

Cobblestone construction in the New World

A restoration case study

John Burnell

The southern shores of early 19th-century Lake Ontario saw the birth and subsequent proliferation of a peculiar type of vernacular construction known as cobblestone construction. Cobblestones, fist-sized stones rounded by glacial action, were set in beds of lime mortar in traditional double-wythe [double skin] stone construction and laid in decorative courses. While this type of construction most likely had roots in southern England, it was new to North America.

Fig. 1 The Howard House.

The heyday of cobblestone building coincided with the construction of the Erie Canal in the 1820s and ended with the beginning of the US Civil War in 1861, when labour and material costs rendered this labour-intensive building practice impractical. In this period, it is believed that some 1,200 structures were built, 90 per cent of which are centered in the Rochester, New York area, though cobblestone construction migrated to states westwards with emigrant New Yorkers practised in this type of building.

Two such buildings took root in north-east Ohio, both within one half-hour of my business. To my delight, my company was recently solicited to perform consultation on one and contracting work on the other. This article will focus on the work we performed on one of the houses, the 1853 Howard House in Aurora, Ohio.

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Fig. 2 (above)
Projecting mortar joints create a honeycomb effect.

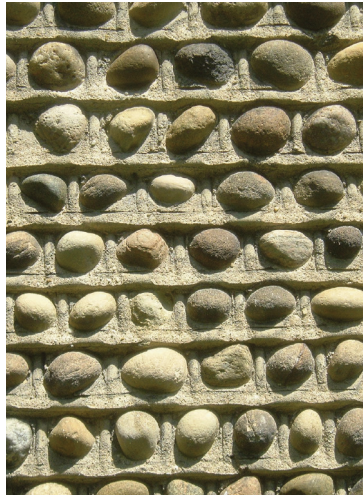


Fig. 3 (above right)
Refined cobble and jointing work on the front central block.

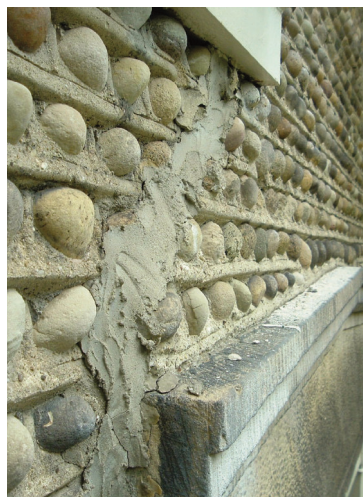
The Howard House: description

The Howard House was built in 1853 by a prosperous merchant who ran a series of water mills on a creek, which happened to furnish the cobbles for the house and above which the house is perched. Built in Gothic Revival style, it consists of a central block with two near symmetrical wings flanking either side (Fig. 1). The rear of the house is coursed sandstone rubble; the cobblestone coursing begins on the sides, with even-sized cobbles with projecting 'V' mortar joints to create a sort of honeycomb effect (Fig. 2). The wings of the front of the house are rubble, rendered with a three-coat plaster, while the front of the central block is reserved for the most refined cobble and jointing work (Fig. 3).

It is the masonry on the front facade that marks the Howard House as a 'late period' cobblestone structure. Architectural historians who have documented and classified cobblestone work have categorized it into three distinct periods – early, middle, and late – according to the level of refinement and ornamentation. It was in the late period that the art and craft of cobblestone construction were at their most refined:

Fig. 4 (below)
Settlement cracks marked out in red.

Fig. 5 (below right)
Crack running from doorway lintel to sill above.



very uniform stones were used for coursing and the jointing work was often at its most elaborate.

Like many lime structures, the Howard House had been introduced to cement. While the house was, overall, in very good shape, over time narrow ($\frac{1}{4}$ inch or less) shear vertical cracks had developed in the walls, some of which ran a good 15 to 20 feet from first storey to second [ground to first floor]. Settlement cracks had developed at all four corners of the wings, running vertically along the butt ends of the quoins from base to roofline. In the front, cracks radiated from all corners of the windows, from the lintels to the sills above and from the sills to the base below (Fig. 4). The widest crack (approximately 1.5 inch wide, see Fig. 5) ran from the stone lintel above the doorway to the sill of the window almost immediately above it. All cracks had been filled with several applications of cement-based mortars over the years and these were as unsightly as they were harmful to the masonry. Our job was to clean them up and get the right material back in.

