

# REPAIR STRATEGY REPORT



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Job Description:  
 Scope: **Report on Strategy for Façade Stonework Repairs (Ref V2)**  
 Job Location: **Reading**  
 Stone Type: **Bath**  
 Finish: **Dressed, Rusticated.**

By: **Ken Jones**  
 Contact Tel: **07720 413 062**

DATE: **03 September 2019**  
 REF: **J2362 / V2**  
 Revision: **0**

## 1 Background & scope

AFJones were commissioned to undertake an initial visual survey and schedule of proposed façade repair work (Nov / Dec 2018). The project to implement these works to the facade got underway in July 2019. However the works to the facade have been halted due to discovery of highly unusual configuration of the wall make up & condition behind the stone facing (more details below). This has led to the need for this report and a changed approach to repairing this facade.

Following our meeting at site (Tues 6 August), and with yourselves & David Evans of Clive Hudson Associates Ltd (Consulting Structural Engineer), I summarised the initial updated findings & situation (ref. my email Fri 9 August 2019). This led on to your instruction to commission this report (12 Aug 2019).

The purpose of this new report is to summarise the new findings from site, and to propose a possible new approach / strategy for the façade repairs for agreement and instruction on implementation.

This report is based upon common sense, practical considerations and a knowledge of stone masonry facades and stone masonry techniques. It is not intended to be a structural engineering report, and therefore any strategy or further works are to be reviewed and approved by a qualified structural engineer.

In addition, the scope of this report is based upon the extent of original repair areas of the stone façade and not the whole building / whole façade (copies of our original notes and scope are attached for reference).

In addition to Structural Engineer approval, we have also recommended that a Conservation Officer is involved in the next site meeting and inspections so that they can understand the issues faced and the approach being adopted. We see this as particularly important now that a bespoke repair strategy is being proposed that will have aesthetic and other consequences. The property is Grade II listed. See our original report which made similar recommendation.

## 2 Partial Extract of Original AFJ Report (Dec 2018)

### Included here for reference and background information.

The building was first Listed in 1978 (Grade II). Described as follows:

ELDON ROAD 1. 5128 (West Side) Nos 8 and 10 SU 7273 7/461 II GV 2. Circa 1840. Probably by Henry or Nathaniel Briant. Bath ashlar pair. Rusticated ground floor and quoins. Band at 1st floor level. Hipped slate roof on deepbracketed eaves, central chimney. 3 storeys and basement, 1st and 2nd floors have 2 windows each, glazing bar sashes, round-headed on 2nd floor, bracketed pediments on 1st floor. Each has a wide 3 light bay with casement windows. Entered from side in porches with Doric piers, cornice and blocking course.



The stone façade has had significant amounts of repair work undertaken in the past. Some / much of the previously undertaken repair works have adopted what appears to be cementitious materials which, in this enlightened age, would no longer be appropriate / acceptable (lime mortars are exclusively used). This includes the Bay Window and the Portico Entablature in particular. The rusticated stone to the side elevation has many / multiple 'plastic' repairs in a reasonable colour matched mix. The plinth stone has been (almost fully) cement rendered over (clearly the plinth is subject to greater weathering and the surface of the stone must have been failing).

Most of the previous repairs are in a fairly good condition (i.e. they appear to be protecting the building / stone from further deterioration, albeit it is very ugly with poor colour match in many areas), except for the plinth render that has started to crack and in places has failed and beginning to peel away.

Often these Stone Skin facades are tied / restrained back to a brick backing wall with Iron cramps; however there is no evidence of rusting and therefore it may be that in this case the design has relied upon cross bonded blocks / elements including the corner quoins to perform the restraint. Unfortunately there are several areas where the facade exhibits significant in-plane cracking / movement combined with out-of-plane movement and cracking as well, mainly to the front elevation, see below.

### Front Elevation

Movement & cracking is particularly marked to the full height adjacent to the corner rusticated quoins, and between the bay windows across the party wall line. The mid-band course shows significant movement / failure, and in some areas the tilting of these stones will be funnelling water behind the front facade which will lead to rapid further deterioration of the stone work in the coming years.

Refer to marked up elevation for proposed areas of treatment.

