Reconstruction of PRC Houses Designated In 1984 Defective Houses Act

REEMA PRC HOUSES

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Registered Practitioner:
Brian J. Stocker MA CEng FI StructE, Chartered Structural Engineer

<table>
<thead>
<tr>
<th>SECTION</th>
<th>DESCRIPTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>Introduction</td>
<td>2</td>
</tr>
<tr>
<td>1.0</td>
<td>Scope</td>
<td>3</td>
</tr>
<tr>
<td>2.0</td>
<td>Investigation and Testing</td>
<td>5</td>
</tr>
<tr>
<td>3.0</td>
<td>Method Statement</td>
<td>6</td>
</tr>
<tr>
<td>4.0</td>
<td>Specification of Materials and Cladding</td>
<td>7</td>
</tr>
<tr>
<td>5.0</td>
<td>Inspection Schedule</td>
<td>12</td>
</tr>
<tr>
<td>6.0</td>
<td>Design Assumptions and Calculations</td>
<td>13</td>
</tr>
<tr>
<td>7.0</td>
<td>Drawings of Existing and Proposed Structure</td>
<td>14-16</td>
</tr>
</tbody>
</table>
SECTION 0 INTRODUCTION

0.1 The objective of the Repair is to examine the precast concrete panels forming the external walls of the house, to effect localised concrete repairs as found necessary, and to clad with insulation and facing brickwork. This will entail providing new foundations between the existing pads to support the new brick skin and inserting new insulated windows and doors where the windows and doors formerly existed. Otherwise it is considered likely that the large wall panels, party wall and precast concrete first floor elements may be able to be retained subject to informed inspection and verification.

It is intended that the external walls will be clad with facing brickwork for their full height.

There is no structural objection to the walls being of alternative facing materials e.g. block and render but mortgage providers have indicated a preference for a simple brick clad elevation.

It is intended that when the repair has been completed the conclusion will be that the structure is adequate for its present use for its normal life provided that normal property maintenance is carried out.

0.2 The original construction consists of foundation pads of in-situ concrete supporting external and load-bearing internal walls and flues.

The external walls consist of storey-height hollow precast concrete panels shaped at their edges to form shuttering for cast-insitu reinforced columns and ring beams. Each panel is of reinforced concrete with 25 to 40 mm thick flanges and a 165mm hollow core. The vertical edges form the shuttering for insitu fine concrete reinforced columns. The trough at the top of the panels forms shuttering for cast insitu concrete ring beams at first floor and roof levels.

Each column is supported on a concrete pad foundation.

This system is repeated at first floor with the columns seated on the first floor ring beams. The cast insitu concrete columns and ring beams form a reinforced concrete frame that ties the large precast concrete panels together to provide monolithic walls.

The ground floor is of solid concrete ground-bearing construction.

The first floor is of precast concrete floor units anchored into the first floor ring beams.

The roof is of traditional construction.

Party walls are of similar construction to the external walls with sometimes the hollow cores of the precast concrete panels filled with sand.

The external walls are finished externally with exposed washed aggregate or textured and painted with a cement paint. Internally the panels are finished with a fibreboard sheet and a skim coat of plaster.

The nature of the problem identified by BRE in the late 1970’s/early 1980’s relates to carbonation of the precast concrete and subsequent corrosion of the reinforcement steel in the external exposure conditions, uniformly found by inspection to be confined to the window and door surrounds that are cast into the panels. Expansion of corroded steel results in spalling and break down of the concrete. The damage here, however, does not present a reduction in the load bearing capacity of the panels. Mild exposure in internal conditions does not pose the same risk of break down. It has been reported that some Reemas had concrete floor units with a high level of chlorides discovered after testing. Localised damage could occur to the concrete due to the chlorides reacting with leaking water. *

* BRO53 “The structural condition of Reema prefabricated reinforced concrete houses”
SECTION 1  SCOPE

1.0 The existing condition of the Reema house will be investigated thoroughly by visual identification and assessment of obvious distortion or deterioration, rusting of reinforcement etc., and recorded photographically, in writing and complete with measurements.

1.1 The system is for use on single houses or pairs of houses and single houses and multiple houses in a terrace of houses. All internal and external PRC elements are to be retained. New foundations will be added between the existing pads and an external insulated brick skin will be constructed. The bath outlet will always be sealed against unwitting concentrations of water likely to affect the concrete floor units in the assumption that chlorides may be present.

1.2 The system applies where there are internal load-bearing and non-load-bearing walls of masonry or timber construction and there are no proposals to modify these.

1.3 The system allows occupants to remain in residence. No decanting is necessary.

1.4 Any additional works commissioned e.g. porches, extensions or the like fall outside the remit of this repair scheme.

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

1.6 An Appointed Contractor will be referred to as the “Repairer”. A Registered Practitioner (as defined by the PRC 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 certification scheme for the repair of PRC homes.

