



N25 Rosslare Europort Access Road

Detailed Design Geotechnical Design Report
(Phase 5)

April 2025

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(Phase 5)**

April 2025

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
P01	April 2025	L Brooks	T Bird	I Duncan	First Issue

Document reference: 229100548-MMD-0600-RE-RP-C-0004 | P1

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1 Introduction

1.1 Scope and objective of the report

This Detailed Design (Phase 5) Geotechnical Design Report (GDR) has been prepared in accordance with Appendix E of TII DN-ERW-03083 “Managing Geotechnical Risk” [1].

The objectives of this report are to:

- Provide engineering designs and highlight engineering considerations for the proposed structures and geotechnical works.

1.2 Description of project

Rosslare Europort is a key strategic transport link between Ireland and both the European mainland and the United Kingdom. It is an important ferry port for all major Roll-On, Roll-Off (RO- RO) passenger and freight services operating on UK and continental routes. Rosslare Europort is the State’s second largest passenger port, and the fourth largest port in terms of overall tonnage. Significant growth is forecast in the coming years which will further increase the Port’s strategic importance for trade, business, and tourism.

The capacity and resilience of the access to the Port is critical to sustaining this strategic connection with the UK and continent. Existing access to Rosslare Europort is via the N25 National Primary Road which currently passes through the village of Rosslare Harbour. Wexford County Council is proposing to provide improved access to Rosslare Europort from the N25 National Primary Road to ensure and secure the sustainability and competitiveness of this key transport link.

Wexford County Council is working in consultation with Transportation Infrastructure Ireland to progress the scheme. Mott MacDonald Ireland has been appointed as technical advisor to assist in the development of the scheme, and Tramore House Regional Design Office is providing project management services on behalf of Wexford County Council.

The site is located in Rosslare Harbour, County Wexford in the Republic of Ireland. The site is located 100m southwest of Rosslare Europort, centred on approximate easting and northing of 712249, 612109 (ITM Coordinates).

In February 2024 the project progressed to Phase 5 “Enabling and Procurement” of the TII Project Management Guidelines. During this phase tender documentation will be compiled to allow for the appointment of a Contractor to execute the Main Contract and to execute enabling works to facilitate the works.

The proposed N25 Rosslare Europort Access Road (REAR) will consist of a combination of existing road and new road corridor to provide a new access route to Rosslare Europort in Co. Wexford. The proposed scheme will consist of approximately 1.45km of road carriageway, a railway underbridge, two access underpasses, footway/cycle facilities and associated local road/access tie-ins. The design of the proposed scheme has been developed to a sufficient level of detail to facilitate the evaluation of potential environmental impacts and to define the land take required to design, construct and operate the scheme.

The proposed project will fully integrate with two approved developments, the N25 Ballygillane Roundabout and the Rosslare Europort Masterplan. Both of these projects have received planning permission. N25 Ballygillane Roundabout commenced construction in May 2022 and substantial completion was reached in August 2023, while the Rosslare Europort Masterplan

commenced construction in June 2023 and is currently scheduled to be completed by the end of 2025. The project also includes an active travel corridor which will provide connectivity with the proposed Rosslare Harbour to Kilrane Active Travel Scheme (existing EuroVelo 1 Cycle Route) and the proposed Rosslare Harbour to Rosslare Strand Greenway Scheme to enable a fully integrated high quality transport network for pedestrians and cyclists into the future.

The scheme utilises the existing Ballygerry Link Road (L3068) and begins at its junction with the existing N25 National Road at the proposed Ballygillane Roundabout scheme. A new section of road then extends from the existing junction of the Ballygerry Link Road/Churchtown Road and turns to the north, crossing over the existing Dublin to Rosslare Harbour railway line before continuing east to connect into Rosslare Europort, via a new roundabout proposed as part of the future development of the Rosslare Europort.

2 Earthworks

The geotechnical parameters for design have been derived in the N25 Rosslare Europort Access Road Detailed Design (Phase 5) Ground Investigation Report (229100548-MMD-0600-RE-RP-C-0003) and have been provided in Table 2.1 below.

Table 2.1: Characteristic geotechnical parameters

Stratum	γ (kN/m ³)	Φ (°)	c' (kPa)	c_u (kPa)	UCS (MPa)
Cohesive Made Ground	17	24	0	50	-
Granular Made Ground	17 19 (sat)	32	0	-	-
Glacial Till – Macamore Clay	20	26	1	50 + 4z	-
Greenore Point Group - Amphibolite	23	46*	170*	-	1.8

* Based on Hoek Brown criterion

2.1 Earthwork design methodology

The overall stability assessment of the earthworks has been undertaken in accordance with the following standards and guidance documents:

- IS EN 1997-1:2005+A1:2013 – Eurocode 7: Geotechnical design – Part 1: General rules
- IS EN 1997-1:2004/NA:2015 – Irish National Annex to Eurocode 7: Geotechnical design – Part 1: General rules
- BS 6031:2009 – Code of practice for earthworks

In Table NA.1 the Irish National Annex to Eurocode 7 Part 1 permits the designer to choose between Design Approaches 1, 2 or 3 for analysis of the STR and GEO limit states. In this case, Design Approach 1 has been adopted for the overall stability assessment as defined in IS EN 1997-1:2005+A1:2013. For partial factors on actions, soil parameters and resistance for slopes and overall stability, the values in Eurocode 7 Part 1 are recommended for use. Design Approach 1 as defined in this standard comprises two design combinations, Design Combination 1 (DA1 C1) comprises the application of elevated partial factors to increase permanent and variable actions and partial factors of unity to material strengths (soil parameters), whereas Design Combination 2 (DA1 C2) comprises the application of partial factors to reduce soil parameters, reduced partial factors to increase variable actions, and partial factors of unity on permanent actions.

IS EN 1997-1:2005+A1:2013 specifies the allocation of partial factors on actions or the effects of actions for structural and geotechnical limit states for DA1-1 and DA1-2. These are summarised below as:

- DA1 C1: A1 “+” M1 “+” R1
- DA1 C2: A2 “+” M2 “+” R1

The overall stability of the cutting has been analysed based on limit equilibrium principles using the GeoStudio Slope/W [2] software package. The analyses were undertaken using the Morgenstern-Price analysis type, considering both moment and force equilibrium.

The overall stability of the earthworks has been analysed to verify that the design effects of actions, E_d , are equal to or lower than the design resistance, R_d , to those actions:

$$E_d \leq R_d$$

This can also be expressed using the degree of utilisation: E_d/R_d (expressed as a percentage). The design is considered unacceptable if the degree of utilisation is >100%.

The partial factors are applied directly by the Slope/W software based on the selected Design Combination. DA1 C1 applies a partial factor of 1.35 on soil unit weight where unfavourable and 1.00 where favourable. These are automatically applied by the Slope/W software to parts of the slip which predominantly provide a driving action and a restoring action respectively.

It is considered that the most likely failure can reasonably be modelled as a circular failure plane and that the failure mechanism will be controlled by material strength properties and not by any geological discontinuities.

2.2 Cutting stability

2.2.1 Method of analysis

The stability analysis considers an assumed linear phreatic surface at 2m bgl at the crest of the slope reducing in depth to 0.5m at the toe of the slope, with a pore pressure ratio, r_u , above this line. As outlined in the ICE Manual of Geotechnical Engineering [4], a reasonable range of r_u for cuttings in cohesive soils is 0.1-0.3 as described by Farrar 1978 [5]. Use of a value of 0.1 is proposed rather than a higher value for the following reasons:

- The phreatic surface level is relatively cautious and coupled with the use of r_u above the surface can result in unrealistically high pore water pressures immediately above the line. This can result in unrealistic critical slip surfaces being determined extending to the base of the unsaturated layer
- Inclusion of 10kPa of short-term construction / maintenance loading in the long-term drained case analysis as described below is considered to be cautious given that such loading would illicit an undrained response and is unlikely to extend to the crest of the slope in the long term
- The slope will be vegetated in the long-term improving shallow slope stability and reducing pore water pressures at shallow depths
- Any significant seepages encountered during construction can be addressed by installation of slope drainage

In any event, sensitivity of slope stability to an increased r_u value of 0.2 has been checked as described in Section 2.2.3.

The cutting is proposed to be formed from Ch 1200 to 1522 and is proposed to have a slope gradient of 1:2.75 (vert:horz). The highest cutting slope height (7.54m) at Ch 1400 has been selected for analysis as the critical section.

The ground model used for analysis of the critical cutting section is provided in Table 2.2.

Table 2.2: Cutting stability analysis ground model

Stratum	Top Level (mAOD)
Glacial Till – Macamore Clay	16.27*
Greenore Point Group - amphibolite	1.64

* Top of cutting

Since the initial slope stability analysis was undertaken, the area of the proposed cutting and new road has been cut to facilitate a road between the port and new car/lorry parking to the west of the port. The cut has a slope angle of approximately 1:1.5 (v:h). Analysis has been undertaken to consider the stability of this existing slope.

Analysis was undertaken using a piezometric line at 2mBGL at the top of the cutting, based on groundwater monitoring and strike information, then following the cutting slope to 0.5mBGL at the base of cutting. Groundwater monitoring does indicate groundwater at shallower depths in some cases, however this is inconsistent and sporadic and considered likely to be representative of limited quantities of perched water in more granular horizons. This is considered to be adequately represented by the r_u value above the piezometric line.

A 10kPa variable surcharge is applied on top of the cutting to represent construction loading.

Drained and undrained analyses have been undertaken.

Furthermore, it has been observed by the Small Boat Harbour owner's association that there is shallow slope movement in the slope behind Small Boat Harbour, north of the site, during heavy rainfall events. A site visit has not indicated a clear back scarp in this slope although the slope was overgrown at the time of the site visit. To consider stability of this existing slope, a slope stability analysis has been undertaken for the characteristic conditions. Further analyses have then been undertaken to consider the effect of the proposed slope at the Small Boat Harbour.

2.2.2 Design assumptions

The cutting stability analysis was undertaken based on the following assumptions:

- Geotechnical parameters have been taken from the N25 Rosslare Europort Access Road Detailed Design (Phase 5) Ground Investigation Report (229100548-MMD-0600-RE-RP-C-0003) [3].
- The critical cross section, taken as the highest cutting slope, has been analysed, based on long section/cross sections from drawing 229100548-MMD-0100-RE-M3-C-2002.
- The datum level for the Glacial Till – Macamore Clay undrained strength has been taken as the top level of the cutting – 16.27mAOD.
- The groundwater level is drawn down by the cutting and carriageway drainage to 0.5mBGL at the base of the cutting.
- A 10kPa variable surcharge is applied on top of the cutting to represent construction loading.
- The Greenore Point Group bedrock has been assigned a 'Bedrock (Impenetrable)' material model in Slope/W based on the assumption that critical slope failures will not pass through this stratum.
- Analysis has been undertaken for the existing slope angles and the proposed slopes.
- An additional cutting cross section named 'Small Boat Harbour' has been analysed. This is to confirm that proposed works do not reduce slope stability of the slope above the harbour.

2.2.3 Cutting stability analysis results

The results of the cutting stability analysis are summarised below in Table 2.3. A selection of Slope/W outputs are provided in Appendix A.

Table 2.3: Cutting stability analysis results

Analysis	Design Combination	Condition	Degree of Utilisation				Reference
			Existing Cut North	Existing Cut South	Proposed Cut North	Proposed Cut South	
Cutting – Chainage 1400	DA1-1	Drained	137%	124%	80%	73%	
		Undrained	35%	28%	42%	19%	
	DA1-2	Drained	164%	148%	100%	86%	Existing north: Figure A.1 Proposed north: Figure A.2 Proposed south: Figure A.3
		Undrained	37%	29%	40%	16%	Proposed north: Figure A.4 Proposed south: Figure A.5
Small Boat Harbour –	Characteristic	Drained	1.08 (0.95 *) (FOS)	-	-	-	Figure A.6 (Figure A.7)
		Undrained	1.69 (FOS)	-	-	-	Figure A.8
	DA1-1	Drained	94%	-	94%	-	Figure A.9
		Undrained	81%	-	76%	-	Figure A.10
	DA1-2	Drained	116%	-	115%	-	Figure A.11
		Undrained	83%	-	79%	-	Figure A.12

* Result in brackets is for pore pressure ratio $r_u = 0.2$ – see below for discussion.

The analyses for the small boat harbour slope are for the slope above the harbour rather than the highway cutting slope.

The cutting stability analysis gives a utilisation for the existing cutting slope considering effective stress (drained) behaviour of 1.64. This indicates that the existing slope represents an inadequate design in accordance with Eurocode 7, and has a lumped factor of safety of approximately 0.8 meaning that if the modelled conditions were representative of those on site, the slope would have been expected to have failed. As the slope is not understood to be showing signs of failure, this indicates that the conditions assumed in the model are not representative of the actual conditions in operation. A combination of factors may have caused the model to not be representative of the on-site conditions, including higher soil parameters being in operation, less onerous groundwater conditions, no variable loading being applied at the slope crest or the slope not yet having reached a drained, effective stress conditions. Whilst the value of effective cohesion adopted may be cautious, this considers long term weathering of the near surface soils, and the soil parameters selected for design have been derived from the scheme ground investigation and correspond well with those proposed in ‘The 1st Hanrahan Lecture: Geotechnical properties of Irish glacial and interglacial soils’ [6]. Therefore, it is likely that the reason for the cutting’s apparent stability is a combination of the other factors. The assumptions in the model, however, are considered reasonable for the design life of the cutting.

The results of the proposed cutting stability analysis indicate that the cutting with a 1:2.75 (v:h) gradient is suitable.

The sensitivity analysis as described above was undertaken for the critical cutting model (DA1-2 drained) to consider the effect of increasing the value of r_u to 0.2 to represent an extreme rainfall event. These results showed a utilisation of 103% - a marginal exceedance of the allowable utilisation. Given the mitigating factors described above, the design slope angle is considered to be adequate.

At the Small Boat Harbour, the analysis gives a factor of safety for the existing slope in characteristic conditions of 1.082 considering effective stress (drained) behaviour of the soil with a pore pressure ratio, r_u of 0.1. Increasing the value of r_u to 0.2, likely to be representative of an extreme rainfall event, gives a factor of safety for a shallow slope failure of 0.948. This indicates

that the slope is marginally stable under existing conditions but that it may be at risk of failure during an extreme rainfall event, as is indicated by the Small Boat Harbour owner's association. The current slope is deemed to be stable under normal conditions but would not give an adequate design in accordance with Eurocode 7 and could show signs of shallow slope movement under heavy rainfall. Design analyses to consider the effect of the proposed slope at the Small Boat Harbour indicate that construction of the proposed cutting would have no impact on the stability of the small boat harbour slope with the degree of utilisation decreasing between the existing and proposed slope profiles. The formation of the cutting would reduce loading at the crest of the Small Boat Harbour slope, decreasing destabilising forces.

2.3 Embankment stability

2.3.1 Method of analysis

The stability analysis considers an assumed phreatic surface, and a pore pressure ratio, r_u , above this line. As outlined in the ICE Manual of Geotechnical Engineering [4], a nominal range of r_u for embankments of 0.05-1 can be adopted to consider the percolation of precipitation. An r_u value of 0.1 has therefore been used above groundwater level to represent partial saturation from precipitation above the piezometric line.

The embankment is proposed on site from Ch 500 to 1200 and is proposed to have a slope gradient of 1:2 (v:h). The embankment slope at Ch 1000 (8.06m high) has been selected for analysis as the critical section.

Sensitivity analysis has been undertaken using both reused Glacial Till – Macamore Clay, to examine the feasibility for reuse, and imported Class 2 fill as the embankment fill.

The imported Class 2 embankment fill is assumed to be derived from off-site cohesive Glacial Till, with an angle of shearing resistance of 33° and effective cohesion of 1kPa. This is considered representative of Class 2 fills more generally available in Ireland, based on experience. It will need to be demonstrated that the imported Class 2 fill where proposed can achieve these values.

For the reused Glacial Till – Macamore Clay a critical angle of shearing resistance of 25° has been used in the analysis.

The ground model used for analysis of the critical embankment section is provided in Table 2.4.

Table 2.4: Embankment stability analysis ground model

Stratum	Top Level (mAOD)
Reused Glacial Till – Macamore Clay / Imported Class 2 fill	18.76*
Class 6B starter layer	11.8**
Glacial Till – Macamore Clay	11.5***
Greenore Point Group - amphibolite	6

* Top of embankment – top level varies due to topography

** Base of embankment – base level varies due to topography

*** Below 300mm starter layer – base level varies due to topography

Analysis was undertaken using a piezometric line at 9.5mAOD, based on groundwater monitoring and strike information.

A 10kPa variable surcharge is applied on top of the embankment on the road area to represent highway loading. A 10kPa permanent surcharge is applied from the edge of the road area to the edge of the embankment in accordance with BS6031.

It is assumed that any soft spots identified, where undrained shear strength is less than 50kPa, will be excavated and replaced with suitable material.

Drained and undrained analyses have been undertaken.

2.3.2 Design assumptions

The embankment stability analyses were undertaken based on the following assumptions:

- Geotechnical parameters have been taken from the N25 Rosslare Europort Access Road Detailed Design (Phase 5) Ground Investigation Report (229100548-MMD-0600-RE-RP-C-0003) [3].
- The imported Class 2 fill embankment fill is assumed to have the following parameters:
 - Bulk unit weight, γ of 20kN/m³
 - Angle of shearing resistance, ϕ of 33°
 - Effective cohesion, c' of 1kPa
 - Undrained shear strength, c_u of 50kPa
- A 0.3m thick Class 6B starter layer has been modelled underneath the embankment, assumed to have the following parameters:
 - Bulk unit weight, γ of 20kN/m³
 - Angle of shearing resistance, ϕ of 40°
 - Effective cohesion, c' of 0kPa
- For the reused Glacial Till – Macamore Clay embankment fill, the critical angle of shearing resistance of 25° and a c' of 1kPa has been used in the analysis.
- The critical cross section, taken as the highest embankment slope, has been analysed, based on long section/cross sections from drawing 229100548-MMD-0100-RE-M3-C-2002, which give a 1:2 (v:h) slope gradient.
- The datum level for the Glacial Till – Macamore Clay undrained strength has been taken as existing ground level – 10.5mAOD.
- A 10kPa variable surcharge is applied on top of the embankment to represent highway loading.
- The Greenore Point Group bedrock has been assigned a 'Bedrock (Impenetrable)' material model in Slope/W.
- Both the eastern and western sides of the embankment have been checked for stability.
- Where an adequate design using reworked Glacial Till – Macamore Clay could not be obtained for a 1:2 (v:h) slope gradient, further analysis was undertaken to determine the steepest gradient that could be achieved using this material.
- Additional analysis has been undertaken to examine if a 1:2 (v:h) slope gradient can be achieved with an embankment core constructed of reused Glacial Till – Macamore Clay and the top and shoulders of the embankment constructed with imported Class 2 fill. Different slope heights have been analysed to ascertain whether the amount of imported Class 2 fill could be reduced at lower slope heights.

2.3.3 Embankment stability analysis results

The results of the embankment stability analyses are summarised below in Table 2.5. The results in **bold** show the solution considered to be the most appropriate, taking into account material reuse (see Section 2.6).

The critical Slope/W outputs for each analysis are provided in Appendix A.

Table 2.5: Embankment stability analysis results

Analysis	Design Combination	Condition	Utilisation	Reference
Class 2 imported fill – Chainage 1000 east (1:2)	DA1-1	Drained	79%	-
		Undrained	67%	-
	DA1-2	Drained	97%	Figure A.13
		Undrained	69%	Figure A.14
Class 2 imported fill – Chainage 1000 west (1:2)	DA1-1	Drained	78%	-
		Undrained	62%	-
	DA1-2	Drained	95%	-
		Undrained	62%	-
Reused Glacial Till – Macamore Clay – Chainage 1000 east (1:2)	DA1-1	Drained	107%	-
		Undrained	67%	-
	DA1-2	Drained	131%	Figure A.15
		Undrained	69%	Figure A.16
Reused Glacial Till – Macamore Clay – Chainage 1000 west (1:2)	DA1-1	Drained	105%	-
		Undrained	62%	-
	DA1-2	Drained	128%	-
		Undrained	62%	-
Reused Glacial Till – Macamore Clay core with imported Class 2 imported fill on top – Chainage 1000 east (1:2)	DA1-1	Drained	84%	-
		Undrained	67%	-
	DA1-2	Drained	100%	Figure A.17
		Undrained	69%	Figure A.18
Reused Glacial Till – Macamore Clay core with imported Class 2 imported fill on top – Chainage 1000 west (1:2)	DA1-1	Drained	83%	-
		Undrained	62%	-
	DA1-2	Drained	99%	Figure A.19
		Undrained	62%	Figure A.20

The results of the embankment stability analysis indicate that the embankment with a 1:2 (v:h) gradient is suitable if Class 2 fill is imported to site. The reused Glacial Till – Macamore Clay as embankment fill does not provide an adequate design at a gradient of 1:2 (v:h) in the drained, long term, condition. Sensitivity analysis showed that the embankment slopes constructed entirely with Glacial Till - Macamore Clay would require a gradient no steeper than 1:2.75 (v:h) to be stable.

If Glacial Till – Macamore Clay is to be used on site as embankment fill, the slopes of the embankment would need to be slackened or used as the embankment core with Class 2 fill forming the top and shoulders.

Analysis with a Glacial Till - Macamore Clay embankment core shows an imported Class 2 fill horizontal cover of 7m, and vertical cover of 3.5m is required around the core for stability at the maximum embankment height. The Class 2 fill cover can be reduced at lower embankment heights – the analysis shows that a 4.5m high embankment requires an imported Class 2 fill horizontal cover of 4m, and vertical cover of 1m. The Standard Earthworks Details (229100548-MMD-0600-RE-DR-C-0003 and 229100548-MMD-0600-RE-DR-C-0004), provided in Appendix C, show the proposed embankment core detail.

Analysis shows that a 3.5m Glacial Till - Macamore Clay embankment core is stable in undrained, short term, conditions at a 1:2 (v:h) gradient. This is expected to be adequate for the

construction period of the embankment core and assumes the core will not be left without the Class 2 fill shoulders for a significant period of time.

As the undrained analysis has an adequate degree of utilisation, there is not a realistic risk of short-term instability during construction and therefore there is not considered to be a requirement for staged construction. It is recommended, however, that vibrating wire piezometers are installed at the maximum embankment height to monitor excess pore water pressure and dissipation times during construction.

2.4 Pond stability

2.4.1 Design methodology

2.4.2 Method of analysis

The stability analysis considers an assumed phreatic surface, and a pore pressure ratio, r_u , above this line. As outlined in the ICE Manual of Geotechnical Engineering [4], a reasonable range of r_u for cuttings in cohesive soils is 0.1-0.3 and a range of r_u for embankments of 0.05-1 can be adopted to consider the percolation of precipitation. An r_u value of 0.1 has therefore been used above groundwater level to represent partial saturation from precipitation above the piezometric line, given the combination of cutting in soils and new embankments. A scenario to model rapid drawdown, to simulate the failure of the pond liner and subsequent rapid drainage of the pond has also been undertaken.

There are three ponds present on site which are proposed to have slope gradients of 30% to 33%. Ponds 1 and 2 are present to the east and west of the proposed embankment at approximate chainage 650. Pond 3 is present north of the alignment at chainage 1175. Several cross sections of each pond have been analysed to find the worst case.

The ground models in Table 2.6 below are based on the cutting and embankment ground models described in Sections 2.2 and 2.3. Where the bund is constructed above the existing ground, it is assumed to be constructed of imported Class 2 fill.

Table 2.6: Pond stability analysis ground model

Pond Number	Stratum	Top Level (mAOD)
Pond 1	Imported Class 2 fill / Glacial Till – Macamore Clay	10.26
	Greenore Point Group - amphibolite	6
Pond 2	Imported Class 2 fill / Glacial Till – Macamore Clay	10.24 – 10.53
	Greenore Point Group - amphibolite	6
Pond 3	Glacial Till – Macamore Clay	14.28
	Greenore Point Group - amphibolite	12.28

The imported Class 2 embankment fill is assumed to be derived from off-site cohesive Glacial Till, with a unit weight of 20kN/m³, an angle of shearing resistance of 33° and effective cohesion of 1kPa. This is considered representative of Class 2 fills more generally available in Ireland, based on experience. It will need to be demonstrated that the imported Class 2 fill can achieve these values.

In ponds 1 and 2, analysis was undertaken using a piezometric line at 9.5mAOD, based on groundwater monitoring and strike information. In pond 3, analysis was undertaken using a

piezometric line at 2mBGL at the top of the cut slope, based on groundwater monitoring and strike information.

A 5kPa variable surcharge is applied on top of the bunds to represent maintenance loading.

It is assumed that any soft spots identified, where undrained shear strength is less than 50kPa, will be excavated and replaced with suitable material.

Drained and undrained analyses have been undertaken.

2.4.3 Design assumptions

The stability analyses were undertaken based on the following assumptions:

- Geotechnical parameters have been taken from the N25 Rosslare Europort Access Road Detailed Design (Phase 5) Ground Investigation Report (229100548-MMD-0600-RE-RP-C-0003) [3].
- The cross sections have been based on long section/cross sections from drawing 229100548-MMD-0100-RE-M2-C-2002, which give a 1:3 (v:h) slope gradient.
- The datum level for the Glacial Till – Macamore Clay undrained strength has been taken as existing ground level.
- Where the pond bund is constructed above the existing ground, it is assumed to be constructed of imported Class 2 fill.
- A 5kPa variable surcharge is applied on top of the bunds to represent maintenance loading.
- The Greenore Point Group bedrock has been assigned a ‘Bedrock (Impenetrable)’ material model in Slope/W, preventing critical failure surfaces from passing through the material.
- A 0.2m thick layer has been included in the analysis at the base of the pond to represent the cover to the pond liner, in accordance with drainage drawings 229100548-MMD-0500-RE-DR-C-2012-2014. This has been modelled with a unit weight of 20kN/m³ and an angle of shearing resistance of 30 degrees.
- Analyses have been undertaken with the pond full of water and dry to find the worst case. In the dry scenario, the groundwater level has been taken as being at the depth of the base of the pond.
- An analysis has been undertaken to consider the slope stability in a rapid drawdown situation, in case of failure of the pond liner. This considers groundwater levels following the surface of the soil within the full pond design depth of water, resulting in levels in the soil equivalent to those for the full pond situation, whilst the pond is modelled as empty.

2.4.4 Pond stability analysis results

The results of the stability analyses for the full pond and dry pond situations are summarised below in Table 2.7. Additional profiles were analysed for pond 2, but the results for these analyses have not been included in Table 2.7 since they are less critical than profile 2.

The critical Slope/W outputs for each analysis are provided in Appendix A.

Table 2.7: Slope stability analysis results

Analysis	Design Combination	Condition	Utilisation		Reference
			North	South	
Pond 1 – Full	DA1-1	Drained	63%	65%	-
		Undrained	14%	14%	-
	DA1-2	Drained	73%	77%	Figure A.21
		Undrained	12%	12%	Figure A.22

Analysis	Design Combination	Condition	Utilisation		Reference
			North	South	
Pond 1 – Dry	DA1-1	Drained	63%	64%	-
		Undrained	16%	16%	-
	DA1-2	Drained	73%	75%	Figure A.23
		Undrained	15%	15%	Figure A.24
Pond 2 – Profile 2 - Full	DA1-1	Drained	63%	64%	-
		Undrained	16%	16%	-
	DA1-2	Drained	73%	74%	Figure A.25
		Undrained	14%	14%	Figure A.26
Pond 2 – Profile 2- Dry	DA1-1	Drained	63%	64%	-
		Undrained	19%	19%	-
	DA1-2	Drained	74%	75%	Figure A.27
		Undrained	18%	18%	Figure A.28
Pond 3 – Dry	DA1-1	Drained	64%	61%	-
		Undrained	20%	20%	-
	DA1-2	Drained	76%	71%	Figure A.29
		Undrained	17%	17%	Figure A.30

The results of the pond stability analysis indicate the ponds are stable with a 1:3 (v:h) gradient if suitable Class 2 fill is imported to site.

An analysis was undertaken for the critical pond slope case (Pond 1 - south) to analyse the risk on slope stability of the pond liner failing and emptying, leading to rapid drawdown. The slope stability analysis modelled a dry pond with the groundwater on either side of the pond at the assumed “full” level (9.5m AOD). This is an onerous case. As this analysis is for the attenuation ponds, any slope stability failure would not have an immediate effect on the new highway and would not affect the travelling public. As such in accordance with IS EN 1997-1 Cl. 2.4.7.1(5), in such situations, reduced partial factors on resistance can be adopted.

The publication ‘Earthworks: a guide’ [9] further supports this approach, quoting a minimum lumped factor of safety of 1.2 as being acceptable for transient drawdown conditions, this can be compared to lumped factors of safety of at least 1.3 for permanent design cases as would have been historically adopted. On this basis a reduction of the partial factor on resistance to 1.2/1.3, or 0.92 would be appropriate. This is equivalent to a maximum acceptable degree of utilisation of 1/0.92, or 108% when adopting a partial factor on resistance of unity. The results for the drained condition (DA1-2) gave a utilisation of 103%. The model also considers a live load maintenance surcharge at the crest which is unlikely to be present as close to the edge of the slope as modelled, and would likely mobilise a short-term undrained response.

Considering all of these aspects, this indicates the pond slopes are adequate in the drawdown scenario. The Slope/W output is provided in Figure A.31.

2.5 Embankment settlement

2.5.1 Method of analysis

The oedometer settlement, ρ_{oed} , of cohesive soil layers was calculated using equation 2.46 in Tomlinson - Foundation Design & Construction [7]:

$$\rho_{oed} = m_v \sigma_z H$$

Where:

m_v is the average coefficient of volume compressibility obtained for the effective pressure increment in the particular layer under consideration.

σ_z is the average effective vertical stress imposed on the particular layer resulting from the net foundation pressure.

H is the thickness of the particular layer under consideration.

The immediate settlement, ρ_i , can be calculated from the oedometer settlement using the following equation from Tomlinson - Foundation Design & Construction [7]:

$$\text{For overconsolidated clays: } \rho_i = 0.5 \text{ to } 0.6 \rho_{oed}$$

$$\text{For normally consolidated clays: } \rho_i = 0.1 \rho_{oed}$$

The consolidation settlement, ρ_c , can be calculated from the oedometer settlement using equation 2.45 in Tomlinson - Foundation Design & Construction [7]:

$$\rho_c = \mu_g \rho_{oed}$$

Where:

μ_g is a coefficient (geological factor) which depends on the type of clay.

ρ_{oed} is settlement as calculated from oedometer tests.

Tomlinson [7] provides typical values of μ_g for various types of clay. A range of μ_g values from 0.2 to 0.5 is suggested for heavily overconsolidated clays including Glacial Till.

The total settlement, ρ_t , can be calculated as the sum of the immediate settlement, ρ_i , and the consolidation settlement, ρ_c .

The settlement of granular soils, ρ , was estimated using Burland and Burbidge's method for estimating the settlement of foundations on sand and gravel [7]:

$$\rho = f_s f_l f_t q'_n B^{0.7} I_c$$

Where:

f_s is the shape factor

f_l is the correction factor for the depth of the granular layer

f_t is the time factor

q'_n is the average net applied pressure

B is foundation depth

I_c is the compressibility index

The self-settlement of the embankment fill, ρ_i , has been calculated using:

$$\rho_i = \frac{\gamma H}{D^*}$$

Where:

γ is the bulk density of the fill material

H is the total height of the embankment

D^* is the equivalent constrained modulus, taken as 6MPa for low plasticity clay

The ground model used for embankment settlement analysis is provided in Table 2.4. The reused Glacial Till – Macamore Clay and imported Class 2 fill are assumed to have the same bulk unit weight and so are interchangeable in this calculation.

One analysis has been undertaken assuming the maximum height of the embankment extends along the whole embankment length to produce the critical scenario. The self-settlement of the fill at the maximum height has been calculated, however this will reduce as the height of the embankment reduces. The embankment close to the bridge structures will be constructed as granular fill, and therefore the settlement is likely to be immediate.

2.5.2 Design assumptions

The embankment settlement analysis was undertaken based on the following assumptions:

- Geotechnical parameters have been taken from the N25 Rosslare Europort Access Road Detailed Design (Phase 5) Ground Investigation Report (229100548-MMD-0600-RE-RP-C-0003) [3].
- The imported Class 2 fill embankment fill is assumed to have the following parameters:
 - Bulk unit weight, γ of 20kN/m³
- An assessment with a 6B starter layer has been undertaken.
- Where present the 0.3m Class 6B starter layer has been assumed to have the following parameters:
 - Bulk unit weight, γ of 20kN/m³
 - Angle of shearing resistance, ϕ of 40°
 - Effective cohesion, c' of 0kPa
- The highest embankment height has been analysed, based on long section/cross sections from drawing 229100548-MMD-0100-RE-M3-C-2002. The dimensions of the embankment have also been taken from this drawing.
- The increase in stress for each layer was calculated using Newmark's method [7].
- The depth of the compressible layer considered has been taken as the depth at which the effective vertical stress due to the embankment load is 20% of the effective overburden stress as recommended by IS EN 1997-1:2005 (Eurocode 7) [8].
- No settlement is assumed to take place in the Greenore Point Group bedrock.
- The self-settlement of the fill at the maximum embankment height has been calculated.

2.5.3 Embankment settlement results

Table 2.8 provides a summary of the estimated settlement for the embankment.

Table 2.8: Summary of estimated settlement

Immediate settlement (mm)	Consolidation settlement (mm)	Fill self-settlement (mm)	Total settlement (mm)
<72	<70	<14	<156

2.6 Re-use of materials

The site won material from cuttings has the potential for re-use where appropriate, including for the embankment and landscape fill.

Excavations may encounter Made Ground, Glacial Till – Macamore Clay and Greenore Point Group Amphibolite. Site won material is anticipated to be predominantly Class 1 or 2 general fill material.

The cutting to facilitate the access road between the lorry park at the north east of the site and the port was constructed after the initial analysis of earthworks and material reuse. No investigation has been undertaken to identify the material that is present on the slopes of the cutting, or in the associated spoil heap. Aerial photography shows the spoil heap to be present north of the cutting, to the east of the lorry park. Due to the time that the spoil heap has been exposed, it is likely that the fines have migrated through the material through percolation of rainfall, moisture contents will be variable and the material will be highly heterogeneous and not suitable for reuse. Therefore, there is less fill available for reuse than originally expected.

The anticipated re-use of materials discussed below is based on the results of the scheme ground investigations and is in accordance with the Specification for Road Works, Series 600 [10].

2.6.1 Topsoil

The topsoil should be sampled, tested and classified in accordance with BS 3882:2015 [11] to determine if suitable for re-use.

2.6.2 Made Ground

A high-level estimation indicates that 5920m³ of Made Ground may be available from the cutting, with an additional 372m³ likely to be available due to removal of existing surfacing and soft estate in At Grade areas, balancing ponds and Made Ground from beneath the embankment footprint.

This material is expected to comprise existing road formation and other heterogeneous material and is therefore presumed to comprise non-compliant material.

Due to its heterogeneity, the remaining Made Ground may be suitable as Class 4 landscape fill or should be classed as non-compliant material should landscape fill not be required.

2.6.3 Glacial Till – Macamore Clay

A high-level estimation indicates that 34634m³ of Glacial Till – Macamore Clay may be available from the cutting. An estimate of the useable of total is 90% to account for wastage during the construction process.

2.6.3.1 Grading

Particle Size Distribution testing was conducted on 53 samples of Glacial Till – Macamore Clay.

The results of the PSD tests undertaken on samples of Glacial Till – Macamore Clay deposits are shown in Figure B.1.

The PSD tests show the majority of the Glacial Till – Macamore Clay can be classified based solely on grading as Class 2A & B with some 2C material as defined in Table 6/1 of Series 600 of the Specification for Road Works.

2.6.3.2 Compaction tests

Five compaction tests were undertaken on the Glacial Till – Macamore Clay.

The results of the compaction tests are shown in Figure B.2.

The results show the Glacial Till – Macamore Clay has an optimum moisture content range of 18-25%.

2.6.3.3 Moisture condition value

5 Moisture Condition Value (MCV) tests were undertaken on the Glacial Till – Macamore Clay.

The results of the MCV tests are shown in Figure B.3.

The MCV tests showed a wide range values, with an acceptable MCV range of 8-13.

2.6.3.4 Natural moisture content

147 moisture content tests were undertaken in the Glacial Till – Macamore Clay.

The typical natural moisture content was observed to be 18-26%, with a range from 3-45%.

The Moisture Content Lower Acceptability Limit (LAL) has been defined by the 10% air voids line and the Moisture Content Upper Acceptability Limit (UAL) has been defined by 90% maximum dry density.

The acceptable moisture content range for the Glacial Till – Macamore Clay has been derived as 18-25%. The typical natural moisture content, 18-26%, falls slightly wet of the acceptable range. It is estimated from moisture content testing that 68% of natural material would fall within the acceptable moisture content range, however this is sample dependent, and testing will be required on the excavated material.

Therefore, some of the Glacial Till – Macamore Clay material may be suitable for reuse without processing, however it should be noted that a large proportion of material tested (32%) fell outside the acceptable moisture content limits. See also discussion related to swelling below.

2.6.3.5 Swelling

Glacial Till – Macamore Clay can exhibit swelling once rehydrated, which has significant implications for the handling, control and placement of the material when used as a fill. In addition, suction measurements on recompacted samples show high initial negative porewater pressures which play a crucial role in embankment stability [12]. When Glacial Till – Macamore Clay is compacted below its in situ moisture content, it exhibits swelling and fracturing when water is added, and this locally reduces suction. Swelling and loss of suction can cause instability of embankments.

Appropriate limits of moisture content of the Glacial Till – Macamore Clay will be imposed for reuse on site, given in Table 2.9. Moisture content testing of the Glacial Till – Macamore Clay is required during time of excavation and during compaction if it is to be reused on site. The vertical deflection (swelling and settlement) of the Glacial Till – Macamore Clay is also required to be monitored during construction.

2.6.3.6 Conclusion

The classification and compaction requirements determined for compliant earthworks materials are detailed in Table 2.9.

Due to the known issues with swelling in the Macamore Clay, great care must be taken in the handling and long-term monitoring of this material when used as a fill – water content of the Glacial Till – Macamore Clay must be measured at time of excavation and during compaction if reused on site.

Table 2.9: Glacial Till – Macamore Clay re-use compliance

Material	General material description	Typical use	Material properties required for acceptability				Compaction requirements	Class
			Property	Defined and tested in accordance with:	Compliance Limits			
					Lower	Upper		
Glacial Till – Macamore Clay	Wet or Dry Cohesive Material	General Fill	Plastic Limit (%)	BS 1377: Part 2	-	-	Using Specification for Road Works – Tab 6/4 Method 1 except for materials with liquid limit greater than 50, determined by BS 1377 : Part 2, only tamping or grid rollers shall be used.	2A or 2B (potentially 2C)
			Water Content (%)	BS 1377: Part 2	18 or in situ moisture content, whichever is higher	Compaction requirement: 25		
			Undrained Shear strength of remoulded material (kPa)		50	-		
			MCV		8	13		

2.6.4 Greenore Point Group

It is not anticipated that the Greenore Point Group bedrock will be encountered during excavation so this stratum has not been assessed for re-use.

3 Structures

3.1 Introduction

Three major structures are proposed as part of the N25 Rosslare Europort Access Road:

- The B1 Ballygerry Underbridge (Ballygerry Overbridge OBH226C) carries the proposed N25 mainline across the Waterford to Rosslare Harbour railway line at Ch 954.
- The B2 Access Underpass carries the proposed N25 mainline across the Rosslare Harbour Wastewater Treatment Plant.
- The B3 Greenway Underpass carries the proposed N25 mainline across the proposed Rosslare to Rosslare Europort Greenway route at Ch 1050.

Three minor structures are proposed as part of the N25 Rosslare Europort Access Road:

- Drainage Culvert C1 will cross under the proposed N25 mainline at Ch 695.
- Drainage Culvert C2 will cross under the proposed access to attenuation pond 2 at mainline Ch 700.
- Attenuation tank present under the shared pedestrian/cyclist facility and verge at approximate chainage Ch. 1425-1500.

3.2 Characteristic geotechnical parameters

The geotechnical parameters for design have been derived in the Detailed Design Ground (Phase 5) Investigation Report (229100548-MMD-0600-RE-RP-C-0003) [3] and have been provided in Table 3.2 below.

Table 3.1: Characteristic geotechnical parameters

Stratum	γ (kN/m ³)	Φ (°)	c' (kPa)	c_u (kPa)	UCS (MPa)
Cohesive Made Ground	17	24	0	50	-
Granular Made Ground	17 19 (sat)	32	0	-	-
Glacial Till – Macamore Clay	20	26	1	50 + 4z	-
Greenore Point Group - Amphibolite	23	46*	170*	-	1.8

* Based on Hoek Brown criterion

3.3 Design ground models

The ground models for the structures are summarised in Table 3.2 to Table 3.8.

Table 3.2: Ground Model B1 - North side abutment and wingwalls

Geology	Description	Top Level (mAOD)
Topsoil	Brown, slightly sandy slightly gravelly SILT	10.41 to 11.00
Made Ground (only in BH115)	Stiff, brown, slightly sandy slightly gravelly CLAY, brick, concrete. Sand is fine to coarse. Gravel is fine to coarse and sub-angular	10.01

Geology	Description	Top Level (mAOD)
Glacial Till	Firm brown, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded	8.91 to 10.65
Greenore Point Group (bedrock)*	Very weak to moderately strong, brown Amphibolite with schistose fabric.	4.38
* Greenore Point Group was only encountered in BHG117		

Table 3.3: Ground Model B1 - South side abutment and wingwalls

Geology	Description	Top Level (mAOD)
Made Ground	Stiff, brown, slightly sandy slightly gravelly CLAY, brick, concrete. Sand is fine to coarse. Gravel is fine to coarse and sub-angular	11.27 to 12.71
Glacial Till	Firm, dark brown, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded	10.07 to 12.65
Greenore Point Group (bedrock)	Very weak to moderately strong brown Amphibolite with schistose fabric.	3.87 to 6.70

Table 3.4: Ground Model B2 - North side abutment and wingwalls

Geology	Description	Top Level (mAOD)
Made Ground (possible railway embankment fill)	Stiff, brown, slightly sandy slightly gravelly CLAY, brick, concrete. Sand is fine to coarse. Gravel is fine to coarse and sub-angular	11.27 to 12.71
Glacial Till	Firm, dark brown, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded	10.07 to 12.65
Greenore Point Group (bedrock)	Very weak to moderately strong brown Amphibolite with schistose fabric.	3.87 to 6.70

Table 3.5: Ground Model B2 - South side abutment and wingwalls

Geology	Description	Top Level (mAOD)
Made Ground (possible embankment fill)	Stiff, brown, slightly sandy slightly gravelly CLAY, brick, concrete. Sand is fine to coarse. Gravel is fine to coarse and sub-angular	11.27 to 11.37
Topsoil *	Topsoil	9.78 to 9.94
Glacial Till	Firm, dark brown, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded	9.38 to 10.27

Geology	Description	Top Level (mAOD)
Greenore Point Group (bedrock) (RC120 only)	Very weak to moderately strong brown Amphibolite with schistose fabric	3.87
* Topsoil was only encountered in BH121 and BH122 located to the south of site away from the railway embankment		

Table 3.6: Ground Model B3

Geology	Description	Top Level (mAOD)
Glacial Till	Soft to stiff, dark brown, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded	11.14 to 16.50
Greenore Point Group (bedrock)*	Very weak to moderately strong brown Amphibolite with schistose fabric	4.38 to 6.70
* Level from exploratory holes near bridge B1 as the exploratory holes within the B3 area terminated before proving bedrock. A geophysical profile from the 2021 Ground Investigation indicates the rockhead may be at approximately 1 to 4.5mAOD.		

Table 3.7: Ground Model C1

Geology	Description	Top Level (mAOD)
Glacial Till	Soft to stiff, dark brown, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded	9.26 to 11.59
Greenore Point Group (bedrock)*	Very weak to moderately strong brown Amphibolite with schistose fabric	4.38 to 6.70
* Level from exploratory holes near bridge B1 as the exploratory holes within the C1 area terminated before the bedrock. A geophysical profile from the 2021 Ground Investigation indicates the rockhead may be at approximately -1 to -2mAOD.		

Table 3.8: Ground Model C2

Geology	Description	Top Level (mAOD)
Glacial Till	Soft to stiff, dark brown, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded	9.26 to 11.59
Greenore Point Group (bedrock)*	Very weak to moderately strong brown Amphibolite with schistose fabric	4.38 to 6.70
* Level from exploratory holes near bridge B1 as the exploratory holes within the C2 area terminated before the bedrock. A geophysical profile from the 2021 Ground Investigation indicates the rockhead may be at approximately -1 to -2mAOD.		

3.4 B1 Ballygerry Underbridge (Railway Overbridge OBH226C)

The proposed B1 Ballygerry Underbridge (Railway Overbridge OBH226C) is a fully integral single span structure. The deck consists of precast prestressed concrete beams with an in situ infill concrete deck, made integral with a flexible support piled abutment. The abutment walls and wingwalls are reinforced soil walls.

The bridge deck will be supported by a flexible support piled abutment. The abutment consists of a single row of continuous flight auger or bored cast in place piles transitioning into concrete columns, which will be sleeved within the retained depth of the soil panel walls to prevent soil-structure interaction with the reinforced soil structure. The beams will be supported on an abutment crossbeam that will be made integral with the bridge deck and columns.

The piles are proposed to have a 0.7m diameter with a spacing of 2.4m.

This section of the report discusses the design approach undertaken for the following external stability verification checks on the piled foundations:

- Pile axial capacity
- Soil structure interaction (including pile lateral capacity)
- Pile group settlement

3.4.1 Pile axial capacity

3.4.1.1 Single pile axial capacity

The axial capacity of individual pile has been calculated in accordance with BS 8004:2015 [13] using partial factors for the STR and GEO limit state as defined in NA to IS EN 1997-1:2005 [8].

The axial capacity of each bored pile has been calculated based on the following formula:

$$R_{c;k} = R_{b;k} + R_{s;k}$$

Where:

$R_{c;k}$ is the characteristic ultimate compressive resistance of an individual pile
 $R_{b;k}$ is the characteristic base resistance of the pile
 $R_{s;k}$ is the characteristic shaft resistance of the pile

Due to the shallow rock level, approximately 5.8m below ground level, the pile will require a rock socket into the Greenore Point Group. Any resistance from the soil above the rock has been ignored for the axial capacity.

The shaft resistance for rock, Q_s , was calculated using each of the equations below taken from Table 54.8 of the ICE Manual of Geotechnical Engineering [14] and multiplied by the surface area of the pile shaft, A_s . The characteristic value/method of determining Q_s was then adopted for the design.

$$Q_s = 0.33 (q_{uc})^{0.5}$$

$$Q_s = 0.2 \text{ to } 0.25 (q_{uc})^{0.5}$$

$$Q_s = 0.22 (q_{uc})^{0.6}$$

$$Q_s = 0.45 (q_{uc})^{0.5}$$

$$Q_s = 0.375 (q_{uc})^{0.515}$$

$$Q_s = \alpha \beta (q_{uc})$$

Where:

q_{uc} is unconfined compressive strength
 α is the adhesion factor
 β is the rock socket side friction factor

Pile ultimate base capacity, $Q_{b_{ult}}$, has been taken as the unconfined compressive strength of the rock.

A model factor has been applied in accordance with NA to IS EN 1997-1:2005 to determine the shaft and base resistance.

3.4.1.2 Pile group capacity

The pile group axial capacity has been calculated in accordance with BS 8004:2015 [13] using partial factors for the STR and GEO limit state as defined in NA to IS EN 1997-1:2005 [8].

The design value of the ultimate compressive resistance of a pile group $R_{group,c,d}$ is calculated from:

$$R_{group,c,d} = \min (R_{sum,c,d}; R_{block,c,d}; R_{row,c,d})$$

Where:

$R_{sum,c,d}$ is the sum of the ultimate compressive resistances of all the individual piles
 $R_{block,c,d}$ is the ultimate compressive resistance of a block that encloses the pile group
 $R_{row,c,d}$ is the ultimate compressive resistance of a row of piles within that block.

The sum of the ultimate compressive resistances of the individual piles $R_{sum,c,d}$ is calculated from:

$$R_{sum,c,d} = \sum_{j=1}^{j=n} (R_{c,d})_j$$

Where:

$(R_{c,d})_j$ is the design value of the ultimate compressive resistance of pile j
 n is the total number of piles in the group

The ultimate compressive resistance of the block that encloses the pile group $R_{block,c,d}$ is calculated from:

$$R_{block,c,d} = (K_0 \times \overline{\sigma'_v} \times \tan \varphi \times A_s \times s_{block}) + (N_q \times \sigma'_{vb} \times A_b)$$

Where:

K_0 is the soil's at-rest earth pressure coefficient
 $\overline{\sigma'_v}$ is the average vertical effective stress over the side of the block
 φ is the soil's angle of shearing resistance
 A_s is the total side area of the block (i.e. perimeter of the block $\times$ pile length)
 s_{block} is a shape factor
 N_q is a bearing coefficient
 A_b is the total base area of the block (i.e. width $\times$ breadth of the block)

3.4.2 Soil Structure Interaction

The substructure and piled foundations are classified as flexible support abutments, where the deck is supported on flexible piles or columns, in accordance with PD 6694-1: 2011+A1:2020, incorporating Corrigendum C1:January 2022 and C2: July 2023.

The geotechnical analysis of the piled foundation has been undertaken using Geosolve's WALLAP V6.06 by applying forces to the abutment to represent the thermal expansion and contraction movement, d_d , of the bridge deck. The analysis has been continued until the depth of soil influenced by the abutment movement, H' , and d'_d output values were the same as the input values, as described in Annex A of PD 6694-1 +A1:2020. This analysis has been undertaken to derive earth pressures at the back of the abutment wall and the subgrade reaction down the pile for the structural team to use in their structural analysis.

Given the piles/columns will be enclosed in sleeves within the reinforced soil block to allow them to flex without displacing the surrounding soil, it has been assumed that only the end screen which is attached to the end of the deck and the piles below the sleeve will move into the fill.

The soil stiffness for granular soils has been derived as a function of the soil strain, using the method in Annex A of PD 6694-1:2011+A1:2020 and multiplied by 1.5 to take into account the strain ratcheting from repeated thermal cycling. A minimum effective mean stress, σ_m , of 50kPa has been used in this derivation to ensure the soil stiffness would not be underestimated at shallow depths.

The design bending moments and shear forces in the piles have been derived from the structural model, using the earth pressures and subgrade reaction from the WALLAP models as described above. Further comparison between the structural model and WALLAP models has been undertaken using the design bending moments and shear forces, to check agreement between the WALLAP and structural models.

The WALLAP models have also been used to determine the pile length required to provide resistance to the lateral actions and assess the design bending moments and shear forces along the piles to inform the reinforcement design.

3.4.3 Pile settlement

The pile group settlement has been estimated using the empirical pile-group settlement ratio, (R_{se}), in accordance with Section 55.5.2 in the ICE Manual of Geotechnical Engineering [14].

$$R_{se} = \frac{0.29}{R^{1.35}} n$$

$$R_{se}(\text{upper bound}) = \frac{0.5}{R} \left(1 + \frac{1}{3R}\right) n$$

$$R_{se}(\text{lower bound}) = \frac{0.17}{R^{1.35}} n$$

Where:

R is the pile group aspect ratio

n is the number of piles in the group

The pile group settlement, W , in accordance with Section 55.5.2 in the ICE Manual of Geotechnical Engineering is:

$$W = R_{se} \times W_s$$

Where:

W_s is the single pile settlement

The settlement of single piles in rock has been estimated using the Pells and Turner method where the load is carried by rock socket skin friction [15]:

$$\rho = \frac{Q I_p}{B E_d}$$

Where:

Q is the total load carried by the pile head
 I_p is an influence factor
 B is the diameter of the socket
 E_d is the deformation modulus of the rock mass surrounding the shaft

3.4.4 Design assumptions

The design assumptions for the analyses of the abutment pile groups have been summarised below:

- The pile arrangement for the abutments and piers used in the analyses is taken from the general arrangement drawings 229100548-MMD-1700-RE-DR-C-2003 - 2005.
- Both drained and undrained analyses have been undertaken.
- Soil structure interaction analysis has been undertaken using the iterative method explained in Section 3.4.2, using a peak angle of shearing resistance for the granular fill behind the abutment of 45°. The earth pressures behind the abutment and the subgrade reaction modulus of the soil down the pile were provided to the structures team to use in their models.
- The thermal expansion of the deck has been applied at the level of the bridge deck neutral axis.
- The pile row has been modelled as a wall in WALLAP.
- The soil surrounding the sleeved section has been modelled as void in WALLAP with no earth pressure applied to the piled abutments and associated positive and negative surcharges to account for the weight of the soil.
- The second WALLAP stage changes the stiffness of the piled section of the 'wall', to model the difference in stiffness between the abutment columns and piles.
- The deck has been modelled in WALLAP as a prop and moment restraint.
- The WALLAP model follows the proposed construction sequence, with fill behind the abutment walls before deck construction.
- One axial check has been undertaken for both the north and south abutments, due to the similar loading and ground conditions, assuming the worst case rock head level from the limited ground investigation data.
- An axial pile group check has been undertaken based on the calculation for coarse soils as the pile has a rock socket.

3.4.5 Design summary

3.4.5.1 Pile group axial capacity

The results of the group axial capacity checks for both abutments are presented in Table 3.9.

Table 3.9: Pile group axial capacity results

Pile length (m)	Design combination	Pile group axial capacity (kN)		Degree of utilisation
		Sum of individual piles	Resistance as row/block	
18.52	DA1-C1	69,588	266,369	58%
	DA1-C2	42,305	213,095	72%

3.4.5.2 Pile group settlement

The results of the pile group settlement analysis are presented in Table 3.10.

Table 3.10: Pile group settlement results

Total settlement (mm)
<10

3.4.5.3 Abutment – pile load effects

The structures team have confirmed that the proposed reinforcement has been designed and can accommodate the individual pile axial and flexural load effects.

3.5 B2 Access Underpass

B2 Access Underpass is a fully integral single span structure. The deck consists of precast prestressed concrete beams with an in-situ infill concrete deck. The abutments are reinforced concrete spread foundations. The wingwalls are reinforced soil with precast concrete wall facing. The deck crosses the access road at a 29° skew. The overall clear span length between the faces of the abutment walls is 7.5m.

3.5.1 General

This section of the report discusses the design approach undertaken for the following external stability verification checks on the shallow foundations.

- Bearing resistance
- Sliding resistance
- Settlement

Bearing and sliding resistance calculations have been undertaken using partial factors for the STR and GEO limit state as defined in NA IS EN 1997-1:2005.

3.5.2 Bearing resistance

3.5.2.1 Drained conditions

For drained conditions, the following equation has been used to calculate the ultimate bearing resistance:

$$\frac{R}{A'} = c' N_c b_c s_c i_c + q' N_q b_q s_q i_q + 0.5 \gamma' B' N_\gamma b_\gamma s_\gamma i_\gamma$$

Where:

R is the ultimate bearing resistance of the foundation
 A' is the effective area of the foundation
 c' is the effective cohesion of the soil below the foundation level

q' is the design effective overburden pressure at the level of the foundation base

γ' is the effective unit weight of the soil below the foundation level

B' is the effective width of the foundation

N are the bearing capacity factors with subscripts for c , q and γ

s are the shape factors of the foundation base with subscripts for c , q and γ

i are the load inclination factors with subscripts for c , q and γ

b are the base inclination factors with subscripts for c , q and γ

3.5.2.2 Undrained conditions

For undrained conditions, the following equation has been used to calculate the ultimate bearing resistance:

$$\frac{R}{A'} = (\pi + 2)c_u b_c s_c i_c + q$$

Where:

R is the ultimate bearing resistance of the foundation

A' is the effective area of the foundation

c_u is the undrained shear strength of the soil below foundation level

b_c is the base inclination factor

s_c is the shape factor of the foundation base

i_c is the load inclination factor

q is the overburden pressure at the level of the foundation base

3.5.3 Sliding resistance

3.5.3.1 Drained conditions

For drained conditions, the following equation has been used to calculate the ultimate sliding resistance, R_d :

$$R_d = V'_d \cdot \tan \delta$$

Where:

V'_d is the effective permanent vertical load of the foundation

δ is the angle of base friction

3.5.3.2 Undrained conditions

For undrained conditions, the following equation has been used to calculate the ultimate sliding resistance, R_d :

$$R_d = A \cdot c_u$$

Where:

A is the effective area of the foundation

c_u is the undrained shear strength of the soil below the base

3.5.4 Design assumptions

The design assumptions for the analyses of the spread foundations have been summarised below:

- The geometry of the foundations used in the analyses has been taken from the appropriate general arrangement drawings 229100548-MMD-1700-RE-DR-C-2103 - 2104.

- The design friction angle, δ_d , used in the sliding resistance calculations was taken as the design constant volume angle of shearing resistance, $\phi'_{cv;d}$, based on the foundation being constructed of cast in situ concrete as recommended by IS EN 1997-1:2005.
- For the settlement estimate, the depth of the compressible layer considered has been taken as the depth at which the effective vertical stress due to the foundation load is 20% of the effective overburden stress as recommended by IS EN 1997-1:2005.
- The settlement of the overconsolidated clays (Glacial Till – Macamore Clay) has determined using a simplified non-linear settlement method of calculation with reference to O'Brien et al. [16].
- For the non-linear settlement calculation, a starting E_u/c_u of 300 has been used based on 0.1% strain.
- An upper and lower bound settlement calculation has been undertaken to give a range of settlement and spring stiffnesses.
- For bearing capacity check, the groundwater level has conservatively been assumed at 2m BGL, which is equivalent to 8mAOD.
- A 1.4m layer of Class 6N fill beneath the foundation has been accounted for to provide adequate bearing resistance. The following properties have been assumed for the Class 6N Fill: unit weight, γ_{bulk} of 20N/m³, effective angle of shearing resistance, ϕ' of 36°, effective cohesion, c' of 0kN/m².
- A bearing resistance check has been undertaken taking into account a 2:1 (v:h) load spread through the Class 6N fill layer on the Glacial Till below.

3.5.5 Design summary

3.5.5.1 Bearing failure results

The results of the bearing analyses for the spread foundations are presented in Table 3.11.

Table 3.11: Bearing failure results

Abutment	Design combination	Maximum Bearing pressure (kPa)	Bearing resistance (kPa)	Degree of utilisation (%)
North	DA1-C1	482	1141 (drained)	42
	DA1-C2	513	379 (drained)	74
South	DA1-C1	576	1088 (drained)	53
	DA1-C2	461	506 (drained)	91

3.5.5.2 Sliding failure results

The results of the sliding analyses for the spread foundations are presented in Table 3.12.

Table 3.12: Sliding failure results

Abutment	Design combination	Resultant Horizontal Force (kN)	Sliding resistance (kN)	Degree of utilisation (%)
North	DA1-C1	6917	14543 (drained)	48
	DA1-C2	5487	9224 (drained)	59
South	DA1-C1	7534	13501 (drained)	56
	DA1-C2	6602	8517 (drained)	70

3.5.5.3 Spread foundations – settlement

The results of the settlement analyses for the spread foundations are presented in Table 3.13.

Table 3.13: Settlement results

Total settlement (mm)
<11

3.6 B3 Greenway Underpass

B3 Greenway Underpass is a precast UAN box section. The wingwalls are reinforced earth retaining panels. The UAN box section spans the proposed greenway at 0° skew. The overall span length is 4m.

3.6.1 General

This section of the report discusses the design approach undertaken for the following external stability verification checks on the box section.

- Bearing resistance
- Sliding resistance
- Settlement

Bearing and sliding resistance calculations have been undertaken using partial factors for the STR and GEO limit state as defined in NA IS EN 1997-1:2005.

3.6.2 Bearing resistance

3.6.2.1 Drained conditions

For drained conditions, the following equation has been used to calculate the ultimate bearing resistance:

$$\frac{R}{A'} = c' N_c b_c s_c i_c + q' N_q b_q s_q i_q + 0.5 \gamma' B' N_\gamma b_\gamma s_\gamma i_\gamma$$

Where:

R is the ultimate bearing resistance of the foundation

A' is the effective area of the foundation

c' is the effective cohesion of the soil below the foundation level

q' is the design effective overburden pressure at the level of the foundation base

γ' is the effective unit weight of the soil below the foundation level

B' is the effective width of the foundation

N are the bearing capacity factors with subscripts for c , q and γ

s are the shape factors of the foundation base with subscripts for c , q and γ

i are the load inclination factors with subscripts for c , q and γ

b are the base inclination factors with subscripts for c , q and γ

3.6.2.2 Undrained conditions

For undrained conditions, the following equation has been used to calculate the ultimate bearing resistance:

$$\frac{R}{A'} = (\pi + 2) c_u b_c s_c i_c + q$$

Where:

R is the ultimate bearing resistance of the foundation

A' is the effective area of the foundation

c_u is the undrained shear strength of the soil below foundation level

b_c is the base inclination factor

s_c is the shape factor of the foundation base

i_c is the load inclination factor

q is the overburden pressure at the level of the foundation base

3.6.3 Sliding resistance

Due to the arrangement of the box and surrounding embankment fill, by inspection the box will not fail in sliding.

3.6.4 Design assumptions

The design assumptions for the analyses of the box section have been summarised below:

- The geometry of the box section used in the analyses has been taken from the appropriate general arrangement drawings 229100548-MMD-1700-RE-DR-C-2203 - 2204.
- The bearing check has been cautiously undertaken assuming a 2m length of the structure, which is the distance between the joints.
- Two sets of loads have been analysed – symmetric and asymmetric. The asymmetric loads include braking loads which creates eccentricity. Only the worst case results have been included in the results table below.
- For the settlement estimate, the depth of the compressible layer considered has been taken as the depth at which the effective vertical stress due to the foundation load is 20% of the effective overburden stress as recommended by IS EN 1997-1:2005.
- The settlement of the overconsolidated clays (Glacial Till – Macamore Clay) has determined using a simplified non-linear settlement method of calculation with reference to O'Brien et al. [16].
- For the non-linear settlement calculation, a starting E_u/c_u of 300 has been used based on 0.1% strain.
- An upper and lower bound settlement calculation has been undertaken to give a range of settlement and spring stiffnesses.
- For bearing capacity check, the groundwater level has conservatively been assumed at the 2m BGL, equivalent to 10mAOD.

3.6.5 Design summary

3.6.5.1 Bearing failure results

The results of the bearing analysis for the box section are presented in Table 3.14.

Table 3.14: Bearing failure results

Design combination	Maximum Bearing pressure (kPa)	Bearing resistance (kPa)	Degree of utilisation (%)
DA1-C1	216	356 (undrained)	61
		1416 (drained)	15
DA1-C2	181	283 (undrained)	64
		866 (drained)	21

3.6.5.2 Settlement

The results of the settlement analyses for the box section are presented in Table 3.15.

Table 3.15: Settlement results

Total settlement (mm)
<5

3.7 C1 Drainage Culvert

C1 drainage culvert is a precast buried box section. The wingwalls are precast concrete walls. Culvert C1 will cross under the proposed N25 Rosslare Europort Access Road at a skew of 20° and run for a length of 36m.

3.7.1 General

This section of the report discusses the design approach undertaken for the following external stability verification checks on the box section.

- Bearing resistance
- Sliding resistance
- Settlement

Bearing and sliding resistance calculations have been undertaken using partial factors for the STR and GEO limit state as defined in NA IS EN 1997-1:2005.

3.7.2 Bearing resistance

3.7.2.1 Drained conditions

For drained conditions, the following equation has been used to calculate the ultimate bearing resistance:

$$\frac{R}{A'} = c' N_c b_c s_c i_c + q' N_q b_q s_q i_q + 0.5 \gamma' B' N_\gamma b_\gamma s_\gamma i_\gamma$$

Where:

R is the ultimate bearing resistance of the foundation

A' is the effective area of the foundation

c' is the effective cohesion of the soil below the foundation level

q' is the design effective overburden pressure at the level of the foundation base

γ' is the effective unit weight of the soil below the foundation level

B' is the effective width of the foundation

N are the bearing capacity factors with subscripts for c , q and γ

s are the shape factors of the foundation base with subscripts for c , q and γ

i are the load inclination factors with subscripts for c , q and γ

b are the base inclination factors with subscripts for c , q and γ

3.7.2.2 Undrained conditions

For undrained conditions, the following equation has been used to calculate the ultimate bearing resistance:

$$\frac{R}{A'} = (\pi + 2)c_u b_c s_c i_c + q$$

Where:

R is the ultimate bearing resistance of the foundation

A' is the effective area of the foundation

c_u is the undrained shear strength of the soil below foundation level

b_c is the base inclination factor

s_c is the shape factor of the foundation base

i_c is the load inclination factor

q is the overburden pressure at the level of the foundation base

3.7.3 Sliding resistance

Due to the arrangement of the box and surrounding embankment fill, by inspection the box will not fail in sliding.

3.7.4 Design assumptions

The design assumptions for the analyses of the box section have been summarised below:

- The geometry of the box section used in the analyses has been taken from the appropriate general arrangement drawings 229100548-MMD-1700-RE-DR-C-2303 - 2304.
- The bearing check has been undertaken cautiously assuming a 2m length of the structure, which is the distance between the joints.
- Two sets of loads have been analysed – symmetric and asymmetric. The asymmetric loads include braking loads which creates eccentricity. Only the worst case results have been included in the results table below.
- For the settlement estimate, the depth of the compressible layer considered has been taken as the depth at which the effective vertical stress due to the foundation load is 20% of the effective overburden stress as recommended by IS EN 1997-1:2005.
- The settlement of the overconsolidated clays (Glacial Till – Macamore Clay) has determined using a simplified non-linear settlement method of calculation with reference to O'Brien et al. [16].
- For the non-linear settlement calculation, a starting E_u/c_u of 300 has been used based on 0.1% strain.
- An upper and lower bound settlement calculation has been undertaken to give a range of settlement and spring stiffnesses.
- For bearing capacity check, the groundwater level has conservatively been assumed to be at the foundation level 7.75mAOD.

3.7.5 Design summary

3.7.5.1 Bearing failure results

The results of the bearing analysis for the culvert are presented in Table 3.16.

Table 3.16: Bearing failure results

Design combination	Maximum Bearing pressure (kPa)	Bearing resistance (kPa)	Degree of utilisation (%)
DA1-C1	215	380 (undrained)	57
		873 (drained)	25
DA1-C2	170	288 (undrained)	59

Design combination	Maximum Bearing pressure (kPa)	Bearing resistance (kPa)	Degree of utilisation (%)
		526 (drained)	32

3.7.5.2 Settlement

The results of the settlement analyses for the box section are presented in Table 3.17.

Table 3.17: Settlement results

Total settlement (mm)
<5

3.8 C2 Drainage Culvert

C2 Drainage Culvert is a precast buried box section. The wingwalls are precast concrete walls. Culvert C2 will cross under the proposed the attenuation pond 2 access road at a skew of 10° with a span of 2.1m.

3.8.1 General

This section of the report discusses the design approach undertaken for the following external stability verification checks on the box section.

- Bearing resistance
- Sliding resistance
- Settlement

Bearing and sliding resistance calculations have been undertaken using partial factors for the STR and GEO limit state as defined in NA IS EN 1997-1:2005.

3.8.2 Bearing resistance

3.8.2.1 Drained conditions

For drained conditions, the following equation has been used to calculate the ultimate bearing resistance:

$$\frac{R}{A'} = c' N_c b_c s_c i_c + q' N_q b_q s_q i_q + 0.5 \gamma' B' N_\gamma b_\gamma s_\gamma i_\gamma$$

Where:

- R is the ultimate bearing resistance of the foundation
- A' is the effective area of the foundation
- c' is the effective cohesion of the soil below the foundation level
- q' is the design effective overburden pressure at the level of the foundation base
- γ' is the effective unit weight of the soil below the foundation level
- B' is the effective width of the foundation
- N are the bearing capacity factors with subscripts for c, q and γ
- s are the shape factors of the foundation base with subscripts for c, q and γ
- i are the load inclination factors with subscripts for c, q and γ
- b are the base inclination factors with subscripts for c, q and γ

3.8.2.2 Undrained conditions

For undrained conditions, the following equation has been used to calculate the ultimate bearing resistance:

$$\frac{R}{A'} = (\pi + 2)c_u b_c s_c i_c + q$$

Where:

R is the ultimate bearing resistance of the foundation

A' is the effective area of the foundation

c_u is the undrained shear strength of the soil below foundation level

b_c is the base inclination factor

s_c is the shape factor of the foundation base

i_c is the load inclination factor

q is the overburden pressure at the level of the foundation base

3.8.3 Sliding resistance

Due to the arrangement of the box and surrounding embankment fill, by inspection the box will not fail in sliding.

3.8.4 Design assumptions

The design assumptions for the analyses of the box section have been summarised below:

- The geometry of the box section used in the analyses has been taken from the appropriate general arrangement drawings 229100548-MMD-1700-RE-DR-C-2403 - 2404.
- The bearing check has been undertaken cautiously assuming a 2m length of the structure, which is the distance between the joints.
- Two sets of loads have been analysed – symmetric and asymmetric. The asymmetric loads include braking loads which creates eccentricity. Only the worst case results have been included in the results table below.
- For the settlement estimate, the depth of the compressible layer considered has been taken as the depth at which the effective vertical stress due to the foundation load is 20% of the effective overburden stress as recommended by IS EN 1997-1:2005.
- The settlement of the overconsolidated clays (Glacial Till – Macamore Clay) has determined using a simplified non-linear settlement method of calculation with reference to O'Brien et al. [16].
- For the non-linear settlement calculation, a starting E_u/c_u of 300 has been used based on 0.1% strain.
- An upper and lower bound settlement calculation has been undertaken to give a range of settlement and spring stiffnesses.
- For bearing capacity check, the groundwater level has conservatively been assumed to be at the foundation level 7.60mAOD.
- The bearing check has been undertaken assuming a 0.2m thickness of granular fill beneath the foundation, assuming a 2:1 (v:h) load spread to the underlying Glacial Till – Macamore Clay.

3.8.5 Design summary

3.8.5.1 Bearing failure results

The results of the bearing analysis for the culvert are presented in Table 3.18.

Table 3.18: Bearing failure results

Design combination	Maximum Bearing pressure (kPa)	Bearing resistance (kPa)	Degree of utilisation (%)
DA1-1	315	384 (undrained)	82
		916 (drained)	34
DA1-2	263	291 (undrained)	91
		551 (drained)	48

3.8.5.2 Settlement

The results of the settlement analyses for the box section are presented in Table 3.19.

Table 3.19: Settlement results

Total settlement (mm)
<10

3.9 Reinforced soil wing walls

The global stability of the reinforced soil wing walls of structures B1 Ballygerry Underbridge (Railway Overbridge OBH226C) and B2 Access Underpass has been analysed.

A typical mass concrete levelling pad is proposed below the facing of the reinforced soil wing walls. The levelling pad acts solely to keep the wall facings level and is not designed to provide any structural/geotechnical support. The role of the walls is to provide stability of the embankment underneath the underbridges.

The contractor is to undertake detailed design of the reinforced soil walls, including additional internal and external stability verification checks, these are outlined as follows:

- Bearing and overturning resistance
- Underlying soil punching failure
- Forward sliding resistance
- Settlement of the reinforced soil wing walls
- Internal stability
- Compound stability

3.9.1 Design methodology

The global stability assessment has been undertaken in accordance with the following standards and guidance documents:

- IS EN 1997-1:2005+A1:2013 – Eurocode 7: Geotechnical design – Part 1: General rules
- IS EN 1997-1:2004/NA:2015 – Irish National Annex to Eurocode 7: Geotechnical design – Part 1: General rules

In Table NA.1 the Irish National Annex to Eurocode 7 Part 1 permits the designer to choose between Design Approaches 1, 2 or 3 for analysis of the STR and GEO limit states. In this case, Design Approach 1 has been adopted for the overall stability assessment as defined in IS EN 1997-1:2005+A1:2013. For partial factors on actions, soil parameters and resistance for slopes and overall stability, the values in Eurocode 7 Part 1 are recommended for use. Design Approach 1 as defined in this standard comprises two design combinations, Design Combination 1 (DA1 C1) comprises the application of elevated partial factors to increase

permanent and variable actions and partial factors of unity to material strengths (soil parameters), whereas Design Combination 2 (DA1 C2) comprises the application of partial factors to reduce soil parameters, reduced partial factors to increase variable actions and partial factors of unity to permanent actions.

IS EN 1997-1:2005+A1:2013 specifies the allocation of partial factors on actions or the effects of actions for structural and geotechnical limit states for DA1-1 and DA1-2. These are summarised below as:

- DA1 C1: A1 “+” M1 “+” R1
- DA1 C2: A2 “+” M2 “+” R1

3.9.2 Method of analysis

The stability modelling was undertaken based on limit equilibrium principles using the GeoStudio Slope/W software package, using the Morgenstern Price method of failure analysis which considers both moment and force equilibrium.

The overall stability of the sections has been analysed to verify that the design effects of actions, E_d , are equal to or lower than the design resistance, R_d , to those actions:

$$E_d \leq R_d$$

This can also be expressed using the degree of utilisation: E_d/R_d (expressed as a percentage). The design is considered unacceptable if degree of utilisation is >100%.

In the global stability analyses, the reinforced soil body has been modelled as a ‘high strength’ material to ensure that the critical slip surface does not pass through the body of the reinforced soil.

Three sections have been chosen for analysis; these are:

- Section 1: B1 - greatest height of reinforced soil block, 5.196m, with an additional slope directly above of height 2.146m with gradient 18°
- Section 2: B1 - reinforced soil block, 3.51, with tallest slope height above block - height 3.88m with gradient 18°
- Section 3: B2 - greatest height of reinforced soil block, 7.42m. No slope above.

Note that slope gradients quoted are those in a direction perpendicular to the alignment of the wall, rather than the perpendicular to the main carriageway.

A variable uniformly distributed load of 20kPa has been modelled up to the crest of the slope for the reinforced soil wing walls to represent the traffic loading on the carriageway. A variable uniformly distributed load of 10kPa has also been modelled along the slope to the edge of the reinforced soil wing walls. Sensitivity to the presence or otherwise of the latter surcharge where it is above the reinforced soil block was checked, and the case with it in place was found to be critical.

The stability analyses consider an assumed phreatic surface, and a pore pressure ratio, r_u above this line. As outlined in the ICE Manual of Geotechnical Engineering the acceptable range of r_u in cohesive slopes is 0.1 to 0.3 as described by Farrar 1978 [5]. For the embankment fill (likely to comprise reworked Glacial Till behind the reinforced soil block), a r_u value of 0.1 has been used above groundwater level to represent partial saturation above the piezometric line.

The length of geotextile reinforcement (L) was initially assumed to be 0.7 times the height of the retaining wall (H), this can be represented as $L/H = 0.7$.

Each section was analysed with $L/H = 0.7$ as an initial estimate. Where this did not provide sufficient resistance to failure, the geotextile reinforcement length was increased to find that required to give an adequate design.

3.9.3 Design assumptions

The assumptions adopted for the analyses of the reinforced soil wing walls have been summarised below:

- The geometry of the reinforced soil section used in the analyses has been taken from the appropriate general arrangement drawings and 3D model.
- The design groundwater level is taken as 2m below the existing ground level based on information provided by Technical Acceptance Report B1 (229100548-MMD-1700-RE-RP-C-0006-P1) and Technical Acceptance Report B2 (229100548-MMD-1700-RE-RP-C-0007-P1).
- A 1.06m thickness of road construction next to the wall at B2 has been included. The road has been assumed to have a unit weight 21kN/m^3 and characteristic angle of shearing resistance, ϕ' of 36° .
- The reinforced soil block has been modelled as a high strength material in Slope/W with unit weight 20kN/m^3 .
- Backfill behind and above the reinforced soil blocks has been assumed to comprise imported Class 2 fill, adopting the soil parameters defined in Section 2.3.2. This is considered to be a conservative assumption given that some or all of the backfill, particularly at the sections of greatest retained height, is likely to comprise Class 6N or 6P structural backfill associated with the bridges.
- No material is assumed to be present in front of the reinforced soil block.
- No granular layer has been assumed below the reinforced soil block.
- The base of the reinforced soil block has cautiously been assumed to be at the proposed ground level (carriageway level where relevant) in front of the wall.

3.9.4 Results of Slope/W analysis and discussion

The initial phase of analysis indicated that in each case, the drained scenario under DA1-C2 was the most critical. This was the model therefore chosen for sensitivity analysis. The results of the sensitivity analysis are shown in Table 3.20 with the minimum required L/H and its respective utilisation shown in **Bold**.

Table 3.20: Sensitivity Analysis of Critical Sections

Section (Drained DA1-C2)	L/H	Utilisation	Reference
Section 1	1	94%	Figure A.32
Section 2	1.5	90%	-
	1	99%	Figure A.33
Section 3	1	84%	-
	0.9	87%	Figure A.34

Another critical scenario was identified for Section 3, which involves the short-term case prior to build up of the carriageway during construction. Analysis was conducted for this scenario in the undrained case with $L/H = 1.25$, with excavation below the finished carriageway level, and led to a utilisation of 99% under DA1-C2. This analysis is shown in Figure A.35.

Based upon the results of this analysis, it was assumed that the sections taken from B1 would be stable in the undrained case with a 0.5m unplanned excavation. This is because the

undrained 1.06m excavation scenario has a significantly lower utilisation than the drained scenario with the existing ground. The assessment of this short-term condition assumes that any excavation below proposed ground level in front of the wall will have a sufficiently short duration that drained, effective stress conditions do not develop in the clay soils. If this cannot be ensured, the Contractor's design will be required to consider the proposed construction sequence, and may, for example, require the reinforced soil block to be founded at the level of the base of the excavation.

A summary of the minimum required cross section width of the reinforced soil block and hence geotextile lengths is shown in Table 3.21

Table 3.21 Minimum required Lengths of Geotextile Reinforcement

Section	Height of reinforced soil wing wall (m)	Length of minimum required geotextile reinforcement (m)
Section 1	5.2	5.2
Section 2	3.5	3.5
Section 3	7.4	9.3

The results of this global stability analysis show the minimum geotextile length of identified critical cross sections. The Contractor is to undertake additional internal and external stability verification checks as mentioned above. The Contractor is to design the reinforced soil walls and confirm there are no additional critical cross sections. The Contractor may find that it is possible to reduce the length of the reinforcements required in some cross-sections by undertaking analysis of further sections.

3.10 Attenuation tank

The attenuation tank is present under the shared pedestrian/cyclist facility and verge, at the base of the cutting, at approximate mainline chainage Ch. 1425-1500. The depth to the top of the tank varies between approximately 0.72 and 2.92m below proposed ground level. The attenuation tank assessment has been undertaken following the guidance in CIRIA C737 [18].

3.10.1 General

This section of the report discusses the design approach undertaken for the following external stability verification checks for the attenuation tank.

- Bearing resistance
- Sliding resistance
- Settlement and heave
- Flotation
- Structural verification
- Slope stability

3.10.2 Bearing resistance

Due to the arrangement of the tank and the structure being lighter than the soil that will be removed, by inspection the tank will not fail in bearing.

3.10.3 Sliding resistance

Due to the arrangement of the tank and surrounding material, by inspection the tank will not fail in sliding.

3.10.4 Settlement and heave

Due to the excavation in Glacial Till – Macamore Clay to the attenuation tank founding level there is a possibility that heave will occur at the base of the excavation. There may also be settlement recovering some of this heave once the attenuation tank and the material on top of the tank has been placed.

The settlement analyses were undertaken using the software Settle3, version 5.022, produced by RocScience [17]. Settle3 is a software tool modelling ground conditions in 3 dimensions, used for the prediction of vertical settlements and time-dependent consolidation under foundations or embankments. Modelling can be staged, and time dependent consolidation analyses can be performed for user-defined intervals.

For the purpose of this analysis, the m_v method using 3D mean stress has been adopted for the prediction of settlement.

The coefficient of volume compressibility has been derived from one-dimensional consolidation tests and SPT 'N' values, as described in the Detailed Design Ground Investigation Report (229100548-MMD-0600-RE-RP-C-0003) [3]. The residual coefficient of volume compressibility used for the heave and reload calculations has been taken from the reloading curve of the one-dimensional consolidation tests.

The heave and settlement analyses have been undertaken in separate Settle3 models, with the net load applied at the level of the base of the excavation.

3.10.5 Flotation

Following the guidance in CIRIA C737 [18] a flotation check has been undertaken as the groundwater may be close to ground surface level. For the flotation assessment, the groundwater level has been assumed as being at ground level.

3.10.6 Slope stability

Following the guidance in CIRIA C737 [18] a slope stability analysis has been undertaken, given the tank is to be placed at the toe of the cutting at the north of the site.

The overall stability of the cutting has been analysed based on limit equilibrium principles using the GeoStudio Slope/W [2] software package. The analyses were undertaken using the Morgenstern-Price analysis type, considering both moment and force equilibrium.

The overall stability of the cutting has been analysed to verify that the design effects of actions, E_d , are equal to or lower than the design resistance, R_d , to those actions:

$$E_d \leq R_d$$

This can also be expressed using the degree of utilisation: E_d/R_d (expressed as a percentage). The design is considered unacceptable if degree of utilisation is >100%.

The partial factors are applied directly by the Slope/W software based on the selected Design Combination. DA1 C1 applies a partial factor of 1.35 on soil unit weight where unfavourable and 1.00 where favourable. These are automatically applied by the Slope/W software to parts of the slip which predominantly provide a driving action and a restoring action respectively.

It is considered that the most likely failure can reasonably be modelled as a circular failure plane and that the failure mechanism will be controlled by material strength properties and not by any geological discontinuities.

The stability analysis considers an assumed phreatic surface, and a pore pressure ratio, r_u , above this line. As outlined in the ICE Manual of Geotechnical Engineering [4], the acceptable range of r_u for cuttings in cohesive slopes is 0.1-0.3 as described by Farrar 1978 [5]. For the Glacial Till – Macamore Clay, an r_u value of 0.1 has been used above groundwater level to represent partial saturation above the piezometric line.

Analysis has been undertaken to show the degree of utilisation of the cutting before attenuation tank installation. Analysis is then undertaken with the tank in place to assess the resisting force required to be provided by the geocellular units and hence the loading on the units required to be resisted.

3.10.7 Design assumptions

The design assumptions for the analyses of the attenuation tank have been summarised below:

- The geometry of the attenuation tank used in the analyses has been taken from the appropriate general arrangement drawings.
- A heave assessment has been undertaken to estimate potential heave following excavation of the Glacial Till – Macamore Clay to allow for installation of the tank. This uses the excavation function in Settle3.
- For the settlement assessment, the depth of the compressible layer considered has been taken as the depth at which the effective vertical stress due to the foundation load is 20% of the effective overburden stress as recommended by IS EN 1997-1:2005.
- For the settlement assessment, the net load has been applied at the level of the base of the tank. The net load takes into account the permanent load of the soil and tank only and assumes that no vehicle or other heavy loading will be present on the tank for an extended period of time.
- In the heave/settlement assessment, the groundwater level has been assumed to reduce from the future ground level to the base of the attenuation tank excavation.
- The analysis assumes that the excavation to install the attenuation tank is undertaken after the cutting has been excavated and that any heave from the cutting excavation will have occurred prior to the excavation for the attenuation tank.
- Following the guidance in CIRIA C737 [18] a structural verification has been undertaken. This has informed the horizontal and vertical pressures that the tank will need to withstand structurally.
 - Two chainages have been analysed, Ch1430 and Ch1490, to analyse the effects of the minimum and maximum overburden thickness.
 - Although only a cycleway and verge is proposed above the tank, the analysis assumes a conservative use as a public highway, with cars and HGVs, with a uniform loading of 10kPa applied in the vertical structural verification, in accordance CIRIA C737.
 - In addition to the uniform load, the following loads have been applied:
 - Accidental case: Analyses include Load Model 1 and SV80 vehicles on top of the tank, to account for heavy vehicles coming off the road onto the cycleway/verge area
 - ULS case: Analysis includes Load Model 3 (using a SV196 vehicle) on the road perpendicular to the area of the tank
 - SLS case: Analysis only includes a uniform loading of 10kPa on top of the tank to represent cycleway and maintenance loading
 - The lateral structural verification includes active earth pressures including those from the cutting slopes required to be resisted by the tank.
 - The soil has been assumed competent with a 2(v):1(h) load spread, in accordance with CIRIA C737.

- A site importance classification factor of 2 has been used, in accordance with CIRIA C737.
- A dynamic factor of 1 or 1.25 has been used depending on overburden thickness, in accordance with CIRIA C737.
- The final design will be completed by the contractor and will be dependent on various factors including the proposed attenuation tank units and anticipated construction loading. Based on the Classification Factor of 2, a minimum of Category 2 checking – checking by an independent team within the same organisation – will be required in accordance with Table 3.2 of CIRIA C737.
- Design assumptions, including the Classification Factor, are to be confirmed by the contractor as part of their detailed design of the attenuation tank.
- In the slope stability assessment, the attenuation tank is assumed to be present from the proposed ground level to the depth shown in the general arrangement drawings.
- In the slope stability assessment, the attenuation tank is modelled with very low strength with a defined point slip surface radius to allow for the slip to pass through the tank.

3.10.8 Design summary

3.10.8.1 Settlement and heave

The results of the settlement and heave analyses for the tank are presented in Table 3.22.

Table 3.22: Settlement results

Heave (mm)	Total displacement (mm)
<35	<-15 (heave)

The results from this analysis show there is initially heave after the attenuation tank excavation. After the tank is placed and fill added on top there is settlement, however due to the tank and fill weight being less than the soil removed, the net displacement is upwards (heave).

3.10.8.2 Structural verification

The minimum required lateral and vertical capacities of the attenuation tank units are presented in Table 3.23. It should be noted that the load derived in Section 3.10.8.4 should also be taken into consideration in addition to those in Table 3.23.

Table 3.23: Required lateral and vertical strength

Case	Vertical (kPa)	Lateral (kPa)
Accidental	196	98
ULS	222	170
SLS	60	54

3.10.8.3 Flotation

The results of the flotation analysis for the tank are presented in Table 3.24. These indicate an adequate resistance to flotation with groundwater at future ground level.

Table 3.24: Flotation results

Degree of Utilisation
98%

3.10.8.4 Attenuation tank cutting stability analysis results

The results of the cutting stability analysis incorporating the tank are summarised below in Table 3.25.

The maximum pressure required that the attenuation tank is required to withstand from the slope is 208kPa (ULS Set C). For a minimum 1.2m deep tank (from ground level to base of tank) this is the maximum value of the pressure distribution required to provide a 125kN/m run resisting force as determined in the analyses.

Table 3.25: Slope stability analysis results

Design Combination	Condition	Utilisation	Reference
DA1-1	Undrained	35%	Figure A.38
	Drained	61%	Figure A.36
DA1-2	Undrained	32%	Figure A.39
	Drained	67%	Figure A.37

4 Strengthened Earthworks

The assessment of the reinforced soil wing walls associated with the bridges is discussed in Section 3.9. The detailed design of these walls will be undertaken by the contractor.

The wing walls are designated as structures in accordance with DN-STR-03001 'Technical Acceptance of Road Structures on Motorways and Other National Roads' and are associated with structures B1 and B2. Requirements for their design have been defined in the Technical Acceptance Reports (TARs) for the associated structures. As such Strengthened Earthwork Appraisal Forms have not been included in this report and reference should be made to the relevant TARs.

5 Drainage

Not required.

6 Pavement Design, Subgrade & Capping

6.1 General

The new carriageway will be constructed on existing ground, generally on Made Ground or Glacial Till – Macamore Clay, at grade or in a cutting and on an embankment across the site.

A summary of CBR recommendations for each material along the Scheme is provided below.

6.2 Made Ground

A total of 14 TRL Dynamic Cone Penetrometer (DCP) tests were undertaken in the Made Ground. The penetration rate was converted into a nominal CBR value using the method described in TII DN-PAV-03021 (Pavement & Foundation Design) [19].

Tests DCP06 to DCP20 were undertaken in Made Ground, alongside the current Ballygerry Link Road.

The DCP tests in the Made Ground were undertaken to a maximum depth of 0.923m. The penetrations rates show a large variation across the depth tested, but generally show a slight decrease with depth. The CBR values range from 6.1% to 27.7%, with an average CBR value of 16%. The wide range and inconsistency of results reflects the variable nature of the Made Ground which includes clay and sand with cobbles.

6.3 Glacial Till – Macamore Clay

A total of seven TRL Dynamic Cone Penetrometer (DCP) tests were undertaken in the Glacial Till – Macamore Clay. The penetration rate was converted into a nominal CBR value using the method described in TII DN-PAV-03021 (Pavement & Foundation Design) [19].

DCP01 – DCP05 were undertaken west of the existing link road in Glacial Till – Macamore Clay. DCP21 and DCP 22 were undertaken north of the site, adjacent to the proposed cutting.

The DCP tests in the Glacial Till – Macamore Clay were undertaken to a maximum depth of 0.925m. The penetration rates show a large variation across the depth tested, but generally show a slight decrease with depth. The CBR values range from 5% to 14.1%, with an average CBR value of 9.7%.

A total of five laboratory CBR tests were undertaken on samples of the Glacial Till – Macamore Clay at a range of moisture contents. The results generally show an increase in moisture content correlates to a decrease in CBR value.

The typical natural moisture content for the Glacial Till – Macamore Clay was observed to be between 18 and 26% (see Section 2.6.3.4). The CBR test results at this range of moisture contents correspond to CBR values ranging from 1.6% -13.5%.

Equilibrium CBR values have also been determined in accordance with Section 3 of DN-PAV-03021 using upper quartile values derived for plasticity index and Appendix C in the Transport and Road Research Laboratory (TRRL) Laboratory Report 1132 [20].

Based on the ground and groundwater conditions described in the scheme GIR [3] it has been assessed that there is a low water table (groundwater at least 2m below sub-grade level) and that average construction conditions will be achieved.

Using a plasticity index of 26% for the Glacial Till – Macamore Clay gives a CBR of 4% for thin and thick layered construction pavement. A thin pavement is defined as 300mm thick. A thick pavement is defined as 1200mm thick with 650mm of capping, more typical of motorway construction [20].

6.4 Summary

Based on the assessment of CBR for the likely sub-grade conditions to be encountered during construction, it is recommended that a CBR of 4% is used throughout for in situ and recompacted materials.

This value accounts for local variations that have been identified in both the geology that are expected to be encountered (varied thickness and composition) and the direct and indirect CBR measurements. The lowest of the in-situ CBR values and equilibrium CBR values has been taken as the design value.

During construction, the Contractor should ensure that the formation is well drained and protected from the adverse effects of moisture content increase and site traffic.

The formation shall be tested to confirm that the sub-grade value of CBR is at least 4%. Should soft spots be identified, the material at the surface will be removed and replaced with suitable Class 1 or Class 2 material.

Where soft spots are identified, the thickness removed will typically be to the level of the formation where CBR is proven to exceed 4%.

7 Assessment of Potential Contamination

7.1 Summary of contamination testing

A ground investigation (GI) was undertaken on site by OBC Geotechnical Limited between 13th July and 26th August 2021. The purpose of the investigation was to confirm ground conditions along the proposed road alignment and to establish the nature, condition and depth of Made Ground/ reclaimed land, superficial deposits and bedrock that would impact on the proposed alignment. The GI was also undertaken to determine the geotechnical and chemical properties of the materials encountered to inform the design of the scheme, with respect to contamination and concrete aggressivity.

In relation to geo-environmental sampling, soil chemical analysis was undertaken on twelve samples taken from across the site during the GI; one sample from within Topsoil, two from the Made Ground and the remaining nine from within the Glacial Till – Macamore Clay. The results of the soil chemical analysis were screened against criteria for 'Commercial' and 'Public Open Space (Park)' land use types. Eight of these soil samples were subjected to leachate analysis; one from within Topsoil, two from Made Ground and the remaining five from the Glacial Till – Macamore Clay. The results of leachate chemical analysis were screened against Environmental Quality Standards (EQS) for Coastal and Transitional Waters and EU Drinking Water Regulations (2014).

Results of the soil and leachate chemical analysis and further information on contamination testing are presented in the Contaminated Land Risk Assessment (CLRA) [21].

7.2 Summary of Contaminated Land Risk Assessment

The results of the CLRA recorded no exceedances for soil samples against either screening criteria, therefore the overall risk to end users from on site soils is considered to be **Very Low**. In addition, visual evidence of asbestos was not noted during the ground investigation and no asbestos was detected during screening of soil samples.

In relation to controlled waters, the leachate testing presented a small number (14 total) of heavy metal and inorganic contaminant exceedances including copper, nickel, lead, zinc, iron, and hexavalent chromium at seven locations across the site. It is feasible that these exceedances may be associated with historical and present-day agricultural land use and also potentially with the use of road infrastructure in the area. However, the soil samples did not record any contaminant exceedances and no other potential sources of contamination have been identified through borehole logs or photographs. Therefore, these exceedances are not considered to be representative of the overall site conditions, nor are they considered to represent a hotspot of contamination.

Furthermore, the nearest surface water feature is greater than 100m from the site and the groundwater aquifer has been classified as being unproductive except for local zones. The proposed end use of the site is for a road and railway bridge which is not considered to result in a significant change to existing site conditions. Moreover, most locations where leachate exceedances were identified are where the associated soils are proposed to be removed from the site during construction (e.g. at TP01, TP03, TP04, TP05 & TP06) which will eliminate the potential contaminant source and break the pollutant linkages. Therefore, the risk to controlled waters is considered to be **Low**.

A foundation works risk assessment is not considered necessary for the site despite piling being proposed for the scheme. This is because Made Ground is not anticipated at the proposed

piling location which is north and south of the railway overbridge. In addition, a poor groundwater aquifer lies beneath the site and as the piles are not anticipated to create a contaminant pathway, the risks are considered to be **Low**.

7.3 Waste classification

A HazWasteOnline™ waste classification assessment has been carried out on 12 soil and sediment samples, all of which returned a non-hazardous result (EWC code 17 05 04). Therefore, it is assumed that these materials would have a non-hazardous waste classification should they require disposal off-site. This analysis has considered the waste classification of soil assuming the material is homogenous and does not contain readily discernible pieces of a material which would be classified as asbestos or coal tar. Any waste soils which contain readily discernible pieces of a material which would be classified as a hazardous waste would be a mixed waste and would need to be described as such. The presence of a hazardous waste within the soil would mean that the whole volume of soil would be classified as hazardous waste. Further treatment, such as removal of visible asbestos pieces may be sufficient to reclassify the waste as non-hazardous.

Additional information relating to waste classification and the HazWasteOnline™ report can be found in the CLRA document [21].

8 Ground Treatment

Section 2.4 considers the re-use of material.

The embankment is proposed to include a 300mm thick starter layer of Class 6B material.

During construction, the formation shall be tested to confirm that the sub-grade value of CBR is at least 4% with an undrained shear strength of at least 50kPa. Should soft spots be identified, the material at the surface will be removed and replaced with suitable Class 1 or Class 2 material. Where soft spots are identified, the thickness removed will typically be the level of the formation where CBR is proven to exceed 4% and an undrained shear strength of 50kPa.

Standard Earthworks Details (229100548-MMD-0600-RE-DR-C-2202 – 2204 and 229100548-MMD-0600-RE-DR-C-2101 - 2107) are provided in Appendix C.

9 Geotechnical Risk Register

The risk assessment is qualitative, and the various threats are assessed using the following criteria:

- Cost;
- Programme;
- Reputation;
- Health and Safety; and
- Environment.

Potential geotechnical hazards identified in association with the scheme are summarised in the risk register presented in Table 9.5. The risk is assessed by interaction of an Impact Index and Likelihood Index, shown in Table 9.1 and Table 9.2 respectively. Table 9.3 is the Risk Matrix, which shows the actual risk level, rated from “Severe” (maximum risk level) to “Negligible” (minimum risk level). Table 9.4 shows the designers actions based on the risk level.

Table 9.1: Impact Classification

Impact		Reputation (R)	Cost (C)	Programme (P)	Health and Safety (H&S)	Environmental (E)
1	Very Low	Negligible	Negligible	Negligible effect on programme	Negligible	Negligible
2	Low	Significant	1% Budget	5% effect on programme	Minor injury	Minor environmental incident
3	Medium	Serious	10% Budget	12% effect on programme	Major injury	Environmental incident requiring management input
4	High	Threat to future work and Client relations	20% Budget	25% effect on programme	Fatality	Environmental incident leading to prosecution or protestor action
5	Very High	Threat to business survival and credibility	50% Budget	50% effect on programme	Multiple fatalities	Major environmental incident with irreversible effects and threat to public health or protected natural resource

Table 9.2: Likelihood Classification

Likelihood		Probability
1	Negligible / Improbable	< 1%
2	Unlikely / Remote	> 1%
3	Likely / Possible	> 10%
4	Probable	> 50%
5	Very Likely / Almost Certain	> 90%

Table 9.3: Risk Matrix

		Impact				
		1	2	3	4	5
Likelihood	1	N	N	N	N	A
	2	N	N	A	A	H
	3	N	A	A	H	S
	4	N	A	H	S	S
	5	A	H	S	S	S

Table 9.4: Designers Action

Risk Product (I x L)	Risk Level	Description	Action by Designer
1 to 4	N	Negligible	None
5 to 9	A	Acceptable	Check that risks cannot be further reduced by simple design changes
10 to 12	H	High	Amend design to reduce risk or seek alternative option.
15 to 25	S	Severe	Only accept option if justifiable on other grounds

Table 9.5: Geotechnical Risk Register

Hazard	Consequence	Impact	Likelihood	Current Risk	Risk Type	Potential Control Measures	Impact	Likelihood	Residual Risk
Variability of excavated material	Variable ground conditions could result in variations in properties that may be non-compliant, and the volume of reusable material may be less than anticipated. Increased volumes of imported material may be required.	4	3	H	C, P	Designer has assessed the reusability of excavated soils based on ground investigation information. Appropriate Limits of use will be defined in the Series 600 Specification Appendices Contractor to verify design assumptions with regular compliance testing. Options for treatment of non-compliant material to be considered.	4	2	A
Reused Glacial Till – Macamore Clay exhibits swelling and loss of suction	Embankment instability.	4	3	H	C, P, H&S, R	Geotechnical testing to be undertaken on material prior to compaction to ensure stability of embankment fill	4	2	A
Excavated material and surfaces degrade on exposure to rain	Increased quantities of waste / wet materials. Waterlogged material difficult to handle. Shallow slip failures in stockpiles.	3	2	A	C, P, R	Designer to assess the reusability of excavated soils based on ground investigation information. Contractor to verify design assumptions with regular compliance testing. Contractor to protect excavated surfaces and minimise stockpiling. Protect necessary stockpiling from degradation by appropriate sealing / shaping.	3	1	N
Ground conditions and geotechnical parameters differ from reported	Possible failure of temporary excavations, earthworks, surface deformation, structural damage.	3	3	A	C, P, H&S, R	Contractor to confirm ground conditions on site are as expected.	3	2	A

Hazard	Consequence	Impact	Likelihood	Current Risk	Risk Type	Potential Control Measures	Impact	Likelihood	Residual Risk
						Use of appropriate design parameters in detailed design based on site wide and specific GI data.			
Presence of soft/loose material at formation level of new road construction	Potential low CBR values at formation level of proposed highway construction could make it unsuitable for road construction.	3	3	A	C, P, H&S, R	Contractor to confirm ground conditions on site are as expected. Design CBR to account for variability. Soft/weak ground to be excavated and replaced with suitable fill.	3	2	A
Ground and groundwater conditions and geotechnical parameters differ from reported leading to embankment and cutting failure resulting from inadequate design	Possible failure of earthworks, surface deformation, structural damage.	4	3	H	C, P, H&S, R	Contractor to confirm ground conditions on site are as expected. Use of appropriate design parameters in detailed design based on site wide and specific GI data. Assessment of both drained and undrained cases has been undertaken. Removal of weak ground below embankments where necessary.	4	2	A
Seepage in excavated cutting slopes	Possible perched groundwater in Glacial Till – Macamore Clay layers may wash out fines, potentially leading to shallow slip failures and fouling toe drainage or being deposited in the carriageway	3	3	A	C, P, H&S, R	Seepages to be dealt with where identified with specific slope drainage connected to the toe drain.	3	2	A
Higher rock head levels than anticipated	Excavations in cuttings may not be achievable with proposed techniques. Piled foundations may refuse at shallow depth.	3	2	A	C, P	Review of appropriate piling techniques dependent on foundation depths required.	3	2	A

Hazard	Consequence	Impact	Likelihood	Current Risk	Risk Type	Potential Control Measures	Impact	Likelihood	Residual Risk
	Redesign of foundations and cut slopes required					Potential probing using rotary open hole techniques along cutting prior to excavation.			
Potential groundwater at shallow depths, particularly within cutting	Possible inadequate design of cutting slopes and slope failure	4	3	H	H&S, C, R	Ongoing groundwater monitoring prior through design and construction. Incorporation of drainage measures if necessary	4	2	A
Ground and groundwater conditions and geotechnical parameters differ from reported resulting in undrained failure of embankment during construction, especially in Glacial Till – Macamore Clay	Possible inadequate design of embankment leading to failure in the short-term during construction	4	3	H	C, P, H&S, R	Undrained analysis has been undertaken which shows an adequate degree of utilisation. It is recommended that vibrating wire piezometers are installed at the maximum embankment height to monitor excess pore water pressure and dissipation times during construction. If pore water pressures are high, then hold periods or staged construction should be implemented to allow the pore pressure to dissipate before placing the next stage of fill material. It is recommended that the embankment is built in consistent stages along a suitable length of embankment (rather than rapid construction of a small stretch of embankment)	4	2	A
Relict shear surfaces	Potential to be reactivated when loaded or excavated. May lead to excavation and cutting instability.	3	3	A	C, P, H&S, R	No evidence of these features in scheme ground investigations. Inspect cutting/excavated surfaces when excavating for shear surfaces.	3	2	A

Hazard	Consequence	Impact	Likelihood	Current Risk	Risk Type	Potential Control Measures	Impact	Likelihood	Residual Risk
Contractor designed reinforced soil walls	Possible inadequate design of reinforced soil walls leading to failure and structural damage.	4	3	H	C, P, H&S, R	Appropriate design parameters and conditions to be provided to Contractor Review and independent checking of Contractor design and assumptions	4	2	A
Contractor designed attenuation tank	Possible inadequate design of attenuation tank leading to failure, surface settlement/deformation and structural damage.	4	3	H	C, P, H&S, R	Appropriate design parameters and conditions to be provided to Contractor Review and independent checking of Contractor design and assumptions	4	2	A

*H&S: Health and Safety, E: Environment, C: Cost, P:Programme, R:Reputation

10 Specification Appendices

The Series 600 Earthworks Specification Appendices covering the geotechnical elements of the works are included in Appendix E. The relevant specification appendices for the scheme are listed below.

- 1/5 Testing to be Carried Out by the Contractor
- 6/1 Requirements for Acceptability and Testing of Earthworks Materials
- 6/2 Requirements for Dealing with Class U2 Unacceptable Material
- 6/3 Requirements for Excavation, Deposition, Compaction (Other Than Dynamic Compaction)
- 6/5 Geotextiles used to Separate Earthworks Materials
- 6/6 Fill to Structures, Fill Above Structural Foundations and Fill Below Structural Foundations
- 6/7 Sub-Formation and Capping and Preparation and Surface Treatment of Formation
- 6/8 Topsoiling, Grass Seeding and Turfing
- 6/9 Earthwork Environmental Bunds, Landscape Areas, Strengthened Earthworks and Reinforced Soil Structures
- 6/11 Swallow Holes and Other Naturally Occurring Cavities and Disused Mine Workings
- 6/12 Instrumentation and Monitoring
- 6/13 Soil Treatment with Lime and/or Hydraulic Binders and Ground Improvement

The Series 1600 Specification Appendices covering the piling and embedded retaining walls are included in Appendix E. The Series 1600 Specification Appendices shall be read in conjunction with TII Publication 'Specification for Road Works Series 1600 – Piling and Embedded Retaining Walls'. The relevant specification appendices for the scheme are listed below.

- 1/5 Testing to be Carried Out by the Contractor
- 16/1 Requirements for Piling and Embedded Retaining Walls
- 16/3 Bored Cast-in-Place Piles
- 16/4 Bored Piles Constructed using Continuous Flight Augers and Concrete or Grout Injection through Hollow Auger Stems
- 16/8 Non-Destructive Methods for Testing Piles
- 16/9 Static Load Testing of Piles

11 Instrumentation and Monitoring

Full details of the proposed instrumentation and monitoring is detailed in the Scheme-wide Specification. The relevant appendices are:

- Appendix 6/12: Instrumentation and Monitoring
- Appendix 16/1: Requirements for Piling and Embedded Retaining Walls

12 Maintenance Requirements

Requirements for geotechnical asset maintenance shall be in accordance with current TII and Wexford County Council procedures for national highways.