### Side Elevation

Generally the previous repairs to this elevation are doing their work, except for the rendered plinth towards the front which is cracking / delaminating. It is very difficult to repair the stone sympathetically once it has been rendered over. The only sensible course of action may be to cut off the cracked render to clean lines and redo it using a lime based 'mortar repair mix', colour matched for Bath Stone. The ease of removal / cutting back of the render is uncertain at this stage.

There are a number of items of pointing, mainly perpends which need to be carried out. There are also several stone piece repairs that can be recommended as labelled on the attached drawing.

### Back Elevation

This elevation is generally unsightly and badly treated in the past: all pointing has been redone with cement based mortar and poor colour match, and there are large areas of mortar-render with 'pretend' scribed pointing lines, and further lower level zones rendered & painted with masonry paint. Immediately above the toilet lean-to, there is a missing ashlar and cracked ashlar to be rebuilt. The lead flashing may need to be redone (?).

It is difficult to tell from visual inspection from ground level, but there may be some bowing / out-of-planarity exhibited in the façade, particularly adjacent to the large window and towards the roof eaves. It may be prudent to check this more closely once scaffold is available and potentially to provide some stainless steel restraints drilled through to fix the facade to the backing wall.

There are some missing stone up at eaves level, cracking to the cill & head and other minor pointing to do.

Quite surprisingly, the façade appears to be largely performing the function it is intended to perform (namely keeping water to the outside of the complete facade line and away from the interior or fabric of the building), despite the poor appearance.

### 3 Wall Condition Exposed / inspected

By the provision of access scaffolding, we have been able to investigate the make up of the façade and samples of the 'backing wall' behind the stone outer 'skin'. This has been possible through the removal of several small areas of stone façade and intrusive exploratory work into the backing wall behind the facade skin.

We had expected that the wall might feature some form of inner skin with a rubble fill between the inner and outer leaves of the wall, (possibly with the inner skin being formed of brick most likely). However, instead there appears to be no inner leaf at all, with the entire thickness of the wall beyond the outer skin being formed of mixed rubble fill which includes many small voids between the rubble elements but the matrix held together with some mixed-in cementitious slurry.

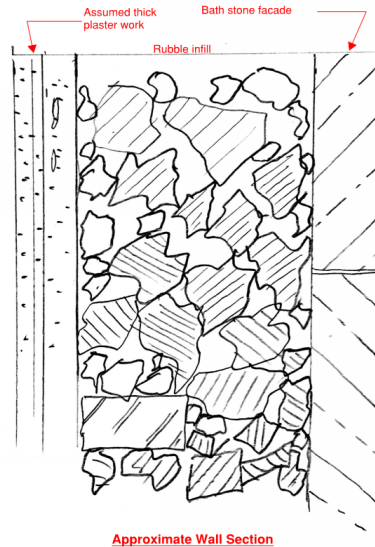


Three separate façade opening up areas all with rubble wall to full depth behind.



First floor string - face has split off and seems to be supported only on rubble infill, which appears to have settled down. Voids in area obvious.

Wall is approximately 350mm thickness overall, including the inner plaster lining and the outer Bath Stone facade. The Bath Stone façade is approximately 60mm thick on the front elevation, perhaps 50mm on the rear elevation. There are occasional 'header' blocks which penetrate deeper into the facade (embedded into the rubble wall), but it is difficult to tell which, and the front elevation seems to have none other than the corner quoins and the window reveals. There are no metal ties or pins within the facade which is unusual.



In addition to this discovery, there are also several areas of evident movement on the façade that were not immediately obvious from the original survey. In particular, the section of front facade wall over the bay window has 'drooped' down. This is evident from the coursing joints and the angle of tilt of the cills. (Note that the adjacent property has similar droop but facade is less dilapidated). This seems to have been caused by an inadequately stiff timber lintel across the bay. There could be a risk that this timber lintel has suffered damp conditions or that it is underdesigned, and we would recommend that this should be looked into and if appropriate addressed or stiffened at this time when the facade is being addressed. However, the state of the structure as a whole is not the purpose of this report which focusses on the external skin stonemasonry. Therefore, this aspect will be left for others to consider further.

