

### **Containment Bund Design Report**

Job No. 24727

Attleborough AD Plant Attleborough, Norfolk, NR17 1AE

**Client: Attleborough AD Plant Limited** 

**Prepared By: Danica Davis** 

December 2021

**Revision 0** 



civil / structural / environmental / surveying





### **REPORT CONTROL SHEET**

Client:	Attleborough AD Plant Limited	Job No.:	24727
Project Name:	Attleborough AD Plant, Attleborough, Norfolk, NR17 1AE		

Issue				
Revision 0	December 2021	Report Prepared by:         Danica Davis B.Sc (Hons)         Graduate Technician         Report Reviewed & Authorised by:         Oliver Jones B.Sc(Hons), CEng MIET, EngTech MICE, GCInstCES, AMIMechE		
		Oliver Jones B.Sc(Hons), CEng MIET, EngTech MICE, GCInstCES,		
		Director - Projects		

### CONDITIONS OF INVESTIGATION & REPORTING

This report and its findings should be considered in relation to the terms of the brief and objectives agreed between Plandescil Ltd and the Client.

The details contained in this report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by Plandescil Ltd has not been independently verified by Plandescil Ltd, unless otherwise stated in the report.

This report was prepared and provided for the sole and specific use of the client. Plandescil Ltd shall not be responsible for any use of the report or its contents for any other purpose. Copies of the report to other parties for information should be copied in full but Plandescil Ltd shall extend no professional liability or warranty to other parties in this connection without written consent.

The copyright of this report and other plans and documents prepared by Plandescil Ltd are owned by them.



### CONTENTS

	REPORT CONTROL SHEET	3
	CONTENTS	4
1.0	BACKGROUND INFORMATION	5
2.0	ANAERBOBIC DIGESTION SITE LAYOUT, PROCESS & CONCEPT	5-7
3.0	DESIGN & METHODOLOGY OF CONTAINMENT BUND	7-8
4.0	REVIEW PERIODS DURING CONSTRUCTION	9
5.0		10
6.0	APPENDIX DETAILS AND DRAWINGS EXPLAINED	11-12

DRAWINGS, CALCULATIONS AND SPECIFICATIONS APPENDIX (Listed in 6.0 APPENDIX DETAILS AND DRAWINGS)



### 1.0 BACKGROUND INFORMATION

- 1.1 Plandescil Ltd have been commissioned to provide the construction specification and details for the civil engineering elements associated with the proposed food waste processes and upgraded existing crop-based processes at Attleborough Anaerobic Digestion Plant in Attleborough, Norfolk. This appointment was received by the client, Attleborough AD Plant Limited. The new food waste processing plant and the existing crop-based processing plant are to be entirely segregated from a process perspective. Nevertheless, both sites share a common drainage system and secondary containment bund structure. Both food waste and crop-based plants will be operated by Eco Verde Energy.
- **1.2** The intention of this report is to clarify any outstanding details for the Environment Agency. It provides the design rational for the secondary containment bund at Attleborough AD Plant, along with requirements for operation and maintenance.
- 1.3 The existing site consists of an existing crop based Anaerobic Digestion Plant, including 2No. existing silage clamps, 3No. existing digester tanks, 1No. existing digestate lagoon and 1No. existing dirty water holding pond. The proposed site is to incorporate a new reception building which will be used for the processing of food waste. The proposed site will also include the installation of 4No. fermenter / post-fermenter tanks, as well as other processing tanks compromising; 1No. Ferric Chloride Tank, 4No. Pre-Storage Tanks and 3No. Pasteurisation Tanks. The 12No. new tanks will be constructed within a proposed CIRIA C736 reinforced concrete secondary containment bund. 2No. new lined digestate lagoons and 1No. new lined surface water attenuation pond are also included in the new site proposals, as well as the reinstatement and re-lining of the existing dirty water holding pond. Additionally, 1No. lined sump pit style leachate tank has been proposed.

### 2.0 ANAEROBIC DIGESTION LAYOUT, PROCESS & CONCEPT

- **2.1** Attleborough AD Plant Limited have instructed Plandescil Ltd to undertake the civil engineering design of the secondary containment bund, hardstanding areas and site drainage for the Attleborough Anaerobic Digestion Facility located in Attleborough, Norfolk.
- 2.2 The containment bund has been designed and constructed in accordance with the latest Environment Agency (EA) guidance document, CIRIA C736 - *Containment Systems for the Prevention of Pollution,* and is designed to be fully SSAFO compliant. Following approval of the design by the project design team and client, the civil engineering contractor, O'Brien Moran & Co Ltd. have been instructed to construct the containment bund in accordance with Plandescil designs. Plandescil have also been tasked with reviewing the construction of the containment bund throughout the build.
- **2.3** Upon finalisation of the site's mechanical and electrical process equipment, the size and capacity of the containment bund was established. A number of liquid-retaining structures



were to be located within the secondary containment bund and had been accounted for within the capacity calculations, including:

- 1No. 26.00m diameter and 8m high post-fermenter tank
- 3No. 26.00m diameter and 8m high fermenter tank
- 2No. 22.75m diameter and 4m high digester tank
- 1No. 19.00m diameter and 4m high Fermenter Tank
- 1No. 10.00m diameter and 6m high pre-storage tank
- 3No. 3.50m diameter and 8m high pre-storage tank
- 3No. 3.00m diameter and 5.50m high pasteurisation tank
- 1 No. 3.20m diameter and 2.50m high Ferric Chloride Tank
- 2.4 The containment capacity is designed in accordance with CIRIA C736, with the calculations demonstrating 25% of the combined volume of the tanks to be a greater volume than 110% of the largest tank volume (displayed on the attached calculation spreadsheet). The proposed footprint of the containment area allowed for the walls to be constructed to a minimum height of 1.75m, which included 250mm freeboard capacity as per page 85 of CIRIA C736. The containment bund occupies an internal footprint area of just over 7,100m<sup>2</sup>.
- 2.5 Minor reductions in level had been allowed for in the bund floor slab to enable rainfall to flow towards the designated sump collection pits. The regional specific rainfall data had been obtained and accounted for within the containment capacity checks.
- 2.6 To comply with the CIRIA C736 secondary containment requirements for the tank installations, it was agreed that all new storage tanks would be constructed with their concrete bases constructed on top of the secondary containment bund floor slab. This allows for a more accurate visual integrity inspection of the storage tanks during the operation phase of the Anaerobic Digestion Facility and provides an additional level of protection to the ground below. The existing 3No. Eco Verde Energy digester tanks are to share the same secondary containment bund structure as the new BioConstruct tank area, however, the bund floor slab will be a retro-fit installation in this existing location, appropriately sealed to the tank structures. The bund wall will remain as the same CIRIA C736 compliant design around the entire perimeter, with exception of the specialist flood gate opening in the south west corner.
- 2.7 The containment bund floor slab has been designed with surface falls to allow for the drainage of liquid towards the primary reinforced concrete bund floor sump, constructed at 3.20m length, 1.20m width and 1.60m depth. Pre-formed MDPE chambers with reinforced concrete surrounds are to be used for the remaining sump pits, installed around the bund floor perimeter, acting as a buffer to the primary sump pit and discharge location. Shallow prefabricated 'Ploycon' drainage channels within the containment bund concrete floor will be cast into the floor by the contractor, to direct the surface water flow towards the primary containment floor sump. All sump pits and drainage channels will be fully sealed and



encased in structural concrete. Refer to Plandescil Ltd. drawing No. 24727/104 Rev 0 for the containment bund drainage details.

- 2.8 Within the containment bund, the ferric chloride tank area will be managed independently with its own spillage capture sump at the designated filling point, as identified on Plandescil Ltd. drawing No. 24727/550 Rev 0. This sump will be manually pumped back into the AD food waste process as part of the operational management of the facility. This arrangement ensures no ferric chloride drippings enter the primary sump pit during the expected HGV tanker filling operations. Capturing any contaminated water from this location will subsequently ensure the overall philosophy of a clean water discharge to the surface water system from the main sump pit is not hindered, providing it is tested to be clean before discharge.
- 2.9 As part of the operational management of the facility, any containment bund liquid captured within the primary drainage sump will be routinely checked, and visually and olfactorily tested prior to being discharged to the surface water system as shown on the proposed drainage layout 'Plandescil Ltd Drawing No. 24727/552 Rev 0'. If the containment sump water is tested as 'clean', the liquid will discharge to the existing lined attenuation pond in the south of the site, via a pumped route. The surface water drainage system has been designed with capacity to allow for the clean internal bund drainage to be pumped into it at a rate of 2l/sec, instead of fully discharging as per a normal event.
- **2.10** Should the containment bund sump liquid be tested as 'dirty', the water will be pumped to the mixing pit within the proposed reception building, for use within the process. All options involve manually operated pumped pipework.

### 3.0 DESIGN & METHODOLOGY OF CONTAINMENT BUND

- **3.1** Following the design approval of the containment bund wall height, footprint area and internal arrangement, Plandescil completed the base slab detailing and wall reinforcement designs. It was agreed that the bund floor would be constructed from a jointed fibre reinforced concrete mix.
- **3.2** The fibre reinforced concrete mix was designed by fibre concrete specialists, Concribe. This was the preferred supplier from the local concrete batching plant used by the contractor.

The fibre mix design specification document provided by Concribe's designers can be found in the Appendix, outlining the proposed static loading and design details. Concribe proposed a single fibre mix specification for the concrete area surrounding the existing tanks, comprised of 150mm construction thickness, fully sealed and jointed to the tanks.

Concribe also proposed a single fibre mix specification for the concrete located under the proposed fermenter tanks and surrounding areas, comprised of 175mm construction



thickness. A layer of A393 steel mesh has been specified in the bottom of the 175mm thick slab to provide additional structural capacity in heavily loaded areas such as beneath fermenter tanks. A provision of 50mm cover is specified this reinforcement.

- **3.3** The containment walls are designed to water retaining concrete specification in accordance with CIRIA C736.
- **3.4** The walls are designed with a concrete toe which joins to the fibre reinforced concrete containment bund floor, creating a fully water retaining structure. The joint formed between the wall and the toe (noted as the kicker joint) during construction is waterproofed through the installation of 'Premcrete HydroStop BR' and is positioned centrally to the wall and runs along the entire perimeter of the containment bund. The joints between each six-metre construction section of wall are waterproofed through the installation of 'Premcrete HydroBar PVC Rearstop' at the base of the toe and 'Premcrete HydroBar PVC Centrestop' through the centre of the wall.
- 3.5 The interaction point between the retaining wall toe and the fibre reinforced concrete containment bund floor is formed into an expansion joint. The expansion joint consists of a connecting reinforcement bar between the two slabs that allows for differential movement. Between the two slabs 'Premcrete Exafoam' is installed and 20mm thick layer of 'Premcrete Intumescent Sealant' applied to the top. At the base of the joint, 'Premcrete 240mm HydroBar PVC Rearstop' is also installed. The waterproofing details described are shown on all drawings detailing the wall section as noted in the Appendix. Refer to Plandescil Ltd Drawing No. 24727/080 Rev B.
- **3.6** In addition to all of this, the contractor has also laid a Bentomat liner product below the jointed concrete layer to allow for an additional containment system below the entire containment bund system. This is installed beneath a 1200g DPM layer and sealed to the external side of the containment bund wall, 100mm above the kicker, forming a fully sealed structure. Details as presented in the Appendix.
- **3.7** The walls have been designed in accordance with CIRIA C736 and are designed to withstand the hydraulic load from a catastrophic failure and the typical operational static loads.
- 3.8 Any post cut saw joints within the fibre reinforced concrete slab or containment wall toe will be filled with an intumescent sealant no more than twenty four hours after cutting to assure water proofing capability. The saw cut joints are to be minimum 1/4 depth and maximum 1/3 depth of the total slab thickness. Details can be found on the drawings in the Appendix.
- **3.9** All pipes, ducts and cables are fixed on cable trays and stanchions positioned above the concrete containment, so as to not penetrate the containment floor or walls. This has been designed in accordance with CIRIA C736 to ensure any potential leakages are visible to onsite, operational staff whilst carrying out daily inspections of the containment bund structure.



