it to members of the press on Friday 11 September. Please contact Dan Donovan to arrange a visit.

Passengers / community members
Network Rail national helpline
03457 11 41 41

Latest travel advice
Please visit National Rail Enquiries

Journalists
Network Rail press office -Dan Donovan
Media Relations Manager
020 3356 8700
Dan.Donovan@networkrail.co.uk

About Network Rail

We own, operate and develop Britain's railway infrastructure; that's 20,000 miles of track, 30,000 bridges, tunnels and viaducts and the thousands of signals, level crossings and stations. We run 20 of the UK's largest stations while all the others, over 2,500, are run by the country's train operating companies.

Usually, there are almost five million journeys made in the UK and over 600 freight trains run on the network. People depend on Britain's railway for their daily commute, to visit friends and loved ones and to get them home safe every day. Our role is to deliver a safe and reliable railway, so we carefully manage and deliver thousands of projects every year that form part of the multi-billion pound Railway Upgrade Plan, to grow and expand the nation's railway network to respond to the tremendous growth and demand the railway has experienced - a doubling of passenger journeys over the past 20 years.

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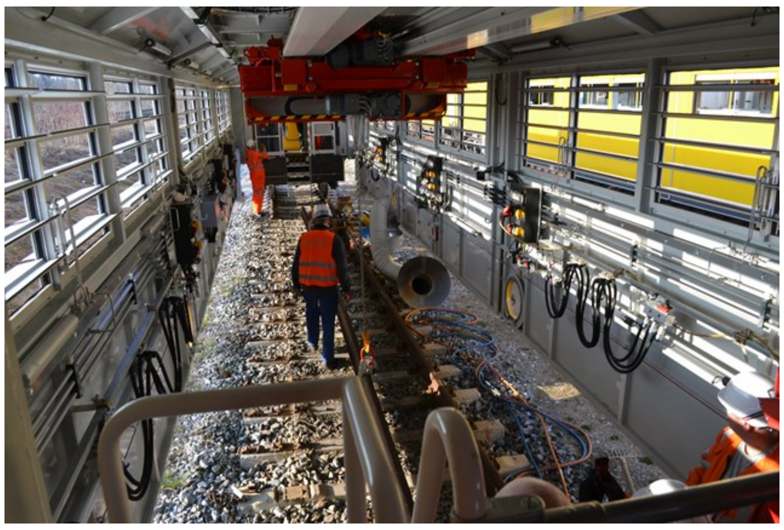
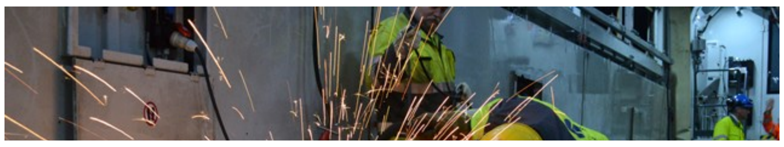
Mobile Maintenance Train (MMT) - 1

Download



Mobile Maintenance Train (MMT) - internal 2

Download



Mobile Maintenance Train (MMT) - internal 3

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Mobile Maintenance Train (MMT) - internal 1

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Mobile Maintenance Trains Overview v2

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Mobile Maintenance Train (MMT) - 2

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Mobile Maintenance Train (MMT) - delivery 4

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Mobile Maintenance Train (MMT) - delivery 2

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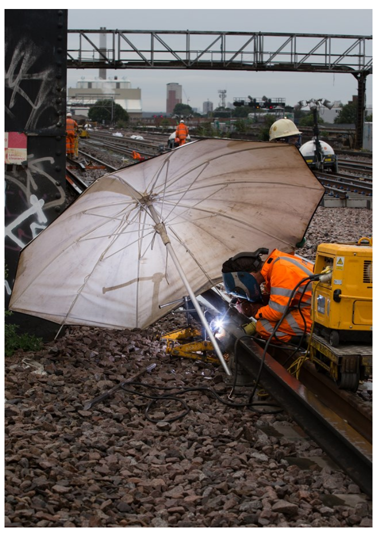

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Mobile Maintenance Train (MMT) - delivery 3

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Working with the Robel MMTs

Robel's Andrew Keens details Network Rail's use of the new equipment on its front line operations.

Over the past two-and-a-half years, readers of *Rail Infrastructure* have received regular updates on Robel's project to build and deliver eight Mobile Maintenance Trains (MMTs) to Network Rail. At the end of August, the last of these eight machines entered operational service, marking the end of this phase of production. August also marked the first anniversary of MMT1 at Darlington being in full operational production.

What benefits will this fleet of MMTs deliver? How and where is Network Rail using them and how will they change the day-to-day maintenance of the railways? I spoke to the Network Rail MMT project team to find out more.

The sixth of Network Rail's Robel MMTs at its Romford depot.
Photograph: Tim Stafford.

Future strategy

From his base in Darlington, Seth Beckreck, project engineer, summed up why the MMT is a vital part of Network Rail's future strategy: 'Network Rail is absolutely committed to improving the safety of staff working on the infrastructure, working conditions and the facilities that our people work in. The MMT delivers a world class safety environment and improves the welfare that we can provide to our people, enabling them to deliver excellent quality work. Within Network Rail, we are committed to our continuous improvement methods, using tools and thinking to challenge ourselves to improve quality and productivity. The MMT is a great example.'

So where will the machines be used? The MMTs are now operational across four Routes - London North Eastern & East Midlands, Anglia, South East and Wessex. The machines are stabled at Basingstoke, Darlington, Derby, Horsham, Paddock Wood, Retford, Romford and Wakefield. Interest has been registered by further Routes as, wherever the MMT shows up, it generates demand. As the concept develops and realises production, work quality and safety benefits, new ideas develop to continuously widen the potential.

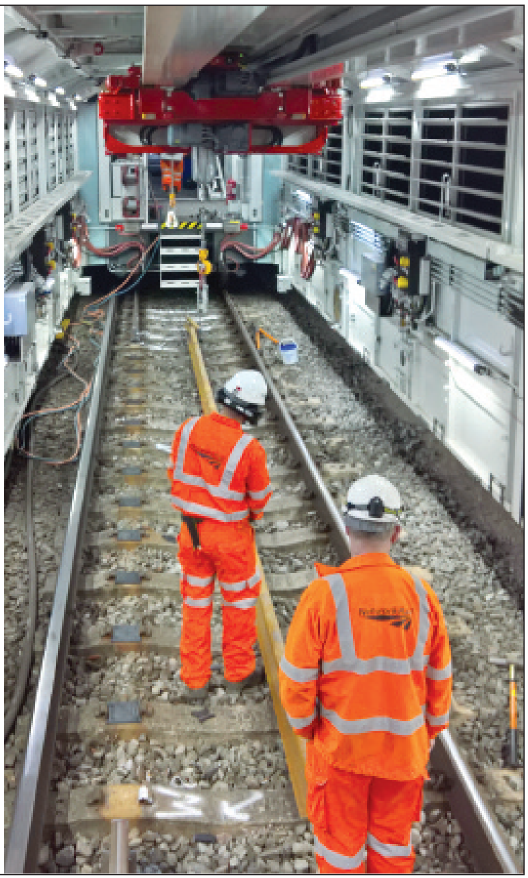
Below: Rail being hoisted in from the intermediate car into the mobile maintenance unit as part of a rail replacement task on the Basingstoke MMT.

In to service

Over this first year, a number of tasks have been undertaken and processes developed, including:

- Rail and insulated rail joint replacement, including welding and associated stressing.
- Pad and insert replacement.
- Wet bed eradication.
- Spot resleepering.
- Track geometry repairs.
- Fishplate oiling.

Importantly, each machine is a tailor made Robel concept, interpreted according to Network Rail's specification and fitted out with the hand-operated tools required for the tasks to be undertaken on each area. Key to the future of this machine will be the development of a greater range of application to give a truly versatile operating platform. Network Rail's intention, in the second year, is to



Left: Old rail removed and the new piece of rail is ready for installation.

Right: New rail installed and the welders are setting up for the first weld.

Right: A pair of Robel verticle tampers being used inside the mobile maintenance unit. *Photograph: Tim Stafford.*

Below: A welder grinding the new weld following completion of the rail defect replacement task.

increase capability to include:

- S&C maintenance and component replacement.
- Sleeper squaring.
- Rail joint straightening.
- Waybeam maintenance.
- Adjustment and switch maintenance.
- Level crossing flushing and unit replacement.
- Signalling and telecommunications on-track equipment replacement, as well as cable running out.

Better processes

To gain a better insight into how these machines are used and how they have changed the day-to-day work processes and conditions of the maintenance gangs, I spoke to James West-Beard, Works Delivery Manager, who is responsible for the operation of the Basingstoke machine. His focus, since going operational in April, has been on rail defect replacement.

To date, his team have replaced, stressed and cleared away the scrap materials relating to more than 80 defects. His message is quite clear: 'The introduction of the MMT on Wessex allows the maintenance departments to carry out planned works whilst we respond to reactive rail defects at short notice. The concept offers the team the chance to complete a task, such as a rail change in one shift, as tools materials and equipment are all on-board. A conventional rail change task may take several shifts to complete as materials and equipment will need to be on-site prior to the work taking place.'

By existing means, the shift would start with the loading of equipment and lighting onto road vehicles at the depot, these vehicles are then driven to an access point and then loaded onto trolleys and pushed a mile or more to the site of work. Petrol driven generators would then be connected and tower lights erected and all equipment off-loaded manually. Rail would be delivered, normally by lorry, to the access point and then manually moved with iron men to site, a slow and labour intensive process.

Possession times are short, typically three hours, and by using these methods the full task could take between three and four shifts. All that has now changed as James points out, 'The mess area allows staff to rest whilst travelling directly to site - the team can relax and prepare for the night ahead. The train has the ability to store all equipment, tools and materials in a safe and compliant manor and, with the overhead gantry hoist in operation, manual handling is significantly reduced.'

Additional benefits

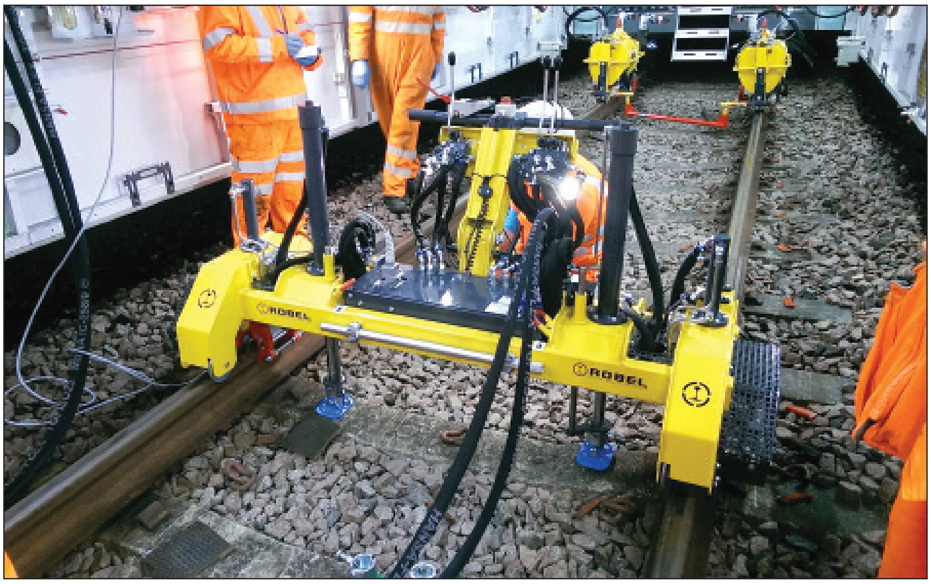
On conventional sites, welfare facilities would be minimal, with the prospect of a long walk back to the vans for a meal break. With the MMT, this is part of the past. 'The toilet and messing facilities all improve the wellbeing of staff,' said James. 'When on-site, the MMT has greatly changed the workplace. It provides an excellent working environment with ample LED lighting, gantry hoists, expanding sidewalls and the ability to power all equipment directly from the power points located throughout the unit. Tasks have become easier and safer to complete. Do not forget the MMT staff remain dry and unaffected by the elements at all times!'

According to James, the integration of Robel Hand-Operated Tools (HOTs) has made life a lot easier for the crew: 'The main HOTs used on-board are the Robel vertical tampers. As these are powered pneumatically and require no engine, the Hand-Arm Vibration Syndrome (HAVS) are significantly reduced. The 415v Robel rail profile grinder is an excellent piece of equipment. As this is electrically powered, the noise levels are extremely low allowing staff to communicate easier and without being subjected to petrol fumes. When welding in the MMU, the extraction kit expels all harmful gases and fumes. A big winner for the Wessex team is the Robel third rail stressing kit

Left: On a recent visit, Mark Carne, Chief Executive, Network Rail (right), is shown around the Basingstoke MMT by James West-Beard. *Photograph: Network Rail.*

Right: An operator using a Robel de-clipping machine to remove clips as part of the re-padding process on the Darlington MMT.

Below: A rail lifter raising the rails to enable the pads to be changed. *Photograph: Tim Stafford.*



which can be installed without the need to lift or slew the conductor rail. The obvious advantages are that we remove the risk of leaving the conductor rail up on the insulator pots and remove the danger of crushing injuries to staff.'

Future possibilities

In the development of the MMT concept, Robel has delivered a visionary step change in rail maintenance, refined in partnership with its clients. A one-stop shop delivering a range of tasks, safer, faster and more efficiently - and with vast potential. It is estimated by Network Rail that the MMT offers a 50% unit cost reduction in rail changing when compared to normal methods.

By developing further work processes and exploring opportunities to work adjacent line open and train in section, Network Rail seeks to further maximise the MMT capability. And there is not only increasing domestic interest - Network Rail has already hosted delegations from Japan and Australia where they are keen to emulate this success.

All photographs: Andrew Keens, unless credited otherwise.

Appendix H

HIGH SPEED TWO PHASE ONE INFORMATION PAPER

D12: TRACK POSSESSIONS FOR HS2 PHASE ONE ENGINEERING WORK

This Information Paper summarises the Promoter's general approach to possessions required to implement the Proposed Scheme for HS2 Phase One. It also describes the possessions that were estimated to be required at the time the HS2 Bill was deposited in November 2013 and provides an indication of the likely effects on rail passenger services.

The actual posessions needed for Phase One of HS2 will not match those described in this paper, but will be determined by the same approach as set out in section 2.

This paper was prepared in relation to the promotion of the Bill for Phase One of the scheme which is now enacted. Although the contents were maintained and updated as considered appropriate during the passage of the Bill (including shortly prior to the enactment of the Bill in February 2017) the contents are now historic and are no longer maintained.

If you have any queries about this paper or about how it might apply to you, please contact the HS2 Helpdesk in the first instance.

The Helpdesk can be reached at:

High Speed Two (HS2) Limited
Two Snowhill, Snow Hill Queensway
Birmingham, B4 6GA

by email: HS2enquiries@hs2.org.uk

or by phone: 08081 434 434 (lines are open 24 hours)

Version 1.3
Last updated 23rd February 2017

D12: TRACK POSSESSIONS FOR HS2 PHASE ONE ENGINEERING WORK

1. Introduction

1.1. High Speed Two (HS2) is the Government's proposal for a new, high speed north-south railway. The proposal is being taken forward in two phases: Phase One will connect London with Birmingham and the West Midlands and Phase Two will extend the route to Manchester, Leeds and beyond.

1.2. HS2 Ltd is the non-departmental public body responsible for developing and promoting these proposals. The company works to a Development Agreement made with the Secretary of State for Transport.

1.3. In November 2013, HS2 Ltd deposited a hybrid Bill[1] with Parliament to seek powers for the construction and operation of Phase One of HS2 (sometimes referred to as 'the Proposed Scheme'). The Bill is the culmination of nearly six years of work, including an Environmental Impact Assessment (EIA), the results of which were reported in an Environmental Statement (ES) submitted alongside the Bill. The Secretary of State has also published draft Environmental Minimum Requirements (EMRs), which set out the environmental and sustainability commitments that will be observed in the construction of the Proposed Scheme.

1.4. The Bill is being promoted through Parliament by the Secretary of State for Transport (the 'Promoter'). The Secretary of State will also appoint a body responsible for delivering the Proposed Scheme under the powers granted by the Bill.

1.5. This body is known as the 'nominated undertaker'. There may well be more than one nominated undertaker – for example, HS2 Ltd could become the nominated undertaker for the main railway works, while Network Rail could become the nominated undertaker for works to an existing station such as Euston. But whoever they are, all nominated undertakers will be bound by the obligations contained in the Bill and the policies established in the EMRs.

1.6. These information papers have been produced to explain the commitments made in the Bill and the EMRs and how they will be applied to the design and construction of the Proposed Scheme. They also provide information about the Proposed Scheme itself, the powers contained in the Bill and how particular decisions about the project have been reached.

[1] The High Speed Rail (London – West Midlands) Bill, hereafter 'the Bill'.

2. Possessions

2.1. This Information Paper summarises the Promoter's approach to engineering access "possessions"[2]. It also describes the possessions that, at the time the HS2 Bill was deposited in November 2013, were estimated to be required to implement the Proposed Scheme and provides an indication of their likely effects on existing rail passenger services.

2.2. While the majority of HS2 Phase One construction will not affect the existing railway, possessions will be needed where works to the existing railway are necessary, such as around Euston and Old Oak Common, to build junctions or to cross other lines.

2.3. As many as possible of these works will be undertaken in the normal night time and weekend maintenance periods so as to minimise disruption to passenger and freight services. However, for certain major HS2 works that cannot be accommodated within these maintenance periods, weekend possessions of a day's duration or longer will be required to implement Phase One. For the purpose of this analysis, weekend possessions are either:

- 24-28 hours (one day); or
- 40-72 hours (2-3 days, a whole weekend, or – in the case of 72 hours – a bank holiday weekend).

2.4. Possessions will be booked by or through Network Rail (NR) in accordance with standard industry processes. The works will either be undertaken by NR on the Promoter's behalf or they will be managed in accordance with standard railway 'asset protection' processes which ensure that NR and its customers are appropriately protected. It is anticipated that NR's existing obligations will influence the way the HS2 works are undertaken. This includes the obligations in its network licence issued by the Office of Rail Regulation.

2.5. The possessions planning process includes consultation with the wider railway industry, including operators and users, to ensure that the relevant information is provided, that the possessions are considered in the context of wider railway operations, and that appropriate mitigation measures are put in place. Where compensation is due for the impacts of possessions on operators, it is anticipated such compensation will be provided in accordance with standard industry processes.

[2] Where a section of rail line is required for maintenance, repair or renewal, trains cannot run when the line is handed over to the engineering contractors, who take possession for a specified period. Each closure period is known as a 'possession'. In this paper, possessions longer than a weekend are described as 'blockades'.

3. Estimated requirement for weekend possessions envisaged at Bill deposit

3.1. Table 3.1 comprises a high level estimate of possessions required, the lines affected and a general indication of the likely disruption that were estimated to result in each case. It should be noted that the number and duration of possessions required could only be estimated at Bill deposit stage. Factors such as revisions to the engineering design, more detailed construction planning, uncertainty over approval processes or unforeseen delays during construction can all affect the timing and duration of the possessions.

Table 3.1 – November 2013 estimate of HS2 Phase One weekend possession requirement

Works	Total weekend possessions	Indicative date	Lines affected	Indicative disruption to passenger services during closure
Euston Station remodelling enabling works	**19** 1 x one day 18 x all-weekend	2015-2017	West Coast Main Line	Mixture of full and partial closures with some trains diverted to other termini.
Old Oak Common Connection to and realignment of Great Western Main Line	**33** (+ 13 half-day) 4 x one day 29 x all-weekend	2021-2025	Great Western Main Line Crossrail	Services reduced so that they can be accommodated on two tracks. Occasional full closure with some trains diverted to other termini.
West Ruislip to Princes Risborough Predominately bridge works	**17** 6 x one day 11 x all-weekend	2016-2022	Chiltern Lines	Mixture of full and partial closures. Some diversions with replacement bus service to cover affected stations
Bicester/Aylesbury to Calvert Bridge over HS2, depot connections and bridge works	**47** (+ 1 half day) 28 x one day 19 x all-weekend	2017-2020	Any future services on East West Railway	Currently freight only. Passenger services may be affected on implementation of East-West Railway.
Coventry to Leamington Spa Bridge works	**4** 4 x all-weekends	2018	Coventry to Leamington Line	Total closures. Replacement bus services
Derby to Birmingham lines Predominately bridge works and connections to new rail excavation	**32** 13 x one day 19 x all-weekend	2017-2022	Derby to Birmingham lines	Mixture of full and partial closures. CrossCountry and freight services diverted.

Works	Total weekend possessions	Indicative date	Lines affected	Indicative disruption to passenger services during closure
material/construction depots				
Handsacre area Fly-over junction to WCML	31 1 x one day 30 x all-weekend	2018-2019	West Coast Main Line	Mixture of full and partial closures of WCML at Handsacre with trains diverted via Birmingham/Wolverhampton.

3.2. On the basis of this analysis, the total number of weekend possessions that would be needed to implement the HS2 Phase One Proposed Scheme is set out in Figures 3.2 below[3].

Table 3.2 Total weekend possessions to implement Phase One of HS2, excluding half-day weekends

Duration	Passenger lines	Freight lines	Total
One day weekend	46	30	76
2-3 day weekend	87	20	107
Total	133	50	183

Note: These totals do not include the 14 half-day weekend possessions (13 for Old Oak Common and one for Calvert), but do include 31 possessions affecting freight lines.

3.3. Where possible, disruption to train services will be minimised by planning the possessions to coincide with times when the railway lines are closed in any event for other maintenance or renewal work. Opportunities to do this will vary depending on how much other work is planned. At Handsacre, for instance, scope is likely to be limited as this part of the West Coast Main Line is normally closed for renewal work only on bank holidays. On lines where major works are planned, the scope will be greater, but HS2 Phase One will need to recognise the cumulative effect on passengers and operators of disruption.

Blockades

3.4. Two longer possessions (known as 'blockades') were also envisaged, but neither affects passenger services:

- Stechford to Aston (Birmingham) – to demolish existing brick arches and replace them with a new bridge over the HS2 line – a one-week closure currently programmed for 2017-2018. This is a freight route that is also

[3] It should be noted that the totals differ from Figure 6.5 (p.131) of the HS2 Strategic Case total for Phase One (223 weekends) as the Strategic Case included 30 weekend and 10 one day possessions on the North London Line to implement the HS1-HS2 Link. This is no longer part of the Proposed Scheme but, otherwise, the estimated possessions reported in this Information Paper are those prepared for the HS2 Strategic Case and deposit of the Bill in Autumn 2013.

occasionally used as a passenger diversionary route when other lines are closed; and

- Euston Station Siding between platforms 15 & 16 that is used for storing empty trains to be closed for 2-3 weeks to realign Platform 15.

4. More information

4.1. More detail on the Bill and related documents can be found at: www.gov.uk/HS2

Appendix I

Planned works

Home > Running the railway > Looking after the railway > Planned works

We always plan essential works with great care to keep disruption to a minimum.

Engineers working to repair the railway on a bridge

As part of our Railway Upgrade Plan, we're working for you to allow trains to run more frequently, faster, and to improve the reliability of the rail network to reduce delays in the future.

Our timetables are planned 12 months in advance, and we schedule in the time needed for planned works to improve the rail network.

When we need to carry out planned engineering works, such as replacing tracks or upgrading signalling systems, we might need to close a section of track for 24 hours or longer to complete the upgrade work efficiently and safely.

Trains run 24 hours a day, 365 days a year, so there's no time when the network isn't being used, meaning works can cause some disruption for passengers and businesses.

National Rail's future engineering information →

Why we carry out planned works over bank holidays

We plan works for certain times so they cause the least disruption to passengers, such as on bank holidays, Sundays and overnight, when the network is less busy.

May bank holiday engineering works →

Early and late May bank holiday travel summary (National Rail) →

Watch to find out why we work over bank holidays

An independent review in 2016 looking at how the rail industry plans and schedules major improvement work concluded that Christmas, Easter and bank holidays are the best times for upgrades that need major lines to be closed. Even though it might seem strange to carry out work at Christmas – when people are travelling to see friends and family – on average, around half the usual five million people travel by train each day during the Christmas period.

How we're reducing the time planned works take

We're investing all the time in new machinery and processes to speed up our planned works while maintaining high levels of safety for workers and passengers on our railway – the safest railway in Europe.

For example, our High Output teams replace tracks overnight using an efficient track relaying system. Significantly reducing the time the work takes reduces disruption for passengers.

In addition, engineering innovations mean trains can often now run on the line at full speed straight after track renewal work, so there are fewer delays to timetables caused by slow trains, and better journey times for passengers. Track renewal typically requires a temporary speed restriction on the line for a week after the work is finished, so the ballast – the stones beneath the track – can settle. Now, improvements in technology create a strong foundation straight away, so this isn’t necessary.

Overview of engineering works on track at Purley

Ballast needs time to settle after laying

When works cause a delay

Some disruption to regular journeys due to maintenance and engineering works is inevitable, so it’s always best to check before travelling. National Rail Enquiries provides details of how planned works are affecting timetables. It also has advice on how to claim compensation due to delays caused by engineering works.

Planned works can occasionally overrun and cause unexpected delays. There are many other reasons why delays happen, such as the weather, signals and points failures, and damage caused by trespassing. Our delays explained section highlights why these situations cause delays and how we’re working hard to prevent the disruption they can cause.

When delays do happen, we know how important it is to keep passengers informed. That’s why we work with the train companies to get essential information out to passengers. Find out how we keep passengers updated about delays.

Related pages

Engineering works at Acton Grange

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Appendix J

Wednesday 19 Jan 2022

Major engineering work to affect CrossCountry services next month

Region & Route: North West & Central | North West & Central: Central

Rail passengers are being advised of changes to journeys over nine days in February 2022 while essential engineering work takes place at Water Orton in North Warwickshire and Duddeston in Birmingham.

Major alterations to track and lineside drainage will take place between 19 and 27 February as part of long-term improvements to the network, including preparations for HS2 – Britain's new zero carbon, high-speed railway

Every effort is being made during construction to reduce the impact on passengers' journeys, but the scale of this phase of work means the railway must be closed to trains over the nine days.

Passengers are being advised that journeys will take longer, could involve rail replacement bus services and that timetables will be different.

The routes affected include services between:

- Birmingham New Street and Leicester, Peterborough, Cambridge and Stansted Airport.

To keep passengers on the move, CrossCountry's long distance trains will be diverted around the work but this will mean longer journey times.

Meanwhile the train operator's regional services linking the East Midlands and Anglia with Birmingham will start and finish at Coleshill Parkway.

Replacement buses will operate between Coleshill Parkway, Water Orton and Birmingham New Street.

Preparatory work will also be taking place affecting CrossCountry services on the preceding weekends of the 5-6 and 12-13 February.

People are urged to check www.nationalrail.co.uk if they are planning to travel on those routes during the essential work, or visit CrossCountry's dedicated webpage.

> **Patrick Cawley, director for 'On Network Works' for Network Rail and HS2, said:** "We're making great progress on HS2 and a key part of this is making sure it works in harmony with the existing railway.
>
> "While this latest phase of work takes place I'd urge people to please check before they travel with CrossCountry or by using the National Rail Enquiries website or app, and I thank everyone in advance for their patience while we help build this railway for the future."

> **Richard Morris, regional director East Midlands & East Anglia for CrossCountry, said**: "We are working collaboratively with our industry colleagues at Network Rail, HS2 and West Midlands Trains on detailed alternative arrangements for our customers to ensure the disruption to their journeys is kept to a minimum. There will be extended journey times for everyone travelling on the affected routes, and on our regional services travel into and out of Birmingham New Street will involve transfer to and from a frequent rail replacement bus service at Coleshill Parkway.
>
> **"**We are putting extra facilities and staffing in place to ensure passengers can interchange between trains and buses as smoothly as possible. I'd urge people to please check before they travel using the National Rail Enquiries website or app."

Passengers who need extra help while travelling are advised to contact CrossCountry's Passenger Assist team by calling 0800 030 9224 or emailing assistance@crosscountrytrains.co.uk.

For further information please visit CrossCountry's dedicated webpage.

Contact information

Passengers / community members
Network Rail national helpline

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Network Rail press office - North West & Central Region
07740 782954
NWCmediarelations@networkrail.co.uk

About Network Rail

We own, operate and develop Britain's railway infrastructure; that's 20,000 miles of track, 30,000 bridges, tunnels and viaducts and the thousands of signals, level crossings and stations. We run 20 of the UK's largest stations while all the others, over 2,500, are run by the country's train operating companies.

Usually, there are almost five million journeys made in the UK and over 600 freight trains run on the network. People depend on Britain's railway for their daily commute, to visit friends and loved ones and to get them home safe every day. Our role is to deliver a safe and reliable railway, so we carefully manage and deliver thousands of projects every year that form part of the multi-billion pound Railway Upgrade Plan, to grow and expand the nation's railway network to respond to the tremendous growth and demand the railway has experienced - a doubling of passenger journeys over the past 20 years.

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Nuneham Viaduct

Coordinates: 51.669456°N 1.240878°W

Nuneham Viaduct,[3] also known as **Nuneham Railway Bridge** and the *Black Bridge* is near the town of Abingdon-on-Thames in Oxfordshire, England. It is a two-span, bowstring truss bridge that carries the Didcot to Oxford section of the Cherwell Valley Line across the River Thames between Abingdon Lock and Sandford Lock. Its name is derived from the neighbouring Nuneham House.[4] The total length is 99 yards (91 m); the southern and northern ends are respectively 57 miles 24 chains (92.22 km) and 57 miles 29 chains (92.32 km) from Paddington (via Didcot station).[3]

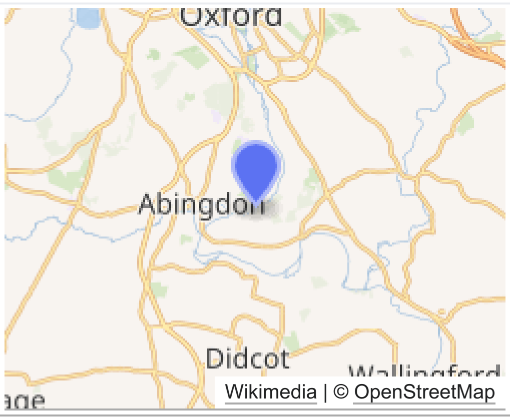
As well as passenger trains, the line over the bridge carries freight from the Port of Southampton to distribution centres in the Midlands and North of England.[5] Up to forty freight trains a day use the route[6][7] which is part of the core UK intermodal freight network,[8] and was to have been part of the proposed Electric Spine.

The bridge suffered a progressive failure with sinking of the southern end of the southern span from March 2022. This led to its closure to all rail traffic on 3 April 2023 and a major remedial project being undertaken.[9]

Nuneham Viaduct

Nuneham Viaduct from downstream

Coordinates	51.669456°N 1.240878°W
Carries	Cherwell Valley Line
Crosses	River Thames
Locale	Abingdon, Oxfordshire
Maintained by	Network Rail
Characteristics	
Total length	99 yards (91 m)
Height	15 feet 9 inches (4.80 m)[1]
History	
Opened	1907 [2]
Location	



History

Nuneham Railway Bridge was built in the early years of the Great Western Railway. The company built a branch line from its main London to Bristol line to serve Oxford, and later Abingdon-on-Thames. This route became known as the Cherwell Valley Line. A bridge to cross the River Thames was required, and its design and alterations had to be approved by the Thames Navigation Commission. These works were supervised by the civil engineer George Treacher.[10]

The original bridge, which opened to traffic in 1844, was constructed of timber but proved inadequate, and work on its replacement began a decade later. In 1856, the second bridge, distinguished from its predecessor by its iron structure, was completed. A third bridge was constructed in 1906–07,[11] consisting of a pair of steel bowstring spans with a pier in the centre of the river.[12][13] In 1929, a new three-arch brick built northern abutment was constructed.[14]


Train-level view of Nuneham Railway Bridge, circa 2009.

2023 abutment replacement

In March 2022, sinking of the south abutment was detected and a temporary speed restriction of 50 miles per hour (80 km/h) was imposed on traffic. In January 2023, remote monitoring equipment was installed and the speed restriction reduced to 20 miles per hour (32 km/h). An attempt to remedy the situation by injecting grout into the structure failed to solve the problem, and at the end of March the speed restriction was reduced to 5 miles per hour (8.0 km/h).[15] On 3 April 2023, the viaduct was closed to all rail traffic, with a bus replacement service operating between Didcot Parkway and Oxford stations.[16][17] *The Sunday Times* claimed that penny-pinching in 1929 during work on the bridge was to blame. It stated that the abutment on the north bank was completely rebuilt with a brick structure, but that on the south bank had remained largely unchanged since Victorian times. No work was done on the south abutment, possibly caused by lack of funds at the time of the Great Depression.[14]

On 5 April 2023, Network Rail tweeted that the viaduct would be closed for several weeks.[18][19] They had already planned some remedial ground-strengthening work for March, and an access road had been built. However, they calculated that the temporary solution would take almost as long to complete as total replacement of the abutment,[20] and on 10 April 2023 they specified the re-opening date as 10 June 2023.[21]


Nuneham Viaduct repair from downstream with south span supported and south abutment removed

The work involved closing the southern half of the river to build a temporary trestle on 24 piles driven into the river bed, which supported the southern span whilst a new abutment was constructed. This involved removing 3,000 cubic metres (3,900 cu yd) of material of the old abutment and embankment, and building new ones, requiring 5,500 tonnes (6,100 short tons) of new material and eight piles up to a depth of up to 25 metres (82 ft).[22][23] Much of the work was carried out by TMS Maritime Ltd under subcontract from Balfour Beatty.[24][25] The line was reopened on 9 June, one day ahead of schedule.[26]

See also

- Crossings of the River Thames

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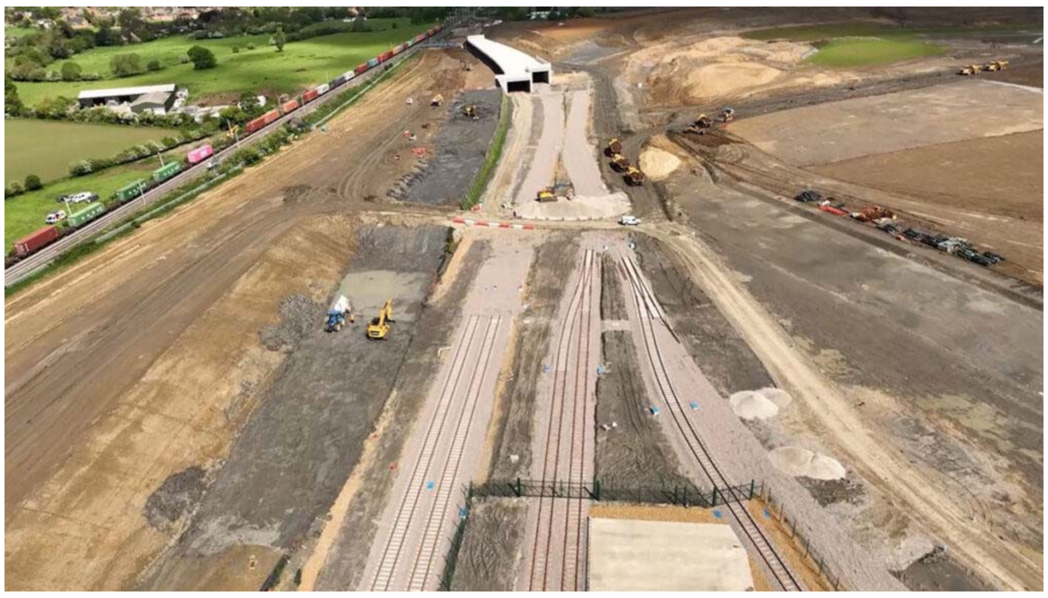
External links

- Nuneham Railway Bridge via structurae.net (https://structurae.net/en/structures/nuneham-railway-bridge)
- Nuneham Railway Bridge, River Thames via geograph.org.uk (https://www.geograph.org.uk/photo/523317)

West Coast Main Line improvements

We're building a railway sidings at Northampton to connect a new freight depot to the West Coast main line to take up to 300 lorries off the road every day.



What work is taking place?

We'll be installing new track, points and signalling systems for freight trains to be able to get onto the West Coast main line.

When is the work taking place?

This project will start on Saturday 2 September and finish on Sunday 10 September.

How will this work affect me?

From Saturday 2 September until Sunday 10 September there will be no direct services between North Wales and London, journeys will take longer on diversionary routes, could involve rail replacement buses and train timetables will be different.

Check before you travel

Please plan ahead by using National Rail.

National Rail →

Why is the work needed?

SEGRO has built a 5 million square ft warehouse space at Northampton to employ up to 7,000 people. This vital rail interchange will introduce four new freight services onto the West Coast main line every day, meaning around 300 fewer journeys by lorry.

About 40% of all UK freight is carried by rail on the West Coast main line, it's the greenest way to transport economically important goods around the country.

Get in touch

If you have any questions please call our dedicated 24-hour National Helpline on 03457 11 41 41 or visit our contact us page.

Together we can end domestic abuse

Aylesbury to Princes Risborough railway improvements

Major railway upgrades are taking place this year in Buckinghamshire which will affect journeys until October.

What work is taking place?

We are working in partnership with HS2 to move and replace more than a mile of track and signalling equipment on the line south of Aylesbury to make way for the new HS2 line which will pass beneath the existing railway.

When completed, this vital work will mean more reliable journeys for passengers travelling between Aylesbury and Princes Risborough on a railway that's fit for the future.

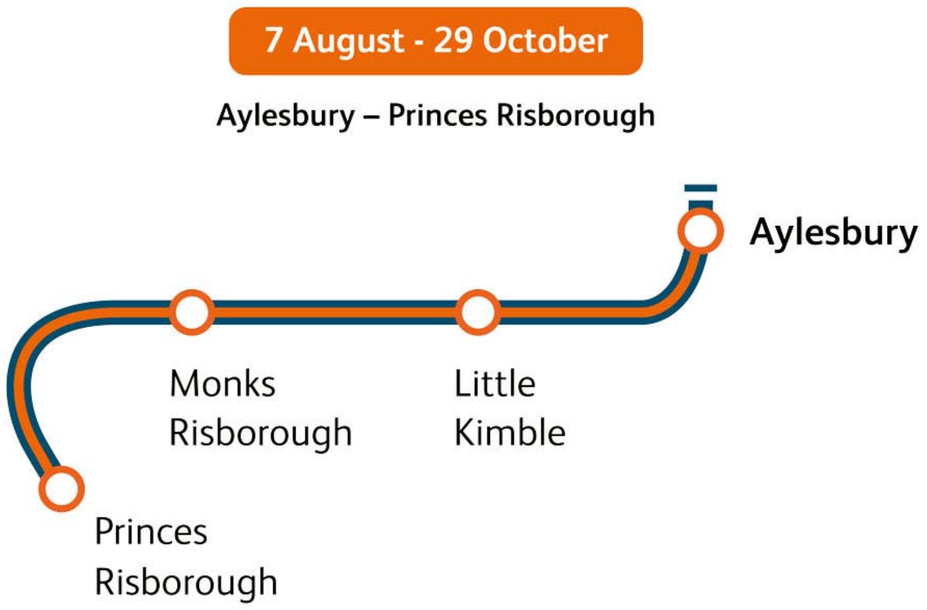
HS2 will help to transform journeys between London, the Midlands and the North, providing zero-carbon journeys from day one and also making space on the existing railway network for more freight and local services.

So far, work has been carried out to remove the old railway tracks and prepare the new embankment for new sleepers and rail which will be installed in the coming weeks.

When is the work taking place?

HS2 work to allow the new high-speed line to pass under the existing railway will affect all journeys between Aylesbury and Princes Risborough until Sunday 29 October.

How will this work affect me?



Buses to replace trains during major upgrades

Monday 7 August to Sunday 29 October

The railway between Aylesbury and Princes Risborough stations is closed. Chiltern Railways will operate rail replacement bus services between: Princes Risborough – Monks Risborough – Little Kimble – Aylesbury.

We are working closely with our partners at Chiltern Railways and advise you check before you travel for updates and details of alternative travel arrangements during the extended closure.

Chiltern Railways →

National Rail →

Earlier this summer our engineers completed major work to replace a Victorian drainage culvert beneath the railway near Aylesbury station to improve future journeys for passengers and freight services. You can find out more about this project here.

Marsh Lane level crossing closure

As part of our work to realign the railway, we need to close Marsh Lane level crossing during the railway closures to allow our engineers and engineering trains safe continuous access to the work site.

After the track realignment work has been completed and the railway reopens in October, upgrades to make Marsh Lane level crossing safer are needed and will take place in 2024.

This means that Marsh Lane level crossing will be closed to pedestrians, cyclists and vehicles from **10pm on Friday 18 August 2023 until spring 2024**.

We understand that this road closure will be extremely disruptive to local people and regret that we need to keep the level crossing closed for such a long period of time.

Diversion route

During the closure of Marsh Lane level crossing, there will be a diversion of North Lee Lane which will travel from Marsh to Little Kimble, then to Princes Risborough and past Terrick and back onto to the A4010 Risborough Road.

Marsh Lane diversionary route map (1 MB, PDF) →

Our project to upgrade the level crossing is still being developed and we'll let local people know more about our plans, including details of exactly when we expect to reopen the crossing to road users, in the coming months.

Latest updates to our railway neighbours

Aylesbury rail upgrades reminder – August 2023	7 MB
Aylesbury culvert repairs information – July 2023	382 KB

Get in touch

If you have any questions please call our dedicated 24-hour National Helpline on 03457 11 41 41 or visit our contact us page.

Reduced service between Newcastle and Morpeth / Edinburgh until at least the end of the day on Friday 3 November

Back

Buses replace trains between Machynlleth and Pwllheli from Friday 1 September to Friday 1 December

See all service disruptions

Engineering work details

Starts 01 Sep 2023 to 01 Dec 2023

Download incident map (PDF 217k)

Train operators affected

Transport for Wales

Route(s) affected

Transport for Wales between Machynlleth and Pwllheli

Description

Engineering work is taking place between Machynlleth and Pwllheli, closing all lines. The 13 week line closure will allow the final phase of the £30m Barmouth Viaduct restoration to safely take place.

From 22:40 on Friday 1 September to the end of the day on Friday 1 December, buses will replace trains between Machynlleth and Pwllheli.

Check before you travel:
You can plan your journey using the National Rail Enquiries Journey Planner

Replacement Bus Travel Advice:
For helpful advice if you need to travel on a rail replacement service, including accessibility and bicycle information, please use this page.

You can find the location of your bus replacement by checking station signs or by searching for your station on our station information pages.

Please be advised that, on occasion, replacement vehicles may be busier than usual, and you should allow extra time for your journey.

Stations

Find a Station
Find a Train Company

Travel Information

Alerts and Notifications
Timetables
Future Engineering Works
Find a Train Company
Safe Train Travel

Inspiration

Days Out Guide
Train Travel in Europe
Interrail

Help and Assistance

Compensation and Refunds
Contact Us
Complaints
Passenger Assist

On the Train

Accessible Train Travel and Facilities
Train Travel with Bicycles
Train Travel with Pets
Train Travel with Children
Food and Drink

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Appendix K

Have your say

Public Consultation:

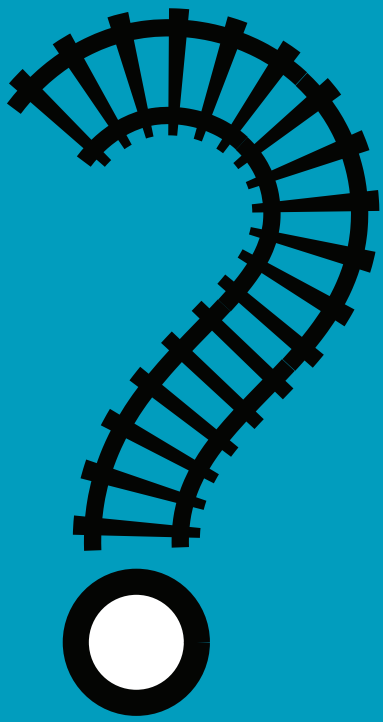
Old Oak Common Lineside Logistics Compound

Project Background

A new lineside logistics compound is required on the south side of the Great Western Mainline (GWML) between Acton West Junction and Kensal Green Junction for the construction of the Network Rail infrastructure supporting the Old Oak Common station. Following the completion of the station work, part will remain as a permanent Network Rail road-rail vehicle access point.
The GWML in the area was constructed either within cuttings or in embankments and these vary between 2m to 30m in height. After extensive research in the area, we have identified that the only suitable area for the compound and access to the south side of the railway, is the land currently occupied by Jewson Ltd, Horn Lane, Acton.

Our Plan

Network Rail are proposing to occupy this site and relocate Jewson's. Additionally, we are seeking to permanently acquire land at the rear of Jewson's for future access needs. We propose the installation of a temporary and permanent road-rail vehicle access points, with associated access. To allow us to do this, Network Rail will be applying for Transport and Works Act Order (TWAO) to the Secretary of State.



Benefits

• Enables delivery of HS2 Old Oak Common station where it integrates with the Great Western Main Line
•Permanent Access will enable the Network Rail access to undertake regular & reactive maintenance works which will in turn de-risk un-planned closure of the Railway through defects, asset failure
• Less closures on the line due to significant increase in physical time on site to carry out essential work

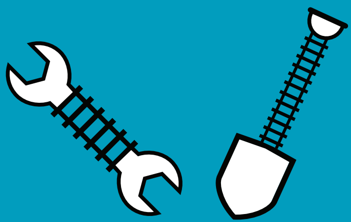
Temporary Lineside Logistics Compound

This site is proposed to be used by Network Rail's contractor who will be undertaking the Old Oak Common station enabling works and changes needed on the railway.

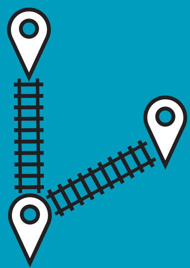
The current warehouse building will be retained and used as a storage facility for vital equipment and key materials, office space and welfare for our team. We will install a road-rail vehicle access point, which will allow machinery to get on and off track safely and efficiently and facilities for material laydown areas. Additional portable tower lighting will be needed for use at night, however, will be directed away from residents where possible to minimise any disturbance.

It is anticipated that this compound will be in use for approximately 8 years and will be operational 24 hours a day.

More efficient delivery



Enabling the build of Old Oak Common Station



More journey opportunities

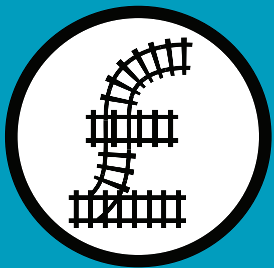
Permanent Road Rail Vehicle Access

Network Rail are proposing to retain one of the road-rail vehicle access point element of the lineside logistics compound following the completion of the OOC station work.

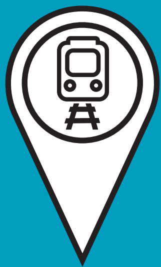
This will remain as a permanent Network Rail road-rail vehicle access point for maintenance requirements and domestic infrastructure renewal works.

Without this location retained as a permanent Network Rail access point for maintenance requirements and domestic infrastructure works, the Great Western Mainline will require extended periods of closure for maintenance and renewal works, having considerable cost and impact on the operational train service for multiple Train operators.

This access point and associated access route will be operational 24 hours a day.

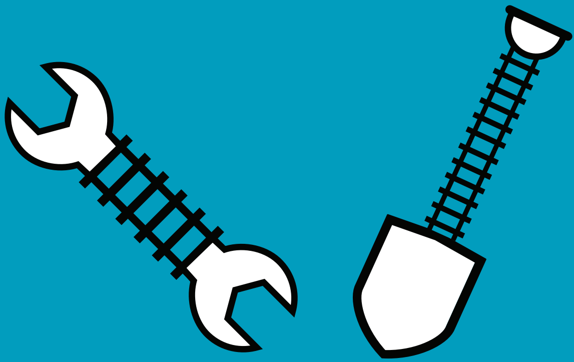


Saving Money



Access for future maintenance and network improvements

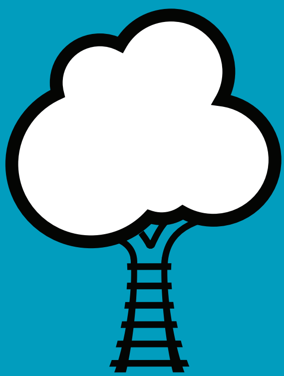
Saving Time



Construction

At the proposed site, Network Rail need to undertake tasks to construct the lineside logistics compound including; site vegetation clearance, surveys, lighting and fencing installation.

In addition, a temporary and permanent Road Rail Vehicle Access Point will be constructed, with a new concrete apron, to allow our machinery to get on and off the railway safely.

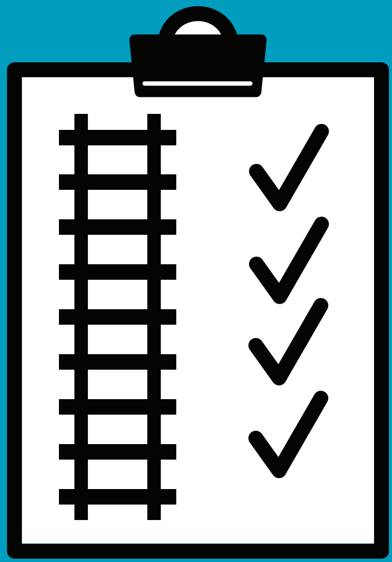


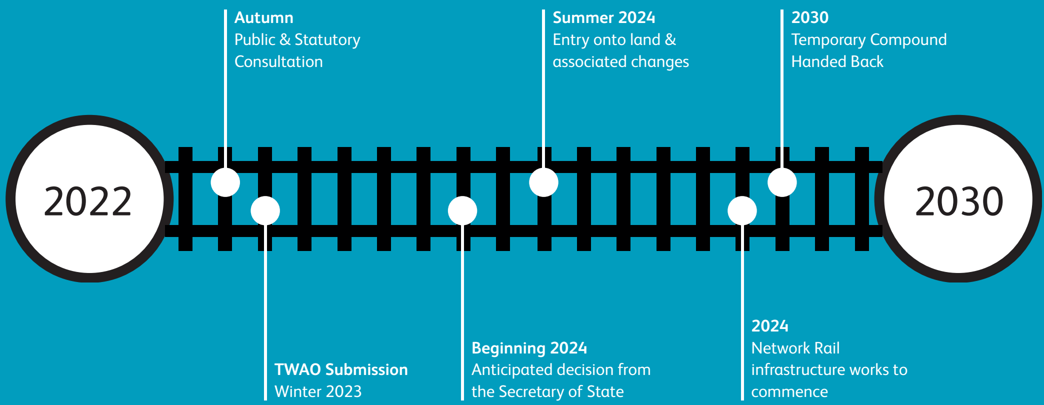
Environment

As the proposed site is under 1 Hectare in size and is not located within an environmentally sensitive location as defined by the Environmental Impact Assessment (EIA) Regulations, Network Rail do not require an EIA screening.
Notwithstanding, Network Rail will be submitting a formal screening request to the Secretary of State.

Consent for the Project

- Network Rail intend to apply for planning permission for the 8 year temporary change of use of the land from a builders merchant to a railway construction and logistics compound.
- Network Rail will be seeking authorisation for acquisition of land outside their current operational and landownership boundary through a Transport and Works Act Order (TWAO) for the Lineside Logistics Compound and Rail-Road access points.
- Network Rail will apply for a planning permission for a temporary change of use on the for the larger logistics compound as part of the Order
- The smaller, permanent access could be considered as permitted development
- No public highway alterations are required with this scheme.



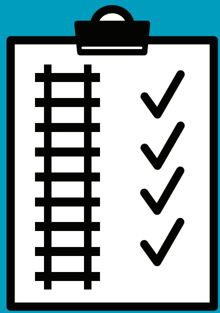


How to have your say

In order for your views to be considered, you can respond by email: OOCrailcompound@networkrail.co.uk

The consultation starts on 10 October 2022 and ends on 20 November 2022.

Please ensure your response is returned to us by the closing date so we have adequate time to consider your comments.



Meet with us

We are holding two events at Friary Park Community Centre Joseph Ave, London W3 6NL on:

Thursday 20th October 2022
15:30 - 20:30

Thursday 3 November 2022
15:30 - 20:30

If you would like to reserve a specific time slot, please email OOCrailcompound@networkrail.co.uk

For further information

You can also call Network Rail's National Helpline on:
03457 11 41 41

or follow us on twitter:
@NetworkRailWest

Business Reply Plus
Licence Number
RTLZ-LUJH-KXHU

2

Network Rail Ltd
167-169 Westbourne Terrace
LONDON
W2 6JX

Insert project name

Fill out the form below, fold in half and glue together, then send back to us using Freepost.

1) Please let us know your views

2) How will this impact you?

NAME

POSTCODE

EMAIL

Thank you: Your enquiries will be analysed by Network Rail. Your personal details will be held securely by Network Rail in accordance with the GDPR – General Data Protection Regulations, will be used solely in connection with the Old Oak Common Lineside Logistics Compound project and will not be passed to any third parties. We may contact you if we have any follow up questions concerning the answers you have provided above. By agreeing to participate in this questionnaire, you agree to being contacted in this way. [ ] Please tick this box if you do not wish us to contact you again.

Old Oak Common Lineside Logistics Compound

Appendix L

OLD OAK COMMON RAILWAY SYSTEMS PROJECT

GRIP 4 Construction Methodology Report

152270-ARC-REP-EMF-000005

JUNE 2020

ELR: MLN1, ANL, WLL9, BOK5

Mileage: Varies

OS Reference: TQ 217 820

Revision Number: **A01**

PLANNING

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Old Oak Common Railway Systems Project

Construction Methodology Report

Author	Michael Howells (Discipline Specific input from – Stuart Wilde/Jim Boyle (OHLE), Jamie Breckenridge/Nicky Surridge (Track), Tim Brain (Signalling), Chris Paddon (Civils), Chuma Odinye (E&P), Ajaz Ahmed (Telecoms)
Checker	Ben Naylor
Reviewer	Nicky Surridge
Approver	Mark Eaden
Report No	152270-ARC-REP-EMF-000005
Date	June 2020

Version control

Version	Date	Author	Changes
A01	23/06/2020	Varies	

This report dated 23 June 2020 has been prepared for Network Rail (the “Client”) in accordance with the terms and conditions of appointment dated 01 November 2018(the “Appointment”) between the Client and **Arcadis UK** (“Arcadis”) for the purposes specified in the Appointment. For avoidance of doubt, no other person(s) may use or rely upon this report or its contents, and Arcadis accepts no responsibility for any such use or reliance thereon by any other third party.

CONTENTS

FIGURES

TABLES

APPENDICES

APPENDIX A

Staging Schematics

APPENDIX B

Staging Layouts

APPENDIX C

Box Plan

APPENDIX D

Synchro Animation

APPENDIX E

RAID Log

APPENDIX F

Pway Gannt Charts

APPENDIX G

Train Consists

LIST OF ACRONYMS

AiP	Approval in Principle
ATF	Auto Transformer Feeder
ATP	Automatic Train Protection
AWS	Automatic Warning System
BBVS	Balfour Beaty VINCI SYSTRA
BIM	Building Information Modelling
CPPP	Confirmed Period Possession Plan
CRE	Contractors Responsible Engineer
CR-T	Contract Requirements - Technical
CSM	Common Safety Method
DMRB	Design Manual for Roads and Bridges
DNO	Distribution Network Operator
EAS	Engineering Access Statement
EDH	Explosive Depth Hardening
E&P	Electrification and Power
EIS	Entry into Service
EMU	Electric Multiple Unit
ESA	Environment and Social Appraisal
ESMP	Environment and Social Management Plan
ETCS	European Train Control System
FSP	Functional Supply Point
GRIP	Governance for Railway Investment Projects
GSM-R	Global System for Mobile telecommunications – Rail
GWML	Great Western Main Line
GWR	Great Western Railway

HEX	Heathrow Express
HS2	High Speed 2
IECC	Integrated Electronic Control Centre
LCV	Line Clear Verification
LDC	Local Distribution Centre
LOC	Location Cases/Cabinets
LOD	Limit of Deviation
LoR	Line of Route
LWR	Long Welded Rail
MEPH	Mechanical, Electrical, Plumbing and Heating
NBS	Non-Booked Service
NLL	North London Line
NR	Network Rail
NRDD	Network Rail Design Delivery
OHLE	Overhead Line Equipment
OOC	Old Oak Common
OOCPA	Old Oak Common and Paddington Approach
OOCRS	Old Oak Common Rail Systems
P2R	Paddington 2 Reading
PSP	Principal Supply Point
QA	Quality Assurance
RAID	Risks, Assumptions, Issues and Dependencies
RATS	Rationalised Auto-Transformer System
REB	Relocatable Equipment Building
RRAP	Road Rail Access Point
RRV	Road Rail Vehicle
S&T	Signalling and Telecommunications
SDSC	Station Design Services Contract

SPT	Signal Post Telephone
TOC	Train Operating Company
TPR	Technical Planning Rules
TPWS	Train Protection and Warning System
TTC	Twin Track Cantilever
TVSC	Thames Valley Signalling Centre
UTX	Under Track Crossing
WCIP	Western Capacity Improvements Project
WLL	West London Line
WON	Weekly Operating Notice

1 Executive Summary

1.1.1.1 The railway systems work required to facilitate the introduction of the largest new Railway Station in the UK for over one-hundred years at Old Oak Common is extensive. It will stretch over a range of approximately 2.5km along a busy railway corridor stretching from East to West along the Great Western Mainline.

1.1.1.2 The works will introduce over three thousand new assets to the railway system the delivery of which will require extensive integration with HS2, Network Rail, Train Operators and Local Authorities.

1.1.1.3 This report has been developed in parallel with the GRIP 4 design works associated with the Old Oak Common Railway Systems and with the support of Babcock our Early Contractor Involvement (ECI) supplier. Consideration for the construction staging has been given by all design disciplines to ensure the phasing proposed, is viable at this stage of design.

1.1.1.4 While this report and the evidence provided demonstrates that the delivery of the Old Oak Common Railway Systems construction is achievable in the given timescales and within the site constraints; additional integration will be required to ensure it interfaces with the emerging methodology of the station construction works and other future developments in the Paddington to Reading corridor.

1.1.1.5 Extensive planning has been undertaken to develop a viable Box Plan and Possession strategy for the works, ensuring that the works, as designed, can be delivered in the anticipated timeframe and within the constraints identified within this report.

1.1.1.6 Opportunities for potential enhancements to the delivery strategy have been identified. Further consideration should be given to these opportunities to provide flexibility within the given programme.

1.1.1.7 The interface with the Station and Bridge development projects is critical to the success of the project and as such extensive integration will be required by the teams delivering the projects.

1.1.1.8 The report identifies the criticality of the delivery of materials by rail – consideration will need to be given to the availability of the rail plant at the various delivery stages.

1.1.1.9 Several assumptions have been made about the availability of access points to the South of the Great Western mainlines. The delivery of this project to the presented time frames is predicated on the access to the South being available.

1.2 Recommendations

1.2.1.1 To ensure the effective delivery of the railway systems works to support the implementation of the Old Oak Common Great Western Mainline station it is recommended that:

- An agreement is to be reached for the provision of access through both the Hitachi North Pole depot and Jewson's yard to validate the assumptions made in this report regarding access from the South of the GWML.
- Additional Integration with the station and bridges delivery is required to ensure alignment of programmes the delivery of both projects in the given timeframes.
- The ETCS delivery programme and methodology is to be fully integrated into this construction methodology at the next delivery stage.
- A Signal Sighting exercise should be considered for every delivery stage where there is a clear impact to the operational railway.
- Ensure signalling design work is commissioned a minimum of two-years out from the anticipated delivery date to allow time for design and sign-off.

- An IDC shall be carried out for each of the delivery stages to ensure the required Engineering Assurance rigour is applied to all works installed in isolation of the full scheme proposal.
- A detailed costing exercise will need to be carried out against the delivery proposals identified within this report to ensure funding can be made available at each of the delivery stages.
- Consideration for more materials to be delivered by road should be made. This is likely to bring cost benefits, as some materials by rail will be expensive.
- A detailed Design Programme to be developed to support each delivery stage, noting lead times for delivery and approvals of all aspects of design
- Suppliers of long-lead items should be consulted at the earliest stage of development to protect the delivery programme
- Agreements on batching of concrete to be reached with HS2 to limit the amount of material being transported by Road.
- A Local Traffic Management Plan should be produced for the railway systems project. It should be integrated into the HS2 Route-Wide Traffic Management Plan to ensure vehicle movements are within the agreed limits.

2 Introduction

2.1 Project Background

2.1.1.1 Arcadis have been commissioned by Network Rail to complete GRIP Stage 4 design of the railway systems associated with the introduction of a new Great Western Mainline (GWML) Station at Old Oak Common. This station will have eight island platforms connected by an elevated central concourse. There is a footbridge at the East and West of the platforms. When constructed it will serve as an interchange hub between High Speed 2 (HS2) services in an adjacent sub-surface station, Crossrail and GWML services. The existing four track railway will be reconfigured to an eight-track system – four tracks for the mainline and four for the Crossrail services. For services departing from Paddington Station it will be the first mainline station destination for trains heading West.

2.1.1.2 The Arcadis railway systems remit interfaces significantly with existing works commissioned at the Old Oak Common site; including the station design being carried out by HS2 Ltd, and the decommissioning of the existing Heathrow Express (HEX) and Great Western Railway (GWR) depots.

2.2 Project Scope

2.2.1.1 The overall OOC Station development is split into two main elements:

- Development of the HS2 station sub-surface “box” and station; the main concourse and shared accommodation facilities; the Civils / Mechanical, Electrical, Plumbing and Heating (MEPH) elements of the GWML station, including two reconstructed under-bridges and undertrack crossings (UTXs). These elements are being developed and designed by HS2 Ltd and their Station Design Services Contract (SDSC) supplier.
- The GWML OOC Railway Systems being developed and designed for Network Rail by Arcadis.

2.2.1.2 The objective of the OOC Railway Systems project is to remodel all railway infrastructure within the project area to enable the new OOC station and platforms to be delivered and to function effectively in meeting the required Train Service Specification. The full scope of the Railway Systems Option Selection design can be found in the Option Selection Report (152270-ARC-REP-EMD-000002).

2.2.1.3 The works will be commissioned in stages around the station construction and available railway access. All rail systems are affected in the area including but not limited to Track; Overhead Line Equipment (OHLE); Signalling; Electrification & Plant (E&P); Telecoms; Lineside Civils and Earthworks.

2.2.1.4 The project is currently undertaking GRIP 4 design development following successful Option Selection in GRIP 3. Options presented during GRIP 3 were evaluated against pre-set criteria and a single option was chosen at an option Selection workshop in July 2019. This option named E1 in GRIP 3 is now being developed to AiP for completion mid-2020 and is now titled GRIP 4 Alignment.

2.2.1.5 The output of GRIP 4 will continue to be integrated with interfacing projects, and design development will continue into GRIP 5 and on into construction.

3 Constructability Background

3.1 GRIP 3 Summary

3.1.1.1 In the GRIP 3 Constructability Report (152270-ARC-REP-EMD-000003) it was deemed that the constructability differences between option groups A, B, C and E are marginal in the context of the 7-year construction programme. The following common challenges affecting all disciplines were identified at GRIP 3 to be further developed at GRIP 4:

- Provision of a rail head to the North of the Up-relief line
- Area required for off-line construction
- Old Oak Common Lane construction compound and access points
- Train and key plant requirements, and removing materials from site
- Railway services diversion strategy

3.1.1.2 In order the tackle the common challenges listed above; the GRIP 3 report highlighted the following next steps:

- Development of the current phasing strategy.
- Consideration of the constructability challenges throughout the GRIP 4 design period, adding value to the design decisions made, as well as creating ongoing detailed dialogue with HS2 and their stations Contractor.
- The GRIP 4 design will be developed in the federated 3D BIM model, which will provide opportunities for presenting the construction phasing strategy within the model environment, greatly helping identify constraints and opportunities.

3.1.1.3 Section 3.2: Purpose of Report covers the above key areas highlighted at GRIP 3, along with how they are tackled throughout the GRIP 4 submission.

3.2 Purpose of Report

3.2.1.1 The purpose of this report is to demonstrate that the Old Oak Common Railway Systems Design can be constructed within the space, access, and time constraints of the critical railway corridor stretching to three miles to the West of Paddington Station along the Great Western Mainline. On top of this, it will provide evidence on how it can be constructed in conjunction with the Old Oak Common GWML Station development, HS2 Box Station works, as well as other significant interfacing projects. It identifies:

- Constructability issues/Risks, opportunities, impacts and mitigation measures
- Traffic management requirements (Rail and Road)
- Typical construction vehicles to be utilised in the delivery
- Feasible construction techniques and equipment
- Interfaces with other projects being delivered in the same area

3.2.1.2 In preparation of the report we utilised the principles of the construction set out in the Network Rail staging strategy titled HS2 OOC GWML Staging Schematics – V6 (Option 2C); which details eighteen construction phases over a period of seven years. Throughout the GRIP 4 design process we have continued to build on the original plan and have iterated the process from 18 key stages to 27 stages (key stages + sub-stages); all detailed within this report.

3.2.1.3 The basis of design for the sequencing comes from the design development that has been undertaken in the discipline areas of Permanent Way (PWay), Overhead-Line Electrification (OHLE) and Signalling. While the staging design has been considered for all stages for PWay and OHLE, the Signalling design stages are only developed to stage 12. This is due to the lag in the design process for the Signalling Approval in Principal (AiP) and as such assumptions have been made on the Signalling sequencing beyond Stage 12.

3.2.1.4 This report does not cover the details of the HS2 construction logistics for the Old Oak Common Station contract. The HS2 Construction and Methodology Report (1SN02-WSP-CL-REP-SS07-000001 C03) is used as a baseline to develop and integrate delivery strategy.

3.2.1.5 No assessment of overall or stage delivery costs has been made as part of this report.

3.2.1.6 In order to best represent the staging methodologies, we have developed a number of visual aids, all of which are appended to, or linked to this report; they are as follows:

- Staging Schematics:
- Staging General Arrangement Layouts:
- Box Plan of Works planned against possessions
- 4D Synchro Model - Animation of Delivery

3.3 Site Constraints

3.3.1 Limits of Deviation (LOD)

3.3.1.1 The LOD are used to show the limits within which the scheduled works, as listed in Schedule 1 of the Hybrid Bill, may be constructed. These limits show the extent of the proposed works based on the design developed to the stage necessary for the preparation of the Bill. The specified LOD for this scheme are displayed in the Staging Layout, found in Appendix B.

3.3.1.2 The railway systems works fall within the LOD for the site, though permission for isolated/ancillary infrastructure such as Distribution Network Operation (DNO) supplies and the Auto Transformer Feeder Station, as well as development of access points which fall outside the LOD but are sited within the railway boundary are permitted where necessary. The introduction of additional access points and compounds may be subject to additional approvals.

3.3.2 Working Hours

3.3.2.1 Construction of the Rail Systems works are part of the wider station development at Old Oak Common, though will be delivered under separate contractual arrangements, likely to multiple contracting organisations.

3.3.2.2 Working Hours will subject to Section 61 applications to the relevant Local Authorities in accordance with the Control of Pollution Act 1974, with the expectation being that there will be variations on how works are packaged and delivered by interfacing Contractors. Core working hours will be from 08:00 to 18:00 on weekdays (excluding Bank Holidays), and from 08:00 to 13:00 on Saturdays, with exceptions to this forming part of the Section 61 applications.

3.3.2.3 The Rail Systems works will interface significantly with existing rail operations, and as such will include periods when it is not practical to adhere to the core working times, and there will be significant periods of possession work taking place during antisocial hours.

3.3.2.4 Access to the operational railway is controlled and requires significant pre-planning, allowing the Contractor(s) to book possessions and blockades considerably in advance of when works will be carried out. This allows for consultation with any necessary stakeholders including Local Authorities, and affected resident to minimize disruption as far as is practicable.

3.3.2.5 The design intent throughout this GRIP 4 period has been to design with construction in mind, and to maximise opportunities for daytime working in secured sites which operate separately from the live railway. These periods will generally be able to be undertaken within the core daytime working hours.

3.3.2.6 Between key stages of off-line construction and during certain commissioning/decommissioning periods, there will be periods of extended track possession working, which will require work outside of the core hours. Effort will be made by the Contractors to mitigate the impacts of these on residents, other affected members of the public, and stakeholder groups. Activities outside core working hours, that could give rise to disturbance, should be kept to a reasonably practicable minimum.

3.3.3 Public, businesses and community relations

3.3.3.1 The approach to community relations for the combined works at Old Oak Common will be detailed in a community engagement framework by the appointed Contractors. An integrated approach to this will need to be taken, given the variety of work packages, and site working arrangements across the site.

3.3.3.2 Consistency in approach to community relations between the rail systems works, and surface / sub-surface stations will be important in its effective management. As the contracting entity for the rail systems works, Network Rail will play a leading role in managing engagement with its neighbours.

3.3.3.3 Residents and businesses in the vicinity of the rail boundary will generally be familiar with living and working near a busy and complex rail corridor, but the extent and duration of work planned in the delivery of the rail systems upgrades and wider station construction will be significantly more impactful than the usual maintenance and renewal activities. Traffic management and the volume of construction vehicles will negatively affect the local area for the duration of the construction period, though the degree of this can be managed to mitigate the impact as far as is practical.

3.3.3.4 With the level of disruption to the local area inevitably being high, a significant level of engagement with local stakeholders and stakeholder representatives will be necessary. Advance notice of specific details of work stages will need to include information on the nature of works, exact locations of areas affected, and durations, including working hours. A community helpline facility to manage enquiries, complaints, and feedback is recommended.

3.3.3.5 Network Rail and the selected Contractors for the railway systems construction are recommended to explore opportunities for proactive community relationships, including for example, initiatives involving education and employment opportunities for local people. The scale and duration of the works are such that education, training and employment opportunities for a wide range of age groups, professions and trades will be significant. A workforce drawn from the local community will help embed support for the works amongst community groups.

3.3.4 Bridges

<u>Scrubs Lane Overbridge (2m 54c)</u>

3.3.4.1 The Overbridge at Scrubs Lane is a Network Rail owned structure which carries the A219 over the railway. The steel girder bridge is a single span over the full rail corridor at the Eastern limits of the site, and there are no intermediate supports within the railway. Mass fill brick abutments at either end constrain the site at the North Pole and Old Oak Common Cross Rail depots, with the Grand Union Canal sited adjacent to the Northern site boundary.

3.3.4.2 Whilst the bridge is not supported within the rail corridor, OHLE registration arms are fixed to the structure, and deep steelwork members constrain headroom affecting any changes to the track alignment and the OHLE alignment, both in terms of vertical and horizontal alignment. The GRIP 4 design has been completed taking these constraints into account, though consideration will still need to be given in the construction phase given limitations on temporary works, and headroom restrictions for large items of plant.

3.3.4.3 No works are proposed to be undertaken to the structure itself as part of the rail systems works, though restrictions to access for inspection and maintenance should be minimised during the construction phase.

3.3.4.4 No impact is foreseen to highway movements on Scrubs Lane, though the 18t highway weight limit may be a consideration for materials and plant movements to and from the site.

Mitre Railway Overbridge (2m 55c)

3.3.4.5 Mitre Bridge carries the two-track West London Line over the Great Western Mainline in a single span and is situated adjacent to Scrubs Lane Overbridge at the Eastern limits of the site. The steel girder structure is supported on abutments at either side of the rail corridor in a similar manner to Scrubs Lane.

3.3.4.6 As with Scrubs Lane Overbridge, no physical works are proposed for the bridge, but the structure remains a significant design constraint which has affected both the horizontal and vertical design of the track and OHLE. These constraints will follow through to the construction phase, with limited headroom a consideration for plant and lifting operations.

3.3.4.7 No impact is foreseen to rail operations on the West London Line.

Old Oak Common Lane Underbridges & Central Line Bridge (3m42c)

3.3.4.8 To the West of the site, the Old Oak Common Lane Underbridges carry the GWML and Wycombe Single Line over Old Oak Common Lane, and in close proximity is the Central Line bridge which carries the GWML over the Central line.

3.3.4.9 Due to the widening of the railway corridor at this location, both bridges over Old Oak Common Lane are to be replaced by wider structures, as is the bridge over the Central Line. Old Oak Common Lane will become a main highway route to the new station and will be subject to lowering and widening to cater for the increased traffic and bus movements.

3.3.4.10 The works to these bridges and the associated highways works to Old Oak Common Lane are to be delivered under the Stations Package, so do not form part of the Railway Systems scope.

3.3.4.11 Additionally, in this area, a major new service crossing point is proposed under the full rail corridor. Details of this interfacing project are included in 3.5 Interfacing Projects.

North London Line Railway Overbridge (3m 56c)

3.3.4.12 To the far Western end of the site, the North London Line Railway overbridge carries the NLL over the GWML. The GWML track in this location is subject to slews as the new alignments diverge into the OOC site.

