

TECHNICAL NOTE – GROUND GAS PROTECTION

Project Name: Plot M, Kingsway, Rochdale
 Project No: MCS2071
 Revision: P01
 Reference: GAS/TECHNOTE/01
 Date: 22nd June 2023
 Author: Joseph Hackwell

This technical note is to advise on the design solution dealing with the ground gas found on development Plot M at Kingsway, Rochdale.

The relevant clauses from the Geo-Environmental and Geotechnical Assessment Report dated February 2022 are as follows noting the classification for this site:

Ground Gas and Assessment Outcome

Ground gas assessment has been undertaken to assess the risks associated with ground gases and volatile vapours to new buildings and their occupants. The results obtained have been assessed in line with relevant guidance (notably CIRIA C665).

Table 7.1: Summary of Recorded Ground Gas Results

Borehole Ref.	Flow* (l/hr)		Carbon Dioxide (% v/v)			Methane (% v/v)		
	Min.	Max.	Min.	Max.	Avg.	Min.	Max.	Avg.
DS101	8.2	8.2	0.1	11.1	7.4	0.5	0.5	0.5
DS102	<0.1	<0.1	0.2	0.8	0.7	<0.1	<0.1	<0.1
DS103	-29.3	8.4	5.1	14.8	11.1	0.6	1.4	1.0
DS204	<0.1	<0.1	0.5	14.7	6.2	<0.1	<0.1	<0.1
DS205	<0.1	<0.1	0.1	2.4	0.9	<0.1	<0.1	<0.1
DS206	<0.1	<0.1	2.3	2.9	2.6	<0.1	<0.1	<0.1
DS207	<0.1	<0.1	0.8	0.9	0.8	<0.1	<0.1	<0.1
DS208	-7.6	46.3	0.6	0.9	0.7	<0.1	<0.1	<0.1
DS209	1.5	25.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
CP201	<0.1	<0.1	0.7	2.9	1.6	<0.1	<0.1	<0.1

Borehole Ref.	Flow* (l/hr)		Carbon Dioxide (% v/v)			Methane (% v/v)		
	Min.	Max.	Min.	Max.	Avg.	Min.	Max.	Avg.
CP202	<0.1	<0.1	3.4	4.7	4.1	<0.1	<0.1	<0.1
CP203	<0.1	<0.1	0.5	7.1	2.8	<0.1	<0.1	<0.1
CP204			1.9	2.8	2.4			
WS1301	<0.1	-3.2	0.1	1.3	0.9	<0.1	<0.1	<0.1
WS1302	-3.9	0.4	0.1	0.4	0.2	<0.1	<0.1	<0.1
WS1305	-3.5	-1.3	<0.1	0.8	0.4	<0.1	<0.1	<0.1
WS1306	<0.1	-3.6	0.2	1.6	0.8	<0.1	<0.1	<0.1
WS1304	<0.1	-3.4	0.1	1.8	0.9	<0.1	<0.1	<0.1
WS1303	-3.6	-3.1	1.1	1.5	1.3	<0.1	<0.1	<0.1

Hydrogen sulphide and carbon monoxide concentrations were not recorded above the limit of detection of the equipment during the monitoring visits except for carbon monoxide

recorded during the first visit. Recording carbon monoxide during the first visit following ground investigation is common and a function of the drilling process.

Table 7-2: Gas Screening Values

Borehole Ref.	GSV (l/hr)	Borehole Specific Classification
		CS
DS101	0.910	3
DS102	0.001	1
DS103	1.243	3
DS204	0.015	2
DS205	0.002	1
DS206	0.003	1
DS207	0.001	1
DS208	0.417	2
DS209	0.000	1
CP201	0.003	1
CP202	0.005	1
CP203	0.007	2
WS1301	-0.042	1
WS1302	0.002	1
WS1305	-0.010	1
WS1306	-0.058	1
WS1304	-0.061	1
WS1303	-0.047	1

Based on the results, it is recommended that gas protection commensurate with a CIRIA C665 CS3 situation is adopted for Unit M2 which is located on the Organic Soils which is evidently producing greater volumes of ground gas. Units M1 and M3 should adopt gas protection commensurate with CS2.

Based on current guidance in BS 8485 the design criteria has therefore been set as follows:

Units M1 & M3

Warehouse Type D Building (low risk) – 1.5 points for CS2
 Office Type C Building (medium/low risk) – 2.5 points for CS2

Warehouse

In accordance with BS 8485 Clause 7.2.1 for low sensitivity buildings on low-risk sites it is possible to rely solely on a membrane or slab; for example, where internal ventilation provides secondary protection. As per annex A.2.2.3 in BS 8485 the industrial ground floor slabs will be formed of a well reinforced ground bearing slab. It will be designed for minimal total and differential settlement and with widely spaced construction joints. There are limited services entering through the floor slab. The combination of all these factors, together with the large inter-connected space of most or all of the building, provides a low gas risk situation. All construction joints in the floor slab and all service penetrations through the floor slab are to be well sealed.

A standard 2000 gauge DPM beneath the slab, lapped and sealed is appropriate protection for the warehouse.

Office/Undercroft

The main office is a jointed concrete ground bearing slab, nominally mesh reinforced. This provides a points score of 0.5 and therefore additional gas protection measures

are required. The use of a validated proprietary gas membrane provide an additional 2 points, see Table 7 in BS8485:2015. The perimeter of the building has a gravel strip so any gas can flow laterally and vent to atmosphere.

Unit M2

Warehouse	Type D Building (low risk) – 2.5 points for CS3
Office	Type C Building (medium/low risk) – 3 points for CS3

Warehouse

In accordance with BS8485:2015 Table 5: cast in situ monolithic reinforced suspended slab with minimal penetrations & crack control reinforcement present will provide 1.5 points. A suitable gas resistant membrane lapped & taped will provide a further 2 points. The perimeter of the building has a gravel strip so any gas can flow laterally and vent to atmosphere. The slab and gas resistant membrane together therefore provide adequate protection to meet the CS3 requirements.

Office/Undercroft

The main office & undercroft is a jointed concrete suspended slab with mesh reinforcement. This provides a score of 1.5 and therefore additional gas protection measures are required. The use of a validated proprietary gas membrane provides an additional 2 points, see Table 7 in BS8485:2015. The perimeter of the building has a gravel strip so any gas can flow laterally and vent to atmosphere. The slab and gas resistant membrane together therefore provide adequate protection to meet the CS3 requirements.

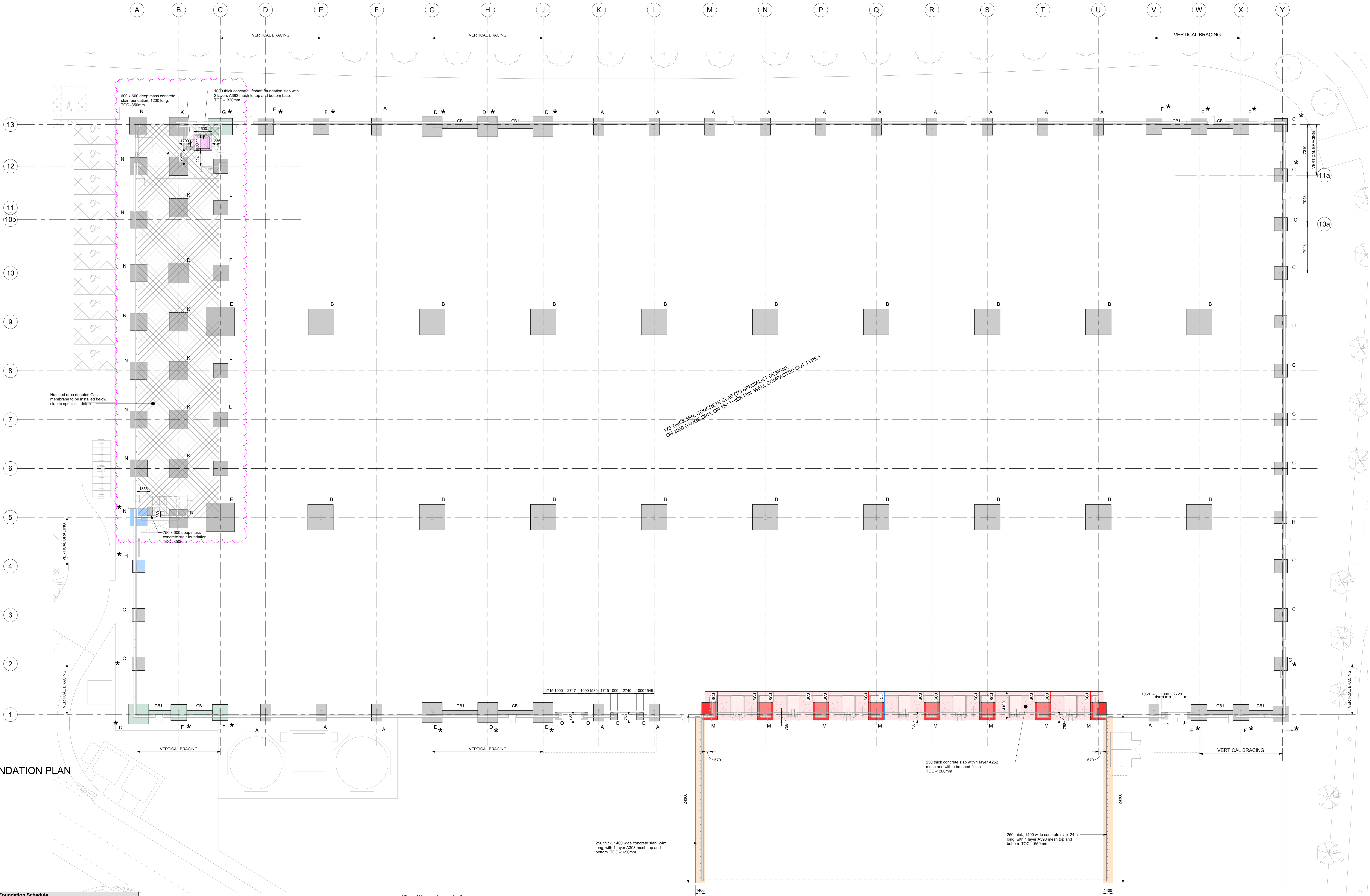
Gas Membrane Criteria

The selected membrane must meet the following criteria:

- Be verified in accordance with the manufacturer's specialist details and CIRA Report C735 and BS8485:2015
- Be sufficiently impervious to the gases with a methane gas transmission rate $\leq 40.0\text{ml/day/m}^2/\text{atm}$ (average) for sheets and joints (tested in accordance with BS ISO 15105-1 manometric method)
- Be sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions
- Be sufficiently strong to withstand in service stresses (e.g. settlement if placed below a flood slab)
- Be sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres and /or reinforcement ties, tearing due to operatives, dropping of tools etc)
- Be capable after installation of providing a complete barrier to the entry of the relevant gas
- Have all penetrations sealed all in accordance with the manufacturer's specialist details and CIRA Report C735 and BS8485:2015
- Not be ordered without prior approval from BWB

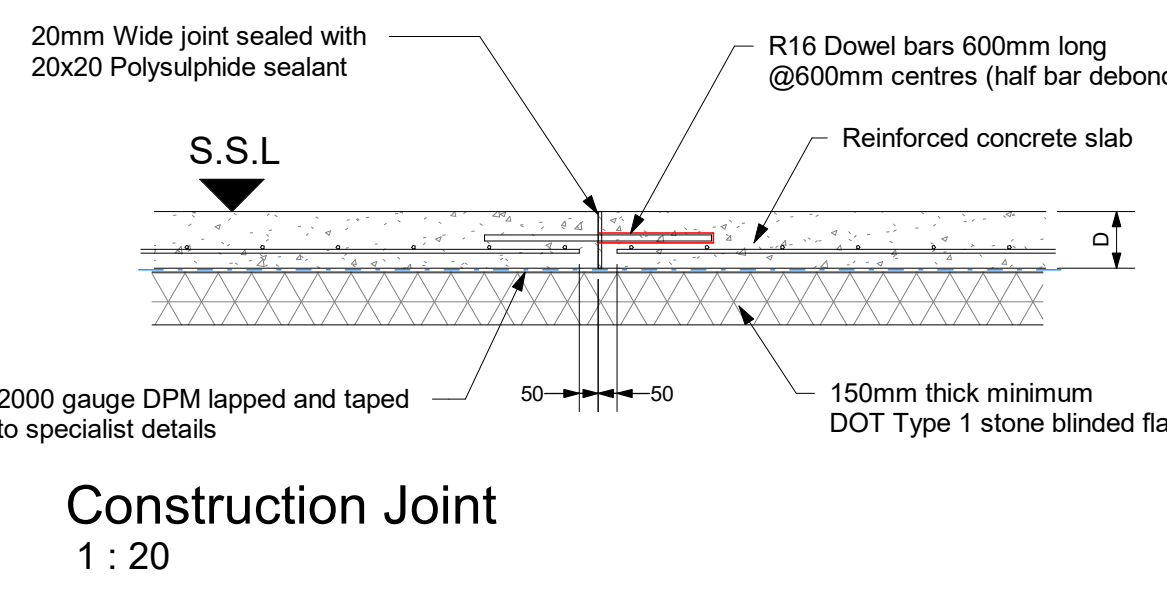
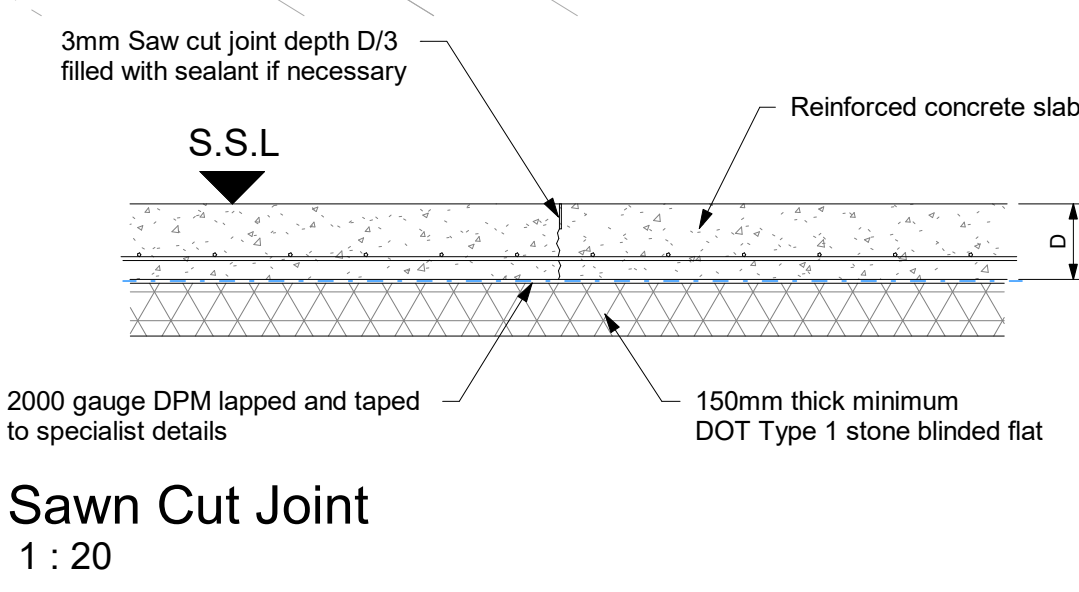
Appendix A

Drawings



FOUNDATION PLAN
1 : 200

Foundation Schedule				
Type Mark	Type	Type Comments	Volume	Count
A	2500 x 1500 x 1200 deep	Mass concrete	4.50 m³	17
B	3700 x 3700 x 1700 deep	Mass concrete	23.27 m³	18
C	1900 x 1900 x 1000 deep	Mass concrete	3.61 m³	12
D	2900 x 2900 x 1400 deep	Mass concrete	11.77 m³	8
E	4100 x 4100 x 2000 deep	Mass concrete	33.62 m³	2
F	2300 x 2300 x 1100 deep	Mass concrete	5.82 m³	11
G	3500 x 2400 x 1400 deep	Mass concrete	11.76 m³	1
H	1800 x 1800 x 900 deep	Mass concrete	2.92 m³	3
J	1000 x 1000 x 500 deep	Mass concrete	0.50 m³	2
K	2700 x 2700 x 1300 deep	Mass concrete	9.48 m³	8
L	2100 x 2100 x 1000 deep	Mass concrete	4.41 m³	5
M	2500 x 2300 x 1400 deep	Mass concrete	9.05 m³	8
N	2500 x 2500 x 1200 deep	Mass concrete	7.50 m³	9
O	1050 x 1000 x 500 deep	Mass concrete	0.53 m³	4



Notes

- Do not scale this drawing. All dimensions must be checked/verified on site. If in doubt ask.
- This drawing is to be read in conjunction with all relevant architectural, engineering and specialist drawings and specifications.
- All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
- Any discrepancies noted on site are to be reported to the engineer immediately.

