

GeoEnginSeer Ltd

Geological Services
Gas Protection Verification
Site Supervision
Ground Gas Sampling



GeoEnginSeer Ltd Geological Services

10 School Street, Wheldon Road, Castleford, West Yorkshire, WF10 2FD

Ground Gas Protection System Verification Plan

Building Warrant Application

Prepared for

The Client: Denton Construction Ltd for: **MSV Housing Group**

Publish Date: 27.01.2025 V2

Version Number: GESL Ref: 1709 V1

Project: Erection of a 2 x two storey buildings to form eight supported living apartments, following demolition of existing industrial buildings.

Planning application reference: 137461/FO/2023 – Manchester City Council

Client: MSV Housing Group

Main Contact: Ian Stanyer, Denton Construction

Email: dentonconstructb@aol.com

Installer: PRS (Manchester) Ltd

Verification Plan Created by: Ben Crowther B.Sc, M.Sc, PGCE, FGS, CIEH, PCA QT, SGPV

Email: GeoEnginSeer@gmail.com

Telephone: 07817 108 921

Web: www.GeoEnginSeerLtd.co.uk

This document has been created in accordance with British Standards 8485:2015+A1:2019 & Construction Industry Research and Information Association
CIRIA 735 – Good Practice on the testing and verification of ground gas protection systems for buildings against hazardous ground gases

Erection of a 2 x two storey buildings to form eight supported living apartments, following demolition of existing industrial buildings.

