# **General Masonry Repair Recommendations**

#### Appearance of the original masonry:

This building is a wonderful example of Victorian Gothic, characterized by a play of materials, textures, and colors important in maintaining the romantic character. The strong impact was created through delineation of the black mortar joints against the red bricks, darker bands of brown sandstone, decorative terra cotta, and the colors of the woodwork that attempt to make the transoms and mullions appear to be brownstone contrasted with copper verdigris at the sashes.

This tight-jointed, black pigment-pointed, deep red brick structure was very high-style and represented the epitomy of high fashion for turn-of-the-century masonry. With the mortar so heavily deteriorated and white calcite formations on the joint surface obscuring the effect of tight, black jointing and the surface staining both from calcite and soot causing a dirty haze on large sections of the building, it is more difficult to appreciate the imposing structure that Victorians saw, but which can be regained with careful repair.



This section of protected original ground-floor pointing still exhibits the impact of the original pointing.



In contrast, heavily deteriorated original pointing is recessed and the lime has been leached to the surface from acid rain attack.

Areas that have been cut with grinders and portland repointed leave only a negative impression.

The original mortar is overloaded with pigment making it weak. This large quantity of pigment filler becomes in a sensse aggregate in the mortar and changes the ratio from 3:1 to 6:1 making it unlikely that the lime could properly coat and bind all of the aggregate together. This is a problem often faced in using dark pigmented mortars. Half of the aggregate is fine clear quartz silica and half a ground carbon acting as pigment. With the tinting coming from crushed carbon which has much less hiding power than finely divided pigments of the same volume, the mortar is automatically weaker. The replica mortar can be made with more stable natural iron oxide pigments.

The use of misshapen or irregular terracotta (brick) masonry building units leads to an out-of-alignment appearance when viewed up close. This is accentuated now by the considerable loss of mortar at the head (vertical) joints. Why these masonry units are so misshapen is uncertain, however it seems possible that in an attempt to get a darker colored brick by extending or increasing firing temperatures, a large number of the bricks have become overfired and some of them have warped under the stress. Additionally, this has made some of them less porous and this contributes to a slightly weaker bond between the mortar and masonry units.

### **Recommendation for scaling back repointing:**

Although this contract is for designing toward a100% repointing of the brick masonry at Auditors, it is our opinion that this is not only unnecessary, but also both inadvisable and prohibitively expensive. Although a more thorough assessment on a foot-by-foot basis around all elevations might be necessary to more accurately estimate the extent of repointing that would be involved under such a scenario, we believe it would be reasonable to assume that 85% of the head-joints on the building will need to be repointed, with 70% of these joints already completely void of mortar (i.e. mortar removal would not be required first), any parapets extending above the roofline and subjected to exponentially increased levels of weathering will require nearly complete repointing, and all protrusions (belt courses) beyond the plane of the building will need to be grouted in place and completely repointed, as well as a good percentage (80%+) of both vertical and horizontal joints for the six courses below these projections.

For both water-shedding and aesthetic reasons we recommend removing the modern portland repointing in place on much of the ground floor, but this work is not as urgent and could be deferred until a later time.

#### Mortar removal methods:

Mortar will need to be removed by hand methods only. The original joints are very narrow (unlike those that have been opened up with a grinder to make repointing easier for masons in recent years) and mechanical methods of removal will not allow the level of care necessary to protect the surrounding bricks. "Sawzall" or reciprocating saw blades in hand holders that cut the joints to a consistent 1/2" depth will both protect the masonry and provide a consistent depth for repointing mortars.

All open joints will be grouted with a custom-made lime grout using specialized caulk guns fit with nozzles made for this application followed by pointing with tools ground to slightly smaller than the width of the joint (far narrower than commercially available masons tools).

If there is less than a 3/16" erosion of the mortar joint face (originally close to flush to the brick faces), no mortar removal is recommended.

### Grouting and Repointing Progression:

The removal and repointing process must proceed in a particular order that is somewhat dependent for timing on the season in which the work is conducted. Masonry work of this kind should not be undertaken during the winter when below freezing conditions can occur while the building is being kept quite wet or the mortar is fresh (less than two weeks old).

Work during very warm summer months will require:

- more regular wetting of the surface and the joint interiors in particular,
- careful timing of joint compaction after grouting to coincide with water leaving the mortar but not so long as to allow mortar setting,
- more attention paid to the timing of each repointing phase to ensure proper suction and therefore appropriate mortar-masonry bonds, as well as to ensure that a surface crust of carbonation does not occur in the mortar joint before the next lift is applied.