NOTE:-

- Depths are minimum and based on an assumed ground bearing pressure of 150kN/m².
- All bored bases to have a 1.2m x 1.2m layer of A252 mesh to the top face centred about the HD bolts.
- Devoted from: *.
- All points to level across doors. Positively restraints and prevent gazing to have individual foundations.
- It is assumed that all personnel doors are fixed to the edge PFC and so no bases allowed for.
- No additional loading for the bases have been allowed for in foundation design. Additional fire protection measures to the superstructure to be provided by others.

KEY LEVELS

- Top of foundation = FFL-350mm
- Top of concrete to syphonic bases = FFL-675mm
- Top of foundation = FFL-1000mm
- Top of concrete to dock bases = FFL-1200mm
- Top of lift pit bases = FFL-1320mm
- Top foundation = FFL-1650mm

NOTE - GROUND BEAMS

GB1 - 600x600mm deep RC ground beam. 4No H12's 1x3 with two legs of H10 shear links @ 250mm c/c. Longitudinal bars to extend into supporting parts by a minimum of 500mm past the centre of the column.

ISSUES & REVISIONS

Rev	Date	Details of Issue / Revision	Drawn	Rev'd
01	13.12.21	Issued for Tender	MP	PD
02	13.12.21	Final boundary note removed	MP	PD
03	28.06.22	Preparation Issues to Contractor - Drawing revised to Glencar protocols. Grid lines revised to Architect's layout.	HA	PC
04	12.07.22	Foundation levels amended	MAK	JH
05	05.08.22	Foundations & Vertical Bracing amended. GLs aligned to Foundation drawings	MAK	JH
06	18.08.22	Foundation Levels Amended	MAK	JH
07	23.08.22	Foundation amended. Gas membrane added	MAK	JH
08	08.09.22	Foundation G amended. Setting out added	MAK	JH
09	13.09.22	Loading Bay Foundation Setting Out Added. Foundations aligned to Fabrication Setting Out	MAK	JH
10	07.10.22	Foundations TOS, SCLs, Foundation O	MAK	JH
11	20.10.22	Foundations & Star Base amended. Construction Joint added	MAK	JH
12	21.11.22	Extent of Gas Membrane Extended	MAK	JH

Client

Contractor

Drawn

BWB Ref

MCS2071

Scale @A0

Reviewed

PC

As indicated

Status

A1

Purpose of Issue

Construction

Project Title

Plot M1
Kingsway Business Park

Project-Originator-Zone-Level-Type-Role-Number

G1135-BWB-M1-00-DR-S-0100

Rev.

C07

Drawing Title

Foundation General
Arrangement

BWB

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Vibro Compaction Notes:-

In the absence of a project specific specification the base specification for vibro works shall be the Specification for 'Ground Treatment' & associated 'Notes for Guidance' published by the ICE and BS EN 1997-1 Eurocode 7 'Geotechnical Design - General Rule'.

For details of ground conditions refer to the Ground Investigation Report

The Vibro Sub Contractor shall be responsible for the design of the vibro system and shall be deemed to have taken due account of the proposed loads and any effects on adjacent structures, services or features, especially with respect to vibrations during the installation of the piling system. Prior to entering into a contract, the Vibro Sub Contractor shall calculate total settlements, differential settlements over stated distances & slab gradients which may occur over a 50 year period taking into account any possible ground water level variations.

Due regard shall be taken of all relevant information noted within the ground investigation report for the design of the vibro system. Should the Vibro Sub Contractor consider the information contained within the report to be inconclusive or deficient in any way, then his tender must include for any additional ground investigation considered necessary. The Vibro Sub Contractor shall inspect trial holes prior to entering into contract to ensure that the proposed vibro technique is suitable for the prevailing ground conditions (undisturbed or disturbed).

The nature, extent and level of the vibro platform shall be agreed with the Principal Contractor.

The Vibro Sub Contractor shall prepare a drawing setting out the position of all Vibro works.

The following safe working (characteristic) loads shall be available, following completion of ground treatment by vibro:-

Foundations - 150 kN/m²
Ground Slabs - 55 kN/m²
Sprinkler Tanks - 100 kN/m²

The Principal Contractor is responsible for removing any known obstructions prior to vibro operations and backfilling resultant excavations as directed by the Engineer. Should unknown obstructions be encountered, then the Engineer shall be informed immediately so that he may consider any necessary remedial work. The Principal Contractor & Vibro Sub Contractor shall liaise to ensure that all backfilling operations are compatible for the vibro technique to be adopted.

Vibro pile testing to be agreed with the Engineer.

Formation to be prepared in accordance with Clause 616 of the Specification for Highway Works upon completion of Vibro works and prior to installation of foundation and ground slab construction.

Foundation Notes:-

The base Specification for foundation works shall be BS8004 'British Standard Code of Practice for Foundations

The Engineer is to be informed immediately if foundation depths substantially exceed the minimum depths indicated upon the drawings.

All obstructions, old foundations, disused sewer etc shall be removed for the extent of the foundation works and backfilled to the approval of the Engineer.

All bases are to be set out symmetrically about column centre lines unless noted otherwise.

Top of foundation level to be -0.35m unless noted otherwise.

The following concrete mixes are to be used in accordance with BS8500 :-

Mass & reinforced bases:
Strength class = C28/35
Max water/cement ratio = 0.55
Max aggregate size = 20mm
Min cement content = 320kg/m³
Consistence class = S3
ACEC class = AC-2

The above concrete mixes have been selected for BRE Special Digest 1.

Unless foundation formations are concreted immediately, then 50mm of blinding concrete shall be provided. All formations for insitu reinforced concrete foundations are to be concrete blinded. The blinding depth shall not be regarded as part of the designed foundation depth noted on the drawings.

Excavation side support and disposal of ground water shall be considered upon the basis of the ground investigation report and on-site visual inspection.

Where trees are located in close proximity to buildings etc, design precautions are to be taken in accordance with the "N.H.B.C" standards (refer to Engineer for further advice).

All concrete mix certificates and the cube testing programme shall be approved by the Engineer prior to the commencement of the works on site.

Gas Protection:-

The Site is typical of a Characteristic Situation 2. Based on current guidance in BS8485:2015 Table 4 the required gas protection score by CS classification and type of building is as follows:

Warehouse Office Type D Building (low risk) – 1.5 points for CS2
Type C Building (Medium/low risk) – 2.5 points for CS2

Warehouse

In accordance with BS8485:2015 Table 5: Cast in situ monolithic reinforced ground bearing Warehouse floor slab with minimal penetrations will provide 1.5 points which meets the CS2 requirements without further protection measures.

Therefore a standard 2000 gauge DPM beneath the slab, lapped and sealed is acceptable protection for the warehouse.

Office/Undercroft

The Main office slab is a 150mm thick jointed concrete ground bearing slab, nominally mesh reinforced. This provides a points score of 0.5 and therefore additional gas protection measures are required. The use of a validated proprietary gas membrane provides an additional 2.0 points, BS8485:2015 Table 7. Therefore a validated gas proof membrane beneath the slab, lapped, taped and sealed is acceptable protection for the office. The selected gas membrane must:

- be verified in accordance with the manufacturer's specialist details and CIRIA Report C735 and BS 8485:2015 checked/verified on site. If in doubt ask;
- be sufficiently impervious to the gases with a methane gas transmission rate <40.0 ml/day/m² @2atm (average) for sheets and joints (tested in accordance with BS ISO 15105-1 manometric method);
- be sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions;
- be sufficiently strong to withstand in service stresses (e.g. settlement if placed below a floor slab);
- be sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc);
- be capable after installation of providing a complete barrier to the entry of the relevant gas;
- have all penetrations sealed;
- not be ordered without prior approval from BWB.

Reinforced Concrete Notes:-

The base Specification for Reinforced Concrete shall be BS8110 'Structural Use of Concrete' and the National Structural Concrete Specification for Building Construction.

The concrete mix to be used is RC40 in accordance with BS5328.

All reinforcement to BS8666:2005 u.o.n

Minimum cover to reinforcement to be 75mm.

Location of daywork joints and details to be agreed with the Engineer prior to commencement of the works on site.

Abbreviations:-
H. High yield type 2 deformed bar.
B. Bottom.
T. Top.
NF. Near face.
EF. Each face.

All concrete mix certificates and the cube testing programme shall be approved by the Engineer prior to commencement of the works on site.

50mm concrete blinding to be incorporated below all ground beams etc. to provide a suitable platform for fixing reinforcement.

Warehouse Ground Floor Slab Notes:

The base specification for ground floor slabs shall be BS8110 'Structural Use Of Concrete' and TR34 'Concrete Industrial Ground Floors - A Guide to Their Design & Construction'.

Drawing to be read in conjunction with the project specification

For details of ground conditions refer to the ground investigation report

Flatness and level tolerance shall be in accordance with TR34 Classification FM2, Properties 1, Tolerance of level to datum plane shall be 3mm.

The abrasion resistance of the floor slab shall be Class AR2 in accordance with BS8204-2.

Curing by spray applied membrane, applied immediately after final trowelling and before saw cutting. Spray or other slab surface treatment to be compatible with slab use and to be applied in accordance with the manufacturers instructions.

All concrete edges must be square, straight and true.

Provide purpose made spacers to ensure that concrete cover to mesh reinforcement is maintained during the concreting process. Dowel bars at construction/contraction joint etc. positions are to be supported by drilled stop-ends and reinforcement stools. Dowel bars at sawn joint positions are to be supported on reinforcement stools. All spacers and stools are to be stable and firmly wired to supported reinforcement. Ensure that all dowels are level and positioned at right angles to the joint face.

Unless stated otherwise the joint layout shall be determined by the sub-contractor following consultation with the engineer.

All sawn joints must be cut to <Slab Depth/3> within 24 hours of casting concrete, unless otherwise discussed and agreed with the contractor and engineer.

Concrete floor slab joints will be sawcut wherever possible and filled with Fosroc Thioflex 600 (or similar approved). During the maintenance period and before issue of the making good defects certificate, joint filler in trafficked areas/racking aisles shall be periodically inspected and if deemed necessary replaced with Fosroc Expoflex 800 (or similar approved) unless otherwise noted in the development specification. Maintenance of floor joints thereafter shall be the responsibility of others.

Alternatively Fosroc Nitoseal MS300 one part joint sealant may be used subject to the engineers approval.

The provision of contraction and similar joints shall be minimized and wherever possible positioned under racking or in other lightly/non trafficked locations. The distance between racking legs and any slab joint shall be 300mm minimum.

The ground floor slab will be designed to support racking leg loads of 7 tonnes, placed back to back with the centreline of the 100mm square base plates, placed a minimum of 300mm apart and a minimum of 150mm away from floor joints anywhere on the slab.

Composite Floor Notes:-

The base specification for composite floors shall be BS8110 'Structural Use of Concrete and BS 5950 Part 4 C.P. for design of floor with profiled steel sheeting. The design of the composite floor & associated support steelwork is to take due account of the SCI document 'Design Guide on the Vibration of Floors'.

No decking lengths are to be cut to single span without approval from the decking manufacturer.

All edge trim to be 1.2mm thick unless noted otherwise secure with restraint straps at 600mm centres. Decking and edge trim to be set out from the centre line of steel. No allowance is made for steelwork/concrete frame tolerances (Composite flooring Sub Contractor to undertake all necessary site measurements).

Minimum bearing requirement for decking is 50mm onto steel, 75mm onto concrete.

Each sheet must have fixings at approx. 300mm centres at panel ends and one fixing in lap joints at the intermediate supports.

Holes in excess of 300mm dia. to have additional trimming.

Shear studs to be 19mm dia. x 95mm long 'through deck, welded unless otherwise noted. Top flange of steel must be completely clean and free of any coatings.

Propping (prior & during concrete pour) by others where:-

- Decking cantilever exceeds 500mm (dependant on slab thickness, top reinforcement steel will be necessary)
- Decking having less than 50mm bearing at ends of span on steel of 75mm on concrete.
- Deck side edge is unsupported or bearing less than 20mm on steel or 50mm on concrete.
- Edge flashing exceeds 114mm or more beyond the supporting edge.
- Span of decking exceeds the design requirements for the construction and/or composite stage.

All work shall be undertaken in accordance with the steel construction institutes publication "Good Practice in Composite Floor Construction" & technical information provided by the manufacturer of the composite steel decking.

Loading Schedule

Live Load 5.0 kN/m²
Plant Deck Live Load 7.5 kN/m²
Partitions 1.0 kN/m²
Services 0.25 kN/m²

All the above loads are characteristic

Unless otherwise stated on drawings, the composite floor construction & supporting steelwork have been designed as un-propped. Any temporary propping requirements to be agreed with the Principal Contractor.

Prior to commencement of work, the composite flooring Sub Contractor shall submit and agree the programme for drawing, manufacture, delivery and erection with the principal contractor. A method statement for installation shall also be agreed with the Principal Contractor prior to commencement of work on site.

The Composite Flooring Sub Contractor shall prepare decking layout drawings, including the position of edge trims, stop ends, studs etc.

Unless otherwise noted the finished level and flatness criteria for the composite floor shall be in accordance with BS 8204: part 2: latest edition "Class SR3" the tolerance of level to datum plain to be specified by the Engineer. No departure from the tolerances stated shall be permitted unless otherwise agreed in writing by the Principal Contractor.

In constructing the composite floor, the Composite Flooring Sub Contractor shall take due account of the aggregate deflections of supporting structural steel members and the composite decking due to concreting operations.

Prior to placement of concrete, surface grease, oil and dirt must be removed. Heaping of wet concrete must be strictly avoided. The wet concrete must be poured evenly, working in the direction of the span only.

Prior to concreting, the Composite Flooring Sub Contractor shall undertake an accurate level survey of the steel decking at 3m centres along the line of all structural steel members. The Composite Flooring Sub Contractor shall issue and agree the results of the survey with the Principal Contractor before any concrete is placed.