Also, the Stringer / Band stones at first floor appears to have sheared off and settled. Originally they would have formed a capping / bridging stone linking the rubble inner core and the rusticated stone, hence forming some sort of tying-in function. Having sheared off, they appear to be supported by the rubble core only and this has pushed the rusticated skin outwards. This original function is very difficult to correct or replicate without dismantling the entire wall and rebuilding.

The original plan for the repairs was to dismantle areas of Bath Stone facade, and rebuild, fixing the new skin back to an inner leaf as the build progressed, giving it stability / strength and effective fixing. However, with no inner leaf being available, and the rubble wall being relatively friable, there is no opportunity to fix back the façade, and if sections of the outer leaf were to be dismantled there would be a risk of instability in the rubble wall of itself, leading to possible collapse or partial collapse that would be difficult to rebuild, let alone the condition being temporarily dangerous.

Ideally, at this time of repair, an inner skin would be put in place instead of the rubble stone in order to provide the backing stiffness. Yet this would imply a virtual dismantling of the façade which would be a very significant undertaking indeed, right down to the foundation level.

Therefore we have attempted to devise a system of repair which simply pins the outer skin almost in-situ / progressively, or at least with minimal areas of removal at any one point in time. The anchorage and effectiveness of the rubble wall as an element of restraint / stability is and would remain unquantified and is purely based on the fact that the walls remain standing albeit with some degree of evident movement and cracking of the outer stone skin.

If a 'pinned in place' façade system is adopted, it effectively would mean that it is impossible to correct the out-of-plane bowing which is particularly evident to the right hand side of the Bay Window. This is far from ideal and not what AFJones would prefer or typically recommend.

#### 4 Possible repair strategy for the façade.

A pinning-in strategy is illustrated in diagrams 1.1 & 1.2 below.

This scheme would involve installing progressively working from the top downwards, in order to stabilise and maintain in-situ as much of the façade as possible. Individual panels would be removed once the section around it is sufficiently stable and pinned.

The anchorage system is based on a well-known drill and resin-fix masonry anchorage system, but adapted for the use on Limestone façade through the use of a Stainless Steel mesh sleeve. The sleeve is injected with resin yet allows it to flow to an extent through the sleeve and engage with the surrounding rubble wall.

The process of repair is likely to be a relatively slow process as each panel will need to be decided at site, and pieces cut to fit as tightly as possible. Even so, joints of 4-5mm might be expected in order to slot stones into cavities.

The scheme shown is indicative and represents the principles only - the actual repairs will be agreed at site with the masons to suit each stone / area in sequence. The repair scheme will be applied to the areas of the façade where cracking and open joints are evident - in other words, to the areas where rebuild was previously suggested. Areas where the stone facade is in relatively adequate condition (i.e. where it is keeping surface water from penetrating through the facade), no pinning will be applied at this time.

Note that the head of each pin anchor location will be 'visible' on the surface albeit with a colour matched mortar. Also note that the replacement panels will be in new Bath Stone but which will mellow in over time. We would suggest the use of Park Lane Bath Stone as one of the best colour match in this instance.

The first floor band / stringer will be capped with new stone which will be pinned onto the existing / remaining stone. Local pinning or stitching may be appropriate, and the treatment would be configured on further local inspection of the areas.

The rusticated areas below the band stringer course is bowed out. Since we will not be able to remove and realign / rebuild then the bowing shape would have to remain but be pinned back into the rubble core.

The rear façade repair area (refer to original AFJ scope proposal), would be treated in the same way. Again we would seek to minimise removal and stabilise the skin into the backing wall wherever possible.

Attachments : Sheets SK 1.1, SK 1.2 & SK 1.3

Pinned face  
(mortar repair  
over heads of  
pins).  
Replacement  
stone panels  
working top to  
bottom.