### 4.0 **REVIEW PERIODS DURING CONSTRUCTION**

- **4.1** The construction of the containment bund will be reviewed at numerous stages throughout the construction phase. The Design Engineers, Plandescil, are responsible for visually inspecting the following elements of construction:
  - Concrete surfacing finish
  - Installation of waterproofing components
  - Installation of joint waterproofing materials
  - Defect remedial procedure and final finish



### 5.0 AD PLANT MAINTENANCE REGIME

- **5.1** Attleborough AD Plant's proposed maintenance regime consists of daily visual leak inspections within the bund and weekly inspections of the containment bund structure. The daily inspection will be carried out by the Client's site operative who will look for visual signs of leakage coming from the storage tanks or mechanical equipment located within the containment bund. If any tanks are found to be leaking, repair works will be undertaken by trained personnel immediately to halt the contamination of liquid within the containment bund.
- **5.2** The weekly inspections will require the site operative to visually inspect the containment bund walls and floor for any signs of cracking within the concrete. If any cracks are found remedial works will immediately be undertaken, using Sikaflex resin injection 'Sikadur 52' to fill and sea the cracks. This process will be carried out by a trained operative or specialist.
- 5.3 Any liquid which falls within the containment bund will be drained and collected into the sealed sumps within the bund. A switch operated pump will be located within the primary sump. Prior to the pump being routinely engaged by the site operative, a visual and olfactory inspection will be carried out to check for any contamination to the liquid within the primary in-situ reinforced concrete drainage sump. If the primary containment sump liquid is tested to be dirty, the pump will be manually switched to discharge any liquid into the AD process. If the liquid is tested as 'clean', the liquid will discharge to the lined surface water attenuation pond, via the pumped route shown on Plandescil drawing No. 24727/552 Rev 0.
- **5.4** The drainage system on site will be checked yearly. The site operators will check for sediment build up in manholes and pipes. The drains will be jetted where required. Manholes will be sludge gulped and checked for any signs of wear and tear, the joints will be resealed and the internals painted with bitumen paint if required.



### 6.0 APPENDIX DETAILS AND DRAWINGS EXPLAINED

### 6.1 Plandescil Ltd Details

Drawing No.	Title	<u>Comments</u>
24727/550 Rev 0	Proposed Site Layout	General site overview with plant items in key
24727/552 Rev 0	Proposed Drainage Layout	General site drainage overview with key
24727/553 Rev 0	Concrete Jointing Layout	Construction drawing showing areas of concrete and how they would be jointed
24727/080 Rev B	1.75m Containment Bund Wall RC Details (6m Bay)	Containment bund wall reinforced concrete and waterproofing design
24727/082 Rev B	Proposed Sump Pit R.C Plans, Elevations and Details	Containment bund sump pit reinforced concrete, waterproofing and elevation design
24727/103 Rev C	Typical Containment Bund Slab & Joint Details	Containment bund floor reinforced concrete and waterproofing design
24727/104 Rev 0	Typical Containment Bund Drainage Details	Containment bund drainage sump details
<u>Comments</u>		
24727 -080-A-01-BS - 1.75m High Containment Wall (6m Bay) Bar Bending Schedule		To be read in conjunction with Plandescil drawing No. 24727/080 Rev B
24727 –082-A-01-BS – Sump Pit Bar Bending Schedule		To be read in conjunction with Plandescil drawing No. 24727/082 Rev B
24727 – Containment Capacity Calculations Rev F		Calculation for bund capacity with finalised site layout

### 6.2 Premcrete Water Bar Details for the Containment Bund

ltem	<u>Comments</u>
Hydrobar PVC Specification	Water Bar Details used in containment
Hydrostop WSM Specification	
Hydrostop BR Safety Data Sheet	



### 6.3 ConCribe Fibre Reinforced Concrete Design Specification for the Containment Bund Floor

<u>ltem</u>	<u>Comments</u>	
ConCribe Design and Product Proposal 175mm	Fibre and mesh reinforced concrete mix design specification for proposed containment bund floor	
ConCribe Design and Product Proposal 150mm	Fibre reinforced concrete mix design specification for existing containment bund floor	

### 6.4 Bentonite Liner Specification for the Containment Bund

ltem	<u>Comments</u>
BENTOMAT AS 5000 Geosynthetic Clay Barrier	Bentonite liner sealed below 1No. 1200g
	DPM liner



# **APPENDIX**



Note:
<ol> <li>All dimensions noted are in millimetres unless stated otherwise.</li> <li>Do not scale from this drawing, if dimensions are not clear ask.</li> <li>This document has been created in accordance with Plandescil Ltd. Terms &amp; Conditions along with the scope of works provided by the client to Plandescil Ltd. Any use of this document other than for its original purpose is prohibited, Plandescil Ltd. accept no liability for any third party uses of this document.</li> <li>Plandescil Ltd. to be immediately notified of any suspected omissions or discrepancies.</li> <li>This drawing is to be read in conjunction with all other relevant documents relating to the project.</li> <li>Refer to Plandescil Ltd Drg 24727 - 001 Rev 0 - Topographical Survey undertaken in April 2021.</li> <li>Proposed Site Layout received from BioConstruct. Refer to EXPORT-pipe system_Attleborough_JAS_210825.dwg</li> </ol>

EXISTING PLANT KEY:

Digester (2No.) (23mØ)

## 

PROPOSED PLANT KEY: BioConstruct Fermenter (3No. @ 26.00mØ) (2) BioConstruct Post-Fermenter (26.00mØ) (3) Ferric Chloride Tank

(5) Pre-Storage Tank (10.00mØ) (6) Pre-Storage Tank (3No. @ 3.50mØ) 7 Pasteurisation Tank (3No.)

(9) Switchboard Room (11) Weighbridge (13) Grid Entry Unit (14) Propane Tanks (15) Gas Upgrading Unit Boiler, Heating Buffer Tank

(18) Gas Processing Unit (19) Active Carbon Tanks (2No.) (20) Reception Building (30.20m x 45.20m)

(21) Odour Control Filter (1No.) (22) Flare - BioConstruct (10.00m Exclusion Zone)

(23) Digestate Storage Lagoon (10,000m³ Storage) (24) Containment Sump - Size Varies (25) Bund Gate (1No.)

(26) LV Switchboard (27) Emergency Generator (28) Condensate Pit

(29) Dirty Water Holding Lagoon (175m³ Storage) (30) Surface Water Attenuation Lagoon (936m<sup>3</sup> Storage) (31) Leachate Tank (20m<sup>3</sup> Storage)

(34) BioConstruct Container

(35) Digestate Pump

(36) Leachate and Clean Water Pumps (2No.) (37) Digestate Removal Station



### Fermenter (19mØ) Silage Clamp (2No.) (30m x 95m) Covered Lagoon Feedhopper (2No.) - To Be Repositioned Substation Transformer CHP Engine - To Be Repositioned Storage Container - To Be Replaced and Repositioned Chiller & Oil Container Technical Container Boiler Dirty Water Holding Lagoon - To Be Regraded/Relined Separator Flare - To Be Retained (EVE) Welfare Facility / Site Office - To Be Repositioned GENERAL KEY: Proposed 150mm Concrete - Fibre Reinforced Proposed 175mm Concrete - A393 Mesh and Fibre Reinforced Proposed D.o.T Type 1 Existing Concrete Apron and Ancillary Equipment Plant Foundations to be Retained / Reinstated (TBC) ---- Proposed Fence Proposed Asphalt Surfacing **APPROVAL & COMMENT** 0 01-12-21 - OAJ First Issue Rev Date Rev By Chkd Description

plandescil consulting engineers Connaught Road Attleborough Norfolk NR17 2BW Telephone: (01953) 452001 Fax: (01953) 456955 E-mail: pdc@plandescil.co.uk www.plandescil.co.uk civil / structural / environmental / surveying Client Attleborough AD Plant Limited Project Attleborough AD Plant, Attleborough, Norfolk, NR17 1AE Drawing Title

Proposed Site Layout

Scale U.N.O.	<sub>Date</sub>	Drawn By
1:200 (A0)	November 2021	TOH
Drawing No.	24727/550	Rev 0



- 1. All dimensions noted are in millimetres unless stated otherwise. 2. Do not scale from this drawing, if dimensions are not clear ask. 3. This document has been created in accordance with Plandescil Ltd. Terms & Conditions along with the scope of works provided by the
- client to Plandescil Ltd. Any use of this document other than for its original purpose is prohibited, Plandescil Ltd. accept no liability for any third party uses of this document.
- 4. Plandescil Ltd. to be immediately notified of any suspected omissions or discrepancies.
- 5. This drawing is to be read in conjunction with all other relevant documents relating to the project.
- 6. Refer to Plandescil Ltd Drg 24727 001 Rev 0 Topographical Survey undertaken in April 2021.
- 7. Proposed Site Layout received from BioConstruct. Refer to EXPORT-pipe system\_Attleborough\_JAS\_210825.dwg

EXISTIN	G PLANT KEY:
1	Digester (2No.) (23mØ)
2	Fermenter (19mØ)
3	Silage Clamp (2No.) (30m x 95m)
4	Covered Lagoon
5	Feedhopper (2No.) - To Be Repositioned
6	Substation
(7)	Transformer
(8)	CHP Engine - To Be Repositioned
(9)	Storage Container - To Be Replaced and Repositioned
(10)	Chiller & Oil Container
(1)	Technical Container
(12)	Boiler
(13)	Dirty Water Holding Lagoon - To Be Regraded/Relined
	Elara To Bo Rotainod (EV/E)
	Welfare Eacility / Site Office - To Be Repositioned
PROPOS	ED PLANT KEY:
(1)	BioConstruct Fermenter (3No. @ 26.00mØ)
(2)	BioConstruct Post-Fermenter (26.00mØ)
(3)	Ferric Chloride Tank
(4)	Technical Building
(5)	Pre-Storage Tank (10.00mØ)
<u>(6)</u>	Pre-Storage Tank (3No. @ 3.50mØ)
(7)	Pasteurisation Tank (3No.)
(8)	Oxygen Generator
(9)	Switchboard Room
(10)	Site Office
(11)	Weighbridge
(12)	
	Grid Entry Unit
	Cas Upgrading Unit
(15)	Boiler, Heating Buffer Tank
(16)	Switchboard Container
	Gas Processing Unit
(19)	Active Carbon Tanks (2No.)
(20)	Reception Building (30.20m x 45.20m)
(21)	Odour Control Filter (1No.)
(22)	Flare - BioConstruct (10.00m Exclusion Zone)
23	Digestate Storage Lagoon (10,000m³ Storage)
24	Containment Sump - Size Varies
25	Bund Gate (1No.)
26	LV Switchboard
(27)	Emergency Generator
(28)	Condensate Pit
(29)	Dirty Water Holding Lagoon (175m³ Storage)
(30)	Surface Water Attenuation Lagoon (936m <sup>3</sup> Storage)
(31)	Leachate Tank (20m <sup>3</sup> Storage)
(32)	
(33)	Stair Access (4No.)
(34)	BioConstruct Container
	Digestate Pump
(36)	Leachate and Clean Water Pumps (2No.)
37	Digestate Kenioval Station
AF	PROVAL & COMMENT
0 01- Rev Date	12-21 - OAJ First Issue e Rev By Chkd Description
	plandescil
ļ	Connaught Road Attleborough Norfolk NR17 2BW
civil	E-mail: pdc@plandescil.co.uk www.plandescil.co.uk
Cl:	
Attl	eborough AD Plant Limite
Project	
Attl Attl NR	eborough AD Plant, eborough, Norfolk, 17 1AF
Drawing Pro	Title posed Drainage Layout
Scale L 1:200 Drawing	J.N.O. Date Drawn By D (A0) November 2021 TOH No. D A 7 O 7 / F F O Rev O
-3	24/2//552 0



- 1. All dimensions noted are in millimetres unless stated otherwise. 2. Do not scale from this drawing, if dimensions are not clear ask.
- 3. This document has been created in accordance with Plandescil Ltd. Terms & Conditions along with the scope of works provided by the client to Plandescil Ltd. Any use of this document other than for its original purpose is prohibited, Plandescil Ltd. accept no liability for any third party uses of this document.
- 4. Plandescil Ltd. to be immediately notified of any suspected omissions or discrepancies.
- 5. This drawing is to be read in conjunction with all other relevant documents relating to the project.
- 6. Refer to Plandescil Ltd Drg 24727 001 Rev 0 Topographical Survey undertaken in April 2021.
- 7. Proposed Site Layout received from BioConstruct. Refer to EXPORT-pipe system\_Attleborough\_JAS\_210825.dwg

### \_\_\_\_\_ I.J.\_\_\_\_ Isolation Joint \_\_\_\_\_LJ. Longitudinal Joint \_\_\_\_\_E.J. Expansion Joint C.J. Contraction Joint Refer to Plandescil drawing Ref: 24727/103 for Joint Construction Details. GENERAL KEY: Proposed 150mm Concrete - Fibre Reinforced Proposed 175mm Concrete - A393 Mesh and Fibre Reinforced Proposed D.o.T Type 1 Existing Concrete Apron and Ancillary Equipment Plant Foundations to be Retained / Reinstated (TBC) ---- Proposed Fence Proposed Asphalt Surfacing **APPROVAL & COMMENT** Rev Date Chkd Description plandesc consulting engine Connaught Road Attleborough Norfolk NR17 2BW Telephone: (01953) 452001 Fax: (01953) 456955 civil / structural / environmental / surveying Client Attleborough AD Plant Limited Project Attleborough AD Plant, Attleborough, Norfolk NR17 1AE Drawing Title Proposed Concrete Jointing Layout Scale U.N.O. Date Drawn By 1:200 (A0) November 2021 TOH Drawing No. 24727/553

CONCRETE JOINTING KEY:



This drawing and the works depicted thereon are the copyright of Plandescil Consulting Engineers Ltd. Unauthorised reproduction infringes copyright.

