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REPORT ON THE CLARA B. PERKINS MEMORIAL CHAPEL BLOSSOM HILL CEMETERY CONCORD, NEW HAMPSHIRE

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This report is based on two inspections of the Perkins Chapel, the first on October 6, 1997, and the second on October 10 after some access had been provided to the roof area through the ceiling of the eastern transept. The purpose of the report is to evaluate various options for heating, insulating, and restoring the interior of the chapel.

Brief history and description of the building: The Clara B. Perkins Memorial Chapel was donated to the City of Concord in 1904 by Miss Susan George Perkins, sister of Commodore George Hamilton Perkins, whose statue stands behind the State House. Susan Perkins was a devoted Concord philanthropist who also made gifts to St. Paul's Episcopal Church, to St. Mary's School, to Norwich University, and to Phillips Exeter Academy. Miss Perkins designated the chapel as a memorial to her mother, Clara Bartlett (Mrs. Hamilton Eliot) Perkins. The chapel has remained essentially unaltered since its construction.

The chapel is a small cruciform building with walls constructed of pitch-faced granite ashlar laid in random fashion. The ashlar blocks appear to be bedded in lime mortar, but the mortar joints are pointed with a hard Portland-cement-bearing gray mortar tooled to a grapevine joint. The north end of the chapel has a semi-octagonal apse, covered with a faceted roof. Transepts project from each side of the building; these have half-hipped roofs with eaves lower than those of the main roof. All roof surfaces of the building are covered with red Vermont slates. The walls are strengthened by short granite buttresses at the two front corners of the body of the building, at the outer corners of the transepts, and at the centers of the side walls of the transepts.

Pointed arches span the door and window openings of the building. The windows are filled with stained glass, presently covered by plywood panels for protection.

The interior of the chapel is a single room with a slightly raised dais at the north end. The transept on the east provides an adjoining niche, while that on the west is subdivided by several rooms and provides a stairway to a partially excavated basement having a furnace room that extends across the building below the transept area. The chapel floor is varnished southern yellow pine.

The walls of the chapel are lime plaster, laid on wooden laths that are nailed to furring strips inside the stone outer walls of the building. This plaster has a float finish that provides a slightly rough texture.

The ceiling of the chapel is a barrel vault that is transformed to a faceted half dome over the apse. The half dome is finished like the walls. The original plastered barrel vault has been removed, and thin sheets of plywood have been bent and nailed to the longitudinal furring strips that formerly held the wooden lath.

The roof frame of the chapel has a series of scissors trusses made of heavy timber. These closely resemble the exposed scissors truss that decorates the front gable of the building above the main doorway. Extending downward from the lower chords of these trusses are a number of short struts. These struts support a series of longitudinal furring strips that conform to the curve of the barrel vault. These strips originally held the wooden lath upon which the ceiling plaster was applied. The plywood ceiling that is presently nailed to these furring strips does not appear to follow the original profile of the barrel vault exactly, probably due to the difficulty of bending the plywood sheets to make full contact with the furring.

Except for the heavy timber scissors trusses, all the roof framing in the building is composed of ordinary two-inch-thick rafters. All wood in the attic area above the vaulted ceiling, including the underside of the roof sheathing boards, has been painted gray, probably as a protection against moisture that might condense above the ceiling in the cold attic. The attic area above the ceiling vault is not ventilated.

The chapel remains in excellent general condition. Due to the strong overhang of the building's eaves, the walls have largely been protected from water and frost damage. The slate roof, formerly somewhat deteriorated, has been restored to sound condition. The copper valleys, formerly leaking (especially at the northeast intersection of the main roof and the eastern transept), have been replaced with new metal. The city's prudence in covering the stained glass windows has generally protected the glass against vandalism.

The major area of damage now visible in the building lies in the lath and plaster beneath the northeastern roof valley. Here, a chronic leak allowed water to run down the wall between the main room and the niche, slowly rotting the wooden lath. This decay eventually caused the collapse of limited areas of plaster at the intersection of those two areas, and in part of the horizontal ceiling of the niche.