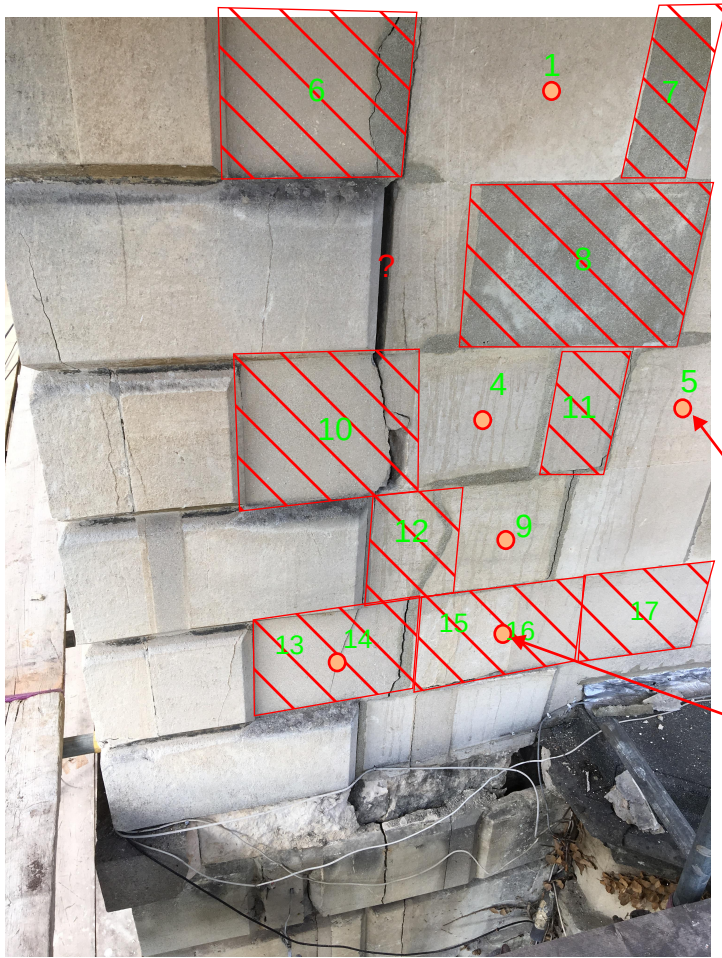
This section similar  
in principle to the above.  
(i.e. Replacing  
broken Stone &  
pinning back working  
top to bottom  
direction.

Special treatment for  
stringer stones: Pin a  
facing stone onto the  
remaining stub of original  
stone once concrete repair  
removed .

Pin-back and replace  
individual panels in similar  
manner. Note that  
impossible to correct the  
lean/ out of plumb in this  
area using this method. So  
purely just stabilising in the  
current position

SK 1.1 Front Facade Repair pinning & panel replacements (principles)

Possible sequence of pins & replacement panels. Working top to bottom. Indicative only, not precise.



Drill & fix anchors. Capped with colour matched mortar repair.

Replacement panels. Some of which might be pinned back to stabilise for works below.

The exact / final choice of pin positions and panel replacements will be agreed with the skilled mason at site with periodic visits. Stability to be maintained. Replacement stones cut to fit.

SK 1.2 Sequence of pinning / replacements (indicative)

8 or 10mm dia St.  
steel threaded bar

Mortar plug  
(colour  
matched, lime  
based)

Resin injection,  
pushes through  
sleeve into voids  
within rubble wall.

St. Steel mesh  
sleeve 12mm dia.

SK 1.3 Proposed Wall Stitching / Facade stabilisation





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Bringing Stone to Life since 1858

## **Copies of the original repairs proposed**

(i.e. original scheme prior to the updated strategy described above).

See next three sheets.

1.7 Take down and rebuild full panel top to bottom, to address bowing and cracking fully. Replace stones where it falls apart or is too badly damaged to reuse. Care to retain as much as possible where intact. Adopt st. steel restraints to backing wall at every course & max. 750mm lateral spacing.

Note: This drawing only shows the proposed repair works in response to the survey & brief. Refer to the accompanying report & schedule for context and further detail.

1.8 Replace cracked band blocks, except try to retain corner stone in current repaired condition (tbc).

1.6 Repoint cracking.

1.4 Piece / replace ashlar panels where cracking in this zone.

1.3 Replace course of ashlar where damaged by needle supports for panel below.

1.1 Band stones need to be replaced and bedded / fixed level. Detail uncertain at present. Support facade above using drilled in angle or needle supports to course above string. Infill new course of ashlar above band after work to band complete.

