EXPERIENTIAL LEARNING SUBMISSION

Chartered Engineer

ABOUT THIS FORM	Use this form to satisfy the academic competence requirements through the Experiential Learning route, to then progress to professional review as a Chartered Engineer with the PWI (CEng MPWI).

	Candidate name	**PWI Membership number**
CANDIDATE DETAILS		

ELIGIBILITY	Before starting your Experiential Learning submission, you must have made an application for academic assessment and had your eligibility for the route confirmed by the Registration team at the PWI, following either an administrative assessment or referral to our Academic Panel where required. To be eligible for this route, you need at least five years' experience and a qualification accredited as meeting the academic requirements for IEng registration or as partially meeting the CEng requirements; or a qualification assessed as equivalent to an accredited qualification; or registration as IEng via an individual route plus Panel approval for this route to CEng.
THE SUBMISSION PROCESS	Please read our CEng Experiential Learning Guidance before completing and submitting this form. Your submission will be reviewed by two trained PWI Assessors and positive recommendations are ratified by the Academic Panel. If successful, you will receive confirmation that your academic ability has been recorded at CEng level and can now progress to professional review. If the Assessors find the submission insufficient, you are permitted one resubmission before your knowledge and understanding could be tested at interview.
SUBMISSION FORM	Complete all applicable fields in this form. Your submission should highlight the knowledge and skills you have gained at work and provide evidence that demonstrates your learning of the underpinning knowledge and understanding needed. Show how, through work projects or activities, you have elevated your prior knowledge to solve a range of rail infrastructure engineering problems, some complex or non-routine. Your submission should be a personal account written in the first person with specific examples. Supporting evidence (not exceeding 12 pages) must clearly signpost to the learning outcome it is intended to reinforce. Email your full submission as one PDF document no larger than 10mb to: profeng@thepwi.org For further help: +44 (0)1277 230031 (option 2) profeng@thepwi.org www.thepwi.org

CHECKLIST

- ☒ Experiential Learning submission sections A – D (2,000 words maximum)
- ☒ Extended CV with timeline (not more than 4 pages with details of projects and major tasks)
- ☒ Continuing Professional Development records for the past three years
- ☒ Current Personal Development Plan
- ☒ Application fee paid
- ☒ Sponsor verified qualification certificates
- ☒ Supporting evidence, signposted to A – D (not more than 12 pages)
- ☒ Signed applicant declaration, including word count
- ☒ Signed Sponsor declaration

INCLUSIVITY The PWI is an inclusive Institution. Please let us know if we can assist with any requirements you may have.

PART A: Personal and employment details

Personal details

Mr	Mrs	Miss	Ms	Other
	☐	☐	☐	☐

First name

Surname

Date of birth

Address

Email

Home phone

Mobile phone

Employment details

Name of employing organisation

Date appointed to company

Work phone

Work address

Work email

R

Job title and Department

Rail Design Director

To whom do you report and their position?

Who reports to you and how many?

Industry classification	Industry discipline: Track and ballast	Subgrade, earthworks, drainage	Bridges, tunnels, other structures	Electrification	Other (please specify below)
					Click or tap here to enter text.
Environment and Sustainability	☐	☐	☐	☐	☐
Occupational safety	☐	☐	☐	☐	☐
Design	☒	☐	☐	☐	☐
Planning and work programme management	☐	☐	☐	☐	☐
Construction and installation	☐	☐	☐	☐	☐
Plant and equipment	☐	☐	☐	☐	☐
Inspection and maintenance	☐	☐	☐	☐	☐
Instrumentation, measurement and data management	☐	☐	☐	☐	☐
Research	☐	☐	☐	☐	☐
Engineering safety management incl regulation, standards, assurance	☐	☐	☐	☐	☐

Background	Contractor	☐	Client	☐	Consultant	☒	Other (please specify)	Click or tap here to enter text.

PART B: Qualification details

Please attach verified copies of your certificates with this application.

Start and finish dates	Certificate / Diploma / Degree (Qualification and course title)	College / University / Training provider	Full / Part time?
		BTEC National Certificate - Civil Engineering	Part time
		HND - Civil Engineering	Part time
		BSc - Civil Engineering (1st Class Honours)	Part time
Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.	Choose an item.

Learning Outcomes

The four questions below enable you to demonstrate whether you have achieved the Learning Outcomes required to be recognised as having the CEng academic base. These follow Engineering Council AHEP4 requirements.

When providing answers, it is important to note that a key difference between the academic base requirements for Incorporated Engineers (typically Level 6) and Chartered Engineers (typically Level 7) is the ability to address **complex** as well as **broadly defined** problems, as defined by the Engineering Council. In addition, candidates should demonstrate they can **evaluate** the impact of their work and the way they communicate. Candidates should provide examples with the following in mind:

- Broadly-defined problems involve a variety of factors which may impose conflicting constraints but can be solved by the application of engineering science and well-proven analysis techniques
- Complex problems have no obvious solution and may involve wide-ranging or conflicting technical issues and/or user needs that can be addressed through creativity and the resourceful application of engineering science.

Reflective statements **must** be included within **each response A - D**. The reflective statement sets out what you have learnt from taking part in the activity, any problems you have encountered, what skills/knowledge you have taken from participating in this project which you can apply elsewhere, and what would you do differently in the future.

Your personal data is stored on our membership database and treated with the highest confidentiality in accordance with the PWI Privacy Policy https://www.thepwi.org/uploads/privacy_policy

Applicant Declaration - Please read it carefully before you sign underneath.

I declare the information in this application to be complete and correct and that the total word count is 2198.

Signed

Date

17/11/2021

Sponsor Declaration - Please read it carefully before you sign underneath.

I confirm that, to the best of my knowledge, this is the original work of Rob Brotherton and I believe he/she has gained the experience referenced herein and thereby met the academic standard required of a Chartered Engineer.

Signed

Date

17/11/2021

Full name:

EngC No.

Please note that each response and reflective statement combined should be approximately 500 words.

A Science, Mathematics, Engineering Analysis and Practice

Describe a project, scheme or operation that you have been involved in which demonstrates a comprehensive knowledge, understanding and application of **engineering principles, technologies and processes** to the analysis and solution of complex problems.

Give examples from the project where data may be uncertain or incomplete and discuss the **limitations** of the techniques employed.

I was the designer for a heavy S&C refurbishment job at The existing S&C was two-levelled through the switch, and some of the baseplates had been changed out during the course of the asset's life – this pattern of historic S&C is obsolete, very uncommon to find on the network, and information around its original design is scarce.

I was presented with a standard topographical survey for the S&C, with rail-points collected at 5m intervals. Using the knowledge I've gained of surveying accuracies, I identified that this data was not comprehensive enough to undertake a thorough bearer-by-bearer analysis of the geometry through the S&C, but was able to utilise design software to interpolate rail positions at each bearer based upon the survey points.

This method is relatively robust for horizontal positions but is less reliable for vertical positions as fluctuations are less predictable; I had noted the switch rails deflecting above the slide chairs when observed under traffic so undertook further practical work on site to measure the void between the rail and the baseplate using some step-gauges to supplement the static topographical survey data I had.

Once I'd augmented the original surveyed points (using Excel and some macro-driven CAD input) to reflect the track position when under-load, I analysed the data at each bearer to calculate the magnitude of track twist. I then used my awareness of recent rolling-contact-fatigue studies to identify a sub-optimal cant profile through the turnout route – I proposed to optimise the cant on the mainline to improve the rail-wheel-interface on both routes.

I acknowledged that I was makings assumptions about the linearity of the existing timber bearers when proposing the designed levels for the turnout route, so procured additional topographical survey to pick up all the bearer centres and ends to validate the assumptions I had made about using the "similar triangles" theory to calculate the levels on the turnout route based upon the design levels on the through route.

Once I had calculated the levels and positions of the turnout route, I observed fluctuations in the proposed gradient between each bearer and encountered difficulty quantifying the gradient to be projected, I concluded that this was due to survey tolerances and their sensitivity when considered over very short distances.

To calculate the true gradient, I devised a method using trigonometry, with the mainline gradient and cant, and angle of divergence as inputs – this enabled me to accurately quantify the gradient from the turnout route to tie the alignment back into existing.

Reflective statement:

The evidence contained within Annex A was a first-pass at documenting the method for calculating the gradient on a canted piece of S&C – when doing some spot checks against the average-gradient method - I soon came to realise that whilst the mathematics I have employed is sound, the input I had used is not.

I concluded that when calculating the gradient using this method, the diverging angle must be taken at the last fixed point, and not the crossing nose – as the gradient will continue to vary non-linearly in this area; furthermore, the cant should be applied over rail head centres and not running edges.

