

The Freemount Pub Manchester

Structural Engineering Living Wall Report

Prepared by:
Reviewed by:
Job Number:

Joe Christian MEng
Will York MEng CEng MStructE
30199

Date
March 2022

Revision
00

Notes/Amendments/Issue Purpose
First Issue

Contents

Page

1	Introduction	3
	Design Standards	
	Limitations	
2	Loading	5
	Masonry Dead Load	
	Planter self weight	
	Wind Load	
3	Wall checks	6
4	Existing PFC	7
5	Wall Tying	8

Appendices:

Appendix A	MobiPanel Brochure
Appendix B	Helifix BowTie Brochure
Appendix C	2017 Structural Drawings

1 Introduction

This report considers the existing building structure's ability to support the proposed living wall system, and recommends remedial work to the structure where needed.

The building

The Freemount is a pub located at 73-75 Oldham Street, Manchester, M4 1EB in the Northern Quarter area. The pub are working with Edible Bus Stop to install a living wall system onto the first and second storeys over the beige render that can be seen in image 1.

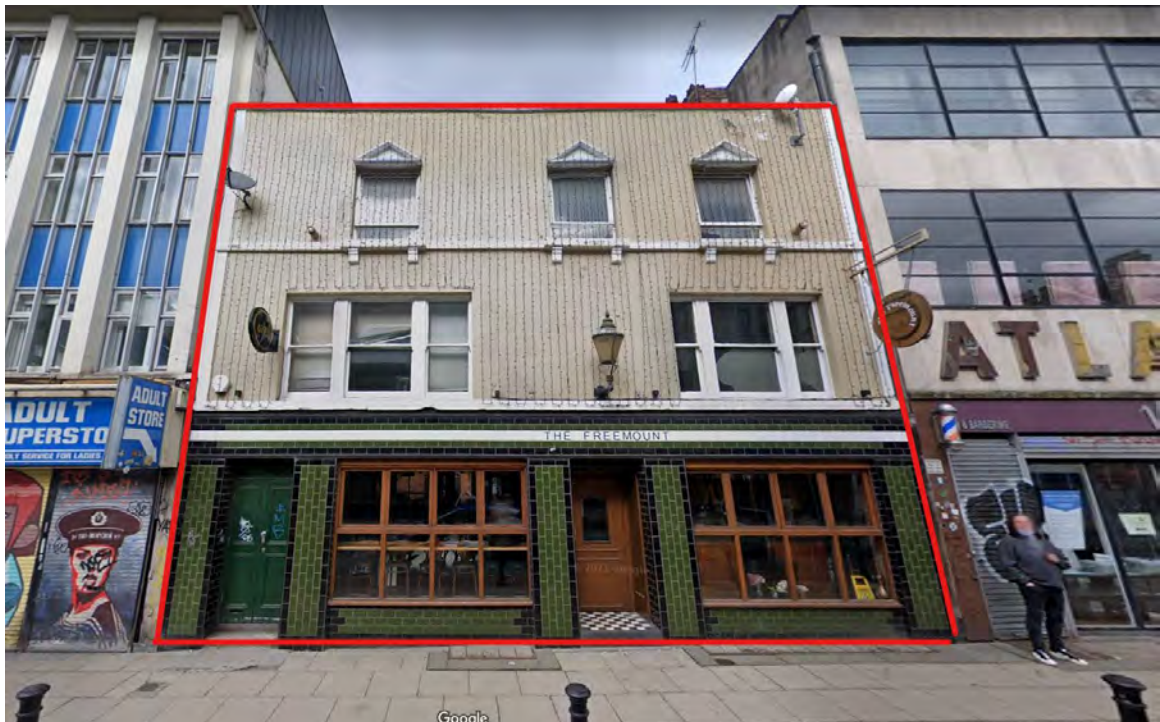


Image 1 - The front elevation of the Freemount Pub. © 2022 Google

The pub has a double height space over the bar to the right of the building, as seen from the perspective of image 1. The previously existing floor was demolished and replaced with a steel PFC to restrain the front façade at first floor level, between the windows. The area to the left of the entrance has the existing first floor remaining and is used as an office space.

The front wall has been measured as 385mm thick. It is presumed this is a 330mm thick solid wall with finishes to both sides. At the ground floor there are steel column flanges visible in the masonry piers either side of the right hand window. Another column flange can be seen to the left of the middle entrance, and it is assumed there is a further column in one or both remaining piers on the left.

Above the ground floor windows are thick steel plates acting as lintels. There is no visible deflection nor cracking above the windows, so it is assumed a fin connected to the plate continues up into the masonry to provide additional stiffness.

Design Standards

The design will satisfy the following standards:

BS EN 1990:2002, EC0 - Basis of Structural Design

BS EN 1991-1-1:2002, EC1 - Actions on Structures

BS EN 1993-1-1:2005, EC3 - Design of Steel Structures

BS EN 1995-1-1:2004, EC5 - Design of Timber Structures

BS EN 1996-1-1:2005, EC6 - Design of Masonry Structures

Limitations

Price & Myers have conducted a check of the front masonry wall and structure in direct connection with this, for the addition of new planter loading only. Planter loads and fixing requirements are provided by Mobilane and have not been subject to further verification by Price & Myers.

It is beyond the scope of this appointment to perform a full building check, and it has been assumed any historic alterations were undertaken by a competent designer.

These calculations are based only on what could be seen during our site investigations and information provided by the client. Due to this there is a risk that findings on site during the construction process may vary from what has been assumed. Price & Myers should be consulted where this is the case.

2 Loading

Masonry Dead Load

Assume masonry unit load is 18 kN/m^3 .

Planter self weight

Planters are provided by Mobilane. From Mobipanel brochure, maximum system weight when fully planted = 40 kg/m^2 elevation.