1.2 Panel bowing badly. Unbuild, then rebuild 4 courses, with restraints to backing wall.

1.5 Repoint junction with Bay Window.

1.9 Replace / rebuild as necessary the plinth stones to front which have failed / moved significantly. Others to expose foundation and ensure resealed properly with DPC or slate.

1.10 Piece repair of ashlar on Bay Plinth where holed.

Key

- Dismantle & rebuild.
- Piece repair or replace stones as noted.

|                                                                                                                              |                   |                                                                   |          |
|------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------------------------------------------------------|----------|
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|                                         |                   | <b>A F Jones Stonemasons</b><br>Bringing Stone to Life since 1858 |          |
| Drawing Title<br><b>Front Elevation Repairs</b>                                                                              |                   |                                                                   |          |
|                                                                                                                              | Date              | Drawn By                                                          |          |
|                                                                                                                              | <b>3 Dec 2018</b> | <b>KJ</b>                                                         |          |
| Project<br><b>10 Eldon Road</b>                                                                                              |                   |                                                                   |          |
| Scale                                                                                                                        | Job Nr            | Drawing Nr                                                        | Rev      |
|                                                                                                                              | <b>02340</b>      | <b>01</b>                                                         | <b>0</b> |

Note: This drawing only shows the proposed repair works in response to the survey & brief. Refer to the accompanying report & schedule for context and further detail.

## Key

- Piece repair or replace stones as noted.
- Mortar repairs (by others).

2.1 Delaminating quoins. These need to be pinned back - but replacements are likely since they may disintegrate on attempted pinning. (Refer also to Back rebuild area associated with this).

2.2 Two No. Pce repairs (cracked / difficult to repair any other way)

2.3 Pce repair rusticated loose block with open joints. Repoint.

2.8 Stones may become dislodged by works to front face. Provisionally allow some time to pin / refix / attend. Note that any damage to plaster, if necessary, by others.

2.7 Isolated pointing of perpend. Allow for 7 No. but recheck on detail inspection on scaffolds.

Specialist render repair (by others?). Prev. render cracking & delaminating. Suggest this needs to be taken off carefully, or at least back to solid line, and lime-based colour matched mortar repair applied in suitable layers (base / scratch / top coats). Note: cutting away render may reveal stone repairs required.

2.4 Minor repointing of joints. Assume 5 No. joints.

2.5 Redo mortar repair to joint.

2.6 Shelter Coat column face to 'consolidate', strengthen it.

Small mortar repairs to damaged pilasters (by others).

See item 1.9 for replaced front plinth.

|                                                                                       |                   |                                                                   |          |
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|  |                   | <b>A F Jones Stonemasons</b><br>Bringing Stone to Life since 1858 |          |
| Drawing Title<br><b>Side Elevation Repairs</b>                                        |                   |                                                                   |          |
|                                                                                       | Date              | Drawn By                                                          |          |
|                                                                                       | <b>8 Dec 2018</b> | <b>KJ</b>                                                         |          |
| Project<br><b>10 Eldon Road</b>                                                       |                   |                                                                   |          |
| Scale                                                                                 | Job Nr            | Drawing Nr                                                        | Rev      |
|                                                                                       | <b>02340</b>      | <b>02</b>                                                         | <b>0</b> |

Very unsightly repair. Suggest possible redo this in colour matched lime mortar? By others

3.4 Panel may be bowed and could need pinning back? Window jamb looks bowed - potentially on the move? Very difficult to tell. May be very fragile panel? Make a provisional allowance for pinning, but works could vary greatly.

3.3 Missing ashlar pieces to u/s roof eaves?

3.2 Allow for stitch repair - resin-drilled-pins across cracked head to stabilise.

3.1 Rebuild area, including replacement ashlar pieces, repoint fully. Will not be pretty but close up gaps and reinstate corner of facade. Note: Downpipe to be removed and reinstated by others / roofers.

See item 2.1 on side elev.

3.5 Ashlar looks in very poor / fragile condition. Possible repair works may be needed. Especially as lead dressing and new roofing works immediately below? Provisional allowance for some undefined work.

Also the cill is highly repaired, cracked and may also need attention to prevent further movement or water ingress in the region?

3.6 Minor pointing in this zone.

Note: This drawing only shows the proposed repair works in response to the survey & brief. Refer to the accompanying report & schedule for context and further detail.

