

6003-MGC-XX-XX-RP-S-0001-S4-FOUNDATIONS

FOUNDATION SUBSTANTIATION



LOCATION AND SITE

There are currently no buildings in the location where the Library & Community Hwb is being proposed to be constructed. It is currently a car park situated behind the high street of Port Talbot, of the proposed site. Station Road is the high street behind the proposed site with the train station and bus station approximately 3 minutes' walk towards the southeast of the car park and a dual carriageway bypass A48 crossing over the top on the south and southwest side of the car park.

There are two churches towards the north of the site near the Afan River, located directly opposite Carmel Chapel is an electrical box underneath the current railway line that passes under the dual carriage way bypass south and southeast of the site.



The historic use of the land on the proposed site, the original mining of the Margam area was of coal, the main development in the industrial area was the Copper Company works at Taibach in 1770, with that came more development near Aberafon in the 1820's the Margam Tin Plate Works opened up north of the existing site with the iron production also starting production in the lower Afan Valley area (Historical Port Talbot, 2023).

PROPOSED DEVELOPMENT

Kate Peters a successful author of fiction novels for teenagers and children, has proposed to build a library & community hwb. The development will consist of a glulam timber post & beam frame and cross laminated timber panels and flooring. It will be primarily constructed from renewable materials and utilising renewable energy sources where possible.

INTERPRETIVE GROUND INVESTIGATION

The site lies within the south of the South Wales Coalfield, this strata within the coalfields consists of sandstone with imbedded coal seams as well as some siltstone and mudstone in the lower layers, alluvial fan deposits and Glacial Sand and Gravel are also present near the site.

The site is also at risk of ground water flooding near the surface, the closest water source is to the south being the Port Talbot Docks as well as the River Afan that passes across the south west of the site.

There is potential for land contamination associated with the previous history and use of the site, steel works, chemical works, and railway activities that have historically taken place on the site.

The ground investigations revealed that the ground conditions were found to be comprised of Made Ground and varies in composition, the made ground was coarse and granular with a mix of slag, ash, brick, concrete and stone, there were some materials such as glass and wood also found (Opus, 2018).

Geology	Typical Description	Depth to top of stratum (m bgl)	Depth to bottom of stratum (m bgl)	Thickness (m)
Made Ground	Medium dense gravelly silty sand with occasional bands of soft and firm gravelly clay recorded across the site. Gravel is angular to subangular, fine to coarse of ash, slag, clinker, sandstone, brick and concrete.	0.00	0.70 - 4.70	0.70 - 4.70
Cohesive Superficial Deposits	Soft and firm sandy gravelly clay with occasional organic matter. Gravel is subrounded, fine to coarse sandstone.	0.75 – 4.70	0.70 - 6.00	0.15 - 2.80
Granular Superficial Deposits	Medium dense to very dense, grey and brown sandy gravel with low to medium cobble content. Cobbles are angular to subrounded of sandstone. Gravel is fine to coarse, subangular to rounded of sandstone and siltstone.	0.70 – 6.00	6.50 - >20.40	5.50 - >15.70
South Wales Middle Coal Measures Formation	Thinly interbedded strong grey highly weathered sandstone and grey weak highly weathered mudstone	6.50*	>8.00	>1.50
* Bedrock recorded beneath the Granular Superficial Deposits in BHH04R only (i.e. east/ north-east area of the site).				

Table 1 Ground Model for Port Talbot Harbourside historical borehole data

Due to the Made Ground and the variation in the thickness and composition of it across the area of the site, the stratum is not a bearing stratum and unsuitable for foundations. The stratum would be suitable for lightly loaded structures, ranging from 85kN/m² - 250kN/m² with shallow pad foundations. There is a recommendation to add vibro-stone columns as ground improvement works, there however could be limitations of the effectiveness of improvement works due to the presence of ground obstructions.

