

Date: 28<sup>th</sup> January 2025  
Reference: 15-974 V27

## GAS MEMBRANE VALIDATION – BENNETT STREET

|                                                           |                                                                                    |
|-----------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>Project Name:</b>                                      | Bennett Street                                                                     |
| <b>Project Number:</b>                                    | 15-974                                                                             |
| <b>Client:</b>                                            | Kellen Homes                                                                       |
| <b>Date:</b>                                              | 27-01-2025                                                                         |
| <b>Project Manager:</b>                                   | M. Dee                                                                             |
| <b>Engineer:</b>                                          | M. Dee                                                                             |
| <b>Ground Gas Risk Assessment:</b>                        | Vapor Membranes Required                                                           |
| <b>Gas Membrane Installers Name &amp; Qualifications:</b> | JCW Gas Membranes Ltd, NVQ Level 2 – Installation of Gas Membranes in Construction |
| <b>Plot:</b>                                              | 20-23                                                                              |

### OVERVIEW

GeoEnginSteer attended site under the supervision of E3P to confirm the integrity of installed gas measures for Plot 20-23 through tracer gas testing on 27<sup>th</sup> January 2025.

The plot floor areas had been screeded with exterior walls built, as such, the gas protective system was covered and unable to be visually inspected. E3P were provided photos from the client showing the installation of a black membrane, additionally, E3P have undertaken visual inspection and confirmed the installation of a Juta TitanFlex (black) membrane on all plots completed to date across the wider site. E3P photographs of membrane provided to E3P are appended to this report.

E3P inspected air vents and confirmed the installation of a minimum of three telescopic air vents on the exterior walls of the plot. Prior to the installation of the gas membrane, E3P undertook sub-floor void inspections of Plots 20-23 on 7<sup>th</sup> June 2024. A 250 mm void space was recorded on all plots, with sub-floor void inspection record and photographs appended to this letter.

GeoEnginSeer undertook integrity testing of the membrane under the supervision of E3P. Integrity testing was undertaken utilising tracer gas leak detection methodologies for all plots, with one test undertaken per plot. GeoEnginSteer integrity testing results and reports are appended to this letter.

The test results show that the tracer gas was present under the foundation but wasn't migrating up into the properties, indicating that the membrane is working as required.



