Penmaenmawr Sea Defence Wall

229m 1438yds

Sheet piled wall and ground anchors

NR/L2/CIV/003/FormA: Certificate of Approval in Principle (AiP)

Revision History

Edition	Description	Prepared		Checked		Approved	
		By	Date	By	Date	By	Date
1	First Issue	TC	05/11/2024	BC	05/11/2024	VF	05/11/2024

Document: 24088W-FOA-001

Project Title	Penmaenmawr Sea Defence Wall	
Project Nr	24088W	
Remit / Technical Work Scope (TWS) Nr	1067_WAL_MPH	A01 – 04/11/2024
Requirements documents reference Nr		
CR-T reference Nr		
FormA / FormD / FormF and other documents associated with this submission		

PART 1: Details

1.1 Brief Description of Existing Conditions

Penmaenmawr sea defence wall is located in Penmaenmawr, Conwy and runs along the coastline of in a NE/SW orientation protecting the existing railway. A location map of the site is presented in Figure 1. The OS grid reference for the site is SH 70586 76267, the nearest postcode is LL34 6NG and the What3Words for the site is /// encoder.corkscrew.festivity.

An area of the sea defence wall, approximately 20m long x 0.50m x 0.70m has been undermined and needs remedial measures to be carried out to ensure long term stability of the existing structure. From observations of site photos, the existing wall is comprised of stone / brick masonry / concrete. The wall is subject to tidal action, which is assumed to be the cause for the undermining observed (refer to Figure 2 overleaf).

Figure 1 - A Google Map extract (2024) showing the location of the site in relation Penmaenmawr.

Figure 2 - Area of undermining, image taken from PPM Scoping Report - 1067_WAL_MPH - 01_03_2023.

In 2023, a site survey was undertaken to determine the interaction between tidal water and the sea wall. The distance between the sea and the sea wall is variable along its length. At the start of the sea wall, the distance between the sea and the wall is 12 m, with a reduction in distance as the wall cambers towards the sea to approximately 3 m. Distance increases towards the end of the wall reaching 6 m,

distances taken from PPM Scoping Document, document reference: PPM Scoping Report – Penmaenmawr Sea Defence Wall – 23_11_2023.

1.2 Proposed Works, Scope of Design and Assets Affected

Asset No 1

Description	Penmaenmawr Sea Defence Wall		
Location	Penmaenmawr, Conwy		
Coordinates (OSGB36 Datum)	53.267408, -3.9428828		
ELR	CNH3	Miles/Yards	229m 1438yds
Asset Nr	N/A	OS grid ref	SH 70520 76252
Proposed works	Permanent	Design Check Category	*CAT II*
Proposed works description Mitigation of undermining of existing sea wall by installing sheet piles in front of the existing wall. Capping of the sheet pile wall is to be undertaken in accordance with NR Standards Details. To limit deflections anchors are to be installed through the sheets and existing sea wall into the retained ground. The existing voids within the wall are to be infilled with grout once the sheet piles are installed.			

1.3 Construction Methodology

The permanent works are envisaged to follow the below construction methodology:

1. Carry out dilapidation survey of the existing sea wall.
2. Installation of sheets to designed toe level.
3. Installation of ground anchors as per specification.
4. Construction and installation of waling beam.
5. Pump grout into voids within existing sea wall

1.4 Temporary Works

The envisaged temporary works to facilitate the permanent construction are detailed, but not limited to the below:

- Working platform for piling works and concrete pump.
- Stability check on existing sea wall, and design of any stability measures.
- Formwork.
- Temporary lighting.
- Removal of minor obstructions.
- Removal of beach material.

Additional temporary works designs outside the scope of this submission will be completed by the Main Contractor. A Form C submission will be prepared as required by NR/L2/CIV/003.

1.5 Proposals for the Staging of the Design and Design Check Submissions

CWP are the Designers for the permanent works to protect the existing sea wall. This preliminary design and Form A submission will be subject to a CAT I check.

The detailed design and Form B submission will be subject to a CAT II check, which will be undertaken by an independent team with CWP.

This Form A refer to the permanent works design for mitigating the undermining of the existing sea wall only. Any temporary works are to be subject to their own separate Form C design submissions.

1.6 Design Criteria and Design Statement

1.6.1 Method of analysis

The method of analysis is in accordance with BS EN 1997-1 following the theory of limit states. The verification methodology based on limit states theory proves the safety of the structure by comparison. The comparing variables include resisting forces / strength / bearing capacity and sliding / stress forces.

Elements considered within the design are detailed in Section 1.6.2.

1.6.2 Geotechnical Design and Considerations

This section, in combination with the ground investigation factual information, forms the GIR, in line with NR/L3/CIV/071.

The proposed permanent works has been assigned as Geotechnical Category 2 as per NA to BS EN 1997-1:2004, encompassing conventional geotechnical structures with no exceptional risk or difficult ground or soil loading conditions.

Desk Study:

The following sources of information have been utilised for this preliminary sources study:

- 68035NGLS_01-02

- 737846-Preliminary Logs
- Structural Soils Penmaenmawr 05.08.24-08.08.24 RM
- PPM Scoping Report – 1067_WAL_MPH – 01_03_2023
- PPM Scoping Report – Penmaenmawr Sea Defence Wall – 23_11_2023
- Anglesey; Llandudno, Conway Mineral Lodes, 1:50,000 sheet
- Geology of the country around Rhyl and Denbigh Memoir for 1:50,000 geological sheets 95 and 107 and parts of sheet 94 and 106
- BGS Online Onshore GeoIndex (Accessed October 2024)
- Coal Authority Interactive Map (Accessed October 2024)

Topography

A topographical survey of the site has been undertaken by Survey Solutions (06/2024). The survey shows relatively level ground behind the existing sea wall with an approximate drop in level by 6 m in front of the sea wall. The ground continues to fall at an approximate angle of 10° towards the north (towards the sea).

Geological Information

The following table summarises the available information for the site including both published literature and site-specific information:

Table 1 - Summary of available information.

Author	Year	Title	Document Reference
British Geological Survey (BGS)	1890	Anglesey; Llandudno, Conway Mineral Lodes, 1:50,000 sheet	N/A
	1984	Geology of the country around Rhyl and Denbigh Memoir for 1:50,000 geological sheets 95 and 107 and parts of sheet 94 and 106	N/A
MPH Construction	2023	Structure Minor Works PPM Scoping Document	PPM Scoping Report – 1067_WAL_MPH – 01_03_2023
		FF08 Structure Minor Works PPM Scoping Document	PPM Scoping Report – Penmaenmawr Sea Defence Wall – 23_11_2023
Structural Soils	2024	Structural Soils Preliminary Logs	737846-Preliminary Logs
		Structural Soils Dynamic Sampling	Structural Soils Penmaenmawr 05.08.24 – 08.08.24 RM
Survey Solutions	2024	Topographic Survey	68035NGLS_01-02

Environmental and Ecological Information

At the time of this writing, an environmental or ecological survey has not been undertaken and provided to CWP.

A Landmark Envirocheck report has not been purchased for this site.