13 References

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A. Slope Stability Outputs

Figure A.1: Cutting - existing north slope - drained - DA1-2

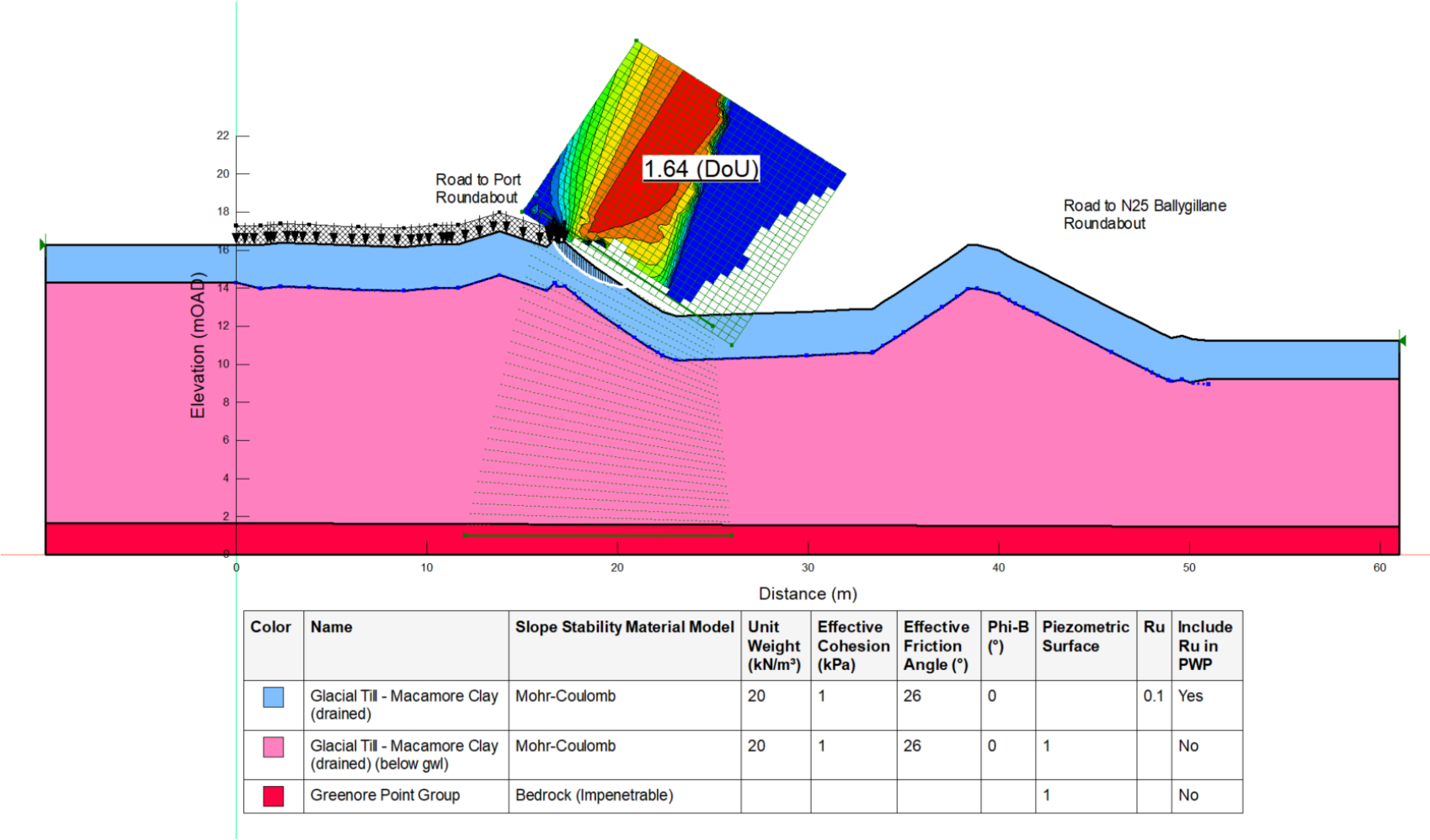


Figure A.2: Cutting – proposed north slope – drained - DA1-2

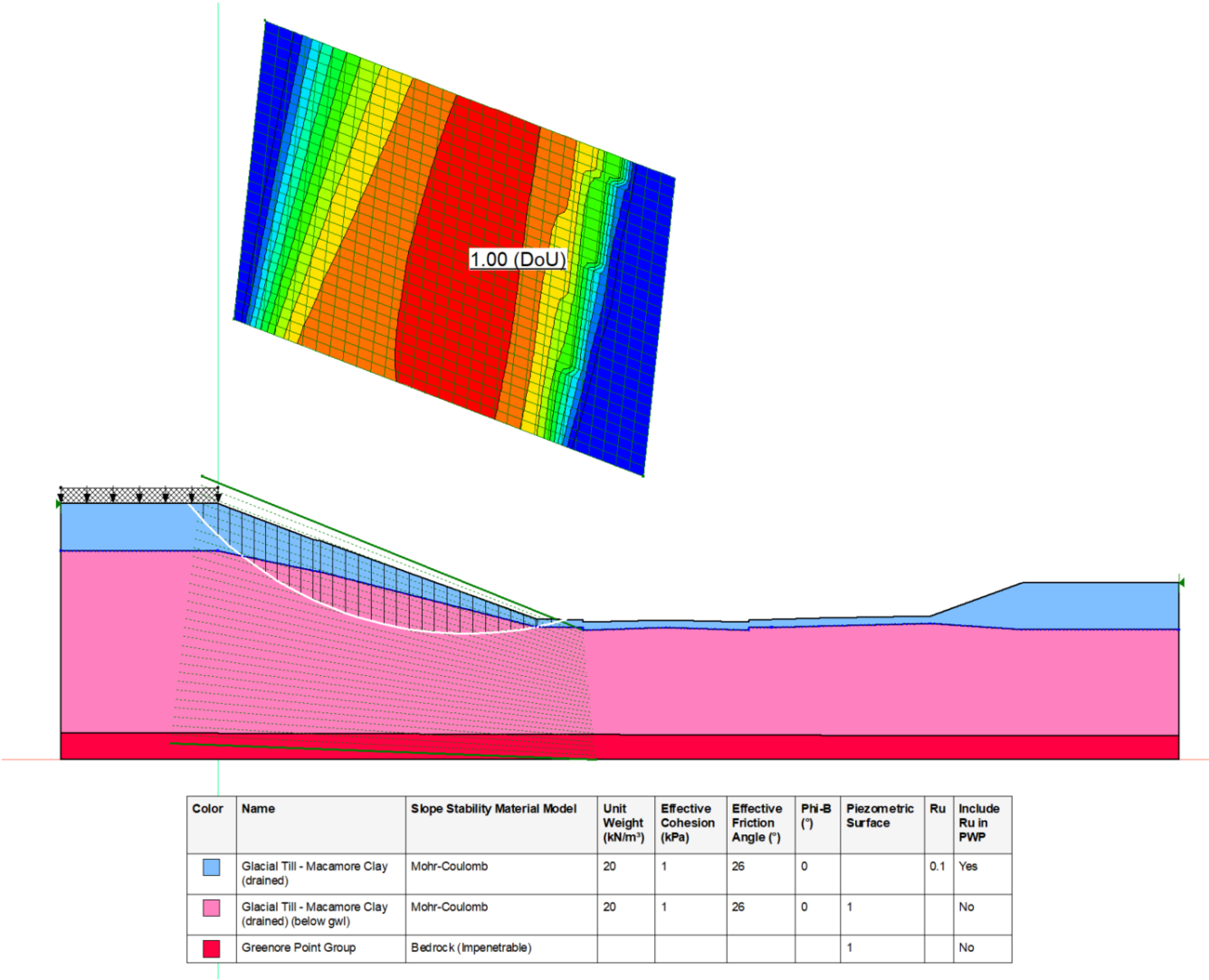


Figure A.3: Cutting – proposed south slope – drained - DA1-2

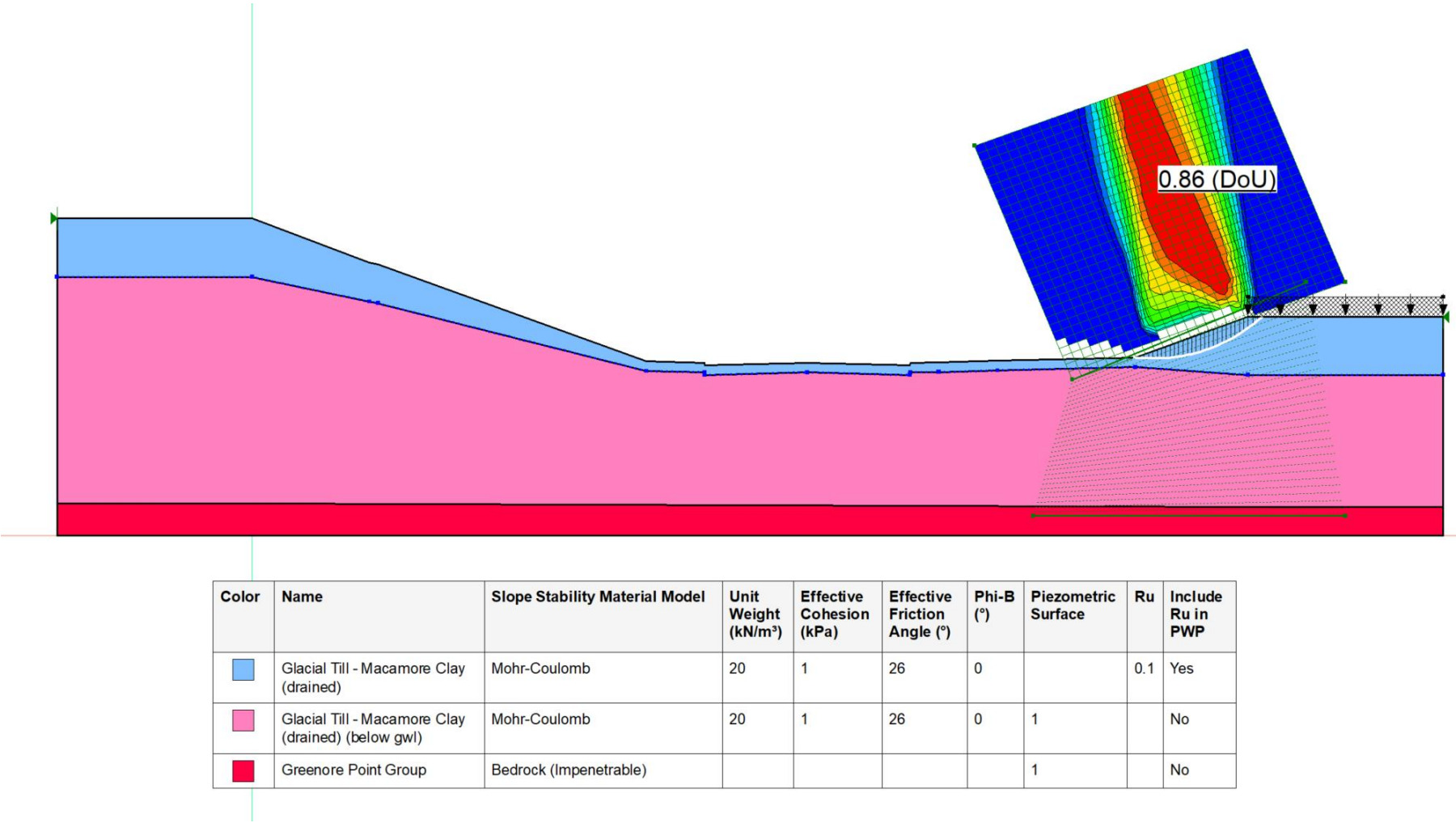


Figure A.4: Cutting – proposed north slope – undrained - DA1-2

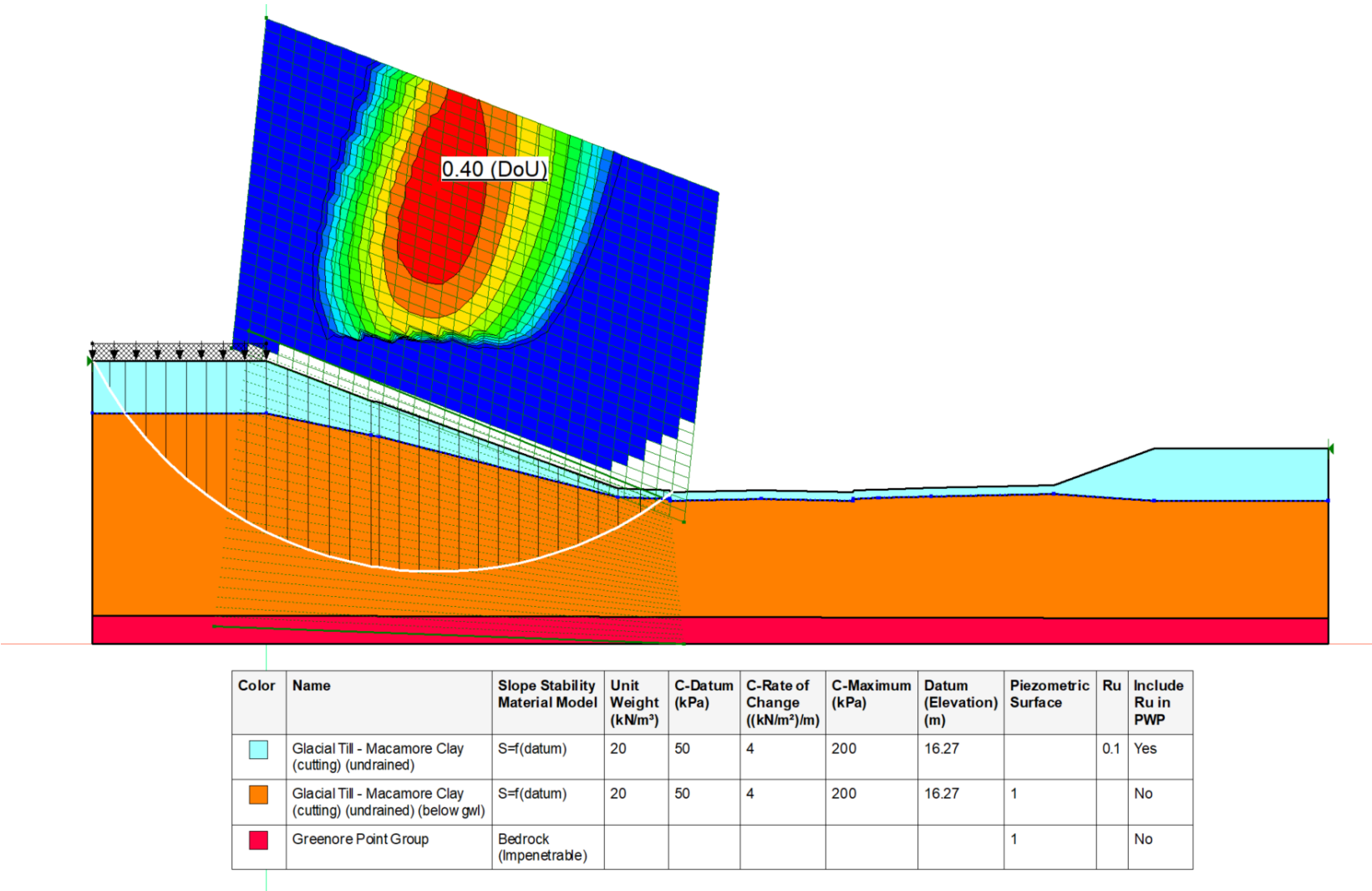


Figure A.5: Cutting – proposed south slope - undrained - DA1-2

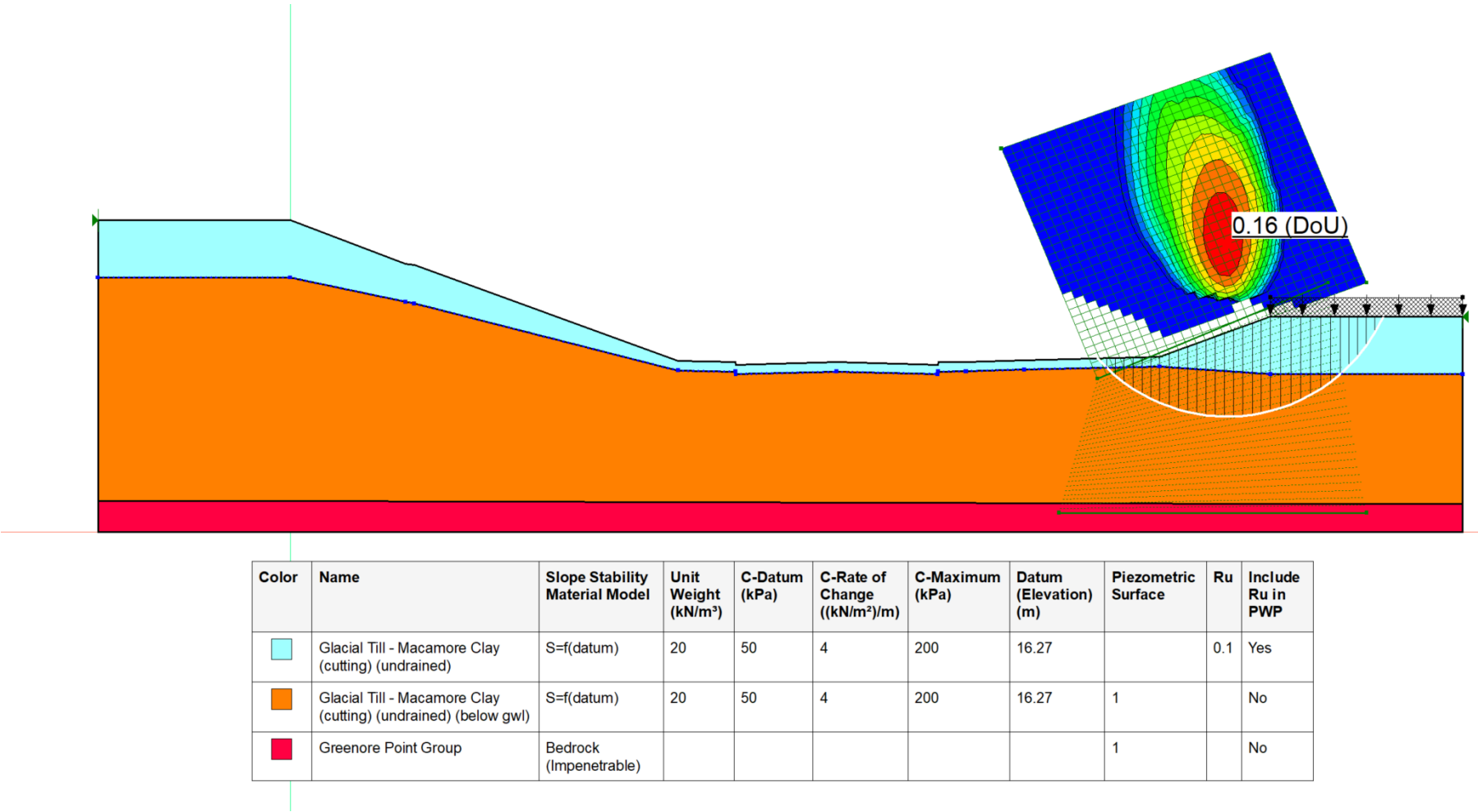


Figure A.6: Existing Small Boat Harbour – drained – characteristic – $r_u = 0.1$

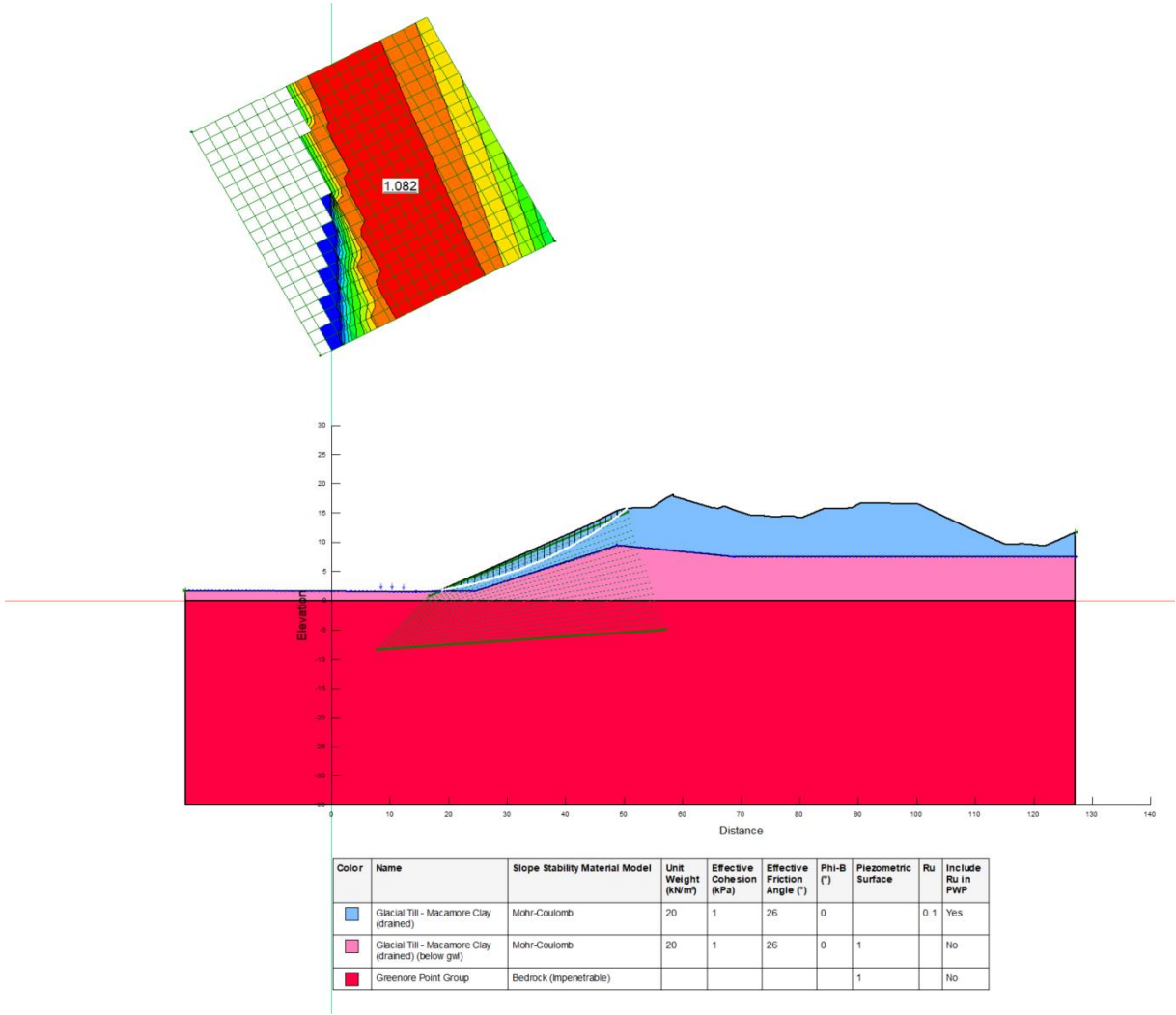


Figure A.7: Existing Small Boat Harbour – drained – characteristic – $r_u = 0.2$

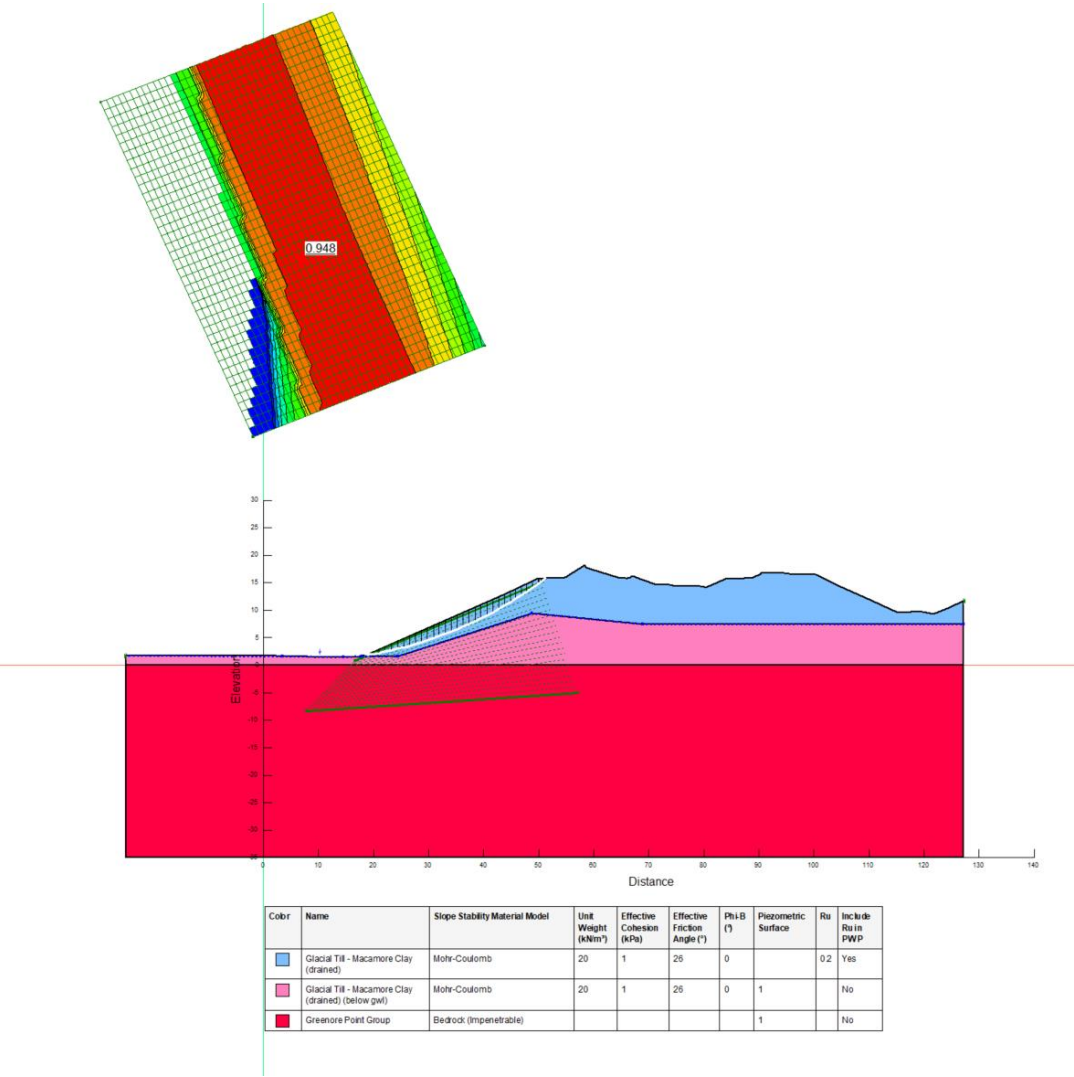


Figure A.8: Existing Small Boat Harbour – undrained - characteristic

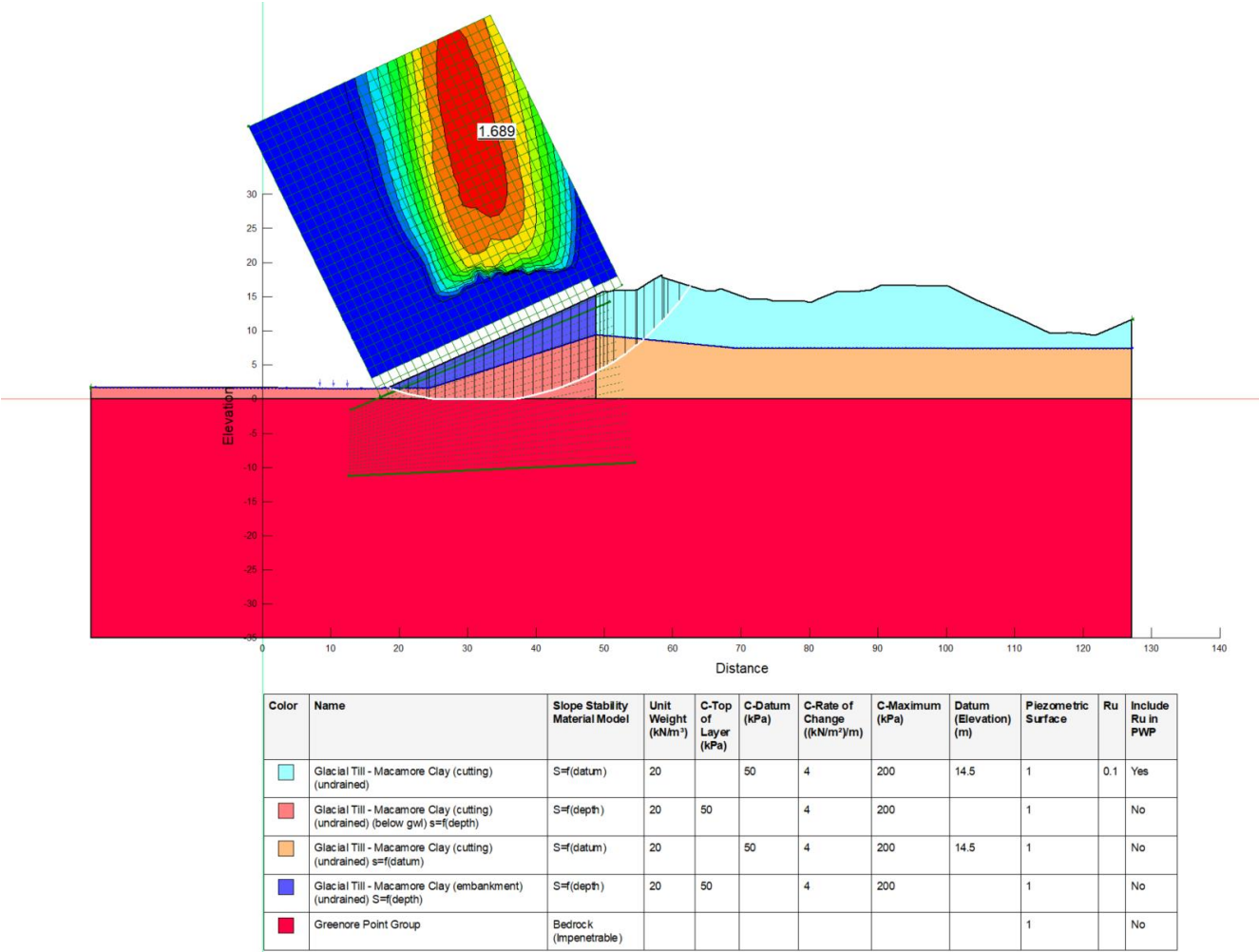


Figure A.9: Small Boat Harbour proposal – drained – DA1-1

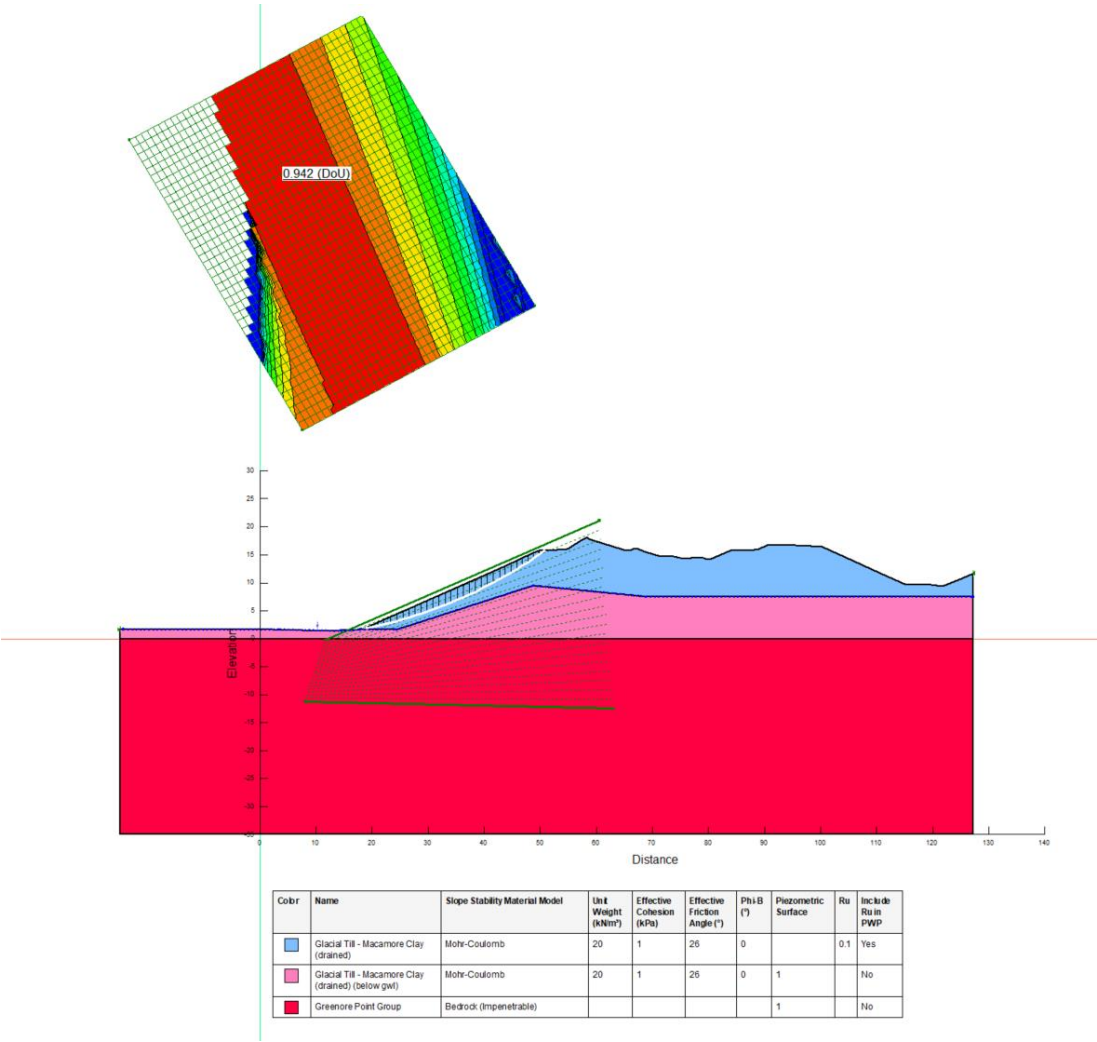


Figure A.10: Small Boat Harbour proposal – undrained – DA1-1

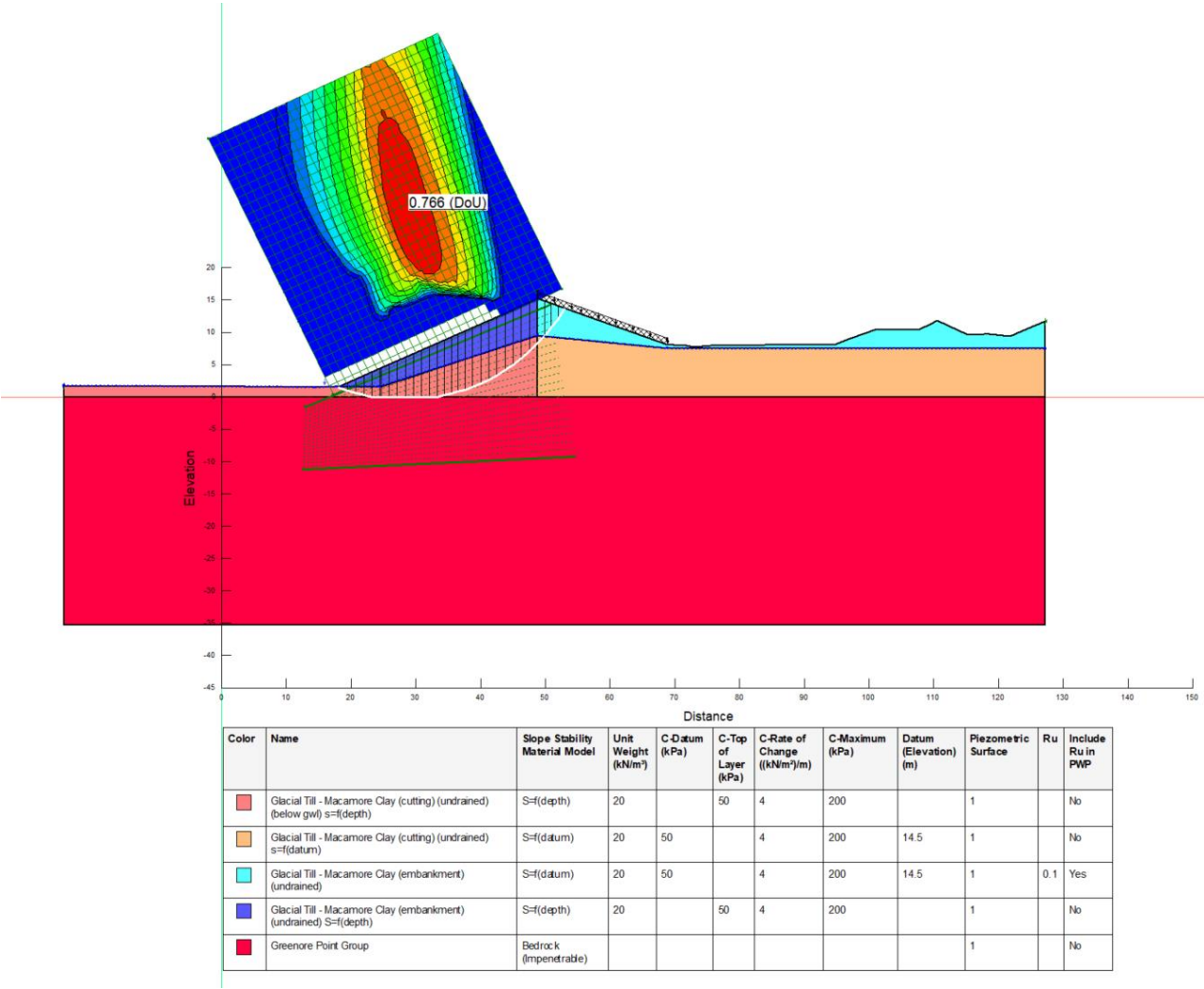


Figure A.11: Small Boat Harbour proposal – drained – DA1-2

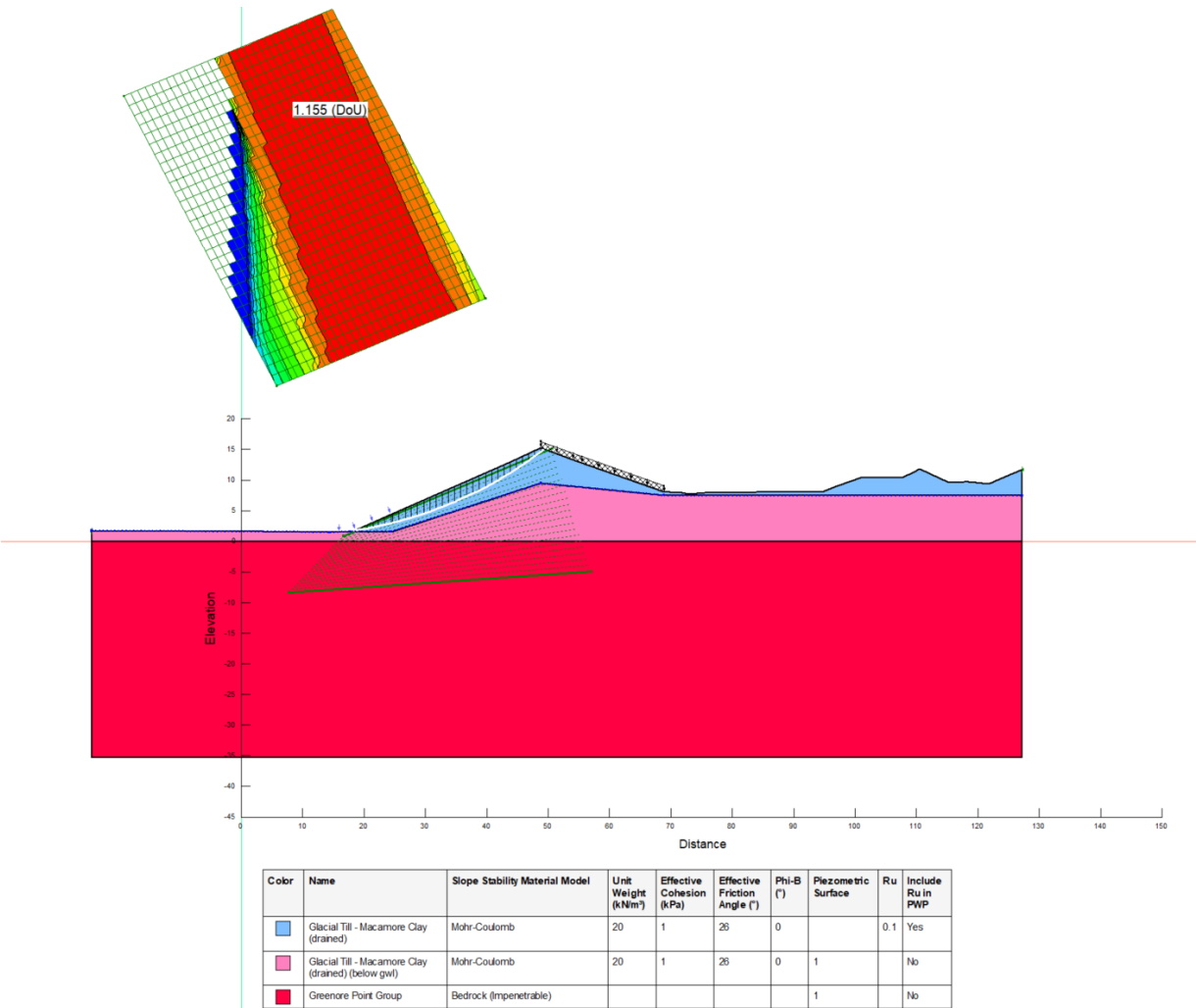


Figure A.12: Small Boat Harbour proposal – undrained – DA1-2

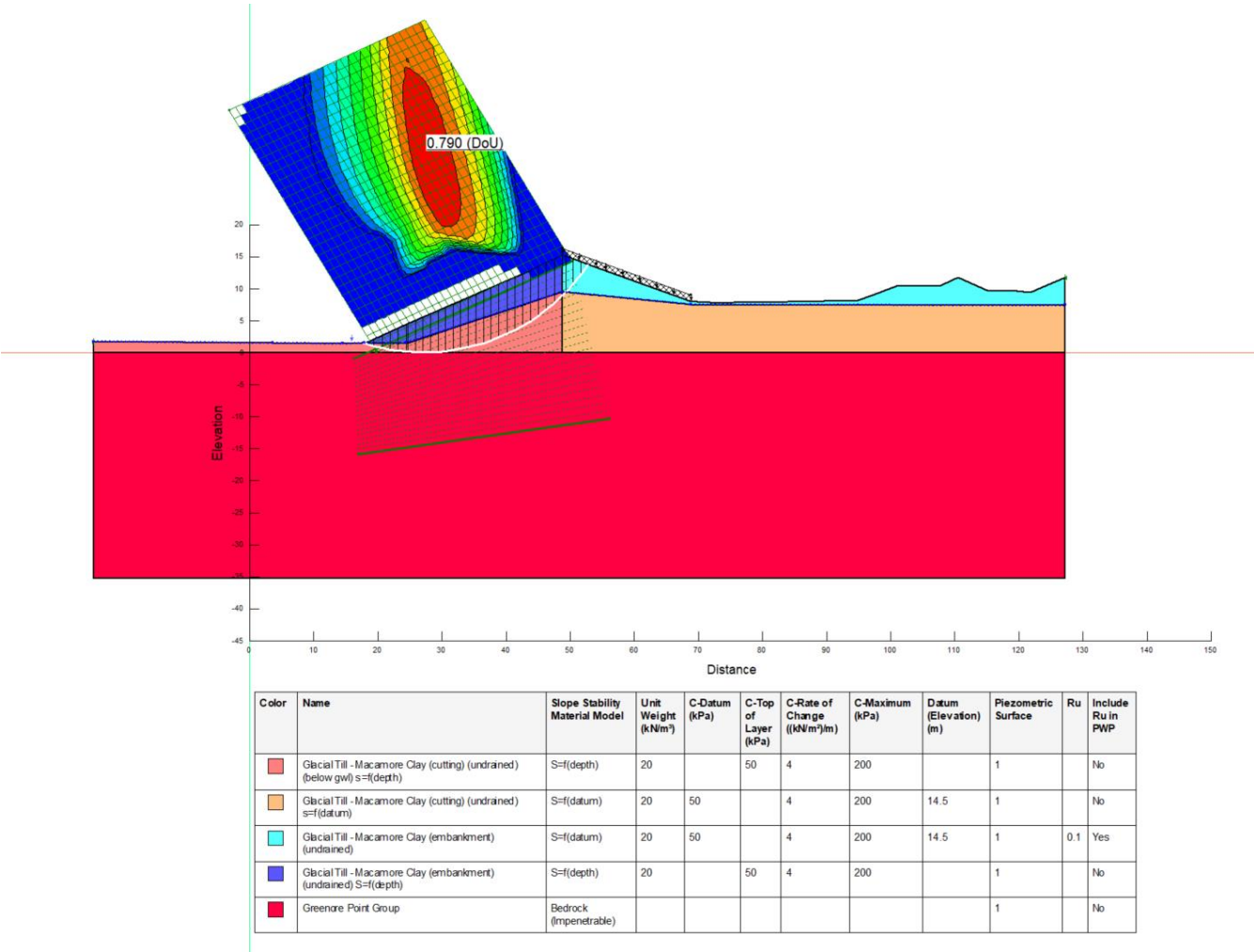


Figure A.13: East embankment slope – imported Class 2 fill (1:2) – drained – DA1-2

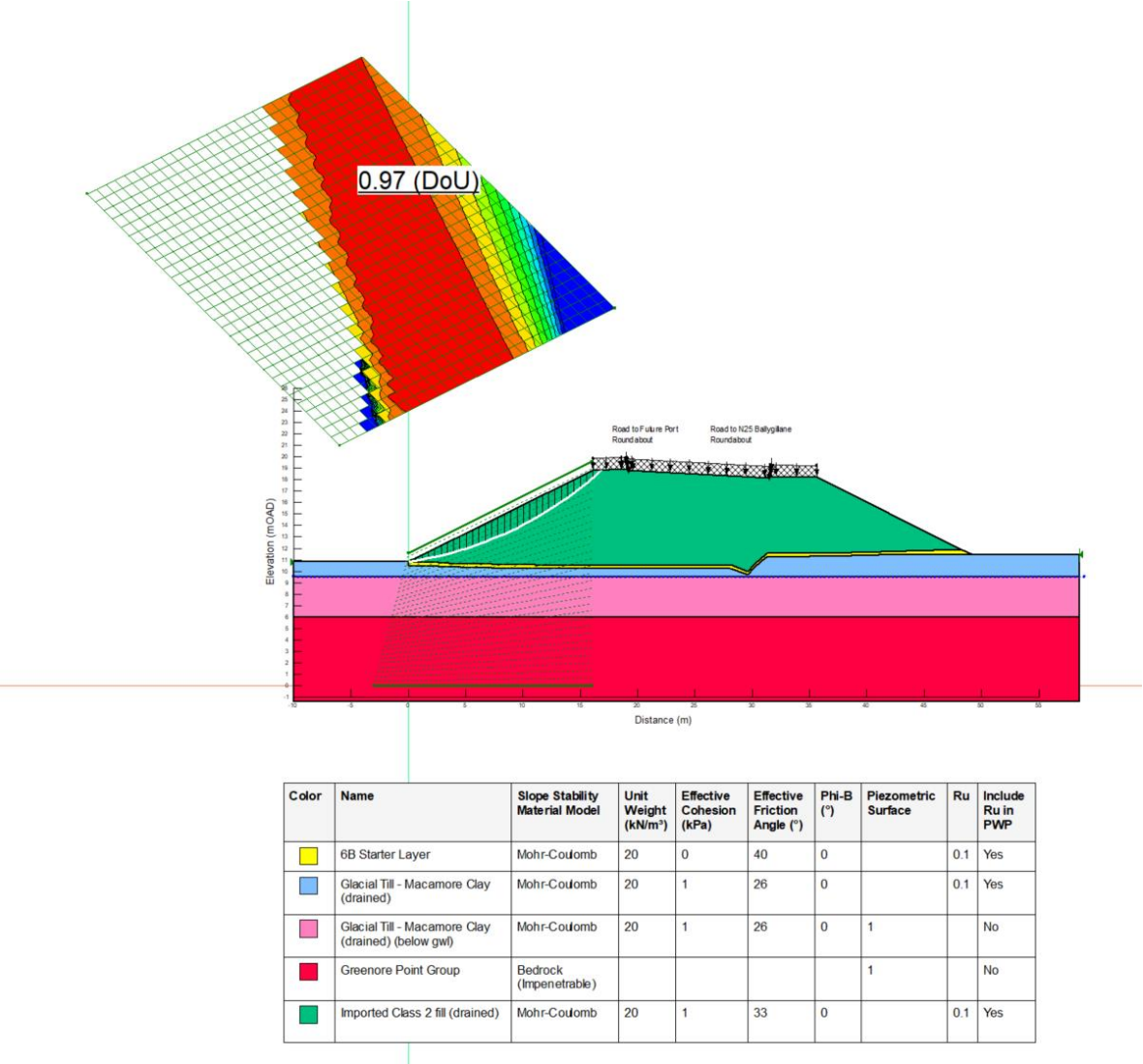


Figure A.14: East embankment slope – imported Class 2 fill (1:2) – undrained – DA1-2

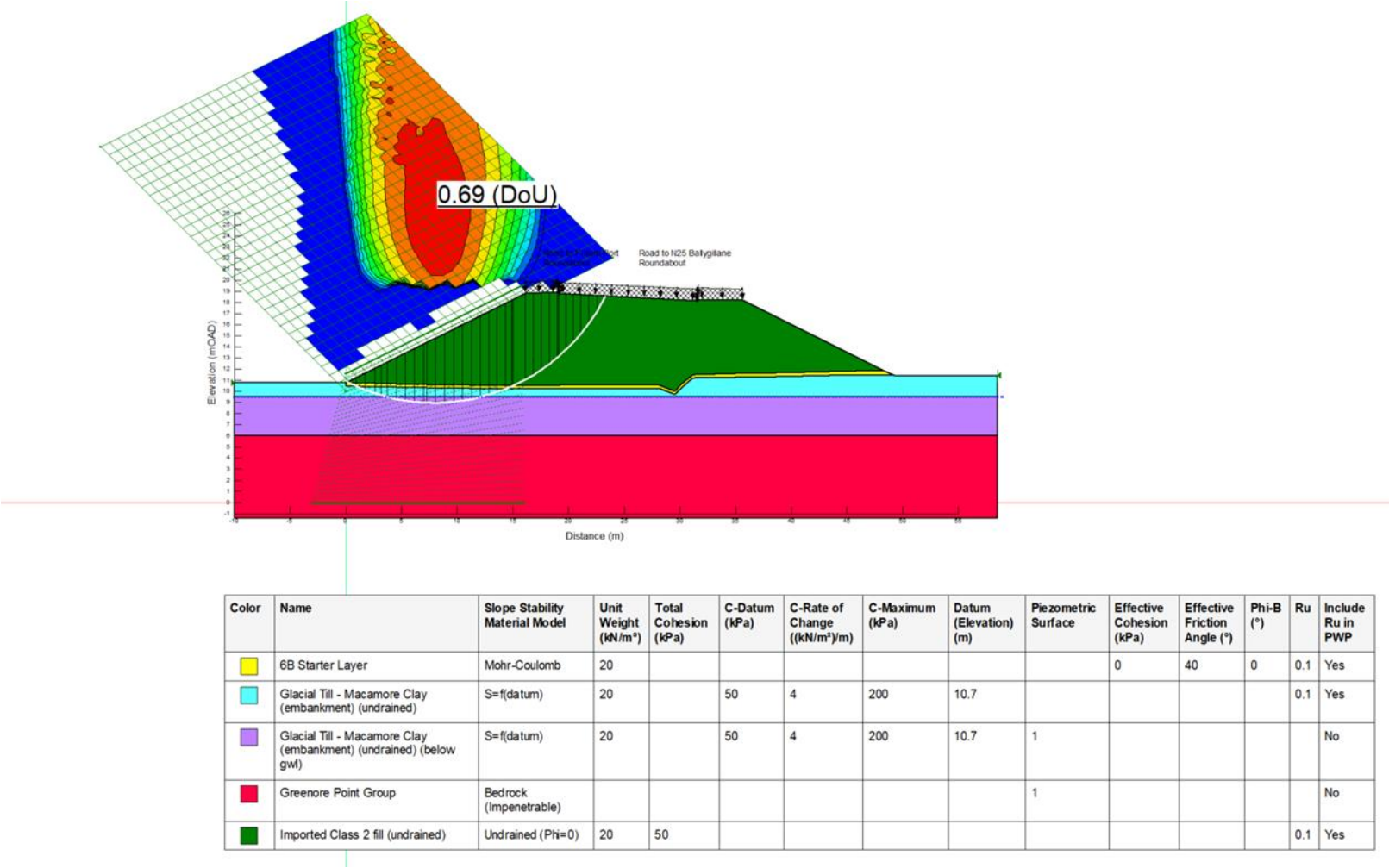


Figure A.15: East embankment slope – reused Glacial Till – Macamore Clay fill (1:2) – drained – DA1-2

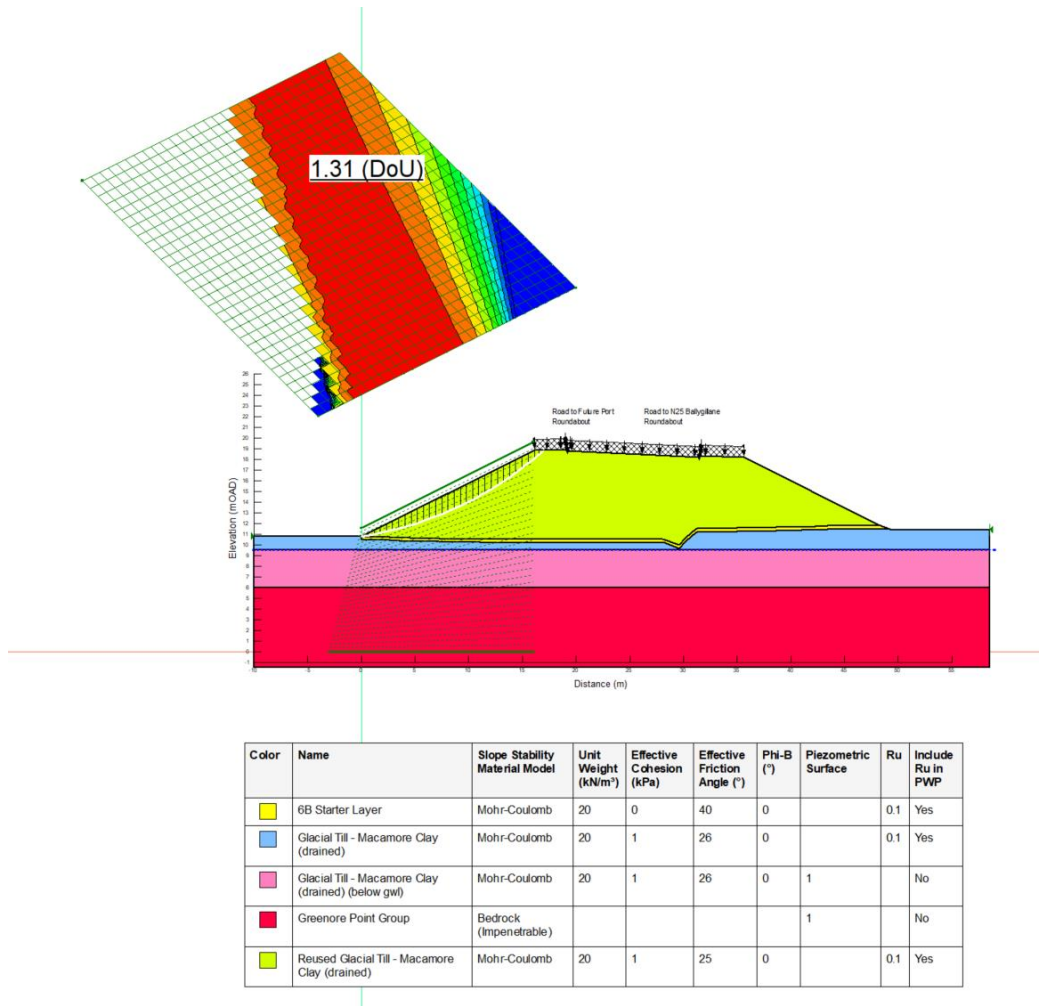


Figure A.16: East embankment slope – reused Glacial Till – Macamore Clay fill (1:2) – undrained – DA1-2

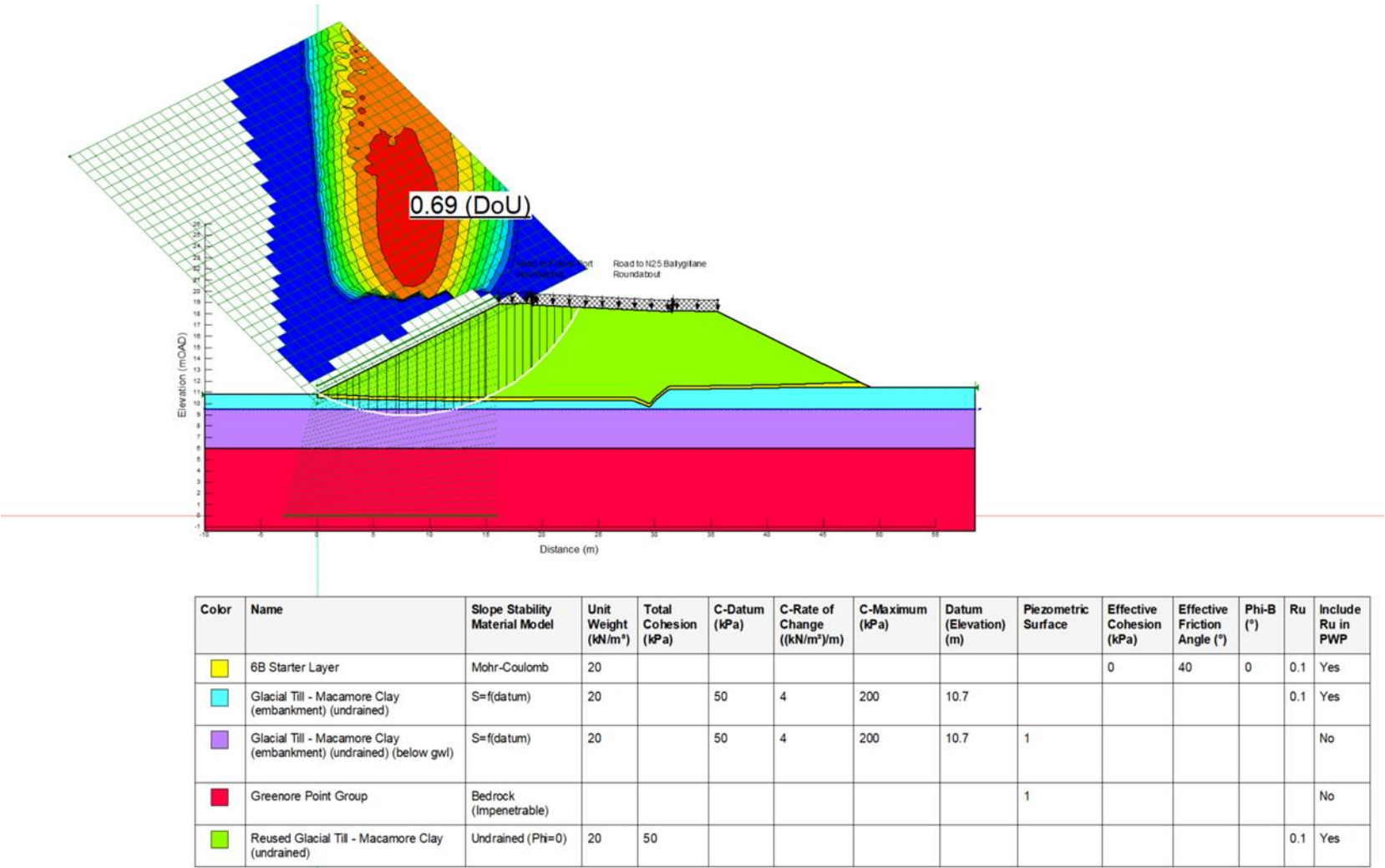


Figure A.17: East embankment slope – Macamore Clay core with imported Class 2 fill on top (1:2) – drained – DA1-2

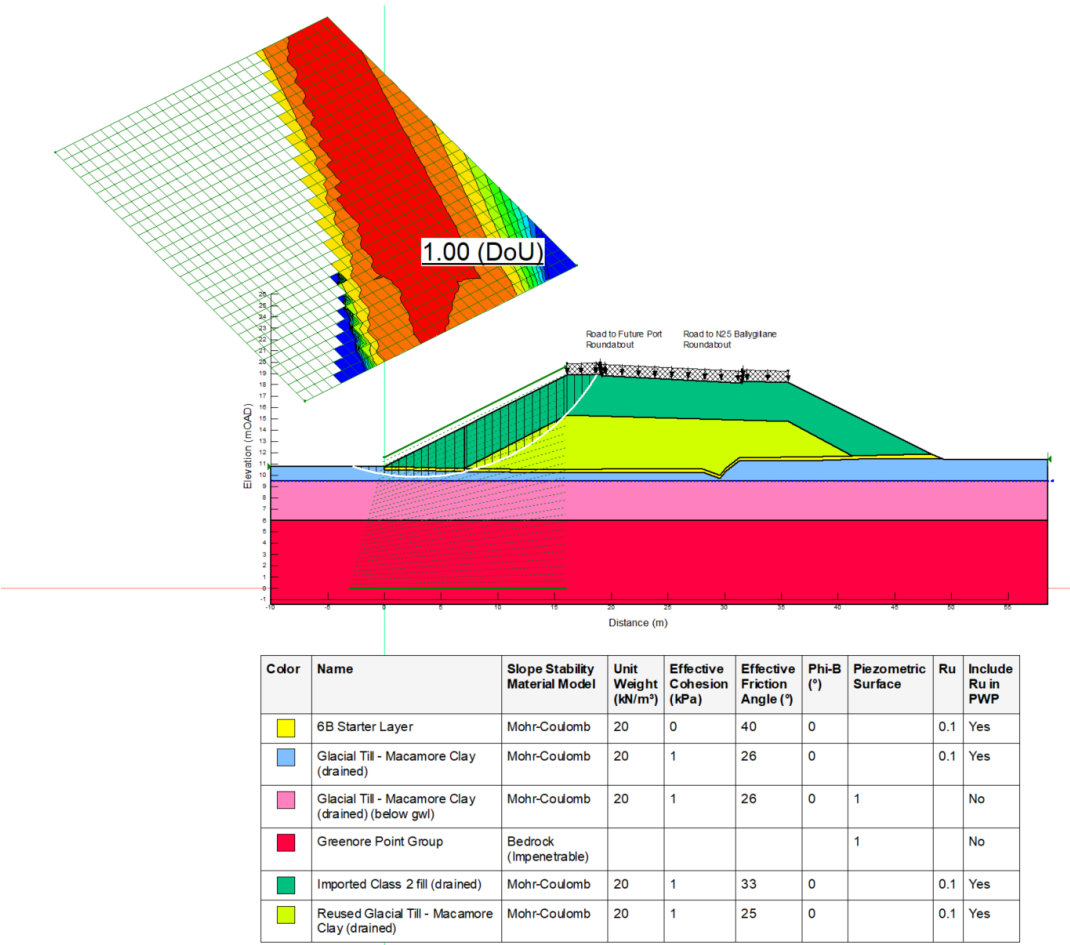


Figure A.18: East embankment slope – Macamore Clay core with imported Class 2 fill on top (1:2) – undrained – DA1-2

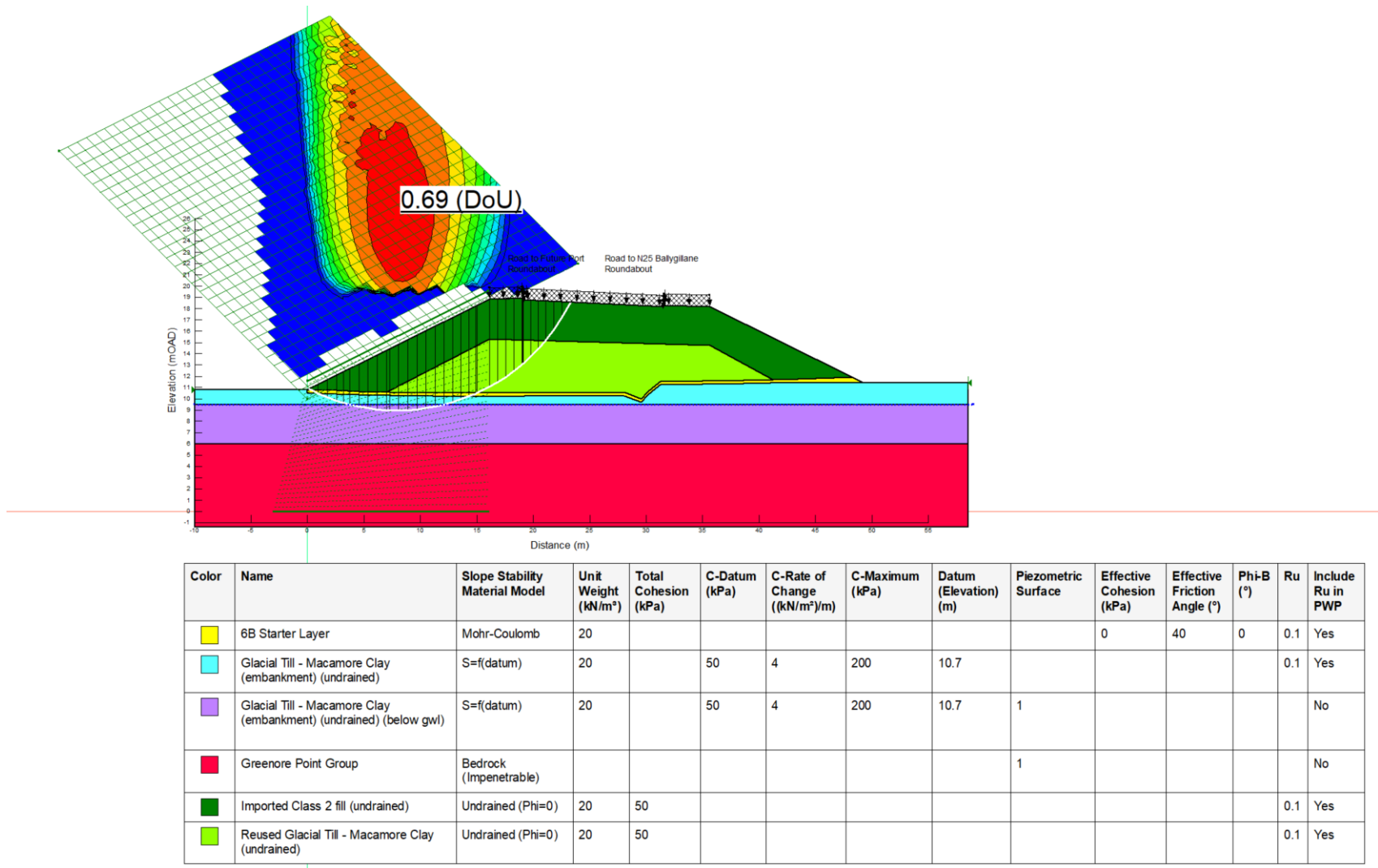


Figure A.19: West embankment slope – Macamore Clay core with imported Class 2 fill on top (1:2) – drained – DA1-2

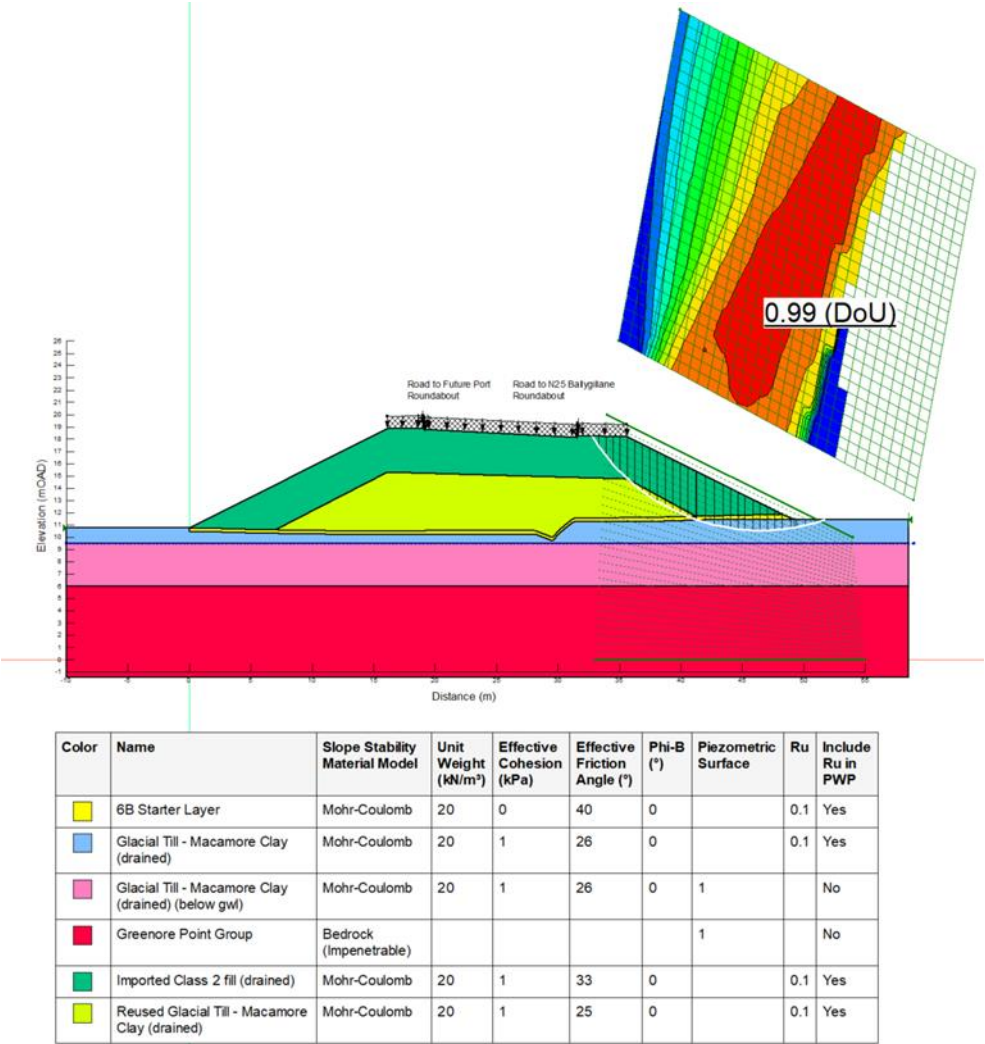


Figure A.20: West embankment slope – Macamore Clay core with imported Class 2 fill on top (1:2) – undrained – DA1-2