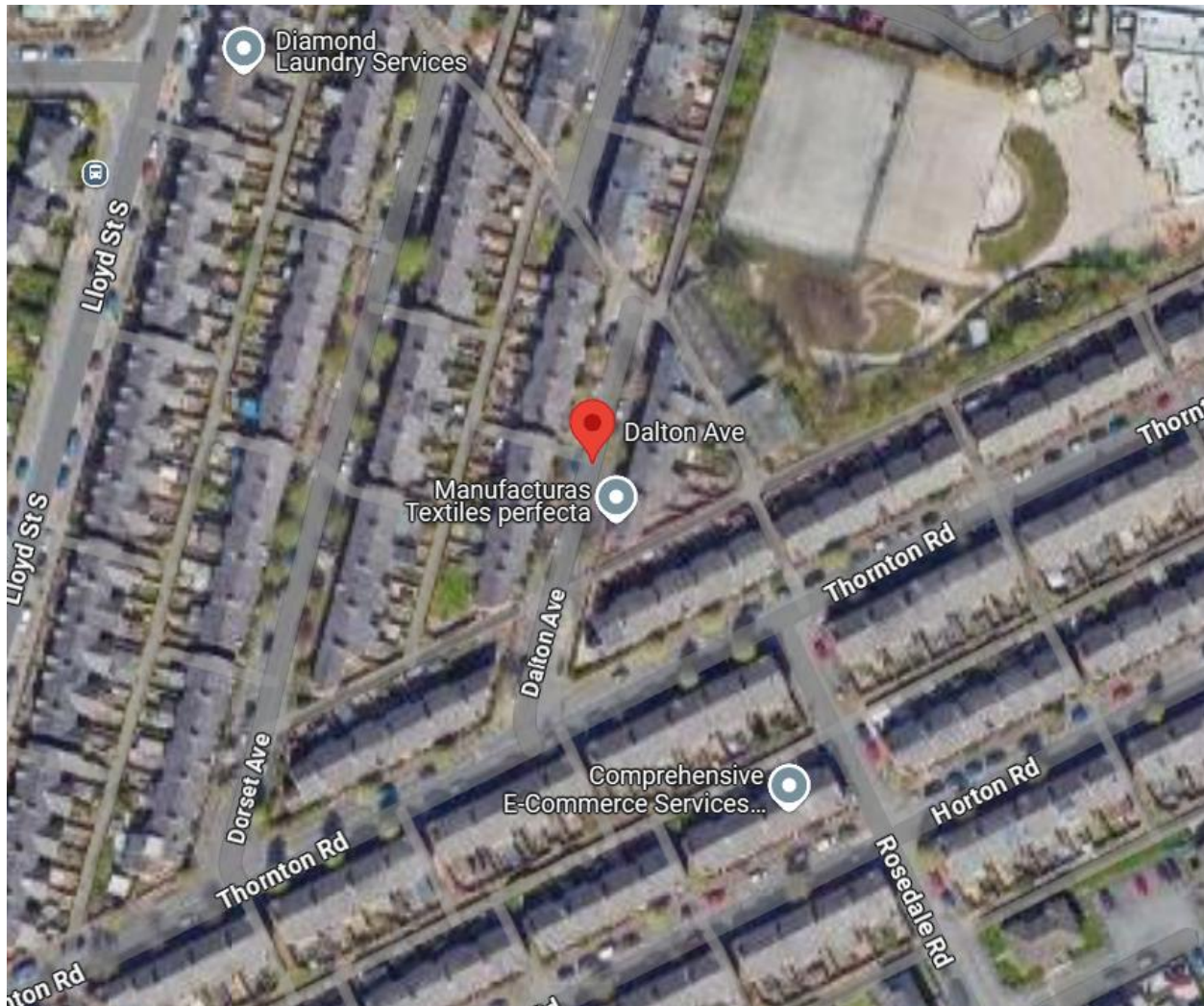


Image courtesy of Google Maps 2025

Executive Summary

Site Address:	Land To The Rear Of Dalton Avenue Manchester M14 7NR												
Relevant Site Investigation Report extract:	Carley Daines & Partners Limited undertook a Phase 1 Preliminary Risk Assessment, reference 22-B-13509, dated October 2022. In addition to both a Phase 2 Geo-Environmental Investigation and Assessment, reference 22-B-13509, dated October 2023, and a Phase 3 Remediation Statement, reference 23-B-13509, dated April 2024. The following extract was taken from the Phase 3 report: Gas protection measures should be installed in accordance with BS8485: 2015. Based on a Type A development and CS2 classification a gas protection score of 3.5 to will need to be achieved. <table><thead><tr><th>Building Type</th><th>Floor Slab Type</th><th>Ventilation</th><th>Membrane</th><th>Required Points Score</th><th>Points Achieved</th></tr></thead><tbody><tr><td>Conventional residential house (Building Type A)</td><td>Block and beam suspended floor (0 Points)</td><td>Suspended beam and block flooring with suspended ventilated void (2.5 points)</td><td>Full gas membrane installed to S8485:2015 and validated to CIRIA 735 (2 points)</td><td>3.5</td><td>4.5 points</td></tr></tbody></table> “ ”	Building Type	Floor Slab Type	Ventilation	Membrane	Required Points Score	Points Achieved	Conventional residential house (Building Type A)	Block and beam suspended floor (0 Points)	Suspended beam and block flooring with suspended ventilated void (2.5 points)	Full gas membrane installed to S8485:2015 and validated to CIRIA 735 (2 points)	3.5	4.5 points
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Site description and context:	The site is almost rectangular in shape, with maximum dimensions of approximately 50m x 13m. The site is enclosed on the north, west and south sides by terraced housing fronting onto Dalton Avenue and Thornton Avenue. To the east is a school with open ground and playing fields closest to the site. The site is presently occupied by two adjoining buildings used for light industry or vehicle maintenance. The site is relatively small and is currently developed with an industrial building dating back to the 1960’s. The precise use is unknown but is believed to be associated with light engineering or motor trade activities.												
Planning Permission:	137461/FO/2023 – Manchester City Council												
Geology and Aquifer Designations:	There is no indicated made ground on site shown on currently available environmental plans. However, a large area to the north east currently occupied by the school and previously by the MCFC stadium was previously a brick works and is indicated as Made & Worked Ground.												



	Drift deposits on and off site are indicated as Devensian Till. Solid geology is indicated as indicated as comprising Sandstone (Cheshire Pebble Beds Formation). In terms of hydrogeology the site is indicated as being above a Principal Bedrock Aquifer and a secondary Superficial Aquifer. The site is within a currently designated Environment Agency Source Protection Zone.												
Ground Gas and Summary of Gas Risk Assessment	Gas screening values should be calculated on a borehole basis in the first instance. Consideration of worst case i.e. highest flow and highest concentrations should only be considered if the CSM warrants it. In line with CIRIA 665 Guidance on Methane and Carbon Dioxide, the site is to be developed for residential end use and the ground gas investigation has identified a maximum carbon dioxide concentration of 10.1% with flows up to 0.80l/hr recorded to date. The maximum recorded concentration for methane was 0.40%. In addition, hydrogen sulphide concentrations of 0.0 ppm were recorded. Given the above gas protection measures are recommended for all buildings on site, however the scope of protection measures for each section will be assessed based on the building type and Characteristic Situation. This has been assessed using the matrix presented in BS8485:2015 and is presented in the table below. Gas protection measures should be installed in accordance with BS8485:2015+A1:2019. Based on a Type A development and CS2 classification a gas protection score of 3.5 to will need to be achieved. <table><tr><th>Building Type</th><th>Floor Slab Type</th><th>Ventilation</th><th>Membrane</th><th>Required Points Score</th><th>Points Achieved</th></tr><tr><td>Conventional residential house (Building Type A)</td><td>Block and beam suspended floor (0 Points)</td><td>Suspended beam and block flooring with suspended ventilated void (2.5 points)</td><td>Full gas membrane installed to S8485:2015 and validated to CIRIA 735 (2 points)</td><td>3.5</td><td>4.5 points</td></tr></table> On the basis of these results, certification of ground gas measures are classified as Situation 2 (Amber 1 (NHBC system ceasing in 2025) conditions and ground gas protection measures should be adopted, utilising Low Permeability membrane and ventilated sub-floor void that creates a permeability contrast to limit the ingress of gas	Building Type	Floor Slab Type	Ventilation	Membrane	Required Points Score	Points Achieved	Conventional residential house (Building Type A)	Block and beam suspended floor (0 Points)	Suspended beam and block flooring with suspended ventilated void (2.5 points)	Full gas membrane installed to S8485:2015 and validated to CIRIA 735 (2 points)	3.5	4.5 points
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	into buildings. Service entries should be sealed with appropriate Visqueen or similar specialist proprietary equipment. Gas protection measures should be installed as prescribed in BRE 414 with the ventilation of the sub-floor void designed to provide a minimum of one complete volume change per 24 hours.
Remediation Strategy and Gas Protection Measures Required	Development should be in accordance with the CS2 standard specified in BS8485:2015+A1:2019 (Code of Practice for the design of protective measures for Methane and Carbon Dioxide ground gases for new buildings). A combination of two or more of the following protection measures should be used to achieve the Gas Protection Score, as determined in Section 4.3.1 of BS8485:2015+A1:2019: • Structural barrier, or basement slab and wall if present. • Ventilation measures. • Gas resistant membrane.



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Annex

A - Example of an appropriate verifier

B - Detailed Drawings of the location of gas protection measures in the build

C - Web Links to Example Materials



Purpose of the Verification Plan

This report has been prepared in general accordance with UK guidance and good practice documents, including (but not limited to):

- BS8485: 2015 + A1: 2019 - Code of Practice for the Design of Protective Measures for Methane & Carbon Dioxide Ground Gases for New Buildings (BSI, 2019).
- CIRIA 665 Assessing risks posed by hazardous ground gases to buildings.
- CIRIA Report C735 - Good Practice on the Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases (CIRIA, 2014).
- Land Contamination: Risk Management (<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>) (Environment Agency, October 2020); and
- BS EN ISO 21365 - Soil quality – Conceptual Site Models for Potentially Contaminated Sites (BSI, 2020).
- Radon: Guidance on protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment projects) 2023 edition.

A copy of this report should be submitted to relevant Regulators / stakeholders for their review, comment and approval.

Limitations of the Verification Plan

This report is based on the information that has been made available to GeoEnginSeer Ltd by the client, contractor and architect regarding the site. The conclusions drawn in the report are considered correct although any subsequent additional information or actions may allow for refinement of the conclusions. It should be noted that: The report has been prepared under the express instruction and is solely for the use of the Client.