Previous Ground Investigations

Historic ground investigation is indicated in Figure 3 (overleaf). A summary of the historic data is detailed in the Geology section of this desk study.

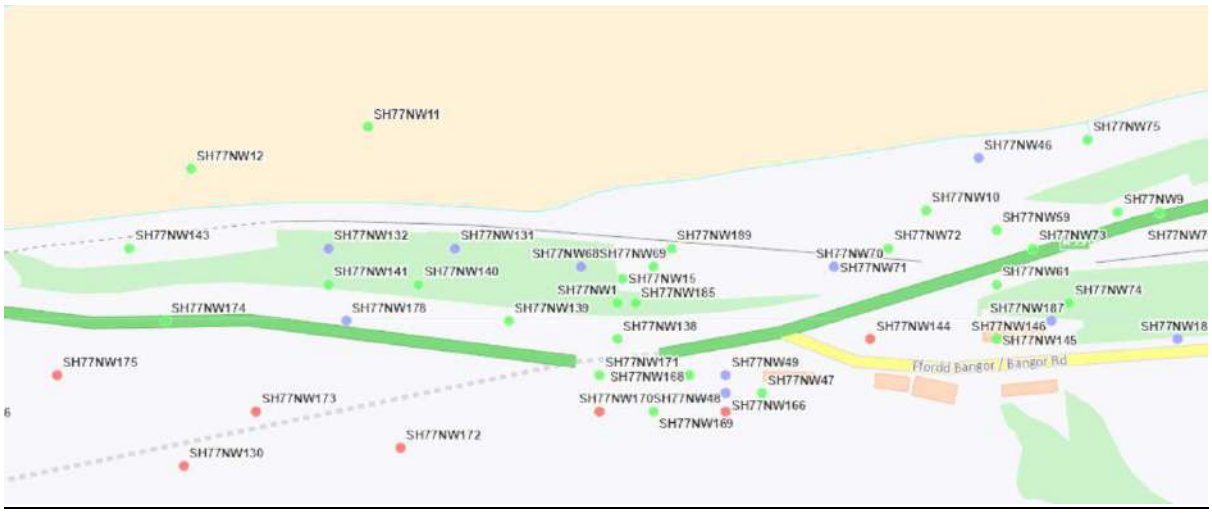

Figure 3 - Extract from BGS GeoIndex (2024) showing available historic ground investigation boreholes.

Field Studies:

The following field studies have been carried out for the site:

- 2No. Scoping reports carried out in March 2023 and November 2023, and
- Topographic survey of the site undertaken in June 2024.

Geology

Made Ground / Artificial Ground

A review of the BGS Online GeoIndex Onshore (accessed October 2024) shows Made Ground is anticipated on site. With the existing land use of a coastal pathway and existing sea wall, it is expected that pathway material is likely to be present on site and granular fill.

Superficial Deposits

A review of the BGS Online GeoIndex Onshore (accessed October 2024) shows that the site is on a superficial boundary with glacial till to the south of the site, tidal flat deposits located centrally to the site and coastal zone deposits located on the northern boundary of the site.

BGS Lexicon descriptions:
Glacial Till – Diamicton.

Tidal Flat Deposits - Tidal flat deposits, including mud flat and sand flat deposits, form extensive nearly horizontal marshy land in the intertidal zone that is alternately covered and uncovered by the rise and fall of the tide. They consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit.

Coastal Zone Deposits - Coastal zone deposits include all deposits of the nearshore environment including foreshore, backshore, estuary (intertidal deposits) and saltmarsh/lowland hinterland

(supratidal deposits). Shingle, gravel, sand, silt and clay, locally with peat layers; may be bedded or chaotic.

Bedrock Geology

The BGS Online GeoIndex Onshore (accessed October 2024) shows that the site is on a geological boundary approximately located through the centre of the site in a west / east orientation. The southern section of the site is detailed as an unnamed igneous intrusion with Cambrian and Ordovician – mudstone, siltstone and sandstone to the north.

BGS Lexicon descriptions:
Unnamed Igneous Intrusion - Metagabbro and microgabbro.

Cambrian and Ordovician Rocks – None recorded or not applicable.

Faults / Linear Features

There are no faults or linear features that directly interact with the site. The nearest fault is located 1.6 km south west of the site which is described as a fault at rockhead. No information on the downthrow or magnitude of the downthrow.

Mining

The site is not located within a known mining/mineral extraction area as indicated by the Coal Authority Interactive Map (accessed October 2024).

Hydrogeology

The BGS Online GeoIndex Onshore (accessed October 2024) indicates that the underlying rock unit, Llanvirin Rocks is a low productivity aquifer which is defined by the BGS as “highly indurated rocks with limited groundwater”.

The BGS Online GeoIndex Onshore (accessed October 2024) indicates that the superficial deposits are classified as a Secondary A aquifer and the bedrock geology as a Secondary B aquifer. The Environment Agency defines Secondary A aquifer as “permeable layers that can support local water supplies and may form an important source of base flow to rivers”. The Environmental Agency defines Secondary B aquifers as “lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks (called fissures) and openings or eroded layers”

The site is not located within an aquifer for superficial deposits.

Geomorphology

Geomorphological mapping has not been completed for this Form A submission.

Man-Made Features

The current site land use is a pathway to the south of the existing sea wall and a rocky beach to the north. The site does not appear to be regularly accessed.

Historical Development

The historical development of the site has been assessed using available historic ordnance survey maps. The Caernarvonshire Sheet IV.SW, surveyed in 1887 and published in 1888 is the earliest historic ordnance survey map available for the site. The historic map shows that the railway and major A road have been constructed prior to 1887. The available maps do not indicate the existing sea wall and therefore, determination of year of construction cannot be made. The build-up of Penmaenmawr can be observed Caernarvonshire Sheet IV.SW (1887) to Caernarvonshire Sheet IV.SW (1899) in terms of additional buildings in and around the town centre.

Historic Aerial Photographs

Not applicable.

Contamination

No information regarding the likely state of contamination of the ground has been sourced.

The site is proximal to an existing railway and an A road and therefore, potential associated contamination may be present on site.

Site Sensitivity and Designated Sites

The site is not located within a designated area or of an area of sensitive land use.

Immediately to the north east of the site are three National Monuments Record of Wales (NMRW).These are as follows:

- Jolly Charles Ship Wreck (240529)
- Submerged Forest, Glan y mor (524742)
- Penmaenmawr Quarry Jetty (518966)

Ecology

An ecological report has not been prepared for this report.

Archaeology and Heritage

No archaeological exploratory searches have been carried out on site for this report.

Located on the beach, in front of the existing sea wall is Penmaenmawr Quarry Jetty and a submerged forest, Glan y Mor according to Coflein, RCAHMW (accessed November 2024).

Statutory Service Information

No utility searches have been carried out for the site.

Ground Conditions

A ground investigation was undertaken by Structural Soils (05/08/2024-08/08/2024) to understand the thickness of superficial deposits and depth to bedrock. Table 2 summarises the ground investigation information.

Table 2 - Summary of ground investigation information.