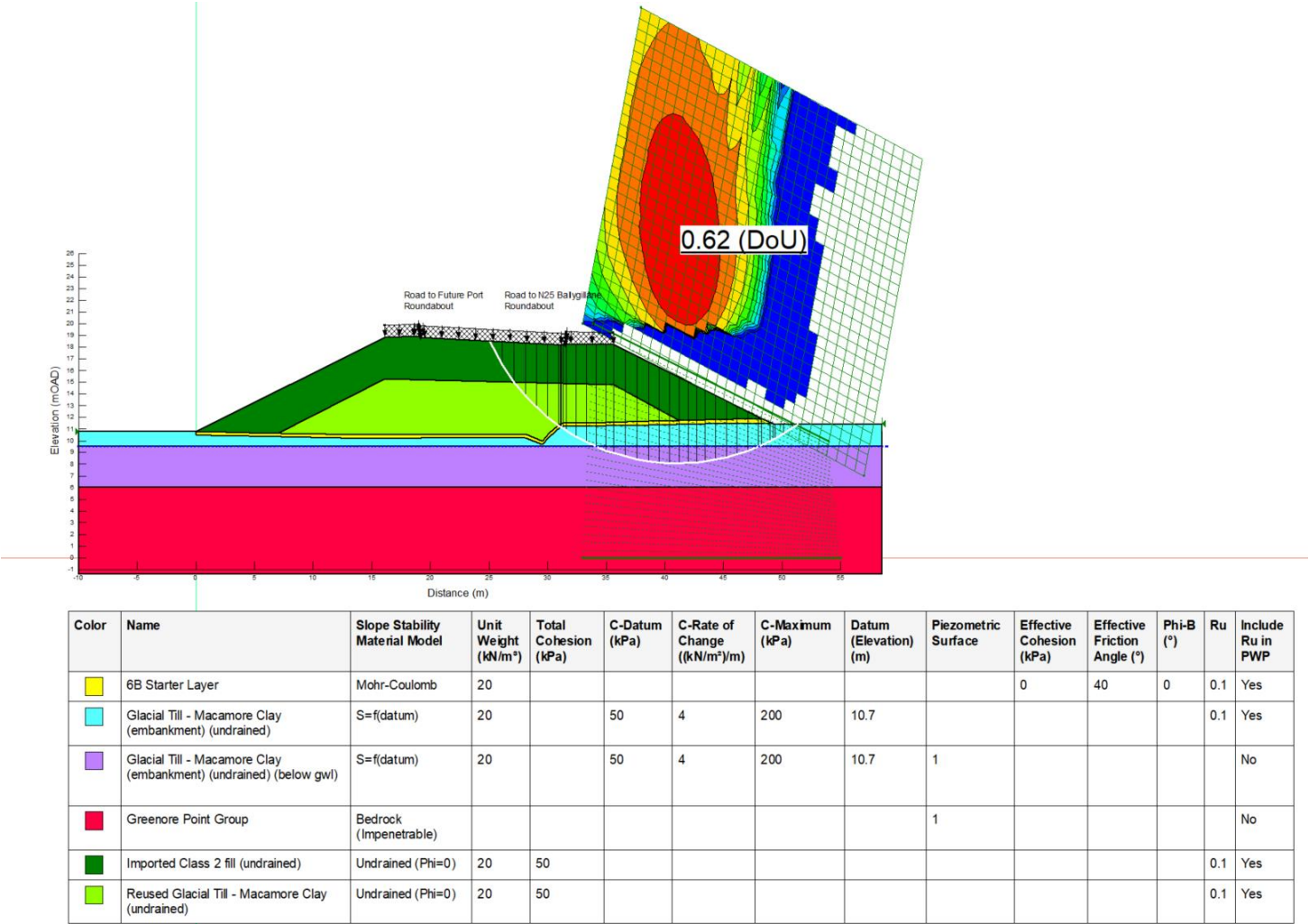


Figure A.21: Pond 1 – P1 – South - full pond - drained - DA1-2

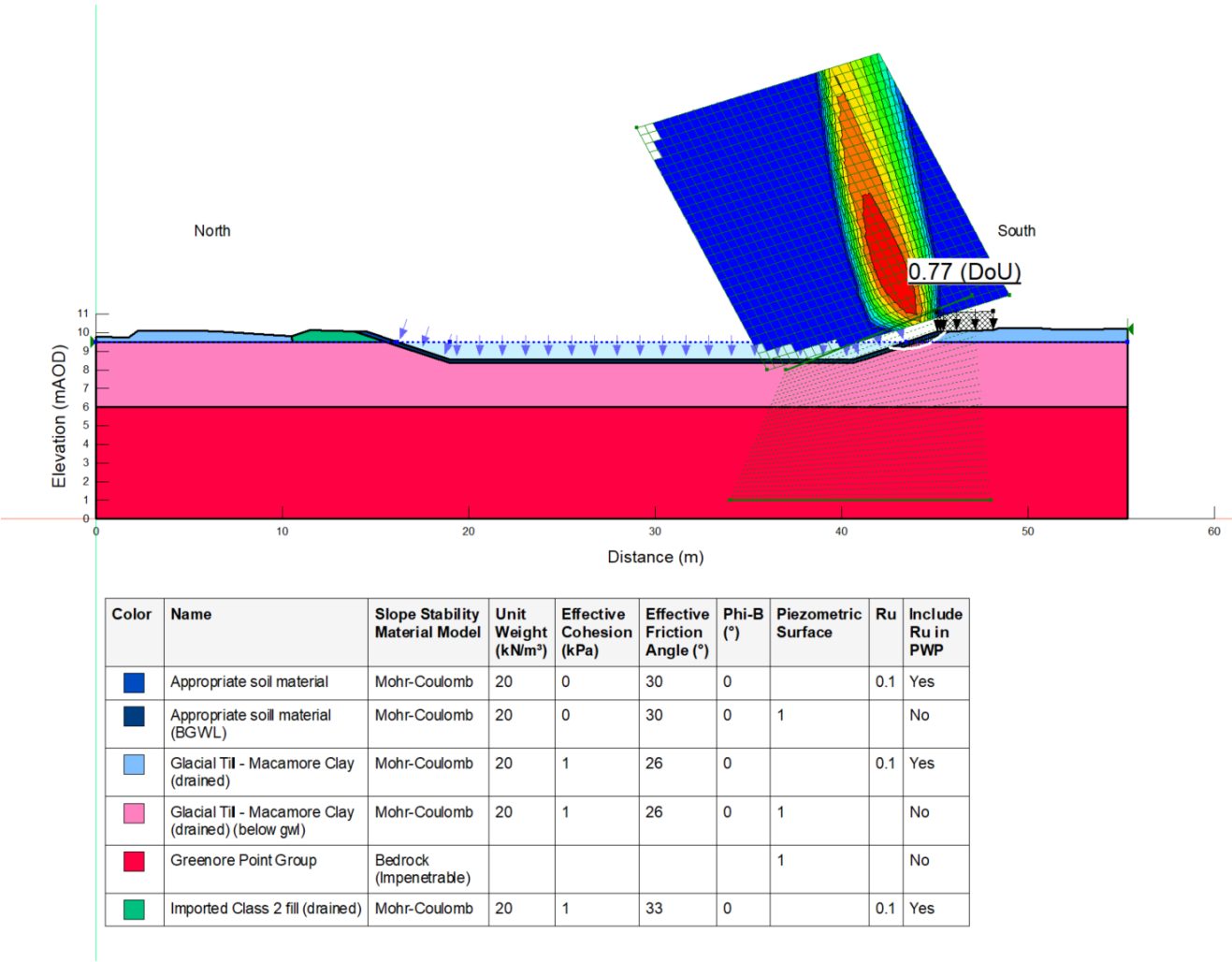


Figure A.22: Pond 1 – P1 – South - full pond – undrained - DA1-2

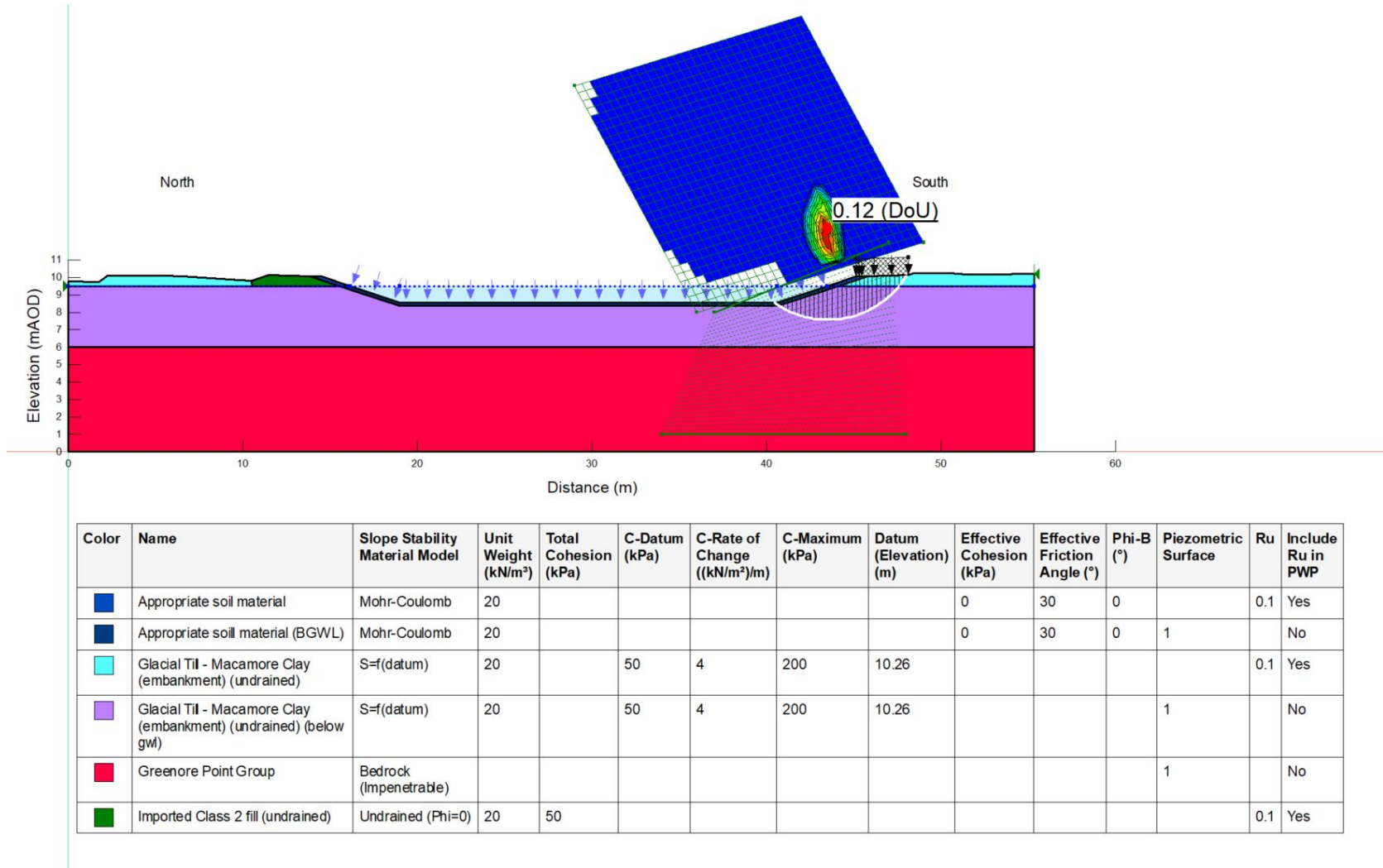


Figure A.23: Pond 1 – P1 – South - dry pond - drained - DA1-2

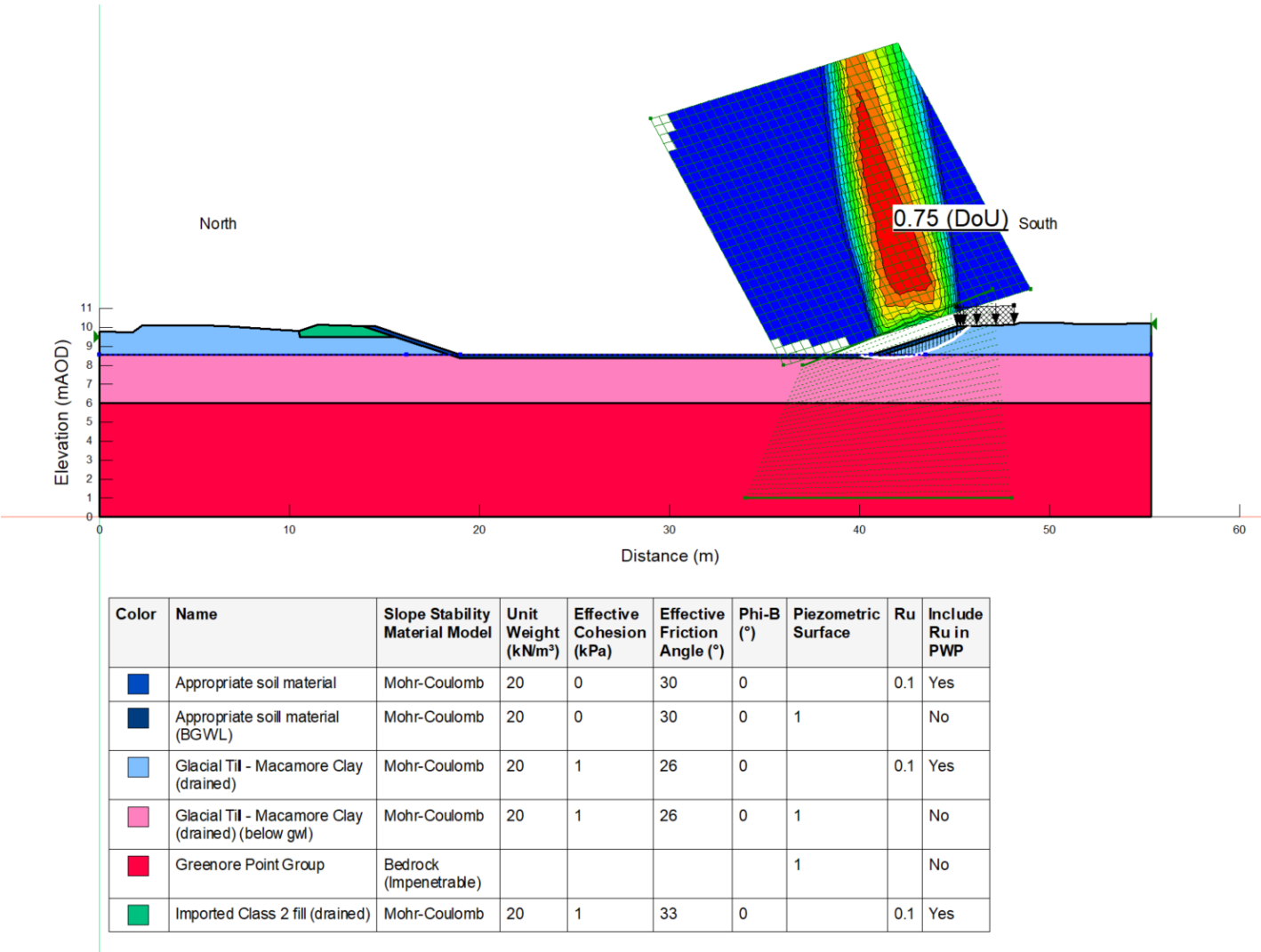


Figure A.24: Pond 1 – P1 – South - dry pond - undrained - DA1-2

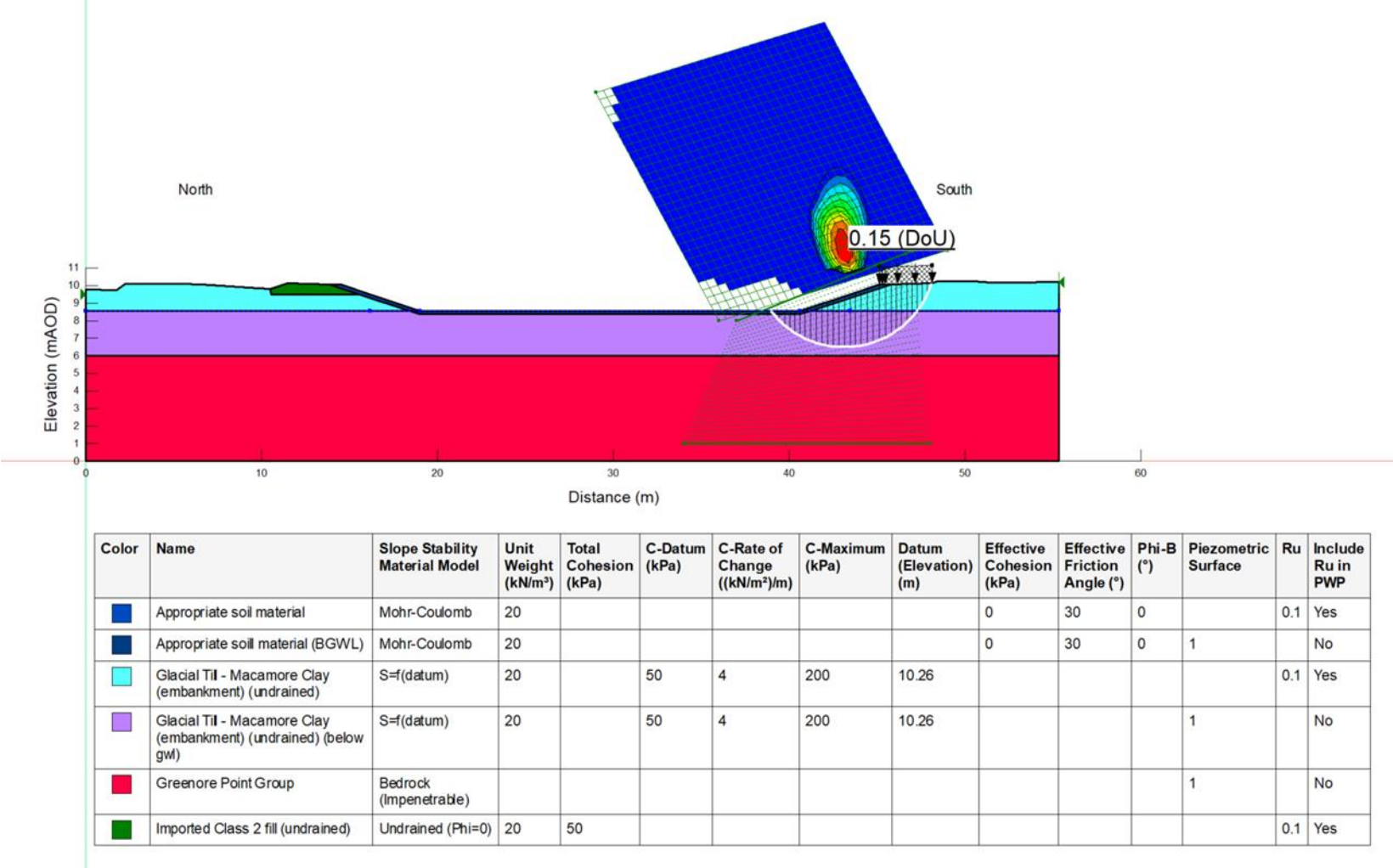


Figure A.25: Pond 2 – P2 – South - full pond - drained - DA1-2

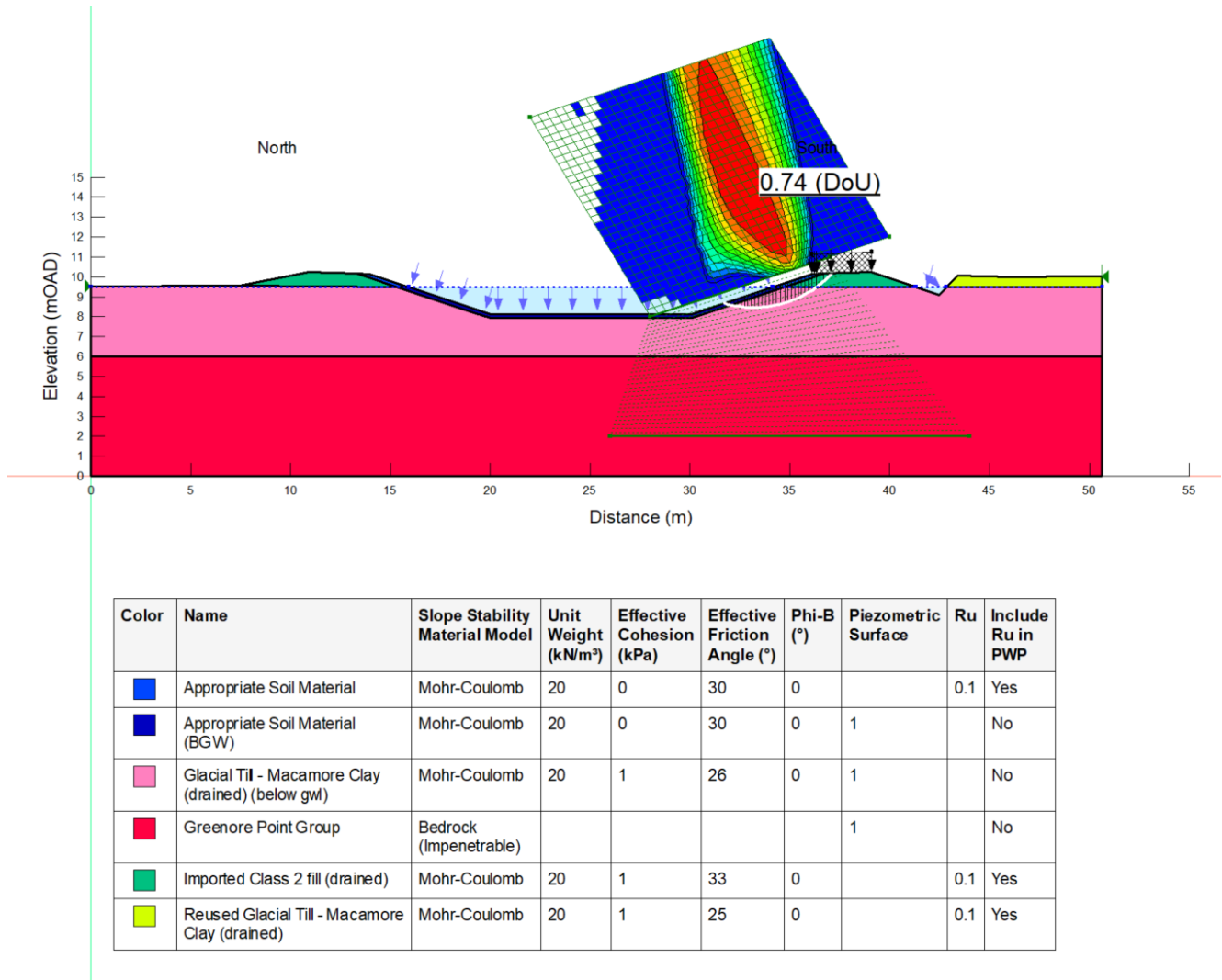


Figure A.26: Pond 2 – P2 – South - full pond – undrained - DA1-2

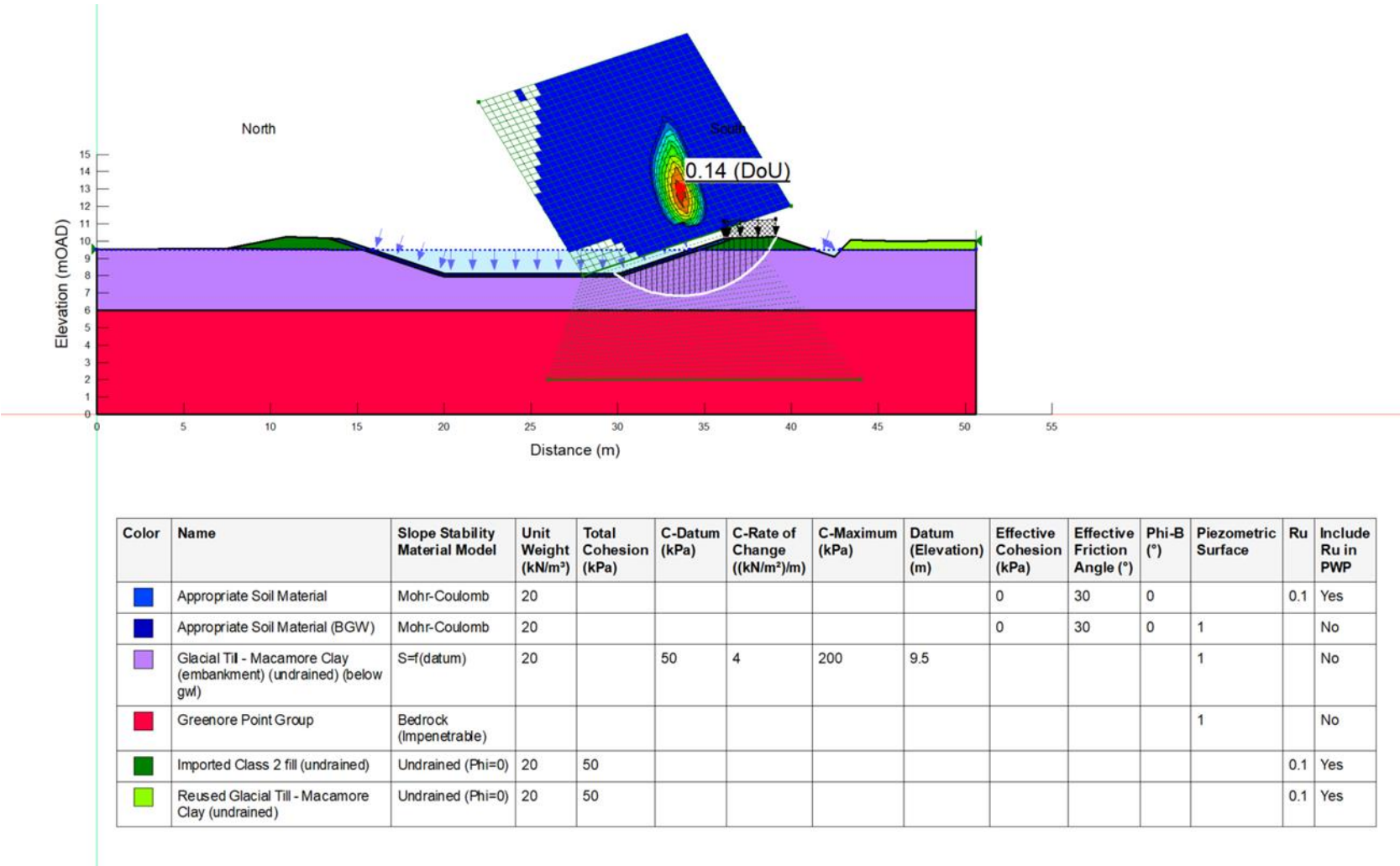


Figure A.27: Pond 2 – P2 – South - dry pond – drained - DA1-2

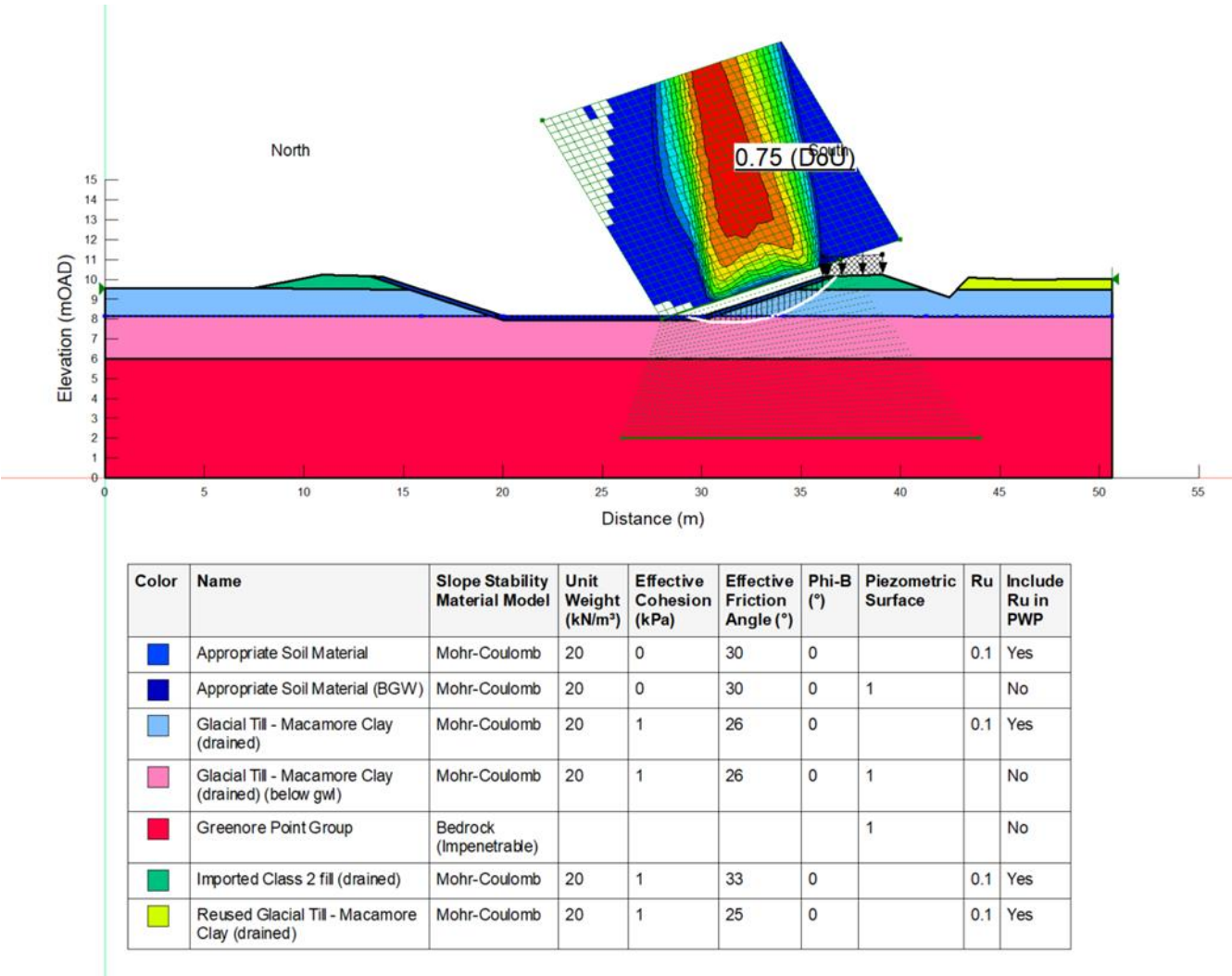


Figure A.28: Pond 2 – P2 – South - dry pond - undrained - DA1-2

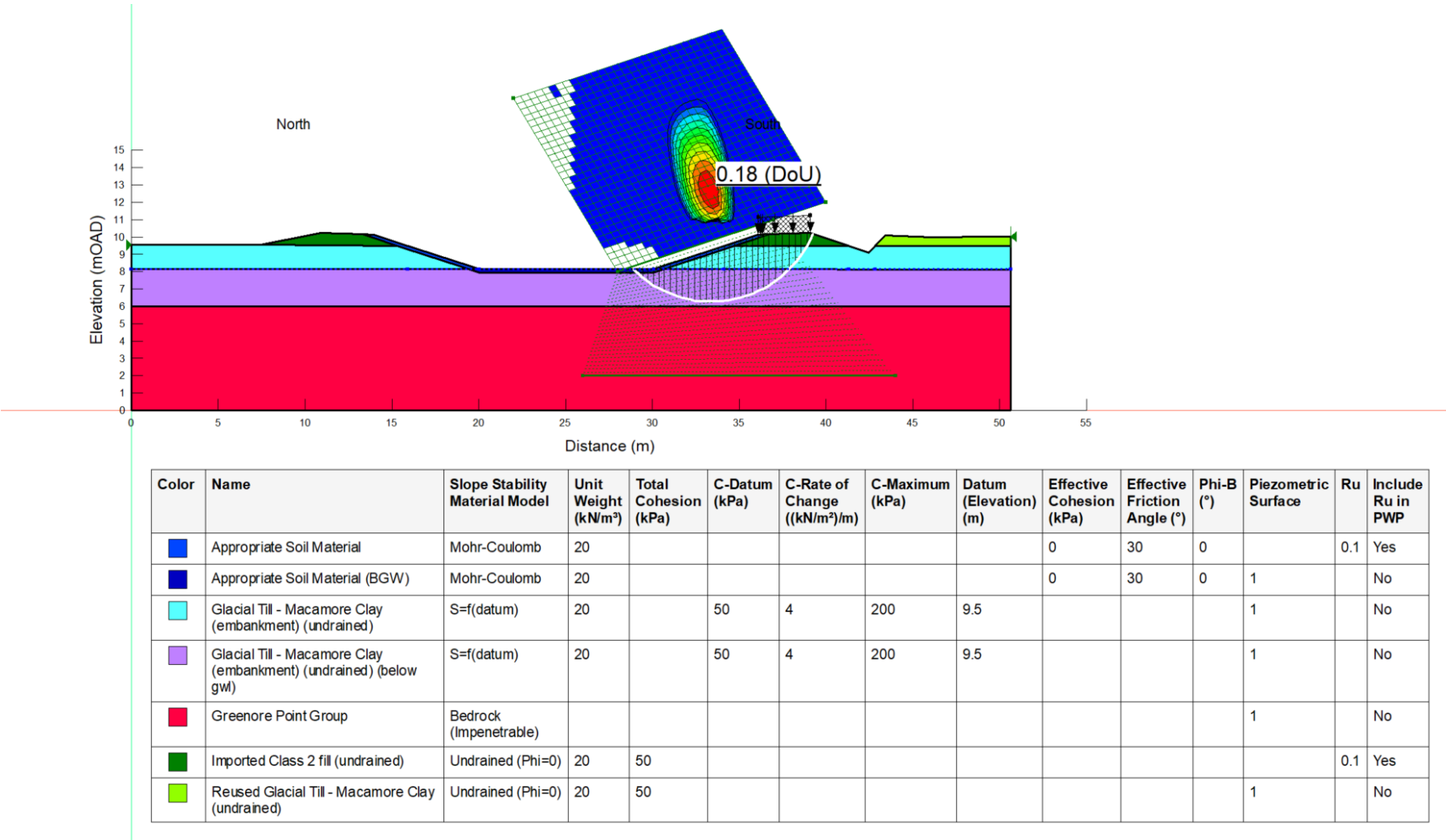


Figure A.29: Pond 3 – P1 – North – dry pond - drained - DA1-2

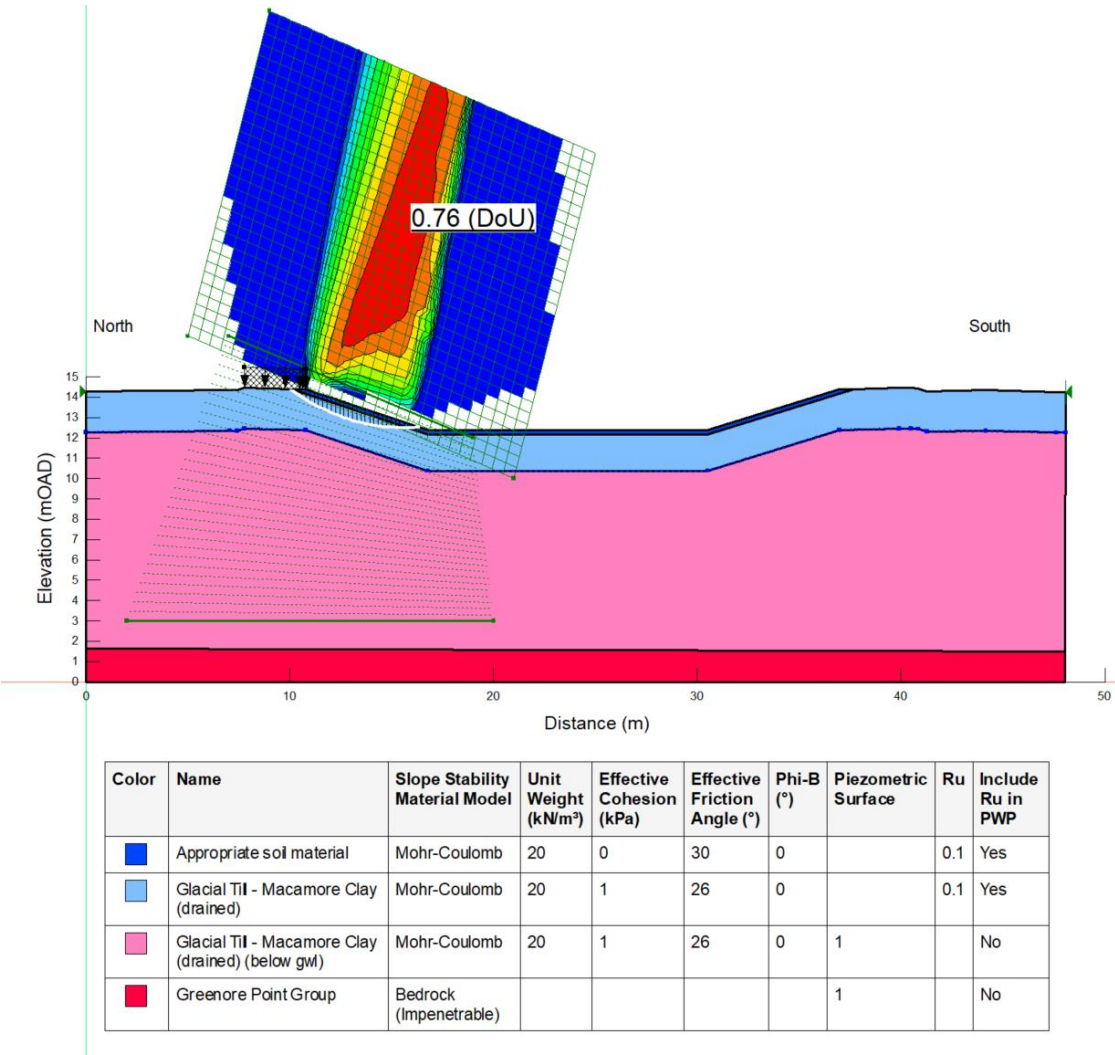


Figure A.30: Pond 3 – P1 – North – dry pond - undrained - DA1-2

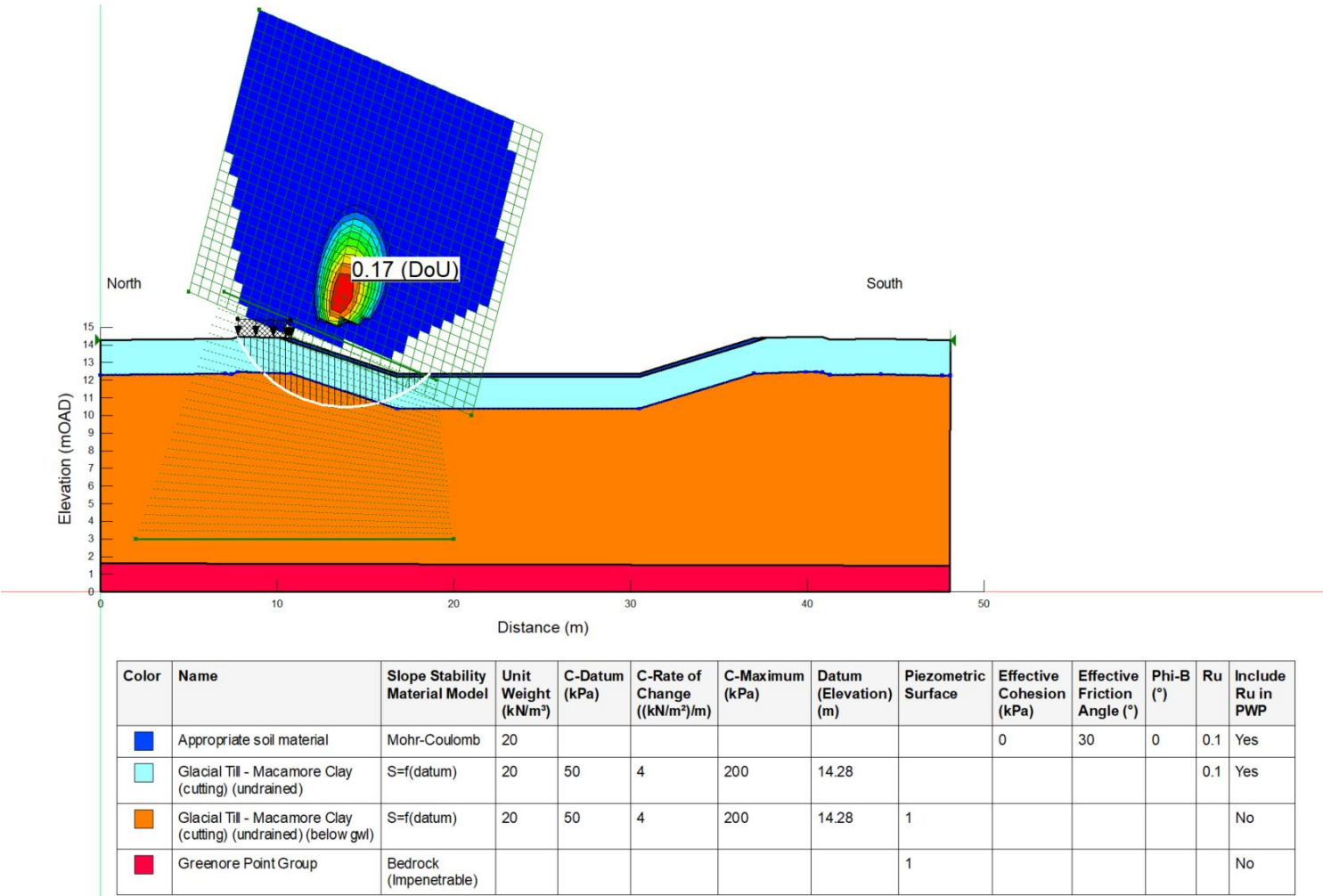


Figure A.31: Pond 1 – rapid drawdown - drained - DA1-2 – L/H = 1.25

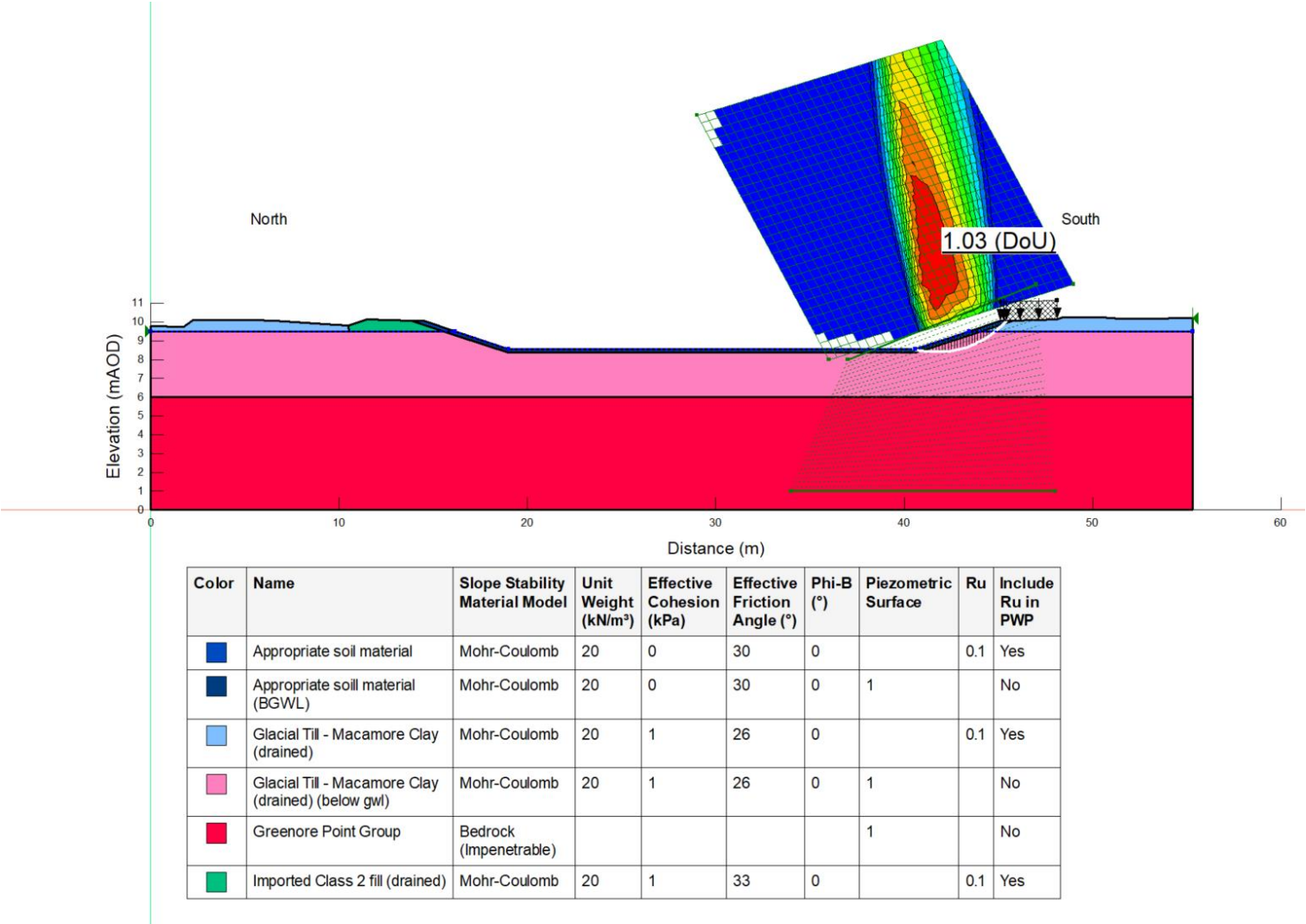


Figure A.32: Section 1 – drained - DA1-2 – L/H = 1

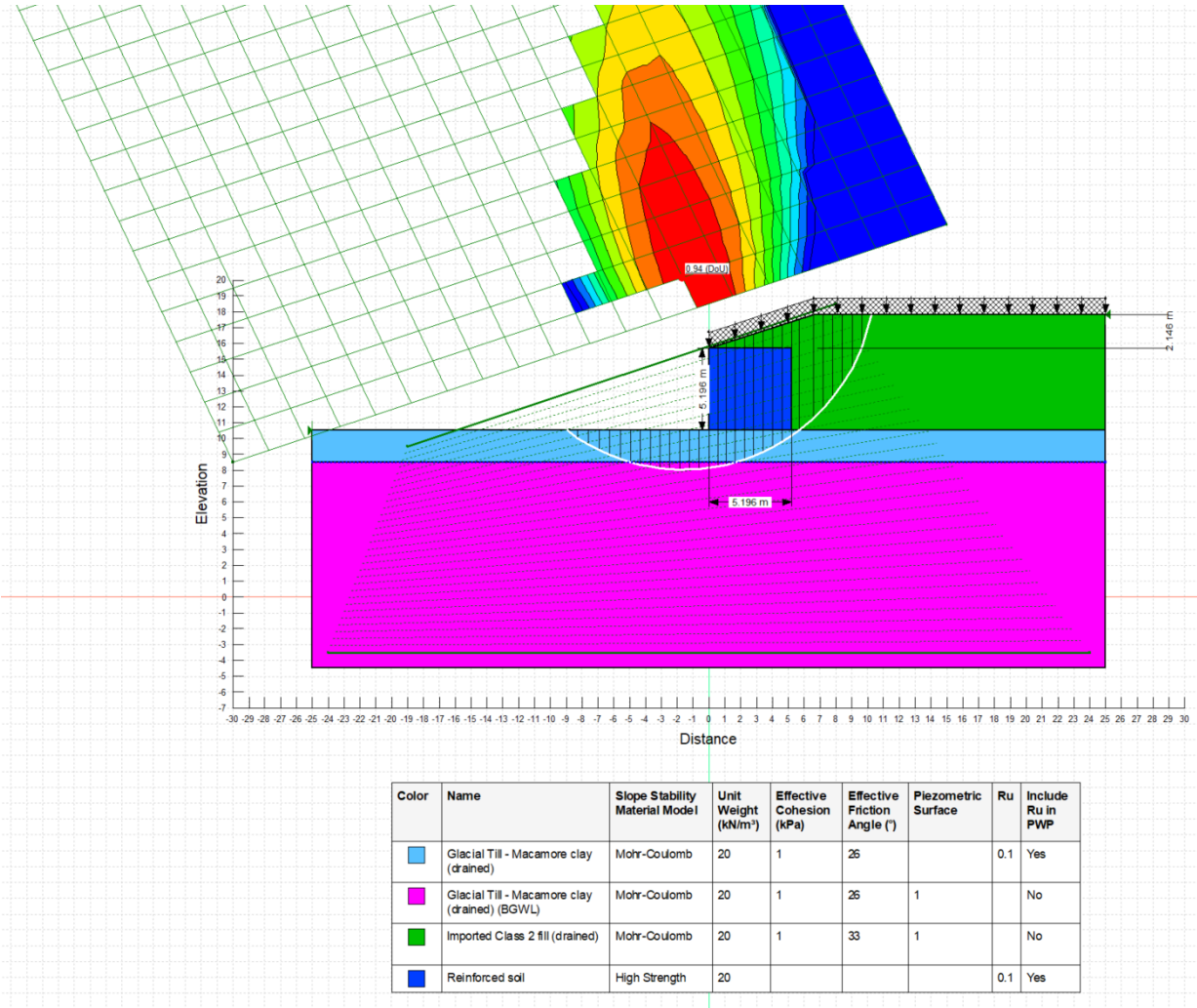


Figure A.33: Section 2 – drained - DA1-2 – L/H = 1

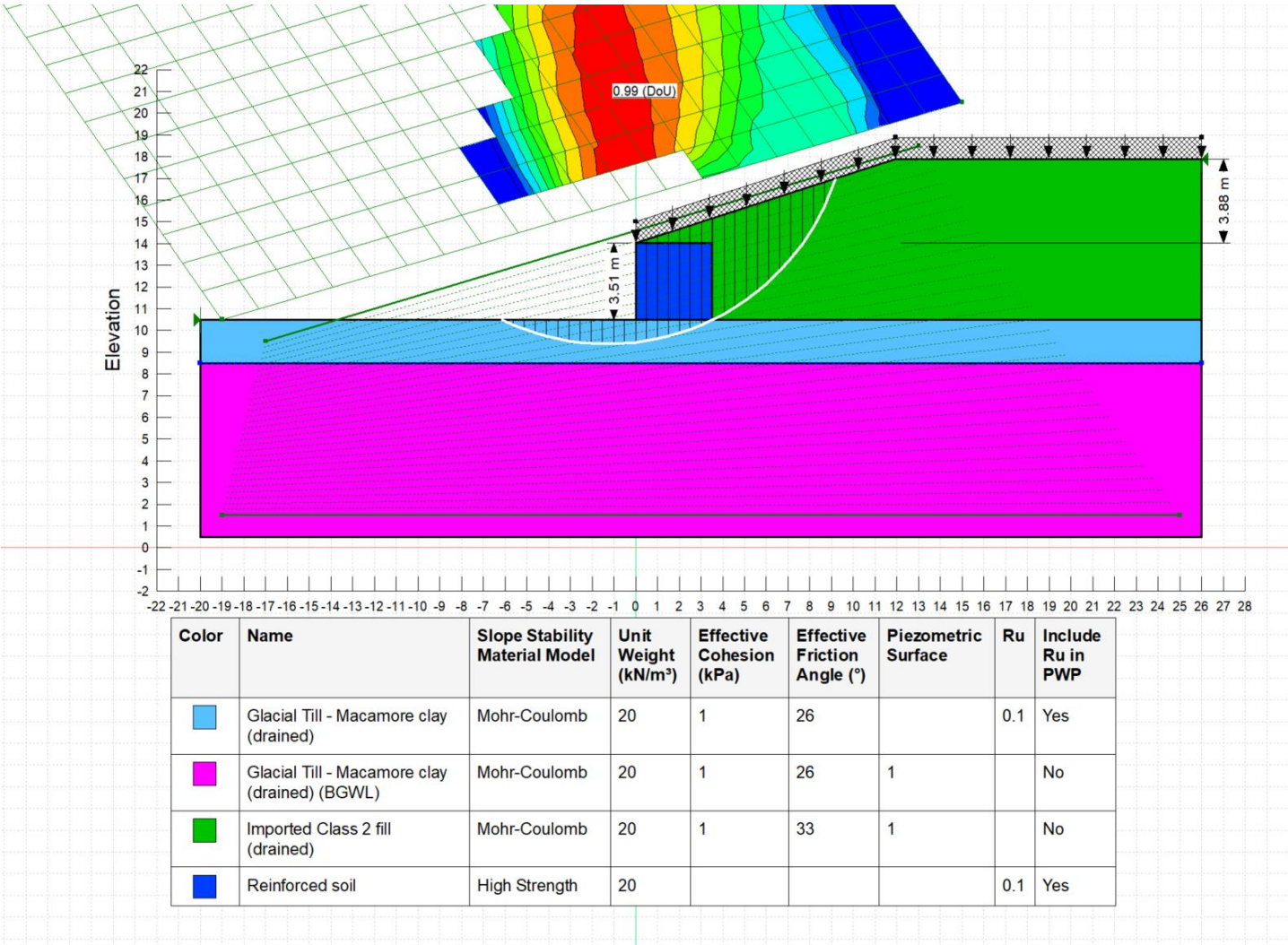


Figure A.34: Section 3 – drained - DA1-2 - L/H = 0.9

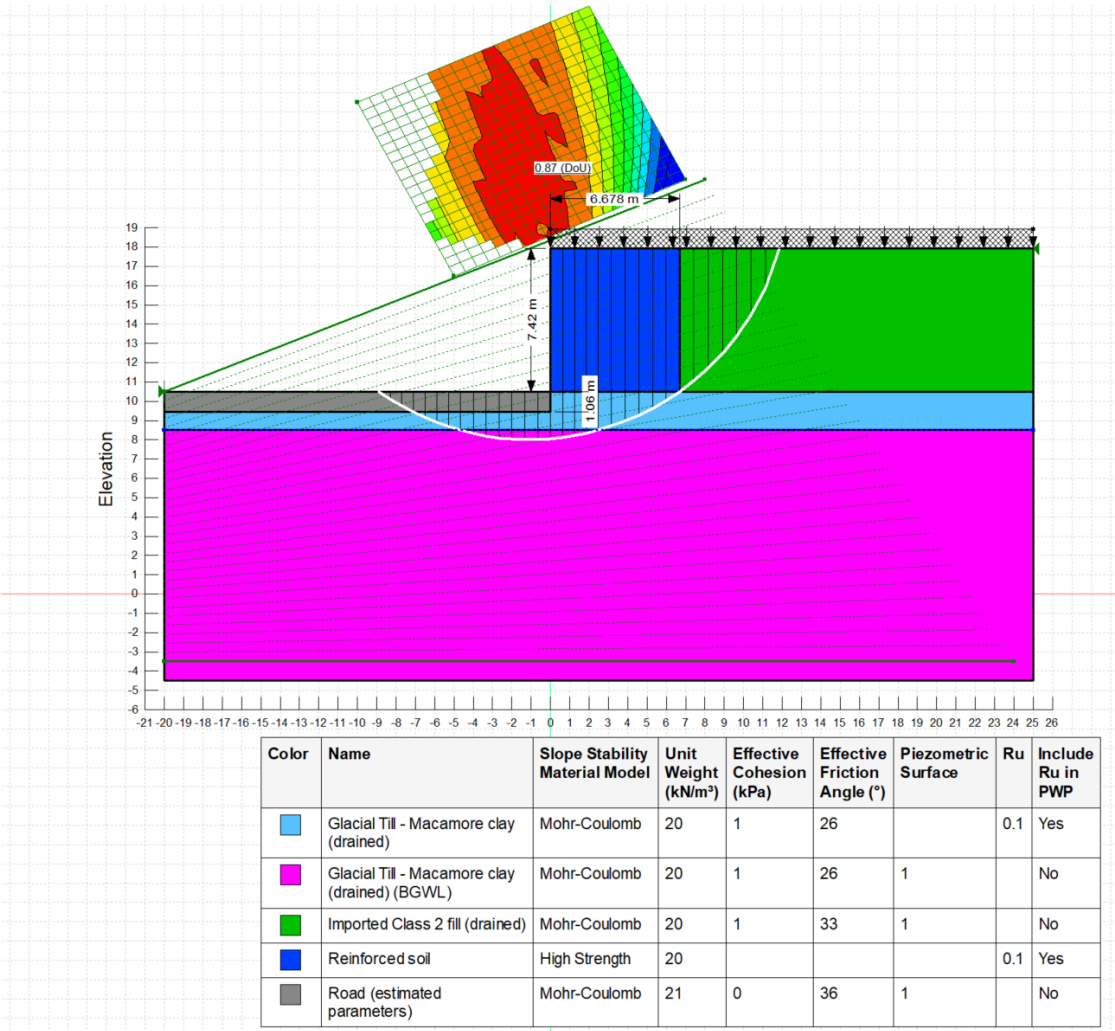


Figure A.35: Section 3 – road excavated - undrained – DA1-2 – L/H = 1.25

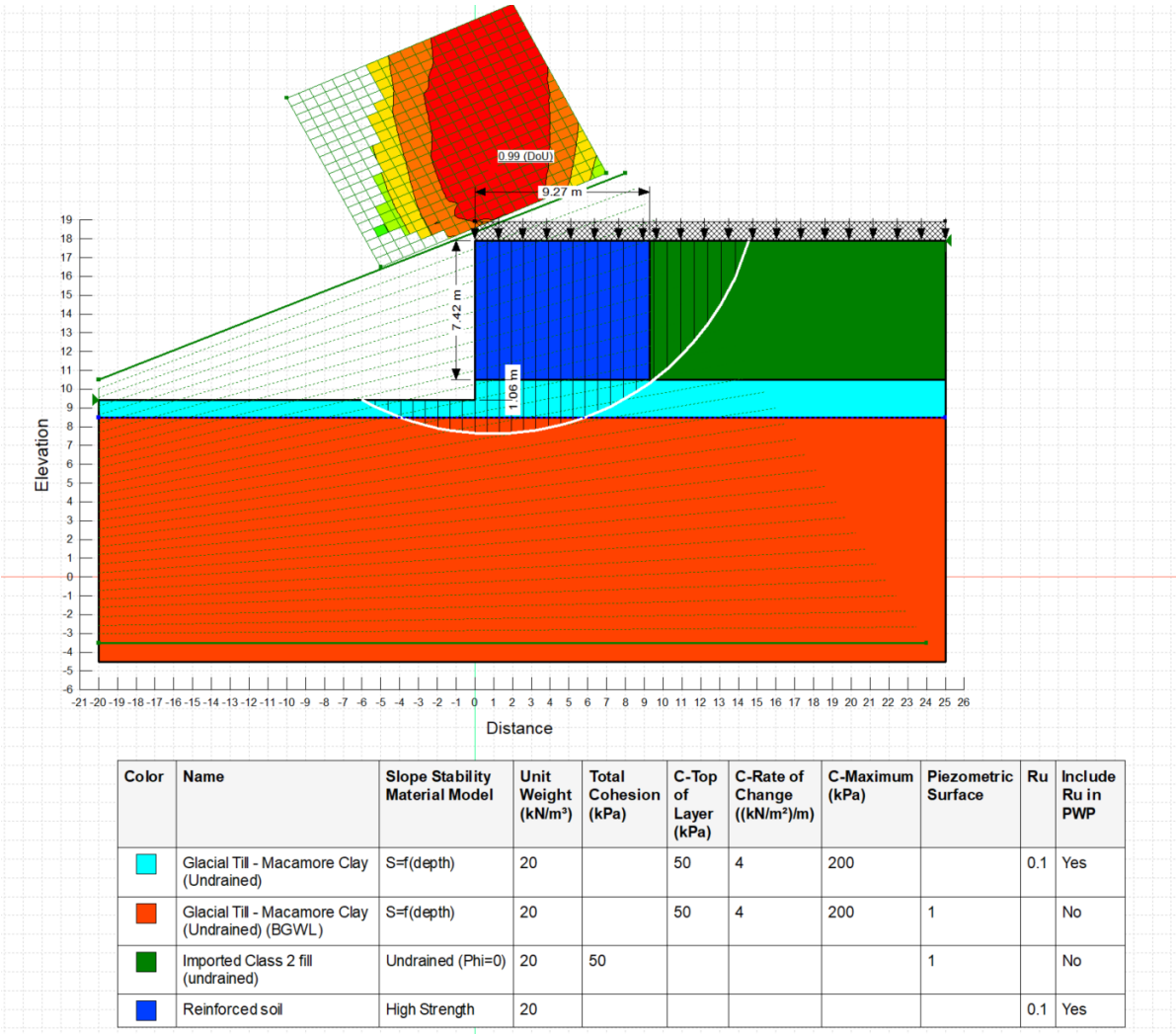


Figure A.36: Attenuation tank – drained – DA1-1

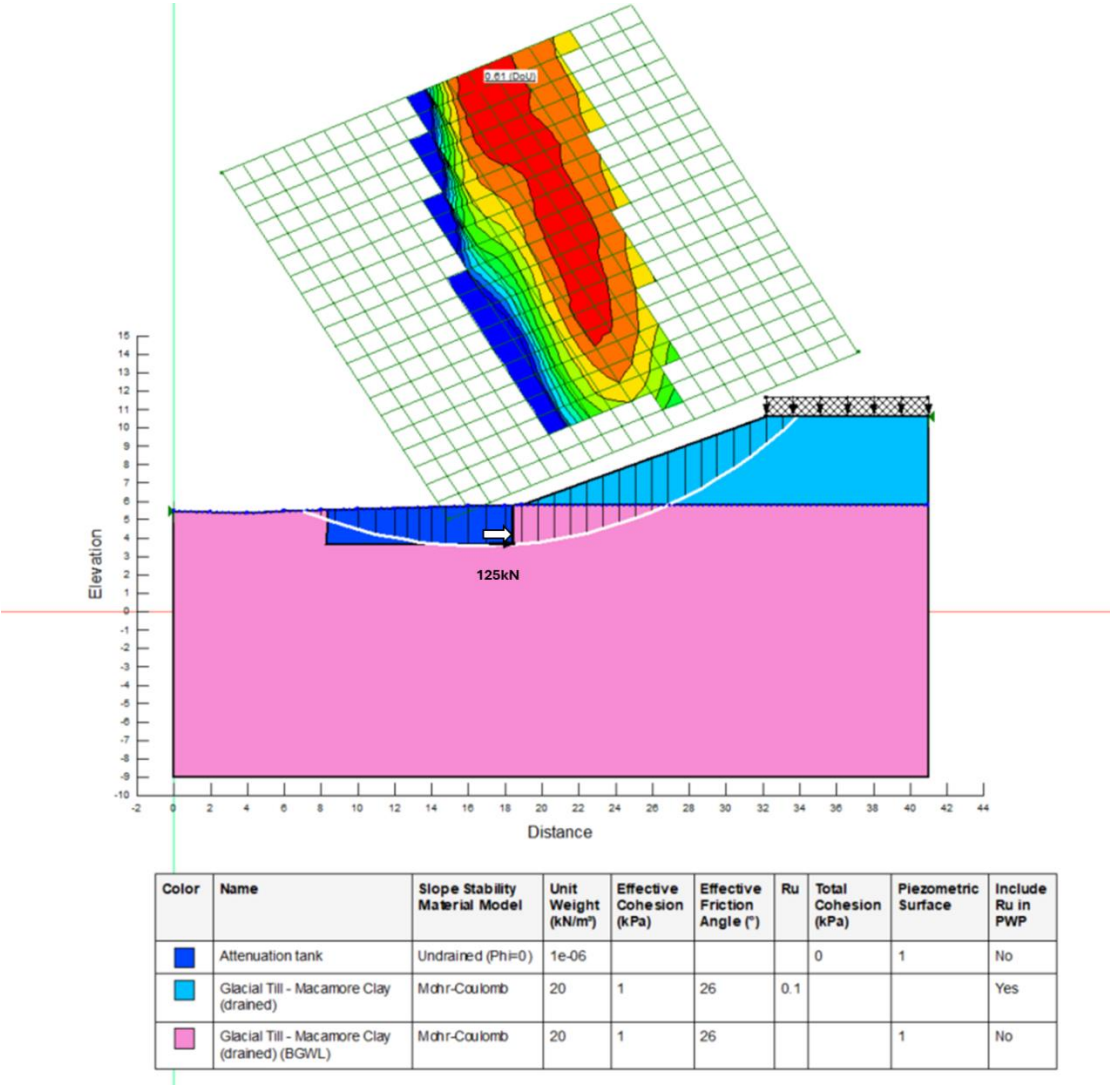


Figure A.37: Attenuation tank – drained – DA1-2

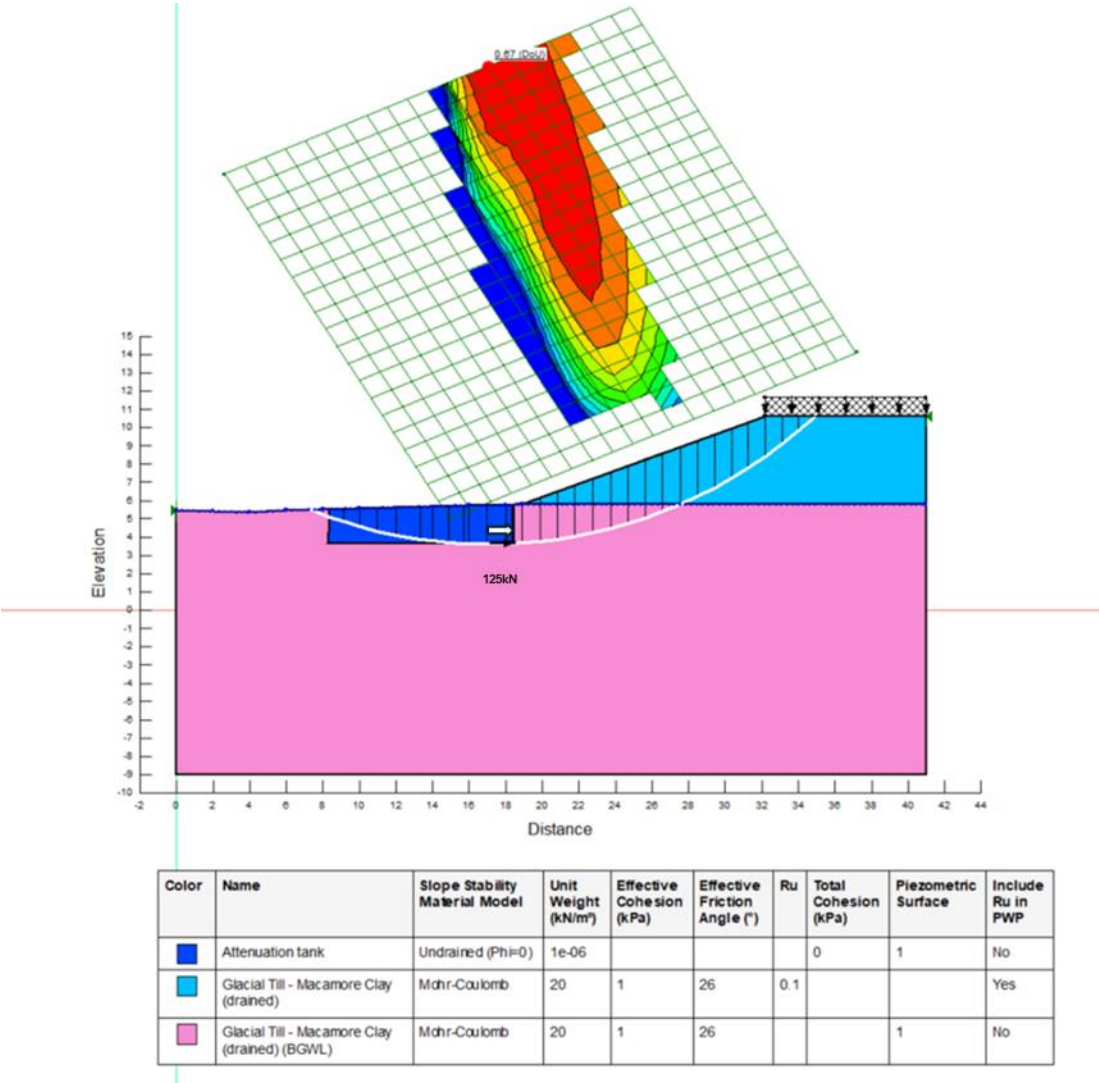


Figure A.38: Attenuation tank – undrained – DA1-1

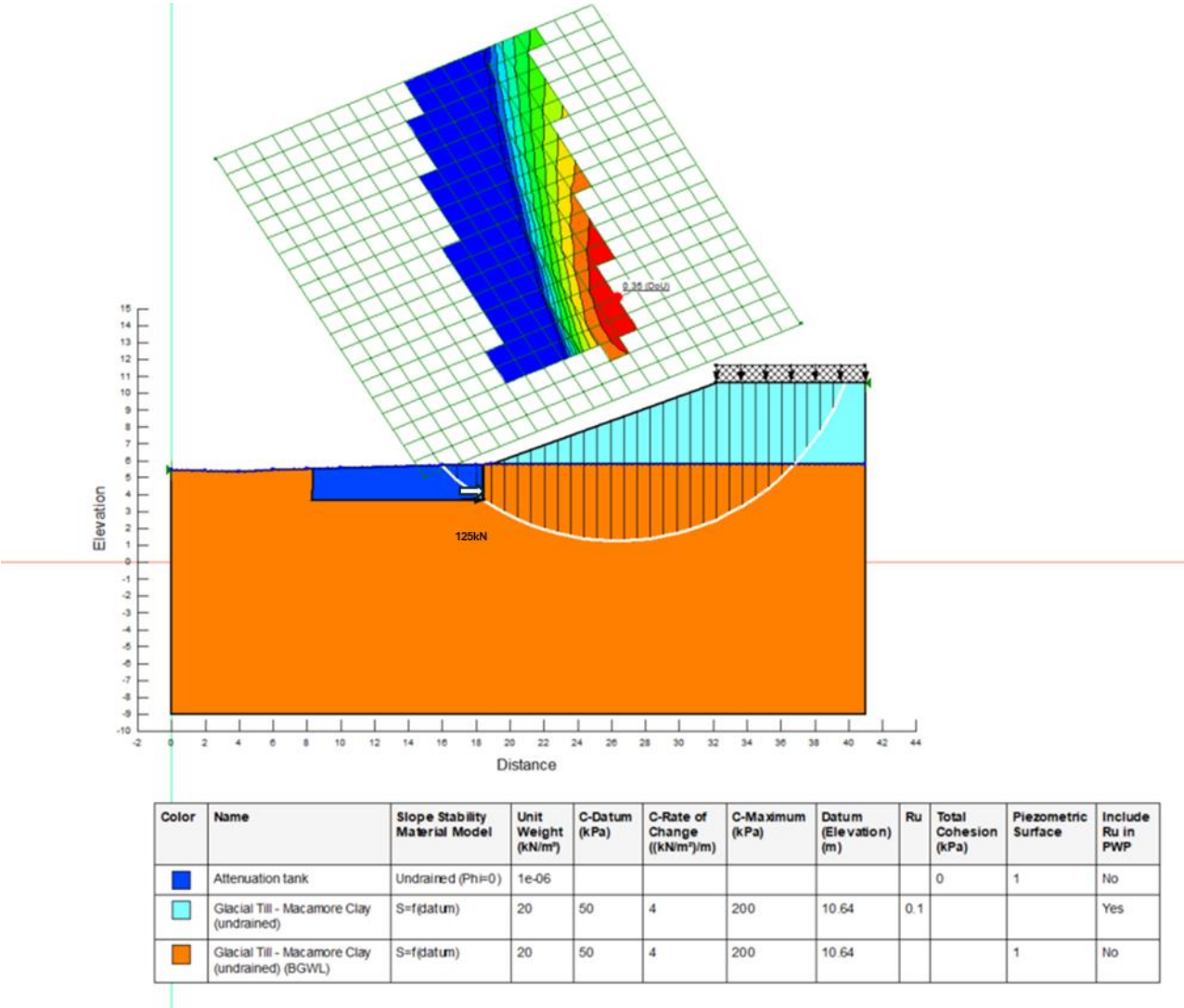
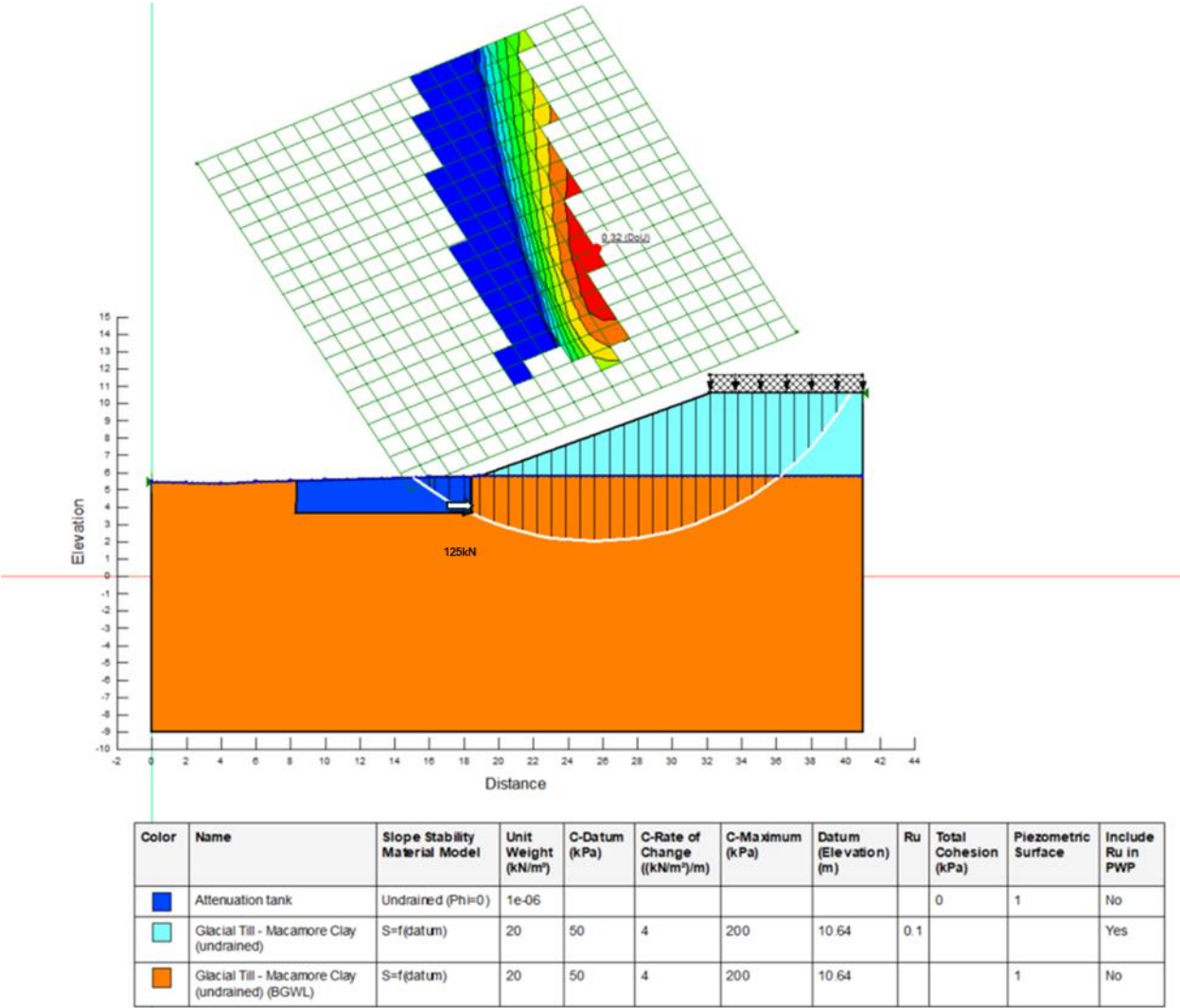


Figure A.39: Attenuation tank – undrained – DA1-2



B. Re-use of materials analysis

Figure B.1: Glacial Till – Macamore Clay Particle Size Distribution

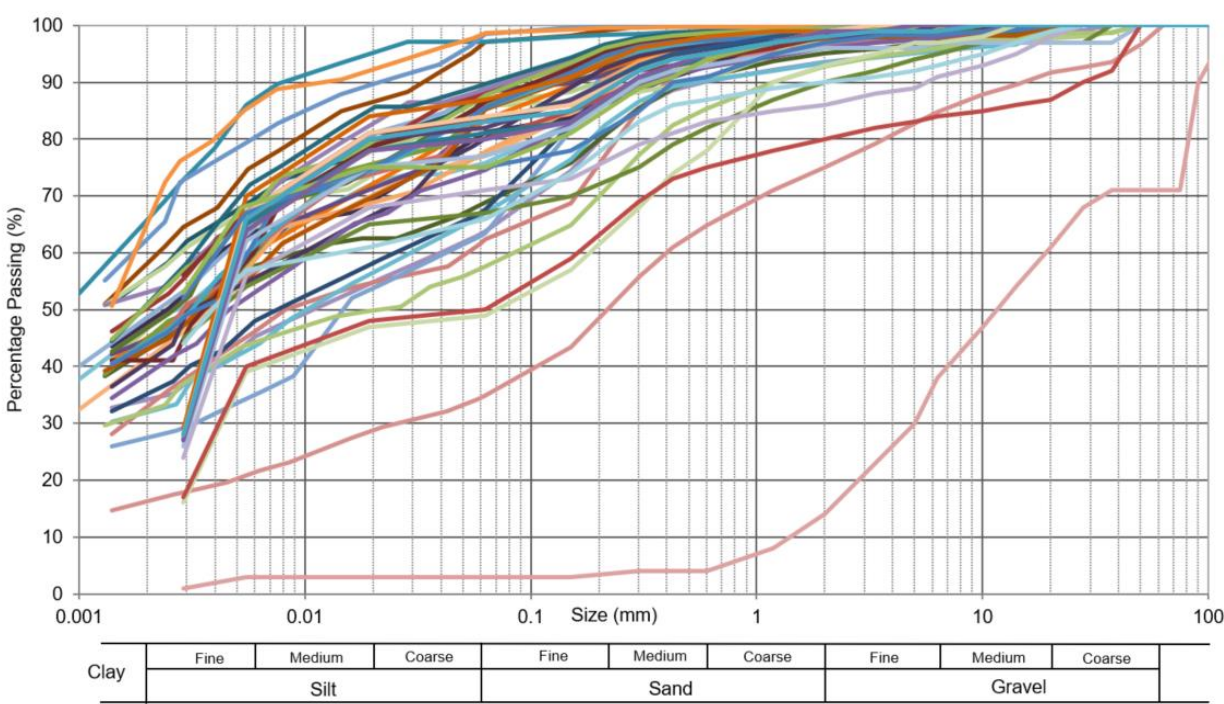


Figure B.2: Glacial Till – Macamore Clay compaction curves

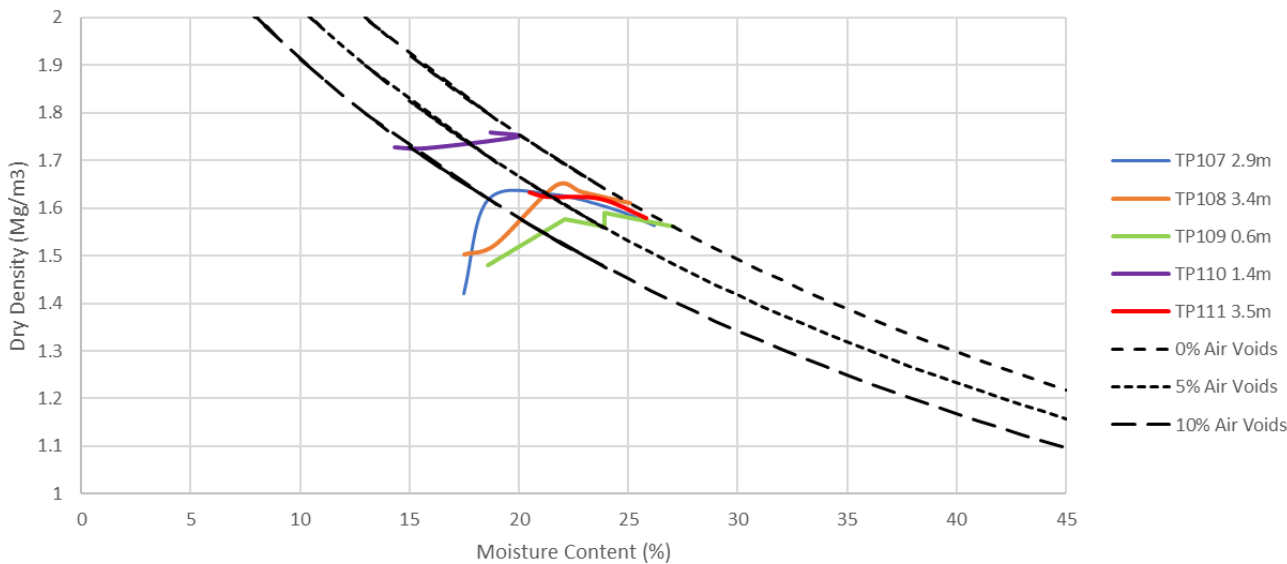
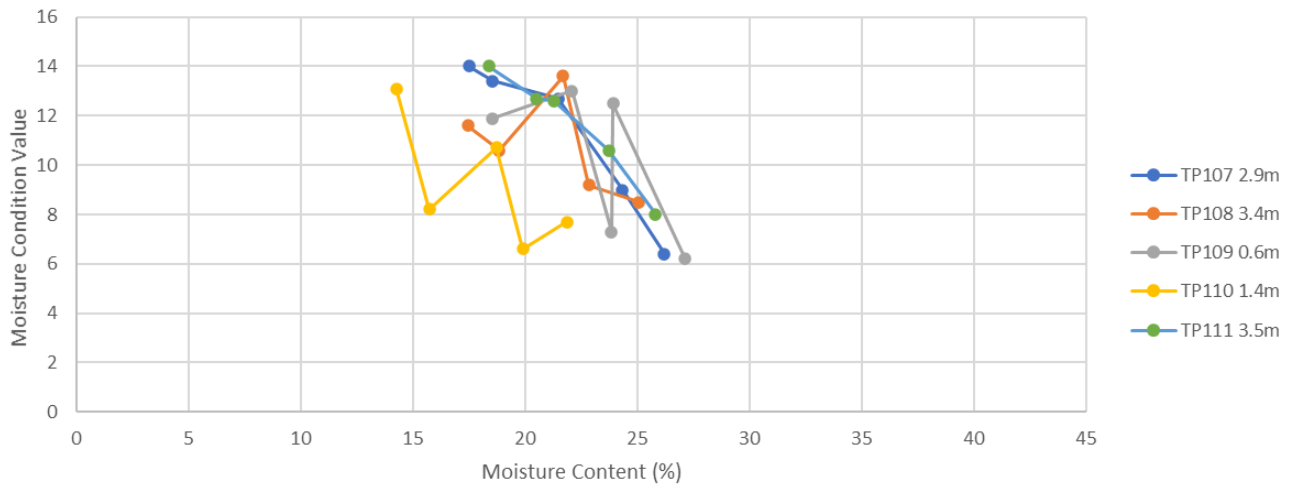
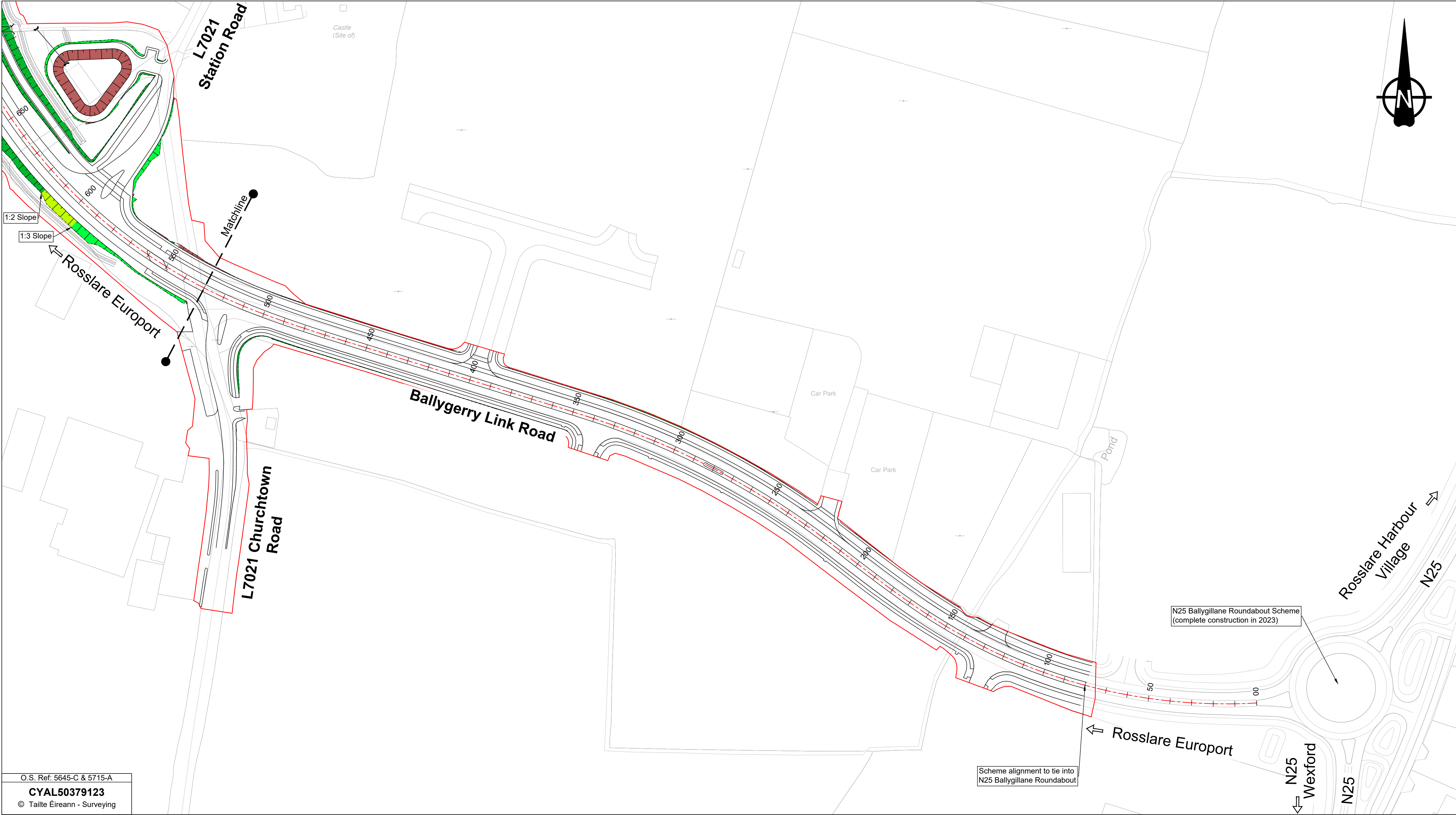


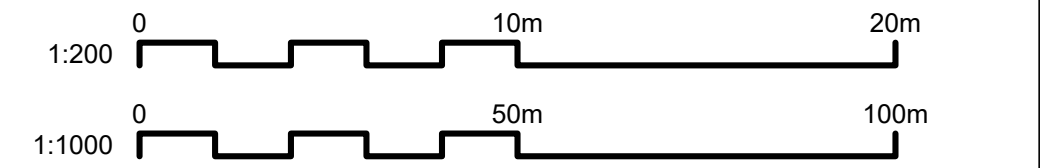
Figure B.3: Glacial Till – Macamore Clay Moisture Content against Moisture Condition Value



C. Standard Earthworks Details



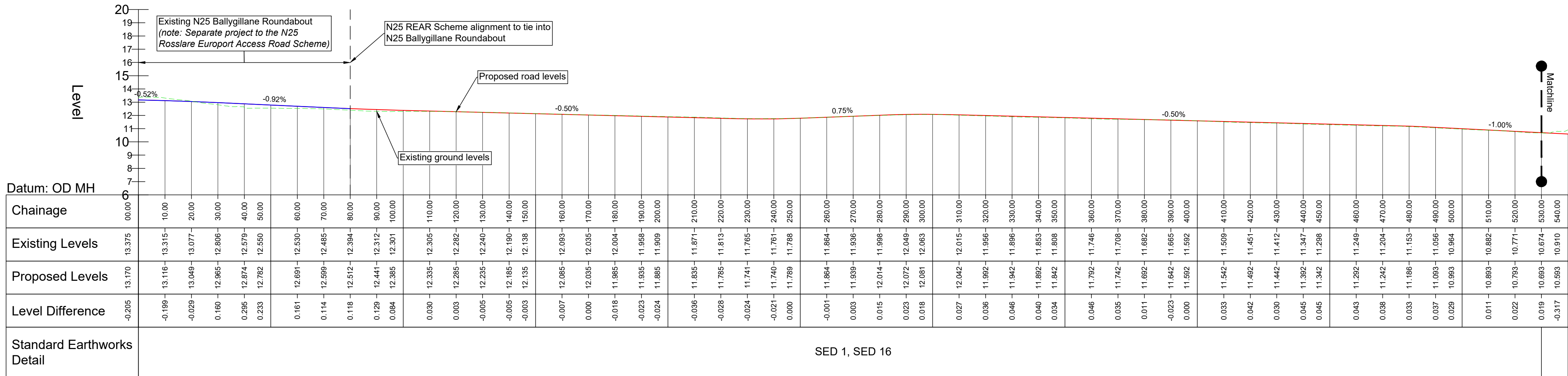
Key to symbols	
	Site Extent Boundary
	Proposed Horizontal Alignment
	Earthwork - Cut Embankment Slope 1 to 2.75
	Earthwork - Fill Embankment Slope 1 to 2
	Earthwork - Fill Embankment Slope 1 to 3
	Earthwork - Fill Embankment Transition



- Notes
- All dimensions are metres unless otherwise shown. Use figure dimensions only. Do not scale from this drawing. All dimensions to be checked on site.
 - All levels in metres O.D. (Malin).
 - This drawing is to be used for the design element identified in the titlebox. Other information shown is to be considered indicative only. The drawing is to be read in conjunction with all other relevant design drawings.
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 - This drawing shall be read in conjunction with Standard Earthwork Details (SED) drawings 29100548-MMD-0600-RE-DR-C-2201 to 2203, series 600 Specification and its Appendices.
 - Additional Standard Earthwork Details, as shown in drawings 29100584-MMD-0600-RE-DR-C-2201 to 2203 to be applied where required by the Designer's Site Representative or dependent on ground conditions encountered.

O.S. Ref: 5645-C & 5715-A
CYAL50379123
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N25 REAR MAINLINE - LONGITUDINAL SECTION - A01
SCALE: H 1:1000,V 1:200. DATUM: 6.000



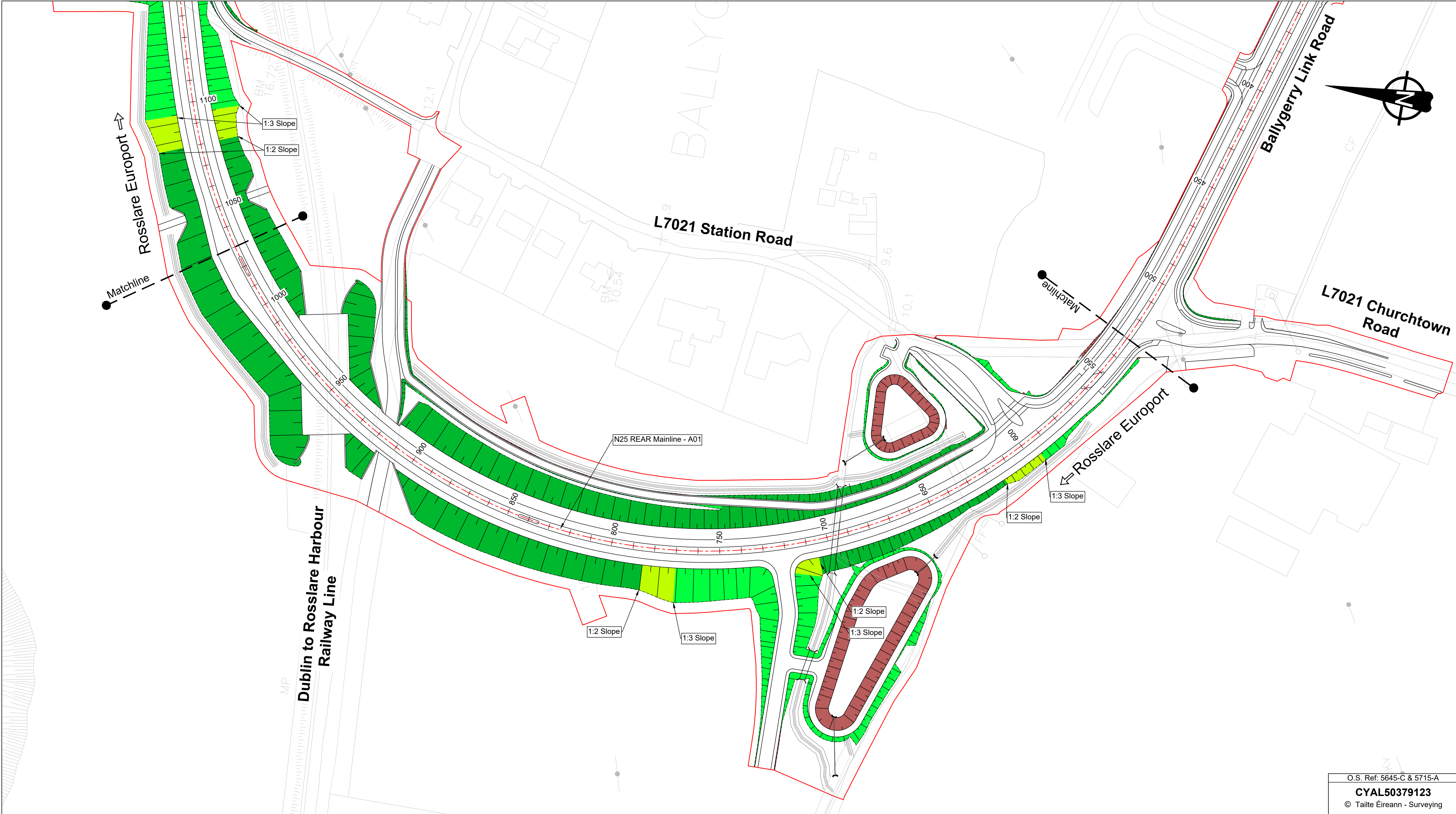
SED 1, SED 16

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P02	15/11/2024	ME	Updated following Client review	TB	JS
P01	19/09/2024	ME	Issue for Client review	TB	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd
M M MOTT MACDONALD 5 Eastgate Avenue Eastgate Little Island Cork Ireland T +353 (0) 21 4809800 E +353 (0) 21 4809801 W www.mottmac.com					
Client			Comhairle Contae Loch Garman Wexford County Council Wexford County Council Carricklawn Wexford Y35 WY93		
Title					
N25 Rosslare Europort Access Road Earthworks Plans and Longitudinal Sections					
Sheet 1 of 7					
Designed	L.Brooks	LB	Eng check	T.Bird	TB
Drawn	M.Ebert	ME	Coordination	J. O'Riordan	JOR
Dwg check	T.Bird	TB	Approved	J.Shinkwin	JS
Scale at A1	1:1000	Status	PRE	Rev	P02
				Security	STD
Drawing Number					
229100548-MMD-0600-RE-DR-C-2101					



Key to symbols

Site Extent Boundary

Proposed Horizontal Alignment

Earthwork - Cut Embankment Slope 1 to 2.75

Earthwork - Fill Embankment Slope 1 to 2

Earthwork - Fill Embankment Slope 1 to 3

Earthwork - Fill Embankment Transition

1:200

010m20m

1:1000

050m100m

Notes

1.

All dimensions are metres unless otherwise shown. Use figure dimensions only. Do not scale from this drawing. All dimensions to be checked on site.

2.

All levels in metres O.D. (Malin).

3.

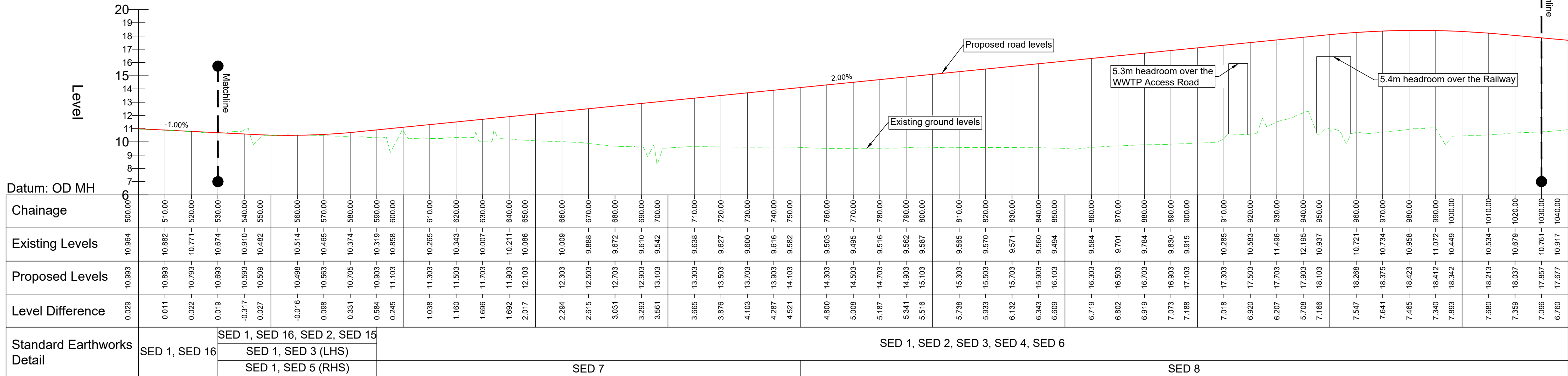
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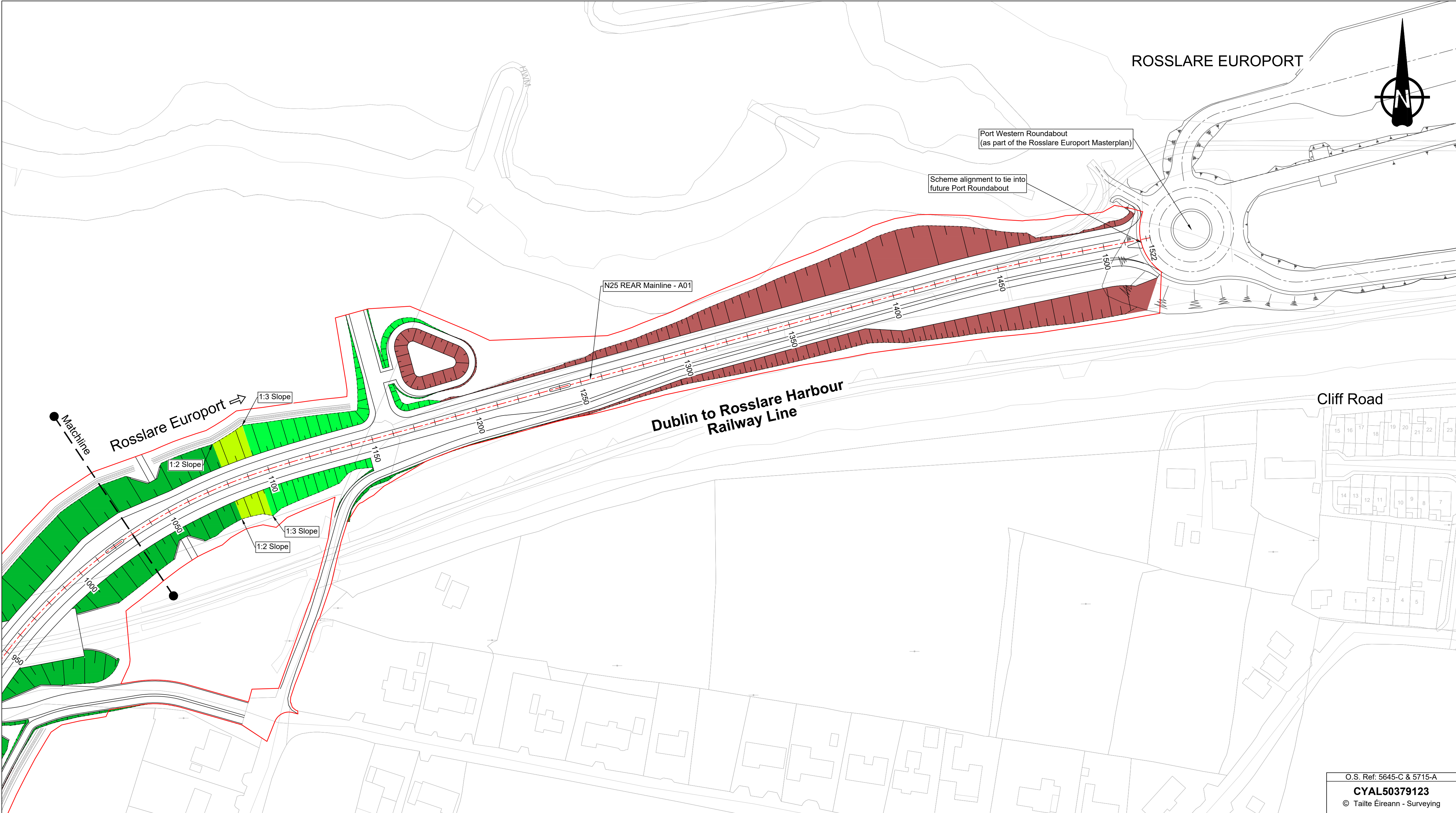
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6.

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N25 REAR MAINLINE - LONGITUDINAL SECTION - A01
SCALE: H 1:1000,V 1:200. DATUM: 6.000





Key to symbols

Site Extent Boundary

Proposed Horizontal Alignment

Earthwork - Cut Embankment Slope 1 to 2.75

Earthwork - Fill Embankment Slope 1 to 2

Earthwork - Fill Embankment Slope 1 to 3

Earthwork - Fill Embankment Transition

1:200

010m20m

1:1000

050m100m

- Notes
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5. This drawing shall be read in conjunction with Standard Earthwork Details (SED) drawings 29100548-MMD-0600-RE-DR-C-2201 to 2203, series 600 Specification and its Appendices.

6. Additional Standard Earthwork Details, as shown in drawings 29100584-MMD-0600-RE-DR-C-2201 to 2203 to be applied where required by the Designer's Site Representative or dependent on ground conditions encountered.

O.S. Ref: 5645-C & 5715-A

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P02	15/11/2024	ME	Updated following Client review	TB	JS
P01	06/09/2024	ME	Issue for Client review	TB	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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County Council

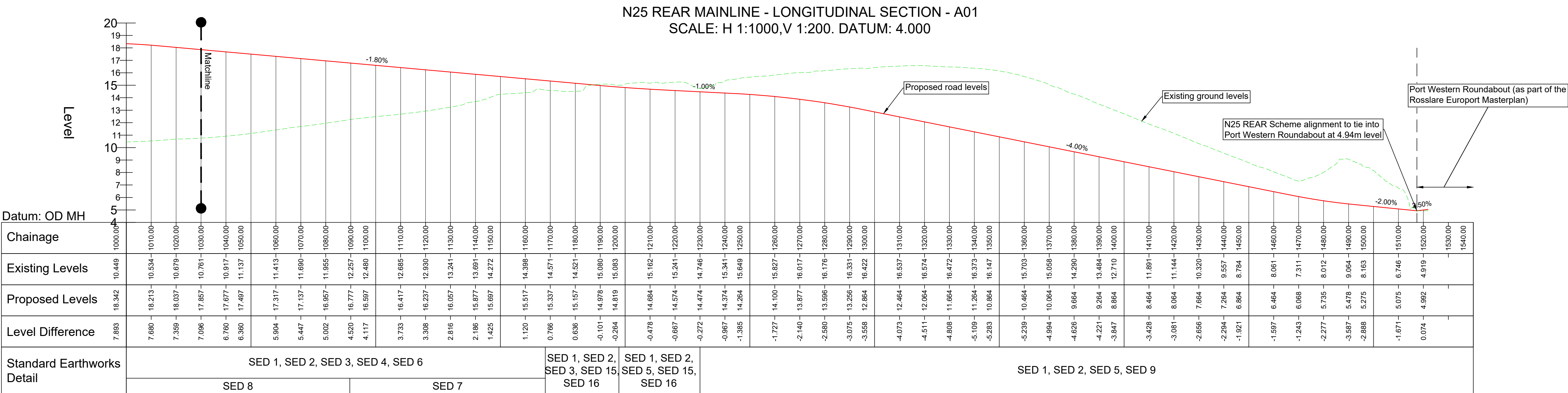
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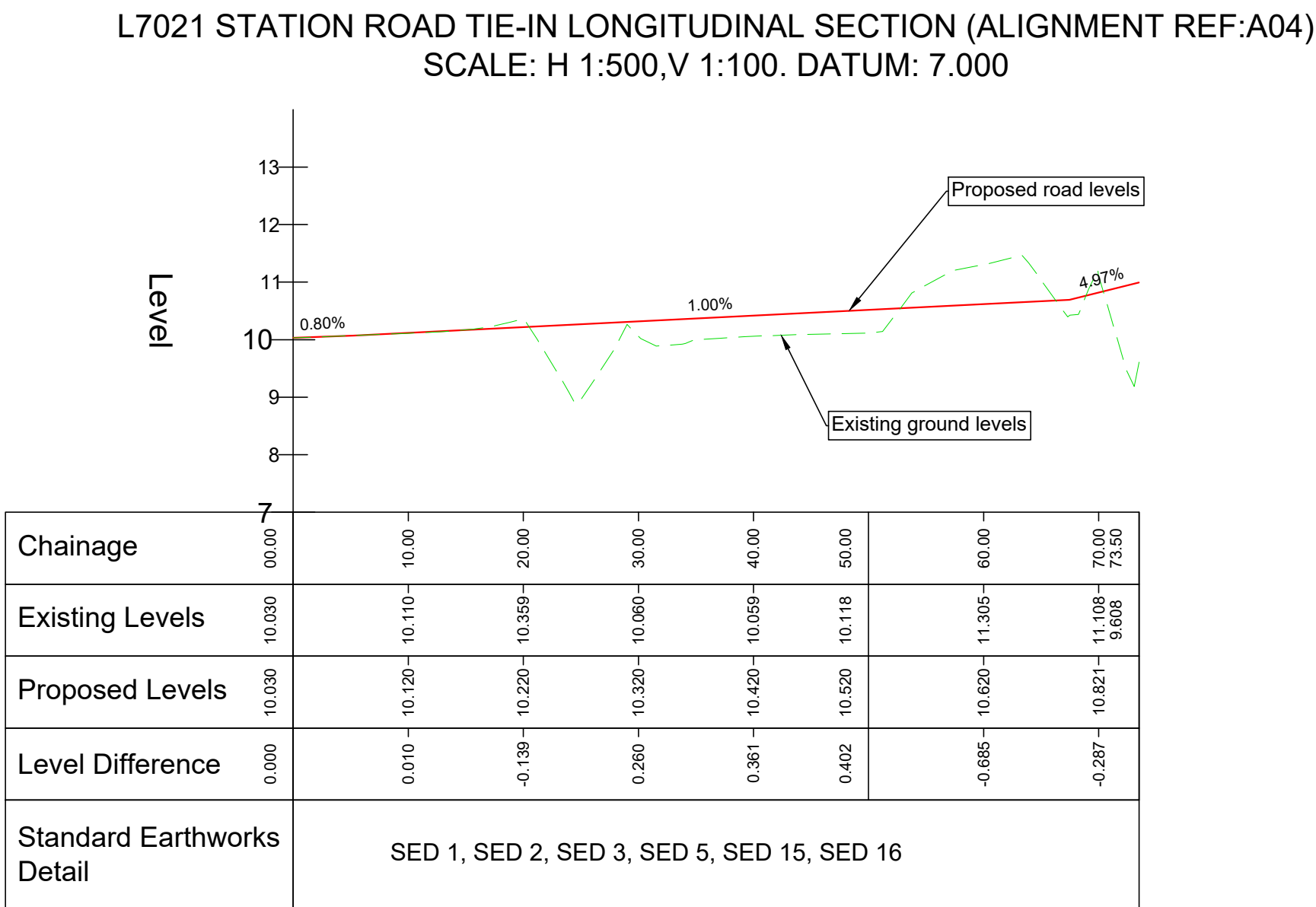
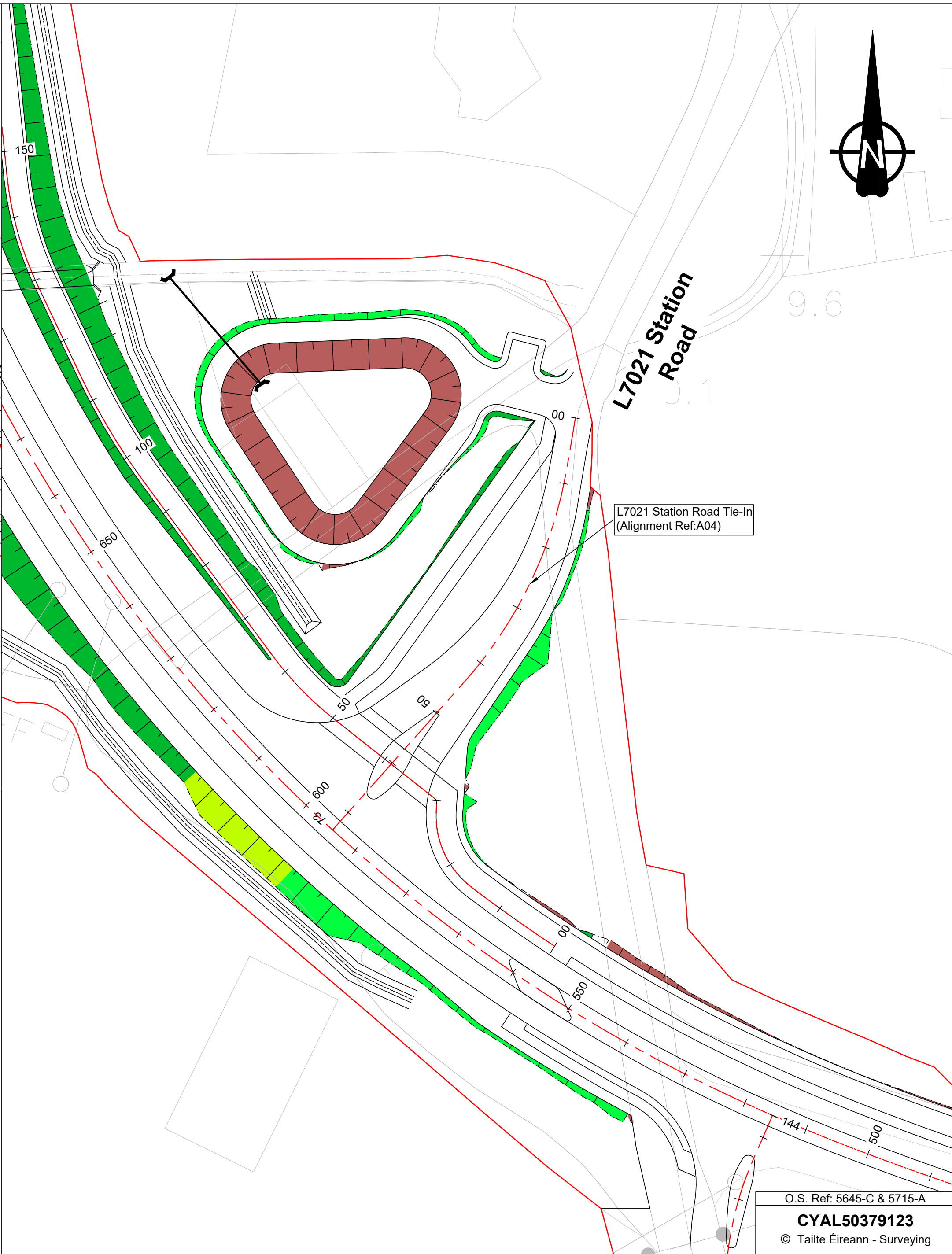
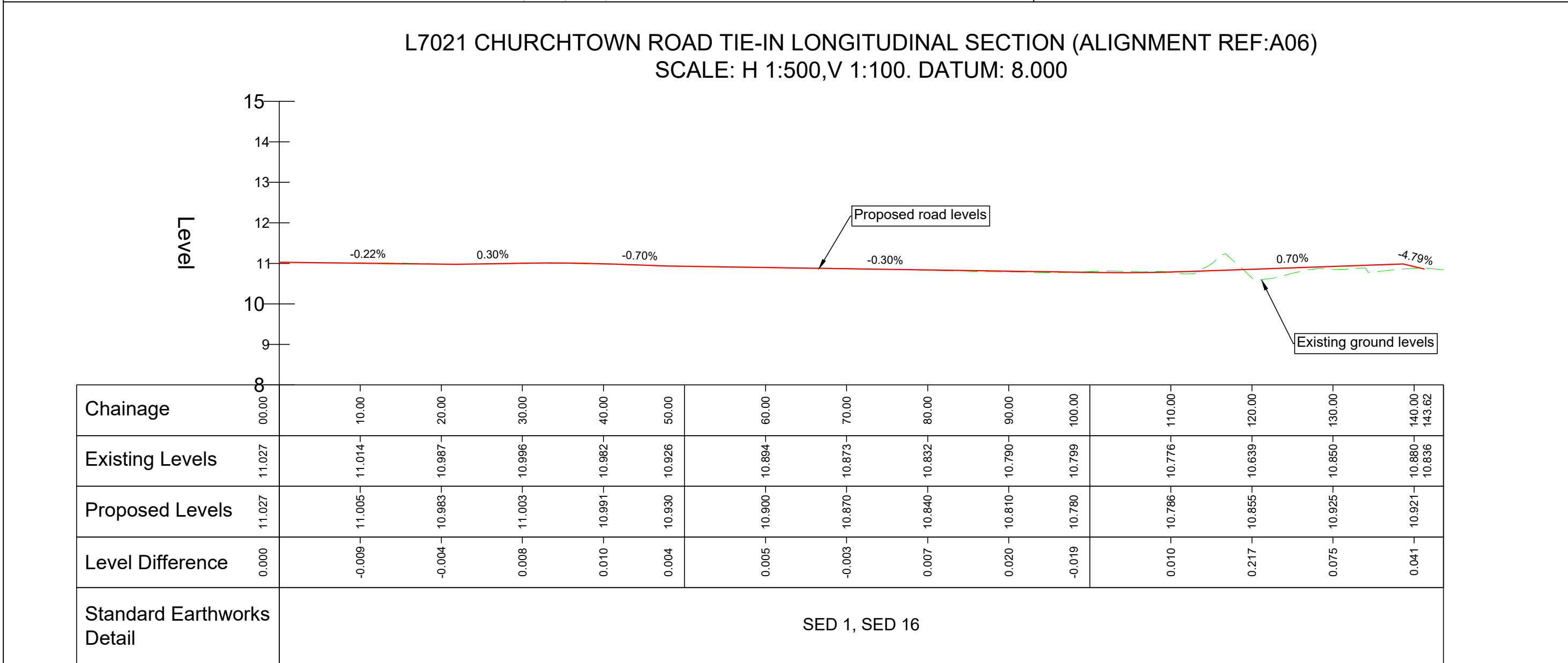
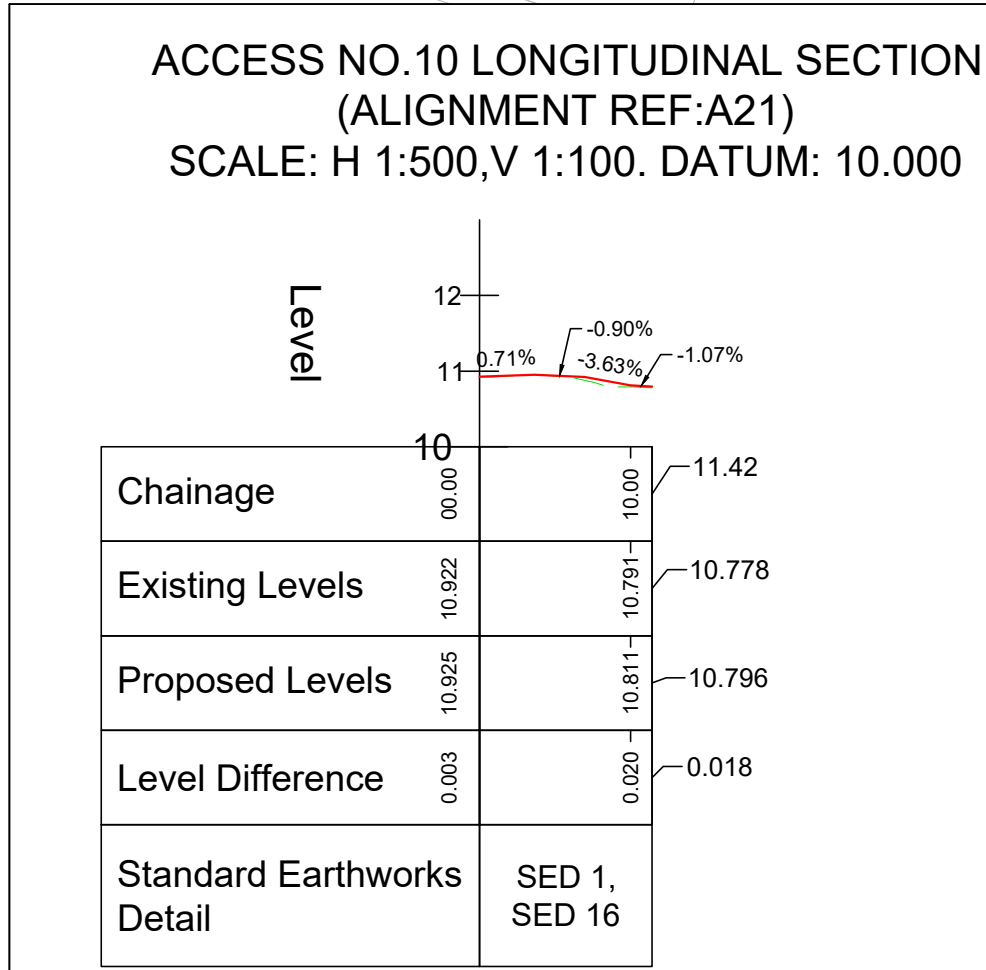
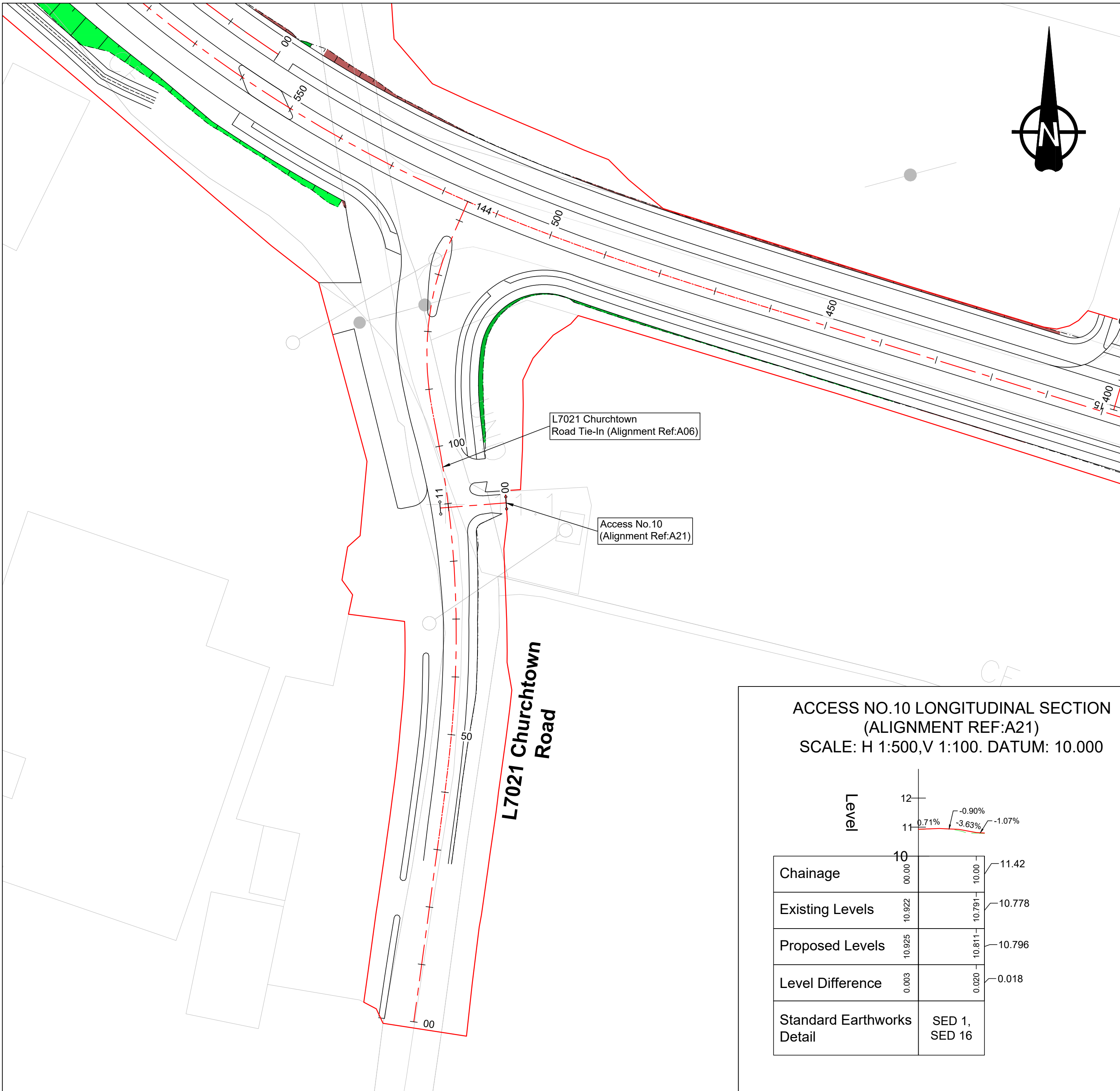
Title

N25 Rosslare Europort Access Road
Earthworks Plans and
Longitudinal Sections

Sheet 3 of 7

Designed	L.Brooks	LB	Eng check	T.Bird	TB
Drawn	M.Ebert	ME	Coordination	J.O'Riordan	JOR
Dwg check	T.Bird	TB	Approved	J.Shinkwin	JS
Scale at A1	1:1000	Status	PRE	Rev	P02
				Security	STD
Drawing Number					
229100548-MMD-0600-RE-DR-C-2103					





Key to symbols

- Site Extent Boundary
- Proposed Horizontal Alignment
- Earthwork - Cut Embankment Slope 1 to 2.75
- Earthwork - Fill Embankment Slope 1 to 2
- Earthwork - Fill Embankment Slope 1 to 3
- Earthwork - Fill Embankment Transition

Notes

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Scale

1:100 0 5m 10m

1:500 0 25m 50m

Rev

Rev	Date	Drawn	Description	Ch'k'd	App'd
P02	15/11/2024	ME	Updated following Client review	TB	JS
P01	06/09/2024	ME	Issue for Client review	TB	JS

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Title

N25 Rosslare Europort Access Road
Earthworks Plans and
Longitudinal Sections

Sheet 4 of 7

Designed	L.Brooks	LB	Eng check	T.Bird	TB
Drawn	M.Ebert	ME	Coordination	J.O'Riordan	JOR
Dwg check	T.Bird	TB	Approved	J.Shinkwin	JS

Scale at A1 1:500 PRE P02 STD

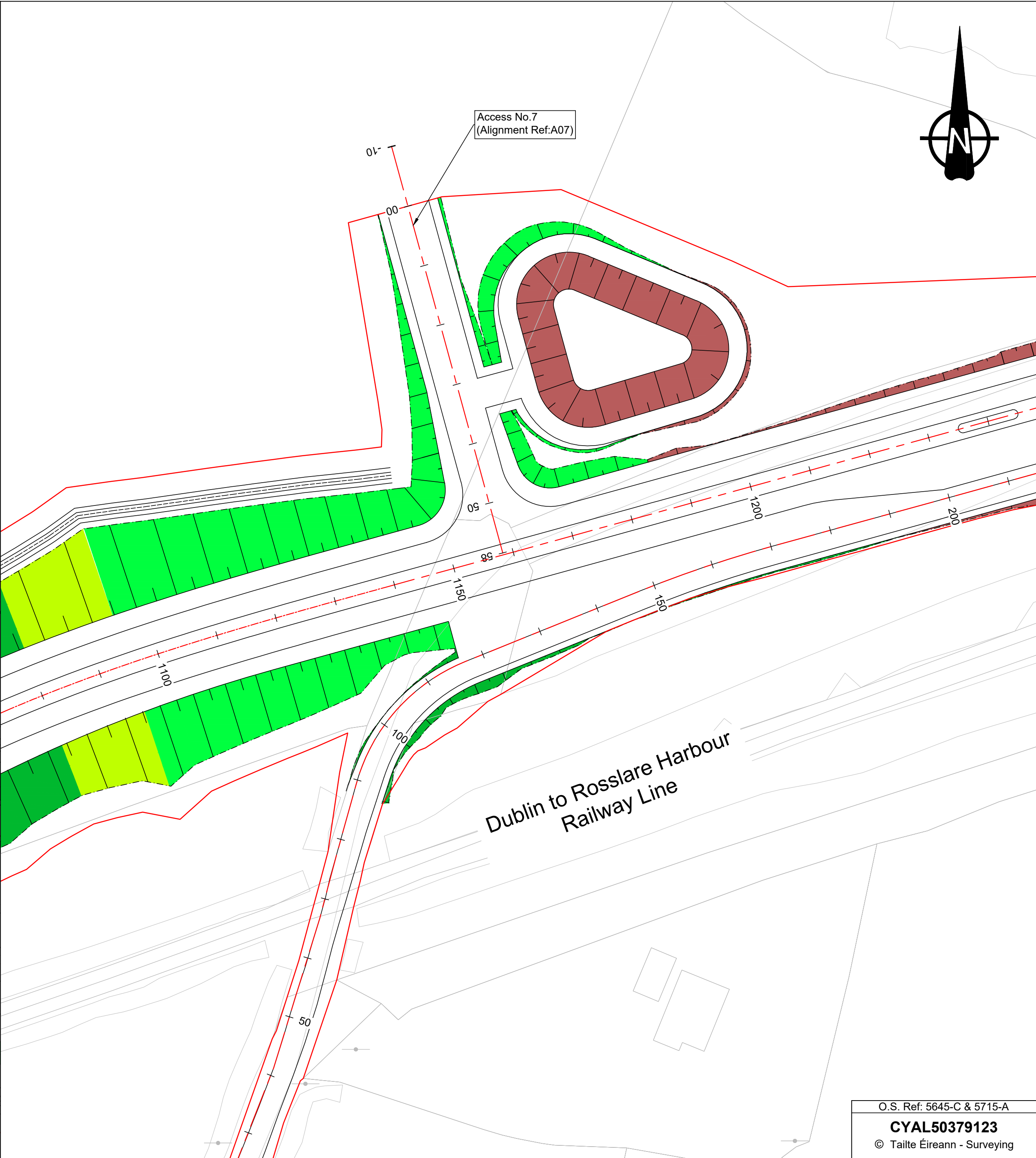
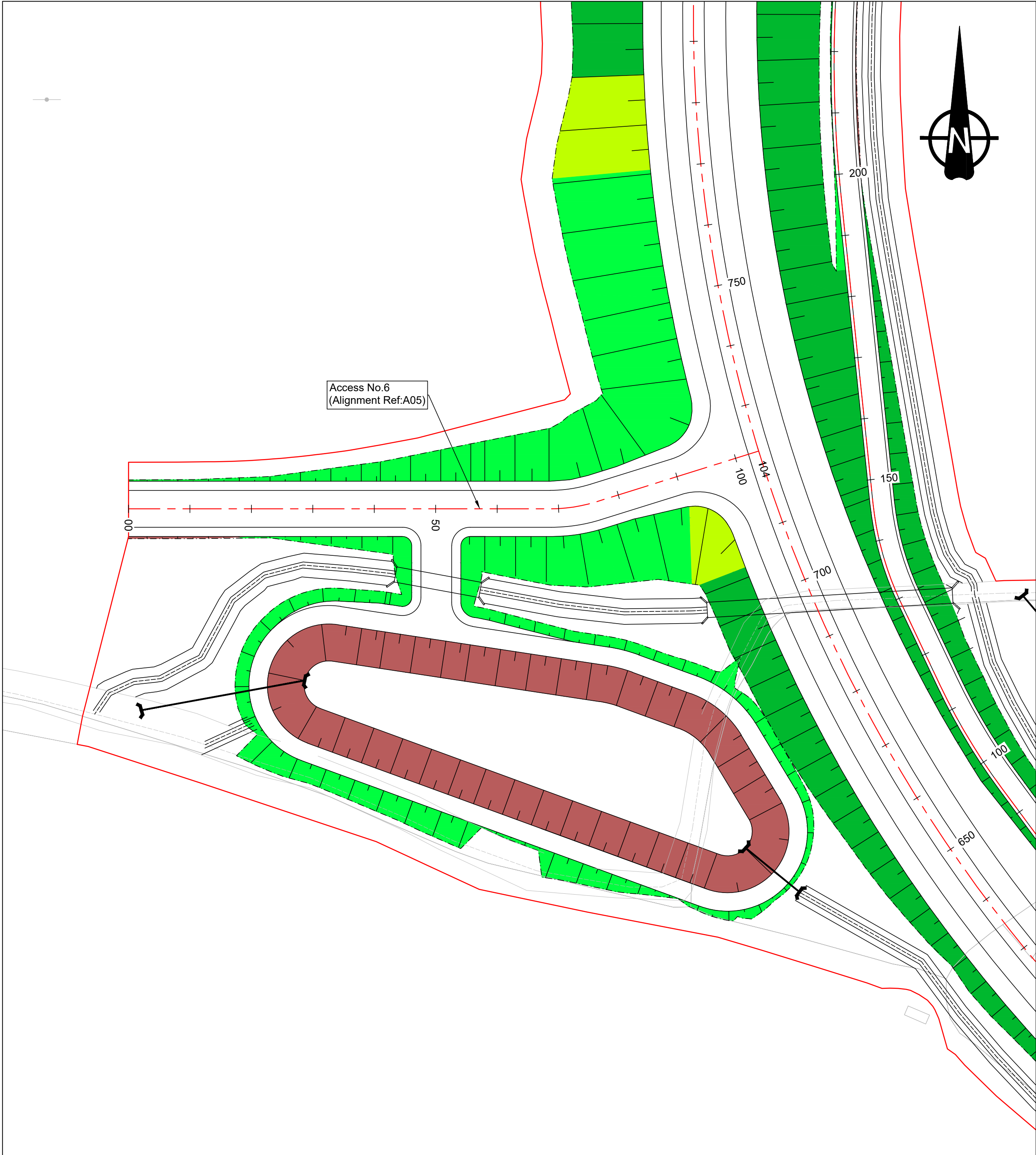
Status

Rev

Security

Drawing Number

229100548-MMD-0600-RE-DR-C-2104



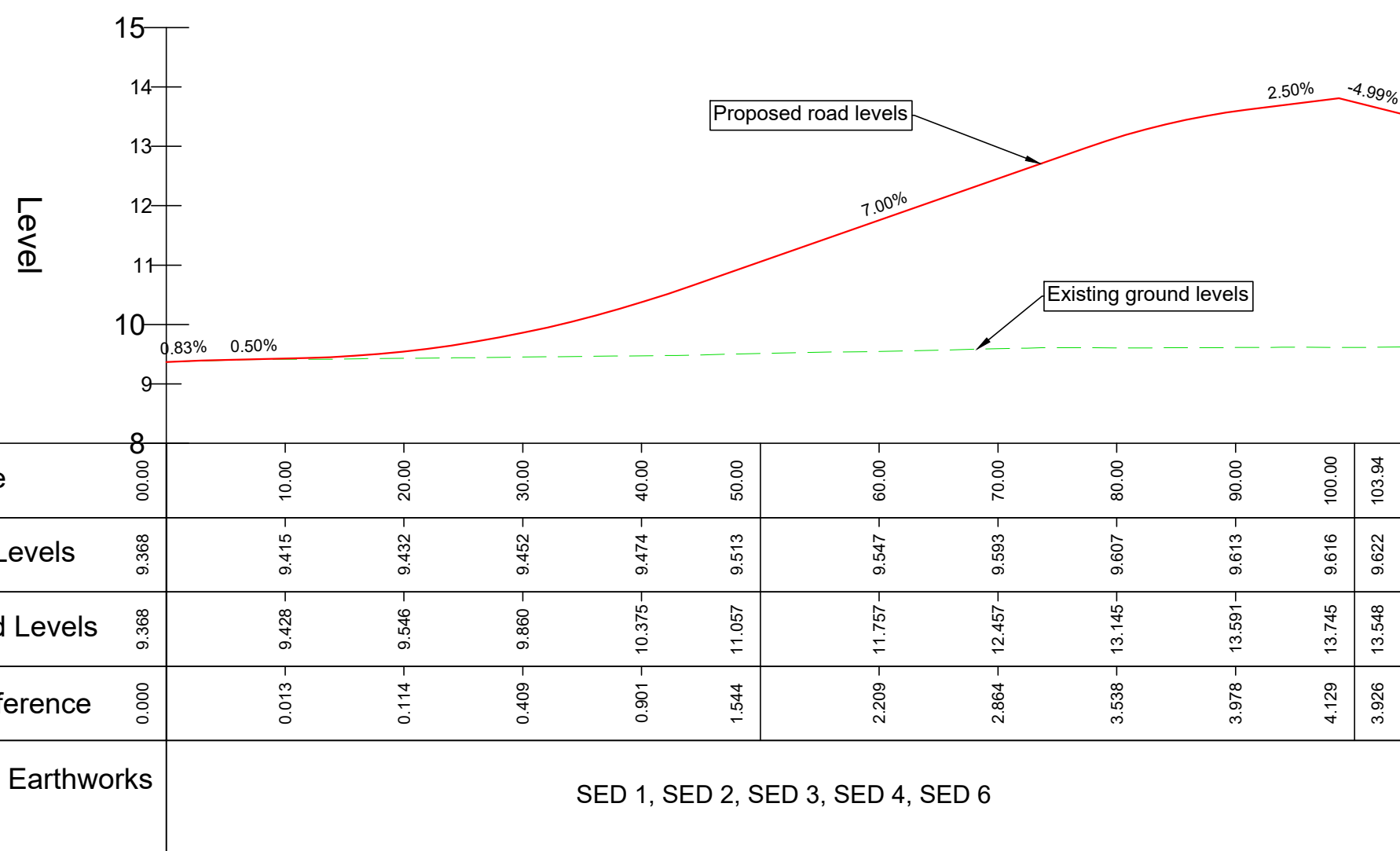
Key to symbols

- Site Extent Boundary
- Proposed Horizontal Alignment
- Earthwork - Cut Embankment Slope 1 to 2.75
- Earthwork - Fill Embankment Slope 1 to 2
- Earthwork - Fill Embankment Slope 1 to 3
- Earthwork - Fill Embankment Transition

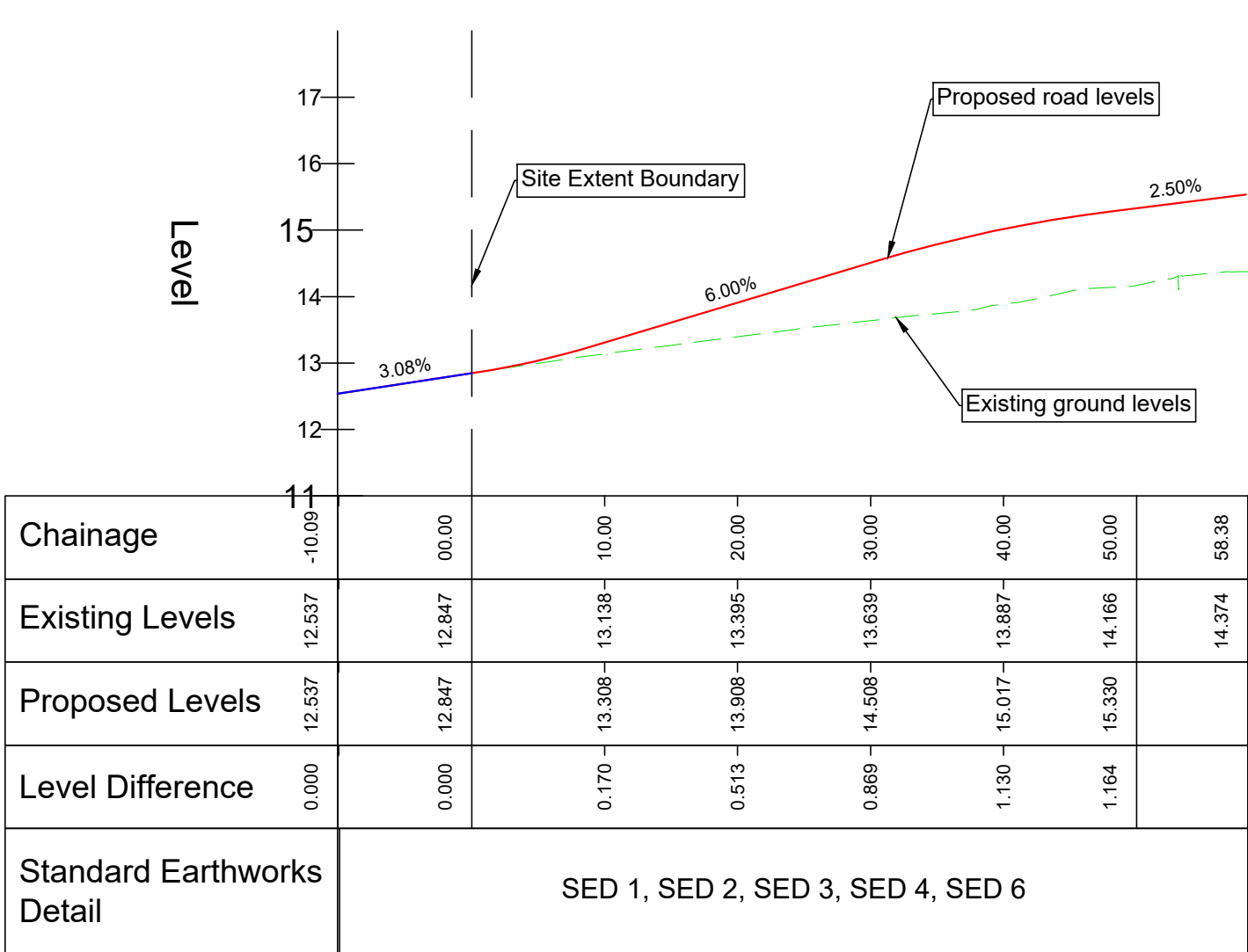
1:100 0 5m 10m
1:500 0 25m 50m

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ACCESS NO.6 LONGITUDINAL SECTION (ALIGNMENT REF:A05)
SCALE: H 1:500,V 1:100. DATUM: 8.000



ACCESS NO.7 LONGITUDINAL SECTION (ALIGNMENT REF:A07)
SCALE: H 1:500,V 1:100. DATUM: 11.000



P02	15/11/2024	ME	Updated following Client review	TB	JS
P01	06/09/2024	ME	Issue for Client review	TB	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Title

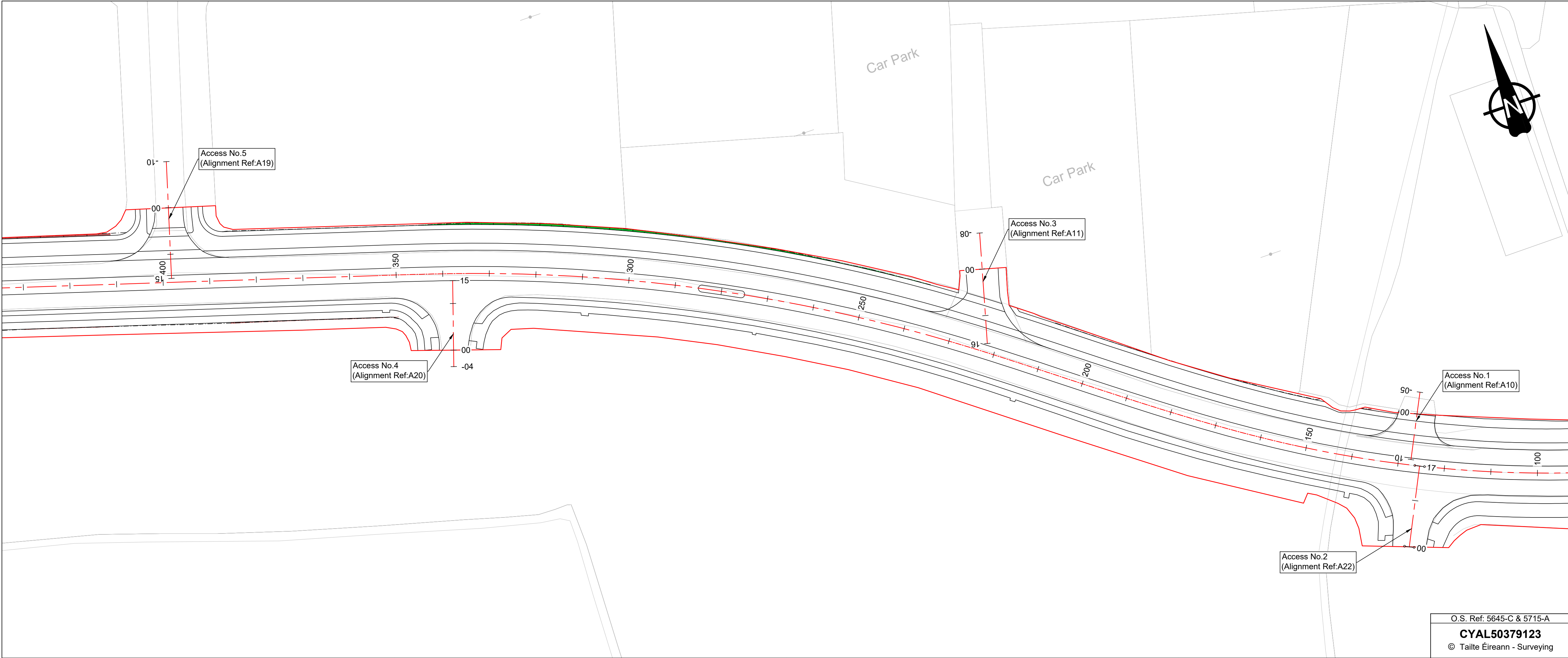
N25 Rosslare Europort Access Road
Earthworks Plans and
Longitudinal Sections

Sheet 5 of 7

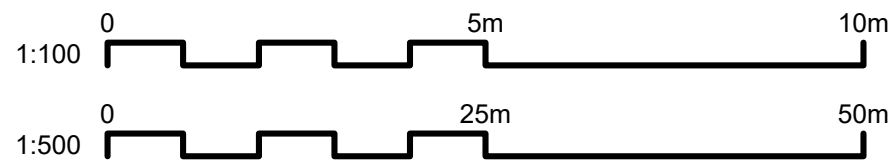
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Drawn	M.Ebert	ME	Coordination	J.O'Riordan	JOR
Dwg check	T.Bird	TB	Approved	J.Shinkwin	JS

Scale at A1 1:500 PRE P02 STD

Drawing Number
229100548-MMD-0600-RE-DR-C-2105



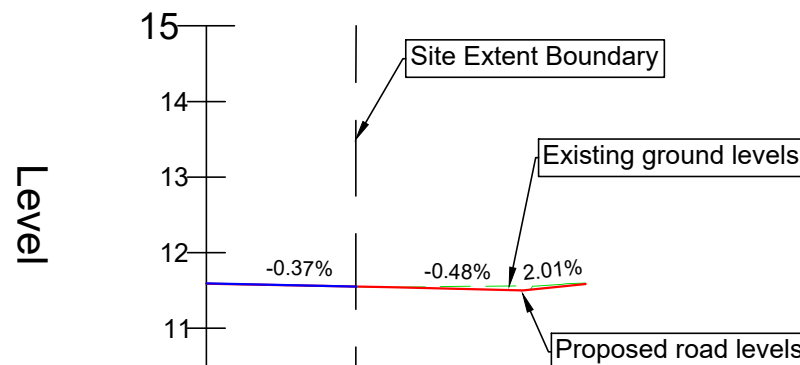
- Key to symbols
- Site Extent Boundary
 - Proposed Horizontal Alignment
 - Earthwork - Cut Embankment Slope 1 to 2.75
 - Earthwork - Fill Embankment Slope 1 to 2
 - Earthwork - Fill Embankment Slope 1 to 3
 - Earthwork - Fill Embankment Transition



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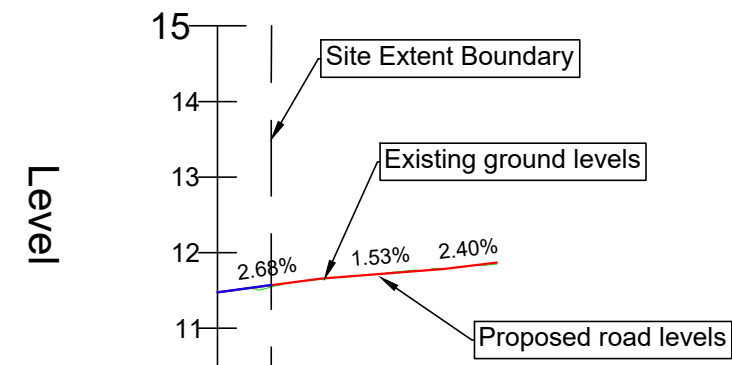
O.S. Ref: 5645-C & 5715-A
CYAL50379123
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ACCESS NO.5 LONGITUDINAL SECTION
(ALIGNMENT REF:A19)
SCALE: H 1:500,V 1:100. DATUM: 10.000



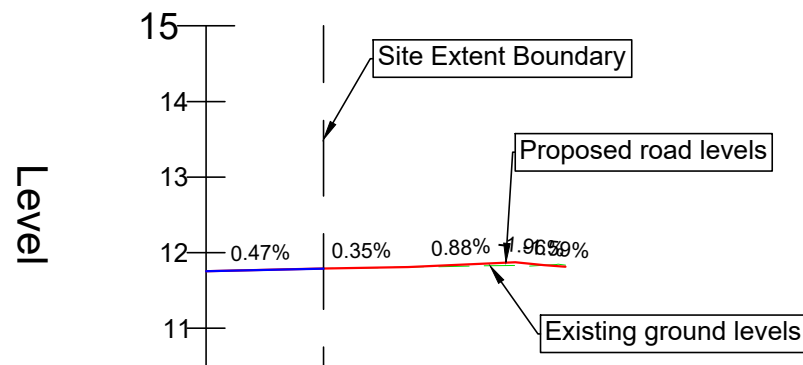
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Existing Levels	11.595	11.549	11.509	11.598
Proposed Levels	11.588	11.551	11.506	11.584
Level Difference	-0.007	0.002	-0.053	-0.013
Standard Earthworks Detail	SED 1, SED 16			

ACCESS NO.4 LONGITUDINAL SECTION
(ALIGNMENT REF:A20)
SCALE: H 1:500,V 1:100. DATUM: 10.000



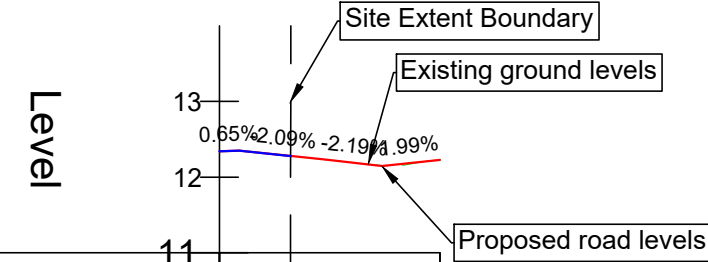
Chainage	-03.555	00.00	10.00	14.91
Existing Levels	11.475	11.544	11.779	11.848
Proposed Levels	11.475	11.570	11.779	11.867
Level Difference	0.000	0.026	-0.018	0.019
Standard Earthworks Detail	SED 1, SED 16			

ACCESS NO.3 LONGITUDINAL SECTION
(ALIGNMENT REF:A11)
SCALE: H 1:500,V 1:100. DATUM: 10.000



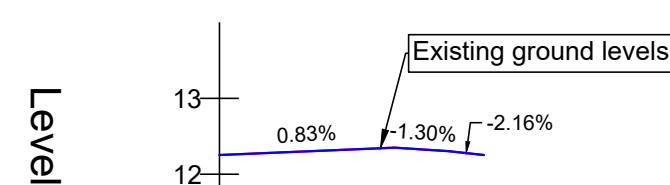
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Proposed Levels	11.755	11.790	11.848	11.812
Level Difference	0.000	0.000	0.025	-0.025
Standard Earthworks Detail	SED 1, SED 16			

ACCESS NO.1 LONGITUDINAL SECTION
(ALIGNMENT REF:A10)
SCALE: H 1:500,V 1:100. DATUM: 11.000



Chainage	-04.70	00.00	09.88
Existing Levels	12.341	12.279	12.228
Proposed Levels	12.341	12.279	12.225
Level Difference	0.000	0.000	-0.003
Standard Earthworks Detail	SED 1, SED 16		

ACCESS NO.2 LONGITUDINAL SECTION
(ALIGNMENT REF:A22)
SCALE: H 1:500,V 1:100. DATUM: 11.000



Chainage	00.00	10.00	17.47
Existing Levels	12.254	12.337	12.254
Proposed Levels	12.254	12.337	12.254
Level Difference	0.000	0.000	0.000
Standard Earthworks Detail	SED 1, SED 16		

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P02	15/11/2024	ME	Updated following Client review	TB	JS
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Rev	Date	Drawn	Description	Ch'k'd	App'd

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Title

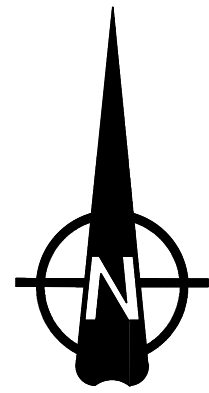
N25 Rosslare Europort Access Road Earthworks Plans and Longitudinal Sections

Sheet 6 of 7

Designed	L.Brooks	LB	Eng check	T.Bird	TB
Drawn	M.Ebert	ME	Coordination	J. O'Riordan	JOR
Dwg check	T.Bird	TB	Approved	J.Shinkwin	JS
Scale at A1	1:500	Status	PRE	Rev	P02
				Security	STD

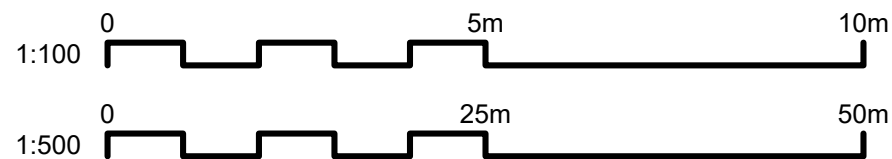
Drawing Number

229100548-MMD-0600-RE-DR-C-2106



Key to symbols

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- Proposed Horizontal Alignment
- Earthwork - Cut Embankment Slope 1 to 2.75
- Earthwork - Fill Embankment Slope 1 to 2
- Earthwork - Fill Embankment Slope 1 to 3
- Earthwork - Fill Embankment Transition



Notes

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P01	06/09/2024	ME	Issue for Client review	TB	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Title

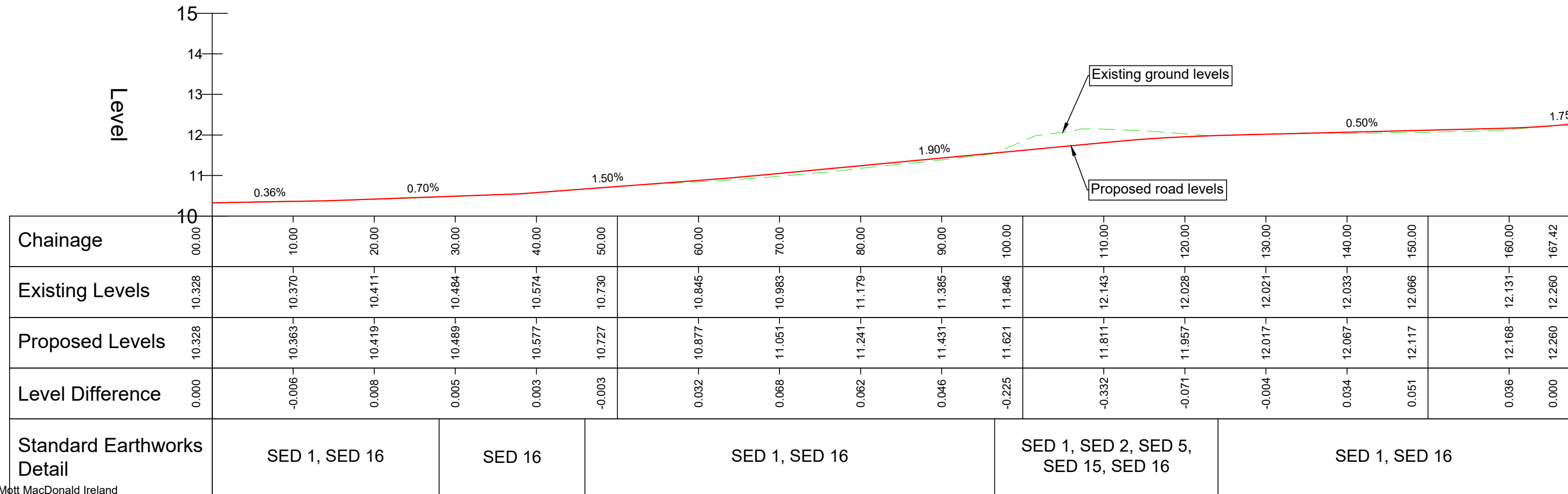
N25 Rosslare Europort Access Road Earthworks Plans and Longitudinal Sections

Sheet 7 of 7

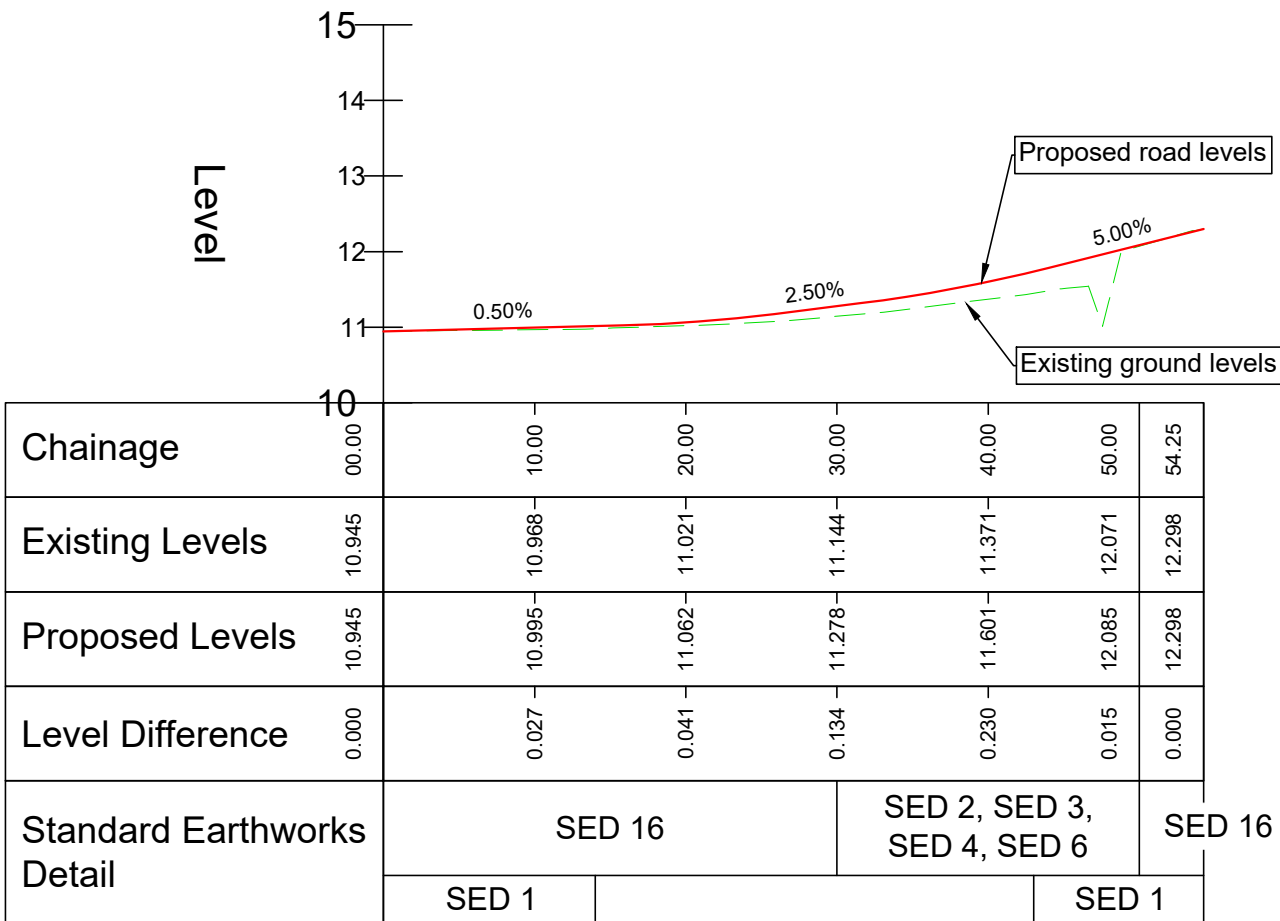
Designed	L.Brooks	LB	Eng check	T.Bird	TB
Drawn	M.Ebert	ME	Coordination	J.O'Riordan	JOR
Dwg check	T.Bird	TB	Approved	J.Shinkwin	JS
Scale at A1	Status	Rev	Security		
1:500	PRE	P02	STD		

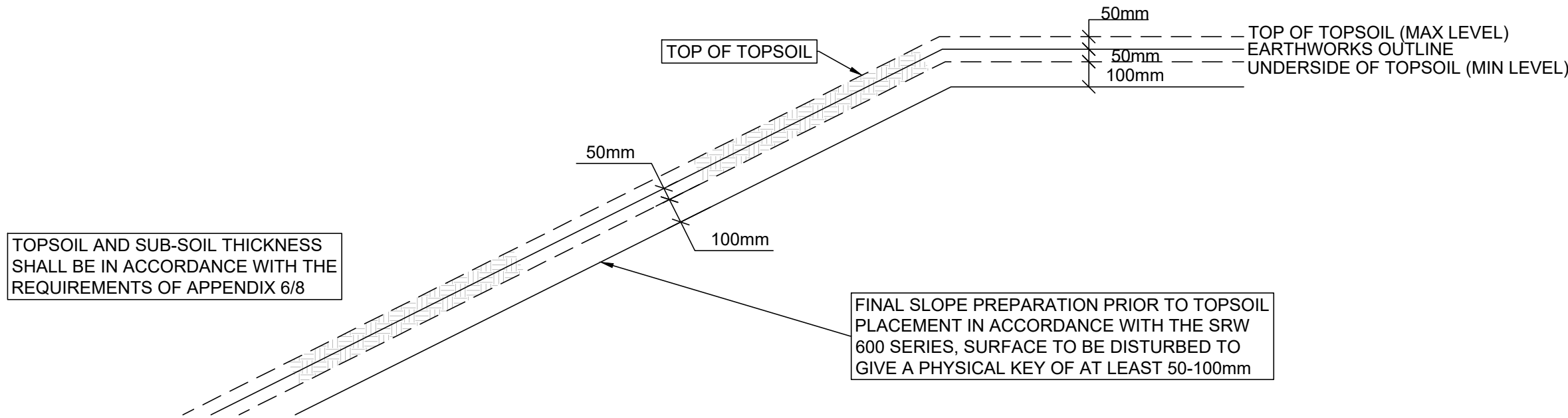
Drawing Number
229100548-MMD-0600-RE-DR-C-2107

ACCESS ROAD TO WASTE WATER TREATMENT PLANT LONGITUDINAL SECTION (ALIGNMENT REF:A08)
SCALE: H 1:500,V 1:100. DATUM: 10.000

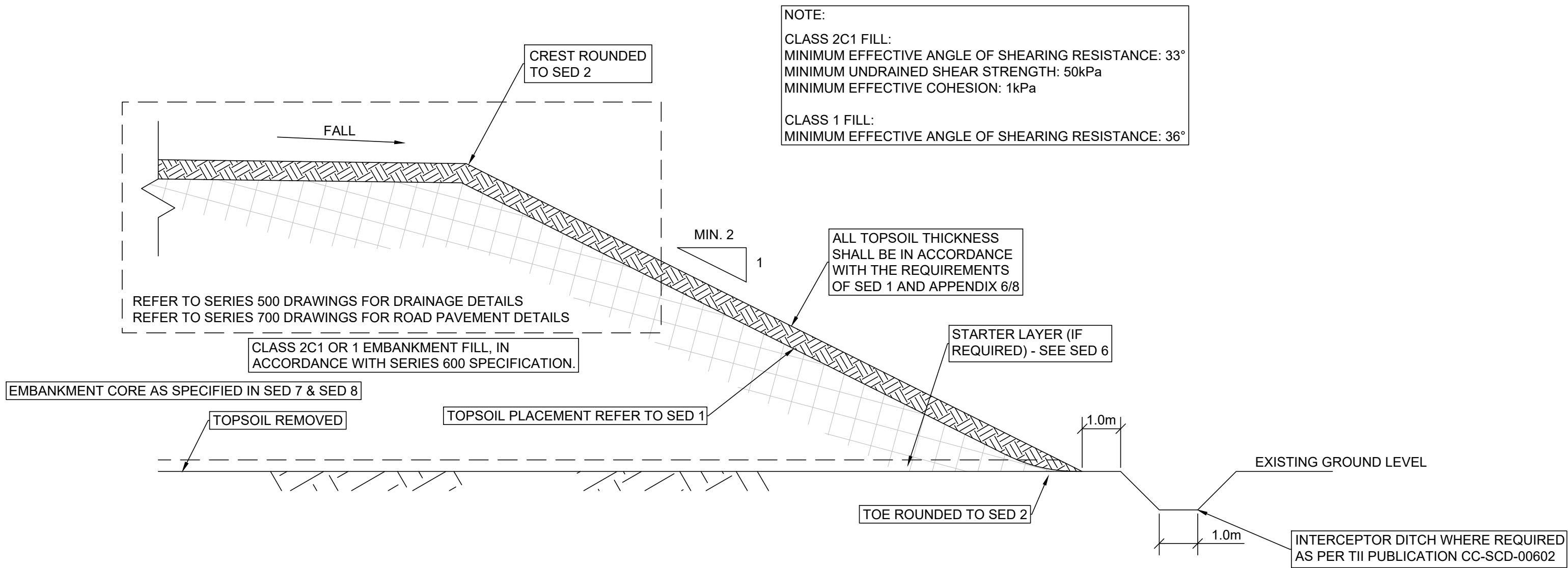


GREENWAY UNDERPASS LONGITUDINAL SECTION (ALIGNMENT REF:A09)
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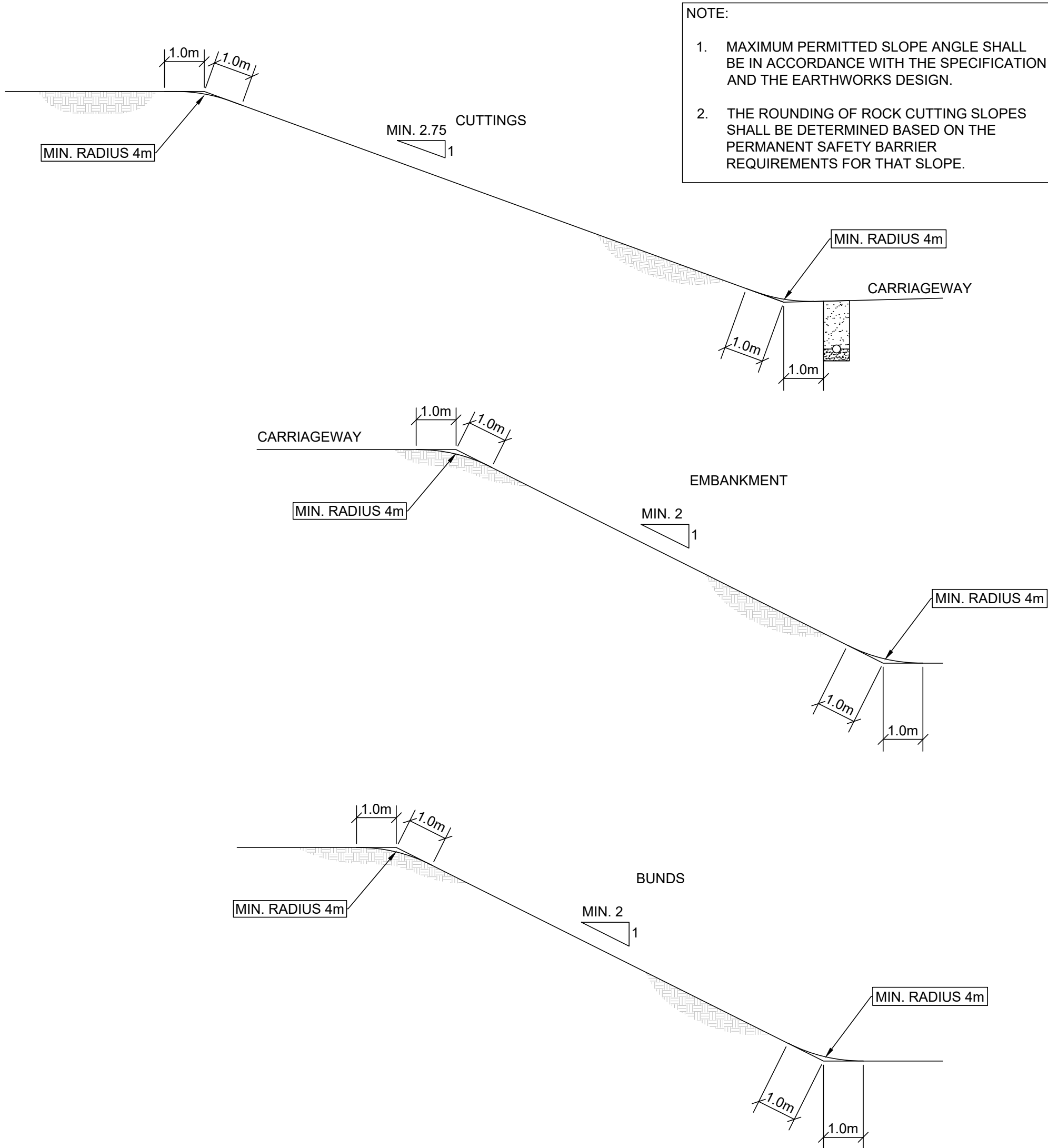




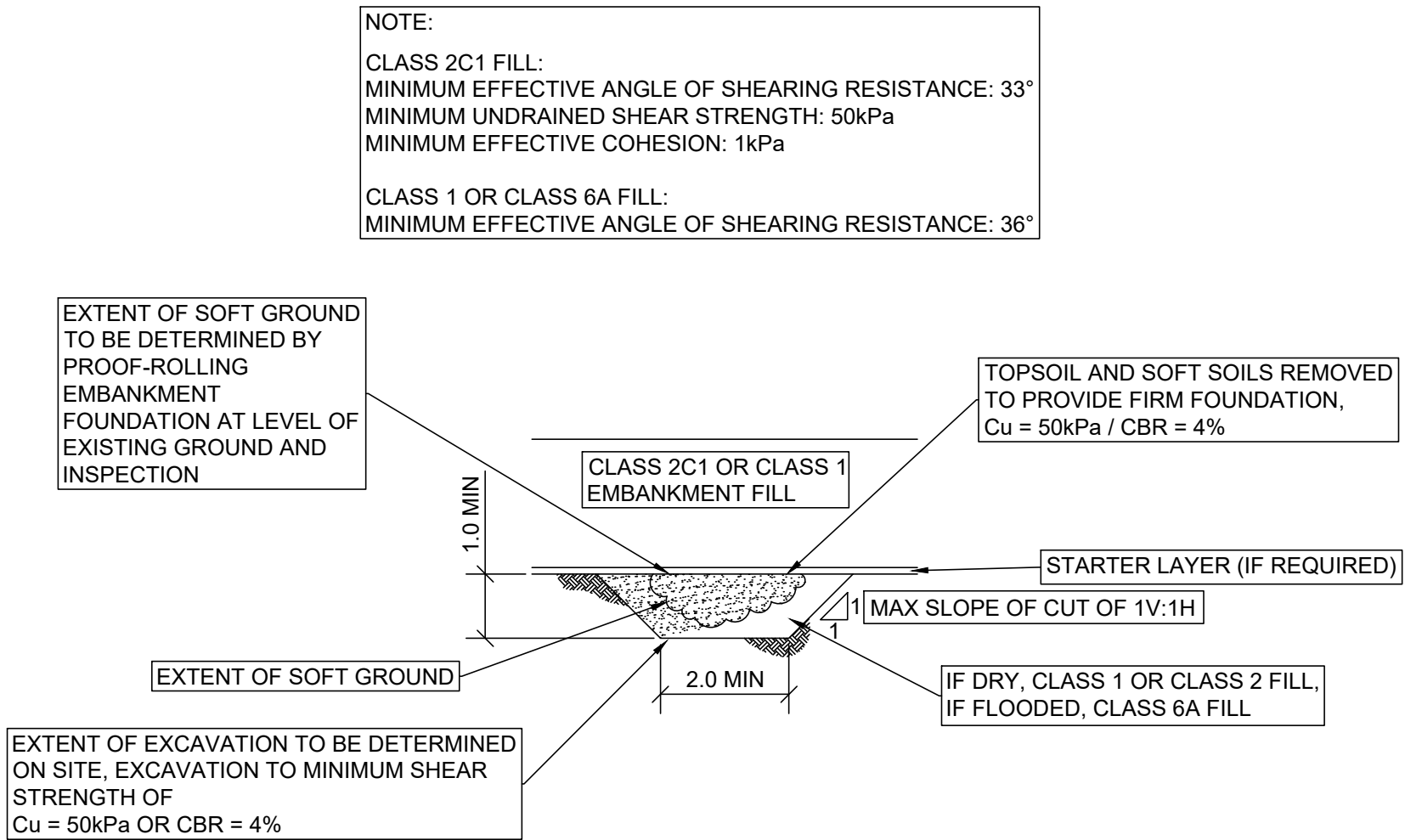
SED 1: TOPSOIL PLACEMENT
NOTE: TOPSOIL DEPTHS ARE VARIABLE. REFER TO APPENDIX 6/8 AND 30/1 FOR DETAILS



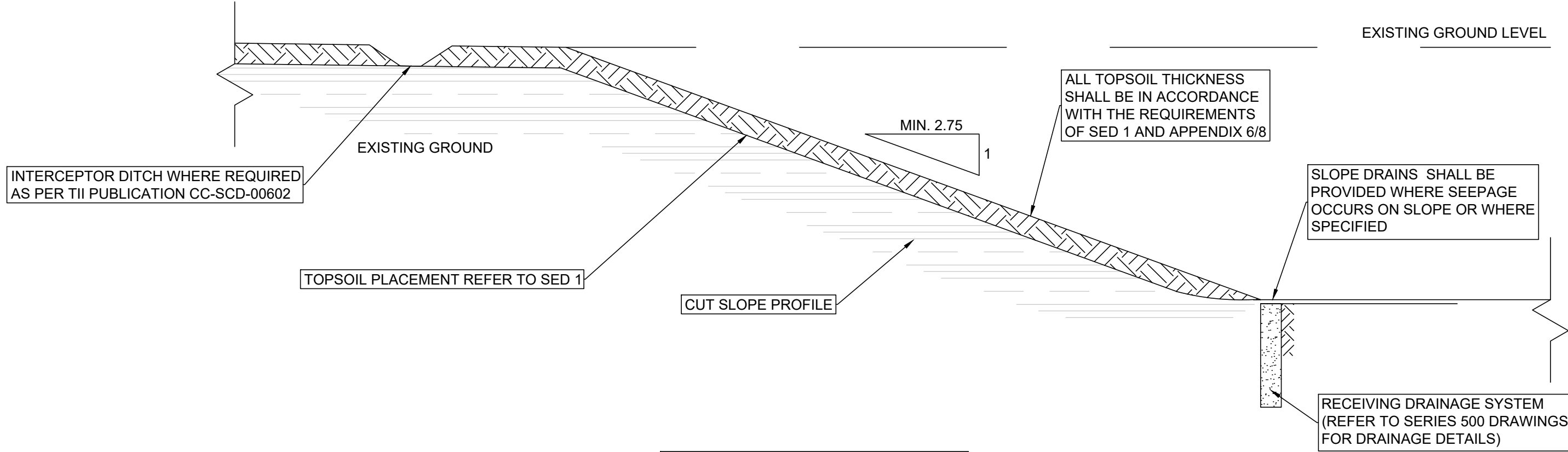
SED 3: TYPICAL EMBANKMENT PROFILE



SED 2: ROUNDING OF EARTHWORKS SLOPES



SED 4: TREATMENT OF SOFT SPOTS IN EMBANKMENT FOUNDATION



SED 5: TYPICAL CUTTING PROFILE

Key to symbols

Notes

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- All fill material shall comply with Specification Appendix 6/1 and Clause 601 of the Specification for Road Works.
- All material to be placed and compacted in accordance with Clause 612 & Table 6/4 of the Specification for Road Works.
- Embankment foundations shall comply with Specification Appendix 6/3 and Clause 604 and 608 of the Specification for Road Works.
- Depth of excavation to ensure removal of all organic or soft/loose material beneath embankment unless otherwise specified in the earthworks plan and profile drawings.
- Topsoil stripping shall be carried out over the full extent of all earthwork foundations.
- Embankment construction shall comply with Specification Appendix 6/3 and Clause 612 of the Specification for Road Works.
- Excavation of cuttings shall comply with Specification Appendix 6/3 and Clause 603 of the Specification for Road Works.
- Installation of any drain at the toe of a cutting shall be undertaken to ensure the adjacent earthworks remain stable during installation. The length of open excavation shall be restricted to suit the ground conditions (typically 10m length).
- The contractor shall notify the designer of any seepage present in earthworks. The contractor shall provide additional drainage measures to intercept and discharge seepage.
- The crest and toe of earthwork slopes shall be rounded to SED2.
- Topsoil to be Class 5 fill.
- The embankment foundation level shall be inspected prior to commencement of filling.
- Pavement formation and subformation levels shall be inspected prior to pavement construction.