The findings of this report represent the professional opinion of experienced Ground Gas System Surveyors. GeoEnginSeer Ltd. does not provide legal advice. The advice of lawyers may also be required.

All work carried out in the preparation of this report has utilised, and is based upon understanding of current relevant UK standards and codes, technology, and legislation. (BS8485:2015+A1:2019 & CIRIA 735).

Changes in the aforementioned legislation and guidance may occur at any time and could render conclusions null.

This report is limited to the boundaries identified by the client on this site and confirmed within this document.

A retrospective fit may be required if additional services are introduced, or if service conduits are not sealed, or if service conduits have services provided through them at a later date and are not sealed to the conduit and or gas protection system. If a site is left open for prolonged periods following verification or works are conducted that may damage the integrity of the installation by follow-on trades, repairs may be needed, the standards observed in a positive verification report may be compromised. Intellectual rights to this document may be rescinded.

The report is limited to the boundaries identified by GeoEnginSeerLtd on this site and confirmed within this document.

Principals of Dalton Avenue Verification Plan

GeoEnginSeerLtd, an independent specialist, has been appointed by the client to create this Verification Plan, conduct Verification visits and to produce a Verification Report for the installation of gas protection measures at Dalton Avenue.

Verifier Experience

GeoEnginSeerLtd staff collectively have a 47-year history in the industry dealing with gas barriers and containment. Ben Crowther – Director details appended below.

GeoEnginSeerLtd has been a verification specialist company for 5 years and has experience with gas and water protective systems ranging from multistory apartment blocks, residential housing, commercial developments and industrial heavy machinery floors as well as HS2 tunnels and shafts.

Verification Testing

A non-destructive testing regime is used to verify installed gas protective measures. GeoEnginSeerLtd can and will conduct the following methods for testing the integrity of the installed materials.

Visual examination, pick testing, Air Lance testing and air flow testing to sub floor void.

Examination of startup test welds by destructive testing shall also occur if heated hand welding is conducted.

Some of these tests adhere to ASTM D4437, 2008 Edition, April 1, 2008, others are novel and are described in the CIRIA C735 code of practice documentation and BS 8485+2015+A1:2019.

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Professionally Designed System:

A Structural Engineer designed system has been produced, in conjunction with the Architects plans with close attentive reference to standard installation principals from manufacturers.

These plans are reproduced in this document but refer to latest editions for scaling or build program.

The wording on the plans details the buildup of layers and placement of the Passive Ventilation Layer and Gas Resistant membrane and other components of this gas protection plan.

Much of the wording is drawn from manufacturers recommendations, which can be found on their websites, under installation details. Links provided in the Appendix.

Assured Professionalism

Guidance and professional bodies such as member of the British Verification Council (Ben Crowther was a founding member) and quality assurance peer review organisations such as CL:AIRE with their TGVP/SGVP system all suggest several key elements are required for the action of verification which are all included in this plan. There is a small additional fee for a declared site through the CL:AIRE system, CL:AIRE Declaration reference to be applied:

GPVS Declaration Reference: 0624-J0100Gas Protection Verification Declaration

Professional Installers:

As the installation may be conducted by professional staff qualified with the NVQL2 diploma in substructure occupations (installation of Gas Membranes) a professionally qualified person is not necessary in this case, with approval from the membrane manufacturer, the materials manufacturer and so experienced ground workers can create an excellent installation as long as manufacturers guidelines are followed.

This document has been created in accordance with British Standards 8485:2015+A1:2019 & Construction Industry Research and Information Association
CIRIA 735 – Good Practice on the testing and verification of ground gas protection systems for buildings against hazardous ground gases



Frequency of Inspection:

Verification is required for all installation events, prior to any covering of the gas barrier on the new build properties.

The plan for Dalton Avenue will be 100% inspection of membrane and evidential reporting on Covering of the membrane, and inspection during installation of insulation for protection of the installed membrane. This is especially the case if experienced ground workers conduct the installation.

Immediately post installation is the Key time that damage can occur and must be dealt with appropriately.

Subgrade

Subgrade quality is key to a successful install, subgrade inspection forms shall be submitted by site management or acceptance forms from professional installers to GeoEnginSeer Ltd.

With Dalton Avenue the subfloor build-up of floor will involve a smoothly rolled subgrade; installed Membrane Gas Barrier, with independent verification, which is required, insulation and floor screed will then be protected with the rapid installation of insulation or screeding.

Additional Important Considerations:

Follow on trades taking care and avoiding damage to the installed material is crucial all levels of Management must pay heed to this to prevent damage as detailed above.

Tool Box talks detailing the above and the importance of reporting damage so it can be repaired is critical.

Individual or Daily Verification Event Recording

Each verification event will photographically document any repairs. These records may include subgrade sign off forms and each report will evidence all non-destructive testing conducted. A report of the event detailing any issues, concerns and all testing will be produced each time verification is required. This will usually be close to the end of each stage of installation, so that repairs can be affected. Air flow testing will occur to any installed ventilation duct work.

Confirmation of appropriate products used over 100% of the installed system will be conducted on each and every verification event.

Communication

Communication is crucial to a successful project. Appropriately timed verification event coordination will occur just before the completion of each section of gas protection measure installation, especially of the gas resistant barrier membrane.

British Standard 8485:2015+A1:2019 Calculated Points System

This has been outlined in the Remedial Strategy document.

The Architect and Manufacturer of gas protection designed solutions for this development provides a system that achieves the points that are required to ensure protection of this property and the occupants.

3.5 points are required for this Type A building, with the precautionary adoption of Characteristic Situation 2, Low Risk is in effect at this site. The installation of an appropriate gas barrier membrane (example link in appendices), and subsequent independent verification testing provides 2.0 points.

In addition, a subfloor void of minimum 150mm, scores an additional 1.5 points depending on Number of air bricks in the surround of the building which should be roughly 1 per 1.5 m and sleeper wall gaps on an equivalent ratio. This gives a total score of 3.5 points in the British Standard ref; above.

