

SPILMAN ASSOCIATES

Geotechnical and Environmental Engineers

Spilman Associates Limited

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ACS Lining Limited

ISLAND ROAD, READING

Gas Protection Measures As Built Drawings & Maintenance Manual

July 2017

Report No J16081/02

Issued By: 

Date Issued: 04 July 2017

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1.0 INTRODUCTION

Ground gas protection measures are detailed on Spilman Associates Limited's sketches reproduced at Appendix A and the methodology for the gas protection measures are reproduced at Appendix B

These measures have been designed to minimise the risk of ingress of ground gases into the buildings.

The gas protection measures have been supplied and installed by ACS Lining Limited.

2.0 GAS PROTECTION MEASURES

The gas protection measures to the offices element of the building comprise two principal elements:

- (a) A high quality tape-jointed gas resistant membrane installed beneath the floor slab. Membrane data sheets are attached at Appendix C.
- (b) The provision of geocomposite gas venting layer beneath the gas membrane to ensure collection and dilution of any gases coming from the ground. Geocomposite data sheets are attached at Appendix D. Cross ventilation beneath the floor slab is achieved by the use of ground level vent boxes on two opposing elevations.

For the main warehouse area the gas protection measures comprise a gas resistant membrane only as detailed at (a) above.

3.0 MAINTENANCE REQUIREMENTS

The gas resistant membrane and geocomposite require no maintenance.

Care must be taken to ensure that the ground level vent boxes remain open to the atmosphere and do not become blocked or obstructed. It is recommended that the vents are formally checked on a weekly basis and that any obstructions identified be removed immediately. Damaged vents should be replaced as necessary.

4.0 MEMBRANE PROTECTION

The gas resistant membrane is installed beneath the floor slab. The integrity of the membrane must be maintained and particular care should be taken in carrying out any of the following works:-

- (a) The installation of holding down bolts
- (b) The installation of any additional service pipes or penetrations of the floor slab
- (c) Undertaking any building modifications or extensions and in particular any works which involve the excavation of pits or bases through the floor slab.

In certain circumstances carrying out any of the above works could invalidate any warranties or guarantees provided.

5.0 FUTURE SERVICES

Advice on the effects of any future building modifications or changes on the installed gas protection measures can be obtained from:-

1. Spilman Associates Limited

38 South Avenue
Stourbridge
West Midlands
DY8 3XY

E-mail: harry@spilmanassociates.co.uk

Tel: 01384 820578

Contact: Harry Spilman

2. ACS Lining Limited

ACS Business Centre
2/4 Middleton Road
Heywood
OL10 2HT

E-mail: steve.acslining@btconnect.com

Tel: 01706 628524

Contact: Steve McConnell

It should be noted that unauthorised changes to the gas protection measures may impact their performance and could invalidate any warranties provided.

APPENDIX A

ISLAND ROAD, READING SPECIFICATION FOR GAS PROTECTION MEASURES

Membrane

1. Gas resistant membrane to be high performance loose lay membrane incorporating an encapsulated aluminium foil (**ACS Gas Membrane**).
2. Installation and protection in accordance with manufacturer's recommendations. Membrane to be laid on blinded stone or geocomposite throughout.
3. Individual membrane sheets to be lapped minimum 100mm and sealed with 30mm wide proprietary butyl tape (**ACS Butyl Sealant Tape**).
4. All services and other penetrations to be sealed with self-adhesive gas resistant membrane (**ACS Adhesive Gas Membrane**).