#### **Basic Progression of the Masonry Work:**

- After the mortar has been cut out by hand to a squared mortar face (not deeper at the center and mortar left attached to the brick at top and bottom of the joint), all joints need to be vacuumed free of debris and rinsed with water. Before grouting or pointing commences, the brick faces must be allowed to dry.
  - Use of acids to clean up after sloppy workmanship will not be tolerated, nor can this masonry structure accommodate it. (See cleaning recommendations for a further discussion of acid cleaning). When installing lime mortar carefully into joints that are damp (not soaking wet) but with dry brick faces, and messes can be quickly and easily cleaned up AFTER the mortar has dried either by dry brushing with a stiff brush, or at most, with application of a weak vinegar solution on the brick face.
- Before pointing commences, the joints will need to be re-wet using a directed spray nozzle.
- The first application of mortar into the joints will bring all deeply voided joints to the same 1/2" depth as the recently cut joints. Grouting can be used to stabilize masonry that is completely devoid of interior mortar. The mix used for this application will be formulated by the conservators to ensure it flows into the joints and follows the voids to their full depth.
- At a spacing of 1-2 hours later depending on ambient conditions, this mortar will need to be compacted into the joint by pounding with wooden wedges slightly smaller than the joint height to ensure proper compression.
  - $\circ\,$  If a joint compresses considerably at this point, the process should be repeated.

• Pointing with the finish lime-sand (no portland cement) mortar will be done using well-aged mortar (prepared at least a week, preferably a month in advance).

Aging lime mortars produces a highly plastic mortar that can be lifted on properly sized pointing tools at the full 1/2" depth and to the width of the joint directly from the hawk with little or no mess or wasting of material.

• If mortar staining of the brick faces occurs, this can be removed after one week with dilute vinegar brushed onto the areas to be treated only.

Under normal spring or fall weather conditions (moderate temperatures and wind), a logical daily progression for the masonry crew then might be to spend two hours grouting in the morning, coming back to pack or compress those joints in the same order they were grouted, and finishing up the day by final pointing of these same and any shallower joints (again following the same progression across the building face as the earlier stages).

In the process of grouting and repointing, the masons need to be aware that while some areas are actually out of alignment and need to be pushed back into place, the majority of the building is not out of alignment, but only appears up close to be uneven due to the misshapen bricks. This is not to imply that sections of regular face bricks that are out of plane due to some localized damage should not be relaid in alignment.

This out-of-alignment appearance is particularly apparent in the window arches trimmed with a double-quirk corner bead constructed through the repetition of a single brick unit flipped over and reversed to correspond to the bonding pattern, with the problem being that it is not symmetrical around the center line of the bead. This is the result of being formed and fired, as opposed to shaped, thus making a unit that is impossible to lay smoothly.

Either the shoulder is out, or the bead is out ... or both. In some cases the masons tried to align the shoulders, leaving the beads out of alignment; in other cases, they laid the beads in line and the shoulders are out of alignment; in still other cases they tried to "cut the difference."

There is no way to make the shoulders or the beads exactly in line with one another without creating some other jagged line.



### **General Stone Repair Recommendations**

<u>Granite:</u> If all the material remains, but cracks are evident, these can be grouted with either a lime grout or a Jahn patching grout. If significant pieces of the stone are missing, then stone dutchmen would be appropriate.

<u>Sandstones</u>: Here we believe a performance spec of 1/2" would be appropriate; up to 1/2" material missing should be ignored, beyond that, replace the unit.

<u>Slate in a "structural" capacity at the belt courses:</u> The slate is blowing itself apart in spite of proper bedding. This may be due in part to the fact it lacks appropriate loading, i.e. only a small portion of the overall stone is under compression while the majority is free-hanging out beyond the plane of the building. As there is no way to add to the loading of the slate in this design, where these slates are failing, replacement with a more appropriate stone for this non-structural application may be the most appropriate approach.

All projection or belt course voids in stone and terra cotta can be addressed in place using grouts as described under the brick masonry repair procedures.

## **Final Thoughts**

Where the belt course continues from one construction era to another and vertical construction joints exist between the two structures, while the belt courses are continuous, it is important to carefully saw-cut the belt courses as well to stop destruction of these areas from thermal expansion and contraction that is otherwise concentrated into a narrow band.



These recommendations for the repair process are only a starting point. The conservator team will need to work out final details appropriate to this building in a "repair drop" on a representative wall section to finalize tools, progression, mortar and grout mixes, etc.