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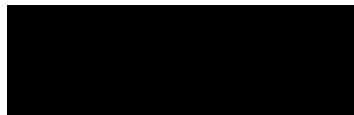
Conclusive Reporting

A final Gas Protection Verification Report for the project will be supplied to the client which will summarise and document all the above testing, materials deployed and as built effectiveness of the passive ventilation system. Any damage, repairs and variations necessary, if any, to this plan will be documented.

Conclusion - Statement

This system provides the minimum of two elements required by the British Standard guidance for the 3.5 points required for the protection of this privately owned residential Type A buildings. The gas protection measures above constitute a satisfactory solution for this system, given the level of risk and allows for structural stability of the development.

Ben Crowther
27.01.2025 V2



SGPV 004



Product Specification

The following pages detail the range of required gas resistant materials available for the Dalton Avenue site, appropriately fitted to the manufacturers standards.

The materials have been chosen to protect different areas of the designed build. The design of protective layers has included a two-tier system to protect this development by placing a lightly reinforced concrete slab to prevent movement and a sealed radon barrier from out leaf to outer leaf of the building.

The following specification is specific to this development – to encompass a minimum standard material to meet the BS8485:2015+A1:2019 characteristic situation 2 – Gas Barrier requirement.

Verification of the installed gas protection scheme is a strict requirement.

Seals between the outer service pipes placed through conduits and the internal face, and possible external face of such conduits also needs careful addressing. In the UK area an accepted suggested material to fit this purpose is Filo Seal, or Stop Aq, Last accessed January 2025).

It is the recommendation of GeoEnginSeer Ltd that, wherever possible, welded seams should be implemented in place of taped seams. There is a tendency of taped and self-adhesive seems to perform to a lesser standard than that of welded seams when installed in adverse weather conditions. Welded seams have been found to be more withstanding of previously conducted destructive testing.



Product	Description	Installation & Testing
CS2 Gas Barrier Visqueen Gas Barrier	Visqueen Gas Barrier is a multi-layer reinforced polyethylene gas barrier with a 20 micron aluminium foil. Visqueen Gas Barrier is suitable for use in all types of buildings to prevent the ingress of harmful levels of ground gases e.g. methane, carbon dioxide and radon.	Installation as per manufacturers guidance. Compliant to BS 8485:2015 + A1:2019. Independently tested to ISO 15105-1. CE Marking
Gas Resistant Self-Adhesive Membrane	Gas Resistant (GR) Self Adhesive Membrane (SAM) is a material designed to prevent the transmission of carbon dioxide, radon and methane gases in tanking applications or where hydrostatic pressure is present. Resistance to gas is achieved by an integral aluminum film. Substrates should be primed with a Tanking Primer prior to application.	Installation as per manufacturers guidance & BBA Cert Annex C - Testing in accordance with CIRIA 735 & BS8485:2015+A1:2019
Preformed Corners or Top hats	Manufacturers can produce formed shapes to fit round difficult corners or pipe joints. These need to be sized correctly for pipe or service entry fittings used in welded/GR-SAM fitted situations	These elements also need to be in line with manufacturers guidance & BBA Cert Annex C - Testing in accordance with CIRIA 735 & BS8485:2015+A1:2019
Seal between inner of conduits for serves and outer of conduit	Filo seal, or similar or better performance material: https://www.filoform.co.uk/filoseal-hd-re-enterable-duct-sealing	No BBA exists so an appropriate gas resistant self-adhesive should be used to ensure gas resistance is achieved.
Liquid Membrane and close sealed foam (e.g. Filoseal or StopAq)	Sealing the gap between service conduits internal face and external surface of the service	Physical and visual checks of the integrity of the seals

Verification Process

Verification is accordance with the Construction Industry Research and Information Association (CIRIA 735) & British Standards 8485:2015+A1:2019.

The following tests will be conducted during the Verification process.

1. Pick & Probe testing on minimum of 100% of all seams
2. Non-Destructive Air Lance testing on a minimum of 100% of all seams to ASTM D4437 (2008)
3. Visual Inspections on minimum of 100% of all seams
4. Destructive Testing on selected seam test welds or field tests where appropriate
5. Verification reporting prior to each major concrete pour, or built wall section, shall be conducted and will include written records, photographic evidence and subgrade sign off records.
6. Visual inspection of Subgrades and subgrade hand over forms where available.
7. Trace gas testing on appropriate locations can be conducted post construction.
8. Air flow testing on passive ventilation to check flow potential in the subfloor voids.

In addition, where possible a quality control regime conducted by a named installer shall be recorded and added to verification reporting upon each verification reporting event.

Risk – Based Approach to Verification

A risk-based system takes account of various factors that will influence the consideration of the scope of verification activities, including integrity testing. The verification specialist will consider the following:

1. Site – specific gas regime.
 2. Number of buildings/plots to be inspected and over the period this will take place.
 3. Complexity of the design and installation.
 4. Qualifications and or experience of the workforce.
 5. Additional gas resistance protection.
-

Elements that have been considered in the generation of this Verification Plan

Gas Regime:

Low Risk	CS2
Intermediate Risk	CS3/4
High Risk	CS4 and above

Design complexity:

Simple	Few service entries/penetrations, gas membrane and sub floor void
Complex	Variety of gas protection measures, numerous columns/penetrations/service entries, corners and small spaces

Number of plots/buildings:

Small	<5
Medium	5-15
Large	>10

Installation workforce: To be confirmed

Non-Specialist	General builder/ground worker
Skilled	Qualified and experienced installer (NVQ 2 qualification in gas protection installation)

:

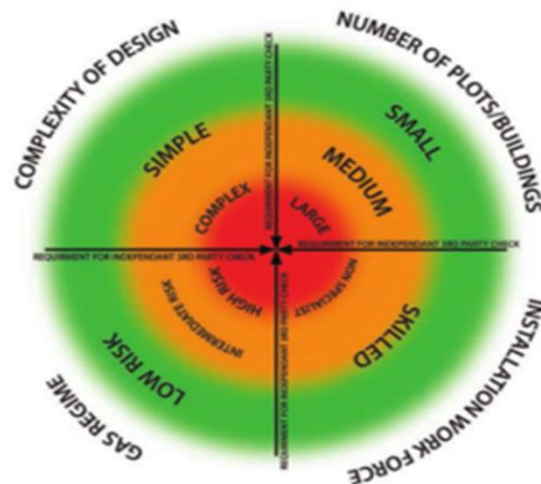


Diagram of risk from Ciria 735

Conclusion: The Gas Regime for this development is a Characteristic Situation 2 = Low Risk

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**Annex**

A – Ben Crowther: GeoEnginSeer Ltd: Verification Specialist: Person Specification.