B Design and Innovation, Health & Safety, and Commercial

Describe a project, scheme or operation you have been involved in which demonstrates your knowledge of design processes and how you used an integrated approach for applying your knowledge of **legal, health & safety, and commercial matters.**

Give examples of new developments or original and innovative thinking with reference to **research and technical literature.**

I lead the multi-disciplinary design on an S&C renewal site that was established as having an existing cable crossing track non-compliantly in hollow steel sleepers, around 400m away from the renewal. The voltage of the cable was in excess of 110V, and when left in hollow steel sleepers, gave rise to a risk from electric shock through wear and tear on the cable from the passage of trains and routine track maintenance.

The cable was due to be replaced like-for-like as part of the renewal, however, through a review of the regulations, I identified that doing so would be a direct contravention of the legal requirements laid out in Electricity at Work Act (with respect to the placing of conductors in positions that may give rise to danger).

The initial proposal from the earlier stages of design development was that an under-track crossing should be provided, but through interrogation of historic records and analysis of site survey information, I was able to determine that this was unsuitable, as existing drainage in both cesses in the cutting would force a proposed under-track crossing to be at a non-compliant depth; and place it at risk of being struck during track renewal activities due to it likely being situated within the ballast renewal zone.

I obtained and reviewed further survey information and aerial imagery that gave me an insight as to the topography of the area, and I was able to successfully identify an alternative location to position the control cabinet. Rather than renewing the cable in its existing location, I proposed that we moved all of the existing Points Heating equipment from the Up cess, to the opposite side of the railway into the Down cess – thus dispensing with the requirements to cross track with the supply cable at all.

Using a HAZID approach and subsequent Designer's Risk Assessment, I ensured that a consultation with the maintenance organisation was undertaken and was able to confirm that moving the equipment did not give rise to additional occupational risks brought about by necessitating crossing the open railway – as both of the nearest access points were also situated in the Down cess.

A new elevated trough route was required to accommodate the renewed cable, but I facilitated a commercial estimate of this upgrade (through provision of a Bill of Quantities - inclusive of the new control cabinet) which concluded a similar value to the allowance assumed for the under-track crossing installation. Furthermore, in moving the control cabinet from its existing location, I was able to specify the re-use of the existing Civils retention feature to accommodate a new location case – preventing inefficient expenditure on a new retaining wall.

Reflective statement:

The provision of the existing Points Heating equipment on the Up-side of the railway at remains a mystery – I assume it may have been down to initial convenience of constructing the existing retaining structures. The discussions I lead during the latter stages of the design process highlighted the importance of reviewing existing information earlier in the project – the lack of initial review of existing infrastructure amounted to significant commercial uncertainty towards the end of the project lifecycle.

C Management, Leadership, Teamwork and Communication

Give examples of how you have applied knowledge of **project and quality management, demonstrated leadership and team working** and **communicated complex engineering matters** with technical and non-technical audiences.

I was the Contractor's Engineering Manager for the Lead Design Organisation for a junction remodelling scheme at – my role on this multi-disciplinary project required me to integrate the design submissions from several external suppliers, manage the requirements of key stakeholders, and coordinate the constructability input from each of the respective construction contractors.

To improve the integration, I managed a federated multidisciplinary 3D CAD coordination model within a locally controlled Common Data Environment – initial attempts by designers entailed "replication" of multidisciplinary design information, but through review at IDC meetings, I identified an opportunity to enhance the way this was managed and took it upon myself to obtain and control a central repository of project CAD data.

I lead regular face-to-face design and constructability review meetings to enhance communication between the team members – the meetings I chaired provided an ideal forum for communicating change with the project management team, and where required, I was able to identify when formal documentation to capture scope and commercial change should be produced. I found that as the team became more familiar with each other, I was able to take a more passive role as individuals became more autonomous and proactive at communicating key information.

I was required to appoint several Design CRE's from external subcontractors – I used my experience and called upon peers for support when dealing with less familiar disciplines, but without being a direct part of the external company's businesses, I found myself reliant upon their quality management systems in terms of the confirmation of suitable competence assessment for the appointments.

With consultation of key stakeholders from the maintenance organisation, I assured the implementation of a revised maintenance strategy for the junction, providing a safe walkway, access steps to a new DNO cubicle, and a portable tool storage pod to facilitate safe and efficient maintenance at the revised junction location.

The project required passive provision for 100mph linespeed - I oversaw the evaluation of clearances to aspirational vehicles which weren't listed in the sectional appendix. I ensured that authorisation from the vehicle manufacturers was granted to allow the project to use the intellectual property contained within the dynamic vehicle models to undertake the clearance analysis.

An example for communicating complex engineering matters is contained within Annex C – this is a user guide I produced to brief both technical and supervisory staff on an intricate construction method for installing bottom ballast under some two-levelled S&C. I produced the guide upon explaining the construction methodology to a member of technical staff who initially failed to understand my proposal; once I'd briefed them with the slides, they then had the confidence to onwardly brief the information to others in their team – which confirmed to me that they understood the proposal.

Reflective statement:

Undertaking this role on similar projects since , I've declined to endorse external CRE appointments on the basis that without proper insight into the parent company's business management system – I'm not able to robustly confirm adequate competence to undertake the role – furthermore, this has led me to question where engineering integration arrangements may be inappropriate.

A cloud-based Common Data Environment (CDE) was not available for the project, which made management of CAD data more onerous and less robust. Having used cloud-based CDE's since, I'd be insistent upon their use on future projects – to embrace the proper definition of the term "common".

When working in new teams, quieter individuals may be less confident in initiating verbal communication, often reliant upon email or similar – once relationships become established, verbal communication becomes a more natural way of exchanging information and is proven to be the most effective, and hence early personal interaction is crucial.

D Engineer in Society

Give examples of how you have applied **ethical and societal values** in your work particularly when balancing risk in the areas of **sustainability, environmental, security and inclusivity**.

Environmental – I was the Responsible Engineer for a renewal at . The environmental survey highlighted newt DNA in a nearby watercourse, which transpired to be newts in the ballast. Through close integration with the construction team, I coordinated the specification of amphibian fencing to trap the newts out. To mitigate the risk of potential shortfall, I instructed modification of the design to provide an intermediate alignment tie-in if the area of ballast was not free from newts upon commencing the renewal.

For the below examples, I was Engineering Manager:
Sustainability – Renewal of ; the existing crossing comprised 8 No. ~16m long hardwood bearers, these could only be procured from South America, and the embodied carbon within them was significant. Subsequently, the crossing was renewed in fibre reinforced foamed urethane longitudinal bearers. I studied technical research and observed that, due to having a much greater modulus of elasticity, the composite bearers were expected to wear approximately 3 times slower than the timber equivalent– thus reducing maintenance intervention requirements.

Security – S&C renewal at requiring DNO cubicle replacement; the existing DNO cubicle was positioned at the top of the embankment with no safe access for the supply authority. Following a review of an environmental map which showed that the bottom of the embankment was located in a flood plain, I managed the design production of a new set of access steps to a renewed DNO cubicle adjacent to the railway. To facilitate security arrangements, I ensured that a palisade fence and gate with dual-locking bar were provided. The design team I managed were based in India and China, so I utilised video conferencing technology to ensure clear communication.

Inclusivity – S&C renewal at foul platform clearances and low footbridges suggested requirements for coper lowering. I procured and reviewed topographical survey to analyse the gradient of the platform surface and concluded that the platform already fell towards the running line, and that any coper lowering would exacerbate the hazard for those in wheelchairs or with pushchairs. I subsequently instructed the team not to design or install the coper modifications, and a gauging risk assessment was produced.

Reflective statement:

Environmental – Newts remained present in the ballast and the renewal at was subsequently curtailed. Uncomfortably, a few of the team exhibited poor ethics and were keen to carry on regardless, on the basis that it was likely to go unnoticed. It was only when reminded of the financial implications that the decision to curtail became widely accepted.