The thickness of wet concrete provided in any one pour shall not exceed the steel decking manufacturers recommendations.

Unless otherwise required by the Principle Contractor the following surface finish to composite floors shall be provided:-

- Where composite floors are to receive floating floors or screeds the surface finish shall be a light tamp.
- All other areas of composite floors shall be power floated.

To avoid any misunderstanding, the Composite Flooring Sub Contractor shall in writing, inform the Principle Contractor the surface finish that will be provided five working days before placing concrete.

Within two working days of concreting the Composite Flooring Sub Contractor shall undertake an accurate level survey of the finish concrete surface on a 3m x 3m grid and immediately issue the results of the Principle Contractor. If the survey indicates that the surface level does not comply with the required level and flatness criteria, the Composite Flooring Sub Contractor shall provide a method statement for remedial work to the Principle Contractor for consideration.

It is important to recognize that the complete composite flooring and associated structure will deflect further but within the parameters of the relevant British Standards, when subject to the application of any other design loads, eg. walls, floating floors, screeds, finishes, ceiling, plant services, superimposed loadings, ect.

Refer to Architects details for fire rating and all penetrating requirements.

Ceiling and services to be supported by proprietary fixing approved by the decking manufacturer. Safe loads for fixing shall not be exceeded.

Edge trims to incorporate fixing slots to facilitate ledger angle installation ect, as required.

Structural Steelwork Notes:-

In the absence of a project specific specification the base Specification for structural steelwork shall be BS5950 'Structural Use of Steelwork in Building' and the 'National Steelwork Specification' produced by the B.C.S.A.

Structural steelwork to be grade S355JR unless noted otherwise.

All reactions (ultimate) shown thus (**) are in kN.
All moments (ultimate) shown thus ** are in kNm.
All beam/column offsets shown thus ** are in mm.

All connections shall have a minimum of 2 No bolts and be designed for a minimum 100 kN (ultimate) reaction unless noted otherwise.

The minimum specification for bolts shall be 8.8 and zinc plated.

Baseplate and holding down bolts to be designed and detailed by the Steelwork Sub Contractor unless noted otherwise.

Holding down bolts and washer plates are to be supplied by the Steelwork Sub Contractor unless noted otherwise.

All beams/stanchions shall be located symmetrically on grid lines unless noted otherwise.

All plan dimensions are shown to centre lines of beams or stanchions unless noted otherwise.

All levels shown thus TOS (**,**) are to tops of beams or stanchions unless noted otherwise.

For details of fire protection to steelwork refer to Architect's details.

All steelwork below ground level to be encased with 100mm concrete (mix as for foundations) and with D49 wrapping fabric as directed by the Engineer.

Design of all temporary works, propping and bracing shall be the responsibility of the Steelwork Sub Contractor.

The Steelwork Sub Contractor shall not form any holes through steel members other than those for connections without the written approval of the Engineer.

Where dissimilar steels are to be connected a suitable isolating material shall be incorporated.

All steelwork receiving timber wallplates, bearers etc are to be predrilled with 12mm dia holes at 450mm centres staggered (900mm pitch on line) as indicated on the Engineers drawing.

Unless otherwise noted in the project specific specification, protection treatment of steelwork shall be in accordance with British Steels 'Prevention of Corrosion of Structural Steelwork' appropriate system. A minimum structural life of 50 years and a first major maintenance of 15 years is to be assumed.

All steelwork faces above ground slab level which are hidden and therefore cannot be maintained (eg. steelwork built into cavity walls) to be given 2 coats of RIW 'Liquid Asphaltic Compound' by the Principal Contractor. Refer to the Architects drawings for the extent of RIW coatings. RIW not to be used on steel surfaces which receive intumescent or other coatings.

All external steelwork to be blast cleaned and hot dipped galvanised to BS 729 unless noted otherwise.

The Steelwork Sub Contractor is to ensure that any shop or site applied primers are compatible with any finishing, intumescent or R.I.W. coatings which may be applied by the Principal Contractor.

The Steelwork Sub Contractor shall submit copies of his drawings to both the Architect and Engineers for comments a minimum of 7 days prior to manufacture.

At all column splice locations the bolt head must be on the visible external surface of steel members.

Refer to the Architect for clear opening requirements to ensure no interference from bolt heads/nuts/shanks etc.

The minimum metal thickness of any cold rolled member shall be 1.3mm.

Assumed Loading:-

Roof: Services load = 0.25 kN/m²
PV load = 0.12 kN/m²
Imposed/snow load = 0.60 kN/m²

Offices: Services load = 0.25 kN/m²
Ceiling load = 0.15 kN/m²
Imposed load = 5.00 kN/m²
Partitions = 1.00 kN/m²

Purlins and Cladding rails

All purlins and cladding rails shall be designed by the specialist manufacturer in accordance with BS 5950.

All fixing cleats, cleaders, sleeves, brackets, packers, sag rods etc. shall be designed and provided as required for the design by the specialist manufacturer and fixed in accordance with the manufacturers recommendations.

Loading schedule:-

Dead load = 0.20 kN/m²
Imposed load = 0.60 kN/m² (Snow load as BS 6399 part 3)
Services = 0.25 kN/m²
PV load = 0.12 kN/m²

The following deflection criteria shall apply:-

Total load span/200
Imposed load span/180

Fire boundary conditions:-

Wherever fire boundary conditions are indicated on drgs, all cladding rails are to be provided with slotted holes (which allows for thermal expansion) in accordance with the manufacturers recommendations.

Notes	
1.	Do not scale this drawing. All dimensions must be checked/verified on site. If in doubt ask.
2.	This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3.	All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4.	Any discrepancies noted on site are to be reported to the engineer immediately.

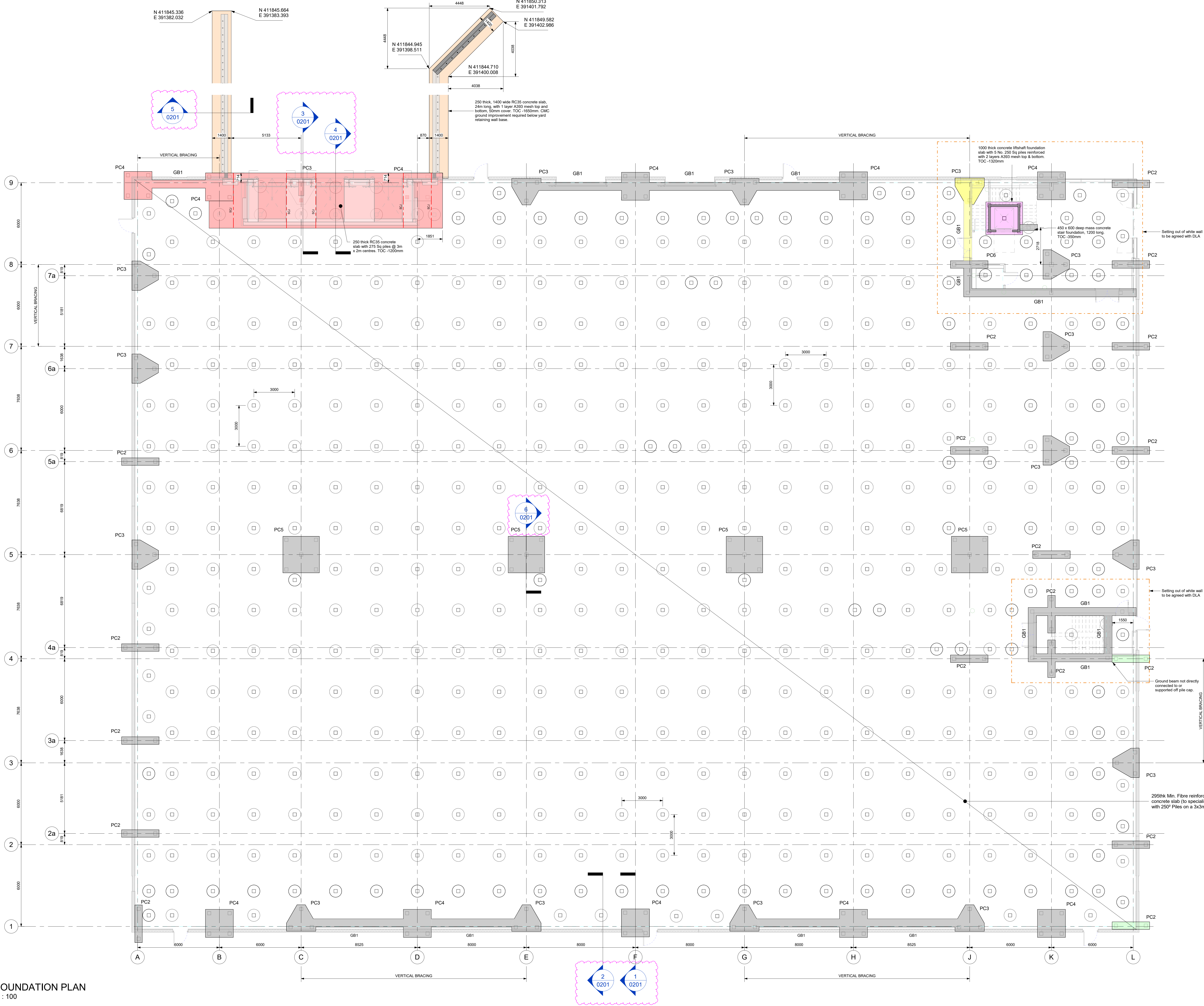
ISSUES & REVISIONS					
Rev	Date	Details of Issue / Revision	Drwn	R'wd	
P1	03.12.21	Issued for Tender	MP	PD	
P2	13.12.21	Notes revised	MP	PD	
P3	28.06.22	Preliminary Issue to Contractor - Drawings revised to Glencar protocols	HA	PC	
C01	07/10/22	Notes Amended	MAK	JH	



