RESTORATION OF THE MICHAEL FULP HOUSE

Morlatton Village, Douglassville, Berks County, PA,

ARCHITECTURAL SPECIFICATIONS AND TIMELINE

A series of structural surveys of the 1783 Michael Fulp House in the summer of 2009 and spring of 2010, conducted by representatives of The Historic Preservation Trust of Berks County, Pennsylvania as owner and its professional consultants, Engineer Richard Ortega and Historic Preservation Architect John Bowie, identified numerous defects, impending failures, and threatening conditions in the masonry walls. These problems included: (a) delamination of wall wythes from the rubble-core; (b) mortar degradation and rotational dislocations in bearing walls and the chimney stack; (c) a threatening instability in the sub-grade foundation ranges; and (d) faults and radiating fractures in several wall ranges, many of which were delineated in a red-ink keyed architect’s drawing of the fault lines in the masonry fabric.

The issues determined to be critical to the stabilization and structural restoration of the building and its defining architectural details were substantially resolved, mitigated, or remedied between August, 2010 and April, 2011. Available resources, authentic and traditional methods, and experienced craftsmanship were directed toward achieving durable structural integrity and retention of original masonry fabric to the greatest extent practicable.

These threatening conditions were addressed and remedied as follows:

I. Foundation masonry defects and failures*:* Decades of incursion of flood-waters from the nearby Schuylkill River and saturation of permeable soils (bedded on less-permeable alluvial clay) by percolating ground water and surface flow, supplemented by a roof-runoff component, had disintegrated much of the bed and joint mortar in the foundation masonry. These periodic saturations caused dislocations of individual stone units and de-stabilization of numerous wall segments. Much of the early mortar had disintegrated to a friable sand-gravel residue of minimal bearing, bonding, or elastic [“cushioning”] value. Loss of effective mortar was so significant in some segments of the foundation perimeter that partial collapses occurred in the interior wythes of the south gable and east eaves wall foundations, and threatened several other foundation segments[photo #48, Oct. 20, 2010].

The degraded condition of the sub-grade foundation ranges supporting the north gable wall and a portion of the east eaves wall, and relentless hydrostatic pressure in the adjacent soils, had caused a partial collapse of the interior face of these foundation segments in the cellar [photo #608, June, 2009]. Timber post-and-beam “dead” shores were installed in 2008 to stabilize the progressive failure and prevent the collapse of the entire gable wall. This large void was consolidated and re-laid in the random rubble method, using the displaced stones pushed into the cellar, and in the process applying numerous bond-stones transversely tying wall wythes to the “rubble” core [photo #1304, October, 2010, is a restored view of the north cellar wall interior]. By means of this bonding technique, both of the re-constructed cellar walls are now more structurally sound than prior to the preliminary stages of disintegration.

Most of the foundation ranges exposed by hand-excavation had suffered similar degradation, presenting varying degrees of failure-risk from hydrostatic thrust enabled by mortar dissolution caused through relentless action of the frequently saturated and slowly-draining soils. Numerous individual stones in the bearing structures had fractured, rotated, or moved laterally out of their reciprocal bearing positions, causing systemic dislocations, delaminating fractures, and high failure-risk in numerous segments of the building.

The tenuous structural survival of the building was due in part to the excellent bearing quality of the amber-colored clay mass on which the base-blocks of the foundation are founded. This sub-base is the same material that has borne the other three 18th century buildings in Morlatton Village for two-and a-half centuries. Despite multiple dislocations in the foundation and upper-wall ranges, the base-blocks bedded on the dense clay sub-base had not discernibly subsided, deflected, or rotated from their original bearing positions.

Despite the sound footing afforded by the clay bed, the masonry structure was in only marginally stable status and facing significant risk of catastrophic failure.

Remediation: The foundation repair methods and restoration work- sequence, implemented between August and December of 2010, consisted of:

(1) consolidating and re-structuring foundation walls, applying traditional lime mortar, formulated with the aid of numerous samples, filling voids with small stones [“pins” and “plugs”], and deploying bond-stones transverse to the long axis of the walls.

(2) Re-setting dismantled and dislodged stones in the wall range from which they were removed, along with stones found elsewhere on-site, typically in the excavations adjacent to the foundation walls. Each stone deployed was not necessarily placed in the precise location it previously occupied, since those positions and alignments had not reliably ensured structural equilibrium and were not as well-bonded as in the re-structured wall ranges.