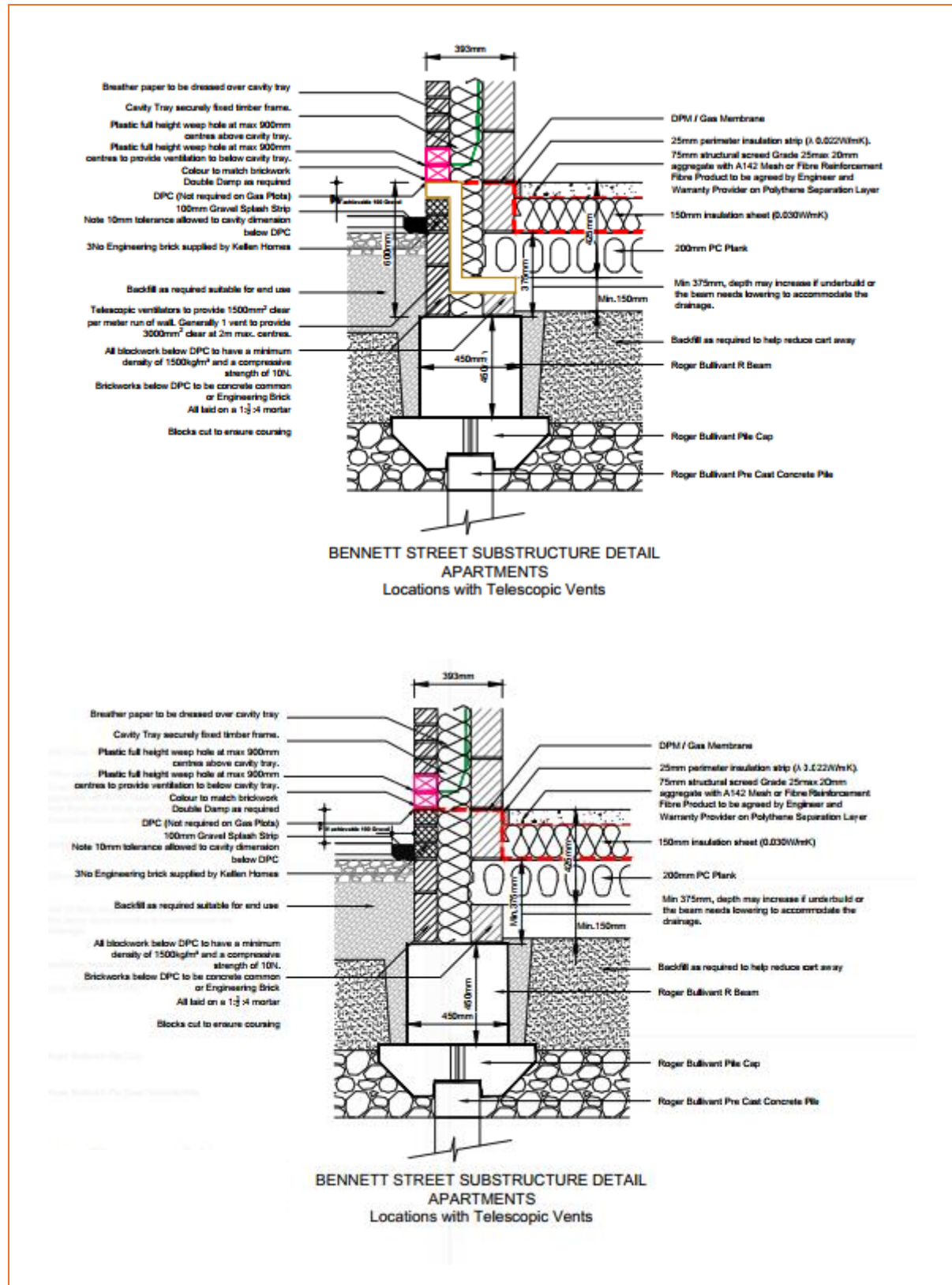


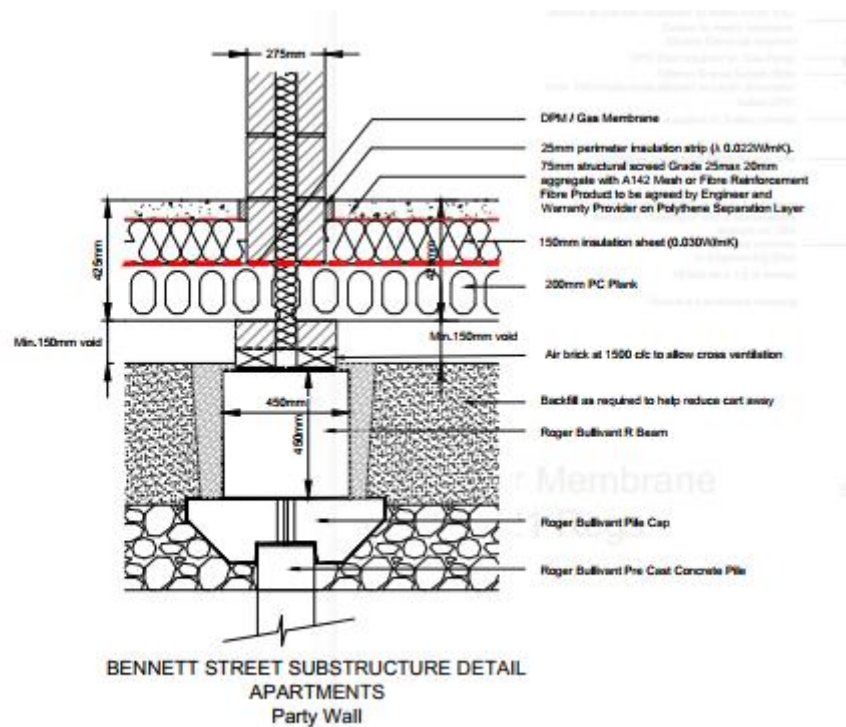
## MEMBRANE SPECIFICATION: JUTA TITANFLEX (BLACK)