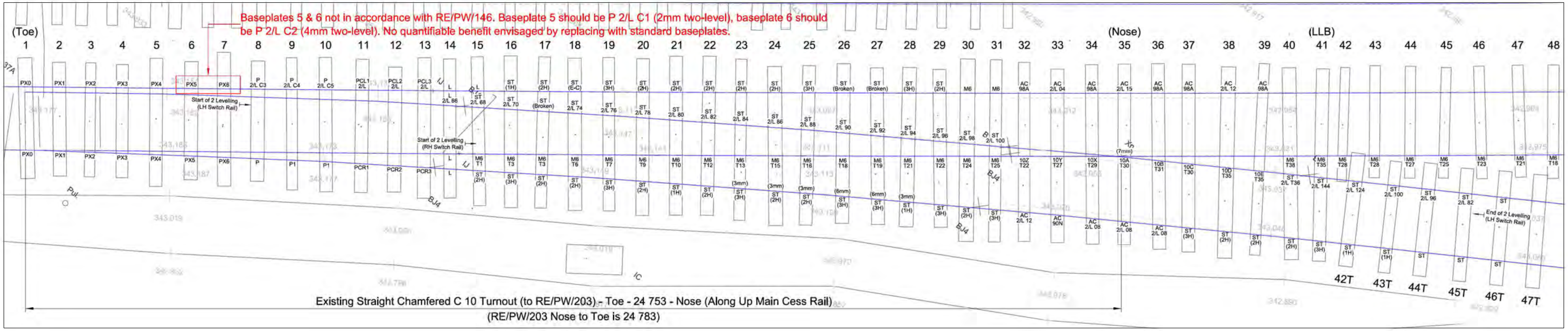
Sustainability – Whilst the replacement bearers are expected to last 3 times longer than the equivalent hardwood, the benefits will only be realised if the rest of the system performs comparably – data for the embodied carbon in the composite bearers is not readily available, and it is therefore difficult to confirm whether this product is actually more sustainable than the timber equivalent.

Security – It would've been more robust to move the DNO cubicle to the boundary fence line at the bottom of the embankment, but environmental constraints rendered this solution inappropriate – the solution chosen cost more but ensured that the railway boundary was kept secure.

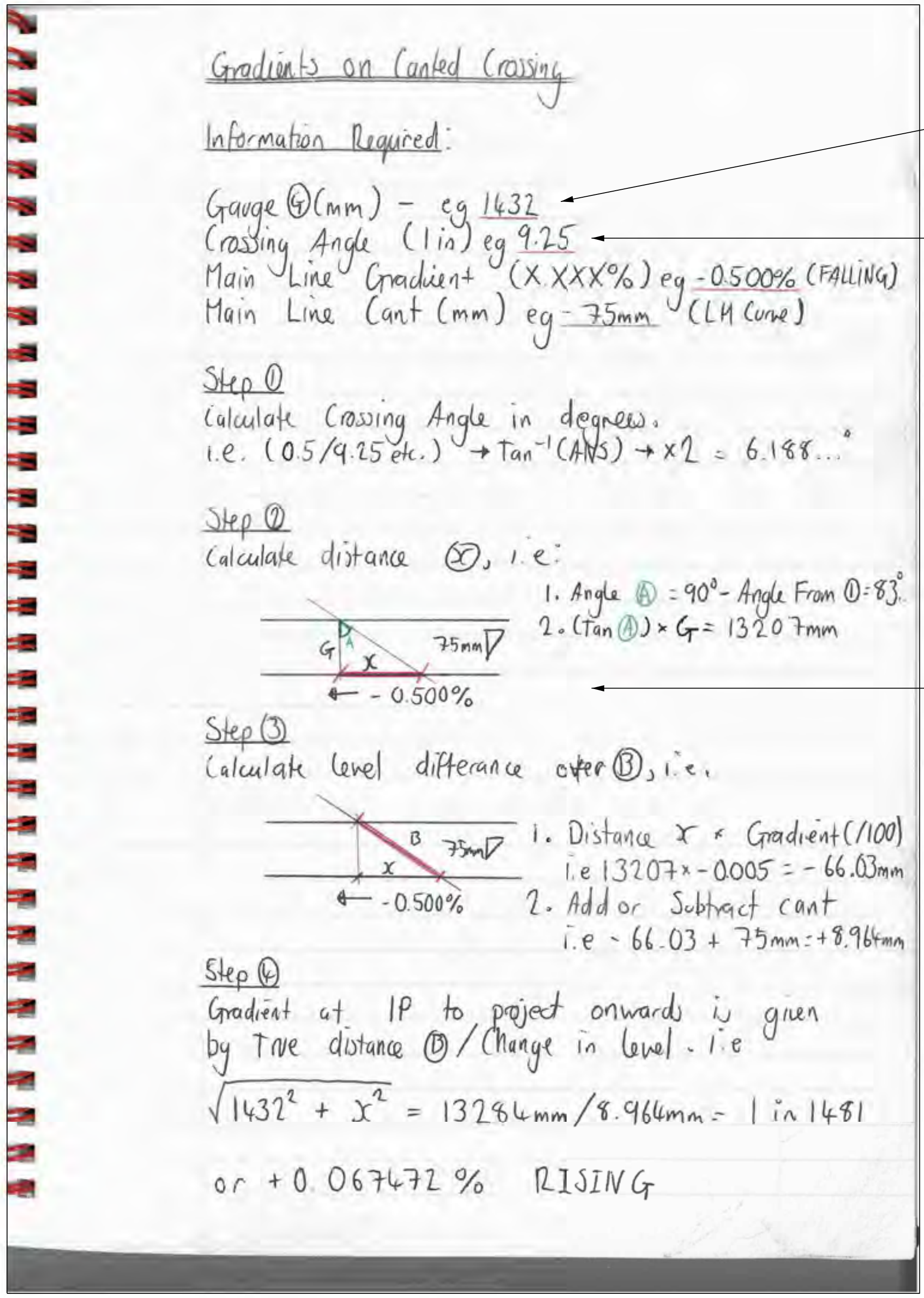
Inclusivity – Compliance to standards nearly drove a reduction in safety to those confined to wheelchairs – the importance of pragmatism must not be underestimated, particularly with respect to the train passenger interface.

Annex A - Science, Mathematics, Engineering Analysis and Practice

Supporting Evidence



S&C Refurbishment - Extract from Layout Drawing Showing Baseplate Analysis



Gradients on Canted Crossing

Information Required:

Gauge (G) (mm) - eg 1432
Crossing Angle (1 in) eg 9.25
Main Line Gradient (X.XXX%) eg -0.500% (FALLING)
Main Line Cant (mm) eg - 75mm (LH Curve)

Step 1
Calculate Crossing Angle in degrees.
i.e. (0.5/9.25 etc.) → Tan⁻¹(ANS) → x2 = 6.188...°

Step 2
Calculate distance (x), i.e:
1. Angle (A) = 90° - Angle From 1 = 83°
2. (Tan (A)) × G = 13207mm

Step 3
Calculate level differance over (B), i.e.
1. Distance x × Gradient (/100)
i.e 13207 × -0.005 = -66.03mm
2. Add or Subtract cant
i.e -66.03 + 75mm = +8.964mm

Step 4
Gradient at IP to project onwards is given by True distance (B) / Change in level. i.e

$\sqrt{1432^2 + x^2}$ = 13284mm / 8.964mm = 1 in 1481

or +0.067472 % RISING

S&C Refurbishment - Initial Notes on Gradient Calculation Principles

Gauge should be taken over rail head centres (nominally 1505mm in the UK).

Angle should be the final diverging angle; taken at the last shared bearer - gradient continues to alter as angle of divergence varies.

Theory is applicable at any point on the turnout - because gradients are measured along track centreline; the relationships may be assumed as linear (as per diagrams) for any given location.

Mainline Bearer Reference (Turnout Bearer Reference)	1 (Toe)	2	3	4	5	6	7	8	9	10	11	12	13
Proposed LH Switch Rail Level at Bearer Centre *	343.237	343.226	343.221	343.220	343.218	343.215	343.213	343.211	343.210	343.206	343.203	343.200	343.198
Proposed RH Stock Rail Level at Bearer Centre *	343.264	343.260	343.255	343.251	343.248	343.240	343.237	343.232	343.228	343.223	343.218	343.212	343.209
Proposed Siding Cant *	-27	-34	-34	-31	-28	-25	-24	-21	-18	-17	-15	-12	-11
Proposed Siding Twist * (Taken every 5 bearers over exact bearer spacing)			1 in 2905 (1mm)	1 in 329 (8mm)	1 in 303 (10mm)	1 in 306 (10mm)	1 in 308 (10mm)	1 in 382 (8mm)	1 in 345 (9mm)	1 in 344 (9mm)	1 in 426 (7mm)	1 in 311 (9mm)	1 in 332 (8mm)

Mainline Bearer Reference (Turnout Bearer Reference)	14	15	16	17	18	19	20	21	22	23	24	25
Proposed LH Switch Rail Level at Bearer Centre *	343.195	343.193	343.189	343.186	343.183	343.181	343.177	343.173	343.169	343.166	343.161	343.158
Proposed RH Stock Rail Level at Bearer Centre *	343.203	343.200	343.194	343.189	343.186	343.181	343.174	343.168	343.164	343.160	343.156	343.150
Proposed Siding Cant *	-8	-7	-5	-3	-3	0	3	5	5	6	5	8
Proposed Siding Twist * (Taken every 5 bearers over exact bearer spacing)	1 in 376 (7mm)	1 in 333 (8mm)	1 in 564 (5mm)	1 in 419 (7mm)	1 in 372 (8mm)	1 in 379 (8mm)	1 in 376 (8mm)	1 in 495 (6mm)	1 in 1499 (2mm)	1 in 987 (3mm)	1 in 3045 (1mm)	1 in 3100 (1mm)

Area of worst case proposed twist. Non-compliant to NR/L2/TRK/2102 (maximum permissible 1 in 375). No action mandated to NR/L2/TRK/001 mod 11 (maximum permissible 1 in 250). Design twist through 2 levelled C switch is 1 in 360.