Exploratory Hole ID	Total Drilled Depth (m bgl)	Water Strike (m bgl)	Installation	In-Situ Testing	Remarks
WS01	3.0	-	-	-	-
WS01a	1.5	-	-	-	Terminated due to inability to progress drilling through siltstone boulders
WS01b	11.5	7.0	-	SPT	-
WS02	12.0	-	-	SPT	No detail of strata from 0.9 – 10.0 m bgl. The borehole logs provided show no description of strata or a material graphic legend for the above depth range.

Geotechnical laboratory testing undertaken comprised:

- Particle Size Distribution (wet sieve), and
- BRE Suite Pyritic Geology.

At the time of this writing, the above geotechnical laboratory testing results have not yet been provided to CWP and therefore, have not been included in the following derivation of parameters. Once the results have been provided to CWP, the material parameters are subject to change and to be detailed in the geotechnical design report.

Based upon the referenced information in Section 1.6, the following ground model has been derived for behind the sea wall. The depth to encountered strata are detailed as m below ground level rather than ordnance datum levels as they have not been provided in the preliminary logs.

Table 3 – Characteristic Ground model behind the sea wall.

Stratum	Top of stratum (mOD)	Thickness of stratum (m)	Description of stratum
Made Ground (Pathway)	10.2	0.3	Dark brown sandy slightly silty angular to subangular GRAVEL
Made Ground (Granular)	9.9	3.7	Light grey BOULDERS with mid cobble content and slightly sandy GRAVEL.

Tidal Flat Deposits (Granular)	6.2	3.3	Gravelly clayey fine to coarse SAND to coarse GRAVEL
Tidal Flat Deposits (Cohesive)	2.9	1.2	Very soft reddish brown gravelly very sandy CLAY
Cambrian and Ordovician Sandstone	1.7	-	Strong very narrowly to narrowly bedded SANDSTONE
Groundwater encountered at 7 m bgl in WS01b.			

Based upon the referenced information in Section 1.6, the following ground model has been derived for the ground in front the sea wall. The depth to encountered strata are detailed as m below ground level rather than ordnance datum levels.

Table 4 – Characteristic Ground model in front of the sea wall.

Stratum	Top of stratum (mOD)	Thickness of stratum (m)	Description of stratum
Beach Deposits (Granular)	4.7	1.7	Light grey BOULDERS with mid cobble content and slightly sandy GRAVEL.
Tidal Flat Deposits (Cohesive)	2.9	1.2	Very soft reddish brown gravelly very sandy CLAY
Cambrian and Ordovician Sandstone	1.7	-	Strong very narrowly to narrowly bedded SANDSTONE
Groundwater taken as sea level.			

Utilising the 2No. ground models, a sketch of existing conditions has been created:

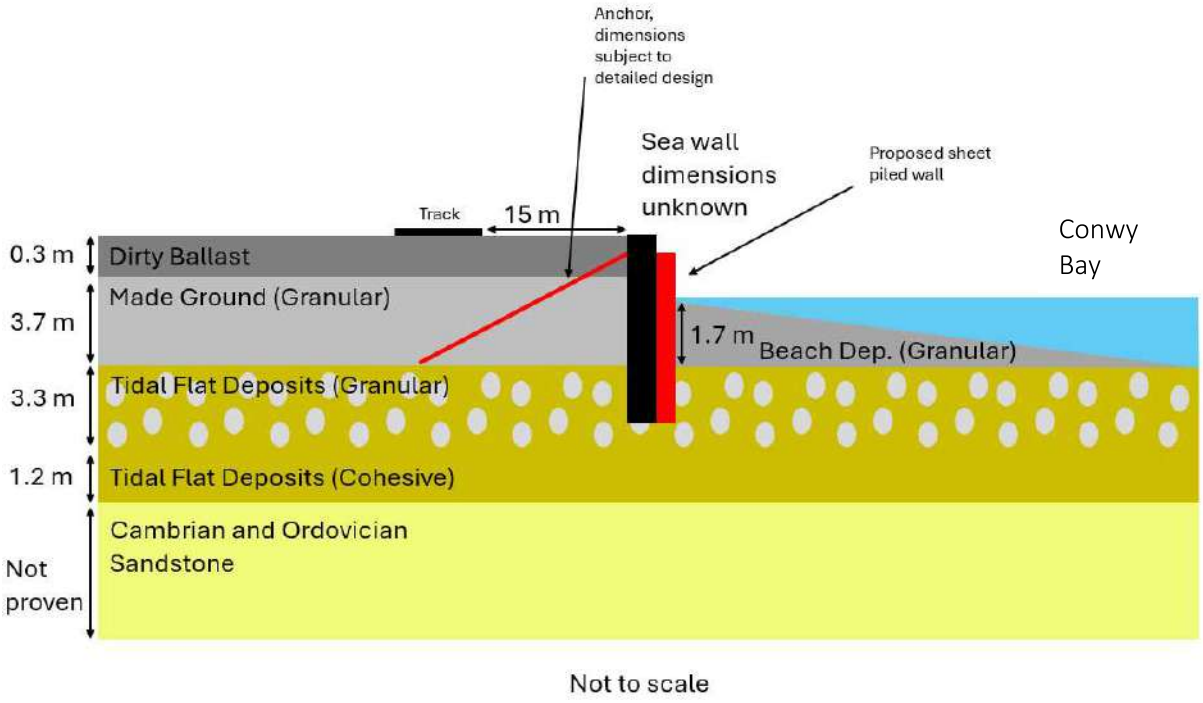

Figure 4 - Conceptual ground model of site.

Characteristic Geotechnical Parameters

A range of indicative characteristic design parameters are presented in Table 5, and are based on soil descriptions, in-situ test results and geotechnical laboratory test results.
Where no field or laboratory data are available, geotechnical parameters have been estimated from published correlations, literature and/or engineering judgement.

Table 5 – Proposed Characteristic Geotechnical Material Parameters.

Stratum	Unit weight ϒ (kN/m³)	Sat unit weight ϒ (kN/m³)	Angle of shearing resistance ϕ' (°)	Cohesion C' (kPa)	Undrained Shear Strength Cu (kPa)	Deformation Modulus E' (MPa)
Made Ground (Pathway)	18-20	19-21	36-40	0	-	10-30
Made Ground (Granular)	16-19	17-20	28-34	0	-	1-10
Tidal Flat Deposits (Granular)	16-19	17-20	28-34	0	-	1-10
Tidal Flat Deposits (Cohesive)	17-20	18-21	22-26	0-2	10-40	3-8
Beach Deposits (Granular)	16-19	17-20	28-36	0	-	1-10
Cambrian and Ordovician Sandstone	20-23	22-25	35-45	10-30	-	20-60

Geotechnical Design

The geotechnical design includes a sheet piled wall installed in front of the existing sea wall to prevent the undermining of the sea wall and subsequent failure. Anchors are to be utilised to aid in the global stability of the sheet pile wall and to mitigate deflection values.

The design was carried out to achieve a degree of utilisation of less than 100% in accordance with BS EN 1997-1:2004.