B – Building Plans, elevations, location plan and setting out of plots

C – Product Specification: Gas Membrane and associated jointing and sealing products.

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Geological Services: Verification Specialist: Freelance Geologist

Ben Crowther trading as GeoEnginSeer Ltd; Independent Geological Services.

CSCS MAP: 06010225 exp 09/2022

Telephone: 07817 108921

Email: geoenginseer@gmail.com Website: www.GeoEnginSeerLtd.com

Qualifications: B.Sc, M.Sc, PGCE, FGS, CIEH, PCA QT (CSSW) SGVP (CL:AIRE)

NVQL3 Assessor of: Verification of Gas Protection Measures (NVQL4)

Confined Spaces L1, IPAF Harness Training, Cradle Safety.

PCA Qualified Technician in structural waterproofing. October 2020

Experience Summary:

15 years local authority regulation

14 years site investigation, site supervision, construction quality assurance and verification

Previous Secretary of, and founder member of the British Verification Council

Attendee of CIRIA Research Group 'Remedial Measures for Proprietary Gas Protection Measures'

Assessor for: NVQL4 Verification of Gas Protection Systems

CL:AIRE GPVS Assessor, SGVP certificate holder No.004

Climber, Fell Runner, Wild Swimmer, Ex Royal Marine Diver.

Recent CPD Summary:

GG5 2 Day A-Z of Ground Gas August 2017

CIRIA Verification Training Event October 2017

PCA Structural Waterproofing Conference 2018, 2019

CIRIA Technical Meeting for Retrospective Fitting of Gas Resistant Membranes 2019

Brownfield Summit Attendance 2018, 2019, 2020, 2021, 2022

DoWCoP CL:AIRE Training March 2021

PCA CSSW Qualified Technician Training 2021, working towards CSSW qualification.

Appeared on: Gassing On! with Neil Salvidge.

