

# Reconstruction of PRC Houses Designated In 1984 Defective Houses Act

## UNDERDOWN/WINGET PRC HOUSES

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PRC House Type: Underdown/Winget House

(The general form of the Underdown and Winget house types is similar)

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## 1.0 INTRODUCTION

The objective of the Repair is to create a fully viable structure in this house type after examination of the 2-storey precast concrete blockwork forming the external walls of the house and undertaking the necessary remedial actions ie:

- a) effect localised crack repairs as found necessary,
- b) insert remedial wall ties in the cavity walls and
- c) clad externally with insulation and facing brickwork.

The new external cladding will entail extending the width of the existing foundations to support the new brick skin and replacing existing doors and window units with insulated doors and double-glazed windows.

It is considered likely that the block-work, party wall structure and timber first floor joists and boarding together with the timber roof construction will be able to be retained subject to informed inspection and verification of structural adequacy.

The external skin may be of alternative facing materials to brickwork, e.g. block and render construction, but mortgage providers have indicated a preference for a simple brick clad elevation.

It is intended that when the remedial works have been completed the structure will be adequate for its present use for its normal life provided that normal property maintenance is carried out upon the structure.

The original external wall construction consists of two skins of 75mm thick x 900mm long x 225mm high specially shaped concrete blocks placed to form a 225mm cavity wall. The continuous vertical void formed at the end of each grouping of concrete wall panels is infilled with site-placed concrete; the concrete infilling being fully or partially reinforced with vertical reinforcement. The columns are normally positioned at 900mm centres. The difference between the Underdown and Winget house types is that the concrete blocks in the Underdown type are reinforced whereas in the Winget house type they are unreinforced. The load-bearing walls are supported on a concrete strip or sometimes a raft foundation.

The ground floor construction can be of timber joists and boards above an oversite layer of concrete or a solid ground-bearing concrete slab.

The first floor is of timber floor joists, supported on an in-situ reinforced concrete ring beam cast within the thickness of the external walls.

The roof is of traditional timber rafters and ceiling joists supported on an insitu concrete ring beam cast within the thickness of the external walls.

Party walls are of similar construction to the external walls. The external walls are finished externally with sand and cement render and internally with plaster.

The problems identified by BRE in the early 1980's include cracking of external render, carbonation of concrete, corrosion of reinforcement in the reinforced concrete columns, and poorly cast columns incorrectly formed at the base and not meeting the reinforced concrete ring beams<sup>1</sup>.

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<sup>1</sup> BRE Report BR55 *The Structural Condition of Underdown and Winget Houses*

The cracking in the external render corresponds to the positioning of the reinforced concrete columns in the walls. The columns are intended to form the lateral support for the blockwork walls against wind pressure and suction. The repair will entail inserting remedial wall ties at vertical centres between the columns so that the two skins of the cavity wall are tied together in case the lateral support from the columns has been lost. With the columns not providing full lateral support the outer skin may be able to move under load and crack the render.

The walls can be structurally adequate without the concrete columns provided the skins are tied together.

The insulation value of the walls does not meet currently acceptable standards. Therefore, it is proposed that a new brickwork skin will be constructed on the outer face of the existing external walls which with an insulated cavity will provide a satisfactory U Value compliant with current requirements.

Internal ties will be provided to connect the edge of the first floor and first floor ceiling to the gable wall to ensure that the block-work is not over-spanned as a structural wall panel.

## 2.0 SCOPE

The existing condition of the Underdown/Winget house will be investigated thoroughly by visual inspection. Evidence of any gross distortion or deterioration or rusting of reinforcement etc will be noted. The condition will be recorded both photographically and in writing. Appropriate indicative measurements will also be noted.

The system is for use on single houses, pairs of houses and multiple houses in a terrace. All original internal and external precast reinforced concrete (PRC) elements are to be retained. Foundations will be widened prior to constructing the external insulated brick skin.

The scheme is intended to allow occupants to remain in residence during the remedial work. Whilst the impact of the repairs on the dwelling's habitability can be significant, decanting may not be necessary and will depend on the preference of the occupants.