The following assumptions have been made during the design:

- An allowance of 5 kN/m^2 has been considered as pedestrian loading behind the existing sea wall as per Table 7 of BS 8002:2015.
- The retained material behind the existing sea wall has been modelled as an active surcharge by multiplying the volume of material by the respective unit weight of the material.
- The existing sea wall surcharge has been modelled by multiplying the volume of the sea wall by the unit weight of concrete.

- The foundation of the sea wall has been assumed as extending beyond the wall laterally by an offset equal to the thickness of the wall. The thickness of the foundation has been taken as the thickness of the wall in the absence of dimension information of the foundation.
- Distance from existing sea wall to sea has been taken as high tide level at closest point to the sea wall as a conservative measure.
- Assumed superficial deposits in front of the proposed sheet piled wall comprises of granular beach deposits of thickness 1.7 m, overlying the cohesive tidal flat deposits at the same level as behind the existing sea wall.
- Handrail will not be required on top of the sheet piled wall as no thoroughfare is anticipated behind the sheet piled wall and in front of the existing sea wall.
- Drainage, environmental and ecological design will be carried out by others.
- Design life of 120 years.

Sheet Piled Wall

The sheet piled wall design has been undertaken utilising CADS Piled Wall Suite (2024). The design has been assessed under the following codes of practice: Eurocode 7 ULS – Design Approach 1 – Combination 1 (DA1:C1), Eurocode 7 ULS – Design Approach 1 – Combination 2 (DA1:C2) and Eurocode 7 SLS (For deflection calculations).

This Form A Design has been carried out using the following:

Sheet pile wall details

- Pu 28-1 (162.3 kg/m^2),
- Structural steel grade = 270 N/mm^2,
- Concrete cube strength = 35 N/mm^2,
- Concrete cover = 75 mm,
- Main bar steel grade = 500 N/mm^2, and
- Link bar steel grade = 500 N/mm^2.

Anchor details

- Prestressed DYWI Drill Hollow Bar R38-550,
- Depth = 0.50 m,
- Free Length = 2.00 m, Root Length = 13 m,
- Slope = 25.00°, Spacing = 0.60 m,
- Pre-stressing Force = 30.00 kN,
- Diameter of Root – 150.00 mm, and
- Concrete Strength in Compression – 40.00 MPa, Coefficient of Cohesion = 0.70.

Waler details:

- 1 x PFC 260 x 90 x 30
- Steel 1xU – section
- Inclination According to Wall

- Simply Supported Beam Type

1.6.3 Design Criteria

- Design Life and other criteria in accordance with NR/L2/CIV/003/F1990 to NR/L2/CIV/003/F1994 and NR/L2/CIV/F1997
  - 120 years
- Operational requirements
  - Mitigate further undermining of existing sea wall along length of proposed sheet piles only
  - Not required to sustain maritime vessel collisions
- Loading requirements
  - The sheet piled wall has been designed for loads associated with pedestrian movement behind the existing sea wall
- Fire resistance and escape times
  - Not Applicable
- Diversity and Inclusion requirements arising from a DIA
  - Not Applicable
- Station pedestrian capacity assessment
  - Not Applicable
- Environmental and sustainable requirements
  - Not Applicable

1.7 Standards to be used in the Design

1.7.1 Date Of Standards Freeze

5th of November 2024

1.7.2 List Of Design Standards

1.7.3 Standard design and details

1. Reference	*Title*
BS EN 1990: 2002+A1:2005	*Basis of Structural Design*
BS EN 1991-1-1:2002	*Actions on structures. General actions – Densities, self-weight and imposed loads for buildings*
~~*BS EN 1991-1-2: 2002*~~	~~*Actions on Structures. General Actions. Actions on Structures Exposed to Fire.*~~
~~*BS EN 1991-1-3:2003+A1: 2015*~~	~~*Actions on structures. General actions – Snow loads*~~
~~*BS EN 1991-1-4:2005 + A1: 2010*~~	~~*Actions on structures. General actions – Wind actions*~~

~~*BS EN 1991-1-5: 2003*~~	~~*Actions on structures. General actions – Thermal Actions*~~
~~*BS EN 1991-1-6: 2005*~~	~~*Actions on structures. General Actions – Actions During Execution*~~
~~*BS EN 1991-1-7:2006 + A1: 2014*~~	~~*Actions on structures. General actions - Accidental actions*~~
~~*BS EN 1991-2: 2003*~~	~~*Actions on structures. Traffic loads on bridges.*~~
~~*BS EN 1991-3 2006*~~	~~*Actions on Structures. Actions induced by cranes and machinery*~~
~~*BS EN 1991-4 2006*~~	~~*Actions on Structures. Silos and Tanks*~~
~~*BS EN 1992-1-1: 2004 + A1: 2014*~~	~~*Design of concrete structures. General rules and rules for buildings.*~~
~~*BS EN 1992-1-2: 2004*~~	~~*Design of concrete structures. General rules – structural fire design*~~
~~*BS EN 1992-2-2005*~~	~~*Design of concrete structures. Concrete Bridges. Design and detailinrules*~~
~~*BS EN 1992-3-2006*~~	~~*Design of concrete structures. - Liquid retaining and containment structures*~~
BS EN 1993-1-1:2005 +A1: 2014	*Design of steel structures. General rules and rules for buildings*
~~*BS EN 1993-1-2: 2005*~~	~~*Design of steel structures. General rules – Structural Fire Design*~~
~~*BS EN 1993-1-3:2006*~~	~~*Design of steel structures. General rules – Supplementary rules for cold-formed members and sheeting*~~
~~*BS EN 1993-1-4-2006 + A1: 2015*~~	~~*Design of steel structures. General rules. Supplementary rules for stainless steels*~~
~~*BS EN 1993-1-5-2006 -A1 2017*~~	~~*Design of steel structures. Plated structural elements*~~
~~*BS EN 1993-1-6-2007 - A1 2017*~~	~~*Design of steel structures. Strength and Stability of Shell Structures*~~
~~*BS EN 1993-1-7-2007*~~	~~*Design of steel structures. Plated structures subjected to out of plane loading*~~
~~*BS EN 1993-1-8:2005*~~	~~*Design of steel structures. Design of joints.*~~
BS EN 1993-1-9: 2005	*Design of steel structures. Fatigue.*
~~*BS EN 1993-1-10: 2005*~~	~~*Design of steel structures. Material toughness and through thickness properties.*~~
~~*BS EN 1993-1-11-2006*~~	~~*Design of steel structures. Design of structures with tension components*~~
~~*BS EN 1993-1-12-2007*~~	~~*Design of steel structures. Additional rules for the extension of EN 1993 up to steel grades S 700*~~
~~*BS EN 1993-2-2006*~~	~~*Design of steel structures. Steel Bridges*~~
~~*BS EN 1993-3-1-2006*~~	~~*Design of steel structures. Towers, masts and chimneys - Towers and masts*~~
~~*BS EN 1993-3-2-2006*~~	~~*Design of steel structures. Towers, masts and chimneys - Chimneys*~~
~~*BS EN 1993-4-1 2007*~~	~~*Design of steel structures. Silos, tanks and pipelines- Silos*~~