Wind Load

CHECK WIND LOAD ON THE FACADE OF THE FREEMOUNT PUB, MANCHESTER, M4 1EB.

$$V_b = C_{dir} C_{season} C_{prob} V_{b,0}$$

$$C_{dir} = 1.0$$

$$C_{season} = 1.0$$

$$C_{prob} = 1.04 \quad (100 \text{ YEAR PERIOD})$$

$$C_{dir} = 1 + 0.003 \times 51 = 1.05$$

$$V_{b,0} = 22.5 \text{ m/s}$$

$$V_b = 1.0 \times 1.0 \times 1.04 \times 1.05 \times 22.5 = 24.6 \text{ m/s}$$

$$q_b = 0.613 V_b^2 = 0.37 \text{ kPa}$$

For $C_e(z)$

$$z = 12 \text{ m (APPROX)}$$

distance to shoreline = 54 km

$$C_e(z) = 2.45$$

For $C_{e,r}$

distance inside town = 10 km

$$C_{e,r} = 0.8$$

$$q_p = C_e(z) C_{e,r} q_b = 2.45 \times 0.8 \times 0.37 = 0.73 \text{ kPa}$$

FACADE IS BUILT INTO LONG STREET, CONSIDER TO BE IN ZONE B FOR WIND ACROSS FACE. HEIGHT & DEPTH NOT MEASURED SO TAKE WORST CASE FRONT ON (D) & REAR WIND (E) FORCES

C_p

$$B = -0.8 + -0.2 = -1.0$$

$$\times 0.73 = -0.73 \text{ kPa}$$

$$D = +0.8 - -0.3 = +1.1$$

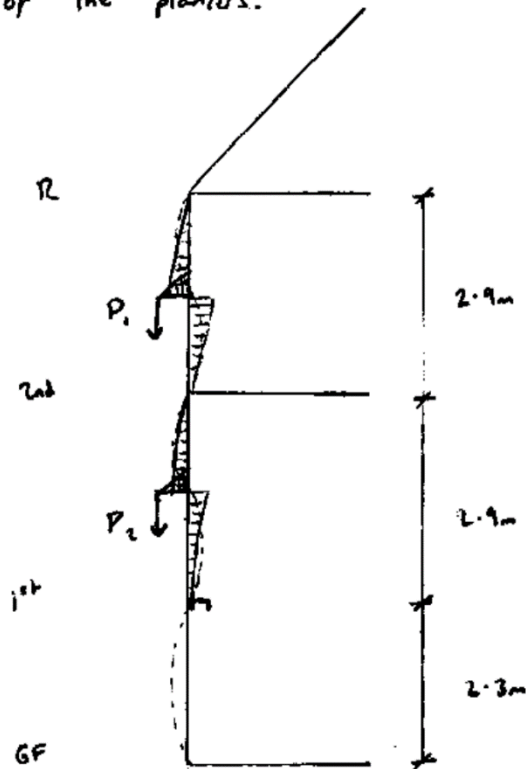
$$\times 0.73 = +0.80 \text{ kPa}$$

$$E = -0.7 - +0.2 = -0.9$$

$$\times 0.73 = -0.66 \text{ kPa}$$

3 Wall checks

Check the moments applied to the wall due to the weight of the planters.



STOREY HEIGHTS ARE APPROXIMATE

ALLOW 40 kg/m^2 FOR PLANTERS

$$P_1 = 40 \times 2.9 = 116 \text{ kg/m}$$

$$P_2 = 40 \times 2.9 = 116 \text{ kg/m}$$

ASSUME AN ECCENTRICITY OF 250 mm

$$\begin{aligned} M_{ed} &= (116 \times 9.81 / 1000) \times 0.25 \text{ m} \times 1.5 \\ &= 0.28 \text{ kNm} \times 1.5 \\ &= 0.42 \text{ kNm/m} \end{aligned}$$

WALL IS APPROX 330 mm THICK SOLID MASONRY.

APPROX REACTION TO EACH FLOOR

$$R = 0.28 \div 2.9 = 0.1 \text{ kN/m}$$

REACTIONS DUE TO WIND LOAD

$$2^{\text{nd}}: 0.8 \text{ kPa} \times \frac{2.9 \text{ m} \times 2}{2} = 2.3 \text{ kN/m}$$

$$1^{\text{st}}: 0.8 \text{ kPa} \times \frac{2.9 \times 2.5}{2} = 2.1 \text{ kN/m}$$

$$\text{NEW REACTION FROM PLANTERS} = \frac{0.1}{2.1} \times 100 = 5\%$$

VERTICAL REACTIONS ON GF WINDOW

$$18 \text{ kN/m}^2 \text{ BRICKWORK} \times 2.9 \text{ m} \times 2 \times 0.33 \text{ m} = 34.5 \text{ kN/m}$$

$$\text{NEW PLANTERS} = 0.4 \times 2.9 \times 2 = 2.3 \text{ kN/m}$$

$$\text{NEW VERTICAL REACTION ON WINDOW LINTELS} = \frac{2.3}{34.5} \times 100 = 7\%$$

LOAD INCREASE FROM PLANTERS < 10 % THEREFORE OK

4 Existing PFC

The existing PFC provides the façade resistance against lateral loading at 1st floor level. The PFC is a 150x90x24. Conservatively assume it is grade S275 steel. Check the utilisation of the PFC against existing wind load and additional planter loading.

$$L = 3.5\text{m}$$

$$W_{\text{existing}} = 2.1 \text{ kN/m Wind Loading}$$

$$W_{\text{planter}} = 0.1 \text{ kN/m Planter Loading}$$

$$M_{\text{Ed}} = (2.1 \times 1.5 + 0.1 \times 1.35) \times 3.5^2 / 8 = 5.0 \text{ kNm}$$

$$M_{\text{b,Rd}} = 35.0 \text{ kNm @ 3.5m} \gg 5.0 \text{ kNm therefore buckling is OK}$$

$$\text{Utilisation} = 5.0/35 = 0.15$$

Existing 150x90x24 PFC is at 15% utilisation therefore OK

5 Wall Tying

Given the age of the building it is assumed that the masonry has not been tied back to the floor structure, during original construction, nor the later removal of the first floor.

Where the addition of the planters will increase the tendency of the wall to pull away from restraining timber floors or roofs, bow wall masonry ties are proposed to create a tie connection.

Use Helifix BowTie 350mm long at every other joist end. This is assumed to be approximately 800mm c/c. It is assumed that joists run front to back. Price & Myers should be informed if joists are found to span in the party wall to party wall direction. The BowTies should be possible to install from an external scaffold with minimal internal disruption.



Image 2 - Helifix BowTie installation detail. Extract from brochure in appendix B



Image 3 - Two red lines showing the approximate level BowTies will be installed in the façade.

Alternatively, Price & Myers can develop a detail using galvanised steel straps, though this is thought to be less appealing to the pub owners as it would involve builders needing access to work within the roof void, and lifting floorboards in the office.

During the initial site visit, damp was found on the wall connected to the eaves, see image 4 below. The attic could not be accessed at the time of the visit. On a return visit on 22nd March 2022, Price & Myers were able to enter the roof void and make a visual inspection of some of the ceiling joists, rafters and wall plate. Ceiling joist and rafter ends were wrapped in damp-proof material apparently intended to isolate them from the damp wall. No obvious signs of decay were observed; therefore we consider our proposed tying-in details to be feasible. Moisture readings were not taken, however, and there was no safe access to the south end of the wall where signs of damp are most pronounced.



Image 4 - Photo taken 15th March 2022 during site visit, showing extensive damp to external wall.