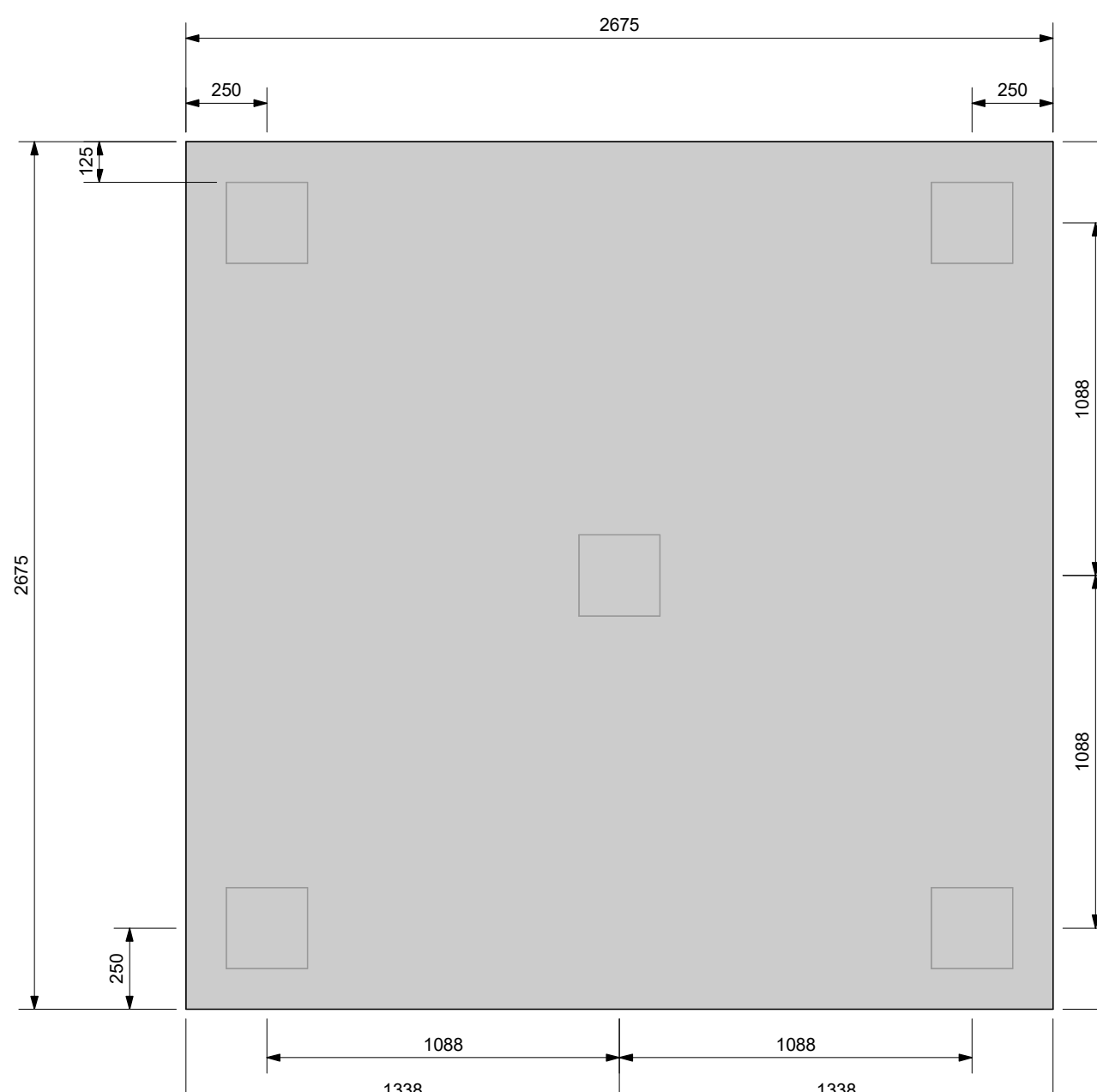
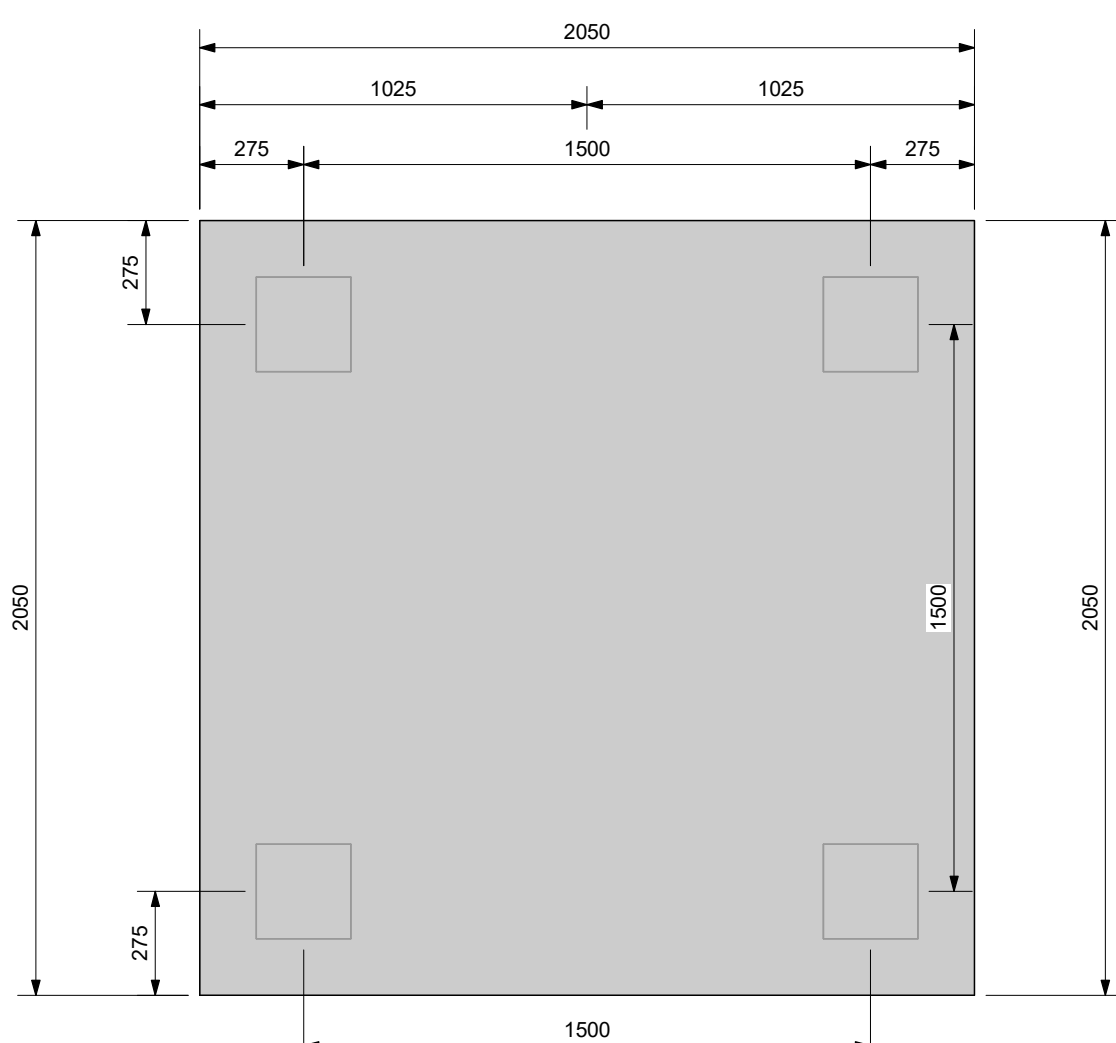
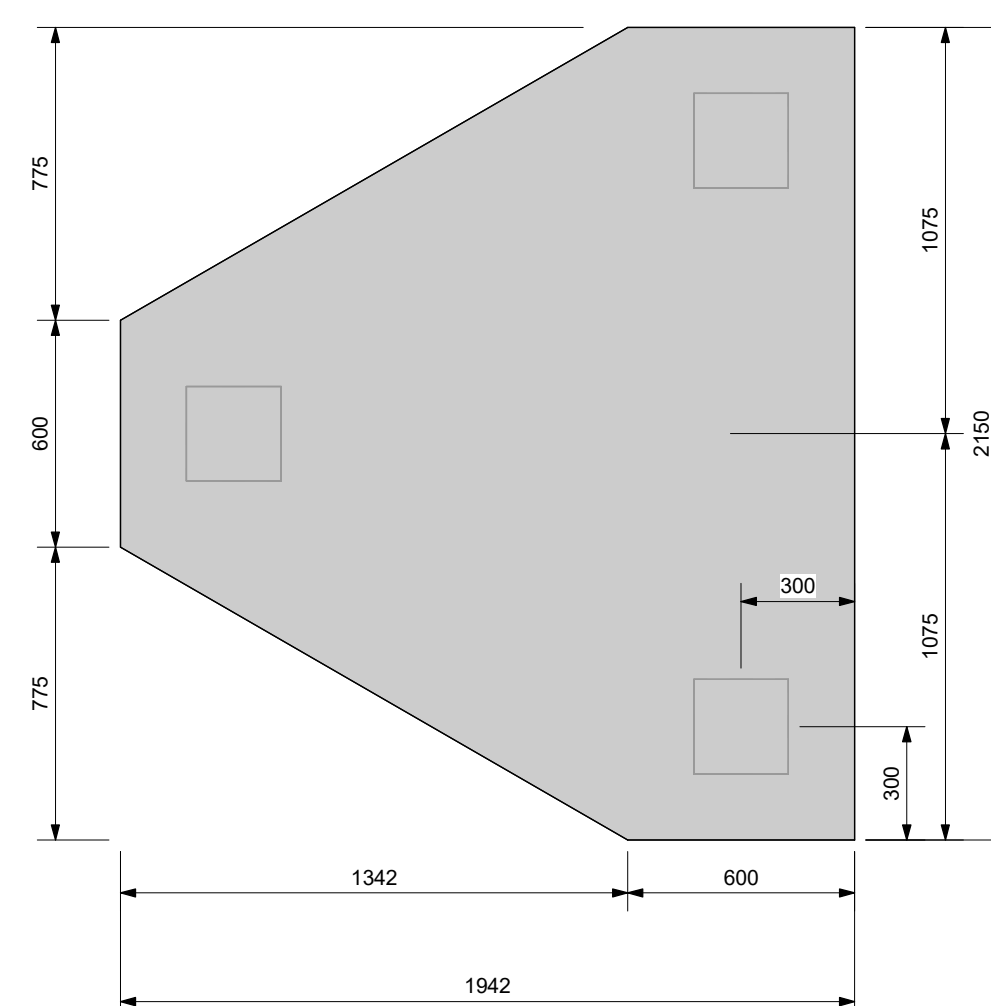
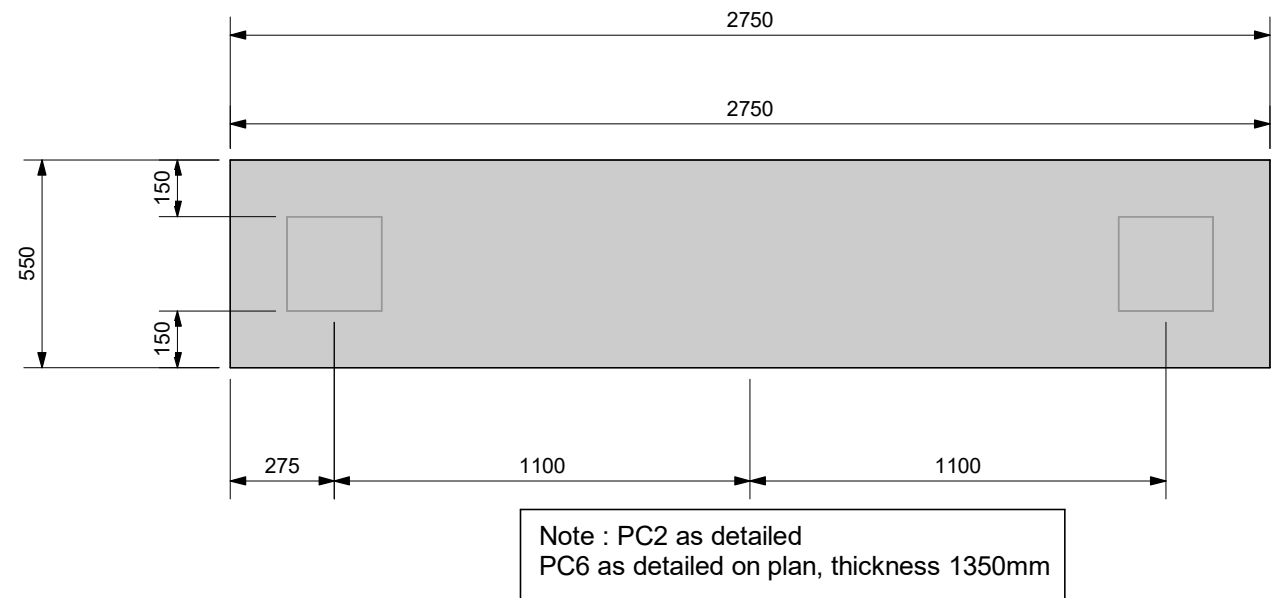
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Client		Contractor		Project Title		Drawing Title	
				Plot M1 Kingsway Business Park		Project Notes	
Drawn	HA	Reviewed	PC	Status	Purpose of Issue	Project-Originator-Zone-Level-Type-Role-Number	Rev.
BWB Ref	MCS2071	Scale @A1	1 : 1	A1	Construction	G1135-BWB-M1-XX-DR-S-0001	C01



Pile Cap Schedule					
Type Mark	Pile Cap Length	Pile Cap Width	Pile Cap Depth	Volume	Count
PC2	2750	550	700	1.05 m³	18
PC3	1942	2150	700	2.19 m³	16
PC4	2050	2050	700	2.94 m³	11
PC5	2675	2675	1000	7.16 m³	4
PC6	2750	550	1350	2.03 m³	1



FOUNDATION PLAN
1 : 100

Notes

- Do not scale this drawing. All dimensions must be checked/verified on site. If in doubt ask.
- This drawing is to be read in conjunction with all relevant architectural, engineers and specialist drawings and specifications.
- All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
- Any discrepancies noted on site are to be reported to the engineer immediately.

NOTE:

- All points to level access doors, Proxal restraints and patent gassing to have individual foundations.
- It is assumed that all personnel doors are fixed to the edge of the pile cap and no bases allowed for.
- Primary pile cap piles to have 75mm embedment into cap. Single slab piles to have 30mm embedment into cap.

NOTE: GROUND BEAMS

GB1 - 600x700 deep RC ground beam. 5No H25 Bm & 5No 100 Top with two legs of H10 shear links @200mm c/c. Longitudinal bars to extend to supporting piles by a minimum of 500mm past the centre of column.

NOTE: GAS MEMBRANE

Gas membrane to be installed below whole area of pit to specialist details.

KEY:

- Top of concrete to warehouse bases = FFL-350mm
- Top of concrete to siphonic bases = FFL-675mm
- Top of concrete to avoid services = FFL-1000mm
- Top of concrete to dock bases = FFL-1200mm
- Top of concrete lift pit = FFL-1320mm
- Top of concrete yard wall bases = FFL-1650mm

ISSUES & REVISIONS

Rev	Date	Details of Issue / Revision	Drawn	Rev'd
P01	03.02.22	Raw text capacitive added	MAK	JPD
P02	28.06.22	Provisional issues to Contractor - Drawings related to Gascon protocols	MAK	JPD
P03	12.07.22	Foundations issues amended	MAK	JPD
P04	15.08.22	Foundations amended. Details added	MAK	JPD
C01	19.09.22	Issues for Construction - Loading Bays & Foundations Amended	MAK	JPD
C02	23.09.22	Foundations amended. Gas membrane added	MAK	JPD
C03	26.09.22	Foundations re-evaluated to suit fabrication layouts	MAK	JPD
C04	08.10.22	Wing wall added. Foundations amended. Gas added	MAK	JPD
C05	12.10.22	Foundations. Setting out added	MAK	JPD
C06	14.10.22	Piling added. GB Removal. Pile Caps & Cut off's added. TPO Amended	MAK	JPD
C07	26.10.22	Placing PC 6 added. GB GC, J & S lowered. GB replace steel bases	MAK	JPD
C08	14.11.22	LIFT base note amended	MAK	JPD
C09	08.01.23	Section markers added	MAK	JPD

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Client: **Wilson Bowden Developments**

Contractor: **Glencar CONSTRUCTION**

Drawn: HA Reviewed: PC
BWB Ref: MCS2071 Scale @A0 As indicated

Project Title: **Plot M2 Kingsway Business Park**

Status: **A** Purpose of Issue: **Construction**

Drawing Title: **Foundation General Arrangement**

Project-Originator-Zone-Level-Type-Role-Number: **G1135-BWB-M2-00-DR-S-0200**

Rev: **C09**

Piling Notes:-

In the absence of a project specific Piling Specification the base specification for piling works shall be the Specification for Piling and Embedded Retaining Walls published by ICE and BS EN 1997-1 Eurocode 7 'Geotechnical Design, General Rules'.

For details of ground conditions refer to the Ground Investigation Report

The Specialist Piling Sub Contractor shall be responsible for the design of the piling system and shall be deemed to have taken due account of the proposed loads and any effects on adjacent structures or features.

Due regard shall be taken of all relevant information noted within the ground investigation report for the design of the piling system. Should the Piling Sub Contractor consider the information contained within the report to be inconclusive or deficient in any way then the tender must include for any additional ground investigation considered necessary.

The nature, extent and level of the piling platform shall be agreed with the Principal Contractor.

Setting out dimensions, as indicated on this drawing, relate to the centre of piles unless otherwise noted.

Refer to drawing for pile cut-off levels.

The method of breaking down piles shall be approved by the Engineer prior to the commencement of work on site.

Following 'breaking down' pile reinforcement shall be bent into the supported structure a minimum of 500mm.

Pile loads (working/characteristic loads) are specified on drawings.

All piles shall be capable of supporting additional forces due to the effects of setting out and rake tolerances ect. The Piling Sub Contractor shall allow, within their design, for the effect of any negative skin friction due to ground conditions.

The Principal Contractor is responsible for removing any known obstructions prior to piling and backfilling resultant excavations as directed by the Engineer. Should unknown obstructions be encountered the Engineer shall be informed immediately so that he may consider any necessary remedial work. The Engineer shall also be notified immediately of any broken piles.

Pile testing to be undertaken as follows:-

Static Load testing	1%
Dynamic testing	10%
Integrity testing	100%

The Engineer and Principal Contractor to select piles to be tested. Precast driven piles with joints relying wholly or partly upon adhesives are not acceptable.

Where trees are located in close proximity to buildings ect, design precautions are to be taken in accordance with the 'N.H.B.C' standards (refer to Engineer for further advise).

Traditional Foundations Notes:-

The base Specification for foundation works shall be BS EN 1997-1 Eurocode 7 'Geotechnical Design, General Rules'.

For details of ground conditions refer to Ground Investigation Report. The Engineer shall be immediately notified of any variations to the reported ground conditions.

The Engineer is to be informed immediately if foundation depths substantially exceed the minimum depths indicated upon the drawings.

All obstructions, old foundations, disused sewer etc shall be removed for the extent of the foundation works and backfilled to the approval of the Engineer.

All bases are to be set out symmetrically about column centre lines unless noted otherwise.

Top of foundation level to be FFL -350mm unless noted otherwise.

The following concrete mixes are to be used in accordance with BS8500 :-

Mass & reinforced bases:
Strength class = C28/35
Max water/cement ratio = 0.55
Max aggregate size = 20mm
Min cement content = 320kg/m3
Consistence class = S3
ACEC class = AC-2

The above concrete mixes have been selected for BRE Special Digest 1.

Unless foundation formations are concreted immediately, then 50mm of blinding concrete shall be provided. All formations for insitu reinforced concrete foundations are to be concrete blinded. The blinding depth shall not be regarded as part of the designed foundation depth noted on the drawings.

Excavation side support and disposal of ground water shall be considered upon the basis of the ground investigation report and on-site visual inspection.

Where trees are located in close proximity to buildings etc, design precautions are to be taken in accordance with the "N.H.B.C" standards (refer to Engineer for further advice).

All concrete mix certificates and the cube testing programme shall be approved by the Engineer prior to the commencement of the works on site.

Location of daywork joints to be agreed with the Engineer prior to commencement of the works on site.

Reinforced Concrete Notes:-

The base Specification for Reinforced Concrete shall be BS EN 1992 Eurocode 2 'Design of Concrete Structures' and the National Structural Concrete Specification. Drawing to be read in conjunction with main BWB specification.

The concrete mix to be used is RC32/40 Class DC2 in accordance with BS8500.

All reinforcement to BS EN 10080 u.d.n

Minimum cover to reinforcement to be 75mm.