3.3.4.13 The bridge is supported by piers in the 6fts between the reliefs and mains which have constrained the alignment design at GRIP4 to save replacing the structure. The proposed track alignment does however require a shortening/reconstruction of the wingwall retaining structure to the London end of the Northern abutment.

3.3.4.14 The bridge also acts as vertical constraint to the movement of plant and materials from Acton Yard to the site

3.3.5 Rail Operations

Great Western Mainline

3.3.5.1 The biggest single constraint to the construction of the rail systems works is the operation of the GWML. Line speeds and service frequency are high into the terminus at London Paddington, and the construction of the proposed rail systems modifications require prolonged phasing to allow rail operations to continue with as limited disruption as practical during the construction period.

3.3.5.2 The phasing approach outlined in this document demonstrates how the proposed railway configuration through Old Oak Common can be delivered whilst keeping the mainline operations at their required frequency.

3.3.5.3 Maximising off-line construction is a core tenet of the construction methodology proposed at GRIP 4, though considerable use of Easter and Christmas blockades and further disruptive possessions are necessary for key commissioning stages of both temporary and permanent design configurations.

Old Oak Common Crossrail Depot

3.3.5.4 Old Oak Common Crossrail train maintenance depot is located to the North of the site, facing East, and with its reception lines running adjacent to the GWML from Mitre & Scrubs bridge, throughout the Eastern site extents to Kensal Green. The Old Oak Common flyover provides access to the depot from the Dn Main line.

3.3.5.5 Western facing connections into the depot reception lines currently existing from the relief lines of the GWML, and Western connection functionality is retained in the GWML GRIP 4 track design.

3.3.5.6 The depot will be operational throughout the construction phases of the railway systems project, and planning access to the railway which IEast impacts the depot operations has been an important part of the construction planning at this GRIP 4 phase, and will continue to need detailed planning in subsequent project phases. The Crossrail depot serves the Crossrail fleet, which will operate principally on the Relief Lines once passenger operation commences.

Hitachi / North Pole Depot

3.3.5.7 To the South of the site adjacent to the Dn Main line, Hitachi's North Pole train maintenance depot runs along the majority of the site boundary. The primary connection to the network faces East connecting via two reception lines from the Dn Main and the E&C line. A secondary connection to the West London Line acts as an irregular / emergency connection. North Pole services the fleet of IEP trains operating principally on the main lines through the site.

3.3.5.8 Access to site from the Southern boundary does not exist at present, though is being arranged through agreement with Hitachi. Available space is extremely limited however, severely restricting compound and lay-down areas.

Adjacent rail operations

3.3.5.9 The North London Line, West London Line, and Central Line all cross under/over the Old Oak Common site at different locations.

3.3.5.10 Structures carrying the West London Line and North London Line over the GWML impose headroom restrictions as commented upon above, though there are no specific implications for the either line's general operations.

3.3.5.11 The Central Line crosses under the GWML and will be affected by the replacement of the bridge, with full possession of the London Underground Lines being necessary during the key stages of the bridge installation and commissioning.

3.4 Stakeholders

3.4.1.1 The proposed rail systems works at Old Oak Common are significant and highly impactful on all those that use, access and live or work near the site.

3.4.1.2 The works form part of the wider Old Oak Common HS2 station development, and as such stakeholder management between the Network Rail On-Network Works, and the wider HS2 station construction is and must continue to be integrated and developed in tandem.

3.4.1.3 The following lists the primary stakeholders affected by and/or impacting upon the proposed works. It is not an exhaustive list.

- High Speed 2 (HS2) – Ultimate Client
- WSP – Designer: HS2 & GWML Station Designer for HS2/BBVS
- Balfour Beatty Vinci Systra (BBVS) – Contractor: HS2 & GWML Station Contractor
- Network Rail – Infrastructure Manager for affected rail network (Arcadis' Client)
- Paddington to Reading (P2R) – Programme team within Network Rail Western Route, managing the HS2 On-Network Works and multiple interfacing projects
- Old Oak and Park Royal Development Corporation – Development Corporation within which the Old Oak Common site sits
- Transport for London (TfL) – Operator of Crossrail services on the network, and the Crossrail maintenance depot to the North of site. Also operator of services running on the West London Line, North London Line, and Central Line which cross over/under the OOC site
- Great Western Railway (GWR) – Primary train operator for passenger services on the GWML
- Hitachi – Depot Operator for North Pole, maintaining the GWR fleet
- Local Highway Authority
- Local Councils

3.5 Interfacing Projects

3.5.1 Introduction

3.5.1.1 To successfully deliver the Old Oak Common Railway Systems works it is essential that a detailed understanding of all other projects being implemented along the Paddington to Reading railway corridor and in the vicinity of the proposed works. Below are details of the key interfacing projects for the construction of the works – additional details can be found in the respective discipline sections where the interface directly impacts the methodology proposed for adoption.

3.5.2 Old Oak Common Great Western Mainline Station, Old Oak Common Lane and Central Line Under bridges and HS2 Box Station

- Current Design Stage: GRIP 4/5
- To be implemented/completed between 2020 to 2027

3.5.2.1 The High Speed 2 (HS2) Old Oak Common Station is the London interchange station of the UK's second high-speed railway. The development forms part of Phase 1 of the HS2 delivery from London to the West Midlands.

3.5.2.2 The works will comprise the construction of a new eight platform station to serve Crossrail (Elizabeth Lin) and the Great Western Mainline and a new sub-surface box station to serve the HS2 line. Coupled with this there will be a new interchange and retail area constructed between the stations.

3.5.2.3 To facilitate the railway systems required for the station operations, bridge enhancements/extensions are required over Old Oak Common Lane and over the Central Line Railway.

3.5.2.4 The integration of the railway systems and the aforementioned developments are critical from not only a design perspective, but from a construction methodology perspective.

3.5.2.5 Works have been commissioned to deliver these works from, in Network Rail terminology GRIP 4/5 – 8. The delivery of the works package has been awarded to Balfour Beaty, Vinci & Systra (BBVS) with WSP as designer.

3.5.2.6 The phasing of the station and bridges work is critical to the railway systems delivery. Ongoing integration is essential to ensure the success of the projects.

3.5.2.7 A critical aspect of the interface with the bridges works is the consideration of designing the bridges for construction traffic and the timings for availability of the bridges for access to the Wycombe Triangle Compound area are to be considered in detail as the projects evolve.

3.5.3 Old Oak Common (OOC) Depot Decommissioning Project

- Current Design Stage: GRIP 5 - 8
- To be implemented/completed between 2019 – June 2021

3.5.3.1 The existing GWR and HEx depots on the OOC site are being decommissioned to make way for the HS2 and OOC GWML Station. This is managed by a separate project team but falls under the same programme of works within Network Rail.

3.5.3.2 Work consists of Track and OHLE modifications / recoveries, cable route modifications, cable diversions, UTX alteration, signalling scheme plan changes, operational changes, boundary modifications and operational changes.

3.5.3.3 This also includes provision of REB's for OOC in their final locations to facilitate LOC suite removals.

3.5.3.4 The timeline of the project should not interface with the construction stages of the railway systems project. There will be an interface with the design process as part of the GRIP 4 deliverables.

3.5.3.5 The interface will be managed by regular discussion between Arcadis and the depot decommissioning project with the sharing of designs to enable relevant information to be shared between parties.

3.5.3.6 Other interfaces with the scheme include any changes made to the ground conditions, boundaries installed during the project, and the space constraints these may place on rolling stock/permeant way alignments. The area covered by the project is highlighted below in green in Figure 1.

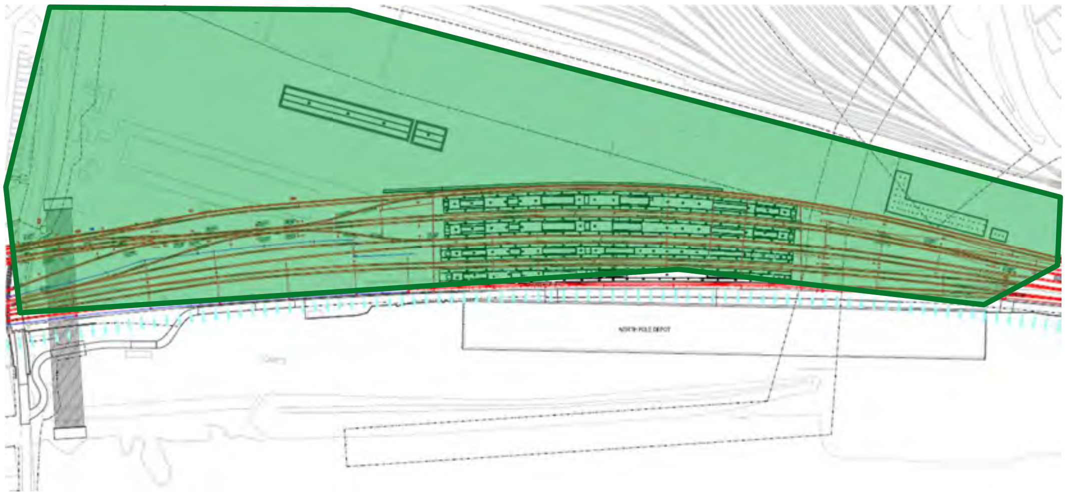

Figure 1: Depot Decommissioning overlay on the proposed railway systems track layout

3.5.4 Old Oak Common - Essential Works Project

- Construction and commissioning by June 2020.
- Decommissioning and handover to HS2 of substations in Depot area by September 2020.

3.5.4.1 The existing E&P and S&T modification will be covered by a separate project (essential works project). This consists of recovery of Feeder Station 2, installation of new DNO, new cable routes, modification of supply to points heating including UTX, and a new substation at Admiral Mews to power 6.6kV ring main.

3.5.4.2 An understanding of the impact of the project upon the railway systems works is vital for the delivery of a well-co-ordinated design at GRIP 3/4. The OOCRS project will be installing infrastructure which will be fed by the existing power supplies. Modifications to the infrastructure will need to be incorporated into the OOCRS works.

3.5.4.3 The interface will be managed by Arcadis E&P discipline and communicated with the wider team at weekly integration meetings. The systems architecture schematic will be regularly updated to reflect change.

3.5.4.4 Due to the project commissioning in June 2020 there will be no direct construction interface, but the positioning/access of the recovered/installed elements will require review to ensure that the staging strategy developed by Arcadis is still valid and if required is updated to take into account any changes.

3.5.5 Network Works Crossrail Projects - Crossrail Programme

3.5.5.1 There are multiple Projects on the Great Western Main Line, that will interface with the delivery of the Old Oak Common Railway Systems project, nominally described as:

- OOCPA - Paddington (0MP) to 3¾ MP;
- Works include - Snagging and close out works ongoing.
- West Inner - 3¾ MP to Airport Junction (12MP);to Maidenhead (25MP)
- Works include - Snagging and close out works ongoing
- GWRM - Maidenhead (25MP) to Reading (36MP) and beyond.
- Works include - Snagging and close out works ongoing. Minor.

3.5.5.2 These have discrete or geographic project elements to deliver the overall Crossrail programme, alongside some “Line of Route” (LoR) type projects and are in final completion and hand-back stages.

3.5.5.3 There will still be some remedial works in these areas after the closure of Crossrail programme, which may need interfacing with. Specifically, recovery of Feeder Station 1, platform extension of Acton mainlines, drainage in OOCPA area, renewal and realignment of Carriage Line 1 (deferred), through alignment designs to East and West.

3.5.5.4 The interface will be managed through regular meeting with the Network Rail (NR) project team, who will inform of any developments on the discrete sites. The main interface stemming from the Crossrail (Elizabeth Line) project is the changes to the drainage system in the OOCPA. This will interface physically with the GRIP 4 design of track drainage. There will be a review of the agreed outfalls and the limitations changes may place of the project.

3.5.5.5 The current expectation is that the Elizabeth Line will be open as a service by mid-2021. All available “As-built” data will need to be shared to ensure full and proper integration is achieved.

3.5.6 West (Inner) Signalling – Introduction of European Train Control System (ETCS)

- Staged commissioning in 2020 and 2022.

3.5.6.1 The introduction of the Crossrail Class 345 EMU fleet, which will not be BR(W) ATP fitted. ETCS is being introduced in stages between Paddington and Reading. The timescale of this require interface with, however the current project instruction is to assume conventional Signalling.

3.5.6.2 The current package of design and delivery is for the introduction of conventional Signalling systems, updates to the delivery programme of ETCS will need to be managed and construction methodologies and delivery programmes updated to suit.

3.5.7 Line of Route Telecoms Cable Upgrades

3.5.7.1 The upgrades to the cabling within the OOC area will directly interface with the railway systems delivery. The interface will be managed through design by ensuring access to facilitate the ongoing renewal of cable routes, fibre optic backbone, GSM-R, & SPTs, etc.

3.5.7.2 There is a construction interface with the construction staging requires the relocation of cables, or replacement to support new assets. This may be integrated with the cable upgrades to ensure cost optimisation across projects. Any work to ensure rework is limited will be controlled by NR whom after receiving designs will be in a position to identify areas of overlap.

3.5.8 West (Inner) Electrification Modification OHLE

3.5.8.1 This work involves the modification of OHLE, (including elements of “Campaign Change plus” and “tangential wiring”), TTC construction and transfers, removal of existing OHLE head spans. This is required in order that legacy OHLE in the West Inner area (1½ MP to 12MP) can perform to levels provided by new electrification introduced by the wider Greater Western Electrification programme.

3.5.8.2 The interface is shared between Arcadis and the NR project team being responsible for the review of Arcadis OHLE deliverables to ensure the design aligns with the West Inner Electrification Modification project. Arcadis has developed design which integrate information provided by NR at regular integration meetings.

3.5.9 Fast and Safer Isolations project

- Ongoing

3.5.9.1 The project covers the rationalisation, introduction and motorisation of OHLE switching between Paddington and Maidenhead.

3.5.9.2 Arcadis are delivering a Form A to provide power to the motorised switches. This will also serve as the interface control by the E&P CRE regularly communicating with NR counterparts in the development of the deliverable. In turn the rest of the project team will be informed by sharing any developments within the Isolations project with the wider team.

3.5.10 Track Renewals, both Plain Line and S&C, and ongoing infrastructure Maintenance

- No defined implementation dates

3.5.10.1 The route has an ongoing work bank of renewal, and maintenance intervention sites, including the S&C around Paddington and the Western Capacity Improvements Project [WCIP]

3.5.10.2 Network Rail development of the Thames Valley section of the GWML for future capacity growth is currently being developed. – Scope unknown currently, but it is essential that the two projects interface and are aware of delivery timeframes and expectations.

3.5.11 Paddington Approaches / Intervention 1

- GRIP 3
- Install during 2024
- Commissioning Christmas 2024

3.5.11.1 Project to introduce a new crossover in Paddington throat to allow parallel moves from high numbered platforms to the mainlines. This project is being developed and introduced concurrently with the Old Oak Common Station and Systems Development works.

3.5.12 Axle Counters project

- Planned for Christmas 2021
- Trains run on new infrastructure 2024

3.5.12.1 Replacement of Track Circuits with Axle counters in the Paddington to Reading area – new REBs, cable routes, scheme plans, train detections, power supply.

3.5.12.2 System is being installed with sufficient capacity to accommodate the new infrastructure. A review of the design as soon as it becomes available is required to ensure that there is sufficient capacity in the system. Records are to be made available for the Signalling design to be integrated from both a design and construction perspective.

3.5.13 Advanced Distance Protection (ADP) to RATS (Rationalised Auto-Transformer System)

- Trains run on new infrastructure 2024

3.5.13.1 Modifications to distribution protection systems. Further details are to be obtained as this project as they emerge.

3.5.14 Western Rail Link to Heathrow – New connection to Heathrow from the West.

- One commissioning identified in Christmas 2026.

3.5.14.1 This scheme will deliver a proposed new direct rail link from the West to Heathrow and aims to improve journeys to Britain's busiest airport and help increase economic productivity in the Thames Valley area.

3.6 Assumptions

3.6.1.1 A full list of assumptions can be found in Appendix E – Constructability RAID Register. In order to set the scene of this report, key assumptions have been listed below:

- The HS2 Construction and Methodology Report (1SN02-WSP-CL-REP-SS07-000001 C03) forms the basis of the Rail Systems assumptions for the OOCRS construction and logistics plans.
- The Network Rail high-level staging strategy schematics (HS2 OOC GWML Staging Schematics – V6 (Option 2C)) forms the basis of the construction sequences further explored within this report.
- Unless the works are being carried out during a possession, no work can be undertaken outside of the defined HS2 working hours: "Core working hours will be from 08:00 to 18:00 on weekdays (excluding bank holidays) and from 08:00 to 13:00 on Saturdays".
- The station/civil engineering contractor shall provide a cleared site at a nominal 500mm below proposed rail level. The formation shall be prepared to an agreed specification (TBC). The boundary extents of this nominal clear are displayed in Appendix B – Staging Layouts, Stage 2A. Through the station area the station contractor would provide a prepared formation level through all tracks 8 through to 1.
- At each stage of construction for the underbridges the contractor shall provide a prepared formation to a distance of 30m from the East abutment of the OOC Lane underbridge and the West abutment of the CL Underbridge. The contractor shall provide a prepared formation for the full distance between the two under bridges.
- The track/rail systems contractor shall carry out all necessary grading activities for drainage crossfall & etc prior to track installation.
- The track/rail systems contractor shall be responsible for all formation grading activities from a line 30m to the West of the abutment of the CL Underbridge.

4 Site Logistics

4.1 Road Rail Access Points (RRAPs)

4.1.1 Existing RRAPs

4.1.2 Acton Yard

4.1.2.1 Acton Yard - Road Rail Access is currently available via Acton Yard 4m 27.5ch Reception Line 3 and is used today for regular construction and maintenance access, shown in Figure 2. This access will be critical to the delivery of materials and plant to the North of station build on the Relief side.

Figure 2: Acton Yard RRAP

4.1.2.2 The existing RRAP is a 10.8m length semi-permanent Strail type crossing. The RRAP would be sufficient for most short wheelbase RRV's but could be extended with approach to a 16m RRAP to accommodate larger OHLE Road rail vehicles.

4.1.2.3 In order to use this access, there will be the precursor of a Relief line possession including the Poplar lines. The RRAP has the benefit of being located in the yard, offering the opportunity to take an early possession of Reception line 2 and 3 to load machines ready for the shift and prior to the Relief line possession being granted.

4.1.2.4 The route taken by the RRVs will be from Reception 3 to the Up Poplar via Points 8128, 8127A, 8126A and 8126C. The machines will clear 8120/B and then cross over via 8120A/B and 8121A/B to the Up Relief. A further move via 8125 A/B can then be made to access the Down Relief. The route is shown in Figure 3.

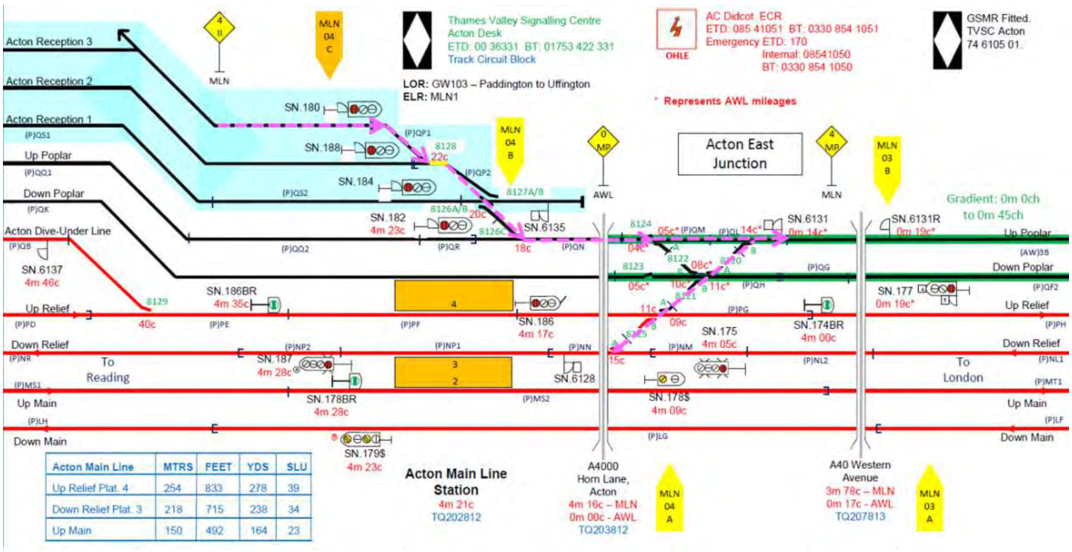

Figure 3: Acton RRAP to Relief

<u>North Pole (Barlby Road)</u>

4.1.2.5 North Pole Depot RRAP is located 1m 73.5ch and is situated on North Pole Line B. The existing RRAP is estimated to be a 14.4m Strail crossing with a concrete apron (see Figure 4).

4.1.2.6 The RRAP is located alongside an existing maintenance compound that is accessed via the Hitachi North Pole Depot. The compound is fenced and of a hard standing approximately 1500m^2 in size.

Figure 4: North Pole Depot RRAP (Barlby Road)

4.1.2.7 In order to utilise this RRAP to gain access to both Up and Down main lines possession protection arrangements should be suitable to allow the use of either 8048A/B or 8063B and 8060 crossovers. The possession limits are discussed in section 6.3.3.

4.1.2.8 The route for access would be from the RRAP located on North Pole Line B via 9001B to the Down Main. Once clearing the points, a move East along the Down Main clear of 8060 would allow a move across 8060 and 8063B crossover to the Up Main. This move is demonstrated in Figure 5.

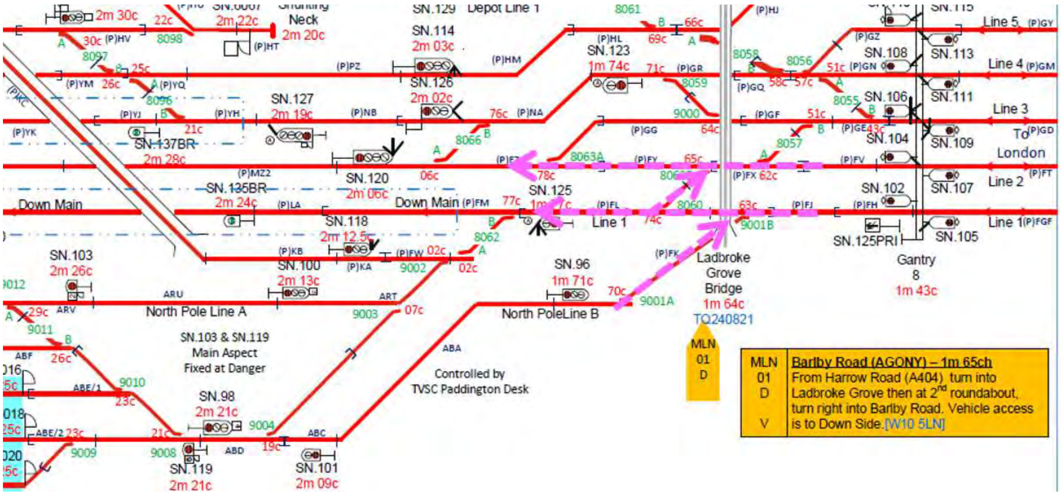

Figure 5: Move from North Pole RRAP to Up and Down Main

4.1.2.9 Access from the public highway to the compound is off Mitre Way , with the entrance from Scrubs Lane; an A-road public highway with easy access links for large vehicles – see Section 4.2. No alteration works would be required to utilise this entrance.

4.1.3 Proposed RRAPs

4.1.3.1 The following paragraph details the RRAP proposals only. For highway access to the RRAPs refer to Section 5.3, and for compound proposals refer to Section 4.2.

North West RRAP (report ref 152270-ARC-REP-ECV-000009)

4.1.3.2 The NW RRAP proposal is a single RRAP situated on the Up-Relief Line, shown in Figure 6, to the North-West of the proposed station. It will allow access onto the Up-Relief Line and Up Relief Loop only, prior to arriving at Platform 7 or 8 at the station. Access to the Down Relief Line will be past the station.

4.1.3.3 However, a double RRAP can be installed if required on both the Up Relief and OOC Turnback Line A. The benefit of this would be allowing access to the Down Relief prior to the station. This currently has not been proposed due to the limited benefits.

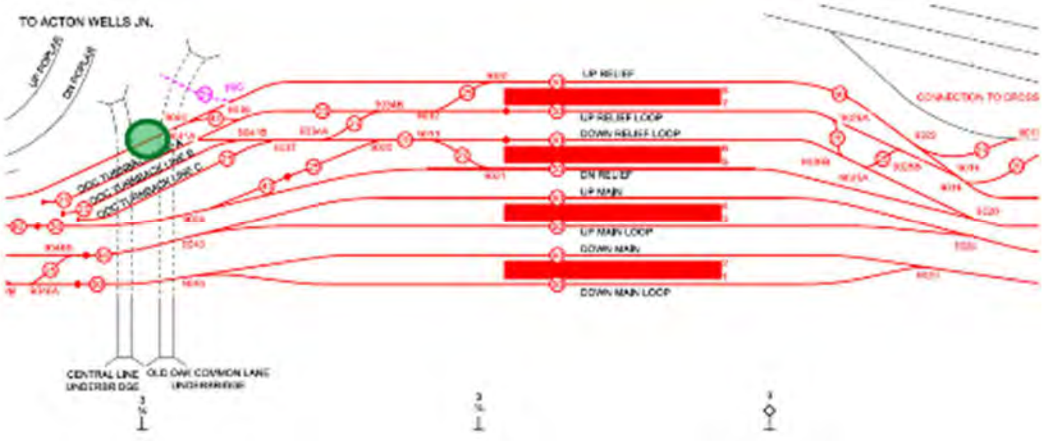

Figure 6: Extract from 152270-25067-P2R-MLN1-DRG-ETR-400001 of NW RRAP location (green)

4.1.3.4 It is assumed that the Acton Northolt Line (ANL), shown in Figure 7, will be disused prior to the NW RRAP being installed. This access has allowed for installation of the proposed Chiltern Line if required (the vehicles will cross over a crossing point on the Chiltern Line to reach the RRAP).

4.1.3.5 Vehicle tracking has allowed for access of an SRS RB25 or similar.

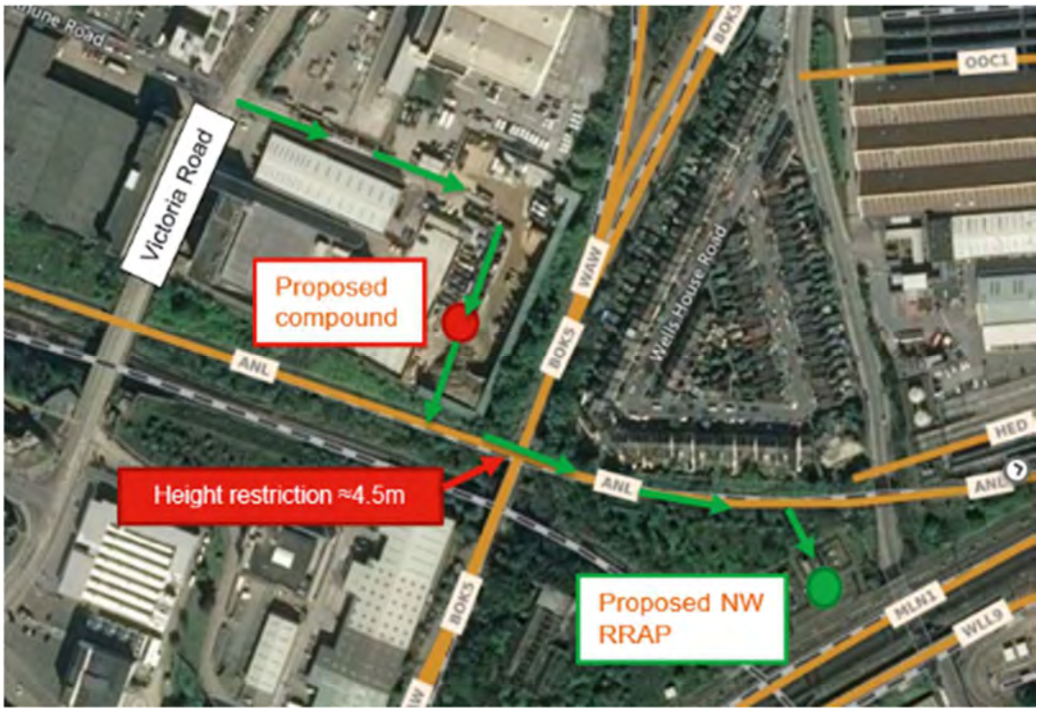

Figure 7: Access to RRAP (green) from public highway (compound in red)

4.1.3.6 A proposed compound area has been designed off Victoria Road. From the compound it is suggested that a private road is created down to the Acton Northolt track below. This will require a cutting, and replacement of the recovered rail track with highway surfacing, to follow the green path shown in Figure 8. Height restrictions will apply for vehicles as they travel under the North London Line; estimated to be 4.5m. This should be sufficient for a Hiab or similar to deliver ATFS equipment for installation.

North East RRAP (report ref 152270-ARC-REP-ECV-000006)

4.1.3.7 The North East RRAP will allow access to the railway whilst OOC is functioning as a terminus for trains from the West. It will allow access onto the Up-Relief Line only (see Figure 8).

4.1.3.8 Vehicle tracking has been designed for an SRS PKR750 or similar. Access off Old Oak Common Lane will take vehicles through the proposed Urban Realm road to the compound. The proposed compound measures approximately 180m x 22m.

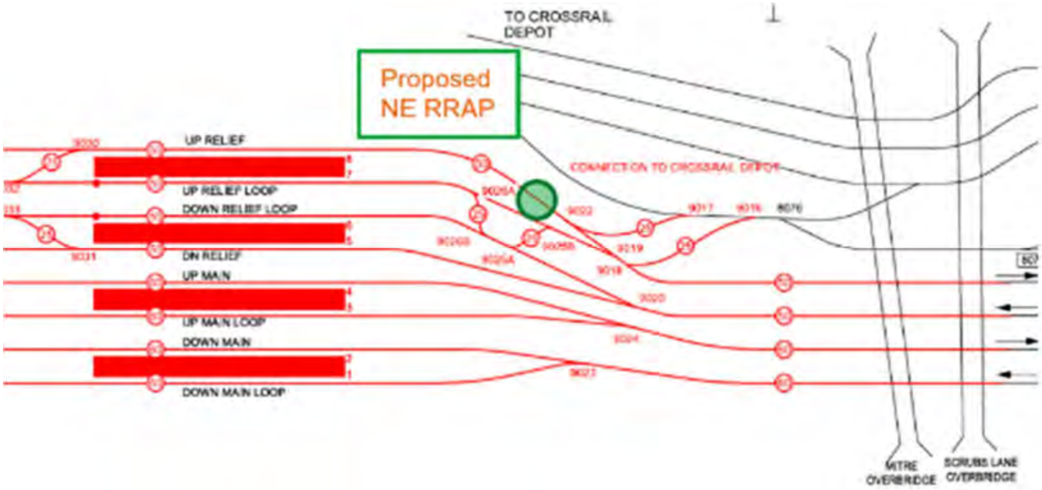

Figure 8: Extract from 152270-25067-P2R-MLN1-DRG-ETR-400001 - Location of NE RRAP (green)

South West RRAP (report ref 152270-ARC-REP-ECV-000008)

4.1.3.9 The proposed SW RRAP has been situated in Hitachi leased land, within the North Pole Depot site (see Figure 9). All existing tracks within the vicinity are being replaced by a new permanent way layout to accommodate the new station.

Figure 9: Proposed SW RRAP

4.1.3.10 Vehicle tracking has been designed for an SRS PKR750 vehicle or similar.

4.1.3.11 Access from this compound is provided onto the Down Main Loop only (see Figure 10). Access to the Down Main can be provided in the form of consecutive RRAPs, however this track sits on a 25mm cant and a transition so will limit the type of vehicle that can access onto it and has not been proposed.

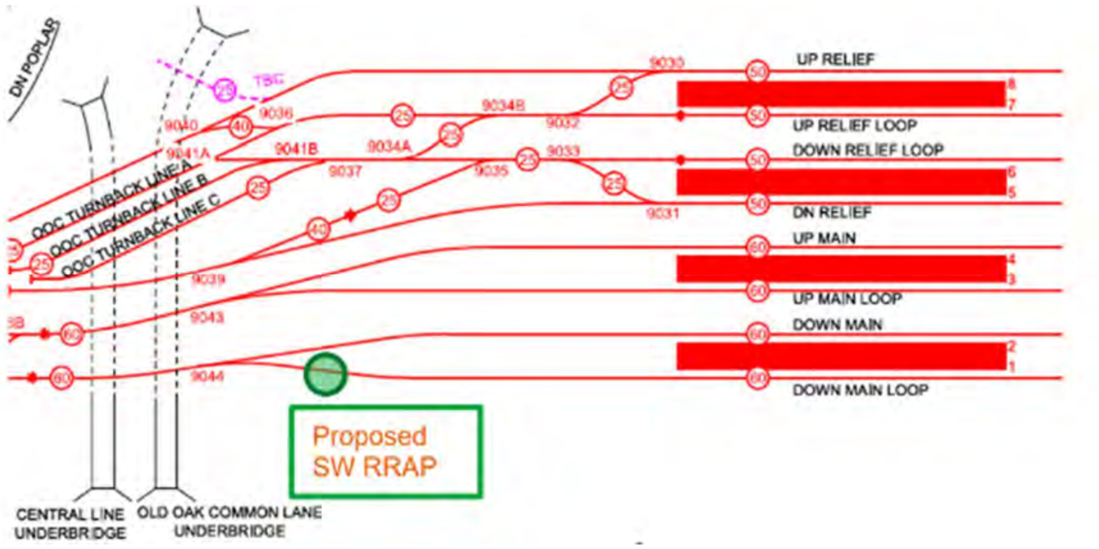

Figure 10: Extract from 152270-25067-P2R-MLN1-DRG-ETR-400001 - Location of SW RRAP (green)

<u>South East RRAP (North Pole Depot - Barlby Road) ref. 152270-ARC-REP-ECV-000007</u>

4.1.3.12 The South East RRAP will utilise the existing RRAP at Barlby Road, within the North Pole Depot. See paragraph for details of existing.

4.1.3.13 Proposals put forward in the RRAP report 152270-ARC-REP-ECV-000007 recommend that the RRAP is extended from (estimated) 14.4m to 16.8m, to allow for the SRS PKR750 vehicle. The compound and RRAP is currently lit and fenced off and is assumed to be classified as Access Point Class 3 and Security Level 2.

4.1.3.14 No changes to the existing track layout are proposed.

4.1.3.15 It is not possible to put a RRAP on the mainline itself, due to clashes with rail apparatus, particularly switches in this location.

4.2 Compounds

4.2.1 Introduction

4.2.1.1 There are several potential compounds to be utilised in this project. The location and use of each are determined by the works to be completed in the surrounding areas. In this section the compounds will be outlined, with the location, uses, timing, land use constraints, and access for each discussed. Following the review of each compound, general considerations will be given to compound security, ground works, vehicles considerations, water supply, as well as potential sustainability opportunities.

4.2.2 Compound Option A – East of HS2 Box Station

4.2.2.1 Where: East of the HS2 Box Station as shown in Figure 11 & Figure 12 below.

4.2.2.2 Use: This compound would be utilised to construct the bulk of the rail systems work to the East of Platforms 3-8. The compound will contain welfare facilities and parking areas for RRVs, as well as a large material laydown/storage zone. At its peak, the compound will serve approx. 40 members of site staff.

4.2.2.3 When: Key compound for RRV parking and material laydown during Stage 5, which will then reduce in size following the P-Way construction in the East.

4.2.2.4 Land purchase/permits: In the permanent case, it is proposed that this site will be provided to Network Rail as a Maintenance Yard, with permanent rail access to the Relief lines.

4.2.2.5 Access: Shuttle buses will take staff from the nearby designated parking zone to Compound A.

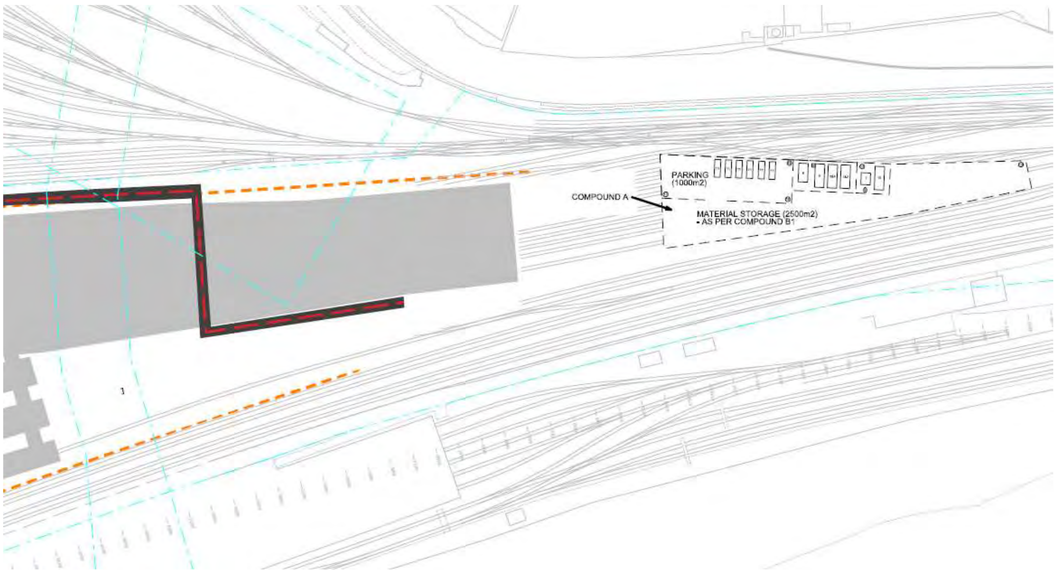

Figure 11: Eastern compound location

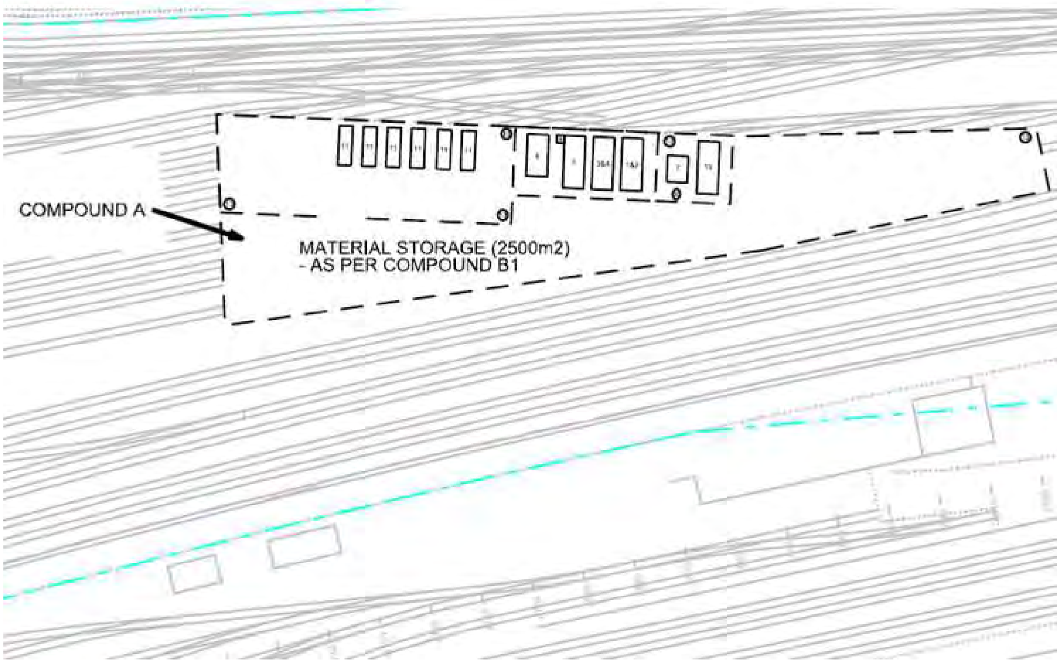

Figure 12: Eastern compound detail

4.2.3 Compound Option B1 & B2 – Main OOC Worksite

4.2.3.1 Where: West of Platforms 7 & 8 within the Main OOC Worksite as shown in Figure 13 below.

4.2.3.2 Use: Two identified compound locations. One will be utilised for material storage, with the other containing welfare facilities and parking for RRV's; the two compounds are approx. 5700m^2 and 2000m^2 respectively.

4.2.3.3 When: Use throughout all Constructability Stages beyond Stage 5A.

4.2.3.4 Land Purchase/Permits: None – part of Main OOC worksite. Integration and collaboration with WSP will be crucial for efficient use of site space.

4.2.3.5 Access: Shuttle buses will take staff from the nearby designated parking zone to Compound B1 & B2

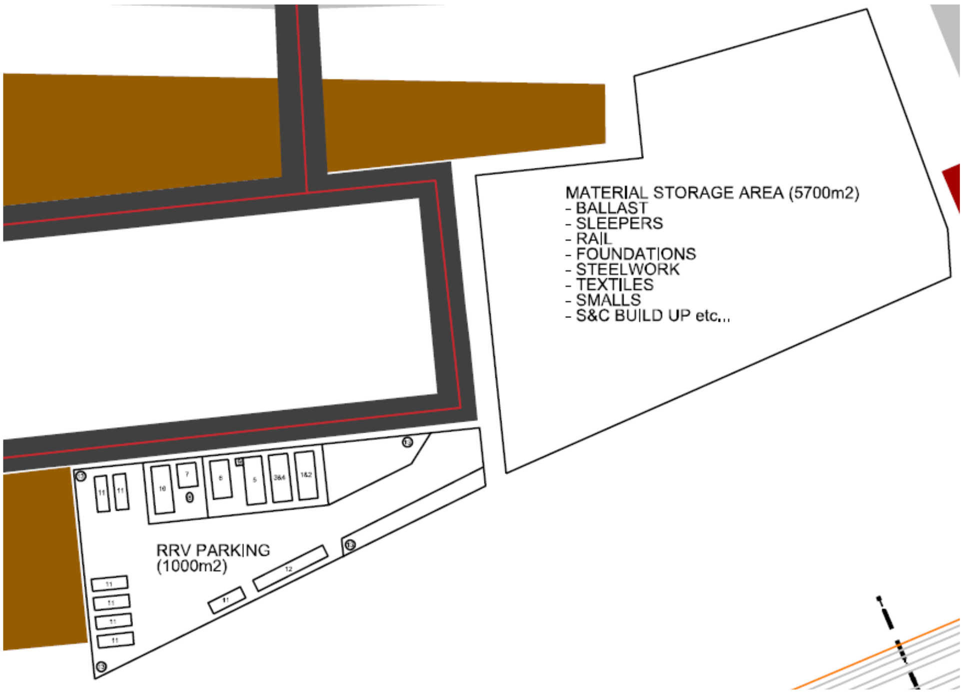

Figure 13: Main OOC worksite compound

4.2.4 Compound Option C – North London Line retaining wall

4.2.4.1 Where, Use, When:

4.2.4.2 The location of this temporary compound is within what WSP have called “Site B”, shown in Figure 14 below, taken from the WSP Logistics drawings found in the HS2 Construction and Methodology Report (1SN02-WSP-CL-REP-SS07-000001 C03). The yellow arrows annotate vehicle access routes, which would allow access between Compound 1 and the main OOC worksite. One key constraint of utilising this compound is managing vehicle movements. During this time period the Station Contractor will be undertaking the reconstruction of Old Oak Common Lane and Central Line. If this compound is to be used, then the interface between the two stakeholder’s vehicle movements will be crucial.

Figure 14: North London Line RW compound

4.2.4.3 Land Purchase/Permits: None

4.2.4.4 Access: Shuttle buses will take staff from the nearby designated parking zone to the Main OOC worksite.

4.2.5 Compound Option D – Acton Yard

4.2.5.1 Where: Acton Yard at 4m 1320yds is highlighted in Figure 15 below. The boundary available for the Rail Systems team has been outlined in Figure 16 below:

Figure 15: Acton Yard location

Figure 16: Acton Yard detail

4.2.5.2 Use: This compound could be utilised throughout the constructability phases, as it provides crucial access to the Relief lines from the West. Acton compound would be particularly useful for the storage and delivery of OHLE Steelwork, signals, signal structures, cable, location cabinets, and if required REB's and PSP's to the main OOC worksite.

4.2.5.3 Land Purchase/Permits: This site may be used in its current configuration to serve the project, but as it is outside of the HS2 Hybrid Bill Statement, development of the site to enhance the existing provision would require its own planning submission, bringing inherent risks and potential programme impacts.

4.2.5.4 The facility at Acton is 3rd party owned/operated and has restrictions on frequency of use and space available for Network Rail operations. However, Acton Yard was used to serve the construction of Crossrail, so subject to the necessary permissions and consents, it is a feasible option

4.2.5.5 Access: Access and egress from Horn Lane; road to the right of the compound in Figure 16. There could be potential restrictions on access due to the ownership of the compound. however, it will predominantly be accessed at the beginning and end of shifts and should not cause a significant disruption to the access and egress from site. The access and egress restrictions will be determined through the permits required and discussions with the 3rd party owners. Shuttle buses from the designated parking site will drop off and pick up via the access established.

4.2.6 Compound Option E – Jewson's Yard

4.2.6.1 Where: Jewson's Yard is located opposite Acton Yard, as shown in Figure 17 & Figure 18.

Figure 17: Jewson's yard location

Figure 18: Jewson's yard detail

4.2.6.2 Use and when: This compound could be utilised throughout the constructability phases, as it provides crucial access to the Mains from the West. Jewson's yard is located in a prime position to be used alongside Acton Yard for the storage and delivery of OHLE Steelwork to the main OOC worksite. The existing warehouses would be retained, hosting both Welfare facilities and material storage. The key advantage of Jewson's Yard is that it is the only viable big yard for the manufacture of OHLE indoors. If it cannot be procured, it will be vital to attain a RRAP via the Hitachi North Pole Depot in order to access to the mains.

4.2.6.3 Land Purchase/Permits: Jewson's Yard would require a compulsory purchase of the land.

4.2.6.4 Access: Access from Horn Lane. There are likely to be some slight restrictions on access and potential traffic management required for larger vehicles due to the congested road and nearby businesses, such as Co-Op directly opposite.

4.2.7 Compound Option F – Barlby Road Compound

4.2.7.1 Where: The location of Barlby Road is shown in Figure 19 & Figure 20 below:

Figure 19: Barlby road compound location

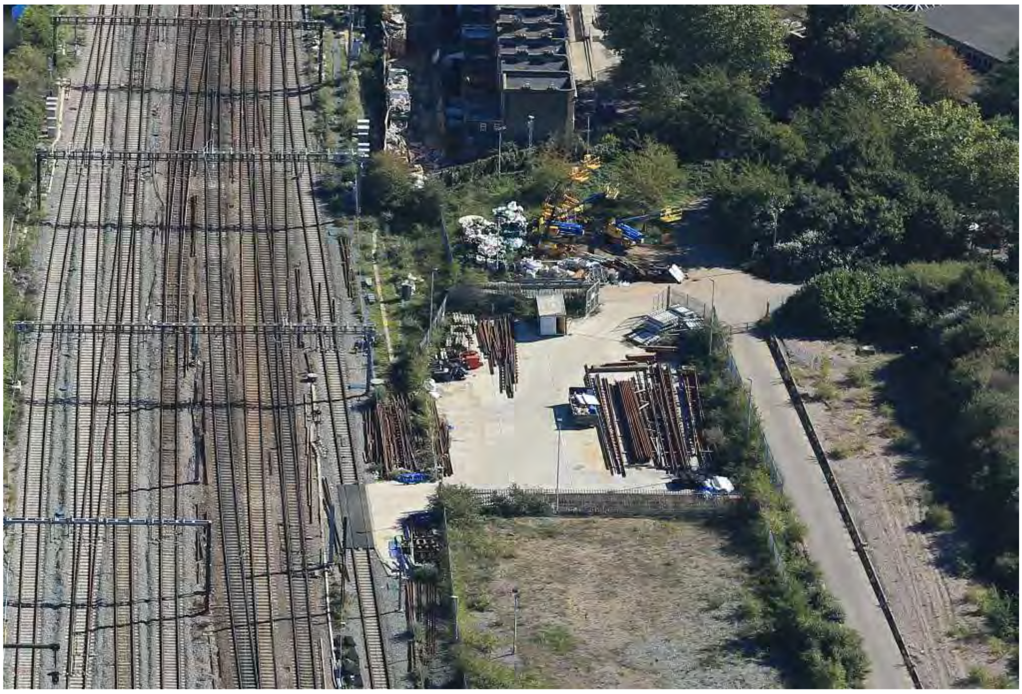

Figure 20: Barlby road compound detail

4.2.7.2 Use: Along with the proposed permanent RRAP serving the Mains from the East, it is also proposed that the existing compound at Barlby Road be utilised for the Old Oak Common Rail Systems logistics. This compound could be used for OLE components and steelwork storage, assembly and delivery for the East of station works for both reliefs and mains.

4.2.7.3 Land Purchase/Permits: Existing compound. No permits or purchase required

4.2.7.4 Access: From Barlby Road. There are areas for the shuttle buses to turn and exit out if necessary, however, there is also the potential to create a loop and continue down the access road, which would avoid the need to turn around and exit from the entrance.

4.2.8 Compound Option G – Hitachi compound

4.2.8.1 Use: Due to the size of this site, the use for this area will be welfare facilities for the mains and to South of the main OOC site.

4.2.8.2 Where: Opposite the OOC main site on the mains side, shown in Figure 21.

4.2.8.3 When: This site will be an access for the majority of the works timeline from 2022.

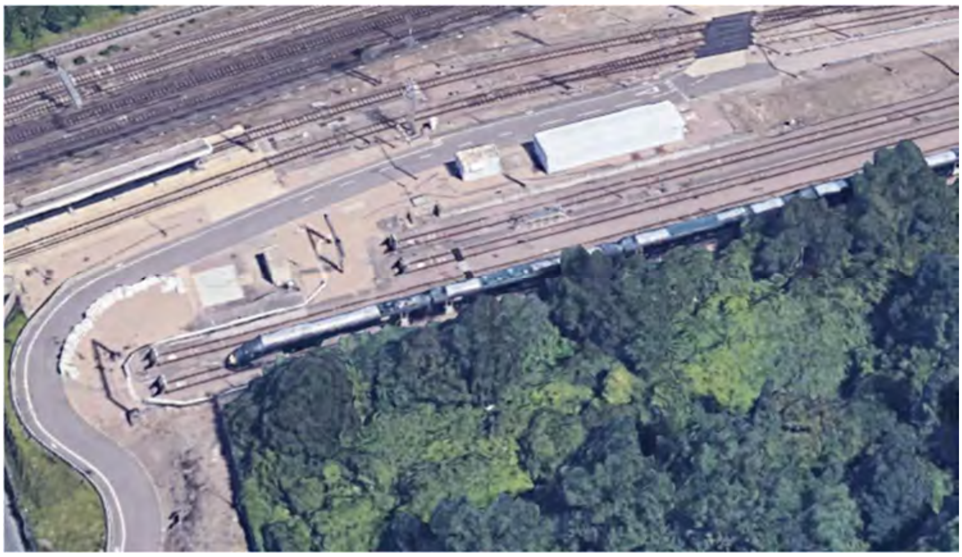

Figure 21: Hitachi compound location

4.2.8.4 Land purchase/permits: Agreement from Hitachi as the depot owner

4.2.8.5 Access: From Old Oak Common Lane onto the access road that leads up to and over the tracks and then runs alongside until it reaches Scrubs Lane. Possibility to create a loop from access area to avoid need to turn around and exit via the entrance. Shuttle buses could drop off at entrance to site or follow loop around.

4.2.9 Security

4.2.9.1 Due to the urban and densely populated area for the works, it is recommended that the compound sites have 24hr security. During the day this will consist of someone managing the reception sign in and sign out area and CCTV cameras around site. During the night, it is suggested that security guards staff the CCTV screens and patrol site. It is suggested that the security fencing be double skinned or anti-climb, approx. 2-2.5m in height. These options should be assessed and taken into account depending on the items stored and risk level. Other considerations are for high value items to be delivered just prior to the works commencing, reducing the time that can attract theft or vandalism on site.

4.2.10 Ground Works

4.2.10.1 Some site investigation will be required to assess the geotechnical properties of the site to ensure it can withstand the weights of the plant equipment, office blocks, vehicles, welfare facilities and material storage.

4.2.10.2 Foundations / ground works for the fencing options, CCTV installations and any additional powering opportunities, such as installation of a solar bank, will also need to be considered. Further ground works will need to be explored for the welfare facilities and potential use of effluent / septic tanks for the sewerage requirements.

4.2.11 Vehicle Considerations

4.2.11.1 Each of the compounds is likely to have plant equipment and vehicles requiring access throughout the duration of the project, such as 360 excavators, trucks, cars, cranes, minibuses and RRVs. Therefore, each should have a designated area for these vehicles to complete their deliveries or be stored on site if required.

4.2.12 Water supply

4.2.12.1 Clean and potable water supplies will be required to all compounds. This would preferably be achieved through temporary connections from the mains water supply. Therefore, an investigation will have to be completed to assess the water supply options in the area and extent of works to achieve a plumbed in water supply onsite. If that is not an option, other avenues such as chemical toilets and bottled water supplies will need to be investigated.

4.2.13 Sustainability

4.2.13.1 There are a few options to increase the sustainability and environmental credentials of a compound. These include different methods of powering the compound such as on-site generation, reducing the amount of energy that is used on the compound through energy efficient fixtures and fittings, obtaining provisions and materials from sustainable suppliers, setting up recycling systems on site, and instilling a sustainable way of working into the workforce.

Powering options

4.2.13.2 Potential power provision options for the compound include solar and wind generated power and / or a bio diesel or diesel generator.

4.2.13.3 An option for the utilisation of renewable power would be to have a solar panel bank on the site. It is possible to hire a solar powered generator, which, in the case of a power drop, can also be powered by a backup generator.

4.2.13.4 A backup diesel generator may be required onsite to fuel in case of emergencies, a power outage or power shortage, as the methods mentioned above can, on occasion, be unreliable. However, if used in conjunction with one another they will increase the reliability, and in turn reduce the amount that this generator will be needed. In order to make this completely sustainable and reduce the amount of greenhouse gases produced this could be swapped for the use of a bio-diesel powered generator.

4.2.13.5 Another power opportunity is to procure a suitable supply from the mains power network, which would generally be readily available given the built-up nature of the surrounding areas. The selection of a green tariff would further enhance the environmental credentials of the power provision.

Sustainable suppliers

4.2.13.6 In order to increase the sustainability of the materials and supplies used to construct and service the compounds, it is recommended to investigate sustainable suppliers. It is worth taking into consideration that sustainable sources can be slightly more expensive, however, the benefits gained may well outweigh the costs.

4.2.13.7 It may be possible to use refurbished options rather than brand new items and materials such as office and welfare facility blocks, fencing and CCTV cameras.

4.2.13.8 The compounds can utilise more sustainable soaps, as some soaps are not suitable anymore due to plastic content. In addition to this, there are also options for recycled or bamboo toilet paper.

4.2.13.9 The switch can also be made to move to greener suppliers of food and snacks, such as more free range, organic, vegetarian or vegan options and options with less packaging or plastic free packaging. They will be a wide selection of local suppliers able to supply the compounds with a variety of food types, and the support of local businesses will be positive for community engagement.

Workforce Sustainability

4.2.13.10 Workforce engagement in sustainability initiatives are crucial to their success, therefore, in order to increase sustainability on the sites, it is important to encourage sustainable habits and ways of working. For example, it should be encouraged for people to recycle and reduce the amount of waste that they are producing. Utilisation of the sustainable food options mentioned in the previous paragraph, providing onsite water fountains and coffee machines for reusable water bottles and coffee cups. Reducing energy demand is a significant part of this as well, therefore, ensuring that lights and pieces of equipment are not left on unnecessarily is vital.

4.3 Labour logistics

4.3.1 Introduction

4.3.1.1 This section outlines the top three potential parking options determined in an investigation for the operatives to utilise and get transport to the Old Oak Common site. In order to establish the potential locations, a radius of 10-15 minutes from the site was determined. Within this radius was Acton, Ealing, Kensal Green, White City, areas of Wembley, Shepard’s Bush and areas of Kensington and Hammersmith. Sites such as existing car parks, yards and brownfield sites in these areas were investigated as potential options.

4.3.1.2 The amount of space required was determined by the assumption that the site would need space for parking approximately 60 vehicles, accommodate the width of a road, toilet block and parking for the shuttle buses. The sites were then assessed against the criteria below and pros and cons listed:

A. Number of spaces / space available
B. Distance from site
C. Time from site
D. Railway owned (5) / privately owned (1)
E. Work required to the area
F. Minibus space and access
G. Access and egress
H. Security
I. Has it been used for a similar reason before?

4.3.2 Option 1 – Gunnersbury Station Car Park

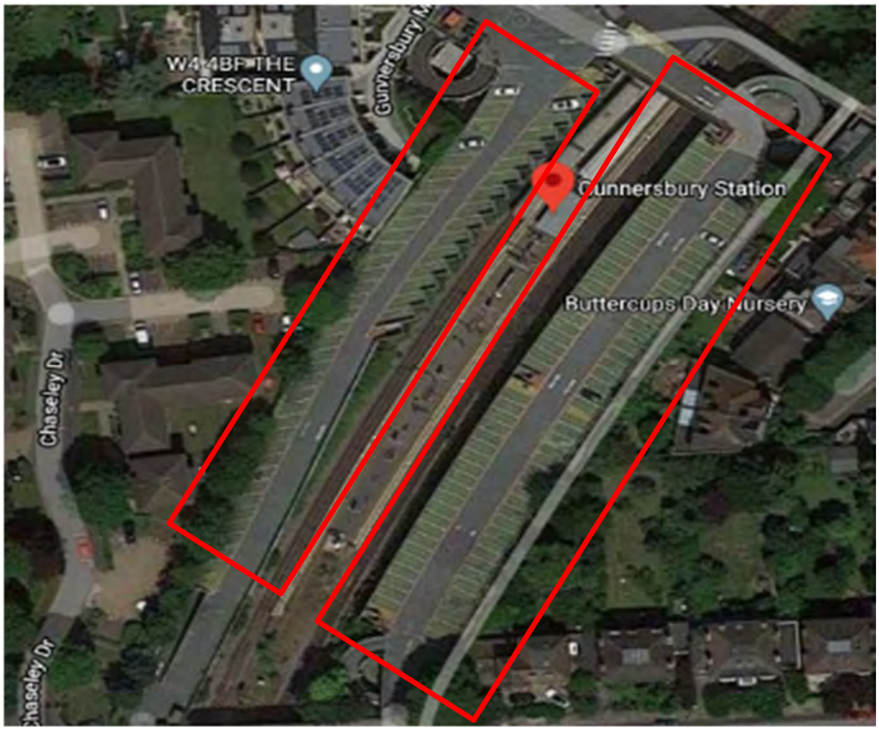

Figure 22: Gunnersbury Station Car Park

4.3.2.1 Distance from Old Oak Common Site: 3.9 – 4.1 miles, 15 - 17 minutes

Pros:

- Existing car park
- Approximately 140 spaces on the top level, further levels available
- Turning and parking area for minibus
- Space for welfare facilities

Cons:

- Just over 15 minutes from the Old Oak Common site
- No charging points

4.3.3 Option 2 – Asda Overflow Car Park

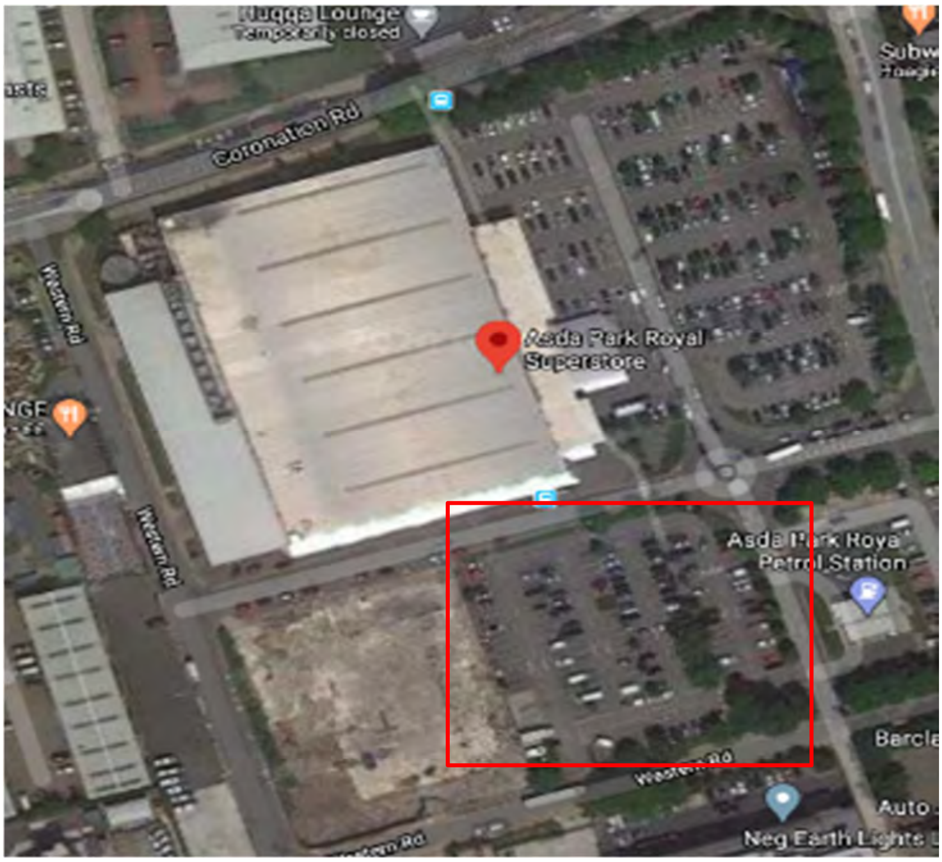

Figure 23: Asda Overflow Car Park

4.3.3.1 Distance from Old Oak Common Station: 1.6 miles, 7 minutes

Pros:

- Existing car park
- 140+ spaces in this area of the car park
- Space for welfare facilities
- Turning and parking space for minibus
- Quite close to OOC site
- Pedestrian walkways

Cons:

- Permission required from Asda to use their overflow carpark
- Electric charging points are in a different area

4.3.4 Option 3 – Kensal (Kensington) Gasworks

Figure 24: Kensington Gasworks

4.3.4.1 Distance from Old Oak Common Station: 2.5 – 3 miles, 10 – 12 minutes

Pros:

- Fairly close to site
- Space for welfare facilities
- Space for minibus parking and turning

Cons:

- Work is required to make a useable car park
- Is it possible to get an electrical supply to the area?
- Access and egress of the site could be more difficult

4.3.5 Parking Option Scores

4.3.5.1 The scores for these sites are shown below:

Table 1: Potential parking options scores

Name	A	B	C	D	E	F	G	H	I	Total
Gunnersbury station	5	3	2	5	5	5	4	5	1	35
Asda Overflow	5	4	4	1	5	4	3	4	1	31
Kensal (Kensington) Gasworks	4	4	3	5	3	4	4	3	5	36

4.3.5.2 The top three potential sites are Kensal Gasworks, with a potential for a significant number of parking spaces and nearby location to the OOC site. This area is one of the few nearby brownfield site, that is attained could be developed to suite the project needs. Gunnersbury Station car park is second, predominantly due to it being an existing car park with a significant number of spaces and has the additional qualities that existing car parks have, such as the security already in place. In addition, it is not privately owned, and it will be more likely that permission for use can be obtained. With this said, it is furthest away from the OOC site. The third option is Asda overflow car park in Park Royal, which is also an existing car park, with little work required to make it into a useable area for this purpose, however, it is a privately owned site and the likelihood of utilisation is reduced.

4.3.6 Shuttle options

4.3.6.1 There are various companies that can offer shuttle buses of different sizes in London. Based on a number of 60 people at the potential parking site there could be several different options and arrangements in order to get them to the required sites.

4.3.6.2 Full-size coaches typically have a capacity of c80 people. This would cover all of those travelling from the parking site; however, for efficient operation it would rely on everyone being there at the same time therefore would and not give much flexibility. Coaches are the largest of the possible vehicles, and this is likely to affect their access to the sites.

4.3.6.3 A more flexible alternative would be to use multiple mini-buses with a 20-person capacity to ferry staff back and forth from site over a wider time-frame, with increased frequencies at peak shift handover times. A mini-bus shuttle would also offer more flexibility in serving multiple drop-off/pick-up locations, and avoid all staff needing to access from a single location.

4.3.7 Public Transport and Active Travel

4.3.7.1 Use of public transport and active travel alternatives such as walking and cycling should be encouraged for all site staff. Whilst there are no underground or overground stations in the immediate vicinity of Old Oak Common, there are multiple options within a 20-30 minute radius for walking, and a 5 minute radius for cycling.

4.3.7.2 Provision of secure and weatherproof cycle storage on site should be made, and sufficient showering and clothes drying / locker facilities for those walking, running or cycling to site.

Incentives could be made to encourage staff to use active travel alternatives to driving, and engagement with the workforce in how the sites can maximise opportunities for such methods will help promote these modes of transport, and enhance the overall sustainability credentials of the scheme..

4.3.8 Onsite Office Space

4.3.8.1 Office space is required in either Jewsons or Acton Yard to allow for contractors, clients and designers onsite. Based on similar projects of this scale the assumption for office space required is approximately 100 people at any one time, though these numbers will vary as peaks and troughs in workload occur around key project phases and milestones. The contractor should engage with Network Rail to make allowance for a sufficient desk allocation for Network Rail staff who will be site based.

4.3.8.2 There are many options for modular office space which can be expanded/contracted with relative ease to suit site workload demands. Given the multi-year duration of the overall programme, office space will need to be high-quality and fit for purpose, providing staff with a working environment which promotes professionalism, cleanliness, safety and security.

4.3.8.3 The location of office setup should consider changing programme requirements over the life of the project, and minimise or eradicate the need to relocate offices during the life of the project. The sites and specification should also consider eventual decommissioning at the end of the project and ease of handback to the site owners.

4.3.8.4 Purchase or hiring of office units are both viable options, and will be subject to overall cost and contractor preference. A central hub site-office setup will be supported by smaller office/welfare facilities at Jewson and Acton Yard compounds.

5 Materials & Haulage

5.1 Introduction

5.1.1.1 The delivery of materials to the OOC site of work presents several challenges due to the capacity of the road and rail network in a heavily urbanised environment.

5.1.1.2 Supplier selection is a key requirement when considering both manufacture, delivery to site, and storage of materials, plant and equipment. Suppliers will need to source material form their supply chain with some having long lead times or scarce national availability

5.1.1.3 Not all manufacturers will have the ability to store orders at their premises and this can become a problem when considered alongside material lead times, resulting in a high volume of materials stored on site. In the early construction phases careful consideration shall be given to these factors when establishing the project supply chain and the size of lay-down and on-site materials storage facilities.

5.2 Materials

5.2.1 Handling and Assembly

5.2.1.1 Across the construction programme the material quantities fluctuate depending on the construction stage requirements. The storage of materials during the work also varies depending on the location of the works and applied methodology of working i.e. possession or high street environment.

5.2.1.2 During the program consideration needs to be applied in the detail of where certain materials are stored, with some materials being easily moved by manual or mechanical means. Wherever possible materials should be delivered “Just in Time” to reduce site congestion and potential for damage, theft, or vandalism.

5.2.1.3 The storage and assembly of equipment should wherever possible be located within a controlled area rather than track-side or in the construction site. For the purpose of these works this should be either Acton or Jewson yard compounds.

5.2.1.4 Just in time delivery methods should be planned wherever possible throughout the works. These are aided with the proximity of the compounds at Acton and Jewson yard. Space within these compounds will include store and workshop space to accommodate assembly works.

5.2.1.5 By using Acton and Jewson Yards as logistics bases, certain equipment as described below can be pre-assembled prior to being transported to site ready for installation. This would allow for the transport of equipment specific to the stage of delivery, reducing the risk of equipment being damaged or misplaced prior or during construction activities.

5.2.1.6 Where possible, rail materials will not be delivered by road but instead will be delivered by Train. Not all materials can effectively be brought to site by train so these will be delivered by road to the either Acton or Jewson’s and then transported by RRV to the site of work during possessions.

5.2.1.7 More specifics around these material deliveries are as follows:

<u>OHLE</u>

5.2.1.8 Typically, the registration equipment is assembled offsite by either the supplier or the installation contractor depending on the equipment type used. The registration assemblies would be stored on secured pallets at the depot in advance of the works until delivery for the shift. Once the delivery shift arrives the correct pallet and equipment is picked and dispatched to site by RRV.

Signalling

5.2.1.9 For Signalling equipment location suites and REB are to be fitted out wherever possible off site. This is critical so that equipment can be installed in a clean controlled environment. This reduces the risk of damage form other disciplines or untrained workforce at remote parts of this site, reducing the risk of equipment failure during commissioning.

5.2.1.10 Additionally, signalling four-foot equipment and smaller trackside equipment can be grouped for delivery at the depot and secured in crates for just in time delivery.

5.2.1.11 For the delivery of REBs, these will need to be via road due to their physical size and to reduce the amount of lifting activities. With road delivery direct to the site the number of lifting operations would be significantly reduced during transfer from road to rail. The method here would be for fitting out of the REB off site, single lift to road haulage followed by another single lift when sited.

5.2.1.12 If delivered by rail the number of times the REB are lifted and handled would significantly increase. in this instance the REB would have to be loaded to road haulage, unloaded at the rail depot (Acton/Jewson), loaded to RRV to site, unloaded and then carried into position. This would significantly increase the chances of damage and potential for future latent failure going undetected. Additional testing should be undertaken for any equipment required to be installed in this manner.

Pway & Drainage

5.2.1.13 Small equipment for Pway such as points operating equipment, rail joints and smalls would be located away from the site until required, reducing the chance of missing or damaged equipment. As with other stages, equipment of this nature would be packed at the depots and delivered just in time to site.

5.2.1.14 There will be large quantities of drainage material to be delivered to site, whilst the bulk materials will be delivered by train some material such as catch pits and textiles will be stored at the depots and brough tot site via RRV.

5.2.1.15 Heavy/bulk materials such as ballast, rail and sleepers are to be delivered to site by train. These are either unloaded from the adjacent lines to the construction site or on the rail head directly into the construction site. Full train delivery detail can be found in the trains consist Appendix G and PWay Gantt charts Appendix F

Civils

5.2.1.16 Signal structures can be prefabricated off-site and delivered in as few parts as possible on a just in time basis. These would be stored at local depots with as much assembly as possible before being conveyed by RRV to site. In some circumstances with larger kit these would be assembled on site prior to lifting into position.

5.2.1.17 Large quantities of troughing materials and other ancillary civils associated with Power, Telecoms and Signalling will be delivered to the local depots by road and then conveyed to site by RRV.

5.2.1.18 Concrete will be required in large volumes. It is assumed concrete can be sourced from the batching plant on site for the OOC station construction otherwise the volumes required for REB foundations, NLL retaining wall construction and general foundations will need to be imported from local batching plants.

5.2.1.19 Graded fill material will be needed and it is proposed that large volumes are either delivered to site by train or by road. Material should be stock piled for use as required during the construction programme.

5.2.2 Quantities

5.2.2.1 Materials delivered by train are scheduled against the delivery programme to prevent holding significant quantities on site at one time. This will allow for a cyclic approach of material being delivered to the site of work and consumed before being replenished.

5.2.2.2 Approximate quantities of total material by train for the construction program are shown in Table 2 below. These volumes are based upon the final layout of the GRIP 4 design and will vary depending on final staging requirements and potential temporary configurations. This detail will become available during later stages of the design.

5.2.2.3 Material quantity varies across the program stages, with material being stored in several laydown areas and site compounds. Some material will also be stored lineside and in wide ways between construction staging. Whilst some material will need to be stored on site for limited periods the overall approach is for just in time delivery, reducing site congestion.

Table 2: Material by Rail Approximate Quantities

Discipline	Material	Quantity
Track	Rail	25567 m
	Ballast	55920 Tonnes
	G44 Sleepers	17790
	S&C Units	35
	Spoil	27960
OHLE	Masts	87
	Portal Booms	32
	TTC Booms	5
	Piles	96
Civils	Engineering Fill	1250 Tonnes
Drainage	Spoil	11876 Tonne
	Pea shingle	5938 Tonnes
	Ballast	5938 Tonnes
	Pipes (6m Lengths)	1810 Tonnes

5.2.3 Lay down areas

5.2.3.1 Whilst most material and equipment are to be delivered within a limited time of installation preventing congestion of the site, it maybe be necessary to deliver S&C panels in advance. In some cases, this is due to manufacture workloads and cost associated with long term storage prior to site delivery.

5.2.3.2 Where S&C units are to be stored on site there must be adequate hard standing of compacted ballast or engineering fill. These areas must be level and of sufficient size to accommodate S&C panels in order to prevent crippling of switch rails and crossing units.