Any additional works that may be commissioned e.g. porches, extensions or similar, will fall outside the remit of this repair scheme.

The system **does** require statutory Building Regulations approval and may or may not require Planning Approval depending on local requirements relating to the appearance/elevations of the building. The requirements of the Building Regulations will be applied to all replacement elements of construction.

An Appointed Contractor will be referred to as the 'Repairer'. A Registered Practitioner (as defined by the BRE Global PRC Homes Repair Scheme) will be referred to as the 'Designer'. Where the Designer appoints the Repairer under direct contract the Repairer must comply with the rules of the BRE Global PRC Homes Repair scheme.

Should any alterations to the Repair Specification be required the Designer must submit a modified Repair Specification for approval by BRE Global.

It is anticipated that the remedial work will take approximately 7 weeks to complete with the major structural works taking 4-5 weeks; making good internally taking the final 2 weeks of the work programme.

It should be stressed that the efficacy of this repair system and its ability to provide the intended future life for the property is predicated upon normal property inspection and maintenance being carried out, following completion of the repair works.

If the visual inspection detailed in Section 3 of this document reveals distress or deterioration of parts of the building not covered by the BRE Global PRC repair specification, then a suitably qualified person must produce a scheme of remedial works that will seek to rectify the problem.

Items not included in the repair specification include:

- a) Insulation to roof spaces
- b) Kitchen fittings
- c) Bathroom fittings
- d) Central heating
- e) Re-roofing
- f) Internal decoration

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- g) Internal doorsets/doors
- h) Plumbing
- i) Electrics
- j) Timber treatment
- k) Landscaping garden walls/gates

### 3.0 INVESTIGATION AND TESTING

If the Designer requires, investigation and testing will be carried out to verify the suitability of the repair system prior to the implementation of the remedial works.

A visual inspection of the dwelling by the Designer is to be performed in order to confirm that the dwelling conforms to the original Underdown/Winget design and no alterations have been carried out that are likely to affect the proposed repair method described in this document.

An appraisal survey of the property undertaken by the Designer is required to ascertain the general condition of the non-PRC elements, internal cracking, distortion of door frames, deflection of floors etc so that these can be compared before and after the repairs are completed.

An investigation of existing foundation details will be undertaken by the Designer to establish their current condition. This will comprise an excavation of trial holes at the front, rear and at the flank walls to determine foundation dimensions and profiles.

The following visual survey checklist shall be used:

Description	Remarks
Is distress/differential settlement visible in any part of external envelope?	
Are the existing walls out of plumb and if so by how much?	
What size are the existing strip foundations?	
Is distress/bowing/deflection/displacement visible in ground or first floors internally?	
Are internal door heads level?	
Are there any cracks across ceilings or above door heads?	

## 4.0 METHOD STATEMENT

### Sequence of Construction

The external walls of the building will be inspected by the Repairer to establish the presence (or otherwise) of cracking patterns in the external render. Such cracking may indicate the locations of joints between adjacent wall panels which tend to coincide with the cast insitu columns and beams at first floor and eaves level.

As necessary, the Repairer will disconnect plumbing, heating, gas and electrical services. Rising mains, meters/switch gear in the vicinity of external walls shall be protected. The existing drains are to be tested and any defective runs noted for repair by others or as an extension of the agreed works.

The Repairer will remove any lean-to structure or outbuilding with connecting roofs to external walls. These may be replaced by others or by the Repairer as an extension of the agreed works.

Where the existing foundations are widened, existing services and drains shall be bridged with concrete lintels and where necessary rainwater gullies and soil and vent pipe connections shall be repositioned.

After widening the existing foundations (if necessary). Remedial wall ties shall be inserted into the external face of the walls at 450mm vertical centres either side of each of the existing reinforced concrete columns at approximately 900mm centres spacing horizontally. This will be undertaken for the full height of the front, rear and flank external walls.

The Repairer will remove the existing soffit boards. Insulation and breathable membrane will be fixed to the outer surface of the walls. New remedial wall ties will be installed and a new brick skin from foundation to roof plate constructed, and the soffit boards will be renewed as shown on the drawing. Windows and doors will be installed as the work progresses and provided with all necessary DPC's and lintels.