Location of daywork joints and details to be agreed with the Engineer prior to commencement of the works on site.

All concrete mix certificates and the cube testing programme shall be approved by the Engineer prior to commencement of the works on site.

50mm concrete blinding to be incorporated below all ground beams etc. to provide a suitable platform for fixing reinforcement.

Gas Protection:-

The Unit is typical of a Characteristic Situation 3. Based on current guidance in BS8485:2015 Table 4 the required gas protection score by CS classification and type of building is as follows:

Warehouse Office Type D Building (low risk) – 2.5 points for CS3 Type C Building (Medium/low risk) – 3 points for CS3

Warehouse

The Warehouse slab is a 295mm thick jointed concrete suspended slab. This provides a points score of 1.5 and therefore additional gas protection measures are required. The use of a validated proprietary gas membrane provides an additional 2.0 points, BS8485:2015 Table 7.Therefore a validated gas proof membrane beneath the slab, lapped, taped and sealed is acceptable protection for the warehouse.

Office/Undercroft

The Main office slab is a 250mm thick jointed concrete suspended slab. This provides a points score of 1.5 and therefore additional gas protection measures are required. The use of a validated proprietary gas membrane provides an additional 2.0 points, BS8485:2015 Table 7.Therefore a validated gas proof membrane beneath the slab, lapped, taped and sealed is acceptable protection for the office.

Gas membranes within the warehouse / offices must:

- be verified in accordance with the manufacturer's specialist details and CIRIA Report C735 and BS 8485:2015
- be sufficiently impervious to the gases with a methane gas transmission rate <40.0 ml/day/m² 2/atm (average) for sheets and joints (tested in accordance with BS ISO 15105-1 manometric method);
- be sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions;
- be sufficiently strong to withstand in service stresses (e.g. settlement if placed below a floor slab);
- be sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc);
- be capable after installation of providing a complete barrier to the entry of the relevant gas;
- have all penetrations sealed;
- not be ordered without prior approval from BWB.

Warehouse Ground Floor Slab Notes:-

The base specification for ground floor slabs shall be BS8110 'Structural Use Of Concrete' and TR34 'Concrete industrial Ground Floors - A Guide to Their Design & Construction'.

Drawing to be read in conjunction with the project specification

For details of ground conditions refer to the ground investigation report

Flatness and level tolerance shall be in accordance with TR34 Classification FM2. Properties 1, Tolerance of level to datum plane shall be 3mm.

The abrasion resistance of the floor slab shall be Class AR2 in accordance with BS8204-2.

Curing by spray applied membrane, applied immediately after final trowelling and before saw cutting. Spray or other slab surface treatment to be compatible with slab use and to be applied in accordance with the manufacturers instructions.

All concrete edges must be square, straight and true.

Provide purpose made spacers to ensure that concrete cover to mesh reinforcement is maintained during the concreting process. Dowel bars at construction/contraction joint etc. positions are to be supported by drilled stop-ends and reinforcement stools. Dowel bars at sawn joint positions are to be supported on reinforcement stools. All spacers and stools are to be stable and firmly wired to supported reinforcement. Ensure that all dowels are level and positioned at right angles to the joint face.

Unless stated otherwise the joint layout shall be determined by the sub-contractor following consultation with the engineer.

All sawn joints must be cut to <Slab Depth/3> within 24 hours of casting concrete, unless otherwise discussed and agreed with the contractor and engineer.

Concrete floor slab joints will be sawcut wherever possible and filled with Fosroc Thioflex 600 (or similar approved). During the maintenance period and before issue of the making good defects certificate, joint filler in trafficked areas/racking aisles shall be periodically inspected and if deemed necessary replaced with Fosroc Expoflex 800 (or similar approved) unless otherwise noted in the development specification. Maintenance of floor joints thereafter shall be the responsibility of others.

Alternatively Fosroc Nitoseal MS300 one part joint sealant may be used subject to the engineers approval.

The provision of contraction and similar joints shall be minimized and wherever possible positioned under racking or in other lightly/non trafficked locations. The distance between racking legs and any slab joint shall be 300mm minimum.

The ground floor slab will be designed to support racking leg loads of 6 tonnes, placed back to back with the centreline of the 100mm square base plates, placed a minimum of 300mm apart and a minimum of 150mm away from floor joints anywhere on the slab.

Composite Floor Notes:-

The base specification for composite floors shall be BS8110 'Structural Use of Concrete and BS 5950 Part 4 C.P. for design of floor with profiled steel sheeting. The design of the composite floor & associated support steelwork is to take due account of the SCI document 'Design Guide on the Vibration of Floors'.

No decking lengths are to be cut to single span without approval from the decking manufacturer.

All edge trim to be 1.2mm thick unless noted otherwise secure with restraint straps at 600mm centres. Decking and edge trim to be set out from the centre line of steel. No allowance is made for steelwork/concrete frame tolerances (Composite flooring Sub Contractor to undertake all necessary site measurements).

Minimum bearing requirement for decking is 50mm onto steel, 75mm onto concrete.

Each sheet must have fixings at approx. 300mm centres at panel ends and one fixing in lap joints at the intermediate supports.

Holes in excess of 300mm dia. to have additional trimming.

Shear studs to be 19mm dia. x 95mm long 'through deck, welded unless otherwise noted. Top flange of steel must be completely clean and free of any coatings.

Propping (prior & during concrete pour) by others where:-

- a) Decking cantilever exceeds 500mm (dependant on slab thickness, top reinforcement steel will be necessary)
- b) Decking having less than 50mm bearing at ends of span on steel of 75mm on concrete.
- c) Deck side edge is unsupported or bearing less than 20mm on steel or 50mm on concrete.
- d) Edge flashing exceeds 114mm or more beyond the supporting edge.
- e) Span of decking exceeds the design requirements for the construction and/or composite stage.

All work shall be undertaken in accordance with the steel construction institutes publication "Good Practice in Composite Floor Construction" & technical information provided by the manufacturer of the composite steel decking.

Loading Schedule

Live Load	5.0 kN/m²
Plant Deck Live Load	7.5 kN/m²
Partitions	1.0 kN/m²
Services	0.25 kN/m²

All the above loads are characteristic

Unless otherwise stated on drawings, the composite floor construction & supporting steelwork have been designed as un-propped. Any temporary propping requirements to be agreed with the Principal Contractor.

Prior to commencement of work, the composite flooring Sub Contractor shall submit and agree the programme for drawing, manufacture, delivery and erection with the principal contractor. A method statement for installation shall also be agreed with the Principal Contractor prior to commencement of work on site.

The Composite Flooring Sub Contractor shall prepare decking layout drawings, including the position of edge trims, stop ends, studs etc.

Unless otherwise noted the finished level and flatness criteria for the composite floor shall be in accordance with BS 8204: part 2: latest edition "Class SR3" the tolerance of level to datum plain to be specified by the Engineer. No departure from the tolerances stated shall be permitted unless otherwise agreed in writing by the Principal Contractor.

In constructing the composite floor, the Composite Flooring Sub Contractor shall take due account of the aggregate deflections of supporting structural steel members and the composite decking due to concreting operations.

Prior to placement of concrete, surface grease, oil and dirt must be removed. Heaping of wet concrete must be strictly avoided. The wet concrete must be poured evenly, working in the direction of the span only.

Prior to concreting, the Composite Flooring Sub Contractor shall undertake an accurate level survey of the steel decking at 3m centres along the line of all structural steel members. The Composite Flooring Sub Contractor shall issue and agree the results of the survey with the Principal Contractor before any concrete is placed.

The thickness of wet concrete provided in any one pour shall not exceed the steel decking manufacturers recommendations.

Unless otherwise required by the Principle Contractor the following surface finish to composite floors shall be provided:-

a) Where composite floors are to receive floating floors or screeds the surface finish shall be a light tamp.

b) All other areas of composite floors shall be power floated.

To avoid any misunderstanding, the Composite Flooring Sub Contractor shall in writing, inform the Principle Contractor the surface finish that will be provided five working days before placing concrete.

Within two working days of concreting the Composite Flooring Sub Contractor shall undertake an accurate level survey of the finish concrete surface on a 3m x 3m grid and immediately issue the results of the Principle Contractor. If the survey indicates that the surface level does not comply with the required level and flatness criteria, the Composite Flooring Sub Contractor shall provide a method statement for remedial work to the Principle Contractor for consideration.

It is important to recognize that the complete composite flooring and associated structure will deflect further but within the parameters of the relevant British Standards, when subject to the application of any other design loads, eg. walls, floating floors, screeds, finishes, ceiling, plant services, superimposed loadings, ect.

Refer to Architects details for fire rating and all penetrating requirements.

Ceiling and services to be supported by proprietary fixing approved by the decking manufacturer. Safe loads for fixing shall not be exceeded.

Edge trims to incorporate fixing slots to facilitate ledger angle installation ect, as required.

Structural Steelwork Notes:-

In the absence of a project specific specification the base Specification for structural steelwork shall be BS5950 'Structural Use of Steelwork in Building' and the 'National Steelwork Specification' produced by the B.C.S.A.

Structural steelwork to be grade S355JR unless noted otherwise.

All reactions (ultimate) shown thus (**) are in kN.
All moments (ultimate) shown thus ** are in kNm.
All beam/column offsets shown thus ** are in mm.

All connections shall have a minimum of 2 No bolts and be designed for a minimum 100 kN (ultimate) reaction unless noted otherwise.

The minimum specification for bolts shall be 8.8 and zinc plated.

Baseplate and holding down bolts to be designed and detailed by the Steelwork Sub Contractor unless noted otherwise.

Holding down bolts and washer plates are to be supplied by the Steelwork Sub Contractor unless noted otherwise.

All beams/stanchions shall be located symmetrically on grid lines unless noted otherwise.

All plan dimensions are shown to centre lines of beams or stanchions unless noted otherwise.

All levels shown thus TOS (** ***) are to tops of beams or stanchions unless noted otherwise.

For details of fire protection to steelwork refer to Architect's details.

All steelwork below ground level to be encased with 100mm concrete (mix as for foundations) and with D49 wrapping fabric as directed by the Engineer.

Design of all temporary works, propping and bracing shall be the responsibility of the Steelwork Sub Contractor.

The Steelwork Sub Contractor shall not form any holes through steel members other than those for connections without the written approval of the Engineer.

Where dissimilar steels are to be connected a suitable isolating material shall be incorporated.

All steelwork receiving timber wallplates, bearers etc are to be predrilled with 12mm dia holes at 450mm centres staggered (900mm pitch on line) as indicated on the Engineers drawing.

Unless otherwise noted in the project specific specification, protection treatment of steelwork shall be in accordance with British Steels 'Prevention of Corrosion of Structural Steelwork' appropriate system. A minimum structural life of 50 years and a first major maintenance of 15 years is to be assumed.

All steelwork faces above ground slab level which are hidden and therefore cannot be maintained (eg. steelwork built into cavity walls) to be given 2 coats of RIW 'Liquid Asphaltic Compound' by the Principal Contractor. Refer to the Architects drawings for the extent of RIW coatings. RIW not to be used on steel surfaces which receive intumescent or other coatings.

All external steelwork to be blast cleaned and hot dipped galvanised to BS 729 unless noted otherwise.

The Steelwork Sub Contractor is to ensure that any shop or site applied primers are compatible with any finishing, intumescent or R.I.W. coatings which may be applied by the Principal Contractor.

The Steelwork Sub Contractor shall submit copies of his drawings to both the Architect and Engineers for comments a minimum of 7 days prior to manufacture.

At all column splice locations the bolt head must be on the visible external surface of steel members.

Refer to the Architect for clear opening requirements to ensure no interference from bolt heads/nuts/shanks etc.

The minimum metal thickness of any cold rolled member shall be 1.3mm.

Assumed Loading:-

Roof: Services load	= 0.25 kN/m²
PV load	= 0.12 kN/m²
Imposed/snow load	= 0.60 kN/m²

Offices: Services load	= 0.25 kN/m²
Ceiling load	= 0.15 kN/m²
Imposed load	= 5.00 kN/m²
Partitions	= 1.00 kN/m²

Purlins and Cladding rails

All purlins and cladding rails shall be designed by the specialist manufacturer in accordance with BS 5950.

All fixing cleats, cleaders, sleeves, brackets, packers, sag rods etc. shall be designed and provided as required for the design by the specialist manufacturer and fixed in accordance with the manufacturers recommendations.

Loading schedule:-

Dead load	= 0.20 kN/m²	
Imposed load	= 0.60 kN/m²	(Snow load as BS 6399 part 3)
Services	= 0.25 kN/m²	
PV load	= 0.12 kN/m²	

The following deflection criteria shall apply:-

Total load	span/200
Imposed load	span/180

Fire boundary conditions:-

Wherever fire boundary conditions are indicated on drgs, all cladding rails are to be provided with slotted holes (which allows for thermal expansion) in accordance with the manufacturers recommendations.

Notes
1. Do not scale this drawing. All dimensions must be checked/verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.

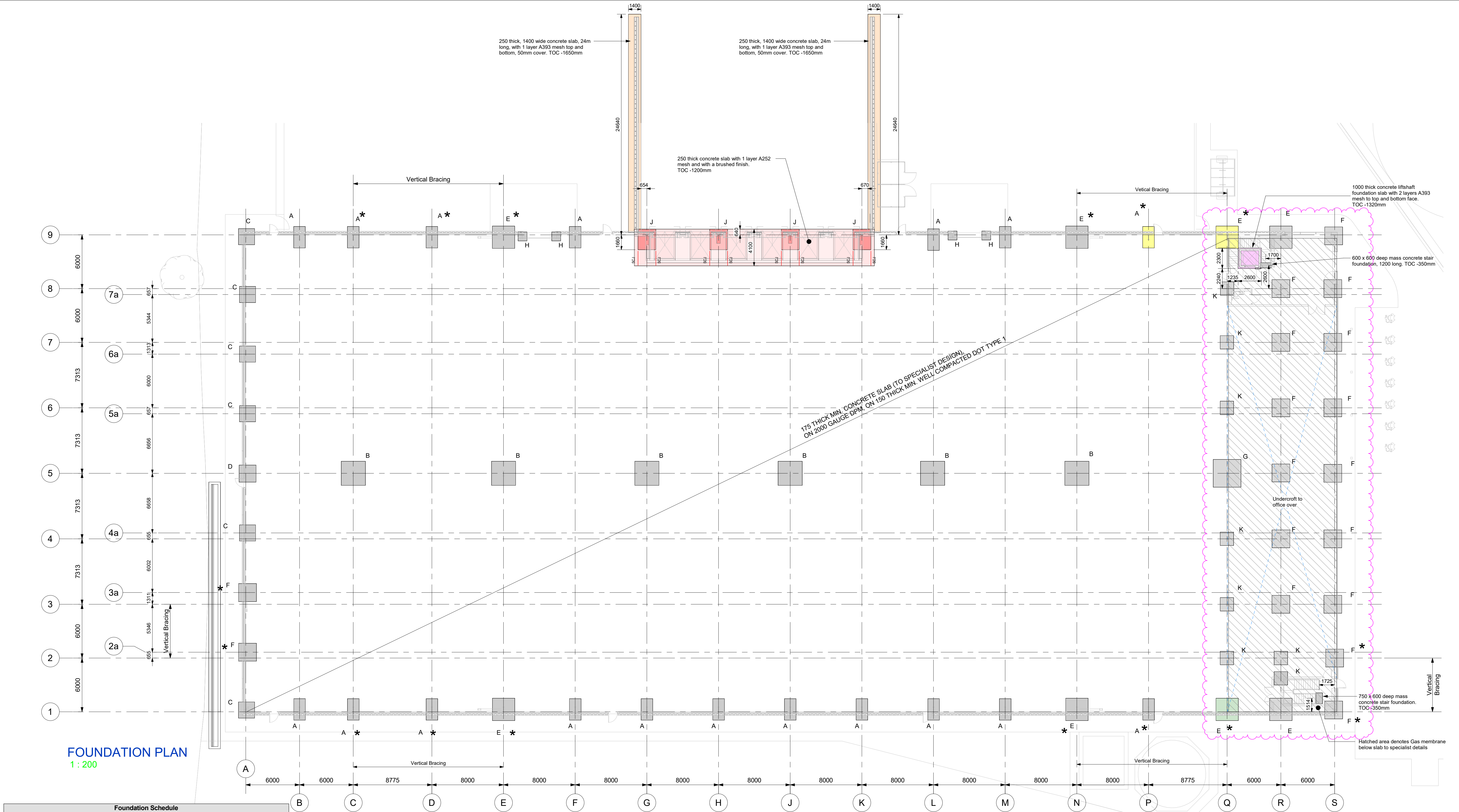
ISSUES & REVISIONS					
Rev	Date	Details of Issue / Revision	Dwn	R'wd	
P01	06.12.21	Issued for Tender	MP	PD	
P02	13.12.21	Notes revised	MP	PD	
P03	28.06.22	Preliminary Issue to Contractor - Drawings revised to Glencar protocols	HA	PC	
C01	14/10/22	Notes Amended	MAK	JH	