5.2.3.3 In some instances, the panels can be stacked but the rail condition must be protected with wood battening. The ordering of stacking panels must be done so to suit the delivery so such that the last item stacked is the first required during construction, thus preventing panels from being trapped in the stacking.

5.2.3.4 Other hard standing areas will be required when storing significant amount of heavy material such as rail, piles or OHLE structures. Storage lay down areas will need to be designed based on ground conditions to guarantee ground bearing support and prevent materials for sinking into the subgrade.

5.2.4 Long Lead items

5.2.4.1 Long lead items have been considered all items that will take more than 3 months to procure and deliver to site. The following sections detail typical lead times for key materials/equipment identifying which are long-lead items.

S&C Manufacture

5.2.4.2 The manufacture of S&C is a long process of design and manufacturing assurance undertaken by the design and construction organisations. The overall strategic ordering of S&C across the UK is overseen by Network Rail, coordinating the national order book against priority of delivery and installation.

5.2.4.3 The process for manufacture begins when the S&C detail is confirmed, this will usually be at the Pway Form B design status. Consideration is also to be given to interfacing disciplines such as signalling for positions of any insulated block joint requirements or specifics around mounting POE.

5.2.4.4 The process for Form C design for manufacture of layouts is an iterative one. The designs will be shared by the Pway designer with the manufacturer, who in turn will commission designers to produce the detailed 1 in 50 manufacturer drawings. These will then be subject to review and sign off by the Design CRE prior to manufacture.

5.2.4.5 The commencement of manufacture will depend on the manufacturer's workload along with availability of components. Where S&C is not as per standard REPW drawings, the lead time for bespoke components can impact the overall timescale for delivery.

5.2.4.6 The programme for integration of OOC S&C requirements will need to be established early in the delivery phase of the project. The Scheme has 35 units of S&C proposed, which will also require associated plain line paneling. The order of the quantities across the 7-year construction period will need d to be carefully integrated alongside the established order book for domestic renewals and other large-scale enhancements projects.

5.2.4.7 Additional to S&C there are other Pway componentry that will require off-site manufacture, such as adjustment switches and any rails below 400m radius that will need pre-curving. These items will require design and sign off by the design CRE.

5.2.4.8 The time scale for the manufacture of S&C units can vary and can be affected by the following circumstances

- The availability of the manufacturer resources in coordination with domestic renewal work banks. This could include design resources and assembly staff.
- National availability of materials such as concrete and steel supplies. In recent times there have been know problems with supply of concrete bearers.

- The requirement to import materials form the continent with uncertain trade future in Britain.
- EDH crossings and certain crossing parts can take longer to precure due to the limited amount of suppliers.
- Storage availability at the manufacturer's yards may be problematic due to the workload, therefore earlier delivery to site may be required.
- The delivery method in itself, where modular delivery by tilting trains need to be planned and coordinated on a national level. It is common for the national tilting wagon and Kirow cranes allocation being oversubscribed.
- Delays in the design process preventing confirmation of the Form C detail. This could be the case where interfacing disciplines are behind schedule or need to change detail.

For OOCRS the coordination with the manufacturers and Network Rail Route Services shall begin as early as possible to secure the programme of required S&C manufacture. This would allow the manufacturers to be assigned confirmed order book priorities and importantly will secure the manufacturing resource to meet the project's staging requirements.

Manufacture lead times would normally be a minimum of 8 months but preferably 12 months' notice to reduce risk. With a programme the size of OOC however, the integration with the national order book should be started as early as possible.

Plain Line Base Plates

5.2.4.9 As part of the OOCRS commissioning strategy and staging, certain NR60 switches will be installed but plain lined until they are brought into use. Plain line base plates for both switch and crossing panels will be required.

5.2.4.10 Whilst these are not bespoke items, they are not commonly manufactured and are unlikely to be stocked items by the manufacturer. It is recommended that when the order for S&C is placed the corresponding Plain line baseplates are ordered at the same time well in advance

5.2.4.11 There are some baseplates for crossings and switches that are readily available with product approval in place, however some of the S&C for OOC that may need to be plain lined may require bespoke baseplates with a requirement for product approval and acceptance.

5.2.4.12 This extra requirement for product approval for a nonstandard item would add to the lead time. Therefore, as soon as the Form B detail design has been confirmed the process for having these manufactured should begin. This will allow for added time for the product approval process.

OHLE Main Steel

5.2.4.13 Lead times for the supply of main steel is typically less than 12 weeks. However, some of the larger main steel items such as the mono-boom type portals and castellated booms can take longer due to the size of steel.

OHLE Registration Assemblies

5.2.4.14 The UKMS100 basic design range has been proposed for use on the OOCRS project using the Series 1 SIC registration assemblies. These are supplied by Furrer+Frey and currently require a 16-week lead time.

OHLE Switch Assemblies

5.2.4.15 There are two preferred suppliers of the switch assemblies used on the GWML, Morris Line (MLE) and Dreischer. It is currently proposed that the MLE switch assemblies will be used on the OOCRS project which have a up to a 16-week lead time.

REB

5.2.4.16 Manufacturing REB's usually takes in excess of 4 months and up to 6 months depending on the complexity, size, and parts required

PSP

5.2.4.17 Manufacturing PSP's usually takes in excess of 4 months and up to 6 months depending on the complexity, size, and parts required.

Signalling Structures

5.2.4.18 Dorman Lightweight signal procurement takes a minimum of around 3 months, but for large orders (in excess of 10 signals) can be in excess of 6 months depending on how busy the manufacturing facility is.

Large Structures/Cantilevers/Gantry

5.2.4.19 Fabrication of gantry depending on working hours can take around 3 months to source, cut, weld, and paint the structure and dropper cages.

5.3 Highway Access Assessment

5.3.1.1 This section of the report identifies the provision of vehicular access to five site compounds identified in Section 4 of this report. It determines routes from the primary highway routes and details any restrictions that may be encountered during the construction of the works.

5.3.1.2 Old Oak Common is situated in a densely populated area to the West of London around three miles from Paddington Station. The main highway access to the area is the A40 which runs from the North-West to the South of the site where Western Avenue becomes the West Way. The A40 is designated as a High Load Route and the M4 to the South of the area is designated as a Heavy Load Route.

5.3.1.3 The proposed construction methodology aims to deliver all bulk materials by rail along with all track, sleepers and track componentry. However, it will be necessary for some large pieces of equipment and Plant to be delivered by road. These include:

- Office and Welfare Cabins
- Principal Supply Points (PSP)
- Relocatable Engineering Buildings (REB),
- Gantry steelwork,
- ATFS Switch equipment
- Mobile Cranes
- Piling Rigs
- Concrete lorries (depending on arrangements with HS2 Construction on batch plant sharing)
- Lorry Mounted cranes (Hiabs)

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5.3.2 Main Old Oak Common Worksite

5.3.2.1 Access from the A40 to the Main Old Oak Common worksite for deliveries is identified in Figure 25. From the A40 the route runs through both residential and commercial areas – consideration will need to be given to the impact of lorry movements to the site for delivery vehicles. There is a bridge to the North end of Victoria road that supports the North London Line – there is a restricted headroom of 4.7m to the bridge soffit. From the South the site can be access via Old Oak Common Lane, however, there is a tighter constraint of 3.8m along this route – coupled with the fact that the route to the South from the A40 is predominantly residential.

5.3.2.2 Consideration will need to be given for the delivery of REBs to site along this route identified in Figure 25 and the use of low-loader transportation should be considered. The REBs detailed at present stand at approximately 3m.

5.3.2.3 Consideration should also be given for the delivery of signal gantries. The gantries, as identified in Section 9.4.6 can be delivered in component parts, these should be sized and mounted for transit to ensure they do not exceed the clearance available.

Figure 25: A40 Route to Main OOC Worksite (©Google Maps, 2019)

5.3.3 Acton Yard

5.3.3.1 Access to the Acton Yard compound can be gained from the A40 heading North or South. The only limitation identified is the “Weak Bridge” on Horn Lane – it has an 18tonne Gross Vehicular Weight (GVW) limit applied to it. This would restrict the delivery of concrete lorries (nominally 26 tonnes GVW) from the South and as such, a diversion to the North would be necessary. While this may not have a big impact on the delivery of materials to the Acton Compound, it will need to be considered in terms of traffic management plans and restrictions may apply on the number of movements along a specific route.

Figure 26:Horn Lane Signed Weight Restriction (©Google Maps, 2019)

Figure 27: Access to Acton Compound from North (©Google Maps, 2019)

5.3.3.2 Acton yard is anticipated to be used as a compound for both the storage of materials and potentially for site offices and welfare facilities. The materials to be stored will include signalling equipment, OLE structures, Trough routes and E&P equipment for installation on the relief lines.

5.3.3.3 As identified above the access to the area is relatively unrestricted other than the weight restriction on the Horn Lane Overbridge, but as with all access to the site, mitigation will be required to ensure traffic movements do not cause unnecessary disruption to the local area.

5.3.4 Jewson's Yard

5.3.4.1 Access to the Main Lines on this project is problematic. Introducing a compound and mains access on the Jewson site is essential to the delivery of the works through Acton Cutting.

Access is needed for OHLE installation and the compound would be used as an assembly point for the OHLE components.

5.3.4.2 Access to the Jewson yard from the A40 heading South is restricted only by the Horn Lane Railway overbridge. To avoid this, a detour is required to South Acton before heading North on the A40 Western Avenue and then left on Friary Road, re-joining Horn Lane at the Jewson compound. This route is through a residential 20mph zone – See Figure 28.

Figure 28: Access route to Jewson's Compound (©Google Maps, 2019)

5.3.4.3 An assessment of the routes to site from the A40 indicate that there are unlikely to be any restrictions to the use of this route for delivery of materials for railway systems installations. It should be noted that any vehicles of a GVW in excess of 18tonnes will not be able to deliver materials to site via this route. Note: Typical flatbed lorries delivering steel work are likely to be in excess of this weight.

5.3.5 Barlby Road Compound & RRAP

5.3.5.1 The Barlby Road Compound can be access via a number of alternative routes. The preferred access routes are identified in Figure 29. The route from the East along Ladbroke Grove (identified in the Hazard Directory) is to an historic gated access, which while eliminating the need to access via the North Pole Depot access (restricted to 4.25m clearance (assumed)) is currently out of use and is directly adjacent to a level crossing that serves a primary school.

5.3.5.2 Should the historic access be required, a detailed plan to mitigate the impact on the residents and school should be agreed with all stakeholders.

5.3.5.3 The alternative access point off Mitre way is restricted in height and requires agreement with Hitachi Rail Europe but would provide adequate access for the typical construction vehicle. It should be noted however, that the Barlby Road access is currently in use and is being accessed by standard Road Rail Vehicles for typical maintenance tasks.

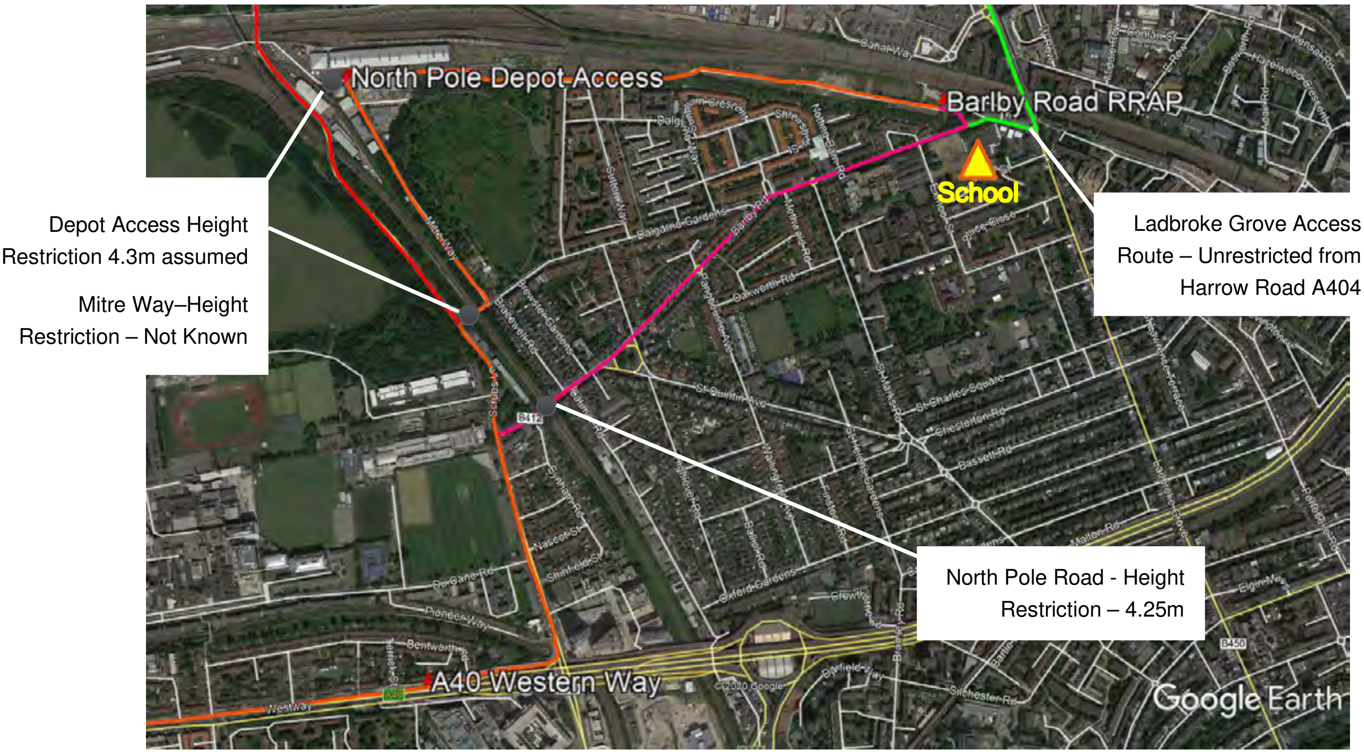

Figure 29: Barlby Road Compound (Access Constraints and Routes) (©Google Maps, 2019)

5.3.6 Hitachi compound – South West RRAP

5.3.6.1 The proposed RRAP within the Hitachi North Pole Depot Compound has the potential to be accessed from either the West or the East. The East access is the primary access point off Mitre Road; this access point has a restricted headroom of 4.25m at the point of entry into the depot site, due to the OLE clearances and the Scrubs Lane underpass. Accessing onto Mitre Road from the A219 there is a low clearance bridge with a height restriction of 4.4m. Mitre road can be accessed from either the South or the North. From the South access is from the A40 which is deemed to be unrestricted from both a standard vehicle weight requirements and standard headroom clearances. From the North via Scrubs Lane there is a Weight restriction applied to Scrubs Lane over bridge of 18 tonnes – See Figure 30.

5.3.6.2 Typical requirements for the Hitachi compound access will be for concrete lorries (typically 4m in height and up to 26 tonnes loaded), Hiab Off-loading lorries (3.95m in height & up to 26 tonnes GVW) and works vehicles for staff accessing the area.

5.3.6.3 As identified above, there are several restrictions to accessing the depot site and a variety of access needs. These needs should be carefully set out in a traffic management plan to prevent, not only disruption to the delivery programme, but to local residents and businesses in the area faced with an increase in vehicle movements during the construction of the Railway Systems works. This will also be necessary to minimise the impact on the operations of depot itself and allow Hitachi sufficient time to plan around key periods of high activity around this compound. Regular collaborative communication throughout the delivery programme with Hitachi will be essential for the effective use of this compound.

5.3.6.4 Consideration should be given to the lifting of the height restriction on the Old Oak Common Lane GWML bridge as it will be replaced, and the road lowered as part of the major civils works on the project. This will provide an opportunity for larger vehicles to utilise this route as the programme develops.

Figure 30: North Pole Depot Access Routes and Restrictions (©Google Maps, 2019)

5.3.6.5 A detailed traffic management plan will need to be developed for the delivery stages of the project. The plan will need to ensure that traffic is managed in line with the Section 14, Traffic Management of the High-Speed Rail (London - West Midlands) - Code of Construction Practice. The aim of the plan is to limit the impact on the residents, businesses, and ensuring the local transport network can continue to function effectively during construction.

5.3.6.6 Careful integration of a traffic management plan will be needed with the HS2 development team. This is to ensure that the combined delivery of the systems and civils projects do not allow an exceedance of the agreed number of traffic movements under the agreements of planning.

5.3.7 North West Road Rail Access Point and HS2 Compound Access

5.3.7.1 An option for a Road Rail Access point and compound off Victoria Road has been presented in this report (see Figure 31). This access point would be utilised for a range of deliveries, specifically those of the ATFS requirements. Access to this point from the main A40 route is deemed to be accessible and is not impaired by weight or height restrictions.

5.3.7.2 The inclusions of the vehicle movements required to deliver the railway systems project into the HS2 traffic management plan will be necessary to ensure an integrated approach to deliveries is achieved. This will prevent an excess of vehicular traffic using the local road network.

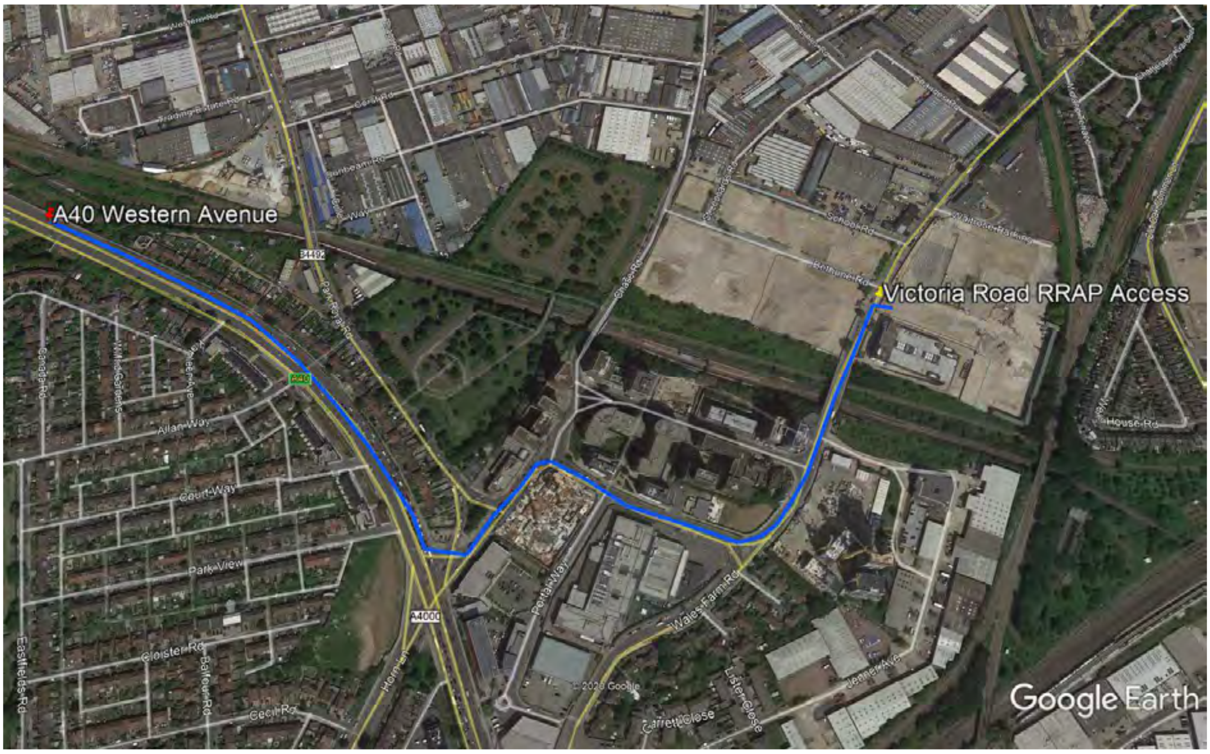

Figure 31: Victoria Road Site Access Route (©Google Maps, 2019)

5.4 Rail Access Assessment

5.4.1.1 The difficulty and restrictions on road haulage into the OOC site are a key driver in delivery of materials by rail. The delivery of material by rail consists of train delivered material and then materials delivered by RRV from Acton or Jewson yard.

5.4.2 Rail Head Operation

5.4.2.1 During the construction of the North of the site and South of the site temporary rail head sidings will be installed to accommodate material delivery by train. Both rail heads being proposed are single line terminal sidings. This is due to the construction site constraints and limited time of use during the overall programme.

5.4.2.2 The duration and purpose of the rail heads can be seen below in Table 3.

Table 3: Rail Head Proposed Timescales

Rail Head	Purpose	Install Date	Recovery Date	Duration
West	Material Delivery and spoil removal for Relief side East of station construction	Aug 2023	Dec 2024	16 months
South	Material Delivery and spoil removal for Mains side complete South of station construction	Jan 2026	Dec 2026	12 months

5.4.2.3 The rail head from the West is proposed to utilise and retain the existing 8110A turnout which previously connected the Up Relief to Reception line 1 during the initial constructability phases.

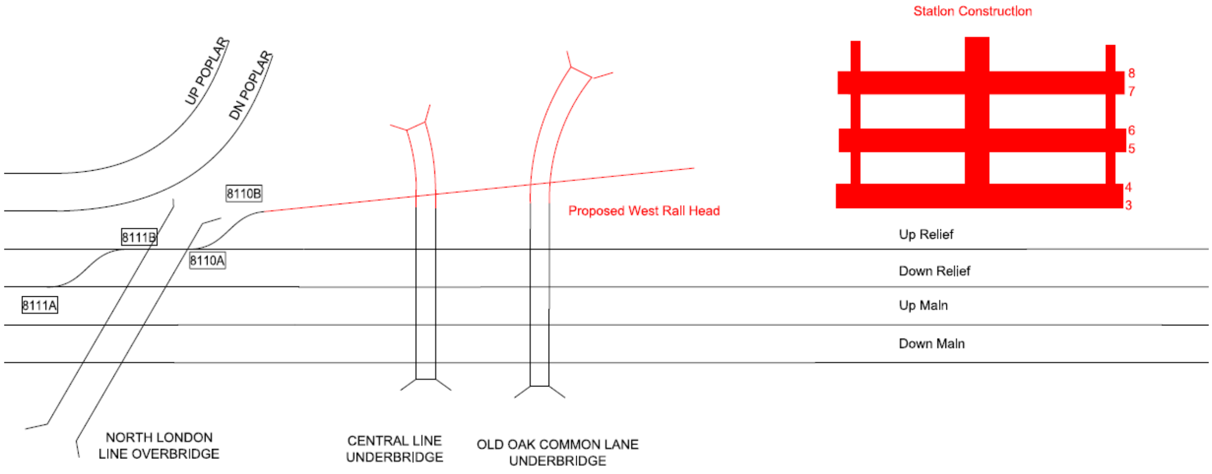

Figure 32: Rail Head to the West

5.4.2.4 The rail head to the South can be seen in Figure 33. The proposal would see the existing Down Main track left in place following the commissioning of the Temporary Down Main alignment, a temporary turnout would then allow for a move in the Down direction into the site.

5.4.2.5 Both sidings will have delivery made by Possession with trains being worked during the day in line with the project working hours constraint. Both rail heads are proposed to be used under possession only. This removes the need for signalling control with exception that the S&C points for entry will remain detected within signalling control system.

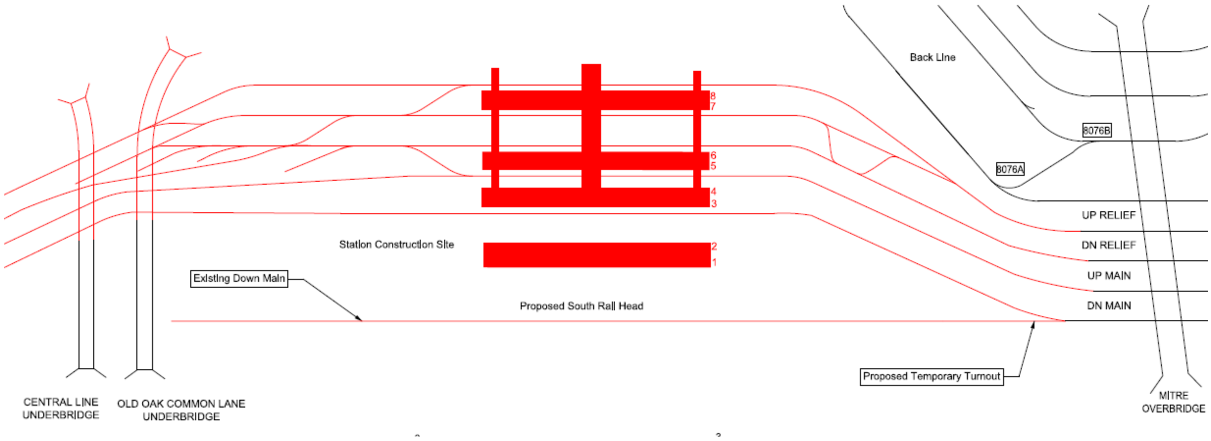

Figure 33: Rail Head to The South

5.4.2.6 A Rail Head Operational Management Plan has been produced (152270-ARC-REP-EMG-000003 – P01). This document includes analysis of rail freight form and to the LDC including localised moves in the vicinity of the site of work.

5.4.3 Rail Haulage

5.4.3.1 There is a significant quantity of material across the construction programme delivered by train. The approximate quantity of the materials are included in Section 5.2.2.

5.4.3.2 When it comes to the logistics of delivering these materials the OOC area produces some challenges due to its proximity to the Paddington and terminus of the GWML. This geographical constraint limits the options for train delivery as all haulage will be incoming from the West.

5.4.3.3 For the staging of permanent way works this at times proves problematic, due to the traditional linear process of cycling trains through the worksite. Traditional methods when staging permanent way works is to have trains flow through the worksite, starting with empty wagons for removal of scrap followed by loaded wagons of new componentry. As the empties are filled, they are normally dispatched clearing the site to pull the loaded wagons into position to begin renewal of components.

5.4.3.4 In the case of OOC this is possible but there is limited head room to the East of the site. Therefore, any trains coming from the West and then dispatched during the works to the East either have to be stacked towards Paddington or crossed over and released by the lines that are not under renewal.

5.4.3.5 This constraint also increases the number of locomotives required for top and tailing trains. Where a site is not at the terminal end of the route there would normally be an exit route opposite to the arrival direction. In the case of OOC this is not the case therefore trains have to in some cases be top and tailed to allow for movements back in the direction of travel. This is also the case when using the terminal rail heads.

5.4.3.6 The use of two locomotives is at times somewhat problematic as this increase not only the number of locomotives required but also the number of drivers required. These extra requirements increase the cost of the delivery by train. To try to avoid this wherever possible trains have been allocated with a single locomotive or staged so that locomotives can be cascaded between consists to reduce the allocation of Locomotives.

5.4.3.7 There also remains an opportunity during the negotiation of possessions in the construction planning stage to try to secure more time for train moves, allowing for run-around moves and further cascading of locomotives.

5.4.3.8 Locomotive moves are covered in more detail in the Rail Head Operational Report

<u>Local Delivery Centres</u>

5.4.3.9 Due to the site constraints and limitations of road haulage, some material that would normally be delivered by road are to be delivered by train. These materials may need to be loaded at local delivery centres or closer to the manufacturers when confirmed during the construction phase.

5.4.3.10 The local delivery centres for the works have been assumed as Westbury or Hincksey yards. The routes form and to these marshalling yards are detailed in the Rail Head Operational Report (152270-ARC-REP-EMG-000003 – P01). The LDC are usually utilised for forming train consist ready for deployment to engineering sites, they can also be used in some cases for loading of materials however often loading is undertaken at the manufacturer or quarry.

5.4.3.11 Westbury yard is located just South of Westbury train station between 109m 55ch to 110 15ch to the WEY line, so approximately 107 miles from the OOC site. The yard consists of an Up and Downside yard for marshalling engineering trains. Westbury is major marshalling yard and is the local delivery centre for the majority of rail infrastructure works on the Western route.

Figure 34: Westbury Up and Down Sidings

5.4.3.12 The yard also has capacity to load wagons with associated compound and haul road on the Upside yard. This offers an opportunity for loading of some materials that are not traditionally brought by train to site. With good road access for bringing materials to site this has been identified as an ideal location to load drainage materials.

Figure 35 Westbury Loading Facilities

5.4.3.13 Hincksey is located to the North of Abingdon just outside Oxford, the yard is located between 61m 65ch to 62m 40ch, so approximately 59 miles from the OOC site. Hincksey is slightly smaller than Westbury yard but also has facility for loading materials. The road access at Hincksey is good with direct links to the A34.

5.4.3.14 Hincksey would be the preferred location for loading Drainage and civils materials that would not traditionally come by train.

Figure 36: Hincksey Yard

Figure 37: Material Loading Hincksey

5.4.3.15 The loading of OHLE equipment to train for transportation to site could be undertaken at Swindon Transfer Sidings. The sidings are located just to the East of Swindon train station between 76m 20ch and 76m 68ch on the MLN1.

5.4.3.16 The sidings in recent times have been developed into the High Output Electrification Depot with the specific purpose of serving the Great Western Electrification Project. Whilst the suggested method of delivery of piles is by flat wagon an opportunity would be to explore the use of purpose-built high output wagons for OHLE foundations and structure delivery.

5.4.3.17 The depot itself has been developed to allow transfer from road haulage to train of OHLE equipment and is along the route for material delivery form Westbury. This makes the location ideal and efficient for OHLE material delivery.

Figure 38: Swindon Transfer Sidings

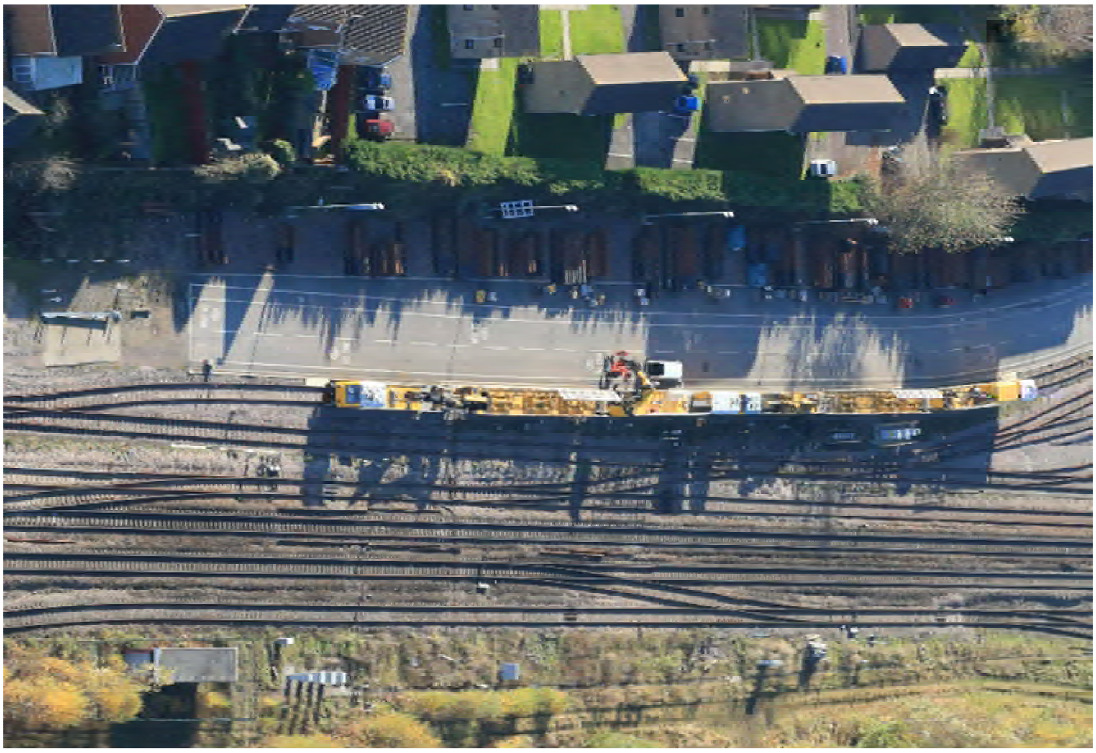

Figure 39: High Output Electrification Depot Swindon

Engineering Wagons

5.4.3.18 The following are Engineering wagons currently proposed for use during the construction programme.

Figure 40: Examples of various engineering wagons

5.4.3.19 Box wagons are proposed for loose engineering materials such as ballast, pea shingle and Type 1. Whilst the train consists have been produced based on Falcons 60T open wagons, the consists in some case could be changed for 30T coalfish open wagons. Additionally, other open wagons are available across the network that could be substituted. Whilst the wagon types could be changed, consideration has to be given to the length of the train consist. Where the quantity remains unchanged but smaller 30T wagons are operated for, the increase in train length may be problematic for the space allocated for stacking trains or undertaking run-around moves.

5.4.3.20 Additional types of wagons are also available to substitute for opens, including auto hopper and side tippers. Whilst side tippers are an alternative to larger open box wagons such as Falcons, they will require detailed planning as the material is tipped in bulk adjacent to the track. This method is less controlled and requires space for material or the correct track interval adjacent to a renewal site.

Allocation of Wagons

5.4.3.21 The allocation of engineering wagons is over seen by Network Rail Route Services. The Western Route is allocated a set number of wagons per each planning year. This allocation is to be shared out amongst the Routes programme of both domestic renewals and enhancements work.

5.4.3.22 For a project as large as OOC staged across several years, there may be requirement that extra wagons are procured or even borrowed from another Network Rail Route.

5.4.4 Train Consists

5.4.4.1 Train consist have been generated for all Pway stages, OHLE and Civils material delivered by train. The full consist detail for each shift can be found in Appendix G.

Allocation of Wagons

5.4.4.2 The allocation of engineering wagons is over seen by Network Rail Route Services. The Western Route is allocated a set number of wagons per each planning year. This allocation is to be shared out amongst the routes programme of both domestic renewals and enhancements work.

5.4.4.3 For a project as large as OOC staged across several years, there may be requirement that extra wagons are procured or even borrowed from another Network Rail Route.

5.4.4.4 Currently on the Western Route the allocation of wagons is as shown in the table below.

Table 4: Western Route Engineering Wagon Allocation

Name	Type	Western Route Allocation
Falcons	Open box wagon	120
Lobster	Open box wagon	25
Coalfish	Open box wagon	180
Side tippers	Side tipping box	40
Auto hoppers	Auto ballast drop Hopper	45
Osprey	Flat wagon with vertical support	23
Salmon	Flat wagon	22
Bass	Open wagon with drop sides	30

Analysis of Wagon Requirement

5.4.4.5 The requirement of engineering wagons across the project has been displayed below in Figure 41 against each stage and Figure 42 against each year

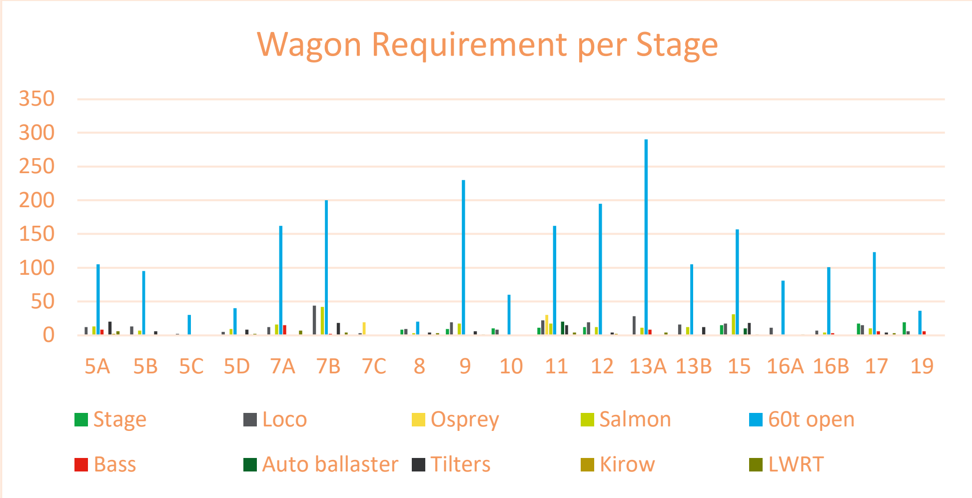

Figure 41: Wagon Requirement by Stage

5.4.4.6 In terms of the largest requirement this comes in the form of open box wagons and is driven by the quantity of ballast coming in and spoil being removed from the site. The peak demand for this is during the heavy Pway stages and is significantly more during the construction stages to the North of the station.

5.4.4.7 The greatest requirement for box wagons at any single time consists of 25 box 60t wagons. The Pway stages to both the North and South takes place over midweek nights with generally 20 box 60t wagons at once. These midweek deliveries would actually be on a cycle one day after the next with at any one time 20 Box wagons in the rail head whilst 20 more are being sent to the LDC for unloading. In this requirement 40 wagons would need to be secured for project use during a typical mid-week delivery stage.

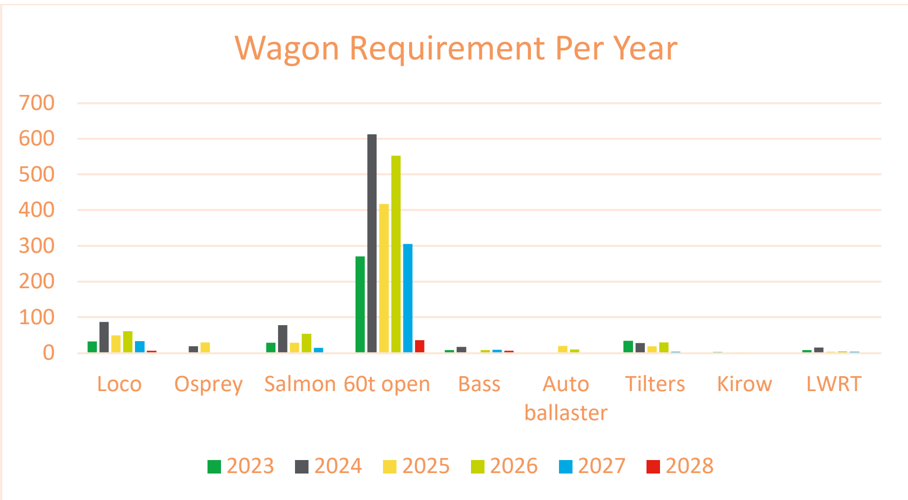

Figure 42: Yearly Wagon Requirements

5.4.4.8 With the Western Route's allocation of Falcons of 120 available wagons, this would require a 3rd of full route's allocation to midweek delivery during these periods.

5.4.4.9 The peak demand on box wagons is during Christmas blockades during 2024, 2025 and 2026 which are the larger possession based Pway stages. Christmas 2024 which is stage 9A and 9B requires at its peak 118 box wagons representing 99% of the Western Route's current allocation.

Table 5: Train Allocation Xmas Blockades

Christmas	Peak 60T Box wagons	Stage
2024	118	9A
2024	112	9B
2025	90	12A
2025	85	12B
2026	86	15

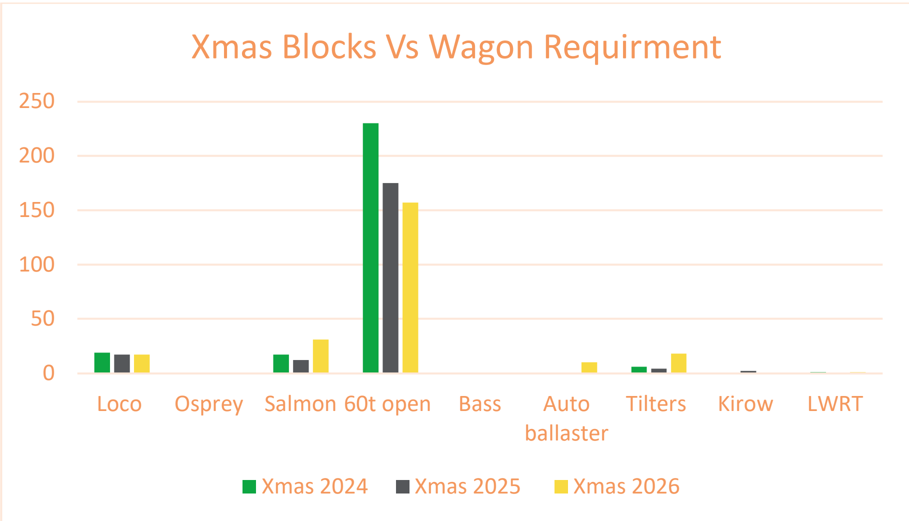

Figure 43: Engineering Wagon Requirement Xmas Blockade

Alternative	Advantage	Disadvantage
Use of smaller 30t wagons	Shared resource load would give total allocation pool of 225 wagons	The use of smaller wagons will increase the consist length and be problematic for run round and storage options Longer trains could slow production rates and ad longer times for train moves.
Use of side tippers	Quick unloading method and would add available 60t wagons	The interval to adjacent line or laydown area may result in double handling slowing production rates.

		Side tippers cannot be loaded with spoil.
Road delivery of Materials to the North and South build sites	Significant reduction in rail requirement with material being delivered prior to possession	The congested site access and road network would be problematic and may impact HS2 station works delivery programme.
Bring Some materials in by RRV prior to the Christmas possession	De- risks blockade removing some train requirement. Allows more time to bring material into the site prior to the work s	Would impact on other deliveries by rail on the lead up to the blockades. This option would also be inefficient.

Table 6: Alternative to 60t Box wagons

5.4.4.10 In order to reduce the requirement for 60t box wagons there are various options that could be considered. These all come with various considerations that will need to be confirmed when more detail is available at the detailed design stage. These options and consideration are shown in Table 6.

<u>Securing Train and Plant Requirements</u>

5.4.4.11 Both wagon, plant and strategic plant requirements are planned during the long-term planning stages. Network Rail Route Services are responsible for overseeing the allocation of wagons, plant and some strategic plant.

5.4.4.12 Usually the high-level requirements of trains will be discussed during the planning discussions when developing the EAS. This will involve interfacing with not just regional but also national allocation of resources. Whilst the fleet allocations are awarded on a route by route basis it may be required that resource is secured from other routes.

5.4.4.13 During these planning stages deconfliction of resource requirement will be carried out based on a project-by-project basis and key route specific decisions. It is important to note that OOCRS work is an enhancement project that will require interfacing with a routine domestic renewals programme. This will create competition for resources across the route during the peak construction times with greater focus on Christmas possessions.

5.4.4.14 Interface with the domestic renewals will not only be a problem with regards securing the train and plant, but also for areas to load such as Westbury or Hincksey which are key LDC for domestic schemes.

5.4.4.15 In order to secure the resource, the project needs the resource requirements should be disclosed to the route planning teams as early as possible. In all case train and OTM requirement should be confirmed by T-52.

5.4.5 OTM & Strategic Plant

5.4.5.1 The allocation of OTM and strategic plant such as Kirow across the UK is generally oversubscribed with a limited amount of available resource.

5.4.5.2 For a large-scale project such as OOC it would be likely that the requirement will add to the pressure on already limited availability. For ordering of tampers, it has been experienced previously for these to be ring-fenced and early allocation of strategic plant to also be secured with suppliers well in advance, restricting availability for other projects. For a project of the scale and important of OOC, it is likely than such ring-fencing will be necessary to secure essential plant early.

Tampers

5.4.5.3 The allocation of tampers is managed by Network Rail Route Services and is generally planned alongside strategic plant. It is recommended that booking of tamper's are undertaken at the same time as train resources, with minimum requirement booked by T-52 weeks.

5.4.5.4 Various tampers are available and operated within the Western and Wales fleet. These are made up of Plain line, multipurpose (compact) and S&C machines with tandem tamping capability.

5.4.5.5 Figure 44: Plasser Theurer 09 3X Continual Tamping Machine is an example of continual tamping Plain line Machine. This machine is ideal for long lengths of plain line volume.

5.4.5.6 Figure 45: Figure Plasser Compact 08-16 4x4 C100-RT is a compact machine which is a plain line and S&C machine. The machine offers limited capability with S&C but is used for simple S&C Turnouts.

5.4.5.7 Figure 46: Matisa B41 Universal Tamping Machine is a universal machine capable of high volume plain line and S&C tamping. This category of tamping machine can be used with similarly capble machines for tandem tamping Crossovers and more complex S&C layouts.

Figure 44: Plasser Theurer 09 3X Continual Tamping Machine

Figure 45: Figure Plasser Compact 08-16 4x4 C100-RT

Figure 46: Matisa B41 Universal Tamping Machine

5.4.5.8 The requirement across the OOC construction will vary, for some stages where there are large lengths of plain line track being renewed continuous tamping plain line machines could be utilised. For other stages where S&C is being installed and longer cross overs tandem tamping with S&C capable machine swill need to be used.

5.4.5.9 An example of this is Acton crossovers where 8112A/B and 8113A/B are being installed. These will require tandem tamping of two compatible machines. The commissioning of other crossovers and other larger turnouts will also require fully capable S&C machines.

5.4.5.10 For tamping of smaller turnouts along with long lengths of plain line, Unimat multipurpose tamping machines with limited S&C capability would be suitable.

5.4.5.11 Additional to the Route fleet, there is also the availability of more mobile beaver tamping machines. The beaver tamper is a tamping machine that is compact and delivered by road. The machine has the capability of its equivalent rail mounted counterparts but is mobile and able to access sites where there is no direct access to the running lines.

5.4.5.12 The use of beaver tampers has been considered for the North of the station build prior to stage 9 when the new lines are connected to the existing network. These machines would be used to bring track that has been installed but not commissioned up to design level. It would then be proposed that prior to final commissioning and following that regular tamping be undertaken.

Figure 47: Road Delivered Beaver Tamper

<u>Kirow Cranes</u>

5.4.5.13 There are three main types of Kirow available in the UK rail industry. Kirow 1200 with a lifting capacity of 120 tonnes, Kirow 810 with a lifting capacity of 100 tonnes and smaller Kirow 250 with lifting capacity 25 Tonnes.

5.4.5.14 All three Kirow crane types could be used for installation of S&C for OOC. The limitation being the smaller Kirow 250 that would need to undertake lifts in tandem to achieve greater lifting capacity for larger S&C panels. Which type of Kirow Crane to be used will normally be based on availability and the weight of S&C to be lifted. For larger switch panels of SG upwards the 1200 and 810 would be a much more capable machine.

5.4.5.15 The allocation of the Kirow fleet is managed by the fleet owners. To secure the required resource, early conversations with the plant suppliers should be held.

Figure 48: Kirow 1200 lifting S&C Panels

LWRT

5.4.5.16 The delivery of long welded rail to site is to be undertaken by delivery from either the RDT or LWRT. The RDT can delivery long welded rail strings to site up to 216m long, dropping them in the four foot or to the shoulder of the site.

5.4.5.17 For OOC delivery the rail length requirement will be 108m, this allows for easier handling as rail lengths are positioned into the site extents without rail access.

Figure 49: Rail Delivery Train

McCullough's

5.4.5.18 In combination with 108m length LWR McCullough's TRT (Trac Rail Transposer) Figure 50: McCullough's TRT will be utilised to be able to move LWR into the construction site. As the station North and South build will not be commissioned or connected to the running line it will not be possible to run the LWRT through the site to place rails at their final position. The TRT will be used through the construction phases to deliver LWR.

Figure 50: McCullough's TRT

Kirow OHLE Piling Operation

5.4.5.19 The installation of steel pile foundations can be carried out using the Kirow KRC250UK Electrification Piling Train (EPT) coupled with two salmon wagons at either side.

5.4.5.20 One salmon wagon will be used to transport piling heads, crane attachments and pile foundations. The second salmon wagon will transport two additional piling racks and will be attached to the other side of the EPT. This arrangement allows for a maximum capacity of 33 piles per piling train.

Figure 51: Piling train arrangement

5.4.6 Transporting Piles

5.4.6.1 Each individual rack on the salmon wagons is capable of securing 11 pile foundations. Piles will be marked with location numbers and a centre line will be drawn to ensure they are perpendicular with the track. They will then be loaded on low sided wagons in such a way as to suit the pre-planned order of installation and secured in frames. Figure X shows the arrangement for securing pile foundations onto the salmon wagon and the storage frames that are used.

Figure 52: Securing and transportation of pile foundations

5.4.6.2 To maximise use of possession time it is anticipated that the EPT will be the last train to run before the possession is granted, and that when the EPT arrives at the destination signal, the possession will then be taken around it. When the possession is taken around the train it is already in position and ready to start working.

5.4.7 Installation

5.4.7.1 The EPT is equipped with two types of pile driver. A side grip pile driver and a top mounted pile driver (PVE piling attachment) to enable more powerful impacts. The EPT uses a manipulator arm to grasp and rotate pile foundations to the correct position.

Figure 53: EPT in operation

6 Possessions and Isolations

6.1 Possession Planning

6.1.1.1 For the timescale of the majority OOCRS work, the allocation of engineering access via planned possessions must be agreed well in advance. The process for agreeing access to undertake the works will be via the EAS (Engineering Access Statement) and TPR (Timetable Planning Rules).

6.1.1.2 The process for such planning happens in the Long-Term Planning arena. This involves discussion between all parties affected such as the infrastructure owner Network Rail, TOC's and FOC's. The aim of these discussions is to deconflict planned major disruptions, align workplans to aid efficiency in delivery, and plan mitigations to interrupted rail services.

6.1.1.3 The TPR are not concerned with the specific details of possession planning but rather to agree the train paths and network use by operators. The EAS act as the precursor to detailed possession planning.

6.1.1.4 Access to the infrastructure for engineering works will be negotiated and agreed over a predetermined schedule of consultations as set out in the EAS. This will be for the time tabled year of December to December. As an example Figure 54 shows the EAS for the timetable year 2020 - 2021, with dates of version issue.

TIMETABLE PLANNING RULES ENGINEERING ACCESS STATEMENT 2020-2021
TIMETABLE ISSUE SCHEDULE

Version	Content	Date of Issue
1.0	Complete half year's rules, Preliminary Principal Rules Designation: **Preliminary Proposal for Principal Rules**	Friday 25/10/19
2.0	Complete half year's rules. Final Principal Rules Designation: **Final Proposal for Principal Rules**	Friday 07/02/20
3.0	Complete year's rules. Preliminary Subsidiary Rules Designation: **Final Principal and Preliminary Proposal Subsidiary Rules**	Friday 27/03/20
4.0	Complete year's rules. Final Subsidiary Rules Designation: **Final Principal and Final Proposal for Subsidiary Rules**	Friday 10/07/20

Figure 54: Engineering Access Statement 2020-2021

6.1.1.5 Each version of the rules can be summarised as follows

- Version 1 issue of draft rule proposals for TOC/FOC responses
- Version 2 issue of the final rules for the first 6 months of the timetable year
- Version 3 Issues of the subsidiary rule changes for TOC/FOC responses
- Version 4 Issue of the final rules for EAS publication

6.1.1.6 The negotiation of the EAS is undertaken between planning stages TT-64 and TT-23 where TT is the beginning of the timetabled year with numerical count down in weeks. At the time of writing the EAS is currently at Version 3.0 for the 2021 (December 2020-December 2021) timetable with Version 4 to be concluded 31/07/2020. Based on TT-64 the EAS for planning year 2022 (December 2021-December 2022) will be first issued in draft in November 2020.

6.1.1.7 With regards to OOCRS possession requirements, early works beginning in the planning year 2021 would have to be negotiated during the period October 2020 -July 2021. Based on this the following regime (Table 7) for agreeing engineering access can be assumed.

Table 7: TPR versions for OOCRS

TT Year (Dec-Dec)	Version 1	Version 2	Version 3	Version 4
2022	Oct 2020	Feb 2021	March 2021	July 2021
2023	Oct 2021	Feb 2022	March 2022	July 2022
2024	Oct 2022	Feb 2023	March 2023	July 2023
2025	Oct 2023	Feb 2024	March 2024	July 2024
2026	Oct 2024	Feb 2025	March 2025	July 2025
2027	Oct 2025	Feb 2026	March 2026	July 2026

6.1.1.8 Upon issue of the final EAS for each timetable year the detailed planning stages will commence with route-based planning teams. More detail is gathered and further deconfliction of all engineering works will begin until final possession delivery during construction which is then published in the CPPP.

6.1.1.9 For the purpose of producing this early stage construction methodology the long-term Planning stages have not yet begun, therefore proposed access is a mix of information gathered by Network Rail during early consultation and interpretation of previous years engineering access.

6.2 Possession Regime

6.2.1 Engineering Access Statement, Section 4

6.2.1.1 The possession regimes under consideration have been determined from the 2021 EAS.

6.2.1.2 Section 4 of the EAS states the standard possession availability, including all NBS and standard routine maintenance opportunity.

6.2.1.3 For the GWML the possession regime works on a two-track regime, alternating between Mains and Reliefs. This regime offers a published time of weekend 0001 Sun to 0900 Sun on either the Mains or Reliefs between Ladbroke Grove and Southall East. This also includes published 0115 Sun to 0500 Sun all lines blocked.

6.2.1.4 The actual access times are reduced by possession arrangements such as placing of protection, issuing worksite authority and taking isolations. The resultant estimated times of actual access duration is shown in Table 8.

Table 8: Section 4 Possessions Times Ladbroke Grove to Southall East

Published Section 4	Published Times	Estimated access duration	Estimated access duration with Isolation
Saturday Night Mains or Relief	0001 Sun – 0900 Sun	7 - 8 hours	6.5 - 7.5 hours
Saturday Night ALB	0115 Sun – 0500 Sun	3 – 4 hours	2 - 2.5 hours
Sunday Night Mains or Relief	2300 Sun – 0500 Mon	4 hours	3 - 3.5 hours
Midweek Nights Mains or Reliefs	0001 Tue-Sat – 0500 Tue-Sat	4 hours	3 - 3.5 hours

6.2.1.5 For the Mains side which would require road rail access at North Pole Depot, consideration of the Section 4 details for Paddington to Ladbroke grove must be noted. This would restrict the Access time due to the blockage of the North Pole depot entrance.

Table 9: Section 4 Possessions Paddington to Ladbroke Grove

Published Section 4	Published Times	Estimated access duration	Estimated access duration with Isolation
Saturday Night Mains blocked including North Pole A+B	0115 Sun – 0715 Sun	5 - 5.5 hours	4.5 -5 hours
Saturday Night ALB	0115 Sun – 0445 Sun	3 – 4 hours	2 - 2.5 hours
Sunday Night	Standard possession opportunity not Available		
Midweek Nights Mains			

6.2.1.6 Additional to the GWML there is also the requirement for access to the NLL (BOK5). The standard possession opportunity for this line is 0010 Sun to 0845 Sun Down line, 0020 Sun to 0905 Sun Up line. This equates to All Line Block of 0020 Sun to 0845 Sun. Sunday night possessions on the NLL are 2325 Sun to 0330 Mon Down line, 2350 Sun to 0330 Mon Up Line. No mid-week standard opportunity exists.

Table 10: Section 4 Possessions Acton Wells to Acton South

Published Section 4	Published Times	Estimated access duration	Estimated access duration with Isolation
Saturday Night Down blocked	0010 Sun – 0845 Sun	7.5 - 8 hours	7-8 hours
Saturday Night Up blocked	0020 Sun – 0905 Sun	7.5 - 8 hours	7-8 hours
Saturday Night ALB	0020 Sun – 0845 Sun	7 - 7.5 hours	6.5 – 7 hours
Sunday Night Down blocked	2325 Sun – 0330 Mon	3-3.5 hours	2. 5 - 3 hours
Sunday Night Up Blocked (ALB)	2350 Sun – 0330 Mon	2.5 – 3.5 hours	2 - 2.5 hours
Midweek Nights	No Standard Possession Opportunity		

6.2.1.7 The Section 4 detail that has been included is a guide to the access regime and standards opportunity based on non-booked services. The actual possession details will be included in the published Section 7 as part of the CPP.

6.2.1.8 The standard regime derived from Section 4 of the EAS does not include specific details concerning possession limits and special operating constraints. The Section 7 detail would include limits of the possession and any associated lines, for example details of the Poplar lines being blocked alongside relief line blocks.

6.2.1.9 Another note affecting planning and access integration is that the NLL and GWML are controlled by different Network Rail Routes, and therefore are subject to differing planning teams.

GW103 PADDINGTON TO UFFINGTON continued...

SECTION		Periods A and B 13.12.2020 to 14.02.2021	Period C 15.02.2021 to 28.03.2021	Period D 29.03.2021 to 15.05.2021	Periods E to G 16.05.2021 to 12.09.2021	Periods H and J 13.09.2021 to 11.12.2021	REMARKS
At Ladbroke Grove (including entrance routes to / from Crossrail and North Pole Depots) 103.2	WEEK END	0115 Sun to 0715 Sun Lines 1 to 3, Down and Up Main Lines, North Pole Lines A+B, E+C Line BLOCKED -or- 0040 Sun to 0740 Sun Lines 4 to 6 and Down and Up Relief Lines BLOCKED -and- 0115 Sun to 0445 Sun All Lines BLOCKED ❶ [All Line Block times will be reduced to finish 0420 Sun until Heathrow Express Depot at Old Oak Common closes]					
	SUN/ MON	STANDARD POSSESSION OPPORTUNITIES NOT AVAILABLE *(Except: when shown in Section 7)*					
	MID WEEK	STANDARD POSSESSION OPPORTUNITIES NOT AVAILABLE *(Except: when shown in Section 5)*					
Ladbroke Grove To Southall East 103.3	WEEK END	0001 Sun to 0800 Sun Down and Up Mains BLOCKED -or- Down and Up Reliefs BLOCKED 2 Track Timetabling in operation ❶ ❷ and- 0115 Sun to 0500 Sun All BLOCKED [All Line Block times will be reduced to finish 0420 Sun until Heathrow Express Depot at Old Oak Common closes]					
	SUN/ MON	2300 Sun to 0500 Mon Down and Up Mains BLOCKED -or- Down and Up Reliefs BLOCKED 2 Track Timetabling in operation ❶ ❷					Acton West Jcn must always be available to provide a route between Acton Yard and the GWML.
	MID WEEK	0001 Tue-Sat to 0500 Tue-Sat Down and Up Mains BLOCKED -or- Down and Up Reliefs BLOCKED 2 Track Timetabling in operation					Acton West Jcn must always be available to provide a route between Acton Yard and the GWML.

❶ Refer to Section 7 as to which lines are to be blocked each week.
~~❷ See note in Timetable Construction Notes on Page One for extended 2 Track Timetabling requirements in Periods C and J~~

Figure 55: Section 4 Standard Possession GW103

SECTION		Periods A and B 13.12.2020 to 14.02.2021	Period C 15.02.2021 to 28.03.2021	Period D 29.03.2021 to 15.05.2021	Periods E to G 16.05.2021 to 12.09.2021	Periods H and J 13.09.2021 to 11.12.2021	REMARKS
Acton Wells Jn (exclusive) and South Acton Jn 1310.5	**WEEK END**	0010 Sun to 0845 Sun Down BLOCKED 0020 Sun to 0905 Sun Up BLOCKED	0010 Sun to 0845 Sun Down BLOCKED 0020 Sun to 0905 Sun Up BLOCKED	0010 Sun to 0845 Sun Down BLOCKED 0020 Sun to 0905 Sun Up BLOCKED	0010 Sun to 0845 Sun Down BLOCKED 0020 Sun to 0905 Sun Up BLOCKED	0010 Sun to 0845 Sun Down BLOCKED 0020 Sun to 0905 Sun Up BLOCKED	
	SUN/ MON	2325 Sun to 0330 Mon Down BLOCKED 2350 Sun to 0330 Mon Up BLOCKED	2325 Sun to 0330 Mon Down BLOCKED 2350 Sun to 0330 Mon Up BLOCKED	2325 Sun to 0330 Mon Down BLOCKED 2350 Sun to 0330 Mon Up BLOCKED	2325 Sun to 0330 Mon Down BLOCKED 2350 Sun to 0330 Mon Up BLOCKED	2325 Sun to 0330 Mon Down BLOCKED 2350 Sun to 0330 Mon Up BLOCKED	Not with possessions between Longhedge Jn and Willesden West London Jn - See SO250 and MD165
	MID WEEK	Standard Possession Opportunities not available 0030 T-F to 0510 T-F BLOCKED 7 w.p.a. (see section 5 NLL Cyclic Type 3) ①					

NOTES
Down = Westbound. Up = Eastbound.
① Divert and/or re-time via STP. See Section 5.

Figure 56: Section 4 Standard Possessions Anglia 13

6.2.2 Engineering Access Statement, Section 5

6.2.2.1 Section 5 of the EAS states the available midweek possession opportunities. GW103 Paddington to Reading is split with mid-week availability alternating between the Reliefs and Mains on a rolling biweekly basis. The mid-weeknight designation of lines in this situation tends to be an opposite of that from the preceding weekend. i.e. a weekend of Relief Line Saturday is followed by mid-week of Mains possessions.

Network Rail
Western Route

Engineering Access Statement 2021
Proposal for Subsidiary Rules Changes
Section 5 - Midweek Night Possession Plan Summary

Version: 3
Date: 27th March 2020
Page 1 of 79

Line of Route	Locations (Lines - All unless stated)	Week Number (1st Half of Year - Page One of Two)																									
		37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	01	02	03	04	05	06	07	08	09	10
GW103	Paddington to Reading (Lines 1-3, Main Line Side)	37		39		41		43		45		47		49		51		01		03		05		07		09	
GW103	Paddington to Reading (Lines 4-6, Relief Line Side)		38		40		42		44		46		48		50		52		02		04		06		08		10
GW103	Reading West Jcn to Moreton Cutting / Foxhall Jcn (Main Line Side)			39			42	43				47				51				03				07			
GW103	Tilehurst East to Didcot East (Relief Line Side)		38			41				45	46				50				02				06				10
GW103 / GW105 / GW600	Foxhall Jcn to Swindon to Wootton Bassett to Thingley Jn Wootton Bassett to Westerleigh			39						45						51						05					
GW105 GW510 GW523	Wootton Bassett Jcn to North Somerset / Westbury Nth Westbury Up Side				40						46						52						06				
GW105	At Bristol Temple Meads (North Side)			39						45						51						05					
GW105	At Bristol Temple Meads (Middle)		38						44						50						04						10
GW105	At Bristol Temple Meads (South Side)						42						48						02						08		
GW105 GW548	Bristol West to Parson Street Parson Street to Portishead	37												49												09	
GW105	Parson Street to Cogload Jcn	37						43						49						03						09	
GW108 GW200	Devon (SLW on One Line for HOTR) Didcot North to Wolvercot Jn (SimBiDS on One Line Only)						42								50				02						08		
GW310 GW300	Wolvercot Jcn to Wylds Lane Abbotswood to Norton Jcn			39						45						51						05					

Figure 57: EAS Section 5 First Half of 2021

Network Rail
Western Route

Engineering Access Statement 2021
Proposal for Subsidiary Rules Changes
Section 5 - Midweek Night Possession Plan Summary

Version: 3
Date: 27th March 2020
Page 3 of 79

Line of Route	Locations (Lines - All unless stated)	Week Number (2^{nd} Half of Year - Page One of Two)																									
GW103	Paddington to Reading (Lines 1-3, Main Line Side)	11		13		15		17		19		21		23		25		27		29		31		33		35	
GW103	Paddington to Reading (Lines 4-6, Relief Line Side)		12		14		16		18		20		22		24		26		28		30		32		34		36
GW103	Reading West Jcn to Moreton Cutting / Foxhall Jcn (Main Line Side)	11				15				19				23				27	28	29		31				35	
GW103	Tilehurst East to Didcot East (Relief Line Side)				14				18				22				26				30				34		
GW103 / GW105 / GW600	Foxhall Jcn to Swindon to Wootton Bassett to Thingley Jn Wootton Bassett to Westerleigh	11						17						23						29						35	
GW105 GW510 GW523	Wootton Bassett Jcn to North Somerset / Westbury Nth Westbury Up Side		12								20				24						30						36
GW105	At Bristol Temple Meads (North Side)	11												23						29						35	
GW105	At Bristol Temple Meads (Middle)																		28						34		
GW105	At Bristol Temple Meads (South Side)				14												26						32				
GW105 GW548	Bristol West to Parson Street Parson Street to Portishead																	27									
GW105	Parson Street to Cogload Jcn									19								27						33			
GW108	Devon (SLW on One Line for HOTR)	11	12	13	14									23	24							31	32	33	34	35	36
GW200	Didcot North to Wolvercot Jn (SimBiDS on One Line Only)				14						20						26						32				
GW310 GW300	Wolvercot Jcn to Wylds Lane Abbotswood to Norton Jcn	11						17						23						29						35	

Figure 58: EAS Section 5 Second Half 2021

6.2.3 Engineering Access Statement, Section 7

6.2.3.1 Section 7 of the EAS details the planned major disruptions also known as abnormal access opportunity. For the OOC programme of works section 7's are only confirmed up to the first 6 months of 2021. For the purpose of producing a comprehensive strategy for delivery of the works, the Section 7 from 2021 has been used as a template for the overall construction programme.

6.2.3.2 For planning years beyond the current EAS development, nonstandard possession requirements that will become the future Section 7 have been detailed in the Outline Construction Programme and can be seen in the Project Box Plan, in Appendix C

6.3 Possession Limits

6.3.1 Introduction

6.3.1.1 Typically, the possession scenarios for the OOC area will vary depending on the integration of works during the planning phases. This is also dependent on whether it is predominantly Mains or Relief side possession.

6.3.1.2 Generally speaking, the possession limits would typically be between Ladbroke Grove and Acton West. These sometime increase in length to Dolphin Junction and Southall. as a minimum for the OOC site the possession would need to be from Ladbroke grove to Acton West. Where there is No Mains access to the East the possession could be reduced to Kensal Green to Acton West.

6.3.1.3 The following sections are instances where closer consideration of protection limits apply

6.3.2 Up and Down Poplar

6.3.2.1 In order to access Acton Yard during a Reliefs Line possession, the blocking of the Up and Down Poplar is required. This would normally be from Acton Wells Jn to Acton West.

6.3.2.2 This possession is important to the proposed access and egress from/to Acton Yard, due to the route of machine moves from Acton Reception 3 to the Up Relief, as detailed in section 4.1, Road Rail Access Points.

6.3.2.3 Another consideration to this part of the possession, is the boundary to the protection at Acton wells junction. The protecting signal for the Up Poplar is AW146 at 0m 41ch. This leaves c500m from the toes of 8120B to the protection, limiting the length of useable line for routing equipment to the Relief lines.

6.3.3 Mains Access to North Pole RRAP

6.3.3.1 For potential early works in the construction phase, and also for works to the East extremities of the site, RRV access via North Pole RRAP will require a block to the entrance of North Pole depot. The possession extents would need to include North Pole Line A and B.

6.3.3.2 Empty Coaching Stock movements into and out of North Pole depot are an important feature of the nightly inspection, cleaning and maintenance regime for the GWR fleet, and impose a significant restriction on available track access at this location. Outstabling of rolling stock in Paddington and other locations can help mitigate reduced depot access, but must be planned well in advance as part of the possession (and fleet maintenance) planning processes.

6.3.3.3 Use of this RRAP requires the possession limits of the Up and Down main to be far enough East to utilise mains crossovers as detailed in Section 4.1.

6.3.3.4 In order to clear the S&C for RRV moves during a possession, the Down Main protection would need to be beyond 8044Apts and for the Up Main protection from SN72.

6.3.4 Back Lines and Cross Rail Depot

6.3.4.1 For installation works for the depot connections at 9017pts and 8077pts, there is a requirement for possession of the Back-line washer bypass and Engineering & Carriage Line.

6.3.4.2 The Engineering & Carriage Line would require protection from 9006Apts. the washer Bypass and Back Line would need published protection arrangement from the cross-rail depot.

6.3.4.3 This protection arrangement would be in place alongside the Relief side possessions, blocking entry form the West 8077pts by default.

6.4 Non-Standard Possessions

6.4.1.1 The extent of access required to deliver the Old Oak Common Rail System works exceeds any such access delivered in the recent history of the GWML. For the majority of the proposed construction works, the Section 7 detail does not yet exist, and will require extensive consultation with all affected stakeholders to ensure sufficient access is available to safely and efficiently deliver the proposed infrastructure. Multi-Day All Line Blocks (ALB) are required at critical stages of the OOCRS works.

6.4.1.2 The details of nonstandard possession requirements that will form the future Section 7 of the EAS can be seen in detail in Appendix C.

6.4.1.3 These possession requirements will need to go through consultation with both TOCs and FOCs as part of the EAS development. The strategy used in order to come up with the construction methodology has been based on previous planning works at GRIP 3 and review of the known available opportunities.

6.4.1.4 Typically, the winter timetable offers increased opportunities to extend possession times compared to the summer timetable. These extensions of time are used to achieve longer Relief or Mains only possessions.

6.4.1.5 Within the proposed construction methodology, 16-hour weekend Relief Line possessions are utilised in 2023 as seen in Table 11.

Table 11: Non-Standard Possession Requirements

Stage	Timing	Possession detail	Justification
5A & 5B	Weeks 41 to ,5 in 2023	Saturday night 16 hours Relief Line with Poplar included	Delivery of Gantry steel work and troughing route via rail. This is due to limitations on road haulage
6	Christmas 2023	4 day all lines block with additional 2 track railway for 5 days relief side	All line block is to cover installation of Acton Cutting OHLE Portals and 4 track signalling Gantry. Extended relief side beyond Christmas to be used for wing wall modifications.
7C	Week 21 2024	Extension of the all line block to 4.5 hrs	Extension of the ALB would be required to allow four track gantry to be erected to the wets of the

Stage	Timing	Possession detail	Justification
			station. Currently no spare capacity during Christmas possessions
9A & 9B	Christmas 2024	6 days ALB followed by 5 days two track railway. Relief side	Stage 9 includes major signalling commissioning for relief sides as well as significant Pway extents and Wiring runs.
11	Weeks 2-5 2025	2 x 54 hours followed by a 72-hour commissioning. this would be followed up with a 16 hour follow up shift.	This Requirement is to install both 8112A/B and 8113A/B along with a significant length of plain line form temporary to final up relief alignment. the option to undertake these works cannot be earlier due to signalling data Changes needing to be in place. Due to temporary alignment and retaining wall staging there is a significant length of associated Plain line and wiring on the Up relief.
12A & 12B	Christmas 2025	6 Day ALB (with a 5 day then 1-day split), with 2TT for additional 4 Days	Significant Stage works
13A	Week 50 & 51 2026	54 hours Mains. This means back to Back 3 weeks of mains, with 3 back to back weekend of reliefs prior.	This stage is to accommodate significant lowers in Acton cutting. Works are significant and require a temporary alignment prior to stage 15 and 9047 A/B install. Stressing and welding to be included within the second 54-hour block.
15	Christmas 2026	6 Day ALB (with a 5 day then 1-day split), with 2TT for additional 4 Days	Installation of 9047A/B, 9023 and 9024 which includes switching over to the final mains alignment and associated wire runs.
16B	Easter 2027	54 hr Relief lines block followed by a 16 hour Follow up	Works for this stage are particularly difficult due to the significant distance between the Up relief and Down relief alignments. This means all Pway material has to be double handled form the Up Relief. Ideally this work would eb done in an ALB.
18	Christmas 2027	Christmas 2027: 2-day ALB with 2TT for additional 3 days. (ALB - OHLE works between Mains and Reliefs. 2TT	The full detail of this possession cannot be quantified until the Temporary signalling designs are complete. The time allows for significant testing and commissioning works. this would also be opportunity for any remaining ALB works.

6.4.1.6 Detail of the breakdown of overall possession timings is contained within the Pway Gantt Charts in Appendix F

6.5 Isolation Limits

6.5.1.1 All isolations are to be planned in accordance with Network Rail Standard NR/L3/ELP/29987, Module 6, Planning of Isolations.

6.5.1.2 The ECO shall consult with the Nominated Person and shall issue the Form B 'Authority to Test' once the isolation of the OHLE has been made and all paperwork is complete and accurate.

6.5.1.3 The Nominated Person shall test and apply the earths to the OHLE, issue the Form C 'Overhead Line Permit' to any COSS(s) whose work requires a Form C to be issued and shall brief the COSS(s) about the isolation and any local hazards.

6.5.1.4 After work has ceased, the COSS(s) shall confirm to the Nominated Person, using the Form C, that the work is finished who shall then remove the isolation as per the requirements of NR/SP/ELP/29987.

6.5.1.5 The "normal" limits of Isolation in the Old Oak Common area run between Ladbrook Grove East (see Figure 59) and Acton West Junction (see Figure 60).