The restoration

Establishing the mortar mix and profile

While we were excited by the opportunity to work on the house, frankly, upon initial glance, we hadn't a clue how to go about the jointing work, as work in duplicating the coursing was going to be involved in restoration. Like many restoration projects, this one was going to be a marriage of accumulated experience and learning on the fly, in sometimes quite varying proportions. Fortunately, we had worked a bit with lime, enough to know the basics, and we also had the good fortune to work with both a sympathetic architect and client on the project, making it easier to focus our energies on the work itself.

Duplicating the original mortar was the first task. We removed several sections of good mortar from the rear of the building and performed an acid digestion test on a sample. The mortar we took out was pretty sturdy, and came out in chunks. A visual inspection of its broken surface, and those of several pieces removed from other parts of the building, revealed a uniform, creamy colour, and no sign of the inclusions of unslaked quicklime common in other lime mortars we'd seen. No records existed for the construction of this house, and the several accounts we'd read about the building of cobblestone structures that were contemporary with the construction of the Howard House revealed little about the making of the mortar. If this mortar had been laid hot, it may have been a well-sieved mix. Our sample would also reveal the aggregate and rough proportions (close to 1:3), as well as small bits of wood that turned up in the filter paper, which were presumed to have come from the burning process.

Lime production in north-east Ohio is all but forgotten, and any evidence of it that remains is buried in old county histories, with scant mention of ‘so-and-so’s lime kiln’ – and one memorable mention of an unfortunate fellow falling into a slaking pit. What is revealed from research, however, is that the early settlers, who came here from New England in the early 19th century, knew lime and where to find it. Limestone is present but certainly not common, as sandstone is the native bedrock, and the early histories make note of bands of limestone within sandstone formations, and beds of marl being quarried for lime production, as well as hydraulic limes being quarried and produced for the extensive canal works once located here. Obviously, with more time and research one could probably determine where and how this particular mortar was furnished, but for the moment it remains a mystery.

The creek that furnished the cobbles more than likely also furnished the sand. The coarse aggregate revealed in the mortar analysis closely resembled concrete sand and the surrounding area happens to have a wealth of sand and gravel pits, making a sand match fairly uncomplicated. Our next step was to create several samples to see if we could match the existing mortar. We formed six different mixes into patties, using a variety of sands with the following limes: a putty, a St Astier NHL 2, and a pre-tinted St Astier NHL 2. We let these cure in the lab and then wetted and brushed them with a restoration cleaner (Vana Trol from Prosoco, USA) to reveal the aggregate. The samples were taken on site and held against each wall in natural light to determine compatibility with the original mortar (Fig. 6).

The mortar choices came down to three samples: a 1:2.5 putty/sand consisting of Niagara Putty, an aged dolomitic lime from Graymont Lime in north-west Ohio, and two NHL 2 mixes, a tinted and untinted 1:2.5 St Astier NHL 2/sand mix. The samples were put into two different sides of the house, allowed to cure, and then washed with acid and measured for matching in place. The putty and untinted NHL 2 both came very close to the original; the tinted NHL 2 matched well pre-acid wash, but came in darker afterwards (Fig. 7).

With the mortar determined and cleared with the client and architect, we could move on to the work in earnest. We began our work at the peak and in the rear of the house, far from any prying eyes but our own, removing cement from the fairly wide (1 inch) coursed rubble joints with a rotary hammer. This work, as demolition work can, proceeded at a fairly rapid pace and a good deal of the prep work needed for the rear of the house was done in a little over a day. We started with the NHL 2 and pointed it in; the joint work for the rubble on the rear was simply flush so it was routine to apply and finish. Fortunately, the rear of the residence



Fig. 6 (above)
Examining a mortar sample.



Fig. 7 (left)
Mortar mix with tinted NHL 2.

was completely shaded and out of the wind; burlap [coarse canvas] was applied and kept damp for the next several days to get the curing process underway.