Rev	Date	Drawn	Description	Ch'k'd	App'd
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P01	19/09/2024	ME	Issue for Client review	TB	JS

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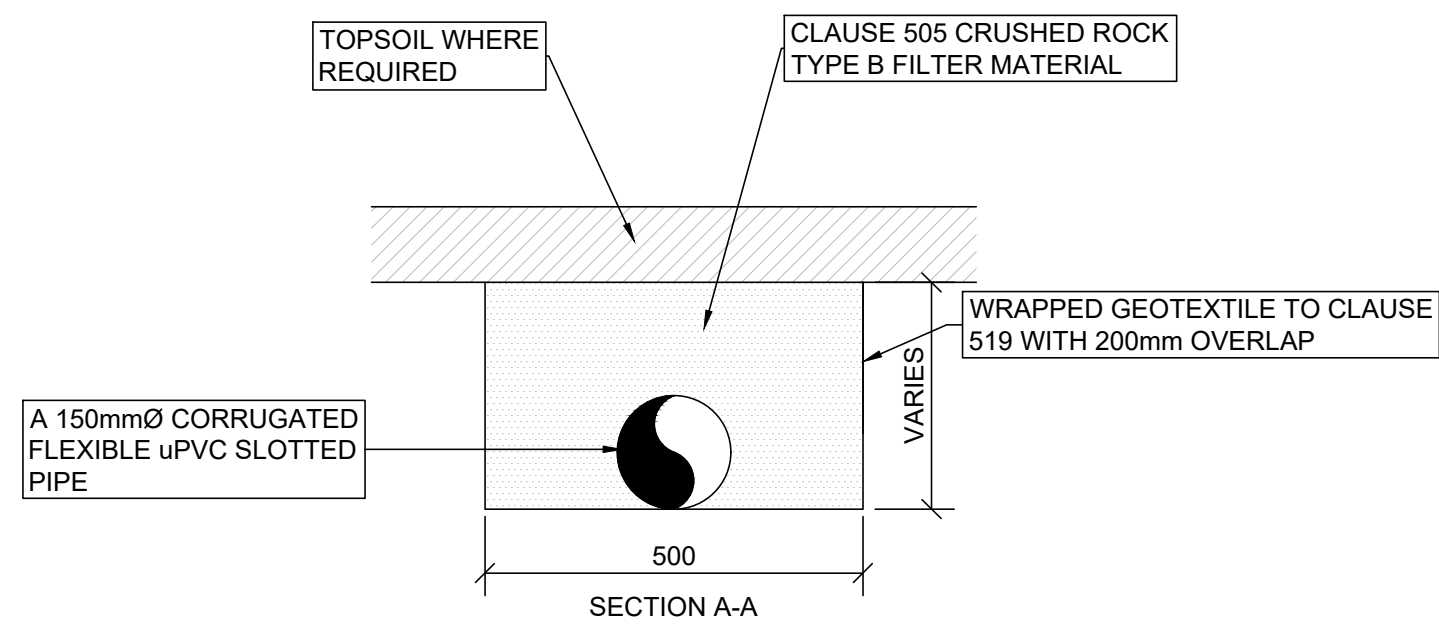
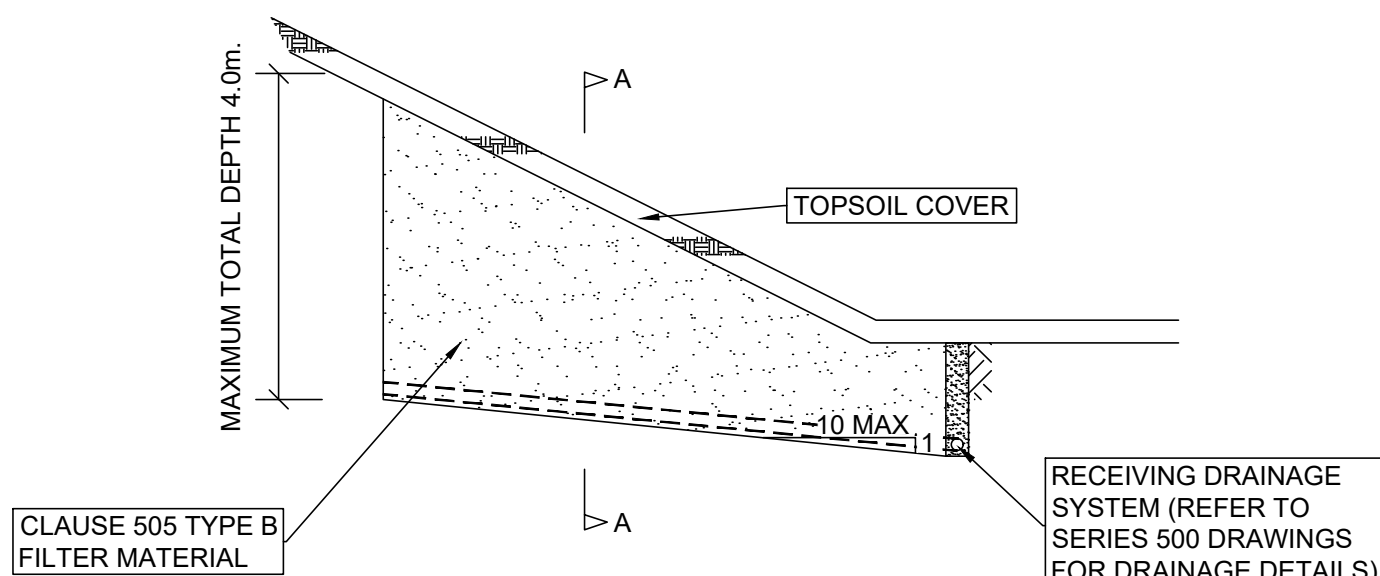
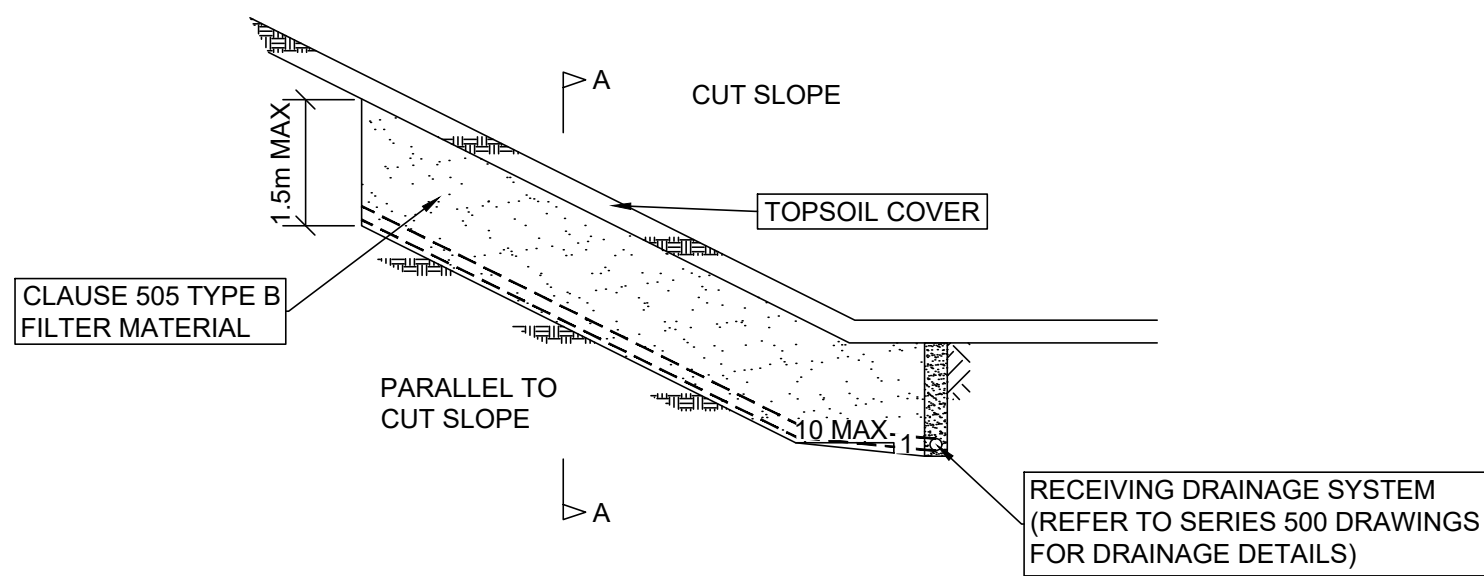
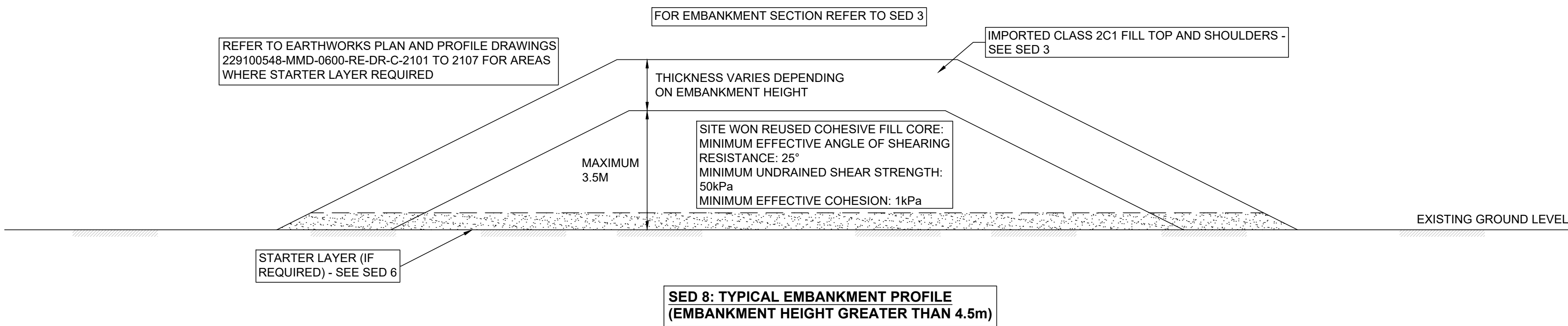
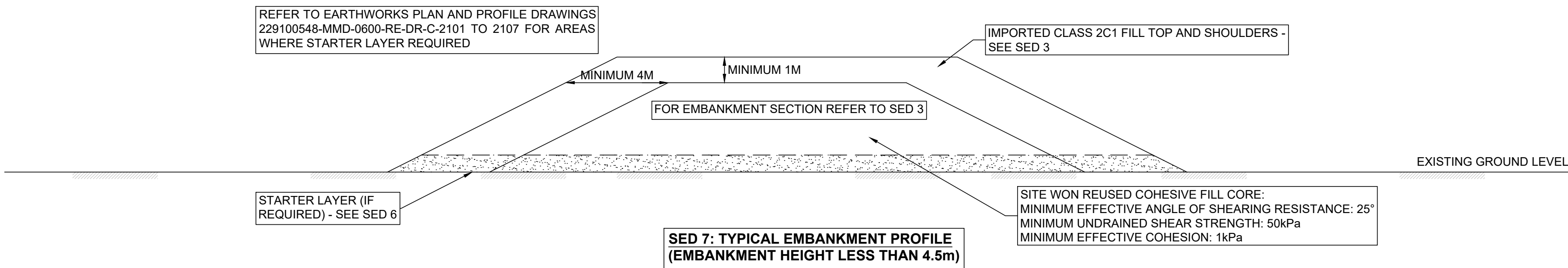
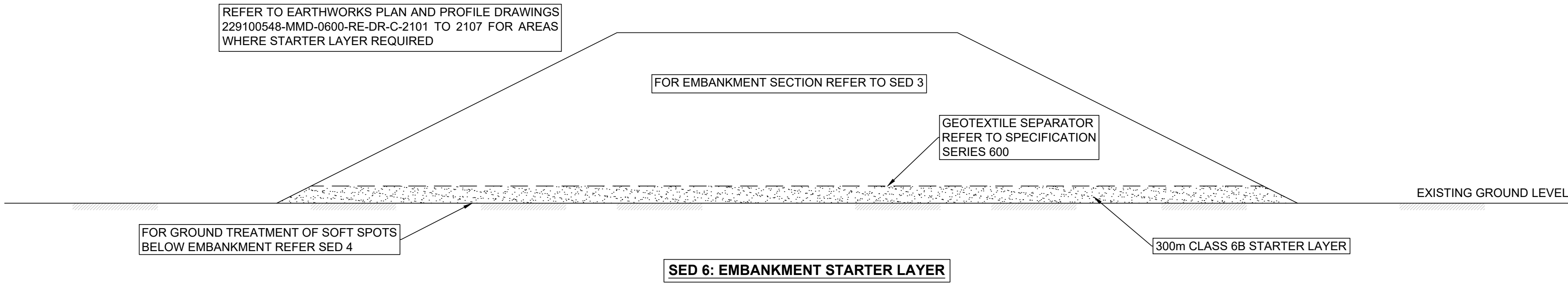
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Loch Garman
Wexford
County Council

Wexford County Council
Carricklawn
Wexford
Y35 WY93

Title
**N25 Rosslare Europort Access Road
Earthworks
Standard Earthwork Details**

Sheet 1 of 4

Designed	L.Brooks	LB	Eng check	T.Bird	TB
Drawn	M.Ebert	ME	Coordination	J.O'Riordan	JOR
Dwg check	L.Brooks	LB	Approved	J.Shinkwin	JS
Scale at A1		Status	Rev	Security	
As shown		PRE	P02	STD	
Drawing Number					
229100548-MMD-0600-RE-DR-C-2201					



Key to symbols

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6. All material to be placed and compacted in accordance with Clause 612 & Table 6/4 of the Specification for Road Works.
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11. Excavation of cuttings shall comply with Specification Appendix 6/3 and Clause 603 of the Specification for Road Works.
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13. The contractor shall notify the designer of any seepage present in earthworks. The contractor shall provide additional drainage measures to intercept and discharge seepage.
14. The crest and toe of earthwork slopes shall be rounded to SED2.
15. Topsoil to be Class 5 fills.
16. The embankment foundation level shall be inspected prior to commencement of filling.
17. Pavement formation and subformation levels shall be inspected prior to pavement construction.

Rev	Date	Drawn	Description	Ch'k'd	App'd
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P01	19/09/2024	ME	Issue for Client review	TB	JS

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Title

N25 Rosslare Europort Access Road
Earthworks
Standard Earthwork Details

Sheet 2 of 4

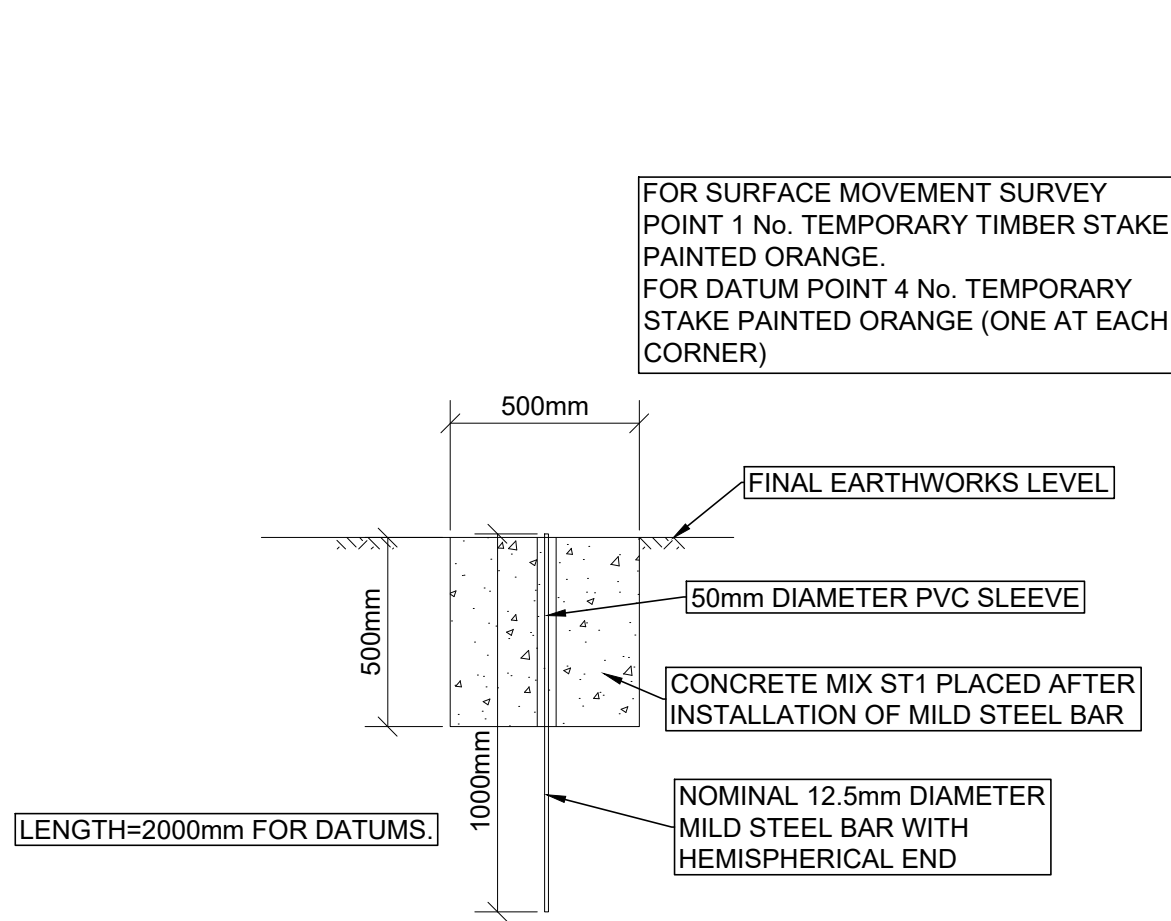
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Drawn	M.Ebert	ME	Coordination	J.O'Riordan	JOR
Dwg check	L.Brooks	LB	Approved	J.Shinkwin	JS
Scale at A1	Status	Rev	Security		
As shown	PRE	P02	STD		

Drawing Number
229100548-MMD-0600-RE-DR-C-2202

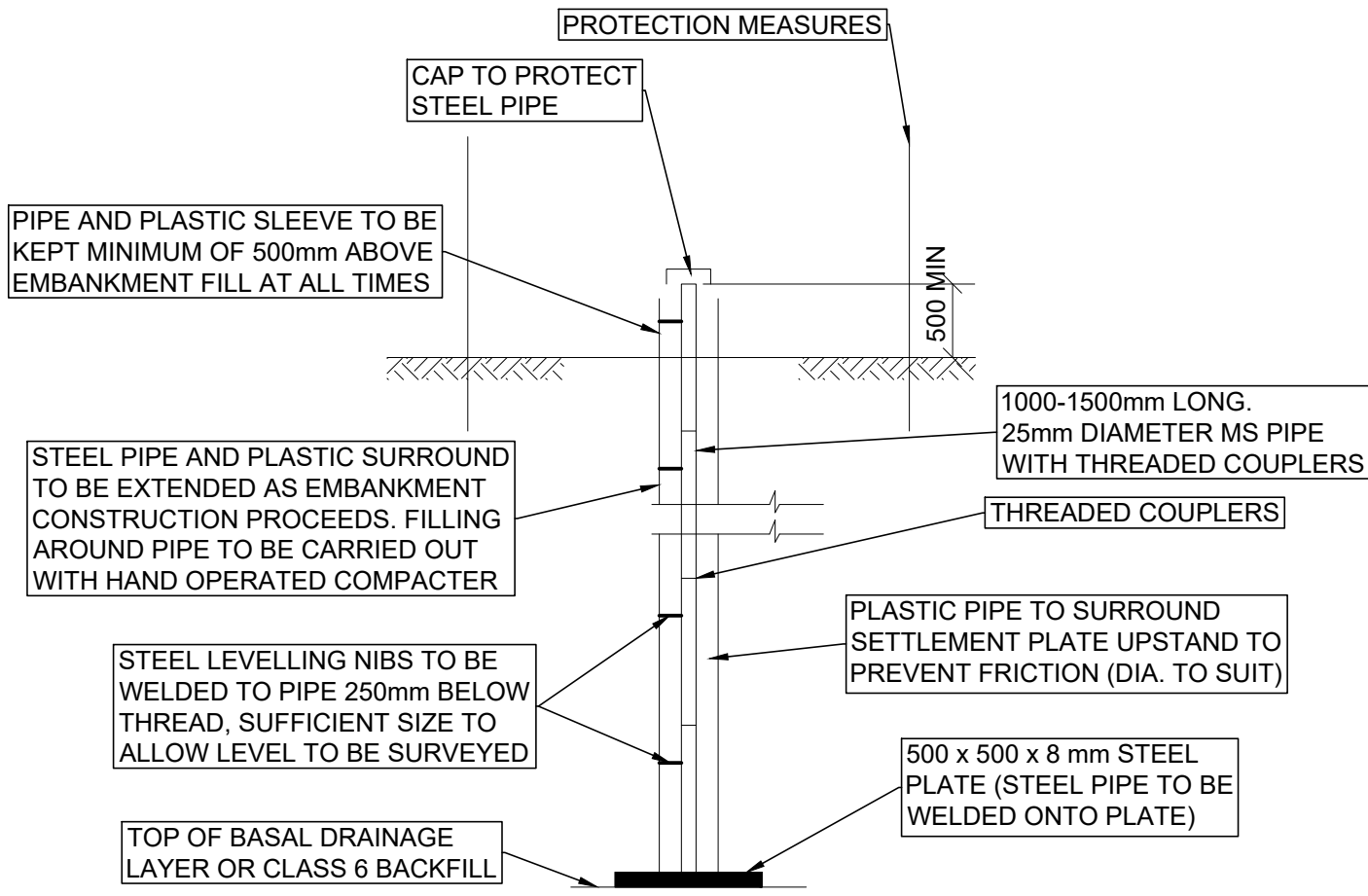
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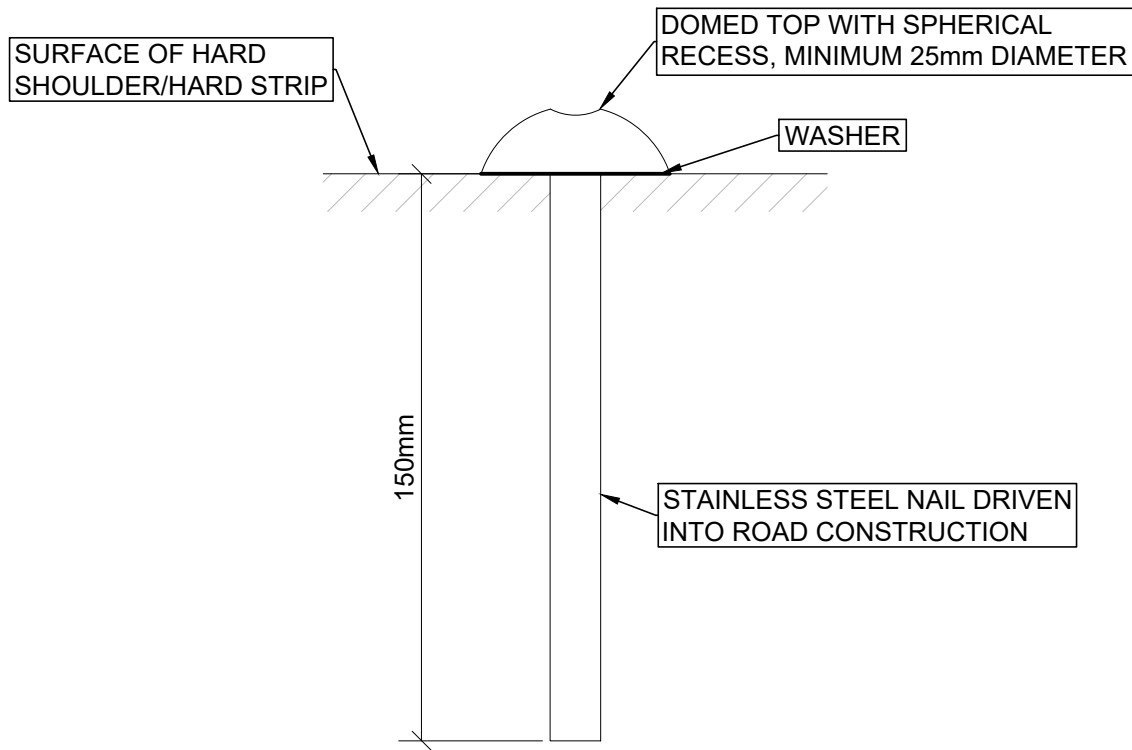
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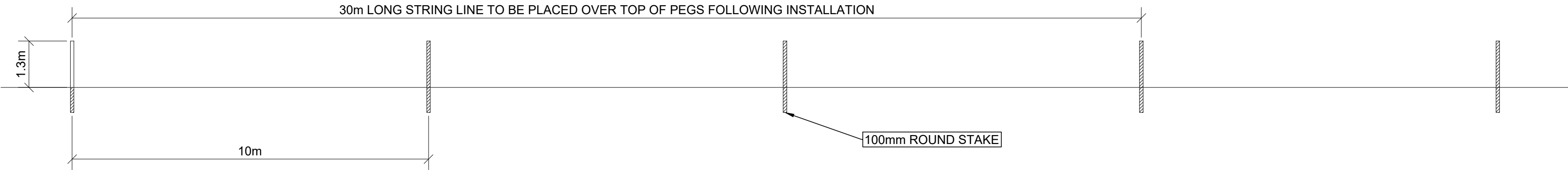
SED 11: SURFACE MOVEMENT SURVEY POINT AND DATUM POINTS



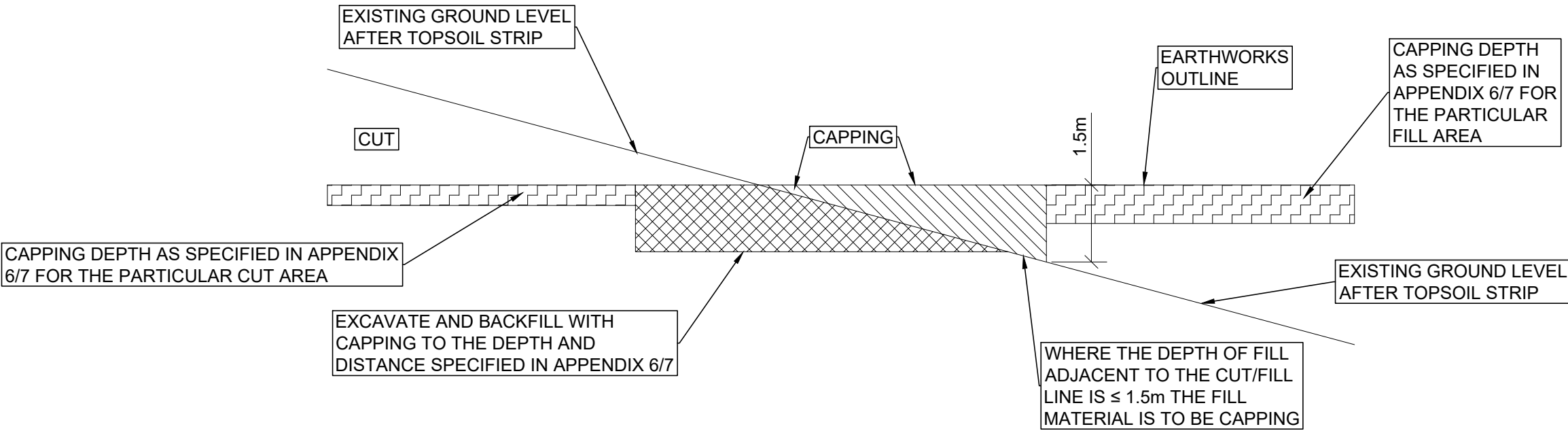
SED 12: SETTLEMENT MONITORING PLATE



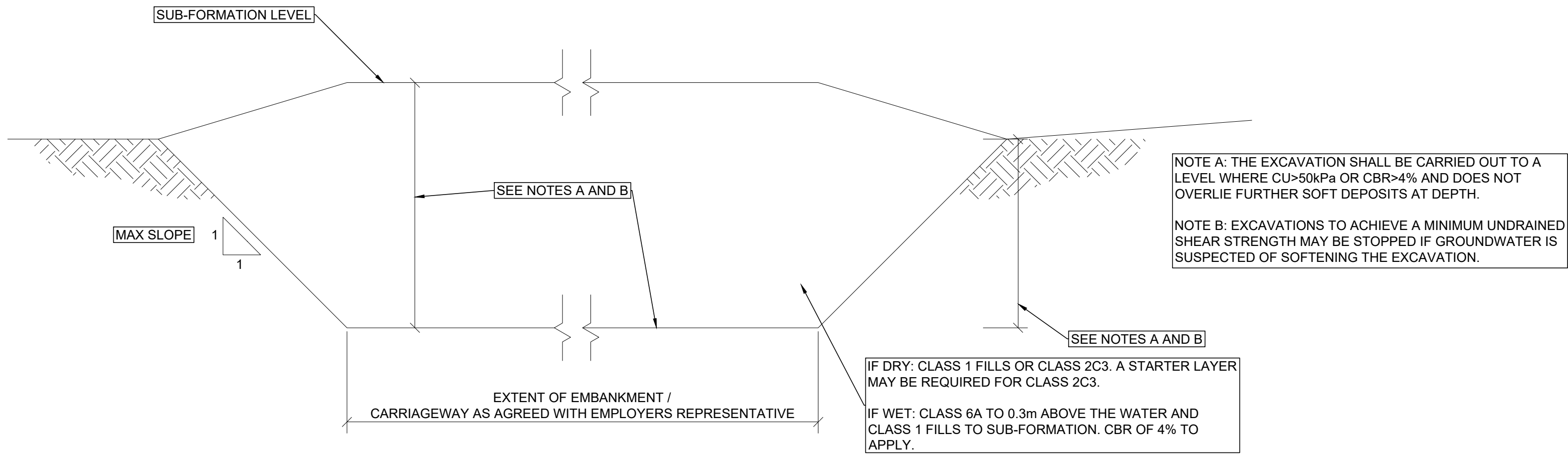
SED 13: CARRIAGEWAY SETTLEMENT MONITORING POINT



SED 14: SIGHT LINES



SED 15: TRANSITION AREA BETWEEN CUT AND FILL



SED 16: GROUND TREATMENT OF SOFT SPOTS FOR CBR <4% OR CU <50KPA AT SUB FORMATION LEVEL IN SHALLOW EMBANKMENT / CUTTING OR AT-GRADE

Key to symbols

Notes

- All dimensions are in meters unless otherwise shown. Use figure dimensions only. Do not scale from this drawing. All dimensions to be checked on site.
- All levels in metres O.D. (Malin).
- This drawing is to be used for the design element identified in the titlebox. Other information shown is to be considered indicative only. The drawing is to be read in conjunction with all other relevant design drawings.
- This drawing shall be read in conjunction with earthworks plan and profile drawings 229100548-MMD-0600-RE-DR-C-2101 to 2107, series 600 Specification and its Appendices.
- All fill material shall comply with Specification Appendix 6/1 and Clause 601 of the Specification for Road Works.
- All material to be placed and compacted in accordance with Clause 612 & Table 6/4 of the Specification for Road Works.
- Embankment foundations shall comply with Specification Appendix 6/3 and Clause 604 and 608 of the Specification for Road Works.
- Depth of excavation to ensure removal of all organic or soft/loose material beneath embankment unless otherwise specified in the earthworks plan and profile drawings.
- Topsoil stripping shall be carried out over the full extent of all earthwork foundations.
- Embankment construction shall comply with Specification Appendix 6/3 and Clause 612 of the Specification for Road Works.
- Excavation of cuttings shall comply with Specification Appendix 6/3 and Clause 603 of the Specification for Road Works.
- Installation of any drain at the toe of a cutting shall be undertaken to ensure the adjacent earthworks remain stable during installation. The length of open excavation shall be restricted to suit the ground conditions (typically 10m length).
- The contractor shall notify the designer of any seepage present in earthworks. The contractor shall provide additional drainage measures to intercept and discharge seepage.
- The crest and toe of earthwork slopes shall be rounded to SED2.
- Topsoil to be Class 5 fills.
- The embankment foundation level shall be inspected prior to commencement of filling.
- Pavement formation and subformation levels shall be inspected prior to pavement construction.

Rev	Date	Drawn	Description	Ch'k'd	App'd
P02	15/11/2024	ME	Updated following Client review	TB	JS
P01	19/09/2024	ME	Issue for Client review	TB	JS

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Wexford
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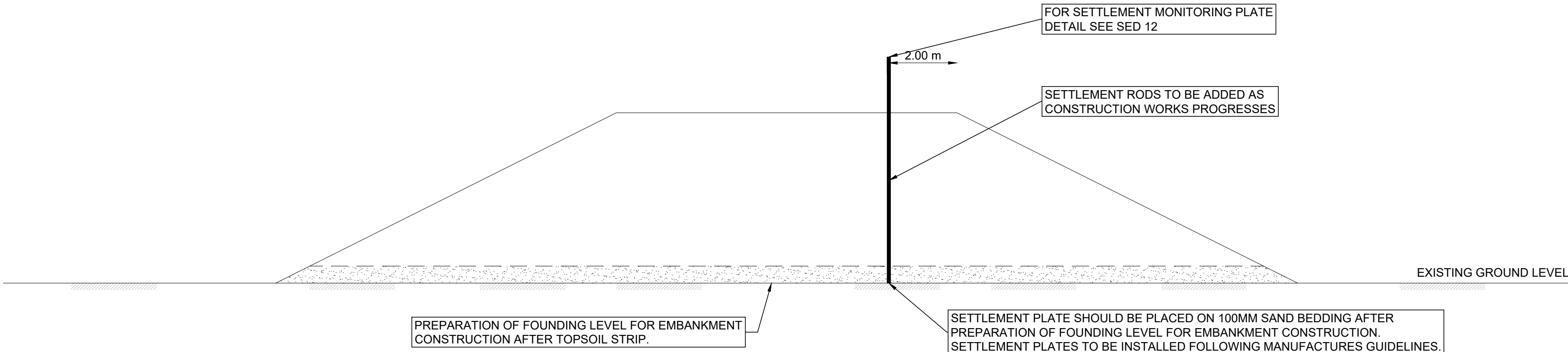
Title
**N25 Rosslare Europort Access Road
Earthworks
Standard Earthwork Details**

Sheet 3 of 4

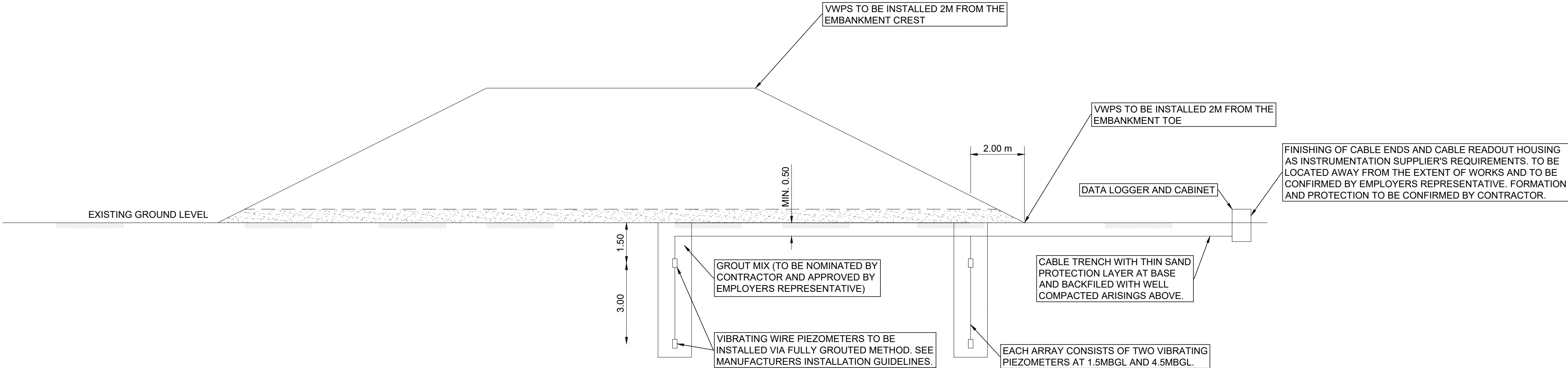
Designed	L.Brooks	LB	Eng check	T.Bird	TB
Drawn	M.Ebert	ME	Coordination	J.O'Riordan	JOR
Dwg check	L.Brooks	LB	Approved	J.Shinkwin	JS

Scale at A1	Status	Rev	Security
As shown	PRE	P02	STD

Drawing Number
229100548-MMD-0600-RE-DR-C-2203



SED 17: SETTLEMENT MONITORING PLATE INSTALLATION



SED 18: VIBRATING WIRE PIEZOMETER INSTALLATION

Key to symbols

Notes

1. All dimensions are in meters unless otherwise shown. Use figure dimensions only. Do not scale from this drawing. All dimensions to be checked on site.
2. All levels in metres O.D. (Malin).
3. This drawing is to be used for the design element identified in the titlebox. Other information shown is to be considered indicative only. The drawing is to be read in conjunction with all other relevant design drawings.
4. This drawing shall be read in conjunction with earthworks plan and profile drawings 229100548-MMD-0600-RE-DR-C-2101 to 2107, series 600 Specification and its Appendices.
5. All fill material shall comply with Specification Appendix 6/1 and Clause 601 of the Specification for Road Works.
6. All material to be placed and compacted in accordance with Clause 612 & Table 6/4 of the Specification for Road Works.
7. Embankment foundations shall comply with Specification Appendix 6/3 and Clause 604 and 608 of the Specification for Road Works.
8. Depth of excavation to ensure removal of all organic or soft/loose material beneath embankment unless otherwise specified in the earthworks plan and profile drawings.
9. Topsoil stripping shall be carried out over the full extent of all earthwork foundations.
10. Embankment construction shall comply with Specification Appendix 6/3 and Clause 612 of the Specification for Road Works.
11. Excavation of cuttings shall comply with Specification Appendix 6/3 and Clause 603 of the Specification for Road Works.
12. Installation of any drain at the toe of a cutting shall be undertaken to ensure the adjacent earthworks remain stable during installation. The length of open excavation shall be restricted to suit the ground conditions (typically 10m length).
13. The contractor shall notify the designer of any seepage present in earthworks. The contractor shall provide additional drainage measures to intercept and discharge seepage.
14. The crest and toe of earthwork slopes shall be rounded to SED2.
15. Topsoil to be Class 5 fills.
16. The embankment foundation level shall be inspected prior to commencement of filling.
17. Pavement formation and subformation levels shall be inspected prior to pavement construction.

P02	15/11/2024	ME	Updated following Client review	TB	JS
P01	19/09/2024	ME	Issue for Client review	TB	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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County Council

Wexford County Council
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Wexford
Y35 WY93

Title
N25 Rosslare Europort Access Road
Earthworks
Standard Earthwork Details

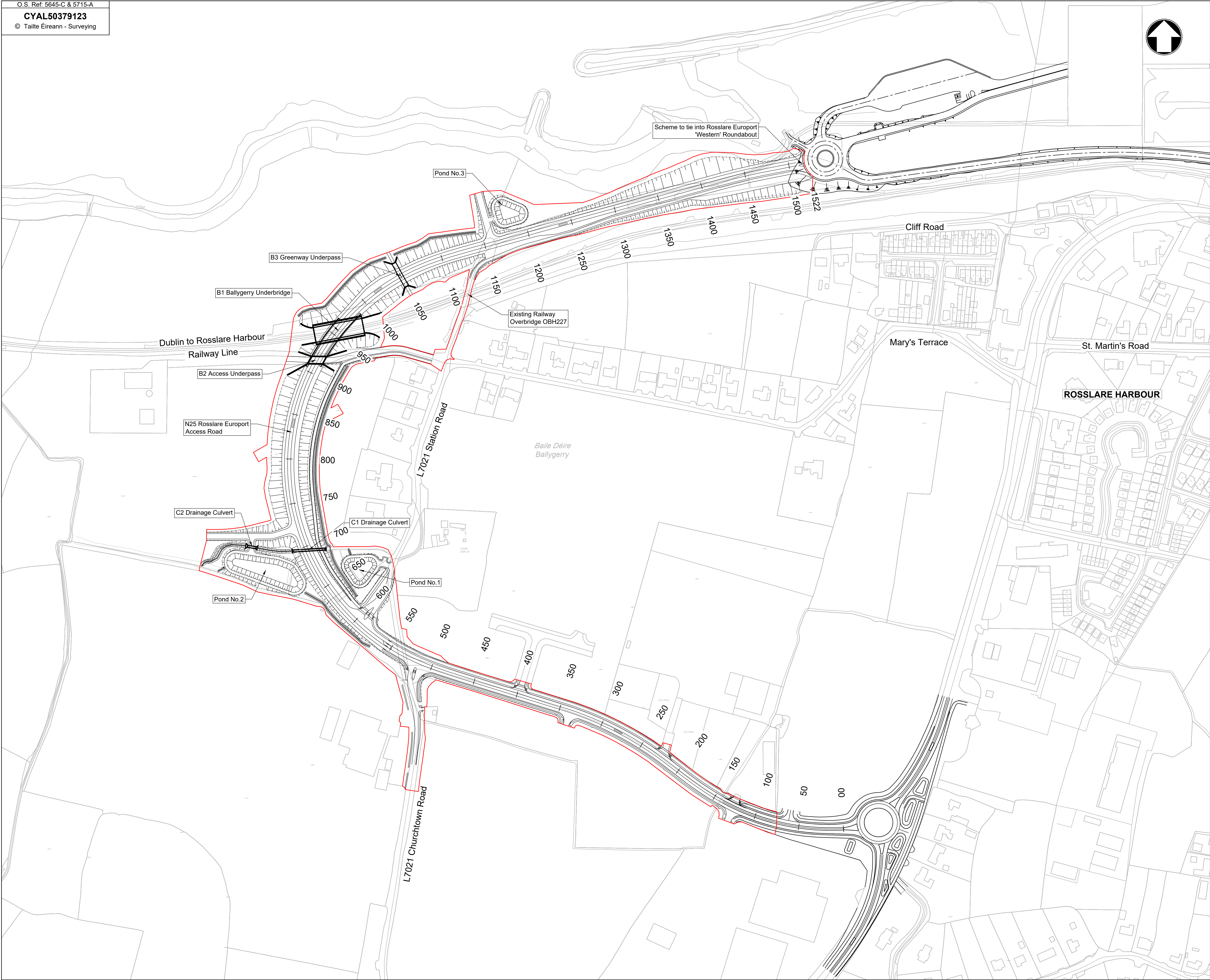
Sheet 4 of 4

Designed	L.Brooks	LB	Eng check	T.Bird	TB
Drawn	M.Ebert	ME	Coordination	J.O'Riordan	JOR
Dwg check	L.Brooks	LB	Approved	J.Shinkwin	JS

Scale at A1	Status	Rev	Security
As shown	PRE	P02	STD

Drawing Number
229100548-MMD-0600-RE-DR-C-2204

D. Structure General Arrangement Drawings



O.S. Ref: 5645-C & 5715-A

CYAL50379123

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Notes

1. This drawing to be read in conjunction with all relevant Engineers drawings and specifications and other documents in the Works Requirements.

2. All chainages are in metres (m).

3. Use figured dimensions only. Do not scale from this drawing. All dimensions to be checked on site.

4. All coordinates relate to ITM - Irish Transverse Mercator.

Key to symbols

Site Extents Boundary

Reference drawings

229100548-MMD-1700-RE-DR-C-2003

229100548-MMD-1700-RE-DR-C-2103

229100548-MMD-1700-RE-DR-C-2203

229100548-MMD-1700-RE-DR-C-2303

229100548-MMD-1700-RE-DR-C-2403

B1 General Arrangement Plan

B2 General Arrangement Plan

B3 General Arrangement Plan

C1 General Arrangement Plan

C2 General Arrangement Plan

P03	28.10.2024	ROC	Issue for Approval	RS	JS
P02	16.09.2024	ROC	Issued for Information	JB	JS
P01	12.07.2024	ROC	Issued for Information	JB	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Roads Department

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Comhairle Contae

Loch Garman

Wexford

County Council

Title

N25 Rosslare Europort Access Road

Structures Location Plan

Designed	J. Bourke	Eng check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg check	J. Bourke	Approved	J. Shinkwin	
MMD Project Number	229100548	Scale at A1	1:2000	Security
Drawing Description	Location Plan			STD
Drawing Number	229100548-MMD-1700-RE-DR-C-2000			Revision
				P03

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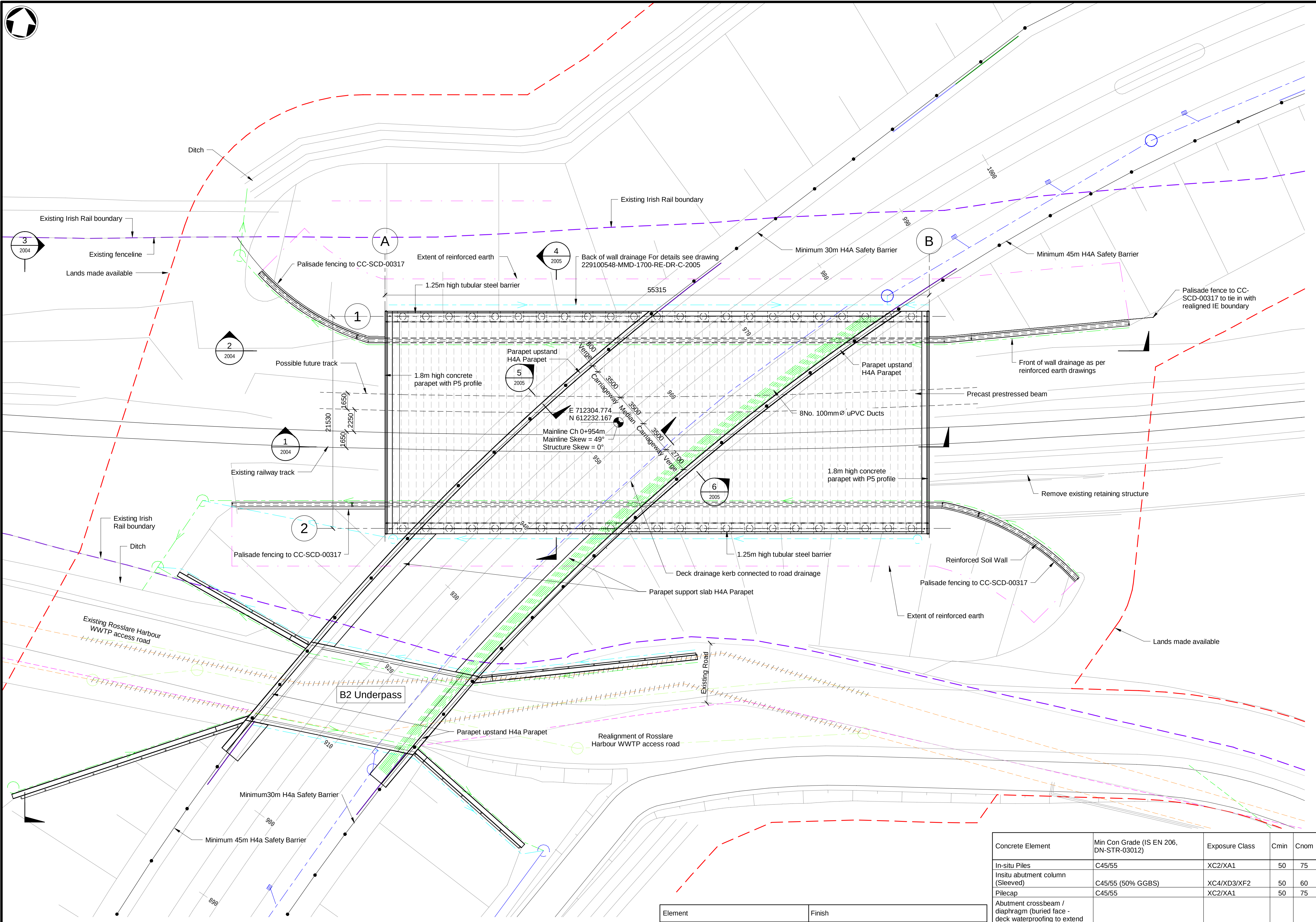
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Plan

1:2000 @ A1

1:4000 @ A3



Plan

1 : 200

Element	Finish
Buried unformed surfaces	U1
Exposed unformed surfaces excluding areas to receive sprayed deck waterproofing	U3
Buried in-situ concrete surfaces	F1 (except surfaces to receive spray applied waterproof which be prepared as per product requirements)
Reinforced Earth Abutment Wall and Wingwalls	Standard pattern profile finish
End Supports – Reinforced concrete Abutment	F4
Parapet edge beam	F3/U3
Precast Beams	F5
Deck Cantilever	F4
Area of deck to receive waterproofing	U4
Coping Beams	F3/U3

Concrete Element	Min Con Grade (IS EN 206, DN-STR-03012)	Exposure Class	Cmin	Cnom
In-situ Piles	C45/55	XC2/XA1	50	75
Insitu abutment column (Sleeved)	C45/55 (50% GGBS)	XC4/XD3/XF2	50	60
Pilecap	C45/55	XC2/XA1	50	75
Abutment crossbeam / diaphragm (buried face - deck waterproofing to extend down full height)	C45/55 (50% GGBS)	XC2/XD3/XA1	50	60
Abutment crossbeam / diaphragm (exposed face)	C45/55 (50% GGBS)	XC4/XD1/XF2	35	45
Precast Beams (External face)	C50/60	XC4/XD1/XF3	35	40
In-situ deck slab (areas protected by waterproofing)	C35/45 (50% GGBS)	XC3	30	40
In-situ parapet support slab (buried face)	C45/55 (50% GGBS)	XC2/XA1/XD3	50	60
Parapet edge beam, Upstand of Parapet Support Slab	C45/55 (50% GGBS)	XC4/XD3/XF4	50	60
Reinforced Soil Wingwalls (Buried face)	C40/50 (50% GGBS)	XC2/XA1/XD3	55	60
Reinforced Soil Wingwalls (Exposed face)	C40/50 (50% GGBS)	XC4/XD1/XF2	35	40
Reinforced Soil Wall Cope (Exposed face)	C40/50 (50% GGBS)	XC4/XD3/XF4	55	60

O.S. Ref: 5645-C & 5715-A

CYAL50379123

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Notes

- All dimensions are in millimetres unless otherwise stated. Use figured dimensions only.
- All levels are in metres above Malin Head Datum. Do not scale from the drawing.
- Survey grid and all coordinates are in Irish Transverse Mercator.
- All dimensions, levels and setting out co-ordinates are to be checked on site by the contractor. Any discrepancies are to be brought to the attention of the design engineer.
- Drawing to be read in conjunction with all drawings, specifications and documents in the Works Requirements.
- Bridge deck waterproofing shall be spray applied and satisfy the requirements of TII Publications Doc. Nos. DN-STR-03012, DN-STR-03009 & CC-SPW-02000.
- Further to note no.6 above, all other buried concrete surfaces shall be treated with two coats of epoxy resin waterproofing paint in accordance with the requirements in TII Publications Doc. Nos. DN-STR-03012 & CC-SPW-02000.
- A 20mm bituminous protection is required as an additional protective layer on all bridge deck waterproofing in accordance with the requirements in TII Publications Doc. Nos. CC-SPW-02000. The 20mm bituminous protection shall comply with IS EN 13108- 4 recipe type F wearing course mixture designation 0/2.
- All exposed concrete shall be impregnated with a hydrophobic pore liner in accordance with the requirements in TII Publications Doc. Nos. DN-STR-03012 & CC- SPW-02000.
- Joints between precast concrete units to be filled in accordance with the requirements in TII Publications Doc. Nos. DN-STR-03012 & CC-SPW-02300.
- Placing and compaction of backfill shall be in accordance with the requirements in TII Publications Doc. Nos. CC-SPW-00600.
- Interface between the natural ground with 6N or 6i6j and interface between embankment fill with 6N or 6i6j to be benched in accordance with the requirements in TII Publications Doc. Nos. CC-SPW-00600.
- External concrete edges to be chamfered 25 x 25mm unless noted otherwise.

Key to symbols

---	Lands Made Available
---	Existing Irish Rail Boundary
---	Proposed Back of Wall Drainage
---	Proposed Front of Wall Drainage
---	Proposed Highway Drainage
---	Proposed Foul Sewer
---	Proposed Kerb Drain
---	Proposed Service Ducts
---	Existing Foul Sewer
---	Existing EIR Underground Services
---	Existing ESB MV Line
---	Existing Services Diverted

Reference drawings

229100548-MMD-1700-RE-DR-C-2004	Sections & Elevations
229100548-MMD-1700-RE-DR-C-2005	Sections & Details

P02	28.10.2024	ROC	Issued for Approval	RS	365
P01	30.04.2024	ROC	Issued for Information	CC	365
Rev	Date	Drawn	Description	Ch'kd	App'd

Status Stamp

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Roads Department
Wexford County Council
Carricklawn
Wexford Town



Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
General Arrangement
Plan

Designed	C. Clarke	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	C. Clarke	Approved	J. Shinkwin	

MMD Project Number

229100548

Scale at A1

As indicated

Security

STD

Drawing Description

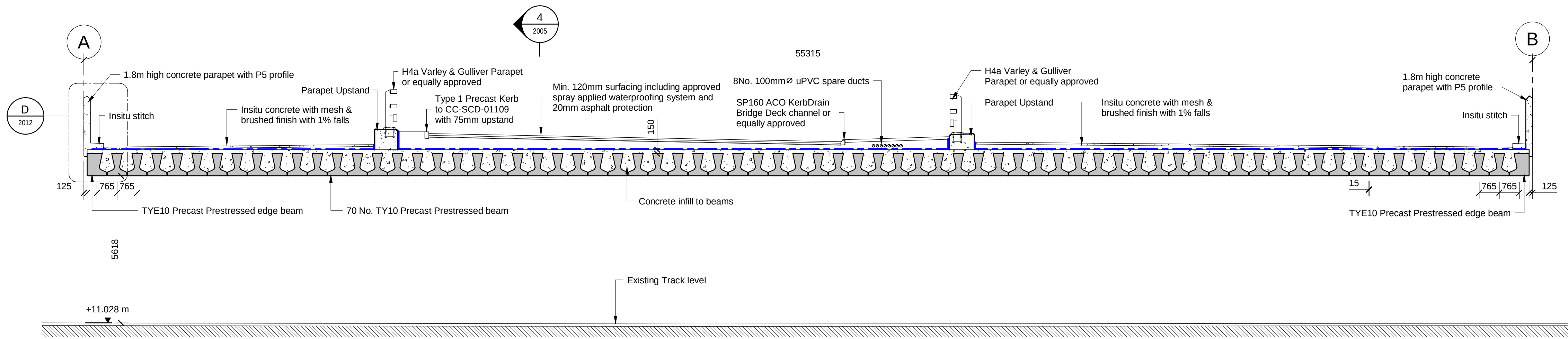
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Drawing Number

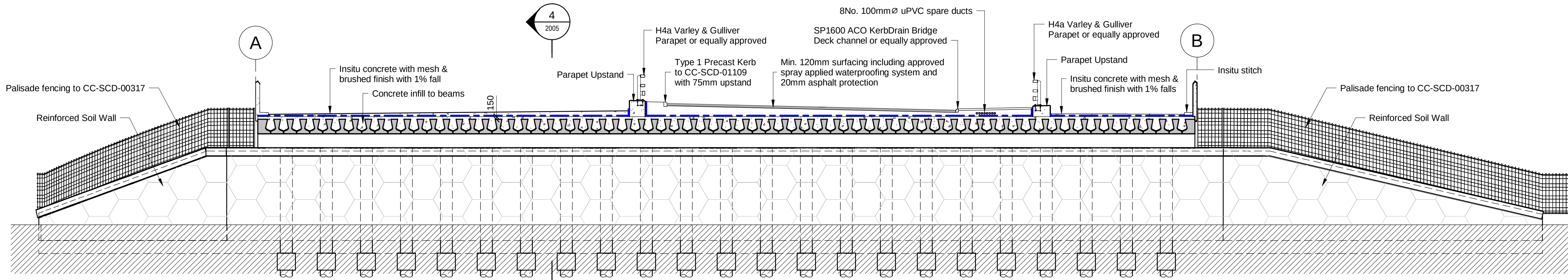
229100548-MMD-1700-RE-DR-C-2003

Rev

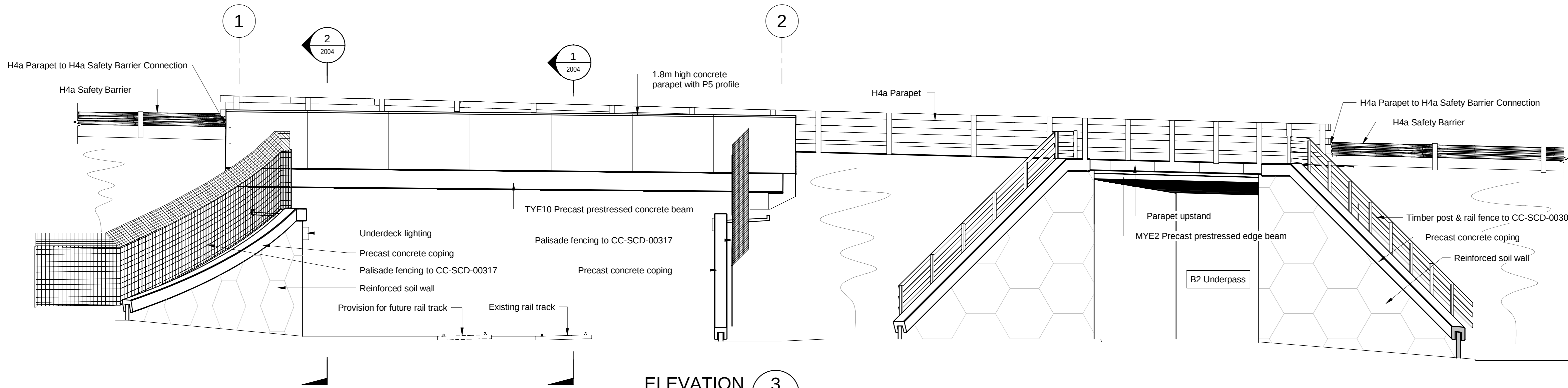
P02



SECTION 1
1 : 100



SECTION 2
1 : 150



ELEVATION 3
1 : 100

Notes

1. Refer to drawing 229100548-MMD-1700-RE-DR-C-2003 for notes.

Key to symbols

- Spray applied waterproofing

Reference drawings

- 229100548-MMD-1700-RE-DR-C-2003 General Arrangement Plan
229100548-MMD-1700-RE-DR-C-2005 Sections & Details

P02	28.10.2024	ROC	Issued for Approval	RS	JS
P01	30.04.2024	ROC	Issued for Information	CC	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Wexford County Council
Carricklawn
Wexford Town



Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
General Arrangement
Sections & Elevation

Designed	C. Clarke	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	C. Clarke	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As indicated	STD

Drawing Description

General Arrangement

Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2004	P02

O.S. Ref: 5645-C & 5715-A

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Safety, Health and Environmental Information

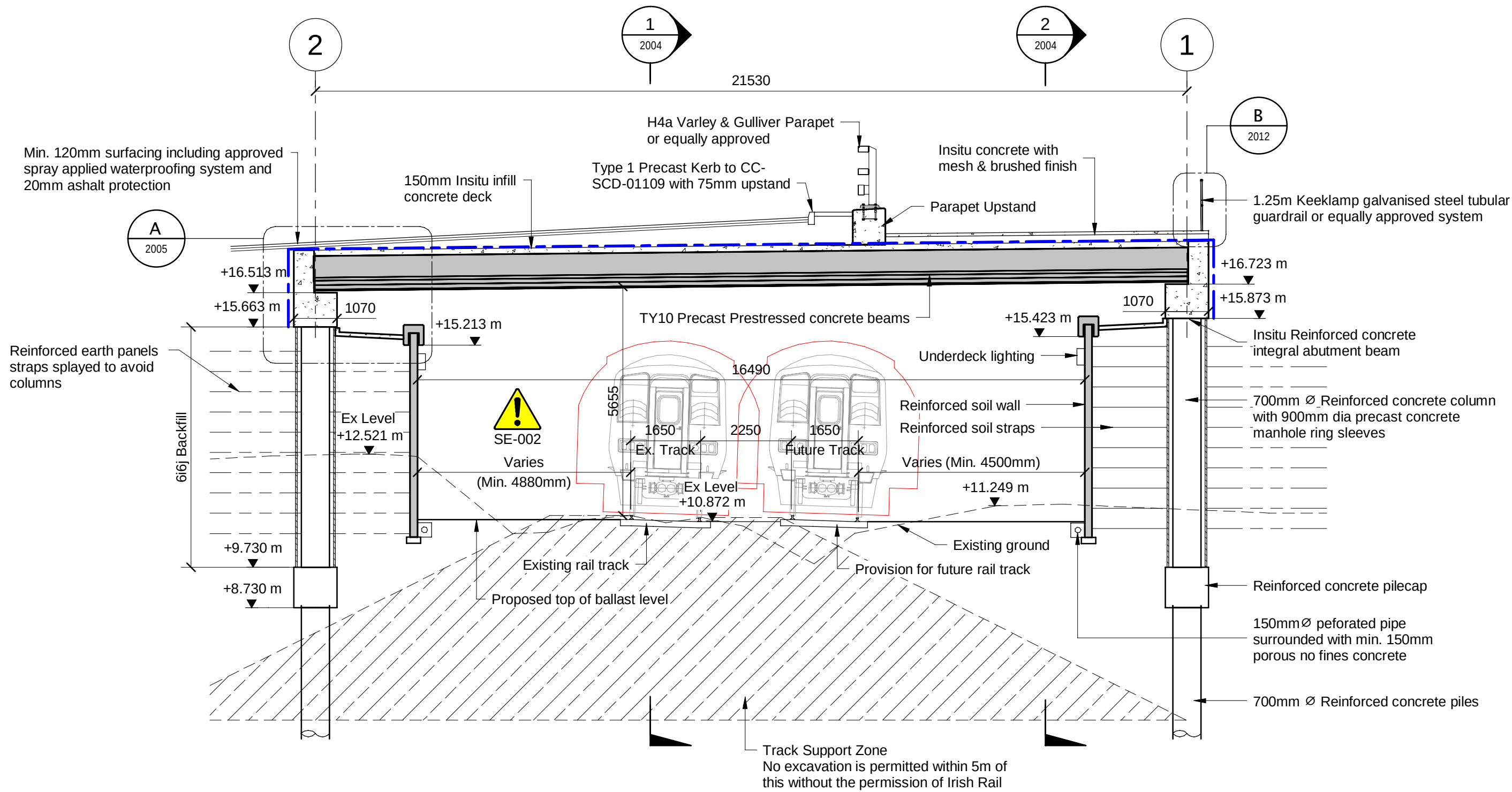
Notes below are additional to hazards/risks normally associated with this type of work. Numbers correspond to Risk Register references.

Residual Risk

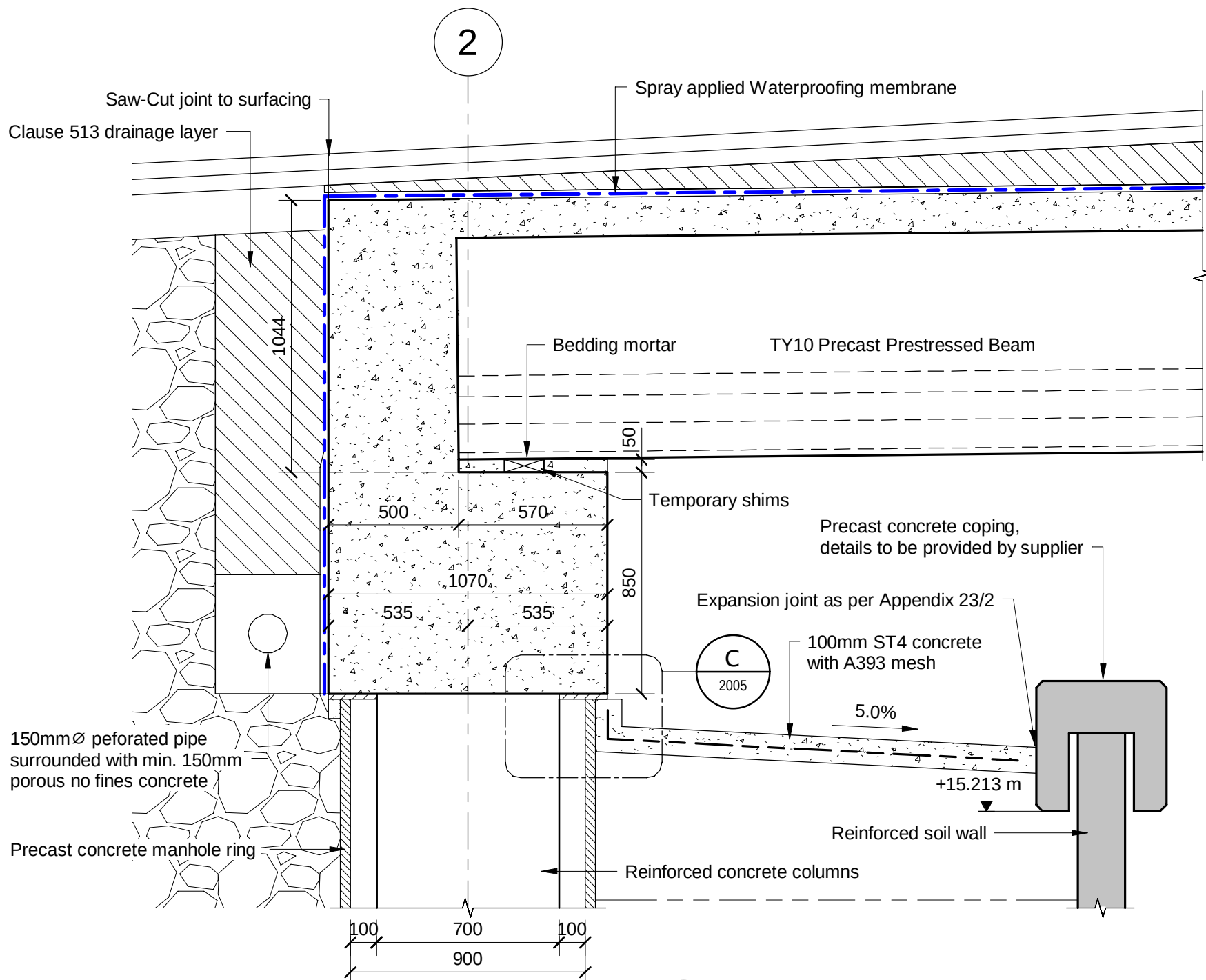
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SE-002

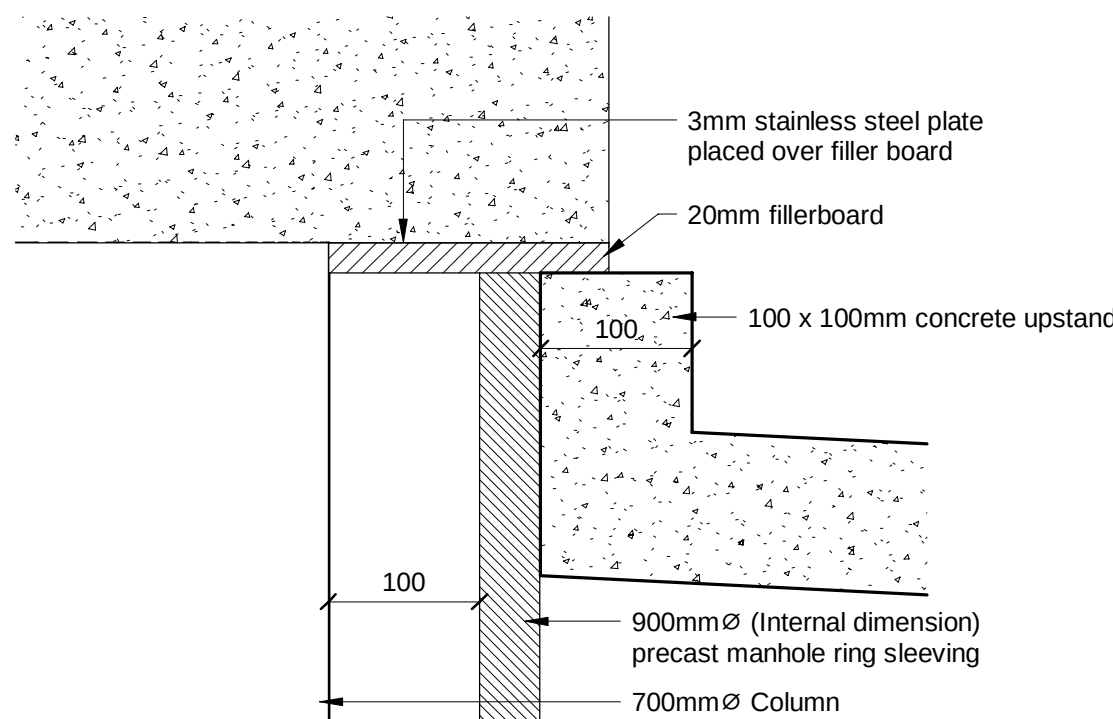
Live rail traffic



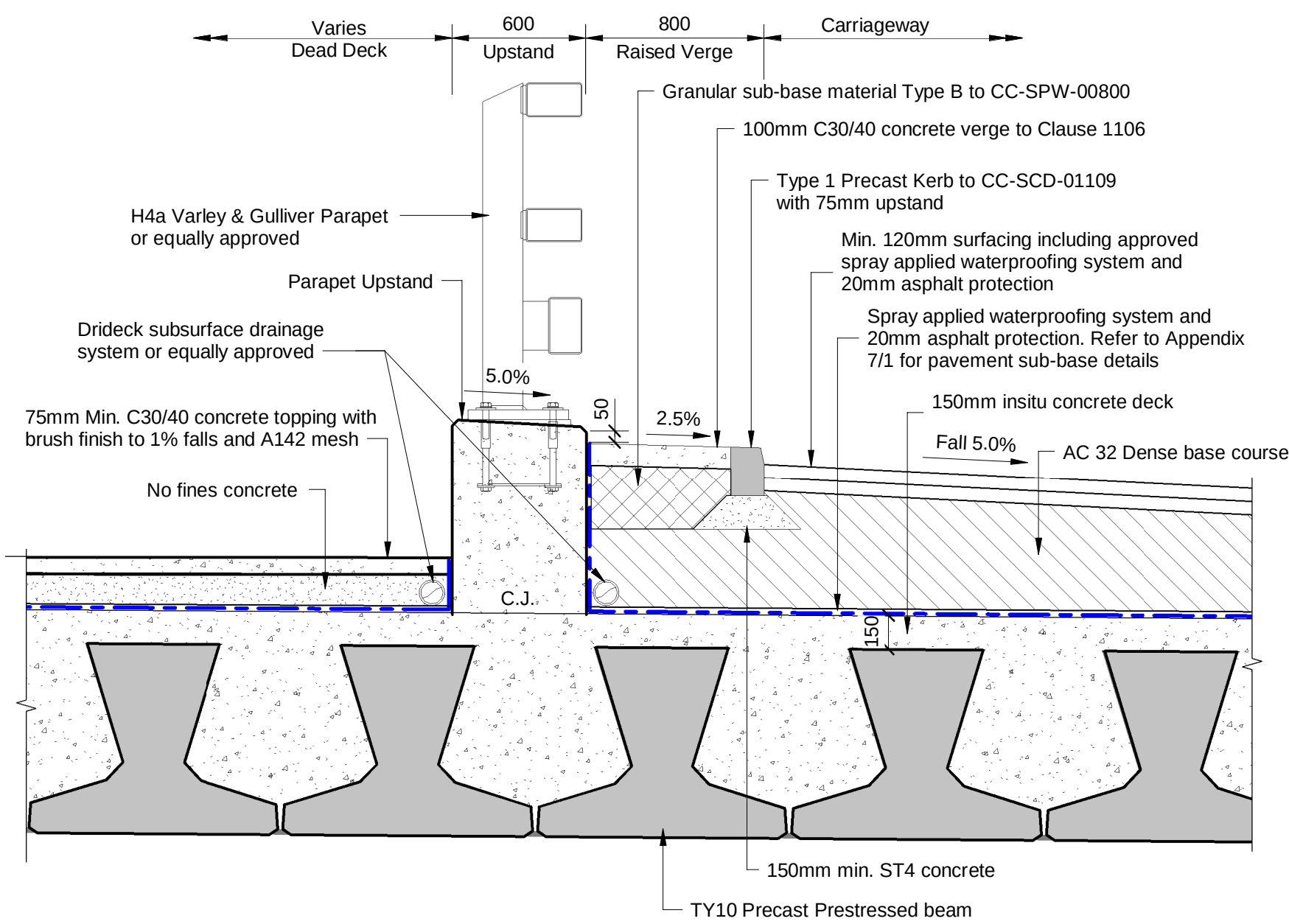
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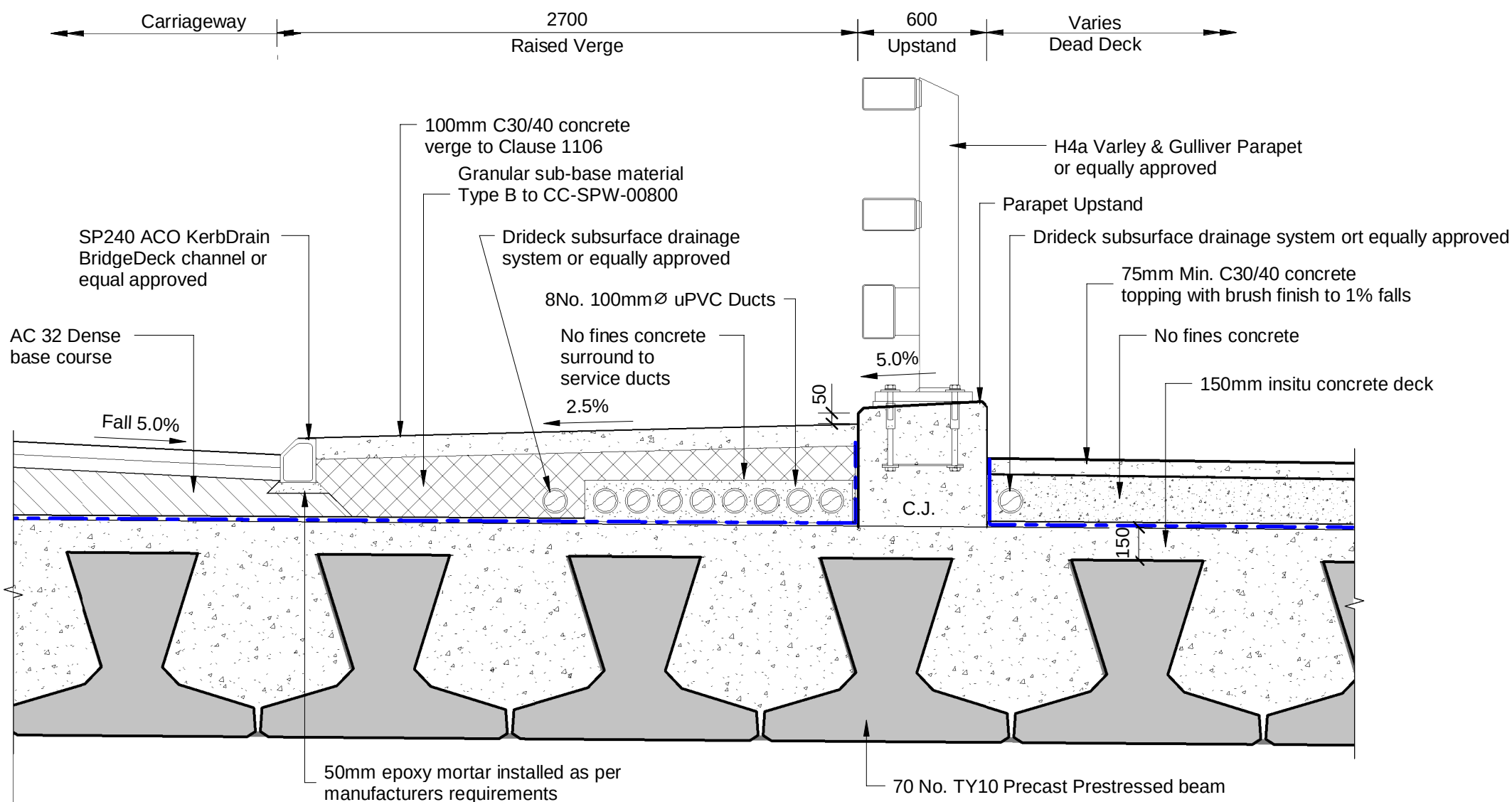
DETAIL A
1 : 20



DETAIL C
1 : 5



SECTION 5
1 : 25



SECTION 6
1 : 25

- Notes
- Refer to drawing 229100548-MMD-1700-RE-DR-C-2003 for notes.

- Key to symbols
- Spray applied waterproofing
 - IRL 1 Rail Gauge

- Reference drawings
- | | |
|---------------------------------|--------------------------|
| 229100548-MMD-1700-RE-DR-C-2003 | General Arrangement Plan |
| 229100548-MMD-1700-RE-DR-C-2004 | Sections & Elevations |

P02	28.10.2024	ROC	Issued for Approval	RS	JS
P01	30.04.2024	ROC	Issued for Information	CC	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Wexford County Council
Carricklawn
Wexford Town

Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
General Arrangement
Sections & Details

Designed	C. Clarke	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	C. Clarke	Approved	J. Shinkwin	
MMD Project Number	229100548	Scale at A1	As indicated	Security STD

Drawing Description

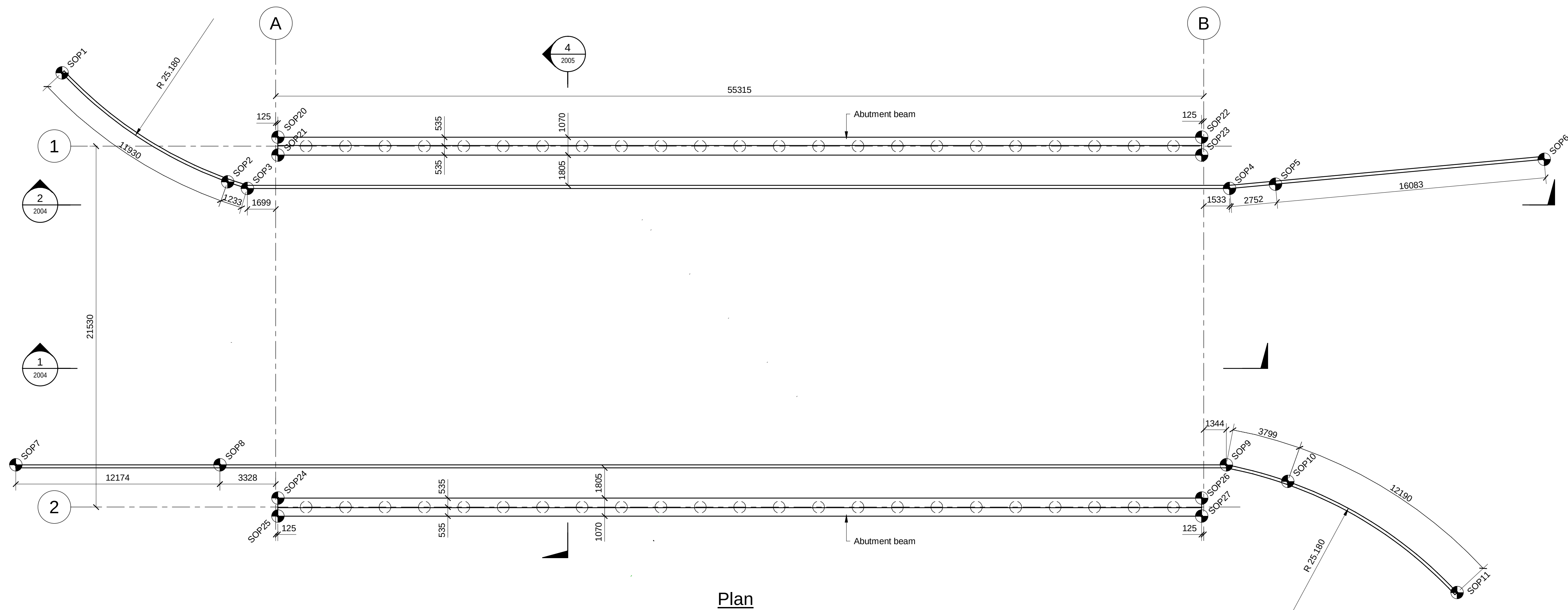
General Arrangement

Drawing Number	229100548-MMD-1700-RE-DR-C-2005	Rev	P02
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A 3D perspective view of a double-deck bridge. The bridge consists of two main horizontal beams, one above the other. Each beam is supported by a series of vertical hangers. The top beam has a series of hangers that are connected to a top deck. The bottom beam has a series of hangers that are connected to a bottom deck. The hangers are arranged in a staggered pattern, with the hangers of the top beam offset from the hangers of the bottom beam. The bridge is shown from a perspective that highlights the depth and the arrangement of the hangers.

O.S. Ref: 5645-C & 5715-A
CYAL50379123
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1. Refer to drawing 229100548-MMD-1700-RE-DR-C-2003 for notes.
2. Column setting out points as per corresponding pile setting out points.
3. Refer to Appendix 1/11 for details of Contractor designed reinforced earth panels.



Setting Out Points

Ref	Easting	Northing	Level	Level Location
SOP1	712266.137	612240.256	12.077	TOW
SOP2	712277.045	612235.706	15.723	TOW
SOP3	712278.266	612235.541	15.723	TOW
SOP4	712335.792	612246.430	15.723	TOW
SOP5	712338.437	612247.188	15.723	TOW
SOP6	712353.898	612251.618	12.000	TOW
SOP7	712267.771	612216.772	17.016	TOW
SOP8	712279.733	612219.036	15.513	TOW
SOP9	712338.672	612230.192	15.513	TOW
SOP10	712342.457	612229.902	15.513	TOW
SOP11	712353.603	612225.267	13.208	TOW
SOP20	712279.490	612238.882	15.873	Abutment Base
SOP21	712279.689	612237.831	15.873	Abutment Base
SOP22	712333.594	612249.123	15.873	Abutment Base
SOP23	712333.793	612248.072	15.873	Abutment Base
SOP24	712283.494	612217.728	15.663	Abutment Base
SOP25	712283.693	612216.676	15.663	Abutment Base
SOP26	712337.599	612227.969	15.663	Abutment Base
SOP27	712337.798	612226.917	15.663	Abutment Base

[illegible]

P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Title
N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
Bridge Abutment Beam Plan
General Arrangement

Designed	C. Clarke		Eng. Check	R. Sexton	
Drawn	R. O'Connor		Coordination	J. O'Riordan	
Dwg. Check	C. Clarke		Approved	J. Shinkwin	

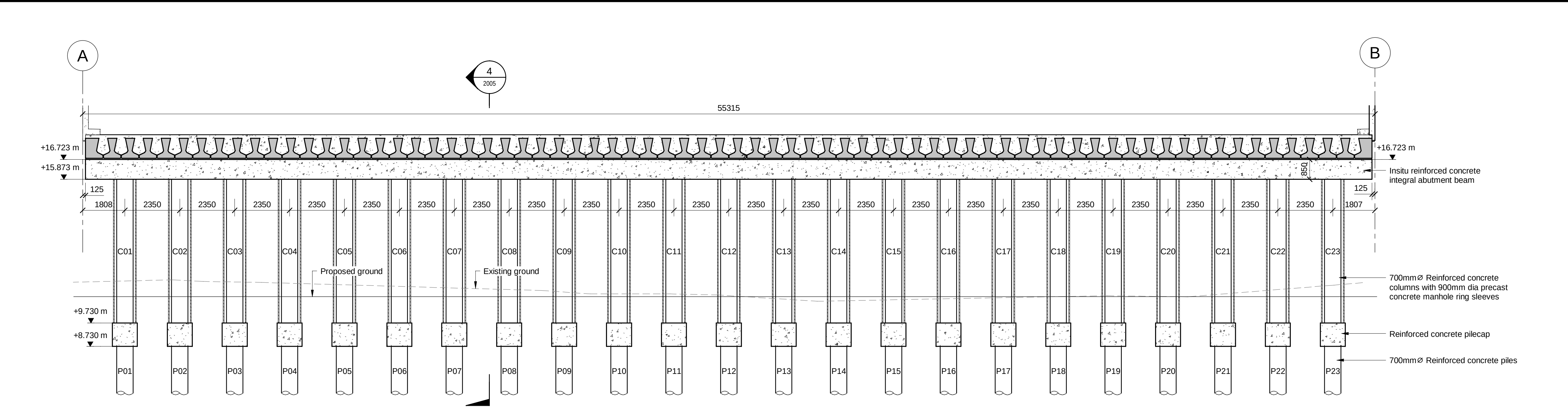
MMD Project Number 229100548	Scale at A1 As indicated	Security STD
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Drawing Description

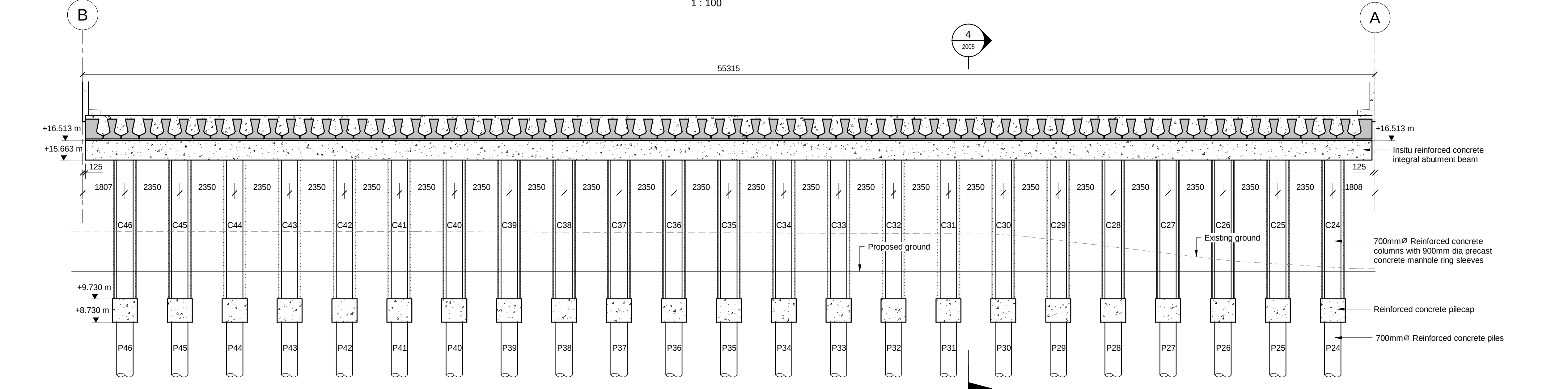
General Arrangement

Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2006	P01

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North Abutment
1 : 100



South Abutment
1 : 100

- Notes
- Refer to drawing 229100548-MMD-1700-RE-DR-C-2003 for notes.
 - Columns shall be treated with two coats of epoxy resin waterproof paint.

Key to symbols

Reference drawings

P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

Status Stamp

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Roads Department
Wexford County Council
Carricklawn
Wexford Town



Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
Bridge Abutment General Arrangement

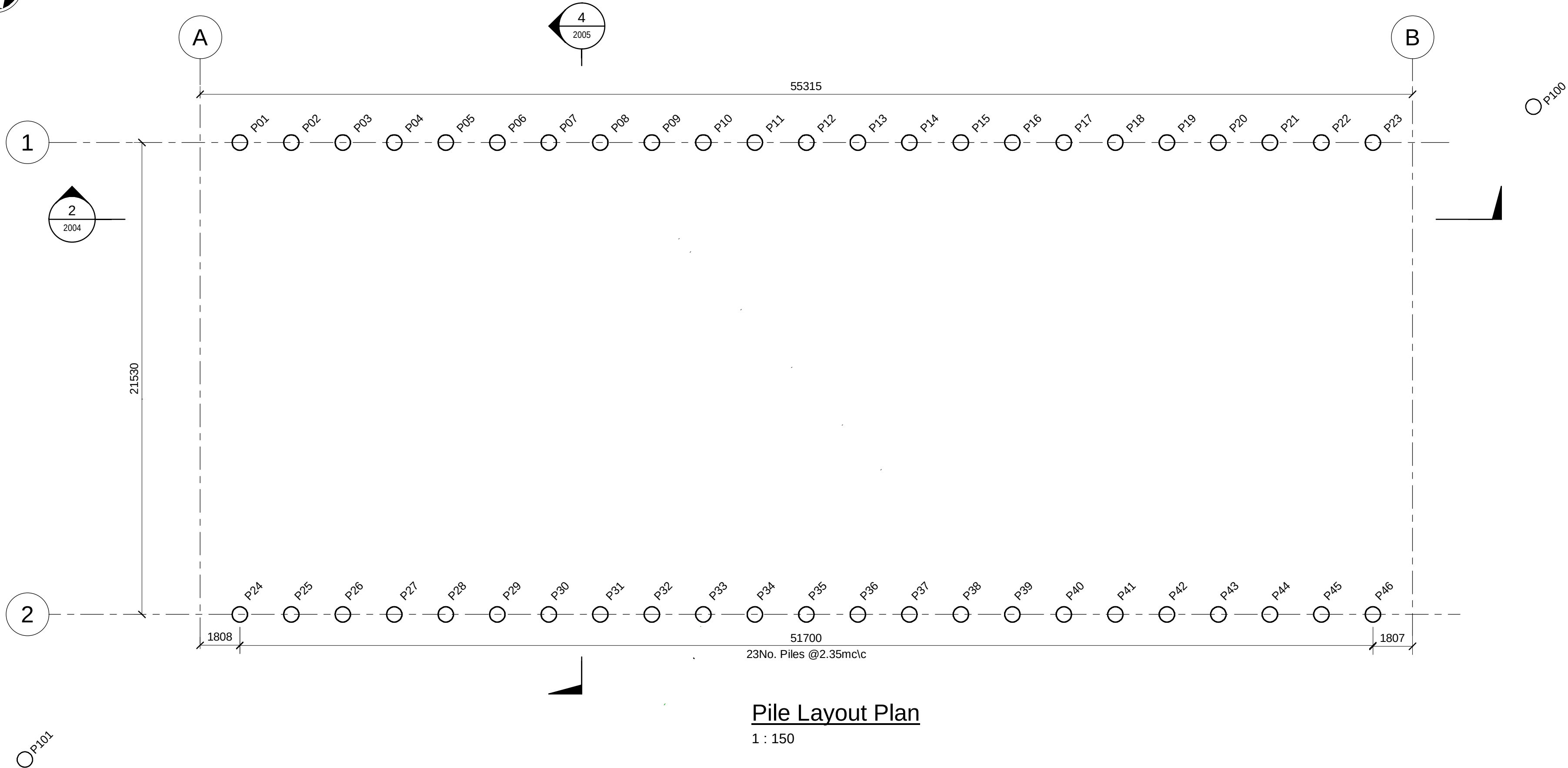
Designed	C. Clarke	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	C. Clarke	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As indicated	STD

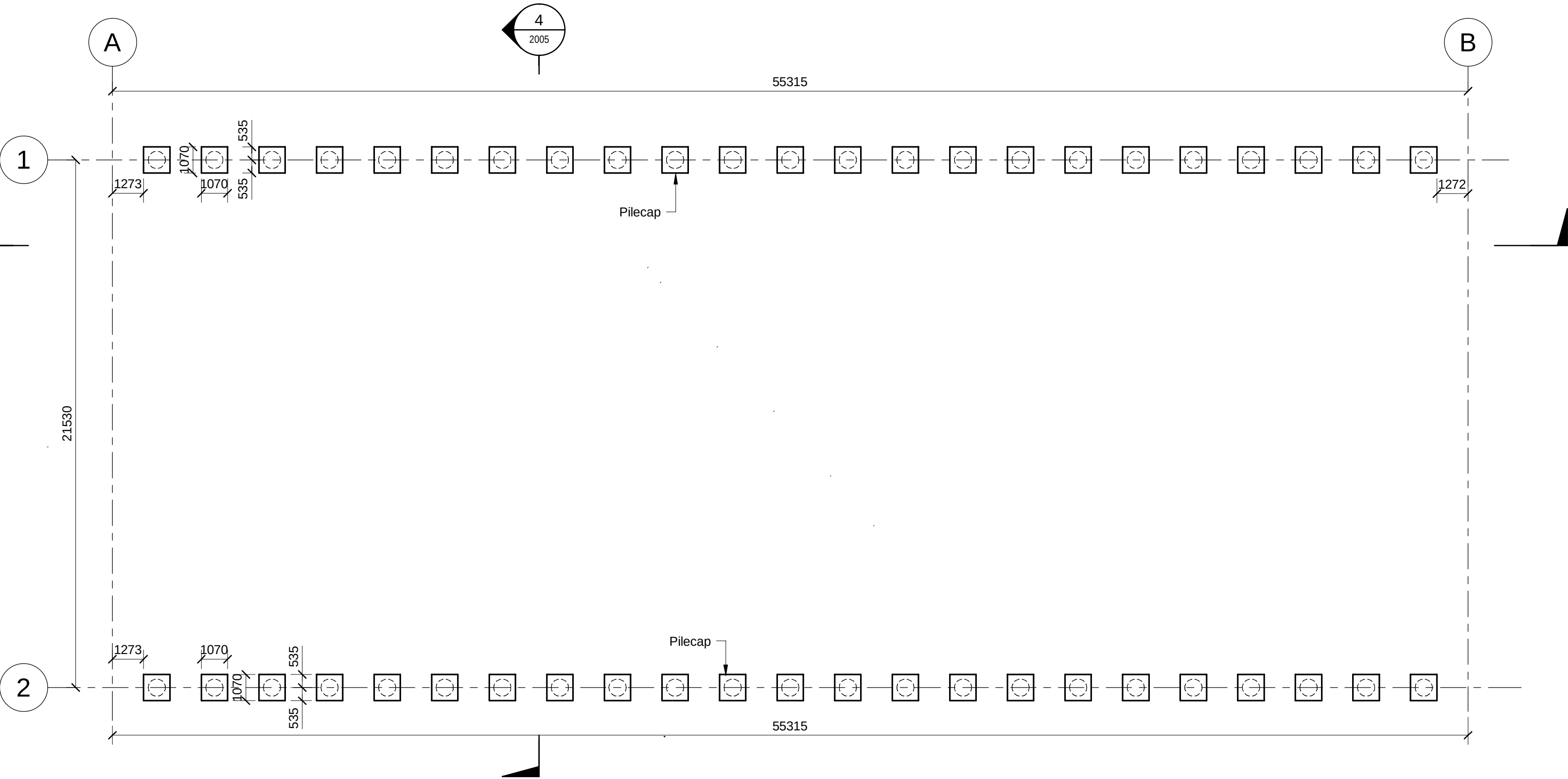
Drawing Description
General Arrangement

Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2007	P01

O.S. Ref: 5645-C & 5715-A
CYAL50379123
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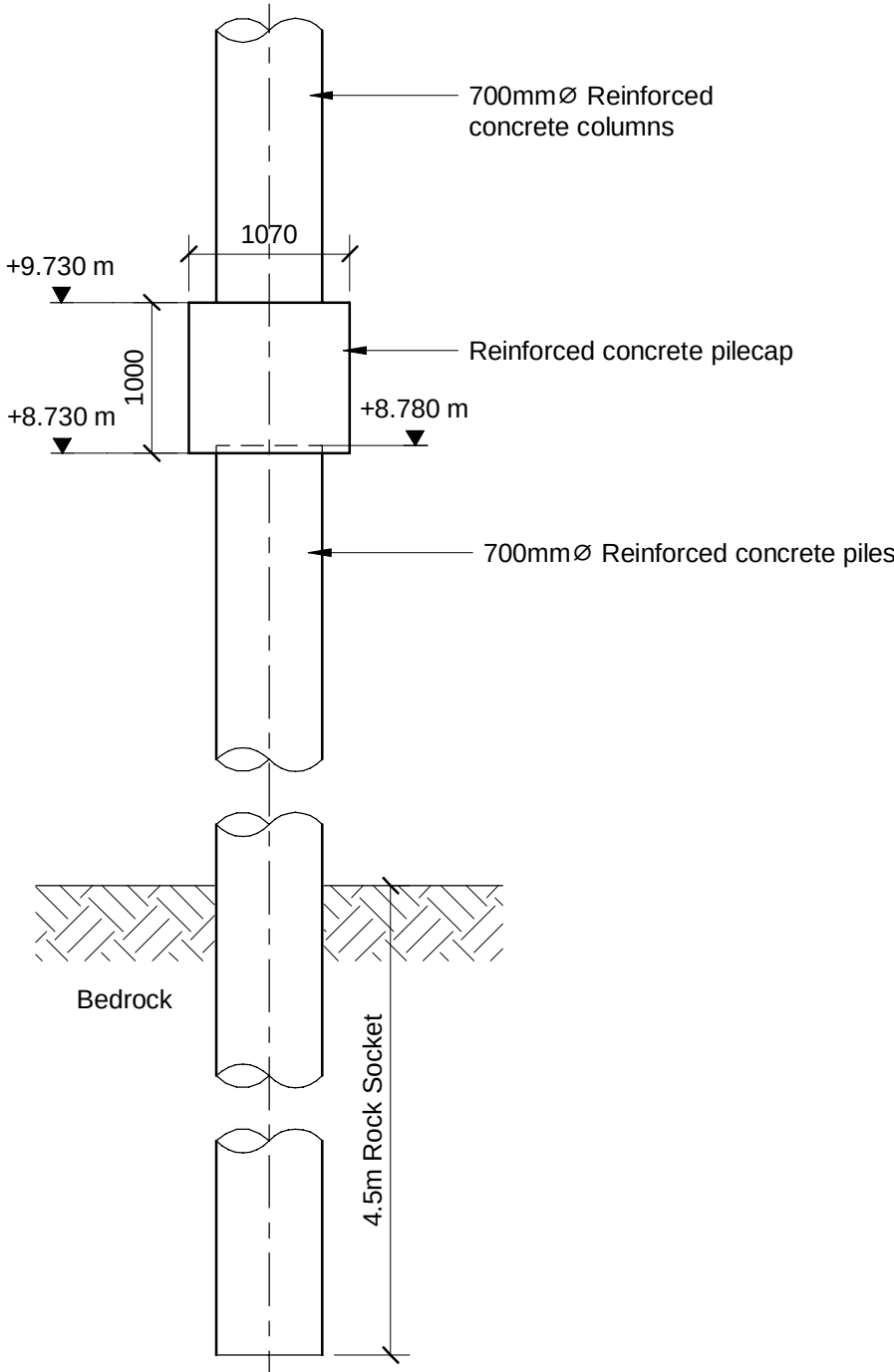


Pile Layout Plan
1 : 150

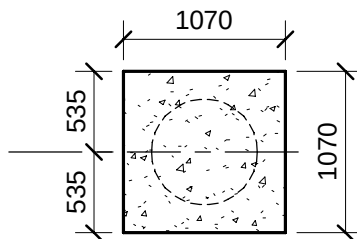


Pile Cap Plan
1 : 150

Piling Schedule					
Plie Ref	Easting	Northing	Cut Off Level m O.D.	Toe Level m O.D.	Comments
P01	712281.243	612238.669	8.780	-1.000	
P02	712283.552	612239.106	8.780	-1.000	
P03	712285.861	612239.543	8.780	-1.000	
P04	712288.170	612239.980	8.780	-1.000	
P05	712290.479	612240.417	8.780	-1.000	
P06	712292.788	612240.855	8.780	-1.000	
P07	712295.097	612241.292	8.780	-1.000	
P08	712297.406	612241.729	8.780	-1.000	
P09	712299.715	612242.166	8.780	-1.000	
P10	712302.024	612242.603	8.780	-1.000	
P11	712304.333	612243.040	8.780	-1.000	
P12	712306.642	612243.477	8.780	-1.000	
P13	712308.951	612243.914	8.780	-1.000	
P14	712311.260	612244.351	8.780	-1.000	
P15	712313.569	612244.788	8.780	-1.000	
P16	712315.878	612245.225	8.780	-1.000	
P17	712318.187	612245.662	8.780	-1.000	
P18	712320.496	612246.099	8.780	-1.000	
P19	712322.805	612246.536	8.780	-1.000	
P20	712325.114	612246.973	8.780	-1.000	
P21	712327.423	612247.410	8.780	-1.000	
P22	712329.732	612247.847	8.780	-1.000	
P23	712332.041	612248.284	8.780	-1.000	
P24	712285.247	612217.515	8.780	-1.000	
P25	712287.556	612217.952	8.780	-1.000	
P26	712289.865	612218.389	8.780	-1.000	
P27	712292.174	612218.826	8.780	-1.000	
P28	712294.483	612219.263	8.780	-1.000	
P29	712296.792	612219.700	8.780	-1.000	
P30	712299.101	612220.137	8.780	-1.000	
P31	712301.410	612220.574	8.780	-1.000	
P32	712303.719	612221.011	8.780	-1.000	
P33	712306.028	612221.448	8.780	-1.000	
P34	712308.337	612221.885	8.780	-1.000	
P35	712310.646	612222.322	8.780	-1.000	
P36	712312.955	612222.760	8.780	-1.000	
P37	712315.264	612223.197	8.780	-1.000	
P38	712317.573	612223.634	8.780	-1.000	
P39	712319.882	612224.071	8.780	-1.000	
P40	712322.191	612224.508	8.780	-1.000	
P41	712324.500	612224.945	8.780	-1.000	
P42	712326.809	612225.382	8.780	-1.000	
P43	712329.118	612225.819	8.780	-1.000	
P44	712331.427	612226.256	8.780	-1.000	
P45	712333.736	612226.693	8.780	-1.000	
P46	712336.045	612227.130	8.780	-1.000	
P100	712338.936	612251.254	0.000	-1.000	Test Pile 1
P101	712276.843	612209.188	0.000	-1.000	Test Pile 2



Typical Pile Detail (Section)
1 : 50



Typical Pilecap Detail (Plan)
1 : 50

Notes

1. Refer to drawing 229100548-MMD-1700-RE-DR-C-2003 for notes.

2. Pile setting out coordinates refer to the centre of the pile

Key to symbols

Reference drawings

P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Client

Wexford County Council
Roads Department
Wexford County Council
Carricklawn
Wexford Town

Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
Bridge Pile & Pilecap
General Arrangement & Details

Designed	C. Clarke	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	C. Clarke	Approved	J. Shinkwin	

MMD Project Number

229100548

Scale at A1

As indicated

Security

STD

Drawing Description

General Arrangement

Drawing Number

229100548-MMD-1700-RE-DR-C-2008

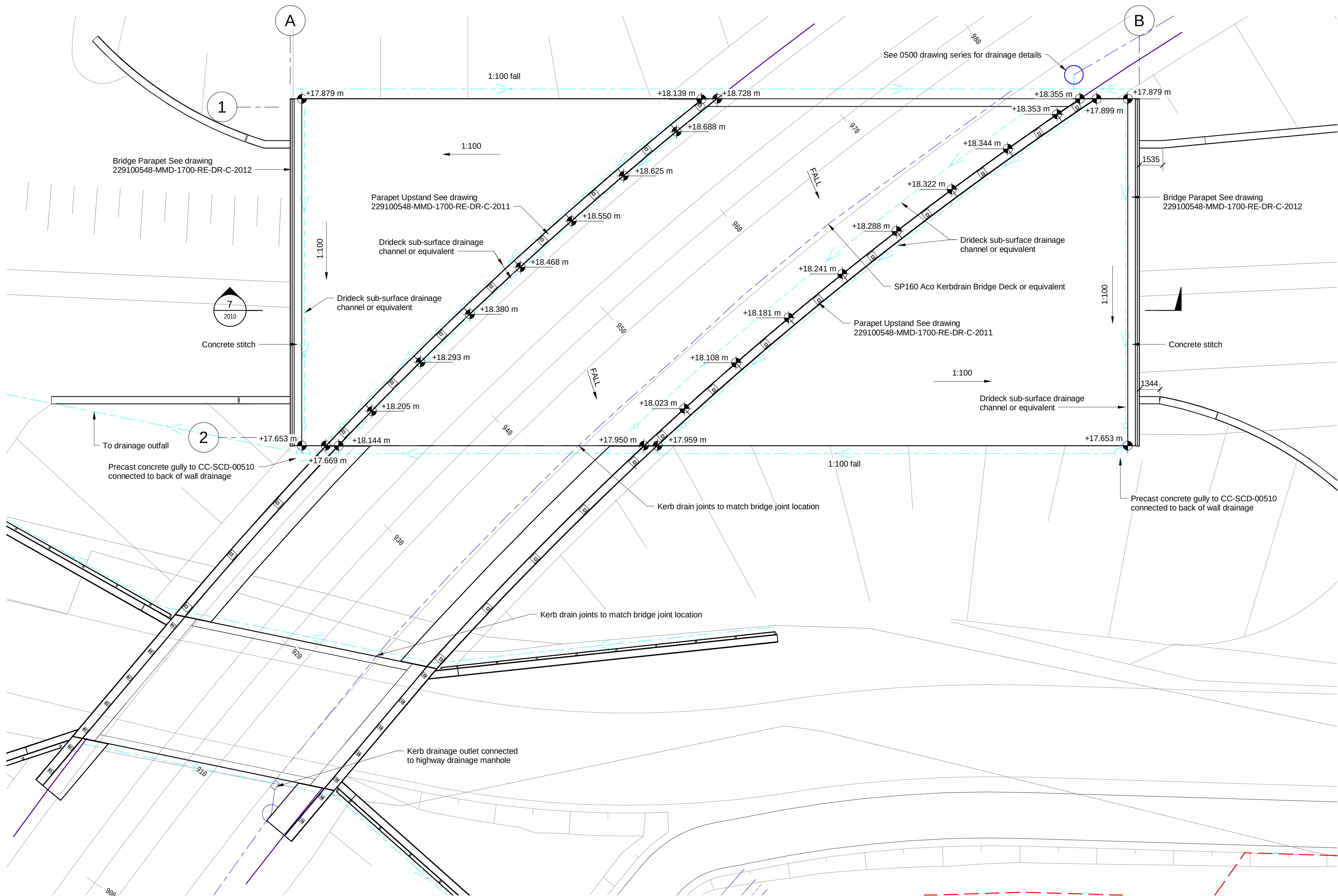
Rev

P01

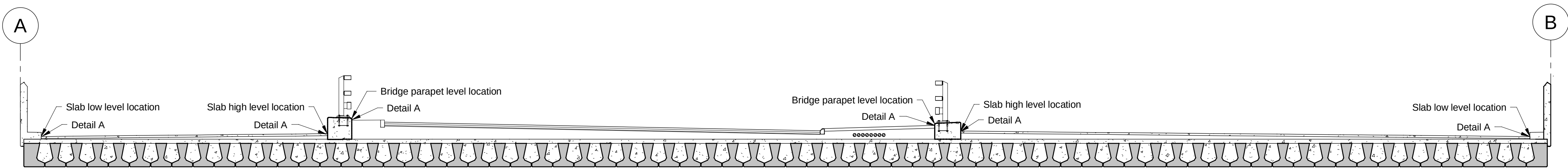
O.S. Ref: 5645-C & 5715-A

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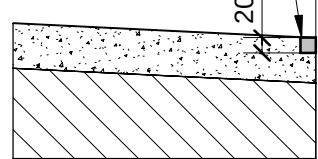
Plan
1 : 150



SECTION
1 : 100

7
2010

Gun applied continuous hydrophilic sealant with 2 part continuous polysulphide sealant



Detail A
1 : 10

Notes

- Refer to drawing 229100548-MMD-1700-RE-DR-C-2003 for notes.
- Sub-surface drainage outfalls to back of wall drainage.