The Repairer will reconnect plumbing, heating, gas and electrical services, rising mains, meters/switch gear as required.

The Repairer shall be required to maintain a photographic record of the works including:

- a. Trial hole excavations
- b. Existing front, rear and side elevations
- c. Existing internal cracking around door heads and across ceilings
- d. Steel dowel pins to connect new foundation concrete and showing the trench excavations.
- e. DPC's in walls near ground and above window and door heads
- f. Sealing around windows and doors

The Repairer will leave site clean and tidy.

## 5.0 SPECIFICATION FOR MATERIALS AND CLADDING

### 5.1 Foundation Concrete

Foundation concrete to be typically Grade 20/25 with a minimum cement content of 350 Kg/m<sup>3</sup> and a maximum aggregate size of 20mm. The foundation concrete grade will be varied by the Building Control Officer to address corrosive ground conditions if found necessary. Trial holes should be dug to ascertain the foundation profiles. Any degradation of the foundation concrete after 50 or so years of life will be apparent. It would be on that basis for example that the BCO would request that sulphate resisting cement should be used or from local knowledge of the presence of claystone.

Anchor bars between new foundation and existing are to be 12mm austenitic stainless-steel dowel bars with a minimum content of 3% molybdenum. 300mm long, resin cement grouted into existing foundations at 450mm centres.

### 5.2 Bricks.

In addition to the requirements below, clay bricks shall comply with BS EN 771-1. Common bricks, facing bricks and engineering bricks shall, depending on their use be considered as load bearing bricks. Facing bricks shall in addition have a coloured and/or textured face as specified. When a sample of these bricks has been approved by the Designer, all deliveries to the site shall be of the same appearance and quality.

Before orders for clay bricks are placed, the Contractor shall satisfy the Registered Practitioner either that the saturation rate of the brick, when determined according to the method set out in Special Publication No 56 by the British Ceramic Research Association does not exceed 1.5kg/m<sup>2</sup> minimum or that he is able to adjust it so as not to exceed this value.

### 5.3 Mortar

**Cement:** to BS EN 197-1: The cement used in mortars shall be Portland cement, Portland blast-furnace cement or sulphate-resisting cement. Masonry cement shall not be used.

**Lime:** Lime used in mortar shall be high-calcium lime or semi-hydraulic lime to conform to the requirements of BS EN 459-1.

**Sand:** Sand for mortar shall comply with the requirements of BS EN 13139. Sand which has been in contact with sea-water shall not be used.

**Water:** Water shall be clean and free from any harmful impurity.

The compressive strength of site-controlled tests on mortars shall be carried out in accordance with BS requirements.

### 5.4 Admixtures

Calcium chloride, or additives based on calcium chloride or any other chloride shall not be used.

### 5.5 Pigments

Pigments shall conform to the requirements of BS EN 12878 and shall be premixed with the cement or the ready-mixed lime:sand, so as not to exceed 10% by weight of the cement in the mortar, care being taken to ensure that the strength of the mortar remains adequate. Colouring agents based on carbon black shall not be used.



### 5.6 Plasticisers

The use of plasticisers shall not be permitted unless approved by the Designer.

### 5.7 Compressive strength

The compressive strength of site-controlled tests on mortars shall be carried out in accordance with BS EN 1996 requirements.

### 5.8 Preparation

The proportions of the constituents in all mortars for brickwork shall be those given in BS EN 1996. Mortars other than cement mortar shall be prepared either by using a lime:sand mixture (coarse sand zone 2) or by mixing cement, dry hydrated lime and sand immediately before the water is added. Where practicable the constituents shall be made up by weight taking 1 m<sup>3</sup> of cement as 1440kg, 1m<sup>3</sup> of lime as 575kg and 1 m<sup>3</sup> of dry sand as 1520kg; when the constituents are not batched by weight, gauge boxes shall be used. Whichever method the Contractor chooses, it shall be used for the site control tests as specified below

When dry hydrated lime is used, whether batched by weight or volume, the content of lime may be increased if desired by up to 50%.