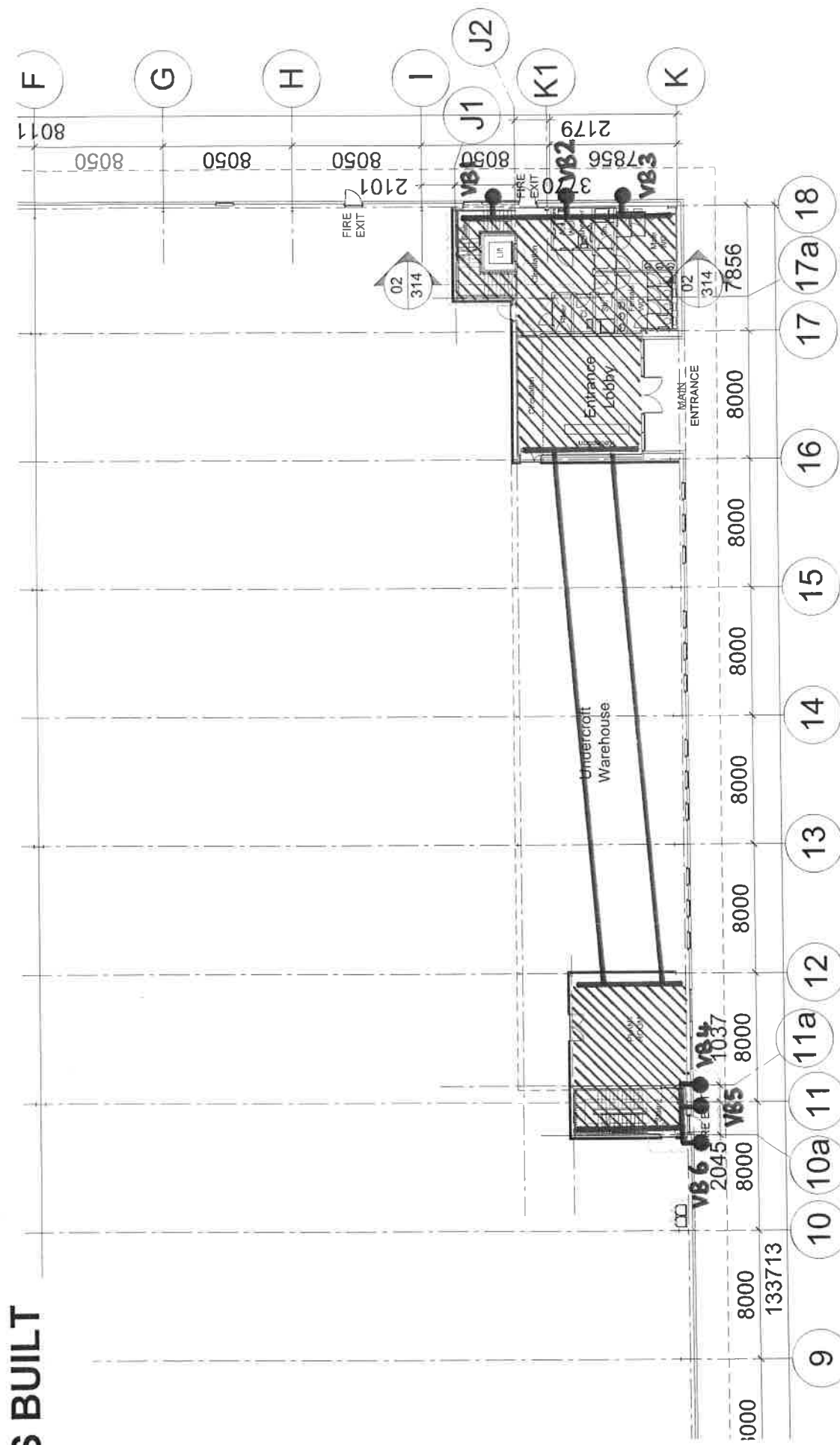
Geocomposite Gas Venting Layer (Office Areas Only)

5. Geocomposite to comprise single sided 25mm thick cusped high density polyethylene core with high permeability geotextile fabric bonded to core dimples (**ACS Gasflow 25**).
6. Core to have a minimum 13mm clear void and a minimum crushing strength of 100kN/m².
7. Geocomposite layer to be placed below all ground floor level office areas at locations shown on Figure 1, 2 & 3.

Perimeter Ventilation (Office Areas Only)

8. Perimeter ventilation via ground level vent boxes (VB) at locations shown on Figures 1, 2 & 3. Exact positions to be agreed on site to suit door openings and Architects requirements.

The architectural floor plan depicts the Undercroft Warehouse, a long, narrow building oriented horizontally. The plan is overlaid with a grid system: vertical grid lines are labeled F, G, H, I, J1, J2, K1, and K; horizontal grid lines are labeled 9, 10, 10a, 11, 11a, 12, 13, 14, 15, 16, 17, and 18. The building's footprint is shaded with diagonal hatching. Key areas include a large 'Undercroft Warehouse' section in the center, an 'Entrance Lobby' at the right end, and a 'Main Entrance' at the bottom right. Multiple fire exits are marked with 'FIRE EXIT' labels and arrows, including one at the top left and another at the bottom right. Various rooms and corridors are labeled, such as 'Lobby', 'Corridor', 'Storage', and 'Mechanical'. Dimensions are provided along the right side, with segments of 8000 units repeated several times. A scale bar at the bottom indicates a length of 133713 units. The plan also shows structural elements like columns and walls, and a north arrow is located near the top center.



100mm ID HDPE GAS COLLECTION MANIFOLD PIPE

VB ● GROUND LEVEL VENT BOX (VB)

SPILMAN ASSOCIATES Geotechnical & Environmental Engineers	Client ACS Lining Limited		Title Gas Protection Measures (Plan) Unit A Office	
	Scheme Island Road, Reading		Scale Not to scale	Fig 1
Date July 2016		Ref J16081		
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4