S&C Refurbishment - Extract from Layout Drawing Showing Track Twist Analysis

S&C Refurbishment - Site Visit to Measure Static Gaps

Letter	Date	Descriptions of revision	Drawn	Chkd.	Appr.

Permanent Way Institution
PWI Central
PO Box 12890
Brentwood
CM14 9RY

Status: FOR INFORMATION

Designed	Checked
	-
Approved	**Date**
-	13/10/2021

Professional Registration

Experiential Learning

Supporting Information - Annex A

Science, Mathematics, Engineering Analysis and Practice

Scales: As Shown | CAD: - -

CAD Ref.: D:\Personal\Professional Registration\Experiential Learning

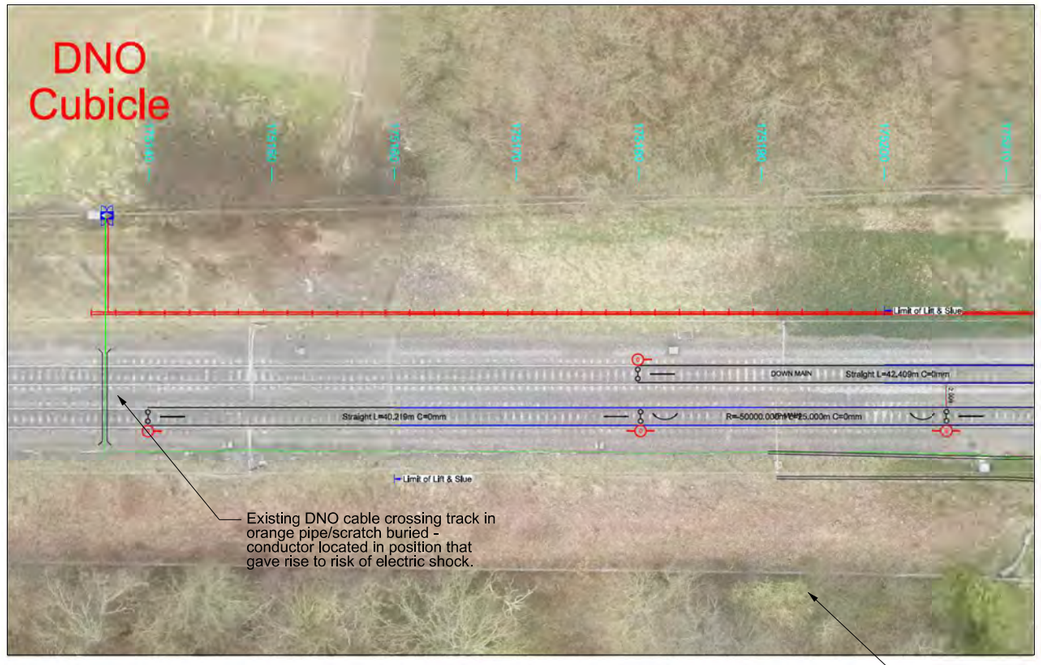
Drawing Number: 1 | Revision: 0

DO NOT SCALE

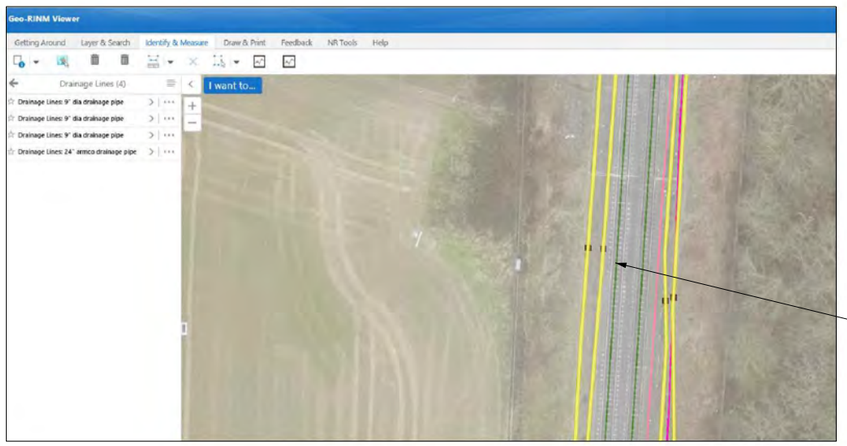
Annex B - Design and Innovation, Health & Safety, and Commercial

Supporting Evidence

- Extract from CAD Coordination Model Showing Existing DNO Supply



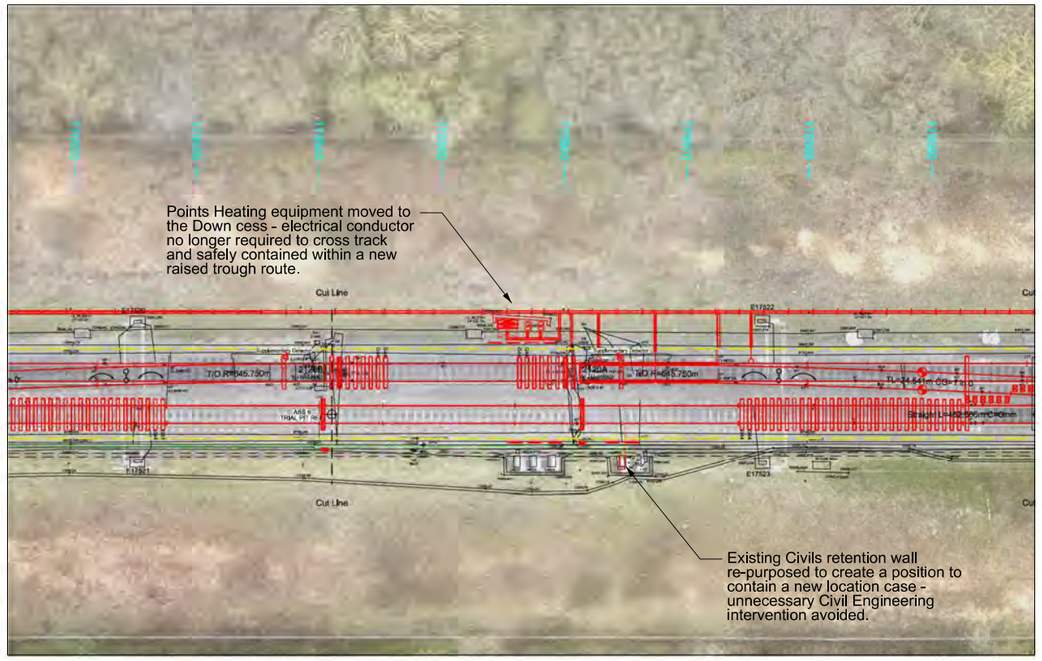
Existing DNO cable crossing track in orange pipe/scratch buried - conductor located in position that gave rise to risk of electric shock.



Hi-resolution aerial imagery sourced free-of-charge (to project) from Network Rail's GeoRINM portal.

Existing buried services (track drainage) identified from Network Rail's GeoRINM portal.