HS2 Align Training for Tunnel Shaft H&S Green Tunnels and Shaft Work: C1 and C2,

2022 Cradle safety and IPAF harness use trained: Operator Licence: OP/2157339

Signature



Annex B

Building Plans

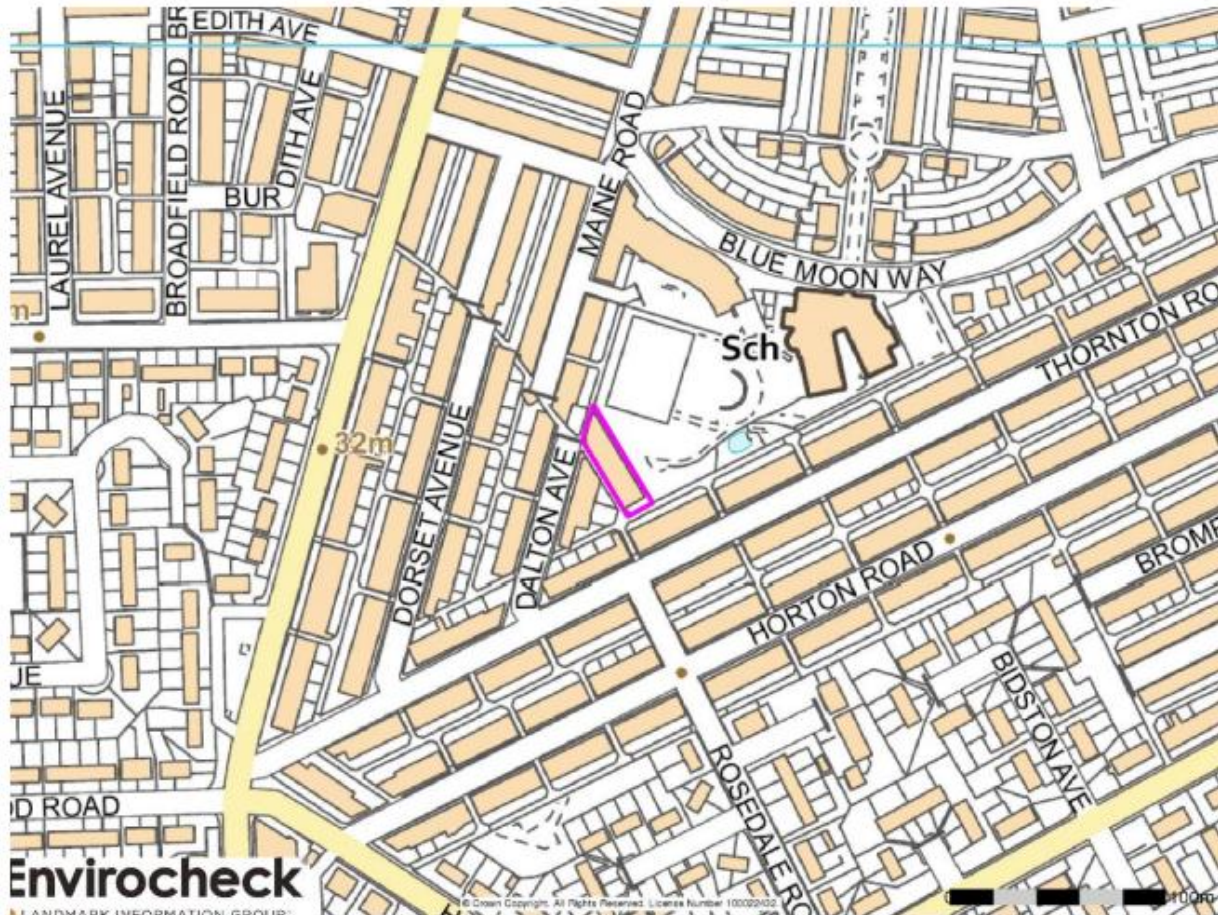


Figure 1: Site Location Plan

Figure 2: Foundation Plan