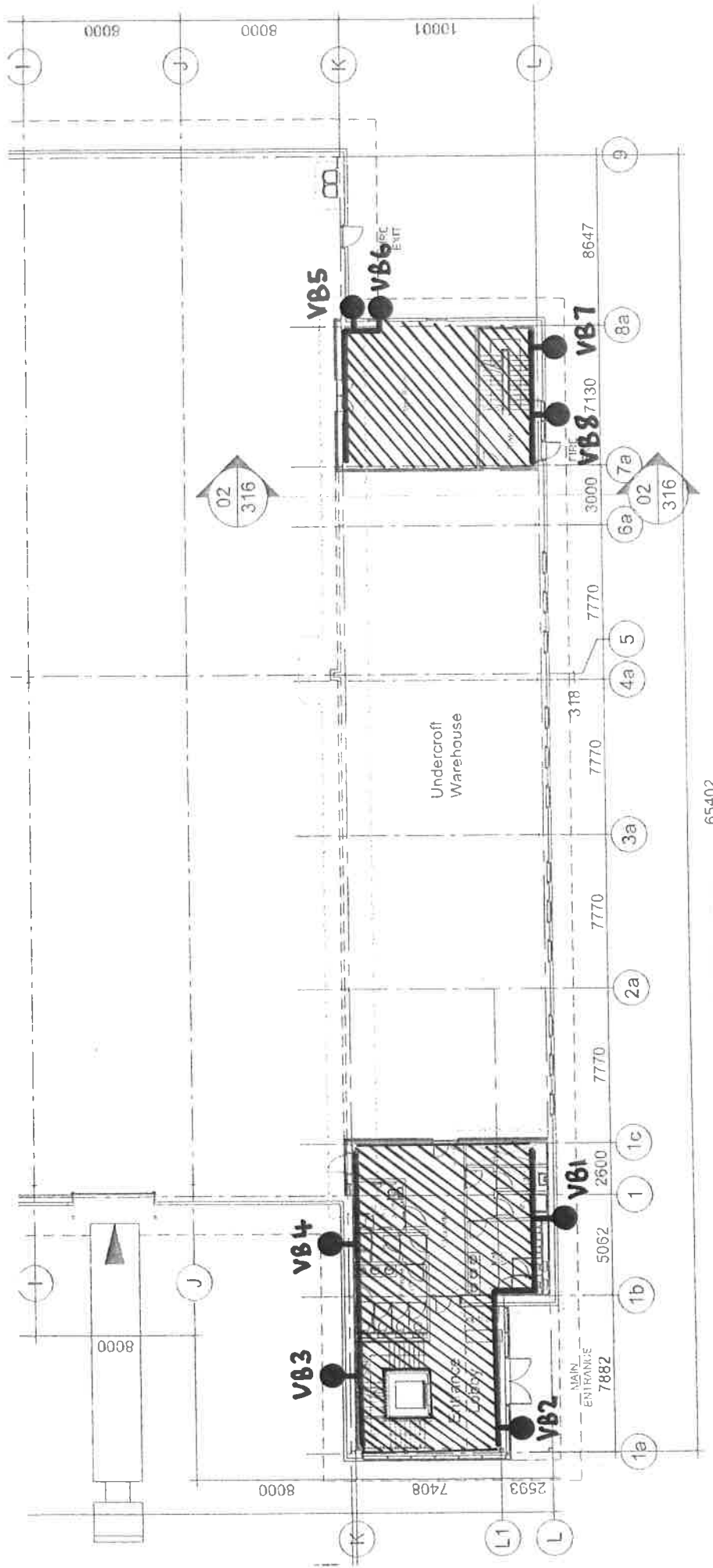
100mm ID HDPE GAS COLLECTION MANIFOLD PIPE

GROUND LEVEL VENT BOX (VB)

VB ●

SPILMAN ASSOCIATES Geotechnical & Environmental Engineers Tel: 01384 820578 Fax: 01384 823251	Client ACS Lining Limited		Scheme Island Road, Reading	Title Gas Protection Measures (Plan) Unit B Office	
	Date July 2016	Ref J16081		Scale Not to scale	Fig 2

AS BUILT



KEY

 GEOCOMPOSITE GAS VENTING LAYER (ACS GASFLOW 25)

 100mm ID HDPE GAS COLLECTION MANIFOLD PIPE

 GROUND LEVEL VENT BOX (VB)

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Client
ACS Lining Limited

Scheme
Island Road, Reading

Date
July 2016

Ref
J16081

Title

Gas Protection Measures (Plan)
Unit C Office

Scale
Not to scale

Fig
3

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Sheet No:

Job No:

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Project:

Island Road, Reading

Subject:

Gas Protection Measures

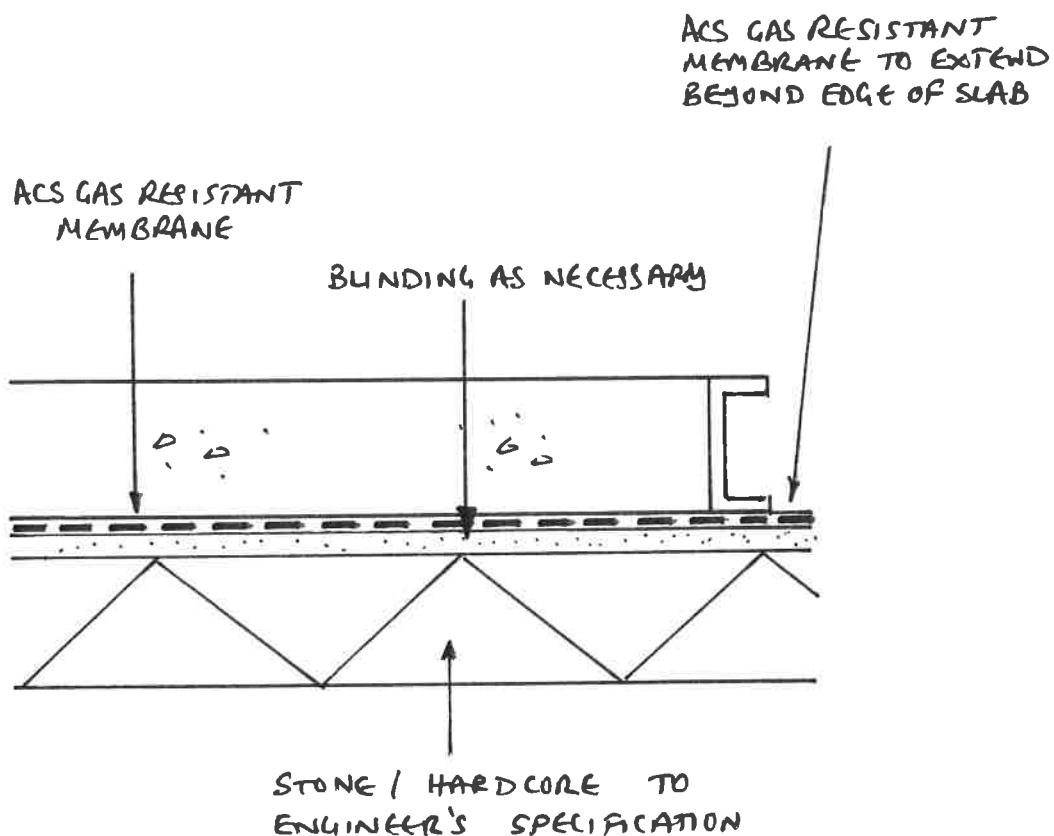
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HDS

