

# Pell Frischmann

## Waun Maenllwyd Wind Farm

### Belltown Power UK Limited

Geotechnical Site Investigation and Access Road Design Technical Note

Project	Waun Maenllwyd, Wales
Client	Belltown Power UK Limited
Document Title or Subject	Geotechnical Site Investigation and Access Road Design Technical Note
Document Reference	108080100
Revision	01
Prepared by	[Redacted – Regulation 13 Personal Data] (Pell Frischmann)
Date	22/07/2024

## 1 Introduction

Pell Frischmann have been commissioned by Belltown Power UK Limited to undertake a Geotechnical Site Assessment Report and Access Road Design. The proposed project involves constructing an access road to facilitate the transportation of turbine blades for the Waun Maenllwyd Wind Farm. The haulage trucks are expected to have a gross weight ranging from 112 to 135 tonnes, with axle weights between 8 and 11.8 tonnes. These loads will be distributed across 2- and 4-wheel per axle configurations. The designated access road, covered in this technical note, is situated at the intersection of the A482 and a private track road in the southern part of Pumsaint, Llanwrda (Northing: 240516, Easting: 265664). The private forest track east of the A482 is paved.

The proposed access road lies within a scheduled monument, with buried archaeological remains which are deemed nationally significant. During the site investigation, Cadw archaeologists identified remnants of Roman pottery in the underlying strata beneath the access road. Consequently, this strata is considered archaeologically sensitive and protected by government regulations.

The extent of the scheduled monument was obtained by the Historic Wales GIS Mapping Service and is presented in **Figure 1**.



Figure 1.

The site investigation was conducted in collaboration with the Welsh government's historic environmental service, Cadw. The study involved a series of archaeological exploration trenches. During the site visit, Cadw had completed one trench to a depth of 1.2 meters below ground level (bgl) and was in the process of excavating two additional trenches. However, at the time of inspection, these additional trenches had only been excavated to a depth of 0.2 meters bgl, providing limited geotechnical information.

In the subsequent sections, the proposed engineered solution for constructing the access road, while safeguarding the existing archaeological strata from any adverse impact, is presented.

## 2 Site Investigation

### 2.1 Site Geology

The British Geological Survey (BGS) maps the site as being underlain by Superficial River Deposits comprising sand and gravel, locally with lenses of silt, clay or peat, and Claerwen Group Mudstone bedrock comprising predominately mudstone with subsidiary laminated hemipelagic mudstone. The shallow depth of the trenches and the presence of archaeological fill prevented direct observation of the mapped geology. However, historical borehole data the vicinity of the site, obtained from the BGS online database, corroborates the aforementioned geological strata, which is likely to extend to greater depths within the site.

### 2.2 General

As previously mentioned, the site investigation comprised a series of archaeological exploration trenches. During the Pell Frischmann site investigation, one of these trenches had been fully excavated. The trench was logged by a senior geotechnical engineer and is designated as TP-01 for the purposes of this report. **Figure 2** illustrates the approximate location of all the trenches. The log for Trench TP-01 is presented in Appendix A.

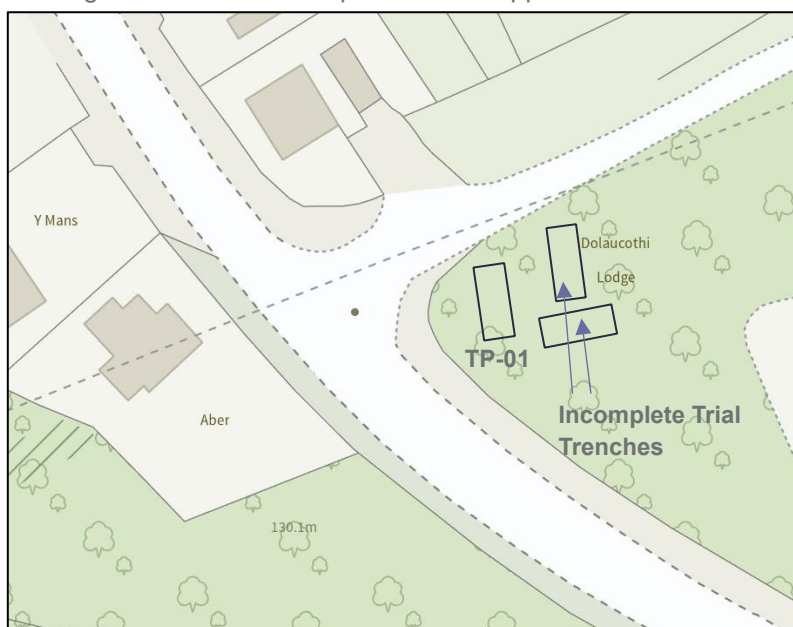


Figure 2.

The underlying strata identified at the site was generally a non-cohesive gravelly Made Ground with a small fraction of silt. The geotechnical parameters used for this report were derived from in-situ testing and published presumptive values.