Image 5 - Photo taken 22nd March 2022 during site visit, showing floor joists into the base of the masonry parapet and rafters landing on top of the parapet. Timber ends are wrapped in plastic.

Appendix A

MobiPanel Brochure

MOBIPANEL



MOBIPANEL



THE LATEST GENERATION IN VERTICAL GREEN

MobiPanel is an innovative and sustainable system for living walls on existing buildings and new developments. The latest generation in vertical green from Mobilane, specially developed to make future-proof and sustainable construction even more accessible. This unique modular system, with its interchangeable plant cassettes in two sizes, makes it possible to give a sustainable and vibrant appearance to both flat and curved walls.

FLEXIBILITY IN DESIGN AND CHOICE OF PLANTS

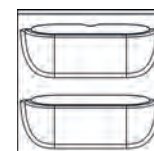
The system has been developed with circularity in mind. All its components can be disassembled, reassembled and recycled. The system is made up of corrosion-resistant profiles that can be installed both horizontally and vertically, depending on the format and layout of the backing wall. The profiles provide the bearing structure for the plant cassettes measuring 40 x 40 cm and the quarter-cassettes (pixels) of 20 x 20 cm. The plant cassettes are fitted with two spacious slots for plants of varying size. This flexibility allows great variation of design and choice of plants.

GREEN APPEARANCE THROUGHOUT THE YEAR

Vertical greenery with a vibrant appearance is really easy to create with MobiPanel. The plant wall stimulates biodiversity, while purifying the air and regulating heat. The automatic irrigation system ensures that the plants receive the correct quantity of water and nutrition throughout the year. This means that the green wall remains a real eyecatcher in the urban environment, offices, parking garages, hospitality sector, etc.



MOBIPANEL MATERIALS



Cassettes, pixels and cover: The cassettes, pixels and cover are made of fire-retardant EPP (B-s2, d0). This material is light, UV-resistant, breathable (for good root growth) and can be fully recycled.



Profiles: The omega profiles are made of high-quality and extremely corrosion-resistant Magnelis steel. The punched-hole pattern is suitable for both vertical and horizontal installation of the profile. This provides space for passing water pipes and electricity cables through with ease. In addition, this allows use on both flat and curved backing walls.



Planting: The plants used in the pre-cultivated cassettes in the MobiPanel system are grown at the Dartplant production site under “On the way to PlanetProof” certification. This independent certification proves that the plants for the MobiPanel facade have been produced more sustainably and are therefore a better choice for nature, climate and animals. The online Mobilane PlantGuide gives an overview of selected plant species that are recommended for planting on the MobiPanel facade.



UNIQUE FEATURES

Suitable for flat and curved walls

Suitable for various wall types including certain types of sandwich panels

Interchangeable plant cassettes in two sizes (40 x 40 cm and 20 x 20 cm)

Economical water consumption

Complies with fire classification B-s2, d0

Reusable and fully recyclable

Equipped with automated irrigation and drainage system

Lightweight and space-saving

Modular system

Easy to install against new and existing facades and walls

BENEFITS

Contributes to greening the living environment

Boosts air quality by absorbing fine dust particles and generating oxygen

Promotes biodiversity

Raises property values

Dampens noise and insulates

Captures rainwater

Provides an immediate green effect



MOBIPANEL



For the outdoor green facade system MobiPanel automatic watering is carried out by means of an irrigation system. Water consumption varies from season to season and depends on the climate and type of planting. Account should be taken of a maximum water consumption of approx 4 litres per m² per day in hot periods. Mobilane can also optionally offer maintenance contract.

BUILDING PLAN

In most cases, the installation can be directly fitted to any back wall by means of the supplied fasteners; as long as the Magnelis omega profiles hang level. The correct distance between them is shown on the supplied building plan specification for the project in question, this must be adhered to. The irrigation system is then connected and activated, after which the cassettes (with planting) can be placed on the profiles.

DIMENSIONS

- The system is made up of cassettes measuring 40 x 40 cm and pixels of 20 x 20 cm.
- The omega profiles and covers have a standard size of 120 cm for efficient transport. They can be custom-made for large projects.

WEIGHT

- Maximum system weight when fully planted: 40 kg/m².

WALL TYPES

Low weight and intelligent design make MobiPanel suitable for greening most types of existing and new facades and walls. For example, backing walls of concrete, stone, sandwich panels, timber frame, etc.

PLACING AND WATERING

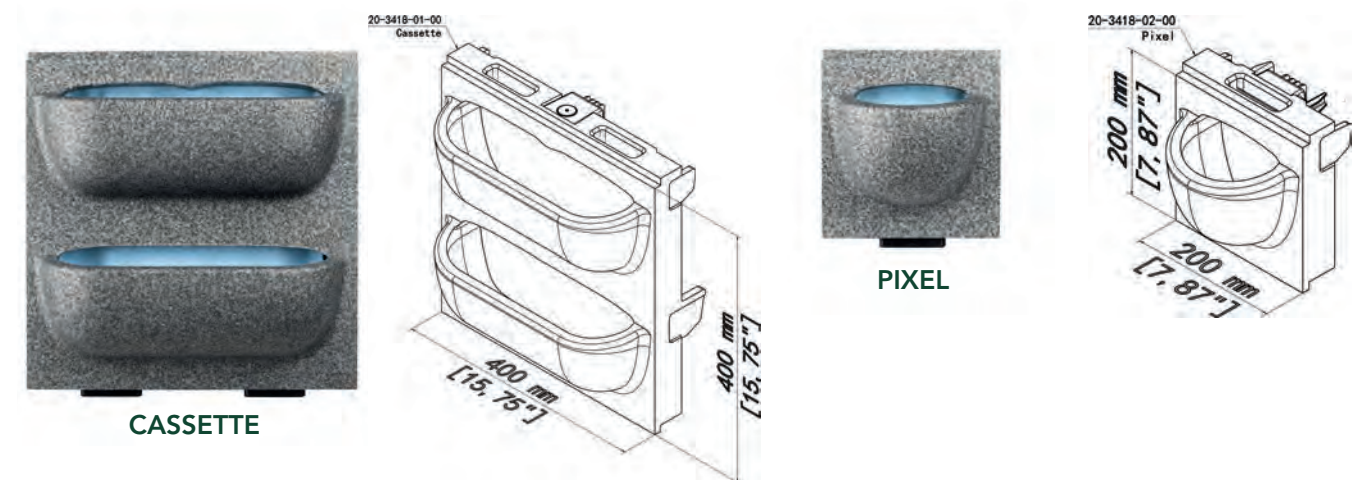
	MobiPanel
Indoor	●
Outdoor	●
Watergift	
Manual	
Tank	
Irrigation system	●

CAPILLARY ACTION

An automated irrigation system provides water and nutrients to the MobiPanel green wall. An irrigation pipe along the top of the wall supplies water to the cassettes and pixels. Each cassette and pixel is fitted with microfibre textile with capillary action to ensure even distribution of water in the cassette. All the plants receive the correct quantity of water and nutrients in this way. Extremely efficient and low water consumption is the result.