Figure 3: Proposed Floor Plans

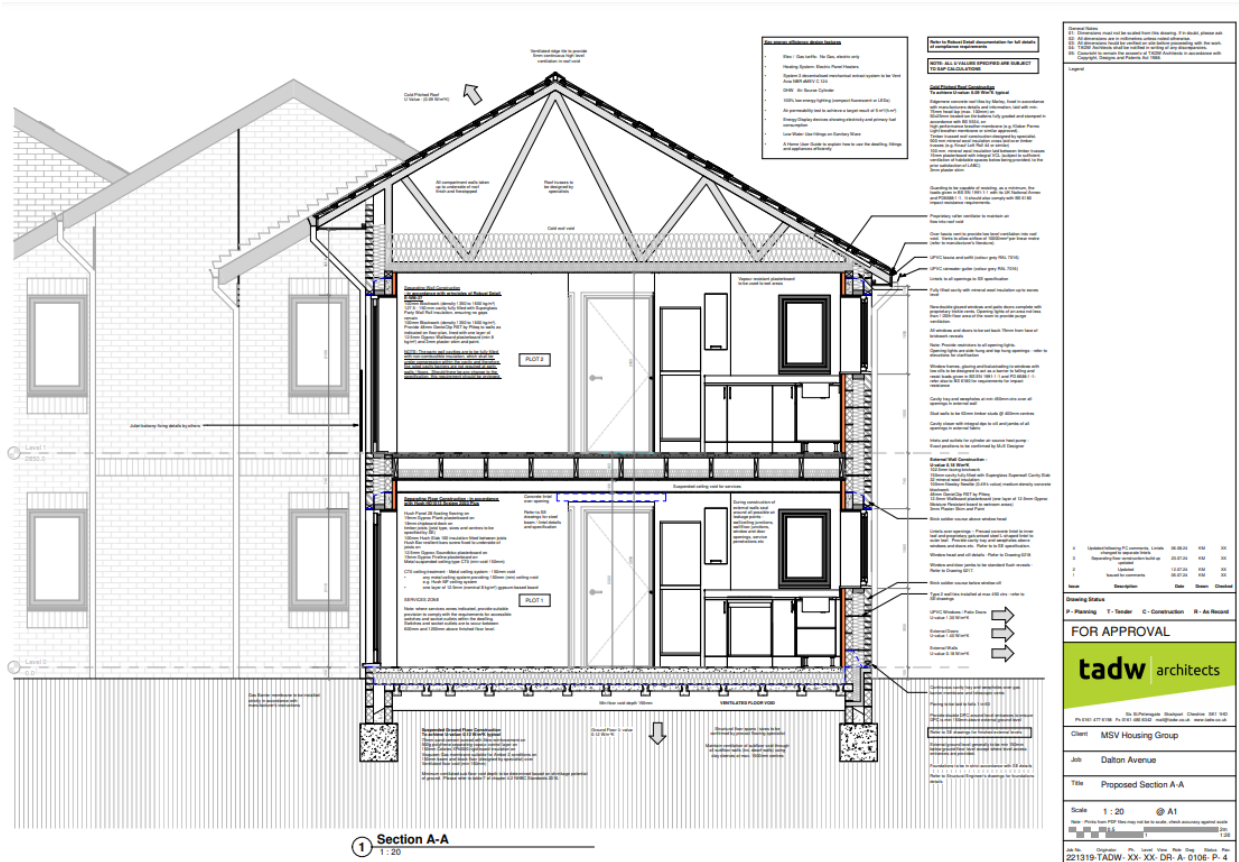


Figure 4: Proposed Section A-A

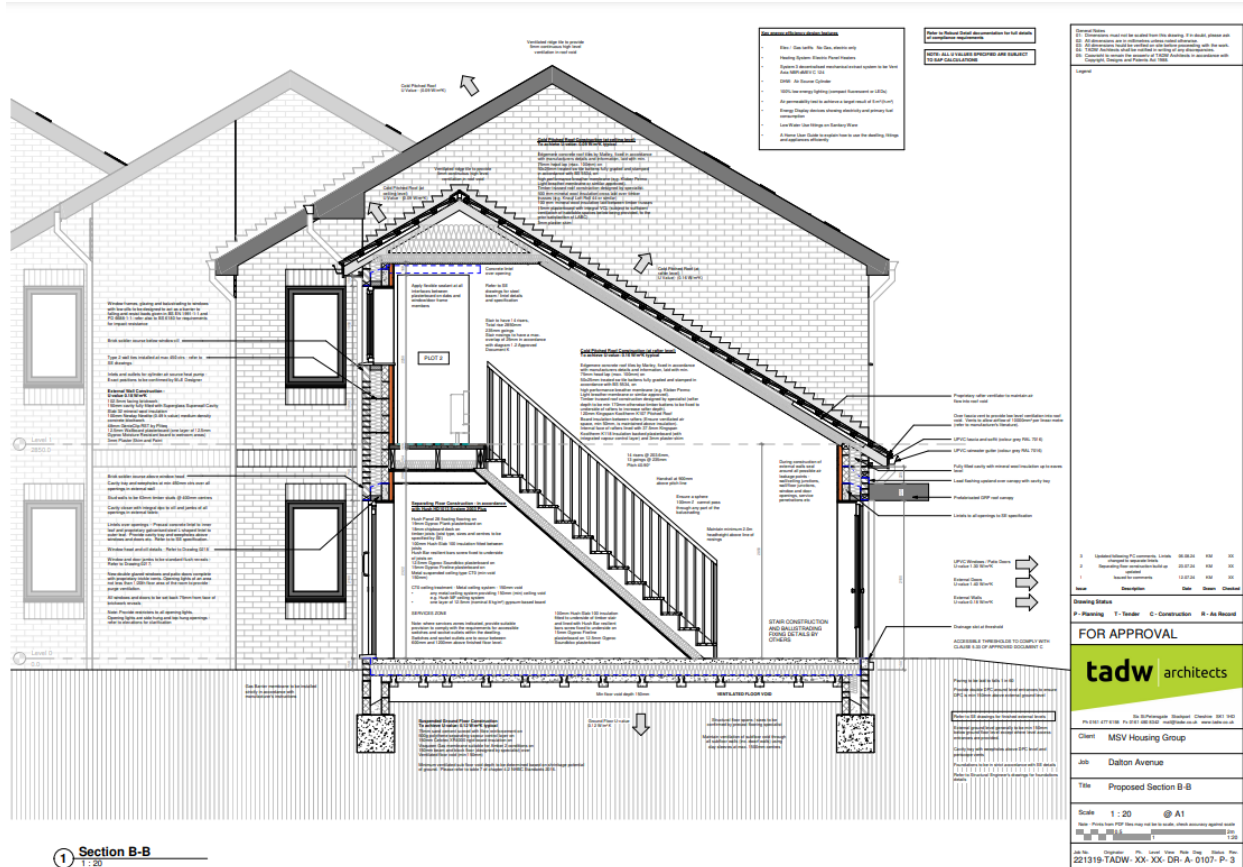


Figure 5: Proposed Section B-B



Figure 6: Proposed Section C-C



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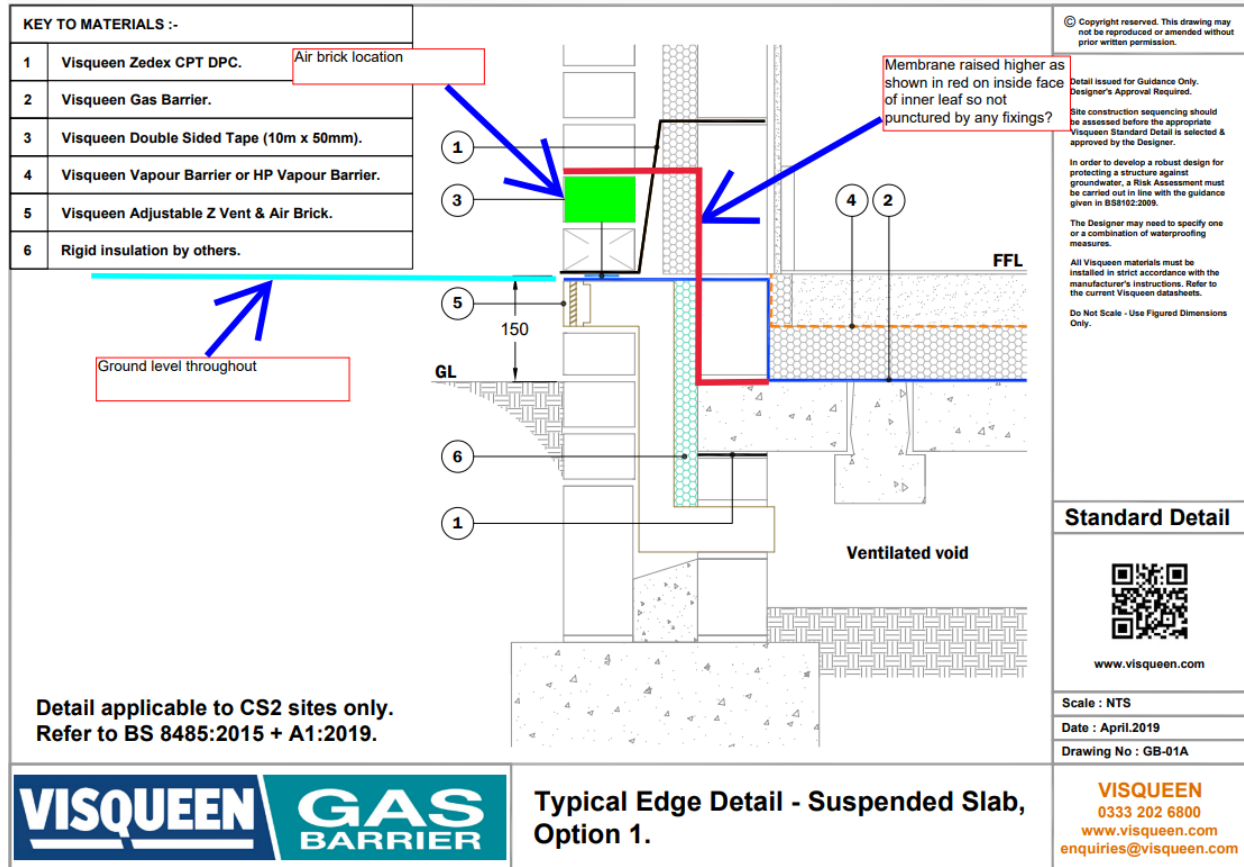