The Kate Peters library and community hwb will span over a large area mainly consisting of timber over 3 storeys high, therefore a heavily loaded structure and piles would need to be considered and recommended.

- Self-weight of the pile and weight of the soil displaced during construction approximately cancel each other out;
- Groundwater assumed to 1m below ground level;
- Assuming suspended floor slabs are adopted;
- No shaft resistance from Made Ground/ Cohesive Superficial Deposits and proposed engineered fill;
- No allowance has been made for negative skin friction resulting from the Cohesive Made Ground/ Superficial Deposits;
- Global factor of safety of 2.5;
- No load testing of working or preliminary piles;
- Pile spacing of at least 3 x pile diameter;
- Pile lengths from existing ground level; and
- C40 Concrete.

Floor slab should be suspended.

(Opus, 2018)

Pile Length (m)	Safe Working Capacity (kN)			
	300mm diameter	450mm diameter	600mm diameter	750mm diameter
10	265	505	810	1150
12	360	670	1070	1550

Table 2 Pile Calculations recommendations for Port Talbot Harbourside

FOUNDATION RECOMMENDATION

Calculations for foundation recommendation.

These calculations were based on dead loads and live loads and the considerations of a 19mm thick hard wood flooring based on the glulam timber columns connected to each pile.

Total load

$$(0.27 + 3) \times (8 \times 8) \times 4 \times 1.15 = 962.7 \text{ kN}$$

Therefore the recommended pile would be based on table 2:

1. 4no piles at 10m in length and 300mm in diameter
2. 3no piles at 12m in diameter and 300mm in diameter

We have selected 4no piles.

The column and beam sizes were selected according to Buckland Timber Glulam Beam Strength Grads and Span Tables specifications.

Strength class of GL24h

Strength Class	Bending Strength	Tensile Strength	Tensile Strength	Compression Strength	Compression Strength	Shear Strength	Modules of Elasticity			Shear Modulus	Characteristic Density kg/m ³
							Mean	Fifth percentile	Mean		
			Parallel to the grain	Perpendicular to the grain	Parallel to the grain	Perpendicular to the grain	Parallel to the grain	Parallel to the grain	Perpendicular to the grain		
	$f_{m,k}$	$f_{t,0,k}$	$f_{t,90,k}$	$f_{c,0,k}$	$f_{c,90,k}$	$f_{v,k}$	$E_{0,mean}$	$E_{0,05}$	$E_{90,mean}$	G_{mean}	P_k
GL20h	20	16	0.5	20	2.5	3.5	8400	7000	300	650	370
GL24h	24	19.2		24			11500	9600			420
GL28h	28	22.3		28			12600	10500			460
GL30h	30	24		30			13600	11300			480
GL32h	32	25.5		32			14200	11800			490

Save Table showing allowable spans in M for varying section sizes and loads - Glue Laminated Timber - GL24h												
Section	Floor						Roof					
Size (mm)	Load Width or Beam Centres (m)						Load Width or Beam Centres (m)					
	2	2.5	3	3.5	4	4.5	2	2.5	3	3.5	4	4.5
180 x 520	10.18	9.50	8.91	8.49	8.10	7.78	11.88	11.05	10.40	9.88	9.45	9.09

(Buckland Timber, 2024)

REFERENCES

Buckland Timber. (2024, April 17). *Glulam Beam Span Tables / Strength Grades*. Retrieved from Buckland Timber:
<https://www.bucklandtimber.co.uk/glulam-span-tables-strength-grades/>

Digi Map. (2023, October 22). *Historic Digimap*. Retrieved from Digimap:
<https://digimap.edina.ac.uk/roam/map/historic?unifiedClient=true>

Historical Port Talbot. (2023, October 22). *A brief history of Port Talbot*. Retrieved from Historical Port Talbot:
<http://www.historicalporttalbot.com/>

Opus. (2018). *Neath Port Talbot Harbourside Interpretive Geo-Environmental Ground Investigation Report*.