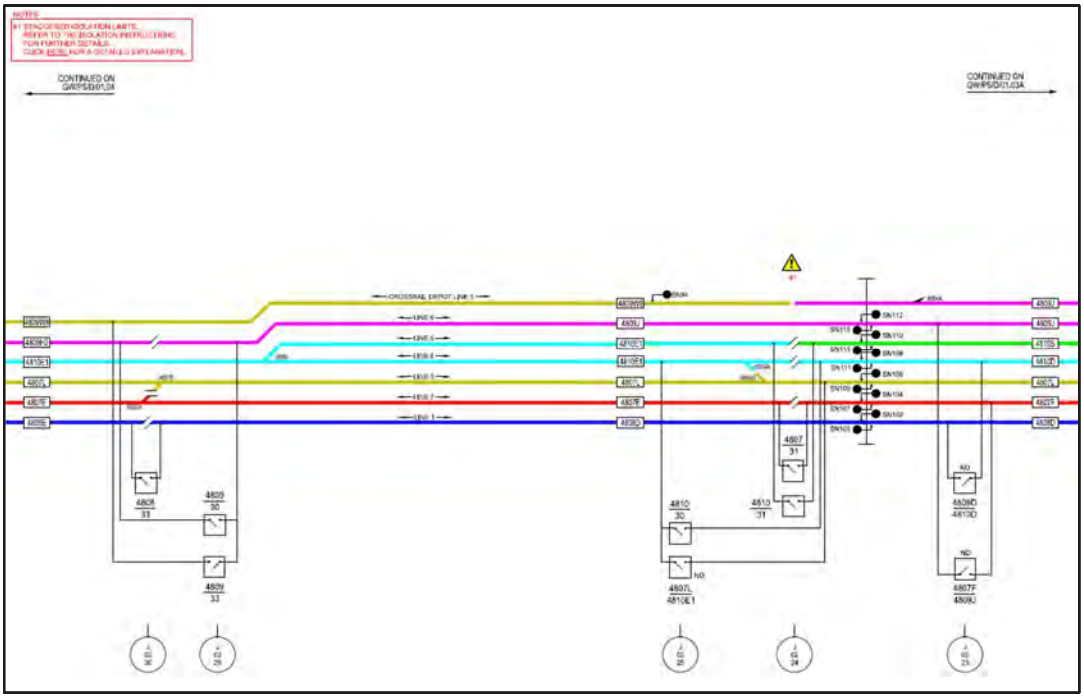

Figure 59: Extract from Isolation Diagram GW/PS/D/01.03B

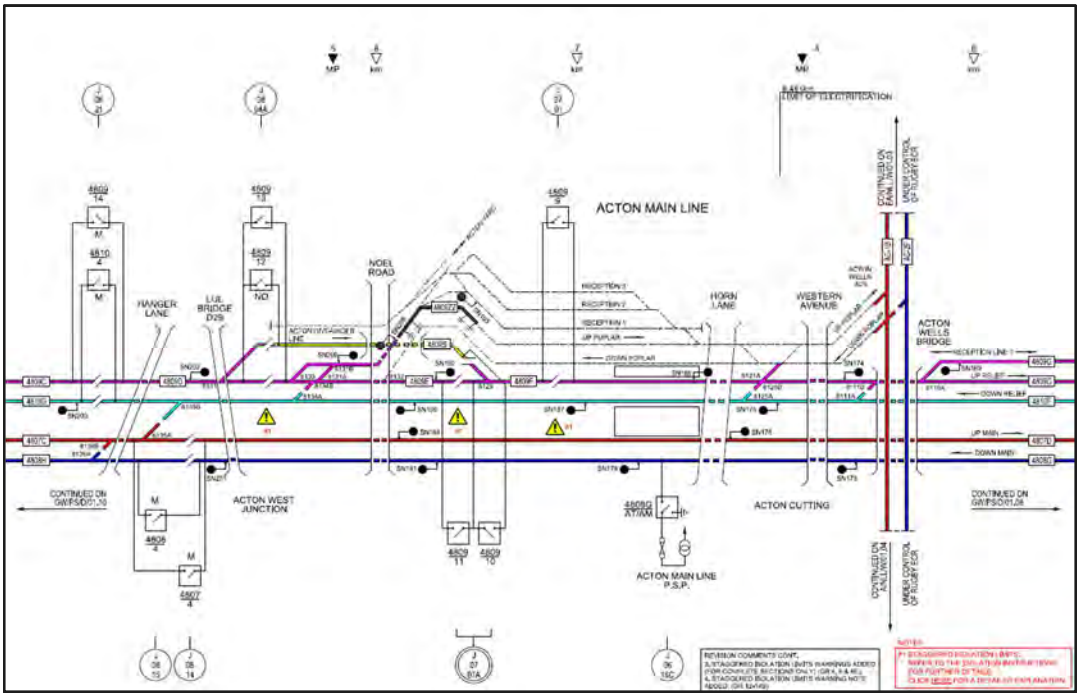

Figure 60: Extract from Isolation Diagram GW/PS/D/01.09

6.6 Route Proving

6.6.1.1 There is a requirement following any engineering possession to validate that the route is clear of vehicles and rail mounted plant. The line clear verification process (LCV) NR/L3/OPS/084 shall be adhered to during all stages of this project, whereby following each possession an enhanced version of the possession management arrangements, as defined by GE/RT8000, shall be followed.

6.6.1.2 Where the LCV process is to be used, this shall be indicated in the published possession details in the Weekly Operating Notice (WON).

7 Testing and Commissioning strategy

7.1 Signalling commissioning strategy

7.1.1.1 The Old Oak Common Rail systems project falls within the geography of the Network Rail Paddington to Reading (P2R) Signalling Team. The overall purpose of this team is to provide vertical integration between projects that may physically, technically, or spatially overlap.

7.1.1.2 Paddington to Reading (P2R) is a stand-alone delivery organisation, responsible for project delivery including;

- Crossrail ONW works Stage M Records updates from 0mp to 29mp
- Cross Rail West Outer Platform extensions (Associated signalling changes) between mile 12 ½ & 29mp
- Western ASDO Eurobalises project between 16 1/2mp and 29mp
- ETCS Level 2 overlay Area B & C 0mp to 12 1/2mp
- Paddington to Stockley Train detection Conversion programme, 0mp to 12 1/2mp
- Colnbrook Branch (Heathrow 3rd runway) 12 1/2mp to 16 1/2mp
- Western Rail Link to Heathrow, 16MP to 12MP.

7.1.1.3 Paddington to Reading is undertaking a large portfolio of projects utilising a functional team structure. The works are planned from GRIP 4-6 and include the HS2 On-Network Works for signalling.

7.1.1.4 The P2R organisation has mandated the frequency of major signalling stages as to minimise the disruption to the infrastructure and to secure the procurement of the key's skills and testing resource. The Periods available for significant changes are therefore prescribed by Network Rail. The Signalling Testing Strategy for Old Oak Common has been designed in partnership with the P2R team, considering their prerequisite data and interlocking change frequency.

7.1.1.5 The OOC rail systems signalling stages comprise 5 major signalling testing stages that all occur over the Christmas period of successive years, with some early additional preparatory stages not included in the scope of this document. The first of the preparatory signalling testing stage is a joint enabling stage between HS2 and Network Rail referred to as stage 4A and Stage R1 respectfully.

7.1.1.6 The first major stage within scope of consideration of the OOC rail systems signalling is aligned to construction stage 6. The Staged Signalling Design is still in production at the time of writing this report, but the following details have been taken from the draft design.

7.1.1.7 The operational signalling changes at stage 6 are relatively minor, with speed changes and route alterations in the data, including the provision for the Rail Head in the Western end of the site. The majority of physical changes on site are not significant in this stage, predominantly including removal of Reception Line 1, where there are only 4 signals and the associated four-foot equipment.

7.1.1.8 The Construction Programme allows 8 months for these works to be undertaken and these are not significant. Also, at this stage there are data design changes associated with the configuration change of the S&C around 9017 points and 8077 points. There are other signalling works detailed in draft on the Scheme Plan around Grand Canal Junction area and Mitre Bridge but the physical relocation of signal SN6080 will be undertaken in a single shift and does not present any significant integration issues.

7.1.1.9 The next significant signalling testing stage is the stage 9 Construction staging. Once again, these details are currently in Draft across 3 Scheme Plans at the time of issuing this report; 20-GW-025-01-02, 20-GW-025-03-02-, 20-GW-025-02-02.

7.1.1.10 Stage 9 20-GW-025-01-02, changes are around the Ladbroke Grove area. These changes are predominantly associated with Crossrail works and do not have a particular influence on the actual HS2 Old Oak Common Station area.

7.1.1.11 There are minor changes to speeds and the temporary removal of certain aspects on signals such as SN123. In terms of construction, these are not physical changes but changes in the Disconnection Box or modules in the back of the signals. Some Associated TPWS will require moving but the volume is not significant, and the movements are minor.

7.1.1.12 Stage 9 20-GW-025-03-02, involves changes to the West end of the site. There are some minor ETCS changes, not associated with the Old Oak Common project. These occur around the Acton West Ground frame; the physical changes are not significant and are unrelated. The biggest changes associated with Old Oak Common are those around Friars Junction. These include the alterations to 3 signals and associated Four Foot equipment and 4-point ends. In this area there are no further changes on the Up and Down Relief until the final stage at stage 18. Furthermore, these works can be carried out at any time aligned to the P-way changes.

7.1.1.13 Stage 9 20-GW-025-02-02 is the central area changes and the most significant works associated with the other rail systems disciplines. There are also significant Crossrail changes on the depot lines.

7.1.1.14 At the East end around 2 1/2mp there are changes to the controls of SN135 signal on the Down Main. These are not physical changes but will have an impact on the four-foot equipment. Movement of overspeed sensors associated with changes on the Down and Up Relief associated with SN134 and SN149 signal respectively also occur at this stage.

7.1.1.15 Most of the physical changes in this area, associated with 9017pts and 9016pts will have happened in between stages 6 and 9, as is typical, and as soon as the P-Way works have completed, the signalling works will follow. The Physical track changes in this area see the relocation of the Down Relief to the North, which in turn moves the associated signals, SN149 in the East and then all the signals through to SN435.

7.1.1.16 The Up Relief is also moved to divert around the new platform 8 of the Old Oak Common station, including the movement of signal SN449 up to SN144 in the East. In Terms of signalling, the physical changes have a lot of time to be undertaken. There are regular midweek and weekend possessions and up until the commissioning of the newly aligned tracks at Christmas in stage 9, this whole area is greenfield as the two Relief lines are running on their original positions.

7.1.1.17 The next significant Construction & Testing Stage for signalling is Stage 12. There is only a year between stages 9 and 12, with Stage 9 taking place at Christmas 2024 and Stage 12 at Christmas 2025. In between the two significant signalling stages the other disciplines begin to transform the Northern section of the station ready to accommodate the new alignment of the Up and Down Main. These lines are temporarily diverted through platforms 4 and 5.

7.1.1.18 Stage 12 20-GW-026-01-02 covers the Eastern area of the Old Oak Common signalling scope of works around Kensal green with significant speed changes. The introduction of the temporary 35/60 replaces the current 85/100 on the Down Main. Apart from replacement of the speed board and associated ATP, there is little else in terms of construction as a lot of the signalling works will have been undertaken in the early build before stage 6.

7.1.1.19 Stage 12 20-GW-026-03-02 covers the West end changes, again, most of the construction required in this area will have been carried out as part of development of stage 6 but these bring those changes into use.

7.1.1.20 Repositioned OSS on the Up Main will have been in situ for some time un-commissioned and the risk to construction and the commissioning will be with reinstating this equipment. Another element of work is the position of the rear car markers on the Up Relief adjacent to

SN192 signal. There is minimal construction risk but early engagement with operations is required.

7.1.1.21 Stage 12 20-GW-026-02-02 covers the Central Area and undergoes another very significant change in terms of signalling. This is arguably the most significant data change throughout the project and the riskiest layout with the diversion of the Main Lines. 9023 points around the 3mp remain in position to support the temporary siding in the East. The entire Down Main is shifted North including signals SN159 and associated four-foot equipment.

7.1.1.22 These works will follow the track works as per the described methodology. Also, at this stage the Up Main is shifted North onto a temporary alignment and signal SN160 and associated four-foot equipment is moved as per the design. These are concurrent activities with the other disciplines and these two signals pose particular risk.

7.1.1.23 The other significant signalling testing stages are aligned to construction stages 15 & the final stages 17 & 18. These stages are in their early design development at the time of issuing this report, and the signalling changes are still being confirmed by the designer. The narrative around the stages can be found in section 6.

7.1.1.24 The Signalling works will always look to follow the general sequence of construction and will always follow closely aligned to the P-Way discipline. Overall, the volumes and complexity of these changes have been developed such that a reasonable and manageable amount of change is introduced gradually as to not import undue risk onto the infrastructure. Changes are introduced in a timely fashion to support operations and drivability.

7.1.1.25 All the Stages have also been designed such that each change is recognisable enough in its own right so that signallers, drivers, and other ops staff have sufficient time for training and staff development.

7.2 Entry into Service considerations

7.2.1.1 Whilst Network Rail acts as Infrastructure Manager, the design and constructability work has taken into account the requirements of NR/L2/INI/CP0075 procedure for the entry into operational service of Railway Infrastructure. This has led to the development of 18 Major Stages. The introduction of Major Stages follows the best practice of projects such as Reading Station Area Remodelling and the Crossrail West On-Network Works.

7.2.1.2 Throughout the design we have ensured that the assets provided, whether new, temporary or modification of legacy assets, are suitable, sufficient, and correctly designed to provide for the safe functional & operational requirements of the railway infrastructure. Significant operational and signalling changes are made with sufficient time between each stage to allow the arrangements to become familiar.

7.2.1.3 The constructability work undertaken in GRIP 4 has identified the Major Stages of this project and identified them as Key EIS Stages in the context of NR/L2/INI/CP0075. This will result in a master schedule of deliverables being produced and agreed upon by the responsible persons at each and every stage.

7.2.1.4 The 18 stages for commissioning of the Old Oak Common project should have a project master file produced to support the safe and compliant authorisation for placement into service. As each of these stages can stand alone, they have protection from project delay and unforeseen circumstances.

7.2.1.5 In GRIP 5, A major project such as this one should also look to align the stage works to the CSM Authorisation Plan. The 18 stages are also designed such that a project master file for each stage will support progressive assurance for the final commissioning and completion of the final technical file.

7.3 S&C Commissioning

7.3.1.1 S&C delivery is staged over the whole construction programme, with the full layout being commissioned in Stage 18 over Christmas 2027.

7.3.1.2 S&C commissioning is required at 5 different stages:

- Stage 9B – Christmas 2024
- Stage 11 – Acton Crossovers January 2025
- Stage 15 – Christmas 2026
- Stage 16b – Easter 2027
- Stage 18 – Christmas 2027

7.3.1.3 Not all the S&C is installed and commissioned at the same time, with a large percentage of the units are installed in final state but not commissioned for some time. Others are installed with just the turnout or through-route Commissioned

7.3.1.4 Section 7.1 details the S&C commissioning strategy across the project, with the following describing the state of installation

- **Installed commissioned** – the criteria are for S&C that is installed and commissioned within the same stage.
- **Installed Not Commissioned** – S&C units that are installed in their final state with all bearers and ironwork, but not commissioned to a later stage
- **Installed Plain lined Baseplates** - for this option S&C layouts will be installed but the switch rails and crossing ironwork will be Plain lined using specialist S&C baseplates.
- **Installed Formation only** – this applies to layouts where plain line baseplates are not available. The S&C formation will be installed but temporary plain line panels will be installed rather than S&C.

Table 12: S&C Commissioning Strategy

Pts No	Installed Commissioned	Installed not commisioned	Installed Plain lined Baseplates	Installed Formation only	Final commissioning
9020	N/A	N/A	Stage 9B	No	Stage 16B
9024	Stage 15	N/A	N/A	N/A	Stage 15
9023	Stage 15	N/A	N/A	N/A	Stage 15
9018	Stage 5B	N/A	N/A	N/A	Stage 9B
9016 (8077)	N/A	Stage 6	N/A	N/A	Stage 9B
9017	N/A	N/A	N/A	Stage 6	Stage 9B
9019	N/A	Stage 5B	N/A	N/A	Stage 9B
9022	N/A	Stage 5B	N/A	N/A	Stage 9B

Pts No	Installed Commissioned	Installed not commisioned	Installed Plain lined Baseplates	Installed Formation only	Final commissioning
9025B	N/A	Stage 5B	N/A	N/A	Stage 9B
9025A	N/A	Stage 5B	N/A	N/A	Stage 9B
9026B	N/A	N/A	Stage 5B	N/A	Stage 18
9026A	N/A	N/A	Stage 5B	N/A	Stage 18
9030	N/A	N/A	N/A	Stage 7B	Stage 18
9031	N/A	N/A	N/A	Stage 7B	Stage 18
9032	N/A	Stage 7B	N/A	N/A	Stage 18
9033	N/A	Stage 17	N/A	N/A	Stage 18
9034B	N/A	Stage 7B	N/A	N/A	Stage 18
9034A	N/A	Stage 7B	N/A	N/A	Stage 18
9035	N/A	Stage 7B	N/A	N/A	Stage 18
9036	N/A	Stage 7B	N/A	N/A	Stage 18
9040	N/A	N/A	Stage 7B	N/A	Stage 18
9037	N/A	Stage 7B	N/A	N/A	Stage 18
9041B	N/A	Stage 7B	N/A	N/A	Stage 18
9041A	N/A	Stage 7B	N/A	N/A	Stage 18
9039	N/A	Stage 16A	N/A	N/A	Stage 18
9043	N/A	N/A	Stage 13B	N/A	Stage 18
9044	N/A	Stage 13B	N/A	N/A	Stage 15
9046B	N/A	Stage 13B	N/A	N/A	Stage 15
9046A	N/A	Stage 13B	N/A	N/A	Stage 15
9047B	Stage 15	N/A	N/A	N/A	Stage 15
9047A	Stage 15	N/A	N/A	N/A	Stage 15
8112B	Stage 11	N/A	N/A	N/A	Stage 11
8112A	Stage 11	N/A	N/A	N/A	Stage 11
8113B	Stage 11	N/A	N/A	N/A	Stage 11
8113A	Stage 11	N/A	N/A	N/A	Stage 11

7.3.1.5 Additional to the strategy above there may be instances where switches are installed with the through or turnout route only operating. In the current proposed strategy, there are no switches proposed to be installed and not detected by the signalling system.

7.3.1.6 9020 and 9039 do however get installed but Clipped out of use with the turn or through route not available. In this instance control measures to clip and padlock the switches will be required.

8 Delivery Strategy

8.1.1.1 The overall construction programme is considered in detail in the Box Plan, Schematics and layout included within Appendices A-C

8.1.1.2 This section of the report covers the overarching construction strategy from enabling phase through to commissioning, detailing discipline specific considerations

8.2 Enabling Phases

Depot Decommissioning

8.2.1.1 Prior to the implementation of the proposed railway systems upgrades, the Depot Decommissioning Project is undertaking works to rationalise the existing depot layouts. These works will not only facilitate the construction of OOCRS but also the construction of the HS2 Box and interchange station.

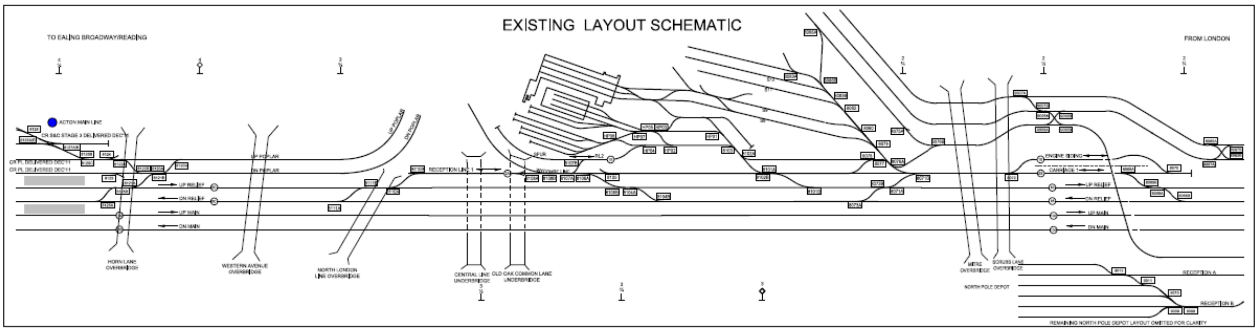

Figure 61: Layout prior to site works commencing

8.2.1.2 The overall scope of Depot Decommission works is to recover the existing GWR HST depot and HEX depot layouts, with rationalisation of the depot connection to the running lines via Reception line 1, Engineering Carriage lines and Cross Rail Depot Back Line. The programme also includes the recovery of the Wycombe branch line to the West of OOC lane Under Bridge.

8.2.1.3 The programme of works is ongoing at the time of producing this report but is currently only outstanding the Stage 4 works. Stage 4 works are separated into two main items of work which involves the recovery of the HEX depot followed by recovery of Reception Line 1.

8.2.1.4 The HEX recovery will also see the recovery of several S&C units currently serving connections to and from the Relief Lines. This will include the recovery of 8104B from the Down Relief with 8104A,8106B and 8101B recovered From the Up relief.

8.2.1.5 In the second part of Stage 4 the project will recover Reception Line 1 and the connection to the Backline via points 8077. 8110A and 8110B are being retained to enable a railhead during the OOCRS and Station construction stages.

8.2.1.6 The final layout, post Depot Decommissioning works, is the foreseen layout from which the OOCRS track layout will be constructed. The existing conditions reports have therefore been assessed based on the anticipated layout post Depot Decommissioning Stage 4.

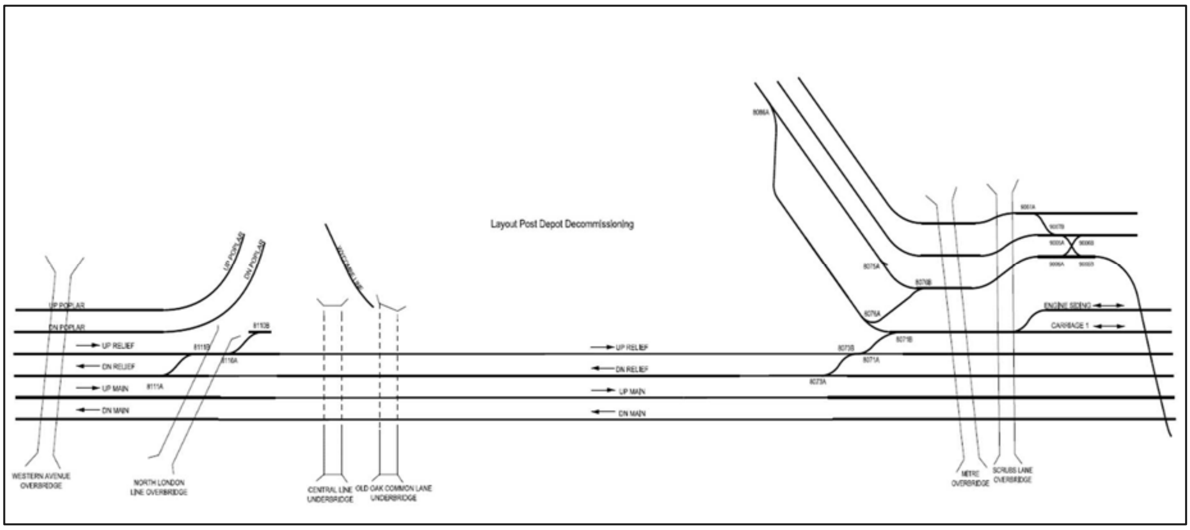

Figure 62: Layout Post Depot Decommissioning

8.2.2 Ground works

8.2.2.1 Prior to the commencement of the rail systems work HS2 will be undertaking construction works for the station and underbridges. This will involve ground preparation works for which there is currently no design detail.

8.2.2.2 In order to understand the level of groundwork required for staging the OORS works, an assumption has been agreed via integration with HS2 and is as follows:

8.2.2.3 The station/civil engineering contractor shall provide a cleared site at a nominal 500mm below proposed rail level. The formation shall be prepared to an agreed specification (TBC). The boundary extents of this nominal clear are displayed in Appendix B – Staging Layouts, Stage 2A. Through the station area the station contractor would provide a prepared formation level through all tracks 8 through to 1.

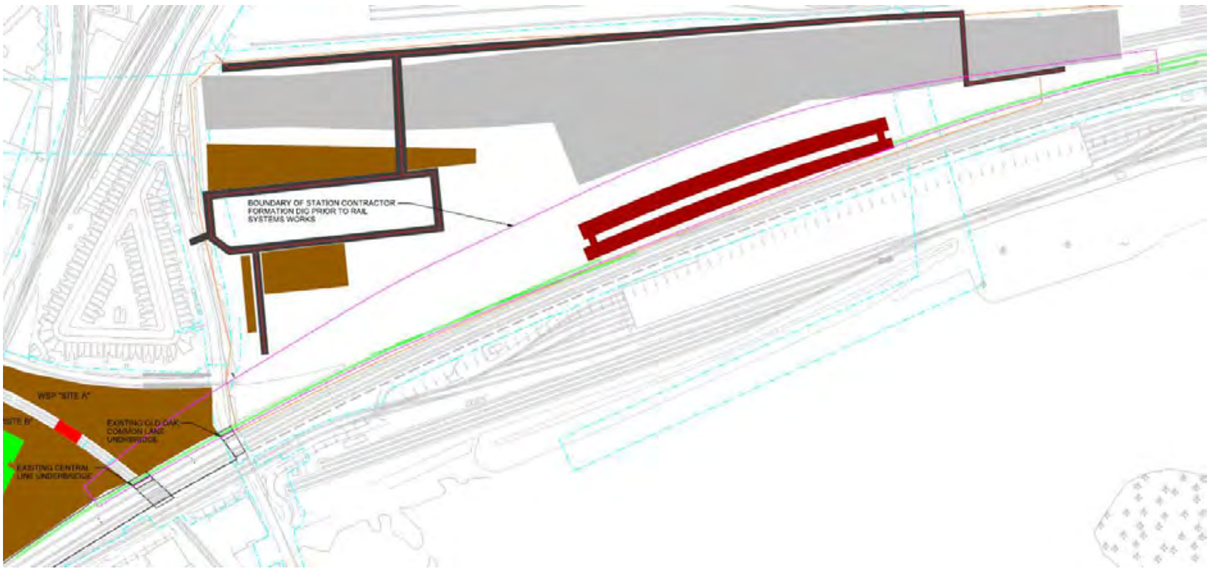

Figure 63 Formation Assumption Extents

8.2.2.4 Additionally, to overall ground clearance there is the unknown risk of existing structures being left beneath the surface that may obstruct the rail systems works. These issues need to be covered in ongoing integration during the project construction stages.

8.2.2.5 As other parties recover infrastructure, as-built detail should be supplied to the rail system constructor to be able to identify any potential remaining structures that may impede installation. Without detail designs at this stage it is not possible to identify what foundations or existing structures will remain in situ.

8.2.2.6 Particular items of concern are as follows

- OHLE Pile foundations
- Existing UTX and Turning Chambers
- Depot and historic building foundation
- Disused equipment loc suite and signalling structures
- Disused and historic abandoned cable routes
- Disused drainage chambers

8.2.3 Establish compounds & RRAPS

8.2.3.1 Compounds have been considered based on logistic needs and available locations within suitable travelling distance of the construction site. Some of the compounds are located within the OOC site and will require ongoing integration with the station works.

8.2.3.2 Two key compounds are Acton and Jewson's yard, utilization of which the construction programme has been broadly based on. prior to the commencement of stage 4, these compounds will need to be established and ready to operate. This is to facilitate the delivery of portal structures to Acton cutting

8.2.3.3 Jewson's yard is a key location to support the proposal for the OOCRS but is reliant on compulsory purchase and/or negotiations with the owner of site. These negotiations should commence as early as possible as works to reconfigure or fit out the compound would need to begin in mid-2022 to prepare for works at Christmas 2022.

8.2.3.4 Acton depot is currently being used by Network Rail and has previously been utilised for delivering Cross Rail works. However, negotiations and arrangements to establish a project hub here if Jewson's is not secured will need to be in place by stage 4.

8.2.3.5 Existing RRAPs already operate at Acton and North Pole Depot (Barlby Road). Further RRAPS will be established at Jewson's and Hitachi North Pole Depot.

8.2.3.6 Jewson's RRAP should be in place for stage 4 Christmas 2022. The proposed new RRAP within the Hitachi North Pole depot would benefit the early stage of works so installation by Christmas 2022 would be beneficial. If negotiations for a RRAP at Jewson could not be agreed, the Hitachi RRAP would have to be used in place of Jewson's to support stage 4 onwards.

8.2.3.7 To date the access at Hitachi and Jewson is yet to be agreed and poses a significant risk to the project if not agreed.

8.3 Construction Phases

8.3.1.1 The construction stages of the programme of OOCRS works are summarised in the following table.

Table 13: High Level Phasing

Construction Phase	Stage From	Stage to
Phase 1	Stage 1	Stage 4
Phase 2	Stage 5	Stage 8
Phase 3	Stage 9	Stage 12
Phase 4	Stage 12	Stage 15
Phase 5	Stage 16	Stage 18

8.3.2 Early Stages - Phase 1

8.3.2.1 The initial stages of the project at the time of writing are underway and fairly advanced. These works are concerned with site clearance and decommissioning of the both the HST and HEX depots. Both depots will be removed from service, with the infrastructure for both being removed to make way for the new station.

8.3.2.2 The first depot to be removed is the HST site, which is the location for early HS2 works and the launch location for tunnel boring machines. The site will then become the location of the Old Oak Common HS2 box station.

8.3.2.3 The HEX depot is the second depot to be removed and is currently sited where the GWML station and Turnback lines are proposed.

8.3.2.4 The layout without the depots can be seen in Figure 64.

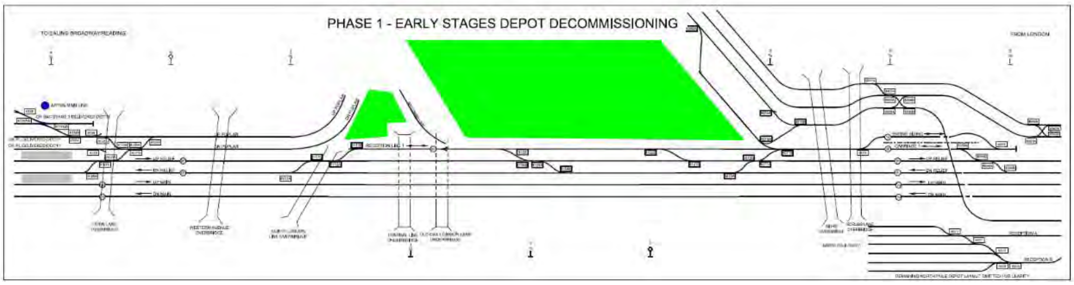

Figure 64: Phase one early stages

8.3.3 North of Station – Phase 2

8.3.3.1 Phase 2 is the start of the Rail Systems works, with platforms 3-8 and the associated infrastructure being built alongside the Rail Systems infrastructure. The majority of this work will be undertaken in a high-street environment separated from the operational railway.

8.3.3.2 The HS2 station works will include the construction of the station building from platforms three to eight, the partial reconstruction of Old Oak Common Lane underbridge and the Central Line underbridge. Materials for these stages are to be delivered via road haulage.

8.3.3.3 The multidisciplinary Rail Systems work will be undertaken in parallel to the station build with integrated logistics and site arrangements. The east of the station infrastructure will be constructed first, followed by the platform areas and then all equipment to the west of the station. The limits of these works will be determined by the ability to work adjacent to the operational railway.

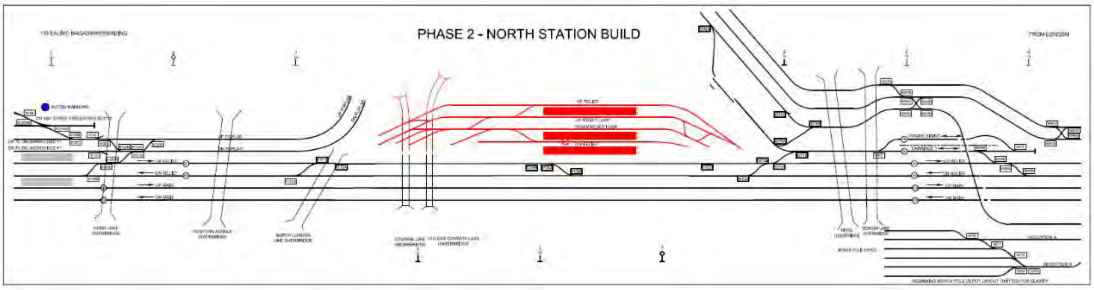

Figure 65: Phase two North of station build

8.3.4 Temporary Alignment – Phase 3

8.3.4.1 In this Phase of work the Relief and Main lines are temporarily diverted through the new layout. This renders the south side of the station infrastructure redundant, allowing for recovery of these assets and allowing the station and bridge construction to the south to begin.

8.3.4.2 This is the first commissioning stage of the project where the existing signalling control system will be altered. Data changes will be required, along with interim signalling designs.

8.3.4.3 The station works will continue behind a solid hoarding, as the lines within the platforms become operational. Any Rail Systems work to the North will be undertaken within possessions.

8.3.4.4 The recovery of assets at the south will be undertaken with adequate separation to the operational running lines. Road access will be via the southern boundary and Hitachi's North Pole Depot.

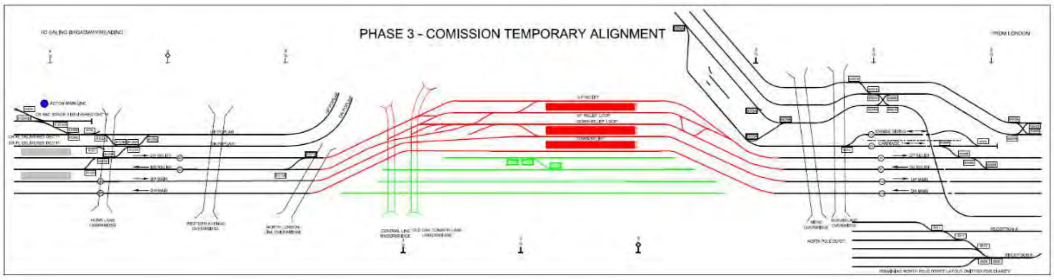

Figure 66: Phase three temporary alignment

8.3.5 South of Station Build - Phase 4

8.3.5.1 During this phase access to the southern site boundary is restricted, with no current road access point, resulting in the site being a construction "island" between operational running lines. Therefore, construction of the Rail Systems works will require road access from the south and additional road rail access to the west.

8.3.5.2 Once the redundant assets to the south are recovered, works to the station platforms 1 and 2 will begin and the remainder of the underbridges to Old Oak Common Lane and the Central Line. Materials for the station works will be brought to site via the new proposed station foot bridges.

8.3.5.3 The Rail Systems work will be carried out in a high-street environment, beginning to the east of the station whilst the under bridges are being constructed to the west. As with the north of the station this will be followed by construction to the west. As much as physically possible up to separation from the running lines will be installed.

8.3.5.4 The majority of material delivery for Rail Systems will be via rail. Inbound engineering trains will be on the Down Main. RRV deliveries will also be on the Down Main and coming from a locally established depot to the west next to Acton Main Line Station or existing North Pole RRAP (Road Rail Access Point) to the east.

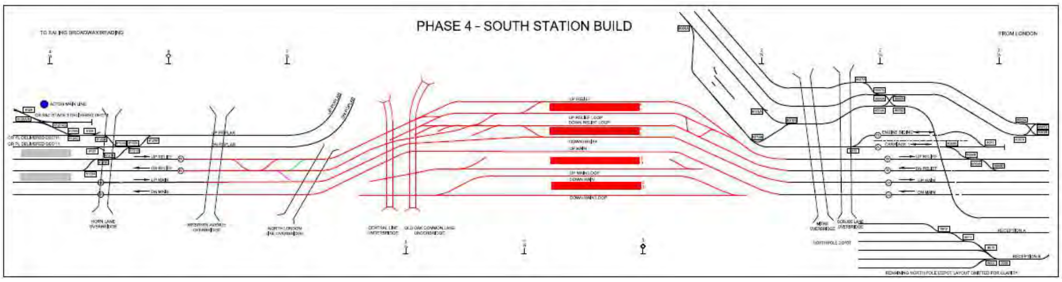

Figure 67: Phase four South station build

8.3.6 Final Commissioning - Phase 5

8.3.6.1 The final stage construction phase sees the staged introduction of the final layout. The station build is completed, and the Rail Systems works is all now in Possessions with no available high-street environment.

8.3.6.2 The works will involve the testing and commission of the final layout. The Main Lines and Reliefs during the stages are staged away from their temporary alignments and begin to be routed along their final paths. The remaining system works is then concerned with installing any assets that have been deferred during the temporary stages.

8.3.6.3 Material delivery during these stages will be by rail and just in time delivery during possessions.

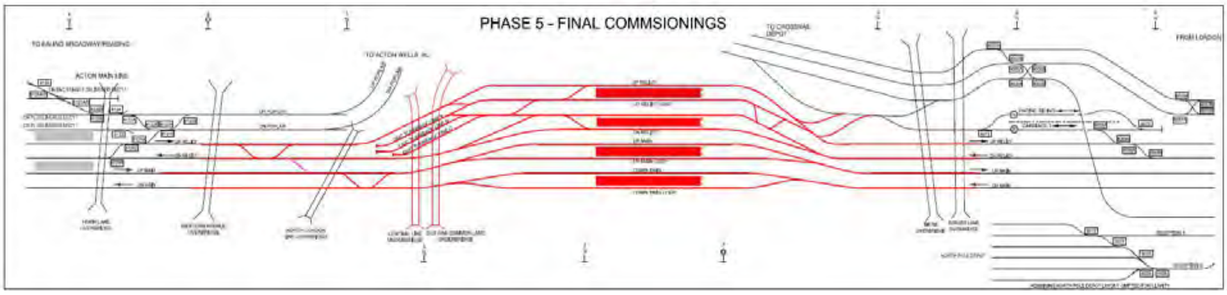

Figure 68: Phase five final commissioning stages

9 Construction Methodology

9.1 Track & Drainage

9.1.1.1 The overall track installations methodologies are based on conventional relaying techniques. Modular layouts have been avoided in the design production however wherever possible the befits of modular delivery have been incorporated.

9.1.1.2 The full detail of the track methodology can be found in the detailed Pway Gannt charts in Appendix F. Staging notes have been included in Table 15 Pway Staging Notes

9.1.2 Delivery of Material

9.1.2.1 More detail on the logistics of material delivery are covered in ch 5. This section is concerned with the specifics around certain Pway related material delivery rationale.

9.1.2.2 Depending on the stage of delivery, heavy materials such as ballast, rail and sleepers are delivered by train. This is either unloaded form trains in possession from adjacent line to the construction site or the purpose-built rail head siding.

9.1.2.3 Rail will be unloaded as CWR in 108m strings from LWRT in the Up Relief 4ft and then positioned within the site for later installation. 108m strings are suggested as opposed to 216m lengths to aid offloading and installation. Once unloaded the rails will be walked into position by the use of McCullough TRT machines

9.1.2.4 All track ballast, spoil removal and drainage aggregate will be unloaded / loaded from open top 60T Falcon wagons. Side tippers have not been proposed due to the need to unload materials far enough away from the Up Relief to allow material to be moved during the day.

9.1.2.5 Concrete sleepers will be unloaded from Salmon wagons. These will be a max of 3 layers at 168 sleepers per wagon. These will then be unloaded into stockpiles on site ready for use.

9.1.2.6 Drainage pipes will be unloaded from Bass wagons in 6m lengths with 24 pipes per wagon. These will be stored in the compounds or transported to the construction area.

9.1.2.7 Small material deliveries are assumed by road or RRV. This will include materials such as drainage rings, catch pits, pads, clips & insulators etc. they will be delivered in the first instance by road to Acton or Jewson yards prior to conveyance to site by RRV.

9.1.3 Plain line methodology

9.1.3.1 The plain line methods to be used are aligned to traditional methods. Where works are in a possession this will consist of relaying being from train consist positioned in the adjacent line. Where the interval is too great, for example in stage 16B, double handling and increase in plant will be required.

9.1.3.2 Formation installation will be undertaken by 3D formation design and controlled dozing. Bulking out will be by traditional RRV and production rates expedited by the use of front shovel excavators where possible. The same 3D dozing techniques will be used for installing bottom ballast to design level.

9.1.3.3 A benefit to the OOC site is that it will be straightforward to access for Bowmag intelligent rollers into the site for compacting the bottom ballast. If this is not possible at any location, triple whackers will be used.

9.1.3.4 Sleepers will be loose-laid with the use of seven sleeper bailers. Where this is not possible and in the high-street environment RRVs with Pandrol chains will be used.

9.1.3.5 Top ballast will be installed form Auto Hoppers where possible, however in the high-street environment with no direct rail connection, top ballast will be unloaded form 60t open wagons.

9.1.4 Acton – Installation of Modular S&C

9.1.4.1 The installation of crossovers 8112AB and 8113AB through Acton Cutting to the West of site on the Up and Down Reliefs are planned to be undertaken during a series of three back to back 54h possessions in April 2025 – Stage 11.

9.1.4.2 Due to the volume of permanent way being renewed and installed in this stage and the tightness of this specific location in the cutting with high retaining walls along both cesses, the installation of the new S&C layout has been considered to be installed as a standard modular S&C layout for both crossovers.

9.1.4.3 For non-modular S&C to be installed in this location would require panels to be delivered and off-loaded to a laydown area large enough to take a complete through-bearer. Due to the tight cesses, lineside furniture, OHLE and also the maximum bearer width of a Tilting Wagon, this is therefore not a feasible as S&C installation methodology for this stage.

9.1.4.4 On completion of excavation and bottom ballast activities, standard modular panels arrive on site on S&C tilting wagons and are offloaded by Kirow crane directly into position on their final alignment. The Kirow relays panels through 8112A and 8113B Pts with all panels fully installed and plated up on the Down Relief.

9.1.4.5 On completion of the Down Relief, the Kirow crosses over onto the opposite line and the second tilting wagon train positions on site. The remaining panels are offloaded and installed through 8112B and 8113A Pts, with all panels fully installed and plated up on the Up Relief. The through route is correctly gauged with modular shrouds between S&C split bearers fully installed and torqued.

9.1.5 Non-Modular S&C Installation

9.1.5.1 With the exception of 8112AB and 8113AB all S&C units will be installed as complete through bearer layouts and installed in panel configuration. To enable this, where applicable all S&C layouts will be pre-delivered by rail utilising an existing live line as a service line or a temporary Rail Head, with panels offloaded to a pre-constructed laydown area by Kirow crane or road crane / crawler crane from the site of work during NBS and ROTR possessions.

9.1.5.2 For switch layouts that have bearers with a maximum width greater than that of a S&C tilting wagon the S&C layout will be temporarily slaved by the S&C manufacturer to allow loading to a train, followed by unloading and panel installation on the prepared bottom ballast.

9.1.5.3 This installation of the S&C panels in the main site of work in the greenfield environment will be carried out by Crawler Crane or Road Crane in a sequential process. Slave bearers and rails will then be removed from the installed layout with the new through bearers installed ‘in the hole’ and subsequent S&C ironwork such as switches and crossings fully installed and set up in preparation for commissioning.

9.1.6 Tamping

9.1.6.1 Post installation tamping of the permanent way will be carried out by a combination of Plain Line, S&C 4x4 and Beaver Tampers.

9.1.6.2 For planned works during NBS, ROTR and blockade possessions all tamping will be carried out by a conventional Plain Line or 4x4 S&C Tamper depending on the workscope for each individual stage.

9.1.6.3 For Stage 5, 7 and 14 the permanent way installation is installed and constructed in a greenfield environment with no live connection to an existing running line. For these stages the first initial tamping will therefore be carried out by a mobile Beaver Tamper. The Beaver Tamper is delivered by road into site and self offloads and onloads to any specified line within the area of work.

9.1.6.4 Tamping is carried out, lifting and slewing the track to design position as required during the standard dayshift site working hours and on completion the Beaver Tamper leaves site by road.

9.1.6.5 As the stages progress and new layouts become accessible via a live open line all follow up tamping of these sections will be carried out by a conventional Plain Line or 4x4 S&C tamper to achieve final design tolerances prior to linespeed opening and commissioning.

9.1.7 Welding & Stressing

9.1.7.1 Welding and stressing of the new installed permanent way will be carried out as each stage permits with regards to possession time for NBS / ROTR planned works, and also achievable yardages for the island working sections in the greenfield sections.

9.1.7.2 Where possible all joints should be welded as soon as possible and if time and anchor lengths allow stressing should be planned and completed simultaneously. Special consideration for stages that are planned to be installed during the winter season should aim to have layouts stressed before the onset of warm weather to reduce the requirement for ESR/TSR requirements in line with the Critical Rail Temperature (CRT) process and to also reduce the risk of track misalignments (buckles).

9.1.7.3 For stages that involve a temporary installation of track that will remain in situ for a prolonged period of time, these should also be planned to be fully welded and stressed.

9.1.7.4 All S&C will be stress compatible with either stress transfer blocks or ball and claw layouts with a fully continuous welded rail of the plain line throughout the scheme, therefore a fully stressed track layout will be provided on completion.

9.1.8 Plain lined S&C

9.1.8.1 In line with the strategy to commissioning S&C at different stages of the project, some layouts will be installed plain lined. This will mean that only one route of the S&C will be used, either the turnout or through route.

9.1.8.2 In order to accommodate this, the S&C can be installed in its final state and then the switch and crossing rail will be removed and replaced with plain rails, removing the switching capability of the layout.

9.1.8.3 Some plain line baseplates are already readily available with product acceptance and manufacturing details already produced. The range of base plates already approved does however not cover all combinations of S&C geometry.

9.1.8.4 Table 14 below details the proposed layouts which are to be plain lined under the current methodology. The layouts that do not currently have catalogue products against them may require new base plates to be cast and then also taken through the product acceptance process.

S&C	Switch Size	Crossing angle	Base plate	Through Route Geometry	S&C Design	Switch hand	Route to PL	Baseplate LH	Baseplate RH
9026A	D	1 in 13.5	057/003846	Straight	NR60	RH	THR	057/003828	057/003829
9026B	D	1 in 13.5	057/003846	Straight	NR60	RH	THR	057/003828	057/003829
9030	C	1 in 9.25	N/A	Straight	NR56V	LH	THR	N/A	N/A
9040	E	1 in 12.5	N/A	Straight	NR60	RH	THR	057/003833	057/003832
9020	SG	1 in 27	N/A	straight	NR60	RH	TO	N/A	N/A
9031	C	1 in 9.25	N/A	Straight	NR56V	RH	THR	N/A	N/A

Table 14: Plain Line Base Plates

9.1.9 Drainage

9.1.9.1 Wherever possible drainage will be installed at the same time as the track formation. In some instances, this is not possible, and the drainage has to be installed after the track.

9.1.9.2 The key consideration when installing the drainage is to maintain routes from the existing and proposed runs to outfall. Once installed, new drainage will start to catch and convey water. A comprehensive drainage strategy and temporary designs will be required to maintain levels and flows throughout.

9.1.9.3 Drainage runs will be excavated by 360 excavators with spoil loaded to dumpers or adjacent trains. Trench support shall be installed throughout lining and levelling of trenches.

9.1.9.4 Geotextiles shall be overlapped into the drainage trench. From track formation, pipes will be installed on a bedding material and connected. Backfill of granular fill will be placed from either dumpers or adjacent open wagons.

Table 15 Pway Staging Notes

Stage	Summary	Methodology
5	• Installation of track and drainage to the East of the site during dayshift working in a greenfield environment	• Material delivery by rail from the Up Relief during ROTR possessions • Laydown and stockpiling areas used throughout this stage with materials unloaded from trains to facilitate dayshift working • Rail unloaded as CWR in 108m strings from LWRT in the Up Relief 4ft and then positioned in site for later installation. 108m strings considered as opposed to 216m to aid offloading and installation • All track ballast, spoil removal and drainage aggregate unloaded / loaded from open top 60T Falcon wagons • New concrete sleepers unloaded from Salmon wagons – max of 3 layers at 168 sleepers per wagon • Drainage pipes unloaded from Bass wagons in 6m lengths with 24 pipes per wagon • Small material deliveries assumed by road such as drainage rings, catchpits, pads, clips & insulators etc • Where applicable S&C panels arrive on Tilting wagons and offloaded with Kirow crane into adjacent laydown areas • Non-modular S&C units constructed and installed utilising temporary slave plain line panels with S&C bearers and ironwork installed where required where panel width greater than allowable for Tilting wagons • Installation of S&C in greenfield environment carried out by Crawler Crane • 9025AB and 9026AB installed with temporary plain line baseplates and rails through the switches with all S&C ironwork programmed to be installed and commissioned in Stage 18 • Spoil removal, drainage and bottom ballast installation constructed using traditional track renewal methodology using tracked excavators, 3D dozers, dumper trucks and RRV plant. • Compaction of formation and bottom ballast achieved by Bomag Roller or Triple Wacker • Sleepers run out and relayed using tracked excavator with 7 sleeper spacer beam attachment • CWR installed in 108m sections using McCulloch Rail Tracked Rail Transposers (TRTs) • Rail clipped up using mechanically operated plant such as Rosenqvist or Cembres • Boxing and Top ballast ran out and profiled from stockpiles using dumper trucks and RRV plant where required • West Rail Head constructed and installed off the back of existing 8110B Pts into site to facilitate deliveries into greenfield site

Stage	Summary	Methodology
		• West Rail Head constructed as a single line protected by a temporary buffer end or chained sleeper with a PLB board • Initial tamping of relayed sections in this stage to be undertaken by Beaver tamper due to no direct access from an operational line for a conventional tamper. Final tamping to design and subsequent linespeed will be undertaken by conventional plain line and 4x4 S&C tampers in the latter stages
6	• Installation and commissioning of 9016 (8077) and 9017 points formation only . during Christmas blockade working	• Installation and commission of 9016 Pts (8077 Pts) • Installation of 9017 Pts – renewal of formation only; S&C temporarily plain lined • 6-day ALB & 5 day 2TT. Possession must include the Back Line into Crossrail Depot • S&C panels, ironwork and all materials delivered and offloaded into wideway during prep shifts prior to Christmas blockade • All track ballast and drainage materials installed from stockpile in wideway • Small material deliveries assumed by road such as drainage rings, catchpits, pads, clips & insulators etc • Installation of S&C carried out by Crawler Crane from wideway • 9017 Pts installed with temporary plain line panels through the switches and crossing with all S&C ironwork programmed to be installed and commissioned in Stage 9 • Spoil removal, drainage and bottom ballast installation constructed using traditional track renewal methodology using tracked excavators, 3D dozers, dumper trucks and RRV plant • On completion stockpiled spoil loaded into train of 15MT Falcon wagons on the Up Relief • Compaction of formation and bottom ballast achieved by Bomag Roller or Triple Wacker • Rail clipped up using mechanically operated plant such as Rosenqvist or Cembres • Boxing and Top ballast ran out and profiled from stockpiles using dumper trucks and RRV plant where required • All joints to be fully welded and track stressed • Tamping undertaken with a 4x4 S&C Tamper – 2 runs of each point end and any associated plain line
7	• Installation of track and drainage to the West of the	• Material delivery by rail from the Up Relief and West rail head during ROTR possessions

Stage	Summary	Methodology
	site during dayshift working in a greenfield environment	• Laydown and stockpiling areas used throughout this stage with materials unloaded from trains to facilitate dayshift working • Rail unloaded as CWR in 108m strings from LWRT in the Up Relief 4ft and then positioned in site for later installation • All track ballast, spoil removal and drainage aggregate unloaded / loaded from open top 60T Falcon wagons • New concrete sleepers unloaded from Salmon wagons – max of 3 layers at 168 sleepers per wagon • Drainage pipes unloaded from Bass wagons in 6m lengths with 24 pipes per wagon • Small material deliveries assumed by road such as drainage rings, catch pits, pads, clips & insulators etc • Where applicable S&C panels arrive on Tilting wagons and offloaded with Kirow crane into adjacent laydown areas • Non-modular S&C units constructed and installed utilising temporary slave plain line panels with S&C bearers and ironwork installed where required where panel width greater than allowable for Tilting wagons • Installation of S&C in greenfield environment carried out by Crawler Crane • 9030 Pts and 9040 Pts installed with temporary plain line panels through the switches and crossings with all S&C bearers and ironwork programmed to be installed and commissioned in later stages • Spoil removal, drainage and bottom ballast installation constructed using traditional track renewal methodology using tracked excavators, 3D dozers, dumper trucks and RRV plant • Compaction of formation and bottom ballast achieved by Bomag Roller or Triple Wacker • Sleepers run out and relayed using tracked excavator with 7 sleeper spacer beam attachment • CWR installed in 108m sections using McCulloch Rail Tracked Rail Transposers (TRTs) • Rail clipped up using mechanically operated plant such as Rosenqvist or Cembres • Boxing and Top ballast ran out and profiled from stockpiles using dumper trucks and RRV plant where required • Initial tamping of relayed sections in this stage to be undertaken by Beaver tamper due to no direct access from an operational line for a conventional tamper. Final tamping to design and subsequent line speed will be undertaken by conventional plain line and 4x4 S&C tampers in the latter stages

Stage	Summary	Methodology
8	• Stage 7 follow up works. • West Rail Head Recovery • Stage 9 prep works	• Joints welded and track stressed where applicable • Ballast delivered and offloaded into site from the West Rail Head on ROTR possession strategy of the Reliefs • Boxing and top ballast ran out and profiled from stockpiles using dumper trucks and RRV plant where required – dayshift greenfield working • Initial tamping of relayed sections in this stage to be undertaken by Beaver tamper due to no direct access from an operational line for a conventional tamper. Final tamping to design and subsequent line speed will be undertaken by conventional plain line and 4x4 S&C tampers in the latter stages • Rail unloaded as CWR in 108m strings from LWRT in the Up Relief 4ft and then positioned in site for later installation • Stage 9 S&C panels arrive on Tilting wagons and offloaded with Kirow crane into adjacent laydown areas, working from the Reliefs • S&C panels, bearers and ironwork positioned on site as required for Christmas installation • West Rail Head recovered in 18m panels and stacked in wide way for installation as plain line panels in later stages • Laydown and material storage areas prepped, RRAPs constructed and site set up and fully prepped in readiness for Stage 9
9	• Up and Dn Reliefs - East • Up and Dn Reliefs - West • 9017 Pts – units only (formation and ballast completed in Stage 6) • 9018 Pts • 9020 Pts – Formation & ballast only (temp plain lined)	• 6-day ALB with additional 5 days 2TT • Access to site from Hitachi for the West and North Pole for the East sections • **Up Relief East (incl 9018 Pts)** • Trains arrive from the West, cross onto the Dn Relief, stack to the East and cascade Locos • Section works East to West with scrap, spoil and ballast loaded and unloaded from trains on the Dn Relief • Rail burned into 20fts, unclipped and scrap rail and sleepers loaded loose to Falcon wagons • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • Plain line sleepers unloaded from Salmon wagons and spaced using excavator with 7 sleeper spacer • Rail clipped up using mechanically operated plant such as Rosenqvist or Cembres • 9018 Pts panels installed from wide way using Crawler Crane • Boxing / top ballast unloaded from Falcon wagons on the Dn Relief and profiled

Stage	Summary	Methodology
		• All trains exit worksite and possession to the West on the Dn Relief • **Up Relief West** • Trains arrive from the West, cross onto the Dn Relief, stack to the East and cascade Locos behind Up Relief trains • Section works East to West with scrap, spoil and ballast loaded and unloaded from trains on the Dn Relief • Rail burned into 20fts, unclipped and scrap rail and sleepers loaded loose to Falcon wagons • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • Plain line sleepers unloaded from Salmon wagons and spaced using excavator with 7 sleeper spacer • Rail clipped up using mechanically operated plant such as Rosenqvist or Cembres • Boxing / top ballast unloaded from Falcon wagons on the Dn Relief and profiled • All trains exit worksite and possession to the West on the Dn Relief • Tamper arrives from the West and tamps to design, 2 runs • On completion of West section Tamper conveys to East section and tamps plain line and 9018 Pts, 2 runs • On completion of Up Relief East tamper stables in Carriage Line for next stage • **Dn Relief West** • Trains arrive from the West on the Up Relief after Up Relief Trains exit the possession • Trains position East, stack and cascade Locos • Section works East to West with scrap, spoil and ballast loaded and unloaded to/from trains on the Up Relief • Rail burned into 20fts, unclipped and scrap rail and sleepers loaded loose to Falcon wagons • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • Plain line sleepers unloaded from Salmon wagons and spaced using excavator with 7 sleeper spacer • Rail clipped up using mechanically operated plant such as Rosenqvist or Cembres • Boxing / top ballast unloaded from Falcon wagons on the Up Relief and profiled • All trains exit worksite and possession to the West on the Dn Relief via 8111 Pts • Convey Tamper from Carriage Line and tamp to design, 2 runs • On completion of Dn Relief West tamper stables in Carriage Line for next stage

Stage	Summary	Methodology
		• **Dn Relief East (incl 9020 Pts)** • Trains arrive from the West on the Up Relief, stack to the East and cascade Locos • Tilting Wagon train with Kirow arrives from the West, onto the Dn Relief via 8097 x-over and stables East • Section works East to West with scrap, spoil and ballast loaded and unloaded to/from trains on the Up Relief • Rail burned into 20fts, unclipped and scrap rail and sleepers loaded loose to Falcon wagons • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • Plain line sleepers unloaded from Salmon wagons and spaced using excavator with 7 sleeper spacer • Rail installed as CWR and clipped up using mechanically operated plant such as Rosenqvist or Cembres • 9020 Pts relayed from Kirow over-end on the Dn Relief, relaying panels from Tilting Wagons on the Up Relief • Boxing / top ballast unloaded from Falcon wagons on the Up Relief and profiled • Convey Tamper from Carriage Line and tamp to design, 2 runs • All trains exit worksite and possession to the West on the Dn Relief via 8111 Pts • Welding of joints on all sections where possible completed in coordination with S&T, OHLE installation works for the remainder of the possession where applicable using insulated bogies if required
10	• Recovery of Up and Dn Mains	• Existing Up and Down Mains burned into 20fts, rails unclipped, removed and stacked with loose sleepers during dayshift working in ALO environment • All scrap materials stockpiled in wide way adjacent to the Up Main for loading • Scrap materials loaded loose to trains on the Up Main during ROTR possessions of the Mains • All trains enter and exit worksite and possession from the West. Train to be top and tailed or Loco requires run round move to exit back to West. • Note: For run round move on the Mains possession and worksite limits would require to cover 8136 x-over at Acton West Jn and 8063B Pts at Ladbroke Grove Jn
11	• Acton Cutting Crossovers – 8112AB & 8113AB	• Renewal of the Up Relief and Dn Relief including the removal of 8111AB and the installation of 8112AB and 8113AB Crossovers • Core works carried out over a series of three back to back 54h possessions of the Reliefs

Stage	Summary	Methodology
		• Due to the volume of track being relayed both the Up and Down reliefs are fully excavated, re-ballasted and relayed as plain line over the first two 54-hour blocks • On the third 54h block temporary plain line panels through the S&C footprint are removed and 8112AB and 8113AB S&C units fully installed and commissioned • Due to the location in Acton cutting it is assumed that Modular S&C units are installed for both crossovers • The Up-Relief renewal involves removal of the Temporary Up Relief and installation to final alignment • 200m of the Temporary Up Relief is lifted out in 18m panels and stacked in the wide way for reuse in the Turnbacks A, B and C in the later stages • The remaining sections of Up Relief and Dn Reliefs are scrapped out loose through the existing S&C and plain line in 9m panels to Falcon and Osprey wagons respectively • Trains arrive from the West, stack to the East, cascade Locos and work back through site East to West • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • Plain line sleepers unloaded from Salmon wagons and spaced using excavator with 7 sleeper spacer • Rail installed as CWR and clipped up using mechanically operated plant such as Rosenqvist or Cembres • 8112AB and 8113AB S&C units installed by Kirow crane and S&C Tilting Wagons • Boxing and top ballast offloaded by a combination of open top Falcon wagons and Autoballasters • Tandem tamping to design carried out by two 4x4 S&C Tampers through the crossovers • Welding of plain line joints carried out where required • Following the third 54h block an extended 16h NBS is required to carry out a spate tamp, welding, OHLE and S&T works • A regime of ROTR possessions will follow to complete welding and stressing for this section
12	• Up and Dn Mains - East • Up and Dn Mains - West • Installation of Temporary Turnout to South Rail Head	• 6-day ALB with additional 5 days 2TT • Possession and worksite require to cover 8136 x-over at Acton West Jn and 8063B Pts at Ladbroke Grove Jn • Access to site from Hitachi for the West and North Pole for the East sections Methodology • **Up Main East & Up Main West**

Stage	Summary	Methodology
		• Staged as two separate renewal sites working simultaneously with own plant, resources and haulage • Trains arrive from the West, cross onto the Dn Main, stack to the East and cascade Locos • Sections work East to West with scrap, spoil and ballast loaded and unloaded to/from trains on the Dn Main • Rail burned into 20fts, unclipped and scrap rail and sleepers loaded loose to Falcon wagons • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • Plain line sleepers unloaded from Salmon wagons and spaced using excavator with 7 sleeper spacer • CWR installed & rail clipped up using mechanically operated plant such as Rosenqvist or Cembres • Boxing / top ballast unloaded from Falcon wagons on the Dn Main and profiled • Convey Tamper into site from the West and tamp to design, 2 runs (both sections) • On completion Tamper stables in Carriage line until next stage • All trains exit worksite and possession to the West on the Dn Main • Welding of joints on all sections where possible completed in coordination with S&T, OHLE installation works for the remainder of the possession where applicable using insulated bogies if required • **Dn Main East (incl Temp Turnout)** • Trains arrive from the West on the Up Main, stack to the East and cascade Locos on completion of Up Mains East & West sections • Tilting Wagon train with Kirow arrives from the West, onto the Dn Main via 8063B Pts and stables East • Section works East to West with scrap, spoil and ballast loaded and unloaded to/from trains on the Up Main • Rail burned into 20fts, unclipped and scrap rail and sleepers loaded loose to Falcon wagons • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • Plain line sleepers unloaded from Salmon wagons and spaced using excavator with 7 sleeper spacer • Rail installed as CWR and clipped up using mechanically operated plant such as Rosenqvist or Cembres

Stage	Summary	Methodology
		• Temporary Turnout relayed from Kirow over-end on the Dn Main, relaying panels from Tilting Wagons on the Up Main • Boxing / top ballast unloaded from Falcon wagons on the Up Main and profiled • Convey Tamper from Carriage Line and tamp to design, 2 runs • All trains exit worksite and possession to the West on the Dn Main via 8136 crossovers • Welding of joints on all sections where possible completed in coordination with S&T, OHLE installation works for the remainder of the possession where applicable using insulated bogies if required • **Dn Main West** • Trains arrive from the West on the Up Main after Dn Main West section Trains exit the possession • Trains position East, stack and cascade Locos • Section works East to West with scrap, spoil and ballast loaded and unloaded to/from trains on the Up Relief • Rail burned into 20fts, unclipped and scrap rail and sleepers loaded loose to Falcon wagons • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • Plain line sleepers unloaded from Salmon wagons and spaced using excavator with 7 sleeper spacer • Rail installed as CWR and clipped up using mechanically operated plant such as Rosenqvist or Cembres • Boxing / top ballast unloaded from Falcon wagons on the Up Main and profiled • All trains exit worksite and possession to the West on the Dn Main via 8136 crossover • Convey Tamper from Carriage Line and tamp to design, 2 runs • On completion Tamper exits worksite and possession to the West on the Dn Main • Welding of joints on all sections where possible completed in coordination with S&T, OHLE installation works for the remainder of the possession where applicable using insulated bogies if required
13	• Up and Dn Main – Acton Lowers	• Methodology • Renewal of the Up Main and Dn Main plain line implementing track design lowers to final alignment • Core works carried out over a series of two back to back 54h possessions of the Mains • Possession and worksite require to cover 8136 x-over at Acton West Jn

Stage	Summary	Methodology
		• Trains arrive from the West, stack to the East, cascade Locos and work back through site East to West • All trains exit worksite and possession to the West on the Dn Main (using 8136 x-over for Dn main renewal trains) • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • Plain line sleepers unloaded from Salmon wagons and spaced using excavator with 7 sleeper spacer • Rail installed as CWR and clipped up using mechanically operated plant such as Rosenqvist or Cembres • Boxing and top ballast offloaded by a combination of open top Falcon wagons and Autoballasters • Tamping to design, 2 runs per line as required • Welding of plain line joints carried out where required • A regime of ROTR possessions will follow to spate tamping, welding and stressing for this section • Installation of track and drainage to the South and West of the site during dayshift working in a greenfield environment • Installation of South Rail Head • Material delivery by rail from the Dn Main or South Rail Head and West rail head during ROTR possessions • Laydown and stockpiling areas used throughout this stage with materials unloaded from trains to facilitate dayshift working • Rail unloaded as CWR in 108m strings from LWRT in the Dn Main 4ft and then positioned in site for later installation • All track ballast, spoil removal and drainage aggregate unloaded / loaded from open top 60T Falcon wagons • New concrete sleepers unloaded from Salmon wagons – max of 3 layers at 168 sleepers per wagon • Drainage pipes unloaded from Bass wagons in 6m lengths with 24 pipes per wagon • Small material deliveries assumed by road such as drainage rings, catch pits, pads, clips & insulators etc • S&C panels arrive on Tilting wagons and offloaded with Kirow crane into adjacent laydown areas from South Rail Head

Stage	Summary	Methodology
		• Non-modular S&C units constructed and installed utilising temporary slave plain line panels with S&C bearers and ironwork installed where required where panel width greater than allowable for Tilting wagons • Installation of S&C in greenfield environment carried out by Crawler Crane • Spoil removal, drainage and bottom ballast installation constructed using traditional track renewal methodology using tracked excavators, 3D dozers, dumper trucks and RRV plant • Compaction of formation and bottom ballast achieved by Bomag Roller or Triple Wacker • Sleepers run out and relayed using tracked excavator with 7 sleeper spacer beam attachment • CWR installed in 108m sections using McCulloch Rail Tracked Rail Transposers (TRTs) • Rail clipped up using mechanically operated plant such as Rosenqvist or Cembres
14	• Stage 13 follow up works • Stage 15 prep works	• Joints welded and track stressed where applicable • Ballast delivered and offloaded into site from the South Rail Head or Dn Main on ROTR possession strategy of the Mains • Boxing and top ballast ran out and profiled from stockpiles using dumper trucks and RRV plant where required – dayshift greenfield working • Initial tamping of relayed sections in this stage to be undertaken by Beaver tamper due to no direct access from an operational line for a conventional tamper. Final tamping to design and subsequent line speed will be undertaken by conventional plain line and 4x4 S&C tampers in the latter stages • Laydown and material storage areas prepped, RRAPs constructed and site set up and fully prepped in readiness for Stage 15
15	• 9023 Pts • 9024 Pts • 9047AB Crossover	• 6 day ALB with additional 5 days 2TT • Possession and worksite require to cover 8136 x-over at Acton West Jn and 8063B Pts at Ladbroke Grove Jn • Access to site from Hitachi for the West and North Pole for the East sections • 9023 Pts • Trains arrive from the West on the Up Main, stack to the East and cascade Locos • Kirow detaches and conveys onto Dn Main via 8063B Pts • Section works East to West with scrap, spoil and ballast loaded and unloaded to/from trains on the Up Main

Stage	Summary	Methodology
		• Existing temporary turnout disc cut into panels and loaded to Salmon wagons on Up Main form Kirow on Dn Main • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • 9023Pts relayed from Kirow over-end on the Dn Main, relaying panels from Tilting Wagons on the Up Main • Boxing / top ballast unloaded from Falcon wagons on the Up Main and profiled • Convey Tamper into site and tamp to design, 2 runs • Convey Tamper into Carriage Line for next stage • All trains exit worksite and possession to the West on the Dn Main via 8136 crossovers • Loco and Kirow consist remains on site for next stage • 9047AB Crossover • Trains arrive from the West on the Dn relief via 8113AB crossover • Kirow positions on Up Main to the West of site and stables • Section works West to East with scrap, spoil and ballast loaded and unloaded to/from trains on the Dn Relief • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • 9047AB relayed from Kirow relaying panels from Tilting Wagons on the Dn Relief • Kirow relays panels on the Up-Main over-end first, followed by Dn Main panels on completion • Boxing / top ballast unloaded from Falcon wagons on the Dn Main and profiled on both lines • Convey Tamper into position from the Carriage Line and tamp to design, 2 runs • Convey Tamper into Carriage Line for next stage • Trains position East on completion, cascade Locos and then exit worksite and possession to the West • Loco and Kirow consist remains on site for next stage • 9024 Pts • Convey Kirow consist back through site to the East and shut down clear on the Up Main • Trains arrive from the West on the Dn Main via 8047 x-over, stack to the East and cascade Locos

Stage	Summary	Methodology
		• Section works East to West with scrap, spoil and ballast loaded and unloaded to/from trains on the Up Main • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • 9024Pts relayed from Kirow over-end on the Up Main, relaying panels from Tilting Wagons on the Dn Main • Plain line sleepers unloaded from Salmon wagons and spaced using excavator with 7 sleeper spacer • Rail installed as CWR and clipped up using mechanically operated plant such as Rosenqvist or Cembres • Boxing / top ballast unloaded from a combination Falcon wagons and Autoballasters and profiled • Convey Tamper into site and tamp to design, 2 runs • Convey Tamper into Carriage Line for next stage • All trains and tamper exit worksite and possession to the West on the Dn Main via 8136 crossovers • Welding of joints on all sections where possible completed in coordination with S&T, OHLE installation works for the remainder of the possession where applicable using insulated bogies if required
16	• Recover temporary Mains Relay PL sections • Install 9039 Pts • Dn Relief to final • Install S&C bearers & ironwork: 9020 and 9040 Pts	• Removal and installation of track to the West of the site during a combination of dayshift working in a greenfield environment and ROTR possessions of the Mains and Reliefs • Rail unloaded as CWR in 216m strings from LWRT and then positioned in site for later installation • All track ballast and spoil removal unloaded / loaded from open top 60T Falcon wagons • Temporary Mains disc cut into 18m panels and lifted out and stacked with McCullochs Panel Lifters during dayshift ALO working • Excavation and bottom ballast works carried out in ROTR possession loading and unloading to/from Trains on the Up Relief and Dn Reliefs • Excavation and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • Plain line panels relayed with McCulloch Panel Lifters • Slave rails removed from panels, CWR installed with TRTs and clipped up using mechanically operated plant such as Rosenqvist or Cembres • S&C panels and ironwork for 9039 Pts arrive as temporary slaved panels on Salmon wagons on the Dn relief and offloaded into site during ROTR possession

Stage	Summary	Methodology
		• Installation of 9039 Pts during dayshift working. ‘Build in hole’ layout using temporary panels. All slave materials removed with S&C bearers and ironwork fully installed • Boxing / top ballast unloaded Falcon wagons on ROTR possession from Train on Up Main • Welding of plain line joints carried out where required in dayshift working • Renewal of the Dn Relief plain line implementing track design to final alignment • Installation of S&C bearers and ironwork on 9020 and 9040 Pts (non-commissioned) • Core works carried out over a 54h possession of the Reliefs and Mains • Trains arrive from the West on the Dn Main, stack to the East, cascade Locos and work back through site East to West • Existing Dn Relief disc cut into 18m panels and recovered by McCullochs Panel Lifter, stacking in wide way for next stage usage • Excavation, drainage and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • Plain line sleepers unloaded from Salmon wagons and spaced using excavator with 7 sleeper spacer • Rail installed as CWR and clipped up using mechanically operated plant such as Rosenqvist or Cembres • Boxing and top ballast offloaded from open top Falcon wagons • Tamping to design, 2 runs per line as required including tamping of 9031 Pts and plain line sections installed in Stage 16.1 • Welding of plain line joints carried out where required • Working from the Up Relief and Up Relief Loop at the same time as the above activities; existing temporary plain line rails, baseplates and bearers removed with new S&C bearers, baseplates and ironwork fully installed as required through 9020 and 9040 Pts. Note: installation only – commissioning planned for Stage 18
17	• Install connections to 9035 and 9033 • Install Remaining Turn Backs	• Removal and installation of final remaining sections of track during a combination of both dayshifts working in a greenfield environment and ROTR possessions of the Mains and Reliefs • Rail unloaded as CWR in 108m strings from LWRT and then positioned in site for later installation • Material delivery by rail from the Dn Relief or Up Main during ROTR possessions • Laydown and stockpiling areas used throughout this stage with materials unloaded from trains to facilitate dayshift working • All track ballast and spoil removal unloaded / loaded from open top 60T Falcon wagons

Stage	Summary	Methodology
		• Excavation, drainage and bottom ballast completed with road rail excavators and 3D dozer • Formation and ballast compaction achieved by Triple Wacker or Bomag roller • Plain line panels relayed with McCulloch Panel Lifters • Slave rails removed from panels, CWR installed with TRTs and clipped up using mechanically operated plant such as Rosenqvist or Cembres • S&C panels and ironwork for 9033 Pts arrive on Tilting Wagons on the Up Relief and relayed by Kirow over-end on the Dn Relief Loop during ROTR possession of the Reliefs • Welding of plain line joints carried out where required in dayshift working • Final tamping to design of all lines in a strategy of ROTR possessions of Mains and Reliefs • Final welding and stressing of all lines in a strategy of ROTR possessions of Mains and Reliefs • Final unloading and profiling of top ballast of all lines strategy of ROTR possessions of Mains and Reliefs • Installation of drainage in a strategy of ROTR possessions of Mains and Reliefs based on achieving 60m of drainage during a standard 8h NBS block
18	• Installation of Switches and final commissioning	• Installation of 9030 and 9031 Pts: remove existing temp plain line, skim ballast and relay new S&C for both layouts (NR56) • 9026AB: remove existing temporary plain line and install ne S&C baseplates and ironwork (NR60) • Commissioning: Full mechanical set up and testing of all remaining S&C units within final layout

9.2 OHLE

9.2.1 Introduction

9.2.1.1 As with the other disciplines, construction of the OHLE is heavily dependent on possession availability. With the multi-day ALB possessions restricted to Christmas periods, it is essential to construct as much of the new OHLE within the 'high street' environment and utilising the current Relief/Mains possession regime. As detailed in the commentary below, the OHLE works have been staged to make the best possible use of the Christmas ALB possessions.