| <div> <div>GROUND GAS PROTECTION<br/>GP<sup>®</sup> TITANFLEX<sup>®</sup><br/>TECHNICAL DATA SHEET</div> <div>  <div>GP<sup>®</sup><br/>TITANFLEX<sup>®</sup></div> </div> </div> |                                                                    |                 |                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|-----------------|-------------------------------------------|
| Feature                                                                                                                                                                                                                                                            | Characteristics                                                    | Test Method     | GP <sup>®</sup> TITANFLEX <sup>®</sup>    |
| Physical Properties                                                                                                                                                                                                                                                | Thickness                                                          | EN 1849-2       | 0.5 mm                                    |
|                                                                                                                                                                                                                                                                    | Width                                                              | EN 1849-2       | 2 m                                       |
|                                                                                                                                                                                                                                                                    | Length                                                             | EN 1849-2       | 50 m                                      |
|                                                                                                                                                                                                                                                                    | Weight                                                             | EN 1849-2       | 500 g/m <sup>2</sup>                      |
| Hydraulic Press                                                                                                                                                                                                                                                    | Water Vapour Transmission Rate                                     | EN 1931         | 0.11 - 0.18 g/m <sup>2</sup> /day         |
|                                                                                                                                                                                                                                                                    | Water Tightness (60 kPa)                                           | EN 1928         | Pass                                      |
|                                                                                                                                                                                                                                                                    | Water Tightness (196 kPa - 20 m Water Head) (Basement Application) | EN 1928         | Pass                                      |
| Mechanical Properties                                                                                                                                                                                                                                              | Resistance to Static Load                                          | EN 12730-B      | ≥ 20 kg                                   |
|                                                                                                                                                                                                                                                                    | Puncture Resistance                                                | EN 12236        | ≥ 2.0 kN                                  |
|                                                                                                                                                                                                                                                                    | Tensile Strength (MD)                                              | EN 12311-1      | > 550 N/50mm                              |
|                                                                                                                                                                                                                                                                    | Tensile Strength (CMD)                                             | EN 12311-1      | > 400 N/50mm                              |
|                                                                                                                                                                                                                                                                    | Tensile Elongation (MD/CMD)                                        | EN 12310-1      | > 550 %                                   |
|                                                                                                                                                                                                                                                                    | Tear Resistance (MD/CMD)                                           | EN 12310-1      | > 300 N                                   |
|                                                                                                                                                                                                                                                                    | Resistance to Impact                                               | EN 12691-B      | 650 mm                                    |
|                                                                                                                                                                                                                                                                    | Reaction to Fire                                                   | EN 13501-1      | E Class                                   |
|                                                                                                                                                                                                                                                                    | Resistance to Artificial Ageing                                    | EN 1296/EN 1928 | Pass                                      |
| Compliance and Certification                                                                                                                                                                                                                                       | Resistance to Chemicals                                            | EN 1296/EN 1928 | Pass                                      |
|                                                                                                                                                                                                                                                                    | CE Mark - EN13967:2012                                             |                 |                                           |
|                                                                                                                                                                                                                                                                    | NHBC Standards Compliant                                           |                 |                                           |
|                                                                                                                                                                                                                                                                    | CIRIA C748 Compliant                                               |                 |                                           |
| Vapour Permeability 100% Concentration                                                                                                                                                                                                                             | BS 8485:2015 Compliant                                             |                 |                                           |
|                                                                                                                                                                                                                                                                    | Transmission Rate of Benzene                                       | EN ISO 15105-2  | < 3.6 mg/m <sup>2</sup> /day              |
|                                                                                                                                                                                                                                                                    | Transmission Rate of Toluene                                       | EN ISO 15105-2  | < 13.8 mg/m <sup>2</sup> /day             |
|                                                                                                                                                                                                                                                                    | Transmission Rate of Ethyl Benzene                                 | EN ISO 15105-2  | < 2.7 mg/m <sup>2</sup> /day              |
|                                                                                                                                                                                                                                                                    | Transmission Rate of Xylenes (M,P,O)                               | EN ISO 15105-2  | < 7.7 mg/m <sup>2</sup> /day              |
|                                                                                                                                                                                                                                                                    | Transmission Rate of Hexane                                        | EN ISO 15105-2  | < 0.6 mg/m <sup>2</sup> /day              |
|                                                                                                                                                                                                                                                                    | Transmission Rate of Vinyl Chloride                                | EN ISO 15105-2  | < 0.05 mg/m <sup>2</sup> /day             |
|                                                                                                                                                                                                                                                                    | Transmission Rate of Trichloroethene (TCE)                         | EN ISO 15105-2  | < 54.7 mg/m <sup>2</sup> /day             |
|                                                                                                                                                                                                                                                                    | Transmission Rate of Tetrachloroethene (PCE)                       | EN ISO 15105-2  | < 26.2 mg/m <sup>2</sup> /day             |
| Gas Permeability                                                                                                                                                                                                                                                   | Transmission Rate of Naphthalene                                   | EN ISO 15105-2  | < 0.0006 mg/m <sup>2</sup> /day           |
|                                                                                                                                                                                                                                                                    | Transmission Rate of CIS-1,2-Dichloroethylene                      | EN ISO 15105-2  | < 1.1 mg/m <sup>2</sup> /day              |
|                                                                                                                                                                                                                                                                    | Methane Permeability                                               | EN ISO 15105-1  | 0.13 ml/m <sup>2</sup> /day/atm           |
|                                                                                                                                                                                                                                                                    | Methane Permeability (Jointed)                                     | EN ISO 15105-1  | 1.00 ml/m <sup>2</sup> /day/atm           |
|                                                                                                                                                                                                                                                                    | Carbon Dioxide Permeability                                        | EN ISO 15105-1  | 3.01 ml/m <sup>2</sup> /day/atm           |
|                                                                                                                                                                                                                                                                    | Vinyl Chloride Gas Permeability                                    | EN ISO 15105-1  | 0.04 ml/m <sup>2</sup> /day/atm           |
|                                                                                                                                                                                                                                                                    | Radon Permeability                                                 | K124/02/95      | 1.0 x 10 <sup>-12</sup> m <sup>2</sup> /S |