Date:

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AS BUILT



DETAIL A

SLAB & PERIMETER SECTIONS
(WAREHOUSE)

SCALE 1:10

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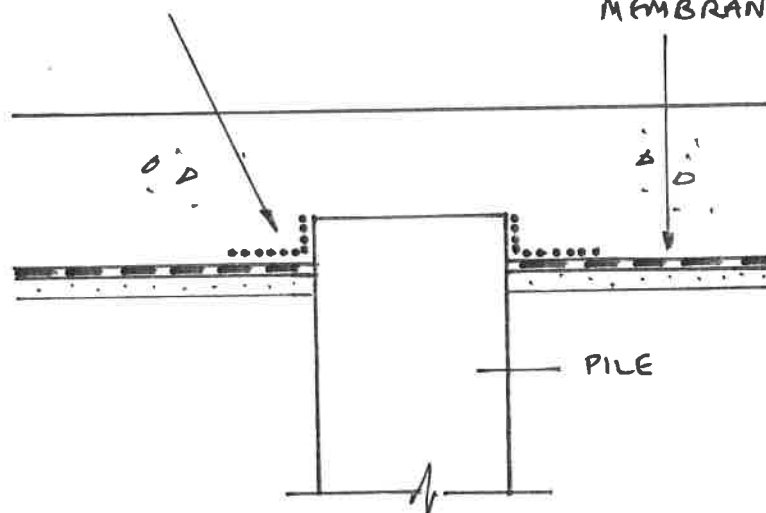
Date:

July 2016

AS BUILT

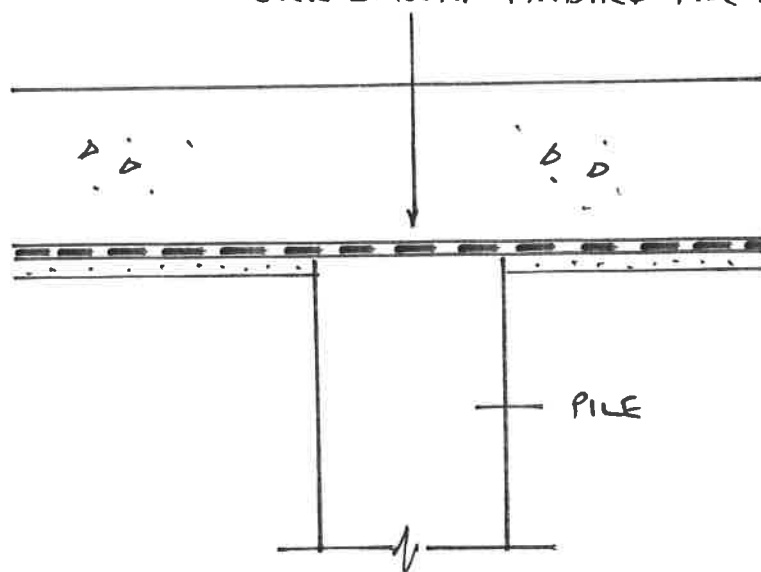
ACS ADHESIVE GAS MEMBRANE
SEAL TO BITUMEN PRIMED
PILE SHAFT

ACS GAS RESISTANT
MEMBRANE



OR

ACS GAS RESISTANT MEMBRANE
OVER SMOOTH FINISHED PILE HEAD



DETAIL B

SECTION AT FLOOR SLAB PILE

NOT TO SCALE

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Subject:

Gas Protection Measures

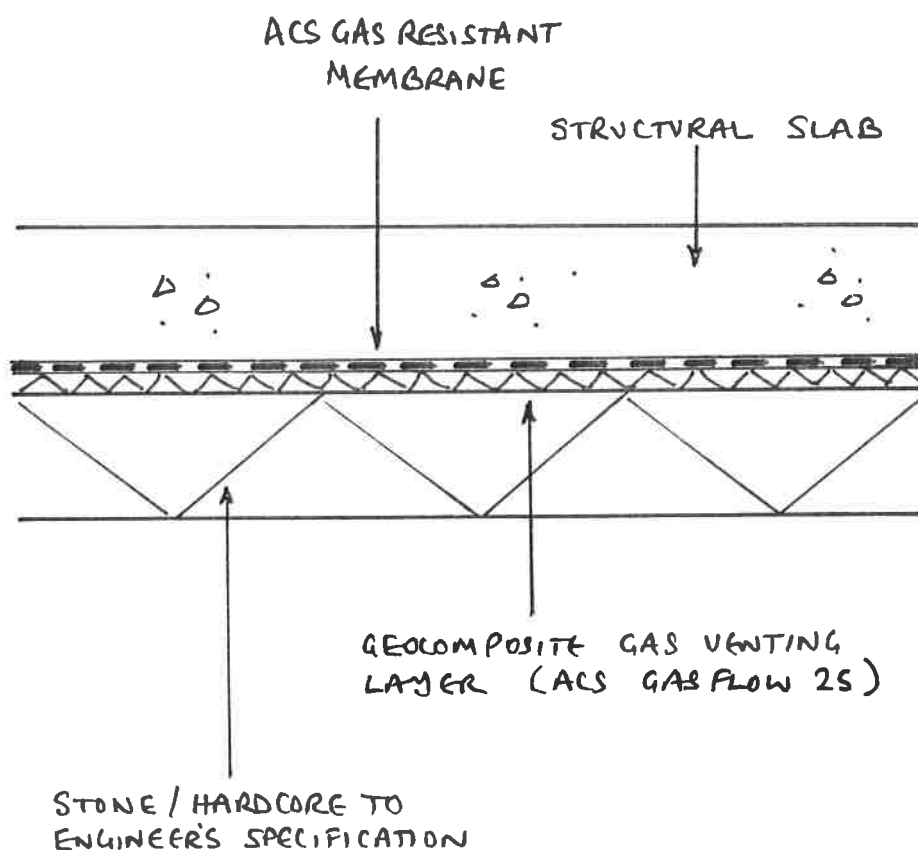
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DETAIL C

FLOOR SLAB SECTION (OFFICE)

SCALE 1:10

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Subject:

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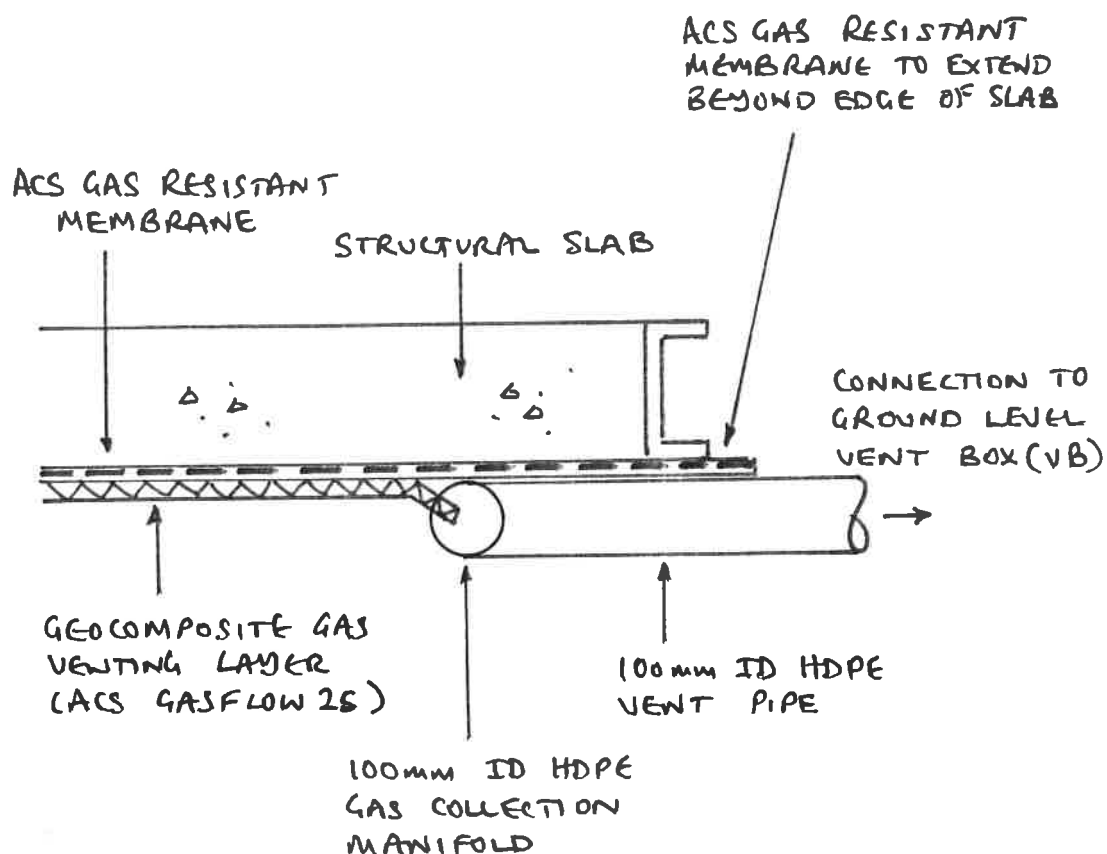
Made by:

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Date:

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AS BUILT



DETAIL D

TYPICAL PERIMETER SECTION
(OFFICES)

SCALE 1:10

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Job No:

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Project:

Island Road, Reading

Subject:

Gas Protection Measures

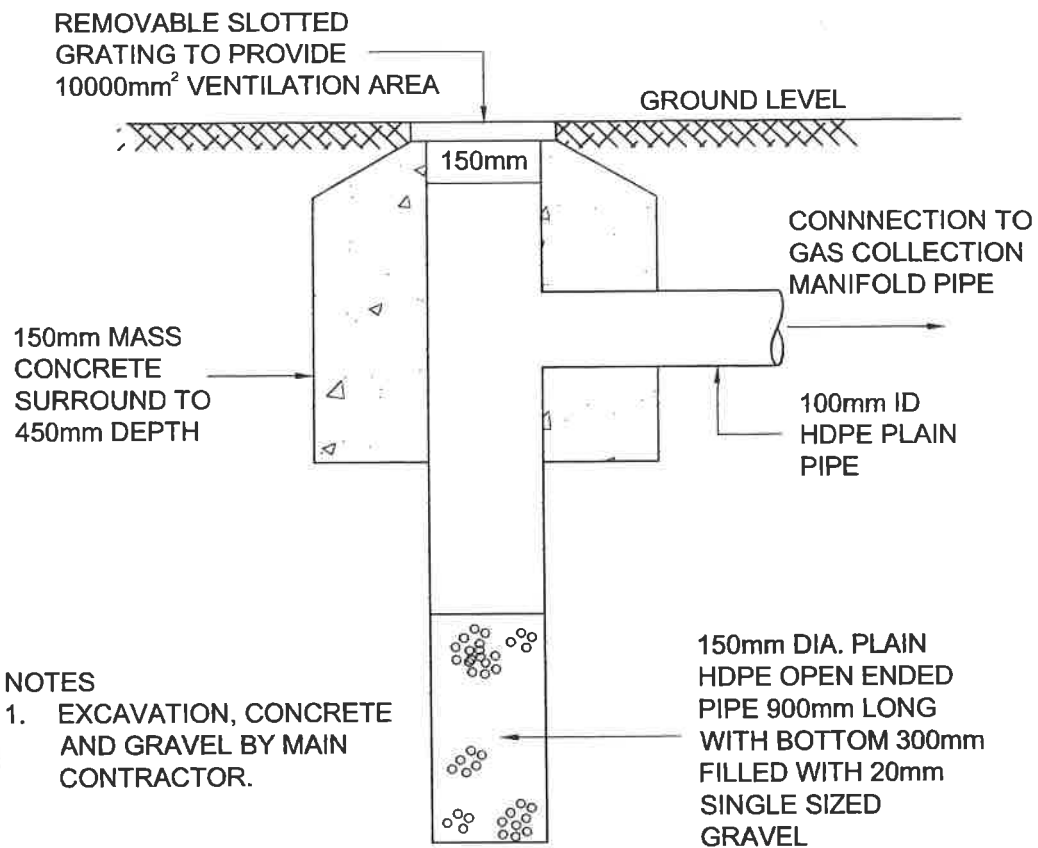
Made by:

HDS

Date:

July 2016

AS BUILT



DETAIL E
GROUND LEVEL VENT BOX (VB)
SCALE - 1:10

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Job No:

J16081

Project:

Island Road, Reading

Subject:

Gas Protection Measures

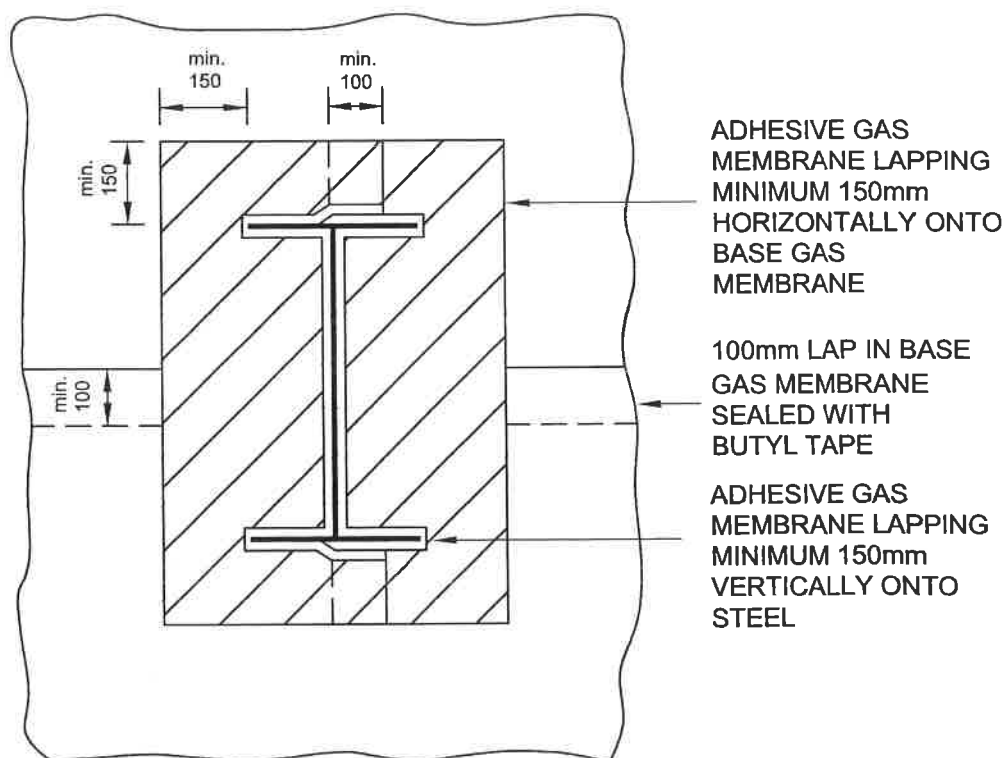
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AS BUILT