1.7 Should alterations be envisaged to his Repair Specification the registered Practitioner must submit a modified Repair Specification for approval by BRE Global.

1.8 It is anticipated that this repair will take approximately 7 weeks to complete with the major structural works taking 4-5 weeks and making good internally occupying the final 2 weeks.

1.9 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 maintenance being carried out, following completion of the repair works.

1.10 If the visual inspection detailed in Section 2.0 reveals distress or decay of parts of the building not covered by the PRC repair system, then a suitably qualified person must produce a scene of works to the problem.
1.11 Items which are not included in the repair system:-

a) Insulation to roof spaces
b) Kitchen fittings
c) Bathroom fittings
d) Central heating
e) Re-roofing
f) Internal decoration
g) Internal doorsets/doors
h) Plumbing
i) Electrics
j) Timber treatment
k) Landscaping
l) Garden walls/gates
SECTION 2 INVESTIGATION AND TESTING

If a Registered Practitioner requires it, investigation and testing may be carried out to verify the suitability of the repair system prior to the implementation of the repair.

2.0 A visual inspection by the Registered Practitioner is to be performed in order to establish that no variation from the standard design has been carried out that is likely to affect the proposed repair method described in this document.

2.1 An appraisal survey of the property is required to ascertain the general condition of the non PRC elements, internal cracking, distortion of door frames etc, deflection of floors so that these can be compared after the reconstruction works are completed. If the above reveals significant cracking of concrete elements, consideration should be given to testing the concrete for depth of carbonation and chloride content.

2.2 An investigation to check existing foundation details is to be made. This will be done by excavating trial holes at front and rear and on the gable walls to determine foundation widths and depths and profiles.

2.3 The following visual survey checklist shall be used:-

<table>
<thead>
<tr>
<th>Question</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>Is distress/differential settlement visible in any part of external envelope?</td>
<td></td>
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<tr>
<td>Are the existing walls out of plumb and if so by how much?</td>
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<tr>
<td>What size are the existing pad foundations?</td>
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<tr>
<td>Is distress/bowing/deflection visible in ground or first floors internally?</td>
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<tr>
<td>Are internal door heads level? Are there any cracks across ceilings or above door heads?</td>
<td></td>
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<tr>
<td>Is the upper triangle of gable wall of timber frame with cladding or PRC construction?</td>
<td></td>
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<tr>
<td>Are any window or door surrounds suffering from reinforcement corrosion and or spalling of concrete</td>
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</table>
SECTION 3     METHOD STATEMENT

3.0   Sequence of Construction

3.1 The external walls of the building will be inspected by a Repairer for rust patterns in the panels indicating corrosion of their mesh reinforcement. The reveals of the doors and windows will be inspected for cracking and/or spalling of the precast concrete edge mouldings due to corrosion of the reinforcement.

All occurrences of rust spalling will to be treated by the Repairer as follows:-

3.1.1 The concrete cover will be removed by power hammer or water blasting to a depth just below the reinforcing bars.
3.1.2 The reinforcement will be cleaned to remove loose rust and scale.
3.1.3 The concrete will be replaced with a trowel applied cementitious mortar (By SIKA or equal)

NB: Warning – danger of breaking out of rebar seriously damaging concrete could cause extensive or excessive damage to the thin flanges of the hollow core concrete wall panels, making repair necessary. The repairer is to inform the Registered Practitioner of the damage and agree remedial action.

3.2 As necessary a 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.

3.3 A 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.

3.4 A Repairer will excavate for new trench fill type foundations between the existing concrete pads to a width of 600mm and a depth the same as the existing depth of the pads and to the approval of the building Inspector. 12mm dowel bars will be fixed to the existing concrete pads by drilling and chemical anchoring and leaving the bars projecting 200mm for casting into the new concrete. The new foundation concrete will be poured in one operation per section between each set of pads. All works to be in accordance with drawing 003 attached.

3.5 Existing services and drains are to be bridged with concrete lintels and where necessary rainwater gullies and soil and vent pipe connections are to be repositioned.

3.6 A Repairer will cut off the existing nibs around the windows and doors and make good surfaces, remove the existing eaves soffits and remove from site, fix insulation and breathable membrane to the outer surface of the wall panels, with wall ties and a new brick skin from foundation to roof plate and renew the eaves soffits as shown on drawing 003. Windows and doors will be installed as the work progresses providing all necessary DPC’s and lintels.

3.7 A Repairer will make sure in the First Floor Bathroom that the bath outlet is sealed and sealant is provided around the bath.