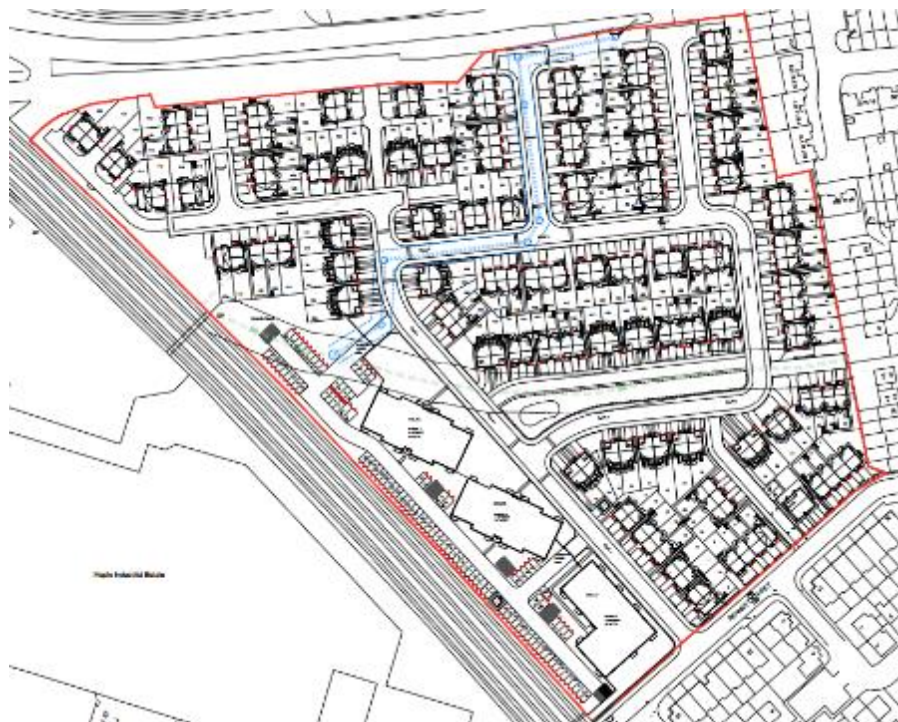


## STRUCTURAL ENGINEER'S SUBSTRUCTURE DESIGN





## PROPOSED DEVELOPMENT PLAN





The gas membrane validation photographs are enclosed within this letter. For information, Table 1 includes references and validation dates of previously validated plots.