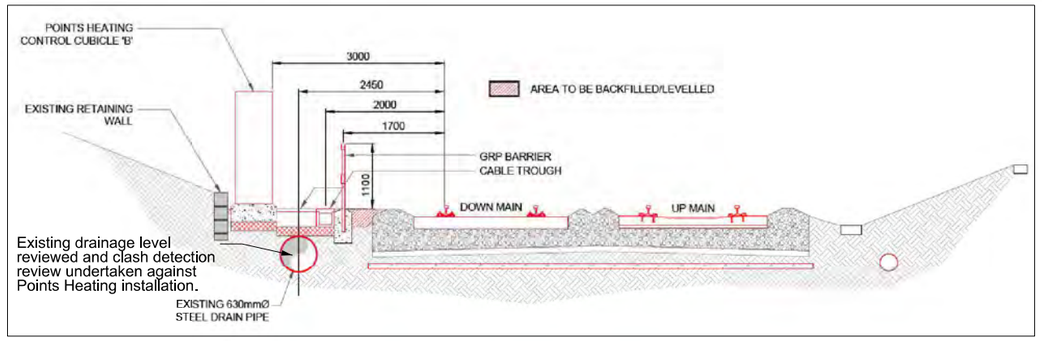
- Extract from CAD Coordination Model Showing Proposed Points Heating Equipment

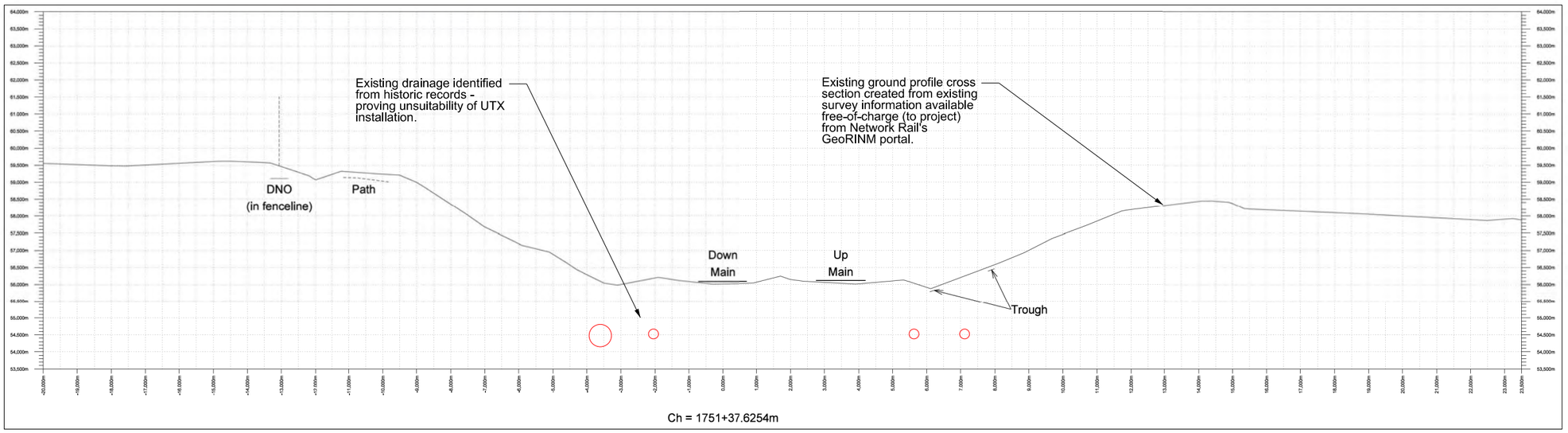


Points Heating equipment moved to the Down cess - electrical conductor no longer required to cross track and safely contained within a new raised trough route.

Existing Civils retention wall re-purposed to create a position to contain a new location case - unnecessary Civil Engineering intervention avoided.

- Cross Section Showing Existing Retaining Structure Utilised for new PHCC





- Cross Section Showing Existing DNO Location - Existing Drainage Superimposed

DO NOT SCALE

Letter	Date	Descriptions of revision	Drawn	Chkd.	Appr.

Permanent Way Institution
PWI Central
PO Box 12890
Brentwood
CM14 9RY

Status: FOR INFORMATION

Designed	Checked
	-
Approved	**Date**
-	13/10/2021

Professional Registration

Experiential Learning

Supporting Information - Annex B

Design and Innovation, Health & Safety and Commercial

Scales	CAD
As Shown	--

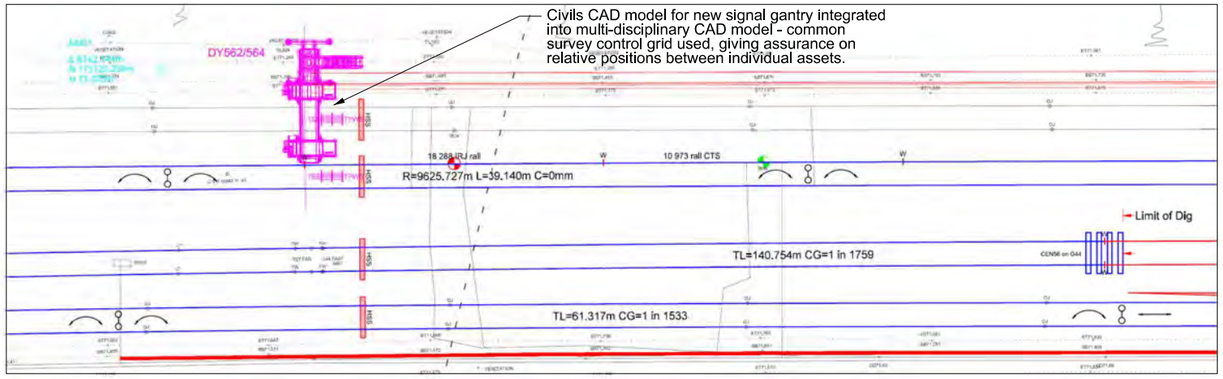
CAD Ref. D:\Personal\Professional Registration\Experiential Learning

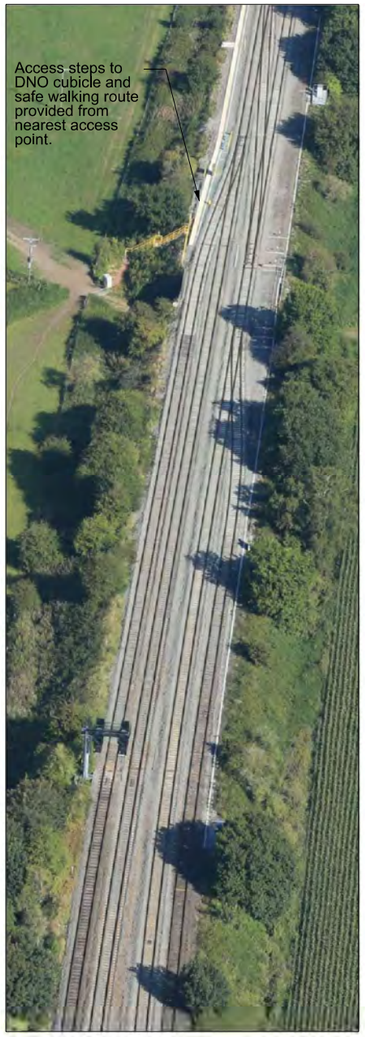
Drawing Number	Revision
[illegible]2	0

Annex C - Management, Leadership, Teamwork and Communication

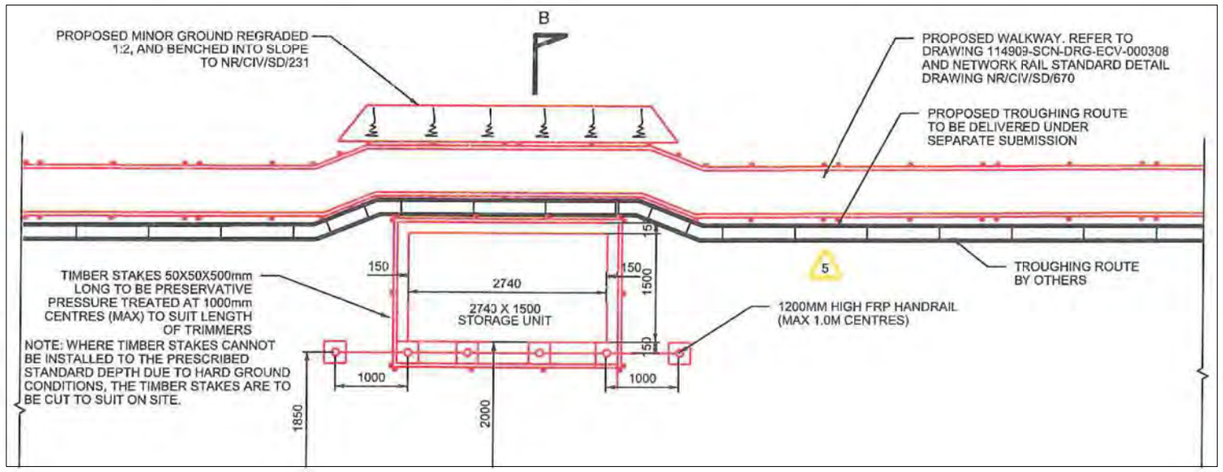
Supporting Evidence

- Extract from Multi-Disciplinary CAD Coordination Model and AIVR Footage





- Extract from Civils Design Drawing Showing Provision of Portable Tool Storage Pod and Safe Walkway



Extracts from IDC/IDR Certificate

Combined IDC/IDR meeting chaired with agreement from DPE.