~~+ A1 2017~~	
~~BS EN 1993-4-2-2007~~	~~Design of steel structures. Silos, tanks and pipelines- Tanks~~
~~BS EN 1993-4-3 2007~~	~~Design of steel structures. Silos, tanks and pipelines. Pipelines~~
BS EN 1993-5 2007	Design of steel structures. Piling
~~BS EN 1993-6 2007~~	~~Design of steel structure. Crane supporting structures~~
~~BS EN 1994-1-1 – 2004~~	~~Design of composite steel and concrete structures. General rules and rules for buildings~~
~~BS EN 1994-1-2 – 2005+A1: 2014~~	~~Design of composite steel and concrete structures. General rules - Structural fire design~~
~~BS EN 1994-2 - 2005~~	~~Design of composite steel and concrete structures. General rules and rules for bridges~~
~~BS EN 1995-1-1:2004+A2:2014~~	~~Design of timber structures. General. Common rules and rules for buildings~~
~~BS EN 1995-1-2:2004~~	~~Design of timber structures. General. Structural fire design.~~
~~BS EN 1995-2:2004~~	~~Design of timber structures. Bridges~~
~~BS EN 1996-1-1: 2005 +A1:2012~~	~~Design of masonry structures. General rules for reinforced and unreinforced masonry structures.~~
~~BS EN 1996-1-2: 2005~~	~~Design of masonry structures. General rules – Structural fire design.~~
~~BS EN 1996-2: 2006~~	~~Design of masonry structures. Design considerations, selection of materials and execution of masonry.~~
~~BS EN 1996-3: 2006~~	~~Design of masonry structures. Simplified calculations for unreinforced masonry structures.~~
BS EN 1997-1: 2004 +A1:2013 incorporating corrigendum February 2009	Geotechnical design. General rules.
BS EN 1997-2: 2007	Geotechnical design. Ground investigation and testing.

Eurocodes – Supplementary documents

Reference	*Title*
~~PD 6687-1: 2010~~	~~Background paper to the UK National Annex BS EN 1992-1 and BS EN 1992-3~~
~~PD 6687-2: 2008~~	~~Recommendations for the design of structures to BS EN 1992-2-2005~~
~~PD 6688 :2011~~	~~Background paper to the UK National Annex to BS EN 1991-2 Traffic loads on bridges~~
~~PD 6693-1: 2012~~	~~Recommendations for the design of timber structures to Eurocode 5~~
~~PD 6694-1:2011~~	~~Recommendations for the design of structures subject to traffic loading to BE EN 1997-1:2004~~
~~PD 6695-1-9 2008~~	~~Recommendations for the design of structures to BS EN 1993-1-9~~
~~PD 6695-1-10:2009~~	~~Recommendations for design of structures to BS EN 1993-1-10~~

~~*PD 6695-2-2008 +A1:2012*~~	~~*Recommendations for the design of bridges to BS EN 1993*~~
~~*PD 6696-2 -2007 + A1:2012*~~	~~*Background paper to BS EN 1994-2 and the UK NA to BS EN 1994-2*~~
~~*PD 6697:2010*~~	~~*Recommendations for design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2*~~
BS EN 206: 2013 + A1: 2016	*Concrete. Specification, performance, production and conformity*
~~*BS EN 338:2016*~~	~~*Structural timber – Strength Classes*~~
~~*BS EN 752: 2017*~~	~~*Drain and sewer systems outside buildings. Sewer system management*~~
~~*BS EN 772-1:2011 +A1:2015*~~	~~*Methods of test for masonry units. Determination of compressive strength*~~
~~*BS EN 1317-5 : 2007 + A2 : 2012*~~	~~*Road Restraint systems. Product requirements and evaluation of conformity for vehicle restraint systems*~~
~~*BS EN 10025-2: 2004*~~	~~*Hot Rolled Products of Structural Steels. Technical Delivery Conditions for Non-Alloy Structural Steels*~~
~~*BS EN 10088-3 2014*~~	~~*Stainless Steels – Technical delivery conditions for semi-finished products, bars, roads, wire, sections and bright products of corrosion resisting steels for general purposes.*~~
~~*BS EN 10210-1: 2006*~~	~~*Hot Finished Structural Hollow Sections of Non-Alloy and Fine Grain Steels.*~~
~~*BS EN 12812: 2008*~~	~~*Falsework – Performance requirements and general design*~~
BS EN ISO 1461: 2009	*Hot Dip Galvanised Coatings on Fabricated Iron and Steel Articles – Specifications and Test Methods*

Supplementary Info - British Standards

Reference	*Title*
~~*BS 476-7: 1997*~~	~~*Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products.*~~
~~*BS 4190: 2014*~~	~~*ISO Metric Black Hexagon Bolts, Screws and Nuts – Specification*~~
~~*BS 4449: 2005+A3:2016*~~	~~*Steel for the reinforcement of concrete – Weldable reinforcing steel – Bar, coil and de-coiled product – Specification*~~
~~*BS 5975: 2015*~~	~~*Code of Practice for Temporary Works Procedures and the Permissible Stress Design of Falsework*~~
~~*BS 5977-1: 1981*~~	~~*Lintels. Method of Assessment of Load.*~~
~~*BS 6180:2011*~~	~~*Barriers in and about buildings. Code of practice (AMD 13292)*~~
~~*BS 6187: 2011*~~	~~*Code of Practice for Full and Partial Demolition.*~~
~~*BS 7371-6: 1998 +A1:2011*~~	~~*Coatings on Metal Fasteners – Specification for Hot Dip Galvanised Coatings*~~
~~*BS 8300: 2009 +A1 2010*~~	~~*Design of buildings and their approaches to meet the needs of disabled people – Code of practice*~~
~~*BS 8666: 2005*~~	~~*Scheduling, dimensioning, bending and cutting of steel reinforcement for*~~

	~~concrete – Specification.~~
~~BS 9999:2008~~	~~Code of practice for fire safety in the design, management and use of buildings~~
BS8081:2015 + A1:2018	Code of practice for grouted anchors

Bridges and Structures, Standards (BD Series)

Reference	*Title*
~~BD 2/12~~	~~Technical Approval of Highway Structures~~
~~BD 13/06~~	~~Design of Steel Bridges~~
~~CS 454~~	~~The Assessment of Highway Bridges and Structures~~
~~BD 29/17~~	~~Design Criteria for Footbridges~~
~~BD 44/15~~	~~The Assessment of Concrete Highway Bridges and Structures~~
~~BD 63/17~~	~~Inspection of Highway Structures~~
~~BD 100/16~~	~~The use of Eurocodes for the Design of Highways Structures~~

Interim Advice Notes

Reference	*Title*
~~IAN 90/07. Amnt No. 1~~	~~Guidance for the use of emergency patching materials~~
~~IAN 97/07~~	~~Assessment and Upgrading of Existing Vehicle Parapets~~
~~IAN 104/15~~	~~The anchorage of reinforcement & fixings in hardened concrete.~~
~~IAN 124/11~~	~~Use of Eurocodes for the design of highway structures~~
~~IAN 128/15/C~~	~~Highways Agency Supply Chain Health and Safety Incident Reporting~~