Insitu testing involved determining undrained shear strength parameters using the tactile criterion method proposed by Look (2007), Section 2.14, *Handbook of Geotechnical Investigation and Design Tables*. Additionally, the undrained Young's modulus was determined through correlations with the undrained shear strength, following the guidelines from CIRIA 126.

### 2.2.1 Geotechnical Parameters

Proposed characteristic geotechnical design parameters are summarised in **Table 1**.

Strata	Depth to Bottom of Strata (m bgl)	Unit Weight	Undrained Shear Strength, $S_u$ (kPa)	Undrained Youngs Modulus <sup>1</sup> $E_u$ (kPa)
Topsoil	0.25	16	-	-
Made Ground (Recent)	0.55	17	-	-
Topsoil (Buried)	0.7	17	50	10,000
Made Ground (Upper Roman Fill)	1.2	18	100	20,000
Made Ground (Lower Roman Fill)	Not Proven	18	200	40,000

**Table 1: Ground Model**

<sup>1</sup> Assuming an  $E_u/C_u$  ratio of 200.

## 2.3 Proposed Vehicle Loads

The proposed vehicle loads were provided by Pell Frischmann highway engineers and are based on the heaviest wind turbine components, including the wind turbine base section and nacelle (turbine housing). For design purposes, the nacelle vehicle loads represent the worst-case load condition. The practical wheel loading contact area was calculated using CIRIA SP123, Section 12.7.5 (Practical Wheel Loading), considering assumed dimensions for the largest vehicular lorry and tire pressures permitted on UK roads. **Table 2** presents the proposed vehicle loads and tire contact area.

Load Type	No of Wheels Per Axle	Axle Weight (t)	Effective Contact Pressure Radius (m)	Load Per Wheel (kPa)
Nacelle Vehicular Load	2	9	0.136	324
	4	11.8	0.136	213

**Table 2: Proposed Vehicle Loads**

## 3 Aluminium Trackway Plates

### 3.1 General

Following discussions with Cadw onsite, the proposed engineered solution should aim to minimise the impact of vehicular loads on the existing archaeological strata. As such, the design of the access road primarily adheres to serviceability requirements.

It is anticipated that the access road will be excavated to achieve a safe vehicular grade. This excavation will involve removing the upper topsoil and recent made ground materials above the archaeological strata, resulting in maximum earthworks cut of approximately 500 mm from the existing ground surface. Considering, the unit weight and depth of soil

removed, if undertaken diligently in 100mm increments, should result in no impact to the underlying archaeological strata. To reinforce the road, trackway plates will be placed atop the existing strata. These trackway plates offer nearly 100% load distribution, effectively spreading vehicular loads over a larger area and significantly reducing their impact. The load transfer beneath the proposed trackway pads ensures that the applied load is comparable to that of an average-sized human walking on the deposits. The aluminium trackway plate proposed as part of this design is present in **Figure 3**.



Figure 3: Aluminium Trackway Panel

3.2 Finite Element Analysis

An advanced finite element analysis has been conducted in Plaxis 3D, utilizing the geotechnical parameters from Section 2 and the trackway plate dimensions and mechanical properties obtained from aluminium trackway panel contractor Davis Trackhire Ltd. These trackway properties are presented in **Table 3**.

Trackway Dimensions			Mechanical Properties		
Section Width, mm	Section Length, mm	Section Depth <sup>1</sup> , mm	Alloy	Density	Modulus of Elasticity
3000	2401	16.4	6005 T6	26.46	70GPa

Table 3: Trackway Dimensions and Mechanical Properties (Davis Trackhire Ltd)

<sup>1</sup>Equivalent solid plate thickness

The proposed trackway plates were modelled as plate elements utilising the dimensions and mechanical properties presented in **Table 3**. The proposed vehicular loads presented in Section 2.1 have been utilised to calculate the vertical displacement within the archaeological strata.

The output of the Plaxis 3D model is presented in **Table 4**.