Multi-disciplinary meetings attended by design, assurance and construction representatives - excellent forum for communication and relationship building.

Page 3 of 10 — Combined Interdisciplinary Check & Interdisciplinary Review Certificate

Form Ref	NR/L2/INI/02009/F0047	Issue Date	05/09/2015	Issue	2.0

IDC STATEMENT:

We the undersigned certify that the drawings listed on the attached schedule(s) in respect of the above project have been the subject of an Interdisciplinary Check, undertaken to eliminate areas of discrepancy between disciplines. This check assumes normal design checks, in accordance with the relevant British, European, Railway Group and Network Rail Company Standards have been carried out by the relevant design organisation(s).

CONTRACTOR'S ENGINEERS RESPONSIBLE FOR INTERDISCIPLINARY CHECK

Function	Contractor	Name	Title	Signature	Date
Track	SCNA				13/7/18
Signalling					
Signalling Power (DC)	NR IDG				18/7/18
Switch Heating					
Rock Fall Protection					
Civils (signal and loc. bases, inc. GI)					18/7/18
Civils (cable route, walkway, base and steps)					
Telecoms					
Construction	SRC NA				18/07/18

IDR STATEMENT

We the undersigned certify that the drawings listed on the attached schedule(s) in respect of the above project have been the subject of an Interdisciplinary Review, undertaken to eliminate areas of discrepancy between disciplines.

NETWORK RAIL STAFF RESPONSIBLE FOR INTERDISCIPLINARY REVIEW

Function	Name	Title	Signature	Date
Buildings				
Civil Engineering				18/07/18
Construction				
Earthworks				
Ergonomics				
ETE / Contact System				
Level Crossings				
Maintenance				
OLE				
Operations				
Plant				
Signalling				18/07/2018
Telecoms				
Track				18/07/18

NetworkRail

Page 4 of 10 — Combined Interdisciplinary Check & Interdisciplinary Review Certificate

Form Ref	NR/L2/INI/02009/F0047	Issue Date	05/09/2015	Issue	2.0

I certify that all reasonable professional skill and care have been used in the IDC / IDR described above. I certify that individuals undertaking the IDC / IDR described above are suitably qualified and competent to carry out these duties. (To be completed by the Designated Project Engineer).

DPE Name	Signature	Date
		18/07/2018

SAFE BY DESIGN STATEMENT:

We the undersigned certify that the designs documents and drawings listed on the attached schedule(s) in respect of the above project have been the subject of a Safety review and the Safe by Design/Life Saving Rules Checklist has been completed.

This review assumes normal design checks, in accordance with the relevant British, European, Railway Group and Network Rail Company Standards have been carried out by the relevant design organisation(s).

Function	Contractor	Name	Init	Title	Signature	Date
CEM (RDE)	SCNA			CEM (OB&U)		18/7/18
DPE	Network Rail			P.E. (Sig)		19/07/2018
Construction Manager						

I confirm that all the relevant disciplines HAVE / ~~HAVE NOT~~ satisfactorily completed The IDC Process on the above documents and the Process ~~IS~~ IS NOT* complete (To be completed by the Contractor's Engineering Manager).

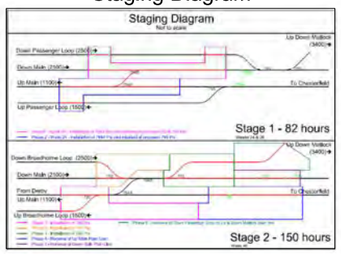
Comments Attached YES / ~~NO~~*

Name	Signature	Date
		19/7/2018

NOTE: This sheet to be attached to office copy of the Design Drawing and Network Rail Acceptance Review copy.

NetworkRail

Staging Diagram



Page 10 of 10 — Combined Interdisciplinary Check & Interdisciplinary Review Certificate

Form Ref	NR/L2/INI/02009/F0047	Issue Date	05/09/2015	Issue	2.0

RECORD OF ATTENDANCE AT INTER-DISCIPLINARY CHECK & REVIEW MEETING:

Location: Doncaster Thorn Lane Briefing Room - G4

Date: Wed 18/07/2018 – 10:00

NAME	COMPANY	PROJECT ROLE
	SCNA	CEM (Design)
	SCNA	E&P CRE (Design)
	Network Rail	Mechanical Engineering Graduate (Track)
	SCNA	Track PE
	Network Rail	Civils PE
	Linbrooke	Signalling Construction Manager
	Linbrooke	Signalling Construction CRE
	TICS	Signalling Testing Manager
	SCNA	Signalling Installation
	SCNA	Signalling Construction CRE
	SCNA	Track CRE (Design)
	SCNA	Track Designer
	Network Rail	Signalling PE/DPE
	GGP Consult	Civils Design PE
	SCNA	SPM
	Network Rail IDG	Signalling Design (CRE Representative)

NetworkRail

DO NOT SCALE

Letter	Date	Descriptions of revision	Drawn	Chkd.	Appr.

Permanent Way Institution
PWI Central
PO Box 12890
Brentwood
CM14 9RY

Status: FOR INFORMATION

Designed	Checked
	-
Approved	**Date**
-	14/10/2021

Professional Registration

Experiential Learning

Supporting Information - Annex C

Management, Leadership, Teamwork and Communication

Scales	CAD
As Shown	--

CAD Ref. D:\Personal\Professional Registration\Experiential Learning

Drawing Number	Revision
[illegible]3	0

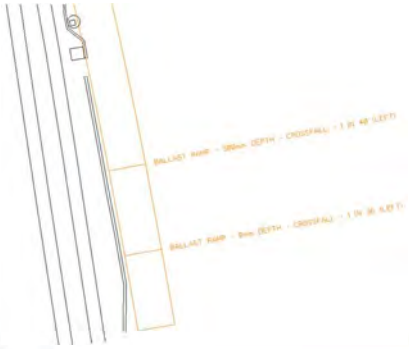
Week 19 – Down Fast and 731A/B Dozer File

Guidance Notes

Central Rail Systems Alliance

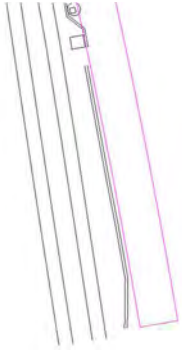
Improving Passenger Journeys

Down Fast – Formation (Low Mileage)



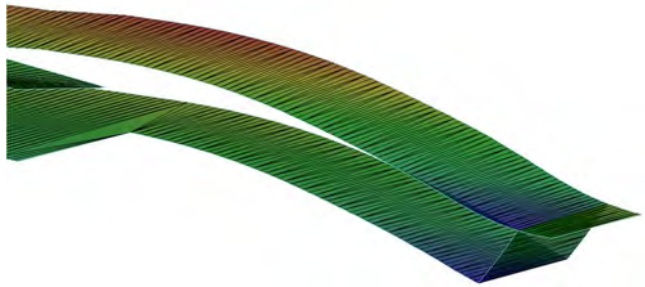
- Crossfall at top of ballast ramp ties in to 40mm cant – nominally halfway between existing (~50mm) and proposed (~30mm) – the low leg is ~15mm low to design.
- Existing trough, OLE foundations and concrete bases shown in black.

Down Fast – Bottom Ballast (Low Mileage)



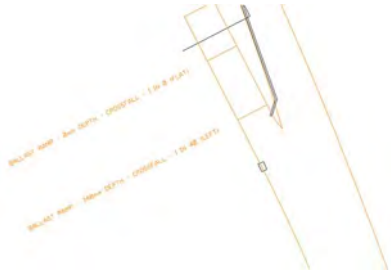
- Crossfall at top of ballast ramp ties in to 40mm cant – nominally halfway between existing (~50mm) and proposed (~30mm) – the low leg is ~15mm low to design.
- Existing trough, OLE foundations and concrete bases shown in black.