Figure 11: Example Membrane Details Visqueen

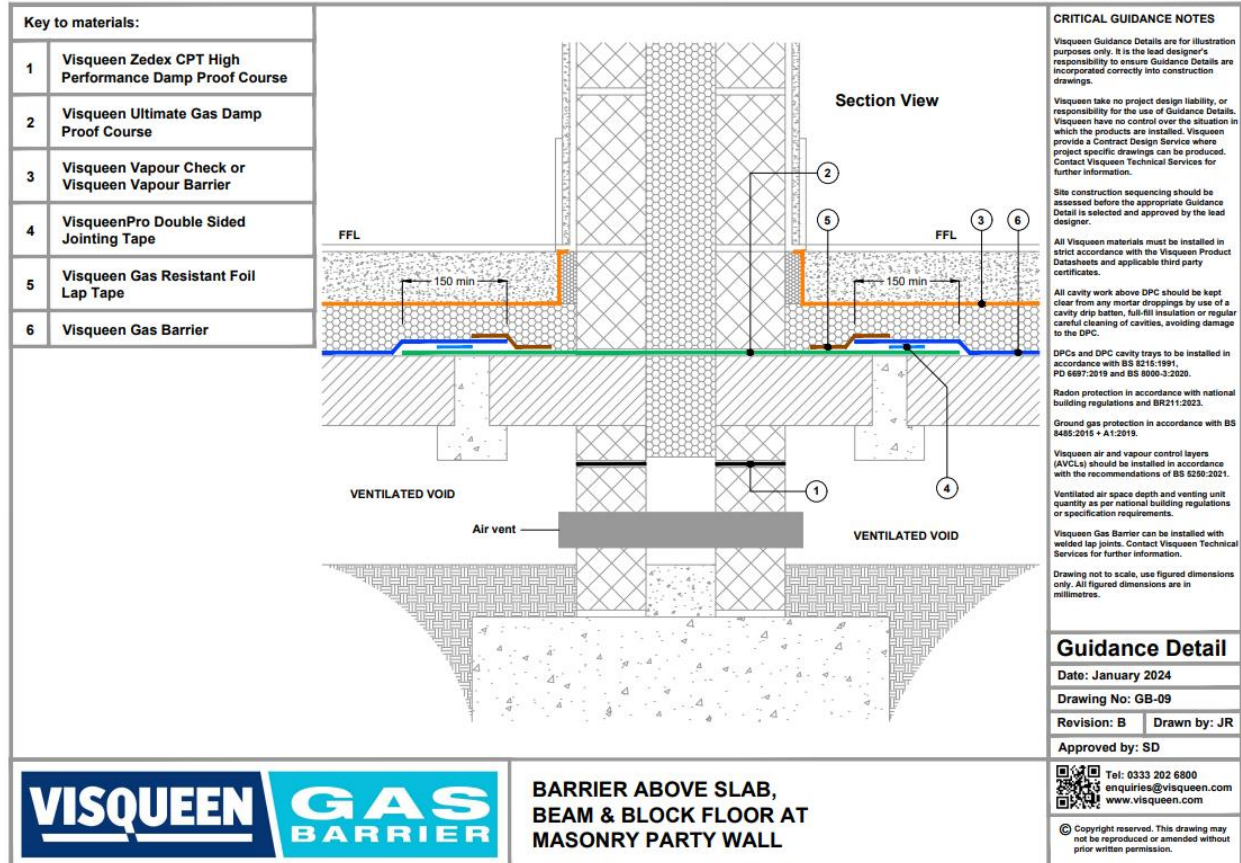


Figure 12: Example Membrane Details Visqueen

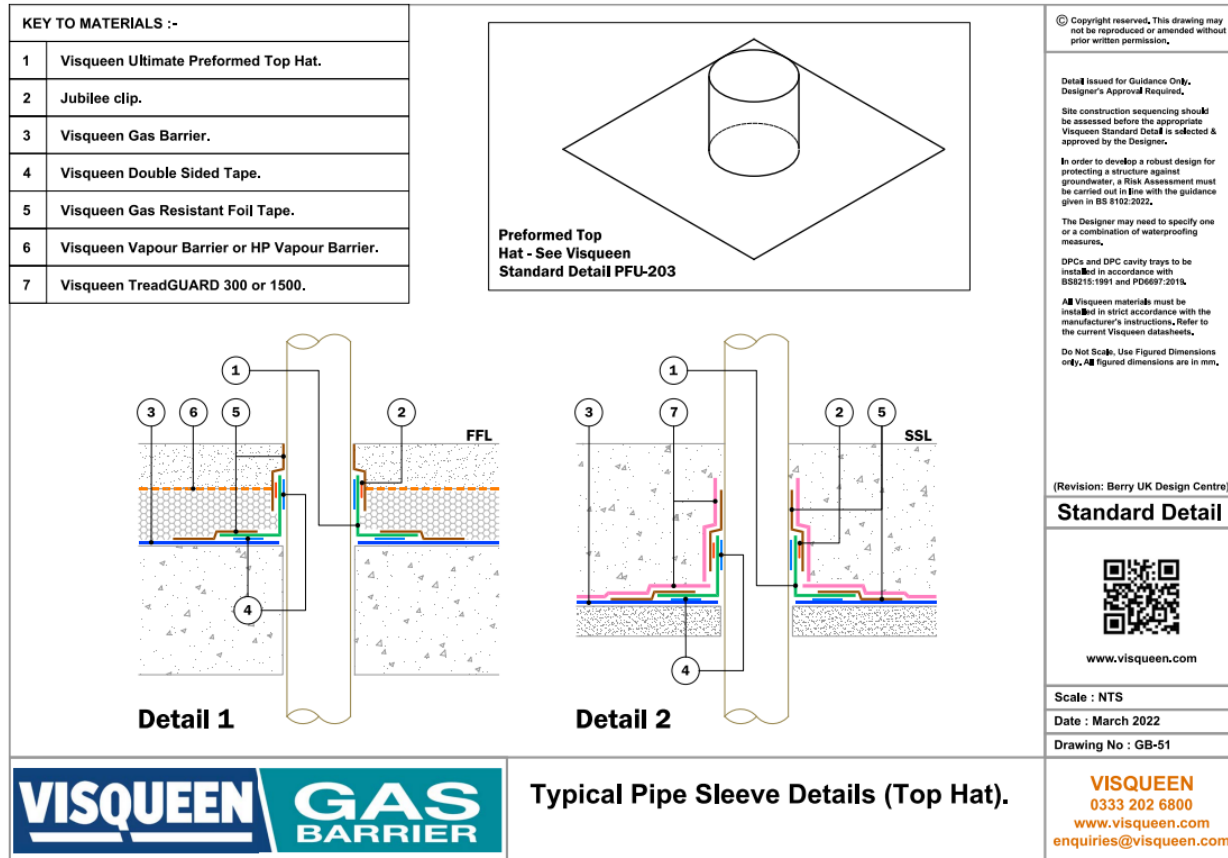


Figure 13: Example Membrane Details Visqueen

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Annex C

Example materials website to use as reference for installation guides.

Links provided to save space:

<https://visqueen.com/products/visqueen-gas-barrier/>

Last accessed January 2025