Moving to the sides of the house gave us our first test in terms of duplicating the mortar profile. Again, the mortar joints on both sides of the house were decorative, with a raised ‘V’ formed around the cobbles, which were laid in levelled horizontal courses. Initial tooling with straight NHL 2 was not completely satisfactory: the mortar tended to tear slightly when attempting to form a clean V with the joiner. We obtained a fatter NHL 2 mortar by mixing the day before pointing and then knocking up, and went one step further by adding a small amount of putty into the mix for good measure, resulting in a mix that was much easier to form with our joiners. During this time, as well,

Fig. 8 (right)
The south-west corner, with NHL 3 mortar mix.



Fig. 9 (far right)
The south-west corner following application of a walnut-shell wash.



Fig. 10 (below)
Rubble coursing behind the outer skin of cobbles.

we were to switch sands. This was as much by accident as by intent: we had simply used some leftover concrete sand from another nearby quarry and this had a deeper buff colour than the sand that we had been using. We found the match to be even closer to the original mortar colour.

Around this time, the weather began to turn, as the work had commenced in early autumn. We switched to an NHL 3.5 to work on the south-west corner, which was where the weathering to the wall – and subsequent cement repair work – had been the most extensive (Fig. 8). The idea was to lessen the risk of frost failure by getting a little quicker initial set out of our mortar. To our dismay, the 3.5 cured to a greyish colour, even with the new sand and after it was brushed down with the Vana

Trol. (Up to this point, we had worked exclusively with NHL 2; we were to learn the grey tone was characteristic of 3.5.) A few experiments with a wash made from crushed black walnut shells, a suggestion from our supplier, who had experience covering over cosmetic unpleasantnesses, did the trick and gave the repair mortar a closer blend to the original (Fig. 9).

The front of the residence was naturally to be the greatest challenge. In the original construction, smaller cobbles were, as at the sides, laid in levelled courses horizontally across the face of the wall. The jointing was more elaborate: each cobble was framed top and bottom by a ribbon joint that ran continuously the length of the course, and a smaller ribbon was applied vertically to either side (Fig. 3). This mortar work

Fig. 11 (below right)
Differing mortars in the rubble and cobble skins.





Fig. 12 String lines were used in re-setting the cobble coursing.

required custom jointers. We were to make use of a chunk of mortar that came out during the raking process, and which contained a clean profile of the ribbon work. Modern convex joiners were cut, ground down, and welded to slickers and, after several trial runs, the tools for the front were at hand.

Repairs to the front-door lintel

In addition to the cracks in the mortar joints from all of the windows, the sandstone lintel over the front door was kicked out of plumb by about 1.5 inches, a state that appeared to be longstanding, judging from historic photographs. This wide joint was covered over with cement repair mortar, and its removal provided a glimpse at the interior of the wall and a good look at the lintel. We had not anticipated re-setting the lintel as part of our original proposal, thinking it would have to be completely removed to be re-set, but the removal of the mortar showed a relatively shallow (approximately 8-inch) lintel atop the wooden framework of the doorway. The lintel, it appeared, might be able to be pushed back into its original place, but not without some surgery; it would have to be separated from all surrounding masonry and the area behind the lintel would have to be cleaned out, and possibly cut back, in order to get it back in place.

In order to isolate the lintel from all surrounding masonry, including at its rear, we had to cut away about eight rows of cobble coursing immediately above it. This would give us our best look at how this structure was built. The cobbles themselves proved to be a veneer layer [single skin], roughly 4–6 inches deep,

behind which was rubble coursing that had been levelled to each cobble course (Fig. 10). Especially noticeable was the brown colour of the mortar for the rubble coursing, which contrasted sharply with the cobble mortar (Fig. 11). Clay mortar formed the interior mortar, which was consistent with other interior mortars seen in vernacular work of the same era here. Some of the interior rubble, dislodged during the removal of the cobble coursing, was re-set with a similar mortar using NHL 2 with a clay/sand mix that a local gravel pit produces for baseball fields.

All lintel work, fortunately, was able to be done without taking the lintel stone off the door-frame. The base of the lintel appeared to be cut somewhat shallow and slightly out of square, a sort of birth defect that gave it the inclination to slide forward over time. The space behind the lintel was cleaned out with a vacuum and the lintel levered back into place with a spud bar [crowbar]. We re-plumbed and re-set it in a shallow bed of mortar back upon the door framework.