Down Fast – Bottom Ballast (Low Mileage)



OFFICIAL

Down Fast & 731A/B's – Formation

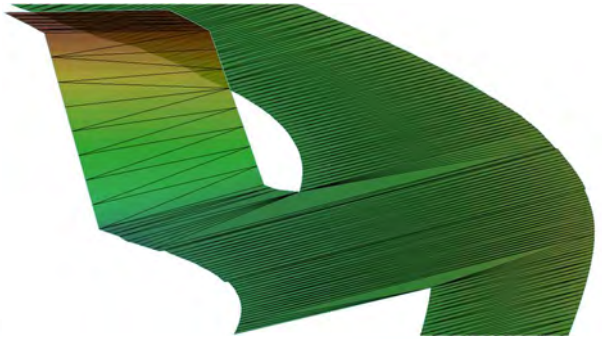


- 1:40 crossfall extended all the way under 731A/B's.
- Resultant dig depth is ~225mm (731B end) and ~340mm at high mileage.
- Ballast ramp on Cement Sidings extended to 8m to accommodate extra dig depth.
- Existing trough, OLE foundations and concrete bases shown in black.

5

OFFICIAL

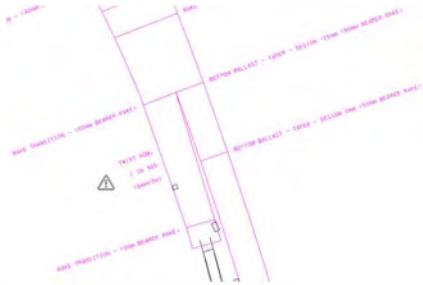
Down Fast & 731A/B's – Formation



6

OFFICIAL

Down Fast & 731A/B's – Bottom Ballast

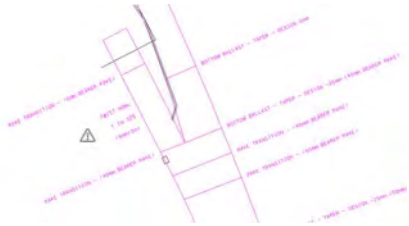


- 40/50mm bearer rake extended all the way under 731A/B's centre section.
- 50mm bearer rake runs off towards 731B points.
- Note twist of 1 in 360 (8mm/3m) expected.
- Existing hand points shown up to IRJ, existing catchpits shown in black.

7

OFFICIAL

Down Fast & 731A/B's – Bottom Ballast



- 40/50mm bearer rake extended all the way under 731A/B's centre section.
- 40mm bearer rake runs off towards cement sidings
- Note twist of 1 in 325 (9mm/3m) expected.
- Existing trough, OLE foundations and concrete bases shown in black.

8

OFFICIAL

Down Fast & 731A/B's – Bottom Ballast

9

OFFICIAL

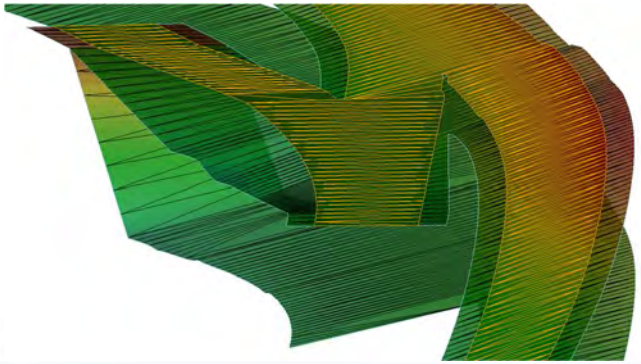
Down Fast & 731A/B's – Bottom Ballast

- Up to ~160mm lift will be required in Cement Sidings where bearer rake of 40/50mm is extended under 731A/B's centre section.
- Note that bottom ballast is installed 25mm low through most of tied bearer area on the Down Fast to avoid leaving the crossover route high (due to rapid change in bearer rake on PL bearers).

10

OFFICIAL

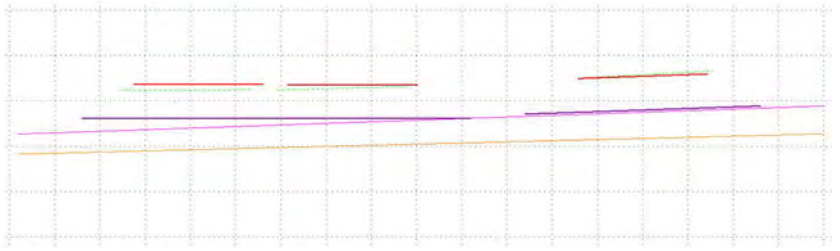
Down Fast & 731A/B's – Bottom Ballast



11

OFFICIAL

Down Fast & 731A/B's – Bottom Ballast



12

OFFICIAL

Down Fast – Formation (High Mileage)

- Crossfall at top of ballast ramp ties in to existing 30mm cant.
- 30mm removed from this week's dig depth (after 731A's - as shown) as this is gained once final alignment is achieved.
- Existing trough, OLE foundations and concrete bases shown in black.

13

OFFICIAL

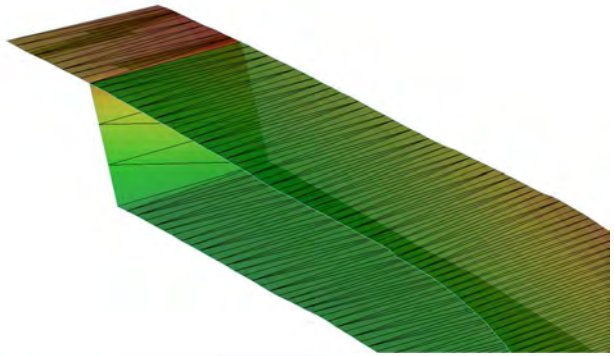
Down Fast – Bottom Ballast (High Mileage)

- Crossfall at top of ballast ramp ties in to existing 30mm cant.
- Bottom ballast level installed to Week 19 design.

14

OFFICIAL

Down Fast – Bottom Ballast (High Mileage)