20	10	5	0

50

10

within 24 hours, cleaned



All dimensions noted are in millimetres unless stated otherwise. 2. All levels to be above Ordnance Survey Datum defined levels (A.O.Dm) unless noted otherwise.

- Do not scale from this drawing, if dimensions are not clear ask. This document has been created in accordance with Plandescil Ltd. Δ Terms & Conditions along with the scope of works provided by the client to Plandescil Ltd. Any use of this document other than for its original purpose is prohibited, Plandescil Ltd. accept no liability for any third party uses of this document.
- 5. Plandescil Ltd. to be immediately notified of any suspected omissions or discrepancies.
- This drawing is to be read in conjunction with all other relevant documents relating to the project. All setting out to be coordinated by the Contractor and to be
- checked onsite prior to construction. To be read in conjunction with the following Plandescil Drawings,
- schedules and documents:
  - 24727/005 Proposed Site Layout 24727/BS080 - 1.75m High Containment Wall
- Contractor led design, Plandescil Ltd conforming to Contractor preferred practices.

**REINFORCED CONCRETE:** 

- 10. Insitu Concrete to be RC40/50 with max w/c ratio 0.45, 360kg/m³ cement/combination content (III-A), with 20mm max. aggregate, chloride content class 0.4cl and minimum slump of class S3 (90mm Slump).
- 11. Insitu Concrete to be in accordance with BS 8110 & BS 8500-1. 12. Reinforcement to be Grade H 500N/mm<sup>2</sup> High Yield, Deformed Type 2 Bar detailed in accordance with BS 4449 and BS 8666. 13. Walls nominal 225mm thick, 50mm cover to bottom, sides and
- top 14. Wall toe nominal 225mm thick, 50mm cover to bottom, sides and top. Wall to have 25x25mm chamfered edges to top.
- 15. Floor Classification to meet FM3 standard for Flatness and Level ±5mm. Construction tolerance to be in accordance with the NSCS for Building Structures.
- 16. Slab to have brushed finish to exposed surface and fair face shutter finish to sides. 17. Walls to have fair faced shuttered finish to sides and top.
- CONCRETE JOINT NOTES: 16. All joint dowel/reinforcement shall be set level and perpendicular to the joint face prior to casting. Damage or bent dowels are to be re-aligned or replaced prior to casting.
- 17. All formed joints are to be cleaned of concrete overruns to ensure accidental restraint is not created
- 18. All joints are to be sufficiently cured and cleaned of all
- contaminations prior to sealing. 19. All sealants are to be installed as per manufacturers specification and must be suitable for the joint type.

FOUNDATION NOTES:

- 20. Assumed GBP value of 225kN/m<sup>2</sup> has been used. Value provided by O'Brien Moran Ltd, following an initial ground treatment review. Confirmation of minimum GBP of 225kN/m<sup>2</sup> required prior to construction.
- 21. Any soft spots or deleterious material is to be removed & taken down to virgin ground level & replaced with compact D.f.T Type 1 or suitable hogging material.
- 22. Overdig to be made up in compacted D.f.T. Type 1 or lean mix concrete.
- ALL PROPRIETARY MATERIALS TO BE FIXED STRICTLY IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS USING MATERIALS APPROVED BY THE MANUFACTURER.

**APPROVAL & COMMENT** B 09-06-21 DAD OAJ Design Amended A 13-01-20 JHB OAJ Client Name Amended OAJ First Issue 0 10-01-20 -Rev Date Rev By Chkd Description

# consulting engine

Connaught Road Attleborough Norfolk NR17 2BW Telephone: (01953) 452001 Fax: (01953) 456955 E-mail: pdc@plandescil.co.uk www.plandescil.co.uk

civil / structural / environmental / surveying

### Client

Attleborough AD Plant Limited Project

Attleborough AD Plant, Attleborough, Norfolk, NR17 1AE

Drawing Title

1.7	75m (	Contair	nment B	und
Wo	all RC	C Detai	Is (6m E	Bay)
Scale	U.N.O.	Date		Drawn I

Drawin	ng No.	24727	7/080	Rev	3
As N	loted	(A1) Januai	<sub>~</sub> у 2020	JHB	
Scale	U.N.O.	Date		Drawn I	Зу





SUMP PIT RETAINING WALL GA (ELEVATION 2, 2No. THUS) SCALE 1:25



TYPICAL PIT SECTION SCALE 1:20









ELEVATION 1 RC (2No. THUS) SCALE 1:10



ELEVATION 2 RC (2No. THUS) SCALE 1:10



TYPICAL SLAB CONSTRUCTION Scale 1:20

- Steel reinforcement, typically A393 mesh top & bottom, 50mm cover to all faces 1200g Polythene DPM

Bentomat AS5000-1 Geosynthetic Clay Barrier laid below DPM

 Min. 150mm thick well compacted D.f.T Type 1 sub-base

NOTES:

- 1. All dimensions noted are in millimetres unless stated otherwise. 2. All levels to be above Ordnance Survey Datum defined levels (A.O.Dm) unless noted otherwise.
- 3. Do not scale from this drawing, if dimensions are not clear ask. 4. This document has been created in accordance with Plandescil Ltd. Terms & Conditions along with the scope of works provided by the client to Plandescil Ltd. Any use of this document other than for its original purpose is prohibited, Plandescil Ltd. accept no liability for
- any third party uses of this document. 5. Plandescil Ltd. to be immediately notified of any suspected
- omissions or discrepancies. 6. This drawing is to be read in conjunction with all other relevant
- documents relating to the project. 7. All setting out to be coordinated by the Contractor and to be
- checked onsite prior to construction. 8. To be read in conjunction with the following Plandescil Drawings, schedules and documents:
- 24727/005 Proposed Site Layout 24727/082/01 BS - Bar Bending Schedule 9. Contractor led design, Plandescil Ltd conforming to Contractor
- preferred practices. **REINFORCED CONCRETE:**
- 10. Insitu Concrete to be RC40/50 with max w/c ratio 0.45, 360kg/m<sup>3</sup> cement/combination content (III-A), with 20mm max. aggregate, chloride content class 0.4cl and minimum slump of class S3
- (90mm Slump). 11. Insitu Concrete to be in accordance with BS 8110 & BS 8500-1. 12. Reinforcement to be Grade H 500N/mm<sup>2</sup> High Yield, Deformed
- Type 2 Bar detailed in accordance with BS 4449 and BS 8666. 13. Walls nominal 225mm thick, 50mm cover to bottom, sides and
- 14. Slab nominal 225mm thick, 50mm cover to bottom, sides and top. 15. Floor Classification to meet FM3 standard for Flatness and Level ±5mm. Construction tolerance to be in accordance with the NSCS for Building Structures.
- 16. Slab to have brushed finish to exposed surface and fair face shutter finish to sides.
- 17. Walls to have fair faced shuttered finish to sides and top.

CONCRETE JOINT NOTES:

- 18. All joint dowel/reinforcement shall be set level and perpendicular to the joint face prior to casting. Damage or bent dowels are to be re-aligned or replaced prior to casting. 19. All formed joints are to be cleaned of concrete overruns to ensure
- accidental restraint is not created 20. All joints are to be sufficiently cured and cleaned of all
- contaminations prior to sealing. 21. All sealants are to be installed as per manufacturers specification and must be suitable for the joint type.

FOUNDATION NOTES:

- 22. Assumed GBP value of 225kN/m<sup>2</sup> has been used. Value provided by O'Brien Moran Ltd, following an initial ground treatment review. Confirmation of minimum GBP of 225kN/m<sup>2</sup> required prior to construction.
- 23. Any soft spots or deleterious material is to be removed & taken down to virgin ground level & replaced with compact D.f.T Type 1 or suitable hogging material. 24. Overdig to be made up in compacted D.f.T. Type 1 or lean mix concrete.





This drawing and the works depicted thereon are the copyright of Plandescil Consulting Engineers Ltd. Unauthorised reproduction infringes copyright.  $\odot$ 

Plandescil Drg 24727/005

16mm Ø M.S 600mm long dowel bars @ max. 400mm ctrs

1 Layer A393 mesh 50mm cover bottom, lapped 400mm continuous through

Dowel cap-end filled with compressible material.

1 Layer A393 mesh 50mm

continuous through

cover bottom, lapped 400mm

16mm Ø M.S 600mm long dowel bars @ max. 400mm ctrs

20mm wide by 25mm deep grove sealed with Premcrete intumescent sealant or similar approved

1 Layer A393 mesh 50mm cover bottom, lapped 400mm continuous through

Post sawn to min  $\frac{1}{4}$  up to

max  $\frac{1}{3}$  slab thickness within

with polysulphide sealant

ctrs

16mm Ø M.S 600mm long dowel bars @ max. 400mm

compressible material.

- Dowel cap-end filled with

16mm Ø M.S 600mm long dowel bars @ max. 400mm ctrs

20mm wide by 25mm deep grove sealed with Premcrete intumescent sealant or similar approved

max  $\frac{1}{3}$  slab thickness within 24 hours, cleaned and filled with polysulphide sealant

Post sawn to min  $\frac{1}{4}$  up to

All dimensions noted are in millimetres unless stated otherwise. 2. All levels to be above Ordnance Survey Datum defined levels (A.O.Dm) unless noted otherwise.

- Do not scale from this drawing, if dimensions are not clear ask. This document has been created in accordance with Plandescil Ltd. 4 Terms & Conditions along with the scope of works provided by the client to Plandescil Ltd. Any use of this document other than for its original purpose is prohibited, Plandescil Ltd. accept no liability for any third party uses of this document.
- 5. Plandescil Ltd. to be immediately notified of any suspected
- omissions or discrepancies. 6. This drawing is to be read in conjunction with all other relevant
- documents relating to the project.
- All setting out to be coordinated by the Contractor and to be checked onsite prior to construction. 8. To be read in conjunction with the following Plandescil Drawings,
- schedules and documents:
  - 24727/008 Proposed Jointing Layout
- 24727/080 Containment Bund Wall RC Details 9. Contractor led design, Plandescil Ltd conforming to Contractor preferred practices.

- **REINFORCED CONCRETE:** 10. 150mm Containment Slab Concrete to be RC32/40 with max w/c
  - ratio 0.45, 300kg/m<sup>3</sup> cement/combination content (III-A), with 20mm max. aggregate (non-limestone).
  - Fibre dosage of 3.0kg/m<sup>3</sup> ConCribe Durus EasyFinish, in accordance with Manufacturer specification and design
  - calculations. • Slab nominal 150mm thick, 50mm cover to bottom and
- sides. 11. 175mm Containment slab Concrete to be RCRC32/40 with max w/c ratio 0.45, 300kg/m<sup>3</sup> cement/combination content (III-A), with
  - 20mm max. aggregate (non-limestone). • Fibre dosage of 4.0kg/m<sup>3</sup> ConCribe Durus EasyFinish, in accordance with Manufacturer specification and design
  - calculations. • Slab nominal 175mm thick, 50mm cover to bottom and sides.
  - Above mix to be used in addition to A393 mesh
- reinforcement in the bottom with 50mm cover to all faces. 12. Insitu Concrete to be in accordance with BS 8110 & BS 8500-1.
- 13. Reinforcement to be Grade H 500N/mm<sup>2</sup> High Yield, Deformed Type 2 Bar detailed in accordance with BS 4449 and BS 8666.

CONCRETE JOINT NOTES:

- 14. All joint dowel/reinforcement shall be set level and perpendicular to the joint face prior to casting. Damage or bent dowels are to be
- re-aligned or replaced prior to casting. 15. All formed joints are to be cleaned of concrete overruns to ensure accidental restraint is not created
- 16. All joints are to be sufficiently cured and cleaned of all
- contaminations prior to sealing.
- 17. All sealants are to be installed as per manufacturers specification
- and must be suitable for the joint type. 18. Joints subject to confirmation by Fibres used in mix design
- supplies. Fibre Supplier/Designer to check and approve joints.

FOUNDATION NOTES:

- 19. Assumed GBP value of 225kN/m<sup>2</sup> has been used. Value provided by O'Brien Moran Ltd, following an initial ground treatment review. Confirmation of minimum GBP of 225kN/m<sup>2</sup> required prior to construction.
- 20. Any soft spots or deleterious material is to be removed & taken down to virgin ground level & replaced with compact D.f.T Type 1
- or suitable hogging material. 21. Overdig to be made up in compacted D.f.T. Type 1 or lean mix concrete

ALL PROPRIETARY MATERIALS TO BE FIXED STRICTLY IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS USING MATERIALS APPROVED BY THE MANUFACTURER.