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Client				Project Title		Drawing Title	
Contractor				Plot M2 Kingsway Business Park		Project Notes	
Drawn	HA	Reviewed	PC	Status	Purpose of Issue	Project-Originator-Zone-Level-Type-Role-Number	Rev.
BWB Ref	MCS2071	Scale @A1	1 : 1	A1	Construction	G1135-BWB-M2-XX-DR-S-0002	C01



Foundation Schedule				
Type Mark	Type	Type Comments	Volume	Count
A	2400 x 1300 x 1000 deep	Mass concrete	3.12 m³	18
B	2700 x 2700 x 1300 deep	Mass concrete	9.48 m³	6
C	1800 x 1800 x 800 deep	Mass concrete	2.59 m³	6
D	1900 x 1900 x 900 deep	Mass concrete	3.25 m³	1
E	2500 x 2500 x 1200 deep	Mass concrete	7.50 m³	8
F	2000 x 2000 x 1000 deep	Mass concrete	4.00 m³	17
G	3100 x 3100 x 1500 deep	Mass concrete	14.42 m³	1
H	1000 x 1000 x 500 deep	Mass concrete	0.50 m³	4
J	2300 x 2000 x 1200 deep	Mass concrete	5.52 m³	4
K	1500 x 1500 x 700 deep	Mass concrete	1.58 m³	8

Notes

- Do not scale this drawing. All dimensions must be checked/verified on site. If in doubt ask.
- This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
- All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
- Any discrepancies noted on site are to be reported to the engineer immediately.

NOTE:-

- Depths are minimum and based on an assumed ground bearing pressure of 150kN/m².
- Bases are all assumed to be pinned.
- All braced bases to have a 1.2m x 1.2m layer of A252 mesh to the top face centred about the HD bolts.
- Denoted thus:- *
- All posts to level access doors, Prowall restraints and patent glazing to have individual foundations.
- It is assumed that all personnel doors are fixed to the edge PFC and so no bases allowed for.

KEY:		
	Top of concrete to warehouse bases	= FFL-350mm
	Top of concrete lift pit	= FFL-1320mm
	Top of concrete to syphonic bases	= FFL-675mm
	Top of concrete to avoid services	= FFL-1000mm
	Top of concrete to dock bases	= FFL-1200mm
	Top of concrete to yard wall bases	= FFL-1650mm

ISSUES & REVISIONS					
Rev	Date	Details of Issue / Revision	Dwn	R'ed	
P1	07.12.21	Issued for Tender	MP	PD	
P2	28.06.22	Preliminary Issue to Contractor - Drawings revised to Glencar protocols	HA	PC	
P3	12/07/22	Foundation levels amended	MAK	JH	
C01	23/08/22	Foundations, Vertical Bracing amended, Gridlines added	MAK	JH	
C02	08/09/22	Pit Setting out Added	MAK	JH	
C03	12/09/22	TOC Level added, Foundation Setting out Added, Foundations Moved	MAK	JH	
C04	13/10/22	TOC Level amended, Contact Office Change	MAK	JH	
C05	21/10/22	Stair Base amended	MAK	JH	
C06	14/11/22	Stair Base amended	MAK	JH	
C07	21/11/22	Extent of Gas Membrane below slab extended	MAK	JH	

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Client

Contractor

Drawn

BWB Ref

HA

MCS21071

Reviewed

PC

Scale @A1

As indicated

Status

A1

Purpose of Issue

Construction

Project Title

Plot M3
Kingsway Business Park

Project-Originator-Zone-Level-Type-Role-Number

G1135-BWB-M3-00-DR-S-0300

Drawing Title

Foundation General
Arrangement

Rev.

C07

Vibro Compaction Notes:-

In the absence of a project specific specification the base specification for vibro works shall be the Specification for 'Ground Treatment' & associated 'Notes for Guidance' published by the ICE and BS EN 1997-1 Eurocode 7 'Geotechnical Design - General Rule'.

For details of ground conditions refer to the Ground Investigation Report

The Vibro Sub Contractor shall be responsible for the design of the vibro system and shall be deemed to have taken due account of the proposed loads and any effects on adjacent structures, services or features, especially with respect to vibrations during the installation of the piling system. Prior to entering into a contract, the Vibro Sub Contractor shall calculate total settlements, differential settlements over stated distances & slab gradients which may occur over a 50 year period taking into account any possible ground water level variations.

Due regard shall be taken of all relevant information noted within the ground investigation report for the design of the vibro system. Should the Vibro Sub Contractor consider the information contained within the report to be inconclusive or deficient in any way, then his tender must include for any additional ground investigation considered necessary. The Vibro Sub Contractor shall inspect trial holes prior to entering into contract to ensure that the proposed vibro technique is suitable for the prevailing ground conditions (undisturbed or disturbed).

The nature, extent and level of the vibro platform shall be agreed with the Principal Contractor.

The Vibro Sub Contractor shall prepare a drawing setting out the position of all Vibro works.

The following safe working (characteristic) loads shall be available, following completion of ground treatment by vibro:-

Foundations - 150 kN/m²
Ground Slabs - 55 kN/m²
Sprinkler Tanks - 100 kN/m²

The Principal Contractor is responsible for removing any known obstructions prior to vibro operations and backfilling resultant excavations as directed by the Engineer. Should unknown obstructions be encountered, then the Engineer shall be informed immediately so that he may consider any necessary remedial work. The Principal Contractor & Vibro Sub Contractor shall liaise to ensure that all backfilling operations are compatible for the vibro technique to be adopted.

Vibro pile testing to be agreed with the Engineer.

Formation to be prepared in accordance with Clause 616 of the Specification for Highway Works upon completion of Vibro works and prior to installation of foundation and ground slab construction.

Foundation Notes:-

The base Specification for foundation works shall be BS8004 'British Standard Code of Practice for Foundations

The Engineer is to be informed immediately if foundation depths substantially exceed the minimum depths indicated upon the drawings.

All obstructions, old foundations, disused sewer etc shall be removed for the extent of the foundation works and backfilled to the approval of the Engineer.

All bases are to be set out symmetrically about column centre lines unless noted otherwise.

Top of foundation level to be -0.35m unless noted otherwise.

The following concrete mixes are to be used in accordance with BS8500 :-

Mass & reinforced bases:
Strength class = C28/35
Max water/cement ratio = 0.55
Max aggregate size = 20mm
Min cement content = 320kg/m³
Consistence class = S3
ACEC class = AC-2

The above concrete mixes have been selected for BRE Special Digest 1.

Unless foundation formations are concreted immediately, then 50mm of blinding concrete shall be provided. All formations for insitu reinforced concrete foundations are to be concrete blinded. The blinding depth shall not be regarded as part of the designed foundation depth noted on the drawings.

Excavation side support and disposal of ground water shall be considered upon the basis of the ground investigation report and on-site visual inspection.

Where trees are located in close proximity to buildings etc, design precautions are to be taken in accordance with the 'N.H.B.C.' standards (refer to Engineer for further advice).
Gas Protection:-

All concrete mix certificates and the cube testing programme shall be approved by the Engineer prior to the commencement of the works on site. On 2 based on current guidance in BS8485:2015 Table 4 the required gas protection score by CS classification and type of building is as follows:

Warehouse Type D Building (low risk) – 1.5 points for CS2
Office Type C Building (Medium/low risk) – 2.5 points for CS2

Warehouse

In accordance with BS8485:2015 Table 5: Cast in situ monolithic reinforced ground bearing Warehouse floor slab with minimal penetrations will provide 1.5 points which meets the CS2 requirements without further protection measures.

Therefore a standard 2000 gauge DPM beneath the slab, lapped and sealed is acceptable protection for the warehouse.

Office/Undercroft

The Main office slab is a 150mm thick jointed concrete ground bearing slab, nominally mesh reinforced. This provides a points score of 0.5 and therefore additional gas protection measures are required. The use of a validated proprietary gas membrane provides an additional 2.0 points. BS8485:2015 Table 7. Therefore a validated gas proof membrane beneath the slab, lapped, taped and sealed is acceptable protection for the office. The selected gas membrane must:

- be verified in accordance with the manufacturer's specialist details and CIRIA Report C735 and BS 8485:2015
- be sufficiently impervious to the gases with a methane gas transmission rate <40.0 ml/day/m² 2/atm (average) for sheets and joints (tested in accordance with BS ISO 15105-1 manometric method);
- be sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions;
- be sufficiently strong to withstand in service stresses (e.g. settlement if placed below a floor slab);
- be sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc);
- be capable after installation of providing a complete barrier to the entry of the relevant gas;
- have all penetrations sealed;
- not be ordered without prior approval from BWB.

Reinforced Concrete Notes:-

The base Specification for Reinforced Concrete shall be BS8110 'Structural Use of Concrete' and the National Structural Concrete Specification for Building Construction.

The concrete mix to be used is RC40 in accordance with BS5328.

All reinforcement to BS8666:2005 u.o.n

Minimum cover to reinforcement to be 75mm.

Location of daywork joints and details to be agreed with the Engineer prior to commencement of the works on site.

Abbreviations:-
H. High yield type 2 deformed bar.
B. Bottom.
T. Top.
NF. Near face.
EF. Each face.

All concrete mix certificates and the cube testing programme shall be approved by the Engineer prior to commencement of the works on site.

50mm concrete blinding to be incorporated below all ground beams etc. to provide a suitable platform for fixing reinforcement.

Warehouse Ground Floor Slab Notes:

The base specification for ground floor slabs shall be BS8110 'Structural Use Of Concrete' and TR34 'Concrete Industrial Ground Floors - A Guide to Their Design & Construction'.

Drawing to be read in conjunction with the project specification

For details of ground conditions refer to the ground investigation report

Flatness and level tolerance shall be in accordance with TR34 Classification FM2, Properties 1, Tolerance of level to datum plane shall be 3mm.

The abrasion resistance of the floor slab shall be Class AR2 in accordance with BS8204-2.

Curing by spray applied membrane, applied immediately after final trowelling and before saw cutting. Spray or other slab surface treatment to be compatible with slab use and to be applied in accordance with the manufacturers instructions.

All concrete edges must be square, straight and true.

Provide purpose made spacers to ensure that concrete cover to mesh reinforcement is maintained during the concreting process. Dowel bars at construction/contraction joint etc. positions are to be supported by drilled stop-ends and reinforcement stools. Dowel bars at sawn joint positions are to be supported on reinforcement stools. All spacers and stools are to be stable and firmly wired to supported reinforcement. Ensure that all dowels are level and positioned at right angles to the joint face.

Unless stated otherwise the joint layout shall be determined by the sub-contractor following consultation with the engineer.

All sawn joints must be cut to <Slab Depth/3> within 24 hours of casting concrete, unless otherwise discussed and agreed with the contractor and engineer.

Concrete floor slab joints will be sawcut wherever possible and filled with Fosroc Thioflex 600 (or similar approved). During the maintenance period and before issue of the making good defects certificate, joint filler in trafficked areas/racking aisles shall be periodically inspected and if deemed necessary replaced with Fosroc Expoflex 800 (or similar approved) unless otherwise noted in the development specification. Maintenance of floor joints thereafter shall be the responsibility of others.

Alternatively Fosroc Nitoseal MS300 one part joint sealant may be used subject to the engineers approval.

The provision of contraction and similar joints shall be minimized and wherever possible positioned under racking or in other lightly/non trafficked locations. The distance between racking legs and any slab joint shall be 300mm minimum.

The ground floor slab will be designed to support racking leg loads on 6 tonnes, placed back to back with the centreline of the 100mm square base plates, placed a minimum of 300mm apart and a minimum of 150mm away from floor joints anywhere on the slab.

Composite Floor Notes:-

The base specification for composite floors shall be BS8110 'Structural Use of Concrete and BS 5950 Part 4 C.P. for design of floor with profiled steel sheeting. The design of the composite floor & associated support steelwork is to take due account of the SCI document 'Design Guide on the Vibration of Floors'.

No decking lengths are to be cut to single span without approval from the decking manufacturer.

All edge trim to be 1.2mm thick unless noted otherwise secure with restraint straps at 600mm centres. Decking and edge trim to be set out from the centre line of steel. No allowance is made for steelwork/concrete frame tolerances (Composite flooring Sub Contractor to undertake all necessary site measurements).

Minimum bearing requirement for decking is 50mm onto steel, 75mm onto concrete.

Each sheet must have fixings at approx. 300mm centres at panel ends and one fixing in lap joints at the intermediate supports.

Holes in excess of 300mm dia. to have additional trimming.

Shear studs to be 19mm dia. x 95mm long 'through deck, welded unless otherwise noted. Top flange of steel must be completely clean and free of any coatings.

Propping (prior & during concrete pour) by others where:-

- Decking cantilever exceeds 500mm (dependant on slab thickness, top reinforcement steel will be necessary)
- Decking having less than 50mm bearing at ends of span on steel of 75mm on concrete.
- Deck side edge is unsupported or bearing less than 20mm on steel or 50mm on concrete.
- Edge flashing exceeds 114mm or more beyond the supporting edge.
- Span of decking exceeds the design requirements for the construction and/or composite stage.

All work shall be undertaken in accordance with the steel construction institutes publication "Good Practice in Composite Floor Construction" & technical information provided by the manufacturer of the composite steel decking.

Loading Schedule

Live Load 5.0 kN/m²
Plant Deck Live Load 7.5 kN/m²
Partitions 1.0 kN/m²
Services 0.25 kN/m²

All the above loads are characteristic

Unless otherwise stated on drawings, the composite floor construction & supporting steelwork have been designed as un-propped. Any temporary propping requirements to be agreed with the Principal Contractor.

Prior to commencement of work, the composite flooring Sub Contractor shall submit and agree the programme for drawing, manufacture, delivery and erection with the principal contractor. A method statement for installation shall also be agreed with the Principal Contractor prior to commencement of work on site.