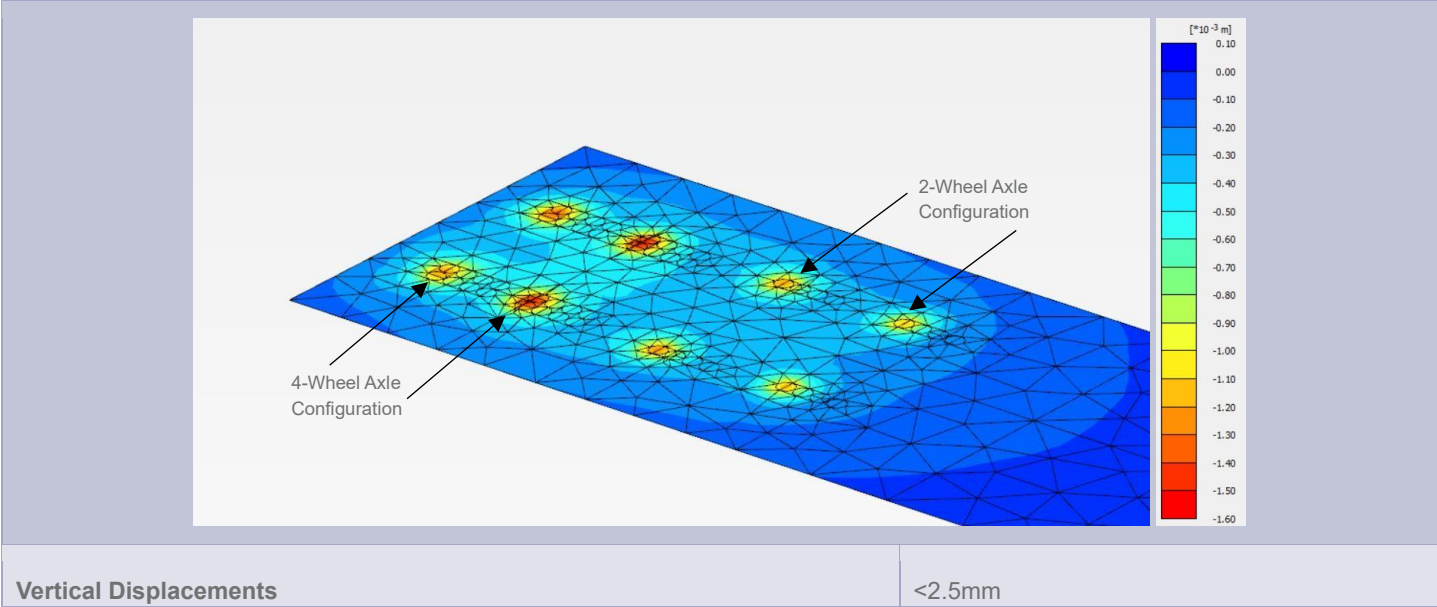


Table 4: Plaxis 3D Output, Vertical Settlement

3.3 Conclusion

Pell Frischmann has been commissioned by Belltown Power UK Limited to undertake a Geotechnical Site Assessment Report and Access Road Design for the proposed Waun Maenllwyd Wind Farm. The access road, located at the intersection of the A428 and a private track road in Pumsaint, Llanwrda, lies within a scheduled monument with nationally significant buried archaeological remains. During the site investigation, Cadw identified remnants of Roman pottery in the underlying strata. Our proposed engineered solution aims to construct the access road while safeguarding the archaeological strata. The maximum vertical settlements calculated indicate that adverse impact to the existing archaeological strata will be no more than that imparted by typical pedestrian loading.

## Appendix A

**PROJECT NUMBER** 108080100  
**PROJECT NAME** Waun Maenllwyd  
**CLIENT** BELLTOWER LTD  
**ADDRESS** PUMSAINT, WALES

EXCAVATION DATE 21/05/2024  
CONTRACTOR CADW  
DRILLING METHOD HAND EXCAVATION

LOGGED BY SMW  
CHECKED BY KS

## COMMENTS

Depth (m)	Penetration Resistance	Samples	Graphic Log	Material Description
0.5  				

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Rev	Suit	Description	Date	Originator	Checker	Approver
P01	1	Initial issue	22-07-2024	SMW	KS	KS

Ref. reference. Rev revision. Suit suitability.

# Pell Frischmann

## Waun Maenllwyd Wind Farm

### Belltown Power UK Limited

Geotechnical Site Investigation and Access Road Design Addendum

# Belltown Power UK Limited

## Geotechnical Site Investigation and Access Road Design Addendum

Project	Waun Maenllwyd, Wales
Client	Belltown Power UK Limited
Document Title or Subject	Geotechnical Site Investigation and Access Road Design Addendum
Document Reference	108080101
Revision	01
Prepared by	[Redacted – Regulation 13 Personal Data] (Pell Frischmann)
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## 1 Introduction

Pell Frischmann have been commissioned by Belltown Power UK Limited to undertake an addendum to the previously issued *Geotechnical Site Assessment Report and Access Road Design Technical Note, Report Ref: 108080100 (Appendix A)*. Through discussion with the client, it is understood the new proposed access route location is now approximately 20m North of the previous proposed access route location.

The findings within the previous report indicating that the use of aluminium trackway plates minimises adverse impacts on the underlying strata to levels comparable with typical pedestrian loading, are applicable to the new proposed site. However, it should be noted that Pell Frischmann have not undertaken a site survey of this new proposed location and do not have any site investigation data. As such, the underlying geological model developed would need to be established with further site investigation works.





Belltown Power UK Limited

Geotechnical Site Investigation and Access Road Design

Addendum

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Geotechnical Site Investigation and Access Road Design  
Addendum

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