CASSETTE

Each plant cassette has two slots providing space for 6 to 8 plants per cassette, depending on the size of the plant pots. The spacious slots provide a great deal of flexibility and plant choice. They also offer the plants more space for the roots to ensure healthy growth. Plenty of space for roots contributes to plant quality; the plants remain healthy even with large variations in temperature.



Air chambers behind the capillary matting ensure a good supply of air to the roots. This contributes to optimal plant growth and quality. By using pixels, systems can be tailor-made to fit precisely and can be used in all designs, including those with unusual dimensions.

WIND LOAD AND VENTILATION

A static load calculation is available for the MobiPanel system, both for attaching the cassettes to the profiles and for attaching the profiles to the backing wall. A separate calculation is available for carrier sandwich panels. Proper ventilation of the living wall is ensured by the gap of 38 mm between the rear of the cassettes and the wall.

THERMAL INSULATION

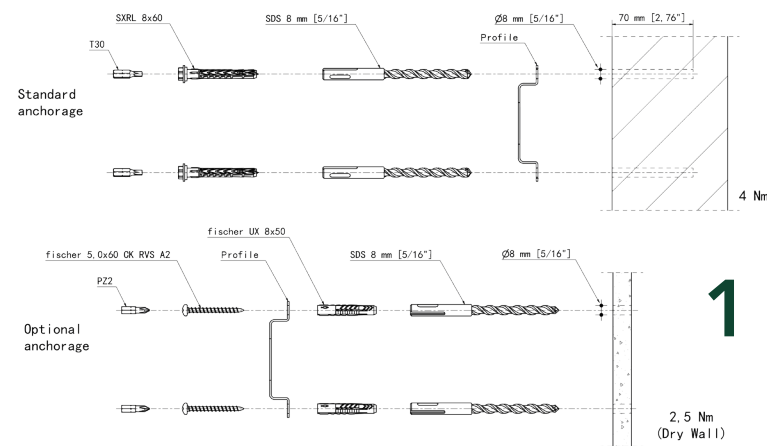
Living walls contribute to the thermal insulation of a building. They heat up less in the summer and lose less heat in the winter. In addition, living walls contribute to cooling the urban climate as a result of evapotranspiration from the greenery.

RECOMMENDATION

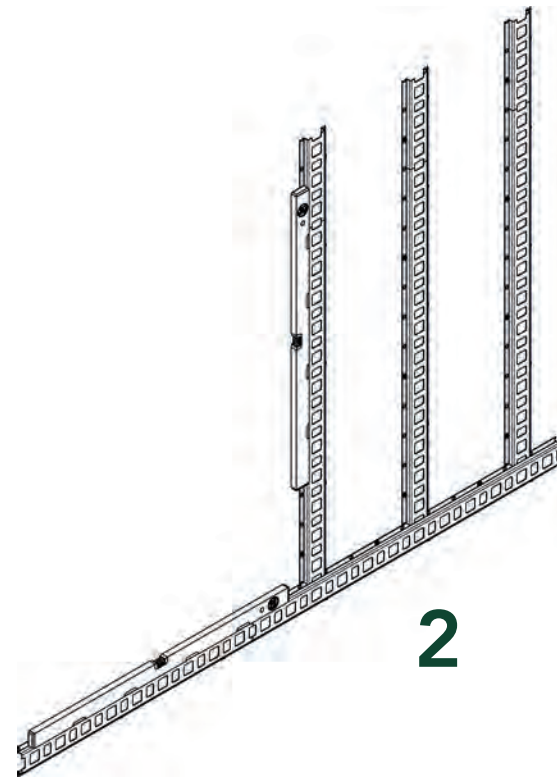
It is recommendable to involve Mobilane as early as possible in the design and construction process to ensure optimal design for the technical requirements, such as the irrigation system and the piping and cabling.