9.2.1.2 Foundations and main steel for Acton Cutting and the structures along the Down Main will be brought in using RRV's and trailers from Acton Yard or the proposed Jewson Yard.

9.2.1.3 The foundations and main steel for the northern station area will be brought to site by train via the proposed railhead. The materials will be unloaded and stored in compounds on site until they are ready to be installed.

9.2.1.4 In the same way as for the northern station area, the foundations and main steel for the Southern station area will be brought to site by train via the proposed existing Down Main railhead. The materials will be unloaded and stored in compounds on site until they are ready to be installed.

9.2.1.5 As detailed in section 4.1.1 above, all SPS, drop tubes and registration equipment will be assembled offsite by either the supplier or the installation contractor and delivered on pallets to site by RRV.

9.2.2 Stage 3 – January to December 2022 (alternate Mains/Relies possessions)

9.2.2.1 Acton Cutting (Down Main and Up Relief)

1. Trial Holes.
2. Installation of augured concrete foundations.
3. Installation of masts and struts/ties.

9.2.2.2 Station South (Down Main)

1. Trial Holes.
2. Installation of steel pile foundations.
3. Installation of masts and struts/ties.

9.2.2.3 Stage 4 – Christmas 2022 (ALB)

9.2.2.4 Acton Cutting (Down Main and Up Relief)

- Erect Portal Booms.

9.2.2.5 Station East (Mains/Reliefs 10 foot)

- Trial Holes.
- Installation of steel pile foundations.
- Installation of masts and struts/ties.

9.2.2.6 Stage 5A – January - March 2023 (high street environment)

9.2.2.7 Station North (East of Station)

- Trial Holes.
- Installation of steel pile foundations.

9.2.2.8 Stage 5C – July - August 2023 (high street environment)

9.2.2.9 Station North (East of Station)

- Installation of masts and struts/ties.
- Erect Portal/TTC Booms.

9.2.2.10 Stage 5D – September - December 2023

9.2.2.11 Acton Cutting (Relief Lines)

- Trial Holes.
- Installation of steel pile foundations.
- Installation of masts.
- Installation of new SPS, cantilevers and ATF support assemblies.
- Transfer WR 63 & 65 from existing structure J-05-36 to structure J-05-35A.
- Splice in new aerial ATF at J-05-33, re-route and terminate at J-05-35A.
- Splice in new aerial ATF at J-06-02 re-route and terminate at J-05-39A.
- Run new ATF cable in Relief Lines 6 foot between structures J-05-35A and J-05-39A.
- Install sealing ends and associated SPS at structures J-05-35A and J-05-39A and connect jumpers to aerial ATF.

9.2.2.12 Station North (West of Station)

- Trial Holes.
- Installation of steel pile foundations.

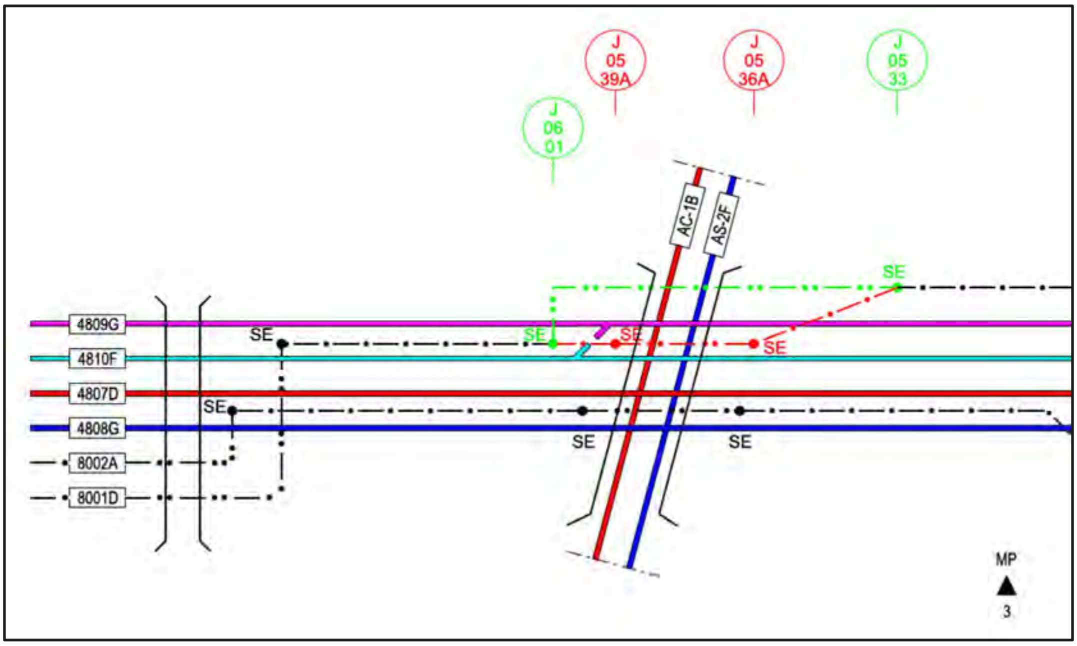

Figure 69: Proposed sectioning update for Acton Cutting ATF prior to Christmas 2023 blockade

9.2.2.13 Stage 6 – Christmas 2023 (ALB)

9.2.2.14 Station North (East of Station)

- Erect 12 No. Portal Booms.

9.2.2.15 Station North (West of Station)

- Erect 5 No. Portal Booms.

9.2.2.16 Stage 7A and 7B – January - July 2024 (high street environment)

9.2.2.17 Station North (East of Station)

- Installation of new SPS, drop tubes, registration assemblies, ATF support assemblies and anchor assemblies.

9.2.2.18 Station North (Station)

- Installation of new OBR drop tubes and registration assemblies.

9.2.2.19 Station North (West of Station)

- Installation of new SPS, drop tubes, registration assemblies, ATF support assemblies and anchor assemblies.

9.2.2.20 Stage 7C – July - August 2024 (high street environment)

9.2.2.21 Station North (West of Station)

- Installation of masts and struts/ties.
- Erect Portal/TTC Booms.

9.2.2.22 Stage 8 – August - December 2024 (high street environment)

9.2.2.23 Station North (West of Station)

- Installation of new SPS, drop tubes, registration assemblies, ATF support assemblies and anchor assemblies.

9.2.2.24 Station North (General)

- Run catenary, install droppers and run contact wire for new wire runs UR01, DR09, DR04, DR06 and UP02.
- Install anchor span insulation and carry out final registration checks for wire runs UR01, DR09, DR04, DR06 and UP02.
- Run new aerial ATF from structure J-04-55C and temporarily anchor at structure J-04-40A.
- Run new aerial ATF from structure J-05-11F and temporarily anchor at structure J-05-32A.
- Run new Relief Lines ATF cable between structures J-04-55C and J-05-11F through newly built platforms 7 & 8.
- Install sealing ends and associated SPS at structures J-04-55C and J-05-11F and connect jumpers to aerial ATF.

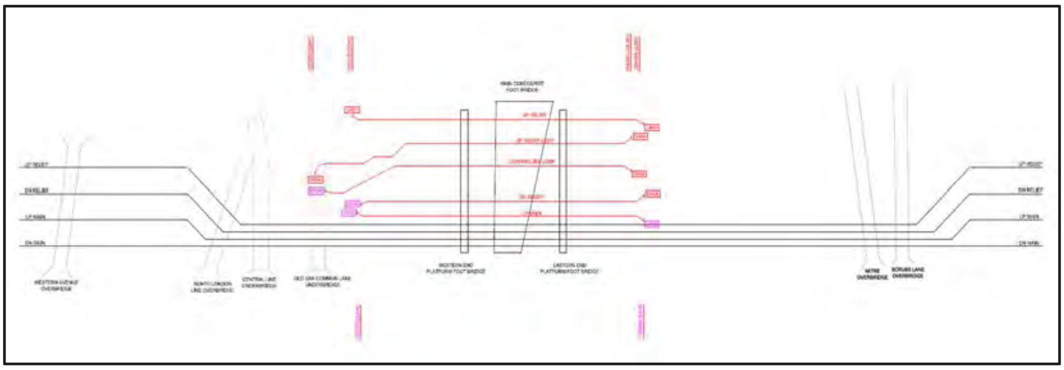

Figure 70: Station North wiring prior to Christmas 2024 blockade

9.2.2.25 Stage 9A and 9B – Christmas 2024 (ALB)

9.2.2.26 Station North (Relief Lines Temporary Alignment)

- Install temporary anchor for existing wire run 53 at structure J-04-43D.
- Run catenary, install droppers and run contact wire for new wire run UR03 from J-04-60D. Note that the new catenary is to be run from structure J-04-60D up to the existing contenary splice for wire run 53 and the new contact wire is to be run up to the existing equalising plate.
- Install temporary anchor for existing wire run 65 at J-05-32A and recover from J-06-01A.
- Anchor existing wire run 65 to create new overlap with wire run UR00.
- Run catenary, install droppers and run contact wire between structures J-05-18A and J-06-02A for new wire run UR00.
- Install temporary anchor for existing wire run 55 at structure J-04-43D.

- Run catenary, install droppers and run contact wire for new wire run DR08 from J-04-60C. Note that the new catenary is to be run from structure J-04-60C up to the existing contenary splice for wire run 55 and the new contact wire is to be run up to the existing equalising plate.
- Install temporary anchor for existing wire run 62 at J-05-32A and recover from J-06-01A.
- Anchor existing wire run 62 to create new overlap with wire run DR01.
- Run catenary, install droppers and run contact wire between structures J-05-18B and J-06-02A for new wire run DR01.
- Install anchor span insulation and carry out final registration checks for wire runs UR00, DR01, 62,65, UR03, DR08, 46 and 42.
- Cut back existing ATF cables and install 2 No. sealing ends and associated SPS at structure J-04-40A.
- Move temporary ATF anchor to final position at J-04-40A and connect jumpers from sealing end to aerial ATF.
- Splice the new ATF into the existing at J-05-32A. Temporarily anchor the remaining existing ATF which is to be recovered in Stage 10.
- Re-route Relief Line ATF to final alignment.

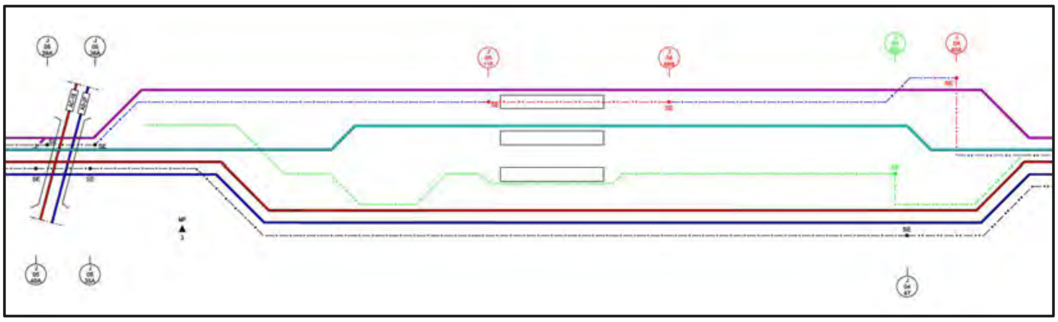

Figure 71: Proposed sectioning update for Christmas 2024 blockade works

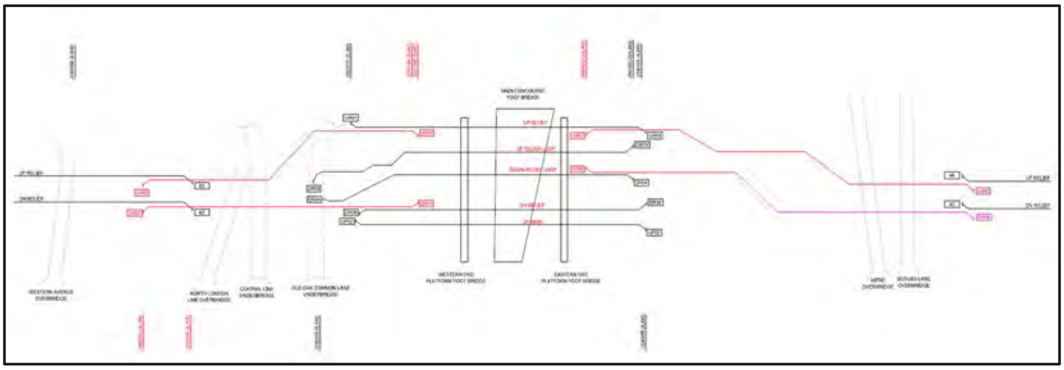

Figure 72: Station North wiring Christmas 2024 blockade

9.2.2.27 Stage 10 – January - February 2025

9.2.2.28 Station South (Existing Main and Relief Lines)

- Trial Hole, installation of steel pile foundation and installation of mast and boom for 2 No. temporary TTC structures.
- Installation of new SPS, drop tubes and registration assemblies.
- Transfer existing OHLE to 5 No. new/temporary structures and re-dropper to facilitate recovery of existing headspan assemblies.
- Recover redundant wire runs, headspan, registration & termination assemblies.

9.2.2.29 Stage 11 – March - December 2025

9.2.2.30 Station South (Existing Main and Relief Lines)

- Recover redundant masts and foundations.

9.2.2.31 Station North (Temporary Up Main)

- Installation of new SPS, drop tubes, registration and anchor assemblies.
- Acton Cutting (Relief Line Crossovers)
- Installation of new SPS, drop tubes, registration and anchor assemblies.
- Run catenary, install droppers and run contact wire between structures J-06-02A and J-06-06B for new wire run X01.
- Install anchor span insulation and carry out final registration checks for wire runs X01.
- Recover redundant wire run, registration & termination assemblies.

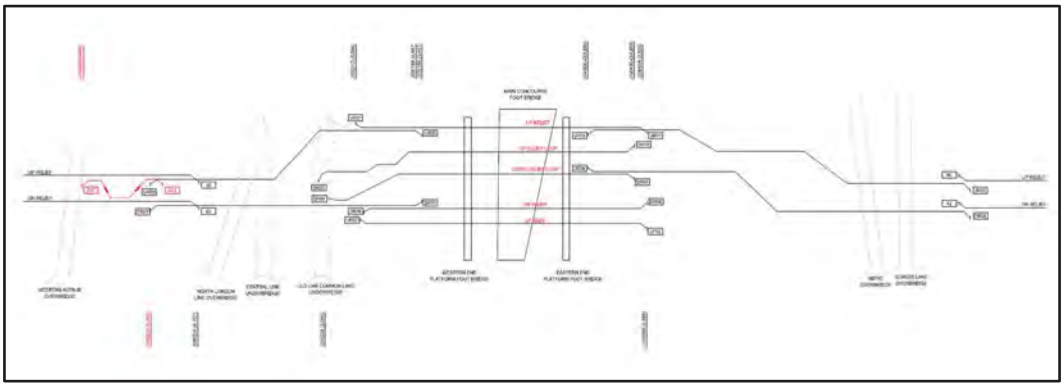

Figure 73: Acton Cutting crossovers wiring prior to Christmas 2025 blockade

9.2.2.32 Stage 12A and 12B – Christmas 2025 (ALB)

9.2.2.33 Station North (Main Lines Temporary Alignment)

- Install temporary anchor for existing wire run 58 at structure J-04-49B.
- Run catenary, install droppers and run contact wire for new wire run UP03 from J-04-60C. Note that the new catenary is to be run from structure J-04-60C up to the existing contenary splice for wire run 58 and the new contact wire is to be run up to the existing equalising plate.
- Install temporary anchor for existing wire run 64 at J-05-32A and recover from J-06-01A.
- Anchor existing wire run 64 to create new overlap with wire run UP01.

- Run catenary, install droppers and run contact wire between structures J-05-18B and J-06-02A for new wire run UP01.
- Install temporary anchor for existing wire run 56 at structure J-04-43D.
- Run catenary, install droppers and run contact wire for new wire run DN03 from J-04-60C. Note that the new catenary is to be run from structure J-04-60C up to the existing contenary splice for wire run 56 and the new contact wire is to be run up to the existing equalising plate.
- Install temporary anchor for existing wire run 61 at J-05-32A and recover from J-06-01A.
- Anchor existing wire run 61 to create new overlap with wire run DN01.
- Run catenary, install droppers and run contact wire between structures J-05-18B and J-06-02A for new wire run DN01.
- Install anchor span insulation and carry out final registration checks for wire runs UP01, DN01, 61,64, UP03, DN03, 47 and 44.

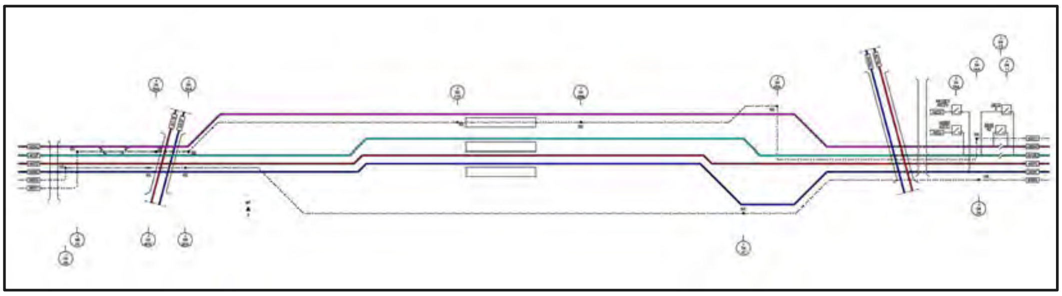

Figure 74: Proposed sectioning update for Christmas 2025 blockade works

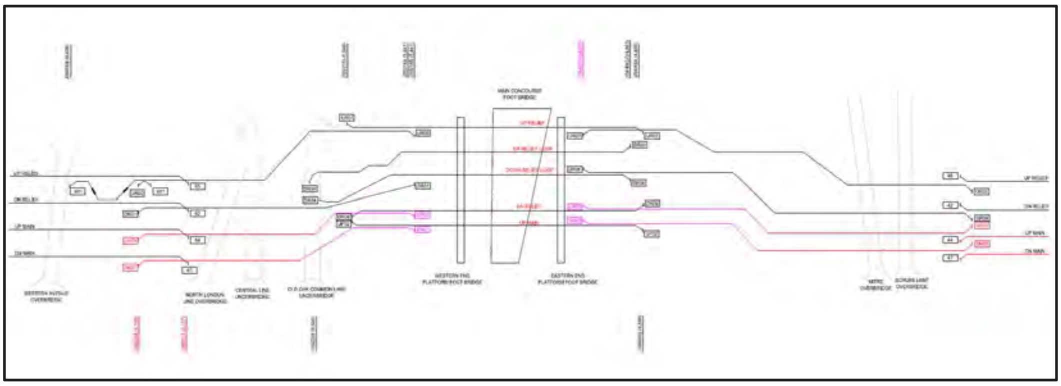

Figure 75: Station North wiring Christmas 2025 blockade

9.2.2.34 Stage 13A – January - March 2026

9.2.2.35 Station South (Existing Main Lines)

- Recover redundant wire runs, registration & termination assemblies.
- Recover redundant booms, masts and foundations.

9.2.2.36 Station South (Proposed Main Lines)

- Trial Holes.

- Installation of steel pile foundations.

9.2.2.37 Station South (Temporary Main Lines)

- Installation of new SPS, drop tubes and ATF support assemblies.
- Run new aerial ATF from structure J-04-36A and temporarily anchor at structure J-04-60C.
- Run new aerial ATF from structure J-05-11E, splice into existing ATF and temporarily anchor at structure J-05-33A.
- Run temporary Main Lines ATF cable between structures J-04-60C and J-05-11E through newly built platforms 3 & 4.
- Install sealing ends and associated SPS at structures J-04-60C and J-05-11E and connect jumpers to aerial ATF.

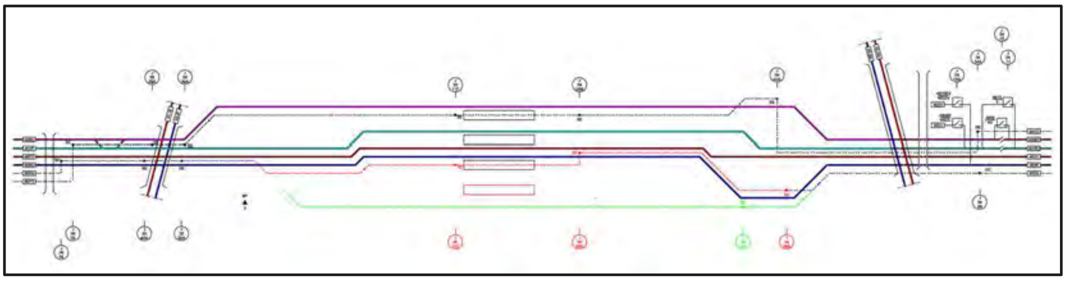

Figure 76: Proposed sectioning update for temporary routing of the Main Lines ATF

9.2.2.38 Stage 14 – August - December 2026

9.2.2.39 Station South (East of Station)

- Recover redundant booms, masts and foundations.
- Installation of masts and struts/ties.
- Erect Portal/TTC Booms.
- Installation of new SPS, drop tubes, registration assemblies and anchor assemblies.

9.2.2.40 Station South (Station)

- Installation of masts.
- Installation of new OBR drop tubes and registration assemblies.

9.2.2.41 Station South (West of Station)

- Installation of masts and struts/ties.
- Erect Portal/TTC Booms.
- Installation of new SPS, drop tubes, registration assemblies and anchor assemblies.

9.2.2.42 Station South (General)

- Run catenary, install droppers and run contact wire for new wire runs DL02, DN02, UL02, DL01 and UL01.
- Install anchor span insulation and carry out final registration checks for wire runs DL02, DN02, UL02, DL01 and UL01.
- Transfer temporary aerial ATF anchors to structures J-04-55B and J-05-11G.
- Re-route Relief Line ATF to final alignment.
- Run new Relief Lines ATF cable between structures J-04-55B and J-05-11G through newly built platforms 1 & 2.
- Install sealing ends and associated SPS at structures J-04-55B and J-05-11G and connect jumpers to aerial ATF.
- Recover temporary cabled ATF routed through platforms 3 & 4 along with sealing ends and associated SPS.

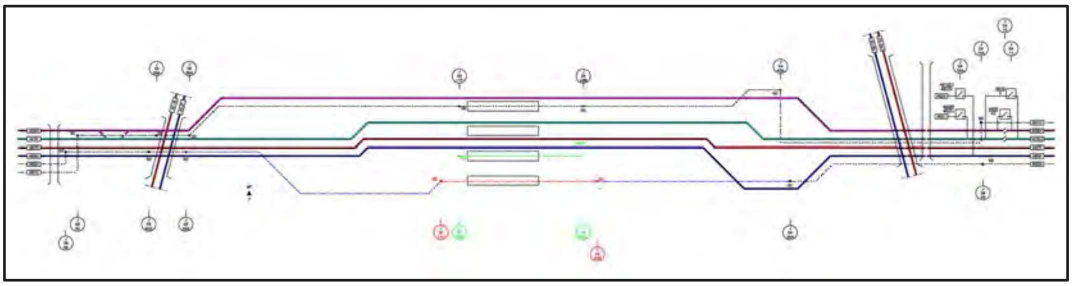

Figure 77: Proposed sectioning update for routing of the Main Lines ATF to final alignment

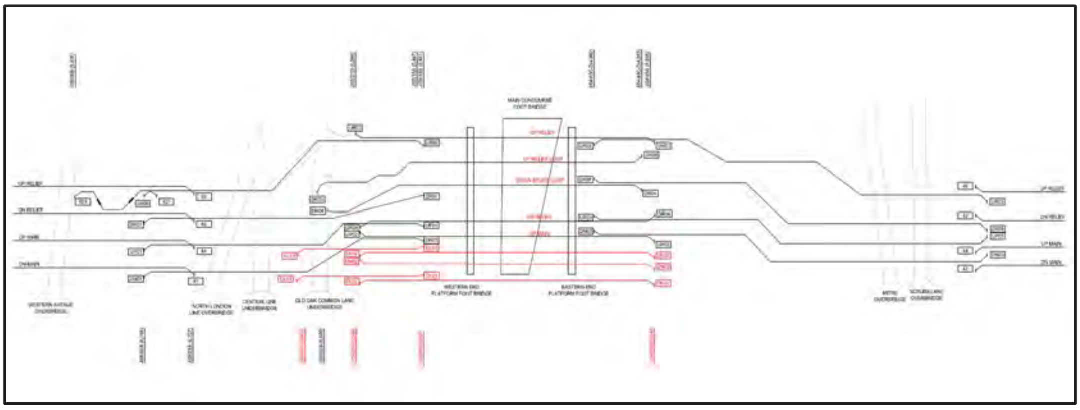

Figure 78: Station South wiring prior to Christmas 2026 blockade

9.2.2.43 Stage 15 – Christmas 2026 (ALB)

9.2.2.44 Main Lines Final Alignment (East of Station)

- Installation of new SPS, drop tubes, registration assemblies, ATF support assemblies and anchor assemblies for new overlap between structures J-04-07C and J-04-17A.
- Transfer overlap for wire runs 44 & 47 to new structures between J-04-07C and J-04-17A and re-dropper.
- Recover temporary wire runs and termination assemblies for UP03 and DN03.
- Reposition SPS, drop tubes, registration assemblies to suit final Main Lines alignment.

- Run catenary, install droppers and run contact wire for new wire run UP03 in final position between structures J-04-07C and J-04-60B.
- Run catenary, install droppers and run contact wire for new wire run DN03 in final position between structures J-04-07C and J-04-60C.
- Run catenary, install droppers and run contact wire for new wire runs DL03 and UL03 between structures J-04-43D and J-04-60C.
- Install anchor span insulation and carry out final registration checks for wire runs UP03, DN03, DL03, UL03, 47 and 44.

9.2.2.45 Main Lines Final Alignment (West of Station)

- Recover temporary wire runs and termination assemblies for UP01 and DN01.
- Reposition SPS, drop tubes, registration assemblies to suit final Main Lines alignment.
- Run catenary, install droppers and run contact wire for new wire runs UP01 and DN01 in final position between structures J-05-16A and J-06-02A.
- Install anchor span insulation and carry out final registration checks for wire runs UP01 and DN01.

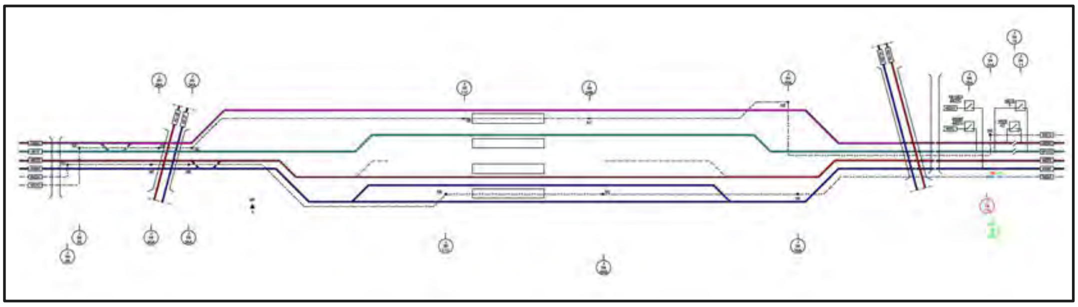

Figure 79: Proposed sectioning update for Main Lines to final alignment

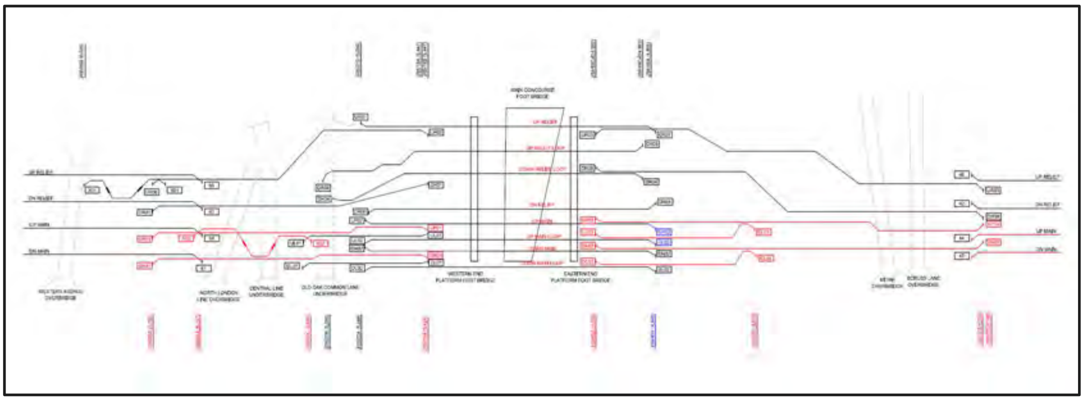

Figure 80: Station South wiring for Main Lines to final alignment

9.2.2.46 Stage 16A – January - March 2027

9.2.2.47 Main Lines Final Alignment (West of Station)

- Reposition SPS, drop tubes, registration and termination assemblies to suit final Main Lines alignment for wire run UP02 and carry out final registration checks.

9.2.2.48 Stage 16B – Easter 2027

9.2.2.49 Relief Lines Final Alignment (East of Station)

- Installation of new SPS, drop tubes, registration assemblies, ATF support assemblies and anchor assemblies for new overlap between structures J-04-07C and J-04-17A.
- Transfer overlap for wire runs 42 & 46 to new structures between J-04-07C and J-04-17A and re-dropper.
- Cut temporary wire run DR08, install new anchor at J-04-36A to terminate in final position and recover remaining wire run and termination assembly.
- Run catenary, install droppers and run contact wire for new wire run DR07 in final position between structures J-04-07C and J-04-60B.
- Reposition SPS, drop tubes, registration and termination assemblies to suit final Relief Lines alignment, install anchor span insulation and carry out final registration checks for wire runs DR06, DR07 and DR08.
- Install Switch Assembly and associated SPS for switch numbers 4810/5 and 4809/42, connect switch feeds and section prove.

Relief Lines Final Alignment (West of Station)

- Recover temporary wire runs and termination assemblies for DR01.
- Reposition SPS, drop tubes, registration assemblies to suit final Relief Lines alignment.
- Run catenary, install droppers and run contact wire for new wire run DR01 in final position between structures J-05-18B and J-06-02A.
- Install anchor span insulation and carry out final registration checks for wire run DR01.

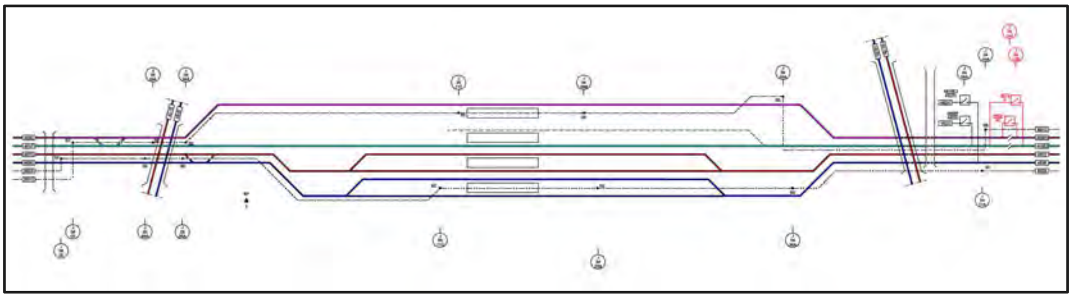

Figure 81: Proposed sectioning update for Relief Lines to final alignment

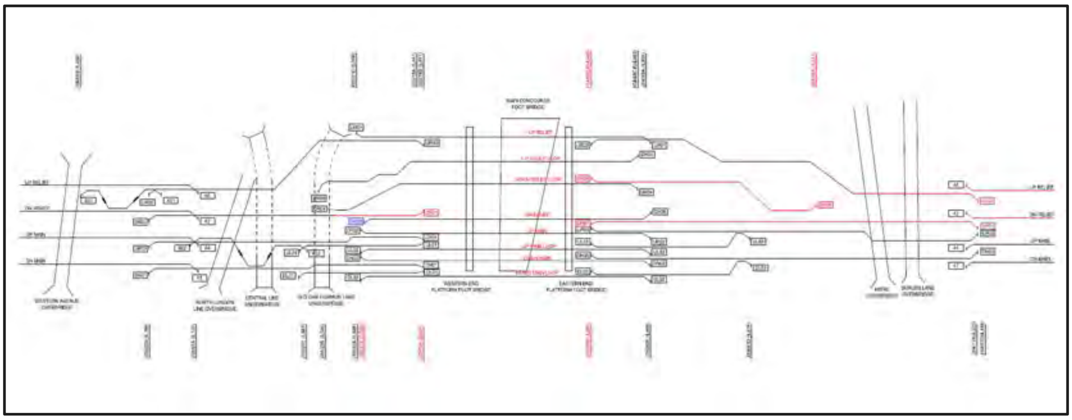

Figure 82: Station North wiring for Relief Lines to final alignment

9.2.2.50 Stage 17 – April - December 2027

9.2.2.51 Relief Line Crossovers (East of Station)

- Install SPS, drop tubes, registration and termination assemblies.
- Run catenary, install droppers and run contact wire for new wire runs UR04 and X06.
- Install anchor span insulation, section insulators and carry out final registration checks for wire runs UR04 and X06.
- Install Switch Assemblies and associated SPS. Note that switch feeds are not connected at this stage.

9.2.2.52 Relief Line Crossovers and Sidings (West of Station)

- Install SPS, drop tubes, registration and termination assemblies.
- Run catenary, install droppers and run contact wire for new wire runs UR02, DR02, DR03, DR05, X03 and X04.
- Install anchor span insulation, section insulators and carry out final registration checks for wire runs UR02, DR02, DR03, DR05, X03 and X04.
- Install Switch Assemblies and associated SPS.
- Connect switch feeds for switch numbers 4809H5/4809H6, 4810E5/4810E6 and 4809H6/4809E6 and section prove. *Note that remaining switch feeds are not connected at this stage.*

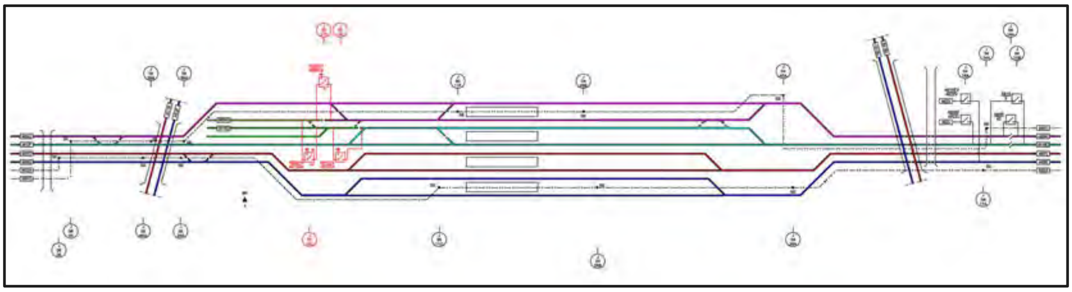

Figure 83: Proposed sectioning update for Relief Line Crossovers

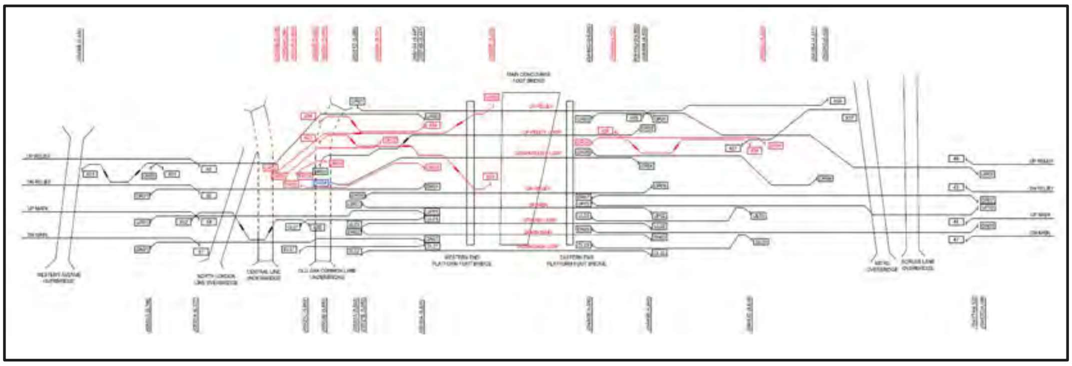

Figure 84: Station North wiring for Relief Line Crossovers

9.2.2.53 Stage 18 – Christmas 2027

9.2.2.54 Final Commissioning

- Cut in overlap insulation assemblies for Eastern and Western overlaps.
- Connect switch feeds for overlap switches and section prove.
- Cut in ATF insulation by structures J-05-12D and J-05-19A.
- Connect switch feeds for ATS switches and section prove.

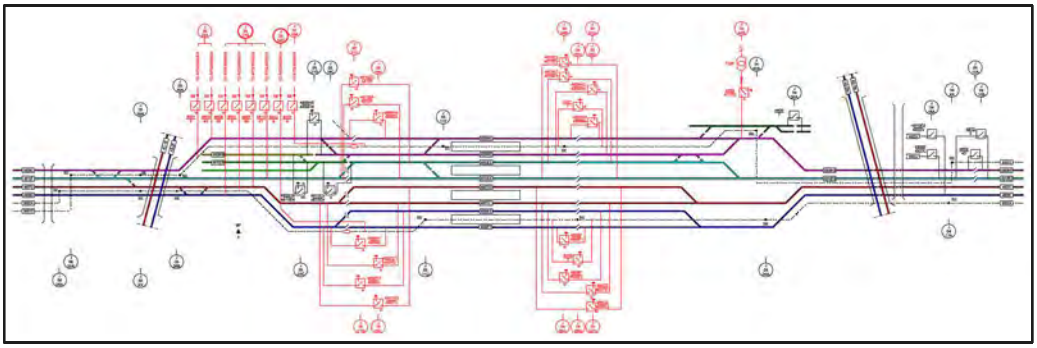

Figure 85: Proposed final sectioning

9.3 Signalling

9.3.1.1 The Signalling Design has been undertaken by Network Rail Design Delivery (NRDD). Arcadis have provided a technical lead & integration role and have undertaken some elements of the detailed design including the location area plans (LAP), configuration of the data model (3D BIM) and supported the overall construction and staging methodology of the project. Within this section of the report Arcadis are aiming to highlight the risks, challenges and complexities associated with the construction of the signalling in the Old Oak Common Area

9.3.1.2 The Signalling works within the Old Oak Common Area are led by the Network Rail, Paddington to Reading (P2R) Signalling delivery organisation. They have an ongoing scope of works that includes the following 7 projects in the same geographical area at the same time:

- Crossrail ONW works Stage M Records updates from 0mp to 29mp.
- Cross Rail West Outer Platform extensions (Associated signalling changes) between mile 12 ½ & 29mp,
- The Western ASDO Eurobalises project between 16 1/2mp and 29mp.
- The ETCS Level 2 overlay Area B & C 0mp to 12 1/2mp.
- Paddington to Stockley Train detection Conversion programme, 0mp to 12 1/2mp
- Colnbrook Branch (Heathrow 3rd runway) 12 1/2mp to 16 1/2mp
- Western Rail Link to Heathrow 16mp to 12mp

9.3.1.3 The nuances of signalling construction are far less complex than the design and testing and commissioning. All Signalling contractors have their own method for construction as they typically provide and install their own Control Centre equipment and their own trackside object controllers and follow the NR installation handbooks for any equipment that is typical.

9.3.1.4 Alstom are the incumbent signalling contractor in this geographical area and the details of the existing signalling system are detailed in the Signalling Design Specification. Throughout the design of the stages and sequence of construction, Arcadis have considered the general sequence for signalling construction. The general sequence of construction has been used to inform the decisions and evaluate risks and impacts. The overall design and methodology of Old Oak Common Rail Systems does not deviate from what is expected in conventional signalling.

9.3.1.5 The site-specific constraints are detailed in Section 3.3, The site logistics are detailed in Section 4 and the Possessions and isolations are detailed in Section 6.

9.3.1.6 One of the biggest assumptions of the constructability is around the unproven construction of the ETCS overlay system. A full Level 2 overlay system is due to be installed, then commissioned between Paddington and Acton by Christmas 2021. This is the first installation of its kind of 12 miles of ETCS level 2 overlay, which involves overlaying the ETCS on to the existing layout around the old oak common area but without any significant alteration to the train detection sections or signal positions.

9.3.1.7 The design of the ETCS will be based upon the existing train detection sections, and positioned to suit the optimum lineside signal locations for the existing layout, prior to the Old Oak Common Project. Upon completion of all stages the final ETCS train stopping positions will be located in accordance with the train detection sections designed around new lineside signal position.

9.3.1.8 The overlay will increase the total volume of four-foot equipment, signage and marker boards, as well as fundamentally changing the way that this area is driven. The transitions onto ETCS signalling for fitted trains will happen around 6 miles on the approach to the Old

Oak Common area from the west and continue all the way into the platforms at Paddington. Trains despatching from Paddington will be exiting the platforms onto the ETCS signalled area and will not transition off ETCS until beyond the Old Oak Common Area.

9.3.1.9 Arcadis have drawn upon their ETCS experience in Europe to provide ongoing assistance to Network Rail as they develop their own plans for the implementation of ETCS. The initial implementation of ETCS does happen in advance of any significant works for the Old Oak Common Scheme but only by 12 months, which in terms of signalling changes, is a short gap in time.

9.3.1.10 Not only does the railway in this area undertake the biggest change in signalling methodology for 100 years, but the scale and complexity of the remodelling of an already ETCS configured railway has not happened in the UK before.

9.3.1.11 The main equipment differences between a conventional signalling system and the ETCS overlay system is the addition of the fixed eurobalises used for location purposes. These are installed on to the Sleepers. There is also a change to the system architecture with the introduction of the RBC to manage the communications between the train, balises and interlocking.

9.3.1.12 The construction methodology makes allowances for the positioning of the balises in the four-foot, with the equipment bing similar to the positioning and installation methodology of the ATP. A balise is typically installed in advance of its commissioning by anything up to 18 months to allow for a period of soak testing.

9.3.1.13 The main construction risks associated with ETCS remodelling are around the temporary staging and implementation of balises and the repetitive configuration of the RBC Data. The P2R signalling organisation have implemented a data configuration strategy that includes a 2-year period between operational requirement and infrastructure changes. Which allows for a significant period of detailed data design to support the resilience of the RBC. Once the RBC is configured the other risk around ETCS installations are associated with inaccurate positioning of Balises.

9.3.1.14 In conventional signalling, there are significant construction tolerances up to 10m for the positioning of Axle counters and some other four-foot equipment. ETCS requires a greater level of accuracy to ensure that the configuration of the train and track communications is valid in the intelligence of the interlocking. To support the risk of inaccuracy of balise installation, the Arcadis Old Oak common Rail Systems design team have worked with the Paddington to Reading team to ensure that the stages align. The details of these stages can be found in Section 7 and the testing and commissioning details in Section 7.4

9.3.1.15 Apart from the introduction of a new signalling system and the first time remodelling of an emerging technology, the complexity in the delivery of Old Oak Common is around the interfaces and volume of work in the same physical footprint. To support the volume of change there is a requirement for multiple construction stages. Where any project undertakes multiple stages. Careful consideration must be given to the construction sequence of the signalling assets. Best practice is to prioritise the installation of equipment that is outside of the changes of the other physical infrastructure.

9.3.1.16 Old Oak common signalling changes take place far outside the boundary of the other discipline changes. These changes include signage, signals, cabling and four-foot equipment. The vast majority of these works can be undertaken during mid-week and weekend rules of the route possessions and should not require irregular disruptive possessions to install.

9.3.1.17 When considering signalling construction risks and methodology, a lot of the main constraints and risks sit within the existing condition of the site. Whereby legacy equipment, cabling and trackside apparatus cases are vulnerable to significant changes. In the instance of Old Oak, there will be entirely new cabling, equipment, and trackside apparatus cases which were replaced or heavily modified in the last 10 years. The signalling in the area is of a modern installation, <10 years, in the context of signalling and the condition and records are well understood.

9.3.2 Temporary signal sighting

9.3.2.1 One of the other considerations for the constructability of the signalling in Old Oak Common area is the complex signal sighting considerations, throughout multiple phases. The construction of a new 8 platform station on a curved, high speed infrastructure, creates challenges in sight lines around the station area.

9.3.2.2 There are also the challenges around signal sighting associated with OLE and other overhead structures. During the physical construction, there are risks around temporary visual obstructions such as hoardings or signage and the nature of a changing view of the site, which may lead to confusion and misreading of signals. To control this risk, the Arcadis construction methodology for signalling recommends that at all times during the construction and intermediary stages, the full signal sighting process must be followed. All signals, whether in temporary or final alignment must have the associated valid signal sighting forms.

9.3.3 Project specific details.

9.3.3.1 The remodelling and additional 4 tracks associated with the introduction of the Old Oak Common Station result in multiple staged changes to a significant number of signals & signage. Whilst the physical construction of the other rail disciplines is largely concentrated over a mile of congested infrastructure, between Mitre Bridge at 2 3/4mp and the North London Line Bridge at 3 3/4mp, the signalling alterations specific to Old Oak Common Station cover a much larger geographical footprint, spanning almost 4 miles.

9.3.3.2 Set out in this section is an overview of the signalling changes from east to west. The changes are described in linear order and do not reflect the sequence in which they are installed. At the time of writing, the Signalling Staged Design is under development by NRDD. The 5 main stages are described in the Signalling Testing Strategy in ch7 in more detail.

9.3.3.3 The aim of this section is to give an overview of the final changes to the signalling infrastructure. Geographically the first impact on the signalling are the speed changes in the east, starting at Kensal Green at 2mp, with a speed change on the Down main from 85/100 to 35/60.

9.3.3.4 As the project move west onto Plan 19-GW-034-01-02 we have the repositioning of multiple axle counter sections on all lines, which results in the repositioning of the axle counter heads. There are no other discipline construction works in this area, therefore the axle counter heads could be drilled and installed under soak operation until such time that they are commissioned.

9.3.3.5 In the 2 1/4mp area repositioning of the over speed sensors for SN120 signal is required. Again, the overspeed signal can be relocated without integration from other disciplines as it is installed in an area where there are no other changes. SN148 is installed on the Up Main at signalling meterage 3920.

9.3.3.6 In the area around Scrubs lane, the changes start to become more substantial. The installation works include new overspeed sensors on all 4 lines, addition of 2 new MARI & SARI indicators on SN143, addition of 1 new stencil indicator on SN139 and a total reconfiguration of the Axle Counter sections on the Carriage line.

9.3.3.7 The area around Mitre Bridge is where the other disciplines work begins, with new P-way and reconfiguration of the OLE. Signalling make changes to SN6080, SN144, SN149, SN151& SN150.

9.3.3.8 The next significant area is the platform area of the Old Oak Common Station. In the final configuration, this new 8 platform station will have 12 parallel signals on the east end and 10 signals on the west end. The construction and sequencing of these 22 signals is fundamental to the successful delivery of these complex works.

9.3.3.9 On the western approach to the station there is a very complex array of S&C, which changes over several iterations throughout the construction. Where possible, limited four-foot equipment has been intended to be positioned in this area as it will be vulnerable to damage and multiple changes. This is a confined area to work in, but the site has been separated physically to allow green field construction for the main works.

9.3.3.10 To the west of the station approach between old oak common bridge and North London Line bridge, the entire landscape of the signalling infrastructure is changed. Woks include the introduction of SN448, SN445, SN452, SN443, SN450, SN449 & SN171. The signalling construction considerations in this area are around the support of the movement of materials to and from site.

9.3.3.11 Immediately to the west of North London Line Bridge there is a significant gantry housing signals SN174. SN170 & SN168. There is a known challenge to install this gantry taking into account the wiring of the OLE.

9.3.3.12 Further to the west, around 4mp at Friars Relief junction, there are more changes with the removal of SN174 to reduce the complexity around the junction. These works are outside the parameters of the other disciplines and therefore constructed in advance of the other works. The final speed and signage changes continue up to the 5mp at Acton.

9.3.3.13 Over the whole site there are new installations or modifications to 55 signals. As detailed in the below table. The final signal ID’s and the approximate meterage off the scheme plan.

Table 16: New & Modified Old Oak Common Signals

Number	ID	Type	Status	Line	Meterage	Change
1	SN123	Straight Post	Modified	Down Relief	3090	4 aspect to 3 aspect
2	SN125	Straight Post	Modified	Down Main	3206	4 aspect to 3 aspect
3	SN114	Straight Post	Modified	Up Relief	3324	4 aspect to 3 aspect
4	SN120	Straight Post	Modified	Up Main	3389	4 aspect to 3 aspect
5	SN127	Straight Post	Modified	Down Relief	3641	4 aspect to 3 aspect
6	SN148	Straight Post	Proposed	Up Main	3920	3 aspect
7	SN134	Straight Post	Modified	Up Relief	3988	4 aspect to 3 aspect
8	SN135	Straight Post	Modified	Down Main	4019	4 aspect to 3 aspect
9	SN137	Straight Post	Modified	Down Relief	4083	4 aspect to 3 aspect
10	SN139	Cantilever	Modified	Carriage Line	4336	add 1 SARI route
11	SN143	Straight Post	Modified	Engine & Carriage Line	4337	add 2 SARI routes remove 1 MARI route
12	SN149	Straight Post	Proposed	Down Relief	4525	4 aspect & JI 2 routes

Number	ID	Type	Status	Line	Meterage	Change
13	SN6080	Ground Position Light	Proposed	Back Line	4586	2 routes
14	SN150	Straight Post	Proposed	Up Main	4642	3 aspect
15	SN144	Straight Post	Proposed	Up Relief	4642	3 aspect & JI 2 routes
16	SN151	Straight Post	Proposed	Down Main	4675	3 aspect & JI 1 route
17	SN419	Straight Post	Proposed	Down Relief Loop	5010	4 aspect
18	SN421	Straight Post	Proposed	Up Relief Loop	5010	4 aspect
19	SN423	Straight Post	Proposed	Up Relief	5010	4 aspect
20	SN410	Straight Post	Proposed	Down Main Loop	5013	Fixed Red
21	SN412	Straight Post	Proposed	Down Main	5013	Fixed Red
22	SN414	Straight Post	Proposed	Up Main Loop	5013	3 aspect
23	SN416	Gantry 1	Proposed	Up Main	5013	3 aspect
24	SN417	Gantry 1	Proposed	Down Relief	5013	4 aspect
25	SN418	Gantry 1	Proposed	Down Relief	5013	Fixed Red
26	SN420	Straight Post	Proposed	Down Relief Loop	5013	3 aspect & JI 1 route
27	SN422	Straight Post	Proposed	Up Relief Loop	5013	3 aspect
28	SN424	Straight Post	Proposed	Up Relief	5013	3 aspect & JI 2 routes
29	SN427 BR	Bracket	Proposed	Down Main	5027	3 aspect banner repeater
30	SN435 BR	Bracket	Proposed	Down Relief Loop	5156	3 aspect banner repeater
31	SN433	Straight Post	Proposed	Down Relief	5303	4 aspect & SARI 4 routes (3 symbol on SP)
32	SN435	Straight Post	Proposed	Down Relief Loop	5303	4 aspect & SARI 4 routes
33	SN437	Straight Post	Proposed	Up Relief Loop	5303	4 aspect & SARI 4 routes
34	SN439	Straight Post	Proposed	Up Relief	5303	4 aspect & SARI 4 routes

Number	ID	Type	Status	Line	Meterage	Change
35	SN436	Straight Post	Proposed	Up Relief Loop	5306	4 aspect
36	SN438	Straight Post	Proposed	Up Relief	5306	4 aspect
37	SN425	Straight Post	Proposed	Down Main Loop	5312	4 aspect
38	SN427	Straight Post	Proposed	Down Main	5312	4 aspect
39	SN429	Straight Post	Proposed	Up Main Loop	5312	3 aspect
40	SN431	Straight Post	Proposed	Up Main	5312	3 aspect
41	SN442	Ground TBC	Proposed	OOC Turnback Line C	5565	3 aspect & SARI 4 routes
42	SN444	Ground TBC	Proposed	OOC Turnback Line B	5622	3 aspect & SARI 4 routes
43	SN446	Ground TBC	Proposed	OOC Turnback Line A	5622	3 aspect & SARI 4 routes
44	SN441	Straight Post	Proposed	Down Main	5665	4 aspect
45	SN443	Straight Post	Proposed	Up Main	5665	4 aspect & JI
46	SN445	Straight Post	Proposed	Down Relief	5665	4 aspect
47	SN440	Straight Post	Proposed	Down Relief	5675	4 aspect & SARI 2 routes
48	SN450	Straight Post	Proposed	Down Main	5675	2 aspect & JI
49	SN452	Straight Post	Proposed	Up Main	5675	4 aspect & JI
50	SN448	Straight Post	Proposed	Up Relief	5679	4 aspect & JI
51	SN449	Straight Post	Proposed	Up Relief	5892	4 aspect & JI
52	SN171	Cantilever	Proposed	Down Relief	5955	4 aspect
53	SN168	Gantry 2	Proposed	Up Main	6040	4 aspect & JI
54	SN170	Gantry 2	Proposed	Down Relief	6040	4 aspect
55	SN174	Gantry 2	Proposed	Up Relief	6040	4 aspect

9.3.3.14 As well as the introduction and modifications there are also the removal of 19 signals as detailed in the below table, with reference to the Scheme Plan that they are removed from.

Table 17: Removed Old Oak Common Signals

Number	ID	Status	Plan
1	SN146	Removed	19-GW-034-01/2

Number	ID	Status	Plan
2	SN6080	Removed	
3	SN144	Removed	
4	SN6072	Removed	
5	SN151	Removed	
6	SN6109	Removed	
7	SN153	Removed	
8	SN154	Removed	
9	SN156	Removed	
10	SN157	Removed	
11	SN159	Removed	
12	SN160	Removed	
13	SN162	Removed	
14	SN163	Removed	
15	SN164	Removed	
16	SN169	Removed	
17	SN6122	Removed	
18	SN174	Removed	19-GW-034-02
19	SN174BR	Removed	

9.3.3.15 There are also 35 new points being installed or significantly modified to require new Points operating Equipment. The POE units are delivered to site pre-built in a factory environment and require connection and testing by signalling.

Table 18: POE Old Oak Common

Number	ID	Status	Line	Scheme Plan Metres (approx.)
1	9016	Proposed	Back Line	4492
2	9017	Proposed	Back Line	4535
3	9020	Proposed	Down Relief	4578
4	9018	Proposed	Up Relief	4630
5	9019	Proposed	Up Relief	4655
6	9024	Proposed	Up Main	4690
7	9023	Proposed	Down Main	4740
8	9025B	Proposed	Up Relief Loop	4750
9	9022	Proposed	Up Relief	4780
10	9025A	Proposed	Down Relief Loop	4810
11	9026B	Proposed	Down Relief Loop	4830
12	9026A	Proposed	Up Relief Loop	4900
13	9030	Proposed	Up Relief	5307
14	9031	Proposed	Down Relief	5307
15	9032	Proposed	Up Relief Loop	5420
16	9033	Proposed	Down Relief Loop	5420
17	9034B	Proposed	Up Relief Loop	5440
18	9035	Proposed	Down Relief Loop	5440
19	9036	Proposed	Up Relief Loop	5480
20	9034A	Proposed	OOC Turnback Line B	5492

Number	ID	Status	Line	Scheme Plan Metres (approx.)
21	9037	Proposed	OOC Turnback Line B	5510
22	9041B	Proposed	OOC Turnback Line B	5550
23	9040	Proposed	Up Relief	5600
24	9041A	Proposed	OOC Turnback Line A	5610
25	9039	Proposed	Down Relief	5620
26	9043	Proposed	Up Main	5620
27	9044	Proposed	Down Main	5620
28	9046B	Proposed	Up Main	5780
29	9046A	Proposed	Down Main	5870
30	9047B	Proposed	Down Main	5895
31	9047A	Proposed	Up Main	5985
32	8112B	Proposed	Up Relief	6185
33	8112A	Proposed	Down Relief	6280
34	8113B	Proposed	Down Relief	6290
35	8113A	Proposed	Up Relief	6400

9.3.4 General Sequence of Signaling Installation

9.3.4.1 Throughout the design of the stages and sequence of construction, the following general sequence for signalling construction has been used to evaluate the credibility of the signalling changes.

Surveys

9.3.4.2 Initial surveys shall be undertaken as required by the signalling contractor to determine the condition of the infrastructure and locations for the positioning of new equipment. In this particular area Alstom have been working concurrently with NR to implement ETCS and other schemes. Accordingly, signalling surveys should not be anything more than closure of existing deficiencies.

Signaling Civils

9.3.4.3 All civil building materials for equipment bases and sub routes are in small quantities and shall be delivered to site using approved access points by lorry / HIAB, or road rail delivery under possession where road access is not available or practical. Civils installation works shall be undertaken during normal working hours where protection methods can be achieved, but if not possible, mid-week and weekend possessions shall be allocated.

9.3.4.4 Civil works shall be co-ordinated with the P/Way contractors and major civils to ensure works can be undertaken safely and ground levels are finalised before construction. There are no areas of significant concern throughout the Old Oak Common Area. All necessary minor civil engineering works will be completed and inspected prior to installing cables, signals, lineside cabinets and new REB's. Delivery shall be undertaken utilising road access with lorry or crane where available or rail access using RRV as required.

Cable Management

9.3.4.5 All signalling cable running will be carried out by the signalling contractor and cable installation shall be undertaken by hand where access allows or by RRV during possessions. Tail cables shall be hand pulled or pre-cut lengths used where appropriate. Cables will be correctly labelled at the time of installation to avoid lengthy identification at termination. Maximum use is to be made of preformed and terminated cables to trackside equipment. Where cables cannot be terminated immediately the cut end shall be sealed and placed in a secure position.

9.3.4.6 All new location cases shall be pre-wired, and factory tested. All quality and testing certification is to be supplied with the location cases and shall be subject to audit by the installation and testing groups.

LOCs & REB's

9.3.4.7 The main construction considerations for LOCs and REBs are in the sighting and positioning of the Civils bases as set out in the Civils section. Within the timings allowed for the OOC stages, the following assumptions have been made. All LOC's and REB's shall be delivered from the manufacturer to the OOC site at the earliest opportunity and will be ready to provide power and testing for at least 6 months in advance of any commissioning stages.

9.3.4.8 REB delivery has been assumed to coincide with the site installation date to avoid the storage of large units at site. Location cases shall be lifted into position and secured immediately. Fire / water proofing works shall be completed following cable termination.

9.3.4.9 The allowances for signalling construction also assume that the signalling contractor will undertake all new cable termination work and populating new locations and REB's. The Signalling Contractor will undertake all new work on existing signalling as detailed on the relevant design.

Trackside and Four-foot Equipment

9.3.4.10 AWS equipment is to be installed in advance in their final position with the permanent magnets omitted, which shall be installed when commissioned.

9.3.4.11 New TPWS loops shall be installed and set to work, likewise all new ATP requirements.

9.3.4.12 New ETCS balises shall be installed in advanced and under soak testing. All non-operational Four-Foot equipment shall be isolated prior to return to traffic and shall remain disconnected until tested and subsequently commissioned.

9.3.4.13 Axle Counter trackside equipment will be installed as sited in positions of safety; preformed leads shall be used to connect to the Axel Counter heads. Installation of the heads will be undertaken during suitable possessions; permission will be sought from NR prior to any grinding of rail embossing before installation.

9.3.4.14 Axle Counter lineside cabling shall be terminated in new termination cabinets, these shall be sited to suit the design of the cable installation and will follow the same principle of location case installation and construction. The housings being of a smaller type will be delivered and installed by hand.

9.3.4.15 It is anticipated that a number of the location cases installed and commissioned during earlier P2R works may be altered and retained in temporary positions for stage works. Wires will be run within the existing cases in accordance with design in readiness for changeover and test. All wiring will be left insulated and secure at the end of each shift, wiring diagrams will be updated to show the stage of installation and left within the location.

Points & Points Operating Equipment

9.3.4.16 The new points and layouts shall where possible be preinstalled off site dependent on the PWay contractors planned methodology of installation. Where the points are fitted on site during the installation of the layout, all fitting will be delivered to site in advance and checked for completeness before the possession activity.

9.3.4.17 Control of the termination of main power cables and energisation of location cases shall be subject to agreement between the NR power engineer, installation and testing. A permit to work system shall be used once any element of the power supply distribution has been energised. This shall be subject to a separate safety procedure.

9.4 Civils

9.4.1.1 This section covers the construction methodology for Civil infrastructure. There is overlap between other discipline sections contained in this report, so this section should not be read in isolation.

9.4.2 North London Line – Embankment Wall

9.4.2.1 Construction works on the North London Line embankment wall can commence once the Reception Line is decommissioned, the track removed, and a path made clear for plant to access. A Form AA/BA will be required for ensuring plant can travel across Old Oak Common and Central Line Bridges.

9.4.2.2 The track alignment for the Up Relief will result in modifications to the existing wing wall to the East of the overbridge. To facilitate modifications to the wing wall, existing structures J/05/35 and J/05/37 will need to be removed. Additionally, the cabled ATF will need to be re-routed and it is proposed to replicate the arrangement on the Mains, where the ATF cable is located in ground troughing in the 6 foot through the bridge. These constructability requirements are presented in section 0.

9.4.2.3 Below (Figure 86) is an extract from the AIP Form 001 design detailing the location of the new retaining wall (in red) and the extent of the existing wall that is to be removed (in green).

9.4.2.4 The construction of the retaining wall is proposed to commence July 2023.

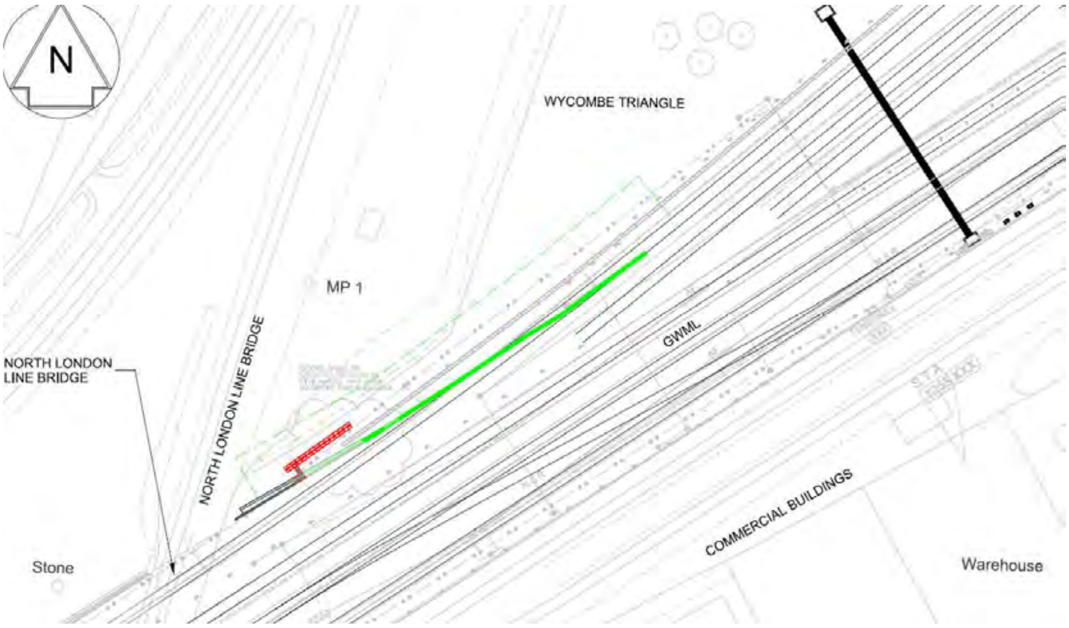

Figure *86: Location of NLL Retaining Wall*

9.4.2.5 A possible construction sequence, that could be followed to construct the North London Line embankment retaining wall is presented below. There will need to be a series of possessions on the Relief lines to ensure some of the retaining wall construction works are completed safely, but with the correct site setup a lot of work can be completed behind a fence without a possession or isolation.

9.4.2.6 Plant to track down over newly constructed Old Oak Common and Central Line bridge and at proposed location see Figure 87.

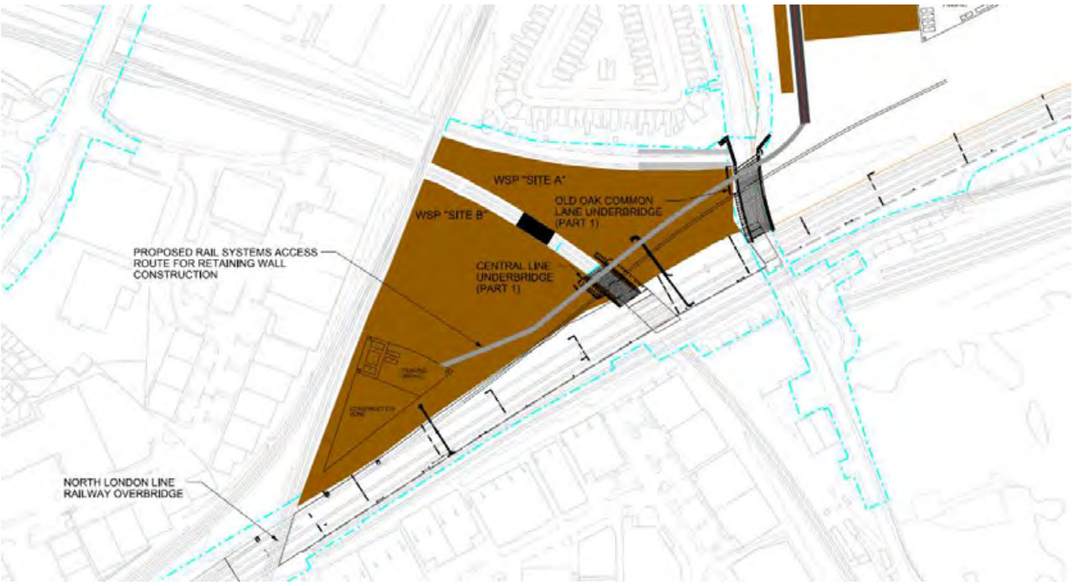

Figure *87: Route across Old Oak Common and Central Line bridge in grey*

9.4.2.7 Once plant can access embankment, de-vegetate to enable regrading works and make access route ready for plant, of which the leading factor will be an estimated 20-50t piling rig. In accordance with Network Rail standard details NR/CIV/SD/270 / NR/CIV/SD/271, vegetation clearance is to be completed within 5m of the structure. The vast majority of vegetation that is currently located at the existing site is likely to be removed to enable the contiguous pile wall and graded embankment works to be completed. This will be completed before any works are undertaken to enable space for plant movements and the storage of materials (see Figure 88)

Figure *88: Access to NLL retaining wall*

9.4.2.8 A concrete pump line will also be required to place concrete in the piles and pile cap. The new access route may require graded fill to be bought, placed and compacted, if the existing embankment ground conditions are not suitable. While regrading works are undertaken excess material, unsuitable for local reuse, will need to be stockpiled locally or removed via reception line for reuse assuming ground is not contaminated.

9.4.2.9 Access route will require a laydown area for the pile cages.

9.4.2.10 Access route may require embankment strengthening measures to create suitable piling platform. All piling platform locations will require CAT 3 check as per NRL3INICP0063. See Figure 89 below.

Figure *89: Piling platform location*

9.4.2.11 Once access route is completed, piling rig to access embankment and travel to the prepared piling platform located adjacent to retaining wall. Piling rig will need to comply with NRL3INICP0063; see Figure 90 below.

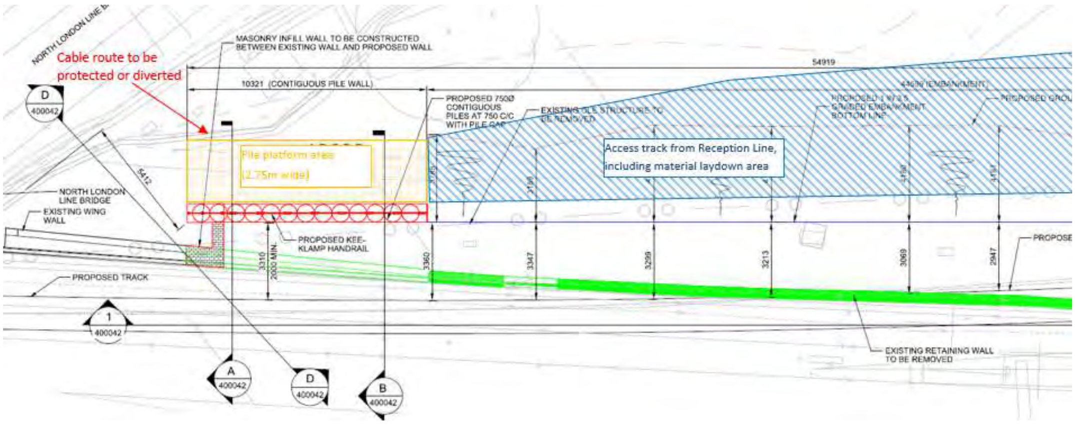

Figure *90: Image from NRL3INICP0063*

9.4.2.12 It is estimated the embankment width at the piling platform location will result in piling being restricted to working during possessions of the Up Relief. Piling take place between July and December 2023.

9.4.2.13 Piling to commence working from the NLL side of the proposed piled retaining wall back towards access. Including excavation of the holes to the required design depth, pouring of the concrete mix when retracting the auger and installation of a reinforced steel cage. The process is repeated along the length of the wall maintaining a top of pile level with existing ground levels.

9.4.2.14 Construction sequenced of piling may require piling 1,3,5,7 etc and then returning to pile 2,4,6,8 etc. to enable suitable concrete curing.

9.4.2.15 From review of 152270-25067-MLN1-DRG-ECV-400042 P01 (Figure 91 below), a concrete volume estimate has been calculated. Piles are 750mm dia. 13no. Piles.

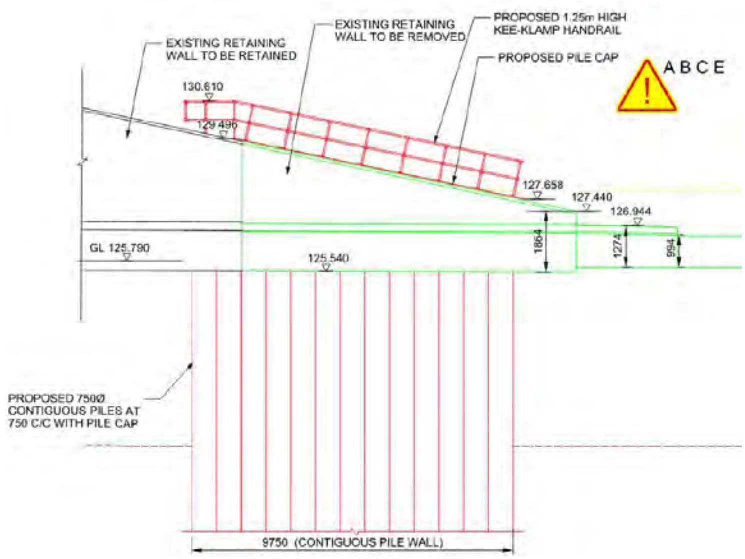

Figure *91: Image of proposed retaining wall taken from (152270-25067-MLN1-DRG-ECV-400042 P01)*

9.4.2.16 At the time of writing the pile design has not been fully completed, so this assessment is based on some assumptions, namely, pile below ground 2/3 and 1/3 above ground. Therefore, assume average pile length is approx. 9m.

- Pile area = (0.750*π^2/4) = 1.850m^2
- Pile volume = (1.850*9) = 16.65m^3
- Total pile concrete = 16.65*13no.=216.45m^3
- Assume concrete batched and delivered in 6m^3 wagons which travel from compound along reception line to embankment access = (217m^3 volume)/(6m^3 wagons) =37 deliveries estimated during piling works.
- A concrete pump will be needed to pump concrete to the piling rig.
- Once piles installed and concrete suitably cured, piles are to be broken down to design levels and prepared for casting of pile cap. This will require minor excavation around the piles for formwork placement. A temporary works design may be required.
- Once formwork for piling cap is constructed and reinforcement placed, concrete can be placed.
- Concrete volume for pile cap (based on 152270-25067-MLN1-DRG-ECV-400042 P01) = 1.0m high x 0.9m wide x 10.5m long. 1x0.9x10.5=9.45m^3.
- Again, concrete will need to be pumped.
- The effective area of existing masonry wall in front of the structure is to be carefully taken down and removed. This includes the 44m length of 2.2m retained height wall and 10m length of varying height retained wall. This will require NBS possessions of the Reliefs and RRV's to take the material away to Acton Yard for possessing or via the access path.