DETAIL F
STEEL COLUMN FLASHING
N.T.S

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Subject:

Gas Protection Measures

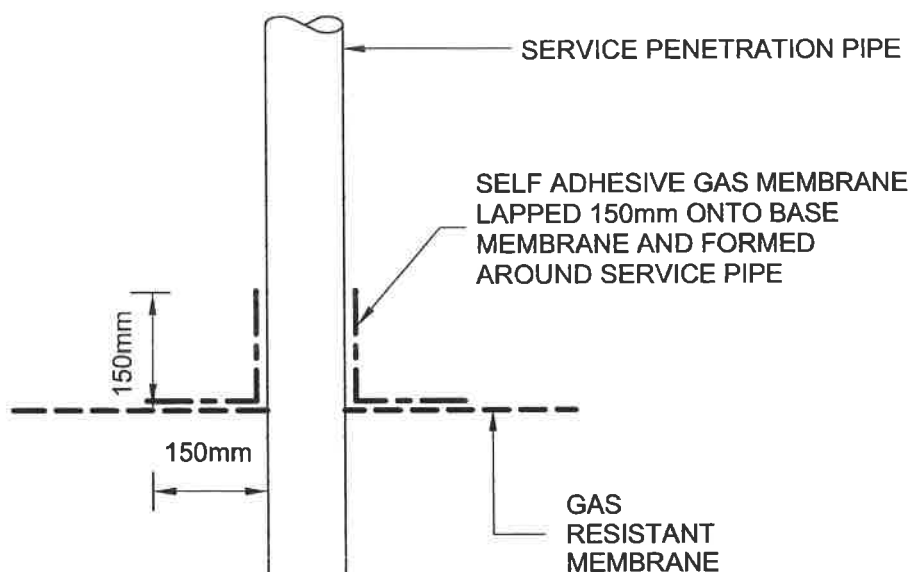
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July 2016

AS BUILT



DETAIL G
SEAL TO SERVICE PIPE
NOT TO SCALE

APPENDIX B

ISLAND ROAD, READING

GAS PROTECTION MEASURES
DESIGN METHODOLOGY

1.0 SITE CLASSIFICATION

The gas protection measures are intended to provide protection to satisfy the requirements of Characteristic Situation 4 in accordance with CIRIA C665 (2007) Assessing Risks Posed by Hazardous Gases to Buildings.

In accordance with BS 8485 (2015) Characteristic Situation 4 would require 3.5 points of protection for the main warehouse areas increasing to 4.5 points for the office areas. These would be achieved by the following:-

Warehouse

<u>Item</u>	<u>Score</u>
1. Cast insitu suspended slab	1.5
2. Gas resistant membrane	2.0
Total	3.5

Office Areas

<u>Item</u>	<u>Score</u>
1. Cast insitu suspended slab	1.5
2. Gas resistant membrane	2.0
3. Passive subfloor gas venting (good performance)	1.5
Total	5.0

2.0 GAS PROTECTION PROPOSALS

The gas protection measures proposed by ACS Lining Limited comprise a high quality 2000 gauge (0.5mm thick) proprietary gas resistant membrane incorporating an encapsulated aluminium foil.

The membrane will be installed in accordance with the manufacturer's requirements and in line with the attached site specific details.

The membrane will be continuous to the entire building footprint including across any cavity walls.

It will be fully sealed around all steel columns and services penetrations.

Independent integrity testing and inspection of the membrane will be arranged by ACS Lining Limited prior to casting the floor slab.

In addition to the above the reinforced concrete cast insitu suspended slab will form an integral part of gas protection measures. This will be installed by others and the main contractor should ensure that it is installed to satisfy the requirements for a 1.5 points score in accordance with Table 5 of BS 8485 (2015).

3.0 VALIDATION PLAN

The gas membrane installation will be independently integrity tested and validated to satisfy the requirements of CIRIA Report C735 (2014).

APPENDIX C

ACS GAS RESISTANT MEMBRANE

ACS Lining Limited have sourced a ground membrane which has been design and developed as a solution to meet today's construction problems with contaminated land.

The material is manufactured using a 20 micron foil core, backed with an interweaved polywoven reinforcement, which gives it the highest tensile and tear strength of any comparable product on the market.

ACS Gas Resistant Membrane is a cost-effective solution to current contaminated land problems.

Product	Gas Barrier (Methane, Carbon Dioxide & Radon)
Roll size	1.6m x 100m
Properties	6 layers polywoven reinforcement/20 micron aluminium foil
Colour	Blue/White
Tensile Strength (BSEN10319)	15.26kN/m
Tear Resistance (ASTMD1004)	154.9N
Weight	40kg/roll
Gas Permeability Methane (ISO 2783 C/P Test)	Below detectable limit

ACS BUTYL SEALANT TAPE

ACS Lining Limited's Butyl Sealant Tape, is manufactured in double sided roll form, for easy on site application to bond and seal various materials. The butyl tape has an elastomeric backbone which is particularly beneficial when different thermal movements are experienced, thereby ensuring a sealed joint, even under pressure.