		RO\	/AL	& COMMENT
С	27-10-21	JHB	OAJ	Minor Amendments
В	09-06-21	DAD	OAJ	Amendments
Α	13-01-20	JHB	OAJ	Client Name Amended
0	10-01-20	-	OAJ	First Issue
Rev	Date	Rev By	Chkd	Description

# plandescil

Connaught Road Attleborough Norfolk NR17 2BW Telephone: (01953) 452001 Fax: (01953) 456955 E-mail: pdc@plandescil.co.uk www.plandescil.co.uk

civil / structural / environmental / surveying

Client

Attleborough AD Plant Limited Project

Attleborough AD Plant, Attleborough, Norfolk, NR17 1AE

Drawing Title

**Typical Containment Bund** Joint Details

Scale U.N.O.	<sub>Date</sub>	Drawn By
As Noted (A	1) January 2020	AF
Drawing No.	24727/103	Rev C

![](_page_19_Figure_0.jpeg)

All dimensions noted are in millimetres unless stated otherwise. 2. All levels to be above Ordnance Survey Datum defined levels (A.O.Dm) unless noted otherwise.

- Do not scale from this drawing, if dimensions are not clear ask. This document has been created in accordance with Plandescil Ltd. 4 Terms & Conditions along with the scope of works provided by the client to Plandescil Ltd. Any use of this document other than for its original purpose is prohibited, Plandescil Ltd. accept no liability for any third party uses of this document.
- 5. Plandescil Ltd. to be immediately notified of any suspected omissions or discrepancies.
- 6. This drawing is to be read in conjunction with all other relevant documents relating to the project.
- All setting out to be coordinated by the Contractor and to be 7.
- checked onsite prior to construction. 8. To be read in conjunction with the following Plandescil Drawings, schedules and documents:
  - 24727/005 Proposed Site Layout
  - 24727/080 1.75m Containment Bund Wall R.C. Details
- 24727/082 Proposed Containment Sump GA & RC Details 9. Contractor led design, Plandescil Ltd conforming to Contractor preferred practices.

**REINFORCED CONCRETE:** 

- 10. 150mm Containment Slab Concrete to be RC32/40 with max w/c ratio 0.45, 300kg/m<sup>3</sup> cement/combination content (III-A), with 20mm max. aggregate (non-limestone).
  - Fibre dosage of 3.0kg/m<sup>3</sup> ConCribe Durus EasyFinish, in accordance with Manufacturer specification and design calculations.
  - Slab nominal 150mm thick, 50mm cover to bottom and sides.
- 11. 175mm Containment slab Concrete to be RCRC32/40 with max w/c ratio 0.45, 300kg/m<sup>3</sup> cement/combination content (III-A), with 20mm max. aggregate (non-limestone).
  - Fibre dosage of 4.0kg/m<sup>3</sup> ConCribe Durus EasyFinish, in accordance with Manufacturer specification and design
  - calculations. • Slab nominal 175mm thick, 50mm cover to bottom and sides
  - Above mix to be used in addition to A393 mesh
- reinforcement in the bottom with 50mm cover to all faces. 12. Insitu Concrete to be in accordance with BS 8110 & BS 8500-1.
- 13. Reinforcement to be Grade H 500N/mm<sup>2</sup> High Yield, Deformed Type 2 Bar detailed in accordance with BS 4449 and BS 8666.

CONCRETE JOINT NOTES:

- 14. All joint dowel/reinforcement shall be set level and perpendicular to the joint face prior to casting. Damage or bent dowels are to be re-aligned or replaced prior to casting.
- 15. All formed joints are to be cleaned of concrete overruns to ensure accidental restraint is not created
- 16. All joints are to be sufficiently cured and cleaned of all
- contaminations prior to sealing. 17. All sealants are to be installed as per manufacturers specification
- and must be suitable for the joint type. 18. Joints subject to confirmation by Fibres used in mix design supplies. Fibre Supplier/Designer to check and approve joints.

FOUNDATION NOTES:

- 19. Assumed GBP value of 225kN/m<sup>2</sup> has been used. Value provided by O'Brien Moran Ltd, following an initial ground treatment review. Confirmation of minimum GBP of 225kN/m<sup>2</sup> required prior to construction.
- 20. Any soft spots or deleterious material is to be removed & taken down to virgin ground level & replaced with compact D.f.T Type 1 or suitable hogging material.
- 21. Overdig to be made up in compacted D.f.T. Type 1 or lean mix concrete.

ALL PROPRIETARY MATERIALS TO BE FIXED STRICTLY IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS USING MATERIALS APPROVED BY THE MANUFACTURER.

APPROVAL & COMMENT										
0	27-10-21	-	OAJ	First Issue						
Rev	Date	Rev By	Chkd	Description						

# plandescil consulting engineers

Connaught Road Attleborough Norfolk NR17 2BW Telephone: (01953) 452001 Fax: (01953) 456955 E-mail: pdc@plandescil.co.uk www.plandescil.co.uk

civil / structural / environmental / surveying

Client

Attleborough AD Plant Limited Project

### Attleborough AD Plant, Attleborough, Norfolk, NR17 1AE

Drawing Title

### **Typical Containment Bund** Drainage Details

Scale U.N.O.	Date	Drawn By
As Noted (A1)	October 2021	TOH
Drawing No. 2	4727/104	Rev 0

Base         OI         H         10         1         62         62         900         21         400         125         400         125           Member         Bar         Type         No. of Mark         No. of & Size         No. of each         No. of more         No. of each         No. of each         No. of Mark         No. of & Size         No. of each         No. of each         No. of more         No. of each
Interview of the consulting engineers         Were proved in the provemental / surveying         Date Propared in the provemental / surveying         Date Propared in the provemental / surveying         Member       Bar       Type No. of in the provemental / surveying         Member m
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$
Civil / structural / environmental / surveying       Date Prepared : 10-Jan-20       By : JHB       Check : AF         Member       Bar       Type       No. of       No. of       No. of       No. of       Total       Stage       A *       B *       C *       D *       E/R *       Rev         BASE       01       H       10       1       62       62       900       21       400       125       400       1
Member         Bar Mark         Type Size         No. of mbrs         No. in each         Total each         Length of each No.         Shape code         A*         B*         C*         D*         E/R*         Rev           BASE         01         H         10         1         62         62         900         21         400         125         400         —         —         —         —         —         —         _         _         _         Mem         mm         mm         mm         mm         mm         mm         mm         _         _         /         #
Member         Bar Mark         Type Size         No. of mbrs         No. each         Tatel bar mark         Shape bar Mm         A * mark         B * Mm         C *         D *         E/R *         Rev           BASE         01         H 10         1         62         62         900         21         400         125         400         -         -         -           (6m Bay)         02         H 10         1         31         31         1650         21         775         125         775         - <td< td=""></td<>
BASE     OI     H     10     1     62     62     900     21     400     125     400     Imm     mm     mm     mm       (6m Bay)     02     H     10     1     31     31     1650     21     775     125     775     Imm     Imm </td
BASE       OI       H       IO       I       622       622       900       21       400       125       400       100       100       100       100       110       31       31       1650       21       775       125       775       100       100       100       100       100       100       100       100       100       100       100       900       000       900       000       900       000       900       000       900       000       900       000       900       000       900       000       900       000       900       000       900       000       900       000       900       000       900       000       900       000       900       000       900       000       900
1011 Bdy/       02       H       10       11       21       31       1030       21       773       123       123       123       123       123       123       12
03       11       12       2       1500       00       5500       5500       5500       1500       1500       1500       1500       1500       1500       1500       1500       900       900       1500       900       1500       1500       1500       1500       1500       1500       1500       900       1500       100       100       100       100       900       100       100       100       900       900       100       100       100       100       900       900       100       100       100       100       900       900       100 <td< td=""></td<>
05       R       25       1       21       21       600       600       600         Approx 6.64m <sup>2</sup> A393 mesh per layer (not including laps, min. 400mm). Total 13.28m <sup>2</sup> Required       Approx 8.64m <sup>2</sup> A393 mesh per layer (not including laps, min. 400mm). Total 13.28m <sup>2</sup> Required       Image: Constraint of the second laps, min. 400mm). Total 13.28m <sup>2</sup> Required         ELEVATION       01       H       10       1       31       31       900       21       400       125       400         (6m Bay)       04       H       10       10       900       00       900       900       Image: Constraint of the second laps, min. 400mm). Total 18.3m <sup>2</sup> required         CORNER 'A'       06       H       10       16       160       1525       21       725       100       725         (10 Total)       Image: Constraint of the second laps
Approx 6.64m² A393 mesh per layer (not including lays, min. 400mm). Total 13.28m² Required       Image: Constant and the second se
Image: style s
Image: Constraint of the second sec
ELEVATION       01       H       10       11       31       31       900       21       400       125       400       Image: Constraint of the state of
(6m Bay)       04       H       10       10       900       00       90
Approx 9.15m² A393 mesh per face (not including laps, min. 400mm). Total 18.3m² required         Approx 9.15m² A393 mesh per face (not including laps, min. 400mm). Total 18.3m² required         Image: Constant of the state of the stat
Image: series of the series
CORNER'A'06H 101016160152521725100725Common pressureCommon pressure <t< td=""></t<>
(10 Total)       Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation -
Bund Wall Corners Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall Realignment Expected         Image: Subject to Confirmation - Potential Wall
Image: state in the state
Image: Second state in the second s
Image: Second
Image: Second
Image: state of the state

					1	Job No	:	24727	Sche	dule No :	01	Rev :	Α	
ρ	b			SC		Dwg N Project	o :	24727/0	080/A	Status :	P Bund Wa	Sheet No :	2/2	
Conr	nauaht Roa	d. Attleboro	uah. Norfolk	. NR17 2BW	/.	riojeci	•	Attlebor	ough AD	Plant, Att F	leborou	gh	)	
	T: (01953)	452001 E: p www.plande	odc@plandes escil.co.uk	cil.co.uk		Date Re	evised :	09-Jun-2	21					
civil /	structur	al / envir	onmenta	l / survey	ving	Date Pr	epared :	26-May-	-20	By:	IGC	Check :	AF	
Bar Mark	Bar Type	Shape				B	AR WEI Bar siz	GHTS  k 2e  mm	g∣					
WIGHT	ijpe	Couc	6	8	10	12	16	20	25	32	40	50		
01	Н	21			34.4									
02	Н	21			31.5									
03	H	00			7.3									
05	Н	00							48.6					
01	Ц	21			17.2									
04	Н	00			5.5									
					0.0									
06	Н	21			150.4									
						<u></u>			<u></u>					
Weight	s of Bar	s   ka			246				49					
Bar Size	e	mm			H 10				H 25					
	-	11	I											

				1		• 4	Job No	:	24727	Sch	edule No :	01	Rev :	Α		
	ar	7			50	~1	Dwg No	<b>b</b> :	24727/	082/B	Status :	Α	Sheet No :	1/1		
Connau	ght Road,	Attle	eborou	ulting gh, Norfo	engir	Deers 2BW.	Project	:	Containment Sump Attleborough AD Plant, Attleborough, Norfolk, NR17 1AE							
	w	ww.p	landes	cil.co.uk			Date Re	Date Revised :		21	By :	JHB	Check :	AF		
civil / stru	ictural .	/ en	viror	nmenta	al / surv	veying	Date Pre	epared :	10-Jan-2	20	By :	JHB	Check :	AF		
Member	Bar Mark	T &	ype Size	No. of mbrs	No. in each	Total No.	Length of each bar † mm	Shape code	A *	<i>B</i> *	<i>C</i> *	<i>D</i> *	<i>E/R</i> *	Rev		
Base Slab	01	Н	10	1	16	16	900	21	400	125	400					
	02	Н	10	1	48	48	1550	21	725	125	725					
	03	Н	16	1	30	30	1250	11	640	640						
	04	Н	10	1	32	32	850	13	400	100	400					
	Ар	prox	. 4.55	5m² A39	93 mesh	per layer	(not inclue	ding laps	, min. 400	mm). Tota	l 9.1m² ree	quired				
Elevation 1	05	Н	10	2	16	32	850	13	400	100	400					
	<b>A</b>	0.1	- 2	<b>72</b> h					0) T.t	10.0		<b>F</b> lowerting (1)				
	Approx.	9. In	10	nesn 2	per elevo	20 au		s, min. 400		10.2m² rec	400	Elevations				
Elevation 2	05	п	10	Z	10	32	050	15	400	100	400					
	Approx.	3.7r	n² A3	93 mesh	per elev	ation (not i	ncluding lap	os, min. 40	00mm). Toto	ıl 7.4m² req	uired (2no.	Elevations)				
					•			-				,				
									-							
	1				1	1		1				I.	1			