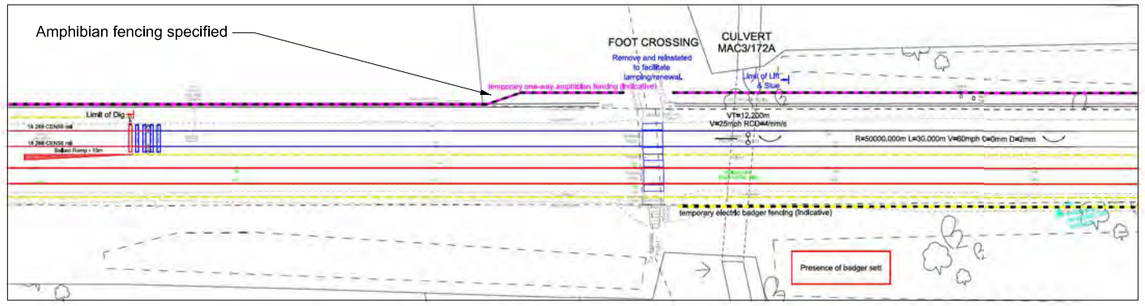


15

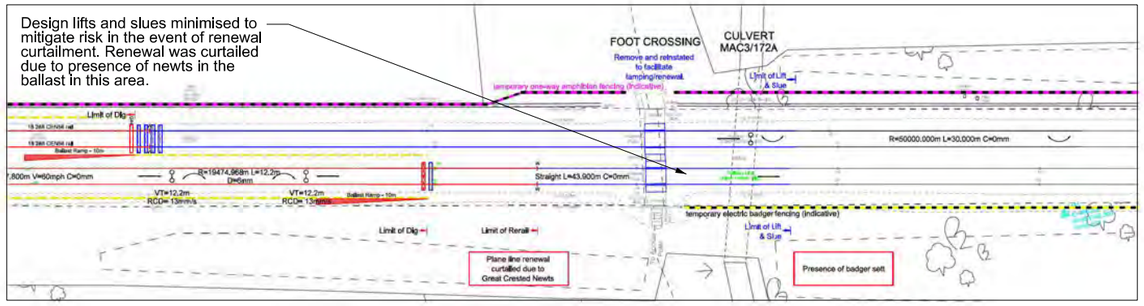
Annex D - Engineer in Society

Supporting Evidence

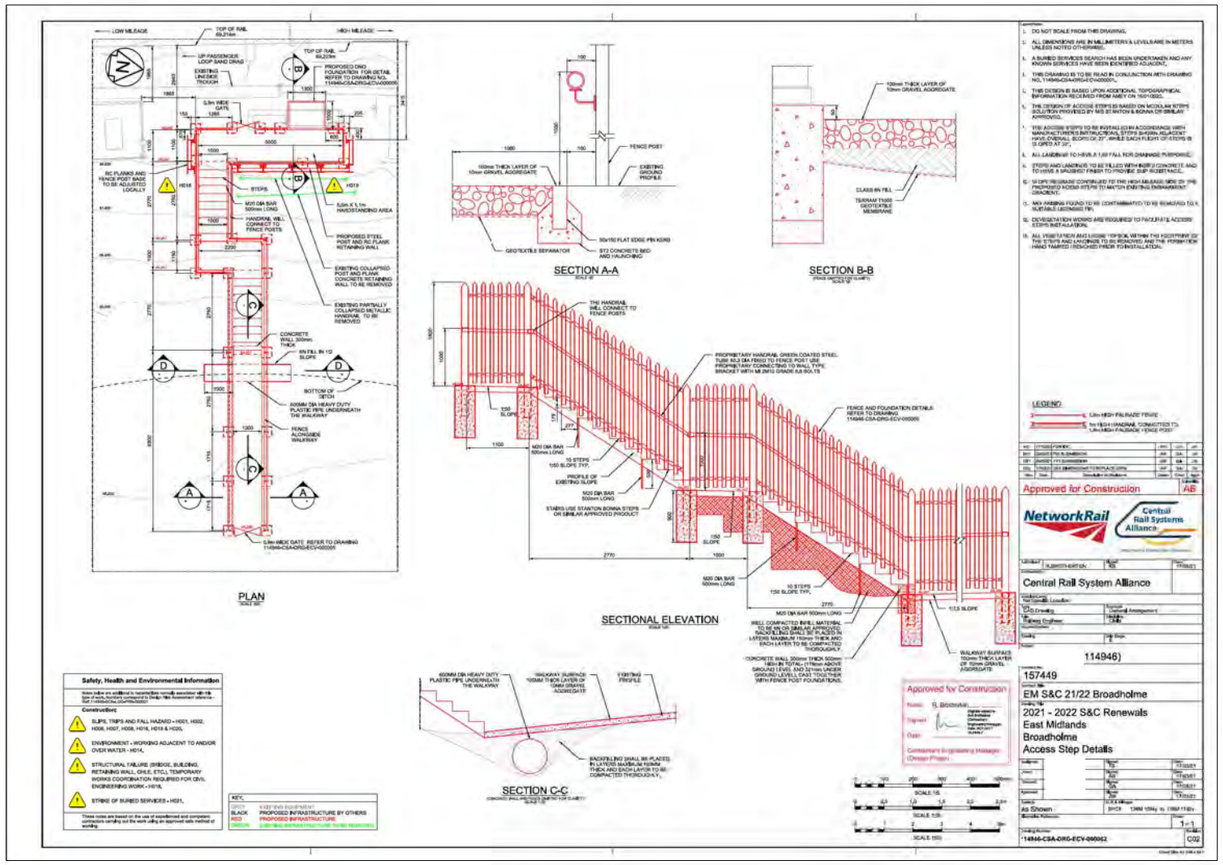
Environmental - - Extract from AFC Drawing



Environmental - - Extract from As-Built Drawing



Security - - Extract from Civils Drawing for Access Steps



Inclusivity - - Extracts from Email Instruction and Survey Analysis

From:
Sent:
To:
Cc:

Subject: RE: ir Adjustments - Proposal
Attachments: 202 Surface Survey.pdf

Importance: High

OFFICIAL

All,

Please see update summary below following analysis of information gathered from site:

- PDF attached shows platform levels falling towards the Down Hertford throughout the area affected.
- RIS-7016-INS defines the requirements for crossfall on platforms as follows:

9.2 Requirements for crossfall on a platform

9.2.1 For new platforms and alterations (as defined) to existing platforms, the surface shall be constructed to provide a fall away from the rear edge of the platform coper, or platform edge if there is no separate platform coper.

9.2.2 If copers are provided, for new or altered platforms they shall be nominally level from the platform edge to the rear of the coper.

9.2.3 The fall shall be at a nominal gradient of 1:50 and within the limits 1:80 to 1:40.

Rationale

G 9.2.4 A crossfall is provided on a platform to provide for drainage and to prevent objects with wheels, for example trollies, baby buggies and suitcases, running off the platform onto the track. However, if the crossfall is too steep it can make it difficult for wheelchair users and for people with ambulatory difficulties to make their way along the platform.

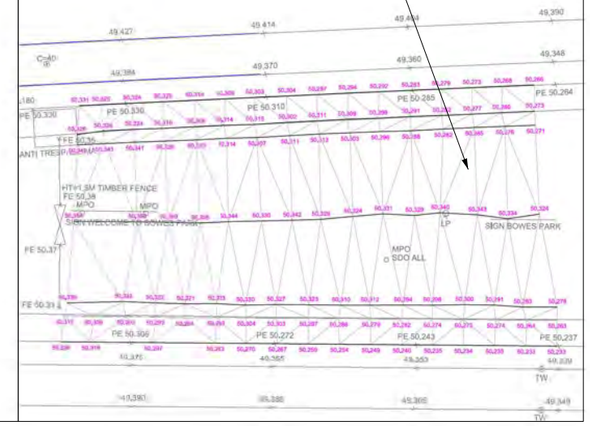
G 9.2.5 The DfT publication 'Inclusive Mobility' indicates a number of reports that suggest that 1:50 is a preferable crossfall with 1:40 being regarded as the steepest acceptable for wheelchair users.

- The above requirement is for new and altered platforms – but we should not worsen an existing non-compliance through our works; **we should therefore not undertake any isolated coper lowering at this location.**
- Further discussion required to agree requirements for derogating against GIRT7073 for the improved foul clearances, and how this should be recorded as an existing risk for future projects.

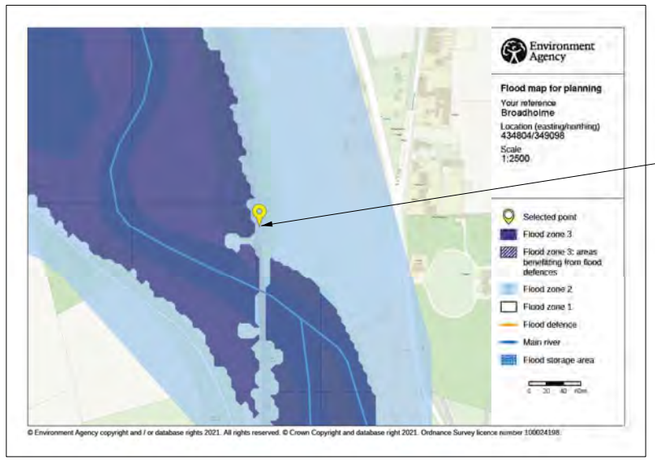
Regards,

Contractor's Engineering Manager

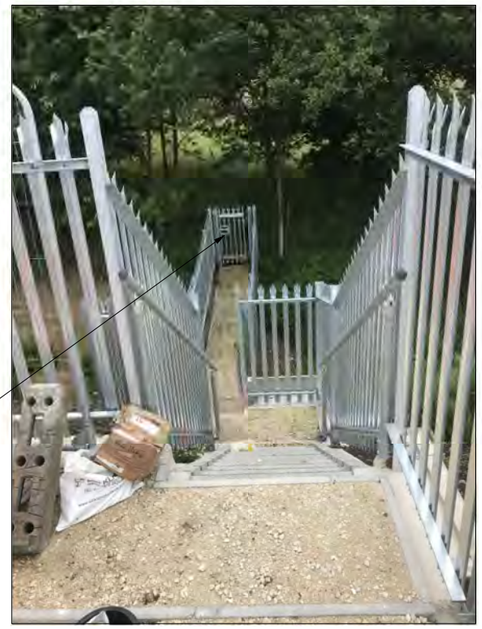
Additional topographical survey analysis showing platform crossfall towards a running line. Marginal tamping into platform triggered a request to lower coping stones to provide +VE clearance - gradient analysis proved this inappropriate.



Security - - Review of Environmental Flood Risk Map and Photo of Secure DNO Access Arrangements During Construction



Review of Environmental Flood Risk map showed that initial revised location for DNO cubicle would've left it susceptible to flooding.



Secure palisade gate for supply authority to access meter at DNO cubicle without risk of coming into contact with the operational railway.

DO NOT SCALE

Letter	Date	Descriptions of revision	Drawn	Chkd.	Appr.

Permanent Way Institution
PWI Central
PO Box 12890
Brentwood
CM14 9RY

Status: FOR INFORMATION

Designed	Checked
	-
Approved	Date
-	13/10/2021

Professional Registration

Experiential Learning

Supporting Information - Annex D

Engineering in Society

Scales: As Shown | CAD --

CAD Ref. D:\Personal\Professional Registration\Experiential Learning

Drawing Number | Revision: 0