The Composite Flooring Sub Contractor shall prepare decking layout drawings, including the position of edge trims, stop ends, studs etc.

Unless otherwise noted the finished level and flatness criteria for the composite floor shall be in accordance with BS 8204: part 2: latest edition "Class SR3" the tolerance of level to datum plain to be specified by the Engineer. No departure from the tolerances stated shall be permitted unless otherwise agreed in writing by the Principal Contractor.

In constructing the composite floor, the Composite Flooring Sub Contractor shall take due account of the aggregate deflections of supporting structural steel members and the composite decking due to concreting operations.

Prior to placement of concrete, surface grease, oil and dirt must be removed. Heaping of wet concrete must be strictly avoided. The wet concrete must be poured evenly, working in the direction of the span only.

Prior to concreting, the Composite Flooring Sub Contractor shall undertake an accurate level survey of the steel decking at 3m centres along the line of all structural steel members. The Composite Flooring Sub Contractor shall issue and agree the results of the survey with the Principal Contractor before any concrete is placed.

The thickness of wet concrete provided in any one pour shall not exceed the steel decking manufacturers recommendations.

Unless otherwise required by the Principle Contractor the following surface finish to composite floors shall be provided:-

a) Where composite floors are to receive floating floors or screeds the surface finish shall be a light tamp.

b) All other areas of composite floors shall be power floated.

To avoid any misunderstanding, the Composite Flooring Sub Contractor shall in writing, inform the Principle Contractor the surface finish that will be provided five working days before placing concrete.

Within two working days of concreting the Composite Flooring Sub Contractor shall undertake an accurate level survey of the finish concrete surface on a 3m x 3m grid and immediately issue the results of the Principle Contractor. If the survey indicates that the surface level does not comply with the required level and flatness criteria, the Composite Flooring Sub Contractor shall provide a method statement for remedial work to the Principle Contractor for consideration.

It is important to recognize that the complete composite flooring and associated structure will deflect further but within the parameters of the relevant British Standards, when subject to the application of any other design loads, eg. walls, floating floors, screeds, finishes, ceiling, plant services, superimposed loadings, ect.

Refer to Architects details for fire rating and all penetrating requirements.

Ceiling and services to be supported by proprietary fixing approved by the decking manufacturer. Safe loads for fixing shall not be exceeded.

Edge trims to incorporate fixing slots to facilitate ledger angle installation ect, as required.

Structural Steelwork Notes:-

In the absence of a project specific specification the base Specification for structural steelwork shall be BS5950 'Structural Use of Steelwork in Building' and the 'National Steelwork Specification' produced by the B.C.S.A.

Structural steelwork to be grade S355JR unless noted otherwise.

All reactions (ultimate) shown thus (**) are in kN.
All moments (ultimate) shown thus ** are in kNm.
All beam/column offsets shown thus ** are in mm.

All connections shall have a minimum of 2 No bolts and be designed for a minimum 100 kN (ultimate) reaction unless noted otherwise.

The minimum specification for bolts shall be 8.8 and zinc plated.

Baseplate and holding down bolts to be designed and detailed by the Steelwork Sub Contractor unless noted otherwise.

Holding down bolts and washer plates are to be supplied by the Steelwork Sub Contractor unless noted otherwise.

All beams/stanchions shall be located symmetrically on grid lines unless noted otherwise.

All plan dimensions are shown to centre lines of beams or stanchions unless noted otherwise.

All levels shown thus TOS (**,**) are to tops of beams or stanchions unless noted otherwise.

For details of fire protection to steelwork refer to Architect's details.

All steelwork below ground level to be encased with 100mm concrete (mix as for foundations) and with D49 wrapping fabric as directed by the Engineer.

Design of all temporary works, propping and bracing shall be the responsibility of the Steelwork Sub Contractor.

The Steelwork Sub Contractor shall not form any holes through steel members other than those for connections without the written approval of the Engineer.

Where dissimilar steels are to be connected a suitable isolating material shall be incorporated.

All steelwork receiving timber wallplates, bearers etc are to be predrilled with 12mm dia holes at 450mm centres staggered (900mm pitch on line) as indicated on the Engineers drawing.

Unless otherwise noted in the project specific specification, protection treatment of steelwork shall be in accordance with British Steels 'Prevention of Corrosion of Structural Steelwork' appropriate system. A minimum structural life of 50 years and a first major maintenance of 15 years is to be assumed.

All steelwork faces above ground slab level which are hidden and therefore cannot be maintained (eg. steelwork built into cavity walls) to be given 2 coats of RIW 'Liquid Asphaltic Compound' by the Principal Contractor. Refer to the Architects drawings for the extent of RIW coatings. RIW not to be used on steel surfaces which receive intumescent or other coatings.

All external steelwork to be blast cleaned and hot dipped galvanised to BS 729 unless noted otherwise.

The Steelwork Sub Contractor is to ensure that any shop or site applied primers are compatible with any finishing, intumescent or R.I.W. coatings which may be applied by the Principal Contractor.

The Steelwork Sub Contractor shall submit copies of his drawings to both the Architect and Engineers for comments a minimum of 7 days prior to manufacture.

At all column splice locations the bolt head must be on the visible external surface of steel members.

Refer to the Architect for clear opening requirements to ensure no interference from bolt heads/nuts/shanks etc.

The minimum metal thickness of any cold rolled member shall be 1.3mm.

Assumed Loading:-

Roof: Services load = 0.25 kN/m²
PV load = 0.12 kN/m²
Imposed/snow load = 0.60 kN/m²

Offices: Services load = 0.25 kN/m²
Ceiling load = 0.15 kN/m²
Imposed load = 5.00 kN/m²
Partitions = 1.00 kN/m²

Purlins and Cladding rails

All purlins and cladding rails shall be designed by the specialist manufacturer in accordance with BS 5950.

All fixing cleats, cleaders, sleeves, brackets, packers, sag rods etc. shall be designed and provided as required for the design by the specialist manufacturer and fixed in accordance with the manufacturers recommendations.

Loading schedule:-

Dead load = 0.20 kN/m²
Imposed load = 0.60 kN/m² (Snow load as BS 6399 part 3)
Services = 0.25 kN/m²
PV load = 0.12 kN/m²

The following deflection criteria shall apply:-

Total load span/200
Imposed load span/180

Fire boundary conditions:-

Wherever fire boundary conditions are indicated on drgs, all cladding rails are to be provided with slotted holes (which allows for thermal expansion) in accordance with the manufacturers recommendations.

Notes		ISSUES & REVISIONS				Client				Project Title		Drawing Title							
1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask. 2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications. 3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise. 4. Any discrepancies noted on site are to be reported to the engineer immediately.		Rev	Date	Details of Issue / Revision		Drwn	R'wd	BWB CONSULTANCY ENVIRONMENT INFRASTRUCTURE BUILDINGS ☐ Birmingham 0121 233 3322 ☐ Leeds 0113 233 8000 ☐ London 020 7407 3879 ☒ Manchester 0161 233 4260 ☐ Nottingham 0115 924 1100 www.bwbconsulting.com				WB Wilson Bowden Developments Glencar CONSTRUCTION				Plot M3 Kingsway Business Park		Project Notes	
		P1	07.12.21	Issued for Tender		MP	PD												
		P2	13.12.21	Notes revised		MP	PD												
		P3	28.06.22	Preliminary Issue to Contractor - Drawings revised to Glencar protocols.		HA	PC												
		C01	13/10/22	Notes Amended, Contact Office Changed		MAK	JH												
						Contractor													
		Drawn	HA	Reviewed	PC	Status		Purpose of Issue		Project-Originator-Zone-Level-Type-Role-Number		Rev.							
		BWB Ref	MCS21071	Scale @A1	1 : 1	A1		Construction		G1135-BWB-M3-XX-DR-S-0003		C01							

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Appendix B

Gas Membrane Data Sheets



Product Specification Sheet

RTEC 4

BS:8485:2015 + A1:2019 Compliant Ground Gas Resistant Membrane

Compatibility Table

	CIRIA 665 CS2	CIRIA 665 CS 3-6	BS8485: 2015	NHBC Amber 1	NHBC Amber 2	BRE 211 Radon	VOC & Hydrocarbons
Radon			*	*	*	*	N/A
Carbon Dioxide	*	*	*	*	*	*	N/A
Methane	*	*	*	*	*	*	N/A
VOC / Hydrocarbons Vapours	*	*	*	*	*	*	*

Technical Data

	Value	Units	Test Method
Width	2	M	EN 1849-2
Length	Various	M	EN 1849-2
Thickness	0.4	mm	EN 1849-2
Radon Perm	1.0×10^{-12}	m^2/s	K124/02/95
Methane Perm	<10	$\text{ml}/\text{m}^2/\text{day}/\text{atm}$	BS EN ISO 15105-1
Carbon Dioxide Perm	<9	$\text{ml}/\text{m}^2/\text{day}/\text{atm}$	BS EN ISO 15105-1
weight	400	g/m^2	EN 1849-2
Oxygen Perm	<3	$\text{ml}/\text{m}^2/\text{day}/\text{atm}$	BS EN ISO 15105-2
Petrol	(ave.) 3.4×10^{-13}	$\text{mol}/\text{m}^2.\text{s}.\text{pa}$	BS EN ISO 15105-2
Diesel	(ave.) 3.4×10^{-13}	$\text{mol}/\text{m}^2.\text{s}.\text{pa}$	BS EN ISO 15105-2
Resistance to static load	>20	kg	EN 12730
Tensile strength (md)	>300	N/50mm	EN 12311-2(A)
Tensile strength (cmd)	>300	N/50mm	EN 12311-2(A)
Tear strength (md)	>230	N	EN 12310-1
Tear strength (cmd)	>230	N	EN 12310-1
Resistance to impact	500	mm	EN 12691-B
Resistance to Puncture	>175	N	ASTM D 4833
Resistance to Puncture	1.7	KN	EN 12236
Reaction to Fire	E	-	EN 13501-1
Resistance to water penetration	pass	-	EN 1928(A)
Durability watertightness after artificial ageing	pass	-	EN 1926
Durability watertightness against chemicals	Pass	-	EN1926
Water Vapour Transmission Rate	0.11 -0.18	$\text{g}/\text{m}^2/\text{day}$	EN1931
Water Tightness (60kpa)	Pass	-	EN1928
Permeability to Liquids	1.0×10^{-6}	$\text{m}^3/(\text{m}^2.\text{d})$	EN1450

**Description**

RTEC 4 is a high-performance Ground Gas resistant membrane. The membrane is extremely robust and provides protection from moisture therefore negates the need for a separate DPM. Suitable for hot-air and wedge welding. [Complies to BS 8485:2015 & A1:2019. CE Certification standard EN13967:2012](#)

GeoGuard Limited

Company Registration No. 11172371 Registered in England





Product Specification Sheet

RTEC GRSAM

Aluminium Foil Gas Resistant Self-Adhesive Membrane

Technical Data

	Value	Units	Test Method
Width	1.05	M	EN 1848-2
Length	19.05	M	EN 1848-2
Thickness	1.5	mm	EN 1848-2
Mass	1700	g/cm ²	EN 1848-2
Water tightness to liquid water		pass	EN 1928
Resistance to Static Load	20	kg	EN 12730
Tensile Properties Maximum Tensile Stress CD	≥2	N/mm ²	EN12311-2
Tensile Properties Maximum Tensile Stress MD	≥2	N/mm ²	EN 12311-2
Elongation at Break MD	≥120	%	EN 12311-2
Elongation at Break CD	≥120	%	EN 12311-2
Durability of Water tightness against ageing		Pass	EN 1847 Method A60
Durability of Water tightness against Chemicals		Pass	EN 1847 Method 60
Resistance to Impact	≥700	mm	EN 12691
Resistance to Tear (Nail Shank) CD	≥110	N	EN 12310-1
Resistance to Tear (Nail Shank)	>110	N	EN 12310-1
Reaction to Fire	Class F	Euro Class	EN - 13501
Joint Strength	≥45	N	EN 12317-2
Peel Strength	1.6	N/mm ²	
Water vapour Transmission (Density Flow Rate)	0.013	g/(day.m ²)	EN 1931
Methane GTR	≤10	ml/m ²	ISO 15105-1
Carbon Dioxide GTR	≤10	ml/m ²	ISO 15105-1
Radon Diffusion	5.0 x10 ⁻¹⁴	m ²	ISO 15105-1
Roll Weight	33	kg	

Description

RTEC GRSAM is a high-performance Aluminium Gas Resistant Self-Adhesive membrane. The RTEC GRSAM is extremely robust and provides protection from Ground Gases & Water.

CE Certification standard EN13967:2012 EN13249:2016

GeoGuard Limited

Company Registration No. 11172371 Registered in England



Appendix C

Gas Membrane Validation Reports



Ground Gas Protection Membrane Validation Report

Dance-Reeves Ltd
Unit A5a
Barton Industrial Estate
Faldo Road
Barton
Beds
MK45 4RP

Client: CBS Concreting
Project/Site: Units M1 , M2 & M3, Sir Isaac Newton Way, Rochdale, OL16 4JN

Report Compiled by: Sean Reid
Date: 22/6/23



Phoenix Geotechnical Ltd
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1. Introduction

1.1 Purpose

Dance-Reeves Ltd installed a ground gas protection membrane at the Unit M1, M2 & M3 Sir Isaac Newton Way, Rochdale OL16 4JN for CBS Concreting. Phoenix Geotechnical carried out the validation/ integrity testing of the ground gas membrane installation on the aforementioned site. This ground gas membrane installation was a complete lineout operation and testing was carried out where practically possible. Phoenix Geotechnical referred to the Dance Reeves Method Statement for the specification of the ground gas protection measures and installation procedures for this particular project.

1.2 Limitations

Phoenix Geotechnical, have prepared this report in accordance with the contract between Dance-Reeves and CBS Concreting under the terms of its appointment for the ground gas membrane installation. This report is not a Guarantee or Warranty.

This report is limited to the verification that the ground gas membrane measures are correctly installed by Dance-Reeves only. Dance-Reeves or Phoenix Geotechnical have not carried out any design work in respect of the gas protection measures prescribed for this site and therefore no professional liability is extended in respect of the gas protection design. Phoenix Geotechnical is guided by Dance-Reeves on when required to visit site to carry out inspections. Once Dance Reeves have left site, responsibility for protection of the membrane passes to the Main Contractor.

Should any damage occur to the membrane following inspection, the Main Contractor should ensure the appropriate remedial action, in accordance with industry good practice and the protocols of Dance Reeves is undertaken prior to pouring the floor slab.

This report has been prepared in accordance with the best available practice and the relevant guidance documents listed below:

Chartered Institute of Environmental Health (2008). The local authority guide to ground gas.

Wilson S, Oliver S, Mallett H, Hutching H and Card G (2007) Assessing risks posed by hazardous ground gases to buildings. CIRIA Report C665.

CIRIA Report C735 (Good Practice on the Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases) and ASTM Standards D4437

CIRIA C748 (2014) Guidance on the Use of Plastic Membranes as VOC Vapour Barriers

CIRIA C795 Retrofitting hazardous ground gas protection measures in existing or refurbished buildings

BRE 414 and 212

BS8485 2015 and A1:2019 Guidelines.