 $Status: P = Preliminary \qquad T = Tender \qquad C = Construction \qquad {}^{\star} In multiples of 5mm \qquad {}^{\dagger} In multiples of 25mm$ 

### plandescil consulting engineers

Connaught Road, Attleborough, Norfolk, NR17 2BW. T: (01953) 452001 E: pdc@plandescil.co.uk www.plandescil.co.uk

civil / structural / environmental / surveying

Job No :	24727	Schedule	• No : <b>01</b>	Rev :	Α
Dwg No :	24727/082	./ <b>B</b> St	atus : <b>A</b>	Sheet No :	1/1
Project :	Containme Attleborouç NR17 1AE	nt Sump 3h AD Pl	ant, Attlebor	ough, No	rfolk,
Date Revised :	27-Oct-21		By : <b>JHB</b>	Check :	AF
Date Prepared :	10-Jan-21		By : <b>JHB</b>	Check :	AF

Bar Mark	Bar Type	Shape Code				B	AR WEIGHTS  kg  Bar size  mm											
			6	8	10	12	16	20	25	32	40	50						
01	Н	21			8.9													
02	Н	21			45.9													
03	Н	11					59.2											
04	Н	13			16.8													
05	Н	13			16.8													
05	Н	13			16.8													
14/					105		50											
weight	s of Bars	5   kg			105		59											
Bar Size	е	mm			H 10		H 16											

alandaa		Job No.	24727									E	Bund Cap	acity Ref	: 24727		Revision: F
plandes	CI																Status: Preliminary
consulting en	gineers	Date prepared	: 16/03/2021														
Connaught Road, Attleborough, Norfolk, NI T: (01953) 452001 e: pdc@plandescil.co.uk, www	R17 2BW. plandescil co.uk	Date revised: Prepared by:	20/10/2021 IHB / AF														Checked by: OAI
		Site Ref:	Attleborough A	AD Plant	-		•									-	
Bund Capacity Calculations																	Section 4. CIRIA C736
																	· · · · · · · · · · · · · · · · · · ·
Volume of inventory																	Comments, sources of information
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total	
	Largest Tank																Arrange tanks from largest to smallest, left to right
Above Ground																	
Tank rated capacity / fill level (m) (h)	7	7	7	7	3	3	3	5	7	7	7	2.5	5.5	5.5	5.5		based on tank dimensions provided by client
Tank diameter (m) (d)	26	26	26	26	22.75	22.75	19	10	3.5	3.5	3.5	3.2	3.5	3.5	3.5		billing and rated capacity, see CIKIA C7.50 page 45
brimful canacity (cum)	1 215 28	1 245 28	1 245 28	1 245 28	1 6 2 5 1 5	1 6 2 5 1 5	1 133 54	471.00	76.03	76.03	76.03	20.10	38.86	38.86	38.86	22 203 41	
Tank Area	4,245.28	4,245.28	4,245.28	530.93	406.49	406.49	283.53	78.54	9.62	9.62	9.62	8.04	7.07	7.07	7.07	3,356.88	1 m2
25% brimful capacity (cu.m)																5,550.85	
110% brimful capacity largest tank (cu.m)																4,669.81	
Total Tank Area																5,550.85	
																3,330.00	
rated capacity (cu.m)	3,714.62	3,714.62	3,714.62	3,714.62	1,218.86	1,218.86	850.16	392.50	67.31	67.31	67.31	20.10	38.86	38.86	38.86	10.077.40	
25% rated capacity (cu.m)																4,719.37	
110% rated capacity largest tank (cu.m)																4,086.08	
Storage Capacity For Calculation																4,/19.3/	Used in calc
Rainfall																	
								<u> </u>									based on data page 45 CIRIA 736. Must be refined by system
24h duration (mm)	55.12							<u> </u>									designer
24h duration (m)	0.055							<u> </u>									+
8d duration (mm)	94.49																
8d duration (m)	0.094																
10d duration (mm)	102 770																Site specific check with MH
10d duration (m)	0.103																
annual rainfall (mm)	624.00																Site specific, check with MH
	0.02																
length of bund (m)																	Need to check intting and stand off distances between tanks and
or equivalent area	7,100.00																Need to check jetting and stand-on distances between tanks and
height of hund (m)	1 75																1.5m is maximum desirable height to be able to see into bund etc.
	1.75																250mm freeboard for secondary containment in the absence of
freeboard (m)	0.25																detailed analysis. Page 85 CIRIA C736
capacity of bund (cu.m)	10,650.00																with no deduction for tank base volume
base volume of remaining diameter tanks		795.99	795.99	795 99	609.43	609.43	425.08	117 75	14 4 2	14 42	14.42	12.06	10.60	9.54	10.60	4 235 72	assume 14 largest diameter tanks are intact and hence taking up
Volume of raised feedhopper area levels		755.55	755.55	755.55	005.45	005.45	425.00	117.75	14.42	14.42	14.42	12.00	10.00	5.54	10.00	200.00	
available bund canacity	6 214 28																
	0,214.20																
volume rainfall arising over 24h (cum)	391 35																these volumes will need refining as set out on page 44 C736
volume rainfall arising over 8d (cu.m)	670.88															1,062.23	Volume of rainfall captured in 24h + 8d
volume rainfall arising over 10d (cu.m)	729.67																
volume rainfall arising over one year (cu.m)	4,430.40																
conservative assessment, remaining capacity								1	1						1		largest tank fails, has rained for 24h before and for 8d afterwards.
<u>(cu.m)</u>	432.68																No firewater.
Firewater																	client advises no risk of fire
foam allowance (m)	0.00																100mm freeboard for firefighting foam. Page 85 CIRIA C736
Firewater estimate (cu.m)	0.00																not included in assessment
Residual Bund Volume conservative assessment, remaining capacity	5,152.05																
(cu.m)	432.68																largest tank fails, has rained for 24h before and for 8d afterwards.
															I		
All Aroa Ex Tarl	$(m^2)_{-}$				2 7/2												
All Area EX Tank	s (iii )=				5,743												Area for hatch comparison (Total containment volume inside wall
Wall Heigh	nts (m)=				1.75												minus all tank areas)

### 

![](_page_25_Picture_1.jpeg)

### Hydrobar PVC

High Performance Waterstop Range

#### DESCRIPTION

HYDROBAR PVC is a range of high performance waterstops extruded from PVC material designed to prevent the passage of water at both construction and expansion joints in watertight structures. The Hydrobar PVC waterstop range includes a range of sizes, pre-formed junction pieces and sections depending upon the exact situation.

#### USES

Hydrobar PVC waterstops are designed for use as method of sealing both construction and expansion joints in cast in-situ concrete structures. The waterstops are intended for use on both water retaining and water excluding structures including: reservoirs, water tanks, dams, swimming pools, basements, tunnels, underground carparks etc.

#### **ADVANTAGES**

- Available in range of profiles and sizes.
- Joints are easily welded on site.
- Full range of preformed junction pieces for ease of use.
- Complete fabrication service available for complicated networks.

![](_page_25_Picture_13.jpeg)

#### TYPICAL PROPERTIES

Property	Value
Elongation at Break	>300%
Tensile Strength	14.9MPa
Shore A Hardness	80 -90
Relative Density	1.44
B. S. Softness	28 @ 20ºC

#### HYDROBAR RANGE

**Hydrobar Centrestop** has been specifically developed, with the unique rib and end bulb profiles to provide a totally effective water barrier when cast centrally within concrete wall and floor joints.

Hydrobar Centrestop has been independently tested in accordance with BS2782 to withstand ingress of water, up to 32M head in construction and expansion joints in water retaining and excluding structures. Hydrobar Centrestop is available in two different web profiles. The standard Hydrobar Centrestop has a web profile of 5mm, the Heavy Duty Centrestop has a web profile of 10mm and is designed for use where more rigidity is required during the concrete pour.

**Hydrobar Rearstop** is a high performance, heavy duty profile waterstop specifically developed to seal joints in concrete structures at the outside surface thus protecting the reinforcing steel against corrosion attack, in addition to providing a totally watertight seal.

![](_page_26_Picture_1.jpeg)

Hydrobar Rearstop has been independently tested to provide a totally effective water barrier up to 32M head in construction, expansion and kicker joints in concrete water retaining and excluding structures.

#### PROCEDURE

Installation of Centrestop: The waterstop must be positioned centrally in the thickness of the section being poured and spanning the construction/expansion joint. The waterstop should be held in position using the metal eyelets, tied to the reinforcement. Ensure the concrete around the waterstop section is well compacted to prevent passage of water around the waterbar through any voids or porous areas.

Installation of Rearstop: Where the waterstop is used to waterproof joints on a vertical section of concrete, the waterstop should be nailed to the shutter through the outer nailing flanges. The nails should be left protruding so that they are cast into the concrete to prevent damage to the waterbar when striking the shutter. Where the waterstop is used to waterproof joints on a ground bearing slab then the waterstop should be laid on the substrate centrally over the joint and tied to prevent displacement during the placement of the concrete.

Jointing of Hydrobar: Jointing of the waterstop is easily carried out on site using a Hydrobar Jointing Jig and Hydrobar Hot Knife. The ends to be jointed should be clamped into the Jointing Jig and pressed against either side of the Hot Knife until an even bead of molten PVC forms along the entire width of the waterstop. The Hot knife should then be removed and the two sections be pushed together allowing the PVC to cool producing a completely fused watertight connection.

![](_page_26_Figure_8.jpeg)

#### PACKAGING

Туре	Width	Roll Length
Centrestop	190 mm 240 mm	25 M 25 M
Rearstop	190 mm 240 mm	25 M 25 M

#### STORAGE

Store Hydrobar PVC in orginal packaging in cool dry conditions.

#### HEALTH AND SAFETY

Please refer to seperate Marerial Safety Datasheet.

The information provided in this data sheet is intended for general guidance only and is given in good faith based on Premcrete's current knowledge and experience. No warranty in respect of fitness for a purpose, or any other liability whatsoever can be inferred from the information contained within this datasheet. Users should determine the suitability of the materials for their particular application and should always refer to the most recent issue of the product data sheet for the product concerned. All materials are supplied in accordance with Premcrete Sales Terms & Conditions (available upon request) PREMCRETE

# Hydrostop WSM

Gun Grade Hydrophilic Sealant

### DESCRIPTION

**HYDROSTOP WSM** is a hydrophilic, gun-grade sealant The hydrophilic properties of Hydrostop WSM display good consistency in swell rate during repeated wet/dry cycling. Expansion of the product on contact with water creates a positive pressure against the faces of the concrete joint, thus preventing the passage of water.

### USES

HYDROSTOP WSM can be used as an adhesive for bonding Hydrostop water bars or as a problem solving hydrophilic sealant in difficult access areas including:

- Sealing around joints in precast manhole covers, cable ducts and pipes etc.
- Sealing around precast segments
- Sealing between rough surfaces, e.g. slurry walls and concrete slabs
- Sealing around H-beams and other penetrations through concrete structures
- Sealing around conventianal rubber and plastic waterstops to provide a 'belt and braces' seal prior to concrete pour

### TYPICAL PROPERTIES

Property	Value
Form	Thiscotropic Sealant
Colour	Black/Grey
Tack-free Time	Approximately 1 hour
Hardness Shore 'A'	30
Cure Rate	3 mm in 24 hours
Swell Ratio	200%

### ADVANTAGES

- Excellent seal on rough concrete: Gives improved water tightness. Plug in irregularities rough concrete to produce a water-tight seal.
- Excellent adhesion: Quick and easy to apply to a variety of damp and uneven joint surfaces remaining firmly in place during concrete pour.
- Water swellable: Expands by 200% producing a watertight compression seal.
- Durable: Excellent wet/dry cycling retaining elastomeric character and swelling performance due to high tolerance of the cementitious environment.

![](_page_28_Picture_0.jpeg)

### PROCEDURE

Surface Preparation: Remove all obvious loose debris and soil, moss and organic growth from the substrate. Hydrostop WSM can be applied to damp concrete but always ensure the surface is free from running water and brush away any standing or seeping water. Divert running channels away from area before application.

Application: Cut the end of the foil sachet and place the sachet inot the sealant applicator gun and apply like a conventional sealant. Extrude a bead of not less than 10mm diameter onto the substrate, ensuring that there is no break in the bead.

### PACKAGING

Pack Size: 600 ml sachet Coverage: A 600 ml sachet will extrude a 6 metre bead 10 mm diameter.

### STORAGE

Shelf life is 9 months. Store in original unopened packaging in a cool, dry conditions.

### LIMITATIONS

Hydrostop WSM should not be used for expansion jointing or for joints subject to significant repetitive movements. Hydrostop WSM should be positioned to ensure that there is a minimum of 70mm concrete cover to accommodate pressure developed during the swelling process. Hydrostop WSM will establish a firm bond to the concrete. However, as with any hydrophilic waterstop, care should be taken during concreting to avoid pouring directly onto the seal.