Key to symbols

- Lands Made Available
- Proposed Back of Wall Drainage
- Proposed Kerb Drain
- Proposed Drideck sub-surface drainage channel or equally approved
- Proposed Sub-surface drainage access chamber

Reference drawings

P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Wexford Town



Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
Deck Drainage & Deck Levels

Designed	C. Clarke	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	C. Clarke	Approved	J. Shinkwin	

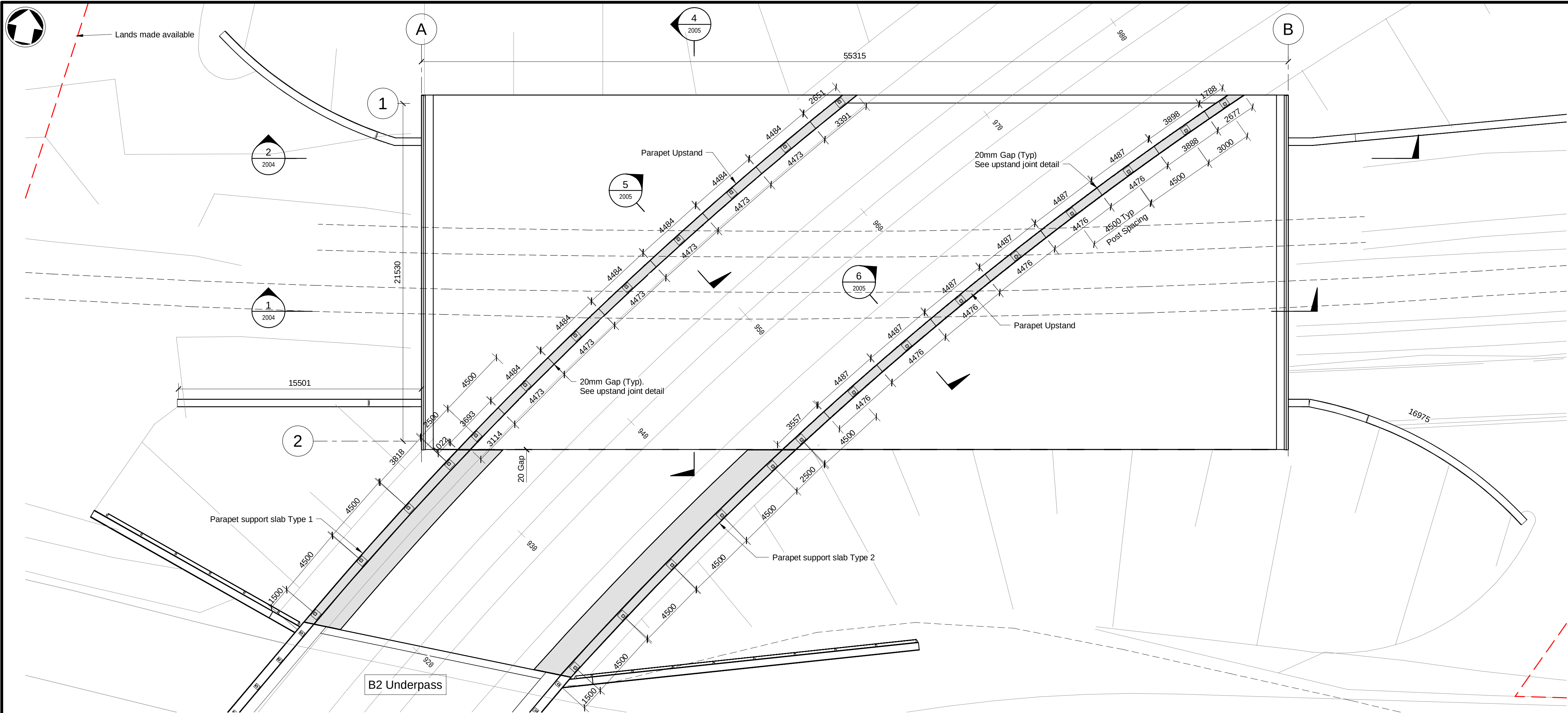
MMD Project Number	Scale at A1	Security
229100548	As indicated	STD

Drawing Description
General Arrangement

Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2010	P01

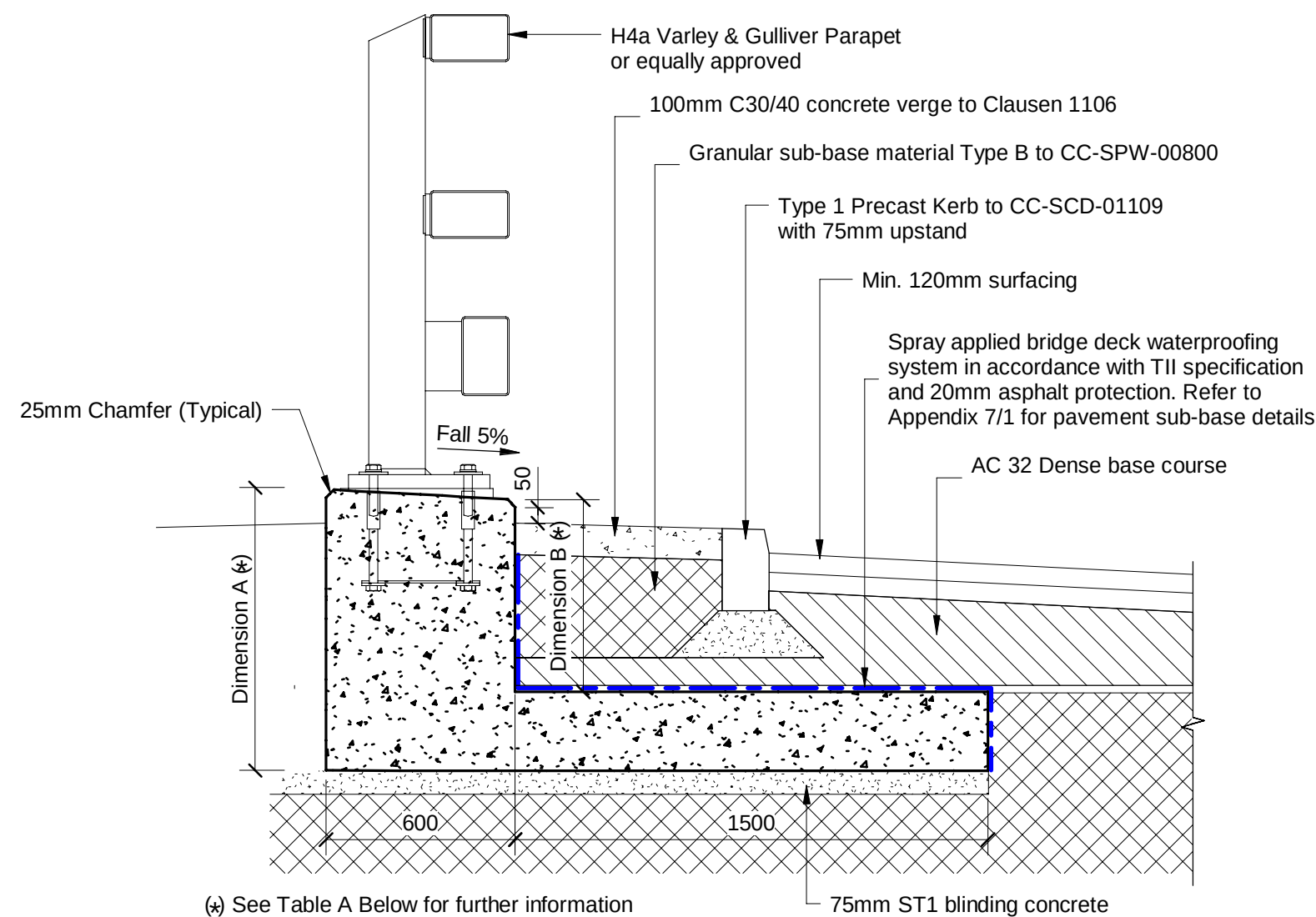
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Plan

1 : 150



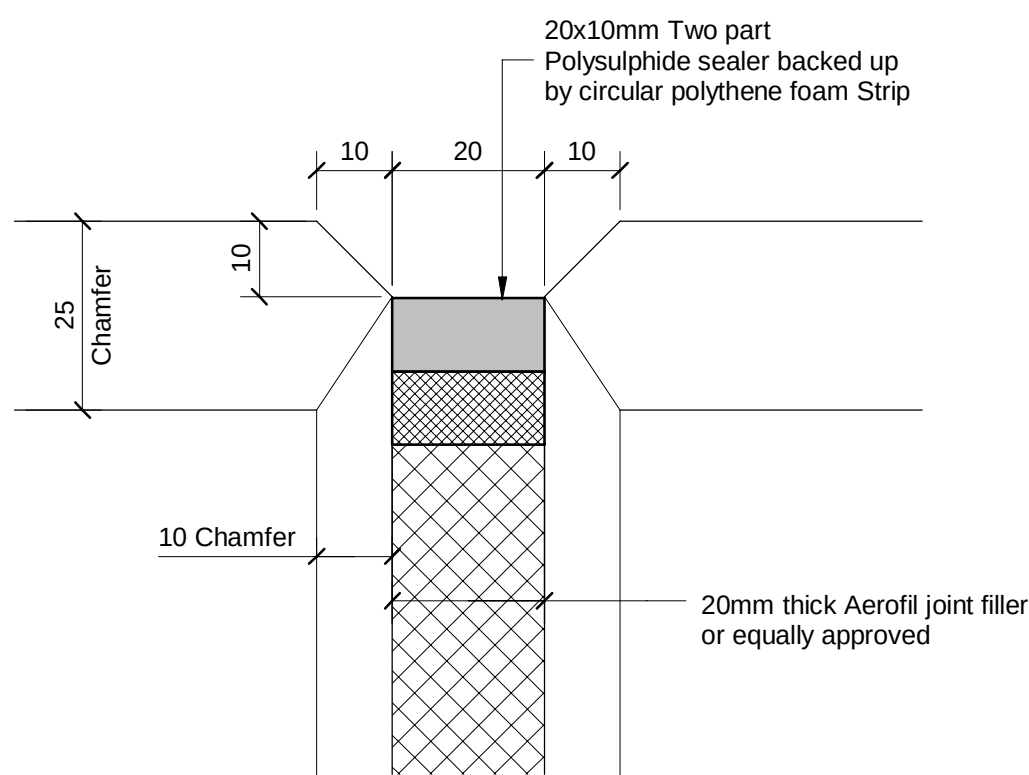
Parapet Support Slab Section

1 : 20

Parapet Support Slab Ref.	Dimension A	Dimension B
Type 1	897	610
Type 2	703	416

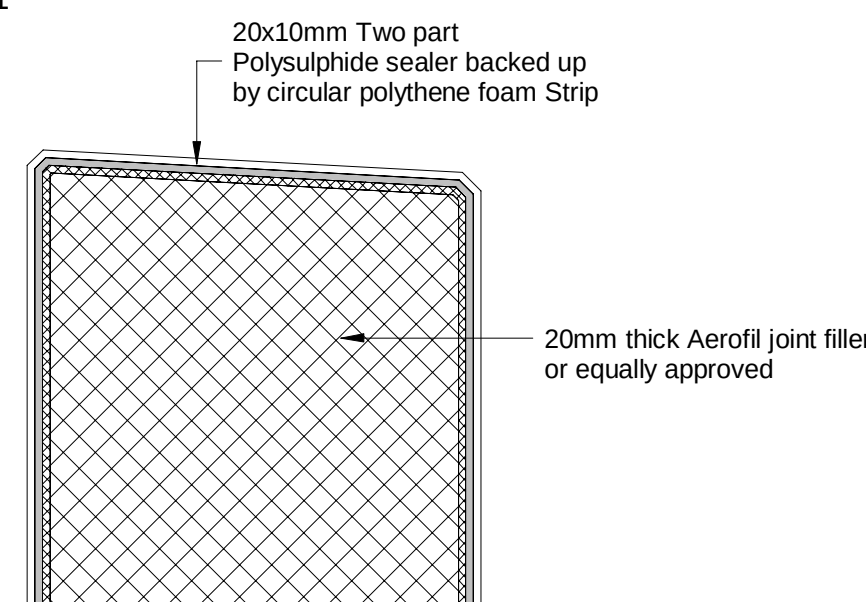
Table A

NOT TO SCALE



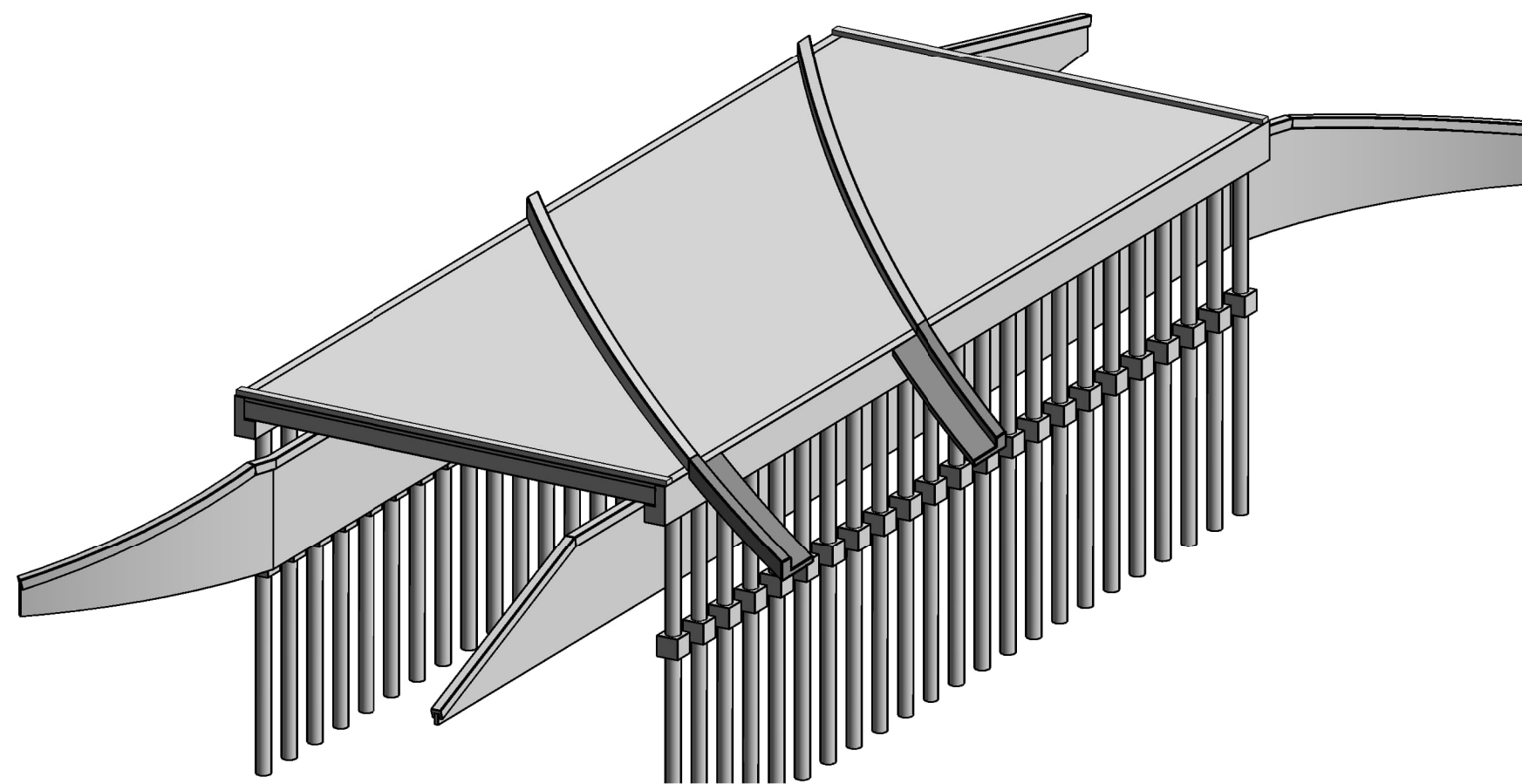
Upstand Joint Detail Elevation

1 : 1



Upstand Joint Detail Section

1 : 10



3D Parapet Upstand & Parapet Support Slab View

O.S. Ref: 5645-C & 5715-A

CYAL50379123

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Notes

- Refer to drawing 229100548-MMD-1700-RE-DR-C-2003 for notes.
- Refer to drawing 229100548-MMD-1700-RE-DR-C-2110 for details of parapets on B2 Access Underpass.

Key to symbols

- Lands Made Available
- Spray applied waterproofing

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P01	28.10.2024	ROC	Issued for Approval	RS	JS

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Wexford County Council
Carricklawn
Wexford Town



Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
Parapet Upstand & Parapet Support Slab
General Arrangement & Details

Designed	C. Clarke	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	C. Clarke	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As indicated	STD

Drawing Description	General Arrangement
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Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2011	P01

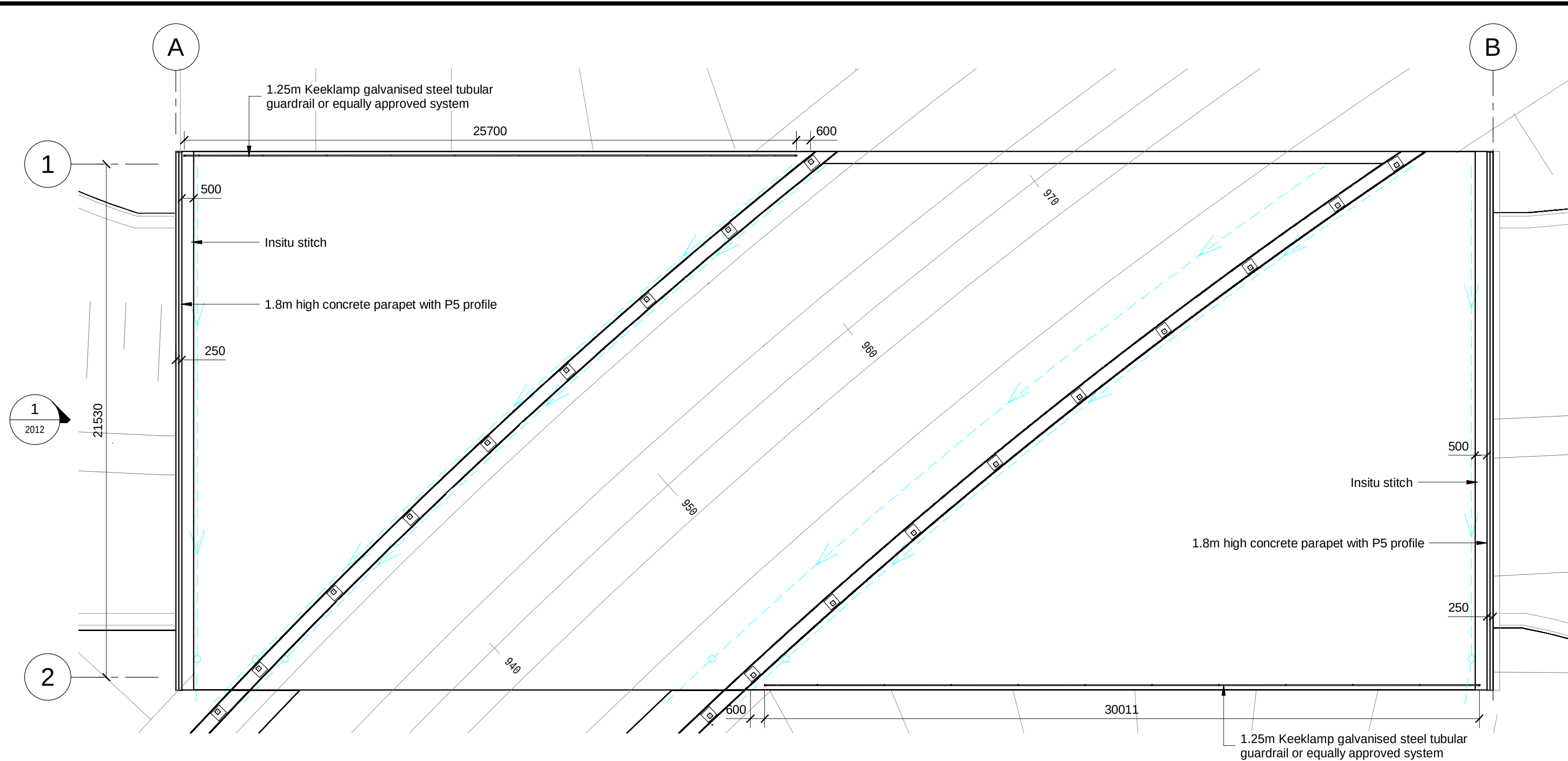


Diagram showing the elevation of the bridge parapet. The total width is 21530. The parapet is composed of 7 panels (3211) with 20mm joints, totaling 22600. The height is 2318. The diagram includes a callout for 'See Bridge Parapet Joint Detail Elevation' and a label for 'TYE10 Precast Prestressed Edge Beam'.

1

2

2004

21530

22600

7 Panels (3211) with 20mm Joints

3211

3211

3211

3211

3211

3211

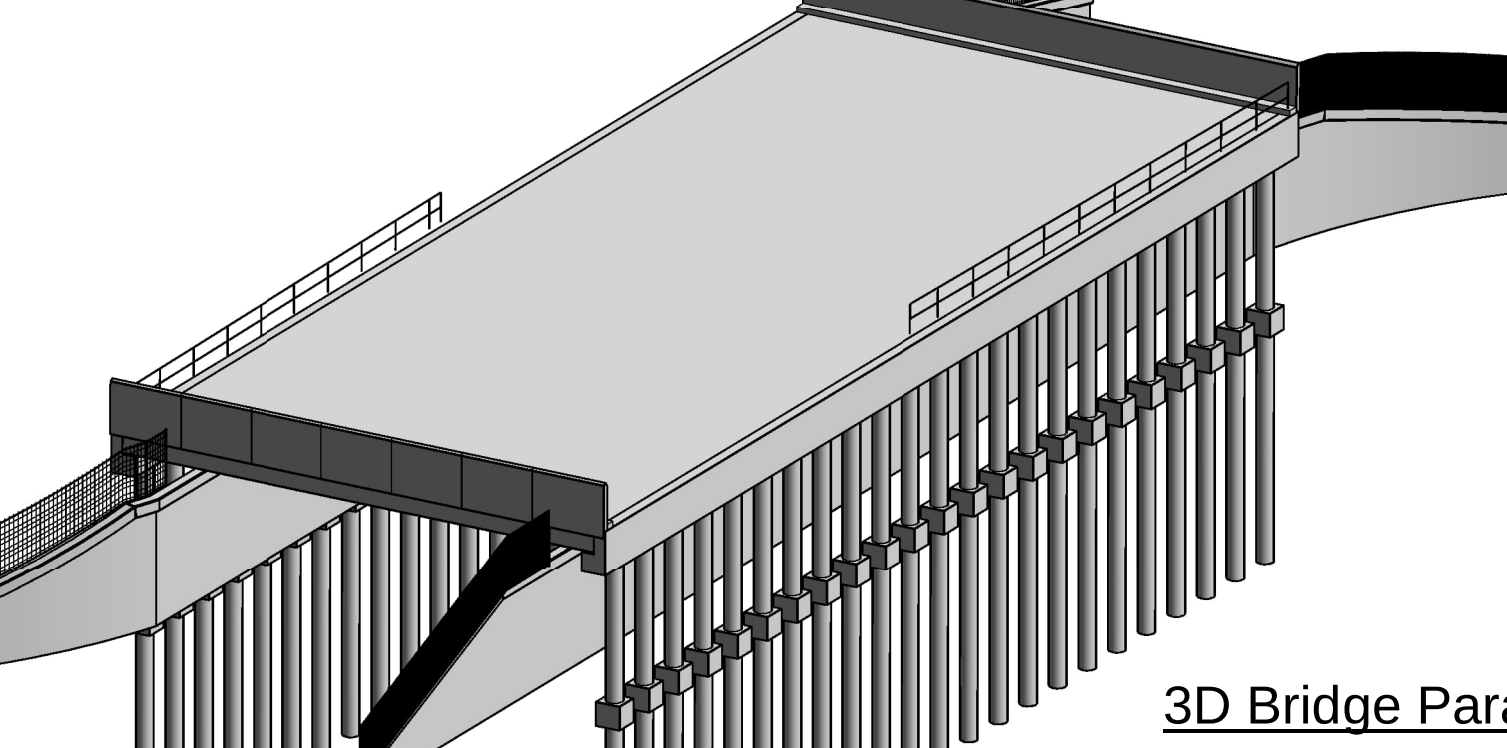
3211

See Bridge Parapet Joint Detail Elevation

2318

TYE10 Precast Prestressed Edge Beam

ELEVATION 1



3D Bridge Parapet View

Diagram illustrating the cross-section of a bridge deck structure. The structure consists of a concrete base (200mm thick) and a concrete topping (75mm Min. C30/40 concrete topping with brush finish to 1% falls and A142 mesh). The total height of the concrete structure is 1250mm. The bridge deck is supported by a keel/lamp system (Keeklamp galvanised steel tubular guardrail or equally approved system). The diagram also indicates the presence of 'No fines concrete' and a 'Bridge deck' layer.

20x10mm Two part Polysulphide sealer backed up by circular polythene foam Strip

10 20 10

10

25 Chamfer

10 Chamfer

20mm thick Aerofill joint filler or equally approved

Technical drawing of a bridge deck cross-section. The drawing includes the following dimensions and components:

- Overall Height:** 2318
- Top Width:** 250 (total), 125 (each side of the central opening)
- Top Opening:** 150 (width), 75 (height)
- Main Height:** 1800
- Insitu stitch:** 500 (width), 2.5% (slope)
- Bottom Width:** 240
- Bottom Opening:** 115 (width), 150 (height)
- Bottom Width (each side of the central opening):** 125
- Labels:**
 - A** (top center)
 - E** (bottom center, 2012)
 - TYE10 Precast Prestressed edge beam** (pointing to the top edge)
 - 100mm duct within deck for lighting cable conduit** (pointing to the bottom opening)
 - TY10 Precast Prestressed beam** (pointing to the bottom edge)

20x10mm Two part
Polysulphide sealer backed up
by circular polythene foam Strip

20mm thick Aerofil joint filler
or equally approved

O.S. Ref: 5645-C & 5715-A
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Reference drawings					
P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

Client

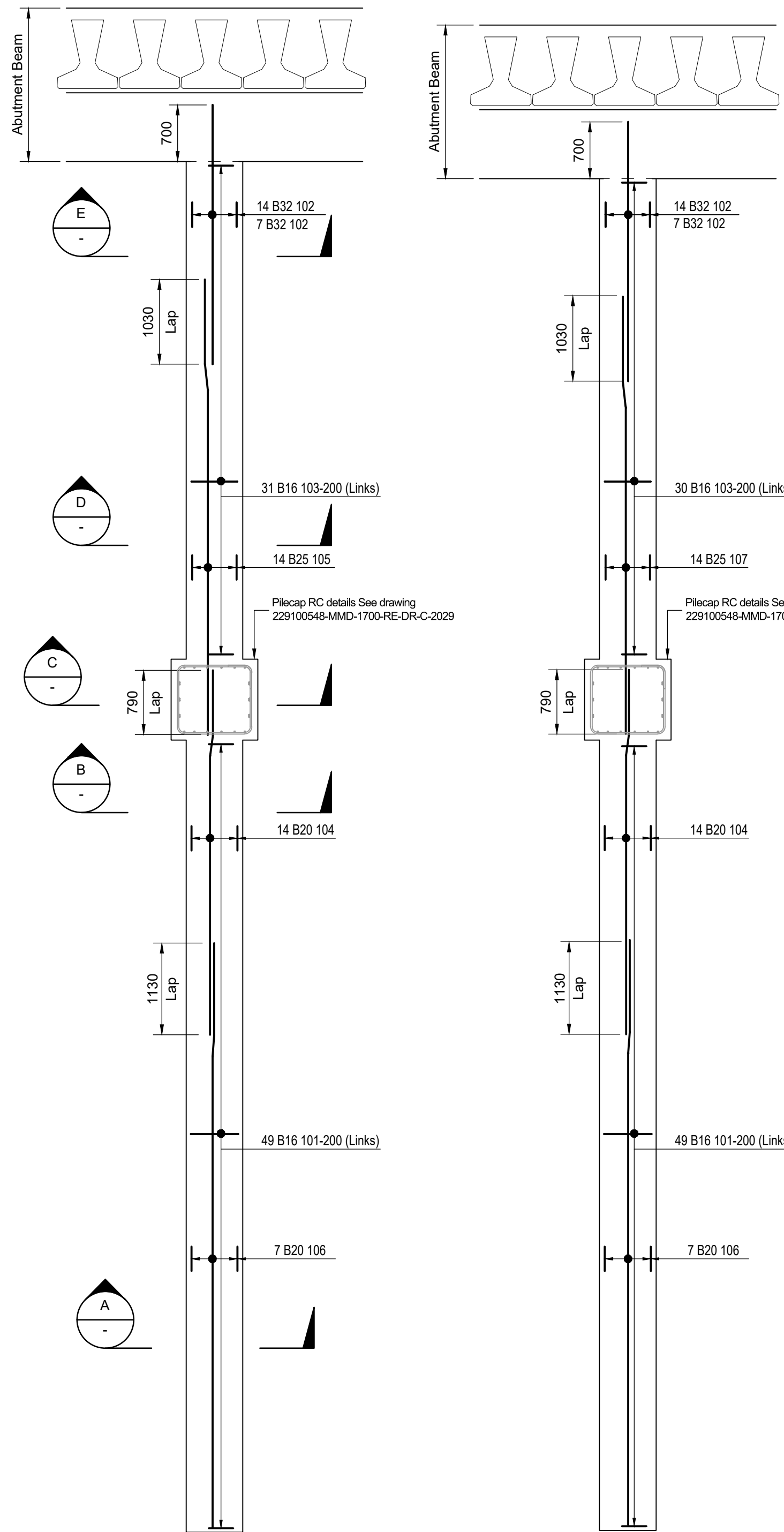
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Roads Department
Wexford County Council
Carricklawn
Wexford Town



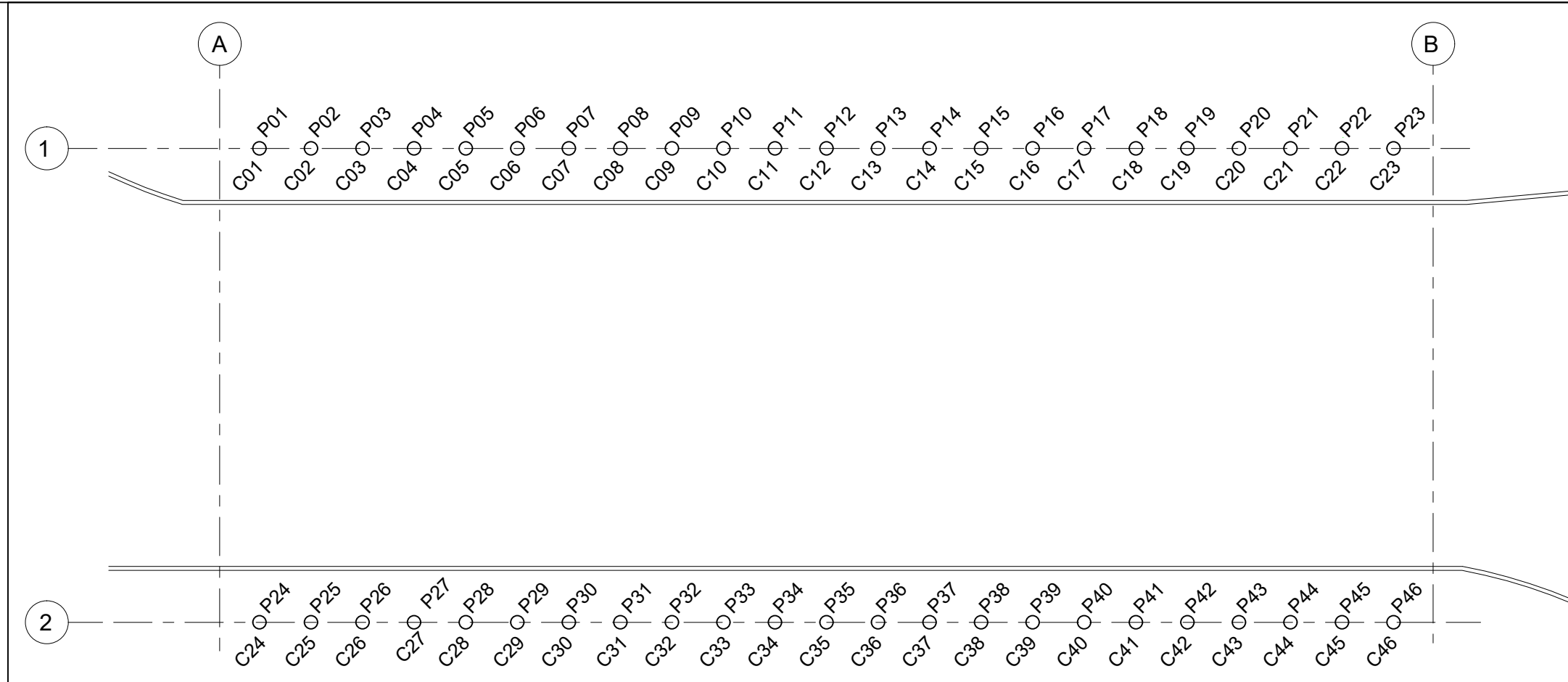
Comhairle Contae
Loch Garman
Wexford
County Council

Designed	C. Clarke		Eng. Check	R. Sexton	
Drawn	R. O'Connor		Coordination	J. O'Riordan	
Dwg. Check	C. Clarke		Approved	J. Shinkwin	
MMD Project Number 229100548		Scale at A1 As indicated			Security STD

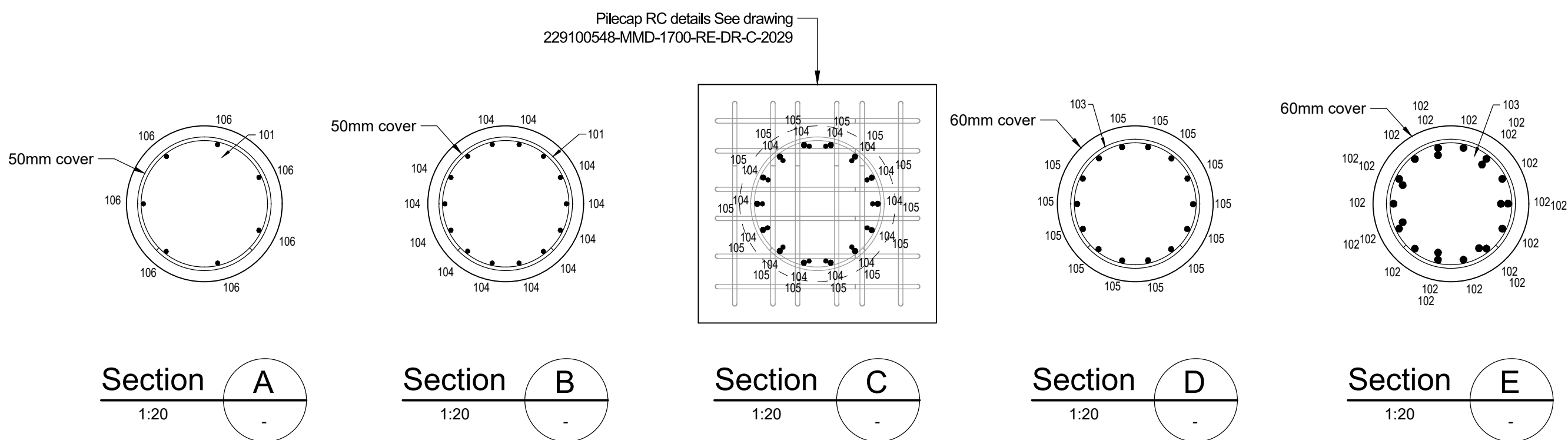
Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2012	P01



Pile/Column Type A (P01-P23) 1:50 @ A1
Pile/Column Type B (P24-P46) 1:50 @ A1



Key Plan
N.T.S.



Concrete Class C45/55

	Bond Condition	Bar Dia							
		8	10	12	16	20	25	32	40
100% lapped in one location	Good	230	320	420	600	790	1030	1310	1780
	Poor	330	460	590	860	1130	1470	1880	2550

- Notes
- Reinforcement to be Grade 500 Type B deformed bars to BS 4449:2005 (+A3 2016) and cut and bent in accordance with BS 8666 2005 unless otherwise specified.
 - All kickers to be 100mm high (minimum).
 - The Contractor is to satisfy themselves as to the accuracy of all reinforcing schedules prior to the ordering, cutting and bending of reinforcement.
 - Concrete elements are not to be loaded before 28 days. Props to be left in place for 28 days. Props to elements at higher levels not to be supported by unpropped elements at lower levels.
 - Reinforcement laps not otherwise defined shall be 50 times the smaller bar diameter.
 - For General Notes refer to drawing 229100548-MMD-1700-RE-DR-C-2003.

Concrete Notes:

- External arises to be chamfered 25x25mm. U.N.O.
- Class of concrete shown thus :
U (unformed), F(formed).
- Concrete to comply with TII Specification Series 1700 and DN-STR-03012.
- All buried surfaces to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
- Spray applied waterproofing membrane to DN-STR-03012 and complying with DN-STR-03009 to be applied to the bridge deck surface and upstands.
- Bedding grout to have a minimum cube compressive strength of 60 MPa unless noted otherwise.

Key to symbols

Reinforcement notation thus;

- T1 Top face, outer bar
- T2 Top face, second bar
- B1 Bottom face, outer bar
- B2 Bottom face, second bar
- N1 Near face, outer bar
- N2 Near face, second bar
- M1 Middle, outer bar
- M2 Middle, second bar
- F1 Far face, outer bar
- F2 Far face, second bar
- EF Each face
- ABR Alternate Bars Reversed
- Alt Alternatively placed
- AT Alternatively turned
- CL Centre line
- Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2002 to
229100548-MMD-1700-RE-DR-C-2012

P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Wexford Town
Y35 WY93



Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
Piles & Columns - Reinforcement
Details

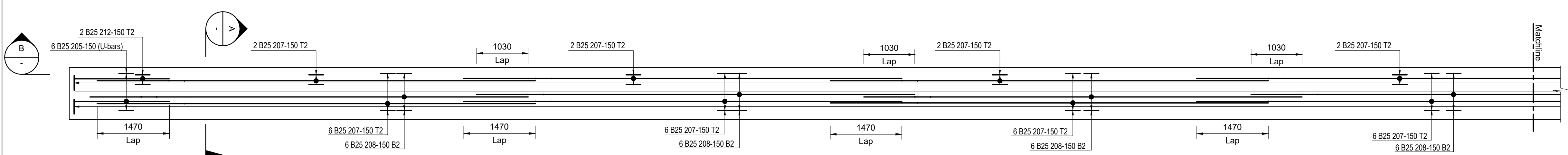
Designed	C. Clarke	Eng check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg check	C. Clarke	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As shown	STD

Drawing Description

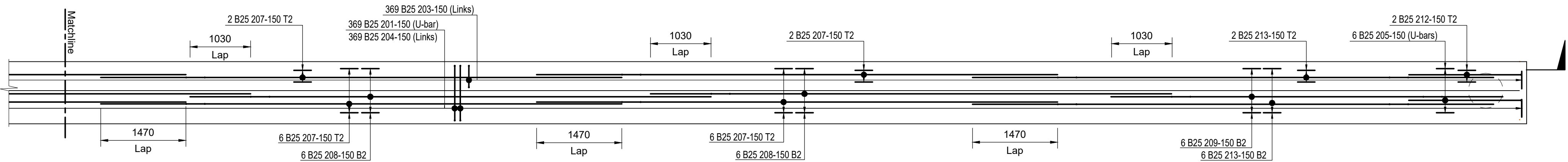
Reinforcement Details

Drawing Number	Revision
229100548-MMD-1700-RE-DR-C-2021	P01



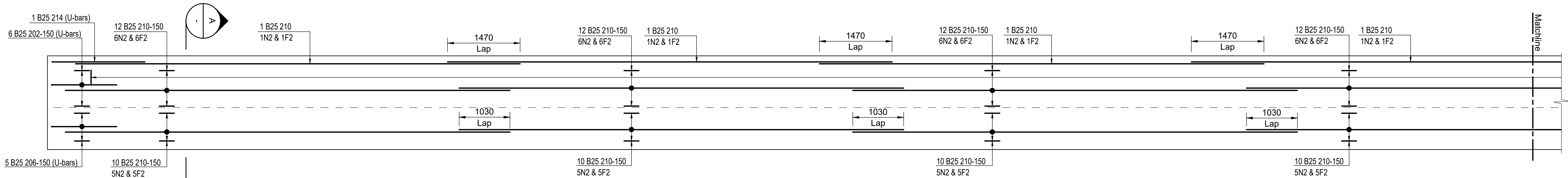
Abutment Beam Plan (2No.)

1:50



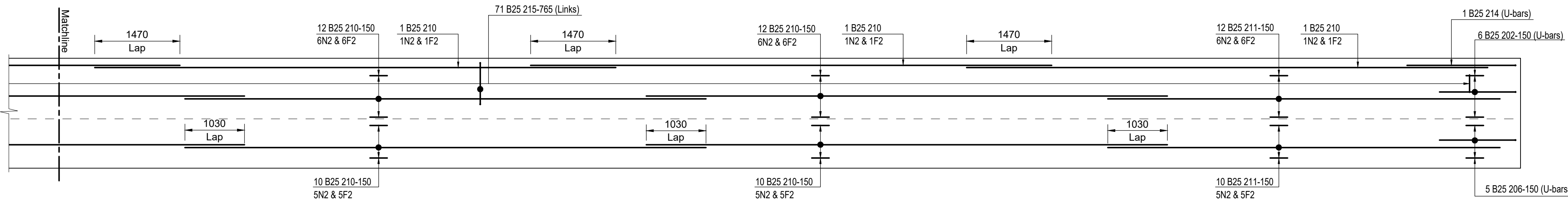
Abutment Beam Plan (2No.)

1:50



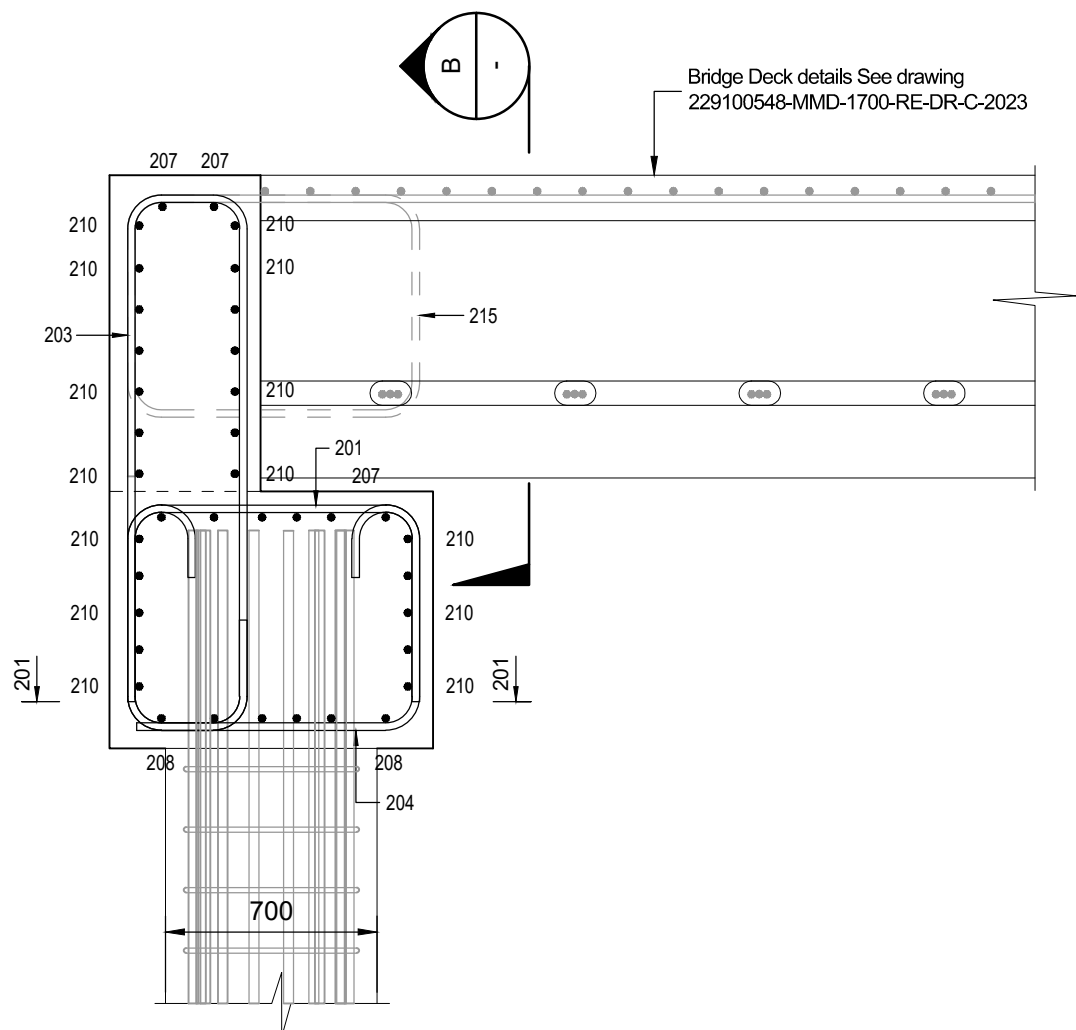
Abutment Beam Elevation (2No.)

1:50



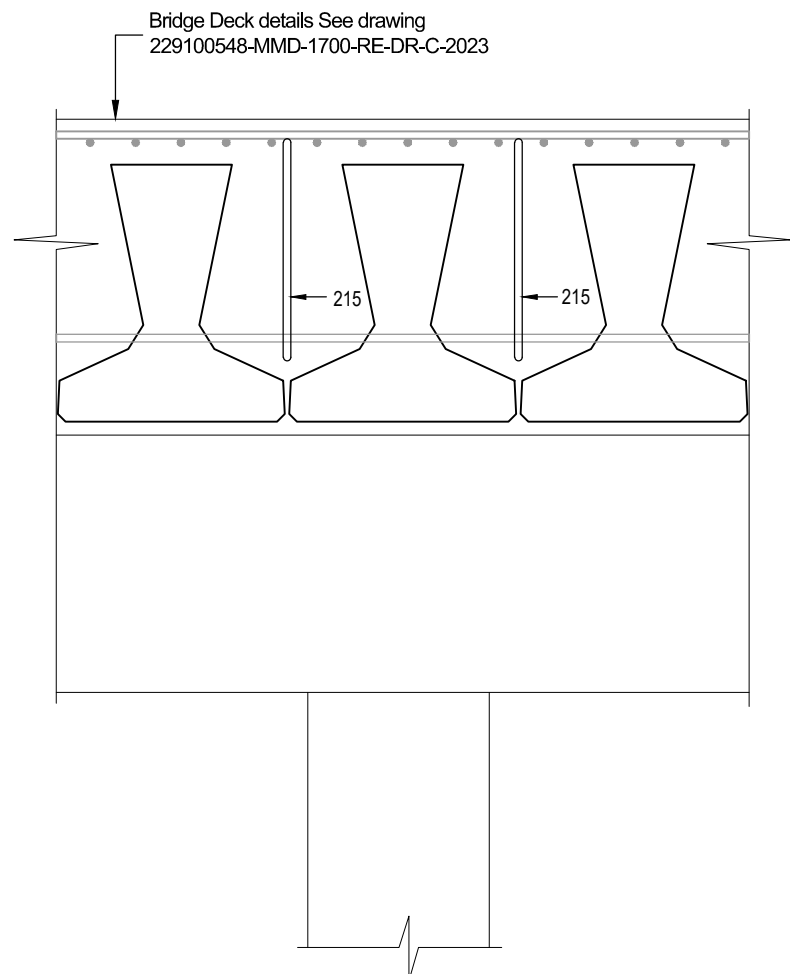
Abutment Beam Elevation (2No.)

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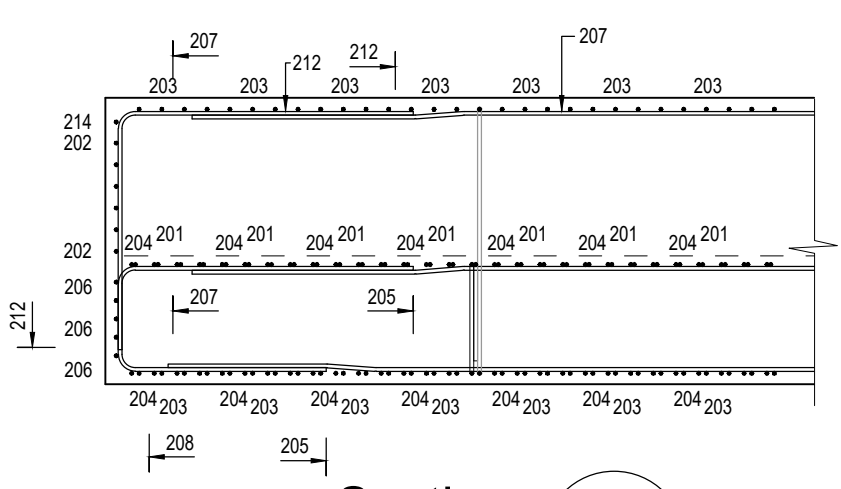
Section A

1:25



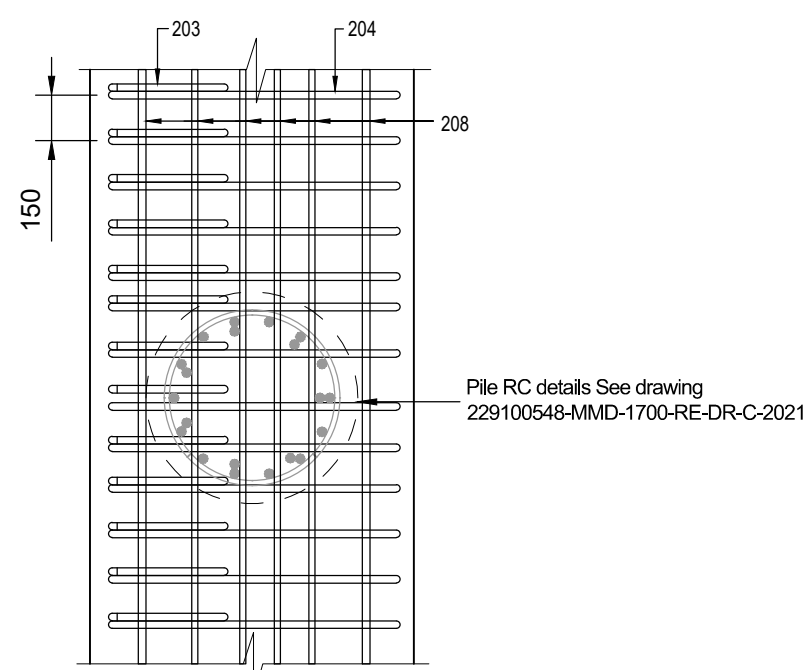
Section B

1:25



Section B

1:50



Column/Abutment Beam Interface

1:25

Concrete Class C45/55

	Bond Condition	Bar Dia						
		8	10	12	16	20	25	32
100% lapped in one location	Good	230	320	420	600	790	1030	1310
	Poor	330	460	590	860	1130	1470	1880

Notes

- Reinforcement to be Grade 500 Type B deformed bars to BS 4449:2005 (+A3 2016) and cut and bent in accordance with BS 8666 2005 unless otherwise specified.
- All kickers to be 100mm high (minimum).
- The Contractor is to satisfy themselves as to the accuracy of all reinforcing schedules prior to the ordering, cutting and bending of reinforcement.
- Concrete elements are not to be loaded before 28 days. Props to be left in place for 28 days. Props to elements at higher levels not to be supported by unpropped elements at lower levels.
- Reinforcement laps not otherwise defined shall be 50 times the smaller bar diameter.
- For General Notes refer to drawing 229100548-MMD-1700-RE-DR-C-2003.

Concrete Notes:

- External arises to be chamfered 25x25mm. U.N.O.
- Class of concrete shown thus :
 - U (unformed), F (formed).
- Concrete to comply with TII Specification Series 1700 and DN-STR-03012.
- All buried surfaces to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
- Spray applied waterproofing membrane to DN-STR-03012 and complying with DN-STR-03009 to be applied to the bridge deck surface and upstands.
- Bedding grout to have a minimum cube compressive strength of 60 MPa unless noted otherwise.

Key to symbols

- Reinforcement notation thus:
- T1 Top face, outer bar
 - T2 Top face, second bar
 - B1 Bottom face, outer bar
 - B2 Bottom face, second bar
 - N1 Near face, outer bar
 - N2 Near face, second bar
 - M1 Middle, outer bar
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 - F1 Far face, outer bar
 - F2 Far face, second bar
 - EF Each face
 - ABR Alternate Bars Reversed
 - Alt Alternatively placed
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 - Cl. Centre line
 - Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2002 to
229100548-MMD-1700-RE-DR-C-2012

P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Client

Wexford County Council
Roads Department
Carrichlawn
Wexford Town
Y35 WY93

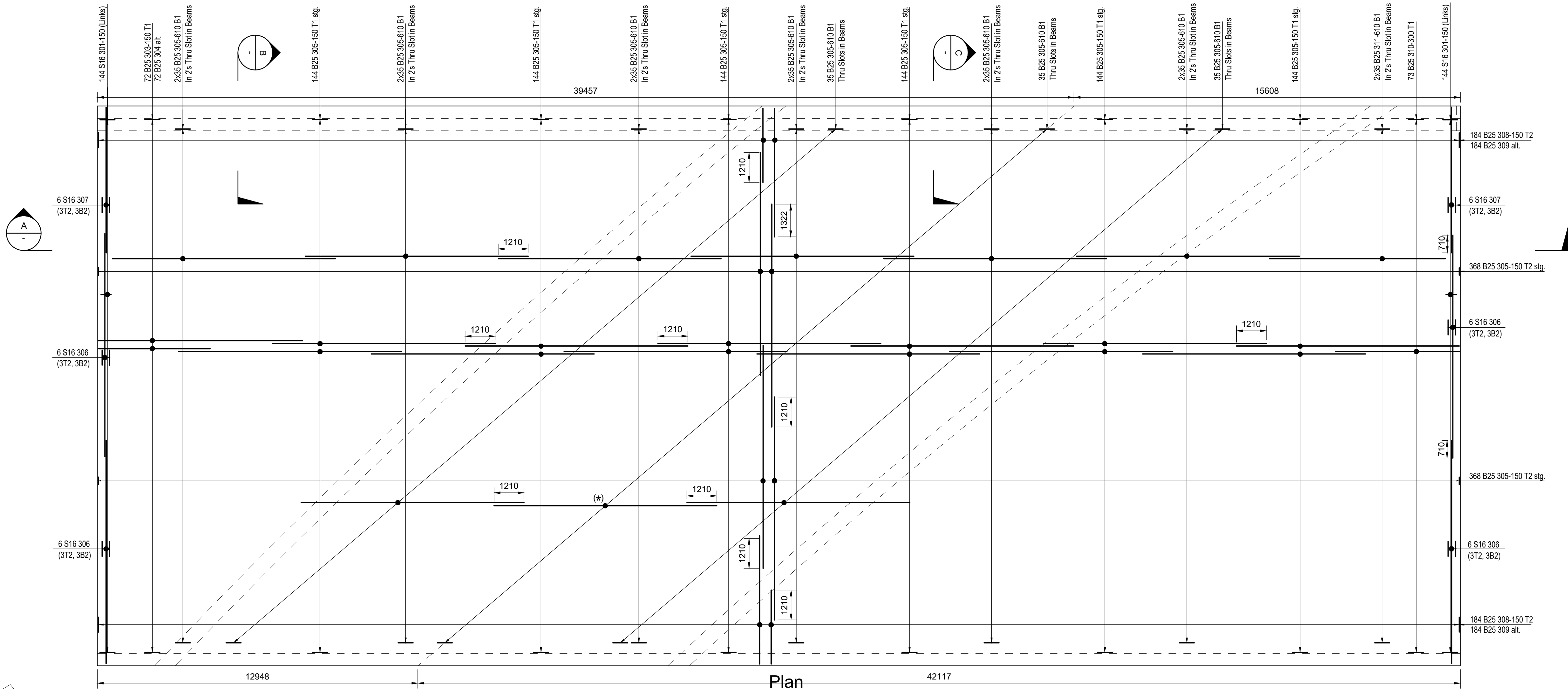
Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
Abutment Beam - Reinforcement
Details

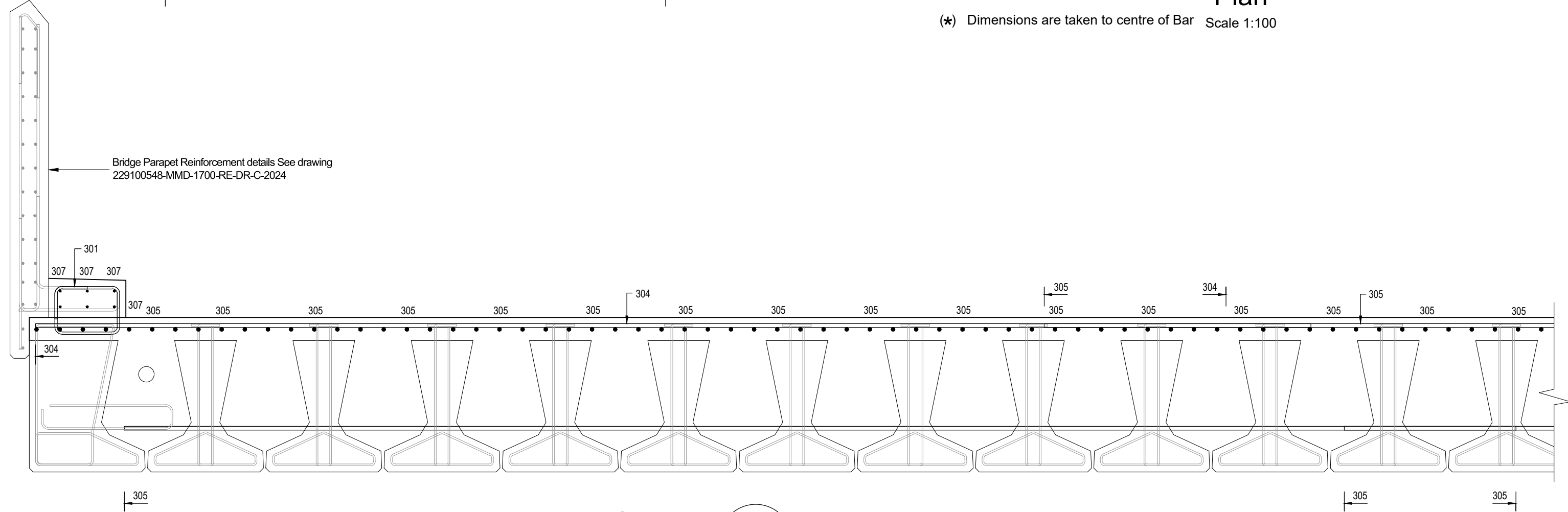
Designed	C. Clarke	Eng check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg check	C. Clarke	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As shown	STD

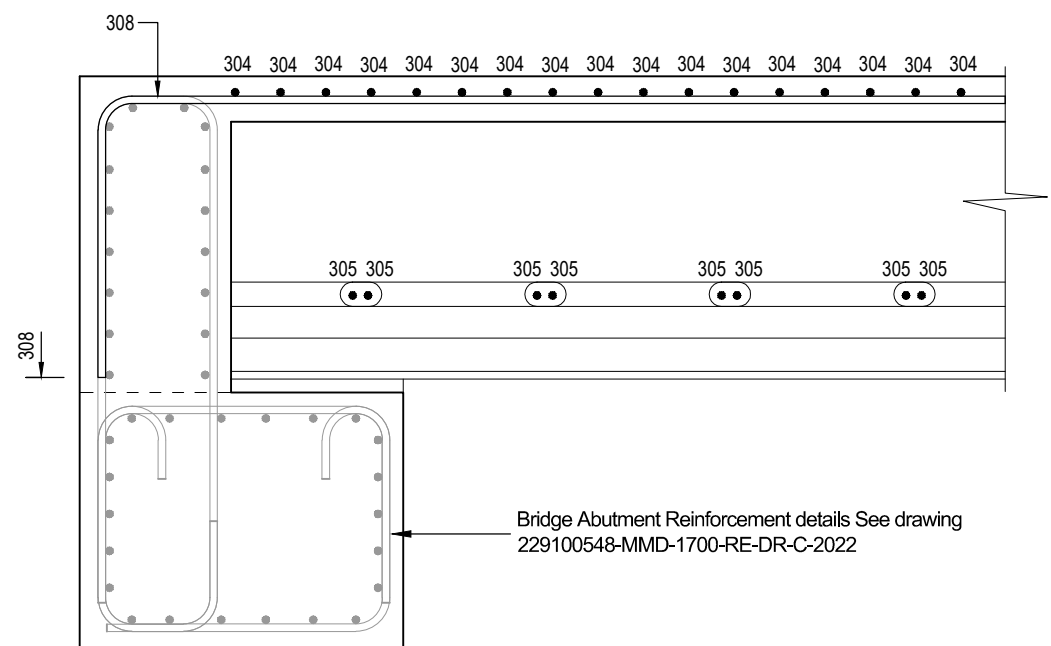
Drawing Description		Revision
Reinforcement Details		
Drawing Number		
229100548-MMD-1700-RE-DR-C-2022	P01	



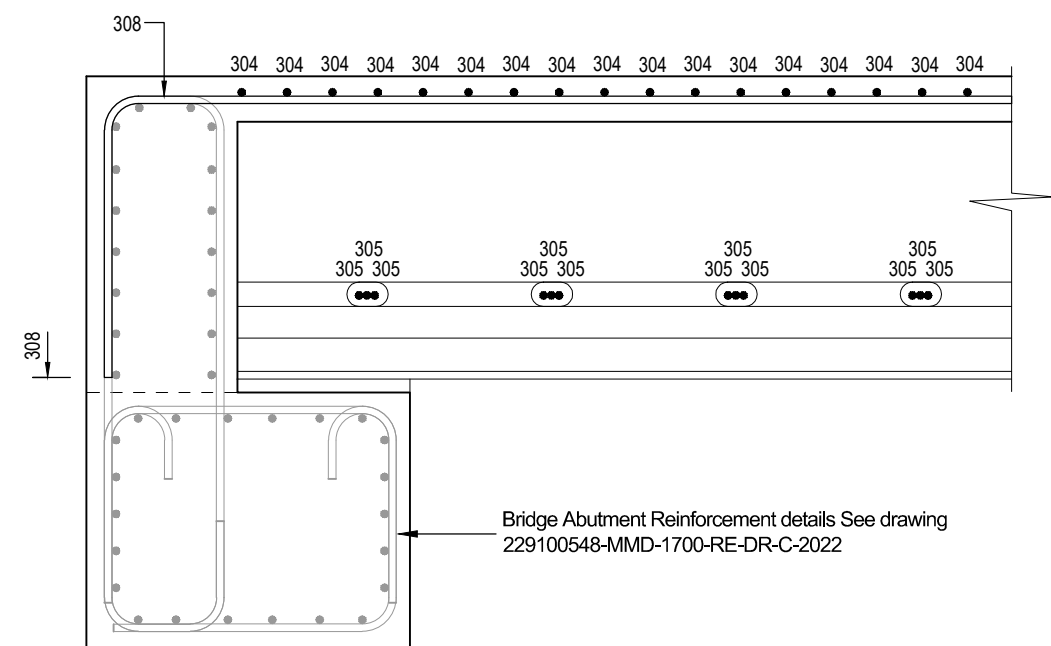
(*) Dimensions are taken to centre of Bar Scale 1:100



Section A
1:25



Section B
1:25



Section C
1:25

- Notes
- Reinforcement to be Grade 500 Type B deformed bars to BS 4449:2005 (+A3 2016) and cut and bent in accordance with BS 8666 2005 unless otherwise specified.
 - All kickers to be 100mm high (minimum).
 - The Contractor is to satisfy themselves as to the accuracy of all reinforcing schedules prior to the ordering, cutting and bending of reinforcement.
 - Concrete elements are not to be loaded before 28 days. Props to be left in place for 28 days. Props to elements at higher levels not to be supported by unpropped elements at lower levels.
 - Reinforcement laps not otherwise defined shall be 50 times the smaller bar diameter.
 - For General Notes refer to drawing 229100548-MMD-1700-RE-DR-C-2003.

Concrete Notes:

- External arises to be chamfered 25x25mm. U.N.O.
- Class of concrete shown thus :
U (unformed), F (formed).
- Concrete to comply with TII Specification Series 1700 and DN-STR-03012.
- All buried surfaces to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
- Spray applied waterproofing membrane to DN-STR-03012 and complying with DN-STR-03009 to be applied to the bridge deck surface and upstands.
- Bedding grout to have a minimum cube compressive strength of 60 MPa unless noted otherwise.

Key to symbols

- Reinforcement notation thus:
- T1 Top face, outer bar
 - T2 Top face, second bar
 - B1 Bottom face, outer bar
 - B2 Bottom face, second bar
 - N1 Near face, outer bar
 - N2 Near face, second bar
 - M1 Middle, outer bar
 - M2 Middle, second bar
 - F1 Far face, outer bar
 - F2 Far face, second bar
 - EF Each face
 - ABR Alternate Bars Reversed
 - Alt Alternatively placed
 - AT Alternatively turned
 - CL Centre line
 - Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2002 to
229100548-MMD-1700-RE-DR-C-2012

P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

Status Stamp

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Roads Department
Carrichlawn
Wexford Town
Y35 WY93



Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
Bridge Deck - Reinforcement Details

Designed	C. Clarke	Eng check	R. Sexton	
Drawn	R. O'Connor	Coordination	J/ O'Riordan	
Dwg check	C. Clarke	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As shown	STD

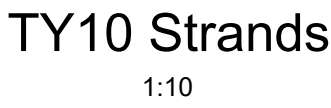
Drawing Description	Revision
Reinforcement Details	

Drawing Number	Revision
229100548-MMD-1700-RE-DR-C-2023	P01

Concrete Class C35/45

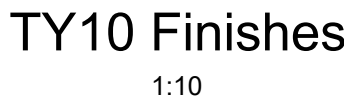
	Bond Condition	Bar Dia						
		8	10	12	16	20	25	32
100% lapped in one location	Good	280	380	490	710	940	1210	1550
	Poor	390	540	700	1020	1340	1730	2220





2No @ 350 - Level D

- ⊕ Denotes Fully Bonded Strand
- Denotes Partially Debonded Strand



Key to symbols

- ### Reference drawings

P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Comhairle Contae
Loch Garman
Wexford
County Council

Title N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
TY Prestressed Beams

MMD Project Number	Scale at A1	Security
229100548	As shown	STD

Drawing Description

Prestressed Beams

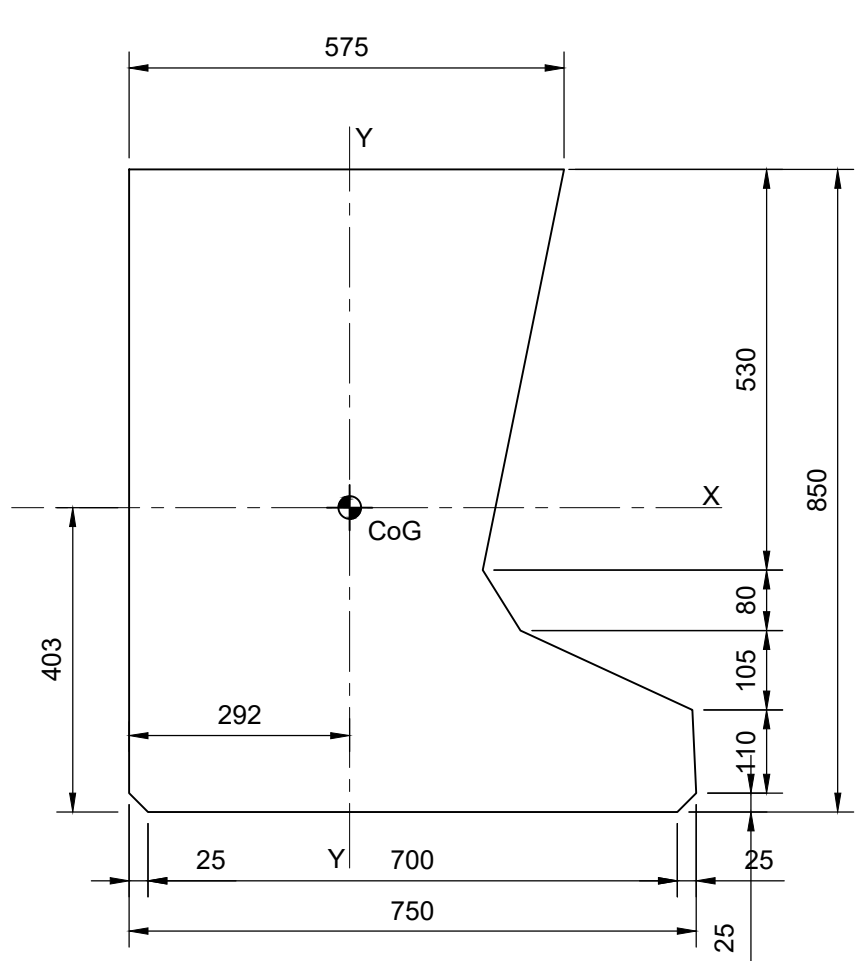
Drawing Number	Revision
229100548-MMD-1700-RE-DR-C-2025	P01

Concrete Class C50/60

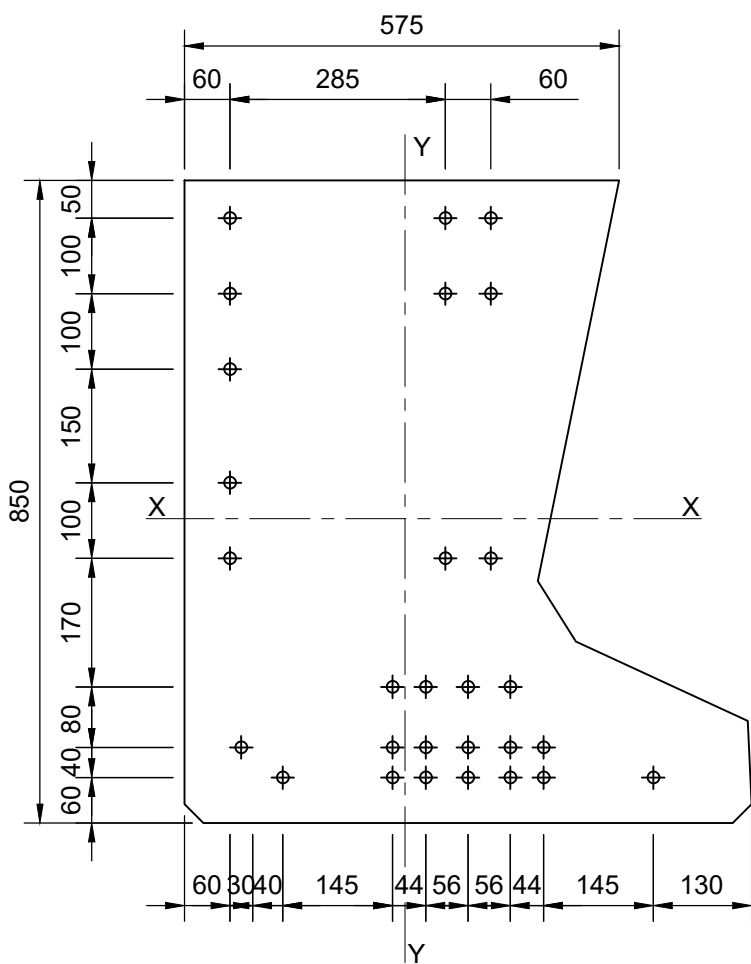
	Bond Condition	Bar Dia							
		8	10	12	16	20	25	32	40
100% lapped in one location	Good	230	320	420	600	790	1030	1310	1780
	Poor	330	460	590	860	1130	1470	1880	2550

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We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties.

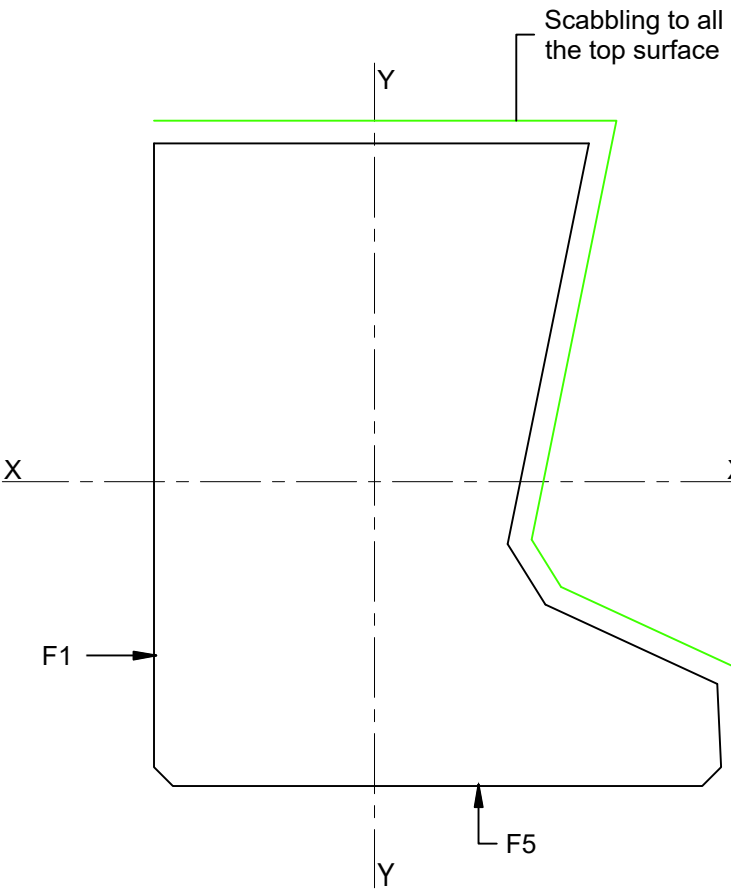


TYE10 Beam Section
1:10



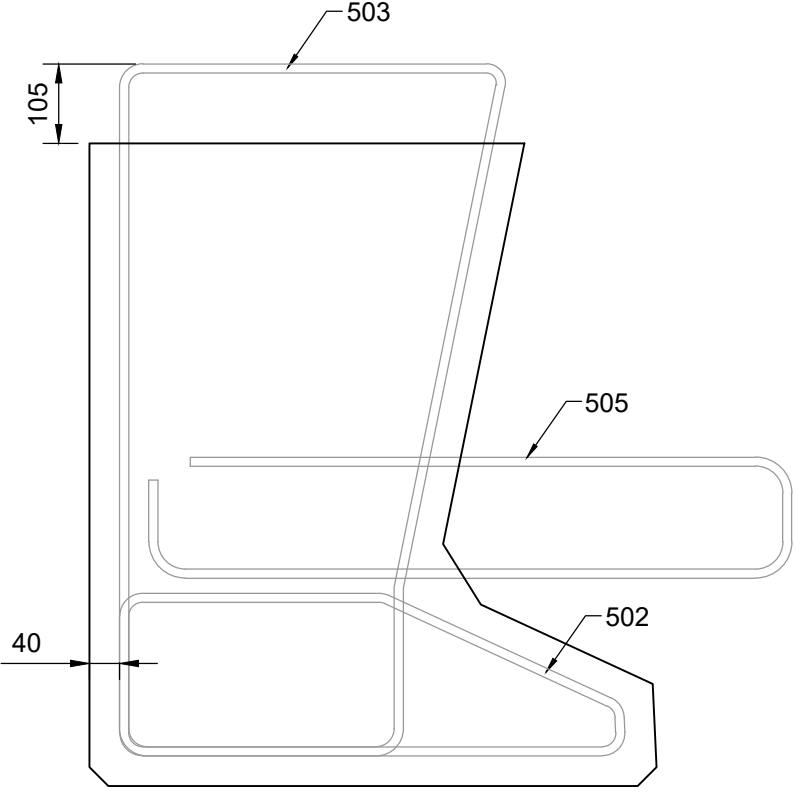
TYE10 Strands
1:10

- ◆ Denotes Fully Bonded Strand
○ Denotes Partially Debonded Strand
- 3 No @ 800 - Level H
 - 3 No @ 700 - Level G
 - 1 No @ 600 - Level F
 - 1 No @ 450 - Level E
 - 3 No @ 350 - Level D
 - 4 No @ 180 - Level C
 - 6 No @ 100 - Level B
 - 7 No @ 60 - Level A

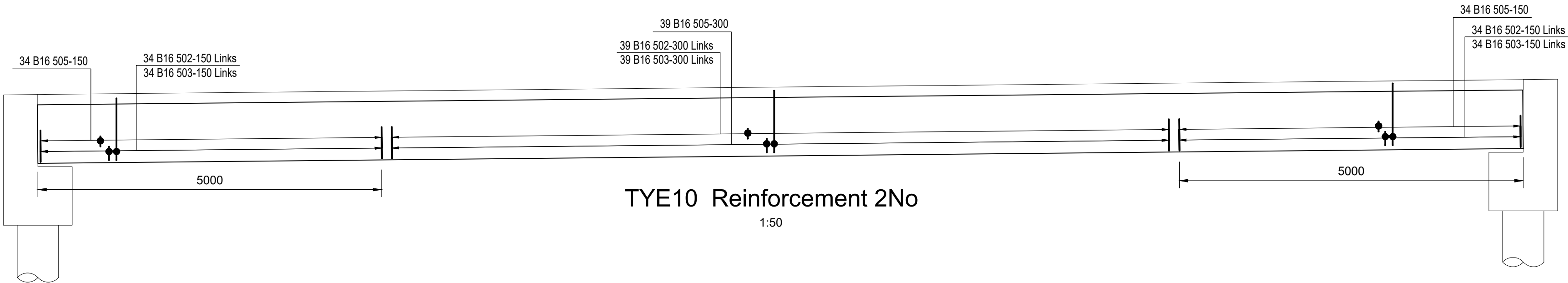


TYE10 Finishes
1:10

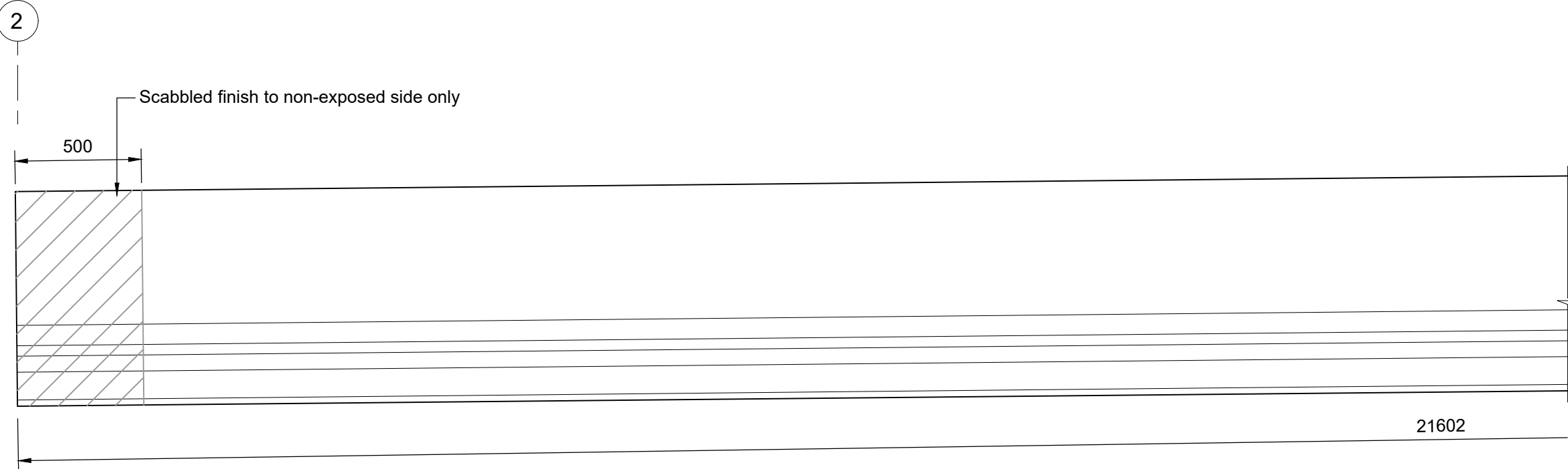
Elevation A



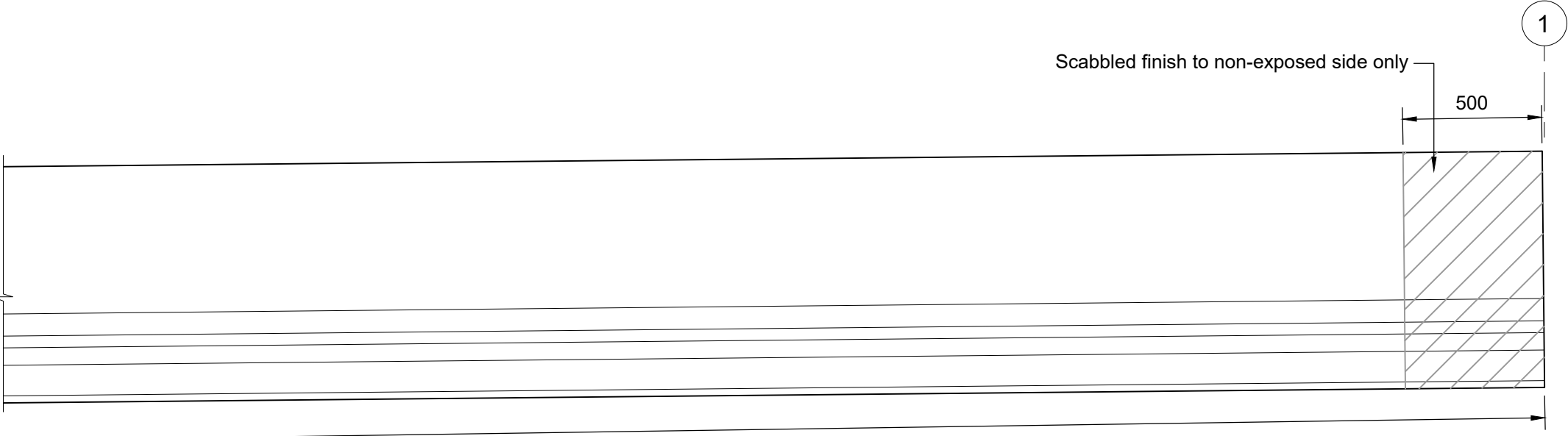
TY10E - Reinforcement
1:10



TYE10 Reinforcement 2No
1:50



Elevation A
1:20



- Notes
- Beam concrete to be grade C50/60 unless noted otherwise.
 - Alternative beam design or alterations are to be to the approval of the Employer's Representative.
 - Formed finish F5 to exposed beam surfaces. Infill beam face to be rough cast exposing aggregate to a minimum roughness of 3mm.
 - Prestressing strands shall be 15.7mm diameter, 7 wire drawn strands to BS 5896:2012 with a nominal tensile strength of 1860 N/sq mm
 - Initial prestress to be 75% of specified characteristic breaking load of 279kN(208kN).
 - Lifting Anchors
 - The contractor shall provide suitable lifting anchors for erection, to the approval of the engineer.
 - Any pockets made for lifting shall be filled with epoxy mortar upon completion of the works. Minimum cover to anchor head to be 15mm.
 - Minimum cube strength of concrete at transfer: 40N/sq mm.
 - The Contractor must submit shop drawings for the beams for the approval by the Engineer prior to manufacture.
 - Strands to be disk cut flush with ends of beams treated with anti-corrosion inhibitor and over coated with an approved epoxy skim.
 - All concrete, materials and workmanship to be in accordance with IS EN 13670
 - Welding of reinforcement is not permitted.
 - Internal beam estimated lifting weight = 18T
 - Edge beam estimated lifting weight = 27T

Key to symbols

- Reinforcement notation thus;
- T1 Top face, outer bar
 - T2 Top face, second bar
 - B1 Bottom face, outer bar
 - B2 Bottom face, second bar
 - N1 Near face, outer bar
 - N2 Near face, second bar
 - M1 Middle, outer bar
 - M2 Middle, second bar
 - F1 Far face, outer bar
 - F2 Far face, second bar
 - EF Each face
 - ABR Alternate Bars Reversed
 - Alt Alternatively placed
 - AT Alternatively turned
 - CL Centre line
 - Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2002 to
229100548-MMD-1700-RE-DR-C-2012

P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
TYE Prestressed Beams

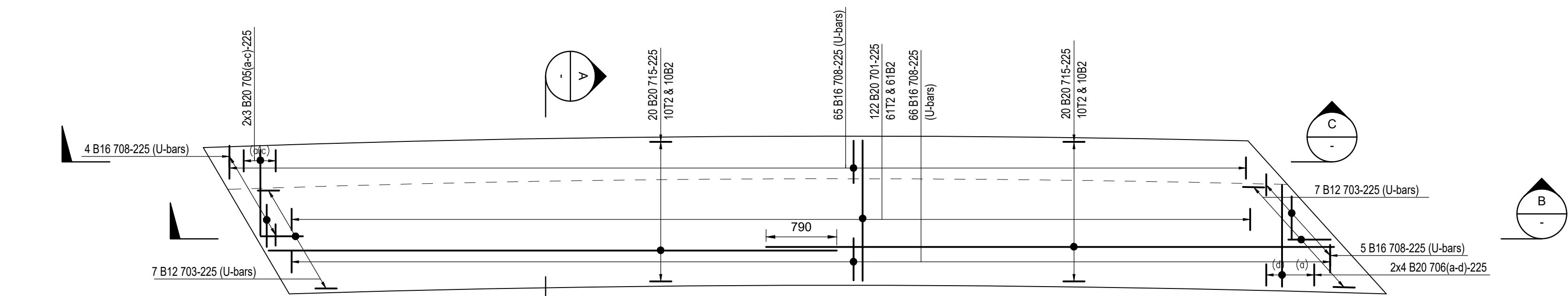
Designed	C. Clarke	Eng check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg check	C. Clarke	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As shown	STD

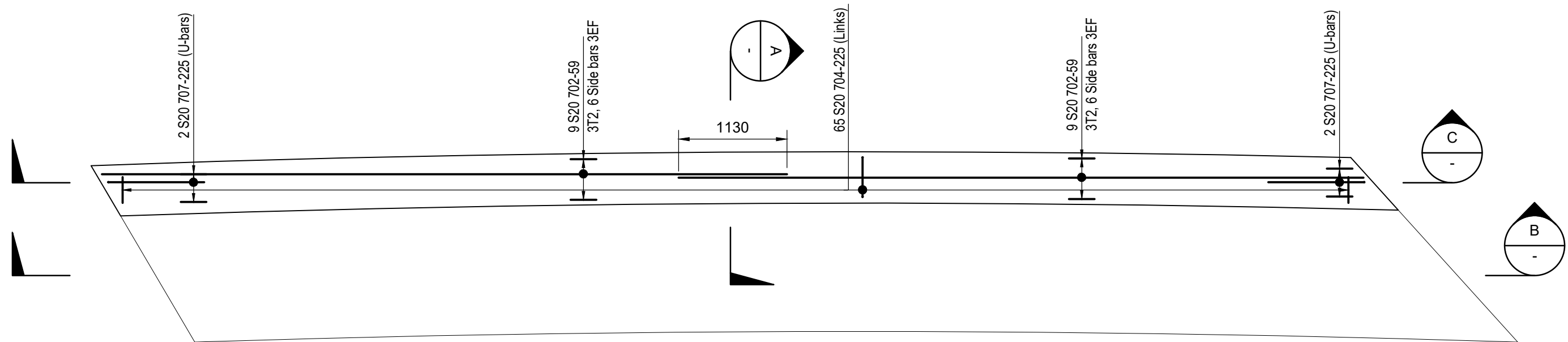
Drawing Description	Revision
Prestressed Beams	
Drawing Number	
229100548-MMD-1700-RE-DR-C-2026	P01

Concrete Class C50/60

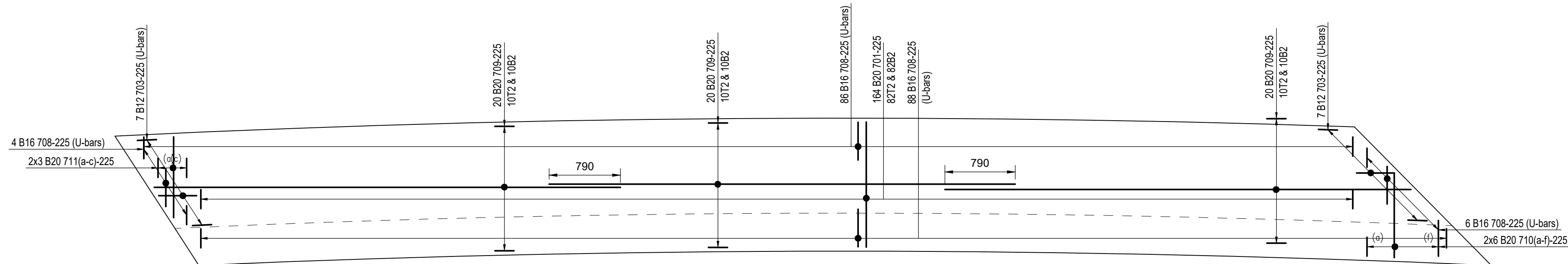
	Bond Condition	Bar Dia						
		8	10	12	16	20	25	32
100% lapped in one location	Good	230	320	420	600	790	1030	1310
	Poor	330	460	590	860	1130	1470	1880



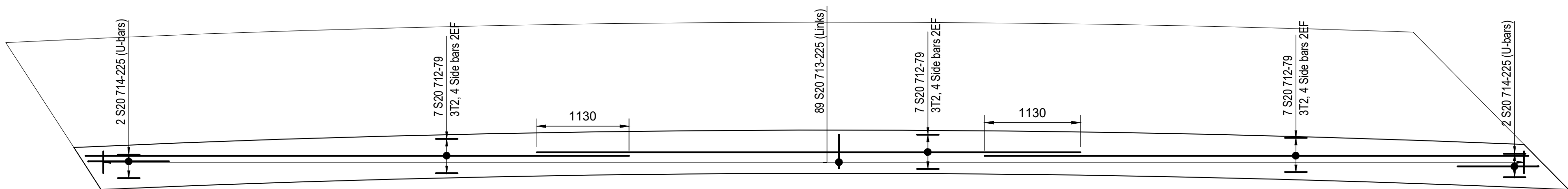
Parapet Support Slab Type 1 (Base)
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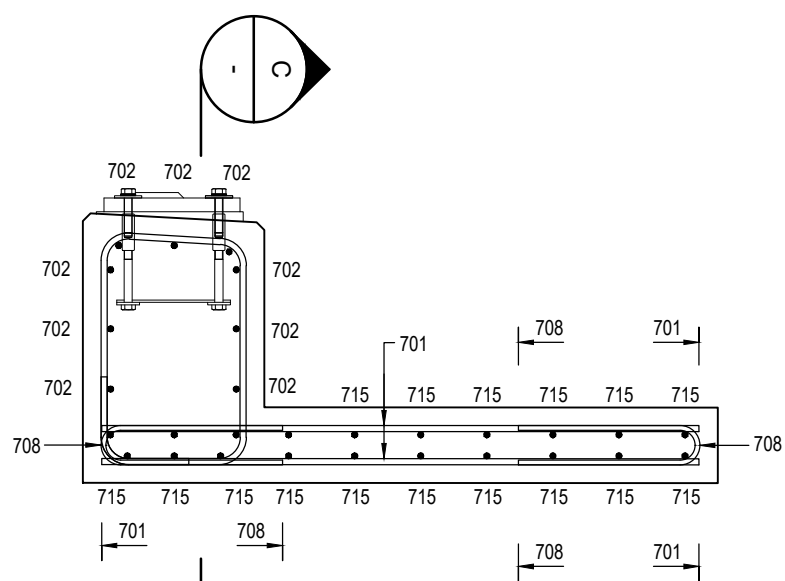
Parapet Support Slab Type 1 (Upstand)
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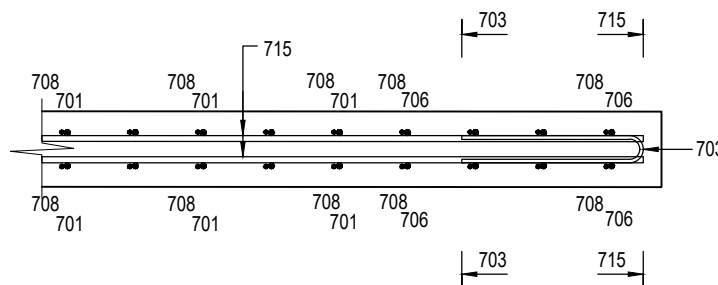
Parapet Support Slab Type 2 (Base)
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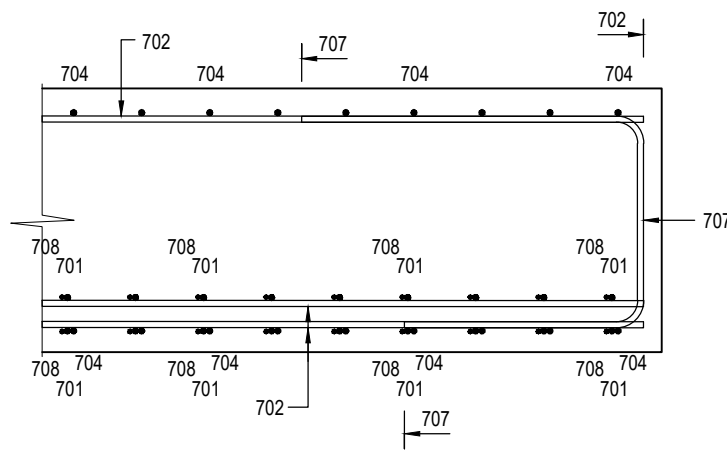
Parapet Support Slab Type 2 (Upstand)
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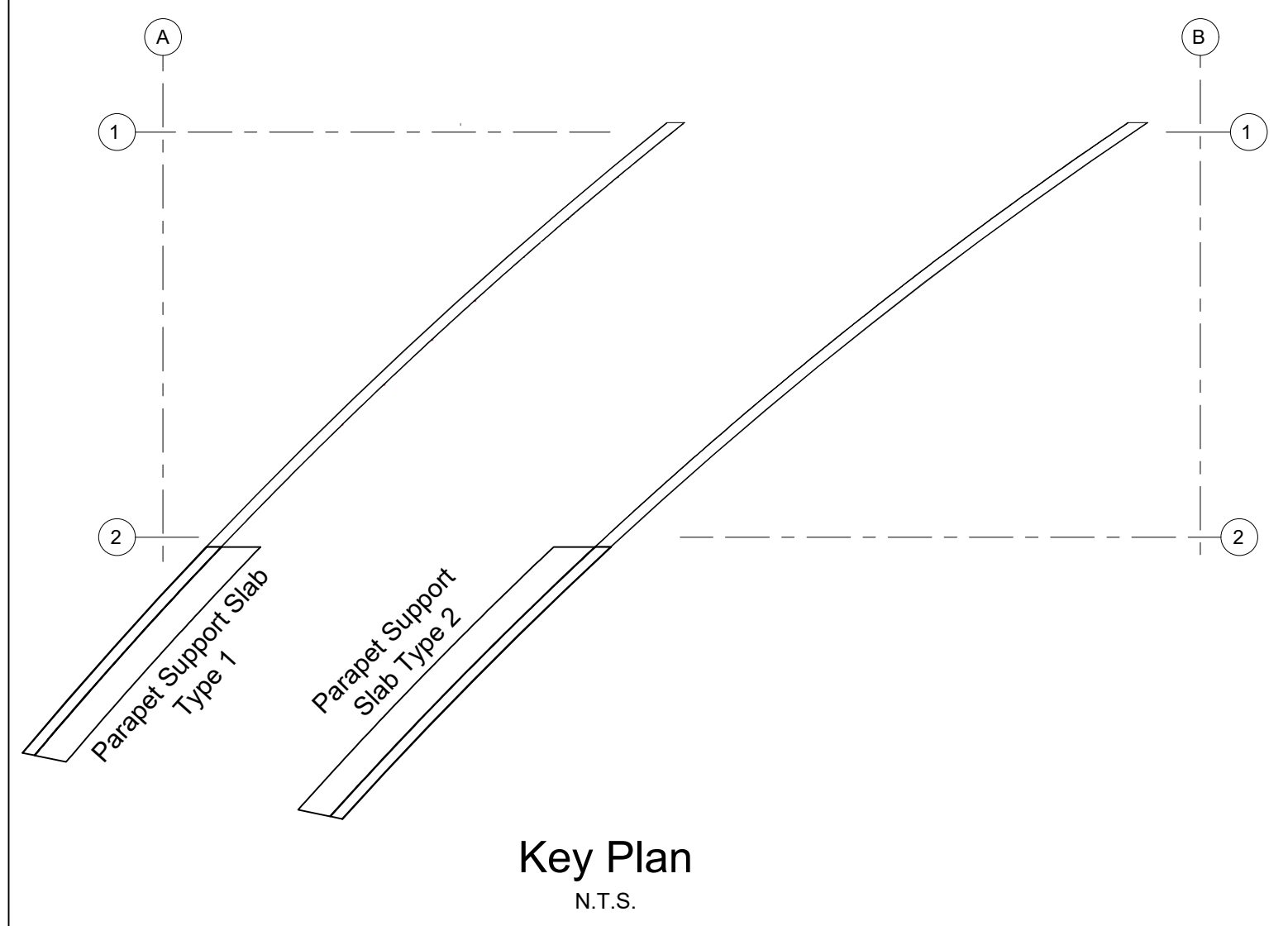
Section A
1:25



Section B
1:25



Section C
1:25



Key Plan
N.T.S.

- Notes
1. Reinforcement to be Grade 500 Type B deformed bars to BS 4449:2005 (+A3 2016) and cut and bent in accordance with BS 8666 2005 unless otherwise specified.
 2. All kickers to be 100mm high (minimum).
 3. The Contractor is to satisfy themselves as to the accuracy of all reinforcing schedules prior to the ordering, cutting and bending of reinforcement.
 4. Concrete elements are not to be loaded before 28 days. Props to be left in place for 28 days. Props to elements at higher levels not to be supported by unpropped elements at lower levels.
 5. Reinforcement laps not otherwise defined shall be 50 times the smaller bar diameter.
 6. For General Notes refer to drawing 229100548-MMD-1700-RE-DR-C-2003.
- Concrete Notes:
- External arises to be chamfered 25x25mm. U.N.O.
 - Class of concrete shown thus :
U (unformed), F(formed).
 - Concrete to comply with TII Specification Series 1700 and DN-STR-03012.
 - All buried surfaces to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
 - Spray applied waterproofing membrane to DN-STR-03012 and complying with DN-STR-03009 to be applied to the bridge deck surface and upstands.
 - Bedding grout to have a minimum cube compressive strength of 60 MPa unless noted otherwise.