Lime:sand mixture (coarse) shall be made up in the proportions given in BS EN 1996 by thoroughly mixing dry hydrated lime:sand and water and it shall be protected from drying out. Ready mixed lime:sand for mortar, delivered wet to the site and complying with BS EN 998-2, may be used in accordance with the guidance notes given in Appendix A to that standard.

Cement and lime:sand: Immediately before the mortar is used, cement and lime:sand mixture shall be thoroughly mixed together in the proportions given in BS EN 1996, with sufficient water to give the workability required by the bricklayer. Wet ready-mixed retarded cement:lime:sand mixtures shall not be used.

Reconstitution: Mortars shall be used before the initial set takes place. (Normally this is within 2 hours of the cement and water being added). Any mortar left after this time shall be discarded; on no account shall mortars be reconstituted.

Cleanliness: All plant and equipment used for mixing and transporting shall be kept clean. All such containers shall be thoroughly washed out whenever mixing ceases or whenever there is a change of mix.

Mixing: All mortars shall be thoroughly mixed together by mechanical means. Mortars mixed by hand shall not be used.

### 5.9 Ancillary Components to BS EN 845-1

Wall ties shall be stainless steel double twist type, unless otherwise stated. The ties shall be of sufficient length to ensure a minimum embedment of 50mm in the outer leaf and be plugged and embedded in the existing concrete blockwork.

Damp proof courses shall be to BS 6515 as shown on the Registered Practitioner's drawings.

### 5.10 Storage of Materials

Bricks and blocks shall be carefully unloaded to minimise damage and placed on the site in different stacks according to strength and marked accordingly, on prepared areas free from clinker or ashes, or sulphate bearing soils. The stacks or packs shall be protected from rain and snow.

Cement shall be stored off the ground in a dry structure so as to permit inspection and use in the order of delivery. Separate storage, clearly marked, shall be provided for different cements. Cement which has been adversely affected by dampness shall not be used.

Hydrated lime shall be stored in the same way as cement.

Sand shall be stored separately, according to type on hard paved areas where it will not become contaminated.

The lime:sand mixture shall be stored separately according to type, on hard paved areas where it will not become contaminated and it shall be protected from drying out.

Rolls of DPC materials shall be stored to avoid damage and distortion.

#### 5.11 Accuracy of Construction

Horizontal dimensions shall be set out with steel tape supported throughout its length. Angles set out by measurement or by builder's square shall be checked by instrument.

Where components such as windows and doors are not built in as the work proceeds the openings to receive such components shall be accurately formed by using jigs and templates.

All brickwork and blockwork shall be built to the tolerances given below. The method of controlling accuracy and setting out shall be in accordance with BS 5606.

- Length: Up to and including 5m  $\pm 10$ mm; over 5m up to and including 10m  $\pm 15$ mm
- Level of bed joint (at storey height): In any 3m length of wall  $\pm 10$ mm, In any wall  $\pm 20$ mm
- Errors of level not to be cumulative over the height of a building
- Height: up to 6m  $\pm 20$ mm
- Straightness: In any 5m (not cumulative)  $\pm 7$ mm
- Verticality: In any 600mm  $\pm 5$ mm, In any 3m  $\pm 10$ mm
- No brickwork or blockwork shall deviate more than 30mm from the vertical in its full height.

#### 5.12 Bricklaying

When the saturation rate of clay bricks exceeds 1.5kg m<sup>-2</sup> minimum, the suction rate of such bricks shall be adjusted by light wetting so as not to exceed 1.5kg m<sup>-2</sup> minimum, care being taken to avoid damage in frosty weather.

All bricks shall be laid on a full bed of mortar. All cross joints, perpends and collar joints (those parallel to the outside face) shall be solidly filled with mortar. Single-frogged bricks shall be laid frog uppermost and double frogged bricks shall be laid with the deeper frog uppermost. All frogs shall be filled with mortar.

Brickwork built with standard 65mm bricks shall rise at the rate of four courses to 300mm. The height of brickwork built in a day shall not exceed 1.5m (twenty courses of standard bricks) without prior permission of the Designer.