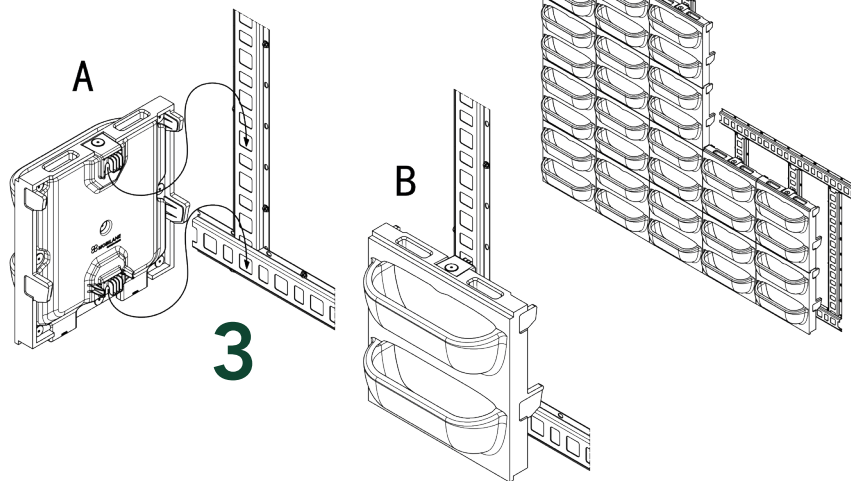
INSTALLATION



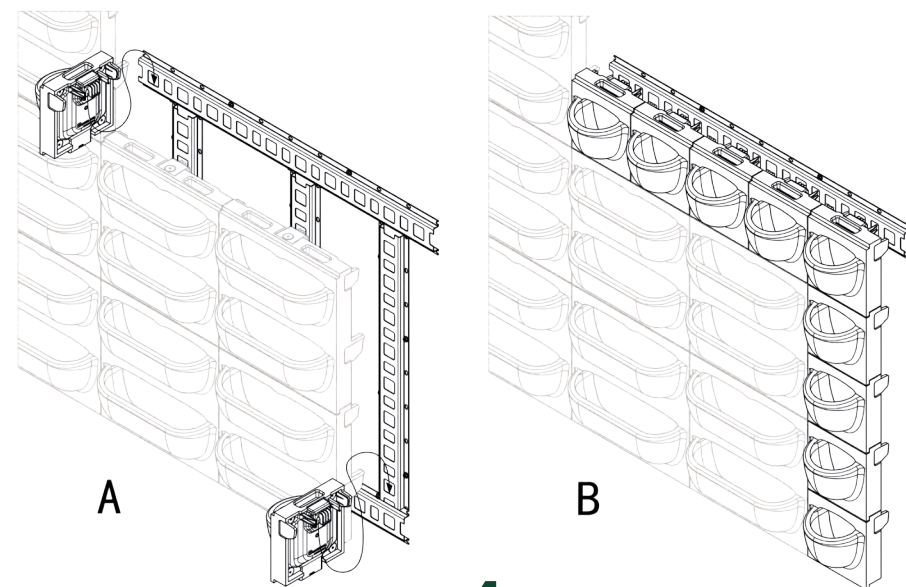
1



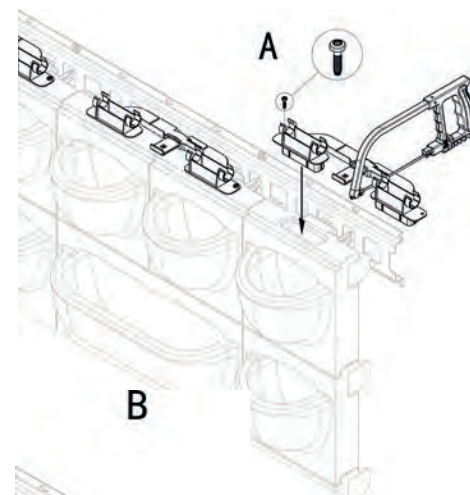
2



3

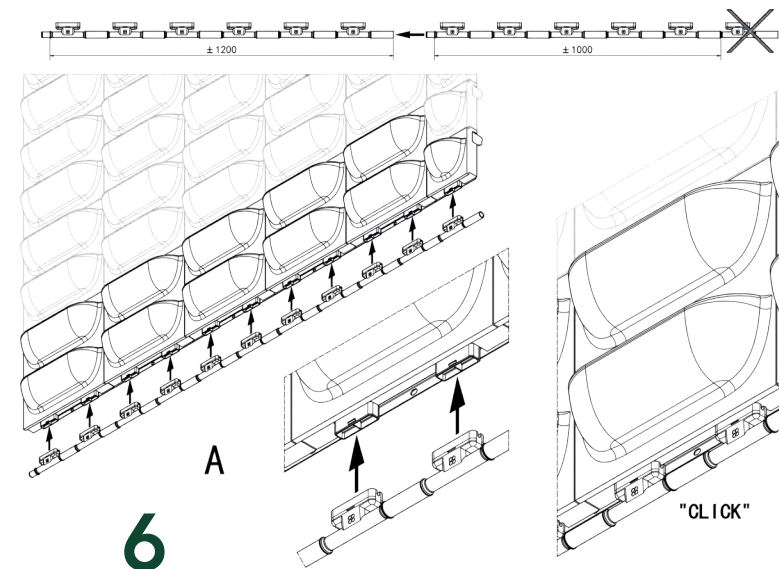
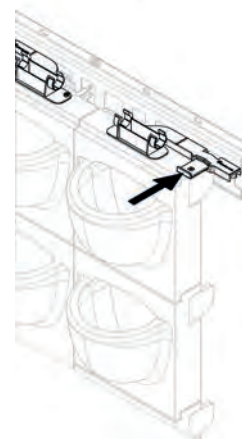


4

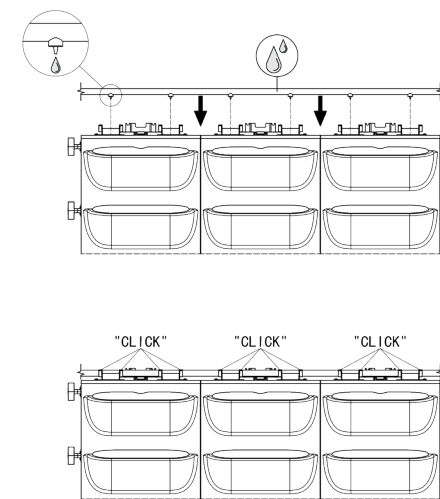


B

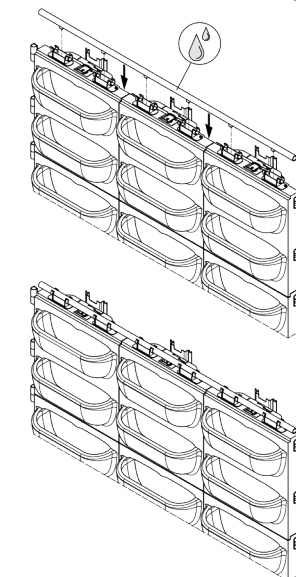
5



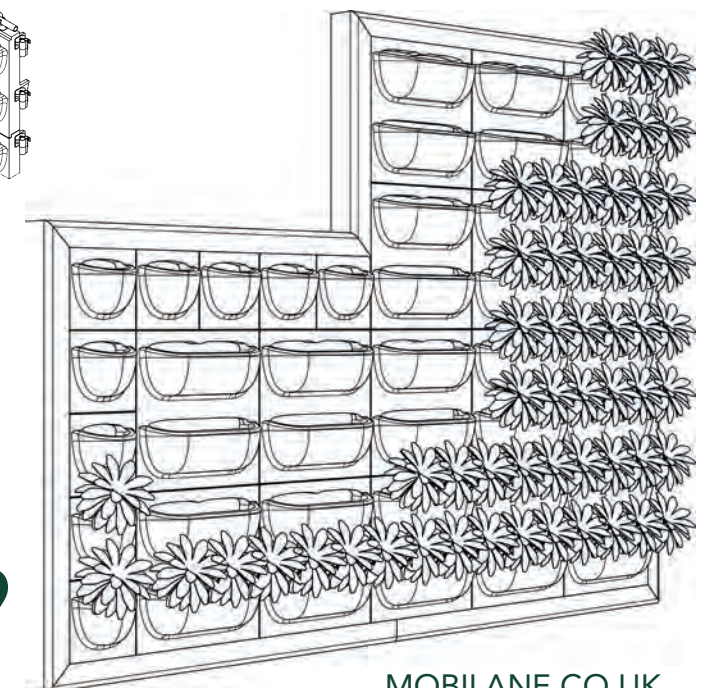
6



8



9



MAINTENANCE



The maintenance of a green facade consists of pruning, replacing bad plants, identifying and controlling any diseases and pests. The frequency of maintenance depends on the types of plants, season, and the associated growth of the planting. Maintenance of a green facade is very important for ensuring optimum appearance and a healthy green facade.

1. PRUNING

For the protection of the green facade, it is essential that the wall is well maintained and the planting is pruned. The wall should be pruned about twice a year, depending on plant type. This should be avoided in colder seasons and nesting periods. The planting in the green facade must be pruned in order to keep it's optimal design, giving the planting light and space grow to grow and bloom again. The green facade is pruned by means of an (electric) hedge trimmer or pruning shears.