Key to symbols

- Reinforcement notation thus;
- T1 Top face, outer bar
 - T2 Top face, second bar
 - B1 Bottom face, outer bar
 - B2 Bottom face, second bar
 - N1 Near face, outer bar
 - N2 Near face, second bar
 - M1 Middle, outer bar
 - M2 Middle, second bar
 - F1 Far face, outer bar
 - F2 Far face, second bar
 - EF Each face
 - ABR Alternate Bars Reversed
 - Alt Alternatively placed
 - AT Alternatively turned
 - CL Centre line
 - Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2002 to
229100548-MMD-1700-RE-DR-C-2012

P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Comhairle Contae
Loch Garman
Wexford
County Council

Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
Parapet Support Slab -
Reinforcement Details

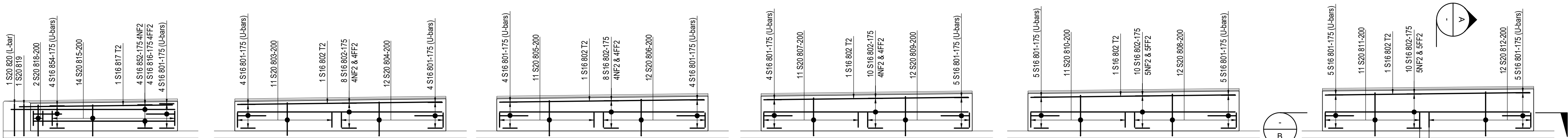
Designed	C. Clarke	Eng check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg check	C. Clarke	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As shown	STD

Drawing Description	Revision
Reinforcement Details	
Drawing Number	Revision
229100548-MMD-1700-RE-DR-C-2027	P01

Concrete Class C45/55

	Bond Condition	Bar Dia						
		8	10	12	16	20	25	32
100% lapped in one location	Good	230	320	420	600	790	1030	1310
	Poor	330	460	590	860	1130	1470	1880



Upstand 1 - Elevation
1:50

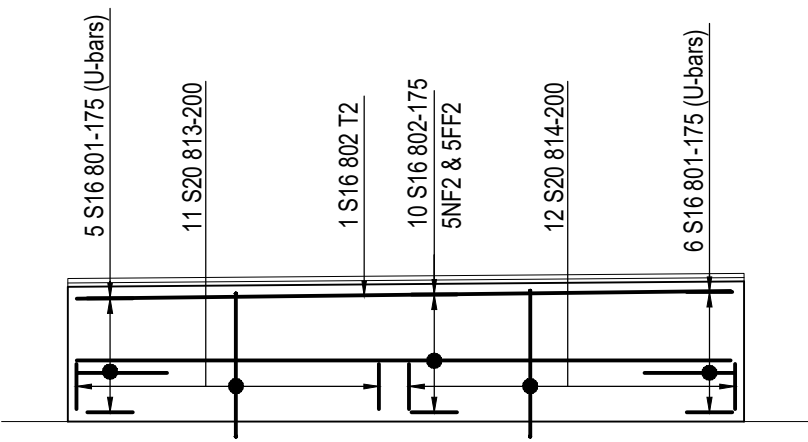
Upstand 2 - Elevation
1:50

Upstand 3 - Elevation
1:50

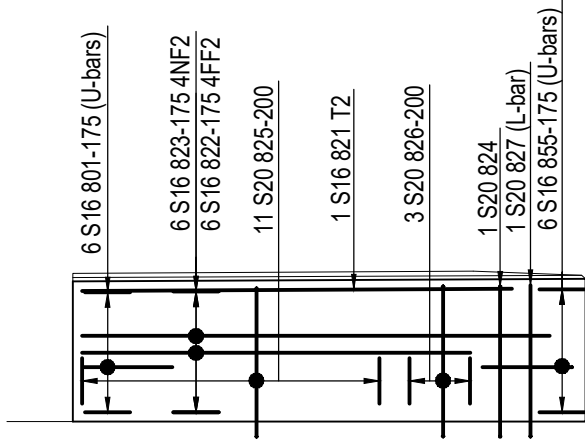
Upstand 4 - Elevation
1:50

Upstand 5 - Elevation
1:50

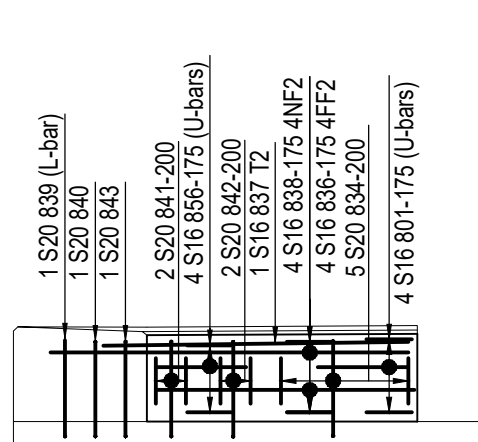
Upstand 6 - Elevation
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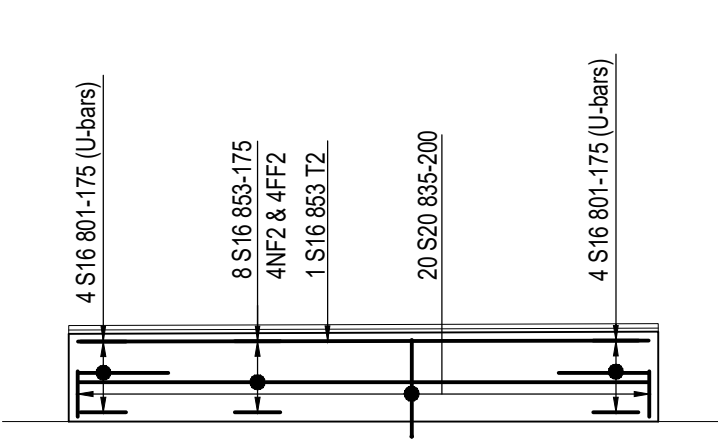
Upstand 7 - Elevation
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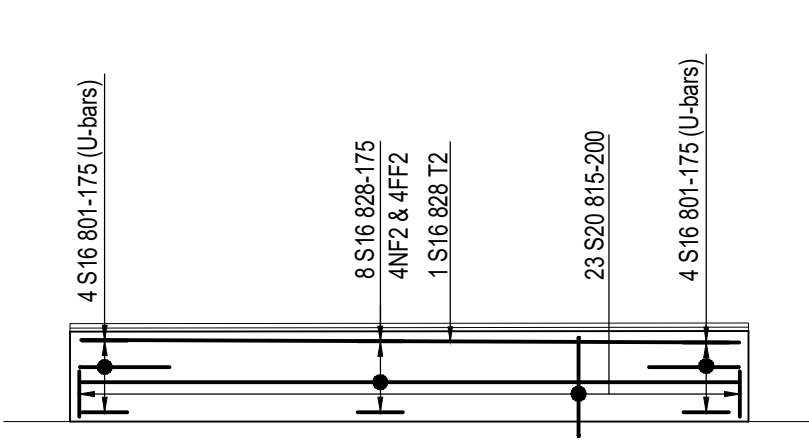
Upstand 8 - Elevation
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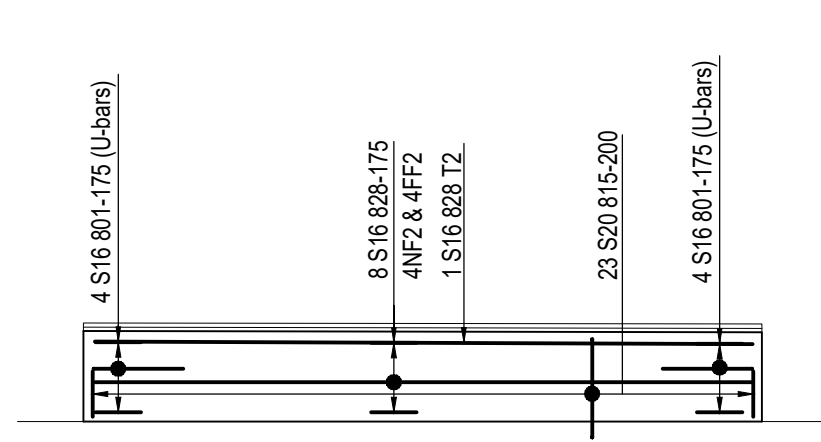
Upstand 9 - Elevation
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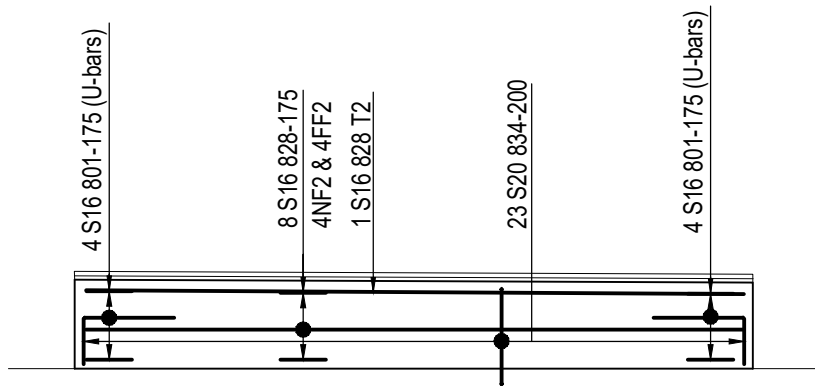
Upstand 10 - Elevation
1:50



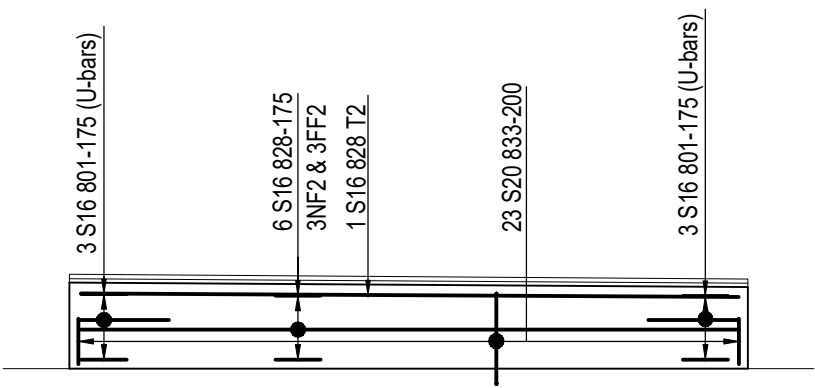
Upstand 11 - Elevation
1:50



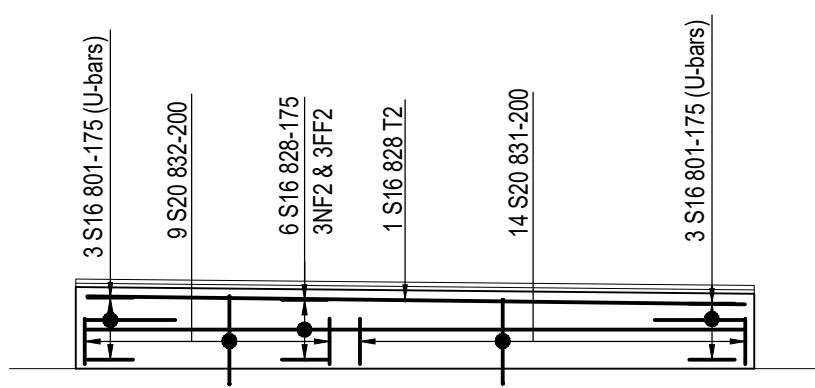
Upstand 12 - Elevation
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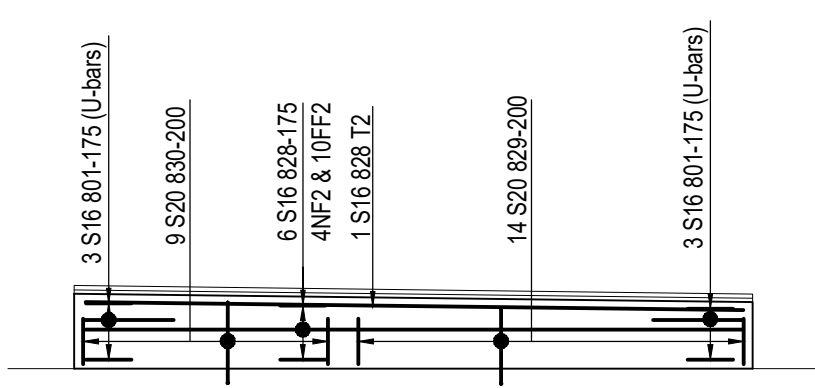
Upstand 13 - Elevation
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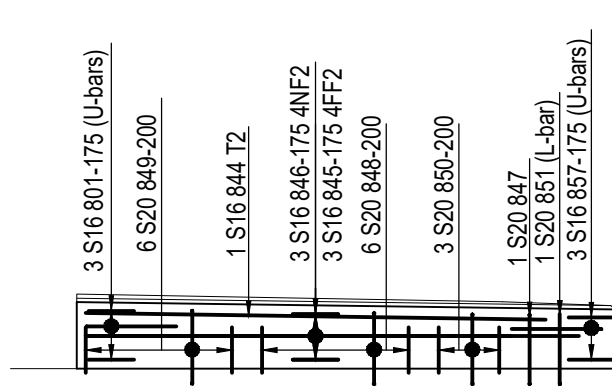
Upstand 14 - Elevation
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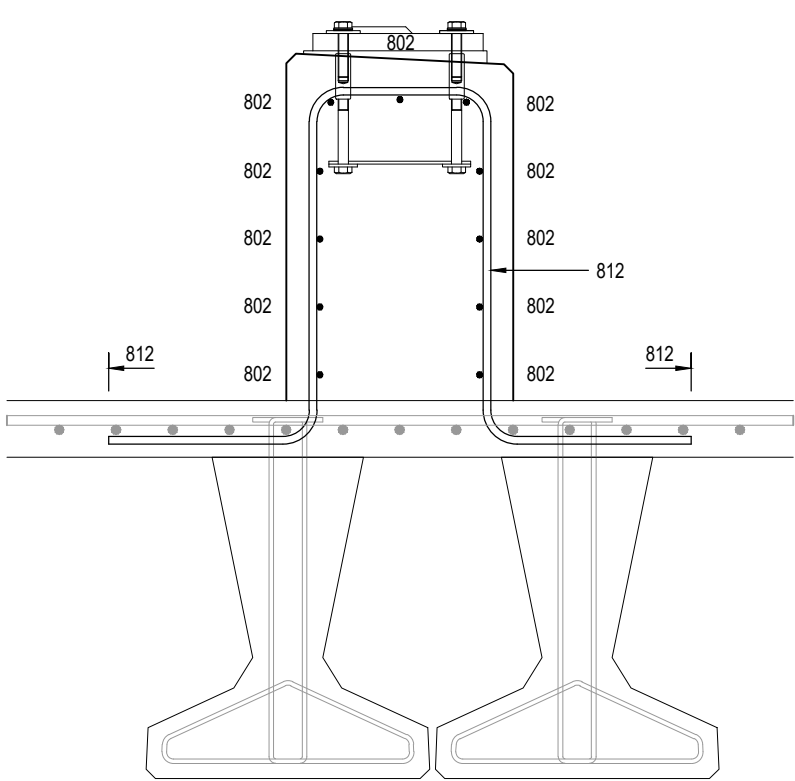
Upstand 15 - Elevation
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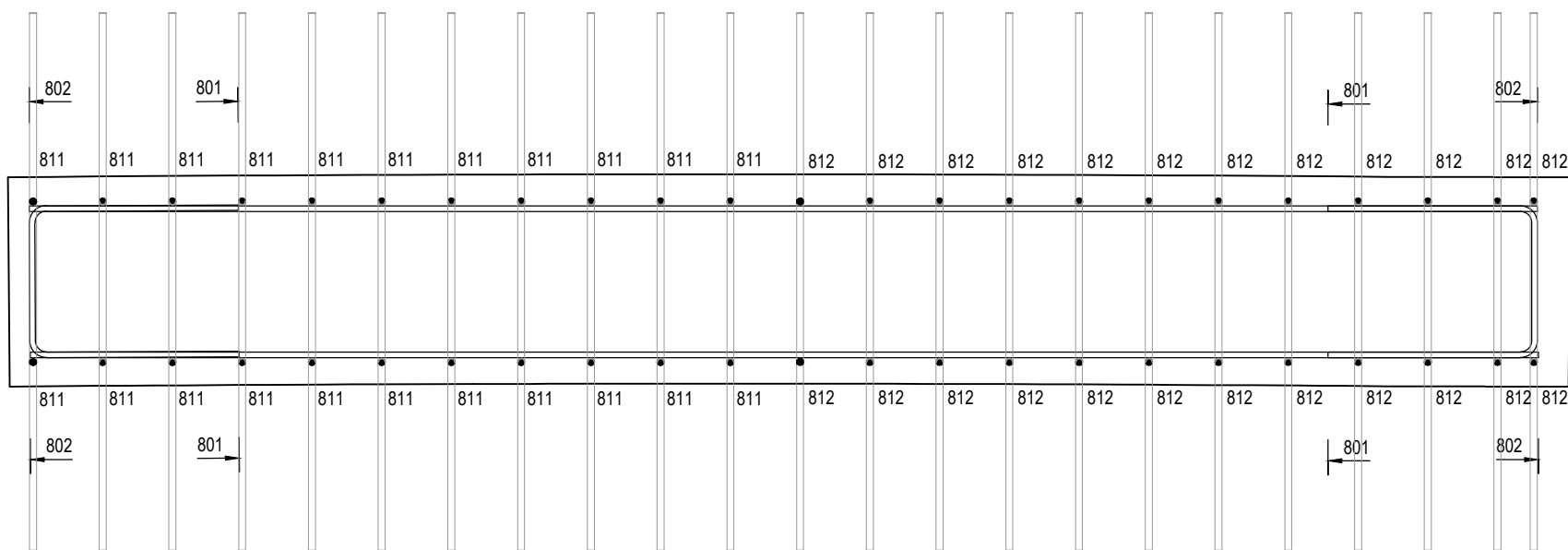
Upstand 16 - Elevation
1:50



Upstand 17 - Elevation
1:25



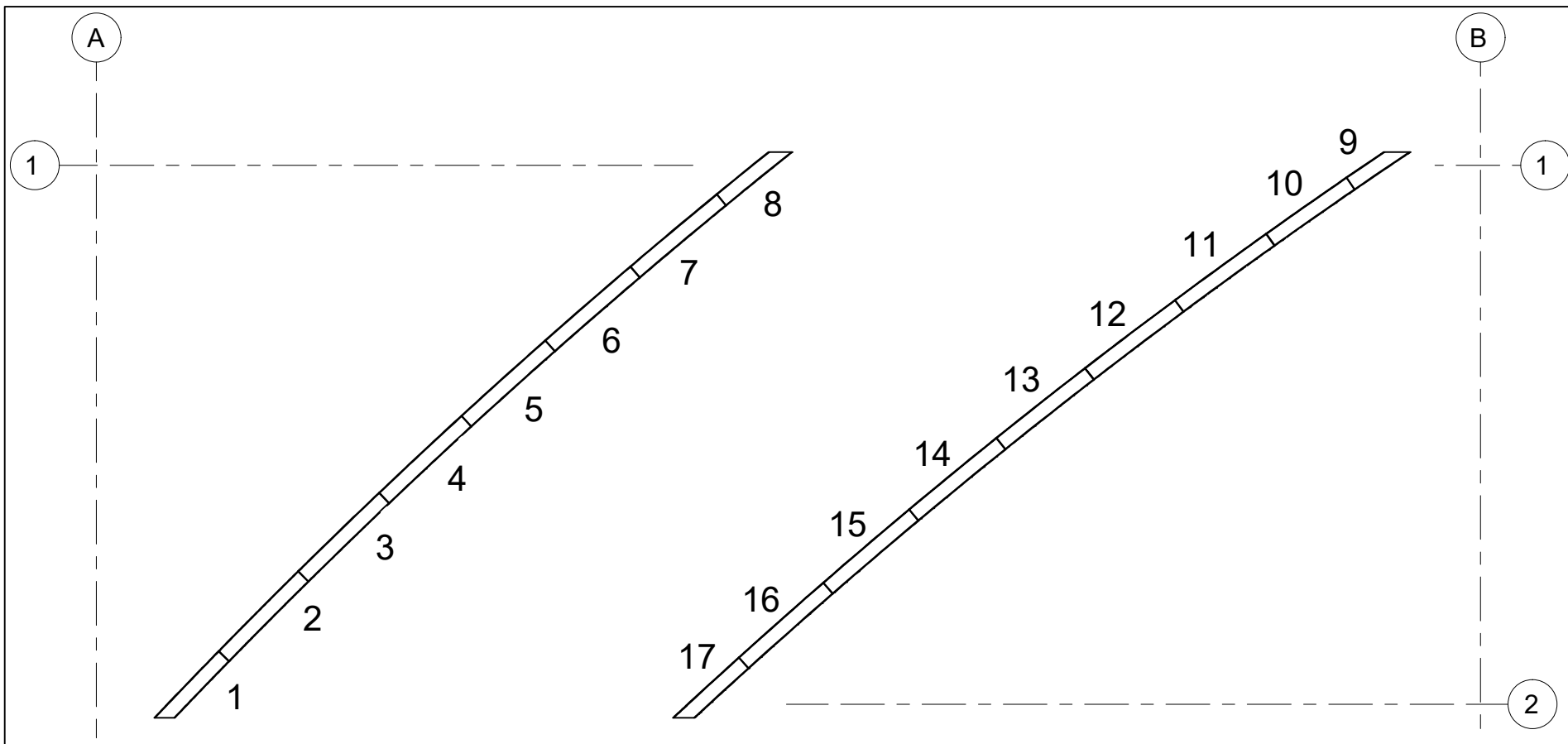
Section -
1:50
A



Section -
1:50
B

Concrete Class C45/55

	Bond Condition	Bar Dia							
		8	10	12	16	20	25	32	40
100% lapped in one location	Good	230	320	420	600	790	1030	1310	1780
	Poor	330	460	590	860	1130	1470	1880	2550



Key Plan
NTS

Notes

- Reinforcement to be Grade 500 Type B deformed bars to BS 4449:2005 (+A3 2016) and cut and bent in accordance with BS 8666 2005 unless otherwise specified.
- All kickers to be 100mm high (minimum).
- The Contractor is to satisfy themselves as to the accuracy of all reinforcing schedules prior to the ordering, cutting and bending of reinforcement.
- Concrete elements are not to be loaded before 28 days. Props to be left in place for 28 days. Props to elements at higher levels not to be supported by unproped elements at lower levels.
- Reinforcement laps not otherwise defined shall be 50 times the smaller bar diameter.

Concrete Notes:

- External arises to be chamfered 25x25mm. U.N.O.
- Class of concrete shown thus :
U (unformed), F(formed).
- Concrete finishes to be as per TII Specification series 1700 unless noted otherwise.
 - Buried unformed surfaces U1
 - Buried formed concrete surfaces F1
 - Exposed unformed surfaces U3
 - Exposed formed surfaces F3
 - Precast parapet walkway F3/U3
 - Precast beams F5
 - Area of deck to receive waterproofing U4
- Concrete to comply with TII Specification Series 1700 and DN-STR-03012.
- All buried surfaces to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
- Spray applied waterproofing membrane to DN-STR-03012 and complying with DN-STR-03009 to be applied to the bridge deck surface and upstands.
- Bedding grout to have a minimum cube compressive strength of 60 MPa unless noted otherwise.

Key to symbols

Reinforcement notation thus;

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- ABR Alternate Bars Reversed
- Alt Alternately placed
- AT Alternately turned
- CL Centre line
- Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2002 to
229100548-MMD-1700-RE-DR-C-2012

P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

Status Stamp

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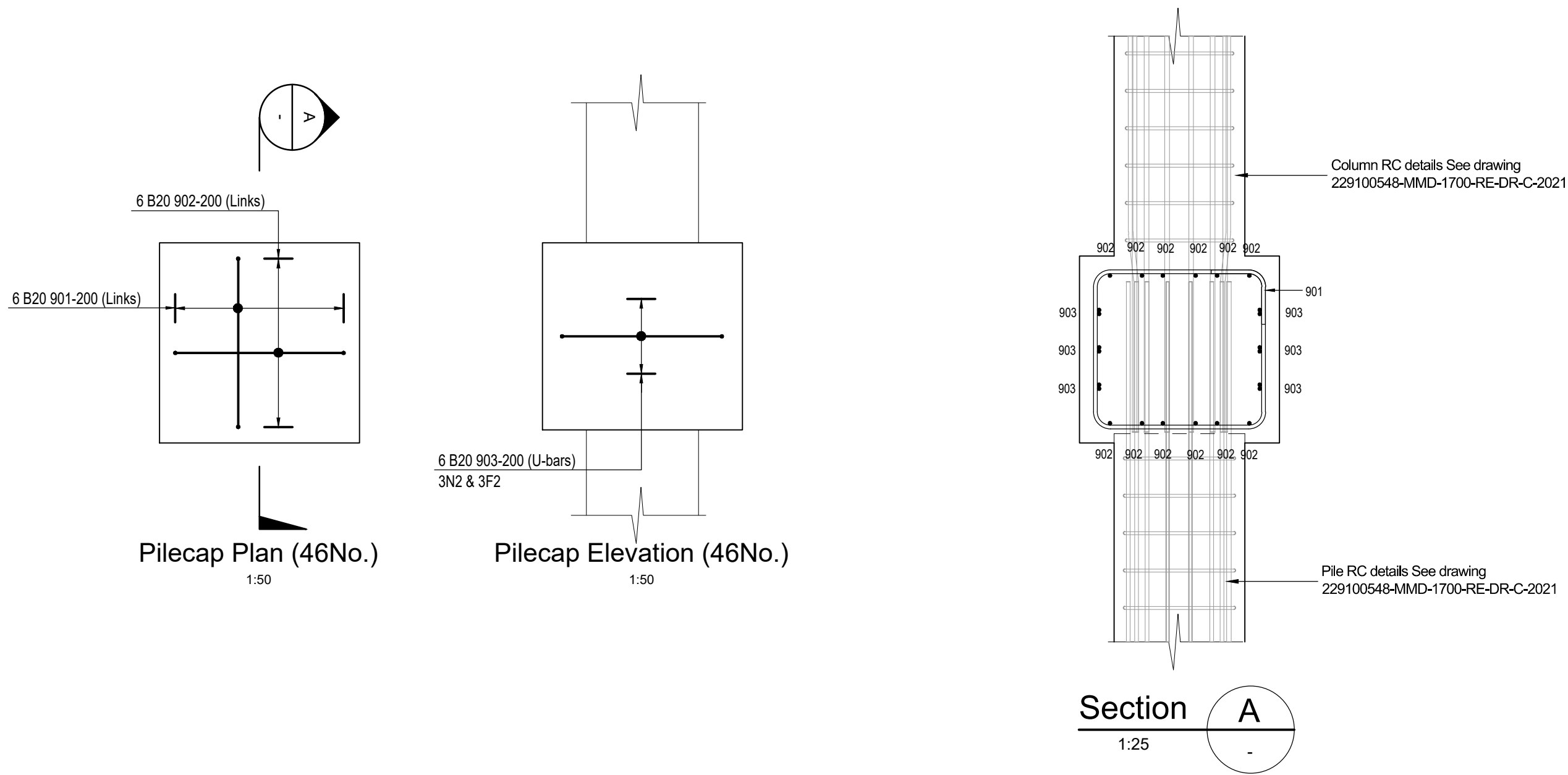
Wexford County Council
Roads Department
Carrichlawn
Wexford Town
Y35 WY93



Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
Parapet Upstands
Reinforcement Details

Designed	C. Clarke	Eng check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg check	C. Clarke	Approved	J. Shinkwin	
MMD Project Number	229100548	Scale at A1	As shown	Security
Drawing Description	Reinforcement Details			
Drawing Number	229100548-MMD-1700-RE-DR-C-2028	Revision	P01	



- Notes
1. Reinforcement to be Grade 500 Type B deformed bars to BS 4449:2005 (+A3 2016) and cut and bent in accordance with BS 8666 2005 unless otherwise specified.
 2. All kickers to be 100mm high (minimum).
 3. The Contractor is to satisfy themselves as to the accuracy of all reinforcing schedules prior to the ordering, cutting and bending of reinforcement.
 4. Concrete elements are not to be loaded before 28 days. Props to be left in place for 28 days. Props to elements at higher levels not to be supported by unpropped elements at lower levels.
 5. Reinforcement laps not otherwise defined shall be 50 times the smaller bar diameter.
 6. For General Notes refer to drawing 229100548-MMD-1700-RE-DR-C-2003.

- Concrete Notes:
- External arises to be chamfered 25x25mm. U.N.O.
 - Class of concrete shown thus :
U (unformed), F(formed).
 - Concrete to comply with TII Specification Series 1700 and DN-STR-03012.
 - All buried surfaces to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
 - Spray applied waterproofing membrane to DN-STR-03012 and complying with DN-STR-03009 to be applied to the bridge deck surface and upstands.
 - Bedding grout to have a minimum cube compressive strength of 60 MPa unless noted otherwise.

Key to symbols

- Reinforcement notation thus;
- T1 Top face, outer bar
 - T2 Top face, second bar
 - B1 Bottom face, outer bar
 - B2 Bottom face, second bar
 - N1 Near face, outer bar
 - N2 Near face, second bar
 - M1 Middle, outer bar
 - M2 Middle, second bar
 - F1 Far face, outer bar
 - F2 Far face, second bar
 - EF Each face
 - ABR Alternate Bars Reversed
 - Alt Alternatively placed
 - AT Alternatively turned
 - CL Centre line
 - Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2002 to
229100548-MMD-1700-RE-DR-C-2012

P01	28.10.2024	ROC	Issued for Approval	RS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

Status Stamp

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Roads Department
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Y35 WY93

Title

N25 Rosslare Europort Access Road
B1 Ballygerry Underbridge
(Railway Overbridge)
Pilecap - Reinforcement Details

Designed	C. Clarke		Eng check	R. Sexton	
Drawn	R. O'Connor		Coordination	J. O'Riordan	
Dwg check	C. Clarke		Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As shown	STD

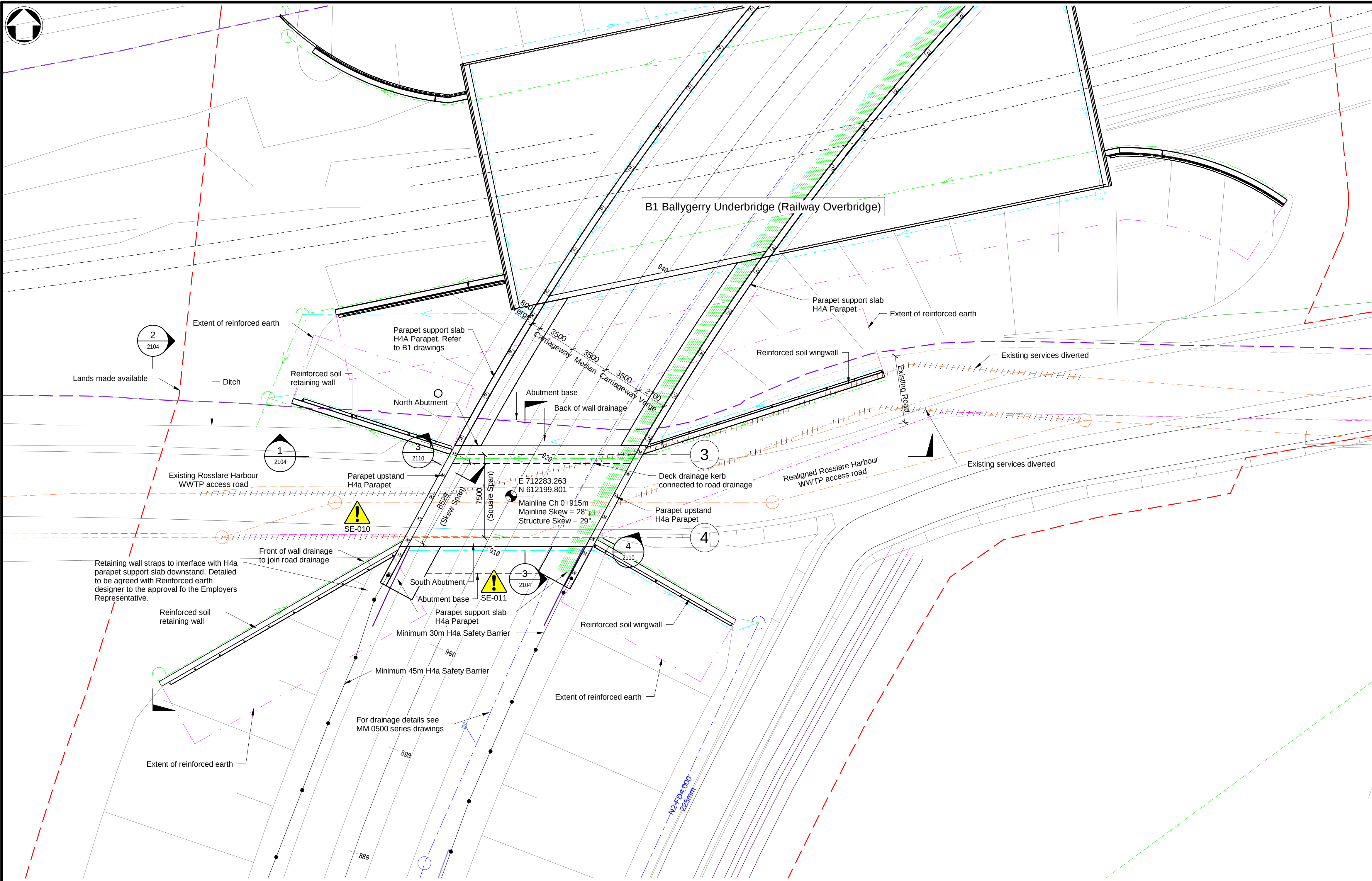
Drawing Description

Reinforcement Details

Drawing Number	Revision
229100548-MMD-1700-RE-DR-C-2029	P01

Concrete Class C45/55

	Bond Condition	Bar Dia							
		8	10	12	16	20	25	32	40
100% lapped in one location	Good	230	320	420	600	790	1030	1310	1780
	Poor	330	460	590	860	1130	1470	1880	2550



Plan

1 : 200

Foundation Notes:

- All Topsoil, Made Ground and soft spots (undrained shear strength <50kPa) shall be excavated from below the footprint of the structure. Excavations shall be backfilled where necessary to the formation level with Class 6N2 upfill.
- Excavations are to be kept free from water. Groundwater control in the form of temporary pumping is not currently expected to be required.
- Employer's Representative is to inspect the formation level of all foundations following stripping of topsoil and/or excavation to founding level. The founding strata shall have a minimum undrained shear strength of 50kPa. Details to be confirmed by testing on site to the agreement of the Employers Representative.
- Contractor to propose specific installation method to suit the site constraints, ground conditions, and project requirements, subject to agreement by the Employer's Representative.
- The Contractor is to issue a Method Statement which clearly identifies how they intend to deal with all elements of the works. This is to be issued to the Employer's Representative for approval prior to construction.
- The formation level of reinforced soil wall shall be accepted by the Employer's Representative prior to placing any backfilling and/or blinding layers. Where excavation and replacement of poor ground is required below the reinforced soil wall, the extent and depth of excavation of replaced ground shall be agreed by the Employer's Representative.

Safety, Health and Environmental Information

Notes below are additional to hazards/risks normally associated with this type of work. Numbers correspond to Risk Register references.

Residual Risk

- | | |
|--|----------------------------------|
| | Live traffic on private road |
| | Bridge beams temporary stability |

Concrete Element	Min Con Grade (IS EN 206, DN-STR-03012)	Exposure Class	Cover Cmin	Cover Cnom
Abutment base (fully buried)	C45/55 (50% GGBS)	XC2/XD2/XA1	45	55
Abutment wall (buried face)	C45/55 (50% GGBS)	XC2/XD3/XA1	45	55
Abutment wall (exposed face)	C45/55 (50% GGBS)	XC4/XD1/XF2	50	60
Precast Beams (External face)	C50/60	XC4/XD1/XF3	35	40
In-situ deck slab, Parapet support slab (areas protected by waterproofing)	C45/55 (50% GGBS)	XC3	25	35
Parapet support slab (buried face)	C45/55 (50% GGBS)	XC2/XA1/XD3	50	60
Parapet edge beam, Upstand of Parapet Support Slab	C45/55 (50% GGBS)	XC4/XD3/XF4	50	60
Reinforced Soil Wingwalls (Buried face)	C40/50 (50% GGBS)	XC2/XA1/XD3	55	60
Reinforced Soil Wingwalls (Exposed face)	C40/50 (50% GGBS)	XC4/XD3/XF2	55	60
Reinforced Soil Wall Cope (Exposed face)	C40/50 (50% GGBS)	XC4/XD3/XF4	55	60

Element	Finish
Buried unformed surfaces	U1
Exposed unformed surfaces excluding areas to receive sprayed deck waterproofing	U3
Buried in-situ concrete surfaces	F1 (except surfaces to receive spray applied waterproof which be prepared as per product requirements)
End Supports – Reinforced Soil Wingwalls	Standard pattern profile finish (To be approved by the Employers Rep Prior to Construction)
End Supports – Reinforced Concrete Abutment Wall	Standard pattern profile finish
Parapet edge beam	F3/U3
Precast Beams	F5
Deck Cantilever	F4
Precast elements	F4
Area of deck to receive waterproofing	U4
Coping Beams	F3/U3

O.S. Ref: 5645-C & 5715-A

CYAL50379123
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Notes

- General Notes:**
- All dimensions are in millimetres unless otherwise stated. Use figured dimensions only.
 - All levels are in metres above Malin Head Datum. Do not scale from the drawing.
 - Survey grid and all coordinates are in Irish Transverse Mercator.
 - All dimensions, levels and setting out co-ordinates are to be checked on site by the contractor. Any discrepancies are to be brought to the attention of the design engineer.
 - Drawing to be read in conjunction with all drawings, specifications and documents in the Works Requirements.
 - Bridge deck waterproofing shall be spray applied and satisfy the requirements of TII Publications Doc. Nos. DN-STR-03012, DN-STR-03009 & CC-SPW-02000.
 - Further to note no.6 above, all other buried concrete surfaces shall be treated with two coats of epoxy resin waterproofing paint in accordance with the requirements in TII Publications Doc. Nos. DN-STR-03012 & CC-SPW-02000.
 - A 20mm bituminous protection is required as an additional protective layer on all bridge deck waterproofing in accordance with the requirements in TII Publications Doc. Nos. CC-SPW-02000. The 20mm bituminous protection shall comply with IS EN 13108- 4 recipe type F wearing course mixture designation 0/2.
 - All exposed concrete shall be impregnated with a hydrophobic pore liner in accordance with the requirements in TII Publications Doc. Nos. DN-STR-03012 & CC-SPW-02000.
 - Joins between precast concrete units to be filled in accordance with the requirements in TII Publications Doc. Nos. DN-STR-03012 & CC-SPW-02300.
 - Placing and compaction of backfill shall be in accordance with the requirements in TII Publications Doc. Nos. CC-SPW-00600.
 - Interface between the natural ground with 6N or 6I6j and interface between embankment fill with 6N or 6I6j to be benched in accordance with the requirements in TII Publications Doc. Nos. CC-SPW-00600.
 - External concrete edges to be chamfered 25 x 25mm unless noted otherwise.

Key to symbols

	Lands Made Available
	Existing Irish Rail Boundary
	Proposed Back of Wall Drainage
	Proposed Front of Wall Drainage
	Proposed Highway Drainage
	Proposed Foul Sewer
	Proposed Kerb Drain
	Proposed Service Ducts
	Existing Foul Sewer
	Existing EIR Underground Services
	Existing ESB MV Line

Reference drawings

- 229100548-MMD-1700-RE-DR-C-2000 - Structures Location Plan
- 229100548-MMD-1700-RE-DR-C-2103 - GA Plan & Section
- 229100548-MMD-1700-RE-DR-C-2104 - GA Sections & Elevations
- 229100548-MMD-1700-RE-DR-C-2105 - Abutment Plan & Setting Out Details
- 229100548-MMD-1700-RE-DR-C-2106 - Abutment Elevations
- 229100548-MMD-1700-RE-DR-C-2107 - Precast Prestressed Beams Detail Sht 1
- 229100548-MMD-1700-RE-DR-C-2108 - Precast Prestressed Beams Detail Sht 2
- 229100548-MMD-1700-RE-DR-C-2110 - Bridge Parapet Details
- 229100548-MMD-1700-RE-DR-C-2121 - Abutment Foundations RC Details
- 229100548-MMD-1700-RE-DR-C-2122 - Abutment Walls RC Details
- 229100548-MMD-1700-RE-DR-C-2122 - Deck RC Details
- 229100548-MMD-1700-RE-DR-C-2123 - Bridge Parapet RC Details

P02	28.10.2024	ROC	Issued for Approval	EOS	JS
P01	30.04.2024	ROC	Issued for Information	CC	JS
Rev	Date	Drawn	Description	Ch'kd	App'd

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Title

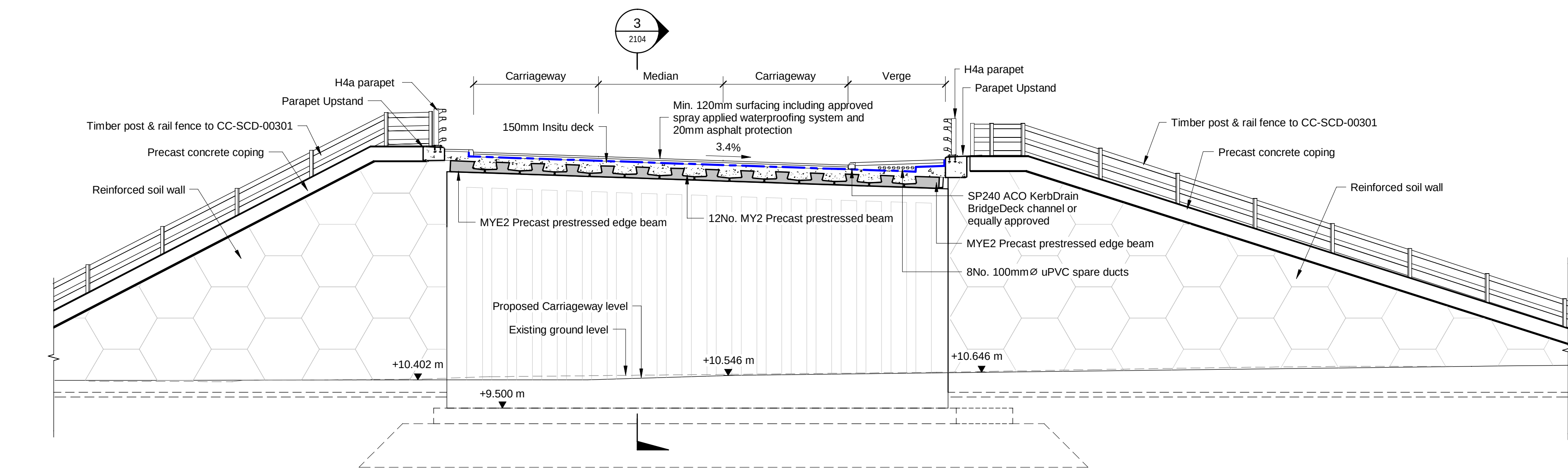
N25 Rosslare Europort Access Road
B2 Access Underpass
General Arrangement
Plan

Designed	E. O'Sullivan	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	E. O'Sullivan	Approved	J. Shinkwin	

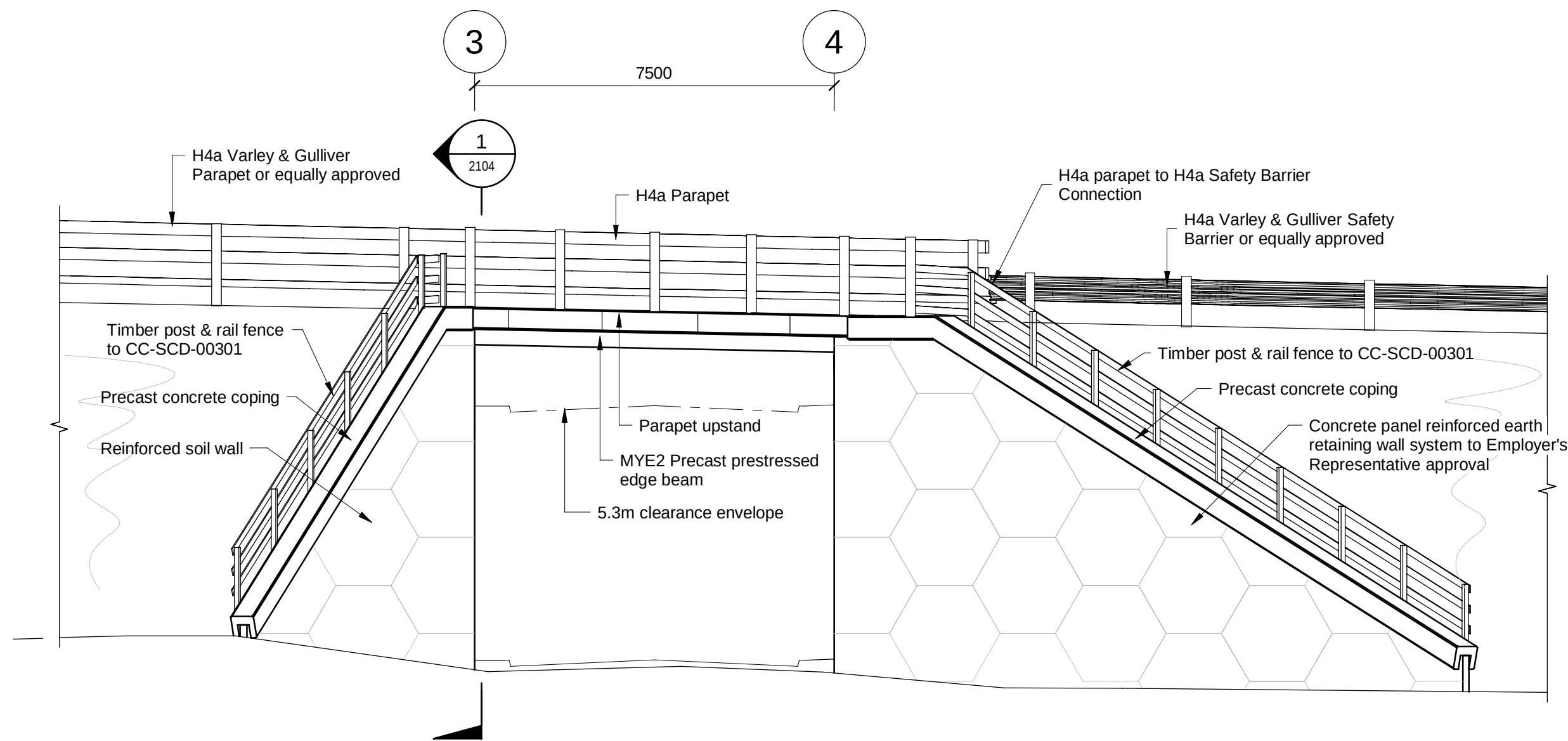
MMD Project Number	Scale at A1	Security
229100548	As indicated	STD

Drawing Description
General Arrangement

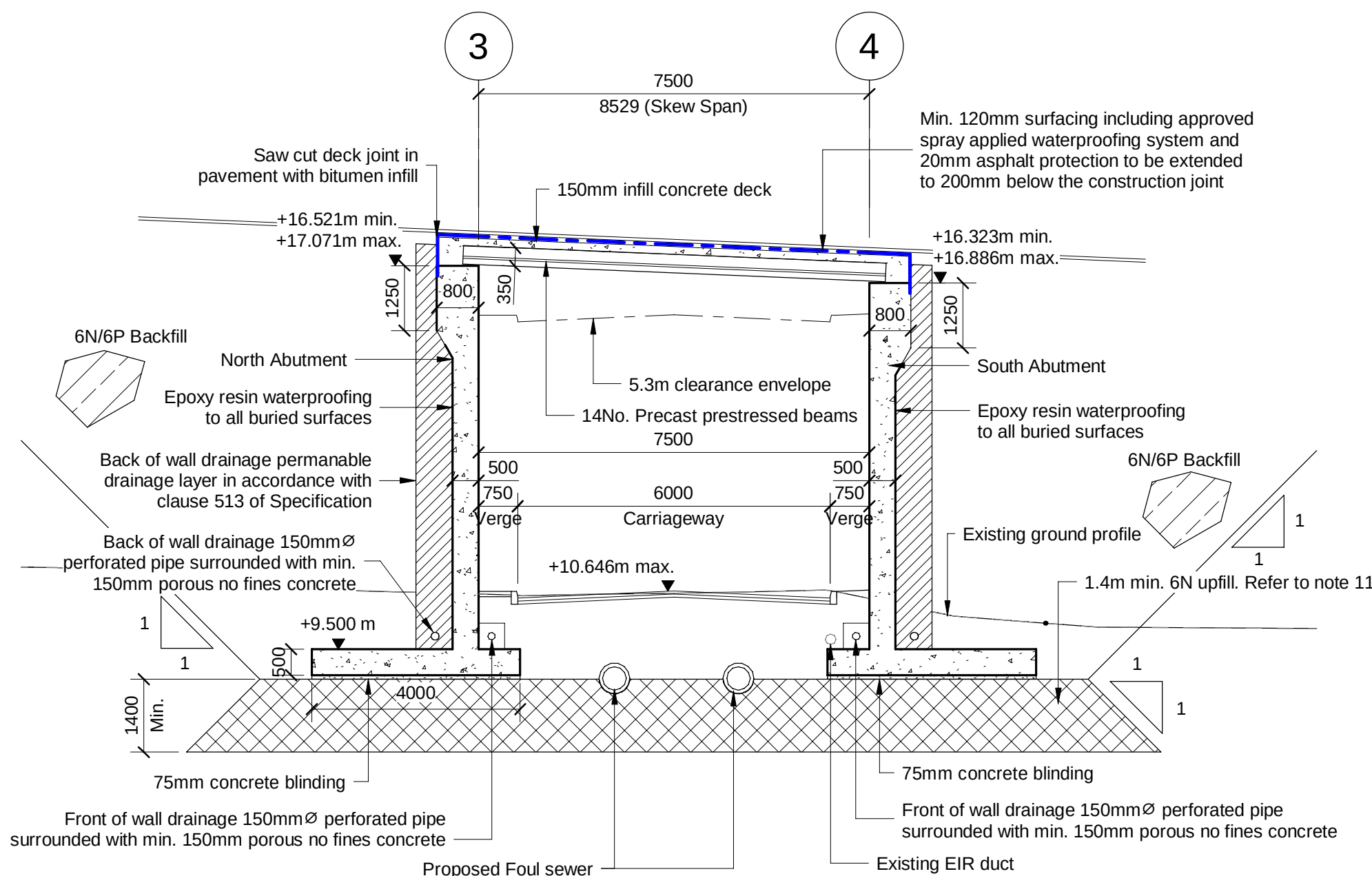
Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2103	P02



SECTION 1
1 : 100



ELEVATION 2
1 : 100



SECTION 3
1 : 100

- Notes
- Refer to drawing 229100548-MMD-17000-RE-DR-C-2103 for notes.
 - Deck to be made integral with substructure prior to backfilling abutments

Key to symbols

Reference drawings

- 229100548-MMD-1700-RE-DR-C-2000 - Structures Location Plan
- 229100548-MMD-1700-RE-DR-C-2103 - GA Plan & Section
- 229100548-MMD-1700-RE-DR-C-2104 - GA Sections & Elevations
- 229100548-MMD-1700-RE-DR-C-2105 - Abutment Plan & Setting Out Details
- 229100548-MMD-1700-RE-DR-C-2106 - Abutment Elevations
- 229100548-MMD-1700-RE-DR-C-2107 - Precast Prestressed Beams Detail Sht 1
- 229100548-MMD-1700-RE-DR-C-2108 - Precast Prestressed Beams Detail Sht 2
- 229100548-MMD-1700-RE-DR-C-2110 - Bridge Parapet Details
- 229100548-MMD-1700-RE-DR-C-2121 - Abutment Foundations RC Details
- 229100548-MMD-1700-RE-DR-C-2122 - Abutment Walls RC Details
- 229100548-MMD-1700-RE-DR-C-2122 - Deck RC Details
- 229100548-MMD-1700-RE-DR-C-2123 - Bridge Parapet RC Details

P02	28.10.2024	ROC	Issued for Approval	EOS	JS
P01	30.04.2024	ROC	Issued for Information	CC	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Title

N25 Rosslare Europort Access Road
B2 Access Underpass
General Arrangement
Sections & Elevations

Designed	E. O'Sullivan	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	E. O'Sullivan	Approved	J. Shinkwin	
MMD Project Number	229100548	Scale at A1	As indicated	Security STD

Drawing Description

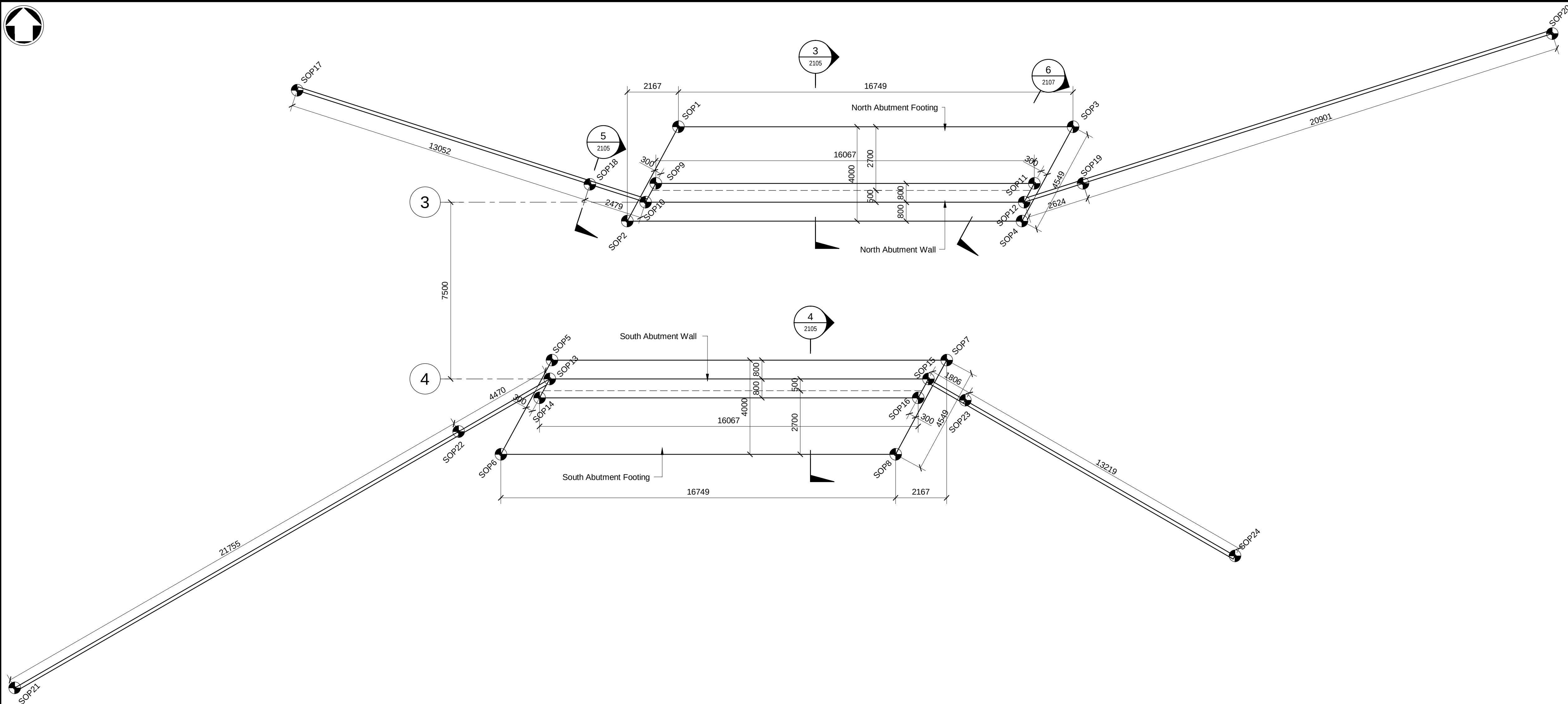
General Arrangement

Drawing Number	229100548-MMD-1700-RE-DR-C-2104	Rev	P02
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O.S. Ref: 5645-C & 5715-A

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Notes

1. Refer to drawing 229100548-MMD-17000-RE-DR-C-2103 for notes.
2. Deck to be made integral with substructure prior to backfilling abutments
3. Refer to Appendix 1/11 for details of Contractor designed reinforced earth panels.
4. Precast concrete wingwalls to abutment joint panels required at the wingwall - abutment interfaces.

Key to symbols

Reference drawings

- | | |
|---------------------------------|---|
| 229100548-MMD-1700-RE-DR-C-2000 | Structures Location Plan |
| 229100548-MMD-1700-RE-DR-C-2103 | GA Plan & Section |
| 229100548-MMD-1700-RE-DR-C-2104 | GA Sections & Elevations |
| 229100548-MMD-1700-RE-DR-C-2105 | Abutment Plan & Setting Out Details |
| 229100548-MMD-1700-RE-DR-C-2106 | Abutment Elevations |
| 229100548-MMD-1700-RE-DR-C-2107 | Precast Prestressed Beams Detail Shrt 1 |
| 229100548-MMD-1700-RE-DR-C-2108 | Precast Prestressed Beams Detail Shrt 2 |
| 229100548-MMD-1700-RE-DR-C-2110 | Bridge Parapet Details |
| 229100548-MMD-1700-RE-DR-C-2121 | Abutment Foundations RC Details |
| 229100548-MMD-1700-RE-DR-C-2122 | Abutment Foundations RC Details |
| 229100548-MMD-1700-RE-DR-C-2122 | Deck RC Details |
| 229100548-MMD-1700-RE-DR-C-2123 | Bridge Parapet RC Details |

P01	28.10.2024	ROC	Issued for Approval	EOS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Title

N25 Rosslare Europort Access Road B2 Access Underpass Abutment Plan & Setting Out Details

Designed	E. O'Sullivan		Eng. Check	R. Sexton	
Drawn	R. O'Connor		Coordination	J. O'Riordan	
Dwg. Check	E. O'Sullivan		Approved	J. Shinkwin	

MMD Project Number

Scale at A1		
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Security

Drawing Description

General Arrangement

Drawing Number

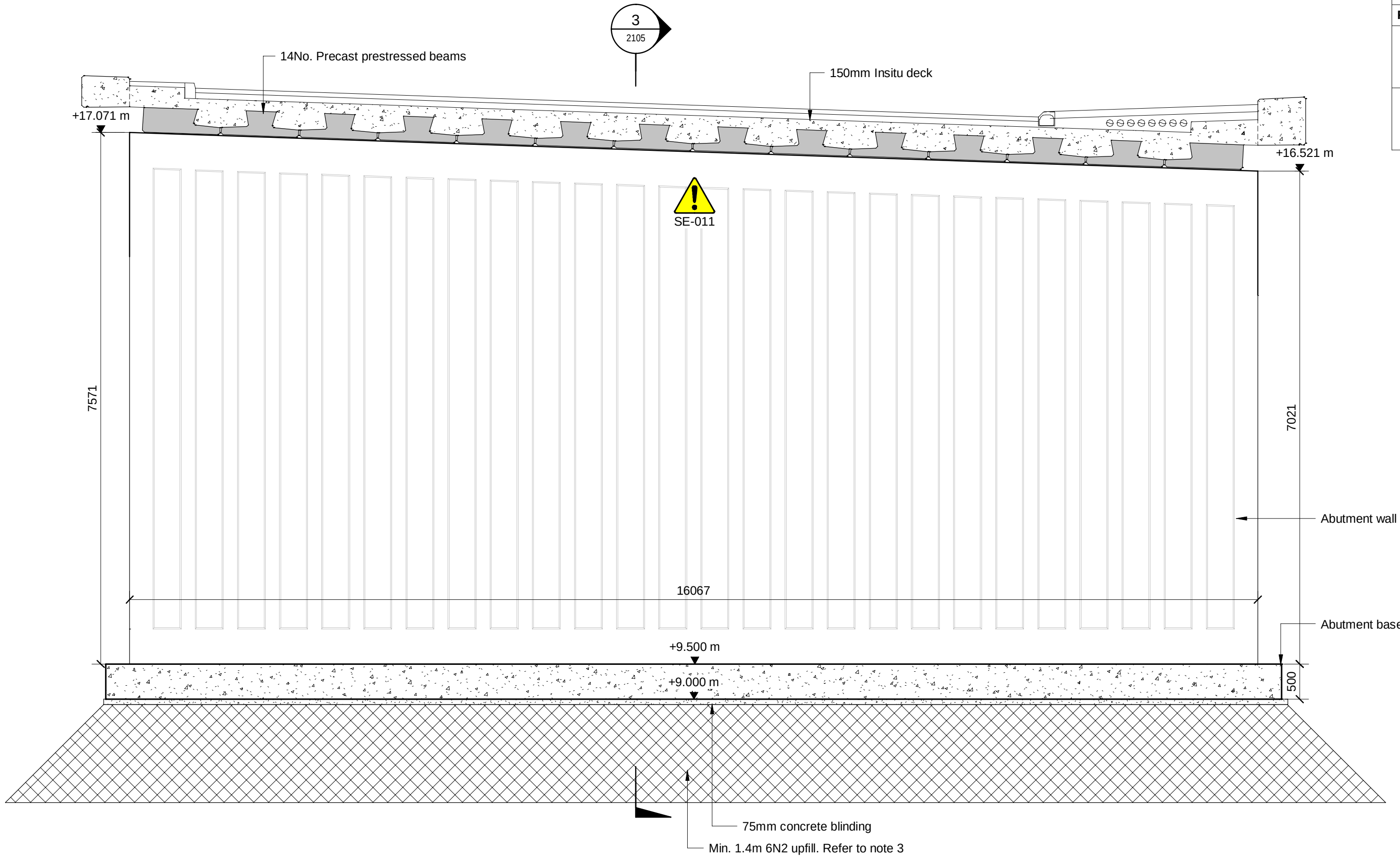
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Rev

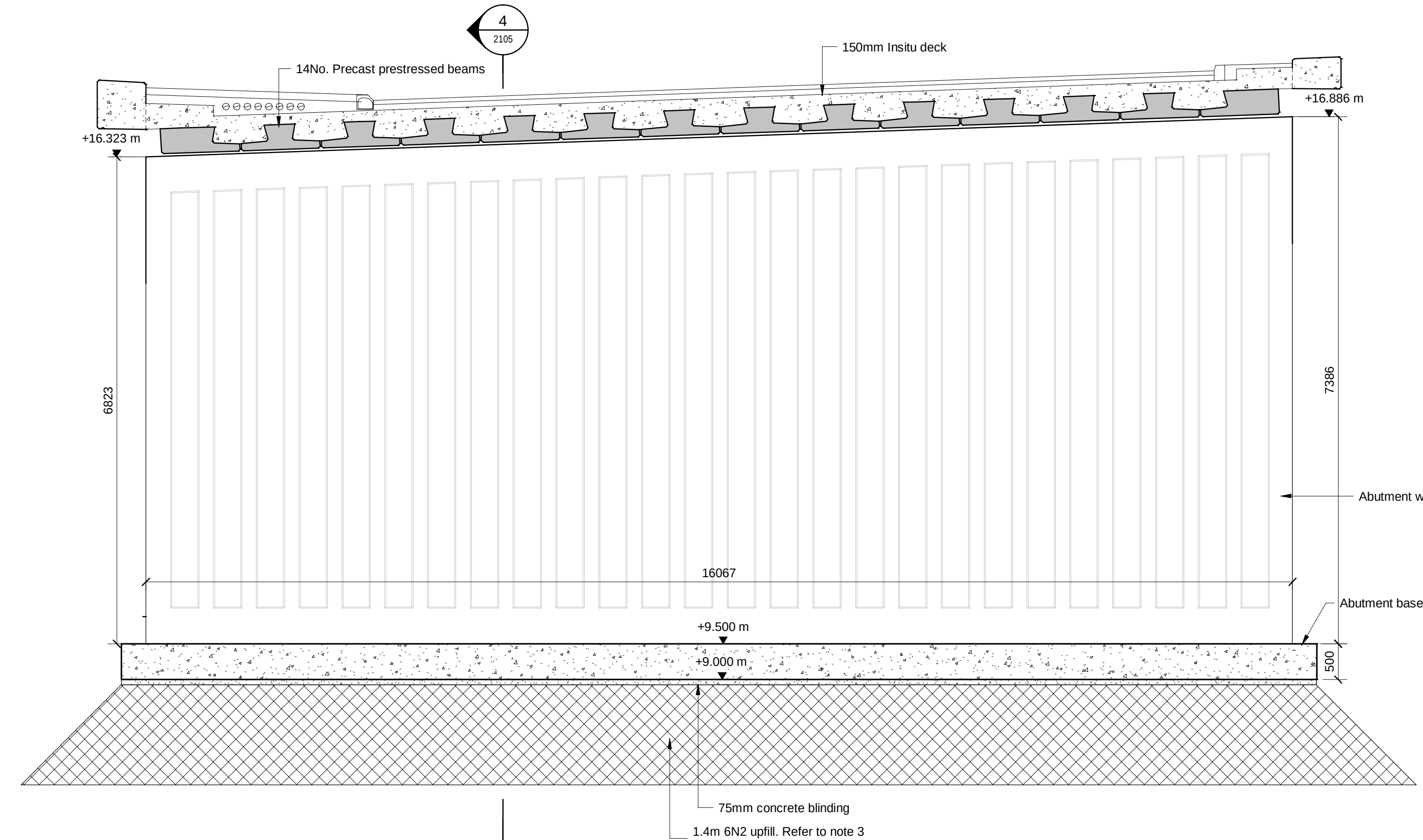
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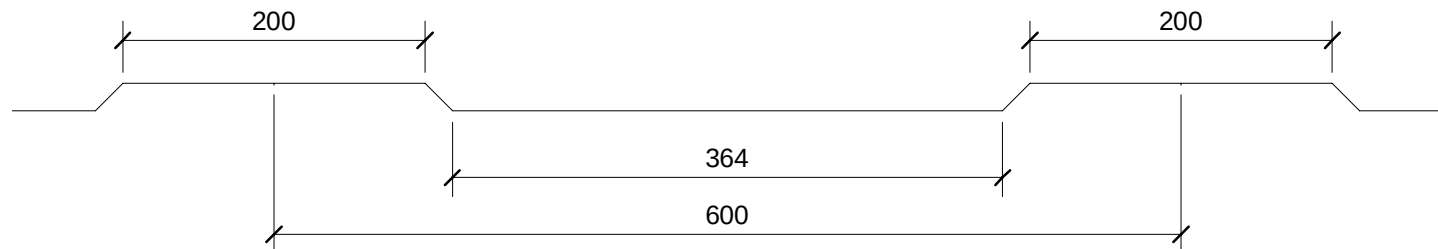


North Abutment Elevation
1 : 50



South Abutment Elevation
1 : 50

Safety, Health and Environmental Information	
Notes below are additional to hazards/risks normally associated with this type of work. Numbers correspond to Risk Register references.	
Residual Risk	
 SE-011	Bridge beams temporary stability



Pattern Profile Finish
1 : 5

- Notes
- Refer to drawing 229100548-MMD-17000-RE-DR-C-2103 for notes.
 - Deck to be made integral with substructure prior to backfilling abutments

Key to symbols

Reference drawings

- 229100548-MMD-1700-RE-DR-C-2000 - Structures Location Plan
- 229100548-MMD-1700-RE-DR-C-2103 - GA Plan & Section
- 229100548-MMD-1700-RE-DR-C-2104 - GA Sections & Elevations
- 229100548-MMD-1700-RE-DR-C-2105 - Abutment Plan & Setting Out Details
- 229100548-MMD-1700-RE-DR-C-2106 - Abutment Elevations
- 229100548-MMD-1700-RE-DR-C-2107 - Precast Prestressed Beams Detail Sht 1
- 229100548-MMD-1700-RE-DR-C-2108 - Precast Prestressed Beams Detail Sht 2
- 229100548-MMD-1700-RE-DR-C-2110 - Bridge Parapet Details
- 229100548-MMD-1700-RE-DR-C-2121 - Abutment Foundations RC Details
- 229100548-MMD-1700-RE-DR-C-2122 - Abutment Walls RC Details
- 229100548-MMD-1700-RE-DR-C-2122 - Deck RC Details
- 229100548-MMD-1700-RE-DR-C-2123 - Bridge Parapet RC Details

Rev	Date	Drawn	Description	Ch'k'd	App'd
P01	28.10.2024	ROC	Issued for Approval	EOS	JS

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 **Comhairle Contae
Loch Garman
Wexford
County Council**

Title

**N25 Rosslare Europort Access Road
B2 Access Underpass
Abutments - General Arrangement**

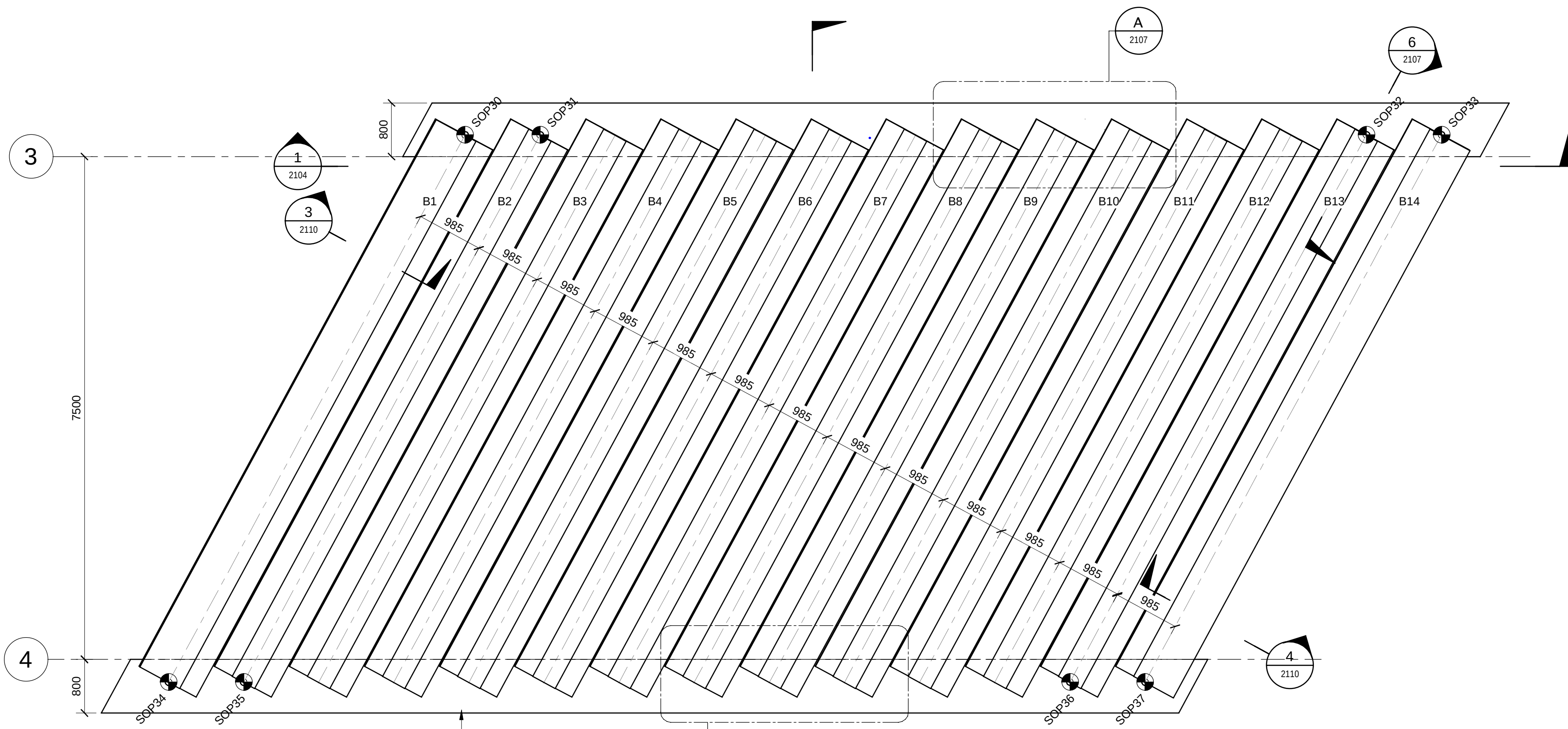
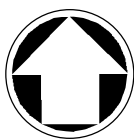
Designed	E. O'Sullivan	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	E. O'Sullivan	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As indicated	STD

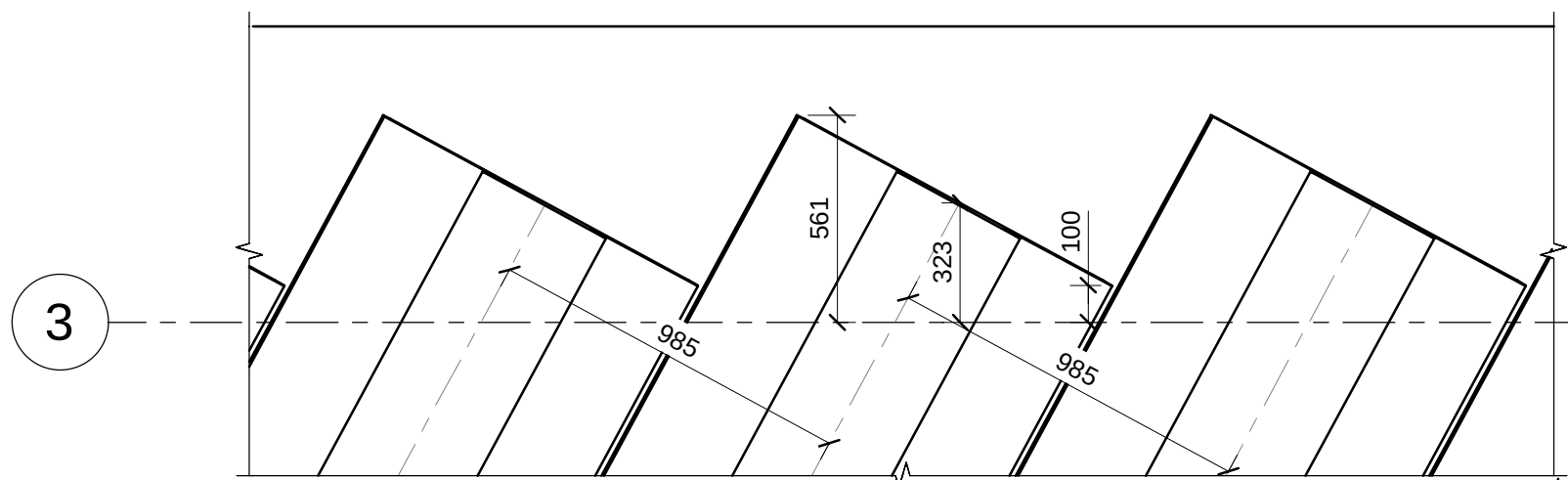
Drawing Description

General Arrangement

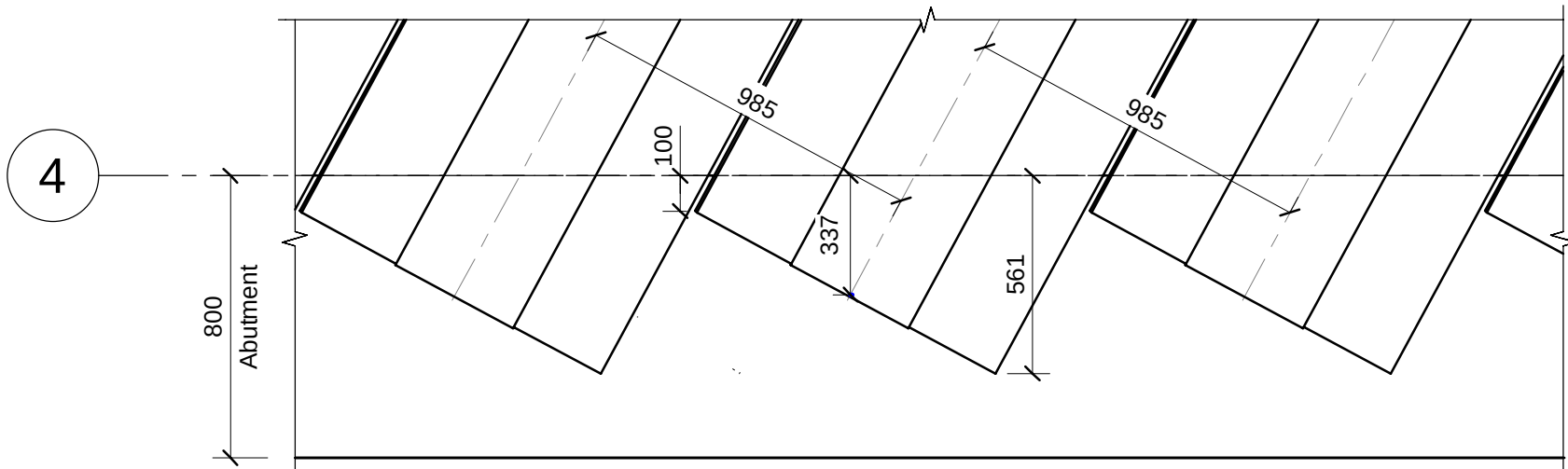
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229100548-MMD-1700-RE-DR-C-2106	P01



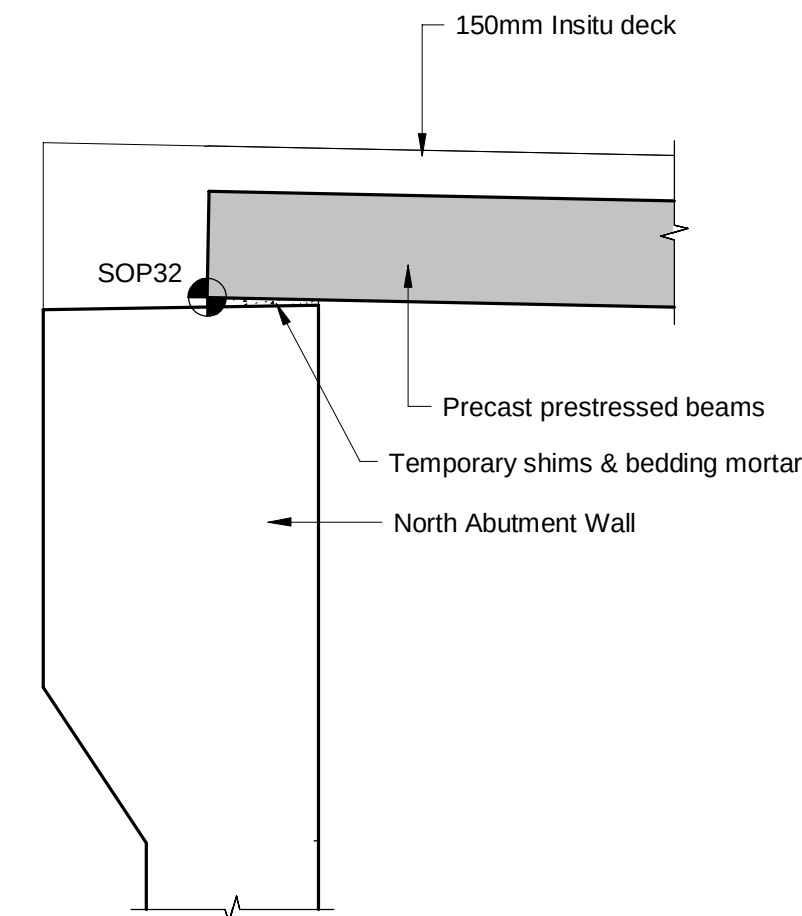
Plan
1 : 50



DETAIL
1 : 20

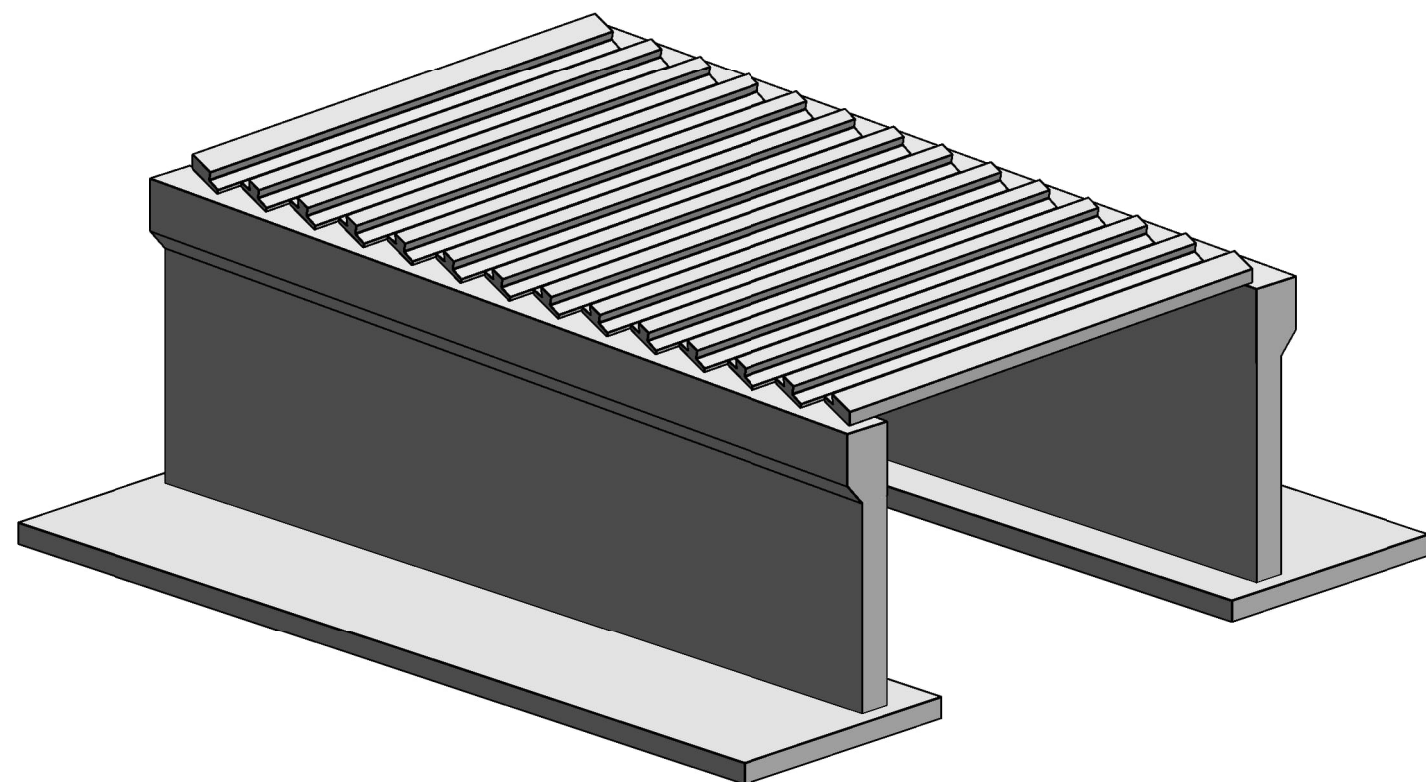


DETAIL
1 : 20



SECTION
1 : 25

6
2105



3D - Prestressed Beams View

Notes

- Refer to drawing 229100548-MMD-17000-RE-DR-C-2103 for notes.
- Deck to be made integral with substructure prior to backfilling abutments

Key to symbols

Setting Out Details

Ref	Easting	Northing	Level mO.D.	Level Location
SOP30	712279.400	612203.939	17.065	Prestressed Beams
SOP31	712280.520	612203.920	17.029	Prestressed Beams
SOP32	712292.841	612203.715	16.61	Prestressed Beams
SOP33	712293.960	612203.696	16.572	Prestressed Beams
SOP34	712274.842	612195.853	16.899	Prestressed Beams
SOP35	712275.963	612195.835	16.858	Prestressed Beams
SOP36	712288.284	612195.630	16.42	Prestressed Beams
SOP37	712289.404	612195.610	16.38	Prestressed Beams

Reference drawings

- 229100548-MMD-1700-RE-DR-C-2000 - Structures Location Plan
- 229100548-MMD-1700-RE-DR-C-2103 - GA Plan & Section
- 229100548-MMD-1700-RE-DR-C-2104 - GA Sections & Elevations
- 229100548-MMD-1700-RE-DR-C-2105 - Abutment Plan & Setting Out Details
- 229100548-MMD-1700-RE-DR-C-2106 - Abutment Elevations
- 229100548-MMD-1700-RE-DR-C-2107 - Precast Prestressed Beams Detail Sht 1
- 229100548-MMD-1700-RE-DR-C-2108 - Precast Prestressed Beams Detail Sht 2
- 229100548-MMD-1700-RE-DR-C-2110 - Bridge Parapet Details
- 229100548-MMD-1700-RE-DR-C-2121 - Abutment Foundations RC Details
- 229100548-MMD-1700-RE-DR-C-2122 - Abutment Walls RC Details
- 229100548-MMD-1700-RE-DR-C-2122 - Deck RC Details
- 229100548-MMD-1700-RE-DR-C-2123 - Bridge Parapet RC Details

Rev	Date	Drawn	Description	Ch'k'd	App'd
P01	28.10.2024	ROC	Issued for Approval	EOS	JS

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Title

N25 Rosslare Europort Access Road
B2 Access Underpass
Precast Prestressed Beams Details
Sheet 1 of 2

Designed	E. O'Sullivan	Eng. Check	R. Sexton
Drawn	R. O'Connor	Coordination	J. O'Riordan
Dwg. Check	E. O'Sullivan	Approved	J. Shinkwin

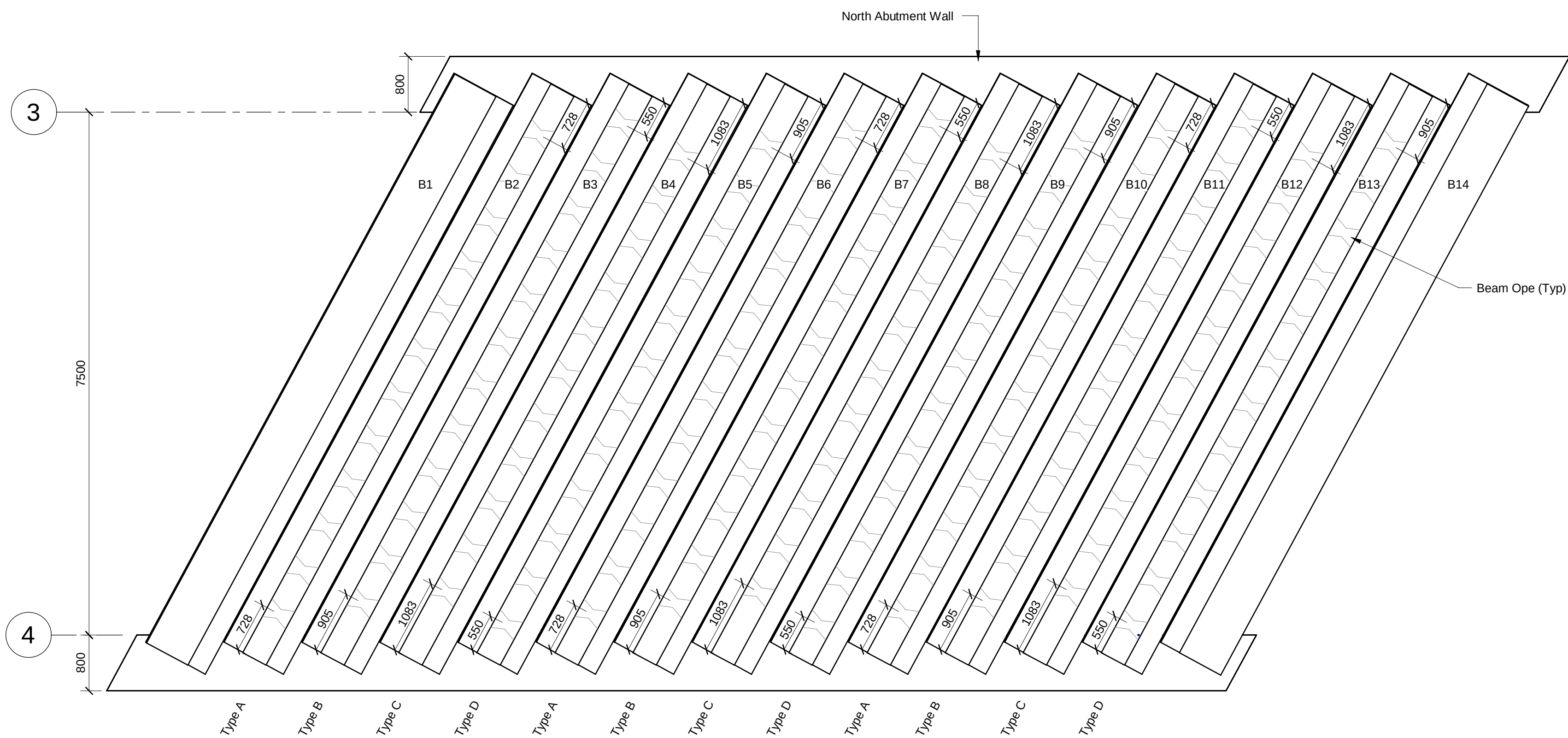
MMD Project Number	Scale at A1	Security
229100548	As indicated	STD

Drawing Description
General Arrangement

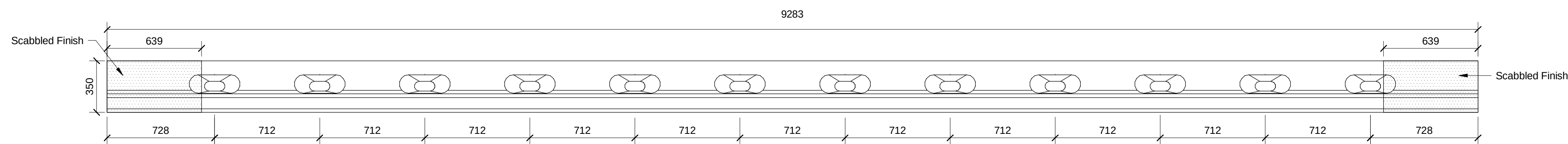
Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2107	P01

O.S. Ref: 5645-C & 5715-A

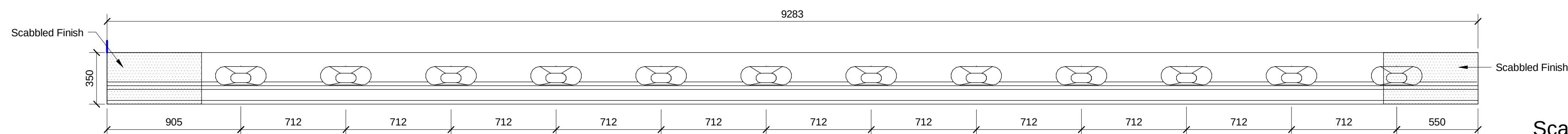
CYAL50379123
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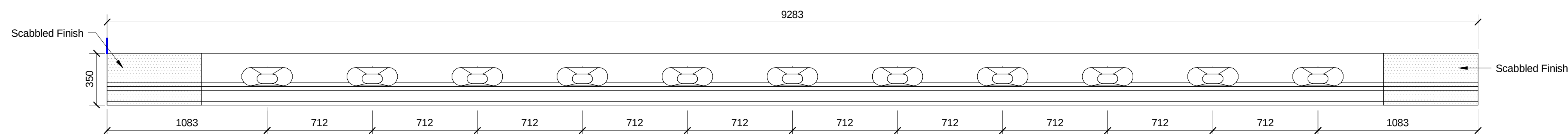
Plan
1 : 50



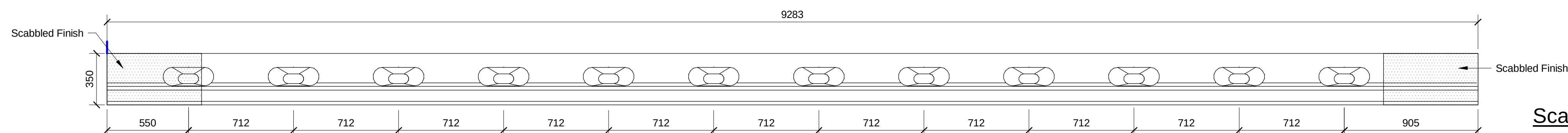
MY2 - Type A (3No.)



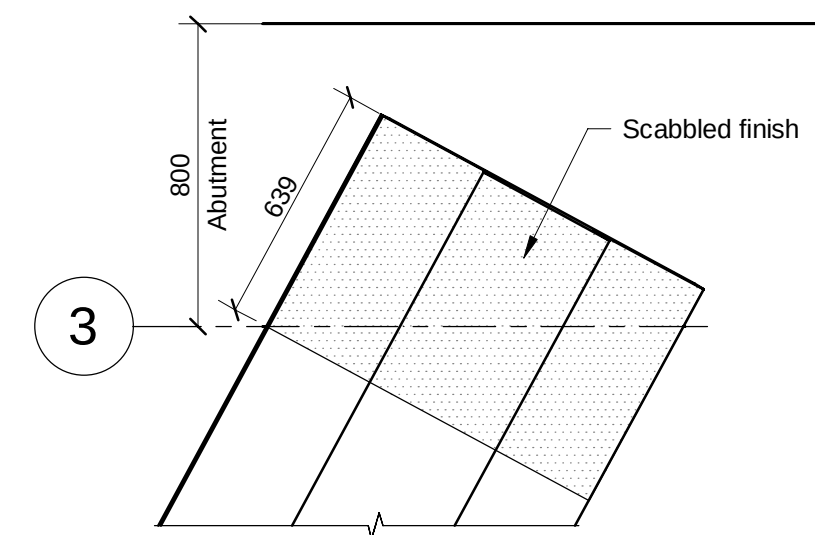
MY2 - Type B (3No.)



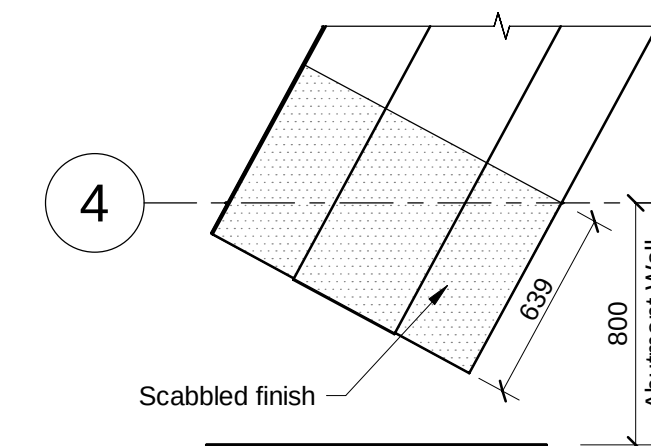
MY2 - Type C (3No.)



MY2 - Type D (3No.)



Scabbled Finish Detail (excluding soffit) - North



Scabbled Finish Detail (excluding soffit) - South

Notes
1. Refer to drawing 229100548-MMD-17000-RE-DR-C-2103 for notes. 2. Deck to be made integral with substructure prior to backfilling abutments

Key to symbols

Reference drawings

- | | | |
|---|---------------------------------|--|
| • | 229100548-MMD-1700-RE-DR-C-2000 | Structures Location Plan |
| • | 229100548-MMD-1700-RE-DR-C-2103 | GA Plan & Section |
| • | 229100548-MMD-1700-RE-DR-C-2104 | GA Sections & Elevations |
| • | 229100548-MMD-1700-RE-DR-C-2105 | Abutment Plan & Setting Out Details |
| • | 229100548-MMD-1700-RE-DR-C-2106 | Abutment Elevation |
| • | 229100548-MMD-1700-RE-DR-C-2107 | Precast Prestressed Beams Detail Sht 1 |
| • | 229100548-MMD-1700-RE-DR-C-2108 | Precast Prestressed Beams Detail Sht 2 |
| • | 229100548-MMD-1700-RE-DR-C-2110 | Bridge Parapet Details |
| • | 229100548-MMD-1700-RE-DR-C-2121 | Abutment Foundations RC Details |
| • | 229100548-MMD-1700-RE-DR-C-2122 | Abutment RC Details |
| • | 229100548-MMD-1700-RE-DR-C-2123 | Deck RC Details |
| • | 229100548-MMD-1700-RE-DR-C-2123 | Bridge Parapet RC Details |

P01	28.10.2024	ROC	Issued for Approval	EOS	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Title N25 Rosslare Europort Access Road B2 Access Underpass Precast Prestressed Beams Details Sheet 2 of 2

Designed	E. O'Sullivan		Eng. Check	R. Sexton	
Drawn	R. O'Connor		Coordination	J. O'Riordan	
Dwg. Check	E. O'Sullivan		Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As indicated	STD

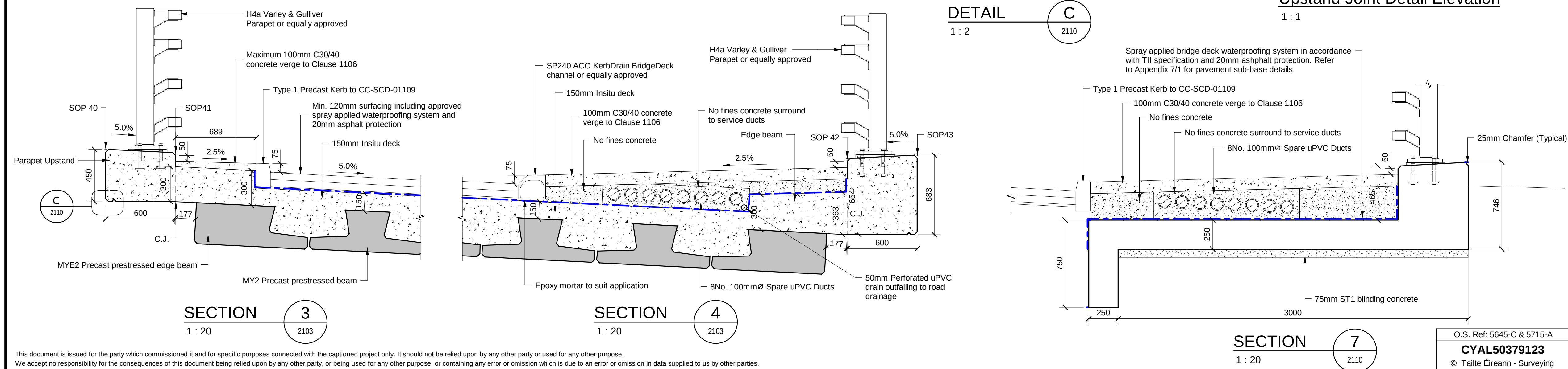
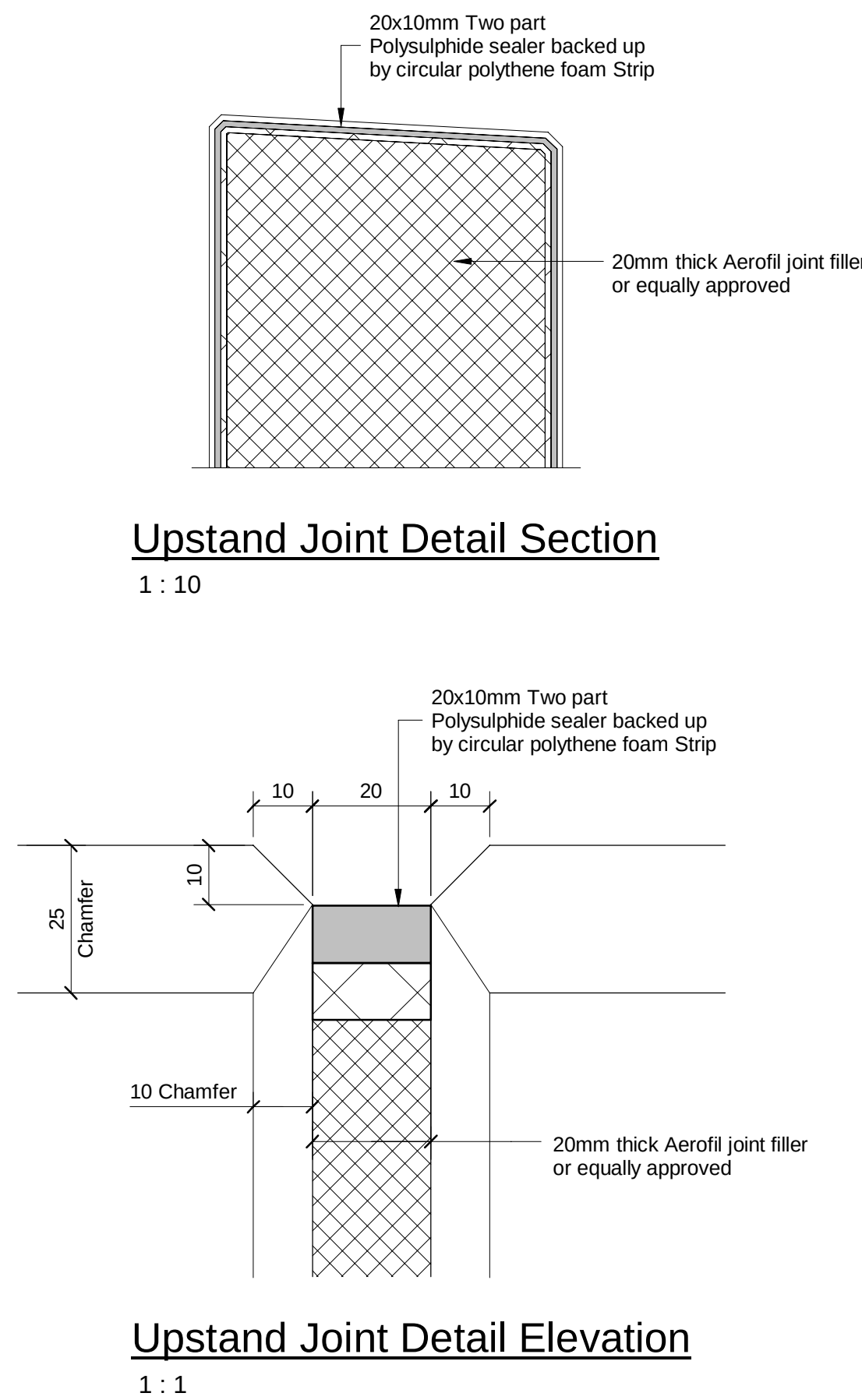
General Arrangement

Drawing Number	Rev
229100548-MMD-1700-BE-DB-C-2108	P01

O.S. Ref: 5645-C & 5715-A

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- 229100548-MMD-1700-RE-DR-C-2000 - Structures Location Plan
- 229100548-MMD-1700-RE-DR-C-2103 - GA Plan & Section
- 229100548-MMD-1700-RE-DR-C-2104 - GA Sections & Elevations
- 229100548-MMD-1700-RE-DR-C-2105 - Abutment Wall Setting Out Details
- 229100548-MMD-1700-RE-DR-C-2106 - Abutment Elevation
- 229100548-MMD-1700-RE-DR-C-2107 - Precast Prestressed Beams Detail Sht 1
- 229100548-MMD-1700-RE-DR-C-2108 - Precast Prestressed Beams Detail Sht 2
- 229100548-MMD-1700-RE-DR-C-2110 - Bridge Parapet Details
- 229100548-MMD-1700-RE-DR-C-2121 - Abutment Foundations RC Details
- 229100548-MMD-1700-RE-DR-C-2122 - Abutment Walls RC Details
- 229100548-MMD-1700-RE-DR-C-2122 - Deck RC Details
- 229100548-MMD-1700-RE-DR-C-2123 - Bridge Parapet RC Details

P01	28.10.2024	ROC	Issued for Approval	EOS	JS
Rev	Date	Drawn	Description	Ch'kd	App'd

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 Wexford County Council
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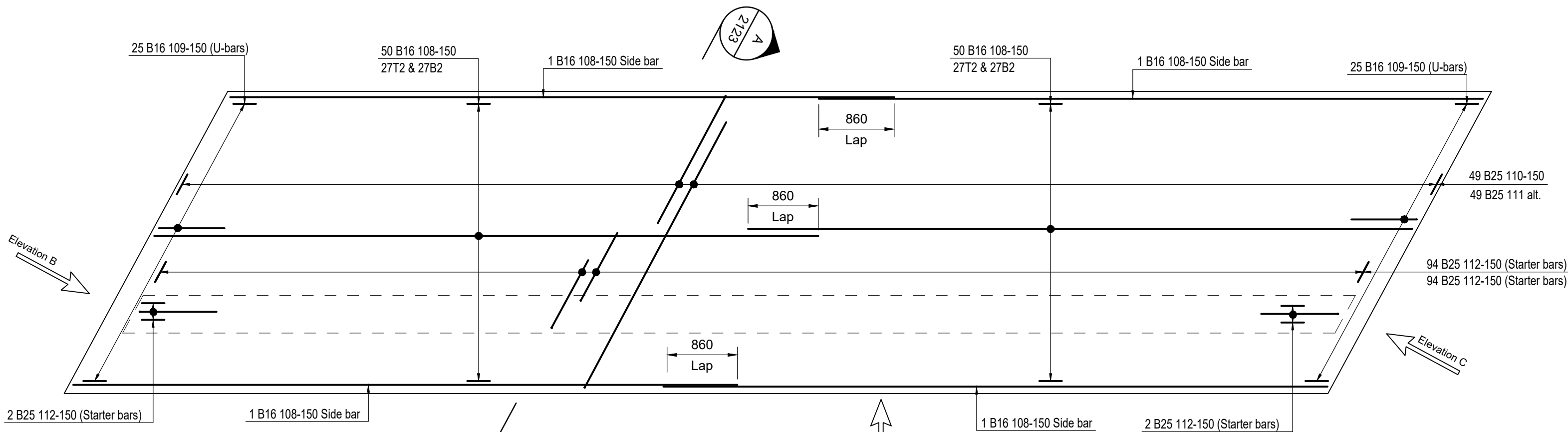
Title	N25 Rosslare Europort Access Road B2 Access Underpass Deck & Parapet Plan
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Designed	E. O'Sullivan		Eng. Check	R. Sexton	
Drawn	R. O'Connor		Coordination	J. O'Riordan	
Dwg. Check	E. O'Sullivan		Approved	J. Shinkwin	

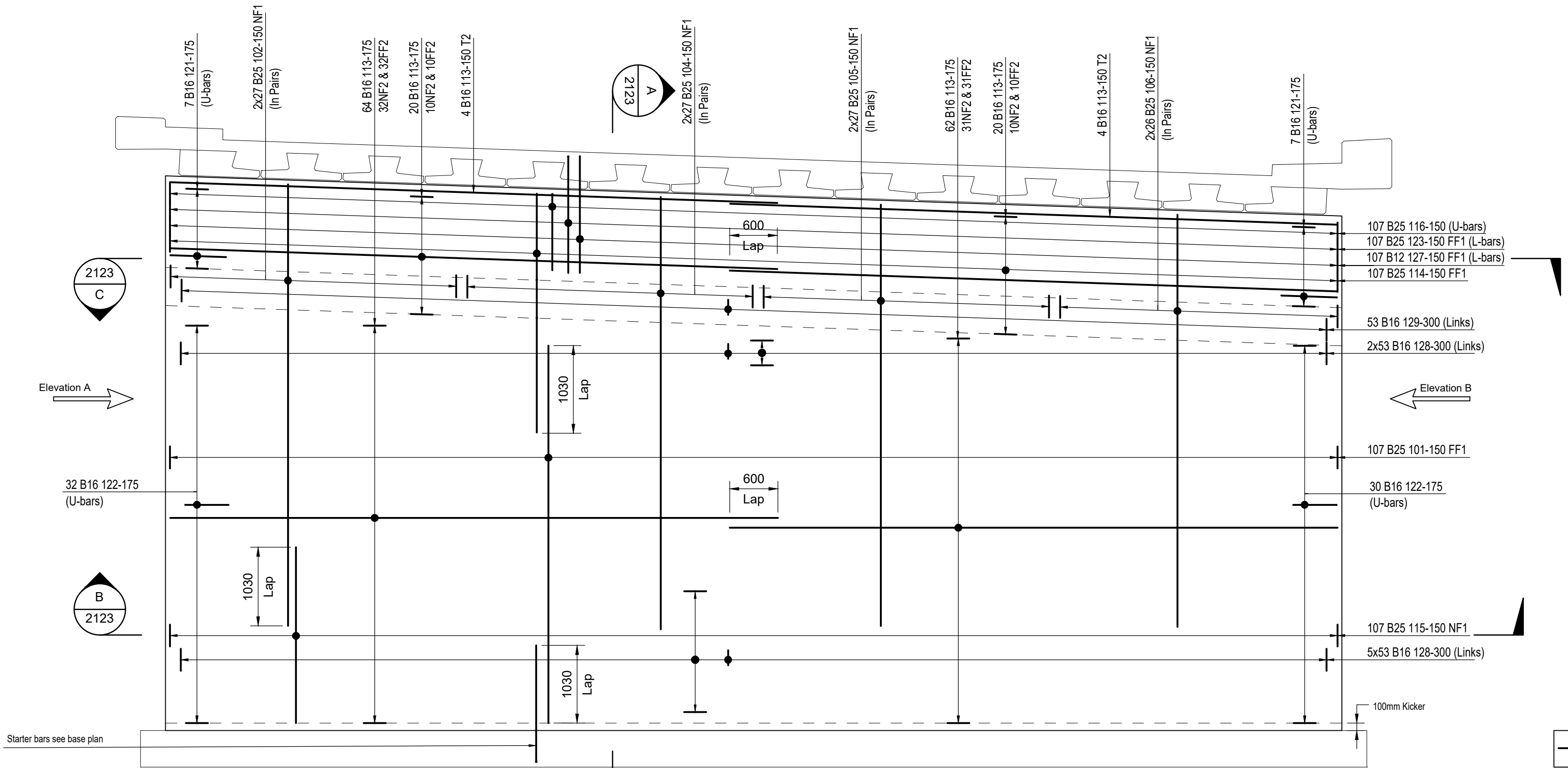
MMD Project Number 229100548	Scale at A1 As indicated	Security STD
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Drawing Description	
General Arrangement	

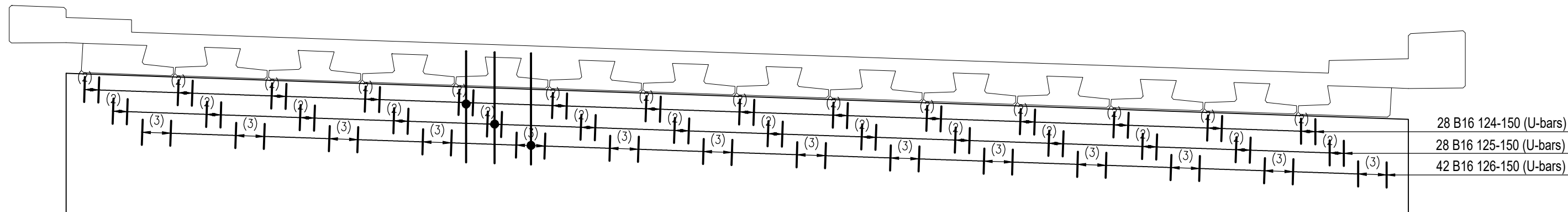
Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2110	P01



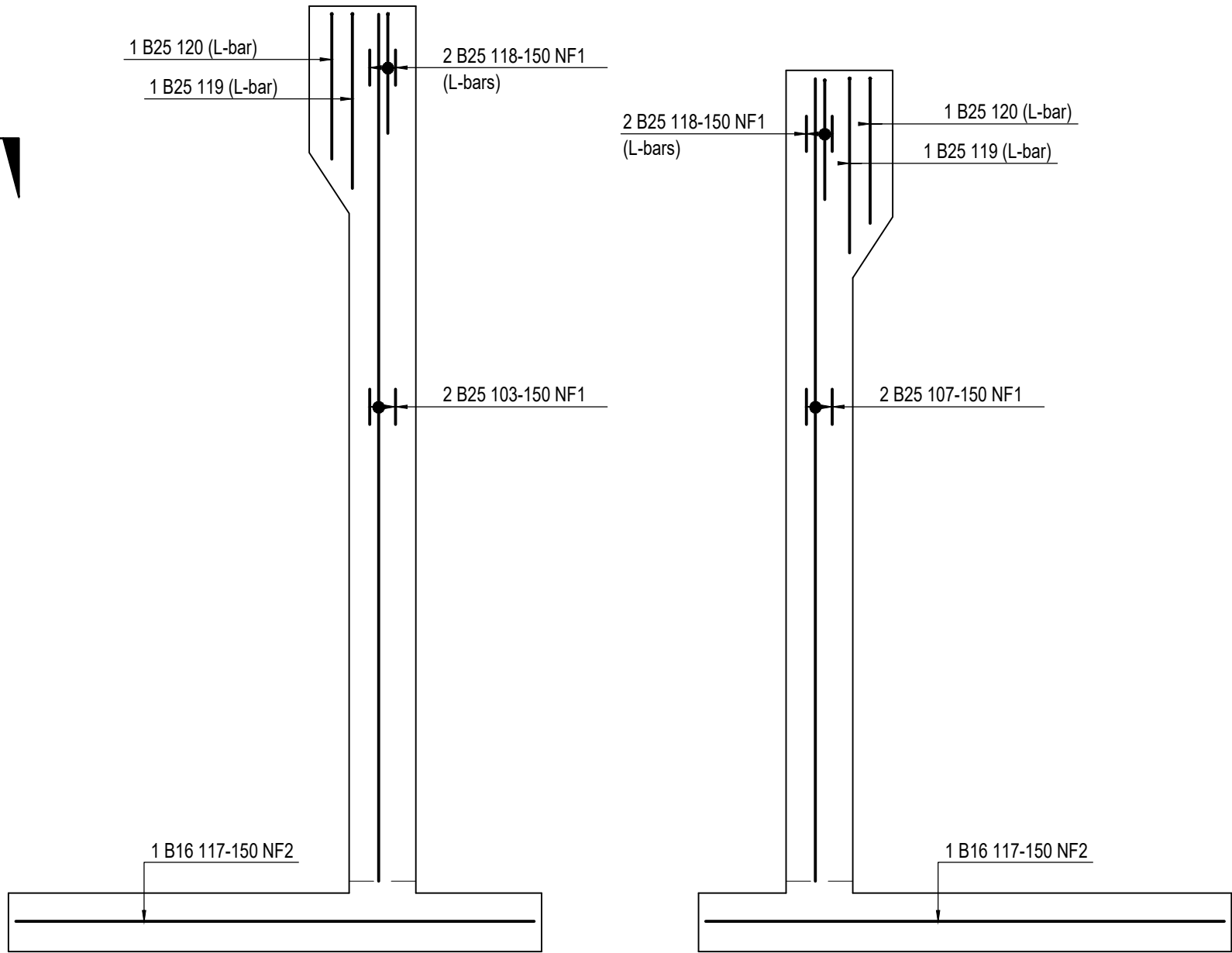
North Abutment Base
1:50



North Abutment Wall (Elevation A)
1:50



North Abutment Wall (Elevation A)
1:50



North Abutment Wall (Elevation B) North Abutment Wall (Elevation C)
1:50

- Notes
- Reinforcement to be Grade 500 Type B deformed bars to BS 4449:2005 (+A3 2016) and cut and bent in accordance with BS 8666 2005 unless otherwise specified.
 - All kickers to be 100mm high (minimum).
 - The Contractor is to satisfy themselves as to the accuracy of all reinforcing schedules prior to the ordering, cutting and bending of reinforcement.
 - Concrete elements are not to be loaded before 28 days. Props to be left in place for 28 days. Props to elements at higher levels not to be supported by unpropped elements at lower levels.
 - Reinforcement laps not otherwise defined shall be 50 times the smaller bar diameter.
 - For General Notes refer to drawing 229100548-MMD-1700-RE-DR-C-2103.
- Concrete Notes:
- External arises to be chamfered 25x25mm. U.N.O.
 - Class of concrete shown thus :
U (unformed), F(formed).
 - Concrete to comply with TII Specification Series 1700 and DN-STR-03012.
 - All buried surfaces to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
 - Spray applied waterproofing membrane to DN-STR-03012 and complying with DN-STR-03009 to be applied to the bridge deck surface and upstands.
 - Bedding grout to have a minimum cube compressive strength of 60 MPa unless noted otherwise.