The cobble coursing

Re-setting the cobble coursing, and making it match the original, was probably the biggest challenge of the project, and it came with its attendant hurdles. Smaller repairs on the front face allowed us to develop a technique for duplicating the jointing. Judging from the look of the original coursing, string lines were involved, and we were to make do with two (Fig. 12). At this stage we used a different mortar mix; we went strictly to a putty because of the delicate lines and ridges formed by the mortar. Also, the aggregate was

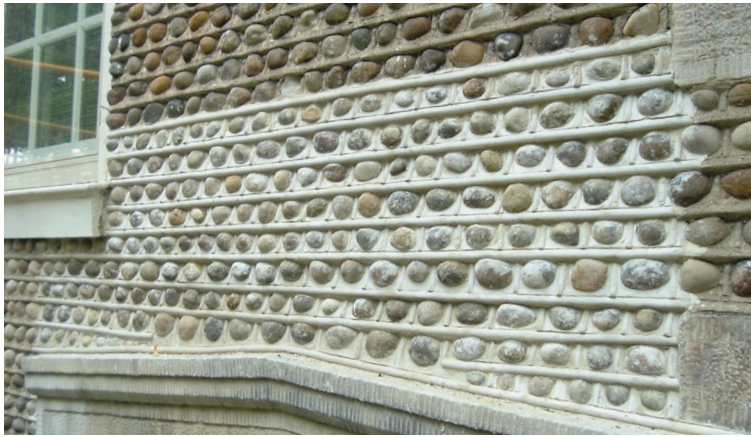


Fig. 13 Initial repairs to the cobble coursing over the front-door lintel.

screened from a coarse sand to finer sand, comparable with regular mason's sand.

With a mix that was nearly like modelling clay, we temporarily dispensed with our tools and set both mortar and cobblestones in with gloved hands; the cobbles, some of which were relatively shallow, stuck right into the putty mortar. This welcome plasticity allowed us to build several courses in a day without compromising lower levels of coursing. An angle iron was used to guide the jointer to form the ribbon pointing along a level plane and connect the new work with the original on either side.

Mortar anxiety

The onset of winter had led to a four-month pause in work on the house. Work had resumed in early summer and in direct sun. The cobblestone work above the lintel had been completed and left to cure (Fig. 13). A few weeks after completion the mortar, which had been kept shaded by a tarpaulin, was checked and found to be slower curing than the other mixes used on the house. A fingernail could still be easily dug in and my partner recognized the expression on my face of what he calls 'mortar anxiety'.

Two miscalculations had been made with the lintel mortar. The first was the putty. It was from a new bucket, but that was all that was new about it; it was some home-brew putty I'd made from a bag of hydrated lime back a few years when I was first getting the lime bug. Though it had congealed into a putty, it was, in fact, a dead lime from a bag that had probably already been largely carbonated. In a mix-up, it made its way to the job site. Compounding the weakness of the lintel mortar was the sand, which probably had a bit too much of its larger aggregate screened out of it. The mortar had to be removed.

Fortunately, the work re-doing the lintel went expeditiously; the jointing techniques had been practised and we had a clearer idea of our mortar mix. Not ones to take any more chances, we ordered a new bucket of putty from Graymont Lime and switched to a more fully graded aggregate. Sure enough, the mortar was crisp and resistant to the fingernail after several weeks of curing. A slight amount of buff pigment had been added to the mix to darken it slightly, as the mortar in the front had a deeper tone than that found on other sides. A wash with heavily diluted acid and a toothbrush was used to remove laitance and reveal the aggregate, bringing the mortar colour closer in line with the original (Fig. 14). (The acid was then washed off with water.)

End thoughts

Projects like this, even with the occasional tribulations that are part of the life of the restorer, are regarded as sheer privilege. The original craftsmanship involved in the house's construction, be it in the excellent condition of much of the mortar, or the seeming fluidity of much of the jointing work, was likely thousands of years in the making. Working in tandem with this long-gone crew of craftsmen gave us – and continues to give us – a sense of awe and inspiration.

Fig. 14 Cobblestone work above the front door, following final repairs.