N.B: Hydrostop WSM should not be used as a sealant in general building applications.

### HEALTH AND SAFETY

Please refer to separate Material Safety datasheets.

The information provided in this data sheet is intended for general guidance only and is given in good faith based on Premcrete's current knowledge and experience. No warranty in respect of fitness for a purpose, or any other liability whatsoever can be inferred from the information contained within this datasheet. Users should determine the suitability of the materials for their particular application and should always refer to the most recent issue of the product data sheet for the product concerned. All materials are supplied in accordance with Premcrete Sales Terms & Conditions (available upon request)

![](_page_29_Picture_0.jpeg)

### HYDROSTOP BR SAFETY DATA SHEET According to 1907/2006/EC, article 31

**IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING** 

**1.1 Product Identifier** Hydrostop BR

> **Relevant uses of the substance or mixture and uses advised against** Hydroswelling Bentonite joint sealant for waterproofing of construction and cold joints in concrete.

1.1 Details of the supplier of the data sheet

Premcrete Seymour House Mayflower Close Chandlers Ford Eastleigh Hampshire SO53 4AR

Sales@premcrete.com www.premcrete.com

**1.2 Emergency telephone number** +44 (0) 800 6191619 6:30am-5:00pm Mon-Fri

### 2. HAZARDS IDENTIFICATION

2.1 None to our knowledge.

#### . COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Mixtures

Chemical Composition: Blend of Butylrubber and Sodium Bentonite

### 4. FIRST AID MEASURES

- 4.1 General advice: In case of doubt or with persisting symptoms obtain medical attention. Never pass anything through the mouth of an unconscious person.
  4.2 Skin contact: Remove soiled clothing.
- **4.3 Eye contact:** Rinse immediately with eye wash or clean water for at least 15 min. Seek medical attention
- **4.4 Ingestion:** Immediately rinse mouth out. Do not induce vomiting. Seek immediate medical advice.

![](_page_29_Picture_18.jpeg)

PAGE: 1 REVISION: 1 REVISION DATE: 23-06-2016

5. FIRE-FIGHTING MEASURES
<ul> <li>5.1 Suitable extinguishing media: Carbon dioxide, dry powder, halon, foam or water</li> <li>5.2 Unsuitable extinguishing media: None</li> <li>5.3 Exposure hazards: None</li> <li>5.4 Special protective equipment: Fire fighters should wear full protective clothing and self-contained breathing apparatus</li> </ul>
6. ACCIDENTAL RELEASE MEASURES
6.1 Personal precautions: None.
6.2 Environmental precautions: Prevent material from entering sewage system, water courses or water treatment installations.
7. HANDLING AND STORAGE
<b>7.1 Storage:</b> Keep cartons dry and closed.
B. EXPOSURE CONTROL/PERSONAL PROTECTION
8.1 Skin protection: Cotton or cotton/synthetic or coveralls are suitable.
9. Physical and chemical properties
9.1 Information on basic and chemical properties
Appearance: Green Solid
Melting point:: 80°C
Flash Point: Not applicable
Flammability: Non-flammable
Auto flammability: Not applicable
Belative density: 1.48
Solubility in water: Non Soluble
Solubility in water. Non Soluble
10. STABILITY AND REACTIVITY
<b>10.1 Stability:</b> Stable under normal ambient conditions
10.2 Conditions to avoid: Avoid water
10.3 Materials to avoid: Water
10.4 Haz decomp Products: None in ambient conditions
11 TOXICOLOGICAL INFORMATION
11.1 Routes of exposure: Eye contact.
12.1 Ecological Information: None

PAGE: 2 REVISION: 1 REVISION DATE: 23-06-2016

#### **13 DISPOSAL CONSIDERATIONS**

### 13.1 Disposal Considerations:

Do not allow into drains or water courses or where ground water or surface waters may be affected. Ensure any containers containing waste material are correctly labelled. Wastes, including emptied containers, are controlled wastes and should be disposed of in accordance with local, state or EC regulations at an authorised site.

#### 14 TRANSPORT INFORMATION

14.1 Transport Information: The product has no classification

### **15 REGULATORY INFORMATION**

### 15.1 Regulatory Information: None

### **16 OTHER INFORMATION**

Training advice: Do not use unless trained to do so.

Recommended uses: The product is only supplied for use in accordance with uses listed in sec 1.

The information supplied in the Safety Data Sheet is designed only as guidance for the safe use, storage and handling of the product. The information is correct to the best of our knowledge and belief at the date of publication however no guarantee is made to its accuracy. This information relates only to the specific materials designated and may not be valid for such material used in combination with any other materials or in any other process.

![](_page_31_Picture_11.jpeg)

PAGE: 3 REVISION: 1 REVISION DATE: 23-06-2016

### DESIGN OF SUPPORTED FIBRE REINFORCED CONCRETE SLAB

### Reference standard of the design

This design is done against CS-TR<sub>34</sub>- 4th Edition - Concrete industrial ground floors a guide to design and construction Concrete Industrial Ground Floors -

The 4th edition of TR<sub>34</sub> is in line with the latest Eurocodes and Standards for the structural design procedures for ground-supported and pile-supported floors.

### Design method

TR<sub>34</sub> is written in a limit state format with emphasis on the ultimate and serviceability limit state (ULS and SLS). For the ultimate limit state the Meyerhof equations were adopted for slab analysis with partial safety factors based on those in the draft Eurcode 2. The equations are based on yield line theory and thus it is necessary to establish positive (sagging) and negative (hogging) moment capacities, Up and Ma. It is assumed that plain concrete does not have any significant ability to redistribute bending moments, but the presence or fibres (macro

synthetic or steel) will enhance ductility and the ability to redistribute bending moments. The ductility of fiber reinforced concrete is characterised by its equivalent flexural strength ratio Re3. This provides a residual (i.e. post cracking) positive bending moment capacity Up as follows: Mp=Fct.Re3/S(h<sub>2</sub>/6)

where:

S = partial safety factor for concrete, taken as 1.5 for the ULS.

Re3= equivalent to actual strength ratio in TR34 (2003) it is recommended that sufficient

fibers be provided to give the minimum Re3 value of 0.3.

h = slab depth (mm)

Fct = characteristic flexural strength of the plain concrete obtained from TR34 (2013) or

Eurocode 2 (2004). The use of Eurocode 2 results in a reduced value of Fct and is not actual in this design.

### Concept

TR 34 design strategy is based on the influence of 4 types of loadings on the slab :

-Uniformly distributed load or UDL, also called flat load, a static load.

-Line load , might it be a wall,

-rolling or live load, typically vehicle on wheels, and

-point loads.

Three loading locations are considered in design as follows:

-internal - the centre of the load is located more than (I + a) from an edge (i.e. a free edge or a joint)

-edge - the centre of the load is located on an edge more than (I + a) from a corner (i.e. a free corner or the intersection of two joints) -corner - the centre of the load is located a from the two edges forming a corner.

where

a = equivalent contact radius of the load

I = radius of relative stiffness.

### Concrete specifications

This design is based on the assumptions that concrete mix follows EN 206. To increase the performance of the fibre reinforced concrete slab, Concribe recommends to keep aggregate size below 22 mm in any case. Water cement ration should also be kept as low as possible, with maximum of 0.5. To prevent drying shrinkage, filler content should be maximum 400 kg/m3 or mix should not content fly ash nor microsilica. Slab thickness should not be below 80 mm, in which case Concribe's screed specifications should be used.

### Added reinforcement

Fibre reinforced concrete performs at reducing crack width and increase joint spacing, but requires added rebar to prevent cracking where stress and therefore risk is greatest. There should be rebars according to the sketch below; in corners, around piles and in front of openings in the building.

![](_page_33_Figure_3.jpeg)

### Treatment of concrete surface

the use of plastic film or curing product, but water, is mandatory to prevent early drying shrinkage. Curing should satisfy the requirments of ASTM C<sub>3</sub>O<sub>9</sub>: Type 1.

### Joints

Jointing should follow the recommended bay size on this design. Joints can be either saw cut or armoured. Saw cut jointing should respect the saw cut depth in the design and be executed within 24 hours after concrete pour, armoured joints should be according to suppliers specifications following this design. Length/width ratio of any bay shall not exceed 1,5: length / width < 1,5

### Liability

ConCribe is unable to have insight in the correctness of the data which the design is based on. This design is therefore only valid for the given data, and covered by Concribe professional indemnity for design and personal damages due to failed design. As Concribe obviously does not have insight in or control over execution of the slab, liability declines for all losses and/or damages consequently.

### Fibre reinforced concrete performance

The strength of fibres is measured as a residual flexural tensile strength. This can be done by performing crack mouth opening displacement (CMOD) tests. A CMOD test is a deformation controlled loading test, where the crack opening is measured as a horizontal deflection. The test setup requires a beam, notched to prevent horizontal cracking, and devices for recording the applied load and the crack opening, which is referred to as CMOD. The FIB model code proposes that it is to be done in accordance with EN 14651 (2005).

![](_page_34_Figure_9.jpeg)

### Design principle

For ground-supported slabs, two ultimate strength modes of failure of the concrete slab are possible, namely flexure (bending) and local punching. Slab design for flexure at the ultimate limit state is based on yield line theory, which requires adequate ductility to assume plastic behaviour. (Ductility requirements are discussed in Section 9.4 and Appendix E.) At the ultimate limit state, the bending moment along the sagging yield lines may be assumed to be the full plastic (or residual post-cracking) value. However, a principal requirement in the design of ground-supported slabs is the avoidance of cracks on the upper surface. Hence, at the ultimate limit state the bending moment of the slab along the hogging yield lines is limited to the design cracking moment of the concrete, with the partial safety factors appropriate to the ultimate limit state.

Design of slabs			TR34 4TH edition 2013		
assumptions:	tensile strength of concrete	is ignored			
Project:	AD20210505	Designed by:	AFO	Rev. by	LLA
Part:	Attleborough 175	Customer:	Adfil	Date	05/05/2021
Restrained slab:	no				

sLade version 2019

Equations	5:		
h	Concrete thickness	<b>175</b> mm	
con	Concrete grade	C32/40	
Dr	Dosage rate	<b>4,0</b> kg/m3	
Ft	Fiber type	Durus EasyFinish	
	Load transfer between joints	Flashjoint	
k-Form	Construction Joint & Screed rail formwork	FlashJoint	
W	Slab weight	4,38 kN/m2	
Foc	Friction slab / subgrade	1,00	
Morgo	90d modulus of rupture MOR90	5,02 Mpa	
Mor	Modulus of rupture 28 d concrete	3,51 Mpa	
Frı	Residual strength Fr1 at CMOD 0,5 mm	1,90 Mpa	
FR4	Residual strength Fr1 at CMOD 3,5 mm	2,11 Mpa	
Sf1	Safety factor racking	1,35	
Sf2	Safety factor other loads	1,35	
Sf <sub>3</sub>	Safety factor dynamic loads	1,5	
Cs28	compressive strength 28 d	40 Мра	
Ecm	modulus of elasticity	35220 Mpa	
Fc	friction coefficient	1	
te	thermal expansion	14,5	
At	temperature difference	10,0 °C	
Pr	poisson ratio	0,25	
je	saw cut depth	58 mm	
Subgrade			
Туре	Subgrade type	Туре 1	
Rcs 2%	Perm. res. Rcs v/ 2% defor. or comp. strength	2,500 N/mm2	
е	Thickness	<b>150</b> mm	
Es	Modulus of elasticity	75,00 N/mm2	
W	Compression under load	5,00 mm	
ks	k-value of subgrade	0,500 N/mm3	
kf	final K value	0,25 N/mm3	
Rs	Radius of relative stifness	509 mm	