- The lower hight section of wall will require controlled excavation of the proposed regraded embankment. Excess material is to be taken off site via the access path.
- In order to construct the propose masonry infill between the existing masonry wall and new piled wall (see Figure 92 below), temporary works will be required to erect a scaffold access. A masonry infill wall will then be constructed between the retained masonry and contiguous piles and made good.

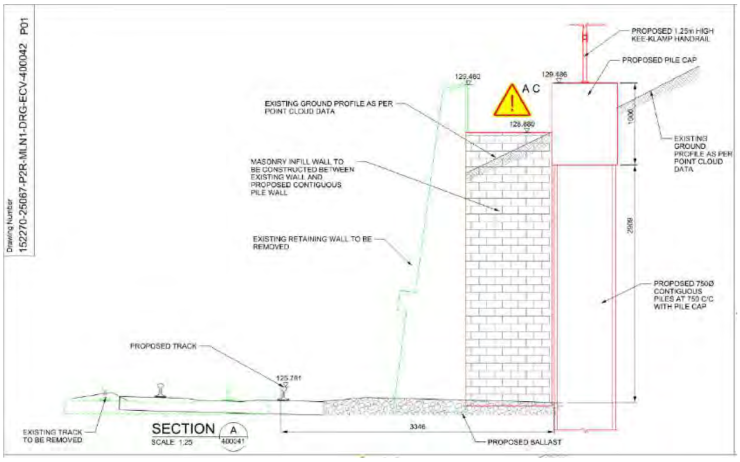

Figure *92: Proposed masonry infill between the existing masonry wall and new piled wall*

- Once new and existing walls are connected, backfill behind with 6N.
- On completion of this contiguous pile section, a 50mm shotcrete rendering will be applied to the trackside face of the structure for aesthetical reasons. This will require a mesh panel to be attached to the pile face. Shotcrete operations will require a possession of the Relief lines.
- Protection of track will be required during shotcrete operations.
- Installation of a 1.25m high 'Kee Klamp®' handrail upon pile cap.
- Working out of the site, regrading embankment in accordance with the design.
- Works substantially complete.

9.4.3 REBs

9.4.3.1 There are currently 5 no. REB's proposed for the signalling systems associated with this project, however, REB R2/140 is proposed to be installed prior to this project commencing as part of another project, so has not been including in this constructability report. Of the 4 no. new REB bases to be constructed and installed as part of this project, all are specified as concrete slab, with the expectation they will be cast in-situ. The site location of the REBs are set out below.

9.4.3.2 REB's foundations will need to be constructed in a sequence that aligns with the commissioning strategy.

9.4.3.3 See below for an example of a construction methodology for REB bases at grade.

9.4.3.4 Preparation works

- If deemed necessary temporary access will be created.
- Any S&T and services within the site boundaries will be established.

- Any services which will need protecting or temporarily diverted from construction work will be completed prior.

Base Construction

- The REB foundations are proposed to be constructed in “High Street” environment by segregating the construction works from railway operations in such a way that safety risks cannot be transferred from the worksite to the operational railway and vice versa, in this context the construction works are deemed to be outside Network Rail managed infrastructure and will not require possessions and isolations to enable works.
- Excavation of the foundations shall be in accordance with the AFC Design.
- Excavations will be carried out with the use of a machine.
- Any oversized cobbles, boulders and organic materials shall be removed from the formation level and any voids will be filled with suitable fill material.
- The reduced levels will then be built up to the required design level using well compacted suitable fill materials and compacted in accordance with agreed AFC design.
- Formwork / steel pans will then be constructed and braced accordingly.
- Pre-bent reinforcement or reinforcing mesh will then be placed
- Dependant on location the concrete will be placed by pump, chute, skip or conveyor.
- A pre-determined wash out pit or constructed wash out pit will used to enable concrete lorries or remixer to be washed.
- Once the concrete has reached sufficient strength shuttering / formwork will be stripped.
- Once suitable curing has taken place the REB unit can be landed.
- REB’s will be delivered to site using a Hiab Lorry.
- Hiab lorry or small mobile crane will lift the REB onto the base. Once in place Signalling will commence cabling in readiness for commissioning.

9.4.3.5 R3/13 base can be constructed during January to March 2023 prior to the P-Way being installed to the East of the station. This will make logistics easier.

9.4.3.6 REB R3/13 can be landed between July to December 2023. It is envisaged the REB will be bought to on a trailer and lifted off on to the newly constructed base by a Hiab or small mobile crane sited in the near vicinity, in this case the REB and lifting plant will need to access site from Wells House road and travel through the station site. It is a good idea to minimise the number of lifts for a REB because they are fragile equipment. If the P-Way works at the East of the station are completed faster than expected the delivery or a path through the stations site is not possible the REB will need to be via RRV.

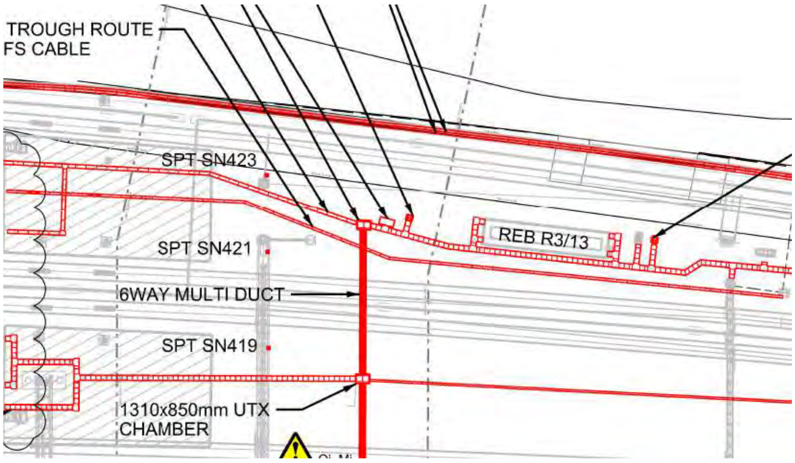

Figure *93: REB R3/13 located at chainage – 4890.000*

9.4.3.7 It is proposed that REB M3/13 base is constructed during January to March 2023 prior to the P-Way being installed to the East of the station.

9.4.3.8 It is proposed that REB M3/13 can be landed between July to December 2023. It is envisaged the REB will be bought to on a trailer and lifted off on to the newly constructed base by a Hiab or small mobile crane sited in the near vicinity, in this case the REB and lifting plant will need to access site from Wells House road and travel through the station site. It is a good idea to minimise the number of lifts for a REB because they are fragile equipment. If the P-Way works at the East of the station are completed faster than expected the delivery or a path through the stations site is not possible the REB will need to be via RRV.

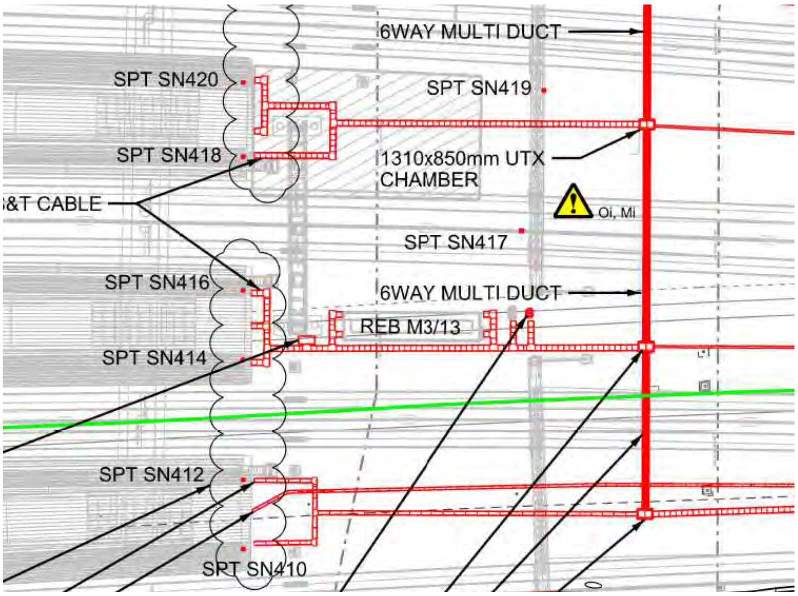

Figure *94: REB M3/13 located at chainage – 4990.000*

9.4.3.9 It is proposed that R3/45 base is constructed during July to August 2023 prior to the P-Way being installed to the West of the station. This is the same timeframe that the OHLE foundations are being installed.

9.4.3.10 It is proposed that REB R3/45 is landed between January to March 2024. It is envisaged the REB will be bought to on a trailer and lifted off on to the newly constructed base by a mobile crane sited in the near vicinity. It is a good idea to minimise the number of lifts for a REB because they are fragile equipment. But again if delivery by RRV is needed then it is possible from Action Yard.

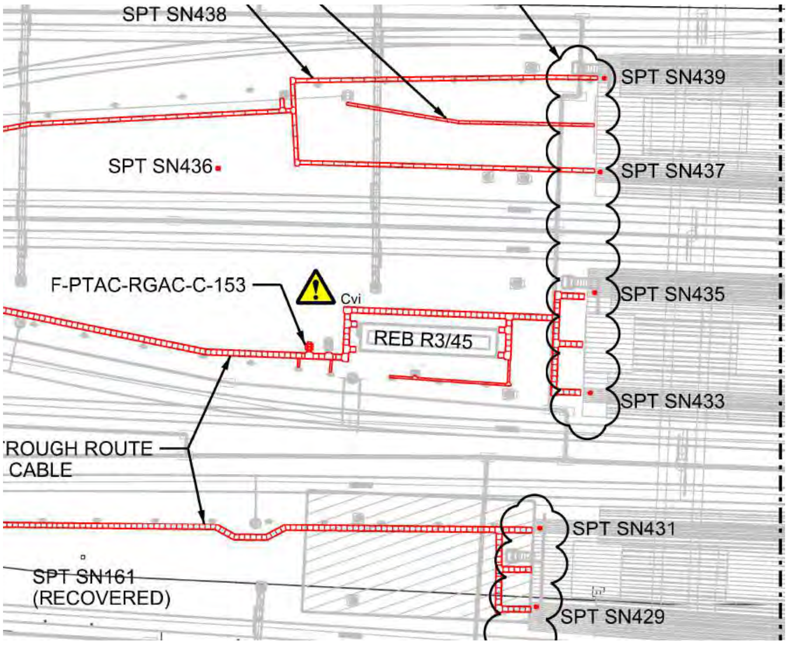

Figure *95: REB R3/45 located at chainage – 5295.000*

9.4.3.11 It is proposed that R3/45 base is constructed during July to August 2023 prior to the P-Way being installed to the West of the station. This is the same timeframe that the OHLE foundations are being installed.

9.4.3.12 It is proposed that REB R3/45 is landed between January to March 2024. It is envisaged the REB will be bought to on a trailer and lifted off on to the newly constructed base by a mobile crane sited in the near vicinity. It is a good idea to minimise the number of lifts for a REB because they are fragile equipment. But again if delivery by RRV is needed then it is possible from Acton Yard.

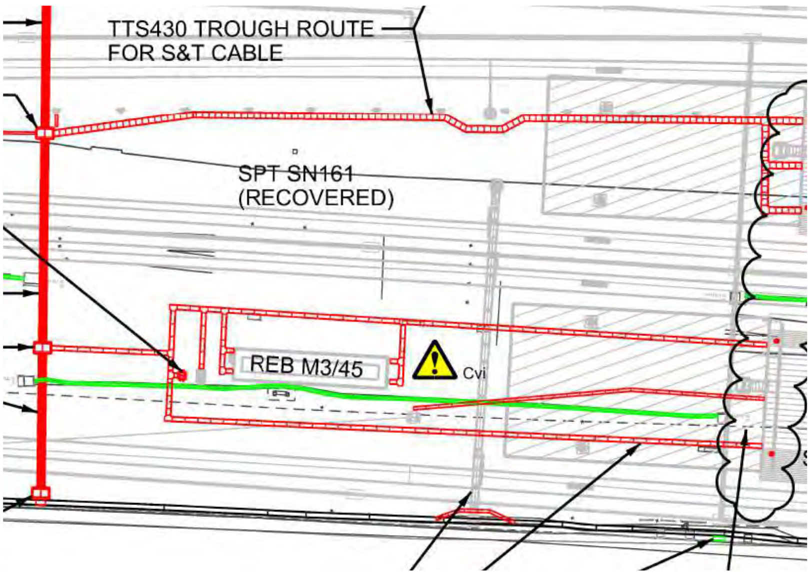

Figure *96:* REB M3/45 located at chainage – 5325.000

9.4.4 PSPs

9.4.4.1 There is currently 1 no. new PSP proposed at approx. chainage 4740. The PSP base design is a concrete slab, with the expectation of cast in-situ. The location of the PSP is set out below in Figure 97. The construction methodology will mirror the REB base methodology outlined above with a few additionally requirements. Namely, the compound is proposed to be fenced with a gate large enough for a lorry to deliver a temporary generator, and an access road is required suitable for turning of a lorry. Lighting of the compound is also required.

9.4.4.2 The PSP is required to power FSP in Loc R2/155 which is needed at the end of 2023. Therefore, the PSP compound is proposed to be constructed January to March 2023, with the PSP delivered no later than the end of 2023.

9.4.4.3 The PSP can be delivered via the access road that is to be constructed and lifted on the base via a small mobile crane. If delivery by road is an issue due to the construction works being undertaken at OOC Station and the Box Station, then then all materials could be delivered by RRV and or Train from Acton Yard on the Up Relief during NBS possessions. This method is not desirable but possible if no other option.

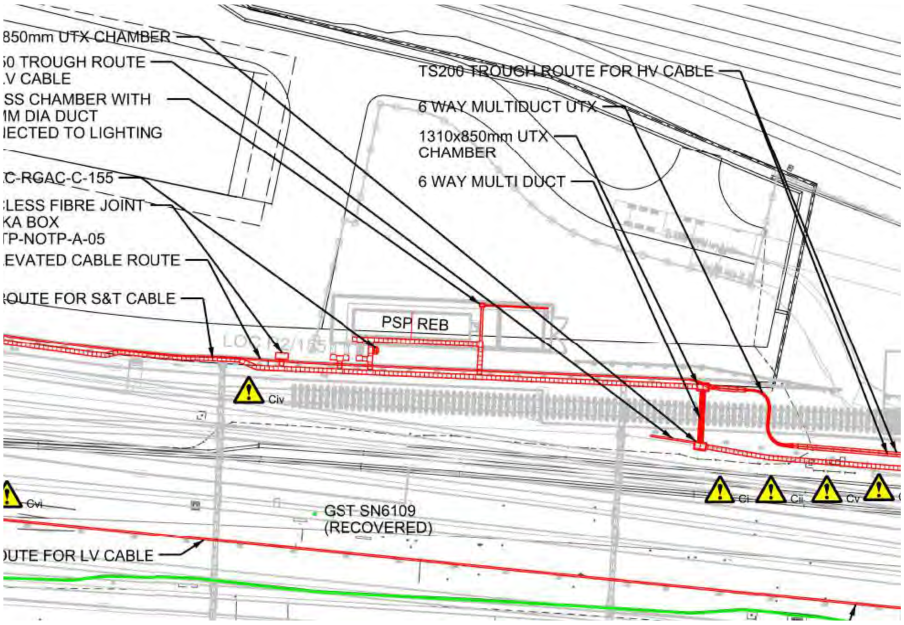

Figure *97:* PSP location

9.4.5 LOC Suites

9.4.5.1 In addition to this section, please refer to Signalling section 9.3

9.4.5.2 At the time of writing the location sighting forms are still in development.

9.4.5.3 Location suites are to be positioned such that access to them is as safe as practicable, and on level and flat ground. The locations will also need to consider future changes or aspirations of rail infrastructure so not to drive relocation costs at a later stage.

9.4.5.4 Typically, location suite construction will consist of a retained hardstanding of compacted graded fill material, with concrete trough route, location precast stool, handrail, and potentially step access, see example below in Figure 98. To avoid having to bond handrail, it is recommended all handrail used is GRP this will save time and cost associated with earthing and bonding activities.

9.4.5.5 Locations cabinets are connected to precast concrete stools, which are embedded in the hardstanding.

9.4.5.6 Earthing matts are installed under the hardstanding and backfilled with conductive aggregate and connected to earthing pots and the location cabinet.

9.4.5.7 Construction of a noncomplex location suite, to the point of ready for landing a LOC case, can be completed by hand if needed, but a small excavator will reduce construction time.

9.4.5.8 For remote sites, materials for location suite construction can be strapped to pallets and delivered by RRV's during NBS possessions.

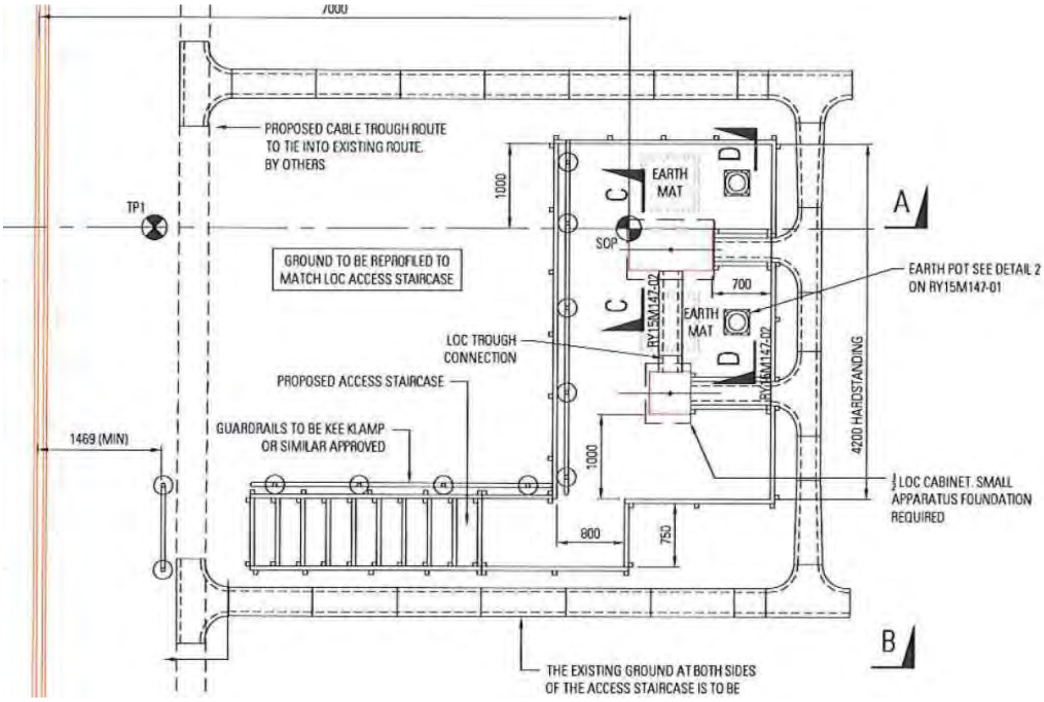

Figure *98:* Typical location suites

9.4.5.9 Where topography is not flat, a location suite may need to be constructed on a staging. This will require concrete pad foundations or if ground conditions are unfavorable, piles.

9.4.5.10 The staging can be either steel or glass reinforced plastic. Ladder access is sometime needed to access the staging. Ideally this type of solution can be avoided if locations suites are sighted with constructability in mind. An example of this type of construction is detailed below in Figure 99.

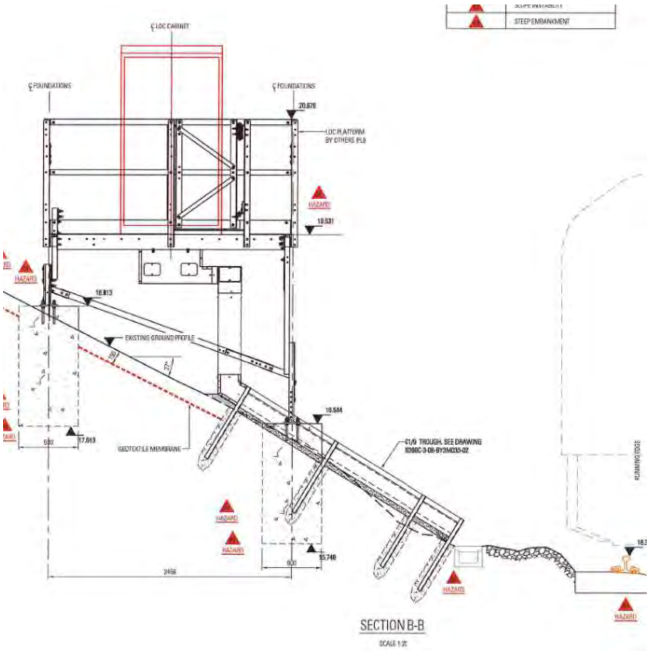

Figure *99:* Location suite with ladder access

9.4.6 Signal Structures

<u>Straight Post Signals</u>

9.4.6.1 There are 41 straight post signals, of which 10 are existing and proposed to be modified. Of the 10 propose to be modified the structures are a mixture of climbable and non-climbable and it is approximated they are around 10 years old.

9.4.6.2 Modified signals mean the signals heads currently installed on the structure will be changed. Changing out the signal heads for the 10 signal posts can be undertaken in normal NBS possessions. Blacking off unused signal aspects and or not wiring up until commissioning is proposed.

9.4.6.3 The 31 new straight post signals shall be position as per signal sighting forms to facilitate the newly remodelled layout. New straight posts signals are proposed to be of the conventional light weight type and non-climbable, which do not require ladder access to the signal head, instead they collapse under guide of a winch mechanism for maintenance.

9.4.6.4 To facilitate works the new signals shall be sited where practicable behind signals and in positions where sighting of existing infrastructure is not restricted.

9.4.6.5 Signal bases will be assessed through design based on ground conditions, to identify the suitability for piles or concrete pad foundations. Buried service investigations should be completed prior to any foundation construction works.

9.4.6.6 It is anticipated signal post foundations with be installed in a sequence that aligns with the commissioning strategy. Broadly speaking this means installing signals at the Eastern extent, then Western extent and completing the station area last.

9.4.6.7 Signal foundations and signal structure erection can be completed in either short weekend possessions, or when locations are adjacent to non-operational new track, works can be completed during day time in a "High Street" environment.

9.4.6.8 A screw pile, pin pile, or prefabricated or cast insitu concrete pad foundation can be installed in short possessions, circa 5 hrs, and the prefabricated light weight straight post can be lifted on and bolted in 30 minutes.

9.4.6.9 Materials and plant for signal construction can come from Acton Yard, or other nearby RRAP points. Delivery is also potentially possible by road through OOC station site compound.

Cantilever Signal - SN171

9.4.6.10 Currently there is one cantilever signal structure being proposed. Cantilever SN171 is adjacent to North London Line bridge at chainage 5955. The structure is founded in the 6ft between the Up Relief and the Down Relief and cantilevers over the Down Relief. The Form 001 design details concrete pile foundation with pile cap.

9.4.6.11 The Cantilever is proposed to be installed during a series of NBS possessions between October to December 2023.

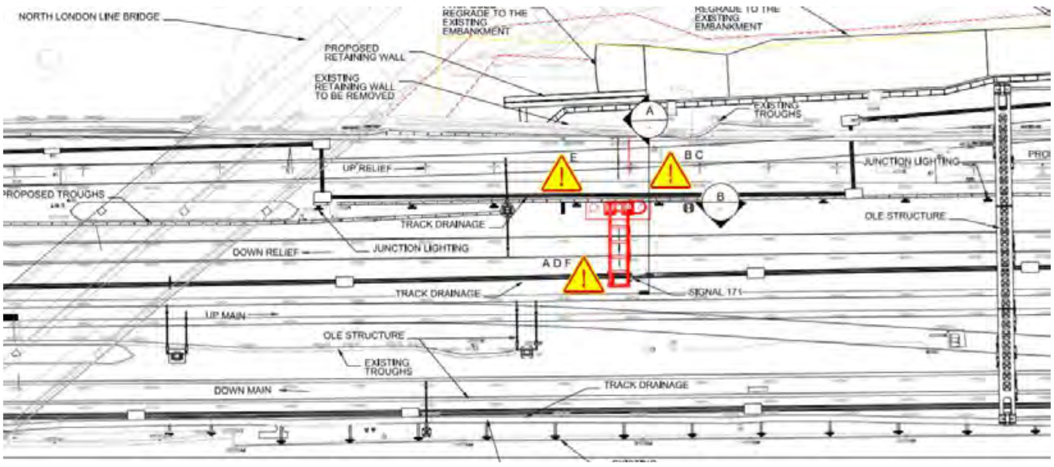

Figure *100:* Cantilever Signal SN171

9.4.6.12 All construction materials and plant will travel from Acton yard during possession.

9.4.6.13 The foundation can be installed from a RRV piling rig positioned on the Up Relief. Concrete can be delivered to site on a RRV trailer and pumped using a small trailer mounted pump.

9.4.6.14 Suitable protection measures will be required to protect the track and ballast during foundation construction.

9.4.6.15 The column, boom, and dropper can be lifted into place using a RRV Crane positioned locally on track. A RRV MEWP or scaffold tower will be required to enable access to bolt the steel work together.

9.4.6.16 Anticipated possession time frame for delivery of cantilever solution based on Form 001 AIP:

- Piling and concrete 16hrs NBS possession
- Pile cap and concrete 16hrs NBS possession
- Streel work installation 16hrs NBS possession

9.4.6.17 There may be opportunities to enhance the foundation design to improve the constructability during the detailed design stage.

Gantry Signals

9.4.6.18 Currently there two gantry signal structures being proposed; they are SN174-SN170-SN168 adjacent to North London Line bridge countryside, and SN418-SN417-SN416 at the London end of OCC Station platforms 4 & 5.

SN174-SN170-SN168

9.4.6.19 The gantry is currently proposed to be installed during November to December 2023 during a series of NBS possessions.

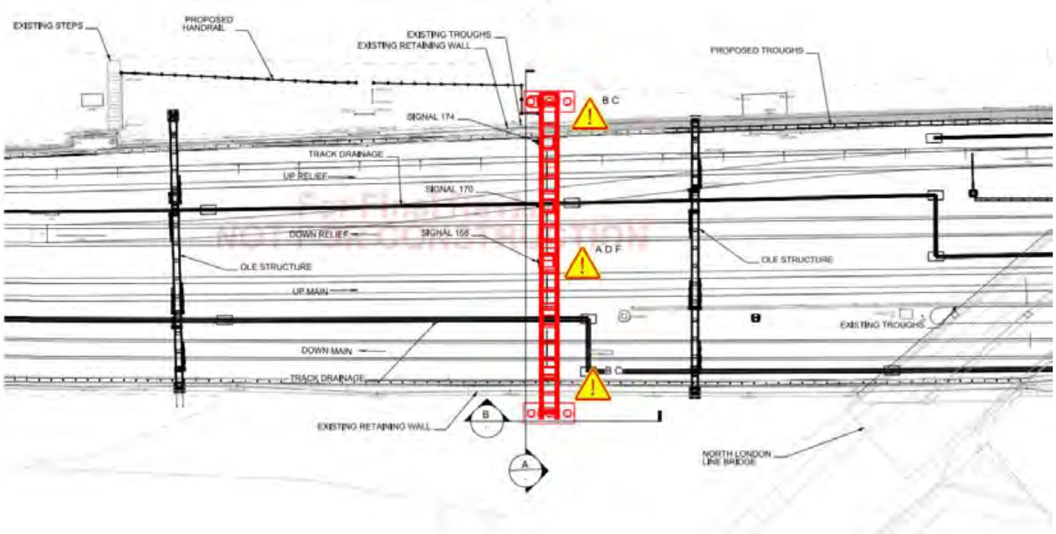

Figure *101:* SN174-SN170-SN168 location

9.4.6.20 The gantry is located in the Acton cutting at chainage 6040 and the foundations are currently proposed to be concrete piles with pile cap located behind the existing retaining wall that run along the cutting. The space is the cess on both sides is very limited, so the foundations have been located behind the cutting retaining wall. It is anticipated that the retaining all on the Down Main and Up Relief cess is too high to allow a RRV Piling Rig to pile behind from track.

9.4.6.21 There may be opportunities to enhance the foundation design to improve the constructability during the detailed design stage.

9.4.6.22 The propose methodology is based on the current Form 001 design proposal for SN174-SN170-SN168 gantry.

9.4.6.23 To construct the Down Main cess foundation, please see proposed access path below. A temporary RRAP will be required to track plant across the North London Line tracks. A survey of the services in the area will need to be undertaken to determine what needs to be protected. A temporary works design will be required to ensure the retaining wall is not overloaded. Protection measures will be needed to ensure the risk of falling from height is eliminated.

9.4.6.24 Vegetation clearance will be required, and some minor regrading works to prepare a piling platform. The piling platform may need to have material imported.

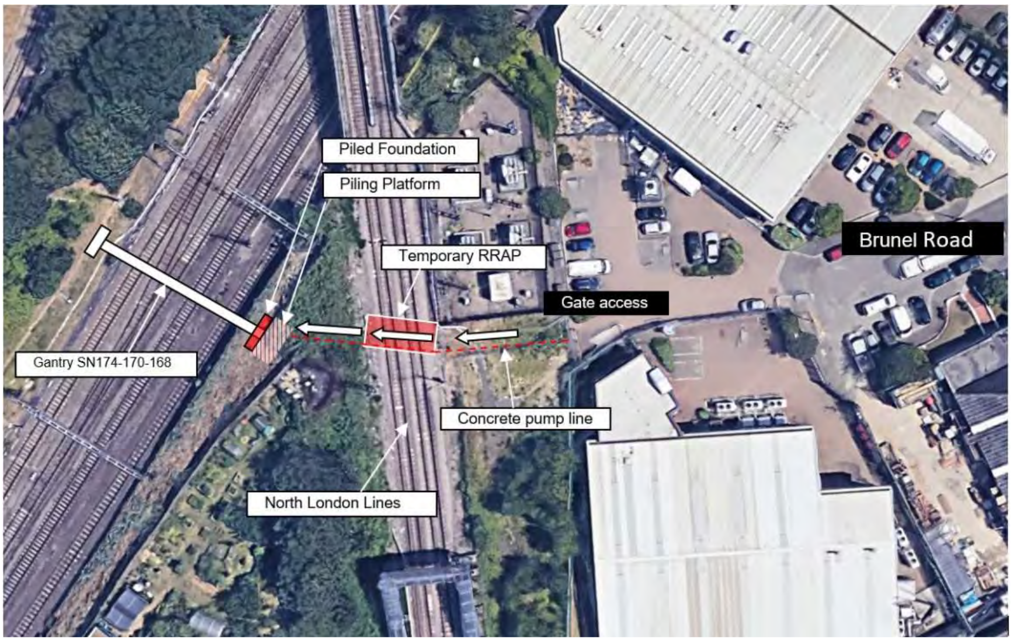

Figure *102:* Proposed access route to SN174-SN170-SN168

9.4.6.25 To supply concrete to the piling rig during piling operations, a concrete pump line will be required. It is proposed the pump line be installed under the track from Brunel Road to the piling rig. This will eliminate the requirement to have North London Line under possession for concrete pouring. Concrete wagons will supply a concrete pump located near the access to the rail corridor on Brunel Road.

9.4.6.26 To construct the Up-Relief Cess foundation, it is proposed that an agreement to access through the Victoria Industrial Estate is reached. A temporary secure access gate will need to be installed to ensure the security rail land.

9.4.6.27 The proposed access route (see Figure 103) for a piling rig and later crane is detailed below. A piling platform which can also be used for a mobile crane can be installed adjacent to the foundation.

9.4.6.28 The access route along the Cess of the Up & Down Poplar will require a temporary RRAP to track plant across along with a concrete pump line. Vegetation clearance and protection of rail services must be carried out. A small tracked excavator should be able to create the access path with a small team to help with the vegetation clearance. Local regrading will need to be done.

9.4.6.29 A temporary works design is needed to ensure the stability of the retaining wall adjacent to the Up-Relief gantry foundation is not compromised by the plant during the works.

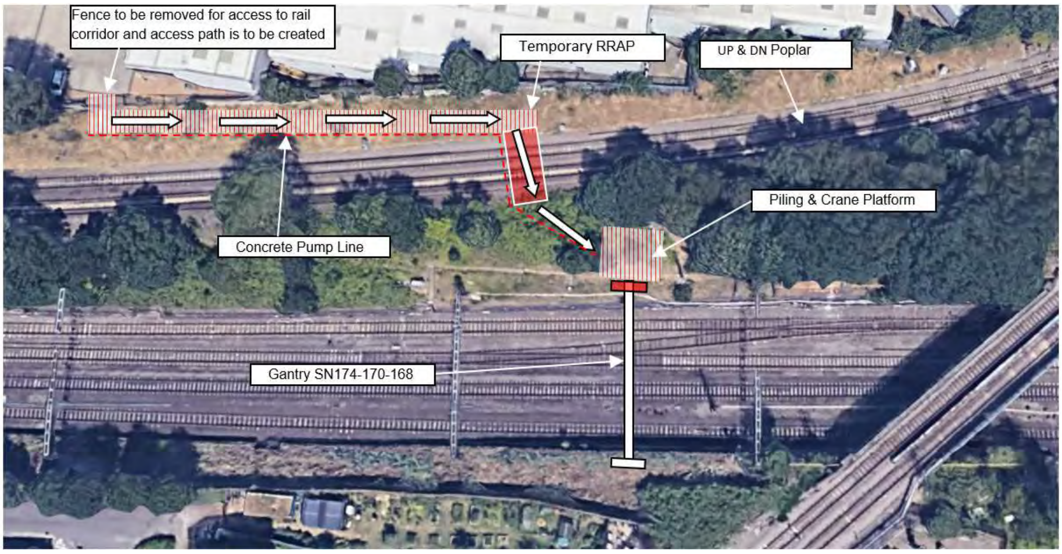

Figure *103:* Proposed access route for piling

9.4.6.30 Once the foundations are installed and suitable cured. The gantry steel work will need to be bought to site. Steel work will need to be sized according to transportation restrictions. The gantry columns are likely to be delivered as complete units, but the boom will need to come in sectioned and spliced.

9.4.6.31 There are multiple options for getting the steel work to site. RRV's can deliver the steel work on RRV trailers on the Up & Down Relief lines travelling from Action Yard. Once the steel work is on site, at the Gantry location, it can be lifted into place from a crane. The boom sections can be supported on timber sleepers and spliced on track. Once bolted together the complete boom can be lifted into place. The boom is best spliced parallel to track and then lifted between the OHLE wires in the 10 foot. The boom can be slung 90 degrees once above the wires and landed on the recently installed columns.

9.4.6.32 RRV MEWP's will be needed to provide access to the top of columns for bolting the boom to the column. Alternatively scaffold towers can be used. Access will be required to the top of both columns to land the boom.

9.4.6.33 If the access route to the Up-Relief foundation is still available, it makes sense to bring a mobile crane to site and use the previously installed piling platform. This will give the best lifting opportunity and avoid the risk of a tandem lift. If this is not possible RRV cranes will be needed and these can be positioned on the Down Relief and or Up Main. Careful consideration will be needed lifting the boom between the overhead lines.

9.4.6.34 Dropper cages can be installed at a later date or if time permitted in the same possession. The delivery of these can be via Acton Yard on RRV's. Dropper cages will need to be lifted to the underside of the boom and then bolted. Therefore, personnel access is required to the boom. This can be via RRV MWEP or scaffold towers.

9.4.6.35 Signal cabling for the signals is located in the Up-Relief cess and so cabling for the proposed gantry will require a cable route to be run up the existing retaining wall on the Up-Relief side to access the leg. This can be installed during a weekend possession lasting around 5hrs.

<u>SN418-SN417-SN416</u>

9.4.6.36 The Gantry located at chainage 5010 at the London end of OOC Platforms 4 & 5 foundations (see Figure 104 below).

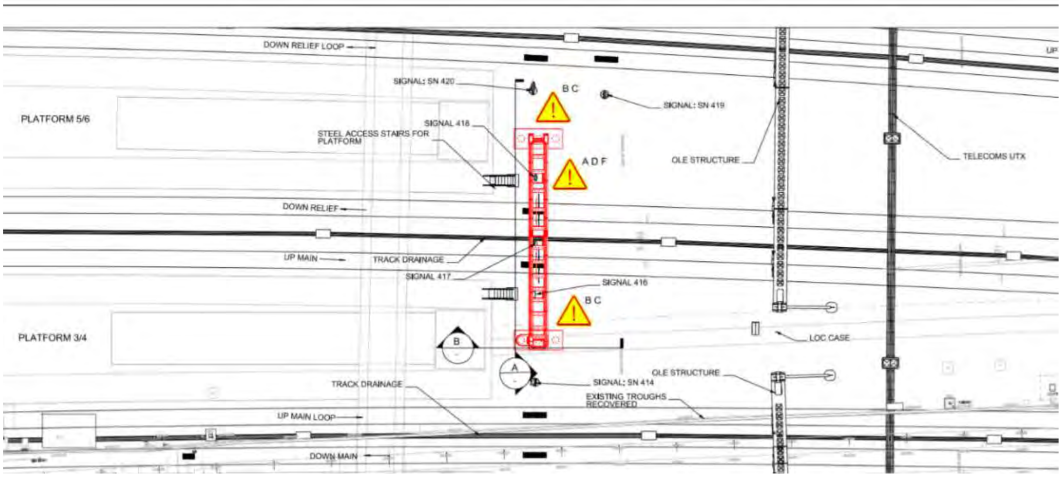

Figure *104:* SN418-SN417-SN416 location

9.4.6.37 The propose methodology is based on the current Form 001 design proposal for SN418-SN417-SN416 gantry.

9.4.6.38 The Form 001 details concrete piles with pile cap. Both foundations can be constructed at the same time. It is proposed this takes place between January and March 2023 at the same time the OHLE structure foundations are being installed. During this date there will be no P-way in place. It is therefore proposed a piling rig be tracked through the station area from Old Oak Common Wells House Road access.

9.4.6.39 A piling platform will need to be constructed.

9.4.6.40 To minimise the amount of deliveries through the station compound, pile cages and reinforcement along with formwork can be transported by RRV from Acton yard and off loaded from the Up-Relief line close to the proposed gantry chainage. Alternatively, materials can be delivered through the station site subject to agreement.

9.4.6.41 A concrete pump will need to be sited nearby to pump concrete into the pile.

9.4.6.42 It is proposed the steelwork for the Gantry be erected once the P-Way has been installed to the East of the station and access is possible for a RRV crane to lift steelwork from the Up Main. This is proposed to take place between March and July 2024. Steelwork is be delivered to site from Acton yard via RRV trailer to minimise bringing materials through the station site.

9.4.6.43 A scaffold tower will need to be erected to enable access to bolt the gantry boom, column, and dropper cages together.

9.4.7 UTX's

9.4.7.1 Working from Country to London, i.e. high chainage to low. All UTX's are proposed to be cut and cover and are based on NR standard designs unless noted otherwise.

9.4.7.2 For the specifics of each UTX please refer to the UTX design drawings:

- 152270-25067-P2R-MLN1-DRG-ECV-400061 & 400064

<u>UTX @ 5870 chainage</u>

9.4.7.3 This UTX has been recently installed as part of another project and is to be used as part of the OOC rail systems project. A new chamber is proposed to be sighted as shown below in Figure 105. The construction method will require a full survey of the cables currently run in the UTX. Normally, there will be a number of ducts free, the Contractor should identify which ducts are free of cables and which are not. It is expected there will be power cables running through this UTX along with Telecoms, and Signalling.

9.4.7.4 The new chamber location will be excavated, a window will be cut in the top of each duct to see what cables are in the duct. The ducts will be carefully cut by hand to reduce risk or damaging cables. Once all the ducts are cut, a multi stack chamber is proposed to be constructed around the ducts and cables. Rings for this stacker chamber will be modified accordingly to fit around the ducts and cables. The works associated with this modification is proposed to take place January and March 2023.

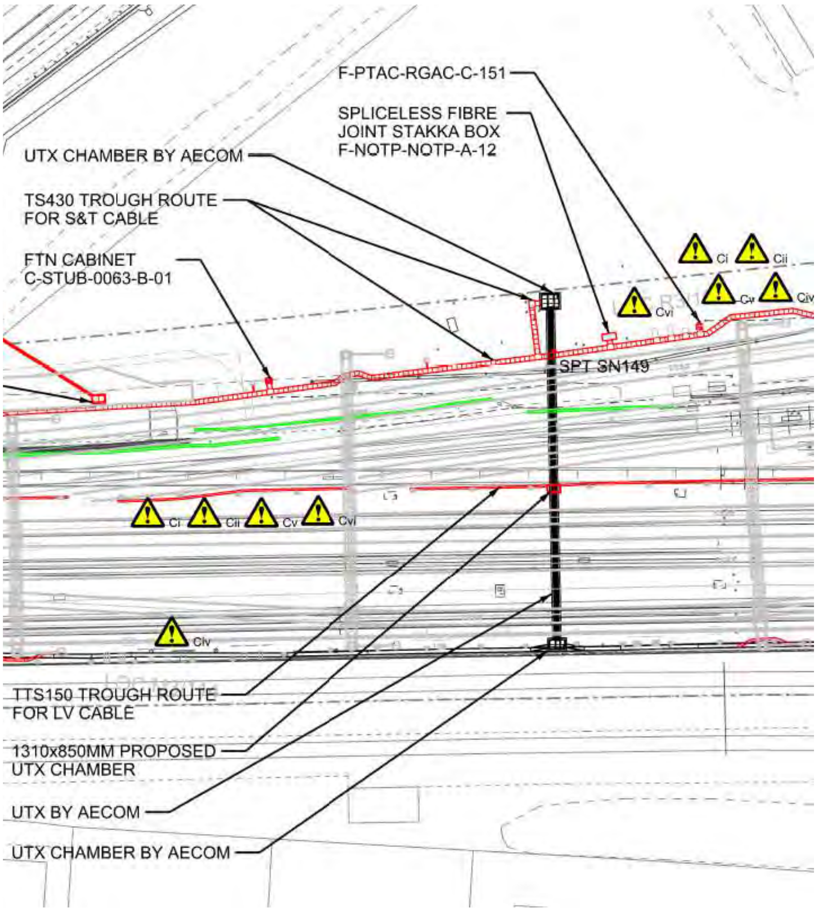

Figure 105: UTX @ 5870 chainage

UTX @ 5700 chainage

9.4.7.5 A UTX for the ATFS is being proposed shown below in Figure 106. Due to the minimal number of chambers this UTX could be completed using guided thrust bore or horizontal directional drilling. In this case the propose construction could be completed in one during January to March 2023.

9.4.7.6 Plant and materials are proposed to be delivered to site road from site access off Wells House road.

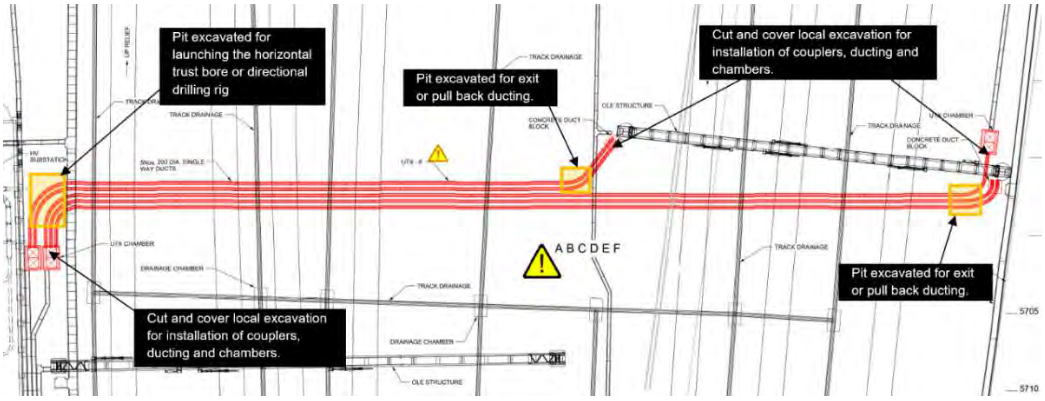

Figure 106: UTX @ 5700 chainage

UTX @ 5353

9.4.7.7 It is proposed the UTX @ 5353 chainage, shown below in Figure 107, is constructed in two halves to maximise construction efficiency. The first half is proposed to be constructed between July and August 2023 when there are no operational P-way to trench under making construction easier and faster. It is anticipated that plant and material, for construction of phase 1, will not be an issue, and can either be delivered via RRV on the Rail Head West from Acton Yard or via road from site access off Wells House road.

9.4.7.8 The second phase is proposed to be constructed between January and March 2026 prior to the final P-way alignment is in place, so again there will be no P-way to trench under. For the 2nd phase plant and materials are proposed to be delivered to site via RRV on the Temp Up Main from West from Acton Yard.

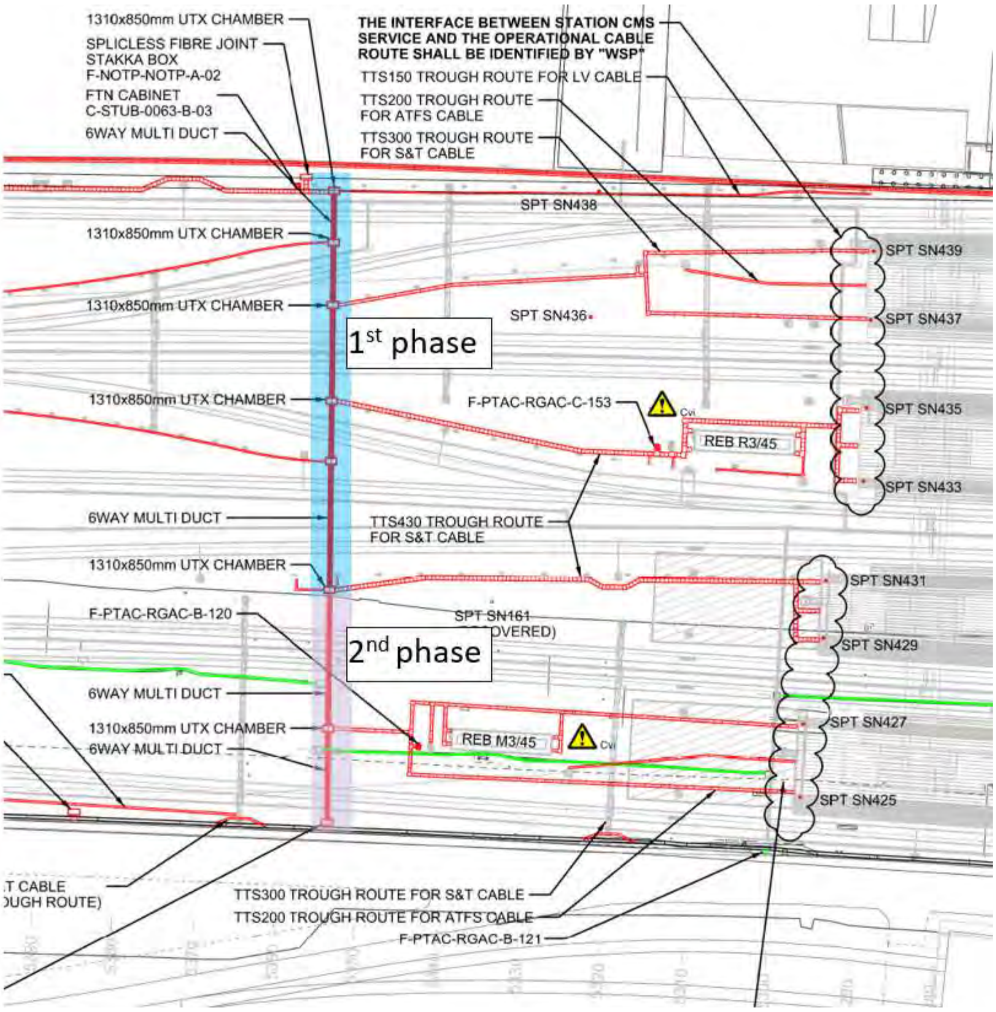

Figure 107: UTX @ 5353 chainage

UTX @ 4980 chainage

9.4.7.9 It is proposed the UTX @ 4980 chainage is constructed in two halves to maximise construction efficiency. The first half is proposed to be constructed between January and March 2023 when there are no operational P-way to trench under making construction easier and faster. It is anticipated that plant and material, for construction of phase 1, will not be an issue, and can either be delivered via RRV on the Up Relief from Acton Yard or via road from site access off Wells House road.

9.4.7.10 The second phase is proposed to be constructed between January to March 2026 prior to the final P-way alignment is in place, so again there will be no P-way to trench under.

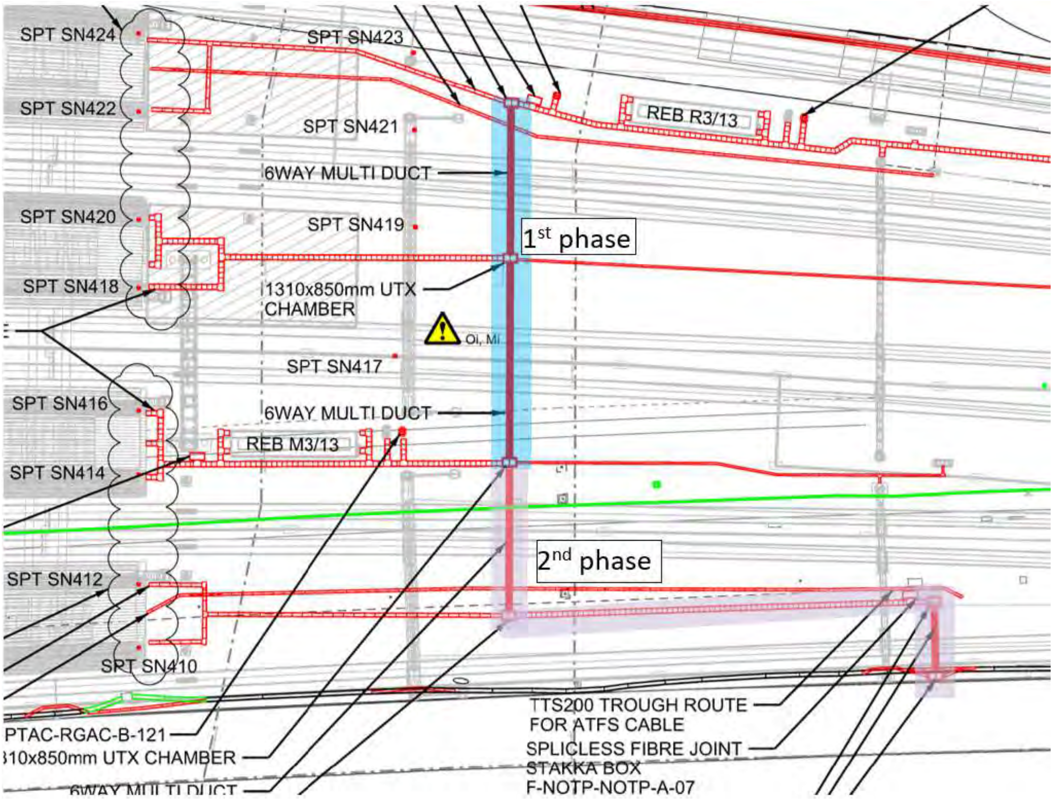

Figure 108: UTX @ 4980 chainage

Other UTX's

9.4.7.11 In addition to the major UTX's noted above, there are a number a single track UTX's to be installed using cut and cover methods. These signal track UTX's can be installed in standard NBS possessions.

9.4.7.12 UTX @ chainage 4700 crossing the line to the cross-rail depot is to be installed between July and August 2024.

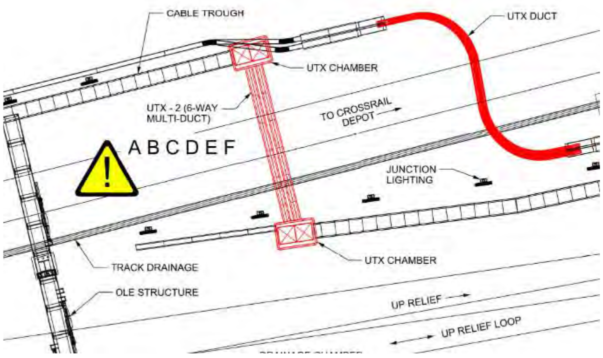

Figure 109: UTX @ 4700 chainage

9.4.7.13 UTX @ chainage 4800 crossing the line to the cross-rail depot is to be installed between July and August 2024.

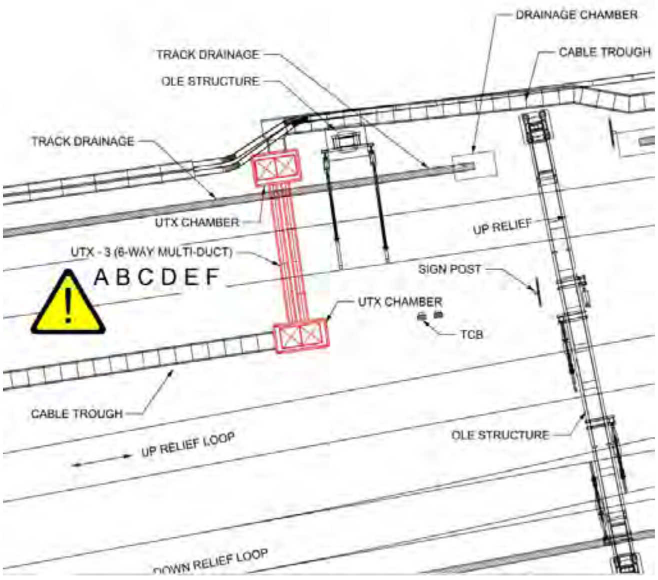

Figure 110: UTX @ 4800 chainage

9.4.7.14 UTX @ chainage 4590 crossing the line to the cross-rail depot is to be installed between July and August 2024. This is a new recently installed UTX and the existing chamber clashes with the Up-Relief line.

9.4.7.15 The existing UTX duct arrangement is unknown at this stage. If the UTX has a series of single ducts, it is proposed the extension be split duct around ducts which have cables in them. If the duct has no cable in then it a coupler can be used with a new duct pipe to the new propose chamber location. If the ducts are multi duct, then the extension could take the form by use of a multi duct repair kit.

9.4.7.16 Careful consideration will be needed working with an operational UTX. Cable slack analysis will be required. If no cable slack is available, cables will need to be disconnected and re-run once modification works have been completed.

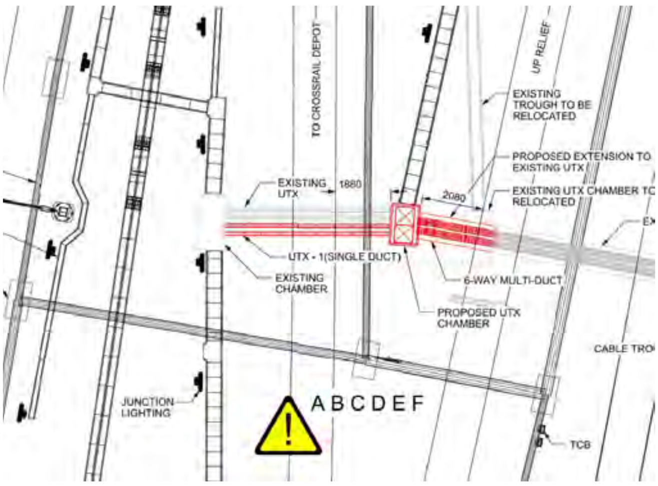

Figure 111: UTX @ 4590 chainage

9.4.8 New Cable Route

9.4.8.1 The strategy for the installation of new cable route, broadly, should target the East of the station site first, then progressively working West. But there will be nuisances to this in certain circumstances.

9.4.8.2 New route proposed alongside new rail track should be installed after the track as been installed to prevent damage during track installation.

9.4.8.3 As part of the OOC Rail Systems project GRIP 4 design, there is approximately the following new trough route required.

- 1700m – C/1/9
- 380m – C/1/29
- 450m – C/1/43

9.4.8.4 Productivity estimates will be impacted by safe system of work, use of plant, site conditions, existing cables, size of trough route, but on average it is expected 35m per team per day.

9.4.8.5 Cable route can be installed where possession access is required over a series of NBS possessions.

9.4.8.6 Where fenced worksites can be established, cable route can be installed during normal working hours.

9.4.8.7 Materials (i.e. trough route) are proposed to be delivered, by lorry, to Acton Yard for storage. Trough route is then proposed to be delivered on pallets to pre-planned drop points in areas where new cable route is required. This will take place during NBS possessions using RRV's and Trailers. Materials will need to be stored at lEast 2m away from track, secured, and on level ground.

9.4.8.8 All new cable trough proposed should be of the lightweight type where possible to mitigate risk of injury from manual lifting. Where possible machinery should be used for installation.

9.5 Power

9.5.1 Electrification & Plan – HV & LV

9.5.1.1 The E&P construction will coordinate with the phased delivery of the track and signalling infrastructure, and installation of the lineside civils in terms of the core cable routes, UTXs and troughing.

9.5.1.2 The following are the core items of equipment and primary constraints associated with the E&P construction.

- Installation of an Auto Transformer Site consisting of 2x Auto transformers with each transformer weighting around 3 tons
- Installation of 25kV traction power cables from Kensal Green Auto Transformer Feeder station (ATFS) to the proposed Auto Transformer Site. There will be 2x single core 400mm2 armoured cables
- Installation of 1x Principal Supply Point, which measures around 3m high, 15m long and 3m deep and weighs around 2 ton.
- Installation of 7x Points Heating Control Cubicles, with each weighting around 250kg
- Installation of 2x DNO cubicles, with each cubicle weighing approximately 300kg
- Installation of 7x Junction Lighting Control Cubicles, with each cubicle weighing approximately 250kg
- Installation of 50x Points Heating Transformers, with each transformer weighing approximately 40kg

- Installation of more than 150 units of 1.5m high Junction lighting Columns together with associated LED luminaires

9.5.2 Equipment Delivery

9.5.2.1 The site of the proposed Auto Transformer Site (ATS) has not been determined, but it is very important to note that good road access is required for the delivery of the transformers.

9.5.2.2 It is envisaged that the PSP will be delivered to site by a combination of road transportation and rail mounted cranes.

9.5.2.3 All other items of E&P equipment could be delivered to site via road transportation.

9.5.3 Construction Compound

9.5.3.1 Construction compounds will be required for the storage of equipment and management of the works during construction stages. Temporary security fencing will be erected around the compounds and portacabins and storage containers will be delivered and installed.

9.5.4 Generic Scope of Works

- Trough route surveys and cable route construction authorisation by NR.
- Vegetation clearance.
- Setting out works and site establishment.
- Deliver materials to site using RRV's.
- Drop materials into cess along proposed cable routes.
- Layout materials along line of route and ground preparation.

9.5.5 Testing & Commissioning

9.5.5.1 All E&P installation must be tested and commissioned in line with all relevant standards, regulations and Best practice.

9.6 Station Interface

9.6.1 Introduction

9.6.1.1 There is a complex interface between the new OOC station and rail systems construction. At the time writing there remains some unknowns around the exact programme of construction for the platforms and the availability of access to undertake rail systems installation. Where unknowns have been identified, assumptions have been made based on previous similar project experiences and best practice examples. Consequently, these assumptions will need to be reviewed once more information is available.

9.6.1.2 Prior to installing any rail systems in the station area, the platforms and concourse overbridge will have been completed or substantially completed.

9.6.1.3 It is assumed all the external works for relevant station structures will be completed prior, and giving suitable time to enable the construction, and commissioning of the rail systems that enable an operational railway through the new platforms.

9.6.1.4 Following the commissioning over Christmas 2024, the new OOC station and worksite will become an operational rail environment. Accordingly, it is recommended the Principal Contractor become the Rail Systems contractor given the changing nature of the site and the main hazard generation from the introduction of an operational railway.

9.6.2 Rail Systems Cable Route

9.6.2.1 Following construction of Platforms 3-8, the Up-Relief line cess cable route is installed in 2024 when the new Up Relief track is installed (prior to the commissioning of the new Up Relief over Christmas 2024).

9.6.2.2 The new platform construction design has provision to run cables through all platforms. According to the WSP constructability report, a minimum of 1100mm (w) x 1800mm (h) access zone has been included within the inverts to allow for a Safe working zone. Additionally, there are 900mm x 1200mm access hatches located at 15m centres for each platform invert compartment, and 350mm x 350mm ventilation openings located at five metre centres within the outer and inner invert walls for air circulation. Based on this there should not be any issues with space to run rail systems cabling.

9.6.2.3 Rail systems cabling routes are proposed to enter each platform, as per the below detail, with route running up to the platform ends. The exact interface detail is to be determined by the Station Designer. It is possible a chamber will need to be constructed for routing cables from troughing into ducts for interface with the platform.

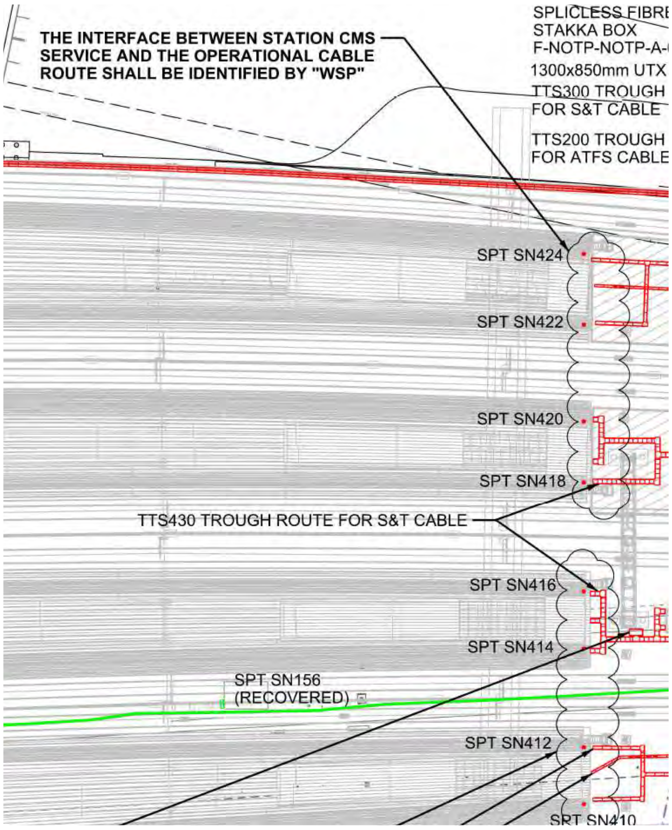

Figure 112: Rail systems cable route

9.6.3 Signal Bracket Supports

9.6.3.1 There are two Banner Repeater bracket support signal structures proposed, one on platform 2, the other is located on platform 6. Signal brackets will be suspended on the platform canopy and installed once access is permitted on the platforms by the station Contractor. The station canopy has been designed to allow for suspended rail systems equipment. The exact location of these structures will require further integration with the station Designer along with sighting acceptance.

9.6.3.2 Similarly, to the Banner Repeaters there are several Off Indicators to be positioned along all platforms. Again, these are proposed to be suspended off the platform canopy. A MEWP will be needed to lift the brackets into position and allow access to bolt to the canopy. Cable management will be via the canopy void which has been designed for cable runs.

9.6.4 Rail Systems Signalling Equipment

<u>Signal Post Telephones</u>

9.6.4.1 Signal Post Telephones (SPTs) will be required at the ends of the platforms. The locations of these have not yet been finalised and will need further integration with the station design during GRIP 5. Typically, SPT's are installed on dedicated posts, however it is understood the station designer has a preference to integrate the SPTs in a dedicated recess on the platform. The exact location of these is not yet known.

9.6.4.2 SPTs can be installed with handheld tools. Once SPTs have been installed hoardings can be erected to protect the newly installed equipment from any remaining works on the platform.

<u>Disconnection Boxes</u>

9.6.4.3 Disconnection boxes will be required to run tail cables to signalling equipment. The exact number of these boxes is not yet known, but it is likely there will be a significant number in the station area. Disconnection boxes sighting forms are to be developed at GRIP stage 5 and integrated with the station designer. Disconnection boxes can be mounted on the platform face or on the platform, and installed with handheld tools.

9.6.5 OHLE

9.6.5.1 New registration assemblies are required through the station on all 8 platforms. It is proposed to used standard SIC registration assemblies with a reduced system height which are to be attached to the station structure.

9.6.5.2 Portal and TTC type supports have been incorporated into the station canopy design to which the 120SHS drop tubes and registration assemblies will be attached. The location of these supports has been provided by the station designer but will require further integration as the design develops.

9.6.5.3 The spacing of the station supports and the width of the main concourse overbridge requires additional registration attachments. These registrations are to be attached to the underside of the main concourse over bridge and both east and west platform end bridges via 120SHS drop tubes with base plates. The proposed support positions, bolt spacings, lengths and loadings will be provided to the station designer so that they can be incorporated into the bridge deck design.

9.6.6 Track Platform Interface

9.6.6.1 In the station environment the track platform interface is a difficult relationship to manage during construction activities. Both station and track works will have a construction tolerance available for installation at this key interface.

9.6.6.2 The normal process for track installation is to install the track low to final design during the installation shift. Over successive tamping follow up shifts the track will be lifted to final positioning. This staged installation of the track alignment is industry norm but can present a problem for any ongoing platform coping work during this stage.

9.6.6.3 In order to obtain the optimum design platform track interface and compliant offsets it is recommended that the final coping position is not set until the final track tamp has been complete. This would also then allow for the coping to be set based on intervals to final track position.

9.6.6.4 Temporary track and platform interfaces should be avoided wherever possible to avoid unsafe steeping and clearances. Currently no stage opening of the station is planned therefore this situation is not expected.

10 Health, Safety, & Security

10.1 Health and Safety

10.1.1.1 During the construction of the Rail Systems for OOC station, there are a vast number of site hazards and risks a Contractor will have to deal with. This section provides an overview of the most significant items which will require particular attention during the construction programme.

- Over congested worksites; there are a number of construction programmes being delivered at the same time. This is creating multiple Contractors working in the same site and presents a challenge specifically around who is the principal Contractor.
- Overlapping demolition and construction; causing confusion over removal and introduction of operational assets.
- Personnel and machinery coming into contact with high voltage electrical cables.
- Personnel and machinery coming into contact with live operational assets (trains, plant, and equipment)
- Personnel coming into contact with machinery, road / rail, and rail vehicles within congested worksites
- Introduction of defective works onto Network Rail operational network
- Change in denotation of lines throughout the construction programme causing confusion and unfamiliarity with which line is named what.
- Platform station curve impacting line of sights for train and plant movements.
- Derailment from non-operational points
- Confusion between non-operational and operation points which leads to unexpected moving parts, leading to risk of derailment, and injury.
- Quality of safety systems of work for remote locations given less attention than worksites around the main station construction, resulting in increased risk of harm and damage.
- Criminal behaviour against personnel particularly at remote locations and during night working.
- Plant and personnel falling into open excavations.
- Damage to partially installed equipment which is not realised to much later e.g. in some cases partially installed equipment remains for a number of years.
- Air pollution from exhaust fumes
- Dust from ballast, as well as site works, and access roads with high volumes of traffic movements
- Contaminated material
- Noise from construction activities will need to be considered at all times, especially when working during night-time and in close proximity to residential buildings.
- Risk to trains from trespass and vandalism activities causing loose materials in site compounds to be put onto operational lines
- Significant changes to operational lines and unfamiliar infrastructure for drivers

10.2 Security

10.2.1.1 To ensure the site is secure there will be a requirement for CCTV, security check points, as well as 24/7 presence on site. A project of this scale has the potential to attract theft of materials, particularly of copper cable, so it is recommended for high-value items to be delivered to site on a just in time basis. These include, but are not limited to;

- HV cables - copper power cable
- Earth matts
- Copper made equipment e.g. Contact Wire, Copper buzz bars
- ATP equipment (legacy system so hard to source and therefore valuable)
- Plant & Machinery – particularly plant and machinery that can be towed or driven on road.

10.2.1.2 Additionally, scrap cable should be removed from site as soon as possible for recycling as this also attracts theft or presents a risk from vandalism.

10.3 Any Line Open (ALO) Working

10.3.1.1 Any Line Open working refers to activities undertaken on the rail infrastructure where plant or loads/attachments associated with it could foreseeably foul lines open to traffic. The works to deliver the Old Oak Common Rail systems will require extensive ALO working.

10.3.1.2 Due to the nature of the proposed works and the congested setting of existing and proposed infrastructure at Old Oak Common, the assessment of ALO conditions will be a fundamental part of the safe planning of works.

10.3.1.3 Construction activities will require the nomination of an ALO champion within the organisation leading the works, and should be planned in accordance with the Code of Practice for Plant Any Line Open (ALO) Working (COP0032), and NR/L2/RMVP10200, the Infrastructure Plant Manual.

10.3.1.4 The construction activities for the rail systems works involve large scale but typically routine and well-developed methods of working, which are able to be planned in a safe and effective manner. Detailed ALO Assessments will be required for all activities, with appropriate risk mitigation measures put in place.

10.3.1.5 Examples of the types of risk mitigations available to eliminate or reduce the risk from ALO working include the placement of physical barriers capable of blocking unplanned plant movements, and slew limiters for cranes and On-Track Plant to prevent them from moving into positions which can foul open lines.

10.3.1.6 It should be noted that ALO working guidelines do not cover working above rail infrastructure. This specific risk is relevant to plant and vehicle movements over the Central Line bridge to the West of the site. Liaison with London Underground as Infrastructure Manager at this location will be necessary to during the planning and approval of such works.

11 Opportunities and Risks

11.1 Opportunity

11.1.1 Combining stage 9&12

11.1.1.1 One potential opportunity is combining Stages 9 & 12. Figure 113 and Figure 114 below display the schematic layout during stages 9B and 12B, respectively. Full versions of these figures can be found in the Staging Schematics in Appendix A.

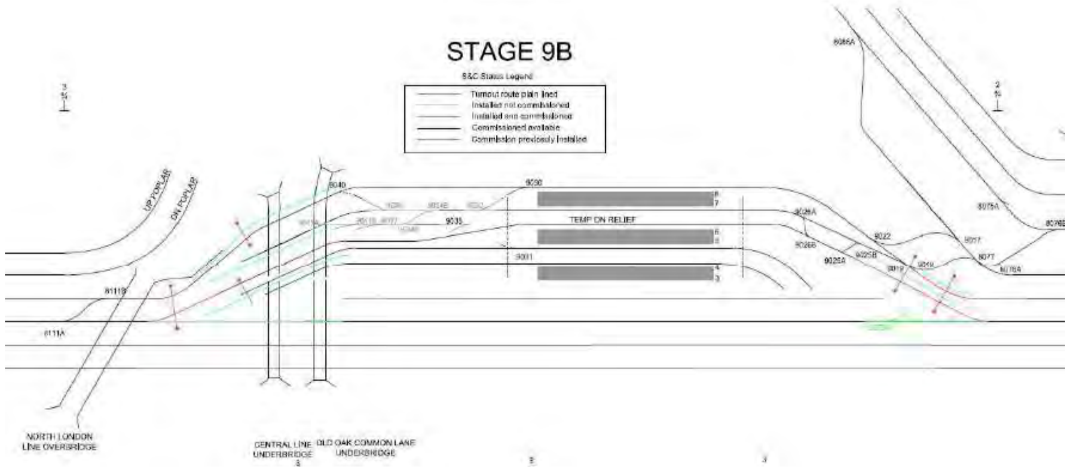

Figure 113: Staging schematic of 9A

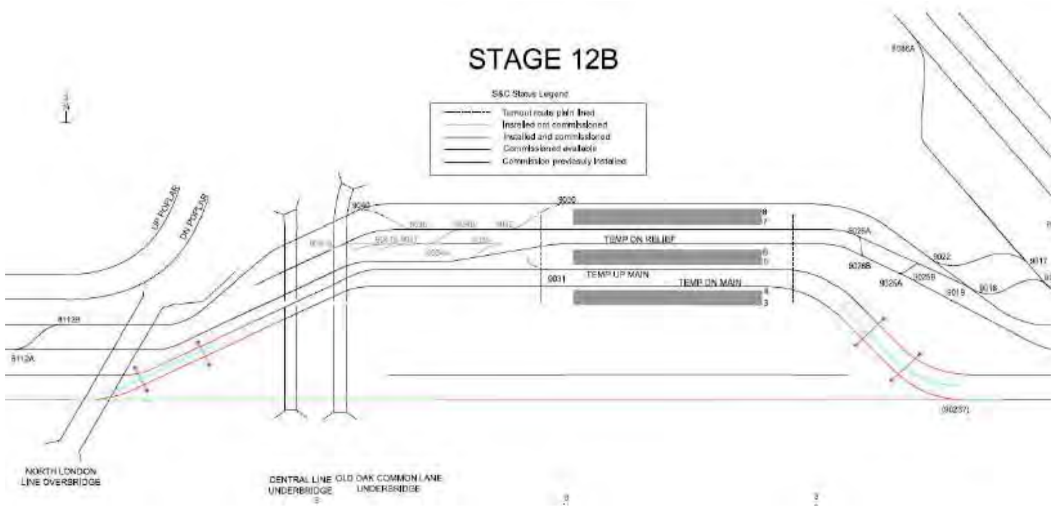

Figure 114: Staging schematic of 12B

11.1.1.2 During Stage 9 the temporary relief lines are installed and commissioned, with the connections to the existing relief lines being recovered. The entire Stage 9 works are proposed during Christmas 2024. Stage 12 follows a similar pattern with the installation and commission of the temporary mains alignments, as well as the recovery of the existing mains connections.