Other Applicable Standards and Publications:

Publisher	*Title or Criteria*
~~Department for Transport~~	~~Accessible Railway Stations: Design Standards – March 2015~~
~~Health and Safety Executive~~	~~HSG 153/2 - Railway Safety Principles and Guidance Part 2A – Guidance on the Infrastructure~~
~~Health and Safety Executive~~	~~HSG 153/3 - Railway Safety Principles and Guidance Part 2B – Guidance of Stations~~
Health and Safety Executive	The Work at Height Regulations 2005 (WAHR)
Health and Safety Executive	The Health and Safety at Work Act (1974)
~~Health and Safety Executive~~	~~The Construction (Design and Management) Regulations (2015)~~
~~Office of Rail Regulation~~	~~Guidance on minor railways~~
~~Rail Safety and Standards Board~~	~~Way Finding at Station: A good practice guide. Railway and Safety Standards Boards.~~
~~Sign Design Society (SDS) and Royal National Institute of Blind People (RNIB)~~	~~Sign Design Guide, Inclusive signage.~~

~~*British Constructional Steelwork Association Ltd*~~	~~*National Structural Steelwork Specification for Building Construction – 6th Edition*~~
BRE	*BRE Special digest 1 – Concrete in aggressive ground*
~~*BRE*~~	~~*BRE 470 – Working Platforms for tracked plant. Good Practice Guide to the design installation, maintenance and repair of ground supported working platforms.*~~

Network Rail Standards:

Reference	*Title*
~~*GI/GN 7616 Issue 2*~~	~~*Guidance on Interface between Station Platform, Track and Trains.*~~
NR/CAT/STP/001 Issue 111	*Catalogue of Network Rail Standards*
~~*NR/CIV/TUM/400 Issue E*~~	~~*Eurocode Design Technical User Manual for non-Station Footbridges and Non-Canopy Station Footbridges*~~
~~*NR/CS/CIV/044 Issue 1*~~	~~*Managing Structures Work*~~
~~*NR/GN/ENV/004 Issue 1*~~	~~*Waste Management Manual*~~
~~*NR/L1/CIV/032*~~	~~*The Management of Structures*~~
~~*NR/L1/FIR/100 Issue 6*~~	~~*Fire Safety Policy*~~
NR/L2/AMG/1030 Issue 1	*Working Safely in the Vicinity of Buried Services*
NR/L2/AMG/1040 Issue 1	*Buried Services Data Feedback*
~~*NR/L2/CIV/003 Issue 6*~~	~~*Engineering and Architectural Assurance of Building and Civil Engineering Works*~~
NR/L2/CIV/003/F1990 Issue 3	*Technical Design Requirements for BS EN 1990: Eurocode Basis of Structural Design*
NR/L2/CIV/003/F1991 Issue 3	*Technical Design Requirements for BS EN 1991: Eurocode 1 Actions on Structures*
~~*NR/L2/CIV/003/F1992 Issue 3*~~	~~*Technical Design Requirements for BS EN 1992: Eurocode 2 Design of Concrete Structures*~~
NR/L2/CIV/003/F1993 Issue 3	*Technical Design Requirements for BS EN 1993: Eurocode 3 - Design of Steel Structures*
NR/L2/CIV/003/F1997 Issue 3	*Technical Design Requirements for BS EN 1997: Eurocode 7 – Geotechnical Design*
~~*NR/L2/CIV/177 Issue 3*~~	~~*Monitoring track over or adjacent to building and civil engineering works*~~
NR/L2/ENV/015 Issue 8	*Environment and Social Minimum Requirements for Projects – Design and Construction*
NR/L2/INI/02009 Issue 1	*Engineering Management of Projects- Module 01 - Roles, Responsibilities and Accountabilities*
NR/L2/OHS/0047 Issue 6	*Application of the Construction, Design & Management Regulations*

~~NR/L2/OHS/019 /01 Issue 1~~	~~Safety of People at work on or near the line – Module 01 Planning and working during incident response~~
~~NR/L2/OHS/019 /02 Issue 1~~	~~Safety of People at work on or near the line – Module 02 Planning and working in a possession~~
~~NR/L2/OHS/019 /03 Issue 1~~	~~Safety of People at work on or near the line – Module 03 Planning and working using protection arrangements~~
~~NR/L2/OHS/019 /04 Issue 1~~	~~Safety of People at work on or near the line – Module 04 Planning and working using warning arrangements~~
~~NR/L3/CIV/020 Issue 1~~	~~Design of Bridges~~
NR/L3/CIV/040 Issue 1	Specification for the Use of Protective Coatings and Systems
~~NR/L3/CIV/065 Issue 6~~	~~Examination of Earthworks~~
NR/L3/CIV/071 Issue 4	Geotechnical Design
NR/L3/CIV//140/73C Issue 2	Steel Piles
NR/L3/CIV/151 Issue 6	Engineering Assurance of Standard Designs and Details for Building and Civil Engineering Works
~~NR/L3/CIV/162 Issue 2~~	~~Platform Extensions~~
NR/L3/INI/CP0044 Issue 5	Planning and managing construction work,
~~NR/L3/INI/CP0063 Issue 1~~	~~Piling Adjacent to the Running Line~~
~~NR/SP/TRK/036 Issue 2~~	~~Gauge capability certification~~
~~RT/ENGP/06 Issue 2~~	~~Buildings, Stations and Depots Engineering Policy~~

Network Rail Model Clauses

NR/L3/CIV/140/….	Title	Applies
10	General	
~~21~~	~~Aerial Survey~~	
~~22~~	~~Land and Trackwork Surveys~~	
~~23~~	~~Structural Repair Survey~~	
25	Presentation of Survey Data and Information	
30 – 35	General Requirements for Ground Investigation	
~~40~~	~~Demolition and Site Clearance~~	
~~50~~	~~General Requirements for Earthworks and Excavations~~	
~~51~~	~~Excavations~~	
~~52~~	~~Earthworks~~	
~~53~~	~~Grouting and Lime Stabilisation of Embankments~~	
70	General Requirements for Piling	
~~71~~	~~Precast Concrete Piles~~	
~~72~~	~~Cast In Place Piles~~	
73	Steel Piles	
~~74~~	~~Timber Piles~~	