Cutting of bricks shall be kept to a minimum and special or standard - special bricks shall be used to maintain bond. When cutting of units is necessary, a bolster shall be used in preference to a trowel. No cutting of high strength perforated bricks shall be allowed except by the use of a carborundum wheel.

Sleeves and holes through walls shall, as far as possible be provided during the building of brickwork. Chasing of completed walls or the cutting of holes through walls shall be carried out only in positions specified by the Designer or agreed by him in writing and then only by using a tool designed to cut the bricks cleanly. No horizontal or diagonal chases shall be permitted.

Ties shall be placed as the work proceeds and set level or with a slight downward slope toward the new outer leaf.

The cavity shall be kept clear of mortar or rubbish as the work proceeds by the use of battens. Mortar droppings reaching the base of the cavity shall be removed daily through temporary openings. Cavity gutters shall not be damaged when cleaning mortar from temporary openings. On completion the loose bricks and blocks shall be properly bedded and jointed after finally cleaning the cavity.

Where cavity DPC's are incorporated weep holes shall be provided through the outer skin at intervals not greater than 900mm horizontally. Weep holes shall be formed by building-in proprietary plastic weep-holes in perpend.

All damp-proof courses shall be bedded.

#### 5.13 Protection Against Weather

**Frost:** The Repairer shall be responsible for avoiding the harmful effects of frost. The Repairer shall use air-entraining agents only when specified by the Registered Practitioner. Calcium chloride of frost-resisting additives based on calcium chloride shall not be used.

**Rain:** Brickwork shall be protected to prevent rain falling directly on its top surface or water being channelled into it until the work has its finally intended protection. It is particularly important to ensure that perforations and frogs are not allowed to fill with water. In any period of interruption through rain, and at the completion of each day's bricklaying, freshly laid brickwork and blockwork shall be protected.

#### 5.14 Site Control Tests

When requested by the Designer, the Repairer shall prepare mortar cubes and arrange for their testing by an independent laboratory.

Four 100mm mortar cubes shall be prepared on site from mortar taken from the mixer, when requested. The Repairer shall record the date of preparation and the position in the work to which the samples relate. Specimens shall be made, stored and tested for strength in accordance with BS EN 1015, half at 7 days and half at 28 days.

Requirements to pass are based on the 28 day tests the results of which shall be deemed to pass if the average strength exceeds the site value for this stage given in BS EN 1996.

In the event of the 28-day site sample failing to meet the requirements, the Repairer, shall, if required by the Designer, take down and rebuild any work affected.

When the average strength of the site samples tested at 7 days exceeds the appropriate 7-day strength in BS EN 1996, the work may proceed while awaiting the results on the 28-day tests.

In the event of the 7-day strengths failing to meet this requirement by a margin not greater than 10%, the Repairer may elect to continue work at his own risk. while awaiting the results of the 28 day tests, or take down the work affected.

**6.0 INSPECTION SCHEDULE**

The inspection schedule for the Designer is divided into three sections each relating to a critical stage of the remedial works.

Description	Remarks
<p>FIRST VISIT</p> <p>Where new foundations are required is ground bearing adequate?</p> <p>Have existing/drain/services been properly bridged or repositioned?</p> <p>Have all fixtures and fittings connected to external walls been removed/made safe?</p> <p>Have adjacent lean-to structures/outbuildings been removed?</p>	
<p>SECOND VISIT</p> <p>Have any concrete repairs been carefully completed?</p> <p>Have all approved remedial wall ties been installed and gable wall ties fitted?</p> <p>Have new foundations been correctly excavated and concreted to the approval of the Building Inspector and in accordance with the drawings?</p> <p>Have DPC's been properly provided?</p> <p>Is cavity insulation fixed securely to ensure residual clear cavity?</p> <p>Have Steel lintels been provided with cavity tray DPC's and windows surrounded with DPC's?</p>	
<p>THIRD VISIT</p> <p>Have windows and door frames been properly sealed with mastic?</p> <p>Are there any new settlement cracks visible internally especially around doors?</p> <p>Is the site clean and tidy?</p>	