(3) The restoration strategy and specifications adopted in this campaign were intended to preserve the historic form, means, materials, and methods of the original construction project. The re-construction program was augmented by the mechanical advantage afforded by strategically inserted transverse bond-stones in degraded wall ranges. In stabilizing foundation walling, this bonding technique, common in regional masonry tradition, performed the function of compressing [“tying”] the junctions between wythes and the wall-core.

(4) The foundation defects were repaired and the exterior faces of all four foundation ranges were parged with mortar, coated with a “green” water-based, liquid-rubber moisture barrier, and covered with an impermeable vertically draining membrane. This moisture barrier releases and conducts the ground water downward to a permeable “French” drain and discharges it through a perforated PVC pipe to a remote outlet. This system drains thousands of gallons of ground-water in a few hours, exponentially faster than natural percolation through topsoil, thus reducing both the erosive effects of water on mortar over time and also relieving the hydrostatic thrust against the foundation walls from water and viscous slurries “perched” on the less permeable clay bed. [deletion].

(5) The above-grade walling under the first floor window in the north gable wall was dismantled, stabilized with raking shores and steel I-beam “needles”, and re-laid with bond-stones introduced across the thickness of the re-erected walls.

II. Failures in the fireplace lintel bearing masonry:

The original fireplace lintel, a beveled white oak beam, had deflected approximately 1” and rotated a few degrees when the “pad-stone” supporting it became dislodged from its originally level and centered bearing-site in the eastern masonry jamb*.*

The displaced lintel had remained marginally stable for an indeterminate time, partially because of the hard layer of 20th-century cementitious plaster on the interior face of the fireplace jamb, which provided an incremental degree of support.

Remediation consisted of:

(1)re-setting the deflected fireplace lintel on a leveled “pad-stone” embedded in the re-structured exterior building wall segment which forms the eastern jamb of the fireplace. (2)Introducing enhanced bonding quality in the restored masonry pursuant to the measures described in the remediation paragraph of section I (3) above.

(3)Treating the end-grain and embedded bearing segment of the lintel with a liquid anti-fungal consolidant.

III. Masonry failure in the east eaves wall*:*

A ten-foot high roughly-arched masonry range in the east eaves wall, extending from ground-level to the upper courses of the wall near the eaves, had gradually become slightly de-laminated, distended, fractured vertically from mid-range to ground-level. This jagged fracture-line intersected and degraded the bearing-site of the fireplace lintel.

The stabilization of this span in November, 2010 required dismantling and re-setting approximately 50 cubic-feet of walling, including the “rubble” core [Photo #404, November, 2010] shows the dismantled wall segment and exposed end-grain of the fireplace lintel]. The restoration masons carefully re-set the exterior layer of stones in the same random rubble pattern as existed prior to restoration, ensuring that the visual and structural integrity of the masonry fabric would be preserved [Photo 3297, April 24, 2011]. This process restored the impaired wall range to a plumb vertical alignment, a condition crucial to maintaining structural and mechanical integrity and a balance of forces acting within the wall [“static equilibrium” or “in compression”].

IV. Masonry failure of the south gable wall and chimney wythes:

Most of the wall between the stable corners piers had suffered considerable disintegration of its bed and joint mortar, multiple fractures [photo #681, July 3, 2009], and failure of the bond between the upper gable and the chimney stack [photo #828, Nov. 10, 2010]. The majority of the wallwas dismantled and re-built from the ground to the raking barge-boards after restoration of the foundation [Photos #1602, December, 2010, and 3302, April 24, 2011]. Heaters and electric blankets were deployed to keep the mortar above 40 degrees Fahrenheit for several days after application.

The back-walls of the fireplace and the sloped chimney were integral to the gable wall and were accordingly re-laid as the un-coursed wall was re-erected in the original “random rubble” method. At each rising scaffold-level [“lift”], the chimney back-wall was masoned across the flue as part of the restored gable-wall between corner piers. The flanking wythes of the chimney were bonded to the gable wall with projecting bond-stones, integrating the intersecting masonry ranges into a stable mechanical system.

After re-structuring the chimney and gable wall, the interior [western] flank of the chimney stack was consolidated and re-plastered with a traditional lime mortar [photo #2546, March 6, 2011].

The project components described above and the related re-pointing were executed between August, 2010 and the end of April, 2011.