75	*Testing Piles*	
76	*General Requirements for Embedded Retaining Walls*	
~~*77*~~	~~*Diaphragm Walls*~~	
~~*78*~~	~~*Embedded Retaining Walls Constructed Using Bored Concrete Piles*~~	
79	*Sheet Pile Walls*	
~~*80*~~	~~*Structural Concrete*~~	
~~*83*~~	~~*Structural Concrete Repairs*~~	
~~*85*~~	~~*Concrete for Ancillary Purposes*~~	
~~*93*~~	~~*Structural Steelwork Repairs*~~	
~~*100*~~	~~*Bearings*~~	
~~*110*~~	~~*General Requirements for Waterproofing Underline Bridges*~~	
~~*111*~~	~~*Tightly Bonded Systems for Underline Bridges*~~	
~~*112*~~	~~*Loose-Laid Systems for Underline Bridges*~~	
~~*113*~~	~~*Waterproofing for Road Carrying Bridges*~~	
~~*114*~~	~~*Tanking*~~	
~~*120*~~	~~*General Requirements for Bridge Installation Methods and Temporary Works*~~	
~~*121*~~	~~*Bridge Installation by Sliding or Rolling*~~	
~~*122*~~	~~*Bridge Installation by Large Capacity Crane*~~	
~~*123*~~	~~*Bridge Installation Using Self Propelled Lifting Vehicles*~~	
~~*124*~~	~~*Temporary Works – Tunnel Constructed Using Shield*~~	
~~*125*~~	~~*Bridge Installation by Thrust Boring*~~	
~~*126*~~	~~*Temporary Bridges*~~	
~~*130*~~	~~*General Requirement for Inspection of New Steelwork, Precast Concrete, Protective Treatment and Waterproofing*~~	
~~*150*~~	~~*Brickwork, Blockwork and Masonry*~~	
~~*153*~~	~~*Brickwork and Masonry Repairs*~~	
~~*160*~~	~~*General Requirements for Structural Timber*~~	
~~*160GN*~~	~~*Guidance Note for Structural Timber*~~	
~~*161*~~	~~*Design Requirements for Structure Timber*~~	
~~*162*~~	~~*Workmanship for Structural Timber*~~	
~~*163*~~	~~*Maintenance and Repair*~~	
~~*164*~~	~~*Timber Preservation and Fire Protection*~~	
~~*170*~~	~~*General Requirements for Protective Treatment*~~	
~~*171*~~	~~*Maintenance Coating Works*~~	
~~*172*~~	~~*Protective Coating of New Structural Steelwork*~~	

~~173~~	~~Protective Coating of Existing Structural Steelwork and Ironwork~~	
~~174~~	~~Protective Coating of Timber Surfaces~~	
~~175~~	~~Protective Coating of Concrete and Masonry Surfaces~~	
~~176~~	~~Protective Coating Systems~~	
~~180~~	~~General Requirements for Building and Structure Drainage~~	
~~185~~	~~Track Drainage~~	
~~190~~	~~External Service Ducts and Cable Troughing~~	
~~200~~	~~General Requirements for Roads and Pavings~~	
~~201C~~	~~Subgrade and Formation Works~~	
~~202~~	~~Road Pavements~~	
~~203~~	~~Kerbs, Footways and Paved Areas~~	
~~204~~	~~Traffic Signs and Road Markings~~	
~~230~~	~~General Requirements for Level Crossings~~	
~~231~~	~~Public Vehicular Level Crossings~~	
~~232~~	~~Occupation and Accommodation Level Crossings~~	
~~233~~	~~Footpath, Bridleway and Other Types of Level Crossings~~	
~~240~~	~~Fencing and Gates~~	
~~250 – 253~~	~~Landscaping - Preparation of Topsoil~~	
~~255~~	~~General Requirements for the Management of Lineside Vegetation~~	

1.8 Variations to Standards

No deviation from standards.

1.9 Requirements for Operation, Inspection, Maintenance, Repair, Renewal or Removal including Special Access Arrangements

The following indicative maintenance for the anchored sheet pile wall is envisaged:

General Aspects:

1. The proposed system does not require regular maintenance.
2. Over the medium term of the design life the structure may undergo a loss of tension of some of the anchors and a re-tensioning programme may need to be conducted.

Maintenance Strategy

Every 20 years:

1. Examine for corrosion of anchor components such as the head, plates and nuts plus replace any corroded component where needed.

2. Check for residual tension in ground anchors and retention where needed. Reference must be made to the proposed design nominal value before defining re-tensioning loads.

At 40 and 80 years:

1. Examine for corrosion of anchor components such as the head, plates and nuts plus replace any corroded component where needed.
2. Check for residual tension in ground anchors and retention where needed. Reference must be made to the proposed design nominal value before defining re-tensioning loads.
3. Acceptance testing to be undertaken on working anchors (minimum 20% of anchors) and results to be reported to a suitably qualified geotechnical engineer who is to decide, based on these results, on potential additional works such as additional anchor testing and anchor replacement.

Any maintenance strategy shall consider access, machinery used, removal of beach material and a separate designer's risk assessment.

1.10 Matters to be Considered in the Design

The following matters have been considered during the permanent works Design: -

1. So far as is reasonably practicable, the Asset affected will be safe in use when used in accordance with its intended purpose.
2. Hazards are managed in accordance with requirements of the CDM Regulations and CSM regulations. Residual risks are documented in a Risk Register. Risks to both (a) health and safety during construction, maintenance, use, railway operations and (b) occupational health and safety, will be as low as reasonably practicable or better.
3. The provisions for examination, maintenance and eventual renewal/removal are satisfactory.
4. The overall Design concept and the appearance of the infrastructure are appropriate for their purpose, location and site conditions.
5. Where the proposal includes the strengthening, partial renewal or removal of structures, the stability of the whole structure and all its parts/elements at all stages of the works will be addressed, including the long-term adequacy of the remaining parts/elements of the structure and supporting soil.
6. The effects of the proposals on existing infrastructure are adequately considered.
7. Arrangements for liaison and consultation with external bodies (such as Local Authorities, statutory undertakers, the British Transport Police, Environmental Regulators and landowners) are satisfactory and the likely effects of the proposals on external organisations will be addressed. Required Permissions/Approvals will be obtained to support the proposals.
8. The impact of the proposals on services and service routes will be adequately investigated and appropriate mitigation measures will be agreed with the appropriate Authority and incorporated into the Design.
9. The effects on other rail engineering disciplines including track, gauging, signalling (including signal sighting), telecommunications, electrification, lighting, and other operational electrical and mechanical equipment have been satisfactorily considered in principle.
10. Mining related risks have been assessed in the development of the proposed design in principle and are considered to be acceptable, in accordance with NR/L2/CIV/191/MOD05.
11. The requirements/recommendations of Railway Group Standards, Railway Industry Standards, Network Rail standards and joint Department for Transport / Transport Scotland document "Design Standards for Accessible Railway Stations" have been addressed and proposed variations from these standards are identified and justified.
12. ~~The requirements of the Building Regulations and any planning conditions will be met in full where applicable.~~
13. The proposed Design loadings are appropriate, and any non-standard accidental loadings are correctly identified.