2. CONTROL OF DISEASES AND PESTS

During inspection visits, the presence of diseases and pests us also carefully considered, and treated if necessary. This happens biological as much as possible. For example, nematodes are used in the control of vine weevil larvae.

3. ANNUAL IRRIGATION SYSTEM CHECK

The irrigation system should be checked regularly. Mobilane offers a suitable irrigation system with integrated nutrient supply for every green facade. Every green facade is different and requires appropriate adjustment. For example, it is important that a wall on the north does not get as much water as a wall on the south, because a wall on the south will consume more water in summer than a northern wall. Many variables are under monitoring to ensure that the green facade has a healthy appearance all year round.

4. NUTRITION

Non-ground-based systems such as Mobilane's MobiPanel, having no connection to the ground, require a permanent and a responsive needs-adapted water and power supply. The MobiPanel facade vegetation system used an irrigation system in which continuous nutrition is added to the water to give the green facade the perfect appearance and keep plants healthy.



PARTS



CASSETTE



OMEGA PROFILE



DRIP ASSEMBLY



PLASSON END CAP
20 MM



PLASSON ELBOW
20MM



PLASSON T-PIECE
20MM



PIXEL



HOSE BRACKET



DRIP LINE



DRIPPER



COVER



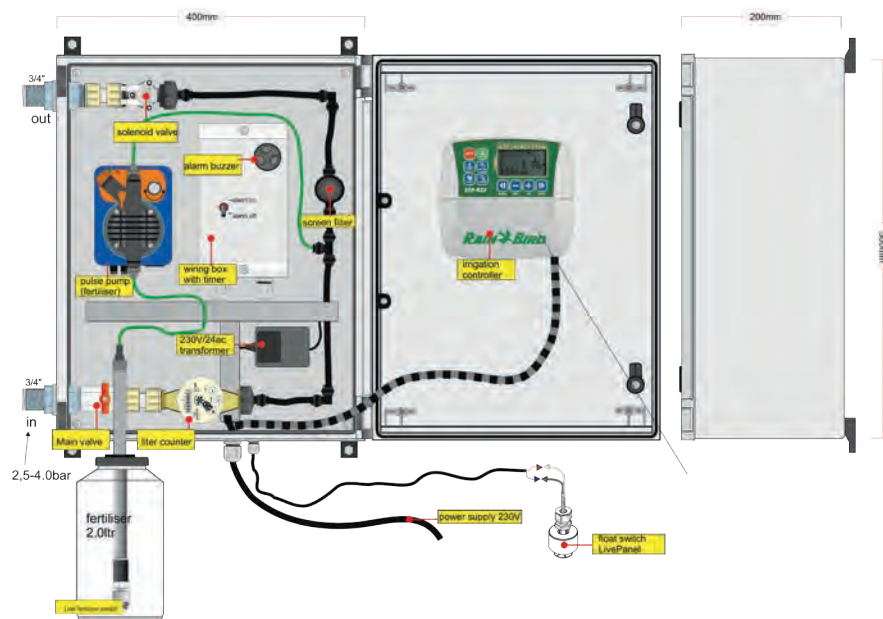
INTERMEDIATE COVER



DRAIN HOSE



IRRIGATION UNIT



SPECIFICATIONS GN81

- Automatic injector pump
- Rainbird controller controlled
- 1 output 3/4" outer wire
- Fertilization tank
- Unit size: 400 x 200 x 500 mm

ALARM OPTIONS*

1. SMS alarm integrated
2. SMS alarm external

OPTIONEEL

- Break tank + pump
- Frost protection
- WiFi module

* The irrigation unit is equipped with a buzzer as standard.



CAD AND BIM

All CAD and BIM models can be downloaded from the Mobilane website www.mobilane.com or by scanning the QR-code. CAD and BIM can be used for Revit, IFC, and Civil 3D by architects, engineers and construction professionals (AEC).

**SCAN FOR CAD AND
BIM MODELS**



Appendix B

Helifix BowTie Brochure

BowTie

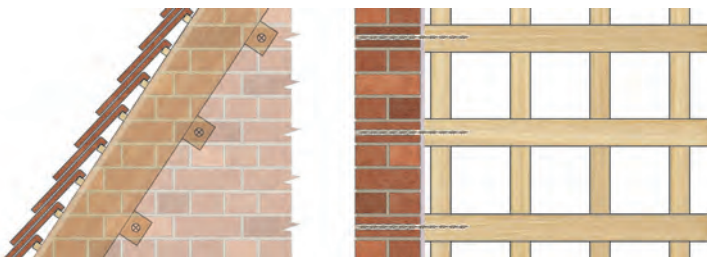
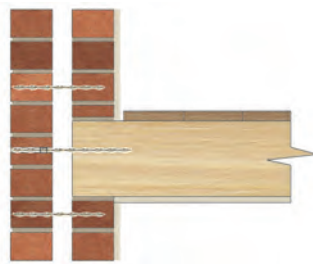
Remedial ties for restraining bowed walls



BowTie into joist end through a solid wall



BowTie into joist end through a cavity wall



Restraining gable walls using mini retrofit purlins and BowTies

Over 100 standard repair specifications are available online, covering all common structural faults.

Relevant Repair Details: RDs RB01, RB03, RB04, RB06, RB07, RB09



For full Product Information, Case Studies and downloadable Repair Details go to:

www.helifix.co.uk/products/remedial-products/bowtie/

Applications

- For stabilising bowed external building walls by securing them to internal floor and ceiling joists
- Standard BowTies are recommended when installing into joist ends

Features

- Quick, easy, non-disruptive external installation
- Self-tapping design – no splitting of timbers
- Effective in all common building materials
- Suitable for hardwood use
- Easily tested for security of fixing
- Fully concealed – no unsightly external plates

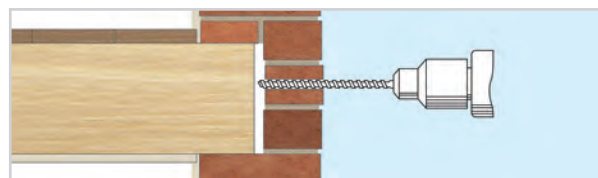


Drilling clearance hole for installing BowTie into joist end

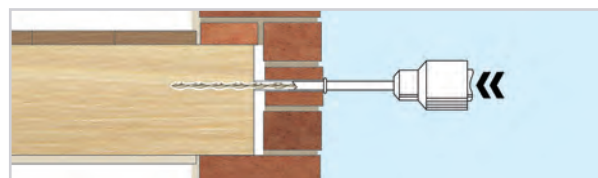
Installation Procedures

1. Mark the positions of the joists on the external wall.
2. Drill clearance holes (normally 12mm), **through the masonry only**, in line with the centre of the joists.
3. Clean out the hole to clear any dust or debris.
4. Fit the power support tool into an SDS rotary hammer drill and insert the BowTie.
5. Drive the BowTie (roto stop) into the joist to the required depth (75mm minimum).
6. Fit the sleeve over the tie and push it to the back of the hole in the masonry (use the support tool).
7. Inject Helifix PolyPlus resin into the hole to fill it completely.
8. Make good all holes at the surface with brick dust or matching mortar or leave ready for any decoration.