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

3.9 A Repairer shall be required to maintain an annotated photographic record of the works including as follows:-

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

3.10 A Repairer will leave site clean and tidy.
SECTION 4  SPECIFICATION FOR MATERIALS AND CLADDING

4.0 Foundation concrete to be typically Grade 20/25 with a minimum cement content of 350 Kg/m³ and a maximum aggregate size of 20mm. The foundation concrete grade will be varied by the Building Control Officer (BCO) to address corrosive ground conditions if found necessary. There will be trial holes dug to ascertain the foundation profiles and 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, and resin cement grouted into existing foundations at 450mm centres.

4.1 Bricks.
In addition to the requirements of b) 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, all deliveries to the site shall be of the same appearance and quality.

b) 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/m² maximum or that it is possible to adjust this, not to exceed this value by pre-wetting – see 4.10.

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

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

c) 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.

d) Water: Water shall be clean and free from any deleterious impurity.

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

4.4 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.

4.5 The use of plasticisers shall not be permitted unless approved by the Registered Practitioner.

The compressive strength of site controlled tests on mortars shall be carried out in accordance with BS requirements.
4.6 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, or if this is impracticable, by volume, using gauge boxes. 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.

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 concrete panels.

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

4.8 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.

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 so stored to avoid damage and distortion.

4.9 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 +or-10mm; over 5m up to and including 10m +or-15mm

Level of bed joint (at storey height)
In any 3m length of wall +or- 10mm, In any wall +or- 20mm
Errors of level not to be cumulative over the height of a building

Height: up to 6m +or- 20mm

Straightness: In any 5m (not cumulative) +or- 7mm

Verticality: In any 600mm +or - 5mm, In any 3m +or-10mm
No brickwork or blockwork shall deviate more than 30mm from the vertical in its full height.
4.10 Bricklaying

When the saturation rate of clay bricks exceeds 1.5kg/m$^2$, the suction rate of such bricks shall be adjusted by light wetting so as not to exceed 1.5kg/m$^2$ maximum, 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 Engineer.

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 Registered Practitioner 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 outside 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 perpends.

All damp-proof courses shall be bedded.
4.11 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 or 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.

4.12 Site Control tests

When requested, 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 Registered Practitioner, 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 Contractor may elect to continue work at his own risk. while awaiting the results of the 28 day tests, or take down the work affected.
## SECTION 5  INSPECTION SCHEDULE

Inspection Schedule for Registered Practitioner (Inspector)
The inspection schedule is divided into three site visit sized sections and critical stages of construction.

<table>
<thead>
<tr>
<th>Description</th>
<th>Remarks</th>
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<tr>
<td><strong>FIRST VISIT</strong></td>
<td></td>
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<tr>
<td>Where new foundations are required</td>
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<td>Is ground bearing adequate?</td>
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<td>Have existing/drain/services been properly</td>
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<td>bridged or repositioned.</td>
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<td>Have all fixtures and fittings connected to</td>
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<td>external walls been removed/made safe?</td>
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<td>Have adjacent lean-to structures/outbuildings</td>
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<td>been removed?</td>
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<td><strong>SECOND VISIT</strong></td>
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<td>Have all concrete repairs been carefully</td>
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<td>completed?</td>
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<td>Have new foundations been correctly excavated</td>
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<td>and concreted to the approval of the Building</td>
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<tr>
<td>Inspector and in accordance with the drawings?</td>
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<td>Have DPC’s been properly provided?</td>
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<td>Is cavity insulation fixed securely to ensure</td>
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<td>residual clear cavity?</td>
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<td>Have Steel lintels been provided with cavity</td>
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<td>tray DPC’s and windows surrounded with DPC’s?</td>
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<td><strong>THIRD VISIT</strong></td>
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<tr>
<td>Have windows and door frames been properly</td>
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<td>sealed with mastic?</td>
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<td>Have acrow props been removed?</td>
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<td>Are there any new cracks visible internally</td>
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<td>especially around doors?</td>
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<tr>
<td>Is the site clean and tidy</td>
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SECTION 6  DESIGN ASSUMPTIONS AND CALCULATIONS

No structural calculations are required for this repair type.
SECTION 7     EXISTING AND PROPOSED STRUCTURAL DETAILS DRAWINGS
NOTES
1. The external walls of the building are to be inspected for rust patterns in the panels indicating inadequate cover to mesh reinforcement.
2. The reveals of the doors and windows are to be inspected for cracking and/or spalling of the precast concrete due to reinforcement corrosion.
3. All occurrences of rust spalling are to be treated as follows:
   3.1 The concrete cover is to be removed by power hammer or water blasting to a depth just below the reinforcing bars.
   3.2 Remove loose rust and scale.
   3.3 The concrete is to be replaced with a trowel applied cementitious mortar (by Sika or equal).

SECTION THROUGH ALL EXTERNAL WALLS

REEMA PRC
CONCRETE REPAIRS

PLAN OF ALL EXTERNAL WALLS SHOWING AREAS OF REPAIR

15 BRE Global Ltd 2014