14. The requirements of **NR/L2/CIV/003/F1990** to **F1997** will be considered after AIP and agreed between the CEM and DPE prior to detailed design, with the selected options/choice recorded in the Detailed Design, excepting the Design Life which is agreed in this AIP.
15. The proposed Design standards and methods of Design will be suitable and in accordance with NR requirements, standards and legislation.
16. ~~A Geotechnical Design Report, which meets the requirements of **BS EN 1997** and **NR/L3/CIV/071** is available. This Report justifies the selection of the Geotechnical Design parameters and outlines any further work required for implementation.~~
17. A plan of geotechnical related construction supervision and monitoring (including details of items to be checked during construction or requiring maintenance or monitoring) will be incorporated in the detailed design and meet the requirements of BS EN 1997.
18. The Design will comply with structure clearance and platform stepping distance requirements.
19. Important Design matters not covered by standards are identified.
20. The proposals are economical.
21. The proposals have considered requirements for environmental and sustainable development. The design has adequately considered the results and actions required from the Environmental and Social Appraisal and the Environmental and Social Management Plan, where required by NR/L2/ENV/015.
22. The selection of post-installed anchors in concrete and masonry will meet the requirements of BS 8539.
23. A completed IDC certificate has been provided with this design to comply with NR/L2/RSE/02009 clause 15.3.
24. A Designer's Risk Assessment has been provided with this AIP design.
25. The permanent works designer has outlined their proposed construction methodology and all envisaged temporary works requirements in order to facilitate construction of the permanent works, including proposals to maintain stability at all times.
26. The permanent works designer has outlined their proposed construction methodology and envisaged temporary works requirements to comply with the Diversity Impact Assessment (DIA), e.g., provision of temporary structures such as accessible temporary footbridges.
27. The provision of new assets has taken account of the effects on existing assets, such as effects on cuttings, embankments, other structures or GSM-R.
28. ~~The design has adequately considered pedestrian flow, fire risk, means of escape and security requirements in principle.~~
29. A specification of workmanship and materials will be provided with the detailed design submission.
30. ~~The AiP design has considered all effects on the existing fire strategy, where applicable, with proposals agreed in principle with the NR fire specialist, where applicable.~~

31. Designer has utilised the contents of the Standard Designs and Details, e.g. the Standard Design Catalogue Index, NR/L3/CIV/151/01, used in accordance with NR/L3/CIV/151, or lineside standards NR/GN/OTK/5000 and NR/GN/OTK/5300

1.11 Any Other Relevant Information

None

1.12 Accompanying Drawings and Other Documents

Document Reference	Document Title	Revision
24088W-001	General Notes	P01
24088W-002	Proposed General Arrangement	P01
24088W-003	Proposed Sections and Details	P01
24088W-RSA-001	Designer's Risk Assessment	P01

PART 2: Designer's Submission

I confirm that the criteria specified in NR/L2/CIV/003 have been considered and:

(a) this Approval in Principle Design is submitted on behalf of

Crouch Waterfall,

15 Apex Court,

Woodlands,

Bristol,

BS32 4JT

and,

(b) unless identified in 1.5 and 1.8, (i) the Design will comply with all relevant standards and will be delivered in accordance with the CR-T & Requirements documents and (ii) the deliverables identified within the CR-T will be completed and submitted in support of this submission.

Signed	Digitally signed by Vera Faustino Date: 2024.11.15 09:14:54	Title	Associate
Name (print)	Vera Faustino	Date	15/11/2024
To be signed by the Contractor's Responsible Engineer appointed for the relevant design phase (CREd).			

PART 3: Construction Organisation's Acknowledgement of Submission By A Sub-Contract Designer

The organisation named in **PART 2** is engaged as a sub-contractor to the organisation stated below. I acknowledge this submission to Network Rail in support of our contract/sub-contract obligation for the provision of this Approval in Principle on behalf of

MPH Construction Ltd

Bromfield House,

Bromfield Trading Estate,

Quens Lane,

Mold,

Flintshire,

CH7 1XB

I confirm that, unless stated in **PART 2**, the submission complies with the CR-T & Requirements documents.

Signed		Title	Construction CRE
Name (print)	Daniel Overson	Date	15/11/2024
To be signed by the Contractor's Responsible Engineer appointed for the Construction phase (CREc)			

PART 4: Project Engineer's Comments

I have considered the submission and confirm that the information specified in NR/L2/CIV/003 and the CR-T is included in this submission. My comments on the submission are in the associated closed out DRN.

Provided that my comments in the DRN are addressed in the Detailed Design, I hereby give Approval in Principle to the proposals.

I have reviewed the submission and confirm that, unless stated in PART 2, it complies with the Asset Manager's requirements for this project as set out in the Requirements documents and CR-T.

I confirm that the Design is to be checked in accordance with NR/L2/CIV/003 with the Design Check Category outlined in Part 1 of this submission.

Signed	Title
Name (print)	Date
To be signed by the Project Engineer (Buildings and Civils)	

Signed	Title
Name (print)	Date
To be signed by other responsible person *(if applicable)*	

PART 4A: Supplementary Network Rail Reviewer Endorsement

Security, Emergency and Contingency review

My comments on the submission are given below. Provided that these comments are addressed, I hereby endorse this FormA submission of the above proposals regarding the security arrangements of railway infrastructure.

Signed	Title
Name (print)	Date
To be signed by the competent security role holder assigned to the project	

Station Pedestrian Capacity and Evacuation Review

My comments on the submission are given below. Provided that these comments are addressed, I hereby endorse this FormA submission of the above proposals regarding Station capacity and evacuation.

Signed	Title
Name (print)	Date
To be signed by the Network Rail Capacity Engineer	

Fire Safety Review

My comments on the submission are given below. Provided that these comments are addressed, I hereby endorse this FormA submission of the above proposals regarding Fire Safety.

Signed	Title
Name (print)	Date
To be signed by the Network Rail Fire Engineer	

ORE/OLEMI design to NR/L2/CIV/074

My comments on the submission are given below. Provided that these comments are addressed, I hereby endorse this FormA submission of the above proposals regarding ORE/OLEMI design.

Signed	Title
Name (print)	Date

To be signed by the Network Rail PE (E&P)

[*Other Discipline*] Review

My comments on the submission are given below. Provided that these comments are addressed, I hereby endorse this FormA *[sic]* submission of the above proposals regarding [***other discipline design***]

Signed	Title
Name (print)	Date
To be signed by the competent [other discipline] role holder assigned to the project	

PART 5: Asset Manager's Approval

I have considered the submission and confirm that this is approved subject to the comments given below being addressed within the Detailed Design.

Signed	Title
Name (Print)	Date
To be signed by the Asset Manager (Structures / Tunnels & Mining)	

Signed	Title
Name (Print)	Date
To be signed by the Asset Manager (Geotechnical)	

Signed	Title
Name (Print)	Date
To be signed by the Asset Manager (Drainage)	

Signed	Title
Name (Print)	Date
To be signed by the Asset Manager (Buildings)	

Signed	Title
Name (Print)	Date
To be signed by the Asset Manager (E&P); for designs to certain clauses of NR/L2/CIV/074	

APPENDIX A

A1.1 Drawings and Models of Proposals

A1.1 DRAWINGS AND MODELS OF PROPOSALS

Drawing Reference	Drawing Title	Revision
24088W-001	General Notes	P01
24088W-002	Proposed General Arrangement	P01
24088W-003	Proposed Sections and Details	P01

APPENDIX B

B1 Designer's Risk Assessment

APPENDIX C

C1 Certificate of interdisciplinary Check

APPENDIX D

D1 other documents such as GIR/GDR reports etc