**Table 1 – Validation Letter Reference**

| <b>PLOT NUMBER</b>        | <b>DATE</b> | <b>REPORT REFERENCE</b> |
|---------------------------|-------------|-------------------------|
| 9-15                      | 19-10-2023  | V1                      |
| 16 & 17                   | 24-10-2023  | V2                      |
| 18 & 19                   | 01-11-2023  | V3                      |
| Apartment Block 3         | 08-03-2024  | V4                      |
| Apartment Block 1         | 14-03-2024  | V5                      |
| Apartment Block 2         | 19-03-2024  | V6                      |
| 136-138 and 147-148       | 15-05-2024  | V7                      |
| 130-135                   | 28-06-2024  | V8                      |
| 123-127                   | 06-08-2024  | V9                      |
| 119-122                   | 22-08-2024  | V10                     |
| 112-114                   | 23-08-2024  | V11                     |
| 117-118                   | 06-09-2024  | V12                     |
| 105 - 107                 | 16-09-2024  | V13                     |
| 95, 96, 101-104, 128, 129 | 23-09-2024  | V14                     |
| 139-146                   | 16-09-2024  | V15                     |
| 91-94, 97, 98             | 02-10-2024  | V16                     |
| 99-100 and 91-92 garages  | 04-10-2024  | V17                     |
| 80-86                     | 11-10-2024  | V18                     |
| 89-90                     | 06-11-2024  | V19                     |
| 71-76                     | 14-11-2024  | V20                     |
| 77-79 and 87-88           | 12-11-2024  | V21                     |
| 170-172                   | 22-11-2024  | V22                     |
| 162-169                   | 28-11-2024  | V23                     |
| 60-65                     | 02-12-2024  | V24                     |
| 66-70                     | 04-12-2024  | V25                     |
| 49-59 and 149-150         | 22-01-2025  | V26                     |
| 20-23                     | 27-01-2025  | V27                     |



**Photographs of membrane and gas measures being installed on Plots 20-23**



**Plate 1 – Black membrane visible across plots 20-23**



**Plate 2 – Subfloor Void Space and Vents Prior to Block and Beam**



**Plate 3 – Membrane present below floor screed – to be extended below garage**



## Floor Void Inspection

7 Jun 2024 / Joe Newall

Complete

|                |                         |
|----------------|-------------------------|
| Score          | 8 / 8 (100%)            |
| Site Name      | Bennett steet           |
| Project Number | 15974                   |
| Conducted on   | 7 Jun 2024 11:56 AM BST |
| Prepared by    | Joe Newall              |

### Location

2 Ercall Avenue  
Manchester  
England  
M12 5LP  
United Kingdom  
(53.46886720015831, -  
2.207784530800445)

### Plot Inspection

8 / 8 (100%)

### Plot Inspection 1

2 / 2 (100%)

### Plot Number

20

### Is the void clear?

Yes

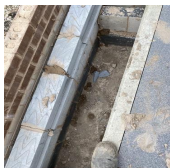


Photo 1

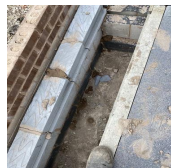


Photo 2

### Depth of Void

250



Photo 3



Photo 4

### Are Sleeper Walls Vented?

Yes



Photo 5



Photo 6



Photo 7



Photo 8

### Plot Inspection 2

2 / 2 (100%)



Plot Number

21

Is the void clear?

Yes



Photo 9



Photo 10

Depth of Void

250



Photo 11



Photo 12

Are Sleeper Walls Vented?

Yes



Photo 13

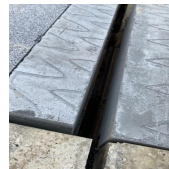


Photo 14



Photo 15

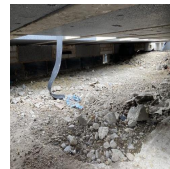


Photo 16



Photo 17

Plot Inspection 3

2 / 2 (100%)

Plot Number

22

Is the void clear?