## Key

- Dismantle & rebuild.
- Piece repair or replace stones as noted.
- Mortar repairs (by others).

|                                                                                                                              |                   |                                                                   |          |
|------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------------------------------------------------------|----------|
| A F Jones Stonemasons Limited<br>33 Bedford Road, Reading, Berkshire RG1 7EX<br>Tel: 0118 957 3537 Email: info@afjones.co.uk |                   |                                                                   |          |
|                                         |                   | <b>A F Jones Stonemasons</b><br>Bringing Stone to Life since 1858 |          |
| Drawing Title<br><b>Back Elevation Repairs</b>                                                                               |                   |                                                                   |          |
|                                                                                                                              | Date              | Drawn By                                                          |          |
|                                                                                                                              | <b>8 Dec 2018</b> | <b>KJ</b>                                                         |          |
| Project<br><b>10 Eldon Road</b>                                                                                              |                   |                                                                   |          |
| Scale                                                                                                                        | Job Nr            | Drawing Nr                                                        | Rev      |
|                                                                                                                              | <b>02340</b>      | <b>03</b>                                                         | <b>0</b> |

## 5 Discussion about other options

To correct the bowing below first floor stringer, including addressing the twisted and dropped stringer itself. At the very least this would involve supporting the whole wall above first floor with temporary supporting through-wall beams with a frame / propping to both exterior and interior propped down to basement / foundation levels, to facilitate a rebuild of the whole section of walling. Rebuilding the whole area may involve taking the rubble wall down to foundation as well as the full outer wall. It would include major disruption to the occupants of the building, including the neighbouring property. The work could lead to many unknown discoveries and support of the lintel over the bay area would have to be carefully considered in the process to avoid movement and possible progressive damage to the decorative elements of the facade which are reliant on this timber lintel (the timber lintel appears to be resting on the rubble skin).

All in all, this option is a major undertaking and would need more investigation and consideration of the temporary works, party wall agreement etc.

Another option we have considered is whether the rubble skin can be injected and grouted to form a more stable inner skin. The difficulty here appears to be how to check where the grout has run to and whether it has actually been delivered to the areas of strength needed. Also it would lock in the out-of-plane stone geometry, can create staining through to the surface of the stone, and sufficient coverage for standard drilled fixings on rebuild would be questionable. Therefore we rejected this option.

Another option to consider is to cut horizontal slots along joint lines and resin or mortar fix st. steel helibars. This repair strategy is often used for ordinary brick facades or stone facades with thick mortar beds. In this case we have fine jointed stone and we anticipate objections to such a strategy from conservation considerations. In addition, it does not solve the temporary stability and replacement of panels, so the pinning and patch-replacement strategy would probably be needed in addition to the helibars; and therefore arguably not adding anything further to the scheme for the front facade. There may be more reason and opportunity to use some helibars in the rear facade since this elevation has less fine jointing and may benefit from helibars within the area being treated. It would still need pinning in places to ensure stability though.

Please note that areas of the facade outside of the originally identified facade repairs is beyond the scope of this report. This is for others to consider on a wider basis / remit.

## 4 Conclusions & next steps

The configuration of this wall / facade is, in our experience, highly unusual in that there appears to be no inner skin of any consistency or notoriety. This is making the repair strategy for the facade challenging and also unusual.

A pinned in-situ repair strategy has been presented above, however we need to be clear that this would not ordinarily be a 'preferred' long-term solution, partly because it does not address the root cause of the issues which includes movement / bulging of the rubble core and the other settlements / movements. It also means that disturbed geometry is just 'fixed' and stability assisted. The pinning strategy is proposed as a practical way of addressing cracks, failed pointing and wider gaps / fissures through the facing Bath Stone outer skin. This should prevent ongoing ingress of surface water through these areas which is a risk to the wall, to the stone face and potentially to internal timber components.

We suggest that this report is reviewed and approved by the Structural Engineer and the Conservation Officer.

Once agreement on the strategy is achieved, if a further meeting on site for the initial panels / fixings and panels is needed to get the work moving forwards with everyone in agreement, this can be arranged. The scheme can be extrapolated from this first agreed segment of work.

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