Loads					
Rolling or li	ve None		kN		
-	axles		2		
Al	axle load	-	1 kN		
WI	wheel load	0,3	1 kN		
Wd	wheel distance	3500	o mm		
Ad	axle distance	3500	o mm		
Rca	radius of contact area	302,00	o mm		
Qı	design load 1	0,19	ə kN		
Q2	design load 2		kN	*if 2h>Ad c	only
Q3	design load 3	C	o kN		
Q4	design load 4		kN		
		cente	r edge	corner	
συ	Corresponding stress	0,01	1 0,01	0,01	
UDL	uniformly distributed load - Static load	150,00	o kN/m2		
Mudl	Moment due to UDL	1,0322	2 kNm/m		
συ	Corresponding stress	0,20	o N/mm2		
Li	line Load	1,00	o kN/m		
Li2	second line load		1 kN/m		
dl	distance between loads	(	o mm		
γ	Amplitude parameter	1,43	1 M		
Cγ	deflection	1,000	o m		
MI	Moment	0,13	3 kNm/m		
συ	Corresponding stress	0,03	3 N/mm2		
Plı	point load	1,00	D N		
Α	Contact area	,	o mm		
mip	Min distance between loads	0,00	o mm		
map	Max distance between loads	0,00	o mm		
ilm	influence load center	0,00	o,oc	100,00	
ile	influence load edge	100,00	0 100,00	100,00	
ilc	influence load corner	100,00	100,00	100,00	
Ср	contact pressure	0,00	o N/mm2		
Lr	loading radius	115,72	1 mm		
Er	equivalent radius	110,03	1 mm		
		PI	L RL	UDL	LL
συ	internal stress	0,0000	0,01	0,20	0,03
	edge stress	0,0001	1 0,01		
	corner stress	0,0001	1 0,01		
	Load transfer corner	0,6800	0		
	Load transfer edge	0,6800	0		
Sc	sollicitation center	0,86	5 N/mm2		
Se	sollicitation edge	0,41	1 N/mm2		
So	sollicitation corner	0,41	1 N/mm2		
Cs	combined sollicitation	0,90	o N/mm2	Design vali	dated

Shrinkage	& curling				
RoRt	Radius of relative stiffness			509 mm	
	shrinkage restraint stress			0,042 Mpa	valid FRC
Δt	linear temp. diff. between to	o & bottom of slab		10°C	
Dt	temperature related stress			0,59 N/mm2	
σο	Max tensile strength at top o	fslab		1915113 Mpa	
9	Internal curling angle			1 Rad	
Crs	curling restraint stress			2,15 Mpa	valid FRC
Lcs	transfer stress at edge / saw o	cuts		0,000 N/mm2	
Joint spaci	ng				
Characteris	sic tensile strenght FRC0.05:	5601981 N		5,6 Mpa	
Characteris	sic tensile strenght C:	3508821 N		3,5 Mpa	
Own weigh	it:	4,38 kN/m2			
UDL:		150 kN/m2			
PL:		o,oo kN	$\sim$		
RL:		o kN			
Friction coe	efficient:	1,00			
L				5 m	
Punching s	shear		<i>p</i>		
The followi	ng approach considers that the	slab carries the punching			
load, even i	if a proportion is actually transf	erred to the subbase. The		( <b>1</b> )	
figure show	vs the 3 different cases of critica	al perimeters for punching	124		
shear.					20
					-24
					1201
A	Contact area	7853,9816	The second	1 201	I .
			(a) Internal	(D) Edge	(c) Conter
Pl	Punching load			o,oo kN	
b	width			89 mm	
1	length			89 mm	
Uo	perimeter at the face of the c	ontact area	354	,4907702 mm	
tcd	design compressive strength			27 Mpa	
Ϋ́C	partial safety factor			1,5	
k2	Conversion factor			0,5040	
Vmax	max. shear stress at surface			6,72 Mpa	
Pmax	Maximum alation 1 11 1			• •	
l.a.	Max punching imposed load			o,oo Mpa	
k1	Max punching imposed load	antact area at a d		o,oo Mpa 2,07	

Shear capa	acity calculation FRC		
Vfu	Shear capacity due to FRC only	o,7.§.tfd.b.d	
d		131,25 mm	
Uo		266 mm	
Uı		1091 mm	
S	size factor	2,1	
tfd	value of fibre induced increase shear str.	0,95 Mpa	
Vcu	Shear capacity plain concrete	3,4 Mpa	
Vfu	Shear capacity FRC	97 kN	Design validated
Design mo	oment		
_			
Fct	Fiber reinforced Concrete flexural strength	5,02 Mpa	
Mυ	ULS design moment $h_2/\gamma.(o, 29.\sigma r_4 + o, 16.\sigma r_1)$	11,11 kNm	
σ1	0,45.fR1	0,85 Mpa	
σ4	0,37.fR4	0,78 Mpa	
h	Thickness	175 mm	
σs	combined sollicitation	o,90 Mpa	
Mυ	Applicable moment due to loads	4,60 kNm	
CONCLUSI	ION as Mp > Mu	design validated	
Added me	sh		
Mait	Moment difference	-25 KNM	
As	Mesn Caracteria a success to the state of	393 mm2/m	
	Concrete cover to bottom	50 mm	
15 Mars	l'ensile strength rebar	500 Mipa	
wim	Moment mesh	25 KNM	
Crackwidt	h		
S	Max strain at dosage rate	2.2 mm*	*EN 14651
wfrc	Crack width FRC	0.31 mm	
-		-15	
Conclusior	1		
-	Dosign	validated	
<u>(</u>	combined sollicitation	1 N/mma	Design validated
Mu	Applicable moment due to loads	r kNm	Design valuated
Mm	Moment mesh	5 kNm	
M+	Moment mesh + FRC	25 kNm	Design validated
IVIL		30 KNIII	Design valuated
	The design is valid as below solution:	<b></b>	
	Construction Joint & Screed rail formwork	FlashJoint	
	Dosage rate	4,0 kg/m3	
	Fiber type	Durus EasyFinish	
	Maximum jointless area with Pl	25 m2	
	* ConCribe cannot guarantee the maximum crack width for s	aw cut spacing of more than indicated as joint	less area

![](_page_39_Picture_1.jpeg)

### THE ONLY JOINT ARMOR WITH LOAD TRANSFER

- Enterily in Aluminium
- Installation directly on the ground
- Works as slab joint
- Transfer loads in the joint

![](_page_39_Figure_7.jpeg)

LIGHT

![](_page_39_Picture_8.jpeg)

![](_page_39_Picture_9.jpeg)

RESISTANT

### **STABLE AND EASY TO INSTALL**

- Installation directly on the ground
- Stable on its base
- Easy to cut
- Possible use of vibration beam

![](_page_40_Figure_6.jpeg)

### **SPLIT JOINT**

- · Allows horizontal movement in the joint
- Leave 5 mm of concrete at surface
- Restrain vertical forces in the joint

![](_page_40_Figure_11.jpeg)

![](_page_41_Figure_1.jpeg)

![](_page_41_Picture_2.jpeg)

Contact : Alan Sergeant - Toftegaard byg - + 45 2372 4449

### DESIGN OF SUPPORTED FIBRE REINFORCED CONCRETE SLAB

### Reference standard of the design

This design is done against CS-TR<sub>34</sub>- 4th Edition - Concrete industrial ground floors a guide to design and construction Concrete Industrial Ground Floors -

The 4th edition of TR<sub>34</sub> is in line with the latest Eurocodes and Standards for the structural design procedures for ground-supported and pile-supported floors.

### Design method

TR<sub>34</sub> is written in a limit state format with emphasis on the ultimate and serviceability limit state (ULS and SLS). For the ultimate limit state the Meyerhof equations were adopted for slab analysis with partial safety factors based on those in the draft Eurcode 2. The equations are based on yield line theory and thus it is necessary to establish positive (sagging) and negative (hogging) moment capacities, Up and Ma. It is assumed that plain concrete does not have any significant ability to redistribute bending moments, but the presence or fibres (macro

synthetic or steel) will enhance ductility and the ability to redistribute bending moments. The ductility of fiber reinforced concrete is characterised by its equivalent flexural strength ratio Re3. This provides a residual (i.e. post cracking) positive bending moment capacity Up as follows: Mp=Fct.Re3/S(h<sub>2</sub>/6)

where:

S = partial safety factor for concrete, taken as 1.5 for the ULS.

Re3= equivalent to actual strength ratio in TR34 (2003) it is recommended that sufficient

fibers be provided to give the minimum Re3 value of 0.3.

h = slab depth (mm)

Fct = characteristic flexural strength of the plain concrete obtained from TR34 (2013) or

Eurocode 2 (2004). The use of Eurocode 2 results in a reduced value of Fct and is not actual in this design.

### Concept

TR 34 design strategy is based on the influence of 4 types of loadings on the slab :

-Uniformly distributed load or UDL, also called flat load, a static load.

-Line load , might it be a wall,

-rolling or live load, typically vehicle on wheels, and

-point loads.

Three loading locations are considered in design as follows:

-internal - the centre of the load is located more than (I + a) from an edge (i.e. a free edge or a joint)

-edge - the centre of the load is located on an edge more than (I + a) from a corner (i.e. a free corner or the intersection of two joints) -corner - the centre of the load is located a from the two edges forming a corner.

where

a = equivalent contact radius of the load

I = radius of relative stiffness.

### Concrete specifications

This design is based on the assumptions that concrete mix follows EN 206. To increase the performance of the fibre reinforced concrete slab, Concribe recommends to keep aggregate size below 22 mm in any case. Water cement ration should also be kept as low as possible, with maximum of 0.5. To prevent drying shrinkage, filler content should be maximum 400 kg/m3 or mix should not content fly ash nor microsilica. Slab thickness should not be below 80 mm, in which case Concribe's screed specifications should be used.

### Added reinforcement

Fibre reinforced concrete performs at reducing crack width and increase joint spacing, but requires added rebar to prevent cracking where stress and therefore risk is greatest. There should be rebars according to the sketch below; in corners, around piles and in front of openings in the building.

![](_page_43_Figure_3.jpeg)

### Treatment of concrete surface

the use of plastic film or curing product, but water, is mandatory to prevent early drying shrinkage. Curing should satisfy the requirments of ASTM C<sub>3</sub>O<sub>9</sub>: Type 1.

### Joints

Jointing should follow the recommended bay size on this design. Joints can be either saw cut or armoured. Saw cut jointing should respect the saw cut depth in the design and be executed within 24 hours after concrete pour, armoured joints should be according to suppliers specifications following this design. Length/width ratio of any bay shall not exceed 1,5: length / width < 1,5

### Liability

ConCribe is unable to have insight in the correctness of the data which the design is based on. This design is therefore only valid for the given data, and covered by Concribe professional indemnity for design and personal damages due to failed design. As Concribe obviously does not have insight in or control over execution of the slab, liability declines for all losses and/or damages consequently.

### Fibre reinforced concrete performance

The strength of fibres is measured as a residual flexural tensile strength. This can be done by performing crack mouth opening displacement (CMOD) tests. A CMOD test is a deformation controlled loading test, where the crack opening is measured as a horizontal deflection. The test setup requires a beam, notched to prevent horizontal cracking, and devices for recording the applied load and the crack opening, which is referred to as CMOD. The FIB model code proposes that it is to be done in accordance with EN 14651 (2005).

![](_page_44_Figure_9.jpeg)

### Design principle

For ground-supported slabs, two ultimate strength modes of failure of the concrete slab are possible, namely flexure (bending) and local punching. Slab design for flexure at the ultimate limit state is based on yield line theory, which requires adequate ductility to assume plastic behaviour. (Ductility requirements are discussed in Section 9.4 and Appendix E.) At the ultimate limit state, the bending moment along the sagging yield lines may be assumed to be the full plastic (or residual post-cracking) value. However, a principal requirement in the design of ground-supported slabs is the avoidance of cracks on the upper surface. Hence, at the ultimate limit state the bending moment of the slab along the hogging yield lines is limited to the design cracking moment of the concrete, with the partial safety factors appropriate to the ultimate limit state.