11.1.1.3 Stage 12 is proposed during Christmas 2025. There is opportunity for the works carried out in Stage 12 to be brought forward into Stage 9, where both the temporary Relief and Main lines would be installed and commissioned in one Christmas period, doing so would bring the construction programme forward by a year. With this said, there are several complexities associated with this opportunity.

11.1.1.4 Pway:

- In order to combine the two stages, the Pway work would require a minimum of 8 days ALB for installation and tamping. To supply the required volume of trains (circa 30 trains), including strategic plants such as Kirows and Tilting Wagons there would ned to be a large commitment not just from the route but national fleet allocation.
- In addition to this, the associated plain line towards the east on both the Mains and Reliefs includes significant track lowers leading to Mitre and Scrubs Lane over bridge. This adds to the planned volume of work that would be required during stage 12 and 9.
- Additional Pway complexity around combining these stages comes from the deviation in existing to temporary alignments. Therefore, the existing adjacent line that would normally accommodate the renewals trains to relay from is disconnected during the renewal if west and east is undertaking in isolation. Ultimately this means both the east and west tie in for both Mains and Reliefs has to be undertaking together allowing a through route for engineering trains. The outcome of this is two concurrent renewals sites in close proximity for each line renewed, adding to complexity and limitations on moving trains.

11.1.1.5 OLE:

- Both proposed stages 9 and 12 will require a minimum of 2 days ALB and a minimum of 4 teams per shift for installation and transfer of the existing OHLE to the temporary alignments. In order to combine the stages, either a minimum of 4 days ALB using a minimum of 4 teams per shift or keeping to the minimum 2 days ALB and a minimum of 8 teams per shift would be required.

11.1.1.6 Signalling:

- 4 days + testing

11.1.1.7 Summary:

- Based on the detail above, a significant ALB period of 12 days would likely be required to complete the Stage 9 & 12 works. There would also be a significant requirement for resources that may be beyond the available national resources. This extra requirement would have a significant impact to passenger services over the period of the blockade and likely require other works to be deferred to release resources.
- If the possession access and resources could be secured it is possible that the stages could be combined. This would need a great deal of scrutiny and would highly likely be a risky strategy to accelerate the programme.

11.1.2 Splitting the bridge deck with WSP

11.1.2.1 Initially, WSP had proposed that Old Oak Common Lane and Central Line Underbridges would be split into three parts and constructed in three phases, as shown in Figure 115 below taken from the HS2 Construction and Methodology Report (1SN02-WSP-CL-REP-SS07-000001 C03). Following integration with the Station Bridges team, the opportunity arose that if the proposed rail systems track layout was pushed further North above a defined break line, the two underbridges could be constructed in two phases, rather than three.

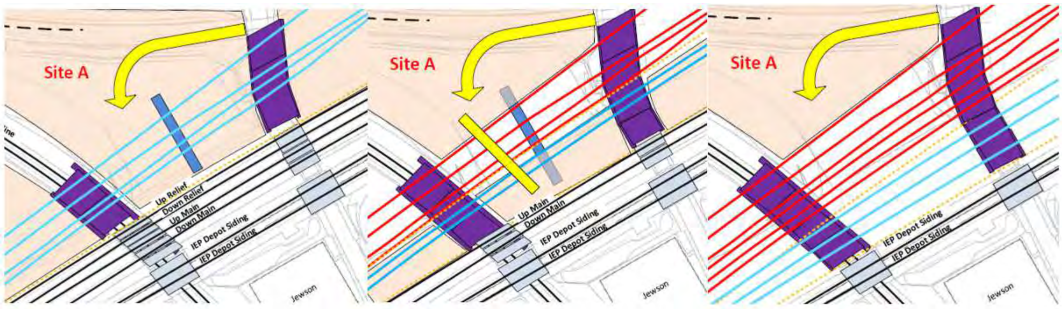

Figure 115: Three phase construction of OOCL and Central Line Underbridge

11.1.2.2 This opportunity was beneficial for all parties and it was decided to be carried forward and integrated within the methodology of this Constructability report. Figure 116 below, taken from the Staging Layout in Appendix B, shows the underbridges constructed in two phases.

11.1.2.3 This allows for enhancements to the underbridge construction programme, as well as providing a large enough space for the Rail Systems team to run the Up Relief, Down Relief, Up Main, Down Main over part 1 of the underbridge construction, resulting in a more efficient programme for the over-arching project works.

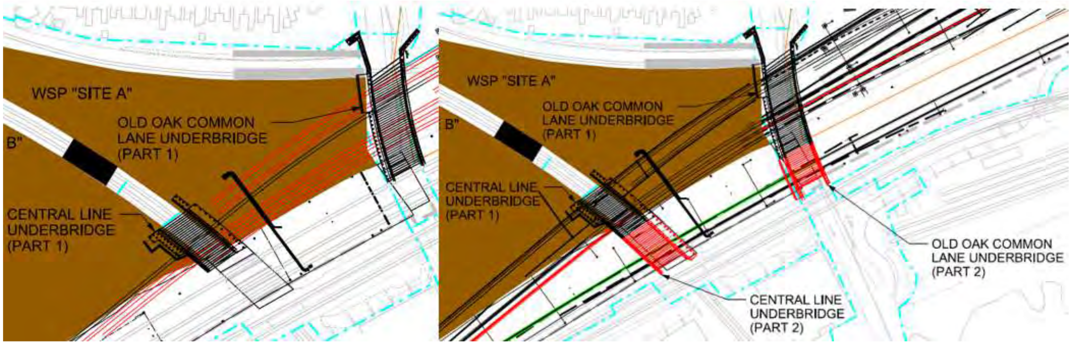

Figure 116: Two phase construction of OOCL and Central Line Underbridge

11.1.3 Eastern Rail Head

11.1.3.1 A rail head connection has been explored in order to feed material into the site by rail to the east of the proposed station. This connection would serve the construction area just north of the existing Up Relief alignment but stopping short of the proposed platforms.

11.1.3.2 Connectivity of this rail head has been considered from both 8077 pts and 8101B pts in their existing position as shown in Figure 117 and Figure 118. Further details around the operational viability of the rail head can be found in the Operational Management Report (152270-ARC-REP-EMG-000003).

11.1.3.3 The eastern rail head would have a limited useable length, in comparison to the western rail head, and would be a terminal siding line with no run-round facility due to space constraints. In addition, 8077 and 8101B points would have to be retained for the length of the rail head usage. The eastern rail head is a viable option and a potential opportunity should the current methodology of material delivery off the Up Relief in ROTR possessions not suffice.

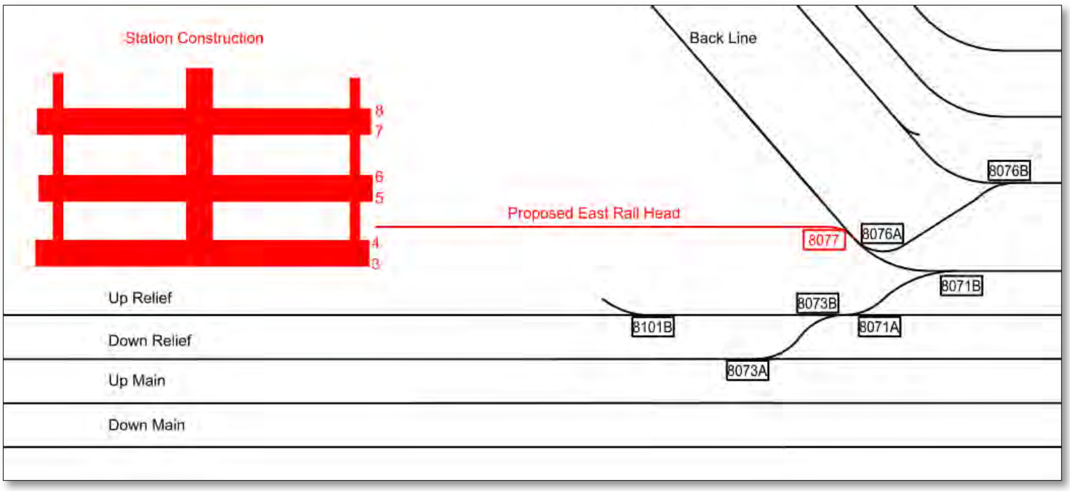

Figure 117: Rail head from 8077 points

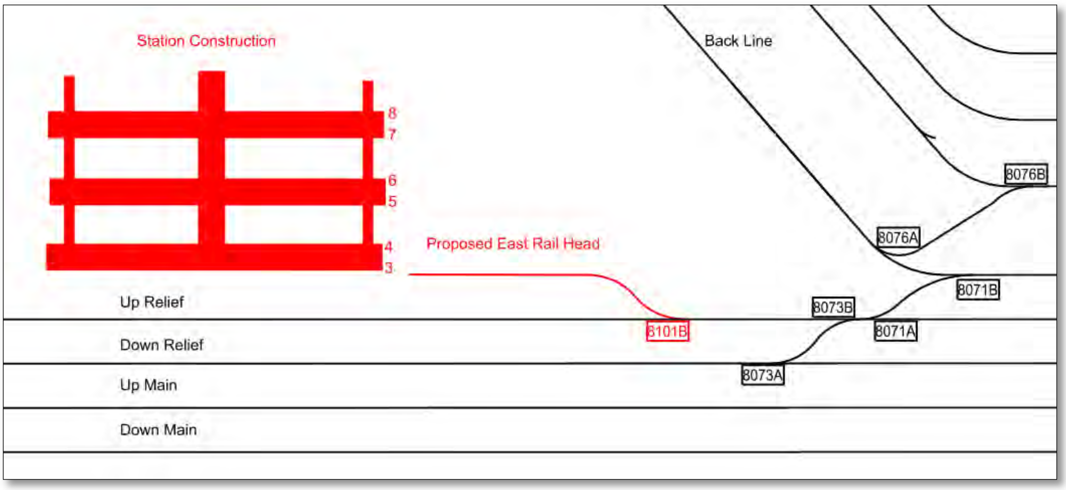

Figure 118: Rail Head from 8101B points

11.2 Risks

11.2.1.1 Throughout the development of the constructability deliverables, a RAID log has been utilised to capture project Risks, Assumptions, Issues, and Dependencies. This register can be found in Appendix E and has been a driver to extract the pertinent details below.

11.2.2 ETCS integration with P2R Design timeframes especially Signalling

11.2.2.1 As discussed in Section 9.3, Arcadis have drawn upon their ETCS experience in Europe to provide ongoing assistance to Network Rail as they develop their own plans for the implementation of ETCS. The initial implementation of ETCS does happen in advance of any significant works for the Old Oak Common Scheme but only by 12 months, which in terms of signalling changes, it is a short gap in time.

11.2.2.2 Not only does the railway in this area undertake the biggest change in signalling methodology for 100 years, the scale and complexity of the remodelling of an already ETCS configured railway has not happened in the UK before. For that reason, it has been highlighted as a key project risk that could have a dramatic effect on the construction programme.

11.2.3 Road and rail access to the South

11.2.3.1 Section 4.1.3, Proposed RRAPs, details the required Western Mains RRAP would be located either out of the Hitachi depot, or off Jewson's yard. The methodology discussed in the track delivery strategy, Section 9.1, highlights the requirement for access to the Down Main in order to deliver materials to site during this complex build.

11.2.3.2 Beyond Stage 12, as shown in schematic of Stage 13B in Figure 119 below, the site is constrained by Hitachi North Pole Depot to the south and the running Mains & Relief Lines to the north. Therefore, without access to the Mains via a RRAP from the Hitachi depot or a compulsory purchase of Jewson's yard, this section of works cannot be built to the proposed programme, presenting a significant risk to the Old Oak Common project.

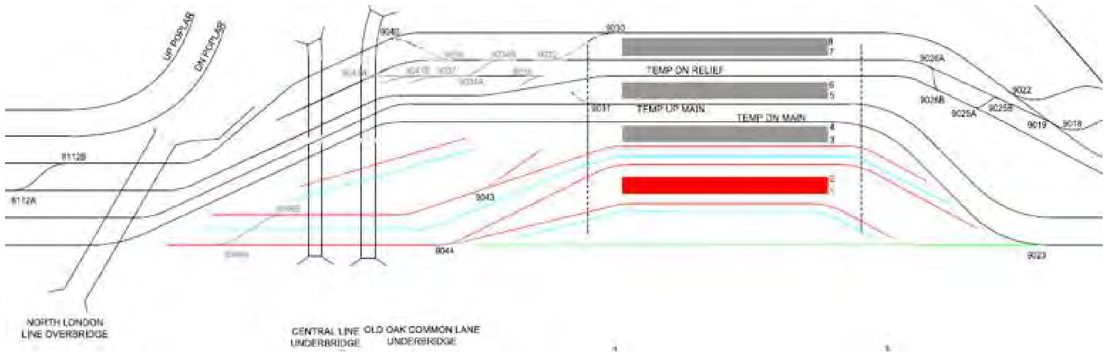

Figure 119: Stage 13B Schematic

11.2.4 Formation proposals

11.2.4.1 The following assumption has been agreed between the OOCRS team and the Station Contract Design during various integration meetings.

11.2.4.2 "The station/civil engineering contractor shall provide a cleared site at a nominal 500mm below proposed rail level. The formation shall be prepared to an agreed specification (TBC).

The extents of the prepared formation shall be be from a line 30m to the east end of the HS2 station box, through the station and Westwards to a line 30m from the west abutment of the Central Line Underbridge. The northern boundary of this formation preparation shall be 2.8m from the new Up Relief track centreline. The southern boundary shall be an agreed safe working distance from the Reception line 1.

Through the station area the station contractor would provide a prepared formation level through all tracks 8 through to 1.

At each stage of construction for the underbridges the contractor shall provide a prepared formation to a distance of 30m from the east abutment of the OOC Lane underbridge and the west abutment of the CL Underbridge. The contractor shall provide a prepared formation for the full distance between the two under bridges.

The track/rail systems contractor shall carry out all necessary grading activities for drainage crossfall & etc prior to track installation.

The track/rail systems contractor shall be responsible for all formation grading activities from a line 30m to the West of the abutment of the CL Underbridge."

11.2.4.3 Altering this assumption would have a significant impact on the quantities of material to be removed by the Rail Systems team, therefore, resulting in a significant impact on the delivery strategy and the proposed construction programme.

11.2.5 BBVS updated programme to be integrated

11.2.5.1 Following instruction from Network Rail, the construction methodology detailed within this report is based on the HS2 Construction and Methodology Report (1SN02-WSP-CL-REP-SS07-000001 C03), as well as the Network Rail high-level staging strategy schematics (HS2 OOC GWML Staging Schematics – V6 (Option 2C)). Further details of these assumptions are listed in Section 3.6, as well as the RAID Log found in Appendix E

11.2.5.2 During the time that the OOCRS team have been working on the GRIP 4 Constructability deliverables, Balfour Beaty VINCI SYSTRA (BBVS) have been appointed as the Station Contractor. Following several integration meetings with WSP, it has become apparent that BBVS have made significant alterations to the station & bridges construction methodology/programme set out in the HS2 Construction and Methodology Report (1SN02-WSP-CL-REP-SS07-000001 C03).

11.2.5.3 Currently the Rail Systems team and BBVS are developing their methodologies in separate work channels with limited integration, based on the instructions from Network Rail and HS2. Therefore, receiving instruction and integrating the two programmes is a significant risk to the project timeline.

12 Sustainability

12.1 Summary

12.1.1.1 The OOC Railway Systems Project Team is committed to providing a sustainable design and construction solution and where it has been practicable, eliminating all risks to the environment associated with the works. Therefore, through the GRIP 4 project stage the project has put in place procedures to ensure sustainability risks and opportunities are identified and addressed - both in the design of the Project and as an on-going process during implementation, testing, commissioning and hand back.

12.1.1.2 The key goals of the construction phases and the project are to:

- Deliver a solution which fulfils the need for a transport interchange and railway station at Old Oak Common
- Provide a solution which conforms to the existing environment and the systems already in situ
- Provide value for money and represents the best value through design and option selection
- Minimise the consumption of natural and non-renewable resources

12.1.1.3 The above goals have been targeted by incorporating environmental and social constraints into the project structure through various documents including the Environmental Strategy (doc ref: 152270-ARC-STR-EEN-000001), Carbon and Waste Management Plan (doc ref: 152270-ARC-REP-EEN-000002) and the review of methods to assess the airborne and ground borne noise and vibration generated by the project and eventual operation of the systems.

12.1.1.4 These have been guided by overarching principles and constraints outlined in the HS2 Environmental Minimum Requirements (EMRs) and the Network Rail standard - Contract Requirements – Environment and Social Minimum Requirements for Projects – Design and Construction NR/L2/ENV/015 Issue 8.

12.1.1.5 Potential environmental, social, and economical risks and opportunities have been highlighted in the Environmental and Social Appraisal (ESA) Tool, undertaken by Network Rail and submitted to Arcadis. The risks and opportunities identified in the ESA have been taken forward by the OOC Railway Systems Project Team and included in the Environment and Social Management Plan (ESMP) (document reference: 152270-ARC-PLN-EEN-000002). Additional information on capital carbon, operational carbon, as well as collaboration initiatives in support of PAS2080 will be provided following the completion of the Project Carbon Report (document reference: 152270-ARC-REP-EEN-000004).

12.1.1.6 This section of the report demonstrates aspects of our Constructability proposals that positively benefit sustainability. As the project is at the AiP stage of design there is an opportunity to develop upon the opportunities expressed and improve upon the design and construction phases within the detailed design to encompass more of the triple bottom line, see Figure 120. Currently the project has explored the environmental and economic sustainability principles which when incorporated with social sustainability practices in later project stages will provide a well-rounded sustainable solution.

Figure 120: Sustainability Triple Bottom Line

12.1.1.7 A list of activities completed to date which contribute to sustainable development are listed below in in Table 19. In addition to our proposed solution, further opportunities have also been listed in Table 20.

Table 19: Activities Undertaken to Improve Sustainability

Activities Undertaken to improve sustainability
Use of Synchro to enable information sharing between project stages visually allowing solutions to be reviewed and improved upon with simulations of installations
Planning of construction works in the design stage to drive efficiencies and minimise waste and re-working activities.
Incorporation of LEAN principles at the GRIP 4 design stage to increase the efficiency including: Elimination of activities, steps, designs that do not add value. Optimisation the work schedules, and ensuring work runs smoothly and to plan. Identification of the processes that would allow further value to be added at future stages. Integration with other construction partners to identify efficiencies
Using computer-based design software over manual drafting to reduce the use of paper.
Designing the positioning of equipment to allow easy to access if maintenance, jointing or future upgrade is required to minimise effort required in future.

Activities Undertaken to improve sustainability
Replacing conventional systems with newer technology where there is no or marginal cost increase when compared using the whole life costs of all options (e.g. TENSOREX C+ of OLE systems as it is assemble offsite and is supplied ready for installation, maintenance-free and easy replacement of individual parts.)
Assessment of the height level of all ground level equipment, as equipment could be more efficient at a different height (e.g. Low Voltage systems)
optimisation material and waste movements to reduce carbon from transportation.

12.1.1.8 Some sustainability items have not yet been implemented into the project but have been either proposed, where the solution has been evaluated against project constraints or have been identified as an opportunity, which needs further review at a later design stage.

12.1.1.9 Table 20 below lists these items. Section 4.2.13 covers compound sustainability.

Table 20: Opportunity to Improve Scheme Sustainability

Proposed or Opportunity	Description
Opportunity	**Use of new compound generator which runs on cleaner fuels, is more efficient and generates less noise**
Environmental: Reduction in emission generation increasing the likelihood of the project being able to offset carbon footprint Social: Reduction in noise pollution and reduced risk fuel theft as if LEAN principles incorporated less quantities required on site at any one time. Reduction in burn rate means less vehicles entering and leaving site. Economic: Less fuel required to run site and less deliveries required	
Opportunity	**Use of renewable power to supply compound energy**
Environmental: Reduction in emission generation increasing the likelihood of the project being able to offset carbon footprint. Less quantities of fuel on site leads to less risk of accidental pollution Social: Reduction in equipment on site for power generation leading to less theft risk and less pollution to the local population Economic: Less fuel required to run site and less deliveries required. Maintenance of renewable energy sources tends to be less than that of conventional generators	
Proposed	**Optimising delivery of material by rail to site to reduce journeys**
Environmental: Less journeys resulting in less emissions Social: Reducing site deliveries decreases negative impacts on the local community and having an optimised schedule allows for quantities on site to be reduced which could improve site tidiness and reduce trespass risk. Economic: trains are able to convey more materials in one journey than HGV with less impact on surrounding roads. Leads to potential saving in fuel costs and traffic management solutions.	

Proposed or Opportunity	Description
Proposed	**Bike storage on site and enrolment to cycle to work scheme and encouraging car sharing**
Environmental: Reduced emissions from workforce commuting to site by encouraging bicycle use Social: Minimising increase of traffic and related transport emissions around residential area. Improvement to staff wellbeing and safer working environment Economic: reducing car use leads to reduction in space required for car parking for construction works. This decreases overall set up costs and demolition costs.	
Proposed	**Staging of construction works into logical packages which are completed in normal working hours**
Environmental: Less disruption to any roosting animals in the area and less emissions from machines through reduction of cold starts Social: Reduces visual/noise pollution to nearby residents outside of the HS2 defined normal working hours. Also less accidents happen per hour when working in regular hours due to better lighting and potentially less fatigue Economic: Reduction/elimination of non-social hour working decreases staffing costs	
Opportunity	**Locally sourcing workforce**
Environmental: Reduced carbon footprint and emissions due to decreased transportation distance. Social: Provides the local community with jobs and improves project image Economic: Supports the local economy, allowing nearby businesses to thrive	
Opportunity	**Sourcing concrete onsite from temporary batching plant**
Environmental: Reduced carbon footprint and emissions due to decreased requirement for concrete wagons driving to site and increased Social: Reducing site deliveries decreases negative impacts on the local community. Economic: Less overheads for transport and wastage increases the cost efficiency	
Opportunity	**Using hydrogen powered tower lights**
Environmental: No ground spill risk from water produced, as well as zero emissions at source Social: Hydrogen powered lights are silent and eliminate noise pollution for nearby residents. In addition, new lens technology can produce light patterns and to reduce light pollution. Economic: Reduction in fuel costs	
Proposed	**Use BIM technology to create quantity schedules and registers of materials on site**
Environmental: Reduces material on site to decrease likelihood of pollution. Can be used to enforce LEAN principles reducing waste Social: Less materials on site creating reduction in trespass risk and visual impact Economic: Save of waste away services and reduction in CapEx	

13 Conclusion and Recommendations

13.1 Conclusion

13.1.1.1 The railway systems work required to facilitate the introduction of the largest new Railway Station in the UK for over one-hundred years at Old Oak Common is extensive. It will stretch over a range of approximately 2.5km along a busy railway corridor stretching from East to West.

13.1.1.2 The works will introduce over three thousand new assets to the railway system which will require extensive integration with the works being carried out by HS2, Network Rail, Train Operators and Local Authorities.

13.1.1.3 This report has been developed in parallel with the GRIP 4 design works associated with the Old Oak Common Railway Systems. Consideration for the construction staging has been given by all design disciplines to ensure the phasing proposed, is viable at this stage of design.

13.1.1.4 While this report and the evidence provided demonstrates that the delivery of the Old Oak Common Railway Systems design is achievable in the given timescales and within the site constraints; additional integration will be required to ensure it interfaces with the emerging methodology of the station construction works and other future developments in the Paddington to Reading corridor.

13.1.1.5 Extensive planning has been undertaken to develop a viable Box Plan and Possession strategy for the works, ensuring that the works, as designed, can be delivered in the anticipated timeframe and within the constraints identified within this report.

13.1.1.6 The quantities of materials assumed in this report have been determined based on the assumption that formation level and treatment of the ground provided by the station works contractor is as stated in Section 3.6 of this report. Any volumes of material in excess of those assumed will have a significant impact on the delivery programme and assumed logistics set out in this report.

13.1.1.7 Opportunities for potential enhancements to the delivery strategy have been identified. Further consideration should be given to these opportunities to provide flexibility within the given programme.

13.1.1.8 The interface with the Station and Bridge development projects is critical to the success of the project and as such extensive integration will be required by the teams delivering the projects.

13.1.1.9 The report identifies the criticality of the delivery of materials by rail – consideration will need to be given to the availability of the rail plant at the various delivery stages.

13.1.1.10 A number of assumptions have been made about the availability of access points to the South of the Great Western mainlines. The delivery of this project to the presented time frames is predicated on the access to the South being available.

13.2 Recommendations

13.2.1.1 To ensure the effective delivery of the railway systems works to support the implementation of the Old Oak Common Great Western Mainline station it is recommended that:

- An agreement is to be reached for the provision of access through both the Hitachi North Pole depot and Jewson's yard to validate the assumptions made in this report regarding access from the South of the GWML.
- Additional Integration with the station and bridges delivery is required to ensure alignment of programmes the delivery of both projects in the given timeframes.

- The ETCS delivery programme and methodology is to be fully integrated into this construction methodology at the next delivery stage.
- A Signal Sighting exercise should be considered for every delivery stage where there is a clear impact to the operational railway.
- Ensure signalling design work is commissioned a minimum of two-years out from the anticipated delivery date to allow time for design and sign-off.
- An IDC shall be carried out for each of the delivery stages to ensure the required Engineering Assurance rigour is applied to all works installed in isolation of the full scheme proposal.
- A detailed costing exercise will need to be carried out against the delivery proposals identified within this report to ensure funding can be made available at each of the delivery stages.
- Consideration for more materials to be delivered by road should be made. This is likely to bring cost benefits, as some materials by rail will be expensive.
- A detailed Design Programme to be developed to support each delivery stage, noting lead times for delivery and approvals of all aspects of design
- Suppliers of long-lead items should be consulted at the earliest stage of development to protect the delivery programme
- Agreements on batching of concrete to be reached with HS2 to limit the amount of material being transported by Road.
- A Local Traffic Management Plan should be produced for the railway systems project. It should be integrated into the HS2 Route-Wide Traffic Management Plan to ensure vehicle movements are within the agreed limits.

APPENDIX A

Staging Schematics

APPENDIX B

Staging Layouts

APPENDIX C

Box Plan

APPENDIX D

Synchro Animation

APPENDIX E

RAID Log

APPENDIX F

Pway Gannt Charts

APPENDIX G

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Appendix M

Access Points at Old Oak Common Station

1. Introduction

The proposed HS2 station on the site of the historic Old Oak Common (OOC) depot removes two access for Road Rail Vehicles and one pedestrian access. The project also introduces a significant volume of assets which will be critical for Crossrail service, GWML service and operation of the station going forwards. Suitable and sufficient access has been identified as a requirement and need consideration at an early stage to ensure space is provided.

This document only considers the final state. Interim access will need to be provided during construction stages which will need be agree elsewhere in line with the AMP.

Relevant requirements below:

Requirement ID	Req'mt Source	Requirement	Owner	Req'mt Type	Priority	Acceptance Criteria	Rationale
RR-OOCS-61	NR Sponsor	Safe access shall be provided as far as reasonably practicable to new, changed and renewed assets such that they can be readily maintained without disruption to the operational railway. Existing access shall be maintained, where practicable, or a suitable replacement access arrangement shall be identified and agreed. The Project shall undertake an appropriate risk assessment, with mitigations and a communication record, to identify where additional PPE or access equipment to undertake maintenance is necessary. This shall be incorporated into and accepted through the Health and safety file / Operations and Maintenance documents.	Client Rep (NR Sponsor) PDR (NR DPE) Contractor's Engineering Manager [CEM]	CSM-RA; CDM; (PIED/SbD); Performance	High	NR agreed Maintenance Strategy. Design General arrangement or local arrangement drawing showing location of equipment to be maintained and the safe access to it. Health and safety file accepted. Operations and Maintenance documents accepted.	The location of the project is strategically critical to the operation and performance of the GWML (GWR), Elizabeth Line (Crossrail), Heathrow Express services, with higher than the national performance targets and significantly restricted maintenance access.

Requirement ID	Req'mt Source	Requirement	Owner	Req'mt Type	Priority	Acceptance Criteria	Rationale
RR-OOCS-63	NR Sponsor	The project shall undertake Reliability, Availability and Maintenance analysis to demonstrate the project's ability to meet client and route reliability and performance requirements. The project shall ensure that scheme design, component construction and maintenance access meet the required service and performance levels. The project team shall ensure that any new assets which are designed and installed as part of this project meet the reliability targets set out in Section 3.3. The project team shall ensure that new assets can be maintained / monitored from a position of safety, without the requirement for a line blockage, OHLE isolation or working at height.	NR Sponsor; DRAM; Local Maintenance Delivery Unit(s)	CDM; CSM-RA and Performance	High	Design Submissions and associated Maintenance Strategy for the OOC GWML station, for acceptance, shall confirm access for maintenance is protected, including evidence of engagement with Route and local Maintenance and NR station facilities (i.e. from Reading station) teams as appropriate. Acceptance of new assets by the route at project hand back.	Lessons learnt from other NR major station locations highlight how maintenance and operations of stations is poorly considered during design development, leading to safety and escalation cost issues.

For further information or comments please contact: Christopher.ford2@networkrail.co.uk

RR-OOCS-86	NR Sponsor: HS2-RQM-00000152	24 hour Access to the lineside and operational infrastructure for local NR Maintenance and Ops organisations shall be provided during all stages of construction. The project shall not adversely affect NR's ability to physically access Network Rail infrastructure.	DRAM; Local Maintenance Delivery Unit(s)	Safety and Performance	High	Construction phasing plan. Maintenance Strategy.	

Requirement ID	Req'mt Source	Requirement	Owner	Req'mt Type	Priority	Acceptance Criteria	Rationale
RR-OOCS-89	CR-OOC-0050.	Lineside access points for classic infrastructure, both vehicular and pedestrian (with steps where necessary) shall be retained or replaced with a suitable alternative (matching all existing facilities from the replaced access as a minimum) that is agreed with NR. New, revised and existing access points shall be reviewed against the Project design, recognising which access points may be used for which maintenance activities, where existing or changed maintenance possession limits are and how protection may be established, or how revised maintenance may impact on the provided Train Service Specification. All new vehicular access points shall provide hard standing parking spaces for vehicles where practicable. All new vehicular access points shall also be evaluated for potential use as Road / Rail on-track points (RRAPs) for RRVs and shall identify the potential for material and equipment access and storage, where practicable.	NR Sponsor; NR Ops; DRAM; Local Maintenance Delivery Unit(s)	Safety and Performance	High	Design submission and maintenance strategy for acceptance, shall demonstrate adequate access points are provided, whether temporary or permanent, for future inspection, examination and maintenance, including site safety arrangements and asset changes with any special needs or features. The location of any new access point shall be agreed with the local MDU. NR Project team shall coordinate with HS2.	Maintenance Strategy (GRIP deliverable) and requested by the Senior Maintenance Interface Manager as part of the AMP process. If there is any requirement to increase the maintenance access points beyond the current number this shall be agreed with HS2 Ltd through the change control procedure. NR/L2/RMVP/0200 applies Note, NR currently has another project evaluating lineside access arrangements in the Paddington – Reading [P2R] area, which shall be included as an interfacing Project.

2. Logistics compound and RRAP sizing requirements

A logistics compound will need to be provided at all new access points on the relief lines. An example of a ‘good’ compound is ‘North Pole’ access at Barlby Road.

Requirements:

It is anticipated that this RRAP area will need to provide:

- A secure compound.
- Level access, for 5m, on the approach to the railway.
- Allow a sept envelope of “HG Rigid Vehicle" from the 1983 Standard British Design Library. To access the railway.

The logistics compound will need to provide:

- room for 8No. Transit vans
- laydown area which is 5m wide by 35m. The laydown area should enable a 30m SG switch to be delivered and then lifted and transported to Track.
- Suitable lighting at a high level, e.g. typical street light.
- Should ideally be located adjacent to the RRAP as any distance between this and RRAP would interfere with productivity and have a possible impact upon rostering.

For further information or comments please contact: Christopher.ford2@networkrail.co.uk

3. Relief Line Access

3.1. Access to the East

An access point is required to the East of OOC Station to allow access to the railway whilst OOC is functioning as a terminus for trains from the West.

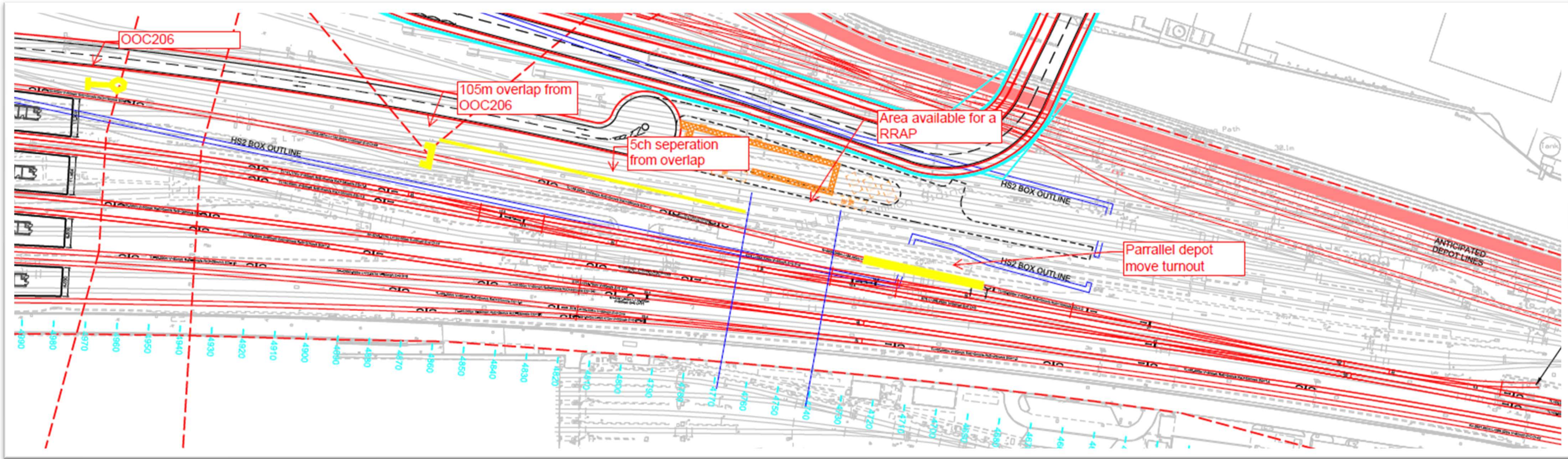
Other RRAPS accessing the relief lines in this scenario include:

Kensal (AGONY) – Restricted access due to depot moves which may need to continue in this situation.

Marcon & Bus depot – Possibly restricted access due to depot moves which may need to be maintained.

Requirement: It is anticipated that a RRAP should be provided due to the possible restrictions on other RRAPs available within a block between OOC and Paddington high level, and the relative ease with which this could be accommodated compared to a RRAP to the West.

The area is severely constrained due to proximity of end of platform signal and depot access. A sensible assumption for RRAP location is shown below, this restricts this report to a single option. This would only be for Platform 8 track.



For further information or comments please contact: Christopher.ford2@networkrail.co.uk

3.2. Access to the West

An access point is required to the West of OOC Station, this is likely the be the most critical access point. All of these allow access to the relief lines. The majority of these options offer enhanced benefit vs the Eastern access as they can be used whilst Crossrail trains turnback at OOC. This is not true for option 1B which would require the turnbacks to be taken out of use as well.

There are significant challenges to overcome for this access point regarding the Adjacent Site development, access through WSP Urban Realm design, provision of Chiltern platforms and future two tracking of the Chiltern lines.

Other RRAPS accessing the relief lines in the scenario of a block to the west of OOC (Exclusive) include:

Acton Yard – This has significant restrictions as the infrastructure is owned by a third party.

There are several pedestrian access points, via ladders, in Acton Cutting.

It can be seen that the access in this area, to the West of OOC Station, is exceedingly poor.

3.2.1. 1A - Off OOC lane Bridge into Feeder station site

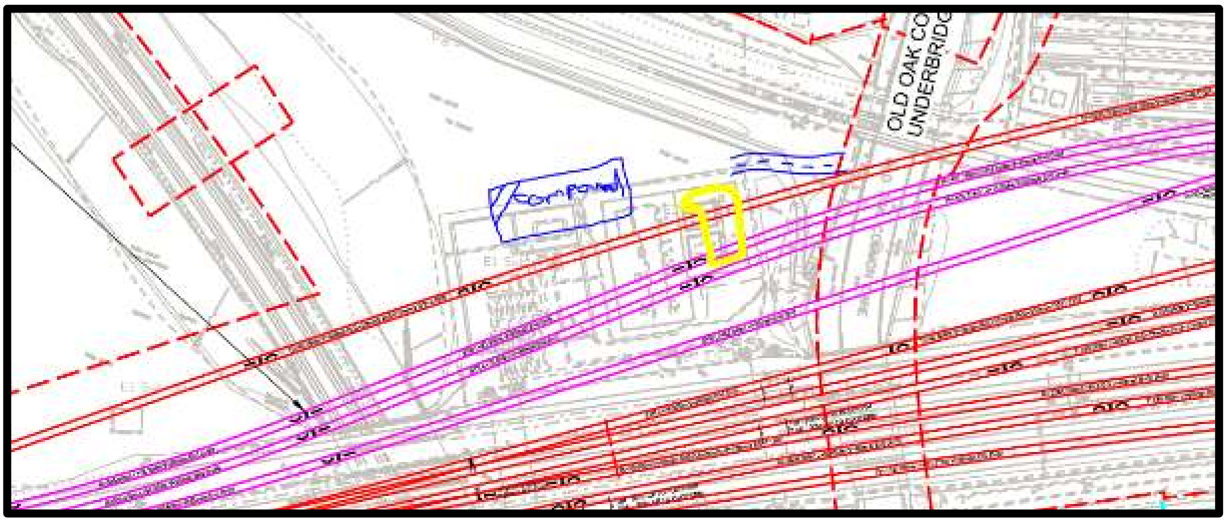
A new road ramp can be placed off Old Oak Common Lane towards the north east side of the new Up Relief line. A RRAP can be placed over the Up-Relief Line and the Turnback Siding 1. There is also space for a large size compound to be placed in this area.

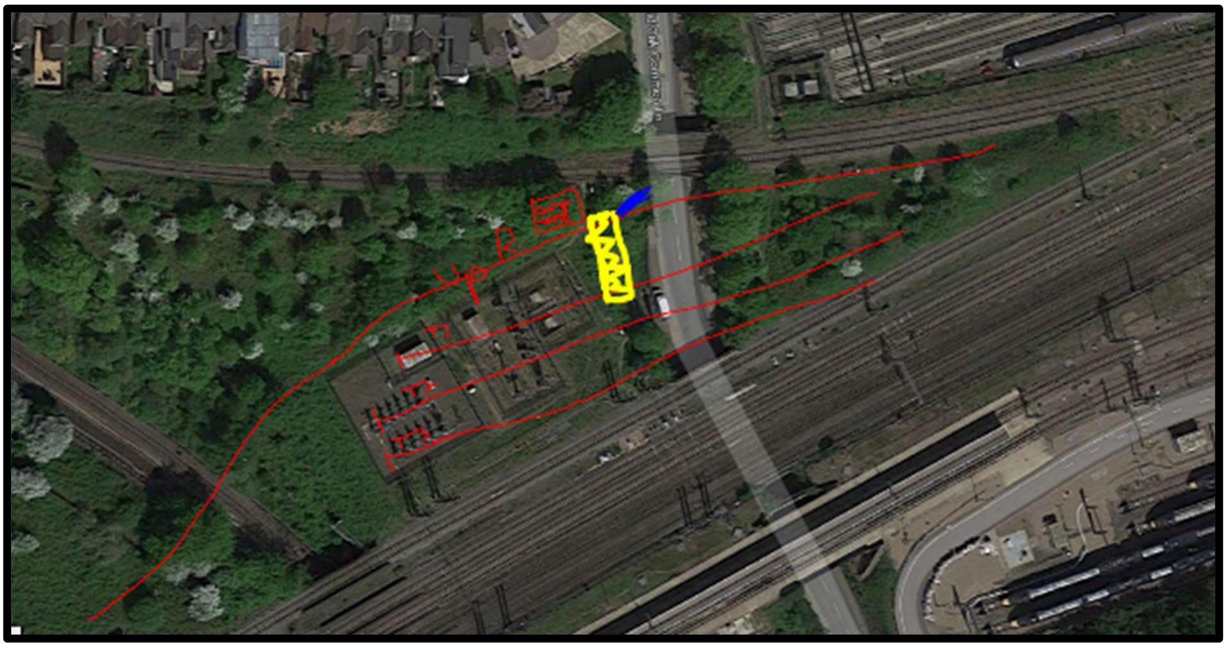
Risks

Possible complexity with Chiltern Lines reconnection

Complexity with interface with OOC road lowering and the raised footpath.

Clearance of vehicles using the RRAP to structures in the area.





For further information or comments please contact: Christopher.ford2@networkrail.co.uk

3.2.2. 1B – Off OOC lane Bridge into Feeder station site – Turnback siding 3 slued North

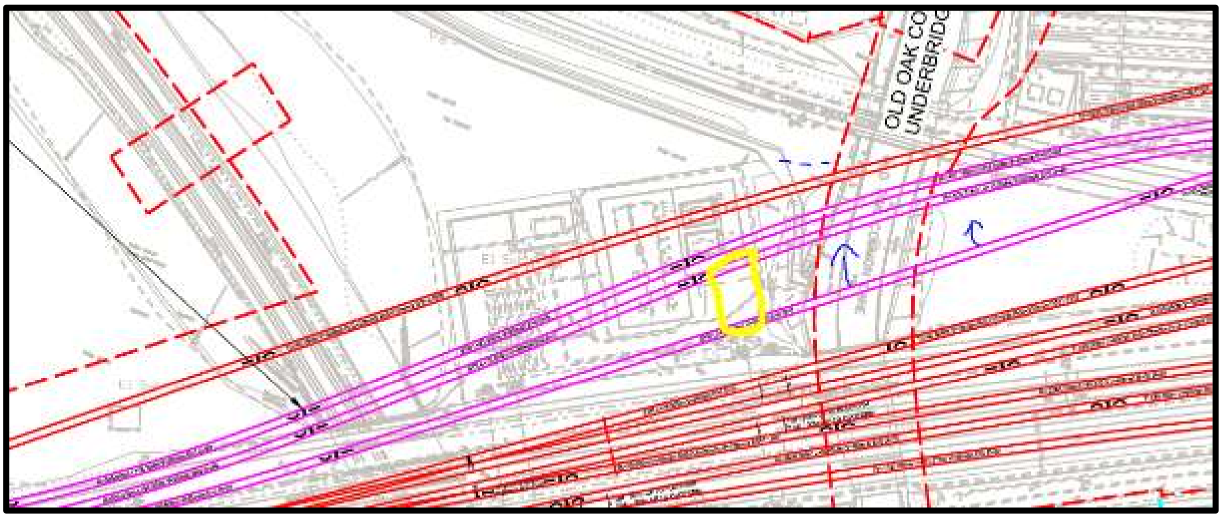
This option is like 1A, with the slight modification to move Turnback siding 3 further north and allow for a road to be connected from OOC lane bridge between the Turnback's and the Down Relief lines. This would require the currently proposed continuous deck to have a large void.

A RRAP can then be put on the Turnback Sidings for maintenance access.

Risks:

May be precluded due to void in bridge deck clashing with temporary slews required for construction of the station.

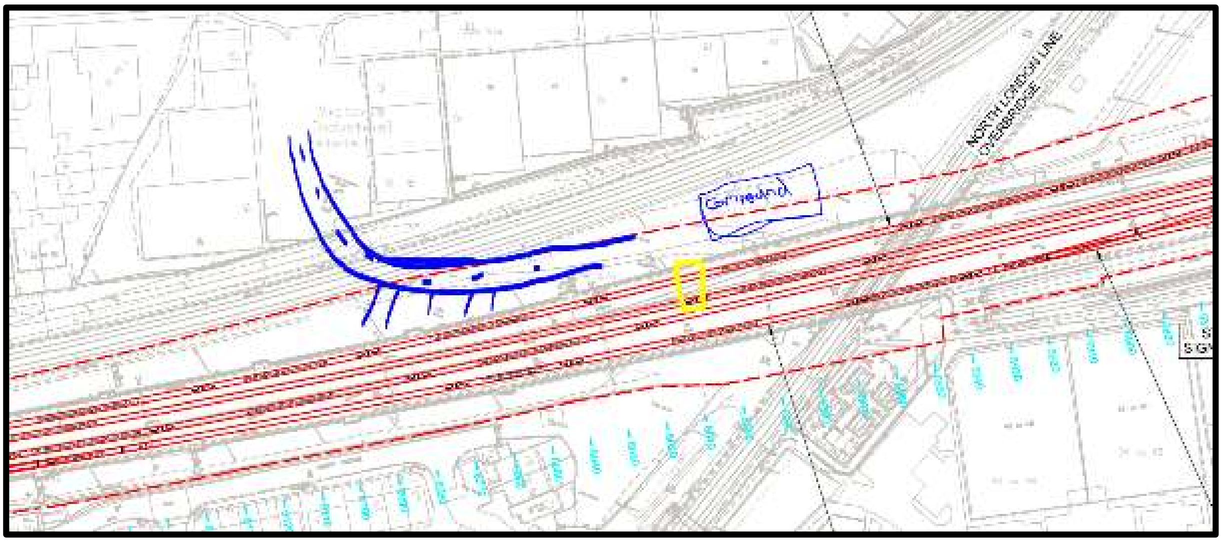
Not usable if turning back trains in the turnback.



For further information or comments please contact: Christopher.ford2@networkrail.co.uk

3.2.3. 2A – Acton East overbridge access to Relief lines

On -Track vehicles can gain access off Westway A40, and through an industrial estate where a new overbridge will be built over the Up/Down Poplar lines and down into the space between the AWL and MLN1 lines. A RRAP can then be placed on the Up and Down Relief lines. There is also space here for a compound.



Risks:

- Significant space and cost to install the bridge
- Risks associated with another overbridge
- Restrictions around future crossovers in Acton cutting

~~3.2.4. 2B – RRAP over Poplar Lines and Relief Lines~~

This option has been discounted by Martin Hayes – PIC (31/01/19)

~~This option is like option 2A, but rather than an Overbridge, 2 RRAPs are installed. One on the Poplar lines and the other on the Up/DN Relief lines. Still space for a compound.~~

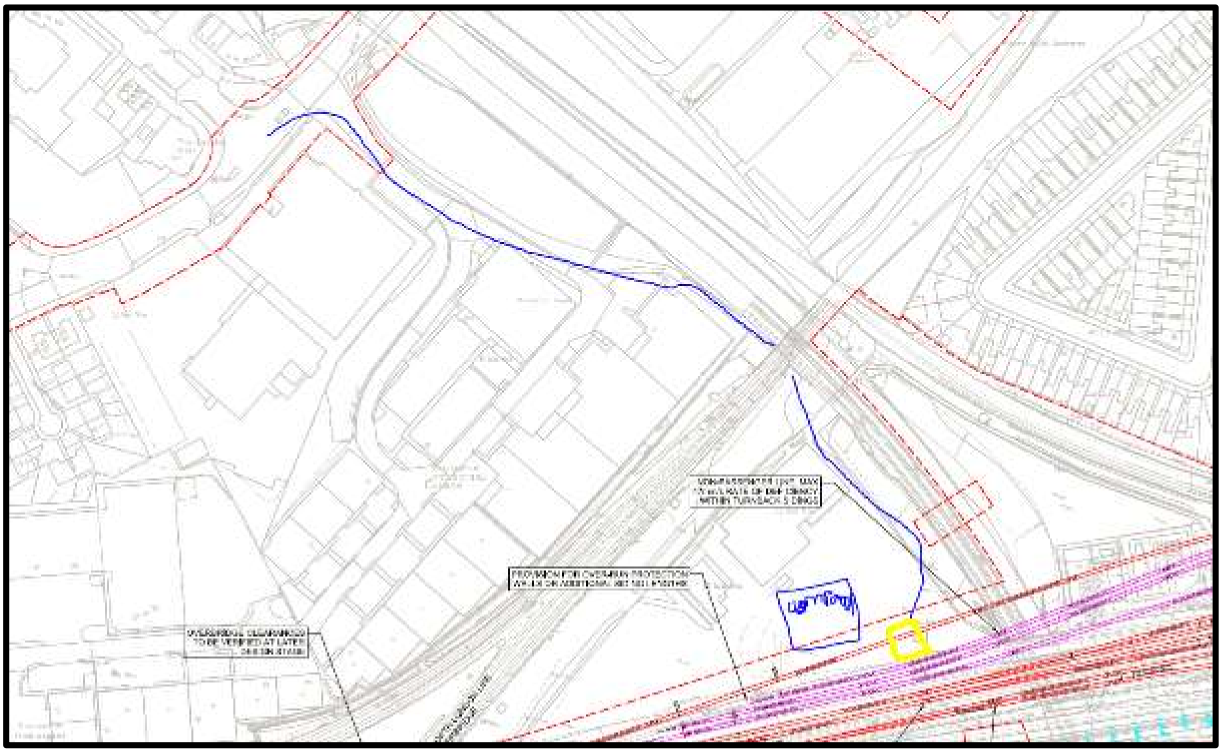
~~Risks~~

- ~~The North London Line Bridge is in this area, so structural clearances will need to be checked against all the RRV vehicles that will use the RRAP.~~
- ~~Clearance between RRV's and line side structures~~
- ~~Using the RRAP means the Poplars can't be used whilst the Reliefs are in possession. Prior agreement will have to be made with the TOC's/FOC's to use the line during relief line possession to west of GWML station. How frequently are the Poplar lines used?~~
- ~~The AWL Poplar Lines are handed back early, at 0100 on Monday, to allow Freight running. This option would therefore be severely restricted.~~
- ~~Restrictions around future crossovers in Acton cutting~~

For further information or comments please contact: Christopher.ford2@networkrail.co.uk

3.2.5. 3A – North London Line abutment access

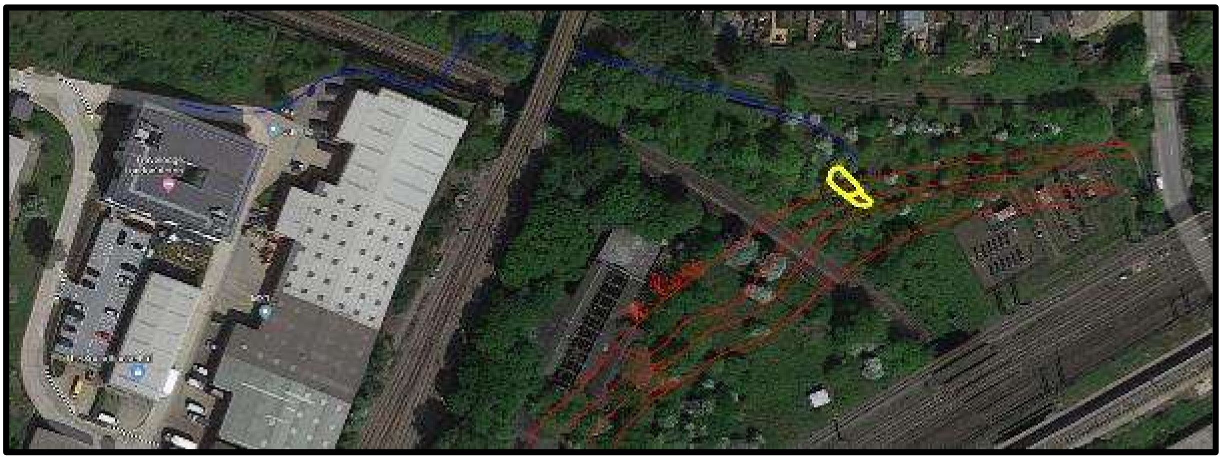
Access can be gained from the A40 to Victoria road, where a new road can be constructed through the field area behind Travelodge and the industrial building to the abutment of the North London Line bridge. The new road will continue through the abutment, requiring significant modification, and carry on into the area between the North London Line Bridge and the Central Line Bridge. The Up-Relief line will be in this area, so, the RRAP can be placed on the Up Relief or both the Up Relief and Turnback lines.

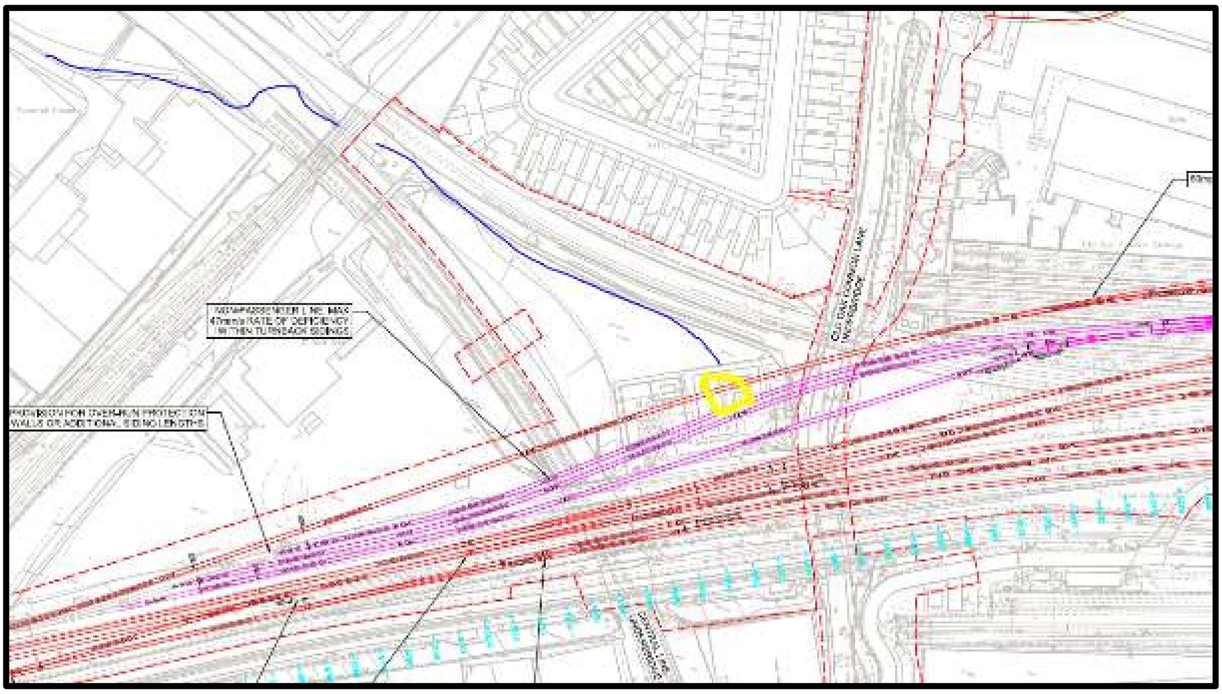


For further information or comments please contact: Christopher.ford2@networkrail.co.uk

3.2.6. 3B - North London Line abutment access

Like 3A but with a new overbridge built from the South West of Central Line to North East of the Central Line, with a new road continuing South to the area between Old Oak Common Lane Bridge and the Central Line bridge. RRAP in same position as in 3A. There is space for a compound in this area.





For further information or comments please contact: Christopher.ford2@networkrail.co.uk

Risks

Constructing a bridge over the operational Central line, adequate protection will need to be in place to ensure safety of the line is not compromised due to the works.

Protection of the central line once the new bridge is operational

Clearance of RRV's going under the bridges

General Risks/Hazards

New path to the station will need security from the public.

3.2.7. Option 4A – Access off Chase Lane and provision of an access Road parallel to the ANL

The Access point would be off Chase Lane which would drop down to the ANL level.

An access road would be created parallel to the ANL, crossing at some points to place it in between the Central Line and ANL. This would require a block of the ANL if operational in the future or provision of a level crossing.

This would take the access road down to the Feeder station site where a site compound could be established and a RRAP provided onto Up Relief.

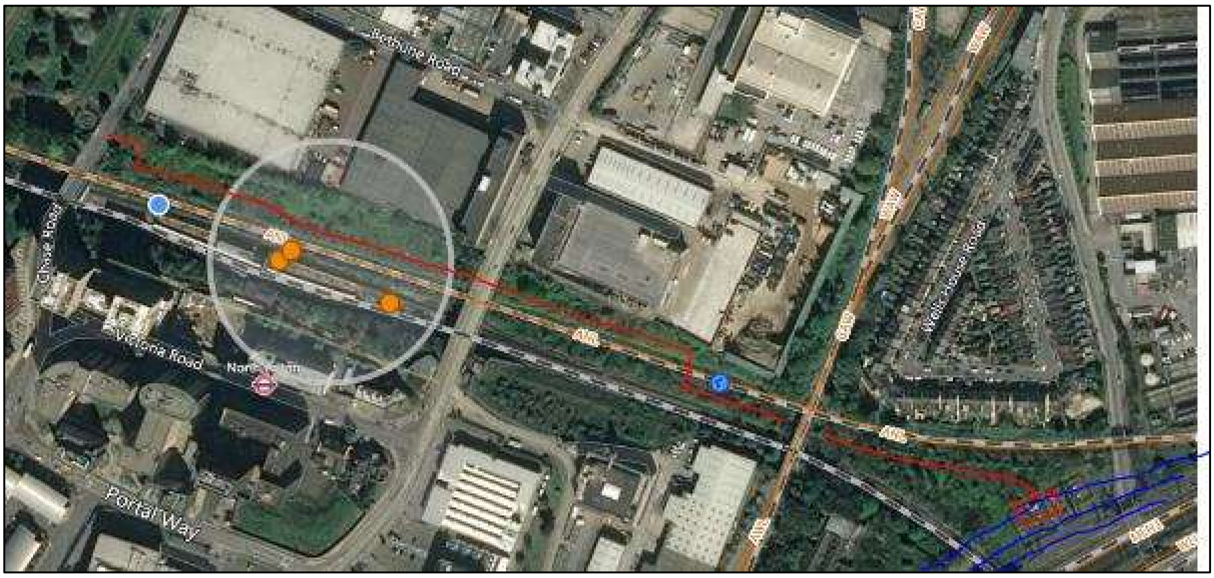
Risks:

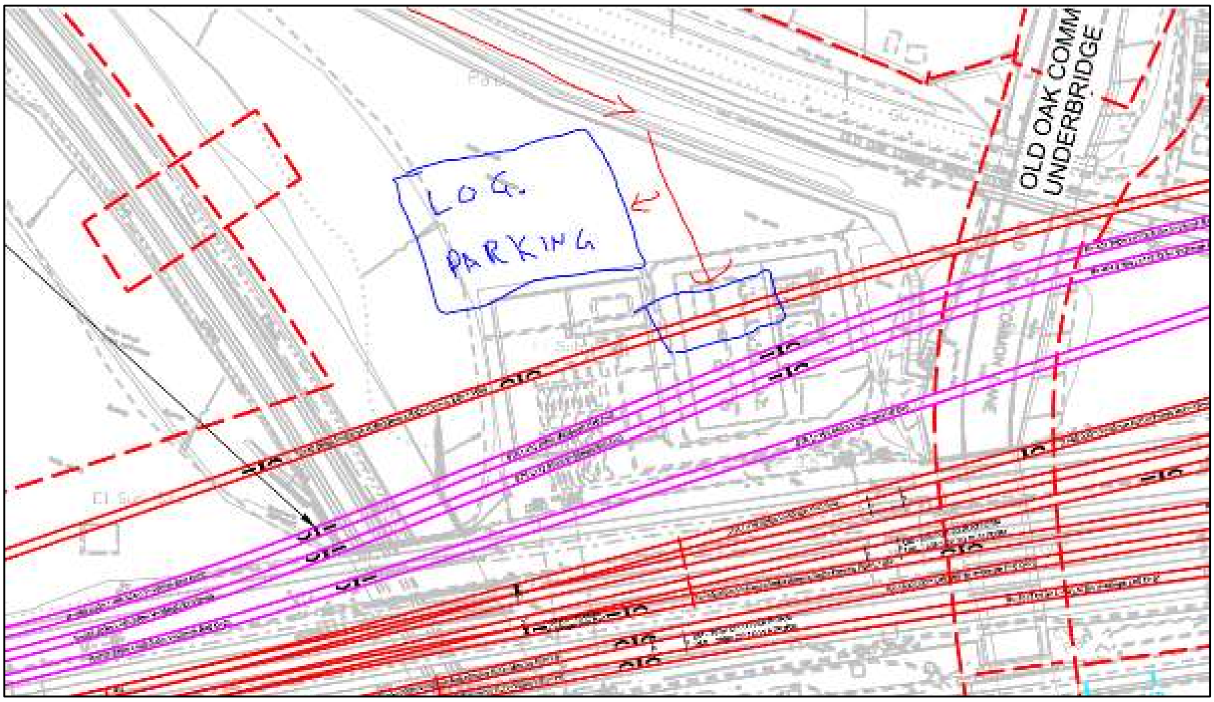
Requires a block of the ANL or level crossing

May preclude two tracking the ANL

Long access road which will require future maintenance, construction, lighting?

For further information or comments please contact: Christopher.ford2@networkrail.co.uk

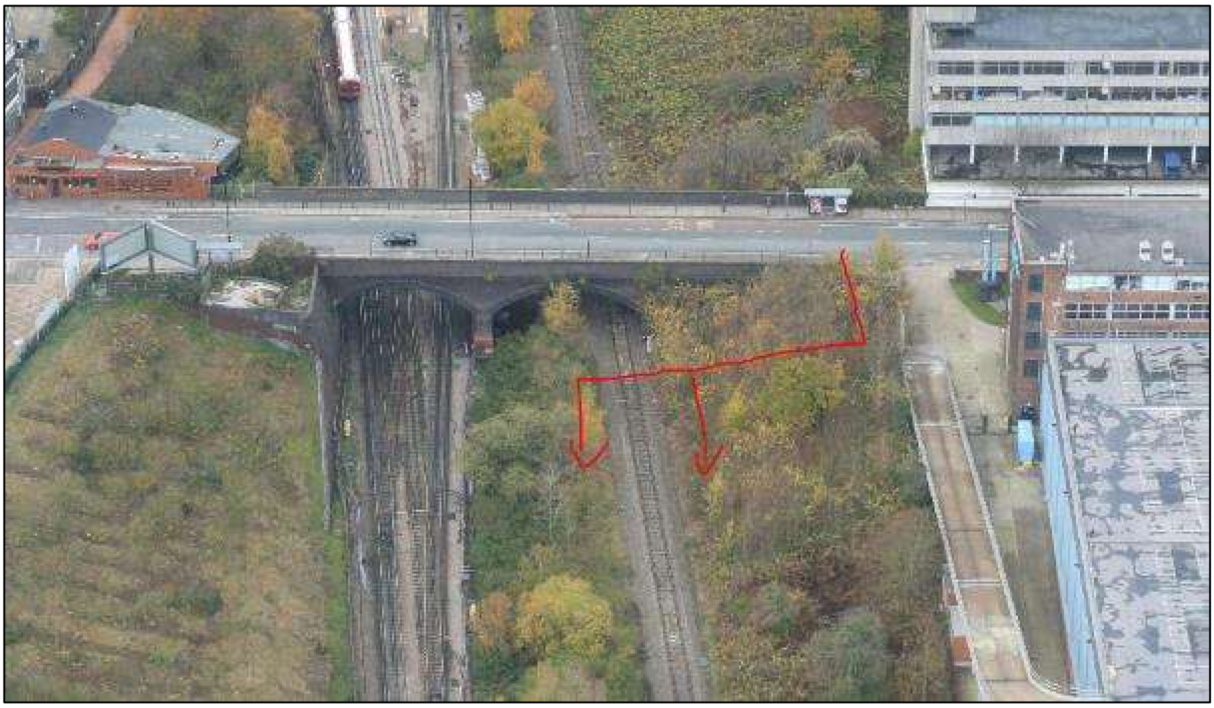




For further information or comments please contact: Christopher.ford2@networkrail.co.uk

3.2.8. Option 4B– Access off Victoria Rd and provision of an access Road parallel to the ANL

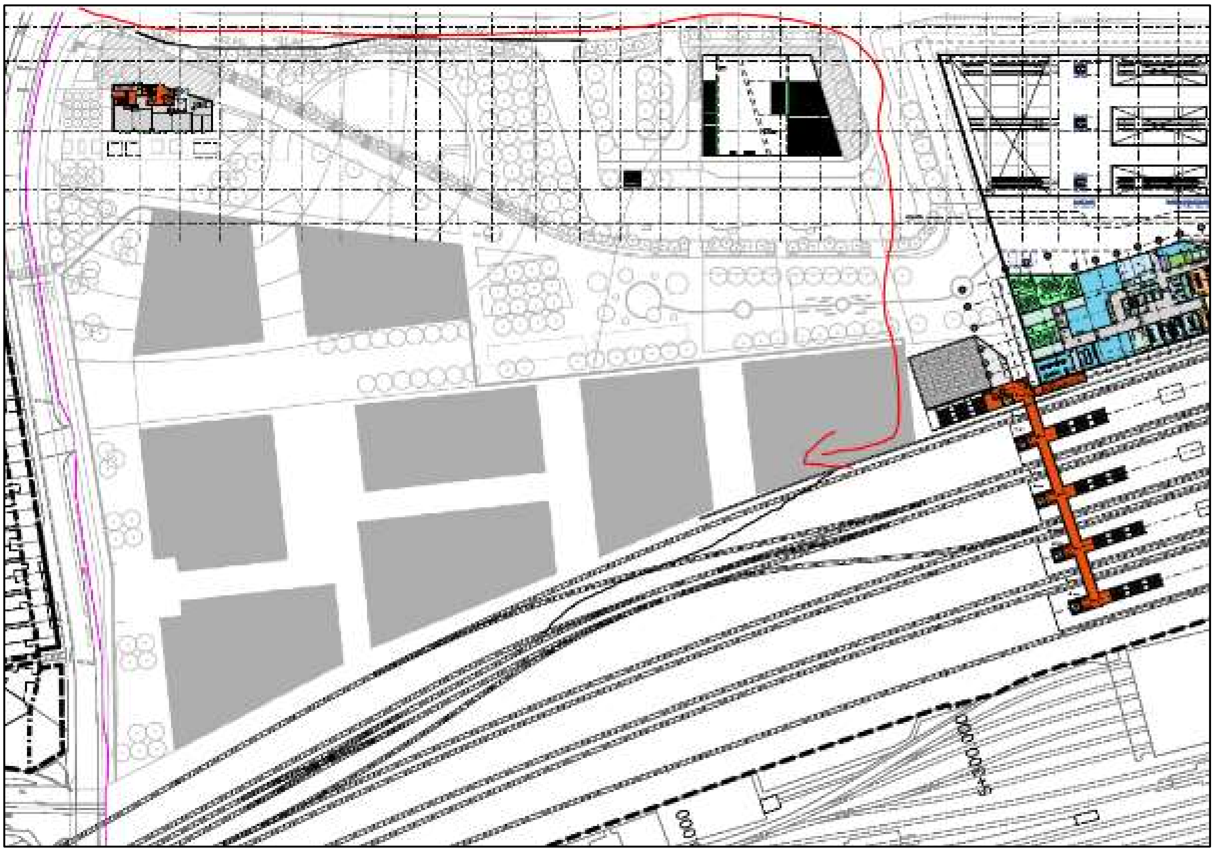
This follows the same principles as Option 4A, however the access is Via Victoria Road. This has the advantage of a shorter access road on railway land, but the disadvantage of the access being on a busier road with a greater level difference.



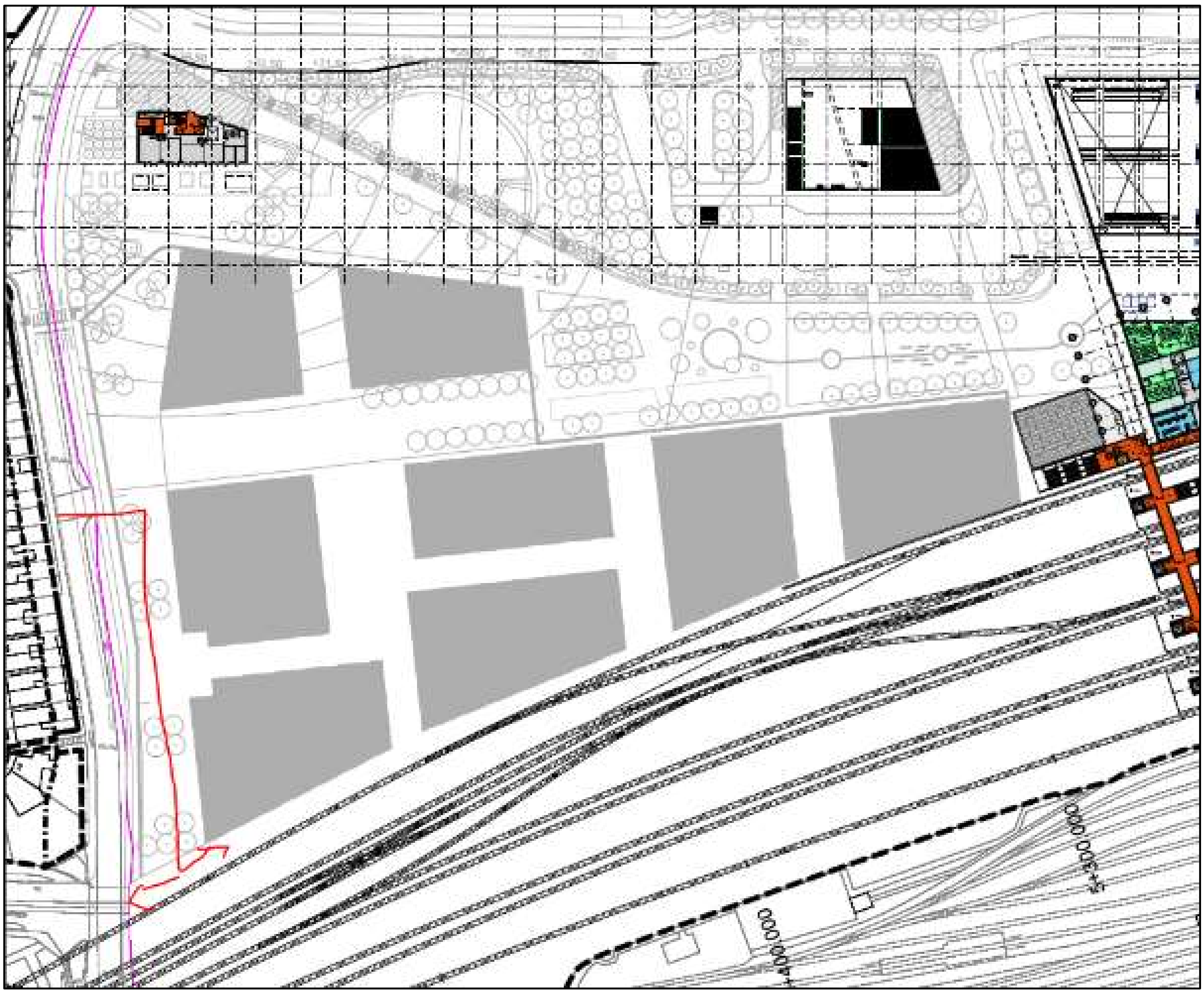
For further information or comments please contact: Christopher.ford2@networkrail.co.uk

3.2.9. Option 5

Option 5 involved access off Old Oak Common lane, through the ASD (exact location to be determined by Urban Realm Designer). A rough sketch of this is shown below. 5A, 5B and 5C are then options which have the same access to the rail corridor but different locations for the RRAP and possible Logistics compound.