Colour	Black
Roll size	1.5mm x 30mm x 30m
Product Specification	Polybutene, inert fillers and oil with an elastomeric backbone, formed into a homogenous tape carried on a release paper
Joint Movement	20%
Service Temperature	-40°C to +90°C
Chemical Resistance:	Dilute acids and alkali – Good Detergents – Good Organic solvents – Poor
UV Resistance:	Very good
Toxicity	Contains no known toxic ingredients Solvent free
Shelf life	One year in ambient condition
Application Temperature	>4°C

ACS Butyl Sealant Tape

ACS ADHESIVE GAS MEMBRANE

ACS Adhesive Gas Membrane is a high-performance gas-resistant membrane doubly reinforced with a 100 micron polyethylene core and a 50 micron aluminium foil gas barrier. Both sides are coated with a self-adhesive modified bitumen compound. The upper surface is finished with a polyethylene film and the underside with a silicone coated release paper for easy installation.

Dimensions and weight

Nominal thickness (mm)	2.0
Nominal weight (kg/m ²)	2.1
Roll length (m)	15
Roll width (m)	1.01

Physical properties

Test Method

Methane gas transmission rate (ml/m ² /24hrs)	BRE gas chromatography ¹	<0.14
Tensile strength at break (N/50mm)	BS 2782 (320A)	(L) 200 (T) 200
Elongation at break (N)	BS 2782 (320A)	(L) 360 (T) 750
Low temperature flexibility (°C)	MOAT No 27 Test 5.4.2	Does not break at -15°C
Water vapour resistance (MN/s/g)	BS 3177	1,740

Notes

¹Tested to BS 903 : Part 17

ACS Adhesive Gas Membrane – Gas Disk

APPENDIX D

ACS GASFLOW 25

GEOCOMPOSITE VOID FORMER

ACS GASFLOW 25 consists of a geotextile filter, thermally bonded on one side of a specially formulated cusped HDPE (High Density Polyethylene) core, suitable for both active and passive venting systems.

GEOTEXTILE

Type		Non woven continuous filament needle punched and heat treated	
Material		Polypropylene	
Mass/unit area	(g/m ²)	140	BS EN 965:1995
Thickness at 2kPa	(mm)	1.2	BS EN 964-1:1995
U.V. resistance		Excellent and 100% stabilised	
Tensile strength long/cross	(kN/m)	7/9	BS EN ISO 10319:1996
Elongation at break long/cross	(%)	80/35	BS EN ISO 10319:1996
Pore size 0 ₉₀	(micron)	100-150	BS 6906 (2)
Gas Flow at 100mm	(l/m ² /s)	15,000	GAS TEST
Puncture resistance	(N)	1400	BS EN ISO 12236:1996
Tear resistance	(N)	200	ASTM D4533-85
Bacteria/chemical resistance		Superior and highly resistant to all common chemicals	

CORE

Type		Single Cusped (Dimpled)	
Material		Gas resistant HDPE (High Density Polyethylene)	
Mass/unit area	(g/m ²)	1250	BS EN 965:1995
Impact resistance		Excellent (even at low temperatures)	
Bacteria/chemical resistance		Superior and highly resistant to all common chemicals	

COMPOSITE

Flow capacity ⁽⁶⁾	(m ³ /m/hr)	2.0	DoE
Intrinsic permeability	(m ²)	1.03 x 10 ⁻⁵	DoE
Forcheimer term	(s/m)	18.0	DoE
Porosity		0.82	DoE
Equivalent clear void	(mm)	13	DoE
Thickness at 2kPa	(mm)	25	BS EN 964-1:1995
Compressive strength	(kPa)	240	ASTM D1621(MOD)
Creep resistance		Less than 6% in 100,000 hours	
Tensile strength long/cross	(kN/m)	13/15	BS EN ISO 10319:1996
Elongation long/cross	(%)	60/30	BS EN ISO 10319:1996
CBR puncture resistance	(N)	3,500	BS EN ISO 10319:1996
Life expectancy	(yrs)	120	
Working temperature	°C	-20 to 80	
Chemical resistance		Superior and excellent resistance to all common chemicals	
Bacteria/fungi		Does not support growth	
Compatibility with gas membranes		Fully compatible. The composite has a flat side in contact with the gas membrane to keep long term contact stresses to an absolute minimum	
Health, safety, environment		INERT. No known health hazard. No precautions necessary	

NOTE

- (1) The geotextile is bonded to the core to prevent intrusion into and blockage of the gas passageways under the action of pressure of backfill material.
- (2) The values given are indicative and correspond to nominal results obtained in our laboratories and testing institutes. The right is reserved to make changes without notice at any time.
- (3) Gasflow 25 has approx 6x the flow performance of 20mm gravel ballast.
- (4) Allowable tolerances are +/- 10% of the typical value.
- (5) Refer to separate sheets for fixing instructions, full range of fittings and packing dimensions.
- (6) 30m foundation, 2m air brick spacing, 1m/s wind speed, 0.6 Pa pressure difference