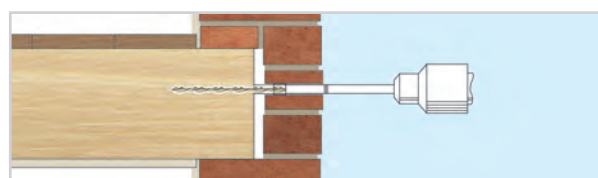
NB With a cavity wall, install 4 additional cavity wall ties in a 300mm square around the BowTie.



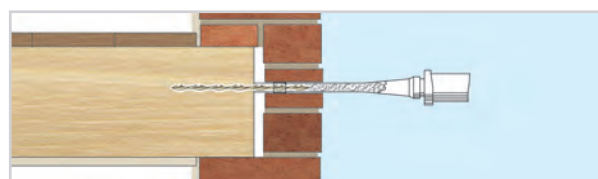
1. Mark the position of the joist centre on the external wall and then drill a clearance hole (normally 12mm) through the wall (and first joist if parallel to the wall). Clean out the hole



2. Fit the BowTie Support Tool to an SDS rotary hammer drill, insert the BowTie and drive it into joist end to the required depth – at least 75mm (or through the second joist if parallel)



3. Fit the plastic sleeve over the BowTie and use the support tool to push it to the back of the hole in the masonry (in the outer leaf in a cavity wall)



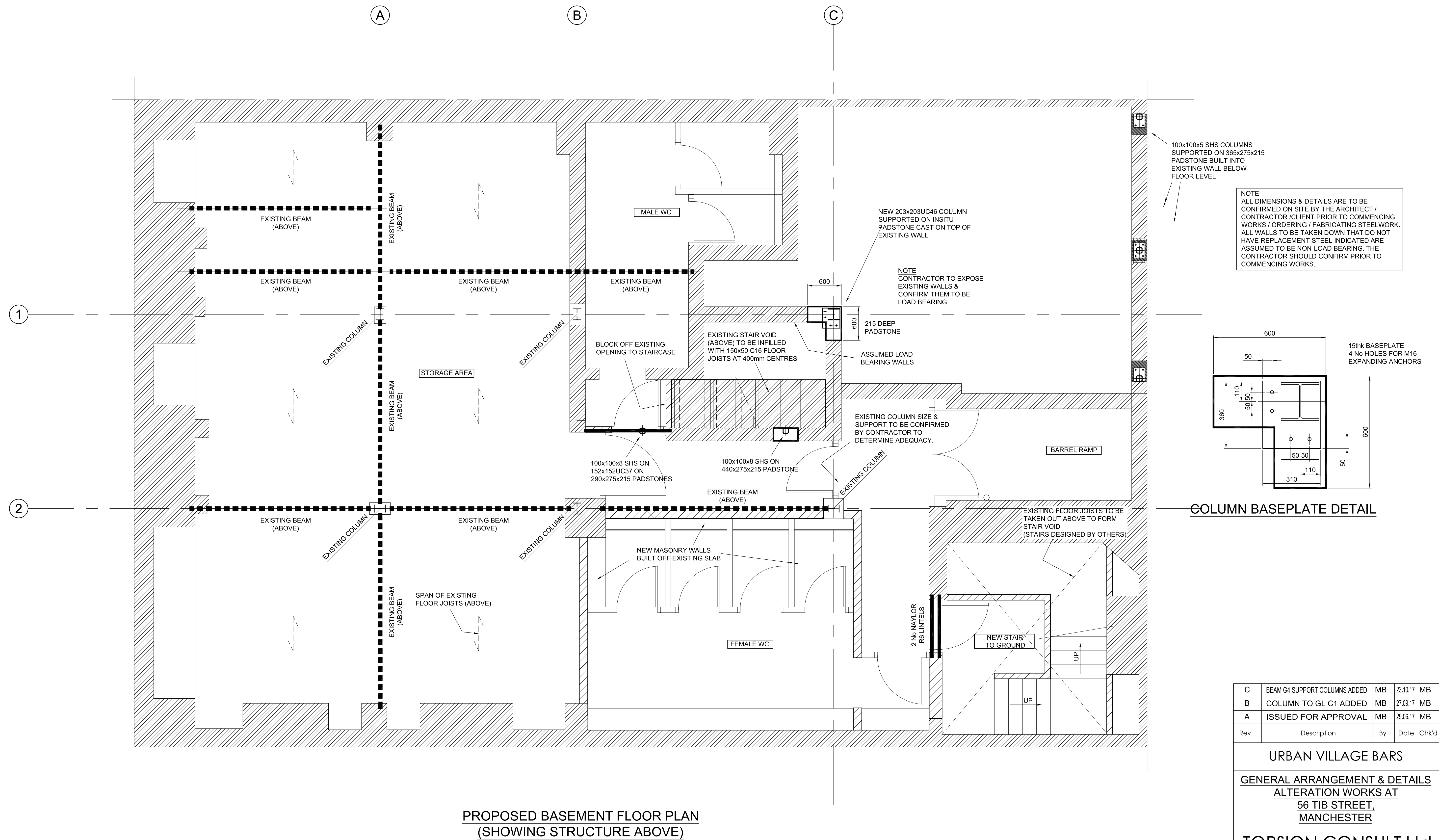
4. Inject PolyPlus resin to fill the hole and bond the BowTie to the masonry and then make good

Technical Specifications

Material:	Austenitic stainless steel Grade 304 (1.4301) or 316 (1.4401)
Diameter:	8mm
Length:	Thickness of the wall + any cavity + sufficient to drive 75mm minimum into the joist end
Standard lengths:	155mm, 170mm, 195mm, 220mm, 245mm, 270mm, 295mm, 325mm and 350mm – in packs of 10
Diameter of masonry clearance hole:	12mm
Fixing density:	Every joist in the affected area is to be secured
Bonding agent (near leaf only):	PolyPlus polyester resin
RECOMMENDED TOOLING	
For drilling clearance holes and insertion of BowTies:	SDS rotary hammer drill 650/700w with roto stop
For injection of PolyPlus resin:	Applicator gun and injection sleeve