For further information or comments please contact: Christopher.ford2@networkrail.co.uk



For further information or comments please contact: Christopher.ford2@networkrail.co.uk

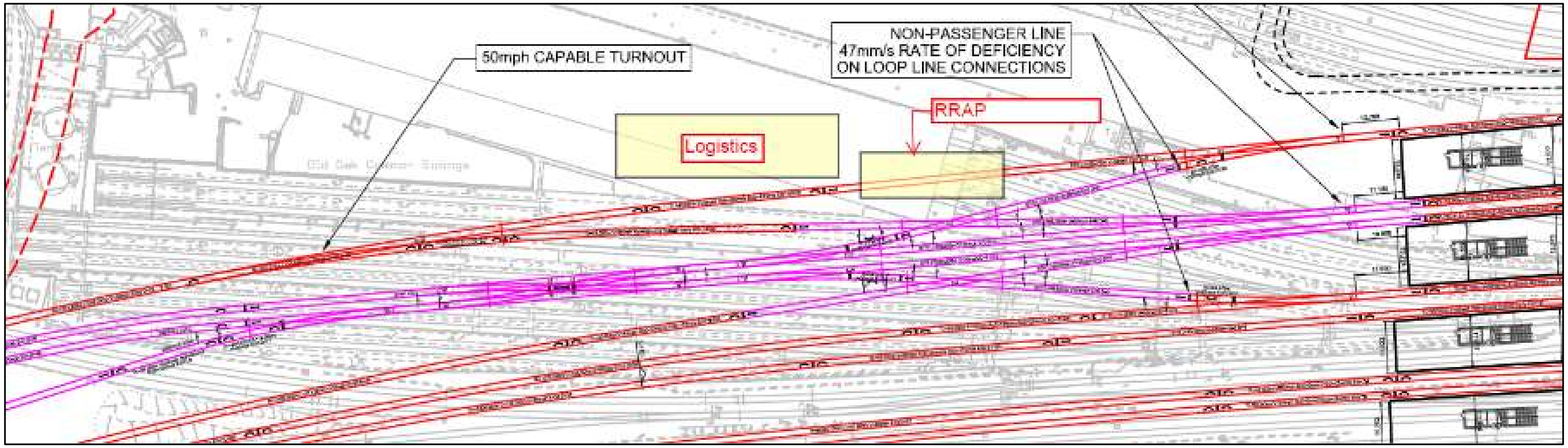
3.2.9.1. 5A – RRAP in 'Guts' of Scissors

RRAP to be provided on the Up Relief in the guts of the scissors.

Risk:

Possibly hard to isolate and may be issues with possession limits, unless signalling controls can be introduced.

This will complicate the Chiltern connection and would require a block of ANL to access.



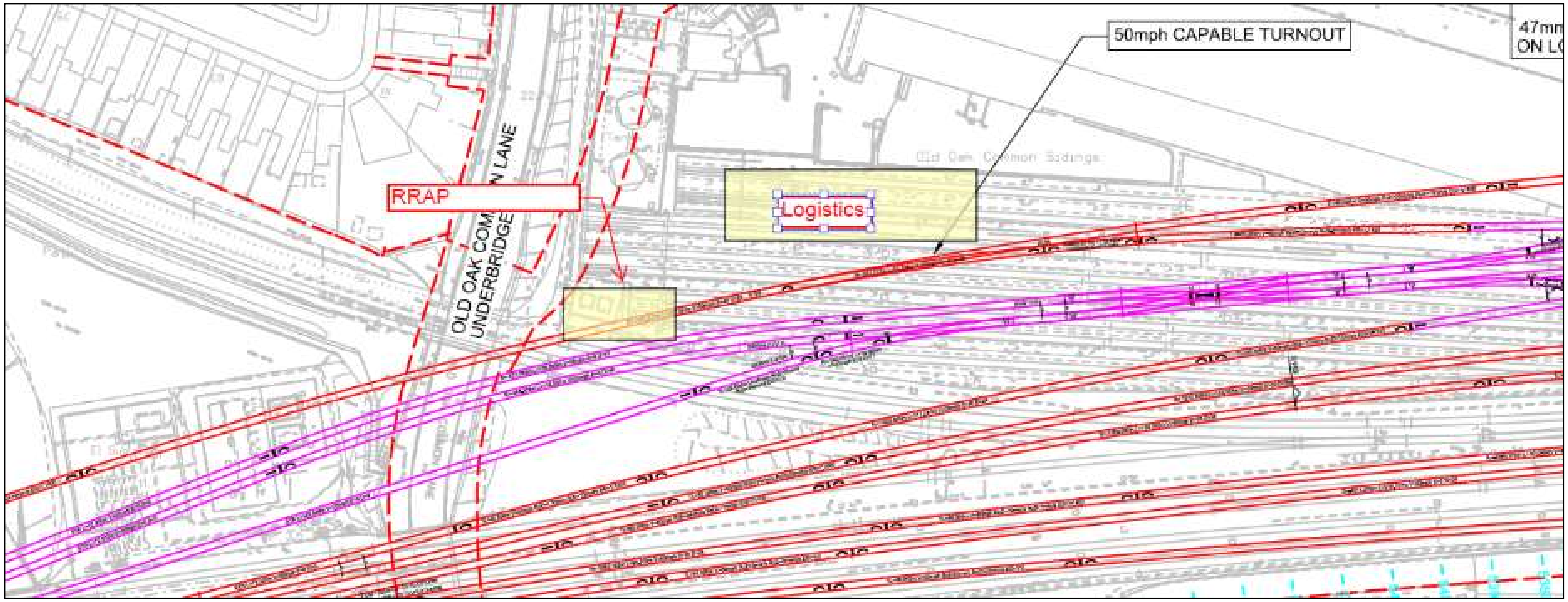
3.2.9.2. 5B – RRAP to Country of Up Relief to Platform 7 turnout

RRAP to be provided to the country of the turnout connecting the Up Relief to Platform 7. This offers an easier and more useful location for the RRAP compared to Option 5A.

Risk: Possible clash with UTX chambers and interface with OOC Ln.

Longer distance for access to be provided through ASD

This would likely preclude, or complicate the Chiltern Platforms. Block of ANLwould be required for access



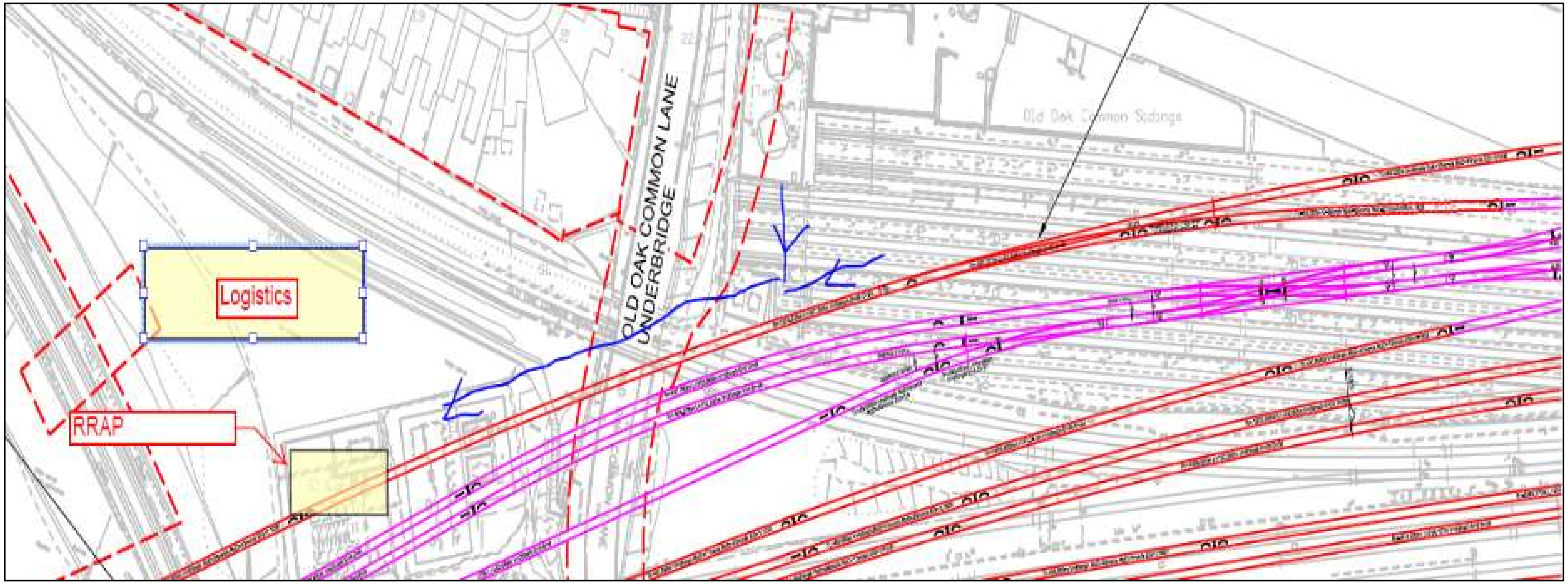
For further information or comments please contact: Christopher.ford2@networkrail.co.uk

3.2.9.3. 5C – RRAP in Feeder station site, with access across OOC Ln bridge.

OOC Ln bridge would need to be widened to allow vehicular access to the North of the Up Relief.

The RRAP and logistics compound would then be in the Feeder Station site.

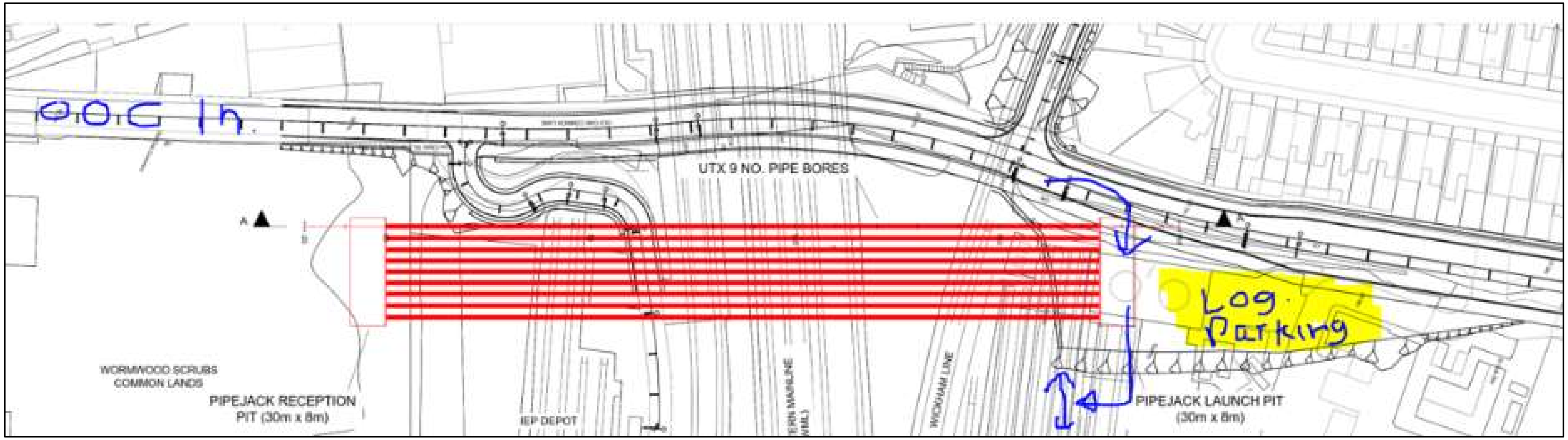
Risk: This would likely preclude Chiltern platforms or at minimum require a block of ANL for access



For further information or comments please contact: Christopher.ford2@networkrail.co.uk

3.2.10. Option 6

Option 6 is based around accessing the rail corridor via the proposed Utilities UTX diversion chambers and associated embankments.



The level area adjacent to the UTX chamber could be used for parking and logistics.

6A, 6B and 6C are as per Option 5A, 5B and 5C above in terms of RRAP location.

Risk:

- All options pose serious constrains on Chiltern connection / platform and would require a block of the ANL line to access.
- Consideration of the grade of embankment would need to be considered.

For further information or comments please contact: Christopher.ford2@networkrail.co.uk

3.3. Relief Lines recommendation

The proposed location for the Eastern Access should be provided to HS2 Ltd to assess the impact on their urban realm and box construction. This could be significant.

The proposed locations for the Western access should be assessed for feasibility and processed in line with iELC. The Western access has a possible significant interface with the proposed operational concept if the turnback lines are planned to be in use whilst there is a relief line block to the West of the station which may preclude some options.

It is advised that OOC Station is treated as a pedestrian access to the mainlines for inspections and fault response. Logistics and storage should be provided in the wide ways off the ends of platforms. Access should be via end of platform bridges and suitable stairs / ramps off the ends of the platforms. Signalling Lock Out Devices should be provided. Parking space for 2No. Transit vans should be allowed for a suitable distance away from the End of Platform bridges to enable transportation of heavy maintenance kit, ideally via the lifts / stairs provided for emergency escape in the Cess of the Up Relief, outside the fence line. This will prove invaluable on mid-week nights.

Note: The Relief lines will be functional after 2023, so opportunities to install these solutions in advance would be beneficial.

Option	Does HS2 Project have the land to install the mitigation	Does HS2 have the powers to install the mitigation	Who is best placed to design (off track)	Who is best placed to install (Off track)
East	TBC – Yes?	Yes	HS2 Ltd	HS2 Ltd
West 1A	Yes	Yes	HS2 Ltd and NR	HS2 Ltd and NR
West 1B	Yes	Yes	HS2 Ltd and NR	HS2 Ltd and NR
West 2A	No – Third party agreements outside of project area	No	NR	NR
~~West 2B~~	~~No – Third party agreements outside of project area~~	~~No~~	~~NR~~	~~NR~~
West 3A	No – Third party agreements outside of project area	No	NR	NR
West 3B	No – Third party agreements outside of project area	No	NR	NR
West 4A	No – Third party agreements outside of project area	Yes	NR	NR

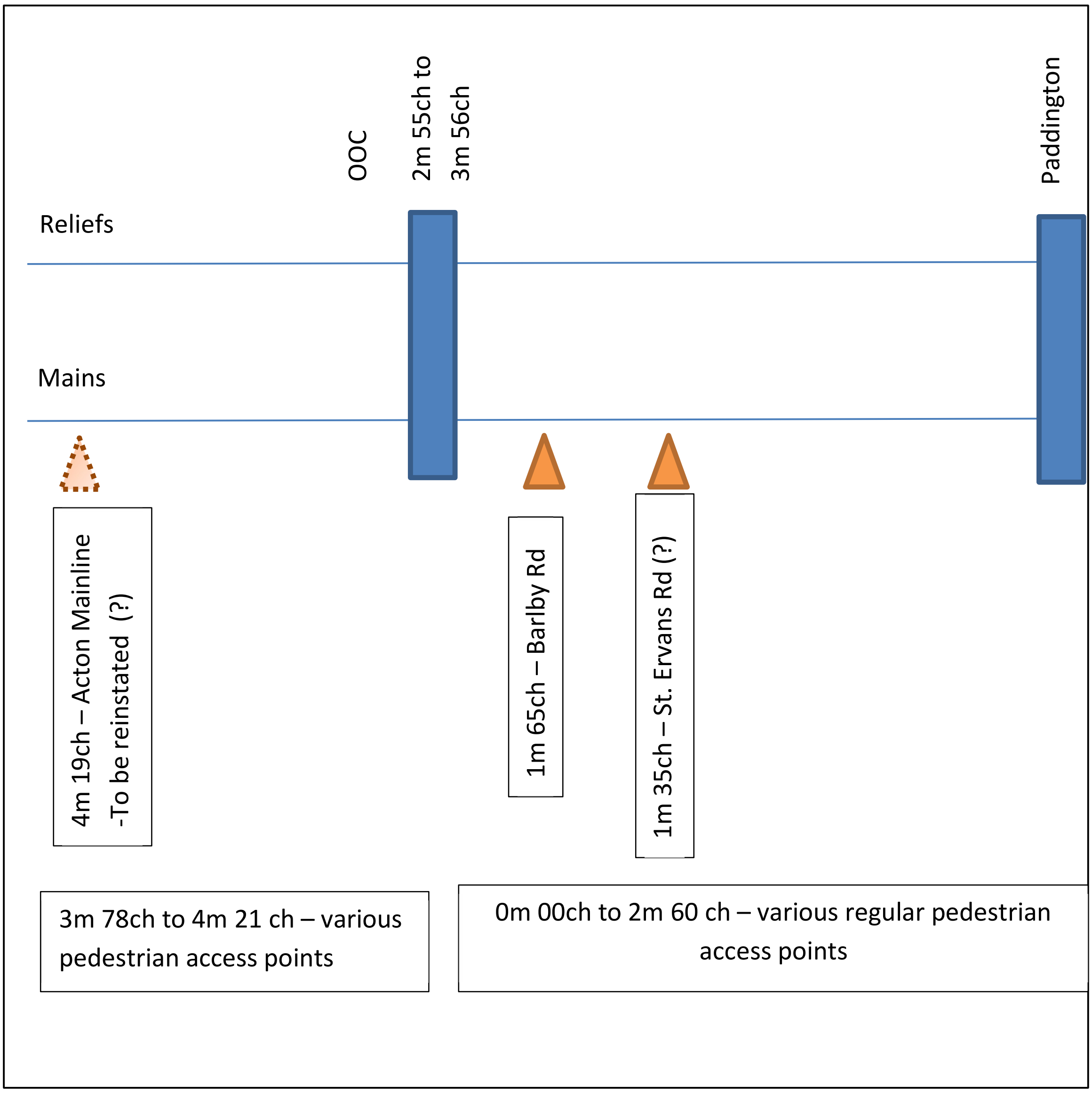
For further information or comments please contact: Christopher.ford2@networkrail.co.uk

West 4B	No – Third party agreements outside of project area	Yes	NR	NR
West 5A	Yes	Yes	HS2 Ltd	HS2 Ltd
West 5B	Yes	Yes	HS2 Ltd	HS2 Ltd
West 5C	Yes	Yes	HS2 Ltd	HS2 Ltd and NR
West 6A	Yes	Yes	HS2 Ltd	HS2 Ltd
West 6B	Yes	Yes	HS2 Ltd	HS2 Ltd
West 6C	Yes	Yes	HS2 Ltd	HS2 Ltd and NR

4. Main Line Access

The project does not affect the boundary fence adjacent to the Down Main.

The current mainline access points are shown schematically below and are unaltered as part of the project.



Generally it is expected that the mainlines will only be subject to either a complete block from the West to Paddington, or a block from the West to OOC, with the exception of North Pole depot access.

The increase in assets on the mainlines is currently proposed to be 4No. Turnouts and 2No. Crossovers with associated OLE and signalling infrastructure.

For further information or comments please contact: Christopher.ford2@networkrail.co.uk

4.1. Access to the East

There is no reduction in access to the East of OOC Station.

The existing RRAP and access at Barlby road is ~90ch away from the Eastern Throat of OOC. It is therefore close enough to reach the assets. This RRAP has a large logistics area associated with it.

Barlby Rd accesses onto North Pole Line B. Due to the location hindering the access between North Pole depot and Paddington Barlby Rd has restricted access times. Mid-week access is granted on an 8 week rotation, it appears that regular Sunday access is in the EAS.

If a new RRAP could be installed to the West of Ladbroke Grove then access to the Main Lines would be significantly improved. Any access would require negotiation with the operators of North Pole Depot. It is anticipated that an access point could be provided to the West of Mitre Bridge or to the West of the E&C line bridge if agreement could be reached with Hitachi.

4.2. Access to the West

4.2.1. Option 1

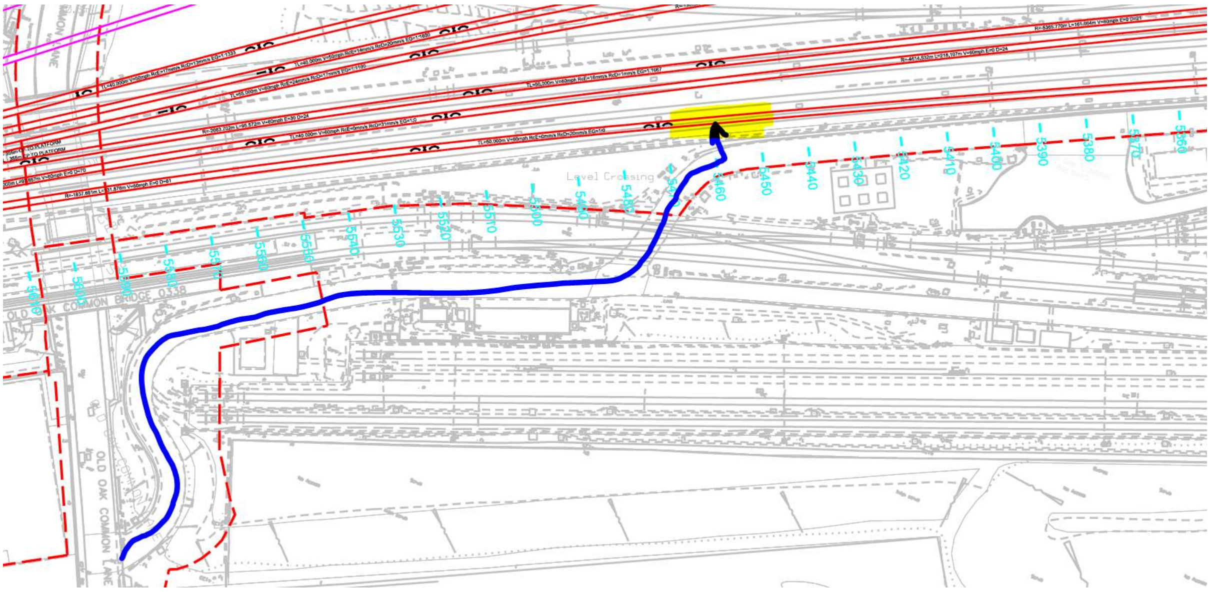
There was a RRAP at Acton Mainline Station which has been removed. It is currently under investigation for relocation 200yards West at Wicks Builders Yard 4m 27ch, placing it approximately 54ch from the Western throat of OOC.

The limits are within the regular possession limits.

For further information or comments please contact: Christopher.ford2@networkrail.co.uk

4.2.2. Option 2

An access point could be installed at North Pole depot, accessed off Old Oak Common Lane. This would require buy-in from Hitachi.



Risk:

- Hitachi interface
- Limited space for logistics area
- Curvey approach road may limit long wheel base deliveries
- Can the depot roads be blocked to allow traversing across the depot level crossing?

4.3. Mainlines recommendation

It is assumed that the majority of access opportunities will allow access from a reinstated Acton Mainline RRAP. This RRAP should be reinstated in the new location.

In the event of OOC acting as a terminus with trains turning back to and from the West Acton Mainline RRAP would not be available. In this situation Barlby Rd RRAP would need to be used. Although Barlby Rd is regularly unavailable to routine mid-week access it is likely that this would be available in any access treating OOC as a terminus from the West.

It is advised that OOC Station is treated as a pedestrian access to the mainlines for inspection and fault response. However, if the RRAPs providing access from the cess, options shown above, cannot be created a pedestrian access point with adjacent parking will be required to facilitate routine maintenance access involving heavier equipment.

For further information or comments please contact: Christopher.ford2@networkrail.co.uk

Logistics and storage should be provided in the wide ways off the ends of platforms. Access should be via end of platform bridges and suitable stairs / ramps off the ends of the platforms. Signalling Lock Out Devices should be provided. Parking space for 2No. Transit vans should be allowed for a suitable distance away from the End of Platform bridges to enable transportation of heavy maintenance kit, ideally via the lifts / stairs provided for emergency escape in the Cess of the Up Relief, outside the fence line. This will prove invaluable on mid-week nights.

Appendix N

North Pole Depot

BGL133270 (Sublease) belongs to Hitachi Rail Europe Limited

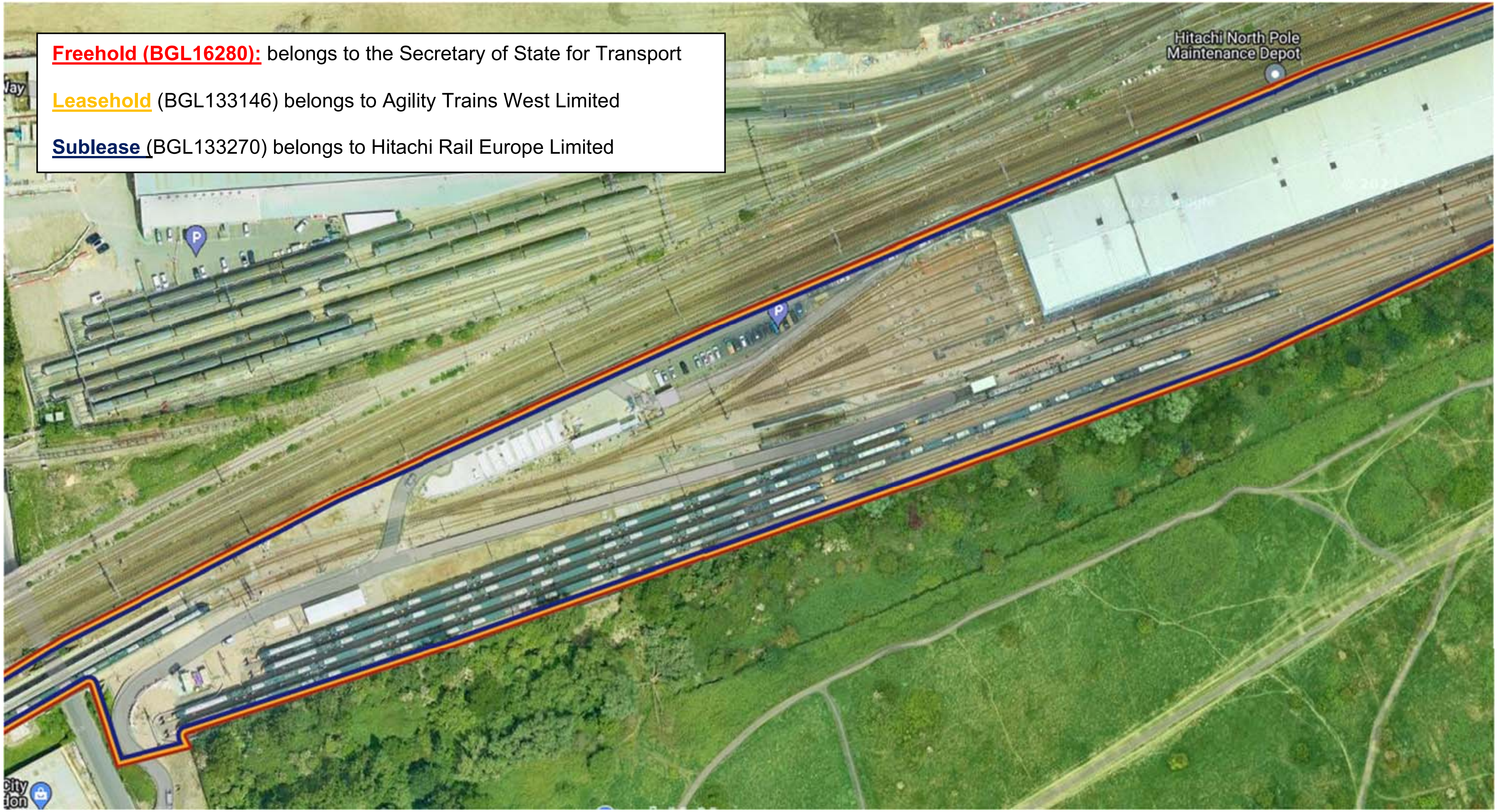
BGL133270

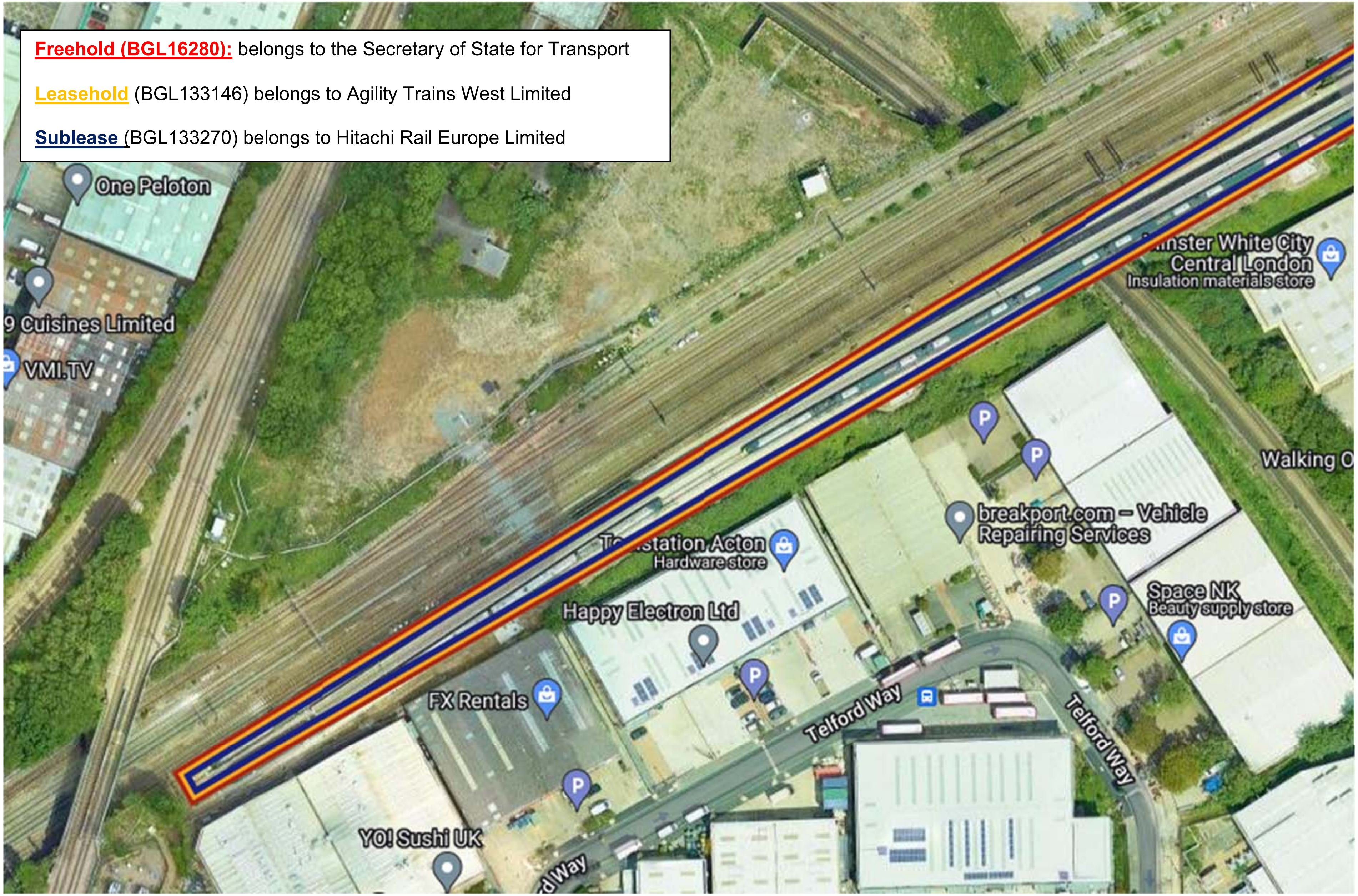
BGL133146 (Leasehold) belongs to Agility Trains West Limited

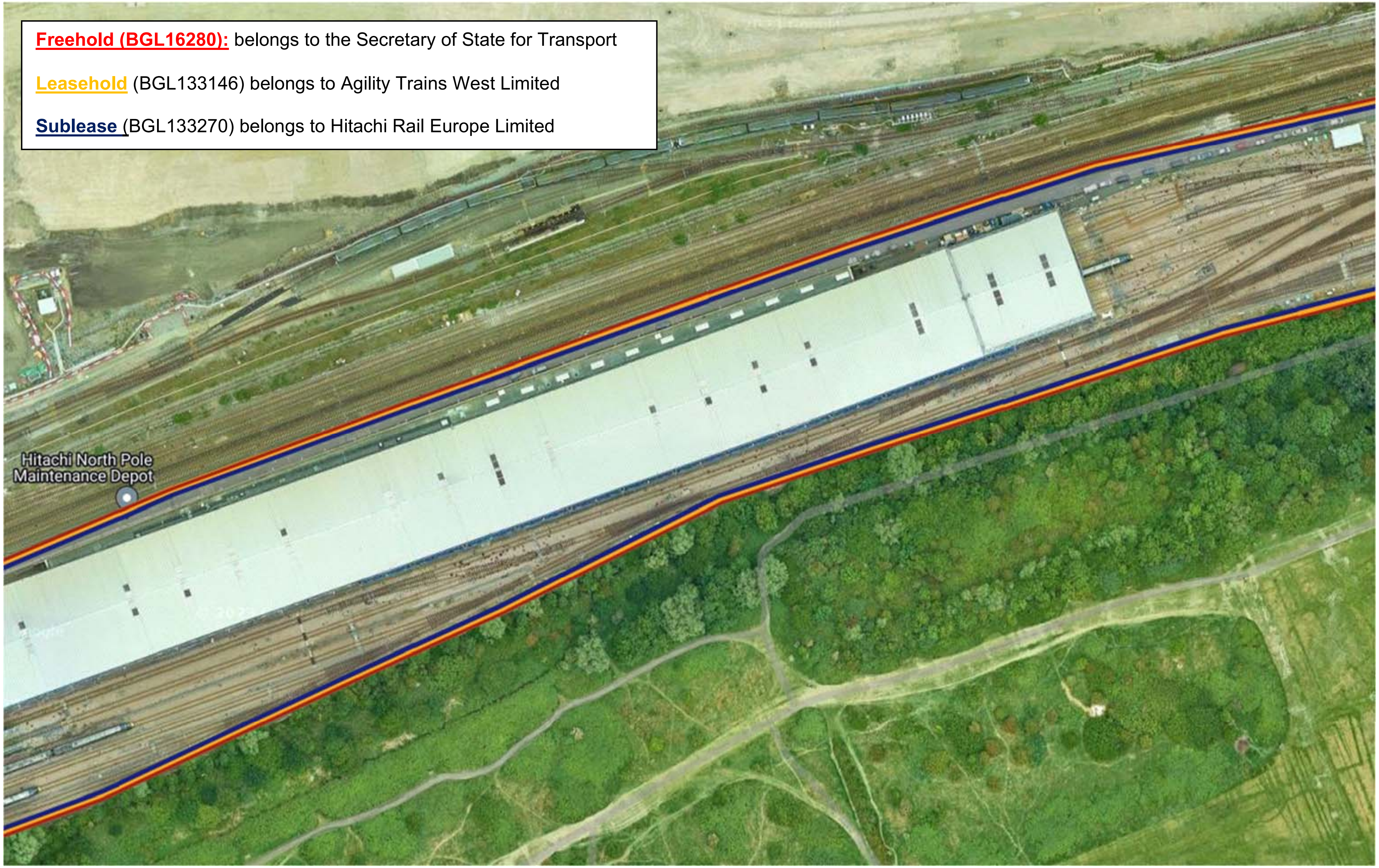
BGL133146

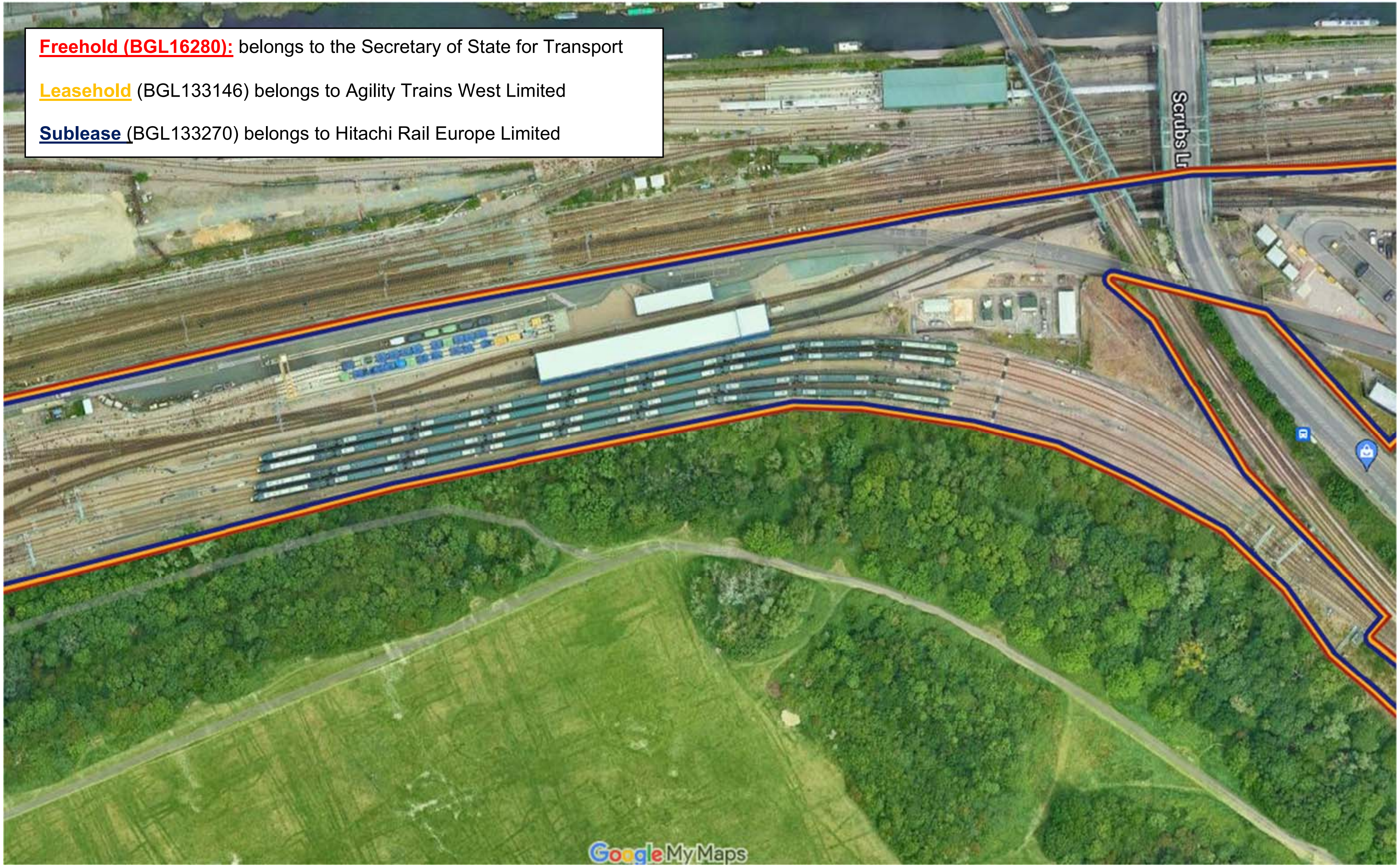
BGL16280 (Freehold) belongs to the Secretary of State for Transport

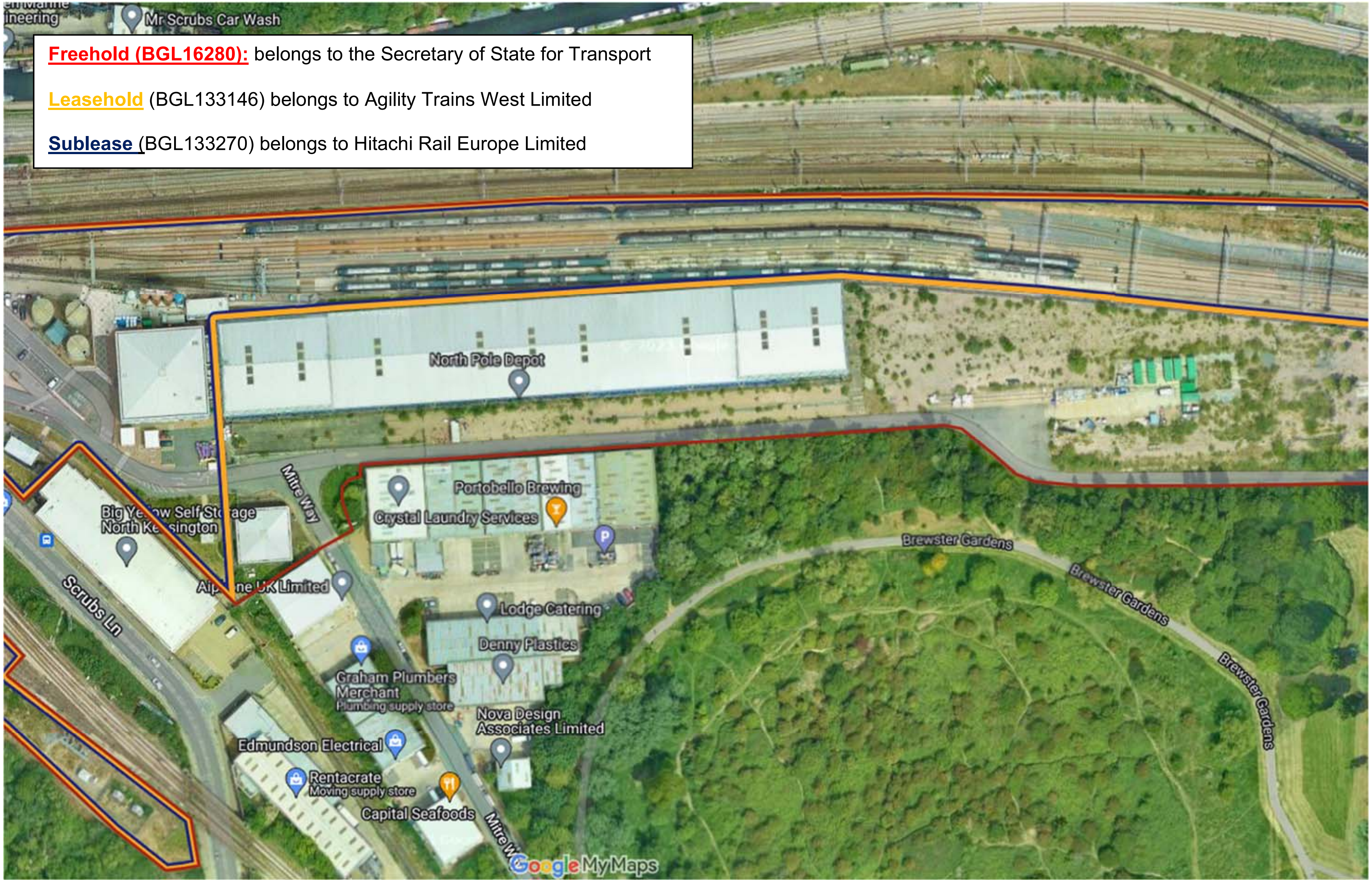
BGL16280

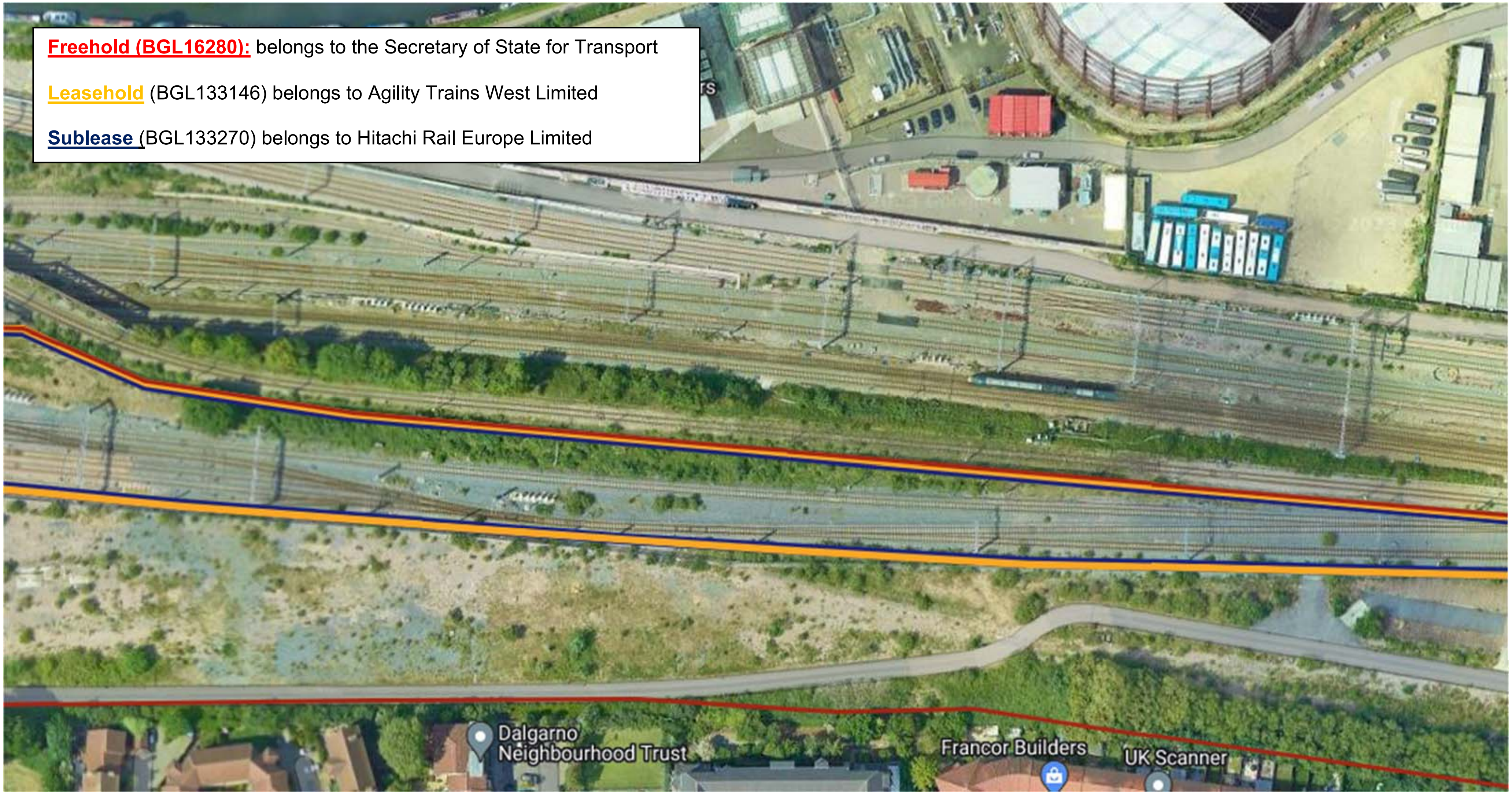

Freehold (BGL16280): belongs to the Secretary of State for Transport
Leasehold (BGL133146) belongs to Agility Trains West Limited
Sublease (BGL133270) belongs to Hitachi Rail Europe Limited
Hitachi North Pole Maintenance Depot


Freehold (BGL16280): belongs to the Secretary of State for Transport
Leasehold (BGL133146) belongs to Agility Trains West Limited
Sublease (BGL133270) belongs to Hitachi Rail Europe Limited
One Peloton
9 Cuisines Limited
VMI.TV
Central London
Insulation materials store
Walking O
breakport.com – Vehicle
Repairing Services
Hardware store
Happy Electron Ltd
Space NK
Beauty supply store
FX Rentals
Telford Way
Telford Way
YO! Sushi UK


Freehold (BGL16280): belongs to the Secretary of State for Transport
Leasehold (BGL133146) belongs to Agility Trains West Limited
Sublease (BGL133270) belongs to Hitachi Rail Europe Limited
Hitachi North Pole Maintenance Depot


Freehold (BGL16280): belongs to the Secretary of State for Transport
Leasehold (BGL133146) belongs to Agility Trains West Limited
Sublease (BGL133270) belongs to Hitachi Rail Europe Limited
Scrubs Ln
Google My Maps


Freehold (BGL16280): belongs to the Secretary of State for Transport
Leasehold (BGL133146) belongs to Agility Trains West Limited
Sublease (BGL133270) belongs to Hitachi Rail Europe Limited
Mr Scrubs Car Wash
North Pole Depot
Portobello Brewing
Crystal Laundry Services
Mitre Way
Brewster Gardens
Scrubs Ln
Lodge Catering
Denny Plastics
Graham Plumbers Merchant
Plumbing supply store
Nova Design Associates Limited
Edmundson Electrical
Rentacrate
Moving supply store
Capital Seafoods
Google My Maps


Freehold (BGL16280): belongs to the Secretary of State for Transport
Leasehold (BGL133146) belongs to Agility Trains West Limited
Sublease (BGL133270) belongs to Hitachi Rail Europe Limited
Dalgarno Neighbourhood Trust
Francor Builders
UK Scanner


Freehold (BGL16280): belongs to the Secretary of State for Transport
Leasehold (BGL133146) belongs to Agility Trains West Limited
Sublease (BGL133270) belongs to Hitachi Rail Europe Limited
Sainsbury's Petrol Station
J M C Waste Disposal
Canal Way
Canal Way
Salters Rd
KM carpet and flooring limited
Specialised Cleaning Services London
Barlby Gardens
Shrewsbury St
Humber Dr

Appendix O

Acton Goods Yard

AGL52214: Unregistered freehold: Network Rail Infrastructure Limited. Leasehold: DB Cargo (UK) Limited

AGL52214

AGL354926: Sublease to Horn Lane Metals Ltd.

AGL354926

AGL531396: Sublease to Network Rail Infrastructure Limited

AGL531396

AGL431619: Freehold owned by Aggregate Industries UK Limited.

AGL431619


Area bordered red:
• Unregistered freehold: Network Rail Infrastructure Limited
• Leasehold (AGL52214) of land known as 'Acton Marshalling Yard' belongs to DB Cargo (UK) Limited
Leasehold (AGL431619) of land known as 'Land lying to the north-west of Horn Lane, London (W3 9EH)' belongs to Aggregate Industries UK Limited
Sublease (AGL354926) of part of land known as 'Goods Yard' belongs to Horn Lane Metals Ltd.
Aggregate Industries
Yeoman Aggregates
Horn Lane Metal
Horn Ln
Acton Goods Yard
Acton Main Line
Harry's Café
Bobbin House

Area bordered **red**:

- Unregistered freehold: Network Rail Infrastructure Limited
- Leasehold (AGL52214) of land known as '*Acton Marshalling Yard'* belongs to DB Cargo (UK) Limited


Area bordered **red**:
- Unregistered freehold: Network Rail Infrastructure Limited
- Leasehold (AGL52214) of land known as '*Acton Marshalling Yard*' belongs to DB Cargo (UK) Limited

Noel Rd
Noel Rd
Sublease (AGL531396) of part of land known as '*Land lying to the east of Noel Road, London*' belongs to Network Rail Infrastructure

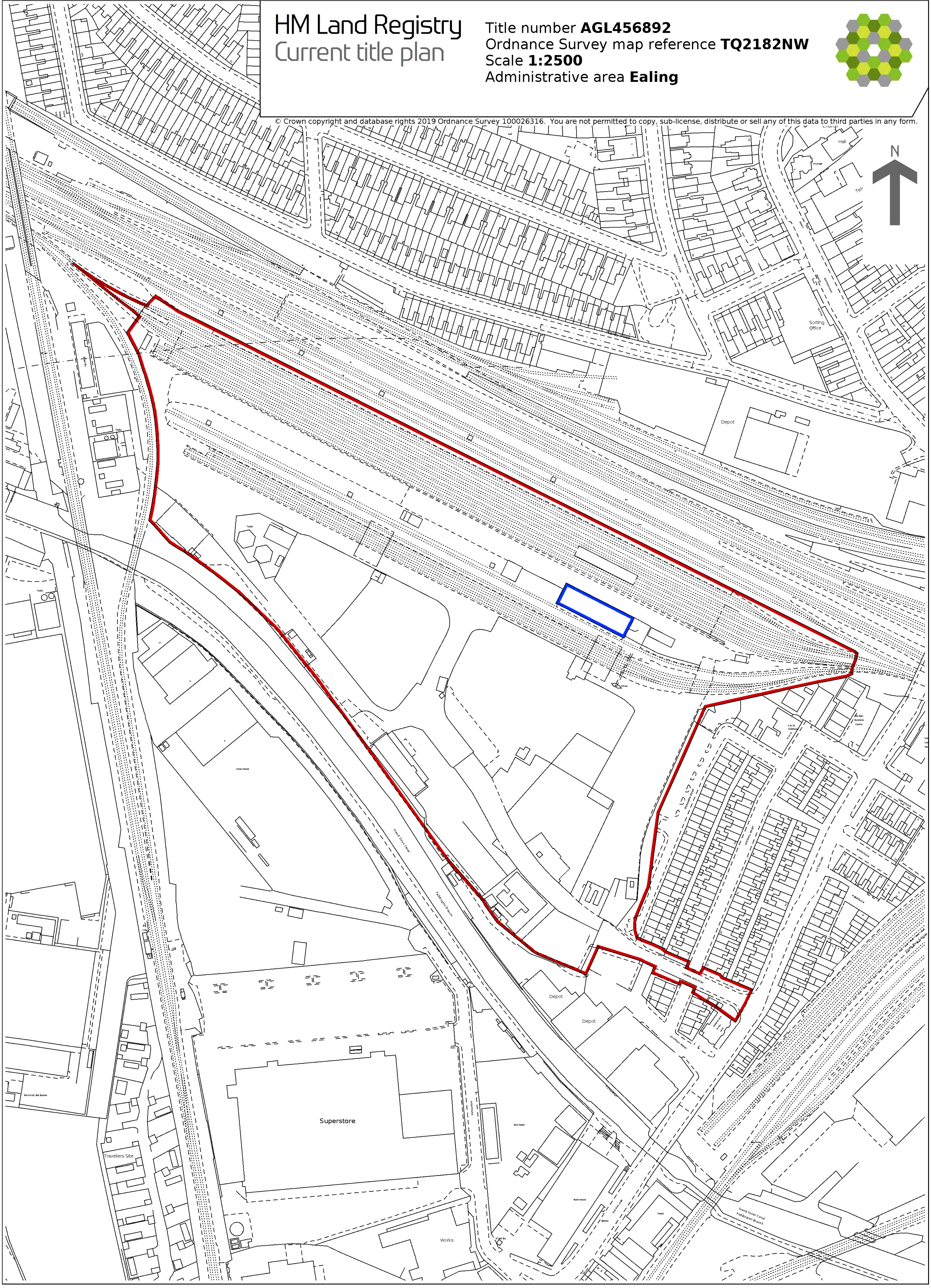
Area bordered **red**:

- <u>Unregistered freehold:</u> Network Rail Infrastructure Limited
- <u>Leasehold</u> (AGL52214) of land known as '*Acton Marshalling Yard'* belongs to DB Cargo (UK) Limited

Appendix P

HM Land Registry
Current title plan

Title number **AGL456892**
Ordnance Survey map reference **TQ2182NW**
Scale **1:2500**
Administrative area **Ealing**



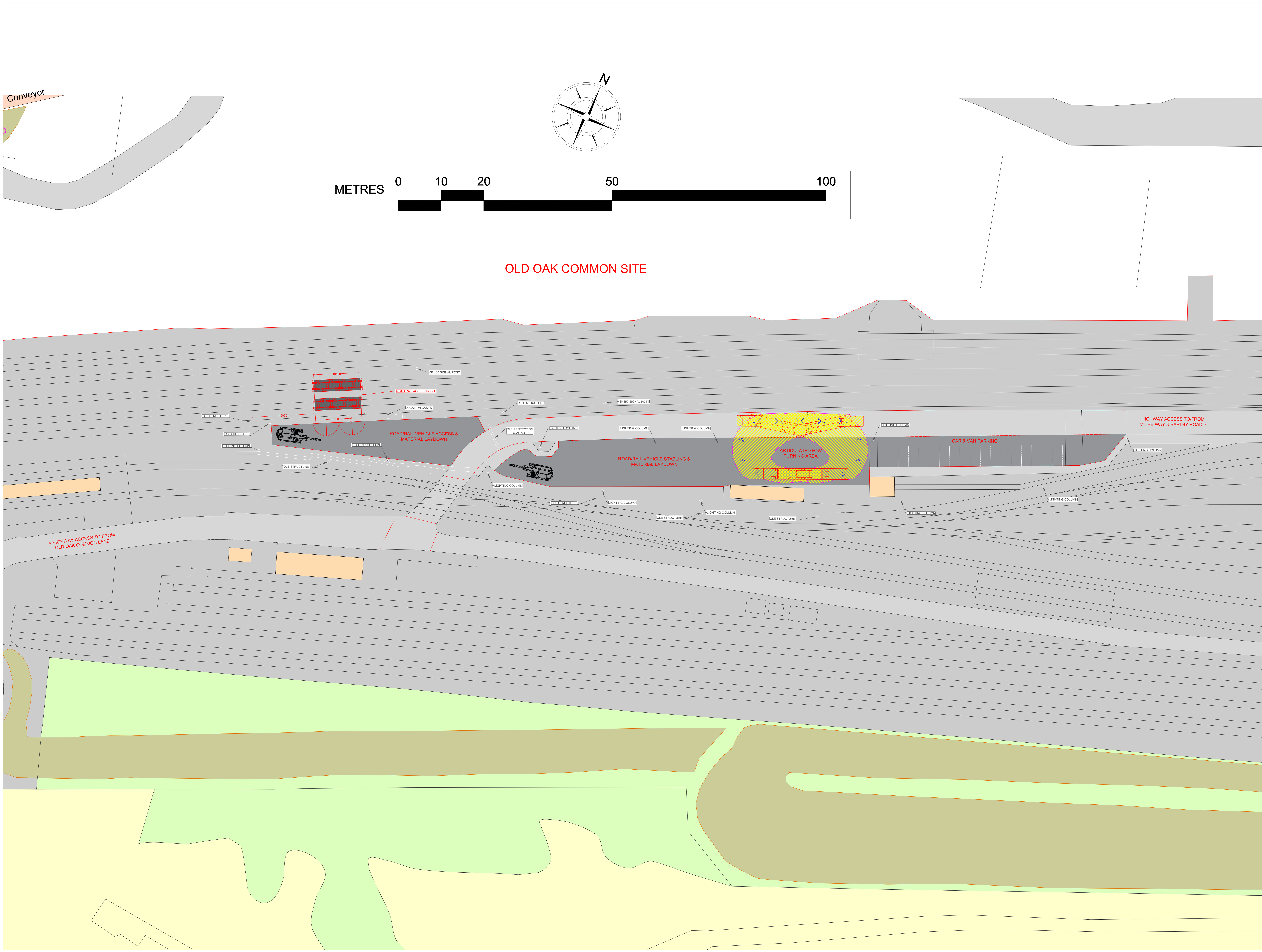
This is a copy of the title plan on 14 OCT 2023 at 07:25:59. This copy does not take account of any application made after that time even if still pending in HM Land Registry when this copy was issued.

This copy is not an 'Official Copy' of the title plan. An official copy of the title plan is admissible in evidence in a court to the same extent as the original. A person is entitled to be indemnified by the registrar if he or she suffers loss by reason of a mistake in an official copy. If you want to obtain an official copy, the HM Land Registry web site explains how to do this.

HM Land Registry endeavours to maintain high quality and scale accuracy of title plan images.The quality and accuracy of any print will depend on your printer, your computer and its print settings.This title plan shows the general position, not the exact line, of the boundaries. It may be subject to distortions in scale. Measurements scaled from this plan may not match measurements between the same points on the ground.

This title is dealt with by HM Land Registry, Wales Office.

Appendix Q



NOTES:

This drawing, the works and concepts depicted are the copyright of Intermodality and may not be reproduced without express written consent.

Chainages, levels and co-ordinates are show in metres. All other dimensions are in millimetres, unless otherwise stated. All clearances and track intervals are quoted to running edge (RE).

This design is based on survey data. Variations to the existing arrangement may have occurred since the survey was completed.

North point is to an approximate orientation.

Track gauge to be nominal 1435mm, unless otherwise stated.

This drawing indicates indicative alignments only, specific work limits are to be confirmed by third parties following option selection.

The installation methodology, staging requirements and track access should be confirmed prior to any design development.

PLAN KEY:

Note not all symbols may be used on the associated plan

Black - Existing or unchanged

Blue - Modified or to be moved

Green - Redundant or to be removed

Red - Proposed or additional

Pink - works by others/Temporary Works

SITE LOCATION:

ELR: MLN1

Chainage(s): 3 miles 25 chains to 3 miles 35 chains

Rev	Amendments	Reviewed by	Date
P01	Draft Submission	NG	10/10/2023

Status Initial Status

Client BELLAVIEW PROPERTIES LIMITED

Project THE NETWORK RAIL (OLD OAK COMMON GREAT WESTERN MAINLINE TRACK ACCESS) ORDER

Title North Pole Depot RRAP General Arrangement Plan **Sheet** 1 of 1

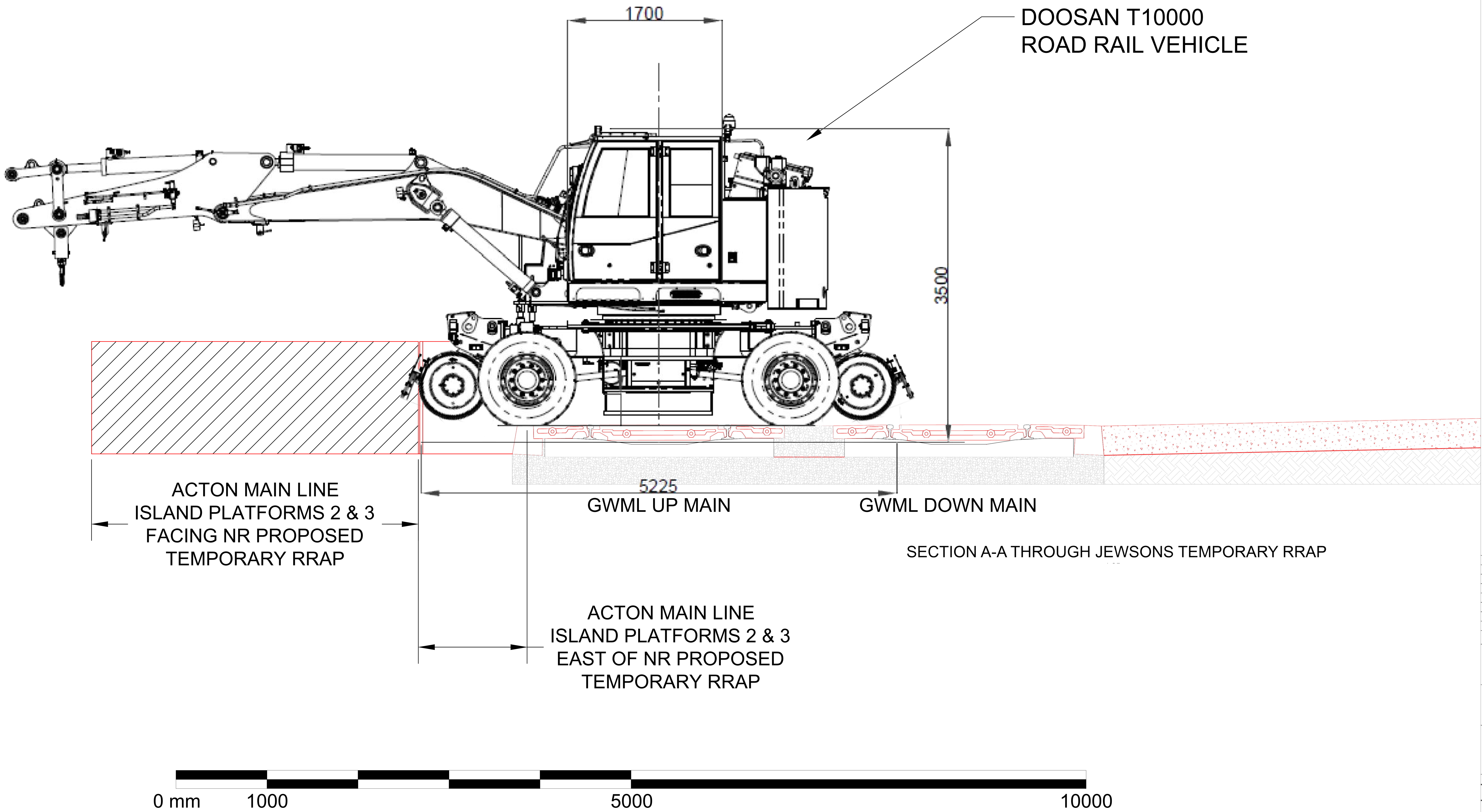
Project	Originator	Volume	Level	Type	Role	Number
200286 -	IMT -	XXX -	XX -	DRG -	TRK -	000001

Internal project reference		200286	
Suitability / Suitable for		S0 Initial Status	
Scale	Created	Revision	
Refer to scale bar	10/10/2023	P01	
Project Lead	Drawn NG	Checked	DP
NG	Reviewed DP	Approved for Issue	NG

intermodality
transport strategy & delivery

Sheet Size A1 841mm x 594mm
Drawing Template 23/01/23

Appendix R



NOTES:

Chainages, levels and co-ordinates are show in metres. All other dimensions are in millimetres, unless otherwise stated. All clearances and track intervals are quoted to running edge (RE).

This design is based on survey data. Variations to the existing arrangement may have occurred since the survey was completed.

North point is to an approximate orientation.

Track gauge to be nominal 1435mm, unless otherwise stated.

Clearance Point = Fouling Point (1970mm) + 5860mm.

This drawing indicates indicative alignments only, specific work limits are to be confirmed by third parties following option selection.

The installation methodology, staging requirements and track access should be confirmed prior to any design development.

PLAN KEY:

Note not all symbols may be used on the associated plan

Black - Existing or unchanged

Blue - Modified or to be moved

Green - Redundant or to be removed

Red - Proposed or additional

Pink - works by others/Temporary Works

CP Clearance Point

FP Fouling Point

SITE LOCATION:

ELR:

Chainage(s):

Rev	Amendments	Reviewed by	Date
P01	Draft Submission	NG	12/10/2023

Status Initial Status

Client BELLAVIEW PROPERTIES LIMITED

Project THE NETWORK RAIL (OLD OAK COMMON GREAT WESTERN MAINLINE TRACK ACCESS) ORDER

Title Acton Main Line Proposed Temporary RRAP Section with RRV **Sheet** 1 of 1

Project	Originator	Volume	Level	Type	Role	Number
200286 -	IMT -	XXX -	XX -	DRG -	TRK -	000101

Internal project reference	200286
Suitability / Suitable for	S0 Initial Status

Scale	Created	Revision
Refer to scale bar	12/10/2023	P01

Project Lead	Drawn	NG	Checked	DP
NG	Reviewed	DP	Approved for Issue	NG

intermodality
transport strategy & delivery

Sheet Size A1 841mm x 594mm
Drawing Template 23/01/23

Appendix S

RE: HS2: construction of Old Oak Common station

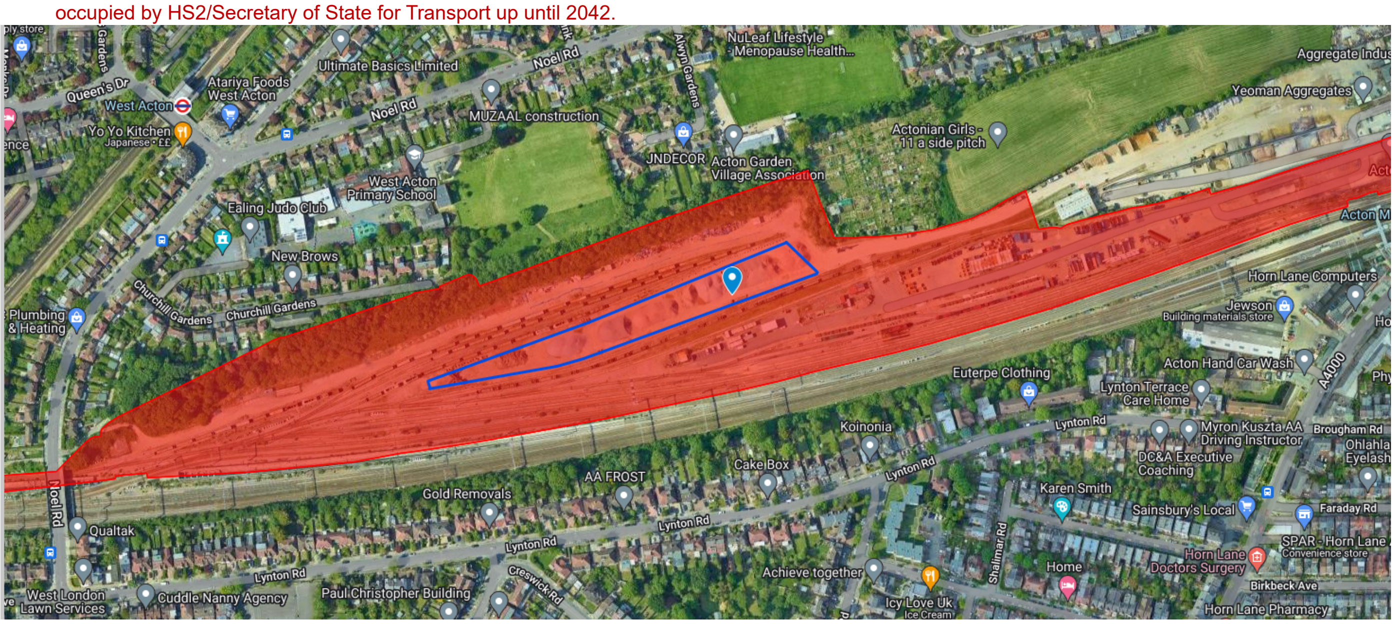
Simon S Lock <Simon.S.Lock@deutschebahn.com>
Fri 13/10/23 13:15
To:Sian Scaife <Sian.Scaife@deutschebahn.com>;Nick Gallop <nick@intermodality.com>

Subject to Contract, Board Approval and Landlord Consent

Hi Nick,

Please see below, hope the info helpful:

1. The access arrangements with Network Rail for their use of the existing RRAP and associated compound within your lease area; Network Rail have access to 3 lease areas within the site, all of which are separate agreements. Network Rail have unrestricted access to their lease areas.
2. Any engagement to date with Network Rail, HS2 or parties acting on their behalf, regarding possible use of Acton Yard in support of OOC construction; Not able to disclose.
3. The extent to which DB Cargo would be willing in principle to make space available within your lease area for OOC construction, in areas such as temporary office accommodation, vehicles and plant, material laydown and provision of trains to move material between the two sites if required; In principle, we may be able to offer an area within the site for such use, however there is short term occupant on the area identified with other serious long-term interest. The footprint is also directly adjacent to active rail infrastructure and the ideal use for this area would be freight use and likely unable to block other freight customers/uses. Not able to comment on train movements & capacity.
4. If so, would you be able to indicate broadly on your lease area (plan attached) where such space could be made available. As below edged blue.
5. Similarly, with Willesden Euroterminal, whether there has been any discussions about providing space to support OOC construction and the extent to which DB Cargo might be willing to make space available in addition to or instead of Acton Yard. Willesden Euroterminal is currently fully occupied by HS2/Secretary of State for Transport up until 2042.



Simon Lock
Property Asset Manager
L.CA+UK-FP

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From: Sian Scaife <Sian.Scaife@deutschebahn.com>
Sent: 12 October 2023 17:41
To: Nick Gallop <nick@intermodality.com>; Simon S Lock <Simon.S.Lock@deutschebahn.com>
Subject: FW: HS2: construction of Old Oak Common station

Nick

You've left it a bit late! I don't work on Fridays, but Simon is the asset manager for the site, is aware of this case and will probably be able to provide some answers.

Thanks

Sian

From: Nick Gallop <nick@intermodality.com>
Sent: 12 October 2023 12:10
To: Sian Scaife <Sian.Scaife@deutschebahn.com>
Subject: HS2: construction of Old Oak Common station

Afternoon Sian

We have been asked by our client Bellaview Properties to make contact with you regarding your leasehold site at Acton Yard. We are aware that the site is leased from Network Rail. As you may be aware, our client's site (which is opposite Acton Yard) is the subject of a TWAO application by Network Rail to take the land on a temporary basis for 6 years in order to create a new Road Rail Access Point (RRAP) to facilitate their track works in connection with the Old Oak Common Station project. We are aware that Acton Yard includes a RRAP that provides access to the relief lines.

The reason for the enquiry is that NR has dismissed the use of Acton Yard site for providing access to the Old Oak Common (OOC) construction site on the basis that it is leased to DB Cargo. Our client would therefore like to ascertain the following if you are able to confirm:

1. The access arrangements with Network Rail for their use of the existing RRAP and associated compound within your lease area;
2. Any engagement to date with Network Rail, HS2 or parties acting on their behalf, regarding possible use of Acton Yard in support of OOC construction;
3. The extent to which DB Cargo would be willing in principle to make space available within your lease area for OOC construction, in areas such as temporary office accommodation, vehicles and plant, material laydown and provision of trains to move material between the two sites if required;
4. If so, would you be able to indicate broadly on your lease area (plan attached) where such space could be made available.
5. Similarly, with Willesden Euroterminal, whether there has been any discussions about providing space to support OOC construction and the extent to which DB Cargo might be willing to make space available in addition to or instead of Acton Yard

We are due to submit evidence to the Public Inquiry shortly (16 October) ahead of the Inquiry hearings starting on 14 November, so if you are able to respond on the points above that would be greatly appreciated.

Regards

Nick Gallop
Director

Tel: 0845 130 4388
Mob: 07736 872582 *(*note EE is having intermittent problems with this number - please email if any issues*)*
Email: nick@intermodality.com
Web: www.intermodality.com

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