Examination of the framing above the opening between the main room and the niche suggests that only limited decay occurred despite the long-continued duration of the leak. Such structural repair as is needed in this area can probably be done by scabbing or sistering new wood against the old. This area should be examined more fully, with strong light, to be certain that no additional hidden structural deterioration is present.

Preservation approaches: The Friends of the Chapel have expressed concern that future repairs should not diminish the historical integrity of the building. The Friends have proposed that the chapel be listed in the National Register of Historic Places, and are anxious that rehabilitation of the structure be approached so as to retain the chapel's eligibility for the Register.

Because the chapel has endured for over ninety years in nearly original condition, the building presently retains a very high degree of historical and architectural integrity. The best way to preserve this integrity will be to base future treatment of the chapel on a set of standards that are used for federally-funded rehabilitation of historic structures. Called the *Secretary of the Interior's Standards for Rehabilitation,* these guidelines are useful for any preservation project, public or private. The *Standards* are not rigid rules, but rather are a set of suggestions that are intended to guide the treatment of a historic building. If applied intelligently to a structure that retains a high degree of integrity, these *Standards* will ensure that the building will keep that integrity.

The ten *Secretary of the Interior's Standards for Rehabilitation* are:

1. A property shall be used for its historical purpose or shall be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.

2. The historical character of a property shall be retained and preserved. The removal of historical materials, or the alteration of features, spaces, and spatial relationships that characterize a property, shall be avoided.

3. Each property shall be recognized as a physical record of its time, place, and use. Alterations that create a false sense of historical development, such as adding conjectural features or elements taken from other historical buildings, shall not be undertaken.

4. Most properties change over time. Changes to a property that have acquired historical significance in their own right shall be retained and preserved.

5. Distinctive materials, features, finishes, and construction techniques, or examples of craftsmanship that characterize a property, shall be preserved.

6. Deteriorated historical features shall be repaired rather than replaced. Where the severity of deterioration requires the replacement of a distinctive feature, the new feature shall match the old in design, scale and proportion, color, texture, and, where possible, in

materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

7. Chemical or mechanical treatments, if appropriate, shall be undertaken using the gentlest means possible. Treatments that cause damage to historical materials shall not be used.

8. Archaeological resources shall be protected and preserved in place. If such resources must be disturbed, mitigation measures shall be undertaken.

9. New additions, exterior alterations, or related new construction shall not destroy historical materials, features, and spatial relationships that characterize a property. New work shall be differentiated from the old, and shall be compatible with the massing, size, scale, and architectural features of the historical property so as to protect the integrity of the property and its environment.

10. New additions and adjacent or related new construction shall be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historical property and its environment would be unimpaired.

Suggestions for treatment of the chapel: The following discussion covers most of the points that were mentioned during the inspection of October 6th. There may be other subjects that will arise during future work on the chapel, but for the moment the issues of greatest interest to the City of Concord and to the Friends of the Chapel include plaster condition and repairs, and heating and insulating of the building. The Friends have already raised funds to deal with the greatest threat to the building, its formerly leaking roof. The Friends have also made plans to protect the stained glass windows with coverings of Lexan, thus permitting the chapel to be used without the need to remove and replace the plywood window covers.

Plaster: As noted above, the original ceiling plaster has been removed except in the half dome above the apse. The barrel vault of the building is presently formed from sheets of plywood. This ceiling can remain in service indefinitely. If found desirable in the future, a new ceiling of plaster could be installed to regain the original curve of the barrel vault, but such an undertaking will undoubtedly have a lower priority than the items mentioned below.

The wall plaster of the building, and the plaster of the surviving areas of original ceiling, is lime plaster. This plaster is composed of hydrated lime and sand, applied in three separate coats. The first or scratch coat includes animal hair as a binder. The three coats of plaster are applied to wooden laths, which are nailed to wall furring or studs and to ceiling joists.

Lime plaster applied over wooden lath was the standard method of covering walls and ceilings in New England from the 1600s until after World War II. It creates a permanent covering that is relatively stable and relatively resistant to water. In setting or hardening,

lime plaster absorbs carbon dioxide from the air and returns to a composition similar to the limestone from which the lime cement was originally manufactured. The chemical composition of lime plaster allows it to endure considerable wetting; the failure of plaster in the eastern transept has been mostly due to the rotting of the wooden lath rather than to the softening of the plaster.