Appendix C

2017 Structural Drawings



C	BEAM G4 SUPPORT COLUMNS ADDED	MB	23.10.17	MB
B	COLUMN TO GL C1 ADDED	MB	27.09.17	MB
A	ISSUED FOR APPROVAL	MB	29.06.17	MB
Rev.	Description	By	Date	Chk'd

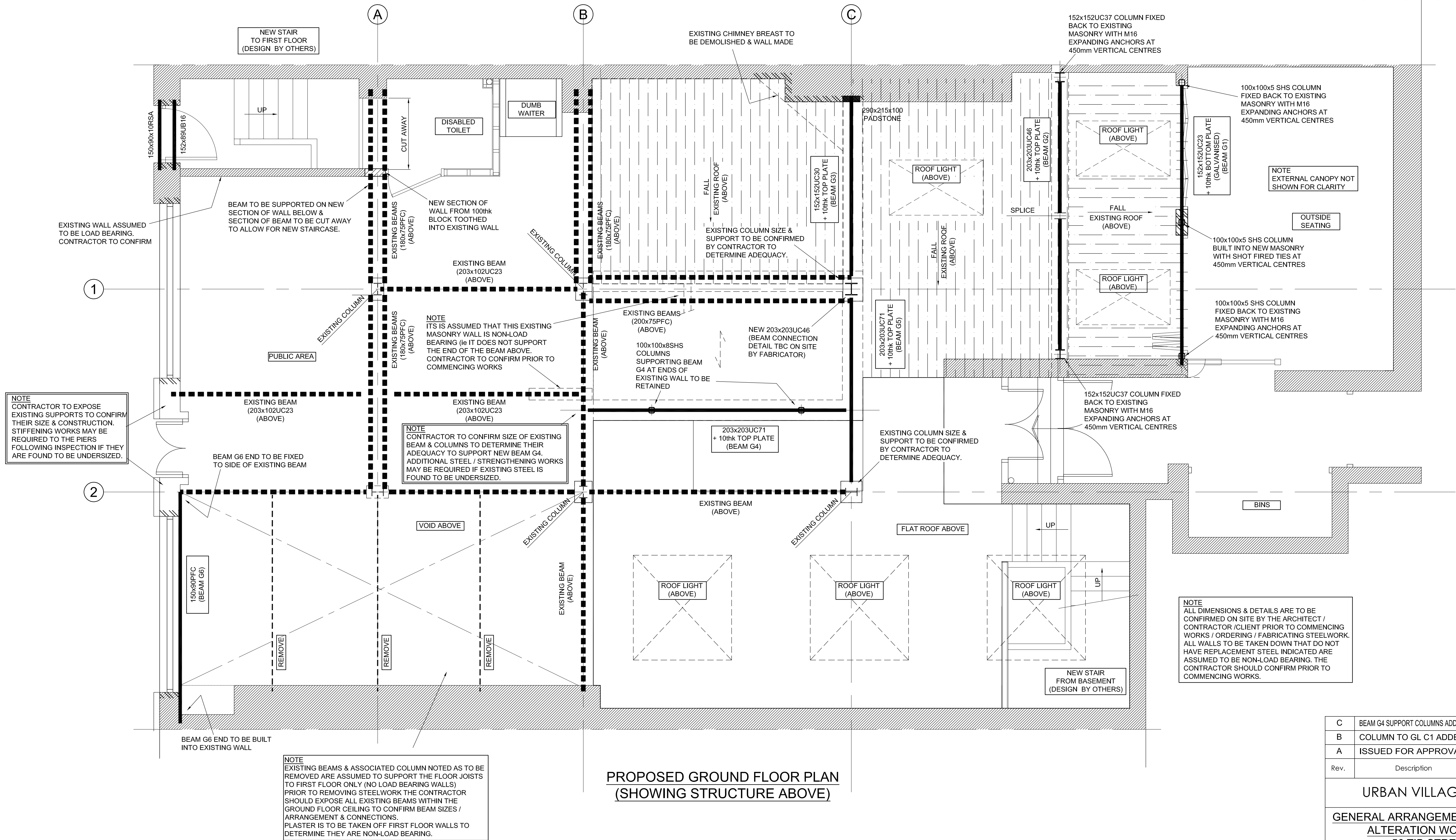
URBAN VILLAGE BARS

GENERAL ARRANGEMENT & DETAILS
ALTERATION WORKS AT
56 TIB STREET,
MANCHESTER

TORSION CONSULT Ltd
CIVIL & STRUCTURAL ENGINEERS

Tel:01625 470781 Mob: 07799 327846
email: mail@torsionconsult.co.uk
www.torsionconsult.co.uk

Drawn By	MB	Date	JUNE 2017
Checked By	MB	Scale	1:33.3
Contract No	TC-3516	Drawing No	104
		Rev	C



PROPOSED GROUND FLOOR PLAN
(SHOWING STRUCTURE ABOVE)

ESSENTIAL BREAKING OUT WORKS REQUIRED PRIOR TO COMMENCEMENT OF WORKS.

TO ENSURE THAT THE BUILDING REMAINS STABLE DURING & AFTER THE ALTERATION WORKS THE FOLLOWING AREAS ARE TO BE EXPOSED / CONFIRMED BY THE CONTRACTOR. THIS LIST IS NOT EXHAUSTIVE & ADDITIONAL BREAKING OUT WORKS MAY BE REQUIRED.

- REMOVE CLADDING FROM ALL BEAMS & COLUMNS ON WHICH NEW BEAMS ARE TO BE SUPPORTED.
- CONFIRM THE SUPPORT OF THE EXISTING COLUMNS TO THE REAR OF THE BUILDING.
- CONFIRM THE MAKE UP OF THE TWO EXISTING PIERS TO EITHER SIDE OF THE FRONT DOORS.
- CONFIRM THAT THE ASSUMPTIONS NOTED ON THESE DRAWINGS FOR LOAD BEARING / NON-LOAD BEARING WALLS ARE CORRECT.

C	BEAM G4 SUPPORT COLUMNS ADDED	MB	23.10.17	MB
B	COLUMN TO GL C1 ADDED	MB	27.09.17	MB
A	ISSUED FOR APPROVAL	MB	29.06.17	MB
Rev.	Description	By	Date	Chk'd
URBAN VILLAGE BARS				
GENERAL ARRANGEMENT & DETAILS ALTERATION WORKS AT 56 TIB STREET, MANCHESTER				
TORSION CONSULT Ltd CIVIL & STRUCTURAL ENGINEERS				
Tel:01625 470781 Mob: 07799 327846 email: mail@torsionconsult.co.uk www.torsionconsult.co.uk				
Drawn By MB		Date JUNE 2017		
Checked By MB		Scale 1:33.3		
Contract No TC-3516		Drawing No 102		Rev C