## **7.0 DESIGN ASSUMPTIONS AND CALCULATIONS**

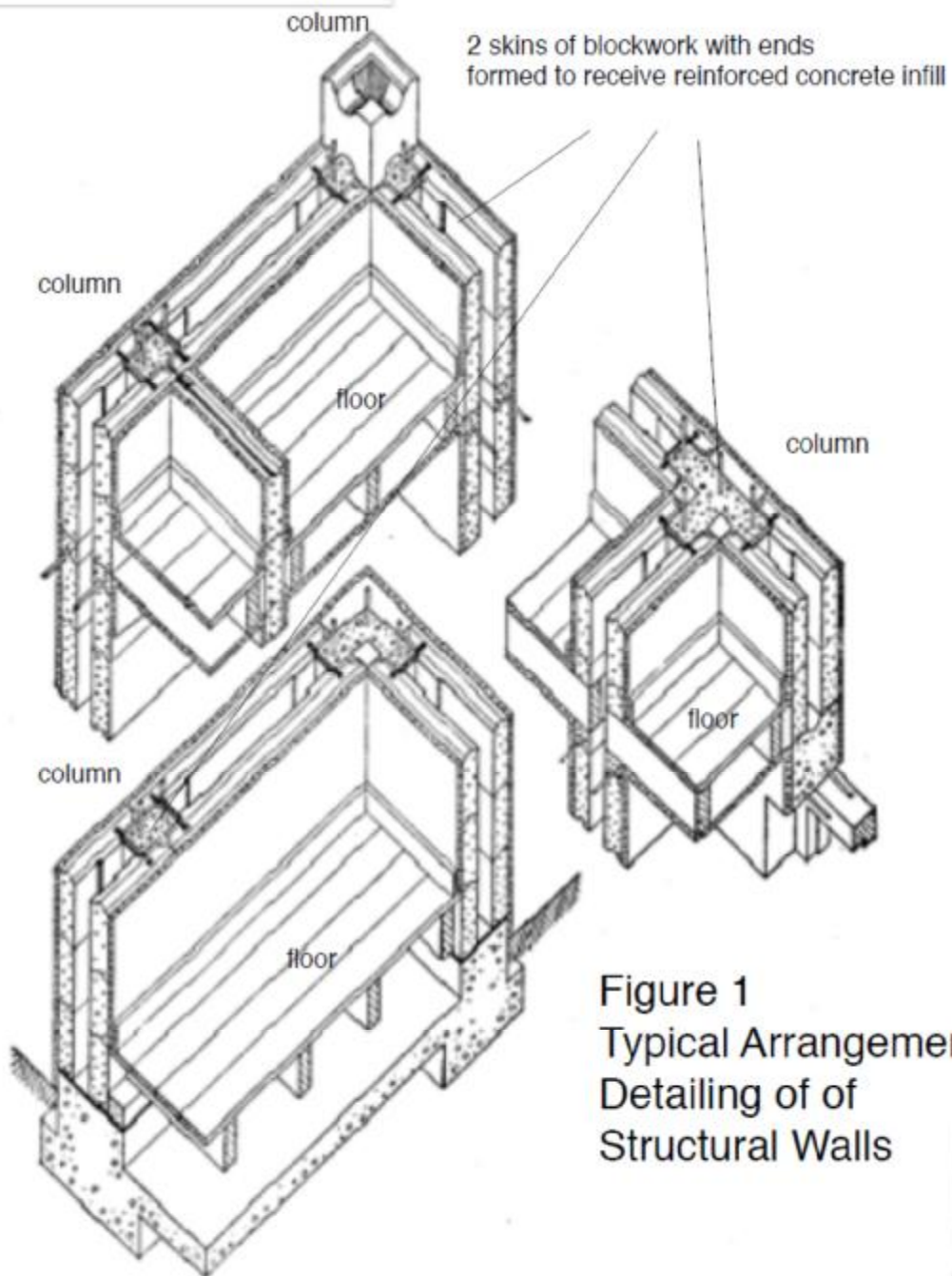
Structural calculations are available for inspection showing for the adequacy of the existing walls with new wall ties.