Although lime plaster is a superior material in many ways, it does have certain drawbacks from the standpoint of modern building practice. First, plastering by hand is labor-intensive and requires a considerable amount of skill. The nailing of thousands of individual wooden laths, and the application of three separate coats of plaster over these laths, requires much time and work. Further, lime plaster sets or hardens slowly. It must absorb carbon dioxide from the atmosphere, and hardens only as it does so. It does not harden by a rapid internal chemical reaction, as does the gypsum plaster more commonly used today.

Further, a substrate of wooden furring strips or studs and wooden laths can shrink or swell with changes in humidity. This motion in the underlying wooden support can cause small but visible cracks to develop over time. In a sound building, these cracks are cosmetic, not structural, but they can require periodic filling and repainting if a perfect surface is desired.

The walls of the chapel show areas where such cracking has occurred and has been patched with spackle or patching plaster. Because the patches were not textured with a wooden float like the original wall plaster, but rather were smoothed with a steel trowel, the filled cracks are made obvious by their different texture.

One suggestion that has been offered for the refinishing of the chapel walls entails the complete removal of all wall plaster and its replacement by gypsum board or “drywall.”

Gypsum board is far more common today than lime plaster. Thus, the use of drywall would be very cost-effective if the chapel were already stripped to its stone walls. But since most of the original wall plaster remains intact, the removal of so much original building fabric appears unnecessary and out of keeping with the fifth and sixth of the *Secretary’s Standards*, given above. Merely in terms of cost, the stripping of the original wall and ceiling material and the installation of gypsum board would certainly be far more expensive than the repair of the damaged plaster at the eastern transept and the repainting of the remaining plastered walls to bring them to a fresh and uniform appearance.

It may be pointed out that new walls of gypsum board would give the chapel a more perfect appearance than it now has. This would be true, at least initially. As mentioned above, however, gypsum is far more susceptible to damage from water or moisture than is lime plaster. In time, walls of gypsum board might well show greater cosmetic disfigurement that do the original lime plaster walls.

Further, hand-troweled plaster has a character that many people find attractive. The broad planes and taped joints of gypsum board lack the subtle undulations of old plaster. In a historic building, any sign of hand craftsmanship is preferable to the texture of a manufactured product.

For these reasons, I would suggest the retention of as much surviving original plaster as possible. Both the walls and the plywood ceiling of the chapel are ready for repainting. During this work, some attention could be given to the smooth-spackled filling of wall cracks, giving them a better match to the original floated wall plaster.

One area where modern gypsum board could be used is in the repairing of the water-damaged plaster at the eastern transept. To save the expense of re-lathing the damaged areas with expanded metal lath (generally used today in preference to wooden lath) and replastering with three-coat work, the Friends might consider using gypsum lath covered with a floated skim coat of gypsum plaster. Gypsum lath (often called "blue board") is a treated gypsum board similar to ordinary drywall, but intended to be covered with a skim coat of troweled plaster. Because gypsum lath is finished by hand, the final surface can be made to match the original wall texture of the chapel.

For further reading on the subject of plaster, a copy of *Preservation Brief 21: Repairing Historic Flat Plaster—Walls and Ceilings* is attached as an appendix to this report.

Heating: The chapel is heated with the original wood-burning convection warm-air furnace. This furnace has a cold-air return register near the western end of the dais, and several warm-air supply registers placed elsewhere in the floor of the chapel. The smoke pipe or breeching is connected to the granite chimney that rises through the western transept at the wall of the main building. The furnace is highly typical of the heating plants used in most new private homes at the turn of the twentieth century. It is presently in good condition, having been reconditioned as necessary in the 1970s. Fuel is reportedly supplied at no cash expense from routine tree cutting on city properties.