Key to symbols

- Reinforcement notation thus:
- T1 Top face, outer bar
 - T2 Top face, second bar
 - B1 Bottom face, outer bar
 - B2 Bottom face, second bar
 - N1 Near face, outer bar
 - N2 Near face, second bar
 - M1 Middle, outer bar
 - M2 Middle, second bar
 - F1 Far face, outer bar
 - F2 Far face, second bar
 - EF Each face
 - ABR Alternate Bars Reversed
 - Alt Alternatively placed
 - AT Alternatively turned
 - CL Centre line
 - Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2102 to
229100548-MMD-1700-RE-DR-C-2110

P01	28.10.2024	ROC	Issued for Approval	CC	RS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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Title

N25 Rosslare Europort Access Road
B2 Access Underpass
General Arrangement
North Abutment - RC Details

Designed	E. O'Sullivan	Eng check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg check	E. O'Sullivan	Approved	J. Shinkwin	

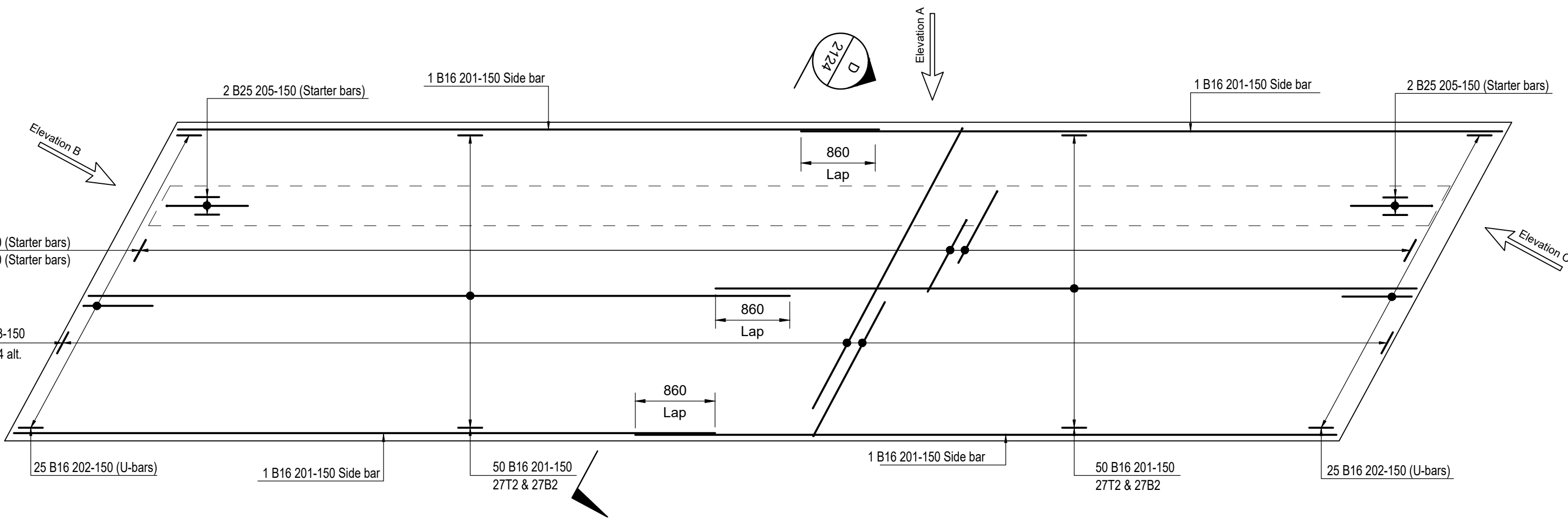
MMD Project Number 229100548	Scale at A1 As shown	Security STD
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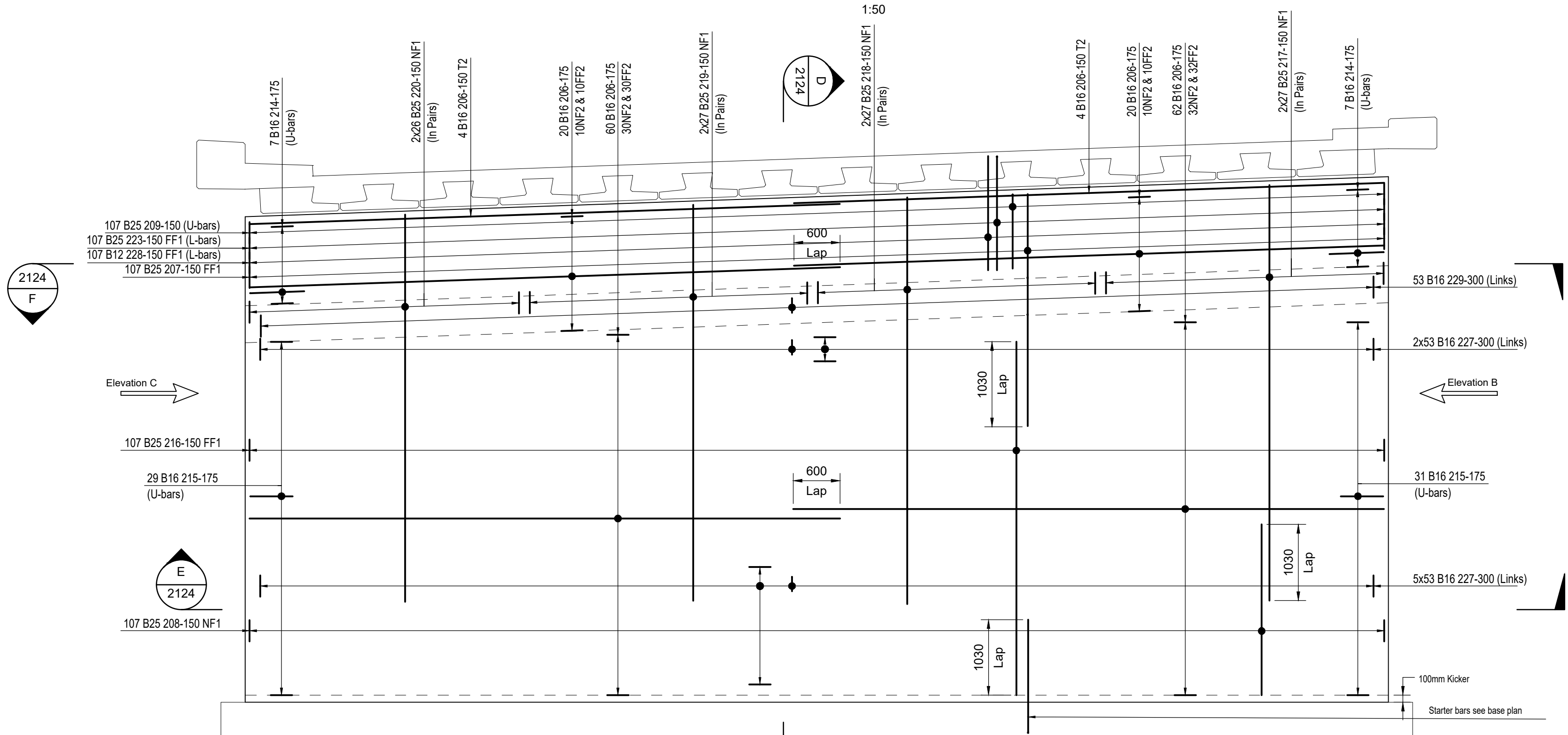
Concrete Class C45/55

	Bond Condition	Bar Dia						
		8	10	12	16	20	25	32
100% lapped in one location	Good	230	320	420	600	790	1030	1310
	Poor	330	460	590	860	1130	1470	1880

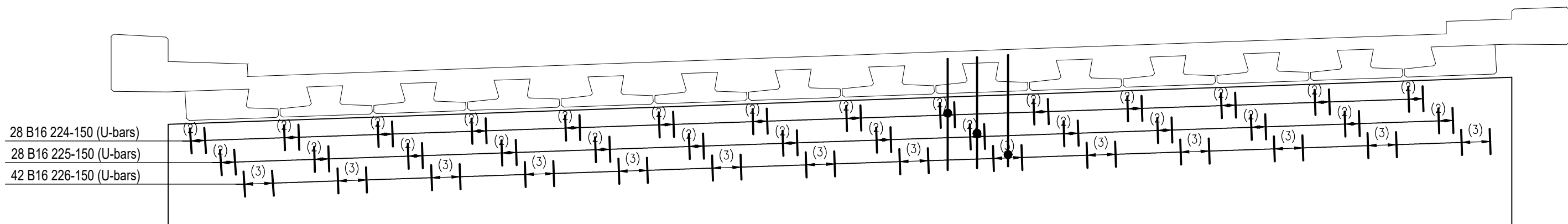
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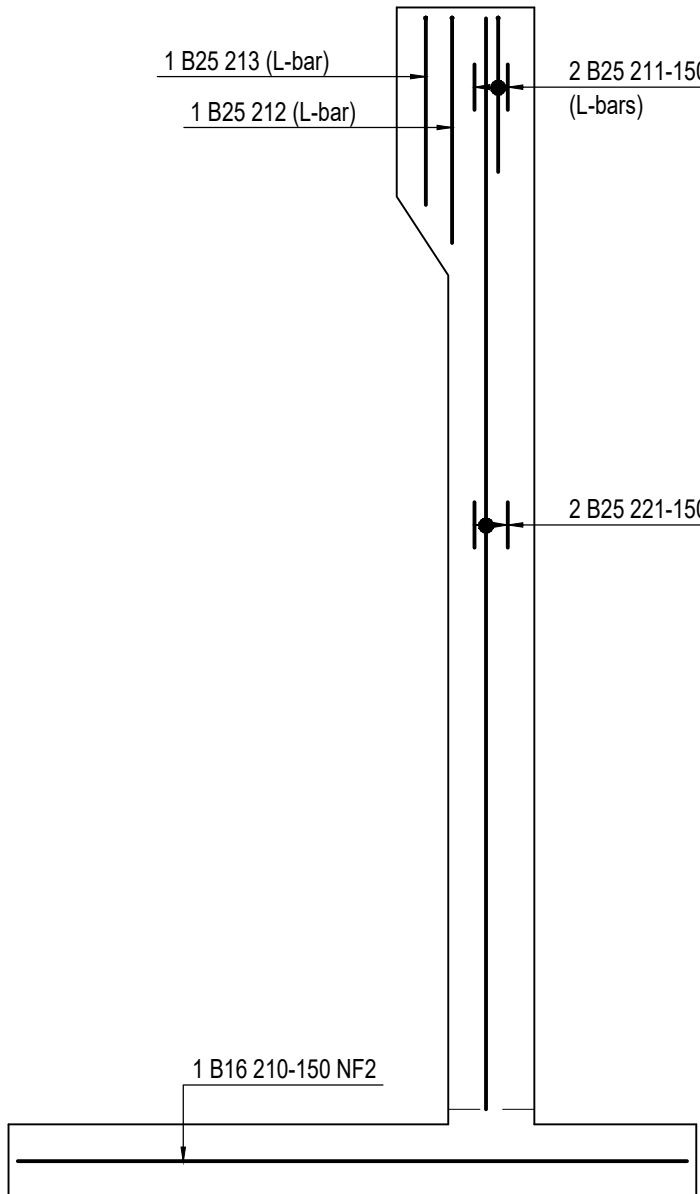
Abutment Base (South)



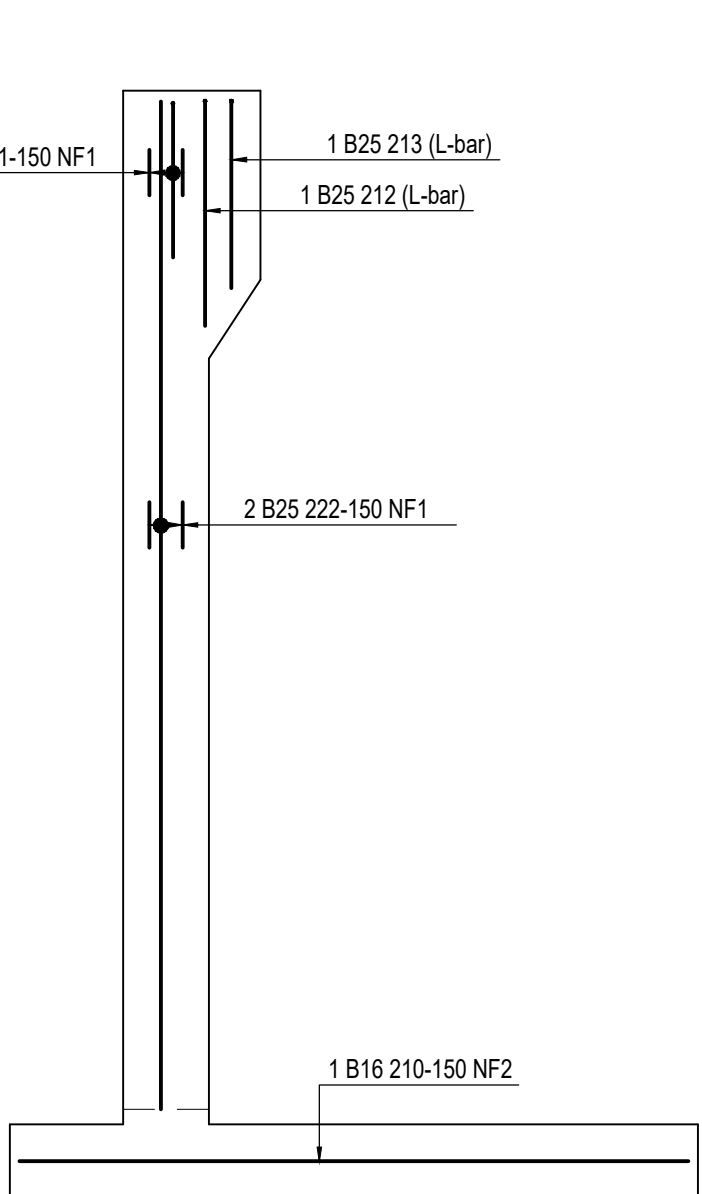
South Abutment Wall (Elevation A)



South Abutment Wall (Elevation A)



South Abutment Wall (Elevation B)



South Abutment Wall (Elevation C)

- Notes
- Reinforcement to be Grade 500 Type B deformed bars to BS 4449:2005 (+A3 2016) and cut and bent in accordance with BS 8666 2005 unless otherwise specified.
 - All kickers to be 100mm high (minimum).
 - The Contractor is to satisfy themselves as to the accuracy of all reinforcing schedules prior to the ordering, cutting and bending of reinforcement.
 - Concrete elements are not to be loaded before 28 days. Props to be left in place for 28 days. Props to elements at higher levels not to be supported by unpropped elements at lower levels.
 - Reinforcement laps not otherwise defined shall be 50 times the smaller bar diameter.
 - For General Notes refer to drawing 229100548-MMD-1700-RE-DR-C-2103.
- Concrete Notes:
- External arises to be chamfered 25x25mm. U.N.O.
 - Class of concrete shown thus :
U (unformed), F(formed).
 - Concrete to comply with TII Specification Series 1700 and DN-STR-03012.
 - All buried surfaces to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
 - Spray applied waterproofing membrane to DN-STR-03012 and complying with DN-STR-03009 to be applied to the bridge deck surface and upstands.
 - Bedding grout to have a minimum cube compressive strength of 60 MPa unless noted otherwise.

- Key to symbols
- Reinforcement notation thus;
- T1 Top face, outer bar
 - T2 Top face, second bar
 - B1 Bottom face, outer bar
 - B2 Bottom face, second bar
 - N1 Near face, outer bar
 - N2 Near face, second bar
 - M1 Middle, outer bar
 - M2 Middle, second bar
 - F1 Far face, outer bar
 - F2 Far face, second bar
 - EF Each face
 - ABR Alternate Bars Reversed
 - Alt Alternatively placed
 - AT Alternatively turned
 - CL Centre line
 - Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2102 to
229100548-MMD-1700-RE-DR-C-2110

P01	28.10.2024	ROC	Issued for Approval	CC	RS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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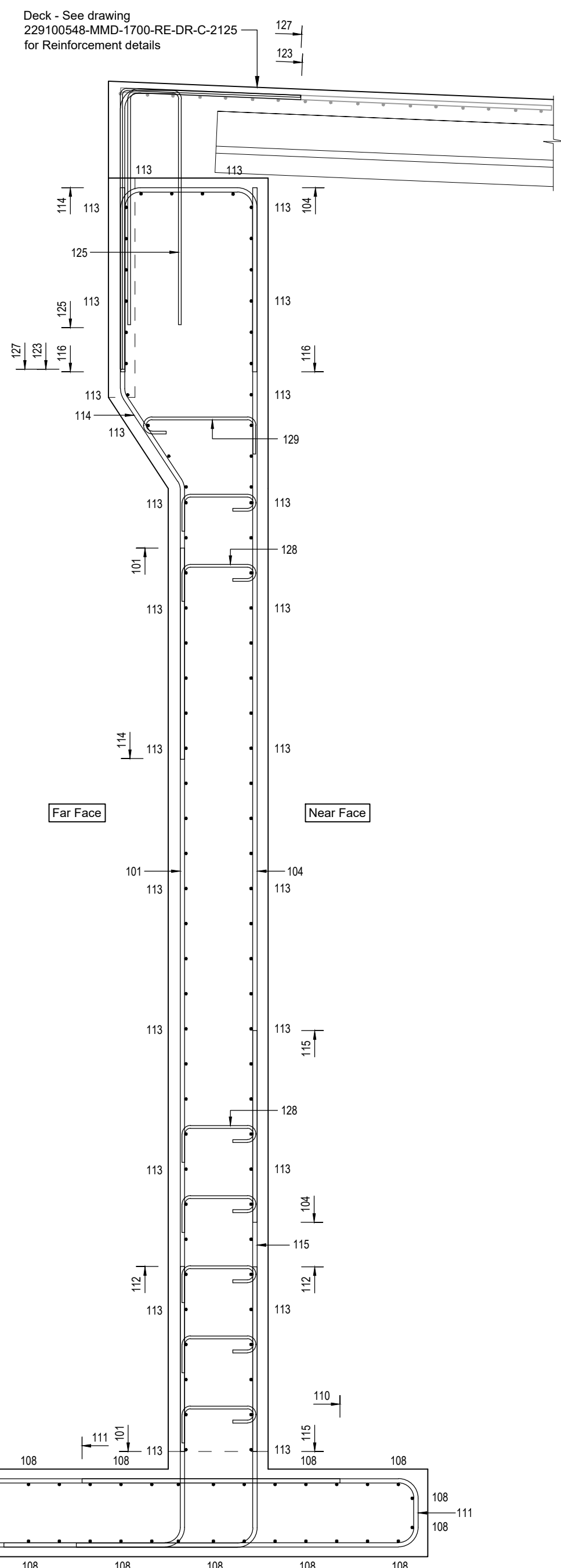
Title

N25 Rosslare Europort Access Road
B2 Access Underpass
General Arrangement
South Abutment - RC Details

Designed	E. O'Sullivan	Eng check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg check	E. O'Sullivan	Approved	J. Shinkwin	
MMD Project Number	229100548	Scale at A1	As shown	Security STD
Drawing Description				
Reinforcement Details				
Drawing Number	229100548-MMD-1700-RE-DR-C-2122	Revision	P01	

Concrete Class C45/55		Bar Dia						
100% lapped in one location	Bond Condition	8	10	12	16	20	25	32
		230	320	420	600	790	1030	1310
		330	460	590	860	1130	1470	1880
								2550

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Notes

1. Reinforcement to be Grade 500 Type B deformed bars to BS 4449:2005 (+A3 2016) and cut and bent in accordance with BS 8666 2005 unless otherwise specified.
2. All kickers to be 100mm high (minimum).
3. The Contractor is to satisfy themselves as to the accuracy of all reinforcing schedules prior to the ordering, cutting and bending of reinforcement.
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5. Reinforcement laps not otherwise defined shall be 50 times the smaller bar diameter.
6. For General Notes refer to drawing 229100548-MMD-1700-RE-DR-C-2103.

Concrete Notes:

- External arises to be chamfered 25x25mm. U.N.O.
- Class of concrete shown thus :
U (unformed), F(formed).
- Concrete to comply with TII Specification Series 1700 and DN-STR-03012.
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- Bedding groud to have a minimum cube compressive strength of 60 MPa unless noted otherwise.

Key to symbols	
Reinforcement notation thus;	
• T1 Top face, outer bar	
• T2 Top face, second bar	
• B1 Bottom face, outer bar	
• B2 Bottom face, second bar	
• N1 Near face, outer bar	
• N2 Near face, second bar	
• M1 Middle, outer bar	
• M2 Middle, second bar	
• F1 Far face, outer bar	
• F2 Far face, second bar	
• EF Each face	
• ABR Alternate Bars Reversed	
• Alt Alternatively placed	
• AT Alternatively turned	
• CL Centre line	
• Stg Staggered	

Reference drawings
229100548-MMD-1700-RE-DR-C-2102 to 229100548-MMD-1700-RE-DR-C-2110

P01	28.10.2024	ROC	Issued for Approval	CC	RS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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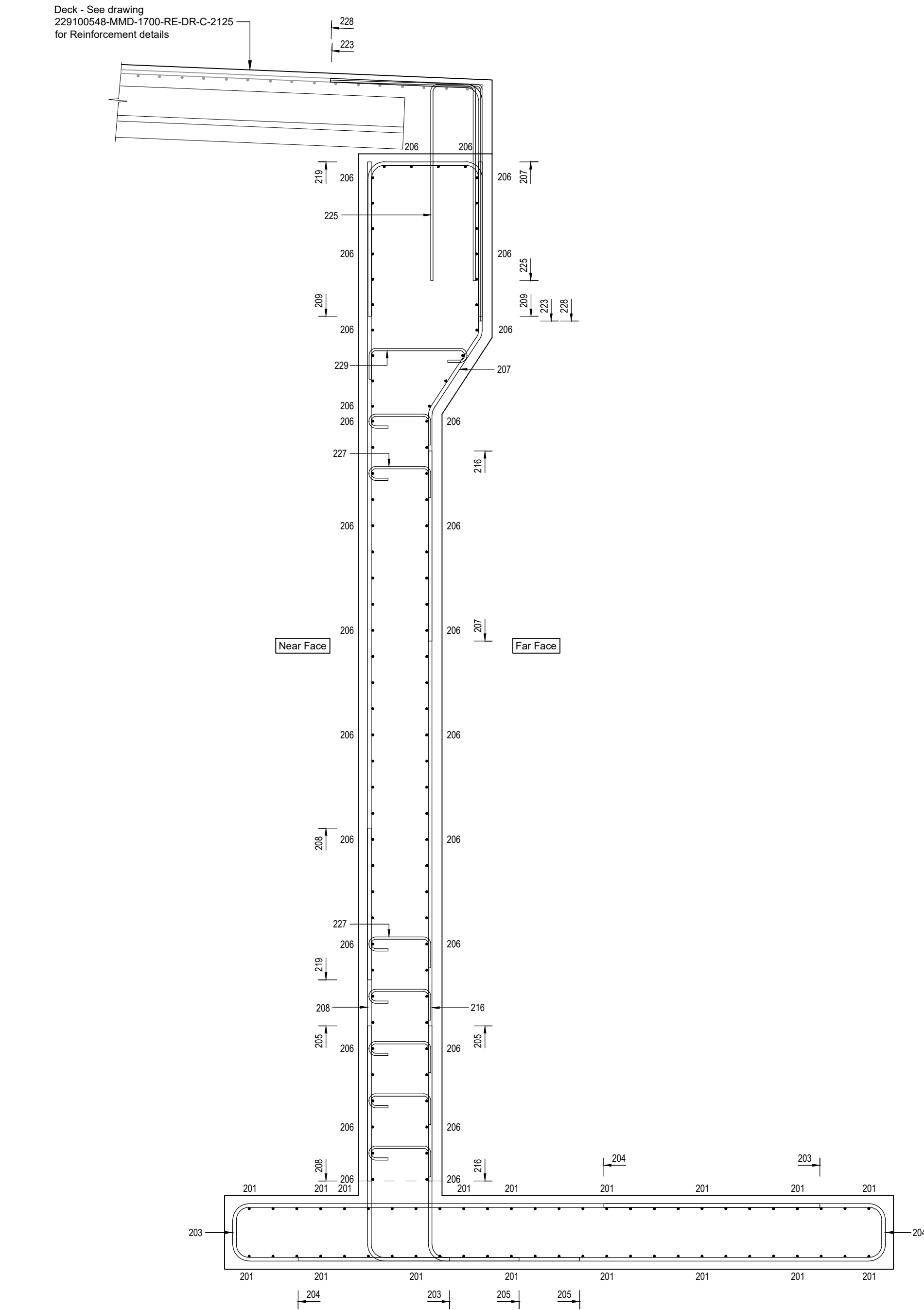
Wexford County Council
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Y35 WY93

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Wexford
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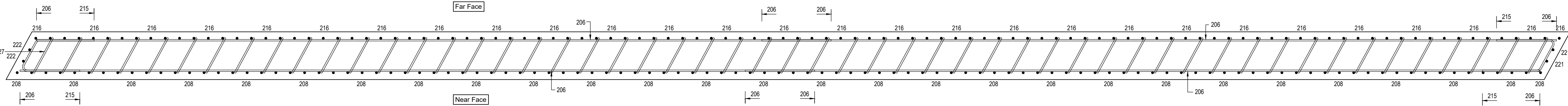
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N25 Rosslare Europort Access Road
B2 Access Underpass
General Arrangement
North Abutment - RC Sections

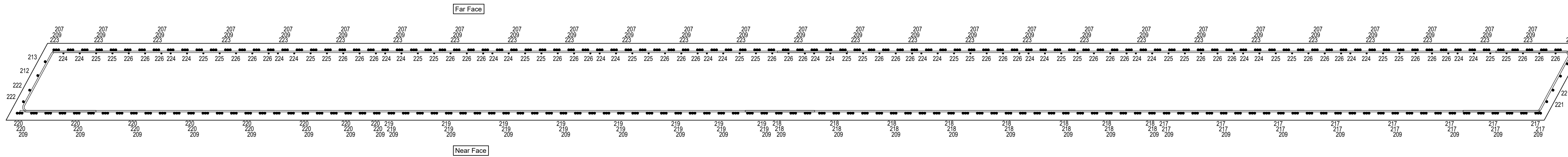
Designed	E. O'Sullivan		Eng check	R. Sexton	
Drawn	R. O'Connor		Coordination	J. O'Riordan	
Dwg check	E. O'Sullivan		Approved	J. Shinkwin	
MMD Project Number		Scale at A1			Security
229100548		As shown			STD
Drawing Description					
Reinforcement Details					
MMD Project Number					Revision
229100548-MMD-1700-RE-DR-C-2123					P01



Section D
1:25
2122



Section E
1:25
2122



Section F
1:25
2122

Concrete Class C45/55

	Bond Condition	Bar Dia							
		8	10	12	16	20	25	32	40
100% lapped in one location	Good	230	320	420	600	790	1030	1310	1780
	Poor	330	460	590	860	1130	1470	1880	2550

- Notes
- Reinforcement to be Grade 500 Type B deformed bars to BS 4449:2005 (+A3 2016) and cut and bent in accordance with BS 8666 2005 unless otherwise specified.
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 - Reinforcement laps not otherwise defined shall be 50 times the smaller bar diameter.
 - For General Notes refer to drawing 229100548-MMD-1700-RE-DR-C-2103.

Concrete Notes:

- External arises to be chamfered 25x25mm. U.N.O.
- Class of concrete shown thus :
 - U (unformed), F(formed).
- Concrete to comply with TII Specification Series 1700 and DN-STR-03012.
- All buried surfaces to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
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- Bedding grout to have a minimum cube compressive strength of 60 MPa unless noted otherwise.

Key to symbols

- Reinforcement notation thus;
- T1 Top face, outer bar
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 - B1 Bottom face, outer bar
 - B2 Bottom face, second bar
 - N1 Near face, outer bar
 - N2 Near face, second bar
 - M1 Middle, outer bar
 - M2 Middle, second bar
 - F1 Far face, outer bar
 - F2 Far face, second bar
 - EF Each face
 - ABR Alternate Bars Reversed
 - Alt Alternatively placed
 - AT Alternatively turned
 - CL Centre line
 - Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2102 to
229100548-MMD-1700-RE-DR-C-2110

P01	28.10.2024	ROC	Issued for Approval	CC	RS
Rev	Date	Drawn	Description	Ch'k'd	App'd

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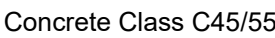
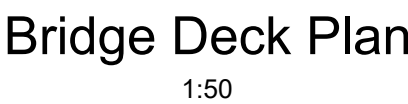
Wexford County Council
Roads Department
Carrichlawn
Wexford Town
Y35 WY93

Comhairle Contae
Loch Garman
Wexford
County Council

Title

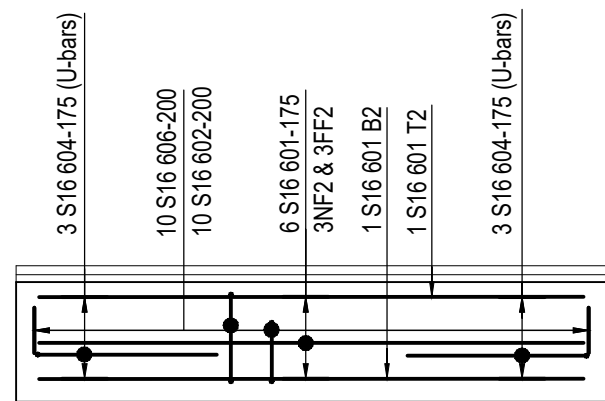
N25 Rosslare Europort Access Road
B2 Access Underpass
General Arrangement
Abutment South - RC Sections

Designed	E. O'Sullivan		Eng check	R. Sexton	
Drawn	R. O'Connor		Coordination	J. O'Riordan	
Dwg check	E. O'Sullivan		Approved	J. Shinkwin	
MMD Project Number 2229100548		Scale at A1 As shown			Security STD
Drawing Description					
Reinforcement Details					
Drawing Number 229100548-MMD-1700-RE-DR-C-2124					Revision P01

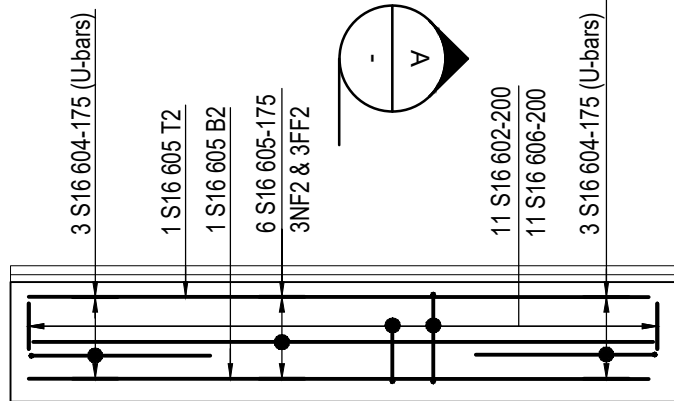


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CYAL50379123
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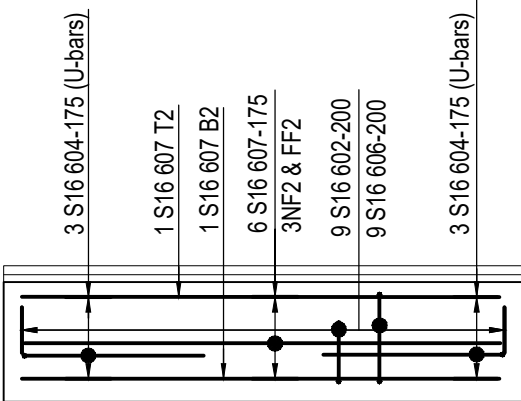
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229100548-MMD-1700-RE-DR-C-2125	P01



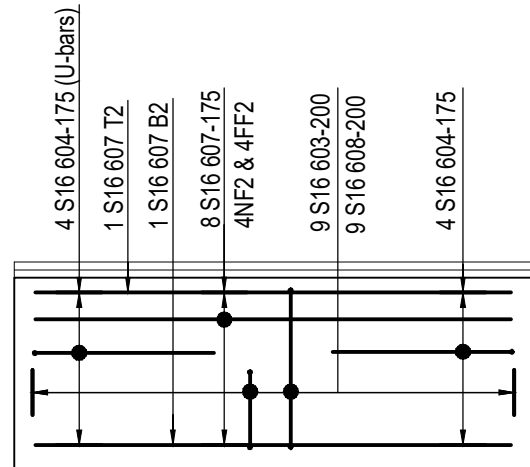
Upstand 1 - Elevation
1:50



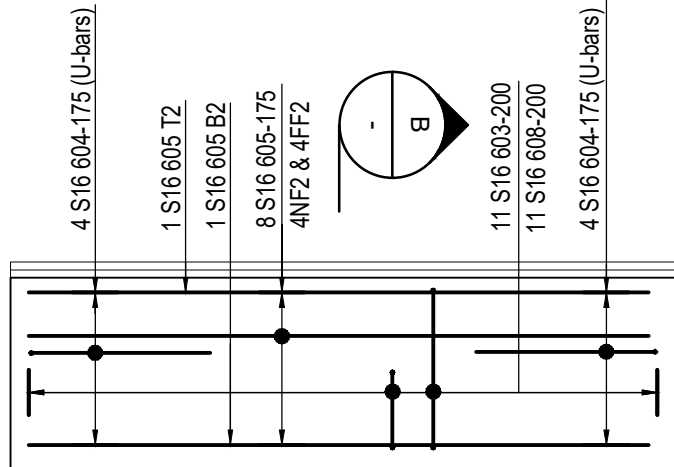
Upstand 2 - Elevation (3No.)
1:50



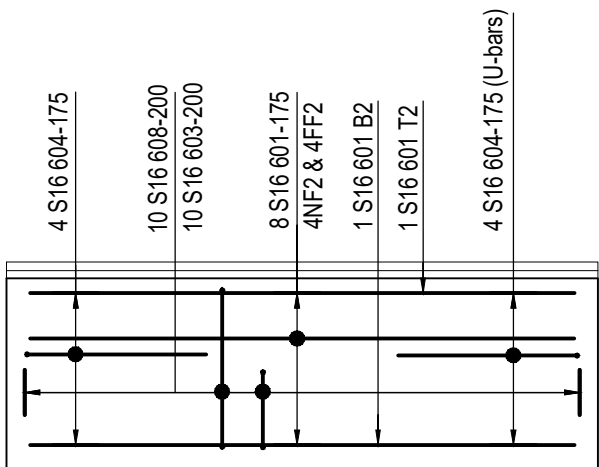
Upstand 3 - Elevation
1:50



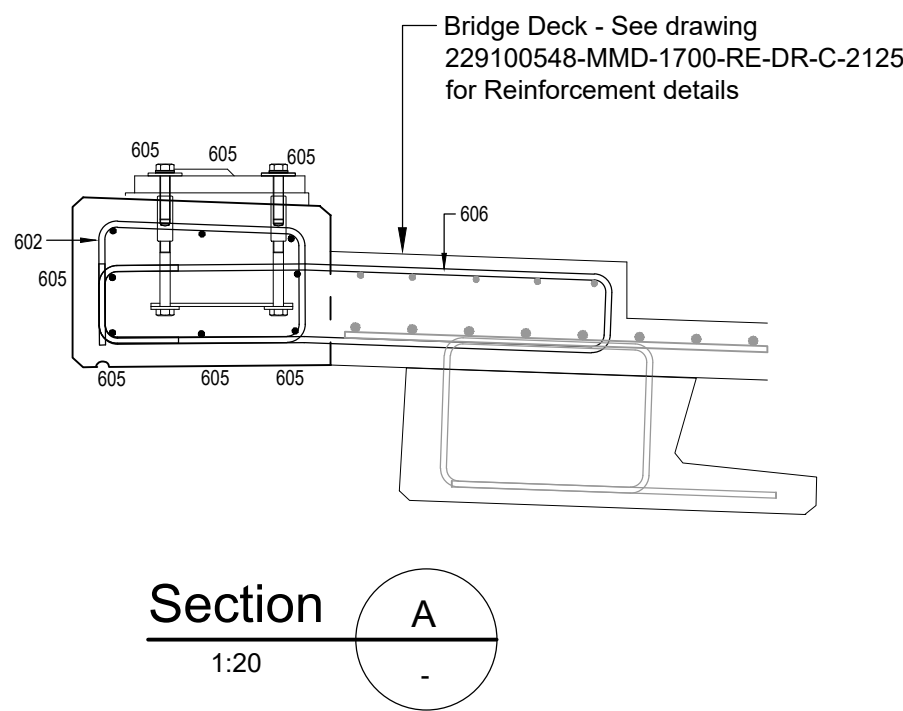
Upstand 4 - Elevation
1:50



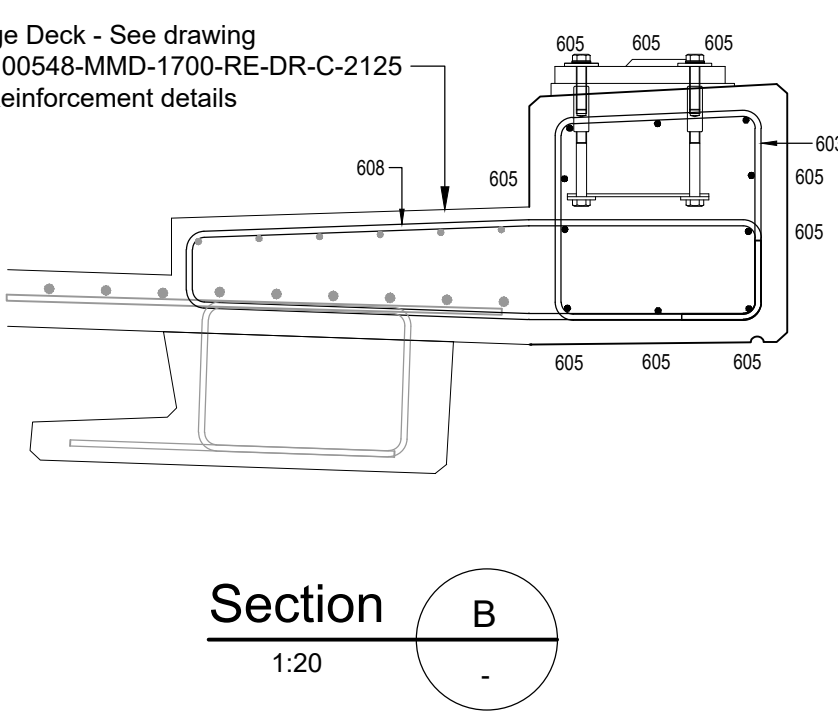
Upstand 5 - Elevation (3No.)
1:50



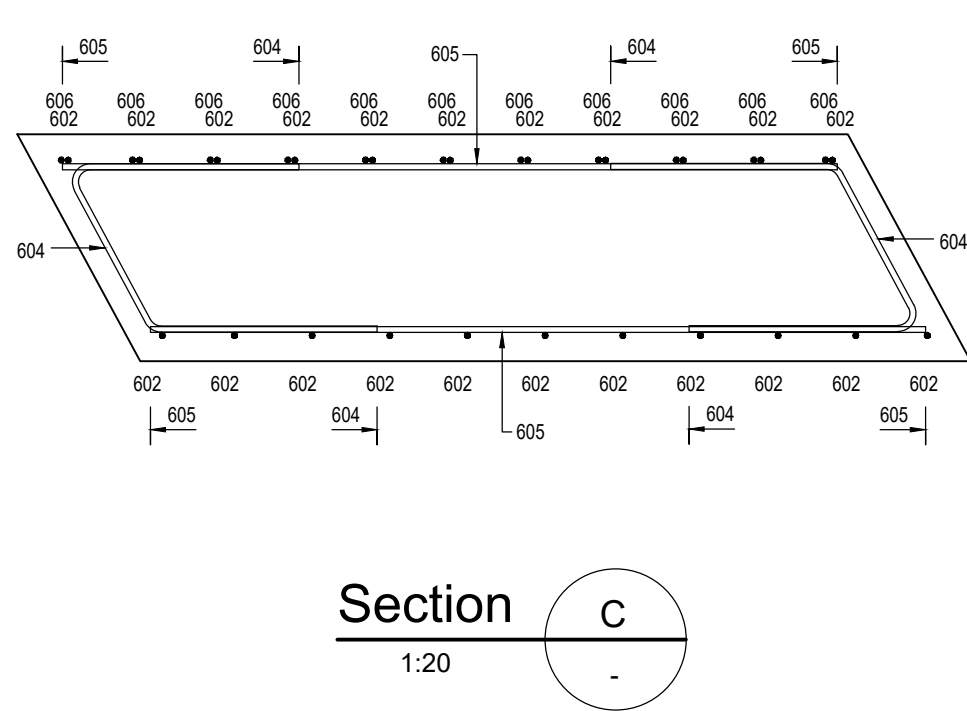
Upstand 6 - Elevation
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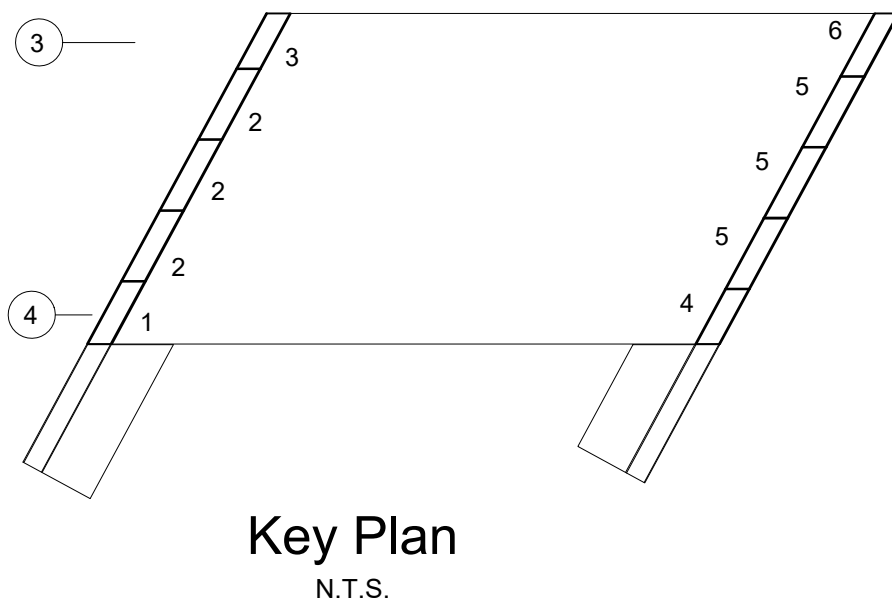
Section A
1:20



Section B
1:20



Section C
1:20



Key Plan
N.T.S.

- Notes
1. Reinforcement to be Grade 500 Type B deformed bars to BS 4449:2005 (+A3 2016) and cut and bent in accordance with BS 8666 2005 unless otherwise specified.
 2. All kickers to be 100mm high (minimum).
 3. The Contractor is to satisfy themselves as to the accuracy of all reinforcing schedules prior to the ordering, cutting and bending of reinforcement.
 4. Concrete elements are not to be loaded before 28 days. Props to be left in place for 28 days. Props to elements at higher levels not to be supported by unpropped elements at lower levels.
 5. Reinforcement laps not otherwise defined shall be 50 times the smaller bar diameter.
 6. For General Notes refer to drawing 229100548-MMD-1700-RE-DR-C-2103.
- Concrete Notes:
- External arises to be chamfered 25x25mm. U.N.O.
 - Class of concrete shown thus :
U (unformed), F(formed).
 - Concrete to comply with TII Specification Series 1700 and DN-STR-03012.
 - All buried surfaces to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
 - Spray applied waterproofing membrane to DN-STR-03012 and complying with DN-STR-03009 to be applied to the bridge deck surface and upstands.
 - Bedding grout to have a minimum cube compressive strength of 60 MPa unless noted otherwise.

Key to symbols

- Reinforcement notation thus;
- T1 Top face, outer bar
 - T2 Top face, second bar
 - B1 Bottom face, outer bar
 - B2 Bottom face, second bar
 - N1 Near face, outer bar
 - N2 Near face, second bar
 - M1 Middle, outer bar
 - M2 Middle, second bar
 - F1 Far face, outer bar
 - F2 Far face, second bar
 - EF Each face
 - ABR Alternate Bars Reversed
 - Alt Alternatively placed
 - AT Alternatively turned
 - CL Centre line
 - Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2102 to
229100548-MMD-1700-RE-DR-C-2110

P01	28.10.2024	ROC	Issued for Approval	CC	RS
Rev	Date	Drawn	Description	Ch'k'd	App'd

Status Stamp

FOR APPROVAL

M

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Comhairle Contae
Loch Garman
Wexford
County Council

Title

N25 Rosslare Europort Access Road
B2 Access Underpass
General Arrangement
Parapet Upstand - RC Details

Designed	E. O'Sullivan	Eng check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg check	E. O'Sullivan	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As shown	STD

Drawing Description

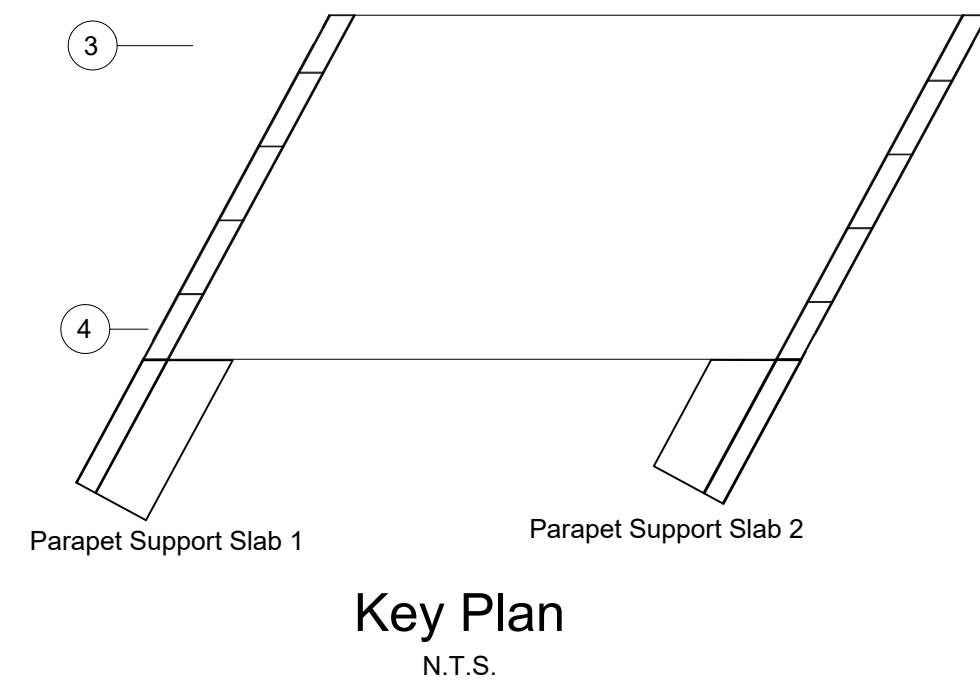
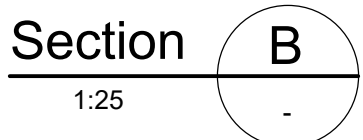
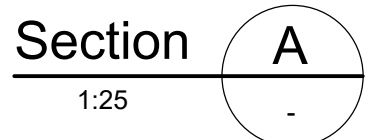
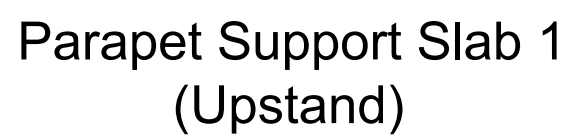
Reinforcement Details

Drawing Number	Revision
229100548-MMD-1700-RE-DR-C-2126	P01

Concrete Class C45/55

	Bond Condition	Bar Dia						
		8	10	12	16	20	25	32
100% lapped in one location	Good	230	320	420	600	790	1030	1310
	Poor	330	460	590	860	1130	1470	1880

O.S. Ref: 5645-C & 5715-A
CYAL50379123
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- ### Notes
1. Reinforcement to be Grade 500 Type B deformed bars to BS 4449:2005 (+A3 2016) and cut and bent in accordance with BS 8666 2005 unless otherwise specified.
 2. All kickers to be 100mm high (minimum).
 3. The Contractor is to satisfy themselves as to the accuracy of all reinforcing schedules prior to the ordering, cutting and bending of reinforcement.
 4. Concrete elements are not to be loaded before 28 days. Props to be left in place for 28 days. Props to elements at higher levels not to be supported by unsupported elements at lower levels.
 5. Reinforcement laps not otherwise defined shall be 50 times the smaller bar diameter.
 6. For General Notes refer to drawing 229100548-MMD-1700-RE-DR-C-2103.
- Concrete Notes:
- External arises to be chamfered 25x25mm. U.N.O.
 - Class of concrete shown thus :
U (unformed), F(formed).
 - Concrete to comply with TII Specification Series 1700 and DN-STR-03012.
 - All buried surfaces to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
 - Spray applied waterproofing membrane to DN-STR-03012 and complying with DN-STR-03009 to be applied to the bridge deck surface and upstands.
 - Bedding groud to have a minimum cube compressive strength of 60 MPa unless noted otherwise.

Key to symbols

- Reinforcement notation thus;
 - T1 Top face, outer bar
 - T2 Top face, second bar
 - B1 Bottom face, outer bar
 - B2 Bottom face, second bar
 - N1 Near face, outer bar
 - N2 Near face, second bar
 - M1 Middle, outer bar
 - M2 Middle, second bar
 - F1 Far face, outer bar
 - F2 Far face, second bar
 - EF Each face
 - ABR Alternate Bars Reversed
 - Alt Alternatively placed
 - AT Alternatively turned
 - CL Centre line
 - Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2102 to
229100548-MMD-1700-RE-DR-C-2110

P01	28.10.2024	ROC	Issue for Approval	CC	RS
Rev	Date	Drawn	Description	Ch'k'd	App'd

Status Stamp

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Client

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Roads Department
Carrichlawn
Wexford Town
Y35 WY93



Title	
-------	--

N25 Rosslare Europort Access Road
B2 Access Underpass
General Arrangement
Parapet Support Slab - RC Details

Designed	E. O'Sullivan		Eng check	R. Sexton	
Drawn	R. O'Connor		Coordination	J. O'Riordan	
Dwg check	E. O'Sullivan		Approved	J. Shinkwin	

MMD Project Number 229100548	Scale at A1 As shown	Security STD
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Drawing Description

Reinforcement Details

Drawing Number

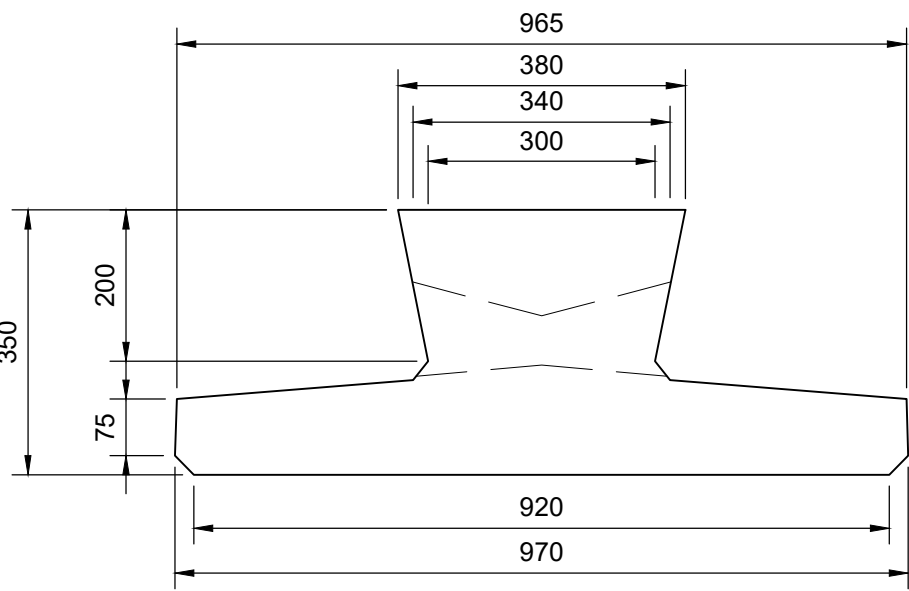
229100548-MMD-1700-RE-DR-C-2127	P01
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Revision

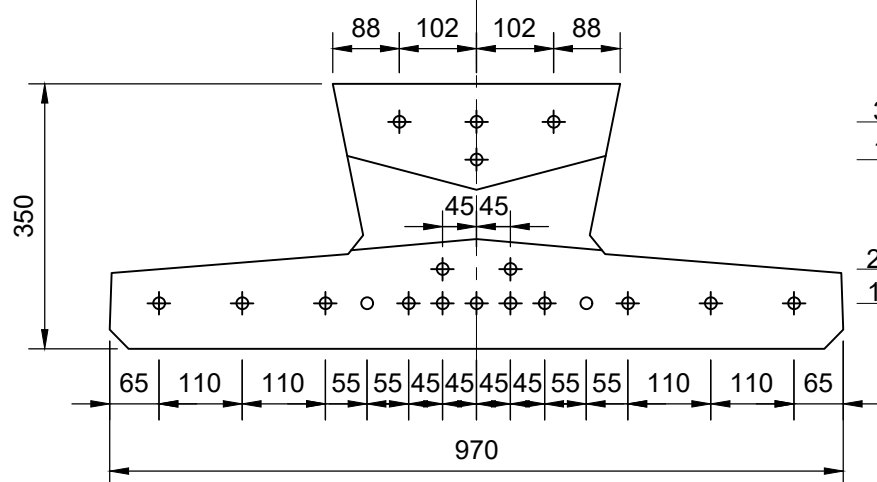
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c:\users\sew38264\appdata\local\projectwise\workdir\mott-gb-pw-09\dms66359\229100548-MMD-1700-RE-DR-C-2127.dwg Nov 26, 2024 - 2:28PM
sew38264

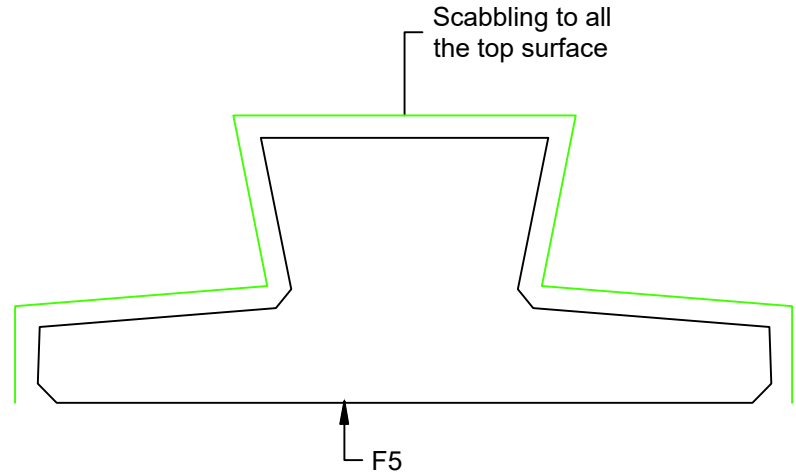


MY2 Beam Section
1:10

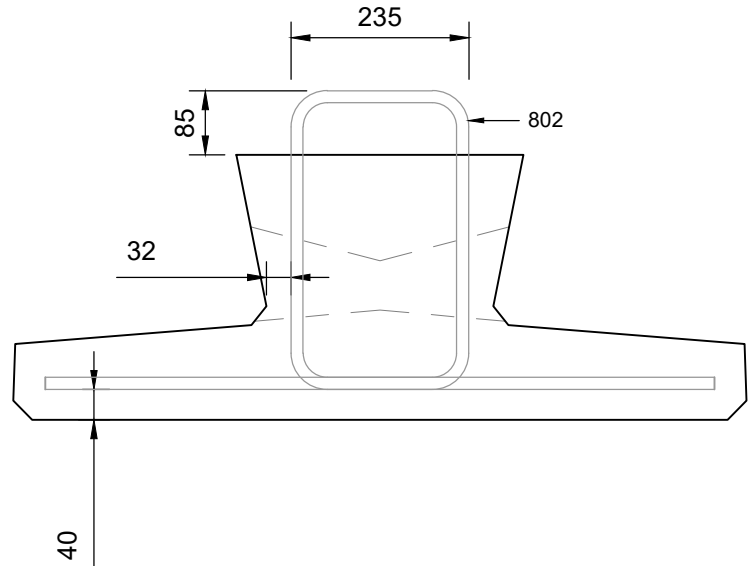


MY2 Strands
1:10

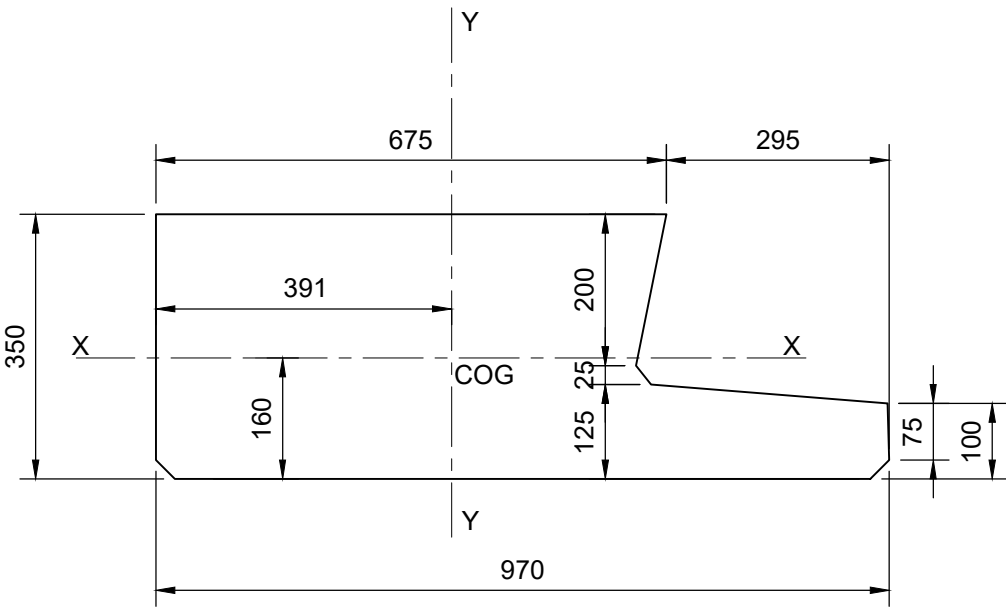
3 No @ 300 - Level D
1 No @ 250 - Level C
2 No @ 105 - Level B
13 No @ 60 - Level A
◆ Denotes Fully Bonded Strand
○ Denotes Partially Debonded Strand



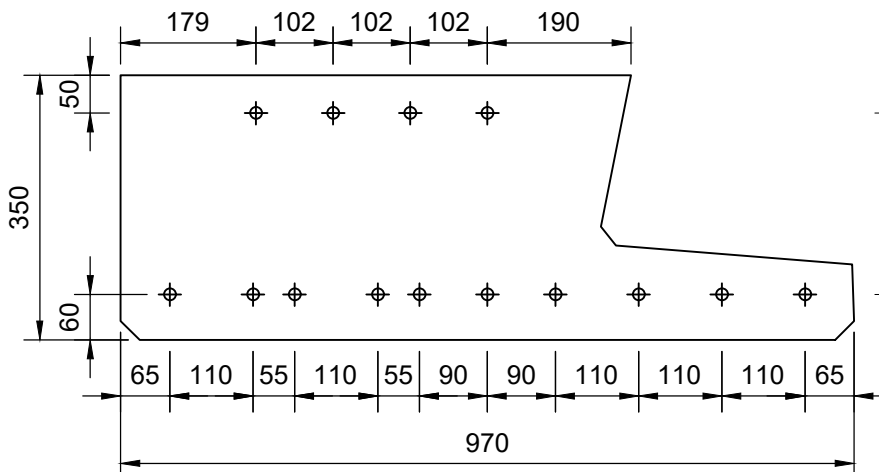
MY2 Finishes
1:10



MY2 Reinforcement
1:10

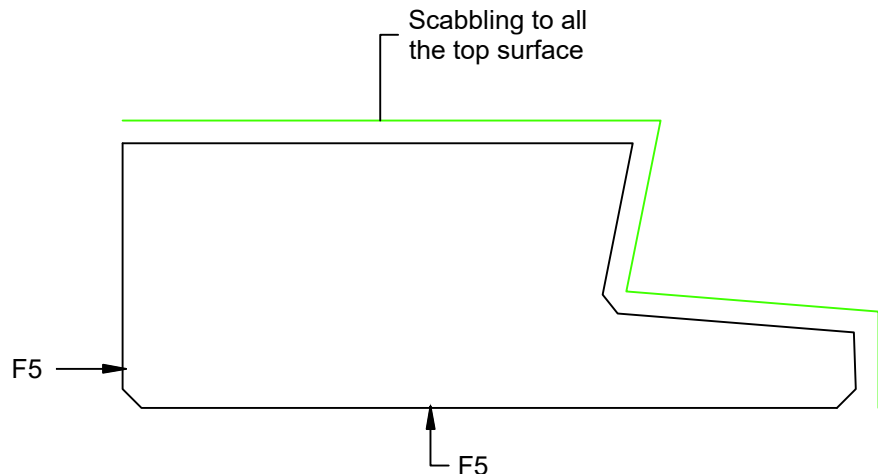


MYE2 Beam Section
1:10

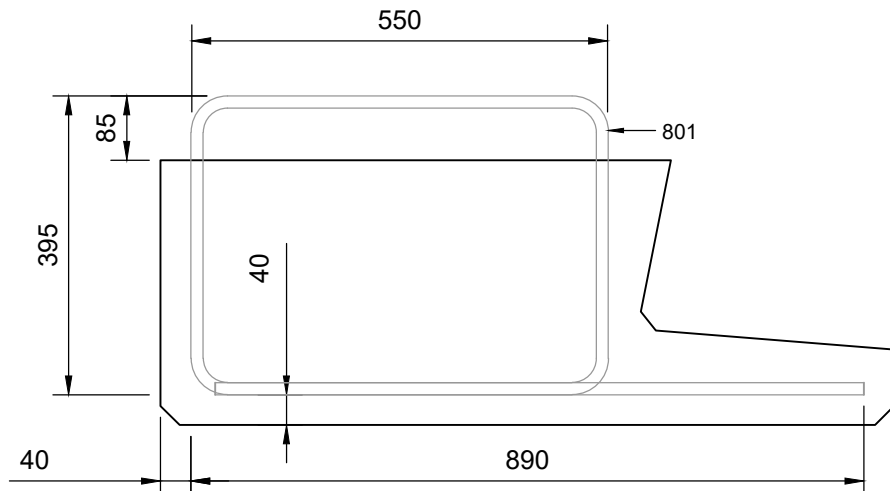


MYE2 Strands
1:10

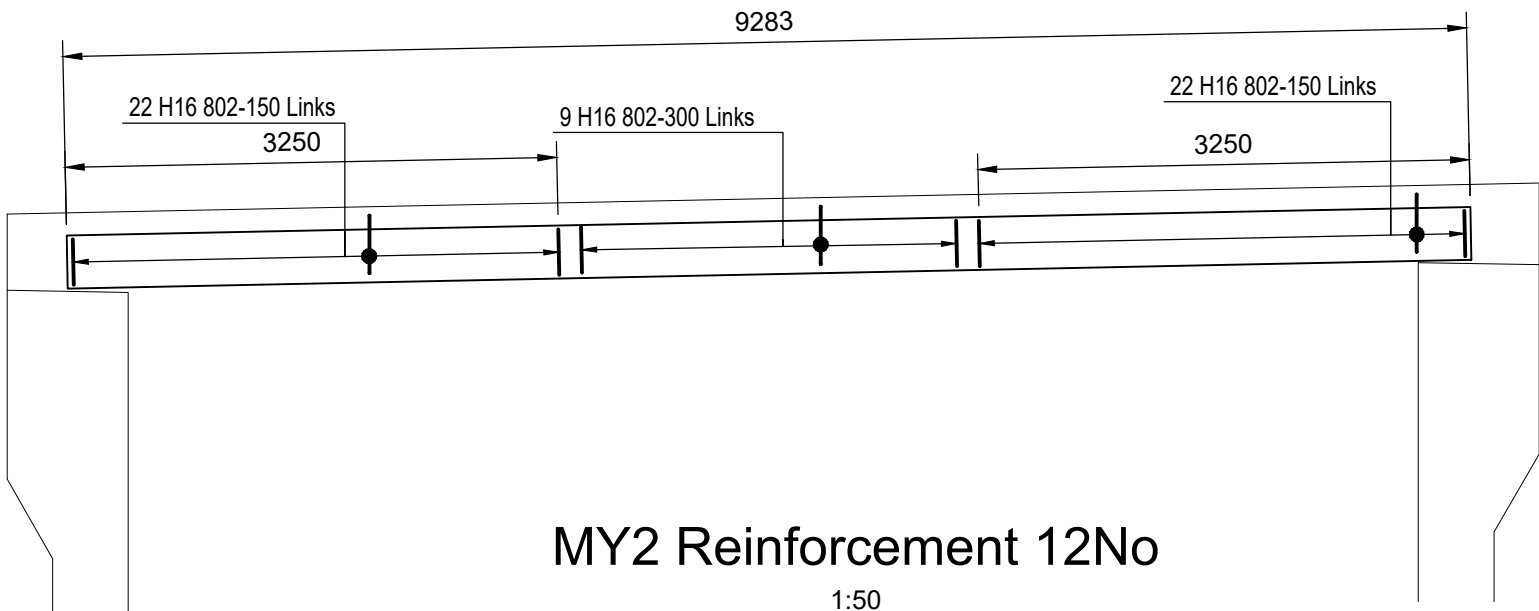
4 No @ 300 - Level B
10 No @ 60 - Level A



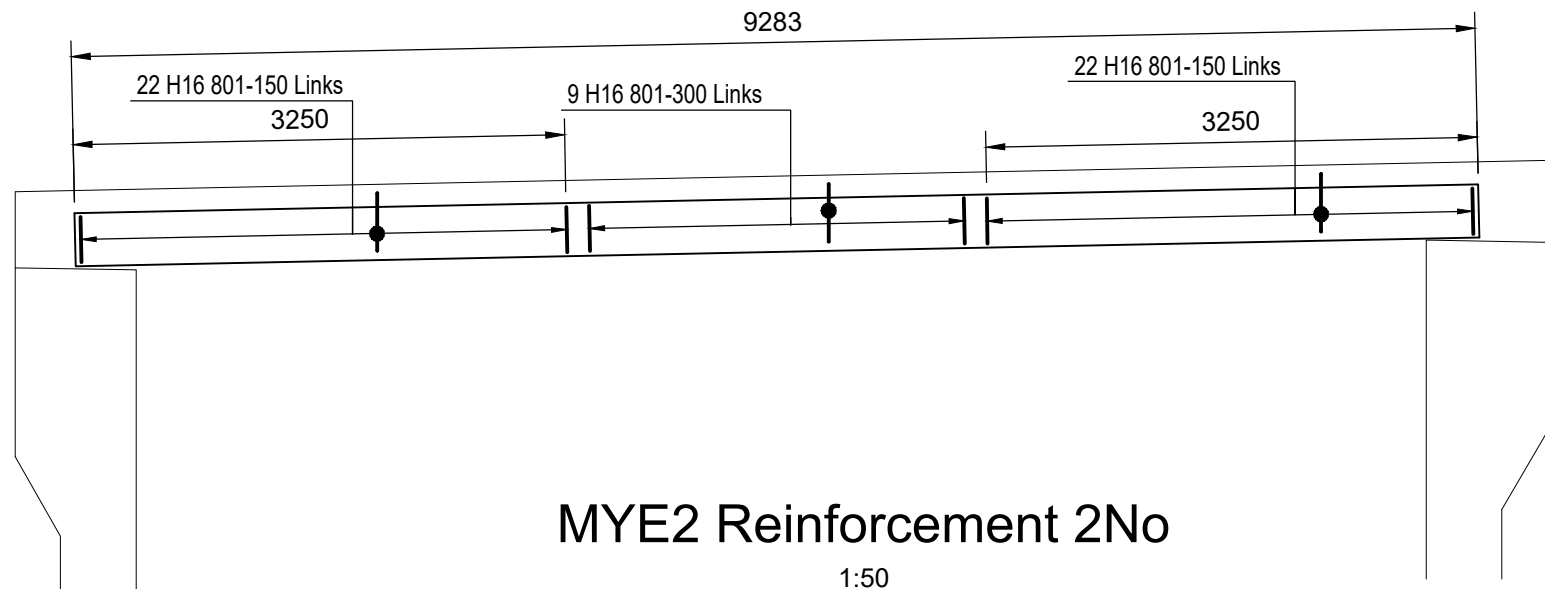
MYE2 Finishes
1:10



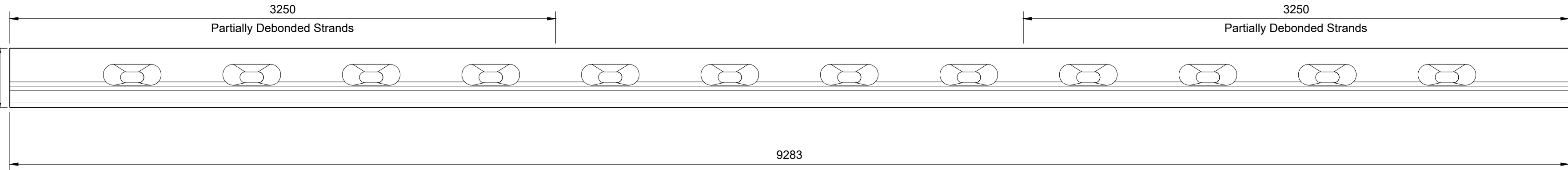
MYE2 Reinforcement
1:10



MY2 Reinforcement 12No
1:50



MYE2 Reinforcement 2No
1:50



MY2 Reinforcement 12No
1:20

- Notes
- Beam concrete to be grade C50/60 unless noted otherwise.
 - Alternative beam design or alterations are to be to the approval of the Employer's Representative.
 - Formed finish F5 to exposed beam surfaces. Infill beam face to be rough cast exposing aggregate to a minimum roughness of 3mm.
 - Prestressing strands shall be 15.7mm diameter, 7 wire drawn strands to BS 5896:2012 with a nominal tensile strength of 1860 N/sq mm
 - Initial prestress to be 75% of specified characteristic breaking load of 279kN(208kN).
 - Lifting Anchors
 - The contractor shall provide suitable lifting anchors for erection, to the approval of the engineer.
 - Any pockets made for lifting shall be filled with epoxy mortar upon completion of the works. Minimum cover to anchor head to be 15mm.
 - Minimum cube strength of concrete at transfer: 40N/sq mm.
 - The Contractor must submit shop drawings for the beams for the approval by the Engineer prior to manufacture.
 - Strands to be disk cut flush with ends of beams treated with anti-corrosion inhibitor and over coated with an approved epoxy skim.
 - All concrete, materials and workmanship to be in accordance with IS EN 13670
 - Welding of reinforcement is not permitted.
 - Internal beam estimated lifting weight = 4.5T
Edge beam estimated lifting weight = 6.5t

Key to symbols

- Reinforcement notation thus;
- T1 Top face, outer bar
 - T2 Top face, second bar
 - B1 Bottom face, outer bar
 - B2 Bottom face, second bar
 - N1 Near face, outer bar
 - N2 Near face, second bar
 - M1 Middle, outer bar
 - M2 Middle, second bar
 - F1 Far face, outer bar
 - F2 Far face, second bar
 - EF Each face
 - ABR Alternate Bars Reversed
 - Alt Alternatively placed
 - AT Alternatively turned
 - CL Centre line
 - Stg Staggered

Reference drawings

229100548-MMD-1700-RE-DR-C-2102 to
229100548-MMD-1700-RE-DR-C-2110

P01	28.10.2024	ROC	Issued for Approval	CC	RS
Rev	Date	Drawn	Description	Ch'k'd	App'd

Status Stamp

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Title

N25 Rosslare Europort Access Road
B2 Access Underpass
General Arrangement
MY2 Prestressed Beam - RC Details

Designed	E. O'Sullivan	Eng check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg check	E. O'Sullivan	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As shown	STD

Drawing Description

Reinforcement Details

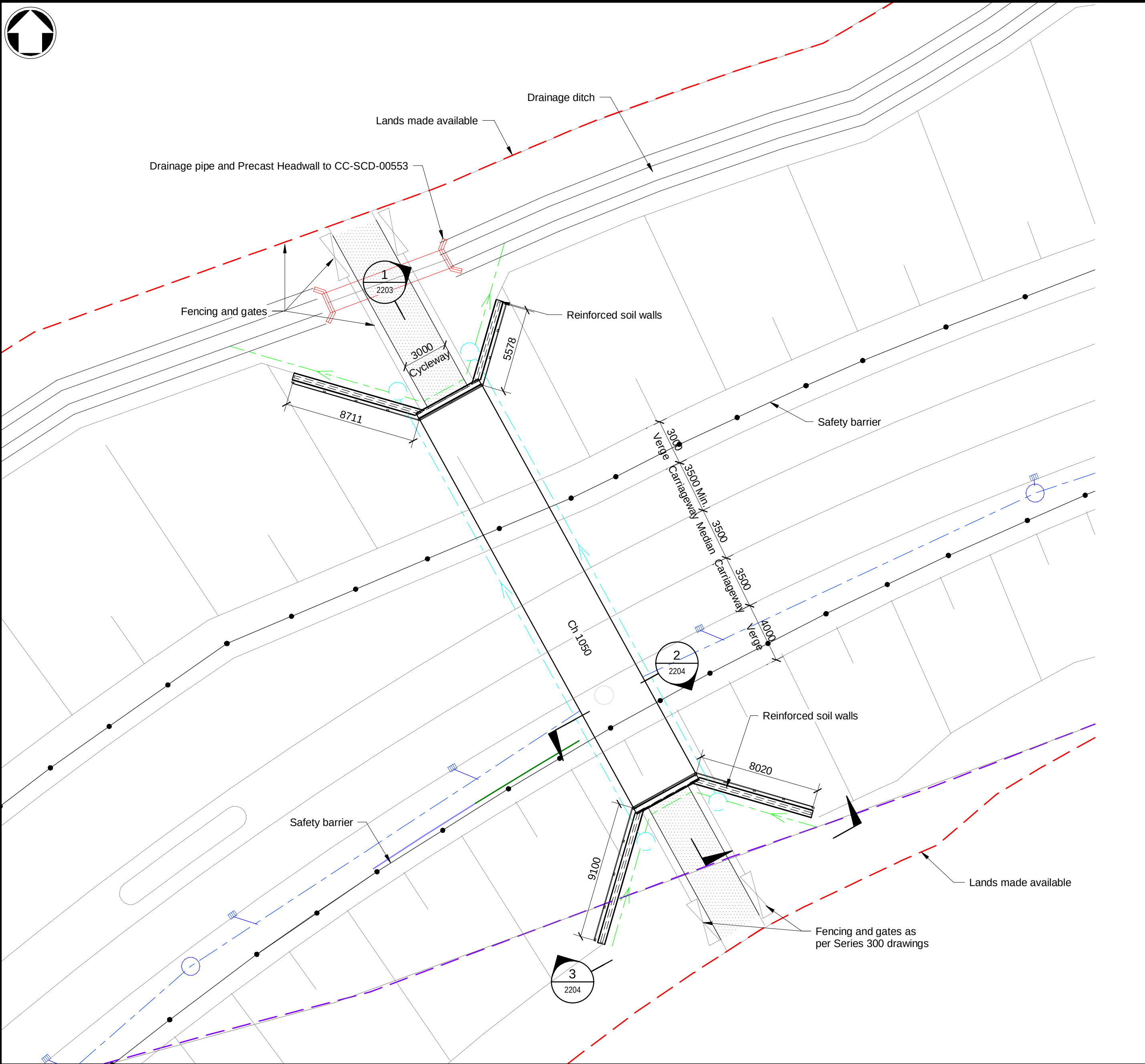
Drawing Number	Revision
229100548-MMD-1700-RE-DR-C-2128	P01

Concrete Class C50/60

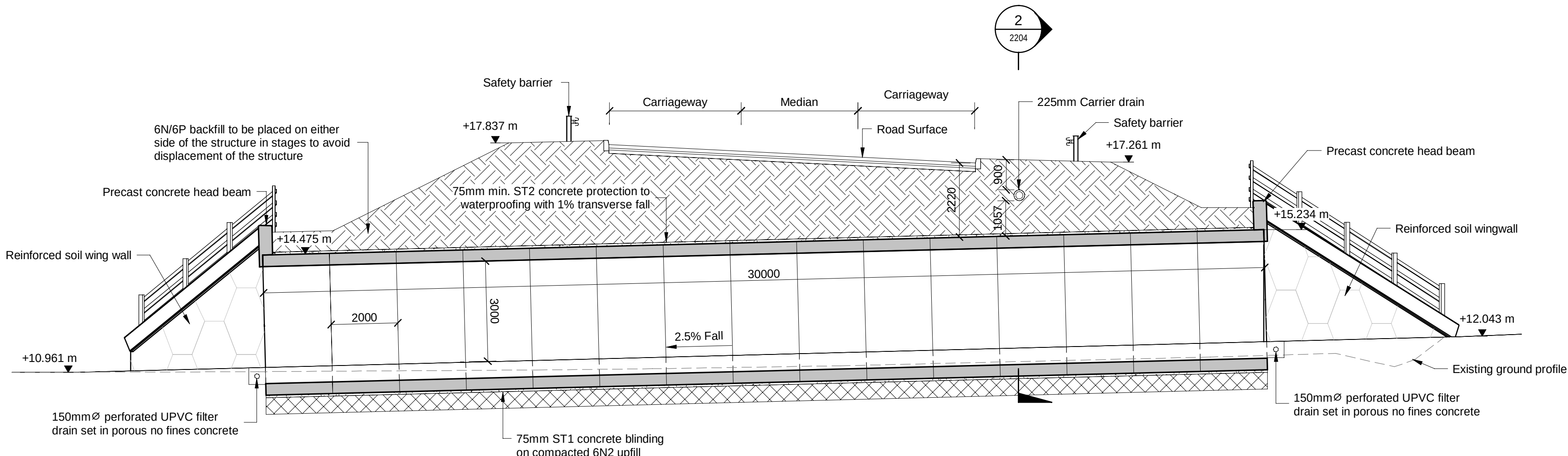
	Bond Condition	Bar Dia							
		8	10	12	16	20	25	32	40
100% lapped in one location	Good	230	320	420	600	790	1030	1310	1780
	Poor	330	460	590	860	1130	1470	1880	2550

O.S. Ref: 5645-C & 5715-A

CYAL50379123
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Plan
1 : 200



SECTION
1 : 100

Element	Finish
Precast Elements	F3
Reinforced Soil Wall Coping	F3/U3
Reinforced Soil Wingwalls	Standard pattern profile finish

Concrete Element	Min Concrete Grade (IS EN 206, DN-STR-03012)	Exposure Class	Cover Cmin	Cover Cnom
UAN wall and base (buried face)	C45/55 (50% GGBS)	XC2/XA1	30	35
UAN wall (exposed face)	C45/55 (50% GGBS)	XC3/XF1	35	40
UAN roof (buried face)	C45/55 (50% GGBS)	XC2, XA1, XD2	45	50
UAN (exposed horizontal face)	C45/55 (50% GGBS)	XC3/XF3	35	40
RC Headwall & Soil Wall Coping	C40/50 (50% GGBS)	XC4/XD3/XF4	55	60
Reinforced Soil Wingwalls (Buried face)	C40/50 (50% GGBS)	XC2/XA1/XD3	55	60
Reinforced Soil Wingwalls (Exposed face)	C40/50 (50% GGBS)	XC4/XD3/XF2	55	60

Geotechnical Information		
Structure Element	Founding Stratum	Minimum Bearing Pressure (kN/m ²)
Culvert Base	Glacial Till - Firm to stiff slightly sandy slightly gravelly clay	140

- General Notes:**
- All dimensions are shown in millimetres unless noted otherwise.
 - Figured dimensions only are to be taken, do not scale from these drawings.
 - All levels shown are in metres above ordnance datum at Malin Head.
 - All coordinates relate to ITM - Irish Transverse Mercator
 - This drawing is a copy of an electronic file and is copyrighted.
 - Refer to Appendix 1/11 of the Specification for details of the Contractor designed precast box units and wingwalls.
- Concrete Notes:**
- External arises to be chamfered 25x25mm. U.N.O.
 - Concrete to comply with TII specification series 1700 and DN-STR-03012.
 - All buried surfaces except reinforced earth wingwalls to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
 - Spray applied waterproofing membrane to DN-STR-03012 and complying with DN-STR-03009 to be applied to the precast unit top and side surfaces, internal buried surfaces and back face of buried headwalls
 - Anti-graffiti coating to all exposed concrete surfaces.
- Foundations Notes:**
- The structure drawing is to be read in conjunction with the relevant earthworks plan and profile drawings. The specification for road works series 600 and its Appendices.
 - Excavations are to be kept free from water. Groundwater control in the form of temporary pumping is not currently expected to be required.
 - All topsoil, made ground and soft spots (undrained shear strength <50kPa) shall be excavated from below the footprint of the structure and at least to the depths and ground conditions identified in the form C. Excavations shall be backfilled where necessary to the formation level with Class 6N2 upfill.
 - Designer's Site Representative (DSR) is to inspect the formation level for all foundations following stripping of topsoil and/or excavation to founding level. Founding strata are to be as per the "Geotechnical Information" table.
 - 1 No. plate loading test (PLT) in accordance with BS 1377 shall be carried out below the footprint of the culvert. The plate to be used shall be a circular plate of 0.455m diameter. The loadings shown in the "Geotechnical Information" table should be attained with less than 3.0mm of settlement. The PLT shall be carried out at excavation formation level.

Key to symbols	
---	Lands Made Available
---	Existing Irish Rail Boundary
---	Proposed Back of Wall Drainage
---	Proposed Front of Wall Drainage
---	Proposed Highway Drainage
---	Proposed Foul Sewer
---	Existing Foul Sewer
---	Existing EIR Underground Services
---	Existing ESB MV Line

P02	23.10.2024	ROC	Precast head beam detail amended	RS	JS
P01	14.05.2024	ROC	Issued for Information	CC	JS
Rev	Date	Drawn	Description	Ch'k'd	App'd

Status Stamp

INFORMATION

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-----------------------	--

Client	Wexford County Council Roads Department Wexford County Council Carricklawn Wexford Town
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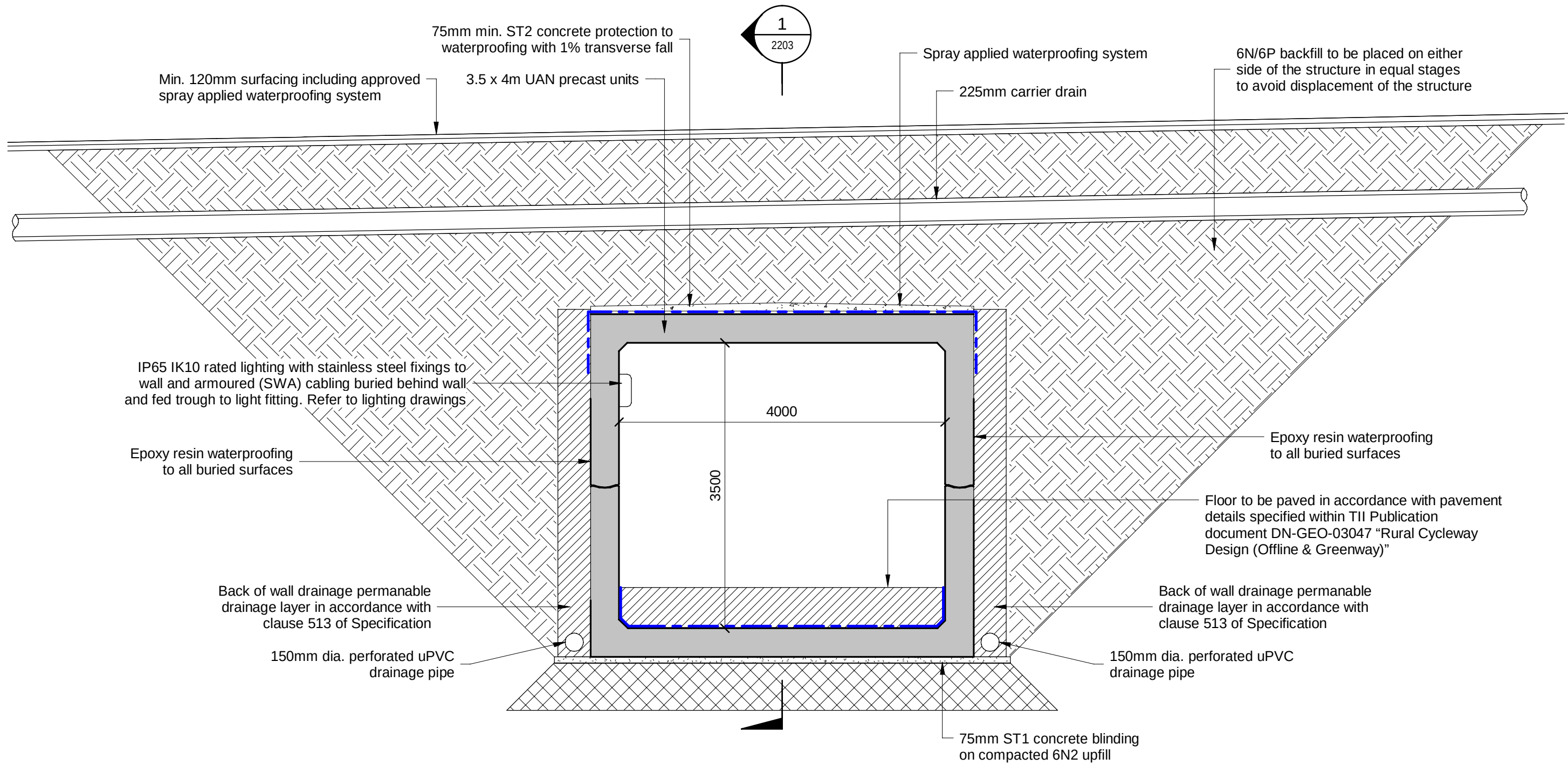
Title
**N25 Rosslare Europort Access Road
B3 Greenway Underpass
General Arrangement
Plan & Section**

Designed	J. Bourke	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	R. Sexton	Approved	J. Shinkwin	
MMD Project Number	229100548	Scale at A1	As indicated	Security STD

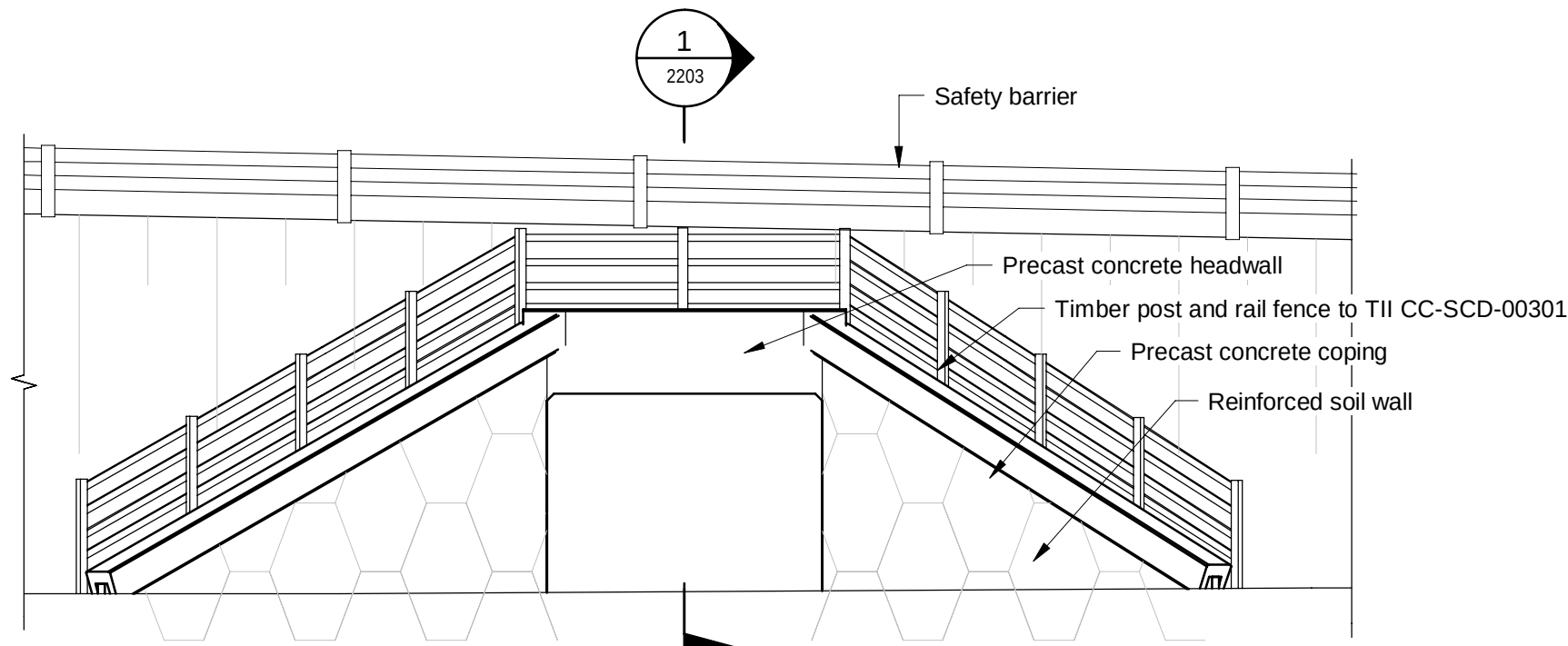
Drawing Description
General Arrangement Plan & Sections

Drawing Number	229100548-MMD-1700-RE-DR-C-2203	Rev	P02
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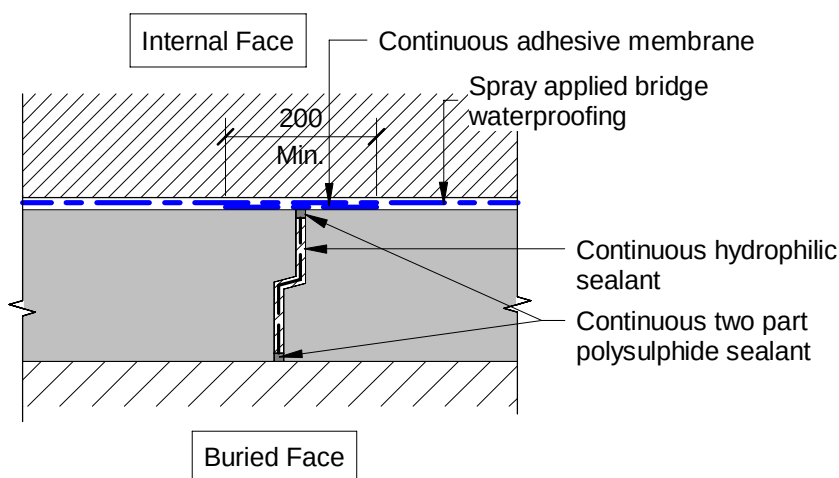
OS Mapping Reference:	
	SOURCE: Reproduced from Ordnance Survey digital map data. All rights reserved. Licence number: 2020/34/CCMA/WexfordCountyCouncil



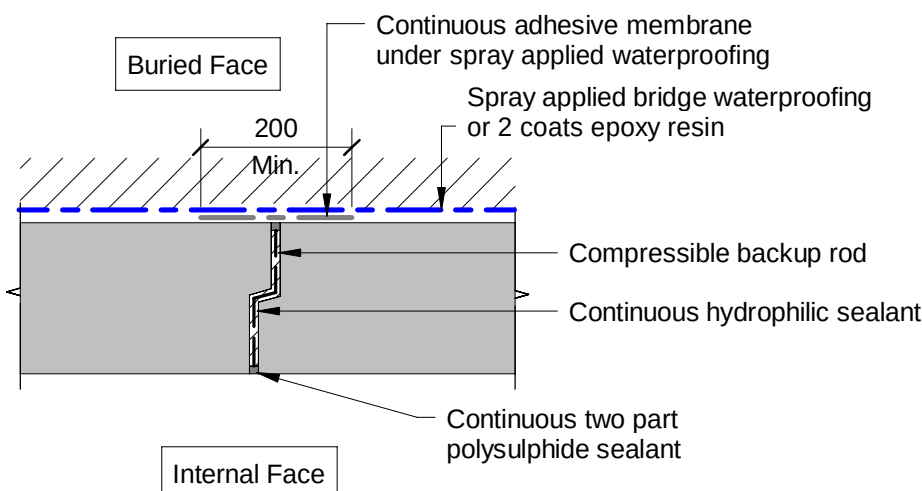
SECTION 2
1 : 50



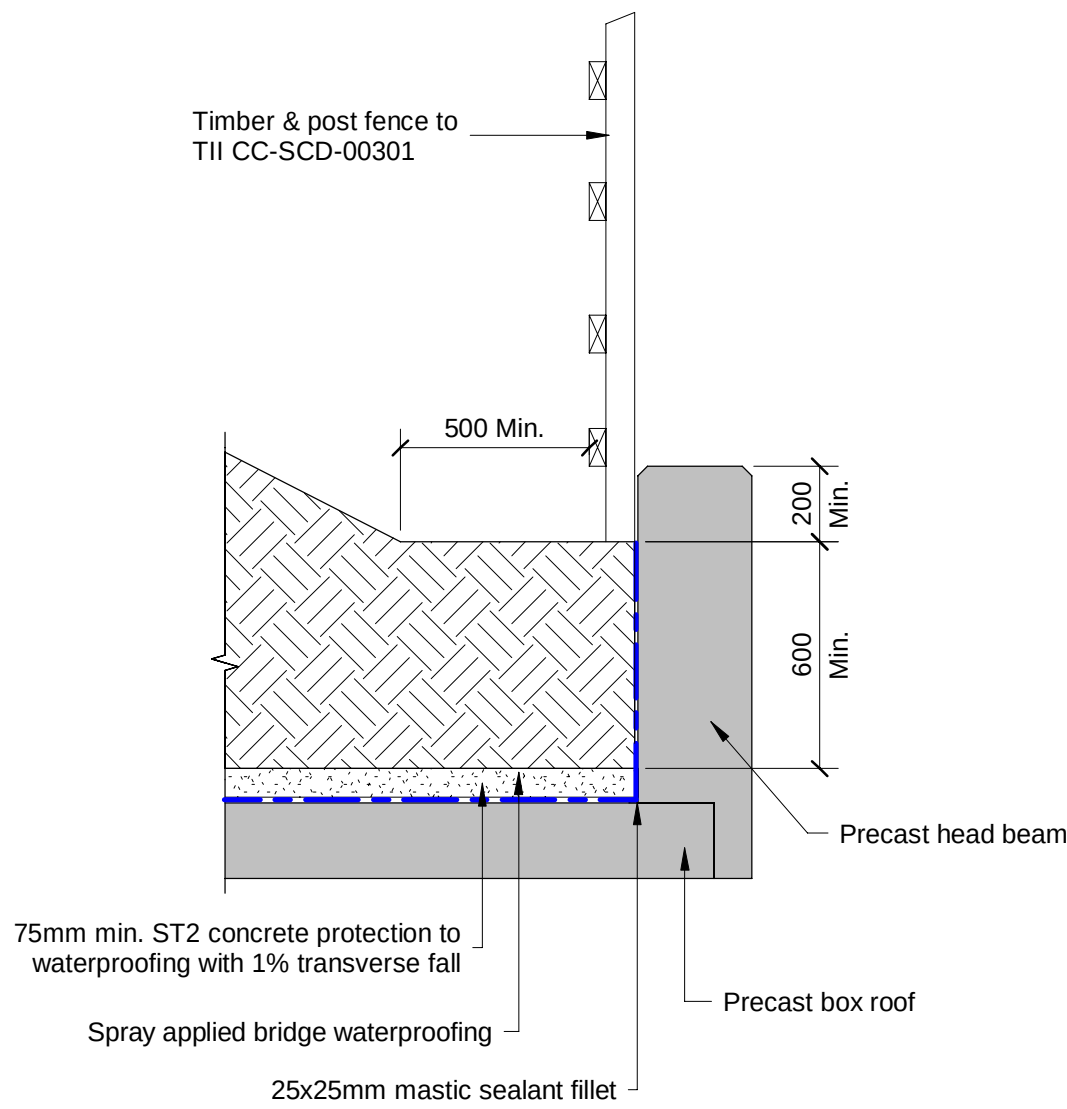
ELEVATION 3
1 : 100



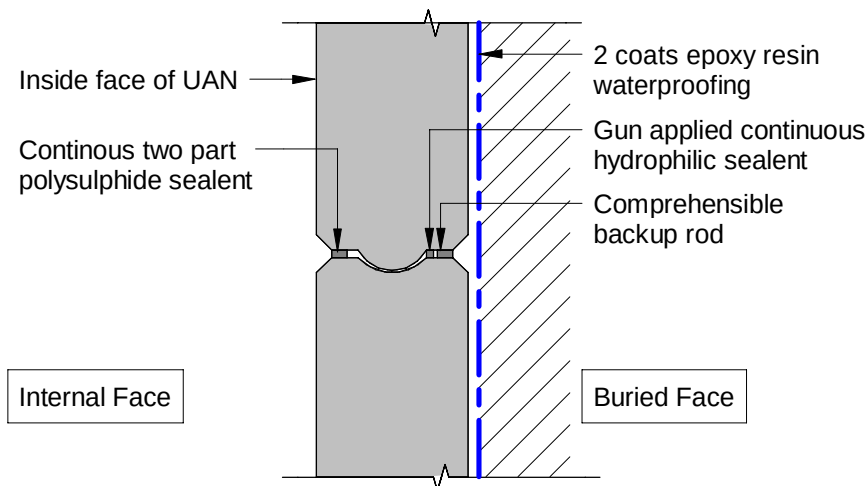
Floor Joint Detail
1 : 10



Roof and Wall Joint Detail
1 : 10



Head Wall Detail
1 : 20



UAN Joint Detail
1 : 10

Notes

1. Refer to drawing 229100548-MMD-1700-RE-DR-C-2203 for notes.

Key to symbols

Reference drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
P03	02.12.2024	RS	Details adder and revised	RS	JS
P02	23.10.2024	ROC	Precast head beam detail amended	RS	JS
P01	14.05.2024	ROC	Issued for Information	CC	JS

Status Stamp	INFORMATION
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Client

Wexford County Council
Roads Department
Wexford County Council
Carricklawn
Wexford Town



Title

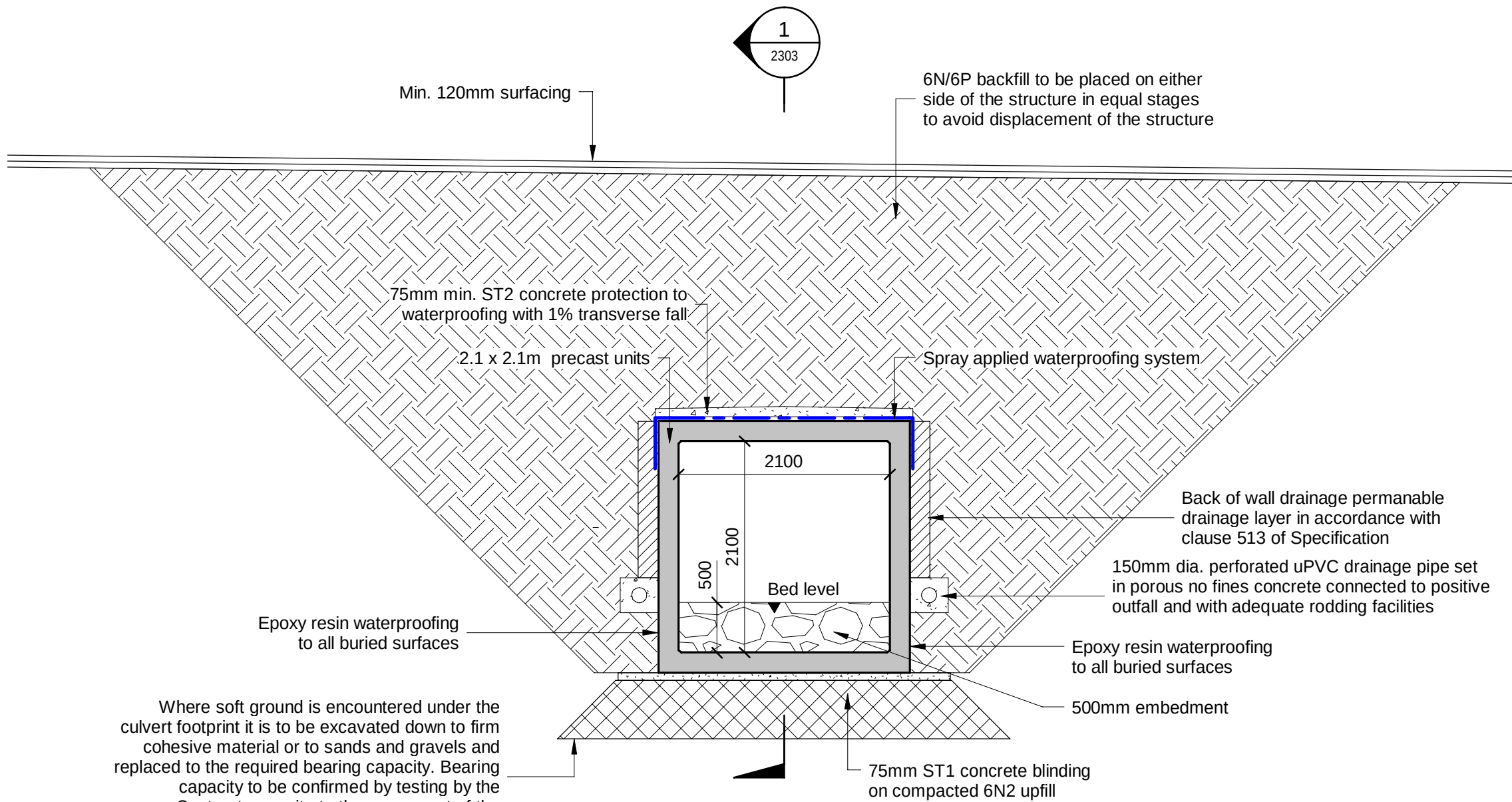
**N25 Rosslare Europort Access Road
B3 Greenway Underpass
Sections & Details**

Designed	J. Bourke	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	R. Sexton	Approved	J. Shinkwin	
MMD Project Number	229100548	Scale at A1	As indicated	Security STD

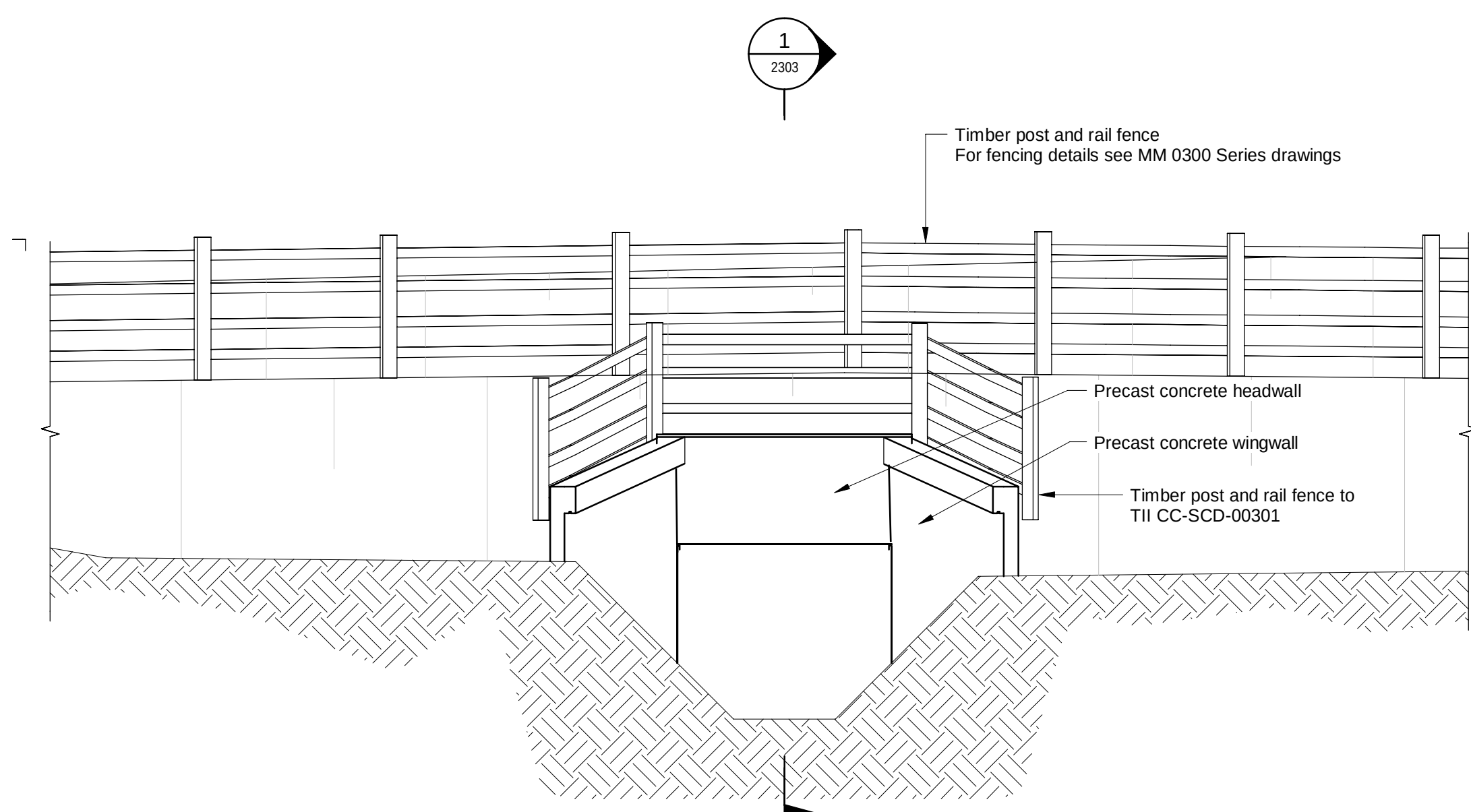
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General Arrangement	
Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2204	P03



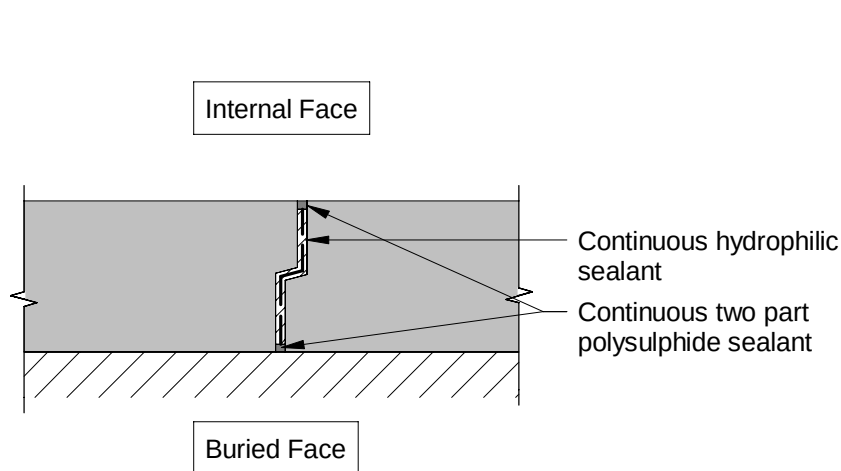
OS Mapping Reference:
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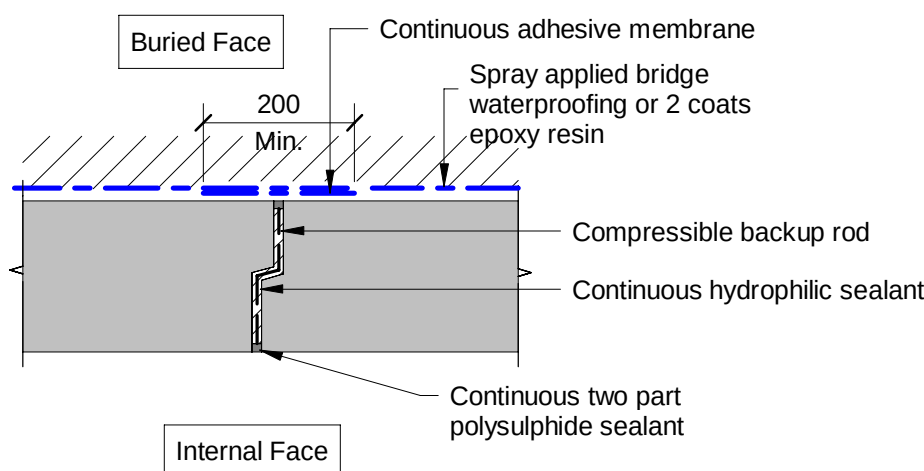
SECTION 2
1 : 50



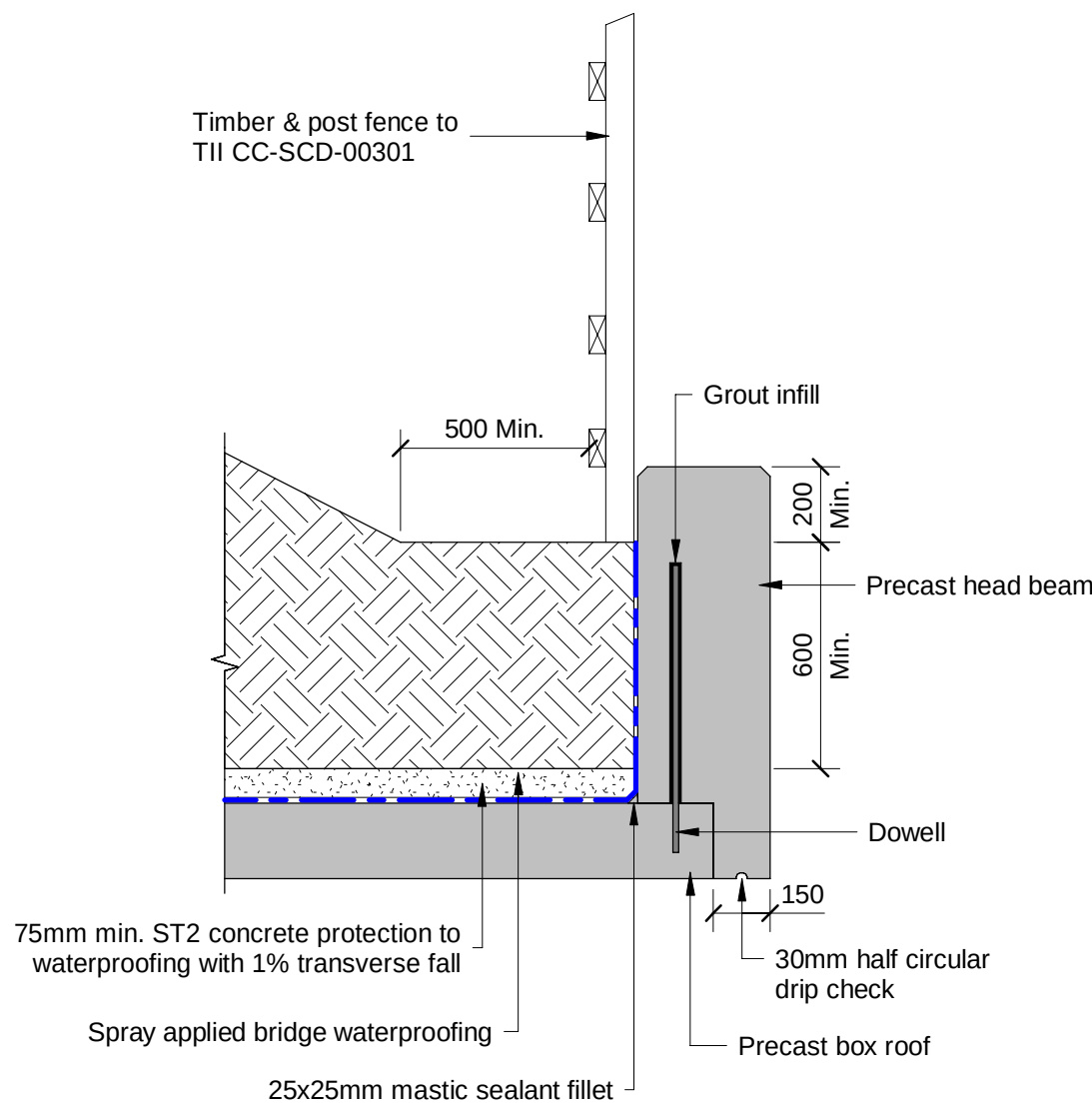
ELEVATION 3
1 : 50



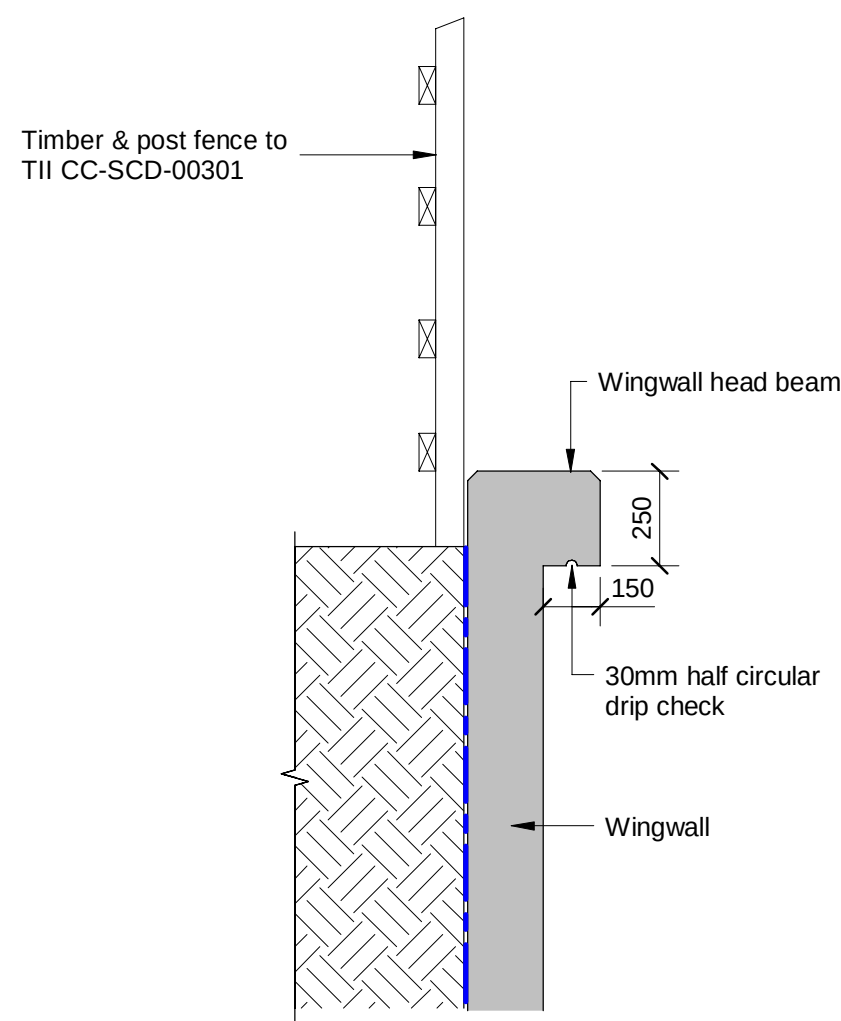
Floor Joint Detail
1 : 10



Roof and Wall Joint Detail
1 : 10



Head Wall Detail
1 : 20



Wingwall Head Detail
1 : 20

- Notes
- Refer to drawing 229100548-MMD-1700-RE-DR-C-2303 for notes.