All Phoenix Geotechnical representatives (validators) have a combined level of 40 years of experience within the ground gas/geomembrane industry and are fully converse within the guidelines list above. This report and its contents should not be used for any purpose other than that for which it was prepared and provided.

Should the Client be required to pass copies of the report to other parties for information, the whole report should so be copied, but no professional liability or warranty shall be extended to other parties by Phoenix Geotechnical in this connection without the explicit written agreement thereto.

PCA membership for Ground Gas Verifiers



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2. Validation Report

2.1 Material Installed

2.1.1 Gas Barrier

RTEC4 ground gas membrane system. RTEC4 ground gas membrane product is colored BLACK for ease of identification on site. It is positioned beneath the ground floor concrete slab. Gas resistant self- adhesive membrane (GRSAM) WHITE was also used to seal the perimeter, corners, pipe entries etc. Dance Reeves installers qualified to NVQ level 2 in gas membranes.

2.1.2 Jointing

Hot Air Welding. The minimum permissible weld is 40mm (Leister Nozzles width). Also used were Twinny Leister Welders. Care was taken to ensure that the membrane was clean and dry at the time of jointing

2.1.3 Tears/Holes & Punctures, Perforations or punctures in the sheet were repaired using patches of Gas Resistant Self Adhesive Membrane (GRSAM) with a minimum 75mm to cover tear, puncture or holes.

3.2 Inspection Method

An Inspection was carried out on the following dates: 29th November 22, 18th January 23, 15th May 23, 17th May 23 & 25th May 23

- 1) The Inspector /Supervisor conducted an initial walkover of areas to be validated to familiarise himself with the area to be inspected. Delivery notes for the materials were requested, however these were not available. RTEC4 is clearly visual on the product.
- 2) On completion of the initial walkover the Inspector visually inspected and probe tested (mechanical stress test where practical) internal details to ensure correct installation integrity. Sample photographs of details for the validation file were then taken. This process was then repeated on all internal and external details.
- 3) The Inspector /Supervisor then carried out inspection and an Air Lancing test (where practical) to all penetrations to ensure integrity of the seal. Sample photographs of penetrations for the validation file were then taken.
- 4) The Inspector/Supervisor then visually inspected and tested the floor membrane joints. Sample photographs of membrane joints for the validation file were then taken. (Mechanical Stress test)
- 5) The Inspector/Supervisor then carried out a thorough inspection of the ground gas membrane, where possible, using Air Lance testing equipment (where practical) to check the barrier for any damage and check any repairs that had already been carried out. The Inspector/Supervisor then informed the Installation Supervisor on the remedial work required. The Inspector remained on site whilst remedial measures were undertaken. Probe tested (Mechanical Stress) for and photos for the validation report.



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On completion of the inspection and subsequent re-inspection of remedial work completed, an inspection by the Inspector and the Supervisor from Dance-Reeves was carried out and signed off prior to handover to following Trades

3.3 Gas Protection Validation Record

(Please refer to the attached Guide Notes).

Job Number:	2023/312	Design Source/Ref:	N/A	Specification Source/Ref:	N/A	Other Documents Attached:	
Site Name/Location:	CBS Concreting Unit M1, M2 & M3 Sir Isaac Newton Way Rochdale OL16 4JN	Building Use:	Commercial		Other (Describe):		
Building Ref:	N/A	Building Description:	M1& M3 Undercroft only, M2 main floor area				
Compiled By:	Sean Reid	Gas Protection Type:	Membrane Only by DR	Floor Type:	Good Sand Blinded		

Ventilated Sub-Floor (If Present)	Inspection Date/Time:	N/A	Inspected By:		Photographed:	
-----------------------------------	-----------------------	-----	---------------	--	---------------	--

Void Former Type	Ã	1.
Height of Void Space	Ã	2.
Gravel Type	Ã	3.
Pipe Size and Spacing	Ã	4.
External wall Airbricks	Ã	5.
Internal Sleeper Walls	Ã	6.
External Vent Trenches/Ducts	Ã	7.



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Gas Barrier	Inspection Dates/Time:	29-11-22 18-1-23 15-5-23 17-5-23 22-5-23	Inspected By:	Sean Reid	Photographed:	yes
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Membrane Type	Ã	8. RTEC4 gas membrane and RTEC GRSAM
Extent of Coverage	Ã	9. Foot print of the Building
Underside of Membrane	Ã	10.The membrane was laid to Sand Blinding
Membrane Condition	Ã	11. The membrane was adequately laid to all areas. Any holes found where repaired using Gas Resistant Self Adhesive membrane (GRSAM). Air Lancing testing was used where possible. Note protective geotextile in the specification.
Laps and Joints	Ã	12. Joints Where visually/pick/probed (Mechanical Stress test) and Air Lanced inspected where practical and all found to be well made with no failures. The welded joints are stronger than a taped joint and therefore as long as they are 40mm they will not pose a problem as the membrane and joint are fully supported after the concrete is cast.
Damp Proof Course	Ã	13.N/A
Service Entries	Ã	14. Joints and Laps (GRSAM) correct heat applied for Adhesion
Cavity Inspection	Ã	15.N/A

Gas Protection Validation Record Guide Notes

1.	Void Former Type	Proprietary type – manufacturer and specification, in accordance with design, installed properly without damage.
2.	Height of Void Space	Height of proprietary former or constructed ventilation space below suspended floor – note any debris on void/obstructions to air flow, note formation soil type (e.g. crushed concrete/brick), any evidence of flooding.
3.	Gravel Type	Gravel type, if used (limestone/granite etc.) and any specification (e.g. 6F2) typical particle dimensions (mm), apparent fines content (low/high), compaction (loose/dense), waterlogging/contamination by clay, organic matter, other debris. Take photographs of stockpile close up shot of stone with tape measure. Alternatively check details on delivery tickets for stone. Take photographs of adjacent plots if at this stage of construction. Check depth of stone conforms to at least 300mm if visible.
4.	Pipe Size and Spacing	Diameter in mm: material type (e.g. PVC): slotted or perforated; positioning and spacing/separation and jointing as on design drawing – if not sketch arrangement – pipes connect with external (telescopic/swan-neck) vents? Take photographs of vents on external walls for each plot. (May be possible to photograph other plots on site which are at stage of installing vents. Will be useful for these plots later on).
5.	External Wall Airbricks	Check numbers, size and positions as design drawing (if not show, make sketch; check for blockage, e.g. by mortar, or soil/pavings etc).



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6.	Internal Sleeper Walls	Check for ventilation holes – e.g. honeycombe brickwork or pip crossings – note size, spacing and location – in accordance with design?
7.	External Vent Trenches/Ducts	Check whether located and constructed in accordance with design drawings; if open-topped gravel, note gravel type and presence of fines/contamination; if pipe or other vents - check positions and construction for functionality and absence of blockages – vents may be built over.
8.	Membrane Type	Note manufacturer and product specification, including batch/roll numbers if present – in accordance with specification? Check stock storage arrangements – protected from dirt and damage?
9.	Extent of Coverage	If membrane is incomplete, further inspection will be required – note areas completed/incomplete – is membrane fully visible or have internal walls been constructed over membrane/screed placed?
10.	Underside of Membrane	Where necessary, for example, when using a granular blanket as a ventilation layer, check the underside of the membrane has adequate protection e.g. minimum 50mm, no fines concrete blinding layer or appropriate geo-textile (see also below).
11.	Slab/Membrane Condition	Record presence of debris/rough surfaces, in particular sharp projections, below or above membrane; record locations of all punctures or repairs, note arrangements to protect membrane surface from traffic/tools and equipment/materials, and temporary weighting down of membrane, e.g. use of boards – record evidence of footprints/tracks on membrane surface, creases or water/wind damage. Take photos of each plot inspected.
12.	Laps & Joints	Check all joints are lapped and sealed in accordance with manufacturer's requirements/specification, particularly where creases/folds are present (usually minimum 150mm laps with double-sided tape, 100mm for welded, between sheets and single tape on top surface; note size of sheets and frequency of edge seals). Take photographs of jointing for each plot.
13.	Damp Proof Course	Record DPC manufacturer and product code – usually integrated with the membrane; measure DPC projection from external wall in mm; check laps and seals between the membrane and DPC – note any potential stress points and tension between the two; check for damage to DPC.
14.	Service Entries and Seals	Note number, position and diameter of service entries – check top hat/self-adhesive seal arrangements in accordance with design/specification (laps and seals between top hat and floor membrane, pipe upstand is usually a minimum of 150mm) check, with jubilee clips to secure top hat seal to pipe – note presence of clips and tightness of connections. Take photographs for all plots inspected. (GRSAM maybe be used)
15.	Cavity Inspection	Check gas membrane or gas resistant DPC is taken across cavity. Check for rips across cavity. Check for jointing detail of gas resistant DPC or membrane across cavity to main membrane. Take photographs for all plots inspected.





This installation has PASSED inspection.

Any proposed remedial works will be noted. All repairs carried out by Dance Reeves.

Inspector/Supervisor: Sean Reid Date: 22/6/23



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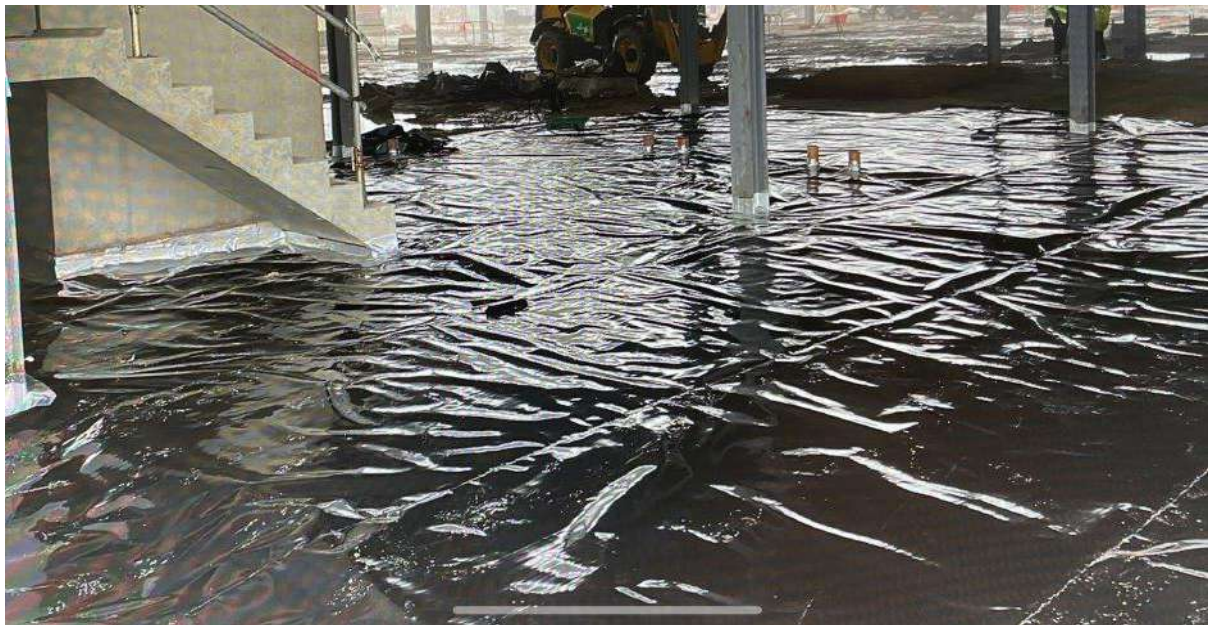
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RTEC4 Gas membrane (Black) Unit M1 Undercroft



RTEC4 Gas membrane (Black) RTEC GRSAM (silver) concrete stair base, steel stanchions & pipe entries
RTEC4 visually inspected
All penetrations Air Lance tested
All welded joints Mechanical Stress tested



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RTEC4 gas membrane (Black)



RTEC4 gas membrane (Black) RTEC GRSAM (white) pipe entry detail

RTEC4 visually inspected

All penetrations Air Lance tested

All welded joints Mechanical Stress tested



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RTEC GRSAM (Silver) Unit M2 docking bays



RTEC GRSAM (silver)
All welded joints Mechanical Stress tested





RTEC GRSAM to concrete Docking bays



RTEC GRSAM (silver)
Air Lance tested
All welded joints Mechanical Stress tested



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RTEC4 Gas membrane (Black) RTEC GRSAM (silver) to perimeter edge detail Unit M2



RTEC4 membrane (Black) RTEC GRSAM (silver)
RTEC4 visually inspected
Air Lance tested
All welded joints Mechanical Stress tested



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RTEC4 Gas membrane (Black) RTEC GRSAM (silver)



RTEC4 membrane (Black) RTEC GRSAM (silver) to concrete edge detail

RTEC4 visually inspected

Air Lance tested

All welded joints Mechanical Stress tested



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RTEC4 Gas membrane (Black) RTEC GRSAM (silver)



RTEC4 membrane (Black) RTEC GRSAM (silver) to concrete edge detail & pipe entries

RTEC4 visually inspected

Air Lance tested

All welded joints Mechanical Stress tested



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RTEC4 Gas membrane (Black) RTEC GRSAM (silver) Unit M2 floor areas



RTEC4 membrane (Black) RTEC GRSAM (silver)

RTEC4 visually inspected

Air Lance tested

All welded joints Mechanical Stress tested



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RTEC4 Gas membrane (Black) RTEC GRSAM (silver) Unit M2 floor areas



RTEC4 membrane (Black) Protective Geotextile felt
RTEC4 visually inspected
Air Lance tested
All welded joints Mechanical Stress tested



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RTEC4 Gas membrane (Black) RTEC GRSAM (silver) Unit M2 floor areas



RTEC4 membrane (Black) Protective Geotextile felt
RTEC4 visually inspected
Air Lance tested
All welded joints Mechanical Stress tested



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RTEC4 Gas membrane (Black) RTEC GRSAM (silver) Unit M2 floor areas



RTEC4 membrane (Black) Protective Geotextile felt
RTEC4 visually inspected
Air Lance tested
All welded joints Mechanical Stress tested



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RTEC4 Gas membrane (Black) RTEC GRSAM (silver) Unit M3 Undercroft



RTEC4 membrane (Black) RTEC GRSAM (silver) to pipe entries, concrete Lift shaft and stair base

RTEC4 visually inspected

Air Lance tested

All welded joints Mechanical Stress tested



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RTEC4 Gas membrane (Black) RTEC GRSAM (silver) Unit M3 Undercroft



RTEC4 membrane (Black) RTEC GRSAM (silver) Steel stanchion detail

RTEC4 visually inspected

Air Lance tested

All welded joints Mechanical Stress tested



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Certification of Validation

CUSTOMER: Dance-Reeves Ltd
Unit A5a Barton Industrial Estate
Faldo road
Barton
Beds
MK45 4RP

APPLICATION: Gas Membrane Installation & Integrity Testing
CBS Concreting
M1, M2 & M3 Units
Sir Isaac Newton Way
Rochdale
OL16 4JN

MATERIALS: RTEC4 Ground Gas Membrane System
RTEC GRSAM Gas Resistant Self -Adhesive Membrane

PHOENIX GEOTECHNICAL LTD certifies the following:

That the above products conform to the specification details for this project.

Dance-Reeves Ltd also confirms, that the method of installation of the above materials conform to the manufacturers recommended installation procedures and in accordance to BS8485:2015, A1:2019 and BRE 212 and 414 guidelines. CIRIA Report C735 (Good Practice on the Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases) ASTM Standards D4437

22nd June 2023

Date



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