Design of slabs			TR34 4TH edition 2013		
assumptions:	tensile strength of concrete	is ignored			
Project:	AD20210505	Designed by:	AFO	Rev. by	LLA
Part:	Attleborough 150	Customer:	Adfil	Date	05/05/2021
Restrained slab:	no				

sLade version 2019

Equations	5:		
h	Concrete thickness	<b>150</b> mm	
con	Concrete grade	C32/40	
Dr	Dosage rate	<b>3,o</b> kg/m3	
Ft	Fiber type	Durus EasyFinish	
	Load transfer between joints	none	
k-Form	Construction Joint & Screed rail formwork	FlashJoint	
W	Slab weight	3,75 kN/m2	
Foc	Friction slab / subgrade	1,00	
Morgo	90d modulus of rupture MOR90	4,63 Mpa	
Mor	Modulus of rupture 28 d concrete	3,51 Mpa	
Fr1	Residual strength Fr1 at CMOD 0,5 mm	1,59 Mpa	
FR4	Residual strength Fr1 at CMOD 3,5 mm	1,90 Mpa	
Sf1	Safety factor racking	1,35	
Sf2	Safety factor other loads	1,35	
Sf <sub>3</sub>	Safety factor dynamic loads	1,5	
Cs28	compressive strength 28 d	40 Mpa	
Ecm	modulus of elasticity	35220 Mpa	
Fc	friction coefficient	1	
te	thermal expansion	14,5	
At	temperature difference	10,0 °C	
Pr	poisson ratio	0,25	
je	saw cut depth	50 mm	
Subgrade			
Туре	Subgrade type	Туре 1	
Rcs 2%	Perm. res. Rcs v/ 2% defor. or comp. strength	2,500 N/mm2	
е	Thickness	<b>150</b> mm	
Es	Modulus of elasticity	> 75,00 N/mm2	
W	Compression under load	5,00 mm	
ks	k-value of subgrade	0,500 N/mm3	
kf	final K value	0,25 N/mm3	
Rs	Radius of relative stifness	453 mm	

Loads					
Rolling or l	ive 2 T forklift	20	kN		
•	axles	1			
Al	axle load	20	kN		
WI	wheel load	5,0	kN		
Wd	wheel distance	1600	mm		
Ad	axle distance	960	mm		
Rca	radius of contact area	302,00	mm		
Qı	design load 1	7,50	kN		
Q2	design load 2		kN	*if 2h>A	d only
Q3	design load 3	7	kN		
Q4	design load 4		kN		
	Company dia setura s	center	edge	corner	
συ	Corresponding stress	0,47	0,70	0,79	
UDL	uniformly distributed load - Static load	50,00	kN/m2		
Mudl	Moment due to UDL	0,4729	kNm/m		
συ	Corresponding stress	0,13	N/mm2		
Li	line Load	1.00	kN/m		
Liz	second line load	-,	kN/m		
dl	distance between loads	0	mm		
V	Amplitude parameter	1,58	m		
Γγ	deflection	1,000	m		
MI	Moment	0,12	kNm/m		
συ	Corresponding stress	0,03	N/mm2		
Pl1	noint load	1 00	N		
Α	Contact area	_ <b>,</b>	mm		
mip	Min distance between loads	0.00	mm		
map	Max distance between loads	0,00	mm		
ilm	influence load center	0.00	0.0	0 100.00	
ile	influence load edge	100.00	100.0	0 100.00	
ilc	influence load corner	100,00	100,0	0 100,00	
Ср	contact pressure	, 0,00	N/mm2	,	
Lr	loading radius	103,21	mm		
Er	equivalent radius	97,61	mm		
		PL	RL	UDL	LL
συ	internal stress	0,0001	0,4	7 0,13	0,03
	edge stress	0,0001	٥,7	0	
	corner stress	0,0001	٥,7	9	
	Load transfer corner	1,0000			
	Load transfer edge	1,0000			
Sc	sollicitation center	1,06	N/mm2		
Se	sollicitation edge	1,29	N/mm2		
So	sollicitation corner	1,38	N/mm2		
Cs	combined sollicitation	1,42	N/mm2	Design v	/alidated

Shrinkage	& curling				
RoRt	Radius of relative stiffness			453 mm	
	shrinkage restraint stress			0,042 Mpa	valid FRC
Δt	linear temp. diff. between to	p & bottom of slab		10°C	
Dt	temperature related stress			0,59 N/mm2	
σο	Max tensile strength at top o	of slab		1915113 Mpa	
9	Internal curling angle			518 Rad	
Crs	curling restraint stress			1,92 Mpa	valid FRC
Lcs	transfer stress at edge / saw	cuts		0,000 N/mm2	
Joint spaci	ng				
Characteris	sic tensile strenght FRC0.05:	5099908 N		5,1 Mpa	
Characteris	sic tensile strenght C:	3508821 N		3,5 Mpa	
Own weigł	nt:	3,75 kN/m2		0.0	
UDL:		50 kN/m2			
PL:		o,oo kN	$\cdot$		
RL:		1 kN	$\sim$		
Friction co	efficient:	1,00			
L				5 m	
Punching:	shear				
The follow load, even figure show shear.	ing approach considers that th if a proportion is actually trans vs the 3 different cases of critic	e slab carries the punching ferred to the subbase. The al perimeters for punching	20	20	2d
А	Contact area	7853,9816	(a) Internal	(b) Edge	(c) Corner
Pl	Punching load			0,00 kN	
b	width			89 mm	
I	length			89 mm	
Uo	perimeter at the face of the	contact area	354	4,4907702 mm	
fcd	design compressive strength	ı		27 Mpa	
Ϋ́c	partial safety factor			1,5	
k2	Conversion factor			0,5040	
Vmax	max. shear stress at surface			6,72 Mpa	
Pmax	Max punching imposed load			o,oo Mpa	
kı				2,15	
U1	perimeter at the face of the	contact area at 2d		1377 mm	

Shear capao	city calculation FRC		
Vfu	Shear capacity due to FRC only	o,7.§.tfd.b.d	
d		112,50 mm	
Uo		266 mm	
Uı		973 mm	
S	size factor	2,2	
tfd	value of fibre induced increase shear str.	o,8o Mpa	
Vcu	Shear capacity plain concrete	3,4 Мра	
Vfu	Shear capacity FRC	75 kN	Design validated
Design mor	nent		
Fct	Fiber reinforced Concrete flexural strength	4,63 Mpa	
Μυ	ULS design moment h2/γ.(0,29.σr4 + 0,16.σr1)	7,16 kNm	
σ1	0,45.fR1	0,72 Mpa	
σ4	o,37.fR4	о,70 Мра	
h	Thickness	150 mm	
σs	combined sollicitation	1,42 Mpa	
Mυ	Applicable moment due to loads	5,33 kNm	
CONCLUSIC	DN as Mp > Mu	design validated	
Added mes	h		
Mdif	Moment difference	3 kNm	
As	Mesh	o mm2/m	
сс	Concrete cover to bottom	50 mm	
Ts	Tensile strength rebar	500 Mpa	
Mm	Moment mesh	o kNm	
Crack width			
_			
S	Max strain at dosage rate	3,0 mm*	^EN 14651
WTC		0,42 mm	
Conclusion			
Conclosion			
	Design	validated	
Cs	combined sollicitation	1 N/mm2	Design validated
Μυ	Applicable moment due to loads	5 kNm	
Mm	Moment mesh	o kNm	
Mt	Moment mesh + FRC	7 kNm	Design validated
	The design is valid as below solution:		
	Construction Joint & Screed rail formwork	FlashJoint	
	Dosage rate	3,0 kg/m3	
	Fiber type	Durus EasyFinish	
	Maximum jointless area with PI	25 m2	
	saw cut depth	50 mm	
	Max. Crack Width	0,42 mm	
	* ConCribe cannot guarantee the maximum crack width for s	aw cut spacing of more than indicated as joint	less area

![](_page_49_Picture_1.jpeg)

### THE ONLY JOINT ARMOR WITH LOAD TRANSFER

- Enterily in Aluminium
- Installation directly on the ground
- Works as slab joint
- Transfer loads in the joint

![](_page_49_Figure_7.jpeg)

![](_page_49_Picture_8.jpeg)

![](_page_49_Picture_9.jpeg)

![](_page_49_Picture_10.jpeg)

LIGHT

### STABLE AND EASY TO INSTALL

- Installation directly on the ground
- Stable on its base
- Easy to cut
- Possible use of vibration beam

![](_page_50_Figure_6.jpeg)

### SPLIT JOINT

- Allows horizontal movement in the joint
- Leave 5 mm of concrete at surface
- Restrain vertical forces in the joint

![](_page_50_Figure_11.jpeg)

![](_page_51_Picture_1.jpeg)

![](_page_51_Picture_2.jpeg)

Contact : Alan Sergeant - Toftegaard byg -+ 45 2372 4449

### **TECHNICAL DATA**

### **BENTOMAT AS5000-1 Self** GEOSYNTHETIC CLAY BARRIER (GBR-C)

BENTOMAT AS5000-1 Self is a reinforced GBR-C consisting of a layer of sodium bentonite between a woven and a nonwoven geotextile, which are needlepunched together to provide internal reinforcement. The internal reinforcement minimizes clay shifting, thus allowing the GBR-C to maintain consistent low permeability and maximum performance under a wide variety of field conditions.

TECHNICAL DATA					
MATERIAL PROPERTY	TEST METHOD	TYPICAL VALUE	TEST FREQUENCY		
GBR-C					
Index Flux (1)	EN 16416	3,0x10 <sup>-09</sup> (m³/m²)/s	Production week (2)		
Hydraulic Conductivity	EN 16416	1,5x10 <sup>-11</sup> m/s	Production week (2)		
Total Mass/Unit Area (3)	EN 14196	5,33 kg/m²	5000 m <sup>2</sup>		
Bentonite Mass/Unit Area (3)	EN 14196	5,00 kg/m²	5000 m <sup>2</sup>		
Tensile Strength MD/CMD (4)	EN ISO 10319	12,0/12,0 kN/m	5000 m <sup>2</sup>		
Elongation at Break MD/CMD	EN ISO 10319	15%	5000 m <sup>2</sup>		
Puncture Resistance (CBR) (5)	EN ISO 12236	2,0 kN	5000 m <sup>2</sup>		
Peel Strength <sup>(6)</sup>	ASTM D 6496	650 N/m	5000 m <sup>2</sup>		
Thickness	EN ISO 9863-1	7,5 mm	5000 m <sup>2</sup>		
Roll Length	_	40,0 m	Continuous		
Roll Width	-	5,0 m	Continuous		
BENTONITE					
Free Swell	ASTM D 5890	25 ml/2 g	5000 m <sup>2</sup>		
Fluid Loss	ASTM D 5891	max 18 ml	5000 m <sup>2</sup>		
Montmorillonite content (7)	XRD	80%	Certified by supplier		
GEOTEXTILES (PP)					
Non-Woven Mass/Unit Area	EN ISO 9864	200 g/m <sup>2</sup>	Certified by supplier		
Woven Mass/Unit Area	EN ISO 9864	130 g/m <sup>2</sup>	Certified by supplier		

Bentonite powder is impregnated into overlap area 50cm from both sides.

Notes:

<sup>1</sup>Index Flux with tolerance +0,5x10<sup>-09</sup> ( $m^3/m^2$ )/s

<sup>2</sup> Production week = average 75 000 m<sup>2</sup> of one type of Bentomat

<sup>3</sup> Bentonite mass/unit area reported at 12% moisture content

<sup>4</sup> Tensile Strength with tolerance –1,0 kN/m

<sup>5</sup> Puncture Resistance (CBR) with tolerance -0,2 kN

<sup>6</sup> Peel Strength testing is performed in machine direction

 $^7$  Montmorillonite content with tolerance  $\pm 10\%$ 

#### www.cetco.com

#### UPDATED: AUGUST 2018

IMPORTANT: The information contained herein supersedes all previous printed versions, and is believed to be accurate and reliable. For the most up-to-date information, please contact CETCO sales team. CETCO accepts no responsibility for the results obtained through application of this product. CETCO reserves the right to update information without notice.

![](_page_52_Picture_16.jpeg)

### civil engineering and building

- Å
- Industrial, Commercial, Agricultural and Domestic building design
- Foundation Design and ground improvements
- Highway Engineering including PDS/Civil 3D
- Retaining walls
- Sheet Piling

### environmental engineering

- Contaminated Land investigations (intrusive & non-intrusive)
- Land remediation verification
- Environmental impact assessments (EIA)
- Flood Risk Assessments
- Water supply, treatment, storage and distribution

### structural engineering

![](_page_53_Picture_15.jpeg)

- Structural calculations for Commercial, Agricultural and Domestic building design
- Structural design using steel, stainless & carbon steel, concrete, timber, alloys and masonry

### surveying land and buildings

- K
- Geomatic / topographical site surveys
- Building, Road, and Earthworks Setting out
- Engineering Setting out
- Establish precise site survey control
- o 3D digital terrain modelling

- Infrastructure planning and design
- Design of sustainable drainage system (SUDS)
- Soakaway design
- Architectural design of industrial buildings
- Planning and building regulation applications

- 3D conceptual models
- Renewable Energy Civil Engineering design and project management
- Anaerobic Digestion and Waste to Energy Project design and detail
- Foul and surface water & effluent/leachate drainage design
- o Drainage network modelling
- o 1D & 2D flood modelling
- Hydraulic river modelling
- Flood Alleviation
- Breach & overtopping analysis
- Reservoir flood inundation modelling
- Consent to discharge applications
- Landscaping design
- Tree surveys
- Environmental Permits
- Maritime and Hydraulic structures
- Structural surveys and structural suitability surveys
- Structural failure studies
- Subsidence claims
- Temporary works design
- o 3D Finite Element Analysis
- Structural enhancement/

Structural monitoring

- remedial workHistoric building advice
- 3D Revit & Level 2 BIM
- structural design & modelling
- o Volumetric analysis
- Site area computations
- Flood risk surveys using GPS active network
- Measured building floor plans and elevation surveys
- Land transfer plans to Land Registry requirements
- o Drainage network surveys
- Assistance/Expert witness in land boundary disputes
- Deterioration monitoring
- Preparation of asset plans
- As built record surveys

![](_page_54_Picture_0.jpeg)

Plandescil Ltd Connaught Road Attleborough Norfolk NR17 2BW

**t:** 01953 452001 **e:** pdc@plandescil.co.uk

plandescil.co.uk

![](_page_54_Picture_4.jpeg)

civil / structural / environmental / surveying