Yes



Photo 18



Photo 19

Depth of Void

250



Photo 20



Photo 21

Are Sleeper Walls Vented?

Yes



Photo 22

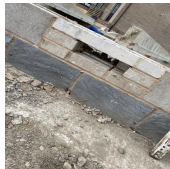


Photo 23



Photo 24



Photo 25

#### Plot Inspection 4

2 / 2 (100%)

Plot Number

23

Is the void clear?

Yes



Photo 26



Photo 27



Photo 28



Photo 29

Depth of Void

250



Photo 30



Photo 31

Are Sleeper Walls Vented?

Yes



Photo 32



Photo 33

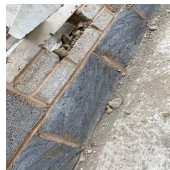


Photo 34



Photo 35



Photo 36



Photo 37



Photo 38



### Media summary



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8



Photo 9



Photo 10



Photo 11



Photo 12



Photo 13



Photo 14



Photo 15



Photo 16



Photo 17



Photo 18



Photo 19



Photo 20



Photo 21



Photo 22



Photo 23



Photo 24



Photo 25



Photo 26



Photo 27



Photo 28



Photo 29



Photo 30



Photo 31



Photo 32



Photo 33



Photo 34



Photo 35



Photo 36



Photo 37



Photo 38



# GeoEnginSeer

FREELANCE DILETTANTE GEOLOGIST

Bennett Street, West Gorton, Manchester,  
E3P

## **Verification Completion Report for Ground Gas Protection Systems**

|      |          |
|------|----------|
| Date | 27.01.25 |
|------|----------|

|                   |                                     |
|-------------------|-------------------------------------|
| Project Title     | Bennett Street Manchester           |
| GES Report Number | 2087                                |
| Date              | 27.01.25                            |
| Client            | E3P                                 |
| Weather           | 7°C raining light wind 0.1 kmph     |
| Development Type  | Residential                         |
| Foundation Type   | Block and Beam                      |
| Plot Numbers      | 20, 21 & 22 (retro tracer gas test) |
| GES Job Ref:      | 1526                                |
| Visit By          | Paul Carter- Jones                  |

**Report By****Checked/Approved By***Signature**Signature:**Name:* Paul Carter – Jones*Name:* Ben Crowther**Company Contact Details**

Kellen Homes,  
 1st Floor 103 Dalton Avenue,  
 Birchwood Park,  
 Warrington,  
 United Kingdom,  
 WA3 6YF

## 1. GAS MEMBRANE

### 1.1 Condition Of Subgrade and Underside Of Gas Membrane

*Check that the subgrade does not contain rough/uneven surfaces, is appropriately clean and that there are no hard/sharp objects. That protective sand blinding or geotextile (if specified) is present and meets the design criteria.*

Unable to check.

### 1.2 Gas Membrane Type

*Manufacturer and product specification, gauge, colour, brand/name, material batch/roll numbers.*

Unable to check.

### 1.3 Laps, Welds and Joint Seals

*Joints lapped and sealed in accordance with manufacturers requirements/specification. Minimum overlap insured? Welds complete? Appropriate joining/double sided tape used?*

Unable to check.

### 1.4 Service Entries Seals

*How many pipe penetrations? Top hats seal arrangements fixed around service entries? Use of jubilee clips? Etc.*

Unable to check.

## 2. VENTILATION SYSTEMS

### 2.1 Subfloor Void

*Is a check possible? Void former? Gravel (type/specification)? Height of void space? Is it clear?*

Unable to check, although trace gas injected upwind into the subfloor void was detected in all vents.

### 2.2 External Wall Airbricks

*How many? Size? Positioning? Spacing? Etc.*

Air bricks (9"x3") were spaced around the properties.