Technically, this furnace has worked successfully for the better part of a century. There is no reason that it cannot continue in use unless there are objections to the labor involved in firing it or to its effectiveness as a heater. It was mentioned during our meeting on October 6th that the furnace is slow to heat the building; this slow response is typical of any convection furnace, which depends on the natural flow of cool and hot air to warm a building. Also, a convection furnace is not as fuel-efficient as a forced-hot-air furnace because there is no forced flow of air across its heated internal surfaces.

On the other hand, it was pointed out that fuel for the chapel is essentially free (except for labor), and that the furnace warms the building to comfortable levels even on cold days if its fire is lighted sufficiently early.

The key factors in evaluating the furnace appear therefore to be the labor in firing it and the possibility that a sudden demand for the use of the chapel will not give adequate time

to warm the building to a comfortable level. These factors are best evaluated by the city and by the Friends.

Installation of a forced-hot-air furnace using a fuel other than wood could have consequences for the chapel. The cleanest and most convenient alternative fuel would be gas. A gas-fired forced-hot-air furnace could be left cold until needed, and would then deliver thermostatically-controlled heat very quickly.

It should be pointed out, however, that the use of gas as a fuel can create problems when the furnace is run only intermittently. One byproduct of gas combustion is a copious amount of water vapor. This vapor is seen emerging from the chimney as a plume of steam on any cold day when a gas-fired furnace is running.

When a gas-fired furnace is run only intermittently, or is run at a minimum thermostat setting, the upper zones of the chimney remain cold. The water vapor that rises through the flue therefore may condense in the chimney, forming ice. The saturation of the mortar joints, and the expansion of this ice in cold weather, can damage a masonry chimney.

For these reasons, I would suggest exploring the possibility of venting a gas furnace through a basement window, using a properly-designed gas vent, if it is thought necessary to replace the wood-burning furnace.

In general, however, I would suggest the conservative approach of retaining the wood-burning furnace in use if its replacement is not required for practical reasons. This would both save money and retain one of the original technologies of the chapel.

Insulation: Because the fuel supply for the chapel is presently free except for labor, there is no reason to insulate the building unless human comfort demands it. Heat loss from such a building, used only on rare occasions in cold weather, is not an economic consideration. As a historic building, the chapel is exempt from government energy regulations.

On the other hand, if the users of the chapel are uncomfortable, or if the installation of a new furnace that burns a costly fuel requires greater economy, insulation might be desirable.

It has been proven that the greatest heat losses in any building occur through the infiltration of air through cracks around doors and windows, and through the passage of heat through ceilings. Heat loss through walls, especially heavy masonry walls like those of the chapel, is of far lesser consequence than loss through ceilings. This is especially true where the only barrier between the auditorium and the cold attic is a thin layer of plywood.

If insulation is thought necessary, the place to insulate is therefore the upper surface of the plywood barrel vault.

While access to the attic is presently difficult, it would be easy to provide a larger trap door in the ceiling of the eastern transept. From this point, careful workers could enter the attic above the plywood and could install either loose or batt insulation.

It would be prudent, however, to install a polyethylene vapor barrier across the upper surface of the barrel vault before laying down any thermal insulation in this area. Water vapor can arise from existing dampness in a building (as from a damp cellar or crawl space) or from the respiration of people in the building.

Water vapor always migrates toward zones of drier air, easily passing through most building materials to find its way to cold, dry areas such as attics. There, the water vapor condenses as frost in cold weather. As the attic area is warmed by the sun or by milder weather, the frost melts and creates dampness that can lead to mildew or decay.

As noted above, all wooden surfaces in the chapel attic were originally painted. This may have been done to help protect them from such condensation. While the original builders used the best means at their command to protect the wooden roof from moisture, it would be prudent to try to improve upon their efforts through the use of a material that was not available in 1904.

Installation of a polyethylene vapor barrier below added insulation effectively seals water vapor in the room below, preventing it from finding its way into the attic.

Because the attic of the chapel is sealed and unventilated, it should be noted that heat build-up in the summer may cause as much discomfort as the loss of warmth in the winter. If the chapel is uncomfortably hot in the summer, insulating the barrel vault would keep the heat in the attic from penetrating the room below.