Key to symbols

Reference drawings

229100548-MMD-1700-RE-DR-C-2000 Structures Location Plan
229100548-MMD-1700-RE-DR-C-2303 GA Plan & Sections

Rev	Date	Drawn	Description	Ch'k'd	App'd
P04	02.12.2024	RS	Waterproof detail amended	RS	JS
P03	01.11.2024	ROC	Wingwall head detail added	RS	JS
P02	16.09.2024	ROC	Revised culvert levels	JB	JS
P01	12.07.2024	ROC	Issued for Information	JB	JS

Status Stamp

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Title
N25 Rosslare Europort Access Road
C1 Culvert
Sections & Details

Designed	J. Bourke	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	J. Bourke	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As indicated	STD

Drawing Description

Sections & Details

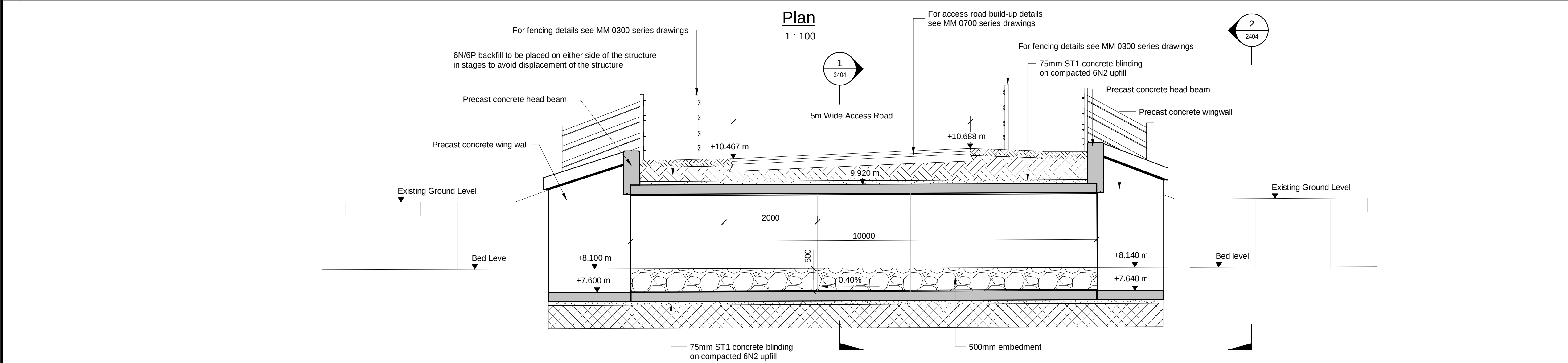
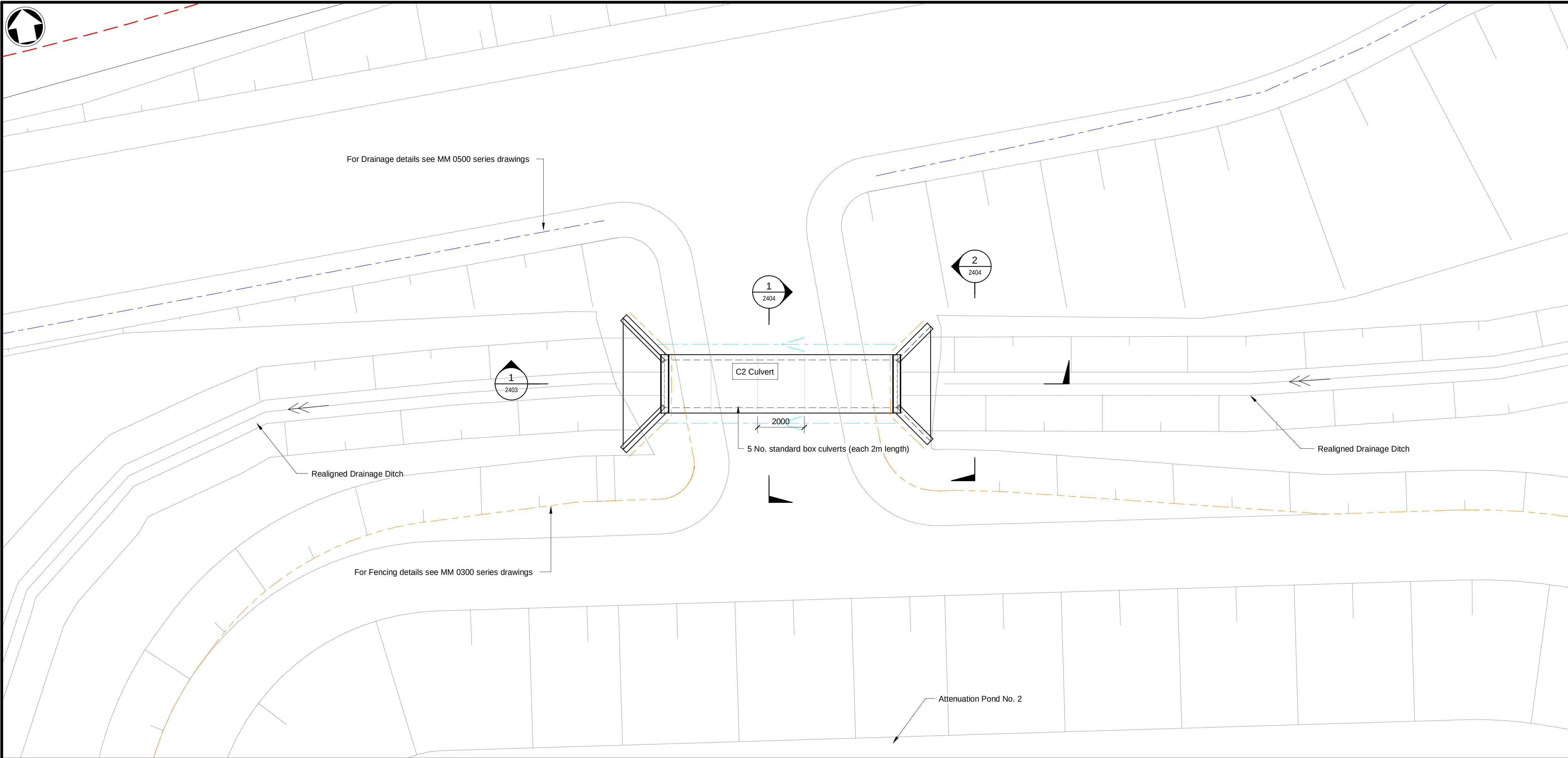
Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2304	P04

O.S. Ref: 5645-C & 5715-A

CYAL50379123

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Concrete Element	Min Concrete Grade (IS EN 206, DN-STR-03012)	Exposure Class	Cover Cmin	Cover Cnom
Culvert wall and base (buried face)	C40/50 (50% GGBS)	XC2/XA1	30	35
Culvert wall (exposed face)	C40/50 (50% GGBS)	XC4/XF1	35	40
Culvert roof (buried face)	C40/50 (50% GGBS)	XC2, XA1, XD2	50	55
Culvert (exposed horizontal face)	C40/50 (50% GGBS)	XC4/XF3	35	40
RC Headwall	C45/55 (50% GGBS)	XC4/XD1	35	40
Precast concrete wingwall (Buried face)	C45/55 (50% GGBS)	XC2/XA1/XD3	50	55
Precast concrete wingwall (Exposed face)	C45/55 (50% GGBS)	XC4/XD1/XF2	35	40

Element	Finish
Precast Elements	F3

- Notes
- General Notes:**
- All dimensions are shown in millimetres unless noted otherwise.
 - Figured dimensions only are to be taken, do not scale from these drawings.
 - All levels shown are in metres above ordnance datum at Malin Head.
 - All coordinates relate to ITM - Irish Transverse Mercator.
 - This drawing is a copy of an electronic file and is copyrighted.
- Concrete Notes:**
- External arises to be chamfered 25x25mm. U.N.O.
 - Concrete to comply with TII specification series 1700 and DN-STR-03012.
 - All buried surfaces except reinforced earth wingwalls to receive 2 coats of epoxy resin waterproofing paint to DN-STR-03012.
 - Spray applied waterproofing membrane to DN-STR-03012 and complying with DN-STR-03009 to be applied to the precast unit top and side surfaces, internal buried surfaces and back face of buried headwalls.

- Key to symbols
- Site Extent Boundary
 - Proposed Fencing
 - Proposed Back of Wall Drainage
 - Proposed Highway Drainage
 - Proposed Safety Barrier

Reference drawings			
229100548-MMD-1700-RE-DR-C-2000	Structures Location Plan		
229100548-MMD-1700-RE-DR-C-2404	Sections & Details		

Rev	Date	Drawn	Description	Ch'k'd	App'd
P03	01.11.2024	ROC	Wingwall head detail added	RS	JS
P02	16.09.2024	ROC	Revised culvert levels	JB	JS
P01	12.07.2024	ROC	Issued for Information	JB	JS

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Title

N25 Rosslare Europort Access Road
C2 Culvert
General Arrangement
Plan & Section

Designed	J. Bourke	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	J. Bourke	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As indicated	STD

Drawing Description

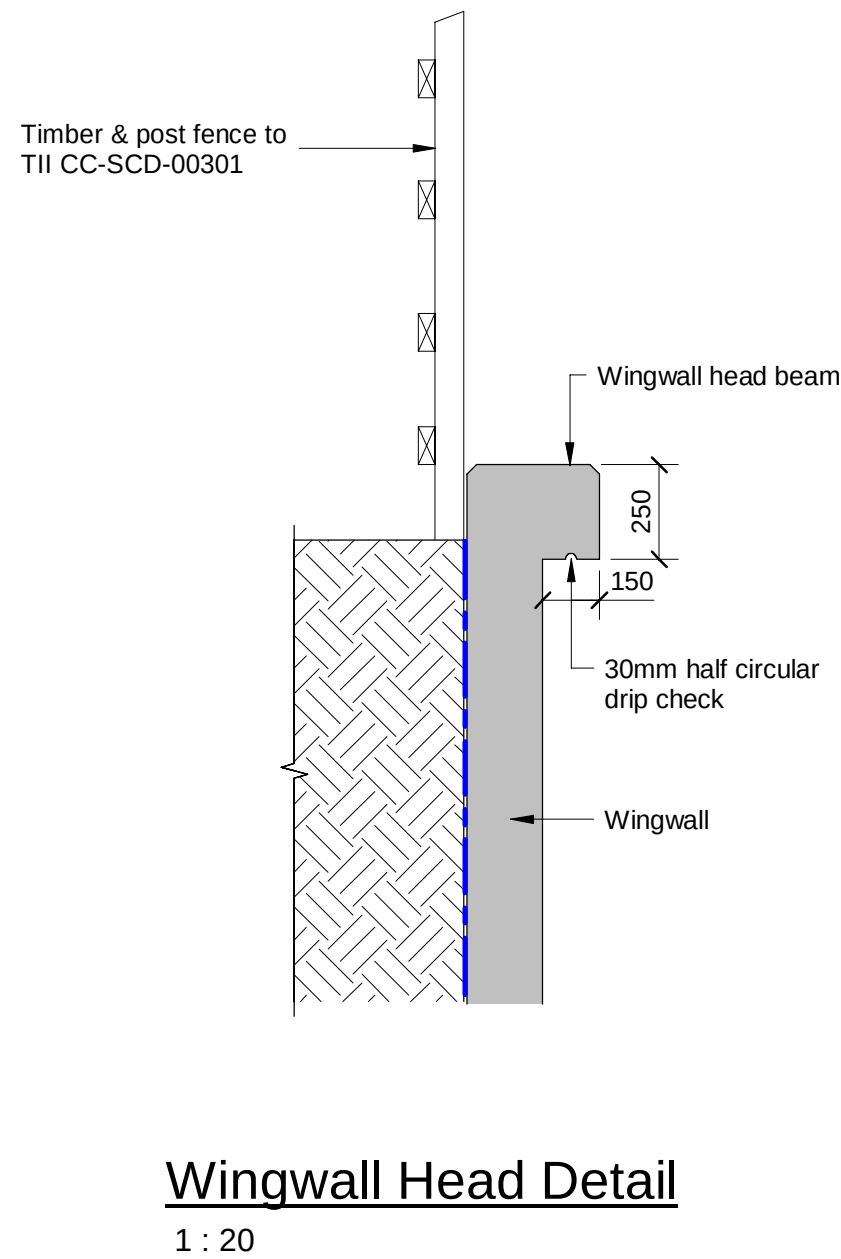
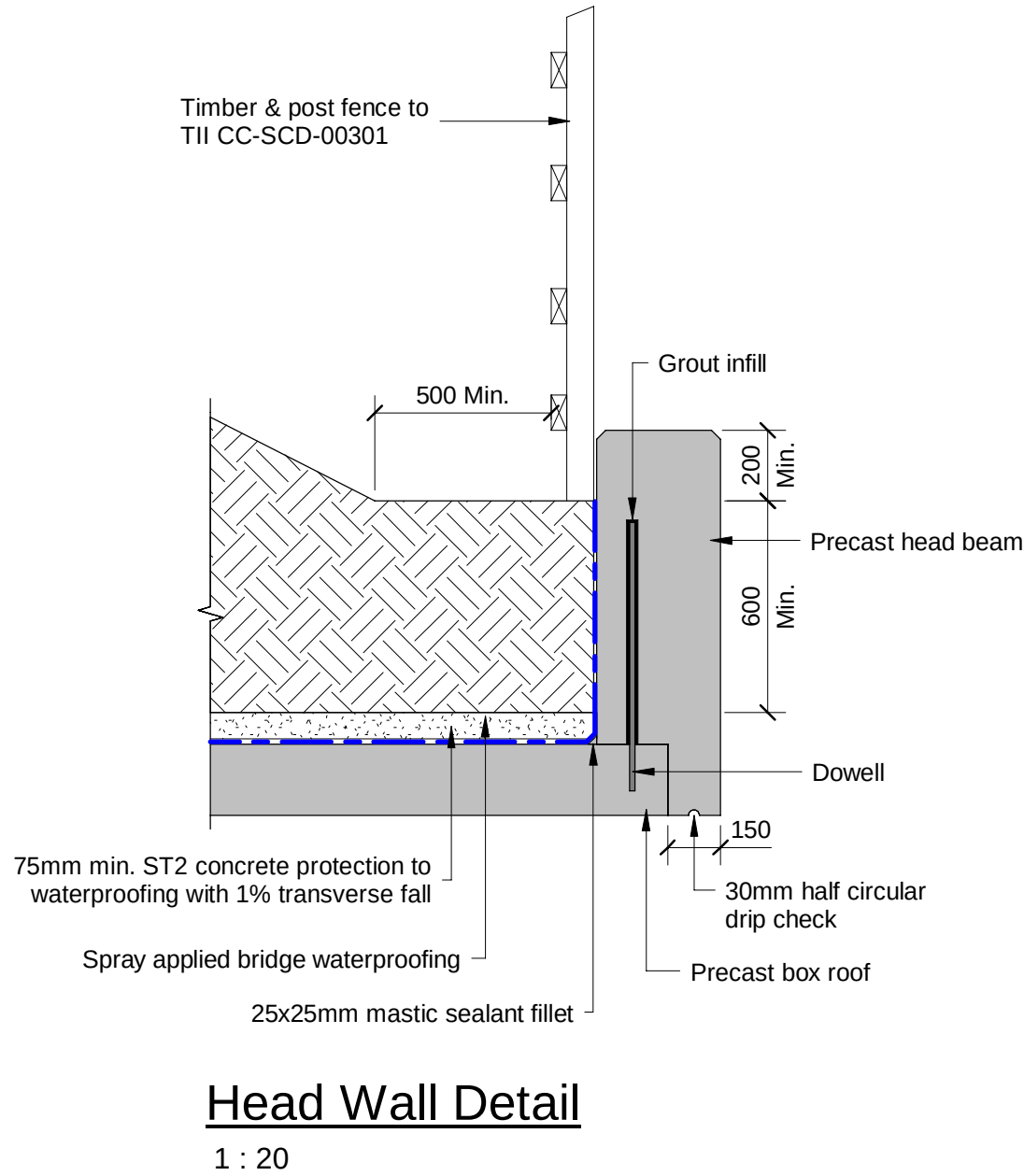
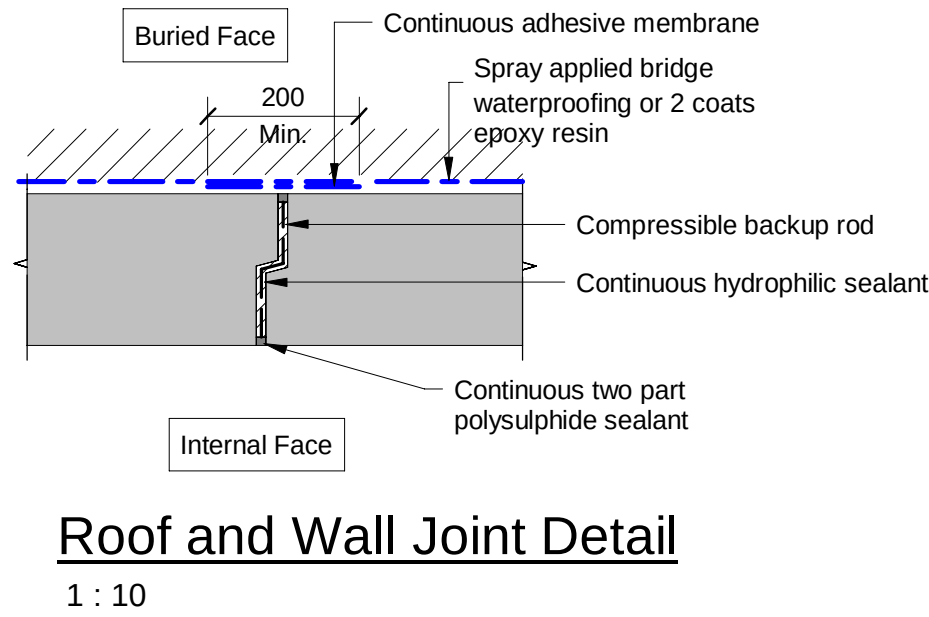
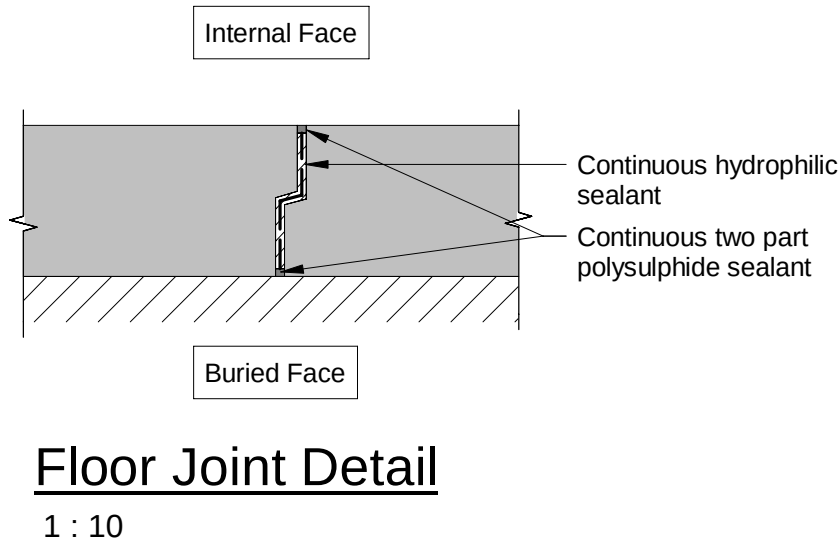
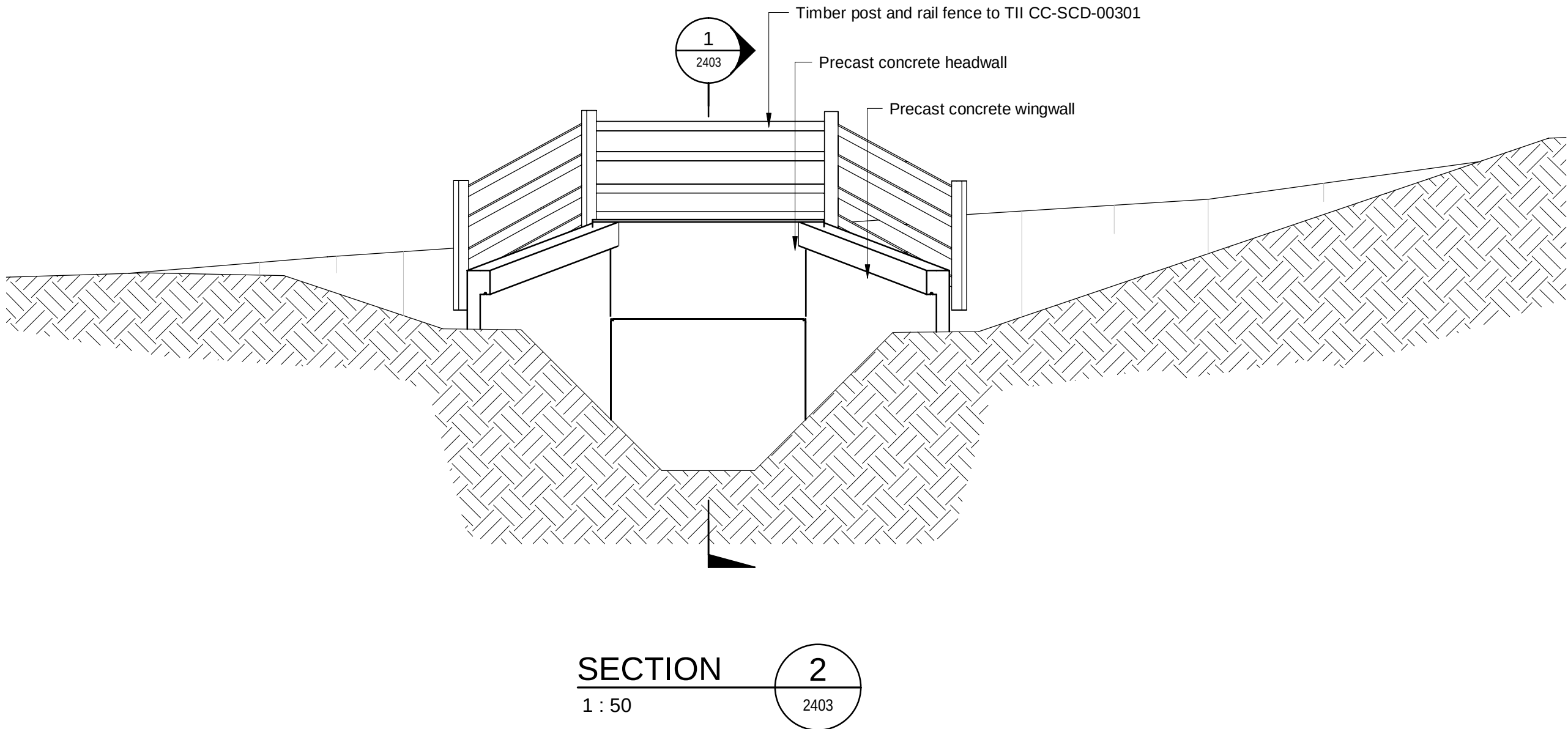
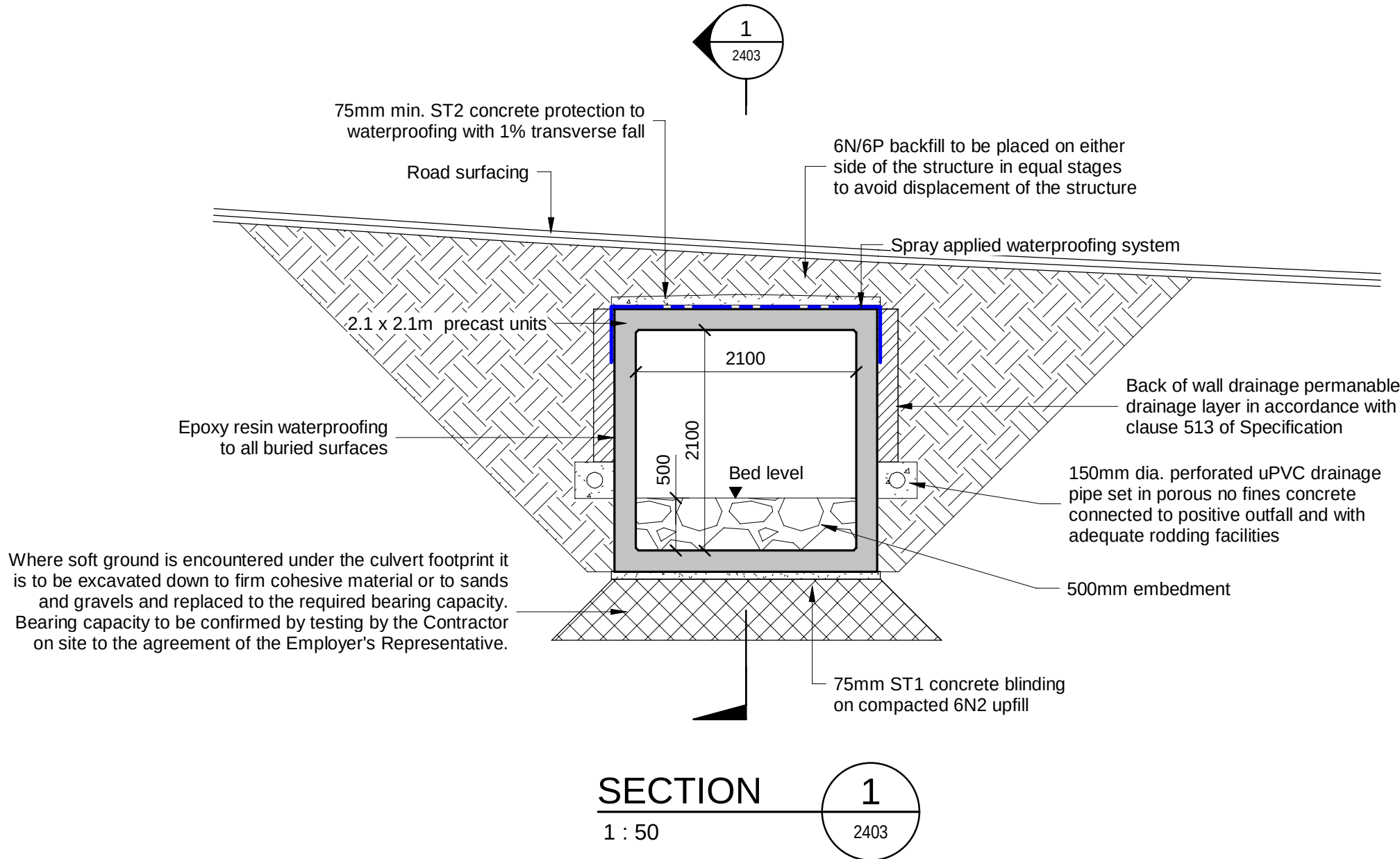
General Arrangement Plan & Sections

Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2403	P03

O.S. Ref: 5645-C & 5715-A

CYAL50379123

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Notes

1. Refer to drawing 229100548-MMD-1700-RE-DR-C-2403 for notes.

Key to symbols

Reference drawings

229100548-MMD-1700-RE-DR-C-2000 Structures Location Plan
229100548-MMD-1700-RE-DR-C-2403 GA Plan & Sections

Rev	Date	Drawn	Description	Ch'k'd	App'd
P04	02.12.2024	RS	Waterproof detail amended	RS	SG
P03	01.11.2024	ROC	Wingwall head detail added	RS	JS
P02	16.09.2024	ROC	Revised culvert levels	JB	JS
P01	12.07.2024	ROC	Issued for Information	JB	JS

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Y35 WY93

 **Comhairle Contae
Loch Garman
Wexford
County Council**

Title

N25 Rosslare Europort Access Road
C2 Culvert
Section, Elevation & Details

Designed	J. Bourke	Eng. Check	R. Sexton	
Drawn	R. O'Connor	Coordination	J. O'Riordan	
Dwg. Check	J. Bourke	Approved	J. Shinkwin	

MMD Project Number	Scale at A1	Security
229100548	As indicated	STD

Drawing Description

Section, Elevation & Details

Drawing Number	Rev
229100548-MMD-1700-RE-DR-C-2404	P04

E. Specification Appendices

APPENDIX 6/1

Requirements for Acceptability and Testing of Earthworks Materials

2. Acceptable limits for the fills in Table 6/1 appropriate to the contract

- a. A schedule of acceptability limits for the fill materials required for this Contract is given in Table 6/1.2 “Compliant Earthworks Materials: Classification and Compaction Requirements” below in accordance with TII Publication Specification CC-SPW-00600. The grading requirements for each class of fill are as given in CC-SPW-00600 Table 6/2 “Grading Requirements for Compliant Earthworks Materials” and Table 6/5 “Grading Requirements for Earthworks Materials Imported onto Site”. The compaction requirements are as given in CC-SPW-00600 Table 6/4 “Method Compaction for Earthworks Materials: Plant and Methods”.
- b. The locations where selected fills are to be used and the fill types to be used are identified on the Standard Earthwork Details and drawings, listed in Table 6/1.1.

Table 6/1.1: List of earthwork drawings

Drawing No.	SED Ref No.	Description
229100548-MMD-0000-RE-DR-C-2000	-	Overall General Layout
229100548-MMD-0600-RE-DR-C-2001 to 2011	-	Earthworks Layout
229100548-MMD-0600-RE-DR-C-2101 - 2107	-	Earthworks Plans and Longitudinal Sections
229100548-MMD-0600-RE-DR-C-2401	-	Instrumentation and Monitoring Arrangement
229100548-MMD-0600-RE-DR-C-2201	SED 1	Topsoil placement
	SED 2	Rounding of earthworks slopes
	SED 3	Typical embankment profile
	SED 4	Treatment of soft spots in embankment foundation
	SED 5	Typical cutting profile
229100548-MMD-0600-RE-DR-C-2202	SED 6	Embankment starter layer
	SED 7	Typical embankment profile (embankment height less than 4.5m)
	SED 8	Typical embankment profile (embankment height greater than 4.5m)
	SED 9	Standard slope drain
	SED 10	Deep counterfort drain
229100548-MMD-0600-RE-DR-C-2203	SED 11	Surface movement survey point and datum points
	SED 12	Settlement monitoring plate
	SED 13	Carriageway settlement monitoring point
	SED 14	Sight lines
	SED 15	Transition area between cut and fill
	SED 16	Ground treatment of soft spots for CBR <4% or c_u <50kpa at sub formation level in shallow embankment / cutting or at-grade
229100548-MMD-0600-RE-DR-C-2204	SED 17	Settlement Monitoring Plate Installation
	SED 18	Vibrating Wire Piezometer Installation

3. Special requirements for determining acceptability

- a. The Contractor shall be responsible for the management and use of all earthwork materials and for providing the materials in accordance with this Specification.
- b. The classification and confirmation of acceptability of the earthwork materials shall be carried out by the Contractor where practicable and safe, at the point of excavation or deposition (where the material alters during transport and deposition only) or where a safe system of work for sampling dictates for on-site materials, and at the point of deposition for imported materials.
- c. If, in the opinion of the Employer's Representative the material has altered its classification or become unacceptable for whatever reason, the classification and acceptability tests given in Table 6/1.2 of Appendix 6/1 and Table 1/5.1 of Appendix 5/1 shall be repeated. Determination of acceptability of materials stockpiled on site shall be undertaken immediately prior to excavation from the stockpile.
- d. With the exception of site won Class 1, 2 and 4 materials, information on material acceptability shall be passed to the Employer's Representative for technical comment, which may incorporate a visit to the source if necessary. The information shall include the following where appropriate:
 - location of fill source;
 - method of extraction;
 - classification of fill;
 - data to show material meets specification criteria limits for acceptable fill; and
 - amount of fill extracted.
- e. Prior to granting approval for site won or imported materials (excluding Class 1, 2 and 4 materials), a full suite of acceptability tests shall be carried out by the Contractor, supported by the information available from ground investigations.
- f. Final compliance testing of the earthwork materials shall be made by the Contractor after deposition. Where the properties of the materials change between source and deposition, or where the material undergoes significant deterioration during compaction, further testing and sampling will be carried out at the point of deposition. The Employer's Representative shall be informed of any changes in properties of earthwork materials.
- g. The Contractor shall submit electronic copies of all compliance test results to the Employer's Representative within five working days of the completion of each test. The copies shall be approved by the Contractor's responsible engineer or technician.

4. Processing to render Unacceptable Material

- a. The Made Ground is assumed as Unacceptable material for reuse. Some of the site arising may be classified as non-complaint or unacceptable material and may be suitable for processing to become acceptable fill material.
- b. Requirements for management of Unacceptable material are detailed in Appendix 6/2 of this specification.
- c. If the Contractor chooses to process site arising material, they shall submit a Method Statement to the Employer's Representative for approval.
- d. The Method Statement shall define the location of materials to be processed, the classes of materials to be produced and details of method of processing.

5. Acceptability for landscape fill

- a. At present there is no requirement for landscape fill. However, if landscape fill is required then Employer's Representative must be informed.

- b. Landscape fill must satisfy the properties required for acceptability, in Table 6/1.2 of Appendix 6/1.

6. Requirements for groundwater lowering or other treatment

- a. The Contractor is responsible for all groundwater lowering where this is required for the purposes of the construction works.
- b. The use of major groundwater lowering measures are not currently envisaged. Should the Contractor wish to apply groundwater lowering then proposals must be submitted to the Employer's Representative for review and agreement a minimum of 5 days prior to the implementation of such measures.
- c. The Contractor is responsible for obtaining all permits and/or licences required to undertake groundwater lowering and for treatment and/or disposal of said groundwater.
- d. Where earthworks operations or ground improvement measures result in the expelling of groundwater into drainage layers or onto earthworks surfaces the discharged water shall be collected, treated if necessary and disposed of by the Contractor.

7. Acceptable earthworks material

- a. Both method and end product compaction are allowed. Consideration should be given to method compaction in accordance with Table 6/1.2 of Appendix 6/1 as a primary source for acceptability and testing of earthwork. For end product approaches, compaction trials will be required prior to using end product compaction with acceptability and testing in accordance with Table 6/1.2 of Appendix 6/1. Refer to Appendix 6/3 for details of compaction methodology and Appendix 1/5 for testing of compaction.
- b. The Contractor shall be responsible for the classification of site arisings and imported material. The Contractor shall also be responsible for the testing of the earthworks materials. The Contractor shall make available a copy of all the classification test results within five working days from the completion of the test, to the Employer's Representative. Where the Employer's Representative is of the opinion that the classification of the site arisings or imported material has changed since sampling, or the material undergoes significant deterioration during compaction (as assessed by the Employer's Representative), the Contractor may be required to repeat the classification tests to check acceptability.
- c. The earthworks material arising from site shall be classified at the point of excavation and imported fill to site shall be classified prior to acceptance on site.
- d. The frequency of testing to determine material acceptability is provided in Appendix 1/5.
- e. As-dug Made Ground is generally not expected to be suitable for re-use as engineering fill due to its variable nature. However, assuming that the material doesn't have any elevated levels of contamination, the material may be suitable for re-use. Appropriate testing would be required to be carried out on the material to assess the suitability for re-use on site in accordance with Table 6/1.2 of Appendix 6/1 and Appendix 1/5.
- f. The use of MCV as a test for acceptability of Class 2 materials shall be determined using field trials as described in NG 631. For Class 2 materials, both MCV and mc testing will be undertaken during field trials. A review of the testing results (carried out by an independent laboratory) will be undertaken. If during field trials, MCV is proven to accurately represent the acceptability of Class 2 Materials, Table 6/1.2 of Appendix 6/1 will be revised to omit or amend the water content testing requirement.
- g. To demonstrate the correlation of CBR and/or strength testing with MCVs, and specifically that of Class 2 fill material to validate the foundation design and formation criteria, additional testing will be required. In-situ plate load tests, DCPs, LWDs and FWDs (e.g. Mexe probe or similar) testing with laboratory MCVs and CBRs measured on

samples taken at the same location, with water content testing to demonstrate sample equivalence will be carried out to demonstrate that $\text{CBR} > 4.0\%$ is achieved on material using the MCV relationship for general fill. A series of tests at a minimum average rate of one set (i.e. 1 Plate Load Test, 1 no. CBR, 1 no. MCV and 1 no. DCP all carried out on a sample of Class 2A/B or 2C1 cohesive general fill material at the same moisture content) per day will be carried out during the first four weeks of earthworks operations, giving a minimum of 20 no. sets of data, to provide an initial correlation. Thereafter test data will be collected at a rate of two sets per month with a minimum of two sets for each earthworks fill element. The initial set up rate of testing shall apply to each major source of material or each sub section where there is significant variation in material classification. At the Employer's Representative's discretion, the rate of testing may be held at the initial set up rate or other alternative testing frequency if required.

- h. The classification of the earthworks materials shall be carried out by the Contractor generally at each point of excavation for on-site materials and at each point of deposition for imported materials. The location of trial pits for classification work shall be agreed with the Employer's Representative. To allow site processing of otherwise acceptable material and with the prior agreement of the Employer's Representative, strength classification (i.e. undrained strength, MCV, or moisture content as specified in Table 6/1.2 of Appendix 6/1) of on-site Class 2 materials may be carried out by the Contractor prior to compaction at each point of deposition.

8. Requirements for in-situ resistivity tests

- a. Where required, the determination of resistivity is to be made by in-situ testing.

9. Requirements for in-situ redox potential tests

- a. Where required, the determination of redox potential is to be made by in-situ testing.

10. Minimum and maximum moisture content for method specification

- a. Table 6/1.2 of Appendix 6/1 defines a set of criteria to be met for the moisture content of material. The permitted maximum and minimum moisture contents are to be determined as part of the source approval testing.
- b. Granular fill:
The permitted upper and lower moisture content shall be a function of the Optimum Moisture Content, when determined as part of the source approval testing, using the method defined in Table 6/1.2 of Appendix 6/1.
- c. Cohesive Fill:
The lower permitted moisture content for cohesive fill shall be the moisture content where a horizontal line plotted equivalent to 105% of the Maximum Dry Density intercepts the 10% air voids line.
The upper permitted moisture content for cohesive fill shall be the dryer moisture content of either:
 - i. The moisture content at 95% of the Maximum Dry Density on the wet side of the compaction curve, (e.g. for moisture contents in excess of the Optimum Moisture Content).
 - ii. The moisture content equivalent to the lowest permissible undrained shear strength as defined in Table 6/1.2 of Appendix 6/1 for the specific fill class.
 - iii. Where the shear strength of the material is less than the minimum permitted in Table 6/1.2 of Appendix 6/1, the material will be deemed to be too wet.

Table 6/1.2: Compliant Earthworks Materials: Classification and Compaction Requirements

Class		General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
					Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
							Lower	Upper	
General Granular Fill	1A	Well graded granular material	General fill	Sand, gravel, crushed rock or crushed concrete with clay, silt or any combination thereof excluding peat, topsoil and other organic material	(i) Grading	Sourced on Site - I.S. EN ISO 17892-4	Tab 6/2	Tab 6/2	Tab 6/4 Method 2 or
					(ii) Uniformity coefficient	See Note 5	10	-	End product: Minimum 95% of MDD. OMC/MDD determined using Vibrating Hammer
	1B	Uniformly graded granular material	General fill	Sand, gravel, crushed rock or crushed concrete with clay, silt or any combination thereof excluding peat, topsoil and other organic material	(i) Grading	Sourced on Site - I.S. EN ISO 17892-4	Tab 6/2	Tab 6/2	Tab 6/4 Method 3 or
					(ii) Uniformity coefficient	See Note 5	-	10	End product: Minimum 95% of MDD. OMC/MDD determined using Vibrating Hammer

Class		General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
					Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
							Lower	Upper	
General Cohesive Fill	2A	Wet cohesive material – derived from Macamore Clay Glacial Till if appropriate	General fill	Clay or silt with sand, gravel, crushed rock, crushed concrete, or any combination thereof excluding peat, topsoil and other organic material	(i) Grading	I.S. EN ISO 17892-4	Tab 6/2	Tab 6/2	Tab 6/4 Method 1 except for materials with liquid limit greater than 50, determined by I.S. EN ISO 17892- 12, only tamping or grid rollers shall be used. End product: Minimum 95% of MDD. OMC/MDD determined using 2.5kg Rammer
					(ii) Plastic limit (PL)	I.S. EN ISO 17892-12	-	-	
					(iii) Water content	I.S. EN ISO 17892-1	Compaction requirement WC = 18% or in situ moisture content, whichever is higher	25%	
					(iv) MCV	Section 32	8	13	
					(v) Undrained shear strength of remoulded material	Section 33	50kPa	-	
					(vi) Effective angle of shearing resistance (ϕ') and effective cohesion (c')	Section 36	26 deg 1kPa	-	
	2B	Dry cohesive material –	General fill	Clay or silt with sand, gravel, crushed rock, crushed concrete, or	(i) Grading	I.S. EN ISO 17892-4	Tab 6/2	Tab 6/2	Tab 6/4 Method 2

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
						Lower	Upper	
	derived from Macamore Clay Glacial Till if appropriate		any combination thereof excluding peat, topsoil and other organic material	(ii) Plastic limit (PL)	I.S. EN ISO 17892-12	-	-	End product: Minimum 95% of MDD. OMC/MDD determined using 4.5kg Rammer
				(iii) Water content	I.S. EN ISO 17892-1	18% or in situ moisture content, whichever is higher	Compaction requirement WC = 25%	
				(iv) MCV	Section 32	8	13	
				(v) Undrained shear strength of remoulded material	Section 33	50kPa	-	
				(vi) Effective angle of shearing resistance (ϕ') and effective cohesion (c')	Section 36	26 deg 1kPa	-	
2C1	Stony cohesive	General fill	Clay or silt with sand, gravel, crushed rock, crushed concrete, or	(i) Grading	I.S. EN ISO 17892-4	Tab 6/2	Tab 6/2	Tab 6/4 Method 2

Class		General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
					Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
							Lower	Upper	
		material (high fines content) – derived from Macamore Clay Glacial Till if appropriate		any combination thereof excluding peat, topsoil and other organic material	(ii) Water content	I.S. EN ISO 17892-1	18% or in situ moisture content, whichever is higher	25%	or End product: Minimum 95% of MDD. OMC/MDD determined using 2.5kg Rammer
			(iii) MCV		Section 32	8	13		
			(iv) Undrained shear strength of remoulded material		Section 33	50kPa	-		
			(v) Effective angle of shearing resistance (φ') and effective cohesion (c')		Section 36	26 deg 1kPa	-		
Topsoil	5A	Topsoil or turf existing on Site	Topsoiling	Topsoil or turf designated as Class 5A in the Contract	(i) Grading	Section 18	-	Section 18	-
	5B	Imported topsoil	Topsoiling	Material complying with BS 3882	-	-	-	-	-
	5C	Imported turf	Turfing	Material complying with BS 3882	-	-	-	-	-

Class		General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
					Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
							Lower	Upper	
Selected Granular Fill	6A	Selected well graded granular material	Placement in water	Natural gravel, crushed gravel, crushed rock or gravel, crushed concrete or any combination thereof, excluding argillaceous and/or micaceous rock (see Note 7)	(i) Grading	Sourced on Site – I.S. EN ISO 17892- 4	Tab 6/2	Tab 6/2	No compaction
						Imported – I.S. EN 933-1	Tab 6/5	Tab 6/5	
					(ii) Uniformity	See Note 5	10	-	
					(iii) Plasticity index	I.S. EN ISO 17892-12	Non-plastic		
					(iv) Los Angeles coefficient	Section 35	-	50	
					(v) Slake Durability	Section 34	95%	-	
	6B	Selected coarse granular material	Starter layer or placement in water	Natural gravel, crushed gravel, crushed rock or gravel, crushed concrete or any combination thereof, excluding argillaceous and/or micaceous rock (see Note 7)	(i) Grading	Sourced on Site – I.S. EN ISO 17892- 4	Tab 6/2	Tab 6/2	Table 6/4 Method 5
						Imported – I.S. EN 933-1	Tab 6/5	Tab 6/5	
					(ii) Plasticity index	I.S. EN ISO 17892-12	Non-plastic		

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
						Lower	Upper	
6C	Selected uniformly graded granular material	Starter layer	Natural gravel, crushed gravel, crushed rock or gravel, crushed concrete or any combination thereof, excluding argillaceous and/or micaceous rock (see Note 7)	(i) Grading	Sourced on Site – I.S. EN ISO 17892- 4	Tab 6/2	Tab 6/2	Tab 6/4 Method 2
					Imported – I.S. EN 933-1	Tab 6/5	Tab 6/5	
				(ii) Uniformity	See Note 5	10	-	
				(iii) Plasticity index	I.S. EN ISO 17892-12	Non-plastic		
				(v) Los Angeles coefficient	Section 35	-	50	
				(vi) Water content	I.S. EN ISO 17892-1	Optimum water content -2%	Optimum water content +1%	
				(vi) Slake durability	Section 34	95%	-	
6F1	Selected granular material	Capping	Natural gravel or sand or a combination of both	(i) Grading	Sourced on Site – I.S. EN ISO 17892- 4	Tab 6/2	Tab 6/2	Tab 6/4 Method 6 or

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612 End product: Minimum 95% of MDD. OMC/MDD determined using Vibrating Hammer
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
						Lower	Upper	
						Imported – I.S. EN 933-1	Tab 6/5 - (0/31.5 or 0/80, GE, UF 9 and OC 75)	
				(ii) Optimum water content	BS 1377-2 (vibrating hammer method)	-	-	
				(iii) Water content	I.S. EN ISO 17892-1	-	Optimum water content	
				(iv) Los Angeles coefficient	Section 35	-	50	
				(v) Slake durability	Section 34	95%	-	
				(vi) Total sulfur content	IS EN 1744-1 clause 11.2	-	1%	
				(vii) Permeability	Section 40	5x10 ⁻⁵ m/s	-	
6F2	Selected granular material	Capping	Crushed rock or crushed gravel or a combination of both, excluding	(i) Grading	Sourced on Site – I.S. EN ISO 17892- 4	Tab 6/2	Tab 6/2	Tab 6/4 Method 6 or

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
						Lower	Upper	
					Imported – I.S. EN 933-1	Tab 6/5 - (0/31.5 or 0/80, GE, UF 9 and OC 75)		
			argillaceous and/or micaceous rock (see Note 7)	(ii) Optimum water content	BS 1377-2 (vibrating hammer method)	-	-	End product: Minimum 95% of MDD.
				(iii) Water content	BS 1377: Part 2	-	Optimum water content	OMC/MDD determined using Vibrating Hammer
				(iv) Los Angeles coefficient	Section 35	-	50	
				(v) Slake Durability	Section 34	95%	-	
				(vi) Total sulfur content	IS EN 1744-1 clause 11.2	-	1%	
				(vii) Permeability	Section 40	5x10 ⁻⁵ m/s	-	
6F3	Selected granular material	Capping	Recycled aggregates (including crushed concrete and/or bituminous materials), natural	(i) Grading	Sourced on Site – I.S. EN ISO 17892- 4	Tab 6/2	Tab 6/2	Tab 6/4 Method 6 or

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
						Lower	Upper	
			(uncrushed) gravel, sand, crushed rock, crushed gravel or a combination thereof, excluding argillaceous and/or micaceous rock (see Note 7) Bituminous materials shall make up less than 50% of the total and shall exclude materials that contain tar and tar-bitumen binders.		Imported – I.S. EN 933-1	Tab 6/5 - (0/31.5 or 0/80, GE, UF 9 and OC 75)		End product: Minimum 95% of MDD.
				(ii) Optimum water content	BS 1377-2 (vibrating hammer method)	-	-	OMC/MDD determined using Vibrating Hammer
				(iii) Water content	I.S. EN ISO 17892-1	Optimum water content -2%	Optimum water content	
				(iv) Los Angeles coefficient	Section 35	-	50	
				(v) Slake Durability	Section 34	95%	-	
				(vi) Total sulfur content	IS EN 1744-1 clause 11.2	-	1%	
				(vii) Permeability	Section 40	5x10 ⁻⁵ m/s	-	
				(viii) Bituminous materials (Ra) content	I.S. EN 933-11	-	50%	

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612				
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:						
						Lower	Upper					
									(ix) Soluble binder content	I.S. EN 12697 1 or I.S. EN 12697-39	-	2%
									(x) Organic content	BS 1377-3	-	1%
6F4	Selected granular material	Capping	Recycled aggregates (including crushed concrete and/or bituminous materials), natural (uncrushed) gravel, sand, crushed rock, crushed gravel or a combination thereof, excluding argillaceous and/or micaceous rock (see Note 7) Bituminous materials shall make up less than 50% of the total and shall exclude materials that contain tar and tar-bitumen binders.	(i) Grading	Sourced on Site – I.S. EN ISO 17892- 4 Imported – I.S. EN 933-1	Tab 6/2 Tab 6/5 - (0/31.5 or 0/80, GE, UF 9 and OC 75)	Tab 6/2	Tab 6/4 Method 6 Maximum compaction layer thickness shall be 200mm or End product: Minimum 95% of MDD. OMC/MDD determined using Vibrating Hammer				
				(ii) Optimum water content	BS 1377-2 (vibrating hammer method)	-	-					
				(iii) Water content	I.S. EN ISO 17892-1	Optimum water content -2%	Optimum water content					
				(iv) Los Angeles coefficient	Section 35	-	50					
				(v) Slake Durability	Section 34	95%	-					

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
						Lower	Upper	
				(vi) Total sulfur content	IS EN 1744-1 clause 11.2	-	1%	
				(vii) Permeability	Section 40	5x10 ⁻⁵ m/s	-	
				(viii) Bituminous materials (Ra) content	I.S. EN 933-11	50%	-	
				(ix) Soluble binder content	I.S. EN 12697 1 or I.S. EN 12697-39	-	10%	
				(x) Organic content	BS 1377-3	-	1%	
6H	Selected granular material	Drainage layer to reinforced soil structures	Natural gravel, natural sand, crushed gravel, crushed rock 7 or gravel, crushed concrete or any combination thereof, excluding argillaceous and/or micaceous rock (see Note 7) Properties (v), (vi), (vii), (viii), (ix) and (x) in next column only apply to material placed above or within 500 mm of metallic reinforcing	(i) Grading	Sourced on Site - I.S. EN ISO 17892-4	Tab 6/2	Tab 6/2	Tab 6/4 Method 3
					Imported – I.S. EN 933-1	Tab 6/5	Tab 6/5	
				(ii) Plasticity index	I.S. EN ISO 17892-12	Non-plastic		
				(iii) Los Angeles coefficient	Section 35	-	50	

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1) elements, facing units or fastenings.	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
						Lower	Upper	
				(iv) Water content	I.S. EN ISO 17892-1	Optimum water content -2%	Optimum water content +1%	
				(v) pH value	I.S. EN 1744-1	Tab 6/3	Tab 6/3	
				(vi) Chloride ion content	I.S. EN 1744-1 clause 7, 8 or 9	-	Tab 6/3	
				(vii) Water-soluble sulfates	I.S. EN 1744-1 clause 10	-	Tab 6/3	
				(viii) Oxidisable sulfides	Section 1.8	-	Tab 6/3	
				(ix) Resistivity	Section 37	Tab 6/3	-	
				(x) Organic content	BS 1377-3	-	Tab 6/3	
			(xi) Slake Durability	Section 34	95%	-		
6I	Selected well graded	Fill to reinforced	Natural gravel, natural sand, crushed gravel, crushed rock, or gravel, crushed concrete, or any	(i) Grading	Sourced on Site - I.S. EN ISO 17892-4	Tab 6/2	Tab 6/2	Tab 6/4 Method 2

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
						Lower	Upper	
	granular material	soil structures	combination thereof, excluding argillaceous and/or micaceous rock (see Note 7) Properties (vi), (vii), (viii), (ix), (x) and (xi) only apply to material placed above or within 500 mm of metallic reinforcing elements, facing units or fastenings.		Imported – I.S. EN 933-1	Tab 6/5	Tab 6/5	
				(ii) Uniformity coefficient	See Note 5	10	-	
				(iii) Water content	I.S. EN ISO 17892-1	Optimum water content -2%	Optimum water content +1%	
				(iv) Effective angle of shearing resistance (φ') and effective cohesion (c')	Section 36	φ' = 36deg c' = 0 kPa	-	
				(v) Effective angle of shearing resistance and adhesion (fill/ elements)	Section 39	Not used	-	
				(vi) pH value	I.S. EN 1744-1	Tab 6/3	Tab 6/3	
				(vii) Chloride ion content	I.S. EN 1744-1 clause 7, 8 or 9	-	Tab 6/3	

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612			
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:					
						Lower	Upper				
							(viii) Water-soluble sulfates		I.S. EN 1744-1 clause 10	-	Tab 6/3
							(ix) Oxidisable sulfides		Section 1.8	-	Tab 6/3
							(x) Resistivity		Section 37	Tab 6/3	-
							(xi) Organic content		BS 1377-3	-	Tab 6/3
							(xii) Los Angeles Coefficient		Section 35	-	50
							(xiii) Slake Durability		Section 34	95%	-
							(xiv) Permeability		Section 40	5x10 ⁻⁵ m/s	-
6J	Selected uniformly graded granular material	Fill to reinforced soil structures	Natural gravel, natural sand, crushed gravel, crushed rock, or gravel, crushed concrete, or any combination thereof, excluding argillaceous and/or micaceous rock (see Note 7) Properties (vi), (vii), (viii), (ix), (x) and (xi) only apply to material	(i) Grading	Sourced on Site - I.S. EN ISO 17892-4	Tab 6/2	Tab 6/2	Tab 6/4 Method 3			
					Imported – I.S. EN 933-1	Tab 6/5	Tab 6/5				
				(ii) Uniformity coefficient	See Note 5	5	10				

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
						Lower	Upper	
			placed above or within 500 mm of metallic reinforcing elements, facing units or fastenings.	(iii) Water content	I.S. EN ISO 17892-1	Optimum water content -2%	Optimum water content +1%	
				(iv) Effective angle of shearing resistance (φ') and effective cohesion (c')	Section 36	φ' = 36 deg c' = 0 kPa	-	
				(v) Effective angle of shearing resistance and adhesion (fill/ elements)	Section 39	Not used	-	
				(vi) pH value	I.S. EN 1744-1	Tab 6/3	Tab 6/3	
				(vii) Chloride ion content	I.S. EN 1744-1 clause 7, 8 or 9	-	Tab 6/3	
				(viii) Water-soluble sulfates	I.S. EN 1744-1 clause 10	-	Tab 6/3	
				(ix) Oxidisable sulfides	Section 1.8	-	Tab 6/3	
				(x) Resistivity	Section 37	Tab 6/3	-	

Class		General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
					Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
							Lower	Upper	
					(xi) Organic content	BS 1377-3	-	Tab 6/3	
					(xii) Los Angeles Coefficient	Section 35	-	50	
					(xiii) Slake Durability	Section 34	95%	-	
					(xiv) Permeability	Section 40	5x10 ⁻⁵ m/s	-	
					6N	Selected granular material	Fill to structures and below structures	Crushed rock and crushed concrete, excluding argillaceous and/or micaceous rock (see Note 7)	
					Imported – I.S. EN 933-1	Tab 6/5	Tab 6/5		
				(ii) Los Angeles coefficient	Section 35	-	50		
				(iii) Effective angle of shearing resistance (ϕ') and effective cohesion (c')	Section 36	ϕ' = 36 deg c' = 0kPa	-		
				(iv) Permeability	Section 40	5x10 ⁻⁵ m/s	-		

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
						Lower	Upper	
				(v) Water content	I.S. EN 17892-1	Optimum water content -2%	Optimum water content +2%	
				(vi) pH value	I.S. EN 1744-1	6	9	
				(vii) Water-soluble sulfates	I.S. EN 1744-1 clause 10	-	0.3%	
				(viii) Total sulfur content	I.S. EN 1744-1 clause 11.2	-	0.1%	
				(ix) Acid soluble sulfates	I.S. EN 1744-1 clause 12	-	0.2%	
				(x) Oxidisable sulfides	Section 1.8	-	0.3%	
				(xii) Slake durability	Section 34	95%	-	
6P	Selected granular material	Fill to structures	Natural gravel, crushed gravel or combination of both, excluding argillaceous and/or micaceous rock (see Note 7)	(i) Grading	Sourced on Site - I.S. EN ISO 17892-4	Tab 6/2	Tab 6/2	End product 95% of maximum dry density of BS 1377-4: Method 3.7 (vibrating hammer method)
					Imported – I.S. EN 933-1	Tab 6/5	Tab 6/5	

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
						Lower	Upper	
				(ii) Los Angeles coefficient	Section 35	-	60	
				(iii) Effective angle of shearing resistance (φ') and effective cohesion (c')	Section 36	φ' = 36 deg c' = 0kPa	-	
				(iv) Permeability	Section 40	5x10 ⁻⁵ m/s	-	
				(v) Water content	I.S. EN 17892-1	Optimum water content -2%	Optimum water content +2%	
				(vi) pH value	I.S. EN 1744-1	6	9	
				(vii) Water-soluble sulfates	I.S. EN 1744-1 clause 10	-	0.3%	
				(viii) Total sulfur content	I.S. EN 1744-1 clause 11.2	-	0.1%	
				(ix) Acid soluble sulfates	I.S. EN 1744-1 clause 12	-	0.2%	
				(x) Oxidisable sulfides	Section 1.8	-	0.3%	

Class	General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Section 1 and Appendix 6/1)	Material Properties Required for Compliance (In Addition to Requirements on Use of Fill Materials in Section 1 and Testing in Section 31)				Compaction Requirements in Clause 612
				Property (See Exceptions in Previous Column)	Defined & Tested in Accordance with:	Compliance Limits Within:		
						Lower	Upper	
				(xii) Slake durability	Section 34	95%	-	

Footnotes to Table 6/1.1

1. App = Appendix
2. Tab = Table
3. Where in the 'Compliance Limits Within' column reference is made to App 6/1, only those properties having limits ascribed to them in Appendix 6/1 shall apply. Where Appendix 6/1 gives limits for other properties not listed in this Table such limits shall also apply.
4. Where I.S. EN ISO 17892-1 is specified for water content, this shall mean I.S. EN ISO 17892-1 (for Site-won materials) or I.S. EN 1097-5 (for imported materials), as appropriate.
5. Uniformity Coefficient is defined as the ratio of the particle diameter D₆₀ to D₁₀ on the particle size distribution curve, where:
6. D₆₀ = particle diameter at which 60% of the soil is finer.
7. D₁₀ = particle diameter at which 10% of the soil is finer.
8. Determination of water content shall be made from that part of the material passing the 20 mm BS Sieve.
9. Argillaceous or micaceous rock may be used in the Permanent Works if it is demonstrated by Los Angeles coefficient and slake durability testing that the argillaceous or micaceous material meets the compliance limits for durability.
10. Where materials are required to be aggregates conforming to I.S. EN 13242, materials certificated as being in accordance with I.S. EN 13285 are compliant for use if they meet all the Contract requirements and the Declaration of Performance for constituent parts to I.S. EN 13242 are provided to the Employer's Representative.
11. Materials shall comply with the current environmental regulations at the time of use.
12. An upper limit is required for the angle of shearing resistance (ϕ') for Class 6N Fill when it is used behind integral bridge abutments or when otherwise required.
13. For Class 6N and 6P fill, the total sulfur content may be between 0.1% and 1% if a petrographic analysis, as described in S.R. 21 Annex E.2.4.5, shows that the material is suitable for the proposed use.

APPENDIX 6/2

Requirements for Dealing with Class U2 Unacceptable Material

11. Drawing references for unacceptable material

- a. Drawing references for excavation of known Unacceptable material (Made Ground) are detailed in Table 6/2.1 below.

Table 6/2.1 – Known Areas of Unacceptable Material

Drawing No.	Description
229100548-MMD-0600-RE-DR-C-2001	Earthworks Layout Sheet 1 of 11
229100548-MMD-0600-RE-DR-C-2002	Earthworks Layout Sheet 2 of 11
229100548-MMD-0600-RE-DR-C-2003	Earthworks Layout Sheet 3 of 11
229100548-MMD-0600-RE-DR-C-2004	Earthworks Layout Sheet 4 of 11
229100548-MMD-0600-RE-DR-C-2005	Earthworks Layout Sheet 5 of 11
229100548-MMD-0600-RE-DR-C-2006	Earthworks Layout Sheet 6 of 11
229100548-MMD-0600-RE-DR-C-2007	Earthworks Layout Sheet 7 of 11
229100548-MMD-0600-RE-DR-C-2008	Earthworks Layout Sheet 8 of 11
229100548-MMD-0600-RE-DR-C-2009	Earthworks Layout Sheet 9 of 11
229100548-MMD-0600-RE-DR-C-2010	Earthworks Layout Sheet 10 of 11
229100548-MMD-0600-RE-DR-C-2011	Earthworks Layout Sheet 11 of 11

12. General

- a. Made Ground is assumed to be Unacceptable material. If Made Ground, and any other material, is determined to be Unacceptable Material then such materials are excavated during construction of the works then the following clauses should apply.
- b. In the event that potentially contaminated material is encountered during the earthworks, the Employer's Representative shall instruct on a course of action to be undertaken. This may include subsequent sampling and laboratory testing, and advice on the suitability of the material for use in the permanent works. The Contractor must:
- Temporarily store in a separate securely fenced off area within a temporary screen fence provided and maintained by the Contractor. Material shall be stored in the area until chemical analyses are carried out to determine its classification.
 - Provide potentially contaminated and/or contaminated stockpile areas with suitable water run-off collection to ensure contaminated water does not impact the site or adjacent waterways, etc.
 - Give notice to the Employer's Representative.
 - Provide a method statement for safe excavation, removal and disposal of the Unacceptable material in accordance with all relevant legislation including the Waste Management Acts (WMA) 1996 to 2005, Waste Management (Permit) Regulations (WMPR) 1998 and with regard to Best Practice Guidance on Preparation of Waste Management Plans for Construction and demolition projects (DoEHLG June 2006).
- c. Any Unacceptable material should be treated as hazardous until proven otherwise.

- d. In the event that contaminated hotspots are identified during the earthworks, these hotspots shall be delineated by further investigation by the Contractor (in consultation with the Employer's Representative) and the affected material removed. The subsequent void shall be backfilled with suitable inert material placed and compacted in accordance with the requirements of Appendix 6/1.
- e. The Contractor shall ensure laboratory contamination testing of materials designated for disposal off-site is carried out to confirm their status with respect to waste disposal.
- f. The use of conventional excavation methods is deemed appropriate for the proposed works. No special precautions or handling requirements are anticipated, other than those previously identified.

13. Methods of excavation, precautions and requirements for handling

- a. The Contractor is responsible for keeping records of the location, volumes, extent, nature and test results for all Unacceptable materials encountered. In the event that potentially contaminated ground is encountered during the works, the Employer's Representative shall be contacted immediately to complete a further examination and confirm the material class.
- b. Suspected Unacceptable material shall be excavated and stockpiled in a secure, covered area. The material may be held in the holding area whilst the appropriate chemical testing is undertaken. Measures to be provided to prevent the migration of contaminants into the natural ground at the base of stockpiles.
- c. Excavation and transportation of Unacceptable material shall consider the health and safety and environmental implications at each location. Method Statements detailing proposed mitigation measures will be required for each location.
- d. The Contractor shall be responsible for ensuring that appropriate Personal Protective Equipment, procedures and safe systems of work are followed by all personnel at all times when working with suspected contaminated materials.

14. Requirements of the Environmental Legislation

- a. The standards that apply to the treatment or disposal of contaminated materials will be those applicable at the time of disposal. The Contractor shall obtain all necessary consents from local and national authorities as legislation and regulation requires.

APPENDIX 6/3

Requirements for Excavation, Deposition, Compaction (Other Than Dynamic Compaction)

1. General

- a. Earthworks requirements are provided on the Scheme General Arrangement Drawings and on the Standard Earthwork Detail Drawings referenced in Table 6/1.1 of Appendix 6/1.
- b. The finished sloped surfaces of all cuttings in material other than bedrock shall have a maximum gradient of 1 vertical to 2.75 horizontal unless noted otherwise in the Earthworks Plans and Longitudinal Sections referenced in Table 6/1.1 of Appendix 6/1.
- c. The finished sloped surfaces of all embankments shall have a maximum gradient of 1 vertical to 2 horizontal unless noted otherwise in the Earthworks Plans and Longitudinal Sections referenced in Table 6/1.1 of Appendix 6/1.

2. Aggressivity

- a. The Contractor shall comply with Section 1.8 of CC-SPW-0060.

3. Separation of Earthworks Materials

- a. The Contractor shall comply with Section 2.5 of CC-SPW-0060.

4. Drainage

- a. The Contractor shall comply to the information provided in Appendix 5/1.

15. Peat

- a. Peat is not expected to be found on Site. If present, the Contractor shall comply with Section 1.9 of CC-SPW-0060.

16. Formation of Cuttings and Cutting Slopes

- a. The Contractor shall comply with Section 3.1.2 of CC-SPW-00600.
- b. The contractor shall be responsible for temporary slope stability assessment and the design of temporary ground support. Where this may impact on the permanent Works design, for example trench excavations at the toe of cuttings, approval is required from the Design Organisation.

17. Soil Cuttings

- a. The Contractor shall carry out regular inspection and monitoring of the slopes, report immediately to the Design Organisation any signs of slope instability, and shall take appropriate measures to ensure the stability of the slope is maintained.
- b. Any groundwater seepages revealed during excavation shall be notified to the Employer's Representative for possible design amendments.
- c. If groundwater is encountered within a cut slope, the Contractor shall deal with this during construction by localised pumping/dewatering, earthworks drainage or other measures as determined by the Contractor to keep the earthworks free of water. If water ingress is found to be a persistent problem, adequate drainage measures may be required as directed and agreed by the Employer's Representative, such as a slope drainage blanket,

over-deepened toe drain, slope drains or counterfort drains. The Contractor shall keep the earthworks free of water.

- d. Protection of the formation or sub-formation in the base of the cutting against weather shall be carried using the same material as used to form the foundation ground treatment and be undertaken across the full width of the base of the cutting.
- e. A hold point shall be provided by the Contractor prior to the placement of topsoil to allow cuttings to be inspected by the Employer's Representative upon completion to assess whether ground conditions are as assumed in the design and to ensure the cut slopes have been excavated to meet the design requirements. Should the ground conditions encountered not meet the design assumptions the Employer's Representative shall inform the Contractor and agree the implementation of appropriate measures to stabilise the slope.
- f. Following topsoil stripping and benching, exposed sub-formations shall be proof rolled by the Contractor and inspected by the Employer's Representative. Any identified soft spots (material with a lower strength than the required design value) shall be notified immediately by the Contractor to the Employer's Representative. Isolated patches of soft, fragmented or otherwise unsuitable material (e.g. obstructions within Made Ground) shall be excavated and backfilled with the same Class of material as the sub-formation.
- g. The Contractor shall ensure that all finished slope surfaces are no steeper than detailed on the earthwork drawings unless agreed with the Employer's Representative. Steeper cutting slopes shall not be permitted unless agreement has been provided by the Employer's Representative.
- h. All temporary drains and ditches alongside cuttings shall be completed and outfalls provided, prior to commencement of any adjacent earthworks.
- i. Cutting faces to receive topsoil shall be made good by the Contractor in accordance with Appendix 6/8 to remove patches of soft, fragmented or insecure material and shall be treated by the Contractor.
- j. All temporary excavations shall be supported where required. No temporary supports shall be left in position upon completion of the works unless previously agreed with the Employer's Representative.
- k. The Contractor shall comply with the Temporary Works Designer requirements when excavating trenches at the toe of any slopes.

18. Rock Cuttings

- a. Not required.

19. Excavation for Foundations

- a. If soft soil or loose material is removed beneath foundations, voids should be backfilled with Class 6N fill.
- b. The location of a house foundation to be removed is shown on drawing 229100548-MMD-0600-RE-DR-C-2004.

20. Watercourses

- a. Not required.

21. Explosives and Blasting for Excavation

- a. Blasting for excavation is not required or permitted.

22. Construction of Fills

- a. The Contractor shall comply with Section 2.15 of CC-SPW-00600.
- b. The Contractor shall comply with Section 3.1.2 of CC-SPW-00600.
- c. Formation for earthworks construction and cutting formations shall be proof rolled using a minimum compactive effort. The minimum compactive effort shall be increased for cutting formations where different compactive efforts, dependent on the type of follow-on earthworks operations, are required by the Specification. The identification of a 'soft spot' is qualitative and depends on the response of the ground to the compactive effort during the proof-rolling.
- d. For the purposes of this contract, the definition of a soft area will correspond to a CBR of less than 4% or undrained shear strength less than 50kPa. As a minimum excessive matting, bow-waving or ground heave shall be indicative of a 'soft spot' which will then require testing by the contractor to determine the CBR of the subgrade. Soft spot treatment is provided on the Standard Earthworks Detail drawing referenced in Table 6/1.1 of Appendix 6/1.
- e. Locations where starter layers are required are shown in the Earthworks Plan and Longitudinal Section Drawings referenced in Table 6/1.1 of Appendix 6/1. The Employer's Representative should assess the need for the additional starter layers following proof rolling and formation testing as per Table 1/5.1 of Appendix 1/5. The topsoil shall be stripped in these areas before construction of the embankment commences. Standard details of the starter layer are shown in SED 6 of the Standard Earthworks Details Drawings referenced in Table 6/1.1 of Appendix 6/1.
- f. The starter layers shall be Class 6B as defined in Table 6/1.2 of Appendix 6/1. Class 6B starter layer shall have a thickness of 300mm.
- g. The Contractor shall comply with Section 8.3 of CC-SPW-00600.
- h. Changes to the slope profiles are not permitted without the agreement of the Employer's Representative.
- i. The Contractor shall comply with Section 8.8 and 17.1 of CC-SPW-00600.
- j. The Contractor shall comply with 17.2 of CC-SPW-00600.
- k. The Contractor shall comply with 8.9 of CC-SPW-00600.

23. Soft Spots

- a. It is considered likely that localised 'soft spots' will be identified during the proof rolling exercise and as such detailed discussion and agreement will be required with the Employer's Representative at the outset in order to adopt a standardised procedure for dealing with this occurrence.
- b. Where a soft spot is identified, the sequence of activities shall include the following:
 - i. Delineation at the current formation the extent of soft spot.
 - ii. Excavation of soft spot, minimum 1m deep and 2m wide.
 - iii. Inspection of the area of the soft spot post removal of affected material.
 - iv. In situ assessment on strength (hand vane shear strength in the case of cohesive soils) at the base and sides of the excavation.
 - v. Survey of the extent of the soft spot excavation by the Contractor.
 - vi. Replacement of affected material with suitable engineered fill, compliant with the requirements of Appendix 1/5 and Table 6/1.2 of Appendix 6/1.

24. Stage Construction

- a. Topsoil shall be removed from beneath all embankments and landscape fill areas.
- b. Where soft ground is encountered beneath embankment locations then ground improvement by 'dig out and replace' method will be applied, in accordance with the Earthworks Drawings 229100548-MMD-0600-RE-DR-C-2201 and 229100548-MMD-0600-RE-DR-C-2203 referenced in Table 6/1.1 of Appendix 6/1 and the instructions of the Employer's Representative.
- c. All soft ground shall be removed and replaced with a starter layer in accordance with Appendix 6/1 and drawings 229100548-MMD-0600-RE-DR-C-2201 and 229100548-MMD-0600-RE-DR-C-2203 referenced in Table 6/1.1 of Appendix 6/1.
- d. The suitability of the formation level shall be confirmed with the Employer's Representative prior to placing the embankment fill.
- e. The Contractor shall keep the earthworks free of water.
- f. Protection of the formation or sub-formation against weather shall be carried out using the same material as used to form the embankment and be undertaken across the full width of the embankment with a thickness of weather protection material no less than 300 mm.
- g. All cohesive/granular fill layer interfaces shall be constructed such that drainage of the interface is towards the edge of the embankment. The slope of this interface shall be such that any water shall drain to the outside of the embankment. Granular material shall be free to drain where it has access to water.
- h. The Contractor shall not allow temporary works fill of more than 2 metres height to remain at side slopes steeper than the design slope for more than 48 hours before trimming back to the design slope. In any event, temporary works side slopes shall not be formed steeper than 1v:1h.
- i. During construction, surcharge loads at the top of the embankment slopes shall not exceed an equivalent 20kPa uniformly distributed load and shall be set at a minimum of 1.5 metres back from the edge of the slope. Should additional surcharge loads or reduced distance to the edge of the slope be required, the Contractor must seek agreement from the Employer's Representative prior to the works.
- j. Overfilling of side slopes and trimming back to achieve adequate compaction of the shoulders of embankments is permitted.
- k. Any temporary increase in width of embankments to permit adequate compaction of side slopes and edges before trimming back shall not exceed 1 metre.
- l. Oversteepening of permanent works embankment slopes is not permitted in the contract without the agreement of the Employer's Representative.
- m. Records shall be maintained detailing the following with respect to the materials used for embankment construction:
 - i. site won material: cutting asset, approximate chainage and date of excavation;
 - ii. imported material: name and location of quarry;
 - iii. material class;
 - iv. material description (cohesive fill and rock); and
 - v. date of placement and compaction where different from the date of excavation.
- n. On completion of the embankment a hold period shall be implemented prior to construction of the prepared subgrade and protection layer.

25. Compaction

- a. Fill material shall be placed and compacted in layers using suitable compaction machinery for each material type as per Table 6/1.2 of Appendix 6/1.

- b. Both method compaction and end product are allowed.
- c. Any testing using a nuclear density gauge (NDG) shall be undertaken to the requirements of BS 1377 : Part 9 section 2.5 using the direct transmission mode. Calibration tests against in-situ density test results shall be undertaken to the requirements of BS 1377 : Part 9 test 2.5.5.3.2 (calibration by container method) on an area of constructed material. Separate calibration tests shall be undertaken for each Class of material used in construction. Additional calibration testing shall be undertaken where the material may be different from that originally used for calibration purposes.
- d. The Contractor will be required to determine the representative dry density for all Class 1 and Class 2 general fill materials. The testing agency in conjunction with the Employer's Representative will need to determine which value will be most appropriate for use in comparing to Nuclear Density Tests at the time of testing.
- e. Site control of method compaction is through classification and acceptability criteria listed in Table 6/1.2 of Appendix 6/1. Testing frequency for method compaction of Class 2 material is presented in Appendix 1/5. The Contractor shall keep sufficient records of man hours, earthworks fill rates and construction plant details, as necessary, to demonstrate compliance with the method specification requirements for the fill materials.

26. Compaction trials

- a. Before placing any fill material in the permanent works, the Contractor shall demonstrate the methods, equipment and materials he proposes to use by constructing an area or areas as appropriate of embankment fill material on a typical prepared sub-formation to the same layer thickness as required in the permanent works.
- b. After completion of each demonstration area the Contractor shall within a period of not greater than 5 days and before commencing the main construction of the appropriate embankment in the permanent works, carry out a minimum of 6 sets of tests and provide the Employer's Representative with records for acceptance. The scope of testing is to be agreed with the Employer's Representative.
- c. The demonstration area shall, if it does not meet the requirements for the permanent works or is located elsewhere on site, be removed and the area reinstated. Material successfully placed may be incorporated into the permanent works.
- d. The Contractor shall provide a method statement for the trial areas to the Employer's Representative for agreement at least 7 days in advance of undertaking the trial.

27. Method compaction

- a. Compaction shall fully comply with the requirements of Tables 6/1.2 of Appendix 6/1 and Appendix 1/5, unless otherwise instructed by the Employer's Representative.
- b. The frequency of field dry density testing shall be in accordance with Appendix 1/5. Unless specified otherwise in the CC-SPW-00600 or this document, where laboratory optimum moisture content and maximum dry density testing of materials is to be undertaken (as detailed in Appendix 1/5) for method compaction, testing shall be undertaken with method stated in Table 6/1.2 of Appendix 6/1.

28. End product specification

- a. The specification for end production testing is provided in Table 1/5.1 of Appendix 1/5.
- b. A nuclear density gauge (NDG) is permitted for use to measure in-situ densities provided that it is calibrated, well maintained and shown to be suitable, to the satisfaction of the Employer's Representative, for each material being tested. For determination of the moisture content (and hence the dry density), correlation against the 'oven dried' moisture

content (BS 1377 (1990) Part 2, Clause 3.2) is required for each material type encountered.

- c. Any testing using a NDG shall be undertaken to the requirements of BS 1377: Part 9 section 2.5 using the direct transmission mode. Calibration tests against in-situ density test results shall be undertaken to the requirements of BS 1377: Part 9 test 2.5.5.3.2 (calibration by container method) on an area of constructed material. Separate calibration tests shall be undertaken for each Class of material used in construction. Additional calibration testing shall be undertaken where the material may be different from that originally used for calibration purposes.
- d. The NDG is to penetrate the layer such that readings are taken mid-height or deeper within the compacted layer.
- e. In situ dry density testing for nuclear density gauge calibration purposes shall be undertaken to BS 1377: Part 9 tests 2.1 or 2.2 as appropriate to the material being tested.
- f. The equipment must be operated and stored in accordance with the manufacturer's recommendations and current safety legislation. It must be used only by personnel fully trained and experienced in its operation.
- g. Where End Product compaction is used, it is recognised that inherent variability in soils may result in a small number of outliers. In consideration of this, not more than 10% of non-compliance for any End Product test, per layer, is permitted. Should the non-compliance rate exceed this value, the material shall be removed and replaced with fill in compliance with the Specification.
- h. For the avoidance of doubt, a layer shall be any layer of fill, from the same source and same class, placed and compacted at the same location and level, on the same working day. Subsequent filling on subsequent days, at same location and level, shall constitute a new layer of fill.

29. Earthworks for Corrugated Steel Buried Structures

- a. Not required.

APPENDIX 6/5

Geotextiles used to Separate Earthworks Materials

- a. Geotextile separators shall be thermally bonded and non-woven or needle punched polyethylene or polypropylene.
- b. Geotextiles shall be provided at locations identified in the Earthworks Plan and Longitudinal Section Drawings and as shown in the Standard Earthworks Details Drawings referenced in Table 6/1.1 of Appendix 6/1. Geotextiles may be required to separate capping from sub-grades in embankments or at grade sections, and below starter layers, and may also be used for filter or pipe drains.
- c. Geotextile shall be used to separate layers within the earthworks (if required), such as to prevent migration of fines from overlying fill into the starter layer.
- d. Geotextiles shall not be placed during periods of extreme cold, extreme heat, when frost is likely and or when there is heavy rainfall.
- e. The material on which the geotextiles are installed shall be free of any sharp protrusions which may damage the fabric. The geotextile shall not be dragged into position or pulled once laid but shall be rolled out across the site such that it shall be in continuous contact with the surface on which it is to be installed and shall not bridge or be stretched over hollows or lumps.
- f. Adjacent sheets of the geotextile shall be jointed according to the Manufacturer's recommendations.
- g. Geotextiles shall be protected at all times against mechanical or chemical damage and shall not be uncovered between manufacture and incorporation in the works. Unless demonstrated otherwise by performing resistance to weathering tests in accordance with EN ISO 12224, all geotextiles shall be completely covered within three days of installation.
- h. The Contractor shall submit a proposal for the geotextile to be used based on Section 9.4 of CC-SPW-00600 and the geotextiles proposed shall have the properties given in Table 6/5.1.
- i. Criteria shall be demonstrated by evidence of testing supplied by the manufacturer, subject to approval by the Employer's Representative, and the testing of geotextiles shall be in accordance with Appendix 1/5.
- j. Placement, lapping and jointing of the geotextile shall be in accordance with the manufacturer's instructions and Section 9 of CC-SPW-00600.
- k. Laying and lapping of geotextiles shall be in accordance with Clause 609.

Table 6/5.1: Geotextile properties as a material separator

Property	Acceptable limits	Test standard
Tensile Strength	As stated in the drawings referenced in Table 6/1.1 of Appendix 6/1	BS EN ISO 10319
Elongation at Maximum Load		BS EN ISO 10319
Static Puncture Resistance (CBR test)		BS EN ISO 12236
Dynamic Perforation Resistance (cone drop test)		BS EN 918
Characteristic Opening Size		BS EN ISO 12956
Cell Wall Permeability		BS EN ISO 11058
Durability		BS EN 13251

APPENDIX 6/6

Fill to Structures, Fill Above Structural Foundations and Fill Below Structural Foundations

- a. The extent of fill to structures and fill above structural foundations is shown in the Structures Drawings given in Table 6/6.1 below.

Table 6/6.1: Drawing reference for fill to structures and fill above structural foundations

Drawing No.	Drawing Title
229100548-MMD-1700-RE-DR-C-2003 - 2005	B1 Ballygerry Underbridge (Railway Overbridge) General Arrangement Plan, Sections & Elevation, Sections & Details
229100548-MMD-1700-RE-DR-C-2103 - 2104	B2 Access Underpass General Arrangement Plan, Sections & Elevation
229100548-MMD-1700-RE-DR-C-2203 - 2204	B3 Greenway Underpass Plan & Section, Sections & Details
229100548-MMD-1700-RE-DR-C-2303 - 2304	C1 Culvert General Arrangement Plan & Section, Sections & Details
229100548-MMD-1700-RE-DR-C-2403 - 2404	C2 Drainage Culvert Plan & Section, Section, Elevation & Details

- b. The investigation shall identify the presence and extent of any 'soft spots' (i.e. strength below that required by the design). For soft spots beneath structures, soft spots shall be excavated and backfilled with compacted Class 6N/6P fill.
- c. Fill to structures and fill above structural foundations shall comprise Class 6N/6P fill, compacted in accordance with the requirements in Table 6/1.2 of Appendix 6/1.
- d. The reinforced soil wall fill shall be Class 6I/6J material, compacted in accordance with the requirements in Table 6/1.2 of Appendix 6/1.

APPENDIX 6/7

Sub-Formation and Capping Preparation and Surface Treatment of Formation

1. Drawings

- a. The design undrained shear strength and CBR values are shown in the Standard Earthworks Details drawings:
 - 229100548-MMD-0600-RE-DR-C-2101
 - 229100548-MMD-0600-RE-DR-C-2102
 - 229100548-MMD-0600-RE-DR-C-2103
 - 229100548-MMD-0600-RE-DR-C-2104
 - 229100548-MMD-0600-RE-DR-C-2105
 - 229100548-MMD-0600-RE-DR-C-2106
 - 229100548-MMD-0600-RE-DR-C-2107
 - 229100548-MMD-0600-RE-DR-C-2201
 - 229100548-MMD-0600-RE-DR-C-2202
 - 229100548-MMD-0600-RE-DR-C-2203
 - 229100548-MMD-0600-RE-DR-C-2204

2. Permitted Classes of Capping

- a. Capping Class 6F1, 6F2, 6F3 or 6F4 is permitted if required.
- b. For capping thickness refer to Appendix 7.

3. Preparation and surface treatment of formations

- c. Any soils identified at formation level with an undrained shear strength, c_u less than 50kPa or CBR less than 4% shall be removed and replaced with Class 1 or 2 fill as shown on the Standard Earthworks Details Drawings referenced in Table 6/1.1 of Appendix 6/1, compacted in accordance with the requirements of Table 6/1.2 of Appendix 6/1. Should placement of fill below water be required, this may be replaced with self-compacting Class 6A Selected Granular Fill.
- d. The frequency of formation testing shall be that stated in Appendix 1/5.
- e. All exposed areas of formation or sub-formation which have deteriorated or softened due to weather or other causes shall be removed and replaced with acceptable materials.
- f. The sub-formation (beneath capping or improvement layer) shall have the same longitudinal gradient, cross fall and surface level tolerances as the formation.
- g. If any degradation of capping is identified prior to placing any pavement materials, remedial measures carried out as agreed by the Employer's Representative.

4. Requirements for sub-formation testing

- a. The sub-formation shall be tested for in-situ CBR (plate load test or Falling Weight Deflectometer (FWD) or Light Weight Deflectometer (LWD) or a combination of testing apparatus) prior to placement of capping to determine the surface modulus. CBR testing shall be in accordance with CC-GSW-04008, CC-GSW-04009 and Appendix B of AM-

PAV-06050. Methodology to be undertaken in accordance with Section 13.10 of CC-SPW-00600.

- b. The frequency of CBR testing shall be as stated in Appendix 1/5, subject to local modification to reflect site conditions and agreement with the Employer's Representative.
- c. Where the in-situ CBR is lower than the design CBR, the capping thickness could be increased accordingly (See Appendix 7). Increased thickness of capping should not be used without consultation with the Employer's Representative.
- d. For cuttings, in-situ CBR testing shall be carried out along each carriageway every 25m in the centre of each carriageway. If the CBR is found to be less than the design CBR, then the subgrade must either be improved to the design CBR or the pavement foundation re-designed to a greater thickness of sub-base.
- e. If it is likely that groundwater is within 1m of the sub-formation, such as in the proposed cutting from Ch 120, the CBR testing shall be supplemented with Dynamic Cone Penetrometer (DCP) tests. CP tests shall be in accordance with DN-PAV-03021 and Appendix D of AM-PAV-06050.
- f. The results of the in-situ testing shall be made available within 48 hours of the testing being completed.
- g. The sub-formation shall be protected at all times. Excavation of cuttings may be halted at any stage providing no less than 300mm of material as weather protection is left in place above the formation or sub-formation level.
- h. Cut-fill transitions shall be treated in accordance with the Standard Earthworks Details drawings to include 600mm of capping a minimum of 7.5m either side of the transition line.
- i. In-situ CBR testing should be carried out at top of capping in all sections of the Works to confirm the in-situ CBR matches the design CBR (see Appendix 7). Testing for CBR will be as described in Appendix 7 and as directed by the Employer's Representative.

APPENDIX 6/8

Topsoiling, Grass Seeding and Turfing

5. Requirements for the stripping, handling, stockpiling and maintenance of topsoil

- a. The full thickness of topsoil is to be stripped in accordance with Section 2.11.1 of CC-SPW-00600. Topsoil is to be stripped below the full embankment footprint.
- b. Topsoil shall be stored in accordance with good horticultural practices and Section 2.11.2 of CC-SPW-00600.
- c. Stockpiles shall not be placed over rooting zones of mature trees in areas where existing trees/habitats may be damaged or where surface run-off may cause pollution.
- d. Generally, topsoil stockpiles shall be 2 metres in height and kept free of weeds. Greater heights may be permitted for short periods with the agreement of the Employer's Representative.
- e. If soils are to be stockpiled for in excess of six months, stockpiles shall be seeded with a grass/clover mixture to minimise soil erosion and reduce the spread of weeds. Stockpiles with seeded grass cover during the summer months shall be maintained by spraying, mowing or strimming to control the spread of weeds. Stockpiles without seeded grass cover shall be sprayed with water as necessary to prevent the generation of dust.
- f. It is expected that there is sufficient topsoil available on-site, however import of Class 5B material is permitted. The sources of any imported Class 5B topsoil must be approved by the Employer's Representative prior to importing it to site.
- g. It is anticipated that all acceptable stripped topsoil will be re-used as part of the works. Should surplus topsoil be accumulated during the works, the Contractor shall liaise with the Employer's Representative regarding storage and/or disposal of the surplus material.
- h. Placed topsoil shall have a maximum thickness of 150mm in accordance with Section 18.11 of CC-SPW-00600 and a minimum thickness of 100mm.

APPENDIX 6/9

Earthwork Environmental Bunds, Landscape Areas, Strengthened Earthworks and Reinforced Soil Structures

6. Earthwork Environmental Bunds

Not used.

7. Landscape Areas

Not used.

8. Strengthened Earthworks

Not used.

9. Reinforced Soil Structures

- a. The locations of the reinforced soil structures are identified in the Structures Drawings referenced in Table 6/6.1 of Appendix 6/6.
- b. The reinforcing elements selected shall be approved by the Employer's Representative.

APPENDIX 6/11

Swallow Holes and Other Naturally Occurring Cavities and Disused Mine Workings

- a. Swallow holes and other naturally occurring cavities are not envisaged to be encountered within the site area. Should such cavities be encountered then the Employer's Representative shall be informed immediately.
- b. Where voids of any sort encountered, the Employer's Representative shall be informed immediately.

APPENDIX 6/12

Instrumentation and Monitoring

- a. This Appendix should, be read in conjunction with the relevant Standard Earthworks Details (SEDs), Earthworks Plan and Profile Drawings referenced in Table 6/1.1 of Appendix 6/1.
- b. Measurement of settlement is required at selected earthwork locations. The locations of the instrumentation are shown in the Instrumentation and Monitoring Arrangement drawing (229100548-MMD-0600-RE-DR-C-2401). The instrumentation shall comprise surface settlement monitoring points.
- c. The surface settlement monitoring plates and installation are shown in SEDs 12 and 17 on drawings 229100548-MMD-0600-RE-DR-C-2203 and 229100548-MMD-0600-RE-DR-C-2204.
- d. The Contractor shall provide, install and maintain for the duration of the contract the instrumentation. The Contractor shall provide the equipment necessary to monitor the instrumentation. Settlement monitoring points shall be constructed at the surface of the finished earthwork.
- e. Settlement monitoring points shall be monitored immediately after installation and every two days for the first week after installation. Thereafter, they shall be monitored as a minimum on a weekly basis or any other interval as required by the Employer's Representative.
- f. All instrumentation shall have its head level and position monitored to allow potential adjustments, to be agreed with the Employer's Representative. Each instrument shall be suitably protected and adequately marked with its reference number.
- g. Levels of settlement monitoring points shall be read using precise levelling techniques referenced to a permanent datum.
- h. The permanent datum shall be fixed into firm ground away from the area of possible settlement at a location agreed with the Employer's Representative.
- i. Within 10m of the interface between Structures and any approach embankments, the differential settlement between any two points shall not exceed 10mm at any time up to the end of the Defects Period for the Works (excluding landscape works).
- j. Vibrating wire piezometers are required at selected earthwork locations. The locations of the instrumentation are shown in the Instrumentation and Monitoring Layout drawing (229100548-MMD-0600-RE-DR-C-2401).
- k. The vibrating wire piezometers are to monitor excess pore water pressure and dissipation times during embankment construction. If pore water pressures are high, then hold periods or staged construction should be implemented to allow the pore pressure to dissipate before placing the next stage of fill material (see Appendix 6/3).
- l. The vibrating wire piezometer installation is shown in SED 18 on drawing 229100548-MMD-0600-RE-DR-C-2240.
- m. An additional vibrating wire piezometer shall be installed at a location to be agreed with the Employer's Representative, distant from the earthwork construction, to allow calibration of those in the embankment foundation.

APPENDIX 6/13

Soil Treatment with Lime and/or Hydraulic Binders and Ground Improvement

- a. Excavation of soft soils and replacement with Class 1 or Class 6 selected granular fill or Class 2C1 cohesive fill will be used to form foundations for shallow embankments, shallow cuttings and at-grade sections as indicated in the SEDs referenced in Table 6/1.1 of Appendix 6/1.
- b. Any soils underlying the ground improvement shall have a minimum undrained shear of 50kPa (for cohesive soils) and/or a minimum CBR of 4% (for granular soils or stony cohesive soils).
- c. If soil treatment of the Macamore Clay – Glacial Till (or any other soils) is proposed by the Contractor, a Soil Treatment Design Mix is required on the proposed methodology. The Employer's Representative is to review the Design Mix report. A compaction trial with proposed soil treatment percentages is required and is to be witnessed by the Employer's Representative. Following the compaction trial, the results shall be subject to review by the Employer's Representative of the compaction and strength achieved in the treatment material before use on site.

APPENDIX 16/1

General Requirements for Piling and Embedded Retaining Walls

1. Introduction

The project specification for Piling and Embedded Retaining Walls, as presented here in, should be read in conjunction with the latest version of the TII Publication 'Specification for Road Works Series 1600 - Piling and Embedded Retaining Walls' and the project-specific civil and structural specifications and project drawings.

2. Nature of Piling Works

The piling works refer to piling and embedded wall elements as depicted on the project drawings, and as described in this project specification and other project documents.

Table 16/0.1: Summary of piling

Structure	Quantity	Piling reference drawing(s)	Pile Dimensions / Section / Layout
Bridge B1 Bearing Piles	24 no. working piles for two bridge abutments	Bored cast in place (BCIP) or CFA types. (Contractor to select most appropriate method for site conditions).	0.7m diameter 9.78m length cut off level Layout as shown on Drawings

Piles are generally required for the following aspects of the scheme development:

- a. Bearing Piles: Bearing piles are required to support the new N25 mainline over the Dublin to Rosslare Europort railway line. Bearing piles shall be reinforced in-situ concrete bored or augured pile type as per the dimensions / geometry and layout shown on the project drawings. The Contractor is required to determine the most appropriate method of pile installation taking account of site- specific ground and groundwater conditions, spatial site constraints, and the proximity of existing railway infrastructure to be safeguarded during construction works.

The Contractor shall review and take account of all available ground investigation information for the site in support of the selected bearing pile installation methodology.

3. Project drawings

The proposed locations of individual bearing piles for the B1 foundations are shown on the project drawings 229100548-MMD-1700-RE-DR-C-2008.

The drawings show the number and layout of bearing piles. The following details are included on the drawings:

- a. Pile I.D. refs and setting out coordinates for bearing piles.
- b. Pile head cut-off-levels (COL) to suit bridge sub-structure designs.
- c. Bearing pile diameter and working pile length below COL.
- d. Bearing pile steel reinforcement cage details and steel anchorage projection above COL.
- e. Indicative location of preliminary test piles associated with bridge B1.

4. Submission of information

The Contractor shall supply the following information in accordance with the agreed contract timescales and at least 4 weeks prior to mobilisation to site.

Bearing piles:

- a. Comprehensive method statement and risk assessment for execution of the piling works, including proposed piling method, details of piling plant & equipment, sequence of pile installation, use of casings or bore support, concreting proposals and placement method, steel reinforcement cage installation, structural monitoring proposals for existing bridge and railway, noise and vibration mitigation proposals, and access proposals.
- b. Safeguards to be established for working in the railway environment and adjacent to water with piling plant and equipment.
- c. Working platform design to accommodate piling and attendant plant at bridge abutment locations; to include design calculation package relating to specific plant proposed for use on site.
- d. Proposals for installation of preliminary test piles and execution of maintained static load tests, including details of proposed reaction system and pile head movement monitoring set-up.
- e. Proposed methods of pile integrity testing and materials testing.
- f. A list of site records to be kept, including records for each pile installed, for quality control and quality assurance purposes.

The Contractor shall produce detailed records of the piling works implemented (installation and testing) to include all information listed in Table 16/1 of TII Series 1600 and the requirements of this project specification.

5. Design standards and criteria

The Contractor is required to construct and test piles in accordance with Eurocode 7, current European Execution Standards, TII Series 1600, industry best practice, this project specification, and the following:

- a. Eurocode 7 and corresponding National Annex, with appropriate partial factors for design, for Ultimate and Serviceability limit state verification of retaining structures, associated wall elements, and supported earthworks.
- b. Design life for structures, as stated in the specification.
- c. Performance requirements for structures, as stated in the specification.

6. Particular requirements

The following particular requirements shall apply to the piling works:

- a. The Contractor should undertake a site walkover inspection to identify the current site conditions to inform planning and programming of the proposed piling works.
- b. The Contractor shall liaise with the Employer and Employer's Representative to ensure that all site constraints are identified and fully understood such that these are accounted for in the design, planning, preparation, and execution of the piling works. Aspects of the site that may constrain piling works include, but are not limited to, the following:
 - i. Working in the railway environment and adjacent to existing railway infrastructure.
 - ii. Existing services and buried utilities that must be safeguarded from damage and distress.
 - iii. Noise and vibration restrictions.
 - iv. Site working hours and controls related to working in the railway environment.
 - v. Proximity to structures and existing railway bridges.

- vi. Demolition, clearance and enabling works ongoing in areas of the site.
- vii. Ground conditions including presence of natural and/or man-made sub-surface obstructions and variable natural stratigraphy.
- c. Piling works are anticipated to commence on site following enabling works and installation of a working platform to accommodate piling rigs and associated attendant plant & equipment. The Contractor shall determine and make provision for access to all pile locations and make provision for any temporary works necessary to safely access (including provision for trackside access where required).
- d. Pile installation tolerances shall be as per TII Series 1600.
- e. The Contractor shall confirm the pile commencing surface, taking cognisance of site topography, and proposed pile cut-off-levels for bridge bearing piles.
- f. The Contractor shall trim concrete pile heads to the cut off levels as stated on the project drawings. Debonding foam / jacket to be applied to vertical steel reinforcement above pile COL to assist pile head trimming operations, where practical.
- g. Pile steel reinforcement shall extend nominally 40 x bar diameter (or as otherwise shown / stated on the project drawings, whichever is the greater) and be connected into reinforced concrete sub-structures. Pile steel anchorages shall comply with Eurocode requirements and the project specification.
- h. Concrete cover to pile steel reinforcement shall be 75mm, unless otherwise stated.
- i. The Contractor shall collate detailed construction observations for bearing pile installation and produce a set of pile records for each pile installed. The Contractor shall install bearing piles at the locations and dimensions as shown on the drawings, ensuring sound structural integrity and durability of the reinforced concrete elements.
- j. Load tests on working piles shall be installed and undertaken at locations to be agreed with the Contractor. Load tests are required to demonstrate the successful installation of the Contractor's proposed piling method (in the site-specific ground conditions) and to verify load-settlement performance of the bearing pile design. The Specified Working Load (SWL) of proposed bearing piles is 1712kN in axial compression and the maximum test load for preliminary pile testing shall be 300% SWL.
- k. The Contractor shall adopt appropriate piling techniques and methods of working so as not to cause any damage or distress to neighbouring structures or buried services (existing or newly constructed) or adversely affect adjacent site activities.
- l. The Contractor shall adopt appropriate piling techniques and methods of working, including the implementation of any track protection measures, so as not to cause any damage or distress to the existing rail line.
- m. The Contractor is responsible for review and interpretation of all available site data and factual ground investigation (GI) information to enable sub-surface characterisation to facilitate the design, execution and testing of piles (as applicable). The Contractor shall identify ground-related risks at the site based on the available data (including information on geology, geo-environmental, geo-chemical, groundwater, buried services, and existing foundations), and from previous experience of piling in similar site conditions, and take cognisance of these in the planning and execution of the piling works (including the choice of pile type and proposed piling plant & equipment).
- n. Assessment of groundwater levels across the site shall be undertaken by the Contractor using the available GI factual reports. Design groundwater levels selected by the Contractor for retaining wall designs shall take cognisance of site observations and wall type proposals and will be subject to review by the Employer and Employer's Representative.
- o. Ground movements shall be minimised by the appropriate design of retaining structure elements and selection of plant which will ameliorate ground disturbance from piling operations. Ground movements estimated by the Contractor from piling operations shall be advised to the Employer and Employer's Representative for review, prior to the installation of piles.

APPENDIX 16/3

Bored Cast-in-Place Piles

1. General

The Contractor may propose a Bored Cast-in-Place (BCIP) pile type for the construction of the 0.7m diameter bridge bearing piles, subject to the Contractor's proposed piling methodology. The Contractor is responsible for selecting the most appropriate method of piling to form the reinforced concrete bearing piles as shown on the project drawings, taking cognisance of the site-specific ground conditions, access constraints, and proximity to existing railway infrastructure. The Contractor shall be responsible for the quality of the reinforced concrete piles installed on site, as verified by piling records and pile integrity and load testing results. The proposed method of piling will be subject to review by the Employer and Employer's Representative.

2. Particular requirements

The following particular requirements apply to the use of BCIP piles.

- a. BCIP piling shall be implemented in accordance with Clause 1603 of TII Series 1600 and the requirements of BS EN 1536.
- b. The Contractor shall provide a detailed risk assessment and method statement (RAMS) for the installation of BCIP piles, to include use of temporary casings or bore support in the site-specific ground conditions, as applicable. The use of permanent steel casings and/or support fluid is not anticipated in the pile design.
- c. Details of proposed concrete mix design shall be provided by the Contractor, to account for the proposed method of concrete delivery / placement using tremie.
- d. Contractor's on-site inspection and testing plan, applicable to the BCIP pile type, shall be provided for review by the Employer and Employer's Representative.
- e. Contractor to provide details of the proposed piling rig to be used and its accessibility on site, noting the railway environment.
- f. Contractor to provide proposals for integrity testing of the BCIP piles, for consideration by the Employer's Representative. Details to include stage of testing, and specific methods to be employed.
- g. The Contractor shall adopt appropriate piling techniques and methods of working, including the implementation of any track protection measures, so as not to cause any damage or distress to the existing rail line.

APPENDIX 16/4

Bored Piles Constructed using Continuous Flight Augers and Concrete or Grout Injection through Hollow Auger Stems

1. General

The Contractor may propose a Continuous Flight Auger (CFA) pile type for the construction of the 0.7m diameter bridge piles, subject to the Contractor's proposed piling methodology. The Contractor is responsible for selecting the most appropriate method of piling to form the reinforced concrete bearing piles as shown on the project drawings, taking cognisance of the site-specific ground conditions, access constraints, and proximity to existing railway infrastructure. The Contractor shall be responsible for the quality of the reinforced concrete piles installed on site, as verified by piling records and pile integrity and load testing results. The proposed method of piling will be subject to review by the Employer and Employer's Representative.

2. Particular requirements

The following particular requirements apply to the use of CFA piles.

- a. CFA piling shall be implemented in accordance with Clause 1604 of TII Series 1600 and the requirements of BS EN 1536.
- b. The Contractor shall provide a detailed risk assessment and method statement (RAMS) for the installation of CFA piles, to include auger type & length, use of temporary casings or bore support in the site-specific ground conditions, as applicable. The use of permanent steel casings is not anticipated in the pile design.
- c. Details of proposed concrete mix design shall be provided by the Contractor, to account for the proposed method of concrete delivery / placement through hollow stem auger.
- d. Contractor's on-site inspection and testing plan, applicable to the CFA pile type, shall be provided for review by the Employer and Employer's Representative.
- e. Contractor to provide details of the proposed piling rig to be used and its accessibility on site, noting the railway environment.
- f. Contractor to provide proposals for integrity testing of the CFA piles, for consideration by the Employer's Representative. Details to include stage of testing, and specific methods to be employed.
- g. If selected for use on site, CFA piles shall be constructed using suitably robust and powerful rigs and equipment with high torque & tooling capable of penetrating the ground to the design depth without premature refusal. The Contractor shall clearly set out in their RAMS the process for site-based verification of ground conditions for each CFA pile installed. Using the automated installation rig monitoring data as part of the verification process, the Contractor will be required to demonstrate achievement of design pile toe elevation and ground properties for review by the Employer's Representative.
- h. Contractor to provide a description of how the CFA rig operator and Contractor's site engineer will interpret the real-time information gleaned from the rig telemetry feedback, drilling rate, applied torque etc. with regards to pile depth and ground conditions.
- i. The Contractor shall seek agreement from the Employer's Representative to terminate CFA auger penetration at the design toe level prior to commencement of concreting.
- j. Automated CFA installation data traces shall be captured by the Contractor and provided to the Employer's Representative for review.
- k. Practical refusal criteria for CFA pile installation, linked to the site-specific ground conditions, shall be defined by the Contractor within the submitted RAMS.

- I. The Contractor shall adopt appropriate piling techniques and methods of working, including the implementation of any track protection measures, so as not to cause any damage or distress to the existing rail line.

APPENDIX 16/8

Non-Destructive Methods for Testing Piles

1. General

Non-destructive testing of piles shall be undertaken by the Contractor in accordance with the requirements of this project specification, TII Series 1600, and the best practice guidance given in CIRIA Report R144 (Turner, 1997).

The Contractor shall adopt appropriate techniques and methods of working, including the implementation of any track protection measures, so as not to cause any damage, distress or disruption to the adjacent, operational rail line.

Integrity testing shall be one or more of the following methods: -

- Low strain integrity testing
- Cross-hole sonic logging method
- Thermal Integrity Profiling (TIP)

All bearing piles are to be tested using low strain integrity testing.

Table 16/8.2: Non-Destructive Pile Testing

Location	Pile diameter (m)	Pile Type	Testing proposed
B1	0.7	Bearing	Low strain integrity testing (all piles) Thermal Integrity Profiling / Cross-hole sonic logging method – 4 No. piles.

2. Particular requirements

The following particular requirements apply to low strain integrity testing of in-situ concrete bearing piles.

- All bearing piles shall be subjected to post-construction integrity testing using low-strain techniques, to assess their structural integrity and ensure they are free from any significant structural faults which could be detrimental to performance or durability of the pile in service.
- The following method of pile integrity testing is to be undertaken as a minimum:
- Transient Dynamic Response (TDR), also known as Impulse Response, or similar alternative low-strain hammer impact test applied at pile head.
- Testing shall only be undertaken by an experienced testing organisation independent of the piling contractor and approved by the Construction Manager. The Contractor shall submit to the Construction Manager details of the proposed testing organisation.
- The Contractor shall make available to the testing organisation's representative on site a plan showing the layout and the constructed length of the piles to be tested.
- Testing shall not be carried out on a pile within seven days of casting. The pile head shall be prepared by removing all loose material and debris to expose sound concrete over an approximately horizontal top surface and be kept free of standing water.
- Interpretation and reporting of integrity test results shall be carried out by the Contractor and integrity test results promptly submitted to the Employer's Representative for review and comment.
- A report of integrity test results should contain a paragraph of conclusions that summarises the opinion of the Contractor (testing specialist) as to the integrity of the piles tested. For example, if no clear signal response is detected from the pile toe using

TDR testing, and no significant reflections are observed along the pile shaft, the Contractor should comment as to what depth in his opinion the test results indicate the pile shaft to be free from significant structural faults prior to the loss of stress-wave energy through signal damping. Comment should be made by the Contractor on the likely cause of the signal attenuation and the length of the pile over which its integrity is deemed inconclusive from the test results.

- i. Preliminary results of the tests shall be submitted by the Sub-Contractor to the Contractor within 7 days of carrying out the tests.

Selected bearing piles shall be tested by using the cross-hole sonic logging method. The following particular requirements apply to using the cross-hole sonic logging method of testing in-situ concrete bearing piles.

- a. Testing will be carried out by an approved testing company holding UKAS or similar accreditation for the Sonic Logging method of assessing foundations and shall be approved by the Employer's Representative.
- b. It is recommended that the access tubing used shall be 38mm internal diameter screwed and socketed, medium gauge, varnished mild steel tubing manufactured according to BS 1387. The tubes shall be sufficiently regular and free from defects so as to permit the free unobstructed passage of the probes. They shall be watertight, free from corrosion with clean internal and external faces, the latter to ensure a good bond between the concrete and tubes. Care shall be taken during concreting not to damage the tubes. If a tremie is used, it shall not be allowed to rest on top of the tubes during concreting.
- c. The Contractor shall submit his proposals for the installation of the tubes to the Employer's Representative 4 weeks prior to construction. The tubes shall be installed as near to parallel as possible. Where several sections of tubing are required to reach the full length, the joints shall be made watertight.
- d. Levels are to be taken on top of each tube and each tube should be plumbed and the length recorded. These details are to be provided to the testing company together with the toe level and the cut-off level of the pile before testing commences. A plan shall be provided showing the layout of piles on the site and the piles to be tested shall be clearly indicated to the testing engineer together with the numbering used for the tubes.
- e. Tubes shall be checked to ensure they are free from blockages and filled with water, prior to our arrival on site. Where only 3 tubes per pile are provided, sonic measurements shall be made between each pair of tubes. Where 4 tubes per pile are provided, pairs of tubes around the periphery shall be tested, followed by testing between diagonally opposite tubes.
- f. All tests shall be carried out by lowering the probes to the base of the tubes and raising them simultaneously, maintaining the probes in the same horizontal plane.

Selected bearing piles shall be tested by using the thermal integrity profiling. The following particular requirements apply to using the cross-hole thermal integrity profiling of in-situ concrete bearing piles.

- a. The following details shall be presented / interpreted in the test report:
 - i. Pile details (as for sonic logging described in 4.3.8)
 - ii. Installation details for the fibre-optic cables.
 - iii. A heat development map showing heat development over time
 - iv. Temperature change profiles from the installed fibre optic cables
 - v. A presentation/comparison with ground conditions.
- b. The piling contractor shall confirm the proposed specification where thermal integrity profiling (TIP) is to be used.

APPENDIX 16/9

Static Load Testing of Piles

1. General

- a. Static load (maintained load) testing of piles shall be undertaken by the Contractor in accordance with the requirements of this project specification, TII Series 1600, and the best practice guidance given in CIRIA Report R144 (Turner, 1997).
- b. Maintained load axial compression testing, data processing, interpretation and reporting of test results shall be carried out by the Contractor on two preliminary test piles (one located at each bridge abutment) for the demonstration of load-settlement performance and axial load-carrying capacity.
- c. The location of test piles are to be confirmed on site, to the approval of the Employer's Representative, to suit access and set-up constraints. The Contractor shall adopt appropriate techniques and methods of working, including the implementation of any track protection measures, so as not to cause any damage, distress or disruption to the adjacent, operational rail line.

2. Particular requirements

- a. The Contractor shall submit a method statement for carrying out the static load tests no less than 21 days before mobilisation of the test load equipment. The method statement shall include for full details of the test load equipment, including:
 - i. method of applying the load and providing the reaction,
 - ii. any calculations for provision of reactions,
 - iii. load monitoring systems,
 - iv. movement monitoring systems.
- b. The testing procedure shall be a maintained load compression test.
- c. Static load testing shall be undertaken after the results of integrity tests on the test piles have been reviewed and accepted by the Employer's Representative.
- d. Static load tests shall be carried out using the Maintained Load (ML) test method, based on multi-cycle extended proof-load testing as per TII Series 1600 Clause 1609. The maximum test load shall be 300% SWL in compression.
- e. Measurement of applied load shall be by use of electronic transducers. Dial gauges shall not be permitted. Measurement equipment shall be protected from sunlight and wind, and care is to be taken to ensure that devices and reaction systems are not subject to vibration. Use of fibre-optic measurement systems is also permitted.
- f. Test piles shall be constructed and tested during the construction of the permanent works piles at each test location.
- g. The Contractor shall provide details of the pile test set-up and reaction system including apparatus for application of load and measurement of pile head deformations. The number of reaction piles / ground anchors required for each pile test shall be determined by the Contractor to suit the applied loads, ground conditions and site accessibility.
- h. The time interval between casting of an in-situ concrete pile and commencement of static load testing shall be a minimum of 14 days, unless otherwise directed or agreed by the Employer or Employer's Representative.
- i. The Contractor shall carry out static load tests at a pile head elevation agreed by the Employer's Representative. Cognisance must be taken of pile length during test and any

implications on the representativeness of the test results to working pile length below defined COL.