The calculations are produced using CADS Wall Frame Designer Max by Computer and Design associates.

## **8.0 GENERAL ARRANGEMENT DRAWINGS**

Drawings are attached showing cross sections through the existing external walls, first floor and the proposed section after the brick cladding has been added with details of the affected elements.

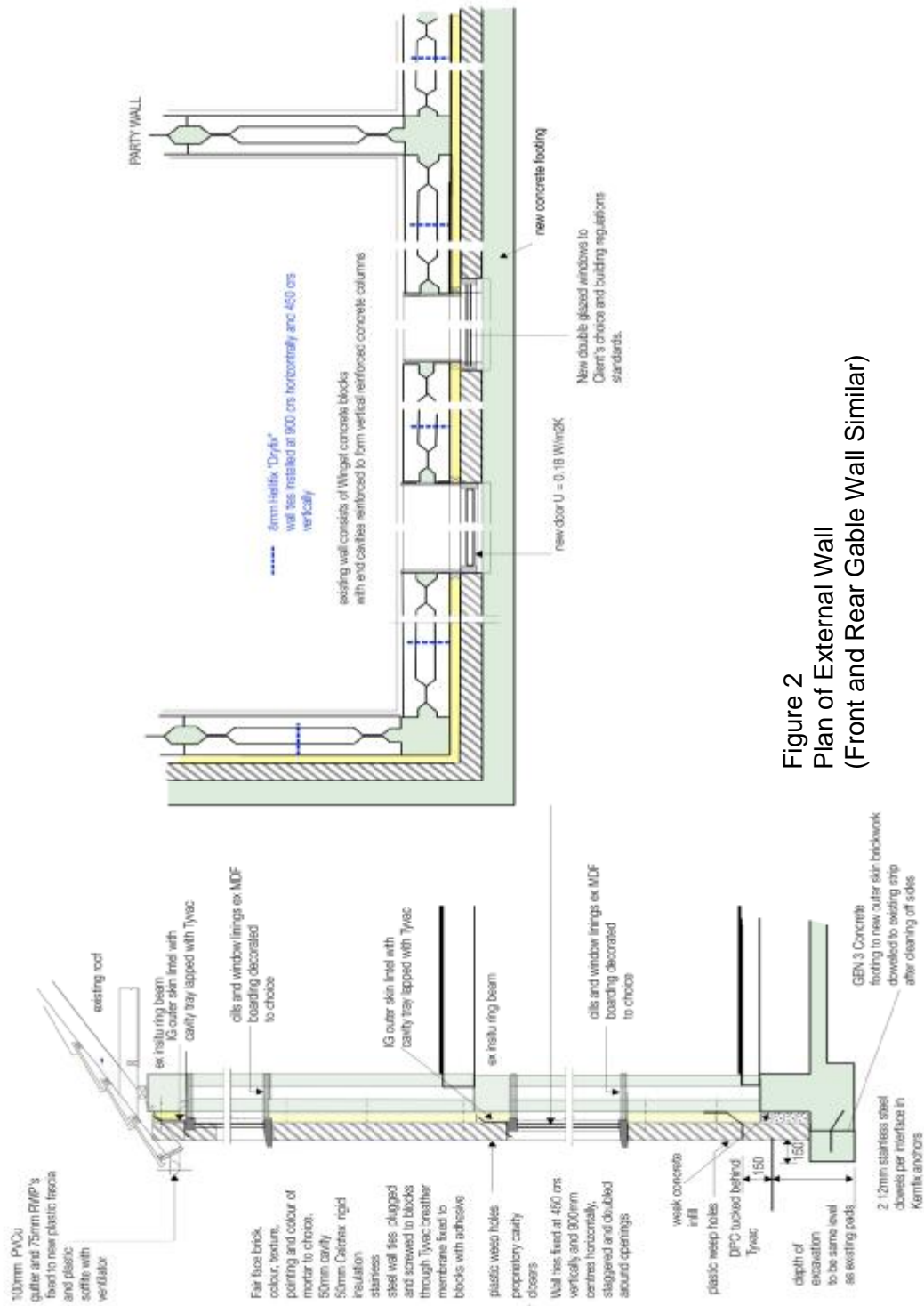
**Bureau Stoker Fitzpatrick**  
**Details of Existing Construction**