### 2.3 Active Venting

*Type of air supply: mechanical, natural, combined? Location/condition/number of fans/vents? Location and size of inlets? Provision of air cleaning devices and air heaters? Supply and exhaust duct work? Alarm provision/installation? Gas monitoring system in under-floor void?*

N/A

### 2.4 Testing Of Air Flow

*Is the air flowing sufficiently through ventilation? Anemometer reading? Smoke test? Tracer gas?*

Tracer gas test carried out through air vents.

### 3. INSPECTION AND INTEGRITY DETAILS

On the 27<sup>th</sup> of January 2025 I attended Bennett Street site in Manchester, to carry out a retro tracer gas integrity test on plots 20, 21 and 22.

A base line reading of background gasses was taken on the handheld GMI gas detector both outside and inside the property and also inside the garages.

The air vents were then sealed, and a tracer gas (carbon dioxide) was pumped in through selected air vents (that were opened then re-sealed) and readings were taken on the opposite side of the property to show that the foundation of the property was filled sufficiently with the tracer gas.

A test was carried out with the gas detector to show the tracer gas was present under the foundation.

An internal walk around with the gas detector was then carried out.

Please see results below.



| PLOT NO. | C02  | LEL | BNZ | 02   | NOTES                                                               |
|----------|------|-----|-----|------|---------------------------------------------------------------------|
| 20       | 0.00 | 00  | 0.0 | 20.9 | Baseline reading before gas injection                               |
|          | 0.00 | 00  | 0.0 | 20.9 | After gas injection. No leaks detected, membrane acting as expected |
|          |      |     |     |      |                                                                     |
|          |      |     |     |      |                                                                     |
| 21       | 0.00 | 00  | 0.0 | 20.9 | Baseline reading before gas injection                               |
|          | 0.00 | 00  | 0.0 | 20.9 | After gas injection. No leaks detected, membrane acting as expected |
|          |      |     |     |      |                                                                     |
|          |      |     |     |      |                                                                     |
| 22       | 0.03 | 00  | 0.0 | 20.9 | Baseline reading before gas injection                               |
|          | 0.03 | 00  | 0.0 | 20.9 | After gas injection. No leaks detected, membrane acting as expected |
|          |      |     |     |      |                                                                     |
|          |      |     |     |      |                                                                     |
|          |      |     |     |      |                                                                     |
|          |      |     |     |      |                                                                     |
|          |      |     |     |      |                                                                     |
|          |      |     |     |      |                                                                     |
|          |      |     |     |      |                                                                     |
|          |      |     |     |      |                                                                     |
|          |      |     |     |      |                                                                     |

## 4. PHOTOGRAPHIC RECORDS

Plots 20, 21 & 22:



Base line readings:



Readings after gas injection:



Site plan:



## 5. CONCLUSION OF SITE VISIT

### 5.1 Details Of Installers

*Are the installers suitably qualified / trained? Names of installers / company details?*

JCW Group Ltd qualified installers of Gas Membranes

### 5.2 Pass / Fail?

*Are the measures inspected acceptable / NOT acceptable? Do they comply with the specifications? Is attention required to specific issues?*

**PASS**

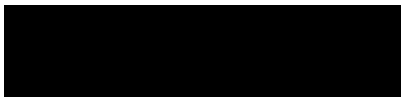
### 5.3 Additional notes

*Remedial actions to be taken? Re-visit to be arranged?*

None.

If you have any questions regarding the above, please do not hesitate to contact me.

Yours sincerely



**Ben Crowther B.Sc, M.Sc, PGCE, FGS, CIEH, PCA-QT, SGPV**  
For and on behalf of GeoEnginSeer Ltd.

**Commorragh, 1 Harrison Street, Cornholme, Todmorden, OL14 8LF : 07817108921**  
geoenginseer@gmail.com



**BGA** British  
Geomembrane  
Association

## 6.0 Limitations and Challenges of Verification Reporting

This report is based on the information that has been made available to us from 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 refinement of the conclusions. It should be noted that: The report has been prepared under the express instructions and 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 and the advice of lawyers may also be required.

All work carried out in preparing 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 this legislation and guidance may occur at any time in the future and cause any conclusions to become inappropriate or incorrect.

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

Should additional services be introduced, or service conduits are not sealed or have services provided through them at a later date that are not sealed to the conduit and or gas protection system, a retrospective fit may be required.

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.