**Figure 1**  
Typical Arrangement and  
Detailing of of  
Structural Walls

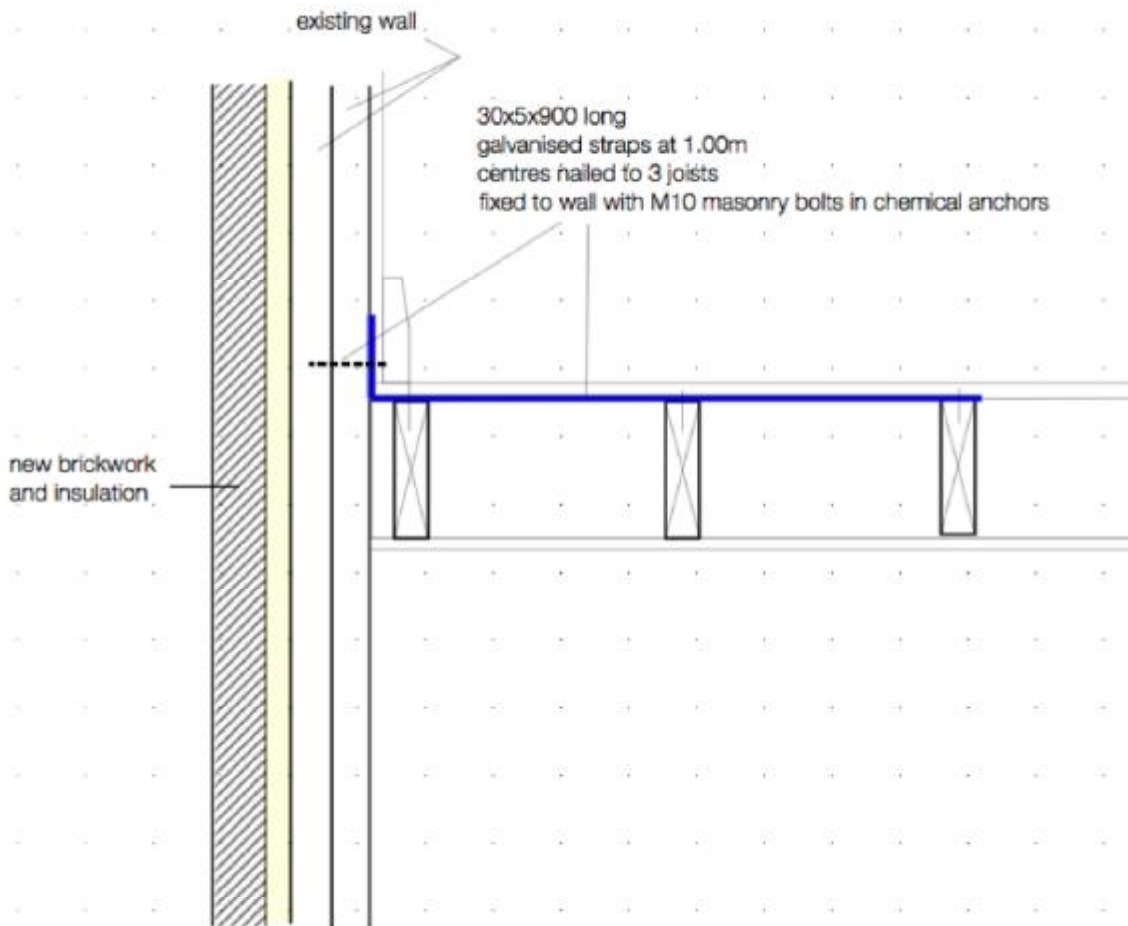


**Bureau Stoker Fitzpatrick  
Details of Existing Construction**



**Figure 2  
Plan of External Wall  
(Front and Rear Gable Wall Similar)**

**Bureau Stocker Fitzpatrick  
Details of Existing Construction**



**Figure 3  
External Wall to First Floor Connection Detail**